AECOM Environment

Prepared for:
Minnesota Pollution Control Agency
October 2021

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Project 1007
Minneapolis, Minnesota

Baseline Ecological Risk Assessment

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List of Acronyms

µg/L	micrograms per liter
µg/kg	micrograms per kilogram
6:2 FTS	6:2 fluorotelomer sulfonic acid
AUF	area use factor
AWQC	ambient water quality criteria
BAF	bioaccumulation factor
BERA	baseline ecological risk assessment
BSAF	biota sediment accumulation factor
bw	body weight
COPEC	chemical of potential ecological concern
CSM	conceptual site model
DNR	Department of Natural Resources
dw	dry weight
ECCC	Environment and Climate Change Canada
Eco-SSL	ecological soil screening level
EPC	exposure point concentration
ERA	ecological risk assessment
ESTCP	Environmental Security Technology Certification Program
ESV	ecological screening value
FEQG	Federal Environmental Quality Guideline
g	gram
GLI	Great Lakes Initiative
HC1	hazardous concentration 1%
HC5	hazardous concentration 5%
HFPO-DA	hexafluoroproylene oxide dimer acid
HQ	hazard quotient
IPaC	Information for Planning and Consultation
kg	kilogram
LD50	median lethal dose
LOAEL	lowest observed adverse effects level
LOD	limit of detection

LOEC	lowest observed effect concentration
MBTA	Migratory Bird Treaty Act
MDHHS	Michigan Department of Health and Human Services
mg	milligram
mm	millimeter
MNDNR	Minnesota Department of Natural Resources
MPCA	Minnesota Pollution Control Agency
N-EtFOSAA	ethylperfluorooctane sulfonamidoacetic acid
N-EtFOSE	N-ethyl perfluoroctane sulfonamide
NHIS	Natural Heritage Information System
NOAEL	no observed adverse effects level
NOEC	no observed effect concentration
NPCA	Norwegian Pollution Control Authority
NWI	National Wetlands Inventory
ODS	Oakdale Disposal Site
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PFAS	per- and polyfluoroalkyl substances
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFDoS	perfluorododecane sulfonic acid
PFNS	perfluorononane sulfonic acid
PFHxS	perfluorohexane sulfonic acid
PFOA	perfluorooctanic acid
PFOS	perfluorooctanesulfonic acid
PFOSA	perfluorooctane sulfonamide
PFTeDA	perfluorotetradecanoic acid
RBSL	risk based screening level
RPD	relative percent difference
SAP	sampling and analysis plan
SERDP	Strategic Environmental Research and Development Program
SLERA	screening level ecological risk assessment

SMDP	scientific management decision point
SUF	seasonal use factors
TDD	total daily dose
TRV	toxicity reference value
UCL	upper confidence limit
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
VBWD	Valley Branch Watershed District
WCL	Washington County Landfill
ww	wet weight

1.0 Introduction

This document presents a Baseline Ecological Risk Assessment (BERA) prepared for Project 1007 located in the east Twin Cities Metro Area of St. Paul, Minnesota. The BERA was completed as part of on-going investigations being conducted by AECOM for the Minnesota Pollution Control Agency (MPCA). The BERA has been prepared in accordance with the *Screening Level Ecological Risk Assessment and Baseline Ecological Risk Assessment Work Plan* (AECOM, 2020a), which was submitted to the MPCA in July 2020.

Project 1007 is a stormwater conveyance system that was constructed by the Valley Branch Watershed District (VBWD) in the east Twin Cities Metro Area to mitigate flooding in the landlocked sub-watershed of the Tri-Lakes area by lowering water levels in Lakes Jane, Olson, and De Montreville. The conveyance system includes a series of open channels, storm sewers, and existing surface water features that carries water out of the Tri-Lakes area, into Raleigh Creek at Tablyn Park, piped under Lake Elmo, and discharging to the east of Lake Elmo. Prior to Project 1007, Eagle Point Lake drained directly into Lake Elmo; however, now the water under most surface water elevation conditions is piped underneath Lake Elmo. There is direct discharge of Project 1007 to Lake Elmo via a secondary overflow structure. Combined surface water flow from the Project 1007 flow path and Lake Elmo then flows through Horseshoe Lake and a series of ponds and channels (West Lakeland Storage Area) before being piped to the St. Croix River.

Two historic PFAS disposal sites are located in the project area. The former Oakdale Disposal Site (ODS) is situated in a wetland area that drains to Raleigh Creek via both surface and groundwater and contributes to the transport of PFAS impacted surface water downstream. The Washington County Landfill (WCL) is located south of the Tri-Lakes Area and has historically discharged to Project 1007 upgradient of the confluence with Raleigh Creek via pipe from 1988 to 1995. This connection has been terminated but impacts could still be discharging to the surface water along the Project 1007 flow path.

PFAS are widespread in areas east of the ODS and the WCL and have been detected in many potable wells in the Project 1007 area. A baseline sampling event and subsequent seasonal and precipitation triggered sampling events have also identified detections of PFAS in surface water, sediment, and foam[1] within the aquatic habitats of the Project 1007 area. These sampling efforts are ongoing and include sediment investigations of wetland areas along Raleigh Creek and continued seasonal surface water sampling. A screening level ecological risk assessment (SLERA; AECOM, 2020a) identified the potential for risks to ecological receptors associated with PFAS exposure in these media and recommended further evaluation in a BERA. The focus of the BERA is to assess the potential for risks to ecological receptors exposed to PFAS in the aquatic habitats of Project 1007 and in aquatic habitats of connecting and adjacent waterways.

Figure 1 shows the extent of Project 1007 waterways located between the Tri-Lakes Area and the ODS to the west and the St. Croix River to the east.

[1] Foam has been observed in several locations throughout the Project 1007 waterways. PFAS analysis has indicated that the foam may contain elevated levels of PFAS relative to the surface water. Additional description of the foam is provided in Section 4.2.

1.1 SLERA Summary and Objectives of the BERA

The objective of this BERA is to identify key receptors, chemicals, media, and pathways that warrant risk management consideration for protection of the aquatic community and wildlife in the Project 1007 study area. If ecological risk drivers are demonstrated through the BERA process based on a reasonably robust site-specific dataset, cleanup goals will be established to facilitate stakeholder discussions regarding the need for a remedial action. Focused data gaps that come to light through this evaluation, such as the collection of specific tissue types not previously sampled, and the benefit of filling these data gaps, are discussed with regards to reducing uncertainty in the BERA conclusions.

A SLERA (AECOM, 2020a) was performed for the Project 1007 waterways using PFAS data from surface water, sediment, and foam samples collected as part of Project 1007 sampling efforts conducted between August 2019 and May 2020**.** The SLERA results indicated that additional study was required to evaluate the potential for ecological risks associated with exposure to PFAS in surface water, sediment, and foam. The presence of PFAS in surface water and sediment may result in bioaccumulation of PFAS in fish and other aquatic and semi-aquatic species that serve as prey items for birds and mammals foraging in the aquatic habitats. PFAS-containing foam may also be an exposure medium for some ecological receptors. The SLERA indicated PFAS exposures may pose a potential risk to some ecological receptors.

In particular, the SLERA identified exceedances of food web-based ecological screening values (ESVs) for wildlife and perfluorooctanesulfonic acid (PFOS) detected in surface water and sediment in multiple areas within the Project 1007 waterways. Less frequent exceedances were noted for direct toxicity-based PFOS ESVs for aquatic life (e.g., fish, invertebrates), and for perfluorooctanoic acid (PFOA) ESVs for wildlife. In addition, concentrations of PFOS were detected in foam at concentrations that may pose a risk to aquatic life exposed directly to the foam, although this pathway is considered uncertain given the short duration the foam is present and because it is not an aqueous medium. The SLERA retained PFOS and PFOA as constituents of potential ecological concern (COPECs) warranting further evaluation.

A BERA Work Plan (AECOM, 2020a) and Sampling and Analysis Plan (SAP; AECOM, 2020b) identified the data needs, sampling methods, and approach for conducting this BERA. The BERA methodology was provided in Section 6 of the SLERA and BERA Work Plan (AECOM, 2020a); any deviations and updates are captured in this document. A BERA field event was conducted in September 2020 by AECOM scientists to collect tissue samples and co-located abiotic media samples (i.e., surface water, sediment, porewater, foam) to provide site-specific information to support the BERA.

This document presents a BERA conducted using abiotic data collected during multiple sampling events in 2019 and 2020 and tissue data collected during the September 2020 BERA sampling event. The primary objective of the BERA is to evaluate whether or not populations of ecological receptors are potentially at risk due to exposure to PFAS present in environmental media within the Project 1007 waterways.

The study area considered in the BERA is described in Section 2. PFAS contamination in aquatic habitats may extend beyond the areas currently being evaluated in Project 1007 investigations. Additional evaluations may be conducted in the future based on the analysis of the data in the BERA.

1.1.1 Position of this BERA and Overall Ecological Risk Assessment

Ecological risk assessments (ERAs) evaluate levels of contaminants in various media (such as water, soil, sediment) to characterize the potential for adverse ecological effects on aquatic life or aquatic-dependent and terrestrial wildlife. As described above, they can be used to identify and characterize the current or potential threats to the environment, to evaluate the ecological impacts of various remediation strategies, and to establish clean-up levels. Data collected in support of an ERA can also be used to develop water quality standards, which set general goals for water quality to protect specific beneficial uses (such as drinking water, aquatic life, and aquatic consumption).

There are many challenges to conducting ERAs for PFAS. With over 5,000 known structures in the PFAS family, there simply is not toxicity, bioaccumulation, or biomagnification data for the vast majority of PFAS that may be found in the environment. Because data collection and risk assessment for these compounds are generally prioritized first towards human health rather than ecological health, the work done for this BERA represents a big leap forward in setting the foundation for a PFAS ERA. This study now provides a large amount of data helping to illustrate the presence of PFAS and the potential concern for ecological health. Ecological data and risk assessments are active areas of work in Minnesota and around the U.S.; therefore, this BERA represents a snapshot in time based on currently available information.

In general, PFOS has been the focus of most regulatory interest with less toxicity data available for other PFAS. At this time, there are little toxicity data available in the literature for most PFAS and there are no federal screening values that are considered widely accepted as benchmarks to judge the likely impacts of most PFAS to ecological health. For some PFAS, only single studies were available to derive the toxicity values used in the BERA. Water quality standards are usually derived to be protective of ecosystems/assemblages of wildlife and aquatic life, and are less centered on single species assessments unless they are deemed to be more sensitive and ecologically, economically, or socially/culturally important.

If the BERA identifies a risk driver based on the available information, it is reasonable to expect that the risk is “real” and there is concern for species within that particular feeding guild, if they are present and foraging as assumed in the BERA. However, the converse is not necessarily true, particularly for emerging contaminants like PFAS where the toxicological and bioaccumulative effects are not completely understood. If a risk is not demonstrated, it may be because the information is simply not available at this time to demonstrate the risk. As more information is gathered, more risks may be identified. As the scientific understanding of PFAS continues, future risk assessments or water quality standards may demonstrate more risks. This BERA demonstrates that even with the limitations discussed, PFAS have a clear potential for adverse ecological outcomes.

1.2 Ecological Risk Assessment Process

As discussed in the SLERA and BERA Work Plan (AECOM, 2020a), the ERA for Project 1007 is being conducted according to the general tiered approach and methodology provided by the United States Environmental Protection Agency (USEPA) (1997). Each successive tier of ERA requires more detailed and quantitative data analysis and interpretation. Conducting assessments in a tiered, stepwise manner allows the risk assessor and risk manager to maximize the use of available information and sampling data, while providing the opportunity to reduce the uncertainties inherent in the ERA process using focused supplemental data collection to fill key data gaps identified in the previous tier of the assessment, as necessary. In accordance with the USEPA guidance and process documents, the principal components of the ERA include:

- **Problem Formulation:** In this phase, the objectives of the ERA are defined, and a plan for characterizing and analyzing potential risks is determined. Available information regarding stressors and specific sites is integrated. Products generated through problem formulation include assessment endpoints and the ecological conceptual site model (CSM);
- **Risk Analysis:** During the risk analysis phase of work, data are evaluated to characterize potential ecological exposures and effects; and
- **Risk Characterization**: During risk characterization, exposure and stressor response profiles are integrated through risk estimation. Risk characterization also includes a summary of uncertainties, strengths, and weaknesses associated with the risk assessment.

These three components are conceptually sequential. However, the risk assessment process is frequently iterative, and new information brought forth during the risk characterization phase, for instance, may lead to a review of the problem formulation phase, or additional data collection and analysis.

The ERA follows the eight-step process for ERA outlined in *Ecological Risk Assessment Guidance for Superfund* (USEPA, 1997) (**Figure 2**). As each of the steps is completed, the results are evaluated and communicated by the risk assessors to the risk managers. Scientific Management Decision Points (SMDPs) occur at key points in the process and are used by the risk assessor and risk manager to determine if the process should continue, and if enough data have been evaluated to determine the outcome of the ERA.

Steps 1 through 5 of the ERA process (i.e., SLERA, BERA Problem Formulation, Study Design and Data Quality Objective Process, and Field Verification Design) were completed and presented in the SLERA and BERA Work Plan (AECOM, 2020a). These steps were completed in a stream-lined fashion because it was understood that the potential for risk to ecological receptors would not be eliminated via a simple screening level evaluation. The *Sampling and Analysis Plan for Baseline Ecological Risk Assessment Field Data Collection Efforts* (AECOM, 2020b) documented the sampling objectives, locations, and methodologies to be used in the BERA field sampling program.

This report documents the completion and results of Steps 6 through 8 of the ERA process outlined below:

Site Investigation and Data Analysis (BERA Field Program) (Step 6)

The Site Investigation and Data Analysis step of the BERA is the implementation of the BERA Work Plan in the BERA field sampling program. The outcome of the Step 6 field investigation is evaluated and presented in the BERA Report (Step 7). A SMDP is only needed in this step if there are changes to the BERA Work Plan. Ongoing interaction with MPCA has occurred through the field event planning and execution to ensure that the BERA is meeting the overall project objectives put forth in the BERA Work Plan; therefore, a separate SMDP is not necessary for this step.

Risk Characterization (Step 7)

Step 7, Risk Characterization, integrates data on exposure and effects to identify the potential for risk to ecological receptors. The outcome of Steps 6 and 7 are presented in this document, the BERA Report, which constitutes the SMDP for Step 7 of the ERA process, and the end of the formal ERA.

Risk Management (Step 8)

The final step in the ERA process is risk management. The BERA helps determine if a potential for actionable ecological risk is present and identifies a range of potential effects associated with potential PFAS exposures, as warranted.

1.3 Report Organization

The rest of this report is organized as follows:

- Section 2.0 provides an overview of the environmental setting, including a brief site history and a description of the biological and wildlife communities of concern in the study area.
- Section 3.0 identifies the datasets used in the BERA, including the 2020 BERA sampling event and other sources existing data.
- Section 4.0 provides a discussion of the detected levels of PFOS in the Project 1007 samples.
- Section 5.0 provides the problem formulation that includes the framework for the BERA and serves to define the risk assessment objectives and the geographic area to be considered. It also identifies the ecological receptors, exposure pathways, and assessment endpoints evaluated in the BERA.
- Section 6.0 presents the risk analysis of exposure and effects. This section considers the magnitude of exposure for identified ecological receptors and identifies the effects data used to assess the potential adverse effects associated with PFAS.
- Section 7.0 provides the risk characterization for each assessment endpoint identified in the BERA and discusses the uncertainties associated with the evaluation.
- Section 8.0 presents the overall findings and conclusions of the BERA.
- Section 9.0 provides a list of references cited in this report.

Appendices A through K provide various supporting documents, including detailed exposure concentration and dose calculations, analytical data reports, and laboratory reports.

2.0 Study Area Description

Project 1007 is located in Washington County, Minnesota and is a 14-mile conveyance system constructed in 1987 by the VBWD as a flood control project for the Tri-Lakes Area. Water is transported from the northwest part of the VBWD to the discharge point at the St. Croix River. PFAS has been detected in sediment, surface water, foam, and biological tissue samples collected from within the Project 1007 waterways and in several of the interconnected waterways adjacent to Project 1007. **Figure 1** presents the overall layout of the Project 1007 area.

2.1 Environmental Setting

The ecological setting within the vicinity of the Project 1007 waterways was initially characterized in the SLERA (AECOM, 2020a) using photographs and field observations from the August 2019 and February 2020 sampling events. This information was supplemented with resources from the United States Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI), Minnesota Department of Natural Resources (MNDNR), and aerial imagery. Potential habitats associated with the Project 1007 waterways are summarized below.

Project 1007 stormwater conveyance system spans from the Tri-Lakes area (Lakes DeMontreville, Olson, and Jane) in the northwest portion of the City of Lake Elmo and extends to the southeast through Lake Elmo, West Lakeland Township and Lakeland until ultimately discharging into the St. Croix River. The system is made up of dams, reinforced concrete stormwater pipes, HDPE pipes, drop pipes, weirs, and other appurtenances that help convey the surface water runoff from flood-prone areas in order to reduce flooding throughout the corridor and to improve the water quality of Lake Elmo. The conduit piping empties into creeks, ponds (retention and natural), and lakes as it passes through the length of the conveyance system. Multiple streams discharge into Project 1007 with Raleigh Creek being one of the largest. The headwaters of Raleigh Creek are a wetland area in the ODS and provides a surface water pathway for PFAS to enter Project 1007 at Tablyn Park.

While pipes and storm sewers do not represent habitat for ecological receptors, the Project 1007 surface waterways (wetlands, streams, creeks, channels, ponds and lakes) provide habitat for a variety of receptors. The following areas and habitats were the focus of the BERA sampling efforts and are the primary focus of the BERA:

- wetlands and the primary stream channel associated with Raleigh Creek;
- the lake habitats of Eagle Point Lake and Lake Elmo; and
- Horseshoe Lake and the stream and pond habitats of the West Lakeland Storage Sites (referred to in this BERA as the West Lakeland Area).

Flow in the Valley Branch Watershed moves through six lentic lakes including: Lake Jane, Lake, DeMontreville, Lake Olson, Eagle Point Lake, Lake Elmo, and Horseshoe Lake. The water depths range from 6 feet at Eagle Point Lake to 140 feet at Lake Elmo (VBWD, 2015). The lakes provide habitat to a range of freshwater fish species including largemouth bass, northern pike, sunfish, shiner, and carp (MNDNR, 2020d). In addition, Lake Elmo provides habitat to additional fish species such as tullibee (cisco), lake trout and rainbow trout. Lake Elmo is located partially within the Lake Elmo Park Reserve which contains approximately 1,732 acres set aside for preservation and includes forested upland, forested wetland, shallow marsh, and emergent wetland. State and federally threatened or endangered species potentially present within the study area are discussed in Section 2.2.

2.1.1 Project 1007 Headwaters and Raleigh Creek

At the headwaters of Project 1007 to the northwest of Lake Elmo are three smaller sized lakes (Lake Jane, Lake Olson, and Lake DeMontreville). These lakes are abutted by limited areas of shallow marsh. Water from these three lakes travels through a series of pipes to the confluence with Raleigh Creek at Tablyn Park. The pipe discharges to a channel with cattail vegetation which passes through a small pond before reaching Tablyn Park. The WCL did historically discharge the effluent of a remediation system designed to treat volatile organic compounds to this section of Project 1007 from 1988 to 1995.

The headwaters of Raleigh Creek, a small intermittent stream, begin just north of the ODS. Downstream of ODS there are several wetland areas which have flow year-round. A sediment investigation of these wetland areas is currently being completed to further understand the extent of PFAS impacts. These wetlands and connecting stream channels were observed to have crayfish, minnows, small bullheads (*Ameiurus* sp.), tadpoles, and green frogs (*Lithobates clamitans)*. Herons, swans, egrets, and other waterfowl are often observed feeding in these wetlands. After one of the wetland and pond areas, the flow passes through a culvert. This culvert, in addition to the larger storage capacity of the wetland, limits movement of water further downstream. Flow from Ideal Avenue to the confluence with Project 1007 at Tablyn Park is intermittent and is only observed during periods of frequent rainfall or snowmelt, limiting the influx of PFAS from Raleigh Creek into the downstream stretches of Project 1007. The intermittent section of Raleigh Creek was dry during the BERA sampling event.

The combined Raleigh Creek and Project 1007 downstream of the confluence typically contains flow all year and discharges into a wetland area at the inlet of Eagle Point Lake. The stream channel is erosional with a rocky bottom and undercut banks. Historical monitoring in Raleigh Creek included collection of benthic invertebrate community survey samples between 2003 and 2007 and visual observations of small fish species (e.g., shiners, sunfish, minnows) (VBWD, 2015). Sampling conducted to support the BERA found minnows, green sunfish (*Lepomis cyanellus*), red ear sunfish (*Lepomis microlophus)*, small bullheads, tadpoles, green frogs, and crayfish within the stream channel.

2.1.2 Eagle Point Lake and Lake Elmo

Raleigh Creek discharges into the northwest corner of Eagle Point Lake which is a larger wetland area before it broadens into the main lake. Eagle Point Lake is located completely within the Lake Elmo Park Reserve. It is primarily surrounded by wetland vegetation. This shallow lake has a maximum depth of about 9 feet and provides habitat for waterfowl and other wildlife. The depth of the lake has been observed to have fluctuations over the year (approximately 4 feet change in 2020), affecting the extent of water within the wetlands surrounding the lake. Carp and bullheads are the predominant fish species in the lake (VBWD, 2015) and bullhead, bluegill (*L. macrochirus*), black crappie (*Pomoxis nigromaculatus*), green sunfish, and largemouth bass (*Micropterus salmoides*) were collected during the BERA sampling event. Multiple snail and crayfish samples were also collected along the edges of the lake to support the BERA.

Water from Eagle Point Lake historically flowed directly into Lake Elmo, but the construction of Project 1007 diverted surface flow between an elevation of 894.0 feet (NGVD29 datum) and 896.5 feet into a 22-inch diameter bypass pipe which carries water from Eagle Point Lake along the bottom of Lake Elmo to a discharge point east of Lake Elmo Avenue (Primary Outlet Structure). When water levels in Eagle Point Lake rise above elevation 896.5 feet, water discharges directly into Lake Elmo (Secondary Outlet Structure). The Primary Outlet Structure was designed to divert approximately

90% of water from Eagle Point Lake through the bypass pipe and under Lake Elmo. During the summer of 2020, water was observed to discharge via the Secondary Outlet Structures after three periods of high rainfall. Besides the flow from the Secondary Outlet Structure, there are no other surface water inputs to Lake Elmo and the primary source is groundwater discharge.

Although the Primary Outlet Structure was designed to limit direct discharges to Lake Elmo from the Project 1007 waterways, PFAS has been detected in surface water, sediment and fish tissue in Lake Elmo and may be from Secondary Outlet Structure discharges or from groundwater discharges. Lake Elmo has a surface area of approximately 284 acres and a maximum depth of nearly 140 feet and currently has a do not eat fish consumption advisory for PFAS for all species, as well as consumption advice for mercury. The fishery in Lake Elmo is managed by the MNDNR and the lake has been historically stocked with walleye (*Sander vitreus*), tiger muskellunge (*Esox masquinongy*), rainbow trout (*Oncorhynchus mykiss*), lake trout (*Salvelinus namaycush*), and brown trout (*Salmo trutta*) (VBWD, 2015). In 2019 Lake Elmo was stocked with tiger muskellunge fingerlings (MNDNR, 2020d). Fish collected from within Lake Elmo during the BERA sampling event included bluegill tullibee (cisco) (*Coregonus artedi*), black crappie, northern pike (*E. lucius*), and largemouth bass.

2.1.3 West Lakeland Area to the St. Croix River

Water from the Lake Elmo outlet and the Eagle Point Lake bypass pipe discharge to the ditch downstream of the Lake Elmo outlet and flows to Horseshoe Lake predominantly through an adjacent golf course via ponds, streams, and pipes. Horseshoe Lake covers approximately 76 acres with a maximum depth of 13 feet and an average depth of 7 feet (VBWD, 2015). Both native and exotic aquatic macrophytes have been observed in the lake (VBWD, 2015). Shallow marsh and emergent wetlands are also present along the perimeter of Horseshoe Lake. Fish in the lake were last surveyed in 1993 with bluegill and black crappie each representing 45% of the species observed. Bluegill and largemouth bass were collected from within Horseshoe Lake during the BERA sampling event.

A discharge pipe followed by a channel transports water from the eastern shore of Horseshoe Lake toward three ponds associated with the West Lakeland Area: North Pond, Middle Pond, and South Pond. These ponds are connected by channels constructed as part of Project 1007. These ponds and streams include areas of open water and emergent wetlands. Portions of the West Lakeland Area have historically been dry but currently all remain saturated, although some fluctuate in size and the presence of aquatic life is dependent upon the duration of saturated conditions. Areas where water remains for long periods of time, such as the north storage site (North Pond), support the growth of submerged and emergent plants (VBWD, 2015). During the summer of 2020, South Pond was observed to be the largest and deepest of the three ponds at over 15 feet deep. Fish collected from within these ponds and channels during the BERA sampling event included multiple bluegill and largemouth bass, and one green sunfish.

Downstream of South Pond, the flow is often piped and the SLERA found that PFAS concentrations were much lower than in upstream locations. Therefore, the focus of the BERA sampling event and the BERA itself are on the aquatic and wetland habitats associated with Raleigh Creek, Eagle Point Lake, Lake Elmo, Horseshoe Lake, and the West Lakeland Area. The flow through the remainder of the Project 1007 waterway and additional waterbodies of interest are described below and considered qualitatively in the BERA.

Flow exits the southern end of South Pond through a Project 1007 channel that flows approximately 1,000 feet before being piped to the Minnesota Department of Transportation pipeline, which moves water under and along I-94. The pipeline discharges into the I-94 Rest Area Pond which covers

approximately 12 acres. This stormwater pond is the last basin before the runoff from Project 1007 enters storm sewers that directly discharge to the St. Croix River (VBWD, 2015). An outlet from the pond was constructed as part of Project 1007 and water is piped along the I-94 corridor to its discharge point at the St. Croix River. The St. Croix River is approximately 0.5 miles across at the discharge point and is a National Scenic River-Way. After the discharge point, the St. Croix River follows south for approximately 16 miles before its confluence with the Mississippi River.

2.1.4 Additional Areas of Investigation Outside the BERA Study Area

Lake Edith and Valley Creek are located south of I-94. Currently this stream and lake are not directly connected to the Project 1007 waterways, but the north branch of Valley Creek may have had a historical connection prior to the construction of Project 1007 via a series of wetlands. The south branch of Valley Creek is a trout stream as a result of groundwater discharge, including that from aquifers known to be impacted by PFAS further west. Lake Edith and the north branch of Valley Creek have had detections of PFAS but results from the south branch are pending. Lake Edith consists of a north basin connected by a narrow channel to a smaller south basin. The lake covers approximately 80 acres with a maximum depth of 38 feet (VBWD, 2015). A large wetland area (Metcalf Marsh) is located approximately 3/4 mile upstream (west) of Lake Edith. This marsh area is characterized by many springs, which contribute water to the marsh and wetland (VBWD, 2015).

Brown's Pond was included in the sampling of forage and predatory fish at the request of MPCA during the BERA field event because of public access and known human consumption of fish from this lake. It is approximately 20 acres and is located completely within Lake Elmo Park Reserve. Brown's Pond is predominantly groundwater fed and had PFAS detections. At the time of the BERA sampling event, the seasonal changes of PFAS in Brown's Pond were not well understood. Brown's Pond is in a buried bedrock valley which may be contributing PFAS impacted water from Lake Elmo south towards Brown's Pond.

Sunfish Lake is located northwest of Lake Elmo. It is approximately 50 acres with a mean depth of 5.2 feet and maximum depth of 13 feet (VBWD, 2015). Sunfish Lake is predominantly groundwater fed and has no surface water outlet. Located between the WCL and Lake Elmo, Sunfish Lake may be receiving PFAS impacted groundwater from the WCL. MNDNR does not have recent data on the fish species present in this lake and the fish population is thought to be limited because of severe winterkills. Waterfowl and a variety of animals have been observed in and around the lake by residents (VBWD, 2015). Continued surface water sampling is planned for Sunfish Lake during summer 2021.

Other nearby lakes and creeks included in the Project 1007 sampling were also screened for potential ecological risk. Streams that contribute to the main Project 1007 flow path are Farney Creek, which flows into Eagle Point Lake, and an unnamed ditch which flows into Raleigh Creek west of Tablyn Park. Goose Lake is located south of Eagle Point Lake and is occasionally pumped into Eagle Point Lake to prevent flooding. Similarly, Friedrich's Pond is located north of Eagle Point Lake and is occasionally pumped into a wetland area north of Eagle Point Lake that may connect to the main flow path during high water conditions. Park Pond, Margaret Lake, Legion's Pond, and Down's Lake were all sampled to determine if these were impacted via groundwater pathways. Additional samples were also collected from piped sections of the waterway which do not provide an ecological exposure.

2.2 Biological Resources within the Study Area

As described in Section 2.1, the Project 1007 waterways include a variety of aquatic habitats including streams, wetlands, and lakes with the final discharge point occurring in a large riverine system (St.

Croix River). Groups of commonly occurring ecological receptors include aquatic plants, water column invertebrates, benthic invertebrates, fish, amphibians and reptiles, and aquatic-dependent birds and mammals. Commonly occurring wildlife potentially present in the aquatic habitats of Project 1007 were identified using habitat type and species information published in the literature. This information was supported by resources available through the MNDNR and observations made during various Project 1007 sampling events. During the development of the SLERA, MNDNR (2020a,b,c) resources were queried to identify threatened and endangered species with the potential to occur within the vicinity of Project 1007. The MNDNR provided access to the confidential Natural Heritage Information System (NHIS) rare features data[2] in September 2021 (MNDNR, 2021c) and rare species observed within one-mile of the Project 1007 waterways were identified.

In addition, USFWS Information for Planning and Consultation (IPaC) was used to evaluate if any special status species or sensitive habitats were within the vicinity of Project 1007 (https://ecos.fws.gov/ipac/). This review did not identify any critical habitats within the area (USFWS, 2021), but did identify the potential presence of four mollusks, three insects, and one mammal with federal listings. Special status species listed by these sources are provided in **Table 1** and discussed below. It is expected that if a federally threatened species occurred within the study area, it would also be documented in the NHIS rare features review (MNDNR, 2021c). Migratory birds that may occur in the vicinity of Project 1007 are also identified in **Table 1**. These species may only be present for a short period of time but are protected under the Migratory Bird Treaty Act (MBTA) of 1918. The Minnesota Breeding Bird Atlas (Pfannmuller, et al. 2017) was also consulted to assess whether any special status birds were likely to or confirmed to breed within the study area.

2.2.1 Aquatic Plants, Water Column Invertebrates, Benthic Invertebrates

Plants and invertebrates form the basis of the food web and adverse effects on these communities could reduce the quantity and quality of food available to higher trophic-level organisms. Vegetation in wetlands and emergent aquatic plants within waterbodies provide cover and forage for lower trophic level receptors like amphibians, fish, and invertebrates and for birds and mammals. Aquatic vegetation within the study area includes native species like pipewort (*Eriocaulon* spp.) and Illinois pondweed (*Potamogeton illinoensis*) preferring clear water, and some undesirable non-native species like curlyleaf pondweed (*P. crispus*) and Eurasian watermilfoil (*Myriophyllum spicatum*). Pond lilies (*Nuphar* spp.) are also present in some ponds.

Cattails (*Typha* spp.) and tall grasses are present along the edges of Eagle Point Lake and several of the ponds, and along some stream channels. Other areas have undercut banks with overhanging shrubs or forested habitat along the shoreline. These undercut banks provide good shelter for fish and invertebrates.

The BERA sampling event was conducted in the fall so aquatic and emergent insects were not observed. However, it is expected that larval stages of semi-aquatic insects such as mayflies, dragonflies, damselflies, mosquitoes, midges are seasonally present. Aerial insects emerging from within the Project 1007 waterways likely provide a food source for bats and insectivorous birds like

[2] Natural Heritage Information System Rare Features Data. Copyright 2021, State of Minnesota, Department of Natural Resources. Rare features data included here were provided by the Division of Ecological and Water Resources, Minnesota Department of Natural Resources, and were current as of September 10, 2021. These data are not based on an exhaustive inventory of the state. The lack of data for any geographic area shall not be construed to mean that no significant features are present.

tree swallows. Other water column invertebrates include zooplankton and aquatic beetles and common benthic macroinvertebrates include a range of species such as freshwater snails and crustaceans.

Crayfish were present in most waterbodies during the BERA sampling event and snails were observed in Eagle Point Lake and Raleigh Creek. Mollusks were also observed within the ponds of the West Lakeland Area. These invertebrates are expected to represent prey items for birds such as herons and egrets and mammals such as raccoons (*Procyon lotor*), mink (*Neovison vison*) and otters (*Lontra canadensis*).

As shown in **Table 1**, multiple special status mollusks (including state and federally endangered; and state threatened and species of concern) are identified as potentially occurring within or near the Project 1007 waterways. These mollusks are expected to be found within the St. Croix River, rather than within the Project 1007 waterways themselves. The mollusk species are all most likely to inhabit large rivers and the few species that may also be found in smaller streams (i.e., elktoe [*Alasmidonta marginata*], round pigtoe [*Pleurobema sintoxia*], spike [*Eurynia dilatate*]) prefer swift currents with sand and gravel substrates (MNDNR, 2021f,g,h), which are present in very few portions of the study area. A few segments of Raleigh Creek may fit this description but only intermittently contain water and are shallow enough that they freeze completely in winter. Waterways within in the lotic portion of the remainder of the study area are slow-moving with a silty bottom and the remaining lentic portion would also not be expected to harbor these protected mollusk species due to lack of appropriate habitat.

Three special status insects, including the rusty patched bumble bee (*Bombus affinis*; federal endangered and on the state watchlist), the Karner blue butterfly (*Lycaeides melissa samuelis*; state and federally listed), and a species of jumping spider (*Pelegrina arizonensis*; state species of concern) were identified as potentially occurring within or near the Project 1007 waterways. The monarch butterfly (*Danaus plexippus*), a candidate species for federal listing, may also occur in the study area. The NHIS (MNDNR, 2021c) indicated that the last observations of the jumping spider were made more than 20 years ago[3] and there were no observations of the Karner blue butterfly within the study area. The two butterfly species and the rusty patched bumble bee are more likely to be found in open upland areas where native terrestrial plants are common, rather than in the aquatic habitats found in the study area.

2.2.2 Fish

In an aquatic environment, fish include those at the bottom of the food web (i.e., small herbivorous or filter feeding fish), mid-level forage fish (e.g., diet of invertebrates and small fish), to predatory fish (e.g., piscivorous fish). These fish, in turn, are an important part of the aquatic food web for higher trophic-level organisms (i.e., omnivorous and piscivorous birds and mammals).

Forage fish observed and sampled within the Project 1007 waterways included bluegill, fathead minnows (*Pimephales promelas*), golden shiner (*Notemigonus crysoleucas*), stickleback (*Culaea inconstans*), red ear sunfish, mudminnow (*Umbra limo*), green sunfish, darter (*Etheostoma* sp.), and crappie. Bluegill were the most frequently sampled forage fish during the BERA sampling event; although they were not observed in Raleigh Creek. Green sunfish were the most frequently observed forage fish in Raleigh Creek. Forage fish sizes ranged from small minnows and shiners (3 to 10

[3] The lack of an observation of a species within the last 20 years may be due to a lack of surveys in the area and does not necessarily indicate that the species is not present if the relevant habitat is still available.

centimeters [cm] long) in Raleigh Creek to larger (> 20 cm) crappie in Eagle Point Lake and Lake Elmo. The larger forage fish are expected to have an omnivorous diet that includes water column invertebrates, benthic invertebrates, fish eggs, minnows, zooplankton, and small amphibians.

Predator fish were observed and sampled within Eagle Point Lake, Lake Elmo, and the West Lakeland Area. Largemouth bass was the most frequently observed and sampled predator fish during the BERA sampling event with a smaller number of northern pike collected. Both of these species are highly piscivorous with a diet likely to include shiners, suckers, perch, bluegill, as well as benthic invertebrates and amphibians. The largest fish collected during the BERA sampling event was a northern pike in Lake Elmo nearly 80 cm long and weighing over 3 kilograms (kg). Although this sample was not retained for use in the BERA, it shows that the lakes support a fishery that includes large predators.

As shown in **Table 1**, six state fish of special status, two state threatened fish, and one state endangered fish (skipjack herring [*Alosa chrysochloris*]) were identified as potentially occurring within or near the Project 1007 waterways. Most of these fish are expected to be found within the St. Croix River, rather than within the Project 1007 waterways themselves. The least darter (*Etheostoma microperca*) and the pugnose shiner (*Notropis anogenus*) are the only species documented outside of the St. Croix River within one-mile of the Project 1007 waterways (MNDNR, 2021c).

2.2.3 Reptiles and Amphibians

The bottomland forest stands in the vicinity and the aquatic habitats within Project 1007 may provide habitat, such as damp leaf litter, moist crevices within trees, fallen trees or logs, submerged structures, banks, and/or aquatic water bodies, for reptiles and amphibians. Reptiles and amphibians such as turtles, frogs, and salamanders play an important role in the aquatic food web.

Tadpoles and adult green frogs (*Lithobates clamitans*) were observed and sampled during the BERA sampling event in September 2020. Green frog tadpoles feed mainly on diatoms and algae while the adults eat insects, worms, and occasionally smaller frogs and fish. Green frog eggs are laid in May through July. Most of the young overwinter as tadpoles and develop into frogs the next summer (MNDNR, 2021), so the presence of tadpoles in late September is not unexpected.

Other reptiles and amphibians that may occur in and near the Project 1007 waterways may include the blue-spotted salamander (*Ambystoma laterale*), tiger salamander (*Ambystoma tigrinum*), painted turtle (*Chrysemys picta*), spiny softshell turtle (*Apalone spinifera*), northern map turtle (*Graptemys geographica*), American toad (*Anaxyrus americanus*), gray treefrog (*Hyla versicolor*), northern leopard frog (*Lithobates pipiens*), western chorus frog (*Pseudacris maculata*), wood frog (*Lithobates sylvaticus*), prairie skink (*Plestiodon septentrionalis*), common garter snake (*Thamnophis sirtalis*), eastern hog-nosed snake (*Heterodon platyrhinos*), redbelly snake (*Storeria occipitomaculata*), western fox snake (*Pantherophis vulpinus)*, and snapping turtle (*Chelydra serpentine*).

As shown in **Table 1**, one state threatened reptile (Blanding's turtle [Emydoidea blandingii]) was identified as potentially occurring within or near the Project 1007 waterway. While this turtle was observed in multiple locations in the vicinity of the waterway, the NHIS (MNDNR, 2021c) indicated that the last observations of this turtle were made more than 20 years ago. However, since vegetated wetlands and streams occur within the study area, the Blanding's turtle could be present in and near the Project 1007 waterways.

2.2.4 Birds

The creeks, streams, ponds, wetlands, lakes, and river of Project 1007 offer foraging opportunities for various types of waterfowl, wading birds, shorebirds, and raptors. Commonly occurring aquatic-dependent birds potentially present in the Project 1007 waterways include the Canada goose (*Branta canadensis*), blue-winged teal (*Anas discors*), mallard (*Anas platyrhynchos*), ring-necked duck (*Aytha collaris*), wood duck (*Aix sponsa*), great blue heron (*Ardea herodias*), and spotted sandpipers (*Actitis macularius*).

Wading birds such as herons and egrets typically stand in shallow waters or walk through shoreline vegetation to hunt mobile prey such as fishes, frogs, and large invertebrates. These birds are expected to be directly exposed to sediment and may bioaccumulate PFAS from small fish, snails, crayfish, and amphibians. Ducks are expected to forage for aquatic plants and invertebrates, and insectivorous birds like the sandpiper will forage for invertebrates along the shoreline. Larger piscivorous birds like the bald eagle (*Haliaeetus leucocephalus*) or osprey (*Pandion haliaetus*) are expected to forage heavily on fish within the larger ponds and lakes. Terrestrial songbirds like tree swallows may be indirectly exposed to PFAS by ingesting aerial insects that bioaccumulated PFAS during their aquatic larval phase in the Project 1007 waterways.

As shown in **Table 1**, two state birds of special status (red-shouldered hawk [*Buteo lineatus*] and Forster's tern [*Sterna forsteri*]) may be present within the Project 1007 waterways; however, the hawk is expected to be found in deciduous forests more than in the waterways. The tern was only documented once in 1994 within one-mile of the Tri-Lakes Area so there is some uncertainty about whether this species may still be present in the area. Some species of migratory birds (e.g., black tern [*Chlidonias niger*], bald eagle [*Haliaeetus leucocephalus*]) may occupy wetlands or shorelines within the Project 1007 waterways during migratory stop-overs, while other migratory species identified on **Table 1** are more likely to be found in upland forests or meadows outside the study area (e.g., wood thrush [*Hylocichla mustelina*], black-billed cuckoo [*Coccyzus erythropthalmus*]).

Of the birds listed in **Table 1**, the Henslow's sparrow (*Ammodramus henslowii*) and the bald eagle are the only migratory species listed by the Minnesota Breeding Bird Atlas (Pfannmuller, et al. 2017) as having 'probable' or 'confirmed' evidence of breeding, respectively, within the study area. However, the Henslow's sparrow (which is also a state endangered bird but was not identified within one-mile of the study area in the NHIS review) is a ground-feeder that prefers upland habitats with open grasslands, especially weedy fields and meadows with terrestrial insects and seeds, over riparian and aquatic habitats. The Henslow's sparrow may have been sighted transiently within the study area, but it is unlikely this species would forage on the benthic and aquatic insects or plants in the waterways under evaluation in this BERA.

Although not identified as a protected migratory bird in the study area by the IPaC query, the Minnesota Breeding Bird Atlas (Pfannmuller, et al. 2017) does indicate that the osprey (*Pandion haliaetus*), a species protected under the MBTA, also has 'confirmed' evidence of breeding within the study area. Eagle nests are not currently known to be present within Lake Elmo Park Reserve (D. MacSwain, personal communication, September 22, 2021) but may be present in areas adjacent to the Project 1007 waterways. An osprey nest was observed near the outlet of Eagle Point Lake during Project 1007 sampling efforts.

Migratory birds passing through the study area may only be present for a short period of time and many resident birds are likely to migrate out of the area for the winter months.

2.2.5 Mammals

The creeks, streams, ponds, wetlands, lakes, and river of Project 1007 offer foraging opportunities for a variety of mammals. Commonly occurring aquatic-dependent mammalian species may include mink, muskrat (*Ondatra zibethicus*), beaver (*Castor canadensis*), river otter, raccoon, and little brown bat (*Myotis lucifugus*).

Herbivorous mammals like the muskrat are expected to consume primarily rooted aquatic plants within the waterways. Bats, like songbirds, may consume aquatic emergent flying insects with a larval phase in the Project 1007 waterways. Larger omnivorous mammals like raccoons are expected to forage in the wetlands, creeks, and along the shoreline of the ponds and lakes. The omnivorous mink may be present in larger perennial waterbodies and, like the raccoon, is expected to consume a mix of amphibians, fish, benthic and aquatic invertebrates, and plants, although mink consume much less plant material and are more carnivorous than the raccoon. The river otter is a piscivorous mammal that is likely to inhabit the larger waterbodies (e.g., larger ponds, Eagle Point Lake, Lake Elmo).

As shown in **Table 1**, no state listed mammalian species were identified as potentially occurring within or near the Project 1007 waterways. The northern long-eared bat (*M. septentrionalis*) is a federally threatened species that was identified in the IPaC review of the area, but the NHIS (MNDNR, 2021) did not identify this state species of concern within a mile of the Project 1007 waterways. In addition, MNDNR (2021b) did not identify winter hibernacula or maternal roost trees near the waterways. No maternal roost trees were identified within Washington County.

3.0 Data Considered in the BERA

The BERA considered surface water, surface sediment (0 to 6 inches below the sediment surface), and foam samples collected from within the Project 1007 waterways over a baseline sampling event and multiple seasonal sampling events between August 2019 and November 2020. These sampling events have been detailed in various Project 1007 memoranda (AECOM, 2019; AECOM 2020c) and are summarized in Section 3.1. In addition, a focused BERA sampling event was conducted in September 2020 which included the collection of surface water, surface sediment, porewater, and biological tissue samples. Details of the BERA sampling event are provided in Section 3.2.

Samples considered in the BERA were collected from the wetlands and aquatic habitats associated with Raleigh Creek, Eagle Point Lake, Lake Elmo, and the West Lakeland Area (which includes Horseshoe Lake and downstream ponds and connecting channels). **Table 2** identifies the PFAS constituents analyzed in each of the media considered in the BERA. **Appendix A** provides the analytical data for each sample included in the BERA. **Figures 3 and 4** present the sampling locations for abiotic and biotic samples considered in the BERA.

3.1 Baseline and Seasonal Sampling Events

An initial Baseline Sampling Event was completed in August 2019 (AECOM, 2019) which consisted of sampling surface water and, if possible, a co-located surface sediment sample (0 to 6 inches below the sediment surface) along the main Project 1007 flow path. Based on the results of this initial study and a further understanding of flow through the system, additional seasonal and event triggered sampling of surface water was completed during 2020. The event triggered sampling events that were conducted to assess PFAS concentrations during both high and low flow conditions as certain areas of the project area, especially Raleigh Creek, were observed to have larger fluctuations in flow throughout the year. This sampling also allowed for the assessment of how flow through the intermittent section of Raleigh Creek affected downstream PFAS concentrations. Additional sediment sampling was also completed during the spring and summer of 2020 to further determine the extent of impacts. Foam was also sampled during these events when observed. Additional lakes and streams outside of the Project 1007 flow path were also sampled as part of these sampling events to determine if nearby waterbodies were also impacted with PFAS. All samples were analyzed by a State approved laboratory.

3.2 BERA Sampling Event

The SLERA (AECOM, 2020a) identified the potential for risks to wildlife receptors consuming vegetation and prey items that bioaccumulated PFOS, and to a lesser extent PFOA. The potential for direct exposure risks to aquatic communities (e.g., water column and benthic invertebrates, fish) was also identified, but to a far lesser extent than the potential wildlife risks. To further evaluate and characterize the potential for risks to these receptors, co-located sampling of various biological tissues and abiotic media was conducted.

A BERA sampling event was conducted in September 2020 to collect biological tissues that could be used in food web modeling proposed in the BERA Work Plan (AECOM, 2020a). The sampling approach for the BERA field effort was described in the *Sampling and Analysis Plan for Baseline Ecological Risk Assessment Field Data Collection Efforts* (AECOM, 2020b). The sampling locations targeted for inclusion in the BERA were based on a review of the PFOS and PFOA concentrations in sediment considered in the SLERA. In sediment and surface water, PFOS was detected more

frequently and at higher concentrations than PFOA. In general, PFOA concentrations showing ESV exceedances in the SLERA also showed PFOS exceedances; therefore, selecting sampling locations based on the presence of PFOS was also expected to capture co-located PFOA concentrations.

The objective of the BERA field work was to fill key data gaps to support the evaluation of potential ecological risks associated with exposure to PFAS released into the surface water and sediment within the Project 1007 waterways. In particular, the primary objective of the sampling was to provide site-specific tissue data for inclusion in the food web models planned for Raleigh Creek, Eagle Point Lake, Lake Elmo, and the West Lakeland Area.

An additional objective of the sampling was to collect co-located abiotic media samples that could be used to support the development of Project 1007 waterway-specific uptake factors. These site-specific uptake factors are more appropriate for use within the Project 1007 waterways than literature values, as the capacity for bioaccumulation is highly dependent upon site conditions. These uptake factors can be used to estimate tissue concentrations for food web modeling in areas where site-specific tissues were not collected and can be used, if needed, to help calculate cleanup goals for ecological receptors.

Appendix B provides the September 2020 sampling event documentation including photographs of sampling areas, tables of field information for the tissue samples collected for analysis, and field forms completed at the sampling locations. **Appendix C** provide the data validation checklists for the analytical samples collected during the BERA sampling event.

Tissue types targeted for collection were primarily based on the prey items identified for inclusion in the BERA food web models for each area (i.e., crayfish, amphibians, forage fish, and predatory fish) with additional 'opportunistic' tissue samples included to provide further information about the distribution of PFAS in different tissue types (i.e., bottom-feeding fish, snails). Sampling was conducted in the fall (September 2020), so collection of aquatic invertebrates (i.e., larval stages of semi-aquatic insects such as mayflies, dragonflies, midges) was not feasible. Fish tissue sampling was conducted via electrofishing, gill nets, dip nets, and minnow traps. Crayfish were collected using crayfish traps baited with cat food, hot dogs, and chicken, electrofishing, and dip nets. Fish sampling was conducted under a scientific permit issued by the Minnesota Department of Natural Resources (MNDNR) (Permit Number 29804A). Snails, tadpoles, and adult frogs were collected by hand or using nets. Amphibians were collected under a special permit for research issued by the MNDNR (Permit Number 3033).

Sampling for crayfish, forage fish, and predatory fish was designed to collect at least eight individual samples of a particular tissue type within each particular area or habitat type to ensure a sufficiently robust dataset for the calculation of statistics, evaluation of risks, and development of uptake factor relationships. Sampling for amphibians was more limited because of permit restrictions but at least eight individuals were targeted for the Raleigh Creek area, as this area had the highest PFOS concentrations in water and sediment. Collection of amphibians was more limited elsewhere in the project area.

Biota tissue targeted for collection included: benthic invertebrates (crayfish), forage fish (bluegill), and predatory fish (largemouth bass). Based on lack of target species at all locations or abundance of non-target species at specific locations, additional biota tissue collected included: amphibians (green frog and unidentified tadpoles), bottom fish (bullhead), forage fish (black crappie, tullibee (cisco),

darter, fathead minnow, golden shiner, green sunfish, mudminnow, red ear sunfish, yellow perch [*Perca flavescens*][4]), and predatory fish (northern pike).

Tissue samples for amphibians, crayfish, bottom fish, forage fish, and predator fish all included whole body samples. These samples were analyzed as received by the laboratory (e.g., crayfish shells were not removed). Snails were removed from their shells prior to analysis as it was assumed that these hard shells would not be consumed by birds or mammals. If necessary to obtain sufficient mass, some tissue samples were composited, and sometimes included multiple species within the same feeding guild (i.e., forage fish). Composite samples are identified in **Appendix B**.

Forage fish and predatory fish were collected to support the BERA and to provide the MPCA with fillet tissue data for use in assessing potential human health risks. These fish were filleted in the field and analyzed as separate fillet and carcass samples (referred to as 'part' samples in the **Appendix B** tissue sampling tables). The weight of the fillets and remaining carcass from each fish was recorded in the field and a 'whole body' fish concentration was mathematically generated from the PFAS concentrations in the fillet and carcass. These calculated 'whole body' fish concentrations were then used to represent fish concentrations for use in the BERA. **Appendix A** provides the calculations for determining the 'whole body' fish concentrations from the fillet and carcass (part) data. Analytical PFAS results for the fillet samples collected has been provided to the MPCA (AECOM, 2021).

Abiotic samples collected during the BERA sampling event were collected in the vicinity of the biological samples. In some cases, multiple biological samples were associated with a single abiotic sample (e.g., multiple fish samples associated with a single surface water sample). Surface water was collected from mid-depth for samples associated with fish samples and from just above the sediment surface for samples associated with crayfish, snails, and amphibians. In the laboratory, surface water samples were analyzed for PFAS in filtered water (dissolved phase) and in unfiltered water (total).

Porewater samples were collected from approximately 6 inches below the sediment surface using a Henry push sampler (M.H.E Products) connected to a peristaltic pump. Water quality measurements were taken of the surface water directly above the sediment and during purging to ensure a porewater sample was being collected. These measurements are included in the field notes (**Appendix B**). In the laboratory, porewater samples were preferentially analyzed for dissolved phase PFAS. PFAS in total (unfiltered) water was analyzed when sufficient sample volume was available. Three locations were analyzed for PFAS in both dissolved phase and total porewater. Sediment samples were also collected from the top 6 inches with an auger; this horizon is expected to represent the most biologically active zone for most benthic receptors. An auger was selected over the use of a shovel to allow for uniform sampling throughout the entire depth interval.

Abiotic samples collected during the BERA sampling event were analyzed by ALS Environmental with Method PFC/537M and biological tissue data were analyzed by SGS AXYS with method MLA-110.

[4] Yellow perch were only collected in Brown's Pond which is outside the five exposure areas evaluated in the food web models. Fish data from this pond are discussed in Section 7.3.6.

3.3 Data Quality

Data quality was reviewed utilizing the MPCA Guidance for Perfluorochemicals Analysis (MPCA 2020a). MPCA uses the Laboratory Data Review Checklist to document data quality for each laboratory report. The Laboratory Data Review Checklists for the BERA sampling event are included in **Appendix C** and consist of a review of sample receipt conditions, calibration, field and laboratory blanks, surrogates (labeled analogs), matrix spike/ matrix spike duplicate percent recoveries and relative percent differences (RPDs), laboratory control sample / laboratory control sample duplicate (percent recoveries and RPDs and field precision. A similar data review process was also completed for baseline and seasonal data collection efforts.

As part of the data quality review process, validation qualifiers were assigned to the results indicating potential quality issues. The data qualifiers used during the data review consist of:

- J – estimated value (+/- indicate the direction of bias)
- UJ – the reporting limit is estimated
- B – the value was within 10 times the associated blank concentration and indicates a high bias
- R – the result is unusable.

Data qualifiers for non-detect results (i.e., U qualifier where the concentration is less than the laboratory reportable limit) were identified by the analytical laboratory.

The majority of estimated flags (J- and UJ) were due to sample receipt temperatures above the MPCA guidance of 6 °C and labeled analog recoveries outside the limits of 50% to 200% (predominantly J+ and UJ). For more difficult matrices, especially tissue samples, some of the results were rejected due to labeled analog recoveries (often for precursor PFAS constituents).

Blank qualifications (B qualifiers) were also more prevalent during the quality review of the tissue data. The B qualifier indicates a potential for high bias (or false positive) due to laboratory contamination.

Results qualified as estimated (J, J+, J-, or UJ) and B are useable; however, bias may be present in the data. The data quality review also found that there is uncertainty in the dataset due to severely low (less than 20%) labeled analog recoveries, and most of these uncertainties were due to difficulties during analysis of the tissue matrix.

Results with J or B qualifiers were used in the BERA as detected concentrations. If the value was flagged with U (identified by the laboratory as not detected) or UJ, the result was considered a non-detect value in the BERA.

3.4 Data Treatment

All analytical data were compiled and tabulated in a database for statistical analysis. Surface water, sediment, and foam data were collected between August 2019 and November 2020 under both the baseline sampling, seasonal sampling, event triggered, and BERA sampling programs. Porewater and tissue samples were only collected under the BERA sampling program in September 2020. Summary statistics were calculated by area for each sampled medium. Foam data were evaluated on a sample-by-sample basis so summary statistics were not calculated for foam.

Data for samples and their duplicates were averaged before summary statistics were calculated, such that a sample and its duplicate were treated as one sample for calculation of summary statistics

(including maximum detection and frequency of detection). Where both the sample and the duplicate were not detected, the resulting value was the average of the limit of detections (LODs). Where both the sample and the duplicate were detected, the resulting value was the average of the detected results. Where one of the pair was reported as not detected and the other was detected, the detected concentration was used.

USEPA's ProUCL Version 5.1 software (USEPA, 2016) was used to calculate the upper confidence limit (UCL) on the mean for each PFAS evaluated in the BERA. A sample size of at least eight is recommended for the calculation of UCLs; however, UCLs may be calculated on smaller datasets with acknowledgment of the higher level of uncertainty in these UCLs. When fewer than eight samples were available (e.g., tissues in some areas), the ProUCL exports and the associated data were reviewed to assess whether the UCL or the maximum detected concentration would be the most appropriate exposure point concentration (EPC) to use in the BERA for the particular analyte/medium/area combination.

The UCL can be used as an EPC to represent overall PFAS exposure for a receptor community (i.e., benthic invertebrates, aquatic invertebrates, fish, wildlife) within a particular area. EPCs were estimated within each medium for each PFAS evaluated in the BERA in order to evaluate the selected ecological exposure pathways and receptors. These EPCs account for the range of media concentrations that ecological receptors may encounter (rather than the maximum concentration considered in the SLERA and in initial media screens for lower trophic level receptors described in Section 6.1). The maximum detected concentration was used as the EPC if sufficient sample numbers were not available or if the dataset had too many non-detects to calculate a UCL.

BERA-specific data were collected from within Raleigh Creek, Eagle Point Lake, Lake Elmo, and the West Lakeland Area and these were the four areas planned for quantitative evaluation in the BERA. Following a review of the analytical data, Raleigh Creek was divided into two separate areas referred to as Raleigh Creek-Upper and Raleigh Creek-Other (**Figure 1**). Raleigh Creek-Upper extends from just downstream of the ODS to the confluence with Project 1007. PFAS concentrations in tissue and abiotic media from this portion of the creek were typically higher than elsewhere in the Project 1007 waterways. Raleigh Creek-Other includes the Project 1007 waterway from location RC16A downstream to the discharge into Eagle Point Lake. Therefore, data and statistics were compiled for a total of five areas (Raleigh Creek-Upper, Raleigh Creek-Other, Eagle Point Lake, Lake Elmo, and the West Lakeland Area) to quantitively evaluate in the BERA.

Data collected from outside of these five areas are also provided in **Appendix A**. These include samples collected from areas that are not representative of ecological habitat (e.g., manhole samples), samples from areas downstream of the South Pond of the West Lakeland Area that showed low concentrations of PFAS in the SLERA, and samples collected from additional waterbodies outside the linear Project 1007 waterway (e.g., Browns Pond). These data are discussed in the uncertainty section (Section 7.3).

4.0 Data Discussion

The data evaluated in the BERA were collected over multiple sampling events and a general summary of the nature and extent of PFAS in various media is provided within this section. The available data help to support the understanding of the CSM within the Project 1007 waterways.

4.1 Surface Water, Sediment, and Porewater

In the upper section of Raleigh Creek before the confluence with Project 1007, the PFAS concentrations are higher for the majority of the compounds analyzed in surface water, sediment, and porewater compared to those in other sampling areas. PFOS has consistently been measured with the highest concentration compared to other PFAS compounds, followed by PFOA, perfluorohexane sulfonic acid (PFHxS), perfluorobutanoic acid (PFBA), and other shorter chain compounds. **Figure 5** provides boxplots showing the range of PFOS concentrations in surface water, sediment, and porewater throughout the BERA exposure areas and these results are discussed in the sub-sections below.

4.1.1 Raleigh Creek

Raleigh Creek exits the ODS via a culvert under Hadley Avenue into a wetland area with PFOS concentrations in total (unfiltered) surface water ranging from 1.5 to 8.8 micrograms per liter (µg/L). The surface water concentrations generally decrease in concentration as additional inputs flow into Raleigh Creek from stormwater detention ponds and other smaller unnamed creeks. Upstream of Ideal Avenue, Raleigh Creek flows through two ponds and a wetland area with dispersed flow before reaching the culvert underneath Ideal Avenue. To prevent downstream flooding, the culverts were set above the wetland elevation, effectively creating an elevation control structure. As a result, flow downstream is intermittent, and Raleigh Creek is only connected to the remainder of Project 1007 in the spring after snow melt and after rain events. The PFOS concentrations in total surface water in Raleigh Creek that enters Project 1007 (sampled at RC12) was measured from 1.1 to 2.1 µg/L.

The PFAS concentrations in the sediment in this area were also generally higher compared to other sections of the Project 1007 corridor, especially in the wetland areas. The longer chain PFAS compounds like PFOS, PFHxS, and PFOA have been previously found to adsorb more to sediment with higher organic content (ITRC, 2020). That trend was observed in this area as a high correlation was found between total organic carbon and PFAS concentrations. The highest PFOS concentration was measured slightly off the main channel at 1,610 micrograms per kilogram (µg/kg) in the wetland directly downstream of the discharge from the ODS. While significantly lower, PFOS concentrations greater than 100 µg/kg were consistently measured in other wetland areas further downstream, including in the ponds and wetlands immediately upstream of the Ideal Avenue culverts. PFOS concentrations were significantly lower in non-wetland stream stretches where flow is more erosional, ranging from 2.9 to 19.6 µg/kg. PFOA, PFHxS, perfluorooctane sulfonamide (PFOSA), and ethylperfluorooctane sulfonamidoacetic acid (N-EtFOSAA) were also consistently detected in the wetland sediment in the upper Raleigh Creek area. Shorter chain compounds, such as PFBA and perfluorobutanesulfonic acid (PFBS), were detected but at lower concentrations.

Porewater was only measured during the BERA sampling event which occurred in September when surface water concentrations of PFAS were lower than earlier in the year. Relative to the other detected PFAS, PFOS in Raleigh Creek was consistently measured at the highest concentrations in the dissolved porewater samples (ranging up to 2.1 µg/L), while PFOA and PFBA were reported at approximately half of the concentrations of PFOS in the same samples.

The samples collected from Project 1007 both upstream and downstream of the confluence with Raleigh Creek at Tablyn Park were grouped as Raleigh Creek-Other for the BERA to distinguish them from the Raleigh Creek samples collected closer to the ODS (Raleigh Creek-Upper). The surface water in Project 1007 from the Tri-Lakes Area has consistent PFAS concentrations that are approximately four orders of magnitude less than what is typically detected in Raleigh Creek-Upper. Surface water concentrations downstream of the confluence vary depending on the flow contribution from Raleigh Creek, with PFOS concentrations in total surface water ranging from 0.0017 to 1.23 µg/L. This segment of Raleigh Creek does consistently have flow during the growing season but has been observed to completely freeze during the winter.

Sediment concentrations downstream of the confluence between Raleigh Creek and Project 1007 are greater than those from Project 1007 upstream of the confluence but still lower than those observed in Raleigh Creek-Upper. Much of this stream segment is erosional with a rocky and sandy bottom (likely low organic carbon content). In addition to PFOS, PFOA, PFOSA, and PFBA were consistently detected. Porewater was also significantly lower in Raleigh Creek-Other compared to the upstream segment of Raleigh Creek.

4.1.2 Eagle Point Lake, Lake Elmo, and the West Lakeland Area

Raleigh Creek flows into the northwest corner of Eagle Point Lake through a wetland area. When Raleigh Creek is flowing into the confluence with Project 1007, Eagle Point Lake receives surface water inputs with high PFAS concentrations; however, input concentrations are lower when Raleigh Creek is not actively flowing. The surface water concentrations of PFAS are consistent throughout the entire lake although there may be some slight seasonal variations depending on the extent to which the upper portion of Raleigh Creek is or is not connected to Project 1007.

Sediment concentrations in Eagle Point Lake were elevated compared to the segment of Raleigh Creek directly upgradient and were similar to those measured in Raleigh Creek-Upper (**Figure 5**). Eagle Point allows for sediment that may contain PFAS to settle out and the lake sediment was found to have high total organic carbon concentrations which could increase sorption of PFAS to the lake sediment. The varying concentrations of PFOS, PFOA, PFHxS, and PFBA at different sediment sampling locations within Eagle Point Lake were found to correlate with total organic carbon concentrations. PFAS concentrations in Eagle Point Lake porewater were also elevated compared to Raleigh Creek-Other, but lower than concentrations in Raleigh Creek-Upper.

Lake Elmo has lower concentrations of PFOS, PFOA, and other long chain PFAS, but PFBA and other short chain compounds were found to be at higher concentrations in Lake Elmo surface water and sediment relative to Eagle Point Lake. This increase could be a result of a groundwater plume discharging into Lake Elmo that has a different PFAS composition than that in the surface water discharge from the ODS. Sediment PFOS concentrations were similar to concentrations in Raleigh Creek-Other (**Figure 5**). No porewater samples were collected from Lake Elmo.

Downstream of Lake Elmo, the discharge from Lake Elmo and the pipe from Eagle Point Dam mix, resulting in higher PFBA concentrations than that observed in Eagle Point Lake but lower PFOS concentrations. In sediment, PFOS and PFOA were the only compounds consistently detected and concentrations were similar to those measured in Lake Elmo. Porewater concentrations of PFOS and PFOA downstream from Lake Elmo within the West Lakeland Area were less than those measured in Eagle Point Lake. PFOS concentrations in surface water and sediment in the West Lakeland Area showed a slightly wider range of concentrations than in Lake Elmo, but on average PFOS concentrations in both areas were similar (**Figure 5**).

4.2 Foam

Foam forms as a result of the surfactant nature of PFAS and other organic compounds found naturally in surface water. The fluorine-carbon tail is hydrophobic or prefers to not be in water while the attached functional group (often referred to as the head) is often hydrophilic or prefers to be in water. These competing chemical properties cause PFAS to form a stable foam as the hydrophobic tails orient themselves together or with other hydrophobic organic matter in the water while the hydrophilic functional groups orient themselves with each other, water trapped within the foam, and other hydrophilic organic chemicals in the water. In surface water impacted with PFAS, foam formation requires turbulence to introduce air bubbles. This turbulence can be a result of water flow around rocks or other debris in the stream, flow through a culvert, or wind action. For larger piles of foam to accumulate, a calm area downstream of the turbulence with a solid substrate for the foam to accumulate against is required.

While the location and physical appearance of foam is variable, foam is consistently observed along both sections of Raleigh Creek, including when Raleigh Creek-Upper was not flowing into the confluence. The size of the accumulated foam piles ranged from the more frequently observed small accumulations along the stream banks to the less frequently observed accumulations of larger piles of 6 inches in height or more than a foot in length. Foam concentration data are presented in **Appendix A**. PFOS concentrations ranged from 30.7 to 13,800 µg/L in Raleigh Creek-Upper and 1.57 to 2,750 µg/L in Raleigh Creek-Other, which is up to 26,000 times higher than PFOS concentrations detected in surface water of these areas. The foam has been observed year round in various locations within Raleigh Creek (although not consistently in the same location) and ranged from larger fluffy piles to thinner piles along the stream banks. Changes in the water level of the stream changes the location of the turbulence and, therefore, the location of the foam. The length of time foam is present at a single location has been found to be variable from limited observations and is not well understood.

Foam was only observed in Eagle Point Lake as a result of turbulence from pumping of Goose Lake. In Lake Elmo, foam was often observed to accumulate along the lake shore in the downwind direction on windy days. PFOS concentrations in foam collected at different times from Lake Elmo ranged from 216 to 904 µg/L. A duplicate foam sample was collected from Lake Elmo (location EP21) and all detected compounds generally had a relative percent difference of less than 10% within that sample.

In the West Lakeland Area, foam was only observed at two locations in stream channels (WL6 and WL11) between larger waterbodies as there is much less stream turbulence to generate the foam in these channels compared to Raleigh Creek. Both of the locations with foam observations in West Lakeland have high turbulence because of culverts which promotes the introduction of air into the surface water and formation of foam. The foam collected from WL6 during the BERA sampling event had the highest PFOS concentration at 20,700 µg/L. Foam collected at this same location in February 2020 had a PFOS concentration of 1,630 µg/L, showing the temporal variability in PFOS concentrations in the foam at a single location. This temporal variability in foam PFOS concentrations has been observed at other locations as well and it is not understood what environmental factors influence the variability.

The range in PFOS concentrations within the foam could be a result of variable PFAS concentrations in the surface water where the foam forms, age of the foam, water body type, and the amount of other organic matter contributing to foam formation. PFOS was the dominant PFAS detected in foam samples, but PFOSA and N-EtFOSAA were also detected at elevated concentrations relative to the surface water concentrations.

4.3 Biological Tissue

Biological tissue samples were collected in September 2020 to support the BERA food chain model including the primary prey items such as benthic invertebrates (crayfish), amphibians, forage fish, and predatory fish that could be consumed by birds and mammals. Other tissue samples collected included snails and bottom-feeding fish (bullhead). These tissue types were not included in the food web model but are discussed below relative to the observed PFAS trends in these species.

Details regarding the composition of tissue samples including the type of sample (individual or composite), type of tissue (e.g., whole body, fillet), species identification, and specimen measurements are provided in Tables 1 through 6 in **Appendix B**. Summary statistics for each tissue type are included in in **Appendix D**. The biological tissue data are discussed in the sections below. **Figure 6** present boxplots of the tissue data for PFOS across tissue types and sampling areas. This figure is useful for looking at trends related to waterbodies and to the trophic levels of the organisms collected. **Figures 7a through 7f** identify the distribution of individual detected PFAS in each tissue sample.

4.3.1 Amphibians

Amphibian tissue samples were collected in Raleigh Creek-Upper, Raleigh Creek-Other, Eagle Point Lake, and the West Lakeland Area and consisted of tadpole composite samples and adult frog whole-body samples (see **Appendix B Table 1** for species and size information). No amphibian tissue samples were collected in Lake Elmo. The tadpoles and adult frogs were identified as green frogs. In Raleigh Creek-Upper, eight samples were collected consisting of three tadpole composite samples (ranging from 4 to 7 individuals per composite) and five individual adult samples. Six samples were collected in the West Lakeland Area including three tadpole and three adult samples. One adult sample was collected in Eagle Point Lake, and one tadpole and two adult samples were collected in Raleigh Creek-Other.

PFOS measured in the amphibian samples are presented for each area in boxplots in **Figure 6.** Highest concentrations of PFOS were detected in amphibian tissue samples collected in Raleigh Creek-Upper whereas the concentrations detected in Raleigh Creek-Other, Eagle Point Lake, and West Lakeland were comparable in range. The range of concentrations detected in amphibians is greater than the ranges detected in snail and crayfish tissue samples but less than forage and predatory fish tissue samples collected in the same areas. This is not unexpected as amphibians, particularly adult frogs consuming insects, worms, small frogs and fish, are at a higher trophic level in the food chain than snails (consuming algae) and similar to or above crayfish (consuming plants, benthic worms, small fish, and detritus).

As indicated in **Figure 7a**, PFOS was generally the dominant PFAS detected in amphibian tissues. Samples collected from locations closer to the ODS in Raleigh Creek-Upper (i.e., RC3A, RC4A) contained higher fractions of PFOSA than downstream samples. The amphibian sample collected from location RC16A in the Project 1007 stream prior to the confluence with Raleigh Creek contains the smallest fraction of PFOS and greater fractions of other PFAS.

PFOS concentrations detected in adult samples ranged higher than in tadpole samples. In adult samples, PFOS ranged from 31 to 737 µg/kg with an average of 217 µg/kg. In tadpoles, PFOS ranged from 3 to 137 µg/kg with an average of 80 µg/kg. The weights of the adult samples ranged from 11.5 to 35 grams (g) and tadpole samples ranged from 2 to 6 g.

4.3.2 Crayfish

Crayfish samples were collected in Raleigh Creek-Upper, Raleigh Creek-Other, Eagle Point Lake, and the West Lakeland Area. No crayfish tissue samples were collected in Lake Elmo. A total of seven samples were collected in Raleigh Creek-Upper, 11 samples in Raleigh Creek-Other, nine samples in Eagle Point Lake, and 12 samples in the West Lakeland Area (see **Appendix B Table 2** for size information). Most samples are individual whole-body samples (25 male and 12 female specimens) ranging in size from 4.1 to 103 millimeters (mm) in length and 2 to 28.4 g in weight. One composite sample consisting of two small specimens (49 to 53 mm and 2.5 to 3 g) was collected in Raleigh Creek-Upper.

One whole crayfish (WL15A) was removed in the tissue processing lab from the gut of a large largemouth bass collected from the West Lakeland Area. This crayfish specimen was analyzed as an individual whole-body tissue sample.

PFOS concentrations detected in crayfish tissue samples ranged from 2.3 to 153 µg/kg with an average of 35 µg/kg. PFOS measured in the crayfish samples are presented for each area in **Figure 6**. Similar to amphibians, the highest concentrations were detected in crayfish collected in Raleigh Creek-Upper followed by the West Lakeland Area. PFOS in tissue measured in Raleigh Creek-Other, Eagle Point Lake, and the West Lakeland Area showed overlapping ranges. The range of concentrations detected in crayfish is comparable to ranges detected in snail tissue and less than amphibian, forage fish, and predatory fish tissue samples collected in the same areas.

Figure 7b shows that PFOS and PFOSA were generally the dominant PFAS detected in crayfish tissues. In several samples collected from locations within Raleigh Creek-Upper (i.e., RC3A, RC23), higher fractions of PFOSA than PFOS were detected and PFOSA accounted for approximately 20% of the total detected PFAS in Eagle Point Lake. In the West Lakeland Area, very little PFOSA was detected and PFOS was the dominant PFAS in crayfish tissues.

4.3.3 Snails

Snail tissue samples were collected opportunistically when available and they are expected to represent a potential prey item for receptors like herons and raccoons. Two composite snail tissue samples were collected in Raleigh Creek-Upper, and four individual and two composite snail tissue samples were collected in Eagle Point Lake. Composite samples consisted of two to four individual specimens. Snails ranged from 15 to 47 mm in length and 3 g to 25.5 g in weight (**Appendix B Table 3**).

PFOS concentrations detected in snail tissue samples from 10.7 to 98.1 µg/kg with an average of 53.1 µg/kg. PFOS measured in the snail samples are presented for each area in **Figure 6**. The range of concentrations measured in snail tissue samples collected in Raleigh Creek-Upper and Eagle Point Lake overlap with the highest concentrations measured in the latter area. Snail concentrations are comparable in range to crayfish and lower than amphibian, forage fish, and predator fish tissue samples collected in the same areas.

Similar to crayfish, snail tissue collected from locations within Raleigh Creek-Upper (i.e., RC3A, RC23) were dominated by PFOS and PFOSA (**Figure 7c**) and contained higher fractions of PFOSA than downstream samples collected from Eagle Point Lake. Samples collected from locations in Eagle Point Lake (i.e., EP17C, EP27B, EP4) were dominated by PFOS.

4.3.4 Bottom Fish

Bottom fish tissue samples were collected opportunistically when available in three areas: Raleigh Creek-Upper (two samples), Raleigh Creek-Other (one sample), and Eagle Point Lake (two samples). Each whole-body sample consisted of an individual specimen of bullhead, which are one of the dominant species in Eagle Point Lake (VBWD, 2015). The bottom fish specimens ranged in size from 12.7 to 225 mm in length and 23 to 192 g in weight (**Appendix B Table 4**).

PFOS concentrations detected in bottom fish samples ranged from 58.7 to 918 µg/kg. The upper end of the range is driven by the two specimens collected in Raleigh Creek-Upper (882 and 918 µg/kg) in contrast to the much lower concentrations detected in the three specimens from Raleigh Creek-Other (58.7 µg/kg) and Eagle Point Lake (112 to 212 µg/kg). This range of concentrations detected in bottom fish overlaps with ranges of forage fish tissue concentrations measured in samples collected in the same areas (**Figure 6**).

Figure 7d shows that the two bottom fish samples collected from Raleigh Creek-Upper were not dominated by PFOS. One sample was dominated by PFOSA (i.e., RC7) and the other by perfluorododecane sulfonic acid (PFDoS) (i.e., RC22). The three samples collected from locations in Raleigh Creek-Other (i.e., RC18) and Eagle Point Lake (i.e., EP1A and EP27C) were dominated by PFOS.

4.3.5 Forage Fish

Forage fish tissue samples were collected from Raleigh Creek-Upper, Raleigh Creek-Other, Eagle Point Lake, Lake Elmo, and the West Lakeland Area for use in the BERA (see **Appendix B, Table 5** for species and size information). The forage fish species collected within these exposure areas included black crappie, bluegill, cisco, golden shiner, fathead minnow, darter, stickleback, mudminnow, and sunfish (including green and red ear).

In Raleigh Creek-Upper, six whole-body samples were collected, four of which are composite samples consisting of two to six individuals which included multiple species and two represent individual specimens (golden shiner and mudminnow). Seven samples were collected in Raleigh Creek-Other including five composite samples which included multiple species and two individual samples (green sunfish). Eight samples were collected in Eagle Point Lake including one whole-body composite of mudminnows and seven individual samples of crappie, green sunfish, and bluegill. Nine samples were collected in Lake Elmo including one whole-body composite of bluegills and eight individual samples of crappie, cisco, and bluegill. In the West Lakeland Area, a total of 26 whole-body individual samples were collected and all were bluegill except one green sunfish.

The smallest forage fish specimens were collected in Raleigh Creek-Upper where the average weight was 14.5 g per sample. Larger individual specimens were collected downstream and as such, the average weight per sample increased from 28.5 g in Raleigh Creek-Other to 139 g in Eagle Point Lake, 85 g in Lake Elmo, and 57 g in the West Lakeland Area. Most specimens were between 1 to 2 years old (if age was recorded).

PFOS concentrations detected in forage fish tissue samples ranged from 6.15 to 6,350 µg/kg, which is higher than the maximum for all other tissue type samples as indicated in the boxplots in **Figure 6**. Highest PFOS concentrations were detected in Raleigh Creek-Upper forage fish (average concentration of 4,950 µg/kg). The widest range of concentrations was measured in Raleigh Creek-Other (average of 215 µg/kg). The range of concentrations measured in Eagle Point Lake, Lake

Elmo, and West Lakeland Area overlapped with slightly higher levels in Eagle Point Lake (averages of 1,630 µg/kg, 803 µg/kg, and 894 µg/kg, respectively).

Figure 7e shows that PFOS was the dominant PFAS detected in forage fish tissues. PFOSA was detected at low levels in samples collected within Raleigh Creek-Upper (i.e., RC3A, RC4A, RC5, RC7, RC22) and was rarely or never detected further downstream. Samples collected from locations in Raleigh Creek-Other (i.e., RC16A, RC21A, RC17) contained a more variable mix of PFAS than samples collected in Raleigh Creek-Upper, Eagle Point Lake, Lake Elmo, or the West Lakeland Area. These differences in PFAS distribution are likely associated with proximity to different sources with PFOSA detected in samples closest to the ODS and the more variable mix of PFAS detected in fish more likely to be exposed to discharge associated with groundwater and/or the WCL (**Figure 1).**

4.3.6 Predator Fish

Specimens of predator fish, including largemouth bass and northern pike, were collected in Eagle Point Lake, Lake Elmo, and the West Lakeland Area for use in the BERA (see **Appendix B, Table 6** for species and size information). In Eagle Point Lake, five individual largemouth bass samples were collected with an average total sample weight of 478 g. In Lake Elmo, eight samples were collected (three northern pike and five largemouth bass) with an average weight of 508 g. In the West Lakeland Area, 12 largemouth bass samples were collected with an average weight of 360 g.

PFOS concentrations detected in predator fish tissue samples are comparable but slightly higher than the ranges detected in forage fish tissue samples and higher than other tissue sample types collected in the same areas, as indicated in boxplots in **Figure 6**. The highest PFOS concentrations were detected in Eagle Point Lake (average of 2,242 µg/kg), with Lake Elmo and West Lakeland having nearly equivalent average concentrations (1,198 and 1,196 µg/kg, respectively).

The distribution of PFAS in predator fish tissues collected from Eagle Point Lake, Lake Elmo, and the West Lakeland Area (**Figure 7f**) was similar to forage fish collected from the same waterbodies with PFOS accounting for nearly all of the detected PFAS.

5.0 Problem Formulation

The BERA Problem Formulation provides the framework for the BERA and serves to define the risk assessment objectives and the geographic area to be considered. It also identifies the ecological receptors, exposure pathways, and endpoints to be evaluated. This information was previously included in the BERA Work Plan (AECOM, 2020a) and is reiterated and updated to reflect current information, as needed, below to ease review of the BERA.

As stated previously, the primary objective of the BERA is to evaluate whether or not populations of ecological receptors are potentially at risk due to exposure to PFAS present in environmental media within the Project 1007 waterways. Protection at the individual-level is appropriate if listed species are present. As indicated in **Table 1**, several listed species may occur in the vicinity of the Project 1007 waterways. The potential risk implications for listed species that may occur in the waterways are considered in Risk Characterization provided in Section 7. In particular, this includes two fish species (least darter and pugnose shiner), the Forster's tern, and the Blanding's turtle documented by the NHIS (MNDNR, 2021c). Although not identified by the NHIS, the federally-listed long-eared bat is also discussed.

The geographic extent of the study area, ecological receptors, the exposure pathways, and the biological endpoints to be considered in the BERA are summarized in the following sections and the ecological CSM is presented in Section 5.4. The CSM describes potential sources, migration routes, routes of exposure, and potential receptors based on available information.

5.1 Geographic Extent of the Study Area

The SLERA (AECOM, 2020a) evaluated surface water, sediment, and foam data collected from the connected waterways within the Project 1007 area from the Tri-Lakes Area and the ODS, downstream to the discharge point in the St. Croix River. The primary finding of the SLERA was that concentrations of PFOS in surface water and sediment collected from Raleigh Creek, Eagle Point Lake, Lake Elmo, and the West Lakeland Area exceeded wildlife ESVs. One sediment sample collected in Eagle Point Lake also exceeded the wildlife ESV for PFOA. PFAS concentrations outside of these areas (e.g., downstream from the West Lakeland Area) were lower than the concentrations in these areas.

Therefore, the focus of the BERA sampling event was to characterize tissue concentrations within Raleigh Creek, Eagle Point Lake, Lake Elmo, and the West Lakeland Area and these areas are the focus of the quantitative BERA evaluations.

5.2 Identification of Ecological Receptors and Potentially Complete Exposure Pathways

As described in Section 2.2, ecological receptors potentially exposed to PFAS associated with the aquatic habitats of Project 1007 include aquatic plants, water column invertebrates, benthic invertebrates, fish, amphibians and reptiles, birds, and mammals. These receptors may be exposed to PFAS either through direct contact with abiotic media (e.g., sediment, surface water, foam) or through consumption of aquatic plants, invertebrates, or other dietary items (e.g., amphibians, fish).

Based on the fate and transport characteristics of PFAS and the findings of the SLERA, wildlife ingestion exposure pathways represent the highest potential for ecological risk within the Project 1007

aquatic habitats. Birds and mammals may consume lower trophic level organisms (aquatic plants, invertebrates, fish) that have bioaccumulated PFAS from environmental media. Based on the comparison of PFAS concentrations to wildlife-based ESVs in the SLERA, PFOS is the primary risk driver with benchmark exceedances for surface water and sediment throughout the waterways.

Direct contact exposures to PFAS in sediment and surface water by aquatic receptors such as invertebrates and fish showed far fewer potential risks in the SLERA than those identified for wildlife. However, additional evaluation was recommended at the conclusion of the SLERA to confirm that direct exposures to PFAS in surface water, sediment, and porewater pose minimal risks.

Additionally, PFAS-containing foam may also be a relevant exposure medium for fish, amphibians and aquatic invertebrates directly exposed to the material. Given that the foam is generally only present intermittently at different locations throughout the Project 1007 waterway and is not an aqueous medium, it is expected that most foam exposures are relatively short in duration and are not expected to result in long-term bioaccumulation into prey items. Therefore, only direct contact exposures for water column receptors were quantitatively evaluated in the BERA, with recognition of the uncertainty in assuming aquatic organisms would reside in the foam.

5.3 Selection of Assessment Endpoints and Measures of Effect

Ecologically-based assessment endpoints and measures of effect were designed to evaluate potential ecotoxicological effects associated with exposure to PFAS within the Project 1007 waterways. According to USEPA (1998), assessment endpoints are formal expressions of the actual environmental value to be protected. They usually describe potential adverse effects to long-term persistence, abundance, or production of populations of key species or key habitats. Typically, assessment endpoints and receptors are selected for their potential exposure, ecological significance, economic importance, and/or societal relevance.

Because assessment endpoints often cannot be measured directly, a set of surrogate endpoints (measures of effect) are generally selected that relate to the assessment endpoints and have measurable attributes (e.g., comparison of media concentrations to screening levels, results of food web models) (USEPA 1997, 1998). These measures of effect provide a quantitative metric for evaluating potential effects of constituents on the ecosystem components potentially at risk. Since each measure of effect has intrinsic and extrinsic strengths and limitations, several measures of effect may be used to evaluate each assessment endpoint.

Ecological receptors are defined as plant and animal populations, communities, habitats, or sensitive environments. If listed species are potentially present for a receptor group, protection at the individual level, rather than the community level is appropriate and is discussed in risk characterization (Section 7). The assessment endpoints and measures of effect selected for the BERA are:

Assessment Endpoint	Measure of Effect
Protection and maintenance of aquatic plant, fish, and water column invertebrate communities within aquatic habitats associated with Project 1007 at levels similar to those of nearby populations not exposed to Project 1007 PFAS.	Comparison of surface water and foam PFAS concentrations to screening levels protective of direct toxicity to aquatic life.
Protection and maintenance of benthic invertebrate communities within aquatic habitats associated with Project 1007 at levels similar to those of nearby populations not exposed to Project 1007 PFAS.	Comparison of sediment PFAS concentrations to direct toxicity freshwater sediment screening levels. Comparison of porewater PFAS concentrations to direct toxicity freshwater surface water screening levels for aquatic life.
Protection and maintenance of semi-aquatic and aquatic wildlife receptors (i.e., birds and mammals expected to forage within the aquatic habitats associated with Project 1007) at levels similar to those of nearby populations not exposed to Project 1007 PFAS.	Comparison of calculated total daily dose (TDD) from exposure to PFAS in surface water, sediment, and ingestion of contaminated prey items to chemical-specific toxicity reference values (TRVs).

Although reptiles may be exposed to PFAS in surface water and sediment, receptor-specific screening values are not available. Therefore, the potential for impacts to reptiles are assessed qualitatively. The available surface water screening levels were designed to be protective of aquatic plants and amphibians, in addition to water column invertebrates and fish.

5.4 Ecological Conceptual Site Model

The ecological CSM for aquatic habitats within the Project 1007 waterways helps to characterize the extent of PFAS contamination and identify mechanisms of fate and transport within the area. The presence of PFAS in surface water, sediment, or porewater may directly impact aquatic and semi-aquatic receptors present in the water bodies (e.g., fish, amphibians, invertebrates) or may result in bioaccumulation of PFAS into fish and other aquatic and semi-aquatic species that serve as prey items for birds and mammals foraging in the aquatic habitats. PFAS-containing foam may also be a temporary exposure medium for some ecological receptors. These PFAS exposures may pose unacceptable potential risk to some ecological receptors.

The purpose of the ecological CSM provided in **Figure 8** is to provide a clear and concise description of how ecological receptors may encounter PFAS via release mechanisms resulting in exposure to media in the aquatic habitats of Project 1007 and in aquatic habitats of connecting and adjacent waterways. The ecological CSM has been developed based on a review of the existing information regarding the impacted media at the site, likely transport pathways, and biological characteristics of the area.

5.4.1 Source Areas

The Project 1007 stormwater conveyance system was constructed to mitigate flooding in landlocked areas of the sub-watershed. The conveyance system transports water approximately 14 miles from the Tri-Lakes Area to the St. Croix River. South of the Tri-Lakes Area is the WCL where PFAS-

impacted water was discharged to the Project 1007 waterways in the late 1980s to the early 1990s. Another prominent water body in the area is Raleigh Creek. Raleigh Creek is a natural stream with headwaters west of Interstate 694 (I-694) that connects with the Project 1007 waterways south of the Tri-Lakes Area near Tablyn Park. Raleigh Creek drains the wetlands immediately around the former ODS where 3M historically disposed of wastes containing PFAS. Runoff from the ODS drains into Raleigh Creek and contributes to the eastward transport of PFAS-impacted surface water within the Project 1007 waterways.

As described in Section 2, the VBWD constructed the Project 1007 stormwater conveyance system in the late 1980s to prevent flooding in the Tri-Lakes area (DeMontreville, Olson, and Jane). This large flood control project directed the flow of water from the Tri-Lakes area through storm sewer pipes, open ditches and existing surface water bodies to the St. Croix River. The primary sources of PFAS contamination contributing to impacts within the Project 1007 waterways are surface water flow exiting the ODS via Raleigh Creek and historic discharges of groundwater from the WCL. Both sites are locations where PFAS manufacturing wastes were disposed of from the 1950s through the early 1970s.

As indicated in **Figure 1**, the ODS is located upstream of the Project 1007 stormwater conveyance route and connects to Project 1007 via Raleigh Creek at Tablyn Park (confluence). The WCL is located approximately 0.3 miles east of the upper reaches of Project 1007 and upstream of the confluence. The WCL was hydraulically connected to Project 1007 via a storm sewer pipe that was installed to divert water from the landfill groundwater gradient control system to the Project 1007 waterways. The connection between the landfill and Project 1007 discharged untreated water from the gradient control system between the late 1980s and the early 1990s. There may also be PFAS impacted groundwater that discharges into Project 1007 from the WCL.

5.4.2 Release Mechanisms and Exposure Media

PFAS wastes within the ODS and WCL were directly discharged into the surface water of the Project 1007 stormwater conveyance route or tributaries to the Project 1007 waterways. Migration of PFAS is expected to occur from these source areas through surface water and groundwater since PFAS are highly soluble in water such that releases at the surface typically result in vertical migration to groundwater. Surface water runoff can also provide a pathway for PFAS to migrate from the disposal sites via channelized or sheet flow leading to downgradient waterbodies.

PFAS leached from the disposal sites into the groundwater and were then transported both vertically and laterally from these primary sources. PFAS in groundwater may discharge into downgradient waterbodies (referred to as gaining stream conditions) and, in some cases, constituents in surface water may discharge into the groundwater (referred to as losing stream conditions). An on-going source assessment is investigating the connections between surface water and groundwater from Project 1007.

Although PFAS are highly water soluble, some may have been adsorbed onto sediment particles within the waterbodies. It is likely that sediment particles containing PFAS are mobilized during storm

events and settle out in downstream depositional areas. PFAS may also be desorbed from sediment particles into the water column at locations downstream or downgradient of the original source areas.

PFAS-containing foam has also been observed within some Project 1007 waterbodies and tributaries (e.g., Project 1007 upstream of the confluence, Raleigh Creek both upstream and downstream of the confluence, Eagle Point Lake, and the stream channel within the West Lakeland Area) and within adjacent waterbodies (Sunfish Lake and Valley Branch Creek). The Michigan Department of Health and Human Services (MDHHS) published a factsheet regarding foam on surface water bodies describing this occurrence (MDHHS, 2019): "Foam can occur naturally or because of pollution in the water. Natural foam can form from decomposing plants and algae and could contain bacteria. Chemicals, like surfactants or detergents, in the water also cause foam on lakes and rivers." Foam generation within Project 1007 is likely caused by agitation in streams due to rapid water flows or in lakes due to wind and wave action. The concentrations of PFAS in foam is related, in part, to the concentration of PFAS in the underlying surface water and the degree to which PFAS concentrates in the foam during the fractionation process. The extent to which natural organic matter contributes to foam formation in the different areas of Project 1007 is unknown.

5.4.3 Ecological Exposure Pathways

A complete ecological exposure pathway is defined in USEPA guidance (1997, 1998) as "one in which the chemical can be traced or expected to travel from the source to a receptor that can be affected by the chemicals." Each exposure pathway includes a potential source of a contaminant, an environmental medium, and a potential exposure route. An exposure pathway must be complete before exposure of receptors to chemicals can occur. A complete exposure pathway must have the following five elements:

1. A source (e.g., PFAS waste);

2. A mechanism for release and migration of chemical (e.g., discharge to surface water);

3. An environmental/physical transport and exposure medium (e.g., surface water, sediment);

4. An exposure point or site of potential contact (e.g., impacted surface water body); and

5. A receptor and route of intake (e.g., dietary ingestion of prey that have taken up PFAS).

If one or more elements are not present, the pathway is incomplete. In accordance with agency guidance, incomplete routes of exposure are not evaluated in the ERA.

PFAS in surface water and sediment may be contacted directly by aquatic plants, fish, reptiles, amphibians, and aquatic and benthic invertebrates living in the water column or sediment. Sediment porewater represents a potential exposure medium for aquatic plants and benthic invertebrates at the groundwater-surface water interface. Wildlife foraging within the Project 1007 waterways could also be exposed directly to PFAS through ingestion of drinking water, incidental ingestion (e.g., ingestion during preening or during foraging activities), and indirectly by ingestion of contaminated prey items. Uptake of PFAS through the different levels of the wildlife food web (trophic levels) can occur through the process of bioaccumulation, and some PFAS may biomagnify.

Chemicals that biomagnify can significantly increase in concentration up the food web, typically having greatest concentrations in the tissue of tertiary level carnivorous or piscivorous (fish-eating) birds and mammals. Conder et al. (2008) noted that the biomagnification of PFAS in aquatic food webs is

lower than that of most persistent lipophilic compounds, with PFOS being the only perfluorinated acid consistently exhibiting the potential for biomagnification. Penland, et al. (2020) found evidence of PFOS biomagnification for several fish species (e.g., bluegill, channel catfish, whitefin shiner), in a freshwater stream system in North Carolina with low levels of PFOS in the water and sediment (0.0043 µg/L in surface water and 0.56 µg/kg in sediment).

Aquatic plants, fish, reptiles, amphibians, aquatic invertebrates, and wildlife may also be exposed to foam on the water surface, when present. Due to the intermittent and typically localized presence of the foam, it is expected that most foam exposures are relatively short in duration and are generally limited to certain locations where the foam has been observed to accumulate. The intermittent and typically localized presence of foam would preclude the potential for bioaccumulation along most of the Project 1007 waterways, with the possible exception of the localized areas where foam has been observed to accumulate more frequently (e.g., sections of Raleigh Creek) and where PFAS may be present in higher concentrations in nearby sediment, plants, and aquatic invertebrates. Direct acute exposure by aquatic plants, fish, reptiles, amphibians, invertebrates, birds, and mammals to foam represents a potentially complete pathway that is challenging to quantify, as foam is not a solid or aqueous medium with readily applicable ESVs and may contain approximately 90% air (Schilling and Zessner, 2011).

6.0 Risk Analysis

The risk analysis phase of the BERA is based on the CSM developed in the problem formulation. Risk analysis includes both the characterization of potential ecological exposure and effects. The ecological exposure assessment involves the identification of potential exposure pathways and an evaluation of the magnitude of exposure for the identified ecological receptors. The ecological effects assessment describes the potential adverse effects associated with the identified COPECs to ecological receptors and reflects the type of assessment endpoints selected. The data and methods that were used to identify and characterize ecological exposure and effects are described in the following sub-sections.

6.1 Risk Analysis for Lower Trophic Level Receptors

The evaluation of risks to aquatic plants, fish, aquatic and benthic invertebrates, and amphibians focused on the comparison of PFAS concentrations in surface water, sediment, or porewater against appropriate risk-based sediment and surface water ESVs provided in **Table 3**. The ESVs are consistent with those used in the SLERA (AECOM, 2020a) and include the following:

- Surface water and porewater
    - o Freshwater aquatic life protection values from Conder, et al (2020) referred to as the hazardous concentration 1% (HC1). These values are protective of 99% of aquatic species. Given the conservative nature of the HC1, data were also considered relative to the hazardous concentration 5% (HC5) which is protective of 95% of aquatic species. This level of protection is similar to the level of protection afforded by EPA's National Recommended Water Quality Criteria for Aquatic Organisms (USEPA, 2018). The HC1 and HC5 ESVs are only available for PFOS and PFOA and were derived using data for freshwater fish, amphibians, plants, and invertebrates (including water fleas, insect larvae, and shellfish).
    - o Chronic recommended water quality risk-based screening levels (RBSLs) for aquatic life (Divine et al., 2020). Acute water quality RBSLs for aquatic life from Divine et al. (2020) were also used to evaluate foam data. Chronic RBSLs represent a 4-day average exposure and sublethal endpoints, while acute RBSLs represent a 1-hour average exposure and lethality as the endpoint.
- Sediment
    - o No effect value protective of benthic invertebrates directly exposed to PFOS in sediment (NPCA 2008). Recent literature from Conder et al. (2020) and Divine, et al. (2020) were reviewed, but lacked available sediment toxicity data for benthic invertebrates.

Surface water direct contact ESVs are available for 11 PFAS and only a single sediment direct contact ESV is available. For the remaining PFAS, appropriate ESVs from reasonable surrogates were identified. In general, surrogate ESVs were selected based on similar carbon chain lengths and functional groups (e.g., perfluoroalkyl sulfonic acids [PFSA], perfluoroalkyl carboxylic acids [PFCA]) (Divine et al., 2020, Zodrow et al., 2020).

Many of the selected surface water ESVs were developed in accordance with the USEPA's Great Lakes Initiative (GLI) methodology (USEPA, 2012; Divine et al., 2020; Zodrow et al., 2020). The GLI methodology provides a scientific approach for the derivation of two tiers of benchmarks (Tier I and Tier II) for the Great Lakes watershed, using robust datasets that are not yet sufficient for the formal

derivation of USEPA's ambient water quality criteria (AWQC). The methodologies allow for using different assessment factors to account for uncertainties associated with less than optimal datasets. Zodrow et al. (2020) and Divine et al. (2020) represent the most recent and comprehensive evaluation of PFAS aquatic toxicology to date and the authors used the GLI approach to develop PFAS benchmarks for use in ERAs.

Uncertainties in the selected benchmarks are expected to be low for data-rich PFAS for which GLI Tier I benchmarks are available (i.e., PFOS and PFOA). Higher uncertainties are expected for GLI Tier II benchmarks. Calculated benchmarks based on limited datasets and use of surrogates are expected to have the most uncertainty. Divine et al. (2020) assigned a moderate to high confidence in PFOS and PFOA Tier I values because they are based on a reasonably robust data set and multiple test species. Lower confidence was indicated for the rest because fewer than five acute toxicity values were available and four or fewer GLI species groups were tested.

Although only minimal exceedances of these ESVs were noted in the SLERA, the BERA re-evaluated the direct contact pathways using the updated dataset (i.e., data collected from the August 2019, Spring 2020, and September 2020 sampling events) and the expanded set of ESVs using surrogate values, as needed.

The direct contact pathways were evaluated for the following five exposure areas: Raleigh Creek-Upper, Raleigh Creek-Other, Eagle Point Lake, Lake Elmo, and the West Lakeland Area. Maximum detected concentrations in surface water, sediment and porewater from each area were screened initially to identify PFAS which warranted further evaluation using the media and area-specific UCL as the EPC for the direct contact evaluations. The evaluation of maximum detected concentrations is not typically included in a BERA, but was included here to confirm the findings of the SLERA using an expanded dataset and media not previously evaluated (i.e., sediment porewater, dissolved phase surface water). **Appendix F** provides the area- and media- specific screening tables.

The UCL was used to represent overall PFAS exposure for benthic invertebrates and aquatic organisms within a particular area. To estimate risks based on direct exposures to surface water, sediment, and porewater, hazard quotients (HQs) were calculated by comparing the EPC for each PFAS (i.e., an estimate of exposure) to the appropriate media-specific ESV (i.e., an estimate of effects) using the following formula:

$$HQ = EPC / ESV$$

PFAS with HQs greater than 1 based on the UCLs were subjected to a more intensive investigation of the data (e.g., detection frequency, magnitude of screening level exceedances, locations with exceedances, confidence in the screening levels, etc.) to build a weight of evidence upon which to base conclusions regarding the potential for ecological risk.

While ecological receptors may be exposed to PFAS in foam, there are uncertainties associated with the mechanism of exposures and the availability of relevant toxicity data and screening levels for foam. Since foam is a more transient and stationary exposure medium than surface water and occurs in individual locations, the foam data were evaluated on a sample-by-sample basis, rather than with UCLs which are more appropriate for exposures averaged over an area. PFAS concentrations were identified if they exceeded either the acute or chronic surface water ESVs. The sample-by-sample foam screening table is provided in **Appendix F**.

6.2 Vertebrate Wildlife Community Risk Analysis

Potential exposure routes for wildlife receptors include potential intentional or incidental ingestion of surface water and sediment, and ingestion of PFAS-contaminated food items (e.g., prey items that have ingested PFAS or plants contaminated via root uptake). The actual amount of exposure to contaminants in the environment by wildlife species as the result of surface water, sediment, or food ingestion depends on several factors.

As an initial assessment of potential wildlife risks, surface water, sediment, and porewater data were compared against wildlife-based surface water and sediment ESVs based on no observed adverse effects level (NOAEL) RBSLs derived by Divine, et al. (2020). These ESVs were derived using food web models based on consumption of plant and prey items impacted by PFAS in water or sediment. The selected wildlife ESVs, shown in **Table 3**, for this initial screen were the lowest of the values derived for the muskrat, little brown bat, river otter, mink, red-winged blackbird (*Agelaius phoeniceus*), tree swallow (*Tachycineta bicolor*), and brown pelican (*Pelecanus occidentalis*). Although not present in the Project 1007 waterways, brown pelican values were utilized based on the need for a piscivorous bird receptor in the evaluation.

In addition to the initial wildlife ESV screen, food web evaluations were completed for the same five exposure areas evaluated for lower trophic level receptors: Raleigh Creek-Upper, Raleigh Creek-Other, Eagle Point Lake, Lake Elmo, and the West Lakeland Area. As shown in **Figures 9 through 11**, the areas under evaluation include a variety of aquatic and wetland habitats. These habitat types include creek and wetland habitats within Raleigh Creek, large open water lake habitat (e.g., Eagle Point Lake and Lake Elmo), and creeks and ponds in the West Lakeland Area. These figures diagram the targeted indicator receptors that were considered in the BERA, including the fish, avian and mammalian indicator species and the feeding guilds they represent.

Some receptor diets (e.g., raccoon, and mink) were slightly modified from those presented in the Work Plan (AECOM, 2020b) to account for potential ingestion of amphibian tissue collected during the BERA field effort.

In addition, due to the availability of fish species at the sampling locations during the September 2020 sampling event, additional forage and predatory fish species were collected. Predatory fish were not anticipated to be present in the West Lakeland Area; therefore, mink and river otter diets in the Work Plan (AECOM, 2020b) did not include predatory fish. Due to the presence of and collection of ample fish samples (see **Appendix B**) within the West Lakeland Area (including predatory fish), the mink and river otter diets were modified to include a higher proportion of fish, including predatory fish, and are now consistent with the dietary assumptions applied to Eagle Point Lake and Lake Elmo.

Wildlife exposure parameters and concentrations of PFAS in sediment, surface water, and food items were used to estimate the potential ingested doses to which wildlife receptors might be exposed within the Project 1007 waterways. Calculation of these ingested doses is discussed below. The models used in this BERA are deterministic models, meaning they represent the average, expected behavior within an exposure area, but lack random variation. In the BERA, single values were selected to represent the exposure parameters such as ingestion rates, body weight, etc. The area-specific food web models are provided in **Appendices G through K**.

6.2.1 Representative Species

Because it is not practical to quantify risks for all species potentially present on a given site, representative wildlife species were selected as receptors for the BERA. The representative aquatic

and semi-aquatic mammalian receptors selected for the food web model included species used in derivation of wildlife RBSLs (Divine et al. 2020) and additional species more likely to forage in the project area. The representative species were selected to include a range of foraging habitats, protective of the guilds for special status and common species that potentially occur within the Project 1007 waterways. The selected species were presented in the Work Plan (AECOM, 2020b) and are discussed below.

Aquatic and Semi-Aquatic Birds. The creeks, streams, ponds, wetlands, and lakes of Project 1007 offer foraging opportunities for various types of waterfowl, wading birds, shorebirds, and top-level piscivores. Of the two state-listed special status bird species identified in **Table 1**, the red-shouldered hawk is expected to be found in upland areas more than within the Project 1007 waterways. However, the Forster's tern may forage within the Project 1007 waterways. Of the migratory birds that are known or suspected to breed in the area, the Henslow's sparrow is an upland ground-feeder that prefers terrestrial invertebrates and seeds rather than the benthic and aquatic insects and plants within the Project 1007 waterways; however, both the bald eagle and the osprey may forage on fish, particularly within Eagle Point Lake and Lake Elmo. Avian receptors were identified to represent the various feeding guilds present in the waterways and to provide surrogates receptors for special status birds potentially foraging in the waterways (i.e., Forster's tern, bald eagle, osprey).

The wood duck, tree swallow, spotted sandpiper, great blue heron, and bald eagle were selected as the representative avian species for evaluation in the food web model. The wood duck is representative of herbivorous birds consuming primarily aquatic plants and is assumed to be protective of the trumpeter swan given its similar diet but lower body weight. The tree swallow is representative of insectivorous birds consuming aquatic emergent flying insects. The spotted sandpiper, a common indicator species used in ERAs, is representative of invertivorous/omnivorous birds consuming primarily benthic invertebrates and a relatively high quantity of sediment. The heron is a piscivorous wading bird consuming primarily forage fish and is also a common indicator species used in ERAs. The bald eagle is a raptor likely to forage within the lake and river habitats; although they forage heavily on fish, other prey items include reptiles, amphibians, birds, and small mammals. However, for the purposes of the BERA, the eagle was assumed to have a diet comprised solely of fish in order to represent piscivorous birds that consume forage fish and predatory fish (e.g., those that may have bioaccumulated higher concentrations of PFAS). The heron and eagle are presumed to be protective of the Forster's tern, which has a diet of small fish, given that the heron has more direct contact with sediment and surface water (the tern dives rather than forages in shallow water) and both the eagle and heron ingest larger fish prey with potentially higher levels of PFAS. The eagle is also assumed to be protective of osprey protected under the MBTA.

Aquatic and Semi-Aquatic Mammals. No aquatic or semi-aquatic special status mammals were identified as potentially occurring at or near the Project 1007 waterways (see **Table 1**). The creeks, streams, ponds, wetlands, and lakes of Project 1007 offer a variety of foraging opportunities for mammals. The muskrat, little brown bat, mink, raccoon and river otter were selected as representative mammalian species. The muskrat is representative of herbivorous mammals consuming primarily rooted aquatic plants. The little brown bat is representative of insectivorous mammals consuming aquatic emergent flying insects. The mink is representative of omnivorous mammals consuming fish, benthic and aquatic invertebrates, and plants and may be present in the perennial waterbodies. The mink is often selected for evaluation in ERAs when bioaccumulative chemicals are of concern, as their potentially highly piscivorous diet and small body weight results in them being a sensitive receptor. The raccoon is a larger omnivorous mammal that is adaptive to both terrestrial and aquatic habitats; therefore, it was selected as the omnivorous mammal more likely to be

present in the creek habitats, which may be seasonally dry. The river otter is a piscivorous mammal consuming primarily fish and is likely to inhabit the larger, deeper waterbodies (ponds and lakes).

6.2.2 Estimation of Exposure

Exposure assumptions (e.g., body weights, food and water ingestion rates, relative consumption of food items, foraging range, seasonal use, etc.) for the selected target wildlife species are provided in **Table 4** with supporting documentation provided in **Appendices G through K**. As discussed in the SLERA and BERA Work Plan (AECOM, 2020a), the parameters presented by Divine et al. (2020) were reviewed and adjusted to reflect Minnesota receptors as needed. As noted above, subsequent dietary modifications were made for some target receptors to account for potential ingestion of amphibian tissue collected during the BERA field event, as well as potential ingestion of predatory fish tissue collected at the West Lakeland Area. These dietary modifications are captured in **Table 4**.

As discussed in Section 3.3, the UCL can be used as an EPC to represent overall PFAS exposure for a receptor community (i.e., benthic invertebrates, aquatic invertebrates, fish, wildlife) within a particular area if there are sufficient samples. If sufficient sample numbers were not available to calculate a UCL, the maximum detected concentration was used as the EPC. The sediment, surface water, and tissue EPCs used in the food web models are identified in the individual area-specific models presented in **Appendices G through K**.

6.2.2.1 Food Item Tissue Concentrations

Prey items for wildlife species evaluated in the food web exposure models include aquatic plants, benthic and aquatic invertebrates, amphibians, forage fish, and predatory fish. As described in Section 3.2, a BERA sampling event was conducted to target tissues for use in the food web model, and to provide a better understanding of PFAS concentrations in biological tissues in the Project 1007 waterway. When available, site-specific tissue data were preferentially used in the food web model. In the absence of site-specific tissue data, tissue concentrations were estimated using Project 1007-specific uptake factors (for amphibians and crayfish) or literature-derived uptake factors (for aquatic plants and aquatic invertebrates).

Snails and bottom fish were collected opportunistically in portions of Raleigh Creek and Eagle Point Lake and were not intended for inclusion in the food web models due to their smaller sample sizes. As shown in **Figure 6**, snail concentrations of PFOS were similar to the crayfish concentrations used to represent benthic invertebrates in the food web models, and bottom fish concentrations were lower than the forage fish and predator fish PFOS concentrations evaluated in the food web models. Therefore, excluding snails and bottom fish from the food web model is not expected to under-estimate wildlife risks.

Site-specific tissue data were used in the relevant exposure areas from which the data were collected. Based on biota availability and presence, not all tissue types were able to be collected from all exposure areas. In these limited instances (i.e., amphibians and crayfish in Lake Elmo [no samples were collected] and amphibians in Eagle Point Lake [only a single sample was collected]), site-specific bioaccumulation factors (BAFs) were developed based on the available tissue and surface water data from elsewhere in the Project 1007 waterway (**Appendix E**).

In general, BAFs were calculated by dividing an individual tissue sample concentration (e.g., PFOS in an amphibian sample from Raleigh Creek-Upper) by the geometric mean of the detected surface water concentrations for the area where the biological sample was collected (e.g., PFOS in surface water from Raleigh Creek-Upper). This process was repeated for each amphibian and crayfish

sample with detected concentrations of PFAS. Then the geometric mean of the individual BAFs was calculated over selected areas with surface water concentrations similar to the surface water in the areas where the BAFs were to be applied. This approach is similar to the approach used by MPCA to derive PFOS BAFs for fish (MPCA, 2020b).

Total surface water concentrations, rather than dissolved phase, were used to derive the BAFs because crayfish and amphibians may ingest particulate matter associated with the surface water and a larger total surface water data set was available in each area (dissolved phase data were only collected in the BERA sampling event). As discussed in Section 7.3.5, dissolved and total surface water concentrations were generally similar, and the differences did not necessarily follow any clear patterns. While sediment and porewater data were also available near the crayfish and amphibian sample locations, the sediment data were more spatially variable, PFAS were detected less frequently in sediment and porewater than in surface water, and crayfish and amphibians may not be significantly exposed to porewater compared to surface water or sediment. The surface water data are expected to be reasonable for estimating bioaccumulation into mobile crayfish and amphibians foraging within an exposure area. While only a sub-set of BAFs were calculated for use in the BERA, the available data provided in **Appendix A** can be used to derive BAFs for other media-tissue pairs that may be relevant to deriving cleanup goals.

Amphibian and crayfish tissue concentrations were calculated for use in the Lake Elmo and Eagle Point Lake food web models by selecting BAFs for areas that have comparable levels of PFAS detected in surface water, which in most cases are Eagle Point Lake and the West Lakeland Area. When individual BAFs were not available for these areas, BAFs calculated for other areas including Raleigh Creek-Upper and Raleigh Creek-Other were included in the calculation. The site-specific BAFs used in the food web models are presented in **Table 5** and the BAF calculations are provided in **Appendix E**.

Since aquatic plants and aquatic (water column) invertebrates were not collected within the Project 1007 waterways, these tissue concentrations were estimated using literature-derived uptake factors.

The available surface water-to-aquatic plant BAFs from Conder et al. (2020), Divine et al. (2020), and Zodrow et al. (2020) and the aquatic plant biota sediment accumulation factors (BSAF) from Divine et al. (2020) and Zodrow et al. (2020) were reviewed for potential use in the BERA. Conder et al. (2020) and Divine et al. (2020) were funded by the Department of Defense (DoD) under the Environmental Security Technology Certification Program (ESTCP) and Strategic Environmental Research and Development Program (SERDP). Zodrow et al. (2020) is a peer-reviewed journal article that builds on the findings in Divine et al. (2020).

Ultimately, the surface water-to-aquatic plant BAFs from Divine et al. (2020) and Zodrow et al. (2020) were selected for use in this BERA based on the plant species most likely ingested by wildlife and the higher frequency of detection of PFAS in surface water relative to sediment. However, the potential for adverse effects to herbivorous receptors was further explored in the risk characterization phase for risk driving PFAS through an evaluation of plant tissue concentrations derived via sediment-plant BSAFs. Surrogate BAFs were used, as needed, and were selected based upon similarity of the functional groups and/or number of perfluorinated carbons (Divine et al. 2020, Zodrow et al. 2020).

Similarly, for aquatic invertebrates the available surface water-to-aquatic invertebrate BAFs from Conder et al. (2020), Divine et al. (2020), and Zodrow et al. (2020) were reviewed for potential use in the BERA. Ultimately, the surface water-to-aquatic invertebrate BAFs from Divine et al. (2020) and Zodrow et al. (2020) were selected for use in this BERA because they are typically based on

geometric means of multiple BAFs, rather than a single study, and were derived from field studies as opposed to laboratory studies. The BAFs in Conder et al. (2020) are based on one of two laboratory studies. As discussed in Divine et al. (2020), "field data are preferred because they provide a more representative measure of uptake from all exposure routes (whereas laboratory studies typically focus on a single exposure media) and concentration of PFAS in biota in the field would be expected to have reached equilibrium with concentrations in the environment." Surrogate BAFs were used, as needed, and were selected based upon similarity of perfluorinated carbon chain length and/or functional groups.

The selected literature-based aquatic plant and aquatic invertebrate BAFs are presented in **Table 6**. Aquatic plant and aquatic invertebrates tissue concentrations were estimated by multiplying the chemical- and receptor-specific BAFs by the surface water EPCs within each exposure area.

6.2.2.2 Calculation of Potential Doses

To estimate potential dietary exposure, a TDD was estimated for each species consistent with USEPA (1997) and generally consistent with SERDP methodologies (Conder et al. 2020; Divine et al. 2020). The TDD calculation considers the following factors: concentrations of the contaminant in the food items that the species would consume, estimated amounts of surface water as drinking water, estimated amounts of abiotic media (e.g., soil, sediment) that it would be incidentally ingested, the relative amount of different food items in its diet, body weight, species-specific area use factors (AUFs), seasonal use factors (SUFs), and food ingestion rates.

The AUF is a ratio based on the size of the available habitat within the exposure area divided by an organisms' home range size. The larger the animal's home range, the smaller the AUF (less likely to forage solely in one exposure area). A SUF is defined as the fraction of the year a receptor spends within the exposure area. Since the target species were selected to be protective of entire guilds and to protect resident species as well as transient species, a default SUF of 1 was applied for all wildlife receptors regardless of potential target receptor seasonal presence. This SUF assumes the receptors are present all year and do not migrate out of the study area for the winter months (forage within the study area for their entire lifespan); this assumption may be conservative for birds that are only present for a portion of the year, but was selected due to the possible presence of species protected under the MBTA as well as all species that are present during a sensitive life stage (e.g., breeding season).

The following generalized equation was used to evaluate the TDD from each source (i.e., food item, drinking water, incidental ingestion):

$$TDD = \frac{\sum(\text{Tissue or Media Concentration} \times \text{Ingestion Rate} \times \text{AUF} \times \text{SUF})}{\text{Body Weight}}$$

This generalized equation was modified for each representative species and exposure area using the exposure parameters presented in **Table 4** and the EPCs considered in the TDD calculations are indicated below:

Area	Abiotic EPCs		Tissue EPCs (µg/kg, wet weight)					
	Sediment (µg/kg, dry weight)	Total - Surface Water (µg/L)	Aquatic Plant [1]	Aquatic Invert. [1]	Benthic Invert.	Amphibian	Forage Fish	Predatory Fish
Raleigh Creek - Upper	154	3.0	574	846	107	730	6009	NS
Raleigh Creek - Other	6.5	0.28	53.7	79.2	24.7	43.2 [2]	370	NS
Eagle Point Lake	74.5	0.32	60.4	88.9	23.3	145 [1]	2104	2466
Lake Elmo	4.5	0.19	36.1	53.3	27.8 [1]	86.7 [1]	1423	1653
West Lakeland Area	2.7	0.20	37.7	55.5	48.2	117	1032	1435

Notes
The EPC is the 95% UCL for measured data, unless otherwise noted.
NS - Not sampled.
1 - EPC is a calculated value.
2 - EPC is a maximum detected value.

6.2.3 Estimation of Effects

TRVs can be defined as the daily dose of a constituent that is considered protective of wildlife (mammals and birds) populations or individuals. The dose is expressed in milligram per kilogram body weight per day (mg/kg-bw/day) and can be based on either a NOAEL or a lowest observed adverse effects level (LOAEL).

USEPA guidance (USEPA, 1997) specifies that it is preferred that TRVs represent a NOAEL for chronic exposure to site-related constituents. Should a NOAEL not be available, USEPA guidance allows the use of the lowest exposure level shown to produce adverse effects (i.e., the LOAEL) in the development of TRVs. Both upper and lower bound TRVs (LOAEL-based TRVs and NOAEL-based TRVs, respectively) were developed for this assessment in order to estimate a range of potential risks to mammalian and avian receptors. The NOAEL-based TRVs represent non-hazardous exposure levels for the wildlife species evaluated, below which adverse effects are not expected for individuals or populations. The LOAEL-based TRVs represent potential exposure levels at which adverse effects may become evident for ecological receptor populations.

Current literature sources of TRVs was reviewed, including Conder et al. (2020), Divine et al. (2020), and Zodrow et al. (2020). The selected TRVs for birds and mammals are presented in **Tables 7 and 8**, respectively. TRVs were preferentially selected from Divine et al. (2020) and Zodrow et al. (2020) due to preference for the Ecological Soil Screening Level (Eco-SSL) TRV-derivation approach (USEPA, 2005) that was used by these sources and that Zodrow et al. (2020) is a peer reviewed journal article. As a secondary source, TRVs were selected from Conder et al. (2020) since these TRVs were based on single-study sources and include TRVs based upon PFAS mixtures. In the absence of available TRVs, surrogate TRVs were assigned based on similar chain length and class.

The selection of surrogates based on similarities in carbon chain length and structure is consistent with Conder et al. (2020), Divine et al. (2020), and Zodrow et al. (2020).

Risk estimates for wildlife receptors are defined as the ingested dose divided by the species-specific TRV:

$$HQ = TDD/TRV$$

Two types of HQs were calculated for birds and mammals using the NOAEL and LOAEL TRVs to estimate the potential for adverse effects due to PFAS. By calculating two HQs, one equal to the dose divided by the NOAEL and one equal to the dose divided by the LOAEL, a risk manager can more definitively assess risk to the typical individual and to the overall population. For the wildlife assessment endpoints evaluated using the food web model, the following general conclusions can be drawn using these three categories to describe potential ecological risk:

- If the NOAEL HQ<1, then no unacceptable risk exists to individuals or receptor populations.
- If the NOAEL HQ>1 but LOAEL HQ <1, risk is unlikely for individuals but cannot be confidently excluded. Unacceptable risks to the receptor population are unlikely.
- If the LOAEL HQ > 1, there is potential risk to the receptor population.

7.0 Risk Characterization

The results of the BERA risk analysis were analyzed and interpreted to determine the likelihood of adverse environmental effects due to PFAS exposure, and to determine whether a conclusion of no significant risk could be reached for each assessment endpoint evaluated. The ecological risk characterization summarizes the results of the risk analysis phase of work and provides interpretation of the ecological significance of the findings.

The sections below discuss the measures of effect for each receptor community (i.e., benthic invertebrates, aquatic organisms, fish, wildlife) and integrates those findings into an overall risk characterization for each exposure area. The assumptions and uncertainties that may impact the risk characterization are also discussed.

7.1 Risk Characterization for Lower Trophic Level Receptors

Potential risks to benthic and aquatic receptors from direct exposure to PFAS in surface water, sediment, and porewater were evaluated using ESV comparisons. Sample-by-sample aquatic life ESV comparisons were conducted for foam. The results and findings are provided in the sub-sections below.

7.1.1 Surface Water, Sediment and Porewater

As described in Section 6.1, maximum detected concentrations in surface water, sediment, and porewater in each area were initially screened to identify PFAS which warranted further evaluation using the UCLs. Media and area-specific UCLs were then calculated for the sub-set of PFAS requiring further evaluation in these three media. **Appendix D** identifies the UCLs and provides the supporting ProUCL documentation. **Appendix F** provides the ESV comparison tables for surface water, sediment, and porewater and **Tables 9 through 11** summarize the resulting HQs for these three media, respectively. The results of the UCL evaluations resulting in HQs above 1 are summarized below.

Area	Direct Exposure HQs > 1 using ESVs and UCLs		
	Surface Water	Sediment [1]	Porewater [2]
Raleigh Creek-Upper	PFOS (total) HQ = 5.4 PFOS (dissolved) HQ = 2.9	No benthic invertebrate HQs > 1	PFOS (dissolved) HQ = 3.5
Raleigh Creek-Other	No aquatic life HQs > 1	No benthic invertebrate HQs > 1	No aquatic life HQs > 1
Eagle Point Lake	No aquatic life HQs > 1	No benthic invertebrate HQs > 1	PFOS (dissolved) HQ = 2.0
Lake Elmo	No aquatic life HQs > 1	No benthic invertebrate HQs > 1	Not sampled
West Lakeland Area	No aquatic life HQs > 1	No benthic invertebrate HQs > 1	No aquatic life HQs > 1

Notes:

1 – A direct exposure ESV for sediment was only available for PFOS and this ESV was used as a surrogate for other long-chain PFAS. It is noted that concentrations of other PFAS were also below the PFOS ESV.

2 – Total porewater was only analyzed in three samples collected from the West Lakeland Area.

As indicated above, PFOS was the only PFAS detected in surface water and porewater above the chronic ESVs protective of aquatic life. In Raleigh Creek-Upper, total and dissolved PFOS in surface water and dissolved PFOS in porewater exceeded the chronic aquatic life ESV (represented by the HC1) and in Eagle Point Lake, dissolved PFOS in porewater exceeded the chronic aquatic life ESV. NOAEL HQs based on the PFOS surface water ESV ranged from 2.0 in Eagle Point Lake to 5.4 in Raleigh Creek-Upper. Section 7.3.5 of the uncertainty assessment provides a discussion of total versus dissolved PFAS concentrations in surface water and porewater.

These exceedances are based on the use of the conservative HC1 of 0.56 micrograms per liter (µg/L) from Conder, et al (2020) as the surface water direct toxicity ESV for PFOS. This value is derived to be protective of 99% of species and may overestimate risks to typical aquatic life species but is included in the BERA as a worst-case comparison to be protective of sensitive species. Comparisons to the PFOS HC5 value (5.85 µg/L; Conder, et al., 2020), did not identify aquatic life exceedances within Raleigh Creek or Eagle Point Lake due to surface water or porewater exposures. The HC5 is protective of 95% of species which is more representative of the methodology used to establish AWQC.

Sediment HQs were less than 1 for all PFAS in all exposure areas. Only a single sediment ESV was available so the PFOS ESV from NPCA (2008) was used as a surrogate for other long-chain PFAS. Conder et al. (2020) and Divine, et al. (2020) indicated that the available toxicity data for benthic invertebrates is lacking and insufficient to develop ESVs. However, the evaluation of porewater against aquatic life ESVs was conducted to provide an assessment for benthic invertebrates exposed to PFAS in sediment porewater. As indicated above, this evaluation only identified HQs above 1 in porewater from Raleigh Creek-Upper and Eagle Point Lake using the conservative HC1, and more emphasis is placed on use of the HC5 (for which no risk was indicated) because it reflects the level of protection afforded by USEPA's AWQC. As described in more detail Section 7.3.2, midges may be more sensitive to water exposures of PFOS (including in porewater) than other tested aquatic species and the HC5 may not be sufficiently protective of chronic impacts to the midge due to porewater exposure.

These results indicate no significant risks to typical benthic and aquatic species present within the Project 1007 waterways due to direct contact with surface water, sediment or porewater. The comparisons to the HC1 show the potential for risks to sensitive species in limited areas (Raleigh Creek-Upper and Eagle Point Lake). A review of the NHIS rare species information (MNDNR, 2021c) did not identify special status aquatic species (e.g., fish, aquatic invertebrates, benthic invertebrates, mollusks) within Raleigh Creek-Upper or Eagle Point Lake; although the least darter and pugnose shiner have each been documented in other waterbodies within the study area.

Although ESVs are not available for aquatic reptiles like water snakes or turtles, the lack of significant risks to other aquatic receptors due to direct exposure to surface water and sediments may indicate that reptiles are not likely to be at risk due to direct exposure to PFAS. To date, few PFAS toxicity studies have been conducted with reptiles and linkages between PFAS exposures and endpoints relevant to ecological risk assessments are uncertain (ITRC, 2020; Ankley, et al., 2021).

- Studies on PFOS in the Great Lakes food-web indicate concentrations in snapping turtles (and Chinook salmon and carp) are, on average, 5- to 10-fold less than those in upper trophic level birds and mammals that prey on turtles (mink and bald eagles) (Kannan et al. 2005).
- Blood plasma of snapping turtles collected from the Great Lakes region contained considerable concentrations of PFOS ranging from 105 to 169 ng/mL (mean: 137 µg/L) in males and from <1 to 8.8 µg/L (mean: 6.13 µg/L) in females. This notable gender difference in

the concentrations of PFOS in snapping turtles suggests oviparous transfer of PFOS through egg-laying, similar to that observed for birds and fish (Kannan et al. 2005).

- A study of sea turtles in the North Pacific has shown higher blood plasma concentrations of PFAS in omnivorous species compared to herbivorous species and detected PFAS in the eggs of the omnivorous hawksbill turtle (*Eretmochelys imbricata*). The study found that maternal offloading was strongest in the first clutch of the season and egg concentrations were highest in nest laid near source areas (e.g., international airports) (Wood, et al., 2021).
- PFAS were also detected in the plasma of sea turtles off the coast of North and South Carolina with concentrations showing differences by species, age, and habitat (Keller, et al., 2005).

Birds with similar dietary habits may be a reasonable potential indicator of risk to reptiles in the absence of PFAS toxicity data specific to reptiles. Since the Blanding's turtle, a state threatened species, has been observed within one-mile of the Project 1007 waterway, the findings for the omnivorous spotted sandpiper in Section 7.2 are considered relative to risks to the Blanding's turtle, which is also expected to consume a diet including invertebrates and fish (MNDNR, 2021d).

7.1.2 Foam

Foam samples have been collected at least once within each exposure area. As described in Section 4.2, foam appears intermittently within the Project 1007 waterways and may be associated with agitation of the surface water due to rapid water flows or wind and wave action. **Appendix B** includes photographs of foam observed within Raleigh Creek, Lake Elmo, and the West Lakeland Area. PFAS in foam is more highly concentrated than in nearby surface water samples (averaging over 10,000 times higher than in surface water). However, the mechanisms for ecological exposures to PFAS in foam are poorly understand and comparison of foam concentrations (approximately 90% air; Schilling and Zessner, 2011) to surface water ESVs introduces uncertainty in the risk characterization. As indicated in the photographs in **Appendix B**, the foam may be spread out along the water surface or accumulated and piled more vertically within vegetation or debris.

Appendix F provides a sample-by-sample evaluation of foam concentrations against both acute and chronic aquatic life ESVs and the results of the comparisons are summarized below.

Area	Summary of Foam Comparisons to Aquatic Life ESVs		
	Number of Samples Collected	Number of Exceedances of Chronic ESVs [1]	Number of Exceedances of Acute ESVs
Raleigh Creek-Upper	7	PFHxS = 1 sample PFHpS = 3 samples PFOS = 7 samples PFNS = 4 samples PFDS = 2 samples PFOSA = 7 samples N-MeFOSA = 2 samples N-EtFOSA = 2 samples N-MeFOSAA = 3 samples N-EtFOSAA = 7 samples	PFOS = 3 samples (maximum concentration of 13,800 µg/L; HQ = 24.2)

Area	Summary of Foam Comparisons to Aquatic Life ESVs		
	Number of Samples Collected	Number of Exceedances of Chronic ESVs [1]	Number of Exceedances of Acute ESVs
Raleigh Creek-Other	7	PFHxS = 1 sample PFHpS = 1 sample PFOS = 7 samples PFNS = 2 samples PFOSA = 3 samples N-MeFOSAA = 1 sample N-EtFOSAA = 3 samples	PFOS = 2 samples (maximum concentration of 2,750 µg/L; HQ = 4.8)
Eagle Point Lake	1	PFOS = 1 sample	None
Lake Elmo	3	PFOS = 3 samples PFOSA = 2 samples N-EtFOSAA = 3 samples	PFOS = 2 samples (maximum concentration of 904 µg/L; HQ = 1.6)
West Lakeland Area	4	PFHpS = 2 samples PFOS = 4 samples PFOSA = 3 samples N-EtFOSAA = 3 samples	PFOS = 2 samples (maximum concentration of 20,700 µg/L; HQ = 36.3)

Notes:

1 – PFOS HC1 screening value of 0.56 µg/L was used as a surrogate to evaluate the other long-chain sulfonic PFAS listed in this table (which did not have PFAS-specific ESVs). This chronic benchmark is protective of 99% of species and it expected to overestimate risks to typical aquatic life species, particularly for short duration foam exposures.

As indicated above, PFOS in all samples exceeded the chronic aquatic life ESV (i.e., the conservative HC1) and nine of the 22 samples also had PFOS concentrations above the acute aquatic life ESV. Several additional PFAS constituents also exceeded the PFOS chronic ESV (used as a surrogate for PFAS without specific ESVs). Concentrations of PFHpS, PFOS, PFNS, PFOSA, N-EtFOSA, N-EtFOSAA also exceeded the PFOS HC5 which is deemed by USEPA to provide an appropriate level of protection to the majority of aquatic species likely to be present in a common surface water body (USEPA, 2010).

Applying surface water screening levels to foam samples is considered to be a conservative approach, as the foam is comprised of air and water and is not an entirely aqueous-exposure medium. Direct contact exposures to the foam by aquatic plants, fish, reptiles, amphibians, and invertebrates are considered. It is expected that most foam exposures are relatively short in duration which would likely limit the potential for long-term chronic impacts on aquatic life, except possibly in areas where the foam occurs more frequently and where PFAS may be present in higher concentrations in nearby sediment and plants.

It is not clear that the acute or chronic ESVs are necessarily applicable to evaluating the exposure of aquatic receptors to foam which is composed of a mixture primarily comprised of air with water and organic materials. Due to the relatively short-term nature of the presence of the foam, the chronic ESVs likely overestimate risks (particularly the HC1 value which is exceeded in all foam samples; see **Appendix F**) and acute ESVs are more applicable to evaluating these exposures.

The most significant exposures to foam may occur for aquatic organisms residing on the water surface (e.g., various species of freshwater aquatic insects) and within the sediment porewater of the banks where foam has been observed to intermittently accumulate. Aquatic organisms such as fish and tadpoles are not expected to typically be in direct contact with the foam but may be exposed to elevated PFAS levels when the foam dissipates back into the water.

Wildlife are not likely to be adversely affected by foam via direct contact (due to the presence of fur, feathers, and scales) and foam is not expected to be a bioaccumulation concern due to the relatively short duration of foam occurrences within a particular area. Ingestion of foam during feeding, preening, or drinking could occur but these would likely be infrequent exposures of short durations and are not comparable to ESVs based on chronic exposures via bioaccumulation. Therefore, foam concentrations were not compared against wildlife ESVs which are based on exposures via bioaccumulation. Uncertainties associated with potential exposures of wildlife to foam are discussed in Section 7.3.4.

The results of the screening indicate the potential for risks to aquatic organisms due to exposure to foam. It is expected that chronic risks are overestimated by the ESVs (as the foam exposure are typically short-term), but acute risks due to PFOS in foam may occur within a sub-set of locations with the highest foam concentrations. These locations include RC5, RC7, and RC12 in Raleigh Creek-Upper, RC17 and RC17A in Raleigh Creek-Other, EP21B in Lake Elmo, and WL6 in the West Lakeland Area. Most of these exceedances occurred in samples collected in late summer/early fall, rather than in samples collected in the spring, so there may be a seasonal component to the development of the most PFAS-concentrated foam.

Given that the least darter (state fish of special status) and the pugnose shiner (state threatened species) have been observed within the Project 1007 waterways, foam could pose a risk to these special status species if they have direct interaction with the foam. In Minnesota, least darters are usually found in low-velocity streams with cool to warm waters that are part of a connected lake or stream system. The darters may also be associated with waterbodies that have dense, submerged, aquatic vegetation (MNDNR, 2021e). The pugnose shiner inhabits clear glacial lakes and low gradient small-to-moderate-sized streams in areas of little current. In summer they tend to move shoreward into vegetated areas and move into deeper waters for the fall and winter (MNDNR, 2021f). The presence of foam within these types of habitats may be a concern for these two listed species.

7.2 Vertebrate Wildlife Community Risk Characterization

Based on the fate and transport characteristics of PFAS and the findings of the SLERA, wildlife ingestion exposure pathways represent the highest potential for ecological risk within the Project 1007 aquatic habitats. As recommended in the Work Plan (AECOM, 2020b), surface water and sediment data were evaluated relative to wildlife ESVs to confirm the findings of the SLERA screening which identified wildlife ESV exceedances for PFOA and PFOS. Porewater data were not evaluated in the SLERA, but porewater data were compared to the wildlife ESVs in the BERA to assess the potential for bioaccumulation of PFAS into sediment-dwelling biota to impact birds and mammals.

Sediment and surface water ESVs protective of wildlife consuming contaminated prey were derived by Divine et al. (2020) using a NOAEL-based food web model and back-calculating an acceptable surface water or sediment concentration. The wildlife ESV comparison tables for surface water, sediment, and porewater are included in **Appendix F** and **Tables 9 through 11** summarize the resulting HQs for these media, respectively. The lowest of the available wildlife ESVs was used for

the ESV comparisons so these evaluations are protective of a range of feeding guilds. The results of the UCL evaluations resulting in wildlife-based HQs above 1 are summarized below.

Area	Wildlife Exposure NOAEL-based HQs > 1 using ESVs and UCLs		
	Surface Water	Sediment	Porewater [1]
Raleigh Creek-Upper	PFHxS (total) HQ = 1.2 [2] PFOS (total) HQ = 40.5 PFOS (dissolved) HQ = 21.5	PFOA HQ = 1.1 PFHpS HQ = 2.3 [3] PFOS HQ = 110 PFOSA HQ = 6.2 [3] N-EtFOSAA HQ = 4.1 [3]	PFOS (dissolved) HQ = 26.1
Raleigh Creek-Other	PFOS (total) HQ = 3.8	PFOS HQ = 4.6	No wildlife HQs > 1
Eagle Point Lake	PFOS (total) HQ = 4.3 PFOS (dissolved) HQ = 6.3	PFOS HQ = 53.2	PFOS (dissolved) HQ = 15.2
Lake Elmo	PFOS (total) HQ = 2.5 PFOS (dissolved) HQ = 4.8	PFOS HQ = 3.2	Not sampled
West Lakeland Area	PFOS (total) HQ = 2.7 PFOS (dissolved) HQ = 3.3	PFOS HQ = 1.9	PFOS (total) HQ = 2.9 PFOS (dissolved) HQ = 7.5
Notes: 1 – Total porewater was only analyzed in three samples collected from the West Lakeland Area. 2 - PFOS wildlife ESV of 0.075 µg/L was used as a surrogate to evaluate these PFAS which did not have PFAS-specific ESVs. 3 - PFOS wildlife ESV of 1.4 µg/kg was used as a surrogate to evaluate these PFAS which did not have PFAS-specific ESVs.			

As indicated above, PFOS exceeded the wildlife-based ESVs in surface water and sediment in all exposure areas. PFOS in porewater also exceeded the wildlife ESV in Raleigh Creek-Upper, Eagle Point Lake, and West Lakeland Area. PFOA slightly exceeded the wildlife ESV in sediment in Raleigh Creek-Upper. Surrogates were applied to evaluate PFAS without wildlife ESVs in Divine et al. (2020), and several PFAS in Raleigh Creek-Upper exceeded the PFOS wildlife ESVs in surface water (PFHxS) and sediment (PFHpS, PFOSA, and N-EtFOSAA). These results essentially confirmed the results of the SLERA which indicated that PFOS, and to a lesser extent PFOA, within Project 1007 waterways may pose a risk to wildlife. The SLERA had not used surrogates but would have identified additional PFAS with exceedances if it had.

The need for further evaluation of the potential for adverse effects on wildlife receptors is also confirmed by comparing the available tissue concentrations to tissue-based Federal Environmental Quality Guidelines (FEQGs) for PFOS derived by Environment and Climate Change Canada (ECCC 2018). ECCC derived FEQGs for tissue based on dietary ingestion for both birds and mammals (units of µg PFOS per kg fish tissue). These FEQGs for wildlife diet (8.2 and 4.6 µg/kg for birds and mammals, respectively) were derived to protect species that consume aquatic biota and represent the PFOS concentration in a food item (i.e., fish or shellfish) that could be consumed by wildlife. PFOS concentrations in nearly all of the site-specific tissues summarized in Section 4.3, with the exception of a few samples from Raleigh Creek-Other, exceed the tissue-based FEQGs; in many cases by orders of magnitude (maximum fish tissue PFOS concentration was 6,350 µg/kg). Like the sediment and surface water ESVs protective of wildlife derived by Divine et al. (2020), the tissue-based FEQGs are based on generic receptors and uptake factors and toxicity data available in the literature at the time and are intended to represent a conservative assessment of the potential for risks to wildlife. These exceedances confirm the findings of the screening conducted using wildlife-based ESVs in surface

water and sediment (summarized in the table above) and indicate that additional evaluation is warranted to further assess the potential for risks to wildlife using more site-specific information and more current toxicity data.

As described in Section 6.2, deterministic food web models were used to quantitatively evaluate the potential for risks to wildlife within each exposure area using the abiotic data evaluated in the ESV comparisons and the tissue data collected during the BERA sampling event. Although the wildlife ESV comparisons summarized above only identified a short list of PFAS exceeding the ESVs, each food web model included all of the PFAS that were detected in more than one area-specific tissue sample. This approach was selected to provide a comprehensive evaluation of the relevant PFAS in each area.

A TDD was calculated for each wildlife receptor in each exposure area using the EPC (i.e., the maximum concentration or the UCL) for surface water, sediment and food items. The estimated TDD was compared to NOAEL- and LOAEL-based TRVs. The results of these comparisons (i.e., HQs) are summarized below. Note, only HQs greater than 1 are shown in the table. The individual food web models are provided in **Appendices G through K** and **Table 12** summarizes the resulting HQs within each exposure area. PFOS was the only PFAS resulting in HQs above 1 for wildlife. The avian and mammalian receptors with PFOS HQs above 1 are summarized below and discussed by area in the following sub-sections.

Receptor	Food Web Model Hazard Quotients > 1				
	Raleigh Creek-Upper	**Raleigh Creek-Other**	**Eagle Point Lake**	**Lake Elmo**	**West Lakeland Area**
Tree Swallow	PFOS NOAEL HQ = 1.5	None	PFOS NOAEL HQ = 1.2	None	None
Spotted Sandpiper	PFOS NOAEL HQ = 3.6	None	None	None	None
Great Blue Heron	PFOS NOAEL HQ = 11.1 PFOS LOAEL HQ = 1.1	None	PFOS NOAEL HQ = 3.9	PFOS NOAEL HQ = 2.6	PFOS NOAEL HQ = 1.9
Muskrat	PFOS NOAEL HQ = 1.9 PFOS LOAEL HQ = 1.1	None	None	None	None
Little Brown Bat	PFOS NOAEL HQ = 1.4	None	None	None	None
Mink	Not evaluated	Not evaluated	PFOS NOAEL HQ = 2.7 PFOS LOAEL HQ = 1.6	PFOS NOAEL HQ = 1.8 PFOS LOAEL HQ = 1.1	PFOS NOAEL HQ = 1.5

The wildlife-based HQs resulting from the area-specific food web models are lower than the HQs based on the literature value (i.e., wildlife ESV) comparisons for surface water, sediment, and porewater. For PFOS, the maximum HQ for the wildlife ESV comparisons was 110 and the maximum site-specific food web model HQ was 11. This result is not unexpected as the wildlife ESVs were selected based on the most conservative of the wildlife receptors modeled by Divine, et al. (2020)

and are intended to represent a conservative assessment of the potential for risks to wildlife. The food web based HQs are derived from actual measured tissue concentrations (with the exception of aquatic plants and aquatic invertebrates) and are expected to more accurately reflect the potential area-specific risks.

7.2.1 Raleigh Creek

Appendices G and H present the food web models for Raleigh Creek-Upper and Raleigh Creek-Other, respectively. Raleigh Creek was divided into two exposure areas due to the differences in concentrations of PFAS between the areas. As examples, the PFOS EPCs for forage fish and sediment were 16 times higher and 24 times higher in the upper portion of the creek than the remainder of the creek, respectively.

Wildlife receptors in both exposure areas were the same and included: wood duck, tree swallow, spotted sandpiper, great blue heron, muskrat, little brown bat, and raccoon. All HQs for Raleigh Creek-Other were less than 1 (**Table 12a**). HQs greater than 1 were calculated for PFOS for five receptors in Raleigh Creek-Upper: tree swallow, spotted sandpiper, great blue heron, muskrat, and little brown bat (**Table 12b**). These receptors are discussed below.

Tree swallow (diet: aquatic plants and benthic and aquatic invertebrates) - Only the NOAEL-based HQ for PFOS was above 1 (HQ = 1.5) for the tree swallow in Raleigh Creek-Upper. The majority of the PFOS TDD came from the ingestion of aquatic invertebrates. Aquatic invertebrate concentrations were estimated from surface water concentrations using a literature-based BAF. The calculated aquatic invertebrate EPC was about eight times higher than the measured crayfish EPC which may indicate that aquatic invertebrate concentrations are overestimated. It would be expected that aquatic invertebrates, such as the larval stages of midges, mayflies, and other flies that have shorter aquatic life cycles than crayfish (less time to accumulate PFOS), should have lower PFOS concentrations than crayfish. If the aquatic invertebrate EPC was set equal to the measured benthic invertebrate (crayfish) EPC, the HQs for the tree swallow would be below 1. Custer et al (2019) found no impact on hatching success for tree swallows in Michigan with dietary concentrations ranging between 105 and 183 µg/kg and a geometric mean of 138 µg/kg PFOS; the crayfish EPC in Raleigh Creek-Upper is 107 µg/kg PFOS. Previous work by the same authors in Minnesota (Custer, et al., 2013) found hatching success to be impacted at lower dietary concentrations (approximately 20 to 70 µg/kg total PFAS); however, hatching success may have been impacted by the presence of co-contaminants (Ankley, et al., 2021).

Spotted sandpiper (diet: benthic and aquatic invertebrates and forage fish) - Only the NOAEL-based HQ for PFOS was above 1 (HQ = 3.6) for the spotted sandpiper in Raleigh Creek-Upper. The majority of the PFOS TDD came from the ingestion of forage fish which only account for 5% of the diet. This finding is due to the elevated PFOS concentrations in forage fish in the upper portion of Raleigh Creek. Benthic invertebrates represent 80% of the modeled diet for the sandpiper and measured crayfish concentrations were used in the food web model to represent this prey item. PFOS data for two snail composite samples were also available in this exposure area with concentrations below the crayfish EPC. Crayfish are higher in the food chain than other benthic invertebrates consumed by the sandpiper (e.g., snails, leeches, worms, mollusks) so the use of crayfish data may over-estimate actual PFOS exposure through the ingestion of benthic invertebrates. As described above for the tree swallow, the aquatic invertebrate EPC was estimated from surface water concentrations using a BAF and the calculated aquatic invertebrate EPC was about eight times higher than the measured crayfish EPC. Although the EPCs for benthic invertebrates (i.e., crayfish) and aquatic invertebrate may over-estimate risks to

the sandpiper, the forage fish EPC is the driver for calculating the NOAEL-based HQ above 1 for PFOS.

Great blue heron (diet: benthic invertebrates, amphibians, and forage fish) – The NOAEL- and LOAEL based HQ for PFOS were above 1 (HQ = 11.1 and 1.1, respectively) for the great blue heron in Raleigh Creek-Upper. Almost all of the PFOS TDD came from the ingestion of forage fish which account for 80% of the diet. The forage fish EPC, as well as the benthic invertebrate and amphibian EPCs, within Raleigh Creek-Upper are based on measured tissue concentrations and reflect actual biota concentrations in this portion of Raleigh Creek.

Muskrat (diet: aquatic plants and benthic and aquatic invertebrates) – The NOAEL- and LOAEL based HQs for PFOS were above 1 (HQ = 1.9 and 1.1, respectively) for the muskrat in Raleigh Creek-Upper. The majority of the PFOS TDD is attributed to the ingestion of aquatic plants which account for 80% of the diet. The aquatic plant EPC for PFOS is calculated from surface water and a BAF from Divine et al (2020) based on studies conducted with floating aquatic plants (i.e., duckweed, water hyacinth, floating aquatic ferns, and coontail). Divine et al (2020) also derived BSAFs for aquatic plants based on studies with bulrushes and other reeds. Muskrats may also feed on these rooted semi-aquatic wetland plants. If the PFOS BSAF and the sediment EPC are used to calculate the plant tissue EPC, the estimated concentration is higher than was estimated with the aquatic plant BAF and surface water (3,551 vs 574 µg/kg wet weight [ww]) and the NOAEL- and LOAEL- based HQs for the muskrat increase to 10 and 5.9, respectively. As described above for the tree swallow, the benthic invertebrate EPC is based on crayfish data and the aquatic invertebrate EPC is a calculated concentration. Although the EPCs for benthic invertebrates (i.e., crayfish) and aquatic invertebrates may over-estimate risks to the muskrat, the plant tissue EPC is the driver for calculating HQs above 1 for PFOS. However, given the differences in estimated plant tissue concentrations using BAFs and BSAFs, there is some uncertainty in the level of potential risk to the muskrat.

Little brown bat (diet: aquatic invertebrates) – Only the NOAEL-based HQ for PFOS was above 1 (HQ = 1.4) for the little brown bat in Raleigh Creek-Upper. The entire modeled diet of the little brown bat is composed of aquatic invertebrates with the EPC calculated from surface water. As described above for the tree swallow, the modeled aquatic invertebrate EPC may over-estimate actual concentrations in aquatic invertebrates, particularly in the aerial insects that are the basis of the diet for the little brown bat and the tree swallow. The modeled PFOS concentration for aquatic invertebrates (846 µg/kg) is approximately eight times higher than the actual measured crayfish concentrations in this exposure area (107 µg/kg) and given the residence time of aerial insects in the system and the higher trophic status of crayfish in the system, aerial insect concentrations would likely be lower than crayfish. If the measured crayfish EPC is used to represent the aerial insect tissue concentration, the NOAEL-based HQ for PFOS is 0.17.

The LOAEL-based HQs above 1 for the great blue heron and muskrat indicate the potential for population-level risks due to food web exposures to PFOS for piscivorous birds and herbivorous mammals that feed entirely within Raleigh Creek-Upper (AUFs = 1 for both receptors). Risks to the muskrat would be higher if plant tissue concentrations were estimated from sediment instead of surface water. For the tree swallow, spotted sandpiper and the little brown bat, the NOAEL-based HQs for PFOS were above 1 (HQ = 1.5, 3.6 and 1.4, respectively), but the LOAEL-based HQs were less than 1 indicating that unacceptable risks to receptor populations are unlikely, but risks to individuals cannot be confidently excluded.

Threatened or endangered birds and mammals have not been documented within one-mile of Raleigh Creek-Upper (MNDNR, 2021c), so protection at the population level is expected to be the most relevant for this area.

The Forster's tern, a state bird of special status, was documented slightly more than one-mile from Raleigh Creek-Upper in 1994 (MNDNR, 2021c) and the wetlands within Raleigh Creek-Upper may provide habitat for foraging; therefore, it is possible that Forster's terns could be present and exposed to elevated PFOS concentrations in forage fish. The tern prefers to forage in deeper, open portions of wetlands (MNDNR, 2021e) which may be present in some segments of Raleigh Creek-Upper. As indicated by the NOAEL-based HQ for PFOS above 1 for the great blue heron (HQ = 11.1), sensitive piscivorous birds such as the Forster's tern that warrant protection at the individual-level, may be adversely affected by PFOS if they forage within Raleigh Creek-Upper.

It is possible that the federally-threatened northern long-eared bat could occasionally forage within Raleigh Creek-Upper given that the IPaC review identified the species as potentially occurring within the BERA study area. However, the NHIS (MNDNR, 2021c) did not identify observations of the species within a mile of the of the Project 1007 waterways (**Table 1**). MNDNR (2021b) did not identify winter hibernacula or maternal roost trees near the waterways; no roost trees were identified within Washington County and the nearest hibernacula is at least 10 miles from the waterways. If resident bats were present, protection at the individual level (rather than the population level) would generally be warranted; however, this does not appear to be the case within the Project 1007 waterways. The NOAEL-based HQ for PFOS of 1.4 for the little brown bat indicates the low potential for risk to individuals if they foraged regularly in Raleigh Creek-Upper. However, as noted above, this HQ is based on modeled not measured tissue that is expected to over-estimate PFOS concentrations in the prey of the bat and the bats have not been documented within the BERA study area.

As indicated in Section 7.1.1, PFAS toxicity information for reptiles is very limited, but the evaluation of potential risks to birds may be useful for assessing potential risk to reptiles such as the Blanding's turtle, a state threatened species that has been observed within one-mile of the Project 1007 waterway. The Blanding's turtle may be found in a variety of wetland and aquatic habitats and may nest in adjacent sandy uplands or agricultural fields (MNDNR, 2021d). NHIS (MNDNR, 2021c) noted four observations of the Blanding's turtle within one-mile of the waterways, although none were seen in Raleigh Creek itself and all observations were made in the 1990s.

Based on generally similar diets of invertebrates and small fish, the findings for the spotted sandpiper are considered to be reasonably representative of risks to the Blanding's turtle in Raleigh Creek. NOAEL-based HQs for PFOS for the spotted sandpiper were 0.35 in Raleigh Creek-Other and 3.6 in Raleigh-Creek-Upper. As described above, the majority of the sandpiper TDD in Raleigh-Creek-Upper is from forage fish ingestion; a mixed diet of invertebrates or invertebrates and amphibians, which may be more reflective of the turtle diet, would result in NOAEL-based HQs below 1 within both Raleigh Creek-Other and Raleigh Creek-Upper. There is uncertainty in the use of avian toxicity data to assess risks to reptiles, but these HQs indicate the potential for adverse effects on Blanding's turtles if they were to consume forage fish from Raleigh Creek-Upper.

7.2.2 Eagle Point Lake

Appendix I presents the food web model for Eagle Point Lake which included the following receptors: wood duck, tree swallow, spotted sandpiper, great blue heron, bald eagle, muskrat, little brown bat, mink, and river otter. HQs greater than 1 were calculated for PFOS for three receptors in Eagle Point Lake: tree swallow, great blue heron, and mink (**Table 12c**). These receptors are discussed below.

Tree swallow (diet: aquatic plants and benthic and aquatic invertebrates) - Only the NOAEL-based HQ for PFOS was above 1 (HQ = 1.2) for the tree swallow in Eagle Point Lake. The majority of the PFOS TDD came from the ingestion of aquatic invertebrates. As described for the tree swallow in Raleigh Creek-Upper, the aquatic invertebrate concentrations were estimated from surface water concentrations using a literature-based BAF. In Eagle Point Lake, the calculated aquatic invertebrate EPC was nearly four times higher than the measured crayfish EPC which may indicate that aquatic invertebrate concentrations are overestimated. It would be expected that aquatic invertebrates (e.g., larval stages of midges, mayflies, and other flies) that have shorter aquatic life cycles than crayfish (less time to accumulate PFOS), should have lower PFOS concentrations than crayfish. If the aquatic invertebrate EPC was set equal to the measured benthic invertebrate (crayfish) EPC, the HQs for the tree swallow would be below 1. Additionally, the crayfish EPC for PFOS in Eagle Point Lake of 23.3 µg/kg is less than the dietary concentration of 138 µg/kg presented in Custer et al. (2019; discussed above for Raleigh Creek-Upper), i.e., concentration at which tree swallow hatching success was not adversely affected. This crayfish EPC is at the low end of the dietary range where hatching success was impacted in sites with co-contaminants (20 to 70 µg/kg total PFAS; Custer, et al., 2013; Ankley, et al., 2021).

Great blue heron (diet: benthic invertebrates, amphibians, and forage fish) – Only the NOAEL-based HQ for PFOS was above 1 (HQ = 3.9) for the great blue heron in Eagle Point Lake. The majority of the PFOS TDD came from the ingestion of forage fish which account for 80% of the diet. The forage fish EPC, as well as the benthic invertebrate EPC, are based on measured tissue concentrations and reflect actual biota concentrations in Eagle Point Lake. The amphibian EPC was calculated from surface water using a Project 1007-specific BAF based on amphibian and surface water data from other exposure areas. Forage fish account for nearly all of the PFOS TDD, so the impact of the benthic invertebrate and amphibian EPCs on the NOAEL-based HQ is minimal.

Mink (diet: benthic and invertebrates, amphibians, forage fish, and aquatic plants) – The NOAEL- and LOAEL based HQ for PFOS were above 1 (HQ = 2.7 and 1.6, respectively) for the mink in Eagle Point Lake. The majority of the PFOS TDD came from the ingestion of forage fish and predator fish which account for 70% of the diet. The mink is also assumed to consume benthic invertebrates, aquatic invertebrates, plants, and amphibians, but the impact of these EPCs on the HQs in minimal. The forage fish and predator fish EPCs are similar (2,104 vs 2,466 µg/kg ww, respectively) and are based on measured tissue concentrations and reflect actual biota concentrations in Eagle Point Lake.

The LOAEL-based HQ above 1 for the mink indicates the potential for population-level risks due to food web exposures to PFOS for piscivorous mammals that feed entirely within Eagle Point Lake (AUF = 1). For the great blue heron, the NOAEL-based HQ for PFOS was above 1 (HQ = 3.9), but the LOAEL-based HQ was less than 1 indicating that unacceptable risks to receptor populations are unlikely, but risks to individuals cannot be confidently excluded. Threatened or endangered birds and mammals have not been documented within one-mile of Eagle Point Lake (MNDNR, 2021c), so protection at the population level is the most relevant for this area.

One observation of the Blanding's turtle occurred within one-mile of Eagle Point Lake (MNDNR, 2021c) and wetland habitat is present surrounding the lake. All HQs for the spotted sandpiper are less than 1 and a mixed diet of invertebrates or invertebrates and amphibians would result in even lower HQs. Although there are uncertainties in the assessment, the low sandpiper HQs suggest that Blanding's turtles, if present, would not be adversely impacted by PFOS in Eagle Point Lake.

As indicated above for the muskrat in Raleigh Creek-Upper and discussed further in Section 7.3.3, the prediction of plant tissue concentrations from surface water data may underestimate actual PFOS concentrations in plants. If the PFOS concentration in plant tissue was modeled from sediment, rather that surface water, then the muskrat in Eagle Point Lake would have a LOAEL-based PFOS HQ of 2.8, indicating the potential for population-level risks.

7.2.3 Lake Elmo

Appendix J presents the food web model for Lake Elmo which included the following receptors: wood duck, tree swallow, spotted sandpiper, great blue heron, bald eagle, muskrat, little brown bat, mink, and river otter. HQs greater than 1 were calculated for PFOS for two receptors in Lake Elmo: great blue heron and mink (**Table 12d**). The findings for Lake Elmo are very similar to the findings for Eagle Point Lake and the Lake Elmo receptors with HQs greater than 1 are discussed below.

> **Great blue heron** (diet: benthic invertebrates, amphibians, and forage fish) – Only the NOAEL-based HQ for PFOS was above 1 (HQ = 2.6) for the great blue heron in Lake Elmo. The majority of the PFOS TDD came from the ingestion of forage fish which account for 80% of the diet. The forage fish EPC is based on measured tissue concentrations and reflects actual biota concentrations in Lake Elmo. The benthic invertebrate and amphibian EPCs were calculated from surface water using Project 1007-specific BAFs based on tissue (crayfish and amphibian, respectively) and surface water data from other exposure areas. Forage fish account for nearly all of the PFOS TDD, so the impact of the benthic invertebrate and amphibian EPCs on the NOAEL-based HQ is minimal.
>
> **Mink** (diet: benthic and invertebrates, amphibians, forage fish, and aquatic plants) – The NOAEL- and LOAEL based HQ for PFOS were above 1 (HQ = 1.8 and 1.1, respectively) for the mink in Lake Elmo. The majority of the PFOS TDD came from the ingestion of forage fish and predator fish which account for 70% of the diet. The mink is also assumed to consume benthic invertebrates, aquatic invertebrates, plants, and amphibians, but the impact of these EPCs on the HQs in minimal. The forage fish and predator fish EPCs are similar (1,423 vs 1,653 µg/kg ww, respectively) and are based on measured tissue concentrations and reflect actual biota concentrations in Lake Elmo.

The LOAEL-based HQ above 1 for the mink indicates the potential for population-level risks due to food web exposures to PFOS for piscivorous mammals that feed entirely within Lake Elmo (AUF = 1). For the great blue heron, the NOAEL-based HQ for PFOS was above 1 (HQ = 2.6), but the LOAEL-based HQ was less than 1 indicating that unacceptable risks to receptor populations are unlikely, but risks to individuals cannot be confidently excluded. Threatened or endangered birds and mammals have not been documented within one-mile of Lake Elmo (MNDNR, 2021c), so protection at the population level is the most relevant for this area.

Similar to Eagle Point Lake, one observation of the Blanding's turtle occurred within one-mile of Lake Elmo (MNDNR, 2021c) and wetland habitat is present surrounding the lake. All HQs for the spotted sandpiper are less than 1 and a mixed diet of invertebrates or invertebrates and amphibians would result in even lower HQs. Although there are uncertainties in the assessment, the low sandpiper HQs suggest that Blanding's turtles, if present, would not be adversely impacted by PFOS in Lake Elmo.

7.2.4 West Lakeland Area

Appendix K presents the food web model for the West Lakeland Area which included the following receptors: wood duck, tree swallow, spotted sandpiper, great blue heron, muskrat, little brown bat,

mink, and river otter. HQs greater than 1 were calculated for PFOS for two receptors in the West Lakeland Area: great blue heron and mink (**Table 12e**). These receptors are discussed below.

> **Great blue heron** (diet: benthic invertebrates, amphibians, and forage fish) – Only the NOAEL-based HQ for PFOS was above 1 (HQ = 1.9) for the great blue heron in the West Lakeland Area. The majority of the PFOS TDD came from the ingestion of forage fish which account for 80% of the diet. The forage fish EPC, as well as the benthic invertebrate and amphibian EPCs, are based on measured tissue concentrations and reflect actual biota concentrations in the West Lakeland Area. Forage fish account for nearly all of the PFOS TDD, so the impact of the benthic invertebrate and amphibian EPCs on the NOAEL-based HQ is minimal.
>
> **Mink** (diet: benthic and invertebrates, amphibians, forage fish, and aquatic plants) – Only the NOAEL-based HQ for PFOS was above 1 (HQ = 1.5) for the mink in the West Lakeland Area. The majority of the PFOS TDD came from the ingestion of forage fish and predator fish which account for 70% of the diet. The mink is also assumed to consume benthic invertebrates, aquatic invertebrates, plants, and amphibians, but the impact of these EPCs on the HQs in minimal. The forage fish and predator fish EPCs are similar (1,032 vs 1,435 µg/kg ww, respectively) and are based on measured tissue concentrations and reflect actual biota concentrations in the West Lakeland Area.

None of the LOAEL-based HQs in the West Lakeland Area were above 1 which indicates that population-level risks due to food web exposures are unlikely. For the great blue heron and the mink, the NOAEL-based HQs for PFOS were above 1 (HQ = 1.9 and 1.5, respectively), but the LOAEL-based HQs were less than 1 indicating that unacceptable risks to receptor populations are unlikely, but risks to individuals cannot be confidently excluded. Threatened or endangered birds and mammals have not been documented within one-mile of the West Lakeland Area (MNDNR, 2021c), so protection at the population level is the most relevant.

One observation of the Blanding's turtle occurred within one-mile of the West Lakeland Area (MNDNR, 2021c) and wetland habitat is present within this area. All HQs for the spotted sandpiper are less than 1 and a mixed diet of invertebrates or invertebrates and amphibians would result in even lower HQs. Although there are uncertainties in the assessment, the low sandpiper HQs suggest that Blanding's turtles, if present, would not be adversely impacted by PFOS in the West Lakeland Area.

7.3 Uncertainties

The objective of the uncertainty analysis is to discuss the assumptions of the BERA process that may influence the risk assessment results and conclusions. Although it is not practical to account for all sources of uncertainty, it is important to identify and address the major elements of uncertainty in the risk evaluation and assessment. Some uncertainties bias the results of the risk assessment towards excessive risk (high), while others bias towards no significant risk (low).

7.3.1 Uncertainties Associated with Site Characterization

The BERA considers abiotic data collected over multiple sampling events in 2019 and 2020 and tissue data collected in September 2020. Samples were collected throughout Raleigh Creek, Eagle Point Lake, Lake Elmo, and the West Lakeland Area. While not every portion of every exposure area has been characterized, it is anticipated that the available abiotic data is representative of conditions through most of the Project 1007 waterways that provide ecological habitat, with focus on potential

source areas or secondary source areas as well as downgradient areas that may have been impacted.

Biological samples were collected in the fall and certain tissue types (e.g., aerial insects and aquatic invertebrates) were not available to be sampled. The food web model used benthic invertebrates (i.e., crayfish) or modeled invertebrate concentrations from surface water to represent prey items for consumers of invertebrates (e.g., the spotted sandpiper, tree swallow, and little brown bat). As indicated in Section 7.2, the modeled aquatic invertebrate EPC for PFOS used to represent aquatic invertebrates and aerial insects in the diet of the spotted sandpiper, tree swallow, and little brown bat in Raleigh Creek-Upper is eight times higher than the measured crayfish EPC from the area, and in Eagle Point Lake the modeled aquatic invertebrate EPC for PFOS is approximately four times higher than the measured crayfish EPC from the area. A similar relationship between these tissue compartments is observed for Raleigh Creek-Other and the West Lakeland Area (crayfish were not collected from Lake Elmo). Given the higher trophic status of the crayfish (relative to aerial insects and aquatic invertebrates) and the longer aquatic lifecycle of the crayfish, crayfish concentrations would likely be higher than aquatic invertebrate concentrations. In addition, at metamorphosis larval insects shed a portion of their body burden for contaminants like metals and polycyclic aromatic hydrocarbons (PAHs) through the loss of their exoskeleton or via excrement, while more lipophilic contaminants like polychlorinated biphenyls (PCBs) may be retained by the adult insect (Kraus, et al., 2014). Although PFAS-specific information related to body burden changes at metamorphosis is not available, PFAS are not lipophilic like PCBs and body burdens may be reduced in the adult aerial insects consumed by swallows and bats. It is expected that these surrogate tissues in the food web model (modeled aquatic invertebrates) are likely to over-estimate concentrations in aerial insects and over-estimate risks to receptors like the spotted sandpiper, tree swallow and little brown bat, but field sampling for aquatic invertebrates or aerial insects would be needed to confirm this assumption.

In addition, the literature-based plant BAFs that were used to estimate dietary tissue concentrations to assess the potential for risk to herbivorous receptors (primarily the muskrat and wood duck) introduce uncertainty, as plant uptake of PFAS is highly dependent on site-specific conditions, including the types of plant species present (Divine et al. 2020). These literature-based plant BAFs may over- or under-predict aquatic plant tissue concentrations, and hence TDD, to herbivores. Field sampling for vegetation could reduce this uncertainty by providing site-specific tissue data.

Sample counts for some tissue types in some areas (e.g., amphibians in the West Lakeland Area, crayfish in Raleigh Creek-Upper) were below the target of eight samples for the calculation of a UCL. In these cases, the ProUCL results were reviewed to determine whether the selected UCL was reasonable to use in place of the maximum detected concentration. Typically, in cases where five or more samples were available and most of the results were detected concentrations, the UCL was deemed to be acceptable for use in the food web model. The UCL, rather than the maximum, is typically preferred in a BERA to represent the EPC, particularly for foraging wildlife. The use of the maximum, rather than the UCL would increase the associated HQs slightly but would not change the overall conclusions within any of the exposure areas.

7.3.2 Uncertainties Associated with ESVs and TRVs

As an emerging contaminant, there are uncertainties associated with the evaluation of PFAS ecological risks that are currently being addressed as the science advances. ESVs and TRVs were generally selected from recent SERDP guidance documents (Conder et al. 2020, Divine et al. 2020) and a peer-reviewed supporting paper (Zodrow et al. 2020).

The lowest of the aquatic life and wildlife-based ESVs were conservatively selected for screening purposes. Exceedances of these values (e.g., the HC1 for direct toxicity to aquatic life or the most conservative wildlife-based ESV) are likely to overestimate potential risks, as evidenced by the lower HQs calculated in the area-specific food web models. The HC1 values for PFOS and PFOA (0.56 and 537 µg/L) derived by Conder et al. (2020) are particularly conservative relative to the Conder et al. (2020) HC5 values (5.85 and 1,112 µg/L, respectively), the chronic RBSLs derived by Divine et al (2020; 51 and 3,900 µg/L, respectively) and chronic aquatic life criteria derived by Giesy et al (2010; 5.1 and 2,900 µg/L, respectively).

Only a single sediment ESV was identified for use in the BERA. This lack of sediment toxicity information represents a potential source of uncertainty. However, this uncertainty was addressed by collecting sediment porewater and comparing those results to surface water ESVs. It is assumed that the surface water ESVs would be protective of benthic invertebrates living in the sediment and exposed to PFAS associated with the sediment porewater. The surface water ESVs for PFOA and PFOS were HC1 and HC5 values based on species sensitivity distributions which considered toxicity data for invertebrates, fish, amphibians, and plants (Conder et al. 2020). For PFOS, benthic invertebrates such as midges (i.e., aquatic flies such as the non-biting midges, also called chironomids) and damselflies were among the more sensitive species while water fleas, mussels, and snails were less sensitive. For PFOA, water fleas were among the more sensitive species and the midge was the least sensitive species considered.

Recent 20-day toxicity tests with midge (*Chironomus* sp.; McCarthy et al. 2021) confirmed previous work showing that midges, which are tested during their larval phase when they reside within the sediment bed, are one of the most sensitive aquatic organisms when exposed to PFOS (Giesy et al. 2010; Qi et al. 2011; Salice et al. 2018; ECCC 2018). McCarthy et al. (2021) reported that PFOS was three orders of magnitude more toxic than PFHxS, and PFHxS was two orders of magnitude more toxic than PFOA. The 20-day survival no observed effect concentration (NOEC) for PFOS was 0.447 µg/L, which is just below the HC1 of 0.56 µg/L; the survival lowest effect concentration (LOEC) was 2.09 µg/L. The NOEC and LOEC reported for PFOS for the growth test endpoint were higher than for the survival endpoint (2.09 and 4.2 µg/L, respectively), and this observation was also made for the remaining five PFAS tested in this study (NOECs and LOECs for growth endpoint higher than those for the survival endpoint).

Invertebrate toxicity data summarized by Ankley et al. (2021) identified adverse reproductive effects for *Chironomus* sp. occurring between 2 and 10 µg/L for PFOS. Based on the findings from McCarthy et al. (2021) and Ankley et al. (2021), the HC5 of 5.85 µg/L, which is expected to be protective of 95% of freshwater aquatic species, may not be sufficiently protective of all *Chironomus* sp. Given that the 20-day survival NOEC from McCarthy et al. (2021) is approximately equal to the HC1, the HC1 is expected to be protective of sensitive midge species.

As indicated below, the surface water ESVs used in the BERA are below the 20-day survival NOECs for the remaining tested PFAS and therefore these ESVs are expected to be sufficiently protective for midge in the Project 1007 waterways.

Analyte	Surface Water Screening Levels (µg/L)	
	Chronic Surface Water ESVs Used in the BERA	20-Day Survival NOEC (McCarthy et al. , 2021)
PFHpA	870	2,460
PFOA	537	59,400
PFNA	120	1,360
PFBS	3,400	42,700
PFHxS	0.56 (PFOS as a surrogate)	934
PFOS	0.56	0.447

TRVs were preferentially selected from sources (Divine et al. 2020, Zodrow et al. 2020) that followed the USEPA (2005) approach for selecting TRVs which considers multiple studies and typically selects a TRV based on a geometric mean of multiple results. These documents only covered a sub-set of PFAS so some TRVs were selected from Conder et al. (2020) based on single-study sources. TRVs based on geometric means may not be protective of the most sensitive species and TRVs based on single studies provide limited toxicity information for a species that may be sensitive or tolerant of PFAS. Currently there is no consensus on the most appropriate TRVs for use in ERAs, but the selected TRVs provide a reasonable assessment of toxicity based on recent guidance.

In the absence of available PFAS-specific ESVs and TRVs, surrogate values were assigned based on similar chain length and functional groups (Divine et al. 2020 and Zodrow et al. 2020). While the use of surrogate values allows the evaluation of additional PFAS, there are uncertainties associated with whether the selected surrogates are more or less toxic than the PFAS they were selected to represent. In general, if more than one surrogate might be applicable to a particular PFAS, the more conservative (i.e., the more protective) surrogate value was selected. This approach limits the likelihood that risks are underestimated through the use of surrogates.

As indicated in Section 7.1.1, very little PFAS toxicity data is available for reptiles and linkages between PFAS exposures and endpoints relevant to ecological risk assessments are uncertain (ITRC, 2020; Ankley, et al., 2021). While studies have shown the presence of PFOS in blood plasma or eggs (Kannan et al. 2005; Keller, et al., 2005; Wood, et al., 2021), the interpretation of these findings in a risk assessment context is limited without reptile-specific toxicity data for ecologically relevant endpoints. The use of spotted sandpiper HQs for PFOS to assess the potential for adverse effects on the Blanding's turtle assumes that birds and the Blanding's turtle show similar sensitivities to PFOS. Given the lack of reptile toxicity data, this assumption cannot be confirmed, and the Blanding's turtle could be more or less sensitive to PFOS than birds. In a review of reptile and avian toxicity data for lead and several organic pollutants, Weir, et al. (2010) indicated that reptiles were more sensitive than birds for five of the fifteen pollutants. Therefore, birds are not universally more sensitive than reptiles and there is uncertainty associated with the use of the spotted sandpiper to evaluate the Blanding's turtle.

7.3.3 Uncertainties Associated with Food Web Modeling

Site-specific fish, amphibian, and invertebrate data were incorporated into the food web models to provide a realistic exposure scenario for wildlife receptors. The use of site-specific tissues helps to reduce uncertainties in the food web model results since BAFs were only used for a sub-set of tissues (i.e., aquatic invertebrates, aquatic plants, amphibians in Eagle Point Lake and Lake Elmo, and crayfish in Lake Elmo). Aquatic invertebrate tissue generally contributes only a small portion of the TDDs for receptors with HQs above 1 and, as discussed in Section 7.2, may over-estimate concentrations for aerial insects consumed by the little brown bat. The amphibian and crayfish BAFs are based on site-specific data and are expected to be representative of concentrations within the Project 1007 waterways.

As indicated in Section 7.2.1, the use of water-to-plant BAFs, rather than a BSAF for plants, may under-estimate plant tissue concentrations, particular for rooted plants that may serve as the food base for the muskrat and wood duck, although no risk was demonstrated for the wood duck when the water-to-plant BAF or sediment-to-plant BSAF for PFOS is applied (all wood duck HQs < 1). If the BSAF for PFOS was used instead of the water-to-plant BAF, the HQs for the muskrat would be above 1 in both Raleigh Creek-Upper and Eagle Point Lake. In the other areas the muskrat risks are lower and would not be above 1 using the BSAF. The PFOS HQs for the muskrat using the BSAF are indicated below:

- Raleigh Creek-Upper NOAEL- and LOAEL- based HQs of 10 and 5.9, respectively
- Eagle Point Lake NOAEL- and LOAEL- based HQs of 4.7 and 2.8, respectively

The differences in predicted plant concentrations between the BAF and the BSAF represents a source of uncertainty that could be addressed by the collection of plants from within Raleigh Creek-Upper and Eagle Point Lake.

The fish-eating receptors evaluated in the BERA include the great blue heron, bald eagle, mink, and river otter and the size ranges of the fish sampled for tissue analysis should be within the size range of fish consumed by these receptors. All but two forage fish were less than 250 mm which is the upper end of the size range for the great blue heron (USEPA, 1993) and the two larger fish were less than 300 mm. It is expected that the remaining receptors are likely to also consume larger fish. The target range for predator fish in the SAP (AECOM, 2020b) was 200 to 300 mm (approximately 8 to 12 inches) with a sub-set of larger fish to be included if encountered. Larger fish were frequently encountered during the BERA sampling effort and the largest of the fish were filleted for the MPCA to consider for human health evaluations. Thirteen predator fish larger than 300 mm and ranging up to 500 mm were also analyzed and included in the BERA food web models for Eagle Point Lake, Lake Elmo, and the West Lakeland Area. This accounted for approximately half of the predator fish evaluated in the BERA with larger fish collected in all three areas. Given that these fish are on the upper end of the targeted size for inclusion in the BERA, they may contain higher PFAS concentrations than the smaller predator fish that are also included in the diet of the bald eagle, mink, and river otter. This may over-estimate risks if smaller fish are consumed more often. However, it is noted that the forage fish and predator fish concentrations of PFOS showed significant overlap (**Figure 6**) and the EPCs used in the food web models were similar within each waterbody so risks are not expected to be significantly over-estimated by the inclusion of larger predator fish.

One food web assumption that has a direct impact on the calculated HQs is the AUF. This parameter accounts for how much a receptor forages within the exposure area relative to the rest of their home range. As indicated in **Table 4**, AUFs of less than 1 were used for receptors with large home ranges

(i.e., wood duck, tree swallow, bald eagle, river otter) and for some species in the smallest exposure areas (i.e., little brown bat and racoon in Raleigh Creek-Upper and great blue heron, little brown bat, and racoon in Raleigh Creek-Other). An increase in the AUF leads to an increase in the HQs. The home ranges for the receptors were identified in the literature and are documented in Table 2 of each of the food web models presented in **Appendices G through K**. If the AUFs were set to 1 for all receptors, the following additional LOAEL-based HQs above 1 for PFOS would be identified:

- Raleigh Creek-Upper tree swallow (LOAEL-based HQ = 1.3) and little brown bat (LOAEL-based HQ = 2.8)

- Eagle Point Lake river otter (LOAEL-based HQ = 1.1)

These LOAEL-based HQs above 1 are indicative of potential population level impacts, if receptor populations only foraged within the specified areas. However, an AUF of 1 represents the most conservative approach and is likely to overestimate risks in small areas like Raleigh Creek which may be too small to support populations of birds and mammals.

As indicated in Section 7.2.1, the federally-threatened northern long-eared bat has not been documented within the BERA study area (MNDNR, 2021c), but could occasionally forage within portions of the BERA study area and, if the AUF was set to 1 in all areas, the NOAEL-based HQ for PFOS for the little brown bat would be above 1 in Raleigh Creek-Upper (HQ = 4.8). The northern long-eared bat has not been documented within Raleigh Creek-Upper and this exposure area may not represent preferred habitat such that the bats would forage over a smaller than expected home range, so the HQ of 4.8 is expected to be an overestimate of risks to bats. As noted in Section 7.2.1, risks to the little brown bat are based on 1. modeled concentrations of aquatic invertebrates using literature-based BAFs and 2. measured crayfish data to represent benthic invertebrates, which are expected to overestimate risks to bats consuming aerial insects.

7.3.4 Uncertainties Associated with Foam Exposures

As indicated in Section 7.1.2, concentrations of PFOS and other long-chain PFAS in foam exceeded the PFOS HC1 and HC5 chronic aquatic life ESVs and PFOS concentrations also exceeded the acute aquatic life ESV. However, these water-based ESVs may not be applicable to evaluating the exposure of aquatic receptors to foam which is composed of a mixture of air, water, and organic materials. In addition, the chronic ESVs are expected to overestimate risks to aquatic life since foam exposures are typically relatively short-term. Additional study of foam toxicity (e.g., *in situ* toxicity tests) may be useful to further assess the potential for impacts to aquatic life due to short-term exposures to high PFAS concentrations detected in foam.

Wildlife ESVs were not used to evaluate PFAS concentrations in foam as wildlife are not likely to be adversely affected by foam via direct contact (due to the presence of fur, feathers, and scales) and foam is not expected to be a bioaccumulation concern due to the relatively short duration of foam occurrences within a particular area. Receptors like ducks may come in direct contact with foam during swimming and foraging activities; however, it is expected that the presence of feathers limits the potential for dermal contact with PFAS. There is limited dermal absorption of PFAS in water through human skin (USEPA, 2020), so dermal exposures to exposed skin on ducks and other waterfowl are also expected to be limited.

Due to the short-term nature of the foam occurrences, foam is not expected to be a concern to wildlife due to bioaccumulation into plants or prey items. It is likely that wildlife encounter and ingest foam on an occasional basis (incidentally ingested during preening and foraging or during ingestion of water);

however, it is not clear what impacts could occur due to occasional ingestion of foam. It is likely this type of exposure is minimal relative to chronic dietary intake and chronic ingestion of drinking water. To asses this potential chronic ingestion exposure scenario, the wood duck food web model for the West Lakeland Area presented in Table 7 of **Appendix K** was modified such that 10% of the drinking water ingested was assumed to be foam and 90% was surface water (rather than all surface water[5]). This increased the ingested 'surface water' dose from 0.0017 to 18.0 µg/kg_{bw}/day and, as shown in the table below, would result in a NOAEL-based HQ of 0.24 and a LOAEL-based HQ of 0.024.

These results represent a highly unlikely scenario in which ducks ingest the highest PFOS levels detected in foam on a chronic basis, but the findings suggest that population level impacts would not be indicated even under this scenario.

Wood Duck PFOS Potential Daily Dose						NOAEL-based TRV	NOAEL-based HQ	LOAEL-based TRV	LOAEL-based HQ
Benthic Invertebrate	Aquatic Invertebrate	Plant	Sediment	Surface Water	Total				
0.066	0.076	0.92	0.0056	18.0	19.1	79	0.24	790	0.024
Potential Daily Dose and TRVs expressed as micrograms PFOS per kilogram body weight per day (µg/kg_{bw}/day).									

Dennis et al. (2021) reported that chronic drinking water ingestion of PFOS by birds may result in greater toxicity than dietary ingestion. The authors suggest a PFOS chronic LOAEL-based drinking water benchmark of 18.67 µg/L; all the surface water EPCs for PFOS are below this level indicating that the water within the Project 1007 is not expected to pose an ingestion-based risk to bird populations. This threshold was based on a 90-day study and did not identify an acute ingestion toxicity threshold. To assess potential acute ingestion risks to birds due to ingestion of PFOS in foam, uncertainty factors were applied to convert the chronic LOAEL benchmark to an acute median lethal dose (LD50) value. Uncertainty factors from the California Department of Toxic Substances Control's ERA guidance (1996) were used to adjust from the chronic LOAEL to a chronic NOAEL (divided by an uncertainty factor of 5) and from the chronic NOAEL to an acute LD50 (multiplied by an uncertainty factor of 500) to result in an estimated LD50 of 1,867 µg/L.

Five of the 22 foam PFOS concentrations exceed this level; three samples from Raleigh Creek-Upper, one sample from Raleigh Creek-Other, and one sample from the West Lakeland Area. These results suggest that some concentrations of PFOS in foam may pose an acute risk to birds. However, there are uncertainties in this evaluation because the toxicity study was designed to assess longer term ingestion of small doses and the uncertainty factors may not accurately estimate the acute toxicity level. In addition, it is unknown what amount of PFOS birds may be exposed to by occasional ingestion of foam which, *in situ*, is predominantly air (Schilling and Zessner, 2011). To date, bird mortalities within the Project 1007 waterway due to ingestion of foam are not known to have occurred.

In addition to being chemical stressors to birds, PFAS are also possible physical stressors due to their properties as fluorosurfactants, e.g., potential for hypothermia in waterfowl as a result of surfactants stripping the oils out of feathers allowing the skin to get wet (USFWS, 2009). If foam occurs frequently

[5] A drinking water concentration of 2,070 µg/L PFOS was assumed based on 90% surface water (using the surface water EPC of 0.20 µg/L = 0.18 µg/L) and 10% foam (using the maximum foam concentration of 20,700 µg/L = 2,070 µg/L).

in areas where waterfowl gather, it is possible that these types of exposures may occur; however, there is a great deal of uncertainty as to if and how the waterfowl may be physically impacted.

7.3.5 Dissolved and Total Surface Water and Porewater Results

The baseline and seasonal sampling events have not previously analyzed porewater and only analyzed for PFAS in total surface water samples. To support the BERA, dissolved phase porewater data were collected as the dissolved phase PFAS are expected to be the most biologically available fraction for benthic invertebrates present in the sediment. Similarly, dissolved phase surface water data were also collected to see if there were differences in PFAS concentrations in the filtered water (dissolved phase) and in whole water (total).

A review of paired dissolved and total results was conducted to see if the dissolved phase results were consistently lower than the total results and to see how similar or different the results were. Sample-by-sample comparisons of the dissolved phase and total concentrations for surface water are presented in **Appendix A Table 6a** and indicate variability among the two phases where total concentrations are not consistently greater than dissolved concentrations per sample and vice versa. In addition, the concentrations of PFAS in dissolved and total phase samples were typically within 15%. Five PFAS compounds (6:2 fluorotelomer sulfonic acid [6:2 FTS], hexafluoroproylene oxide dimer acid [HFPO-DA], N-EtFOSAA, N-ethyl perfluoroctane sulfonamide [N-EtFOSE], and perfluorotetradecanoic acid [PFTeDA]) had RPDs of total and dissolved concentrations ranging from 72 to 169%. However, these compounds also had lower frequency of detection for both phases than the other PFAS and in some cases (HFPO-DA and PFTeDA) were only detected once in total and dissolved samples. The range of PFOS concentrations detected in dissolved and total phase samples collected in Raleigh Creek, Eagle Point Lake, Lake Elmo, and the West Lakeland Area show substantial overlap (**Figure 12**).

Only three locations were analyzed for PFAS in both dissolved phase and total porewater. Similar to surface water, concentrations of PFAS are variable among the dissolved and total porewater samples and are typically within 15% (**Appendix A Table 6b**).

These results show that in general, the dissolved and total results were similar and that, across all PFAS and samples, when the results were different the total results were not consistently higher or lower than the dissolved phase results. As indicated in **Figure 12**, for PFOS the total results ranged slightly higher than the dissolved in Raleigh Creek-Upper and results in the other areas were nearly the same. Given that the results are not particularly different for PFOS, the only PFAS showing potential risks in the food web model, future sampling of dissolved phase surface water for risk assessment purposes is likely not necessary.

7.3.6 Uncertainties Associated with PFAS Exposures in Nearby Waterbodies

Although the focus of the BERA is on Raleigh Creek, Eagle Point Lake, Lake Elmo, and the West Lakeland Area, samples have been collected from several additional waterbodies in the vicinity of Project 1007 (**Figure 13**). Other waterbodies sampled include Valley Branch/Lake Edith, Sunfish Lake, Goose Lake, Fredrich's Pond, Margaret Lake, Park Pond, St. Croix River, Legion's Pond, Down's Lake, Goose Lake, Farney Creek, and samples collected near the ODS. While many samples were collected from within areas likely to provide habitat for aquatic receptors and wildlife (e.g., Valley Branch, Sunfish Lake, Browns Pond), other samples were collected from culverts and retention ponds that were sampled to help define the nature and extent of PFAS but do not offer viable ecological habitat. However, all samples were included in the evaluation below.

Appendix F provides ESV comparison tables for the surface water, sediment, and foam samples collected from these areas. In surface water, the maximum detected concentration of PFOS from this dataset exceeded the NOAEL-based wildlife ESV, but not the chronic aquatic life ESV. In sediment, the maximum detected concentration of PFOS exceeded the wildlife ESV, but not the benthic aquatic life ESV. In foam, PFOS concentrations in the seven samples collected outside the BERA exposure areas exceeded the HC1 chronic surface water ESV (0.56 µg/L), four of the samples exceeded the HC5 (5.85 µg/L), and none of the foam samples exceeded the acute surface water ESV (570 µg/L).

The HQs above 1 for the individual samples collected from outside the BERA exposure areas are shown below.

HQs > 1 Outside the BERA Exposure Areas		
Surface Water – NOAEL-based Wildlife HQs	**Sediment - NOAEL-based Wildlife HQs**	**Foam - Chronic Aquatic Life HQs**
ODS Culvert and Retention Pond - PFOS HQ = 1.5 (OD1), 4.3 (OD2), 2.7 (OD2) Raleigh Creek Culvert - PFOS HQ = 4.4 (RC3CUL) West Lakeland Area Upstream from Rest Area Pond - PFOS HQ = 1.5 (WL18), 1.5 (WL18), 2.6 (WL18) Downstream from Rest Area Pond - PFOS HQ = 1.9 (WL19), 2.2 (WL20)	Farney Creek - PFOS HQ = 1.7 (FC2A)	Farney Creek - PFOS HQ = 91 (FC2) Sunfish Lake - PFOS HQ = 2.0 (EP25) Goose Lake - PFOS HQ = 3.0 (GL1) Friedrich's Pond - PFOS HQ = 21 (FP1) Valley Branch - PFOS HQ = 4.6 (VB1), 184 (VB3), 174 (VB3)

Of the locations identified above, the ODS samples and the Raleigh Creek culvert sample represent conditions associated with the disposal area. They were collected to better determine potential flow paths of PFAS entering Raleigh Creek from ODS and are essentially accounted for within the Raleigh Creek-Upper datasets evaluated in the BERA. The West Lakeland Area surface water samples collected in the vicinity of the I-94 Rest Area Pond and a Farney Creek sediment sample resulted in wildlife-based HQs slightly above 1. However, as indicated in Section 7.2, the wildlife ESVs over-estimate risks to wildlife when compared to the food web models conducted with measured tissue samples. Therefore, the wildlife HQs above 1 based on the surface water and sediment evaluations are likely to overestimate actual risks. While tissue sampling could be conducted to better assess conditions in Farney Creek and in the vicinity of the I-94 Rest Area Pond, this is a relatively low priority data gap to address due to the low NOAEL-based HQs for the existing samples.

Although concentrations of PFOS in foam in the samples collected from Farney Creek, Sunfish Lake, Goose Lake, Friedrich's Pond, and Valley Branch exceeded the most conservative chronic surface water ESV for PFOS, they did not exceed the acute ESV which is likely more applicable to the intermittent foam exposures for aquatic life.

Several of the listed mollusk and fish species (**Table 1**) were identified within the St. Croix River (MNDNR, 2021c). Surface water concentrations from the St. Croix River were previously evaluated in the SLERA (AECOM, 2020a) and were included in the 'Other Areas' dataset presented in **Appendix A** and screened in in **Appendix F**. All PFAS concentrations in surface water were below the chronic

aquatic life ESVs indicating that, based on the available toxicity information, mollusks and fish in the St. Croix River are not expected to be adversely impacted by PFAS associated with Project 1007.

During the BERA sampling effort, forage fish (yellow perch) and predator fish (northern pike) tissue samples were collected from within Brown's Pond (see **Appendix B** for the sizes of fish collected). The Brown's Pond data are not presented on **Figure 6** but PFOS in forage fish and predator fish in the pond had lower concentrations than fish from the BERA exposure areas. Forage fish from Brown's Pond averaged 9.6 µg/kg of PFOS and predator fish averaged 18.5 µg/kg. These PFOS fish concentrations are nearly two orders of magnitude lower than the forage fish and predator fish EPCs evaluated in the West Lakeland Area food web model, indicating that the Brown's Pond fish would not pose a risk to birds and mammals foraging in the pond.

The distribution of PFAS detected in forage fish and predator fish collected from Brown's Pond was more variable than in fish collected from within the Project 1007 waterways (**Figure 14**). In fish collected from the BERA exposure areas (**Figures 7e and 7f**), PFOS was the dominant PFAS, particularly in predator fish where it accounted for at least 98% of the total PFAS concentrations detected. In Brown's Pond, PFOS still dominated but only accounted for 50 to 70% of the total PFAS body burden in forage fish and 60 to 80% in predator fish.

Sediment sampling was conducted in February 2021 within the Ideal Avenue Wetland Complex as part of the on-going characterization of the Project 1007 area. This wetland area is within the existing Raleigh Creek-Upper exposure area. Although these data are not yet validated and were not collected for BERA purposes, the PFOS data collected from the top 12 inches (the most surficial horizon) were reviewed to assess whether they might influence the BERA findings. The 42 wetland samples reviewed had PFOS concentrations ranging from 12.7 to 520 µg/kg which is within the range of PFOS concentrations within the Raleigh Creek-Upper dataset. The inclusion of the 42 wetland samples with the existing 39 Raleigh Creek-Upper samples (representing the top 6 inches of sediment) would decrease the UCL for the area slightly (154 vs 149 µg/kg). This assessment indicates that the new data would not significantly change the findings of the BERA. These new data are from a deeper horizon than considered in the BERA, and the more surficial sediments within the wetland may contain higher concentrations of PFOS and other PFAS. If the on-going validation and assessment of the Ideal Avenue Wetland Complex sediment data (which includes samples down to 4 feet) indicate that PFOS concentrations are highest at the surface, then additional sampling of the top 6 inches of sediment may be warranted to assess potential ecological risks.

8.0 Summary and Conclusions

This section presents a summary of the BERA findings and provides an interpretation of the magnitude of potential ecological risk and its significance. The results of this evaluation can be used to determine whether or not a decision can be made that ecological exposure pathways have the potential to pose (or do not pose) a risk to ecological receptors within the Project 1007 waterways. If a determination of no risk can be made, no additional ecological risk evaluation is warranted. Conversely, if a determination of no risk cannot be made, then additional ecological risk evaluation may be required to fill data gaps and lessen sources of uncertainty. The ERA may also move into Risk Management following the BERA.

The primary objective of this BERA was to evaluate whether or not populations of ecological receptors are potentially at risk from exposure to PFAS detected in surface water, sediment, and porewater within the Project 1007 waterways. Exposure areas evaluated in the BERA included: Raleigh Creek-Upper, Raleigh Creek-Other, Eagle Point Lake, Lake Elmo, and the West Lakeland Area. Available data included surface water, sediment, porewater and biological tissue for species likely to represent prey items for birds and mammals foraging within the Project 1007 waterways. Samples were collected over multiple sampling events in 2019 and 2020. Risks to lower trophic level aquatic and benthic receptors were evaluated using direct toxicity-based ESVs and risks to birds and mammals were assessed using deterministic food web models that incorporated area-specific tissue data when available.

The conclusions of the BERA are provided below:

- Aquatic plant, fish, amphibian, water column invertebrate, and benthic invertebrate communities
    - The comparisons of surface water, sediment, and porewater data against chronic exposure ESVs identified no significant risks to most benthic and aquatic species present within the Project 1007 waterways due to direct contact with PFAS. The surface water ESVs (used to evaluate surface water and porewater) were designed to be protective of 95% of all aquatic species and the sediment ESV represents a no effect value protective of benthic invertebrates.

    - Comparisons of surface water and porewater data to the most conservative surface water ESV (i.e., the HC1) for PFOS identified exceedances in Raleigh Creek-Upper and Eagle Point Lake. The NHIS (MNDNR, 2021c) did not identify special status aquatic species (e.g., fish, aquatic invertebrates, benthic invertebrates, mollusks) within Raleigh Creek-Upper or Eagle Point Lake; although two listed fish species (the least darter and pugnose shiner) have each been documented in other waterbodies within the study area. Given that these listed species have not been documented in the areas with HC1 exceedances, these species do not currently appear likely to be adversely impacted by PFOS in surface water. Surveys for the least darter and pugnose shiner could be conducted to assess whether these listed species are present in areas where the surface water exceedances of the HC1 for PFOS occur.

    - The comparison of foam data to acute surface water ESVs identified PFOS concentrations above the ESV in Raleigh Creek-Upper, Raleigh Creek-Other, Lake Elmo, and the West Lakeland Area. Chronic surface water ESVs for PFOS are also exceeded in these areas; however, chronic exposures to PFAS in foam are not

expected for aquatic life but could occur if foam persists in the same area. Although there are significant uncertainties associated with the applicability of this screening, the results indicate the potential for impacts to aquatic life, potentially including the least darter and pugnose shiner, when foam is present and as it dissipates.

- The potential for risks to reptiles is evaluated qualitatively due to a lack of receptor-specific ESVs. Given the lack of significant risks to other aquatic receptors due to direct exposure to surface water and sediments, reptiles may not be at risk due to direct exposure to PFAS. The potential for risks due to exposure to foam may exist, but there are significant uncertainties associated with the impact of this potential exposure medium. The use of the spotted sandpiper as a surrogate species for the evaluation of the state threatened Blanding's turtle indicates the potential for adverse impacts where the NOAEL-based HQs for PFOS are above 1 (i.e., Raleigh Creek-Upper); although there are uncertainties associated with the applicability of avian HQs to reptiles and whether the turtles are present. Surveys for the Blanding's turtle could be conducted to assess whether this species is present within Raleigh Creek-Upper since this area appears to have potentially attractive habitat and elevated PFAS concentrations.

- Avian wildlife communities

  - All NOAEL- and LOAEL-based HQs for the wood duck and bald eagle were less than 1 in all of the BERA exposure areas. No further evaluation or remedial action is warranted for these receptors.

  - The NOAEL-based HQ for PFOS for the spotted sandpiper was above 1 in Raleigh Creek-Upper (HQ = 3.6). Similarly, for the tree swallow the NOAEL-based HQs for PFOS were above 1 in Raleigh Creek-Upper (HQ = 1.5) and Eagle Point Lake (HQ = 1.2). For both birds, the LOAEL-based HQs were less than 1, indicating that population-level risks are unlikely. Threatened and endangered invertivorous birds have not been documented within one-mile of this area, so protection at the population level is the most relevant for this area. Therefore, no further evaluation or remedial action is warranted for invertivorous birds.

  - As discussed above, the spotted sandpiper was also considered as a surrogate species for the state threatened Blanding's turtle and that evaluation indicated the potential for adverse impacts in Raleigh Creek-Upper, if the turtles are present.

  - The LOAEL-based HQ above 1 for the great blue heron in Raleigh Creek-Upper indicates the potential for population-level risks due to food web exposures to PFOS for piscivorous birds. The NOAEL-based HQs, but not the LOAEL-based HQs, for PFOS for the great blue heron were above 1 in Eagle Point Lake, Lake Elmo, and West Lakeland Area. Threatened and endangered piscivorous shorebirds have not been documented within one-mile of these areas, so protection at the population level is the most relevant. Therefore, no further evaluation or remedial action is warranted for piscivorous shorebirds in Eagle Point Lake, Lake Elmo, and the West Lakeland Area. Further evaluation or remedial action is warranted based on the potential for population-level risks to the great blue heron in Raleigh Creek-Upper. Risks to the heron are primarily associated with the consumption of forage fish that have bioaccumulated PFOS. The Forster's tern, a state bird of special status, was

observed slightly more than one mile from Raleigh Creek-Upper in 1994. The deeper pools within the wetlands of Raleigh Creek-Upper may provide areas for the tern to forage for small fish and, if the tern is present, the elevated HQs for the great blue heron indicate that the tern could be adversely affected by PFOS in forage fish in Raleigh Creek-Upper.

- Mammalian wildlife communities
  - All NOAEL- and LOAEL-based HQs for the raccoon and the river otter were less than 1 in all of the BERA exposure areas where these receptors were evaluated. No further evaluation or remedial action is warranted for these receptors.

  - The NOAEL-based HQ for PFOS for the little brown bat was above 1 in Raleigh Creek-Upper (HQ = 1.4). However, the LOAEL-based HQ was less than 1, indicating that population-level risks to typical bat species are unlikely and further evaluation or remedial action is not warranted. While it is possible that the federally threatened northern long-eared bat could occasionally forage in Raleigh Creek-Upper, the species has not been documented within one-mile of the Project 1007 waterways (MNDNR, 2021c) and hibernacula and roosting trees are not present nearby. Resident populations of this special status species do not appear to be present and the consideration of individual-level risks using NOAEL-based HQ is not warranted for the northern long-eared bat.

  - The LOAEL-based HQ above 1 for the muskrat in Raleigh Creek-Upper indicates the potential for population-level risks due to food web exposures to PFOS for herbivorous mammals. HQs for the muskrat would be higher if plant tissue concentrations were estimated from sediment rather than surface water and would also result in a LOAEL-based HQ above 1 for the muskrat in Eagle Point Lake. Therefore, there is some uncertainty in the risk estimates for the muskrat that could be refined through the collection of plant tissues in Raleigh Creek-Upper and Eagle Point Lake. Further evaluation or remedial action is warranted based on the potential for population-level risks to the muskrat (based on modeling plant tissue from sediment) in Raleigh Creek-Upper and Eagle Point Lake.

  - The LOAEL-based HQs above 1 for the mink in Eagle Point Lake and Lake Elmo indicate the potential for population-level risks due to food web exposures to PFOS for piscivorous mammals. The NOAEL-based HQ, but not the LOAEL-based HQ, for PFOS for the mink was above 1 in the West Lakeland Area. Threatened and endangered piscivorous mammals have not been documented within one-mile of the Project 1007 waterways, so protection at the population level is the most relevant. Therefore, no further evaluation or remedial action is warranted for piscivorous mammals in the West Lakeland Area. Further evaluation or remedial action is warranted based on the potential for population-level risks to the mink in Eagle Point Lake and Lake Elmo. Risks to the mink are primarily associated with the consumption of forage fish and predator fish that have bioaccumulated PFOS, and site-specific data for those dietary items were applied.

The potential for wildlife to be significantly exposed to PFAS in foam is not expected, but the importance of wildlife exposures via ingestion or direct contact is a source of uncertainty. In particular, the exposure of birds to elevated concentrations of PFAS in foam via incidental ingestion represents a

significant uncertainty. The identification of water ingestion-based acute toxicity data would help to address this data gap.

As indicated by these findings, the greatest potential for risk occurs for piscivorous birds and mammals with relatively small home ranges (i.e., bald eagles and river otters with larger home ranges were not at significant risk). PFOS concentrations in forage fish in Raleigh Creek-Upper and in forage fish and predator fish in Eagle Point Lake and Lake Elmo are elevated enough to pose a population-level risk to piscivorous birds and mammals like the great blue heron and the mink. These fish are exposed directly to PFOS in the water column and potentially in the sediment (during foraging or nesting activities or as eggs and larvae), but likely the greatest exposure for these fish is through their diet. Forage fish will consume plant matter, invertebrates, and small fish and predator fish will ingest primarily other fish as well as invertebrates.

A remedial action may be warranted to reduce surface water and sediment concentrations to levels that would reduce the potential for population-level risks to the great blue heron and mink by reducing PFOS levels available to fish and aquatic organisms.

Risks to piscivorous birds and mammals were evaluated using site-specific fish tissue so additional analytical data would not be necessary to refine the risk estimates. A population survey could be conducted to assess the use of these exposure areas by great blue heron and mink. The food web model assumed that these receptors obtained all of their diets from Raleigh Creek-Upper, Eagle Point Lake, and Lake Elmo. If that is not the case, the HQs and the extent of remedial action warranted could be reduced.

Based on the results of the food web modeling, PFOS accumulating in plant matter may also pose a population-level risk to herbivorous mammals like the muskrat in Raleigh Creek-Upper and Eagle Point Lake. There are more uncertainties associated with this evaluation since plant tissue was not collected during the BERA sampling event and HQs are based on estimated plant tissue concentrations. Collection of plant matter is recommended to refine the risk estimates for the muskrat. However, if a remedial action is anticipated to address risks to piscivorous birds and mammals, the associated PFAS reductions would also be expected to lower risks to herbivores.

There are uncertainties associated with the potential presence of some state listed species within areas with elevated PFOS concentrations. warranted. The Blanding's turtle has not been observed in the vicinity of the Project 1007 waterways since the 1990s (MNDNR, 2021c) but potential habitat occurs within Raleigh Creek-Upper where elevated concentrations of PFOS in prey items could adversely impact the turtle, if present (based on using the spotted sandpiper as a surrogate species to assess risks to the turtle). Similarly, the Forster's tern was observed once in 1994 slightly more than a mile from potential habitat in Raleigh Creek-Upper. Two listed fish species, the least darter and pugnose shiner, have been documented as recently as 2019 in the vicinity of the Project 1007 waterways (MNDNR, 2021c) but it is unknown if these species occur in Raleigh Creek-Upper where the PFOS EPC in surface water exceeds the most conservative surface water ESV (i.e., the HC1). Conducting surveys to assess the potential for these species to be present in Raleigh Creek-Upper could be useful in determining the level of protection warranted in this area.

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Tables

Table 1 Summary of Special Status Species that Potentially Occur at Project 1007

Scientific Name	Common Name	MNDNR Natural Heritage Information System Review	MNDNR - State Rank	USFWS - Federal Rank	IPaC Review - Potentially Near Site?
Rare Species Present In the Vicinity of Project 1007 Waterway					
Birds					
Buteo lineatus	Red-shouldered Hawk	Yes	SPC	NL	
Sterna forsteri	Forster's Tern	Yes **	SPC	NL	
Mammals					
Myotis septentrionalis	Northern Long-eared Bat	No	SPC	THR	Yes
Reptiles					
Emydoidea blandingii	Blanding's Turtle	Yes **	THR	NL	
Fishes					
Acipenser fulvescens	Lake Sturgeon	Yes [St. Croix River]	SPC	NL	
Anguilla rostrata	American Eel	Yes ** [St. Croix River]	SPC	NL	
Alosa chrysochloris	Skipjack Herring	Yes ** [St. Croix River]	END	NL	
Cycleptus elongatus	Blue Sucker	Yes ** [St. Croix River]	SPC	NL	
Etheostoma microperca	Least Darter	Yes	SPC	NL	
Necturus maculosus	Mudpuppy	Yes [St. Croix River]	SPC	NL	
Notropis anogenus	Pugnose Shiner	Yes	THR	NL	
Percina evides	Gilt Darter	Yes ** [St. Croix River]	SPC	NL	
Polyodon spathula	Paddlefish	Yes [St. Croix River]	THR	NL	
Insects					
Bombus affinis	Rusty patched bumble bee	Yes	Watchlist	END	Yes
Danaus plexippus	Monarch Butterfly	No	NL	Candidate	Yes
Lycaeides melissa samuelis	Karner Blue Butterfly	No	END	END	Yes
Pelegrina arizonensis	A Jumping Spider	Yes **	SPC	NL	
Mollusks					
Actinonaias ligamentina	Mucket	Yes [St. Croix River]	THR	NL	
Alasmidonta marginata	Elktoe	Yes [St. Croix River]	THR	NL	
Arcidens confragosus	Rock Pocketbook	Yes [St. Croix River]	END	NL	
Cumberlandia monodonta	Spectaclecase	Yes ** [St. Croix River]	END	END	Yes
Cyclonaias tuberculata	Purple Wartyback	Yes [St. Croix River]	END	NL	
Ellipsaria lineolata	Butterfly	Yes [St. Croix River]	THR	NL	
Elliptio crassidens	Elephant-ear	Yes [St. Croix River]	END	NL	
Elliptio dilatatus	Spike	Yes [St. Croix River]	THR	NL	
Epioblasma triquetra	Snuffbox	No	END	END	Yes
Lampsilis higginsii	Higgins Eye	Yes [St. Croix River]	END	END	Yes
Lasmigona costata	Fluted-Shell	Yes [St. Croix River]	THR	NL	
Ligumia recta	Black Sandshell	Yes [St. Croix River]	SPC	NL	
Megalonaias nervosa	Washboard	Yes [St. Croix River]	END	NL	
Pleurobema sintoxia	Round Pigtoe	Yes [St. Croix River]	SPC	NL	
Quadrula fragosa	Winged Mapleleaf	Yes [St. Croix River]	END	END	Yes
Quadrula metanevra	Monkeyface	Yes [St. Croix River]	THR	NL	
Reginaia ebenus	Ebonyshell	Yes [St. Croix River]	END	NL	
Simpsonaias ambigua	Salamander Mussel	Yes [St. Croix River]	END	NL	
Tritogonia verrucosa	Pistolgrip	Yes [St. Croix River]	END	NL	
Plants					
Taenidia integerrima	Yellow Pimpernel	Yes **	SPC	NL	
Trichophorum clintonii	Clinton's Bulrush	Yes	THR	NL	

Table 1 Summary of Special Status Species that Potentially Occur at Project 1007

Other Special Status Species Potentially Near the Project - Migratory Birds Identified by IPaC Review		
Scientific Name	**Common Name**	**Probability of Presence Within Project 1007 Waterways? ***
Ammodramus henslowii	Henslow's Sparrow	Some probability of presence from June to August; breeding season May to August
Ammodramus leconteii	Le Conte's Sparrow	Some probability of presence in October; breeding season June to August; several periods without survey data
Antrostomus vociferus	Eastern Whip-poor-will	Some probability of presence in May; breeding season May to August
Cardellina canadensis	Canada Warbler	Some probability of presence in May; breeding season May to August
Chlidonias niger	Black Tern	Some probability of presence in September; breeding season May to August
Coccyzus erythropthalmus	Black-billed Cuckoo	Some probability of presence from May to June; breeding season May to October
Dolichonyx oryzivorus	Bobolink	Some probability of presence from May, June, and September; breeding season May to August
Euphagus carolinus	Rusty Blackbird	Some probability of presence in March, April, and September; no breeding in the area
Haliaeetus leucocephalus	Bald Eagle	Some probability of presence in all months; breeding season December to August
Hylocichla mustelina	Wood Thrush	Some probability of presence from May to July; breeding season May to August
Melanerpes erythrocephalus	Red-headed Woodpecker	Some probability of presence in January, June, and September; breeding season May to September
Tringa flavipes	Lesser Yellowlegs	Some probability of presence from April to August; no breeding in the area
Vermivora chrysoptera	Golden-winged Warbler	Some probability of presence in May; breeding season May to July

Notes:

END = Endangered
NL = Not Listed
IPaC = Information for Planing and Consultation
SPC = Special Concern
MNDNR = Minnesota Department of Natural Resources
THR = Threatened

The study area for the MNDNR and USFWS reviews extended approximately one-mile from the Project 1007 waterways.

* Information obtained from IPaC Migratory Bird Probability of Presence graphs based on survey activities and species observations.

** Last observation of the species within the area was more than 20 years ago. This may be due to a lack of surveys in the area and does not necessarily indicate that the species is not present if the relevant habitat is still available.

Sources:

MNDNR Natural Heritage Information System. 2021. Rare Features Data.
Copyright 2021, State of Minnesota, Department of Natural Resources. Rare features data included here were provided by the Division of Ecological and Water Resources, Minnesota Department of Natural Resources, and were current as of September 10, 2021. These data are not based on an exhaustive inventory of the state. The lack of data for any geographic area shall not be construed to mean that no significant features are present.

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Table 2 Project 1007 PFAS Constituents Considered in the BERA

Analyte Name	PFAS Abbreviation	CAS #	Media Analyzed
Perfluorobutanoic acid	PFBA	375-22-4	SW, SD, PW, TS
Perfluoropentanoic acid	PFPeA	2706-90-3	SW, SD, PW, TS
Perfluorohexanoic acid	PFHxA	307-24-4	SW, SD, PW, TS
Perfluoroheptanoic acid	PFHpA	375-85-9	SW, SD, PW, TS
Perfluorooctanoic acid	PFOA	335-67-1	SW, SD, PW, TS
Perfluorononanoic acid	PFNA	375-95-1	SW, SD, PW, TS
Perfluorodecanoic acid	PFDA	335-76-2	SW, SD, PW, TS
Perfluoroundecanoic acid	PFUnA	2058-94-8	SW, SD, PW, TS
Perfluorododecanoic acid	PFDoA	307-55-1	SW, SD, PW, TS
Perfluorotridecanoic acid	PFTrDA	72629-94-8	SW, SD, PW, TS
Perfluorotetradecanoic acid	PFTeDA	376-06-7	SW, SD, PW, TS
Perfluorobutanesulfonic acid	PFBS	375-73-5	SW, SD, PW, TS
Perfluoropentane sulfonic acid	PFPeS	2706-91-4	SW, SD, PW, TS
Perfluorohexane sulfonic acid	PFHxS	355-46-4	SW, SD, PW, TS
Perfluoroheptane sulfonic acid	PFHpS	375-92-8	SW, SD, PW, TS
Perfluorooctanesulfonic acid	PFOS	1763-23-1	SW, SD, PW, TS
Perfluoroonoane sulfonic acid	PFNS	68259-12-1	SW, SD, PW, TS
Perfluorodecane sulfonic acid	PFDS	335-77-3	SW, SD, PW, TS
Perfluorododecane sulfonic acid	PFDoS	79780-39-5	SW, SD, TS
4:2 Fluorotelomer sulfonic acid	4:2 FTS	757124-72-4	SW, SD, PW, TS
6:2 Fluorotelomer sulfonic acid	6:2 FTS	27619-97-2	SW, SD, PW, TS
8:2 Fluorotelomer sulfonic acid	8:2 FTS	39108-34-4	SW, SD, PW, TS
10:2 Fluorotelomer sulfonic acid	10:2 FTS	120226-60-0	SW, SD, PW
3:3 Fluorotelomer carboxylic acid	3:3 FTCA	1169706-83-5	TS
5:3 Fluorotelomer carboxylic acid	5:3 FTCA	1799325-94-2	TS
7:3 Fluorotelomer carboxylic acid	7:3 FTCA	812-70-4	TS
Perfluorooctane sulfonamide	PFOSA	754-91-6	SW, SD, PW, TS
N-Methyl perfluoroctane sulfonamide	N-MeFOSA	31506-32-8	SW, SD, PW, TS
N-Ethyl perfluoroctane sulfonamide	N-EtFOSA	4151-50-2	SW, SD, PW, TS
Methylperfluorooctane sulfonamidoacetic acid	N-MeFOSAA	2355-31-9	SW, SD, PW, TS
Ethylperfluorooctane sulfonamidoacetic acid	N-EtFOSAA	2991-50-6	SW, SD, PW, TS
N-Methyl perfluoroctane sulfonamide	N-MeFOSE	24448-09-7	SW, SD, PW, TS
N-Ethyl perfluoroctane sulfonamido ethanol	N-EtFOSE	1691-99-2	SW, SD, PW, TS
Hexafluoroproylene oxide dimer acid	HFPO-DA	13252-13-6	SW, SD, PW, TS
4,8-dioxa-3H-perfluorononanoate	ADONA	919005-14-4	SW, SD, PW, TS
9-chlorohexadexadecafluoro-3-oxanonane-1-sulfonate	9CL-PF3ONS	756426-58-1	SW, SD, PW, TS
11-chloroeicosafluoro-3-oxanonane-1-sulfonate	11CL-PF3OUDS	763051-92-9	SW, SD, PW, TS
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	TS
Perfluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	TS
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	TS
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	TS

Notes

Short-chain PFCAs
Long-chain PFCAs
Short-chain PFSAs
Long-chain PFSAs
Fluortelomers
FOSA, FASE, FASAAs
Replacement Chemistries

SW - Surface Water
SD - Sediment
PW - Porewater
TS - Tissue

CAS - Chemical Abstracts Service
FASE - perfluoroalkane sulfonamido ethanols
FASAA - perrfluoroalkane sulfonamido acetic acids
FOSA - perfluorooctane sulfonamides
PFAS - Per- and polyfluoroalkyl substances
PFCA - Perfluoroalkyl carboxylic acids
PFSA- perfluoroalkane sulfonic acids

Table 3 Ecological Screening Values for Surface Water and Sediment

		Surface Water ESVs									Sediment ESVs					
		Aquatic Life (chronic) (µg/L)			Aquatic Life (acute) (µg/L)			Wildlife (µg/L)			Benthic Aquatic Life (µg/kg)			Wildlife (µg/kg)		
Analyte	**CAS #**															
Short-chain PFCAs																
PFBA	375-22-4	470	[2]		4200	[2]		660	[3]		--			1600	[3]	
PFPeA	2706-90-3	140	[2]		1000	[2]		660	[3]	Surr - PFBA	--			1600	[3]	Surr - PFBA
PFHxA	307-24-4	2300	[2]		8800	[2]		210	[3]		--			1800	[3]	
PFHpA	375-85-9	870	[2]		7800	[2]		210	[3]	Surr - PFHxA	--			1800	[3]	Surr - PFHxA
Long-chain PFCAs																
PFOA	335-67-1	537	[1]		53000	[2]		4.4	[3]		--			6	[3]	
PFNA	375-95-1	120	[2]		900	[2]		2.2	[3]		--			10	[3]	
PFDA	335-76-2	140	[2]		1000	[2]		2.2	[3]	Surr - PFNA	--			10	[3]	Surr - PFNA
PFUnA	2058-94-8	49	[2]		440	[2]		2.2	[3]	Surr - PFDA	--			10	[3]	Surr - PFNA
PFDoA	307-55-1	72	[2]		640	[2]		2.2	[3]	Surr - PFNA	--			10	[3]	Surr - PFNA
PFTrDA	72629-94-8	72	[2]	Surr - PFDoA	640	[2]	Surr - PFDoA	2.2	[3]	Surr - PFDA	--			10	[3]	Surr - PFNA
PFTeDA	376-06-7	72	[2]	Surr - PFDoA	640	[2]	Surr - PFDoA	2.2	[3]	Surr - PFDA	--			10	[3]	Surr - PFNA
Short-chain PFSAs																
PFBS	375-73-5	3400	[2]		17000	[2]		640	[3]		--			730	[3]	
PFPeS	2706-91-4	3400	[2]	Surr - PFBS	17000	[2]	Surr - PFBS	640	[2]	Surr - PFBS	--			730	[3]	Surr - PFBS
Long-chain PFSAs																
PFHxS	355-46-4	0.56	[1]	Surr - PFOS	570	[2]	Surr - PFOS	0.075	[3]	Surr - PFOS	220	[4]	Surr - PFOS	1.4	[3]	Surr - PFOS
PFHpS	375-92-8	0.56	[1]	Surr - PFOS	570	[2]	Surr - PFOS	0.075	[3]	Surr - PFOS	220	[4]	Surr - PFOS	1.4	[3]	Surr - PFOS
PFOS	1763-23-1	0.56	[1]		570	[2]		0.075	[3]		220		[4]	1.4	[3]	
PFNS	68259-12-1	0.56	[1]	Surr - PFOS	570	[2]	Surr - PFOS	0.075	[3]	Surr - PFOS	220	[4]	Surr - PFOS	1.4	[3]	Surr - PFOS
PFDS	335-77-3	0.56	[1]	Surr - PFOS	570	[2]	Surr - PFOS	0.075	[3]	Surr - PFOS	220	[4]	Surr - PFOS	1.4	[3]	Surr - PFOS
PFDoS	79780-39-5	0.56	[1]	Surr - PFOS	570	[2]	Surr - PFOS	0.075	[3]	Surr - PFOS	220	[4]	Surr - PFOS	1.4	[3]	Surr - PFOS
Fluortelomers																
4:2 FTS	757124-72-4	3400	[2]	Surr - PFBS	17000	[2]	Surr - PFBS	640	[2]	Surr - PFBS	--			730	[3]	Surr - PFBS
6:2 FTS	27619-97-2	537	[1]	Surr - PFOA	53000	[2]	Surr - PFOA	4.4	[1]	Surr - PFOA	220	[4]	Surr - PFOS	6	[3]	Surr - PFOA
8:2 FTS	39108-34-4	0.56	[1]	Surr - PFOS	570	[2]	Surr - PFOS	0.075	[3]	Surr - PFOS	220	[4]	Surr - PFOS	1.4	[3]	Surr - PFOS
10:2 FTS	120226-60-0	0.56	[1]	Surr - PFOS	570	[2]	Surr - PFOS	0.075	[3]	Surr - PFOS	220	[4]	Surr - PFOS	1.4	[3]	Surr - PFOS
3:3 FTCA	1169706-83-5	470	[2]	Surr - PFBA	4200	[2]	Surr - PFBA	660	[3]	Surr - PFBA	--			1600	[3]	Surr - PFBA
5:3 FTCA	1799325-94-2	2300	[2]	Surr - PFHxA	8800	[2]	Surr - PFHxA	210	[3]	Surr - PFHxA	--			1800	[3]	Surr - PFHxA
7:3 FTCA	812-70-4	537	[1]	Surr - PFOA	53000	[2]	Surr - PFOA	4.4	[1]	Surr - PFOA	220	[4]	Surr - PFOS	1.4	[3]	Surr - PFOS
FOSA, FASE, FASAAs																
PFOSA	754-91-6	0.56	[1]	Surr - PFOS	570	[2]	Surr - PFOS	0.075	[3]	Surr - PFOS	220	[4]	Surr - PFOS	1.4	[3]	Surr - PFOS
N-MeFOSA	31506-32-8	0.56	[1]	Surr - PFOS	570	[2]	Surr - PFOS	0.075	[3]	Surr - PFOS	220	[4]	Surr - PFOS	1.4	[3]	Surr - PFOS
N-EtFOSA	4151-50-2	0.56	[1]	Surr - PFOS	570	[2]	Surr - PFOS	0.075	[3]	Surr - PFOS	220	[4]	Surr - PFOS	1.4	[3]	Surr - PFOS
N-MeFOSAA	2355-31-9	0.56	[1]	Surr - PFOS	570	[2]	Surr - PFOS	0.075	[3]	Surr - PFOS	220	[4]	Surr - PFOS	1.4	[3]	Surr - PFOS
N-EtFOSAA	2991-50-6	0.56	[1]	Surr - PFOS	570	[2]	Surr - PFOS	0.075	[3]	Surr - PFOS	220	[4]	Surr - PFOS	1.4	[3]	Surr - PFOS
N-MeFOSE	24448-09-7	0.56	[1]	Surr - PFOS	570	[2]	Surr - PFOS	0.075	[3]	Surr - PFOS	220	[4]	Surr - PFOS	1.4	[3]	Surr - PFOS
N-EtFOSE	1691-99-2	0.56	[1]	Surr - PFOS	570	[2]	Surr - PFOS	0.075	[3]	Surr - PFOS	220	[4]	Surr - PFOS	1.4	[3]	Surr - PFOS

Table 3 Ecological Screening Values for Surface Water and Sediment

		Surface Water ESVs									Sediment ESVs					
		Aquatic Life (chronic) (µg/L)			Aquatic Life (acute) (µg/L)			Wildlife (µg/L)			Benthic Aquatic Life (µg/kg)			Wildlife (µg/kg)		
Analyte	**CAS #**															
Replacement Chemistries																
HFPO-DA	13252-13-6	2300	[2]	Surr - PFHxA	8800	[2]	Surr - PFHxA	210	[3]	Surr - PFHxA	--			1800	[3]	Surr - PFHxA
ADONA	919005-14-4	537	[1]	Surr - PFOA	53000	[2]	Surr - PFOA	4.4	[1]	Surr - PFOA	220	[4]	Surr - PFOS	6	[3]	Surr - PFOA
9CL-PF3ONS	756426-58-1	0.56	[1]	Surr - PFOS	570	[2]	Surr - PFOS	0.075	[3]	Surr - PFOS	220	[4]	Surr - PFOS	1.4	[3]	Surr - PFOS
11CL-PF3OUDS	763051-92-9	49	[2]	Surr - PFUnA	440	[2]	Surr - PFUnA	0.075	[3]	Surr - PFOS	220	[4]	Surr - PFOS	1.4	[3]	Surr - PFOS
PFEESA	113507-82-7	140	[2]	Surr - PFPeA	1000	[2]	Surr - PFPeA	640	[2]	Surr - PFBS	--			730	[3]	Surr - PFBS
NFDHA	151772-58-6	140	[2]	Surr - PFPeA	1000	[2]	Surr - PFPeA	640	[2]	Surr - PFBS	--			730	[3]	Surr - PFBS
PFMPA	377-73-1	140	[2]	Surr - PFPeA	1000	[2]	Surr - PFPeA	640	[2]	Surr - PFBS	--			730	[3]	Surr - PFBS
PFMBA	863090-89-5	140	[2]	Surr - PFPeA	1000	[2]	Surr - PFPeA	640	[2]	Surr - PFBS	--			730	[3]	Surr - PFBS

Notes:
See Table 2 for PFAS analyte abbreviations.
µg/kg - micrograms per kilogram
µg/L - micrograms per liter
-- No Ecological Screening Value
CAS - Chemical Abstracts Service
ESV - Ecological Screening Value
Surr - Surrogate selected when ESV not available. Surrogates selected based on carbon chain length and PFAS classification.

1 - Hazardous Concentration 1% (HC1) (Conder, et al., 2020).
2 - Chronic recommended water quality (RWQ) risk-based screening level (RBSL)(Divine, et al., 2020).
3 - Aquatic risk-based screening level for wildlife. Selected level is the lowest of the values derived by Devine, et al (2020) for the muskrat, little brown bat, river otter, mink, red-winged blackbird, tree swallow, and brown pelican.
4 - No toxic effects level for benthic invertebrates (NPCA, 2008).

Table 4 Exposure Parameters for Wildlife Receptors

Parameter	Parameter Definition	Units	Birds					Mammals				
			Avian Consumer (Herbivore)	Avian Consumer (Invertivore)	Avian Consumer (Omnivore / Invertivore)	Avian Consumer (Piscivore)	Avian Consumer (Piscivore)	Mammalian Consumer (Herbivore)	Mammalian Consumer (Invertivore)	Mammalian Consumer (Omnivore / Invertivore)	Mammalian Consumer (Omnivore / Invertivore)	Mammalian Consumer (Piscivore)
			Wood Duck	**Tree Swallow**	**Spotted Sandpiper**	**Great Blue Heron**	**Bald Eagle**	**Muskrat**	**Little Brown Bat**	**Raccoon**	**Mink**	**River Otter**
			Aix sponsa	*Tachycineta bicolor*	*Actitis macularius*	*Ardea herodias*	*Haliaeetus leucocephalus*	*Ondatra zibethicus*	*Myotis lucifugus*	*Procyon lotor*	*Neovison vison*	*Lontra canadensis*
BW	Body Weight	kg	0.70	0.020	0.043	2.4	4.15	1.6	0.0085	8.6	1.4	7.7
FIR_{dw}	Daily Food Ingestion Rate (dry matter) [1]	kg, dw/day	0.041	0.012	0.0076	0.11	0.12	0.14	0.0016	0.050	0.054	0.28
FIR_{ww}	Daily Food Ingestion Rate (wet matter) [2]	kg, ww/day	0.13	0.035	0.023	0.43	0.50	0.54	0.0049	0.20	0.22	0.78
P_{veg}	Proportion of Diet - Vegetation	kg diet item, ww/kg diet, ww	0.90	0.17	--	--	--	0.80	--	0.45	0.050	--
IR_{veg}	Vegetation Ingestion Rate [3]	kg ww/day	0.11	0.0060	--	--	--	0.43	--	0.090	0.011	--
P_{bi}	Proportion of Diet - Benthic Invertebrates	kg diet item, ww/kg diet, ww	0.050	0.26	0.80	0.15	--	0.10	--	0.40	0.10	0.15
IR_{bi}	Benthic Invertebrate Ingestion Rate [3]	kg ww/day	0.0064	0.0092	0.018	0.065	--	0.054	--	0.080	0.022	0.12
P_{ai}	Proportion of Diet - Aquatic Invertebrates	kg diet item, ww/kg diet, ww	0.050	0.57	0.15	--	--	0.10	1.0	0.050	0.10	--
IR_{ai}	Aquatic Invertebrate Ingestion Rate [3]	kg ww/day	0.0064	0.020	0.0034	--	--	0.054	0.0049	0.010	0.022	--
P_{am}	Proportion of Diet - Amphibians	kg diet item, ww/kg diet, ww	--	--	--	0.050	--	--	--	0.050	0.050	0.050
IR_{am}	Amphibian Ingestion Rate [3]	kg ww/day	--	--	--	0.022	--	--	--	0.010	0.011	0.039
P_{ff}	Proportion of Diet - Forage Fish	kg diet item, ww/kg diet, ww	--	--	0.050	0.80	0.45	--	--	0.050	0.20	0.35
IR_{ff}	Forage Fish Ingestion Rate [3]	kg ww/day	--	--	0.0011	0.35	0.22	--	--	0.010	0.044	0.27
P_{pf}	Proportion of Diet - Predatory Fish	kg diet item, ww/kg diet, ww	--	--	--	--	0.55	--	--	--	0.50	0.45
IR_{pf}	Predatory Fish Ingestion Rate [3]	kg ww/day	--	--	--	--	0.27	--	--	--	0.11	0.35
P_s	Proportion of Diet - Sediment	kg sediment, dw/kg diet, dw	0.24	--	0.073	0.0040	--	0.020	--	0.094	0.030	--
IR_S	Sediment Ingestion Rate [4]	kg dw/day	0.0098	--	0.00055	0.00043	--	0.0027	--	0.0047	0.0016	--
IR_W	Water Ingestion Rate [5]	L/day or kg/day	0.041	0.0040	0.054	0.11	0.15	0.88	0.0010	0.41	0.055	0.41
HR	Home Range	acres	776	194	5.0	11	4646	0.32	74	385	19	2842
SUF	Seasonal Use Factor [6]	proportion	1	1	1	1	1	1	1	1	1	1
AUF_{RC-U}	Area Use Factor for Raleigh Creek - Upper (21 acres) [6]	proportion	0.027	0.11	1	1	--	1	0.28	0.055	--	--
AUF_{RC-O}	Area Use Factor for Raleigh Creek - Other (6 acres) [6]	proportion	0.0077	0.031	1	0.55	--	1	0.081	0.016	--	--
AUF_{EPL}	Area Use Factor for Eagle Point Lake (160 acres) [6]	proportion	0.21	0.82	1	1	0.034	1	1	--	1	0.056
AUF_{LE}	Area Use Factor for Lake Elmo (284 acres) [6]	proportion	0.37	1	1	1	0.061	1	1	--	1	0.10
AUF_{WLA}	Area Use Factor for West Lakeland Area (116 acres) [6]	proportion	0.15	0.60	1	1	--	1	1	--	1	0.041

Notes:
See individual food web models in Appendices G through K for additional details and study references.

1 - Dry weight food ingestion rate (FIR) is applied to concentrations of PFAS in sediment, generally reported on dry weight basis.
2 - Wet weight FIR is applied to tissue data, reported on fresh or wet weight basis.
3 - Dietary ingestion rates were calculated by multiplying the receptor- and tissue-specific proportion of diet by the receptor-specific FIR_{ww}.
4 - IR_S is calculated by multiplying the receptor-specific P_S by the receptor-specific FIR_{dw}.
5 - IR_W is reported in L/day or kg/day because 1 L of water has weight of 1 kg
6 - AUF values for receptors were calculated by dividing the size of the exposure area by the home range. If the home range is smaller than the exposure area, an AUF of 1 was used. Site Use Factor (SUF) of 1 was selected for all receptors.

dw - dry weight
EPL - Eagle Point Lake
kg - kilogram
L - liters
LE - Lake Elmo
RC - Raleigh Creek
WLA - West Lakeland Area
ww - wet weight

Exposure Areas (Acres):
RC - Upper = 21
RC - Other = 6
EPL = 160
LE = 284
WLA = 116

Table 5 Project 1007-Specific BAFs for Amphibians and Crayfish

Analyte	Project 1007-Specific Aquatic Bioaccumulation Factors			
	Water to Amphibian BAF (L water / kg tissue ww)		Water to Crayfish BAF (L water / kg tissue ww)	
	Value	Basis	Value	Basis
Short-chain PFCAs				
PFBA	2.7	Raleigh Creek - Upper & West Lakeland Area [1]	12	Raleigh Creek - Upper & West Lakeland Area [1]
PFPeA	NC	ND in Amphibian Tissue	26	Eagle Point Lake
PFHxA	2.2	Raleigh Creek - Upper	15	Eagle Point Lake
PFHpA	NC	ND in Amphibian Tissue	31	Eagle Point Lake & West Lakeland Area
Long-chain PFCAs				
PFOA	3.3	West Lakeland Area	43	Eagle Point Lake & West Lakeland Area
PFNA	184	West Lakeland Area	161	West Lakeland Area
PFDA	689	Eagle Point Lake & West Lakeland Area	436	Eagle Point Lake & West Lakeland Area
PFUnA	473	Raleigh Creek - Upper, Eagle Point Lake, West Lakeland Area	327	Eagle Point Lake & West Lakeland Area
PFDoA	1618	Raleigh Creek - Upper	73	Eagle Point Lake
PFTrDA	132	Raleigh Creek - Upper, Raleigh Creek - Other, West Lakeland	105	West Lakeland Area
PFTeDA	45.9	Raleigh Creek - Other, West Lakeland Area	45	Eagle Point Lake & West Lakeland Area
Short-chain PFSAs				
PFBS	10.3	Raleigh Creek - Upper	48	Eagle Point Lake & West Lakeland Area
PFPeS	10.1	Raleigh Creek - Upper	67	Eagle Point Lake
Long-chain PFSAs				
PFHxS	6.6	Raleigh Creek - Upper	23	Eagle Point Lake & West Lakeland Area
PFHpS	53.6	Eagle Point Lake & West Lakeland Area	66	West Lakeland Area
PFOS	454	Eagle Point Lake & West Lakeland Area	145	Eagle Point Lake & West Lakeland Area
Fluortelomers				
6:2 FTS	131	West Lakeland Area	87	Raleigh Creek - Other & West Lakeland Area
FOSA, FASE, FASAAs				
PFOSA	468	Eagle Point Lake & West Lakeland Area	1895	Eagle Point Lake & West Lakeland Area
N-EtFOSAA	185	Eagle Point Lake & West Lakeland Area	194	Eagle Point Lake & West Lakeland Area
N-MeFOSAA	241	Raleigh Creek - Upper	321	Raleigh Creek - Upper
N-EtFOSE	NC	ND in Amphibian Tissue	NC	ND in Crayfish Tissue

Notes:
See Table 2 for PFAS analyte abbreviations.
See Appendix E for calculation of Project 1007-specific BAFs. BAFs were only calculated for PFAS evaluated in Lake Elmo and Eagle Point Lake where certain tissue types were not collected.
The individual amphibian and crayfish BAFs were calculated based on the available tissue data and surface water data in the areas identified. The selected BAF is the geometric mean of the individual BAFs from the indicated areas.
BAFs were preferentially selected from Eagle Point Lake and the West Lakeland Area due to similarities in water concentrations with Lake Elmo.
BAFs from Raleigh Creek - Upper and Raleigh Creek - Other were used when insufficient individual BAFs were available from Eagle Point Lake and the West Lakeland Area.

BAF - bioaccumulation factor
kg - kilogram
L - liter
NC - not calculated
ND - not detected
ww - wet weight

1 - The geometric mean BAFs for PFBA were calculated based on individual BAFs from Raleigh Creek - Upper and West Lakeland Areas for which surface water concentrations were comparable to Lake Elmo.

Table 6 Literature-Derived BAFs Used in the Food Web Models

Analyte	Literature-based Aquatic Bioaccumulation Factors							
	Water to Aquatic Plant BAF (L water / kg tissue)				Water to Aquatic Invertebrate BAF (L water / kg tissue)			
	Value (tissue dw)	Value (tissue ww)[1]	Reference	Notes	Aquatic/Benthic Invert. Value (tissue dw)[2]	Aquatic/Benthic Invert. Value (tissue ww)[3]	Reference	Notes
Short-chain PFCAs								
PFBA	19	2.8	Divine et al. (2020); Zodrow et al. (2020)	Geomean	298	54	Zodrow et al. (2020) (Surr - PFBS)	
PFPeA	191	27.7	Surr - PFHxA		298	54	Surr - PFBS	
PFHxA	191	27.7	Divine et al. (2020); Zodrow et al. (2020)	Geomean	2238	403	Divine et al. (2020); Zodrow et al. (2020)	Geomean
PFHpA	228	33.06	Surr - PFOA		351	63	Divine et al. (2020)	Geomean
Long-chain PFCAs								
PFOA	228	33	Divine et al. (2020); Zodrow et al. (2020)	Geomean	379	68	Divine et al. (2020); Zodrow et al. (2020)	Geomean
PFNA	5,188	752	Divine et al. (2020); Zodrow et al. (2020)	Geomean	983	177	Divine et al. (2020); Zodrow et al. (2020)	Geomean
PFDA	12,360	1,792	Divine et al. (2020)	Geomean	707	127	Divine et al. (2020)	Geomean
PFUnA	12,360	1,792	Surr - PFDA		707	127	Surr - PFDA	
PFDoA	12,360	1,792	Surr - PFDA		707	127	Surr - PFDA	
PFTrDA	12,360	1,792	Surr - PFDA		707	127	Surr - PFDA	
PFTeDA	12,360	1,792	Surr - PFDA		707	127	Surr - PFDA	
Short-chain PFSAs								
PFBS	8.0	1.2	Divine et al. (2020); Zodrow et al. (2020)	Geomean	298	54	Divine et al. (2020); Zodrow et al. (2020)	Geomean
PFPeS	8.0	1.2	Surr - PFBS		1327	239	Surr - PFHxS	
Long-chain PFSAs								
PFHxS	12	1.7	Divine et al. (2020)	Geomean	1327	239	Divine et al. (2020)	Geomean
PFHpS	228	33	Surr - PFOA		1549	279	Surr - PFOS	
PFOS	1,305	189	Divine et al. (2020); Zodrow et al. (2020)	Geomean	1549	279	Divine et al. (2020); Zodrow et al. (2020)	Geomean
PFNS	1,305	189	Surr - PFOS		1549	279	Surr - PFOS	
PFDS	1,305	189	Surr - PFOS		1549	279	Surr - PFOS	
PFDoS	1,305	189	Surr - PFOS		1549	279	Surr - PFOS	
Fluortelomers								
4:2 FTS	8.0	1.2	Surr - PFBS		298	54	Surr - PFBS	
6:2 FTS	12	1.7	Surr - PFHxS		1327	239	Surr - PFHxS	
8:2 FTS	1,305	189	Surr - PFOS		1549	279	Surr - PFOS	
10:2 FTS	12,360	1,792	Surr - PFDA		707	127	Surr - PFDA	
3:3 FTCA	19	2.8	Surr - PFBA		298	54	Surr - PFBS	
5:3 FTCA	19	2.8	Surr - PFBA		2238	403	Surr - PFHxA	
7:3 FTCA	228	33.1	Surr - PFOA		379	68	Surr - PFOA	
FOSA, FASE, FASAAs								
PFOSA	1,305	189	Surr - PFOS		1549	279	Surr - PFOS	
N-EtFOSA	1,305	189	Surr - PFOS		1549	279	Surr - PFOS	
N-MeFOSA	1,305	189	Surr - PFOS		1549	279	Surr - PFOS	
N-EtFOSAA	1,305	189	Surr - PFOS		1549	279	Surr - PFOS	
N-MeFOSAA	1,305	189	Surr - PFOS		1549	279	Surr - PFOS	
N-EtFOSE	1,305	189	Surr - PFOS		1549	279	Surr - PFOS	
N-MeFOSE	1,305	189	Surr - PFOS		1549	279	Surr - PFOS	
Replacement Chemistries								
HFPO-DA	191	28	Surr - PFHxA		2238	403	Surr - PFHxA	
ADONA	228	33.1	Surr - PFOA		1327	239	Surr - PFHxS	
9CL-PF3ONS	1,305	189	Surr - PFOS		1549	279	Surr - PFOS	
11CL-PF3OUDS	1,305	189	Surr - PFOS		707	127	Surr - PFDA	
PFMPA	19	2.8	Surr - PFBA		298	54	Surr - PFBS	
PFEESA	8.0	1.2	Surr - PFBS		298	54	Surr - PFBS	
PFMBA	19	2.8	Surr - PFBA		298	54	Surr - PFBS	
NFDHA	19	2.8	Surr - PFBA		298	54	Surr - PFBS	

Notes:
See Table 2 for PFAS analyte abbreviations.
dw - dry weight
Geomean - Geometric mean. The selected BAF is based on the geometric mean of several individual BAFs.
kg - kilogram
L - liter
Surr - Surrogate selected when ESV not available. Surrogates selected based on carbon chain length and PFAS classification.
ww - wet weight

1 - Converted to ww tissue using 85.5% moisture content (average of algae [84%] and aquatic macrophytes [87%]; Table 4-2 EPA 1993)

2 - Aquatic/Benthic Invert Values are based on filter-feeding benthic invertebrates (oyster, mussel, gastropod, snail, other bivalves) and were selected to represent aquatic invertebrates (including aerial insects) exposed to PFAS in water. Filter-feeding benthic invertebrates are expected to have exposure to contaminants in the water column similar to other aquatic invertebrate species and expected to have lower exposure to sediments.
3 - Converted to ww tissue using 82% moisture content (bivalves (without shell); Table 4-1 EPA 1993)

Table 7 Toxicity Reference Values for Birds

Analyte	TRVs for Birds (µg/kg-day)					
	NOAEL	Reference	Basis	LOAEL	Reference	Basis
Short-chain PFCAs						
PFBA	1,000	[2] Surr - PFOA		10,000	[2] Surr - PFOA	
PFPeA	1,000	[2] Surr - PFOA		10,000	[2] Surr - PFOA	
PFHxA	1,000	[2] Surr - PFOA		10,000	[2] Surr - PFOA	
PFHpA	1,000	[2] Surr - PFOA		10,000	[2] Surr - PFOA	
Long-chain PFCAs						
PFOA	1,000	[2]	No effect on growth (body weight) of 1-day old chickens; exposed to PFOA/PFDA/PFOS mixture	10,000		Application of a NOAEL-to-LOAEL adjustment factor of 10; consistent with Divine et al. (2020), Zodrow et al. (2020), and USEPA (2005)
PFNA	1,000	[2] Surr - PFOA		10,000	[2] Surr - PFOA	
PFDA	1,000	[2]	No effect on growth (body weight) of 1-day old chickens; exposed to PFOA/PFDA/PFOS mixture	10,000		Application of a NOAEL-to-LOAEL adjustment factor of 10; consistent with Divine et al. (2020), Zodrow et al. (2020), and USEPA (2005)
PFUnA	1,000	[2] Surr - PFOA		10,000	[2] Surr - PFOA	
PFDoA	1,000	[2] Surr - PFOA		10,000	[2] Surr - PFOA	
PFTrDA	1,000	[2] Surr - PFOA		10,000	[2] Surr - PFOA	
PFTeDA	1,000	[2] Surr - PFOA		10,000	[2] Surr - PFOA	
Short-chain PFSAs						
PFBS	92,000	[1]	No effect on survival and reproduction in Bobwhite Quail	153,000	[1]	Lowest bounded LOAEL (Effect on growth in Bobwhite Quail)
PFPeS	92,000	[1] Surr - PFBS		153,000	[1] Surr - PFBS	
Long-chain PFSAs						
PFHxS	79.0	[1] Surr - PFOS		790	[1] Surr - PFOS	
PFHpS	79.0	[1] Surr - PFOS		790	[1] Surr - PFOS	
PFOS	79.0	[1]	No effect on reproduction and survival in Bobwhite Quail	790	[1]	Lowest bounded LOAEL (Effect on reproduction and survival in Bobwhite Quail; exposure included during sensitive life stage, i.e., egg-laying)
PFNS	79.0	[1] Surr - PFOS		790	[1] Surr - PFOS	
PFDS	79.0	[1] Surr - PFOS		790	[1] Surr - PFOS	
PFDoS	79.0	[1] Surr - PFOS		790	[1] Surr - PFOS	
Fluortelomers						
4:2 FTS	92,000	[1] Surr - PFBS		153,000	[1] Surr - PFBS	
6:2 FTS	1,000	[2] Surr - PFOA		10,000	[2] Surr - PFOA	
8:2 FTS	79.0	[1] Surr - PFOS		790	[1] Surr - PFOS	
10:2 FTS	79.0	[1] Surr - PFOS		790	[1] Surr - PFOS	
3:3 FTCA	92,000	[1] Surr - PFBS		153,000	[1] Surr - PFBS	
5:3 FTCA	92,000	[1] Surr - PFBS		153,000	[1] Surr - PFBS	
7:3 FTCA	1,000	[2] Surr - PFOA		10,000	[2] Surr - PFOA	

Table 7 Toxicity Reference Values for Birds

Analyte	TRVs for Birds (µg/kg-day)					
	NOAEL	Reference	Basis	LOAEL	Reference	Basis
FOSA, FASE, FASAAs						
PFOSA	79.0	[1] Surr - PFOS		790	[1] Surr - PFOS	
N-EtFOSA	79.0	[1] Surr - PFOS		790	[1] Surr - PFOS	
N-MeFOSA	79.0	[1] Surr - PFOS		790	[1] Surr - PFOS	
N-EtFOSAA	79.0	[1] Surr - PFOS		790	[1] Surr - PFOS	
N-MeFOSAA	79.0	[1] Surr - PFOS		790	[1] Surr - PFOS	
N-EtFOSE	79.0	[1] Surr - PFOS		790	[1] Surr - PFOS	
N-MeFOSE	79.0	[1] Surr - PFOS		790	[1] Surr - PFOS	
Replacement Chemistries						
HFPO-DA	1,000	[2] Surr - PFOA		10,000	[2] Surr - PFOA	
ADONA	1,000	[2] Surr - PFOA		10,000	[2] Surr - PFOA	
9CL-PF3ONS	79.0	[1] Surr - PFOS		790	[1] Surr - PFOS	
11CL-PF3OUDS	79.0	[1] Surr - PFOS		790	[1] Surr - PFOS	
PFMPA	92,000	[1] Surr - PFBS		153,000	[1] Surr - PFBS	
PFEESA	92,000	[1] Surr - PFBS		153,000	[1] Surr - PFBS	
PFMBA	92,000	[1] Surr - PFBS		153,000	[1] Surr - PFBS	
NFDHA	92,000	[1] Surr - PFBS		153,000	[1] Surr - PFBS	

Notes:
See Table 2 for PFAS analyte abbreviations.
See individual food web models in Appendices G through K for additional details and study references.
TRVs were selected from the following hierarchy due to preference for EcoSSL TRV-derivation approach (USEPA 2005) and that Zodrow et al. (2020) has been peer reviewed:
1 - Divine et al. (2020) and/or Zodrow et al. (2020)
2 - Condor et al. (2020)
µg/kg-day - micrograms per kilogram body weight per day
EcoSSL - Ecological Soil Screening Level
LOAEL - lowest observed adverse effects level
NOAEL - no observed adverse effects level
Surr - Surrogate selected when TRV not available. Surrogates selected based on carbon chain length and PFAS classification.
TRV - toxicity reference value
USEPA - United States Environmental Protection Agency

Table 8 Toxicity Reference Values for Mammals

Analyte	TRVs for Mammals (µg/kg-day)					
	NOAEL	Reference	Basis	LOAEL	Reference	Basis
Short-chain PFCAs						
PFBA	73,000	[1]	No effect on growth or reproduction	175,000	[1]	Lowest bounded LOAEL (Effect on reproduction)
PFPeA	84,000	[1] Surr - PFHxA		175,000	[1] Surr - PFHxA	
PFHxA	84,000	[1]	No effect on growth, reproduction, or survivial	175,000	[1]	Lowest bounded LOAEL (Effect on reproduction & survival in mice)
PFHpA	300	[1] Surr - PFOA		600	[1] Surr - PFOA	
Long-chain PFCAs						
PFOA	300	[1]	No effect on growth, reproduction, or survival	600	[1]	Lowest bounded LOAEL (Effect on reproduction & survival in mice)
PFNA	830	[1]	No effect on reproduction (# live pups) in mice	1,100	[1]	Lowest bounded LOAEL (decreased reproduction in mice)
PFDA	100	[2]	No effect on growth (fetal body weight per litter) in pregnant mice	6,400	[2]	23% control-adjusted decrease in growth (fetal body weight per litter) in pregnant mice
PFUnA	300	[2]	No effect on growth (body weight in adults and pups) in rats	1,000	[2]	13-19% control-adjusted decrease in growth (body weight of pups) in rats
PFDoA	500	[2]	No effect on growth (body weight in adults and pups) in rats	2,500	[2]	20-40% control-adjusted decrease in growth (body weight in adults and pups) in rats
PFTrDA	500	[2] Surr - PFDoA		2,500	[2] Surr - PFDoA	
PFTeDA	3,000	[2]	No effect on growth (body weight in adults and pups) in rats	10,000	[2]	8-18% control-adjusted decrease in growth (body weight of pups) in rats
Short-chain PFSAs						
PFBS	50,000	[1]	No effect on reproduction in mice	200,000	[1]	Lowest bounded LOAEL (Effect on reproduction in mice)
PFPeS	50,000	[1] Surr - PFBS		200,000	[1] Surr - PFBS	
Long-chain PFSAs						
PFHxS	300	[2]	No effect on reproduction (litter size) in mice	1,000	[2]	14% control-adjusted decrease in reproduction (litter size) in mice
PFHpS	300	[2] Surr - PFHxS		1,000	[2] Surr - PFHxS	
PFOS	100	[1]	No effect on growth, reproduction, or survivial	170	[1]	Lowest bounded LOAEL (Effect on reproduction in mice)
PFNS	100	[1] Surr - PFOS		170	[1] Surr - PFOS	
PFDS	100	[1] Surr - PFOS		170	[1] Surr - PFOS	
PFDoS	100	[1] Surr - PFOS		170	[1] Surr - PFOS	

Table 8 Toxicity Reference Values for Mammals

Analyte	TRVs for Mammals (µg/kg-day)					
	NOAEL	Reference	Basis	LOAEL	Reference	Basis
Fluortelomers						
4:2 FTS	50,000	[1] Surr - PFBS		200,000	[1] Surr - PFBS	
6:2 FTS	300	[2] Surr - PFHxS		1,000	[2] Surr - PFHxS	
8:2 FTS	100	[1] Surr - PFOS		170	[1] Surr - PFOS	
10:2 FTS	300	[2] Surr - PFUnA		1,000	[2] Surr - PFUnA	
3:3 FTCA	73,000	[1] Surr - PFBA		175,000	[1] Surr - PFBA	
5:3 FTCA	73,000	[1] Surr - PFBA		175,000	[1] Surr - PFBA	
7:3 FTCA	300	[1] Surr - PFOA		600	[1] Surr - PFOA	
FOSA, FASE, FASAAs						
PFOSA	100	[1] Surr - PFOS		170	[1] Surr - PFOS	
N-EtFOSA	100	[1] Surr - PFOS		170	[1] Surr - PFOS	
N-MeFOSA	100	[1] Surr - PFOS		170	[1] Surr - PFOS	
N-EtFOSAA	100	[1] Surr - PFOS		170	[1] Surr - PFOS	
N-MeFOSAA	100	[1] Surr - PFOS		170	[1] Surr - PFOS	
N-EtFOSE	100	[1]	No effect on growth or reproduction	1,000	[1]	Lowest bounded LOAEL (Effect on reproduction and growth in rabbit)
N-MeFOSE	100	[1] Surr - N-ETFOSE		1,000	[1] Surr - N-ETFOSE	
Replacement Chemistries						
HFPO-DA	300	[1] Surr - PFOA		600	[1] Surr - PFOA	
ADONA	300	[1] Surr - PFOA		600	[1] Surr - PFOA	
9CL-PF3ONS	100	[1] Surr - PFOS		170	[1] Surr - PFOS	
11CL-PF3OUDS	100	[1] Surr - PFOS		170	[1] Surr - PFOS	
PFMPA	73,000	[1] Surr - PFBA		175,000	[1] Surr - PFBA	
PFEESA	50,000	[1] Surr - PFBS		200,000	[1] Surr - PFBS	
PFMBA	73,000	[1] Surr - PFBA		175,000	[1] Surr - PFBA	
NFDHA	73,000	[1] Surr - PFBA		175,000	[1] Surr - PFBA	

Notes:
See Table 2 for PFAS analyte abbreviations.
See individual food web models in Appendices G through K for additional details and study references.
TRVs were selected from the following hierarchy due to preference for EcoSSL TRV-derivation approach (USEPA 2005) and that Zodrow et al. (2020) has been peer reviewed:
1 - Divine et al. (2020) and/or Zodrow et al. (2020)
2 - Condor et al. (2020)
µg/kg-day - micrograms per kilogram body weight per day
EcoSSL - Ecological Soil Screening Level
LOAEL - lowest observed adverse effects level
NOAEL - no observed adverse effects level
Surr - Surrogate selected when TRV not available. Surrogates selected based on carbon chain length and PFAS classification.
TRV - toxicity reference value
USEPA - United States Environmental Protection Agency

Table 9a Summary of Surface Water HQs - Raleigh Creek - Upper

Analyte	FOD	Percent Detected	Maximum HQ		UCL HQ	
			Aquatic Life	Wildlife	Aquatic Life	Wildlife
TOTAL RECOVERABLE PHASE RESULTS						
Short-chain PFCAs						
PFBA	55 : 55	100%	0.0023	0.0017	NE	NE
PFPeA	60 : 60	100%	0.00093	0.00020	NE	NE
PFHxA	59 : 60	98%	0.00012	0.0013	NE	NE
PFHpA	59 : 60	98%	0.00035	0.0014	NE	NE
Long-chain PFCAs						
PFOA	60 : 60	100%	0.0046	0.56	NE	NE
PFNA	58 : 60	97%	0.00019	0.011	NE	NE
PFDA	58 : 60	97%	0.00019	0.012	NE	NE
PFUNA	5 : 60	8%	0.000017	0.00039	NE	NE
PFDoA	1 : 60	2%	0.000006	0.00020	NE	NE
PFTrDA	1 : 60	2%	0.000029	0.0010	NE	NE
Short-chain PFSAs						
PFBS	59 : 60	98%	0.000023	0.00012	NE	NE
PFPeS	59 : 60	98%	0.000029	0.00016	NE	NE
Long-chain PFSAs						
PFHxS	59 : 60	98%	0.43	**3.2**	NE	**1.2**
PFHpS	58 : 60	97%	0.20	**1.5**	NE	0.48
PFOS	60 : 60	100%	**15.7**	**117**	**5.4**	**40.5**
PFNS	23 : 60	38%	0.0066	0.049	NE	NE
PFDS	15 : 60	25%	0.0032	0.024	NE	NE
PFDoS	1 : 47	2%	0.0008	0.0061	NE	NE
Fluortelomers						
6:2 FTS	8 : 60	13%	0.0001	0.0061	NE	NE
FOSA, FASE, FASAAs						
PFOSA	56 : 60	93%	0.22	**1.6**	NE	0.43
N-EtFOSA	5 : 60	8%	0.0069	0.051	NE	NE
N-MeFOSAA	5 : 60	8%	0.0022	0.017	NE	NE
N-EtFOSAA	55 : 60	92%	0.85	**6.4**	NE	0.90
N-EtFOSE	4 : 60	7%	0.03	0.24	NE	NE
Replacement Chemistries						
HFPO-DA	2 : 60	3%	0.00000021	0.0000023	NE	NE
DISSOLVED PHASE RESULTS						
Short-chain PFCAs						
PFBA	9 : 9	100%	0.0023	0.0017	NE	NE
PFPeA	9 : 9	100%	0.00048	0.00010	NE	NE
PFHxA	8 : 9	89%	0.000070	0.00076	NE	NE
PFHpA	9 : 9	100%	0.000097	0.00040	NE	NE
Long-chain PFCAs						
PFOA	9 : 9	100%	0.0012	0.1477	NE	NE
PFNA	8 : 9	89%	0.000051	0.0028	NE	NE
PFDA	8 : 9	89%	0.000086	0.0055	NE	NE
PFTrDA	2 : 9	22%	0.000031	0.0010	NE	NE
PFTeDA	3 : 9	33%	0.000057	0.0019	NE	NE

Table 9a Summary of Surface Water HQs - Raleigh Creek - Upper

Analyte	FOD	Percent Detected	Maximum HQ		UCL HQ	
			Aquatic Life	Wildlife	Aquatic Life	Wildlife
DISSOLVED PHASE RESULTS (continued)						
Short-chain PFSAs						
PFBS	9 : 9	100%	0.0000085	0.000045	NE	NE
PFPeS	8 : 9	89%	0.000014	0.000072	NE	NE
Long-chain PFSAs						
PFHxS	9 : 9	100%	0.13	0.93	NE	NE
PFHpS	8 : 9	89%	0.046	0.35	NE	NE
PFOS	9 : 9	100%	**3.8**	**28.0**	**2.9**	**21.5**
PFNS	4 : 9	44%	0.0054	0.040	NE	NE
Fluortelomers						
6:2 FTS	2 : 9	22%	0.0000013	0.00016	NE	NE
FOSA, FASE, FASAAs						
PFOSA	8 : 9	89%	0.059	0.44	NE	NE
N-MeFOSA	3 : 9	33%	0.0014	0.011	NE	NE
N-EtFOSAA	7 : 9	78%	0.032	0.24	NE	NE
N-EtFOSE	2 : 9	22%	0.00054	0.0040	NE	NE
Replacement Chemistries						
HFPO-DA	1 : 9	11%	0.00000014	0.0000015	NE	NE

Notes:

This table summarizes the surafce water screening evaluation presented in Appendix F.

Analyte presented if detected in at least one sample from this area.

Boldface indicates Maximum HQ > 1.

Shading indicates UCL HQ>1

ESV - Ecological Screening Value.

FOD - Frequency of Detection.

HQ - Hazard Quotient (Maximum Concentration or UCL/ESV).

NE - Not Evaluated. Comparison not necessary if Maximum HQ < 1.

UCL - Upper Confidence Limit.

Table 9b Summary of Surface Water HQs - Raleigh Creek - Other

Analyte	FOD	Percent Detected	Maximum HQ		UCL HQ	
			Aquatic Life	Wildlife	Aquatic Life	Wildlife
TOTAL RECOVERABLE PHASE RESULTS						
Short-chain PFCAs						
PFBA	42 : 42	100%	0.00071	0.00050	NE	NE
PFPeA	45 : 45	100%	0.00026	0.00006	NE	NE
PFHxA	39 : 45	87%	0.000028	0.00031	NE	NE
PFHpA	45 : 45	100%	0.000071	0.00029	NE	NE
Long-chain PFCAs						
PFOA	45 : 45	100%	0.0010	0.12	NE	NE
PFNA	27 : 45	60%	0.000035	0.0019	NE	NE
PFDA	9 : 45	20%	0.000028	0.0018	NE	NE
PFTrDA	5 : 45	11%	0.000033	0.0011	NE	NE
PFTeDA	1 : 45	2%	0.000064	0.0021	NE	NE
Short-chain PFSAs						
PFBS	45 : 45	100%	0.0000056	0.000030	NE	NE
PFPeS	12 : 45	27%	0.0000059	0.000032	NE	NE
Long-chain PFSAs						
PFHxS	45 : 45	100%	0.094	0.71	NE	NE
PFHpS	8 : 45	18%	0.028	0.21	NE	NE
PFOS	45 : 45	100%	**2.2**	**16.4**	0.51	**3.8**
Fluortelomers						
6:2 FTS	3 : 45	7%	0.000026	0.0031	NE	NE
FOSA, FASE, FASAAs						
PFOSA	10 : 45	22%	0.020	0.15	NE	NE
N-EtFOSAA	9 : 45	20%	0.016	0.12	NE	NE
N-EtFOSE	1 : 45	2%	0.00025	0.0019	NE	NE
DISSOLVED PHASE RESULTS						
Short-chain PFCAs						
PFBA	6 : 6	100%	0.00023	0.00017	NE	NE
PFPeA	6 : 6	100%	0.000056	0.000012	NE	NE
PFHpA	6 : 6	100%	0.0000053	0.000022	NE	NE
Long-chain PFCAs						
PFOA	6 : 6	100%	0.000017	0.0021	NE	NE
PFUNA	1 : 6	17%	0.000033	0.00073	NE	NE
PFDoA	1 : 6	17%	0.000053	0.0017	NE	NE
Short-chain PFSAs						
PFBS	6 : 6	100%	0.00000088	0.0000047	NE	NE
Long-chain PFSAs						
PFHxS	6 : 6	100%	0.0068	0.051	NE	NE
PFOS	6 : 6	100%	0.012	0.087	NE	NE
FOSA, FASE, FASAAs						
PFOSA	1 : 6	17%	0.0012	0.0091	NE	NE
N-EtFOSAA	1 : 6	17%	0.0014	0.011	NE	NE

Notes:
This table summarizes the surafce water screening evaluation presented in Appendix F.
Analyte presented if detected in at least one sample from this area.
Boldface indicates Maximum HQ > 1.
Shading indicates UCL HQ>1
ESV - Ecological Screening Value.
FOD - Frequency of Detection.
HQ - Hazard Quotient (Maximum Concentration or UCL/ESV).
NE - Not Evaluated. Comparison not necessary if Maximum HQ < 1.
UCL - Upper Confidence Limit.

Table 9c Summary of Surface Water HQs - Eagle Point Lake

Analyte	FOD	Percent Detected	Maximum HQ		UCL HQ	
			Aquatic Life	Wildlife	Aquatic Life	Wildlife
TOTAL RECOVERABLE PHASE RESULTS						
Short-chain PFCAs						
PFBA	40 : 40	100%	0.00032	0.00023	NE	NE
PFPeA	41 : 42	98%	0.000086	0.000018	NE	NE
PFHxA	42 : 42	100%	0.0000078	0.000086	NE	NE
PFHpA	42 : 42	100%	0.000017	0.000071	NE	NE
Long-chain PFCAs						
PFOA	42 : 42	100%	0.00028	0.034	NE	NE
PFNA	40 : 42	95%	0.000034	0.0019	NE	NE
PFDA	38 : 42	90%	0.000047	0.0030	NE	NE
PFUNA	1 : 42	2%	0.000053	0.0012	NE	NE
PFDoA	1 : 42	2%	0.000039	0.0013	NE	NE
PFTrDA	6 : 42	14%	0.00010	0.0031	NE	NE
PFTeDA	5 : 41	12%	0.000040	0.0013	NE	NE
Short-chain PFSAs						
PFBS	41 : 42	98%	0.0000021	0.000011	NE	NE
PFPeS	38 : 41	93%	0.0000020	0.000011	NE	NE
Long-chain PFSAs						
PFHxS	42 : 42	100%	0.025	0.19	NE	NE
PFHpS	39 : 42	93%	0.010	0.077	NE	NE
PFOS	42 : 42	100%	**1.2**	**9.1**	0.57	**4.3**
Fluortelomers						
6:2 FTS	13 : 42	31%	0.00011	0.014	NE	NE
8:2 FTS	1 : 42	2%	0.00036	0.0027	NE	NE
FOSA, FASE, FASAAs						
PFOSA	30 : 42	71%	0.0084	0.062	NE	NE
N-MeFOSA	2 : 42	5%	0.00089	0.0067	NE	NE
N-EtFOSAA	22 : 41	54%	0.011	0.080	NE	NE
N-EtFOSE	3 : 40	8%	0.0018	0.013	NE	NE
DISSOLVED PHASE RESULTS						
Short-chain PFCAs						
PFBA	12 : 12	100%	0.00036	0.00026	NE	NE
PFPeA	12 : 12	100%	0.00010	0.000021	NE	NE
PFHxA	12 : 12	100%	0.000010	0.00010	NE	NE
PFHpA	12 : 12	100%	0.000016	0.000067	NE	NE
Long-chain PFCAs						
PFOA	12 : 12	100%	0.00030	0.036	NE	NE
PFNA	9 : 12	75%	0.000053	0.0029	NE	NE
PFDA	5 : 12	42%	0.000079	0.0050	NE	NE
PFTrDA	9 : 12	75%	0.00044	0.015	NE	NE
PFTeDA	6 : 11	55%	0.000071	0.0023	NE	NE
Short-chain PFSAs						
PFBS	12 : 12	100%	0.0000021	0.000011	NE	NE
PFPeS	12 : 12	100%	0.0000032	0.000017	NE	NE
Long-chain PFSAs						
PFHxS	12 : 12	100%	0.054	0.40	NE	NE
PFHpS	12 : 12	100%	0.0095	0.071	NE	NE
PFOS	12 : 12	100%	**2.0**	**14.7**	0.84	**6.3**

Table 9c Summary of Surface Water HQs - Eagle Point Lake

Analyte	FOD	Percent Detected	Maximum HQ		UCL HQ	
			Aquatic Life	Wildlife	Aquatic Life	Wildlife
DISSOLVED PHASE RESULTS (continued)						
Fluortelomers						
6:2 FTS	2 : 12	17%	0.0000035	0.00043	NE	NE
8:2 FTS	1 : 12	8%	0.00073	0.0055	NE	NE
FOSA, FASE, FASAAs						
PFOSA	11 : 11	100%	0.0034	0.025	NE	NE
N-MeFOSA	6 : 11	55%	0.0014	0.011	NE	NE
N-EtFOSAA	2 : 11	18%	0.0012	0.0091	NE	NE
N-MeFOSE	1 : 11	9%	0.00057	0.0043	NE	NE
N-EtFOSE	6 : 11	55%	0.0010	0.0076	NE	NE
Replacement Chemistries						
HFPO-DA	3 : 12	25%	0.00000015	0.0000017	NE	NE

Notes:
This table summarizes the surafce water screening evaluation presented in Appendix F.
Analyte presented if detected in at least one sample from this area.
Boldface indicates Maximum HQ > 1.
Shading indicates UCL HQ>1
ESV - Ecological Screening Value.
FOD - Frequency of Detection.
HQ - Hazard Quotient (Maximum Concentration or UCL/ESV).
NE - Not Evaluated. Comparison not necessary if Maximum HQ < 1.
UCL - Upper Confidence Limit.

Table 9d Summary of Surface Water HQs - Lake Elmo

Analyte	FOD	Percent Detected	Maximum HQ		UCL HQ	
			Aquatic Life	Wildlife	Aquatic Life	Wildlife
TOTAL RECOVERABLE PHASE RESULTS						
Short-chain PFCAs						
PFBA	31 : 31	100%	0.0022	0.0015	NE	NE
PFPeA	34 : 34	100%	0.00014	0.000029	NE	NE
PFHxA	34 : 34	100%	0.000010	0.00010	NE	NE
PFHpA	34 : 34	100%	0.000016	0.000067	NE	NE
Long-chain PFCAs						
PFOA	34 : 34	100%	0.00020	0.024	NE	NE
PFNA	21 : 34	62%	0.000016	0.00086	NE	NE
PFDA	17 : 34	50%	0.000019	0.0012	NE	NE
PFTrDA	2 : 34	6%	0.000024	0.00077	NE	NE
PFTeDA	1 : 34	3%	0.000033	0.0011	NE	NE
Short-chain PFSAs						
PFBS	34 : 34	100%	0.0000016	0.0000088	NE	NE
PFPeS	34 : 34	100%	0.0000018	0.0000094	NE	NE
Long-chain PFSAs						
PFHxS	34 : 34	100%	0.023	0.17	NE	NE
PFHpS	32 : 34	94%	0.0079	0.059	NE	NE
PFOS	34 : 34	100%	0.86	**6.4**	NE	**2.5**
6:2 FTS	8 : 34	24%	0.00016	0.020	NE	NE
FOSA, FASE, FASAAs						
PFOSA	16 : 34	47%	0.0051	0.038	NE	NE
N-MeFOSAA	1 : 34	3%	0.0042	0.031	NE	NE
N-EtFOSAA	6 : 34	18%	0.0040	0.030	NE	NE
N-EtFOSE	1 : 34	3%	0.00027	0.0020	NE	NE
DISSOLVED PHASE RESULTS						
Short-chain PFCAs						
PFBA	6 : 6	100%	0.0017	0.0012	NE	NE
PFPeA	6 : 6	100%	0.00016	0.000033	NE	NE
PFHxA	6 : 6	100%	0.000009	0.00010	NE	NE
PFHpA	6 : 6	100%	0.000015	0.00006	NE	NE
Long-chain PFCAs						
PFOA	6 : 6	100%	0.00019	0.023	NE	NE
PFNA	4 : 6	67%	0.000015	0.00082	NE	NE
PFDA	1 : 6	17%	0.000016	0.0010	NE	NE
PFTrDA	1 : 6	17%	0.000025	0.00082	NE	NE
PFTeDA	2 : 6	33%	0.000054	0.0018	NE	NE

Table 9d Summary of Surface Water HQs - Lake Elmo

Analyte	FOD	Percent Detected	Maximum HQ		UCL HQ	
			Aquatic Life	Wildlife	Aquatic Life	Wildlife
DISSOLVED PHASE RESULTS (continued)						
Short-chain PFSAs						
PFBS	6 : 6	100%	0.0000015	0.0000078	NE	NE
PFPeS	6 : 6	100%	0.0000018	0.000010	NE	NE
Long-chain PFSAs						
PFHxS	6 : 6	100%	0.021	0.16	NE	NE
PFHpS	6 : 6	100%	0.0066	0.049	NE	NE
PFOS	6 : 6	100%	0.70	**5.2**	NE	**4.8**
FOSA, FASE, FASAAs						
PFOSA	4 : 6	67%	0.0029	0.021	0.00	0.0043
N-MeFOSA	2 : 6	33%	0.00084	0.0063	0.00	0.0025
N-EtFOSAA	1 : 6	17%	0.0018	0.013	0.00	0.011
N-EtFOSE	2 : 6	33%	0.00048	0.0036	0.00	0.0014

Notes:
This table summarizes the surafce water screening evaluation presented in Appendix F.
Analyte presented if detected in at least one sample from this area.
Boldface indicates Maximum HQ > 1.
Shading indicates UCL HQ>1
ESV - Ecological Screening Value.
FOD - Frequency of Detection.
HQ - Hazard Quotient (Maximum Concentration or UCL/ESV).
NE - Not Evaluated. Comparison not necessary if Maximum HQ < 1.
UCL - Upper Confidence Limit.

Table 9e Summary of Surface Water HQs - West Lakeland Area

Analyte	FOD	Percent Detected	Maximum HQ		UCL HQ	
			Aquatic Life	Wildlife	Aquatic Life	Wildlife
TOTAL RECOVERABLE PHASE RESULTS						
Short-chain PFCAs						
PFBA	74 : 74	100%	0.0017	0.0012	NE	NE
PFPeA	72 : 82	88%	0.00013	0.000027	NE	NE
PFHxA	82 : 82	100%	0.0000083	0.000090	NE	NE
PFHpA	80 : 82	98%	0.000013	0.000053	NE	NE
Long-chain PFCAs						
PFOA	82 : 82	100%	0.00020	0.025	NE	NE
PFNA	60 : 82	73%	0.000023	0.0013	NE	NE
PFDA	33 : 82	40%	0.000041	0.0026	NE	NE
PFUNA	1 : 82	1%	0.000011	0.00023	NE	NE
PFTrDA	4 : 82	5%	0.000024	0.00077	NE	NE
PFTeDA	8 : 82	10%	0.000061	0.0020	NE	NE
Short-chain PFSAs						
PFBS	72 : 82	88%	0.0000017	0.0000088	NE	NE
PFPeS	72 : 82	88%	0.0000015	0.0000080	NE	NE
Long-chain PFSAs						
PFHxS	82 : 82	100%	0.023	0.17	NE	NE
PFHpS	71 : 82	87%	0.0066	0.049	NE	NE
PFOS	82 : 82	100%	**1.3**	**10.0**	0.36	**2.7**
Fluortelomers						
6:2 FTS	19 : 82	23%	0.00011	0.013	NE	NE
FOSA, FASE, FASAAs						
PFOSA	35 : 82	43%	0.0051	0.038	NE	NE
N-EtFOSA	1 : 82	1%	0.00057	0.0043	NE	NE
N-EtFOSAA	18 : 82	22%	0.016	0.12	NE	NE
N-EtFOSE	2 : 82	2%	0.00084	0.0063	NE	NE
DISSOLVED PHASE RESULTS						
Short-chain PFCAs						
PFBA	13 : 13	100%	0.0010	0.0007	NE	NE
PFPeA	13 : 13	100%	0.00011	0.00002	NE	NE
PFHxA	13 : 13	100%	0.0000074	0.000081	NE	NE
PFHpA	13 : 13	100%	0.000013	0.000052	NE	NE
Long-chain PFCAs						
PFOA	13 : 13	100%	0.00016	0.020	NE	NE
PFNA	6 : 13	46%	0.000013	0.0007	NE	NE
PFDA	11 : 13	85%	0.000016	0.0010	NE	NE
PFUNA	1 : 13	8%	0.000033	0.00073	NE	NE
PFDoA	6 : 13	46%	0.000051	0.0017	NE	NE
Short-chain PFSAs						
PFBS	13 : 13	100%	0.0000013	0.0000069	NE	NE
PFPeS	13 : 13	100%	0.0000017	0.0000092	NE	NE
Long-chain PFSAs						
PFHxS	13 : 13	100%	0.023	0.17	NE	NE
PFHpS	13 : 13	100%	0.0052	0.0387	NE	NE
PFOS	13 : 13	100%	0.55	**4.1**	NE	**3.3**

Table 9e Summary of Surface Water HQs - West Lakeland Area

Analyte	FOD	Percent Detected	Maximum HQ		UCL HQ	
			Aquatic Life	Wildlife	Aquatic Life	Wildlife
DISSOLVED PHASE RESULTS (continued)						
Fluortelomers						
6:2 FTS	2 : 13	15%	0.0000026	0.00032	NE	NE
8:2 FTS	1 : 13	8%	0.00030	0.0023	NE	NE
FOSA, FASE, FASAAs						
PFOSA	13 : 13	100%	0.0025	0.019	NE	NE
N-MeFOSA	1 : 12	8%	0.0011	0.0080	NE	NE
N-EtFOSAA	1 : 12	8%	0.0029	0.021	NE	NE
N-EtFOSE	2 : 13	15%	0.00036	0.0027	NE	NE

Notes:
This table summarizes the surafce water screening evaluation presented in Appendix F.
Analyte presented if detected in at least one sample from this area.
Boldface indicates Maximum HQ > 1.
Shading indicates UCL HQ>1
ESV - Ecological Screening Value.
FOD - Frequency of Detection.
HQ - Hazard Quotient (Maximum Concentration or UCL/ESV).
NE - Not Evaluated. Comparison not necessary if Maximum HQ < 1.
UCL - Upper Confidence Limit.

Table 10a Summary of Surface Sediment HQs - Raleigh Creek - Upper

Analyte	FOD	Percent Detected	Maximum HQ		UCL HQ	
			Aquatic Life	Wildlife	Aquatic Life	Wildlife
Short-chain PFCAs						
PFBA	31 : 39	79%	No ESV	0.0069	No ESV	NE
PFPeA	14 : 39	36%	No ESV	0.00056	No ESV	NE
PFHxA	26 : 39	67%	No ESV	0.0023	No ESV	NE
PFHpA	20 : 39	51%	No ESV	0.0016	No ESV	NE
Long-chain PFCAs						
PFOA	39 : 39	100%	No ESV	**13.1**	No ESV	**1.1**
PFNA	18 : 39	46%	No ESV	0.13	No ESV	NE
PFDA	34 : 39	87%	No ESV	0.88	No ESV	NE
PFUNA	20 : 39	51%	No ESV	0.069	No ESV	NE
PFDoA	22 : 39	56%	No ESV	0.14	No ESV	NE
PFTrDA	9 : 39	23%	No ESV	0.038	No ESV	NE
PFTeDA	12 : 39	31%	No ESV	0.038	No ESV	NE
Short-chain PFSAs						
PFBS	12 : 39	31%	No ESV	0.00057	No ESV	NE
PFPeS	15 : 38	39%	No ESV	0.0013	No ESV	NE
Long-chain PFSAs						
PFHxS	23 : 39	59%	0.037	**5.9**	NE	0.49
PFHpS	23 : 39	59%	0.098	**15.4**	NE	**2.3**
PFOS	39 : 39	100%	**7.3**	**1150**	0.70	**110**
PFNS	20 : 39	51%	0.016	**2.5**	NE	0.41
PFDS	28 : 39	72%	0.028	**4.4**	NE	0.98
PFDoS	18 : 30	60%	0.011	**1.8**	NE	0.53
Fluortelomers						
6:2 FTS	12 : 39	31%	0.046	**1.7**	NE	0.09
8:2 FTS	2 : 39	5%	0.00025	0.040	NE	NE
FOSA, FASE, FASAAs						
PFOSA	38 : 39	97%	0.23	**35.9**	NE	**6.2**
N-MeFOSA	26 : 39	67%	0.014	**2.1**	NE	0.30
N-EtFOSA	19 : 39	49%	0.021	**3.3**	NE	0.36
N-MeFOSAA	17 : 39	44%	0.0038	0.59	NE	NE
N-EtFOSAA	39 : 39	100%	0.11	**16.7**	NE	**4.1**
N-MeFOSE	2 : 39	5%	0.00073	0.11	NE	NE
N-EtFOSE	7 : 39	18%	0.0067	**1.1**	NE	0.37

Notes:
This table summarizes the surface water screening evaluation presented in Appendix F.
Analyte presented if detected in at least one sample from this area.
Boldface indicates Maximum HQ > 1.
Shading indicates UCL HQ>1
ESV - Ecological Screening Value.
FOD - Frequency of Detection.
HQ - Hazard Quotient (Maximum Concentration or UCL/ESV).
NE - Not Evaluated. Comparison not necessary if Maximum HQ < 1.
No ESV - No ESV available.
UCL - Upper Confidence Limit.

Table 10b Summary of Surface Sediment HQs - Raleigh Creek - Other

Analyte	FOD	Percent Detected	Maximum HQ		UCL HQ	
			Aquatic Life	Wildlife	Aquatic Life	Wildlife
Short-chain PFCAs						
PFBA	7 : 22	32%	No ESV	0.00073	No ESV	NE
PFPeA	4 : 22	18%	No ESV	0.00021	No ESV	NE
PFHxA	6 : 22	27%	No ESV	0.00028	No ESV	NE
PFHpA	1 : 22	5%	No ESV	0.000046	No ESV	NE
Long-chain PFCAs						
PFOA	18 : 22	82%	No ESV	0.14	No ESV	NE
PFNA	1 : 22	5%	No ESV	0.0084	No ESV	NE
PFDA	9 : 22	41%	No ESV	0.021	No ESV	NE
PFUNA	7 : 22	32%	No ESV	0.027	No ESV	NE
PFDoA	3 : 22	14%	No ESV	0.009	No ESV	NE
PFTeDA	6 : 22	27%	No ESV	0.057	No ESV	NE
Long-chain PFSAs						
PFHxS	1 : 22	5%	0.00039	0.061	NE	NE
PFOS	21 : 22	95%	0.064	**10.0**	NE	**4.6**
PFNS	1 : 22	5%	0.00026	0.041	NE	NE
PFDS	6 : 22	27%	0.00068	0.11	NE	NE
Fluortelomers						
6:2 FTS	4 : 22	18%	0.0080	0.29	NE	NE
8:2 FTS	2 : 22	9%	0.00024	0.037	NE	NE
FOSA, FASE, FASAAs						
PFOSA	15 : 22	68%	0.0025	0.40	NE	NE
N-MeFOSA	4 : 22	18%	0.00064	0.10	NE	NE
N-MeFOSAA	2 : 22	9%	0.00049	0.076	NE	NE
N-EtFOSAA	12 : 22	55%	0.0064	1.0	NE	NE

Notes:
This table summarizes the surface water screening evaluation presented in Appendix F.
Analyte presented if detected in at least one sample from this area.
Boldface indicates Maximum HQ > 1.
Shading indicates UCL HQ>1
ESV - Ecological Screening Value.
FOD - Frequency of Detection.
HQ - Hazard Quotient (Maximum Concentration or UCL/ESV).
NE - Not Evaluated. Comparison not necessary if Maximum HQ < 1.
No ESV - No ESV available.
UCL - Upper Confidence Limit.

Table 10c Summary of Surface Sediment HQs - Eagle Point Lake

Analyte	FOD	Percent Detected	Maximum HQ		UCL HQ	
			Aquatic Life	Wildlife	Aquatic Life	Wildlife
Short-chain PFCAs						
PFBA	23 : 36	64%	No ESV	0.0015	No ESV	NE
PFPeA	8 : 36	22%	No ESV	0.00056	No ESV	NE
PFHxA	22 : 36	61%	No ESV	0.00083	No ESV	NE
PFHpA	20 : 36	56%	No ESV	0.00061	No ESV	NE
Long-chain PFCAs						
PFOA	34 : 36	94%	No ESV	**1.8**	No ESV	0.89
PFNA	15 : 36	42%	No ESV	0.16	No ESV	NE
PFDA	27 : 36	75%	No ESV	0.14	No ESV	NE
PFUNA	2 : 36	6%	No ESV	0.026	No ESV	NE
PFTeDA	5 : 36	14%	No ESV	0.16	No ESV	NE
Short-chain PFSAs						
PFBS	16 : 36	44%	No ESV	0.0006	No ESV	NE
PFPeS	18 : 36	50%	No ESV	0.0014	No ESV	NE
Long-chain PFSAs						
PFHxS	25 : 36	69%	0.012	**1.8**	NE	0.64
PFHpS	23 : 36	64%	0.0059	0.93	NE	NE
PFOS	36 : 36	100%	0.66	**104**	NE	**53.2**
PFNS	2 : 36	6%	0.00094	0.15	NE	NE
PFDS	3 : 36	8%	0.0012	0.20	NE	NE
Fluortelomers						
6:2 FTS	9 : 36	25%	0.013	0.47	NE	NE
8:2 FTS	2 : 36	6%	0.00059	0.093	NE	NE
FOSA, FASE, FASAAs						
PFOSA	31 : 36	86%	0.011	**1.7**	NE	0.69
N-MeFOSA	12 : 36	33%	0.0011	0.18	NE	NE
N-MeFOSAA	1 : 36	3%	0.0004	0.064	NE	NE
N-EtFOSAA	29 : 36	81%	0.015	**2.4**	NE	0.91
N-EtFOSE	1 : 36	3%	0.00050	0.079	NE	NE

Notes:
This table summarizes the surface water screening evaluation presented in Appendix F.
Analyte presented if detected in at least one sample from this area.
Boldface indicates Maximum HQ > 1.
Shading indicates UCL HQ>1
ESV - Ecological Screening Value.
FOD - Frequency of Detection.
HQ - Hazard Quotient (Maximum Concentration or UCL/ESV).
NE - Not Evaluated. Comparison not necessary if Maximum HQ < 1.
No ESV - No ESV available.
UCL - Upper Confidence Limit.

Table 10d Summary of Surface Sediment HQs - Lake Elmo

Analyte	FOD	Percent Detected	Maximum HQ		UCL HQ	
			Aquatic Life	Wildlife	Aquatic Life	Wildlife
Short-chain PFCAs						
PFBA	3 : 8	38%	No ESV	0.0033	No ESV	NE
PFHxA	2 : 8	25%	No ESV	0.00011	No ESV	NE
Long-chain PFCAs						
PFOA	5 : 8	63%	No ESV	0.23	No ESV	NE
Long-chain PFSAs						
PFOS	8 : 8	100%	0.023	**3.6**	NE	**3.2**
Fluortelomers						
6:2 FTS	1 : 8	13%	0.021	0.76	NE	NE

Notes:
This table summarizes the surface water screening evaluation presented in Appendix F.
Analyte presented if detected in at least one sample from this area.
Boldface indicates Maximum HQ > 1.
Shading indicates UCL HQ>1
ESV - Ecological Screening Value.
FOD - Frequency of Detection.
HQ - Hazard Quotient (Maximum Concentration or UCL/ESV).
NE - Not Evaluated. Comparison not necessary if Maximum HQ < 1.
No ESV - No ESV available.
UCL - Upper Confidence Limit.

Table 10e Summary of Surface Sediment HQs - West Lakeland Area

Analyte	FOD	Percent Detected	Maximum HQ		UCL HQ	
			Aquatic Life	Wildlife	Aquatic Life	Wildlife
Short-chain PFCAs						
PFBA	8 : 31	26%	No ESV	0.00060	No ESV	NE
PFPeA	4 : 31	13%	No ESV	0.00020	No ESV	NE
PFHxA	3 : 31	10%	No ESV	0.00025	No ESV	NE
Long-chain PFCAs						
PFOA	23 : 31	74%	No ESV	0.078	No ESV	NE
PFNA	1 : 31	3%	No ESV	0.011	No ESV	NE
PFDA	3 : 31	10%	No ESV	0.0077	No ESV	NE
PFUNA	2 : 31	6%	No ESV	0.0074	No ESV	NE
PFTeDA	10 : 31	32%	No ESV	0.054	No ESV	NE
Short-chain PFSAs						
Long-chain PFSAs						
PFHxS	1 : 31	3%	0.00045	0.070	NE	NE
PFOS	31 : 31	100%	0.039	**6.1**	NE	**1.9**
PFDS	1 : 31	3%	0.00020	0.031	NE	NE
Fluortelomers						
6:2 FTS	4 : 31	13%	0.010	0.373	NE	NE
FOSA, FASE, FASAAs						
PFOSA	2 : 31	6%	0.00045	0.071	NE	NE
N-MeFOSA	5 : 31	16%	0.00045	0.070	NE	NE
N-EtFOSAA	4 : 31	13%	0.0027	0.43	NE	NE

Notes:
This table summarizes the surface water screening evaluation presented in Appendix F.
Analyte presented if detected in at least one sample from this area.
Boldface indicates Maximum HQ > 1.
Shading indicates UCL HQ>1
ESV - Ecological Screening Value.
FOD - Frequency of Detection.
HQ - Hazard Quotient (Maximum Concentration or UCL/ESV).
NE - Not Evaluated. Comparison not necessary if Maximum HQ < 1.
No ESV - No ESV available.
UCL - Upper Confidence Limit.

Table 11a Summary of Porewater HQs - Raleigh Creek - Upper

Analyte	FOD	Percent Detected	Maximum HQ		UCL HQ	
			Aquatic Life	Wildlife	Aquatic Life	Wildlife
DISSOLVED PHASE RESULTS						
Short-chain PFCAs						
PFBA	6 : 6	100%	0.0018	0.0013	NE	NE
PFPeA	6 : 6	100%	0.00041	0.000088	NE	NE
PFHxA	5 : 6	83%	0.000057	0.00062	NE	NE
PFHpA	6 : 6	100%	0.000078	0.00032	NE	NE
Long-chain PFCAs						
PFOA	6 : 6	100%	0.0011	0.13	NE	NE
PFNA	5 : 6	83%	0.000046	0.0025	NE	NE
PFDA	5 : 6	83%	0.00011	0.00682	NE	NE
PFUNA	1 : 6	17%	0.000037	0.00082	NE	NE
PFDoA	1 : 6	17%	0.000039	0.0013	NE	NE
PFTrDA	2 : 6	33%	0.000025	0.00082	NE	NE
PFTeDA	1 : 6	17%	0.000056	0.0018	NE	NE
Short-chain PFSAs						
PFBS	6 : 6	100%	0.0000074	0.000039	NE	NE
PFPeS	5 : 6	83%	0.000013	0.000069	NE	NE
Long-chain PFSAs						
PFHxS	6 : 6	100%	0.11	0.79	NE	NE
PFHpS	5 : 6	83%	0.036	0.27	NE	NE
PFOS	6 : 6	100%	**3.8**	**28.0**	**3.5**	**26.1**
PFNS	4 : 6	67%	0.0045	0.033	NE	NE
PFDS	2 : 6	33%	0.00091	0.0068	NE	NE
Fluortelomers						
6:2 FTS	1 : 6	17%	0.0000012	0.00015	NE	NE
FOSA, FASE, FASAAs						
PFOSA	6 : 6	100%	0.063	0.467	NE	NE
N-MeFOSA	1 : 6	17%	0.0011	0.0079	NE	NE
N-EtFOSAA	5 : 6	83%	0.080	0.60	NE	NE
N-EtFOSE	1 : 6	17%	0.00025	0.0019	NE	NE
Replacement Chemistries						
HFPO-DA	1 : 6	17%	0.00000013	0.0000015	NE	NE

Notes:
This table summarizes the porewater screening evaluation presented in Appendix F.
Analyte presented if detected in at least one sample from this area.
Boldface indicates Maximum HQ > 1.
Shading indicates UCL HQ>1
ESV - Ecological Screening Value.
FOD - Frequency of Detection.
HQ - Hazard Quotient (Maximum Concentration or UCL/ESV).
NE - Not Evaluated. Comparison not necessary if Maximum HQ < 1.
UCL - Upper Confidence Limit.

Table 11b Summary of Porewater HQs - Raleigh Creek - Other

Analyte	FOD	Percent Detected	Maximum HQ		UCL HQ	
			Aquatic Life	Wildlife	Aquatic Life	Wildlife
DISSOLVED PHASE RESULTS						
Short-chain PFCAs						
PFBA	7 : 7	100%	0.00021	0.00015	NE	NE
PFPeA	7 : 7	100%	0.000062	0.000013	NE	NE
PFHpA	7 : 7	100%	0.0000061	0.000025	NE	NE
Long-chain PFCAs						
PFOA	7 : 7	100%	0.000022	0.0027	NE	NE
PFNA	2 : 7	29%	0.000013	0.00068	NE	NE
PFDA	1 : 7	14%	0.0000093	0.00059	NE	NE
PFDoA	1 : 7	14%	0.000019	0.00064	NE	NE
Short-chain PFSAs						
PFBS	7 : 7	100%	0.00000091	0.0000048	NE	NE
PFPeS	2 : 7	29%	0.00000050	0.0000027	NE	NE
Long-chain PFSAs						
PFHxS	7 : 7	100%	0.0071	0.053	NE	NE
PFOS	7 : 7	100%	0.093	0.69	NE	NE
FOSA, FASE, FASAAs						
PFOSA	4 : 7	57%	0.0048	0.036	NE	NE
N-MeFOSA	1 : 7	14%	0.0010	0.0076	NE	NE
N-EtFOSAA	2 : 7	29%	0.0021	0.016	NE	NE
N-EtFOSE	2 : 7	29%	0.00043	0.0032	NE	NE

Notes:
This table summarizes the porewater screening evaluation presented in Appendix F.
Analyte presented if detected in at least one sample from this area.
Boldface indicates Maximum HQ > 1.
Shading indicates UCL HQ>1
ESV - Ecological Screening Value.
FOD - Frequency of Detection.
HQ - Hazard Quotient (Maximum Concentration or UCL/ESV).
NE - Not Evaluated. Comparison not necessary if Maximum HQ < 1.
UCL - Upper Confidence Limit.

Table 11c Summary of Porewater HQs - Eagle Point Lake

Analyte	FOD	Percent Detected	Maximum HQ		UCL HQ	
			Aquatic Life	Wildlife	Aquatic Life	Wildlife
DISSOLVED PHASE RESULTS						
Short-chain PFCAs						
PFBA	6 : 6	100%	0.00060	0.00042	NE	NE
PFPeA	6 : 6	100%	0.00019	0.000039	NE	NE
PFHxA	6 : 6	100%	0.000019	0.00020	NE	NE
PFHpA	6 : 6	100%	0.000036	0.00015	NE	NE
Long-chain PFCAs						
PFOA	6 : 6	100%	0.00045	0.055	NE	NE
PFNA	6 : 6	100%	0.000047	0.0025	NE	NE
PFDA	5 : 6	83%	0.000058	0.0037	NE	NE
PFTrDA	2 : 6	33%	0.00031	0.010	NE	NE
Short-chain PFSAs						
PFBS	6 : 6	100%	0.0000038	0.000020	NE	NE
PFPeS	6 : 6	100%	0.0000059	0.000031	NE	NE
Long-chain PFSAs						
PFHxS	6 : 6	100%	0.045	0.33	NE	NE
PFHpS	6 : 6	100%	0.018	0.13	NE	NE
PFOS	6 : 6	100%	**2.7**	**20**	**2.0**	**15.2**
PFNS	1 : 6	17%	0.0043	0.032	NE	NE
Fluortelomers						
8:2 FTS	1 : 6	17%	0.00029	0.0021	NE	NE
FOSA, FASE, FASAAs						
PFOSA	4 : 5	80%	0.0027	0.020	NE	NE
N-EtFOSAA	1 : 5	20%	0.0023	0.017	NE	NE
N-EtFOSE	1 : 5	20%	0.00038	0.0028	NE	NE
Replacement Chemistries						
HFPO-DA	2 : 6	33%	0.00000015	0.0000016	NE	NE

Notes:
This table summarizes the porewater screening evaluation presented in Appendix F.
Analyte presented if detected in at least one sample from this area.
Boldface indicates Maximum HQ > 1.
Shading indicates UCL HQ>1
ESV - Ecological Screening Value.
FOD - Frequency of Detection.
HQ - Hazard Quotient (Maximum Concentration or UCL/ESV).
NE - Not Evaluated. Comparison not necessary if Maximum HQ < 1.
UCL - Upper Confidence Limit.

Table 11d Summary of Porewater HQs - West Lakeland Area

Analyte	FOD	Percent Detected	Maximum HQ		UCL HQ	
			Aquatic Life	Wildlife	Aquatic Life	Wildlife
TOTAL RECOVERABLE PHASE RESULTS [1]						
Short-chain PFCAs						
PFBA	3 : 3	100%	0.00091	0.00065	NE	NE
PFPeA	3 : 3	100%	0.00011	0.000024	NE	NE
PFHxA	3 : 3	100%	0.0000078	0.000086	NE	NE
PFHpA	3 : 3	100%	0.000014	0.000057	NE	NE
Long-chain PFCAs						
PFOA	3 : 3	100%	0.00015	0.018	NE	NE
PFNA	2 : 3	67%	0.000013	0.00073	NE	NE
PFDA	3 : 3	100%	0.000011	0.00073	NE	NE
PFTrDA	2 : 3	67%	0.000026	0.00086	NE	NE
Short-chain PFSAs						
PFBS	3 : 3	100%	0.0000016	0.0000083	NE	NE
PFPeS	3 : 3	100%	0.0000016	0.0000083	NE	NE
Long-chain PFSAs						
PFHxS	3 : 3	100%	0.018	0.13	NE	NE
PFHpS	3 : 3	100%	0.0038	0.028	NE	NE
PFOS	3 : 3	100%	0.39	**2.9**	NE	**2.9**
FOSA, FASE, FASAAs						
PFOSA	2 : 3	67%	0.0029	0.021	NE	NE
DISSOLVED PHASE RESULTS						
Short-chain PFCAs						
PFBA	9 : 9	100%	0.00094	0.00067	NE	NE
PFPeA	9 : 9	100%	0.00011	0.000023	NE	NE
PFHxA	9 : 9	100%	0.0000078	0.000086	NE	NE
PFHpA	9 : 9	100%	0.000014	0.000057	NE	NE
Long-chain PFCAs						
PFOA	9 : 9	100%	0.00017	0.020	NE	NE
PFNA	5 : 9	56%	0.000018	0.00095	NE	NE
PFDA	5 : 9	56%	0.00011	0.0068	NE	NE
PFUNA	1 : 9	11%	0.000037	0.00082	NE	NE
PFDoA	1 : 9	11%	0.000032	0.0010	NE	NE
Short-chain PFSAs						
PFBS	9 : 9	100%	0.0000018	0.000010	NE	NE
PFPeS	9 : 9	100%	0.0000024	0.000013	NE	NE
Long-chain PFSAs						
PFHxS	9 : 9	100%	0.020	0.15	NE	NE
PFHpS	8 : 9	89%	0.0054	0.040	NE	NE
PFOS	9 : 9	100%	**1.5**	**10.9**	1.0	**7.5**
PFNS	1 : 9	11%	0.0012	0.0089	NE	NE
FOSA, FASE, FASAAs						
PFOSA	7 : 9	78%	0.0091	0.068	NE	NE
N-EtFOSAA	1 : 9	11%	0.021	0.16	NE	NE

Notes:
This table summarizes the porewater screening evaluation presented in Appendix F.
Analyte presented if detected in at least one sample from this area.
Boldface indicates Maximum HQ > 1.
Shading indicates UCL HQ>1
1 - An insufficient number of samples was available to calculate UCLs for total data so the maximum concentration was used in the UCL HQ calculation.

ESV - Ecological Screening Value.
FOD - Frequency of Detection.
HQ - Hazard Quotient (Maximum Concentration or UCL/ESV).
NE - Not Evaluated. Comparison not necessary if Maximum HQ < 1.
UCL - Upper Confidence Limit.

Table 12a: Summary of Wildlife HQs - Raleigh Creek - Upper

Analyte	Hazard Quotients for Potential PFAS Exposure													
	Wood Duck		Tree Swallow		Spotted Sandpiper		Great Blue Heron		Muskrat		Little Brown Bat		Raccoon	
	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ
PFCAs														
PFBA	1.6E-05	1.6E-06	3.1E-03	3.1E-04	5.4E-03	5.4E-04	3.8E-04	3.8E-05	2.4E-05	9.8E-06	5.8E-05	2.4E-05	9.6E-08	4.0E-08
PFPeA	6.8E-06	6.8E-07	3.4E-04	3.4E-05	4.0E-04	4.0E-05	1.0E-05	1.0E-06	5.8E-06	2.8E-06	5.0E-06	2.4E-06	1.4E-08	6.9E-09
PFHxA	2.3E-05	2.3E-06	4.4E-03	4.4E-04	3.6E-03	3.6E-04	5.9E-05	5.9E-06	2.6E-05	1.2E-05	7.7E-05	3.7E-05	5.6E-08	2.7E-08
PFHpA	1.6E-05	1.6E-06	8.0E-04	8.0E-05	1.3E-03	1.3E-04	1.7E-04	1.7E-05	3.8E-03	1.9E-03	3.1E-03	1.6E-03	1.1E-05	5.3E-06
PFOA	1.4E-04	1.4E-05	7.5E-03	7.5E-04	1.3E-02	1.3E-03	9.5E-03	9.5E-04	3.4E-02	1.7E-02	3.0E-02	1.5E-02	1.1E-04	5.3E-05
PFNA	2.3E-05	2.3E-06	3.0E-04	3.0E-05	2.2E-04	2.2E-05	3.1E-04	3.1E-05	1.7E-03	1.3E-03	2.3E-04	1.8E-04	3.9E-06	2.9E-06
PFDA	7.7E-05	7.7E-06	7.5E-04	7.5E-05	1.5E-03	1.5E-04	4.3E-03	4.3E-04	4.7E-02	7.4E-04	2.0E-03	3.1E-05	1.3E-04	2.0E-06
PFUnA	3.9E-06	3.9E-07	1.0E-04	1.0E-05	7.5E-04	7.5E-05	6.9E-04	6.9E-05	8.8E-04	2.6E-04	3.0E-05	9.0E-06	5.0E-06	1.5E-06
PFDoA	4.2E-06	4.2E-07	1.4E-04	1.4E-05	1.2E-03	1.2E-04	1.0E-03	1.0E-04	5.9E-04	1.2E-04	1.8E-05	3.6E-06	4.3E-06	8.6E-07
PFTrDA	1.7E-05	1.7E-06	1.8E-04	1.8E-05	3.9E-04	3.9E-05	2.8E-04	2.8E-05	2.1E-03	4.2E-04	8.7E-05	1.7E-05	5.4E-06	1.1E-06
PFTeDA	1.8E-07	1.8E-08	2.6E-05	2.6E-06	2.7E-04	2.7E-05	2.1E-04	2.1E-05	6.2E-06	1.9E-06	NC	NC	1.4E-07	4.1E-08
PFSAs														
PFBS	9.5E-09	5.7E-09	2.4E-06	1.4E-06	6.6E-06	4.0E-06	3.3E-07	2.0E-07	2.2E-06	5.6E-07	5.0E-06	1.3E-06	1.5E-08	3.7E-09
PFPeS	2.8E-08	1.7E-08	1.0E-05	6.1E-06	1.3E-05	7.6E-06	1.2E-06	7.5E-07	6.9E-06	1.7E-06	2.7E-05	6.7E-06	2.4E-08	6.0E-09
PFHxS	8.4E-05	8.4E-06	2.9E-02	2.9E-03	3.6E-02	3.6E-03	1.5E-02	1.5E-03	2.9E-03	8.6E-04	1.1E-02	3.3E-03	1.1E-05	3.2E-06
PFHpS	1.2E-04	1.2E-05	1.4E-02	1.4E-03	2.5E-02	2.5E-03	6.1E-02	6.1E-03	2.3E-03	7.0E-04	5.4E-03	1.6E-03	1.3E-05	3.9E-06
PFOS	3.6E-02	3.6E-03	**1.5E+00**	1.5E-01	**3.6E+00**	3.6E-01	**1.1E+01**	**1.1E+00**	**1.9E+00**	**1.1E+00**	**1.4E+00**	8.1E-01	8.8E-03	5.2E-03
PFNS	1.4E-05	1.4E-06	5.5E-04	5.5E-05	9.3E-03	9.3E-04	4.2E-02	4.2E-03	6.4E-04	3.8E-04	4.1E-04	2.4E-04	1.9E-05	1.1E-05
PFDS	1.6E-05	1.6E-06	8.1E-04	8.1E-05	2.1E-02	2.1E-03	8.5E-02	8.5E-03	6.9E-04	4.1E-04	2.8E-04	1.7E-04	3.9E-05	2.3E-05
PFDoS	1.4E-05	1.4E-06	1.2E-03	1.2E-04	1.5E-02	1.5E-03	3.3E-02	3.3E-03	8.2E-04	4.8E-04	2.1E-04	1.2E-04	2.1E-05	1.2E-05
FOSA, FASE, FASAAs														
PFOSA	7.12E-04	7.12E-05	7.39E-02	7.39E-03	6.40E-01	6.40E-02	6.16E-01	6.16E-02	5.25E-02	3.09E-02	1.47E-02	8.66E-03	7.42E-04	4.37E-04
N-EtFOSAA	8.2E-04	8.2E-05	3.3E-02	3.3E-03	5.5E-02	5.5E-03	5.7E-02	5.7E-03	4.3E-02	2.5E-02	3.0E-02	1.8E-02	1.3E-04	7.8E-05
N-MeFOSAA	1.0E-05	1.0E-06	3.5E-04	3.5E-05	1.5E-03	1.5E-04	1.1E-03	1.1E-04	3.9E-04	2.3E-04	2.3E-04	1.3E-04	2.3E-06	1.4E-06
Fluortelomers														
6:2 FTS	4.3E-07	4.3E-08	8.1E-05	8.1E-06	1.5E-04	1.5E-05	4.7E-04	4.7E-05	9.9E-05	3.0E-05	4.1E-04	1.2E-04	1.6E-06	4.8E-07
5:3 FTCA	NC	NC	NC	NC	NC	NC	4.6E-07	2.8E-07	NC	NC	NC	NC	4.1E-09	1.7E-09
7:3 FTCA	NC	NC	NC	NC	1.2E-04	1.2E-05	6.8E-04	6.8E-05	NC	NC	NC	NC	2.1E-06	1.0E-06

Notes:
See Appendix G for complete food web calculations.
HQs above 1 are bolded and highlighted.

HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
NC - Not Calculated
NOAEL - No Observed Adverse Effects Level

Table 12b: Summary of Wildlife HQs - Raleigh Creek - Other

Analyte	Hazard Quotients for Potential PFAS Exposure													
	Wood Duck		Tree Swallow		Spotted Sandpiper		Great Blue Heron		Muskrat		Little Brown Bat		Raccoon	
	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ
PFCAs														
PFBA	1.0E-06	1.0E-07	2.1E-04	2.1E-05	1.5E-03	1.5E-04	8.8E-05	8.8E-06	5.5E-06	2.3E-06	3.7E-06	1.5E-06	7.6E-09	3.2E-09
PFHxA	9.3E-07	9.3E-08	1.8E-04	1.8E-05	5.6E-04	5.6E-05	3.1E-06	3.1E-07	3.7E-06	1.8E-06	3.1E-06	1.5E-06	2.4E-09	1.2E-09
PFHpA	6.2E-07	6.2E-08	3.4E-05	3.4E-06	2.5E-04	2.5E-05	5.9E-06	5.9E-07	5.3E-04	2.7E-04	1.2E-04	6.2E-05	4.9E-07	2.5E-07
PFOA	5.0E-06	5.0E-07	2.8E-04	2.8E-05	1.9E-03	1.9E-04	6.2E-05	6.2E-06	4.3E-03	2.2E-03	1.1E-03	5.3E-04	3.9E-06	1.9E-06
PFNA	1.2E-06	1.2E-07	2.1E-05	2.1E-06	2.3E-04	2.3E-05	4.3E-05	4.3E-06	3.3E-04	2.5E-04	1.2E-05	9.0E-06	2.8E-07	2.1E-07
PFDA	2.3E-06	2.3E-07	3.2E-05	3.2E-06	5.0E-04	5.0E-05	3.2E-04	3.2E-05	5.0E-03	7.8E-05	5.6E-05	8.8E-07	5.0E-06	7.7E-08
PFUnA	7.8E-08	7.8E-09	9.7E-06	9.7E-07	3.3E-04	3.3E-05	1.0E-04	1.0E-05	8.0E-05	2.4E-05	NC	NC	4.5E-07	1.3E-07
PFDoA	7.1E-08	7.1E-09	1.2E-05	1.2E-06	4.0E-04	4.0E-05	9.2E-05	9.2E-06	5.9E-05	1.2E-05	NC	NC	3.1E-07	6.2E-08
PFTrDA	1.6E-06	1.6E-07	2.0E-05	2.0E-06	2.0E-04	2.0E-05	4.3E-05	4.3E-06	7.1E-04	1.4E-04	8.2E-06	1.6E-06	5.6E-07	1.1E-07
PFTeDA	1.1E-05	1.1E-06	9.9E-05	9.9E-06	2.4E-04	2.4E-05	4.6E-05	4.6E-06	7.6E-04	2.3E-04	9.0E-06	2.7E-06	4.8E-07	1.4E-07
PFSAs														
PFBS	6.9E-10	4.2E-10	1.6E-07	9.8E-08	3.0E-06	1.8E-06	9.3E-08	5.6E-08	6.1E-07	1.5E-07	2.1E-07	5.1E-08	1.8E-09	4.6E-10
PFPeS	9.5E-10	5.7E-10	3.2E-07	1.9E-07	2.5E-06	1.5E-06	6.0E-08	3.6E-08	8.4E-07	2.1E-07	7.3E-07	1.8E-07	1.4E-09	3.6E-10
PFHxS	3.7E-06	3.7E-07	1.3E-03	1.3E-04	6.4E-03	6.4E-04	5.5E-04	5.5E-05	4.5E-04	1.3E-04	4.7E-04	1.4E-04	5.2E-07	1.6E-07
PFHpS	1.9E-06	1.9E-07	2.8E-04	2.8E-05	1.9E-03	1.9E-04	3.8E-04	3.8E-05	1.6E-04	4.8E-05	9.4E-05	2.8E-05	2.0E-07	6.0E-08
PFOS	9.6E-04	9.6E-05	4.1E-02	4.1E-03	3.5E-01	3.5E-02	3.8E-01	3.8E-02	1.8E-01	1.1E-01	3.7E-02	2.2E-02	2.2E-04	1.3E-04
PFNS	7.8E-08	7.8E-09	NC	NC	2.5E-04	2.5E-05	7.1E-04	7.1E-05	9.7E-07	5.7E-07	NC	NC	1.5E-07	8.9E-08
PFDS	2.8E-07	2.8E-08	2.9E-05	2.9E-06	1.2E-03	1.2E-04	9.3E-04	9.3E-05	5.7E-05	3.4E-05	NC	NC	4.5E-07	2.7E-07
PFDoS	8.8E-08	8.8E-09	1.8E-05	1.8E-06	5.4E-04	5.4E-05	1.8E-05	1.8E-06	3.4E-05	2.0E-05	NC	NC	1.4E-07	8.5E-08
FOSA, FASE, FASAAs														
PFOSA	1.2E-05	1.2E-06	1.3E-03	1.3E-04	3.6E-02	3.6E-03	5.3E-03	5.3E-04	3.3E-03	1.9E-03	2.5E-04	1.5E-04	1.0E-05	6.2E-06
N-EtFOSAA	6.0E-06	6.0E-07	2.4E-04	2.4E-05	1.8E-03	1.8E-04	1.0E-03	1.0E-04	1.0E-03	6.1E-04	2.1E-04	1.2E-04	1.1E-06	6.4E-07
Fluortelomers														
6:2 FTS	5.6E-07	5.6E-08	1.2E-04	1.2E-05	9.8E-04	9.8E-05	6.1E-05	6.1E-06	6.0E-04	1.8E-04	5.1E-04	1.5E-04	1.1E-06	3.2E-07

Notes:
See Appendix H for complete food web calculations.
HQs above 1 are bolded and highlighted.

HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
NC - Not Calculated
NOAEL - No Observed Adverse Effects Level

Table 12c: Summary of Wildlife HQs - Eagle Point Lake

Analyte	Hazard Quotients for Potential PFAS Exposure																	
	Wood Duck		Tree Swallow		Spotted Sandpiper		Great Blue Heron		Bald Eagle		Muskrat		Little Brown Bat		Mink		River Otter	
	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ
PFCAs																		
PFBA	3.4E-05	3.4E-06	6.6E-03	6.6E-04	2.3E-03	2.3E-04	2.1E-04	2.1E-05	2.4E-06	2.4E-07	6.8E-06	2.8E-06	5.0E-05	2.1E-05	3.1E-06	1.3E-06	8.3E-08	3.5E-08
PFPeA	1.1E-05	1.1E-06	5.7E-04	5.7E-05	1.6E-04	1.6E-05	6.8E-06	6.8E-07	1.2E-08	1.2E-09	1.2E-06	5.8E-07	3.5E-06	1.7E-06	1.7E-07	8.3E-08	2.7E-09	1.3E-09
PFHxA	2.2E-05	2.2E-06	4.3E-03	4.3E-04	5.1E-04	5.1E-05	2.4E-05	2.4E-06	5.1E-07	5.1E-08	3.3E-06	1.6E-06	3.4E-05	1.6E-05	1.2E-06	5.7E-07	9.1E-09	4.4E-09
PFHpA	1.4E-05	1.4E-06	7.5E-04	7.5E-05	2.4E-04	2.4E-05	1.1E-05	1.1E-06	2.5E-07	2.5E-08	4.4E-04	2.2E-04	1.2E-03	6.1E-04	9.4E-05	4.7E-05	2.1E-06	1.1E-06
PFOA	1.2E-04	1.2E-05	5.8E-03	5.8E-04	1.6E-03	1.6E-04	2.9E-04	2.9E-05	3.5E-06	3.5E-07	3.4E-03	1.7E-03	1.0E-02	5.1E-03	7.4E-04	3.7E-04	2.0E-05	1.0E-05
PFNA	4.2E-05	4.2E-06	5.3E-04	5.3E-05	7.1E-05	7.1E-06	2.3E-04	2.3E-05	3.4E-06	3.4E-07	4.1E-04	3.1E-04	2.0E-04	1.5E-04	1.0E-04	7.6E-05	4.5E-06	3.4E-06
PFDA	1.1E-04	1.1E-05	1.1E-03	1.1E-04	6.2E-04	6.2E-05	2.2E-03	2.2E-04	8.1E-05	8.1E-06	8.6E-03	1.3E-04	1.2E-03	1.9E-05	2.4E-02	3.7E-04	9.1E-04	1.4E-05
PFUnA	1.6E-04	1.6E-05	1.5E-03	1.5E-04	2.5E-04	2.5E-05	3.3E-04	3.3E-05	1.1E-05	1.1E-06	4.3E-03	1.3E-03	6.3E-04	1.9E-04	1.2E-03	3.7E-04	4.3E-05	1.3E-05
PFDoA	1.7E-04	1.7E-05	1.6E-03	1.6E-04	1.6E-04	1.6E-05	1.6E-04	1.6E-05	3.4E-06	3.4E-07	2.8E-03	5.5E-04	4.1E-04	8.1E-05	3.6E-04	7.1E-05	1.1E-05	2.1E-06
PFTrDA	6.9E-05	6.9E-06	NC	NC	2.4E-05	2.4E-06	6.0E-05	6.0E-06	1.4E-06	1.4E-07	1.1E-03	2.2E-04	1.7E-04	3.3E-05	1.1E-04	2.1E-05	3.1E-06	6.1E-07
PFTeDA	6.0E-05	6.0E-06	5.8E-04	5.8E-05	8.8E-05	8.8E-06	4.3E-05	4.3E-06	8.3E-07	8.3E-08	1.6E-04	4.8E-05	2.4E-05	7.1E-06	1.3E-05	3.9E-06	3.5E-07	1.1E-07
PFSAs																		
PFBS	1.9E-08	1.1E-08	3.4E-06	2.1E-06	1.6E-06	9.8E-07	9.0E-08	5.4E-08	3.0E-09	1.8E-09	4.5E-07	1.1E-07	2.9E-06	7.3E-07	3.8E-07	9.5E-08	1.2E-08	2.9E-09
PFPeS	3.4E-08	2.0E-08	8.7E-06	5.2E-06	2.0E-06	1.2E-06	8.0E-08	4.8E-08	4.8E-11	2.9E-11	8.3E-07	2.1E-07	9.8E-06	2.4E-06	3.7E-07	9.3E-08	4.8E-09	1.2E-09
PFHxS	1.0E-04	1.0E-05	2.6E-02	2.6E-03	4.5E-03	4.5E-04	2.2E-03	2.2E-04	3.1E-05	3.1E-06	3.3E-04	1.0E-04	4.5E-03	1.4E-03	3.0E-04	9.1E-05	9.6E-06	2.9E-06
PFHpS	7.6E-05	7.6E-06	8.5E-03	8.5E-04	2.1E-03	2.1E-04	6.1E-03	6.1E-04	1.2E-04	1.2E-05	1.8E-04	5.5E-05	1.5E-03	4.5E-04	7.7E-04	2.3E-04	3.4E-05	1.0E-05
PFOS	3.1E-02	3.1E-03	**1.2E+00**	1.2E-01	9.6E-01	9.6E-02	**3.9E+00**	3.9E-01	1.2E-01	1.2E-02	2.1E-01	1.2E-01	5.1E-01	3.0E-01	**2.7E+00**	**1.6E+00**	1.1E-01	6.3E-02
PFNS	7.5E-06	7.5E-07	NC	NC	1.3E-03	1.3E-04	7.0E-03	7.0E-04	2.6E-04	2.6E-05	3.5E-06	2.1E-06	NC	NC	5.8E-03	3.4E-03	2.3E-04	1.3E-04
PFDS	1.0E-05	1.0E-06	NC	NC	5.2E-04	5.2E-05	2.5E-03	2.5E-04	9.0E-05	9.0E-06	4.6E-06	2.7E-06	NC	NC	2.0E-03	1.2E-03	7.9E-05	4.7E-05
FOSA, FASE, FASAAs																		
PFOSA	4.0E-04	4.0E-05	5.2E-02	5.2E-03	5.9E-02	5.9E-03	3.0E-02	3.0E-03	4.3E-04	4.3E-05	4.3E-03	2.5E-03	2.4E-03	1.4E-03	8.8E-03	5.2E-03	4.6E-04	2.7E-04
N-EtFOSAA	2.1E-04	2.1E-05	7.6E-03	7.6E-04	3.2E-03	3.2E-04	3.6E-03	3.6E-04	7.0E-05	7.0E-06	1.2E-03	7.1E-04	2.8E-03	1.6E-03	1.5E-03	8.9E-04	6.5E-05	3.8E-05
N-MeFOSAA	3.3E-06	3.3E-07	NC	NC	1.1E-04	1.1E-05	4.9E-04	4.9E-05	1.1E-05	1.1E-06	1.5E-06	9.0E-07	NC	NC	2.2E-04	1.3E-04	9.8E-06	5.8E-06
Fluortelomers																		
6:2 FTS	9.6E-06	9.6E-07	2.0E-03	2.0E-04	1.5E-03	1.5E-04	5.6E-04	5.6E-05	1.1E-05	1.1E-06	4.8E-04	1.5E-04	1.8E-03	5.5E-04	1.1E-03	3.4E-04	4.9E-05	1.5E-05

Notes:
See Appendix I for complete food web calculations.
HQs above 1 are bolded and highlighted.

HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
NC - Not Calculated
NOAEL - No Observed Adverse Effects Level

Table 12d: Summary of Wildlife HQs - Lake Elmo

Analyte	Hazard Quotients for Potential PFAS Exposure																	
	Wood Duck		Tree Swallow		Spotted Sandpiper		Great Blue Heron		Bald Eagle		Muskrat		Little Brown Bat		Mink		River Otter	
	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ
PFCAs																		
PFBA	3.4E-04	3.4E-05	4.6E-02	4.6E-03	8.4E-03	8.4E-04	4.1E-04	4.1E-05	6.2E-06	6.2E-07	3.8E-05	1.6E-05	3.3E-04	1.4E-04	1.3E-05	5.4E-06	3.3E-07	1.4E-07
PFHpA	1.8E-05	1.8E-06	6.8E-04	6.8E-05	1.6E-04	1.6E-05	4.1E-05	4.1E-06	1.2E-06	1.2E-07	3.3E-04	1.7E-04	9.5E-04	4.7E-04	1.0E-04	5.1E-05	5.8E-06	2.9E-06
PFOA	1.8E-04	1.8E-05	7.3E-03	7.3E-04	1.9E-03	1.9E-04	2.6E-04	2.6E-05	5.5E-06	5.5E-07	3.3E-03	1.7E-03	9.7E-03	4.8E-03	7.5E-04	3.7E-04	3.8E-05	1.9E-05
PFNA	4.9E-05	4.9E-06	5.0E-04	5.0E-05	1.1E-04	1.1E-05	1.3E-04	1.3E-05	4.5E-06	4.5E-07	2.8E-04	2.1E-04	1.3E-04	9.8E-05	8.9E-05	6.7E-05	6.4E-06	4.8E-06
PFDA	1.4E-04	1.4E-05	1.1E-03	1.1E-04	4.8E-04	4.8E-05	1.3E-03	1.3E-04	7.7E-05	7.7E-06	6.4E-03	1.0E-04	9.2E-04	1.4E-05	1.3E-02	2.0E-04	8.7E-04	1.4E-05
PFUnA	NC	NC	NC	NC	3.6E-05	3.6E-06	1.9E-04	1.9E-05	1.7E-05	1.7E-06	NC	NC	NC	NC	9.9E-04	3.0E-04	6.4E-05	1.9E-05
PFDoA	NC	NC	NC	NC	1.8E-05	1.8E-06	9.7E-05	9.7E-06	8.3E-06	8.3E-07	NC	NC	NC	NC	2.8E-04	5.7E-05	1.9E-05	3.7E-06
PFTrDA	1.8E-04	1.8E-05	1.2E-03	1.2E-04	1.1E-04	1.1E-05	7.5E-05	7.5E-06	4.7E-06	4.7E-07	1.7E-03	3.4E-04	2.5E-04	4.9E-05	2.2E-04	4.4E-05	1.1E-05	2.2E-06
PFTeDA	2.6E-04	2.6E-05	1.6E-03	1.6E-04	8.8E-05	8.8E-06	7.8E-05	7.8E-06	4.7E-06	4.7E-07	4.0E-04	1.2E-04	5.8E-05	1.7E-05	3.9E-05	1.2E-05	1.8E-06	5.4E-07
PFSAs																		
PFHxS	1.1E-04	1.1E-05	2.7E-02	2.7E-03	3.4E-03	3.4E-04	6.1E-04	6.1E-05	3.1E-05	3.1E-06	2.8E-04	8.5E-05	3.9E-03	1.2E-03	2.5E-04	7.5E-05	1.0E-05	3.1E-06
PFHpS	7.4E-05	7.4E-06	7.5E-03	7.5E-04	2.1E-03	2.1E-04	4.8E-03	4.8E-04	1.6E-04	1.6E-05	1.3E-04	4.0E-05	9.9E-04	3.0E-04	6.1E-04	1.8E-04	4.8E-05	1.4E-05
PFOS	3.1E-02	3.1E-03	9.6E-01	9.6E-02	7.0E-01	7.0E-02	**2.6E+00**	2.6E-01	1.4E-01	1.4E-02	1.3E-01	7.5E-02	3.0E-01	1.8E-01	**1.8E+00**	**1.1E+00**	1.3E-01	7.5E-02
PFNS	NC	NC	NC	NC	8.1E-04	8.1E-05	4.3E-03	4.3E-04	1.5E-04	1.5E-05	NC	NC	NC	NC	1.5E-03	8.8E-04	1.3E-04	7.4E-05
PFDS	NC	NC	NC	NC	9.2E-05	9.2E-06	4.9E-04	4.9E-05	2.8E-05	2.8E-06	NC	NC	NC	NC	3.4E-04	2.0E-04	2.4E-05	1.4E-05
FOSA, FASE, FASAAs																		
PFOSA	2.4E-04	2.4E-05	1.6E-02	1.6E-03	1.6E-02	1.6E-03	3.0E-02	3.0E-03	7.0E-04	7.0E-05	1.3E-03	7.6E-04	1.6E-03	9.6E-04	6.0E-03	3.6E-03	6.3E-04	3.7E-04
N-EtFOSAA	1.2E-04	1.2E-05	3.8E-03	3.8E-04	1.2E-03	1.2E-04	1.4E-03	1.4E-04	3.7E-05	3.7E-06	4.8E-04	2.8E-04	1.1E-03	6.6E-04	4.2E-04	2.5E-04	3.5E-05	2.0E-05
N-MeFOSAA	3.9E-04	3.9E-05	1.4E-02	1.4E-03	4.9E-03	4.9E-04	5.8E-04	5.8E-05	1.6E-05	1.6E-06	1.7E-03	9.9E-04	3.7E-03	2.2E-03	4.5E-04	2.7E-04	2.6E-05	1.5E-05
Fluortelomers																		
6:2 FTS	1.3E-04	1.3E-05	2.4E-02	2.4E-03	5.1E-03	5.1E-04	3.1E-04	3.1E-05	9.8E-06	9.8E-07	3.5E-03	1.0E-03	3.9E-02	1.2E-02	2.5E-03	7.4E-04	9.5E-05	2.9E-05

Notes:
See Appendix K for complete food web calculations.
HQs above 1 are bolded and highlighted.

HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
NC - Not Calculated
NOAEL - No Observed Adverse Effects Level

Table 12e: Summary of Wildlife HQs - West Lakeland Area

Analyte	Hazard Quotients for Potential PFAS Exposure															
	Wood Duck		Tree Swallow		Spotted Sandpiper		Great Blue Heron		Muskrat		Little Brown Bat		Mink		River Otter	
	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ
PFCAs																
PFBA	7.0E-05	7.0E-06	1.5E-02	1.5E-03	5.0E-03	5.0E-04	2.9E-04	2.9E-05	2.0E-05	8.5E-06	1.7E-04	7.1E-05	7.5E-06	3.1E-06	9.5E-08	4.0E-08
PFHxA	1.8E-05	1.8E-06	3.4E-03	3.4E-04	4.7E-04	4.7E-05	7.0E-07	7.0E-08	3.6E-06	1.7E-06	3.8E-05	1.8E-05	1.2E-06	5.9E-07	2.9E-09	1.4E-09
PFHpA	7.6E-06	7.6E-07	4.1E-04	4.1E-05	1.5E-04	1.5E-05	6.7E-06	6.7E-07	3.4E-04	1.7E-04	9.7E-04	4.8E-04	4.8E-05	2.4E-05	5.4E-07	2.7E-07
PFOA	7.5E-05	7.5E-06	5.1E-03	5.1E-04	3.2E-03	3.2E-04	2.4E-04	2.4E-05	3.6E-03	1.8E-03	9.4E-03	4.7E-03	7.7E-04	3.8E-04	1.7E-05	8.4E-06
PFNA	2.3E-05	2.3E-06	3.5E-04	3.5E-05	1.3E-04	1.3E-05	3.8E-05	3.8E-06	3.2E-04	2.4E-04	1.5E-04	1.1E-04	4.8E-05	3.6E-05	1.1E-06	8.1E-07
PFDA	8.4E-05	8.4E-06	1.1E-03	1.1E-04	7.4E-04	7.4E-05	9.4E-04	9.4E-05	9.6E-03	1.5E-04	1.4E-03	2.1E-05	9.8E-03	1.5E-04	2.7E-04	4.2E-06
PFUnA	2.3E-05	2.3E-06	3.3E-04	3.3E-05	2.4E-04	2.4E-05	1.7E-04	1.7E-05	9.0E-04	2.7E-04	1.2E-04	3.7E-05	6.5E-04	1.9E-04	1.7E-05	5.2E-06
PFDoA	3.2E-07	3.2E-08	6.4E-05	6.4E-06	1.1E-04	1.1E-05	5.4E-05	5.4E-06	1.6E-05	3.2E-06	NC	NC	1.3E-04	2.6E-05	3.6E-06	7.2E-07
PFTrDA	8.8E-06	8.8E-07	1.2E-04	1.2E-05	8.2E-05	8.2E-06	4.2E-05	4.2E-06	2.0E-04	4.1E-05	2.8E-05	5.7E-06	1.1E-04	2.3E-05	3.0E-06	5.9E-07
PFTeDA	2.5E-05	2.5E-06	2.5E-04	2.5E-05	6.5E-05	6.5E-06	2.8E-05	2.8E-06	9.3E-05	2.8E-05	1.4E-05	4.1E-06	1.1E-05	3.4E-06	2.4E-07	7.3E-08
PFSAs																
PFHxS	5.2E-05	5.2E-06	1.8E-02	1.8E-03	4.0E-03	4.0E-04	3.5E-04	3.5E-05	3.2E-04	9.6E-05	4.3E-03	1.3E-03	1.8E-04	5.4E-05	1.9E-06	5.8E-07
PFHpS	3.2E-05	3.2E-06	4.7E-03	4.7E-04	1.4E-03	1.4E-04	9.8E-04	9.8E-05	1.4E-04	4.2E-05	1.1E-03	3.2E-04	2.4E-04	7.1E-05	6.1E-06	1.8E-06
PFOS	1.4E-02	1.4E-03	6.7E-01	6.7E-02	6.8E-01	6.8E-02	**1.9E+00**	1.9E-01	1.4E-01	8.2E-02	3.2E-01	1.9E-01	**1.5E+00**	8.9E-01	4.2E-02	2.5E-02
PFNS	NC	NC	NC	NC	3.0E-04	3.0E-05	1.6E-03	1.6E-04	NC	NC	NC	NC	1.9E-03	1.1E-03	5.1E-05	3.0E-05
PFDS	1.2E-06	1.2E-07	NC	NC	9.9E-05	9.9E-06	5.1E-04	5.1E-05	NC	NC	NC	NC	6.2E-04	3.7E-04	1.6E-05	9.7E-06
FOSA, FASE, FASAAs																
PFOSA	1.4E-04	1.4E-05	8.4E-03	8.4E-04	6.8E-03	6.8E-04	2.1E-03	2.1E-04	1.5E-03	9.0E-04	3.0E-03	1.8E-03	1.3E-03	7.5E-04	3.6E-05	2.1E-05
N-EtFOSAA	1.6E-04	1.6E-05	6.9E-03	6.9E-04	2.5E-03	2.5E-04	7.7E-04	7.7E-05	1.5E-03	9.0E-04	3.7E-03	2.2E-03	6.5E-04	3.8E-04	1.5E-05	8.9E-06
N-MeFOSAA	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	1.4E-04	8.0E-05	3.2E-06	1.9E-06
N-EtFOSE	3.0E-05	3.0E-06	1.2E-03	1.2E-04	1.4E-04	1.4E-05	2.7E-07	2.7E-08	2.9E-04	2.9E-05	7.5E-04	7.5E-05	1.0E-03	1.0E-04	2.3E-05	2.3E-06
Fluortelomers																
6:2 FTS	2.4E-05	2.4E-06	8.5E-03	8.5E-04	1.5E-03	1.5E-04	1.9E-04	1.9E-05	1.9E-03	5.6E-04	2.7E-02	8.0E-03	1.6E-03	4.9E-04	2.4E-05	7.2E-06
Replacement Chemistries																
ADONA	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	1.3E-04	6.7E-05	3.1E-06	1.6E-06
NFDHA	NC	NC	NC	NC	2.4E-07	1.4E-07	1.3E-06	7.7E-07	NC	NC	NC	NC	3.6E-07	1.5E-07	1.6E-08	6.8E-09

Notes:
See Appendix K for complete food web calculations.
HQs above 1 are bolded and highlighted.

HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
NC - Not Calculated
NOAEL - No Observed Adverse Effects Level

Figures

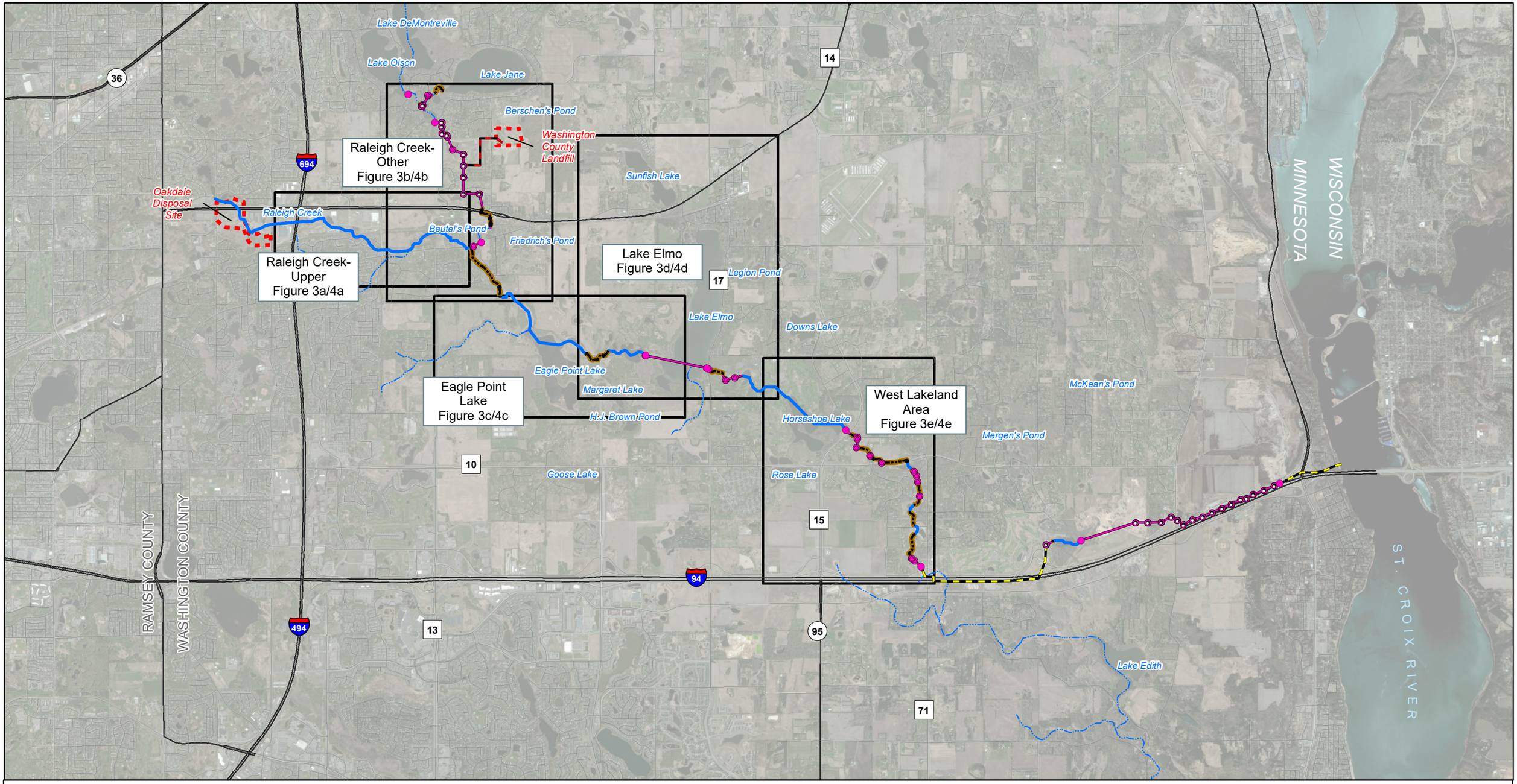

Figure 1
Project 1007 Overview

Baseline Ecological Risk Assessment
Minnesota Pollution Control Agency

Project 1007 Structures
- Catch Basin
- Manhole
- Other Structure
- Channel
- Culvert
- Pipe
- Washington County Landfill connection
- MnDOT Pipeline
- Water Body
- Streams and Creeks
- Raleigh Creek

AECOM

N W E S

0 0.5 1 1.5 2 Miles

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; Other Sources: MDH, Barr Engineering
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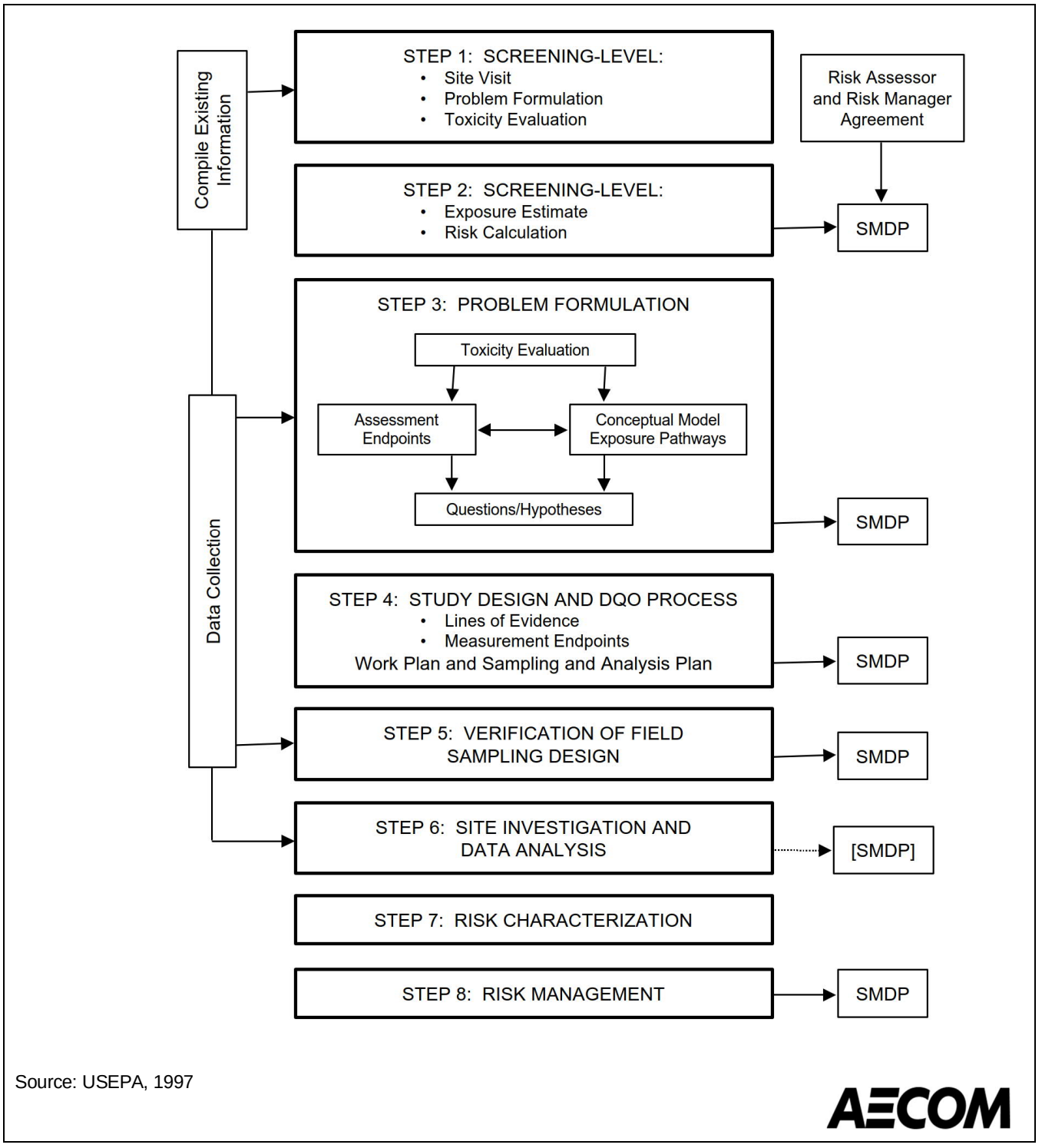
Figure 2
Eight Step Process for Ecological Risk Assessment for Superfund



Source: USEPA, 1997

AECOM

Figure 3a
Abiotic Sampling Locations:
Raleigh Creek-Upper

Baseline Ecological Risk Assessment
Minnesota Pollution Control Agency

Project 1007 Structures
- Catch Basin
- Manhole
- Other Structure
- Channel
- Culvert
- Pipe
- Washington County Landfill connection
- Streams and creeks
- Raleigh Creek

- Surface Water Body
- Confluence of Project 1007 and Raleigh Creek

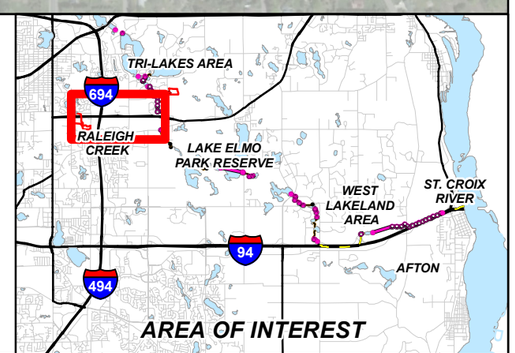
Abiotic Media Samples
- PoreWater
- Surface Water
- Sediment
- Foam

NOTE:
OD1, RC3MAN, OD2, RC3CUL, and RC8 are located outside of the main Project 1007 flow path and were analyzed as "Other Areas" for the BERA Report.

N W E S

AECOM

0 250 500 750 1,000 Feet



Service Layer Credits: MnGeo WMS service, 2016 aerial photography Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; Other Sources: MDH, VBWD
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Figure 3b
Abiotic Sampling Locations:
Raleigh Creek - Other

Baseline Ecological Risk Assessment
Minnesota Pollution Control Agency

Project 1007 Structures
- Catch Basin
- Manhole
- Other Structure
- Channel
- Culvert
- Pipe
- Washington County Landfill connection
- MnDOT Pipeline
- Streams and Creeks
- Raleigh Creek

- Surface Water Body

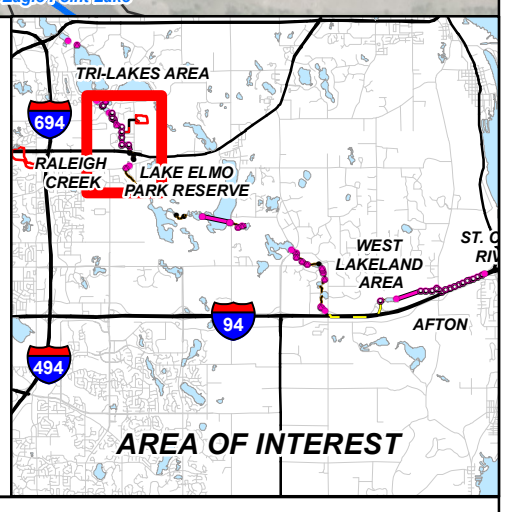
Abiotic Media Samples
- Pore Water
- Surface Water
- Sediment
- Foam

Note:
While RC1, RC2, and RC24 are located along the Project 1007 flow path, these were analyzed as "Other Areas" in the BERA Report. FP1 is located outside of the main Project 1007 flow path and was also analyzed as an "Other Area."

N W E S

AECOM

0 250 500 750 1,000 Feet



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RC18B
RC18C
EP17A
EP17
EP17B
EP17C
FC1
FC2
RC19
FC2A
EP1
EP19
EP3
EP1A
EP4
EP7
EP5
EP28
EP8
EP27A
EP27B
EP26C
EP26B
EP26A
EP27C
Eagle Point Lake
Eagle Point Lake Dam
Lake Elmo
EP2C
EP18D
ML1
Margaret Lake
EP2
EP2B
EP18
BP1
EP2A
EP18A
PP1
Browns Pond
15th St N

Figure 3c
Abiotic Sampling Locations:
Eagle Point Lake

Baseline Ecological Risk Assessment
Minnesota Pollution Control Agency

Project 1007 Structures
- Catch Basin
- Manhole
- Other Structure
- Channel
- Culvert
- Pipe
- Washington County Landfill connection
- Streams and creeks
- Raleigh Creek

- Surface Water Body
- Confluence of Project 1007 and Raleigh Creek

Abiotic Media Samples
- PoreWater
- Surface Water
- Sediment
- Foam

NOTE:
RC19, FC1, FC2, RC2A, PP1, ML1, and BP1 are located outside of the main Project 1007 flow path and were analyzed as “Other Areas” for the BERA Report.

N
W E
S

AECOM

0 250 500 750 1,000
Feet

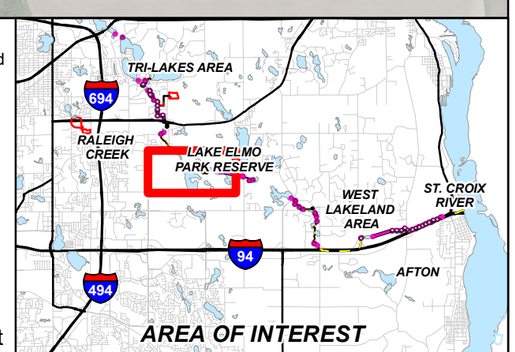

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Figure 3d
Abiotic Sampling Locations: Lake Elmo

Baseline Ecological Risk Assessment
Minnesota Pollution Control Agency

Project 1007 Structures

- Catch Basin
- Manhole
- Other Structure
- Channel
- Culvert
- Pipe
- Washington County Landfill connection
- MnDOT Pipeline
- Streams and Creeks
- Raleigh Creek

- Surface Water Body

Abiotic Media Samples

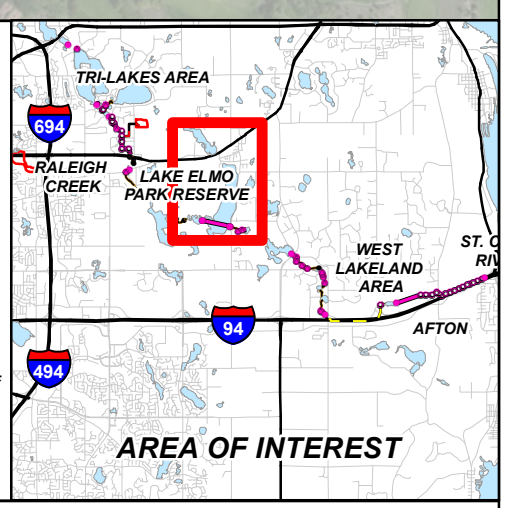
- Pore Water
- Surface Water
- Sediment
- Foam

NOTE:
EP24, EP25, LP1, and ML1 are located outside of the main Project 1007 flow path and were analyzed as “Other Areas” for the BERA Report.

N W E S

0 250 500 750 1,000 Feet

AECOM



Service Layer Credits: MnGeo WMS service, 2016 aerial photography Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; Other Sources: MDH, VBWD

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Figure 3e
Abiotic Sampling Locations:
West Lakeland Area

Baseline Ecological Risk Assessment
Minnesota Pollution Control Agency

Project 1007 Structures

- Catch Basin
- Manhole
- Other Structure
- Channel
- Culvert
- Pipe
- Washington County Landfill connection
- MnDOT Pipeline
- Streams and Creeks
- Raleigh Creek
- Surface Water Body

Abiotic Media Samples

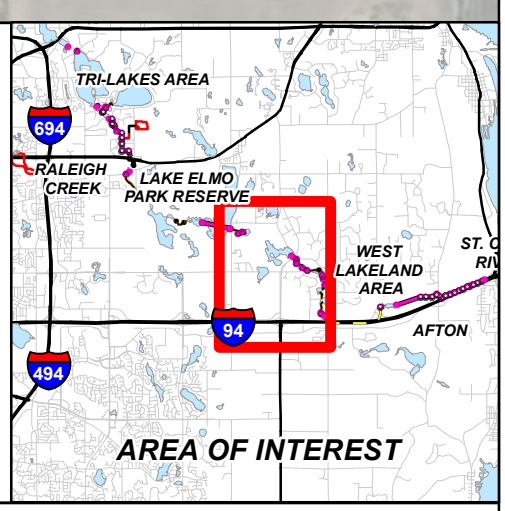
- Pore Water
- Surface Water
- Sediment
- Foam

NOTE:
DL1 and VB1 are located outside of the main Project 1007 flow path and were analyzed as "Other Areas" for the BERA Report.

N
W E
S

0 250 500 750 1,000
Feet

AECOM



Service Layer Credits: MnGeo WMS service, 2016 aerial photography Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; Other Sources: MDH, VBWD
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Figure 4a
Biological Sampling Locations: Raleigh Creek-Upper

Baseline Ecological Risk Assessment
Minnesota Pollution Control Agency

Project 1007 Structures

- Catch Basin
- Manhole
- Other Structure
- Channel
- Culvert
- Pipe
- Washington County Landfill connection
- Streams and creeks
- Raleigh Creek
- Surface Water Body
- Confluence of Project 1007 and Raleigh Creek

Ecological Tissue Samples

- Bottom Fish
- Forage Fish
- Predatory Fish
- Amphibian
- Crayfish
- Snails

N W E S

0 250 500 750 1,000 Feet

AECOM

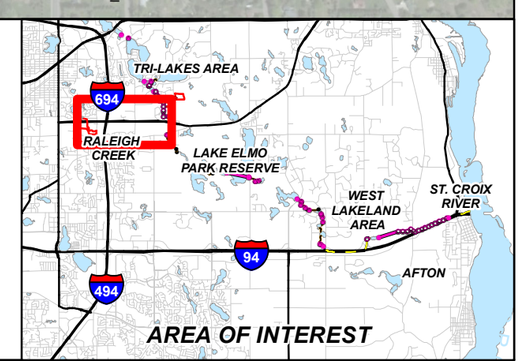

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Figure 4b
Biological Sampling Locations:
Raleigh Creek - Other

Baseline Ecological Risk Assessment
Minnesota Pollution Control Agency

AECOM

Project 1007 Structures

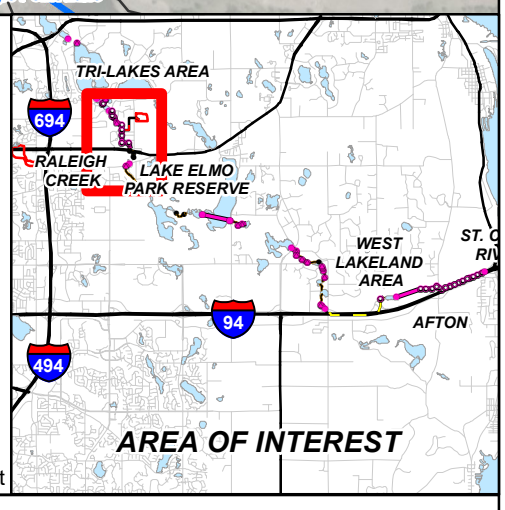
- Catch Basin
- Manhole
- Other Structure
- Channel
- Culvert
- Pipe
- Washington County Landfill connection
- MnDOT Pipeline
- Streams and Creeks
- Raleigh Creek
- Surface Water Body

Ecological Tissue

- Bottom Fish
- Forarge Fish
- Predatory Fish
- Amphibian
- Crayfish
- Snails

N W E S

0 250 500 750 1,000 Feet



Service Layer Credits: MnGeo WMS service, 2016 aerial photography Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; Other Sources: MDH, VBWD

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EP17A
EP17C
EP19
EP1A
EP4
EP5
EP27B
EP26A
EP27C
EP18C
EP18
BP1
Eagle Point Lake
Eagle Point Lake Dam
Lake Elmo
Margaret Lake
Browns Pond
Inwood Ave N
15th St N

Figure 4c
Biological Sampling Locations: Eagle Point Lake

Baseline Ecological Risk Assessment
Minnesota Pollution Control Agency

Project 1007 Structures
- Catch Basin
- Manhole
- Other Structure
- Channel
- Culvert
- Pipe
- Washington County Landfill connection
- Streams and creeks
- Raleigh Creek

- Surface Water Body
- Confluence of Project 1007 and Raleigh Creek

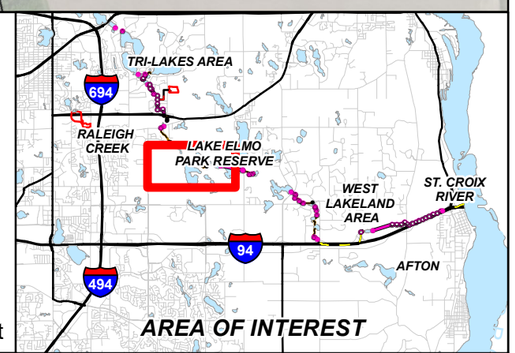
Ecological Tissue Samples
- Bottom Fish
- Forage Fish
- Predatory Fish
- Amphibian
- Crayfish
- Snails

NOTE:
BP1 is located outside of the main Project 1007 flow path and were analyzed separately in the BERA Report.

N W E S

AECOM

0 250 500 750 1,000 Feet



Service Layer Credits: MnGeo WMS service, 2016 aerial photography Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; Other Sources: MDH, VBWD
AECOM Path: C:\Users\lilianageorgeta.roi\AECOM Directory\GDS GIS Services - GIS CAD PROJECTS\DCS AMERICAS\CENTRAL REGION US\MPCA\Project 1007 - Twin Cities East Metro, Minnesota, USA\02. Workspace\20210406\Individual\Figure2c_BioticSamplingLoc_EPL.mxd Revised: 4/7/2021 By MGD

Figure 4d
Biological Sampling Locations: Lake Elmo

Baseline Ecological Risk Assessment
Minnesota Pollution Control Agency

AECOM

Project 1007 Structures

- Catch Basin
- Manhole
- Other Structure
- Channel
- Culvert
- Pipe
- Washington County Landfill connection
- MnDOT Pipeline
- Streams and Creeks
- Raleigh Creek

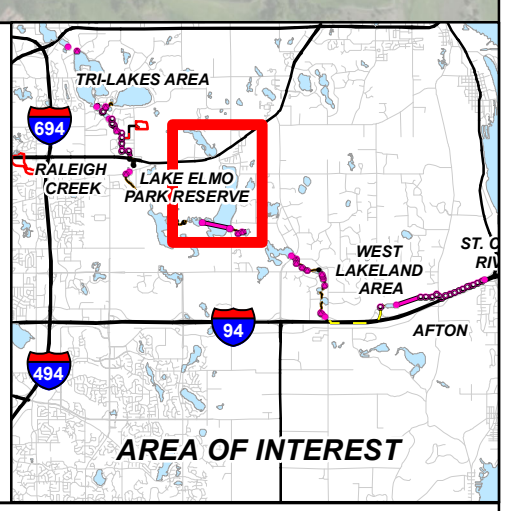
- Surface Water Body

Ecological Tissue

- Bottom Fish
- Forarge Fish
- Predatory Fish
- Amphibian
- Crayfish
- Snails

N W E S

0 250 500 750 1,000 Feet



Service Layer Credits: MnGeo WMS service, 2016 aerial photography Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; Other Sources: MDH, VBWD

AECOM Path: C:\Users\lilianageorgeta.croi\AECOM Directory\GDS GIS Services - GIS CAD PROJECTS\DCS AMERICAS\CENTRAL REGION US\MPCA\Project 1007 - Twin Cities East Metro, Minnesota, USA\02. Workspace\20210406\Individual\Figure 2d Biotic Sampling Locations - Lake Elmo.mxd Revised: 4/7/2021 By MGD

Figure 4e
Biological Sampling Locations:
West Lakeland Area

Baseline Ecological Risk Assessment
Minnesota Pollution Control Agency

Project 1007 Structures

- Catch Basin
- Manhole
- Other Structure
- Channel
- Culvert
- Pipe
- Washington County Landfill connection
- MnDOT Pipeline
- Streams and Creeks
- Raleigh Creek
- Surface Water Body

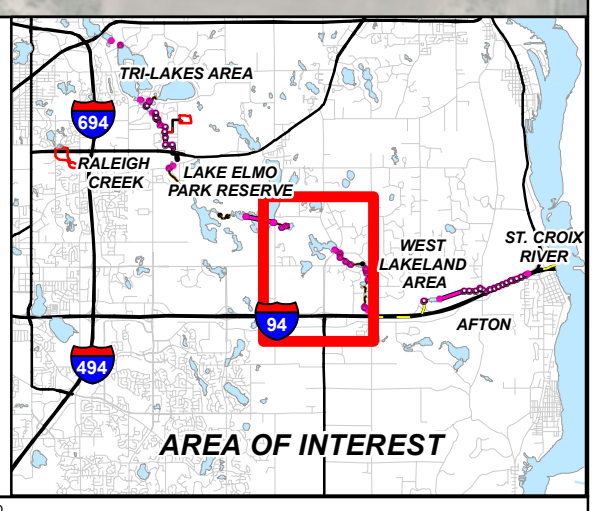
Ecological Tissue

- Bottom Fish
- Forarge Fish
- Predatory Fish
- Amphibian
- Crayfish
- Snails

N W E S

0 250 500 750 1,000 Feet

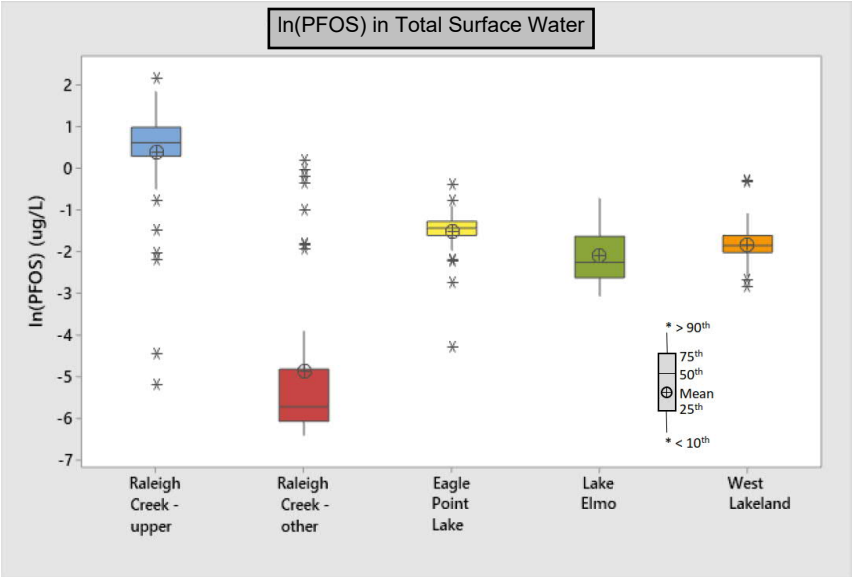
AECOM

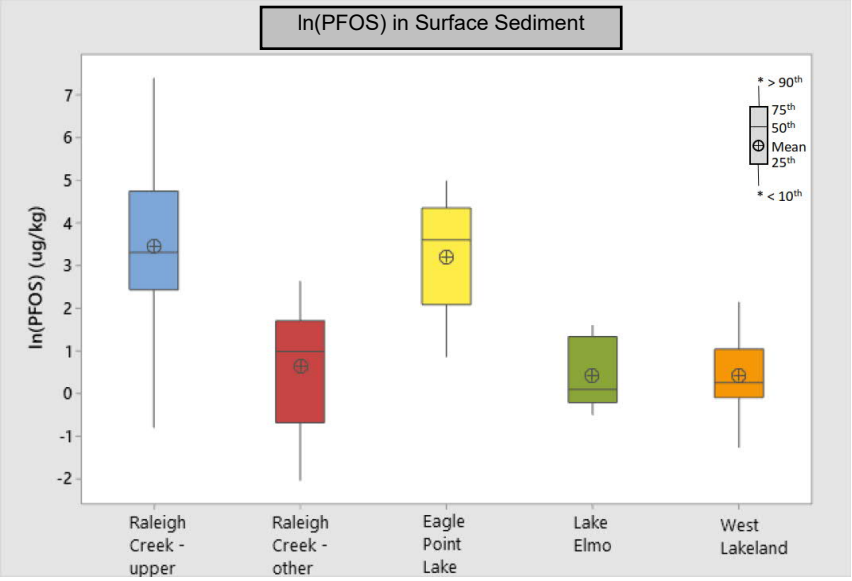


Service Layer Credits: MnGeo WMS service, 2016 aerial photography Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; Other Sources: MDH, VBWD

AECOM Path: C:\Users\lilianageorgeta.croi\AECOM Directory\GDS GIS Services - GIS CAD PROJECTS\DCS AMERICAS\CENTRAL REGION US\MPCA\Project 1007 - Twin Cities East Metro, Minnesota, USA\02. Workspace\20210406\Individual\Figure 2e_Biotic Sampling Loc_WLA.mxd Revised: 4/7/2021 By MGD

Figure 5
Boxplots of Surface Water, Sediment, and Porewater Data for PFOS





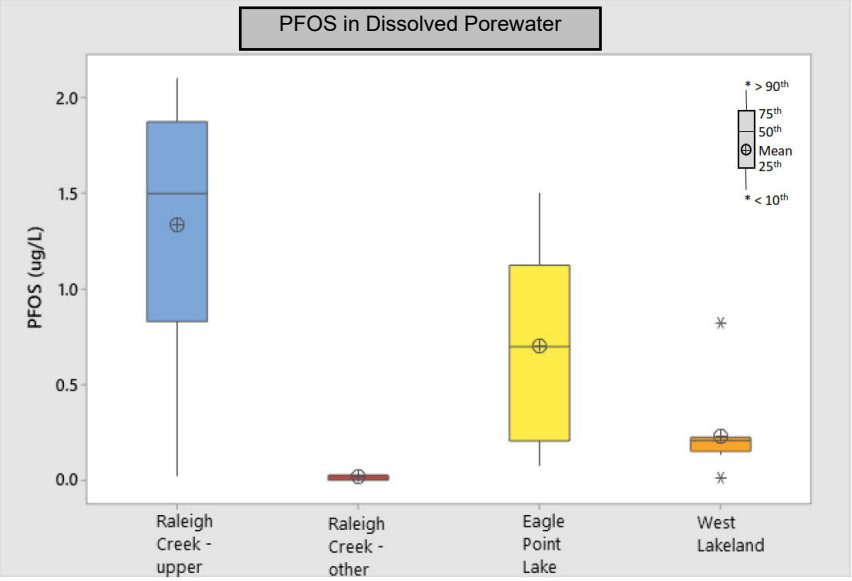
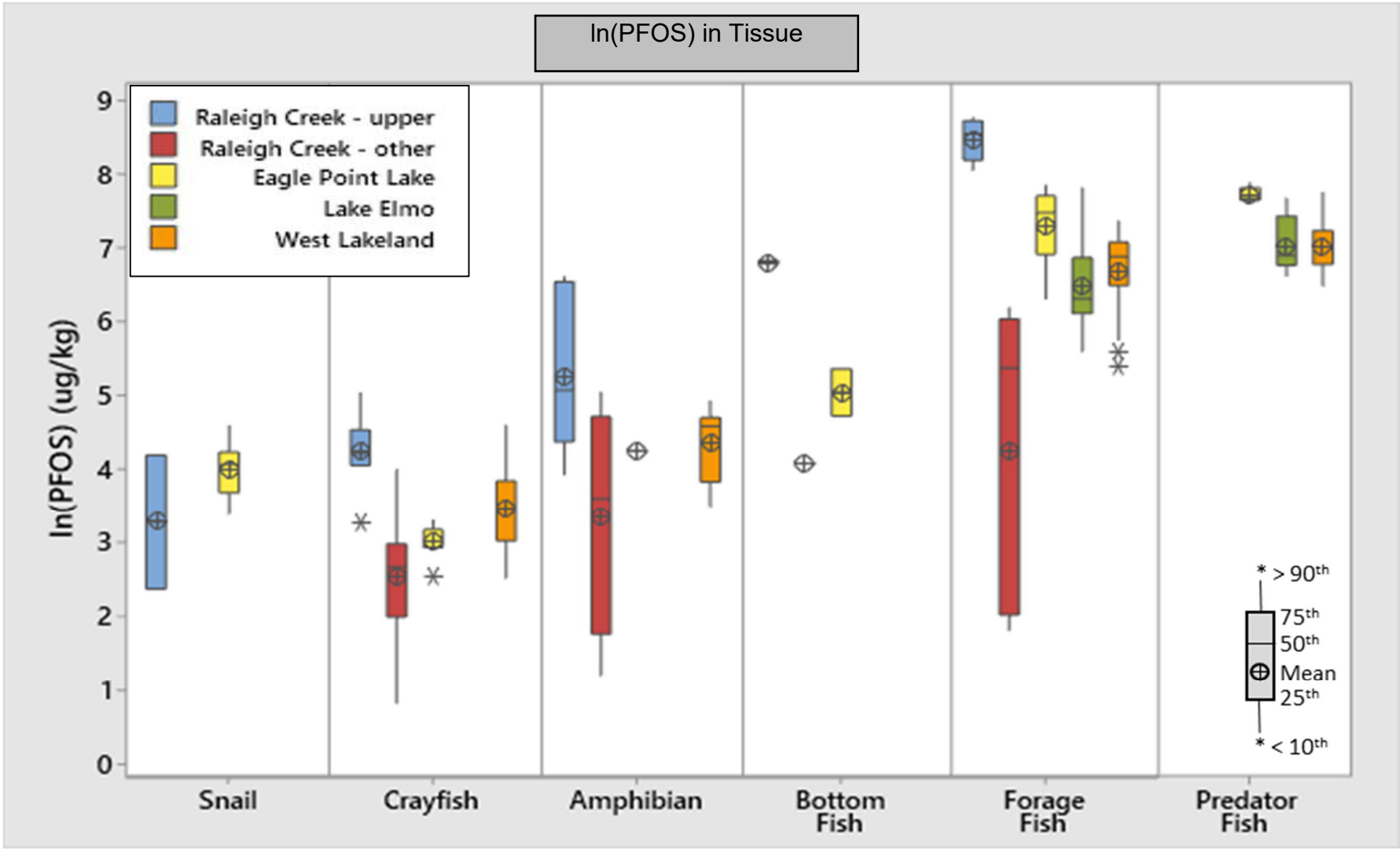


Figure 6
Boxplots of PFOS in Tissue



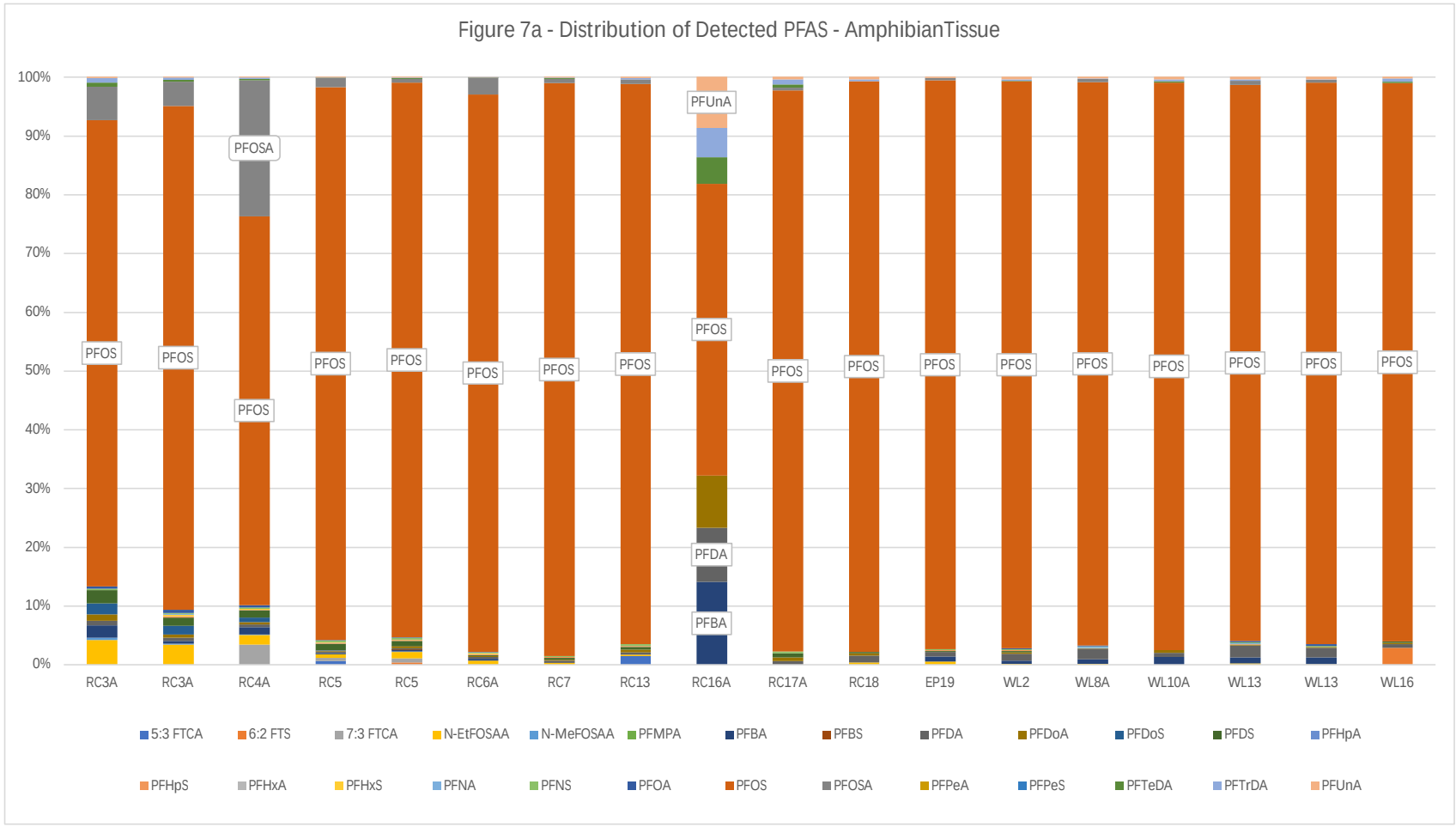


Figure 7a - Distribution of Detected PFAS - AmphibianTissue
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
PFOS
PFOSA
PFUnA
PFDA
PFBA
RC3A
RC3A
RC4A
RC5
RC5
RC6A
RC7
RC13
RC16A
RC17A
RC18
EP19
WL2
WL8A
WL10A
WL13
WL13
WL16
5:3 FTCA
6:2 FTS
7:3 FTCA
N-EtFOSAA
N-MeFOSAA
PFMPA
PFBA
PFBS
PFDA
PFDoA
PFDoS
PFDS
PFHpA
PFHpS
PFHxA
PFHxS
PFNA
PFNS
PFOA
PFOS
PFOSA
PFPeA
PFPeS
PFTeDA
PFTrDA
PFUnA

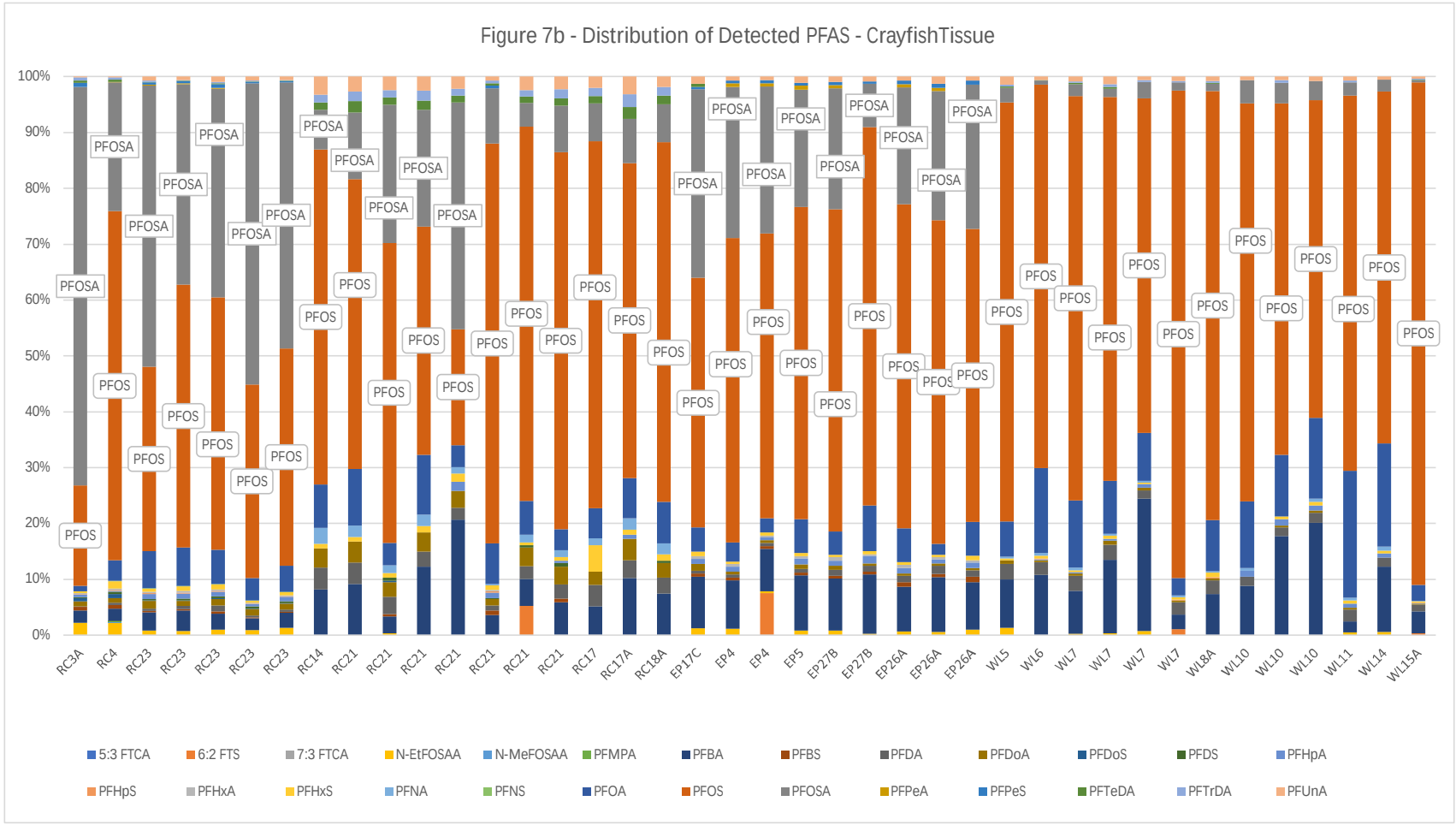


Figure 7b - Distribution of Detected PFAS - CrayfishTissue
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
RC3A RC4 RC23 RC23 RC23 RC23 RC23 RC14 RC21 RC21 RC21 RC21 RC21 RC21 RC21 RC17 RC17A RC18A EP17C EP4 EP4 EP5 EP27B EP27B EP26A EP26A EP26A WL5 WL6 WL7 WL7 WL7 WL7 WL8A WL10 WL10 WL10 WL11 WL14 WL15A
5:3 FTCA
6:2 FTS
7:3 FTCA
N-EtFOSAA
N-MeFOSAA
PFMPA
PFBA
PFBS
PFDA
PFDoA
PFDoS
PFDS
PFHpA
PFHpS
PFHxA
PFHxS
PFNA
PFNS
PFOA
PFOS
PFOSA
PFPeA
PFPeS
PFTeDA
PFTrDA
PFUnA

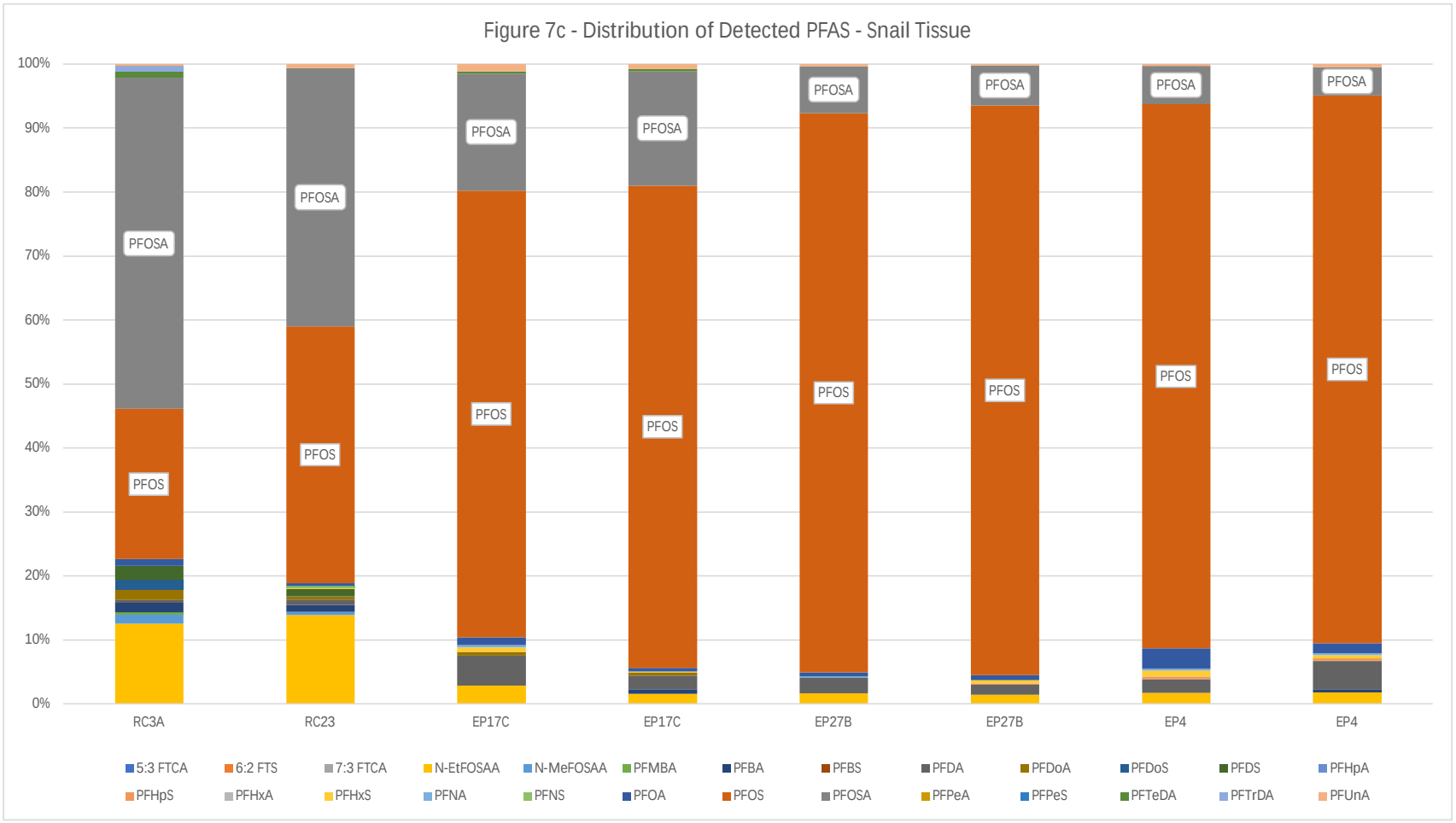


Figure 7c - Distribution of Detected PFAS - Snail Tissue
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
RC3A
RC23
EP17C
EP17C
EP27B
EP27B
EP4
EP4
PFOSA
PFOS
5:3 FTCA
6:2 FTS
7:3 FTCA
N-EtFOSAA
N-MeFOSAA
PFMBA
PFBA
PFBS
PFDA
PFDoA
PFDoS
PFDS
PFHpA
PFHpS
PFHxA
PFHxS
PFNA
PFNS
PFOA
PFOS
PFOSA
PFPeA
PFPeS
PFTeDA
PFTrDA
PFUnA

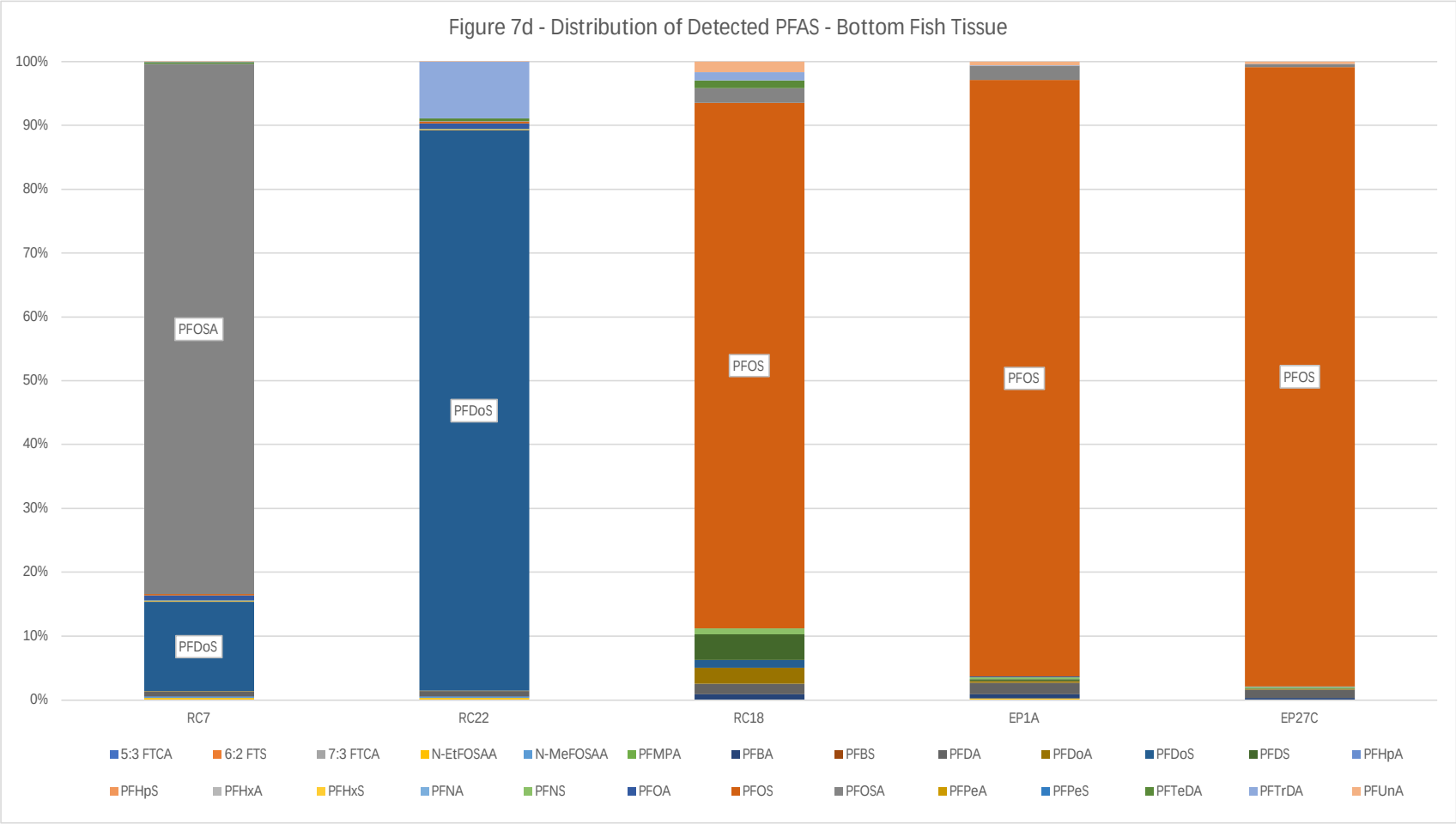


Figure 7d - Distribution of Detected PFAS - Bottom Fish Tissue
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
PFOSA
PFDoS
PFDoS
PFOS
PFOS
PFOS
RC7
RC22
RC18
EP1A
EP27C
5:3 FTCA
6:2 FTS
7:3 FTCA
N-EtFOSAA
N-MeFOSAA
PFMPA
PFBA
PFBS
PFDA
PFDoA
PFDoS
PFDS
PFHpA
PFHpS
PFHxA
PFHxS
PFNA
PFNS
PFOA
PFOS
PFOSA
PFPeA
PFPeS
PFTeDA
PFTrDA
PFUnA

Figure 7e - Distribution of Detected PFAS - Forage Fish Tissue

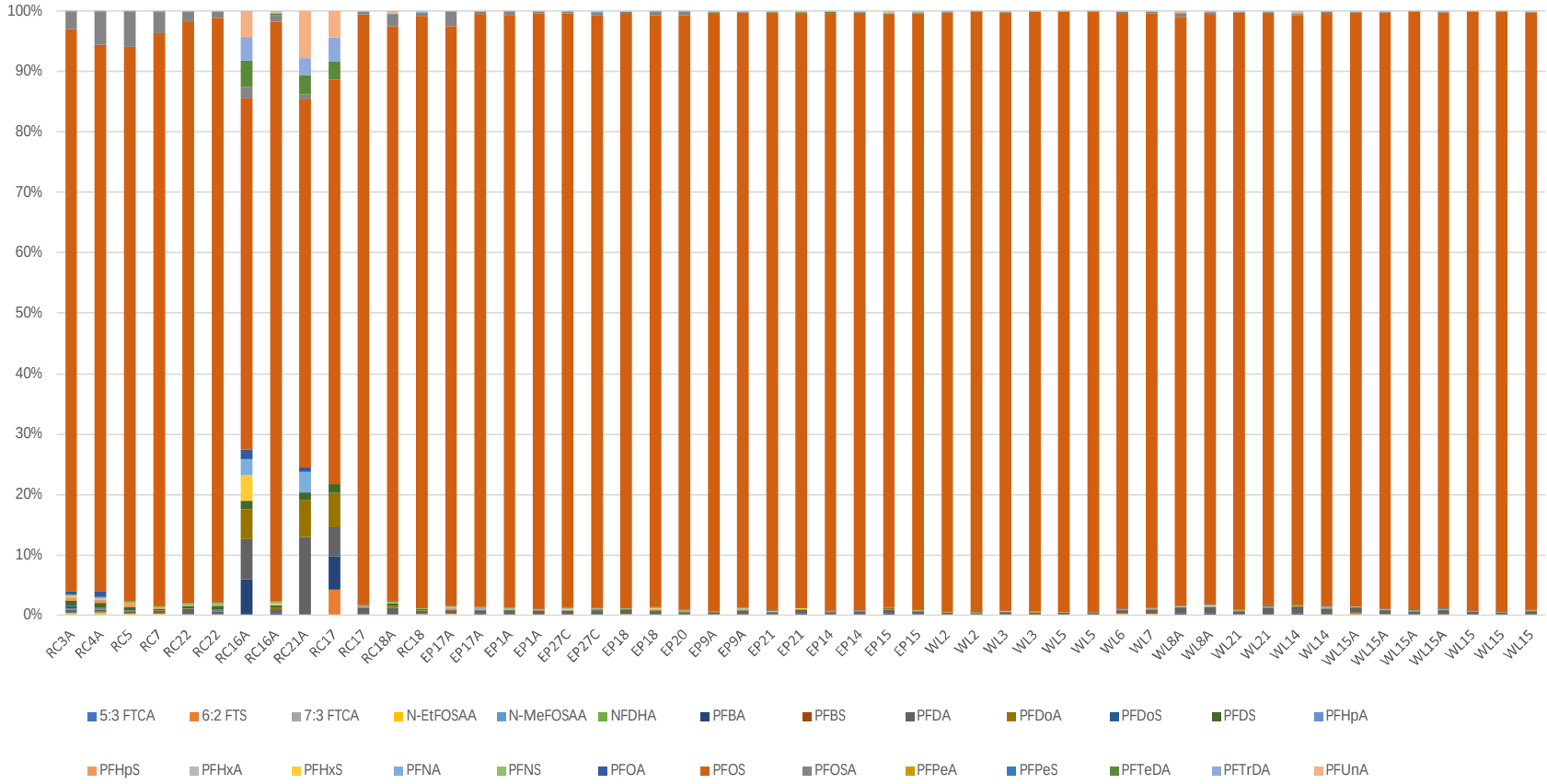


Figure 7f - Distribution of Detected PFAS - Predator Fish Tissue

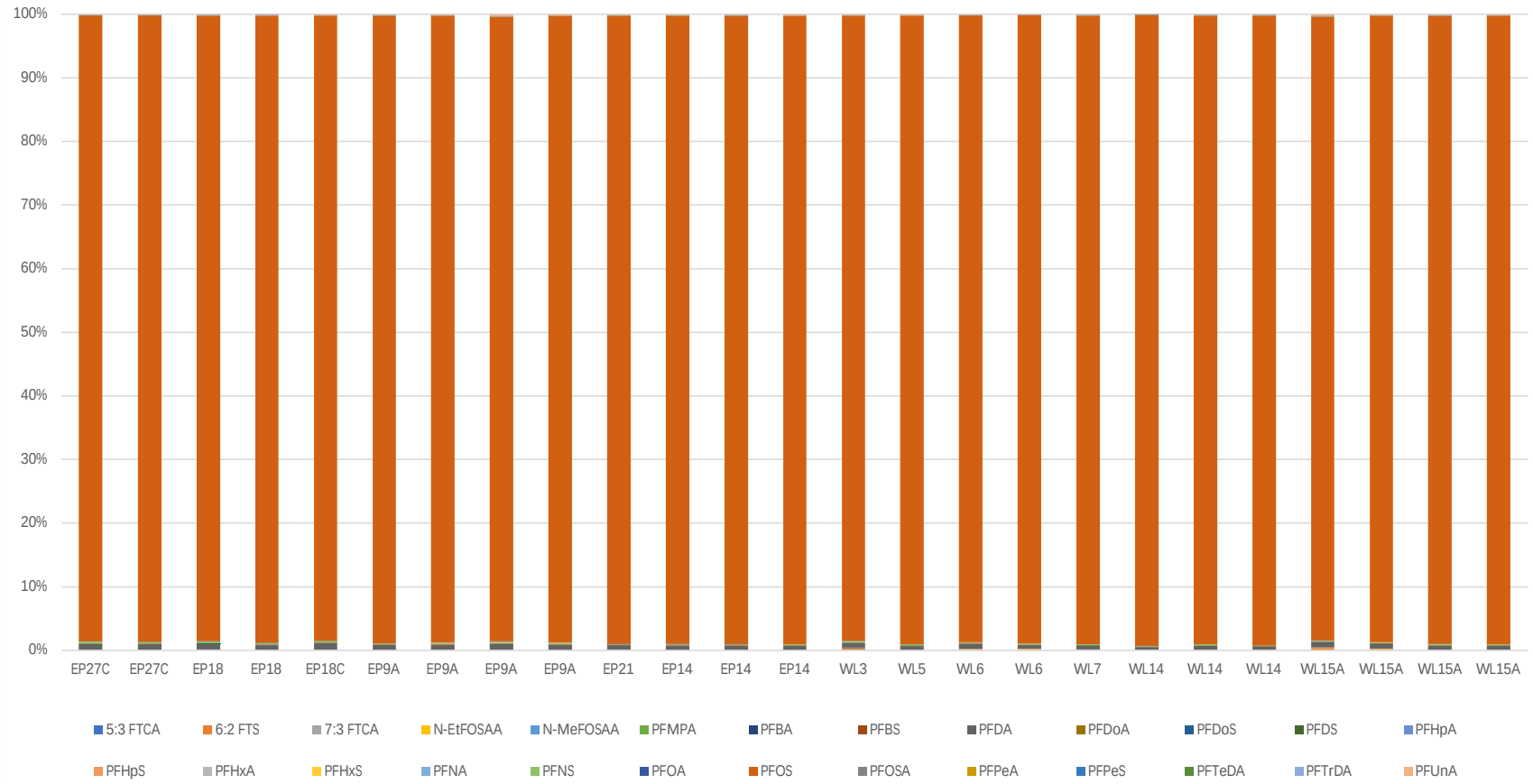
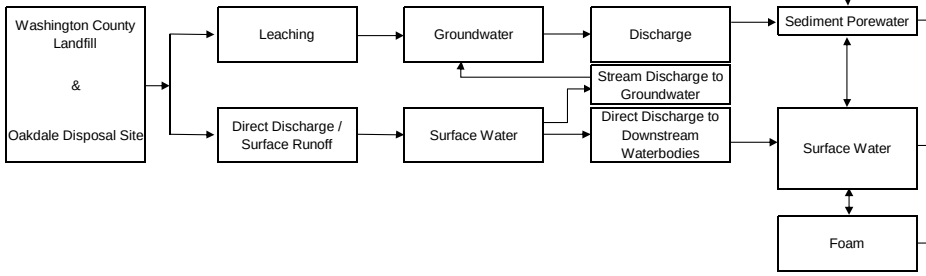


Figure 8
Ecological Conceptual Site Model



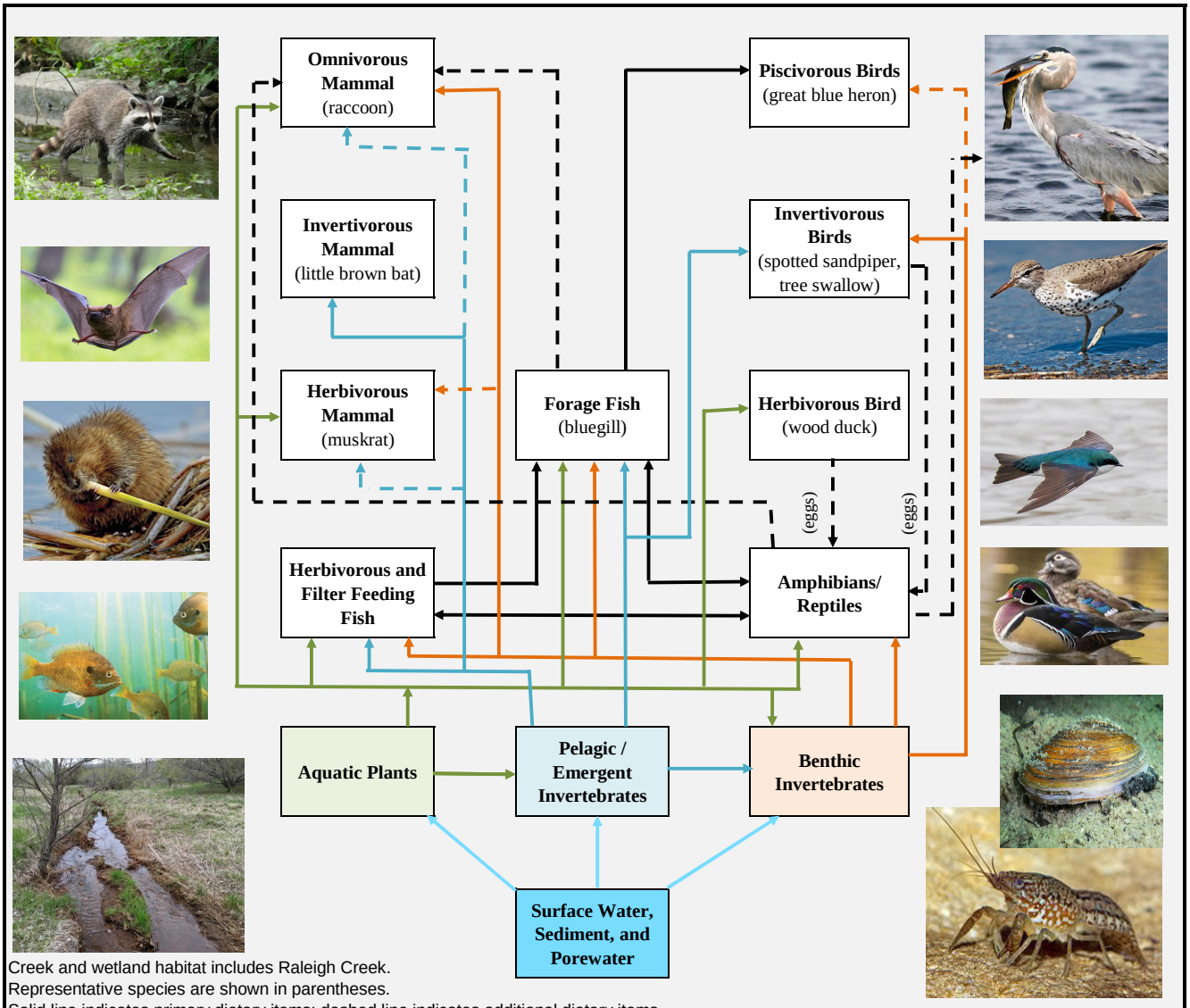
	Potential Ecological Receptors/Exposure Pathways				
Potential Exposure Route	**Aquatic Plant Community**	**Fish and Aquatic Invertebrate Communities**	**Reptile and Amphibian Communities**	**Benthic Macroinvertebrate Community**	**Aquatic Dependent Avian and Mammalian Communities**
Sediment – Incidental Ingestion	○	●(c)	●(b)	●	●
Sediment – Direct Contact	●	●(c)	●(b)	●	○
Sediment – Bioaccumulation (Diet)	○	●(c)	●(b)	●	●
Sediment Porewater – Direct Contact	●	○	○	●(a)	○
Surface Water – Incidental Ingestion	○	●	●(b)	●(a)	●
Surface Water – Direct Contact	●	●	●(b)	●(a)	○
Surface Water – Bioaccumulation (Diet)	○	●	●(b)	●(a)	●
Foam – Incidental Ingestion	○	●	●(b)	○	○
Foam – Direct Contact	●	●	●(b)	○	○

Notes:
● Potentially complete pathway.
○ Pathway considered to be incomplete, not relevant to the receptor group, or insignificant and not evaluated quantitatively.

(a) The highly soluble nature of PFOS and some other long-chain PFAS results in a high capacity for uptake from the water-column into aquatic tissues as well as into benthic organism tissues at the sediment-surface water interface.
(b) Pathways for reptiles to be evaluated qualitatively due to a lack of receptor-specific screening values.
(c) Fish, particularly bottom-dwelling fish, are also exposed to PFOS in sediment during nesting and foraging; however, sediment screening values for fish are not available so these exposures are considered qualitatively.

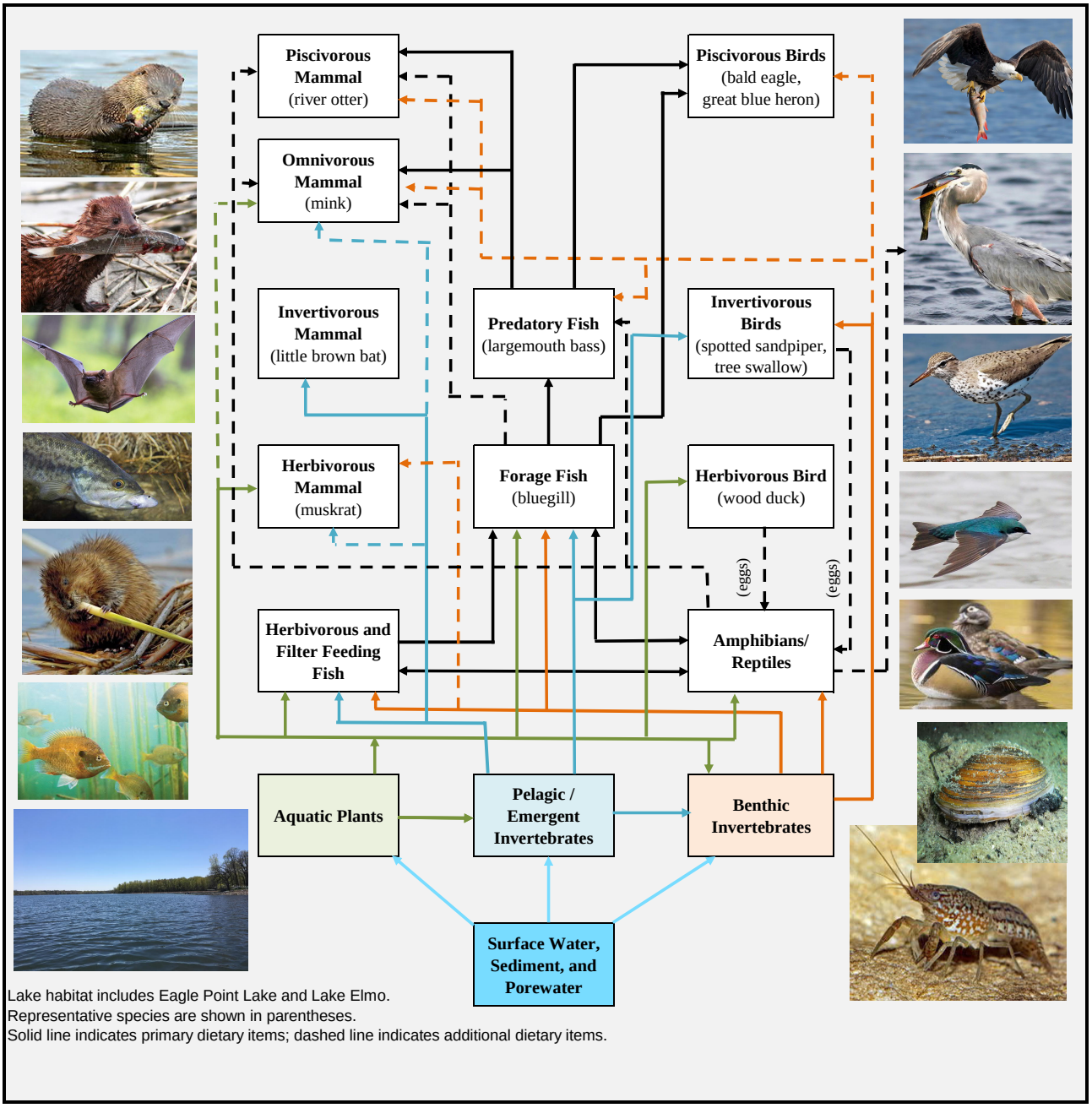
Figure 9

Aquatic Ecological Food Web Model – Creek and Wetland Habitat



Creek and wetland habitat includes Raleigh Creek.
Representative species are shown in parentheses.
Solid line indicates primary dietary items; dashed line indicates additional dietary items.

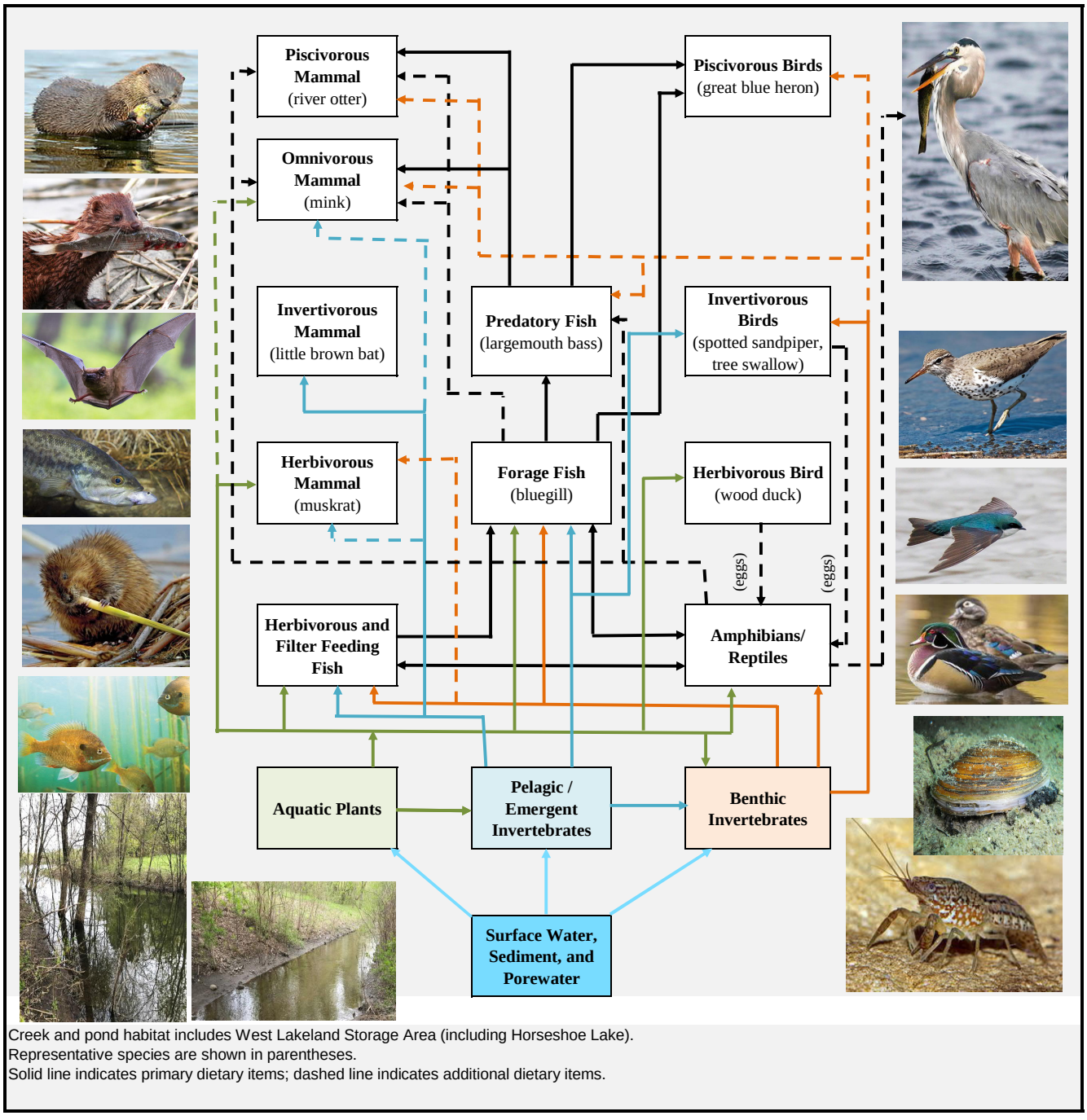
Figure 10
Aquatic Ecological Food Web Model – Lake Habitat



Lake habitat includes Eagle Point Lake and Lake Elmo.
Representative species are shown in parentheses.
Solid line indicates primary dietary items; dashed line indicates additional dietary items.

Figure 11

Aquatic Ecological Food Web Model – Creek and Pond Habitat



Creek and pond habitat includes West Lakeland Storage Area (including Horseshoe Lake).
Representative species are shown in parentheses.
Solid line indicates primary dietary items; dashed line indicates additional dietary items.

Figure 12
Boxplots of Dissolved and Total Surface Water Data for PFOS

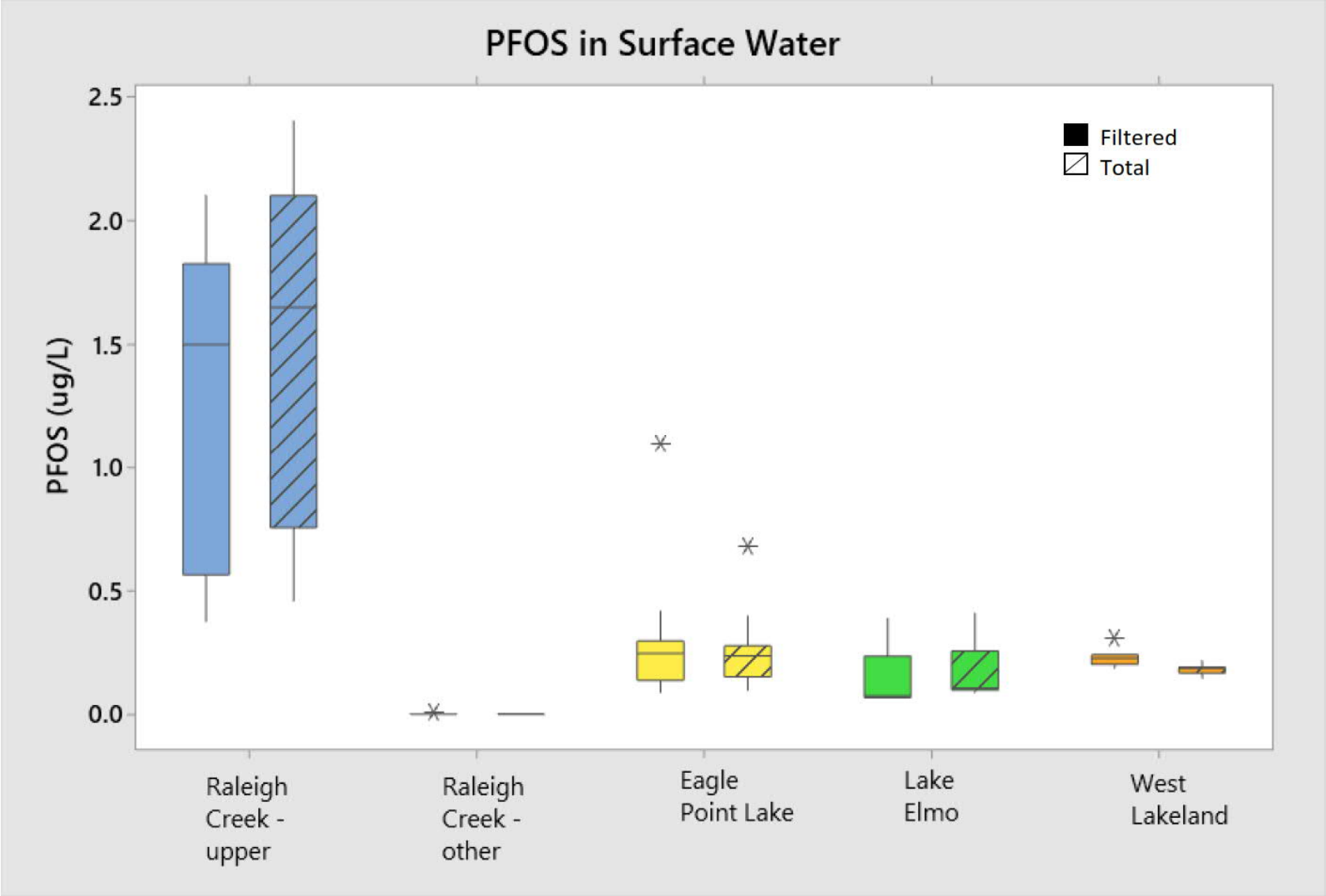


Figure 13
Abiotic Sampling Locations Outside the BERA Study Area

Baseline Ecological Risk Assessment
Minnesota Pollution Control Agency

Project 1007 Structures

- Catch Basin
- Manhole
- Other Structure
- Channel
- Culvert
- Pipe
- Washington County Landfill connection
- Streams and creeks
- Raleigh Creek

- Surface Water Body
- Confluence of Project 1007 and Raleigh Creek

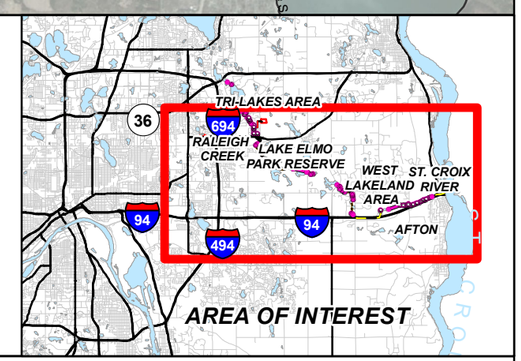
Abiotic Media Samples

- Pore Water
- Surface Water
- Sediment
- Foam

N W E S

AECOM

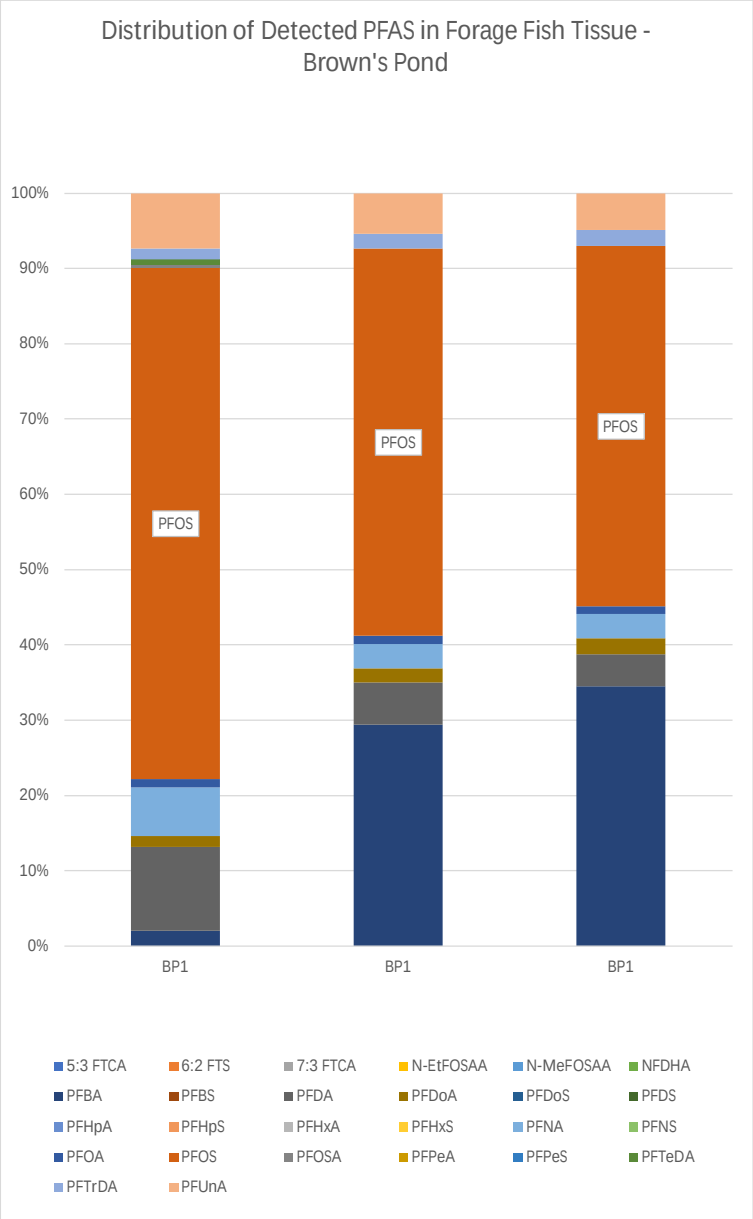
0 0.5 1 1.5 2 Miles

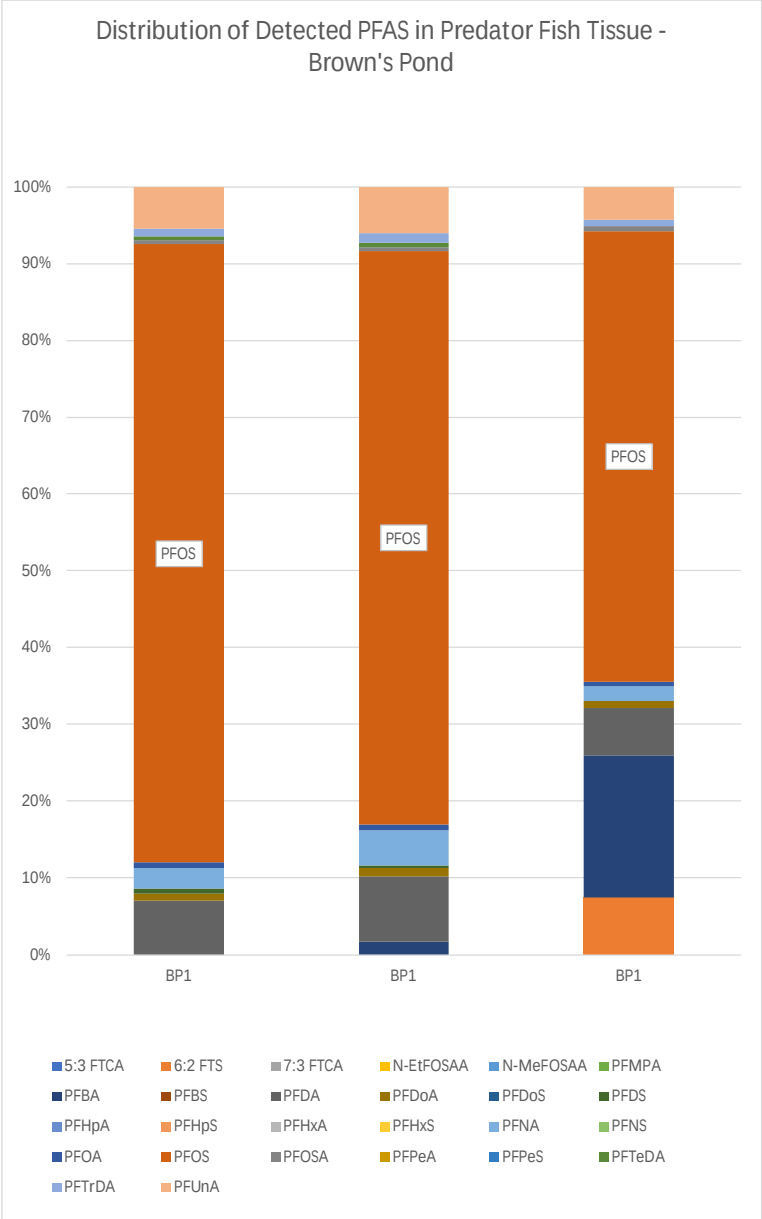


Service Layer Credits: MnGeo WMS service, 2016 aerial photography Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; Other Sources: MDH, VBWD

AECOM Path: C:\Users\lilianageorgeta.croi\AECOM Directory\GDS GIS Services - GIS CAD PROJECTS\DCS AMERICAS\CENTRAL REGION US\MPCA\Project 1007 - Twin Cities East Metro, Minnesota, USA\02. Workspace\20210406\Individual\Figure 3f Abiotic - Other Loca - Copy.mxd Revised: 4/6/2021 By MGD

Figure 14 Distribution of PFAS Detected in Brown's Pond Fish Tissue





Appendix A

Analytical Data Evaluated in the BERA

Appendix A Table 1a
Raleigh Creek Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper
		Location	RC3A	RC4A	RC5	RC6	RC6A	RC7	RC7	RC22
		Location ID	S016-338	S016-052	S016-189	S016-190	S016-375	S016-053	S016-053	PS00175
		Sample Date	9/19/2020	9/18/2020	9/18/2020	9/18/2020	9/20/2020	9/19/2020	9/19/2020	9/18/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	QC-FR	Sample
		Sample ID	S016-338.2009191045.000S	S016-052.2009181430.000S	S016-189.2009181530.000S	S016-190.2009181215.000S	S016-375.2009201710.000S	S016-053.2009191300.000S	S016-053.2009191305.000SR	PS00175.2009180920.000S
		Sample Name	RC3A-WAT-BULK-01-091920	RC4A-WAT-BULK-01-091820	RC5-WAT-BULK-01-091820	RC6-WAT-BULK-01-091820	RC6A-WAT-BULK-01-092020	RC7-WAT-BULK-01-091920	RC7-WAT-BULK-02-091920	RC22-WAT-BULK-01-091820
		Parent Sample ID	NA	NA	NA	NA	NA	NA	S016-053.2009191300.000S	NA
Fraction	Compound	CAS #								
Dissolved	10:2 FTS	120226-60-0	< 0.0043 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.004 U	< 0.0043 U	< 0.0044 U	< 0.0043 U
Dissolved	11Cl-PF3OUdS	763051-92-9	< 0.0043 U	< 0.0041 UJ	< 0.0042 U	< 0.0042 U	< 0.004 U	< 0.0043 U	< 0.0044 U	< 0.0043 U
Dissolved	4:2 FTS	757124-72-4	< 0.0043 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.004 U	< 0.0043 U	< 0.0044 U	< 0.0043 U
Dissolved	6:2 FTS	27619-97-2	< 0.0043 U	< 0.0041 U	0.00069 J+	0.00066 J+	< 0.004 U	< 0.0043 U	< 0.0044 U	< 0.0043 U
Dissolved	8:2 FTS	39108-34-4	< 0.0043 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.004 U	< 0.0043 U	< 0.0044 U	< 0.0043 U
Dissolved	9Cl-PF3ONS	756426-58-1	< 0.0043 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.004 U	< 0.0043 U	< 0.0044 U	< 0.0043 U
Dissolved	ADONA	919005-14-4	< 0.0043 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.004 U	< 0.0043 U	< 0.0044 U	< 0.0043 U
Dissolved	HFPO-DA	13252-13-6	< 0.0043 U	< 0.0041 UJ	0.00032 J	< 0.0042 U	< 0.004 U	< 0.0043 U	< 0.0044 U	< 0.0043 U
Dissolved	N-EtFOSA	4151-50-2	< 0.0043 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.004 U	< 0.0043 U	< 0.0044 U	< 0.0043 U
Dissolved	N-EtFOSAA	2991-50-6	0.0059	0.011	0.012	0.016	0.018	0.0042 BJ	0.0089 B	< 0.0043 U
Dissolved	N-EtFOSE	1691-99-2	< 0.0043 UJ	< 0.0041 U	0.0003 J+	0.00021 BJ+	< 0.004 U	< 0.0043 U	< 0.0044 U	< 0.0043 U
Dissolved	N-MeFOSA	31506-32-8	< 0.0043 U	0.00077 JB	< 0.0042 U	< 0.0042 U	< 0.004 U	< 0.0043 U	0.00049 BJ	< 0.0043 U
Dissolved	N-MeFOSAA	2355-31-9	< 0.0043 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.004 U	< 0.0043 U	< 0.0044 U	< 0.0043 U
Dissolved	N-MeFOSE	24448-09-7	< 0.0043 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.004 U	< 0.0043 U	< 0.0044 U	< 0.0043 U
Dissolved	PFBA	375-22-4	0.25	1.1 J+	0.92 J+	0.83 J+	0.68	0.42	0.44	0.3
Dissolved	PFBS	375-73-5	0.011 J+	0.029	0.028 J+	0.025	0.021	0.017	0.015	0.0097
Dissolved	PFDA	335-76-2	0.0026 J	0.005	0.0063	0.0075	0.011	0.0074	0.0076	0.0016 J
Dissolved	PFDoA	307-55-1	< 0.0043 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.004 U	< 0.0043 U	< 0.0044 U	< 0.0043 U
Dissolved	PFDS	335-77-3	< 0.0043 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.04 U	< 0.0043 U	< 0.0044 U	< 0.0043 U
Dissolved	PFHpA	375-85-9	0.018	0.081	0.084	0.078	0.067 B	0.053 B	0.056 B	0.025
Dissolved	PFHpS	375-92-8	0.0094	0.014	0.022	0.024	0.016 J	0.012	0.017 J	0.0037 J
Dissolved	PFHxA	307-24-4	0.03	0.16	0.15	0.13	0.11	0.071	0.072	0.036
Dissolved	PFHxS	355-46-4	0.036	0.065	0.07	0.069	0.05	0.045	0.046	0.019
Dissolved	PFNA	375-95-1	0.0025 J	0.0039 J	0.0048	0.005	0.0046	0.0034 J	0.0048	0.0015 J
Dissolved	PFNS	68259-12-1	< 0.0043 U	0.0011 J	< 0.0042 U	0.0013 J	< 0.004 U	0.0012 J	< 0.0044 U	< 0.0043 U
Dissolved	PFOA	335-67-1	0.16 J+	0.65	0.61 J+	0.61	0.52	0.42	0.41	0.16
Dissolved	PFOS	1763-23-1	0.43	0.98	1.5	1.5	1.9	1.6	1.6	0.38
Dissolved	PFOSA	754-91-6	0.006	0.026	0.019	0.02	0.033	0.024	0.021	0.0015 J
Dissolved	PFPeA	2706-90-3	0.022	0.067	0.058	0.058	0.037	0.027	0.026	0.022
Dissolved	PFPeS	2706-91-4	0.015 J+	0.046 J+	0.046 J+	0.043 J+	0.032 J+	0.026 J+	0.021 J+	0.01 J+
Dissolved	PFTeDA	376-06-7	0.0041 BJ+	< 0.0041 U	0.0034 BJ+	0.0027 BJ+	< 0.004 U	< 0.0043 U	< 0.0044 U	< 0.0043 U
Dissolved	PFTrDA	72629-94-8	0.0022 J+	< 0.0041 U	0.0013 J+	< 0.0042 U	< 0.004 U	< 0.0043 U	< 0.0044 U	< 0.0043 U
Dissolved	PFUnA	2058-94-8	< 0.0043 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.004 U	< 0.0043 U	< 0.0044 U	< 0.0043 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 1a
Raleigh Creek Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other
		Location	RC23	RC13	RC16A	RC14	RC21	RC17	RC18A	RC18
		Location ID	PS00176	S016-062	S016-314	S016-063	S016-280	S016-065	S016-339	82-0109-00-208
		Sample Date	9/28/2020	9/21/2020	9/19/2020	9/21/2020	9/21/2020	9/19/2020	9/21/2020	9/17/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	PS00176.2009281710.000S	S016-062.2009211400.000S	S016-314.2009191720.000S	S016-063.2009211410.000S	S016-280.2009211420.000S	S016-065.2009191625.000S	S016-339.2009211310.000S	82-0109-00-208.2009170845.000S
		Sample Name	RC23-WAT-BULK-01-092820	RC13-WAT-BULK-01-092120	RC16A-WAT-BULK-01-091920	RC14-WAT-BULK-01-092120	RC21-WAT-BULK-01-092120	RC17-WAT-BULK-01-091920	RC18A-WAT-BULK-01-092120	RC18-WAT-BULK-01-091720
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #								
Dissolved	10:2 FTS	120226-60-0	< 0.0044 U	< 0.0041 U	< 0.0042 U	< 0.0041 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	11Cl-PF3OUdS	763051-92-9	< 0.0044 U	< 0.0041 U	< 0.0042 U	< 0.0041 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.0041 UJ
Dissolved	4:2 FTS	757124-72-4	< 0.0044 U	< 0.0041 U	< 0.0042 U	< 0.0041 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	6:2 FTS	27619-97-2	< 0.0044 U	< 0.0041 U	< 0.0042 U	< 0.0041 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	8:2 FTS	39108-34-4	< 0.0044 U	< 0.0041 U	< 0.0042 U	< 0.0041 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	9Cl-PF3ONS	756426-58-1	< 0.0044 U	< 0.0041 U	< 0.0042 U	< 0.0041 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	ADONA	919005-14-4	< 0.0044 U	< 0.0041 U	< 0.0042 U	< 0.0041 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	HFPO-DA	13252-13-6	< 0.0044 U	< 0.0041 U	< 0.0042 U	< 0.0041 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	N-EtFOSA	4151-50-2	< 0.0044 U	< 0.0041 U	< 0.0042 U	< 0.0041 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.0042 UJ
Dissolved	N-EtFOSAA	2991-50-6	0.01	< 0.0041 U	< 0.0042 U	< 0.0041 U	< 0.0041 U	0.00081 BJ	< 0.0042 U	< 0.0041 UJ
Dissolved	N-EtFOSE	1691-99-2	< 0.0044 U	< 0.0041 U	< 0.0042 U	< 0.0041 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.0042 UJ
Dissolved	N-MeFOSA	31506-32-8	0.00079 BJ	< 0.0041 U	< 0.0042 U	< 0.0041 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.0041 UJ
Dissolved	N-MeFOSAA	2355-31-9	< 0.0044 U	< 0.0041 U	< 0.0042 U	< 0.0041 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.0041 UJ
Dissolved	N-MeFOSE	24448-09-7	< 0.0044 U	< 0.0041 U	< 0.0042 U	< 0.0041 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.0042 UJ
Dissolved	PFBA	375-22-4	0.31	0.087	0.092	0.087	0.086	0.092	0.089	0.11
Dissolved	PFBS	375-73-5	0.014	0.0025 J	0.0026 J	0.0027 J	0.0025 J	0.0026 J	0.0026 J	0.003 J
Dissolved	PFDA	335-76-2	0.012	< 0.0041 U	< 0.0042 U	< 0.0041 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	PFDoA	307-55-1	< 0.0044 U	< 0.0041 U	< 0.0042 U	< 0.0041 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	0.0038 BJ+
Dissolved	PFDS	335-77-3	< 0.0044 U	< 0.0041 U	< 0.0042 U	< 0.0041 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.0042 UJ
Dissolved	PFHpA	375-85-9	0.048	0.0024 J	0.0046 B	0.0032 J	0.004 J	0.0031 BJ	0.0041 J	0.0038 J
Dissolved	PFHpS	375-92-8	0.026 J+	< 0.0041 U	< 0.0042 U	< 0.0041 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	PFHxA	307-24-4	0.055	< 0.0092 U	< 0.0092 U	< 0.0092 U	< 0.0092 U	< 0.0092 U	< 0.0092 U	< 0.0092 U
Dissolved	PFHxS	355-46-4	0.048	0.0041 J	0.0037 J	0.0028 J	0.0022 J	0.0031 J	0.0037 J	0.0038 J
Dissolved	PFNA	375-95-1	0.0061	< 0.0041 U	< 0.0042 U	< 0.0041 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	PFNS	68259-12-1	0.003 J	< 0.0041 U	< 0.0042 U	< 0.0041 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	PFOA	335-67-1	0.41	0.0078	0.0084	0.0083	0.0075	0.0085	0.0085	0.0093
Dissolved	PFOS	1763-23-1	2.1	0.0041 J+	0.0035 J	0.0031 J+	0.0032 J+	0.0027 J	0.0038 J+	0.0065
Dissolved	PFOSA	754-91-6	0.016	< 0.0041 U	0.00068 J	< 0.0041 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	PFPeA	2706-90-3	0.027	0.0066	0.0078	0.0068	0.0072	0.0073	0.0069	0.0075
Dissolved	PFPeS	2706-91-4	0.019	< 0.0041 U	< 0.0042 U	< 0.0041 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	PFTeDA	376-06-7	< 0.0044 UJ	< 0.0041 UJ	< 0.0042 U	< 0.0041 UJ	< 0.0041 UJ	< 0.0042 U	< 0.0042 U	R
Dissolved	PFTrDA	72629-94-8	< 0.0044 U	< 0.0041 U	< 0.0042 U	< 0.0041 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.0042 UJ
Dissolved	PFUnA	2058-94-8	< 0.0044 U	< 0.0041 U	< 0.0042 U	< 0.0041 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	0.0016 J+

NOTES
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Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 1a
Raleigh Creek Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper
		Location	RC3	RC3	RC3	RC3	RC3	RC3	RC3	RC3
		Location ID	S016-051	S016-051	S016-051	S016-051	S016-051	S016-051	S016-051	S016-051
		Sample Date	8/12/2019	8/14/2019	2/24/2020	4/28/2020	4/29/2020	5/4/2020	5/18/2020	6/29/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	S016-051.1908121710.000S	S016-051.1908141715.000S	S016-051.2002241010.000S	S016-051.2004281730.000S	S016-051.2004290900.000S	S016-051.2005041045.000S	S016-051.2005181810.000S	S016-051.2006291445.000S
		Sample Name	RC3-WAT-SUR-01-081219	RC3-WAT-SUR-01-081419	RC3-WAT-BULK-01-022420	RC3-WAT-BULK-01-042820	RC3-WAT-BULK-01-042920	RC3-WAT-BULK-01-050420	RC3-WAT-BULK-01-051820	RC3-WAT-BULK-01-062920
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.0033 U	< 0.00296 U	< 0.00309 U	< 0.00353 U	< 0.00303 U	< 0.00291 U	< 0.0223 U	< 0.00303 UJ
Total	4:2 FTS	757124-72-4	< 0.0033 U	< 0.00296 U	< 0.00309 U	< 0.00353 U	< 0.00303 U	< 0.00291 U	< 0.0223 U	< 0.00303 UJ
Total	6:2 FTS	27619-97-2	< 0.00297 U	< 0.00266 U	< 0.00278 U	< 0.00318 U	< 0.00272 U	< 0.00262 U	< 0.0201 U	< 0.00273 UJ
Total	8:2 FTS	39108-34-4	< 0.0033 U	< 0.00296 U	< 0.00309 U	< 0.00353 U	< 0.00303 U	< 0.00291 U	< 0.0223 U	< 0.00303 UJ
Total	9Cl-PF3ONS	756426-58-1	< 0.0033 U	< 0.00296 U	< 0.00309 U	< 0.00353 U	< 0.00303 U	< 0.00291 U	< 0.0223 U	< 0.00303 UJ
Total	ADONA	919005-14-4	< 0.0033 U	< 0.00296 U	< 0.00309 U	< 0.00353 U	< 0.00303 U	< 0.00291 U	< 0.0223 U	< 0.00303 UJ
Total	HFPO-DA	13252-13-6	< 0.0033 U	< 0.00296 U	< 0.00293 U	< 0.00336 U	< 0.00288 U	< 0.00276 U	< 0.0212 U	< 0.00288 UJ
Total	N-EtFOSA	4151-50-2	0.00386 J	< 0.00185 U	0.00318 J	< 0.00221 U	< 0.00189 U	0.00352 J	< 0.0139 U	< 0.00189 UJ
Total	N-EtFOSAA	2991-50-6	0.478	0.129	0.24	0.0918	0.0782	0.0919	0.0958	0.125 J-
Total	N-EtFOSE	1691-99-2	0.00747 J	< 0.00555 U	0.0182	< 0.00662 U	< 0.00568 U	< 0.00545 U	< 0.0418 U	< 0.00568 UJ
Total	N-MeFOSA	31506-32-8	< 0.000949 U	< 0.000851 U	< 0.000888 U	< 0.00102 U	< 0.00087 U	< 0.000835 U	< 0.00641 U	< 0.000871 UJ
Total	N-MeFOSAA	2355-31-9	0.00124 J	< 0.00074 U	< 0.000772 U	< 0.000883 U	< 0.000757 U	< 0.000726 U	< 0.00557 U	< 0.000758 UJ
Total	N-MeFOSE	24448-09-7	< 0.00826 U	< 0.0074 U	< 0.00772 U	< 0.00883 U	< 0.00757 U	< 0.00726 U	< 0.0557 U	< 0.00758 UJ
Total	PFBA	375-22-4	0.412	0.301	0.904	0.701	0.566	0.745	0.601	R
Total	PFBS	375-73-5	0.0252	0.0159	0.0614	0.0684	0.0787	0.0644	0.0625	0.031 J-
Total	PFDA	335-76-2	0.0148	0.00991	0.0102	0.0147	0.017	0.0165	0.0263	0.0231 J-
Total	PFDoA	307-55-1	< 0.000826 U	< 0.00074 U	< 0.000772 U	< 0.000883 U	< 0.000757 U	< 0.000726 U	< 0.00557 U	< 0.000758 UJ
Total	PFDoS	79780-39-5	< 0.000826 U	< 0.00074 U	< 0.000772 U	< 0.000883 U	< 0.000757 U	< 0.000726 U	< 0.00557 U	< 0.000758 UJ
Total	PFDS	335-77-3	0.00179 J	< 0.00074 U	< 0.000772 U	< 0.000883 U	< 0.000757 U	< 0.000726 U	< 0.00557 U	0.00177 J-
Total	PFHpA	375-85-9	0.0709	0.0491	0.173	0.257	0.301	0.248	0.232	0.0891 J-
Total	PFHpS	375-92-8	0.0412	0.0256	0.0536	0.0871	0.11	0.104	0.0959	0.0788 J-
Total	PFHxA	307-24-4	0.0768	0.0521	0.225	0.229	0.272	0.226	0.194	0.0852 J-
Total	PFHxS	355-46-4	0.0872	0.0593	0.171	0.202	0.242	0.219	0.239	0.0985 J-
Total	PFNA	375-95-1	0.00681	0.00531	0.00949	0.0137	0.0164	0.015	0.0232	0.0117 J-
Total	PFNS	68259-12-1	0.00195 J	0.000982 J	< 0.000772 U	0.0011 J	0.00129 J	0.0012 J	< 0.00557 U	0.00292 J-
Total	PFOA	335-67-1	0.832	0.548	1.68	2.26	2.45	2.17	2.28	0.898 J-
Total	PFOS	1763-23-1	3.9	2.47	2.94	4.81	5.24	6.26	8.81	5.48 J-
Total	PFOSA	754-91-6	0.123	0.0561	0.0405	0.0499	0.0463	0.0605	0.0645	0.0514 J-
Total	PFPeA	2706-90-3	0.0405	0.0267	0.105	0.111	0.13	0.109	0.0962	0.0436 J-
Total	PFPeS	2706-91-4	0.0311	0.0183	0.0688	0.0865	0.0995	0.0905	0.0826	0.0374 J-
Total	PFTeDA	376-06-7	< 0.000826 U	< 0.00074 U	< 0.000772 U	< 0.000883 U	< 0.000757 U	< 0.000726 U	< 0.00557 U	< 0.000758 UJ
Total	PFTrDA	72629-94-8	< 0.000826 U	< 0.00074 U	< 0.000772 U	< 0.000883 U	< 0.000757 U	< 0.000726 U	< 0.00557 U	< 0.000758 UJ
Total	PFUnA	2058-94-8	0.000847 J	< 0.00074 U	< 0.000772 U	< 0.000883 U	< 0.000757 U	< 0.000726 U	< 0.00557 U	< 0.000758 UJ

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

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- = Result may be biased low.
CAS = Chemical Abstracts Service.
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J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 1a
Raleigh Creek Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper
		Location	RC3	RC3	RC3	RC3	RC3	RC3	RC3	RC3
		Location ID	S016-051	S016-051	S016-051	S016-051	S016-051	S016-051	S016-051	S016-051
		Sample Date	7/28/2020	8/26/2020	9/1/2020	9/1/2020	9/4/2020	9/16/2020	9/16/2020	10/8/2020
		Sample Type Code	Sample	Sample	Sample	QC-FR	Sample	Sample	QC-FR	Sample
		Sample ID	S016-051.2007281400.000S	S016-051.2008260900.000S	S016-051.2009011435.000S	S016-051.2009011440.000SR	S016-051.2009041330.000S	S016-051.2009161610.000S	S016-051.2009161620.000SR	S016-051.2010081015.000S
		Sample Name	RC3-WAT-BULK-01-072820	RC3-WAT-BULK-01-082620	RC3-WAT-BULK-01-090120	RC3-WAT-BULK-02-090120	RC3-WAT-BULK-01-090420	RC3-WAT-BULK-01-091620	RC3-WAT-BULK-02-091620	RC3MAN-WAT-BULK-01-100820
		Parent Sample ID	NA	NA	NA	S016-051.2009041330.000S	NA	NA	S016-051.2009161610.000S	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	< 0.0041 U	< 0.0044 U	< 0.0042 U
Total	11Cl-PF3OUdS	763051-92-9	< 0.00148 U	< 0.00146 UJ	< 0.00147 U	< 0.0015 U	< 0.0015 UJ	< 0.0041 UJ	< 0.0044 UJ	< 0.0042 U
Total	4:2 FTS	757124-72-4	< 0.00148 U	< 0.00146 UJ	< 0.00147 U	< 0.00149 U	< 0.0015 UJ	< 0.0041 U	< 0.0044 U	< 0.0042 U
Total	6:2 FTS	27619-97-2	< 0.00134 U	< 0.00131 UJ	0.00353 J	< 0.00135 U	< 0.00135 UJ	0.029 BJ	0.025 BJ	< 0.0042 U
Total	8:2 FTS	39108-34-4	< 0.00148 U	< 0.00146 UJ	< 0.00147 U	< 0.00149 U	< 0.0015 UJ	< 0.0041 U	< 0.0044 U	< 0.0042 U
Total	9Cl-PF3ONS	756426-58-1	< 0.00149 U	< 0.00146 UJ	< 0.00147 U	< 0.0015 U	< 0.0015 UJ	< 0.0041 U	< 0.0044 U	< 0.0042 U
Total	ADONA	919005-14-4	< 0.00148 U	< 0.00146 UJ	< 0.00147 U	< 0.00149 U	< 0.0015 UJ	< 0.0041 U	< 0.0044 U	< 0.0042 U
Total	HFPO-DA	13252-13-6	< 0.00141 U	< 0.00139 UJ	< 0.00139 U	< 0.00142 U	< 0.00143 UJ	0.00031 J	< 0.0044 U	< 0.0042 UJ
Total	N-EtFOSA	4151-50-2	0.00145 J	0.00117 J-	< 0.000916 U	< 0.000934 U	< 0.000938 UJ	< 0.0041 U	< 0.0044 U	< 0.0042 U
Total	N-EtFOSAA	2991-50-6	0.118	0.111 J-	0.042	0.0419	0.0438 J-	0.029 J+	0.02 J+	0.0015 J+
Total	N-EtFOSE	1691-99-2	< 0.00277 U	< 0.00273 UJ	< 0.00274 U	< 0.00279 U	< 0.00281 UJ	< 0.0041 U	< 0.0044 U	< 0.0042 U
Total	N-MeFOSA	31506-32-8	< 0.000426 U	< 0.000419 UJ	< 0.000422 U	< 0.00043 U	< 0.000431 UJ	< 0.0041 U	< 0.0044 U	< 0.0042 U
Total	N-MeFOSAA	2355-31-9	0.000426 J	0.000644 J-	< 0.000367 U	0.000417 J	< 0.000375 UJ	< 0.0041 U	< 0.0044 U	< 0.0042 UJ
Total	N-MeFOSE	24448-09-7	< 0.0037 U	< 0.00364 UJ	< 0.00367 U	< 0.00374 U	< 0.00375 UJ	< 0.0041 U	< 0.0044 U	< 0.0042 U
Total	PFBA	375-22-4	0.214	0.486 J-	0.392	0.351	0.388 J-	0.31	0.29	0.17
Total	PFBS	375-73-5	0.0202	0.0274 J-	0.0215	0.0197	0.0218 J-	0.014	0.013	0.0073
Total	PFDA	335-76-2	0.0119	0.0131 J-	0.00739	0.00721	0.00806 J-	0.0084	0.0069	0.0034 J
Total	PFDoA	307-55-1	0.000442 J	< 0.000364 UJ	< 0.000367 U	< 0.000374 U	< 0.000375 UJ	< 0.0041 U	< 0.0044 U	< 0.0042 U
Total	PFDoS	79780-39-5	0.000456 J	< 0.000364 UJ	< 0.000367 U	< 0.000374 U	< 0.000375 UJ	NA	NA	NA
Total	PFDS	335-77-3	0.00113 J	0.00095 J-	0.000369 J	< 0.000374 U	0.000396 J-	0.00048 J	0.00031 J	< 0.0042 U
Total	PFHpA	375-85-9	0.0657	0.0867 J-	0.0601	0.0546	0.0607 J-	0.046	0.038	0.013 J+
Total	PFHpS	375-92-8	0.0384	0.0477 J-	0.0286	0.0269	0.0303 J-	0.029 J-	0.021 J-	0.011
Total	PFHxA	307-24-4	0.058	0.108 J-	0.0707	0.0719	0.0764 J-	0.068	0.064	0.02
Total	PFHxS	355-46-4	0.0706	0.109 J-	0.0646	0.0629	0.0691 J-	0.047	0.038 J-	0.029 J+
Total	PFNA	375-95-1	0.00677	0.00789 J-	0.00499	0.00508	0.00548 J-	0.0067	0.0052	0.0019 J
Total	PFNS	68259-12-1	0.00113 J	0.00102 J-	< 0.000367 U	0.000511 J	0.00047 J-	0.0013 J-	< 0.0044 UJ	< 0.0042 U
Total	PFOA	335-67-1	0.611	0.937 J-	0.603	0.563	0.629 J-	0.51	0.46	0.14
Total	PFOS	1763-23-1	3.48 D1	3.6 J-	1.96	2.01	2.07 J-	1.5	1.3	0.23
Total	PFOSA	754-91-6	0.0597	0.0795 J-	0.024	0.0236	0.0281 J-	0.019 J	0.014 J	< 0.0042 U
Total	PFPeA	2706-90-3	0.0275	0.0522 J-	0.0387	0.0348	0.0386 J-	0.024	0.022	0.016
Total	PFPeS	2706-91-4	0.0253	0.0324 J-	0.0223	0.022	0.0231 J-	0.019	0.014	0.0046
Total	PFTeDA	376-06-7	< 0.00037 U	< 0.000364 UJ	< 0.000367 U	< 0.000374 U	< 0.000375 UJ	< 0.0041 U	< 0.0044 U	< 0.0042 UJ
Total	PFTrDA	72629-94-8	< 0.00037 U	< 0.000364 UJ	< 0.000367 U	< 0.000374 U	< 0.000375 UJ	< 0.0041 U	< 0.0044 U	< 0.0042 U
Total	PFUnA	2058-94-8	0.000434 J	< 0.000364 UJ	< 0.000367 U	< 0.000374 U	< 0.000375 UJ	< 0.0041 U	< 0.0044 U	< 0.0042 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 1a
Raleigh Creek Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper
		Location	RC3	RC3	RC3A	RC4	RC4A	RC5	RC5	RC5
		Location ID	S016-051	S016-051	S016-338	S016-052	S016-052	S016-189	S016-189	S016-189
		Sample Date	10/13/2020	10/13/2020	9/19/2020	8/12/2019	9/18/2020	8/12/2019	2/24/2020	5/4/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	S016-051.2010130745.000S	S016-051.2010130820.000S	S016-338.2009191045.000S	S016-052.1908121635.000S	S016-052.2009181430.000S	S016-189.1908121555.000S	S016-189.2002241315.000S	S016-189.2005041155.000S
		Sample Name	RC3MAN-WAT-BULK-01-101320	RC3CUL-WAT-BULK-01-101320	RC3A-WAT-BULK-01-091920	RC4-WAT-SUR-01-081219	RC4A-WAT-BULK-01-091820	RC5-WAT-SUR-01-081219	RC5-WAT-BULK-01-022420	RC5-WAT-BULK-01-050420
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	< 0.0046 U	< 0.004 U	< 0.0042 U	NA	< 0.004 U	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.0046 U	< 0.004 U	< 0.0042 U	< 0.00327 U	< 0.004 U	< 0.00328 U	< 0.00296 U	< 0.024 U
Total	4:2 FTS	757124-72-4	< 0.0046 U	< 0.004 U	< 0.0042 U	< 0.00327 U	< 0.004 U	< 0.00328 U	< 0.00296 U	< 0.024 U
Total	6:2 FTS	27619-97-2	< 0.0046 U	< 0.004 U	0.0009 J	< 0.00294 U	< 0.004 U	< 0.00295 U	< 0.00266 U	< 0.021 U
Total	8:2 FTS	39108-34-4	< 0.0046 U	< 0.004 U	< 0.0042 U	< 0.00327 U	< 0.004 U	< 0.00328 U	< 0.00296 U	< 0.024 U
Total	9Cl-PF3ONS	756426-58-1	< 0.0046 U	< 0.004 U	< 0.0042 U	< 0.00327 U	< 0.004 U	< 0.00328 U	< 0.00296 U	< 0.024 U
Total	ADONA	919005-14-4	< 0.0046 U	< 0.004 U	< 0.0042 U	< 0.00327 U	< 0.004 U	< 0.00328 U	< 0.00296 U	< 0.024 U
Total	HFPO-DA	13252-13-6	< 0.0046 UJ	< 0.004 UJ	< 0.0042 U	< 0.00327 U	< 0.004 U	< 0.00328 U	< 0.00281 U	< 0.022 U
Total	N-EtFOSA	4151-50-2	< 0.0046 UJ	< 0.004 U	< 0.0042 U	< 0.00204 U	< 0.004 U	< 0.00205 U	< 0.00185 U	< 0.015 U
Total	N-EtFOSAA	2991-50-6	< 0.0046 U	< 0.004 U	0.01 B	0.0499	0.02	0.0311	0.0268	0.0247
Total	N-EtFOSE	1691-99-2	< 0.0046 U	0.00016 J	< 0.0042 U	< 0.00613 U	< 0.004 U	< 0.00615 U	< 0.00555 U	< 0.045 U
Total	N-MeFOSA	31506-32-8	< 0.0046 U	< 0.004 U	< 0.0042 U	< 0.00094 U	< 0.004 U	< 0.000942 U	< 0.000851 U	< 0.006 U
Total	N-MeFOSAA	2355-31-9	< 0.0046 U	< 0.004 UJ	< 0.0042 U	< 0.000818 U	< 0.004 U	< 0.000819 U	< 0.00074 U	< 0.006 U
Total	N-MeFOSE	24448-09-7	< 0.0046 U	< 0.004 U	< 0.0042 U	< 0.00818 U	< 0.004 U	< 0.00819 U	< 0.0074 U	< 0.06 U
Total	PFBA	375-22-4	0.11	0.14	0.22	0.694	1.1	0.404	0.764	0.786
Total	PFBS	375-73-5	0.0048	0.0064	0.01	0.0208	0.028	0.0145	0.034	0.0604
Total	PFDA	335-76-2	0.0024 J	0.0022 J	0.0033 J	0.00604	0.0066	0.00824	0.00624	0.00989 J
Total	PFDoA	307-55-1	< 0.0046 U	< 0.004 U	< 0.0042 U	< 0.000818 U	< 0.004 U	< 0.000819 U	< 0.00074 U	< 0.006 U
Total	PFDoS	79780-39-5	NA	NA	NA	< 0.000818 U	NA	< 0.000819 U	< 0.00074 U	< 0.006 U
Total	PFDS	335-77-3	< 0.0046 U	< 0.004 U	0.00062 J	< 0.000818 U	< 0.004 U	< 0.000819 U	< 0.00074 U	< 0.006 U
Total	PFHpA	375-85-9	0.0062	0.0095	0.023	0.0462	0.11	0.036	0.107	0.211
Total	PFHpS	375-92-8	0.003 J	0.0057	0.012	0.0175	0.026	0.0188	0.0258	0.0474
Total	PFHxA	307-24-4	0.011 J+	0.02 J+	0.038	0.0901	0.17	0.0602	0.141	0.198
Total	PFHxS	355-46-4	0.01	0.021	0.033	0.0584	0.071	0.0435	0.0933	0.184
Total	PFNA	375-95-1	0.0014 J	0.0017 J	0.0026 J	0.00358	0.0036 J	0.0038	0.00615	0.0114 J
Total	PFNS	68259-12-1	< 0.0046 U	< 0.004 U	< 0.0042 U	< 0.000818 U	0.00074 J	< 0.000819 U	< 0.00074 U	< 0.006 U
Total	PFOA	335-67-1	0.043	0.079	0.19	0.57	0.72	0.395	0.949	1.76
Total	PFOS	1763-23-1	0.11	0.13	0.61	1.59	1.2	1.99	1.4	3.42
Total	PFOSA	754-91-6	< 0.0046 U	0.00063 J	0.0094	0.0356	0.028	0.0308	0.0188	0.0363
Total	PFPeA	2706-90-3	0.01	0.012	0.02	0.0386	0.064	0.0264	0.0662	0.0955
Total	PFPeS	2706-91-4	0.0022 J	0.0059	0.017	0.0232	0.041 J+	0.0155	0.0352	0.0736
Total	PFTeDA	376-06-7	< 0.0046 UJ	< 0.004 U	< 0.0042 U	< 0.000818 U	< 0.004 U	< 0.000819 U	< 0.00074 U	< 0.006 U
Total	PFTrDA	72629-94-8	< 0.0046 U	< 0.004 U	< 0.0042 U	< 0.000818 U	< 0.004 U	< 0.000819 U	< 0.00074 U	< 0.006 U
Total	PFUnA	2058-94-8	< 0.0046 U	< 0.004 U	< 0.0042 U	< 0.000818 U	< 0.004 U	< 0.000819 U	< 0.00074 U	< 0.006 U

NOTES
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Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 1a
Raleigh Creek Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper
		Location	RC5	RC5	RC5	RC6	RC6	RC6A	RC7A	RC22
		Location ID	S016-189	S016-189	S016-189	S016-190	S016-190	S016-375	S016-313	PS00175
		Sample Date	5/4/2020	7/28/2020	9/18/2020	8/12/2019	9/18/2020	9/20/2020	2/24/2020	5/14/2020
		Sample Type Code	QC-FR	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	S016-189.2005041200.000SR	S016-189.2007281440.000S	S016-189.2009181530.000S	S016-190.1908121510.000S	S016-190.2009181215.000S	S016-375.2009201710.000S	S016-313.2002241720.000S	PS00175.2005140950.000S
		Sample Name	RC5-WAT-BULK-02-050420	RC5-WAT-BULK-01-072820	RC5-WAT-BULK-01-091820	RC6-WAT-SUR-01-081219	RC6-WAT-BULK-01-091820	RC6A-WAT-BULK-01-092020	RC7A-WAT-BULK-01-022420	RC22-WAT-BULK-01-051420
		Parent Sample ID	S016-189.2005041155.000S	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	NA	NA	< 0.004 U	NA	< 0.0042 U	< 0.0042 U	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.00297 U	< 0.00148 U	< 0.004 U	< 0.00296 U	< 0.0042 U	< 0.0042 U	< 0.00295 U	< 0.00294 U
Total	4:2 FTS	757124-72-4	< 0.00297 U	< 0.00148 U	< 0.004 U	< 0.00296 U	< 0.0042 U	< 0.0042 U	< 0.00295 U	< 0.00294 U
Total	6:2 FTS	27619-97-2	< 0.00268 U	0.00893	< 0.004 U	< 0.00266 U	< 0.0042 U	< 0.0042 U	< 0.00265 U	< 0.00265 U
Total	8:2 FTS	39108-34-4	< 0.00297 U	< 0.00148 U	< 0.004 U	< 0.00296 U	< 0.0042 U	< 0.0042 U	< 0.00295 U	< 0.00294 U
Total	9Cl-PF3ONS	756426-58-1	< 0.00297 U	< 0.00148 U	< 0.004 U	< 0.00296 U	< 0.0042 U	< 0.0042 U	< 0.00295 U	< 0.00294 U
Total	ADONA	919005-14-4	< 0.00297 U	< 0.00148 U	< 0.004 U	< 0.00296 U	< 0.0042 U	< 0.0042 U	< 0.00295 U	< 0.00294 U
Total	HFPO-DA	13252-13-6	< 0.00283 U	< 0.00141 U	0.00048 J	< 0.00296 U	< 0.0042 U	< 0.0042 U	< 0.0028 U	< 0.0028 U
Total	N-EtFOSA	4151-50-2	< 0.00186 U	< 0.000925 U	< 0.004 U	< 0.00185 U	< 0.0042 U	< 0.0042 U	< 0.00184 U	< 0.00184 U
Total	N-EtFOSAA	2991-50-6	0.0234	0.0664	0.017	0.0286	0.024	0.013 B	0.0161	0.0112
Total	N-EtFOSE	1691-99-2	< 0.00558 U	< 0.00277 U	< 0.004 U	< 0.00555 U	0.00016 BJ+	< 0.0042 U	< 0.00553 U	< 0.00552 U
Total	N-MeFOSA	31506-32-8	< 0.000855 U	< 0.000426 U	< 0.004 U	< 0.000851 U	< 0.0042 U	< 0.0042 U	< 0.000847 U	< 0.000847 U
Total	N-MeFOSAA	2355-31-9	< 0.000744 U	< 0.00037 U	< 0.004 U	< 0.00074 U	< 0.0042 U	< 0.0042 U	< 0.000737 U	< 0.000736 U
Total	N-MeFOSE	24448-09-7	< 0.00744 U	< 0.0037 U	< 0.004 U	< 0.0074 U	< 0.0042 U	< 0.0042 U	< 0.00737 U	< 0.00736 U
Total	PFBA	375-22-4	0.778	0.223	0.96	0.417	0.97	0.71	0.659	0.574
Total	PFBS	375-73-5	0.0593	0.0187	0.028	0.0161	0.027	0.021	0.0329	0.0383
Total	PFDA	335-76-2	0.00888	0.0101	0.0084	0.00887	0.01	0.013	0.00512	0.00645
Total	PFDoA	307-55-1	< 0.000744 U	< 0.00037 U	< 0.004 U	< 0.00074 U	< 0.0042 U	< 0.0042 U	< 0.000737 U	< 0.000736 U
Total	PFDoS	79780-39-5	< 0.000744 U	< 0.00037 U	NA	< 0.00074 U	NA	NA	< 0.000737 U	< 0.000736 U
Total	PFDS	335-77-3	< 0.000744 U	0.000644 J	< 0.004 U	< 0.00074 U	0.00068 J	0.00052 J	< 0.000737 U	< 0.000736 U
Total	PFHpA	375-85-9	0.192	0.0498	0.095	0.0365	0.091	0.069	0.0979	0.132
Total	PFHpS	375-92-8	0.0614	0.0296	0.019	0.0173	0.021	0.022	0.0221	0.0345
Total	PFHxA	307-24-4	0.202	0.053	0.14	0.0609	0.14	0.11	0.135	0.13
Total	PFHxS	355-46-4	0.174	0.0614	0.07	0.0433	0.07	0.058	0.0845	0.12
Total	PFNA	375-95-1	0.0107	0.00571	0.004 J	0.0038	0.0055	0.005	0.00533	0.00735
Total	PFNS	68259-12-1	< 0.000744 U	0.00116 J	0.0009 J	< 0.00074 U	0.0012 J	0.0019 J	< 0.000737 U	< 0.000736 U
Total	PFOA	335-67-1	1.69	0.538	0.69	0.382	0.7	0.54	0.88	1.13
Total	PFOS	1763-23-1	3.14	2.51 D1	1.6	2.77	1.8	2.2	1.37	2.08
Total	PFOSA	754-91-6	0.0329	0.0442	0.025	0.0321	0.027	0.038	0.0168	0.0195
Total	PFPeA	2706-90-3	0.0912	0.0247	0.055	0.0276	0.054	0.04	0.0584	0.0537
Total	PFPeS	2706-91-4	0.0723	0.022	0.043 J+	0.0163	0.042	0.032	0.0356	0.0472
Total	PFTeDA	376-06-7	< 0.000744 U	< 0.00037 U	< 0.004 U	< 0.00074 U	< 0.0042 U	< 0.0042 U	< 0.000737 U	< 0.000736 U
Total	PFTrDA	72629-94-8	< 0.000744 U	< 0.00037 U	< 0.004 U	< 0.00074 U	< 0.0042 U	< 0.0042 U	< 0.000737 U	< 0.000736 U
Total	PFUnA	2058-94-8	< 0.000744 U	0.000403 J	< 0.004 U	< 0.00074 U	< 0.0042 U	< 0.0042 U	< 0.000737 U	< 0.000736 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 1a
Raleigh Creek Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper
		Location	RC22	RC22	RC23	RC23	RC7	RC7	RC7	RC7
		Location ID	PS00175	PS00175	PS00176	PS00176	S016-053	S016-053	S016-053	S016-053
		Sample Date	7/28/2020	9/18/2020	5/14/2020	9/28/2020	8/12/2019	8/14/2019	4/29/2020	5/8/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	PS00175.2007281645.000S	PS00175.2009180920.000S	PS00176.2005141110.000S	PS00176.2009281710.000S	S016-053.1908121405.000S	S016-053.1908141400.000S	S016-053.2004290945.000S	S016-053.2005080945.000S
		Sample Name	RC22-WAT-BULK-01-072820	RC22-WAT-BULK-01-091820	RC23-WAT-BULK-01-051420	RC23-WAT-BULK-01-092820	RC7-WAT-SUR-01-081219	RC7-WAT-SUR-01-081419	RC7-WAT-BULK-01-042920	RC7-WAT-BULK-01-050820
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	NA	< 0.0044 U	NA	< 0.0042 U	NA	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.00151 U	< 0.0044 U	< 0.0222 U	< 0.0042 UJ	< 0.00295 U	< 0.00313 U	< 0.00309 U	< 0.00297 UJ
Total	4:2 FTS	757124-72-4	< 0.0015 U	< 0.0044 U	< 0.0222 U	< 0.0042 U	< 0.00295 U	< 0.00313 U	< 0.00309 U	< 0.00297 UJ
Total	6:2 FTS	27619-97-2	0.0221 B	< 0.0044 U	< 0.02 U	< 0.0042 U	< 0.00265 U	< 0.00282 U	< 0.00278 U	< 0.00267 UJ
Total	8:2 FTS	39108-34-4	< 0.0015 U	< 0.0044 U	< 0.0222 U	< 0.0042 U	< 0.00295 U	< 0.00313 U	< 0.00309 U	< 0.00297 UJ
Total	9Cl-PF3ONS	756426-58-1	< 0.00151 U	< 0.0044 U	< 0.0222 U	< 0.0042 UJ	< 0.00295 U	< 0.00313 U	< 0.00309 U	< 0.00297 UJ
Total	ADONA	919005-14-4	< 0.0015 U	< 0.0044 U	< 0.0222 U	< 0.0042 UJ	< 0.00295 U	< 0.00313 U	< 0.00309 U	< 0.00297 UJ
Total	HFPO-DA	13252-13-6	< 0.00143 U	< 0.0044 U	< 0.0211 U	< 0.0042 U	< 0.00295 U	< 0.00313 U	< 0.00293 U	< 0.00282 UJ
Total	N-EtFOSA	4151-50-2	< 0.00094 U	< 0.0044 U	< 0.0139 U	< 0.0042 U	< 0.00184 U	< 0.00196 U	< 0.00193 U	< 0.00186 UJ
Total	N-EtFOSAA	2991-50-6	0.0464	< 0.0044 U	0.0138	0.015 J+	0.0115	0.0118	0.0137	0.0119 J-
Total	N-EtFOSE	1691-99-2	< 0.00281 U	< 0.0044 U	< 0.0416 U	< 0.0042 U	< 0.00553 U	< 0.00587 U	< 0.00579 U	< 0.00557 UJ
Total	N-MeFOSA	31506-32-8	< 0.000432 U	< 0.0044 U	< 0.00638 U	< 0.0042 U	< 0.000848 U	< 0.0009 U	< 0.000887 U	< 0.000854 UJ
Total	N-MeFOSAA	2355-31-9	< 0.000376 U	< 0.0044 U	< 0.00555 U	< 0.0042 U	< 0.000737 U	< 0.000783 U	< 0.000772 U	< 0.000743 UJ
Total	N-MeFOSE	24448-09-7	< 0.00376 U	< 0.0044 U	< 0.0555 U	< 0.0042 U	< 0.00737 U	< 0.00783 U	< 0.00772 U	< 0.00743 UJ
Total	PFBA	375-22-4	0.189 J+	0.29	0.688	0.29	0.349	0.158	0.318	0.713 J-
Total	PFBS	375-73-5	0.0147	0.01	0.0528	0.014	0.0145	0.00569	0.025	0.0529 J-
Total	PFDA	335-76-2	0.0107	0.0035 J	0.00681 J	0.016	0.00793	0.00666	0.00606	0.00775 J-
Total	PFDoA	307-55-1	< 0.000376 U	< 0.0044 U	< 0.00555 U	< 0.0042 U	< 0.000737 U	< 0.000783 U	< 0.000772 U	< 0.000743 UJ
Total	PFDoS	79780-39-5	< 0.000376 U	NA	< 0.00555 U	NA	< 0.000737 U	< 0.000783 U	< 0.000772 U	< 0.000743 UJ
Total	PFDS	335-77-3	0.000702 J	0.00038 J	< 0.00555 U	0.00032 J	< 0.000737 U	< 0.000783 U	< 0.000772 U	< 0.000743 UJ
Total	PFHpA	375-85-9	0.04	0.028 B	0.164	0.044	0.0338	0.015	0.0738	0.163 J-
Total	PFHpS	375-92-8	0.0257	0.0053	0.036	0.024 J+	0.0157	0.00915	0.0269	0.0498 J-
Total	PFHxA	307-24-4	0.0436	0.036	0.166	0.06	0.0463	0.0223	0.0781	0.175 J-
Total	PFHxS	355-46-4	0.0518	0.02	0.148	0.043 J+	0.0367	0.0183	0.0693	0.146 J-
Total	PFNA	375-95-1	0.00502	0.0018 J	0.00741 J	0.0073	0.00402	0.00252	0.00588	0.00883 J-
Total	PFNS	68259-12-1	0.000892 J	0.00038 J	< 0.00555 U	0.0037 J	< 0.000737 U	< 0.000783 U	< 0.000772 U	< 0.000743 UJ
Total	PFOA	335-67-1	0.458	0.16	1.34	0.4	0.347	0.184	0.67	1.39 J-
Total	PFOS	1763-23-1	2.7	0.46	2.84	2.4	1.91	1.54	1.85	2.67 J-
Total	PFOSA	754-91-6	0.0414	0.0015 J	0.0224	0.02	0.0247	0.0172	0.0185	0.0256 J-
Total	PFPeA	2706-90-3	0.0209	0.025	0.0797	0.025	0.0218	0.0125	0.0406	0.0793 J-
Total	PFPeS	2706-91-4	0.0165	0.01	0.0623	0.021	0.0137	0.00623	0.0267	0.0613 J-
Total	PFTeDA	376-06-7	< 0.000376 U	< 0.0044 U	< 0.00555 U	< 0.0042 UJ	< 0.000737 U	< 0.000783 U	< 0.000772 U	< 0.000743 UJ
Total	PFTrDA	72629-94-8	< 0.000376 U	< 0.0044 U	< 0.00555 U	< 0.0042 U	< 0.000737 U	< 0.000783 U	< 0.000772 U	< 0.000743 UJ
Total	PFUnA	2058-94-8	0.000473 J	< 0.0044 U	< 0.00555 U	< 0.0042 U	< 0.000737 U	< 0.000783 U	< 0.000772 U	< 0.000743 UJ

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 1a
Raleigh Creek Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper
		Location	RC7	RC7	RC7	RC7	RC7	RC7	RC7	RC20
		Location ID	S016-053	S016-053	S016-053	S016-053	S016-053	S016-053	S016-053	S016-276
		Sample Date	5/18/2020	6/29/2020	7/28/2020	7/28/2020	8/26/2020	9/1/2020	9/19/2020	5/8/2020
		Sample Type Code	Sample	Sample	Sample	QC-FR	Sample	Sample	Sample	Sample
		Sample ID	S016-053.2005181200.000S	S016-053.2006291500.000S	S016-053.2007281530.000S	S016-053.2007281535.000SR	S016-053.2008260930.000S	S016-053.2009010930.000S	S016-053.2009191300.000S	S016-276.2005081405.000S
		Sample Name	RC7-WAT-BULK-01-051820	RC7-WAT-BULK-01-062920	RC7-WAT-BULK-01-072820	RC7-WAT-BULK-02-072820	RC7-WAT-BULK-01-082620	RC7-WAT-BULK-01-090120	RC7-WAT-BULK-01-091920	RC20-WAT-BULK-01-050820
		Parent Sample ID	NA	NA	NA	S016-053.2007281530.000S	NA	NA	NA	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	NA	< 0.0042 U	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.0237 U	< 0.00292 UJ	< 0.0015 U	< 0.00146 U	< 0.00145 UJ	< 0.0015 U	< 0.0042 U	< 0.00298 UJ
Total	4:2 FTS	757124-72-4	< 0.0237 U	< 0.00292 UJ	< 0.0015 U	< 0.00146 U	< 0.00144 UJ	< 0.0015 U	< 0.0042 U	< 0.00298 UJ
Total	6:2 FTS	27619-97-2	< 0.0213 U	< 0.00263 UJ	< 0.00135 U	< 0.00132 U	0.00624 J-	0.004 J	< 0.0042 U	< 0.00268 UJ
Total	8:2 FTS	39108-34-4	< 0.0237 U	< 0.00292 UJ	< 0.0015 U	< 0.00146 U	< 0.00144 UJ	< 0.0015 U	< 0.0042 U	< 0.00298 UJ
Total	9Cl-PF3ONS	756426-58-1	< 0.0237 U	< 0.00292 UJ	< 0.00151 U	< 0.00146 U	< 0.00145 UJ	< 0.00151 U	< 0.0042 U	< 0.00298 UJ
Total	ADONA	919005-14-4	< 0.0237 U	< 0.00292 UJ	< 0.0015 U	< 0.00146 U	< 0.00144 UJ	< 0.0015 U	< 0.0042 U	< 0.00298 UJ
Total	HFPO-DA	13252-13-6	< 0.0225 U	< 0.00277 UJ	< 0.00143 U	< 0.00139 U	< 0.00137 UJ	< 0.00143 U	< 0.0042 U	< 0.00283 UJ
Total	N-EtFOSA	4151-50-2	< 0.0148 U	< 0.00182 UJ	< 0.000938 U	< 0.000912 U	< 0.000902 UJ	< 0.000939 U	< 0.0042 U	< 0.00186 UJ
Total	N-EtFOSAA	2991-50-6	0.0151	0.0197 J-	0.0491 J+	0.06 J+	0.0197 J-	0.0154	0.0078 B	0.00679 J-
Total	N-EtFOSE	1691-99-2	< 0.0444 U	< 0.00547 UJ	< 0.00281 U	< 0.00273 U	< 0.0027 UJ	< 0.00281 U	< 0.0042 U	< 0.00559 UJ
Total	N-MeFOSA	31506-32-8	< 0.00681 U	< 0.000839 UJ	< 0.000432 U	< 0.00042 U	< 0.000415 UJ	< 0.000432 U	< 0.0042 U	< 0.000857 UJ
Total	N-MeFOSAA	2355-31-9	< 0.00592 U	< 0.00073 UJ	< 0.000375 U	0.000566 J	< 0.000361 UJ	< 0.000375 U	< 0.0042 U	< 0.000745 UJ
Total	N-MeFOSE	24448-09-7	< 0.0592 U	< 0.0073 UJ	< 0.00375 U	< 0.00365 U	< 0.00361 UJ	< 0.00375 U	< 0.0042 U	< 0.00745 UJ
Total	PFBA	375-22-4	0.383	R	0.21	0.217 J+	0.399 J	0.282	0.41	0.604 J-
Total	PFBS	375-73-5	0.0404	0.0114 J-	0.0165	0.0167	0.0187 J-	0.0129	0.017	0.0503 J-
Total	PFDA	335-76-2	0.00657 J	0.00637 J-	0.0137	0.0141	0.0114 J-	0.00764	0.0086	0.00816 J-
Total	PFDoA	307-55-1	< 0.00592 U	< 0.00073 UJ	< 0.000375 U	< 0.000365 U	< 0.000361 UJ	< 0.000375 U	< 0.0042 U	< 0.000745 UJ
Total	PFDoS	79780-39-5	< 0.00592 U	< 0.00073 UJ	< 0.000375 U	< 0.000365 U	< 0.000361 UJ	< 0.000375 U	NA	< 0.000745 UJ
Total	PFDS	335-77-3	< 0.00592 U	< 0.00073 UJ	0.000682 J	0.000609 J	< 0.000361 UJ	< 0.000375 U	< 0.0042 U	< 0.000745 UJ
Total	PFHpA	375-85-9	0.141	0.0306 J-	0.0424	0.0421	0.0426 J-	0.0322	0.056 B	0.144 J-
Total	PFHpS	375-92-8	0.0356	0.0167 J-	0.0288 J+	0.0296 J+	0.0246 J-	0.0178	0.015	0.0386 J-
Total	PFHxA	307-24-4	0.122	0.0322 J-	0.0506	0.0471	0.0639 J-	0.0443	0.065	0.138 J-
Total	PFHxS	355-46-4	0.132	0.0359 J-	0.0534	0.0512	0.0546 J-	0.0381	0.041	0.128 J-
Total	PFNA	375-95-1	0.00862 J	0.00377 J-	0.00559	0.00605	0.00517 J-	0.00392	0.0044	0.00742 J-
Total	PFNS	68259-12-1	< 0.00592 U	< 0.00073 UJ	0.00106 J	0.00113 J	0.00102 J-	0.000759 J	0.00097 J	< 0.000745 UJ
Total	PFOA	335-67-1	1.25	0.304 J-	0.485	0.467	0.485 J-	0.334	0.39	1.15 J-
Total	PFOS	1763-23-1	2.58	1.73 J-	2.82	3.05 D1	2.5 J-	1.83	1.7	2.48 J-
Total	PFOSA	754-91-6	0.0231	0.0145 J-	0.0486 J+	0.0557 J+	0.0405 J-	0.0281	0.024	0.0167 J-
Total	PFPeA	2706-90-3	0.0573	0.018 J-	0.0235	0.0242	0.0303 J-	0.0211	0.027	0.0692 J-
Total	PFPeS	2706-91-4	0.0471	0.0124 J	0.0183	0.0172	0.0177 J-	0.0132	0.021 J+	0.056 J-
Total	PFTeDA	376-06-7	< 0.00592 U	< 0.00073 UJ	< 0.000375 U	< 0.000365 U	< 0.000361 UJ	< 0.000375 U	< 0.0042 U	< 0.000745 UJ
Total	PFTrDA	72629-94-8	< 0.00592 U	< 0.00073 UJ	< 0.000375 U	< 0.000365 U	< 0.000361 UJ	< 0.000375 U	< 0.0042 U	< 0.000745 UJ
Total	PFUnA	2058-94-8	< 0.00592 U	< 0.00073 UJ	0.000437 J	0.000524 J	< 0.000361 UJ	< 0.000375 U	< 0.0042 U	< 0.000745 UJ

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 1a
Raleigh Creek Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper
		Location	RC20	RC20	RC20	RC8	RC9	RC10	RC11	RC12
		Location ID	S016-276	S016-276	S016-276	S016-056	S016-057	S016-058	S016-059	S016-060
		Sample Date	5/18/2020	6/29/2020	9/1/2020	8/12/2019	8/12/2019	8/12/2019	8/14/2019	8/14/2019
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	S016-276.2005181130.000S	S016-276.2006291640.000S	S016-276.2009010900.000S	S016-056.1908121330.000S	S016-057.1908121300.000S	S016-058.1908121535.000S	S016-059.1908141140.000S	S016-060.1908141040.000S
		Sample Name	RC20-WAT-BULK-01-051820	RC20-WAT-BULK-01-062920	RC20-WAT-BULK-01-090120	RC8-WAT-SUR-01-081219	RC9-WAT-SUR-01-081219	RC10-WAT-SUR-01-081219	RC11-WAT-SUR-01-081419	RC12-WAT-SUR-01-081419
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.0229 U	< 0.003 UJ	< 0.00151 U	< 0.0229 U	< 0.00304 U	< 0.00296 U	< 0.00288 U	< 0.00291 U
Total	4:2 FTS	757124-72-4	< 0.0229 U	< 0.003 UJ	< 0.0015 U	< 0.0229 U	< 0.00304 U	< 0.00296 U	< 0.00288 U	< 0.00291 U
Total	6:2 FTS	27619-97-2	< 0.0206 U	< 0.0027 UJ	< 0.00136 U	< 0.0206 U	< 0.00274 U	< 0.00266 U	< 0.00259 U	< 0.00262 U
Total	8:2 FTS	39108-34-4	< 0.0229 U	< 0.003 UJ	< 0.0015 U	< 0.0229 U	< 0.00304 U	< 0.00296 U	< 0.00288 U	< 0.00291 U
Total	9Cl-PF3ONS	756426-58-1	< 0.0229 U	< 0.003 UJ	< 0.00151 U	< 0.0229 U	< 0.00304 U	< 0.00296 U	< 0.00288 U	< 0.00291 U
Total	ADONA	919005-14-4	< 0.0229 U	< 0.003 UJ	< 0.0015 U	< 0.0229 U	< 0.00304 U	< 0.00296 U	< 0.00288 U	< 0.00291 U
Total	HFPO-DA	13252-13-6	< 0.0218 U	< 0.00285 UJ	< 0.00143 U	< 0.0229 U	< 0.00304 U	< 0.00296 U	< 0.00288 U	< 0.00291 U
Total	N-EtFOSA	4151-50-2	< 0.0143 U	< 0.00187 UJ	< 0.00094 U	< 0.0143 U	< 0.0019 U	< 0.00185 U	< 0.0018 U	< 0.00182 U
Total	N-EtFOSAA	2991-50-6	0.0154	0.0153 J-	0.00187	< 0.00572 U	0.00278 J	0.00166 J	0.00662	0.00516
Total	N-EtFOSE	1691-99-2	< 0.0429 U	< 0.00562 UJ	< 0.00281 U	< 0.0429 U	< 0.00571 U	< 0.00555 U	< 0.00539 U	< 0.00545 U
Total	N-MeFOSA	31506-32-8	< 0.00658 U	< 0.000862 UJ	< 0.000433 U	< 0.00658 U	< 0.000875 U	< 0.000851 U	< 0.000827 U	< 0.000836 U
Total	N-MeFOSAA	2355-31-9	< 0.00572 U	< 0.00075 UJ	< 0.000376 U	< 0.00572 U	< 0.000761 U	< 0.00074 U	< 0.000719 U	< 0.000727 U
Total	N-MeFOSE	24448-09-7	< 0.0572 U	< 0.0075 UJ	< 0.00376 U	< 0.0572 U	< 0.00761 U	< 0.0074 U	< 0.00719 U	< 0.00727 U
Total	PFBA	375-22-4	0.324	R	0.155	0.15	0.207	0.175	0.239	0.214
Total	PFBS	375-73-5	0.0337	0.0101 J-	0.0147	< 0.00572 U	0.0154	0.0114	0.00663	0.00636
Total	PFDA	335-76-2	0.00864 J	0.00604 J-	0.00414	< 0.00572 U	0.00551	0.00336	0.00422	0.00441
Total	PFDoA	307-55-1	< 0.00572 U	< 0.00075 UJ	< 0.000376 U	< 0.00572 U	< 0.000761 U	< 0.00074 U	< 0.000719 U	< 0.000727 U
Total	PFDoS	79780-39-5	< 0.00572 U	< 0.00075 UJ	< 0.000376 U	< 0.00572 U	< 0.000761 U	< 0.00074 U	< 0.000719 U	< 0.000727 U
Total	PFDS	335-77-3	< 0.00572 U	< 0.00075 UJ	< 0.000376 U	< 0.00572 U	< 0.000761 U	< 0.00074 U	< 0.000719 U	< 0.000727 U
Total	PFHpA	375-85-9	0.12	0.0284 J-	0.0251	< 0.00572 U	0.0278	0.0157	0.0146	0.0145
Total	PFHpS	375-92-8	0.0302	0.0147 J-	0.0175	< 0.00572 U	0.0172	0.00848	0.00749	0.00734
Total	PFHxA	307-24-4	0.0957	0.028 J-	0.0345	0.00945 J	0.0397	0.0225	0.0212	0.0222
Total	PFHxS	355-46-4	0.108	0.0306 J-	0.0404	< 0.00572 U	0.0384	0.0252	0.0187	0.0194
Total	PFNA	375-95-1	0.00848 J	0.00364 J-	0.00307	< 0.00572 U	0.00351	0.00217 J	0.00239	0.00217
Total	PFNS	68259-12-1	< 0.00572 U	< 0.00075 UJ	< 0.000376 U	< 0.00572 U	< 0.000761 U	< 0.00074 U	< 0.000719 U	< 0.000727 U
Total	PFOA	335-67-1	1.05	0.271 J-	0.263	0.0227	0.276	0.137	0.163	0.164
Total	PFOS	1763-23-1	2.65	1.53 J-	1.77	0.0116 J	1.78	1.07	1.15	1.22
Total	PFOSA	754-91-6	0.0275	0.0137 J-	0.00861	< 0.00572 U	0.00926	0.00513	0.00974	0.0104
Total	PFPeA	2706-90-3	0.0471	0.0156 J-	0.0133	0.0124 J	0.0149	0.0116	0.0127	0.0136
Total	PFPeS	2706-91-4	0.0398	0.0108 J-	0.0144	< 0.00572 U	0.0137	0.0082	0.00515	0.00549
Total	PFTeDA	376-06-7	< 0.00572 U	< 0.00075 UJ	< 0.000376 U	< 0.00572 U	< 0.000761 U	< 0.00074 U	< 0.000719 U	< 0.000727 U
Total	PFTrDA	72629-94-8	< 0.00572 U	< 0.00075 UJ	< 0.000376 U	< 0.00572 U	< 0.000761 U	< 0.00074 U	< 0.000719 U	< 0.000727 U
Total	PFUnA	2058-94-8	< 0.00572 U	< 0.00075 UJ	< 0.000376 U	< 0.00572 U	< 0.000761 U	< 0.00074 U	< 0.000719 U	< 0.000727 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 1a
Raleigh Creek Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper
		Location	RC12	RC12	RC12	RC12	RC12	RC12	RC13	RC13
		Location ID	S016-060	S016-060	S016-060	S016-060	S016-060	S016-060	S016-062	S016-062
		Sample Date	4/28/2020	4/29/2020	5/18/2020	6/29/2020	7/28/2020	9/1/2020	8/12/2019	9/21/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	S016-060.2004281800.000S	S016-060.2004291030.000S	S016-060.2005181050.000S	S016-060.2006291540.000S	S016-060.2007281245.000S	S016-060.2009010815.000S	S016-062.1908121130.000S	S016-062.2009211400.000S
		Sample Name	RC12-WAT-BULK-01-042820	RC12-WAT-BULK-01-042920	RC12-WAT-BULK-01-051820	RC12-WAT-BULK-01-062920	RC12-WAT-BULK-01-072820	RC12-WAT-BULK-01-090120	RC13-WAT-SUR-01-081219	RC13-WAT-BULK-01-092120
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	NA	NA	< 0.0039 U
Total	11Cl-PF3OUdS	763051-92-9	< 0.00323 U	< 0.00311 U	< 0.00293 U	< 0.00303 UJ	< 0.00292 UJ	< 0.00151 U	< 0.00292 U	< 0.0039 U
Total	4:2 FTS	757124-72-4	< 0.00323 U	< 0.00311 U	< 0.00293 U	< 0.00303 UJ	< 0.00292 UJ	< 0.0015 U	< 0.00292 U	< 0.0039 U
Total	6:2 FTS	27619-97-2	< 0.00291 U	< 0.0028 U	< 0.00264 U	< 0.00273 UJ	< 0.00262 UJ	0.0032 J	< 0.00263 U	< 0.0039 U
Total	8:2 FTS	39108-34-4	< 0.00323 U	< 0.00311 U	< 0.00293 U	< 0.00303 UJ	< 0.00292 UJ	< 0.0015 U	< 0.00292 U	< 0.0039 U
Total	9Cl-PF3ONS	756426-58-1	< 0.00323 U	< 0.00311 U	< 0.00293 U	< 0.00303 UJ	< 0.00292 UJ	< 0.00151 U	< 0.00292 U	< 0.0039 U
Total	ADONA	919005-14-4	< 0.00323 U	< 0.00311 U	< 0.00293 U	< 0.00303 UJ	< 0.00292 UJ	< 0.0015 U	< 0.00292 U	< 0.0039 U
Total	HFPO-DA	13252-13-6	< 0.00307 U	< 0.00295 U	< 0.00278 U	< 0.00288 UJ	< 0.00277 UJ	< 0.00143 U	< 0.00292 U	< 0.0039 U
Total	N-EtFOSA	4151-50-2	< 0.00202 U	< 0.00194 U	< 0.00183 U	< 0.00189 UJ	< 0.00182 UJ	< 0.00094 U	< 0.00183 U	< 0.0039 U
Total	N-EtFOSAA	2991-50-6	0.01	0.00798	0.00861	0.0108 J-	0.0226 J-	0.00202	0.00383	< 0.0039 U
Total	N-EtFOSE	1691-99-2	< 0.00606 U	< 0.00582 U	< 0.00549 U	< 0.00568 UJ	< 0.00547 UJ	< 0.00281 U	< 0.00548 U	< 0.0039 U
Total	N-MeFOSA	31506-32-8	< 0.000929 U	< 0.000893 U	< 0.000843 U	< 0.000871 UJ	< 0.000838 UJ	< 0.000432 U	< 0.00084 U	< 0.0039 U
Total	N-MeFOSAA	2355-31-9	< 0.000808 U	< 0.000777 U	< 0.000733 U	< 0.000757 UJ	< 0.000729 UJ	< 0.000376 U	< 0.00073 U	< 0.0039 U
Total	N-MeFOSE	24448-09-7	< 0.00808 U	< 0.00777 U	< 0.00733 U	< 0.00757 UJ	< 0.00729 UJ	< 0.00376 U	< 0.0073 U	< 0.0039 U
Total	PFBA	375-22-4	0.422	0.325	0.228	R	0.245 J	R	0.189	0.087
Total	PFBS	375-73-5	0.025	0.0176	0.0223	0.00776 J-	0.0159 J-	0.0117	0.0113	0.0028 J
Total	PFDA	335-76-2	0.00528	0.00391	0.00382	0.00443 J-	0.00989 J-	0.00183	0.0042	< 0.0039 U
Total	PFDoA	307-55-1	< 0.000808 U	< 0.000777 U	< 0.000733 U	< 0.000757 UJ	< 0.000729 UJ	< 0.000376 U	< 0.00073 U	< 0.0039 U
Total	PFDoS	79780-39-5	< 0.000808 U	< 0.000777 U	< 0.000733 U	< 0.000757 UJ	< 0.000729 UJ	< 0.000376 U	< 0.00073 U	NA
Total	PFDS	335-77-3	< 0.000808 U	< 0.000777 U	< 0.000733 U	< 0.000757 UJ	< 0.000729 UJ	< 0.000376 U	< 0.00073 U	< 0.0039 U
Total	PFHpA	375-85-9	0.0761	0.0568	0.0782	0.0202 J-	0.0384 J-	0.0169	0.0112	0.0047 B
Total	PFHpS	375-92-8	0.0201	0.017	0.0223	0.00922 J-	0.0208 J-	0.00912	0.00855	< 0.0039 U
Total	PFHxA	307-24-4	0.0873	0.0576	0.0634	0.0207 J-	0.0452 J-	0.0244	0.0159	< 0.0092 U
Total	PFHxS	355-46-4	0.0634	0.051	0.0738	0.0237 J-	0.0446 J-	0.027	0.0228	0.0037 J
Total	PFNA	375-95-1	0.00469	0.00395	0.0048	0.00288 J-	0.00403 J-	0.00197	0.00115 J	< 0.0039 U
Total	PFNS	68259-12-1	< 0.000808 U	< 0.000777 U	< 0.000733 U	< 0.000757 UJ	0.000861 J-	< 0.000376 U	< 0.00073 U	< 0.0039 U
Total	PFOA	335-67-1	0.658	0.498	0.681	0.19 J-	0.384 J-	0.161	0.103	0.0083
Total	PFOS	1763-23-1	1.34	1.34	1.49	1.05 J-	2.14 J-	1.06	0.964	0.0056
Total	PFOSA	754-91-6	0.012	0.00992	0.0117	0.0098 J-	0.0361 J-	0.00612	0.00665	< 0.0039 U
Total	PFPeA	2706-90-3	0.0457	0.0331	0.0306	0.0128 J-	0.0271 J-	0.0128	0.00936	0.0078
Total	PFPeS	2706-91-4	0.0259	0.0193	0.0277	0.00804 J-	0.0163 J-	0.0088	0.00861	0.0017 J+
Total	PFTeDA	376-06-7	< 0.000808 U	< 0.000777 U	< 0.000733 U	< 0.000757 UJ	< 0.000729 UJ	< 0.000376 U	< 0.00073 U	< 0.0039 UJ
Total	PFTrDA	72629-94-8	< 0.000808 U	< 0.000777 U	< 0.000733 U	< 0.000757 UJ	< 0.000729 UJ	< 0.000376 U	< 0.00073 U	0.0021 J
Total	PFUnA	2058-94-8	< 0.000808 U	< 0.000777 U	< 0.000733 U	< 0.000757 UJ	< 0.000729 UJ	< 0.000376 U	< 0.00073 U	< 0.0039 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
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NA = Not Applicable/Not Analyzed.

Appendix A Table 1a
Raleigh Creek Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other
		Location	RC16A	RC16A	RC16A	RC16	RC15	RC14	RC14	RC14
		Location ID	S016-314	S016-314	S016-314	S016-064	82-0399-00-202	S016-063	S016-063	S016-063
		Sample Date	5/7/2020	7/29/2020	9/19/2020	8/12/2019	8/12/2019	8/12/2019	2/24/2020	4/28/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	S016-314.2005071610.000S	S016-314.2007291715.000S	S016-314.2009191720.000S	S016-064.1908121425.000S	82-0399-00-202.1908121330.000S	S016-063.1908121050.000S	S016-063.2002241800.000S	S016-063.2004281830.000S
		Sample Name	RC16A-WAT-BULK-01-050720	RC16A-WAT-BULK-01-072920	RC16A-WAT-BULK-01-091920	RC16-WAT-SUR-01-081219	RC15-WAT-SUR-01-081219	RC14-WAT-SUR-01-081219	RC14-WAT-BULK-01-022420	RC14-WAT-BULK-01-042820
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	NA	NA	< 0.0042 U	NA	NA	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.00302 UJ	< 0.00145 UJ	< 0.0042 U	< 0.0029 U	< 0.00286 U	< 0.00283 U	< 0.0034 U	< 0.00302 U
Total	4:2 FTS	757124-72-4	< 0.00302 UJ	< 0.00145 UJ	< 0.0042 U	< 0.0029 U	< 0.00286 U	< 0.00283 U	< 0.0034 U	< 0.00302 U
Total	6:2 FTS	27619-97-2	< 0.00272 UJ	< 0.0013 UJ	< 0.0042 U	< 0.00261 U	< 0.00257 U	< 0.00255 U	< 0.00306 U	0.00325 J
Total	8:2 FTS	39108-34-4	< 0.00302 UJ	< 0.00145 UJ	< 0.0042 U	< 0.0029 U	< 0.00286 U	< 0.00283 U	< 0.0034 U	< 0.00302 U
Total	9Cl-PF3ONS	756426-58-1	< 0.00302 UJ	< 0.00145 UJ	< 0.0042 U	< 0.0029 U	< 0.00286 U	< 0.00283 U	< 0.0034 U	< 0.00302 U
Total	ADONA	919005-14-4	< 0.00302 UJ	< 0.00145 UJ	< 0.0042 U	< 0.0029 U	< 0.00286 U	< 0.00283 U	< 0.0034 U	< 0.00302 U
Total	HFPO-DA	13252-13-6	< 0.00287 UJ	< 0.00138 UJ	< 0.0042 U	< 0.0029 U	< 0.00286 U	< 0.00283 U	< 0.00323 U	< 0.00287 U
Total	N-EtFOSA	4151-50-2	< 0.00189 UJ	< 0.000905 UJ	< 0.0042 U	< 0.00181 U	< 0.00179 U	< 0.00177 U	< 0.00212 U	< 0.00189 U
Total	N-EtFOSAA	2991-50-6	< 0.000755 UJ	< 0.000362 UJ	< 0.0042 U	< 0.000726 U	< 0.000715 U	< 0.000707 U	< 0.00085 U	< 0.000755 U
Total	N-EtFOSE	1691-99-2	< 0.00567 UJ	< 0.00271 UJ	< 0.0042 U	< 0.00544 U	< 0.00536 U	< 0.00531 U	< 0.00637 U	< 0.00567 U
Total	N-MeFOSA	31506-32-8	< 0.000869 UJ	< 0.000416 UJ	< 0.0042 U	< 0.000835 U	< 0.000822 U	< 0.000814 U	< 0.000977 U	< 0.000869 U
Total	N-MeFOSAA	2355-31-9	< 0.000755 UJ	< 0.000362 UJ	< 0.0042 U	< 0.000726 U	< 0.000715 U	< 0.000707 U	< 0.00085 U	< 0.000755 U
Total	N-MeFOSE	24448-09-7	< 0.00755 UJ	< 0.00362 UJ	< 0.0042 U	< 0.00726 U	< 0.00715 U	< 0.00707 U	< 0.0085 U	< 0.00755 U
Total	PFBA	375-22-4	0.0876 J-	0.0709 J	0.096	0.0938	0.0984	0.108	0.0884	0.0676
Total	PFBS	375-73-5	0.00269 J-	0.00256 J-	0.0026 J	0.00229 J	0.00217 J	0.00194 J	0.00262	0.00199
Total	PFDA	335-76-2	< 0.000755 UJ	< 0.000362 UJ	< 0.0042 U	< 0.000726 U	< 0.000715 U	< 0.000707 U	< 0.00085 U	< 0.000755 U
Total	PFDoA	307-55-1	< 0.000755 UJ	< 0.000362 UJ	< 0.0042 U	< 0.000726 U	< 0.000715 U	< 0.000707 U	< 0.00085 U	< 0.000755 U
Total	PFDoS	79780-39-5	< 0.000755 UJ	< 0.000362 UJ	NA	< 0.000726 U	< 0.000715 U	< 0.000707 U	< 0.00085 U	< 0.000755 U
Total	PFDS	335-77-3	< 0.000755 UJ	< 0.000362 UJ	< 0.0042 U	< 0.000726 U	< 0.000715 U	< 0.000707 U	< 0.00085 U	< 0.000755 U
Total	PFHpA	375-85-9	0.0022 J-	0.00222 J-	0.0027 BJ	0.00155 J	0.00183 J	0.00191 J	0.00232 J	0.00203
Total	PFHpS	375-92-8	< 0.000755 UJ	< 0.000362 UJ	< 0.0042 U	< 0.000726 U	< 0.000715 U	< 0.000707 U	< 0.00085 U	< 0.000755 U
Total	PFHxA	307-24-4	0.00469 J-	0.0041 J-	< 0.0092 U	0.00415 J	0.00427 J	0.00449 J	0.00427 J	0.00376
Total	PFHxS	355-46-4	0.00333 J-	0.00314 J-	0.004 J	0.00254 J	0.00271 J	0.00333 J	0.00315	0.00264
Total	PFNA	375-95-1	< 0.000755 UJ	0.000827 J-	< 0.0042 U	< 0.000726 U	< 0.000715 U	0.000735 J	< 0.00085 U	0.000772 J
Total	PFNS	68259-12-1	< 0.000755 UJ	< 0.000362 UJ	< 0.0042 U	< 0.000726 U	< 0.000715 U	< 0.000707 U	< 0.00085 U	< 0.000755 U
Total	PFOA	335-67-1	0.0074 J-	0.00841 J-	0.0092	0.00792	0.0071	0.00807	0.00732	0.00601
Total	PFOS	1763-23-1	0.00236 J-	0.00327 J-	0.0036 J	0.00197 J	0.00166 J	0.00187 J	0.00203	0.00246
Total	PFOSA	754-91-6	< 0.000755 UJ	0.000371 J-	< 0.0042 U	< 0.000726 U	< 0.000715 U	< 0.000707 U	< 0.00085 U	< 0.000755 U
Total	PFPeA	2706-90-3	0.00624 J-	0.0055 J-	0.0079	0.00506 J	0.00522 J	0.00522 J	0.00632	0.00521
Total	PFPeS	2706-91-4	< 0.000755 UJ	0.000401 J-	< 0.0042 U	< 0.000726 U	< 0.000715 U	< 0.000707 U	< 0.00085 U	< 0.000755 U
Total	PFTeDA	376-06-7	< 0.000755 UJ	< 0.000362 UJ	< 0.0042 U	< 0.000726 U	< 0.000715 U	< 0.000707 U	< 0.00085 U	< 0.000755 U
Total	PFTrDA	72629-94-8	< 0.000755 UJ	< 0.000362 UJ	< 0.0042 U	< 0.000726 U	< 0.000715 U	< 0.000707 U	< 0.00085 U	< 0.000755 U
Total	PFUnA	2058-94-8	< 0.000755 UJ	< 0.000362 UJ	< 0.0042 U	< 0.000726 U	< 0.000715 U	< 0.000707 U	< 0.00085 U	< 0.000755 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 1a
Raleigh Creek Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other
		Location	RC14	RC14	RC14	RC14	RC14	RC14	RC14	RC14
		Location ID	S016-063	S016-063	S016-063	S016-063	S016-063	S016-063	S016-063	S016-063
		Sample Date	4/29/2020	5/7/2020	5/18/2020	6/29/2020	7/28/2020	8/26/2020	9/1/2020	9/21/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	S016-063.2004291145.000S	S016-063.2005071245.000S	S016-063.2005181015.000S	S016-063.2006291620.000S	S016-063.2007281250.000S	S016-063.2008260945.000S	S016-063.2009011030.000S	S016-063.2009211410.000S
		Sample Name	RC14-WAT-BULK-01-042920	RC14-WAT-BULK-01-050720	RC14-WAT-BULK-01-051820	RC14-WAT-BULK-01-062920	RC14-WAT-BULK-01-072820	RC14-WAT-BULK-01-082620	RC14-WAT-BULK-01-090120	RC14-WAT-BULK-01-092120
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	NA	NA	< 0.004 U
Total	11Cl-PF3OUdS	763051-92-9	< 0.00313 U	< 0.00296 UJ	< 0.00293 U	< 0.00303 UJ	< 0.00296 UJ	< 0.00147 UJ	< 0.00149 U	< 0.004 U
Total	4:2 FTS	757124-72-4	< 0.00313 U	< 0.00296 UJ	< 0.00293 U	< 0.00303 UJ	< 0.00296 UJ	< 0.00147 UJ	< 0.00148 U	< 0.004 U
Total	6:2 FTS	27619-97-2	< 0.00282 U	< 0.00266 UJ	< 0.00263 U	< 0.00272 UJ	< 0.00266 UJ	0.0015 J-	< 0.00134 U	< 0.004 U
Total	8:2 FTS	39108-34-4	< 0.00313 U	< 0.00296 UJ	< 0.00293 U	< 0.00303 UJ	< 0.00296 UJ	< 0.00147 UJ	< 0.00148 U	< 0.004 U
Total	9Cl-PF3ONS	756426-58-1	< 0.00313 U	< 0.00296 UJ	< 0.00293 U	< 0.00303 UJ	< 0.00296 UJ	< 0.00148 UJ	< 0.00149 U	< 0.004 U
Total	ADONA	919005-14-4	< 0.00313 U	< 0.00296 UJ	< 0.00293 U	< 0.00303 UJ	< 0.00296 UJ	< 0.00147 UJ	< 0.00148 U	< 0.004 U
Total	HFPO-DA	13252-13-6	< 0.00298 U	< 0.00281 UJ	< 0.00278 U	< 0.00287 UJ	< 0.00281 UJ	< 0.0014 UJ	< 0.00141 U	< 0.004 U
Total	N-EtFOSA	4151-50-2	< 0.00196 U	< 0.00185 UJ	< 0.00183 U	< 0.00189 UJ	< 0.00185 UJ	< 0.00092 UJ	< 0.000927 U	< 0.004 U
Total	N-EtFOSAA	2991-50-6	< 0.000783 U	< 0.00074 UJ	< 0.000732 U	< 0.000756 UJ	< 0.00074 UJ	0.00072 J-	< 0.000371 U	< 0.004 U
Total	N-EtFOSE	1691-99-2	< 0.00588 U	< 0.00555 UJ	< 0.00549 U	< 0.00567 UJ	< 0.00555 UJ	< 0.00275 UJ	< 0.00277 U	< 0.004 U
Total	N-MeFOSA	31506-32-8	< 0.000901 U	< 0.000851 UJ	< 0.000841 U	< 0.00087 UJ	< 0.000851 UJ	< 0.000423 UJ	< 0.000426 U	< 0.004 U
Total	N-MeFOSAA	2355-31-9	< 0.000783 U	< 0.00074 UJ	< 0.000732 U	< 0.000756 UJ	< 0.00074 UJ	< 0.000368 UJ	< 0.000371 U	< 0.004 U
Total	N-MeFOSE	24448-09-7	< 0.00783 U	< 0.0074 UJ	< 0.00732 U	< 0.00756 UJ	< 0.0074 UJ	< 0.00368 UJ	< 0.00371 U	< 0.004 U
Total	PFBA	375-22-4	0.0811	0.0386 J-	0.0784	R	0.0782 J-	0.0785 J	0.079	0.087
Total	PFBS	375-73-5	0.00247	0.00147 J-	0.00247	0.00221 J-	0.0025 J-	0.00275 J-	0.00263	0.003 J
Total	PFDA	335-76-2	< 0.000783 U	< 0.00074 UJ	< 0.000732 U	< 0.000756 UJ	< 0.00074 UJ	< 0.000368 UJ	< 0.000371 U	< 0.004 U
Total	PFDoA	307-55-1	< 0.000783 U	< 0.00074 UJ	< 0.000732 U	< 0.000756 UJ	< 0.00074 UJ	< 0.000368 UJ	< 0.000371 U	< 0.004 U
Total	PFDoS	79780-39-5	< 0.000783 U	< 0.00074 UJ	< 0.000732 U	< 0.000756 UJ	< 0.00074 UJ	< 0.000368 UJ	< 0.000371 U	NA
Total	PFDS	335-77-3	< 0.000783 U	< 0.00074 UJ	< 0.000732 U	< 0.000756 UJ	< 0.00074 UJ	< 0.000368 UJ	< 0.000371 U	< 0.004 U
Total	PFHpA	375-85-9	0.00198	0.00167 J-	0.00199	0.00194 J-	0.00214 J-	0.00203 J-	0.00207	0.0044 B
Total	PFHpS	375-92-8	< 0.000783 U	< 0.00074 UJ	< 0.000732 U	< 0.000756 UJ	< 0.00074 UJ	< 0.000368 UJ	< 0.000371 U	< 0.004 U
Total	PFHxA	307-24-4	0.004	0.00249 J-	0.00476	0.00402 J-	0.00455 J-	0.00448 J-	0.00456	< 0.0092 U
Total	PFHxS	355-46-4	0.00301	0.00263 J-	0.00299	0.00231 J-	0.00286 J-	0.00319 J-	0.00312	0.0043
Total	PFNA	375-95-1	< 0.000783 U	< 0.00074 UJ	< 0.000732 U	< 0.000756 UJ	0.000743 J-	0.000815 J-	0.000699 J	< 0.004 U
Total	PFNS	68259-12-1	< 0.000783 U	< 0.00074 UJ	< 0.000732 U	< 0.000756 UJ	< 0.00074 UJ	< 0.000368 UJ	< 0.000371 U	< 0.004 U
Total	PFOA	335-67-1	0.00656	0.00573 J-	0.00681	0.00577 J-	0.00691 J-	0.00767 J-	0.00726	0.0079
Total	PFOS	1763-23-1	0.0022	0.00214 J-	0.0111	0.00371 J-	0.00283 J-	0.00278 J-	0.00253 J	0.0032 J
Total	PFOSA	754-91-6	< 0.000783 U	< 0.00074 UJ	< 0.000732 U	< 0.000756 UJ	< 0.00074 UJ	< 0.000368 UJ	< 0.000371 U	< 0.004 U
Total	PFPeA	2706-90-3	0.00583	0.00303 J-	0.00573	0.00539 J	0.00589 J-	0.00613 J-	0.00592	0.008
Total	PFPeS	2706-91-4	< 0.000783 U	< 0.00074 UJ	< 0.000732 U	< 0.000756 UJ	< 0.00074 UJ	< 0.00037 UJ	< 0.000373 U	< 0.004 U
Total	PFTeDA	376-06-7	< 0.000783 U	< 0.00074 UJ	< 0.000732 U	< 0.000756 UJ	< 0.00074 UJ	< 0.000368 UJ	< 0.000371 U	< 0.004 UJ
Total	PFTrDA	72629-94-8	< 0.000783 U	< 0.00074 UJ	< 0.000732 U	< 0.000756 UJ	< 0.00074 UJ	< 0.000368 UJ	< 0.000371 U	0.0019 J
Total	PFUnA	2058-94-8	< 0.000783 U	< 0.00074 UJ	< 0.000732 U	< 0.000756 UJ	< 0.00074 UJ	< 0.000368 UJ	< 0.000371 U	< 0.004 U

NOTES
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Analytical method (other events) = AXYS_MLA-110.

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Raleigh Creek Surface Water
Project 1007
Minneapolis, Minnesota

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		Location	RC21	RC21	RC21	RC21	RC21	RC21	RC21	RC21
		Location ID	S016-280	S016-280	S016-280	S016-280	S016-280	S016-280	S016-280	S016-280
		Sample Date	2/24/2020	4/23/2020	4/28/2020	4/29/2020	5/7/2020	5/7/2020	5/18/2020	6/29/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	QC-FR	Sample	Sample
		Sample ID	S016-280.2002241715.000S	S016-280.2004231400.000S	S016-280.2004281900.000S	S016-280.2004291130.000S	S016-280.2005071215.000S	S016-280.2005071220.000SR	S016-280.2005181000.000S	S016-280.2006291600.000S
		Sample Name	RC21-WAT-BULK-01-022420	RC21-WAT-BULK-01-042320	RC21-WAT-BULK-01-042820	RC21-WAT-BULK-01-042920	RC21-WAT-BULK-01-050720	RC21-WAT-BULK-02-050720	RC21-WAT-BULK-01-051820	RC21-WAT-BULK-01-062920
		Parent Sample ID	NA	NA	NA	NA	NA	S016-280.2005071215.000S	NA	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.00328 U	< 0.00301 U	< 0.00299 U	< 0.00296 U	< 0.00297 UJ	< 0.00303 UJ	< 0.00298 U	< 0.00293 UJ
Total	4:2 FTS	757124-72-4	< 0.00328 U	< 0.00301 U	< 0.00299 U	< 0.00296 U	< 0.00297 UJ	< 0.00303 UJ	< 0.00298 U	< 0.00293 UJ
Total	6:2 FTS	27619-97-2	< 0.00295 U	< 0.00271 U	< 0.00269 U	< 0.00267 U	< 0.00267 UJ	< 0.00273 UJ	< 0.00268 U	< 0.00263 UJ
Total	8:2 FTS	39108-34-4	< 0.00328 U	< 0.00301 U	< 0.00299 U	< 0.00296 U	< 0.00297 UJ	< 0.00303 UJ	< 0.00298 U	< 0.00293 UJ
Total	9Cl-PF3ONS	756426-58-1	< 0.00328 U	< 0.00301 U	< 0.00299 U	< 0.00296 U	< 0.00297 UJ	< 0.00303 UJ	< 0.00298 U	< 0.00293 UJ
Total	ADONA	919005-14-4	< 0.00328 U	< 0.00301 U	< 0.00299 U	< 0.00296 U	< 0.00297 UJ	< 0.00303 UJ	< 0.00298 U	< 0.00293 UJ
Total	HFPO-DA	13252-13-6	< 0.00312 U	< 0.00286 U	< 0.00284 U	< 0.00281 U	< 0.00282 UJ	< 0.00288 UJ	< 0.00283 U	< 0.00278 UJ
Total	N-EtFOSA	4151-50-2	< 0.00205 U	< 0.00188 U	< 0.00187 U	< 0.00185 U	< 0.00185 UJ	< 0.0019 UJ	< 0.00186 U	< 0.00183 UJ
Total	N-EtFOSAA	2991-50-6	< 0.00082 U	< 0.000752 U	0.00798	0.00185	< 0.000742 UJ	< 0.000758 UJ	0.00554	0.00906 J-
Total	N-EtFOSE	1691-99-2	< 0.00615 U	< 0.00564 U	< 0.00561 U	< 0.00555 U	< 0.00556 UJ	< 0.00569 UJ	< 0.00559 U	< 0.00548 UJ
Total	N-MeFOSA	31506-32-8	< 0.000943 U	< 0.000864 U	< 0.00086 U	< 0.000851 U	< 0.000853 UJ	< 0.000872 UJ	< 0.000856 U	< 0.000841 UJ
Total	N-MeFOSAA	2355-31-9	< 0.00082 U	< 0.000752 U	< 0.000747 U	< 0.00074 U	< 0.000742 UJ	< 0.000758 UJ	< 0.000745 U	< 0.000731 UJ
Total	N-MeFOSE	24448-09-7	< 0.0082 U	< 0.00752 U	< 0.00747 U	< 0.0074 U	< 0.00742 UJ	< 0.00758 UJ	< 0.00745 U	< 0.00731 UJ
Total	PFBA	375-22-4	0.0884	0.0737	0.332	0.0903	0.059 J-	0.0893 J	0.17	0.125 J
Total	PFBS	375-73-5	0.00267	0.00226	0.0191	0.00458	0.00183 J-	0.0024 J-	0.0141	0.00621 J-
Total	PFDA	335-76-2	< 0.00082 U	< 0.000752 U	0.00395	0.00126 J	< 0.000742 UJ	< 0.000758 UJ	0.00307	0.00347 J-
Total	PFDoA	307-55-1	< 0.00082 U	< 0.000752 U	< 0.000747 U	< 0.00074 U	< 0.000742 UJ	< 0.000758 UJ	< 0.000745 U	< 0.000731 UJ
Total	PFDoS	79780-39-5	< 0.00082 U	< 0.000752 U	< 0.000747 U	< 0.00074 U	< 0.000742 UJ	< 0.000758 UJ	< 0.000745 U	< 0.000731 UJ
Total	PFDS	335-77-3	< 0.00082 U	< 0.000752 U	< 0.000747 U	< 0.00074 U	< 0.000742 UJ	< 0.000758 UJ	< 0.000745 U	< 0.000731 UJ
Total	PFHpA	375-85-9	0.00239 J	0.00181 J	0.0617	0.0132	0.00178 J-	0.00212 J-	0.0453	0.0156 J-
Total	PFHpS	375-92-8	< 0.00082 U	< 0.000752 U	0.0156	0.00407	< 0.000742 UJ	< 0.000758 UJ	0.0131	0.00703 J-
Total	PFHxA	307-24-4	0.00458 J	0.004 J	0.0643	0.0127	0.00339 J-	0.00405 J-	0.0396	0.0166 J-
Total	PFHxS	355-46-4	0.00329	0.00281	0.0529	0.0149	0.00286 J-	0.00284 J-	0.0465	0.0181 J-
Total	PFNA	375-95-1	0.000826 J	< 0.000752 U	0.00424	0.00148 J	0.000751 J-	< 0.000758 UJ	0.00314	0.00228 J-
Total	PFNS	68259-12-1	< 0.00082 U	< 0.000752 U	< 0.000747 U	< 0.00074 U	< 0.000742 UJ	< 0.000758 UJ	< 0.000745 U	< 0.000731 UJ
Total	PFOA	335-67-1	0.00748	0.00672	0.52	0.131	0.00629 J-	0.00631 J-	0.394	0.149 J-
Total	PFOS	1763-23-1	0.00215	0.0021	1.23	0.366	0.00209 J-	0.00243 J-	0.962	0.839 J-
Total	PFOSA	754-91-6	< 0.00082 U	< 0.000752 U	0.011	0.0027	< 0.000742 UJ	< 0.000758 UJ	0.00791	0.00772 J-
Total	PFPeA	2706-90-3	0.00623	0.00537	0.0367	0.00831	0.00433 J-	0.0055 J-	0.0207	0.0105 J-
Total	PFPeS	2706-91-4	< 0.00082 U	< 0.000752 U	0.0202	0.00424	< 0.000742 UJ	< 0.000758 UJ	0.0169	0.00586 J-
Total	PFTeDA	376-06-7	< 0.00082 U	< 0.000752 U	< 0.000747 U	< 0.00074 U	< 0.000742 UJ	< 0.000758 UJ	< 0.000745 U	< 0.000731 UJ
Total	PFTrDA	72629-94-8	< 0.00082 U	< 0.000752 U	< 0.000747 U	< 0.00074 U	< 0.000742 UJ	< 0.000758 UJ	< 0.000745 U	< 0.000731 UJ
Total	PFUnA	2058-94-8	< 0.00082 U	< 0.000752 U	< 0.000747 U	< 0.00074 U	< 0.000742 UJ	< 0.000758 UJ	< 0.000745 U	< 0.000731 UJ

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 1a
Raleigh Creek Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other
		Location	RC21	RC21	RC21	RC21	RC21	RC17	RC17	RC17
		Location ID	S016-280	S016-280	S016-280	S016-280	S016-280	S016-065	S016-065	S016-065
		Sample Date	7/28/2020	8/26/2020	9/1/2020	9/4/2020	9/21/2020	8/12/2019	8/12/2019	8/14/2019
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	QC-FR	Sample
		Sample ID	S016-280.2007281330.000S	S016-280.2008261015.000S	S016-280.2009011005.000S	S016-280.2009041245.000S	S016-280.2009211420.000S	S016-065.1908121310.000S	S016-065.1908121315.000SR	S016-065.1908140950.000S
		Sample Name	RC21-WAT-BULK-01-072820	RC21-WAT-BULK-01-082620	RC21-WAT-BULK-01-090120	RC21-WAT-BULK-01-090420	RC21-WAT-BULK-01-092120	RC17-WAT-SUR-01-081219	RC17-WAT-SUR-02-081219	RC17-WAT-SUR-01-081419
		Parent Sample ID	NA	NA	NA	NA	NA	NA	S016-065.1908121310.000S	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	< 0.0041 U	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.00145 U	< 0.00171 UJ	< 0.00149 U	< 0.00145 UJ	< 0.0041 U	< 0.0029 U	< 0.00288 U	< 0.00289 U
Total	4:2 FTS	757124-72-4	< 0.00145 U	< 0.00171 UJ	< 0.00148 U	< 0.00145 UJ	< 0.0041 U	< 0.0029 U	< 0.00288 U	< 0.00289 U
Total	6:2 FTS	27619-97-2	< 0.00131 U	< 0.00154 UJ	< 0.00134 U	< 0.00131 UJ	< 0.0041 U	< 0.00261 U	< 0.00259 U	0.0137 J
Total	8:2 FTS	39108-34-4	< 0.00145 U	< 0.00171 UJ	< 0.00148 U	< 0.00145 UJ	< 0.0041 U	< 0.0029 U	< 0.00288 U	< 0.00289 U
Total	9Cl-PF3ONS	756426-58-1	< 0.00146 U	< 0.00171 UJ	< 0.00149 U	< 0.00146 UJ	< 0.0041 U	< 0.0029 U	< 0.00288 U	< 0.00289 U
Total	ADONA	919005-14-4	< 0.00145 U	< 0.00171 UJ	< 0.00148 U	< 0.00145 UJ	< 0.0041 U	< 0.0029 U	< 0.00288 U	< 0.00289 U
Total	HFPO-DA	13252-13-6	< 0.00138 U	< 0.00162 UJ	< 0.00141 U	< 0.00138 UJ	< 0.0041 U	< 0.0029 U	< 0.00288 U	< 0.00289 U
Total	N-EtFOSA	4151-50-2	< 0.000908 U	< 0.00107 UJ	< 0.000928 U	< 0.000907 UJ	< 0.0041 U	< 0.00181 U	< 0.0018 U	< 0.0018 U
Total	N-EtFOSAA	2991-50-6	0.00202	< 0.000427 UJ	< 0.000371 U	< 0.000363 UJ	< 0.0041 U	< 0.000725 U	< 0.00072 U	0.00296
Total	N-EtFOSE	1691-99-2	< 0.00272 U	< 0.00319 UJ	< 0.00278 U	< 0.00272 UJ	< 0.0041 U	< 0.00544 U	< 0.0054 U	< 0.00541 U
Total	N-MeFOSA	31506-32-8	< 0.000418 U	< 0.000491 UJ	< 0.000427 U	< 0.000417 UJ	< 0.0041 U	< 0.000833 U	< 0.000828 U	< 0.00083 U
Total	N-MeFOSAA	2355-31-9	< 0.000363 U	< 0.000427 UJ	< 0.000371 U	< 0.000363 UJ	< 0.0041 U	< 0.000725 U	< 0.00072 U	< 0.000722 U
Total	N-MeFOSE	24448-09-7	< 0.00363 U	< 0.00427 UJ	< 0.00371 U	< 0.00363 UJ	< 0.0041 U	< 0.00725 U	< 0.0072 U	< 0.00722 U
Total	PFBA	375-22-4	0.0765	0.0897 J	0.084 J+	R	0.092	0.0879	0.0974	0.194
Total	PFBS	375-73-5	0.00344	0.00276 J-	0.00277	0.00136 J-	0.003 J	0.00211 J	0.00195 J	0.00524
Total	PFDA	335-76-2	0.000812 J	< 0.000427 UJ	< 0.000371 U	< 0.000363 UJ	< 0.0041 U	< 0.000725 U	< 0.00072 U	0.00191
Total	PFDoA	307-55-1	< 0.000363 U	< 0.000427 UJ	< 0.000371 U	< 0.000363 UJ	< 0.0041 U	< 0.000725 U	< 0.00072 U	< 0.000722 U
Total	PFDoS	79780-39-5	< 0.000363 U	< 0.000427 UJ	< 0.000371 U	< 0.000363 UJ	NA	< 0.000725 U	< 0.00072 U	< 0.000722 U
Total	PFDS	335-77-3	< 0.000363 U	< 0.000427 UJ	< 0.000371 U	< 0.000363 UJ	< 0.0041 U	< 0.000725 U	< 0.00072 U	< 0.000722 U
Total	PFHpA	375-85-9	0.00448	0.00238 J-	0.00247	0.00163 J-	0.0048 B	0.00191 J	0.00196 J	0.00878
Total	PFHpS	375-92-8	0.00104 J	< 0.000427 UJ	< 0.000371 U	< 0.000363 UJ	< 0.0041 U	< 0.000725 U	< 0.00072 U	0.0042
Total	PFHxA	307-24-4	0.00637	0.00498 J-	0.00493	0.00282 J-	< 0.0092 U	0.00398 J	0.00382 J	0.0142
Total	PFHxS	355-46-4	0.00586	0.00357 J-	0.00348	0.00277 J-	0.0028 J	0.00293 J	0.00299 J	0.0121
Total	PFNA	375-95-1	0.00106 J	0.000955 J-	0.000613 J	0.000622 J-	< 0.0041 U	< 0.000725 U	0.000788 J	0.00139 J
Total	PFNS	68259-12-1	< 0.000363 U	< 0.000427 UJ	< 0.000371 U	< 0.000363 UJ	< 0.0041 U	< 0.000725 U	< 0.00072 U	< 0.000722 U
Total	PFOA	335-67-1	0.0332	0.00817 J-	0.00884	0.00701 J-	0.0087	0.00799	0.00823	0.095
Total	PFOS	1763-23-1	0.146	0.0031 J-	0.0154	0.00331 J-	0.0034 J	0.00204 J	0.00164 J	0.702
Total	PFOSA	754-91-6	0.00241	< 0.000427 UJ	< 0.000371 U	< 0.000363 UJ	< 0.0041 U	< 0.000725 U	< 0.00072 U	0.0057
Total	PFPeA	2706-90-3	0.00658	0.00658 J-	0.00631	0.00306 J-	0.0082	0.00528 J	0.00541 J	0.00988
Total	PFPeS	2706-91-4	0.00139 J	< 0.000429 UJ	0.000528 J	< 0.000365 UJ	< 0.0041 U	< 0.000725 U	< 0.00072 U	0.00342
Total	PFTeDA	376-06-7	< 0.000363 U	< 0.000427 UJ	< 0.000371 U	< 0.000363 UJ	< 0.0041 UJ	< 0.000725 U	< 0.00072 U	< 0.000722 U
Total	PFTrDA	72629-94-8	< 0.000363 U	< 0.000427 UJ	< 0.000371 U	< 0.000363 UJ	0.0024 J	< 0.000725 U	< 0.00072 U	< 0.000722 U
Total	PFUnA	2058-94-8	< 0.000363 U	< 0.000427 UJ	< 0.000371 U	< 0.000363 UJ	< 0.0041 U	< 0.000725 U	< 0.00072 U	< 0.000722 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 1a
Raleigh Creek Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other
		Location	RC17	RC17	RC17	RC17	RC17A	RC17A	RC17A	RC18A
		Location ID	S016-065	S016-065	S016-065	S016-065	S016-066	S016-066	S016-066	S016-339
		Sample Date	5/5/2020	7/28/2020	9/19/2020	9/19/2020	2/24/2020	2/24/2020	2/24/2020	9/21/2020
		Sample Type Code	Sample	Sample	Sample	QC-FR	Sample	Sample	QC-FR	Sample
		Sample ID	S016-065.2005050945.000S	S016-065.2007280900.000S	S016-065.2009191625.000S	S016-065.2009191630.000SR	S016-066.2002241520.000S	S016-066.2002241530.000S	S016-066.2002241535.000SR	S016-339.2009211310.000S
		Sample Name	RC17-WAT-BULK-01-050520	RC17-WAT-BULK-01-072820	RC17-WAT-BULK-01-091920	RC17-WAT-BULK-02-091920	RC17A-WAT-SML-01-022420	RC17A-WAT-BULK-01-022420	RC17A-WAT-BULK-02-022420	RC18A-WAT-BULK-01-092120
		Parent Sample ID	NA	NA	NA	S016-065.2009191625.000S	NA	NA	S016-066.2002241530.000S	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	NA	NA	< 0.0042 U	< 0.0042 U	NA	NA	NA	< 0.004 U
Total	11Cl-PF3OUdS	763051-92-9	< 0.00301 UJ	< 0.0015 U	< 0.0042 U	< 0.0042 U	< 0.00332 U	< 0.00296 U	< 0.00296 U	< 0.004 U
Total	4:2 FTS	757124-72-4	< 0.00301 UJ	< 0.0015 U	< 0.0042 U	< 0.0042 U	< 0.00332 U	< 0.00296 U	< 0.00296 U	< 0.004 U
Total	6:2 FTS	27619-97-2	< 0.00271 UJ	< 0.00135 U	< 0.0042 U	< 0.0042 U	< 0.00299 U	< 0.00266 U	< 0.00267 U	< 0.004 U
Total	8:2 FTS	39108-34-4	< 0.00301 UJ	< 0.0015 U	< 0.0042 U	< 0.0042 U	< 0.00332 U	< 0.00296 U	< 0.00296 U	< 0.004 U
Total	9Cl-PF3ONS	756426-58-1	< 0.00301 UJ	< 0.00151 U	< 0.0042 U	< 0.0042 U	< 0.00332 U	< 0.00296 U	< 0.00296 U	< 0.004 U
Total	ADONA	919005-14-4	< 0.00301 UJ	< 0.0015 U	< 0.0042 U	< 0.0042 U	< 0.00332 U	< 0.00296 U	< 0.00296 U	< 0.004 U
Total	HFPO-DA	13252-13-6	< 0.00286 UJ	< 0.00143 U	< 0.0042 U	< 0.0042 U	< 0.00316 U	< 0.00281 U	< 0.00282 U	< 0.004 U
Total	N-EtFOSA	4151-50-2	< 0.00188 UJ	< 0.000939 U	< 0.0042 U	< 0.0042 U	< 0.00208 U	< 0.00185 U	< 0.00185 U	< 0.004 U
Total	N-EtFOSAA	2991-50-6	< 0.000753 UJ	0.00188	< 0.0042 U	< 0.0042 U	< 0.000831 U	< 0.00074 U	< 0.000741 U	< 0.004 U
Total	N-EtFOSE	1691-99-2	< 0.00565 UJ	< 0.00281 U	< 0.0042 U	0.00014 BJ	< 0.00623 U	< 0.00555 U	< 0.00556 U	< 0.004 U
Total	N-MeFOSA	31506-32-8	< 0.000866 UJ	< 0.000432 U	< 0.0042 U	< 0.0042 U	< 0.000955 U	< 0.00085 U	< 0.000852 U	< 0.004 U
Total	N-MeFOSAA	2355-31-9	< 0.000753 UJ	< 0.000376 U	< 0.0042 U	< 0.0042 U	< 0.000831 U	< 0.00074 U	< 0.000741 U	< 0.004 U
Total	N-MeFOSE	24448-09-7	< 0.00753 UJ	< 0.00376 U	< 0.0042 U	< 0.0042 U	< 0.00831 U	< 0.0074 U	< 0.00741 U	< 0.004 U
Total	PFBA	375-22-4	0.076 J-	0.0413	0.092	0.095	0.088	0.0878	0.089	0.088
Total	PFBS	375-73-5	0.00225 J-	0.00199	0.0029 J	0.0029 J	0.00249	0.00263	0.00267	0.0028 J
Total	PFDA	335-76-2	< 0.000753 UJ	0.000856 J	< 0.0042 U	< 0.0042 U	< 0.000831 U	< 0.00074 U	< 0.000741 U	< 0.004 U
Total	PFDoA	307-55-1	< 0.000753 UJ	< 0.000376 U	< 0.0042 U	< 0.0042 U	< 0.000831 U	< 0.00074 U	< 0.000741 U	< 0.004 U
Total	PFDoS	79780-39-5	< 0.000753 UJ	< 0.000376 U	NA	NA	< 0.000831 U	< 0.00074 U	< 0.000741 U	NA
Total	PFDS	335-77-3	< 0.000753 UJ	< 0.000376 U	< 0.0042 U	< 0.0042 U	< 0.000831 U	< 0.00074 U	< 0.000741 U	< 0.004 U
Total	PFHpA	375-85-9	0.00213 J-	0.00386	0.0037 BJ	0.0054 B	0.00247 J	0.00203 J	0.00245 J	0.0031 BJ
Total	PFHpS	375-92-8	< 0.000753 UJ	0.00117 J	< 0.0042 U	< 0.0042 U	< 0.000831 U	< 0.00074 U	< 0.000741 U	< 0.004 U
Total	PFHxA	307-24-4	0.00411 J-	0.00441	< 0.0092 U	< 0.0092 U	0.00467 J	0.00443 J	0.00455 J	< 0.0092 U
Total	PFHxS	355-46-4	0.00305 J-	0.00569	0.0027 J	0.0033 J	0.00358	0.00306	0.00325	0.0043
Total	PFNA	375-95-1	< 0.000753 UJ	0.00101 J	< 0.0042 U	0.0014 J	0.000939 J	< 0.00074 U	0.000746 J	< 0.004 U
Total	PFNS	68259-12-1	< 0.000753 UJ	< 0.000376 U	< 0.0042 U	< 0.0042 U	< 0.000831 U	< 0.00074 U	< 0.000741 U	< 0.004 U
Total	PFOA	335-67-1	0.00652 J-	0.0327	0.0092	0.01	0.00814	0.00746	0.00771	0.0095
Total	PFOS	1763-23-1	0.00312 J-	0.164	0.0035 J	0.0037 J	0.00508	0.00191	0.00236	0.005
Total	PFOSA	754-91-6	< 0.000753 UJ	0.00315	< 0.0042 U	< 0.0042 U	< 0.000831 U	< 0.00074 U	< 0.000741 U	< 0.004 U
Total	PFPeA	2706-90-3	0.00557 J-	0.00369	0.0085	0.0083	0.00656	0.00633	0.00633	0.0083
Total	PFPeS	2706-91-4	< 0.000753 UJ	0.00117 J	< 0.0042 U	< 0.0042 U	< 0.000831 U	< 0.00074 U	< 0.000741 U	< 0.004 U
Total	PFTeDA	376-06-7	< 0.000753 UJ	< 0.000376 U	< 0.0042 U	< 0.0042 U	< 0.000831 U	< 0.00074 U	< 0.000741 U	< 0.004 UJ
Total	PFTrDA	72629-94-8	< 0.000753 UJ	< 0.000376 U	0.0019 BJ	< 0.0042 U	< 0.000831 U	< 0.00074 U	< 0.000741 U	0.0016 J
Total	PFUnA	2058-94-8	< 0.000753 UJ	< 0.000376 U	< 0.0042 U	< 0.0042 U	< 0.000831 U	< 0.00074 U	< 0.000741 U	< 0.004 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 1a
Raleigh Creek Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other
		Location	RC18A	RC18A	RC18	RC18	RC18	RC18	RC18
		Location ID	S016-339	S016-339	82-0109-00-208	82-0109-00-208	82-0109-00-208	82-0109-00-208	82-0109-00-208
		Sample Date	5/5/2020	5/5/2020	8/13/2019	2/25/2020	5/5/2020	7/28/2020	8/26/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	S016-339.2005051700.000S	S016-339.2005051730.000S	82-0109-00-208.1908131000.000S	82-0109-00-208.2002251045.000S	82-0109-00-208.2005051030.000S	82-0109-00-208.2007281230.000S	82-0109-00-208.2008261100.000S
		Sample Name	RC18A-WAT-SML-01-050520	RC18A-WAT-BULK-01-050520	RC18-WAT-SUR-01-081319	RC18-WAT-BULK-01-022520	RC18-WAT-BULK-01-050520	RC18-WAT-BULK-01-072820	RC18-WAT-BULK-01-082620
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #							
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.00309 UJ	< 0.00302 UJ	< 0.00298 U	< 0.00294 U	< 0.00304 UJ	< 0.00153 U	< 0.00157 UJ
Total	4:2 FTS	757124-72-4	< 0.00309 UJ	< 0.00302 UJ	< 0.00298 U	< 0.00294 U	< 0.00304 UJ	< 0.00152 U	< 0.00156 UJ
Total	6:2 FTS	27619-97-2	< 0.00278 UJ	< 0.00272 UJ	< 0.00268 U	< 0.00265 U	< 0.00274 UJ	< 0.00137 U	< 0.00141 UJ
Total	8:2 FTS	39108-34-4	< 0.00309 UJ	< 0.00302 UJ	< 0.00298 U	< 0.00294 U	< 0.00304 UJ	< 0.00152 U	< 0.00156 UJ
Total	9Cl-PF3ONS	756426-58-1	< 0.00309 UJ	< 0.00302 UJ	< 0.00298 U	< 0.00294 U	< 0.00304 UJ	< 0.00153 U	< 0.00157 UJ
Total	ADONA	919005-14-4	< 0.00309 UJ	< 0.00302 UJ	< 0.00298 U	< 0.00294 U	< 0.00304 UJ	< 0.00152 U	< 0.00156 UJ
Total	HFPO-DA	13252-13-6	< 0.00294 UJ	< 0.00287 UJ	< 0.00298 U	< 0.00279 U	< 0.00289 UJ	< 0.00145 U	< 0.00149 UJ
Total	N-EtFOSA	4151-50-2	< 0.00193 UJ	< 0.00189 UJ	< 0.00186 U	< 0.00184 U	< 0.0019 UJ	< 0.000953 U	< 0.000978 UJ
Total	N-EtFOSAA	2991-50-6	< 0.000773 UJ	< 0.000755 UJ	< 0.000745 U	< 0.000735 U	< 0.00076 UJ	0.00183	< 0.000391 UJ
Total	N-EtFOSE	1691-99-2	< 0.0058 UJ	< 0.00566 UJ	< 0.00559 U	< 0.00551 U	< 0.0057 UJ	< 0.00285 U	< 0.00293 UJ
Total	N-MeFOSA	31506-32-8	< 0.000889 UJ	< 0.000868 UJ	< 0.000857 U	< 0.000846 U	< 0.000874 UJ	< 0.000438 U	< 0.00045 UJ
Total	N-MeFOSAA	2355-31-9	< 0.000773 UJ	< 0.000755 UJ	< 0.000745 U	< 0.000735 U	< 0.00076 UJ	< 0.000381 U	< 0.000391 UJ
Total	N-MeFOSE	24448-09-7	< 0.00773 UJ	< 0.00755 UJ	< 0.00745 U	< 0.00735 U	< 0.0076 UJ	< 0.00381 U	< 0.00391 UJ
Total	PFBA	375-22-4	0.0842 J-	0.0744 J-	0.0727	0.0867	0.0823 J-	0.0796	R
Total	PFBS	375-73-5	0.00261 J-	0.00221 J-	0.0018	0.00252	0.00263 J-	0.00332	0.00281 J-
Total	PFDA	335-76-2	< 0.000773 UJ	< 0.000755 UJ	< 0.000745 U	< 0.000735 U	< 0.00076 UJ	0.000879 J	0.000418 J-
Total	PFDoA	307-55-1	< 0.000773 UJ	< 0.000755 UJ	< 0.000745 U	< 0.000735 U	< 0.00076 UJ	< 0.000381 U	< 0.000391 UJ
Total	PFDoS	79780-39-5	< 0.000773 UJ	< 0.000755 UJ	< 0.000745 U	< 0.000735 U	< 0.00076 UJ	< 0.000381 U	< 0.000391 UJ
Total	PFDS	335-77-3	< 0.000773 UJ	< 0.000755 UJ	< 0.000745 U	< 0.000735 U	< 0.00076 UJ	< 0.000381 U	< 0.000391 UJ
Total	PFHpA	375-85-9	0.00199 J-	0.00196 J-	0.00165 J	0.0021 J	0.00214 J-	0.00558	0.00254 J-
Total	PFHpS	375-92-8	< 0.000773 UJ	< 0.000755 UJ	< 0.000745 U	< 0.000735 U	< 0.00076 UJ	0.00112 J	< 0.000391 UJ
Total	PFHxA	307-24-4	0.00438 J-	0.00413 J-	0.00388 J	0.00465 J	0.00442 J-	0.00718	0.00469 J-
Total	PFHxS	355-46-4	0.00284 J-	0.00324 J-	0.00298	0.00327	0.00314 J-	0.00608	0.00332 J-
Total	PFNA	375-95-1	< 0.000773 UJ	< 0.000755 UJ	0.000791 J	< 0.000735 U	< 0.00076 UJ	0.00109 J	0.000857 J-
Total	PFNS	68259-12-1	< 0.000773 UJ	< 0.000755 UJ	< 0.000745 U	< 0.000735 U	< 0.00076 UJ	< 0.000381 U	< 0.000391 UJ
Total	PFOA	335-67-1	0.00645 J-	0.00693 J-	0.00876	0.00738	0.00685 J-	0.0342	0.00819 J-
Total	PFOS	1763-23-1	0.00428 J-	0.00589 J-	0.00248	0.00244	0.00379 J-	0.162	0.00317 J-
Total	PFOSA	754-91-6	< 0.000773 UJ	< 0.000755 UJ	< 0.000745 U	< 0.000735 U	< 0.00076 UJ	0.00254	0.000398 J-
Total	PFPeA	2706-90-3	0.0061 J-	0.00558 J-	0.0045	0.00619	0.0061 J-	0.00628	0.0068 J-
Total	PFPeS	2706-91-4	< 0.000773 UJ	< 0.000755 UJ	< 0.000745 U	< 0.000735 U	< 0.00076 UJ	0.00146 J	0.000399 J-
Total	PFTeDA	376-06-7	< 0.000773 UJ	< 0.000755 UJ	< 0.000745 U	< 0.000735 U	< 0.00076 UJ	< 0.000381 U	< 0.000391 UJ
Total	PFTrDA	72629-94-8	< 0.000773 UJ	< 0.000755 UJ	< 0.000745 U	< 0.000735 U	< 0.00076 UJ	< 0.000381 U	< 0.000391 UJ
Total	PFUnA	2058-94-8	< 0.000773 UJ	< 0.000755 UJ	< 0.000745 U	< 0.000735 U	< 0.00076 UJ	< 0.000381 U	< 0.000391 UJ

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 1a
Raleigh Creek Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Raleigh Creek - other	RA_Raleigh Creek - other
		Location	RC18	RC18
		Location ID	82-0109-00-208	82-0109-00-208
		Sample Date	9/1/2020	9/17/2020
		Sample Type Code	Sample	Sample
		Sample ID	82-0109-00-208.2009011100.000S	82-0109-00-208.2009170845.000S
		Sample Name	RC18-WAT-BULK-01-090120	RC18-WAT-BULK-01-091720
		Parent Sample ID	NA	NA
Fraction	Compound	CAS #		
Total	10:2 FTS	120226-60-0	NA	< 0.004 U
Total	11Cl-PF3OUdS	763051-92-9	< 0.00153 U	< 0.004 U
Total	4:2 FTS	757124-72-4	< 0.00152 U	< 0.004 U
Total	6:2 FTS	27619-97-2	< 0.00137 U	< 0.004 U
Total	8:2 FTS	39108-34-4	< 0.00152 U	< 0.004 U
Total	9Cl-PF3ONS	756426-58-1	< 0.00153 U	< 0.004 U
Total	ADONA	919005-14-4	< 0.00152 U	< 0.004 U
Total	HFPO-DA	13252-13-6	< 0.00145 U	< 0.004 U
Total	N-EtFOSA	4151-50-2	< 0.000953 U	< 0.004 U
Total	N-EtFOSAA	2991-50-6	< 0.000381 U	< 0.004 U
Total	N-EtFOSE	1691-99-2	< 0.00285 U	< 0.004 UJ
Total	N-MeFOSA	31506-32-8	< 0.000438 U	< 0.004 U
Total	N-MeFOSAA	2355-31-9	< 0.000381 U	< 0.004 U
Total	N-MeFOSE	24448-09-7	< 0.00381 U	< 0.004 UJ
Total	PFBA	375-22-4	0.0803	0.11
Total	PFBS	375-73-5	0.00272	0.0034 J
Total	PFDA	335-76-2	< 0.000381 U	< 0.004 U
Total	PFDoA	307-55-1	< 0.000381 U	< 0.004 U
Total	PFDoS	79780-39-5	< 0.000381 U	NA
Total	PFDS	335-77-3	< 0.000381 U	< 0.004 U
Total	PFHpA	375-85-9	0.00247	0.0033 J
Total	PFHpS	375-92-8	< 0.000381 U	< 0.004 U
Total	PFHxA	307-24-4	0.00469	< 0.0092 U
Total	PFHxS	355-46-4	0.00336	0.0032 J
Total	PFNA	375-95-1	0.000747 J	0.0014 J
Total	PFNS	68259-12-1	< 0.000381 U	< 0.004 U
Total	PFOA	335-67-1	0.00945	0.015
Total	PFOS	1763-23-1	0.02	0.004
Total	PFOSA	754-91-6	< 0.000381 U	< 0.004 U
Total	PFPeA	2706-90-3	0.00623	0.0076
Total	PFPeS	2706-91-4	0.000481 J	< 0.004 U
Total	PFTeDA	376-06-7	< 0.000381 U	0.0046 J+
Total	PFTrDA	72629-94-8	< 0.000381 U	0.0021 J
Total	PFUnA	2058-94-8	< 0.000381 U	< 0.004 U

NOTES
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Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table1b
Raleigh Creek Sediment
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper
		Location	RC3	RC3	RC3	RC3A	RC3B	RC3B	RC3A	RC4
		Location ID	S016-051	S016-051	S016-051	S016-338	S016-338	S016-338	S016-338	S016-052
		Sample Date	8/12/2019	8/12/2019	4/25/2020	4/25/2020	8/12/2020	8/12/2020	9/20/2020	8/12/2019
		Sample Type Code	Sample	QC-FR	Sample	Sample	Sample	QC-FR	Sample	Sample
		Sample ID	S016-051.1908121700.000S	S016-051.1908121705.000SR	S016-051.2004250900.000S	S016-338.2004250930.000S	S016-338.2008120850.000S	S016-338.2008120855.000SR	S016-338.2009200915.000S	S016-052.1908121630.000S
		Sample Name	RC3-SED-0-6-01-081219	RC3-SED-0-6-02-081219	RC3-SED-WET-0-6-01-042520	RC3A-SED-WET-0-6-01-042520	RC3B-SED-WET-0-6-01-081220	RC3B-SED-WET-0-6-02-081220	RC3A-SED-0-6-01-092020	RC4-SED-0-6-01-081219
		Parent Sample ID	NA	S016-051.1908121700.000S	NA	NA	NA	S016-338.2008120850.000S	NA	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	NA	< 1.5 U	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.312 U	< 0.341 U	< 0.32 UJ	< 0.33 UJ	< 0.214 U	< 0.158 U	< 1.5 UJ	< 0.385 U
Total	4:2 FTS	757124-72-4	< 0.312 U	< 0.341 U	< 0.32 UJ	< 0.33 UJ	< 0.214 U	< 0.157 U	< 1.5 U	< 0.385 U
Total	6:2 FTS	27619-97-2	< 0.281 U	< 0.307 U	< 0.288 UJ	< 0.297 UJ	3.8	0.619	< 1.5 U	< 0.347 U
Total	8:2 FTS	39108-34-4	< 0.312 U	< 0.341 U	< 0.32 UJ	< 0.33 UJ	< 0.214 U	< 0.157 U	0.056 J	< 0.385 U
Total	9Cl-PF3ONS	756426-58-1	< 0.312 U	< 0.341 U	< 0.32 UJ	< 0.33 UJ	< 0.215 U	< 0.158 U	< 1.5 U	< 0.385 U
Total	ADONA	919005-14-4	< 0.312 U	< 0.341 U	< 0.32 UJ	< 0.33 UJ	< 0.214 U	< 0.157 U	< 1.5 U	< 0.385 U
Total	HFPO-DA	13252-13-6	< 0.312 U	< 0.341 U	< 0.304 UJ	< 0.314 UJ	< 0.203 U	< 0.15 U	< 1.5 U	< 0.385 U
Total	N-EtFOSA	4151-50-2	0.493	0.589	4.6 J-	2.83 J	0.264 J	0.186 J	< 1.5 U	1.28
Total	N-EtFOSAA	2991-50-6	2.25	3.14	16.8 J-	16.2 J-	3.53	2.48	5.5	13.3
Total	N-EtFOSE	1691-99-2	< 0.585 U	< 0.639 U	1.48 J	0.854 J	< 0.4 U	0.457 J	0.56 J	1.11
Total	N-MeFOSA	31506-32-8	< 0.0897 U	< 0.0979 U	0.314 J-	2.97 J	0.701	0.807	< 1.5 U	0.121
Total	N-MeFOSAA	2355-31-9	< 0.078 U	< 0.0852 U	0.141 J-	0.49 J-	0.214	0.316	< 1.5 U	0.187
Total	N-MeFOSE	24448-09-7	< 0.78 U	< 0.852 U	< 0.799 UJ	< 0.826 UJ	< 0.535 U	< 0.394 U	0.083 J	< 0.963 U
Total	PFBA	375-22-4	< 0.312 U	< 0.341 U	2.28 J	10.6 J-	15	6.44	< 1.5 U	0.841
Total	PFBS	375-73-5	< 0.078 U	< 0.0852 U	0.173 J-	0.356 J-	0.616	0.214	< 1.5 U	< 0.0964 U
Total	PFDA	335-76-2	< 0.078 U	0.094	0.803 J-	0.813 J-	13.2	4.4	< 1.5 U	0.301
Total	PFDoA	307-55-1	< 0.078 U	< 0.0852 U	0.349 J-	0.589 J-	0.777	0.946	< 1.5 U	0.272
Total	PFDoS	79780-39-5	< 0.078 U	0.103	0.777 J-	0.749 J-	1.71	1.85	NA	0.392
Total	PFDS	335-77-3	< 0.078 U	0.107	1.12 J-	1.78 J-	5.18	7	< 1.5 U	0.647
Total	PFHpA	375-85-9	< 0.078 U	< 0.0852 U	0.618 J-	1.09 J-	4.66	1.23	< 1.5 U	0.111
Total	PFHpS	375-92-8	< 0.078 U	< 0.0852 U	0.562 J-	2.64 J-	36.4	6.62	0.12 J	0.171
Total	PFHxA	307-24-4	< 0.078 U	< 0.0852 U	0.497 J-	1.65 J-	6.29	1.91	< 1.5 U	0.112
Total	PFHxS	355-46-4	< 0.078 U	< 0.0852 U	0.813 J-	2.76 J-	12.7	3.73	< 1.5 U	0.22
Total	PFNA	375-95-1	< 0.078 U	< 0.0852 U	0.148 J-	0.28 J-	1.94	0.615	0.55 BJ	< 0.0964 U
Total	PFNS	68259-12-1	< 0.078 U	< 0.0852 U	0.151 J-	0.773 J-	3.81	3.11	< 1.5 U	< 0.107 U
Total	PFOA	335-67-1	0.217	0.581	7.73 J-	24.2 J-	123	34.5	0.91 BJ	1.53
Total	PFOS	1763-23-1	5.89	14	140 J-	179 J-	2570	649	23	59.9
Total	PFOSA	754-91-6	1.71	3.04	14.1 J-	50.2 J-	22.3	19.2	3.6	5.09
Total	PFPeA	2706-90-3	< 0.156 U	< 0.17 U	0.282 J-	0.507 J-	1.3	0.473	< 1.5 U	< 0.193 U
Total	PFPeS	2706-91-4	< 0.078 U	< 0.0852 U	0.255 J-	0.585 J-	1.44	0.45	0.12 J	< 0.0964 U
Total	PFTeDA	376-06-7	< 0.078 U	< 0.0852 U	0.155 J-	0.156 J-	0.096 J	0.07 J	0.38 BJ	< 0.0964 U
Total	PFTrDA	72629-94-8	< 0.078 U	< 0.0852 U	0.178 J-	0.156 J-	0.133 J	0.148 J	< 1.5 U	0.159
Total	PFUnA	2058-94-8	< 0.078 U	< 0.0852 U	0.116 J-	0.249 J-	0.633	0.561	< 1.5 U	< 0.0964 U

NOTES
All results are reported in micrograms per kilogram (ug/kg).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

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- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table1b
Raleigh Creek Sediment
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper
		Location	RC4A	RC4A	RC5	RC5	RC5	RC5	RC6	RC6
		Location ID	S016-052	S016-052	S016-189	S016-189	S016-189	S016-189	S016-190	S016-190
		Sample Date	8/13/2020	9/18/2020	8/12/2019	4/24/2020	4/24/2020	9/18/2020	8/12/2019	4/24/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	S016-052.2008131015.000S	S016-052.2009181450.000S	S016-189.1908121550.000S	S016-189.2004241000.000S	S016-189.2004241015.000S	S016-189.2009181550.000S	S016-190.1908121505.000S	S016-190.2004241120.000S
		Sample Name	RC4A-SED-WET-0-6-01-081320	RC4A-SED-0-6-01-091820	RC5-SED-0-6-01-081219	RC5-SED-0-4-01-042420	RC5-SED-4-6-01-042420	RC5-SED-0-6-01-091820	RC6-SED-0-6-01-081219	RC6-SED-WET-0-6-01-042420
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	NA	< 1.2 U	NA	NA	NA	< 1.2 U	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.153 U	< 1.2 UJ	< 0.265 U	< 0.302 UJ	< 0.307 UJ	< 1.2 UJ	< 0.357 U	< 0.485 UJ
Total	4:2 FTS	757124-72-4	< 0.153 U	< 1.2 U	< 0.265 U	< 0.302 UJ	< 0.307 UJ	< 1.2 U	< 0.357 U	< 0.485 UJ
Total	6:2 FTS	27619-97-2	0.525 J	< 1.2 U	< 0.238 U	1.01 J-	< 0.276 UJ	< 1.2 U	< 0.321 U	< 0.437 UJ
Total	8:2 FTS	39108-34-4	< 0.153 U	< 1.2 U	< 0.265 U	< 0.302 UJ	< 0.307 UJ	< 1.2 U	< 0.357 U	< 0.485 UJ
Total	9Cl-PF3ONS	756426-58-1	< 0.153 U	< 1.2 U	< 0.265 U	< 0.302 UJ	< 0.307 UJ	< 1.2 U	< 0.357 U	< 0.485 UJ
Total	ADONA	919005-14-4	< 0.153 U	< 1.2 U	< 0.265 U	< 0.302 UJ	< 0.307 UJ	< 1.2 U	< 0.357 U	< 0.485 UJ
Total	HFPO-DA	13252-13-6	< 0.145 U	< 1.2 U	< 0.265 U	< 0.287 UJ	< 0.292 UJ	< 1.2 U	< 0.357 U	< 0.461 UJ
Total	N-EtFOSA	4151-50-2	0.398	< 1.2 U	0.193	0.576 J-	0.405 J-	0.19 J	0.318	1.13 J-
Total	N-EtFOSAA	2991-50-6	10	1.8	2.84	3.98 J-	3.25 J-	1.1 J	6.31	23.4 J-
Total	N-EtFOSE	1691-99-2	0.509 J	< 1.2 U	< 0.497 U	< 0.567 UJ	< 0.576 UJ	< 1.2 U	< 0.669 U	1.06 J-
Total	N-MeFOSA	31506-32-8	0.392	0.095 J	0.107	0.313 J-	0.414 J-	0.16 J	< 0.103 U	1.3 J-
Total	N-MeFOSAA	2355-31-9	0.832	< 1.2 U	< 0.0662 U	0.091 J-	< 0.0768 UJ	< 1.2 U	0.113	0.635 J-
Total	N-MeFOSE	24448-09-7	< 0.382 U	< 1.2 U	< 0.662 U	< 0.756 UJ	< 0.768 UJ	< 1.2 U	< 0.892 U	< 1.21 UJ
Total	PFBA	375-22-4	0.422 J	< 1.2 U	0.314	0.612 J	0.481 J-	< 1.2 U	0.566	3.05 J
Total	PFBS	375-73-5	0.04 J	< 1.2 U	< 0.0662 U	< 0.0756 UJ	< 0.0768 UJ	< 1.2 U	< 0.0892 U	0.331 J-
Total	PFDA	335-76-2	0.314	< 1.2 U	0.175	0.2 J-	0.194 J-	< 1.2 U	0.453	1.54 J-
Total	PFDoA	307-55-1	0.533	< 1.2 U	0.127	0.118 J-	< 0.0768 UJ	< 1.2 U	0.208	1.4 J-
Total	PFDoS	79780-39-5	0.598	NA	< 0.0662 U	0.098 J-	< 0.0768 UJ	NA	0.156	2.51 J-
Total	PFDS	335-77-3	1.66	0.34 J	0.316	0.323 J-	0.08 J-	< 1.2 U	0.568	4.83 J-
Total	PFHpA	375-85-9	0.097 J	< 1.2 U	< 0.0662 U	< 0.0756 UJ	< 0.0768 UJ	< 1.2 U	0.108	1.06 J-
Total	PFHpS	375-92-8	0.19	0.082 J	< 0.0662 U	< 0.0756 UJ	< 0.0768 UJ	< 1.2 U	0.119	1.27 J-
Total	PFHxA	307-24-4	0.138 J	< 1.2 U	< 0.0662 U	0.088 J-	0.083 J-	0.38 J	0.106	0.943 J-
Total	PFHxS	355-46-4	0.295	0.43 J	0.081	0.12 J-	0.108 J-	< 1.2 U	0.173	1.81 J-
Total	PFNA	375-95-1	0.064 J	0.46 BJ	< 0.0662 U	< 0.0756 UJ	< 0.0768 UJ	< 1.2 U	< 0.0892 U	0.303 J-
Total	PFNS	68259-12-1	0.119 J	< 1.2 U	0.118	0.097 J-	< 0.0768 UJ	< 1.2 U	< 0.0892 U	0.608 J-
Total	PFOA	335-67-1	1.67	0.94 BJ	0.634	0.664 J-	0.653 J-	0.52 BJ	1.34	14.9 J-
Total	PFOS	1763-23-1	55.2	15	27.5	24 J-	24.1 J-	8.1	65.8	261 J-
Total	PFOSA	754-91-6	4.87	1.1 J	1.2	2.47 J-	3.89 J-	0.95 J	3.99	10.2 J-
Total	PFPeA	2706-90-3	< 0.0765 U	< 1.2 U	< 0.132 U	< 0.151 UJ	< 0.154 UJ	0.26 BJ	< 0.178 U	0.423 J-
Total	PFPeS	2706-91-4	< 0.0384 U	NA	< 0.0662 U	< 0.0756 UJ	< 0.0768 UJ	< 1.2 U	< 0.0892 U	0.406 J-
Total	PFTeDA	376-06-7	0.05 J	0.28 BJ	< 0.0662 U	< 0.0756 UJ	< 0.0768 UJ	0.23 BJ	< 0.0892 U	0.269 J-
Total	PFTrDA	72629-94-8	0.117 J	< 1.2 U	< 0.0662 U	< 0.0756 UJ	< 0.0768 UJ	< 1.2 U	< 0.0892 U	0.377 J-
Total	PFUnA	2058-94-8	0.071 J	< 1.2 U	< 0.0662 U	< 0.0756 UJ	< 0.0768 UJ	< 1.2 U	0.097	0.434 J-

NOTES
All results are reported in micrograms per kilogram (ug/kg).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table1b
Raleigh Creek Sediment
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper
		Location	RC6A	RC6A	RC6A	RC7	RC7	RC7	RC22	RC22
		Location ID	S016-375	S016-375	S016-375	S016-053	S016-053	S016-053	PS00175	PS00175
		Sample Date	8/12/2020	9/21/2020	9/21/2020	8/12/2019	9/20/2020	9/21/2020	5/14/2020	8/13/2020
		Sample Type Code	Sample	Sample	QC-FR	Sample	Sample	Sample	Sample	Sample
		Sample ID	S016-375.2008121030.000S	S016-375.2009211000.000S	S016-375.2009211005.000SR	S016-053.1908121400.000S	S016-053.2009201100.000S	S016-053.2009211240.000S	PS00175.2005141015.000S	PS00175.2008130915.000S
		Sample Name	RC6A-SED-WET-0-6-01-081220	RC6A-SED-0-6-01-092120	RC6A-SED-0-6-02-092120	RC7-SED-0-6-01-081219	RC7-SED-0-6-01-092020	RC7-SED-0-6-01-092120	RC22-SED-WET-0-6-01-051420	RC22-SED-EAST-0-6-01-081320
		Parent Sample ID	NA	NA	S016-375.2009211000.000S	NA	NA	NA	NA	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	NA	< 1.6 U	< 1.4 U	NA	< 0.9 U	< 0.96 U	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.142 U	< 1.6 UJ	< 1.4 UJ	< 0.298 U	< 0.9 UJ	< 0.96 UJ	< 0.334 UJ	< 0.147 U
Total	4:2 FTS	757124-72-4	< 0.142 U	< 1.6 U	< 1.4 U	< 0.298 U	< 0.9 U	< 0.96 U	< 0.334 UJ	< 0.147 U
Total	6:2 FTS	27619-97-2	0.354 J	< 1.6 U	< 1.4 U	< 0.268 U	< 0.9 U	0.16 J	< 0.3 UJ	0.412 J
Total	8:2 FTS	39108-34-4	< 0.142 U	< 1.6 U	< 1.4 U	< 0.298 U	< 0.9 U	< 0.96 U	< 0.334 UJ	< 0.147 U
Total	9Cl-PF3ONS	756426-58-1	< 0.142 U	< 1.6 U	< 1.4 U	< 0.298 U	< 0.9 U	< 0.96 U	< 0.334 UJ	< 0.147 U
Total	ADONA	919005-14-4	< 0.142 U	< 1.6 U	< 1.4 U	< 0.298 U	< 0.9 U	< 0.96 U	< 0.334 UJ	< 0.147 U
Total	HFPO-DA	13252-13-6	< 0.135 U	< 1.6 U	< 1.4 U	< 0.298 U	< 0.9 U	< 0.96 U	< 0.317 UJ	< 0.14 U
Total	N-EtFOSA	4151-50-2	0.145 J	0.38 J	0.25 J	< 0.186 U	< 0.9 U	< 0.96 U	< 0.208 UJ	0.111 J
Total	N-EtFOSAA	2991-50-6	2.3	3.5	4.2	0.617	0.49 J	0.55 J	3.54 J-	2.11
Total	N-EtFOSE	1691-99-2	< 0.265 U	< 1.6 U	< 1.4 U	< 0.559 U	< 0.9 U	< 0.96 U	< 0.625 UJ	< 0.275 U
Total	N-MeFOSA	31506-32-8	0.137 J	0.83 J	0.72 J	< 0.0858 U	0.11 J	0.16 J	0.33 J	0.267
Total	N-MeFOSAA	2355-31-9	0.073 J	< 1.6 U	< 1.4 U	< 0.0746 U	< 0.9 U	< 0.96 U	0.091 J-	0.085 J
Total	N-MeFOSE	24448-09-7	< 0.355 U	< 1.6 U	< 1.4 U	< 0.746 U	< 0.9 U	< 0.96 U	< 0.834 UJ	< 0.367 U
Total	PFBA	375-22-4	0.526 J	1.5 J	1.6	0.53	< 0.9 U	0.75 J	1.28 J-	0.499 J
Total	PFBS	375-73-5	< 0.0355 U	< 1.6 U	< 1.4 U	< 0.0746 U	< 0.9 U	< 0.96 U	0.114 J-	< 0.0367 U
Total	PFDA	335-76-2	0.275	1.1 BJ	1.1 BJ	0.139	< 0.9 U	< 0.96 U	0.81 J-	0.376
Total	PFDoA	307-55-1	0.099 J	0.5 J	0.42 J	< 0.0746 U	< 0.9 U	< 0.96 U	0.385 J-	0.134 J
Total	PFDoS	79780-39-5	0.079 J	NA	NA	< 0.0746 U	NA	NA	0.115 J-	0.055 J
Total	PFDS	335-77-3	0.312	0.76 J	0.66 J	0.135	< 0.9 U	< 0.96 U	0.966 J-	0.38
Total	PFHpA	375-85-9	0.1 J	< 1.6 U	< 1.4 U	< 0.0746 U	< 0.9 U	< 0.96 U	0.484 J-	0.088 J
Total	PFHpS	375-92-8	0.073 J	0.18 J	0.2 J	< 0.0746 U	< 0.9 U	< 0.96 U	0.485 J-	0.084 J
Total	PFHxA	307-24-4	0.098 J	0.86 J	0.75 J	0.092	< 0.9 U	0.49 J	0.427 J-	0.114 J
Total	PFHxS	355-46-4	0.094 J	< 1.6 U	< 1.4 U	< 0.0746 U	< 0.9 U	< 0.96 U	0.608 J-	0.109 J
Total	PFNA	375-95-1	< 0.0355 U	0.58 BJ	< 1.4 U	< 0.0746 U	< 0.9 U	< 0.96 U	0.14 J-	0.041 J
Total	PFNS	68259-12-1	0.078 J	0.76 J	0.66 J	< 0.0746 U	< 0.9 U	< 0.96 U	0.292 J-	0.115 J
Total	PFOA	335-67-1	1.02	2.6	2.8	0.684	0.31 BJ	0.28 BJ	5.96 J-	1.16
Total	PFOS	1763-23-1	26.4	50	54	11.5	2.9	0.46 J	129 J-	37.5
Total	PFOSA	754-91-6	2.21	7.1	7.9	1.38	0.27 J	0.18 J	4.38 J-	2.15
Total	PFPeA	2706-90-3	< 0.071 U	< 1.6 U	0.33 BJ	< 0.149 U	< 0.9 U	0.36 BJ	0.197 J-	< 0.0734 U
Total	PFPeS	2706-91-4	< 0.0357 U	0.18 J	0.2 J	< 0.0746 U	< 0.9 U	< 0.96 U	0.156 J-	< 0.0369 U
Total	PFTeDA	376-06-7	< 0.0355 U	< 1.6 U	< 1.4 U	< 0.0746 U	0.31 BJ	< 0.96 U	< 0.0834 UJ	< 0.0367 U
Total	PFTrDA	72629-94-8	< 0.0355 U	< 1.6 U	< 1.4 U	< 0.0746 U	< 0.9 U	< 0.96 U	< 0.0834 UJ	< 0.0367 U
Total	PFUnA	2058-94-8	0.076 J	0.31 J	0.37 J	< 0.0746 U	< 0.9 U	< 0.96 U	0.299 J-	0.129 J

NOTES
All results are reported in micrograms per kilogram (ug/kg).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table1b
Raleigh Creek Sediment
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper
		Location	RC22	RC22	RC23	RC23	RC23	RC23	RC26
		Location ID	PS00175	PS00175	PS00176	PS00176	PS00176	PS00176	S016-376
		Sample Date	8/14/2020	9/18/2020	5/14/2020	8/14/2020	8/14/2020	9/28/2020	8/14/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	PS00175.2008141020.000S	PS00175.2009181630.000S	PS00176.2005141120.000S	PS00176.2008141040.000S	PS00176.2008141100.000S	PS00176.2009281715.000S	S016-376.2008141130.000S
		Sample Name	RC22-SED-WEST-0-6-01-081420	RC22-SED-0-6-01-091820	RC23-SED-WET-0-6-01-051420	RC23-SED-EAST-0-6-01-081420	RC23-SED-WEST-0-6-01-081420	RC23-SED-0-6-01-092820	RC26-SED-WET-0-6-01-081420
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #							
Total	10:2 FTS	120226-60-0	NA	< 1.6 U	NA	NA	NA	< 1.5 U	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.159 U	< 1.6 UJ	< 0.341 UJ	< 0.152 U	< 0.156 U	< 1.5 U	< 0.15 U
Total	4:2 FTS	757124-72-4	< 0.159 U	< 1.6 U	< 0.341 UJ	< 0.152 U	< 0.156 U	< 1.5 U	< 0.15 U
Total	6:2 FTS	27619-97-2	0.297 J	< 1.6 U	< 0.307 UJ	10.2	1.87	< 1.5 U	0.281 J
Total	8:2 FTS	39108-34-4	< 0.159 U	0.048 J	< 0.341 UJ	< 0.152 U	< 0.156 U	< 1.5 U	< 0.15 U
Total	9Cl-PF3ONS	756426-58-1	< 0.159 U	< 1.6 U	< 0.341 UJ	< 0.152 U	< 0.156 U	< 1.5 U	< 0.15 U
Total	ADONA	919005-14-4	< 0.159 U	< 1.6 U	< 0.341 UJ	< 0.152 U	< 0.156 U	< 1.5 U	< 0.15 U
Total	HFPO-DA	13252-13-6	< 0.151 U	< 1.6 U	< 0.324 UJ	< 0.144 U	< 0.148 U	< 1.5 U	< 0.142 U
Total	N-EtFOSA	4151-50-2	< 0.0991 U	< 1.6 U	< 0.213 UJ	0.244 J	0.192 J	< 1.5 U	< 0.0936 U
Total	N-EtFOSAA	2991-50-6	0.485	3.9	2.5 J-	3.24	2.3	9.6	1.11
Total	N-EtFOSE	1691-99-2	< 0.296 U	< 1.6 U	< 0.64 UJ	< 0.284 U	< 0.291 U	< 1.5 U	< 0.28 U
Total	N-MeFOSA	31506-32-8	0.247	0.18 J	0.268 J	0.231	0.302	0.57 BJ	0.092 J
Total	N-MeFOSAA	2355-31-9	0.068 J	< 1.6 U	0.111 J-	0.159	0.159	< 1.5 U	0.254
Total	N-MeFOSE	24448-09-7	< 0.396 U	0.16 J	< 0.854 UJ	< 0.379 U	< 0.389 U	< 1.5 U	< 0.374 U
Total	PFBA	375-22-4	0.579 J	0.66 J	0.922 J-	0.616	0.498 J	0.63 J	3.27
Total	PFBS	375-73-5	0.04 J	< 1.6 U	0.109 J-	0.105 J	0.068 J	< 1.5 U	0.08 J
Total	PFDA	335-76-2	1.02	0.65 BJ	0.912 J-	0.838	0.782	1.3 J	1.81
Total	PFDoA	307-55-1	0.25	0.58 J	0.184 J-	0.152	0.131 J	0.96 J+	0.341
Total	PFDoS	79780-39-5	0.107 J	NA	0.185 J-	0.128 J	0.096 J	NA	0.157
Total	PFDS	335-77-3	0.546	0.8 J	0.707 J-	0.686	0.452	3.7	1.32
Total	PFHpA	375-85-9	0.171	< 1.6 U	0.252 J-	0.274	0.154 J	0.51 J	0.535
Total	PFHpS	375-92-8	0.205	0.18 J	0.414 J-	0.337	0.324	0.52 J	0.262
Total	PFHxA	307-24-4	0.21	< 1.6 U	0.241 J-	0.27	0.153 J	< 1.5 U	0.716
Total	PFHxS	355-46-4	0.278	< 1.6 U	0.565 J-	0.438	0.391	0.79 J	0.406
Total	PFNA	375-95-1	0.088 J	0.62 BJ	0.106 J-	0.078 J	0.081 J	< 1.5 U	0.166
Total	PFNS	68259-12-1	0.181	0.8 J	0.322 J-	0.317	0.246	1.1 J+	0.471
Total	PFOA	335-67-1	3.02	1.4 BJ	3.71 J-	3.13	2.67	4.3	5.19
Total	PFOS	1763-23-1	82.8	47	124 J-	113	115	200	158
Total	PFOSA	754-91-6	2.46	1.6 J	4.27 J-	3.78	4.08	11	5.47
Total	PFPeA	2706-90-3	0.081 J	< 1.6 U	< 0.171 UJ	< 0.0758 U	< 0.0778 U	< 1.5 U	0.502
Total	PFPeS	2706-91-4	0.063 J	0.18 J	0.138 J-	0.119 J	0.081 J	0.28 J+	0.122 J
Total	PFTeDA	376-06-7	< 0.0396 U	< 1.6 U	< 0.0854 UJ	< 0.0379 U	< 0.0389 U	< 1.5 U	< 0.0374 U
Total	PFTrDA	72629-94-8	0.046 J	< 1.6 U	< 0.0854 UJ	< 0.0379 U	< 0.0389 U	< 1.5 U	0.068 J
Total	PFUnA	2058-94-8	0.199	0.51 J	0.171 J-	0.138 J	0.117 J	0.69 J+	0.353

NOTES
All results are reported in micrograms per kilogram (ug/kg).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table1b
Raleigh Creek Sediment
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper
		Location	RC26	RC20A	RC8	RC9	RC10	RC11	RC12	RC12
		Location ID	S016-376	S016-276	S016-056	S016-057	S016-058	S016-059	S016-060	S016-060
		Sample Date	8/14/2020	8/12/2020	8/12/2019	8/12/2019	8/12/2019	8/12/2019	8/12/2019	4/24/2020
		Sample Type Code	QC-FR	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	S016-376.2008141150.000SR	S016-276.2008121430.000S	S016-056.1908121325.000S	S016-057.1908121255.000S	S016-058.1908121530.000S	S016-059.1908121500.000S	S016-060.1908121445.000S	S016-060.2004241350.000S
		Sample Name	RC26-SED-WET-0-6-02-081420	RC20A-SED-WET-0-6-01-081220	RC8-SED-0-6-01-081219	RC9-SED-0-6-01-081219	RC10-SED-0-6-01-081219	RC11-SED-0-6-01-081219	RC12-SED-0-6-01-081219	RC12-SED-COMP-0-6-01-042420
		Parent Sample ID	S016-376.2008141130.000S	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.136 U	< 0.151 U	< 0.303 U	< 0.31 U	< 0.3 U	< 0.298 U	< 0.292 U	< 0.318 UJ
Total	4:2 FTS	757124-72-4	< 0.136 U	< 0.151 U	< 0.303 U	< 0.31 U	< 0.3 U	< 0.298 U	< 0.292 U	< 0.318 UJ
Total	6:2 FTS	27619-97-2	0.297 J	0.343 J	< 0.273 U	< 0.279 U	< 0.27 U	< 0.268 U	< 0.262 U	< 0.286 UJ
Total	8:2 FTS	39108-34-4	< 0.136 U	< 0.151 U	< 0.303 U	< 0.31 U	< 0.3 U	< 0.298 U	< 0.292 U	< 0.318 UJ
Total	9Cl-PF3ONS	756426-58-1	< 0.136 U	< 0.151 U	< 0.303 U	< 0.31 U	< 0.3 U	< 0.298 U	< 0.292 U	< 0.318 UJ
Total	ADONA	919005-14-4	< 0.136 U	< 0.151 U	< 0.303 U	< 0.31 U	< 0.3 U	< 0.298 U	< 0.292 U	< 0.318 UJ
Total	HFPO-DA	13252-13-6	< 0.129 U	< 0.143 U	< 0.303 U	< 0.31 U	< 0.3 U	< 0.298 U	< 0.292 U	< 0.302 UJ
Total	N-EtFOSA	4151-50-2	0.106 J	0.195 J	< 0.19 U	< 0.194 U	< 0.187 U	< 0.186 U	< 0.182 U	< 0.199 UJ
Total	N-EtFOSAA	2991-50-6	1.37	3.39	0.094	0.371	0.136	0.235	0.178	0.261 J-
Total	N-EtFOSE	1691-99-2	< 0.253 U	< 0.282 U	< 0.569 U	< 0.582 U	< 0.562 U	< 0.559 U	< 0.547 U	< 0.597 UJ
Total	N-MeFOSA	31506-32-8	0.105 J	0.116 J	< 0.0872 U	< 0.0893 U	< 0.0862 U	< 0.0858 U	< 0.0838 U	< 0.0915 UJ
Total	N-MeFOSAA	2355-31-9	0.292	0.455	< 0.0758 U	< 0.0776 U	< 0.0749 U	< 0.0746 U	< 0.0729 U	< 0.0796 UJ
Total	N-MeFOSE	24448-09-7	< 0.339 U	< 0.378 U	< 0.758 U	< 0.776 U	< 0.749 U	< 0.746 U	< 0.729 U	< 0.796 UJ
Total	PFBA	375-22-4	3.09	1.6	< 0.303 U	0.311	< 0.3 U	0.5	0.52	0.895 J-
Total	PFBS	375-73-5	0.079 J	0.08 J	< 0.0758 U	< 0.0776 U	< 0.0749 U	< 0.0746 U	< 0.0729 U	< 0.0796 UJ
Total	PFDA	335-76-2	1.98	1.9	0.079	0.17	0.132	0.257	0.459	0.275 J-
Total	PFDoA	307-55-1	0.475	0.486	< 0.0758 U	< 0.0776 U	< 0.0749 U	< 0.0746 U	< 0.0729 U	< 0.0796 UJ
Total	PFDoS	79780-39-5	0.221	0.194	< 0.0758 U	< 0.0776 U	< 0.0749 U	< 0.0746 U	< 0.0729 U	< 0.0796 UJ
Total	PFDS	335-77-3	1.71	1.71	< 0.0758 U	0.106	< 0.0749 U	< 0.0746 U	< 0.0729 U	< 0.0796 UJ
Total	PFHpA	375-85-9	0.613	0.37	< 0.0758 U	< 0.0776 U	< 0.0749 U	< 0.0746 U	< 0.0729 U	0.164 J-
Total	PFHpS	375-92-8	0.33	0.45	< 0.0758 U	< 0.0776 U	< 0.0749 U	< 0.0746 U	< 0.0729 U	0.081 J-
Total	PFHxA	307-24-4	0.778	0.388	< 0.0758 U	< 0.0776 U	< 0.0749 U	< 0.0746 U	0.115	0.163 J-
Total	PFHxS	355-46-4	0.41	0.44	< 0.0758 U	< 0.0776 U	< 0.0749 U	< 0.0746 U	< 0.0729 U	0.123 J-
Total	PFNA	375-95-1	0.189	0.191	< 0.0758 U	< 0.0776 U	< 0.0749 U	< 0.0746 U	< 0.0729 U	< 0.0796 UJ
Total	PFNS	68259-12-1	0.511	0.49	< 0.0758 U	< 0.0776 U	< 0.0749 U	< 0.0746 U	< 0.0729 U	< 0.0796 UJ
Total	PFOA	335-67-1	5.68	5.29	0.08	0.655	0.401	0.474	0.948	1.98 J-
Total	PFOS	1763-23-1	197	178	0.721	14.9	7.98	10	19.6	25.8 J-
Total	PFOSA	754-91-6	5.96	12.1	< 0.0758 U	0.779	0.75	0.714	1.02	0.948 J-
Total	PFPeA	2706-90-3	0.48	0.261 J	< 0.152 U	< 0.155 U	< 0.15 U	< 0.149 U	< 0.146 U	0.187 J-
Total	PFPeS	2706-91-4	0.147 J	0.148 J	< 0.0758 U	< 0.0776 U	< 0.0749 U	< 0.0746 U	< 0.0729 U	< 0.0796 UJ
Total	PFTeDA	376-06-7	0.049 J	0.045 J	< 0.0758 U	< 0.0776 U	< 0.0749 U	< 0.0746 U	< 0.0729 U	< 0.0796 UJ
Total	PFTrDA	72629-94-8	0.077 J	0.066 J	< 0.0758 U	< 0.0776 U	< 0.0749 U	< 0.0746 U	< 0.0729 U	< 0.0796 UJ
Total	PFUnA	2058-94-8	0.364	0.461	< 0.0758 U	< 0.0776 U	< 0.0749 U	< 0.0746 U	< 0.0729 U	< 0.0796 UJ

NOTES
All results are reported in micrograms per kilogram (ug/kg).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table1b
Raleigh Creek Sediment
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - other	RA_Raleigh Creek - other
		Location	RC12	RC12	RC13	RC13	RC13	RC16A	RC16A
		Location ID	S016-060	S016-060	S016-062	S016-062	S016-062	S016-314	S016-314
		Sample Date	4/25/2020	8/13/2020	8/12/2019	9/23/2020	9/23/2020	4/30/2020	4/30/2020
		Sample Type Code	Sample	Sample	Sample	Sample	QC-FR	Sample	QC-FR
		Sample ID	S016-060.2004251015.000S	S016-060.2008131300.000S	S016-062.1908121125.000S	S016-062.2009230945.000S	S016-062.2009230950.000SR	S016-314.2004301130.000S	S016-314.2004301145.000SR
		Sample Name	RC12-SED-0-6-01-042520	RC12-SED-BANK-EAST-0-6-01-081320	RC13-SED-0-6-01-081219	RC13-SED-0-6-01-092320	RC13-SED-0-6-02-092320	RC16A-SED-WET-0-6-01-043020	RC16A-SED-WET-0-6-02-043020
		Parent Sample ID	NA	NA	NA	NA	S016-062.2009230945.000S	NA	S016-314.2004301130.000S
Fraction	Compound	CAS #							
Total	10:2 FTS	120226-60-0	NA	NA	NA	< 1.4 U	< 1 U	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.32 UJ	< 0.155 U	< 0.289 U	< 1.4 U	< 1 UJ	< 0.314 U	< 0.319 U
Total	4:2 FTS	757124-72-4	< 0.32 UJ	< 0.155 U	< 0.289 U	< 1.4 U	< 1 U	< 0.314 U	< 0.319 U
Total	6:2 FTS	27619-97-2	< 0.288 UJ	0.232 J	< 0.26 U	< 1.4 U	< 1 U	< 0.283 U	< 0.287 U
Total	8:2 FTS	39108-34-4	< 0.32 UJ	< 0.155 U	< 0.289 U	< 1.4 U	< 1 U	< 0.314 U	< 0.319 U
Total	9Cl-PF3ONS	756426-58-1	< 0.32 UJ	< 0.155 U	< 0.289 U	< 1.4 U	< 1 U	< 0.314 U	< 0.319 U
Total	ADONA	919005-14-4	< 0.32 UJ	< 0.155 U	< 0.289 U	< 1.4 U	< 1 U	< 0.314 U	< 0.319 U
Total	HFPO-DA	13252-13-6	< 0.304 UJ	< 0.147 U	< 0.289 U	< 1.4 U	< 1 U	< 0.298 U	< 0.303 U
Total	N-EtFOSA	4151-50-2	< 0.2 UJ	< 0.0966 U	< 0.181 U	< 1.4 U	< 1 U	< 0.196 UJ	< 0.199 UJ
Total	N-EtFOSAA	2991-50-6	0.223 J-	0.158	0.194	1.3 BJ	0.99 J	< 0.0785 U	0.096 J
Total	N-EtFOSE	1691-99-2	< 0.6 UJ	< 0.289 U	< 0.542 U	< 1.4 U	< 1 U	< 0.589 U	< 0.598 U
Total	N-MeFOSA	31506-32-8	< 0.0919 UJ	< 0.0444 U	< 0.0831 U	< 1.4 U	0.12 BJ	< 0.0903 UJ	< 0.0917 UJ
Total	N-MeFOSAA	2355-31-9	< 0.0799 UJ	< 0.0386 U	< 0.0723 U	< 1.4 U	< 1 U	< 0.0785 U	0.107 J
Total	N-MeFOSE	24448-09-7	< 0.799 UJ	< 0.386 U	< 0.723 U	< 1.4 U	< 1 U	< 0.785 U	< 0.797 U
Total	PFBA	375-22-4	0.36 J-	0.798	< 0.289 U	< 1.4 U	0.44 J	< 0.314 U	< 0.319 U
Total	PFBS	375-73-5	< 0.0799 UJ	< 0.0386 U	< 0.0723 U	< 1.4 UJ	< 1 UJ	< 0.0785 U	< 0.0797 U
Total	PFDA	335-76-2	0.186 J-	0.588	0.172	0.49 J	0.29 J	< 0.0785 U	< 0.0797 U
Total	PFDoA	307-55-1	< 0.0799 UJ	0.056 J	< 0.0723 U	< 1.4 U	< 1 U	< 0.0785 U	< 0.0797 U
Total	PFDoS	79780-39-5	< 0.0799 UJ	< 0.0386 U	< 0.0723 U	NA	NA	< 0.0785 U	< 0.0797 U
Total	PFDS	335-77-3	< 0.0799 UJ	0.096 J	< 0.0723 U	0.47 J	0.26 J	< 0.0785 U	< 0.0797 U
Total	PFHpA	375-85-9	0.09 J-	0.133 J	< 0.0723 U	< 1.4 U	< 1 U	< 0.0785 U	< 0.0797 U
Total	PFHpS	375-92-8	< 0.0799 UJ	0.065 J	< 0.0723 U	< 1.4 U	< 1 U	< 0.0785 U	< 0.0797 U
Total	PFHxA	307-24-4	0.102 J-	0.146 J	< 0.0723 U	< 1.4 U	< 1 U	0.105 J	< 0.0797 U
Total	PFHxS	355-46-4	< 0.0799 UJ	0.083 J	< 0.0723 U	< 1.4 U	< 1 U	< 0.0785 U	< 0.0797 U
Total	PFNA	375-95-1	< 0.0799 UJ	0.059 J	< 0.0723 U	< 1.4 U	< 1 U	< 0.0785 U	< 0.0797 U
Total	PFNS	68259-12-1	< 0.0799 UJ	0.092 J	< 0.0723 U	< 1.4 U	< 1 U	< 0.0785 U	< 0.0797 U
Total	PFOA	335-67-1	1.17 J-	1.46	0.311	0.4 J	0.31 J	0.359 J	0.107 J
Total	PFOS	1763-23-1	12 J-	34.8	7.67	9.5	11	0.792	0.623
Total	PFOSA	754-91-6	0.199 J-	0.895	0.339	0.82 J	1.2	< 0.0785 U	< 0.0797 U
Total	PFPeA	2706-90-3	< 0.16 UJ	0.15 J	< 0.145 U	0.34 J	0.35 J	< 0.157 U	< 0.159 U
Total	PFPeS	2706-91-4	< 0.0799 UJ	< 0.0388 U	< 0.0723 U	< 1.4 U	< 1 U	< 0.0785 U	< 0.0797 U
Total	PFTeDA	376-06-7	< 0.0799 UJ	< 0.0386 U	< 0.0723 U	0.45 BJ	0.28 BJ	< 0.0785 U	< 0.0797 U
Total	PFTrDA	72629-94-8	< 0.0799 UJ	< 0.0386 U	< 0.0723 U	< 1.4 U	< 1 U	< 0.0785 U	< 0.0797 U
Total	PFUnA	2058-94-8	< 0.0799 UJ	0.089 J	< 0.0723 U	0.29 J	< 1 U	< 0.0785 U	< 0.0797 U

NOTES
All results are reported in micrograms per kilogram (ug/kg).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table1b
Raleigh Creek Sediment
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other
		Location	RC16A	RC16	RC15	RC14	RC14	RC21	RC21
		Location ID	S016-314	S016-064	82-0399-00-202	S016-063	S016-063	S016-280	S016-280
		Sample Date	9/21/2020	8/12/2019	8/12/2019	8/12/2019	9/23/2020	4/23/2020	8/13/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	S016-314.2009211100.000S	S016-064.1908121420.000S	82-0399-00-202.1908121325.000S	S016-063.1908121045.000S	S016-063.2009231015.000S	S016-280.2004230950.000S	S016-280.2008131120.000S
		Sample Name	RC16A-SED-0-6-01-092120	RC16-SED-0-6-01-081219	RC15-SED-0-6-01-081219	RC14-SED-0-6-01-081219	RC14-SED-0-6-01-092320	RC21-SED-COMP-0-3-01-042320	RC21-SED-BANK-WEST-0-6-01-081320
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #							
Total	10:2 FTS	120226-60-0	< 1.4 U	NA	NA	NA	< 1.1 U	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 1.4 UJ	< 0.298 U	< 0.312 U	< 0.295 U	< 1.1 UJ	< 0.309 UJ	< 0.16 U
Total	4:2 FTS	757124-72-4	< 1.4 U	< 0.298 U	< 0.312 U	< 0.295 U	< 1.1 U	< 0.309 UJ	< 0.16 U
Total	6:2 FTS	27619-97-2	< 1.4 U	< 0.268 U	< 0.281 U	< 0.265 U	< 1.1 U	< 0.278 UJ	0.489 BJ
Total	8:2 FTS	39108-34-4	0.052 J	< 0.298 U	< 0.312 U	< 0.295 U	0.04 BJ	< 0.309 UJ	< 0.16 U
Total	9Cl-PF3ONS	756426-58-1	< 1.4 U	< 0.298 U	< 0.312 U	< 0.295 U	< 1.1 U	< 0.309 UJ	< 0.16 U
Total	ADONA	919005-14-4	< 1.4 U	< 0.298 U	< 0.312 U	< 0.295 U	< 1.1 U	< 0.309 UJ	< 0.16 U
Total	HFPO-DA	13252-13-6	< 1.4 U	< 0.298 U	< 0.312 U	< 0.295 U	< 1.1 U	< 0.293 UJ	< 0.152 U
Total	N-EtFOSA	4151-50-2	< 1.4 U	< 0.186 U	< 0.195 U	< 0.184 U	< 1.1 U	< 0.193 UJ	< 0.1 UJ
Total	N-EtFOSAA	2991-50-6	< 1.4 UJ	< 0.0745 U	< 0.0781 U	0.096	< 1.1 UJ	< 0.0772 UJ	< 0.04 U
Total	N-EtFOSE	1691-99-2	< 1.4 U	< 0.558 U	< 0.586 U	< 0.552 U	< 1.1 U	< 0.579 UJ	< 0.299 U
Total	N-MeFOSA	31506-32-8	0.11 J	< 0.0856 U	< 0.0898 U	< 0.0847 U	0.14 BJ	< 0.0888 UJ	< 0.046 UJ
Total	N-MeFOSAA	2355-31-9	< 1.4 U	< 0.0745 U	< 0.0781 U	< 0.0737 U	< 1.1 U	< 0.0772 UJ	< 0.04 U
Total	N-MeFOSE	24448-09-7	< 1.4 U	< 0.745 U	< 0.781 U	< 0.737 U	< 1.1 U	< 0.772 UJ	< 0.4 U
Total	PFBA	375-22-4	< 1.4 U	< 0.298 U	< 0.312 U	< 0.295 U	< 1.1 U	0.425 J-	0.489 J
Total	PFBS	375-73-5	< 1.4 U	< 0.0745 U	< 0.0781 U	< 0.0737 U	< 1.1 UJ	< 0.0772 UJ	< 0.04 U
Total	PFDA	335-76-2	< 1.4 U	< 0.0745 U	< 0.0781 U	< 0.0737 U	< 1.1 U	0.103 J-	0.081 J
Total	PFDoA	307-55-1	< 1.4 U	< 0.0745 U	< 0.0781 U	< 0.0737 U	< 1.1 U	< 0.0772 UJ	< 0.04 U
Total	PFDoS	79780-39-5	NA	< 0.0745 U	< 0.0781 U	< 0.0737 U	NA	< 0.0772 UJ	< 0.04 U
Total	PFDS	335-77-3	< 1.4 U	< 0.0745 U	< 0.0781 U	< 0.0737 U	< 1.1 U	< 0.0772 UJ	< 0.04 U
Total	PFHpA	375-85-9	< 1.4 U	< 0.0745 U	< 0.0781 U	< 0.0737 U	< 1.1 U	< 0.0772 UJ	< 0.04 U
Total	PFHpS	375-92-8	< 1.4 U	< 0.0745 U	< 0.0781 U	< 0.0737 U	< 1.1 U	< 0.0772 UJ	< 0.04 U
Total	PFHxA	307-24-4	< 1.4 U	< 0.0745 U	< 0.0781 U	< 0.0737 U	< 1.1 U	< 0.0772 UJ	0.062 J
Total	PFHxS	355-46-4	< 1.4 U	< 0.0745 U	< 0.0781 U	< 0.0737 U	< 1.1 U	< 0.0772 UJ	< 0.04 U
Total	PFNA	375-95-1	< 1.4 U	< 0.0745 U	< 0.0781 U	< 0.0737 U	< 1.1 U	< 0.0772 UJ	< 0.04 U
Total	PFNS	68259-12-1	< 1.4 U	< 0.0745 U	< 0.0781 U	< 0.0737 U	< 1.1 U	< 0.0772 UJ	< 0.04 U
Total	PFOA	335-67-1	0.2 BJ	< 0.0745 U	< 0.0781 U	< 0.0737 U	0.21 J	0.344 J-	0.226
Total	PFOS	1763-23-1	0.52 J	< 0.0745 U	0.133	0.499	0.25 J	4.2 J-	2.3
Total	PFOSA	754-91-6	< 1.4 U	< 0.0745 U	< 0.0781 U	< 0.0737 U	< 1.1 U	0.203 J-	0.39 B
Total	PFPeA	2706-90-3	< 1.4 U	< 0.149 U	< 0.156 U	< 0.147 U	< 1.1 U	< 0.154 UJ	0.089 J
Total	PFPeS	2706-91-4	< 1.4 U	< 0.0745 U	< 0.0781 U	< 0.0737 U	< 1.1 U	< 0.0772 UJ	< 0.0402 U
Total	PFTeDA	376-06-7	0.39 BJ	< 0.0745 U	< 0.0781 U	< 0.0737 U	0.38 BJ	< 0.0772 UJ	< 0.04 U
Total	PFTrDA	72629-94-8	< 1.4 U	< 0.0745 U	< 0.0781 U	< 0.0737 U	< 1.1 U	< 0.0772 UJ	< 0.04 U
Total	PFUnA	2058-94-8	0.27 J	< 0.0745 U	< 0.0781 U	< 0.0737 U	< 1.1 U	< 0.0772 UJ	< 0.04 U

NOTES
All results are reported in micrograms per kilogram (ug/kg).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table1b
Raleigh Creek Sediment
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other
		Location	RC21A	RC21B	RC17	RC17	RC17	RC17	RC17
		Location ID	S016-280	S016-280	S016-065	S016-065	S016-065	S016-065	S016-065
		Sample Date	9/22/2020	9/22/2020	8/12/2019	8/12/2019	4/23/2020	4/23/2020	4/23/2020
		Sample Type Code	Sample	Sample	Sample	QC-FR	Sample	Sample	Sample
		Sample ID	S016-280.2009221645.000S	S016-280.2009221730.000S	S016-065.1908121300.000S	S016-065.1908121305.000SR	S016-065.2004231110.000S	S016-065.2004231130.000S	S016-065.2004231200.000S
		Sample Name	RC21A-SED-0-6-01-092220	RC21B-SED-0-6-01-092220	RC17-SED-0-6-01-081219	RC17-SED-0-6-02-081219	RC17-SED-BANK-EAST-0-3-01-042320	RC17-SED-BANK-EAST-3-6-01-042320	RC17-SED-BANK-WEST-0-3-01-042320
		Parent Sample ID	NA	NA	NA	S016-065.1908121300.000S	NA	NA	NA
Fraction	Compound	CAS #							
Total	10:2 FTS	120226-60-0	< 1.5 U	< 1.1 U	NA	NA	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 1.5 UJ	< 1.1 UJ	< 0.302 U	< 0.309 U	< 0.326 UJ	< 0.308 UJ	< 0.325 UJ
Total	4:2 FTS	757124-72-4	< 1.5 U	< 1.1 U	< 0.302 U	< 0.309 U	< 0.326 UJ	< 0.308 UJ	< 0.325 UJ
Total	6:2 FTS	27619-97-2	< 1.5 U	< 1.1 U	< 0.272 U	< 0.278 U	< 0.294 UJ	< 0.277 UJ	< 0.292 UJ
Total	8:2 FTS	39108-34-4	< 1.5 U	< 1.1 U	< 0.302 U	< 0.309 U	< 0.326 UJ	< 0.308 UJ	< 0.325 UJ
Total	9Cl-PF3ONS	756426-58-1	< 1.5 U	< 1.1 U	< 0.302 U	< 0.309 U	< 0.326 UJ	< 0.308 UJ	< 0.325 UJ
Total	ADONA	919005-14-4	< 1.5 U	< 1.1 U	< 0.302 U	< 0.309 U	< 0.326 UJ	< 0.308 UJ	< 0.325 UJ
Total	HFPO-DA	13252-13-6	< 1.5 U	< 1.1 U	< 0.302 U	< 0.309 U	< 0.31 UJ	< 0.292 UJ	< 0.308 UJ
Total	N-EtFOSA	4151-50-2	< 1.5 U	< 1.1 U	< 0.189 U	< 0.193 U	< 0.204 UJ	< 0.192 UJ	< 0.203 UJ
Total	N-EtFOSAA	2991-50-6	1.4 J	< 1.1 UJ	< 0.0755 U	< 0.0772 U	0.223 J-	0.126 J-	0.127 J-
Total	N-EtFOSE	1691-99-2	< 1.5 U	< 1.1 U	< 0.566 U	< 0.579 U	< 0.612 UJ	< 0.577 UJ	< 0.609 UJ
Total	N-MeFOSA	31506-32-8	< 1.5 U	0.11 BJ	< 0.0869 U	< 0.0888 U	< 0.0938 UJ	< 0.0885 UJ	< 0.0933 UJ
Total	N-MeFOSAA	2355-31-9	< 1.5 U	< 1.1 U	< 0.0755 U	< 0.0772 U	< 0.0816 UJ	< 0.077 UJ	< 0.0811 UJ
Total	N-MeFOSE	24448-09-7	< 1.5 U	< 1.1 U	< 0.755 U	< 0.772 U	< 0.816 UJ	< 0.77 UJ	< 0.811 UJ
Total	PFBA	375-22-4	< 1.5 U	0.58 J	< 0.302 U	< 0.309 U	0.824 J-	1.16 J-	0.627 J-
Total	PFBS	375-73-5	< 1.5 U	< 1.1 U	< 0.0755 U	< 0.0772 U	< 0.0816 UJ	< 0.077 UJ	< 0.0811 UJ
Total	PFDA	335-76-2	< 1.5 U	< 1.1 U	< 0.0755 U	< 0.0772 U	0.214 J-	0.181 J-	0.084 J-
Total	PFDoA	307-55-1	< 1.5 U	< 1.1 U	< 0.0755 U	< 0.0772 U	0.085 J-	0.093 J-	< 0.0811 UJ
Total	PFDoS	79780-39-5	NA	NA	< 0.0755 U	< 0.0772 U	< 0.0816 UJ	< 0.077 UJ	< 0.0811 UJ
Total	PFDS	335-77-3	< 1.5 U	< 1.1 U	< 0.0755 U	< 0.0772 U	0.103 J-	0.15 J-	0.131 J-
Total	PFHpA	375-85-9	< 1.5 U	< 1.1 U	< 0.0755 U	< 0.0772 U	< 0.0816 UJ	0.083 J-	< 0.0811 UJ
Total	PFHpS	375-92-8	< 1.5 U	< 1.1 U	< 0.0755 U	< 0.0772 U	< 0.0816 UJ	< 0.077 UJ	< 0.0811 UJ
Total	PFHxA	307-24-4	< 1.5 U	0.5 J	< 0.0755 U	< 0.0772 U	0.084 J-	0.123 J-	< 0.0811 UJ
Total	PFHxS	355-46-4	< 1.5 U	< 1.1 U	< 0.0755 U	< 0.0772 U	< 0.0816 UJ	< 0.077 UJ	< 0.0811 UJ
Total	PFNA	375-95-1	< 1.5 U	< 1.1 U	< 0.0755 U	< 0.0772 U	0.084 J-	< 0.077 UJ	< 0.0811 UJ
Total	PFNS	68259-12-1	< 1.5 U	< 1.1 U	< 0.0755 U	< 0.0772 U	< 0.0816 UJ	< 0.077 UJ	< 0.0811 UJ
Total	PFOA	335-67-1	0.43 J	0.29 J	< 0.0755 U	< 0.0772 U	0.425 J-	0.857 J-	0.416 J-
Total	PFOS	1763-23-1	2.8	0.29 J	1.29	0.864	9.92 J-	11.8 J-	5.31 J-
Total	PFOSA	754-91-6	0.19 J	0.13 J	< 0.0755 U	< 0.0772 U	0.393 J-	0.474 J-	0.182 J-
Total	PFPeA	2706-90-3	< 1.5 U	0.34 J	< 0.151 U	< 0.154 U	< 0.163 UJ	0.192 J-	< 0.162 UJ
Total	PFPeS	2706-91-4	< 1.5 U	< 1.1 U	< 0.0755 U	< 0.0772 U	< 0.0816 UJ	< 0.077 UJ	< 0.0811 UJ
Total	PFTeDA	376-06-7	0.42 BJ	< 1.1 U	< 0.0755 U	< 0.0772 U	< 0.0816 UJ	< 0.077 UJ	< 0.0811 UJ
Total	PFTrDA	72629-94-8	< 1.5 U	< 1.1 U	< 0.0755 U	< 0.0772 U	< 0.0816 UJ	< 0.077 UJ	< 0.0811 UJ
Total	PFUnA	2058-94-8	< 1.5 U	< 1.1 U	< 0.0755 U	< 0.0772 U	0.118 J-	0.104 J-	0.083 J-

NOTES
All results are reported in micrograms per kilogram (ug/kg).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table1b
Raleigh Creek Sediment
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other
		Location	RC17	RC17A	RC18C	RC18B	RC18A	RC18	RC18
		Location ID	S016-065	S016-066	S016-339	S016-339	S016-339	82-0109-00-208	82-0109-00-208
		Sample Date	4/23/2020	9/23/2020	8/12/2020	8/12/2020	9/23/2020	8/13/2019	4/23/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	S016-065.2004231215.000S	S016-066.2009231155.000S	S016-339.2008121655.000S	S016-339.2008121710.000S	S016-339.2009231300.000S	82-0109-00-208.1908130955.000S	82-0109-00-208.2004231400.000S
		Sample Name	RC17-SED-BANK-WEST-3-6-01-042320	RC17A-SED-0-6-01-092320	RC18C-SED-WET-0-6-01-081220	RC18B-SED-WET-0-6-01-081220	RC18A-SED-0-6-01-092320	RC18-SED-0-6-01-081319	RC18-SED-COMP-0-3-01-042320
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #							
Total	10:2 FTS	120226-60-0	NA	< 1.1 U	NA	NA	< 1.5 U	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.318 UJ	< 1.1 UJ	< 0.165 U	< 0.153 U	< 1.5 UJ	< 0.296 U	< 0.325 UJ
Total	4:2 FTS	757124-72-4	< 0.318 UJ	< 1.1 U	< 0.165 U	< 0.153 U	< 1.5 U	< 0.296 U	< 0.325 UJ
Total	6:2 FTS	27619-97-2	< 0.286 UJ	< 1.1 U	0.334 BJ	1.76 B	< 1.5 U	1.56 J	< 0.293 UJ
Total	8:2 FTS	39108-34-4	< 0.318 UJ	< 1.1 U	< 0.165 U	< 0.153 U	< 1.5 U	< 0.296 U	< 0.325 UJ
Total	9Cl-PF3ONS	756426-58-1	< 0.318 UJ	< 1.1 U	< 0.166 U	< 0.153 U	< 1.5 U	< 0.296 U	< 0.325 UJ
Total	ADONA	919005-14-4	< 0.318 UJ	< 1.1 U	< 0.165 U	< 0.153 U	< 1.5 U	< 0.296 U	< 0.325 UJ
Total	HFPO-DA	13252-13-6	< 0.302 UJ	< 1.1 U	< 0.157 U	< 0.145 U	< 1.5 U	< 0.296 U	< 0.309 UJ
Total	N-EtFOSA	4151-50-2	< 0.199 UJ	< 1.1 U	< 0.103 UJ	< 0.0954 UJ	< 1.5 U	< 0.185 U	< 0.203 UJ
Total	N-EtFOSAA	2991-50-6	0.09 J-	0.62 J	0.661	< 0.0382 U	0.85 J	0.465	0.147 J-
Total	N-EtFOSE	1691-99-2	< 0.597 UJ	< 1.1 U	< 0.309 U	< 0.286 U	< 1.5 U	< 0.555 U	< 0.609 UJ
Total	N-MeFOSA	31506-32-8	< 0.0915 UJ	0.097 BJ	< 0.0475 UJ	< 0.0439 UJ	< 1.5 U	< 0.0852 U	< 0.0934 UJ
Total	N-MeFOSAA	2355-31-9	< 0.0795 UJ	< 1.1 U	0.042 J	< 0.0382 U	< 1.5 U	< 0.074 U	< 0.0813 UJ
Total	N-MeFOSE	24448-09-7	< 0.795 UJ	< 1.1 U	< 0.413 U	< 0.382 U	< 1.5 U	< 0.74 U	< 0.813 UJ
Total	PFBA	375-22-4	0.848 J-	< 1.1 U	< 0.165 U	< 0.153 U	< 1.5 U	< 0.296 U	< 0.325 UJ
Total	PFBS	375-73-5	< 0.0795 UJ	< 1.1 U	< 0.0413 U	< 0.0382 U	< 1.5 U	< 0.074 U	< 0.0813 UJ
Total	PFDA	335-76-2	0.103 J-	< 1.1 U	0.191	0.039 J	< 1.5 U	0.183	< 0.0813 UJ
Total	PFDoA	307-55-1	< 0.0795 UJ	< 1.1 U	0.075 J	< 0.0382 U	< 1.5 U	< 0.074 U	< 0.0813 UJ
Total	PFDoS	79780-39-5	< 0.0795 UJ	NA	< 0.0413 U	< 0.0382 U	NA	< 0.074 U	< 0.0813 UJ
Total	PFDS	335-77-3	0.121 J-	< 1.1 U	0.133 J	< 0.0382 U	< 1.5 U	0.15	< 0.0813 UJ
Total	PFHpA	375-85-9	< 0.0795 UJ	< 1.1 U	< 0.0413 U	< 0.0382 U	< 1.5 U	< 0.074 U	< 0.0813 UJ
Total	PFHpS	375-92-8	< 0.0795 UJ	< 1.1 U	< 0.0413 U	< 0.0382 U	< 1.5 U	< 0.074 U	< 0.0813 UJ
Total	PFHxA	307-24-4	< 0.0795 UJ	0.46 J	< 0.0413 U	< 0.0382 U	< 1.5 U	< 0.074 U	< 0.0813 UJ
Total	PFHxS	355-46-4	< 0.0795 UJ	< 1.1 U	< 0.0413 U	< 0.0382 U	< 1.5 U	0.086 J	< 0.0813 UJ
Total	PFNA	375-95-1	< 0.0795 UJ	< 1.1 U	< 0.0413 U	< 0.0382 U	< 1.5 U	< 0.074 U	< 0.0813 UJ
Total	PFNS	68259-12-1	< 0.0795 UJ	< 1.1 U	0.057 J	< 0.0382 U	< 1.5 U	< 0.074 U	< 0.0813 UJ
Total	PFOA	335-67-1	0.468 J-	0.32 J	0.155 J	0.052 J	0.29 J	0.319	0.143 J-
Total	PFOS	1763-23-1	5.76 J-	2.7	14	1.16	3.3	14	4.52 J-
Total	PFOSA	754-91-6	0.21 J-	0.16 J	0.557	0.065 BJ	0.15 J	0.461	0.144 J-
Total	PFPeA	2706-90-3	< 0.159 UJ	< 1.1 U	< 0.0826 U	< 0.0764 U	0.31 J	< 0.148 U	< 0.163 UJ
Total	PFPeS	2706-91-4	< 0.0795 UJ	< 1.1 U	< 0.0415 U	< 0.0384 U	< 1.5 U	< 0.074 U	< 0.0813 UJ
Total	PFTeDA	376-06-7	< 0.0795 UJ	0.26 BJ	< 0.0413 U	< 0.0382 U	0.57 BJ	< 0.074 U	< 0.0813 UJ
Total	PFTrDA	72629-94-8	< 0.0795 UJ	< 1.1 U	< 0.0443 U	< 0.0382 U	< 1.5 U	< 0.074 U	< 0.0813 UJ
Total	PFUnA	2058-94-8	0.093 J-	0.21 J	0.089 J	< 0.0382 U	< 1.5 U	< 0.074 U	< 0.0813 UJ

NOTES
All results are reported in micrograms per kilogram (ug/kg).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table1b
Raleigh Creek Sediment
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Raleigh Creek - other
		Location	RC18
		Location ID	82-0109-00-208
		Sample Date	9/17/2020
		Sample Type Code	Sample
		Sample ID	82-0109-00-208.2009171000.000S
		Sample Name	RC18-SED-0-6-01-091720
		Parent Sample ID	NA
Fraction	Compound	CAS #	
Total	10:2 FTS	120226-60-0	< 1.1 U
Total	11Cl-PF3OUdS	763051-92-9	< 1.1 UJ
Total	4:2 FTS	757124-72-4	< 1.1 U
Total	6:2 FTS	27619-97-2	< 1.1 U
Total	8:2 FTS	39108-34-4	< 1.1 U
Total	9Cl-PF3ONS	756426-58-1	< 1.1 U
Total	ADONA	919005-14-4	< 1.1 U
Total	HFPO-DA	13252-13-6	< 1.1 U
Total	N-EtFOSA	4151-50-2	< 1.1 U
Total	N-EtFOSAA	2991-50-6	< 1.1 UJ
Total	N-EtFOSE	1691-99-2	< 1.1 U
Total	N-MeFOSA	31506-32-8	< 1.1 U
Total	N-MeFOSAA	2355-31-9	< 1.1 U
Total	N-MeFOSE	24448-09-7	< 1.1 U
Total	PFBA	375-22-4	< 1.1 U
Total	PFBS	375-73-5	< 1.1 U
Total	PFDA	335-76-2	< 1.1 U
Total	PFDoA	307-55-1	< 1.1 U
Total	PFDoS	79780-39-5	NA
Total	PFDS	335-77-3	< 1.1 U
Total	PFHpA	375-85-9	< 1.1 U
Total	PFHpS	375-92-8	< 1.1 U
Total	PFHxA	307-24-4	< 1.1 U
Total	PFHxS	355-46-4	< 1.1 U
Total	PFNA	375-95-1	< 1.1 U
Total	PFNS	68259-12-1	< 1.1 U
Total	PFOA	335-67-1	0.17 BJ
Total	PFOS	1763-23-1	0.32 J
Total	PFOSA	754-91-6	0.08 J
Total	PFPeA	2706-90-3	< 1.1 U
Total	PFPeS	2706-91-4	< 1.1 U
Total	PFTeDA	376-06-7	0.43 BJ
Total	PFTrDA	72629-94-8	< 1.1 U
Total	PFUnA	2058-94-8	< 1.1 U

NOTES
All results are reported in micrograms per kilogram (ug/kg).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 1c
Raleigh Creek Pore Water
Project 1007
Minneaplis, Minnesota

		Location Group	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper
		Location	RC3A	RC4A	RC5	RC6A	RC6A	RC7	RC13
		Location ID	S016-338	S016-052	S016-189	S016-375	S016-375	S016-053	S016-062
		Sample Date	9/20/2020	9/18/2020	9/16/2020	9/21/2020	9/21/2020	9/20/2020	9/23/2020
		Sample Type Code	Sample	Sample	Sample	Sample	QC-FR	Sample	Sample
		Sample ID	S016-338.2009200900.000S	S016-052.2009181440.000S	S016-189.2009161540.000S	S016-375.2009210950.000S	S016-375.2009210955.000SR	S016-053.2009201045.000S	S016-062.2009230940.000S
		Sample Name	RC3A-POWAT-01-092020	RC4A-POWAT-01-091820	RC5-WAT-POWAT-01-091820	RC6A-POWAT-01-092120	RC6A-POWAT-02-092120	RC7-POWAT-01-092020	RC13-POWAT-01-092320
		Parent Sample ID	NA	NA	NA	NA	S016-375.2009210950.000S	NA	NA
Fraction	Compound	CAS #							
Dissolved	10:2 FTS	120226-60-0	< 0.004 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0041 U	< 0.0045 U	< 0.0043 U
Dissolved	11Cl-PF3OUdS	763051-92-9	< 0.004 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0041 U	< 0.0045 U	< 0.0043 U
Dissolved	4:2 FTS	757124-72-4	< 0.004 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0041 U	< 0.0045 U	< 0.0043 U
Dissolved	6:2 FTS	27619-97-2	< 0.004 U	0.00066 J+	< 0.0042 U	< 0.0042 U	< 0.0041 U	< 0.0045 U	< 0.0043 U
Dissolved	8:2 FTS	39108-34-4	< 0.004 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0041 U	< 0.0045 U	< 0.0043 U
Dissolved	9Cl-PF3ONS	756426-58-1	< 0.004 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0041 U	< 0.0045 U	< 0.0043 U
Dissolved	ADONA	919005-14-4	< 0.004 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0041 U	< 0.0045 U	< 0.0043 U
Dissolved	HFPO-DA	13252-13-6	< 0.004 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0041 U	< 0.0045 U	0.00031 J
Dissolved	N-EtFOSA	4151-50-2	< 0.004 U	< 0.0043 U	< 0.0044 UJ	< 0.0042 U	< 0.0041 U	< 0.0045 U	< 0.0043 U
Dissolved	N-EtFOSAA	2991-50-6	0.045	0.023	0.011 J+	0.01	0.012	0.0099	< 0.0043 UJ
Dissolved	N-EtFOSE	1691-99-2	< 0.004 U	< 0.0043 UJ	< 0.0044 UJ	< 0.0042 U	0.00014 J	< 0.0045 U	< 0.0043 U
Dissolved	N-MeFOSA	31506-32-8	< 0.004 U	< 0.0043 U	0.00059 BJ+	< 0.0042 U	< 0.0041 U	< 0.0045 U	< 0.0043 U
Dissolved	N-MeFOSAA	2355-31-9	< 0.004 U	< 0.0043 U	< 0.0042 UJ	< 0.0042 U	< 0.0041 U	< 0.0045 U	< 0.0043 UJ
Dissolved	N-MeFOSE	24448-09-7	< 0.004 U	< 0.0043 UJ	< 0.0044 UJ	< 0.0042 U	< 0.0041 U	< 0.0045 U	< 0.0043 U
Dissolved	PFBA	375-22-4	0.3	0.86 J+	0.6	0.66	0.7	0.54	0.1
Dissolved	PFBS	375-73-5	0.016	0.025 J+	0.016	0.019	0.02 J+	0.019	0.0032 J
Dissolved	PFDA	335-76-2	0.0094	0.0047	0.0089	0.011	0.01	0.015	< 0.0043 U
Dissolved	PFDoA	307-55-1	< 0.004 U	< 0.0043 U	0.0028 BJ+	< 0.0042 U	< 0.0041 U	< 0.0045 U	< 0.0043 U
Dissolved	PFDS	335-77-3	0.00048 J	< 0.0043 U	0.00051 J-	< 0.042 U	< 0.041 U	< 0.0045 U	< 0.0043 U
Dissolved	PFHpA	375-85-9	0.059	0.068	0.043	0.056 B	0.062 B	0.065	0.0025 J
Dissolved	PFHpS	375-92-8	0.018	0.016	0.0098	0.018 J+	0.022 J+	0.014 J	< 0.0043 U
Dissolved	PFHxA	307-24-4	0.063	0.13	0.076	0.1	0.097	0.094	< 0.0092 U
Dissolved	PFHxS	355-46-4	0.054	0.059	0.03	0.045	0.048	0.046	0.0024 J
Dissolved	PFNA	375-95-1	0.0047	0.0043 J	0.0031 J	0.004 J	0.0046	0.0055	< 0.0043 U
Dissolved	PFNS	68259-12-1	0.00096 J	0.00071 J	0.0012 J	0.0026 J	0.0023 J	< 0.0045 U	< 0.0043 U
Dissolved	PFOA	335-67-1	0.48	0.54 J+	0.38	0.5	0.5	0.57	0.01
Dissolved	PFOS	1763-23-1	2.1	1.2	1.1	1.7 J+	1.8 J+	1.8	0.026 J+
Dissolved	PFOSA	754-91-6	0.025	0.027	0.035	0.029	0.032	0.032	0.001 J
Dissolved	PFPeA	2706-90-3	0.031	0.058	0.039	0.036	0.039	0.045	0.0087
Dissolved	PFPeS	2706-91-4	0.027 J+	0.044 J+	0.023 J+	0.032 J+	0.031 J+	0.027 J+	< 0.0043 U
Dissolved	PFTeDA	376-06-7	< 0.004 U	0.004 BJ+	< 0.0044 UJ	< 0.0042 U	< 0.0041 U	< 0.0045 U	< 0.0043 UJ
Dissolved	PFTrDA	72629-94-8	< 0.004 U	0.0018 J+	< 0.0044 UJ	< 0.0042 U	< 0.0041 U	< 0.0045 U	0.0016 J
Dissolved	PFUnA	2058-94-8	< 0.004 U	< 0.0043 U	0.0018 J+	< 0.0042 U	< 0.0041 U	< 0.0045 U	< 0.0043 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method = ALS_Method PFC/537M

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 1c
Raleigh Creek Pore Water
Project 1007
Minneaplis, Minnesota

		Location Group	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other
		Location	RC16A	RC14	RC21A	RC17	RC17A	RC18A	RC18
		Location ID	S016-314	S016-063	S016-280	S016-065	S016-066	S016-339	82-0109-00-208
		Sample Date	9/21/2020	9/23/2020	9/22/2020	9/21/2020	9/23/2020	9/23/2020	9/17/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	S016-314.2009211050.000S	S016-063.2009231020.000S	S016-280.2009221630.000S	S016-065.2009211230.000S	S016-066.2009231150.000S	S016-339.2009231240.000S	82-0109-00-208.2009170915.000S
		Sample Name	RC16A-POWAT-01-092120	RC14-POWAT-01-092320	RC21A-POWAT-01-092220	RC17-POWAT-01-092120	RC17A-POWAT-01-092320	RC18A-POWAT-01-092320	RC18-POWAT-01-091720
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #							
Dissolved	10:2 FTS	120226-60-0	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0042 U	< 0.0042 U
Dissolved	11Cl-PF3OUdS	763051-92-9	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0042 U	< 0.0042 UJ
Dissolved	4:2 FTS	757124-72-4	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0042 U	< 0.0042 U
Dissolved	6:2 FTS	27619-97-2	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0042 U	< 0.0042 U
Dissolved	8:2 FTS	39108-34-4	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0042 U	< 0.0042 U
Dissolved	9Cl-PF3ONS	756426-58-1	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0042 U	< 0.0042 U
Dissolved	ADONA	919005-14-4	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0042 U	< 0.0042 U
Dissolved	HFPO-DA	13252-13-6	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0042 U	< 0.0042 U
Dissolved	N-EtFOSA	4151-50-2	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0042 U	< 0.0044 UJ
Dissolved	N-EtFOSAA	2991-50-6	0.00077 J	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0042 U	0.0012 J+
Dissolved	N-EtFOSE	1691-99-2	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	0.00024 J	< 0.0042 U	0.00022 BJ
Dissolved	N-MeFOSA	31506-32-8	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0042 U	0.00057 BJ+
Dissolved	N-MeFOSAA	2355-31-9	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0042 U	< 0.0042 UJ
Dissolved	N-MeFOSE	24448-09-7	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0042 U	< 0.0044 UJ
Dissolved	PFBA	375-22-4	0.093	0.1	0.096	0.093	0.1	0.1	0.093
Dissolved	PFBS	375-73-5	0.0025 J	0.0028 J	0.0027 J	0.0027 J	0.0027 J	0.0031 J	0.0028 J
Dissolved	PFDA	335-76-2	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0042 U	0.0013 J
Dissolved	PFDoA	307-55-1	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0042 U	0.0014 BJ+
Dissolved	PFDS	335-77-3	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0042 U	< 0.0044 UJ
Dissolved	PFHpA	375-85-9	0.0035 J	0.0053	0.0034 J	0.0043 J	0.0035 J	0.0037 J	0.0022 J
Dissolved	PFHpS	375-92-8	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0042 U	< 0.0042 U
Dissolved	PFHxA	307-24-4	< 0.0092 U	< 0.0092 U	< 0.0092 U	< 0.0092 U	< 0.0092 U	< 0.0092 U	< 0.0092 U
Dissolved	PFHxS	355-46-4	0.0021 J	0.0031 J	0.0023 J	0.004 J	0.0025 J	0.0039 J	0.0029 J
Dissolved	PFNA	375-95-1	< 0.0044 U	0.0015 J	0.0013 J	< 0.0044 U	< 0.0044 U	< 0.0042 U	< 0.0042 U
Dissolved	PFNS	68259-12-1	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0042 U	< 0.0042 U
Dissolved	PFOA	335-67-1	0.008	0.012	0.0088	0.0088	0.01	0.011	0.011
Dissolved	PFOS	1763-23-1	0.0037 J+	0.0037 J+	0.0051 J+	0.0032 J+	0.011 J+	0.052 J+	0.031
Dissolved	PFOSA	754-91-6	0.0012 J	< 0.0044 U	< 0.0044 U	< 0.0044 U	0.0008 J	0.002 J	0.0027 J
Dissolved	PFPeA	2706-90-3	0.0066	0.0087	0.0074	0.007	0.0083	0.0082	0.0084
Dissolved	PFPeS	2706-91-4	< 0.0044 U	< 0.0044 U	< 0.0044 U	0.0016 J+	< 0.0044 U	< 0.0042 U	0.0017 J+
Dissolved	PFTeDA	376-06-7	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0042 U	NA
Dissolved	PFTrDA	72629-94-8	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0042 U	< 0.0044 UJ
Dissolved	PFUnA	2058-94-8	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0044 U	< 0.0042 U	< 0.0042 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method = ALS_Method PFC/537M

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 1d
Raleigh Creek Foam
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper
		Location	RC5	RC5	RC7A	RC7	RC7	RC12	RC12
		Location ID	S016-189	S016-189	S016-313	S016-053	S016-053	S016-060	S016-060
		Sample Date	2/24/2020	9/20/2020	2/24/2020	8/12/2019	8/14/2019	8/14/2019	4/28/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	S016-189.2002241300.000S	S016-189.2009201130.000S	S016-313.2002241725.000S	S016-053.1908121355.000S	S016-053.1908141415.000S	S016-060.1908141105.000S	S016-060.2004281750.000S
		Sample Name	RC5-FOAM-01-022420	RC5-FOAM-01-092020	RC7A-FOAM-01-022420	RC7-FOAM-081219	RC7-FOAM-081419	RC12-FOAM-081419	RC12-FOAM-01-042820
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #							
Total	11Cl-PF3OUdS	763051-92-9	< 0.0432 U	< 0.785 U	< 3.18 U	< 0.311 U	< 32 U	< 32 U	< 0.281 U
Total	4:2 FTS	757124-72-4	< 0.0432 U	< 0.784 U	< 3.18 U	< 0.311 U	< 32 U	< 32 U	< 0.281 U
Total	6:2 FTS	27619-97-2	< 0.0389 U	4.45	< 2.87 U	< 0.28 U	592	361 J	< 0.253 U
Total	8:2 FTS	39108-34-4	< 0.0432 U	< 0.784 U	< 3.18 U	< 0.311 U	< 32 U	< 32 U	< 0.281 U
Total	9Cl-PF3ONS	756426-58-1	< 0.0432 U	< 0.786 U	< 3.18 U	< 0.311 U	< 32 U	< 32 U	< 0.281 U
Total	ADONA	919005-14-4	< 0.0432 U	< 0.784 U	< 3.18 U	< 0.311 U	< 32 U	< 32 U	< 0.281 U
Total	HFPO-DA	13252-13-6	< 0.0411 U	< 0.745 U	< 3.02 U	< 0.311 U	< 32 U	< 32 U	< 0.267 U
Total	N-EtFOSA	4151-50-2	0.204	< 0.49 U	54.1	5.5	< 20 U	< 20 U	< 0.176 U
Total	N-EtFOSAA	2991-50-6	4.01	22.2	96.4	94.5	263	168	7.7
Total	N-EtFOSE	1691-99-2	< 0.0811 U	< 1.47 U	< 5.97 U	< 0.583 U	< 60 U	< 60 U	< 0.527 U
Total	N-MeFOSA	31506-32-8	0.0131 J	< 0.225 U	5.31	2.12	< 9.2 U	< 9.2 U	< 0.08 U
Total	N-MeFOSAA	2355-31-9	0.0274	0.715 J	1.32 J	1.18	< 8 U	< 8 U	< 0.07 U
Total	N-MeFOSE	24448-09-7	< 0.108 U	< 1.96 U	< 7.96 U	< 0.777 U	< 80 U	< 80 U	< 0.703 U
Total	PFBA	375-22-4	0.51	1.24 J	< 3.18 U	< 0.311 U	< 32 U	< 32 U	0.501 J
Total	PFBS	375-73-5	0.0205 J	< 0.196 U	< 0.796 U	< 0.0777 U	< 8 U	< 8 U	< 0.07 U
Total	PFDA	335-76-2	0.378	19.8	8.2	1.62	96.5	72.8	2.52
Total	PFDoA	307-55-1	< 0.0108 U	< 0.196 U	< 0.796 U	1.17	< 8 U	< 8 U	0.0748 J
Total	PFDoS	79780-39-5	< 0.0108 U	< 0.196 U	< 0.796 U	< 0.0777 U	< 8 U	< 8 U	< 0.07 U
Total	PFDS	335-77-3	0.0155 J	0.472 J	3.16	3.1	< 8 U	< 8 U	0.221 J
Total	PFHpA	375-85-9	0.0905	0.877	< 0.796 U	< 0.0777 U	< 8 U	< 8 U	0.155
Total	PFHpS	375-92-8	0.0788	26.4	< 0.796 U	< 0.0777 U	24.9	< 8 U	1.91
Total	PFHxA	307-24-4	0.0924 J	0.372 J	< 0.796 U	< 0.0777 U	< 8 U	< 8 U	0.124 J
Total	PFHxS	355-46-4	0.0752	2.9	< 0.796 U	< 0.0777 U	< 8 U	< 8 U	0.371
Total	PFNA	375-95-1	0.0394	7.42	< 0.796 U	< 0.0777 U	14.7 J	11.1 J	0.653
Total	PFNS	68259-12-1	0.0416	1.66	2.95	1.1	12.6 J	< 8 U	0.364
Total	PFOA	335-67-1	1.24	141	5.21	0.658	175	16.2 J	9.11
Total	PFOS	1763-23-1	30.7	4410	531	40.1	13800	10500	391
Total	PFOSA	754-91-6	2.96	42.2	103	18.8	270	71.1	3.79
Total	PFPeA	2706-90-3	0.0438 J	< 0.392 U	< 1.59 U	< 0.155 U	< 16 U	< 16 U	< 0.141 U
Total	PFPeS	2706-91-4	0.0233	< 0.197 U	< 0.796 U	< 0.0777 U	< 8 U	< 8 U	< 0.07 U
Total	PFTeDA	376-06-7	< 0.0108 U	< 0.196 U	< 0.796 U	< 0.0777 U	< 8 U	< 8 U	< 0.07 U
Total	PFTrDA	72629-94-8	< 0.0108 U	< 0.196 U	< 0.796 U	< 0.0777 U	< 8 U	< 8 U	< 0.07 U
Total	PFUnA	2058-94-8	0.0217 J	0.311 J	1.8	1.93	< 8 U	< 8 U	0.158

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
J = Estimated concentration.
QC-FR = Duplicate sample.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 1d
Raleigh Creek Foam
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other
		Location	RC16	RC21	RC21	RC21	RC17	RC17A	RC18A
		Location ID	S016-064	S016-280	S016-280	S016-280	S016-065	S016-066	S016-339
		Sample Date	4/7/2020	2/24/2020	4/23/2020	7/22/2020	8/14/2019	8/14/2019	5/5/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	S016-064.2004071600.000S	S016-280.2002241700.000S	S016-280.2004231020.000S	S016-280.2007221200.000S	S016-065.1908140945.000S	S016-066.1908141000.000S	S016-339.2005051800.000S
		Sample Name	RC16-FOAM-01-040720	RC21-FOAM-01-022420	RC21-FOAM-01-042320	RC21-FOAM-01-072220	RC17-FOAM-081419	RC17A-FOAM-081419	RC18A-FOAM-FRESH-01-050520
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #							
Total	11Cl-PF3OUdS	763051-92-9	< 0.0234 U	< 0.0174 U	< 0.023 U	< 0.0324 UJ	< 8 U	< 0.316 U	< 0.026 U
Total	4:2 FTS	757124-72-4	< 0.0234 U	< 0.0174 U	< 0.023 U	< 0.0324 UJ	< 8 U	< 0.316 U	< 0.026 U
Total	6:2 FTS	27619-97-2	< 0.021 U	< 0.0157 U	0.0561 J	< 0.0292 UJ	< 7.2 U	< 0.285 U	< 0.024 U
Total	8:2 FTS	39108-34-4	< 0.0234 U	< 0.0174 U	< 0.023 U	< 0.0324 UJ	< 8 U	< 0.316 U	< 0.026 U
Total	9Cl-PF3ONS	756426-58-1	< 0.0234 U	< 0.0174 U	< 0.023 U	< 0.0324 UJ	< 8 U	< 0.316 U	< 0.026 U
Total	ADONA	919005-14-4	< 0.0234 U	< 0.0174 U	< 0.023 U	< 0.0324 UJ	< 8 U	< 0.316 U	< 0.026 U
Total	HFPO-DA	13252-13-6	< 0.0222 U	< 0.0166 U	< 0.021 U	< 0.0308 UJ	< 8 U	< 0.316 U	< 0.025 U
Total	N-EtFOSA	4151-50-2	< 0.0146 U	< 0.0109 U	< 0.014 U	0.0208 J-	< 5 U	0.211 J	< 0.016 U
Total	N-EtFOSAA	2991-50-6	0.0727	0.136	0.0259	14.1 J-	92.5	10.6	0.324
Total	N-EtFOSE	1691-99-2	< 0.0438 U	< 0.0327 U	< 0.043 U	< 0.0608 UJ	< 15 U	< 0.593 U	< 0.049 U
Total	N-MeFOSA	31506-32-8	< 0.00672 U	< 0.00501 U	< 0.006 U	< 0.00932 UJ	< 2.3 U	< 0.0909 U	< 0.007 U
Total	N-MeFOSAA	2355-31-9	0.0511	0.0315	0.0147	0.132 J-	2.1 J	0.216	0.0814
Total	N-MeFOSE	24448-09-7	< 0.0584 U	< 0.0436 U	< 0.057 U	< 0.0811 UJ	< 20 U	< 0.791 U	< 0.066 U
Total	PFBA	375-22-4	0.0995	0.103	0.0793	0.13 J-	< 8 U	< 0.316 U	0.0963
Total	PFBS	375-73-5	< 0.00584 U	0.00471 J	< 0.005 U	< 0.00811 UJ	< 2 U	< 0.0791 U	< 0.006 U
Total	PFDA	335-76-2	0.475	2.88	0.139	2.48 J-	31.5	5.26	0.697
Total	PFDoA	307-55-1	0.037	0.0237	0.00968 J	0.164 J-	< 2 U	< 0.0791 U	0.149
Total	PFDoS	79780-39-5	< 0.00584 U	< 0.00436 U	< 0.005 U	< 0.00811 UJ	< 2 U	< 0.0791 U	< 0.006 U
Total	PFDS	335-77-3	< 0.00584 U	< 0.00436 U	< 0.005 U	0.339 J-	< 2 U	0.147 J	0.0452
Total	PFHpA	375-85-9	< 0.00584 U	0.0599	0.00617 J	0.0244 J-	< 2 U	< 0.0791 U	< 0.006 U
Total	PFHpS	375-92-8	0.0164	0.642	0.00909 J	0.219 J-	< 2 U	0.243	0.0153
Total	PFHxA	307-24-4	< 0.00584 U	0.0174 J	0.00651 J	0.0179 J-	< 2 U	< 0.0791 U	0.007 J
Total	PFHxS	355-46-4	0.0144 J	1.13	0.0353	0.0347 J-	< 2 U	< 0.0791 U	0.026
Total	PFNA	375-95-1	0.352	7.31	0.184	0.26 J-	< 2 U	0.332	0.312
Total	PFNS	68259-12-1	< 0.00584 U	< 0.00436 U	< 0.005 U	0.536 J-	3.17 J	0.582	0.0211 J
Total	PFOA	335-67-1	0.117	6.79	0.212	0.499 J-	3.75 J	0.504	0.165
Total	PFOS	1763-23-1	3.67	56.4	1.57	147 J-	2750	595	8.22
Total	PFOSA	754-91-6	0.0521	0.214	0.0143	3.93 J-	51	8.78	0.0946
Total	PFPeA	2706-90-3	< 0.0117 U	< 0.00872 U	< 0.011 U	< 0.0162 UJ	< 4 U	< 0.158 U	< 0.013 U
Total	PFPeS	2706-91-4	< 0.00584 U	< 0.00436 U	< 0.005 U	< 0.00811 UJ	< 2 U	< 0.0791 U	< 0.006 U
Total	PFTeDA	376-06-7	< 0.00584 U	< 0.00436 U	< 0.005 U	0.0113 J	< 2 U	< 0.0791 U	0.0128 J
Total	PFTrDA	72629-94-8	0.00678 J	0.00653 J	< 0.005 U	0.0232 J-	< 2 U	< 0.0791 U	0.0292
Total	PFUnA	2058-94-8	0.153	0.196	0.03	0.619 J-	3.63 J	0.401	0.375

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
J = Estimated concentration.
QC-FR = Duplicate sample.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 1e
Raleigh Creek Amphibian Tissue
Project 1007
Minneapolis, Minnesota

Location Group		RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper
Location		RC3A	RC3A	RC4A	RC7	RC5	RC5
Location ID		S016-338	S016-338	S016-052	S016-053	S016-189	S016-189
Sample Type Code		Sample	Sample	Sample	Sample	Sample	Sample
Sample ID		S016-338.2009190825.000S	S016-338.2009240825.000S	S016-052.2009180940.000S	S016-053.2009221645.000S	S016-189.2009181110.000S	S016-189.2009221245.000S
Sample Name		RC3A-AMPH-COMP-ONE-01-091920	RC3A-AMPH-COMP-TWO-01-092420	RC4A-AMPH-COMP-01-091820	RC7-AMPH-01-092220	RC5-AMPH-ONE-01-091820	RC5-AMPH-TWO-01-092220
Sample Date		9/19/2020	9/24/2020	9/18/2020	9/22/2020	9/18/2020	9/22/2020
Compound	CAS #						
11Cl-PF3OUdS	763051-92-9	< 0.485 U	< 0.373 U	< 0.383 U	< 0.374 U	< 0.385 U	< 0.389 U
3:3 FTCA	1169706-83-5	< 0.485 U	< 0.372 U	< 0.383 U	< 0.374 U	< 0.385 U	< 0.388 U
4:2 FTS	757124-72-4	< 0.485 U	< 0.372 U	< 0.383 U	< 0.374 U	< 0.385 U	< 0.388 U
5:3 FTCA	1799325-94-2	< 3.03 U	< 2.33 U	< 2.39 U	< 2.34 U	4.74 J+	< 2.43 U
6:2 FTS	27619-97-2	< 0.437 U	< 0.335 U	< 0.345 U	< 0.337 U	< 0.347 U	3.39
7:3 FTCA	812-70-4	< 3.03 U	< 2.33 U	5 J	< 2.34 U	3.74 J	5.46 J
8:2 FTS	39108-34-4	< 0.485 U	< 0.372 U	< 0.383 U	< 0.374 U	< 0.385 U	< 0.388 U
9Cl-PF3ONS	756426-58-1	< 0.486 U	< 0.373 U	< 0.384 U	< 0.375 U	< 0.386 U	< 0.389 U
ADONA	919005-14-4	< 0.485 U	< 0.372 U	< 0.383 U	< 0.374 U	< 0.385 U	< 0.388 U
HFPO-DA	13252-13-6	< 0.461 U	< 0.353 U	< 0.364 U	< 0.355 U	< 0.365 U	< 0.369 U
N-EtFOSA	4151-50-2	R	< 0.233 U	< 0.239 UJ	< 0.234 UJ	R	< 0.243 UJ
N-EtFOSAA	2991-50-6	2.73	3.17	2.46	0.51	4.91	8.52
N-EtFOSE	1691-99-2	R	R	R	R	R	R
N-MeFOSA	31506-32-8	R	< 0.107 UJ	R	< 0.107 UJ	< 0.111 UJ	< 0.112 UJ
N-MeFOSAA	2355-31-9	0.244 J	0.163 J	0.121 J	< 0.0935 U	0.109 J	0.124 J
N-MeFOSE	24448-09-7	R	R	R	< 0.935 UJ	< 0.962 UJ	< 0.971 UJ
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.121 U	< 0.093 U	< 0.0957 U	< 0.0935 U	< 0.0962 U	< 0.0971 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.242 U	< 0.266 U	< 0.191 U	< 0.187 U	< 0.192 U	< 0.194 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.242 U	< 0.186 U	< 0.191 U	< 0.187 U	< 0.192 U	< 0.194 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.121 U	< 0.093 U	< 0.0957 U	< 0.0935 U	< 0.0962 U	< 0.0971 U
PFBA	375-22-4	1.33 J	0.377 J	1.86	< 0.374 U	0.929 J	2.31
PFBS	375-73-5	< 0.121 U	< 0.093 U	< 0.0957 U	< 0.0935 U	< 0.0962 U	0.197 J
PFDA	335-76-2	0.49	0.56	0.59	0.61	1.94	2.26
PFDoA	307-55-1	0.69	0.45	0.63	0.302 J	1.59	2.59
PFDoS	79780-39-5	1.21	1.39	1.15	< 0.0935 U	0.314 J	0.299 J
PFDS	335-77-3	1.45	1.30	1.79	0.49	7.83	6.64
PFHpA	375-85-9	< 0.121 U	< 0.093 U	< 0.0957 U	< 0.0935 U	< 0.0962 U	< 0.0971 U
PFHpS	375-92-8	< 0.121 U	0.194 J	0.179 J	0.23 J	1.34	1.08
PFHxA	307-24-4	< 0.121 U	< 0.093 U	< 0.0957 U	< 0.0935 U	< 0.0962 U	0.136 J
PFHxS	355-46-4	< 0.121 U	0.206 J	0.157 J	< 0.0935 U	0.43	0.79
PFNA	375-95-1	< 0.121 U	0.118 J	< 0.0957 U	< 0.0935 U	< 0.0962 U	< 0.0971 U
PFNS	68259-12-1	0.181 J	0.188 J	0.304 J	0.271 J	2.71	2.44
PFOA	335-67-1	0.237 J	0.49	0.66	< 0.0935 U	0.312 J	0.65
PFOS	1763-23-1	50.90	78.70	96.90	159.00	688.00	737.00
PFOSA	754-91-6	3.61	3.77	33.80	1.17	11.20	5.03
PFPeA	2706-90-3	< 0.242 U	< 0.186 U	< 0.191 U	< 0.187 U	< 0.192 U	< 0.194 U
PFPeS	2706-91-4	< 0.122 U	< 0.0935 U	< 0.0962 U	< 0.0939 U	< 0.0966 U	0.253 J
PFTeDA	376-06-7	0.414 J+	0.284 J	0.316 J+	0.201 J+	0.31 J+	1.14 J+
PFTrDA	72629-94-8	0.507 B	0.318 BJ	0.355 BJ	0.143 BJ	0.414 B	0.672 B
PFUnA	2058-94-8	0.144 BJ	0.116 BJ	0.165 BJ	0.188 BJ	0.699 B	0.815 B

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 1e
Raleigh Creek Amphibian Tissue
Project 1007
Minneapolis, Minnesota

	Location Group	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other
	Location	RC6A	RC13	RC16A	RC17A	RC18
	Location ID	S016-375	S016-062	S016-314	S016-066	82-0109-00-208
	Sample Type Code	Sample	Sample	Sample	Sample	Sample
	Sample ID	S016-375.2009201300.000S	S016-062.2009210830.000S	S016-314.2009191630.000S	S016-066.2009211205.000S	82-0109-00-208.2009151500.000S
	Sample Name	RC6A-AMPH-01-092020	RC13-AMPH-01-092120	RC16A-AMPH-01-091920	RC17A-AMPH-01-092120	RC18-AMPH-01-091520
	Sample Date	9/20/2020	9/21/2020	9/19/2020	9/21/2020	9/15/2020
Compound	CAS #					
11Cl-PF3OUdS	763051-92-9	< 0.391 U	< 0.378 U	< 0.703 U	< 0.393 U	< 0.385 U
3:3 FTCA	1169706-83-5	< 0.39 U	< 0.377 U	< 0.702 U	< 0.392 U	< 0.385 U
4:2 FTS	757124-72-4	< 0.39 U	< 0.377 U	< 0.702 U	< 0.392 U	< 0.385 U
5:3 FTCA	1799325-94-2	< 2.44 U	2.4 J+	< 4.39 U	< 2.45 U	< 2.4 U
6:2 FTS	27619-97-2	< 0.352 U	< 0.34 U	< 0.632 U	< 0.353 U	< 0.347 U
7:3 FTCA	812-70-4	< 2.44 U	< 2.36 U	< 4.39 U	< 2.45 U	< 2.4 U
8:2 FTS	39108-34-4	< 0.39 U	< 0.377 U	< 0.702 U	< 0.392 U	< 0.385 U
9Cl-PF3ONS	756426-58-1	< 0.391 U	< 0.378 U	< 0.704 U	< 0.393 U	< 0.386 U
ADONA	919005-14-4	< 0.39 U	< 0.377 U	< 0.702 U	< 0.392 U	< 0.385 U
HFPO-DA	13252-13-6	< 0.371 U	< 0.358 U	< 0.667 U	< 0.373 U	< 0.365 U
N-EtFOSA	4151-50-2	R	R	< 0.439 UJ	< 0.245 UJ	< 0.24 UJ
N-EtFOSAA	2991-50-6	2.43	0.354 J	< 0.175 U	< 0.098 U	0.172 J
N-EtFOSE	1691-99-2	R	R	< 1.31 UJ	< 0.733 UJ	R
N-MeFOSA	31506-32-8	R	R	< 0.202 U	< 0.113 U	< 0.111 U
N-MeFOSAA	2355-31-9	< 0.0976 U	< 0.0943 U	< 0.175 U	< 0.098 U	< 0.0962 U
N-MeFOSE	24448-09-7	R	R	< 1.75 UJ	< 0.98 U	< 0.962 U
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.0976 U	< 0.0943 U	< 0.175 U	< 0.098 U	< 0.0962 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.195 U	< 0.189 U	< 0.351 U	< 0.196 U	< 0.192 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.195 U	< 0.189 U	< 0.351 U	< 0.196 U	< 0.192 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.0976 U	< 0.0943 U	< 0.175 U	< 0.098 U	< 0.0962 U
PFBA	375-22-4	0.999 J	< 0.377 U	0.951 J	< 0.392 U	< 0.385 U
PFBS	375-73-5	< 0.0976 U	< 0.0943 U	< 0.175 U	< 0.098 U	< 0.0962 U
PFDA	335-76-2	1.28	0.70	0.624 J	0.197 J	0.53
PFDoA	307-55-1	0.39 J	0.73	0.598 J	0.203 J	0.157 J
PFDoS	79780-39-5	< 0.0976 U	< 0.0943 U	< 0.175 U	< 0.098 U	< 0.0962 U
PFDS	335-77-3	0.63	0.73	< 0.175 U	0.232 J	0.122 J
PFHpA	375-85-9	< 0.0976 U	< 0.0943 U	< 0.175 U	< 0.098 U	< 0.0962 U
PFHpS	375-92-8	0.387 J	0.278 J	< 0.175 U	< 0.098 U	< 0.0962 U
PFHxA	307-24-4	< 0.0976 U	< 0.0943 U	< 0.175 U	< 0.098 U	< 0.0962 U
PFHxS	355-46-4	0.56	< 0.0943 U	< 0.175 U	< 0.098 U	< 0.0962 U
PFNA	375-95-1	< 0.0976 U	< 0.0943 U	< 0.175 U	< 0.098 U	< 0.0962 U
PFNS	68259-12-1	0.46	0.44	< 0.175 U	0.101 J	< 0.0962 U
PFOA	335-67-1	0.43	< 0.0943 U	< 0.175 U	< 0.098 U	< 0.0962 U
PFOS	1763-23-1	324.00	153.00	3.35	30.80	43.20
PFOSA	754-91-6	9.33	1.28	< 0.175 U	0.137 BJ	< 0.0962 U
PFPeA	2706-90-3	< 0.195 U	< 0.189 U	< 0.351 U	< 0.196 U	< 0.192 U
PFPeS	2706-91-4	0.171 J	< 0.0948 U	< 0.176 U	< 0.0985 U	< 0.0966 U
PFTeDA	376-06-7	0.171 J+	R	0.303 J	0.177 J	< 0.0962 U
PFTrDA	72629-94-8	0.181 BJ	0.297 BJ	0.339 BJ	0.287 BJ	0.127 BJ
PFUnA	2058-94-8	0.257 BJ	0.349 BJ	0.579 BJ	0.138 BJ	0.197 BJ

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 1f
Raleigh Creek Crayfish Tissue
Project 1007
Minneapolis, Minnesota

	Location Group	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper
	Location	RC3A	RC4A	RC23	RC23	RC23	RC23
	Location ID	S016-338	S016-052	PS00176	PS00176	PS00176	PS00176
	Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample
	Sample ID	S016-338.2009200850.000S	S016-052.2009250940.000S	PS00176.2009240915.000S	PS00176.2009250940.000S	PS00176.2009250941.000S	PS00176.2009250942.000S
	Sample Name	RC3A-CRAY-01-092020	RC4A-CRAY-01-092520	RC23-CRAY-FOUR-01-092420	RC23-CRAY-COMP-01-092520	RC23-CRAY-ONE-01-092520	RC23-CRAY-THREE-01-092520
	Sample Date	9/20/2020	9/25/2020	9/24/2020	9/25/2020	9/25/2020	9/25/2020
Compound	CAS #						
11Cl-PF3OUdS	763051-92-9	< 0.401 U	< 0.381 U	< 0.395 U	< 0.399 U	< 0.393 U	< 0.389 U
3:3 FTCA	1169706-83-5	< 0.4 U	< 0.381 U	< 0.394 U	< 0.398 U	< 0.392 U	< 0.388 U
4:2 FTS	757124-72-4	< 0.4 U	< 0.381 U	< 0.394 U	< 0.398 U	< 0.392 U	< 0.388 U
5:3 FTCA	1799325-94-2	< 2.5 U	< 2.38 U	< 2.46 U	< 2.49 U	< 2.45 U	< 2.43 U
6:2 FTS	27619-97-2	< 0.361 U	< 0.343 U	< 0.355 U	< 0.359 U	< 0.353 U	< 0.35 U
7:3 FTCA	812-70-4	< 2.5 U	< 2.38 U	< 2.46 U	< 2.49 U	< 2.45 U	< 2.43 U
8:2 FTS	39108-34-4	< 0.4 U	< 0.381 U	< 0.394 U	< 0.398 U	< 0.392 U	< 0.388 U
9Cl-PF3ONS	756426-58-1	< 0.401 U	< 0.382 U	< 0.395 U	< 0.399 U	< 0.393 U	< 0.389 U
ADONA	919005-14-4	< 0.4 U	< 0.381 U	< 0.394 U	< 0.398 U	< 0.392 U	< 0.388 U
HFPO-DA	13252-13-6	< 0.38 U	< 0.362 U	< 0.374 U	< 0.378 U	< 0.373 U	< 0.369 U
N-EtFOSA	4151-50-2	< 0.25 U	< 0.238 UJ	< 0.246 U	R	< 0.245 U	< 0.243 U
N-EtFOSAA	2991-50-6	3.27	5.4	1.41	1.5	1.95	1.75
N-EtFOSE	1691-99-2	R	R	R	R	R	R
N-MeFOSA	31506-32-8	< 0.115 UJ	< 0.11 UJ	< 0.113 UJ	< 0.114 UJ	< 0.113 UJ	< 0.112 UJ
N-MeFOSAA	2355-31-9	< 0.1 U	0.194 J	< 0.0985 U	< 0.0995 U	< 0.098 U	< 0.0971 U
N-MeFOSE	24448-09-7	< 1 U	< 0.952 UJ	< 0.985 UJ	R	< 0.98 U	< 0.971 UJ
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.1 U	< 0.0952 U	< 0.0985 U	< 0.0995 U	< 0.098 U	< 0.0971 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.2 U	< 0.19 U	< 0.197 U	< 0.199 U	< 0.196 U	< 0.194 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.2 U	0.624 J	< 0.197 U	< 0.199 U	< 0.196 U	< 0.194 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.1 U	< 0.0952 U	< 0.0985 U	< 0.0995 U	< 0.098 U	< 0.0971 U
PFBA	375-22-4	3.14 B	5.32 B	5.73 B	7.21	5.68 B	4.2 B
PFBS	375-73-5	0.951	1.63	0.421	0.452	0.703	0.216 J
PFDA	335-76-2	0.159 J	0.959	0.721	1.19	2.09	0.762
PFDoA	307-55-1	1.25	2.07	2.32	1.74	2.36	2.18
PFDoS	79780-39-5	0.924	1.8	0.134 J	0.138 J	0.222 J	0.133 J
PFDS	335-77-3	0.243 J	1.09	0.47	0.645	0.699	0.794
PFHpA	375-85-9	0.689	0.235 J+	1.6	1.73	1.67	0.78
PFHpS	375-92-8	0.11 J	0.569	0.235 J	0.389 J	0.32 J	0.196 J
PFHxA	307-24-4	0.216 J	0.595	0.4	0.642	0.424	0.221 J
PFHxS	355-46-4	0.53	3.12	0.984	1.51	1.77	0.683
PFNA	375-95-1	< 0.1 U	< 0.0952 U	0.118 J	0.104 J	< 0.098 U	< 0.0971 U
PFNS	68259-12-1	< 0.1 U	0.267 J	0.103 J	0.18 J	0.179 J	0.185 J
PFOA	335-67-1	1.38	8.86	11.5	13.4	12.1	7.76
PFOS	1763-23-1	26.2	153	57.2	92.6	88.9	67.4
PFOSA	754-91-6	104	56.5	87.4	70.6	73.5	105
PFPeA	2706-90-3	< 0.2 U	0.301 J	0.276 J	0.324 J	0.277 J	< 0.194 U
PFPeS	2706-91-4	1.08	< 0.0957 U	0.753	0.846	1.26	0.488
PFTeDA	376-06-7	0.623	0.813	0.193 J	0.16 J	0.323 J	0.132 J
PFTrDA	72629-94-8	0.805 B	1.02 B	0.306 BJ	0.204 BJ	0.578 B	0.272 BJ
PFUnA	2058-94-8	0.233 BJ	0.386 B	1.27	1.18 B	1.84	1.38

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 1f
Raleigh Creek Crayfish Tissue
Project 1007
Minneapolis, Minnesota

Location Group		RA_Raleigh Creek - upper	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other
Location		RC23	RC14	RC21B	RC21	RC21	RC21	RC21A
Location ID		PS00176	S016-063	S016-280	S016-280	S016-280	S016-280	S016-280
Sample Type Code		Sample	Sample	Sample	Sample	Sample	Sample	Sample
Sample ID		PS00176.2009250943.000S	S016-063.2009210800.000S	S016-280.2009210900.000S	S016-280.2009210915.000S	S016-280.2009210916.000S	S016-280.2009210917.000S	S016-280.2009210945.000S
Sample Name		RC23-CRAY-TWO-01-092520	RC14-CRAY-01-092120	RC21B-CRAY-01-092120	RC21-CRAY-ONE-01-092120	RC21-CRAY-THREE-01-092120	RC21-CRAY-TWO-01-092120	RC21A-CRAY-ONE-01-092120
Sample Date		9/25/2020	9/21/2020	9/21/2020	9/21/2020	9/21/2020	9/21/2020	9/21/2020
Compound	CAS #							
11Cl-PF3OUdS	763051-92-9	< 0.381 U	< 0.389 U	< 0.397 U	< 0.383 U	< 0.387 U	< 0.399 U	< 0.389 U
3:3 FTCA	1169706-83-5	< 0.381 U	< 0.388 U	< 0.396 U	< 0.383 U	< 0.386 U	< 0.398 U	< 0.388 U
4:2 FTS	757124-72-4	< 0.381 U	< 0.388 U	< 0.396 U	< 0.383 U	< 0.386 U	< 0.398 U	< 0.388 U
5:3 FTCA	1799325-94-2	< 2.38 U	< 2.43 U	< 2.48 U	< 2.39 U	< 2.42 U	< 2.49 U	< 2.43 U
6:2 FTS	27619-97-2	< 0.343 U	< 0.35 U	< 0.357 U	< 0.345 U	< 0.348 U	< 0.359 U	< 0.35 U
7:3 FTCA	812-70-4	< 2.38 U	< 2.43 U	< 2.48 U	< 2.39 U	< 2.42 U	< 2.49 U	< 2.43 U
8:2 FTS	39108-34-4	< 0.381 U	< 0.388 U	< 0.396 U	< 0.383 U	< 0.386 U	< 0.398 U	< 0.388 U
9Cl-PF3ONS	756426-58-1	< 0.382 U	< 0.389 U	< 0.397 U	< 0.384 U	< 0.387 U	< 0.399 U	< 0.389 U
ADONA	919005-14-4	< 0.381 U	< 0.388 U	< 0.396 U	< 0.383 U	< 0.386 U	< 0.398 U	< 0.388 U
HFPO-DA	13252-13-6	< 0.362 U	< 0.369 U	< 0.376 U	< 0.364 U	< 0.367 U	< 0.378 U	< 0.369 U
N-EtFOSA	4151-50-2	< 0.238 U	R	< 0.248 UJ	< 0.239 U	< 0.242 U	< 0.249 UJ	< 0.243 UJ
N-EtFOSAA	2991-50-6	2.07	< 0.0971 U	< 0.099 U	0.173 J	< 0.0966 U	< 0.0995 U	< 0.0971 U
N-EtFOSE	1691-99-2	< 0.712 UJ	R	R	R	R	R	R
N-MeFOSA	31506-32-8	< 0.11 UJ	< 0.112 UJ	< 0.114 UJ	< 0.11 UJ	R	< 0.114 UJ	< 0.112 UJ
N-MeFOSAA	2355-31-9	< 0.0952 U	< 0.0971 U	< 0.099 U	< 0.0957 U	< 0.0966 U	< 0.0995 U	< 0.0971 U
N-MeFOSE	24448-09-7	< 0.952 UJ	< 0.971 UJ	< 0.99 U	< 0.957 U	< 0.966 UJ	< 0.995 UJ	< 0.971 UJ
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.0952 U	< 0.0971 U	< 0.099 U	< 0.0957 U	< 0.0966 U	< 0.0995 U	< 0.0971 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.19 U	< 0.194 U	< 0.198 U	< 0.191 U	< 0.193 U	< 0.199 U	< 0.194 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.19 U	< 0.194 U	< 0.198 U	< 0.191 U	< 0.193 U	< 0.199 U	< 0.194 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.0952 U	< 0.0971 U	< 0.099 U	< 0.0957 U	< 0.0966 U	< 0.0995 U	< 0.0971 U
PFBA	375-22-4	4.3 B	1.76 B	1.3 BJ-	1.46 BJ	1.42 BJ	2.28 B	2.75
PFBS	375-73-5	0.189 J	< 0.0971 U	< 0.099 U	0.2 J	< 0.0966 U	< 0.0995 U	0.575
PFDA	335-76-2	0.649	0.85	0.548	1.52	0.321 J	0.24 J	0.709
PFDoA	307-55-1	1.7	0.73	0.533	1.3	0.393	0.333 J	0.868
PFDoS	79780-39-5	0.116 J	< 0.0971 U	< 0.099 U	0.099 J	< 0.0966 U	< 0.0995 U	< 0.0971 U
PFDS	335-77-3	0.605	< 0.0971 U	< 0.099 U	0.305 J	< 0.0966 U	< 0.0995 U	0.116 J
PFHpA	375-85-9	1.21	< 0.0971 U	< 0.099 U	< 0.0957 U	< 0.0966 U	0.177 J	0.71
PFHpS	375-92-8	0.215 J	< 0.0971 U	< 0.099 U	< 0.0957 U	< 0.0966 U	< 0.0995 U	0.199 J
PFHxA	307-24-4	0.25 J	< 0.0971 U	< 0.128 U	< 0.0957 U	< 0.0966 U	< 0.0995 U	0.183 J
PFHxS	355-46-4	0.847	0.181 J	0.108 J	0.388	0.133 J	0.161 J	0.603
PFNA	375-95-1	0.1 J	0.605	0.297 J	0.676	0.234 J	0.129 J	0.192 J
PFNS	68259-12-1	0.138 J	< 0.0971 U	< 0.099 U	< 0.0957 U	< 0.0966 U	< 0.0995 U	< 0.0971 U
PFOA	335-67-1	7.31	1.67	1.43	1.98	1.25	0.435	5.5
PFOS	1763-23-1	61.7	12.9	7.36	26.3	4.74	2.29	54.1
PFOSA	754-91-6	75.6	1.54	1.69	12.1	2.42	4.48	7.48
PFPeA	2706-90-3	< 0.19 U	< 0.194 U	< 0.198 U	< 0.191 U	< 0.193 U	< 0.199 U	< 0.194 U
PFPeS	2706-91-4	0.422	< 0.0976 U	< 0.0995 U	< 0.0962 U	< 0.0971 U	< 0.1 U	0.372 J
PFTeDA	376-06-7	0.097 J	0.273 J	0.285 J	0.635	0.195 J	0.134 J	0.346 J+
PFTrDA	72629-94-8	0.141 BJ	0.298 BJ	0.25 BJ	0.658 B	0.209 BJ	0.132 BJ	0.344 BJ
PFUnA	2058-94-8	0.94 B	0.699 B	0.372 BJ	1.18 B	0.289 BJ	0.242 BJ	0.536 B

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 1f
Raleigh Creek Crayfish Tissue
Project 1007
Minneapolis, Minnesota

	Location Group	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other
	Location	RC21A	RC21A	RC17	RC17A	RC18A
	Location ID	S016-280	S016-280	S016-065	S016-066	S016-339
	Sample Type Code	Sample	Sample	Sample	Sample	Sample
	Sample ID	S016-280.2009210946.000S	S016-280.2009210947.000S	S016-065.2009191500.000S	S016-066.2009211155.000S	S016-339.2009211245.000S
	Sample Name	RC21A-CRAY-THREE-01-092120	RC21A-CRAY-TWO-01-092120	RC17-CRAY-ONE-01-091920	RC17A-CRAY-01-092120	RC18A-CRAY-01-092120
	Sample Date	9/21/2020	9/21/2020	9/19/2020	9/21/2020	9/21/2020
Compound	CAS #					
11Cl-PF3OUdS	763051-92-9	< 0.393 U	< 0.391 U	< 0.397 U	< 0.387 U	< 0.399 U
3:3 FTCA	1169706-83-5	< 0.392 U	< 0.39 U	< 0.396 U	< 0.386 U	< 0.398 U
4:2 FTS	757124-72-4	< 0.392 U	< 0.39 U	< 0.396 U	< 0.386 U	< 0.398 U
5:3 FTCA	1799325-94-2	< 2.45 U	< 2.44 U	< 2.48 U	< 2.42 U	< 2.49 U
6:2 FTS	27619-97-2	1.53	< 0.352 U	< 0.357 U	< 0.348 U	< 0.359 U
7:3 FTCA	812-70-4	< 2.45 U	< 2.44 U	< 2.48 U	< 2.42 U	< 2.49 U
8:2 FTS	39108-34-4	< 0.392 U	< 0.39 U	< 0.396 U	< 0.386 U	< 0.398 U
9Cl-PF3ONS	756426-58-1	< 0.393 U	< 0.391 U	< 0.397 U	< 0.387 U	< 0.399 U
ADONA	919005-14-4	< 0.392 U	< 0.39 U	< 0.396 U	< 0.386 U	< 0.398 U
HFPO-DA	13252-13-6	< 0.373 U	< 0.371 U	< 0.376 U	R	< 0.378 U
N-EtFOSA	4151-50-2	R	R	R	R	R
N-EtFOSAA	2991-50-6	< 0.098 U	< 0.0976 U	< 0.099 U	< 0.0966 U	< 0.0995 U
N-EtFOSE	1691-99-2	R	R	R	R	R
N-MeFOSA	31506-32-8	< 0.113 UJ	< 0.112 U	< 0.114 UJ	< 0.111 UJ	< 0.114 UJ
N-MeFOSAA	2355-31-9	< 0.098 U	< 0.0976 U	< 0.099 U	< 0.0966 U	< 0.0995 U
N-MeFOSE	24448-09-7	< 0.98 UJ	< 0.976 UJ	R	R	R
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.098 U	< 0.0976 U	< 0.099 U	< 0.0966 U	< 0.0995 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.196 U	< 0.195 U	< 0.198 U	< 0.193 U	< 0.199 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.196 U	< 0.195 U	< 0.198 U	< 0.193 U	< 0.199 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.098 U	< 0.0976 U	< 0.099 U	< 0.0966 U	< 0.0995 U
PFBA	375-22-4	1.41 J	1.51 BJ	1.13 BJ	1.63 B	2.14 B
PFBS	375-73-5	< 0.098 U	0.173 J	< 0.099 U	< 0.0966 U	< 0.0995 U
PFDA	335-76-2	0.677	0.639	0.835	0.508	0.839
PFDoA	307-55-1	0.977	0.814	0.53	0.619	0.743
PFDoS	79780-39-5	< 0.098 U	< 0.0976 U	< 0.099 U	< 0.0966 U	< 0.0995 U
PFDS	335-77-3	0.113 J	0.163 J	< 0.099 U	< 0.0966 U	0.13 J
PFHpA	375-85-9	< 0.098 U	0.116 J	< 0.099 U	0.121 J	< 0.0995 U
PFHpS	375-92-8	< 0.098 U	< 0.0976 U	< 0.099 U	< 0.0966 U	< 0.0995 U
PFHxA	307-24-4	< 0.098 U	< 0.0976 U	< 0.099 U	< 0.0966 U	< 0.0995 U
PFHxS	355-46-4	0.147 J	0.172 J	1.03 J	0.144 J	0.338 J
PFNA	375-95-1	0.416	0.314 J	0.269 J	0.324 J	0.565
PFNS	68259-12-1	< 0.098 U	< 0.0976 U	< 0.099 U	< 0.0966 U	< 0.0995 U
PFOA	335-67-1	1.77	0.948	1.19	1.15	2.15
PFOS	1763-23-1	19.6	17.3	14.4	9.01	18.6
PFOSA	754-91-6	1.25	2.14	1.48	1.26	1.95
PFPeA	2706-90-3	< 0.196 U	< 0.195 U	< 0.198 U	< 0.193 U	< 0.199 U
PFPeS	2706-91-4	< 0.0985 U	< 0.098 U	< 0.0995 U	< 0.0971 U	< 0.1 U
PFTeDA	376-06-7	0.345 J	0.336 J	0.295 J	0.337 J	0.445
PFTrDA	72629-94-8	0.331 BJ	0.405 B	0.316 BJ	0.362 BJ	0.458 B
PFUnA	2058-94-8	0.705 B	0.584 B	0.439 B	0.51 B	0.525 B

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 1g
Raleigh Creek Snail Tissue
Project 1007
Minneapolis, Minnesota

	Location Group	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper
	Location	RC3A	RC23
	Location ID	S016-338	PS00176
	Sample Type Code	Sample	Sample
	Sample ID	S016-338.2009240826.000S	PS00176.2009240916.000S
	Sample Name	RC3A-SNAIL-COMP-01-092420	RC23-SNAIL-COMP-01-092420
	Sample Date	9/24/2020	9/24/2020
Compound	CAS #		
11Cl-PF3OUdS	763051-92-9	< 0.485 U	< 1.01 U
3:3 FTCA	1169706-83-5	< 0.485 U	< 1.01 U
4:2 FTS	757124-72-4	< 0.485 U	< 1.01 U
5:3 FTCA	1799325-94-2	< 3.03 U	< 6.33 U
6:2 FTS	27619-97-2	< 0.437 U	< 0.913 U
7:3 FTCA	812-70-4	< 3.03 U	< 6.33 U
8:2 FTS	39108-34-4	< 0.485 U	< 1.01 U
9Cl-PF3ONS	756426-58-1	< 0.486 U	< 1.02 U
ADONA	919005-14-4	< 0.485 U	< 1.01 U
HFPO-DA	13252-13-6	< 0.461 U	< 0.962 U
N-EtFOSA	4151-50-2	< 0.303 UJ	< 0.633 U
N-EtFOSAA	2991-50-6	5.71	22.9
N-EtFOSE	1691-99-2	R	R
N-MeFOSA	31506-32-8	< 0.139 UJ	< 0.291 U
N-MeFOSAA	2355-31-9	0.669 J	0.784 J
N-MeFOSE	24448-09-7	R	< 2.53 UJ
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.121 U	< 0.253 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.242 U	< 0.506 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.242 U	< 0.506 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	0.137 J	< 0.253 U
PFBA	375-22-4	0.678 J	1.68 J
PFBS	375-73-5	< 0.121 U	< 0.253 U
PFDA	335-76-2	0.208 J	1.45
PFDoA	307-55-1	0.746	0.788 J
PFDoS	79780-39-5	0.679	< 0.253 U
PFDS	335-77-3	1.02	1.87
PFHpA	375-85-9	< 0.121 U	< 0.253 U
PFHpS	375-92-8	< 0.121 U	< 0.253 U
PFHxA	307-24-4	< 0.121 U	< 0.253 U
PFHxS	355-46-4	< 0.121 U	0.267 J
PFNA	375-95-1	< 0.121 U	< 0.253 U
PFNS	68259-12-1	< 0.121 U	0.629 J
PFOA	335-67-1	0.466 J	0.655 J
PFOS	1763-23-1	10.7	66
PFOSA	754-91-6	23.6	66.3
PFPeA	2706-90-3	< 0.242 U	< 0.506 U
PFPeS	2706-91-4	< 0.122 U	< 0.254 U
PFTeDA	376-06-7	0.46 J+	< 0.253 UJ
PFTrDA	72629-94-8	0.371 BJ	< 0.253 U
PFUnA	2058-94-8	0.14 BJ	1.09 B

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 1h
Raleigh Creek Bottom Fish Tissue
Project 1007
Minneapolis, Minnesota

	Location Group	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Eagle Point Lake	RA_Raleigh Creek - other
	Location	RC22	RC7	EP27C	RC18
	Location ID	PS00175	S016-053	82-0109-00-457	82-0109-00-208
	Sample Type Code	Sample	Sample	Sample	Sample
	Sample ID	PS00175.2009180915.000S	S016-053.2009181300.000S	82-0109-00-457.2009151030.000S	82-0109-00-208.2009191400.000S
	Sample Name	RC22-BOTF-WHO-01-091820	RC7-BOTF-WHO-01-091820	EP27C-BOTF-WHO-01-091520	RC18-BOTF-WHO-01-091920
	Sample Date	9/18/2020	9/18/2020	9/15/2020	9/19/2020
Compound	CAS #				
11Cl-PF3OUdS	763051-92-9	< 0.397 U	< 0.401 U	< 0.387 U	< 0.397 U
3:3 FTCA	1169706-83-5	< 0.396 U	< 0.4 U	< 0.386 U	< 0.396 U
4:2 FTS	757124-72-4	< 0.396 U	< 0.4 U	< 0.386 U	< 0.396 U
5:3 FTCA	1799325-94-2	< 2.48 U	< 2.5 U	< 2.42 U	< 2.48 U
6:2 FTS	27619-97-2	< 0.357 U	< 0.361 U	< 0.348 U	< 0.357 U
7:3 FTCA	812-70-4	< 2.48 U	< 2.5 U	< 2.42 U	< 2.48 U
8:2 FTS	39108-34-4	< 0.396 U	< 0.4 U	< 0.386 U	< 0.396 U
9Cl-PF3ONS	756426-58-1	< 0.397 U	< 0.401 U	< 0.387 U	< 0.397 U
ADONA	919005-14-4	< 0.396 U	< 0.4 U	< 0.386 U	< 0.396 U
HFPO-DA	13252-13-6	< 0.376 UJ	< 0.38 UJ	< 0.367 UJ	< 0.376 UJ
N-EtFOSA	4151-50-2	< 0.248 UJ	< 0.25 UJ	< 0.242 UJ	< 0.248 UJ
N-EtFOSAA	2991-50-6	1.91	2.25	< 0.0966 U	< 0.099 U
N-EtFOSE	1691-99-2	R	R	R	R
N-MeFOSA	31506-32-8	< 0.114 UJ	< 0.115 UJ	< 0.111 UJ	< 0.114 UJ
N-MeFOSAA	2355-31-9	0.117 J	0.156 J	< 0.0966 U	< 0.099 U
N-MeFOSE	24448-09-7	R	< 1 UJ	R	R
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.099 U	< 0.1 U	< 0.0966 U	< 0.099 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.326 U	< 0.359 U	< 0.3 U	< 0.537 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.198 U	< 0.2 U	< 0.193 U	< 0.198 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.099 U	< 0.1 U	< 0.0966 U	< 0.099 U
PFBA	375-22-4	0.649 BJ	0.905 BJ	0.69 BJ	0.641 BJ
PFBS	375-73-5	< 0.099 U	< 0.1 U	< 0.0966 U	< 0.099 U
PFDA	335-76-2	8.85	8.44	2.78	1.16
PFDoA	307-55-1	3.07	3.26	0.27 J	1.77
PFDoS	79780-39-5	1.09	0.7	< 0.0966 U	0.861
PFDS	335-77-3	8.02	7.32	0.25 J	2.88
PFHpA	375-85-9	< 0.099 U	< 0.1 U	< 0.0966 U	< 0.099 U
PFHpS	375-92-8	0.797	1.3	< 0.0966 U	< 0.099 U
PFHxA	307-24-4	< 0.099 U	< 0.1 U	< 0.0966 U	< 0.114 U
PFHxS	355-46-4	0.12 J	0.383 J	< 0.0966 U	< 0.099 U
PFNA	375-95-1	< 0.099 U	< 0.1 U	< 0.0966 U	< 0.099 U
PFNS	68259-12-1	3.91	3.42	0.439	0.652
PFOA	335-67-1	0.414	0.872	0.126 J	< 0.099 U
PFOS	1763-23-1	882	918	212	58.7
PFOSA	754-91-6	89.5	155	1.12	1.63
PFPeA	2706-90-3	< 0.198 U	< 0.2 U	< 0.193 U	< 0.198 U
PFPeS	2706-91-4	< 0.0995 U	< 0.101 U	< 0.0971 U	< 0.0995 U
PFTeDA	376-06-7	0.585 J+	0.517 J+	< 0.0966 UJ	0.855
PFTrDA	72629-94-8	0.658 B	0.58 B	< 0.0966 U	0.916 B
PFUnA	2058-94-8	2.83	2.5	0.742 B	1.18 B

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 1i
Raleigh Creek Forage Fish Tissue
Project 1007
Minneapolis, Minnesota

Location Group		RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper	RA_Raleigh Creek - upper
Location		RC3A	RC4A	RC5	RC7	RC22	RC22
Location ID		S016-338	S016-052	S016-189	S016-053	PS00175	PS00175
Sample Type Code		Sample	Sample	Sample	Sample	Sample	Sample
Sample ID		S016-338.2009191415.000S	S016-052.2009181040.000S	S016-189.2009181100.000S	S016-053.2009201400.000S	PS00175.2009180916.000S	PS00175.2009180917.000S
Sample Name		RC3A-FORE-COMP-ONE-01-091920	RC4A-FORE-COMP-091820	RC5-FORE-WHO-ONE-091820	RC7-FORE-COMP-ONE-01-092020	RC22-FORE-COMP-TWO-091820	RC22-FORE-WHO-091820
Sample Date		9/19/2020	9/18/2020	9/18/2020	9/20/2020	9/18/2020	9/18/2020
Compound	CAS #						
11Cl-PF3OUdS	763051-92-9	< 0.397 U	< 0.393 U	< 0.385 U	< 0.395 U	< 0.391 U	< 0.385 U
3:3 FTCA	1169706-83-5	< 0.396 U	< 0.392 U	< 0.385 U	< 0.394 U	< 0.39 U	< 0.385 U
4:2 FTS	757124-72-4	< 0.396 U	< 0.392 U	< 0.385 U	< 0.394 U	< 0.39 U	< 0.385 U
5:3 FTCA	1799325-94-2	< 2.48 U	< 2.45 U	< 2.4 U	< 2.46 U	< 2.44 U	< 2.4 U
6:2 FTS	27619-97-2	< 0.357 U	< 0.353 U	< 0.347 U	< 0.355 U	< 0.352 U	3.02
7:3 FTCA	812-70-4	< 2.48 U	< 2.45 U	< 2.4 U	< 2.46 U	< 2.44 U	4.36 J
8:2 FTS	39108-34-4	< 0.396 U	< 0.392 U	< 0.385 U	< 0.394 U	< 0.39 U	< 0.385 U
9Cl-PF3ONS	756426-58-1	< 0.397 U	< 0.393 U	< 0.386 U	< 0.395 U	< 0.391 U	< 0.386 U
ADONA	919005-14-4	< 0.396 U	< 0.392 U	< 0.385 U	< 0.394 U	< 0.39 U	< 0.385 U
HFPO-DA	13252-13-6	< 0.376 UJ	< 0.373 UJ	< 0.365 UJ	R	< 0.371 U	< 0.365 UJ
N-EtFOSA	4151-50-2	< 0.248 U	0.295 J+	0.596	< 0.246 UJ	< 0.244 UJ	< 0.24 UJ
N-EtFOSAA	2991-50-6	25.8 J-	38 J-	26.8 J-	12.4 J-	8.3 J-	11.6 J-
N-EtFOSE	1691-99-2	1.5 J+	R	< 0.719 UJ	R	R	R
N-MeFOSA	31506-32-8	< 0.114 U	< 0.113 U	0.125 J	< 0.113 UJ	< 0.112 U	< 0.111 UJ
N-MeFOSAA	2355-31-9	0.274 J	0.585	0.19 J	0.496	0.499	0.435
N-MeFOSE	24448-09-7	R	R	R	R	R	< 0.962 UJ
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.099 U	< 0.098 U	< 0.0962 U	< 0.0985 U	< 0.0976 U	< 0.0962 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.198 U	< 0.548 U	< 0.192 U	< 0.198 U	< 0.195 U	< 0.295 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.198 U	< 0.196 U	< 0.192 U	< 0.197 U	< 0.195 U	< 0.192 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.099 U	< 0.098 U	< 0.0962 U	< 0.0985 U	< 0.0976 U	< 0.0962 U
PFBA	375-22-4	1.17 J	1.71	0.79 J	0.647 J	0.596 J	0.553 J
PFBS	375-73-5	< 0.099 U	< 0.098 U	< 0.0962 U	< 0.0985 U	< 0.0976 U	< 0.0962 U
PFDA	335-76-2	22.4	26.1	21.8	13.9	34.8	23
PFDoA	307-55-1	5.81	7.34	4.28	2.21	2.3	6.44
PFDoS	79780-39-5	26.6	14.6	6.86	0.498	0.625	9.43
PFDS	335-77-3	42.1	52	35.2	8.34	12.9	40.2
PFHpA	375-85-9	0.339 J	0.834	< 0.0962 U	< 0.0985 U	< 0.0976 U	< 0.0962 U
PFHpS	375-92-8	29.2	33.9	39.6	3.12	5.87	2.28
PFHxA	307-24-4	< 0.262 U	0.273 J	< 0.207 U	< 0.0985 U	< 0.0976 U	< 0.159 U
PFHxS	355-46-4	7.66	11.4	4.18	0.205 J	0.808	0.126 J
PFNA	375-95-1	1.89	3	1.47	0.17 J	0.474	< 0.0962 U
PFNS	68259-12-1	13.6	18	19.9	8.86	13.2	29
PFOA	335-67-1	22.8	63.4	4.23	0.557	1	0.257 J
PFOS	1763-23-1	4720	6060	6350	3150	3790	5630
PFOSA	754-91-6	146	367	405	117	61.7 J-	57.1 J-
PFPeA	2706-90-3	< 0.198 U	< 0.196 U	< 0.192 U	< 0.197 U	< 0.195 U	< 0.192 U
PFPeS	2706-91-4	0.232 J	0.58	0.183 J	< 0.099 U	< 0.098 U	< 0.0966 U
PFTeDA	376-06-7	1.01	0.91	0.844	0.588 J+	0.264 J+	1.71
PFTrDA	72629-94-8	1.67	1.93	1.09	0.491	0.32 J	1.78
PFUnA	2058-94-8	2.88	3.53	2.71	2.56	4.58	5.19

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 1i
Raleigh Creek Forage Fish Tissue
Project 1007
Minneapolis, Minnesota

Location Group		RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other	RA_Raleigh Creek - other
Location		RC16A	RC16A	RC21A	RC17	RC17	RC18A
Location ID		S016-314	S016-314	S016-280	S016-065	S016-065	S016-339
Sample Type Code		Sample	Sample	Sample	Sample	Sample	Sample
Sample ID		S016-314.2009191631.000S	S016-314.2009191632.000S	S016-280.2009210948.000S	S016-065.2009191501.000S	S016-065.2009191502.000S	S016-339.2009211135.000S
Sample Name		RC16A-FORE-COMP-ONE-01-091920	RC16A-FORE-COMP-TWO-01-091920	RC21A-FORE-WHO-01-092120	RC17-FORE-COMP-ONE-01-091920	RC17-FORE-COMP-TWO-01-091920	RC18A-FORE-WHO-01-092120
Sample Date		9/19/2020	9/19/2020	9/21/2020	9/19/2020	9/19/2020	9/21/2020
Compound	CAS #						
11Cl-PF3OUdS	763051-92-9	< 0.387 U	< 0.389 U	< 0.393 U	< 0.387 U	< 0.389 U	< 0.393 U
3:3 FTCA	1169706-83-5	< 0.386 U	< 0.388 U	< 0.392 U	< 0.386 U	< 0.388 U	< 0.392 U
4:2 FTS	757124-72-4	< 0.386 U	< 0.388 U	< 0.392 U	< 0.386 U	< 0.388 U	< 0.392 U
5:3 FTCA	1799325-94-2	< 2.42 U	< 2.43 U	< 2.45 U	< 2.42 U	< 2.43 U	< 2.45 U
6:2 FTS	27619-97-2	< 0.348 U	< 0.35 U	< 0.353 U	0.488 J	< 0.35 U	< 0.353 U
7:3 FTCA	812-70-4	< 2.42 U	< 2.43 U	< 2.45 U	< 2.42 U	< 2.43 U	< 2.45 U
8:2 FTS	39108-34-4	< 0.386 U	< 0.388 U	< 0.392 U	< 0.386 U	< 0.388 U	< 0.392 U
9Cl-PF3ONS	756426-58-1	< 0.387 U	< 0.389 U	< 0.393 U	< 0.387 U	< 0.389 U	< 0.393 U
ADONA	919005-14-4	< 0.386 U	< 0.388 U	< 0.392 U	< 0.386 U	< 0.388 U	< 0.392 U
HFPO-DA	13252-13-6	< 0.367 UJ	< 0.369 U	< 0.373 U	< 0.367 UJ	< 0.369 U	R
N-EtFOSA	4151-50-2	< 0.242 UJ	< 0.243 UJ	< 0.245 UJ	< 0.242 UJ	R	R
N-EtFOSAA	2991-50-6	< 0.0966 U	0.167 J	< 0.098 U	< 0.0966 U	0.277 J	0.195 J
N-EtFOSE	1691-99-2	R	R	R	R	R	< 0.733 U
N-MeFOSA	31506-32-8	< 0.111 UJ	< 0.112 UJ	< 0.113 UJ	< 0.111 UJ	< 0.112 UJ	< 0.113 UJ
N-MeFOSAA	2355-31-9	< 0.0966 U	< 0.0971 U	< 0.098 U	< 0.0966 U	< 0.0971 U	< 0.098 U
N-MeFOSE	24448-09-7	R	R	R	R	R	< 0.98 U
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.0966 U	< 0.0971 U	< 0.098 U	< 0.0966 U	< 0.0971 U	< 0.098 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.325 U	< 0.335 U	< 0.196 U	< 0.603 U	< 0.194 U	< 0.196 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.193 U	< 0.194 U	< 0.196 U	< 0.193 U	< 0.194 U	< 0.196 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.0966 U	< 0.0971 U	< 0.098 U	< 0.0966 U	< 0.0971 U	< 0.098 U
PFBA	375-22-4	0.634 J	0.596 J	< 0.392 U	0.624 J	0.671 J	R
PFBS	375-73-5	< 0.0966 U	< 0.0971 U	< 0.098 U	< 0.0966 U	< 0.0971 U	< 0.098 U
PFDA	335-76-2	0.704	1.61	2.2	0.539	5.52	4.78
PFDoA	307-55-1	0.522	0.63	1.03	0.644	0.131 J	1.3
PFDoS	79780-39-5	< 0.0966 U	< 0.0971 U	< 0.098 U	< 0.0966 U	< 0.0971 U	< 0.098 U
PFDS	335-77-3	0.149 J	0.694	0.217 J	0.168 J	0.174 J	1.58
PFHpA	375-85-9	< 0.0966 U	< 0.0971 U	< 0.098 U	< 0.0966 U	< 0.0971 U	< 0.098 U
PFHpS	375-92-8	< 0.0966 U	0.34 J	< 0.098 U	< 0.0966 U	0.18 J	0.125 J
PFHxA	307-24-4	< 0.107 U	< 0.0971 U	< 0.098 U	< 0.114 U	< 0.0971 U	< 0.098 U
PFHxS	355-46-4	0.449	0.318 J	< 0.098 U	< 0.0966 U	< 0.0971 U	< 0.098 U
PFNA	375-95-1	0.281 J	0.397	0.58	< 0.0966 U	0.513	0.224 J
PFNS	68259-12-1	< 0.0966 U	0.475	< 0.098 U	< 0.0966 U	0.587	0.934
PFOA	335-67-1	0.161 J	0.191 J	0.122 J	< 0.0966 U	0.392	0.103 J
PFOS	1763-23-1	6.15	214	10.3	7.56	482	372
PFOSA	754-91-6	0.198 BJ	2.52	0.138 BJ	< 0.0966 U	1.95	7.85
PFPeA	2706-90-3	< 0.193 U	< 0.194 U	< 0.196 U	< 0.193 U	< 0.194 U	< 0.196 UJ
PFPeS	2706-91-4	< 0.0971 U	< 0.0976 U	< 0.0985 U	< 0.0971 U	< 0.0976 U	< 0.0985 U
PFTeDA	376-06-7	0.462	0.424 J+	0.532 J+	0.337 J	< 0.0971 UJ	R
PFTrDA	72629-94-8	0.414	0.366 J	0.481 B	0.453	< 0.0971 U	0.389 BJ
PFUnA	2058-94-8	0.455 B	0.589 B	1.32 B	0.491 B	0.697 B	1.48 B

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 1i
Raleigh Creek Forage Fish Tissue
Project 1007
Minneapolis, Minnesota

	Location Group	RA_Raleigh Creek - other
	Location	RC18
	Location ID	82-0109-00-208
	Sample Type Code	Sample
	Sample ID	82-0109-00-208.2009191401.000S
	Sample Name	RC18-FORE-COMP-01-091920
	Sample Date	9/19/2020
Compound	CAS #	
11Cl-PF3OUdS	763051-92-9	< 0.383 U
3:3 FTCA	1169706-83-5	< 0.383 U
4:2 FTS	757124-72-4	< 0.383 U
5:3 FTCA	1799325-94-2	< 2.39 U
6:2 FTS	27619-97-2	< 0.345 U
7:3 FTCA	812-70-4	< 2.39 U
8:2 FTS	39108-34-4	< 0.383 U
9Cl-PF3ONS	756426-58-1	< 0.384 U
ADONA	919005-14-4	< 0.383 U
HFPO-DA	13252-13-6	< 0.364 UJ
N-EtFOSA	4151-50-2	< 0.239 UJ
N-EtFOSAA	2991-50-6	0.975
N-EtFOSE	1691-99-2	R
N-MeFOSA	31506-32-8	< 0.11 UJ
N-MeFOSAA	2355-31-9	< 0.0957 U
N-MeFOSE	24448-09-7	R
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.0957 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.215 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.191 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.0957 U
PFBA	375-22-4	0.499 J
PFBS	375-73-5	< 0.0957 U
PFDA	335-76-2	1.77
PFDoA	307-55-1	0.614
PFDoS	79780-39-5	< 0.0957 U
PFDS	335-77-3	0.59
PFHpA	375-85-9	< 0.0957 U
PFHpS	375-92-8	< 0.0957 U
PFHxA	307-24-4	< 0.0957 U
PFHxS	355-46-4	< 0.0957 U
PFNA	375-95-1	< 0.0957 U
PFNS	68259-12-1	0.753
PFOA	335-67-1	< 0.0957 U
PFOS	1763-23-1	417
PFOSA	754-91-6	2.1
PFPeA	2706-90-3	< 0.191 U
PFPeS	2706-91-4	< 0.0962 U
PFTeDA	376-06-7	0.296 J+
PFTrDA	72629-94-8	0.25 J
PFUnA	2058-94-8	0.703 B

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 2a
Eagle Point Lake Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake
		Location	EP17A	EP17C	EP1A	EP1A	EP27C	EP27C
		Location ID	82-0109-00-452	82-0109-00-452	82-0109-00-205	82-0109-00-205	82-0109-00-457	82-0109-00-457
		Sample Date	9/19/2020	9/24/2020	9/15/2020	9/15/2020	9/15/2020	9/15/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	82-0109-00-452.2009191600.000S	82-0109-00-452.2009241655.000S	82-0109-00-205.2009151330.000S	82-0109-00-205.2009151340.000S	82-0109-00-457.2009151450.000S	82-0109-00-457.2009151500.000S
		Sample Name	EP17A-WAT-BULK-01-091920	EP17C-WAT-BULK-01-092420	EP1A-WAT-MID-01-091520	EP1A-WAT-BOT-01-091520	EP27C-WAT-MID-01-091520	EP27C-WAT-BOT-01-091520
		Parent Sample ID	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #						
Dissolved	10:2 FTS	120226-60-0	< 0.0043 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0042 U	< 0.0045 U
Dissolved	11Cl-PF3OUdS	763051-92-9	< 0.0043 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0042 U	< 0.0045 U
Dissolved	4:2 FTS	757124-72-4	< 0.0043 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0042 U	< 0.0045 U
Dissolved	6:2 FTS	27619-97-2	< 0.0043 U	< 0.0043 U	< 0.0042 U	0.00067 J	< 0.0042 U	< 0.0045 U
Dissolved	8:2 FTS	39108-34-4	< 0.0043 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0042 U	< 0.0045 U
Dissolved	9Cl-PF3ONS	756426-58-1	< 0.0043 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0042 U	< 0.0045 U
Dissolved	ADONA	919005-14-4	< 0.0043 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0042 U	< 0.0045 U
Dissolved	HFPO-DA	13252-13-6	< 0.0043 U	0.00035 J	< 0.0042 U	< 0.0042 U	< 0.0042 U	< 0.0045 U
Dissolved	N-EtFOSA	4151-50-2	< 0.0043 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0042 U	< 0.0045 U
Dissolved	N-EtFOSAA	2991-50-6	< 0.0043 U	< 0.0043 UJ	< 0.0042 U	0.00051 J	< 0.0042 U	< 0.0045 U
Dissolved	N-EtFOSE	1691-99-2	< 0.0043 U	< 0.0043 U	0.00025 J+	0.00021 J+	0.00057 J+	0.00023 J+
Dissolved	N-MeFOSA	31506-32-8	0.00056 BJ	< 0.0043 U	0.00047 BJ	< 0.0042 U	0.00065 BJ	0.00048 BJ
Dissolved	N-MeFOSAA	2355-31-9	< 0.0043 U	< 0.0043 UJ	< 0.0042 U	< 0.0042 U	< 0.0042 U	< 0.0045 U
Dissolved	N-MeFOSE	24448-09-7	< 0.0043 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0042 U	< 0.0045 U
Dissolved	PFBA	375-22-4	0.11	0.15	0.13	0.13	0.15	0.15
Dissolved	PFBS	375-73-5	0.0035 J	0.0051	0.0064	0.0058	0.0068	0.0069
Dissolved	PFDA	335-76-2	< 0.0043 U	0.0014 J	< 0.0042 U	< 0.0042 U	< 0.0042 U	< 0.0045 U
Dissolved	PFDoA	307-55-1	< 0.0043 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0042 U	< 0.0045 U
Dissolved	PFDS	335-77-3	< 0.0043 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0042 U	< 0.0045 U
Dissolved	PFHpA	375-85-9	0.0055 B	0.0092	0.01	0.0094 B	0.014	0.012
Dissolved	PFHpS	375-92-8	0.0015 J	0.0024 J	0.0023 J	0.0023 J	0.0044	0.004 J
Dissolved	PFHxA	307-24-4	0.01	0.014	0.011	0.0091 J	0.014	0.015
Dissolved	PFHxS	355-46-4	0.0063	0.01	0.009	0.01	0.015	0.012
Dissolved	PFNA	375-95-1	< 0.0043 U	< 0.0043 U	0.0012 J	0.0019 J	0.0018 J	0.0024 J
Dissolved	PFNS	68259-12-1	< 0.0043 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0042 U	< 0.0045 U
Dissolved	PFOA	335-67-1	0.038	0.077	0.077	0.078	0.13	0.12
Dissolved	PFOS	1763-23-1	0.11	0.2 J+	0.14	0.14	0.25	0.28
Dissolved	PFOSA	754-91-6	0.00083 J	0.0012 J	0.001 J	0.00081 J	0.0015 J	0.0012 J
Dissolved	PFPeA	2706-90-3	0.0085	0.012	0.012	0.011	0.012	0.012
Dissolved	PFPeS	2706-91-4	0.0029 J+	0.0047 J+	0.0049	0.0036 J	0.0055	0.0054
Dissolved	PFTeDA	376-06-7	< 0.0043 U	< 0.0043 UJ	0.0037 J+	0.0038 J+	0.0049 J+	0.0041 J
Dissolved	PFTrDA	72629-94-8	< 0.0043 U	< 0.0043 U	0.0017 J	0.0015 J	0.0023 J	0.0015 J
Dissolved	PFUnA	2058-94-8	< 0.0043 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0042 U	< 0.0045 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 2a
Eagle Point Lake Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake
		Location	EP27B	EP26A	EP18	EP19	EP4	EP5
		Location ID	82-0109-00-457	82-0109-00-456	82-0109-00-455	82-0109-00-453	82-0109-00-209	S016-069
		Sample Date	9/24/2020	9/17/2020	9/15/2020	9/19/2020	9/24/2020	9/24/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	82-0109-00-457.2009241555.000S	82-0109-00-456.2009171300.000S	82-0109-00-455.2009151530.000S	82-0109-00-453.2009191815.000S	82-0109-00-209.2009241115.000S	S016-069.2009240845.000S
		Sample Name	EP27B-WAT-BULK-01-092420	EP26A-WAT-BULK-01-091720	EP18-WAT-MID-01-091520	EP19-WAT-BULK-01-091920	EP4-WAT-BULK-01-092420	EP5-WAT-BULK-01-092420
		Parent Sample ID	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #						
Dissolved	10:2 FTS	120226-60-0	< 0.0042 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.0041 U	< 0.0045 U
Dissolved	11Cl-PF3OUdS	763051-92-9	< 0.0042 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.0041 U	< 0.0045 U
Dissolved	4:2 FTS	757124-72-4	< 0.0042 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.0041 U	< 0.0045 U
Dissolved	6:2 FTS	27619-97-2	< 0.0042 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	0.0019 J	< 0.0045 U
Dissolved	8:2 FTS	39108-34-4	< 0.0042 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	0.00041 J+	< 0.0045 U
Dissolved	9Cl-PF3ONS	756426-58-1	< 0.0042 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.0041 U	< 0.0045 U
Dissolved	ADONA	919005-14-4	< 0.0042 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.0041 U	< 0.0045 U
Dissolved	HFPO-DA	13252-13-6	< 0.0042 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	0.00032 J	0.00034 J
Dissolved	N-EtFOSA	4151-50-2	< 0.0042 U	R	< 0.0042 U	< 0.0042 U	< 0.0041 U	< 0.0045 UJ
Dissolved	N-EtFOSAA	2991-50-6	< 0.0042 U	R	< 0.0042 U	0.00068 J	< 0.0041 UJ	< 0.0045 UJ
Dissolved	N-EtFOSE	1691-99-2	< 0.0042 U	R	0.00022 J+	0.00036 BJ+	< 0.0041 U	< 0.0045 UJ
Dissolved	N-MeFOSA	31506-32-8	< 0.0042 U	R	0.00081 BJ	< 0.0042 U	< 0.0041 U	0.00048 BJ
Dissolved	N-MeFOSAA	2355-31-9	< 0.0042 U	R	< 0.0042 U	< 0.0042 U	< 0.0041 UJ	< 0.0045 UJ
Dissolved	N-MeFOSE	24448-09-7	< 0.0042 U	R	< 0.0042 U	< 0.0042 U	< 0.0041 U	0.00032 J+
Dissolved	PFBA	375-22-4	0.14	0.16 J+	0.17	0.13 J+	0.13	0.13
Dissolved	PFBS	375-73-5	0.0054	0.005	0.0073	0.0045	0.0072	0.0046
Dissolved	PFDA	335-76-2	0.0026 J	0.011 J+	< 0.0042 U	< 0.0042 U	0.0012 J	0.0015 J
Dissolved	PFDoA	307-55-1	< 0.0042 U	R	< 0.0042 U	< 0.0042 U	< 0.0041 U	< 0.0045 U
Dissolved	PFDS	335-77-3	< 0.0042 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.0041 U	< 0.0045 U
Dissolved	PFHpA	375-85-9	0.012	0.014	0.014	0.011	0.012	0.013
Dissolved	PFHpS	375-92-8	0.0032 J	0.0053	0.0051	0.0035 J	0.0037 J	0.0026 J
Dissolved	PFHxA	307-24-4	0.014	0.016	0.018	0.01	0.022	0.014
Dissolved	PFHxS	355-46-4	0.0098	0.015	0.017	0.0089	0.03	0.0091
Dissolved	PFNA	375-95-1	0.0021 J	0.0063	0.0018 J	0.0014 J	< 0.0041 U	0.0014 J
Dissolved	PFNS	68259-12-1	< 0.0042 U	< 0.0041 U	< 0.0042 U	< 0.0042 U	< 0.0041 U	< 0.0045 U
Dissolved	PFOA	335-67-1	0.094	0.12	0.16	0.062	0.09	0.073
Dissolved	PFOS	1763-23-1	0.42 J+	1.1 J+	0.27	0.18	0.32	0.25 J+
Dissolved	PFOSA	754-91-6	0.0019 J	R	0.001 J	0.0014 J	0.0015 J	0.0016 J+
Dissolved	PFPeA	2706-90-3	0.012	0.012	0.012	0.012	0.014	0.012
Dissolved	PFPeS	2706-91-4	0.0072 J+	0.0058 J+	0.0079	0.0052 J+	0.011	0.0047 J+
Dissolved	PFTeDA	376-06-7	< 0.0042 UJ	R	0.0051 J+	0.0041 BJ+	< 0.0041 UJ	< 0.0045 UJ
Dissolved	PFTrDA	72629-94-8	0.0022 J	0.032 J+	0.0019 J	0.0017 J+	< 0.0041 U	0.0021 J
Dissolved	PFUnA	2058-94-8	< 0.0042 U	R	< 0.0042 U	< 0.0042 U	< 0.0041 U	< 0.0045 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 2a
Eagle Point Lake Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake
		Location	EP17	EP17	EP17A	EP17C	EP1	EP1
		Location ID	82-0109-00-452	82-0109-00-452	82-0109-00-452	82-0109-00-452	82-0109-00-205	82-0109-00-205
		Sample Date	5/11/2020	7/28/2020	9/19/2020	9/24/2020	8/13/2019	8/13/2019
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	82-0109-00-452.2005111100.000S	82-0109-00-452.2007281045.000S	82-0109-00-452.2009191600.000S	82-0109-00-452.2009241655.000S	82-0109-00-205.1908131030.000S	82-0109-00-205.1908131035.000S
		Sample Name	EP17-WAT-BULK-01-051120	EP17-WAT-BULK-01-072820	EP17A-WAT-BULK-01-091920	EP17C-WAT-BULK-01-092420	EP1-WAT-18-21-01-081319	EP1-WAT-SUR-01-081319
		Parent Sample ID	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #						
Total	10:2 FTS	120226-60-0	NA	NA	< 0.0045 U	< 0.0041 U	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.00305 UJ	< 0.00297 UJ	< 0.0045 U	< 0.0041 U	< 0.00287 U	< 0.0029 U
Total	4:2 FTS	757124-72-4	< 0.00305 UJ	< 0.00297 UJ	< 0.0045 U	< 0.0041 UJ	< 0.00287 U	< 0.0029 U
Total	6:2 FTS	27619-97-2	< 0.00275 UJ	< 0.00267 UJ	< 0.0045 U	< 0.0041 U	< 0.00259 U	< 0.00261 U
Total	8:2 FTS	39108-34-4	< 0.00305 UJ	< 0.00297 UJ	< 0.0045 U	< 0.0041 U	< 0.00287 U	< 0.0029 U
Total	9Cl-PF3ONS	756426-58-1	< 0.00305 UJ	< 0.00297 UJ	< 0.0045 U	< 0.0041 U	< 0.00287 U	< 0.0029 U
Total	ADONA	919005-14-4	< 0.00305 UJ	< 0.00297 UJ	< 0.0045 U	< 0.0041 U	< 0.00287 U	< 0.0029 U
Total	HFPO-DA	13252-13-6	< 0.0029 UJ	< 0.00282 UJ	< 0.0045 U	< 0.0041 U	< 0.00287 U	< 0.0029 U
Total	N-EtFOSA	4151-50-2	< 0.00191 UJ	< 0.00186 UJ	< 0.0045 U	< 0.0041 U	< 0.0018 U	< 0.0018 U
Total	N-EtFOSAA	2991-50-6	< 0.000763 UJ	0.00362 J-	0.0013 BJ	0.00079 J	NA	< 0.000724 U
Total	N-EtFOSE	1691-99-2	< 0.00572 UJ	< 0.00557 UJ	< 0.0045 U	< 0.0041 U	< 0.00539 U	< 0.00543 U
Total	N-MeFOSA	31506-32-8	< 0.000877 UJ	< 0.000854 UJ	< 0.0045 U	< 0.0041 U	< 0.000827 U	< 0.000833 U
Total	N-MeFOSAA	2355-31-9	< 0.000763 UJ	< 0.000743 UJ	< 0.0045 U	< 0.0041 U	< 0.000719 U	< 0.000724 U
Total	N-MeFOSE	24448-09-7	< 0.00763 UJ	< 0.00743 UJ	< 0.0045 U	< 0.0041 U	< 0.00719 U	< 0.00724 U
Total	PFBA	375-22-4	0.104 J	0.104 J-	0.12	0.14	0.0964	0.0953
Total	PFBS	375-73-5	0.00272 J-	0.00425 J-	0.0039 J	0.0051	0.00299	0.00307
Total	PFDA	335-76-2	< 0.000763 UJ	0.00196 J-	< 0.0045 U	0.0014 J	0.00141 J	0.0011 J
Total	PFDoA	307-55-1	< 0.000763 UJ	< 0.000743 UJ	< 0.0045 U	< 0.0041 U	< 0.000719 U	< 0.000724 U
Total	PFDoS	79780-39-5	< 0.000763 UJ	< 0.000743 UJ	NA	NA	< 0.000719 U	< 0.000724 U
Total	PFDS	335-77-3	< 0.000763 UJ	< 0.000743 UJ	< 0.0045 U	< 0.0041 U	< 0.000719 U	< 0.000724 U
Total	PFHpA	375-85-9	0.00302 J-	0.00695 J-	0.011 B	0.013	0.00421	0.00452
Total	PFHpS	375-92-8	< 0.000763 UJ	0.00232 J-	0.0021 J	0.0026 J	0.00105 J	< 0.000724 U
Total	PFHxA	307-24-4	0.00501 J-	0.00968 J-	0.01	0.014	0.00613 J	0.00713
Total	PFHxS	355-46-4	0.00413 J-	0.00783 J-	0.0085	0.011 J+	0.00524	0.00543
Total	PFNA	375-95-1	< 0.000763 UJ	0.00138 J-	0.0012 J	0.0014 J	0.00116 J	0.000894 J
Total	PFNS	68259-12-1	< 0.000763 UJ	< 0.000743 UJ	< 0.0045 U	< 0.0041 U	< 0.000719 U	< 0.000724 U
Total	PFOA	335-67-1	0.0152 J-	0.0558 J-	0.04	0.076	0.0287	0.0372
Total	PFOS	1763-23-1	0.0643 J-	0.335 J-	0.14	0.21	0.157	0.16
Total	PFOSA	754-91-6	< 0.000763 UJ	0.00468 J-	0.00072 J	0.0011 J	0.000723 J	< 0.000724 U
Total	PFPeA	2706-90-3	0.00616 J-	0.00863 J-	0.0095	0.012	0.00657	0.00696
Total	PFPeS	2706-91-4	< 0.000763 UJ	0.00216 J-	0.0026 J	0.005 J+	NA	0.00101 J
Total	PFTeDA	376-06-7	< 0.000763 UJ	< 0.000743 UJ	< 0.0045 U	0.0024 J+	< 0.000719 U	< 0.000724 U
Total	PFTrDA	72629-94-8	< 0.000763 UJ	< 0.000743 UJ	< 0.0045 U	0.0014 J	< 0.000719 U	< 0.000724 U
Total	PFUnA	2058-94-8	< 0.000763 UJ	< 0.000743 UJ	< 0.0045 U	< 0.0041 U	< 0.000719 U	< 0.000724 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 2a
Eagle Point Lake Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake
		Location	EP1	EP1A	EP1A	EP27C	EP27C	EP27B
		Location ID	82-0109-00-205	82-0109-00-205	82-0109-00-205	82-0109-00-457	82-0109-00-457	82-0109-00-457
		Sample Date	8/13/2019	9/15/2020	9/15/2020	9/15/2020	9/15/2020	9/24/2020
		Sample Type Code	QC-FR	Sample	Sample	Sample	Sample	Sample
		Sample ID	82-0109-00-205.1908131040.000SR	82-0109-00-205.2009151330.000S	82-0109-00-205.2009151340.000S	82-0109-00-457.2009151450.000S	82-0109-00-457.2009151500.000S	82-0109-00-457.2009241555.000S
		Sample Name	EP1-WAT-SUR-02-081319	EP1A-WAT-MID-01-091520	EP1A-WAT-BOT-01-091520	EP27C-WAT-MID-01-091520	EP27C-WAT-BOT-01-091520	EP27B-WAT-BULK-01-092420
		Parent Sample ID	82-0109-00-205.1908131035.000S	NA	NA	NA	NA	NA
Fraction	Compound	CAS #						
Total	10:2 FTS	120226-60-0	NA	< 0.004 U	< 0.0042 U	< 0.0042 U	< 0.0043 U	< 0.0039 U
Total	11Cl-PF3OUdS	763051-92-9	< 0.00286 U	< 0.004 UJ	< 0.0042 UJ	< 0.0042 UJ	< 0.0043 UJ	< 0.0039 U
Total	4:2 FTS	757124-72-4	< 0.00286 U	< 0.004 U	< 0.0042 U	< 0.0042 U	< 0.0043 U	< 0.0039 U
Total	6:2 FTS	27619-97-2	< 0.00258 U	0.0034 BJ+	0.0046 BJ+	0.0056 J+	0.0055 J+	< 0.0039 U
Total	8:2 FTS	39108-34-4	< 0.00286 U	< 0.004 U	< 0.0042 U	0.0002 BJ+	< 0.0043 U	< 0.0039 U
Total	9Cl-PF3ONS	756426-58-1	< 0.00286 U	< 0.004 U	< 0.0042 U	< 0.0042 U	< 0.0043 U	< 0.0039 U
Total	ADONA	919005-14-4	< 0.00286 U	< 0.004 U	< 0.0042 U	< 0.0042 U	< 0.0043 U	< 0.0039 U
Total	HFPO-DA	13252-13-6	< 0.00286 U	< 0.004 U	< 0.0042 U	< 0.0042 U	< 0.0043 U	< 0.0039 U
Total	N-EtFOSA	4151-50-2	< 0.00179 U	< 0.004 U	< 0.0042 U	< 0.0042 U	< 0.0043 U	< 0.0039 U
Total	N-EtFOSAA	2991-50-6	0.000847 J	0.0025 J	< 0.0042 UJ	0.0019 J	0.0025 J	0.0014 J
Total	N-EtFOSE	1691-99-2	< 0.00537 U	< 0.004 U	< 0.0042 U	< 0.0042 U	< 0.0043 U	< 0.0039 U
Total	N-MeFOSA	31506-32-8	< 0.000823 U	< 0.004 U	< 0.0042 U	< 0.0042 U	< 0.0043 U	< 0.0039 U
Total	N-MeFOSAA	2355-31-9	< 0.000715 U	< 0.004 U	< 0.0042 U	< 0.0042 U	< 0.0043 U	< 0.0039 U
Total	N-MeFOSE	24448-09-7	< 0.00715 U	< 0.004 U	< 0.0042 U	< 0.0042 U	< 0.0043 U	< 0.0039 U
Total	PFBA	375-22-4	0.0934	0.11	0.12	0.12	0.11	0.12
Total	PFBS	375-73-5	0.00336	0.0043	0.0046	0.0052	0.0049	0.0049
Total	PFDA	335-76-2	0.00109 J	0.0013 J	0.0016 J	0.0013 J	0.0018 J	0.0026 J
Total	PFDoA	307-55-1	< 0.000715 U	< 0.004 U	< 0.0042 U	< 0.0042 U	< 0.0043 U	< 0.0039 U
Total	PFDoS	79780-39-5	< 0.000715 U	NA	NA	NA	NA	NA
Total	PFDS	335-77-3	< 0.000715 U	< 0.004 UJ	< 0.0042 UJ	< 0.0042 UJ	< 0.0043 UJ	< 0.0039 U
Total	PFHpA	375-85-9	0.00432	0.0076	0.0086	0.011	0.0099	0.015
Total	PFHpS	375-92-8	0.00115 J	0.0037 J	0.004 J	0.0042 J	0.0042 J	0.0039 J
Total	PFHxA	307-24-4	0.00677 J	0.012	0.013	0.014	0.014	0.015
Total	PFHxS	355-46-4	0.0058	0.0084	0.009	0.0087	0.01	0.012 J+
Total	PFNA	375-95-1	0.00103 J	0.0019 J	0.0015 J	0.0022 J	0.0021 J	0.0021 J
Total	PFNS	68259-12-1	< 0.000715 U	< 0.004 U	< 0.0042 U	< 0.0042 UJ	< 0.0043 UJ	< 0.0039 U
Total	PFOA	335-67-1	0.0349	0.057	0.058	0.086	0.081	0.089
Total	PFOS	1763-23-1	0.165	0.15	0.16	0.22	0.25	0.4
Total	PFOSA	754-91-6	< 0.000715 U	0.0011 J	0.0011 J	0.0011 J	0.0011 J	0.002 J
Total	PFPeA	2706-90-3	0.0071	0.0088	0.01	0.0099	0.01	0.011
Total	PFPeS	2706-91-4	0.000945 J	0.0035 J	0.0034 J	0.0042 J	0.0042 J	0.0049 J+
Total	PFTeDA	376-06-7	< 0.000715 U	< 0.004 UJ	< 0.0042 U	0.0023 J	< 0.0043 U	0.0029 J+
Total	PFTrDA	72629-94-8	< 0.000715 U	< 0.004 U	< 0.0042 U	< 0.0042 U	< 0.0043 U	0.0025 J
Total	PFUnA	2058-94-8	< 0.000715 U	< 0.004 U	< 0.0042 U	< 0.0042 U	< 0.0043 U	< 0.0039 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 2a
Eagle Point Lake Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake
		Location	EP26A	EP2	EP2	EP18	EP18	EP18
		Location ID	82-0109-00-456	82-0109-00-206	82-0109-00-206	82-0109-00-455	82-0109-00-455	82-0109-00-455
		Sample Date	9/17/2020	8/13/2019	8/13/2019	5/12/2020	6/29/2020	7/6/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	82-0109-00-456.2009171300.000S	82-0109-00-206.1908130955.000S	82-0109-00-206.1908131000.000S	82-0109-00-455.2005121145.000S	82-0109-00-455.2006291745.000S	82-0109-00-455.2007061100.000S
		Sample Name	EP26A-WAT-BULK-01-091720	EP2-WAT-18-21-01-081319	EP2-WAT-SUR-01-081319	EP18-WAT-BULK-01-051220	EP18-WAT-BULK-01-062920	EP18-WAT-BULK-01-070620
		Parent Sample ID	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #						
Total	10:2 FTS	120226-60-0	< 0.0041 U	NA	NA	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.0041 U	< 0.00284 U	< 0.0226 U	< 0.00294 U	< 0.00295 UJ	< 0.00313 U
Total	4:2 FTS	757124-72-4	< 0.0041 U	< 0.00284 U	< 0.0226 U	< 0.00294 U	< 0.00295 UJ	< 0.00313 U
Total	6:2 FTS	27619-97-2	0.00063 J	< 0.00255 U	< 0.0406 U	< 0.00264 U	< 0.00265 UJ	0.0039 J
Total	8:2 FTS	39108-34-4	< 0.0041 U	< 0.00284 U	< 0.0226 U	< 0.00294 U	< 0.00295 UJ	< 0.00313 U
Total	9Cl-PF3ONS	756426-58-1	< 0.0041 U	< 0.00284 U	< 0.0226 U	< 0.00294 U	< 0.00295 UJ	< 0.00313 U
Total	ADONA	919005-14-4	< 0.0041 U	< 0.00284 U	< 0.0226 U	< 0.00294 U	< 0.00295 UJ	< 0.00313 U
Total	HFPO-DA	13252-13-6	< 0.0041 U	< 0.00284 U	< 0.0226 U	< 0.00279 U	< 0.0028 UJ	< 0.00297 U
Total	N-EtFOSA	4151-50-2	< 0.0041 U	< 0.00177 U	< 0.0141 U	< 0.00184 U	< 0.00184 UJ	< 0.00195 U
Total	N-EtFOSAA	2991-50-6	0.006 J+	< 0.00071 U	< 0.0113 U	< 0.000734 U	< 0.000736 UJ	< 0.000781 U
Total	N-EtFOSE	1691-99-2	0.001 J+	< 0.00532 U	< 0.0423 U	< 0.00551 U	< 0.00552 UJ	< 0.00586 U
Total	N-MeFOSA	31506-32-8	0.0005 BJ	< 0.000816 U	< 0.00649 U	< 0.000844 U	< 0.000847 UJ	< 0.000899 U
Total	N-MeFOSAA	2355-31-9	< 0.0041 UJ	< 0.00071 U	< 0.00564 U	< 0.000734 U	< 0.000736 UJ	< 0.000781 U
Total	N-MeFOSE	24448-09-7	< 0.0041 U	< 0.0071 U	< 0.0564 U	< 0.00734 U	< 0.00736 UJ	< 0.00781 U
Total	PFBA	375-22-4	0.15	0.121	0.0949	0.0596	R	0.139
Total	PFBS	375-73-5	0.0071	0.00489	< 0.00564 U	0.00379	0.00545 J-	0.00187
Total	PFDA	335-76-2	0.0066	0.00209	< 0.00564 U	0.001 J	0.00134 J-	< 0.000781 U
Total	PFDoA	307-55-1	0.0028 J+	< 0.00071 U	< 0.00564 U	< 0.000734 U	< 0.000736 UJ	< 0.000781 U
Total	PFDoS	79780-39-5	NA	< 0.00071 U	< 0.00564 U	< 0.000734 U	< 0.000736 UJ	< 0.000781 U
Total	PFDS	335-77-3	< 0.0041 U	< 0.00071 U	< 0.00564 U	< 0.000734 U	< 0.000736 UJ	< 0.000781 U
Total	PFHpA	375-85-9	0.011	0.0097	0.00865 J	0.0124	0.013 J-	0.00277
Total	PFHpS	375-92-8	0.0058	0.00225	< 0.00564 U	0.0029	0.00323 J-	< 0.000781 U
Total	PFHxA	307-24-4	0.016	0.0127	0.011 J	0.0109	0.0143 J-	0.00573
Total	PFHxS	355-46-4	0.012	0.00932	0.00779 J	0.0123	0.013 J-	0.00212 J
Total	PFNA	375-95-1	0.0041 J	0.00139 J	< 0.00564 U	0.0014 J	0.00162 J-	0.000957 J
Total	PFNS	68259-12-1	< 0.0041 U	< 0.00071 U	< 0.00564 U	< 0.000734 U	< 0.000736 UJ	< 0.000781 U
Total	PFOA	335-67-1	0.15 J+	0.078	0.0674	0.111	0.107 J-	0.016
Total	PFOS	1763-23-1	0.68	0.279	0.254	0.244	0.324 J-	0.0138
Total	PFOSA	754-91-6	0.0027 J	< 0.00071 U	< 0.00564 U	0.00107 BJ	0.000965 J-	< 0.000781 U
Total	PFPeA	2706-90-3	0.011	0.00989	< 0.0113 U	0.00599	0.0104 J-	0.00714
Total	PFPeS	2706-91-4	0.0068	0.00338	< 0.00564 U	0.00369	0.00459 J-	< 0.000781 U
Total	PFTeDA	376-06-7	R	< 0.00071 U	< 0.00564 U	< 0.000734 U	< 0.000736 UJ	< 0.000781 UJ
Total	PFTrDA	72629-94-8	0.0069	< 0.00071 U	< 0.00564 U	< 0.000734 U	< 0.000736 UJ	< 0.000781 U
Total	PFUnA	2058-94-8	0.0026 J	< 0.00071 U	< 0.00564 U	< 0.000734 U	< 0.000736 UJ	< 0.000781 U

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Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

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- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
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Eagle Point Lake Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake
		Location	EP18	EP18	EP3	EP3	EP19	EP19
		Location ID	82-0109-00-455	82-0109-00-455	82-0109-00-207	82-0109-00-207	82-0109-00-453	82-0109-00-453
		Sample Date	7/29/2020	9/15/2020	8/13/2019	8/13/2019	2/25/2020	4/29/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	82-0109-00-455.2007291030.000S	82-0109-00-455.2009151530.000S	82-0109-00-207.1908131150.000S	82-0109-00-207.1908131155.000S	82-0109-00-453.2002251245.000S	82-0109-00-453.2004291445.000S
		Sample Name	EP18-WAT-BULK-01-072920	EP18-WAT-MID-01-091520	EP3-WAT-18-21-01-081319	EP3-WAT-SUR-01-081319	EP19-WAT-BULK-01-022520	EP19-WAT-BULK-01-042920
		Parent Sample ID	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #						
Total	10:2 FTS	120226-60-0	NA	< 0.0039 U	NA	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.0015 U	< 0.0039 UJ	< 0.00288 U	< 0.00284 U	< 0.003 U	< 0.00298 U
Total	4:2 FTS	757124-72-4	< 0.0015 U	< 0.0039 U	< 0.00288 U	< 0.00284 U	< 0.003 U	< 0.00298 U
Total	6:2 FTS	27619-97-2	0.0609 B	0.002 BJ+	< 0.00259 U	< 0.00256 U	< 0.0027 U	< 0.00268 U
Total	8:2 FTS	39108-34-4	< 0.0015 U	< 0.0039 U	< 0.00288 U	< 0.00284 U	< 0.003 U	< 0.00298 U
Total	9Cl-PF3ONS	756426-58-1	< 0.00151 U	< 0.0039 U	< 0.00288 U	< 0.00284 U	< 0.003 U	< 0.00298 U
Total	ADONA	919005-14-4	< 0.0015 U	< 0.0039 U	< 0.00288 U	< 0.00284 U	< 0.003 U	< 0.00298 U
Total	HFPO-DA	13252-13-6	< 0.00143 U	< 0.0039 U	< 0.00288 U	< 0.00284 U	< 0.00285 U	< 0.00283 U
Total	N-EtFOSA	4151-50-2	< 0.000939 U	< 0.0039 U	NA	NA	< 0.00187 U	< 0.00186 U
Total	N-EtFOSAA	2991-50-6	0.0011 J	< 0.0039 UJ	< 0.00072 U	< 0.000711 U	< 0.000749 U	< 0.000744 U
Total	N-EtFOSE	1691-99-2	< 0.00281 U	< 0.0039 U	NA	NA	< 0.00562 U	< 0.00558 U
Total	N-MeFOSA	31506-32-8	< 0.000432 U	< 0.0039 U	< 0.000828 U	< 0.000818 U	< 0.000862 U	< 0.000856 U
Total	N-MeFOSAA	2355-31-9	< 0.000376 U	< 0.0039 U	< 0.00072 U	< 0.000711 U	< 0.000749 U	< 0.000744 U
Total	N-MeFOSE	24448-09-7	< 0.00376 U	< 0.0039 U	< 0.0072 U	< 0.00711 U	< 0.00749 U	< 0.00744 U
Total	PFBA	375-22-4	R	0.13	0.109	0.107	0.116	0.125
Total	PFBS	375-73-5	0.00421	0.0054	0.00425	0.00391	0.00399	0.00573
Total	PFDA	335-76-2	0.00112 J	0.0013 J	0.0014 J	0.00125 J	0.00096 J	0.000984 J
Total	PFDoA	307-55-1	< 0.000376 U	< 0.0039 U	< 0.00072 U	< 0.000711 U	< 0.000749 U	< 0.000744 U
Total	PFDoS	79780-39-5	< 0.000376 U	NA	< 0.00072 U	< 0.000711 U	< 0.000749 U	< 0.000744 U
Total	PFDS	335-77-3	< 0.000376 U	< 0.0039 UJ	< 0.00072 U	< 0.000711 U	< 0.000749 U	< 0.000744 U
Total	PFHpA	375-85-9	0.00935	0.014	0.00666	0.00751	0.00563	0.014
Total	PFHpS	375-92-8	0.00303	0.0046	0.00128 J	0.00121 J	0.00115 J	0.00249
Total	PFHxA	307-24-4	0.011	0.018	0.00948	0.00965	0.00824	0.0157
Total	PFHxS	355-46-4	0.0111	0.012	0.00729	0.00797	0.00638	0.0124
Total	PFNA	375-95-1	0.00145 J	0.0026 J	0.00115 J	0.000945 J	0.00116 J	0.00114 J
Total	PFNS	68259-12-1	< 0.000376 U	< 0.0039 UJ	< 0.00072 U	< 0.000711 U	< 0.000749 U	< 0.000744 U
Total	PFOA	335-67-1	0.0875	0.1	0.0553	0.0536	0.038	0.102
Total	PFOS	1763-23-1	0.35	0.24	0.229	0.217	0.112	0.212
Total	PFOSA	754-91-6	0.00142 BJ	0.0013 J	< 0.00072 U	< 0.000711 U	< 0.000749 U	0.000842 J
Total	PFPeA	2706-90-3	0.0082	0.011	0.0082	0.00846	0.0085	0.0103
Total	PFPeS	2706-91-4	0.00331 J+	0.0048	0.00216	0.00212	0.00185	0.00436
Total	PFTeDA	376-06-7	< 0.000376 U	< 0.0039 UJ	< 0.00072 U	< 0.000711 U	< 0.000749 U	< 0.000744 U
Total	PFTrDA	72629-94-8	< 0.000376 U	< 0.0039 U	< 0.00072 U	< 0.000711 U	< 0.000749 U	< 0.000744 U
Total	PFUnA	2058-94-8	< 0.000376 U	< 0.0039 U	< 0.00072 U	< 0.000711 U	< 0.000749 U	< 0.000744 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 2a
Eagle Point Lake Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake
		Location	EP19	EP19	EP19	EP19	EP19	EP19
		Location ID	82-0109-00-453	82-0109-00-453	82-0109-00-453	82-0109-00-453	82-0109-00-453	82-0109-00-453
		Sample Date	5/4/2020	5/18/2020	6/29/2020	7/29/2020	7/29/2020	8/26/2020
		Sample Type Code	Sample	Sample	Sample	Sample	QC-FR	Sample
		Sample ID	82-0109-00-453.2005041530.000S	82-0109-00-453.2005181450.000S	82-0109-00-453.2006291300.000S	82-0109-00-453.2007290915.000S	82-0109-00-453.2007290930.000SR	82-0109-00-453.2008261500.000S
		Sample Name	EP19-WAT-BULK-01-050420	EP19-WAT-BULK-01-051820	EP19-WAT-BULK-01-062920	EP19-WAT-BULK-01-072920	EP19-WAT-BULK-02-072920	EP19-WAT-BULK-01-082620
		Parent Sample ID	NA	NA	NA	NA	82-0109-00-453.2007290915.000S	NA
Fraction	Compound	CAS #						
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.00314 U	< 0.00294 U	< 0.00295 UJ	< 0.00148 U	< 0.00152 UJ	< 0.00147 UJ
Total	4:2 FTS	757124-72-4	< 0.00314 U	< 0.00294 U	< 0.00295 UJ	< 0.00147 U	< 0.00152 UJ	< 0.00147 UJ
Total	6:2 FTS	27619-97-2	< 0.00283 U	< 0.00265 U	< 0.00265 UJ	0.0084 B	< 0.00137 UJ	0.00273 J-
Total	8:2 FTS	39108-34-4	< 0.00314 U	< 0.00294 U	< 0.00295 UJ	< 0.00147 U	< 0.00152 UJ	< 0.00147 UJ
Total	9Cl-PF3ONS	756426-58-1	< 0.00314 U	< 0.00294 U	< 0.00295 UJ	< 0.00148 U	< 0.00152 UJ	< 0.00147 UJ
Total	ADONA	919005-14-4	< 0.00314 U	< 0.00294 U	< 0.00295 UJ	< 0.00147 U	< 0.00152 UJ	< 0.00147 UJ
Total	HFPO-DA	13252-13-6	< 0.00298 U	< 0.00279 U	< 0.0028 UJ	< 0.0014 U	< 0.00144 UJ	< 0.0014 UJ
Total	N-EtFOSA	4151-50-2	< 0.00196 U	< 0.00184 U	< 0.00184 UJ	< 0.000922 U	< 0.000949 UJ	< 0.000919 UJ
Total	N-EtFOSAA	2991-50-6	< 0.000785 U	0.0014 J	0.00134 J-	0.0025	0.00227 J-	0.00166 J-
Total	N-EtFOSE	1691-99-2	< 0.00589 U	< 0.00551 U	< 0.00553 UJ	< 0.00276 U	< 0.00284 UJ	< 0.00275 UJ
Total	N-MeFOSA	31506-32-8	< 0.000903 U	< 0.000845 U	< 0.000847 UJ	< 0.000424 U	< 0.000436 UJ	< 0.000423 UJ
Total	N-MeFOSAA	2355-31-9	< 0.000785 U	< 0.000735 U	< 0.000737 UJ	< 0.000369 U	< 0.000379 UJ	< 0.000368 UJ
Total	N-MeFOSE	24448-09-7	< 0.00785 U	< 0.00735 U	< 0.00737 UJ	< 0.00369 U	< 0.00379 UJ	< 0.00368 UJ
Total	PFBA	375-22-4	0.133	0.112	0.128 J	0.108 J+	0.0889 J-	0.0701 J
Total	PFBS	375-73-5	0.00587	0.00486	0.00495 J-	0.0046	0.00448 J-	0.00349 J-
Total	PFDA	335-76-2	0.000791 J	0.00108 J	0.00197 J-	0.00171	0.00172 J-	0.00154 J-
Total	PFDoA	307-55-1	< 0.000785 U	< 0.000735 U	< 0.000737 UJ	< 0.000369 U	< 0.000379 UJ	< 0.000368 UJ
Total	PFDoS	79780-39-5	< 0.000785 U	< 0.000735 U	< 0.000737 UJ	< 0.000369 U	< 0.000379 UJ	< 0.000368 UJ
Total	PFDS	335-77-3	< 0.000785 U	< 0.000735 U	< 0.000737 UJ	< 0.000369 U	< 0.000379 UJ	< 0.000368 UJ
Total	PFHpA	375-85-9	0.0143	0.0118	0.0104 J-	0.0081	0.00736 J-	0.00555 J-
Total	PFHpS	375-92-8	0.00265	0.00292	0.00286 J-	0.00257	0.00236 J-	0.00185 J-
Total	PFHxA	307-24-4	0.0162	0.0131	0.0115 J-	0.0111	0.00942 J-	0.00687 J-
Total	PFHxS	355-46-4	0.0137	0.0118	0.0106 J-	0.0102	0.00964 J-	0.00825 J-
Total	PFNA	375-95-1	0.00108 J	0.00118 J	0.00147 J-	0.00114 J	0.00133 J-	0.00123 J-
Total	PFNS	68259-12-1	< 0.000785 U	< 0.000735 U	< 0.000737 UJ	< 0.000369 U	< 0.000379 UJ	< 0.000368 UJ
Total	PFOA	335-67-1	0.113	0.0979	0.084 J-	0.0723	0.0692 J-	0.0522 J-
Total	PFOS	1763-23-1	0.214	0.249	0.359 J-	0.343	0.331 J-	0.266 J-
Total	PFOSA	754-91-6	0.00102 J	0.00195	0.00171 J-	0.00275 B	0.00256 J-	0.00219 J-
Total	PFPeA	2706-90-3	0.0111	0.00931	0.00944 J-	0.00901	0.00808 J-	0.00573 J-
Total	PFPeS	2706-91-4	0.00476	0.00389	0.00334 J-	0.00288	0.00271 J-	0.00192 J-
Total	PFTeDA	376-06-7	< 0.000785 U	< 0.000735 U	< 0.000737 UJ	< 0.000369 U	< 0.000379 UJ	< 0.000368 UJ
Total	PFTrDA	72629-94-8	< 0.000785 U	< 0.000735 U	< 0.000737 UJ	< 0.000369 U	< 0.000379 UJ	< 0.000368 UJ
Total	PFUnA	2058-94-8	< 0.000785 U	< 0.000735 U	< 0.000737 UJ	< 0.000369 U	< 0.000379 UJ	< 0.000368 UJ

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

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- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 2a
Eagle Point Lake Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake
		Location	EP19	EP19	EP19	EP5	EP4	EP4	EP4
		Location ID	82-0109-00-453	82-0109-00-453	82-0109-00-453	S016-069	82-0109-00-209	82-0109-00-209	82-0109-00-209
		Sample Date	9/1/2020	9/4/2020	9/19/2020	9/24/2020	8/13/2019	5/4/2020	9/24/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	82-0109-00-453.2009011250.000S	82-0109-00-453.2009041100.000S	82-0109-00-453.2009191815.000S	S016-069.2009240845.000S	82-0109-00-209.1908131320.000S	82-0109-00-209.2005041455.000S	82-0109-00-209.2009241115.000S
		Sample Name	EP19-WAT-BULK-01-090120	EP19-WAT-BULK-01-090420	EP19-WAT-BULK-01-091920	EP5-WAT-BULK-01-092420	EP4-WAT-SUR-01-081319	EP4-WAT-BULK-01-050420	EP4-WAT-BULK-01-092420
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #							
Total	10:2 FTS	120226-60-0	NA	NA	< 0.0042 U	< 0.0041 U	NA	NA	< 0.0039 U
Total	11Cl-PF3OUdS	763051-92-9	< 0.00147 U	< 0.00145 UJ	< 0.0042 U	< 0.0041 U	< 0.00298 U	< 0.00306 U	< 0.0039 U
Total	4:2 FTS	757124-72-4	< 0.00146 U	< 0.00144 UJ	< 0.0042 U	< 0.0041 U	< 0.00298 U	< 0.00306 U	< 0.0039 U
Total	6:2 FTS	27619-97-2	< 0.00132 U	< 0.0013 UJ	< 0.0042 U	< 0.0041 U	< 0.00268 U	0.0042 J	< 0.0039 U
Total	8:2 FTS	39108-34-4	< 0.00146 U	< 0.00144 UJ	< 0.0042 U	< 0.0041 U	< 0.00298 U	< 0.00306 U	< 0.0039 U
Total	9Cl-PF3ONS	756426-58-1	< 0.00147 U	< 0.00145 UJ	< 0.0042 U	< 0.0041 U	< 0.00298 U	< 0.00306 U	< 0.0039 U
Total	ADONA	919005-14-4	< 0.00146 U	< 0.00144 UJ	< 0.0042 U	< 0.0041 U	< 0.00298 U	< 0.00306 U	< 0.0039 U
Total	HFPO-DA	13252-13-6	< 0.00139 U	< 0.00137 UJ	< 0.0042 U	< 0.0041 U	< 0.00298 U	< 0.00291 U	< 0.0039 U
Total	N-EtFOSA	4151-50-2	< 0.000915 U	< 0.000903 UJ	< 0.0042 U	< 0.0041 U	< 0.00186 U	< 0.00191 U	< 0.0039 U
Total	N-EtFOSAA	2991-50-6	0.00116 J	0.00103 J-	0.0017 BJ	0.0017 J	< 0.000744 U	0.000875 J	0.0019 J
Total	N-EtFOSE	1691-99-2	< 0.00274 U	< 0.0027 UJ	< 0.0042 U	0.00021 BJ	< 0.00558 U	< 0.00574 U	0.00015 BJ
Total	N-MeFOSA	31506-32-8	< 0.000421 U	< 0.000415 UJ	< 0.0042 U	0.00049 BJ	< 0.000855 U	< 0.00088 U	< 0.0039 U
Total	N-MeFOSAA	2355-31-9	< 0.000366 U	< 0.000361 UJ	< 0.0042 U	< 0.0041 U	< 0.000744 U	< 0.000765 U	< 0.0039 U
Total	N-MeFOSE	24448-09-7	< 0.00366 U	< 0.00361 UJ	< 0.0042 U	< 0.0041 U	< 0.00744 U	< 0.00765 U	< 0.0039 U
Total	PFBA	375-22-4	0.11 J+	0.102 J	0.12	0.12	0.107	0.128	0.12
Total	PFBS	375-73-5	0.00438	0.00407 J-	0.0046	0.0046	0.004	0.00586	0.0054
Total	PFDA	335-76-2	0.00116 J	0.00117 J-	0.0016 J	0.0016 J	0.0018	0.000812 J	0.0017 J
Total	PFDoA	307-55-1	< 0.000366 U	< 0.000361 UJ	< 0.0042 U	< 0.0041 U	< 0.000744 U	< 0.000765 U	< 0.0039 U
Total	PFDoS	79780-39-5	< 0.000366 U	< 0.000361 UJ	NA	NA	< 0.000744 U	< 0.000765 U	NA
Total	PFDS	335-77-3	< 0.000366 U	< 0.000361 UJ	< 0.0042 U	< 0.0041 U	< 0.000744 U	< 0.000765 U	< 0.0039 U
Total	PFHpA	375-85-9	0.00574	0.00546 J-	0.011	0.013	0.00701	0.0143	0.012
Total	PFHpS	375-92-8	0.00176	0.00164 J-	0.0041 J	0.0023 J	0.00159	0.00265	0.0032 J
Total	PFHxA	307-24-4	0.009	0.00818 J-	0.015	0.015	0.00953	0.0162	0.013
Total	PFHxS	355-46-4	0.00809	0.00691 J-	0.011	0.0088 J+	0.0079	0.0129	0.01 J+
Total	PFNA	375-95-1	0.00124 J	0.00102 J-	0.0015 J	0.0015 J	0.00129 J	0.00123 J	0.0018 J
Total	PFNS	68259-12-1	< 0.000366 U	< 0.000361 UJ	< 0.0042 U	< 0.0041 U	< 0.000744 U	< 0.000765 U	< 0.0039 U
Total	PFOA	335-67-1	0.0501	0.0421 J-	0.07	0.073	0.0549	0.108	0.072
Total	PFOS	1763-23-1	0.225	0.197 J-	0.28	0.26	0.274	0.228	0.28 J+
Total	PFOSA	754-91-6	0.00126 J	0.00104 J-	0.0014 J	0.0012 J	< 0.000744 U	0.00113 J	0.0014 J
Total	PFPeA	2706-90-3	0.00861	0.00775 J-	0.01	0.011	0.0084	0.011	0.011
Total	PFPeS	2706-91-4	0.00225	0.00172 J-	0.0046	0.0042 J+	0.00167	0.00423	0.0049 J+
Total	PFTeDA	376-06-7	< 0.000366 U	< 0.000361 UJ	< 0.0042 U	0.0028 J+	< 0.000744 U	< 0.000765 U	0.0027 J+
Total	PFTrDA	72629-94-8	< 0.000366 U	< 0.000361 UJ	0.0015 BJ	0.0031 J	< 0.000744 U	< 0.000765 U	0.0026 J
Total	PFUnA	2058-94-8	< 0.000366 U	< 0.000361 UJ	< 0.0042 U	< 0.0041 U	< 0.000744 U	< 0.000765 U	< 0.0039 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
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Eagle Point Lake Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake
		Location	EP5	EP7	EP8	EP8	EP8	EP8	EP8
		Location ID	S016-069	82-0109-00-210	82-0109-00-211	82-0109-00-211	82-0109-00-211	82-0109-00-211	82-0109-00-211
		Sample Date	8/13/2019	8/13/2019	8/13/2019	2/25/2020	5/8/2020	7/29/2020	9/16/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	S016-069.1908131155.000S	82-0109-00-210.1908131045.000S	82-0109-00-211.1908130950.000S	82-0109-00-211.2002251730.000S	82-0109-00-211.2005081310.000S	82-0109-00-211.2007291330.000S	82-0109-00-211.2009161215.000S
		Sample Name	EP5-WAT-SUR-01-081319	EP7-WAT-SUR-01-081319	EP8-WAT-SUR-01-081319	EP8-WAT-BULK-01-022520	EP8-WAT-BULK-01-050820	EP8-WAT-BULK-01-072920	EP8-WAT-BULK-01-091620
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #							
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	NA	< 0.0041 U
Total	11Cl-PF3OUdS	763051-92-9	< 0.00306 U	< 0.00305 U	< 0.00292 U	< 0.00301 U	< 0.00313 UJ	< 0.00149 U	< 0.0041 UJ
Total	4:2 FTS	757124-72-4	< 0.00306 U	< 0.00305 U	< 0.00292 U	< 0.00301 U	< 0.00313 UJ	< 0.00148 U	< 0.0041 U
Total	6:2 FTS	27619-97-2	< 0.00275 U	< 0.00275 U	< 0.00263 U	< 0.00271 U	< 0.00282 UJ	0.00863 B	0.0023 BJ+
Total	8:2 FTS	39108-34-4	< 0.00306 U	< 0.00305 U	< 0.00292 U	< 0.00301 U	< 0.00313 UJ	< 0.00148 U	< 0.0041 U
Total	9Cl-PF3ONS	756426-58-1	< 0.00306 U	< 0.00305 U	< 0.00292 U	< 0.00301 U	< 0.00313 UJ	< 0.00149 U	< 0.0041 U
Total	ADONA	919005-14-4	< 0.00306 U	< 0.00305 U	< 0.00292 U	< 0.00301 U	< 0.00313 UJ	< 0.00148 U	< 0.0041 U
Total	HFPO-DA	13252-13-6	< 0.00306 U	< 0.00305 U	< 0.00292 U	< 0.00286 U	< 0.00298 UJ	< 0.00141 U	< 0.0041 U
Total	N-EtFOSA	4151-50-2	< 0.00191 U	< 0.00191 U	< 0.00182 U	< 0.00188 U	< 0.00196 UJ	< 0.000927 U	< 0.0041 U
Total	N-EtFOSAA	2991-50-6	< 0.000764 U	< 0.000763 U	< 0.000729 U	< 0.000752 U	< 0.000784 UJ	0.00297	0.0018 J
Total	N-EtFOSE	1691-99-2	< 0.00573 U	< 0.00572 U	< 0.00547 U	< 0.00564 U	< 0.00588 UJ	< 0.00277 U	< 0.0041 U
Total	N-MeFOSA	31506-32-8	< 0.000878 U	< 0.000878 U	< 0.000839 U	< 0.000865 U	< 0.000901 UJ	< 0.000427 U	< 0.0041 U
Total	N-MeFOSAA	2355-31-9	< 0.000764 U	< 0.000763 U	< 0.000729 U	< 0.000752 U	< 0.000784 UJ	< 0.000371 U	< 0.0041 U
Total	N-MeFOSE	24448-09-7	< 0.00764 U	< 0.00763 U	< 0.00729 U	< 0.00752 U	< 0.00784 UJ	< 0.00371 U	< 0.0041 U
Total	PFBA	375-22-4	0.109	0.0985	0.111	0.114	0.141 J	0.105 J+	0.11
Total	PFBS	375-73-5	0.00427	0.00407	0.00426	0.0038	0.00593 J-	0.00497	0.004 J
Total	PFDA	335-76-2	0.00142 J	0.00154	0.00159	0.00124 J	0.0015 J-	0.00215	0.0022 J
Total	PFDoA	307-55-1	< 0.000764 U	< 0.000763 U	< 0.000729 U	< 0.000752 U	< 0.000784 UJ	< 0.000371 U	< 0.0041 U
Total	PFDoS	79780-39-5	< 0.000764 U	< 0.000763 U	< 0.000729 U	< 0.000752 U	< 0.000784 UJ	< 0.000371 U	NA
Total	PFDS	335-77-3	< 0.000764 U	< 0.000763 U	< 0.000729 U	< 0.000752 U	< 0.000784 UJ	< 0.000371 U	< 0.0041 UJ
Total	PFHpA	375-85-9	0.00766	0.00691	0.00766	0.00576	0.0145 J-	0.00926	0.0068
Total	PFHpS	375-92-8	0.00209	0.00183	0.00218	0.000952 J	0.0027 J-	0.00362	0.0021 J
Total	PFHxA	307-24-4	0.00971	0.00946	0.00995	0.00905	0.0162 J-	0.0115	0.013
Total	PFHxS	355-46-4	0.00836	0.00742	0.00834	0.00617	0.014 J-	0.0115	0.0074
Total	PFNA	375-95-1	0.00117 J	0.000933 J	0.00126 J	0.00111 J	0.00121 J-	0.00151	0.0017 J
Total	PFNS	68259-12-1	< 0.000764 U	< 0.000763 U	< 0.000729 U	< 0.000752 U	< 0.000784 UJ	< 0.000371 U	< 0.0041 UJ
Total	PFOA	335-67-1	0.061	0.0545	0.0717	0.0385	0.111 J-	0.085	0.054
Total	PFOS	1763-23-1	0.237	0.219	0.276	0.109	0.24 J-	0.468	0.2
Total	PFOSA	754-91-6	< 0.000764 U	< 0.000763 U	0.000805 J	< 0.000752 U	0.00114 J-	0.00276 B	0.0012 J
Total	PFPeA	2706-90-3	0.00855	0.00751	0.00858	0.00848	0.0109 J-	0.00906	0.0081
Total	PFPeS	2706-91-4	0.00208	0.0015	0.00227	0.00168	0.00492 J-	0.0034	0.003 J
Total	PFTeDA	376-06-7	< 0.000764 U	< 0.000763 U	< 0.000729 U	< 0.000752 U	< 0.000784 UJ	< 0.000371 U	< 0.0041 U
Total	PFTrDA	72629-94-8	< 0.000764 U	< 0.000763 U	< 0.000729 U	< 0.000752 U	< 0.000784 UJ	< 0.000371 U	< 0.0041 U
Total	PFUnA	2058-94-8	< 0.000764 U	< 0.000763 U	< 0.000729 U	< 0.000752 U	< 0.000784 UJ	< 0.000371 U	< 0.0041 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 2b
Eagle Point Lake Sediment
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake
		Location	EP17	EP17	EP17A	EP17C	EP17B	EP17C
		Location ID	82-0109-00-452	82-0109-00-452	82-0109-00-452	82-0109-00-452	82-0109-00-452	82-0109-00-452
		Sample Date	4/25/2020	4/25/2020	8/12/2020	8/12/2020	8/12/2020	9/24/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	82-0109-00-452.2004251215.000S	82-0109-00-452.2004251245.000S	82-0109-00-452.2008121530.000S	82-0109-00-452.2008121600.000S	82-0109-00-452.2008121630.000S	82-0109-00-452.2009241715.000S
		Sample Name	EP17-SED-WET-0-6-01-042520	EP17-SED-0-6-01-042520	EP17A-SED-WET-0-6-01-081220	EP17C-SED-WET-0-6-01-081220	EP17B-SED-WET-0-6-01-081220	EP17C-SED-0-6-01-092420
		Parent Sample ID	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #						
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	< 1.6 U
Total	11Cl-PF3OUdS	763051-92-9	< 0.585 U	< 0.344 U	< 0.155 U	< 0.152 U	< 0.153 U	< 1.6 U
Total	4:2 FTS	757124-72-4	< 0.585 U	< 0.344 U	< 0.155 U	< 0.152 U	< 0.153 U	< 1.6 U
Total	6:2 FTS	27619-97-2	< 0.526 U	< 0.31 U	1.11 B	0.311 BJ	0.196 BJ	< 1.6 U
Total	8:2 FTS	39108-34-4	< 0.585 U	< 0.344 U	< 0.155 U	< 0.152 U	< 0.153 U	< 1.6 U
Total	9Cl-PF3ONS	756426-58-1	< 0.585 U	< 0.344 U	< 0.155 U	< 0.152 U	< 0.154 U	< 1.6 U
Total	ADONA	919005-14-4	< 0.585 U	< 0.344 U	< 0.155 U	< 0.152 U	< 0.153 U	< 1.6 U
Total	HFPO-DA	13252-13-6	< 0.555 U	< 0.327 U	< 0.147 U	< 0.144 U	< 0.146 U	< 1.6 U
Total	N-EtFOSA	4151-50-2	< 0.365 U	< 0.215 UJ	< 0.0967 UJ	< 0.0949 UJ	< 0.0958 UJ	< 1.6 U
Total	N-EtFOSAA	2991-50-6	1.04	0.27	0.545	0.538	0.067 J	< 1.6 U
Total	N-EtFOSE	1691-99-2	< 1.1 U	< 0.645 UJ	< 0.289 U	< 0.284 U	< 0.287 U	< 1.6 U
Total	N-MeFOSA	31506-32-8	< 0.168 U	< 0.0989 UJ	< 0.0445 U	< 0.0437 UJ	< 0.0441 UJ	< 1.6 U
Total	N-MeFOSAA	2355-31-9	< 0.146 U	0.09 J	< 0.0387 U	< 0.038 U	< 0.0383 U	< 1.6 U
Total	N-MeFOSE	24448-09-7	< 1.46 U	< 0.86 U	< 0.387 U	< 0.38 U	< 0.383 U	< 1.6 U
Total	PFBA	375-22-4	1.98 J	0.626 J	0.824	0.477 J	0.188 J	< 1.6 U
Total	PFBS	375-73-5	< 0.146 U	0.137 J	0.145 J	0.092 J	< 0.0383 U	< 1.6 U
Total	PFDA	335-76-2	0.804	0.602	0.652	0.677	0.223	< 1.6 U
Total	PFDoA	307-55-1	< 0.146 U	< 0.086 U	< 0.0387 U	< 0.038 U	< 0.0383 U	< 1.6 U
Total	PFDoS	79780-39-5	< 0.146 U	< 0.086 U	< 0.0387 U	< 0.038 U	< 0.0383 U	NA
Total	PFDS	335-77-3	0.273 J	< 0.086 U	0.041 J	< 0.038 U	< 0.0383 U	< 1.6 U
Total	PFHpA	375-85-9	0.216 J	0.164 J	0.321	0.167	0.055 J	< 1.6 U
Total	PFHpS	375-92-8	0.284	0.377	0.999	0.612	0.127 J	< 1.6 U
Total	PFHxA	307-24-4	0.203 J	0.159 J	0.414	0.216	0.046 J	< 1.6 U
Total	PFHxS	355-46-4	0.551	0.609	1.73	1.02	0.188	< 1.6 U
Total	PFNA	375-95-1	0.192 J	0.11 J	0.155	0.129 J	0.04 J	< 1.6 U
Total	PFNS	68259-12-1	0.207 J	< 0.086 U	< 0.0387 U	< 0.038 U	< 0.0383 U	< 1.6 U
Total	PFOA	335-67-1	2.92	2.66	10.5	4.64	0.773	< 1.6 U
Total	PFOS	1763-23-1	90.7	73.1	108	98.5	33.7	5.8
Total	PFOSA	754-91-6	1.35	0.416	0.817	0.493	0.283 B	0.2 J
Total	PFPeA	2706-90-3	< 0.292 U	< 0.172 U	0.131 J	< 0.0759 U	< 0.0766 U	< 1.6 U
Total	PFPeS	2706-91-4	< 0.146 U	0.146 J	0.32	0.204	< 0.0385 U	< 1.6 U
Total	PFTeDA	376-06-7	< 0.146 U	< 0.086 U	< 0.0387 U	< 0.038 U	< 0.0383 U	< 1.6 U
Total	PFTrDA	72629-94-8	< 0.146 U	< 0.086 U	< 0.0387 U	< 0.038 U	< 0.0383 U	< 1.6 U
Total	PFUnA	2058-94-8	0.254 J	< 0.086 U	< 0.0387 U	< 0.038 U	< 0.0383 U	< 1.6 U

NOTES
All results are reported in micrograms per kilogram (ug/kg).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 2b
Eagle Point Lake Sediment
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake
		Location	EP1	EP1A	EP1A	EP27C	EP27B	EP27A
		Location ID	82-0109-00-205	82-0109-00-205	82-0109-00-205	82-0109-00-457	82-0109-00-457	82-0109-00-457
		Sample Date	8/27/2019	8/18/2020	9/15/2020	8/18/2020	8/18/2020	8/18/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	82-0109-00-205.1908270940.000S	82-0109-00-205.2008181330.000S	82-0109-00-205.2009151440.000S	82-0109-00-457.2008181015.000S	82-0109-00-457.2008181110.000S	82-0109-00-457.2008181310.000S
		Sample Name	EP1-SED-0-6-01-082719	EP1A-SED-0-6-01-081820	EP1A-SED-0-6-01-091520	EP27C-SED-WET-0-6-01-081820	EP27B-SED-0-6-01-081820	EP27A-SED-0-6-01-081820
		Parent Sample ID	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #						
Total	10:2 FTS	120226-60-0	NA	NA	< 2.7 U	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.272 U	< 0.194 UJ	< 2.7 UJ	< 0.293 UJ	< 0.147 UJ	< 0.263 UJ
Total	4:2 FTS	757124-72-4	< 0.272 U	< 0.194 UJ	< 2.7 U	< 0.292 UJ	< 0.147 UJ	< 0.263 UJ
Total	6:2 FTS	27619-97-2	< 0.245 U	1.93 J-	< 2.7 U	< 0.264 UJ	2.8 J-	< 0.237 UJ
Total	8:2 FTS	39108-34-4	< 0.272 U	< 0.194 UJ	< 2.7 U	< 0.292 UJ	< 0.147 UJ	< 0.263 UJ
Total	9Cl-PF3ONS	756426-58-1	< 0.272 U	< 0.195 UJ	< 2.7 U	< 0.293 UJ	< 0.148 UJ	< 0.264 UJ
Total	ADONA	919005-14-4	< 0.272 U	< 0.194 UJ	< 2.7 U	< 0.292 UJ	< 0.147 UJ	< 0.263 UJ
Total	HFPO-DA	13252-13-6	< 0.272 U	< 0.184 UJ	< 2.7 U	< 0.278 UJ	< 0.14 UJ	< 0.25 UJ
Total	N-EtFOSA	4151-50-2	< 0.17 U	R	< 2.7 U	< 0.183 UJ	< 0.092 UJ	R
Total	N-EtFOSAA	2991-50-6	0.253	1.58 J-	1.4 J	0.781 J-	0.05 J-	2.17 J-
Total	N-EtFOSE	1691-99-2	< 0.511 U	< 0.363 UJ	< 2.7 U	< 0.547 UJ	< 0.275 UJ	< 0.492 UJ
Total	N-MeFOSA	31506-32-8	< 0.0783 U	0.093 J	< 2.7 U	0.117 J	< 0.0423 UJ	0.193 J
Total	N-MeFOSAA	2355-31-9	< 0.0681 U	< 0.0485 UJ	< 2.7 U	< 0.0731 UJ	< 0.0368 UJ	< 0.0657 UJ
Total	N-MeFOSE	24448-09-7	< 0.681 U	< 0.485 UJ	< 2.7 U	< 0.731 UJ	< 0.368 UJ	< 0.657 UJ
Total	PFBA	375-22-4	< 0.272 U	0.815 J-	< 2.7 U	0.799 J-	0.239 J-	1.36 J-
Total	PFBS	375-73-5	< 0.0681 U	0.111 J-	< 2.7 U	0.177 J-	0.172 J-	0.128 J-
Total	PFDA	335-76-2	0.126 J	0.254 BJ-	0.85 BJ	0.323 BJ-	0.091 BJ-	0.36 BJ-
Total	PFDoA	307-55-1	< 0.0681 U	< 0.0485 UJ	< 2.7 U	< 0.0731 UJ	< 0.0368 UJ	< 0.0657 UJ
Total	PFDoS	79780-39-5	< 0.0681 U	< 0.0485 UJ	NA	< 0.0731 UJ	< 0.0368 UJ	< 0.0657 UJ
Total	PFDS	335-77-3	0.081 J	< 0.0485 UJ	< 2.7 U	< 0.0731 UJ	< 0.0368 UJ	< 0.0657 UJ
Total	PFHpA	375-85-9	< 0.0681 U	0.161 BJ-	< 2.7 U	0.318 BJ-	0.041 BJ-	0.137 BJ-
Total	PFHpS	375-92-8	< 0.0681 U	0.264 J-	0.56 J	0.342 J-	0.09 J-	0.31 J-
Total	PFHxA	307-24-4	< 0.0681 U	0.21 BJ-	< 2.7 U	0.279 BJ-	0.076 BJ-	0.234 BJ-
Total	PFHxS	355-46-4	0.077 J	0.508 J-	< 2.7 U	1.28 J-	0.241 J-	0.595 J-
Total	PFNA	375-95-1	< 0.0681 U	< 0.0485 UJ	< 2.7 U	0.119 J-	< 0.0368 UJ	0.072 BJ-
Total	PFNS	68259-12-1	< 0.0681 U	< 0.0485 UJ	< 2.7 U	< 0.0731 UJ	< 0.0368 UJ	< 0.0657 UJ
Total	PFOA	335-67-1	0.491	2.48 J-	3.1	5.92 BJ-	0.673 BJ-	2.48 J-
Total	PFOS	1763-23-1	12.5	43.4 J-	40	44.5 J-	11.8 J-	60.1 J-
Total	PFOSA	754-91-6	0.169 J	0.867 J-	0.89 J	0.791 J-	0.05 J-	1.37 J-
Total	PFPeA	2706-90-3	< 0.136 U	0.099 J-	< 2.7 U	< 0.146 UJ	< 0.0736 UJ	< 0.131 UJ
Total	PFPeS	2706-91-4	< 0.0681 U	0.122 J-	0.56 J	0.346 J-	0.114 J-	0.177 J-
Total	PFTeDA	376-06-7	< 0.0681 U	< 0.0485 UJ	0.96 BJ	< 0.0731 UJ	< 0.0368 UJ	< 0.0657 UJ
Total	PFTrDA	72629-94-8	< 0.0681 U	< 0.0485 UJ	< 2.7 U	< 0.0731 UJ	< 0.0368 UJ	< 0.0657 UJ
Total	PFUnA	2058-94-8	< 0.0681 U	< 0.0485 UJ	< 2.7 U	< 0.0731 UJ	< 0.0368 UJ	< 0.0657 UJ

NOTES
All results are reported in micrograms per kilogram (ug/kg).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 2b
Eagle Point Lake Sediment
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake
		Location	EP27C	EP27B	EP26A	EP26B	EP26C	EP26A
		Location ID	82-0109-00-457	82-0109-00-457	82-0109-00-456	82-0109-00-456	82-0109-00-456	82-0109-00-456
		Sample Date	9/15/2020	9/24/2020	8/18/2020	8/18/2020	8/18/2020	9/17/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	82-0109-00-457.2009151510.000S	82-0109-00-457.2009241605.000S	82-0109-00-456.2008180930.000S	82-0109-00-456.2008180940.000S	82-0109-00-456.2008181000.000S	82-0109-00-456.2009171345.000S
		Sample Name	EP27C-SED-0-6-01-091520	EP27B-SED-0-6-01-092420	EP26A-SED-WET-0-6-01-081820	EP26B-SED-0-6-01-081820	EP26C-SED-0-6-01-081820	EP26A-SED-0-6-01-091720
		Parent Sample ID	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #						
Total	10:2 FTS	120226-60-0	< 4.2 U	< 1.2 U	NA	NA	NA	< 1.2 U
Total	11Cl-PF3OUdS	763051-92-9	< 4.2 UJ	< 1.2 U	< 0.367 UJ	< 0.402 UJ	< 0.377 UJ	< 1.2 UJ
Total	4:2 FTS	757124-72-4	< 4.2 U	< 1.2 U	< 0.367 UJ	< 0.402 UJ	< 0.376 UJ	< 1.2 U
Total	6:2 FTS	27619-97-2	< 4.2 U	< 1.2 U	< 0.33 UJ	< 0.362 UJ	< 0.339 UJ	< 1.2 U
Total	8:2 FTS	39108-34-4	0.13 J	< 1.2 U	< 0.367 UJ	< 0.402 UJ	< 0.376 UJ	0.036 J
Total	9Cl-PF3ONS	756426-58-1	< 4.2 U	< 1.2 U	< 0.367 UJ	< 0.403 UJ	< 0.377 UJ	< 1.2 U
Total	ADONA	919005-14-4	< 4.2 U	< 1.2 U	< 0.367 UJ	< 0.402 UJ	< 0.376 UJ	< 1.2 U
Total	HFPO-DA	13252-13-6	< 4.2 U	< 1.2 U	< 0.348 UJ	< 0.382 UJ	< 0.357 UJ	< 1.2 U
Total	N-EtFOSA	4151-50-2	< 4.2 U	< 1.2 U	< 0.229 UJ	< 0.251 UJ	< 0.235 UJ	< 1.2 U
Total	N-EtFOSAA	2991-50-6	3.3 J	0.32 BJ	2.59 J-	2.05 J-	2.77 J-	0.65 J
Total	N-EtFOSE	1691-99-2	< 4.2 U	< 1.2 U	< 0.685 UJ	< 0.751 UJ	< 0.703 UJ	0.11 J
Total	N-MeFOSA	31506-32-8	< 4.2 U	0.15 BJ	0.246 J-	0.251 J	0.188 J	0.088 J
Total	N-MeFOSAA	2355-31-9	< 4.2 U	< 1.2 U	< 0.0916 UJ	< 0.1 UJ	< 0.094 UJ	< 1.2 U
Total	N-MeFOSE	24448-09-7	< 4.2 U	< 1.2 U	< 0.916 UJ	< 1 UJ	< 0.94 UJ	< 1.2 U
Total	PFBA	375-22-4	< 4.2 U	< 1.2 U	2.38 J-	1.34 J-	0.921 J-	< 1.2 U
Total	PFBS	375-73-5	< 4.2 U	< 1.2 U	0.3 J-	0.376 J-	0.265 J-	< 1.2 U
Total	PFDA	335-76-2	1.4 BJ	< 1.2 U	0.751 J-	0.577 J-	0.872 J-	< 1.2 U
Total	PFDoA	307-55-1	< 4.2 U	< 1.2 U	< 0.0916 UJ	< 0.1 UJ	< 0.094 UJ	< 1.2 U
Total	PFDoS	79780-39-5	NA	NA	< 0.0916 UJ	< 0.1 UJ	< 0.094 UJ	NA
Total	PFDS	335-77-3	< 4.2 U	< 1.2 U	< 0.0916 UJ	< 0.1 UJ	< 0.094 UJ	< 1.2 U
Total	PFHpA	375-85-9	1.1 J	< 1.2 U	0.509 J-	0.355 J-	0.349 J-	< 1.2 U
Total	PFHpS	375-92-8	0.99 J	0.11 J	0.554 J-	0.536 J-	1.3 J-	< 1.2 U
Total	PFHxA	307-24-4	1.5 J	< 1.2 U	0.623 J-	0.416 J-	0.267 J-	< 1.2 U
Total	PFHxS	355-46-4	2.1 J	< 1.2 U	1.37 J-	1.47 J-	2.56 J-	< 1.2 U
Total	PFNA	375-95-1	1.6 BJ	< 1.2 U	0.174 J-	0.158 J-	0.227 J-	< 1.2 U
Total	PFNS	68259-12-1	< 4.2 U	< 1.2 U	0.114 J-	< 0.1 UJ	< 0.094 UJ	< 1.2 U
Total	PFOA	335-67-1	11	0.44 J	8.34 J-	6.35 J-	7.99 J-	0.5 BJ
Total	PFOS	1763-23-1	66	24	116 J-	86 J-	145 J-	11
Total	PFOSA	754-91-6	1.3 J	0.12 J	2.15 J-	1.74 J-	2.24 J-	0.13 J
Total	PFPeA	2706-90-3	0.9 BJ	< 1.2 U	0.272 J-	< 0.201 UJ	< 0.188 UJ	< 1.2 U
Total	PFPeS	2706-91-4	0.99 J	< 1.2 U	0.421 J-	0.428 J-	0.505 J-	< 1.2 U
Total	PFTeDA	376-06-7	1.6 BJ	< 1.2 U	< 0.0916 UJ	< 0.1 UJ	< 0.094 UJ	0.27 BJ
Total	PFTrDA	72629-94-8	< 4.2 U	< 1.2 U	< 0.0916 UJ	< 0.1 UJ	< 0.094 UJ	< 1.2 U
Total	PFUnA	2058-94-8	< 4.2 U	< 1.2 U	< 0.0916 UJ	< 0.1 UJ	< 0.094 UJ	< 1.2 U

NOTES
All results are reported in micrograms per kilogram (ug/kg).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 2b
Eagle Point Lake Sediment
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake
		Location	EP2	EP2C	EP2A	EP2B	EP18	EP18D
		Location ID	82-0109-00-206	82-0109-00-206	82-0109-00-206	82-0109-00-206	82-0109-00-455	82-0109-00-455
		Sample Date	8/27/2019	8/18/2020	8/18/2020	8/18/2020	5/12/2020	8/18/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	82-0109-00-206.1908270915.000S	82-0109-00-206.2008181035.000S	82-0109-00-206.2008181345.000S	82-0109-00-206.2008181400.000S	82-0109-00-455.2005121130.000S	82-0109-00-455.2008181410.000S
		Sample Name	EP2-SED-0-6-01-082719	EP2C-SED-0-6-01-081820	EP2A-SED-WET-0-6-01-081820	EP2B-SED-WET-0-6-01-081820	EP18-SED-0-6-01-051220	EP18D-SED-0-6-01-081820
		Parent Sample ID	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #						
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.32 U	< 0.239 UJ	< 0.158 UJ	< 0.147 UJ	< 0.64 UJ	< 0.376 UJ
Total	4:2 FTS	757124-72-4	< 0.32 U	< 0.238 UJ	< 0.158 UJ	< 0.147 UJ	< 0.64 UJ	< 0.375 UJ
Total	6:2 FTS	27619-97-2	< 0.288 U	< 0.215 UJ	< 0.143 UJ	< 0.133 UJ	1.62 J-	< 0.338 UJ
Total	8:2 FTS	39108-34-4	< 0.32 U	< 0.238 UJ	< 0.158 UJ	< 0.147 UJ	< 0.64 UJ	< 0.375 UJ
Total	9Cl-PF3ONS	756426-58-1	< 0.32 U	< 0.239 UJ	< 0.159 UJ	< 0.148 UJ	< 0.64 UJ	< 0.376 UJ
Total	ADONA	919005-14-4	< 0.32 U	< 0.238 UJ	< 0.158 UJ	< 0.147 UJ	< 0.64 UJ	< 0.375 UJ
Total	HFPO-DA	13252-13-6	< 0.32 U	< 0.226 UJ	< 0.15 UJ	< 0.14 UJ	< 0.608 UJ	< 0.356 UJ
Total	N-EtFOSA	4151-50-2	< 0.2 U	R	< 0.0988 UJ	< 0.092 UJ	< 0.4 UJ	< 0.234 UJ
Total	N-EtFOSAA	2991-50-6	< 0.0801 U	1.33 J-	< 0.0395 UJ	0.227 J-	2.19 J-	1.25 J-
Total	N-EtFOSE	1691-99-2	< 0.6 U	< 0.446 UJ	< 0.296 UJ	< 0.275 UJ	< 1.2 UJ	< 0.701 UJ
Total	N-MeFOSA	31506-32-8	< 0.0921 U	0.16 J	< 0.0455 UJ	< 0.0423 UJ	0.187 J-	0.125 J
Total	N-MeFOSAA	2355-31-9	< 0.0801 U	< 0.0596 UJ	< 0.0395 UJ	< 0.0368 UJ	< 0.16 UJ	< 0.0938 UJ
Total	N-MeFOSE	24448-09-7	< 0.8 U	< 0.596 UJ	< 0.395 UJ	< 0.368 UJ	< 1.6 UJ	< 0.938 UJ
Total	PFBA	375-22-4	< 0.32 U	0.591 J-	0.219 J-	0.154 J-	1.13 J	2.32 J-
Total	PFBS	375-73-5	< 0.0801 U	0.15 J-	< 0.0395 UJ	< 0.0368 UJ	0.234 J-	0.438 J-
Total	PFDA	335-76-2	< 0.0801 U	0.366 BJ-	0.046 BJ-	0.084 BJ-	0.615 J-	0.51 BJ-
Total	PFDoA	307-55-1	< 0.0801 U	< 0.0596 UJ	< 0.0395 UJ	< 0.0368 UJ	< 0.16 UJ	< 0.0938 UJ
Total	PFDoS	79780-39-5	< 0.0801 U	< 0.0596 UJ	< 0.0395 UJ	< 0.0368 UJ	< 0.16 UJ	< 0.0938 UJ
Total	PFDS	335-77-3	< 0.0801 U	< 0.0596 UJ	< 0.0395 UJ	< 0.0368 UJ	< 0.16 UJ	< 0.0938 UJ
Total	PFHpA	375-85-9	< 0.0801 U	0.128 BJ-	0.042 BJ-	< 0.0368 UJ	0.265 J-	0.426 BJ-
Total	PFHpS	375-92-8	< 0.0801 U	0.357 J-	0.043 J-	< 0.0368 UJ	0.523 J-	0.567 J-
Total	PFHxA	307-24-4	< 0.0801 U	0.142 BJ-	0.062 BJ-	< 0.0368 UJ	0.209 J-	0.487 BJ-
Total	PFHxS	355-46-4	< 0.0801 U	0.921 J-	0.102 J-	0.056 J-	1.06 J-	1.53 J-
Total	PFNA	375-95-1	< 0.0801 U	0.097 BJ-	< 0.0395 UJ	< 0.0368 UJ	< 0.16 UJ	0.138 BJ-
Total	PFNS	68259-12-1	< 0.0801 U	< 0.0596 UJ	< 0.0395 UJ	< 0.0368 UJ	< 0.16 UJ	< 0.0938 UJ
Total	PFOA	335-67-1	0.541	3.16 J-	0.603 BJ-	0.295 BJ-	3.76 J-	7.5 J-
Total	PFOS	1763-23-1	6.2	51.9 J-	5.99 J-	10.2 J-	91.2 J-	78.3 J-
Total	PFOSA	754-91-6	< 0.0801 U	0.943 J-	< 0.0395 UJ	0.168 J-	1.9 J-	1.15 J-
Total	PFPeA	2706-90-3	< 0.16 U	< 0.119 UJ	< 0.0791 UJ	< 0.0736 UJ	< 0.32 UJ	0.214 J-
Total	PFPeS	2706-91-4	< 0.0801 U	0.206 J-	< 0.0397 UJ	< 0.037 UJ	0.284 J-	0.561 J-
Total	PFTeDA	376-06-7	< 0.0801 U	< 0.0596 UJ	< 0.0395 UJ	< 0.0368 UJ	< 0.16 UJ	< 0.0938 UJ
Total	PFTrDA	72629-94-8	< 0.0801 U	< 0.0596 UJ	< 0.0395 UJ	< 0.0368 UJ	< 0.16 UJ	< 0.0938 UJ
Total	PFUnA	2058-94-8	< 0.0801 U	< 0.0596 UJ	< 0.0395 UJ	< 0.0368 UJ	< 0.16 UJ	< 0.0938 UJ

NOTES
All results are reported in micrograms per kilogram (ug/kg).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 2b
Eagle Point Lake Sediment
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake
		Location	EP18C	EP18A	EP18B	EP3	EP4	EP4
		Location ID	82-0109-00-455	82-0109-00-455	82-0109-00-455	82-0109-00-207	82-0109-00-209	82-0109-00-209
		Sample Date	8/18/2020	8/18/2020	8/18/2020	8/27/2019	8/13/2019	9/24/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	82-0109-00-455.2008181420.000S	82-0109-00-455.2008181445.000S	82-0109-00-455.2008181500.000S	82-0109-00-207.1908271015.000S	82-0109-00-209.1908131315.000S	82-0109-00-209.2009241130.000S
		Sample Name	EP18C-SED-0-6-01-081820	EP18A-SED-WET-0-6-01-081820	EP18B-SED-WET-0-6-01-081820	EP3-SED-0-6-01-082719	EP4-SED-0-6-01-081319	EP4-SED-0-6-01-092420
		Parent Sample ID	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #						
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	< 1.3 U
Total	11Cl-PF3OUdS	763051-92-9	< 0.356 UJ	< 0.23 UJ	< 0.153 UJ	< 0.516 U	< 0.286 U	< 1.3 UJ
Total	4:2 FTS	757124-72-4	< 0.355 UJ	< 0.229 UJ	< 0.153 UJ	< 0.516 U	< 0.286 U	< 1.3 U
Total	6:2 FTS	27619-97-2	< 0.32 UJ	0.29 J-	< 0.138 UJ	< 0.464 U	< 0.258 U	0.35 J
Total	8:2 FTS	39108-34-4	< 0.355 UJ	< 0.229 UJ	< 0.153 UJ	< 0.516 U	< 0.286 U	< 1.3 U
Total	9Cl-PF3ONS	756426-58-1	< 0.356 UJ	< 0.23 UJ	< 0.154 UJ	< 0.516 U	< 0.286 U	< 1.3 U
Total	ADONA	919005-14-4	< 0.355 UJ	< 0.229 UJ	< 0.153 UJ	< 0.516 U	< 0.286 U	< 1.3 U
Total	HFPO-DA	13252-13-6	< 0.338 UJ	< 0.218 UJ	< 0.145 UJ	< 0.516 U	< 0.286 U	< 1.3 U
Total	N-EtFOSA	4151-50-2	R	< 0.143 UJ	< 0.0957 UJ	< 0.322 U	< 0.179 U	< 1.3 U
Total	N-EtFOSAA	2991-50-6	2.8 J-	0.588 J-	0.039 J-	1.74	0.218	0.75 J
Total	N-EtFOSE	1691-99-2	< 0.665 UJ	< 0.429 UJ	< 0.286 UJ	< 0.967 U	< 0.537 U	< 1.3 U
Total	N-MeFOSA	31506-32-8	0.236 J	< 0.0659 UJ	< 0.044 UJ	< 0.148 U	< 0.0823 U	< 1.3 U
Total	N-MeFOSAA	2355-31-9	< 0.0889 UJ	< 0.0573 UJ	< 0.0383 UJ	< 0.129 U	< 0.0716 U	< 1.3 U
Total	N-MeFOSE	24448-09-7	< 0.889 UJ	< 0.573 UJ	< 0.383 UJ	< 1.29 U	< 0.716 U	< 1.3 U
Total	PFBA	375-22-4	2.11 J-	0.771 J-	0.182 J-	0.709 J	< 0.286 U	< 1.3 U
Total	PFBS	375-73-5	0.291 J-	0.139 J-	< 0.0383 UJ	0.208 J	< 0.0716 U	< 1.3 U
Total	PFDA	335-76-2	0.57 BJ-	0.359 BJ-	0.097 BJ-	0.516	0.083 J	< 1.3 U
Total	PFDoA	307-55-1	< 0.0889 UJ	< 0.0573 UJ	< 0.0383 UJ	< 0.129 U	< 0.0716 U	< 1.3 U
Total	PFDoS	79780-39-5	< 0.0889 UJ	< 0.0573 UJ	< 0.0383 UJ	< 0.129 U	< 0.0716 U	NA
Total	PFDS	335-77-3	< 0.0889 UJ	< 0.0573 UJ	< 0.0383 UJ	< 0.129 U	< 0.0716 U	< 1.3 U
Total	PFHpA	375-85-9	0.372 BJ-	0.336 BJ-	< 0.0383 UJ	0.273	< 0.0716 U	< 1.3 U
Total	PFHpS	375-92-8	0.723 J-	0.299 J-	0.042 J-	0.56	< 0.0716 U	< 1.3 U
Total	PFHxA	307-24-4	0.363 BJ-	0.384 BJ-	< 0.0383 UJ	0.144 J	< 0.0716 U	0.48 J
Total	PFHxS	355-46-4	1.46 J-	0.945 J-	0.059 J-	1.29	< 0.0716 U	< 1.3 U
Total	PFNA	375-95-1	0.128 BJ-	0.123 BJ-	< 0.0383 UJ	< 0.129 U	< 0.0716 U	< 1.3 U
Total	PFNS	68259-12-1	< 0.0889 UJ	< 0.0573 UJ	< 0.0383 UJ	< 0.129 U	< 0.0716 U	< 1.3 U
Total	PFOA	335-67-1	5.58 BJ-	4.61 BJ-	0.386 BJ-	6.97	0.229	0.48 J
Total	PFOS	1763-23-1	110 J-	51.2 J-	10.7 J-	75.3	7.18	4.9 J
Total	PFOSA	754-91-6	2.38 J-	0.46 J-	0.051 J-	1.43	0.134 J	0.13 J
Total	PFPeA	2706-90-3	0.19 J-	0.128 J-	< 0.0766 UJ	< 0.258 U	< 0.143 U	0.3 J
Total	PFPeS	2706-91-4	0.337 J-	0.259 J-	< 0.0385 UJ	0.298	< 0.0716 U	< 1.3 U
Total	PFTeDA	376-06-7	< 0.0889 UJ	< 0.0573 UJ	< 0.0383 UJ	< 0.129 U	< 0.0716 U	0.3 BJ
Total	PFTrDA	72629-94-8	< 0.0889 UJ	< 0.0573 UJ	< 0.0383 UJ	< 0.129 U	< 0.0716 U	< 1.3 U
Total	PFUnA	2058-94-8	< 0.0889 UJ	< 0.0573 UJ	< 0.0383 UJ	< 0.129 U	< 0.0716 U	< 1.3 U

NOTES
All results are reported in micrograms per kilogram (ug/kg).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 2b
Eagle Point Lake Sediment
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake
		Location	EP4	EP7	EP19	EP19	EP28	EP5	EP5
		Location ID	82-0109-00-209	82-0109-00-210	82-0109-00-453	82-0109-00-453	82-0109-00-458	S016-069	S016-069
		Sample Date	9/24/2020	8/13/2019	4/25/2020	9/20/2020	8/19/2020	8/13/2019	9/24/2020
		Sample Type Code	QC-FR	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	82-0109-00-209.2009241135.000SR	82-0109-00-210.1908131430.000S	82-0109-00-453.2004251315.000S	82-0109-00-453.2009201320.000S	82-0109-00-458 .2008190850.000S	S016-069.1908131150.000S	S016-069.2009240930.000S
		Sample Name	EP4-SED-0-6-02-092420	EP7-SED-0-6-01-081319	EP19-SED-WET-0-6-01-042520	EP19-SED-0-6-01-092020	EP28-SED-0-6-01-081920	EP5-SED-0-6-01-081319	EP5-SED-0-6-01-092420
		Parent Sample ID	82-0109-00-209.2009241130.000S	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #							
Total	10:2 FTS	120226-60-0	< 0.95 U	NA	NA	< 1 U	NA	NA	< 1.3 U
Total	11Cl-PF3OUdS	763051-92-9	< 0.95 UJ	< 0.291 U	< 0.317 U	< 1 UJ	< 0.147 UJ	< 0.305 U	< 1.3 UJ
Total	4:2 FTS	757124-72-4	< 0.95 U	< 0.291 U	< 0.317 U	< 1 U	< 0.147 UJ	< 0.305 U	< 1.3 U
Total	6:2 FTS	27619-97-2	< 0.95 U	< 0.262 U	< 0.285 U	< 1 U	0.157 J-	< 0.274 U	< 1.3 U
Total	8:2 FTS	39108-34-4	< 0.95 U	< 0.291 U	< 0.317 U	< 1 U	< 0.147 UJ	< 0.305 U	< 1.3 U
Total	9Cl-PF3ONS	756426-58-1	< 0.95 U	< 0.291 U	< 0.317 U	< 1 U	< 0.148 UJ	< 0.305 U	< 1.3 U
Total	ADONA	919005-14-4	< 0.95 U	< 0.291 U	< 0.317 U	< 1 U	< 0.147 UJ	< 0.305 U	< 1.3 U
Total	HFPO-DA	13252-13-6	< 0.95 U	< 0.291 U	< 0.301 U	< 1 U	< 0.14 UJ	< 0.305 U	< 1.3 U
Total	N-EtFOSA	4151-50-2	< 0.95 U	< 0.182 U	< 0.198 UJ	< 1 U	< 0.092 UJ	< 0.19 U	< 1.3 U
Total	N-EtFOSAA	2991-50-6	0.55 J	0.244	0.123 J	< 1 UJ	< 0.0368 UJ	< 0.0762 U	< 1.3 UJ
Total	N-EtFOSE	1691-99-2	< 0.95 U	< 0.545 U	< 0.594 U	< 1 U	< 0.275 UJ	< 0.571 U	< 1.3 U
Total	N-MeFOSA	31506-32-8	< 0.95 U	< 0.0836 U	< 0.0911 UJ	< 1 U	< 0.0423 UJ	< 0.0876 U	< 1.3 U
Total	N-MeFOSAA	2355-31-9	< 0.95 U	< 0.0727 U	< 0.0793 U	< 1 U	< 0.0368 UJ	< 0.0762 U	< 1.3 U
Total	N-MeFOSE	24448-09-7	< 0.95 U	< 0.727 U	< 0.792 U	< 1 U	< 0.368 UJ	< 0.762 U	< 1.3 U
Total	PFBA	375-22-4	< 0.95 U	< 0.291 U	0.52 J	< 1 U	0.164 J-	< 0.305 U	< 1.3 U
Total	PFBS	375-73-5	< 0.95 U	< 0.0727 U	< 0.0793 U	< 1 U	< 0.0368 UJ	< 0.0762 U	< 1.3 U
Total	PFDA	335-76-2	< 0.95 U	0.102 J	< 0.0793 U	< 1 U	0.092 J-	< 0.0762 U	< 1.3 U
Total	PFDoA	307-55-1	< 0.95 U	< 0.0727 U	< 0.0793 U	< 1 U	< 0.0368 UJ	< 0.0762 U	< 1.3 U
Total	PFDoS	79780-39-5	NA	< 0.0727 U	< 0.0793 U	NA	< 0.0368 UJ	< 0.0762 U	NA
Total	PFDS	335-77-3	< 0.95 U	< 0.0727 U	< 0.0793 U	< 1 U	< 0.0368 UJ	< 0.0762 U	< 1.3 U
Total	PFHpA	375-85-9	< 0.95 U	< 0.0727 U	< 0.0793 U	< 1 U	< 0.0368 UJ	< 0.0762 U	< 1.3 U
Total	PFHpS	375-92-8	< 0.95 U	< 0.0727 U	< 0.0793 U	< 1 U	< 0.0368 UJ	< 0.0762 U	< 1.3 U
Total	PFHxA	307-24-4	< 0.95 U	< 0.0727 U	< 0.0793 U	0.4 J	< 0.0368 UJ	< 0.0762 U	< 1.3 U
Total	PFHxS	355-46-4	< 0.95 U	< 0.0727 U	0.089 J	< 1 U	0.049 J-	< 0.0762 U	< 1.3 U
Total	PFNA	375-95-1	< 0.95 U	< 0.0727 U	< 0.0793 U	< 1 U	< 0.0368 UJ	< 0.0762 U	< 1.3 U
Total	PFNS	68259-12-1	< 0.95 U	< 0.0727 U	< 0.0793 U	< 1 U	< 0.0368 UJ	< 0.0762 U	< 1.3 U
Total	PFOA	335-67-1	0.21 J	0.195	0.425	0.2 BJ	0.399 J-	< 0.0762 U	0.28 J
Total	PFOS	1763-23-1	2.7 J	10.1	7.54	2.4	11.4 J-	3.5	2.8
Total	PFOSA	754-91-6	< 0.95 U	0.114 J	0.125 J	< 1 U	0.042 J-	< 0.0762 U	< 1.3 U
Total	PFPeA	2706-90-3	< 0.95 U	< 0.145 U	< 0.158 U	< 1 U	< 0.0736 UJ	< 0.152 U	< 1.3 U
Total	PFPeS	2706-91-4	< 0.95 U	< 0.0727 U	< 0.0793 U	< 1 U	< 0.037 UJ	< 0.0762 U	< 1.3 U
Total	PFTeDA	376-06-7	0.28 BJ	< 0.0727 U	< 0.0793 U	< 1 U	< 0.0368 UJ	< 0.0762 U	0.38 BJ
Total	PFTrDA	72629-94-8	< 0.95 U	< 0.0727 U	< 0.0793 U	< 1 U	< 0.0368 UJ	< 0.0762 U	< 1.3 U
Total	PFUnA	2058-94-8	< 0.95 U	< 0.0727 U	< 0.0793 U	< 1 U	< 0.0368 UJ	< 0.0762 U	0.26 J

NOTES
All results are reported in micrograms per kilogram (ug/kg).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 2c
Eagle Point Lake Pore Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake
		Location	EP17C	EP27B	EP26A	EP19	EP4	EP5
		Location ID	82-0109-00-452	82-0109-00-457	82-0109-00-456	82-0109-00-453	82-0109-00-209	S016-069
		Sample Date	9/24/2020	9/24/2020	9/18/2020	9/20/2020	9/24/2020	9/24/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	82-0109-00-452.2009241700.000S	82-0109-00-457.2009241600.000S	82-0109-00-456.2009181315.000S	82-0109-00-453.2009201310.000S	82-0109-00-209.2009241125.000S	S016-069.2009240915.000S
		Sample Name	EP17C-POWAT-01-092420	EP27B-POWAT-01-092420	EP26A-POWAT-01-091720	EP19-POWAT-01-092020	EP4-POWAT-01-092420	EP5-POWAT-01-092420
		Parent Sample ID	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #						
Dissolved	10:2 FTS	120226-60-0	< 0.0044 U	< 0.0043 U	< 0.0041 U	< 0.0042 U	< 0.0045 U	< 0.0045 U
Dissolved	11Cl-PF3OUdS	763051-92-9	< 0.0044 U	< 0.0043 U	< 0.0041 U	< 0.0042 U	< 0.0045 U	< 0.0045 U
Dissolved	4:2 FTS	757124-72-4	< 0.0044 U	< 0.0043 U	< 0.0041 U	< 0.0042 U	< 0.0045 U	< 0.0045 U
Dissolved	6:2 FTS	27619-97-2	< 0.0044 U	< 0.0043 U	< 0.0041 U	< 0.0042 U	< 0.0045 U	< 0.0045 U
Dissolved	8:2 FTS	39108-34-4	< 0.0044 U	< 0.0043 U	0.00016 J+	< 0.0042 U	< 0.0045 U	< 0.0045 U
Dissolved	9Cl-PF3ONS	756426-58-1	< 0.0044 U	< 0.0043 U	< 0.0041 U	< 0.0042 U	< 0.0045 U	< 0.0045 U
Dissolved	ADONA	919005-14-4	< 0.0044 U	< 0.0043 U	< 0.0041 U	< 0.0042 U	< 0.0045 U	< 0.0045 U
Dissolved	HFPO-DA	13252-13-6	0.00033 J	< 0.0043 U	< 0.0041 U	< 0.0042 U	0.00034 J	< 0.0045 U
Dissolved	N-EtFOSA	4151-50-2	< 0.0044 U	< 0.0043 U	R	< 0.0042 U	< 0.0045 U	< 0.0045 U
Dissolved	N-EtFOSAA	2991-50-6	< 0.0044 U	< 0.0043 UJ	R	0.0013 BJ	< 0.0045 U	< 0.0045 U
Dissolved	N-EtFOSE	1691-99-2	< 0.0044 U	0.00021 J	R	< 0.0042 U	< 0.0045 U	< 0.0045 U
Dissolved	N-MeFOSA	31506-32-8	< 0.0044 U	< 0.0043 U	R	< 0.0042 U	< 0.0045 U	< 0.0045 U
Dissolved	N-MeFOSAA	2355-31-9	< 0.0044 U	< 0.0043 U	R	< 0.0042 U	< 0.0045 U	< 0.0045 U
Dissolved	N-MeFOSE	24448-09-7	< 0.0044 U	< 0.0043 U	R	< 0.0042 U	< 0.0045 U	< 0.0045 U
Dissolved	PFBA	375-22-4	0.28	0.16	0.18 J+	0.17	0.15	0.086
Dissolved	PFBS	375-73-5	0.013	0.0067	0.0077	0.007	0.006	0.0034 J
Dissolved	PFDA	335-76-2	0.0024 J	0.0071	0.0081 J+	0.008	0.0018 J	< 0.0045 U
Dissolved	PFDoA	307-55-1	< 0.0044 U	< 0.0043 U	NA	< 0.0042 U	< 0.0045 U	< 0.0045 U
Dissolved	PFDS	335-77-3	< 0.0044 U	< 0.0043 U	< 0.0041 U	< 0.0042 U	< 0.0045 U	< 0.0045 U
Dissolved	PFHpA	375-85-9	0.031	0.02	0.015	0.017	0.013	0.0085
Dissolved	PFHpS	375-92-8	0.0057	0.01	0.005	0.0073 J+	0.0034 J	0.00093 J
Dissolved	PFHxA	307-24-4	0.043	0.018	0.021	0.031	0.017	0.012
Dissolved	PFHxS	355-46-4	0.025	0.025	0.018	0.014	0.01	0.0048
Dissolved	PFNA	375-95-1	0.0022 J	0.0033 J	0.0056	0.0028 J	0.0012 J	0.0012 J
Dissolved	PFNS	68259-12-1	< 0.0044 U	0.0024 J+	< 0.0041 U	< 0.0042 U	< 0.0045 U	< 0.0045 U
Dissolved	PFOA	335-67-1	0.24	0.19	0.15	0.14	0.08	0.053
Dissolved	PFOS	1763-23-1	0.49 J+	1 J+	0.91 J+	1.5	0.25 J+	0.08 J+
Dissolved	PFOSA	754-91-6	0.0015 J	0.00081 J	R	0.00088 J	0.00083 J	< 0.0045 U
Dissolved	PFPeA	2706-90-3	0.026	0.015	0.014	0.017	0.012	0.0085
Dissolved	PFPeS	2706-91-4	0.02 J+	0.01 J+	0.009 J+	0.0085 J+	0.0046 J+	0.0021 J+
Dissolved	PFTeDA	376-06-7	< 0.0044 UJ	< 0.0043 UJ	R	< 0.0042 UJ	< 0.0045 U	< 0.0045 U
Dissolved	PFTrDA	72629-94-8	< 0.0044 U	0.0015 J	0.022 J+	< 0.0042 U	< 0.0045 U	< 0.0045 U
Dissolved	PFUnA	2058-94-8	< 0.0044 U	< 0.0043 U	R	< 0.0042 U	< 0.0045 U	< 0.0045 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method = ALS_Method PFC/537M

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 2d
Eagle Point Lake Foam
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Eagle Point Lake
		Location	EP18
		Location ID	82-0109-00-455
		Sample Date	7/6/2020
		Sample Type Code	Sample
		Sample ID	82-0109-00-455.2007061030.000S
		Sample Name	EP18-FOAM-01-070620
		Parent Sample ID	NA
Fraction	Compound	CAS #	
Total	11Cl-PF3OUdS	763051-92-9	< 0.0374 U
Total	4:2 FTS	757124-72-4	< 0.0374 U
Total	6:2 FTS	27619-97-2	< 0.0337 U
Total	8:2 FTS	39108-34-4	< 0.0374 U
Total	9Cl-PF3ONS	756426-58-1	< 0.0374 U
Total	ADONA	919005-14-4	< 0.0374 U
Total	HFPO-DA	13252-13-6	< 0.0356 U
Total	N-EtFOSA	4151-50-2	< 0.0234 U
Total	N-EtFOSAA	2991-50-6	0.0915
Total	N-EtFOSE	1691-99-2	< 0.0702 U
Total	N-MeFOSA	31506-32-8	< 0.0108 U
Total	N-MeFOSAA	2355-31-9	0.0132 J
Total	N-MeFOSE	24448-09-7	< 0.0936 U
Total	PFBA	375-22-4	0.137
Total	PFBS	375-73-5	< 0.00936 U
Total	PFDA	335-76-2	0.301
Total	PFDoA	307-55-1	0.054
Total	PFDoS	79780-39-5	< 0.00936 U
Total	PFDS	335-77-3	0.0212 J
Total	PFHpA	375-85-9	0.0101 J
Total	PFHpS	375-92-8	0.0523
Total	PFHxA	307-24-4	0.0102 J
Total	PFHxS	355-46-4	0.0154 J
Total	PFNA	375-95-1	0.263
Total	PFNS	68259-12-1	< 0.00936 U
Total	PFOA	335-67-1	0.591
Total	PFOS	1763-23-1	13.3
Total	PFOSA	754-91-6	0.0393 J
Total	PFPeA	2706-90-3	< 0.0187 U
Total	PFPeS	2706-91-4	< 0.00936 U
Total	PFTeDA	376-06-7	< 0.00936 UJ
Total	PFTrDA	72629-94-8	0.0173 J
Total	PFUnA	2058-94-8	0.204

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
J = Estimated concentration.
QC-FR = Duplicate sample.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 2e
Eagle Point Lake Amphibian Tissue
Project 1007
Minneapolis, Minnesota

	Location Group	RA_Eagle Point Lake
	Location	EP19
	Location ID	82-0109-00-453
	Sample Type Code	Sample
	Sample ID	82-0109-00-453.2009191750.000S
	Sample Name	EP19-AMPH-01-091920
	Sample Date	9/19/2020
Compound	CAS #	
11Cl-PF3OUdS	763051-92-9	< 0.391 U
3:3 FTCA	1169706-83-5	< 0.39 U
4:2 FTS	757124-72-4	< 0.39 U
5:3 FTCA	1799325-94-2	< 2.44 U
6:2 FTS	27619-97-2	< 0.352 U
7:3 FTCA	812-70-4	< 2.44 U
8:2 FTS	39108-34-4	< 0.39 U
9Cl-PF3ONS	756426-58-1	< 0.391 U
ADONA	919005-14-4	< 0.39 U
HFPO-DA	13252-13-6	< 0.371 U
N-EtFOSA	4151-50-2	< 0.244 UJ
N-EtFOSAA	2991-50-6	0.397 J
N-EtFOSE	1691-99-2	< 0.73 UJ
N-MeFOSA	31506-32-8	< 0.112 U
N-MeFOSAA	2355-31-9	< 0.0976 U
N-MeFOSE	24448-09-7	< 0.976 U
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.0976 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.195 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.195 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.0976 U
PFBA	375-22-4	0.646 J
PFBS	375-73-5	< 0.0976 U
PFDA	335-76-2	0.53
PFDoA	307-55-1	< 0.0976 U
PFDoS	79780-39-5	< 0.0976 U
PFDS	335-77-3	0.126 J
PFHpA	375-85-9	< 0.0976 U
PFHpS	375-92-8	0.109 J
PFHxA	307-24-4	< 0.0976 U
PFHxS	355-46-4	< 0.0976 U
PFNA	375-95-1	< 0.0976 U
PFNS	68259-12-1	0.106 J
PFOA	335-67-1	< 0.0976 U
PFOS	1763-23-1	69.90
PFOSA	754-91-6	0.293 BJ
PFPeA	2706-90-3	< 0.195 U
PFPeS	2706-91-4	< 0.098 U
PFTeDA	376-06-7	< 0.0976 U
PFTrDA	72629-94-8	< 0.0976 U
PFUnA	2058-94-8	0.125 BJ

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 2f
Eagle Point Lake Crayfish Tissue
Project 1007
Minneapolis, Minnesota

Location Group		RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake
Location		EP17C	EP27B	EP27B	EP26A	EP26A
Location ID		82-0109-00-452	82-0109-00-457	82-0109-00-457	82-0109-00-456	82-0109-00-456
Sample Type Code		Sample	Sample	Sample	Sample	Sample
Sample ID		82-0109-00-452.2009241020.000S	82-0109-00-457.2009240950.000S	82-0109-00-457.2009240951.000S	82-0109-00-456.2009171145.000S	82-0109-00-456.2009251045.000S
Sample Name		EP17C-CRAY-01-092420	EP27B-CRAY-ONE-01-092420	EP27B-CRAY-TWO-01-092420	EP26A-CRAY-THREE-01-091720	EP26A-CRAY-ONE-01-092520
Sample Date		9/24/2020	9/24/2020	9/24/2020	9/17/2020	9/25/2020
Compound	CAS #					
11Cl-PF3OUdS	763051-92-9	< 0.401 U	< 0.399 U	< 0.397 U	< 0.389 U	< 0.399 U
3:3 FTCA	1169706-83-5	< 0.4 U	< 0.398 U	< 0.396 U	< 0.388 U	< 0.398 U
4:2 FTS	757124-72-4	< 0.4 U	< 0.398 U	< 0.396 U	< 0.388 U	< 0.398 U
5:3 FTCA	1799325-94-2	< 2.5 U	< 2.49 U	< 2.48 U	< 2.43 U	< 2.49 U
6:2 FTS	27619-97-2	< 0.361 U	< 0.359 U	< 0.357 U	< 0.35 U	< 0.359 U
7:3 FTCA	812-70-4	< 2.5 U	< 2.49 U	< 2.48 U	< 2.43 U	< 2.49 U
8:2 FTS	39108-34-4	< 0.4 U	< 0.398 U	< 0.396 U	< 0.388 U	< 0.398 U
9Cl-PF3ONS	756426-58-1	< 0.401 U	< 0.399 U	< 0.397 U	< 0.389 U	< 0.399 U
ADONA	919005-14-4	< 0.4 U	< 0.398 U	< 0.396 U	< 0.388 U	< 0.398 U
HFPO-DA	13252-13-6	< 0.38 U	< 0.378 U	< 0.376 U	< 0.369 U	< 0.378 U
N-EtFOSA	4151-50-2	R	< 0.249 U	< 0.248 UJ	< 0.243 UJ	< 0.249 UJ
N-EtFOSAA	2991-50-6	0.362 J	0.294 J	0.108 J	0.299 J	0.195 J
N-EtFOSE	1691-99-2	R	R	R	R	R
N-MeFOSA	31506-32-8	R	< 0.114 UJ	< 0.114 U	< 0.112 UJ	< 0.114 U
N-MeFOSAA	2355-31-9	< 0.1 U	< 0.0995 U	< 0.099 U	< 0.0971 U	< 0.0995 U
N-MeFOSE	24448-09-7	< 1 UJ	< 0.995 UJ	R	< 0.971 UJ	R
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.1 U	< 0.0995 U	< 0.099 U	< 0.0971 U	< 0.0995 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.2 U	< 0.199 U	< 0.198 U	< 0.194 U	< 0.199 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.2 U	< 0.199 U	< 0.198 U	< 0.194 U	< 0.199 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.1 U	< 0.0995 U	< 0.099 U	< 0.0971 U	< 0.0995 U
PFBA	375-22-4	2.61 B	3.26 B	4.24 B	3.65 B	3.36 B
PFBS	375-73-5	0.163 J	0.197 J	0.186 J	0.399	0.183 J
PFDA	335-76-2	0.151 J	0.372 J	0.407	0.512	0.5
PFDoA	307-55-1	0.344 J	0.252 J	0.194 J	0.178 J	0.161 J
PFDoS	79780-39-5	< 0.1 U	< 0.0995 U	< 0.099 U	< 0.0971 U	< 0.0995 U
PFDS	335-77-3	< 0.1 U	< 0.0995 U	< 0.099 U	< 0.0971 U	< 0.0995 U
PFHpA	375-85-9	0.247 J	0.31 J	0.492	0.461	0.248 J
PFHpS	375-92-8	< 0.1 U	< 0.0995 U	< 0.099 U	< 0.0971 U	< 0.0995 U
PFHxA	307-24-4	0.15 J	0.228 J	0.128 J	0.262 J	0.128 J
PFHxS	355-46-4	0.22 J	0.138 J	0.239 J	0.216 J	0.135 J
PFNA	375-95-1	< 0.1 U	< 0.0995 U	< 0.099 U	< 0.0971 U	< 0.0995 U
PFNS	68259-12-1	< 0.1 U	< 0.0995 U	< 0.099 U	< 0.0971 U	< 0.0995 U
PFOA	335-67-1	1.23	1.47	3.27	2.75	0.68
PFOS	1763-23-1	12.7	20.3	27	26.5	19.8
PFOSA	754-91-6	9.6	7.59	3.11	9.58	7.91
PFPeA	2706-90-3	< 0.2 U	0.215 J	< 0.198 U	0.261 J	0.206 J
PFPeS	2706-91-4	0.128 J	0.204 J	0.141 J	0.299 J	0.253 J
PFTeDA	376-06-7	0.155 J	< 0.0995 U	< 0.099 U	< 0.0971 U	< 0.0995 U
PFTrDA	72629-94-8	< 0.1 U	< 0.0995 U	< 0.099 U	< 0.0971 U	< 0.0995 U
PFUnA	2058-94-8	0.361 BJ	0.328 BJ	0.361 BJ	0.313 BJ	0.432 B

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 2f
Eagle Point Lake Crayfish Tissue
Project 1007
Minneapolis, Minnesota

	Location Group	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake
	Location	EP26A	EP4	EP4	EP5
	Location ID	82-0109-00-456	82-0109-00-209	82-0109-00-209	S016-069
	Sample Type Code	Sample	Sample	Sample	Sample
	Sample ID	82-0109-00-456.2009251046.000S	82-0109-00-209.2009231750.000S	82-0109-00-209.2009231751.000S	S016-069.2009241810.000S
	Sample Name	EP26A-CRAY-TWO-01-092520	EP4-CRAY-ONE-01-092320	EP4-CRAY-TWO-01-092320	EP5-CRAY-ONE-01-092420
	Sample Date	9/25/2020	9/23/2020	9/23/2020	9/24/2020
Compound	CAS #				
11Cl-PF3OUdS	763051-92-9	< 0.387 U	< 0.389 U	< 0.383 U	< 0.401 U
3:3 FTCA	1169706-83-5	< 0.386 U	< 0.388 U	< 0.383 U	< 0.4 U
4:2 FTS	757124-72-4	< 0.386 U	< 0.388 U	< 0.383 U	< 0.4 U
5:3 FTCA	1799325-94-2	< 2.42 U	< 2.43 U	< 2.39 U	< 2.5 U
6:2 FTS	27619-97-2	< 0.348 U	< 0.35 U	3.17	< 0.361 U
7:3 FTCA	812-70-4	< 2.42 U	< 2.43 U	< 2.39 U	< 2.5 U
8:2 FTS	39108-34-4	< 0.386 U	< 0.388 U	< 0.383 U	< 0.4 U
9Cl-PF3ONS	756426-58-1	< 0.387 U	< 0.389 U	< 0.384 U	< 0.401 U
ADONA	919005-14-4	< 0.386 U	< 0.388 U	< 0.383 U	< 0.4 U
HFPO-DA	13252-13-6	< 0.367 U	< 0.369 U	< 0.364 U	< 0.38 U
N-EtFOSA	4151-50-2	< 0.242 UJ	< 0.243 UJ	< 0.239 UJ	< 0.25 U
N-EtFOSAA	2991-50-6	0.396	0.399	0.153 J	0.274 J
N-EtFOSE	1691-99-2	R	R	R	R
N-MeFOSA	31506-32-8	< 0.111 UJ	< 0.112 UJ	< 0.11 UJ	< 0.115 UJ
N-MeFOSAA	2355-31-9	< 0.0966 U	< 0.0971 U	< 0.0957 U	< 0.1 U
N-MeFOSE	24448-09-7	< 0.966 UJ	< 0.971 UJ	< 0.957 UJ	< 1 UJ
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.0966 U	< 0.0971 U	< 0.0957 U	< 0.1 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.193 U	< 0.194 U	< 0.191 U	< 0.2 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.193 U	< 0.194 U	< 0.191 U	< 0.2 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.0966 U	< 0.0971 U	< 0.0957 U	< 0.1 U
PFBA	375-22-4	3.29 B	3.02	3.21 B	3.27 B
PFBS	375-73-5	0.358 J	0.172 J	0.187 J	0.167 J
PFDA	335-76-2	0.456	0.199 J	0.252 J	0.21 J
PFDoA	307-55-1	0.146 J	0.168 J	0.188 J	0.28 J
PFDoS	79780-39-5	< 0.0966 U	< 0.0971 U	< 0.0957 U	< 0.1 U
PFDS	335-77-3	< 0.0966 U	< 0.0971 U	< 0.0957 U	< 0.1 U
PFHpA	375-85-9	0.373 J	0.305 J	0.211 J	0.34 J
PFHpS	375-92-8	< 0.0966 U	< 0.0971 U	< 0.0957 U	< 0.1 U
PFHxA	307-24-4	0.163 J	0.181 J	0.154 J	0.133 J
PFHxS	355-46-4	0.316 J	0.153 J	0.243 J	0.199 J
PFNA	375-95-1	< 0.0966 U	< 0.0971 U	< 0.0957 U	< 0.1 U
PFNS	68259-12-1	< 0.0966 U	< 0.0971 U	< 0.0957 U	< 0.1 U
PFOA	335-67-1	2.34	1.17	1.07	2.01
PFOS	1763-23-1	20.3	19	21.5	18.5
PFOSA	754-91-6	10	9.4	11.1	6.96
PFPeA	2706-90-3	< 0.193 U	0.241 J	0.22 J	0.235 J
PFPeS	2706-91-4	0.275 J	0.181 J	0.267 J	0.175 J
PFTeDA	376-06-7	< 0.0966 U	< 0.0971 UJ	< 0.0957 UJ	< 0.1 U
PFTrDA	72629-94-8	< 0.0966 U	< 0.0971 U	< 0.0957 U	< 0.1 U
PFUnA	2058-94-8	0.283 BJ	0.234 BJ	0.248 BJ	0.354 BJ

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 2g
Eagle Point Lake Snail Tissue
Project 1007
Minneapolis, Minnesota

Location Group		RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake
Location		EP17C	EP17C	EP27B	EP27B	EP4
Location ID		82-0109-00-452	82-0109-00-452	82-0109-00-457	82-0109-00-457	82-0109-00-209
Sample Type Code		Sample	Sample	Sample	Sample	Sample
Sample ID		82-0109-00-452.2009241650.000S	82-0109-00-452.2009241651.000S	82-0109-00-457.2009240952.000S	82-0109-00-457.2009240953.000S	82-0109-00-209.2009241110.000S
Sample Name		EP17C-SNAIL-ONE-01-092420	EP17C-SNAIL-TWO-01-092420	EP27B-SNAIL-ONE-01-092420	EP27B-SNAIL-TWO-01-092420	EP4-SNAIL-COMP-TWO-01-092420
Sample Date		9/24/2020	9/24/2020	9/24/2020	9/24/2020	9/24/2020
Compound	CAS #					
11Cl-PF3OUdS	763051-92-9	< 0.385 U	< 0.393 U	< 0.385 U	< 0.399 U	< 0.391 U
3:3 FTCA	1169706-83-5	< 0.385 U	< 0.392 U	< 0.385 U	< 0.398 U	< 0.39 U
4:2 FTS	757124-72-4	< 0.385 U	< 0.392 U	< 0.385 U	< 0.398 U	< 0.39 U
5:3 FTCA	1799325-94-2	< 2.4 U	< 2.45 U	< 2.4 U	< 2.49 U	< 2.44 U
6:2 FTS	27619-97-2	< 0.347 U	< 0.353 U	< 0.347 U	< 0.359 U	< 0.352 U
7:3 FTCA	812-70-4	< 2.4 U	< 2.45 U	< 2.4 U	< 2.49 U	< 2.44 U
8:2 FTS	39108-34-4	< 0.385 U	< 0.392 U	< 0.385 U	< 0.398 U	< 0.39 U
9Cl-PF3ONS	756426-58-1	< 0.386 U	< 0.393 U	< 0.386 U	< 0.399 U	< 0.391 U
ADONA	919005-14-4	< 0.385 U	< 0.392 U	< 0.385 U	< 0.398 U	< 0.39 U
HFPO-DA	13252-13-6	< 0.365 U	< 0.373 U	< 0.365 U	< 0.378 U	< 0.371 U
N-EtFOSA	4151-50-2	< 0.24 UJ	< 0.245 UJ	< 0.24 UJ	< 0.249 UJ	< 0.244 UJ
N-EtFOSAA	2991-50-6	1.22	0.926	1.11	0.985	1.16
N-EtFOSE	1691-99-2	R	R	R	R	R
N-MeFOSA	31506-32-8	< 0.111 UJ	< 0.113 UJ	< 0.111 UJ	< 0.114 UJ	< 0.112 UJ
N-MeFOSAA	2355-31-9	< 0.0962 U	< 0.098 U	< 0.0962 U	< 0.0995 U	< 0.0976 U
N-MeFOSE	24448-09-7	< 0.962 UJ	< 0.98 UJ	< 0.962 UJ	< 0.995 UJ	< 0.976 UJ
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.0962 U	< 0.098 U	< 0.0962 U	< 0.0995 U	< 0.0976 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.192 U	< 0.196 U	< 0.192 U	< 0.199 U	< 0.195 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.192 U	< 0.196 U	< 0.192 U	< 0.199 U	< 0.195 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.0962 U	< 0.098 U	< 0.0962 U	< 0.0995 U	< 0.0976 U
PFBA	375-22-4	< 0.385 U	0.401 J	< 0.385 U	< 0.398 U	< 0.39 U
PFBS	375-73-5	< 0.0962 U	< 0.098 U	< 0.0962 U	< 0.0995 U	< 0.0976 U
PFDA	335-76-2	1.99	1.23	1.65	1.1	1.42
PFDoA	307-55-1	0.241 J	0.271 J	< 0.0962 U	< 0.0995 U	< 0.0976 U
PFDoS	79780-39-5	< 0.0962 U	< 0.098 U	< 0.0962 U	< 0.0995 U	< 0.0976 U
PFDS	335-77-3	< 0.0962 U	< 0.098 U	< 0.0962 U	< 0.0995 U	< 0.0976 U
PFHpA	375-85-9	< 0.0962 U	< 0.098 U	< 0.0962 U	< 0.0995 U	< 0.0976 U
PFHpS	375-92-8	< 0.0962 U	< 0.098 U	< 0.0962 U	0.126 J	0.257 J
PFHxA	307-24-4	< 0.0962 U	< 0.098 U	< 0.0962 U	< 0.0995 U	< 0.0976 U
PFHxS	355-46-4	0.301 J	0.11 J	< 0.0962 U	0.321 J	0.625
PFNA	375-95-1	0.168 J	< 0.098 U	0.137 J	< 0.0995 U	0.198 J
PFNS	68259-12-1	< 0.0962 U	< 0.098 U	< 0.0962 U	< 0.0995 U	< 0.0976 U
PFOA	335-67-1	0.497	0.316 J	0.437	0.566	2.1
PFOS	1763-23-1	29.7	43.4	59.4	61	56.5
PFOSA	754-91-6	7.78	10.3	4.99	4.27	3.98
PFPeA	2706-90-3	< 0.192 U	< 0.196 U	< 0.192 U	< 0.199 U	< 0.195 U
PFPeS	2706-91-4	< 0.0966 U	< 0.0985 U	< 0.0966 U	< 0.1 U	< 0.098 U
PFTeDA	376-06-7	0.133 J+	0.194 J+	< 0.0962 U	< 0.0995 U	< 0.0976 U
PFTrDA	72629-94-8	< 0.102 U	< 0.098 U	< 0.0962 U	< 0.0995 U	< 0.0976 U
PFUnA	2058-94-8	0.493 B	0.448 B	0.227 BJ	0.156 BJ	0.199 BJ

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 2g
Eagle Point Lake Snail Tissue
Project 1007
Minneapolis, Minnesota

	Location Group	RA_Eagle Point Lake
	Location	EP4
	Location ID	82-0109-00-209
	Sample Type Code	Sample
	Sample ID	82-0109-00-209.2009241111.000S
	Sample Name	EP4-SNAIL-ONE-01-092420
	Sample Date	9/24/2020
Compound	CAS #	
11Cl-PF3OUdS	763051-92-9	< 0.397 U
3:3 FTCA	1169706-83-5	< 0.396 U
4:2 FTS	757124-72-4	< 0.396 U
5:3 FTCA	1799325-94-2	< 2.48 U
6:2 FTS	27619-97-2	< 0.357 U
7:3 FTCA	812-70-4	< 2.48 U
8:2 FTS	39108-34-4	< 0.396 U
9Cl-PF3ONS	756426-58-1	< 0.397 U
ADONA	919005-14-4	< 0.396 U
HFPO-DA	13252-13-6	< 0.376 U
N-EtFOSA	4151-50-2	< 0.248 UJ
N-EtFOSAA	2991-50-6	2.06
N-EtFOSE	1691-99-2	R
N-MeFOSA	31506-32-8	< 0.114 UJ
N-MeFOSAA	2355-31-9	< 0.099 U
N-MeFOSE	24448-09-7	< 0.99 UJ
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.099 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.198 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.198 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.099 U
PFBA	375-22-4	0.481 J
PFBS	375-73-5	< 0.099 U
PFDA	335-76-2	5.12
PFDoA	307-55-1	0.127 J
PFDoS	79780-39-5	< 0.099 U
PFDS	335-77-3	< 0.099 U
PFHpA	375-85-9	< 0.099 U
PFHpS	375-92-8	0.35 J
PFHxA	307-24-4	< 0.099 U
PFHxS	355-46-4	0.588
PFNA	375-95-1	0.306 J
PFNS	68259-12-1	< 0.099 U
PFOA	335-67-1	1.82
PFOS	1763-23-1	98.1
PFOSA	754-91-6	5.03
PFPeA	2706-90-3	< 0.198 U
PFPeS	2706-91-4	< 0.0995 U
PFTeDA	376-06-7	< 0.099 U
PFTrDA	72629-94-8	< 0.099 U
PFUnA	2058-94-8	0.566 B

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 2h
Eagle Point Lake Bottom Fish Tissue
Project 1007
Minneapolis, Minnesota

Location Group	RA_Eagle Point Lake
Location	EP1A
Location ID	82-0109-00-205
Sample Type Code	Sample
Sample ID	82-0109-00-205.2009150930.000S
Sample Name	EP1A-BOTF-WHO-01-091520
Sample Date	9/15/2020

Compound	CAS #	
11Cl-PF3OUdS	763051-92-9	< 0.387 U
3:3 FTCA	1169706-83-5	< 0.386 U
4:2 FTS	757124-72-4	< 0.386 U
5:3 FTCA	1799325-94-2	< 2.42 U
6:2 FTS	27619-97-2	< 0.348 U
7:3 FTCA	812-70-4	< 2.42 U
8:2 FTS	39108-34-4	< 0.386 U
9Cl-PF3ONS	756426-58-1	< 0.387 U
ADONA	919005-14-4	< 0.386 U
HFPO-DA	13252-13-6	< 0.367 U
N-EtFOSA	4151-50-2	R
N-EtFOSAA	2991-50-6	0.247 J
N-EtFOSE	1691-99-2	R
N-MeFOSA	31506-32-8	< 0.111 UJ
N-MeFOSAA	2355-31-9	< 0.0966 U
N-MeFOSE	24448-09-7	R
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.0966 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.193 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.193 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.0966 U
PFBA	375-22-4	0.809 BJ
PFBS	375-73-5	< 0.0966 U
PFDA	335-76-2	2.13
PFDoA	307-55-1	0.384 J
PFDoS	79780-39-5	< 0.0966 U
PFDS	335-77-3	0.285 J
PFHpA	375-85-9	< 0.0966 U
PFHpS	375-92-8	< 0.0966 U
PFHxA	307-24-4	< 0.152 U
PFHxS	355-46-4	< 0.0966 U
PFNA	375-95-1	< 0.0966 U
PFNS	68259-12-1	0.371 J
PFOA	335-67-1	0.185 J
PFOS	1763-23-1	112
PFOSA	754-91-6	2.65
PFPeA	2706-90-3	< 0.193 U
PFPeS	2706-91-4	< 0.0971 U
PFTeDA	376-06-7	< 0.0966 UJ
PFTrDA	72629-94-8	0.125 BJ
PFUnA	2058-94-8	0.687 B

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 2i
Eagle Point Lake Forage Fish Tissue
Project 1007
Minneapolis, Minnesota

	Location Group	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake
	Location	EP17A	EP17A	EP1A	EP1A	EP1A
	Location ID	82-0109-00-452	82-0109-00-452	82-0109-00-205	82-0109-00-205	82-0109-00-205
	Sample Type Code	Sample	Sample	Sample	Sample	Sample
	Sample ID	82-0109-00-452.2009191300.000S	82-0109-00-452.2009191301.000S	82-0109-00-205.2009150931.000S	82-0109-00-205.2009150932.000S	82-0109-00-205.2009150933.000S
	Sample Name	EP17A-FORE-COMP-ONE-01-091920	EP17A-FORE-WHO-01-091920	EP1A-FORE-FIL-01-091520	EP1A-FORE-PART-01-091520	EP1A-FORE-WHO-01-091520
	Sample Date	9/19/2020	9/19/2020	9/15/2020	9/15/2020	9/15/2020
Compound	CAS #					
11Cl-PF3OUdS	763051-92-9	< 0.393 U	< 0.383 U	< 0.393 U	< 0.381 U	< 0.401 U
3:3 FTCA	1169706-83-5	< 0.392 U	< 0.383 U	< 0.392 U	< 0.381 U	< 0.4 U
4:2 FTS	757124-72-4	< 0.392 U	< 0.383 U	< 0.392 U	< 0.381 U	< 0.4 U
5:3 FTCA	1799325-94-2	< 2.45 U	< 2.39 U	< 2.45 U	< 2.38 U	< 2.5 U
6:2 FTS	27619-97-2	2.39	< 0.345 U	< 0.353 U	< 0.343 U	< 0.361 U
7:3 FTCA	812-70-4	< 2.45 U	< 2.39 U	< 2.45 U	< 2.38 U	< 2.5 U
8:2 FTS	39108-34-4	< 0.392 U	< 0.383 U	< 0.392 U	< 0.381 U	< 0.4 U
9Cl-PF3ONS	756426-58-1	< 0.393 U	< 0.384 U	< 0.393 U	< 0.382 U	< 0.401 U
ADONA	919005-14-4	< 0.392 U	< 0.383 U	< 0.392 U	< 0.381 U	< 0.4 U
HFPO-DA	13252-13-6	< 0.373 U	< 0.364 U	< 0.373 U	< 0.362 U	< 0.38 U
N-EtFOSA	4151-50-2	< 0.245 UJ	< 0.239 UJ	< 0.245 UJ	< 0.238 UJ	R
N-EtFOSAA	2991-50-6	0.694	3.4 J-	0.677	1.55 J-	0.571
N-EtFOSE	1691-99-2	R	R	R	R	R
N-MeFOSA	31506-32-8	< 0.113 UJ	< 0.11 U	< 0.113 UJ	< 0.11 UJ	< 0.115 UJ
N-MeFOSAA	2355-31-9	< 0.098 U	0.267 J	< 0.098 U	< 0.0952 U	< 0.1 U
N-MeFOSE	24448-09-7	< 0.98 UJ	R	R	R	R
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.098 U	< 0.0957 U	< 0.098 U	< 0.0952 U	< 0.1 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.515 U	< 1.38 U	< 0.196 U	< 0.722 U	< 0.395 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.196 U	< 0.191 U	< 0.196 U	< 0.19 U	< 0.2 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.098 U	< 0.0957 U	< 0.098 U	0.118 J	< 0.1 U
PFBA	375-22-4	< 0.392 U	0.692 J	< 0.392 U	< 0.381 U	< 0.4 U
PFBS	375-73-5	< 0.098 U	< 0.0957 UJ	< 0.098 U	< 0.0952 U	< 0.1 U
PFDA	335-76-2	6.23	16.2	7.05	16.7	4.05
PFDoA	307-55-1	0.735	0.678	0.238 J	0.602	0.131 J
PFDoS	79780-39-5	< 0.098 U	< 0.0957 U	< 0.098 U	< 0.0952 U	< 0.1 U
PFDS	335-77-3	0.915	1.55	0.53	1.44	0.183 J
PFHpA	375-85-9	< 0.098 U	< 0.0957 U	< 0.098 U	< 0.0952 U	< 0.1 U
PFHpS	375-92-8	2.4	3.64	1.42	3.64	0.401
PFHxA	307-24-4	< 0.122 U	< 0.205 U	< 0.098 U	< 0.0952 U	< 0.1 U
PFHxS	355-46-4	0.841	0.947	0.602	1.5	0.102 J
PFNA	375-95-1	0.715	2.87	0.534	1.29	0.11 J
PFNS	68259-12-1	1.58	5.09	1.4	3.72	0.567
PFOA	335-67-1	1.02	2.55	0.493	1.23	0.167 J
PFOS	1763-23-1	1050	2540	942	2270	549
PFOSA	754-91-6	25.6	9.45	3.51	11.8	1.61
PFPeA	2706-90-3	< 0.196 U	< 0.191 U	< 0.196 U	< 0.19 U	< 0.2 U
PFPeS	2706-91-4	< 0.0985 U	< 0.0962 U	< 0.0985 U	< 0.0957 U	< 0.101 U
PFTeDA	376-06-7	0.259 J+	< 0.125 UJ	< 0.098 U	0.146 J	< 0.1 UJ
PFTrDA	72629-94-8	0.264 BJ	0.197 J	0.101 BJ	0.232 BJ	< 0.1 U
PFUnA	2058-94-8	1.12 B	2.23	0.91 B	2.29	0.598 B

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 2i
Eagle Point Lake Forage Fish Tissue
Project 1007
Minneapolis, Minnesota

Location Group		RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake
Location		EP27C	EP27C	EP27C	EP18	EP18
Location ID		82-0109-00-457	82-0109-00-457	82-0109-00-457	82-0109-00-455	82-0109-00-455
Sample Type Code		Sample	Sample	Sample	Sample	Sample
Sample ID		82-0109-00-457.2009151000.000S	82-0109-00-457.2009151001.000S	82-0109-00-457.2009151002.000S	82-0109-00-455.2009151030.000S	82-0109-00-455.2009151031.000S
Sample Name		EP27C-FORE-FIL-ONE-01-091520	EP27C-FORE-PART-ONE-01-091520	EP27C-FORE-WHO-TWO-01-091520	EP18-FORE-WHO-TWO-01-091520	EP18-FORE-PART-ONE-01-091520
Sample Date		9/15/2020	9/15/2020	9/15/2020	9/15/2020	9/15/2020
Compound	CAS #					
11Cl-PF3OUdS	763051-92-9	< 0.391 U	< 0.399 U	< 0.391 U	< 0.395 U	< 0.385 U
3:3 FTCA	1169706-83-5	< 0.39 U	< 0.398 U	< 0.39 U	< 0.394 U	< 0.385 U
4:2 FTS	757124-72-4	< 0.39 U	< 0.398 U	< 0.39 U	< 0.394 U	< 0.385 U
5:3 FTCA	1799325-94-2	< 2.44 U	< 2.49 U	< 2.44 U	< 2.46 U	< 2.4 U
6:2 FTS	27619-97-2	< 0.352 U	< 0.359 U	< 0.352 U	3.29	< 0.347 U
7:3 FTCA	812-70-4	< 2.44 U	< 2.49 U	< 2.44 U	< 2.46 U	< 2.4 U
8:2 FTS	39108-34-4	< 0.39 U	< 0.398 U	< 0.39 U	< 0.394 U	< 0.385 U
9Cl-PF3ONS	756426-58-1	< 0.391 U	< 0.399 U	< 0.391 U	< 0.395 U	< 0.386 U
ADONA	919005-14-4	< 0.39 U	< 0.398 U	< 0.39 U	0.833 J+	< 0.385 U
HFPO-DA	13252-13-6	< 0.371 U	< 0.378 U	< 0.371 U	< 0.374 UJ	< 0.365 U
N-EtFOSA	4151-50-2	< 0.244 UJ	< 0.249 UJ	R	< 0.246 UJ	< 0.24 UJ
N-EtFOSAA	2991-50-6	0.451	1.19 J-	0.455 J-	0.847 J-	1.67 J-
N-EtFOSE	1691-99-2	R	R	R	R	R
N-MeFOSA	31506-32-8	< 0.112 UJ	< 0.114 UJ	< 0.112 UJ	< 0.113 UJ	< 0.111 UJ
N-MeFOSAA	2355-31-9	< 0.0976 U	< 0.0995 U	< 0.0976 U	< 0.0985 U	< 0.0962 U
N-MeFOSE	24448-09-7	< 0.976 UJ	R	R	R	R
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.0976 U	< 0.0995 U	< 0.0976 U	< 0.0985 U	< 0.0962 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.267 U	< 0.351 U	< 0.286 U	< 0.197 U	< 0.834 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.195 U	< 0.199 U	< 0.195 U	< 0.197 U	< 0.192 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.0976 U	< 0.0995 U	< 0.0976 U	< 0.0985 U	< 0.0962 U
PFBA	375-22-4	< 0.39 U	< 0.398 U	< 0.39 U	< 0.394 U	< 0.385 U
PFBS	375-73-5	< 0.0976 U	< 0.0995 U	< 0.0976 U	< 0.0985 U	< 0.0962 U
PFDA	335-76-2	6.36	19.3	8.03	10.8	20.2
PFDoA	307-55-1	0.142 J	0.415	1.19	0.564	0.733
PFDoS	79780-39-5	< 0.0976 U	< 0.0995 U	< 0.0976 U	< 0.0985 U	< 0.0962 U
PFDS	335-77-3	0.258 J	0.888	0.997	0.95	2.15
PFHpA	375-85-9	< 0.0976 U	< 0.0995 U	< 0.0976 U	< 0.0985 U	< 0.0962 U
PFHpS	375-92-8	1.26	4.8	0.427	0.394	4.4
PFHxA	307-24-4	< 0.0976 U	< 0.151 U	< 0.0976 U	0.126 J	< 0.133 U
PFHxS	355-46-4	0.558	1.68	< 0.0976 U	< 0.0985 U	1.48
PFNA	375-95-1	0.56	1.43	0.107 J	< 0.0985 U	1.35
PFNS	68259-12-1	1.09	3.81	1.58	2.95	5.18
PFOA	335-67-1	0.737	2.1	0.166 J	< 0.0985 U	1.08
PFOS	1763-23-1	885	2550	977	1580	2520
PFOSA	754-91-6	1.71	8.05	4.73	2.59	16.6
PFPeA	2706-90-3	< 0.195 U	< 0.199 U	< 0.195 U	< 0.197 U	< 0.192 U
PFPeS	2706-91-4	< 0.098 U	< 0.1 U	< 0.098 U	< 0.099 U	< 0.0966 U
PFTeDA	376-06-7	< 0.0976 UJ	< 0.141 UJ	0.447 J+	0.146 J	0.19 J+
PFTrDA	72629-94-8	< 0.0976 U	0.198 BJ	0.51 B	0.276 BJ	0.259 BJ
PFUnA	2058-94-8	0.701 B	2.08	1.8	2.17	2.48

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 2i
Eagle Point Lake Forage Fish Tissue
Project 1007
Minneapolis, Minnesota

Location Group	RA_Eagle Point Lake
Location	EP18
Location ID	82-0109-00-455
Sample Type Code	Sample
Sample ID	82-0109-00-455.2009151032.000S
Sample Name	EP18-FORE-FIL-ONE-01-091520
Sample Date	9/15/2020

Compound	CAS #	
11Cl-PF3OUdS	763051-92-9	< 0.401 U
3:3 FTCA	1169706-83-5	< 0.4 U
4:2 FTS	757124-72-4	< 0.4 U
5:3 FTCA	1799325-94-2	< 2.5 U
6:2 FTS	27619-97-2	< 0.361 U
7:3 FTCA	812-70-4	< 2.5 U
8:2 FTS	39108-34-4	< 0.4 U
9Cl-PF3ONS	756426-58-1	< 0.401 U
ADONA	919005-14-4	< 0.4 U
HFPO-DA	13252-13-6	< 0.38 U
N-EtFOSA	4151-50-2	< 0.25 UJ
N-EtFOSAA	2991-50-6	0.776 J-
N-EtFOSE	1691-99-2	< 0.748 UJ
N-MeFOSA	31506-32-8	< 0.115 U
N-MeFOSAA	2355-31-9	< 0.1 U
N-MeFOSE	24448-09-7	R
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.1 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.263 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.2 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.1 U
PFBA	375-22-4	< 0.4 U
PFBS	375-73-5	< 0.1 UJ
PFDA	335-76-2	7.9
PFDoA	307-55-1	0.39 J
PFDoS	79780-39-5	< 0.1 U
PFDS	335-77-3	0.771
PFHpA	375-85-9	< 0.1 U
PFHpS	375-92-8	1.41
PFHxA	307-24-4	< 0.1 U
PFHxS	355-46-4	0.601
PFNA	375-95-1	0.564
PFNS	68259-12-1	1.68
PFOA	335-67-1	0.469
PFOS	1763-23-1	1110
PFOSA	754-91-6	3.94
PFPeA	2706-90-3	< 0.2 U
PFPeS	2706-91-4	< 0.101 U
PFTeDA	376-06-7	< 0.1 U
PFTrDA	72629-94-8	0.121 BJ
PFUnA	2058-94-8	1.12 B

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 2j
Eagle Point Lake Predator Fish Tissue
Project 1007
Minneapolis, Minnesota

	Location Group	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake
	Location	EP27C	EP27C	EP27C	EP27C	EP18	EP18
	Location ID	82-0109-00-457	82-0109-00-457	82-0109-00-457	82-0109-00-457	82-0109-00-455	82-0109-00-455
	Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample
	Sample ID	82-0109-00-457.2009151003.000S	82-0109-00-457.2009151004.000S	82-0109-00-457.2009151005.000S	82-0109-00-457.2009151006.000S	82-0109-00-455.2009151000.000S	82-0109-00-455.2009151001.000S
	Sample Name	EP27C-PRED-FIL-ONE-01-091520	EP27C-PRED-FIL-TWO-01-091520	EP27C-PRED-PART-ONE-01-091520	EP27C-PRED-PART-TWO-01-091520	EP18-PRED-FIL-TWO-01-091520	EP18-PRED-PART-TWO-01-091520
	Sample Date	9/15/2020	9/15/2020	9/15/2020	9/15/2020	9/15/2020	9/15/2020
Compound	CAS #						
11Cl-PF3OUdS	763051-92-9	< 0.397 U	< 0.401 U	< 0.374 U	< 0.399 U	< 0.387 U	< 0.389 U
3:3 FTCA	1169706-83-5	< 0.396 U	< 0.4 U	< 0.374 U	< 0.398 U	< 0.386 U	< 0.388 U
4:2 FTS	757124-72-4	< 0.396 U	< 0.4 U	< 0.374 U	< 0.398 U	< 0.386 U	< 0.388 U
5:3 FTCA	1799325-94-2	< 2.48 U	< 2.5 U	< 2.34 U	< 2.49 U	< 2.42 U	< 2.43 U
6:2 FTS	27619-97-2	1.17 BJ	0.41 BJ	< 0.337 U	0.37 BJ	7.17 B	0.697 BJ
7:3 FTCA	812-70-4	< 2.48 U	< 2.5 U	< 2.34 U	< 2.49 U	< 2.42 U	< 2.43 U
8:2 FTS	39108-34-4	< 0.396 U	< 0.4 U	< 0.374 U	< 0.398 U	< 0.386 U	< 0.388 U
9Cl-PF3ONS	756426-58-1	< 0.397 U	< 0.401 U	< 0.375 U	< 0.399 U	< 0.387 U	< 0.389 U
ADONA	919005-14-4	< 0.396 U	< 0.4 U	< 0.374 U	< 0.398 U	< 0.386 U	< 0.388 U
HFPO-DA	13252-13-6	< 0.376 U	< 0.38 U	< 0.355 U	< 0.378 U	< 0.367 U	< 0.369 U
N-EtFOSA	4151-50-2	< 0.248 UJ	< 0.25 UJ	< 0.234 UJ	< 0.249 UJ	< 0.242 U	< 0.243 UJ
N-EtFOSAA	2991-50-6	0.488	0.293 J	1.23 J-	0.681	0.371 J	0.633 J-
N-EtFOSE	1691-99-2	R	R	R	R	< 0.723 UJ	R
N-MeFOSA	31506-32-8	< 0.114 UJ	< 0.115 U	< 0.107 UJ	< 0.114 UJ	< 0.111 U	< 0.112 UJ
N-MeFOSAA	2355-31-9	< 0.099 U	< 0.1 U	0.191 J	0.144 J	< 0.0966 U	0.18 J
N-MeFOSE	24448-09-7	R	R	R	R	R	R
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.099 U	< 0.1 U	< 0.0935 U	< 0.0995 U	< 0.0966 U	< 0.0971 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.198 U	< 0.2 U	< 0.187 U	< 0.199 U	< 0.193 U	< 0.235 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.198 U	< 0.2 U	< 0.187 U	< 0.199 U	< 0.193 U	< 0.194 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.099 U	< 0.1 U	< 0.0935 U	< 0.0995 U	< 0.0966 U	< 0.0971 U
PFBA	375-22-4	< 0.396 U	< 0.4 U	< 0.374 U	< 0.398 U	< 0.386 U	< 0.388 U
PFBS	375-73-5	< 0.099 U	< 0.1 U	< 0.0935 U	< 0.0995 U	< 0.0966 U	< 0.0971 U
PFDA	335-76-2	7.43	6.77	21.7	23.5	9	21.9
PFDoA	307-55-1	0.275 J	0.239 J	0.813	0.793	0.377 J	0.894
PFDoS	79780-39-5	< 0.099 U	< 0.1 U	< 0.0935 U	< 0.0995 U	< 0.0966 U	0.111 J
PFDS	335-77-3	0.424	0.458	1.61	1.34	0.855	2.52
PFHpA	375-85-9	< 0.099 U	< 0.1 U	< 0.0935 U	< 0.0995 U	< 0.0966 U	< 0.0971 U
PFHpS	375-92-8	0.379 J	0.329 J	1.7	1.48	0.344 J	1.07
PFHxA	307-24-4	< 0.099 U	< 0.1 U	< 0.0935 U	< 0.0995 U	< 0.0966 U	< 0.0971 U
PFHxS	355-46-4	< 0.099 U	< 0.1 U	0.094 J	0.113 J	< 0.0966 U	0.099 J
PFNA	375-95-1	< 0.099 U	< 0.1 U	0.216 J	0.23 J	< 0.0966 U	0.119 J
PFNS	68259-12-1	1.21	1.34	5.33	4.97	2.21	6.47
PFOA	335-67-1	< 0.099 U	< 0.1 U	0.131 J	0.197 J	< 0.0966 U	0.154 J
PFOS	1763-23-1	800	752	2370	2500	1050	2590
PFOSA	754-91-6	0.877 B	0.703 B	3.96	3.43	0.607 B	2.63
PFPeA	2706-90-3	< 0.198 U	< 0.2 U	< 0.187 U	< 0.199 U	< 0.193 U	< 0.194 U
PFPeS	2706-91-4	< 0.0995 U	< 0.101 U	< 0.0939 U	< 0.1 U	< 0.0971 U	< 0.0976 U
PFTeDA	376-06-7	< 0.099 UJ	< 0.1 U	0.187 J+	0.101 J	< 0.0966 U	0.116 J
PFTrDA	72629-94-8	0.149 BJ	< 0.1 U	0.318 BJ	0.24 BJ	< 0.0966 U	0.289 BJ
PFUnA	2058-94-8	0.969 B	0.975 B	3.28	3.33	1.29 B	3.06

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 2j
Eagle Point Lake Predator Fish Tissue
Project 1007
Minneapolis, Minnesota

	Location Group	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake	RA_Eagle Point Lake
	Location	EP18	EP18	EP18C	EP18C
	Location ID	82-0109-00-455	82-0109-00-455	82-0109-00-455	82-0109-00-455
	Sample Type Code	Sample	Sample	Sample	Sample
	Sample ID	82-0109-00-455.2009151033.000S	82-0109-00-455.2009151034.000S	82-0109-00-455.2009160800.000S	82-0109-00-455.2009160801.000S
	Sample Name	EP18-PRED-FIL-ONE-01-091520	EP18-PRED-PART-ONE-01-091520	EP18C-PRED-FIL-01-091620	EP18C-PRED-PART-01-091620
	Sample Date	9/15/2020	9/15/2020	9/16/2020	9/16/2020
Compound	CAS #				
11Cl-PF3OUdS	763051-92-9	< 0.389 U	< 0.381 U	< 0.397 U	< 0.397 U
3:3 FTCA	1169706-83-5	< 0.388 U	< 0.381 U	< 0.396 U	< 0.396 U
4:2 FTS	757124-72-4	< 0.388 U	< 0.381 U	< 0.396 U	< 0.396 U
5:3 FTCA	1799325-94-2	< 2.43 U	< 2.38 U	< 2.48 U	< 2.48 U
6:2 FTS	27619-97-2	0.376 BJ	< 0.343 U	7.97	0.648 BJ
7:3 FTCA	812-70-4	< 2.43 U	< 2.38 U	< 2.48 U	< 2.48 U
8:2 FTS	39108-34-4	< 0.388 U	< 0.381 U	< 0.396 U	< 0.396 U
9Cl-PF3ONS	756426-58-1	< 0.389 U	< 0.382 U	< 0.397 U	< 0.397 U
ADONA	919005-14-4	< 0.388 U	< 0.381 U	< 0.396 U	< 0.396 U
HFPO-DA	13252-13-6	< 0.369 U	< 0.362 U	< 0.376 U	< 0.376 UJ
N-EtFOSA	4151-50-2	< 0.243 UJ	< 0.238 UJ	< 0.248 UJ	< 0.248 UJ
N-EtFOSAA	2991-50-6	0.198 J-	0.697 J-	0.334 J-	0.588 J-
N-EtFOSE	1691-99-2	< 0.726 UJ	R	< 0.741 UJ	< 0.741 UJ
N-MeFOSA	31506-32-8	< 0.112 U	R	< 0.114 U	< 0.114 U
N-MeFOSAA	2355-31-9	< 0.0971 U	0.175 J	< 0.099 U	0.184 J
N-MeFOSE	24448-09-7	R	< 0.952 UJ	R	R
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.0971 U	< 0.0952 U	< 0.099 U	< 0.099 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.194 U	< 0.19 U	< 0.198 U	< 0.198 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.194 U	< 0.19 U	< 0.198 U	< 0.198 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.0971 U	< 0.0952 U	< 0.099 U	< 0.099 U
PFBA	375-22-4	< 0.388 U	< 0.381 U	0.598 J	< 0.396 U
PFBS	375-73-5	< 0.0971 U	< 0.0952 U	< 0.099 U	< 0.099 U
PFDA	335-76-2	6.7	20.3	12.5	29.4
PFDoA	307-55-1	0.202 J	0.557	0.446	0.952
PFDoS	79780-39-5	< 0.0971 U	< 0.0952 U	< 0.099 U	< 0.099 U
PFDS	335-77-3	0.375 J	1.31	0.879	2.19
PFHpA	375-85-9	< 0.0971 U	0.105 J	< 0.099 U	< 0.099 U
PFHpS	375-92-8	0.315 J	1.38	0.403	1.33
PFHxA	307-24-4	< 0.0971 U	< 0.0952 U	0.178 J	< 0.099 U
PFHxS	355-46-4	< 0.0971 U	0.107 J	< 0.099 U	0.134 J
PFNA	375-95-1	< 0.0971 U	0.213 J	0.115 J	0.211 J
PFNS	68259-12-1	1.18	4.7	2.3	7.12
PFOA	335-67-1	< 0.0971 U	0.232 J	0.157 J	0.311 J
PFOS	1763-23-1	826	2470	1240	3030
PFOSA	754-91-6	0.504 B	2.22 J-	0.57 B	2.42
PFPeA	2706-90-3	< 0.194 U	< 0.19 U	< 0.198 U	< 0.198 U
PFPeS	2706-91-4	< 0.0976 U	< 0.0957 U	< 0.0995 U	< 0.0995 U
PFTeDA	376-06-7	< 0.0971 U	< 0.0952 U	< 0.099 U	0.128 J
PFTrDA	72629-94-8	0.098 BJ	0.254 BJ	0.126 BJ	0.282 BJ
PFUnA	2058-94-8	0.917 B	2.74	1.65	3.7

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 2k
Eagle Point Lake Forage Fish - Calculated Whole Body Concentrations
Project 1007
Minneapolis, Minnesota

Location Group			Eagle Point Lake			Eagle Point Lake		
Location ID			82-0109-00-455 EP18			82-0109-00-205 EP1A		
Sample Type Code			Sample - Fillet	Sample - Carcass	Calculated	Sample - Fillet	Sample - Carcass	Calculated
Sample ID			82-0109-00-455.2009151032.000S	82-0109-00-455.2009151031.000S	Whole Body	82-0109-00-205.2009150931.000S	82-0109-00-205.2009150932.000S	Whole Body
Sample Name			EP18-FORE-FIL-ONE-01-091520	EP18-FORE-PART-ONE-01-091520	Concentration[1]	EP1A-FORE-FIL-01-091520	EP1A-FORE-PART-01-091520	Concentration[1]
Sample Date			9/15/2020	9/15/2020		9/15/2020	9/15/2020	
Compound	CAS #	Units						
6:2 FTS	27619-97-2	ug/kg	< 0.361	< 0.347	NC	< 0.353	< 0.343	NC
N-EtFOSAA	2991-50-6	ug/kg	0.776	1.67	1.5	0.677	1.55	1.34
N-EtFOSE	1691-99-2	ug/kg	< 0.748	R	NC	R	R	NC
N-MeFOSAA	2355-31-9	ug/kg	< 0.1	< 0.0962	NC	< 0.098	< 0.0952	NC
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	ug/kg	< 0.263	< 0.834	NC	< 0.196	< 0.722	NC
Perfluoro-4-methoxybutanoic acid	863090-89-5	ug/kg	< 0.1	< 0.0962	NC	< 0.098	0.118	0.11
PFBA	375-22-4	ug/kg	< 0.4	< 0.385	NC	< 0.392	< 0.381	NC
PFDA	335-76-2	ug/kg	7.9	20.2	17.6	7.05	16.7	14.38
PFDoA	307-55-1	ug/kg	0.39	0.733	0.7	0.238	0.602	0.51
PFDoS	79780-39-5	ug/kg	< 0.1	< 0.0962	NC	< 0.098	< 0.0952	NC
PFDS	335-77-3	ug/kg	0.771	2.15	1.9	0.53	1.44	1.22
PFHpA	375-85-9	ug/kg	< 0.1	< 0.0962	NC	< 0.098	< 0.0952	NC
PFHpS	375-92-8	ug/kg	1.41	4.4	3.8	1.42	3.64	3.11
PFHxS	355-46-4	ug/kg	0.601	1.48	1.3	0.602	1.5	1.28
PFNA	375-95-1	ug/kg	0.564	1.35	1.2	0.534	1.29	1.11
PFNS	68259-12-1	ug/kg	1.68	5.18	4.4	1.4	3.72	3.16
PFOA	335-67-1	ug/kg	0.469	1.08	1.0	0.493	1.23	1.05
PFOS	1763-23-1	ug/kg	1110	2520	2222	942	2270	1950
PFOSA	754-91-6	ug/kg	3.94	16.6	13.9	3.51	11.8	9.80
PFTeDA	376-06-7	ug/kg	< 0.1	0.19	0.17	< 0.098	0.146	0.13
PFTrDA	72629-94-8	ug/kg	0.121	0.259	0.23	0.101	0.232	0.20
PFUnA	2058-94-8	ug/kg	1.12	2.48	2.2	0.91	2.29	1.96
Weight	--	grams	46	172	218	78	246	324
Percent Fillet weight	--	%	--	--	21%	--	--	24%
Percent Carcass weight	--	%	--	--	79%	--	--	76%

Notes
ug/kg - micrograms per kilogram (wet weight)
< - Not detected. Concentration is less than the laboratory reportable limit (RL).
CAS - Chemical Abstracts Service.
NC - Not calculated.
R - Rejected.

Compounds are presented if they were detected at least once in fillet or carcass samples.
Results not detected above RLs are presented as < RL.
Whole body concentrations were not calculated if the compound was not detected in both fillet and carcass samples or if one result was rejected.
If a compound was only detected in the fillet or carcass, the RL was used to represent the non-detect result in the whole body calculation.

[1] - Calculated whole body fish concentration =
(fillet concentration * [fillet weight/total weight]) +
(part concentration * [part weight/total weight])

Appendix A Table 2k
Eagle Point Lake Forage Fish - Calculated Whole Body Concentrations
Project 1007
Minneapolis, Minnesota

	Location Group		Eagle Point Lake		
	Location ID		82-0109-00-457 EP27C		
	Sample Type Code		Sample - Fillet	Sample - Carcass	
	Sample ID		82-0109-00-457.2009151000.000S	82-0109-00-457.2009151001.000S	Calculated
	Sample Name		EP27C-FORE-FIL-ONE-01-091520	EP27C-FORE-PART-ONE-01-091520	Whole Body
	Sample Date		9/15/2020	9/15/2020	Concentration[1]
Compound	CAS #	Units			
6:2 FTS	27619-97-2	ug/kg	< 0.352	< 0.359	NC
N-EtFOSAA	2991-50-6	ug/kg	0.451	1.19	1.0
N-EtFOSE	1691-99-2	ug/kg	R	R	NC
N-MeFOSAA	2355-31-9	ug/kg	< 0.0976	< 0.0995	NC
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	ug/kg	< 0.267	< 0.351	NC
Perfluoro-4-methoxybutanoic acid	863090-89-5	ug/kg	< 0.0976	< 0.0995	NC
PFBA	375-22-4	ug/kg	< 0.39	< 0.398	NC
PFDA	335-76-2	ug/kg	6.36	19.3	16
PFDoA	307-55-1	ug/kg	0.142	0.415	0.35
PFDoS	79780-39-5	ug/kg	< 0.0976	< 0.0995	NC
PFDS	335-77-3	ug/kg	0.258	0.888	0.7
PFHpA	375-85-9	ug/kg	< 0.0976	< 0.0995	NC
PFHpS	375-92-8	ug/kg	1.26	4.8	4.0
PFHxS	355-46-4	ug/kg	0.558	1.68	1.4
PFNA	375-95-1	ug/kg	0.56	1.43	1.2
PFNS	68259-12-1	ug/kg	1.09	3.81	3.2
PFOA	335-67-1	ug/kg	0.737	2.1	1.8
PFOS	1763-23-1	ug/kg	885	2550	2171
PFOSA	754-91-6	ug/kg	1.71	8.05	6.6
PFTeDA	376-06-7	ug/kg	< 0.0976	< 0.141	NC
PFTrDA	72629-94-8	ug/kg	< 0.0976	0.198	0.18
PFUnA	2058-94-8	ug/kg	0.701	2.08	1.8
Weight	--	grams	56	190	246
Percent Fillet weight	--	%	--	--	23%
Percent Carcass weight	--	%	--	--	77%

Notes
ug/kg - micrograms per kilogram (wet weight)
< - Not detected. Concentration is less than the laborator
reportable limit (RL).
CAS - Chemical Abstracts Service.
NC - Not calculated.
R - Rejected.

Compounds are presented if they were detected at least once in fillet or carcass samples.
Results not detected above RLs are presented as < RL.
Whole body concentrations were not calculated if the compound was not detected in both fillet and carcass samples or if one result was rejected.
If a compound was only detected in the fillet or carcass, the RL was used to represent the non-detect result in the whole body calculation.

[1] - Calculated whole body fish concentration =
(fillet concentration * [fillet weight/total weight]) +
(part concentration * [part weight/total weight])

Appendix A Table 2I
Eagle Point Lake Predator Fish - Calculated Whole Body Concentrations
Project 1007
Minneapolis, Minnesota

Location Group			Eagle Point Lake			Eagle Point Lake		
Location ID			82-0109-00-455			82-0109-00-455		
Location			EP18			EP18		
Sample Type Code			Sample - Fillet	Sample - Carcass	Calculated	Sample - Fillet	Sample - Carcass	Calculated
Sample ID			82-0109-00-455.20091510330005	82-0109-00-455.20091510340005	Whole Body	82-0109-00-455.20091510000005	82-0109-00-455.20091510010005	Whole Body
Sample Name			EP18-PRED-FIL-ONE-01-091520	EP18-PRED-PART-ONE-01-091520	Concentration[1]	EP18-PRED-FIL-TWO-01-091520	EP18-PRED-PART-TWO-01-091520	Concentration[1]
Sample Date			9/15/2020	9/15/2020		9/15/2020	9/15/2020	
Compound	CAS #	Units						
6:2 FTS	27619-97-2	ug/kg	0.376	< 0.343	0.35	7.17	0.697	2.01
N-EtFOSAA	2991-50-6	ug/kg	0.198	0.697	0.59	0.371	0.633	0.58
N-EtFOSE	1691-99-2	ug/kg	< 0.726	R	NC	< 0.723	R	NC
N-MeFOSAA	2355-31-9	ug/kg	< 0.0971	0.175	0.16	< 0.0966	0.18	0.16
PFBA	375-22-4	ug/kg	< 0.388	< 0.381	NC	< 0.386	< 0.388	NC
PFDA	335-76-2	ug/kg	6.7	20.3	17	9	21.9	19.28
PFDoA	307-55-1	ug/kg	0.202	0.557	0.48	0.377	0.894	0.79
PFDoS	79780-39-5	ug/kg	< 0.0971	< 0.0952	NC	< 0.0966	0.111	0.11
PFDS	335-77-3	ug/kg	0.375	1.31	1.11	0.855	2.52	2.18
PFHpA	375-85-9	ug/kg	< 0.0971	0.105	0.10	< 0.0966	< 0.0971	NC
PFHpS	375-92-8	ug/kg	0.315	1.38	1.15	0.344	1.07	0.92
PFHxA	307-24-4	ug/kg	< 0.0971	< 0.0952	NC	< 0.0966	< 0.0971	NC
PFHxS	355-46-4	ug/kg	< 0.0971	0.107	0.10	< 0.0966	0.099	0.10
PFNA	375-95-1	ug/kg	< 0.0971	0.213	0.19	< 0.0966	0.119	0.11
PFNS	68259-12-1	ug/kg	1.18	4.7	3.94	2.21	6.47	5.61
PFOA	335-67-1	ug/kg	< 0.0971	0.232	0.20	< 0.0966	0.154	0.14
PFOS	1763-23-1	ug/kg	826	2470	2114	1050	2590	2277
PFOSA	754-91-6	ug/kg	0.504	2.22	1.85	0.607	2.63	2.22
PFTeDA	376-06-7	ug/kg	< 0.0971	< 0.0952	NC	< 0.0966	0.116	0.11
PFTrDA	72629-94-8	ug/kg	0.098	0.254	0.22	< 0.0966	0.289	0.25
PFUnA	2058-94-8	ug/kg	0.917	2.74	2.35	1.29	3.06	2.70
Weight	--	grams	106	384	490	82	322	404
Percent Fillet weight	--	%	--	--	22%	--	--	20%
Percent Carcass weight	--	%	--	--	78%	--	--	80%

Notes
ug/kg - micrograms per kilogram (wet weight)
< - Not detected. Concentration is less than the laboratory reportable limit (RL).
CAS - Chemical Abstracts Service.
NC - Not calculated.
R - Rejected.

Compounds are presented if they were detected at least once in fillet or carcass samples.
Results not detected above RLs are presented as < RL.
Whole body concentrations were not calculated if the compound was not detected in both fillet and carcass samples or if one result was rejected.
If a compound was only detected in the fillet or carcass, the RL was used to represent the non-detect result in the whole body calculation.

[1] - Calculated whole body fish concentration =
(fillet concentration * [fillet weight/total weight]) +
(part concentration * [part weight/total weight])

Appendix A Table 2I
Eagle Point Lake Predator Fish - Calculated Whole Body Concentrations
Project 1007
Minneapolis, Minnesota

Location Group			Eagle Point Lake			Eagle Point Lake		
Location ID			82-0109-00-455			82-0109-00-457		
Location			EP18C			EP27C		
Sample Type Code			Sample - Fillet	Sample - Carcass	Calculated	Sample - Fillet	Sample - Carcass	Calculated
Sample ID			82-0109-00-455.2009160800.000S	82-0109-00-455.2009160801.000S	Whole Body	82-0109-00-457.2009151003.000S	82-0109-00-457.2009151005.000S	Whole Body
Sample Name			EP18C-PRED-FIL-01-091620	EP18C-PRED-PART-01-091620	Concentration[1]	EP27C-PRED-FIL-ONE-01-091520	EP27C-PRED-PART-ONE-01-091520	Concentration[1]
Sample Date			9/16/2020	9/16/2020		9/15/2020	9/15/2020	
Compound	CAS #	Units						
6:2 FTS	27619-97-2	ug/kg	7.97	0.648	2.26	1.17	< 0.337	0.51
N-EtFOSAA	2991-50-6	ug/kg	0.334	0.588	0.53	0.488	1.23	1.08
N-EtFOSE	1691-99-2	ug/kg	< 0.741	< 0.741	NC	R	R	NC
N-MeFOSAA	2355-31-9	ug/kg	< 0.099	0.184	0.17	< 0.099	0.191	0.17
PFBA	375-22-4	ug/kg	0.598	< 0.396	0.44	< 0.396	< 0.374	NC
PFDA	335-76-2	ug/kg	12.5	29.4	26	7.43	21.7	19
PFDoA	307-55-1	ug/kg	0.446	0.952	0.84	0.275	0.813	0.70
PFDoS	79780-39-5	ug/kg	< 0.099	< 0.099	NC	< 0.099	< 0.0935	NC
PFDS	335-77-3	ug/kg	0.879	2.19	1.90	0.424	1.61	1.37
PFHpA	375-85-9	ug/kg	< 0.099	< 0.099	NC	< 0.099	< 0.0935	NC
PFHpS	375-92-8	ug/kg	0.403	1.33	1.13	0.379	1.7	1.43
PFHxA	307-24-4	ug/kg	0.178	< 0.099	0.12	< 0.099	< 0.0935	NC
PFHxS	355-46-4	ug/kg	< 0.099	0.134	0.13	< 0.099	0.094	0.10
PFNA	375-95-1	ug/kg	0.115	0.211	0.19	< 0.099	0.216	0.19
PFNS	68259-12-1	ug/kg	2.3	7.12	6.06	1.21	5.33	4.48
PFOA	335-67-1	ug/kg	0.157	0.311	0.28	< 0.099	0.131	0.12
PFOS	1763-23-1	ug/kg	1240	3030	2636	800	2370	2047
PFOSA	754-91-6	ug/kg	0.57	2.42	2.01	0.877	3.96	3.33
PFTeDA	376-06-7	ug/kg	< 0.099	0.128	0.12	< 0.099	0.187	0.17
PFTrDA	72629-94-8	ug/kg	0.126	0.282	0.25	0.149	0.318	0.28
PFUnA	2058-94-8	ug/kg	1.65	3.7	3.25	0.969	3.28	2.80
Weight	--	grams	104	368	472	114	440	554
Percent Fillet weight	--	%	--	--	22%	--	--	21%
Percent Carcass weight	--	%	--	--	78%	--	--	79%

Notes
ug/kg - micrograms per kilogram (wet weight)
< - Not detected. Concentration is less than the laboratory reportable limit (RL).
CAS - Chemical Abstracts Service.
NC - Not calculated.
R - Rejected.

Compounds are presented if they were detected at least once in fillet or carcass samples.
Results not detected above RLs are presented as < RL.
Whole body concentrations were not calculated if the compound was not detected in both fillet and carcass samples or if one result was rejected.
If a compound was only detected in the fillet or carcass, the RL was used to represent the non-detect result in the whole body calculation.

[1] - Calculated whole body fish concentration =
(fillet concentration * [fillet weight/total weight]) +
(part concentration * [part weight/total weight])

Appendix A Table 2l
Eagle Point Lake Predator Fish - Calculated Whole Body Concentrations
Project 1007
Minneapolis, Minnesota

	Location Group		Eagle Point Lake		
	Location ID		82-0109-00-457		
	Location		EP27C		
	Sample Type Code		Sample - Fillet	Sample - Carcass	Calculated
	Sample ID		82-0109-00-457.2009151004.000S	82-0109-00-457.2009151006.000S	Whole Body
	Sample Name		EP27C-PRED-FIL-TWO-01-091520	EP27C-PRED-PART-TWO-01-091520	Concentration[1]
	Sample Date		9/15/2020	9/15/2020	
Compound	CAS #	Units			
6:2 FTS	27619-97-2	ug/kg	0.41	0.37	0.38
N-EtFOSAA	2991-50-6	ug/kg	0.293	0.681	0.60
N-EtFOSE	1691-99-2	ug/kg	R	R	NC
N-MeFOSAA	2355-31-9	ug/kg	< 0.1	0.144	0.13
PFBA	375-22-4	ug/kg	< 0.4	< 0.398	NC
PFDA	335-76-2	ug/kg	6.77	23.5	20
PFDoA	307-55-1	ug/kg	0.239	0.793	0.68
PFDoS	79780-39-5	ug/kg	< 0.1	< 0.0995	NC
PFDS	335-77-3	ug/kg	0.458	1.34	1.16
PFHpA	375-85-9	ug/kg	< 0.1	< 0.0995	NC
PFHpS	375-92-8	ug/kg	0.329	1.48	1.24
PFHxA	307-24-4	ug/kg	< 0.1	< 0.0995	NC
PFHxS	355-46-4	ug/kg	< 0.1	0.113	0.11
PFNA	375-95-1	ug/kg	< 0.1	0.23	0.20
PFNS	68259-12-1	ug/kg	1.34	4.97	4.21
PFOA	335-67-1	ug/kg	< 0.1	0.197	0.18
PFOS	1763-23-1	ug/kg	752	2500	2136
PFOSA	754-91-6	ug/kg	0.703	3.43	2.86
PFTeDA	376-06-7	ug/kg	< 0.1	0.101	0.10
PFTrDA	72629-94-8	ug/kg	< 0.1	0.24	0.21
PFUnA	2058-94-8	ug/kg	0.975	3.33	2.84
Weight	--	grams	98	372	470
Percent Fillet weight	--	%	--	--	21%
Percent Carcass weight	--	%	--	--	79%

Notes
ug/kg - micrograms per kilogram (wet weight)
< - Not detected. Concentration is less than the laboratory reportable limit (RL).
CAS - Chemical Abstracts Service.
NC - Not calculated.
R - Rejected.

Compounds are presented if they were detected at least once in fillet or carcass samples.
Results not detected above RLs are presented as < RL.
Whole body concentrations were not calculated if the compound was not detected in both fillet and carcass samples or if one result was rejected.
If a compound was only detected in the fillet or carcass, the RL was used to represent the non-detect result in the whole body calculation.

[1] - Calculated whole body fish concentration =
(fillet concentration * [fillet weight/total weight]) +
(part concentration * [part weight/total weight])

Appendix A Table 3a
Lake Elmo Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo
		Location	EP20	EP9A	EP21A	EP14	EP15	EP23
		Location ID	82-0109-00-454	82-0106-00-304	82-0106-00-303	82-0106-00-208	82-0106-00-209	82-0106-00-302
		Sample Date	9/20/2020	9/19/2020	9/19/2020	9/19/2020	9/19/2020	9/24/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	82-0109-00-454.2009201440.000S	82-0106-00-304.2009190945.000S	82-0106-00-303.2009191020.000S	82-0106-00-208.2009191005.000S	82-0106-00-209.2009191035.000S	82-0106-00-302.2009241650.000S
		Sample Name	EP20-WAT-BULK-01-092020	EP9A-WAT-MID-01-091920	EP21A-WAT-MID-01-091920	EP14-WAT-MID-01-091920	EP15-WAT-MID-01-091920	EP23-WAT-BULK-01-092420
		Parent Sample ID	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #						
Dissolved	10:2 FTS	120226-60-0	< 0.0043 U	< 0.0044 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	11Cl-PF3OUdS	763051-92-9	< 0.0043 U	< 0.0044 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	4:2 FTS	757124-72-4	< 0.0043 U	< 0.0044 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	6:2 FTS	27619-97-2	< 0.0043 U	< 0.0044 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	8:2 FTS	39108-34-4	< 0.0043 U	< 0.0044 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	9Cl-PF3ONS	756426-58-1	< 0.0043 U	< 0.0044 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	ADONA	919005-14-4	< 0.0043 U	< 0.0044 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	HFPO-DA	13252-13-6	< 0.0043 U	< 0.0044 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	N-EtFOSA	4151-50-2	< 0.0043 U	< 0.0044 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	N-EtFOSAA	2991-50-6	0.001 J	< 0.0044 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	N-EtFOSE	1691-99-2	< 0.0043 U	0.00027 BJ+	< 0.0043 UJ	0.00024 BJ+	< 0.0042 U	< 0.0041 U
Dissolved	N-MeFOSA	31506-32-8	< 0.0043 U	0.00047 BJ	< 0.0043 U	0.00047 BJ	< 0.0042 U	< 0.0041 U
Dissolved	N-MeFOSAA	2355-31-9	< 0.0043 U	< 0.0044 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	N-MeFOSE	24448-09-7	< 0.0043 U	< 0.0044 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	PFBA	375-22-4	0.13	0.74 J	0.75 J+	0.66 J+	0.81	0.76
Dissolved	PFBS	375-73-5	0.005	0.0039 J	0.0039 J	0.0034 J	0.0033 J	0.0034 J
Dissolved	PFDA	335-76-2	0.0023 J	< 0.0044 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	PFDoA	307-55-1	< 0.0043 U	< 0.0044 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	PFDS	335-77-3	< 0.0043 U	< 0.0044 U	< 0.0043 U	< 0.0042 U	< 0.042 U	< 0.041 U
Dissolved	PFHpA	375-85-9	0.013	0.011 B	0.012 B	0.01 B	0.0089	0.0069
Dissolved	PFHpS	375-92-8	0.0037 J+	0.0017 J	0.0018 J	0.0013 J	0.0011 J+	0.0015 J
Dissolved	PFHxA	307-24-4	0.016	0.02	0.021	0.018	0.02	0.019
Dissolved	PFHxS	355-46-4	0.012	0.0093	0.0083	0.0085	0.0073	0.0083
Dissolved	PFNA	375-95-1	0.0016 J	0.0018 J	0.0018 J	0.0014 J	< 0.0042 U	< 0.0041 U
Dissolved	PFNS	68259-12-1	< 0.0043 U	< 0.0044 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	PFOA	335-67-1	0.1	0.083	0.081	0.077	0.082	0.079
Dissolved	PFOS	1763-23-1	0.39	0.076 J	0.078	0.064	0.086	0.092 J+
Dissolved	PFOSA	754-91-6	0.0016 J	0.00054 J	< 0.0043 U	< 0.0042 U	0.00063 J	0.00073 J
Dissolved	PFPeA	2706-90-3	0.01	0.022	0.02	0.021	0.018	0.019
Dissolved	PFPeS	2706-91-4	0.0062 J+	0.004 J+	0.0038 J+	0.0038 J+	0.0043 J+	0.0048 J+
Dissolved	PFTeDA	376-06-7	< 0.0043 U	< 0.0044 U	0.0039 BJ+	0.0032 BJ+	< 0.0042 U	< 0.0041 UJ
Dissolved	PFTrDA	72629-94-8	< 0.0043 U	< 0.0044 U	0.0018 J+	< 0.0042 U	< 0.0042 U	< 0.0041 U
Dissolved	PFUnA	2058-94-8	< 0.0043 U	< 0.0044 U	< 0.0043 U	< 0.0042 U	< 0.0042 U	< 0.0041 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 3a
Lake Elmo Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo
		Location	EP20	EP20	EP20	EP20	EP20	EP20
		Location ID	82-0109-00-454	82-0109-00-454	82-0109-00-454	82-0109-00-454	82-0109-00-454	82-0109-00-454
		Sample Date	2/25/2020	4/29/2020	5/7/2020	5/7/2020	5/7/2020	5/18/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	82-0109-00-454.2002251800.000S	82-0109-00-454.2004291345.000S	82-0109-00-454.2005071400.000S	82-0109-00-454.2005071430.000S	82-0109-00-454.2005071435.000S	82-0109-00-454.2005181400.000S
		Sample Name	EP20-WAT-BULK-01-022520	EP20-WAT-BULK-01-042920	EP20-WAT-SML-01-050720	EP20-WAT-EPI-01-050720	EP20-WAT-BULK-01-050720	EP20-WAT-BULK-01-051820
		Parent Sample ID	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #						
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.00326 U	< 0.0031 U	< 0.00319 UJ	< 0.00311 UJ	< 0.00298 UJ	< 0.003 U
Total	4:2 FTS	757124-72-4	< 0.00326 U	< 0.0031 U	< 0.00319 UJ	< 0.00311 UJ	< 0.00298 UJ	< 0.003 U
Total	6:2 FTS	27619-97-2	< 0.00294 U	< 0.00279 U	< 0.00287 UJ	< 0.0028 UJ	< 0.00268 UJ	< 0.0027 U
Total	8:2 FTS	39108-34-4	< 0.00326 U	< 0.0031 U	< 0.00319 UJ	< 0.00311 UJ	< 0.00298 UJ	< 0.003 U
Total	9Cl-PF3ONS	756426-58-1	< 0.00326 U	< 0.0031 U	< 0.00319 UJ	< 0.00311 UJ	< 0.00298 UJ	< 0.003 U
Total	ADONA	919005-14-4	< 0.00326 U	< 0.0031 U	< 0.00319 UJ	< 0.00311 UJ	< 0.00298 UJ	< 0.003 U
Total	HFPO-DA	13252-13-6	< 0.0031 U	< 0.00295 U	< 0.00303 UJ	< 0.00296 UJ	< 0.00283 UJ	< 0.00285 U
Total	N-EtFOSA	4151-50-2	< 0.00204 U	< 0.00194 U	< 0.00199 UJ	< 0.00195 UJ	< 0.00186 UJ	< 0.00188 U
Total	N-EtFOSAA	2991-50-6	< 0.000816 U	< 0.000775 U	< 0.000797 UJ	< 0.000778 UJ	< 0.000745 UJ	< 0.00075 U
Total	N-EtFOSE	1691-99-2	< 0.00612 U	< 0.00581 U	< 0.00598 UJ	< 0.00584 UJ	< 0.00559 UJ	< 0.00563 U
Total	N-MeFOSA	31506-32-8	< 0.000938 U	< 0.000892 U	< 0.000917 UJ	< 0.000895 UJ	< 0.000857 UJ	< 0.000863 U
Total	N-MeFOSAA	2355-31-9	< 0.000816 U	< 0.000775 U	< 0.000797 UJ	< 0.000778 UJ	< 0.000745 UJ	< 0.00075 U
Total	N-MeFOSE	24448-09-7	< 0.00816 U	< 0.00775 U	< 0.00797 UJ	< 0.00778 UJ	< 0.00745 UJ	< 0.0075 U
Total	PFBA	375-22-4	0.12	0.123	0.13 J-	0.127 J-	0.125 J-	0.0952
Total	PFBS	375-73-5	0.00449	0.00464	0.00477 J-	0.00468 J-	0.00467 J-	0.00414
Total	PFDA	335-76-2	0.000914 J	0.000874 J	0.00177 J-	0.00112 J-	0.00115 J-	0.00105 J
Total	PFDoA	307-55-1	< 0.000816 U	< 0.000775 U	< 0.000797 UJ	< 0.000778 UJ	< 0.000745 UJ	< 0.00075 U
Total	PFDoS	79780-39-5	< 0.000816 U	< 0.000775 U	< 0.000797 UJ	< 0.000778 UJ	< 0.000745 UJ	< 0.00075 U
Total	PFDS	335-77-3	< 0.000816 U	< 0.000775 U	< 0.000797 UJ	< 0.000778 UJ	< 0.000745 UJ	< 0.00075 U
Total	PFHpA	375-85-9	0.00739	0.00713	0.00761 J-	0.00787 J-	0.00726 J-	0.0059
Total	PFHpS	375-92-8	0.00204	0.00179	0.00222 J-	0.00191 J-	0.00202 J-	0.00164
Total	PFHxA	307-24-4	0.01	0.00929	0.00986 J-	0.00985 J-	0.00999 J-	0.00766
Total	PFHxS	355-46-4	0.00911	0.0081	0.00906 J-	0.00896 J-	0.00884 J-	0.00798
Total	PFNA	375-95-1	0.00116 J	0.00119 J	0.000997 J-	0.00106 J-	0.00106 J-	0.000873 J
Total	PFNS	68259-12-1	< 0.000816 U	< 0.000775 U	< 0.000797 UJ	< 0.000778 UJ	< 0.000745 UJ	< 0.00075 U
Total	PFOA	335-67-1	0.0596	0.0609	0.0627 J-	0.062 J-	0.0607 J-	0.0513
Total	PFOS	1763-23-1	0.208	0.19	0.271 J-	0.201 J-	0.215 J-	0.193
Total	PFOSA	754-91-6	0.00135 J	0.000823 J	0.00145 J-	0.00125 J-	0.000934 J-	0.000898 BJ
Total	PFPeA	2706-90-3	0.00857	0.00842	0.00868 J-	0.00861 J-	0.00839 J-	0.00637
Total	PFPeS	2706-91-4	0.00261	0.00275	0.00311 J-	0.00311 J-	0.00287 J-	0.0027
Total	PFTeDA	376-06-7	< 0.000816 U	< 0.000775 U	< 0.000797 UJ	< 0.000778 UJ	< 0.000745 UJ	< 0.00075 U
Total	PFTrDA	72629-94-8	< 0.000816 U	< 0.000775 U	< 0.000797 UJ	< 0.000778 UJ	< 0.000745 UJ	< 0.00075 U
Total	PFUnA	2058-94-8	< 0.000816 U	< 0.000775 U	< 0.000797 UJ	< 0.000778 UJ	< 0.000745 UJ	< 0.00075 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 3a
Lake Elmo Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo
		Location	EP20	EP20	EP20	EP20	EP9	EP9
		Location ID	82-0109-00-454	82-0109-00-454	82-0109-00-454	82-0109-00-454	82-0106-00-207	82-0106-00-207
		Sample Date	6/29/2020	7/29/2020	8/26/2020	9/20/2020	8/13/2019	8/13/2019
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	82-0109-00-454.2006291145.000S	82-0109-00-454.2007291345.000S	82-0109-00-454.2008261315.000S	82-0109-00-454.2009201440.000S	82-0106-00-207.1908131550.000S	82-0106-00-207.1908131555.000S
		Sample Name	EP20-WAT-BULK-01-062920	EP20-WAT-BULK-01-072920	EP20-WAT-BULK-01-082620	EP20-WAT-BULK-01-092020	EP9-WAT-18-21-01-081319	EP9-WAT-SUR-01-081319
		Parent Sample ID	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #						
Total	10:2 FTS	120226-60-0	NA	NA	NA	< 0.0042 U	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.00297 UJ	< 0.00155 U	< 0.00151 U	< 0.0042 U	< 0.00294 U	< 0.00297 U
Total	4:2 FTS	757124-72-4	< 0.00297 UJ	< 0.00155 U	< 0.00151 U	< 0.0042 U	< 0.00294 U	< 0.00297 U
Total	6:2 FTS	27619-97-2	0.00791 J-	< 0.0014 U	< 0.00136 U	0.00056 J	< 0.00265 U	< 0.00267 U
Total	8:2 FTS	39108-34-4	< 0.00297 UJ	< 0.00155 U	< 0.00151 U	< 0.0042 U	< 0.00294 U	< 0.00297 U
Total	9Cl-PF3ONS	756426-58-1	< 0.00297 UJ	< 0.00156 U	< 0.00151 U	< 0.0042 U	< 0.00294 U	< 0.00297 U
Total	ADONA	919005-14-4	< 0.00297 UJ	< 0.00155 U	< 0.00151 U	< 0.0042 U	< 0.00294 U	< 0.00297 U
Total	HFPO-DA	13252-13-6	< 0.00282 UJ	< 0.00148 U	< 0.00143 U	< 0.0042 U	< 0.00294 U	< 0.00297 U
Total	N-EtFOSA	4151-50-2	< 0.00186 UJ	< 0.00097 U	< 0.000941 U	< 0.0042 U	< 0.00184 U	< 0.00185 U
Total	N-EtFOSAA	2991-50-6	0.000798 J-	0.00223	0.00101 J	< 0.0042 U	< 0.000736 U	< 0.000742 U
Total	N-EtFOSE	1691-99-2	< 0.00557 UJ	< 0.0029 U	< 0.00282 U	< 0.0042 U	< 0.00552 U	< 0.00556 U
Total	N-MeFOSA	31506-32-8	< 0.000855 UJ	< 0.000446 U	< 0.000433 U	< 0.0042 U	< 0.000847 U	< 0.000853 U
Total	N-MeFOSAA	2355-31-9	< 0.000743 UJ	< 0.000388 U	< 0.000376 U	< 0.0042 U	< 0.000736 U	< 0.000742 U
Total	N-MeFOSE	24448-09-7	< 0.00743 UJ	< 0.00388 U	< 0.00376 U	< 0.0042 U	< 0.00736 U	< 0.00742 U
Total	PFBA	375-22-4	0.146 J	0.114	0.0908	0.12	0.391	0.514
Total	PFBS	375-73-5	0.0053 J-	0.0055	0.00424	0.0056	0.00125 J	0.00293
Total	PFDA	335-76-2	0.0014 J-	0.00217	0.00247	0.0027 J	< 0.000736 U	< 0.000742 U
Total	PFDoA	307-55-1	< 0.000743 UJ	< 0.000388 U	< 0.000376 U	< 0.0042 U	< 0.000736 U	< 0.000742 U
Total	PFDoS	79780-39-5	< 0.000743 UJ	< 0.000388 U	< 0.000376 U	NA	< 0.000736 U	< 0.000742 U
Total	PFDS	335-77-3	< 0.000743 UJ	< 0.000388 U	< 0.000376 U	< 0.0042 U	< 0.000736 U	< 0.000742 U
Total	PFHpA	375-85-9	0.0128 J-	0.0103	0.009	0.014	0.00473	0.00541
Total	PFHpS	375-92-8	0.0032 J-	0.00337	0.00341	0.0044	0.000829 J	< 0.000742 U
Total	PFHxA	307-24-4	0.0138 J-	0.0132	0.0105	0.014	0.00887	0.0131
Total	PFHxS	355-46-4	0.013 J-	0.0122	0.012	0.01	0.00645	0.0064
Total	PFNA	375-95-1	0.00149 J-	0.00161	0.00162	0.0019 J	< 0.000736 U	< 0.000742 U
Total	PFNS	68259-12-1	< 0.000743 UJ	< 0.000388 U	< 0.000376 U	< 0.0042 U	< 0.000736 U	< 0.000742 U
Total	PFOA	335-67-1	0.105 J-	0.0925	0.0913	0.1	0.0663	0.0658
Total	PFOS	1763-23-1	0.313 J-	0.482	0.457	0.41	0.0673	0.0732
Total	PFOSA	754-91-6	0.00156 J-	0.00283	0.00173	0.0014 J	< 0.000736 U	< 0.000742 U
Total	PFPeA	2706-90-3	0.0111 J-	0.0103	0.00778	0.011	0.00684	0.0127
Total	PFPeS	2706-91-4	0.00437 J-	0.00387	0.00341	0.006 J+	0.00109 J	0.0016
Total	PFTeDA	376-06-7	< 0.000743 UJ	< 0.000388 U	< 0.000376 U	< 0.0042 U	< 0.000736 U	< 0.000742 U
Total	PFTrDA	72629-94-8	< 0.000743 UJ	< 0.000388 U	< 0.000376 U	< 0.0042 U	< 0.000736 U	< 0.000742 U
Total	PFUnA	2058-94-8	< 0.000743 UJ	< 0.000388 U	< 0.000376 U	< 0.0042 U	< 0.000736 U	< 0.000742 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 3a
Lake Elmo Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo
		Location	EP9	EP9	EP9A	EP9A	EP21A	EP21A
		Location ID	82-0106-00-207	82-0106-00-207	82-0106-00-304	82-0106-00-304	82-0106-00-303	82-0106-00-303
		Sample Date	5/12/2020	7/29/2020	9/19/2020	9/19/2020	4/23/2020	4/24/2020
		Sample Type Code	Sample	Sample	Sample	QC-FR	Sample	Sample
		Sample ID	82-0106-00-207.2005121410.000S	82-0106-00-207.2007291220.000S	82-0106-00-304.2009190945.000S	82-0106-00-304.2009190950.000SR	82-0106-00-303.2004231300.000S	82-0106-00-303.2004241425.000S
		Sample Name	EP9-WAT-BULK-01-051220	EP9-WAT-BULK-01-072920	EP9A-WAT-MID-01-091920	EP9A-WAT-MID-02-091920	EP21A-WAT-BULK-01-042320	EP21A-WAT-BULK-01-042420
		Parent Sample ID	NA	NA	NA	82-0106-00-304.2009190945.000S	NA	NA
Fraction	Compound	CAS #						
Total	10:2 FTS	120226-60-0	NA	NA	< 0.0041 U	< 0.0042 U	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.00298 U	< 0.00145 U	< 0.0041 U	< 0.0042 U	< 0.00379 U	< 0.00288 U
Total	4:2 FTS	757124-72-4	< 0.00298 U	< 0.00145 U	< 0.0041 U	< 0.0042 U	< 0.00379 U	< 0.00288 U
Total	6:2 FTS	27619-97-2	< 0.00268 U	0.0077 B	< 0.0041 U	< 0.0042 U	< 0.00341 U	< 0.00259 U
Total	8:2 FTS	39108-34-4	< 0.00298 U	< 0.00145 U	< 0.0041 U	< 0.0042 U	< 0.00379 U	< 0.00288 U
Total	9Cl-PF3ONS	756426-58-1	< 0.00298 U	< 0.00145 U	< 0.0041 U	< 0.0042 U	< 0.00379 U	< 0.00288 U
Total	ADONA	919005-14-4	< 0.00298 U	< 0.00145 U	< 0.0041 U	< 0.0042 U	< 0.00379 U	< 0.00288 U
Total	HFPO-DA	13252-13-6	< 0.00283 U	< 0.00137 U	< 0.0041 U	< 0.0042 U	< 0.0036 U	< 0.00273 U
Total	N-EtFOSA	4151-50-2	< 0.00186 U	< 0.000903 U	< 0.0041 U	< 0.0042 U	< 0.00237 U	< 0.0018 U
Total	N-EtFOSAA	2991-50-6	< 0.000744 U	< 0.000361 U	< 0.0041 U	< 0.0042 U	< 0.000947 U	< 0.000719 U
Total	N-EtFOSE	1691-99-2	< 0.00558 U	< 0.0027 U	0.00015 BJ	< 0.0042 U	< 0.00711 U	< 0.00539 U
Total	N-MeFOSA	31506-32-8	< 0.000856 U	< 0.000416 U	< 0.0041 U	< 0.0042 U	< 0.00109 U	< 0.000827 U
Total	N-MeFOSAA	2355-31-9	< 0.000744 U	< 0.000361 U	< 0.0041 U	< 0.0042 U	< 0.000947 U	< 0.000719 U
Total	N-MeFOSE	24448-09-7	< 0.00744 U	< 0.00361 U	< 0.0041 U	< 0.0042 U	< 0.00947 U	< 0.00719 U
Total	PFBA	375-22-4	0.66	R	0.83	0.82 J-	0.772	0.806
Total	PFBS	375-73-5	0.00277	0.00341	0.0036 J	0.0034 J	0.003	0.00306
Total	PFDA	335-76-2	< 0.000744 U	0.000616 J	< 0.0041 U	< 0.0042 U	0.00204	< 0.000719 U
Total	PFDoA	307-55-1	< 0.000744 U	< 0.000361 U	< 0.0041 U	< 0.0042 U	< 0.000947 U	< 0.000719 U
Total	PFDoS	79780-39-5	< 0.000744 U	< 0.000361 U	NA	NA	< 0.000947 U	< 0.000719 U
Total	PFDS	335-77-3	< 0.000744 U	< 0.000361 U	< 0.0041 U	< 0.0042 U	< 0.000947 U	< 0.000719 U
Total	PFHpA	375-85-9	0.00539	0.00607	0.011 B	0.009 B	0.0057	0.00608
Total	PFHpS	375-92-8	0.000784 J	0.00111 J	0.0021 J	0.0015 J	0.00102 J	0.000889 J
Total	PFHxA	307-24-4	0.0146	0.0148	0.022	0.022	0.0155	0.016
Total	PFHxS	355-46-4	0.00627	0.00739	0.0087	0.0079	0.00633	0.00646
Total	PFNA	375-95-1	< 0.000744 U	0.00069 J	0.0015 J	< 0.0042 U	0.00107 J	< 0.000719 U
Total	PFNS	68259-12-1	< 0.000744 U	< 0.000361 U	< 0.0041 U	< 0.0042 U	< 0.000947 U	< 0.000719 U
Total	PFOA	335-67-1	0.0615	0.0678	0.084	0.083	0.0658	0.0621
Total	PFOS	1763-23-1	0.0523	0.0929	0.11	0.1 J	0.183	0.0688
Total	PFOSA	754-91-6	< 0.000744 U	0.00058 BJ	< 0.0041 U	< 0.0042 U	< 0.000947 U	< 0.000719 U
Total	PFPeA	2706-90-3	0.0138	0.015	0.019	0.018	0.0158	0.0162
Total	PFPeS	2706-91-4	0.00201	0.00225	0.0041 J	0.0055 J+	0.00206	0.00208
Total	PFTeDA	376-06-7	< 0.000744 U	< 0.000361 U	< 0.0041 U	< 0.0042 U	< 0.000947 U	< 0.000719 U
Total	PFTrDA	72629-94-8	< 0.000744 U	< 0.000361 U	< 0.0041 U	< 0.0042 U	< 0.000947 U	< 0.000719 U
Total	PFUnA	2058-94-8	< 0.000744 U	< 0.000361 U	< 0.0041 U	< 0.0042 U	< 0.000947 U	< 0.000719 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 3a
Lake Elmo Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo
		Location	EP21A	EP21B	EP21A	EP21A	EP21A	EP21A
		Location ID	82-0106-00-303	82-0106-00-303	82-0106-00-303	82-0106-00-303	82-0106-00-303	82-0106-00-303
		Sample Date	4/24/2020	5/5/2020	7/29/2020	8/26/2020	8/26/2020	9/1/2020
		Sample Type Code	Sample	Sample	Sample	Sample	QC-FR	Sample
		Sample ID	82-0106-00-303.2004241515.000S	82-0106-00-303.2005051455.000S	82-0106-00-303.2007291250.000S	82-0106-00-303.2008261415.000S	82-0106-00-303.2008261430.000SR	82-0106-00-303.2009011325.000S
		Sample Name	EP21A-WAT-SML-01-042420	EP21B-WAT-BULK-01-050520	EP21A-WAT-BULK-01-072920	EP21A-WAT-BULK-01-082620	EP21A-WAT-BULK-02-082620	EP21A-WAT-BULK-01-090120
		Parent Sample ID	NA	NA	NA	NA	82-0106-00-303.2008261415.000S	NA
Fraction	Compound	CAS #						
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.00302 UJ	< 0.00311 UJ	< 0.00145 U	< 0.00152 UJ	< 0.00147 U	< 0.00149 U
Total	4:2 FTS	757124-72-4	< 0.00302 UJ	< 0.00311 UJ	< 0.00145 U	< 0.00152 UJ	< 0.00147 U	< 0.00149 U
Total	6:2 FTS	27619-97-2	< 0.00272 UJ	< 0.0028 UJ	0.0859 B	< 0.00137 UJ	0.00489 J	0.00615
Total	8:2 FTS	39108-34-4	< 0.00302 UJ	< 0.00311 UJ	< 0.00145 U	< 0.00152 UJ	< 0.00147 U	< 0.00149 U
Total	9Cl-PF3ONS	756426-58-1	< 0.00302 UJ	< 0.00311 UJ	< 0.00146 U	< 0.00152 UJ	< 0.00148 U	< 0.00149 U
Total	ADONA	919005-14-4	< 0.00302 UJ	< 0.00311 UJ	< 0.00145 U	< 0.00152 UJ	< 0.00147 U	< 0.00149 U
Total	HFPO-DA	13252-13-6	< 0.00287 UJ	< 0.00295 UJ	< 0.00138 U	< 0.00144 UJ	< 0.0014 U	< 0.00141 U
Total	N-EtFOSA	4151-50-2	< 0.00189 UJ	< 0.00194 UJ	< 0.000908 U	< 0.000949 UJ	< 0.00092 U	< 0.000931 U
Total	N-EtFOSAA	2991-50-6	< 0.000756 UJ	< 0.000776 UJ	< 0.000363 U	< 0.00038 UJ	0.000489 J	0.000662 J
Total	N-EtFOSE	1691-99-2	< 0.00567 UJ	< 0.00582 UJ	< 0.00272 U	< 0.00284 UJ	< 0.00275 U	< 0.00278 U
Total	N-MeFOSA	31506-32-8	< 0.000869 UJ	< 0.000893 UJ	< 0.000418 U	< 0.000437 UJ	< 0.000423 U	< 0.000428 U
Total	N-MeFOSAA	2355-31-9	0.00233 J-	< 0.000776 UJ	< 0.000363 U	< 0.00038 UJ	< 0.000368 U	< 0.000372 U
Total	N-MeFOSE	24448-09-7	< 0.00756 UJ	< 0.00776 UJ	< 0.00363 U	< 0.0038 UJ	< 0.00368 U	< 0.00372 U
Total	PFBA	375-22-4	1.02 J	0.814 J-	R	R	0.619 J+	0.73 J+
Total	PFBS	375-73-5	0.0032 J-	0.00314 J-	0.00333	0.0029 J-	0.00342	0.00381
Total	PFDA	335-76-2	0.00186 J-	< 0.000776 UJ	0.000604 J	0.000831 J-	0.000813 J	0.00167
Total	PFDoA	307-55-1	< 0.000756 UJ	< 0.000776 UJ	< 0.000363 U	< 0.00038 UJ	< 0.000368 U	< 0.000372 U
Total	PFDoS	79780-39-5	< 0.000756 UJ	< 0.000776 UJ	< 0.000363 U	< 0.00038 UJ	< 0.000368 U	< 0.000372 U
Total	PFDS	335-77-3	< 0.000756 UJ	< 0.000776 UJ	< 0.000363 U	< 0.00038 UJ	< 0.000368 U	< 0.000372 U
Total	PFHpA	375-85-9	0.00588 J-	0.00566 J-	0.00555	0.00491 J-	0.00589	0.00553
Total	PFHpS	375-92-8	0.001 J-	0.00084 J-	0.00108 J	0.0011 J-	0.00112 J	0.0013 J
Total	PFHxA	307-24-4	0.0169 J-	0.0161 J-	0.0155	0.0118 J-	0.0147	0.0159
Total	PFHxS	355-46-4	0.00688 J-	0.00685 J-	0.00759	0.00721 J-	0.00739	0.0078
Total	PFNA	375-95-1	0.000936 J-	< 0.000776 UJ	0.00065 J	0.000797 J-	0.000962 J	0.00088 J
Total	PFNS	68259-12-1	< 0.000756 UJ	< 0.000776 UJ	< 0.000363 U	< 0.00038 UJ	< 0.000368 U	< 0.000372 U
Total	PFOA	335-67-1	0.0686 J-	0.065 J-	0.0653	0.0635 J-	0.067	0.0701
Total	PFOS	1763-23-1	0.17 J-	0.0777 J-	0.0945	0.118 J-	0.121	0.184
Total	PFOSA	754-91-6	0.000798 J-	< 0.000776 UJ	0.00065 BJ	0.000442 J-	0.000449 J	0.000576 J
Total	PFPeA	2706-90-3	0.0163 J-	0.0164 J-	0.0147	0.0114 J-	0.0139	0.0163
Total	PFPeS	2706-91-4	0.00227 J-	0.00219 J-	0.00237	0.00193 J-	0.00238	0.00228
Total	PFTeDA	376-06-7	< 0.000756 UJ	< 0.000776 UJ	< 0.000363 U	< 0.00038 UJ	< 0.000368 U	< 0.000372 U
Total	PFTrDA	72629-94-8	< 0.000756 UJ	< 0.000776 UJ	< 0.000363 U	< 0.00038 UJ	< 0.000368 U	< 0.000372 U
Total	PFUnA	2058-94-8	< 0.000756 UJ	< 0.000776 UJ	< 0.000363 U	< 0.00038 UJ	< 0.000368 U	< 0.000372 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 3a
Lake Elmo Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo
		Location	EP21A	EP14	EP14	EP14	EP15	EP15
		Location ID	82-0106-00-303	82-0106-00-208	82-0106-00-208	82-0106-00-208	82-0106-00-209	82-0106-00-209
		Sample Date	9/19/2020	8/13/2019	8/13/2019	9/19/2020	8/13/2019	8/13/2019
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	82-0106-00-303.2009191020.000S	82-0106-00-208.1908131515.000S	82-0106-00-208.1908131520.000S	82-0106-00-208.2009191005.000S	82-0106-00-209.1908131440.000S	82-0106-00-209.1908131445.000S
		Sample Name	EP21A-WAT-MID-01-091920	EP14-WAT-18-21-01-081319	EP14-WAT-SUR-01-081319	EP14-WAT-MID-01-091920	EP15-WAT-18-21-01-081319	EP15-WAT-SUR-01-081319
		Parent Sample ID	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #						
Total	10:2 FTS	120226-60-0	< 0.004 U	NA	NA	< 0.0041 U	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.004 U	< 0.00295 U	< 0.00294 U	< 0.0041 U	< 0.00292 U	< 0.00288 U
Total	4:2 FTS	757124-72-4	< 0.004 U	< 0.00295 U	< 0.00294 U	< 0.0041 U	< 0.00292 U	< 0.00288 U
Total	6:2 FTS	27619-97-2	< 0.004 U	< 0.00266 U	< 0.00265 U	< 0.0041 U	< 0.00263 U	< 0.00259 U
Total	8:2 FTS	39108-34-4	< 0.004 U	< 0.00295 U	< 0.00294 U	< 0.0041 U	< 0.00292 U	< 0.00288 U
Total	9Cl-PF3ONS	756426-58-1	< 0.004 U	< 0.00295 U	< 0.00294 U	< 0.0041 U	< 0.00292 U	< 0.00288 U
Total	ADONA	919005-14-4	< 0.004 U	< 0.00295 U	< 0.00294 U	< 0.0041 U	< 0.00292 U	< 0.00288 U
Total	HFPO-DA	13252-13-6	< 0.004 U	< 0.00295 U	< 0.00294 U	< 0.0041 U	< 0.00292 U	< 0.00288 U
Total	N-EtFOSA	4151-50-2	< 0.004 U	< 0.00185 U	< 0.00184 U	< 0.0041 U	< 0.00182 U	< 0.0018 U
Total	N-EtFOSAA	2991-50-6	< 0.004 U	< 0.000739 U	< 0.000736 U	0.00098 BJ	< 0.00073 U	< 0.000719 U
Total	N-EtFOSE	1691-99-2	< 0.004 U	< 0.00554 U	< 0.00552 U	< 0.0041 U	< 0.00547 U	< 0.00539 U
Total	N-MeFOSA	31506-32-8	< 0.004 U	< 0.000849 U	< 0.000846 U	< 0.0041 U	< 0.000839 U	< 0.000827 U
Total	N-MeFOSAA	2355-31-9	< 0.004 U	< 0.000739 U	< 0.000736 U	< 0.0041 U	< 0.00073 U	< 0.000719 U
Total	N-MeFOSE	24448-09-7	< 0.004 U	< 0.00739 U	< 0.00736 U	< 0.0041 U	< 0.0073 U	< 0.00719 U
Total	PFBA	375-22-4	0.79	0.358	0.589	0.82	0.743	0.988
Total	PFBS	375-73-5	0.0034 J	0.0017	0.00258	0.0037 J	0.00305	0.00357
Total	PFDA	335-76-2	< 0.004 U	< 0.000739 U	< 0.000736 U	< 0.0041 U	< 0.00073 U	< 0.000719 U
Total	PFDoA	307-55-1	< 0.004 U	< 0.000739 U	< 0.000736 U	< 0.0041 U	< 0.00073 U	< 0.000719 U
Total	PFDoS	79780-39-5	NA	< 0.000739 U	< 0.000736 U	NA	< 0.00073 U	< 0.000719 U
Total	PFDS	335-77-3	< 0.004 U	< 0.000739 U	< 0.000736 U	< 0.0041 U	< 0.00073 U	< 0.000719 U
Total	PFHpA	375-85-9	0.0088 B	0.00461	0.00533	0.0089 B	0.00561	0.00678
Total	PFHpS	375-92-8	0.0022 J	0.000871 J	0.001 J	0.0018 J	0.00103 J	0.000889 J
Total	PFHxA	307-24-4	0.022	0.00931	0.0117	0.022	0.0142	0.0163
Total	PFHxS	355-46-4	0.0092	0.00609	0.00665	0.009	0.00775	0.00599
Total	PFNA	375-95-1	< 0.004 U	< 0.000739 U	< 0.000736 U	< 0.0041 U	0.000786 J	0.000724 J
Total	PFNS	68259-12-1	< 0.004 U	< 0.000739 U	< 0.000736 U	< 0.0041 U	< 0.00073 U	< 0.000719 U
Total	PFOA	335-67-1	0.083	0.0642	0.065	0.086	0.0681	0.075
Total	PFOS	1763-23-1	0.11	0.0884	0.0851	0.11	0.0696	0.0676
Total	PFOSA	754-91-6	< 0.004 U	< 0.000739 U	< 0.000736 U	< 0.0041 U	< 0.00073 U	< 0.000719 U
Total	PFPeA	2706-90-3	0.019	0.00804	0.0113	0.018	0.0134	0.0159
Total	PFPeS	2706-91-4	0.0035 J	0.00131 J	0.00152	0.004 J	0.00218	0.00221
Total	PFTeDA	376-06-7	< 0.004 U	< 0.000739 U	< 0.000736 U	< 0.0041 U	< 0.00073 U	< 0.000719 U
Total	PFTrDA	72629-94-8	< 0.004 U	< 0.000739 U	< 0.000736 U	< 0.0041 U	< 0.00073 U	< 0.000719 U
Total	PFUnA	2058-94-8	< 0.004 U	< 0.000739 U	< 0.000736 U	< 0.0041 U	< 0.00073 U	< 0.000719 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 3a
Lake Elmo Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo
		Location	EP15	EP15	EP23	EP23	EP23	EP23
		Location ID	82-0106-00-209	82-0106-00-209	82-0106-00-302	82-0106-00-302	82-0106-00-302	82-0106-00-302
		Sample Date	5/12/2020	9/19/2020	5/7/2020	5/7/2020	7/29/2020	9/24/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	82-0106-00-209.2005121330.000S	82-0106-00-209.2009191035.000S	82-0106-00-302.2005071700.000S	82-0106-00-302.2005071715.000S	82-0106-00-302.2007291530.000S	82-0106-00-302.2009241650.000S
		Sample Name	EP15-WAT-BULK-01-051220	EP15-WAT-MID-01-091920	EP23-WAT-SML-01-050720	EP23-WAT-BULK-01-050720	EP23-WAT-BULK-01-072920	EP23-WAT-BULK-01-092420
		Parent Sample ID	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #						
Total	10:2 FTS	120226-60-0	NA	< 0.004 U	NA	NA	NA	< 0.0039 U
Total	11Cl-PF3OUdS	763051-92-9	< 0.00294 U	< 0.004 U	< 0.0031 UJ	< 0.00302 UJ	< 0.0015 UJ	< 0.0039 U
Total	4:2 FTS	757124-72-4	< 0.00294 U	< 0.004 U	< 0.0031 UJ	< 0.00302 UJ	< 0.0015 UJ	< 0.0039 U
Total	6:2 FTS	27619-97-2	0.0123 J	< 0.004 U	< 0.00279 UJ	< 0.00271 UJ	0.00924 BJ-	< 0.0039 U
Total	8:2 FTS	39108-34-4	< 0.00294 U	< 0.004 U	< 0.0031 UJ	< 0.00302 UJ	< 0.0015 UJ	< 0.0039 U
Total	9Cl-PF3ONS	756426-58-1	< 0.00294 U	< 0.004 U	< 0.0031 UJ	< 0.00302 UJ	< 0.0015 UJ	< 0.0039 U
Total	ADONA	919005-14-4	< 0.00294 U	< 0.004 U	< 0.0031 UJ	< 0.00302 UJ	< 0.0015 UJ	< 0.0039 U
Total	HFPO-DA	13252-13-6	< 0.00279 U	< 0.004 U	< 0.00295 UJ	< 0.00287 UJ	< 0.00142 UJ	< 0.0039 U
Total	N-EtFOSA	4151-50-2	< 0.00184 U	< 0.004 U	< 0.00194 UJ	< 0.00189 UJ	< 0.000937 UJ	< 0.0039 U
Total	N-EtFOSAA	2991-50-6	< 0.000736 U	< 0.004 U	< 0.000776 UJ	< 0.000754 UJ	< 0.000375 UJ	< 0.0039 U
Total	N-EtFOSE	1691-99-2	< 0.00552 U	< 0.004 U	< 0.00582 UJ	< 0.00566 UJ	< 0.0028 UJ	< 0.0039 U
Total	N-MeFOSA	31506-32-8	< 0.000846 U	< 0.004 U	< 0.000892 UJ	< 0.000867 UJ	< 0.000431 UJ	< 0.0039 U
Total	N-MeFOSAA	2355-31-9	< 0.000736 U	< 0.004 U	< 0.000776 UJ	< 0.000754 UJ	< 0.000375 UJ	< 0.0039 U
Total	N-MeFOSE	24448-09-7	< 0.00736 U	< 0.004 U	< 0.00776 UJ	< 0.00754 UJ	< 0.00375 UJ	< 0.0039 U
Total	PFBA	375-22-4	0.478	0.75	0.91 J	0.804 J	R	0.77
Total	PFBS	375-73-5	0.0022	0.0036 J	0.00334 J-	0.00326 J-	0.0031 J-	0.0035 J
Total	PFDA	335-76-2	< 0.000736 U	< 0.004 U	< 0.000776 UJ	< 0.000754 UJ	0.000504 J-	< 0.0039 U
Total	PFDoA	307-55-1	< 0.000736 U	< 0.004 U	< 0.000776 UJ	< 0.000754 UJ	< 0.000375 UJ	< 0.0039 U
Total	PFDoS	79780-39-5	< 0.000736 U	NA	< 0.000776 UJ	< 0.000754 UJ	< 0.000375 UJ	NA
Total	PFDS	335-77-3	< 0.000736 U	< 0.004 U	< 0.000776 UJ	< 0.000754 UJ	< 0.000375 UJ	< 0.039 U
Total	PFHpA	375-85-9	0.00491	0.0097	0.00598 J-	0.00511 J-	0.00578 J-	0.011
Total	PFHpS	375-92-8	0.000783 J	0.0022 J	0.000796 J-	< 0.000754 UJ	0.00103 J-	0.0014 J
Total	PFHxA	307-24-4	0.0111	0.019	0.0164 J-	0.0154 J-	0.0141 J-	0.02
Total	PFHxS	355-46-4	0.00586	0.0097	0.00702 J-	0.00651 J-	0.0074 J-	0.0074 J+
Total	PFNA	375-95-1	< 0.000736 U	< 0.004 U	< 0.000776 UJ	< 0.000754 UJ	0.000694 J-	0.0012 J
Total	PFNS	68259-12-1	< 0.000736 U	< 0.004 U	< 0.000776 UJ	< 0.000754 UJ	< 0.000375 UJ	< 0.0039 U
Total	PFOA	335-67-1	0.0608	0.078	0.0675 J-	0.0609 J-	0.0658 J-	0.079
Total	PFOS	1763-23-1	0.0468	0.092	0.0561 J-	0.0484 J-	0.0912 J-	0.1
Total	PFOSA	754-91-6	< 0.000736 U	< 0.004 U	< 0.000776 UJ	< 0.000754 UJ	0.000402 BJ-	< 0.0039 U
Total	PFPeA	2706-90-3	0.01	0.018	0.0167 J-	0.0149 J-	0.0125 J-	0.019
Total	PFPeS	2706-91-4	0.00166	0.0039 J	0.00236 J-	0.00207 J-	0.00222 J-	0.003 J+
Total	PFTeDA	376-06-7	< 0.000736 U	< 0.004 U	< 0.000776 UJ	< 0.000754 UJ	< 0.000375 UJ	0.0024 J+
Total	PFTrDA	72629-94-8	< 0.000736 U	0.0017 BJ	< 0.000776 UJ	< 0.000754 UJ	< 0.000375 UJ	0.0017 J
Total	PFUnA	2058-94-8	< 0.000736 U	< 0.004 U	< 0.000776 UJ	< 0.000754 UJ	< 0.000375 UJ	< 0.0039 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 3b
Lake Elmo Sediment
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo
		Location	EP20	EP9	EP9	EP21A	EP21A	EP21B
		Location ID	82-0109-00-454	82-0106-00-207	82-0106-00-207	82-0106-00-303	82-0106-00-303	82-0106-00-303
		Sample Date	4/27/2020	8/27/2019	8/27/2019	4/23/2020	4/25/2020	5/5/2020
		Sample Type Code	Sample	Sample	QC-FR	Sample	Sample	Sample
		Sample ID	82-0109-00-454.2004270930.000S	82-0106-00-207.1908270755.000S	82-0106-00-207.1908270755.000SR	82-0106-00-303.2004231240.000S	82-0106-00-303.2004251030.000S	82-0106-00-303.2005051530.000S
		Sample Name	EP20-SED-WET-0-6-01-042720	EP9-SED-0-6-01-082719	EP9-SED-0-6-02-082719	EP21A-SED-FOAM-0-6-01-042320	EP21A-SED-0-6-01-042520	EP21B-BEACH-FOAM-01-050520
		Parent Sample ID	NA	NA	82-0106-00-207.1908270755.000S	NA	NA	NA
Fraction	Compound	CAS #						
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.319 UJ	< 0.684 U	< 0.661 U	< 0.318 UJ	< 0.301 U	< 0.389 U
Total	4:2 FTS	757124-72-4	< 0.319 UJ	< 0.684 U	< 0.661 U	< 0.318 UJ	< 0.301 U	< 0.389 U
Total	6:2 FTS	27619-97-2	< 0.287 UJ	< 0.615 U	< 0.595 U	< 0.312 UJ	< 0.271 U	< 0.375 U
Total	8:2 FTS	39108-34-4	< 0.319 UJ	< 0.684 U	< 0.661 U	< 0.318 UJ	< 0.301 U	< 0.389 U
Total	9Cl-PF3ONS	756426-58-1	< 0.319 UJ	< 0.684 U	< 0.661 U	< 0.318 UJ	< 0.301 U	< 0.389 U
Total	ADONA	919005-14-4	< 0.319 UJ	< 0.684 U	< 0.661 U	< 0.318 UJ	< 0.301 U	< 0.389 U
Total	HFPO-DA	13252-13-6	< 0.303 UJ	< 0.684 U	< 0.661 U	< 0.302 UJ	< 0.286 U	< 0.37 U
Total	N-EtFOSA	4151-50-2	< 0.2 UJ	< 0.427 U	< 0.413 U	< 0.199 UJ	< 0.188 U	< 0.243 U
Total	N-EtFOSAA	2991-50-6	< 0.0798 UJ	< 0.171 U	< 0.165 U	< 0.0795 UJ	< 0.0752 U	< 0.0973 U
Total	N-EtFOSE	1691-99-2	< 0.599 UJ	< 1.28 U	< 1.24 U	< 0.596 UJ	< 0.564 U	< 0.73 U
Total	N-MeFOSA	31506-32-8	< 0.0918 UJ	< 0.197 U	< 0.19 U	< 0.0914 UJ	< 0.0864 U	< 0.112 U
Total	N-MeFOSAA	2355-31-9	< 0.0798 UJ	< 0.171 U	< 0.165 U	< 0.0795 UJ	< 0.0752 U	< 0.0973 U
Total	N-MeFOSE	24448-09-7	< 0.798 UJ	< 1.71 U	< 1.65 U	< 0.795 UJ	< 0.752 U	< 0.973 U
Total	PFBA	375-22-4	< 0.319 UJ	1.24 J	1.25 J	0.464 J-	< 0.301 U	< 0.389 U
Total	PFBS	375-73-5	< 0.0798 UJ	< 0.171 U	< 0.165 U	< 0.0795 UJ	< 0.0752 U	< 0.0973 U
Total	PFDA	335-76-2	< 0.0798 UJ	< 0.171 U	< 0.165 U	< 0.0795 UJ	< 0.0752 U	< 0.0973 U
Total	PFDoA	307-55-1	< 0.0798 UJ	< 0.171 U	< 0.165 U	< 0.0795 UJ	< 0.0752 U	< 0.0973 U
Total	PFDoS	79780-39-5	< 0.0798 UJ	< 0.171 U	< 0.165 U	< 0.0795 UJ	< 0.0752 U	< 0.0973 U
Total	PFDS	335-77-3	< 0.0798 UJ	< 0.171 U	< 0.165 U	< 0.0795 UJ	< 0.0752 U	< 0.0973 U
Total	PFHpA	375-85-9	< 0.0798 UJ	< 0.171 U	< 0.165 U	< 0.0795 UJ	< 0.0752 U	< 0.0973 U
Total	PFHpS	375-92-8	< 0.0798 UJ	< 0.171 U	< 0.165 U	< 0.0795 UJ	< 0.0752 U	< 0.0973 U
Total	PFHxA	307-24-4	< 0.0798 UJ	< 0.171 U	0.2 J	< 0.0795 UJ	< 0.0752 U	< 0.0973 U
Total	PFHxS	355-46-4	< 0.0798 UJ	< 0.171 U	< 0.165 U	< 0.0795 UJ	< 0.0752 U	< 0.0973 U
Total	PFNA	375-95-1	< 0.0798 UJ	< 0.171 U	< 0.165 U	< 0.0795 UJ	< 0.0752 U	< 0.0973 U
Total	PFNS	68259-12-1	< 0.0798 UJ	< 0.171 U	< 0.165 U	< 0.0795 UJ	< 0.0752 U	< 0.0973 U
Total	PFOA	335-67-1	0.114 J-	1.24	1.46	0.095 J-	< 0.0752 U	0.117 J
Total	PFOS	1763-23-1	4.44 J-	5.46	4.48	0.619 J-	1.12	2.45
Total	PFOSA	754-91-6	< 0.0798 UJ	< 0.171 U	< 0.165 U	< 0.0795 UJ	< 0.0752 U	< 0.0973 U
Total	PFPeA	2706-90-3	< 0.16 UJ	< 0.342 U	< 0.331 U	< 0.159 UJ	< 0.15 U	< 0.195 U
Total	PFPeS	2706-91-4	< 0.0798 UJ	< 0.171 U	< 0.165 U	< 0.0795 UJ	< 0.0752 U	< 0.0973 U
Total	PFTeDA	376-06-7	< 0.0798 UJ	< 0.171 U	< 0.165 U	< 0.0795 UJ	< 0.0752 U	< 0.0973 U
Total	PFTrDA	72629-94-8	< 0.0798 UJ	< 0.171 U	< 0.165 U	< 0.0795 UJ	< 0.0752 U	< 0.0973 U
Total	PFUnA	2058-94-8	< 0.0798 UJ	< 0.171 U	< 0.165 U	< 0.0795 UJ	< 0.0752 U	< 0.0973 U

NOTES
All results are reported in micrograms per kilogram (ug/kg).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 3b
Lake Elmo Sediment
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo
		Location	EP14	EP15	EP23
		Location ID	82-0106-00-208	82-0106-00-209	82-0106-00-302
		Sample Date	8/27/2019	8/27/2019	4/27/2020
		Sample Type Code	Sample	Sample	Sample
		Sample ID	82-0106-00-208.1908270720.000S	82-0106-00-209.1908270700.000S	82-0106-00-302.2004271230.000S
		Sample Name	EP14-SED-0-6-01-082719	EP15-SED-0-6-01-082719	EP23-SED-0-6-01-042720
		Parent Sample ID	NA	NA	NA
Fraction	Compound	CAS #			
Total	10:2 FTS	120226-60-0	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.312 U	< 0.374 U	< 0.317 UJ
Total	4:2 FTS	757124-72-4	< 0.312 U	< 0.374 U	< 0.317 UJ
Total	6:2 FTS	27619-97-2	< 0.281 U	4.53	< 0.285 UJ
Total	8:2 FTS	39108-34-4	< 0.312 U	< 0.374 U	< 0.317 UJ
Total	9Cl-PF3ONS	756426-58-1	< 0.312 U	< 0.374 U	< 0.317 UJ
Total	ADONA	919005-14-4	< 0.312 U	< 0.374 U	< 0.317 UJ
Total	HFPO-DA	13252-13-6	< 0.312 U	< 0.374 U	< 0.301 UJ
Total	N-EtFOSA	4151-50-2	< 0.195 U	< 0.234 U	< 0.198 UJ
Total	N-EtFOSAA	2991-50-6	< 0.0779 U	< 0.0934 U	< 0.0792 UJ
Total	N-EtFOSE	1691-99-2	< 0.585 U	< 0.701 U	< 0.594 UJ
Total	N-MeFOSA	31506-32-8	< 0.0896 U	< 0.107 U	< 0.0911 UJ
Total	N-MeFOSAA	2355-31-9	< 0.0779 U	< 0.0934 U	< 0.0792 UJ
Total	N-MeFOSE	24448-09-7	< 0.779 U	< 0.934 U	< 0.792 UJ
Total	PFBA	375-22-4	< 0.312 U	5.21	< 0.317 UJ
Total	PFBS	375-73-5	< 0.0779 U	< 0.0934 U	< 0.0792 UJ
Total	PFDA	335-76-2	< 0.0779 U	< 0.0934 U	< 0.0792 UJ
Total	PFDoA	307-55-1	< 0.0779 U	< 0.0934 U	< 0.0792 UJ
Total	PFDoS	79780-39-5	< 0.0779 U	< 0.0934 U	< 0.0792 UJ
Total	PFDS	335-77-3	< 0.0779 U	< 0.0934 U	< 0.0792 UJ
Total	PFHpA	375-85-9	< 0.0779 U	< 0.0934 U	< 0.0792 UJ
Total	PFHpS	375-92-8	< 0.0779 U	< 0.0934 U	< 0.0792 UJ
Total	PFHxA	307-24-4	< 0.0779 U	0.126 J	< 0.0792 UJ
Total	PFHxS	355-46-4	< 0.0779 U	< 0.0934 U	< 0.0792 UJ
Total	PFNA	375-95-1	< 0.0779 U	< 0.0934 U	< 0.0792 UJ
Total	PFNS	68259-12-1	< 0.0779 U	< 0.0934 U	< 0.0792 UJ
Total	PFOA	335-67-1	< 0.0779 U	0.373	< 0.0792 UJ
Total	PFOS	1763-23-1	1.1	0.847	0.812 J-
Total	PFOSA	754-91-6	< 0.0779 U	< 0.0934 U	< 0.0792 UJ
Total	PFPeA	2706-90-3	< 0.156 U	< 0.187 U	< 0.158 UJ
Total	PFPeS	2706-91-4	< 0.0779 U	< 0.0934 U	< 0.0792 UJ
Total	PFTeDA	376-06-7	< 0.0779 U	< 0.0934 U	< 0.0792 UJ
Total	PFTrDA	72629-94-8	< 0.0779 U	< 0.0934 U	< 0.0792 UJ
Total	PFUnA	2058-94-8	< 0.0779 U	< 0.0934 U	< 0.0792 UJ

NOTES
All results are reported in micrograms per kilogram (ug/kg).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 3c
Lake Elmo Foam
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo
		Location	EP21A	EP21B	EP21B
		Location ID	82-0106-00-303	82-0106-00-303	82-0106-00-303
		Sample Date	4/23/2020	5/5/2020	5/5/2020
		Sample Type Code	Sample	Sample	QC-FR
		Sample ID	82-0106-00-303.2004231200.000S	82-0106-00-303.2005051435.000S	82-0106-00-303.2005051440.000SR
		Sample Name	EP21A-FOAM-01-042320	EP21B-FOAM-01-050520	EP21B-FOAM-02-050520
		Parent Sample ID	NA	NA	82-0106-00-303.2005051435.000S
Fraction	Compound	CAS #			
Total	11Cl-PF3OUdS	763051-92-9	< 0.445 U	< 0.44 U	< 0.398 U
Total	4:2 FTS	757124-72-4	< 0.445 U	< 0.44 U	< 0.398 U
Total	6:2 FTS	27619-97-2	< 0.401 U	< 0.396 U	< 0.358 U
Total	8:2 FTS	39108-34-4	< 0.445 U	< 0.44 U	< 0.398 U
Total	9Cl-PF3ONS	756426-58-1	< 0.445 U	< 0.44 U	< 0.398 U
Total	ADONA	919005-14-4	< 0.445 U	< 0.44 U	< 0.398 U
Total	HFPO-DA	13252-13-6	< 0.423 U	< 0.418 U	< 0.378 U
Total	N-EtFOSA	4151-50-2	< 0.278 U	< 0.275 U	< 0.249 U
Total	N-EtFOSAA	2991-50-6	1.3	3.12	2.81
Total	N-EtFOSE	1691-99-2	< 0.835 U	< 0.825 U	< 0.747 U
Total	N-MeFOSA	31506-32-8	< 0.128 U	< 0.127 U	< 0.114 U
Total	N-MeFOSAA	2355-31-9	< 0.111 U	0.365	0.358
Total	N-MeFOSE	24448-09-7	< 1.11 U	< 1.1 U	< 0.995 U
Total	PFBA	375-22-4	0.897 J	0.839 J	0.83
Total	PFBS	375-73-5	< 0.111 U	< 0.11 U	< 0.099 U
Total	PFDA	335-76-2	2.11	10.8	10.4
Total	PFDoA	307-55-1	< 0.111 U	0.125 J	0.144 J
Total	PFDoS	79780-39-5	< 0.111 U	< 0.11 U	< 0.099 U
Total	PFDS	335-77-3	< 0.111 U	< 0.11 U	< 0.099 U
Total	PFHpA	375-85-9	< 0.111 U	< 0.11 U	< 0.099 U
Total	PFHpS	375-92-8	0.15 J	0.503	0.498
Total	PFHxA	307-24-4	< 0.111 U	< 0.11 U	< 0.099 U
Total	PFHxS	355-46-4	< 0.111 U	< 0.11 U	< 0.099 U
Total	PFNA	375-95-1	0.26	0.999	1
Total	PFNS	68259-12-1	< 0.111 U	< 0.11 U	< 0.099 U
Total	PFOA	335-67-1	0.521	1.05	1.07
Total	PFOS	1763-23-1	216	904	862
Total	PFOSA	754-91-6	0.463	0.737	0.692
Total	PFPeA	2706-90-3	< 0.223 U	< 0.22 U	< 0.199 U
Total	PFPeS	2706-91-4	< 0.111 U	< 0.11 U	< 0.099 U
Total	PFTeDA	376-06-7	< 0.111 U	< 0.11 U	< 0.099 U
Total	PFTrDA	72629-94-8	< 0.111 U	< 0.11 U	< 0.099 U
Total	PFUnA	2058-94-8	0.331	0.952	1.1

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
J = Estimated concentration.
QC-FR = Duplicate sample.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 3d
Lake Elmo Forage Fish Tissue
Project 1007
Minneapolis, Minnesota

	Location Group	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo
	Location	EP20	EP9A	EP9A	EP9A	EP21
	Location ID	82-0109-00-454	82-0106-00-304	82-0106-00-304	82-0106-00-304	82-0106-00-303
	Sample Type Code	Sample	Sample	Sample	Sample	Sample
	Sample ID	82-0109-00-454.2009201430.000S	82-0106-00-304.2009180900.000S	82-0106-00-304.2009180901.000S	82-0106-00-304.2009180902.000S	82-0106-00-303.2009180837.000S
	Sample Name	EP20-FORE-COMP-TWO-01-092020	EP9A-FORE-FIL-ONE-01-091820	EP9A-FORE-PART-ONE-01-091820	EP9A-FORE-WHO-TWO-01-091820	EP21-FORE-FIL-THREE-01-091820
	Sample Date	9/20/2020	9/18/2020	9/18/2020	9/18/2020	9/18/2020
Compound	CAS #					
11Cl-PF3OUdS	763051-92-9	< 0.395 U	< 0.393 U	< 0.383 U	< 0.393 U	< 0.397 U
3:3 FTCA	1169706-83-5	< 0.394 U	< 0.392 U	< 0.383 U	< 0.392 U	< 0.396 U
4:2 FTS	757124-72-4	< 0.394 U	< 0.392 U	< 0.383 U	< 0.392 U	< 0.396 U
5:3 FTCA	1799325-94-2	< 2.46 U	< 2.45 U	< 2.39 U	< 2.45 U	< 2.48 U
6:2 FTS	27619-97-2	< 0.355 U	< 0.353 U	< 0.345 U	< 0.353 U	< 0.357 U
7:3 FTCA	812-70-4	< 2.46 U	< 2.45 U	< 2.39 U	< 2.45 U	< 2.48 U
8:2 FTS	39108-34-4	< 0.394 U	< 0.392 U	< 0.383 U	< 0.392 U	< 0.396 U
9Cl-PF3ONS	756426-58-1	< 0.395 U	< 0.393 U	< 0.384 U	< 0.393 U	< 0.397 U
ADONA	919005-14-4	< 0.394 U	< 0.392 U	< 0.383 U	< 0.392 U	< 0.396 U
HFPO-DA	13252-13-6	< 0.374 U	< 0.373 U	< 0.364 UJ	< 0.373 U	< 0.376 U
N-EtFOSA	4151-50-2	< 0.246 UJ	R	R	< 0.245 U	< 0.248 UJ
N-EtFOSAA	2991-50-6	0.707 J-	< 0.098 U	< 0.0957 U	< 0.098 U	< 0.099 U
N-EtFOSE	1691-99-2	< 0.737 UJ	R	R	< 0.733 UJ	R
N-MeFOSA	31506-32-8	< 0.113 U	< 0.113 UJ	< 0.11 UJ	< 0.113 U	< 0.114 UJ
N-MeFOSAA	2355-31-9	< 0.0985 U	< 0.098 U	< 0.0957 U	< 0.098 U	0.124 J
N-MeFOSE	24448-09-7	R	R	R	R	R
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.0985 U	< 0.098 U	< 0.0957 U	< 0.098 U	< 0.099 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.318 U	< 0.196 U	< 0.191 U	< 0.196 U	< 0.198 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.197 U	< 0.196 U	< 0.191 U	< 0.196 U	< 0.198 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.0985 U	< 0.098 U	< 0.0957 U	< 0.098 U	< 0.099 U
PFBA	375-22-4	0.574 J	< 0.392 U	0.628 J	0.439 J	0.646 J
PFBS	375-73-5	< 0.0985 U	< 0.098 U	< 0.0957 U	< 0.098 U	< 0.099 U
PFDA	335-76-2	13	1.03	2.26	8.94	1.79
PFDoA	307-55-1	0.688	0.173 J	0.402	0.649	0.228 J
PFDoS	79780-39-5	< 0.0985 U	< 0.098 U	< 0.0957 U	< 0.098 U	< 0.099 U
PFDS	335-77-3	0.554	< 0.098 U	< 0.0957 U	0.222 J	< 0.099 U
PFHpA	375-85-9	< 0.0985 U	< 0.098 U	< 0.0957 U	< 0.098 U	< 0.099 U
PFHpS	375-92-8	3.73	< 0.098 U	0.19 J	1.74	0.298 J
PFHxA	307-24-4	< 0.0985 U	< 0.098 U	< 0.0957 U	< 0.098 U	< 0.099 U
PFHxS	355-46-4	0.543	< 0.098 U	< 0.0957 U	0.386 J	< 0.099 U
PFNA	375-95-1	0.412	< 0.098 U	< 0.0957 U	1.13	< 0.099 U
PFNS	68259-12-1	2.37	< 0.098 U	0.149 J	0.565	< 0.099 U
PFOA	335-67-1	0.842	< 0.098 U	0.114 J	1.43	0.125 J
PFOS	1763-23-1	2460	246	518	1110	269
PFOSA	754-91-6	16	< 0.098 U	0.25 BJ	0.304 J	0.102 J
PFPeA	2706-90-3	< 0.197 U	< 0.196 U	< 0.191 U	< 0.196 U	< 0.198 U
PFPeS	2706-91-4	< 0.099 U	< 0.0985 U	< 0.0962 U	< 0.0985 U	< 0.0995 U
PFTeDA	376-06-7	0.246 J	0.255 J+	0.464	0.221 J	0.267 J
PFTrDA	72629-94-8	0.31 J	0.152 BJ	0.398 B	0.298 BJ	0.377 BJ
PFUnA	2058-94-8	1.93	0.275 BJ	0.583 B	1.71	0.317 BJ

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 3d
Lake Elmo Forage Fish Tissue
Project 1007
Minneapolis, Minnesota

	Location Group	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo
	Location	EP21	EP21	EP21	EP14	EP14
	Location ID	82-0106-00-303	82-0106-00-303	82-0106-00-303	82-0106-00-208	82-0106-00-208
	Sample Type Code	Sample	Sample	Sample	Sample	Sample
	Sample ID	82-0106-00-303.2009180839.000S	82-0106-00-303.2009180840.000S	82-0106-00-303.2009180835.000S	82-0106-00-208.2009181330.000S	82-0106-00-208.2009181331.000S
	Sample Name	EP21-FORE-PART-SEVEN-01-091820	EP21-FORE-PART-THREE-01-091820	EP21-FORE-FIL-SEVEN-01-091820	EP14-FORE-FIL-ONE-01-091820	EP14-FORE-FIL-TWO-01-091820
	Sample Date	9/18/2020	9/18/2020	9/18/2020	9/18/2020	9/18/2020
Compound	CAS #					
11Cl-PF3OUdS	763051-92-9	< 0.381 U	< 0.397 U	< 0.391 U	< 0.393 U	< 0.389 U
3:3 FTCA	1169706-83-5	< 0.381 U	< 0.396 U	< 0.39 U	< 0.392 U	< 0.388 U
4:2 FTS	757124-72-4	< 0.381 U	< 0.396 U	< 0.39 U	< 0.392 U	< 0.388 U
5:3 FTCA	1799325-94-2	< 2.38 U	< 2.48 U	< 2.44 U	< 2.45 U	< 2.43 U
6:2 FTS	27619-97-2	< 0.343 U	< 0.357 U	< 0.352 U	< 0.353 U	< 0.35 U
7:3 FTCA	812-70-4	< 2.38 U	< 2.48 U	< 2.44 U	< 2.45 U	< 2.43 U
8:2 FTS	39108-34-4	< 0.381 U	< 0.396 U	< 0.39 U	< 0.392 U	< 0.388 U
9Cl-PF3ONS	756426-58-1	< 0.382 U	< 0.397 U	< 0.391 U	< 0.393 U	< 0.389 U
ADONA	919005-14-4	< 0.381 U	< 0.396 U	< 0.39 U	< 0.392 U	< 0.388 U
HFPO-DA	13252-13-6	< 0.362 U	< 0.376 U	< 0.371 U	< 0.373 U	< 0.369 U
N-EtFOSA	4151-50-2	R	< 0.248 UJ	< 0.244 UJ	< 0.245 UJ	< 0.243 UJ
N-EtFOSAA	2991-50-6	< 0.0952 U	< 0.099 U	< 0.0976 U	< 0.098 U	< 0.0971 U
N-EtFOSE	1691-99-2	R	0.744 J+	R	< 0.733 UJ	< 0.726 UJ
N-MeFOSA	31506-32-8	< 0.11 UJ	< 0.114 UJ	< 0.112 U	R	< 0.112 U
N-MeFOSAA	2355-31-9	< 0.0952 U	0.19 J	< 0.0976 U	< 0.098 U	< 0.0971 U
N-MeFOSE	24448-09-7	R	R	R	< 0.98 U	R
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.0952 U	< 0.099 U	< 0.0976 U	< 0.098 U	< 0.0971 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.284 U	0.839 J	< 0.195 U	< 0.196 U	< 0.194 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.19 U	< 0.198 U	< 0.195 U	< 0.196 U	< 0.194 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.0952 U	< 0.099 U	< 0.0976 U	< 0.098 U	< 0.0971 U
PFBA	375-22-4	< 0.381 U	1.07 J	< 0.39 U	0.458 J	0.405 J
PFBS	375-73-5	< 0.0952 U	< 0.099 U	< 0.0976 U	< 0.098 U	< 0.0971 U
PFDA	335-76-2	2.86	3.8	1.25	0.905	2.18
PFDoA	307-55-1	0.395	0.524	0.155 J	0.148 J	0.391
PFDoS	79780-39-5	< 0.0952 U	< 0.099 U	< 0.0976 U	< 0.098 U	< 0.0971 U
PFDS	335-77-3	< 0.0952 U	< 0.099 U	< 0.0976 U	< 0.098 U	< 0.0971 U
PFHpA	375-85-9	< 0.0952 U	0.275 J	< 0.0976 U	< 0.098 U	< 0.0971 U
PFHpS	375-92-8	0.339 J	0.607	0.122 J	< 0.098 U	0.118 J
PFHxA	307-24-4	< 0.152 U	< 0.099 U	< 0.0976 U	< 0.098 U	< 0.0971 U
PFHxS	355-46-4	0.14 J	0.123 J	< 0.0976 U	< 0.098 U	< 0.0971 U
PFNA	375-95-1	0.127 J	0.174 J	< 0.0976 U	< 0.098 U	< 0.0971 U
PFNS	68259-12-1	0.156 J	0.155 J	< 0.0976 U	< 0.098 U	0.188 J
PFOA	335-67-1	0.364 J	0.314 J	< 0.0976 U	< 0.098 U	0.126 J
PFOS	1763-23-1	514	611	221	194	416
PFOSA	754-91-6	0.423	0.308 J	0.119 J	< 0.098 U	0.107 J
PFPeA	2706-90-3	< 0.19 U	< 0.198 U	< 0.195 U	< 0.196 U	< 0.194 U
PFPeS	2706-91-4	< 0.0957 U	< 0.0995 U	< 0.098 U	< 0.0985 U	< 0.0976 U
PFTeDA	376-06-7	0.439 J+	0.487	0.193 J	0.228 J	0.356 J
PFTrDA	72629-94-8	0.409 B	0.534 B	0.205 BJ	0.162 BJ	0.328 BJ
PFUnA	2058-94-8	0.615 B	0.629 B	0.255 BJ	0.241 BJ	0.598 B

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 3d
Lake Elmo Forage Fish Tissue
Project 1007
Minneapolis, Minnesota

	Location Group	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo
	Location	EP14	EP14	EP15	EP15
	Location ID	82-0106-00-208	82-0106-00-208	82-0106-00-209	82-0106-00-209
	Sample Type Code	Sample	Sample	Sample	Sample
	Sample ID	82-0106-00-208.2009181332.000S	82-0106-00-208.2009181333.000S	82-0106-00-209.2009180920.000S	82-0106-00-209.2009180921.000S
	Sample Name	EP14-FORE-PART-ONE-01-091820	EP14-FORE-PART-TWO-01-091820	EP15-FORE-WHO-ONE-01-091820	EP15-FORE-WHO-THREE-01-091820
	Sample Date	9/18/2020	9/18/2020	9/18/2020	9/18/2020
Compound	CAS #				
11Cl-PF3OUdS	763051-92-9	< 0.385 U	< 0.391 U	< 0.378 U	< 0.399 U
3:3 FTCA	1169706-83-5	< 0.385 U	< 0.39 U	< 0.377 U	< 0.398 U
4:2 FTS	757124-72-4	< 0.385 U	< 0.39 U	< 0.377 U	< 0.398 U
5:3 FTCA	1799325-94-2	< 2.4 U	< 2.44 U	< 2.36 U	< 2.49 U
6:2 FTS	27619-97-2	< 0.347 U	< 0.352 U	< 0.34 U	< 0.359 U
7:3 FTCA	812-70-4	< 2.4 U	< 2.44 U	< 2.36 U	< 2.49 U
8:2 FTS	39108-34-4	< 0.385 U	< 0.39 U	< 0.377 U	< 0.398 U
9Cl-PF3ONS	756426-58-1	< 0.386 U	< 0.391 U	< 0.378 U	< 0.399 U
ADONA	919005-14-4	< 0.385 U	< 0.39 U	< 0.377 U	< 0.398 U
HFPO-DA	13252-13-6	< 0.365 U	< 0.371 UJ	< 0.358 U	< 0.378 U
N-EtFOSA	4151-50-2	R	< 0.244 UJ	R	R
N-EtFOSAA	2991-50-6	< 0.0962 U	0.098 J-	< 0.0943 U	< 0.0995 U
N-EtFOSE	1691-99-2	R	R	R	R
N-MeFOSA	31506-32-8	< 0.111 UJ	< 0.112 UJ	< 0.108 UJ	R
N-MeFOSAA	2355-31-9	< 0.0962 U	< 0.0976 U	< 0.0943 U	< 0.0995 U
N-MeFOSE	24448-09-7	R	R	R	< 0.995 U
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.0962 U	< 0.0976 U	< 0.0943 U	< 0.0995 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.192 U	< 0.322 U	< 0.21 U	< 0.199 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.192 U	< 0.195 U	< 0.189 U	< 0.199 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.0962 U	< 0.0976 U	< 0.0943 U	< 0.0995 U
PFBA	375-22-4	0.641 J	0.648 J	0.908 J	0.661 J
PFBS	375-73-5	< 0.0962 U	< 0.0976 U	< 0.0943 U	< 0.0995 U
PFDA	335-76-2	2.93	5.56	1.84	3.35
PFDoA	307-55-1	0.539	0.984	0.619	0.659
PFDoS	79780-39-5	< 0.0962 U	< 0.0976 U	< 0.0943 U	< 0.0995 U
PFDS	335-77-3	0.127 J	0.176 J	< 0.0943 U	0.122 J
PFHpA	375-85-9	< 0.0962 U	< 0.0976 U	< 0.0943 U	< 0.0995 U
PFHpS	375-92-8	0.267 J	0.326 J	< 0.0943 U	0.454
PFHxA	307-24-4	< 0.0962 U	< 0.0976 U	< 0.0943 U	< 0.0995 U
PFHxS	355-46-4	< 0.0962 U	< 0.0976 U	< 0.0943 U	0.102 J
PFNA	375-95-1	< 0.0962 U	0.12 J	< 0.0943 U	0.176 J
PFNS	68259-12-1	0.183 J	0.478	0.104 J	0.179 J
PFOA	335-67-1	0.226 J	0.22 J	0.293 J	0.487
PFOS	1763-23-1	635	925	270	591
PFOSA	754-91-6	0.165 J	0.396	0.126 BJ	0.232 BJ
PFPeA	2706-90-3	< 0.192 U	< 0.195 U	< 0.189 U	< 0.199 U
PFPeS	2706-91-4	< 0.0966 U	< 0.098 U	< 0.0948 U	< 0.1 U
PFTeDA	376-06-7	0.645 J+	0.665	0.397 J+	0.595 J+
PFTrDA	72629-94-8	0.437 J	0.685 J	0.32 J	0.517 B
PFUnA	2058-94-8	0.775 B	1.4	0.778 B	1 B

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 3e
Lake Elmo Predator Fish Tissue
Project 1007
Minneapolis, Minnesota

	Location Group	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo
	Location	EP9A	EP9A	EP9A	EP9A	EP9A	EP9A
	Location ID	82-0106-00-304	82-0106-00-304	82-0106-00-304	82-0106-00-304	82-0106-00-304	82-0106-00-304
	Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample
	Sample ID	82-0106-00-304.2009180904.000S	82-0106-00-304.2009180906.000S	82-0106-00-304.2009180907.000S	82-0106-00-304.2009180908.000S	82-0106-00-304.2009180909.000S	82-0106-00-304.2009180910.000S
	Sample Name	EP9A-PRED-FIL-ONE-01-091820	EP9A-PRED-FIL-TWO-01-091820	EP9A-PRED-PART-ONE-01-091820	EP9A-PRED-PART-TWO-01-091820	EP9A-PRED-WHO-FIVE-01-091820	EP9A-PRED-WHO-SIX-01-091820
	Sample Date	9/18/2020	9/18/2020	9/18/2020	9/18/2020	9/18/2020	9/18/2020
Compound	CAS #						
11Cl-PF3OUdS	763051-92-9	< 0.399 U	< 0.389 U	< 0.395 U	< 0.371 U	< 0.38 U	< 0.376 U
3:3 FTCA	1169706-83-5	< 0.398 U	< 0.388 U	< 0.394 U	< 0.37 U	< 0.379 U	< 0.376 U
4:2 FTS	757124-72-4	< 0.398 U	< 0.388 U	< 0.394 U	< 0.37 U	< 0.379 U	< 0.376 U
5:3 FTCA	1799325-94-2	< 2.49 U	< 2.43 U	< 2.46 U	< 2.31 U	< 2.37 U	< 2.35 U
6:2 FTS	27619-97-2	0.375 BJ	0.679 BJ	0.448 BJ-	< 0.334 U	< 0.342 U	< 0.338 U
7:3 FTCA	812-70-4	< 2.49 U	< 2.43 U	< 2.46 U	< 2.31 U	< 2.37 U	< 2.35 U
8:2 FTS	39108-34-4	< 0.398 U	< 0.388 U	< 0.394 U	< 0.37 U	< 0.379 U	< 0.376 U
9Cl-PF3ONS	756426-58-1	< 0.399 U	< 0.389 U	< 0.395 U	< 0.371 U	< 0.38 U	< 0.377 U
ADONA	919005-14-4	< 0.398 U	< 0.388 U	< 0.394 U	< 0.37 U	< 0.379 U	< 0.376 U
HFPO-DA	13252-13-6	< 0.378 U	< 0.369 U	< 0.374 UJ	< 0.352 UJ	< 0.36 UJ	< 0.357 UJ
N-EtFOSA	4151-50-2	< 0.249 UJ	< 0.243 U	< 0.246 UJ	< 0.231 UJ	R	< 0.235 UJ
N-EtFOSAA	2991-50-6	< 0.0995 U	< 0.0971 U	0.135 J-	0.113 J-	0.204 J-	0.134 J
N-EtFOSE	1691-99-2	< 0.744 UJ	< 0.726 U	R	< 0.693 UJ	R	< 0.702 UJ
N-MeFOSA	31506-32-8	< 0.114 UJ	< 0.112 U	< 0.113 UJ	< 0.106 U	< 0.109 UJ	< 0.108 U
N-MeFOSAA	2355-31-9	< 0.0995 U	< 0.0971 U	0.192 J	< 0.0926 U	< 0.0948 U	< 0.0939 U
N-MeFOSE	24448-09-7	< 0.995 UJ	< 0.971 U	R	R	R	R
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.0995 U	< 0.0971 U	< 0.0985 U	< 0.0926 U	< 0.0948 U	< 0.0939 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.199 U	< 0.194 U	< 0.2 U	< 0.185 U	< 0.19 U	< 0.188 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.199 U	< 0.194 U	< 0.197 U	< 0.185 U	< 0.19 U	< 0.188 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.0995 U	< 0.0971 U	< 0.0985 U	< 0.0926 U	< 0.0948 U	< 0.0939 U
PFBA	375-22-4	0.41 J	< 0.388 U	< 0.394 U	< 0.37 U	< 0.379 U	< 0.376 U
PFBS	375-73-5	< 0.0995 U	< 0.0971 U	< 0.0985 U	< 0.0926 U	< 0.0948 U	< 0.0939 U
PFDA	335-76-2	6.09	3.49	20.9	9.25	8.05	9.18
PFDoA	307-55-1	0.704	0.394	2.06	0.981	0.981	0.898
PFDoS	79780-39-5	< 0.0995 U	< 0.0971 U	< 0.0985 U	< 0.0926 U	< 0.0948 U	< 0.0939 U
PFDS	335-77-3	0.128 J	< 0.0971 U	0.544	0.303 J	0.187 J	0.21 J
PFHpA	375-85-9	< 0.0995 U	< 0.0971 U	< 0.0985 U	< 0.0926 U	< 0.0948 U	< 0.0939 U
PFHpS	375-92-8	0.239 J	0.474	1.11	1.32	1.04	1.53
PFHxA	307-24-4	< 0.0995 U	< 0.0971 U	< 0.0985 U	< 0.0926 U	< 0.0948 U	< 0.0939 U
PFHxS	355-46-4	< 0.0995 U	0.103 J	< 0.0985 U	0.326 J	0.332 J	0.362 J
PFNA	375-95-1	< 0.0995 U	0.176 J	0.119 J	0.4	0.642	0.487
PFNS	68259-12-1	0.34 J	0.206 J	1.5	0.656	0.387	0.572
PFOA	335-67-1	< 0.0995 U	0.131 J	0.121 J	0.361 J	0.625	0.289 J
PFOS	1763-23-1	856	438	2450	1100	852	1060
PFOSA	754-91-6	< 0.0995 U	0.399 B	0.214 BJ	0.531 B	0.643 B	0.58 B
PFPeA	2706-90-3	< 0.199 U	< 0.194 U	< 0.197 U	< 0.185 U	< 0.19 U	< 0.188 U
PFPeS	2706-91-4	< 0.1 U	< 0.0976 U	< 0.099 U	< 0.0931 U	< 0.0953 U	< 0.0944 U
PFTeDA	376-06-7	0.247 J+	R	0.766 J+	0.398	R	0.4
PFTrDA	72629-94-8	0.34 BJ	0.147 BJ	0.907 B	0.495 B	0.431 B	0.481 B
PFUnA	2058-94-8	1.37	0.724 B	4.35	1.96	1.96	2.13

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 3e
Lake Elmo Predator Fish Tissue
Project 1007
Minneapolis, Minnesota

Location Group		RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo	RA_Lake Elmo
Location		EP21	EP21	EP14	EP14	EP14	EP14
Location ID		82-0106-00-303	82-0106-00-303	82-0106-00-208	82-0106-00-208	82-0106-00-208	82-0106-00-208
Sample Type Code		Sample	Sample	Sample	Sample	Sample	Sample
Sample ID		82-0106-00-303.2009180847.000S	82-0106-00-303.2009180846.000S	82-0106-00-208.2009181334.000S	82-0106-00-208.2009181335.000S	82-0106-00-208.2009181336.000S	82-0106-00-208.2009181337.000S
Sample Name		EP21-PRED-FIL-THREE-01-091820	EP21-PRED-PART-THREE-01-091820	EP14-PRED-FIL-ONE-01-091820	EP14-PRED-FIL-THREE-01-091820	EP14-PRED-FIL-TWO-01-091820	EP14-PRED-PART-ONE-01-091820
Sample Date		9/18/2020	9/18/2020	9/18/2020	9/18/2020	9/18/2020	9/18/2020
Compound	CAS #						
11Cl-PF3OUdS	763051-92-9	< 0.391 U	< 0.393 U	< 0.399 U	< 0.344 U	< 0.378 U	< 0.401 U
3:3 FTCA	1169706-83-5	< 0.39 U	< 0.392 U	< 0.398 U	< 0.343 U	< 0.377 U	< 0.4 U
4:2 FTS	757124-72-4	< 0.39 U	< 0.392 U	< 0.398 U	< 0.343 U	< 0.377 U	< 0.4 U
5:3 FTCA	1799325-94-2	< 2.44 U	< 2.45 U	< 2.49 U	< 2.15 U	< 2.36 U	< 2.5 U
6:2 FTS	27619-97-2	< 0.352 U	2.98	< 0.359 U	< 0.309 U	< 0.34 U	< 0.361 U
7:3 FTCA	812-70-4	< 2.44 U	< 2.45 U	< 2.49 U	< 2.15 U	< 2.36 U	< 2.5 U
8:2 FTS	39108-34-4	< 0.39 U	< 0.392 U	< 0.398 U	< 0.343 U	< 0.377 U	< 0.4 U
9Cl-PF3ONS	756426-58-1	< 0.391 U	< 0.393 U	< 0.399 U	< 0.344 U	< 0.378 U	< 0.401 U
ADONA	919005-14-4	< 0.39 U	< 0.392 U	< 0.398 U	< 0.343 U	< 0.377 U	< 0.4 U
HFPO-DA	13252-13-6	< 0.371 U	< 0.373 UJ	< 0.378 U	< 0.326 U	< 0.358 U	< 0.38 U
N-EtFOSA	4151-50-2	< 0.244 UJ	< 0.245 UJ	< 0.249 UJ	< 0.215 U	< 0.236 UJ	< 0.25 UJ
N-EtFOSAA	2991-50-6	< 0.0976 U	< 0.098 U	< 0.0995 U	< 0.0858 U	< 0.0943 U	< 0.1 U
N-EtFOSE	1691-99-2	< 0.73 UJ	R	R	0.74 J+	R	R
N-MeFOSA	31506-32-8	< 0.112 U	< 0.113 UJ	< 0.114 UJ	< 0.0987 UJ	< 0.108 UJ	< 0.115 UJ
N-MeFOSAA	2355-31-9	< 0.0976 U	0.123 J	< 0.0995 U	< 0.0858 U	< 0.0943 U	< 0.1 U
N-MeFOSE	24448-09-7	R	R	R	< 0.858 UJ	R	R
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.0976 U	< 0.098 U	< 0.0995 U	< 0.0858 U	< 0.0943 U	< 0.1 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.195 U	< 0.289 U	< 0.199 U	< 0.172 U	< 0.189 U	< 0.2 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.195 U	< 0.196 U	< 0.199 U	< 0.172 U	< 0.189 U	< 0.2 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.0976 U	< 0.098 U	< 0.0995 U	< 0.0858 U	< 0.0943 U	< 0.1 U
PFBA	375-22-4	< 0.39 U	< 0.392 U	< 0.398 U	< 0.343 U	< 0.377 U	< 0.4 U
PFBS	375-73-5	< 0.0976 U	< 0.098 U	< 0.0995 U	< 0.0858 U	< 0.0943 U	< 0.1 U
PFDA	335-76-2	6.29	14.6	2.78	3.13	1.85	6.75
PFDoA	307-55-1	0.983	2.27	0.519	0.57	0.386	0.985
PFDoS	79780-39-5	< 0.0976 U	< 0.098 U	< 0.0995 U	< 0.0858 U	< 0.0943 U	< 0.1 U
PFDS	335-77-3	0.197 J	0.408	< 0.0995 U	0.104 J	< 0.0943 U	0.162 J
PFHpA	375-85-9	< 0.0976 U	< 0.098 U	< 0.0995 U	< 0.0858 U	< 0.0943 U	0.114 J
PFHpS	375-92-8	0.349 J	0.917	0.135 J	0.096 J	0.122 J	0.51
PFHxA	307-24-4	< 0.0976 U	< 0.098 U	< 0.0995 U	< 0.0858 U	< 0.0943 U	< 0.1 U
PFHxS	355-46-4	< 0.0976 U	< 0.098 U	< 0.0995 U	< 0.0858 U	< 0.0943 U	< 0.1 U
PFNA	375-95-1	< 0.0976 U	0.252 J	< 0.0995 U	< 0.0858 U	< 0.0943 U	< 0.1 U
PFNS	68259-12-1	0.378 J	0.969	0.164 J	0.175 J	0.127 J	0.431
PFOA	335-67-1	< 0.0976 U	0.119 J	< 0.0995 U	< 0.0858 U	< 0.0943 U	0.141 J
PFOS	1763-23-1	959	2230	362	442	284	859
PFOSA	754-91-6	< 0.0976 U	0.169 J	< 0.0995 U	< 0.0858 U	< 0.0943 U	0.211 J
PFPeA	2706-90-3	< 0.195 U	< 0.196 U	< 0.199 U	< 0.172 U	< 0.189 U	< 0.2 U
PFPeS	2706-91-4	< 0.098 U	< 0.0985 U	< 0.1 U	< 0.0863 U	< 0.0948 U	< 0.101 U
PFTeDA	376-06-7	0.437	0.96	0.187 J+	0.316 J	0.214 J	0.419 J+
PFTrDA	72629-94-8	0.52 B	1.25 B	0.199 BJ	0.355 B	0.217 BJ	0.381 BJ
PFUnA	2058-94-8	1.57	4.14	0.729 B	0.784 B	0.549 B	1.64

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 3e
Lake Elmo Predator Fish Tissue
Project 1007
Minneapolis, Minnesota

	Location Group	RA_Lake Elmo	RA_Lake Elmo
	Location	EP14	EP14
	Location ID	82-0106-00-208	82-0106-00-208
	Sample Type Code	Sample	Sample
	Sample ID	82-0106-00-208.2009181338.000S	82-0106-00-208.2009181339.000S
	Sample Name	EP14-PRED-PART-THREE-01-091820	EP14-PRED-PART-TWO-01-091820
	Sample Date	9/18/2020	9/18/2020
Compound	CAS #		
11Cl-PF3OUdS	763051-92-9	< 0.367 U	< 0.385 U
3:3 FTCA	1169706-83-5	< 0.367 U	< 0.385 U
4:2 FTS	757124-72-4	< 0.367 U	< 0.385 U
5:3 FTCA	1799325-94-2	< 2.29 U	< 2.4 U
6:2 FTS	27619-97-2	< 0.331 U	< 0.347 U
7:3 FTCA	812-70-4	< 2.29 U	< 2.4 U
8:2 FTS	39108-34-4	< 0.367 U	< 0.385 U
9Cl-PF3ONS	756426-58-1	< 0.368 U	< 0.386 U
ADONA	919005-14-4	< 0.367 U	< 0.385 U
HFPO-DA	13252-13-6	< 0.349 U	< 0.365 UJ
N-EtFOSA	4151-50-2	R	< 0.24 UJ
N-EtFOSAA	2991-50-6	< 0.0917 U	< 0.0962 UJ
N-EtFOSE	1691-99-2	R	R
N-MeFOSA	31506-32-8	< 0.106 UJ	< 0.111 U
N-MeFOSAA	2355-31-9	0.104 J	< 0.0962 U
N-MeFOSE	24448-09-7	R	R
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.0917 U	< 0.0962 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.183 U	< 0.192 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.183 U	< 0.192 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.0917 U	< 0.0962 U
PFBA	375-22-4	0.525 J	< 0.385 U
PFBS	375-73-5	< 0.0917 U	< 0.0962 U
PFDA	335-76-2	8.28	7.57
PFDoA	307-55-1	1.37	1.28
PFDoS	79780-39-5	< 0.0917 U	< 0.0962 U
PFDS	335-77-3	0.234 J	0.222 J
PFHpA	375-85-9	< 0.0917 U	< 0.0962 U
PFHpS	375-92-8	0.318 J	0.474
PFHxA	307-24-4	< 0.0917 U	< 0.0962 U
PFHxS	355-46-4	< 0.0917 U	< 0.0962 U
PFNA	375-95-1	0.163 J	< 0.0962 U
PFNS	68259-12-1	0.463	0.518
PFOA	335-67-1	0.208 J	< 0.0962 U
PFOS	1763-23-1	1150	1050
PFOSA	754-91-6	0.179 J	0.17 J
PFPeA	2706-90-3	< 0.183 U	< 0.192 U
PFPeS	2706-91-4	< 0.0922 U	< 0.0966 U
PFTeDA	376-06-7	0.804 J+	0.561
PFTrDA	72629-94-8	0.812 B	0.661 B
PFUnA	2058-94-8	2.2	2.09

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 3f
Lake Elmo Forage Fish - Calculated Whole Body Concentrations
Project 1007
Minneapolis, Minnesota

	Location Group		Lake Elmo			Lake Elmo		
	Location ID		82-0106-00-208 EP14			82-0106-00-208 EP14		
	Sample Type Code		Sample - Fillet	Sample - Carcass	Calculated Whole Body Concentration[1]	Sample - Fillet	Sample - Carcass	Calculated Whole Body Concentration[1]
	Sample ID		82-0106-00-208.2009181330.000S	82-0106-00-208.2009181332.000S		82-0106-00-208.2009181331.000S	82-0106-00-208.2009181333.000S	
	Sample Name		EP14-FORE-FIL-ONE-01-091820	EP14-FORE-PART-ONE-01-091820		EP14-FORE-FIL-TWO-01-091820	EP14-FORE-PART-TWO-01-091820	
	Sample Date		9/18/2020	9/18/2020		9/18/2020	9/18/2020	
Compound	CAS #	Units						
6:2 FTS	27619-97-2	ug/kg	< 0.353	< 0.347	NC	< 0.35	< 0.352	NC
N-EtFOSAA	2991-50-6	ug/kg	< 0.098	< 0.0962	NC	< 0.0971	0.098	0.1
N-EtFOSE	1691-99-2	ug/kg	< 0.733	R	NC	< 0.726	R	NC
N-MeFOSAA	2355-31-9	ug/kg	< 0.098	< 0.0962	NC	< 0.0971	< 0.0976	NC
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	ug/kg	< 0.196	< 0.192	NC	< 0.194	< 0.322	NC
Perfluoro-4-methoxybutanoic acid	863090-89-5	ug/kg	< 0.098	< 0.0962	NC	< 0.0971	< 0.0976	NC
PFBA	375-22-4	ug/kg	0.458	0.641	0.60	0.405	0.648	0.60
PFDA	335-76-2	ug/kg	0.905	2.93	2.53	2.18	5.56	4.87
PFDoA	307-55-1	ug/kg	0.148	0.539	0.46	0.391	0.984	0.86
PFDoS	79780-39-5	ug/kg	< 0.098	< 0.0962	NC	< 0.0971	< 0.0976	NC
PFDS	335-77-3	ug/kg	< 0.098	0.127	0.12	< 0.0971	0.176	0.16
PFHpA	375-85-9	ug/kg	< 0.098	< 0.0962	NC	< 0.0971	< 0.0976	NC
PFHpS	375-92-8	ug/kg	< 0.098	0.267	0.23	0.118	0.326	0.28
PFHxS	355-46-4	ug/kg	< 0.098	< 0.0962	NC	< 0.0971	< 0.0976	NC
PFNA	375-95-1	ug/kg	< 0.098	< 0.0962	NC	< 0.0971	0.12	0.12
PFNS	68259-12-1	ug/kg	< 0.098	0.183	0.17	0.188	0.478	0.42
PFOA	335-67-1	ug/kg	< 0.098	0.226	0.20	0.126	0.22	0.20
PFOS	1763-23-1	ug/kg	194	635	546.80	416	925	820.59
PFOSA	754-91-6	ug/kg	< 0.098	0.165	0.15	0.107	0.396	0.34
PFTeDA	376-06-7	ug/kg	0.228	0.645	1	0.356	0.665	0.60
PFTrDA	72629-94-8	ug/kg	0.162	0.437	0.38	0.328	0.685	0.61
PFUnA	2058-94-8	ug/kg	0.241	0.775	0.67	0.598	1.4	1.24
Weight	--	grams	14	56	70	16	62	78
Percent Fillet weight	--	%	--	--	20%	--	--	21%
Percent Carcass weight	--	%	--	--	80%	--	--	79%

Notes
ug/kg - micrograms per kilogram (wet weight)
< - Not detected. Concentration is less than the laboratory reportable limit (RL).
CAS - Chemical Abstracts Service.
NC - Not calculated.
R - Rejected.

Compounds are presented if they were detected at least once in fillet or carcass samples.
Results not detected above RLs are presented as < RL.
Whole body concentrations were not calculated if the compound was not detected in both fillet and carcass samples or if one result was rejected.
If a compound was only detected in the fillet or carcass, the RL was used to represent the non-detect result in the whole body calculation.

[1] - Calculated whole body fish concentration =
(fillet concentration * [fillet weight/total weight]) +
(part concentration * [part weight/total weight])

Appendix A Table 3f
Lake Elmo Forage Fish - Calculated Whole Body Concentrations
Project 1007
Minneapolis, Minnesota

Location Group			Lake Elmo			Lake Elmo		
Location ID			82-0106-00-303 EP21			82-0106-00-303 EP21		
Sample Type Code			Sample - Fillet	Sample - Carcass	Calculated	Sample - Fillet	Sample - Carcass	Calculated
Sample ID			82-0106-00-303.2009180835.000S	82-0106-00-303.2009180839.000S	Whole Body	82-0106-00-303.2009180837.000S	82-0106-00-303.2009180840.000S	Whole Body
Sample Name			EP21-FORE-FIL-SEVEN-01-091820	EP21-FORE-PART-SEVEN-01-091820	Concentration[1]	EP21-FORE-FIL-THREE-01-091820	EP21-FORE-PART-THREE-01-091820	Concentration[1]
Sample Date			9/18/2020	9/18/2020		9/18/2020	9/18/2020	
Compound	CAS #	Units						
6:2 FTS	27619-97-2	ug/kg	< 0.352	< 0.343	NC	< 0.357	< 0.357	NC
N-EtFOSAA	2991-50-6	ug/kg	< 0.0976	< 0.0952	NC	< 0.099	< 0.099	NC
N-EtFOSE	1691-99-2	ug/kg	R	R	NC	R	0.744	NC
N-MeFOSAA	2355-31-9	ug/kg	< 0.0976	< 0.0952	NC	0.124	0.19	0.17
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	ug/kg	< 0.195	< 0.284	NC	< 0.198	0.839	0.69
Perfluoro-4-methoxybutanoic acid	863090-89-5	ug/kg	< 0.0976	< 0.0952	NC	< 0.099	< 0.099	NC
PFBA	375-22-4	ug/kg	< 0.39	< 0.381	NC	0.646	1.07	0.97
PFDA	335-76-2	ug/kg	1.25	2.86	2.5	1.79	3.8	3.34
PFDoA	307-55-1	ug/kg	0.155	0.395	0.34	0.228	0.524	0.46
PFDoS	79780-39-5	ug/kg	< 0.0976	< 0.0952	NC	< 0.099	< 0.099	NC
PFDS	335-77-3	ug/kg	< 0.0976	< 0.0952	NC	< 0.099	< 0.099	NC
PFHpA	375-85-9	ug/kg	< 0.0976	< 0.0952	NC	< 0.099	0.275	0.23
PFHpS	375-92-8	ug/kg	0.122	0.339	0.29	0.298	0.607	0.54
PFHxS	355-46-4	ug/kg	< 0.0976	0.14	0.13	< 0.099	0.123	0.12
PFNA	375-95-1	ug/kg	< 0.0976	0.127	0.12	< 0.099	0.174	0.16
PFNS	68259-12-1	ug/kg	< 0.0976	0.156	0.14	< 0.099	0.155	0.14
PFOA	335-67-1	ug/kg	< 0.0976	0.364	0.30	0.125	0.314	0.27
PFOS	1763-23-1	ug/kg	221	514	447	269	611	532
PFOSA	754-91-6	ug/kg	0.119	0.423	0.35	0.102	0.308	0.26
PFTeDA	376-06-7	ug/kg	0.193	0.439	0.38	0.267	0.487	0.44
PFTrDA	72629-94-8	ug/kg	0.205	0.409	0.36	0.377	0.534	0.50
PFUnA	2058-94-8	ug/kg	0.255	0.615	0.5	0.317	0.629	0.56
Weight	--	grams	16	54	70	54	180	234
Percent Fillet weight	--	%	--	--	23%	--	--	23%
Percent Carcass weight	--	%	--	--	77%	--	--	77%

Notes
ug/kg - micrograms per kilogram (wet weight)
< - Not detected. Concentration is less than the laborator reportable limit (RL).
CAS - Chemical Abstracts Service.
NC - Not calculated.
R - Rejected.

Compounds are presented if they were detected at least once in fillet or carcass samples.
Results not detected above RLs are presented as < RL.
Whole body concentrations were not calculated if the compound was not detected in both fillet and carcass samples or if one result was rejected.
If a compound was only detected in the fillet or carcass, the RL was used to represent the non-detect result in the whole body calculation.

[1] - Calculated whole body fish concentration =
(fillet concentration * [fillet weight/total weight]) +
(part concentration * [part weight/total weight])

Appendix A Table 3f
Lake Elmo Forage Fish - Calculated Whole Body Concentrations
Project 1007
Minneapolis, Minnesota

			Location Group	Lake Elmo		
			Location ID	82-0106-00-304 EP9A		
			Sample Type Code	Sample - Fillet	Sample - Carcass	Calculated Whole Body Concentration[1]
			Sample ID	82-0106-00-304.2009180900.000S	82-0106-00-304.2009180901.000S	
			Sample Name	EP9A-FORE-FIL-ONE-01-091820	EP9A-FORE-PART-ONE-01-091820	
			Sample Date	9/18/2020	9/18/2020	
Compound	CAS #	Units				
6:2 FTS	27619-97-2	ug/kg		< 0.353	< 0.345	NC
N-EtFOSAA	2991-50-6	ug/kg		< 0.098	< 0.0957	NC
N-EtFOSE	1691-99-2	ug/kg		R	R	NC
N-MeFOSAA	2355-31-9	ug/kg		< 0.098	< 0.0957	NC
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	ug/kg		< 0.196	< 0.191	NC
Perfluoro-4-methoxybutanoic acid	863090-89-5	ug/kg		< 0.098	< 0.0957	NC
PFBA	375-22-4	ug/kg		< 0.392	0.628	0.57
PFDA	335-76-2	ug/kg		1.03	2.26	1.96
PFDoA	307-55-1	ug/kg		0.173	0.402	0.35
PFDoS	79780-39-5	ug/kg		< 0.098	< 0.0957	NC
PFDS	335-77-3	ug/kg		< 0.098	< 0.0957	NC
PFHpA	375-85-9	ug/kg		< 0.098	< 0.0957	NC
PFHpS	375-92-8	ug/kg		< 0.098	0.19	0.17
PFHxS	355-46-4	ug/kg		< 0.098	< 0.0957	NC
PFNA	375-95-1	ug/kg		< 0.098	< 0.0957	NC
PFNS	68259-12-1	ug/kg		< 0.098	0.149	0.14
PFOA	335-67-1	ug/kg		< 0.098	0.114	0.11
PFOS	1763-23-1	ug/kg		246	518	452
PFOSA	754-91-6	ug/kg		< 0.098	0.25	0.21
PFTeDA	376-06-7	ug/kg		0.255	0.464	0.41
PFTrDA	72629-94-8	ug/kg		0.152	0.398	0.34
PFUnA	2058-94-8	ug/kg		0.275	0.583	0.51
Weight	--	grams		20	62	82
Percent Fillet weight	--	%		--	--	24%
Percent Carcass weight	--	%		--	--	76%

Notes
ug/kg - micrograms per kilogram (wet weight)
< - Not detected. Concentration is less than the laborator
reportable limit (RL).
CAS - Chemical Abstracts Service.
NC - Not calculated.
R - Rejected.

Compounds are presented if they were detected at least once in fillet or carcass samples.
Results not detected above RLs are presented as < RL.
Whole body concentrations were not calculated if the compound was not detected in both fillet and carcass samples or if one result was rejected.
If a compound was only detected in the fillet or carcass, the RL was used to represent the non-detect result in the whole body calculation.

[1] - Calculated whole body fish concentration =
(fillet concentration * [fillet weight/total weight]) +
(part concentration * [part weight/total weight])

Appendix A Table 3g
Lake Elmo Predator Fish - Calculated Whole Body Concentrations
Project 1007
Minneapolis, Minnesota

Location Group			Lake Elmo			Lake Elmo		
Location ID			82-0106-00-208			82-0106-00-208		
Location			EP14			EP14		
Sample Type Code			Sample - Fillet	Sample - Carcass	Calculated	Sample - Fillet	Sample - Carcass	Calculated
Sample ID			82-0106-00-208.2009181334.000S	82-0106-00-208.2009181337.000S	Whole Body	82-0106-00-208.2009181335.000S	82-0106-00-208.2009181338.000S	Whole Body
Sample Name			EP14-PRED-FIL-ONE-01-091820	EP14-PRED-PART-ONE-01-091820	Concentration[1]	EP14-PRED-FIL-THREE-01-091820	EP14-PRED-PART-THREE-01-091820	Concentration[1]
Sample Date			9/18/2020	9/18/2020		9/18/2020	9/18/2020	
Compound	CAS #	Units						
6:2 FTS	27619-97-2	ug/kg	< 0.359	< 0.361	NC	< 0.309	< 0.331	NC
N-EtFOSAA	2991-50-6	ug/kg	< 0.0995	< 0.1	NC	< 0.0858	< 0.0917	NC
N-EtFOSE	1691-99-2	ug/kg	R	R	NC	0.74	R	NC
N-MeFOSAA	2355-31-9	ug/kg	< 0.0995	< 0.1	NC	< 0.0858	0.104	0.10
PFBA	375-22-4	ug/kg	< 0.398	< 0.4	NC	< 0.343	0.525	0.49
PFDA	335-76-2	ug/kg	2.78	6.75	5.82	3.13	8.28	7.34
PFDoA	307-55-1	ug/kg	0.519	0.985	0.88	0.57	1.37	1.22
PFDoS	79780-39-5	ug/kg	< 0.0995	< 0.1	NC	< 0.0858	< 0.0917	NC
PFDS	335-77-3	ug/kg	< 0.0995	0.162	0.15	0.104	0.234	0.21
PFHpA	375-85-9	ug/kg	< 0.0995	0.114	0.11	< 0.0858	< 0.0917	NC
PFHpS	375-92-8	ug/kg	0.135	0.51	0.42	0.096	0.318	0.28
PFHxA	307-24-4	ug/kg	< 0.0995	< 0.1	NC	< 0.0858	< 0.0917	NC
PFHxS	355-46-4	ug/kg	< 0.0995	< 0.1	NC	< 0.0858	< 0.0917	NC
PFNA	375-95-1	ug/kg	< 0.0995	< 0.1	NC	< 0.0858	0.163	0.15
PFNS	68259-12-1	ug/kg	0.164	0.431	0.37	0.175	0.463	0.41
PFOA	335-67-1	ug/kg	< 0.0995	0.141	0.13	< 0.0858	0.208	0.19
PFOS	1763-23-1	ug/kg	362	859	742	442	1150	1020
PFOSA	754-91-6	ug/kg	< 0.0995	0.211	0.18	< 0.0858	0.179	0.16
PFTeDA	376-06-7	ug/kg	0.187	0.419	0.36	0.316	0.804	0.71
PFTrDA	72629-94-8	ug/kg	0.199	0.381	0.34	0.355	0.812	0.73
PFUnA	2058-94-8	ug/kg	0.729	1.64	1.43	0.784	2.2	1.94
Weight	--	grams	24	78	102	108	482	590
Percent Fillet weight	--	%	--	--	24%	--	--	18%
Percent Carcass weight	--	%	--	--	76%	--	--	82%

Notes
ug/kg - micrograms per kilogram (wet weight)
< - Not detected. Concentration is less than the laboratory reportable limit (RL).
CAS - Chemical Abstracts Service.
NC - Not calculated.
R - Rejected.

Compounds are presented if they were detected at least once in fillet or carcass samples.
Results not detected above RLs are presented as < RL.
Whole body concentrations were not calculated if the compound was not detected in both fillet and carcass samples or if one result was rejected.
If a compound was only detected in the fillet or carcass, the RL was used to represent the non-detect result in the whole body calculation.

[1] - Calculated whole body fish concentration =
(fillet concentration * [fillet weight/total weight]) +
(part concentration * [part weight/total weight])

Appendix A Table 3g
Lake Elmo Predator Fish - Calculated Whole Body Concentrations
Project 1007
Minneapolis, Minnesota

Location Group			Lake Elmo			Lake Elmo		
Location ID			82-0106-00-208			82-0106-00-303		
Location			EP14			EP21		
Sample Type Code			Sample - Fillet	Sample - Carcass	Calculated	Sample - Fillet	Sample - Carcass	Calculated
Sample ID			82-0106-00-208.2009181336.000S	82-0106-00-208.2009181339.000S	Whole Body	82-0106-00-303.2009180847.000S	82-0106-00-303.2009180846.000S	Whole Body
Sample Name			EP14-PRED-FIL-TWO-01-091820	EP14-PRED-PART-TWO-01-091820	Concentration[1]	EP21-PRED-FIL-THREE-01-091820	EP21-PRED-PART-THREE-01-091820	Concentration[1]
Sample Date			9/18/2020	9/18/2020		9/18/2020	9/18/2020	
Compound	CAS #	Units						
6:2 FTS	27619-97-2	ug/kg	< 0.34	< 0.347	NC	< 0.352	2.98	2.4
N-EtFOSAA	2991-50-6	ug/kg	< 0.0943	< 0.0962	NC	< 0.0976	< 0.098	NC
N-EtFOSE	1691-99-2	ug/kg	R	R	NC	< 0.73	R	NC
N-MeFOSAA	2355-31-9	ug/kg	< 0.0943	< 0.0962	NC	< 0.0976	0.123	0.1
PFBA	375-22-4	ug/kg	< 0.377	< 0.385	NC	< 0.39	< 0.392	NC
PFDA	335-76-2	ug/kg	1.85	7.57	6.39	6.29	14.6	13
PFDoA	307-55-1	ug/kg	0.386	1.28	1.10	0.983	2.27	2.0
PFDoS	79780-39-5	ug/kg	< 0.0943	< 0.0962	NC	< 0.0976	< 0.098	NC
PFDS	335-77-3	ug/kg	< 0.0943	0.222	0.20	0.197	0.408	0.4
PFHpA	375-85-9	ug/kg	< 0.0943	< 0.0962	NC	< 0.0976	< 0.098	NC
PFHpS	375-92-8	ug/kg	0.122	0.474	0.40	0.349	0.917	0.8
PFHxA	307-24-4	ug/kg	< 0.0943	< 0.0962	NC	< 0.0976	< 0.098	NC
PFHxS	355-46-4	ug/kg	< 0.0943	< 0.0962	NC	< 0.0976	< 0.098	NC
PFNA	375-95-1	ug/kg	< 0.0943	< 0.0962	NC	< 0.0976	0.252	0.2
PFNS	68259-12-1	ug/kg	0.127	0.518	0.44	0.378	0.969	0.8
PFOA	335-67-1	ug/kg	< 0.0943	< 0.0962	NC	< 0.0976	0.119	0.1
PFOS	1763-23-1	ug/kg	284	1050	892	959	2230	1944
PFOSA	754-91-6	ug/kg	< 0.0943	0.17	0.15	< 0.0976	0.169	0.2
PFTeDA	376-06-7	ug/kg	0.214	0.561	0.49	0.437	0.96	0.8
PFTrDA	72629-94-8	ug/kg	0.217	0.661	0.57	0.52	1.25	1.1
PFUnA	2058-94-8	ug/kg	0.549	2.09	1.77	1.57	4.14	3.6
Weight	--	grams	54	208	262	218	752	970
Percent Fillet weight	--	%	--	--	21%	--	--	22%
Percent Carcass weight	--	%	--	--	79%	--	--	78%

Notes
ug/kg - micrograms per kilogram (wet weight)
< - Not detected. Concentration is less than the laboratory reportable limit (RL).
CAS - Chemical Abstracts Service.
NC - Not calculated.
R - Rejected.

Compounds are presented if they were detected at least once in fillet or carcass samples.
Results not detected above RLs are presented as < RL.
Whole body concentrations were not calculated if the compound was not detected in both fillet and carcass samples or if one result was rejected.
If a compound was only detected in the fillet or carcass, the RL was used to represent the non-detect result in the whole body calculation.

[1] - Calculated whole body fish concentration =
(fillet concentration * [fillet weight/total weight]) +
(part concentration * [part weight/total weight])

Appendix A Table 3g
Lake Elmo Predator Fish - Calculated Whole Body Concentrations
Project 1007
Minneapolis, Minnesota

			Location Group	Lake Elmo			Lake Elmo		
			Location ID	82-0106-00-304			82-0106-00-304		
			Location	EP9A			EP9A		
			Sample Type Code	Sample - Fillet	Sample - Carcass	Calculated	Sample - Fillet	Sample - Carcass	Calculated
			Sample ID	82-0106-00-304.2009180904.000S	82-0106-00-304.2009180907.000S	Whole Body	82-0106-00-304.2009180906.000S	82-0106-00-304.2009180908.000S	Whole Body
			Sample Name		EP9A-PRED-PART-ONE-01-091820	Concentration[1]	EP9A-PRED-FIL-TWO-01-091820	EP9A-PRED-PART-TWO-01-091820	Concentration[1]
			Sample Date	9/18/2020	9/18/2020		9/18/2020	9/18/2020	
Compound	CAS #	Units							
6:2 FTS	27619-97-2	ug/kg	0.375	0.448	0.43	0.679	< 0.334	0.41
N-EtFOSAA	2991-50-6	ug/kg	< 0.0995	0.135	0.13	< 0.0971	0.113	0.11
N-EtFOSE	1691-99-2	ug/kg	< 0.744	R	NC	< 0.726	< 0.693	NC
N-MeFOSAA	2355-31-9	ug/kg	< 0.0995	0.192	0.17	< 0.0971	< 0.0926	NC
PFBA	375-22-4	ug/kg	0.41	< 0.394	0.40	< 0.388	< 0.37	NC
PFDA	335-76-2	ug/kg	6.09	20.9	17.88	3.49	9.25	7.92
PFDoA	307-55-1	ug/kg	0.704	2.06	1.78	0.394	0.981	0.85
PFDoS	79780-39-5	ug/kg	< 0.0995	< 0.0985	NC	< 0.0971	< 0.0926	NC
PFDS	335-77-3	ug/kg	0.128	0.544	0.46	< 0.0971	0.303	0.26
PFHpA	375-85-9	ug/kg	< 0.0995	< 0.0985	NC	< 0.0971	< 0.0926	NC
PFHpS	375-92-8	ug/kg	0.239	1.11	0.93	0.474	1.32	1.13
PFHxA	307-24-4	ug/kg	< 0.0995	< 0.0985	NC	< 0.0971	< 0.0926	NC
PFHxS	355-46-4	ug/kg	< 0.0995	< 0.0985	NC	0.103	0.326	0.27
PFNA	375-95-1	ug/kg	< 0.0995	0.119	0.12	0.176	0.4	0.35
PFNS	68259-12-1	ug/kg	0.34	1.5	1.26	0.206	0.656	0.55
PFOA	335-67-1	ug/kg	< 0.0995	0.121	0.12	0.131	0.361	0.31
PFOS	1763-23-1	ug/kg	856	2450	2125	438	1100	947
PFOSA	754-91-6	ug/kg	< 0.0995	0.214	0.19	0.399	0.531	0.50
PFTeDA	376-06-7	ug/kg	0.247	0.766	0.66	R	0.398	NC
PFTrDA	72629-94-8	ug/kg	0.34	0.907	0.79	0.147	0.495	0.41
PFUnA	2058-94-8	ug/kg	1.37	4.35	3.74	0.724	1.96	1.68
Weight	--	grams	142	554	696	100	334	434
Percent Fillet weight	--	%	--	--	20%	--	--	23%
Percent Carcass weight	--	%	--	--	80%	--	--	77%

Notes
ug/kg - micrograms per kilogram (wet weight)
< - Not detected. Concentration is less than the laboratory reportable limit (RL).
CAS - Chemical Abstracts Service.
NC - Not calculated.
R - Rejected.

Compounds are presented if they were detected at least once in fillet or carcass samples.
Results not detected above RLs are presented as < RL.
Whole body concentrations were not calculated if the compound was not detected in both fillet and carcass samples or if one result was rejected.
If a compound was only detected in the fillet or carcass, the RL was used to represent the non-detect result in the whole body calculation.

[1] - Calculated whole body fish concentration =
(fillet concentration * [fillet weight/total weight]) +
(part concentration * [part weight/total weight])

Appendix A Table 4a
West Lakeland Area Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
		Location	WL2	WL3	WL5	WL8	WL15	WL15A	WL16
		Location ID	82-0074-00-203	82-0074-00-204	82-0074-00-205	PS00167	PS00171	PS00171	PS00172
		Sample Date	9/17/2020	9/17/2020	9/17/2020	9/16/2020	9/16/2020	9/16/2020	9/23/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	82-0074-00-203.2009171130.000S	82-0074-00-204.2009171200.000S	82-0074-00-205.2009171115.000S	PS00167.2009161715.000S	PS00171.2009161530.000S	PS00171.2009161545.000S	PS00172.2009231435.000S
		Sample Name	WL2-WAT-MID-01-091720	WL3-WAT-MID-01-091720	WL5-WAT-MID-01-091720	WL8A-WAT-BULK-01-091620	WL15-WAT-MID-01-091620	WL15A-WAT-MID-01-091620	WL16-WAT-BULK-01-092320
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #							
Dissolved	10:2 FTS	120226-60-0	< 0.0042 U	< 0.0043 U	< 0.004 U	< 0.0051 U	< 0.0041 U	< 0.0041 U	< 0.004 U
Dissolved	11Cl-PF3OUdS	763051-92-9	< 0.0042 UJ	< 0.0043 UJ	< 0.004 UJ	< 0.0051 UJ	< 0.0041 UJ	< 0.0041 UJ	< 0.004 U
Dissolved	4:2 FTS	757124-72-4	< 0.0042 U	< 0.0043 U	< 0.004 U	< 0.0051 U	< 0.0041 U	< 0.0041 U	< 0.004 U
Dissolved	6:2 FTS	27619-97-2	< 0.0042 U	< 0.0043 U	< 0.004 U	< 0.0051 U	< 0.0041 U	0.0014 J	< 0.004 U
Dissolved	8:2 FTS	39108-34-4	< 0.0042 U	< 0.0043 U	< 0.004 U	< 0.0051 U	< 0.0041 U	< 0.0041 U	< 0.004 U
Dissolved	9Cl-PF3ONS	756426-58-1	< 0.0042 U	< 0.0043 U	< 0.004 U	< 0.0051 U	< 0.0041 U	< 0.0041 U	< 0.004 U
Dissolved	ADONA	919005-14-4	< 0.0042 U	< 0.0043 U	< 0.004 U	< 0.0051 U	< 0.0041 U	< 0.0041 U	< 0.004 U
Dissolved	HFPO-DA	13252-13-6	< 0.0042 U	< 0.0043 U	< 0.004 U	< 0.0051 U	< 0.0041 U	< 0.0041 U	< 0.004 U
Dissolved	N-EtFOSA	4151-50-2	< 0.0042 UJ	< 0.0045 UJ	< 0.0041 UJ	< 0.0044 UJ	< 0.0042 UJ	< 0.0042 UJ	< 0.004 U
Dissolved	N-EtFOSAA	2991-50-6	< 0.0042 U	< 0.0043 UJ	< 0.004 UJ	< 0.0051 UJ	< 0.0041 UJ	0.0016 J+	< 0.004 U
Dissolved	N-EtFOSE	1691-99-2	< 0.0042 UJ	< 0.0045 UJ	< 0.0041 UJ	< 0.0044 UJ	< 0.0042 UJ	< 0.0042 UJ	0.0002 J
Dissolved	N-MeFOSA	31506-32-8	0.0006 BJ	< 0.0043 U	< 0.004 UJ	< 0.0051 UJ	< 0.0041 U	< 0.0041 UJ	< 0.004 U
Dissolved	N-MeFOSAA	2355-31-9	< 0.0042 U	< 0.0043 UJ	< 0.004 UJ	< 0.0051 UJ	< 0.0041 UJ	< 0.0041 UJ	< 0.004 U
Dissolved	N-MeFOSE	24448-09-7	< 0.0042 UJ	< 0.0045 UJ	< 0.0041 UJ	< 0.0044 UJ	< 0.0042 UJ	< 0.0042 UJ	< 0.004 U
Dissolved	PFBA	375-22-4	0.46	0.38	0.4	0.46	0.42	0.47	0.34
Dissolved	PFBS	375-73-5	0.0042	0.0043 J	0.0042	0.0042 J	0.0043	0.0044	0.0036 J
Dissolved	PFDA	335-76-2	0.0017 J	0.0013 J	0.0021 J	0.002 J	0.0022 J	0.0019 J	0.0012 J
Dissolved	PFDoA	307-55-1	< 0.0042 U	< 0.0043 UJ	0.0023 BJ+	0.0037 BJ+	< 0.0041 UJ	0.0029 BJ+	< 0.004 U
Dissolved	PFDS	335-77-3	< 0.0042 UJ	< 0.0045 UJ	< 0.004 UJ	< 0.0044 UJ	< 0.0042 UJ	< 0.0042 UJ	< 0.004 U
Dissolved	PFHpA	375-85-9	0.0091	0.0088	0.0084	0.008	0.009	0.0094	0.0091
Dissolved	PFHpS	375-92-8	0.0018 J	0.0018 J	0.0023 J	0.002 J	0.0029 J	0.0025 J	0.0025 J+
Dissolved	PFHxA	307-24-4	0.015	0.015	0.016	0.014	0.015	0.014	0.014
Dissolved	PFHxS	355-46-4	0.0099	0.011	0.011	0.011	0.011	0.012	0.01
Dissolved	PFNA	375-95-1	< 0.0042 U	0.0015 J	0.0015 J	< 0.0051 U	0.0016 J	0.0012 J	< 0.004 U
Dissolved	PFNS	68259-12-1	< 0.0042 U	< 0.0043 U	< 0.004 U	< 0.0051 U	< 0.0041 U	< 0.0041 U	< 0.004 U
Dissolved	PFOA	335-67-1	0.078	0.08	0.086	0.073	0.088	0.076	0.071
Dissolved	PFOS	1763-23-1	0.21	0.22	0.25	0.21	0.31	0.23	0.19 J+
Dissolved	PFOSA	754-91-6	0.00088 J	0.00092 J	0.0011 J	0.00094 J	0.00098 J	0.0012 J	0.00095 J
Dissolved	PFPeA	2706-90-3	0.016	0.015	0.014	0.015	0.016	0.015	0.013
Dissolved	PFPeS	2706-91-4	0.0043 J+	0.0049 J+	0.0053 J+	0.0035 J+	0.0049 J+	0.0044 J+	0.004 J+
Dissolved	PFTeDA	376-06-7	R	< 0.0045 UJ	R	< 0.0044 UJ	< 0.0042 UJ	< 0.0042 UJ	< 0.004 UJ
Dissolved	PFTrDA	72629-94-8	< 0.0042 UJ	< 0.0045 UJ	< 0.0041 UJ	< 0.0044 UJ	< 0.0042 UJ	< 0.0042 UJ	< 0.004 U
Dissolved	PFUnA	2058-94-8	< 0.0042 U	< 0.0043 U	< 0.004 UJ	0.0016 J+	< 0.0041 U	< 0.0041 U	< 0.004 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4a
West Lakeland Area Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
		Location	WL21	WL6	WL7	WL10	WL11	WL13
		Location ID	PS00174	S016-071	S016-072	S016-073	S016-074	S016-075
		Sample Date	9/16/2020	9/17/2020	9/17/2020	9/21/2020	9/22/2020	9/16/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	PS00174.2009161610.000S	S016-071.2009171430.000S	S016-072.2009171615.000S	S016-073.2009211710.000S	S016-074.2009221205.000S	S016-075.2009161600.000S
		Sample Name	WL21-WAT-MID-01-091620	WL6-WAT-BULK-01-091720	WL7-WAT-BULK-01-091720	WL10-WAT-BULK-01-092120	WL11-WAT-BULK-01-092220	WL13-WAT-MID-01-091620
		Parent Sample ID	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #						
Dissolved	10:2 FTS	120226-60-0	< 0.0041 U	< 0.0043 U	< 0.0045 U	< 0.0041 U	< 0.0041 U	< 0.0042 U
Dissolved	11Cl-PF3OUdS	763051-92-9	< 0.0041 UJ	< 0.0043 UJ	< 0.0045 UJ	< 0.0041 U	< 0.0041 U	< 0.0042 UJ
Dissolved	4:2 FTS	757124-72-4	< 0.0041 U	< 0.0043 U	< 0.0045 U	< 0.0041 U	< 0.0041 U	< 0.0042 U
Dissolved	6:2 FTS	27619-97-2	0.00064 J	< 0.0043 U	< 0.0045 U	< 0.0041 U	< 0.0041 U	< 0.0042 U
Dissolved	8:2 FTS	39108-34-4	< 0.0041 U	0.00017 J	< 0.0045 U	< 0.0041 U	< 0.0041 U	< 0.0042 U
Dissolved	9Cl-PF3ONS	756426-58-1	< 0.0041 U	< 0.0043 U	< 0.0045 U	< 0.0041 U	< 0.0041 U	< 0.0042 U
Dissolved	ADONA	919005-14-4	< 0.0041 U	< 0.0043 U	< 0.0045 U	< 0.0041 U	< 0.0041 U	< 0.0042 U
Dissolved	HFPO-DA	13252-13-6	< 0.0041 U	< 0.0043 U	< 0.0045 U	< 0.0041 U	< 0.0041 U	< 0.0042 U
Dissolved	N-EtFOSA	4151-50-2	< 0.0042 UJ	< 0.0042 UJ	< 0.0043 UJ	< 0.0041 U	< 0.0041 U	< 0.0042 UJ
Dissolved	N-EtFOSAA	2991-50-6	R	< 0.0043 UJ	< 0.0045 UJ	< 0.0041 U	< 0.0041 U	< 0.0042 UJ
Dissolved	N-EtFOSE	1691-99-2	< 0.0042 UJ	0.00014 BJ	< 0.0043 UJ	< 0.0041 U	< 0.0041 U	< 0.0042 UJ
Dissolved	N-MeFOSA	31506-32-8	R	< 0.0043 UJ	< 0.0045 UJ	< 0.0041 U	< 0.0041 U	< 0.0042 U
Dissolved	N-MeFOSAA	2355-31-9	R	< 0.0043 UJ	< 0.0045 UJ	< 0.0041 U	< 0.0041 UJ	< 0.0042 UJ
Dissolved	N-MeFOSE	24448-09-7	< 0.0042 UJ	< 0.0042 UJ	< 0.0043 UJ	< 0.0041 U	< 0.0041 U	< 0.0042 UJ
Dissolved	PFBA	375-22-4	0.48	0.43	0.39	0.37	0.39	0.47
Dissolved	PFBS	375-73-5	0.0043	0.0043	0.0041 J	0.0038 J	0.0037 J	0.004 J
Dissolved	PFDA	335-76-2	0.002 J	0.002 J	0.002 J	< 0.0041 U	< 0.0041 U	0.002 J
Dissolved	PFDoA	307-55-1	0.0019 BJ+	0.0032 BJ+	0.0022 BJ+	< 0.0041 U	< 0.0041 U	< 0.0042 UJ
Dissolved	PFDS	335-77-3	< 0.0042 UJ	< 0.0042 UJ	< 0.0045 UJ	< 0.004 U	< 0.0041 U	< 0.0042 UJ
Dissolved	PFHpA	375-85-9	0.011	0.0099	0.0091	0.011	0.0092	0.0083
Dissolved	PFHpS	375-92-8	0.0026 J	0.0018 J	0.0024 J	0.0026 J+	0.0024 J+	0.0018 J
Dissolved	PFHxA	307-24-4	0.015	0.016	0.015	0.015	0.017	0.014
Dissolved	PFHxS	355-46-4	0.0099	0.013	0.01	0.0096	0.0098	0.012
Dissolved	PFNA	375-95-1	< 0.0041 U	< 0.0043 U	0.0015 J	< 0.0041 U	< 0.0041 U	0.0014 J
Dissolved	PFNS	68259-12-1	< 0.0041 U	< 0.0043 U	< 0.0043 U	< 0.0041 U	< 0.0041 U	< 0.0042 U
Dissolved	PFOA	335-67-1	0.077	0.081	0.079	0.071	0.074	0.079
Dissolved	PFOS	1763-23-1	0.24	0.23	0.24	0.19 J+	0.2 J+	0.25
Dissolved	PFOSA	754-91-6	0.0014 J+	0.00089 J	0.0012 J	0.001 J	0.00094 J	0.0013 J
Dissolved	PFPeA	2706-90-3	0.015	0.016	0.016	0.013	0.013	0.015
Dissolved	PFPeS	2706-91-4	0.0058 J+	0.0059 J+	0.0043 J+	0.0042 J+	0.0039 J+	0.0044 J+
Dissolved	PFTeDA	376-06-7	< 0.0042 UJ	< 0.0042 UJ	R	< 0.0041 UJ	< 0.0041 UJ	< 0.0042 UJ
Dissolved	PFTrDA	72629-94-8	< 0.0042 UJ	< 0.0042 UJ	< 0.0043 UJ	< 0.0041 U	< 0.0041 U	< 0.0042 UJ
Dissolved	PFUnA	2058-94-8	< 0.0041 UJ	< 0.0043 U	< 0.0045 U	< 0.0041 U	< 0.0041 U	< 0.0042 U

NOTES
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CAS = Chemical Abstracts Service.
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Appendix A Table 4a
West Lakeland Area Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
		Location	EP10	EP11	EP11	EP11	EP12	EP12	EP12	EP16
		Location ID	PI00001	PI00002	PI00002	PI00002	S016-070	S016-070	S016-070	S016-234
		Sample Date	8/13/2019	8/13/2019	2/25/2020	2/25/2020	8/13/2019	8/13/2019	11/21/2019	11/21/2019
		Sample Type Code	Sample	Sample	Sample	QC-FR	Sample	QC-FR	Sample	Sample
		Sample ID	PI00001.1908131420.000S	PI00002.1908131410.000S	PI00002.2002251050.000S	PI00002.2002251055.000SR	S016-070.1908131320.000S	S016-070.1908131325.000SR	S016-070.1911211135.000S	S016-234.1911211050.000S
		Sample Name	EP10-WAT-SUR-01-081319	EP11-WAT-SUR-01-081319	EP11-WAT-BULK-01-022520	EP11-WAT-BULK-02-022520	EP12-WAT-SUR-01-081319	EP12-WAT-SUR-02-081319	EP12-WAT-SUR-01-112119	EP16-WAT-SUR-01-112119
		Parent Sample ID	NA	NA	NA	PI00002.2002251050.000S	NA	S016-070.1908131320.000S	NA	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.0029 U	< 0.00289 U	< 0.00295 U	< 0.00306 U	< 0.0029 U	< 0.00286 U	< 0.00296 U	< 0.00294 U
Total	4:2 FTS	757124-72-4	< 0.0029 U	< 0.00289 U	< 0.00295 U	< 0.00306 U	< 0.0029 U	< 0.00286 U	< 0.00296 U	< 0.00294 U
Total	6:2 FTS	27619-97-2	< 0.00261 U	< 0.0026 U	< 0.00265 U	< 0.00275 U	< 0.00261 U	< 0.00257 U	< 0.00532 U	< 0.00529 U
Total	8:2 FTS	39108-34-4	< 0.0029 U	< 0.00289 U	< 0.00295 U	< 0.00306 U	< 0.0029 U	< 0.00286 U	< 0.00296 U	< 0.00294 U
Total	9Cl-PF3ONS	756426-58-1	< 0.0029 U	< 0.00289 U	< 0.00295 U	< 0.00306 U	< 0.0029 U	< 0.00286 U	< 0.00296 U	< 0.00294 U
Total	ADONA	919005-14-4	< 0.0029 U	< 0.00289 U	< 0.00295 U	< 0.00306 U	< 0.0029 U	< 0.00286 U	< 0.00296 U	< 0.00294 U
Total	HFPO-DA	13252-13-6	< 0.0029 U	< 0.00289 U	< 0.0028 U	< 0.00291 U	< 0.0029 U	< 0.00286 U	< 0.00296 U	< 0.00294 U
Total	N-EtFOSA	4151-50-2	< 0.00181 U	< 0.0018 U	< 0.00184 U	< 0.00191 U	< 0.00181 U	< 0.00179 U	< 0.00185 U	< 0.00184 U
Total	N-EtFOSAA	2991-50-6	< 0.000726 U	< 0.000722 U	< 0.000737 U	< 0.000765 U	< 0.000724 U	< 0.000714 U	< 0.00148 U	< 0.00147 U
Total	N-EtFOSE	1691-99-2	< 0.00544 U	< 0.00541 U	< 0.00553 U	< 0.00574 U	< 0.00543 U	< 0.00536 U	< 0.00554 U	< 0.00551 U
Total	N-MeFOSA	31506-32-8	< 0.000834 U	< 0.00083 U	< 0.000848 U	< 0.000879 U	< 0.000833 U	< 0.000821 U	< 0.00085 U	< 0.000845 U
Total	N-MeFOSAA	2355-31-9	< 0.000726 U	< 0.000722 U	< 0.000737 U	< 0.000765 U	< 0.000724 U	< 0.000714 U	< 0.000739 U	< 0.000735 U
Total	N-MeFOSE	24448-09-7	< 0.00726 U	< 0.00722 U	< 0.00737 U	< 0.00765 U	< 0.00724 U	< 0.00714 U	< 0.00739 U	< 0.00735 U
Total	PFBA	375-22-4	0.153	0.745	0.813	0.767	0.607	0.595	0.404	0.403
Total	PFBS	375-73-5	0.00395	0.00313	0.00334	0.00334	0.00344	0.00346	0.00302	0.0035
Total	PFDA	335-76-2	0.00183	< 0.000722 U	< 0.000737 U	< 0.000765 U	< 0.000724 U	0.000919 J	< 0.000739 U	< 0.000735 U
Total	PFDoA	307-55-1	< 0.000726 U	< 0.000722 U	< 0.000737 U	< 0.000765 U	< 0.000724 U	< 0.000714 U	< 0.000739 U	< 0.000735 U
Total	PFDoS	79780-39-5	< 0.000726 U	< 0.000722 U	< 0.000737 U	< 0.000765 U	< 0.000724 U	< 0.000714 U	< 0.000739 U	< 0.000735 U
Total	PFDS	335-77-3	< 0.000726 U	< 0.000722 U	< 0.000737 U	< 0.000765 U	< 0.000724 U	< 0.000714 U	< 0.000739 U	< 0.000735 U
Total	PFHpA	375-85-9	0.00769	0.00596	0.00614	0.00576	0.00698	0.00712	0.0057	0.00677
Total	PFHpS	375-92-8	0.002	0.000758 J	0.000748 J	0.000888 J	0.000975 J	0.000963 J	0.00123 J	0.00106 J
Total	PFHxA	307-24-4	0.01	0.015	0.0163	0.0153	0.0146	0.0154	0.0114	0.0125
Total	PFHxS	355-46-4	0.00843	0.00801	0.00687	0.00682	0.00768	0.00783	0.00736	0.007
Total	PFNA	375-95-1	0.00147	< 0.000722 U	< 0.000737 U	< 0.000765 U	0.000748 J	0.00103 J	< 0.000739 U	0.000768 J
Total	PFNS	68259-12-1	< 0.000726 U	< 0.000722 U	< 0.000737 U	< 0.000765 U	< 0.000724 U	< 0.000714 U	< 0.000739 U	< 0.000735 U
Total	PFOA	335-67-1	0.0667	0.0692	0.0651	0.0636	0.072	0.0739	0.0603	0.0578
Total	PFOS	1763-23-1	0.288	0.0757	0.0552	0.0636	0.118	0.147	0.11	0.115
Total	PFOSA	754-91-6	< 0.000726 U	< 0.000722 U	< 0.000737 U	< 0.000765 U	< 0.000724 U	< 0.000714 U	< 0.000739 U	< 0.000735 U
Total	PFPeA	2706-90-3	0.0082	0.0131	0.0168	0.0159	0.014	0.0146	0.011	0.0121
Total	PFPeS	2706-91-4	0.00237	0.00225	0.00236	0.00229	0.00252	0.00186	0.00182	0.00248
Total	PFTeDA	376-06-7	< 0.000726 U	< 0.000722 U	< 0.000737 U	< 0.000765 U	< 0.000724 U	< 0.000714 U	< 0.000739 U	< 0.000735 U
Total	PFTrDA	72629-94-8	< 0.000726 U	< 0.000722 U	< 0.000737 U	< 0.000765 U	< 0.000724 U	< 0.000714 U	< 0.000739 U	< 0.000735 U
Total	PFUnA	2058-94-8	< 0.000726 U	< 0.000722 U	< 0.000737 U	< 0.000765 U	< 0.000724 U	< 0.000714 U	< 0.000739 U	< 0.000735 U

NOTES
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Analytical method (other events) = AXYS_MLA-110.

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- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4a
West Lakeland Area Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
		Location	EP16	EP16	EP16	EP16	EP16	EP16	EP16	EP16
		Location ID	S016-234	S016-234	S016-234	S016-234	S016-234	S016-234	S016-234	S016-234
		Sample Date	11/21/2019	2/25/2020	4/29/2020	5/11/2020	5/18/2020	6/29/2020	7/29/2020	8/26/2020
		Sample Type Code	QC-FR	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	S016-234.1911211055.000SR	S016-234.2002251110.000S	S016-234.2004291530.000S	S016-234.2005111400.000S	S016-234.2005181545.000S	S016-234.2006291815.000S	S016-234.2007291315.000S	S016-234.2008261730.000S
		Sample Name	EP16-WAT-SUR-02-112119	EP16-WAT-BULK-01-022520	EP16-WAT-BULK-01-042920	EP16-WAT-BULK-01-051120	EP16-WAT-BULK-01-051820	EP16-WAT-BULK-01-062920	EP16-WAT-BULK-01-072920	EP16-WAT-BULK-01-082620
		Parent Sample ID	S016-234.1911211050.000S	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.00295 U	< 0.00304 U	< 0.00309 U	< 0.003 U	< 0.00293 U	< 0.00297 UJ	< 0.0015 U	< 0.00144 UJ
Total	4:2 FTS	757124-72-4	< 0.00295 U	< 0.00304 U	< 0.00309 U	< 0.003 U	< 0.00293 U	< 0.00297 UJ	< 0.0015 U	< 0.00144 UJ
Total	6:2 FTS	27619-97-2	< 0.0053 U	< 0.00274 U	< 0.00278 U	< 0.002 U	< 0.00264 U	0.0124 J-	0.00926 B	< 0.00129 UJ
Total	8:2 FTS	39108-34-4	< 0.00295 U	< 0.00304 U	< 0.00309 U	< 0.003 U	< 0.00293 U	< 0.00297 UJ	< 0.0015 U	< 0.00144 UJ
Total	9Cl-PF3ONS	756426-58-1	< 0.00295 U	< 0.00304 U	< 0.00309 U	< 0.003 U	< 0.00293 U	< 0.00297 UJ	< 0.0015 U	< 0.00144 UJ
Total	ADONA	919005-14-4	< 0.00295 U	< 0.00304 U	< 0.00309 U	< 0.003 U	< 0.00293 U	< 0.00297 UJ	< 0.0015 U	< 0.00144 UJ
Total	HFPO-DA	13252-13-6	< 0.00295 U	< 0.00289 U	< 0.00293 U	< 0.002 U	< 0.00279 U	< 0.00283 UJ	< 0.00142 U	< 0.00136 UJ
Total	N-EtFOSA	4151-50-2	< 0.00184 U	< 0.0019 U	< 0.00193 U	< 0.001 U	< 0.00183 U	< 0.00186 UJ	< 0.000937 U	< 0.000898 UJ
Total	N-EtFOSAA	2991-50-6	< 0.00147 U	< 0.00076 U	< 0.000772 U	< 0 U	< 0.000733 U	< 0.000744 UJ	0.00907	0.00091 J-
Total	N-EtFOSE	1691-99-2	< 0.00552 U	< 0.0057 U	< 0.00579 U	< 0.005 U	< 0.0055 U	< 0.00558 UJ	< 0.0028 U	< 0.00269 UJ
Total	N-MeFOSA	31506-32-8	< 0.000847 U	< 0.000874 U	< 0.000888 U	< 0 U	< 0.000843 U	< 0.000855 UJ	< 0.000431 U	< 0.000413 UJ
Total	N-MeFOSAA	2355-31-9	< 0.000736 U	< 0.00076 U	< 0.000772 U	< 0 U	< 0.000733 U	< 0.000744 UJ	< 0.000375 U	< 0.000359 UJ
Total	N-MeFOSE	24448-09-7	< 0.00736 U	< 0.0076 U	< 0.00772 U	< 0.007 U	< 0.00733 U	< 0.00744 UJ	< 0.00375 U	< 0.00359 UJ
Total	PFBA	375-22-4	0.361	0.543	0.432	0.581	0.285	R	R	R
Total	PFBS	375-73-5	0.00347	0.0035	0.0046	0.00415	0.00342	0.00427 J-	0.00464	0.00438 J-
Total	PFDA	335-76-2	< 0.000736 U	< 0.00076 U	< 0.000772 U	< 0 U	< 0.000733 U	0.00177 J-	0.00575	0.00122 J-
Total	PFDoA	307-55-1	< 0.000736 U	< 0.00076 U	< 0.000772 U	< 0 U	< 0.000733 U	< 0.000744 UJ	< 0.000375 U	< 0.000359 UJ
Total	PFDoS	79780-39-5	< 0.000736 U	< 0.00076 U	< 0.000772 U	< 0 U	< 0.000733 U	< 0.000744 UJ	< 0.000375 U	< 0.000359 UJ
Total	PFDS	335-77-3	< 0.000736 U	< 0.00076 U	< 0.000772 U	< 0 U	< 0.000733 U	< 0.000744 UJ	< 0.000375 U	< 0.000359 UJ
Total	PFHpA	375-85-9	0.00614	0.00617	0.0111	0.00935	0.00859	0.00919 J-	0.0079	0.00701 J-
Total	PFHpS	375-92-8	0.00118 J	0.0011 J	0.00192	0.0017	0.00155	0.00219 J-	0.00296	0.00188 J-
Total	PFHxA	307-24-4	0.0125	0.0123	0.0162	0.0166	0.0117	0.0151 J-	0.0142	0.0123 J-
Total	PFHxS	355-46-4	0.0072	0.00678	0.01	0.00944	0.00872	0.0103 J-	0.0104	0.00857 J-
Total	PFNA	375-95-1	< 0.000736 U	0.000897 J	0.00106 J	0.000981 J	0.000869 J	0.00142 J-	0.00182	0.00116 J-
Total	PFNS	68259-12-1	< 0.000736 U	< 0.00076 U	< 0.000772 U	< 0 U	< 0.000733 U	< 0.000744 UJ	< 0.000375 U	< 0.000359 UJ
Total	PFOA	335-67-1	0.0573	0.0555	0.0927	0.0832	0.0778	0.0848 J-	0.0825	0.0648 J-
Total	PFOS	1763-23-1	0.13	0.0814	0.146	0.134	0.135	0.298 J-	0.748	0.233 J-
Total	PFOSA	754-91-6	< 0.000736 U	< 0.00076 U	< 0.000772 U	< 0 U	< 0.000733 U	0.00115 J-	0.00286 B	0.00202 J-
Total	PFPeA	2706-90-3	0.0107	0.0136	0.0134	0.0146	0.00912	0.014 J-	0.0129	0.0115 J-
Total	PFPeS	2706-91-4	0.00223	0.00199	0.00355	0.00334	0.00281	0.00305 J-	0.00302	0.00237 J-
Total	PFTeDA	376-06-7	< 0.000736 U	< 0.00076 U	< 0.000772 U	< 0 U	< 0.000733 U	< 0.000744 UJ	< 0.000375 U	< 0.000359 UJ
Total	PFTrDA	72629-94-8	< 0.000736 U	< 0.00076 U	< 0.000772 U	< 0 U	< 0.000733 U	< 0.000744 UJ	< 0.000375 U	< 0.000359 UJ
Total	PFUnA	2058-94-8	< 0.000736 U	< 0.00076 U	< 0.000772 U	< 0 U	< 0.000733 U	< 0.000744 UJ	0.000515 J	< 0.000359 UJ

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Project 1007
Minneapolis, Minnesota

		Location Group	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
		Location	EP16	EP16	EP16	EP13	EP13	WL1	WL2
		Location ID	S016-234	S016-234	S016-234	PS00165	PS00165	PS00166	82-0074-00-203
		Sample Date	9/1/2020	9/4/2020	9/16/2020	8/15/2019	9/16/2020	8/15/2019	8/15/2019
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	S016-234.2009011550.000S	S016-234.2009040915.000S	S016-234.2009161420.000S	PS00165.1908150755.000S	PS00165.2009161445.000S	PS00166.1908150720.000S	82-0074-00-203.1908150635.000S
		Sample Name	EP16-WAT-BULK-01-090120	EP16-WAT-BULK-01-090420	EP16-WAT-BULK-01-091620	EP13-WAT-SUR-01-081519	EP13-WAT-BULK-01-091620	WL1-WAT-SUR-01-081519	WL2-WAT-18-21-01-081519
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #							
Total	10:2 FTS	120226-60-0	NA	NA	< 0.004 U	NA	< 0.0042 U	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.00148 UJ	< 0.00147 UJ	< 0.004 UJ	< 0.0224 U	< 0.0042 UJ	< 0.00293 U	< 0.0222 U
Total	4:2 FTS	757124-72-4	< 0.00148 UJ	< 0.00147 UJ	< 0.004 U	< 0.0224 U	< 0.0042 U	< 0.00293 U	< 0.0222 U
Total	6:2 FTS	27619-97-2	0.00561 BJ-	0.0138 BJ-	0.044 J+	< 0.0403 U	0.0029 BJ+	< 0.00264 U	< 0.04 U
Total	8:2 FTS	39108-34-4	< 0.00148 UJ	< 0.00147 UJ	< 0.004 U	< 0.0224 U	< 0.0042 U	< 0.00293 U	< 0.0222 U
Total	9Cl-PF3ONS	756426-58-1	< 0.00148 UJ	< 0.00147 UJ	< 0.004 U	< 0.0224 U	< 0.0042 U	< 0.00293 U	< 0.0222 U
Total	ADONA	919005-14-4	< 0.00148 UJ	< 0.00147 UJ	< 0.004 U	< 0.0224 U	< 0.0042 U	< 0.00293 U	< 0.0222 U
Total	HFPO-DA	13252-13-6	< 0.0014 UJ	< 0.00139 UJ	< 0.004 U	< 0.0224 U	< 0.0042 U	< 0.00293 U	< 0.0222 U
Total	N-EtFOSA	4151-50-2	< 0.000923 UJ	< 0.000917 UJ	< 0.004 U	< 0.014 U	< 0.0042 U	< 0.00183 U	< 0.0139 U
Total	N-EtFOSAA	2991-50-6	0.00095 J-	0.000758 J-	< 0.004 UJ	< 0.0112 U	< 0.0042 UJ	< 0.000734 U	< 0.0111 U
Total	N-EtFOSE	1691-99-2	< 0.00276 UJ	< 0.00274 UJ	< 0.004 U	< 0.0419 U	< 0.0042 U	< 0.0055 U	< 0.0417 U
Total	N-MeFOSA	31506-32-8	< 0.000425 UJ	< 0.000422 UJ	< 0.004 U	< 0.00643 U	< 0.0042 U	< 0.000844 U	< 0.00639 U
Total	N-MeFOSAA	2355-31-9	< 0.000369 UJ	< 0.000367 UJ	< 0.004 U	< 0.00559 U	< 0.0042 U	< 0.000734 U	< 0.00555 U
Total	N-MeFOSE	24448-09-7	< 0.00369 UJ	< 0.00367 UJ	< 0.004 U	< 0.0559 U	< 0.0042 U	< 0.00734 U	< 0.0555 U
Total	PFBA	375-22-4	0.384 J	0.364 J	0.58	0.214	0.47	0.439	0.29
Total	PFBS	375-73-5	0.00446 J-	0.00412 J-	0.0035 J	< 0.00559 U	0.0036 J	0.00363	< 0.00555 U
Total	PFDA	335-76-2	0.00117 J-	0.000962 J-	0.0013 J	< 0.00559 U	0.0015 J	< 0.000734 U	< 0.00555 U
Total	PFDoA	307-55-1	< 0.000369 UJ	< 0.000367 UJ	< 0.004 U	< 0.00559 U	< 0.0042 U	< 0.000734 U	< 0.00555 U
Total	PFDoS	79780-39-5	< 0.000369 UJ	< 0.000367 UJ	NA	< 0.00559 U	NA	< 0.000734 U	< 0.00555 U
Total	PFDS	335-77-3	< 0.000369 UJ	< 0.000367 UJ	< 0.004 UJ	< 0.00559 U	< 0.0042 UJ	< 0.000734 U	< 0.00555 U
Total	PFHpA	375-85-9	0.0072 J-	0.00659 J-	0.0059	< 0.00559 U	0.0063 B	0.00599	0.00619 J
Total	PFHpS	375-92-8	0.00174 J-	0.00171 J-	0.0018 J	< 0.00559 U	0.0014 J	0.00122 J	< 0.00555 U
Total	PFHxA	307-24-4	0.0125 J-	0.0133 J-	0.019	0.00831 J	0.014	0.011	0.0103 J
Total	PFHxS	355-46-4	0.00834 J-	0.0082 J-	0.0071	0.00611 J	0.0057	0.00682	0.00657 J
Total	PFNA	375-95-1	0.000962 J-	0.001 J-	0.0025 J	< 0.00559 U	0.0013 J	0.000904 J	< 0.00555 U
Total	PFNS	68259-12-1	< 0.000369 UJ	< 0.000367 UJ	< 0.004 UJ	< 0.00559 U	< 0.0042 U	< 0.000734 U	< 0.00555 U
Total	PFOA	335-67-1	0.0647 J-	0.0629 J-	0.077	0.0516	0.049	0.0583	0.0517
Total	PFOS	1763-23-1	0.216 J-	0.2 J-	0.13	0.156	0.12	0.157	0.148
Total	PFOSA	754-91-6	0.000863 J-	0.00088 J-	0.00092 J	< 0.00559 U	0.00073 J	< 0.000734 U	< 0.00555 U
Total	PFPeA	2706-90-3	0.0124 J-	0.0118 J-	0.013	< 0.0112 U	0.018	0.00993	< 0.0111 U
Total	PFPeS	2706-91-4	0.00246 J-	0.00233 J-	0.0033 J	< 0.00559 U	0.0027 J	0.00189	< 0.00555 U
Total	PFTeDA	376-06-7	< 0.000369 UJ	< 0.000367 UJ	< 0.004 U	< 0.00559 U	0.0023 BJ	< 0.000734 U	< 0.00555 U
Total	PFTrDA	72629-94-8	< 0.000369 UJ	< 0.000367 UJ	< 0.004 U	< 0.00559 U	< 0.0042 U	< 0.000734 U	< 0.00555 U
Total	PFUnA	2058-94-8	< 0.000369 UJ	< 0.000367 UJ	< 0.004 U	< 0.00559 U	< 0.0042 U	< 0.000734 U	< 0.00555 U

NOTES
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Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

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- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4a
West Lakeland Area Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
		Location	WL2	WL2	WL3	WL3	WL3	WL5
		Location ID	82-0074-00-203	82-0074-00-203	82-0074-00-204	82-0074-00-204	82-0074-00-204	82-0074-00-205
		Sample Date	8/15/2019	9/17/2020	8/14/2019	8/15/2019	9/17/2020	8/14/2019
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	82-0074-00-203.1908150640.000S	82-0074-00-203.2009171130.000S	82-0074-00-204.1908141540.000S	82-0074-00-204.1908151540.000S	82-0074-00-204.2009171200.000S	82-0074-00-205.1908141405.000S
		Sample Name	WL2-WAT-SUR-01-081519	WL2-WAT-MID-01-091720	WL3-WAT-18-21-01-081419	WL3-WAT-SUR-01-081419	WL3-WAT-MID-01-091720	WL5-WAT-SUR-01-081419
		Parent Sample ID	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #						
Total	10:2 FTS	120226-60-0	NA	< 0.004 U	NA	NA	< 0.0042 U	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.0029 U	< 0.004 U	< 0.0226 U	< 0.0221 U	< 0.0042 U	< 0.0231 U
Total	4:2 FTS	757124-72-4	< 0.0029 U	< 0.004 U	< 0.0226 U	< 0.0221 U	< 0.0042 U	< 0.0231 U
Total	6:2 FTS	27619-97-2	< 0.00261 U	< 0.004 U	< 0.0406 U	< 0.0398 U	< 0.0042 U	0.0587 J
Total	8:2 FTS	39108-34-4	< 0.0029 U	< 0.004 U	< 0.0226 U	< 0.0221 U	< 0.0042 U	< 0.0231 U
Total	9Cl-PF3ONS	756426-58-1	< 0.0029 U	< 0.004 U	< 0.0226 U	< 0.0221 U	< 0.0042 U	< 0.0231 U
Total	ADONA	919005-14-4	< 0.0029 U	< 0.004 U	< 0.0226 U	< 0.0221 U	< 0.0042 U	< 0.0231 U
Total	HFPO-DA	13252-13-6	< 0.0029 U	< 0.004 U	< 0.0226 U	< 0.0221 U	< 0.0042 U	< 0.0231 U
Total	N-EtFOSA	4151-50-2	< 0.00181 U	< 0.004 U	< 0.0141 U	< 0.0138 U	< 0.0042 U	< 0.0145 U
Total	N-EtFOSAA	2991-50-6	< 0.000725 U	< 0.004 UJ	< 0.0113 U	< 0.0111 U	0.00078 J	< 0.0116 U
Total	N-EtFOSE	1691-99-2	< 0.00544 U	0.00014 J+	< 0.0423 U	< 0.0415 U	0.00047 J+	< 0.0434 U
Total	N-MeFOSA	31506-32-8	< 0.000834 U	< 0.004 U	< 0.00648 U	< 0.00636 U	< 0.0042 U	< 0.00665 U
Total	N-MeFOSAA	2355-31-9	< 0.000725 U	< 0.004 UJ	< 0.00564 U	< 0.00553 U	< 0.0042 U	< 0.00578 U
Total	N-MeFOSE	24448-09-7	< 0.00725 U	< 0.004 U	< 0.0564 U	< 0.0553 U	< 0.0042 U	< 0.0578 U
Total	PFBA	375-22-4	0.331	0.49	0.227	0.267	0.45	0.257
Total	PFBS	375-73-5	0.00373	0.0038 J	< 0.00564 U	< 0.00553 U	0.0052	< 0.00578 U
Total	PFDA	335-76-2	0.000789 J	0.0013 J	< 0.00564 U	< 0.00553 U	< 0.0042 U	< 0.00578 U
Total	PFDoA	307-55-1	< 0.000725 U	< 0.004 UJ	< 0.00564 U	< 0.00553 U	< 0.0042 U	< 0.00578 U
Total	PFDoS	79780-39-5	< 0.000725 U	NA	< 0.00564 U	< 0.00553 U	NA	< 0.00578 U
Total	PFDS	335-77-3	< 0.000725 U	< 0.004 U	< 0.00564 U	< 0.00553 U	< 0.0042 U	< 0.00578 U
Total	PFHpA	375-85-9	0.00579	0.0083	0.00627 J	0.0066 J	0.0084	0.00648 J
Total	PFHpS	375-92-8	0.00109 J	0.0021 J	< 0.00564 U	< 0.00553 U	0.0031 J	< 0.00578 U
Total	PFHxA	307-24-4	0.0106	0.016	0.0106 J	0.0104 J	0.016	0.0099 J
Total	PFHxS	355-46-4	0.00731	0.009	0.00826 J	0.00703 J	0.012	0.00652 J
Total	PFNA	375-95-1	< 0.000725 U	0.0015 J	< 0.00564 U	< 0.00553 U	0.0018 J	< 0.00578 U
Total	PFNS	68259-12-1	< 0.000725 U	< 0.004 U	< 0.00564 U	< 0.00553 U	< 0.0042 U	< 0.00578 U
Total	PFOA	335-67-1	0.0581	0.071	0.0543	0.0586	0.072	0.0579
Total	PFOS	1763-23-1	0.167	0.18	0.163	0.148	0.19	0.146
Total	PFOSA	754-91-6	< 0.000725 U	0.0007 J	< 0.00564 U	< 0.00553 U	0.00079 J	< 0.00578 U
Total	PFPeA	2706-90-3	0.00984	0.014	< 0.0113 U	< 0.0111 U	0.013	< 0.0116 U
Total	PFPeS	2706-91-4	0.00215	0.003 J	< 0.00564 U	< 0.00553 U	0.0051	< 0.00578 U
Total	PFTeDA	376-06-7	< 0.000725 U	0.0021 J+	< 0.00564 U	< 0.00553 U	0.0044 B	< 0.00578 U
Total	PFTrDA	72629-94-8	< 0.000725 U	0.0014 J	< 0.00564 U	< 0.00553 U	0.0016 J	< 0.00578 U
Total	PFUnA	2058-94-8	< 0.000725 U	< 0.004 UJ	< 0.00564 U	< 0.00553 U	< 0.0042 U	< 0.00578 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4a
West Lakeland Area Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
		Location	WL5	WL6	WL6	WL6	WL6	WL6	WL6	WL6
		Location ID	82-0074-00-205	S016-071	S016-071	S016-071	S016-071	S016-071	S016-071	S016-071
		Sample Date	9/17/2020	8/14/2019	2/25/2020	4/29/2020	5/7/2020	5/18/2020	6/29/2020	7/29/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	82-0074-00-205.2009171115.000S	S016-071.1908141335.000S	S016-071.2002251610.000S	S016-071.2004291600.000S	S016-071.2005071500.000S	S016-071.2005181610.000S	S016-071.2006291900.000S	S016-071.2007291600.000S
		Sample Name	WL5-WAT-MID-01-091720	WL6-WAT-SUR-01-081419	WL6-WAT-BULK-01-022520	WL6-WAT-BULK-01-042920	WL6-WAT-BULK-01-050720	WL6-WAT-BULK-01-051820	WL6-WAT-BULK-01-062920	WL6-WAT-BULK-01-072920
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	< 0.0041 U	NA	NA	NA	NA	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.0041 U	< 0.0227 U	< 0.00308 U	< 0.00294 U	< 0.00308 UJ	< 0.00296 U	< 0.00296 UJ	< 0.00145 U
Total	4:2 FTS	757124-72-4	< 0.0041 U	< 0.0227 U	< 0.00308 U	< 0.00294 U	< 0.00308 UJ	< 0.00296 U	< 0.00296 UJ	< 0.00144 U
Total	6:2 FTS	27619-97-2	< 0.0041 U	< 0.0409 U	< 0.00277 U	< 0.00265 U	< 0.00277 UJ	< 0.00267 U	< 0.00266 UJ	< 0.0013 U
Total	8:2 FTS	39108-34-4	< 0.0041 U	< 0.0227 U	< 0.00308 U	< 0.00294 U	< 0.00308 UJ	< 0.00296 U	< 0.00296 UJ	< 0.00144 U
Total	9Cl-PF3ONS	756426-58-1	< 0.0041 U	< 0.0227 U	< 0.00308 U	< 0.00294 U	< 0.00308 UJ	< 0.00296 U	< 0.00296 UJ	< 0.00145 U
Total	ADONA	919005-14-4	< 0.0041 U	< 0.0227 U	< 0.00308 U	< 0.00294 U	< 0.00308 UJ	< 0.00296 U	< 0.00296 UJ	< 0.00144 U
Total	HFPO-DA	13252-13-6	< 0.0041 U	< 0.0227 U	< 0.00292 U	< 0.00279 U	< 0.00292 UJ	< 0.00281 U	< 0.00281 UJ	< 0.00137 U
Total	N-EtFOSA	4151-50-2	< 0.0041 U	< 0.0142 U	< 0.00192 U	< 0.00184 U	< 0.00192 UJ	< 0.00185 U	< 0.00185 UJ	< 0.000902 U
Total	N-EtFOSAA	2991-50-6	< 0.0041 U	< 0.0114 U	< 0.00077 U	< 0.000735 U	< 0.00077 UJ	< 0.00074 U	< 0.000739 UJ	0.00107 J
Total	N-EtFOSE	1691-99-2	< 0.0041 U	< 0.0426 U	< 0.00577 U	< 0.00551 U	< 0.00577 UJ	< 0.00555 U	< 0.00555 UJ	< 0.0027 U
Total	N-MeFOSA	31506-32-8	< 0.0041 U	< 0.00653 U	< 0.000885 U	< 0.000845 U	< 0.000885 UJ	< 0.000851 U	< 0.00085 UJ	< 0.000415 U
Total	N-MeFOSAA	2355-31-9	< 0.0041 U	< 0.00568 U	< 0.00077 U	< 0.000735 U	< 0.00077 UJ	< 0.00074 U	< 0.000739 UJ	< 0.000361 U
Total	N-MeFOSE	24448-09-7	< 0.0041 U	< 0.0568 U	< 0.0077 U	< 0.00735 U	< 0.0077 UJ	< 0.0074 U	< 0.00739 UJ	< 0.00361 U
Total	PFBA	375-22-4	0.4	0.218	0.455	0.385	0.379 J-	0.384	R	0.398 J+
Total	PFBS	375-73-5	0.0037 J	< 0.00568 U	0.0037	0.00467	0.00462 J-	0.00417	0.00308 J-	0.00451
Total	PFDA	335-76-2	< 0.0041 U	< 0.00568 U	< 0.00077 U	< 0.000735 U	< 0.00077 UJ	< 0.00074 U	0.00121 J-	0.00139 J
Total	PFDoA	307-55-1	< 0.0041 U	< 0.00568 U	< 0.00077 U	< 0.000735 U	< 0.00077 UJ	< 0.00074 U	< 0.000739 UJ	< 0.000361 U
Total	PFDoS	79780-39-5	NA	< 0.00568 U	< 0.00077 U	< 0.000735 U	< 0.00077 UJ	< 0.00074 U	< 0.000739 UJ	< 0.000361 U
Total	PFDS	335-77-3	< 0.0041 U	< 0.00568 U	< 0.00077 U	< 0.000735 U	< 0.00077 UJ	< 0.00074 U	< 0.000739 UJ	< 0.000361 U
Total	PFHpA	375-85-9	0.0073	< 0.00568 U	0.00614	0.0101	0.00971 J-	0.00963	0.00711 J-	0.00844
Total	PFHpS	375-92-8	0.0022 J	< 0.00568 U	0.00102 J	0.0018	0.00176 J-	0.00166	0.00224 J-	0.00234
Total	PFHxA	307-24-4	0.017	0.00793 J	0.0127	0.0153	0.015 J-	0.0146	0.0097 J-	0.0144
Total	PFHxS	355-46-4	0.01	0.0079 J	0.0077	0.011	0.0108 J-	0.0106	0.00936 J-	0.0111
Total	PFNA	375-95-1	0.0011 J	< 0.00568 U	< 0.00077 U	0.000776 J	0.000872 J-	0.000823 J	0.00101 J-	0.00112 J
Total	PFNS	68259-12-1	< 0.0041 U	< 0.00568 U	< 0.00077 U	< 0.000735 U	< 0.00077 UJ	< 0.00074 U	< 0.000739 UJ	< 0.000361 U
Total	PFOA	335-67-1	0.074 J+	0.0565	0.0513	0.0863	0.0824 J-	0.081	0.0742 J-	0.0846
Total	PFOS	1763-23-1	0.19	0.149	0.0808	0.125	0.13 J-	0.122	0.235 J-	0.273
Total	PFOSA	754-91-6	0.00097 J	< 0.00568 U	< 0.00077 U	< 0.000735 U	< 0.00077 UJ	< 0.00074 U	0.0013 J-	0.00122 J
Total	PFPeA	2706-90-3	0.013	< 0.0114 U	0.0129	0.0125	0.0126 J-	0.0124	0.00914 J-	0.0127
Total	PFPeS	2706-91-4	0.0041	< 0.00568 U	0.00216	0.00384	0.00324 J-	0.00318	0.00251 J-	0.00315
Total	PFTeDA	376-06-7	0.0023 J	< 0.00568 U	< 0.00077 U	< 0.000735 U	< 0.00077 UJ	< 0.00074 U	< 0.000739 UJ	< 0.000361 U
Total	PFTrDA	72629-94-8	< 0.0041 U	< 0.00568 U	< 0.00077 U	< 0.000735 U	< 0.00077 UJ	< 0.00074 U	< 0.000739 UJ	< 0.000361 U
Total	PFUnA	2058-94-8	< 0.0041 U	< 0.00568 U	< 0.00077 U	< 0.000735 U	< 0.00077 UJ	< 0.00074 U	< 0.000739 UJ	< 0.000361 U

NOTES
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Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
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West Lakeland Area Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
		Location	WL6	WL6	WL6	WL7	WL7	WL7	WL7	WL7
		Location ID	S016-071	S016-071	S016-071	S016-072	S016-072	S016-072	S016-072	S016-072
		Sample Date	8/26/2020	9/1/2020	9/17/2020	8/14/2019	2/25/2020	5/7/2020	5/7/2020	9/17/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	QC-FR	Sample
		Sample ID	S016-071.2008261615.000S	S016-071.2009011645.000S	S016-071.2009171430.000S	S016-072.1908141140.000S	S016-072.2002251700.000S	S016-072.2005071320.000S	S016-072.2005071325.000SR	S016-072.2009171615.000S
		Sample Name	WL6-WAT-BULK-01-082620	WL6-WAT-BULK-01-090120	WL6-WAT-BULK-01-091720	WL7-WAT-SUR-01-081419	WL7-WAT-BULK-01-022520	WL7-WAT-BULK-01-050720	WL7-WAT-BULK-02-050720	WL7-WAT-BULK-01-091720
		Parent Sample ID	NA	NA	NA	NA	NA	NA	S016-072.2005071320.000S	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	NA	NA	< 0.004 U	NA	NA	NA	NA	< 0.0042 U
Total	11Cl-PF3OUdS	763051-92-9	< 0.00151 U	< 0.00147 UJ	< 0.004 U	< 0.00289 U	< 0.00308 U	< 0.0029 UJ	< 0.00291 UJ	< 0.0042 U
Total	4:2 FTS	757124-72-4	< 0.00151 U	< 0.00147 UJ	< 0.004 U	< 0.00289 U	< 0.00308 U	< 0.0029 UJ	< 0.00291 UJ	< 0.0042 U
Total	6:2 FTS	27619-97-2	< 0.00136 U	< 0.00132 UJ	< 0.004 U	< 0.0026 U	< 0.00277 U	< 0.00261 UJ	< 0.00262 UJ	< 0.0042 U
Total	8:2 FTS	39108-34-4	< 0.00151 U	< 0.00147 UJ	< 0.004 U	< 0.00289 U	< 0.00308 U	< 0.0029 UJ	< 0.00291 UJ	< 0.0042 U
Total	9Cl-PF3ONS	756426-58-1	< 0.00151 U	< 0.00147 UJ	< 0.004 U	< 0.00289 U	< 0.00308 U	< 0.0029 UJ	< 0.00291 UJ	< 0.0042 U
Total	ADONA	919005-14-4	< 0.00151 U	< 0.00147 UJ	< 0.004 U	< 0.00289 U	< 0.00308 U	< 0.0029 UJ	< 0.00291 UJ	< 0.0042 U
Total	HFPO-DA	13252-13-6	< 0.00143 U	< 0.00139 UJ	< 0.004 U	< 0.00289 U	< 0.00292 U	< 0.00275 UJ	< 0.00276 UJ	< 0.0042 U
Total	N-EtFOSA	4151-50-2	< 0.000944 U	< 0.000917 UJ	< 0.004 U	< 0.00181 U	< 0.00192 U	< 0.00181 UJ	< 0.00182 UJ	< 0.0042 U
Total	N-EtFOSAA	2991-50-6	0.000811 J	0.000843 J-	< 0.004 U	< 0.000723 U	< 0.000769 U	< 0.000724 UJ	< 0.000727 UJ	< 0.0042 U
Total	N-EtFOSE	1691-99-2	< 0.00282 U	< 0.00274 UJ	< 0.004 UJ	< 0.00542 U	< 0.00577 U	< 0.00543 UJ	< 0.00545 UJ	< 0.0042 U
Total	N-MeFOSA	31506-32-8	< 0.000434 U	< 0.000422 UJ	< 0.004 U	< 0.000832 U	< 0.000885 U	< 0.000833 UJ	< 0.000836 UJ	< 0.0042 U
Total	N-MeFOSAA	2355-31-9	< 0.000377 U	< 0.000367 UJ	< 0.004 U	< 0.000723 U	< 0.000769 U	< 0.000724 UJ	< 0.000727 UJ	< 0.0042 U
Total	N-MeFOSE	24448-09-7	< 0.00377 U	< 0.00367 UJ	< 0.004 U	< 0.00723 U	< 0.00769 U	< 0.00724 UJ	< 0.00727 UJ	< 0.0042 U
Total	PFBA	375-22-4	0.392 J+	0.379 J	0.49	0.403	0.461	0.369 J-	0.424 J-	0.39
Total	PFBS	375-73-5	0.00434	0.00561 J-	0.0054	0.0033	0.00389	0.00451 J-	0.00482 J-	0.004 J
Total	PFDA	335-76-2	0.00108 J	0.00104 J-	< 0.004 U	< 0.000723 U	< 0.000769 U	< 0.000724 UJ	< 0.000727 UJ	< 0.0042 U
Total	PFDoA	307-55-1	< 0.000377 U	< 0.000367 UJ	< 0.004 U	< 0.000723 U	< 0.000769 U	< 0.000724 UJ	< 0.000727 UJ	< 0.0042 U
Total	PFDoS	79780-39-5	< 0.000377 U	< 0.000367 UJ	NA	< 0.000723 U	< 0.000769 U	< 0.000724 UJ	< 0.000727 UJ	NA
Total	PFDS	335-77-3	< 0.000377 U	< 0.000367 UJ	< 0.004 U	< 0.000723 U	< 0.000769 U	< 0.000724 UJ	< 0.000727 UJ	< 0.0042 U
Total	PFHpA	375-85-9	0.00704	0.00652 J-	0.0095	0.00649	0.00575	0.00986 J-	0.0108 J-	0.01
Total	PFHpS	375-92-8	0.00179	0.00185 J-	0.0037 J	0.00149	0.000961 J	0.00174 J-	0.00188 J-	0.0028 J
Total	PFHxA	307-24-4	0.0137	0.0124 J-	0.016	0.00986	0.0129	0.0151 J-	0.017 J-	0.017
Total	PFHxS	355-46-4	0.0102	0.00977 J-	0.012	0.00988	0.00824	0.0116 J-	0.0121 J-	0.01
Total	PFNA	375-95-1	0.00101 J	0.000947 J-	0.0014 J	0.000954 J	0.000837 J	0.000863 J-	0.00102 J-	< 0.0042 U
Total	PFNS	68259-12-1	< 0.000377 U	< 0.000367 UJ	< 0.004 U	< 0.000723 U	< 0.000769 U	< 0.000724 UJ	< 0.000727 UJ	< 0.0042 U
Total	PFOA	335-67-1	0.0732	0.0688 J-	0.11	0.0656	0.0538	0.0854 J-	0.0925 J-	0.072 J+
Total	PFOS	1763-23-1	0.213	0.217 J-	0.19	0.169	0.081	0.135 J-	0.144 J-	0.19
Total	PFOSA	754-91-6	0.00109 J	0.000938 J-	0.00077 J	< 0.000723 U	< 0.000769 U	< 0.000724 UJ	< 0.000727 UJ	0.00082 J
Total	PFPeA	2706-90-3	0.0125	0.0121 J-	0.014	0.00886	0.0129	0.0124 J-	0.0138 J-	0.013
Total	PFPeS	2706-91-4	0.00275	0.00267 J-	0.0038 J	0.00213	0.00214	0.00368 J-	0.00404 J-	0.0042 J
Total	PFTeDA	376-06-7	< 0.000377 U	< 0.000367 UJ	0.004 BJ+	< 0.000723 U	< 0.000769 U	< 0.000724 UJ	< 0.000727 UJ	< 0.0042 U
Total	PFTrDA	72629-94-8	< 0.000377 U	< 0.000367 UJ	0.0017 J	< 0.000723 U	< 0.000769 U	< 0.000724 UJ	< 0.000727 UJ	< 0.0042 U
Total	PFUnA	2058-94-8	< 0.000377 U	< 0.000367 UJ	< 0.004 U	< 0.000723 U	< 0.000769 U	< 0.000724 UJ	< 0.000727 UJ	< 0.0042 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4a
West Lakeland Area Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
		Location	WL8	WL8	WL9	WL9	WL9	WL9	WL9	WL9
		Location ID	PS00167	PS00167	PS00168	PS00168	PS00168	PS00168	PS00168	PS00168
		Sample Date	8/14/2019	9/16/2020	8/14/2019	8/14/2019	2/25/2020	2/25/2020	2/25/2020	2/25/2020
		Sample Type Code	Sample	Sample	Sample	QC-FR	Sample	QC-FR	Sample	QC-FR
		Sample ID	PS00167.1908141110.000S	PS00167.2009161715.000S	PS00168.1908141640.000S	PS00168.1908141645.000SR	PS00168.2002251500.000S	PS00168.2002251515.000SR	PS00168.2002251525.000S	PS00168.2002251530.000SR
		Sample Name	WL8-WAT-SUR-01-081419	WL8A-WAT-BULK-01-091620	WL9-WAT-SUR-01-081419	WL9-WAT-SUR-02-081419	WL9-WAT-SML-01-022520	WL9-WAT-SML-02-022520	WL9-WAT-BULK-01-022520	WL9-WAT-BULK-02-022520
		Parent Sample ID	NA	NA	NA	PS00168.1908141640.000S	NA	PS00168.2002251500.000S	NA	PS00168.2002251525.000S
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	NA	< 0.0041 U	NA	NA	NA	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.0232 U	< 0.0041 UJ	< 0.003 U	< 0.0029 U	< 0.00549 U	< 0.00581 U	< 0.00295 U	< 0.00293 U
Total	4:2 FTS	757124-72-4	< 0.0232 U	< 0.0041 U	< 0.003 U	< 0.0029 U	< 0.00549 U	< 0.00581 U	< 0.00295 U	< 0.00293 U
Total	6:2 FTS	27619-97-2	< 0.0417 U	0.019 BJ+	< 0.0027 U	< 0.00261 U	0.00537 J	< 0.00523 U	< 0.00266 U	< 0.00263 U
Total	8:2 FTS	39108-34-4	< 0.0232 U	< 0.0041 U	< 0.003 U	< 0.0029 U	< 0.00549 U	< 0.00581 U	< 0.00295 U	< 0.00293 U
Total	9Cl-PF3ONS	756426-58-1	< 0.0232 U	< 0.0041 U	< 0.003 U	< 0.0029 U	< 0.00549 U	< 0.00581 U	< 0.00295 U	< 0.00293 U
Total	ADONA	919005-14-4	< 0.0232 U	< 0.0041 U	< 0.003 U	< 0.0029 U	< 0.00549 U	< 0.00581 U	< 0.00295 U	< 0.00293 U
Total	HFPO-DA	13252-13-6	< 0.0232 U	< 0.0041 U	< 0.003 U	< 0.0029 U	< 0.00522 U	< 0.00552 U	< 0.0028 U	< 0.00278 U
Total	N-EtFOSA	4151-50-2	< 0.0145 U	< 0.0041 U	< 0.00187 U	< 0.00181 U	< 0.00343 U	< 0.00363 U	< 0.00185 U	< 0.00183 U
Total	N-EtFOSAA	2991-50-6	< 0.0116 U	< 0.0041 UJ	< 0.00075 U	< 0.000724 U	< 0.00137 U	< 0.00145 U	< 0.000738 U	< 0.000732 U
Total	N-EtFOSE	1691-99-2	< 0.0434 U	< 0.0041 U	< 0.00562 U	< 0.00543 U	< 0.0103 U	< 0.0109 U	< 0.00554 U	< 0.00549 U
Total	N-MeFOSA	31506-32-8	< 0.00666 U	< 0.0041 U	< 0.000862 U	< 0.000833 U	< 0.00158 U	< 0.00167 U	< 0.000849 U	< 0.000841 U
Total	N-MeFOSAA	2355-31-9	< 0.00579 U	< 0.0041 U	< 0.00075 U	< 0.000724 U	< 0.00137 U	< 0.00145 U	< 0.000738 U	< 0.000732 U
Total	N-MeFOSE	24448-09-7	< 0.0579 U	< 0.0041 U	< 0.0075 U	< 0.00724 U	< 0.0137 U	< 0.0145 U	< 0.00738 U	< 0.00732 U
Total	PFBA	375-22-4	0.275	0.35	0.433	0.385	0.471	0.428	0.422	0.461
Total	PFBS	375-73-5	< 0.00579 U	0.004 J	0.0038	0.00366	0.00393	0.00388	0.00376	0.00374
Total	PFDA	335-76-2	< 0.00579 U	0.0012 J	< 0.00075 U	< 0.000724 U	< 0.00137 U	< 0.00145 U	< 0.000738 U	< 0.000732 U
Total	PFDoA	307-55-1	< 0.00579 U	< 0.0041 U	< 0.00075 U	< 0.000724 U	< 0.00137 U	< 0.00145 U	< 0.000738 U	< 0.000732 U
Total	PFDoS	79780-39-5	< 0.00579 U	NA	< 0.00075 U	< 0.000724 U	< 0.00137 U	< 0.00145 U	< 0.000738 U	< 0.000732 U
Total	PFDS	335-77-3	< 0.00579 U	< 0.0041 UJ	< 0.00075 U	< 0.000724 U	< 0.00137 U	< 0.00145 U	< 0.000738 U	< 0.000732 U
Total	PFHpA	375-85-9	0.00656 J	0.0067 B	0.00708	0.00629	0.00635	0.00536 J	0.00583	0.00615
Total	PFHpS	375-92-8	< 0.00579 U	0.0019 J	0.00158	0.000913 J	< 0.00137 U	< 0.00145 U	0.000899 J	0.000884 J
Total	PFHxA	307-24-4	0.011 J	0.016	0.0122	0.0121	0.0136	0.0124 J	0.0126	0.0122
Total	PFHxS	355-46-4	0.00917 J	0.0069	0.0101	0.00923	0.00834	0.00662	0.00799	0.00884
Total	PFNA	375-95-1	< 0.00579 U	0.0018 J	0.00112 J	0.0011 J	< 0.00137 U	< 0.00145 U	0.000823 J	0.000819 J
Total	PFNS	68259-12-1	< 0.00579 U	< 0.0041 U	< 0.00075 U	< 0.000724 U	< 0.00137 U	< 0.00145 U	< 0.000738 U	< 0.000732 U
Total	PFOA	335-67-1	0.058	0.061	0.069	0.0677	0.053	0.043	0.0542	0.0524
Total	PFOS	1763-23-1	0.151	0.15	0.177	0.179	0.0801	0.0558	0.0842	0.0807
Total	PFOSA	754-91-6	< 0.00579 U	0.0011 J	< 0.00075 U	< 0.000724 U	< 0.00137 U	< 0.00145 U	< 0.000738 U	< 0.000732 U
Total	PFPeA	2706-90-3	< 0.0116 U	0.012	0.0117	0.0111	0.0135	0.0134	0.0122	0.0128
Total	PFPeS	2706-91-4	< 0.00579 U	0.0032 J	0.00202	0.00193	0.00215 J	0.00187 J	0.00235	0.00232
Total	PFTeDA	376-06-7	< 0.00579 U	0.0028 BJ+	< 0.00075 U	< 0.000724 U	< 0.00137 U	< 0.00145 U	< 0.000738 U	< 0.000732 U
Total	PFTrDA	72629-94-8	< 0.00579 U	< 0.0041 U	< 0.00075 U	< 0.000724 U	< 0.00137 U	< 0.00145 U	< 0.000738 U	< 0.000732 U
Total	PFUnA	2058-94-8	< 0.00579 U	< 0.0041 U	< 0.00075 U	< 0.000724 U	< 0.00137 U	< 0.00145 U	< 0.000738 U	< 0.000732 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4a
West Lakeland Area Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
		Location	WL9	WL9	WL9	WL9	WL9	WL9	WL9	WL10
		Location ID	PS00168	PS00168	PS00168	PS00168	PS00168	PS00168	PS00168	S016-073
		Sample Date	4/29/2020	5/7/2020	5/7/2020	5/7/2020	7/31/2020	7/31/2020	9/16/2020	8/13/2019
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	QC-FR	Sample	Sample
		Sample ID	PS00168.2004291630.000S	PS00168.2005071030.000S	PS00168.2005071045.000S	PS00168.2005071100.000S	PS00168.2007311330.000S	PS00168.2007311345.000SR	PS00168.2009160900.000S	S016-073.1908131535.000S
		Sample Name	WL9-WAT-BULK-01-042920	WL9-WAT-SML-01-050720	WL9-WAT-BULK-01-050720	WL9-WAT-EPI-01-050720	WL9-WAT-BULK-01-073120	WL9-WAT-BULK-02-073120	WL9-WAT-BULK-01-091620	WL10-WAT-SUR-01-081319
		Parent Sample ID	NA	NA	NA	NA	NA	PS00168.2007311330.000S	NA	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	NA	< 0.0043 U	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.00307 U	< 0.00317 UJ	< 0.00293 UJ	< 0.00288 UJ	< 0.00148 U	< 0.0015 U	< 0.0043 UJ	< 0.0231 U
Total	4:2 FTS	757124-72-4	< 0.00307 U	< 0.00317 UJ	< 0.00293 UJ	< 0.00288 UJ	< 0.00147 U	< 0.0015 U	< 0.0043 U	< 0.0231 U
Total	6:2 FTS	27619-97-2	< 0.00277 U	< 0.00285 UJ	< 0.00264 UJ	< 0.00259 UJ	0.01 J	< 0.00135 UJ	0.003 BJ+	< 0.0416 U
Total	8:2 FTS	39108-34-4	< 0.00307 U	< 0.00317 UJ	< 0.00293 UJ	< 0.00288 UJ	< 0.00147 U	< 0.0015 U	< 0.0043 U	< 0.0231 U
Total	9Cl-PF3ONS	756426-58-1	< 0.00307 U	< 0.00317 UJ	< 0.00293 UJ	< 0.00288 UJ	< 0.00148 U	< 0.00151 U	< 0.0043 U	< 0.0231 U
Total	ADONA	919005-14-4	< 0.00307 U	< 0.00317 UJ	< 0.00293 UJ	< 0.00288 UJ	< 0.00147 U	< 0.0015 U	< 0.0043 U	< 0.0231 U
Total	HFPO-DA	13252-13-6	< 0.00292 U	< 0.00301 UJ	< 0.00279 UJ	< 0.00274 UJ	< 0.0014 U	< 0.00143 U	< 0.0043 U	< 0.0231 U
Total	N-EtFOSA	4151-50-2	< 0.00192 U	< 0.00198 UJ	< 0.00183 UJ	< 0.0018 UJ	< 0.000921 U	< 0.000939 U	< 0.0043 U	< 0.0144 U
Total	N-EtFOSAA	2991-50-6	< 0.000768 U	< 0.000793 UJ	< 0.000733 UJ	< 0.000721 UJ	0.000905 J	0.0008 J	< 0.0043 UJ	< 0.0115 U
Total	N-EtFOSE	1691-99-2	< 0.00576 U	< 0.00594 UJ	< 0.0055 UJ	< 0.0054 UJ	< 0.00276 U	< 0.00281 U	< 0.0043 U	< 0.0433 U
Total	N-MeFOSA	31506-32-8	< 0.000883 U	< 0.000912 UJ	< 0.000843 UJ	< 0.000829 UJ	< 0.000424 U	< 0.000432 U	< 0.0043 U	< 0.00664 U
Total	N-MeFOSAA	2355-31-9	< 0.000768 U	< 0.000793 UJ	< 0.000733 UJ	< 0.000721 UJ	< 0.000369 U	< 0.000375 U	< 0.0043 U	< 0.00577 U
Total	N-MeFOSE	24448-09-7	< 0.00768 U	< 0.00793 UJ	< 0.00733 UJ	< 0.00721 UJ	< 0.00369 U	< 0.00375 U	< 0.0043 U	< 0.0577 U
Total	PFBA	375-22-4	0.377	0.404 J-	0.319 J-	0.349 J-	R	0.323 J+	0.33	0.136
Total	PFBS	375-73-5	0.00452	0.00489 J-	0.00404 J-	0.00416 J-	0.00477	0.00379	0.0041 J	< 0.00577 U
Total	PFDA	335-76-2	< 0.000768 U	0.000919 J-	< 0.000733 UJ	0.000753 J-	0.00109 J	0.00101 J	< 0.0043 U	< 0.00577 U
Total	PFDoA	307-55-1	< 0.000768 U	< 0.000793 UJ	< 0.000733 UJ	< 0.000721 UJ	< 0.000369 U	< 0.000375 U	< 0.0043 U	< 0.00577 U
Total	PFDoS	79780-39-5	< 0.000768 U	< 0.000793 UJ	< 0.000733 UJ	< 0.000721 UJ	< 0.000369 U	< 0.000375 U	NA	< 0.00577 U
Total	PFDS	335-77-3	< 0.000768 U	< 0.000793 UJ	< 0.000733 UJ	< 0.000721 UJ	< 0.000369 U	< 0.000375 U	< 0.0043 UJ	< 0.00577 U
Total	PFHpA	375-85-9	0.01	0.00972 J-	0.00963 J-	0.01 J-	0.00846	0.00777	0.011	0.00614 J
Total	PFHpS	375-92-8	0.0018	0.00174 J-	0.00171 J-	0.00186 J-	0.00218	0.00243	0.0023 J	< 0.00577 U
Total	PFHxA	307-24-4	0.0159	0.0159 J-	0.0131 J-	0.0154 J-	0.0139	0.0131	0.014	0.00783 J
Total	PFHxS	355-46-4	0.0107	0.0111 J-	0.0105 J-	0.0115 J-	0.0109	0.011	0.0073	0.00712 J
Total	PFNA	375-95-1	0.000865 J	< 0.000793 UJ	< 0.000733 UJ	0.000799 J-	0.00113 J	0.00121 J	0.0016 J	< 0.00577 U
Total	PFNS	68259-12-1	< 0.000768 U	< 0.000793 UJ	< 0.000733 UJ	< 0.000721 UJ	< 0.000369 U	< 0.000375 U	< 0.0043 U	< 0.00577 U
Total	PFOA	335-67-1	0.0861	0.0821 J-	0.0798 J-	0.0855 J-	0.0819	0.0825	0.061	0.0539
Total	PFOS	1763-23-1	0.128	0.141 J-	0.118 J-	0.134 J-	0.252	0.248	0.14	0.156
Total	PFOSA	754-91-6	< 0.000768 U	< 0.000793 UJ	< 0.000733 UJ	< 0.000721 UJ	0.00114 BJ	0.00144 J	0.00091 J	< 0.00577 U
Total	PFPeA	2706-90-3	0.0123	0.0131 J-	0.0107 J-	0.0117 J-	0.0132	0.0107	0.014	< 0.0115 U
Total	PFPeS	2706-91-4	0.00361	0.00347 J-	0.00295 J-	0.00346 J-	0.00315	0.00325	0.003 J	< 0.00577 U
Total	PFTeDA	376-06-7	< 0.000768 U	< 0.000793 UJ	< 0.000733 UJ	< 0.000721 UJ	< 0.000369 U	< 0.000375 U	< 0.0043 UJ	< 0.00577 U
Total	PFTrDA	72629-94-8	< 0.000768 U	< 0.000793 UJ	< 0.000733 UJ	< 0.000721 UJ	< 0.000369 U	< 0.000375 U	< 0.0043 U	< 0.00577 U
Total	PFUnA	2058-94-8	< 0.000768 U	< 0.000793 UJ	< 0.000733 UJ	< 0.000721 UJ	< 0.000369 U	< 0.000375 U	< 0.0043 U	< 0.00577 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4a
West Lakeland Area Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
		Location	WL10	WL10	WL11	WL11	WL11	WL21	WL12	WL12
		Location ID	S016-073	S016-073	S016-074	S016-074	S016-074	PS00174	PS00169	PS00169
		Sample Date	8/14/2019	9/21/2020	8/13/2019	5/5/2020	9/22/2020	9/16/2020	8/14/2019	2/26/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	S016-073.1908141430.000S	S016-073.2009211710.000S	S016-074.1908131600.000S	S016-074.2005051125.000S	S016-074.2009221205.000S	PS00174.2009161610.000S	PS00169.1908141605.000S	PS00169.2002261350.000S
		Sample Name	WL10-WAT-SUR-01-081419	WL10-WAT-BULK-01-092120	WL11-WAT-SUR-01-081319	WL11-WAT-BULK-01-050520	WL11-WAT-BULK-01-092220	WL21-WAT-MID-01-091620	WL12-WAT-SUR-01-081419	WL12-WAT-BULK-01-022620
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	NA	< 0.004 U	NA	NA	< 0.0039 U	< 0.004 U	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.00316 U	< 0.004 U	< 0.00306 U	< 0.00302 UJ	< 0.0039 U	< 0.004 UJ	< 0.0232 U	< 0.0031 U
Total	4:2 FTS	757124-72-4	< 0.00316 U	< 0.004 U	< 0.00306 U	< 0.00302 UJ	< 0.0039 U	< 0.004 U	< 0.0232 U	< 0.0031 U
Total	6:2 FTS	27619-97-2	< 0.00285 U	< 0.004 U	< 0.00276 U	< 0.00272 UJ	< 0.0039 U	0.012 BJ+	< 0.0417 U	< 0.00279 U
Total	8:2 FTS	39108-34-4	< 0.00316 U	< 0.004 U	< 0.00306 U	< 0.00302 UJ	< 0.0039 U	< 0.004 U	< 0.0232 U	< 0.0031 U
Total	9Cl-PF3ONS	756426-58-1	< 0.00316 U	< 0.004 U	< 0.00306 U	< 0.00302 UJ	< 0.0039 U	< 0.004 U	< 0.0232 U	< 0.0031 U
Total	ADONA	919005-14-4	< 0.00316 U	< 0.004 U	< 0.00306 U	< 0.00302 UJ	< 0.0039 U	< 0.004 U	< 0.0232 U	< 0.0031 U
Total	HFPO-DA	13252-13-6	< 0.00316 U	< 0.004 U	< 0.00306 U	< 0.00287 UJ	< 0.0039 U	< 0.004 U	< 0.0232 U	< 0.0031 U
Total	N-EtFOSA	4151-50-2	< 0.00198 U	< 0.004 U	< 0.00191 U	< 0.00189 UJ	< 0.0039 U	< 0.004 U	< 0.0145 U	< 0.00194 U
Total	N-EtFOSAA	2991-50-6	< 0.000791 U	0.0012 BJ	< 0.000766 U	< 0.000755 UJ	0.0015 BJ	< 0.004 UJ	< 0.0116 U	< 0.000774 U
Total	N-EtFOSE	1691-99-2	< 0.00593 U	< 0.004 U	< 0.00574 U	< 0.00567 UJ	< 0.0039 U	< 0.004 U	< 0.0434 U	< 0.00581 U
Total	N-MeFOSA	31506-32-8	< 0.000909 U	< 0.004 U	< 0.000881 U	< 0.000869 UJ	< 0.0039 U	< 0.004 U	< 0.00666 U	< 0.00089 U
Total	N-MeFOSAA	2355-31-9	< 0.000791 U	< 0.004 U	< 0.000766 U	< 0.000755 UJ	< 0.0039 U	< 0.004 U	< 0.00579 U	< 0.000774 U
Total	N-MeFOSE	24448-09-7	< 0.00791 U	< 0.004 U	< 0.00766 U	< 0.00755 UJ	< 0.0039 U	< 0.004 U	< 0.0579 U	< 0.00774 U
Total	PFBA	375-22-4	0.38	0.39	0.36	0.388 J-	0.39	0.34	0.249	0.463
Total	PFBS	375-73-5	0.00407	0.0041	0.00438	0.00467 J-	0.0042	0.0041	< 0.00579 U	0.00374
Total	PFDA	335-76-2	< 0.000791 U	0.0012 J	0.00106 J	< 0.000755 UJ	< 0.0039 U	< 0.004 U	< 0.00579 U	< 0.000774 U
Total	PFDoA	307-55-1	< 0.000791 U	< 0.004 U	< 0.000766 U	< 0.000755 UJ	< 0.0039 U	< 0.004 U	< 0.00579 U	< 0.000774 U
Total	PFDoS	79780-39-5	< 0.000791 U	NA	< 0.000766 U	< 0.000755 UJ	NA	NA	< 0.00579 U	< 0.000774 U
Total	PFDS	335-77-3	< 0.000791 U	< 0.004 U	< 0.000766 U	< 0.000755 UJ	< 0.0039 U	< 0.004 UJ	< 0.00579 U	< 0.000774 U
Total	PFHpA	375-85-9	0.00669	0.01	0.00729	0.01 J-	0.011	0.0069 B	0.00637 J	0.00585
Total	PFHpS	375-92-8	0.00155	0.0031 J	0.00105 J	0.00183 J-	0.0034 J	0.0019 J	< 0.00579 U	0.000935 J
Total	PFHxA	307-24-4	0.0122	0.016	0.0122	0.0158 J-	0.017	0.015	0.00989 J	0.0126
Total	PFHxS	355-46-4	0.00995	0.011	0.00941	0.0109 J-	0.013	0.0076	0.00655 J	0.00829
Total	PFNA	375-95-1	0.00121 J	0.0014 J	0.00101 J	0.000806 J-	0.0012 J	0.0013 J	< 0.00579 U	< 0.000774 U
Total	PFNS	68259-12-1	< 0.000791 U	< 0.004 U	< 0.000766 U	< 0.000755 UJ	< 0.0039 U	< 0.004 U	< 0.00579 U	< 0.000774 U
Total	PFOA	335-67-1	0.0699	0.08	0.0673	0.0846 J-	0.077	0.061	0.0565	0.0549
Total	PFOS	1763-23-1	0.177	0.2	0.18	0.136 J-	0.19	0.15	0.185	0.0761
Total	PFOSA	754-91-6	< 0.000791 U	0.00091 J	< 0.000766 U	< 0.000755 UJ	0.00069 J	0.00093 J	< 0.00579 U	< 0.000774 U
Total	PFPeA	2706-90-3	0.0114	0.014	0.0112	0.0127 J-	0.015	0.013	< 0.0116 U	0.0129
Total	PFPeS	2706-91-4	0.00202	0.0037 J	0.00245	0.00359 J-	0.0041 J+	0.0036 J	< 0.00579 U	0.00231
Total	PFTeDA	376-06-7	< 0.000791 U	< 0.004 U	< 0.000766 U	< 0.000755 UJ	< 0.0039 U	0.0028 BJ+	< 0.00579 U	< 0.000774 U
Total	PFTrDA	72629-94-8	< 0.000791 U	< 0.004 U	< 0.000766 U	< 0.000755 UJ	< 0.0039 U	0.0013 J	< 0.00579 U	< 0.000774 U
Total	PFUnA	2058-94-8	< 0.000791 U	< 0.004 U	< 0.000766 U	< 0.000755 UJ	< 0.0039 U	< 0.004 U	< 0.00579 U	< 0.000774 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4a
West Lakeland Area Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
		Location	WL12	WL12	WL12	WL12	WL13	WL13	WL14	WL16
		Location ID	PS00169	PS00169	PS00169	PS00169	S016-075	S016-075	PS00170	PS00172
		Sample Date	4/29/2020	5/7/2020	5/7/2020	7/31/2020	8/14/2019	9/16/2020	8/14/2019	8/14/2019
		Sample Type Code	Sample	Sample	QC-FR	Sample	Sample	Sample	Sample	Sample
		Sample ID	PS00169.2004291700.000S	PS00169.2005071200.000S	PS00169.2005071210.000SR	PS00169.2007311430.000S	S016-075.1908141450.000S	S016-075.2009161600.000S	PS00170.1908141135.000S	PS00172.1908141345.000S
		Sample Name	WL12-WAT-BULK-01-042920	WL12-WAT-BULK-01-050720	WL12-WAT-BULK-02-050720	WL12-WAT-BULK-01-073120	WL13-WAT-SUR-01-081419	WL13-WAT-MID-01-091620	WL14-WAT-SUR-01-081419	WL16-WAT-SUR-01-081419
		Parent Sample ID	NA	NA	PS00169.2005071200.000S	NA	NA	NA	NA	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	< 0.004 U	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.00296 U	< 0.00295 UJ	< 0.003 UJ	< 0.0015 UJ	< 0.00296 U	< 0.004 UJ	< 0.00304 U	< 0.00305 U
Total	4:2 FTS	757124-72-4	< 0.00296 U	< 0.00295 UJ	< 0.003 UJ	< 0.0015 UJ	< 0.00296 U	< 0.004 U	< 0.00304 U	< 0.00305 U
Total	6:2 FTS	27619-97-2	< 0.00267 U	< 0.00266 UJ	< 0.0027 UJ	0.0149 BJ-	< 0.00267 U	0.026 BJ+	< 0.00274 U	< 0.00274 U
Total	8:2 FTS	39108-34-4	< 0.00296 U	< 0.00295 UJ	< 0.003 UJ	< 0.0015 UJ	< 0.00296 U	< 0.004 U	< 0.00304 U	< 0.00305 U
Total	9Cl-PF3ONS	756426-58-1	< 0.00296 U	< 0.00295 UJ	< 0.003 UJ	< 0.00151 UJ	< 0.00296 U	< 0.004 U	< 0.00304 U	< 0.00305 U
Total	ADONA	919005-14-4	< 0.00296 U	< 0.00295 UJ	< 0.003 UJ	< 0.0015 UJ	< 0.00296 U	< 0.004 U	< 0.00304 U	< 0.00305 U
Total	HFPO-DA	13252-13-6	< 0.00282 U	< 0.00281 UJ	< 0.00285 UJ	< 0.00143 UJ	< 0.00296 U	< 0.004 U	< 0.00304 U	< 0.00305 U
Total	N-EtFOSA	4151-50-2	< 0.00185 U	< 0.00185 UJ	< 0.00188 UJ	< 0.000938 UJ	< 0.00185 U	< 0.004 U	< 0.0019 U	< 0.0019 U
Total	N-EtFOSAA	2991-50-6	< 0.000741 U	< 0.000739 UJ	< 0.000751 UJ	0.00102 J-	< 0.000741 U	0.0017 J	< 0.00076 U	< 0.000762 U
Total	N-EtFOSE	1691-99-2	< 0.00556 U	< 0.00554 UJ	< 0.00563 UJ	< 0.00281 UJ	< 0.00556 U	< 0.004 U	< 0.0057 U	< 0.00571 U
Total	N-MeFOSA	31506-32-8	< 0.000852 U	< 0.000849 UJ	< 0.000864 UJ	< 0.000432 UJ	< 0.000852 U	< 0.004 U	< 0.000875 U	< 0.000876 U
Total	N-MeFOSAA	2355-31-9	< 0.000741 U	< 0.000739 UJ	< 0.000751 UJ	< 0.000375 UJ	< 0.000741 U	< 0.004 U	< 0.00076 U	< 0.000762 U
Total	N-MeFOSE	24448-09-7	< 0.00741 U	< 0.00739 UJ	< 0.00751 UJ	< 0.00375 UJ	< 0.00741 U	< 0.004 U	< 0.0076 U	< 0.00762 U
Total	PFBA	375-22-4	0.384	0.409 J-	0.389 J-	R	0.342	0.36	0.323	0.389
Total	PFBS	375-73-5	0.00472	0.00467 J-	0.00465 J-	0.00405 J-	0.00335	0.0041	0.00351	0.0038
Total	PFDA	335-76-2	< 0.000741 U	< 0.000739 UJ	< 0.000751 UJ	0.00128 J-	< 0.000741 U	0.0015 J	0.00118 J	0.000963 J
Total	PFDoA	307-55-1	< 0.000741 U	< 0.000739 UJ	< 0.000751 UJ	< 0.000375 UJ	< 0.000741 U	< 0.004 U	< 0.00076 U	< 0.000762 U
Total	PFDoS	79780-39-5	< 0.000741 U	< 0.000739 UJ	< 0.000751 UJ	< 0.000375 UJ	< 0.000741 U	NA	< 0.00076 U	< 0.000762 U
Total	PFDS	335-77-3	< 0.000741 U	< 0.000739 UJ	< 0.000751 UJ	< 0.000375 UJ	< 0.000741 U	< 0.004 UJ	< 0.00076 U	< 0.000762 U
Total	PFHpA	375-85-9	0.0104	0.0103 J-	0.0108 J-	0.00883 J-	0.00596	0.0078 B	0.00702	0.00752
Total	PFHpS	375-92-8	0.00162	0.00206 J-	0.00191 J-	0.00239 J-	0.0011 J	0.0021 J	0.00137 J	0.00179
Total	PFHxA	307-24-4	0.0153	0.0171 J-	0.0156 J-	0.0155 J-	0.00987	0.016	0.0115	0.013
Total	PFHxS	355-46-4	0.0111	0.0116 J-	0.0111 J-	0.0113 J-	0.00851	0.0082	0.00986	0.0103
Total	PFNA	375-95-1	< 0.000741 U	0.000825 J-	0.000809 J-	0.00118 J-	0.000796 J	0.002 J	0.000963 J	0.00114 J
Total	PFNS	68259-12-1	< 0.000741 U	< 0.000739 UJ	< 0.000751 UJ	< 0.000375 UJ	< 0.000741 U	< 0.004 U	< 0.00076 U	< 0.000762 U
Total	PFOA	335-67-1	0.0844	0.0895 J-	0.0867 J-	0.0819 J-	0.0577	0.067	0.0659	0.0739
Total	PFOS	1763-23-1	0.124	0.133 J-	0.135 J-	0.271 J-	0.159	0.17	0.183	0.169
Total	PFOSA	754-91-6	0.000907 J	< 0.000739 UJ	< 0.000751 UJ	0.00129 BJ-	< 0.000741 U	0.00091 J	< 0.00076 U	< 0.000762 U
Total	PFPeA	2706-90-3	0.0125	0.0133 J-	0.0125 J-	0.0135 J-	0.0101	0.012	0.0114	0.0131
Total	PFPeS	2706-91-4	0.00353	0.00365 J-	0.00377 J-	0.00335 J-	0.00209	0.0041	0.00237	0.0021
Total	PFTeDA	376-06-7	< 0.000741 U	< 0.000739 UJ	< 0.000751 UJ	< 0.000375 UJ	< 0.000741 U	< 0.004 U	< 0.00076 U	< 0.000762 U
Total	PFTrDA	72629-94-8	< 0.000741 U	< 0.000739 UJ	< 0.000751 UJ	< 0.000375 UJ	< 0.000741 U	< 0.004 U	< 0.00076 U	< 0.000762 U
Total	PFUnA	2058-94-8	< 0.000741 U	< 0.000739 UJ	< 0.000751 UJ	< 0.000375 UJ	< 0.000741 U	< 0.004 U	< 0.00076 U	< 0.000762 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

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- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4a
West Lakeland Area Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
		Location	WL16	WL15	WL15	WL15	WL15	WL15	WL15	WL15
		Location ID	PS00172	PS00171	PS00171	PS00171	PS00171	PS00171	PS00171	PS00171
		Sample Date	9/23/2020	8/14/2019	2/26/2020	4/29/2020	5/5/2020	5/18/2020	6/29/2020	7/31/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	PS00172.2009231435.000S	PS00171.1908141020.000S	PS00171.2002261400.000S	PS00171.2004291730.000S	PS00171.2005051235.000S	PS00171.2005181640.000S	PS00171.2006291930.000S	PS00171.2007311515.000S
		Sample Name	WL16-WAT-BULK-01-092320	WL15-WAT-SUR-01-081419	WL15-WAT-BULK-01-022620	WL15-WAT-BULK-01-042920	WL15-WAT-BULK-01-050520	WL15-WAT-BULK-01-051820	WL15-WAT-BULK-01-062920	WL15-WAT-BULK-01-073120
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	< 0.004 U	NA	NA	NA	NA	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.004 U	< 0.0222 U	< 0.00393 U	< 0.00299 U	< 0.00304 UJ	< 0.003 U	< 0.00311 UJ	< 0.00151 UJ
Total	4:2 FTS	757124-72-4	< 0.004 U	< 0.0222 U	< 0.00393 U	< 0.00299 U	< 0.00304 UJ	< 0.003 U	< 0.00311 UJ	< 0.0015 UJ
Total	6:2 FTS	27619-97-2	< 0.004 U	< 0.0399 U	< 0.00354 U	< 0.00269 U	< 0.00274 UJ	< 0.0027 U	0.0083 J-	0.00884 BJ-
Total	8:2 FTS	39108-34-4	< 0.004 U	< 0.0222 U	< 0.00393 U	< 0.00299 U	< 0.00304 UJ	< 0.003 U	< 0.00311 UJ	< 0.0015 UJ
Total	9Cl-PF3ONS	756426-58-1	< 0.004 U	< 0.0222 U	< 0.00393 U	< 0.00299 U	< 0.00304 UJ	< 0.003 U	< 0.00311 UJ	< 0.00151 UJ
Total	ADONA	919005-14-4	< 0.004 U	< 0.0222 U	< 0.00393 U	< 0.00299 U	< 0.00304 UJ	< 0.003 U	< 0.00311 UJ	< 0.0015 UJ
Total	HFPO-DA	13252-13-6	< 0.004 U	< 0.0222 U	< 0.00393 U	< 0.00284 U	< 0.00289 UJ	< 0.00285 U	< 0.00296 UJ	< 0.00143 UJ
Total	N-EtFOSA	4151-50-2	< 0.004 U	< 0.0139 U	< 0.00246 U	< 0.00187 U	< 0.0019 UJ	< 0.00187 U	< 0.00194 UJ	< 0.00094 UJ
Total	N-EtFOSAA	2991-50-6	< 0.004 U	< 0.0111 U	< 0.000983 U	< 0.000749 U	< 0.00076 UJ	0.00234	< 0.000778 UJ	< 0.000455 UJ
Total	N-EtFOSE	1691-99-2	< 0.004 U	< 0.0416 U	< 0.00737 U	< 0.00561 U	< 0.0057 UJ	< 0.00562 U	< 0.00583 UJ	< 0.00281 UJ
Total	N-MeFOSA	31506-32-8	< 0.004 U	< 0.00637 U	< 0.00113 U	< 0.000861 U	< 0.000874 UJ	< 0.000862 U	< 0.000894 UJ	< 0.000432 UJ
Total	N-MeFOSAA	2355-31-9	< 0.004 U	< 0.00554 U	< 0.000983 U	< 0.000749 U	< 0.00076 UJ	< 0.00075 U	< 0.000778 UJ	< 0.000376 UJ
Total	N-MeFOSE	24448-09-7	< 0.004 U	< 0.0554 U	< 0.00983 U	< 0.00749 U	< 0.0076 UJ	< 0.0075 U	< 0.00778 UJ	< 0.00376 UJ
Total	PFBA	375-22-4	0.37	0.285	0.46	0.259	0.39 J-	0.223	R	R
Total	PFBS	375-73-5	0.0048	< 0.00554 U	0.00402	0.00325	0.00453 J-	0.0026	0.0042 J-	0.00435 J-
Total	PFDA	335-76-2	< 0.004 U	< 0.00554 U	< 0.000983 U	0.00127 J	< 0.00076 UJ	0.00361	< 0.000778 UJ	0.00138 J-
Total	PFDoA	307-55-1	< 0.004 U	< 0.00554 U	< 0.000983 U	< 0.000749 U	< 0.00076 UJ	< 0.00075 U	< 0.000778 UJ	< 0.000376 UJ
Total	PFDoS	79780-39-5	NA	< 0.00554 U	< 0.000983 U	< 0.000749 U	< 0.00076 UJ	< 0.00075 U	< 0.000778 UJ	< 0.000376 UJ
Total	PFDS	335-77-3	< 0.004 U	< 0.00554 U	< 0.000983 U	< 0.000749 U	< 0.00076 UJ	< 0.00075 U	< 0.000778 UJ	< 0.000376 UJ
Total	PFHpA	375-85-9	0.01	0.00752 J	0.00638	0.0083	0.00987 J-	0.00697	0.0083 J-	0.00795 J-
Total	PFHpS	375-92-8	0.0025 J	< 0.00554 U	0.00103 J	0.00266	0.00175 J-	0.0036	0.00179 J-	0.00239 J-
Total	PFHxA	307-24-4	0.015	0.0122 J	0.0129	0.011	0.0154 J-	0.00864	0.0134 J-	0.0142 J-
Total	PFHxS	355-46-4	0.011	0.00844 J	0.00831	0.0106	0.0111 J-	0.00968	0.0105 J-	0.0107 J-
Total	PFNA	375-95-1	0.0015 J	< 0.00554 U	< 0.000983 U	0.00152	0.000893 J-	0.00277	0.000906 J-	0.00111 J-
Total	PFNS	68259-12-1	< 0.004 U	< 0.00554 U	< 0.000983 U	< 0.000749 U	< 0.00076 UJ	< 0.00075 U	< 0.000778 UJ	< 0.000376 UJ
Total	PFOA	335-67-1	0.075	0.0556	0.0541	0.0854	0.086 J-	0.0843	0.0784 J-	0.0814 J-
Total	PFOS	1763-23-1	0.22	0.151	0.091	0.336	0.132 J-	0.736	0.152 J-	0.262 J-
Total	PFOSA	754-91-6	0.0011 J	< 0.00554 U	< 0.000983 U	0.00128 J	< 0.00076 UJ	0.00194	0.00159 J-	0.00113 BJ-
Total	PFPeA	2706-90-3	0.015	< 0.0111 U	0.0131	0.00859	0.0128 J-	0.00738	0.0122 J-	0.0126 J-
Total	PFPeS	2706-91-4	0.0037 J+	< 0.00554 U	0.00247	0.00278	0.00351 J-	0.00247	0.00336 J-	0.00292 J-
Total	PFTeDA	376-06-7	< 0.004 U	< 0.00554 U	< 0.000983 U	< 0.000749 U	< 0.00076 UJ	< 0.00075 U	< 0.000778 UJ	< 0.000376 UJ
Total	PFTrDA	72629-94-8	< 0.004 U	< 0.00554 U	< 0.000983 U	< 0.000749 U	< 0.00076 UJ	< 0.00075 U	< 0.000778 UJ	< 0.000376 UJ
Total	PFUnA	2058-94-8	< 0.004 U	< 0.00554 U	< 0.000983 U	< 0.000749 U	< 0.00076 UJ	< 0.00075 U	< 0.000778 UJ	< 0.000376 UJ

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4a
West Lakeland Area Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
		Location	WL15	WL15	WL15	WL15	WL15A	WL17
		Location ID	PS00171	PS00171	PS00171	PS00171	PS00171	S016-076
		Sample Date	8/26/2020	9/1/2020	9/4/2020	9/16/2020	9/16/2020	8/13/2019
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	PS00171.2008261700.000S	PS00171.2009011735.000S	PS00171.2009041000.000S	PS00171.2009161530.000S	PS00171.2009161545.000S	S016-076.1908131605.000S
		Sample Name	WL15-WAT-BULK-01-082620	WL15-WAT-BULK-01-090120	WL15-WAT-BULK-01-090420	WL15-WAT-MID-01-091620	WL15A-WAT-MID-01-091620	WL17-WAT-SUR-01-081319
		Parent Sample ID	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #						
Total	10:2 FTS	120226-60-0	NA	NA	NA	< 0.0041 U	< 0.0041 U	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.00148 U	< 0.00148 UJ	< 0.00152 UJ	< 0.0041 UJ	< 0.0041 UJ	< 0.00292 U
Total	4:2 FTS	757124-72-4	< 0.00147 U	< 0.00147 UJ	< 0.00151 UJ	< 0.0041 U	< 0.0041 U	< 0.00292 U
Total	6:2 FTS	27619-97-2	< 0.00133 U	0.00972 BJ-	< 0.00136 UJ	0.023 BJ+	0.023 BJ+	< 0.00263 U
Total	8:2 FTS	39108-34-4	< 0.00147 U	< 0.00147 UJ	< 0.00151 UJ	< 0.0041 U	< 0.0041 U	< 0.00292 U
Total	9Cl-PF3ONS	756426-58-1	< 0.00148 U	< 0.00148 UJ	< 0.00152 UJ	< 0.0041 U	< 0.0041 U	< 0.00292 U
Total	ADONA	919005-14-4	< 0.00147 U	< 0.00147 UJ	< 0.00151 UJ	< 0.0041 U	< 0.0041 U	< 0.00292 U
Total	HFPO-DA	13252-13-6	< 0.0014 U	< 0.0014 UJ	< 0.00144 UJ	< 0.0041 U	< 0.0041 U	< 0.00292 U
Total	N-EtFOSA	4151-50-2	< 0.000921 U	< 0.000921 UJ	< 0.000946 UJ	0.00032 BJ	< 0.0041 U	< 0.00182 U
Total	N-EtFOSAA	2991-50-6	0.000479 J	0.00058 J-	0.000682 J-	< 0.0041 UJ	0.0019 J	< 0.00073 U
Total	N-EtFOSE	1691-99-2	< 0.00276 U	< 0.00276 UJ	< 0.00283 UJ	< 0.0041 U	< 0.0041 U	< 0.00547 U
Total	N-MeFOSA	31506-32-8	< 0.000424 U	< 0.000424 UJ	< 0.000435 UJ	< 0.0041 U	< 0.0041 U	< 0.000839 U
Total	N-MeFOSAA	2355-31-9	< 0.000368 U	< 0.000368 UJ	< 0.000378 UJ	< 0.0041 U	< 0.0041 U	< 0.00073 U
Total	N-MeFOSE	24448-09-7	< 0.00368 U	< 0.00368 UJ	< 0.00378 UJ	< 0.0041 U	< 0.0041 U	< 0.0073 U
Total	PFBA	375-22-4	R	0.394 J	0.396 J	0.38	0.38	0.42
Total	PFBS	375-73-5	0.00379	0.00419 J-	0.00436 J-	0.0044	0.0044	0.00436
Total	PFDA	335-76-2	0.00094 J	0.000923 J-	0.00104 J-	< 0.0041 U	0.0016 J	0.00114 J
Total	PFDoA	307-55-1	< 0.000368 U	< 0.000368 UJ	< 0.000378 UJ	< 0.0041 U	< 0.0041 U	< 0.00073 U
Total	PFDoS	79780-39-5	< 0.000368 U	< 0.000368 UJ	< 0.000378 UJ	NA	NA	< 0.00073 U
Total	PFDS	335-77-3	< 0.000368 U	< 0.000368 UJ	< 0.000378 UJ	< 0.0041 UJ	< 0.0041 UJ	< 0.00073 U
Total	PFHpA	375-85-9	0.00695	0.00725 J-	0.00726 J-	0.0072 B	0.01	0.00772
Total	PFHpS	375-92-8	0.00197	0.00178 J-	0.00184 J-	0.0028 J	0.0031 J	0.00163
Total	PFHxA	307-24-4	0.0118	0.013 J-	0.0131 J-	0.016	0.016	0.0128
Total	PFHxS	355-46-4	0.00957	0.0107 J-	0.0103 J-	0.0082	0.01	0.0103
Total	PFNA	375-95-1	0.00109 J	0.000895 J-	0.000919 J-	0.0019 J	0.0021 J	0.000868 J
Total	PFNS	68259-12-1	< 0.000368 U	< 0.000368 UJ	< 0.000378 UJ	< 0.0041 U	< 0.0041 U	< 0.00073 U
Total	PFOA	335-67-1	0.0688	0.0707 J-	0.0715 J-	0.074	0.069	0.0758
Total	PFOS	1763-23-1	0.226	0.208 J-	0.218 J-	0.2	0.17	0.185
Total	PFOSA	754-91-6	0.00121 J	0.00122 J-	0.000961 J-	0.0011 J	0.001 J	< 0.00073 U
Total	PFPeA	2706-90-3	0.0111	0.0127 J-	0.0131 J-	0.013	0.013	0.0127
Total	PFPeS	2706-91-4	0.0026	0.00273 J-	0.00292 J-	0.004 J	0.003 J	0.0022
Total	PFTeDA	376-06-7	< 0.000368 U	< 0.000368 UJ	< 0.000378 UJ	< 0.0041 U	0.0022 BJ	< 0.00073 U
Total	PFTrDA	72629-94-8	< 0.000368 U	< 0.000368 UJ	< 0.000378 UJ	< 0.0041 U	< 0.0041 U	< 0.00073 U
Total	PFUnA	2058-94-8	< 0.000368 U	< 0.000368 UJ	< 0.000378 UJ	< 0.0041 U	< 0.0041 U	< 0.00073 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4b
West Lakeland Area Sediment
Project 1007
Minneapolis, Minnesota

		Location Group	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
		Location	EP12	EP12	EP12	EP16	EP16	EP16	EP13	WL2
		Location ID	S016-070	S016-070	S016-070	S016-234	S016-234	S016-234	PS00165	82-0074-00-203
		Sample Date	8/13/2019	8/13/2019	11/21/2019	11/21/2019	4/27/2020	4/27/2020	8/15/2019	8/15/2019
		Sample Type Code	Sample	QC-FR	Sample	QC-FR	Sample	QC-FR	Sample	Sample
		Sample ID	S016-070.1908131310.000S	S016-070.1908131315.000SR	S016-070.1911211140.000S	S016-234.1911211105.000SR	S016-234.2004271400.000S	S016-234.2004271415.000SR	PS00165.1908150750.000S	82-0074-00-203.1908150630.000S
		Sample Name	EP12-SED-0-6-01-081319	EP12-SED-0-6-02-081319	EP12-SED-0-6-01-112119	EP16-SED-0-6-02-112119	EP16-SED-0-6-01-042720	EP16-SED-0-6-02-042720	EP13-SED-0-6-01-081519	WL2-SED-0-6-01-081519
		Parent Sample ID	NA	S016-070.1908131310.000S	NA	S016-234.1911211100.000S	NA	S016-234.2004271400.000S	NA	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.319 U	< 0.303 U	< 0.334 U	< 0.285 U	< 0.316 U	< 0.32 U	< 0.472 U	< 0.286 U
Total	4:2 FTS	757124-72-4	< 0.319 U	< 0.303 U	< 0.334 U	< 0.285 U	< 0.316 U	< 0.32 U	< 0.472 U	< 0.286 U
Total	6:2 FTS	27619-97-2	1.24 J	< 0.273 U	< 0.601 U	< 0.513 U	< 0.285 U	< 0.288 U	2.24 J	< 0.257 U
Total	8:2 FTS	39108-34-4	< 0.319 U	< 0.303 U	< 0.334 U	< 0.285 U	< 0.316 U	< 0.32 U	< 0.472 U	< 0.286 U
Total	9Cl-PF3ONS	756426-58-1	< 0.319 U	< 0.303 U	< 0.334 U	< 0.285 U	< 0.316 U	< 0.32 U	< 0.472 U	< 0.286 U
Total	ADONA	919005-14-4	< 0.319 U	< 0.303 U	< 0.334 U	< 0.285 U	< 0.316 U	< 0.32 U	< 0.472 U	< 0.286 U
Total	HFPO-DA	13252-13-6	< 0.319 U	< 0.303 U	< 0.334 U	< 0.285 U	< 0.301 U	< 0.304 U	< 0.472 U	< 0.286 U
Total	N-EtFOSA	4151-50-2	< 0.199 U	< 0.189 U	< 0.209 U	< 0.178 U	< 0.198 U	< 0.2 U	< 0.295 U	< 0.179 U
Total	N-EtFOSAA	2991-50-6	< 0.0798 U	< 0.0757 U	< 0.167 U	< 0.143 U	< 0.0791 U	< 0.0801 U	< 0.118 U	< 0.0714 U
Total	N-EtFOSE	1691-99-2	< 0.598 U	< 0.568 U	< 0.626 U	< 0.534 U	< 0.593 U	< 0.6 U	< 0.885 U	< 0.536 U
Total	N-MeFOSA	31506-32-8	< 0.0917 U	< 0.0871 U	< 0.0961 U	< 0.0819 U	< 0.091 U	< 0.0921 U	< 0.136 U	< 0.0822 U
Total	N-MeFOSAA	2355-31-9	< 0.0798 U	< 0.0757 U	< 0.0835 U	< 0.0713 U	< 0.0791 U	< 0.0801 U	< 0.118 U	< 0.0714 U
Total	N-MeFOSE	24448-09-7	< 0.798 U	< 0.757 U	< 0.835 U	< 0.713 U	< 0.791 U	< 0.801 U	< 1.18 U	< 0.714 U
Total	PFBA	375-22-4	< 0.319 U	< 0.303 U	< 0.334 U	0.691	0.387 J-	0.395 J-	0.958 J	< 0.286 U
Total	PFBS	375-73-5	< 0.0798 U	< 0.0757 U	< 0.0835 U	< 0.0713 U	< 0.0791 U	< 0.0801 U	< 0.118 U	< 0.0714 U
Total	PFDA	335-76-2	< 0.0798 U	< 0.0757 U	< 0.0835 U	0.077 J	< 0.0791 U	< 0.0801 U	< 0.118 U	< 0.0714 U
Total	PFDoA	307-55-1	< 0.0798 U	< 0.0757 U	< 0.0835 U	< 0.0713 U	< 0.0791 U	< 0.0801 U	< 0.118 U	< 0.0714 U
Total	PFDoS	79780-39-5	< 0.0798 U	< 0.0757 U	< 0.0835 U	< 0.0713 U	< 0.0791 UJ	< 0.0801 UJ	< 0.118 U	< 0.0714 U
Total	PFDS	335-77-3	< 0.0798 U	< 0.0757 U	< 0.0835 U	< 0.0713 U	< 0.0791 U	< 0.0801 U	< 0.118 U	< 0.0714 U
Total	PFHpA	375-85-9	< 0.0798 U	< 0.0757 U	< 0.0835 U	< 0.0713 U	< 0.0791 U	< 0.0801 U	< 0.118 U	< 0.0714 U
Total	PFHpS	375-92-8	< 0.0798 U	< 0.0757 U	< 0.0835 U	< 0.0713 U	< 0.0791 U	< 0.0801 U	< 0.118 U	< 0.0714 U
Total	PFHxA	307-24-4	< 0.0798 U	< 0.0757 U	< 0.0835 U	< 0.0713 U	< 0.0791 U	< 0.0801 U	< 0.118 U	< 0.0714 U
Total	PFHxS	355-46-4	< 0.0798 U	< 0.0757 U	< 0.0835 U	< 0.0713 U	< 0.0791 U	< 0.0801 U	< 0.118 U	< 0.0714 U
Total	PFNA	375-95-1	< 0.0798 U	< 0.0757 U	< 0.0835 U	< 0.0713 U	< 0.0791 U	< 0.0801 U	< 0.118 U	0.11 J
Total	PFNS	68259-12-1	< 0.0798 U	< 0.0757 U	< 0.0835 U	< 0.0713 U	< 0.0791 U	< 0.0801 U	< 0.118 U	< 0.0714 U
Total	PFOA	335-67-1	< 0.0798 U	< 0.0757 U	< 0.0835 U	0.426	0.122 J-	0.113 J-	0.237	< 0.0714 U
Total	PFOS	1763-23-1	0.797	0.76	0.54	7.37	1.23 J-	1.3 J-	0.287	0.83
Total	PFOSA	754-91-6	< 0.0798 U	< 0.0757 U	< 0.0835 U	< 0.0713 U	< 0.0791 U	< 0.0801 UJ	< 0.118 U	< 0.0714 U
Total	PFPeA	2706-90-3	< 0.16 U	< 0.151 U	< 0.167 U	< 0.143 U	< 0.158 U	< 0.16 UJ	< 0.236 U	< 0.143 U
Total	PFPeS	2706-91-4	< 0.0798 U	< 0.0757 U	< 0.0835 U	< 0.0713 U	< 0.0791 U	< 0.0801 UJ	< 0.118 U	< 0.0714 U
Total	PFTeDA	376-06-7	< 0.0798 U	< 0.0757 U	< 0.0835 U	< 0.0713 U	< 0.0791 U	< 0.0801 UJ	< 0.118 U	< 0.0714 U
Total	PFTrDA	72629-94-8	< 0.0798 U	< 0.0757 U	< 0.0835 U	< 0.0713 U	< 0.0791 U	< 0.0801 UJ	< 0.118 U	< 0.0714 U
Total	PFUnA	2058-94-8	< 0.0798 U	< 0.0757 U	< 0.0835 U	< 0.0713 U	< 0.0791 U	< 0.0801 UJ	< 0.118 U	0.074 J

NOTES
All results are reported in micrograms per kilogram (ug/kg).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4b
West Lakeland Area Sediment
Project 1007
Minneapolis, Minnesota

		Location Group	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
		Location	WL2	WL3	WL5	WL5	WL6	WL6	WL7
		Location ID	82-0074-00-203	82-0074-00-204	82-0074-00-205	82-0074-00-205	S016-071	S016-071	S016-072
		Sample Date	9/22/2020	8/27/2019	8/14/2019	9/17/2020	8/14/2019	9/24/2020	8/14/2019
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	82-0074-00-203.2009220950.000S	82-0074-00-204.1908271120.000S	82-0074-00-205.1908141400.000S	82-0074-00-205.2009171600.000S	S016-071.1908141330.000S	S016-071.2009241620.000S	S016-072.1908141135.000S
		Sample Name	WL2-SED-0-6-01-092220	WL3-SED-0-6-01-082719	WL5-SED-0-6-01-081419	WL5-SED-0-6-01-091720	WL6-SED-0-6-01-081419	WL6-SED-0-6-01-092420	WL7-SED-0-6-01-081419
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #							
Total	10:2 FTS	120226-60-0	< 1.3 U	NA	NA	< 1.1 U	NA	< 1.3 U	NA
Total	11Cl-PF3OUdS	763051-92-9	< 1.3 UJ	< 0.298 U	< 0.304 U	< 1.1 UJ	< 0.305 U	< 1.3 UJ	< 0.276 U
Total	4:2 FTS	757124-72-4	< 1.3 U	< 0.298 U	< 0.304 U	< 1.1 U	< 0.305 U	< 1.3 U	< 0.276 U
Total	6:2 FTS	27619-97-2	< 1.3 U	< 0.269 U	< 0.273 U	< 1.1 U	< 0.274 U	< 1.3 U	< 0.248 U
Total	8:2 FTS	39108-34-4	< 1.3 U	< 0.298 U	< 0.304 U	< 1.1 U	< 0.305 U	< 1.3 U	< 0.276 U
Total	9Cl-PF3ONS	756426-58-1	< 1.3 U	< 0.298 U	< 0.304 U	< 1.1 U	< 0.305 U	< 1.3 U	< 0.276 U
Total	ADONA	919005-14-4	< 1.3 U	< 0.298 U	< 0.304 U	< 1.1 U	< 0.305 U	< 1.3 U	< 0.276 U
Total	HFPO-DA	13252-13-6	< 1.3 U	< 0.298 U	< 0.304 U	< 1.1 U	< 0.305 U	< 1.3 U	< 0.276 U
Total	N-EtFOSA	4151-50-2	< 1.3 U	< 0.187 U	< 0.19 U	< 1.1 U	< 0.191 U	< 1.3 U	< 0.172 U
Total	N-EtFOSAA	2991-50-6	< 1.3 UJ	0.081 J	< 0.0759 U	< 1.1 UJ	< 0.0762 U	< 1.3 UJ	< 0.0689 U
Total	N-EtFOSE	1691-99-2	< 1.3 U	< 0.56 U	< 0.569 U	< 1.1 U	< 0.572 U	< 1.3 U	< 0.517 U
Total	N-MeFOSA	31506-32-8	< 1.3 U	< 0.0858 U	< 0.0873 U	0.09 J	< 0.0877 U	< 1.3 U	< 0.0792 U
Total	N-MeFOSAA	2355-31-9	< 1.3 U	< 0.0746 U	< 0.0759 U	< 1.1 U	< 0.0762 U	< 1.3 U	< 0.0689 U
Total	N-MeFOSE	24448-09-7	< 1.3 U	< 0.746 U	< 0.759 U	< 1.1 U	< 0.762 U	< 1.3 U	< 0.689 U
Total	PFBA	375-22-4	< 1.3 U	< 0.298 U	< 0.304 U	< 1.1 U	0.361 J	< 1.3 U	< 0.276 U
Total	PFBS	375-73-5	< 1.3 U	< 0.0746 U	< 0.0759 U	< 1.1 U	< 0.0762 U	< 1.3 UJ	< 0.0689 U
Total	PFDA	335-76-2	< 1.3 U	< 0.0746 U	< 0.0759 U	< 1.1 U	< 0.0762 U	< 1.3 U	< 0.0689 U
Total	PFDoA	307-55-1	< 1.3 U	< 0.0746 U	< 0.0759 U	< 1.1 U	< 0.0762 U	< 1.3 U	< 0.0689 U
Total	PFDoS	79780-39-5	NA	< 0.0746 U	< 0.0759 U	NA	< 0.0762 U	NA	< 0.0689 U
Total	PFDS	335-77-3	< 1.3 U	< 0.0746 U	< 0.0759 U	< 1.1 U	< 0.0762 U	< 1.3 U	< 0.0689 U
Total	PFHpA	375-85-9	< 1.3 U	< 0.0746 U	< 0.0759 U	< 1.1 U	< 0.0762 U	< 1.3 U	< 0.0689 U
Total	PFHpS	375-92-8	< 1.3 U	< 0.0746 U	< 0.0759 U	< 1.1 U	< 0.0762 U	< 1.3 U	< 0.0689 U
Total	PFHxA	307-24-4	0.45 J	< 0.0746 U	< 0.0759 U	< 1.1 U	< 0.0762 U	< 1.3 U	< 0.0689 U
Total	PFHxS	355-46-4	< 1.3 U	< 0.0746 U	< 0.0759 U	< 1.1 U	< 0.0762 U	< 1.3 U	< 0.0689 U
Total	PFNA	375-95-1	< 1.3 U	< 0.0746 U	< 0.0759 U	< 1.1 U	< 0.0762 U	< 1.3 U	< 0.0689 U
Total	PFNS	68259-12-1	< 1.3 U	< 0.0746 U	< 0.0759 U	< 1.1 U	< 0.0762 U	< 1.3 U	< 0.0689 U
Total	PFOA	335-67-1	0.29 J	< 0.0746 U	< 0.0759 U	0.19 BJ	0.221	0.26 J	< 0.0689 U
Total	PFOS	1763-23-1	1.3 J	2.86	1.05	1.7	4.81	2.3	1.1
Total	PFOSA	754-91-6	< 1.3 U	< 0.0746 U	< 0.0759 U	0.1 J	< 0.0762 U	< 1.3 U	< 0.0689 U
Total	PFPeA	2706-90-3	0.29 J	< 0.149 U	< 0.152 U	< 1.1 U	< 0.152 U	0.28 J	< 0.138 U
Total	PFPeS	2706-91-4	< 1.3 U	< 0.0746 U	< 0.0759 U	< 1.1 U	< 0.0762 U	< 1.3 U	< 0.0689 U
Total	PFTeDA	376-06-7	0.37 BJ	< 0.0746 U	< 0.0759 U	0.23 BJ	< 0.0762 U	0.32 BJ	< 0.0689 U
Total	PFTrDA	72629-94-8	< 1.3 U	< 0.0746 U	< 0.0759 U	< 1.1 U	< 0.0762 U	< 1.3 U	< 0.0689 U
Total	PFUnA	2058-94-8	< 1.3 U	< 0.0746 U	< 0.0759 U	< 1.1 U	< 0.0762 U	< 1.3 U	< 0.0689 U

NOTES
All results are reported in micrograms per kilogram (ug/kg).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4b
West Lakeland Area Sediment
Project 1007
Minneapolis, Minnesota

		Location Group	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
		Location	WL7	WL8A	WL22	WL9	WL9	WL10	WL10	WL10A
		Location ID	S016-072	PS00167	PS00178	PS00168	PS00168	S016-073	S016-073	S016-073
		Sample Date	9/24/2020	9/22/2020	8/19/2020	8/14/2019	8/14/2019	8/13/2019	9/22/2020	9/22/2020
		Sample Type Code	Sample	Sample	Sample	Sample	QC-FR	Sample	Sample	Sample
		Sample ID	S016-072.2009241530.000S	PS00167.2009221045.000S	PS00178.2008190955.000S	PS00168.1908141630.000S	PS00168.1908141635.000SR	S016-073.1908131530.000S	S016-073.2009221235.000S	S016-073.2009221345.000S
		Sample Name	WL7-SED-0-6-01-092420	WL8A-SED-0-6-01-092220	WL22-SED-0-6-01-081920	WL9-SED-0-6-01-081419	WL9-SED-0-6-02-081419	WL10-SED-0-6-01-081319	WL10-SED-0-6-01-092220	WL10A-SED-0-6-01-092220
		Parent Sample ID	NA	NA	NA	NA	PS00168.1908141630.000S	NA	NA	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	< 1.1 U	< 1.3 U	NA	NA	NA	NA	< 1.2 U	< 1.2 U
Total	11Cl-PF3OUdS	763051-92-9	< 1.1 UJ	< 1.3 UJ	< 0.153 UJ	< 0.296 U	< 0.296 U	< 0.266 U	< 1.2 UJ	< 1.2 UJ
Total	4:2 FTS	757124-72-4	< 1.1 U	< 1.3 U	< 0.153 UJ	< 0.296 U	< 0.296 U	< 0.266 U	< 1.2 U	< 1.2 U
Total	6:2 FTS	27619-97-2	< 1.1 U	< 1.3 U	0.201 J-	< 0.266 U	< 0.267 U	< 0.239 U	< 1.2 U	< 1.2 U
Total	8:2 FTS	39108-34-4	< 1.1 U	< 1.3 U	< 0.153 UJ	< 0.296 U	< 0.296 U	< 0.266 U	< 1.2 U	< 1.2 U
Total	9Cl-PF3ONS	756426-58-1	< 1.1 U	< 1.3 U	< 0.153 UJ	< 0.296 U	< 0.296 U	< 0.266 U	< 1.2 U	< 1.2 U
Total	ADONA	919005-14-4	< 1.1 U	< 1.3 U	< 0.153 UJ	< 0.296 U	< 0.296 U	< 0.266 U	< 1.2 U	< 1.2 U
Total	HFPO-DA	13252-13-6	< 1.1 U	< 1.3 U	< 0.145 UJ	< 0.296 U	< 0.296 U	< 0.266 U	< 1.2 U	< 1.2 U
Total	N-EtFOSA	4151-50-2	< 1.1 U	< 1.3 U	< 0.0956 UJ	< 0.185 U	< 0.185 U	< 0.166 U	< 1.2 U	< 1.2 U
Total	N-EtFOSAA	2991-50-6	< 1.1 UJ	< 1.3 UJ	< 0.0382 UJ	< 0.074 U	< 0.0741 U	< 0.0665 U	0.6 J	0.59 J
Total	N-EtFOSE	1691-99-2	< 1.1 U	< 1.3 U	< 0.286 UJ	< 0.555 U	< 0.556 U	< 0.499 U	< 1.2 U	< 1.2 U
Total	N-MeFOSA	31506-32-8	< 1.1 U	< 1.3 U	< 0.044 UJ	< 0.0851 U	< 0.0852 U	< 0.0765 U	0.088 BJ	< 1.2 U
Total	N-MeFOSAA	2355-31-9	< 1.1 U	< 1.3 U	< 0.0382 UJ	< 0.074 U	< 0.0741 U	< 0.0665 U	< 1.2 U	< 1.2 U
Total	N-MeFOSE	24448-09-7	< 1.1 U	< 1.3 U	< 0.382 UJ	< 0.74 U	< 0.741 U	< 0.665 U	< 1.2 U	< 1.2 U
Total	PFBA	375-22-4	< 1.1 U	< 1.3 U	0.342 J-	< 0.296 U	< 0.296 U	< 0.266 U	< 1.2 U	< 1.2 U
Total	PFBS	375-73-5	< 1.1 U	< 1.3 U	< 0.0382 UJ	< 0.074 U	< 0.0741 U	< 0.0665 U	< 1.2 U	< 1.2 UJ
Total	PFDA	335-76-2	< 1.1 U	< 1.3 U	0.047 J-	< 0.074 U	< 0.0741 U	< 0.0665 U	< 1.2 U	< 1.2 U
Total	PFDoA	307-55-1	< 1.1 U	< 1.3 U	< 0.0382 UJ	< 0.074 U	< 0.0741 U	< 0.0665 U	< 1.2 U	< 1.2 U
Total	PFDoS	79780-39-5	NA	NA	< 0.0382 UJ	< 0.074 U	< 0.0741 U	< 0.0665 U	NA	NA
Total	PFDS	335-77-3	< 1.1 U	< 1.3 U	< 0.0382 UJ	< 0.074 U	< 0.0741 U	< 0.0665 U	< 1.2 U	< 1.2 U
Total	PFHpA	375-85-9	< 1.1 U	< 1.3 U	< 0.0382 UJ	< 0.074 U	< 0.0741 U	< 0.0665 U	< 1.2 U	< 1.2 U
Total	PFHpS	375-92-8	< 1.1 U	< 1.3 U	< 0.0382 UJ	< 0.074 U	< 0.0741 U	< 0.0665 U	< 1.2 U	< 1.2 U
Total	PFHxA	307-24-4	0.37 J	< 1.3 U	0.047 J-	< 0.074 U	< 0.0741 U	< 0.0665 U	< 1.2 U	< 1.2 U
Total	PFHxS	355-46-4	< 1.1 U	< 1.3 U	< 0.0382 UJ	< 0.074 U	< 0.0741 U	< 0.0665 U	< 1.2 U	< 1.2 U
Total	PFNA	375-95-1	< 1.1 U	< 1.3 U	< 0.0382 UJ	< 0.074 U	< 0.0741 U	< 0.0665 U	< 1.2 U	< 1.2 U
Total	PFNS	68259-12-1	< 1.1 U	< 1.3 U	< 0.0382 UJ	< 0.074 U	< 0.0741 U	< 0.0665 U	< 1.2 U	< 1.2 U
Total	PFOA	335-67-1	0.27 J	0.38 J	0.26 J-	< 0.074 U	< 0.0741 U	0.125 J	0.31 J	0.34 J
Total	PFOS	1763-23-1	0.88 J	0.95 J	3.25 J-	0.917	0.66	3.18	1.2	1.5
Total	PFOSA	754-91-6	< 1.1 U	< 1.3 U	< 0.0382 UJ	< 0.074 U	< 0.0741 U	< 0.0665 U	< 1.2 U	< 1.2 U
Total	PFPeA	2706-90-3	< 1.1 U	< 1.3 U	< 0.0765 UJ	< 0.148 U	< 0.148 U	< 0.133 U	< 1.2 U	0.32 J
Total	PFPeS	2706-91-4	< 1.1 U	< 1.3 U	< 0.0384 UJ	< 0.074 U	< 0.0741 U	< 0.0665 U	< 1.2 U	< 1.2 U
Total	PFTeDA	376-06-7	0.38 BJ	0.48 BJ	< 0.0382 UJ	< 0.074 U	< 0.0741 U	< 0.0665 U	0.39 BJ	0.54 BJ
Total	PFTrDA	72629-94-8	< 1.1 U	< 1.3 U	< 0.0382 UJ	< 0.074 U	< 0.0741 U	< 0.0665 U	< 1.2 U	< 1.2 U
Total	PFUnA	2058-94-8	< 1.1 U	< 1.3 U	< 0.0382 UJ	< 0.074 U	< 0.0741 U	< 0.0665 U	< 1.2 U	< 1.2 U

NOTES
All results are reported in micrograms per kilogram (ug/kg).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4b
West Lakeland Area Sediment
Project 1007
Minneapolis, Minnesota

		Location Group	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
		Location	WL12	WL14	WL15	WL16	WL21	WL23	WL11	WL11
		Location ID	PS00169	PS00170	PS00171	PS00172	PS00174	PS00179	S016-074	S016-074
		Sample Date	8/14/2019	8/14/2019	8/14/2019	9/23/2020	8/19/2020	8/19/2020	8/13/2019	9/22/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	PS00169.1908141600.000S	PS00170.1908141130.000S	PS00171.1908141015.000S	PS00172.2009231445.000S	PS00174.2008191140.000S	PS00179.2008191110.000S	S016-074.1908131555.000S	S016-074.2009221200.000S
		Sample Name	WL12-SED-0-6-01-081419	WL14-SED-0-6-01-081419	WL15-SED-0-6-01-081419	WL16-SED-0-6-01-092320	WL21-SED-0-6-01-081920	WL23-SED-0-6-01-081920	WL11-SED-0-6-01-081319	WL11-SED-0-6-01-092220
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	NA	NA	NA	< 1.1 U	NA	NA	NA	< 1.1 U
Total	11Cl-PF3OUdS	763051-92-9	< 0.295 U	< 0.3 U	< 0.317 U	< 1.1 UJ	< 0.155 UJ	< 0.102 UJ	< 0.31 U	< 1.1 UJ
Total	4:2 FTS	757124-72-4	< 0.295 U	< 0.3 U	< 0.317 U	< 1.1 U	< 0.155 UJ	< 0.102 UJ	< 0.31 U	< 1.1 U
Total	6:2 FTS	27619-97-2	< 0.266 U	< 0.27 U	< 0.286 U	< 1.1 U	< 0.139 UJ	< 0.0917 UJ	< 0.558 U	0.7 J
Total	8:2 FTS	39108-34-4	< 0.295 U	< 0.3 U	< 0.317 U	< 1.1 U	< 0.155 UJ	< 0.102 UJ	< 0.31 U	< 1.1 U
Total	9Cl-PF3ONS	756426-58-1	< 0.295 U	< 0.3 U	< 0.317 U	< 1.1 U	< 0.155 UJ	< 0.102 UJ	< 0.31 U	< 1.1 U
Total	ADONA	919005-14-4	< 0.295 U	< 0.3 U	< 0.317 U	< 1.1 U	< 0.155 UJ	< 0.102 UJ	< 0.31 U	< 1.1 U
Total	HFPO-DA	13252-13-6	< 0.295 U	< 0.3 U	< 0.317 U	< 1.1 U	< 0.147 UJ	< 0.0967 UJ	< 0.31 U	< 1.1 U
Total	N-EtFOSA	4151-50-2	< 0.185 U	< 0.187 U	< 0.198 U	< 1.1 U	R	< 0.0636 UJ	< 0.194 U	< 1.1 U
Total	N-EtFOSAA	2991-50-6	< 0.0739 U	< 0.075 U	< 0.0793 U	< 1.1 UJ	0.105 J-	< 0.0254 UJ	< 0.155 U	< 1.1 UJ
Total	N-EtFOSE	1691-99-2	< 0.554 U	< 0.562 U	< 0.595 U	< 1.1 U	< 0.289 UJ	< 0.19 UJ	< 0.582 U	< 1.1 U
Total	N-MeFOSA	31506-32-8	< 0.085 U	< 0.0862 U	< 0.0912 U	0.088 BJ	< 0.0445 UJ	< 0.0292 UJ	< 0.0892 U	0.098 BJ
Total	N-MeFOSAA	2355-31-9	< 0.0739 U	< 0.075 U	< 0.0793 U	< 1.1 U	< 0.0387 UJ	< 0.0254 UJ	< 0.0775 U	< 1.1 U
Total	N-MeFOSE	24448-09-7	< 0.739 U	< 0.75 U	< 0.793 U	< 1.1 U	< 0.387 UJ	< 0.254 UJ	< 0.775 U	< 1.1 U
Total	PFBA	375-22-4	< 0.295 U	< 0.3 U	< 0.317 U	< 1.1 U	0.522 J-	0.171 J-	< 0.31 U	0.54 J
Total	PFBS	375-73-5	< 0.0739 U	< 0.075 U	< 0.0793 U	< 1.1 U	< 0.0387 UJ	< 0.0254 UJ	< 0.0775 U	< 1.1 U
Total	PFDA	335-76-2	< 0.0739 U	< 0.075 U	< 0.0793 U	< 1.1 U	0.068 J-	< 0.0254 UJ	< 0.0775 U	< 1.1 U
Total	PFDoA	307-55-1	< 0.0739 U	< 0.075 U	< 0.0793 U	< 1.1 U	< 0.0387 UJ	< 0.0254 UJ	< 0.0775 U	< 1.1 U
Total	PFDoS	79780-39-5	< 0.0739 U	< 0.075 U	< 0.0793 U	NA	< 0.0387 UJ	< 0.0254 UJ	< 0.0775 U	NA
Total	PFDS	335-77-3	< 0.0739 U	< 0.075 U	< 0.0793 U	< 1.1 U	0.044 J-	< 0.0254 UJ	< 0.0775 U	< 1.1 U
Total	PFHpA	375-85-9	< 0.0739 U	< 0.075 U	< 0.0793 U	< 1.1 U	< 0.0387 UJ	< 0.0254 UJ	< 0.0775 U	< 1.1 U
Total	PFHpS	375-92-8	< 0.0739 U	< 0.075 U	< 0.0793 U	< 1.1 U	< 0.0387 UJ	< 0.0254 UJ	< 0.0775 U	< 1.1 U
Total	PFHxA	307-24-4	< 0.0739 U	< 0.075 U	< 0.0793 U	< 1.1 U	< 0.0387 UJ	< 0.0254 UJ	< 0.0775 U	< 1.1 U
Total	PFHxS	355-46-4	< 0.0739 U	< 0.075 U	< 0.0793 U	< 1.1 U	0.098 J-	< 0.0254 UJ	< 0.0775 U	< 1.1 U
Total	PFNA	375-95-1	< 0.0739 U	< 0.075 U	< 0.0793 U	< 1.1 U	< 0.0387 UJ	< 0.0254 UJ	< 0.0775 U	< 1.1 U
Total	PFNS	68259-12-1	< 0.0739 U	< 0.075 U	< 0.0793 U	< 1.1 U	< 0.0387 UJ	< 0.0254 UJ	< 0.0775 U	< 1.1 U
Total	PFOA	335-67-1	< 0.0739 U	0.203	0.137 J	0.27 J	0.376 J-	0.053 J-	0.092 J	0.47 J
Total	PFOS	1763-23-1	0.939	3.82	3.17	1.8	8.59 J-	0.917 J-	1.14	2.5
Total	PFOSA	754-91-6	< 0.0739 U	< 0.075 U	< 0.0793 U	< 1.1 U	0.079 J-	< 0.0254 UJ	< 0.0775 U	< 1.1 U
Total	PFPeA	2706-90-3	< 0.148 U	< 0.15 U	< 0.159 U	0.24 J	< 0.0773 UJ	< 0.0509 UJ	< 0.155 U	< 1.1 U
Total	PFPeS	2706-91-4	< 0.0739 U	< 0.075 U	< 0.0793 U	< 1.1 U	< 0.0389 UJ	< 0.0256 UJ	< 0.0775 U	< 1.1 U
Total	PFTeDA	376-06-7	< 0.0739 U	< 0.075 U	< 0.0793 U	0.23 BJ	< 0.0387 UJ	< 0.0254 UJ	< 0.0775 U	0.31 BJ
Total	PFTrDA	72629-94-8	< 0.0739 U	< 0.075 U	< 0.0793 U	< 1.1 U	< 0.0387 UJ	< 0.0254 UJ	< 0.0775 U	< 1.1 U
Total	PFUnA	2058-94-8	< 0.0739 U	< 0.075 U	< 0.0793 U	< 1.1 U	0.052 J-	< 0.0254 UJ	< 0.0775 U	< 1.1 U

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Analytical method (other events) = AXYS_MLA-110.

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- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4b
West Lakeland Area Sediment
Project 1007
Minneapolis, Minnesota

		Location Group	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
		Location	WL13	WL13	WL17	EP16
		Location ID	S016-075	S016-075	S016-076	S016-234
		Sample Date	8/14/2019	9/25/2020	8/13/2019	11/21/2019
		Sample Type Code	Sample	Sample	Sample	Sample
		Sample ID	S016-075.1908141445.000S	S016-075.2009250900.000S	S016-076.1908131600.000S	S016-234.1911211100.000S
		Sample Name	WL13-SED-0-6-01-081419	WL13-SED-0-6-01-092520	WL17-SED-0-6-01-081319	EP16-SED-0-6-01-112119
		Parent Sample ID	NA	NA	NA	NA
Fraction	Compound	CAS #				
Total	10:2 FTS	120226-60-0	NA	< 0.99 U	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.312 U	< 0.99 UJ	< 0.295 U	< 0.302 U
Total	4:2 FTS	757124-72-4	< 0.312 U	< 0.99 U	< 0.295 U	< 0.302 U
Total	6:2 FTS	27619-97-2	< 0.281 U	< 0.99 U	< 0.266 U	< 0.543 U
Total	8:2 FTS	39108-34-4	< 0.312 U	< 0.99 U	< 0.295 U	< 0.302 U
Total	9Cl-PF3ONS	756426-58-1	< 0.312 U	< 0.99 U	< 0.295 U	< 0.302 U
Total	ADONA	919005-14-4	< 0.312 U	< 0.99 U	< 0.295 U	< 0.302 U
Total	HFPO-DA	13252-13-6	< 0.312 U	< 0.99 U	< 0.295 U	< 0.302 U
Total	N-EtFOSA	4151-50-2	< 0.195 U	< 0.99 U	< 0.185 U	< 0.189 U
Total	N-EtFOSAA	2991-50-6	< 0.0781 U	< 0.99 UJ	< 0.0738 U	< 0.151 U
Total	N-EtFOSE	1691-99-2	< 0.586 U	< 0.99 U	< 0.554 U	< 0.566 U
Total	N-MeFOSA	31506-32-8	< 0.0898 U	0.074 BJ	< 0.0849 U	< 0.0868 U
Total	N-MeFOSAA	2355-31-9	< 0.0781 U	< 0.99 U	< 0.0738 U	< 0.0755 U
Total	N-MeFOSE	24448-09-7	< 0.781 U	< 0.99 U	< 0.738 U	< 0.755 U
Total	PFBA	375-22-4	< 0.312 U	< 0.99 U	< 0.295 U	0.785
Total	PFBS	375-73-5	< 0.0781 U	< 0.99 U	< 0.0738 U	< 0.0755 U
Total	PFDA	335-76-2	< 0.0781 U	< 0.99 U	< 0.0738 U	< 0.0755 U
Total	PFDoA	307-55-1	< 0.0781 U	< 0.99 U	< 0.0738 U	< 0.0755 U
Total	PFDoS	79780-39-5	< 0.0781 U	NA	< 0.0738 U	< 0.0755 U
Total	PFDS	335-77-3	< 0.0781 U	< 0.99 U	< 0.0738 U	< 0.0755 U
Total	PFHpA	375-85-9	< 0.0781 U	< 0.99 U	< 0.0738 U	< 0.0755 U
Total	PFHpS	375-92-8	< 0.0781 U	< 0.99 U	< 0.0738 U	< 0.0755 U
Total	PFHxA	307-24-4	< 0.0781 U	< 0.99 U	< 0.0738 U	< 0.0755 U
Total	PFHxS	355-46-4	< 0.0781 U	< 0.99 U	< 0.0738 U	< 0.0755 U
Total	PFNA	375-95-1	< 0.0781 U	< 0.99 U	< 0.0738 U	< 0.0755 U
Total	PFNS	68259-12-1	< 0.0781 U	< 0.99 U	< 0.0738 U	< 0.0755 U
Total	PFOA	335-67-1	0.106 J	0.3 J	0.081 J	0.486
Total	PFOS	1763-23-1	2.04	0.56 J	1.7	5.67
Total	PFOSA	754-91-6	< 0.0781 U	< 0.99 U	< 0.0738 U	< 0.0755 U
Total	PFPeA	2706-90-3	< 0.156 U	< 0.99 U	< 0.148 U	< 0.151 U
Total	PFPeS	2706-91-4	< 0.0781 U	< 0.99 U	< 0.0738 U	< 0.0755 U
Total	PFTeDA	376-06-7	< 0.0781 U	0.27 BJ	< 0.0738 U	< 0.0755 U
Total	PFTrDA	72629-94-8	< 0.0781 U	< 0.99 U	< 0.0738 U	< 0.0755 U
Total	PFUnA	2058-94-8	< 0.0781 U	< 0.99 U	< 0.0738 U	< 0.0755 U

NOTES
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CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4c
West Lakeland Area Pore Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
		Location	WL2	WL5	WL6	WL7	WL8A	WL8A
		Location ID	82-0074-00-203	82-0074-00-205	S016-071	S016-072	PS00167	PS00167
		Sample Date	9/22/2020	9/17/2020	9/24/2020	9/24/2020	9/22/2020	9/22/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	QC-FR
		Sample ID	82-0074-00-203.2009220945.000S	82-0074-00-205.2009171545.000S	S016-071.2009241610.000S	S016-072.2009241520.000S	PS00167.2009221030.000S	PS00167.2009221035.000SR
		Sample Name	WL2-POWAT-01-092220	WL5-POWAT-01-091720	WL6-POWAT-01-092420	WL7-POWAT-01-092420	WL8A-POWAT-01-092220	WL8A-POWAT-02-092220
		Parent Sample ID	NA	NA	NA	NA	NA	PS00167.2009221030.000S
Fraction	Compound	CAS #						
Dissolved	10:2 FTS	120226-60-0	< 0.0044 U	< 0.0041 U	< 0.0042 U	< 0.004 U	< 0.0042 U	< 0.0043 U
Dissolved	11Cl-PF3OUdS	763051-92-9	< 0.0044 U	< 0.0041 UJ	< 0.0042 U	< 0.004 U	< 0.0042 U	< 0.0043 U
Dissolved	4:2 FTS	757124-72-4	< 0.0044 U	< 0.0041 U	< 0.0042 U	< 0.004 U	< 0.0042 U	< 0.0043 U
Dissolved	6:2 FTS	27619-97-2	< 0.0044 U	< 0.0041 U	< 0.0042 U	< 0.004 U	< 0.0042 U	< 0.0043 U
Dissolved	8:2 FTS	39108-34-4	< 0.0044 U	< 0.0041 U	< 0.0042 U	< 0.004 U	< 0.0042 U	< 0.0043 U
Dissolved	9Cl-PF3ONS	756426-58-1	< 0.0044 U	< 0.0041 U	< 0.0042 U	< 0.004 U	< 0.0042 U	< 0.0043 U
Dissolved	ADONA	919005-14-4	< 0.0044 U	< 0.0041 U	< 0.0042 U	< 0.004 U	< 0.0042 U	< 0.0043 U
Dissolved	HFPO-DA	13252-13-6	< 0.0044 U	< 0.0041 U	< 0.0042 U	< 0.004 U	< 0.0042 U	< 0.0043 U
Dissolved	N-EtFOSA	4151-50-2	< 0.0044 U	< 0.0044 UJ	< 0.0042 U	< 0.004 U	< 0.0042 U	< 0.0043 U
Dissolved	N-EtFOSAA	2991-50-6	< 0.0044 U	0.012 J+	< 0.0042 U	< 0.004 U	< 0.0042 U	< 0.0043 U
Dissolved	N-EtFOSE	1691-99-2	< 0.0044 U	< 0.0044 UJ	< 0.0042 U	< 0.004 U	< 0.0042 U	< 0.0043 U
Dissolved	N-MeFOSA	31506-32-8	< 0.0044 U	< 0.0041 UJ	< 0.0042 U	< 0.004 U	< 0.0042 U	< 0.0043 U
Dissolved	N-MeFOSAA	2355-31-9	< 0.0044 U	< 0.0041 UJ	< 0.0042 U	< 0.004 U	< 0.0042 U	< 0.0043 U
Dissolved	N-MeFOSE	24448-09-7	< 0.0044 U	< 0.0044 UJ	< 0.0042 U	< 0.004 U	< 0.0042 U	< 0.0043 U
Dissolved	PFBA	375-22-4	0.23	0.36	0.27	0.42	0.35	0.39
Dissolved	PFBS	375-73-5	0.0062	0.0039 J	0.0035 J	0.0046	0.0039 J	0.0039 J
Dissolved	PFDA	335-76-2	< 0.0044 U	0.015	< 0.0042 U	0.0016 J	< 0.0042 U	< 0.0043 U
Dissolved	PFDoA	307-55-1	< 0.0044 U	0.0023 BJ+	< 0.0042 U	< 0.004 U	< 0.0042 U	< 0.0043 U
Dissolved	PFDS	335-77-3	< 0.044 U	< 0.0044 UJ	< 0.0042 U	< 0.004 U	< 0.0042 U	< 0.0043 U
Dissolved	PFHpA	375-85-9	0.0083	0.0081	0.0067	0.01	0.01	0.0091
Dissolved	PFHpS	375-92-8	< 0.044 U	0.0028 J	0.0015 J	0.0023 J	0.002 J+	0.0022 J+
Dissolved	PFHxA	307-24-4	0.0095	0.014	0.011	0.015	0.015	0.018
Dissolved	PFHxS	355-46-4	0.0077	0.0095	0.0057	0.011	0.0073	0.0078
Dissolved	PFNA	375-95-1	< 0.0044 U	0.0021 J	0.0012 J	< 0.004 U	< 0.0042 U	< 0.0043 U
Dissolved	PFNS	68259-12-1	< 0.0044 U	< 0.0041 U	< 0.0042 U	< 0.004 U	0.00067 J	< 0.0043 U
Dissolved	PFOA	335-67-1	0.055	0.089	0.054	0.08	0.078	0.082
Dissolved	PFOS	1763-23-1	0.0083 J+	0.82	0.15 J+	0.17 J+	0.14 J+	0.14 J+
Dissolved	PFOSA	754-91-6	< 0.0044 U	0.0051	< 0.0042 U	0.0013 J	< 0.0042 U	0.0026 J
Dissolved	PFPeA	2706-90-3	0.0078	0.015	0.01	0.015	0.013	0.014
Dissolved	PFPeS	2706-91-4	0.0081 J+	0.0042 J+	0.0032 J+	0.0054 J+	0.0051 J+	0.0058 J+
Dissolved	PFTeDA	376-06-7	< 0.0044 U	NA	< 0.0042 UJ	< 0.004 UJ	< 0.0042 UJ	< 0.0043 U
Dissolved	PFTrDA	72629-94-8	< 0.0044 U	< 0.0041 UJ	< 0.0042 U	< 0.004 U	< 0.0042 U	< 0.0043 U
Dissolved	PFUnA	2058-94-8	< 0.0044 U	0.0018 J+	< 0.0042 U	< 0.004 U	< 0.0042 U	< 0.0043 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method = ALS_Method PFC/537M

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4c
West Lakeland Area Pore Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
		Location	WL10A	WL11	WL13	WL16
		Location ID	S016-073	S016-074	S016-075	PS00172
		Sample Date	9/22/2020	9/22/2020	9/25/2020	9/23/2020
		Sample Type Code	Sample	Sample	Sample	Sample
		Sample ID	S016-073.2009221325.000S	S016-074.2009221210.000S	S016-075.2009250850.000S	PS00172.2009231440.000S
		Sample Name	WL10A-POWAT-01-092220	WL11-POWAT-01-092220	WL13-POWAT-01-092520	WL16-POWAT-01-092320
		Parent Sample ID	NA	NA	NA	NA
Fraction	Compound	CAS #				
Dissolved	10:2 FTS	120226-60-0	< 0.0043 U	< 0.0042 U	< 0.0046 U	< 0.0045 U
Dissolved	11Cl-PF3OUdS	763051-92-9	< 0.0043 U	< 0.0042 U	< 0.0046 U	< 0.0045 U
Dissolved	4:2 FTS	757124-72-4	< 0.0043 U	< 0.0042 U	< 0.0046 U	< 0.0045 U
Dissolved	6:2 FTS	27619-97-2	< 0.0043 U	< 0.0042 U	< 0.0046 U	< 0.0045 U
Dissolved	8:2 FTS	39108-34-4	< 0.0043 U	< 0.0042 U	< 0.0046 U	< 0.0045 U
Dissolved	9Cl-PF3ONS	756426-58-1	< 0.0043 U	< 0.0042 U	< 0.0046 U	< 0.0045 U
Dissolved	ADONA	919005-14-4	< 0.0043 U	< 0.0042 U	< 0.0046 U	< 0.0045 U
Dissolved	HFPO-DA	13252-13-6	< 0.0043 U	< 0.0042 U	< 0.0046 U	< 0.0045 U
Dissolved	N-EtFOSA	4151-50-2	< 0.0043 U	< 0.0042 U	< 0.0046 U	< 0.0045 U
Dissolved	N-EtFOSAA	2991-50-6	< 0.0043 U	< 0.0042 U	< 0.0046 U	< 0.0045 U
Dissolved	N-EtFOSE	1691-99-2	< 0.0043 U	< 0.0042 U	< 0.0046 U	< 0.0045 U
Dissolved	N-MeFOSA	31506-32-8	< 0.0043 U	< 0.0042 U	< 0.0046 U	< 0.0045 U
Dissolved	N-MeFOSAA	2355-31-9	< 0.0043 U	< 0.0042 U	< 0.0046 U	< 0.0045 U
Dissolved	N-MeFOSE	24448-09-7	< 0.0043 U	< 0.0042 U	< 0.0046 U	< 0.0045 U
Dissolved	PFBA	375-22-4	0.44	0.38	0.41	0.44
Dissolved	PFBS	375-73-5	0.0046	0.004 J	0.0044 J	0.0041 J
Dissolved	PFDA	335-76-2	< 0.0043 U	0.0013 J	0.0014 J	0.0026 J
Dissolved	PFDoA	307-55-1	< 0.0043 U	< 0.0042 U	< 0.0046 U	< 0.0045 U
Dissolved	PFDS	335-77-3	< 0.0043 U	< 0.0042 U	< 0.0046 U	< 0.0045 U
Dissolved	PFHpA	375-85-9	0.0086	0.012	0.009	0.011
Dissolved	PFHpS	375-92-8	0.003 J	0.0026 J+	0.0029 J	0.0028 J
Dissolved	PFHxA	307-24-4	0.018	0.014	0.017	0.015
Dissolved	PFHxS	355-46-4	0.011	0.0091	0.011	0.0093
Dissolved	PFNA	375-95-1	< 0.0043 U	0.0015 J	0.0012 J	0.0012 J
Dissolved	PFNS	68259-12-1	< 0.0043 U	< 0.0042 U	< 0.0046 U	< 0.0045 U
Dissolved	PFOA	335-67-1	0.088	0.085	0.089	0.081
Dissolved	PFOS	1763-23-1	0.22 J+	0.23 J+	0.22 J+	0.25 J+
Dissolved	PFOSA	754-91-6	0.001 J	0.0011 J	0.0013 J	0.00099 J
Dissolved	PFPeA	2706-90-3	0.015	0.014	0.015	0.014
Dissolved	PFPeS	2706-91-4	0.0046 J+	0.0047 J+	0.0058 J+	0.0047 J+
Dissolved	PFTeDA	376-06-7	< 0.0043 UJ	< 0.0042 U	< 0.0046 U	< 0.0045 UJ
Dissolved	PFTrDA	72629-94-8	< 0.0043 U	< 0.0042 U	< 0.0046 U	< 0.0045 U
Dissolved	PFUnA	2058-94-8	< 0.0043 U	< 0.0042 U	< 0.0046 U	< 0.0045 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method = ALS_Method PFC/537M

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4c
West Lakeland Area Pore Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
		Location	WL6	WL7	WL13
		Location ID	S016-071	S016-072	S016-075
		Sample Date	9/24/2020	9/24/2020	9/25/2020
		Sample Type Code	Sample	Sample	Sample
		Sample ID	S016-071.2009241610.000S	S016-072.2009241520.000S	S016-075.2009250850.000S
		Sample Name	WL6-POWAT-01-092420	WL7-POWAT-01-092420	WL13-POWAT-01-092520
		Parent Sample ID	NA	NA	NA
Fraction	Compound	CAS #			
Total	10:2 FTS	120226-60-0	< 0.0045 U	< 0.0042 U	< 0.0042 U
Total	11Cl-PF3OUdS	763051-92-9	< 0.0045 U	< 0.0042 U	< 0.0042 U
Total	4:2 FTS	757124-72-4	< 0.0045 U	< 0.0042 U	< 0.0042 U
Total	6:2 FTS	27619-97-2	< 0.0045 U	< 0.0042 U	< 0.0042 U
Total	8:2 FTS	39108-34-4	< 0.0045 U	< 0.0042 U	< 0.0042 U
Total	9Cl-PF3ONS	756426-58-1	< 0.0045 U	< 0.0042 U	< 0.0042 U
Total	ADONA	919005-14-4	< 0.0045 U	< 0.0042 U	< 0.0042 U
Total	HFPO-DA	13252-13-6	< 0.0045 U	< 0.0042 U	< 0.0042 U
Total	N-EtFOSA	4151-50-2	< 0.0045 U	< 0.0042 U	< 0.0042 U
Total	N-EtFOSAA	2991-50-6	< 0.0045 U	< 0.0042 U	< 0.0042 U
Total	N-EtFOSE	1691-99-2	< 0.0045 U	< 0.0042 U	< 0.0042 U
Total	N-MeFOSA	31506-32-8	< 0.0045 U	< 0.0042 U	< 0.0042 U
Total	N-MeFOSAA	2355-31-9	< 0.0045 U	< 0.0042 U	< 0.0042 U
Total	N-MeFOSE	24448-09-7	< 0.0045 U	< 0.0042 U	< 0.0042 U
Total	PFBA	375-22-4	0.26	0.43	0.4
Total	PFBS	375-73-5	0.004 J	0.0053	0.0042
Total	PFDA	335-76-2	0.0014 J	0.0016 J	0.0013 J
Total	PFDoA	307-55-1	< 0.0045 U	< 0.0042 U	< 0.0042 U
Total	PFDS	335-77-3	< 0.0045 U	< 0.0042 U	< 0.0042 U
Total	PFHpA	375-85-9	0.0063	0.012	0.012
Total	PFHpS	375-92-8	0.0012 J	0.0021 J	0.0019 J
Total	PFHxA	307-24-4	0.013	0.018	0.016
Total	PFHxS	355-46-4	0.0079 J+	0.0098 J+	0.0095 J+
Total	PFNA	375-95-1	0.0016 J	< 0.0042 U	0.0013 J
Total	PFNS	68259-12-1	< 0.0045 U	< 0.0042 U	< 0.0042 U
Total	PFOA	335-67-1	0.052	0.077	0.078
Total	PFOS	1763-23-1	0.16	0.2	0.22
Total	PFOSA	754-91-6	< 0.0045 U	0.0016 J	0.0013 J
Total	PFPeA	2706-90-3	0.01	0.016	0.015
Total	PFPeS	2706-91-4	0.003 J+	0.0053 J+	0.004 J+
Total	PFTeDA	376-06-7	< 0.0045 UJ	< 0.0042 UJ	< 0.0042 UJ
Total	PFTrDA	72629-94-8	< 0.0045 U	0.0016 J	0.0019 J
Total	PFUnA	2058-94-8	< 0.0045 U	< 0.0042 U	< 0.0042 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method = ALS_Method PFC/537M

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4d
West Lakeland Area Foam
Project 1007
Minneapolis, Minnesota

		Location Group	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
		Location	EP16	WL6	WL6	WL11
		Location ID	S016-234	S016-071	S016-071	S016-074
		Sample Date	7/29/2020	2/25/2020	9/17/2020	5/5/2020
		Sample Type Code	Sample	Sample	Sample	Sample
		Sample ID	S016-234.2007291325.000S	S016-071.2002251630.000S	S016-071.2009171445.000S	S016-074.2005051120.000S
		Sample Name	EP16-FOAM-01-072920	WL6-FOAM-01-022520	WL6-FOAM-01-091720	WL11-FOAM-01-050520
		Parent Sample ID	NA	NA	NA	NA
Fraction	Compound	CAS #				
Total	11Cl-PF3OUdS	763051-92-9	< 0.0254 UJ	< 3.17 U	< 7.49 U	< 0.039 U
Total	4:2 FTS	757124-72-4	< 0.0254 UJ	< 3.17 U	< 7.48 U	< 0.039 U
Total	6:2 FTS	27619-97-2	< 0.0229 UJ	< 2.85 U	< 6.74 U	< 0.035 U
Total	8:2 FTS	39108-34-4	< 0.0254 UJ	< 3.17 U	< 7.48 U	< 0.039 U
Total	9Cl-PF3ONS	756426-58-1	< 0.0254 UJ	< 3.17 U	< 7.5 U	< 0.039 U
Total	ADONA	919005-14-4	< 0.0254 UJ	< 3.17 U	< 7.48 U	< 0.039 U
Total	HFPO-DA	13252-13-6	< 0.0241 UJ	< 3.01 U	< 7.1 U	< 0.037 U
Total	N-EtFOSA	4151-50-2	0.0233 J	< 1.98 U	< 4.67 U	< 0.024 U
Total	N-EtFOSAA	2991-50-6	15.5 J-	8.4	128	0.553
Total	N-EtFOSE	1691-99-2	< 0.0474 UJ	< 5.94 U	< 14 U	< 0.074 U
Total	N-MeFOSA	31506-32-8	< 0.00729 UJ	< 0.911 U	< 2.15 U	< 0.011 U
Total	N-MeFOSAA	2355-31-9	0.201 J	< 0.792 U	3.81 J	0.0131 J
Total	N-MeFOSE	24448-09-7	< 0.0634 UJ	< 7.92 U	< 18.7 U	< 0.099 U
Total	PFBA	375-22-4	0.722 J-	< 3.17 U	< 7.48 U	0.431
Total	PFBS	375-73-5	0.00643 J-	< 0.792 U	< 1.87 U	< 0.009 U
Total	PFDA	335-76-2	2.58 J	15.3	143	0.489
Total	PFDoA	307-55-1	0.784 J	< 0.792 U	< 1.87 U	< 0.009 U
Total	PFDoS	79780-39-5	< 0.00634 UJ	< 0.792 U	< 1.87 U	< 0.009 U
Total	PFDS	335-77-3	0.266 J-	< 0.792 U	< 1.87 U	< 0.009 U
Total	PFHpA	375-85-9	0.0266 J-	< 0.792 U	< 1.87 U	0.0202 J
Total	PFHpS	375-92-8	0.0208 J-	1.65	10.6	0.257
Total	PFHxA	307-24-4	0.0255 J-	< 0.792 U	< 1.87 U	0.0221 J
Total	PFHxS	355-46-4	0.0227 J-	< 0.792 U	< 1.87 U	0.0576
Total	PFNA	375-95-1	0.0359 J	2.73	22.7	0.169
Total	PFNS	68259-12-1	0.543 J-	< 0.792 U	5.63 J	0.0288 J
Total	PFOA	335-67-1	0.372 J-	1.54 J	9.48	1.25
Total	PFOS	1763-23-1	57 J	1630	20700	87.1
Total	PFOSA	754-91-6	2.44 J	8.57	33	0.225
Total	PFPeA	2706-90-3	0.0248 J-	< 1.58 U	< 3.74 U	< 0.019 U
Total	PFPeS	2706-91-4	< 0.00637 UJ	< 0.792 U	< 1.88 U	< 0.009 U
Total	PFTeDA	376-06-7	0.0616 J-	< 0.792 U	< 1.87 U	< 0.009 U
Total	PFTrDA	72629-94-8	NA	< 0.792 U	< 1.87 U	< 0.009 U
Total	PFUnA	2058-94-8	2.33 J	0.846 J	4.65 J	0.0323

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
J = Estimated concentration.
QC-FR = Duplicate sample.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4e
West Lakeland Area Amphibian Tissue
Project 1007
Minneapolis, Minnesota

	Location Group	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
	Location	WL2	WL8A	WL10A	WL13	WL13	WL16
	Location ID	82-0074-00-203	PS00167	S016-073	S016-075	S016-075	PS00172
	Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample
	Sample ID	82-0074-00-203.2009220830.000S	PS00167.2009250950.000S	S016-073.2009211415.000S	S016-075.2009231515.000S	S016-075.2009231516.000S	PS00172.2009231005.000S
	Sample Name	WL2-AMPH-01-092220	WL8A-AMPH-01-092520	WL10A-AMPH-01-092120	WL13-AMPH-ONE-01-092320	WL13-AMPH-TWO-01-092320	WL16-AMPH-01-092320
	Sample Date	9/22/2020	9/25/2020	9/21/2020	9/23/2020	9/23/2020	9/23/2020
Compound	CAS #						
11Cl-PF3OUdS	763051-92-9	< 0.389 U	< 0.383 U	< 0.38 U	< 0.391 U	< 0.393 U	< 0.376 U
3:3 FTCA	1169706-83-5	< 0.388 U	< 0.383 U	< 0.379 U	< 0.39 U	< 0.392 U	< 0.376 U
4:2 FTS	757124-72-4	< 0.388 U	< 0.383 U	< 0.379 U	< 0.39 U	< 0.392 U	< 0.376 U
5:3 FTCA	1799325-94-2	< 2.43 U	< 2.39 U	< 2.37 U	< 2.44 U	< 2.45 U	< 2.35 U
6:2 FTS	27619-97-2	< 0.35 U	< 0.345 U	< 0.342 U	< 0.352 U	< 0.353 U	1.58
7:3 FTCA	812-70-4	< 2.43 U	< 2.39 U	< 2.37 U	< 2.44 U	< 2.45 U	< 2.35 U
8:2 FTS	39108-34-4	< 0.388 U	< 0.383 U	< 0.379 U	< 0.39 U	< 0.392 U	< 0.376 U
9Cl-PF3ONS	756426-58-1	< 0.389 U	< 0.384 U	< 0.38 U	< 0.391 U	< 0.393 U	< 0.377 U
ADONA	919005-14-4	< 0.388 U	< 0.383 U	< 0.379 U	< 0.39 U	< 0.392 U	< 0.376 U
HFPO-DA	13252-13-6	< 0.369 U	< 0.364 U	< 0.36 U	< 0.371 U	< 0.373 U	< 0.357 U
N-EtFOSA	4151-50-2	R	< 0.239 UJ	R	R	< 0.245 UJ	R
N-EtFOSAA	2991-50-6	0.184 J	0.198 J	< 0.0948 U	0.284 J	0.123 J	< 0.0939 U
N-EtFOSE	1691-99-2	R	R	R	R	R	R
N-MeFOSA	31506-32-8	< 0.112 U	R	< 0.109 U	< 0.112 UJ	< 0.113 UJ	< 0.108 U
N-MeFOSAA	2355-31-9	< 0.0971 U	< 0.0957 U	< 0.0948 U	< 0.0976 U	< 0.098 U	< 0.0939 U
N-MeFOSE	24448-09-7	< 0.971 UJ	R	< 0.948 UJ	R	R	< 0.939 UJ
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.0971 U	< 0.0957 U	< 0.0948 U	< 0.0976 U	< 0.098 U	< 0.0939 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.22 U	< 0.191 U	< 0.19 U	< 0.195 U	< 0.276 U	< 0.188 UJ
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.194 U	< 0.191 U	< 0.19 U	< 0.195 U	< 0.196 U	< 0.188 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.0971 U	< 0.0957 U	< 0.0948 U	< 0.0976 U	< 0.098 U	< 0.0939 U
PFBA	375-22-4	0.587 J	1.15 J	0.457 J	1.1 J	1.16 J	< 0.376 U
PFBS	375-73-5	< 0.0971 U	< 0.0957 U	< 0.0948 U	< 0.0976 U	< 0.098 U	< 0.0939 U
PFDA	335-76-2	1.15	2.57	0.244 J	2.17	1.62	0.33 J
PFDoA	307-55-1	0.314 J	0.159 J	0.165 J	0.175 J	0.134 J	0.124 J
PFDoS	79780-39-5	< 0.0971 U	< 0.0957 U	< 0.0948 U	< 0.0976 U	< 0.098 U	< 0.0939 U
PFDS	335-77-3	0.234 J	< 0.0957 U	< 0.0948 U	< 0.0976 U	< 0.098 U	0.116 J
PFHpA	375-85-9	< 0.0971 U	< 0.0957 U	< 0.0948 U	< 0.0976 U	< 0.098 U	< 0.0939 U
PFHpS	375-92-8	0.104 J	< 0.0957 U	< 0.0948 U	0.1 J	< 0.098 U	< 0.0939 U
PFHxA	307-24-4	< 0.0971 U	< 0.0957 U	< 0.0948 U	< 0.0976 U	< 0.098 U	< 0.0939 U
PFHxS	355-46-4	< 0.0971 U	< 0.0957 U	< 0.0948 U	< 0.0976 U	< 0.098 U	< 0.0939 U
PFNA	375-95-1	< 0.0971 U	0.283 J	< 0.0948 U	0.153 J	< 0.098 U	< 0.0939 U
PFNS	68259-12-1	0.21 J	0.16 J	< 0.0948 U	0.156 J	0.144 J	< 0.0939 U
PFOA	335-67-1	0.13 J	0.241 J	< 0.0948 U	0.275 J	0.304 J	< 0.0939 U
PFOS	1763-23-1	100.00	137.00	32.90	102.00	94.40	51.20
PFOSA	754-91-6	< 0.0971 U	0.724 B	< 0.0948 U	0.709 B	0.469 B	< 0.0939 U
PFPeA	2706-90-3	< 0.194 U	< 0.191 U	< 0.19 U	< 0.195 U	< 0.196 U	< 0.188 U
PFPeS	2706-91-4	< 0.0976 U	< 0.0962 U	< 0.0953 U	< 0.098 U	< 0.0985 U	< 0.0944 U
PFTeDA	376-06-7	0.11 J	< 0.0957 U	0.103 J	< 0.0976 UJ	< 0.098 U	0.15 J
PFTrDA	72629-94-8	0.225 BJ	0.118 BJ	0.098 BJ	0.263 BJ	0.137 BJ	0.261 BJ
PFUnA	2058-94-8	0.428 B	0.443 B	0.145 BJ	0.489 B	0.395 B	0.164 BJ

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4f
West Lakeland Area Crayfish Tissue
Project 1007
Minneapolis, Minnesota

	Location Group	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
	Location	WL5	WL6	WL7	WL7	WL7	WL7
	Location ID	82-0074-00-205	S016-071	S016-072	S016-072	S016-072	S016-072
	Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample
	Sample ID	82-0074-00-205.2009171100.000S	S016-071.2009231545.000S	S016-072.2009231700.000S	S016-072.2009231701.000S	S016-072.2009231702.000S	S016-072.2009231703.000S
	Sample Name	WL5-CRAY-01-091720	WL6-CRAY-01-092320	WL7-CRAY-FOUR-01-092320	WL7-CRAY-ONE-01-092320	WL7-CRAY-THREE-01-092320	WL7-CRAY-TWO-01-092320
	Sample Date	9/17/2020	9/23/2020	9/23/2020	9/23/2020	9/23/2020	9/23/2020
Compound	CAS #						
11Cl-PF3OUdS	763051-92-9	< 0.391 U	< 0.387 U	< 0.378 U	< 0.387 U	< 0.399 U	< 0.395 U
3:3 FTCA	1169706-83-5	< 0.39 U	< 0.386 U	< 0.377 U	< 0.386 U	< 0.398 U	< 0.394 U
4:2 FTS	757124-72-4	< 0.39 U	< 0.386 U	< 0.377 U	< 0.386 U	< 0.398 U	< 0.394 U
5:3 FTCA	1799325-94-2	< 2.44 U	< 2.42 U	< 2.36 U	< 2.42 U	< 2.49 U	< 2.46 U
6:2 FTS	27619-97-2	< 0.352 U	< 0.348 U	< 0.34 U	< 0.348 U	< 0.359 U	0.632 J
7:3 FTCA	812-70-4	< 2.44 U	< 2.42 U	< 2.36 U	< 2.42 U	< 2.49 U	< 2.46 U
8:2 FTS	39108-34-4	< 0.39 U	< 0.386 U	< 0.377 U	< 0.386 U	< 0.398 U	< 0.394 U
9Cl-PF3ONS	756426-58-1	< 0.391 U	< 0.387 U	< 0.378 U	< 0.387 U	< 0.399 U	< 0.395 U
ADONA	919005-14-4	< 0.39 U	< 0.386 U	< 0.377 U	< 0.386 U	< 0.398 U	< 0.394 U
HFPO-DA	13252-13-6	< 0.371 U	< 0.367 U	< 0.358 U	< 0.367 U	< 0.378 U	< 0.374 U
N-EtFOSA	4151-50-2	< 0.244 UJ	< 0.242 UJ	< 0.236 UJ	< 0.242 UJ	< 0.249 UJ	< 0.246 U
N-EtFOSAA	2991-50-6	0.789	< 0.0966 U	0.148 J	0.138 J	0.36 J	< 0.0985 U
N-EtFOSE	1691-99-2	R	R	R	R	R	R
N-MeFOSA	31506-32-8	< 0.112 UJ	< 0.111 UJ	< 0.108 UJ	< 0.111 UJ	< 0.114 UJ	< 0.113 UJ
N-MeFOSAA	2355-31-9	< 0.0976 U	< 0.0966 U	< 0.0943 U	< 0.0966 U	< 0.0995 U	< 0.0985 U
N-MeFOSE	24448-09-7	< 0.976 UJ	R	R	R	R	< 0.985 UJ
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.0976 U	< 0.0966 U	< 0.0943 U	< 0.0966 U	< 0.0995 U	< 0.0985 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.195 U	< 0.193 U	< 0.189 U	< 0.193 U	< 0.199 U	< 0.197 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.195 U	< 0.193 U	< 0.189 U	< 0.193 U	< 0.199 U	< 0.197 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.0976 U	< 0.0966 U	< 0.0943 U	< 0.0966 U	< 0.0995 U	< 0.0985 U
PFBA	375-22-4	5.24 B	7.43	4.19 B	6.05 B	11.7	1.58 B
PFBS	375-73-5	< 0.0976 U	< 0.0966 U	< 0.0943 U	< 0.0966 U	< 0.0995 U	< 0.0985 U
PFDA	335-76-2	1.66	1.63	1.5	1.26	0.72	1.31
PFDoA	307-55-1	0.37 J	0.178 J	0.207 J	0.335 J	0.242 J	0.205 J
PFDoS	79780-39-5	< 0.0976 U	< 0.0966 U	< 0.0943 U	< 0.0966 U	< 0.0995 U	< 0.0985 U
PFDS	335-77-3	< 0.0976 U	< 0.0966 U	< 0.0943 U	< 0.0966 U	< 0.0995 U	< 0.0985 U
PFHpA	375-85-9	< 0.0976 U	0.129 J	0.151 J	0.139 J	0.325 J	< 0.0985 U
PFHpS	375-92-8	< 0.0976 U	0.133 J	< 0.0943 U	< 0.0966 U	< 0.0995 U	0.11 J
PFHxA	307-24-4	< 0.0976 U	< 0.0966 U	< 0.0943 U	< 0.0966 U	< 0.0995 U	< 0.0985 U
PFHxS	355-46-4	0.196 J	0.299 J	0.204 J	0.272 J	0.144 J	0.221 J
PFNA	375-95-1	0.196 J	0.351 J	0.248 J	0.158 J	0.158 J	0.198 J
PFNS	68259-12-1	< 0.0976 U	< 0.0966 U	< 0.0943 U	< 0.0966 U	< 0.0995 U	< 0.0985 U
PFOA	335-67-1	3.81	10.5	6.59	4.36	4.24	1.89
PFOS	1763-23-1	45.2	47.4	39.8	31.6	29.6	52.3
PFOSA	754-91-6	1.55	0.503 B	1.16	0.68 B	1.45	0.896 B
PFPeA	2706-90-3	< 0.195 U	< 0.193 U	< 0.189 U	< 0.193 U	< 0.199 UJ	< 0.197 U
PFPeS	2706-91-4	< 0.098 U	< 0.0971 U	< 0.0948 U	< 0.0971 U	< 0.1 U	< 0.099 U
PFTeDA	376-06-7	0.157 J+	0.097 J	0.116 J	0.139 J	< 0.0995 UJ	< 0.0985 U
PFTrDA	72629-94-8	0.224 BJ	< 0.0966 U	0.155 BJ	0.242 BJ	0.162 BJ	0.117 BJ
PFUnA	2058-94-8	0.851 B	0.415 B	0.47 B	0.606 B	0.294 BJ	0.475 B

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4f
West Lakeland Area Crayfish Tissue
Project 1007
Minneapolis, Minnesota

Location Group		RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
Location		WL8A	WL10	WL10	WL10	WL11	WL14	WL15A
Location ID		PS00167	S016-073	S016-073	S016-073	S016-074	PS00170	PS00188
Sample Type Code		Sample	Sample	Sample	Sample	Sample	Sample	Sample
Sample ID		PS00167.2009211600.000S	S016-073.2009211350.000S	S016-073.2009211351.000S	S016-073.2009211352.000S	S016-074.2009211435.000S	PS00170.2009231515.000S	PS00188 .2009161130.000S
Sample Name		WL8A-CRAY-01-092120	WL10-CRAY-ONE-01-092120	WL10-CRAY-THREE-01-092120	WL10-CRAY-TWO-01-092120	WL11-CRAY-01-092120	WL14-CRAY-01-092320	WL15A-CRAY-EATEN-01-091620
Sample Date		9/21/2020	9/21/2020	9/21/2020	9/21/2020	9/21/2020	9/23/2020	9/16/2020
Compound	CAS #							
11Cl-PF3OUdS	763051-92-9	< 0.383 U	< 0.395 U	< 0.401 U	< 0.397 U	< 0.387 U	< 0.871 U	< 0.387 U
3:3 FTCA	1169706-83-5	< 0.383 U	< 0.394 U	< 0.4 U	< 0.396 U	< 0.386 U	< 0.87 U	< 0.386 U
4:2 FTS	757124-72-4	< 0.383 U	< 0.394 U	< 0.4 U	< 0.396 U	< 0.386 U	< 0.87 U	< 0.386 U
5:3 FTCA	1799325-94-2	< 2.39 U	< 2.46 U	< 2.5 U	< 2.48 U	< 2.42 U	< 5.43 U	< 2.42 U
6:2 FTS	27619-97-2	< 0.345 U	< 0.355 U	< 0.361 U	< 0.357 U	< 0.348 U	< 0.784 U	0.399 J
7:3 FTCA	812-70-4	< 2.39 U	< 2.46 U	< 2.5 U	< 2.48 U	< 2.42 U	< 5.43 U	< 2.42 U
8:2 FTS	39108-34-4	< 0.383 U	< 0.394 U	< 0.4 U	< 0.396 U	< 0.386 U	< 0.87 U	< 0.386 U
9Cl-PF3ONS	756426-58-1	< 0.384 U	< 0.395 U	< 0.401 U	< 0.397 U	< 0.387 U	< 0.872 U	< 0.387 U
ADONA	919005-14-4	< 0.383 U	< 0.394 U	< 0.4 U	< 0.396 U	< 0.386 U	< 0.87 U	< 0.386 U
HFPO-DA	13252-13-6	< 0.364 U	< 0.374 UJ	< 0.38 UJ	< 0.376 U	< 0.367 U	< 0.826 U	< 0.367 U
N-EtFOSA	4151-50-2	< 0.239 U	< 0.246 UJ	< 0.25 UJ	< 0.248 UJ	< 0.242 UJ	< 0.543 U	R
N-EtFOSAA	2991-50-6	< 0.0957 U	< 0.0985 U	< 0.1 U	< 0.099 U	0.163 J	0.298 J	< 0.0966 U
N-EtFOSE	1691-99-2	R	R	R	R	R	< 1.63 U	R
N-MeFOSA	31506-32-8	< 0.11 UJ	< 0.113 UJ	< 0.115 UJ	< 0.114 UJ	< 0.111 UJ	< 0.25 U	< 0.111 UJ
N-MeFOSAA	2355-31-9	< 0.0957 U	< 0.0985 U	< 0.1 U	< 0.099 U	< 0.0966 U	< 0.217 U	< 0.0966 U
N-MeFOSE	24448-09-7	R	< 0.985 UJ	R	< 0.99 UJ	R	< 2.17 U	R
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.0957 U	< 0.0985 U	< 0.1 U	< 0.099 U	< 0.0966 U	< 0.217 U	< 0.0966 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.191 U	< 0.197 U	< 0.2 U	< 0.198 U	< 0.193 U	< 0.435 U	< 0.193 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.191 U	< 0.197 U	< 0.2 U	< 0.198 U	< 0.193 U	< 0.435 U	< 0.193 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.0957 U	< 0.0985 U	< 0.1 U	< 0.099 U	< 0.0966 U	< 0.217 U	< 0.0966 U
PFBA	375-22-4	3.95 B	1.73 B	5.04 B	4.39 B	0.685 BJ	5.66	4.21
PFBS	375-73-5	< 0.0957 U	< 0.0985 U	< 0.1 U	< 0.099 U	< 0.0966 U	< 0.217 U	< 0.0966 U
PFDA	335-76-2	1.31	0.328 J	0.438	0.377 J	0.746	0.827 J	1.37
PFDoA	307-55-1	0.213 J	< 0.0985 U	0.105 J	0.1 J	0.122 J	< 0.217 U	0.165 J
PFDoS	79780-39-5	< 0.0957 U	< 0.0985 U	< 0.1 U	< 0.099 U	< 0.0966 U	< 0.217 U	< 0.0966 U
PFDS	335-77-3	< 0.0957 U	< 0.0985 U	< 0.1 U	< 0.099 U	< 0.0966 U	< 0.217 U	< 0.0966 U
PFHpA	375-85-9	< 0.0957 U	0.21 J	0.321 J	0.187 J	0.245 J	0.331 J	0.108 J
PFHpS	375-92-8	0.11 J	< 0.0985 U	< 0.1 U	< 0.099 U	< 0.0966 U	< 0.217 U	0.111 J
PFHxA	307-24-4	< 0.0957 U	< 0.0985 U	< 0.1 U	< 0.099 U	< 0.0966 U	< 0.217 U	< 0.0966 U
PFHxS	355-46-4	0.433	< 0.0985 U	0.144 J	0.155 J	0.197 J	0.266 J	0.204 J
PFNA	375-95-1	0.149 J	0.1 J	< 0.1 U	0.125 J	0.192 J	0.348 J	0.132 J
PFNS	68259-12-1	< 0.0957 U	< 0.0985 U	< 0.1 U	< 0.099 U	< 0.0966 U	< 0.217 U	< 0.0966 U
PFOA	335-67-1	4.89	2.34	3.12	3.14	7.9	8.97	3.13
PFOS	1763-23-1	41.3	14	17.9	12.4	23.4	30.7	97.9
PFOSA	754-91-6	0.72 B	0.822 B	1.03 B	0.74 B	0.828 B	1.02	0.425 B
PFPeA	2706-90-3	< 0.191 U	< 0.197 U	< 0.2 U	< 0.198 U	< 0.193 U	< 0.435 U	< 0.193 U
PFPeS	2706-91-4	< 0.0962 U	< 0.099 U	< 0.101 U	< 0.0995 U	< 0.0971 U	< 0.218 U	< 0.0971 U
PFTeDA	376-06-7	0.109 J	< 0.0985 U	< 0.1 U	< 0.099 U	< 0.0966 U	< 0.217 UJ	0.105 J
PFTrDA	72629-94-8	0.14 BJ	< 0.0985 U	0.148 BJ	< 0.099 U	0.102 BJ	< 0.217 U	0.169 J
PFUnA	2058-94-8	0.435 B	0.121 BJ	0.176 BJ	0.173 BJ	0.242 BJ	0.273 BJ	0.41 B

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4g
West Lakeland Area Forage Fish Tissue
Project 1007
Minneapolis, Minnesota

	Location Group	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
	Location	WL2	WL2	WL3	WL3	WL5	WL6
	Location ID	82-0074-00-203	82-0074-00-203	82-0074-00-204	82-0074-00-204	82-0074-00-205	S016-071
	Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample
	Sample ID	82-0074-00-203.2009171000.000S	82-0074-00-203.2009171001.000S	82-0074-00-204.2009171030.000S	82-0074-00-204.2009171031.000S	82-0074-00-205.2009170930.000S	S016-071.2009171230.000S
	Sample Name	WL2-FORE-WHO-ONE-01-091720	WL2-FORE-WHO-TWO-01-091720	WL3-FORE-WHO-TWO-01-091720	WL3-FORE-WHO-ONE-01-091720	WL5-FORE-WHO-TWO-01-091720	WL6-FORE-WHO-01-091720
	Sample Date	9/17/2020	9/17/2020	9/17/2020	9/17/2020	9/17/2020	9/17/2020
Compound	CAS #						
11Cl-PF3OUdS	763051-92-9	< 0.391 U	< 0.385 U	< 0.393 U	< 0.385 U	< 0.393 U	< 0.401 U
3:3 FTCA	1169706-83-5	< 0.39 U	< 0.385 U	< 0.392 U	< 0.385 U	< 0.392 U	< 0.4 U
4:2 FTS	757124-72-4	< 0.39 U	< 0.385 U	< 0.392 U	< 0.385 U	< 0.392 U	< 0.4 U
5:3 FTCA	1799325-94-2	< 2.44 U	< 2.4 U	< 2.45 U	< 2.4 U	< 2.45 U	< 2.5 U
6:2 FTS	27619-97-2	< 0.352 U	< 0.347 U	< 0.353 U	0.658 J	< 0.353 U	1.32 J
7:3 FTCA	812-70-4	< 2.44 U	< 2.4 U	< 2.45 U	< 2.4 U	< 2.45 U	< 2.5 U
8:2 FTS	39108-34-4	< 0.39 U	< 0.385 U	< 0.392 U	< 0.385 U	< 0.392 U	< 0.4 U
9Cl-PF3ONS	756426-58-1	< 0.391 U	< 0.386 U	< 0.393 U	< 0.386 U	< 0.393 U	< 0.401 U
ADONA	919005-14-4	< 0.39 U	< 0.385 U	< 0.392 U	< 0.385 U	< 0.392 U	< 0.4 U
HFPO-DA	13252-13-6	< 0.371 U	< 0.365 U	< 0.373 U	< 0.365 U	< 0.373 U	< 0.38 U
N-EtFOSA	4151-50-2	< 0.244 UJ	< 0.24 UJ	R	< 0.24 UJ	R	< 0.25 UJ
N-EtFOSAA	2991-50-6	0.293 J-	0.267 J+	0.528 J-	0.278 J-	0.266 J-	0.338 J
N-EtFOSE	1691-99-2	R	R	R	R	R	R
N-MeFOSA	31506-32-8	< 0.112 UJ	< 0.111 UJ	< 0.113 UJ	< 0.111 UJ	< 0.113 UJ	< 0.115 UJ
N-MeFOSAA	2355-31-9	< 0.0976 U	< 0.0962 U	< 0.098 U	< 0.0962 U	< 0.098 U	< 0.1 U
N-MeFOSE	24448-09-7	R	R	R	R	R	< 1 UJ
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.0976 U	< 0.0962 U	< 0.098 U	< 0.0962 U	< 0.098 U	< 0.1 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.195 U	< 0.192 U	< 0.196 U	< 0.292 U	< 0.655 U	< 0.2 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.195 U	< 0.192 U	< 0.196 U	< 0.192 U	< 0.196 U	< 0.2 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.0976 U	< 0.0962 U	< 0.098 U	< 0.0962 U	< 0.098 U	< 0.1 U
PFBA	375-22-4	0.494 J	0.516 J	0.509 J	0.521 J	0.512 J	0.517 J
PFBS	375-73-5	< 0.0976 U	< 0.0962 U	< 0.098 U	< 0.0962 U	< 0.098 U	< 0.1 U
PFDA	335-76-2	3.94	3.19	5.4	6.43	3.91	3.11
PFDoA	307-55-1	0.31 J	0.294 J	0.543	0.361 J	0.213 J	0.297 J
PFDoS	79780-39-5	< 0.0976 U	< 0.0962 U	< 0.098 U	< 0.0962 U	< 0.098 U	< 0.1 U
PFDS	335-77-3	0.245 J	0.314 J	0.446	0.495	0.21 J	0.205 J
PFHpA	375-85-9	< 0.0976 U	< 0.0962 U	< 0.098 U	< 0.0962 U	< 0.098 U	< 0.1 U
PFHpS	375-92-8	0.442	0.358 J	0.475	0.573	0.389 J	0.226 J
PFHxA	307-24-4	< 0.0976 U	< 0.0962 U	< 0.098 U	< 0.0962 U	< 0.098 U	< 0.1 U
PFHxS	355-46-4	0.151 J	0.104 J	0.11 J	0.127 J	0.117 J	0.111 J
PFNA	375-95-1	< 0.0976 U	< 0.0962 U	< 0.098 U	< 0.0962 U	< 0.098 U	< 0.1 U
PFNS	68259-12-1	0.775	0.77	1.31	1.76	0.766	0.461
PFOA	335-67-1	0.305 J	0.158 J	0.135 J	0.175 J	0.194 J	0.237 J
PFOS	1763-23-1	1060	1060	1160	1560	1040	578
PFOSA	754-91-6	0.899	0.918	0.803	0.912	0.66	0.913
PFPeA	2706-90-3	< 0.195 U	< 0.192 U	< 0.196 U	< 0.192 U	< 0.196 U	< 0.2 U
PFPeS	2706-91-4	< 0.098 U	< 0.0966 U	< 0.0985 U	< 0.0966 U	< 0.0985 U	< 0.101 U
PFTeDA	376-06-7	0.236 J+	0.124 J	0.29 J+	< 0.0962 U	0.102 J	0.143 J+
PFTrDA	72629-94-8	0.196 BJ	0.309 BJ	0.396 J	0.244 BJ	0.184 BJ	0.135 BJ
PFUnA	2058-94-8	0.854 B	0.846 B	1.47	1.06 B	0.652 B	0.825 B

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4g
West Lakeland Area Forage Fish Tissue
Project 1007
Minneapolis, Minnesota

Location Group		RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
Location		WL7	WL5	WL8A	WL8A	WL21	WL21
Location ID		S016-072	82-0074-00-205	PS00167	PS00167	PS00174	PS00174
Sample Type Code		Sample	Sample	Sample	Sample	Sample	Sample
Sample ID		S016-072.2009171330.000S	82-0074-00-205.2009171000.000S	PS00167.2009161615.000S	PS00167.2009161616.000S	PS00174.2009161400.000S	PS00174.2009161401.000S
Sample Name		WL7-FORE-WHO-01-091720	WL5-FORE-WHO-ONE-01-091720	WL8A-FORE-WHO-ONE-01-091620	WL8A-FORE-WHO-TWO-01-091620	WL21-FORE-WHO-ONE-01-091620	WL21-FORE-WHO-TWO-01-091620
Sample Date		9/17/2020	9/17/2020	9/16/2020	9/16/2020	9/16/2020	9/16/2020
Compound	CAS #						
11Cl-PF3OUdS	763051-92-9	< 0.393 U	< 0.399 U	< 0.399 U	< 0.383 U	< 0.387 U	< 0.383 U
3:3 FTCA	1169706-83-5	< 0.392 U	< 0.398 U	< 0.398 U	< 0.383 U	< 0.386 U	< 0.383 U
4:2 FTS	757124-72-4	< 0.392 U	< 0.398 U	< 0.398 U	< 0.383 U	< 0.386 U	< 0.383 U
5:3 FTCA	1799325-94-2	< 2.45 U	< 2.49 U	< 2.49 U	< 2.39 U	< 2.42 U	< 2.39 U
6:2 FTS	27619-97-2	0.383 J	< 0.359 U	< 0.359 U	< 0.345 U	< 0.348 U	< 0.345 U
7:3 FTCA	812-70-4	< 2.45 U	< 2.49 U	< 2.49 U	< 2.39 U	< 2.42 U	< 2.39 U
8:2 FTS	39108-34-4	< 0.392 U	< 0.398 U	< 0.398 U	< 0.383 U	< 0.386 U	< 0.383 U
9Cl-PF3ONS	756426-58-1	< 0.393 U	< 0.399 U	< 0.399 U	< 0.384 U	< 0.387 U	< 0.384 U
ADONA	919005-14-4	< 0.392 U	< 0.398 U	< 0.398 U	< 0.383 U	< 0.386 U	< 0.383 U
HFPO-DA	13252-13-6	< 0.373 U	< 0.378 U	< 0.378 U	< 0.364 U	< 0.367 U	< 0.364 U
N-EtFOSA	4151-50-2	R	R	< 0.249 UJ	< 0.239 UJ	< 0.242 UJ	R
N-EtFOSAA	2991-50-6	0.592	0.212 J-	0.262 J	0.235 J	0.201 J	0.131 J-
N-EtFOSE	1691-99-2	R	R	R	R	R	R
N-MeFOSA	31506-32-8	R	< 0.114 UJ	< 0.114 UJ	< 0.11 UJ	< 0.111 UJ	< 0.11 UJ
N-MeFOSAA	2355-31-9	< 0.098 U	< 0.0995 U	< 0.0995 U	< 0.0957 U	< 0.0966 U	< 0.0957 U
N-MeFOSE	24448-09-7	R	R	R	R	R	R
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.098 U	< 0.0995 U	< 0.0995 U	< 0.0957 U	< 0.0966 U	< 0.0957 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	0.249 J	< 0.199 U	< 0.199 U	< 0.211 U	< 0.46 U	< 0.191 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.196 U	< 0.199 U	< 0.199 U	< 0.191 U	< 0.193 U	< 0.191 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.098 U	< 0.0995 U	< 0.0995 U	< 0.0957 U	< 0.0966 U	< 0.0957 U
PFBA	375-22-4	< 0.392 U	0.572 J	0.512 J	0.646 J	0.621 J	0.639 J
PFBS	375-73-5	< 0.098 U	< 0.0995 U	< 0.0995 U	< 0.0957 U	< 0.0966 U	< 0.0957 U
PFDA	335-76-2	3.01	4.18	2	3.56	4.41	10.4
PFDoA	307-55-1	0.209 J	0.24 J	0.26 J	0.175 J	0.258 J	0.322 J
PFDoS	79780-39-5	< 0.098 U	< 0.0995 U	< 0.0995 U	< 0.0957 U	< 0.0966 U	< 0.0957 U
PFDS	335-77-3	0.143 J	0.245 J	< 0.0995 U	< 0.0957 U	0.212 J	0.189 J
PFHpA	375-85-9	< 0.098 U	< 0.0995 U	< 0.0995 U	< 0.0957 U	< 0.0966 U	< 0.0957 U
PFHpS	375-92-8	0.365 J	0.254 J	< 0.0995 U	0.351 J	0.441	0.339 J
PFHxA	307-24-4	< 0.098 U	< 0.0995 U	< 0.0995 U	< 0.148 U	< 0.0966 U	< 0.0957 U
PFHxS	355-46-4	< 0.098 U	< 0.0995 U	< 0.0995 U	0.211 J	0.125 J	0.153 J
PFNA	375-95-1	< 0.098 U	< 0.0995 U	0.131 J	0.268 J	< 0.0966 U	0.34 J
PFNS	68259-12-1	0.366 J	1.11	0.172 J	0.257 J	0.648	0.672
PFOA	335-67-1	0.179 J	0.175 J	0.272 J	0.488	0.185 J	1.11
PFOS	1763-23-1	433	1220	217	313	745	843
PFOSA	754-91-6	0.817 B	0.78	1.17	0.682	0.775	0.911
PFPeA	2706-90-3	< 0.196 U	< 0.199 U	< 0.199 U	< 0.191 U	< 0.193 U	< 0.191 U
PFPeS	2706-91-4	< 0.0985 U	< 0.1 U	< 0.1 U	< 0.0962 U	< 0.0971 U	< 0.0962 U
PFTeDA	376-06-7	< 0.098 UJ	0.114 J+	0.116 J+	0.099 J	0.135 J	0.188 J+
PFTrDA	72629-94-8	0.245 BJ	0.216 BJ	0.21 BJ	0.119 BJ	0.199 BJ	0.184 BJ
PFUnA	2058-94-8	0.605 B	0.84 B	0.662 B	0.534 B	0.929 B	1.56

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4g
West Lakeland Area Forage Fish Tissue
Project 1007
Minneapolis, Minnesota

Location Group		RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
Location		WL14	WL14	WL15A	WL15A	WL15A
Location ID		PS00170	PS00170	PS00188	PS00188	PS00188
Sample Type Code		Sample	Sample	Sample	Sample	Sample
Sample ID		PS00170.2009161200.000S	PS00170.2009161201.000S	PS00188 .2009161131.000S	PS00188 .2009161132.000S	PS00188 .2009161133.000S
Sample Name		WL14-FORE-WHO-ONE-01-091620	WL14-FORE-WHO-TWO-01-091620	WL15A-FORE-WHO-FOUR-01-091620	WL15A-FORE-WHO-ONE-01-091620	WL15A-FORE-WHO-THREE-01-091620
Sample Date		9/16/2020	9/16/2020	9/16/2020	9/16/2020	9/16/2020
Compound	CAS #					
11Cl-PF3OUdS	763051-92-9	< 0.395 U	< 0.391 U	< 0.399 U	< 0.393 U	< 0.397 U
3:3 FTCA	1169706-83-5	< 0.394 U	< 0.39 U	< 0.398 U	< 0.392 U	< 0.396 U
4:2 FTS	757124-72-4	< 0.394 U	< 0.39 U	< 0.398 U	< 0.392 U	< 0.396 U
5:3 FTCA	1799325-94-2	< 2.46 U	< 2.44 U	< 2.49 U	< 2.45 U	< 2.48 U
6:2 FTS	27619-97-2	< 0.355 U	< 0.352 U	5.01	1.57	< 0.357 U
7:3 FTCA	812-70-4	< 2.46 U	< 2.44 U	< 2.49 U	< 2.45 U	< 2.48 U
8:2 FTS	39108-34-4	< 0.394 U	< 0.39 U	< 0.398 U	< 0.392 U	< 0.396 U
9Cl-PF3ONS	756426-58-1	< 0.395 U	< 0.391 U	< 0.399 U	< 0.393 U	< 0.397 U
ADONA	919005-14-4	< 0.394 U	< 0.39 U	< 0.398 U	< 0.392 U	< 0.396 U
HFPO-DA	13252-13-6	< 0.374 U	< 0.371 U	< 0.378 U	< 0.373 U	< 0.376 U
N-EtFOSA	4151-50-2	< 0.246 UJ	< 0.244 UJ	< 0.249 UJ	< 0.245 UJ	< 0.248 UJ
N-EtFOSAA	2991-50-6	0.438	0.43 J-	0.247 J-	0.506 J-	0.127 J-
N-EtFOSE	1691-99-2	R	R	R	R	R
N-MeFOSA	31506-32-8	< 0.113 UJ	< 0.112 UJ	< 0.114 UJ	< 0.113 UJ	< 0.114 UJ
N-MeFOSAA	2355-31-9	< 0.0985 U	< 0.0976 U	< 0.0995 U	< 0.098 U	< 0.099 U
N-MeFOSE	24448-09-7	R	R	R	R	R
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.0985 U	< 0.0976 U	< 0.0995 U	< 0.098 U	< 0.099 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.197 U	< 0.223 U	< 0.199 U	< 0.213 U	0.818 J
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.197 U	< 0.195 U	< 0.199 U	< 0.196 U	< 0.198 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.0985 U	< 0.0976 U	< 0.0995 U	< 0.098 U	< 0.099 U
PFBA	375-22-4	0.556 J	0.543 J	0.715 J	0.825 J	0.907 J
PFBS	375-73-5	< 0.0985 U	< 0.0976 U	< 0.0995 U	< 0.098 U	< 0.099 U
PFDA	335-76-2	2.86	8.83	9.79	6.84	6.34
PFDoA	307-55-1	0.278 J	0.318 J	0.423	0.344 J	0.286 J
PFDoS	79780-39-5	< 0.0985 U	< 0.0976 U	< 0.0995 U	< 0.098 U	< 0.099 U
PFDS	335-77-3	0.146 J	0.225 J	0.217 J	0.244 J	0.252 J
PFHpA	375-85-9	< 0.0985 U	< 0.0976 U	< 0.0995 U	< 0.098 U	< 0.099 U
PFHpS	375-92-8	0.126 J	0.742	0.722	0.393	0.579
PFHxA	307-24-4	< 0.0985 U	< 0.0976 U	< 0.0995 U	< 0.098 U	< 0.099 U
PFHxS	355-46-4	< 0.0985 U	0.177 J	0.129 J	0.11 J	< 0.099 U
PFNA	375-95-1	0.134 J	0.408	0.203 J	0.159 J	0.138 J
PFNS	68259-12-1	0.263 J	0.772	0.894	0.887	1
PFOA	335-67-1	0.133 J	1.08	0.329 J	0.517	0.394 J
PFOS	1763-23-1	270	836	1200	1070	1210
PFOSA	754-91-6	0.73	1.04	0.972 B	1.03	0.841 B
PFPeA	2706-90-3	< 0.197 U	< 0.195 U	< 0.199 U	< 0.196 U	< 0.198 U
PFPeS	2706-91-4	< 0.099 U	< 0.098 U	< 0.1 U	< 0.0985 U	< 0.0995 U
PFTeDA	376-06-7	0.122 J	0.126 J	0.128 J+	0.181 J+	0.154 J+
PFTrDA	72629-94-8	0.304 BJ	0.285 BJ	0.219 J	0.29 BJ	0.247 J
PFUnA	2058-94-8	0.83 B	1.29 B	1.46	1.5	1.02 B

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4g
West Lakeland Area Forage Fish Tissue
Project 1007
Minneapolis, Minnesota

	Location Group	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
	Location	WL15A	WL15	WL15	WL15
	Location ID	PS00188	PS00171	PS00171	PS00171
	Sample Type Code	Sample	Sample	Sample	Sample
	Sample ID	PS00188 .2009161134.000S	PS00171.2009161220.000S	PS00171.2009161221.000S	PS00171.2009161222.000S
	Sample Name	WL15A-FORE-WHO-TWO-01-091620	WL15-FORE-WHO-ONE-01-091620	WL15-FORE-WHO-THREE-01-091620	WL15-FORE-WHO-TWO-01-091620
	Sample Date	9/16/2020	9/16/2020	9/16/2020	9/16/2020
Compound	CAS #				
11Cl-PF3OUdS	763051-92-9	< 0.393 U	< 0.383 U	< 0.393 U	< 0.385 U
3:3 FTCA	1169706-83-5	< 0.392 U	< 0.383 U	< 0.392 U	< 0.385 U
4:2 FTS	757124-72-4	< 0.392 U	< 0.383 U	< 0.392 U	< 0.385 U
5:3 FTCA	1799325-94-2	< 2.45 U	< 2.39 U	< 2.45 U	< 2.4 U
6:2 FTS	27619-97-2	< 0.353 U	< 0.345 U	< 0.353 U	< 0.347 U
7:3 FTCA	812-70-4	< 2.45 U	< 2.39 U	< 2.45 U	< 2.4 U
8:2 FTS	39108-34-4	< 0.392 U	< 0.383 U	< 0.392 U	< 0.385 U
9Cl-PF3ONS	756426-58-1	< 0.393 U	< 0.384 U	< 0.393 U	< 0.386 U
ADONA	919005-14-4	< 0.392 U	< 0.383 U	< 0.392 U	< 0.385 U
HFPO-DA	13252-13-6	< 0.373 U	< 0.364 U	< 0.373 U	< 0.365 U
N-EtFOSA	4151-50-2	< 0.245 UJ	< 0.239 UJ	< 0.245 UJ	< 0.24 UJ
N-EtFOSAA	2991-50-6	0.377 J	0.202 J-	0.24 J-	0.127 J-
N-EtFOSE	1691-99-2	R	R	R	R
N-MeFOSA	31506-32-8	< 0.113 UJ	< 0.11 UJ	< 0.113 UJ	< 0.111 UJ
N-MeFOSAA	2355-31-9	< 0.098 U	< 0.0957 U	< 0.098 U	< 0.0962 U
N-MeFOSE	24448-09-7	R	R	R	R
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.098 U	< 0.0957 U	< 0.098 U	< 0.0962 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.77 U	< 0.415 U	< 0.196 U	< 0.364 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.196 U	< 0.191 U	< 0.196 U	< 0.192 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.098 U	< 0.0957 U	< 0.098 U	< 0.0962 U
PFBA	375-22-4	0.607 J	0.714 J	0.61 J	0.673 J
PFBS	375-73-5	< 0.098 U	< 0.0957 U	< 0.098 U	< 0.0962 U
PFDA	335-76-2	6.44	5.15	5.92	4.93
PFDoA	307-55-1	0.217 J	0.18 J	0.184 J	0.237 J
PFDoS	79780-39-5	< 0.098 U	< 0.0957 U	< 0.098 U	< 0.0962 U
PFDS	335-77-3	0.144 J	0.106 J	0.153 J	0.208 J
PFHpA	375-85-9	< 0.098 U	< 0.0957 U	< 0.098 U	< 0.0962 U
PFHpS	375-92-8	0.914	0.412	0.363 J	0.534
PFHxA	307-24-4	< 0.098 U	< 0.0957 U	< 0.098 U	< 0.0962 U
PFHxS	355-46-4	0.19 J	0.112 J	< 0.098 U	0.15 J
PFNA	375-95-1	0.188 J	0.132 J	0.125 J	0.155 J
PFNS	68259-12-1	0.576	0.597	0.995	0.626
PFOA	335-67-1	0.289 J	0.363 J	0.228 J	0.314 J
PFOS	1763-23-1	829	973	1380	771
PFOSA	754-91-6	0.967	0.582 B	0.57 B	0.636 B
PFPeA	2706-90-3	< 0.196 U	< 0.191 U	< 0.196 U	< 0.192 U
PFPeS	2706-91-4	< 0.0985 U	< 0.0962 U	< 0.0985 U	< 0.0966 U
PFTeDA	376-06-7	0.2 J+	< 0.0957 UJ	< 0.098 UJ	< 0.0962 U
PFTrDA	72629-94-8	0.155 BJ	0.149 J	0.189 J	0.182 J
PFUnA	2058-94-8	0.783 B	0.565 B	0.675 B	0.76 B

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4h
West Lakeland Area Predator Fish Tissue
Project 1007
Minneapolis, Minnesota

Location Group		RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
Location		WL3	WL5	WL6	WL6	WL7	WL14
Location ID		82-0074-00-204	82-0074-00-205	S016-071	S016-071	S016-072	PS00170
Sample Type Code		Sample	Sample	Sample	Sample	Sample	Sample
Sample ID		82-0074-00-204.2009171032.000S	82-0074-00-205.2009170931.000S	S016-071.2009171231.000S	S016-071.2009171232.000S	S016-072.2009171331.000S	PS00170.2009161202.000S
Sample Name		WL3-PRED-WHO-01-091720	WL5-PRED-WHO-01-091720	WL6-PRED-WHO-ONE-01-091720	WL6-PRED-WHO-TWO-01-091720	WL7-PRED-WHO-01-091720	WL14-PRED-WHO-FOUR-01-091620
Sample Date		9/17/2020	9/17/2020	9/17/2020	9/17/2020	9/17/2020	9/16/2020
Compound	CAS #						
11Cl-PF3OUdS	763051-92-9	< 0.397 U	< 0.391 U	< 0.401 U	< 0.399 U	< 0.38 U	< 0.387 U
3:3 FTCA	1169706-83-5	< 0.396 U	< 0.39 U	< 0.4 U	< 0.398 U	< 0.379 U	< 0.386 U
4:2 FTS	757124-72-4	< 0.396 U	< 0.39 U	< 0.4 U	< 0.398 U	< 0.379 U	< 0.386 U
5:3 FTCA	1799325-94-2	< 2.48 U	< 2.44 U	< 2.5 U	< 2.49 U	< 2.37 U	< 2.42 U
6:2 FTS	27619-97-2	4.08 B	0.436 BJ	1.05 BJ	5.42 B	0.722 BJ	< 0.348 U
7:3 FTCA	812-70-4	< 2.48 U	< 2.44 U	< 2.5 U	< 2.49 U	< 2.37 U	< 2.42 U
8:2 FTS	39108-34-4	< 0.396 U	< 0.39 U	< 0.4 U	< 0.398 U	< 0.379 U	< 0.386 U
9Cl-PF3ONS	756426-58-1	< 0.397 U	< 0.391 U	< 0.401 U	< 0.399 U	< 0.38 U	< 0.387 U
ADONA	919005-14-4	< 0.396 U	< 0.39 U	< 0.4 U	0.499 J	< 0.379 U	< 0.386 U
HFPO-DA	13252-13-6	< 0.376 U	< 0.371 U	< 0.38 U	< 0.378 UJ	< 0.36 UJ	< 0.367 U
N-EtFOSA	4151-50-2	R	< 0.244 UJ	R	< 0.249 UJ	< 0.237 UJ	< 0.242 UJ
N-EtFOSAA	2991-50-6	0.324 J-	0.358 J-	0.395 J	0.594 J-	0.384	0.397 J-
N-EtFOSE	1691-99-2	R	R	R	R	R	1.08 J+
N-MeFOSA	31506-32-8	< 0.114 UJ	< 0.112 U	< 0.115 UJ	< 0.114 UJ	< 0.109 UJ	< 0.111 U
N-MeFOSAA	2355-31-9	0.114 J	0.11 J	< 0.1 U	0.171 J	< 0.0948 U	< 0.0966 U
N-MeFOSE	24448-09-7	R	R	R	R	R	R
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.099 U	< 0.0976 U	< 0.1 U	< 0.0995 U	< 0.0948 U	< 0.0966 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.198 U	< 0.195 U	< 0.2 U	< 0.409 U	< 0.19 U	< 0.193 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.198 U	< 0.195 U	< 0.2 U	< 0.199 U	< 0.19 U	< 0.193 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.099 U	< 0.0976 U	< 0.1 U	< 0.0995 U	< 0.0948 U	< 0.0966 U
PFBA	375-22-4	0.576 J	< 0.39 U	< 0.4 U	0.49 J	< 0.379 U	< 0.386 U
PFBS	375-73-5	< 0.099 U	< 0.0976 U	< 0.1 U	< 0.0995 U	< 0.0948 U	< 0.0966 U
PFDA	335-76-2	8.02	11.2	5.37	12.4	7.4	7.46
PFDoA	307-55-1	0.896	0.677	0.439	0.577	0.4	0.223 J
PFDoS	79780-39-5	< 0.099 U	< 0.0976 U	< 0.1 U	< 0.0995 U	< 0.0948 U	< 0.0966 U
PFDS	335-77-3	0.711	1.18	0.181 J	0.857	0.394	0.346 J
PFHpA	375-85-9	< 0.099 U	< 0.0976 U	< 0.1 U	< 0.0995 U	< 0.0948 U	< 0.0966 U
PFHpS	375-92-8	0.361 J	0.579	0.36 J	0.391 J	0.481	0.811
PFHxA	307-24-4	0.105 J	< 0.0976 U	< 0.1 U	0.116 J	< 0.0948 U	< 0.0966 U
PFHxS	355-46-4	< 0.099 U	< 0.0976 U	< 0.1 U	< 0.0995 U	0.098 J	0.122 J
PFNA	375-95-1	< 0.099 U	< 0.0976 U	< 0.1 U	< 0.0995 U	< 0.0948 U	0.167 J
PFNS	68259-12-1	1.6	2.82	0.558	3.58	0.983	1.38
PFOA	335-67-1	0.133 J	0.1 J	< 0.1 U	< 0.0995 U	0.117 J	0.14 J
PFOS	1763-23-1	1130	1780	650	2290	1160	1450
PFOSA	754-91-6	0.741 B	0.663 BJ-	0.98 B	0.797 B	0.792 B	0.689
PFPeA	2706-90-3	< 0.198 U	< 0.195 U	< 0.2 U	< 0.199 U	< 0.19 U	< 0.193 U
PFPeS	2706-91-4	< 0.0995 U	< 0.098 U	< 0.101 U	< 0.1 U	< 0.0953 U	< 0.0971 U
PFTeDA	376-06-7	0.158 J+	0.161 J	< 0.1 UJ	R	0.131 J+	0.131 J
PFTrDA	72629-94-8	0.546 B	0.524 B	0.209 BJ	0.331 BJ	0.278 BJ	0.175 BJ
PFUnA	2058-94-8	2.1	2.27	0.98 B	1.81	1.14 B	0.944 B

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4h
West Lakeland Area Predator Fish Tissue
Project 1007
Minneapolis, Minnesota

	Location Group	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland	RA_West Lakeland
	Location	WL14	WL14	WL15A	WL15A	WL15A
	Location ID	PS00170	PS00170	PS00188	PS00188	PS00188
	Sample Type Code	Sample	Sample	Sample	Sample	Sample
	Sample ID	PS00170.2009161203.000S	PS00170.2009161204.000S	PS00188 .2009161135.000S	PS00188 .2009161136.000S	PS00188 .2009161137.000S
	Sample Name	WL14-PRED-WHO-THREE-01-091620	WL14-PRED-WHO-TWO-01-091620	WL15A-PRED-WHO-FOUR-01-091620	WL15A-PRED-WHO-ONE-01-091620	WL15A-PRED-WHO-THREE-01-091620
	Sample Date	9/16/2020	9/16/2020	9/16/2020	9/16/2020	9/16/2020
Compound	CAS #					
11Cl-PF3OUdS	763051-92-9	< 0.397 U	< 0.399 U	< 0.395 U	< 0.395 U	< 0.385 U
3:3 FTCA	1169706-83-5	< 0.396 U	< 0.398 U	< 0.394 U	< 0.394 U	< 0.385 U
4:2 FTS	757124-72-4	< 0.396 U	< 0.398 U	< 0.394 U	< 0.394 U	< 0.385 U
5:3 FTCA	1799325-94-2	< 2.48 U	< 2.49 U	< 2.46 U	< 2.46 U	< 2.4 U
6:2 FTS	27619-97-2	< 0.357 U	< 0.359 U	2.76	2.64	< 0.347 U
7:3 FTCA	812-70-4	< 2.48 U	< 2.49 U	< 2.46 U	< 2.46 U	< 2.4 U
8:2 FTS	39108-34-4	< 0.396 U	< 0.398 U	< 0.394 U	< 0.394 U	< 0.385 U
9Cl-PF3ONS	756426-58-1	< 0.397 U	< 0.399 U	< 0.395 U	< 0.395 U	< 0.386 U
ADONA	919005-14-4	< 0.396 U	< 0.398 U	< 0.394 U	0.469 J	< 0.385 U
HFPO-DA	13252-13-6	< 0.376 U	< 0.378 U	< 0.374 U	< 0.374 U	< 0.365 UJ
N-EtFOSA	4151-50-2	< 0.248 UJ	< 0.249 U	R	< 0.246 UJ	R
N-EtFOSAA	2991-50-6	0.517 J-	0.243 J	0.277 J	0.203 J-	0.264 J
N-EtFOSE	1691-99-2	1.24 J+	< 0.744 UJ	R	R	R
N-MeFOSA	31506-32-8	< 0.114 U	< 0.114 U	< 0.113 UJ	< 0.113 UJ	< 0.111 UJ
N-MeFOSAA	2355-31-9	< 0.099 U	< 0.0995 U	< 0.0985 U	< 0.0985 U	< 0.0962 U
N-MeFOSE	24448-09-7	R	R	R	R	R
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.099 U	< 0.0995 U	< 0.0985 U	< 0.0985 U	< 0.0962 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.198 U	< 0.199 U	< 0.216 U	< 0.341 U	< 0.544 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.198 U	< 0.199 U	< 0.197 U	< 0.197 U	< 0.192 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.099 U	< 0.0995 U	< 0.0985 U	< 0.0985 U	< 0.0962 U
PFBA	375-22-4	< 0.396 U	< 0.398 U	< 0.394 U	0.409 J	< 0.385 U
PFBS	375-73-5	< 0.099 U	< 0.0995 U	< 0.0985 U	< 0.0985 U	< 0.0962 U
PFDA	335-76-2	7.69	4.54	6.14	7.89	8.08
PFDoA	307-55-1	0.315 J	0.219 J	0.439	0.615	0.608
PFDoS	79780-39-5	< 0.099 U	< 0.0995 U	< 0.0985 U	< 0.0985 U	< 0.0962 U
PFDS	335-77-3	0.339 J	0.208 J	0.326 J	0.555	0.488
PFHpA	375-85-9	< 0.099 U	< 0.0995 U	< 0.0985 U	< 0.0985 U	< 0.0962 U
PFHpS	375-92-8	0.552	0.46	0.325 J	0.347 J	0.368 J
PFHxA	307-24-4	< 0.099 U	< 0.0995 U	< 0.0985 U	< 0.0985 U	< 0.0962 U
PFHxS	355-46-4	0.104 J	< 0.0995 U	< 0.0985 U	< 0.0985 U	0.103 J
PFNA	375-95-1	0.105 J	< 0.0995 U	0.21 J	< 0.0985 U	< 0.0962 U
PFNS	68259-12-1	1.13	0.678	0.795	1.21	1.22
PFOA	335-67-1	0.146 J	< 0.0995 U	0.145 J	< 0.0985 U	0.148 J
PFOS	1763-23-1	1140	816	700	1080	1080
PFOSA	754-91-6	0.872	0.791	0.645	0.674	0.653
PFPeA	2706-90-3	< 0.198 U	< 0.199 U	< 0.197 U	< 0.197 U	< 0.192 U
PFPeS	2706-91-4	< 0.0995 U	< 0.1 U	< 0.099 U	< 0.099 U	< 0.0966 U
PFTeDA	376-06-7	0.115 J	0.136 J	0.183 J+	0.282 J	0.235 J
PFTrDA	72629-94-8	0.272 BJ	0.162 BJ	0.436 B	0.525 B	0.533 B
PFUnA	2058-94-8	1.2 B	0.855 B	1.47	1.72	1.79

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 4h
West Lakeland Area Predator Fish Tissue
Project 1007
Minneapolis, Minnesota

Location Group	RA_West Lakeland
Location	WL15A
Location ID	PS00188
Sample Type Code	Sample
Sample ID	PS00188 .2009161138.000S
Sample Name	WL15A-PRED-WHO-TWO-01-091620
Sample Date	9/16/2020

Compound	CAS #	
11Cl-PF3OUdS	763051-92-9	< 0.395 U
3:3 FTCA	1169706-83-5	< 0.394 U
4:2 FTS	757124-72-4	< 0.394 U
5:3 FTCA	1799325-94-2	< 2.46 U
6:2 FTS	27619-97-2	< 0.355 U
7:3 FTCA	812-70-4	< 2.46 U
8:2 FTS	39108-34-4	< 0.394 U
9Cl-PF3ONS	756426-58-1	< 0.395 U
ADONA	919005-14-4	< 0.394 U
HFPO-DA	13252-13-6	< 0.374 U
N-EtFOSA	4151-50-2	R
N-EtFOSAA	2991-50-6	0.22 J
N-EtFOSE	1691-99-2	R
N-MeFOSA	31506-32-8	< 0.113 UJ
N-MeFOSAA	2355-31-9	< 0.0985 U
N-MeFOSE	24448-09-7	R
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.0985 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.202 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.197 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.0985 U
PFBA	375-22-4	< 0.394 U
PFBS	375-73-5	< 0.0985 U
PFDA	335-76-2	8.09
PFDoA	307-55-1	0.605
PFDoS	79780-39-5	< 0.0985 U
PFDS	335-77-3	0.389 J
PFHpA	375-85-9	< 0.0985 U
PFHpS	375-92-8	0.358 J
PFHxA	307-24-4	< 0.0985 U
PFHxS	355-46-4	< 0.0985 U
PFNA	375-95-1	< 0.0985 U
PFNS	68259-12-1	1.07
PFOA	335-67-1	< 0.0985 U
PFOS	1763-23-1	1080
PFOSA	754-91-6	0.545
PFPeA	2706-90-3	< 0.197 U
PFPeS	2706-91-4	< 0.099 U
PFTeDA	376-06-7	0.276 J
PFTrDA	72629-94-8	0.544 B
PFUnA	2058-94-8	1.71

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 5a
Other Areas Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Other	RA_Other
		Location	BP1	VB3
		Location ID	82-0111-00-201	S016-316
		Sample Date	9/19/2020	9/16/2020
		Sample Type Code	Sample	QC-FR
		Sample ID	82-0111-00-201.2009190940.000S	S016-316.2009161515.000SR
		Sample Name	BP1-WAT-MID-01-091920	VB3-WAT-BULK-02-091620
		Parent Sample ID	NA	S016-316.2009161515.000S
Fraction	Compound	CAS #		
Dissolved	10:2 FTS	120226-60-0	< 0.0044 U	< 0.004 U
Dissolved	11Cl-PF3OUdS	763051-92-9	< 0.0044 U	< 0.004 UJ
Dissolved	4:2 FTS	757124-72-4	< 0.0044 U	< 0.004 U
Dissolved	6:2 FTS	27619-97-2	< 0.0044 U	< 0.004 U
Dissolved	8:2 FTS	39108-34-4	< 0.0044 U	< 0.004 U
Dissolved	9Cl-PF3ONS	756426-58-1	< 0.0044 U	< 0.004 U
Dissolved	ADONA	919005-14-4	< 0.0044 U	< 0.004 U
Dissolved	HFPO-DA	13252-13-6	0.00031 J	< 0.004 U
Dissolved	N-EtFOSA	4151-50-2	< 0.0044 U	< 0.004 UJ
Dissolved	N-EtFOSAA	2991-50-6	< 0.0044 U	< 0.004 UJ
Dissolved	N-EtFOSE	1691-99-2	< 0.0044 UJ	< 0.004 UJ
Dissolved	N-MeFOSA	31506-32-8	0.00046 BJ	< 0.004 UJ
Dissolved	N-MeFOSAA	2355-31-9	< 0.0044 U	< 0.004 UJ
Dissolved	N-MeFOSE	24448-09-7	< 0.0044 U	< 0.004 UJ
Dissolved	PFBA	375-22-4	0.15 J+	0.25
Dissolved	PFBS	375-73-5	0.0036 J+	0.0026 J
Dissolved	PFDA	335-76-2	< 0.0044 U	< 0.004 U
Dissolved	PFDoA	307-55-1	< 0.0044 U	< 0.004 UJ
Dissolved	PFDS	335-77-3	< 0.0044 U	< 0.004 UJ
Dissolved	PFHpA	375-85-9	0.0065 B	0.0035 J
Dissolved	PFHpS	375-92-8	< 0.0044 U	< 0.004 U
Dissolved	PFHxA	307-24-4	< 0.0092 U	< 0.0092 U
Dissolved	PFHxS	355-46-4	0.0017 J	0.0031 J
Dissolved	PFNA	375-95-1	0.0013 J	< 0.004 U
Dissolved	PFNS	68259-12-1	< 0.0044 U	< 0.004 U
Dissolved	PFOA	335-67-1	0.014 J+	0.014
Dissolved	PFOS	1763-23-1	0.002 J	0.019
Dissolved	PFOSA	754-91-6	< 0.0044 U	< 0.004 U
Dissolved	PFPeA	2706-90-3	0.0099	0.012
Dissolved	PFPeS	2706-91-4	< 0.0044 U	0.0019 J+
Dissolved	PFTeDA	376-06-7	0.0037 BJ+	R
Dissolved	PFTrDA	72629-94-8	0.0013 J+	0.017 BJ+
Dissolved	PFUnA	2058-94-8	< 0.0044 U	< 0.004 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 5a
Other Areas Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other
		Location	RC1	RC1	RC2	RC2	RC2	RC24	RC25
		Location ID	82-0103-00-205	82-0103-00-205	82-0104-00-204	82-0104-00-204	82-0104-00-204	PI00003	PI00004
		Sample Date	8/15/2019	8/15/2019	8/15/2019	8/15/2019	8/15/2019	7/29/2020	7/29/2020
		Sample Type Code	Sample	Sample	QC-FR	Sample	Sample	Sample	Sample
		Sample ID	82-0103-00-205.1908151130.000S	82-0103-00-205.1908151320.000S	82-0104-00-204.1908151130.000SR	82-0104-00-204.1908151135.000S	82-0104-00-204.1908151140.000S	PI00003 .2007291645.000S	PI00004.2007291220.000S
		Sample Name	RC1-WAT-SUR-01-081519	RC1-WAT-18-21-01-081519	RC2-WAT-SUR-02-081519	RC2-WAT-18-21-01-081519	RC2-WAT-SUR-01-081519	RC24-WAT-BULK-01-072920	RC25-WAT-BULK-01-072920
		Parent Sample ID	NA	NA	82-0104-00-204.1908151140.000S	NA	NA	NA	NA
Fraction	Compound	CAS #							
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.00288 U	< 0.00289 U	< 0.00285 U	< 0.00285 U	< 0.00288 U	< 0.00149 UJ	< 0.00144 UJ
Total	4:2 FTS	757124-72-4	< 0.00288 U	< 0.00289 U	< 0.00285 U	< 0.00285 U	< 0.00288 U	< 0.00148 UJ	< 0.00144 UJ
Total	6:2 FTS	27619-97-2	< 0.00259 U	< 0.0026 U	0.0366 J	< 0.00256 U	< 0.00259 U	< 0.00134 UJ	0.0085 BJ-
Total	8:2 FTS	39108-34-4	< 0.00288 U	< 0.00289 U	< 0.00285 U	< 0.00285 U	< 0.00288 U	< 0.00148 UJ	< 0.00144 UJ
Total	9Cl-PF3ONS	756426-58-1	< 0.00288 U	< 0.00289 U	< 0.00285 U	< 0.00285 U	< 0.00288 U	< 0.00149 UJ	< 0.00144 UJ
Total	ADONA	919005-14-4	< 0.00288 U	< 0.00289 U	< 0.00285 U	< 0.00285 U	< 0.00288 U	< 0.00148 UJ	< 0.00144 UJ
Total	HFPO-DA	13252-13-6	< 0.00288 U	< 0.00289 U	< 0.00285 U	< 0.00285 U	< 0.00288 U	< 0.00141 UJ	< 0.00137 UJ
Total	N-EtFOSA	4151-50-2	< 0.0018 U	< 0.00181 U	< 0.00178 U	< 0.00178 U	< 0.0018 U	< 0.000928 UJ	< 0.0009 UJ
Total	N-EtFOSAA	2991-50-6	< 0.000721 U	< 0.000723 U	< 0.000712 U	< 0.000712 U	< 0.000721 U	< 0.000371 UJ	< 0.00036 UJ
Total	N-EtFOSE	1691-99-2	< 0.0054 U	< 0.00542 U	< 0.00534 U	< 0.00534 U	< 0.0054 U	< 0.00278 UJ	< 0.00269 UJ
Total	N-MeFOSA	31506-32-8	< 0.000829 U	< 0.000831 U	< 0.000819 U	< 0.000819 U	< 0.000829 U	< 0.000427 UJ	< 0.000414 UJ
Total	N-MeFOSAA	2355-31-9	< 0.000721 U	< 0.000723 U	< 0.000712 U	< 0.000712 U	< 0.000721 U	< 0.000371 UJ	< 0.00036 UJ
Total	N-MeFOSE	24448-09-7	< 0.00721 U	< 0.00723 U	< 0.00712 U	< 0.00712 U	< 0.00721 U	< 0.00371 UJ	< 0.0036 UJ
Total	PFBA	375-22-4	0.0919	0.0876	0.182	0.156	0.119	0.059 J	0.0846 J-
Total	PFBS	375-73-5	0.00221	0.00203	0.00191	0.00161	0.00164	0.00219 J-	0.00309 J-
Total	PFDA	335-76-2	< 0.000721 U	< 0.000723 U	< 0.000712 U	< 0.000712 U	< 0.000721 U	0.0004 J-	< 0.00036 UJ
Total	PFDoA	307-55-1	< 0.000721 U	< 0.000723 U	< 0.000712 U	< 0.000712 U	< 0.000721 U	< 0.000371 UJ	< 0.00036 UJ
Total	PFDoS	79780-39-5	< 0.000721 U	< 0.000723 U	< 0.000712 U	< 0.000712 U	< 0.000721 U	< 0.000371 UJ	< 0.00036 UJ
Total	PFDS	335-77-3	< 0.000721 U	< 0.000723 U	< 0.000712 U	< 0.000712 U	< 0.000721 U	< 0.000371 UJ	< 0.00036 UJ
Total	PFHpA	375-85-9	0.0019 J	0.00207 J	0.00227 J	0.00236 J	0.00252 J	0.00237 J-	0.00219 J-
Total	PFHpS	375-92-8	< 0.000721 U	< 0.000723 U	< 0.000712 U	< 0.000712 U	< 0.000721 U	< 0.000371 UJ	< 0.00036 UJ
Total	PFHxA	307-24-4	0.00423 J	0.00384 J	0.00518 J	0.00461 J	0.00482 J	0.00357 J-	0.00484 J-
Total	PFHxS	355-46-4	0.00287	0.00262	0.00377	0.0028	0.00302	0.00318 J-	0.0033 J-
Total	PFNA	375-95-1	0.000843 J	< 0.000723 U	0.00141 J	0.00127 J	0.00115 J	0.000854 J-	0.000748 J-
Total	PFNS	68259-12-1	< 0.000721 U	< 0.000723 U	< 0.000712 U	< 0.000712 U	< 0.000721 U	< 0.000371 UJ	< 0.00036 UJ
Total	PFOA	335-67-1	0.00738	0.00811	0.00952	0.00928	0.0107	0.00725 J-	0.00785 J-
Total	PFOS	1763-23-1	0.00178	0.00132 J	0.0042	0.0016	0.00169	0.00262 BJ-	0.00281 BJ-
Total	PFOSA	754-91-6	< 0.000721 U	< 0.000723 U	< 0.000712 U	< 0.000712 U	< 0.000721 U	< 0.000371 UJ	< 0.00036 UJ
Total	PFPeA	2706-90-3	0.00534	0.00473	0.00678	0.0061	0.00628	0.00441 J-	0.00608 J-
Total	PFPeS	2706-91-4	< 0.000721 U	< 0.000723 U	< 0.000712 U	< 0.000712 U	< 0.000721 U	< 0.000373 UJ	0.000455 J-
Total	PFTeDA	376-06-7	< 0.000721 U	< 0.000723 U	< 0.000712 U	< 0.000712 U	< 0.000721 U	< 0.000371 UJ	< 0.00036 UJ
Total	PFTrDA	72629-94-8	< 0.000721 U	< 0.000723 U	< 0.000712 U	< 0.000712 U	< 0.000721 U	< 0.000371 UJ	< 0.00036 UJ
Total	PFUnA	2058-94-8	< 0.000721 U	< 0.000723 U	< 0.000712 U	< 0.000712 U	< 0.000721 U	< 0.000371 UJ	< 0.00036 UJ

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 5a
Other Areas Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other
		Location	EP24	EP24	EP24	EP24	EP25	FP1	OD1
		Location ID	82-0107-00-204	82-0107-00-204	82-0107-00-204	82-0107-00-204	82-0107-00-205	PS00181	S016-389
		Sample Date	5/7/2020	5/7/2020	7/28/2020	9/16/2020	5/11/2020	7/29/2020	10/13/2020
		Sample Type Code	QC-FR	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	82-0107-00-204.2005070900.000SR	82-0107-00-204.2005071710.000S	82-0107-00-204.2007281715.000S	82-0107-00-204.2009161320.000S	82-0107-00-205.2005111230.000S	PS00181 .2007291100.000S	S016-389.2010130910.000S
		Sample Name	EP24-WAT-BULK-02-050720	EP24-WAT-BULK-01-050720	EP24-WAT-BULK-01-072820	EP24-WAT-BULK-01-091620	EP25-WAT-BULK-01-051120	FP1-WAT-BULK-01-072920	OD1-WAT-BULK-01-101320
		Parent Sample ID	82-0107-00-204.2005071710.000S	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #							
Total	10:2 FTS	120226-60-0	NA	NA	NA	< 0.0042 U	NA	NA	< 0.004 U
Total	11Cl-PF3OUdS	763051-92-9	< 0.00294 UJ	< 0.00292 UJ	< 0.00147 U	< 0.0042 U	< 0.00297 UJ	< 0.00148 U	< 0.004 U
Total	4:2 FTS	757124-72-4	< 0.00294 UJ	< 0.00292 UJ	< 0.00146 U	< 0.0042 U	< 0.00297 UJ	< 0.00147 U	< 0.004 U
Total	6:2 FTS	27619-97-2	< 0.00265 UJ	< 0.00263 UJ	0.0124 B	< 0.0042 U	< 0.00268 UJ	0.104 B	< 0.004 U
Total	8:2 FTS	39108-34-4	< 0.00294 UJ	< 0.00292 UJ	< 0.00146 U	< 0.0042 U	< 0.00297 UJ	< 0.00147 U	< 0.004 U
Total	9Cl-PF3ONS	756426-58-1	< 0.00294 UJ	< 0.00292 UJ	< 0.00147 U	< 0.0042 U	< 0.00297 UJ	< 0.00148 U	< 0.004 U
Total	ADONA	919005-14-4	< 0.00294 UJ	< 0.00292 UJ	< 0.00146 U	< 0.0042 U	< 0.00297 UJ	< 0.00147 U	< 0.004 U
Total	HFPO-DA	13252-13-6	< 0.0028 UJ	< 0.00278 UJ	< 0.00139 U	< 0.0042 U	< 0.00282 UJ	< 0.0014 U	< 0.004 U
Total	N-EtFOSA	4151-50-2	< 0.00184 UJ	< 0.00183 UJ	< 0.000915 U	< 0.0042 U	< 0.00186 UJ	< 0.000922 U	< 0.004 U
Total	N-EtFOSAA	2991-50-6	< 0.000736 UJ	< 0.00073 UJ	< 0.000366 U	< 0.0042 U	< 0.000743 UJ	< 0.000369 U	< 0.004 U
Total	N-EtFOSE	1691-99-2	< 0.00552 UJ	< 0.00548 UJ	< 0.00274 U	< 0.0042 U	< 0.00557 UJ	< 0.00276 U	< 0.004 U
Total	N-MeFOSA	31506-32-8	< 0.000847 UJ	< 0.00084 UJ	< 0.000421 U	0.00055 BJ	< 0.000855 UJ	< 0.000424 U	0.00048 BJ
Total	N-MeFOSAA	2355-31-9	< 0.000736 UJ	< 0.00073 UJ	< 0.000366 U	< 0.0042 U	< 0.000743 UJ	< 0.000369 U	< 0.004 U
Total	N-MeFOSE	24448-09-7	< 0.00736 UJ	< 0.0073 UJ	< 0.00366 U	< 0.0042 U	< 0.00743 UJ	< 0.00369 U	< 0.004 U
Total	PFBA	375-22-4	4.93 J	5.02 J	R	4.7	3.82 J	R	0.12
Total	PFBS	375-73-5	0.00382 J-	0.00398 J-	0.00445	0.0039 J	0.00303 J-	0.00147 J	0.0055
Total	PFDA	335-76-2	< 0.000736 UJ	< 0.00073 UJ	< 0.000366 U	< 0.0042 U	< 0.000743 UJ	< 0.000369 U	0.0016 J
Total	PFDoA	307-55-1	< 0.000736 UJ	< 0.00073 UJ	< 0.000366 U	< 0.0042 U	< 0.000743 UJ	< 0.000369 U	< 0.004 U
Total	PFDoS	79780-39-5	< 0.000736 UJ	< 0.00073 UJ	< 0.000366 U	NA	< 0.000743 UJ	< 0.000369 U	NA
Total	PFDS	335-77-3	< 0.000736 UJ	< 0.00073 UJ	< 0.000366 U	< 0.0042 U	< 0.000743 UJ	< 0.000369 U	< 0.004 U
Total	PFHpA	375-85-9	0.0104 J-	0.00983 J-	0.00944	0.017	0.00913 J-	0.00208	0.0065
Total	PFHpS	375-92-8	< 0.000736 UJ	< 0.00073 UJ	< 0.000366 U	< 0.0042 U	< 0.000743 UJ	< 0.000369 U	0.0072
Total	PFHxA	307-24-4	0.0528 J-	0.0527 J-	0.0481	0.073	0.0462 J-	0.00369	0.012
Total	PFHxS	355-46-4	0.00214 J-	0.00213 J-	0.00242	0.003 J	0.00193 J-	0.00243	0.0055
Total	PFNA	375-95-1	< 0.000736 UJ	< 0.00073 UJ	0.000723 J	< 0.0042 U	0.000942 J-	0.000697 J	< 0.004 U
Total	PFNS	68259-12-1	< 0.000736 UJ	< 0.00073 UJ	< 0.000366 U	< 0.0042 U	< 0.000743 UJ	< 0.000369 U	< 0.004 U
Total	PFOA	335-67-1	0.0816 J-	0.0825 J-	0.0967	0.12	0.0723 J-	0.00817	0.035
Total	PFOS	1763-23-1	0.00162 J-	0.00116 J-	0.00269	0.018	0.00291 J-	0.00456	0.11
Total	PFOSA	754-91-6	0.00124 J-	< 0.00073 UJ	< 0.000366 U	< 0.0042 U	< 0.000743 UJ	< 0.000369 U	0.00079 J
Total	PFPeA	2706-90-3	0.0561 J-	0.0559 J-	0.0488	0.06	0.048 J-	0.00479	0.0095
Total	PFPeS	2706-91-4	0.000905 J-	0.00115 J-	0.00124 J+	0.0037 J	0.00107 J-	< 0.000371 U	0.0021 J
Total	PFTeDA	376-06-7	< 0.000736 UJ	< 0.00073 UJ	< 0.000366 U	< 0.0042 U	< 0.000743 UJ	< 0.000369 U	< 0.004 UJ
Total	PFTrDA	72629-94-8	< 0.000736 UJ	< 0.00073 UJ	< 0.000366 U	< 0.0042 U	< 0.000743 UJ	< 0.000369 U	< 0.004 U
Total	PFUnA	2058-94-8	< 0.000736 UJ	< 0.00073 UJ	< 0.000366 U	< 0.0042 U	< 0.000743 UJ	< 0.000369 U	< 0.004 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 5a
Other Areas Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other
		Location	OD2	OD2	RC3CUL	FC1	FC1	FC2	BP1
		Location ID	PS00186	PS00186	S016-390	S016-315	S016-315	S016-351	82-0111-00-201
		Sample Date	10/8/2020	10/13/2020	10/8/2020	5/5/2020	7/28/2020	6/29/2020	5/4/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	PS00186.2010081040.000S	PS00186.2010130845.000S	S016-390.2010081330.000S	S016-315.2005051130.000S	S016-315.2007281200.000S	S016-351.2006291720.000S	82-0111-00-201.2005041530.000S
		Sample Name	OD2-WAT-BULK-01-100820	OD2-WAT-BULK-01-101320	RC3CUL-WAT-BULK-01-100820	FC1-WAT-BULK-01-050520	FC1-WAT-BULK-01-072820	FC2-WAT-BULK-01-062920	BP1-WAT-BULK-01-050420
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #							
Total	10:2 FTS	120226-60-0	< 0.0042 U	< 0.0039 U	< 0.0042 U	NA	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.0042 U	< 0.0039 U	< 0.0042 U	< 0.00299 UJ	< 0.00293 UJ	< 0.00301 UJ	< 0.00295 U
Total	4:2 FTS	757124-72-4	< 0.0042 U	< 0.0039 U	< 0.0042 U	< 0.00299 UJ	< 0.00293 UJ	< 0.00301 UJ	< 0.00295 U
Total	6:2 FTS	27619-97-2	< 0.0042 U	< 0.0039 U	< 0.0042 U	< 0.00269 UJ	< 0.00263 UJ	< 0.00271 UJ	< 0.00265 U
Total	8:2 FTS	39108-34-4	< 0.0042 U	< 0.0039 U	< 0.0042 U	< 0.00299 UJ	< 0.00293 UJ	< 0.00301 UJ	< 0.00295 U
Total	9Cl-PF3ONS	756426-58-1	< 0.0042 U	< 0.0039 U	< 0.0042 U	< 0.00299 UJ	< 0.00293 UJ	< 0.00301 UJ	< 0.00295 U
Total	ADONA	919005-14-4	< 0.0042 U	< 0.0039 U	< 0.0042 U	< 0.00299 UJ	< 0.00293 UJ	< 0.00301 UJ	< 0.00295 U
Total	HFPO-DA	13252-13-6	< 0.0042 U	< 0.0039 U	< 0.0042 UJ	< 0.00284 UJ	< 0.00278 UJ	< 0.00286 UJ	< 0.0028 U
Total	N-EtFOSA	4151-50-2	< 0.0042 U	< 0.0039 U	< 0.0042 U	< 0.00187 UJ	< 0.00183 UJ	< 0.00188 UJ	< 0.00184 U
Total	N-EtFOSAA	2991-50-6	< 0.0042 U	< 0.0039 U	0.0011 J	< 0.000748 UJ	< 0.000732 UJ	< 0.000752 UJ	< 0.000737 U
Total	N-EtFOSE	1691-99-2	< 0.0042 U	< 0.0039 U	< 0.0042 U	< 0.00561 UJ	< 0.00549 UJ	< 0.00564 UJ	< 0.00553 U
Total	N-MeFOSA	31506-32-8	< 0.0042 U	< 0.0039 U	< 0.0042 U	< 0.00086 UJ	< 0.000842 UJ	< 0.000864 UJ	< 0.000847 U
Total	N-MeFOSAA	2355-31-9	< 0.0042 UJ	< 0.0039 U	< 0.0042 UJ	< 0.000748 UJ	< 0.000732 UJ	< 0.000752 UJ	< 0.000737 U
Total	N-MeFOSE	24448-09-7	< 0.0042 U	< 0.0039 U	< 0.0042 U	< 0.00748 UJ	< 0.00732 UJ	< 0.00752 UJ	< 0.00737 U
Total	PFBA	375-22-4	0.13	0.086	0.18	0.193 J-	0.21 J-	R	0.123
Total	PFBS	375-73-5	0.0051	0.0032 J	0.0089	0.00392 J-	0.00451 J-	0.0024 J-	0.00223
Total	PFDA	335-76-2	0.0052	0.0045	0.0035 J	< 0.000748 UJ	< 0.000732 UJ	< 0.000752 UJ	< 0.000737 U
Total	PFDoA	307-55-1	0.0013 J	< 0.0039 U	< 0.0042 U	< 0.000748 UJ	< 0.000732 UJ	< 0.000752 UJ	< 0.000737 U
Total	PFDoS	79780-39-5	NA	NA	NA	< 0.000748 UJ	< 0.000732 UJ	< 0.000752 UJ	< 0.000737 U
Total	PFDS	335-77-3	< 0.0042 U	< 0.0039 U	< 0.0042 U	< 0.000748 UJ	< 0.000732 UJ	< 0.000752 UJ	< 0.000737 U
Total	PFHpA	375-85-9	0.014	0.0087	0.014	0.00207 J-	0.00273 J-	0.00154 J-	0.00301
Total	PFHpS	375-92-8	0.005	0.0051	0.0099	< 0.000748 UJ	< 0.000732 UJ	< 0.000752 UJ	< 0.000737 U
Total	PFHxA	307-24-4	0.017	0.014 J+	0.028 J+	0.00618 J-	0.00762 J-	0.00388 J-	0.00532
Total	PFHxS	355-46-4	0.011 J+	0.0095	0.036 J+	0.00254 J-	0.00253 J-	0.00139 J-	< 0.000737 U
Total	PFNA	375-95-1	0.0033 J	0.0023 J	0.0026 J	< 0.000748 UJ	< 0.000732 UJ	< 0.000752 UJ	< 0.000737 U
Total	PFNS	68259-12-1	0.0012 J	< 0.0039 U	< 0.0042 U	< 0.000748 UJ	< 0.000732 UJ	< 0.000752 UJ	< 0.000737 U
Total	PFOA	335-67-1	0.1	0.071	0.16	0.00999 J-	0.0134 J-	0.00754 J-	0.0119
Total	PFOS	1763-23-1	0.32	0.2	0.33	0.00415 J-	0.00845 J-	0.0056 J-	0.00124 J
Total	PFOSA	754-91-6	0.0014 J	0.001 J	0.00095 J	< 0.000748 UJ	< 0.000732 UJ	< 0.000752 UJ	< 0.000737 U
Total	PFPeA	2706-90-3	0.011	0.0075	0.019	0.00902 J-	0.0116 J-	0.00657 J	0.0073
Total	PFPeS	2706-91-4	0.005	0.0027 J	0.01	< 0.000748 UJ	0.000811 J-	< 0.000752 UJ	< 0.000737 U
Total	PFTeDA	376-06-7	< 0.0042 UJ	< 0.0039 UJ	< 0.0042 UJ	< 0.000748 UJ	< 0.000732 UJ	< 0.000752 UJ	< 0.000737 U
Total	PFTrDA	72629-94-8	< 0.0042 U	< 0.0039 U	< 0.0042 U	< 0.000748 UJ	< 0.000732 UJ	< 0.000752 UJ	< 0.000737 U
Total	PFUnA	2058-94-8	< 0.0042 U	< 0.0039 U	< 0.0042 U	< 0.000748 UJ	< 0.000732 UJ	< 0.000752 UJ	< 0.000737 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

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- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 5a
Other Areas Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other
		Location	BP1	BP1	GL1	GL2	PP1	ML1	LP1
		Location ID	82-0111-00-201	82-0111-00-201	82-0113-00-201	82-0113-00-201	PS00187	PS00190	PS00182
		Sample Date	9/19/2020	9/19/2020	5/12/2020	6/29/2020	11/18/2020	11/18/2020	9/4/2020
		Sample Type Code	Sample	QC-FR	Sample	Sample	Sample	Sample	Sample
		Sample ID	82-0111-00-201.2009190940.000S	82-0111-00-201.2009190945.000SR	82-0113-00-201.2005121015.000S	82-0113-00-201.2006291400.000S	PS00187.2011181230.000S	PS00190.2011181450.000S	PS00182 .2009040845.000S
		Sample Name	BP1-WAT-MID-01-091920	BP1-WAT-MID-02-091920	GL1-WAT-BULK-01-051220	GL2-WAT-BULK-01-062920	PP1-WAT-BULK-01-111820	ML1-WAT-BULK-01-111820	LP1-WAT-BULK-01-090420
		Parent Sample ID	NA	82-0111-00-201.2009190940.000S	NA	NA	NA	NA	NA
Fraction	Compound	CAS #							
Total	10:2 FTS	120226-60-0	< 0.0042 U	< 0.0039 U	NA	NA	< 0.0043 U	< 0.0041 U	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.0042 U	< 0.0039 U	< 0.00292 U	< 0.003 UJ	< 0.0043 U	< 0.0041 U	< 0.00148 UJ
Total	4:2 FTS	757124-72-4	< 0.0042 U	< 0.0039 U	< 0.00292 U	< 0.003 UJ	< 0.0043 U	< 0.0041 U	< 0.00147 UJ
Total	6:2 FTS	27619-97-2	< 0.0042 U	< 0.0039 U	< 0.00263 U	< 0.0027 UJ	< 0.0043 U	< 0.0041 U	< 0.00133 UJ
Total	8:2 FTS	39108-34-4	< 0.0042 U	< 0.0039 U	< 0.00292 U	< 0.003 UJ	< 0.0043 U	< 0.0041 U	< 0.00147 UJ
Total	9Cl-PF3ONS	756426-58-1	< 0.0042 U	< 0.0039 U	< 0.00292 U	< 0.003 UJ	< 0.0043 U	< 0.0041 U	< 0.00148 UJ
Total	ADONA	919005-14-4	< 0.0042 U	< 0.0039 U	< 0.00292 U	< 0.003 UJ	< 0.0043 U	< 0.0041 U	< 0.00147 UJ
Total	HFPO-DA	13252-13-6	< 0.0042 U	< 0.0039 U	< 0.00277 U	< 0.00285 UJ	< 0.0043 U	< 0.0041 U	< 0.0014 UJ
Total	N-EtFOSA	4151-50-2	< 0.0042 U	< 0.0039 U	< 0.00182 U	< 0.00187 UJ	< 0.0043 U	< 0.0041 U	< 0.000922 UJ
Total	N-EtFOSAA	2991-50-6	< 0.0042 U	< 0.0039 U	< 0.00073 U	< 0.00075 UJ	< 0.0043 U	< 0.0041 U	< 0.000369 UJ
Total	N-EtFOSE	1691-99-2	< 0.0042 U	< 0.0039 U	< 0.00547 U	< 0.00562 UJ	< 0.0043 U	< 0.0041 U	< 0.00276 UJ
Total	N-MeFOSA	31506-32-8	< 0.0042 U	< 0.0039 U	< 0.000839 U	< 0.000862 UJ	< 0.0043 U	0.00046 J	< 0.000424 UJ
Total	N-MeFOSAA	2355-31-9	< 0.0042 U	< 0.0039 U	< 0.00073 U	< 0.00075 UJ	< 0.0043 U	< 0.0041 U	< 0.000369 UJ
Total	N-MeFOSE	24448-09-7	< 0.0042 U	< 0.0039 U	< 0.0073 U	< 0.0075 UJ	< 0.0043 U	< 0.0041 U	< 0.00369 UJ
Total	PFBA	375-22-4	0.13	0.13	0.0306	R	0.04	0.36	0.125 J-
Total	PFBS	375-73-5	0.0026 J	0.0021 J	< 0.00073 U	0.00105 J-	0.0012 J	0.0072	0.00209 J-
Total	PFDA	335-76-2	< 0.0042 U	< 0.0039 U	< 0.00073 U	< 0.00075 UJ	< 0.0043 U	< 0.0041 U	< 0.000369 UJ
Total	PFDoA	307-55-1	< 0.0042 U	< 0.0039 U	< 0.00073 U	< 0.00075 UJ	< 0.0043 U	< 0.0041 U	< 0.000369 UJ
Total	PFDoS	79780-39-5	NA	NA	< 0.00073 U	< 0.00075 UJ	NA	NA	< 0.000369 UJ
Total	PFDS	335-77-3	< 0.0042 U	< 0.0039 U	< 0.00073 U	< 0.00075 UJ	< 0.0043 U	< 0.0041 U	< 0.000369 UJ
Total	PFHpA	375-85-9	0.0075	0.0056	0.00128 J	0.00164 J-	0.002 J	0.011	0.00299 J-
Total	PFHpS	375-92-8	< 0.0042 U	< 0.0039 U	< 0.00073 U	< 0.00075 UJ	0.0012 J	0.0011 J	< 0.000369 UJ
Total	PFHxA	307-24-4	< 0.0092 U	< 0.0092 U	0.00183 J	0.00276 J-	< 0.0092 U	0.032	0.0053 J-
Total	PFHxS	355-46-4	< 0.0042 U	< 0.0039 U	< 0.00073 U	< 0.00075 UJ	< 0.0043 U	0.0056	0.000958 J-
Total	PFNA	375-95-1	< 0.0042 U	< 0.0039 U	< 0.00073 U	< 0.00075 UJ	< 0.0043 U	< 0.0041 U	0.00107 J-
Total	PFNS	68259-12-1	< 0.0042 U	< 0.0039 U	< 0.00073 U	< 0.00075 UJ	< 0.0043 U	< 0.0041 U	< 0.000369 UJ
Total	PFOA	335-67-1	0.015	0.014	0.00471	0.00621 J-	0.0064	0.081	0.0108 J-
Total	PFOS	1763-23-1	0.0023 J	0.003 J	0.00302	0.00427 J-	0.0038 J	0.015	0.00532 J-
Total	PFOSA	754-91-6	< 0.0042 U	< 0.0039 U	< 0.00073 U	< 0.00075 UJ	< 0.0043 U	< 0.0041 U	0.000841 J-
Total	PFPeA	2706-90-3	0.0089	0.0084	0.00265 J	0.00448 J-	0.0037 J	0.029	0.0107 J-
Total	PFPeS	2706-91-4	< 0.0042 U	< 0.0039 U	< 0.00073 U	< 0.00075 UJ	< 0.0043 U	0.0058	< 0.000371 UJ
Total	PFTeDA	376-06-7	< 0.0042 UJ	< 0.0039 UJ	< 0.00073 U	< 0.00075 UJ	< 0.0043 U	< 0.0041 U	< 0.000369 UJ
Total	PFTrDA	72629-94-8	0.0016 J	0.0014 J	< 0.00073 U	< 0.00075 UJ	< 0.0043 U	< 0.0041 U	< 0.000369 UJ
Total	PFUnA	2058-94-8	< 0.0042 U	< 0.0039 U	< 0.00073 U	< 0.00075 UJ	< 0.0043 U	< 0.0041 U	< 0.000369 UJ

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 5a
Other Areas Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other
		Location	DL1	WL18	WL18	WL18	WL19	WL20	SC1	SC2
		Location ID	82-0110-00-452	SS00087	SS00087	SS00087	SS00088	SS00089	S016-077	S016-078
		Sample Date	9/4/2020	8/15/2019	2/26/2020	5/8/2020	8/15/2019	8/15/2019	8/12/2019	8/12/2019
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	82-0110-00-452 .2009040815.000S	SS00087.1908151130.000S	SS00087.2002261615.000S	SS00087.2005081115.000S	SS00088.1908151230.000S	SS00089.1908151330.000S	S016-077.1908120715.000S	S016-078.1908120732.000S
		Sample Name	DL1-WAT-BULK-01-090420	WL18-WAT-SUR-01-081519	WL18-WAT-BULK-01-022620	WL18-WAT-BULK-01-050820	WL19-WAT-SUR-01-081519	WL20-WAT-SUR-01-081519	SC1-WAT-18-21-01-081219	SC2-WAT-18-21-01-081219
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.00145 UJ	< 0.00287 U	< 0.00292 U	< 0.00307 UJ	< 0.00304 U	< 0.0226 U	< 0.00281 U	< 0.0257 U
Total	4:2 FTS	757124-72-4	< 0.00145 UJ	< 0.00287 U	< 0.00292 U	< 0.00307 UJ	< 0.00304 U	< 0.0226 U	< 0.00281 U	< 0.0257 U
Total	6:2 FTS	27619-97-2	< 0.00131 UJ	< 0.00259 U	< 0.00263 U	< 0.00276 UJ	< 0.00273 U	0.0452 J	< 0.00253 U	< 0.0231 U
Total	8:2 FTS	39108-34-4	< 0.00145 UJ	< 0.00287 U	< 0.00292 U	< 0.00307 UJ	< 0.00304 U	< 0.0226 U	< 0.00281 U	< 0.0257 U
Total	9Cl-PF3ONS	756426-58-1	< 0.00146 UJ	< 0.00287 U	< 0.00292 U	< 0.00307 UJ	< 0.00304 U	< 0.0226 U	< 0.00281 U	< 0.0257 U
Total	ADONA	919005-14-4	< 0.00145 UJ	< 0.00287 U	< 0.00292 U	< 0.00307 UJ	< 0.00304 U	< 0.0226 U	< 0.00281 U	< 0.0257 U
Total	HFPO-DA	13252-13-6	< 0.00138 UJ	< 0.00287 U	< 0.00292 U	< 0.00291 UJ	< 0.00304 U	< 0.0226 U	< 0.00281 U	< 0.0257 U
Total	N-EtFOSA	4151-50-2	< 0.000908 UJ	< 0.0018 U	< 0.00183 U	< 0.00192 UJ	< 0.0019 U	< 0.0141 U	< 0.00175 U	< 0.016 U
Total	N-EtFOSAA	2991-50-6	< 0.000363 UJ	< 0.000719 U	< 0.00073 U	< 0.000766 UJ	< 0.00076 U	< 0.0113 U	< 0.000702 U	< 0.00642 U
Total	N-EtFOSE	1691-99-2	< 0.00272 UJ	< 0.00539 U	< 0.00548 U	< 0.00575 UJ	< 0.0057 U	< 0.0424 U	< 0.00526 U	< 0.0481 U
Total	N-MeFOSA	31506-32-8	< 0.000418 UJ	< 0.000827 U	< 0.00084 U	< 0.000881 UJ	< 0.000874 U	< 0.00651 U	< 0.000807 U	< 0.00738 U
Total	N-MeFOSAA	2355-31-9	< 0.000363 UJ	< 0.000719 U	< 0.00073 U	< 0.000766 UJ	< 0.00076 U	< 0.00566 U	< 0.000702 U	< 0.00642 U
Total	N-MeFOSE	24448-09-7	< 0.00363 UJ	< 0.00719 U	< 0.0073 U	< 0.00766 UJ	< 0.0076 U	< 0.0566 U	< 0.00702 U	< 0.0642 U
Total	PFBA	375-22-4	0.0371 J-	0.43	0.449	0.451 J	0.303	0.203	0.102	< 0.0257 U
Total	PFBS	375-73-5	0.000854 J-	0.0039	0.00384	0.00451 J-	0.00398	< 0.00566 U	0.00125 J	< 0.00642 U
Total	PFDA	335-76-2	< 0.000363 UJ	< 0.000719 U	0.000874 J	< 0.000766 UJ	< 0.00076 U	< 0.00566 U	< 0.000702 U	< 0.00642 U
Total	PFDoA	307-55-1	< 0.000363 UJ	< 0.000719 U	< 0.00073 U	< 0.000766 UJ	< 0.00076 U	< 0.00566 U	< 0.000702 U	< 0.00642 U
Total	PFDoS	79780-39-5	< 0.000363 UJ	< 0.000719 U	< 0.00073 U	< 0.000766 UJ	< 0.00076 U	< 0.00566 U	< 0.000702 U	< 0.00642 U
Total	PFDS	335-77-3	< 0.000363 UJ	< 0.000719 U	< 0.00073 U	< 0.000766 UJ	< 0.00076 U	< 0.00566 U	< 0.000702 U	< 0.00642 U
Total	PFHpA	375-85-9	0.00157 J-	0.00733	0.00652	0.00998 J-	0.00644	0.00572 J	0.00216 J	< 0.00642 U
Total	PFHpS	375-92-8	< 0.000363 UJ	0.00136 J	0.00114 J	0.00163 J-	0.00128 J	< 0.00566 U	< 0.000702 U	< 0.00642 U
Total	PFHxA	307-24-4	0.00232 J-	0.0123	0.0125	0.0155 J-	0.0114	0.00851 J	0.00328 J	< 0.00642 U
Total	PFHxS	355-46-4	< 0.000363 UJ	0.0098	0.00859	0.0114 J-	0.00938	0.0074 J	0.00239 J	< 0.00642 U
Total	PFNA	375-95-1	0.000805 J-	0.00118 J	0.000886 J	< 0.000766 UJ	0.000948 J	< 0.00566 U	< 0.000702 U	< 0.00642 U
Total	PFNS	68259-12-1	< 0.000363 UJ	< 0.000719 U	< 0.00073 U	< 0.000766 UJ	< 0.00076 U	< 0.00566 U	< 0.000702 U	< 0.00642 U
Total	PFOA	335-67-1	0.00343 J-	0.0697	0.0559	0.0792 J-	0.0566	0.0495	0.0177	< 0.00642 U
Total	PFOS	1763-23-1	0.00194 J-	0.17	0.11	0.116 J-	0.142	0.166	0.0377	< 0.00642 U
Total	PFOSA	754-91-6	< 0.000363 UJ	< 0.000719 U	< 0.00073 U	< 0.000766 UJ	< 0.00076 U	< 0.00566 U	< 0.000702 U	< 0.00642 U
Total	PFPeA	2706-90-3	0.00339 J-	0.0119	0.0131	0.0126 J-	0.0102	< 0.0113 U	0.0032 J	< 0.0128 U
Total	PFPeS	2706-91-4	< 0.000365 UJ	0.0026	0.00233	0.00354 J-	0.00196	< 0.00566 U	< 0.000702 U	< 0.00642 U
Total	PFTeDA	376-06-7	< 0.000363 UJ	< 0.000719 U	< 0.00073 U	< 0.000766 UJ	< 0.00076 U	< 0.00566 U	< 0.000702 U	< 0.00642 U
Total	PFTrDA	72629-94-8	< 0.000363 UJ	< 0.000719 U	< 0.00073 U	< 0.000766 UJ	< 0.00076 U	< 0.00566 U	< 0.000702 U	< 0.00642 U
Total	PFUnA	2058-94-8	< 0.000363 UJ	< 0.000719 U	< 0.00073 U	< 0.000766 UJ	< 0.00076 U	< 0.00566 U	< 0.000702 U	< 0.00642 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 5a
Other Areas Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other
		Location	SC3	SC4	VB1	VB1	VB1	VB2	VB2	VB3
		Location ID	S016-079	S016-080	S006-732	S006-732	S006-732	S006-734	S006-734	S016-316
		Sample Date	8/12/2019	8/12/2019	4/29/2020	5/4/2020	7/31/2020	2/26/2020	5/4/2020	5/4/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	S016-079.1908120743.000S	S016-080.1908120750.000S	S006-732.2004291740.000S	S006-732.2005041045.000S	S006-732.2007311600.000S	S006-734.2002261550.000S	S006-734.2005041145.000S	S016-316.2005041300.000S
		Sample Name	SC3-WAT-18-21-01-081219	SC4-WAT-18-21-01-081219	VB1-WAT-BULK-01-042920	VB1-WAT-BULK-01-050420	VB1-WAT-BULK-01-073120	VB2-WAT-BULK-01-022620	VB2-WAT-BULK-01-050420	VB3-WAT-BULK-01-050420
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #								
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.00279 U	< 0.00282 U	< 0.00306 U	< 0.00309 U	< 0.00148 UJ	< 0.00302 U	< 0.00299 U	< 0.00295 U
Total	4:2 FTS	757124-72-4	< 0.00279 U	< 0.00282 U	< 0.00306 U	< 0.00309 U	< 0.00148 UJ	< 0.00302 U	< 0.00299 U	< 0.00295 U
Total	6:2 FTS	27619-97-2	< 0.00251 U	< 0.00254 U	< 0.00276 U	< 0.00278 U	0.00851 BJ-	< 0.00272 U	< 0.00269 U	< 0.00266 U
Total	8:2 FTS	39108-34-4	< 0.00279 U	< 0.00282 U	< 0.00306 U	< 0.00309 U	< 0.00148 UJ	< 0.00302 U	< 0.00299 U	< 0.00295 U
Total	9Cl-PF3ONS	756426-58-1	< 0.00279 U	< 0.00282 U	< 0.00306 U	< 0.00309 U	< 0.00149 UJ	< 0.00302 U	< 0.00299 U	< 0.00295 U
Total	ADONA	919005-14-4	< 0.00279 U	< 0.00282 U	< 0.00306 U	< 0.00309 U	< 0.00148 UJ	< 0.00302 U	< 0.00299 U	< 0.00295 U
Total	HFPO-DA	13252-13-6	< 0.00279 U	< 0.00282 U	< 0.00291 U	< 0.00294 U	< 0.00141 UJ	< 0.00302 U	< 0.00284 U	< 0.0028 U
Total	N-EtFOSA	4151-50-2	< 0.00175 U	< 0.00176 U	< 0.00191 U	< 0.00193 U	< 0.000927 UJ	< 0.00189 U	< 0.00187 U	< 0.00185 U
Total	N-EtFOSAA	2991-50-6	< 0.000698 U	< 0.000705 U	< 0.000765 U	< 0.000773 U	< 0.000371 UJ	< 0.000754 U	< 0.000747 U	< 0.000738 U
Total	N-EtFOSE	1691-99-2	< 0.00524 U	< 0.00529 U	< 0.00574 U	< 0.0058 U	< 0.00277 UJ	< 0.00566 U	< 0.0056 U	< 0.00554 U
Total	N-MeFOSA	31506-32-8	< 0.000803 U	< 0.000811 U	< 0.00088 U	< 0.000889 U	< 0.000426 UJ	< 0.000867 U	< 0.000859 U	< 0.000849 U
Total	N-MeFOSAA	2355-31-9	< 0.000698 U	< 0.000705 U	< 0.000765 U	< 0.000773 U	< 0.000371 UJ	< 0.000754 U	< 0.000747 U	< 0.000738 U
Total	N-MeFOSE	24448-09-7	< 0.00698 U	< 0.00705 U	< 0.00765 U	< 0.00773 U	< 0.00371 UJ	< 0.00754 U	< 0.00747 U	< 0.00738 U
Total	PFBA	375-22-4	0.0126	0.0182	0.136	0.169	0.153 J	0.229	0.229	0.235
Total	PFBS	375-73-5	< 0.000698 U	< 0.000705 U	0.00415	0.00427	0.00427 J-	0.00249	0.00272	0.00224
Total	PFDA	335-76-2	< 0.000698 U	< 0.000705 U	< 0.000765 U	< 0.000773 U	< 0.000371 UJ	< 0.000754 U	< 0.000747 U	< 0.000738 U
Total	PFDoA	307-55-1	< 0.000698 U	< 0.000705 U	< 0.000765 U	< 0.000773 U	< 0.000371 UJ	< 0.000754 U	< 0.000747 U	< 0.000738 U
Total	PFDoS	79780-39-5	< 0.000698 U	< 0.000705 U	< 0.000765 U	< 0.000773 U	< 0.000371 UJ	< 0.000754 U	< 0.000747 U	< 0.000738 U
Total	PFDS	335-77-3	< 0.000698 U	< 0.000705 U	< 0.000765 U	< 0.000773 U	< 0.000371 UJ	< 0.000754 U	< 0.000747 U	< 0.000738 U
Total	PFHpA	375-85-9	< 0.000698 U	< 0.000705 U	0.00199	0.0022	0.00334 J-	0.00163 J	0.00158	0.0014 J
Total	PFHpS	375-92-8	< 0.000698 U	< 0.000705 U	< 0.000765 U	< 0.000773 U	< 0.000371 UJ	< 0.000754 U	< 0.000747 U	< 0.000738 U
Total	PFHxA	307-24-4	< 0.000698 U	< 0.000705 U	0.00594	0.0063	0.00767 J-	0.00382 J	0.00411	0.00355
Total	PFHxS	355-46-4	< 0.000698 U	< 0.000705 U	0.00433	0.00429	0.00503 J-	0.00369	0.00337	0.00325
Total	PFNA	375-95-1	< 0.000698 U	< 0.000705 U	< 0.000765 U	< 0.000773 U	< 0.000371 UJ	< 0.000754 U	< 0.000747 U	< 0.000738 U
Total	PFNS	68259-12-1	< 0.000698 U	< 0.000705 U	< 0.000765 U	< 0.000773 U	< 0.000371 UJ	< 0.000754 U	< 0.000747 U	< 0.000738 U
Total	PFOA	335-67-1	< 0.000698 U	0.00078 J	0.00753	0.00834	0.0161 J-	0.0123	0.0127	0.0121
Total	PFOS	1763-23-1	< 0.000698 U	< 0.000705 U	0.00257	0.00386	0.0049 BJ-	0.0134	0.0141	0.0144
Total	PFOSA	754-91-6	< 0.000698 U	< 0.000705 U	< 0.000765 U	< 0.000773 U	< 0.000371 UJ	< 0.000754 U	< 0.000747 U	< 0.000738 U
Total	PFPeA	2706-90-3	< 0.0014 U	< 0.00141 U	0.0101	0.0121	0.0138 J-	0.00776	0.00786	0.00793
Total	PFPeS	2706-91-4	< 0.000698 U	< 0.000705 U	< 0.000765 U	< 0.000773 U	0.000843 J-	0.000935 J	0.000921 J	0.000921 J
Total	PFTeDA	376-06-7	< 0.000698 U	< 0.000705 U	< 0.000765 U	< 0.000773 U	< 0.000371 UJ	< 0.000754 U	< 0.000747 U	< 0.000738 U
Total	PFTrDA	72629-94-8	< 0.000698 U	< 0.000705 U	< 0.000765 U	< 0.000773 U	< 0.000371 UJ	< 0.000754 U	< 0.000747 U	< 0.000738 U
Total	PFUnA	2058-94-8	< 0.000698 U	< 0.000705 U	< 0.000765 U	< 0.000773 U	< 0.000371 UJ	< 0.000754 U	< 0.000747 U	< 0.000738 U

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 5a
Other Areas Surface Water
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other
		Location	VB3	VB3	VB3	VB3	VB3	VB3	VB3
		Location ID	S016-316	S016-316	S016-316	S016-316	S016-316	S016-316	S016-316
		Sample Date	5/18/2020	6/29/2020	7/31/2020	8/26/2020	9/1/2020	9/16/2020	9/16/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	QC-FR
		Sample ID	S016-316.2005181715.000S	S016-316.2006292000.000S	S016-316.2007311630.000S	S016-316.2008261355.000S	S016-316.2009011030.000S	S016-316.2009161515.000S	S016-316.2009161515.000SR
		Sample Name	VB3-WAT-BULK-01-051820	VB3-WAT-BULK-01-062920	VB3-WAT-BULK-01-073120	VB3-WAT-BULK-01-082620	VB3-WAT-BULK-01-090120	VB3-WAT-BULK-01-091620	VB3-WAT-BULK-02-091620
		Parent Sample ID	NA	NA	NA	NA	NA	NA	S016-316.2009161515.000S
Fraction	Compound	CAS #							
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	< 0.0045 U	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.003 U	< 0.00294 UJ	< 0.00147 UJ	< 0.00151 U	< 0.00147 UJ	< 0.0045 UJ	NA
Total	4:2 FTS	757124-72-4	< 0.003 U	< 0.00294 UJ	< 0.00147 UJ	< 0.00151 U	< 0.00147 UJ	< 0.0045 U	NA
Total	6:2 FTS	27619-97-2	< 0.0027 U	< 0.00265 UJ	0.00816 BJ-	< 0.00136 U	< 0.00133 UJ	0.016 BJ+	NA
Total	8:2 FTS	39108-34-4	< 0.003 U	< 0.00294 UJ	< 0.00147 UJ	< 0.00151 U	< 0.00147 UJ	< 0.0045 U	NA
Total	9Cl-PF3ONS	756426-58-1	< 0.003 U	< 0.00294 UJ	< 0.00147 UJ	< 0.00151 U	< 0.00148 UJ	< 0.0045 U	NA
Total	ADONA	919005-14-4	< 0.003 U	< 0.00294 UJ	< 0.00147 UJ	< 0.00151 U	< 0.00147 UJ	< 0.0045 U	NA
Total	HFPO-DA	13252-13-6	< 0.00285 U	< 0.00279 UJ	< 0.0014 UJ	< 0.00143 U	< 0.0014 UJ	< 0.0045 U	NA
Total	N-EtFOSA	4151-50-2	< 0.00188 U	< 0.00184 UJ	< 0.000919 UJ	< 0.000944 U	< 0.00092 UJ	< 0.0045 U	NA
Total	N-EtFOSAA	2991-50-6	< 0.000751 U	< 0.000735 UJ	< 0.000367 UJ	< 0.000377 U	< 0.000368 UJ	< 0.0045 UJ	NA
Total	N-EtFOSE	1691-99-2	< 0.00563 U	< 0.00551 UJ	< 0.00275 UJ	< 0.00282 U	< 0.00275 UJ	< 0.0045 U	NA
Total	N-MeFOSA	31506-32-8	< 0.000864 U	< 0.000845 UJ	< 0.000423 UJ	< 0.000434 U	< 0.000423 UJ	< 0.0045 U	NA
Total	N-MeFOSAA	2355-31-9	< 0.000751 U	< 0.000735 UJ	< 0.000367 UJ	< 0.000377 U	< 0.000368 UJ	< 0.0045 U	NA
Total	N-MeFOSE	24448-09-7	< 0.00751 U	< 0.00735 UJ	< 0.00367 UJ	< 0.00377 U	< 0.00368 UJ	< 0.0045 U	NA
Total	PFBA	375-22-4	0.229	R	0.237 J	0.187 J+	0.246 J-	0.2	NA
Total	PFBS	375-73-5	0.00228	0.00237 J-	0.00245 J-	0.00224	0.00272 J-	0.0028 J	NA
Total	PFDA	335-76-2	< 0.000751 U	< 0.000735 UJ	< 0.000367 UJ	< 0.000377 U	< 0.000368 UJ	< 0.0045 U	NA
Total	PFDoA	307-55-1	< 0.000751 U	< 0.000735 UJ	< 0.000367 UJ	< 0.000377 U	< 0.000368 UJ	< 0.0045 U	NA
Total	PFDoS	79780-39-5	< 0.000751 U	< 0.000735 UJ	< 0.000367 UJ	< 0.000377 U	< 0.000368 UJ	NA	NA
Total	PFDS	335-77-3	< 0.000751 U	< 0.000735 UJ	< 0.000367 UJ	< 0.000377 U	< 0.000368 UJ	< 0.0045 UJ	NA
Total	PFHpA	375-85-9	0.0014 J	0.00148 J-	0.00136 J-	0.00137 J	0.00146 J-	0.0016 BJ	NA
Total	PFHpS	375-92-8	< 0.000751 U	< 0.000735 UJ	< 0.000367 UJ	< 0.000377 U	< 0.000368 UJ	< 0.0045 U	NA
Total	PFHxA	307-24-4	0.00353	0.00392 J-	0.00401 J-	0.00341	0.00395 J-	< 0.0092 U	NA
Total	PFHxS	355-46-4	0.00332	0.00317 J-	0.00343 J-	0.00343	0.00348 J-	0.0022 J	NA
Total	PFNA	375-95-1	< 0.000751 U	< 0.000735 UJ	< 0.000367 UJ	< 0.000377 U	< 0.000368 UJ	< 0.0045 U	NA
Total	PFNS	68259-12-1	< 0.000751 U	< 0.000735 UJ	< 0.000367 UJ	< 0.000377 U	< 0.000368 UJ	< 0.0045 U	NA
Total	PFOA	335-67-1	0.0114	0.0121 J-	0.0136 J-	0.013	0.012 J-	0.011	NA
Total	PFOS	1763-23-1	0.0133	0.0123 J-	0.0134 J-	0.0142	0.0127 J-	0.0094	NA
Total	PFOSA	754-91-6	< 0.000751 U	0.000761 J-	< 0.000367 UJ	< 0.000377 U	< 0.000368 UJ	< 0.0045 U	NA
Total	PFPeA	2706-90-3	0.00828	0.00918 J-	0.00858 J-	0.00704	0.00891 J-	0.01	NA
Total	PFPeS	2706-91-4	0.000802 J	0.000862 J-	0.000858 J-	0.000856 J	0.000911 J-	< 0.0045 U	NA
Total	PFTeDA	376-06-7	< 0.000751 U	< 0.000735 UJ	< 0.000367 UJ	< 0.000377 U	< 0.000368 UJ	0.0029 BJ	NA
Total	PFTrDA	72629-94-8	< 0.000751 U	< 0.000735 UJ	< 0.000367 UJ	< 0.000377 U	< 0.000368 UJ	< 0.0045 U	NA
Total	PFUnA	2058-94-8	< 0.000751 U	< 0.000735 UJ	< 0.000367 UJ	< 0.000377 U	< 0.000368 UJ	< 0.0045 U	NA

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 5b
Other Areas Sediment
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other
		Location	RC1	RC2	EP24	RC19	FC1	FC2A	FC2
		Location ID	82-0103-00-205	82-0104-00-204	82-0107-00-204	S016-068	S016-315	S016-351	S016-351
		Sample Date	8/15/2019	8/15/2019	4/27/2020	8/13/2019	4/23/2020	8/14/2020	8/14/2020
		Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample
		Sample ID	82-0103-00-205.1908151315.000S	82-0104-00-204.1908151130.000S	82-0107-00-204.2004271130.000S	S016-068.1908131040.000S	S016-315.2004231445.000S	S016-351.2008140840.000S	S016-351.2008140900.000S
		Sample Name	RC1-SED-0-6-01-081519	RC2-SED-0-6-01-081519	EP24-SED-0-6-01-042720	RC19-SED-0-6-01-081319	FC1-SED-0-3-01-042320	FC2A-SED-0-6-01-081420	FC2-SED-0-6-01-081420
		Parent Sample ID	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #							
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.296 U	< 0.355 U	< 0.324 UJ	< 0.297 U	< 0.325 UJ	< 0.152 U	< 0.152 U
Total	4:2 FTS	757124-72-4	< 0.296 U	< 0.355 U	< 0.324 UJ	< 0.297 U	< 0.325 UJ	< 0.151 U	< 0.152 U
Total	6:2 FTS	27619-97-2	< 0.266 U	< 0.32 U	< 0.292 UJ	< 0.268 U	< 0.292 UJ	0.369 BJ	0.286 BJ
Total	8:2 FTS	39108-34-4	< 0.296 U	< 0.355 U	< 0.324 UJ	< 0.297 U	< 0.325 UJ	< 0.151 U	< 0.152 U
Total	9Cl-PF3ONS	756426-58-1	< 0.296 U	< 0.355 U	< 0.324 UJ	< 0.297 U	< 0.325 UJ	< 0.152 U	< 0.152 U
Total	ADONA	919005-14-4	< 0.296 U	< 0.355 U	< 0.324 UJ	< 0.297 U	< 0.325 UJ	< 0.151 U	< 0.152 U
Total	HFPO-DA	13252-13-6	< 0.296 U	< 0.355 U	< 0.308 UJ	< 0.297 U	< 0.309 UJ	< 0.144 U	< 0.144 U
Total	N-EtFOSA	4151-50-2	< 0.185 U	< 0.222 U	< 0.203 UJ	< 0.186 U	< 0.203 UJ	< 0.0946 UJ	< 0.095 UJ
Total	N-EtFOSAA	2991-50-6	< 0.0739 U	< 0.0888 U	< 0.0811 UJ	< 0.0743 U	< 0.0812 UJ	< 0.0379 U	< 0.038 U
Total	N-EtFOSE	1691-99-2	< 0.554 U	< 0.666 U	< 0.608 UJ	< 0.558 U	< 0.609 UJ	< 0.283 U	< 0.284 U
Total	N-MeFOSA	31506-32-8	< 0.085 U	< 0.102 U	< 0.0933 UJ	< 0.0855 U	< 0.0934 UJ	< 0.0435 UJ	< 0.0437 U
Total	N-MeFOSAA	2355-31-9	< 0.0739 U	< 0.0888 U	< 0.0811 UJ	< 0.0743 U	< 0.0812 UJ	< 0.0379 U	< 0.038 U
Total	N-MeFOSE	24448-09-7	< 0.739 U	< 0.888 U	< 0.811 UJ	< 0.743 U	< 0.812 UJ	< 0.379 U	< 0.38 U
Total	PFBA	375-22-4	< 0.296 U	0.67	3.61 J-	1.56	0.463 J-	0.283 J	< 0.152 U
Total	PFBS	375-73-5	< 0.0739 U	< 0.0888 U	< 0.0811 UJ	< 0.0743 U	< 0.0812 UJ	< 0.0379 U	< 0.038 U
Total	PFDA	335-76-2	< 0.0739 U	< 0.0888 U	< 0.0811 UJ	0.116 J	< 0.0812 UJ	0.171	< 0.038 U
Total	PFDoA	307-55-1	< 0.0739 U	< 0.0888 U	< 0.0811 UJ	< 0.0743 U	< 0.0812 UJ	0.056 J	< 0.038 U
Total	PFDoS	79780-39-5	< 0.0739 U	< 0.0888 U	< 0.0811 UJ	< 0.0743 U	< 0.0812 UJ	< 0.0379 U	< 0.038 U
Total	PFDS	335-77-3	< 0.0739 U	< 0.0888 U	< 0.0811 UJ	< 0.0743 U	< 0.0812 UJ	0.063 J	< 0.038 U
Total	PFHpA	375-85-9	< 0.0739 U	< 0.0888 U	< 0.0811 UJ	< 0.0743 U	< 0.0812 UJ	< 0.0379 U	< 0.038 U
Total	PFHpS	375-92-8	< 0.0739 U	< 0.0888 U	< 0.0811 UJ	< 0.0743 U	< 0.0812 UJ	< 0.0379 U	< 0.038 U
Total	PFHxA	307-24-4	< 0.0739 U	< 0.0888 U	< 0.0811 UJ	0.092 J	< 0.0812 UJ	< 0.0379 U	< 0.038 U
Total	PFHxS	355-46-4	< 0.0739 U	< 0.0888 U	< 0.0811 UJ	< 0.0743 U	< 0.0812 UJ	0.038 J	< 0.038 U
Total	PFNA	375-95-1	< 0.0739 U	< 0.0888 U	< 0.0811 UJ	0.096 J	< 0.0812 UJ	0.065 J	< 0.038 U
Total	PFNS	68259-12-1	< 0.0739 U	< 0.0888 U	< 0.0811 UJ	< 0.0743 U	< 0.0812 UJ	< 0.0379 U	< 0.038 U
Total	PFOA	335-67-1	< 0.0739 U	< 0.0888 U	0.108 J-	0.621	0.145 J-	0.217	< 0.038 U
Total	PFOS	1763-23-1	< 0.0739 U	< 0.0888 U	0.165 J-	1.42	0.854 J-	2.32 B	< 0.038 U
Total	PFOSA	754-91-6	< 0.0739 U	< 0.0888 U	< 0.0811 UJ	< 0.0743 U	< 0.0812 UJ	< 0.0379 U	< 0.038 U
Total	PFPeA	2706-90-3	< 0.148 U	< 0.178 U	< 0.162 UJ	0.149 J	< 0.162 UJ	< 0.0757 U	< 0.076 U
Total	PFPeS	2706-91-4	< 0.0739 U	< 0.0888 U	< 0.0811 UJ	< 0.0743 U	< 0.0812 UJ	< 0.038 U	< 0.0382 U
Total	PFTeDA	376-06-7	< 0.0739 U	< 0.0888 U	< 0.0811 UJ	< 0.0743 U	< 0.0812 UJ	< 0.0379 U	< 0.038 U
Total	PFTrDA	72629-94-8	< 0.0739 U	< 0.0888 U	< 0.0811 UJ	< 0.0743 U	< 0.0812 UJ	0.038 J	< 0.038 U
Total	PFUnA	2058-94-8	< 0.0739 U	< 0.0888 U	< 0.0811 UJ	< 0.0743 U	< 0.0812 UJ	0.098 J	< 0.038 U

NOTES
All results are reported in micrograms per kilogram (ug/kg).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 5b
Other Areas Sediment
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other
		Location	FC2	BP1	GL1	VB1	VB3	VB3	VB3
		Location ID	S016-351	82-0111-00-201	82-0113-00-201	S006-732	S016-316	S016-316	S016-316
		Sample Date	8/14/2020	4/27/2020	5/12/2020	4/27/2020	4/27/2020	4/27/2020	8/13/2020
		Sample Type Code	QC-FR	Sample	Sample	Sample	Sample	QC-FR	Sample
		Sample ID	S016-351.2008140905.000SR	82-0111-00-201.2004271100.000S	82-0113-00-201.2005121000.000S	S006-732.2004271200.000S	S016-316.2004271230.000S	S016-316.2004271235.000SR	S016-316.2008131350.000S
		Sample Name	FC2-SED-0-6-02-081420	BP1-SED-0-6-01-042720	GL1-SED-0-6-01-051220	VB1-SED-COMP-0-6-01-042720	VB3-SED-COMP-0-6-01-042720	VB3-SED-COMP-0-6-02-042720	VB3-SED-BANK-SOUTH-0-6-01-081320
		Parent Sample ID	S016-351.2008140900.000S	NA	NA	NA	NA	S016-316.2004271230.000S	NA
Fraction	Compound	CAS #							
Total	10:2 FTS	120226-60-0	NA	NA	NA	NA	NA	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.153 U	< 0.318 UJ	< 0.321 UJ	< 0.32 UJ	< 0.315 UJ	< 0.285 UJ	< 0.151 U
Total	4:2 FTS	757124-72-4	< 0.152 U	< 0.318 UJ	< 0.321 UJ	< 0.32 UJ	< 0.315 UJ	< 0.285 UJ	< 0.151 U
Total	6:2 FTS	27619-97-2	0.318 BJ	< 0.335 UJ	< 0.289 UJ	< 0.288 UJ	< 0.325 UJ	< 0.288 UJ	0.357 BJ
Total	8:2 FTS	39108-34-4	< 0.152 U	< 0.318 UJ	< 0.321 UJ	< 0.32 UJ	< 0.315 UJ	< 0.285 UJ	< 0.151 U
Total	9Cl-PF3ONS	756426-58-1	< 0.153 U	< 0.318 UJ	< 0.321 UJ	< 0.32 UJ	< 0.315 UJ	< 0.285 UJ	< 0.151 U
Total	ADONA	919005-14-4	< 0.152 U	< 0.318 UJ	< 0.321 UJ	< 0.32 UJ	< 0.315 UJ	< 0.285 UJ	< 0.151 U
Total	HFPO-DA	13252-13-6	< 0.145 U	< 0.303 UJ	< 0.305 UJ	< 0.304 UJ	< 0.299 UJ	< 0.27 UJ	< 0.143 U
Total	N-EtFOSA	4151-50-2	< 0.0952 UJ	< 0.199 UJ	< 0.2 UJ	< 0.2 UJ	< 0.197 UJ	< 0.178 UJ	< 0.0942 UJ
Total	N-EtFOSAA	2991-50-6	< 0.0381 U	< 0.0796 UJ	< 0.0802 UJ	< 0.08 UJ	< 0.0787 UJ	< 0.0711 UJ	< 0.0377 U
Total	N-EtFOSE	1691-99-2	< 0.285 U	< 0.597 UJ	< 0.601 UJ	< 0.6 UJ	< 0.59 UJ	< 0.534 UJ	< 0.282 U
Total	N-MeFOSA	31506-32-8	< 0.0438 U	< 0.0916 UJ	< 0.0922 UJ	< 0.092 UJ	< 0.0905 UJ	< 0.0818 UJ	< 0.0433 U
Total	N-MeFOSAA	2355-31-9	< 0.0381 U	< 0.0796 UJ	< 0.0802 UJ	0.081 J-	< 0.0787 UJ	< 0.0711 UJ	< 0.0377 U
Total	N-MeFOSE	24448-09-7	< 0.381 U	< 0.796 UJ	< 0.802 UJ	< 0.8 UJ	< 0.787 UJ	< 0.711 UJ	< 0.377 U
Total	PFBA	375-22-4	< 0.152 U	< 0.318 UJ	< 0.321 UJ	< 0.32 UJ	1.49 J-	0.74 J-	0.257 J
Total	PFBS	375-73-5	< 0.0381 U	< 0.0796 UJ	< 0.0802 UJ	< 0.08 UJ	< 0.0787 UJ	< 0.0711 UJ	< 0.0377 U
Total	PFDA	335-76-2	< 0.0381 U	< 0.0796 UJ	< 0.0802 UJ	< 0.08 UJ	< 0.0787 UJ	< 0.0711 UJ	< 0.0377 U
Total	PFDoA	307-55-1	< 0.0381 U	< 0.0796 UJ	< 0.0802 UJ	< 0.08 UJ	< 0.0787 UJ	< 0.0711 UJ	< 0.0377 U
Total	PFDoS	79780-39-5	< 0.0381 U	< 0.0796 UJ	< 0.0802 UJ	< 0.08 UJ	< 0.0787 UJ	< 0.0711 UJ	< 0.0377 U
Total	PFDS	335-77-3	< 0.0381 U	< 0.0796 UJ	< 0.0802 UJ	< 0.08 UJ	< 0.0787 UJ	< 0.0711 UJ	< 0.0377 U
Total	PFHpA	375-85-9	< 0.0381 U	< 0.0796 UJ	< 0.0802 UJ	< 0.08 UJ	< 0.0787 UJ	< 0.0711 UJ	< 0.0377 U
Total	PFHpS	375-92-8	< 0.0381 U	< 0.0796 UJ	< 0.0802 UJ	< 0.08 UJ	< 0.0787 UJ	< 0.0711 UJ	< 0.0377 U
Total	PFHxA	307-24-4	< 0.0381 U	< 0.0796 UJ	< 0.0802 UJ	< 0.08 UJ	0.117 J-	< 0.0711 UJ	< 0.0377 U
Total	PFHxS	355-46-4	< 0.0381 U	< 0.0796 UJ	< 0.0802 UJ	< 0.08 UJ	< 0.0787 UJ	< 0.0711 UJ	< 0.0377 U
Total	PFNA	375-95-1	< 0.0381 U	< 0.0796 UJ	< 0.0802 UJ	< 0.08 UJ	< 0.0787 UJ	< 0.0711 UJ	< 0.0377 U
Total	PFNS	68259-12-1	< 0.0381 U	< 0.0796 UJ	< 0.0802 UJ	< 0.08 UJ	< 0.0787 UJ	< 0.0711 UJ	< 0.0377 U
Total	PFOA	335-67-1	< 0.0381 U	< 0.0796 UJ	< 0.0802 UJ	< 0.08 UJ	0.781 J-	0.408 J-	0.074 J
Total	PFOS	1763-23-1	0.071 BJ	0.18 J-	0.121 J-	< 0.08 UJ	1.37 J-	0.862 J-	0.321
Total	PFOSA	754-91-6	< 0.0381 U	< 0.0796 UJ	< 0.0802 UJ	< 0.08 UJ	< 0.0787 UJ	< 0.0711 UJ	< 0.0377 U
Total	PFPeA	2706-90-3	< 0.0762 U	< 0.159 UJ	< 0.16 UJ	< 0.16 UJ	0.191 J-	< 0.142 UJ	< 0.0754 U
Total	PFPeS	2706-91-4	< 0.0383 U	< 0.0796 UJ	< 0.0802 UJ	< 0.08 UJ	< 0.0787 UJ	< 0.0711 UJ	< 0.0379 U
Total	PFTeDA	376-06-7	< 0.0381 U	< 0.0796 UJ	< 0.0802 UJ	< 0.08 UJ	< 0.0787 UJ	< 0.0711 UJ	< 0.0377 U
Total	PFTrDA	72629-94-8	< 0.0381 U	< 0.0796 UJ	< 0.0802 UJ	< 0.08 UJ	< 0.0787 UJ	< 0.0711 UJ	< 0.0377 U
Total	PFUnA	2058-94-8	< 0.0381 U	< 0.0796 UJ	< 0.0802 UJ	< 0.08 UJ	< 0.0787 UJ	< 0.0711 UJ	< 0.0377 U

NOTES
All results are reported in micrograms per kilogram (ug/kg).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 5b
Other Areas Sediment
Project 1007
Minneapolis, Minnesota

		Location Group	RA_Other	RA_Other
		Location	VB3	VB3
		Location ID	S016-316	S016-316
		Sample Date	8/13/2020	8/13/2020
		Sample Type Code	QC-FR	Sample
		Sample ID	S016-316.2008131355.000SR	S016-316.2008131400.000S
		Sample Name	VB3-SED-BANK-SOUTH-0-6-02-081320	VB3-SED-0-6-01-081320
		Parent Sample ID	S016-316.2008131350.000S	NA
Fraction	Compound	CAS #		
Total	10:2 FTS	120226-60-0	NA	NA
Total	11Cl-PF3OUdS	763051-92-9	< 0.151 U	< 0.156 U
Total	4:2 FTS	757124-72-4	< 0.151 U	< 0.156 U
Total	6:2 FTS	27619-97-2	0.339 BJ	0.378 BJ
Total	8:2 FTS	39108-34-4	< 0.151 U	< 0.156 U
Total	9Cl-PF3ONS	756426-58-1	< 0.151 U	< 0.156 U
Total	ADONA	919005-14-4	< 0.151 U	< 0.156 U
Total	HFPO-DA	13252-13-6	< 0.143 U	< 0.148 U
Total	N-EtFOSA	4151-50-2	< 0.0943 UJ	< 0.0974 UJ
Total	N-EtFOSAA	2991-50-6	< 0.0377 U	< 0.0389 U
Total	N-EtFOSE	1691-99-2	< 0.282 U	< 0.291 U
Total	N-MeFOSA	31506-32-8	< 0.0434 UJ	< 0.0448 UJ
Total	N-MeFOSAA	2355-31-9	< 0.0377 U	< 0.0389 U
Total	N-MeFOSE	24448-09-7	< 0.377 U	< 0.389 U
Total	PFBA	375-22-4	0.257 J	0.284 J
Total	PFBS	375-73-5	< 0.0377 U	< 0.0389 U
Total	PFDA	335-76-2	< 0.0377 U	< 0.0389 U
Total	PFDoA	307-55-1	< 0.0377 U	< 0.0389 U
Total	PFDoS	79780-39-5	< 0.0377 U	< 0.0389 U
Total	PFDS	335-77-3	< 0.0377 U	< 0.0389 U
Total	PFHpA	375-85-9	< 0.0377 U	< 0.0389 U
Total	PFHpS	375-92-8	< 0.0377 U	< 0.0389 U
Total	PFHxA	307-24-4	< 0.0377 U	< 0.0389 U
Total	PFHxS	355-46-4	< 0.0377 U	< 0.0389 U
Total	PFNA	375-95-1	< 0.0377 U	< 0.0389 U
Total	PFNS	68259-12-1	< 0.0377 U	< 0.0389 U
Total	PFOA	335-67-1	0.081 J	0.062 J
Total	PFOS	1763-23-1	0.478	0.208
Total	PFOSA	754-91-6	< 0.0377 U	< 0.0389 U
Total	PFPeA	2706-90-3	< 0.0755 U	< 0.0779 U
Total	PFPeS	2706-91-4	< 0.0379 U	< 0.0391 U
Total	PFTeDA	376-06-7	< 0.0377 U	< 0.0389 U
Total	PFTrDA	72629-94-8	< 0.0377 U	< 0.0389 U
Total	PFUnA	2058-94-8	< 0.0377 U	< 0.0389 U

NOTES
All results are reported in micrograms per kilogram (ug/kg).
Analytical method (BERA event) = ALS_Method PFC/537M
Analytical method (other events) = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 5c
Other Areas Foam
Project 1007
Minneapolis, Minnesota

			Location Group	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other
			Location	EP25	FP1	FC2	GL2	VB1	VB3	VB3
			Location ID	82-0107-00-205	PS00181	S016-351	82-0113-00-201	S006-732	S016-316	S016-316
			Sample Date	5/11/2020	7/31/2020	6/29/2020	6/29/2020	4/7/2020	4/7/2020	9/16/2020
			Sample Type Code	Sample	Sample	Sample	Sample	Sample	Sample	Sample
			Sample ID	82-0107-00-205.2005111245.000S	PS00181 .2007311230.000S	S016-351.2006291715.000S	82-0113-00-201.2006291345.000S	S006-732.2004071745.000S	S016-316.2004071820.000S	S016-316.2009161545.000S
			Sample Name	EP25-FOAM-01-051120	FP1-FOAM-01-073120	FC2-FOAM-01-062920	GL2-FOAM-01-062920	VB1-FOAM-01-040720	VB3-FOAM-01-040720	VB3-FOAM-01-091620
			Parent Sample ID	NA	NA	NA	NA	NA	NA	NA
Fraction	Compound	CAS #								
Total	11Cl-PF3OUdS	763051-92-9	< 0.025 U	< 0.0125 UJ	< 0.0236 UJ	< 0.0325 UJ	< 0.0235 U	< 0.0433 U	< 0.0388 U
Total	4:2 FTS	757124-72-4	< 0.025 U	< 0.0125 UJ	< 0.0236 UJ	< 0.0325 UJ	< 0.0235 U	< 0.0433 U	< 0.0388 U
Total	6:2 FTS	27619-97-2	< 0.022 U	< 0.0112 UJ	< 0.0213 UJ	< 0.0293 UJ	< 0.0212 U	< 0.039 U	< 0.035 UJ
Total	8:2 FTS	39108-34-4	< 0.025 U	< 0.0125 UJ	0.0317 J-	< 0.0325 UJ	< 0.0235 U	< 0.0433 U	< 0.0388 UJ
Total	9Cl-PF3ONS	756426-58-1	< 0.025 U	< 0.0125 UJ	< 0.0236 UJ	< 0.0325 UJ	< 0.0235 U	< 0.0433 U	< 0.0389 U
Total	ADONA	919005-14-4	< 0.025 U	< 0.0125 UJ	< 0.0236 UJ	< 0.0325 UJ	< 0.0235 U	< 0.0433 U	< 0.0388 U
Total	HFPO-DA	13252-13-6	< 0.024 U	< 0.0118 UJ	< 0.0225 UJ	< 0.0309 UJ	< 0.0224 U	< 0.0411 U	< 0.0369 UJ
Total	N-EtFOSA	4151-50-2	< 0.015 U	< 0.00779 UJ	< 0.0148 UJ	< 0.0203 UJ	< 0.0147 U	< 0.0271 U	< 0.0242 UJ
Total	N-EtFOSAA	2991-50-6	0.0235	0.0968 J-	0.826 J-	0.151 J-	0.287	0.0205 J	0.0385 J+
Total	N-EtFOSE	1691-99-2	< 0.047 U	< 0.0233 UJ	< 0.0443 UJ	< 0.061 UJ	< 0.0441 U	< 0.0812 U	< 0.0726 UJ
Total	N-MeFOSA	31506-32-8	< 0.007 U	< 0.00358 UJ	< 0.0068 UJ	< 0.00935 UJ	0.0175	< 0.0125 U	< 0.0112 UJ
Total	N-MeFOSAA	2355-31-9	0.0153	0.0322 J	0.626 J-	0.0488 J-	0.415	0.0168 J	0.0146 J+
Total	N-MeFOSE	24448-09-7	< 0.063 U	< 0.0312 UJ	< 0.0591 UJ	< 0.0813 UJ	0.119 J	< 0.108 U	< 0.097 UJ
Total	PFBA	375-22-4	4.9	0.0659 J-	0.179 J-	0.123 J-	0.127	0.252	0.498
Total	PFBS	375-73-5	< 0.006 U	< 0.00312 UJ	< 0.00591 UJ	< 0.00813 UJ	< 0.00588 U	< 0.0108 U	< 0.0097 UJ
Total	PFDA	335-76-2	0.155	0.514 J-	3.32 J-	0.256 J-	0.0687	0.0648	0.0846 J+
Total	PFDoA	307-55-1	0.0117 J	0.0175 J	0.122 J	0.0578 J	0.0301	0.0141 J	0.0199 J+
Total	PFDoS	79780-39-5	< 0.006 U	< 0.00312 UJ	< 0.00591 UJ	< 0.00813 UJ	< 0.00588 U	< 0.0108 U	< 0.0097 U
Total	PFDS	335-77-3	< 0.006 U	0.00556 J-	0.0487 J-	0.0156 J-	0.0194	< 0.0108 U	< 0.0097 U
Total	PFHpA	375-85-9	0.0153	0.00825 J-	0.0367 J-	0.0122 J-	< 0.00588 U	0.0239 J	0.0232 J+
Total	PFHpS	375-92-8	< 0.006 U	0.0515 J-	0.181 J-	< 0.00813 UJ	0.0105 J	0.7	0.46
Total	PFHxA	307-24-4	0.0586	0.00642 J-	0.062 J-	0.00989 J-	0.0135 J	< 0.0108 U	0.013 J+
Total	PFHxS	355-46-4	< 0.006 U	0.0291 J-	0.0459 J-	< 0.00813 UJ	0.0163 J	0.218	0.232 J+
Total	PFNA	375-95-1	0.106	0.662 J-	2.1 J-	0.0585 J-	0.0398	0.317	0.317 J+
Total	PFNS	68259-12-1	< 0.006 U	0.00312 J-	< 0.0187 UJ	< 0.00813 UJ	< 0.00588 U	< 0.0108 U	< 0.0097 U
Total	PFOA	335-67-1	0.481	0.365 J-	1.21 J-	0.04 J-	0.0845	2.42	4.19 J+
Total	PFOS	1763-23-1	1.11	12 J-	50.8 J-	1.68 J-	2.55	103	97.6 J+
Total	PFOSA	754-91-6	0.00793 J	0.0583 J-	0.545 J-	0.0101 J-	0.123	0.0113 J	0.0122 J+
Total	PFPeA	2706-90-3	0.0701	< 0.00623 UJ	0.0194 J-	< 0.0163 UJ	0.0128 J	< 0.0217 U	0.0506 J+
Total	PFPeS	2706-91-4	< 0.006 U	< 0.00313 UJ	< 0.00591 UJ	< 0.00813 UJ	< 0.00588 U	< 0.0108 U	< 0.00975 U
Total	PFTeDA	376-06-7	< 0.006 U	< 0.00312 UJ	0.0108 J	< 0.00813 UJ	0.00595 J	< 0.0125 U	NA
Total	PFTrDA	72629-94-8	< 0.006 U	0.00575 J-	0.0188 J-	0.0152 J-	< 0.00588 U	< 0.0108 U	< 0.0101 U
Total	PFUnA	2058-94-8	0.084	0.192 J-	0.658 J	0.321 J-	0.0581	0.0689	0.11 J+

NOTES
All results are reported in micrograms per liter (ug/L).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
J = Estimated concentration.
QC-FR = Duplicate sample.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 5d
Other Areas Forage Fish Tissue
Project 1007
Minneapolis, Minnesota

Location Group		RA_Other	RA_Other	RA_Other	RA_Other	RA_Other
Location		BP1	BP1	BP1	BP1	BP1
Location ID		82-0111-00-201	82-0111-00-201	82-0111-00-201	82-0111-00-201	82-0111-00-201
Sample Type Code		Sample	Sample	Sample	Sample	Sample
Sample ID		82-0111-00-201.2009191300.000S	82-0111-00-201.2009200800.000S	82-0111-00-201.2009200801.000S	82-0111-00-201.2009200802.000S	82-0111-00-201.2009200803.000S
Sample Name		BP1-FORE-WHO-THREE-01-091920	BP1-FORE-FIL-ONE-01-092020	BP1-FORE-FIL-TWO-01-092020	BP1-FORE-PART-ONE-01-092020	BP1-FORE-PART-TWO-01-092020
Sample Date		9/19/2020	9/20/2020	9/20/2020	9/20/2020	9/20/2020
Compound	CAS #					
11Cl-PF3OUdS	763051-92-9	< 0.393 U	< 0.399 U	< 0.395 U	< 0.383 U	< 0.391 U
3:3 FTCA	1169706-83-5	< 0.392 U	< 0.398 U	< 0.394 U	< 0.383 U	< 0.39 U
4:2 FTS	757124-72-4	< 0.392 U	< 0.398 U	< 0.394 U	< 0.383 U	< 0.39 U
5:3 FTCA	1799325-94-2	< 2.45 U	< 2.49 U	< 2.46 U	< 2.39 U	< 2.44 U
6:2 FTS	27619-97-2	< 0.353 U	< 0.359 U	< 0.355 U	< 0.345 U	< 0.352 U
7:3 FTCA	812-70-4	< 2.45 U	< 2.49 U	< 2.46 U	< 2.39 U	< 2.44 U
8:2 FTS	39108-34-4	< 0.392 U	< 0.398 U	< 0.394 U	< 0.383 U	< 0.39 U
9Cl-PF3ONS	756426-58-1	< 0.393 U	< 0.399 U	< 0.395 U	< 0.384 U	< 0.391 U
ADONA	919005-14-4	< 0.392 U	< 0.398 U	< 0.394 U	< 0.383 U	< 0.39 U
HFPO-DA	13252-13-6	< 0.373 UJ	< 0.378 U	< 0.374 U	< 0.364 U	< 0.371 UJ
N-EtFOSA	4151-50-2	< 0.245 UJ	< 0.249 U	< 0.246 UJ	R	< 0.244 UJ
N-EtFOSAA	2991-50-6	< 0.098 U	< 0.0995 U	< 0.0985 U	< 0.0957 U	< 0.0976 U
N-EtFOSE	1691-99-2	R	< 0.744 UJ	< 0.737 UJ	R	R
N-MeFOSA	31506-32-8	< 0.113 UJ	< 0.114 UJ	< 0.113 UJ	< 0.11 UJ	R
N-MeFOSAA	2355-31-9	< 0.098 U	< 0.0995 U	< 0.0985 U	< 0.0957 U	< 0.0976 U
N-MeFOSE	24448-09-7	R	< 0.995 UJ	< 0.985 UJ	R	R
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.098 U	< 0.0995 U	< 0.0985 U	< 0.0957 U	< 0.0976 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.196 U	< 0.199 U	< 0.197 U	< 0.191 U	< 0.252 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.196 U	< 0.199 U	< 0.197 U	< 0.191 U	< 0.195 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.098 U	< 0.0995 U	< 0.0985 U	< 0.0957 U	< 0.0976 U
PFBA	375-22-4	0.454 J	2.1	2.46	4.39	5.76
PFBS	375-73-5	< 0.098 U	< 0.0995 U	< 0.0985 U	< 0.0957 U	< 0.0976 U
PFDA	335-76-2	2.5	0.296 J	0.162 J	0.866	0.746
PFDoA	307-55-1	0.321 J	< 0.0995 U	0.106 J	0.29 J	0.37 J
PFDoS	79780-39-5	< 0.098 U	< 0.0995 U	< 0.0985 U	< 0.0957 U	< 0.0976 U
PFDS	335-77-3	< 0.098 U	< 0.0995 U	< 0.0985 U	< 0.0957 U	< 0.0976 U
PFHpA	375-85-9	< 0.098 U	< 0.0995 U	< 0.0985 U	< 0.0957 U	< 0.0976 U
PFHpS	375-92-8	< 0.098 U	< 0.0995 U	< 0.0985 U	< 0.0957 U	< 0.0976 U
PFHxA	307-24-4	< 0.098 U	< 0.0995 U	< 0.0985 U	< 0.0957 U	< 0.0976 U
PFHxS	355-46-4	< 0.098 U	< 0.0995 U	< 0.0985 U	< 0.0957 U	< 0.0976 U
PFNA	375-95-1	1.43	0.208 J	0.151 J	0.493	0.573
PFNS	68259-12-1	< 0.098 U	< 0.0995 U	< 0.0985 U	< 0.0957 U	< 0.0976 U
PFOA	335-67-1	0.248 J	0.129 J	< 0.0985 U	0.145 J	0.172 J
PFOS	1763-23-1	15.2	1.65	1.6	8.39	8.54
PFOSA	754-91-6	0.109 BJ	< 0.0995 U	< 0.0985 U	< 0.0957 U	< 0.0976 U
PFPeA	2706-90-3	< 0.196 U	< 0.199 U	< 0.197 U	< 0.191 U	< 0.195 U
PFPeS	2706-91-4	< 0.0985 U	< 0.1 U	< 0.099 U	< 0.0962 U	< 0.098 U
PFTeDA	376-06-7	0.149 J	< 0.0995 U	< 0.0985 U	0.137 J+	0.215 J+
PFTrDA	72629-94-8	0.308 BJ	0.146 BJ	< 0.0985 U	0.283 BJ	0.369 BJ
PFUnA	2058-94-8	1.66	0.327 BJ	0.231 BJ	0.837 B	0.852 B

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 5e
Other Areas Predator Fish Tissue
Project 1007
Minneapolis, Minnesota

Location Group		RA_Other	RA_Other	RA_Other	RA_Other	RA_Other	RA_Other
Location		BP1	BP1	BP1	BP1	BP1	BP1
Location ID		82-0111-00-201	82-0111-00-201	82-0111-00-201	82-0111-00-201	82-0111-00-201	82-0111-00-201
Sample Type Code		Sample	Sample	Sample	Sample	Sample	Sample
Sample ID		82-0111-00-201.2009200806.000S	82-0111-00-201.2009200808.000S	82-0111-00-201.2009200810.000S	82-0111-00-201.2009200811.000S	82-0111-00-201.2009200812.000S	82-0111-00-201.2009200813.000S
Sample Name		BP1-PRED-FIL-ONE-01-092020	BP1-PRED-FIL-SIX-01-092020	BP1-PRED-FIL-TWO-01-092020	BP1-PRED-PART-ONE-01-092020	BP1-PRED-PART-SIX-01-092020	BP1-PRED-PART-TWO-01-092020
Sample Date		9/20/2020	9/20/2020	9/20/2020	9/20/2020	9/20/2020	9/20/2020
Compound	CAS #						
11Cl-PF3OUdS	763051-92-9	< 0.401 U	< 0.354 U	< 0.395 U	< 0.381 U	< 0.391 U	< 0.395 U
3:3 FTCA	1169706-83-5	< 0.4 U	< 0.354 U	< 0.394 U	< 0.381 U	< 0.39 U	< 0.394 U
4:2 FTS	757124-72-4	< 0.4 U	< 0.354 U	< 0.394 U	< 0.381 U	< 0.39 U	< 0.394 U
5:3 FTCA	1799325-94-2	< 2.5 U	< 2.21 U	< 2.46 U	< 2.38 U	< 2.44 U	< 2.46 U
6:2 FTS	27619-97-2	< 0.361 U	< 0.319 U	< 0.355 U	< 0.343 U	< 0.352 U	2.42
7:3 FTCA	812-70-4	< 2.5 U	< 2.21 U	< 2.46 U	< 2.38 U	< 2.44 U	< 2.46 U
8:2 FTS	39108-34-4	< 0.4 U	< 0.354 U	< 0.394 U	< 0.381 U	< 0.39 U	< 0.394 U
9Cl-PF3ONS	756426-58-1	< 0.401 U	< 0.355 U	< 0.395 U	< 0.382 U	< 0.391 U	< 0.395 U
ADONA	919005-14-4	< 0.4 U	< 0.354 U	< 0.394 U	< 0.381 U	< 0.39 U	< 0.394 U
HFPO-DA	13252-13-6	< 0.38 U	< 0.336 U	< 0.374 U	< 0.362 U	< 0.371 U	< 0.374 U
N-EtFOSA	4151-50-2	< 0.25 U	< 0.221 U	< 0.246 UJ	R	< 0.244 UJ	< 0.246 UJ
N-EtFOSAA	2991-50-6	< 0.1 U	< 0.0885 U	< 0.0985 U	< 0.0952 U	< 0.0976 U	< 0.0985 U
N-EtFOSE	1691-99-2	< 0.748 UJ	< 0.662 UJ	< 0.737 U	R	R	R
N-MeFOSA	31506-32-8	< 0.115 U	< 0.102 U	< 0.113 UJ	< 0.11 UJ	< 0.112 UJ	< 0.113 UJ
N-MeFOSAA	2355-31-9	< 0.1 U	< 0.0885 U	< 0.0985 U	< 0.0952 U	< 0.0976 U	< 0.0985 U
N-MeFOSE	24448-09-7	R	R	< 0.985 U	R	R	R
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	< 0.1 U	< 0.0885 U	< 0.0985 U	< 0.0952 U	< 0.0976 U	< 0.0985 U
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	< 0.2 U	< 0.177 U	< 0.197 U	< 0.19 U	< 0.195 U	< 0.197 U
Perfluoro-3-methoxypropanoic acid	377-73-1	< 0.2 U	< 0.177 U	< 0.197 U	< 0.19 U	< 0.195 U	< 0.197 U
Perfluoro-4-methoxybutanoic acid	863090-89-5	< 0.1 U	< 0.0885 U	< 0.0985 U	< 0.0952 U	< 0.0976 U	< 0.0985 U
PFBA	375-22-4	< 0.4 U	< 0.354 U	3.08	< 0.381 U	0.585 J	5.27
PFBS	375-73-5	< 0.1 U	< 0.0885 U	< 0.0985 U	< 0.0952 U	< 0.0976 U	< 0.0985 U
PFDA	335-76-2	0.603	1.23	0.662	1.78	3.03	1.89
PFDoA	307-55-1	< 0.1 U	0.145 J	0.115 J	0.233 J	0.408	0.283 J
PFDoS	79780-39-5	< 0.1 U	< 0.0885 U	< 0.0985 U	< 0.0952 U	< 0.0976 U	< 0.0985 U
PFDS	335-77-3	< 0.1 U	< 0.0885 U	< 0.0985 U	0.138 J	0.121 J	< 0.0985 U
PFHpA	375-85-9	< 0.1 U	< 0.0885 U	< 0.0985 U	< 0.0952 U	< 0.0976 U	< 0.0985 U
PFHpS	375-92-8	< 0.1 U	< 0.0885 U	< 0.0985 U	< 0.0952 U	< 0.0976 U	< 0.0985 U
PFHxA	307-24-4	< 0.1 U	< 0.0885 U	< 0.0985 U	< 0.0952 U	< 0.0976 U	< 0.0985 U
PFHxS	355-46-4	< 0.1 U	< 0.0885 U	< 0.0985 U	< 0.0952 U	< 0.0976 U	< 0.0985 U
PFNA	375-95-1	0.223 J	0.436	0.265 J	0.662	1.72	0.577
PFNS	68259-12-1	< 0.1 U	< 0.0885 U	< 0.0985 U	< 0.0952 U	< 0.0976 U	< 0.0985 U
PFOA	335-67-1	< 0.1 U	0.105 J	< 0.0985 U	0.176 J	0.283 J	0.154 J
PFOS	1763-23-1	6.19	11.4	7.13	20.2	26.9	17.8
PFOSA	754-91-6	0.109 J	0.116 J	0.141 J	0.126 J	0.146 J	0.171 BJ
PFPeA	2706-90-3	< 0.2 U	< 0.177 U	< 0.197 U	< 0.19 U	< 0.195 U	< 0.197 U
PFPeS	2706-91-4	< 0.101 U	< 0.0889 U	< 0.099 U	< 0.0957 U	< 0.098 U	< 0.099 U
PFTeDA	376-06-7	< 0.1 U	0.105 J	< 0.112 UJ	0.104 J	0.201 J	< 0.0985 UJ
PFTrDA	72629-94-8	< 0.1 U	0.153 BJ	0.1 BJ	0.23 BJ	0.47 B	0.265 BJ
PFUnA	2058-94-8	0.45 B	0.908 B	0.541 B	1.36	2.16	1.28

NOTES
All results are reported in micrograms per kilogram wet weight (ug/kg ww).
Analytical method = AXYS_MLA-110.

+ = Result may be biased high.
- = Result may be biased low.
CAS = Chemical Abstracts Service.
B = Analyte was present in a blank.
J = Estimated concentration.
R = Rejected result.
U = Concentration is less than the laboratory reportable limit.
NA = Not Applicable/Not Analyzed.

Appendix A Table 5f
P1007 Other Areas Forage Fish - Calculated Whole Body Concentrations
Project 1007
Minneapolis, Minnesota

			Location Group	Browns Pond			Browns Pond		
			Location ID	82-0111-00-201			82-0111-00-201		
			Location	BP1			BP1		
			Sample Type Code	Sample - Fillet	Sample - Carcass	Calculated	Sample - Fillet	Sample - Carcass	Calculated
			Sample ID	82-0111-00-201.2009200800.0005	82-0111-00-201.2009200802.0005	Whole Body	82-0111-00-201.2009200801.0005	82-0111-00-201.2009200803.0005	Whole Body
			Sample Name	BP1-FORE-FIL-ONE-01-092020	BP1-FORE-PART-ONE-01-092020	Concentration[1]	BP1-FORE-FIL-TWO-01-092020	BP1-FORE-PART-TWO-01-092020	Concentration[1]
			Sample Date	9/20/2020	9/20/2020		9/20/2020	9/20/2020	
Compound	CAS #	Units							
6:2 FTS	27619-97-2	ug/kg	< 0.359	< 0.345	NC	< 0.355	< 0.352	NC
N-EtFOSAA	2991-50-6	ug/kg	< 0.0995	< 0.0957	NC	< 0.0985	< 0.0976	NC
N-EtFOSE	1691-99-2	ug/kg	< 0.744	R	NC	< 0.737	R	NC
N-MeFOSAA	2355-31-9	ug/kg	< 0.0995	< 0.0957	NC	< 0.0985	< 0.0976	NC
Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	ug/kg	< 0.199	< 0.191	NC	< 0.197	< 0.252	NC
Perfluoro-4-methoxybutanoic acid	863090-89-5	ug/kg	< 0.0995	< 0.0957	NC	< 0.0985	< 0.0976	NC
PFBA	375-22-4	ug/kg	2.1	4.39	3.79	2.46	5.76	4.99
PFDA	335-76-2	ug/kg	0.296	0.866	0.72	0.162	0.746	0.61
PFDoA	307-55-1	ug/kg	< 0.0995	0.29	0.24	0.106	0.37	0.31
PFDoS	79780-39-5	ug/kg	< 0.0995	< 0.0957	NC	< 0.0985	< 0.0976	NC
PFDS	335-77-3	ug/kg	< 0.0995	< 0.0957	NC	< 0.0985	< 0.0976	NC
PFHpA	375-85-9	ug/kg	< 0.0995	< 0.0957	NC	< 0.0985	< 0.0976	NC
PFHpS	375-92-8	ug/kg	< 0.0995	< 0.0957	NC	< 0.0985	< 0.0976	NC
PFHxS	355-46-4	ug/kg	< 0.0995	< 0.0957	NC	< 0.0985	< 0.0976	NC
PFNA	375-95-1	ug/kg	0.208	0.493	0.42	0.151	0.573	0.47
PFNS	68259-12-1	ug/kg	< 0.0995	< 0.0957	NC	< 0.0985	< 0.0976	NC
PFOA	335-67-1	ug/kg	0.129	0.145	0.14	< 0.0985	0.172	0.15
PFOS	1763-23-1	ug/kg	1.65	8.39	6.63	1.6	8.54	6.92
PFOSA	754-91-6	ug/kg	< 0.0995	< 0.0957	NC	< 0.0985	< 0.0976	NC
PFTeDA	376-06-7	ug/kg	< 0.0995	0.137	0.13	< 0.0985	0.215	0.19
PFTrDA	72629-94-8	ug/kg	0.146	0.283	0.25	< 0.0985	0.369	0.31
PFUnA	2058-94-8	ug/kg	0.327	0.837	0.70	0.231	0.852	0.71
Weight	--	grams	50	142	192	36	118	154
Percent Fillet weight	--	%	--	--	26%	--	--	23%
Percent Carcass weight	--	%	--	--	74%	--	--	77%

Notes
ug/kg - micrograms per kilogram (wet weight)
< - Not detected. Concentration is less than the laboratory reportable limit (RL).
CAS - Chemical Abstracts Service.
NC - Not calculated.
R - Rejected.

Compounds are presented if they were detected at least once in fillet or carcass samples.
Results not detected above RLs are presented as < RL.
Whole body concentrations were not calculated if the compound was not detected in both fillet and carcass samples or if one result was rejected.
If a compound was only detected in the fillet or carcass, the RL was used to represent the non-detect result in the whole body calculation.

[1] - Calculated whole body fish concentration =
(fillet concentration * [fillet weight/total weight]) +
(part concentration * [part weight/total weight])

Appendix A Table 5g
P1007 Other Areas Predator Fish - Calculated Whole Body Concentrations
Project 1007
Minneapolis, Minnesota

Location Group			Browns Pond			Browns Pond		
Location ID			82-0111-00-201			82-0111-00-201		
Location			BP1			BP1		
Sample Type Code			Sample - Fillet	Sample - Carcass		Sample - Fillet	Sample - Carcass	
Sample ID			82-0111-00-201.2009200806.0009	82-0111-00-201.2009200811.0009		82-0111-00-201.2009200808.0009	82-0111-00-201.2009200812.0009	
Sample Name			BP1-PRED-FIL-ONE-01-092020	BP1-PRED-PART-ONE-01-092020	Calculated	BP1-PRED-FIL-SIX-01-092020	BP1-PRED-PART-SIX-01-092020	Calculated
Sample Date			9/20/2020	9/20/2020	Wholebody[1]	9/20/2020	9/20/2020	Wholebody[1]
Compound	CAS #	Units						
6:2 FTS	27619-97-2	ug/kg	< 0.361	< 0.343	NC	< 0.319	< 0.352	NC
N-EtFOSAA	2991-50-6	ug/kg	< 0.1	< 0.0952	NC	< 0.0885	< 0.0976	NC
N-EtFOSE	1691-99-2	ug/kg	< 0.748	R	NC	< 0.662	R	NC
N-MeFOSAA	2355-31-9	ug/kg	< 0.1	< 0.0952	NC	< 0.0885	< 0.0976	NC
PFBA	375-22-4	ug/kg	< 0.4	< 0.381	NC	< 0.354	0.585	0.53
PFDA	335-76-2	ug/kg	0.603	1.78	1.53	1.23	3.03	2.60
PFDoA	307-55-1	ug/kg	< 0.1	0.233	0.205	0.145	0.408	0.34
PFDoS	79780-39-5	ug/kg	< 0.1	< 0.0952	NC	< 0.0885	< 0.0976	NC
PFDS	335-77-3	ug/kg	< 0.1	0.138	0.130	< 0.0885	0.121	0.11
PFHpA	375-85-9	ug/kg	< 0.1	< 0.0952	NC	< 0.0885	< 0.0976	NC
PFHpS	375-92-8	ug/kg	< 0.1	< 0.0952	NC	< 0.0885	< 0.0976	NC
PFHxA	307-24-4	ug/kg	< 0.1	< 0.0952	NC	< 0.0885	< 0.0976	NC
PFHxS	355-46-4	ug/kg	< 0.1	< 0.0952	NC	< 0.0885	< 0.0976	NC
PFNA	375-95-1	ug/kg	0.223	0.662	0.569	0.436	1.72	1.41
PFNS	68259-12-1	ug/kg	< 0.1	< 0.0952	NC	< 0.0885	< 0.0976	NC
PFOA	335-67-1	ug/kg	< 0.1	0.176	0.160	0.105	0.283	0.24
PFOS	1763-23-1	ug/kg	6.19	20.2	17.2	11.4	26.9	23
PFOSA	754-91-6	ug/kg	0.109	0.126	0.122	0.116	0.146	0.14
PFTeDA	376-06-7	ug/kg	< 0.1	0.104	0.103	0.105	0.201	0.18
PFTrDA	72629-94-8	ug/kg	< 0.1	0.23	0.203	0.153	0.47	0.39
PFUnA	2058-94-8	ug/kg	0.45	1.36	1.17	0.908	2.16	1.86
Weight	--	grams	70	262	332	142	446	588
Percent Fillet weight	--	%	--	--	21%	--	--	24%
Percent Carcass weight	--	%	--	--	79%	--	--	76%

Notes
ug/kg - micrograms per kilogram (wet weight)
< - Not detected. Concentration is less than the laboratory reportable limit (RL).
CAS - Chemical Abstracts Service.
NC - Not calculated.
R - Rejected.

Compounds are presented if they were detected at least once in fillet or carcass samples.
Results not detected above RLs are presented as < RL.
Whole body concentrations were not calculated if the compound was not detected in both fillet and carcass samples or if one result was rejected.
If a compound was only detected in the fillet or carcass, the RL was used to represent the non-detect result in the whole body calculation.

[1] - Calculated whole body fish concentration =
(fillet concentration * [fillet weight/total weight]) +
(part concentration * [part weight/total weight])

Appendix A Table 5g
P1007 Other Areas Predator Fish - Calculated Whole Body Concentrations
Project 1007
Minneapolis, Minnesota

			Location Group	Browns Pond		
			Location ID	82-0111-00-201		
			Location	BP1		
			Sample Type Code	Sample - Fillet	Sample - Carcass	
			Sample ID	82-0111-00-201.2009200810.0009	82-0111-00-201.2009200813.0009	
			Sample Name	BP1-PRED-FIL-TWO-01-092020	BP1-PRED-PART-TWO-01-092020	Calculated
			Sample Date	9/20/2020	9/20/2020	Wholebody[1]
Compound	CAS #	Units				
6:2 FTS	27619-97-2	ug/kg	< 0.355	2.42	1.90
N-EtFOSAA	2991-50-6	ug/kg	< 0.0985	< 0.0985	NC
N-EtFOSE	1691-99-2	ug/kg	< 0.737	R	NC
N-MeFOSAA	2355-31-9	ug/kg	< 0.0985	< 0.0985	NC
PFBA	375-22-4	ug/kg	3.08	5.27	4.72
PFDA	335-76-2	ug/kg	0.662	1.89	1.58
PFDoA	307-55-1	ug/kg	0.115	0.283	0.24
PFDoS	79780-39-5	ug/kg	< 0.0985	< 0.0985	NC
PFDS	335-77-3	ug/kg	< 0.0985	< 0.0985	NC
PFHpA	375-85-9	ug/kg	< 0.0985	< 0.0985	NC
PFHpS	375-92-8	ug/kg	< 0.0985	< 0.0985	NC
PFHxA	307-24-4	ug/kg	< 0.0985	< 0.0985	NC
PFHxS	355-46-4	ug/kg	< 0.0985	< 0.0985	NC
PFNA	375-95-1	ug/kg	0.265	0.577	0.50
PFNS	68259-12-1	ug/kg	< 0.0985	< 0.0985	NC
PFOA	335-67-1	ug/kg	< 0.0985	0.154	0.14
PFOS	1763-23-1	ug/kg	7.13	17.8	15
PFOSA	754-91-6	ug/kg	0.141	0.171	0.16
PFTeDA	376-06-7	ug/kg	< 0.112	< 0.0985	NC
PFTrDA	72629-94-8	ug/kg	0.1	0.265	0.22
PFUnA	2058-94-8	ug/kg	0.541	1.28	1.09
Weight	--	grams	9600%	286	382
Percent Fillet weight	--	%	--	--	25%
Percent Carcass weight	--	%	--	--	75%

Notes
ug/kg - micrograms per kilogram (wet weight)
< - Not detected. Concentration is less than the laboratory reportable limit (RL).
CAS - Chemical Abstracts Service.
NC - Not calculated.
R - Rejected.

Compounds are presented if they were detected at least once in fillet or carcass samples.
Results not detected above RLs are presented as < RL.
Whole body concentrations were not calculated if the compound was not detected in both fillet and carcass samples or if one result was rejected.
If a compound was only detected in the fillet or carcass, the RL was used to represent the non-detect result in the whole body calculation.

[1] - Calculated whole body fish concentration =
(fillet concentration * [fillet weight/total weight]) +
(part concentration * [part weight/total weight])

Appendix A Table 6a
Relative Percent Difference Calculations for Dissolved and Total Surface Water
Project 1007
Minneapolis, Minnesota

Location	Location Group	Sample Name [filtered sample]	Analyte	Dissolved Surface Water (ug/L)	Total Surface Water (ug/L)	Relative Percent Difference
EP1A	Eagle Point Lake	EP1A-WAT-BOT-01-091520	6:2 FTS	0.00067 J	0.0046 BJ+	**149**
WL15A	WLA - South Pond	WL15A-WAT-MID-01-091620	6:2 FTS	0.0014 J	0.023 BJ+	**177**
WL21	WLA - Middle Pond	WL21-WAT-MID-01-091620	6:2 FTS	0.00064 J	0.012 BJ+	**180**
RC5	Raleigh Creek	RC5-WAT-BULK-01-091820	HFPO-DA	0.00032 J	0.00048 J	**40.0**
EP19	Eagle Point Lake	EP19-WAT-BULK-01-091920	N-EtFOSAA	0.00068 J	0.0017 BJ	**85.7**
RC23	Raleigh Creek	RC23-WAT-BULK-01-092820	N-EtFOSAA	0.01	0.015 J+	**40.0**
RC3A	Raleigh Creek	RC3A-WAT-BULK-01-091920	N-EtFOSAA	0.0059	0.01 B	**51.6**
RC4A	Raleigh Creek	RC4A-WAT-BULK-01-091820	N-EtFOSAA	0.011	0.02	**58.1**
RC5	Raleigh Creek	RC5-WAT-BULK-01-091820	N-EtFOSAA	0.012	0.017	**34.5**
RC6	Raleigh Creek	RC6-WAT-BULK-01-091820	N-EtFOSAA	0.016	0.024	**40.0**
RC6A	Raleigh Creek	RC6A-WAT-BULK-01-092020	N-EtFOSAA	0.018	0.013 B	**-32.3**
RC7	Raleigh Creek	RC7-WAT-BULK-01-091920	N-EtFOSAA	0.0066 BJ	0.0078 B	16.7
WL15A	WLA - South Pond	WL15A-WAT-MID-01-091620	N-EtFOSAA	0.0016 J+	0.0019 J	17.1
EP9A	Lake Elmo	EP9A-WAT-MID-01-091920	N-EtFOSE	0.00027 BJ+	0.00015 BJ	**-57.1**
RC6	Raleigh Creek	RC6-WAT-BULK-01-091820	N-EtFOSE	0.00021 BJ+	0.00016 BJ+	-27.0
EP5	Eagle Point Lake	EP5-WAT-BULK-01-092420	N-MeFOSA	0.00048 BJ	0.00049 BJ	2.1
BP1	Browns Pond	BP1-WAT-MID-01-091920	PFBA	0.15 J+	0.13	-14.3
EP14	Lake Elmo	EP14-WAT-MID-01-091920	PFBA	0.66 J+	0.82	21.6
EP15	Lake Elmo	EP15-WAT-MID-01-091920	PFBA	0.81	0.75	-7.7
EP17A	Eagle Point Lake	EP17A-WAT-BULK-01-091920	PFBA	0.11	0.12	8.7
EP17C	Eagle Point Lake	EP17C-WAT-BULK-01-092420	PFBA	0.15	0.14	-6.9
EP18	Eagle Point Lake	EP18-WAT-MID-01-091520	PFBA	0.17	0.13	-26.7
EP19	Eagle Point Lake	EP19-WAT-BULK-01-091920	PFBA	0.13 J+	0.12	-8.0
EP1A	Eagle Point Lake	EP1A-WAT-BOT-01-091520	PFBA	0.13	0.12	-8.0
EP1A	Eagle Point Lake	EP1A-WAT-MID-01-091520	PFBA	0.13	0.11	-16.7
EP20	Lake Elmo	EP20-WAT-BULK-01-092020	PFBA	0.13	0.12	-8.0
EP21A	Lake Elmo	EP21A-WAT-MID-01-091920	PFBA	0.75 J+	0.79	5.2
EP23	Eagle Point Lake	EP23-WAT-BULK-01-092420	PFBA	0.76	0.77	1.3
EP26A	Eagle Point Lake	EP26A-WAT-BULK-01-091720	PFBA	0.16 J+	0.15	-6.5
EP27B	Eagle Point Lake	EP27B-WAT-BULK-01-092420	PFBA	0.14	0.12	-15.4
EP27C	Eagle Point Lake	EP27C-WAT-BOT-01-091520	PFBA	0.15	0.11	**-30.8**
EP27C	Eagle Point Lake	EP27C-WAT-MID-01-091520	PFBA	0.15	0.12	-22.2
EP4	Eagle Point Lake	EP4-WAT-BULK-01-092420	PFBA	0.13	0.12	-8.0
EP5	Eagle Point Lake	EP5-WAT-BULK-01-092420	PFBA	0.13	0.12	-8.0
EP9A	Lake Elmo	EP9A-WAT-MID-01-091920	PFBA	0.74 J	0.83	11.5
RC13	Raleigh Creek	RC13-WAT-BULK-01-092120	PFBA	0.087	0.087	0.0
RC14	Raleigh Creek	RC14-WAT-BULK-01-092120	PFBA	0.087	0.087	0.0
RC16A	Raleigh Creek	RC16A-WAT-BULK-01-091920	PFBA	0.092	0.096	4.3
RC17	Raleigh Creek	RC17-WAT-BULK-01-091920	PFBA	0.092	0.094	2.2
RC18	Raleigh Creek	RC18-WAT-BULK-01-091720	PFBA	0.11	0.11	0.0
RC18A	Raleigh Creek	RC18A-WAT-BULK-01-092120	PFBA	0.089	0.088	-1.1
RC21A	Raleigh Creek	RC21-WAT-BULK-01-092120	PFBA	0.086	0.092	6.7
RC22	Raleigh Creek	RC22-WAT-BULK-01-091820	PFBA	0.3	0.29	-3.4
RC23	Raleigh Creek	RC23-WAT-BULK-01-092820	PFBA	0.31	0.29	-6.7
RC3A	Raleigh Creek	RC3A-WAT-BULK-01-091920	PFBA	0.25	0.22	-12.8
RC4A	Raleigh Creek	RC4A-WAT-BULK-01-091820	PFBA	1.1 J+	1.1	0.0
RC5	Raleigh Creek	RC5-WAT-BULK-01-091820	PFBA	0.92 J+	0.96	4.3
RC6	Raleigh Creek	RC6-WAT-BULK-01-091820	PFBA	0.83 J+	0.97	15.6
RC6A	Raleigh Creek	RC6A-WAT-BULK-01-092020	PFBA	0.68	0.71	4.3
RC7	Raleigh Creek	RC7-WAT-BULK-01-091920	PFBA	0.43	0.41	-4.8
VB3	Valley Branch	VB3-WAT-BULK-02-091620	PFBA	0.25	0.2	-22.2
WL10A	WLA - Unnamed Channel	WL10-WAT-BULK-01-092120	PFBA	0.37	0.39	5.3
WL11	WLA - Unnamed Channel	WL11-WAT-BULK-01-092220	PFBA	0.39	0.39	0.0
WL13	WLA - Unnamed Channel	WL13-WAT-MID-01-091620	PFBA	0.47	0.36	-26.5
WL15	WLA - South Pond	WL15-WAT-MID-01-091620	PFBA	0.42	0.38	-10.0
WL15A	WLA - South Pond	WL15A-WAT-MID-01-091620	PFBA	0.47	0.38	-21.2
WL16	WLA - South Pond	WL16-WAT-BULK-01-092320	PFBA	0.34	0.37	8.5
WL2	WLA - Horseshoe Lake	WL2-WAT-MID-01-091720	PFBA	0.46	0.49	6.3
WL21	WLA - Middle Pond	WL21-WAT-MID-01-091620	PFBA	0.48	0.34	**-34.1**
WL3	WLA - Horseshoe Lake	WL3-WAT-MID-01-091720	PFBA	0.38	0.45	16.9
WL5	WLA - Horseshoe Lake	WL5-WAT-MID-01-091720	PFBA	0.4	0.4	0.0
WL6	WLA - Culvert	WL6-WAT-BULK-01-091720	PFBA	0.43	0.49	13.0
WL7	WLA - Unnamed Channel	WL7-WAT-BULK-01-091720	PFBA	0.39	0.39	0.0
WL8A	WLA - North Pond	WL8A-WAT-BULK-01-091620	PFBA	0.46	0.35	-27.2
BP1	Browns Pond	BP1-WAT-MID-01-091920	PFBS	0.0036 J+	0.0024 J	**-40.0**
EP14	Lake Elmo	EP14-WAT-MID-01-091920	PFBS	0.0034 J	0.0037 J	8.5
EP15	Lake Elmo	EP15-WAT-MID-01-091920	PFBS	0.0033 J	0.0036 J	8.7
EP17A	Eagle Point Lake	EP17A-WAT-BULK-01-091920	PFBS	0.0035 J	0.0039 J	10.8
EP17C	Eagle Point Lake	EP17C-WAT-BULK-01-092420	PFBS	0.0051	0.0051	0.0
EP18	Eagle Point Lake	EP18-WAT-MID-01-091520	PFBS	0.0073	0.0054	-29.9
EP19	Eagle Point Lake	EP19-WAT-BULK-01-091920	PFBS	0.0045	0.0046	2.2
EP1A	Eagle Point Lake	EP1A-WAT-BOT-01-091520	PFBS	0.0058	0.0046	-23.1
EP1A	Eagle Point Lake	EP1A-WAT-MID-01-091520	PFBS	0.0064	0.0043	**-39.3**
EP20	Lake Elmo	EP20-WAT-BULK-01-092020	PFBS	0.005	0.0056	11.3
EP21A	Lake Elmo	EP21A-WAT-MID-01-091920	PFBS	0.0039 J	0.0034 J	-13.7
EP23	Eagle Point Lake	EP23-WAT-BULK-01-092420	PFBS	0.0034 J	0.0035 J	2.9
EP26A	Eagle Point Lake	EP26A-WAT-BULK-01-091720	PFBS	0.005	0.0071	**34.7**
EP27B	Eagle Point Lake	EP27B-WAT-BULK-01-092420	PFBS	0.0054	0.0049	-9.7
EP27C	Eagle Point Lake	EP27C-WAT-BOT-01-091520	PFBS	0.0069	0.0049	**-33.9**
EP27C	Eagle Point Lake	EP27C-WAT-MID-01-091520	PFBS	0.0068	0.0052	-26.7
EP4	Eagle Point Lake	EP4-WAT-BULK-01-092420	PFBS	0.0072	0.0054	-28.6
EP5	Eagle Point Lake	EP5-WAT-BULK-01-092420	PFBS	0.0046	0.0046	0.0
EP9A	Lake Elmo	EP9A-WAT-MID-01-091920	PFBS	0.0039 J	0.0035 J	-10.8
RC13	Raleigh Creek	RC13-WAT-BULK-01-092120	PFBS	0.0025 J	0.0028 J	11.3
RC14	Raleigh Creek	RC14-WAT-BULK-01-092120	PFBS	0.0027 J	0.003 J	10.5
RC16A	Raleigh Creek	RC16A-WAT-BULK-01-091920	PFBS	0.0026 J	0.0026 J	0.0
RC17	Raleigh Creek	RC17-WAT-BULK-01-091920	PFBS	0.0026 J	0.0029 J	10.9
RC18	Raleigh Creek	RC18-WAT-BULK-01-091720	PFBS	0.003 J	0.0034 J	12.5
RC18A	Raleigh Creek	RC18A-WAT-BULK-01-092120	PFBS	0.0026 J	0.0028 J	7.4
RC21A	Raleigh Creek	RC21-WAT-BULK-01-092120	PFBS	0.0025 J	0.003 J	18.2

Appendix A Table 6a
Relative Percent Difference Calculations for Dissolved and Total Surface Water
Project 1007
Minneapolis, Minnesota

Location	Location Group	Sample Name [filtered sample]	Analyte	Dissolved Surface Water (ug/L)	Total Surface Water (ug/L)	Relative Percent Difference
RC22	Raleigh Creek	RC22-WAT-BULK-01-091820	PFBS	0.0097	0.01	3.0
RC23	Raleigh Creek	RC23-WAT-BULK-01-092820	PFBS	0.014	0.014	0.0
RC3A	Raleigh Creek	RC3A-WAT-BULK-01-091920	PFBS	0.011 J+	0.01	-9.5
RC4A	Raleigh Creek	RC4A-WAT-BULK-01-091820	PFBS	0.029	0.028	-3.5
RC5	Raleigh Creek	RC5-WAT-BULK-01-091820	PFBS	0.028 J+	0.028	0.0
RC6	Raleigh Creek	RC6-WAT-BULK-01-091820	PFBS	0.025	0.027	7.7
RC6A	Raleigh Creek	RC6A-WAT-BULK-01-092020	PFBS	0.021	0.021	0.0
RC7	Raleigh Creek	RC7-WAT-BULK-01-091920	PFBS	0.016	0.017	6.1
VB3	Valley Branch	VB3-WAT-BULK-02-091620	PFBS	0.0026 J	0.0028 J	7.4
WL10A	WLA - Unnamed Channel	WL10-WAT-BULK-01-092120	PFBS	0.0038 J	0.0041	7.6
WL11	WLA - Unnamed Channel	WL11-WAT-BULK-01-092220	PFBS	0.0037 J	0.0042	12.7
WL13	WLA - Unnamed Channel	WL13-WAT-MID-01-091620	PFBS	0.004 J	0.0041	2.5
WL15	WLA - South Pond	WL15-WAT-MID-01-091620	PFBS	0.0043	0.0044	2.3
WL15A	WLA - South Pond	WL15A-WAT-MID-01-091620	PFBS	0.0044	0.0044	0.0
WL16	WLA - South Pond	WL16-WAT-BULK-01-092320	PFBS	0.0036 J	0.0048	28.6
WL2	WLA - Horseshoe Lake	WL2-WAT-MID-01-091720	PFBS	0.0042	0.0038 J	-10.0
WL21	WLA - Middle Pond	WL21-WAT-MID-01-091620	PFBS	0.0043	0.0041	-4.8
WL3	WLA - Horseshoe Lake	WL3-WAT-MID-01-091720	PFBS	0.0043 J	0.0052	18.9
WL5	WLA - Horseshoe Lake	WL5-WAT-MID-01-091720	PFBS	0.0042	0.0037 J	-12.7
WL6	WLA - Culvert	WL6-WAT-BULK-01-091720	PFBS	0.0043	0.0054	22.7
WL7	WLA - Unnamed Channel	WL7-WAT-BULK-01-091720	PFBS	0.0041 J	0.004 J	-2.5
WL8A	WLA - North Pond	WL8A-WAT-BULK-01-091620	PFBS	0.0042 J	0.004 J	-4.9
EP17C	Eagle Point Lake	EP17C-WAT-BULK-01-092420	PFDA	0.0014 J	0.0014 J	0.0
EP20	Lake Elmo	EP20-WAT-BULK-01-092020	PFDA	0.0023 J	0.0027 J	16.0
EP26A	Eagle Point Lake	EP26A-WAT-BULK-01-091720	PFDA	0.011 J+	0.0066	**-50.0**
EP27B	Eagle Point Lake	EP27B-WAT-BULK-01-092420	PFDA	0.0026 J	0.0026 J	0.0
EP4	Eagle Point Lake	EP4-WAT-BULK-01-092420	PFDA	0.0012 J	0.0017 J	**34.5**
EP5	Eagle Point Lake	EP5-WAT-BULK-01-092420	PFDA	0.0015 J	0.0016 J	6.5
RC22	Raleigh Creek	RC22-WAT-BULK-01-091820	PFDA	0.0016 J	0.0035 J	**74.5**
RC23	Raleigh Creek	RC23-WAT-BULK-01-092820	PFDA	0.012	0.016	28.6
RC3A	Raleigh Creek	RC3A-WAT-BULK-01-091920	PFDA	0.0026 J	0.0033 J	23.7
RC4A	Raleigh Creek	RC4A-WAT-BULK-01-091820	PFDA	0.005	0.0066	27.6
RC5	Raleigh Creek	RC5-WAT-BULK-01-091820	PFDA	0.0063	0.0084	28.6
RC6	Raleigh Creek	RC6-WAT-BULK-01-091820	PFDA	0.0075	0.01	28.6
RC6A	Raleigh Creek	RC6A-WAT-BULK-01-092020	PFDA	0.011	0.013	16.7
RC7	Raleigh Creek	RC7-WAT-BULK-01-091920	PFDA	0.0075	0.0086	13.7
WL13	WLA - Unnamed Channel	WL13-WAT-MID-01-091620	PFDA	0.002 J	0.0015 J	-28.6
WL15A	WLA - South Pond	WL15A-WAT-MID-01-091620	PFDA	0.0019 J	0.0016 J	-17.1
WL2	WLA - Horseshoe Lake	WL2-WAT-MID-01-091720	PFDA	0.0017 J	0.0013 J	-26.7
WL8A	WLA - North Pond	WL8A-WAT-BULK-01-091620	PFDA	0.002 J	0.0012 J	**-50.0**
BP1	Browns Pond	BP1-WAT-MID-01-091920	PFHpA	0.0065 B	0.0066	1.5
EP14	Lake Elmo	EP14-WAT-MID-01-091920	PFHpA	0.01 B	0.0089 B	-11.6
EP15	Lake Elmo	EP15-WAT-MID-01-091920	PFHpA	0.0089	0.0097	8.6
EP17A	Eagle Point Lake	EP17A-WAT-BULK-01-091920	PFHpA	0.0055 B	0.011 B	**66.7**
EP17C	Eagle Point Lake	EP17C-WAT-BULK-01-092420	PFHpA	0.0092	0.013	**34.2**
EP18	Eagle Point Lake	EP18-WAT-MID-01-091520	PFHpA	0.014	0.014	0.0
EP19	Eagle Point Lake	EP19-WAT-BULK-01-091920	PFHpA	0.011	0.011	0.0
EP1A	Eagle Point Lake	EP1A-WAT-BOT-01-091520	PFHpA	0.0094 B	0.0086	-8.9
EP1A	Eagle Point Lake	EP1A-WAT-MID-01-091520	PFHpA	0.01	0.0076	-27.3
EP20	Lake Elmo	EP20-WAT-BULK-01-092020	PFHpA	0.013	0.014	7.4
EP21A	Lake Elmo	EP21A-WAT-MID-01-091920	PFHpA	0.012 B	0.0088 B	**-30.8**
EP23	Eagle Point Lake	EP23-WAT-BULK-01-092420	PFHpA	0.0069	0.011	**45.8**
EP26A	Eagle Point Lake	EP26A-WAT-BULK-01-091720	PFHpA	0.014	0.011	-24.0
EP27B	Eagle Point Lake	EP27B-WAT-BULK-01-092420	PFHpA	0.012	0.015	22.2
EP27C	Eagle Point Lake	EP27C-WAT-BOT-01-091520	PFHpA	0.012	0.0099	-19.2
EP27C	Eagle Point Lake	EP27C-WAT-MID-01-091520	PFHpA	0.014	0.011	-24.0
EP4	Eagle Point Lake	EP4-WAT-BULK-01-092420	PFHpA	0.012	0.012	0.0
EP5	Eagle Point Lake	EP5-WAT-BULK-01-092420	PFHpA	0.013	0.013	0.0
EP9A	Lake Elmo	EP9A-WAT-MID-01-091920	PFHpA	0.011 B	0.01 B	-9.5
RC13	Raleigh Creek	RC13-WAT-BULK-01-092120	PFHpA	0.0024 J	0.0047 B	**64.8**
RC14	Raleigh Creek	RC14-WAT-BULK-01-092120	PFHpA	0.0032 J	0.0044 B	**31.6**
RC16A	Raleigh Creek	RC16A-WAT-BULK-01-091920	PFHpA	0.0046 B	0.0027 BJ	**-52.1**
RC17	Raleigh Creek	RC17-WAT-BULK-01-091920	PFHpA	0.0031 BJ	0.0046 BJ	**39.0**
RC18	Raleigh Creek	RC18-WAT-BULK-01-091720	PFHpA	0.0038 J	0.0033 J	-14.1
RC18A	Raleigh Creek	RC18A-WAT-BULK-01-092120	PFHpA	0.0041 J	0.0031 BJ	-27.8
RC21A	Raleigh Creek	RC21-WAT-BULK-01-092120	PFHpA	0.004 J	0.0048 B	18.2
RC22	Raleigh Creek	RC22-WAT-BULK-01-091820	PFHpA	0.025	0.028 B	11.3
RC23	Raleigh Creek	RC23-WAT-BULK-01-092820	PFHpA	0.048	0.044	-8.7
RC3A	Raleigh Creek	RC3A-WAT-BULK-01-091920	PFHpA	0.018	0.023	24.4
RC4A	Raleigh Creek	RC4A-WAT-BULK-01-091820	PFHpA	0.081	0.11	**30.4**
RC5	Raleigh Creek	RC5-WAT-BULK-01-091820	PFHpA	0.084	0.095	12.3
RC6	Raleigh Creek	RC6-WAT-BULK-01-091820	PFHpA	0.078	0.091	15.4
RC6A	Raleigh Creek	RC6A-WAT-BULK-01-092020	PFHpA	0.067 B	0.069	2.9
RC7	Raleigh Creek	RC7-WAT-BULK-01-091920	PFHpA	0.055 B	0.056 B	1.8
VB3	Valley Branch	VB3-WAT-BULK-02-091620	PFHpA	0.0035 J	0.0016 BJ	**-74.5**
WL10A	WLA - Unnamed Channel	WL10-WAT-BULK-01-092120	PFHpA	0.011	0.01	-9.5
WL11	WLA - Unnamed Channel	WL11-WAT-BULK-01-092220	PFHpA	0.0092	0.011	17.8
WL13	WLA - Unnamed Channel	WL13-WAT-MID-01-091620	PFHpA	0.0083	0.0078 B	-6.2
WL15	WLA - South Pond	WL15-WAT-MID-01-091620	PFHpA	0.009	0.0072 B	-22.2
WL15A	WLA - South Pond	WL15A-WAT-MID-01-091620	PFHpA	0.0094	0.01	6.2
WL16	WLA - South Pond	WL16-WAT-BULK-01-092320	PFHpA	0.0091	0.01	9.4
WL2	WLA - Horseshoe Lake	WL2-WAT-MID-01-091720	PFHpA	0.0091	0.0083	-9.2
WL21	WLA - Middle Pond	WL21-WAT-MID-01-091620	PFHpA	0.011	0.0069 B	**-45.8**
WL3	WLA - Horseshoe Lake	WL3-WAT-MID-01-091720	PFHpA	0.0088	0.0084	-4.7
WL5	WLA - Horseshoe Lake	WL5-WAT-MID-01-091720	PFHpA	0.0084	0.0073	-14.0
WL6	WLA - Culvert	WL6-WAT-BULK-01-091720	PFHpA	0.0099	0.0095	-4.1
WL7	WLA - Unnamed Channel	WL7-WAT-BULK-01-091720	PFHpA	0.0091	0.01	9.4
WL8A	WLA - North Pond	WL8A-WAT-BULK-01-091620	PFHpA	0.008	0.0067 B	-17.7
EP14	Lake Elmo	EP14-WAT-MID-01-091920	PFHpS	0.0013 J	0.0018 J	**32.3**
EP15	Lake Elmo	EP15-WAT-MID-01-091920	PFHpS	0.0011 J+	0.0022 J	**66.7**

Appendix A Table 6a
Relative Percent Difference Calculations for Dissolved and Total Surface Water
Project 1007
Minneapolis, Minnesota

Location	Location Group	Sample Name [filtered sample]	Analyte	Dissolved Surface Water (ug/L)	Total Surface Water (ug/L)	Relative Percent Difference
EP17A	Eagle Point Lake	EP17A-WAT-BULK-01-091920	PFHpS	0.0015 J	0.0021 J	**33.3**
EP17C	Eagle Point Lake	EP17C-WAT-BULK-01-092420	PFHpS	0.0024 J	0.0026 J	8.0
EP18	Eagle Point Lake	EP18-WAT-MID-01-091520	PFHpS	0.0051	0.0046	-10.3
EP19	Eagle Point Lake	EP19-WAT-BULK-01-091920	PFHpS	0.0035 J	0.0041 J	15.8
EP1A	Eagle Point Lake	EP1A-WAT-BOT-01-091520	PFHpS	0.0023 J	0.004 J	**54.0**
EP1A	Eagle Point Lake	EP1A-WAT-MID-01-091520	PFHpS	0.0023 J	0.0037 J	**46.7**
EP20	Lake Elmo	EP20-WAT-BULK-01-092020	PFHpS	0.0037 J+	0.0044	17.3
EP21A	Lake Elmo	EP21A-WAT-MID-01-091920	PFHpS	0.0018 J	0.0022 J	20.0
EP23	Eagle Point Lake	EP23-WAT-BULK-01-092420	PFHpS	0.0015 J	0.0014 J	-6.9
EP26A	Eagle Point Lake	EP26A-WAT-BULK-01-091720	PFHpS	0.0053	0.0058	9.0
EP27B	Eagle Point Lake	EP27B-WAT-BULK-01-092420	PFHpS	0.0032 J	0.0039 J	19.7
EP27C	Eagle Point Lake	EP27C-WAT-BOT-01-091520	PFHpS	0.004 J	0.0042 J	4.9
EP27C	Eagle Point Lake	EP27C-WAT-MID-01-091520	PFHpS	0.0044	0.0042 J	-4.7
EP4	Eagle Point Lake	EP4-WAT-BULK-01-092420	PFHpS	0.0037 J	0.0032 J	-14.5
EP5	Eagle Point Lake	EP5-WAT-BULK-01-092420	PFHpS	0.0026 J	0.0023 J	-12.2
EP9A	Lake Elmo	EP9A-WAT-MID-01-091920	PFHpS	0.0017 J	0.0018 J	5.7
RC22	Raleigh Creek	RC22-WAT-BULK-01-091820	PFHpS	0.0037 J	0.0053	**35.6**
RC23	Raleigh Creek	RC23-WAT-BULK-01-092820	PFHpS	0.026 J+	0.024 J+	-8.0
RC3A	Raleigh Creek	RC3A-WAT-BULK-01-091920	PFHpS	0.0094	0.012	24.3
RC4A	Raleigh Creek	RC4A-WAT-BULK-01-091820	PFHpS	0.014	0.026	**60.0**
RC5	Raleigh Creek	RC5-WAT-BULK-01-091820	PFHpS	0.022	0.019	-14.6
RC6	Raleigh Creek	RC6-WAT-BULK-01-091820	PFHpS	0.024	0.021	-13.3
RC6A	Raleigh Creek	RC6A-WAT-BULK-01-092020	PFHpS	0.016 J	0.022	**31.6**
RC7	Raleigh Creek	RC7-WAT-BULK-01-091920	PFHpS	0.015	0.015	0.0
WL10A	WLA - Unnamed Channel	WL10-WAT-BULK-01-092120	PFHpS	0.0026 J+	0.0031 J	17.5
WL11	WLA - Unnamed Channel	WL11-WAT-BULK-01-092220	PFHpS	0.0024 J+	0.0034 J	**34.5**
WL13	WLA - Unnamed Channel	WL13-WAT-MID-01-091620	PFHpS	0.0018 J	0.0021 J	15.4
WL15	WLA - South Pond	WL15-WAT-MID-01-091620	PFHpS	0.0029 J	0.0028 J	-3.5
WL15A	WLA - South Pond	WL15A-WAT-MID-01-091620	PFHpS	0.0025 J	0.0031 J	21.4
WL16	WLA - South Pond	WL16-WAT-BULK-01-092320	PFHpS	0.0025 J+	0.0025 J	0.0
WL2	WLA - Horseshoe Lake	WL2-WAT-MID-01-091720	PFHpS	0.0018 J	0.0021 J	15.4
WL21	WLA - Middle Pond	WL21-WAT-MID-01-091620	PFHpS	0.0026 J	0.0019 J	**-31.1**
WL3	WLA - Horseshoe Lake	WL3-WAT-MID-01-091720	PFHpS	0.0018 J	0.0031 J	**53.1**
WL5	WLA - Horseshoe Lake	WL5-WAT-MID-01-091720	PFHpS	0.0023 J	0.0022 J	-4.4
WL6	WLA - Culvert	WL6-WAT-BULK-01-091720	PFHpS	0.0018 J	0.0037 J	**69.1**
WL7	WLA - Unnamed Channel	WL7-WAT-BULK-01-091720	PFHpS	0.0024 J	0.0028 J	15.4
WL8A	WLA - North Pond	WL8A-WAT-BULK-01-091620	PFHpS	0.002 J	0.0019 J	-5.1
EP14	Lake Elmo	EP14-WAT-MID-01-091920	PFHxA	0.018	0.022	20.0
EP15	Lake Elmo	EP15-WAT-MID-01-091920	PFHxA	0.02	0.019	-5.1
EP17A	Eagle Point Lake	EP17A-WAT-BULK-01-091920	PFHxA	0.01	0.01	0.0
EP17C	Eagle Point Lake	EP17C-WAT-BULK-01-092420	PFHxA	0.014	0.014	0.0
EP18	Eagle Point Lake	EP18-WAT-MID-01-091520	PFHxA	0.018	0.018	0.0
EP19	Eagle Point Lake	EP19-WAT-BULK-01-091920	PFHxA	0.01	0.015	**40.0**
EP1A	Eagle Point Lake	EP1A-WAT-BOT-01-091520	PFHxA	0.0091 J	0.013	**35.3**
EP1A	Eagle Point Lake	EP1A-WAT-MID-01-091520	PFHxA	0.011	0.012	8.7
EP20	Lake Elmo	EP20-WAT-BULK-01-092020	PFHxA	0.016	0.014	-13.3
EP21A	Lake Elmo	EP21A-WAT-MID-01-091920	PFHxA	0.021	0.022	4.7
EP23	Eagle Point Lake	EP23-WAT-BULK-01-092420	PFHxA	0.019	0.02	5.1
EP26A	Eagle Point Lake	EP26A-WAT-BULK-01-091720	PFHxA	0.016	0.016	0.0
EP27B	Eagle Point Lake	EP27B-WAT-BULK-01-092420	PFHxA	0.014	0.015	6.9
EP27C	Eagle Point Lake	EP27C-WAT-BOT-01-091520	PFHxA	0.015	0.014	-6.9
EP27C	Eagle Point Lake	EP27C-WAT-MID-01-091520	PFHxA	0.014	0.014	0.0
EP4	Eagle Point Lake	EP4-WAT-BULK-01-092420	PFHxA	0.022	0.013	**-51.4**
EP5	Eagle Point Lake	EP5-WAT-BULK-01-092420	PFHxA	0.014	0.015	6.9
EP9A	Lake Elmo	EP9A-WAT-MID-01-091920	PFHxA	0.02	0.022	9.5
RC22	Raleigh Creek	RC22-WAT-BULK-01-091820	PFHxA	0.036	0.036	0.0
RC23	Raleigh Creek	RC23-WAT-BULK-01-092820	PFHxA	0.055	0.06	8.7
RC3A	Raleigh Creek	RC3A-WAT-BULK-01-091920	PFHxA	0.03	0.038	23.5
RC4A	Raleigh Creek	RC4A-WAT-BULK-01-091820	PFHxA	0.16	0.17	6.1
RC5	Raleigh Creek	RC5-WAT-BULK-01-091820	PFHxA	0.15	0.14	-6.9
RC6	Raleigh Creek	RC6-WAT-BULK-01-091820	PFHxA	0.13	0.14	7.4
RC6A	Raleigh Creek	RC6A-WAT-BULK-01-092020	PFHxA	0.11	0.11	0.0
RC7	Raleigh Creek	RC7-WAT-BULK-01-091920	PFHxA	0.071	0.065	-8.8
WL10A	WLA - Unnamed Channel	WL10-WAT-BULK-01-092120	PFHxA	0.015	0.016	6.5
WL11	WLA - Unnamed Channel	WL11-WAT-BULK-01-092220	PFHxA	0.017	0.017	0.0
WL13	WLA - Unnamed Channel	WL13-WAT-MID-01-091620	PFHxA	0.014	0.016	13.3
WL15	WLA - South Pond	WL15-WAT-MID-01-091620	PFHxA	0.015	0.016	6.5
WL15A	WLA - South Pond	WL15A-WAT-MID-01-091620	PFHxA	0.014	0.016	13.3
WL16	WLA - South Pond	WL16-WAT-BULK-01-092320	PFHxA	0.014	0.015	6.9
WL2	WLA - Horseshoe Lake	WL2-WAT-MID-01-091720	PFHxA	0.015	0.016	6.5
WL21	WLA - Middle Pond	WL21-WAT-MID-01-091620	PFHxA	0.015	0.015	0.0
WL3	WLA - Horseshoe Lake	WL3-WAT-MID-01-091720	PFHxA	0.015	0.016	6.5
WL5	WLA - Horseshoe Lake	WL5-WAT-MID-01-091720	PFHxA	0.016	0.017	6.1
WL6	WLA - Culvert	WL6-WAT-BULK-01-091720	PFHxA	0.016	0.016	0.0
WL7	WLA - Unnamed Channel	WL7-WAT-BULK-01-091720	PFHxA	0.015	0.017	12.5
WL8A	WLA - North Pond	WL8A-WAT-BULK-01-091620	PFHxA	0.014	0.016	13.3
EP14	Lake Elmo	EP14-WAT-MID-01-091920	PFHxS	0.0085	0.009	5.7
EP15	Lake Elmo	EP15-WAT-MID-01-091920	PFHxS	0.0073	0.0097	28.2
EP17A	Eagle Point Lake	EP17A-WAT-BULK-01-091920	PFHxS	0.0063	0.0085	29.7
EP17C	Eagle Point Lake	EP17C-WAT-BULK-01-092420	PFHxS	0.01	0.011 J+	9.5
EP18	Eagle Point Lake	EP18-WAT-MID-01-091520	PFHxS	0.017	0.012	**-34.5**
EP19	Eagle Point Lake	EP19-WAT-BULK-01-091920	PFHxS	0.0089	0.011	21.1
EP1A	Eagle Point Lake	EP1A-WAT-BOT-01-091520	PFHxS	0.01	0.009	-10.5
EP1A	Eagle Point Lake	EP1A-WAT-MID-01-091520	PFHxS	0.009	0.0084	-6.9
EP20	Lake Elmo	EP20-WAT-BULK-01-092020	PFHxS	0.012	0.01	-18.2
EP21A	Lake Elmo	EP21A-WAT-MID-01-091920	PFHxS	0.0083	0.0092	10.3
EP23	Eagle Point Lake	EP23-WAT-BULK-01-092420	PFHxS	0.0083	0.0074 J+	-11.5
EP26A	Eagle Point Lake	EP26A-WAT-BULK-01-091720	PFHxS	0.015	0.012	-22.2
EP27B	Eagle Point Lake	EP27B-WAT-BULK-01-092420	PFHxS	0.0098	0.012 J+	20.2
EP27C	Eagle Point Lake	EP27C-WAT-BOT-01-091520	PFHxS	0.012	0.01	-18.2

Appendix A Table 6a
Relative Percent Difference Calculations for Dissolved and Total Surface Water
Project 1007
Minneapolis, Minnesota

Location	Location Group	Sample Name [filtered sample]	Analyte	Dissolved Surface Water (ug/L)	Total Surface Water (ug/L)	Relative Percent Difference
EP27C	Eagle Point Lake	EP27C-WAT-MID-01-091520	PFHxS	0.015	0.0087	**-53.2**
EP4	Eagle Point Lake	EP4-WAT-BULK-01-092420	PFHxS	0.03	0.01 J+	**-100**
EP5	Eagle Point Lake	EP5-WAT-BULK-01-092420	PFHxS	0.0091	0.0088 J+	-3.4
EP9A	Lake Elmo	EP9A-WAT-MID-01-091920	PFHxS	0.0093	0.0083	-11.4
RC13	Raleigh Creek	RC13-WAT-BULK-01-092120	PFHxS	0.0041 J	0.0037 J	-10.3
RC14	Raleigh Creek	RC14-WAT-BULK-01-092120	PFHxS	0.0028 J	0.0043	**42.3**
RC16A	Raleigh Creek	RC16A-WAT-BULK-01-091920	PFHxS	0.0037 J	0.004 J	7.8
RC17	Raleigh Creek	RC17-WAT-BULK-01-091920	PFHxS	0.0031 J	0.003 J	-3.3
RC18	Raleigh Creek	RC18-WAT-BULK-01-091720	PFHxS	0.0038 J	0.0032 J	-17.1
RC18A	Raleigh Creek	RC18A-WAT-BULK-01-092120	PFHxS	0.0037 J	0.0043	15.0
RC21A	Raleigh Creek	RC21-WAT-BULK-01-092120	PFHxS	0.0022 J	0.0028 J	24.0
RC22	Raleigh Creek	RC22-WAT-BULK-01-091820	PFHxS	0.019	0.02	5.1
RC23	Raleigh Creek	RC23-WAT-BULK-01-092820	PFHxS	0.048	0.043 J+	-11.0
RC3A	Raleigh Creek	RC3A-WAT-BULK-01-091920	PFHxS	0.036	0.033	-8.7
RC4A	Raleigh Creek	RC4A-WAT-BULK-01-091820	PFHxS	0.065	0.071	8.8
RC5	Raleigh Creek	RC5-WAT-BULK-01-091820	PFHxS	0.07	0.07	0.0
RC6	Raleigh Creek	RC6-WAT-BULK-01-091820	PFHxS	0.069	0.07	1.4
RC6A	Raleigh Creek	RC6A-WAT-BULK-01-092020	PFHxS	0.05	0.058	14.8
RC7	Raleigh Creek	RC7-WAT-BULK-01-091920	PFHxS	0.046	0.041	-11.5
VB3	Valley Branch	VB3-WAT-BULK-02-091620	PFHxS	0.0031 J	0.0022 J	**-34.0**
WL10A	WLA - Unnamed Channel	WL10-WAT-BULK-01-092120	PFHxS	0.0096	0.011	13.6
WL11	WLA - Unnamed Channel	WL11-WAT-BULK-01-092220	PFHxS	0.0098	0.013	28.1
WL13	WLA - Unnamed Channel	WL13-WAT-MID-01-091620	PFHxS	0.012	0.0082	**-37.6**
WL15	WLA - South Pond	WL15-WAT-MID-01-091620	PFHxS	0.011	0.0082	-29.2
WL15A	WLA - South Pond	WL15A-WAT-MID-01-091620	PFHxS	0.012	0.01	-18.2
WL16	WLA - South Pond	WL16-WAT-BULK-01-092320	PFHxS	0.01	0.011	9.5
WL2	WLA - Horseshoe Lake	WL2-WAT-MID-01-091720	PFHxS	0.0099	0.009	-9.5
WL21	WLA - Middle Pond	WL21-WAT-MID-01-091620	PFHxS	0.0099	0.0076	-26.3
WL3	WLA - Horseshoe Lake	WL3-WAT-MID-01-091720	PFHxS	0.011	0.012	8.7
WL5	WLA - Horseshoe Lake	WL5-WAT-MID-01-091720	PFHxS	0.011	0.01	-9.5
WL6	WLA - Culvert	WL6-WAT-BULK-01-091720	PFHxS	0.013	0.012	-8.0
WL7	WLA - Unnamed Channel	WL7-WAT-BULK-01-091720	PFHxS	0.01	0.01	0.0
WL8A	WLA - North Pond	WL8A-WAT-BULK-01-091620	PFHxS	0.011	0.0069	**-45.8**
EP18	Eagle Point Lake	EP18-WAT-MID-01-091520	PFNA	0.0018 J	0.0026 J	**36.4**
EP19	Eagle Point Lake	EP19-WAT-BULK-01-091920	PFNA	0.0014 J	0.0015 J	6.9
EP1A	Eagle Point Lake	EP1A-WAT-BOT-01-091520	PFNA	0.0019 J	0.0015 J	-23.5
EP1A	Eagle Point Lake	EP1A-WAT-MID-01-091520	PFNA	0.0012 J	0.0019 J	**45.2**
EP20	Lake Elmo	EP20-WAT-BULK-01-092020	PFNA	0.0016 J	0.0019 J	17.1
EP26A	Eagle Point Lake	EP26A-WAT-BULK-01-091720	PFNA	0.0063	0.0041 J	**-42.3**
EP27B	Eagle Point Lake	EP27B-WAT-BULK-01-092420	PFNA	0.0021 J	0.0021 J	0.0
EP27C	Eagle Point Lake	EP27C-WAT-BOT-01-091520	PFNA	0.0024 J	0.0021 J	-13.3
EP27C	Eagle Point Lake	EP27C-WAT-MID-01-091520	PFNA	0.0018 J	0.0022 J	20.0
EP5	Eagle Point Lake	EP5-WAT-BULK-01-092420	PFNA	0.0014 J	0.0015 J	6.9
EP9A	Lake Elmo	EP9A-WAT-MID-01-091920	PFNA	0.0018 J	0.0015 J	-18.2
RC22	Raleigh Creek	RC22-WAT-BULK-01-091820	PFNA	0.0015 J	0.0018 J	18.2
RC23	Raleigh Creek	RC23-WAT-BULK-01-092820	PFNA	0.0061	0.0073	17.9
RC3A	Raleigh Creek	RC3A-WAT-BULK-01-091920	PFNA	0.0025 J	0.0026 J	3.9
RC4A	Raleigh Creek	RC4A-WAT-BULK-01-091820	PFNA	0.0039 J	0.0036 J	-8.0
RC5	Raleigh Creek	RC5-WAT-BULK-01-091820	PFNA	0.0048	0.004 J	-18.2
RC6	Raleigh Creek	RC6-WAT-BULK-01-091820	PFNA	0.005	0.0055	9.5
RC6A	Raleigh Creek	RC6A-WAT-BULK-01-092020	PFNA	0.0046	0.005	8.3
RC7	Raleigh Creek	RC7-WAT-BULK-01-091920	PFNA	0.0041 J	0.0044	7.1
WL13	WLA - Unnamed Channel	WL13-WAT-MID-01-091620	PFNA	0.0014 J	0.002 J	**35.3**
WL15	WLA - South Pond	WL15-WAT-MID-01-091620	PFNA	0.0016 J	0.0019 J	17.1
WL15A	WLA - South Pond	WL15A-WAT-MID-01-091620	PFNA	0.0012 J	0.0021 J	**54.5**
WL3	WLA - Horseshoe Lake	WL3-WAT-MID-01-091720	PFNA	0.0015 J	0.0018 J	18.2
WL5	WLA - Horseshoe Lake	WL5-WAT-MID-01-091720	PFNA	0.0015 J	0.0011 J	**-30.8**
RC23	Raleigh Creek	RC23-WAT-BULK-01-092820	PFNS	0.003 J	0.0037 J	20.9
RC4A	Raleigh Creek	RC4A-WAT-BULK-01-091820	PFNS	0.0011 J	0.00074 J	**-39.1**
RC6	Raleigh Creek	RC6-WAT-BULK-01-091820	PFNS	0.0013 J	0.0012 J	-8.0
RC7	Raleigh Creek	RC7-WAT-BULK-01-091920	PFNS	0.0012 J	0.00097 J	-21.2
BP1	Browns Pond	BP1-WAT-MID-01-091920	PFOA	0.014 J+	0.015	6.9
EP14	Lake Elmo	EP14-WAT-MID-01-091920	PFOA	0.077	0.086	11.0
EP15	Lake Elmo	EP15-WAT-MID-01-091920	PFOA	0.082	0.078	-5.0
EP17A	Eagle Point Lake	EP17A-WAT-BULK-01-091920	PFOA	0.038	0.04	5.1
EP17C	Eagle Point Lake	EP17C-WAT-BULK-01-092420	PFOA	0.077	0.076	-1.3
EP18	Eagle Point Lake	EP18-WAT-MID-01-091520	PFOA	0.16	0.1	**-46.2**
EP19	Eagle Point Lake	EP19-WAT-BULK-01-091920	PFOA	0.062	0.07	12.1
EP1A	Eagle Point Lake	EP1A-WAT-BOT-01-091520	PFOA	0.078	0.058	-29.4
EP1A	Eagle Point Lake	EP1A-WAT-MID-01-091520	PFOA	0.077	0.057	-29.9
EP20	Lake Elmo	EP20-WAT-BULK-01-092020	PFOA	0.1	0.1	0.0
EP21A	Lake Elmo	EP21A-WAT-MID-01-091920	PFOA	0.081	0.083	2.4
EP23	Eagle Point Lake	EP23-WAT-BULK-01-092420	PFOA	0.079	0.079	0.0
EP26A	Eagle Point Lake	EP26A-WAT-BULK-01-091720	PFOA	0.12	0.15 J+	22.2
EP27B	Eagle Point Lake	EP27B-WAT-BULK-01-092420	PFOA	0.094	0.089	-5.5
EP27C	Eagle Point Lake	EP27C-WAT-BOT-01-091520	PFOA	0.12	0.081	**-38.8**
EP27C	Eagle Point Lake	EP27C-WAT-MID-01-091520	PFOA	0.13	0.086	**-40.7**
EP4	Eagle Point Lake	EP4-WAT-BULK-01-092420	PFOA	0.09	0.072	-22.2
EP5	Eagle Point Lake	EP5-WAT-BULK-01-092420	PFOA	0.073	0.073	0.0
EP9A	Lake Elmo	EP9A-WAT-MID-01-091920	PFOA	0.083	0.084	1.2
RC13	Raleigh Creek	RC13-WAT-BULK-01-092120	PFOA	0.0078	0.0083	6.2
RC14	Raleigh Creek	RC14-WAT-BULK-01-092120	PFOA	0.0083	0.0079	-4.9
RC16A	Raleigh Creek	RC16A-WAT-BULK-01-091920	PFOA	0.0084	0.0092	9.1
RC17	Raleigh Creek	RC17-WAT-BULK-01-091920	PFOA	0.0085	0.0096	12.2
RC18	Raleigh Creek	RC18-WAT-BULK-01-091720	PFOA	0.0093	0.015	**46.9**
RC18A	Raleigh Creek	RC18A-WAT-BULK-01-092120	PFOA	0.0085	0.0095	11.1
RC21A	Raleigh Creek	RC21-WAT-BULK-01-092120	PFOA	0.0075	0.0087	14.8
RC22	Raleigh Creek	RC22-WAT-BULK-01-091820	PFOA	0.16	0.16	0.0
RC23	Raleigh Creek	RC23-WAT-BULK-01-092820	PFOA	0.41	0.4	-2.5
RC3A	Raleigh Creek	RC3A-WAT-BULK-01-091920	PFOA	0.16 J+	0.19	17.1

Appendix A Table 6a
Relative Percent Difference Calculations for Dissolved and Total Surface Water
Project 1007
Minneapolis, Minnesota

Location	Location Group	Sample Name [filtered sample]	Analyte	Dissolved Surface Water (ug/L)	Total Surface Water (ug/L)	Relative Percent Difference
RC4A	Raleigh Creek	RC4A-WAT-BULK-01-091820	PFOA	0.65	0.72	10.2
RC5	Raleigh Creek	RC5-WAT-BULK-01-091820	PFOA	0.61 J+	0.69	12.3
RC6	Raleigh Creek	RC6-WAT-BULK-01-091820	PFOA	0.61	0.7	13.7
RC6A	Raleigh Creek	RC6A-WAT-BULK-01-092020	PFOA	0.52	0.54	3.8
RC7	Raleigh Creek	RC7-WAT-BULK-01-091920	PFOA	0.42	0.39	-7.4
VB3	Valley Branch	VB3-WAT-BULK-02-091620	PFOA	0.014	0.011	-24.0
WL10A	WLA - Unnamed Channel	WL10-WAT-BULK-01-092120	PFOA	0.071	0.08	11.9
WL11	WLA - Unnamed Channel	WL11-WAT-BULK-01-092220	PFOA	0.074	0.077	4.0
WL13	WLA - Unnamed Channel	WL13-WAT-MID-01-091620	PFOA	0.079	0.067	-16.4
WL15	WLA - South Pond	WL15-WAT-MID-01-091620	PFOA	0.088	0.074	-17.3
WL15A	WLA - South Pond	WL15A-WAT-MID-01-091620	PFOA	0.076	0.069	-9.7
WL16	WLA - South Pond	WL16-WAT-BULK-01-092320	PFOA	0.071	0.075	5.5
WL2	WLA - Horseshoe Lake	WL2-WAT-MID-01-091720	PFOA	0.078	0.071	-9.4
WL21	WLA - Middle Pond	WL21-WAT-MID-01-091620	PFOA	0.077	0.061	-23.2
WL3	WLA - Horseshoe Lake	WL3-WAT-MID-01-091720	PFOA	0.08	0.072	-10.5
WL5	WLA - Horseshoe Lake	WL5-WAT-MID-01-091720	PFOA	0.086	0.074 J+	-15.0
WL6	WLA - Culvert	WL6-WAT-BULK-01-091720	PFOA	0.081	0.11	**30.4**
WL7	WLA - Unnamed Channel	WL7-WAT-BULK-01-091720	PFOA	0.079	0.072 J+	-9.3
WL8A	WLA - North Pond	WL8A-WAT-BULK-01-091620	PFOA	0.073	0.061	-17.9
BP1	Browns Pond	BP1-WAT-MID-01-091920	PFOS	0.002 J	0.0027 J	29.8
EP14	Lake Elmo	EP14-WAT-MID-01-091920	PFOS	0.064	0.11	**52.9**
EP15	Lake Elmo	EP15-WAT-MID-01-091920	PFOS	0.086	0.092	6.7
EP17A	Eagle Point Lake	EP17A-WAT-BULK-01-091920	PFOS	0.11	0.14	24.0
EP17C	Eagle Point Lake	EP17C-WAT-BULK-01-092420	PFOS	0.2 J+	0.21	4.9
EP18	Eagle Point Lake	EP18-WAT-MID-01-091520	PFOS	0.27	0.24	-11.8
EP19	Eagle Point Lake	EP19-WAT-BULK-01-091920	PFOS	0.18	0.28	**43.5**
EP1A	Eagle Point Lake	EP1A-WAT-BOT-01-091520	PFOS	0.14	0.16	13.3
EP1A	Eagle Point Lake	EP1A-WAT-MID-01-091520	PFOS	0.14	0.15	6.9
EP20	Lake Elmo	EP20-WAT-BULK-01-092020	PFOS	0.39	0.41	5.0
EP21A	Lake Elmo	EP21A-WAT-MID-01-091920	PFOS	0.078	0.11	**34.0**
EP23	Eagle Point Lake	EP23-WAT-BULK-01-092420	PFOS	0.092 J+	0.1	8.3
EP26A	Eagle Point Lake	EP26A-WAT-BULK-01-091720	PFOS	1.1 J+	0.68	**-47.2**
EP27B	Eagle Point Lake	EP27B-WAT-BULK-01-092420	PFOS	0.42 J+	0.4	-4.9
EP27C	Eagle Point Lake	EP27C-WAT-BOT-01-091520	PFOS	0.28	0.25	-11.3
EP27C	Eagle Point Lake	EP27C-WAT-MID-01-091520	PFOS	0.25	0.22	-12.8
EP4	Eagle Point Lake	EP4-WAT-BULK-01-092420	PFOS	0.32	0.28 J+	-13.3
EP5	Eagle Point Lake	EP5-WAT-BULK-01-092420	PFOS	0.25 J+	0.26	3.9
EP9A	Lake Elmo	EP9A-WAT-MID-01-091920	PFOS	0.076 J	0.11	**36.6**
RC13	Raleigh Creek	RC13-WAT-BULK-01-092120	PFOS	0.0041 J+	0.0056	**30.9**
RC14	Raleigh Creek	RC14-WAT-BULK-01-092120	PFOS	0.0031 J+	0.0032 J	3.2
RC16A	Raleigh Creek	RC16A-WAT-BULK-01-091920	PFOS	0.0035 J	0.0036 J	2.8
RC17	Raleigh Creek	RC17-WAT-BULK-01-091920	PFOS	0.0027 J	0.0036 J	28.6
RC18	Raleigh Creek	RC18-WAT-BULK-01-091720	PFOS	0.0065	0.004	**-47.6**
RC18A	Raleigh Creek	RC18A-WAT-BULK-01-092120	PFOS	0.0038 J+	0.005	27.3
RC21A	Raleigh Creek	RC21-WAT-BULK-01-092120	PFOS	0.0032 J+	0.0034 J	6.1
RC22	Raleigh Creek	RC22-WAT-BULK-01-091820	PFOS	0.38	0.46	19.0
RC23	Raleigh Creek	RC23-WAT-BULK-01-092820	PFOS	2.1	2.4	13.3
RC3A	Raleigh Creek	RC3A-WAT-BULK-01-091920	PFOS	0.43	0.61	**34.6**
RC4A	Raleigh Creek	RC4A-WAT-BULK-01-091820	PFOS	0.98	1.2	20.2
RC5	Raleigh Creek	RC5-WAT-BULK-01-091820	PFOS	1.5	1.6	6.5
RC6	Raleigh Creek	RC6-WAT-BULK-01-091820	PFOS	1.5	1.8	18.2
RC6A	Raleigh Creek	RC6A-WAT-BULK-01-092020	PFOS	1.9	2.2	14.6
RC7	Raleigh Creek	RC7-WAT-BULK-01-091920	PFOS	1.6	1.7	6.1
VB3	Valley Branch	VB3-WAT-BULK-02-091620	PFOS	0.019	0.0094	**-67.6**
WL10A	WLA - Unnamed Channel	WL10-WAT-BULK-01-092120	PFOS	0.19 J+	0.2	5.1
WL11	WLA - Unnamed Channel	WL11-WAT-BULK-01-092220	PFOS	0.2 J+	0.19	-5.1
WL13	WLA - Unnamed Channel	WL13-WAT-MID-01-091620	PFOS	0.25	0.17	**-38.1**
WL15	WLA - South Pond	WL15-WAT-MID-01-091620	PFOS	0.31	0.2	**-43.1**
WL15A	WLA - South Pond	WL15A-WAT-MID-01-091620	PFOS	0.23	0.17	-30.0
WL16	WLA - South Pond	WL16-WAT-BULK-01-092320	PFOS	0.19 J+	0.22	14.6
WL2	WLA - Horseshoe Lake	WL2-WAT-MID-01-091720	PFOS	0.21	0.18	-15.4
WL21	WLA - Middle Pond	WL21-WAT-MID-01-091620	PFOS	0.24	0.15	**-46.2**
WL3	WLA - Horseshoe Lake	WL3-WAT-MID-01-091720	PFOS	0.22	0.19	-14.6
WL5	WLA - Horseshoe Lake	WL5-WAT-MID-01-091720	PFOS	0.25	0.19	-27.3
WL6	WLA - Culvert	WL6-WAT-BULK-01-091720	PFOS	0.23	0.19	-19.0
WL7	WLA - Unnamed Channel	WL7-WAT-BULK-01-091720	PFOS	0.24	0.19	-23.3
WL8A	WLA - North Pond	WL8A-WAT-BULK-01-091620	PFOS	0.21	0.15	**-33.3**
EP17A	Eagle Point Lake	EP17A-WAT-BULK-01-091920	PFOSA	0.00083 J	0.00072 J	-14.2
EP17C	Eagle Point Lake	EP17C-WAT-BULK-01-092420	PFOSA	0.0012 J	0.0011 J	-8.7
EP18	Eagle Point Lake	EP18-WAT-MID-01-091520	PFOSA	0.001 J	0.0013 J	26.1
EP19	Eagle Point Lake	EP19-WAT-BULK-01-091920	PFOSA	0.0014 J	0.0014 J	0.0
EP1A	Eagle Point Lake	EP1A-WAT-BOT-01-091520	PFOSA	0.00081 J	0.0011 J	**30.4**
EP1A	Eagle Point Lake	EP1A-WAT-MID-01-091520	PFOSA	0.001 J	0.0011 J	9.5
EP20	Lake Elmo	EP20-WAT-BULK-01-092020	PFOSA	0.0016 J	0.0014 J	-13.3
EP27B	Eagle Point Lake	EP27B-WAT-BULK-01-092420	PFOSA	0.0019 J	0.002 J	5.1
EP27C	Eagle Point Lake	EP27C-WAT-BOT-01-091520	PFOSA	0.0012 J	0.0011 J	-8.7
EP27C	Eagle Point Lake	EP27C-WAT-MID-01-091520	PFOSA	0.0015 J	0.0011 J	**-30.8**
EP4	Eagle Point Lake	EP4-WAT-BULK-01-092420	PFOSA	0.0015 J	0.0014 J	-6.9
EP5	Eagle Point Lake	EP5-WAT-BULK-01-092420	PFOSA	0.0016 J+	0.0012 J	-28.6
RC22	Raleigh Creek	RC22-WAT-BULK-01-091820	PFOSA	0.0015 J	0.0015 J	0.0
RC23	Raleigh Creek	RC23-WAT-BULK-01-092820	PFOSA	0.016	0.02	22.2
RC3A	Raleigh Creek	RC3A-WAT-BULK-01-091920	PFOSA	0.006	0.0094	**44.2**
RC4A	Raleigh Creek	RC4A-WAT-BULK-01-091820	PFOSA	0.026	0.028	7.4
RC5	Raleigh Creek	RC5-WAT-BULK-01-091820	PFOSA	0.019	0.025	27.3
RC6	Raleigh Creek	RC6-WAT-BULK-01-091820	PFOSA	0.02	0.027	29.8
RC6A	Raleigh Creek	RC6A-WAT-BULK-01-092020	PFOSA	0.033	0.038	14.1
RC7	Raleigh Creek	RC7-WAT-BULK-01-091920	PFOSA	0.023	0.024	4.3
WL10A	WLA - Unnamed Channel	WL10-WAT-BULK-01-092120	PFOSA	0.001 J	0.00091 J	-9.4
WL11	WLA - Unnamed Channel	WL11-WAT-BULK-01-092220	PFOSA	0.00094 J	0.00069 J	**-30.7**
WL13	WLA - Unnamed Channel	WL13-WAT-MID-01-091620	PFOSA	0.0013 J	0.00091 J	**-35.3**

Appendix A Table 6a
Relative Percent Difference Calculations for Dissolved and Total Surface Water
Project 1007
Minneapolis, Minnesota

Location	Location Group	Sample Name [filtered sample]	Analyte	Dissolved Surface Water (ug/L)		Total Surface Water (ug/L)		Relative Percent Difference
WL15	WLA - South Pond	WL15-WAT-MID-01-091620	PFOSA	0.00098	J	0.0011	J	11.5
WL15A	WLA - South Pond	WL15A-WAT-MID-01-091620	PFOSA	0.0012	J	0.001	J	-18.2
WL16	WLA - South Pond	WL16-WAT-BULK-01-092320	PFOSA	0.00095	J	0.0011	J	14.6
WL2	WLA - Horseshoe Lake	WL2-WAT-MID-01-091720	PFOSA	0.00088	J	0.0007	J	-22.8
WL21	WLA - Middle Pond	WL21-WAT-MID-01-091620	PFOSA	0.0014	J+	0.00093	J	**-40.3**
WL3	WLA - Horseshoe Lake	WL3-WAT-MID-01-091720	PFOSA	0.00092	J	0.00079	J	-15.2
WL5	WLA - Horseshoe Lake	WL5-WAT-MID-01-091720	PFOSA	0.0011	J	0.00097	J	-12.6
WL6	WLA - Culvert	WL6-WAT-BULK-01-091720	PFOSA	0.00089	J	0.00077	J	-14.5
WL7	WLA - Unnamed Channel	WL7-WAT-BULK-01-091720	PFOSA	0.0012	J	0.00082	J	**-37.6**
WL8A	WLA - North Pond	WL8A-WAT-BULK-01-091620	PFOSA	0.00094	J	0.0011	J	15.7
BP1	Browns Pond	BP1-WAT-MID-01-091920	PFPeA	0.0099		0.0087		-12.9
EP14	Lake Elmo	EP14-WAT-MID-01-091920	PFPeA	0.021		0.018		-15.4
EP15	Lake Elmo	EP15-WAT-MID-01-091920	PFPeA	0.018		0.018		0.0
EP17A	Eagle Point Lake	EP17A-WAT-BULK-01-091920	PFPeA	0.0085		0.0095		11.1
EP17C	Eagle Point Lake	EP17C-WAT-BULK-01-092420	PFPeA	0.012		0.012		0.0
EP18	Eagle Point Lake	EP18-WAT-MID-01-091520	PFPeA	0.012		0.011		-8.7
EP19	Eagle Point Lake	EP19-WAT-BULK-01-091920	PFPeA	0.012		0.01		-18.2
EP1A	Eagle Point Lake	EP1A-WAT-BOT-01-091520	PFPeA	0.011		0.01		-9.5
EP1A	Eagle Point Lake	EP1A-WAT-MID-01-091520	PFPeA	0.012		0.0088		**-30.8**
EP20	Lake Elmo	EP20-WAT-BULK-01-092020	PFPeA	0.01		0.011		9.5
EP21A	Lake Elmo	EP21A-WAT-MID-01-091920	PFPeA	0.02		0.019		-5.1
EP23	Eagle Point Lake	EP23-WAT-BULK-01-092420	PFPeA	0.019		0.019		0.0
EP26A	Eagle Point Lake	EP26A-WAT-BULK-01-091720	PFPeA	0.012		0.011		-8.7
EP27B	Eagle Point Lake	EP27B-WAT-BULK-01-092420	PFPeA	0.012		0.011		-8.7
EP27C	Eagle Point Lake	EP27C-WAT-BOT-01-091520	PFPeA	0.012		0.01		-18.2
EP27C	Eagle Point Lake	EP27C-WAT-MID-01-091520	PFPeA	0.012		0.0099		-19.2
EP4	Eagle Point Lake	EP4-WAT-BULK-01-092420	PFPeA	0.014		0.011		-24.0
EP5	Eagle Point Lake	EP5-WAT-BULK-01-092420	PFPeA	0.012		0.011		-8.7
EP9A	Lake Elmo	EP9A-WAT-MID-01-091920	PFPeA	0.022		0.019		-14.6
RC13	Raleigh Creek	RC13-WAT-BULK-01-092120	PFPeA	0.0066		0.0078		16.7
RC14	Raleigh Creek	RC14-WAT-BULK-01-092120	PFPeA	0.0068		0.008		16.2
RC16A	Raleigh Creek	RC16A-WAT-BULK-01-091920	PFPeA	0.0078		0.0079		1.3
RC17	Raleigh Creek	RC17-WAT-BULK-01-091920	PFPeA	0.0073		0.0084		14.0
RC18	Raleigh Creek	RC18-WAT-BULK-01-091720	PFPeA	0.0075		0.0076		1.3
RC18A	Raleigh Creek	RC18A-WAT-BULK-01-092120	PFPeA	0.0069		0.0083		18.4
RC21A	Raleigh Creek	RC21-WAT-BULK-01-092120	PFPeA	0.0072		0.0082		13.0
RC22	Raleigh Creek	RC22-WAT-BULK-01-091820	PFPeA	0.022		0.025		12.8
RC23	Raleigh Creek	RC23-WAT-BULK-01-092820	PFPeA	0.027		0.025		-7.7
RC3A	Raleigh Creek	RC3A-WAT-BULK-01-091920	PFPeA	0.022		0.02		-9.5
RC4A	Raleigh Creek	RC4A-WAT-BULK-01-091820	PFPeA	0.067		0.064		-4.6
RC5	Raleigh Creek	RC5-WAT-BULK-01-091820	PFPeA	0.058		0.055		-5.3
RC6	Raleigh Creek	RC6-WAT-BULK-01-091820	PFPeA	0.058		0.054		-7.1
RC6A	Raleigh Creek	RC6A-WAT-BULK-01-092020	PFPeA	0.037		0.04		7.8
RC7	Raleigh Creek	RC7-WAT-BULK-01-091920	PFPeA	0.027		0.027		0.0
VB3	Valley Branch	VB3-WAT-BULK-02-091620	PFPeA	0.012		0.01		-18.2
WL10A	WLA - Unnamed Channel	WL10-WAT-BULK-01-092120	PFPeA	0.013		0.014		7.4
WL11	WLA - Unnamed Channel	WL11-WAT-BULK-01-092220	PFPeA	0.013		0.015		14.3
WL13	WLA - Unnamed Channel	WL13-WAT-MID-01-091620	PFPeA	0.015		0.012		-22.2
WL15	WLA - South Pond	WL15-WAT-MID-01-091620	PFPeA	0.016		0.013		-20.7
WL15A	WLA - South Pond	WL15A-WAT-MID-01-091620	PFPeA	0.015		0.013		-14.3
WL16	WLA - South Pond	WL16-WAT-BULK-01-092320	PFPeA	0.013		0.015		14.3
WL2	WLA - Horseshoe Lake	WL2-WAT-MID-01-091720	PFPeA	0.016		0.014		-13.3
WL21	WLA - Middle Pond	WL21-WAT-MID-01-091620	PFPeA	0.015		0.013		-14.3
WL3	WLA - Horseshoe Lake	WL3-WAT-MID-01-091720	PFPeA	0.015		0.013		-14.3
WL5	WLA - Horseshoe Lake	WL5-WAT-MID-01-091720	PFPeA	0.014		0.013		-7.4
WL6	WLA - Culvert	WL6-WAT-BULK-01-091720	PFPeA	0.016		0.014		-13.3
WL7	WLA - Unnamed Channel	WL7-WAT-BULK-01-091720	PFPeA	0.016		0.013		-20.7
WL8A	WLA - North Pond	WL8A-WAT-BULK-01-091620	PFPeA	0.015		0.012		-22.2
EP14	Lake Elmo	EP14-WAT-MID-01-091920	PFPeS	0.0038	J+	0.004	J	5.1
EP15	Lake Elmo	EP15-WAT-MID-01-091920	PFPeS	0.0043	J+	0.0039	J	-9.8
EP17A	Eagle Point Lake	EP17A-WAT-BULK-01-091920	PFPeS	0.0029	J+	0.0026	J	-10.9
EP17C	Eagle Point Lake	EP17C-WAT-BULK-01-092420	PFPeS	0.0047	J+	0.005	J+	6.2
EP18	Eagle Point Lake	EP18-WAT-MID-01-091520	PFPeS	0.0079		0.0048		**-48.8**
EP19	Eagle Point Lake	EP19-WAT-BULK-01-091920	PFPeS	0.0052	J+	0.0046		-12.2
EP1A	Eagle Point Lake	EP1A-WAT-BOT-01-091520	PFPeS	0.0036	J	0.0034	J	-5.7
EP1A	Eagle Point Lake	EP1A-WAT-MID-01-091520	PFPeS	0.0049		0.0035	J	**-33.3**
EP20	Lake Elmo	EP20-WAT-BULK-01-092020	PFPeS	0.0062	J+	0.006	J+	-3.3
EP21A	Lake Elmo	EP21A-WAT-MID-01-091920	PFPeS	0.0038	J+	0.0035	J	-8.2
EP23	Eagle Point Lake	EP23-WAT-BULK-01-092420	PFPeS	0.0048	J+	0.003	J+	**-46.2**
EP26A	Eagle Point Lake	EP26A-WAT-BULK-01-091720	PFPeS	0.0058	J+	0.0068		15.9
EP27B	Eagle Point Lake	EP27B-WAT-BULK-01-092420	PFPeS	0.0072	J+	0.0049	J+	**-38.0**
EP27C	Eagle Point Lake	EP27C-WAT-BOT-01-091520	PFPeS	0.0054		0.0042	J	-25.0
EP27C	Eagle Point Lake	EP27C-WAT-MID-01-091520	PFPeS	0.0055		0.0042	J	-26.8
EP4	Eagle Point Lake	EP4-WAT-BULK-01-092420	PFPeS	0.011		0.0049	J+	**-76.7**
EP5	Eagle Point Lake	EP5-WAT-BULK-01-092420	PFPeS	0.0047	J+	0.0042	J+	-11.2
EP9A	Lake Elmo	EP9A-WAT-MID-01-091920	PFPeS	0.004	J+	0.0048	J	18.2
RC22	Raleigh Creek	RC22-WAT-BULK-01-091820	PFPeS	0.01	J+	0.01		0.0
RC23	Raleigh Creek	RC23-WAT-BULK-01-092820	PFPeS	0.019		0.021		10.0
RC3A	Raleigh Creek	RC3A-WAT-BULK-01-091920	PFPeS	0.015	J+	0.017		12.5
RC4A	Raleigh Creek	RC4A-WAT-BULK-01-091820	PFPeS	0.046	J+	0.041	J+	-11.5
RC5	Raleigh Creek	RC5-WAT-BULK-01-091820	PFPeS	0.046	J+	0.043	J+	-6.7
RC6	Raleigh Creek	RC6-WAT-BULK-01-091820	PFPeS	0.043	J+	0.042		-2.4
RC6A	Raleigh Creek	RC6A-WAT-BULK-01-092020	PFPeS	0.032	J+	0.032		0.0
RC7	Raleigh Creek	RC7-WAT-BULK-01-091920	PFPeS	0.024	J+	0.021	J+	-13.3
WL10A	WLA - Unnamed Channel	WL10-WAT-BULK-01-092120	PFPeS	0.0042	J+	0.0037	J	-12.7
WL11	WLA - Unnamed Channel	WL11-WAT-BULK-01-092220	PFPeS	0.0039	J+	0.0041	J+	5.0
WL13	WLA - Unnamed Channel	WL13-WAT-MID-01-091620	PFPeS	0.0044	J+	0.0041		-7.1
WL15	WLA - South Pond	WL15-WAT-MID-01-091620	PFPeS	0.0049	J+	0.004	J	-20.2
WL15A	WLA - South Pond	WL15A-WAT-MID-01-091620	PFPeS	0.0044	J+	0.003	J	**-37.8**
WL16	WLA - South Pond	WL16-WAT-BULK-01-092320	PFPeS	0.004	J+	0.0037	J+	-7.8

Appendix A Table 6a
Relative Percent Difference Calculations for Dissolved and Total Surface Water
Project 1007
Minneapolis, Minnesota

Location	Location Group	Sample Name [filtered sample]	Analyte	Dissolved Surface Water (ug/L)		Total Surface Water (ug/L)		Relative Percent Difference
WL2	WLA - Horseshoe Lake	WL2-WAT-MID-01-091720	PFPeS	0.0043	J+	0.003	J	**-35.6**
WL21	WLA - Middle Pond	WL21-WAT-MID-01-091620	PFPeS	0.0058	J+	0.0036	J	**-46.8**
WL3	WLA - Horseshoe Lake	WL3-WAT-MID-01-091720	PFPeS	0.0049	J+	0.0051		4.0
WL5	WLA - Horseshoe Lake	WL5-WAT-MID-01-091720	PFPeS	0.0053	J+	0.0041		-25.5
WL6	WLA - Culvert	WL6-WAT-BULK-01-091720	PFPeS	0.0059	J+	0.0038	J	**-43.3**
WL7	WLA - Unnamed Channel	WL7-WAT-BULK-01-091720	PFPeS	0.0043	J+	0.0042	J	-2.4
WL8A	WLA - North Pond	WL8A-WAT-BULK-01-091620	PFPeS	0.0035	J+	0.0032	J	-9.0
EP27C	Eagle Point Lake	EP27C-WAT-MID-01-091520	PFTeDA	0.0049	J+	0.0023	J	**-72.2**
BP1	Browns Pond	BP1-WAT-MID-01-091920	PFTrDA	0.0013	J+	0.0015	J	14.3
EP19	Eagle Point Lake	EP19-WAT-BULK-01-091920	PFTrDA	0.0017	J+	0.0015	BJ	-12.5
EP26A	Eagle Point Lake	EP26A-WAT-BULK-01-091720	PFTrDA	0.032	J+	0.0069		**-129**
EP27B	Eagle Point Lake	EP27B-WAT-BULK-01-092420	PFTrDA	0.0022	J	0.0025	J	12.8
EP5	Eagle Point Lake	EP5-WAT-BULK-01-092420	PFTrDA	0.0021	J	0.0031	J	**38.5**

Notes
Only paired samples with detected concentrations for both total and dissolved phase were included in this evaluation.
Shading indicates relative percent difference of >30%.
Relative percent difference calculated as: (a -b) / [(a + b)/2] * 100
where:
a = total phase concentration
b = dissolved phase concentration

ug/L - microgram per liter
+ - Result may be biased high
B - Analyte was present in a blank
J - Estimated concentration
WLA - West Lakeland Area

Appendix A Table 6b
Relative Percent Difference Calculations for Dissolved and Total Porewater
Project 1007
Minneapolis, Minnesota

Location	Location Group	Sample Name [filtered sample]	Analyte	Dissolved Surface Water		Total Surface Water (ug/L)	Relative Percent Difference
WL6	WLA - Culvert	WL6-POWAT-01-092420	PFBA	0.27		0.26	-3.8
WL13	WLA - Unnamed Channel	WL13-POWAT-01-092520	PFBA	0.41		0.4	-2.5
WL7	WLA - Unnamed Channel	WL7-POWAT-01-092420	PFBA	0.42		0.43	2.4
WL6	WLA - Culvert	WL6-POWAT-01-092420	PFBS	0.0035	J	0.004	13.3
WL13	WLA - Unnamed Channel	WL13-POWAT-01-092520	PFBS	0.0044	J	0.0042	-4.7
WL7	WLA - Unnamed Channel	WL7-POWAT-01-092420	PFBS	0.0046		0.0053	14.1
WL13	WLA - Unnamed Channel	WL13-POWAT-01-092520	PFDA	0.0014	J	0.0013	-7.4
WL7	WLA - Unnamed Channel	WL7-POWAT-01-092420	PFDA	0.0016	J	0.0016	0.0
WL6	WLA - Culvert	WL6-POWAT-01-092420	PFHpA	0.0067		0.0063	-6.2
WL13	WLA - Unnamed Channel	WL13-POWAT-01-092520	PFHpA	0.009		0.012	28.6
WL7	WLA - Unnamed Channel	WL7-POWAT-01-092420	PFHpA	0.01		0.012	18.2
WL6	WLA - Culvert	WL6-POWAT-01-092420	PFHpS	0.0015	J	0.0012	-22.2
WL13	WLA - Unnamed Channel	WL13-POWAT-01-092520	PFHpS	0.0029	J	0.0019	**-41.7**
WL7	WLA - Unnamed Channel	WL7-POWAT-01-092420	PFHpS	0.0023	J	0.0021	-9.1
WL6	WLA - Culvert	WL6-POWAT-01-092420	PFHxA	0.011		0.013	16.7
WL13	WLA - Unnamed Channel	WL13-POWAT-01-092520	PFHxA	0.017		0.016	-6.1
WL7	WLA - Unnamed Channel	WL7-POWAT-01-092420	PFHxA	0.015		0.018	18.2
WL6	WLA - Culvert	WL6-POWAT-01-092420	PFHxS	0.0057		0.0079	**32.4**
WL13	WLA - Unnamed Channel	WL13-POWAT-01-092520	PFHxS	0.011		0.0095	-14.6
WL7	WLA - Unnamed Channel	WL7-POWAT-01-092420	PFHxS	0.011		0.0098	-11.5
WL6	WLA - Culvert	WL6-POWAT-01-092420	PFNA	0.0012	J	0.0016	28.6
WL13	WLA - Unnamed Channel	WL13-POWAT-01-092520	PFNA	0.0012	J	0.0013	8.0
WL6	WLA - Culvert	WL6-POWAT-01-092420	PFOA	0.054		0.052	-3.8
WL13	WLA - Unnamed Channel	WL13-POWAT-01-092520	PFOA	0.089		0.078	-13.2
WL7	WLA - Unnamed Channel	WL7-POWAT-01-092420	PFOA	0.08		0.077	-3.8
WL6	WLA - Culvert	WL6-POWAT-01-092420	PFOS	0.15	J+	0.16	6.5
WL13	WLA - Unnamed Channel	WL13-POWAT-01-092520	PFOS	0.22	J+	0.22	0.0
WL7	WLA - Unnamed Channel	WL7-POWAT-01-092420	PFOS	0.17	J+	0.2	16.2
WL13	WLA - Unnamed Channel	WL13-POWAT-01-092520	PFOSA	0.0013	J	0.0013	0.0
WL7	WLA - Unnamed Channel	WL7-POWAT-01-092420	PFOSA	0.0013	J	0.0016	20.7
WL6	WLA - Culvert	WL6-POWAT-01-092420	PFPeA	0.01		0.01	0.0
WL13	WLA - Unnamed Channel	WL13-POWAT-01-092520	PFPeA	0.015		0.015	0.0
WL7	WLA - Unnamed Channel	WL7-POWAT-01-092420	PFPeA	0.015		0.016	6.5
WL6	WLA - Culvert	WL6-POWAT-01-092420	PFPeS	0.0032	J+	0.003	-6.5
WL13	WLA - Unnamed Channel	WL13-POWAT-01-092520	PFPeS	0.0058	J+	0.004	**-36.7**
WL7	WLA - Unnamed Channel	WL7-POWAT-01-092420	PFPeS	0.0054	J+	0.0053	-1.9

Notes
Only paired samples with detected concentrations for both total and dissolved phase were included in this evaluation.
Shading indicates relative percent difference of >30%.
Relative percent difference calculated as: (a -b) / [(a + b)/2] * 100
where:
a = total phase concentration
b = dissolved phase concentration

ug/L - microgram per liter
+ - Result may be biased high
J - Estimated concentration
WLA - West Lakeland Area

Appendix B

BERA Sampling Event Documentation

Appendix B-1

P1007 Photographic Log

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
1	7/28/2020

Sample ID and Location:

RC3
Raleigh Creek Exits ODS

Description:

Raleigh Creek exits Oakdale Disposal Site (ODS) through a culvert underneath Hadley Ave into a wetland area. The stream channel is well defined but the area does become flooded during high rain events. Small fish and crayfish were observed in the stream channel.

Photo No.	Date:
2	7/28/2020

Sample ID and Location:

RC3A
Wetland downstream of ODS

Description:

Small snails were collected in this area.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
3	9/18/2020

Sample ID and Location:

RC3A
Wetland downstream of ODS

Description:

Fathead minnows were collected with a dip net in the stream channel.

Photo No.	Date:
4	8/15/2019

Sample ID and Location:

RC4
Wetlands east of I-694

Description:

The wetland area continues after Raleigh Creek passes underneath Interstate 694. In most areas the main channel is defined but it does fan out. Multiple stormwater ponds discharge to Raleigh Creek in this area.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
5	9/18/2020

Sample ID and Location:

RC4
Wetlands east of I-694

Description:

Large tadpoles were collected via crayfish traps.

Photo No.	Date:
6	7/28/20

Sample ID and Location:

RC5
Wetlands upstream of railroad track

Description:

Raleigh Creek passes through another culvert and into a third wetland area that is bounded by a road and railroad tracks. Raleigh Creek has been observed to be flowing year round, including winter, up to the rail road tracks.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
7	9/16/20

Sample ID and Location:

RC5

Description:

Foam is often observed in the wetland areas. It accumulates along the bank edge or on plant material. The color (white to brown) and size of the pile of accumulated foam is variable. This foam was collected during the BERA sampling event.

Photo No.	Date:
8	9/18/20

Sample ID and Location:

RC5

Description:

Frog captured near RC5.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
9	8/12/19

Sample ID and Location:

RC7

Description:

Raleigh Creek then enters a wooded residential area. Birds and fish are observed in this area. Neighborhood stormwater retention ponds discharge into Raleigh Creek. These ponds provide additional ecological habitat. Photo is taken during low flow.

Photo No.	Date:
10	4/29/20

Sample ID and Location:

RC7

Description:

Flow is variable throughout the year but does remain flowing during the summer months. It has been observed to completely freeze during the winter. The stream tends to be more erosional in this area with undercut banks and a rockier stream bottom.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
11	8/12/19

Sample ID and Location:

RC7

Description:

Larger piles of foam are often observed accumulating on stream debris in this area.

Photo No.	Date:
12	9/2/20

Sample ID and Location:

RC7

Description:

Green sunfish collected with a trap near RC7.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
13	5/14/20

Sample ID and Location:

RC22

Description:

Raleigh Creek flows into a pond at the edge of the neighborhood.

Photo No.	Date:
14	9/18/20

Sample ID and Location:

RC23

Description:

The water level in the pond varies greatly depending on rainfall during the summer. The small pond remaining was full of trapped mud minnows, small bullheads, and fathead minnows. Raccoon and bird tracks were observed around the pond. Herons and egrets are often observed feeding from the pond.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
15	5/14/20

Sample ID and Location:

RC23

Description:

A second pond is directly adjacent to the first. This pond is deeper and tends to remain inundated for longer periods. It has more floating and submerged vegetation.

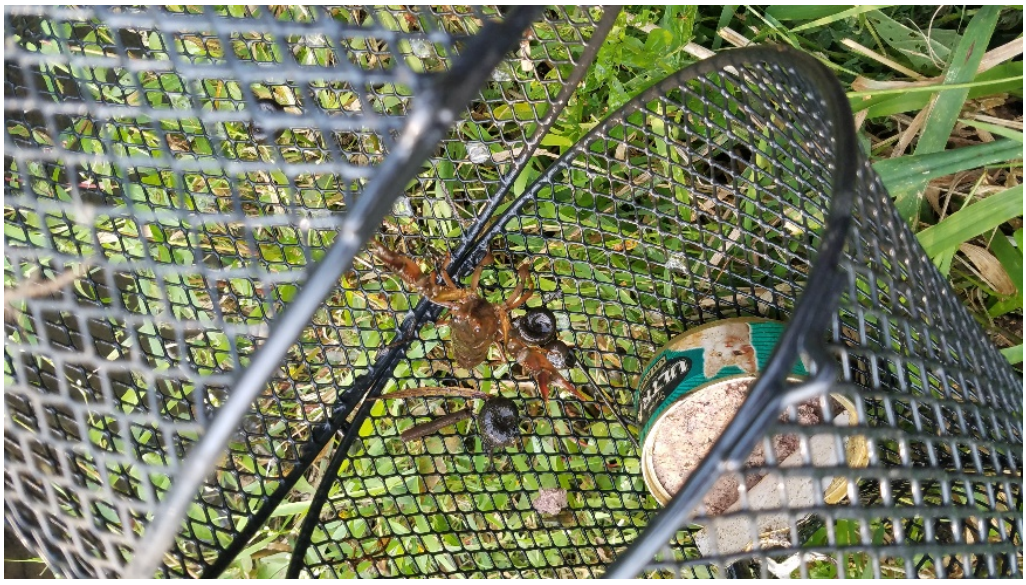
Photo No.	Date:
16	5/14/20

Sample ID and Location:

RC23

Description:

Small snails were found in a trap set in the southern pond.



AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
17	5/14/20

Sample ID and Location:

RC20

Description:

A wetland area extends from the ponds to a storm culvert. This area become flooded after rain events.

Photo No.	Date:
18	5/21/20

Sample ID and Location:

RC20

Description:

There are three main stream channels. Pictured is the largest.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
19	5/14/20

Sample ID and Location:

RC20

Description:

A storm culvert at the end of the wetland area is set 3-4 inches above the wetland area. This and the flow through the wetland controls the water flow downstream of Raleigh Creek.

Photo No.	Date:
20	5/12/20

Sample ID and Location:

RC20

Description:

Downstream of the culverts Raleigh Creek becomes more channelized with a rocky bottom.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
21	5/05/20

Sample ID and Location:

RC12

Description:

Raleigh Creek is often dry except after rain events and in the spring after snow melt downstream of the culverts. The stream bottom is rocky with some depositional areas comprised mostly of sand.

Photo No.	Date:
22	8/12/19

Sample ID and Location:

RC12

Description:

After a rain event, the stream is flowing.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
23	5/7/20

Sample ID and Location:

RC16

Description:

There is a small section of Project 1007 that is not piped after it exits the pipe from the Tri-Lakes Area and upstream of the confluence with Raleigh Creek. The stream is channelized but has wetland vegetation along it.

Photo No.	Date:
24	8/12/19

Sample ID and Location:

RC14

Description:

Project 1007 flowing into the confluence with Raleigh Creek at Tablyn Park.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
25	8/13/20

Sample ID and Location:

RC21

Description:

Downstream of the confluence, foam often forms and accumulates along the stream bank. This segment of Raleigh Creek is flowing continuously except during colder winters when it freezes. The PFAS concentrations vary depending on whether Raleigh Creek is connected.

Photo No.	Date:
26	9/20/20

Sample ID and Location:

RC21

Description:

Multiple crayfish were caught via electroshocking and nets downstream of the confluence. Rocks and undercut banks provide a good habitat for crayfish.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
27	8/14/19

Sample ID and Location:

RC17

Description:

Raleigh Creek then flows through a wooded area and into Lake Elmo Park Reserve. This section of the creek has always been observed to be flowing. Small minnows, crayfish, and frogs have been observed.

Photo No.	Date:
28	9/19/20

Sample ID and Location:

RC18

Description:

As Raleigh Creek enters Lake Elmo Park, the channel widens, and flow rate is reduced. The stream bottom is less rocky and is more depositional.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
29	4/23/20

Sample ID and Location:

RC18

Description:

Large piles of foam have been observed in this area. Fish have been observed swimming beneath the foam.

Photo No.	Date:
30	9/21/20

Sample ID and Location:

RC18A

Description:

A crayfish was caught in a trap in this segment of Raleigh Creek.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
31	9/21/20

Sample ID and Location:

RC18

Description:

A Henry Sampler was used to sample pore water. It was placed at the bottom of the streambank, near where the trap was set and good crayfish habitat, to collect a sample representative of the environment the crayfish is most likely to be exposed to.

Photo No.	Date:
32	9/19/20

Sample ID and Location:

RC18

Description:

Multiple green sunfish and mud minnows were collected with electroshocking and nets along this segment of Raleigh Creek

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
33	4/25/20

Sample ID and Location:

EP17

Description:

The inlet to Eagle Point Lake is a wetland area. Tall vegetation grows along the edges and becomes inundated during high rain periods and after snow melt.

Photo No.	Date:
34	9/24/20

Sample ID and Location:

EP17

Description:

Large snails were observed along the shores of Eagle Point Lake. Multiple were collected for analysis.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
35	7/31/19

Sample ID and Location:

EP3

Description:

Raleigh Creek terminates into Eagle Point Lake. This is the outlet of Eagle Point Lake. Turtles, fish, birds including herons and egrets, and muskrats have been observed.

Photo No.	Date:
36	9/15/20

Sample ID and Location:

EP1A

Description:

Multiple bullheads were caught in the gill nets placed in Eagle Point Lake.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
37	9/15/20

Sample ID and Location:

EP18

Description:

Gill nets were used to catch bullheads, bluegills, and large mouth bass on Eagle Point Lake.

Photo No.	Date:
38	9/15/20

Sample ID and Location:

EP26

Description:

Tall grasses and cattails grow along the shoreline of Eagle Point Lake. A crayfish was collected here along the edge of the grasses with a trap.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
39	8/13/19

Sample ID and Location:

EP4

Description:

Eagle Point Lake discharges into a wetland area with a defined channel.

Photo No.	Date:
40	7/31/19

Sample ID and Location:

EP8

Description:

Photo is taken from the top of Eagle Point Dam. Water flows into Eagle Point Dam Lake. From here is it piped under Lake Elmo.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
41	4/27/20

Sample ID and Location:

EP20

Description:

The emergency overflow of the Eagle Point Dam flows into a wetland area. The water here was found to have low dissolved oxygen concentrations and dead fish. The dam does overflow into this area multiple times throughout the year.

Photo No.	Date:
42	4/27/20

Sample ID and Location:

EP20

Description:

Small bluegills and minnows were captured in traps in this area.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
43	5/12/20

Sample ID and Location:

EP15

Description:

Lake Elmo looking to the south from EP15.

Photo No.	Date:
44	5/13/19

Sample ID and Location:

EP14

Description:

Small amount of foam was observed along bank of Lake Elmo near sample location. Foam has also been observed on the west side of the lake depending on the wind direction.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
45	8/13/19

Sample ID and Location:

EP11

Description:

Downstream of Lake Elmo, water from Lake Elmo and Eagle Point Dam are discharged and form a stream that passes through a heavily wooded area. Fish and birds have been observed.

Photo No.	Date:
46	8/13/19

Sample ID and Location:

WL1

Description:

The second golf course pond is lined with rip rap and is immediately adjacent to a mowed fairway.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
47	9/17/2020

Sample ID and Location:

WL2

Description:

Water is piped into Horseshoe Lake. The shoreline of Horseshoe Lake consists of trees and shrubs, a housing development, and a golf course.

Photo No.	Date:
48	9/17/2020

Sample ID and Location:

WL2

Description:

A frog was captured with a dip net along the shore of Horseshoe Lake.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
49	9/17/2020

Sample ID and Location:

WL2

Description:

Collection of the porewater sample at WL2.

Photo No.	Date:
50	9/17/20

Sample ID and Location:

WL5

Description:

Crayfish were caught along the undercut bank in Horseshoe Lake.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
51	9/17/20

Sample ID and Location:

WL6

Description:

Horseshoe Lake discharges via a culvert to a channel that is surrounded by tall grasses and cattails. Smaller largemouth bass and bluegills were caught in the channel between Horseshoe Lake and North Pond.

Photo No.	Date:
52	9/17/20

Sample ID and Location:

WL6

Description:

Foam bubbles are often observed exiting the culvert and occasionally large foam piles are observed such as that collected during the BERA sampling event.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
53	9/17/20

Sample ID and Location:

WL6

Description:

Crayfish remains were observed along the stream channel.

Photo No.	Date:
54	9/17/20

Sample ID and Location:

WL7

Description:

Crayfish were collected via traps and electroshocking along the channel as it flowed from Horseshoe Lake, through farm fields, to the inlet of North Pond.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
55	9/16/20

Sample ID and Location:

WL8 (North Pond)

Description:

Project 1007 flows through three ponds with the first being North Pond.

Photo No.	Date:
56	9/16/20

Sample ID and Location:

WL9

Description:

The ponds are connected by channels. Vegetation around the ponds is primarily trees, shrubs, and tall grasses. Houses border the ponds but rarely have mowed grass at the pond or channel edges. The channel between North and Middle Ponds is shallower and rockier. No fish were observed here but crayfish were harvested.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
57	9/16/20

Sample ID and Location:

WL10

Description:

Multiple crayfish were collected via electroshock and dip nets.

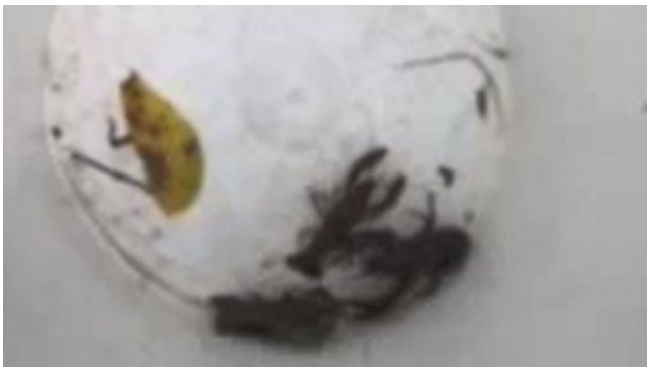


Photo No.	Date:
58	9/16/20

Sample ID and Location:

WL10

Description:

Henry Sampler used to collect pore water samples. The tubing was connected to a peristaltic pump.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
59	9/16/20

Sample ID and Location:

WL21 (Middle Pond)

Description:

Electrofishing was used for sampling on Middle and South Ponds. Fish were observed at the inlet and outlets of the ponds.

Photo No.	Date:
60	9/16/20

Sample ID and Location:

WL21 (Middle Pond)

Description:

Middle Pond has submerged and floating vegetation. The shoreline is surrounded by trees and shrubs.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
61	9/28/20

Sample ID and Location:

WL14

Description:

Deer have been observed around the ponds and channels.

Photo No.	Date:
62	9/16/20

Sample ID and Location:

WL23 (South Pond)

Description:

Electrofishing was used on Middle and South Ponds to collect fish samples.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
63	9/16/20

Sample ID and Location:

WL15 (South Pond)

Description:

South Pond is the largest and deepest of the three ponds. The outlet is to a channel which is then primarily piped to the St. Croix River.

Photo No.	Date:
64	9/16/20

Sample ID and Location:

WL21 (Middle Pond)

Description:

Electrofishing was used for sampling on Middle and South Ponds. Fish were observed at the inlet and outlets of the ponds.

AECOM

PHOTOGRAPHIC LOG

Project Name:	Site Location:	Project No.
Project 1007 BERA | MPCA	Twin Cities East Metro, Minnesota	60638005

Photo No.	Date:
65	9/16/20

Sample ID and Location:

WL15

Description:

Largemouth bass and bluegills were caught on South Pond.

Appendix B-2

Field Information for Tissue Sampling

Appendix B Table 1
Field Information for Amphibian Samples Used in the BERA
Project 1007
Minneapolis, Minnesota

Tissue Type	Body Part	Area	Location	Date Tissue Collected	Tissue Sample ID	Total Weight (g)	Species	Notes
Amphibian	Whole body	Raleigh Creek - upper	RC13	09/21/2020	RC13-AMPH-01-092120	11.5	Green frog	
Amphibian	Whole body (composite)	Raleigh Creek - upper	RC3A	09/19/2020	RC3A-AMPH-COMP-ONE-01-091920	4	Tadpole	composite of 4 individuals
Amphibian	Whole body (composite)	Raleigh Creek - upper	RC3A	09/24/2020	RC3A-AMPH-COMP-TWO-01-092420	5.5	Tadpole	composite of 7 individuals
Amphibian	Whole body (composite)	Raleigh Creek - upper	RC4A	09/18/2020	RC4A-AMPH-COMP-01-091820	6	Tadpole	composite of 6 individuals
Amphibian	Whole body	Raleigh Creek - upper	RC5	09/18/2020	RC5-AMPH-ONE-01-091820	18	Green frog	
Amphibian	Whole body	Raleigh Creek - upper	RC5	09/22/2020	RC5-AMPH-TWO-01-092220	23.5	Green frog	
Amphibian	Whole body	Raleigh Creek - upper	RC6A	09/20/2020	RC6A-AMPH-01-092020	17	Green frog	
Amphibian	Whole body	Raleigh Creek - upper	RC7	09/22/2020	RC7-AMPH-01-092220	27.5	Green frog	
Amphibian	Whole body	Raleigh Creek - other	RC16A	09/19/2020	RC16A-AMPH-01-091920	2	Tadpole	
Amphibian	Whole body	Raleigh Creek - other	RC17A	09/21/2020	RC17A-AMPH-01-092120	18	Green frog	
Amphibian	Whole body	Raleigh Creek - other	RC18	09/15/2020	RC18-AMPH-01-091520	34	Green frog	
Amphibian	Whole body	Eagle Point Lake	EP19	09/19/2020	EP19-AMPH-01-091920	13	Green frog	
Amphibian	Whole body	West Lakeland	WL2	09/22/2020	WL2-AMPH-01-092220	20	Green frog	
Amphibian	Whole body	West Lakeland	WL8A	09/25/2020	WL8A-AMPH-01-092520	6	Tadpole	
Amphibian	Whole body	West Lakeland	WL16	09/23/2020	WL16-AMPH-01-092320	35	Green frog	
Amphibian	Whole body	West Lakeland	WL10A	09/21/2020	WL10A-AMPH-01-092120	34.5	Green frog	
Amphibian	Whole body	West Lakeland	WL13	09/23/2020	WL13-AMPH-ONE-01-092320	5	Tadpole	
Amphibian	Whole body	West Lakeland	WL13	09/23/2020	WL13-AMPH-TWO-01-092320	5	Tadpole	

Notes
g - grams.

Appendix B Table 2
Field Information for Crayfish Samples Used in the BERA
Project 1007
Minneapolis, Minnesota

Tissue Type	Body Part	Area	Location	Date Tissue Collected	Tissue Sample ID	Length (mm)	Total Weight (g)	Sex	Notes
Crayfish	Whole body	Raleigh Creek - upper	RC23	09/24/2020	RC23-CRAY-FOUR-01-092420	72	9	Male	
Crayfish	Whole body	Raleigh Creek - upper	RC23	09/25/2020	RC23-CRAY-ONE-01-092520	83	16	Male	
Crayfish	Whole body	Raleigh Creek - upper	RC23	09/25/2020	RC23-CRAY-THREE-01-092520	70	9.5	Male	
Crayfish	Whole body	Raleigh Creek - upper	RC23	09/25/2020	RC23-CRAY-TWO-01-092520	74	15	Male	
Crayfish	Whole body (composite)	Raleigh Creek - upper	RC23	09/25/2020	RC23-CRAY-COMP-01-092520	53 & 49	3 & 2.5	Male/Female	composite of 2 individuals
Crayfish	Whole body	Raleigh Creek - upper	RC3A	09/20/2020	RC3A-CRAY-01-092020	70	15	NR	
Crayfish	Whole body	Raleigh Creek - upper	RC4A	09/25/2020	RC4A-CRAY-01-092520	92	21.5	Male	missing a claw
Crayfish	Whole body	Raleigh Creek - other	RC14	09/21/2020	RC14-CRAY-01-092120	64	6	Female	
Crayfish	Whole body	Raleigh Creek - other	RC17	09/19/2020	RC17-CRAY-ONE-01-091920	72	10	Male	
Crayfish	Whole body	Raleigh Creek - other	RC17A	09/21/2020	RC17A-CRAY-01-092120	65	5.5	Male	
Crayfish	Whole body	Raleigh Creek - other	RC18A	09/21/2020	RC18A-CRAY-01-092120	67	7	Female	missing a claw
Crayfish	Whole body	Raleigh Creek - other	RC21	09/21/2020	RC21-CRAY-ONE-01-092120	90	21	Female	
Crayfish	Whole body	Raleigh Creek - other	RC21	09/21/2020	RC21-CRAY-THREE-01-092120	70	9.5	Male	
Crayfish	Whole body	Raleigh Creek - other	RC21	09/21/2020	RC21-CRAY-TWO-01-092120	72	10.5	Male	
Crayfish	Whole body	Raleigh Creek - other	RC21A	09/21/2020	RC21A-CRAY-ONE-01-092120	77	11	Male	missing a claw
Crayfish	Whole body	Raleigh Creek - other	RC21A	09/21/2020	RC21A-CRAY-THREE-01-092120	70	9.5	Male	
Crayfish	Whole body	Raleigh Creek - other	RC21A	09/21/2020	RC21A-CRAY-TWO-01-092120	75	11	Male	
Crayfish	Whole body	Raleigh Creek - other	RC21B	09/21/2020	RC21B-CRAY-01-092120	62	5	Female	
Crayfish	Whole body	Eagle Point Lake	EP17C	09/24/2020	EP17C-CRAY-01-092420	76	12	Male	
Crayfish	Whole body	Eagle Point Lake	EP26A	09/25/2020	EP26A-CRAY-ONE-01-092520	64	7.5	Male	
Crayfish	Whole body	Eagle Point Lake	EP26A	09/17/2020	EP26A-CRAY-THREE-01-091720	58	6	Male	
Crayfish	Whole body	Eagle Point Lake	EP26A	09/25/2020	EP26A-CRAY-TWO-01-092520	77	12.5	Male	
Crayfish	Whole body	Eagle Point Lake	EP27B	09/24/2020	EP27B-CRAY-ONE-01-092420	85	16.5	Male	
Crayfish	Whole body	Eagle Point Lake	EP27B	09/24/2020	EP27B-CRAY-TWO-01-092420	80	14.5	Male	
Crayfish	Whole body	Eagle Point Lake	EP4	09/23/2020	EP4-CRAY-ONE-01-092320	70	7.5	Male	
Crayfish	Whole body	Eagle Point Lake	EP4	09/23/2020	EP4-CRAY-TWO-01-092320	80	18.5	Male	
Crayfish	Whole body	Eagle Point Lake	EP5	09/24/2020	EP5-CRAY-ONE-01-092420	69	8	Male	
Crayfish	Whole body	West Lakeland	WL6	09/23/2020	WL6-CRAY-01-092320	73	10.5	Female	
Crayfish	Whole body	West Lakeland	WL5	09/17/2020	WL5-CRAY-01-091720	64	8	Male	
Crayfish	Whole body	West Lakeland	WL8A	09/21/2020	WL8A-CRAY-01-092120	92	18	Female	
Crayfish	Whole body	West Lakeland	WL15A	09/16/2020	WL15A-CRAY-EATEN-01-091620	NR	NR	NR	found inside fish at lab
Crayfish	Whole body	West Lakeland	WL10	09/21/2020	WL10-CRAY-ONE-01-092120	60	5	Male	
Crayfish	Whole body	West Lakeland	WL10	09/21/2020	WL10-CRAY-THREE-01-092120	58	3.5	Male	
Crayfish	Whole body	West Lakeland	WL10	09/21/2020	WL10-CRAY-TWO-01-092120	70	11	Male	
Crayfish	Whole body	West Lakeland	WL11	09/21/2020	WL11-CRAY-01-092120	72	9	Female	
Crayfish	Whole body	West Lakeland	WL13	09/23/2020	WL13-CRAY-01-092320	4.1	2	Female	
Crayfish	Whole body	West Lakeland	WL7	09/23/2020	WL7-CRAY-FOUR-01-092320	62	5.5	Female	
Crayfish	Whole body	West Lakeland	WL7	09/23/2020	WL7-CRAY-ONE-01-092320	97	25.5	Female	
Crayfish	Whole body	West Lakeland	WL7	09/23/2020	WL7-CRAY-THREE-01-092320	55	3.5	Female	
Crayfish	Whole body	West Lakeland	WL7	09/23/2020	WL7-CRAY-TWO-01-092320	103	28.4	Female	

Notes
g - grams.
mm - millimeter.
NR - Not Recorded.

Appendix B Table 3
Field Information for Snail Samples Used in the BERA
Project 1007
Minneapolis, Minnesota

Tissue Type	Body Part	Area	Location	Date Tissue Collected	Tissue Sample ID	Length (mm)	Total Weight (g)	Notes
Snail	Whole body (composite)	Raleigh Creek - upper	RC23	09/24/2020	RC23-SNAIL-COMP-01-092420	15 to 35	3	number of individuals not recorded
Snail	Whole body (composite)	Raleigh Creek - upper	RC3A	09/24/2020	RC3A-SNAIL-COMP-01-092420	20 each	5	composite of 4 individuals
Snail	Whole body	Eagle Point Lake	EP17C	09/24/2020	EP17C-SNAIL-ONE-01-092420	46	24	
Snail	Whole body	Eagle Point Lake	EP17C	09/24/2020	EP17C-SNAIL-TWO-01-092420	47	25.5	
Snail	Whole body	Eagle Point Lake	EP27B	09/24/2020	EP27B-SNAIL-ONE-01-092420	46	24	
Snail	Whole body	Eagle Point Lake	EP27B	09/24/2020	EP27B-SNAIL-TWO-01-092420	43	19	
Snail	Whole body (composite)	Eagle Point Lake	EP4	09/24/2020	EP4-SNAIL-ONE-01-092420	47 & 45	25 & 21	composite of 2 individuals; bigger snails
Snail	Whole body (composite)	Eagle Point Lake	EP4	09/24/2020	EP4-SNAIL-COMP-TWO-01-092420	43 & 45	19 & 20.5	composite of 2 individuals; smaller snails

Notes
g - grams.
mm - millimeter.
NR - Not Recorded.

Appendix B Table 4
Field Information for Bottom Fish Samples Used in the BERA
Project 1007
Minneapolis, Minnesota

Tissue Type	Body Part	Area	Location	Length (mm)	Total Weight (g)	Sex	Species
Fish-Bottom	Whole body	Raleigh Creek - upper	RC7	127	23	NR	Bullhead
Fish-Bottom	Whole body	Raleigh Creek - upper	RC22	140	28	NR	Bullhead
Fish-Bottom	Whole body	Raleigh Creek - other	RC18	126	26	NR	Bullhead
Fish-Bottom	Whole body	Eagle Point Lake	EP1A	160	84	Female	Bullhead
Fish-Bottom	Whole body	Eagle Point Lake	EP27C	225	192	Female	Bullhead

Notes
g - grams.
mm - millimeter.
NR - Not Recorded.

Appendix B Table 5
Field Information for Forage Fish Samples Used in the BERA
Project 1007
Minneapolis, Minnesota

Tissue Type	Body Part	Area	Location	Date Tissue Collected	Tissue Sample ID	Length (mm)	Total Weight (g)	Approx Age (years)	Sex	Species	Notes
Fish-Forage	Whole body	Raleigh Creek - upper	RC22	09/18/2020	RC22-FORE-WHO-091820	110	6	NR	NR	Golden shiner	
Fish-Forage	Whole body (composite)	Raleigh Creek - upper	RC22	09/18/2020	RC22-FORE-COMP-TWO-091820	110 & 110	20	NR	NR	Golden shiner	composite of 2 individuals; 10 g each
Fish-Forage	Whole body (composite)	Raleigh Creek - upper	RC3A	09/19/2020	RC3A-FORE-COMP-ONE-01-091920	30 (fathead minnow) & 20 (stickleback)	3	NR	NR	5 Fathead minnows, 1 Stickleback	composite of 6 individuals
Fish-Forage	Whole body (composite)	Raleigh Creek - upper	RC4A	09/18/2020	RC4A-FORE-COMP-091820	40 (fathead minnow) & 20 (stickleback)	6	NR	NR	3 Fathead minnows, 1 Stickleback	composite of 4 individuals
Fish-Forage	Whole body	Raleigh Creek - upper	RC5	09/18/2020	RC5-FORE-WHO-ONE-091820	105	10	NR	NR	Mudminnow	
Fish-Forage	Whole body (composite)	Raleigh Creek - upper	RC7	09/20/2020	RC7-FORE-COMP-ONE-01-092020	100	36	NR	NR	Green sunfish	composite of 3 individuals; 14 g, 11 g, 10 g
Fish-Forage	Whole body (composite)	Raleigh Creek - other	RC16A	09/19/2020	RC16A-FORE-COMP-ONE-01-091920	50	18	NR	NR	Mudminnow	composite of 4 individuals; 18 g, 1 g, 1 g, 1 g
Fish-Forage	Whole body (composite)	Raleigh Creek - other	RC16A	09/19/2020	RC16A-FORE-COMP-TWO-01-091920	30	9	NR	NR	Green sunfish	composite of 3 individuals; 6 g, 2 g, 1 g
Fish-Forage	Whole body (composite)	Raleigh Creek - other	RC17	09/19/2020	RC17-FORE-COMP-ONE-01-091920	darters: 58-65, mudminnow: 80 and 65	12	NR	NR	3 Darter, 2 Mudminnow	composite of 5 individuals
Fish-Forage	Whole body (composite)	Raleigh Creek - other	RC17	09/19/2020	RC17-FORE-COMP-TWO-01-091920	55-70	20	NR	NR	Green sunfish	composite of 4 individuals
Fish-Forage	Whole body (composite)	Raleigh Creek - other	RC18	09/19/2020	RC18-FORE-COMP-01-091920	red ear: 65, 2 green sunfish: 70, 1 darter: 45	16	NR	NR	1 Red ear, 2 Green sunfish, 1 Darter	composite of 4 individuals
Fish-Forage	Whole body	Raleigh Creek - other	RC18A	09/21/2020	RC18A-FORE-WHO-01-092120	138	51.5	NR	NR	Green sunfish	
Fish-Forage	Whole body	Raleigh Creek - other	RC21A	09/21/2020	RC21A-FORE-WHO-01-092120	144	73	NR	NR	Green sunfish	
Fish-Forage	Whole body (composite)	Eagle Point Lake	EP17A	09/19/2020	EP17A-FORE-COMP-ONE-01-091920	63-83	24	NR	NR	Mudminnow	composite of 7 mudminnows
Fish-Forage	Whole body	Eagle Point Lake	EP17A	09/19/2020	EP17A-FORE-WHO-01-091920	77	4	NR	NR	Crappie	
Fish-Forage	Whole body	Eagle Point Lake	EP18	09/15/2020	EP18-FORE-WHO-TWO-01-091520	170	102	2	Unknown	Green sunfish	
Fish-Forage	Whole body	Eagle Point Lake	EP1A	09/15/2020	EP1A-FORE-WHO-01-091520	160	84	2	Female	Bluegill	
Fish-Forage	Whole body	Eagle Point Lake	EP27C	09/15/2020	EP27C-FORE-WHO-TWO-01-091520	172	110	2	Male	Bluegill	
Fish-Forage	Fillet	Eagle Point Lake	EP18	09/15/2020	EP18-FORE-FIL-ONE-01-091520	240	218	2	Female	Crappie	
Fish-Forage	Part	Eagle Point Lake	EP18	09/15/2020	EP18-FORE-PART-ONE-01-091520						
Fish-Forage	Fillet	Eagle Point Lake	EP1A	09/15/2020	EP1A-FORE-FIL-01-091520	262	324	3	Female	Crappie	
Fish-Forage	Part	Eagle Point Lake	EP1A	09/15/2020	EP1A-FORE-PART-01-091520						
Fish-Forage	Fillet	Eagle Point Lake	EP27C	09/15/2020	EP27C-FORE-FIL-ONE-01-091520	245	246	2	Female	Crappie	gut contained 1 golden shiner
Fish-Forage	Part	Eagle Point Lake	EP27C	09/15/2020	EP27C-FORE-PART-ONE-01-091520						
Fish-Forage	Whole body (composite)	Lake Elmo	EP20	09/20/2020	EP20-FORE-COMP-TWO-01-092020	NR	10	NR	NR	Bluegill	composite of 3 individuals; 1 g, 5 g, & 4 g
Fish-Forage	Whole body	Lake Elmo	EP15	09/18/2020	EP15-FORE-WHO-ONE-01-091820	165	80	2	Male	Bluegill	
Fish-Forage	Whole body	Lake Elmo	EP15	09/18/2020	EP15-FORE-WHO-THREE-01-091820	120	30	2	Female	Bluegill	
Fish-Forage	Whole body	Lake Elmo	EP9A	09/18/2020	EP9A-FORE-WHO-TWO-01-091820	210	118	5	Female	Black crappie	
Fish-Forage	Fillet	Lake Elmo	EP14	09/18/2020	EP14-FORE-FIL-ONE-01-091820	160	70	2	Female	Bluegill	
Fish-Forage	Part	Lake Elmo	EP14	09/18/2020	EP14-FORE-PART-ONE-01-091820						
Fish-Forage	Fillet	Lake Elmo	EP14	09/18/2020	EP14-FORE-FIL-TWO-01-091820	160	78	2	Female	Bluegill	
Fish-Forage	Part	Lake Elmo	EP14	09/18/2020	EP14-FORE-PART-TWO-01-091820						
Fish-Forage	Fillet	Lake Elmo	EP21	09/18/2020	EP21-FORE-FIL-SEVEN-01-091820	155	70	2	Female	Bluegill	
Fish-Forage	Part	Lake Elmo	EP21	09/18/2020	EP21-FORE-PART-SEVEN-01-091820						
Fish-Forage	Fillet	Lake Elmo	EP21	09/18/2020	EP21-FORE-FIL-THREE-01-091820	295	234	2	Male	Cisco	
Fish-Forage	Part	Lake Elmo	EP21	09/18/2020	EP21-FORE-PART-THREE-01-091820						
Fish-Forage	Fillet	Lake Elmo	EP9A	09/18/2020	EP9A-FORE-FIL-ONE-01-091820	165	82	2	Male	Bluegill	
Fish-Forage	Part	Lake Elmo	EP9A	09/18/2020	EP9A-FORE-PART-ONE-01-091820						

Appendix B Table 5
Field Information for Forage Fish Samples Used in the BERA
Project 1007
Minneapolis, Minnesota

Tissue Type	Body Part	Area	Location	Date Tissue Collected	Tissue Sample ID	Length (mm)	Total Weight (g)	Approx Age (years)	Sex	Species	Notes
Fish-Forage	Whole body	West Lakeland	WL6	09/17/2020	WL6-FORE-WHO-01-091720	175	112	2	NR	Bluegill	
Fish-Forage	Whole body	West Lakeland	WL2	09/17/2020	WL2-FORE-WHO-ONE-01-091720	145	66	2	Male	Bluegill	
Fish-Forage	Whole body	West Lakeland	WL2	09/17/2020	WL2-FORE-WHO-TWO-01-091720	165	76	2	Male	Bluegill	
Fish-Forage	Whole body	West Lakeland	WL3	09/17/2020	WL3-FORE-WHO-ONE-01-091720	135	48	2	Male	Bluegill	
Fish-Forage	Whole body	West Lakeland	WL3	09/17/2020	WL3-FORE-WHO-TWO-01-091720	155	80	2	Female	Bluegill	
Fish-Forage	Whole body	West Lakeland	WL5	09/17/2020	WL5-FORE-WHO-ONE-01-091720	150	72	2	Female	Bluegill	
Fish-Forage	Whole body	West Lakeland	WL5	09/17/2020	WL5-FORE-WHO-TWO-01-091720	138	62	2	Female	Bluegill	
Fish-Forage	Whole body	West Lakeland	WL21	09/16/2020	WL21-FORE-WHO-ONE-01-091620	180	110	3	Male	Bluegill	
Fish-Forage	Whole body	West Lakeland	WL21	09/16/2020	WL21-FORE-WHO-ONE-01-091620	180	110	3	Male	Bluegill	
Fish-Forage	Whole body	West Lakeland	WL21	09/16/2020	WL21-FORE-WHO-TWO-01-091620	120	36	1	Female	Bluegill	
Fish-Forage	Whole body	West Lakeland	WL21	09/16/2020	WL21-FORE-WHO-TWO-01-091620	120	36	1	Female	Bluegill	
Fish-Forage	Whole body	West Lakeland	WL8A	09/16/2020	WL8A-FORE-WHO-ONE-01-091620	172	82	2	NR	Green sunfish	
Fish-Forage	Whole body	West Lakeland	WL8A	09/16/2020	WL8A-FORE-WHO-TWO-01-091620	160	75	2	Female	Bluegill	
Fish-Forage	Whole body	West Lakeland	WL15	09/16/2020	WL15-FORE-WHO-ONE-01-091620	125	32	1	Female	Bluegill	
Fish-Forage	Whole body	West Lakeland	WL15	09/16/2020	WL15-FORE-WHO-ONE-01-091620	125	32	1	Female	Bluegill	
Fish-Forage	Whole body	West Lakeland	WL15	09/16/2020	WL15-FORE-WHO-THREE-01-091620	123	38	1	Female	Bluegill	
Fish-Forage	Whole body	West Lakeland	WL15	09/16/2020	WL15-FORE-WHO-THREE-01-091620	123	38	1	Female	Bluegill	
Fish-Forage	Whole body	West Lakeland	WL15	09/16/2020	WL15-FORE-WHO-TWO-01-091620	130	34	1	Female	Bluegill	
Fish-Forage	Whole body	West Lakeland	WL15	09/16/2020	WL15-FORE-WHO-TWO-01-091620	130	34	1	Female	Bluegill	
Fish-Forage	Whole body	West Lakeland	WL15A	09/16/2020	WL15A-FORE-WHO-FOUR-01-091620	142	46	1	Female	Bluegill	
Fish-Forage	Whole body	West Lakeland	WL15A	09/16/2020	WL15A-FORE-WHO-ONE-01-091620	135	44	1	Female	Bluegill	
Fish-Forage	Whole body	West Lakeland	WL15A	09/16/2020	WL15A-FORE-WHO-THREE-01-09162(	133	40	1	Female	Bluegill	
Fish-Forage	Whole body	West Lakeland	WL15A	09/16/2020	WL15A-FORE-WHO-TWO-01-091620	132	36	1	Female	Bluegill	
Fish-Forage	Whole body	West Lakeland	WL13	09/16/2020	WL13-FORE-WHO-ONE-01-091620	170	84	2	NR	Bluegill	
Fish-Forage	Whole body	West Lakeland	WL13	09/16/2020	WL13-FORE-WHO-TWO-01-091620	140	40	1	NR	Bluegill	
Fish-Forage	Whole body	West Lakeland	WL7	09/17/2020	WL7-FORE-WHO-01-091720	102	20	2	NR	Bluegill	
Fish-Forage	Whole body	Other - Browns Pond	BP1	09/19/2020	BP1-FORE-WHO-THREE-01-091920	127	24	4	NR	Yellow perch	
Fish-Forage	Fillet	Other - Browns Pond	BP1	09/20/2020	BP1-FORE-FIL-ONE-01-092020	240	192	3	Female	Yellow perch	
Fish-Forage	Part	Other - Browns Pond	BP1	09/20/2020	BP1-FORE-PART-ONE-01-092020						
Fish-Forage	Fillet	Other - Browns Pond	BP1	09/20/2020	BP1-FORE-FIL-TWO-01-092020	234	154	3	Female	Yellow perch	
Fish-Forage	Part	Other - Browns Pond	BP1	09/20/2020	BP1-FORE-PART-TWO-01-092020						

Notes
g - grams.
mm - millimeter.
NR - Not Recorded.
Shading indicates data not applicable.

Appendix B Table 6
Field Information for Predator Fish Samples Used in the BERA
Project 1007
Minneapolis, Minnesota

Tissue Type	Body Part	Area	Location	Date Tissue Collected	Tissue Sample ID	Length (mm)	Fillet Weight (g)	Parts Weight (g)	Total Weight (g)	Approx Age (years)	Sex	Species
Fish-Predator	Fillet	Eagle Point Lake	EP18	09/15/2020	EP18-PRED-FIL-ONE-01-091520	315	106	384	490	2	Male	Largemouth bass
Fish-Predator	Part	Eagle Point Lake	EP18	09/15/2020	EP18-PRED-PART-ONE-01-091520							
Fish-Predator	Fillet	Eagle Point Lake	EP18	09/15/2020	EP18-PRED-FIL-TWO-01-091520	295	82	322	404	2	Female	Largemouth bass
Fish-Predator	Part	Eagle Point Lake	EP18	09/15/2020	EP18-PRED-PART-TWO-01-091520							
Fish-Predator	Fillet	Eagle Point Lake	EP18C	09/16/2020	EP18C-PRED-FIL-ONE-01-091620	300	104	368	472	2	Male	Largemouth bass
Fish-Predator	Part	Eagle Point Lake	EP18C	09/16/2020	EP18C-PRED-PART-01-091620							
Fish-Predator	Fillet	Eagle Point Lake	EP27C	09/15/2020	EP27C-PRED-FIL-ONE-01-091520	315	114	440	554	2	Female	Largemouth bass
Fish-Predator	Part	Eagle Point Lake	EP27C	09/15/2020	EP27C-PRED-PART-ONE-01-091520							
Fish-Predator	Fillet	Eagle Point Lake	EP27C	09/15/2020	EP27C-PRED-FIL-TWO-01-091520	308	98	372	470	2	Male	Largemouth bass
Fish-Predator	Part	Eagle Point Lake	EP27C	09/15/2020	EP27C-PRED-PART-TWO-01-091520							
Fish-Predator	Whole body	Lake Elmo	EP9A	09/18/2020	EP9A-PRED-WHO-FIVE-01-091820	500			584	2	Male	Northern pike
Fish-Predator	Whole body	Lake Elmo	EP9A	09/18/2020	EP9A-PRED-WHO-SIX-01-091820	440			422	2	Male	Northern pike
Fish-Predator	Fillet	Lake Elmo	EP14	09/18/2020	EP14-PRED-FIL-ONE-01-091820	200	24	78	102	1	Female	Largemouth bass
Fish-Predator	Part	Lake Elmo	EP14	09/18/2020	EP14-PRED-PART-ONE-01-091820							
Fish-Predator	Fillet	Lake Elmo	EP14	09/18/2020	EP14-PRED-FIL-THREE-01-091820	355	108	482	590	2	Female	Largemouth bass
Fish-Predator	Part	Lake Elmo	EP14	09/18/2020	EP14-PRED-PART-THREE-01-091820							
Fish-Predator	Fillet	Lake Elmo	EP14	09/18/2020	EP14-PRED-FIL-TWO-01-091820	275	54	208	262	1	Male	Largemouth bass
Fish-Predator	Part	Lake Elmo	EP14	09/18/2020	EP14-PRED-PART-TWO-01-091820							
Fish-Predator	Fillet	Lake Elmo	EP21	09/18/2020	EP21-PRED-FIL-THREE-01-091820	390	218	752	970	3	Male	Largemouth bass
Fish-Predator	Part	Lake Elmo	EP21	09/18/2020	EP21-PRED-PART-THREE-01-091820							
Fish-Predator	Fillet	Lake Elmo	EP9A	09/18/2020	EP9A-PRED-FIL-ONE-01-091820	365	142	554	696	3	Male	Largemouth bass
Fish-Predator	Part	Lake Elmo	EP9A	09/18/2020	EP9A-PRED-PART-ONE-01-091820							
Fish-Predator	Fillet	Lake Elmo	EP9A	09/18/2020	EP9A-PRED-FIL-TWO-01-091820	423	100	334	434	2	Male	Northern pike
Fish-Predator	Part	Lake Elmo	EP9A	09/18/2020	EP9A-PRED-PART-TWO-01-091820							
Fish-Predator	Whole body	West Lakeland	WL6	09/17/2020	WL6-PRED-WHO-ONE-01-091720	151			44	1	NR	Largemouth bass
Fish-Predator	Whole body	West Lakeland	WL6	09/17/2020	WL6-PRED-WHO-TWO-01-091720	172			70	1	NR	Largemouth bass
Fish-Predator	Whole body	West Lakeland	WL3	09/17/2020	WL3-PRED-WHO-01-091720	265			654	2	Female	Largemouth bass
Fish-Predator	Whole body	West Lakeland	WL5	09/17/2020	WL5-PRED-WHO-01-091720	300			400	2	Female	Largemouth bass
Fish-Predator	Whole body	West Lakeland	WL15A	09/16/2020	WL15A-PRED-WHO-FOUR-01-091620	320			526	2	NR	Largemouth bass
Fish-Predator	Whole body	West Lakeland	WL15A	09/16/2020	WL15A-PRED-WHO-ONE-01-091620	360			694	3	NR	Largemouth bass
Fish-Predator	Whole body	West Lakeland	WL15A	09/16/2020	WL15A-PRED-WHO-THREE-01-091620	365			838	3	NR	Largemouth bass
Fish-Predator	Whole body	West Lakeland	WL15A	09/16/2020	WL15A-PRED-WHO-TWO-01-091620	355			686	3	NR	Largemouth bass
Fish-Predator	Whole body	West Lakeland	WL13	09/16/2020	WL13-PRED-WHO-FOUR-01-091620	170			50	1	NR	Largemouth bass
Fish-Predator	Whole body	West Lakeland	WL13	09/16/2020	WL13-PRED-WHO-THREE-01-091620	200			90	1	NR	Largemouth bass
Fish-Predator	Whole body	West Lakeland	WL13	09/16/2020	WL13-PRED-WHO-TWO-01-091620	205			120	1	NR	Largemouth bass
Fish-Predator	Whole body	West Lakeland	WL7	09/17/2020	WL7-PRED-WHO-01-091720	142			142	1	NR	Largemouth bass
Fish-Predator	Fillet	Other - Browns Pond	BP1	09/20/2020	BP1-PRED-FIL-ONE-01-092020	415	70	262	332	2	Female	Northern pike
Fish-Predator	Part	Other - Browns Pond	BP1	09/20/2020	BP1-PRED-PART-ONE-01-092020							
Fish-Predator	Fillet	Other - Browns Pond	BP1	09/20/2020	BP1-PRED-FIL-SIX-01-092020	495	142	446	588	2	Unknown	Northern pike
Fish-Predator	Part	Other - Browns Pond	BP1	09/20/2020	BP1-PRED-PART-SIX-01-092020							
Fish-Predator	Fillet	Other - Browns Pond	BP1	09/20/2020	BP1-PRED-FIL-TWO-01-092020	437	96	286	382	2	Male	Northern pike
Fish-Predator	Part	Other - Browns Pond	BP1	09/20/2020	BP1-PRED-PART-TWO-01-092020							

Notes
g - grams.
mm - millimeter.
NR - Not Recorded.
Shading indicates data not applicable.

Appendix B-3

Field Forms for BERA Sampling Effort

ECO SURFACE WATER SAMPLE FORM

Location Type:

BANK/SHORE IN WATER BODY WETLANDS

CREEK/CHANNEL CENTER CREEK/CHANNEL BANK

Sampling Type: BULK MID BOT

Sampling Device: DIPPER GRAB PERISTALTIC

*Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Date: 9/19/20

Location ID: RC3A

Sample Depth:

Field Staff: AS/AL/DB

Duplicate or MS/MSD Taken: □ Yes ☒ No

Fall Seasonal Sample □ Yes ☒ No

Corresponding species sample(s) and ID(s)?

RC3A-AMPH-COMP-ONE-01-091920 @1020

+ small tad pools

Are there corresponding sediment and porewater samples? Sample IDs?

There will be ~ 40 feet east of trap

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample?

No

Other details (describe foam here if observed):

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point:

Surface water estimated width at sample location (feet):

Sample location relative to channel bottom and distance from bank:

Flow Speed (circle): NO LOW L-M MODERATE M-H HIGH

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID:

Temperature (°C): 11.96 pH: 6.97

Temp corr cond (umhos/cm): ~~1,621~~ 2545 Dissolved Oxygen: 3.26 ORP: -128.3

SAMPLES COLLECTED

SAMPLE ID: RC3A-WAT-BULK-01-091920 **Time:** 1045

SAMPLE ID (if multiple water or foam): **Time:**

DUP SAMPLE ID (if applicable): **Time:**

MS/MSD SAMPLE ID (if applicable): **Time:**

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
Y				PFAS - Filtered	ALS
Y				PFAS - Unfiltered	ALS
Y				TOC	Pace
Y				DOC	Pace
				QUAL (if seasonal)	Pace
				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

☒ Picture of Sample Location (**required**) Amanda Phone ☒ GPS'd Amanda

Location of photos: □ Foam Observed No foam

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):
CREEK/CHANNEL POND LAKE
BANK WETLAND BEACH OTHER

Date: 9/20/20
Location ID: RC3A
Field Staff: AL/AS

Sampling Device (circle): SHOVEL AUGER GRAB
Sample Depth: 6 INCHES

Porewater Device (if appl): SED POINT PUSH POINT
Duplicate or MS/MSD Taken: ☐ Yes ☒ No

What is the corresponding species sample and ID?
RC3A-CRAY-ONE-092020 0850 RC3A-AMPH-COMP-ONE-0 09192
RC3A-FORE-COMP-ONE-01-092020

Is there a corresponding water sample? Sample ID?
YES RC3A-WATR-BULK-A-091920

Is there a corresponding porewater sample? Sample ID?
YES RC3A-POWAT-01-092020

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):
Center of creek, next to tadpole/minnow collecte ~30 feet down

Surface water estimated depth (in/ft) and width (if applicable): 3 inches

Soil Description (primary, secondary, moist, color, odor, organic content):
30% muck/organic (twig), grass) 10% silt, 55% m→c sand, 15% f pebbles
organic odor
gradient of crayfish typ location

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:
Temperature (°C): 12.75 pH: 6.72
Temp corr cond (umhos/cm): 2533 Dissolved Oxygen: 4.17 ORP: 78.9

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:
Temperature (°C): 14.48 pH: 6.17
Temp corr cond (umhos/cm): 1.169 Dissolved Oxygen: 3.38 ORP: -97.9

SAMPLES COLLECTED

SAMPLE ID: RC3A-SED-0-6-01-092020 Time: 0915
POREWATER SAMPLE ID (if applicable): RC3A-POWAT-01-092020 Time: 0900
DUP SAMPLE ID (if applicable): Time:
MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
Y			Y	PFAS (both)	ALS
Y				TOC (sed only)	Pace
Y				CEC (sed only)	MVTL
~~Y~~			Y	DOC (porewater only)	Pace

Sample Checklist
☐ Picture of Sample Location (required) Amanda
☐ Picture of sediment Amanda
Location of photos:
☐ GPS'd Amanda

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

→ approx width of cre

some kind of erosion control? plastic in center of creek about 6 inches down (see picture)
-only under sediment location, NOT under powat location

ECO SURFACE WATER SAMPLE FORM

Location Type:

BANK/SHORE IN WATER BODY WETLANDS

CREEK/CHANNEL CENTER CREEK/CHANNEL BANK

Sampling Type: BULK MID BOT

Sampling Device: DIPPER GRAB PERISTALTIC

*Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Date: 9/18/20

Location ID: RC4A

Sample Depth: BULK

Field Staff: AS, RF, JM

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

Fall Seasonal Sample ☐ Yes ☒ No

Corresponding species sample(s) and ID(s)?

creek w/ H+A

Are there corresponding sediment and porewater samples? Sample IDs?

yes

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample?

no

Other details (describe foam here if observed):

no

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point: 8 inches

Surface water estimated width at sample location (feet): 4 ft

Sample location relative to channel bottom and distance from bank:

Flow Speed (circle): NO LOW L-M MODERATE M-H HIGH

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID: Bulk | hung core

Temperature (°C): 13.97 pH: 6.60

Temp corr cond (umhos/cm): 2178 Dissolved Oxygen: 2.60 ORP: -67.9

SAMPLES COLLECTED

SAMPLE ID: RC4A-WAT-BULK-01-091820 Time: 1430

SAMPLE ID (if multiple water or foam): Time:

DUP SAMPLE ID (if applicable): Time:

MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
X				PFAS - Filtered	ALS
X				PFAS - Unfiltered	ALS
X				TOC	Pace
X				DOC	Pace
				QUAL (if seasonal)	Pace
				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

☒ Picture of Sample Location (**required**) AS ☐ GPS'd

Location of photos: ☐ Foam Observed

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):

CREEK/CHANNEL POND LAKE

BANK WETLAND BEACH OTHER

Sampling Device (circle): SHOVEL AUGER GRAB

Porewater Device (if appl): SED POINT PUSH POINT

Date: 9-18-20

Location ID: RCHA

Field Staff: AS, RF, JM

Sample Depth: 0-6

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

What is the corresponding species sample and ID?

ask A/H

Is there a corresponding water sample? Sample ID?

yes, RCHA-WAT-BULK-01-091820

Is there a corresponding **porewater** sample? Sample ID?

yes, RCHA-POWAT-01-091820?

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):

center of creek, 50 FT E of RCH culvert,

Surface water estimated depth (in/ft) and width (if applicable): 10 inches

Soil Description (primary, secondary, moist, color, odor, organic content):

Clay, 75 15% f sand, 10% organics, organic odor dark brown to black,

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:

Temperature (°C): 13.47 pH: 6.60

Temp corr cond (umhos/cm): 2178 Dissolved Oxygen: 2.10 ORP: -67.9

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:

Temperature (°C): 14.74 pH: 6.75

Temp corr cond (umhos/cm): 1920 Dissolved Oxygen: 0.82 ORP: -148.0

SAMPLES COLLECTED

SAMPLE ID: RCHA-SED-0-6-01-091820 Time: 1450

POREWATER SAMPLE ID (if applicable): RCHA-POWAT-01-091820 Time: 1440

DUP SAMPLE ID (if applicable): Time:

MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
X			X	PFAS (both)	ALS
X				TOC (sed only)	Pace
X				CEC (sed only)	MVTL
X			X	DOC (porewater only)	Pace

Sample Checklist

☒ Picture of Sample Location (**required**) AS ☐ Picture of sediment

Location of photos: ☐ GPS'd

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SURFACE WATER SAMPLE FORM

Location Type:

BANK/SHORE IN WATER BODY WETLANDS

CREEK/CHANNEL CENTER CREEK/CHANNEL BANK

Sampling Type: BULK MID BOT

Sampling Device: DIPPER GRAB PERISTALTIC

*Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Date: 9-18-20

Location ID: RC5

Sample Depth: BULK

Field Staff: AS, RF, JM

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

Fall Seasonal Sample ☒ Yes ☐ No

Corresponding species sample(s) and ID(s)?

n/a

Are there corresponding sediment and porewater samples? Sample IDs?

no

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample?

yes

Other details (describe foam here if observed):

no

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point: 6 inches

Surface water estimated width at sample location (feet): 3 ft

Sample location relative to channel bottom and distance from bank: center, 2ft wide

Flow Speed (circle): NO LOW L-M MODERATE M-H HIGH

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID:

Temperature (°C): 13.31 pH: 6.78

Temp corr cond (umhos/cm): 1960 Dissolved Oxygen: 0.16 ORP: -122.6

SAMPLES COLLECTED

SAMPLE ID: RC5-WAT-BULK-01-091820 **Time:** 1530

SAMPLE ID (if multiple water or foam): RC5-FOAM-01-092020 **Time:** 1130

DUP SAMPLE ID (if applicable): **Time:**

MS/MSD SAMPLE ID (if applicable): **Time:**

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
X				PFAS - Filtered	ALS
X				PFAS - Unfiltered	ALS
X				TOC	Pace
X				DOC	Pace
X				QUAL (if seasonal)	Pace
				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

☒ Picture of Sample Location (**required**) ☐ GPS'd

Location of photos: ☐ Foam Observed

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):	Date: 9-18-20
(CREEK)/CHANNEL POND LAKE	Location ID: RC5
BANK WETLAND BEACH OTHER	Field Staff:
Sampling Device (circle): SHOVEL (AUGER) GRAB	Sample Depth: 0-6
Porewater Device (if appl): SED POINT (PUSH POINT)	Duplicate or MS/MSD Taken: ☐ Yes ☐ No

What is the corresponding species sample and ID?
frog

Is there a corresponding water sample? Sample ID?
RC5-WAT-BULK-01-091820

Is there a corresponding **porewater** sample? Sample ID?
RC5-POWAT

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):
center of creek 100 ft E of culvert

Surface water estimated depth (in/ft) and width (if applicable): 6 inches, 2 ft wide

Soil Description (primary, secondary, moist, color, odor, organic content):
[illegible]% sand, [illegible]% 25% fine, 10% coarse, 45% med. 10% organics, 15% silt sample saved, but not the collected for sample ~2nd auger 20% clay, 10% sand, 10% [illegible] which was then moved, today with very need to fill 1/4 of the CEC bottle

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID: Puffel bag			
Temperature (°C): 13.31	pH: 6.78		
Temp corr cond (umhos/cm): 1260	Dissolved Oxygen: 0.16	ORP: -122.5	

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:		
Temperature (°C): 13.48	pH: 6.82	
Temp corr cond (umhos/cm): 1398	Dissolved Oxygen: 1.31	ORP: -122.6

SAMPLES COLLECTED

SAMPLE ID: RC5-SED-0-6-01-091820	**Time:** 1550
POREWATER SAMPLE ID (if applicable): RC5-POWAT-01-091820	**Time:** 1540
DUP SAMPLE ID (if applicable):	**Time:**
MS/MSD SAMPLE ID (if applicable):	**Time:**

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
X			X	PFAS (both)	ALS
X				TOC (sed only)	Pace
X				CEC (sed only)	MVTL
			X	DOC (porewater only)	Pace

Sample Checklist

☒ Picture of Sample Location (required) AS ☐ Picture of sediment

Location of photos: ☒ GPS'd Saved on 2020 Fall KMZ

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SURFACE WATER SAMPLE FORM

Location Type:

BANK/SHORE IN WATER BODY (WETLANDS)

(CREEK/CHANNEL CENTER) CREEK/CHANNEL BANK

Sampling Type: (BULK) MID BOT

Sampling Device: (DIPPER) GRAB PERISTALTIC

*Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Date:

Location ID: RC6

Sample Depth: BULK

Field Staff: HT/AE/JM

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

Fall Seasonal Sample ☐ Yes ☐ No

Corresponding species sample(s) and ID(s)?

3 minnows - comp RC6-FORE-COMP-ONE-01-091820 @ 1150

Are there corresponding sediment and porewater samples? Sample IDs?

No (not yet?)

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample?

No

Other details (describe foam here if observed):

No foam at this location, foam upgradient at RC5

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point: 8 inches

Surface water estimated width at sample location (feet): 3 feet

Sample location relative to channel bottom and distance from bank:

Flow Speed (circle): NO (LOW) L-M MODERATE M-H HIGH

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID:

Temperature (°C): 10.98 pH: 6.93

Temp corr cond (umhos/cm): 1.420 Dissolved Oxygen: 6.02 ORP: -43.2

SAMPLES COLLECTED

SAMPLE ID: RC6-WAT-BULK-01-091820 **Time:** 1215

SAMPLE ID (if multiple water or foam): **Time:**

DUP SAMPLE ID (if applicable): **Time:**

MS/MSD SAMPLE ID (if applicable): **Time:**

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
✓				PFAS - Filtered	ALS
✓				PFAS - Unfiltered	ALS
✓				TOC	Pace
✓				DOC	Pace
				QUAL (if seasonal)	Pace
				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

☐ Picture of Sample Location (**required**) Hanna ☐ GPS'd Amanda

Location of photos: ☐ Foam Observed

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

ECO SURFACE WATER SAMPLE FORM

Location Type:

BANK/SHORE IN WATER BODY WETLANDS (area is wetlands)

CREEK/CHANNEL CENTER CREEK/CHANNEL BANK (Sample from creek)

Sampling Type: BULK MID BOT

Sampling Device: DIPPER GRAB PERISTALTIC

*Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Date: 9/20/20

Location ID: RC6A

Sample Depth: BULK

Field Staff: AS/RF

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

Fall Seasonal Sample ☐ Yes ☒ No

Corresponding species sample(s) and ID(s)?

Check w/ Al/Amanda

Are there corresponding sediment and porewater samples? Sample IDs?

No

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample?

No

Other details (describe foam here if observed):

No foam

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point: 4 inches

Surface water estimated width at sample location (feet): 4 feet

Sample location relative to channel bottom and distance from bank: 1 ft from North bank

Flow Speed (circle): NO LOW L-M MODERATE M-H HIGH

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID:

Temperature (°C): 16.63 pH: 6.79

Temp corr cond (umhos/cm): 1.649 Dissolved Oxygen: 6.72 ORP: 735

SAMPLES COLLECTED

SAMPLE ID: RC6A-WAT-BULK-01-092020 **Time:** 1710

SAMPLE ID (if multiple water or foam): **Time:**

DUP SAMPLE ID (if applicable): **Time:**

MS/MSD SAMPLE ID (if applicable): **Time:**

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
X				PFAS - Filtered	ALS
X				PFAS - Unfiltered	ALS
X				TOC	Pace
X				DOC	Pace
				QUAL (if seasonal)	Pace
				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

☒ Picture of Sample Location (**required**) AS ☐ GPS'd

Location of photos: ☐ Foam Observed

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

SED-0-6-01-092120

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle): RC6A

CREEK/CHANNEL POND LAKE

BANK WETLAND BEACH OTHER

Sampling Device (circle): SHOVEL AUGER GRAB

Porewater Device (if appl): SED POINT PUSH POINT

Date: 9/21/20 09:60 AM

Location ID: RC6A-SED-0-6-01-092120

Field Staff: RF CK

Sample Depth: 0-6 in

Duplicate or MS/MSD Taken: DUP ☒ Yes ☐ No

What is the corresponding species sample and ID? No

Is there a corresponding water sample? Sample ID? NO

Is there a corresponding **porewater** sample? Sample ID? Yes

RC6A-POWAT-01-092120

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):

ONE FOOT FROM NORTH BANK OF THE CREEK

Surface water estimated depth (in/ft) and width (if applicable): Depth = 3in., Width = 6 FT.

Soil Description (primary, secondary, moist, color, odor, organic content):

40% clay
40% silt
5% gravel
15% coarse sand

No odor
No organic content
Chocolate brown (60% dark)

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:

Temperature (°C): pH:

Temp corr cond (umhos/cm): Dissolved Oxygen: ORP:

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:

Temperature (°C): 14.10 °C pH: 6.29

Temp corr cond (umhos/cm): 1644 Dissolved Oxygen: 3.64 ORP: 136.2

SAMPLES COLLECTED

SAMPLE ID: RC6A-SED-0-6-092120 Time: 10:00

POREWATER SAMPLE ID (if applicable): RC6A-POWAT-01-092120 Time: 09:50

DUP SAMPLE ID (if applicable): RC6A-POWAT-02-092120 Time: 09:55

MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
	✓		✓	PFAS (both)	ALS
				TOC (sed only)	Pace
				CEC (sed only)	MVTL
			✓	DOC (porewater only)	Pace

Sample Checklist

☐ Picture of Sample Location (**required**) ☐ Picture of sediment

Location of photos: ☐ GPS'd

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SURFACE WATER SAMPLE FORM

Location Type:

BANK/SHORE IN WATER BODY WETLANDS

~~CREEK/CHANNEL CENTER~~ CREEK/CHANNEL BANK

Sampling Type: BULK MID BOT

Sampling Device: ~~DIPPER~~ GRAB PERISTALTIC

*Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Date: 9/19/20

Location ID: RC7

Sample Depth:

Field Staff: AS/AL

Duplicate or MS/MSD Taken: ☑ Yes ☐ No

Fall Seasonal Sample ☐ Yes ☐ No

Corresponding species sample(s) and ID(s)?

RC7-BOTF-WHO-ONE-01-091920 @1300

- about 75 feet downgradient of RC7, by culvert (~2 feet west of culvert)

Are there corresponding sediment and porewater samples? Sample IDs?

Not yet

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample?

Yes

Other details (describe foam here if observed):

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point: 6 inches

Surface water estimated width at sample location (feet): 8 feet

Sample location relative to channel bottom and distance from bank:

Flow Speed (circle): NO LOW L-M MODERATE M-H HIGH

FIELD WATER QUALITY PARAMETERS – Come back

YSI/Hanna SN or other ID:

Temperature (°C): 12.92 pH: 7.07

Temp corr cond (umhos/cm): 1.158 Dissolved Oxygen: 5.52 ORP: 80.0

SAMPLES COLLECTED

SAMPLE ID: RC7-WAT-BULK-01-091920 Time: ~~1315~~ 1300

SAMPLE ID (if multiple water or foam): RC7-WAT-BULK-02-091920 Time: ~~1320~~ 1305

DUP SAMPLE ID (if applicable): Time:

MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
Y				PFAS - Filtered	ALS
Y	Y			PFAS - Unfiltered	ALS
Y				TOC	Pace
Y				DOC	Pace
Y				QUAL (if seasonal)	Pace
				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

☑ Picture of Sample Location (required) Amanda Phone ☐ GPS'd

Location of photos: ☐ Foam Observed

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

RC13 - Clear

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):
CREEK/CHANNEL POND LAKE
BANK WETLAND BEACH OTHER

Date: 9/20/20

Location ID: RC7 by culvert

Field Staff: AS/AK/KH

Sampling Device (circle): SHOVEL AUGER GRAB

Sample Depth: 3 inches (POWAT) sed =

Porewater Device (if appl): SED POINT PUSH POINT

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

What is the corresponding species sample and ID?
RC7-BOTF-WHO-ONG-01-091920

Is there a corresponding water sample? Sample ID?
RC7-WAT-BULK-01-091920

Is there a corresponding **porewater** sample? Sample ID?
RC7-POWAT-01-092020 @ 1045

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):
center of creek, 1 ft from culvert

Surface water estimated depth (in/ft) and width (if applicable): 2 inches, 5 ft

Soil Description (primary, secondary, moist, color, odor, organic content):
5% med sand, 20% coarse, 50% f gravel, 25% med gravel
SA - brown, trace organic odor

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:
Temperature (°C): 12.69 pH: 7.04
Temp corr cond (umhos/cm): 1.124 Dissolved Oxygen: 4.06 ORP: 69.1

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:
Temperature (°C): 13.41 pH: 6.83
Temp corr cond (umhos/cm): 1.164 Dissolved Oxygen: 0.96 ORP: 59.5

SAMPLES COLLECTED

SAMPLE ID: RC7-SED-0-6-01-092020 Time: 1100
POREWATER SAMPLE ID (if applicable): RC7-SED-0-6-01-092020 Time: 1045
DUP SAMPLE ID (if applicable): Time:
MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
Y			Y	PFAS (both)	ALS
Y				TOC (sed only)	Pace
Y				CEC (sed only)	MVTL
			Y	DOC (porewater only)	Pace

Sample Checklist
☒ Picture of Sample Location (**required**)
Location of photos:
☒ Picture of sediment Amanda
☐ GPS'd

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SURFACE WATER SAMPLE FORM

Location Type:

BANK/SHORE | IN WATER BODY | WETLANDS

CREEK/CHANNEL CENTER | CREEK/CHANNEL BANK

Sampling Type: BULK | MID | BOT

Sampling Device: DIPPER | GRAB | PERISTALTIC

*Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Date: 9-18-20

Location ID: RC22

Sample Depth: BULK

Field Staff: AS, RF, JM, HT

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

Fall Seasonal Sample ☒ Yes ☐ No

Corresponding species sample(s) and ID(s)?

Fish 30 ft east of staff gauge

Are there corresponding sediment and porewater samples? Sample IDs?

Yes - see sediment form

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample?

No

Other details (describe foam here if observed):

dry pond, some organic sheen in patches, no foam, muddy

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point: 2-4 inches

Surface water estimated width at sample location (feet): 15 ft

Sample location relative to channel bottom and distance from bank:

Flow Speed (circle): NO | LOW | L-M | MODERATE | M-H | HIGH

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID: Ruth Thing

Temperature (°C): 25.86 pH: 7.65

Temp corr cond (umhos/cm): 1324 Dissolved Oxygen: 5.60 ORP: 39.2

SAMPLES COLLECTED

SAMPLE ID: RC22-WAT-BULK-01-091820 Time: ~~1420~~ collected

SAMPLE ID (if multiple water or foam): Time: from

DUP SAMPLE ID (if applicable): Time: ~~1420~~ earlier

MS/MSD SAMPLE ID (if applicable): Time: put all data on this form is from 1420

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
X				PFAS - Filtered	ALS
X				PFAS - Unfiltered	ALS
X				TOC	Pace
X				DOC	Pace
X				QUAL (if seasonal)	Pace
				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

☒ Picture of Sample Location (**required**) AS ☐ GPS'd

Location of photos: ☐ Foam Observed

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):

CREEK/CHANNEL POND LAKE

BANK WETLAND BEACH OTHER

Sampling Device (circle): SHOVEL AUGER GRAB

Porewater Device (if appl): SED POINT PUSH POINT

Date: 9-18-20

Location ID: RC22

Field Staff: AS, JM, RH

Sample Depth: 0-6

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

What is the corresponding species sample and ID?

Fish

Is there a corresponding water sample? Sample ID?

RC22-WAT-BULK-01-091820

Is there a corresponding **porewater** sample? Sample ID?

no - failed Porewater Attempt

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):

10 ft from N Bank, 30 ft east of staff gauge

Surface water estimated depth (in/ft) and width (if applicable): 4 inches, 12 ft wide (dry)

Soil Description (primary, secondary, moist, color, odor, organic content):

60% silt, 20% clay, 10% muck/organics, 10% fine sand dark brown, slight organic odor

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:

Temperature (°C): see other forms pH:

Temp corr cond (umhos/cm): Dissolved Oxygen: ORP:

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID: n/a

Temperature (°C): pH:

Temp corr cond (umhos/cm): Dissolved Oxygen: ORP:

SAMPLES COLLECTED

SAMPLE ID: RC22-SED-0-6-01-091820 **Time:** 1630

POREWATER SAMPLE ID (if applicable): N/A **Time:**

DUP SAMPLE ID (if applicable): **Time:**

MS/MSD SAMPLE ID (if applicable): **Time:**

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
X				PFAS (both)	ALS
X				TOC (sed only)	Pace
X				CEC (sed only)	MVTL
				DOC (porewater only)	Pace

Sample Checklist

☑ Picture of Sample Location (**required**) AS ☒ Picture of sediment

Location of photos: ☐ GPS'd

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SURFACE WATER SAMPLE FORM

Location Type:

BANK/SHORE IN WATER BODY WETLANDS

CREEK/CHANNEL CENTER CREEK/CHANNEL BANK

Sampling Type: BULK MID BOT

Sampling Device: DIPPER GRAB PERISTALTIC

*Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Date: 9/19/20

Location ID: RC16A RC16A

Sample Depth: 6-4"

Field Staff: JM/GS

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

Fall Seasonal Sample ☐ Yes ☒ No

Corresponding species sample(s) and ID(s)?
Yes, minnow, bluegill, dwarf sculpin tadpole

Are there corresponding sediment and porewater samples? Sample IDs?
NO

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample?
NO

Other details (describe foam here if observed):
None

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point: 4 inches

Surface water estimated width at sample location (feet): 7 feet

Sample location relative to channel bottom and distance from bank: 3 feet

Flow Speed (circle): NO LOW (L-M) MODERATE M-H HIGH

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID: Hanna

Temperature (°C): 15.35 pH: 7.34

Temp corr cond (umhos/cm): 412 Dissolved Oxygen: 10.03 ORP: 93.2

SAMPLES COLLECTED

RC16A

SAMPLE ID: ~~RC17A~~-WAT-BULK-01-091920 Time: 1720

SAMPLE ID (if multiple water or foam): yes-see below for fish samples Time:

DUP SAMPLE ID (if applicable): Time:

MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
X				PFAS - Filtered	ALS
X				PFAS - Unfiltered	ALS
X				TOC	Pace
X				DOC	Pace
				QUAL (if seasonal)	Pace
				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

☒ Picture of Sample Location (**required**) ☐ GPS'd

Location of photos: by culvert James ☐ Foam Observed

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

RC16A-FORE-COMP-TWO-01-091920 @1630
RC16A-FORE-COMP-ONE-01-091920
RC16A-AMPH-ONE-01-091920

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):

CREEK/CHANNEL POND LAKE

BANK WETLAND BEACH OTHER

Sampling Device (circle): SHOVEL AUGER GRAB

Porewater Device (if appl): SED POINT PUSH POINT

Date: 9/21/20 10:50AM

Location ID: RC16A

Field Staff: RF CK

Sample Depth: 0-6 in

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

What is the corresponding species sample and ID?

No

Is there a corresponding water sample? Sample ID?

[redacted]

Is there a corresponding **porewater** sample? Sample ID?

RC16A-POWAT-01-092120

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):

One FOOT IN [redacted] FROM Bank,

Surface water estimated depth (in/ft) and width (if applicable): 10in deep, 7 feet wide

Soil Description (primary, secondary, moist, color, odor, organic content):

"Rocky mountain gray" 75% clay 10% organics 10% silt 5% fine sand slight odor

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:

Temperature (°C): pH:

Temp corr cond (umhos/cm): Dissolved Oxygen: ORP:

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:

Temperature (°C): 17.31°C pH: 6.36

Temp corr cond (umhos/cm): 888 Dissolved Oxygen: 0.49 ORP: -152.0

SAMPLES COLLECTED

SAMPLE ID: RC16A-SED-0-6-01-092120 Time: 11 AM

POREWATER SAMPLE ID (if applicable): RC16A-POWAT-01-092120 Time: 10:50AM

DUP SAMPLE ID (if applicable): Time:

MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
			✓	PFAS (both)	ALS
				TOC (sed only)	Pace
				CEC (sed only)	MVTL
			✓	DOC (porewater only)	Pace

Sample Checklist

☐ Picture of Sample Location **(required)** ☐ Picture of sediment

Location of photos: ☐ GPS'd

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO ~~SEDIMENT~~ SAMPLE FORM

Location of Sample Collection (circle): RC13 Water

CREEK/CHANNEL POND LAKE

BANK WETLAND BEACH OTHER

Sampling Device (circle): SHOVEL AUGER GRAB

Porewater Device (if appl): SED POINT PUSH POINT

Date: 9/21/20 1400

Location ID: RC13-WAT-BULK-01-092120

Field Staff: RF CK

Sample Depth:

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

What is the corresponding species sample and ID?

Sed

Is there a corresponding ~~water~~ sample? Sample ID?

RC13-SED-0-6-01-092120

Is there a corresponding **porewater** sample? Sample ID?

RC13-POWAT-0-6-01-092120

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):

Middle

Surface water estimated depth (in/ft) and width (if applicable): 1.5 FT

Soil Description (primary, secondary, moist, color, odor, organic content):

NA

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:

Temperature (°C): 16.77 pH: 7.69

Temp corr cond (umhos/cm): 482 Dissolved Oxygen: 7.13 ORP: 62.8

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:

Temperature (°C): pH:

Temp corr cond (umhos/cm): Dissolved Oxygen: ORP:

SAMPLES COLLECTED

SAMPLE ID: **Time:**

POREWATER SAMPLE ID (if applicable): **Time:**

DUP SAMPLE ID (if applicable): **Time:**

MS/MSD SAMPLE ID (if applicable): **Time:**

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
✓				PFAS (both)	ALS
✓				TOC (sed only)	Pace
✓				CEC (sed only)	MVTL
✓				DOC (porewater only)	Pace

Sample Checklist

☐ Picture of Sample Location (**required**) ☐ Picture of sediment

Location of photos: ☐ GPS'd

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):
CREEK/CHANNEL POND LAKE
BANK WETLAND BEACH OTHER

Sampling Device (circle): SHOVEL AUGER GRAB

Porewater Device (if appl): SED POINT PUSH POINT

Date: 9/23/20

Location ID: RC13

Field Staff:

Sample Depth: 0-6 for soil, 0-3 for sed

Duplicate or MS/MSD Taken: ☑ Yes ☐ No
DUP-SOIL

What is the corresponding species sample and ID?
RC13-CRAY-01-092120 (and/or frog?)

Is there a corresponding water sample? Sample ID?
RC13-WAT-BULK-01-092022

Is there a corresponding **porewater** sample? Sample ID?
RC13-POWAT-01-092320

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):
ON the NORTH BANK of RALEIGH CREEK, 200 FT UPSTREAM OF CONFLUENCE

Surface water estimated depth (in/ft) and width (if applicable): ~~0.5m~~ depth, 6 FT WIDE

Soil Description (primary, secondary, moist, color, odor, organic content):
low plasticity clay, 10% fine sand, 20% silt, 10% organ
(roots/grass)
sample from actual bank, water lvl 8 inches deep at ba
large boulders + tr
(possi
at lo

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:

Temperature (°C): 15.44 pH: 6.85

Temp corr cond (umhos/cm): 496 Dissolved Oxygen: 5.35 ORP: 170.5

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:

Temperature (°C): 16.05 pH: 6.81

Temp corr cond (umhos/cm): 0.490 Dissolved Oxygen: 5.69 ORP: 141.9

SAMPLES COLLECTED

SAMPLE ID: RC13-SED-0-6-01-092320 Time: 0945

POREWATER SAMPLE ID (if applicable): RC13-POWAT-01-092320 Time: 0940

DUP SAMPLE ID (if applicable): RC13-SED-0-6-02-092320 Time: 0950

MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
✓	✓ (SOIL)		✓	PFAS (both)	ALS
✓				TOC (sed only)	Pace
✓				CEC (sed only)	MVTL
			✓	DOC (porewater only)	Pace

Sample Checklist

☑ Picture of Sample Location (**required**) Amanda ☑ Picture of sediment Amanda

Location of photos: ☑ GPS'd Amanda

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle): RC14

CREEK/CHANNEL POND LAKE

BANK WETLAND BEACH OTHER

Sampling Device (circle): SHOVEL AUGER GRAB

Porewater Device (if appl): SED POINT PUSH POINT

Date: 9/21/20 1410

Location ID: RC14-WAT-BULK-01-092120

Field Staff: RF CK

Sample Depth: 1 ft

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

What is the corresponding species sample and ID?

RC14-WAT-BULK-01-092220 (water quality)

Sed

Is there a corresponding ~~water~~ sample? Sample ID?

~~RC14-SED-0-092120~~ RC14-SED-0-6-01-092220

Is there a corresponding **porewater** sample? Sample ID?

RC14-POWAT-01-092220

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):

Middle

Surface water estimated depth (in/ft) and width (if applicable): 1 ft

Soil Description (primary, secondary, moist, color, odor, organic content):

NA

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:

Temperature (°C): 15.39 pH: 7.28

Temp corr cond (umhos/cm): 486 Dissolved Oxygen: 6.69 ORP: 73.7

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:

Temperature (°C): pH:

Temp corr cond (umhos/cm): Dissolved Oxygen: ORP:

SAMPLES COLLECTED

SAMPLE ID: **Time:**

POREWATER SAMPLE ID (if applicable): **Time:**

DUP SAMPLE ID (if applicable): **Time:**

MS/MSD SAMPLE ID (if applicable): **Time:**

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
✓				PFAS (both)	ALS
✓				TOC (sed only)	Pace
✓				CEC (sed only)	MVTL
✓				DOC (porewater only)	Pace

Sample Checklist

☐ Picture of Sample Location (**required**) ☐ Picture of sediment

Location of photos: ☐ GPS'd

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):
CREEK/CHANNEL POND LAKE
BANK WETLAND BEACH OTHER

Date: 9/23/20
Location ID: RC14
Field Staff: CR, AL

Sampling Device (circle): SHOVEL AUGER GRAB
Porewater Device (if appl): SED POINT PUSH POINT
Sample Depth:
Duplicate or MS/MSD Taken: ☐ Yes ☐ No

What is the corresponding species sample and ID?
RC14-CRAY-01-092120

Is there a corresponding water sample? Sample ID?

Is there a corresponding **porewater** sample? Sample ID?

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):
west bank at tall grass - 40 feet upgradient of confl, 60 feet downgradient of culvert

Surface water estimated depth (in/ft) and width (if applicable):
~2 inches deep at bank

Soil Description (primary, secondary, moist, color, odor, organic content):
60% clay, 15-20% silt, 15% fine sand, 5% fine gravel

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:
Temperature (°C): 17.21 pH: 7.53
Temp corr cond (umhos/cm): 487 Dissolved Oxygen: 5.70 ORP: 129.5

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:
Temperature (°C): 21.60 pH: 7.57
Temp corr cond (umhos/cm): 503 Dissolved Oxygen: 3.81 ORP: 97.3

SAMPLES COLLECTED

SAMPLE ID: RC14-SED-0-6-01-092320 Time: 1015
POREWATER SAMPLE ID (if applicable): RC14-POWAT-01-092320 Time: 1020
DUP SAMPLE ID (if applicable): Time:
MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
✓			✓	PFAS (both)	ALS
✓				TOC (sed only)	Pace
✓				CEC (sed only)	MVTL
			✓	DOC (porewater only)	Pace

Sample Checklist
☑ Picture of Sample Location (**required**)
Location of photos: Awards
☐ Picture of sediment
☑ GPS'd Awards

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle): RC21

CREEK/CHANNEL POND LAKE

BANK WETLAND BEACH OTHER

Sampling Device (circle): SHOVEL AUGER GRAB

Porewater Device (if appl): SED POINT PUSH POINT

Date: 9/21/20 1420

Location ID: RC21-WAT-BULK-01-092120

Field Staff: RF CK

Sample Depth:

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

What is the corresponding species sample and ID?

Is there a corresponding water sample? Sample ID?

Is there a corresponding **porewater** sample? Sample ID?

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake): Middle

Surface water estimated depth (in/ft) and width (if applicable): ~2" 1 FT

Soil Description (primary, secondary, moist, color, odor, organic content):

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:

Temperature (°C): 16.34 pH: 7.22

Temp corr cond (umhos/cm): 486 Dissolved Oxygen: 7.08 ORP: 76.0

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:

Temperature (°C): pH:

Temp corr cond (umhos/cm): Dissolved Oxygen: ORP:

SAMPLES COLLECTED

SAMPLE ID: **Time:**

POREWATER SAMPLE ID (if applicable): **Time:**

DUP SAMPLE ID (if applicable): **Time:**

MS/MSD SAMPLE ID (if applicable): **Time:**

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
				PFAS (both)	ALS
				TOC (sed only)	Pace
				CEC (sed only)	MVTL
				DOC (porewater only)	Pace

Sample Checklist

☐ Picture of Sample Location (**required**) ☐ Picture of sediment

Location of photos: ☐ GPS'd

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

PFAS, filt and unfil, qual, toc, doc

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):
CREEK/CHANNEL POND LAKE
BANK WETLAND BEACH OTHER

Date: 9/22/20
Location ID: RC21A
Field Staff: AL CK
Sample Depth: 0-6 SED

Sampling Device (circle): SHOVEL AUGER GRAB
Porewater Device (if appl): SED POINT PUSH POINT
Duplicate or MS/MSD Taken: ☐ Yes ☒ No

What is the corresponding species sample and ID?
RC21A-CRAY-01-092220

Is there a corresponding water sample? Sample ID?
Yes RC21-WAT-BULK-01-092120

Is there a corresponding porewater sample? Sample ID?
RC21A-POWAT-01-092220

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):
100 FEET NORTH OF RC21 PROPER, ~~center channel~~ moved to western bank near tree

Surface water estimated depth (in/ft) and width (if applicable):

Soil Description (primary, secondary, moist, color, odor, organic content):
center → ~~clay, med plasticity, 10% F-S sand, 5% fine gravel~~
actual sample (bank): sandy silt (~70% silt, 20% fine sand, 10% clay)

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:
Temperature (°C): 17.56 °C pH: 7.03
Temp corr cond (umhos/cm): 0.487 Dissolved Oxygen: 8.13 ORP: 68.02

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:
Temperature (°C): 19.04 pH: 6.73
Temp corr cond (umhos/cm): 0.491 Dissolved Oxygen: 3.12 ORP: 449

SAMPLES COLLECTED

SAMPLE ID: RC21A-SED-0-6-01-092220 Time: 1645
POREWATER SAMPLE ID (if applicable): RC21A-POWAT-01-092220 Time: 1630
DUP SAMPLE ID (if applicable): Time:
MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
✓			✓	PFAS (both)	ALS
✓				TOC (sed only)	Pace
✓				CEC (sed only)	MVTL
			✓	DOC (porewater only)	Pace

Sample Checklist
☐ Picture of Sample Location (**required**) Location of photos: Amanda
☐ Picture of sediment
☐ GPS'd

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):

CREEK/CHANNEL POND LAKE

BANK WETLAND BEACH OTHER

Sampling Device (circle): SHOVEL AUGER GRAB

Porewater Device (if appl): SED POINT PUSH POINT

Date: 9/22/20

Location ID: RC21B

Field Staff: CC/ML

Sample Depth: 0-4 inches

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

What is the corresponding species sample and ID?

RC21B-CRAY-01-092120 @ ~100/50 feet downgradient of RC21 / same where we saw fish once

Is there a corresponding water sample? Sample ID?

RC21-WAT-BULK-01-092120

Is there a corresponding **porewater** sample? Sample ID?

Porewater not possible

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):

East bank near roots

Surface water estimated depth (in/ft) and width (if applicable): ~1 inch

Soil Description (primary, secondary, moist, color, odor, organic content):

Sandy gravel (f = 60%, m = 15%), 20% m→c sand, 5% silt/clay

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:

Temperature (°C): 19.1 pH: 7.14

Temp corr cond (umhos/cm): 0.354 Dissolved Oxygen: 8.21 ORP: 62.2

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:

Temperature (°C): pH:

Temp corr cond (umhos/cm): Dissolved Oxygen: ORP:

SAMPLES COLLECTED

SAMPLE ID: RC21B-SED-0-6-01-092220 **Time:** ~~1700~~ 1730

POREWATER SAMPLE ID (if applicable): **Time:**

DUP SAMPLE ID (if applicable): **Time:**

MS/MSD SAMPLE ID (if applicable): **Time:**

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
✓				PFAS (both)	ALS
✓				TOC (sed only)	Pace
				CEC (sed only)	MV
				DOC (porewater only)	F

Sample Checklist

✓ Picture of Sample Location (**required**) Amanda ☐ Picture of sediment

Location of photos: ☐ GPS'd Maps?

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SURFACE WATER SAMPLE FORM

Location Type: Creek RC17

Date: 9/19/20

BANK/SHORE IN WATER BODY WETLANDS

Location ID: RC17-WAT-BULK-01-091920

CREEK/CHANNEL CENTER CREEK/CHANNEL BANK

Sample Depth: 0-6"

Sampling Type: BULK MID BOT

Field Staff: James & Garret

Sampling Device: DIPPER GRAB PERISTALTIC

Duplicate or MS/MSD Taken: ☒ Yes ☐ No

*Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Fall Seasonal Sample ☒ Yes ☐ No

Corresponding species sample(s) and ID(s)?
Crayfish(2), Sonney darters & bluegill

Are there corresponding sediment and porewater samples? Sample IDs?

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample?
Yes

Other details (describe foam here if observed):

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point: 0-6 inches

Surface water estimated width at sample location (feet): 7 feet

Sample location relative to channel bottom and distance from bank: 2 feet from bank

Flow Speed (circle): NO LOW L-M MODERATE M-H HIGH

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID: 03306 03306003199

Temperature (°C): 5.35 pH: 7.61

Temp corr cond (umhos/cm): 405 Dissolved Oxygen: 11.71 ORP: 61.9

SAMPLES COLLECTED

SAMPLE ID: RC17-WAT-BULK-01-091920 Time: 1625

SAMPLE ID (if multiple water or foam): Time:

DUP SAMPLE ID (if applicable): RC17-WAT-BULK-02-091920 Time: ~~1625~~ 1630

MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
X	X			PFAS - Filtered	ALS
X				PFAS - Unfiltered	ALS
X				TOC	Pace
X				DOC	Pace
X				QUAL (if seasonal)	Pace
X				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

☒ Picture of Sample Location (**required**) ☐ GPS'd

Location of photos: ☐ Foam Observed

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):

CREEK/CHANNEL POND LAKE

BANK WETLAND BEACH OTHER

Sampling Device (circle): SHOVEL AUGER GRAB

Porewater Device (if appl): SED POINT PUSH POINT

Date: 9/21/20

Location ID: RC17-SED-0-6-01-092120

Field Staff: RF CK

Sample Depth: 4in

Duplicate or MS/MSD Taken: ☐ Yes ☐ No

What is the corresponding species sample and ID?

~~RC17-SC~~ No

Is there a corresponding water sample? Sample ID?

No

Is there a corresponding **porewater** sample? Sample ID?

RC17-POWAT-01-092120

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):

Within the east bank

Surface water estimated depth (in/ft) and width (if applicable): 4in depth, 10FT wide

Soil Description (primary, secondary, moist, color, odor, organic content):

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:

Temperature (°C): pH:

Temp corr cond (umhos/cm): Dissolved Oxygen: ORP: 86.1

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:

Temperature (°C): 18.31 pH: ~~7.10~~ 7.10

Temp corr cond (umhos/cm): 488 Dissolved Oxygen: ~~5.75~~ 5.75 ORP: 64.6

SAMPLES COLLECTED

SAMPLE ID: RC17-SED-0-6-01-092120 **Time:** 12:50

POREWATER SAMPLE ID (if applicable): RC17-POWAT-01-092120 **Time:** 12:40

DUP SAMPLE ID (if applicable): **Time:**

MS/MSD SAMPLE ID (if applicable): **Time:**

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
			✓	PFAS (both)	ALS
				TOC (sed only)	Pace
				CEC (sed only)	MVTL
			✓	DOC (porewater only)	Pace

Sample Checklist

☐ Picture of Sample Location **(required)** ☐ Picture of sediment

Location of photos: ☐ GPS'd

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):

CREEK/CHANNEL POND LAKE

BANK WETLAND BEACH OTHER

Sampling Device (circle): SHOVEL AUGER GRAB

Porewater Device (if appl): SED POINT PUSH POINT

Date: 9/23/20

Location ID: RC17A

Field Staff: CK/RF/AL

Sample Depth: 0-6 inches for both

Duplicate or MS/MSD Taken: ☐ Yes ☐ No

What is the corresponding species sample and ID?
RC17A-CRAY-01-092320
renamed from RC17B

Is there a corresponding water sample? Sample ID?
RC17-WAT-BULK-01-092320

Is there a corresponding porewater sample? Sample ID?
RC17A-POWAT-01-92320

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):
20 feet from both crayfish flags (btwn), on south bank, un
log pile, shade

Surface water estimated depth (in/ft) and width (if applicable): 2½ inch

Soil Description (primary, secondary, moist, color, odor, organic content):
clay, low plasticity, with 20% fine sand, 10% f gra
(65%) 5% silt

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:

Temperature (°C): ~~7.82~~ 16.35 pH: 7.82

Temp corr cond (umhos/cm): 0.489 Dissolved Oxygen: 4.34 ORP: ~~56~~ 58.7

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:

Temperature (°C): 16.89 pH: 7.61

Temp corr cond (umhos/cm): 0.497 Dissolved Oxygen: 1.15 ORP: 13.3

SAMPLES COLLECTED

SAMPLE ID: RC17A-SED-0-6-01-092320 Time: 1155

POREWATER SAMPLE ID (if applicable): RC17A-POWAT-01-092320 Time: 1150

DUP SAMPLE ID (if applicable): Time:

MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
✓			✓	PFAS (both)	ALS
✓				TOC (sed only)	Pace
✓				CEC (sed only)	MVTL
			✓	DOC (porewater only)	Pace

Sample Checklist

~~☐~~ Picture of Sample Location (**required**) Amanda ☐ Picture of sediment

Location of photos: ~~☐~~ GPS'd Amanda

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

Bulk Water

ECO ~~SEDIMENT~~ SAMPLE FORM

Location of Sample Collection (circle): WATER

CREEK/CHANNEL POND LAKE

BANK WETLAND BEACH OTHER

Sampling Device (circle): SHOVEL AUGER GRAB

Porewater Device (if appl): SED POINT PUSH POINT

Date:

Location ID: RC18A-WAT-BULK-01-092120

Field Staff: RF CK

Sample Depth:

Duplicate or MS/MSD Taken: ☐ Yes ☐ No

What is the corresponding species sample and ID?

No

Is there a corresponding water sample? Sample ID?

RC18A-WAT-BULK-01-092120

Is there a corresponding **porewater** sample? Sample ID?

No

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):

Central channel, grab sample,

Surface water estimated depth (in/ft) and width (if applicable):

Soil Description (primary, secondary, moist, color, odor, organic content):

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:

Temperature (°C): 16.88 pH: 7.24

Temp corr cond (umhos/cm): 482 Dissolved Oxygen: 80.1 ORP: 7.28

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:

Temperature (°C): pH:

Temp corr cond (umhos/cm): Dissolved Oxygen: ORP:

SAMPLES COLLECTED

SAMPLE ID: **Time:** 13:10

POREWATER SAMPLE ID (if applicable): **Time:**

DUP SAMPLE ID (if applicable): **Time:**

MS/MSD SAMPLE ID (if applicable): **Time:**

Planned Analysis (check if collected)

~~Primary~~ WATER	Dup	MS/MSD	Porewater	Analysis	Lab
✓				PFAS (both)	ALS
✓				TOC (sed only)	Pace
✓				CEC (sed only)	MVTL
✓				DOC (porewater only)	Pace

Sample Checklist

☐ Picture of Sample Location (**required**) ☐ Picture of sediment

Location of photos: ☐ GPS'd

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):
CREEK/CHANNEL POND LAKE
BANK WETLAND BEACH OTHER

Date: 9/23/20
Location ID: RCUBA
Field Staff: AL/RF/GS
Sampling Device (circle): SHOVEL AUGER GRAB
Sample Depth: 0-6 inches (both)
Porewater Device (if appl): SED POINT PUSH POINT
Duplicate or MS/MSD Taken: ☐ Yes ☐ No

What is the corresponding species sample and ID?
RCUBA-CRAY-01-092320

Is there a corresponding water sample? Sample ID?
RCUBA-WAT-BULK-01-092320

Is there a corresponding **porewater** sample? Sample ID?
RCUBA-POWAT-01-092320

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):
East bank, 15 feet upgradient of culvert (right as you face)

Surface water estimated depth (in/ft) and width (if applicable):

Soil Description (primary, secondary, moist, color, odor, organic content):
50% SILT 25% fine to medium sand 5% coarse sand
10% CLAY 10% organic (rocks/grass)
No plasticity

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:
Temperature (°C): 17.83 pH: 8.17
Temp corr cond (umhos/cm): 0.484 Dissolved Oxygen: 8.27 ORP: 74.5

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:
Temperature (°C): 20.66 pH: 7.64
Temp corr cond (umhos/cm): 259 Dissolved Oxygen: 2.73 ORP: -77.0

SAMPLES COLLECTED

SAMPLE ID: RCUBA-SED-0-6-01-092320 **Time:** 1300
POREWATER SAMPLE ID (if applicable): RCUBA-POWAT-01-092320 **Time:** 1240
DUP SAMPLE ID (if applicable): **Time:**
MS/MSD SAMPLE ID (if applicable): **Time:**

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
✓			✓	PFAS (both)	ALS
✓				TOC (sed only)	Pace
✓				CEC (sed only)	MVTL
			✓	DOC (porewater only)	Pace

Sample Checklist
✓ Picture of Sample Location (**required**) Amanda ☐ Picture of sediment
Location of photos: ☐ GPS'd Amanda

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SURFACE WATER SAMPLE FORM

Location Type:

BANK/SHORE IN WATER BODY WETLANDS

CREEK/CHANNEL CENTER (circled) CREEK/CHANNEL BANK

Sampling Type: BULK MID BOT

Sampling Device: DIPPER GRAB (circled) PERISTALTIC

Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Date: 9/17/20

Location ID: RC18

Sample Depth: BULK

Field Staff: AS / HT / RF / AL

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

Fall Seasonal Sample ☐ Yes ☒ No

Corresponding species sample(s) and ID(s)?
Frog

Are there corresponding sediment and porewater samples? Sample IDs? yes
RC18-SED-0-6-01-091720 RC18+POWAT-01-091720

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample? NO

Other details (describe foam here if observed):
calm, clear, no odor, small foam observed

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point:

Surface water estimated width at sample location (feet):

Sample location relative to channel bottom and distance from bank:

Flow Speed (circle): NO LOW (circled) L-M MODERATE M-H HIGH

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID:

Temperature (°C): ~~7.10~~ 14.18 13.63 pH: ~~7.10~~ 7.16

Temp corr cond (umhos/cm): 479 0428 Dissolved Oxygen: 3.35 10.50 ORP: ~~2~~ 96.2

SAMPLES COLLECTED

SAMPLE ID: RC18-WAT-BULK-01-091720	**Time:** 845
SAMPLE ID (if multiple water or foam):	**Time:**
DUP SAMPLE ID (if applicable):	**Time:**
MS/MSD SAMPLE ID (if applicable):	**Time:**

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
X				PFAS - Filtered	ALS
X				PFAS - Unfiltered	ALS
X				TOC	Pace
X				DOC	Pace
X				QUAL (if seasonal)	Pace
				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

☒ Picture of Sample Location **(required)** ☐ GPS'd

Location of photos: AT ☐ Foam Observed

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):

CREEK/CHANNEL POND LAKE

BANK WETLAND BEACH OTHER

Sampling Device (circle): SHOVEL AUGER GRAB

Porewater Device (if appl): SED POINT PUSH POINT

Date: 9/17/20

Location ID: RC18

Field Staff: HT / AS / A

Sample Depth: 0-6

Duplicate or MS/MSD Taken: ☐ Yes ☐ No

What is the corresponding species sample and ID?

Frog

Is there a corresponding water sample? Sample ID?

yes RC18-WAT-~~[illegible]~~-01-091720

Is there a corresponding **porewater** sample? Sample ID?

yes RC18-POWAT-01-091720

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):

15 feet from culvert, 5 feet from south side of channel

Surface water estimated depth (in/ft) and width (if applicable): 3 feet 15 feet wide

Soil Description (primary, secondary, moist, color, odor, organic content):

50% silt, 20% coarse sand

trace organic ~~[illegible]~~ 60% M sand 15% f sand

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:

Temperature (°C): 18.63 pH: 7.16

Temp corr cond (umhos/cm): 0.429 Dissolved Oxygen: 10.60 ORP: 66.2

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:

Temperature (°C): 14.18 pH: 7.10

Temp corr cond (umhos/cm): 0.479 Dissolved Oxygen: 3.35 ORP: -117.9

SAMPLES COLLECTED

SAMPLE ID: RC18-~~[illegible]~~SED-0-6-01-091720 Time: 1000

POREWATER SAMPLE ID (if applicable): RC18-POWAT-01-091720 Time: 915

DUP SAMPLE ID (if applicable): Time:

MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
X			X	PFAS (both)	ALS
X				TOC (sed only)	Pace
X				CEC (sed only)	MVTL
			X	DOC (porewater only)	Pace

Sample Checklist

☐ Picture of Sample Location (**required**) ☐ Picture of sediment

Location of photos: ☐ GPS'd

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SURFACE WATER SAMPLE FORM

Location Type: ~~BOG~~ EP17A

Date: 9/19/20

BANK/SHORE IN WATER BODY (WETLANDS)

Location ID:

CREEK/CHANNEL CENTER CREEK/CHANNEL BANK

Sample Depth: 0-3'

Sampling Type: (BULK) MID BOT

Field Staff: James McCoy / Garret

Sampling Device: (DIPPER) GRAB PERISTALTIC

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

*Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Fall Seasonal Sample ☒ Yes ☐ No

Corresponding species sample(s) and ID(s)?

Yes, mud minnows & bluegill

Are there corresponding sediment and porewater samples? Sample IDs?

NO

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample? Maybe, NO?

Other details (describe foam here if observed): Organic sheen

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point: 0-16"

Surface water estimated width at sample location (feet): N/A

Sample location relative to channel bottom and distance from bank: 50' in from bank on edge of cattails

Flow Speed (circle): (NO) LOW L-M MODERATE M-H HIGH

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID: YSE

Temperature (°C): 16.32 pH: 6.77

Temp corr cond (umhos/cm): 465 Dissolved Oxygen: 8.02 ORP: -57.6

SAMPLES COLLECTED

SAMPLE ID: EP17A-WAT-BULK-01-091920 Time: 1600

SAMPLE ID (if multiple water or foam): Time:

DUP SAMPLE ID (if applicable): Time:

MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
X				PFAS - Filtered	ALS
X				PFAS - Unfiltered	ALS
X				TOC	Pace
X				DOC	Pace
X				QUAL (if seasonal)	Pace
				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

☒ Picture of Sample Location (**required**) ☐ GPS'd

Location of photos: ☐ Foam Observed

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

Water and

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):

CREEK/CHANNEL POND LAKE

BANK WETLAND BEACH OTHER

Sampling Device (circle): SHOVEL AUGER GRAB

Porewater Device (if appl): SED POINT PUSH POINT

Date: 9/24/20

Location ID: EP17C

Field Staff: HT/AL/MG

Sample Depth: 0-6

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

What is the corresponding species sample and ID?

EP17C-SNAILS-COMP-01-092420 @ 1650 (4 snails)

EP17C-CRAY-_____-01-092420 @ _____

Is there a corresponding water sample? Sample ID?

EP17C-WAT-BULK-01-092420

Is there a corresponding porewater sample? Sample ID?

EP17C-POWAT-01-092420 @ 1700

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):

2 feet north from "bank" but water levels very low, 15 feet north of Landyl

Surface water estimated depth (in/ft) and width (if applicable): 2-3 inches

Soil Description (primary, secondary, moist, color, odor, organic content):

65% f→c sand (mostly m+c), 15% fine gravel, 20% organic (wood, roots, grass) small organic

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:

Temperature (°C): 23.39 pH: 7.01

Temp corr cond (umhos/cm): 0.446 Dissolved Oxygen: 11.84 ORP: -45.5

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:

Temperature (°C): 17.87 pH: 5.94

Temp corr cond (umhos/cm): 0.905 Dissolved Oxygen: 8.03 ORP: -58.8

SAMPLES COLLECTED

SAMPLE ID: EP17C-SED-0-6-01-092420 Time: 1715

POREWATER SAMPLE ID (if applicable): EP17C-POWAT-01-092420 Time: 1700

BULK DUP SAMPLE ID (if applicable): EP17C-WAT-BULK-01-092420 Time: 1655

MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
✓				PFAS (both)	ALS
✓				TOC (sed only)	Pace
✓				CEC (sed only)	MVTL
				DOC (porewater only)	Pace

Sample Checklist

☐ Picture of Sample Location (**required**) ☐ Picture of sediment

Location of photos: ☐ GPS'd

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

Midwater
Bot water
Pore water
Sediment

Northern most wet in EPL

ECO SURFACE WATER SAMPLE FORM

Location Type: Eagle Point Lake, north

BANK/SHORE | IN WATER BODY | WETLANDS

CREEK/CHANNEL CENTER | CREEK/CHANNEL BANK

Sampling Type: BULK | MID | BOT

Sampling Device: DIPPER | GRAB | PERISTALTIC

*Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Date:

Location ID: EP1A

Sample Depth: 2feet - 5feet

Field Staff: HT / AG

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

Fall Seasonal Sample ☐ Yes ☒ No

Corresponding species sample(s) and ID(s)?
Brown bullhead - bottom

water depth - 5feet

Are there corresponding sediment and porewater samples? Sample IDs?
EP1A-~~POINT~~ POWAT-01-091520, EP1A-SED-0-6-01-091520

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample?

Other details (describe foam here if observed):

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point: 5feet

Surface water estimated width at sample location (feet): ~50 feet from west side of lake

Sample location relative to ~~channel~~ bottom and distance from bank:

Flow Speed (circle): NO | LOW | L-M | MODERATE | M-H | HIGH

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID: 9 5235 /

Temperature (°C): 18.84 / 14.5 pH: 7.95 / 7.88

Temp corr cond (umhos/cm): 446 / 415 Dissolved Oxygen: 11.06 mg/L / 11.3 ORP: 92.0 mV / 60.1

D1
BOT

SAMPLES COLLECTED

SAMPLE ID: EP1A-WAT-MID-01-091520 Time: 1330

SAMPLE ID (if multiple water or foam): EP1A-WAT-BOT-01-091520 Time: 1340

DUP SAMPLE ID (if applicable): Time:

MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary MID	~~Dup~~ BOT	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
X	X			PFAS - Filtered	ALS
X	X			PFAS - Unfiltered	ALS
X	X			TOC	Pace
X	X			DOC	Pace
				QUAL (if seasonal)	Pace
				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

☐ Picture of Sample Location (**required**) ☐ GPS'd

Location of photos: HT ☐ Foam Observed

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):
CREEK/CHANNEL POND LAKE
BANK WETLAND BEACH OTHER

Date: 9/15/100
Location ID: E1A
Field Staff: AL/LT
Sample Depth: 0-4

Sampling Device (circle): SHOVEL AUGER GRAB
Porewater Device (if appl): SED POINT PUSH POINT

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

What is the corresponding species sample and ID?

Is there a corresponding water sample? Sample ID?

Is there a corresponding **porewater** sample? Sample ID?
no - not able to

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):

Surface water estimated depth (in/ft) and width (if applicable):

Soil Description (primary, secondary, moist, color, odor, organic content):
0024,0 no sand
10% organic, 30% clay, 60% silt dark brown low plasticity

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:
Temperature (°C):
Temp corr cond (umhos/cm):
pH:
Dissolved Oxygen:
ORP:

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:
Temperature (°C):
Temp corr cond (umhos/cm):
pH: NOT ABLE TO SAMPLE
Dissolved Oxygen:
ORP

SAMPLES COLLECTED

SAMPLE ID: E1A-SED-0-6-01-091520 **Time:** 1440
POREWATER SAMPLE ID (if applicable): **Time:**
DUP SAMPLE ID (if applicable): **Time:**
MS/MSD SAMPLE ID (if applicable): **Time:**

Planned Analysis (check if collected)					
Primary ~~MS~~	~~Dup~~	MS/MSD	Porewater	Analysis	Lab
X				PFAS (both)	ALS
X				TOC (sed only)	Pace
X				CEC (sed only)	MVTL
				DOC (porewater only)	Pace

Sample Checklist
☐ Picture of Sample Location (**required**) ☐ Picture of sediment
Location of photos: ☐ GPS'd

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

sediment
100
ine for
push
point

Water and

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):

CREEK/CHANNEL POND LAKE

BANK WETLAND BEACH OTHER

Sampling Device (circle): SHOVEL AUGER GRAB

Porewater Device (if appl): SED POINT PUSH POINT

Date: 9/24/20

Location ID: EP27B

Field Staff: AC/MD/HT

Sample Depth: (0 inches for both)

Duplicate or MS/MSD Taken: ☐ Yes ☒ ~~No~~

What is the corresponding species sample and ID?

EP27B-CRAY-? -01-092420

EP27B-SNAILS-COMP-01-092420 @ 1550

Is there a corresponding water sample? Sample ID?

EP27B-WAT-BULK-01-092420

Is there a corresponding porewater sample? Sample ID?

EP27B-POWAT-01-092420

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):

1 foot East of bank

Surface water estimated depth (in/ft) and width (if applicable): 3 inches

Soil Description (primary, secondary, moist, color, odor, organic content):

40% Low plasticity clay, 25% silt, 20% fine sand, 15% organic (roots)

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:

Temperature (°C): pH: 7.68

Temp corr cond (umhos/cm): 0.395 Dissolved Oxygen: 8.52 ORP: -67.0

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:

Temperature (°C): 18.34 pH: 6.28

Temp corr cond (umhos/cm): 0.514 Dissolved Oxygen: 2.59 ORP: -103.2

SAMPLES COLLECTED

~~SAMPLE ID:~~ ~~EP27B-POWAT-01-092420~~ Time:

POREWATER SAMPLE ID (if applicable): EP27B-POWAT-01-092420 Time: 1600

~~DUP SAMPLE ID~~ (if applicable): EP27B-WAT-BULK-01-092420 Time: 1555

~~MS/MSD~~ SAMPLE ID (if applicable): EP27B-SED-0-6-01-092420 Time: 1605

BULK SED

Planned Analysis (check if collected)

Primary	~~Dup~~ BULK	MS/MSD	Porewater	Analysis	Lab
✓	✓		✓	PFAS (both)	ALS
✓	✓			TOC (sed only)	Pace
✓				CEC (sed only)	MVTL
			✓	DOC (porewater only)	Pace

Sample Checklist

☒ Picture of Sample Location (**required**) Amanda ☐ Picture of sediment

Location of photos: ☒ GPS'd screenshot pin

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SURFACE WATER SAMPLE FORM

Location Type: EP26A

BANK/SHORE | IN WATER BODY | WETLANDS

CREEK/CHANNEL CENTER | CREEK/CHANNEL BANK

Sampling Type: BULK | MID | BOT

Sampling Device: DIPPER | GRAB | PERISTALTIC

*Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Date: 9/17/20

Location ID:

Sample Depth: ~~[illegible]~~ porewater bulk

Field Staff: AC/AS

Duplicate or MS/MSD Taken: ☐ Yes ☑ No

Fall Seasonal Sample ☐ Yes ☐ No

Corresponding species sample(s) and ID(s)?

Crayfish: EP26A-CRAY-01-091720 @ 1145

Are there corresponding sediment and porewater samples? Sample IDs?

EP26A-SED-0-6-01-091720 @ 1345 EP26A-POWAT-01-091720 @ 1315

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample?

NO

Other details (describe foam here if observed):

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point:

Surface water estimated width at sample location (feet):

Sample location relative to channel bottom and distance from bank:

Flow Speed (circle): NO | LOW | L-M | MODERATE | M-H | HIGH

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID: ON SEED PAGE

Temperature (°C): pH:

Temp corr cond (umhos/cm): Dissolved Oxygen: ORP:

SAMPLES COLLECTED

SAMPLE ID: EP26A-WAT-BULK-01-091720 Time: 1300

SAMPLE ID (if multiple water or foam): Time:

DUP SAMPLE ID (if applicable): Time:

MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
✓				PFAS - Filtered	ALS
✓				PFAS - Unfiltered	ALS
✓				TOC	Pace
✓				DOC	Pace
				QUAL (if seasonal)	Pace
				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

☑ Picture of Sample Location (**required**) Amanda Phone ☐ GPS'd

Location of photos: ☐ Foam Observed No

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):

CREEK/CHANNEL POND LAKE

BANK (WETLAND) BEACH OTHER

Sampling Device (circle): SHOVEL (AUGER) GRAB

Porewater Device (if appl): SED POINT (PUSH POINT)

Date: 9/17/20 1130

Location ID: EP26A

Field Staff: AL/AS

Sample Depth: 6 inches

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

What is the corresponding species sample and ID?

Crayfish EP26A-CRAY-01-091720

Is there a corresponding water sample? Sample ID?

Bulk + PW

Is there a corresponding **porewater** sample? Sample ID?

yes

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):

~5 feet south of cattails, edge

Surface water estimated depth (in/ft) and width (if applicable): 1 foot

Soil Description (primary, secondary, moist, color, odor, organic content):

f→c sand (70% c, 10% f, 20% m), 30% grass/wood organic, organic odor, brown 5% clay/silt, 3% fine rocks gravel

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:

Temperature (°C): 16.91 pH: 6.83

Temp corr cond (umhos/cm): 0.436 Dissolved Oxygen: 3.35 ORP: -37.2

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:

Temperature (°C): 17.06 pH: 5.97

Temp corr cond (umhos/cm): 0.499 Dissolved Oxygen: 3.75 ORP: -52.4

SAMPLES COLLECTED

SAMPLE ID: EP26A-SED-0-6-01-091720 Time: 1345

POREWATER SAMPLE ID (if applicable): EP26A-POWAT-01-091720 Time: 1315

DUP SAMPLE ID (if applicable): Time:

MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
✓			✓	PFAS (both)	ALS
✓				TOC (sed only)	Pace
✓				CEC (sed only)	MVTL
			✓	DOC (porewater only)	Pace

Sample Checklist

☒ Picture of Sample Location (**required**) Amanda ☒ Picture of sediment

Location of photos: ☐ GPS'd

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SURFACE WATER SAMPLE FORM

Location Type: Eagle Point Lake

Date: 9/15/20

BANK/SHORE (IN WATER BODY) WETLANDS

Location ID: EP27C

CREEK/CHANNEL CENTER CREEK/CHANNEL BANK

Sample Depth: 3 feet

Sampling Type: BULK (MID) (BOT)

Field Staff: HT / AG

Sampling Device: (DIPPER) GRAB (PERISTALTIC)

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

*Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Fall Seasonal Sample ☐ Yes ☒ No

Corresponding species sample(s) and ID(s)?

Are there corresponding sediment and porewater samples? Sample IDs?

No → ~~no~~ sediment too fine, clogged

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample?

Other details (describe foam here if observed):

located at narrowest point in lake at EP27C

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point: 5.5 feet

Surface water estimated width at sample location (feet): 150 feet from west side

Sample location relative to channel bottom and distance from bank:

Flow Speed (circle): (NO) LOW L-M MODERATE M-H HIGH

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID:

Temperature (°C): ~~19.35~~ 19.44 pH: 9.04 / 8.48

Temp corr cond (umhos/cm): 413 / 429 Dissolved Oxygen: 12.45 / 12.18 ORP 957 / 927

SAMPLES COLLECTED

SAMPLE ID: EP27C-WAT-MID-01-091520	**Time:**	1450
SAMPLE ID (if multiple water or foam): EP27C-WAT-BOT-01-091520	**Time:**	1500
DUP SAMPLE ID (if applicable):	**Time:**	
MS/MSD SAMPLE ID (if applicable):	**Time:**	

Planned Analysis (check if collected)

Primary (MID)	~~Dup~~ (BOT)	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
X	X			PFAS - Filtered	ALS
X	X			PFAS - Unfiltered	ALS
X	X			TOC	Pace
X	X			DOC	Pace
X				QUAL (if seasonal)	Pace
				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

☐ Picture of Sample Location (**required**) ☐ GPS'd

Location of photos: ☐ Foam Observed

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):

CREEK/CHANNEL POND (LAKE)

BANK WETLAND BEACH OTHER

Sampling Device (circle): SHOVEL (AUGER) GRAB

Porewater Device (if appl): SED POINT PUSH POINT

Date: 9/15/20

Location ID: EP27C

Field Staff: AG / MT

Sample Depth: ~~5.5 feet~~ 0-6 inches

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

What is the corresponding species sample and ID?

Is there a corresponding water sample? Sample ID?

EP27C-WAT-MID-01-091520 EP27C-WAT-BOT-01-091520

Is there a corresponding **porewater** sample? Sample ID?

NO

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, (bottom of pond/lake)):

weeds in area

Surface water estimated depth (in/ft) and width (if applicable): 5.5 feet

Soil Description (primary, secondary, moist, color, odor, organic content):

20% organic (fine, no roots), 10% clay, 70% silt

dark brown

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:

Temperature (°C): pH:

Temp corr cond (umhos/cm): Dissolved Oxygen: ORP:

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:

Temperature (°C): pH:

Temp corr cond (umhos/cm): Dissolved Oxygen: ORP:

Didn't do pore water

SAMPLES COLLECTED

SAMPLE ID: **Time:** 1510

POREWATER SAMPLE ID (if applicable): **Time:**

DUP SAMPLE ID (if applicable): **Time:**

MS/MSD SAMPLE ID (if applicable): **Time:**

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
				PFAS (both)	ALS
				TOC (sed only)	Pace
				CEC (sed only)	MVTL
				DOC (porewater only)	Pace

Sample Checklist

☐ Picture of Sample Location (**required**) ☐ Picture of sediment

Location of photos: ☐ GPS'd

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SURFACE WATER SAMPLE FORM

Location Type: EP southside eagle point lake

Date: 9/15/20

BANK/SHORE | (IN WATER BODY) | WETLANDS

Location ID: EP18

CREEK/CHANNEL CENTER | CREEK/CHANNEL BANK

Sample Depth: 2 feet

Sampling Type: BULK | (MID) | BOT

Field Staff: HT / AG

Sampling Device: (DIPPER) | GRAB | PERISTALTIC

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

*Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Fall Seasonal Sample ☒ Yes ☐ No

Corresponding species sample(s) and ID(s)?

Are there corresponding sediment and porewater samples? Sample IDs?

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample?

Other details (describe foam here if observed):

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point:

Surface water estimated width at sample location (feet):

Sample location relative to channel bottom and distance from bank:

Flow Speed (circle): (NO) | LOW | L-M | MODERATE | M-H | HIGH

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID:

Temperature (°C): 20.54 pH: 9.08

Temp corr cond (umhos/cm): 374 Dissolved Oxygen: 15.08 ORP: 76.9

SAMPLES COLLECTED

SAMPLE ID: EP18-WAT-MID-01-091520 **Time:** 1530

SAMPLE ID (if multiple water or foam): **Time:**

DUP SAMPLE ID (if applicable): **Time:**

MS/MSD SAMPLE ID (if applicable): **Time:**

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
✓				PFAS - Filtered	ALS
✓				PFAS - Unfiltered	ALS
✓				TOC	Pace
✓				DOC	Pace
				QUAL (if seasonal)	Pace
				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

☐ Picture of Sample Location (**required**) ☐ GPS'd

Location of photos: ☐ Foam Observed

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

ECO SURFACE WATER SAMPLE FORM

Location Type:

BANK/SHORE IN WATER BODY WETLANDS - drainage

CREEK/CHANNEL CENTER CREEK/CHANNEL BANK Channel of EPL

Sampling Type: BULK MID BOT

Sampling Device: DIPPER GRAB PERISTALTIC

*Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Date: 9/19/20

Location ID: EP19

Sample Depth:

Field Staff: AL/AS

Duplicate or MS/MSD Taken: ☐ Yes ☐ No

Fall Seasonal Sample ☑ Yes ☐ No

Corresponding species sample(s) and ID(s)?
EP19-AMPH-ONE-01-091920 @ 1750

Are there corresponding sediment and porewater samples? Sample IDs?
Not yet

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample?
Yes

Other details (describe foam here if observed):

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point: 6 inches

Surface water estimated width at sample location (feet): 20 feet

Sample location relative to channel bottom and distance from bank: 4 feet from north bank

Flow Speed (circle): NO LOW L-M MODERATE M-H HIGH, ripples due to wind

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID:

Temperature (°C): 17.63 pH: 6.96

Temp corr cond (umhos/cm): 0.452 Dissolved Oxygen: 2.44 ORP: 12.7

SAMPLES COLLECTED

SAMPLE ID: EP19-WAT-BULK-01-091920 **Time:** 1815

SAMPLE ID (if multiple water or foam): **Time:**

DUP SAMPLE ID (if applicable): **Time:**

MS/MSD SAMPLE ID (if applicable): **Time:**

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
✓				PFAS - Filtered	ALS
✓				PFAS - Unfiltered	ALS
✓				TOC	Pace
✓				DOC	Pace
✓				QUAL (if seasonal)	Pace
				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

☑ Picture of Sample Location (**required**) ☐ GPS'd

Location of photos: Amanda ☐ Foam Observed

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):
CREEK/CHANNEL POND LAKE
BANK WETLAND BEACH OTHER

Date: 9/20/20
Location ID: EP19
Field Staff: AS / ALR

Sampling Device (circle): SHOVEL AUGER GRAB
Sample Depth: 5-6 inches

Porewater Device (if appl): SED POINT PUSH POINT
Duplicate or MS/MSD Taken: ☐ Yes ☒ No

What is the corresponding species sample and ID?
EP19-AMPH-ONE-01-092020 (1 frog)

Is there a corresponding water sample? Sample ID?
EP19-WAT-BULK-01-091920

Is there a corresponding **porewater** sample? Sample ID?
EP19-POWAT-01-092020

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):
3 feet from bank (north bank

Surface water estimated depth (in/ft) and width (if applicable):

Soil Description (primary, secondary, moist, color, odor, organic content):
25% f sand
15% f > mgravel
5% silt
45% m > c sand no odor
10% Organics (grass/roots)

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:
Temperature (°C): 17.42 pH: 6.81
Temp corr cond (umhos/cm): 0.459 Dissolved Oxygen: 4.64 ORP: 110.4

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:
Temperature (°C): 17.41 pH: 6.03
Temp corr cond (umhos/cm): 0.203 Dissolved Oxygen: 1.38 ORP: -73.2

SAMPLES COLLECTED

SAMPLE ID: EP19-SED-0-6-01-092020 Time: 1320
POREWATER SAMPLE ID (if applicable): EP19-POWAT-01-092020 Time: 1310
DUP SAMPLE ID (if applicable): Time:
MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
✓			✓	PFAS (both)	ALS
✓				TOC (sed only)	Pace
✓				CEC (sed only)	MVTL
			✓	DOC (porewater only)	Pace

Sample Checklist
☒ Picture of Sample Location (**required**) Amanda
Location of photos:
☒ Picture of sediment Amanda
☐ GPS'd

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SEDIMENT SAMPLE FORM Surface Water

Location of Sample Collection (circle):
CREEK/CHANNEL POND (LAKE)
BANK WETLAND BEACH OTHER

Date: 9/20/20 @ KHS
Location ID: EP20
Field Staff: AS/AL/KF

Sampling Device (circle): SHOVEL AUGER GRAB DIPPER
Porewater Device (if appl): SED POINT PUSH POINT BULK

Sample Depth: BULK
Duplicate or MS/MSD Taken: ☐ Yes ☑ No

What is the corresponding species sample and ID?
EP20-FORE-COMP-ONE-01-092020 1430 ← near trap
EP20-FORE-COMP-TWO-01-092020 1430 ← caught at others (sunfish)

Is there a corresponding water sample? Sample ID?
EP20-WAT-BULK-01-092020

Is there a corresponding **porewater** sample? Sample ID?
No Also a seasonal sample (full kit)

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):
3-4 feet from southern bank near trap

Surface water estimated depth (in/ft) and width (if applicable): 1 foot deep

Soil Description (primary, secondary, moist, color, odor, organic content):
Sand

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:
Temperature (°C): 15.68 pH: 6.59
Temp corr cond (umhos/cm): 0.562 Dissolved Oxygen: 2.15 ORP: 29.3

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:
Temperature (°C): pH:
Temp corr cond (umhos/cm): Dissolved Oxygen: ORP:

SAMPLES COLLECTED

SAMPLE ID: EP20-WAT-BULK-01-092020 Time: ~~1430~~ 1440
~~POREWATER SAMPLE ID (if applicable)~~: Time:
DUP SAMPLE ID (if applicable): Time:
MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
✓	PFAS-filt/unfilt			PFAS (both)	ALS
✓	TOC/DOC			TOC (sed only)	Pace
✓	Quality			CEC (sed only)	MVTL
✓	AN/ME	TAL		DOC (porewater only)	Pace

Sample Checklist
☐ Picture of Sample Location (**required**) ☐ Picture of sediment
Location of photos: ☐ GPS'd

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):	Date: 09/24/2020
CREEK/CHANNEL (circled) POND LAKE	Location ID: EP-4
BANK WETLAND BEACH OTHER	Field Staff: AL/MD
Sampling Device (circle): SHOVEL AUGER (circled) GRAB	Sample Depth: 0-6 inches (both)
Porewater Device (if appl): SED POINT PUSH POINT (circled)	Duplicate (circled) or MS/MSD (circled) Taken: ☑ Yes ☐ No — SED / SED

What is the corresponding species sample and ID?
EP4-~~SED-0-6~~-CRAY-01-092~~3~~420   EP4-SNAILS-COMP-01-092420 (4 snails)

Is there a corresponding water sample? Sample ID?
EP4-WAT-BULK-01-092420

Is there a corresponding porewater sample? Sample ID?
EP4-POWAT-01-092420

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):
~15 feet upgradient of culvert on northwest side

Surface water estimated depth (in/ft) and width (if applicable): 1 foot

Soil Description (primary, secondary, moist, color, odor, organic content):
sandy gravel, 20% m sand, 50% f gravel, 15% clay 5% silt, 10% organic (roots)

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:

Temperature (°C): 18.94	pH: 7.11	
Temp corr cond (umhos/cm): 0.408	Dissolved Oxygen: 7.73	ORP: -11.3

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:

Temperature (°C): 19.55	pH: 6.93	
Temp corr cond (umhos/cm): 0.524	Dissolved Oxygen: 7.63	ORP: -32.9

SAMPLES COLLECTED

SAMPLE ID: EP4-SED-0-6-01-092420	Time: 1130
POREWATER SAMPLE ID (if applicable): EP4-POWAT-01-092420	Time: 1125
~~DUP~~ SAMPLE ID (if applicable): EP4-WAT-BULK-01-092420 (BULK WATER)	Time: ~~1105~~ 1115
MS/MSD SAMPLE ID (if applicable):	Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
✓	SED	SED	✓ (fil)	PFAS (both)	ALS
✓				TOC (sed only)	Pace
✓				CEC (sed only)	MVTL
			✓	DOC (porewater only)	Pace

Sample Checklist

☑ Picture of Sample Location (required) Amanda	☐ Picture of sediment
Location of photos:	☐ GPS'd

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

1135 DUP
1140 MS/MSD

EP4-SNAIL-COMP-01-092420 (1110)
- collected 4 medium-sized snails along north eastern bank
- all roughly the same size ~1.5-2in diameter

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):
CREEK/CHANNEL POND LAKE
BANK WETLAND BEACH OTHER

Date: 09/24/2020
Location ID: EP5
Field Staff: AL / MD
Sample Depth: 4 in. deep (POWAT) 6 inches (sed

Sampling Device (circle): SHOVEL AUGER GRAB
Porewater Device (if appl): SED POINT PUSH POINT
Duplicate or MS/MSD Taken: ☐ Yes ☐ No

What is the corresponding species sample and ID?
EP5-CRAY-01-092320

Is there a corresponding water sample? Sample ID?
EP5-WAT-BULK-01-092420

Is there a corresponding **porewater** sample? Sample ID?
EP5-POWAT-01-092420

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):
80 feet upgradient of culverts (across EP5)

Surface water estimated depth (in/ft) and width (if applicable): 3 inches

Soil Description (primary, secondary, moist, color, odor, organic content):
- sample collected 45° into the western bank into the Northwest bank out a undercut right next to trap
- 40% clay, low plasticity; 25% f-m sand; 15% fine gravel
  15% organic (roots + grass); 5% silt

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:
Temperature (°C): 18.67 pH: 6.39
Temp corr cond (umhos/cm): 0.408 Dissolved Oxygen: 7.54 ORP: 150.3

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:
Temperature (°C): pH:
Temp corr cond (umhos/cm): Dissolved Oxygen: ORP:

SAMPLES COLLECTED

SAMPLE ID: EP5-SED-0-6-01-092420 Time: 0930
POREWATER SAMPLE ID (if applicable): EP5-POWAT-01-092420 Time: 0915
~~DUP~~ SAMPLE ID (if applicable): EP5-WAT-BULK-01-092420 Time: 0845 (BULK EXTRA)
MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	~~Dup~~ BULK	MS/MSD	Porewater	Analysis	Lab
✓	✓(6 liters)		✓(6 L)	PFAS (both)	ALS
✓	✓(water)			TOC (sed only)	Pace
✓				CEC (sed only)	MVTL
	✓		✓	DOC (porewater only)	Pace

Sample Checklist
✓ Picture of Sample Location (**required**) Amanda ☐ Picture of sediment
Location of photos: ☐ GPS'd Not necessary

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SURFACE WATER SAMPLE FORM

Location Type: Lake

BANK/SHORE (IN WATER BODY) WETLANDS

CREEK/CHANNEL CENTER CREEK/CHANNEL BANK

Sampling Type: BULK (MID) BOT

Sampling Device: (DIPPER) GRAB PERISTALTIC

*Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Date: 9/19/20

Location ID: EP9A

Sample Depth: 3 feet

Field Staff: A Tavara, J McCoy, H Orr

Duplicate or MS/MSD Taken: ☒ Yes ☐ No

Fall Seasonal Sample ☒ Yes ☐ No

Corresponding species sample(s) and ID(s)? ~7 Pike & 1 bass
EP9A 2 forage

Are there corresponding sediment and porewater samples? Sample IDs?

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample?

Other details (describe foam here if observed):

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point: 10 feet

Surface water estimated width at sample location (feet): Lake width

Sample location relative to channel bottom and distance from bank:

Flow Speed (circle): NO (LOW) L-M MODERATE M-H HIGH

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID: Hanna

Temperature (°C): 17.65 pH: 7.60

Temp corr cond (umhos/cm): 343 Dissolved Oxygen: 8.94 ORP: 123.3

SAMPLES COLLECTED

SAMPLE ID: EP9A-WAT-MID-01-091920 Time: 945

SAMPLE ID (if multiple water or foam): Time:

DUP SAMPLE ID (if applicable): EP9A-WAT-MID-02-091920 Time: 950

MS/MSD SAMPLE ID (if applicable): EP9A-WAT-MID-03-091920 Time: 955

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
✓	✓	✓	~~Both~~	PFAS - Filtered	ALS
✓	✓	✓	Fall	PFAS - Unfiltered	ALS
✓				TOC	Pace
✓				DOC	Pace
✓				QUAL (if seasonal)	Pace
✓				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

☒ Picture of Sample Location (**required**) ☐ GPS'd

Location of photos: Drew Phone - emailed ☐ Foam Observed

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

EP9A-WAT-MID-01-091920
EP9A-MID-02-091920
EP9A-MID-03-091920

ECO SURFACE WATER SAMPLE FORM

Location Type: Lake

Date: 9/19/20

BANK/SHORE | IN WATER BODY | WETLANDS

Location ID: EP21A

CREEK/CHANNEL CENTER | CREEK/CHANNEL BANK

Sample Depth: 3 feet

Sampling Type: BULK | MID | BOT

Field Staff: A Tavara, J. McCoy, H. Orr

Sampling Device: DIPPER | GRAB | PERISTALTIC

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

*Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Fall Seasonal Sample ☒ Yes ☐ No

Corresponding species sample(s) and ID(s)?

EP21A - Crappie caught here

Are there corresponding sediment and porewater samples? Sample IDs?

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample?

Other details (describe foam here if observed): Can see foam on canoe launch just north of location Wind 15 mph from South

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point: 3 feet

Surface water estimated width at sample location (feet): Lake

Sample location relative to channel bottom and distance from bank: 7 feet deep 130 feet offshore

Flow Speed (circle): NO | LOW | L-M | MODERATE | M-H | HIGH

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID: Hanna

Temperature (°C): 17.77 pH: 7.85

Temp corr cond (umhos/cm): 344 Dissolved Oxygen: 8.98 ORP: 105.5

SAMPLES COLLECTED

EP21A

SAMPLE ID: ~~EP21A~~-WAT-MID-01-091920 Time: 1020

SAMPLE ID (if multiple water or foam): Time:

DUP SAMPLE ID (if applicable): Time:

MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
✓				PFAS - Filtered	ALS
✓				PFAS - Unfiltered	ALS
✓				TOC	Pace
✓				DOC	Pace
✓				QUAL (if seasonal)	Pace
				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

✓ Picture of Sample Location (required) ~~GPS'd~~ James

Location of photos: Drew Phone - emailed ~~Foam Observed~~ on bank near canoe launch

Some on water from wind mixing

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

ECO SURFACE WATER SAMPLE FORM

Location Type: Lake/Eco

BANK/SHORE (IN WATER BODY) WETLANDS

CREEK/CHANNEL CENTER CREEK/CHANNEL BANK

Sampling Type: BULK (MID) BOT

Sampling Device: (DIPPER) GRAB PERISTALTIC

*Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Date: 9/19/20

Location ID: EP14

Sample Depth: 3 feet

Field Staff: A Tarara, J McCoy, H Orr

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

Fall Seasonal Sample ☐ Yes ☒ No

Corresponding species sample(s) and ID(s)?

EP14 - No fish here

Are there corresponding sediment and porewater samples? Sample IDs?

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample?

Other details (describe foam here if observed):

Wind 10 mph from south

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point: 3 feet

Surface water estimated width at sample location (feet): Lake

Sample location relative to channel bottom and distance from bank: 8 feet to bottom 120 feet from shore

Flow Speed (circle): NO (LOW) L-M MODERATE M-H HIGH

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID: Hanna

Temperature (°C): 17.77 pH: 7.81

Temp corr cond (umhos/cm): 344 Dissolved Oxygen: 9.01 ORP: 108.9

SAMPLES COLLECTED

SAMPLE ID: EP14-WAT-MID-01-091920 Time: 10:05

SAMPLE ID (if multiple water or foam): Time:

DUP SAMPLE ID (if applicable): Time:

MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
✓				PFAS - Filtered	ALS
✓				PFAS - Unfiltered	ALS
✓				TOC	Pace
✓				DOC	Pace
				QUAL (if seasonal)	Pace
				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

☒ Picture of Sample Location (**required**) ☐ GPS'd

Location of photos: Drew Phone - emailed ☐ Foam Observed

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

ECO SURFACE WATER SAMPLE FORM

Location Type: Lake / Eco

Date: 9/19/20

BANK/SHORE (IN WATER BODY) WETLANDS

Location ID: EP15

CREEK/CHANNEL CENTER CREEK/CHANNEL BANK

Sample Depth: 3 feet

Sampling Type: BULK (MID) BOT

Field Staff: A Tarara, J. McCoy, H. Orr

Sampling Device: (DIPPER) GRAB PERISTALTIC

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

*Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Fall Seasonal Sample ☒ Yes ☐ No

Corresponding species sample(s) and ID(s)?

EP15 1 small Bass

Are there corresponding sediment and porewater samples? Sample IDs?

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample?

Other details (describe foam here if observed):

Wind 15 mph from south - foam on water from wind

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point: 3 feet

Surface water estimated width at sample location (feet): Lake

Sample location relative to channel bottom and distance from bank: 9 feet deep 120 feet from shore

Flow Speed (circle): NO (LOW) L-M MODERATE M-H HIGH

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID: Hanna

Temperature (°C): 17.82 pH: 7.84

Temp corr cond (umhos/cm): 344 Dissolved Oxygen: 9.21 ORP: 96.5

SAMPLES COLLECTED

SAMPLE ID: EP15-WAT-MID-01-091920 **Time:** 1035

SAMPLE ID (if multiple water or foam): **Time:**

DUP SAMPLE ID (if applicable): **Time:**

MS/MSD SAMPLE ID (if applicable): **Time:**

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
✓				PFAS - Filtered	ALS
✓				PFAS - Unfiltered	ALS
✓				TOC	Pace
✓				DOC	Pace
✓				QUAL (if seasonal)	Pace
				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

☒ Picture of Sample Location (required) ☒ GPS'd James

Location of photos: Drew Phone - emailed ☐ Foam Observed Turbid water from wind

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

ECO SURFACE WATER SAMPLE FORM

Location Type: BANK/SHORE IN WATER BODY WETLANDS

CREEK/CHANNEL CENTER CREEK/CHANNEL BANK

Sampling Type: ~~BULK~~ MID BOT

Sampling Device: DIPPER GRAB PERISTALTIC

*Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Date: ~~9/18/~~ 9/19/20

Location ID: BP1

Sample Depth:

Field Staff: ALIAS

Duplicate or MS/MSD Taken: ☒ Yes ☐ No

Fall Seasonal Sample ☒ Yes ☐ No

Corresponding species sample(s) and ID(s)?

Are there corresponding sediment and porewater samples? Sample IDs?

No

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample?

yes - coincident

Other details (describe foam here if observed):

No foam

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point:

Surface water estimated width at sample location (feet):

Sample location relative to channel bottom and distance from bank:

Flow Speed (circle): NO LOW L-M MODERATE M-H HIGH – ripples, wind

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID:

Temperature (°C): 16.70 pH: 6.84

Temp corr cond (umhos/cm): 0.111 Dissolved Oxygen: 8.61 ORP: 96.2

SAMPLES COLLECTED

SAMPLE ID: BP1-WAT-MID-01-091920 Time: 0940

SAMPLE ID (if multiple water or foam): Time: ~~0945~~

DUP SAMPLE ID (if applicable): BP1-WAT-MID-02-091920 Time: 0945

MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
Y	~~Y~~			PFAS - Filtered	ALS
Y	Y			PFAS - Unfiltered	ALS
Y				TOC	Pace
Y				DOC	Pace
Y				QUAL (if seasonal)	Pace
				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

☐ Picture of Sample Location (**required**) ☐ GPS'd

Location of photos: Amanda Lanning ☐ Foam Observed

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

ECO SURFACE WATER SAMPLE FORM

Location Type: Horseshoe Lake

BANK/SHORE IN WATER BODY WETLANDS

CREEK/CHANNEL CENTER CREEK/CHANNEL BANK

Sampling Type: BULK (MID) BOT

Sampling Device: (DIPPER) GRAB PERISTALTIC

*Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Date: 9/17/20

Location ID: WL2

Sample Depth: 3 feet

Field Staff: AT / DT

Duplicate or MS/MSD Taken: ☐ Yes ☐ No

Fall Seasonal Sample ☐ Yes ☐ No

Corresponding species sample(s) and ID(s)?
Forage + predator

Are there corresponding sediment and porewater samples? Sample IDs?
none

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample?

Other details (describe foam here if observed):
no foam, water greenish in color, murky, can't see bottom
some overhanging vegetation

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point: About 10 ~~ft~~ feet from stormwater inlet

Surface water estimated width at sample location (feet): depth unknown

Sample location relative to channel bottom and distance from bank:

Flow Speed (circle): (NO) LOW L-M MODERATE M-H HIGH

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID:

Temperature (°C): 18.18 pH: 7.71

Temp corr cond (umhos/cm): 0.429 Dissolved Oxygen: 9.09 ORP: 156.7

SAMPLES COLLECTED

SAMPLE ID: WL2-WAT-MID-01-091720 **Time:**

SAMPLE ID (if multiple water or foam): **Time:**

DUP SAMPLE ID (if applicable): **Time:**

MS/MSD SAMPLE ID (if applicable): **Time:**

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
				PFAS - Filtered	ALS
				PFAS - Unfiltered	ALS
				TOC	Pace
				DOC	Pace
				QUAL (if seasonal)	Pace
				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

☐ Picture of Sample Location (**required**) ☐ GPS'd

Location of photos: ☐ Foam Observed

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

ECO SURFACE WATER SAMPLE FORM

Location Type: Horseshoe Lake

Date: 9/17/20

BANK/SHORE (IN WATER BODY) WETLANDS

Location ID: WL3

CREEK/CHANNEL CENTER CREEK/CHANNEL BANK

Sample Depth: 3 feet

Sampling Type: BULK MID BOT

Field Staff: AT / DT

Sampling Device: DIPPER GRAB PERISTALTIC

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

**Note if a "stand alone" fall sample, field quality parameters do not need to be collected*

Fall Seasonal Sample ☐ Yes ☒ No

Corresponding species sample(s) and ID(s)?

Are there corresponding sediment and porewater samples? Sample IDs?

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample?

Other details (describe foam here if observed):

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point:

Surface water estimated width at sample location (feet):

Sample location relative to channel bottom and distance from bank:

Flow Speed (circle): NO LOW L-M MODERATE M-H HIGH

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID:

Temperature (°C): 18.36 pH: 7.43

Temp corr cond (umhos/cm): 0.418 Dissolved Oxygen: 9.14 ORP: 117.3

SAMPLES COLLECTED

SAMPLE ID: WL3-WAT-MID-01-091720 **Time:** 1200

SAMPLE ID (if multiple water or foam): **Time:**

DUP SAMPLE ID (if applicable): **Time:**

MS/MSD SAMPLE ID (if applicable): **Time:**

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
				PFAS - Filtered	ALS
				PFAS - Unfiltered	ALS
				TOC	Pace
				DOC	Pace
				QUAL (if seasonal)	Pace
				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

☐ Picture of Sample Location (**required**) ☐ GPS'd

Location of photos: ☐ Foam Observed

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):

CREEK/CHANNEL (POND) LAKE

(BANK) WETLAND BEACH OTHER

Sampling Device (circle): SHOVEL (AUGER) GRAB

Porewater Device (if appl): SED POINT (PUSH POINT)

Date: WL5 9/17/20

Location ID:

Field Staff: HT / RF

Sample Depth: 0-6

Duplicate or MS/MSD Taken: ☐ Yes ☐ No

What is the corresponding species sample and ID?
crayfish

Is there a corresponding water sample? Sample ID?
WL5-WAT-MID-01-091720

Is there a corresponding **porewater** sample? Sample ID?
WL5-POWAT-01-091720

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):
sample taken @ bank mud & sediment crayfish found in under cuttings of rock

Surface water estimated depth (in/ft) and width (if applicable):

Soil Description (primary, secondary, moist, color, odor, organic content):
5% organic (roots + small pieces) 85% sand (f-m)
10% silt no odor
~~did not take sed~~ bottom is rocky → didn't submit

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:

Temperature (°C): 17.92 pH: 8.00

Temp corr cond (umhos/cm): 924 Dissolved Oxygen: 9.37 ORP: 104.4

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:

Temperature (°C): 17.25 pH: 6.82

Temp corr cond (umhos/cm): 240 Dissolved Oxygen: 3.74 ORP: -101.5

SAMPLES COLLECTED

SAMPLE ID: WL5-SED-0-6-01-091720 **Time:** ~~1545~~ 1600

POREWATER SAMPLE ID (if applicable): WL5-POWAT-01-091720 **Time:** 1545

DUP SAMPLE ID (if applicable): **Time:**

MS/MSD SAMPLE ID (if applicable): **Time:**

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
				PFAS (both)	ALS
				TOC (sed only)	Pace
				CEC (sed only)	MVTL
				DOC (porewater only)	Pace

Sample Checklist

☐ Picture of Sample Location (**required**) ☐ Picture of sediment

Location of photos: ☐ GPS'd

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SURFACE WATER SAMPLE FORM

Location Type: Horseshoe Lake

BANK/SHORE (IN WATER BODY) WETLANDS

CREEK/CHANNEL CENTER CREEK/CHANNEL BANK

Sampling Type: BULK (MID) BOT

Sampling Device: (DIPPER) GRAB PERISTALTIC

*Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Date: 9/17/26

Location ID: WLSA

Sample Depth: 3 feet

Field Staff: HT / DT

Duplicate or MS/MSD Taken: □ Yes ☒ No

Fall Seasonal Sample □ Yes ☒ No

Corresponding species sample(s) and ID(s)?

Are there corresponding sediment and porewater samples? Sample IDs?

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample?

Other details (describe foam here if observed):

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point:

Surface water estimated width at sample location (feet):

Sample location relative to channel bottom and distance from bank:

Flow Speed (circle): (NO) LOW L-M MODERATE M-H HIGH

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID:

Temperature (°C): 18.56 pH: 7.51

Temp corr cond (umhos/cm): 426 Dissolved Oxygen: 8.72 ORP: 170.4

SAMPLES COLLECTED

SAMPLE ID: WLSA-WAT-MID-01-091720 **Time:**

SAMPLE ID (if multiple water or foam): **Time:**

DUP SAMPLE ID (if applicable): **Time:**

MS/MSD SAMPLE ID (if applicable): **Time:**

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
				PFAS - Filtered	ALS
				PFAS - Unfiltered	ALS
				TOC	Pace
				DOC	Pace
				QUAL (if seasonal)	Pace
				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

□ Picture of Sample Location (**required**) □ GPS'd

Location of photos: □ Foam Observed

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

ECO SURFACE WATER SAMPLE FORM

Location Type: Channel

BANK/SHORE IN WATER BODY WETLANDS

CREEK/CHANNEL CENTER CREEK/CHANNEL BANK

Sampling Type: BULK MID BOT

Sampling Device: DIPPER GRAB PERISTALTIC

*Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Date: 9/17/20

Location ID: WLG

Sample Depth: 12-18 inches

Field Staff: HT / RF

Duplicate or MS/MSD Taken: ☐ Yes ☐ No

Fall Seasonal Sample ☒ Yes ☐ No

Corresponding species sample(s) and ID(s)?

Fish, foam

Are there corresponding sediment and porewater samples? Sample IDs?

NO

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample?

Other details (describe foam here if observed):

Foam down gradient 20 feet brownish on outside actively generating consist on outfalls 10 inches high 18 inches long

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point: 2 feet took sample off N side culvert to avoid foam

Surface water estimated width at sample location (feet): 15 feet

Sample location relative to channel bottom and distance from bank: 4 feet

Flow Speed (circle): NO LOW L-M MODERATE M-H HIGH

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID:

Temperature (°C): 18.75 pH: 8.09

Temp corr cond (umhos/cm): 0.424 Dissolved Oxygen: 9.62 ORP: 113.8

SAMPLES COLLECTED

SAMPLE ID: WLG-WAT-BULK-01-091720 Time: 1430

SAMPLE ID (if multiple water or foam): WLG-FOAM-01-091720 Time: 1445

DUP SAMPLE ID (if applicable): Time:

MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
✓				PFAS - Filtered	ALS
✓				PFAS - Unfiltered	ALS
✓				TOC	Pace
✓				DOC	Pace
✓				QUAL (if seasonal)	Pace
				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

☐ Picture of Sample Location (**required**) ☐ GPS'd

Location of photos: HT RF-foam ☐ Foam Observed

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):
(CREEK/CHANNEL) POND LAKE
BANK WETLAND BEACH OTHER

Sampling Device (circle): SHOVEL (AUGER) GRAB

Porewater Device (if appl): SED POINT (PUSH POINT)

Date: 9/24/20

Location ID: WL6

Field Staff: RF

Sample Depth:

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

What is the corresponding species sample and ID?
Cray Fish

Is there a corresponding water sample? Sample ID?

Is there a corresponding **porewater** sample? Sample ID?
WLC-POWAT-01-092420

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):
Bank

Surface water estimated depth (in/ft) and width (if applicable): NA

Soil Description (primary, secondary, moist, color, odor, organic content):
40% clay, 25% coarse sand, 20% organics, 10% silt, 5% gravel
- dark chocolate brown, no odor

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:

Temperature (°C): 18.79 pH: 8.16

Temp corr cond (umhos/cm): 427 Dissolved Oxygen: 7.96 ORP: 48.1

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:

Temperature (°C): 16.66 pH: 7.17

Temp corr cond (umhos/cm): 672 Dissolved Oxygen: 1.72 ORP: 4.5

SAMPLES COLLECTED

SAMPLE ID: WLC-SED-0-6-01-092420 **Time:** 1620

POREWATER SAMPLE ID (if applicable): WLC-POWAT-01-092420 **Time:** 1610

DUP SAMPLE ID (if applicable): **Time:**

MS/MSD SAMPLE ID (if applicable): **Time:**

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
X			X	PFAS (both)	ALS
X				TOC (sed only)	Pace
				CEC (sed only)	MVTL
			X	DOC (porewater only)	Pace

Sample Checklist

☐ Picture of Sample Location (**required**) ☐ Picture of sediment

Location of photos: ☐ GPS'd

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SURFACE WATER SAMPLE FORM

Location Type: creek

Date: 9/17/20

BANK/SHORE IN WATER BODY WETLANDS

Location ID: WL7

CREEK/CHANNEL CENTER CREEK/CHANNEL BANK

Sample Depth: BULK

Sampling Type: BULK MID BOT

Field Staff: AL, AS

Sampling Device: DIPPER GRAB PERISTALTIC

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

*Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Fall Seasonal Sample ☐ Yes ☒ No

Corresponding species sample(s) and ID(s)?

Fish TBD

Are there corresponding sediment and porewater samples? Sample IDs?

No

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample?

no

Other details (describe foam here if observed):

crayfish trap set near culvert

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point: 1 ft

Surface water estimated width at sample location (feet): 15 ft

Sample location relative to channel bottom and distance from bank: 4 ft from [redacted]bank - past culvert

Flow Speed (circle): NO LOW L-M MODERATE M-H HIGH South

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID:

Temperature (°C): 18.21 pH: 8.31

Temp corr cond (umhos/cm): 0.383 Dissolved Oxygen: 9.97 ORP: 478

SAMPLES COLLECTED

SAMPLE ID: WL7-WAT-BULK-01-091720 Time: 1615

SAMPLE ID (if multiple water or foam): Time:

DUP SAMPLE ID (if applicable): Time:

MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
X				PFAS - Filtered	ALS
X				PFAS - Unfiltered	ALS
X				TOC	Pace
X				DOC	Pace
				QUAL (if seasonal)	Pace
				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

☒ Picture of Sample Location (**required**) AL ☐ GPS'd

Location of photos: ☐ Foam Observed

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):

CREEK/CHANNEL (circled) POND LAKE

BANK WETLAND BEACH OTHER

Sampling Device (circle): SHOVEL AUGER (circled) GRAB

Porewater Device (if appl): SED POINT PUSH POINT (circled)

Date: 9/24/20 1530

Location ID: ~~[illegible]~~ WL7

Field Staff: RF DB

Sample Depth:

Duplicate or MS/MSD Taken: ☐ Yes ☐ No

What is the corresponding species sample and ID?

Crayfish, Frog

Is there a corresponding water sample? Sample ID?

Is there a corresponding porewater sample? Sample ID?

WL7-POWAT-01-092420 @ 1520

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):

Bank

Surface water estimated depth (in/ft) and width (if applicable): NA

Soil Description (primary, secondary, moist, color, odor, organic content):

40% organics, 30% silt, 20% coarse sand, 10% fine sand.

- organic odor, dark chocolate brown

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:

Temperature (°C): 19.25 pH: 7.66

Temp corr cond (umhos/cm): 428 Dissolved Oxygen: 9.75 ORP: 100.5

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:

Temperature (°C): 19.16 pH: 7.16

Temp corr cond (umhos/cm): 431 Dissolved Oxygen: 1.61 ORP: -17.6

SAMPLES COLLECTED

SAMPLE ID: WL7-SED-0-6-01-092420	Time: 1530
POREWATER SAMPLE ID (if applicable): WL7-POWAT-01-092420	Time: 1520
DUP SAMPLE ID (if applicable):	Time:
MS/MSD SAMPLE ID (if applicable):	Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
X					
X			X	PFAS (both)	ALS
				TOC (sed only)	Pace
				CEC (sed only)	MVTL
			X	DOC (porewater only)	Pace

Sample Checklist

☐ Picture of Sample Location **(required)** ☐ Picture of sediment

Location of photos: ☐ GPS'd

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SURFACE WATER SAMPLE FORM

Location Type: WL8A

BANK/SHORE (IN WATER BODY) WETLANDS

CREEK/CHANNEL CENTER CREEK/CHANNEL BANK

Sampling Type: BULK (MID) BOT

Sampling Device: (DIPPER) GRAB PERISTALTIC

*Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Date: 9/16/20

Location ID: WL8A

Sample Depth: 8 inches

Field Staff: AL

Duplicate or MS/MSD Taken: □ Yes ☒ No

Fall Seasonal Sample □ Yes ☒ No

Corresponding species sample(s) and ID(s)?

2 Forage Fish

Are there corresponding sediment and porewater samples? Sample IDs?

No

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample? No

Other details (describe foam here if observed):

N/A

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point: 3 feet

Surface water estimated width at sample location (feet): N/A

Sample location relative to channel bottom and distance from bank: 2 feet south of bank

Flow Speed (circle): (NO) LOW L-M MODERATE M-H HIGH

Ripples from wind (East 5-10 mph)

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID: N/A

Temperature (°C): N/A 19.69 pH: [redacted] 8.30

Temp corr cond (umhos/cm): N/A 0.386 Dissolved Oxygen: N/A 9.67 ORP: 240

SAMPLES COLLECTED

SAMPLE ID: WL8A-WAT-MID-01-091620 Time: 1715

SAMPLE ID (if multiple water or foam): N/A Time:

DUP SAMPLE ID (if applicable): N/A Time:

MS/MSD SAMPLE ID (if applicable): N/A Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
✓				✓ PFAS - Filtered	ALS
✓				✓ PFAS - Unfiltered	ALS
✓				✓ TOC	Pace
✓				✓ DOC	Pace
				QUAL (if seasonal)	Pace
				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

☒ Picture of Sample Location (**required**) ☒ GPS'd Amanda Phone

Location of photos: Amanda phone □ Foam Observed

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle): Northend

Date:

CREEK/CHANNEL (POND) LAKE

Location ID: WL8A

BANK WETLAND BEACH OTHER

Field Staff: CK/IAL

Sampling Device (circle): SHOVEL (AUGER) GRAB

Sample Depth: 0-6 inches

Porewater Device (if appl): SED POINT (PUSH POINT)

Duplicate or MS/MSD Taken: ~~☐ Yes~~ ☐ No

What is the corresponding species sample and ID? CRAY WL8A-CRAY-01-092120 for porewater

Is there a corresponding water sample? Sample ID? WL8A-WAT-BULK-01-_____?

Is there a corresponding **porewater** sample? Sample ID? WL8A-POWAT-01-092220

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake): bank at west entrance trap about 4 feet south of bank

Surface water estimated depth (in/ft) and width (if applic.): 10" deep

Soil Description (primary, secondary, moist, color, odor, organic content): 60% clay, 25% med to coarse sand, 5% fine gravel, 5% silt, 5% organic (roots)

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:

Temperature (°C): 16.89 pH: 7.66 ORP: 31.2

Temp corr cond (umhos/cm): 0.430 Dissolved Oxygen: 6.53

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:

Temperature (°C): 19.04 pH: 6.55 ORP: -71.4

Temp corr cond (umhos/cm): 0.573 Dissolved Oxygen: 1.79 OR:

SAMPLES COLLECTED

SAMPLE ID: WL8A-SED-0-6-01-092220 Time: 1045

POREWATER SAMPLE ID (if applicable): WL8A-POWAT-01-092220 Time: 1030

DUP SAMPLE ID (if applicable): WL8A-POWAT-02-092220 Time: 1035

MS/MSD SAMPLE ID (if applicable): WL8A-POWAT-03-092220 Time: 1040

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
✓	POWAT	POWAT	✓	PFAS (both)	ALS
✓				TOC (sed only)	Pace
				CEC (sed only)	MVTL
			✓	DOC (porewater only)	Pace

Sample Checklist

☐ Picture of Sample Location (**required**) Amanda ☐ Picture of sediment Amanda

Location of photos: ☐ GPS'd Amanda

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO ~~SEDIMENT~~ SAMPLE FORM

Location of Sample Collection (circle): WATER	Date: 9/21/20 @ 17:10pm
CREEK/CHANNEL POND LAKE	Location ID: WL10-WAT-BULK-01-092120
BANK WETLAND BEACH OTHER	Field Staff: RF CK
Sampling Device (circle): SHOVEL AUGER GRAB	Sample Depth: Surface water
Porewater Device (if appl): SED POINT PUSH POINT	Duplicate or MS/MSD Taken: ☐ Yes ☒ No

What is the corresponding species sample and ID?

No

Is there a corresponding water sample? Sample ID?

~~No~~ THIS IS A SURFACE WATER SAMPLE

Is there a corresponding **porewater** sample? Sample ID? No

1 of 10

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):

central channel

Surface water estimated depth (in/ft) and width (if applicable): 12IN, 12FT WIDE

Soil Description (primary, secondary, moist, color, odor, organic content):

N/A

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:			
Temperature (°C): 18.36 °C	pH: 7.66		
Temp corr cond (umhos/cm): 429	Dissolved Oxygen: 7.44	ORP: 70.8	

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:		
Temperature (°C):	pH:	
Temp corr cond (umhos/cm):	Dissolved Oxygen:	ORP:

SAMPLES COLLECTED

SAMPLE ID:	**Time:**
POREWATER SAMPLE ID (if applicable):	**Time:**
DUP SAMPLE ID (if applicable):	**Time:**
MS/MSD SAMPLE ID (if applicable):	**Time:**

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
✓				PFAS (both)	ALS
				TOC (sed only)	Pace
				CEC (sed only)	MVTL
				DOC (porewater only)	Pace

Sample Checklist

☐ Picture of Sample Location (**required**) ☐ Picture of sediment

Location of photos: ☐ GPS'd

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):
CREEK/CHANNEL POND LAKE
BANK WETLAND BEACH OTHER

Date: 9/22/20
Location ID: WL10
Field Staff: CK AL
Sampling Device (circle): SHOVEL AUGER GRAB
Sample Depth: 6 inches
Porewater Device (if appl): ~~SED POINT~~ PUSH POINT
Duplicate or MS/MSD Taken: ☐ Yes ☒ No

What is the corresponding species sample and ID?
WL10-CRAY-01-092120

Is there a corresponding water sample? Sample ID?
WL10-WAT-BULK-01-092120

Is there a corresponding porewater sample? Sample ID?
~~WL10-POWAT-01-20~~ Not possible

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):

Surface water estimated depth (in/ft) and width (if applicable):

Soil Description (primary, secondary, moist, color, odor, organic content):
0-1.5: ~~sandy~~ gravelly sand (80% sand, M-C, 20% fine g
1.5-6: clay with fine sand (15% sand)

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:
Temperature (°C): 18.04 pH: 7.30
Temp corr cond (umhos/cm): 422 Dissolved Oxygen: 5.98 ORP: 47.6

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID: N/A
Temperature (°C): pH:
Temp corr cond (umhos/cm): Dissolved Oxygen: ORP:

SAMPLES COLLECTED

SAMPLE ID: WL10-SED-0-6-01-092220 Time: 1235
POREWATER SAMPLE ID (if applicable): Time:
DUP SAMPLE ID (if applicable): Time:
MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
✓				PFAS (both)	ALS
✓				TOC (sed only)	Pace
✓				CEC (sed only)	MVTL
				DOC (porewater only)	Pace

Sample Checklist
☒ Picture of Sample Location (required) Amanda ☐ Picture of sediment
Location of photos: ☐ GPS'd

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):
CREEK/CHANNEL POND LAKE
BANK WETLAND BEACH OTHER

Date: 9/22/20
Location ID: WL10A
Field Staff: CK, AL
Sampling Device (circle): SHOVEL (AUGER) GRAB
Sample Depth: 0-6 inches
Porewater Device (if appl): SED POINT (PUSH POINT)
Duplicate or MS/MSD Taken: ☐ Yes ☒ No

What is the corresponding species sample and ID?
WL10A-CRAY-01-092120

Is there a corresponding water sample? Sample ID?
WL10-WAT-BULK-01-092120 (10 will cover 10A)

Is there a corresponding porewater sample? Sample ID?
~~WL10-WAT-BULK-01-092120~~

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):
~20 feet southeast of foot bridge, taken from east bank (We fa from n east ban

Surface water estimated depth (in/ft) and width (if applicable): 1 foot deep

Soil Description (primary, secondary, moist, color, odor, organic content):
0-1.5": muck sand (70%) 30% fine gravel
1.5-6": clay with fine sand (15% sand)

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:
Temperature (°C): 18.30 pH: 7.61
Temp corr cond (umhos/cm): 0.430 Dissolved Oxygen: 9.30 ORP: 61.9

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:
Temperature (°C): 18.59 pH: 7.36
Temp corr cond (umhos/cm): 0.428 Dissolved Oxygen: 6.15 ORP: 38.8

SAMPLES COLLECTED

SAMPLE ID: WL10A-SED-0-6-01-092220 Time: 1345
POREWATER SAMPLE ID (if applicable): WL10A-SED-0-6-01-092220 Time: 1325
DUP SAMPLE ID (if applicable): Time:
MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
				PFAS (both)	ALS
				TOC (sed only)	Pace
				CEC (sed only)	MVTL
				DOC (porewater only)	Pace

Sample Checklist
☐ Picture of Sample Location (**required**)
Location of photos:
☐ Picture of sediment
☐ GPS'd

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):
~~CREEK/CHANNEL~~ ~~POND~~ LAKE
BANK WETLAND BEACH OTHER

Sampling Device (circle): SHOVEL AUGER GRAB

Porewater Device (if appl): SED POINT PUSH POINT

Date: 9/22/20

Location ID: WL11

Field Staff: CK/AL

Sample Depth: PW: 4-5 inches, SED: 6 inc

Duplicate or MS/MSD Taken: ☐ Yes ☑ No

What is the corresponding species sample and ID?
~~Crabs~~ WL11-CRAY-01-092120

Is there a corresponding water sample? Sample ID?
WL11-WAT-BULK-01-09_22

Is there a corresponding **porewater** sample? Sample ID?
WL11-POWAT-01-092220

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):
~200 feet north of bridge

Surface water estimated depth (in/ft) and width (if applicable):

Soil Description (primary, secondary, moist, color, odor, organic content):
Top 4.5", f→c sand (70%), 20% gravel, 10% silt
Bottom (-2", sandy (m→c) clay (70% clay, 30% sand)

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:
Temperature (°C): 17.97 pH: 7.45
Temp corr cond (umhos/cm): 0.430 Dissolved Oxygen: 10.62 ORP: ~~-53.8~~

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:
Temperature (°C): 17.94 pH: ~~6.99~~ 6.95
Temp corr cond (umhos/cm): 0.430 Dissolved Oxygen: 3.31 ORP: ~~-11.9~~

SAMPLES COLLECTED

SAMPLE ID: WL11-SED-0-6-01-092220 Time: 1200
POREWATER SAMPLE ID (if applicable): WL11-POWAT-01-092220 Time: 1210
~~DUP SAMPLE ID (if applicable):~~ WL11-WAT-BULK-01-092220 Time: 1205
MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
				PFAS (both)	ALS
				TOC (sed only)	Pace
				CEC (sed only)	MVTL
				DOC (porewater only)	Pace

Sample Checklist
☑ Picture of Sample Location (**required**) Amanda ☐ Picture of sediment
Location of photos: ☑ GPS'd

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SURFACE WATER SAMPLE FORM

Location Type:

BANK/SHORE (IN WATER BODY) WETLANDS

CREEK/CHANNEL CENTER CREEK/CHANNEL BANK

Sampling Type: BULK (MID) BOT

Sampling Device: DIPPER (GRAB) PERISTALTIC

*Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Date: 9/14/20

Location ID: WL21

Sample Depth: 18 inches

Field Staff: AS/HT/KR

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

Fall Seasonal Sample ☒ Yes ☐ No

Corresponding species sample(s) and ID(s)?

Are there corresponding sediment and porewater samples? Sample IDs?

No

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample?

No

Other details (describe foam here if observed):

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point: unknown

Surface water estimated width at sample location (feet): ~~WAST~~ middle of narrow channel ~50 feet from south east side

Sample location relative to channel bottom and distance from bank:

Flow Speed (circle): (NO) LOW L-M MODERATE M-H HIGH

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID:

Temperature (°C): 20.02 pH: 8.36

Temp corr cond (umhos/cm): 425 Dissolved Oxygen: 9.42 ORP: 857

SAMPLES COLLECTED

SAMPLE ID: WL21-WAT-MID-01-091620 **Time:** 1610

SAMPLE ID (if multiple water or foam): **Time:**

DUP SAMPLE ID (if applicable): **Time:**

MS/MSD SAMPLE ID (if applicable): **Time:**

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
✓				PFAS - Filtered	ALS
✓				PFAS - Unfiltered	ALS
✓				TOC	Pace
✓				DOC	Pace
✓				QUAL (if seasonal)	Pace
				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist collected QUAL, An/Cat on 9/24 at 13:10

☐ Picture of Sample Location (**required**) Hanna ☐ GPS'd

Location of photos: ☐ Foam Observed

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):
(CREEK/CHANNEL) POND LAKE
(BANK) WETLAND BEACH OTHER

Date: 9/25/20
Location ID: WL13
Field Staff: HT/AL/MD

Sampling Device (circle): SHOVEL (AUGER) GRAB
Sample Depth: 0-6
Porewater Device (if appl): SED POINT (PUSH POINT)
Duplicate or MS/MSD Taken: ☐ Yes ☒ No

What is the corresponding species sample and ID?
crayfish & frog?

Is there a corresponding water sample? Sample ID?
WL13-WAT-MID-01- taken during fish sampling

Is there a corresponding **porewater** sample? Sample ID?
WL13-POWAT-01-092520

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):
About 4 inches from water edge

Surface water estimated depth (in/ft) and width (if applicable): 4 inches

Soil Description (primary, secondary, moist, color, odor, organic content):
Top 2 inches- sandy clay (65% low plasticity clay, 20% m-c sand) 10% organics (grass/roots)
Bottom 4 inches- 50% m-c sand, 15% fine gravel, 15% clay, 10% fine sand
porewater prom ~5 inches b/c hit refusal 20% fine silt

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:
Temperature (°C): 18.79 pH: 5.95
Temp corr cond (umhos/cm): 382 Dissolved Oxygen: 8.50 ORP: 137.0

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:
Temperature (°C): 18.40 pH: 6.82
Temp corr cond (umhos/cm): 386 Dissolved Oxygen: 3.97 ORP: -22.5

SAMPLES COLLECTED

SAMPLE ID: WL13-SED-0-6-01-092520 Time: 9:00
POREWATER SAMPLE ID (if applicable): WL13-POWAT-01-092520 Time: 8:50
DUP SAMPLE ID (if applicable): Time:
MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
X			X-filtered	PFAS (both)	ALS
X				TOC (sed only)	Pace
X				CEC (sed only)	MVTL
			X	DOC (porewater only)	Pace

Sample Checklist
☒ Picture of Sample Location (**required**) ☐ Picture of sediment
Location of photos: HT ☐ GPS'd

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

ECO SURFACE WATER SAMPLE FORM

Location Type: channel

BANK/SHORE (IN WATER BODY) WETLANDS

(CREEK/CHANNEL CENTER) CREEK/CHANNEL BANK

Sampling Type: BULK (MID) BOT

Sampling Device: DIPPER (GRAB) PERISTALTIC

*Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Date: 9/16/20

Location ID: WL14

Sample Depth: 18 inches

Field Staff: HT, JK, AS

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

Fall Seasonal Sample ☐ Yes ☒ No

Corresponding species sample(s) and ID(s)?

Are there corresponding sediment and porewater samples? Sample IDs?

no sediment

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample?

Other details (describe foam here if observed):

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point: 3 feet

Surface water estimated width at sample location (feet):

Sample location relative to channel bottom and distance from bank:

Flow Speed (circle): NO LOW (L-M) MODERATE M-H HIGH

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID:

Temperature (°C): 20.20 pH: 8.51

Temp corr cond (umhos/cm): 421 Dissolved Oxygen: 10.42 ORP: 94.5mV

SAMPLES COLLECTED

SAMPLE ID: WL14-WAT-MID-01-091520 **Time:** 1600

SAMPLE ID (if multiple water or foam): **Time:**

DUP SAMPLE ID (if applicable): **Time:**

MS/MSD SAMPLE ID (if applicable): **Time:**

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
✓				PFAS - Filtered	ALS
✓				PFAS - Unfiltered	ALS
✓				TOC	Pace
✓				DOC	Pace
				QUAL (if seasonal)	Pace
				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

☐ Picture of Sample Location (**required**) Hanna ☐ GPS'd

Location of photos: ☐ Foam Observed

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

ECO SURFACE WATER SAMPLE FORM

Location Type:

BANK/SHORE | IN WATER BODY | WETLANDS

CREEK/CHANNEL CENTER | CREEK/CHANNEL BANK

Sampling Type: BULK | MID | BOT

Sampling Device: DIPPER | GRAB | PERISTALTIC

*Note if a "stand alone" fall sample, field quality parameters do not need to be collected

Date: 9/16/20

Location ID: WL15

Sample Depth: MID 15 inches

Field Staff: HT, AS, IK

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

Fall Seasonal Sample ☒ Yes ☐ No

Corresponding species sample(s) and ID(s)?

Are there corresponding sediment and porewater samples? Sample IDs?

NO

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample?

fall + eco

Other details (describe foam here if observed):

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point: 3 Feet

Surface water estimated width at sample location (feet): 20 feet

Sample location relative to channel bottom and distance from bank:

Flow Speed (circle): NO | LOW | L-M | MODERATE | M-H | HIGH

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID:

Temperature (°C): 20.22 pH: 8.46

Temp corr cond (umhos/cm): 421 Dissolved Oxygen: 10.14 ORP: 104.2 mV

SAMPLES COLLECTED

SAMPLE ID: WL15-WAT-MID-01-091620 **Time:** 1530

SAMPLE ID (if multiple water or foam): **Time:**

DUP SAMPLE ID (if applicable): **Time:**

MS/MSD SAMPLE ID (if applicable): **Time:**

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
X				PFAS - Filtered	ALS
X				PFAS - Unfiltered	ALS
X				TOC	Pace
X				DOC	Pace
X				QUAL (if seasonal)	Pace
X				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

☐ Picture of Sample Location (**required**) Hanna ☐ GPS'd

Location of photos: ☐ Foam Observed No

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

ECO SURFACE WATER SAMPLE FORM

Location Type:

BANK/SHORE ~~IN WATER BODY~~ WETLANDS

CREEK/CHANNEL CENTER CREEK/CHANNEL BANK

Sampling Type: BULK MID BOT

Sampling Device: DIPPER GRAB PERISTALTIC

**Note if a "stand alone" fall sample, field quality parameters do not need to be collected*

Date: 9/16/20

Location ID: WL1SA

Sample Depth: 18 inches

Field Staff: HT, KR, AS

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

Fall Seasonal Sample ☐ Yes ☒ No

Corresponding species sample(s) and ID(s)?

Are there corresponding sediment and porewater samples? Sample IDs?

NO

Is this coincident with a fall seasonal sample or a standalone fall seasonal sample?

Other details (describe foam here if observed):

SAMPLE POINT CONDITIONS

Surface water estimated depth (inches) at sample point: more than 6 feet

Surface water estimated width at sample location (feet): 8

Sample location relative to channel bottom and distance from bank:

Flow Speed (circle): NO LOW L-M MODERATE M-H HIGH

FIELD WATER QUALITY PARAMETERS

YSI/Hanna SN or other ID:

Temperature (°C): 19.95 pH: 8.49

Temp corr cond (umhos/cm): 420 Dissolved Oxygen: 10.70 ORP: 98.3 mV

SAMPLES COLLECTED

SAMPLE ID: WL1SA-WAT-MID-01-091620 **Time:** 1545

SAMPLE ID (if multiple water or foam): **Time:**

DUP SAMPLE ID (if applicable): **Time:**

MS/MSD SAMPLE ID (if applicable): **Time:**

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Add'l Depth or Seasonal (indicate)	Analysis	Lab
✓				PFAS - Filtered	ALS
✓				PFAS - Unfiltered	ALS
✓				TOC	Pace
✓				DOC	Pace
				QUAL (if seasonal)	Pace
				ANIONS & CATIONS (if seasonal)	Pace

Sample Checklist

☒ Picture of Sample Location (**required**) Amanda ☐ GPS'd

Location of photos: ☐ Foam Observed

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: WAT

Depth/Secondary Sample Type: BULK (water from creeks/channels or less than 3 feet deep), MID (middle - lakes/ponds), BOT (bottom - lakes/ponds)

Examples: EP3-WAT-MID-01-0922220; EP9A-WAT-BOT-01-092220; RC3-WAT-BULK-01-092220

ECO SEDIMENT SAMPLE FORM

Location of Sample Collection (circle):

CREEK/CHANNEL POND (LAKE)

BANK WETLAND BEACH OTHER

Sampling Device (circle): SHOVEL (AUGER) GRAB

Porewater Device (if appl): SED POINT (PUSH POINT)

Date: 9/23/20

Location ID: WL16

Field Staff: RF CK

Sample Depth:

Duplicate or MS/MSD Taken: ☐ Yes ☒ No

What is the corresponding species sample and ID?

?

Is there a corresponding water sample? Sample ID?

WL16-WAT-BULK-01-092320

Is there a corresponding **porewater** sample? Sample ID?

WL16-POWAT-01-092320

SAMPLE POINT CONDITIONS

Location within water body and distance from bank (center of creek, bank, bottom of pond/lake):

EAST SIDE OF LAKE, @ UNKNOWN LAKE NAME

Surface water estimated depth (in/ft) and width (if applicable):

Soil Description (primary, secondary, moist, color, odor, organic content):

70% silt 10% organics 15% sand fine 5% clay

FIELD WATER QUALITY PARAMETERS - BULK WATER

YSI/Hanna SN or other ID:

Temperature (°C): 20.71 °C pH: 8.14

Temp corr cond (umhos/cm): 419 Dissolved Oxygen: 6.20 ORP: 9.4

FIELD WATER QUALITY PARAMETERS - PORE WATER (if applicable)

YSI/Hanna SN or other ID:

Temperature (°C): 22.77 pH: 6.95

Temp corr cond (umhos/cm): 421 Dissolved Oxygen: 3.56 ORP: -44.8

SAMPLES COLLECTED

SAMPLE ID: WL16-WAT-BULK-01-092320 Time: 1435

POREWATER SAMPLE ID (if applicable): WL16-POWAT-01-092320 Time: 1440

DUP SAMPLE ID (if applicable): WL16-SED-0-6-01-092320 Time: 1445

MS/MSD SAMPLE ID (if applicable): Time:

Planned Analysis (check if collected)

Primary	Dup	MS/MSD	Porewater	Analysis	Lab
			✓	PFAS (both)	ALS
				TOC (sed only)	Pace
				CEC (sed only)	MVTL
			✓	DOC (porewater only)	Pace

Sample Checklist

☐ Picture of Sample Location (**required**) ☐ Picture of sediment

Location of photos: ☐ GPS'd Amanda

Sample Naming Convention

LOCID-SAMPLETYPE-DEPTH/DETAILS-01-MMDDYY

Sample Type: SED, POWAT

Depth/Secondary Sample Type: sediment - depth in inches; porewater - none

Examples: WL11-SED-0-6-01-092220; WL17-POWAT-01-0922220

Appendix C

Data Validation Checklists and Qualifiers for the BERA Sampling Event

Appendix C-1

Abiotic Data - ALS-Kelso

MINNESOTA

Minnesota Department of Agriculture 651-201-6148
Minnesota Department of Health 651-201-5357
Minnesota Pollution Control Agency 651-757-2560

Laboratory data review checklist

Doc Type: Data Review

Instructions: The following is the informal checklist that should be used to review data for the Minnesota Department of Agriculture, Minnesota Pollution Control Agency, and Minnesota Department of Health. The information follows the general format of the National Functional Guidelines, which is the primary data review tool used in the U.S. Environmental Protection Agency's Contract Laboratory Program for Superfund analytical work. Refer to the appropriate guidance document for each agency for instructions.

Project information

Project name: Project 1007

Work order number/Lab report ID: K2008566 Report date (mm/dd/yyyy): 10/8/2020

Laboratory: ALS - Kelso, Washington Review date (mm/dd/yyyy): 11/22/2020

1. Chain of custody, preservation, and holding times

Questions			Yes	No	N/A	Comments
A.	Is there a chain of custody (COC) with the report?		☒	☐	☐	
B.	Is there a sample condition form with the report?		☒	☐	☐	Receipt form indicated a trip blank was received but not listed on the COC (results were not reported for the trip blank in this SDG - see SDG K2008577). COCs listed many water samples that are not reported in this SDG. Receipt form discusses issues with water samples (2 listed on COC were not received, and two additional samples were received that were not listed on COC).
C.	Were there samples preserved according to program requirements?		☒	☐	☐	
D.	Were samples received in the correct containers?		☒	☐	☐	
	i.	Was there enough sample volume/weight to complete all requested analyses?	☒	☐	☐	
	ii.	Was there enough sample collected to complete required batch QC?	☒	☐	☐	
E.	Were samples received within holding time for sample prep for all requested analyses?		☒	☐	☐	
F.	Are there notes about sample condition or holding time issues on the COC? Explain the data impact.		☐	☒	☐	

G.	Are there narration or data qualifiers with the report about sample condition or holding time issues? Explain the data impact.	☐	☒	☐	
H.	Are lab IDs cross-referenced correctly with the field IDs.	☒	☐	☐	Yes, but no sample summary table included in the report.

2. Calibration

Question		Yes	No	N/A	Comments
A.	Do the report narrative or data qualifiers indicate calibration problems for any analyses? If yes, explain the data impact.	☒	☐	☐	MN limits used during review. See data qualification summary for exceedances and qualifications.

3. Blanks

Question			Yes	No	N/A	Comments
A.	Do any of the analyses contain samples for field or trip blanks?		☒	☐	☐	Trip blank reported in K2008577
	i.	If yes, are there target analytes present above the reporting limit in the blanks?	☐	☒	☐	The trip blank was nondetect.
	ii.	If yes, are the same compounds also present in the samples? Explain possible data impact.	☐	☐	☒	
B.	Do method blanks for any analyses contain target analytes above the reporting limit?		☐	☒	☐	Detects were below the RL: PFOA 0.16 J ng/g
	i.	If yes, are the same compounds present in the samples?	☒	☐	☐	
	ii.	Is the amount of target analyte in the method blank more than 1/10th of that in the sample(s)? Explain the possible impact on sample results.	☒	☐	☐	See data qualification summary for associated samples and qualifications.
C.	Do instrument blanks contain analytes above the reporting limit?		☐	☒	☐	Detects were below the RL. See data qualification summary for calibration blank detects and qualifications.

4. Surrogates or organic analysis

Question			Yes	No	N/A	Comments
A.	Are the lab recovery limits for surrogates specified on the report?		☒	☐	☐	MPCA limits used: 50% to 200%
B.	Are the surrogates outside lab QC limits? (These should have a data qualifier.)		☐	☒	☐	
	i.	If yes, are the surrogates above the lab QC limits?	☐	☐	☒	
	ii.	Below the lab QC limits?	☐	☐	☒	

	iii.	Were the affected samples re-analyzed? Discuss in the case narrative.	☐	☐	☒	
	iv.	Explain what this could mean for the affected samples. Include in narrative.	☐	☐	☒	

5. Laboratory control sample/Laboratory control sample duplicate (LCS/LCSD)

Question			Yes	No	N/A	Comments
A.	Are there LCS/LCSD samples present for the reporting analyses?		☒	☐	☐	
B.	Are there LCS/LCSD compounds outside lab limits? If the LCS/LCSD fails, the LCS/LCSD and samples must be re-analyzed.		☐	☒	☐	MPCA PFAS sed/other limits used: 50% to 150%.
	i.	If yes, are there compounds above the lab QC limits? If yes, an explanation is required. Include in narrative.	☐	☐	☒	
	ii.	Below the QC limits? If yes, an explanation is required. Include in narrative.	☐	☐	☒	

6. Matrix spike/Matrix spike duplicate/Sample duplicate (MS/MSD/DUP)

Question				Yes	No	N/A	Comments
A.	Do the analytical methods used require an MS and/or MSD? If no, skip to 6.B.			☒	☐	☐	
	i.	Have the required matrix spikes been prepared and reported?		☐	☒	☐	None for this SDG
	ii.	If no, is there and explanation in the report as to why?		☐	☒	☐	
	iii.	Did the lab process an alternate spiked sample (such as LCSD) instead?		☒	☐	☐	Laboratory duplicate
	iv.	Are the lab QC limits specified on the report?		☒	☐	☐	
	v.	Are there compounds outside the lab QC limits?		☐	☐	☒	
	vi.	If yes, did the lab re-run an MS/MSD?		☐	☐	☒	
		1.	Did the re-run MS/MSD pass? Discuss the case narrative.	☐	☐	☒	
		2.	Did the re-run MS/MSD fail? Discuss the case narrative.	☐	☐	☒	
		3.	Is the source sample also flagged for MS/MSD compounds outside the lab QC limits?	☐	☐	☒	
B.	Was a duplicate sample submitted for the analytical method(s)?			☒	☐	☐	Laboratory duplicate FDs: RC22-SED-0-6-01-091820/RC22-SED-0-6-02-091820

	i.	Is the Relative Percentage Difference (RPD) within 20%* for the duplicate pair? If no, explain possible causes and data impact. **Other RPDs may be acceptable. Check with regulatory agency.*	☒	☐	☐	50% RPD limit for PFAS (sed). RPDs ok

7. Method detection limits/Report limits

Question		Yes	No	N/A	Comments
A.	Are reporting limits clearly listed on the report for all analyses?	☒	☐	☐	
B.	Do the reporting limits meet the program required limits listed? If not, an explanation is required.	☐	☒	☐	Results for 11Cl-PF3OUdS, 9Cl-PF3ONS and ADONA were nondetect and reported to the RL, while other PFAS compound were reported to the method detection limit (MDL).

8. Sample information

Questions		Yes	No	N/A	Comments
A.	Are sample numbers cross-referenced correctly with the associated QC?	☒	☐	☐	
B.	Are soil samples reported in dry weight basis?	☒	☐	☐	
C.	Are percent moisture results reported?	☒	☐	☐	
D.	Are positive detections reported?	☒	☐	☐	
E.	Are sample analytes appropriately flagged if the QC failed?	☒	☐	☐	

9. Report narrative

Question		Yes	No	N/A	Comments
A.	Is a narrative provided with the laboratory report which describes all problems with the analyses and all corrective actions taken to address these problems?	☒	☐	☐	

10. Additional comments about the lab report

Reviewed using MPCA Guidance on Perfluorochemicals Analysis (July 2020).

See attachedment for qualification.

Certification

By typing my name below, I certify the above statements to be true and correct, to the best of my knowledge, and that this information can be used for the purpose of processing this form.

Authorized Representative

Name: Lisa Smith Title: Environmental Chemist (CEAC)

(This document has been electronically signed.) Date (mm/dd/yyyy): 11/22/2020

Data Validation Qualifications for K2008566

Calibration (Section 2): Calibration noncompliances and the results qualified are summarized below.

Calibration (Date)	Analyte	%D or %R	Limit	Qualifiers
ICV KC2000521-08 (9/29/20)	EtFOSAA	36.4 %D	±30 %D	Associated results were qualified as estimated (UJ and J): RC7-SED-0-6-01-092120 (K2008566-001) EP19-SED-0-6-01-092020 (K2008566-005) EP27C-SED-0-6-01-091520 (K2008566-006) EP26A-SED-0-6-01-091720 (K2008566-007) RC16A-SED-0-6-01-092120 (K2008566-008) RC18-SED-0-6-01-091720 (K2008566-009) WL5-SED-0-6-01-091720 (K2008566-011) RC7-SED-0-6-01-092020 (K2008566-013)
ICV KC2000533-08 (9/29/20)	11Cl-PF3OUdS	38.22 %D	±30 %D	Associated results were nondetect and qualified as estimated (UJ): All samples were associated with this ICV.
CCV KC2000531 (10/6/2020) 698188	PFOA	151%	70-130%	No results reported from this CCV.

Method blank and instrument blank detections (Section 3Bii and C): Detects within 10 times the blank concentrations were qualified B.

Blank Sample ID	Analyte	Concentration (ng/g)	Results Qualified B
Method Blank KQ2014193-05	PFOA	0.16 J	RC7-SED-0-6-01-092120 (K2008566-001) RC3A-SED-0-6-01-092020 (K2008566-002) RC4A-SED-0-6-01-091820 (K2008566-003) RC5A-SED-0-6-01-091820 (K2008566-004) EP19-SED-0-6-01-092020 (K2008566-005) EP26A-SED-0-6-01-091720 (K2008566-007) RC16A-SED-0-6-01-092120 (K2008566-008) RC18-SED-0-6-01-091720 (K2008566-009) WL5-SED-0-6-01-091720 (K2008566-011) RC7-SED-0-6-01-092020 (K2008566-013) RC22-SED-0-6-01-091820 (K2008566-014)
CCB 9/30/20 20:25	PFPeA	0.31 J	RC7-SED-0-6-01-092120 (K2008566-001) RC5A-SED-0-6-01-091820 (K2008566-004) EP27C-SED-0-6-01-091520 (K2008566-006) RC6A-SED-0-6-02-092120091820 (K2008566-015)
	PFOA	0.25 J	RC7-SED-0-6-01-092120 (K2008566-001) RC3A-SED-0-6-01-092020 (K2008566-002) RC4A-SED-0-6-01-091820 (K2008566-003) RC5A-SED-0-6-01-091820 (K2008566-004) EP19-SED-0-6-01-092020 (K2008566-005) EP26A-SED-0-6-01-091720 (K2008566-007) RC16A-SED-0-6-01-092120 (K2008566-008) RC18-SED-0-6-01-091720 (K2008566-009)

Blank Sample ID	Analyte	Concentration (ng/g)	Results Qualified B
			WL5-SED-0-6-01-091720 (K2008566-011) RC7-SED-0-6-01-092020 (K2008566-013) RC22-SED-0-6-01-091820 (K2008566-014)
	PFNA	0.36 J	RC3A-SED-0-6-01-092020 (K2008566-002) RC4A-SED-0-6-01-091820 (K2008566-003) EP27C-SED-0-6-01-091520 (K2008566-006) RC6A-SED-0-6-01-092120 (K2008566-012) RC22-SED-0-6-01-091820 (K2008566-014)
	PFDA	0.27 J	EP1A-SED-0-6-01-091520 (K2008566-010) EP27C-SED-0-6-01-091520 (K2008566-006) RC6A-SED-0-6-01-092120 (K2008566-012) RC22-SED-0-6-01-091820 (K2008566-014) RC6A-SED-0-6-02-092120 (K2008566-015)
	PFTeDA	0.29 J	RC3A-SED-0-6-01-092020 (K2008566-002) RC4A-SED-0-6-01-091820 (K2008566-003) RC5A-SED-0-6-01-091820 (K2008566-004) EP27C-SED-0-6-01-091520 (K2008566-006) EP26A-SED-0-6-01-091720 (K2008566-007) RC16A-SED-0-6-01-092120 (K2008566-008) RC18-SED-0-6-01-091720 (K2008566-009) EP1A-SED-0-6-01-091520 (K2008566-010) WL5-SED-0-6-01-091720 (K2008566-011) RC7-SED-0-6-01-092020 (K2008566-013)

MINNESOTA

Laboratory data review checklist

Minnesota Department of Agriculture 651-201-6148
Minnesota Department of Health 651-201-5357
Minnesota Pollution Control Agency 651-757-2560

Doc Type: Data Review

Instructions: The following is the informal checklist that should be used to review data for the Minnesota Department of Agriculture, Minnesota Pollution Control Agency, and Minnesota Department of Health. The information follows the general format of the National Functional Guidelines, which is the primary data review tool used in the U.S. Environmental Protection Agency's Contract Laboratory Program for Superfund analytical work. Refer to the appropriate guidance document for each agency for instructions.

Project information

Project name: Project 1007

Work order number/Lab report ID: K2008577 Report date (mm/dd/yyyy): 10/27/2020

Laboratory: ALS - Kelso, Washington Review date (mm/dd/yyyy): 11/22/2020

1. Chain of custody, preservation, and holding times

Questions			Yes	No	N/A	Comments
A.	Is there a chain of custody (COC) with the report?		☒	☐	☐	
B.	Is there a sample condition form with the report?		☒	☐	☐	Receipt form indicated a trip blank was received but not listed on the COC.
C.	Were there samples preserved according to program requirements?		☒	☐	☐	
D.	Were samples received in the correct containers?		☒	☐	☐	
	i.	Was there enough sample volume/weight to complete all requested analyses?	☒	☐	☐	
	ii.	Was there enough sample collected to complete required batch QC?	☒	☐	☐	
E.	Were samples received within holding time for sample prep for all requested analyses?		☒	☐	☐	
F.	Are there notes about sample condition or holding time issues on the COC? Explain the data impact.		☒	☐	☐	Sample WL5-POWAT-01-091720 (K2008577-006) was re-extracted 21 days over hold time. See data qualification summary for qualifications.
G.	Are there narration or data qualifiers with the report about sample condition or holding time issues? Explain the data impact.		☐	☒	☐	
H.	Are lab IDs cross-referenced correctly with the field IDs.		☐	☒	☐	No sample summary table included in the report.

					The lab report for the long list of PFAS analytes lists the field ID for sample K2008577-005 as B3-WAT-BULK-02-091620 rather than what is on the COC (B3-WAT-BULK-01-091620).

2. Calibration

Question		Yes	No	N/A	Comments
A.	Do the report narrative or data qualifiers indicate calibration problems for any analyses? If yes, explain the data impact.	☒	☐	☐	MN limits used for review. See data qualification summary for exceedances and qualifications.

3. Blanks

Question			Yes	No	N/A	Comments
A.	Do any of the analyses contain samples for field or trip blanks?		☒	☐	☐	Trip blank reported
	i.	If yes, are there target analytes present above the reporting limit in the blanks?	☐	☒	☐	The trip blank was nondetect.
	ii.	If yes, are the same compounds also present in the samples? Explain possible data impact.	☐	☐	☒	
B.	Do method blanks for any analyses contain target analytes above the reporting limit?		☐	☒	☐	Blank detects were below the RL.
	i.	If yes, are the same compounds present in the samples?	☒	☐	☐	
	ii.	Is the amount of target analyte in the method blank more than 1/10th of that in the sample(s)? Explain the possible impact on sample results.	☒	☐	☐	See data qualification summary for summary of detects and qualifications.
C.	Do instrument blanks contain analytes above the reporting limit?		☐	☒	☐	Detects were below the RL. See data qualification summary for calibration blank detects and qualifications.

4. Surrogates or organic analysis

Question			Yes	No	N/A	Comments
A.	Are the lab recovery limits for surrogates specified on the report?		☒	☐	☐	MPCA limits used: 50% to 200%
B.	Are the surrogates outside lab QC limits? (These should have a data qualifier.)		☒	☐	☐	
	i.	If yes, are the surrogates above the lab QC limits?	☒	☐	☐	
	ii.	Below the lab QC limits?	☒	☐	☐	

	iii.	Were the affected samples re-analyzed? Discuss in the case narrative.	☐	☒	☐	
	iv.	Explain what this could mean for the affected samples. Include in narrative.	☒	☐	☐	See data qualification summary for summary of qualifications. Two results rejected due to severly low labeled analog recoveries.

5. Laboratory control sample/Laboratory control sample duplicate (LCS/LCSD)

Question			Yes	No	N/A	Comments
A.	Are there LCS/LCSD samples present for the reporting analyses?		☒	☐	☐	
B.	Are there LCS/LCSD compounds outside lab limits? If the LCS/LCSD fails, the LCS/LCSD and samples must be re-analyzed.		☒	☐	☐	MPCA PFAS water limits used: 70% to 130%.
	i.	If yes, are there compounds above the lab QC limits? If yes, an explanation is required. Include in narrative.	☒	☐	☐	
	ii.	Below the QC limits? If yes, an explanation is required. Include in narrative.	☒	☐	☐	See data qualification summary for summary of exceedances and qualifications.

6. Matrix spike/Matrix spike duplicate/Sample duplicate (MS/MSD/DUP)

Question				Yes	No	N/A	Comments
A.	Do the analytical methods used require an MS and/or MSD? If no, skip to 6.B.			☒	☐	☐	
	i.	Have the required matrix spikes been prepared and reported?		☐	☒	☐	None for this SDG
	ii.	If no, is there and explanation in the report as to why?		☐	☒	☐	
	iii.	Did the lab process an alternate spiked sample (such as LCSD) instead?		☒	☐	☐	LCSDs
	iv.	Are the lab QC limits specified on the report?		☒	☐	☐	
	v.	Are there compounds outside the lab QC limits?		☐	☐	☒	
	vi.	If yes, did the lab re-run an MS/MSD?		☐	☐	☒	
		1.	Did the re-run MS/MSD pass? Discuss the case narrative.	☐	☐	☒	
		2.	Did the re-run MS/MSD fail? Discuss the case narrative.	☐	☐	☒	
		3.	Is the source sample also flagged for MS/MSD compounds outside the lab QC limits?	☐	☐	☒	
B.	Was a duplicate sample submitted for the analytical method(s)?			☒	☐	☐	LCSD

	i.	Is the Relative Percentage Difference (RPD) within 20%* for the duplicate pair? If no, explain possible causes and data impact. **Other RPDs may be acceptable. Check with regulatory agency.*	☐	☒	☐	30% limit for PFAS (water). KQ2014877-01/KQ2014877-02: PFHpS 41% RPD The associated result was nondetect. No qualifiers.

7. Method detection limits/Report limits

Question		Yes	No	N/A	Comments
A.	Are reporting limits clearly listed on the report for all analyses?	☒	☐	☐	
B.	Do the reporting limits meet the program required limits listed? If not, an explanation is required.	☐	☒	☐	Results for 11Cl-PF3OUdS, 9Cl-PF3ONS and ADONA were nondetect and reported to the RL, while other PFAS compound were reported to the method detection limit (MDL).

8. Sample information

Questions		Yes	No	N/A	Comments
A.	Are sample numbers cross-referenced correctly with the associated QC?	☒	☐	☐	
B.	Are soil samples reported in dry weight basis?	☐	☐	☒	
C.	Are percent moisture results reported?	☐	☐	☒	
D.	Are positive detections reported?	☒	☐	☐	
E.	Are sample analytes appropriately flagged if the QC failed?	☒	☐	☐	

9. Report narrative

Question		Yes	No	N/A	Comments
A.	Is a narrative provided with the laboratory report which describes all problems with the analyses and all corrective actions taken to address these problems?	☒	☐	☐	

10. Additional comments about the lab report

Reviewed using MPCA Guidance on Perfluorochemicals Analysis (July 2020).

See attachedment for qualification.

Two results rejected due to severly low labeled analog recoveries.

Certification

By typing my name below, I certify the above statements to be true and correct, to the best of my knowledge, and that this information can be used for the purpose of processing this form.

Authorized Representative

Name: Lisa Smith Title: Environmental Chemist (CEAC)

(This document has been electronically signed.) Date (mm/dd/yyyy): 11/23/2020

Data Validation Qualifications for K2008577

Holding Times (Section 1F): Sample WL5-POWAT-01-091720 (K2008577-006) was re-extracted 21 days over hold time. Associated results (EtFOSA, EtFOSAA, MeFOSAA, PFDS, and PFTrDA) were nondetect and qualified UJ.

Calibration (Section 2): Calibration noncompliances and the results qualified are summarized below.

Calibration (Date)	Analyte	%D or %R	Limit	Qualifiers
CCV K2008577 (10/06/20 19:30) 698188	PFOA	151 %R	70-130%	Results not reported from this CCV.
CCV KC2000531 (10/6/20 23:25) 698189	PFBS	139 %R	70-130%	J+: BPI-WAT-MID-01-091920
	PFOA	145 %R	70-130%	
	PFTrDA	136 %R	70-130%	
	PFTeDA	170 %R	70-130%	
	NMeFOSE	267 %R	70-130%	Associated results were nondetect and were acceptable without qualification.
	NEtFOSE	292 %R	70-130%	
	6:2 FTS	134 %R	70-130%	
CCV KC2000537 (10/07/20 05:53) 698190	11Cl-PF3OUdS	132 %R	70-130%	Associated results were nondetect and were acceptable without qualification.
CCV KC2000572 (10/23/20 5:52) 700485	PFTeDA	142 %R	70-130%	Results not reported from this CCV.
	EtFOSA	143 %R	70-130%	Associated results were nondetect and were acceptable without qualification.
	NEtFOSE	185 %R	70-130%	

Method blank and instrument blank detections (Section 3Bii and C): Detects within 10 times the blank concentrations were qualified B.

Method Blank ID	Prep Date	Compound	Blank Concentration (ng/L)	Results Qualified B
KQ2014290-03	9/29/2020 15:17	MeFOSA	0.51 J	Associated results were nondetect.
		PFDoDA	1.4 J	WL5-POWAT-01-091720 (K2008577-006)
		PFTeDA	2.6 J	WL5-POWAT-01-091720 (K2008577-006) VB3-WAT-BULK-02-091620 (K2008577-005)
		PFTrDA	3.6 J	
KQ2014429-03	10/1/2020 7:40	MeFOSA	0.75 J	BPI-WAT-MID-01-091920 (K2008577-003)
		PFTeDA	3.7 J	
		PFBS	0.3 J	Associated results were greater than 10 times the blank value. No qualifiers.
		EtFOSA	0.38 J	Associated results were nondetect.
		N-EtFOSE	0.93 J	
		N-MeFOSE	1.1 J	
KQ2014877-03	10/7/2020 7:56	PFBA	0.53 J	Associated results were greater than 10 times the blank value. No qualifiers.
KQ2016108-03	10/22/2020 8:46	N-EtFOSE	0.18 J	No associated results.
		MeFOSA	0.62 J	
		PFOA	0.99 J	

CCB Blank ID	Date/Time	Compound	Blank Concentration (ng/L)	Results Qualified B
KQ2014730-02	10/5/20 21:16	MeFOSA	0.77 J	EP24-WAT-BULK-01-091620 (K2008577-004)
		EtFOSA	0.40 J	Associated results were nondetect.
KQ2014843-02	10/6/20 23:36	PFHpA	0.66 J	BPI-WAT-MID-01-091920 (K2008577-003)
		PFTeDA	3.1 J	
		MeFOSA	0.58 J	
KQ2015031-02	10/8/20 10:29	PFHpA	0.67 J	RC21-WAT-BULK-01-092120 (K2008577-007) RC14-WAT-BULK-01-092120 (K2008577-009) RC13-WAT-BULK-01-092120 (K2008577-011) RC18A-WAT-BULK-01-092120 (K2008577-013)
		MeFOSA	0.62 J	Associated results were nondetect.
		EtFOSAA	0.92 J	WL10-WAT-BULK-01-092120 (K2008577-016)
KQ2015034-02	10/8/20 21:12	MeFOSA	0.63 J	Associated results were nondetect.
		EtFOSA	0.38 J	
		N-EtFOSE	0.18 J	
KQ2015208-02	10/9/20 15:39	MeFOSA	0.68 J	Associated results were nondetect.
KQ2016092-02	10/20/20 13:59	PFOA	0.37 J	No associated results.
KQ2016454-02	10/23/20 06:03	PFOS	0.57 J	No associated results.
		PFOA	0.62 J	No associated results.

Labeled Analogs - surrogates (Section 4Bii): Results associated with low recoveries were qualified as estimated (UJ and J+), as these labeled analogs are used to quantitate the analyte of interest and an inverse relationship exists. Two results were rejected (R) due to severely low recoveries.

Sample ID	Lab ID	Labeled Analog	% Recovery (Limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
BPI-WAT-MID-02-091920	K2008577-001	13C2-4:2 FTS	248	No qualifier
		13C2-PFTeDA	40	UJ
BPI-WAT-MID-01-091920	K2008577-002	13C2-4:2 FTS	305	No qualifier
		13C2-6:2 FTS	250	No qualifier
		13C2-PFTeDA	49	UJ
BPI-WAT-MID-01-091920	K2008577-003	13C2-4:2 FTS	246	No qualifier
		D9-EtFOSE	37	UJ
EP24-WAT-BULK-01-091620	K2008577-004	13C2-4:2 FTS	274	No qualifier
		13C2-6:2 FTS	201	No qualifier
VB3-WAT-BULK-02-091620	K2008577-005	13C2-PFDoDA	44	UJ
		13C2-PFTeDA	5	R
		D3-MeFOSA	40	UJ
		D3-MeFOSAA	36	UJ
		D5-EfFOSAA	33	UJ

Sample ID	Lab ID	Labeled Analog	% Recovery (Limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
		D5-EtFOSA	27	UJ
		D7-MeFOSE	42	UJ
		D9-EtFOSE	25	UJ
WL5-POWAT-01-091720	K2008577-006	13C2-PFDoDA	37	J+
		13C2-PFTeDA	3	R
		D3-MeFOSA	46	UJ
		D3-MeFOSAA	31	UJ
		D5-EfFOSAA	25	UJ
		D7-MeFOSE	44	UJ
		D9-EtFOSE	30	UJ
RC21-WAT-BULK-01-092120	K2008577-007	13C2-4:2 FTS	238	No qualifier
		13C2-6:2 FTS	212	No qualifier
		13C2-PFTeDA	33	UJ
RC21-WAT-BULK-01-092120	K2008577-008	13C2-PFTeDA	45	UJ
RC14-WAT-BULK-01-092120	K2008577-009	13C2-4:2 FTS	251	No qualifier
		13C2-6:2 FTS	249	No qualifier
		13C2-PFTeDA	36	UJ
RC14-WAT-BULK-01-092120	K2008577-010	13C2-PFTeDA	45	UJ
RC13-WAT-BULK-01-092120	K2008577-011	13C2-4:2 FTS	288	No qualifier
		13C2-6:2 FTS	232	No qualifier
		13C2-PFTeDA	37	UJ
RC13-WAT-BULK-01-092120	K2008577-012	13C2-PFTeDA	45	UJ
RC18A-WAT-BULK-01-092120	K2008577-013	13C2-4:2 FTS	222	No qualifier
		13C2-6:2 FTS	220	No qualifier
		13C2-PFTeDA	45	UJ
WL10-WAT-BULK-01-092120	K2008577-017	13C2-PFTeDA	44	UJ

Laboratory control sample/Laboratory control sample duplicate (Section 5Bii): Results associated with low recoveries were nondetect and qualified as estimated (UJ) and detects associated with high recoveries were qualified as J+:

LCS/LCSD IDs (Batch)	Compound	LCS % Recovery	Recovery Limits	Qualifiers
KQ2014290-01/ KQ2014290-02 (698190)	11Cl-PF3OUdS	73/**68**	70-130	Associated results were nondetect and qualified UJ: VB3-WAT-BULK-02-091620 (K2008577-005) WL5-POWAT-01-091720 (K2008577-006)
KQ2014290-01/ KQ2014290-02 (699134)	MeFOSAA	122/**132**	70-130	Associated results were nondetect. No qualifiers.
	PFDoDA	**146/133**	70-130	J+: WL5-POWAT-01-091720 (K2008577-006)
	PFUnDA	126/**131**	70-130	
	PFPeS	**143**/125	70-130	J+: VB3-WAT-BULK-02-091620 (K2008577-005) WL5-POWAT-01-091720 (K2008577-006)

LCS/LCSD IDs (Batch)	Compound	LCS % Recovery	Recovery Limits	Qualifiers
KQ2014290-01/ KQ2014290-02 (699503)	PFDS	**67/58**	70-130	Associated results were nondetect and qualified UJ: VB3-WAT-BULK-02-091620 (K2008577-005) WL5-POWAT-01-091720 (K2008577-006)
	PFTrDA	**148/157**	70-130	J+: VB3-WAT-BULK-02-091620 (K2008577-005) WL5-POWAT-01-091720 (K2008577-006)
KQ2014429-01/ KQ2014429-02 (698189)	4:2 FTS	**137**/120	70-130	Associated results were nondetect. No qualifiers.
	6:2 FTS	**138**/125	70-130	
	PFBA	**134**/130	70-130	J+: BPI-WAT-MID-01-091920 (K2008577-003)
KQ2014429-01/ KQ2014429-02 (699503)	PFPeS	**166/153**	70-130	Associated results were nondetect. No qualifiers.
	PFTrDA	**139**/109	70-130	J+: BPI-WAT-MID-01-091920 (K2008577-003)
KQ2016108-01/ KQ2016108-02 (700485)	EtFOSA	**154/145**	70-130	Associated results were nondetect. No qualifiers.
	NEtFOSE	**187/226**	70-130	
	NMeFOSE	**137/153**	70-130	
	PFTeDA	**134**/124	70-130	J+: WL5-POWAT-01-091720 (K2008577-006)
KQ2014635-01/ KQ2014635-02	11Cl-PF3OUdS	**143/142**	70-130	Associated results were nondetect. No qualifiers.
	PFDoA	129/**149**	70-130	
	PFHpS	**132/136**	70-130	J+: WL10-WAT-BULK-01-092120 (K2008577-017)
	PFPeS	**146/141**	70-130	J+: RC17-POWAT-01-092120 (K2008577-015) WL10-WAT-BULK-01-092120 (K2008577-017)
	PFOS	127/**132**	70-130	J+: RC21-WAT-BULK-01-092120 (K2008577-008) RC14-WAT-BULK-01-092120 (K2008577-010) RC13-WAT-BULK-01-092120 (K2008577-012) RC18A-WAT-BULK-01-092120 (K2008577-014) RC17-POWAT-01-092120 (K2008577-015) WL10-WAT-BULK-01-092120 (K2008577-017)
KQ2014877-01/ KQ2014877-02	11Cl-PF3OUdS	**138/147**	70-130	Associated results were nondetect. No qualifiers.
	PFHxS	119/**137**	70-130	
	PFNS	**136/139**	70-130	
	PFPeS	**135**/114	70-130	
KQ2014524-01/ KQ2014524-01 (698467)	PFPeS	130/**133**	70-130	J+: RC13-WAT-BULK-01-092120-U (K2008577-011) RC18A-WAT-BULK-01-092120-U (K2008577-013)

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Data Validation Report

Project:	MCPA – Project 1007
Laboratory:	ALS – Kelso, Washington
Work Order (WO):	K2008578
Analyses/Method:	Polyfluorinated Alkyl Substances (PFASs)/PFAS by HPLC/MS/MS
Validation Level:	Stage 4 for 100% of samples
Prepared by:	Lisa Smith (CEAC) Completed on: 11/20/2020

The samples listed below were collected by AECOM at the Project 1007 Site on September 16 through 20, 2020.

Sample ID	Quality Control	Sample Date	Laboratory ID
RC3-WAT-BULK-01-091620-U		9/16/2020	K2008578-001
RC3-WAT-BULK-02-091620-U	Field Duplicate	9/16/2020	K2008578-002
RC3A-WAT-BULK-01-091920-U		9/19/2020	K2008578-003
RC3A-WAT-BULK-01-091920-F		9/19/2020	K2008578-004
RC3A-POWAT-01-092020-F		9/20/2020	K2008578-005
RC4A-WAT-BULK-01-091820-U		9/18/2020	K2008578-606
RC4A-WAT-BULK-01-091820-F		9/18/2020	K2008578-007
RC4A-POWAT-01-091820-F		9/18/2020	K2008578-008
RC5A-BULK-WAT-01-091820-U		9/18/2020	K2008578-009
RC5A-BULK-WAT-01-091820-F		9/18/2020	K2008578-010
RC5A-POWAT-01-0-6-01-091820		9/16/2020	K2008578-011
RC3-WAT-BULK-03-091620	Field Triplicate; MS/MSD	9/16/2020	K2008578-012
Field QC Samples:			
TRIP BLANK 1	Trip Blank	9/16/2020	K2008578-013
TRIP BLANK 2	Trip Blank	9/16/2020	K2008578-014

Data validation activities were conducted with reference to:

- Guidance for Perfluorochemicals Analysis, Minnesota Pollution Control Agency (MPCA), July 2020.
- Data Validation Guidelines Module 3: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by QSM Table B-15, May 1, 2020.

Control limits noted for this review were those from the MPCA Guidance for Perfluorochemicals Analysis, July 2020 and were used to evaluate whether quality control criteria were met.

REVIEW ELEMENTS

The data were evaluated based on the following parameters (where applicable to the method):

✓	Data completeness (chain-of-custody (COC)/sample integrity
✓	Sample Receipt and Holding times
✗	Initial calibration/continuing calibration verification
✗	Laboratory and field blanks
✗	Labeled Analogs (Surrogates)
✓	Internal Standards
✗	Matrix spike (MS) and/or matrix spike duplicate (MSD) results
✗	Laboratory control sample (LCS)
✗	Field duplicates
✓	Quantitation and Result Verifications

The symbol (✓) indicates that no validation qualifiers were applied based on this parameter. The symbol (✗) indicates that a QC nonconformance resulted in the qualification of data. Any QC nonconformance that resulted in the qualification of data is discussed below. In addition, nonconformances or other issues that were noted during validation, but did not result in qualification of data, may be discussed for informational purposes only.

SUMMARY

Based on the results of the validation, the data are valid as reported and may be used for decision making purposes. Data qualifications were required as listed in Table 1. Results reported below the reporting limit (RL) were qualified as estimated (J) by the laboratory; qualifications of these results were accepted by the validator, but are not shown in Table 1.

DETAILED REVIEW

Data Completeness

The analytical data package was verified as complete, with the exception that raw instrument printouts were not provided for the initial calibrations. Summary forms were reviewed.

Sample Receipt and Holding Times

Samples were received at the laboratory intact and within the temperature requirement of <6 °C. Two trip blanks were received; however, were not listed on the chain of custody (COC).

Samples were extracted within the 14-day holding time, and analyzed within 28 days of extraction, with the exception of sample RC5A-POWAT-01-0-6-01-091820-F (K2008578-011). The sample was re-extracted 22 days over hold time. Associated detects (PFDS) were qualified as estimated biased low (J-) and nondetects (EtFOSA, EtFOSAA, MeFOSAA, PFTeDA, and PFTrDA) were qualified UJ.

Calibration

Initial calibrations (ICALs) for the target compounds were performed using linear calibrations. Relative standard deviations (RSDs) were within 20% and correlation coefficients were within the criteria of ≥ 0.99.

Initial and continuing calibration verifications (ICVs and CCVs) were performed at the correct frequency, ICVs were within ±30 % Difference (%D) and CCVs were within the criteria of 70-130% recovery, except as listed in the table below.

Calibration (Date)	Analyte	%D or %R	Limit	Qualifiers
ICV KC2000521-08 (9/29/20)	EtFOSAA	36.4 %D	±30 %D	EtFOSAA results not reported from this ICV.
ICV KC2000533-08 (9/29/20)	11Cl-PF3OUdS	38.22 %D	±30 %D	Associated results were nondetect and qualified as estimated (UJ): RC3-WAT-BULK-01-091620 (K2008578-001) RC3-WAT-BULK-02-091620 (K2008578-002) RC3-WAT-BULK-03-091620 (K2008578-012)
CCV KC2000521 (10/1/2020) 697611	8:2 FTS	138 %R	70-130%	Associated results were nondetect. No qualifiers.
CCV KC2000531 (10/6/20) 698189	PFBS	139 %R	70-130%	Associated detects were qualified as estimated biased high (J+): RC3A-WAT-BULK-01-091920 RC4A-POWAT-01-091820 RC5A-BULK-WAT-01-091820
	PFOA	145 %R	70-130%	
	PFTrDA	136 %R	70-130%	
	PFTeDA	170 %R	70-130%	
	NMeFOSE	267 %R	70-130%	
	NEtFOSE	292 %R	70-130%	
	6:2 FTS	134 %R	70-130%	
CCV KC2000572 (10/23/20) 700485	PFTeDA	142 %R	70-130%	Associated results were nondetect. No qualifiers.
	EtFOSA	143 %R	70-130%	
	NEtFOSE	185 %R	70-130%	
CCV KC2000572 (10/28/20) 701226	NEtFOSE	133 %R	70-130%	Associated results were nondetect. No qualifiers.
CCV KC2000537 (10/7/20 5:53) 698190	11Cl-PF3OUdS	132 %R	70-130%	Associated results were nondetect. No qualifiers.

One ICV and CCV were recalculated for PFOS during the validation. Results reported are verified to be correct.

Laboratory and Field Blanks

Method blanks were analyzed to assess laboratory contamination. Target analytes were not detected in method blanks, with the exception of those listed in the table below. Results within 10 times the blank concentration were qualified B.

Method Blank ID	Prep Date	Compound	Blank Concentration (ng/L)	Qualifiers
KQ2014249-04	9/29/2020 9:47	6:2 FTS	4.3 J	Results qualified B: RC3-WAT-BULK-01-091620 (K2008578-001) RC3-WAT-BULK-02-091620 (K2008578-002) RC3-WAT-BULK-03-091620 (K2008578-012)
		8:2 FTS	0.16 J	Associated results were nondetect.
KQ2014290-03	9/29/2020 15:17	MeFOSA	0.51 J	Results qualified B: C5A-POWAT-01-0-6-01-091820 (K2008578-011)
		PFDoDA	1.4 J	
		PFTeDA	2.6 J	No associated results.
		PFTrDA	3.6 J	
KQ2014429-03	10/1/2020 7:40	MeFOSA	0.75 J	Results qualified B: RC4A-WAT-BULK-01-091820 (K2008578-007)
		PFTeDA	3.7 J	Results qualified B: RC5A-BULK-WAT-01-091820 (K2008578-010) RC4A-POWAT-01-091820 (K2008578-008) RC3A-WAT-BULK-01-091920 (K2008578-004)
		PFBS	0.3 J	Associated results were greater than 10 times the blank value. No qualifiers.
		EtFOSA	0.38 J	Associated results were nondetect.
		N-EtFOSE	0.93 J	
		N-MeFOSE	1.1 J	
KQ2014435-03	10/1/2020 9:03	N-EtFOSAA	1.3 J	RC3A-WAT-BULK-01-091920 (K2008578-003)
		PFHpA	0.96 J	Associated results were greater than 10 times the blank value. No qualifiers.
		N-EtFOSE	0.16 J	Associated results were nondetect.
		PFTrDA	1.4 J	
KQ2014516-03	10/2/2020 7:03	PFBA	0.53 J	Associated results were greater than 10 times the blank value. No qualifiers.
		PFHpA	0.73 J	
		MeFOSA	0.71 J	Associated results were nondetect.
KQ2016108-03	10/22/2020 8:46	N-EtFOSE	0.18 J	Associated results were nondetect.
		MeFOSA	0.62 J	No associated results.
		PFOA	0.99 J	

Continuing calibration blanks (CCBs) were analyzed after the CCVs. CCB detections along with data qualifiers are listed below.

CCB Blank ID	Date/Time	Compound	Blank Concentration (ng/L)	Qualifiers
KQ2014505-02	10/1/20 18:11	EtFOSA	0.60 J	Results qualified B: RC3-WAT-BULK-03-091620 (K2008578-012)
KQ2014704-02	10/2/20 14:32	PFOA	0.36 J	Associated results were greater than 10 times the blank value. No qualifiers.
KQ2014730-02	10/5/20 21:16	MeFOSA	0.77 J	Associated results were nondetect.
		EtFOSA	0.40 J	Associated results were nondetect.
KQ2014843-02	10/6/20 23:36	PFHpA	0.66 J	Associated results were greater than 10 times the blank value. No qualifiers.

CCB Blank ID	Date/Time	Compound	Blank Concentration (ng/L)	Qualifiers
		PFTeDA	3.1 J	Associated detects previous qualified due to method blanks.
		MeFOSA	0.58 J	Associated results were nondetect.
KQ2015031-02	10/8/20 10:29	PFHpA	0.67 J	Associated results were greater than 10 times the blank value. No qualifiers.
		MeFOSA	0.62 J	Associated results were nondetect.
		EtFOSAA	0.92 J	Associated results were greater than 10 times the blank value. No qualifiers.
KQ2016454-02	10/23/20 06:03	PFOS	0.57 J	No associated results.
		PFOA	0.62 J	No associated results.
KQ2016704-02	10/28/20 16:44	PFOA	0.44 J	No associated results.

Two trip blanks were associated with this sample group. The trip blanks were nondetect, with the exception of Trip Blank 2 which had a PFHpA detection of 0.96 J ng/L. PFHpA sample concentrations were greater than 10 times the blank concentration and were acceptable without qualification.

Labeled Analogs

Labeled analogs are spiked into all field samples, field QC samples, and method QC samples and are used during quantitation and to evaluate accuracy. Recoveries (%Rs) were within acceptable MPCA limits of 50% to 200%, with the exception of samples listed below. Results associated with low recoveries were qualified as estimated (UJ and J+), as these labeled analogs are used to quantitate the analyte of interest and an inverse relationship exists. Results qualified are also listed below.

Sample ID	Lab ID	Labeled Analog	% Recovery (Limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
RC3-WAT-BULK-01-091620	K2008578-001	D5-EtFOSAA	45	J+
RC3A-WAT-BULK-01-091920	K2008578-004	13C2-PFTeDA	38	J+
		13C3-PFBS	45	J+
		D9-EtFOSE	36	UJ
RC4A-WAT-BULK-01-091820	K2008578-006	13C2-4:2 FTS	241	No qualifier
RC4A-WAT-BULK-01-091820	K2008578-007	13C3-HFPO-DA	49	UJ
RC4A-POWAT-01-091820	K2008578-008	13C2-PFTeDA	44	J+
		13C3-PFBS	47	J+
		D7-MeFOSE	46	UJ
		D9-EtFOSE	33	UJ
RC5A-BULK-WAT-01-091820	K2008578-010	13C2-4:2 FTS	205	No qualifier
		13C3-PFBS	47	J+
		D9-EtFOSE	37	J+
RC5A-POWAT-01-0-6-01-091820	K2008578-011	13C2-PFDoDA	37	J+
		13C2-PFTeDA	38	UJ
		D3-MeFOSA	49	J+
		D3-MeFOSAA	29	UJ
		D5-EtFOSAA	22	J+

Sample ID	Lab ID	Labeled Analog	% Recovery (Limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
		D9-EtFOSE	31	UJ

Internal Standards

The recoveries for the internal standard 13C7-PFUnDA were within acceptable MPCA limits of 50% to 150%.

MS/MSD Results

Additional sample volume was provided for an MS/MSD for sample RC3-WAT-BULK-03-091620-U. MS/MSD recoveries and RPDs were within the MPCA control limits, and were acceptable except as noted in the table below.

Compound	MS/MSD % Recovery	Recovery Limits	Qualifiers
RC3-WAT-BULK-03-091620-U:			
6:2 FTS	**-160/-135**	70-130	The detects for this sample (and the associated field duplicates) were qualified as estimated biased low (J-): RC3-WAT-BULK-01-091620-U RC3-WAT-BULK-02-091620-U RC3-WAT-BULK-03-091620-U
PFHxS	**36/59**	70-130	
PFHpS	**42/57**	70-130	
EtFOSAA	110/**131**	70-130	The detects for this sample (and the associated field duplicates) were qualified as estimated biased high (J+): RC3-WAT-BULK-01-091620-U RC3-WAT-BULK-02-091620-U RC3-WAT-BULK-03-091620-U
PFBA	**-45/32**	70-130	The sample concentration was greater than 4 times the spike concentration. No qualifiers.
PFOA	**-141/-110**	70-130	
PFOS	**-537**/71	70-130	

LCS Results

LCSs are analyzed to monitor the accuracy of the analytical method independent of matrix effects. Laboratory control sample duplicates (LCSDs) results were provided to assess laboratory precision. The LCS/LCSD %Rs and RPDs were within the MPCA limits except as listed below.

LCS/LCSD IDs (Batch)	Compound	LCS % Recovery	Recovery Limits	Qualifiers
KQ2014249-03 (697611)	8:2 FTS	**132/--**	70-130	Associated results were nondetect. No qualifiers.
	PFDS	**61/--**	70-130	Not associated with results reported.

LCS/LCSD IDs (Batch)	Compound	LCS % Recovery	Recovery Limits	Qualifiers
	PFNS	**68/--**	70-130	UJ/J- RC3-WAT-BULK-01-091620 RC3-WAT-BULK-02-091620 RC3-WAT-BULK-03-091620
KQ2014249-03 698697	6:2 FTS	**184/--**	70-130	J+ RC3-WAT-BULK-01-091620 RC3-WAT-BULK-02-091620 RC3-WAT-BULK-03-091620
KQ2014290-01/ KQ2014290-02 (698190)	11Cl-PF3OUdS	73/**68**	70-130	The associated result was previously qualified due to an ICV exceedance. No further qualifiers.
KQ2014290-01/ KQ2014290-02 (699134)	MeFOSAA	122/**132**	70-130	Associated results were nondetect. No qualifiers.
	PFDoDA	**146/133**	70-130	J+: RC5A-POWAT-01-0-6-01-091820
	PFPeS	**143**/125	70-130	
	PFUnDA	126/**131**	70-130	
KQ2014290-01/ KQ2014290-02 (699503)	PFDS	**67/58**	70-130	Not associated with results reported.
	PFTrDA	**148/157**	70-130	
KQ2014429-01/ KQ2014429-02 (698189)	4:2 FTS	**137**/120	70-130	Associated results were nondetect. No qualifiers.
	6:2 FTS	**138**/125	70-130	J+: RC4A-POWAT-01-091820 RC5A-BULK-WAT-01-091820
	PFBA	**134**/130	70-130	J+: RC3A-WAT-BULK-01-091920 RC4A-WAT-BULK-01-091820 RC4A-POWAT-01-091820 RC5A-BULK-WAT-01-091820
KQ2014429-01/ KQ2014429-02 (699503)	PFPeS	**166/153**	70-130	J+: RC3A-WAT-BULK-01-091920 RC4A-POWAT-01-091820 RC5A-BULK-WAT-01-091820 RC4A-WAT-BULK-01-091820
	PFTrDA	**139**/109	70-130	J+: RC3A-WAT-BULK-01-091920 RC4A-POWAT-01-091820 RC5A-BULK-WAT-01-091820
KQ2016108-01/ KQ2016108-02 (700485)	EtFOSA	**154/145**	70-130	Associated results were nondetect. No qualifiers.
	NEtFOSE	**187/226**	70-130	
	NMeFOSE	**137/153**	70-130	
	PFTeDA	**134**/124	70-130	
KQ2014516-01/ KQ2014516-02 (698467)	10:2 FTS	120/**178**	70-130	Associated results were nondetect. No qualifiers.
	PFPeS	119/**145**	70-130	J+: RC3A-POWAT-01-092020
KQ2014524-01/ KQ2014524-01 (698467)	PFPeS	130/**133**	70-130	J+: RC4A-WAT-BULK-01-091820 RC5A-BULK-WAT-01-091820

Field Duplicate Results

Field duplicates are collected to assess the overall precision of field sampling and laboratory analysis. Samples RC3-WAT-BULK-02-091620-U and RC3-WAT-BULK-03-091620-U were collected as duplicates of RC3-WAT-BULK-01-091620-U. RPDs for the field duplicates were within the 30 percent limit for water sample, or were within ± 2 times the RL, with the exception of those indicated in bold in the table below. Results associated with field imprecision were qualified as estimated (J).

Analyte	Parent Sample Result (ng/L)	Field Duplicate Result (ng/L)	Triplicate Result (ng/L)	RPD (%)
RC3-WAT-BULK-01-091620-U/RC3-WAT-BULK-02-091620-U/RC3-WAT-BULK-03-091620-U:				
6:2 FTS	29	25	68	**106**
EtFOSA	4.1 U	4.4 U	0.38 J	--
EtFOSAA	29	20	20	**39**
HFPO-DA	0.31 J	4.4 U	0.31 J	--
PFBA	310	290	280	10
PFBS	14	13	14	7.3
RLPFDA	8.4	6.9	7.4	20
PFDS	0.48 J	0.31 J	4.4 U	±RL
PFHpA	46	38	42	19
PFHpS	29	21	25	**32**
PFHxA	68	64	61	11
PFHxS	47	38	41	21
PFNA	6.7	5.2	7.1	30
PFNS	1.3 J	4.4 U	4.4 U	--
PFOA	510	460	460	10
PFOS	1500	1300	1300	15
PFOSA	19	14	16	**31**
PFPeA	24	22	22	8.8
PFPeS	19	14	16	31

Quantitation and Result Verifications

Raw data, including quantitation reports, mass abundance reports (and ion profiles), sample prep logs, and instrument run logs were review and results were accurately identified and quantitated, with no transcription errors. The raw data were reviewed and recalculated for PFOS. No anomalies were observed during the re-calculation and verification of the results. Re-calculations are included in Attachment A.

Multiple sample dilutions were performed due to high analyte concentrations. These results were reviewed, and results quantitated within the instrument calibration range and reported from the lowest dilution were generally selected for use.

Results for 11Cl-PF3OUdS, 9Cl-PF3ONS and ADONA were nondetect and reported to the RL, while other PFAS compound were reported to the method detection limit (MDL).

Quantitations were performed to include branched isomer where applicable. In addition, signal to noise ratios were greater than 10:1 for ions used for quantification.

Qualified Analytical Results

Data qualifications for reportable results are listed in Table 1. Results reported below the RL were qualified as estimated (J) by the laboratory; qualifications of these results were accepted by the Validator; however, are not listed in the table below.

Table 1 - Data Validation Summary of Qualified Data

Sample ID	Lab ID	Analyte	CAS Number	Sample Conc (ng/L)	Validation Qualifier (1)	Reason Code (2)
RC3-WAT-BULK-01-091620	K2008578-001	11Cl-PF3OUdS	763051-92-9	4.1	UJ	c
RC3-WAT-BULK-01-091620	K2008578-001	6:2 FTS	27619-97-2	29	BJ	fd,l,mb,ms
RC3-WAT-BULK-01-091620	K2008578-001	EtFOSAA	2991-50-6	29	J+	fd,ms,s
RC3-WAT-BULK-01-091620	K2008578-001	PFHpS	375-92-8	29	J-	fd,ms
RC3-WAT-BULK-01-091620	K2008578-001	PFHxS	355-46-4	47	J-	ms
RC3-WAT-BULK-01-091620	K2008578-001	PFNS	68259-12-1	1.3	J-	l
RC3-WAT-BULK-01-091620	K2008578-001	PFOSA	754-91-6	19	J	fd
RC3-WAT-BULK-02-091620	K2008578-002	11Cl-PF3OUdS	763051-92-9	4.4	UJ	c
RC3-WAT-BULK-02-091620	K2008578-002	6:2 FTS	27619-97-2	25	BJ	fd,l,mb,ms
RC3-WAT-BULK-02-091620	K2008578-002	EtFOSAA	2991-50-6	20	J+	fd,ms
RC3-WAT-BULK-02-091620	K2008578-002	PFHpS	375-92-8	21	J-	fd,ms
RC3-WAT-BULK-02-091620	K2008578-002	PFHxS	355-46-4	38	J-	ms
RC3-WAT-BULK-02-091620	K2008578-002	PFNS	68259-12-1	0.59	UJ	l
RC3-WAT-BULK-02-091620	K2008578-002	PFOSA	754-91-6	14	J	fd
RC3A-WAT-BULK-01-091920	K2008578-003	EtFOSAA	2991-50-6	10	B	mb
RC3A-WAT-BULK-01-091920	K2008578-004	NEtFOSE	1691-99-2	0.13	UJ	s
RC3A-WAT-BULK-01-091920	K2008578-004	PFBA	375-22-4	250	J+	l
RC3A-WAT-BULK-01-091920	K2008578-004	PFBS	375-73-5	11	J+	s
RC3A-WAT-BULK-01-091920	K2008578-004	PFOA	335-67-1	160	J+	c
RC3A-WAT-BULK-01-091920	K2008578-004	PFPeS	2706-91-4	15	J+	l
RC3A-WAT-BULK-01-091920	K2008578-004	PFTeDA	376-06-7	4.1	BJ+	c,cb,mb,s
RC3A-WAT-BULK-01-091920	K2008578-004	PFTrDA	72629-94-8	2.2	J+	c,l
RC3A-POWAT-01-092020	K2008578-005	PFPeS	2706-91-4	27	J+	l
RC4A-WAT-BULK-01-091820	K2008578-006	PFPeS	2706-91-4	41	J+	l
RC4A-WAT-BULK-01-091820	K2008578-007	11Cl-PF3OUdS	763051-92-9	4.1	UJ	c
RC4A-WAT-BULK-01-091820	K2008578-007	HFPO-DA	13252-13-6	0.29	UJ	s
RC4A-WAT-BULK-01-091820	K2008578-007	MeFOSA	31506-32-8	0.77	JB	mb
RC4A-WAT-BULK-01-091820	K2008578-007	PFBA	375-22-4	1100	J+	l
RC4A-WAT-BULK-01-091820	K2008578-007	PFPeS	2706-91-4	46	J+	l
RC4A-POWAT-01-091820	K2008578-008	6:2 FTS	27619-97-2	0.66	J+	c,l
RC4A-POWAT-01-091820	K2008578-008	NEtFOSE	1691-99-2	0.13	UJ	s
RC4A-POWAT-01-091820	K2008578-008	NMeFOSE	24448-09-7	0.3	UJ	s

Sample ID	Lab ID	Analyte	CAS Number	Sample Conc (ng/L)	Validation Qualifier [1]	Reason Code [2]
RC4A-POWAT-01-091820	K2008578-008	PFBA	375-22-4	860	J+	l
RC4A-POWAT-01-091820	K2008578-008	PFBS	375-73-5	25	J+	s
RC4A-POWAT-01-091820	K2008578-008	PFOA	335-67-1	540	J+	c
RC4A-POWAT-01-091820	K2008578-008	PFPeS	2706-91-4	44	J+	l
RC4A-POWAT-01-091820	K2008578-008	PFTeDA	376-06-7	4	BJ+	c,cb,mb,s
RC4A-POWAT-01-091820	K2008578-008	PFTrDA	72629-94-8	1.8	J+	c,l
RC5A-BULK-WAT-01-091820	K2008578-009	PFPeS	2706-91-4	43	J+	l
RC5A-BULK-WAT-01-091820	K2008578-010	6:2 FTS	27619-97-2	0.69	J+	c,l
RC5A-BULK-WAT-01-091820	K2008578-010	NEtFOSE	1691-99-2	0.3	J+	c,s
RC5A-BULK-WAT-01-091820	K2008578-010	PFBA	375-22-4	920	J+	l
RC5A-BULK-WAT-01-091820	K2008578-010	PFBS	375-73-5	28	J+	s
RC5A-BULK-WAT-01-091820	K2008578-010	PFOA	335-67-1	610	J+	c
RC5A-BULK-WAT-01-091820	K2008578-010	PFPeS	2706-91-4	46	J+	l
RC5A-BULK-WAT-01-091820	K2008578-010	PFTeDA	376-06-7	3.4	BJ+	c,cb,mb
RC5A-BULK-WAT-01-091820	K2008578-010	PFTrDA	72629-94-8	1.3	J+	c,l
RC5A-POWAT-01-0-6-01-091820	K2008578-011	EtFOSAA	2991-50-6	11	J+	s
RC5A-POWAT-01-0-6-01-091820	K2008578-011	EtFOSA	4151-50-2	0.27	UJ	h
RC5A-POWAT-01-0-6-01-091820	K2008578-011	MeFOSA	31506-32-8	0.59	BJ+	mb,s
RC5A-POWAT-01-0-6-01-091820	K2008578-011	MeFOSAA	2355-31-9	1.4	UJ	s
RC5A-POWAT-01-0-6-01-091820	K2008578-011	NEtFOSE	1691-99-2	0.13	UJ	h,s
RC5A-POWAT-01-0-6-01-091820	K2008578-011	NMeFOSE	24448-09-7	0.3	UJ	h
RC5A-POWAT-01-0-6-01-091820	K2008578-011	PFDoA	307-55-1	2.8	BJ+	l,mb,s
RC5A-POWAT-01-0-6-01-091820	K2008578-011	PFDS	335-77-3	0.51	J-	h
RC5A-POWAT-01-0-6-01-091820	K2008578-011	PFPeS	2706-91-4	23	J+	l
RC5A-POWAT-01-0-6-01-091820	K2008578-011	PFTeDA	376-06-7	2	UJ	h,s
RC5A-POWAT-01-0-6-01-091820	K2008578-011	PFTrDA	72629-94-8	1.3	UJ	h
RC5A-POWAT-01-0-6-01-091820	K2008578-011	PFUnA	2058-94-8	1.8	J+	l
RC3-WAT-BULK-03-091620	K2008578-012	11Cl-PF3OUdS	763051-92-9	4.4	UJ	c
RC3-WAT-BULK-03-091620	K2008578-012	6:2 FTS	27619-97-2	68	BJ	fd,l,mb,ms
RC3-WAT-BULK-03-091620	K2008578-012	EtFOSA	4151-50-2	0.38	JB	cb
RC3-WAT-BULK-03-091620	K2008578-012	EtFOSAA	2991-50-6	20	J+	fd,ms
RC3-WAT-BULK-03-091620	K2008578-012	PFHpS	375-92-8	25	J-	fd,ms

Sample ID	Lab ID	Analyte	CAS Number	Sample Conc (ng/L)	Validation Qualifier (1)	Reason Code (2)
RC3-WAT-BULK-03-091620	K2008578-012	PFHxS	355-46-4	41	J-	ms
RC3-WAT-BULK-03-091620	K2008578-012	PFNS	68259-12-1	0.59	UJ	l
RC3-WAT-BULK-03-091620	K2008578-012	PFOSA	754-91-6	16	J	fd

(1): Data Validation Qualifiers:

B	The analyte was detected in the sample at a concentration within ten times the blank concentration.
J	Estimated (+/- indicates high or low bias)
UJ	Estimated reporting limit

(2): Reason Codes:

c	Calibration
cb	Calibration blank
fd	Field duplicate
l	Laboratory control sample
mb	Method blank
ms	Matrix spike
s	Surrogate (labeled analog)

Attachment A

MINNESOTA

Minnesota Department of Agriculture 651-201-6148
Minnesota Department of Health 651-201-5357
Minnesota Pollution Control Agency 651-757-2560

Laboratory data review checklist

Doc Type: Data Review

Instructions: The following is the informal checklist that should be used to review data for the Minnesota Department of Agriculture, Minnesota Pollution Control Agency, and Minnesota Department of Health. The information follows the general format of the National Functional Guidelines, which is the primary data review tool used in the U.S. Environmental Protection Agency's Contract Laboratory Program for Superfund analytical work. Refer to the appropriate guidance document for each agency for instructions.

Project information

Project name: Project 1007

Work order number/Lab report ID: K2008579 Report date (mm/dd/yyyy): 10/28/2020

Laboratory: ALS - Kelso, Washington Review date (mm/dd/yyyy): 11/25/2020

1. Chain of custody, preservation, and holding times

Questions			Yes	No	N/A	Comments
A.	Is there a chain of custody (COC) with the report?		☒	☐	☐	
B.	Is there a sample condition form with the report?		☒	☐	☐	Receipt form indicated a trip blank was received but was not listed on the COC.
C.	Were there samples preserved according to program requirements?		☒	☐	☐	
D.	Were samples received in the correct containers?		☒	☐	☐	
	i.	Was there enough sample volume/weight to complete all requested analyses?	☒	☐	☐	
	ii.	Was there enough sample collected to complete required batch QC?	☒	☐	☐	
E.	Were samples received within holding time for sample prep for all requested analyses?		☒	☐	☐	
F.	Are there notes about sample condition or holding time issues on the COC? Explain the data impact.		☒	☐	☐	
G.	Are there narration or data qualifiers with the report about sample condition or holding time issues? Explain the data impact.		☒	☐	☐	Three samples were re-extracted 22 days over holding time. See data qualification summary for qualifications.
H.	Are lab IDs cross-referenced correctly with the field IDs.		☒	☐	☐	Yes, but no sample summary table included in the report.

2. Calibration

Question			Yes	No	N/A	Comments
A.	Do the report narrative or data qualifiers indicate calibration problems for any analyses? If yes, explain the data impact.		☒	☐	☐	MN limits used for review. See data qualification summary for exceedances and qualifications.

3. Blanks

Question			Yes	No	N/A	Comments
A.	Do any of the analyses contain samples for field or trip blanks?		☒	☐	☐	Trip blank reported
	i.	If yes, are there target analytes present above the reporting limit in the blanks?	☐	☒	☐	The trip blank was nondetect.
	ii.	If yes, are the same compounds also present in the samples? Explain possible data impact.	☐	☐	☒	
B.	Do method blanks for any analyses contain target analytes above the reporting limit?		☐	☒	☐	Blank detects were below the RL.
	i.	If yes, are the same compounds present in the samples?	☒	☐	☐	
	ii.	Is the amount of target analyte in the method blank more than 1/10th of that in the sample(s)? Explain the possible impact on sample results.	☒	☐	☐	See data qualification summary for summary of detects and qualifications.
C.	Do instrument blanks contain analytes above the reporting limit?		☐	☒	☐	Detects were below the RL. See data qualification summary for calibration blank detects and qualifications.

4. Surrogates or organic analysis

Question			Yes	No	N/A	Comments
A.	Are the lab recovery limits for surrogates specified on the report?		☒	☐	☐	MPCA limits used: 50% to 200%
B.	Are the surrogates outside lab QC limits? (These should have a data qualifier.)		☒	☐	☐	
	i.	If yes, are the surrogates above the lab QC limits?	☒	☐	☐	
	ii.	Below the lab QC limits?	☒	☐	☐	
	iii.	Were the affected samples re-analyzed? Discuss in the case narrative.	☐	☒	☐	
	iv.	Explain what this could mean for the affected samples. Include in narrative.	☒	☐	☐	See data qualification summary for summary of qualifications. Three results rejected due to severly low labeled analog recoveries.

5. Laboratory control sample/Laboratory control sample duplicate (LCS/LCSD)

Question			Yes	No	N/A	Comments
A.	Are there LCS/LCSD samples present for the reporting analyses?		☒	☐	☐	
B.	Are there LCS/LCSD compounds outside lab limits? If the LCS/LCSD fails, the LCS/LCSD and samples must be re-analyzed.		☒	☐	☐	MPCA PFAS water limits used: 70% to 130%.
	i.	If yes, are there compounds above the lab QC limits? If yes, an explanation is required. Include in narrative.	☒	☐	☐	
	ii.	Below the QC limits? If yes, an explanation is required. Include in narrative.	☒	☐	☐	See data qualification summary for summary of exceedances and qualifications.

6. Matrix spike/Matrix spike duplicate/Sample duplicate (MS/MSD/DUP)

Question				Yes	No	N/A	Comments
A.	Do the analytical methods used require an MS and/or MSD? If no, skip to 6.B.			☒	☐	☐	
	i.	Have the required matrix spikes been prepared and reported?		☒	☐	☐	EP9A-WAT-MID-03-091920-U (K2008579-008)
	ii.	If no, is there and explanation in the report as to why?		☐	☒	☐	
	iii.	Did the lab process an alternate spiked sample (such as LCSD) instead?		☒	☐	☐	LCSDs
	iv.	Are the lab QC limits specified on the report?		☒	☐	☐	
	v.	Are there compounds outside the lab QC limits?		☒	☐	☐	See data qualification summary for summary of exceedances and qualifications.
	vi.	If yes, did the lab re-run an MS/MSD?		☐	☒	☐	
		1.	Did the re-run MS/MSD pass? Discuss the case narrative.	☐	☐	☒	
		2.	Did the re-run MS/MSD fail? Discuss the case narrative.	☐	☐	☒	
		3.	Is the source sample also flagged for MS/MSD compounds outside the lab QC limits?	☐	☐	☒	
B.	Was a duplicate sample submitted for the analytical method(s)?			☒	☐	☐	LCSD; MSD FDs: EP9A-WAT-MID-01-091920/EP9A-WAT-MID-02-091920/EP9A-WAT-MID-03-091920
	i.	Is the Relative Percentage Difference (RPD) within 20%* for the duplicate pair? If no, explain possible causes and data impact. **Other RPDs may be acceptable. Check with regulatory agency.*		☐	☒	☐	30% limit for PFAS (water). MSD - RPDs ok LCSD and FD - See data qualification summary for summary of exceedances and qualifications.

7. Method detection limits/Report limits

Question		Yes	No	N/A	Comments
A.	Are reporting limits clearly listed on the report for all analyses?	☒	☐	☐	
B.	Do the reporting limits meet the program required limits listed? If not, an explanation is required.	☐	☒	☐	Results for 11Cl-PF3OUdS, 9Cl-PF3ONS and ADONA were nondetect and reported to the RL, while other PFAS compound were reported to the method detection limit (MDL).

8. Sample information

Questions		Yes	No	N/A	Comments
A.	Are sample numbers cross-referenced correctly with the associated QC?	☒	☐	☐	
B.	Are soil samples reported in dry weight basis?	☐	☐	☒	
C.	Are percent moisture results reported?	☐	☐	☒	
D.	Are positive detections reported?	☒	☐	☐	
E.	Are sample analytes appropriately flagged if the QC failed?	☒	☐	☐	

9. Report narrative

Question		Yes	No	N/A	Comments
A.	Is a narrative provided with the laboratory report which describes all problems with the analyses and all corrective actions taken to address these problems?	☒	☐	☐	Numerous issues discussed in case narrative.

10. Additional comments about the lab report

Reviewed using MPCA Guidance on Perfluorochemicals Analysis (July 2020).

See attachedment for qualification.

Three results rejected due to severly low labeled analog recoveries.

Certification

By typing my name below, I certify the above statements to be true and correct, to the best of my knowledge, and that this information can be used for the purpose of processing this form.

Authorized Representative

Name: Lisa Smith Title: Environmental Chemist (CEAC)

(This document has been electronically signed.) Date (mm/dd/yyyy): 11/25/2020

Data Validation Qualifications for K2008579

Holding Times (Section 1G): Three samples were re-extracted 22 days over hold time. The results reported from the re-extractions were nondetect and qualified UJ. The samples and analytes qualified are listed below.

Field Sample ID	Lab ID	Compounds
WL2-WAT-MID-01-091720	K2008579-013	EtFOSA
WL2-WAT-MID-01-091720	K2008579-013	NEtFOSE
WL2-WAT-MID-01-091720	K2008579-013	NMeFOSE
WL2-WAT-MID-01-091720	K2008579-013	PFDS
WL2-WAT-MID-01-091720	K2008579-013	PFTrDA
WL7-WAT-BULK-01-091720	K2008579-015	EtFOSA
WL7-WAT-BULK-01-091720	K2008579-015	NEtFOSE
WL7-WAT-BULK-01-091720	K2008579-015	NMeFOSE
WL7-WAT-BULK-01-091720	K2008579-015	PFDS
WL7-WAT-BULK-01-091720	K2008579-015	PFTrDA
WL5-WAT-MID-01-091720	K2008579-017	EtFOSA
WL5-WAT-MID-01-091720	K2008579-017	NEtFOSE
WL5-WAT-MID-01-091720	K2008579-017	NMeFOSE
WL5-WAT-MID-01-091720	K2008579-017	PFDS
WL5-WAT-MID-01-091720	K2008579-017	PFTrDA

Calibration (Section 2): Calibration noncompliances and the results qualified are summarized below.

Calibration (Date)	Analyte	%D or %R	Limit	Qualifiers
ICV KC2000533-08 (9/29/20)	11Cl-PF3OUdS	38.22 %D	±30 %D	Associated results were nondetect and qualified as estimated (UJ): EP16-WAT-BULK-01-091620 (K2008579-011)
ICV KC2000521-08 (9/29/20)	EtFOSAA	36.4 %D	±30 %D	Associated results were nondetect and qualified as estimated (UJ): EP16-WAT-BULK-01-091620 (K2008579-011)
CCV KC2000537 10/07/20 05:53 698190	11Cl-PF3OUdS	132 %R	70-130%	Associated results were nondetect and were acceptable without qualification.
CCV KC2000521 10/01/20 18:00	8:2 FTS	138 %R	70-130%	Associated results were nondetect and were acceptable without qualification.
CCV K2008577 (10/06/20 19:30) 698188	PFOA	151 %R	70-130%	J+: WL7-WAT-BULK-01-091720 (K2008579-014) WL5-WAT-MID-01-091720 (K2008579-016)
CCV KC2000531 (10/6/20 23:25) 698189	PFBS	139 %R	70-130%	Results not reported from this CCV.
	PFOA	145 %R	70-130%	
	PFTrDA	136 %R	70-130%	J+: EP21A-WAT-MID-01-091920 (K2008579-010)

Calibration (Date)	Analyte	%D or %R	Limit	Qualifiers
	PFTeDA	170 %R	70-130%	J+: EP14-WAT-MID-01-091920 (K2008579-004) EP21A-WAT-MID-01-091920 (K2008579-010)
	NEtFOSE	292 %R	70-130%	J+: EP14-WAT-MID-01-091920 (K2008579-004) EP9A-WAT-MID-01-091920 (K2008579-006)
	NMeFOSE	267 %R	70-130%	Associated results were nondetect and were acceptable without qualification.
	6:2 FTS	134 %R	70-130%	
CCV KC2000572 (10/23/20 5:52) 700485	PFTeDA	142 %R	70-130%	Results not reported from this CCV.
	EtFOSA	143 %R	70-130%	Associated results were nondetect and were acceptable without qualification.
	NEtFOSE	185 %R	70-130%	

Method blank and instrument blank detections (Section 3Bii and C): Detects within 10 times the blank concentrations were qualified B.

Method Blank ID	Prep Date	Compound	Blank Concentration (ng/L)	Results Qualified B
KQ2014249-04	9/29/20 9:47	6:2 FTS	4.3 J	Associated results were greater than 10 times the blank value. No qualifiers.
		8:2 FTS	0.16 J	Associated results were nondetect.
KQ2014290-03	9/29/2020 15:17	MeFOSA	0.51 J	WL2-WAT-MID-01-091720 (K2008579-013)
		PFDoDA	1.4 J	WL5-WAT-MID-01-091720 (K2008579-017) WL7-WAT-BULK-01-091720 (K2008579-015)
		PFTeDA	2.6 J	WL2-WAT-MID-01-091720 (K2008579-013) WL5-WAT-MID-01-091720 (K2008579-017) WL7-WAT-BULK-01-091720 (K2008579-015)
		PFTrDA	3.6 J	Associated results were nondetect.
KQ2014429-03	10/1/2020 7:40	MeFOSA	0.75 J	EP14-WAT-MID-01-091920 (K2008579-004) EP9A-WAT-MID-01-091920 (K2008579-006)
		PFTeDA	3.7 J	EP14-WAT-MID-01-091920 (K2008579-004) EP21A-WAT-MID-01-091920 (K2008579-010)
		PFBS	0.3 J	Associated results were greater than 10 times the blank value. No qualifiers.
		EtFOSA	0.38 J	Associated results were nondetect.
		NEtFOSE	0.93 J	EP14-WAT-MID-01-091920 (K2008579-004) EP9A-WAT-MID-01-091920 (K2008579-006)
		NMeFOSE	1.1 J	Associated results were nondetect or greater than 10 times the blank value. No qualifiers.
KQ2014435-03	10/1/20 9:03	EtFOSAA	1.3 J	EP14-WAT-MID-01-091920 (K2008579-003)
		NEtFOSE	0.16 J	EP9A-WAT-MID-01-091920 (K2008579-005)
		PFHpA	0.96 J	EP14-WAT-MID-01-091920 (K2008579-003) EP9A-WAT-MID-01-091920 (K2008579-005) EP9A-WAT-MID-02-091920 (K2008579-007) EP9A-WAT-MID-03-091920 (K2008579-008) EP21A-WAT-MID-01-091920 (K2008579-009)
		PFTrDA	1.4 J	Associated results were nondetect or greater than 10 times the blank value. No qualifiers.
KQ2014516-03	10/2/20	MeFOSA	0.71 J	Associated results were nondetect.

Method Blank ID	Prep Date	Compound	Blank Concentration (ng/L)	Results Qualified B
	7:03	PFBA	0.53 J	Associated results were greater than 10 times the blank value. No qualifiers.
KQ2016108-03	10/22/2020 8:46	N-EtFOSE	0.18 J	Associated results were nondetect.
		MeFOSA	0.62 J	No associated results.
		PFOA	0.99 J	No associated results.

CCB Blank ID	Date/Time	Compound	Blank Concentration (ng/L)	Results Qualified B
KQ2014505-02	10/1/20 18:11	EtFOSA	0.60 J	Associated results were nondetect.
KQ2014704-02	10/2/20 14:32	PFOA	0.36 J	No associated results.
KQ2014730-02	10/5/20 21:16	MeFOSA	0.77 J	No associated results.
		EtFOSA	0.40 J	No associated results.
KQ2014843-02	10/6/20 23:36	PFHpA	0.66 J	EP14-WAT-MID-01-091920 (K2008579-004) EP9A-WAT-MID-01-091920 (K2008579-006) EP21A-WAT-MID-01-091920 (K2008579-010)
		PFTeDA	3.1 J	EP14-WAT-MID-01-091920 (K2008579-004) EP21A-WAT-MID-01-091920 (K2008579-010)
		MeFOSA	0.58 J	EP14-WAT-MID-01-091920 (K2008579-004) EP9A-WAT-MID-01-091920 (K2008579-006)
KQ2015031-02	10/8/20 10:29	PFHpA	0.67 J	Associated results were greater than 10 times the blank value. No qualifiers.
		MeFOSA	0.62 J	Associated results were greater than 10 times the blank value. No qualifiers.
		EtFOSAA	0.92 J	EP14-WAT-MID-01-091920 (K2008579-003)
KQ2016092-02	10/20/20 13:59	PFOA	0.37 J	No associated results.
KQ2016454-02	10/23/20 06:03	PFOS	0.57 J	No associated results.
		PFOA	0.62 J	No associated results.

Labeled Analogs - surrogates (Section 4Bii): Results associated with low recoveries were qualified as estimated (UJ and J+), as these labeled analogs are used to quantitate the analyte of interest and an inverse relationship exists. Three results were rejected (R) due to severely low recoveries.

Sample ID	Lab ID	Labeled Analog	% Recovery (Limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
EP9A-WAT-MID-01-091920	K2008579-006	D9-EtFOSE	44	J+
EP21A-WAT-MID-01-091920	K2008579-010	13C2-PFTeDA	46	J+
		D9-EtFOSE	38	UJ
WL2-WAT-MID-01-091720	K2008579-012	13C2-4:2 FTS	282	No qualifier
WL2-WAT-MID-01-091720	K2008579-013	13C2-PFTeDA	4	R
		D3-MeFOSA	41	J+

Sample ID	Lab ID	Labeled Analog	% Recovery (Limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
		D3-MeFOSAA	26	UJ
		D5-EtFOSAA	25	UJ
		D9-EtFOSE	32	J+
		13C2-PFDoDA	35	UJ
		13C2-PFUnDA	47	UJ
WL7-WAT-BULK-01-091720	K2008579-014	13C2-4:2 FTS	321	No qualifier
		13C2-6:2 FTS	227	No qualifier
WL7-WAT-BULK-01-091720	K2008579-015	13C2-PFTeDA	7	R
		D3-MeFOSA	43	UJ
		D3-MeFOSAA	31	UJ
		D5-EtFOSAA	30	UJ
		D9-EtFOSE	42	UJ
		13C2-PFDoDA	40	J+
WL5-WAT-MID-01-091720	K2008579-016	13C2-4:2 FTS	303	No qualifier
		13C2-6:2 FTS	219	No qualifier
WL5-WAT-MID-01-091720	K2008579-017	13C2-PFTeDA	5	R
		D3-MeFOSA	44	UJ
		D3-MeFOSAA	30	UJ
		D5-EtFOSA	28	UJ
		D5-EtFOSAA	24	UJ
		D9-EtFOSE	34	UJ
		13C2-PFDoDA	32	J+
		13C2-PFUnDA	47	UJ

Laboratory control sample/Laboratory control sample duplicate (Section 5Bii): Results associated with low recoveries were nondetect and qualified as estimated (UJ) and detects associated with high recoveries were qualified as J+:

LCS/LCSD IDs (Batch)	Compound	LCS/LCSD % Recovery	Recovery Limits	Qualifiers
KQ2014290-01/ KQ2014290-02 (698190)	11Cl-PF3OUdS	73/**68**	70-130	Associated results were nondetect and qualified UJ: WL2-WAT-MID-01-091720-F (K2008579-013) WL7-WAT-BULK-01-091720-F (K2008579-015) WL5-WAT-MID-01-091720-F (K2008579-017)
KQ2014290-01/ KQ2014290-02 (699134)	MeFOSAA	122/**132**	70-130	Associated results were nondetect. No qualifiers.
	PFDoDA	**146/133**	70-130	J+: WL7-WAT-BULK-01-091720 (K2008579-015) WL5-WAT-MID-01-091720 (K2008579-017)
	PFUnDA	126/**131**	70-130	Associated results were nondetect. No qualifiers.
	PFPeS	**143**/125	70-130	J+: WL2-WAT-MID-01-091720 (K2008579-013) WL7-WAT-BULK-01-091720 (K2008579-015) WL5-WAT-MID-01-091720 (K2008579-017)
KQ2014290-01/ KQ2014290-02 (699503)	PFDS	**67/58**	70-130	PFDS sample results not reported from this LCS.
	PFTrDA	**148/157**	70-130	Associated results were nondetect. No qualifiers.

LCS/LCSD IDs (Batch)	Compound	LCS/LCSD % Recovery	Recovery Limits	Qualifiers
KQ2014429-01/ KQ2014429-02 (698189)	4:2 FTS	**137/**120	70-130	Associated results were nondetect. No qualifiers.
	6:2 FTS	**138/**125	70-130	
	PFBA	**134/**130	70-130	J+: EP14-WAT-MID-01-091920 (K2008579-004) EP9A-WAT-MID-01-091920 (K2008579-006) EP21A-WAT-MID-01-091920 (K2008579-010)
KQ2014429-01/ KQ2014429-02 (699503)	PFPeS	**166/153**	70-130	J+: EP14-WAT-MID-01-091920 (K2008579-004) EP9A-WAT-MID-01-091920 (K2008579-006) EP21A-WAT-MID-01-091920 (K2008579-010)
	PFTrDA	**139/**109	70-130	Associated results were nondetect. No qualifiers.
KQ2014249-03	6:2 FTS	**184/**--	70-130	J+: EP16-WAT-BULK-01-091620 (K2008579-011)
	8:2 FTS	**132/**--	70-130	Associated results were nondetect. No qualifiers.
	PFNS	**68/**--	70-130	Associated results were nondetect and qualified UJ: EP16-WAT-BULK-01-091620 (K2008579-011)
	PFDS	**61/**--	70-130	
KQ2014516-01/ KQ2014516-02 (698467)	10:2 FTS	120/**178**	70-130	Associated results were nondetect. No qualifiers.
	PFPeS	119/**145**	70-130	J+: EP20-WAT-BULK-01-092020-F (K2008579-002)
KQ2016108-01/ KQ2016108-02 (700485)	EtFOSA	**154/145**	70-130	Associated results were nondetect. No qualifiers.
	NEtFOSE	**187/226**	70-130	
	NMeFOSE	**137/153**	70-130	
	PFTeDA	**134/**124	70-130	PFTeDA sample results not reported from this LCS.
KQ2014524-01/ KQ2014524-01 (698467)	PFPeS	130/**133**	70-130	J+: EP20-WAT-BULK-01-092020 (K2008579-001)

Matrix spike/Matrix spike duplicate (Section 6Av): Results associated with low recoveries were qualified as estimated biased low (J-) and detects associated with high recoveries were qualified as J+:

Compound	MS/MSD % Recovery	Recovery Limits	Qualifiers
EP9A-WAT-MID-03-091920-U:			
PFBA	113/**38**	70-130	The detects for this sample (and the associated field duplicates) were qualified as estimated biased low (J-): EP9A-WAT-MID-01-091920 (K2008579-006) EP9A-WAT-MID-02-091920 (K2008579-007) EP9A-WAT-MID-03-091920 (K2008579-008)
PFOS	**137/**97	70-130	The detects for this sample (and the associated field duplicates) were qualified as estimated biased high (J+): EP9A-WAT-MID-01-091920 (K2008579-006) EP9A-WAT-MID-02-091920 (K2008579-007) EP9A-WAT-MID-03-091920 (K2008579-008)
PFPeS	**175/156**	70-130	
PFTrDA	**164/150**	70-130	Associated results were nondetect and were acceptable without qualification.

Laboratory control sample/Laboratory control sample duplicate RPDs (Section 6Bi): Detects associated with high RPDs were qualified as J+:

LCS/LCSD IDs (Batch)	Compound	RPD	RPD Limit	Qualifiers
KQ2014516-01/ KQ2014516-02 (698467)	10:2 FTS	39	30	Associated results were nondetect. No qualifiers.
	PFHpS	35	30	J+: EP20-WAT-BULK-01-092020 (K2008579-002)

Field duplicate RPDs (Section 6Bi): PFOS detects for samples EP9A-WAT-MID-01-091920 (K2008579-006), EP9A-WAT-MID-02-091920 (K2008579-007), and EP9A-WAT-MID-03-091920 (K2008579-008) were qualified as estimated (J) due to an RPD of 36%.

Any R qualifiers take precedence over other qualifiers. Results with both high bias (J+) and low bias (J-), should be qualified as estimated (J).

MINNESOTA

Minnesota Department of Agriculture 651-201-6148
Minnesota Department of Health 651-201-5357
Minnesota Pollution Control Agency 651-757-2560

Laboratory data review checklist

Doc Type: Data Review

Instructions: The following is the informal checklist that should be used to review data for the Minnesota Department of Agriculture, Minnesota Pollution Control Agency, and Minnesota Department of Health. The information follows the general format of the National Functional Guidelines, which is the primary data review tool used in the U.S. Environmental Protection Agency's Contract Laboratory Program for Superfund analytical work. Refer to the appropriate guidance document for each agency for instructions.

Project information

Project name: Project 1007

Work order number/Lab report ID: K2008580 Report date (mm/dd/yyyy): 10/27/2020

Laboratory: ALS - Kelso, Washington Review date (mm/dd/yyyy): 11/27/2020

1. Chain of custody, preservation, and holding times

Questions			Yes	No	N/A	Comments
A.	Is there a chain of custody (COC) with the report?		☒	☐	☐	
B.	Is there a sample condition form with the report?		☒	☐	☐	Receipt form indicated a trip blank was received but was not listed on the COC.
C.	Were there samples preserved according to program requirements?		☒	☐	☐	
D.	Were samples received in the correct containers?		☒	☐	☐	
	i.	Was there enough sample volume/weight to complete all requested analyses?	☒	☐	☐	
	ii.	Was there enough sample collected to complete required batch QC?	☒	☐	☐	
E.	Were samples received within holding time for sample prep for all requested analyses?		☒	☐	☐	
F.	Are there notes about sample condition or holding time issues on the COC? Explain the data impact.		☒	☐	☐	
G.	Are there narration or data qualifiers with the report about sample condition or holding time issues? Explain the data impact.		☒	☐	☐	Trip blank noted as being extracted over hold time. No qualifiers as the trip blank sample date is usually set as that of the earliest sample collected.
H.	Are lab IDs cross-referenced correctly with the field IDs.		☒	☐	☐	Yes, but no sample summary table included in the report.

2. Calibration

Question		Yes	No	N/A	Comments
A.	Do the report narrative or data qualifiers indicate calibration problems for any analyses? If yes, explain the data impact.	☒	☐	☐	MN limits used for review. See data qualification summary for exceedances and qualifications.

3. Blanks

Question			Yes	No	N/A	Comments
A.	Do any of the analyses contain samples for field or trip blanks?		☒	☐	☐	Trip blank reported
	i.	If yes, are there target analytes present above the reporting limit in the blanks?	☐	☒	☐	The trip blank was nondetect.
	ii.	If yes, are the same compounds also present in the samples? Explain possible data impact.	☐	☐	☒	
B.	Do method blanks for any analyses contain target analytes above the reporting limit?		☐	☒	☐	Blank detects were below the RL.
	i.	If yes, are the same compounds present in the samples?	☒	☐	☐	
	ii.	Is the amount of target analyte in the method blank more than 1/10th of that in the sample(s)? Explain the possible impact on sample results.	☒	☐	☐	See data qualification summary for summary of detects and qualifications.
C.	Do instrument blanks contain analytes above the reporting limit?		☐	☒	☐	Detects were below the RL. See data qualification summary for calibration blank detects and qualifications.

4. Surrogates or organic analysis

Question			Yes	No	N/A	Comments
A.	Are the lab recovery limits for surrogates specified on the report?		☒	☐	☐	MPCA limits used: 50% to 200%
B.	Are the surrogates outside lab QC limits? (These should have a data qualifier.)		☒	☐	☐	
	i.	If yes, are the surrogates above the lab QC limits?	☒	☐	☐	
	ii.	Below the lab QC limits?	☒	☐	☐	
	iii.	Were the affected samples re-analyzed? Discuss in the case narrative.	☐	☒	☐	
	iv.	Explain what this could mean for the affected samples. Include in narrative.	☒	☐	☐	See data qualification summary for summary of qualifications. Twenty-one results rejected due to severly low labeled analog recoveries.

5. Laboratory control sample/Laboratory control sample duplicate (LCS/LCSD)

Question			Yes	No	N/A	Comments
A.	Are there LCS/LCSD samples present for the reporting analyses?		☒	☐	☐	
B.	Are there LCS/LCSD compounds outside lab limits? If the LCS/LCSD fails, the LCS/LCSD and samples must be re-analyzed.		☒	☐	☐	MPCA PFAS water limits used: 70% to 130%.
	i.	If yes, are there compounds above the lab QC limits? If yes, an explanation is required. Include in narrative.	☒	☐	☐	
	ii.	Below the QC limits? If yes, an explanation is required. Include in narrative.	☒	☐	☐	See data qualification summary for summary of exceedances and qualifications.

6. Matrix spike/Matrix spike duplicate/Sample duplicate (MS/MSD/DUP)

Question				Yes	No	N/A	Comments
A.	Do the analytical methods used require an MS and/or MSD? If no, skip to 6.B.			☒	☐	☐	
	i.	Have the required matrix spikes been prepared and reported?		☐	☒	☐	None for this SDG.
	ii.	If no, is there and explanation in the report as to why?		☐	☒	☐	
	iii.	Did the lab process an alternate spiked sample (such as LCSD) instead?		☒	☐	☐	LCSDs
	iv.	Are the lab QC limits specified on the report?		☒	☐	☐	
	v.	Are there compounds outside the lab QC limits?		☐	☐	☒	
	vi.	If yes, did the lab re-run an MS/MSD?		☐	☐	☒	
		1.	Did the re-run MS/MSD pass? Discuss the case narrative.	☐	☐	☒	
		2.	Did the re-run MS/MSD fail? Discuss the case narrative.	☐	☐	☒	
		3.	Is the source sample also flagged for MS/MSD compounds outside the lab QC limits?	☐	☐	☒	
B.	Was a duplicate sample submitted for the analytical method(s)?			☒	☐	☐	LCSD
	i.	Is the Relative Percentage Difference (RPD) within 20%* for the duplicate pair? If no, explain possible causes and data impact. **Other RPDs may be acceptable. Check with regulatory agency.*		☐	☒	☐	30% limit for PFAS (water). LCSD - See data qualification summary for summary of exceedances and qualifications.

7. Method detection limits/Report limits

Question		Yes	No	N/A	Comments
A.	Are reporting limits clearly listed on the report for all analyses?	☒	☐	☐	
B.	Do the reporting limits meet the program required limits listed? If not, an explanation is required.	☐	☒	☐	Results for 11Cl-PF3OUdS, 9Cl-PF3ONS and ADONA were nondetect and reported to the RL, while other PFAS compound were reported to the method detection limit (MDL).

8. Sample information

Questions		Yes	No	N/A	Comments
A.	Are sample numbers cross-referenced correctly with the associated QC?	☒	☐	☐	
B.	Are soil samples reported in dry weight basis?	☐	☐	☒	
C.	Are percent moisture results reported?	☐	☐	☒	
D.	Are positive detections reported?	☒	☐	☐	
E.	Are sample analytes appropriately flagged if the QC failed?	☒	☐	☐	

9. Report narrative

Question		Yes	No	N/A	Comments
A.	Is a narrative provided with the laboratory report which describes all problems with the analyses and all corrective actions taken to address these problems?	☒	☐	☐	Numerous issues discussed in case narrative.

10. Additional comments about the lab report

Reviewed using MPCA Guidance on Perfluorochemicals Analysis (July 2020).

See attachedment for qualification.

Twenty-one results rejected due to severly low labeled analog recoveries.

Certification

By typing my name below, I certify the above statements to be true and correct, to the best of my knowledge, and that this information can be used for the purpose of processing this form.

Authorized Representative

Name: Lisa Smith Title: Environmental Chemist (CEAC)

(This document has been electronically signed.) Date (mm/dd/yyyy): 11/27/2020

Data Validation Qualifications for K2008580

Calibration (Section 2): Calibration noncompliances and the results qualified are summarized below.

Calibration (Date)	Analyte	%D or %R	Limit	Qualifiers
ICV KC2000533-08 (9/29/20)	11Cl-PF3OUdS	38.22 %D	±30 %D	Associated results were nondetect and qualified as estimated (UJ): EP27C-WAT-BOT-01-091520 (K2008580-005) EP27C-WAT-MID-01-091520 (K2008580-007) EP18-WAT-MID-01-091520 (K2008580-009) EP8-WAT-BULK-01-091620 (K2008580-013)
ICV KC2000521-08 (9/29/20)	EtFOSAA	36.4 %D	±30 %D	Associated results were qualified as estimated (UJ/J): EP27C-WAT-BOT-01-091520 (K2008580-005) EP27C-WAT-MID-01-091520 (K2008580-007) EP18-WAT-MID-01-091520 (K2008580-009) EP8-WAT-BULK-01-091620 (K2008580-013)
CCV KC2000537 10/07/20 05:53 698190	11Cl-PF3OUdS	132 %R	70-130%	Associated results were nondetect and were acceptable without qualification.
CCV KC2000521 10/01/20 18:00	8:2 FTS	138 %R	70-130%	J+: EP27C-WAT-MID-01-091520 (K2008580-007)
CCV K2008577 (10/06/20 19:30) 698188	PFOA	151 %R	70-130%	J+: EP26A-WAT-BULK-01-091720 (K2008580-001)
CCV KC2000531 (10/6/20 23:25) 698189	PFBS	139 %R	70-130%	Results not reported from this CCV.
	PFOA	145 %R	70-130%	
	PFTrDA	136 %R	70-130%	J+: EP19-WAT-BULK-01-091920 (K2008580-004)
	PFTeDA	170 %R	70-130%	
	NEtFOSE	292 %R	70-130%	
	NMeFOSE	267 %R	70-130%	J+: EP26A-WAT-BULK-01-091720 (K2008580-002) EP20A-POWAT-01-091720 (K2008580-014)
	6:2 FTS	134 %R	70-130%	Associated results were nondetect and were acceptable without qualification.
CCV KC2000572 10/23/20 00:43 700484	PFTeDA	141 %R	70-130%	Results not reported from this CCV.
	EtFOSAA	59.8 %R	70-130%	
CCV KC2000572 10/23/20 03:23 700484	PFTeDA	142 %R	70-130%	Results not reported from this CCV.
CCV KC2000572 (10/23/20 5:52) 700484	PFTeDA	142 %R	70-130%	Results not reported from this CCV.

Method blank and instrument blank detections (Section 3Bii and C): Detects within 10 times the blank concentrations were qualified B.

Method Blank ID	Prep Date	Compound	Blank Concentration (ng/L)	Results Qualified B
KQ2014249-04	9/29/20 9:47	6:2 FTS	4.3 J	EP18-WAT-MID-01-091520 (K2008580-009) EP8-WAT-BULK-01-091620 (K2008580-013)
		8:2 FTS	0.16 J	EP27C-WAT-MID-01-091520 (K2008580-007)
KQ2014275-03	9/29/2020 12:47	PFHpA	0.98 J	Associated results were greater than 10 times the blank value. No qualifiers.
		MeFOSA	0.79 J	No associated results.
KQ2014429-03	10/1/2020 7:40	MeFOSA	0.75 J	EP26A-WAT-BULK-01-091720 (K2008580-002)
		PFTeDA	3.7 J	EP19-WAT-BULK-01-091920 (K2008580-004)
		NEtFOSE	0.93 J	
		PFBS	0.3 J	Associated results were greater than 10 times the blank value. No qualifiers.
		EtFOSA	0.38 J	Associated results were nondetect.
		NMeFOSE	1.1 J	EP26A-WAT-BULK-01-091720 (K2008580-002) EP20A-POWAT-01-091720 (K2008580-014)
KQ2014435-03	10/1/20 9:03	EtFOSAA	1.3 J	EP19-WAT-BULK-01-091920 (K2008580-003)
		NEtFOSE	0.16 J	Associated results were nondetect.
		PFHpA	0.96 J	Associated results were nondetect or greater than 10 times the blank value. No qualifiers.
		PFTrDA	1.4 J	EP19-WAT-BULK-01-091920 (K2008580-003) EP15-WAT-MID-01-091920 (K2008580-011)
KQ2014516-03	10/2/20 7:03	MeFOSA	0.71 J	Associated results were nondetect.
		PFBA	0.53 J	Associated results were greater than 10 times the blank value. No qualifiers.
		PFHpA	0.73 J	

CCB Blank ID	Date/Time	Compound	Blank Concentration (ng/L)	Results Qualified B
KQ2014505-02	10/1/20 18:11	EtFOSA	0.60 J	Associated results were nondetect.
KQ2014704-02	10/2/20 14:32	PFOA	0.36 J	No associated results.
KQ2014730-02	10/5/20 21:16	MeFOSA	0.77 J	EP26A-WAT-BULK-01-091720 (K2008580-001) EP27C-WAT-BOT-01-091520 (K2008580-006) EP27C-WAT-MID-01-091520 (K2008580-008) EP18-WAT-MID-01-091520 (K2008580-010)
		EtFOSA	0.40 J	Associated results were nondetect.
KQ2014843-02	10/6/20 23:36	PFHpA	0.66 J	Associated results were greater than 10 times the blank value. No qualifiers.
		PFTeDA	3.1 J	Associated results were greater than 10 times the blank value. No qualifiers.
		MeFOSA	0.58 J	Associated results were nondetect or greater than 10 times the blank value. No qualifiers.

CCB Blank ID	Date/Time	Compound	Blank Concentration (ng/L)	Results Qualified B
KQ2015031-02	10/8/20 10:29	PFHpA	0.67 J	Associated results were nondetect or greater than 10 times the blank value. No qualifiers.
		MeFOSA	0.62 J	Associated results were nondetect.
		EtFOSAA	0.92 J	EP19-WAT-BULK-01-091920 (K2008580-003) EP19-POWAT-01-092020 (K2008580-015)
KQ2016092-02	10/20/20 13:59	PFOA	0.37 J	No associated results.
KQ2016364-02	10/23/20 00:53	PFOA	0.94 J	No associated results.
KQ2016364-08	10/23/20 03:33	PFOA	0.55 J	No associated results.
		EtFOSAA	1.1 J	
KQ2016454-02	10/23/20 06:03	PFOS	0.57 J	No associated results.
		PFOA	0.62 J	

Labeled Analogs - surrogates (Section 4Bii): Results associated with low recoveries were qualified as estimated (UJ and J+), as these labeled analogs are used to quantitate the analyte of interest and an inverse relationship exists. Twenty-one results were rejected (R) due to severely low recoveries.

Sample ID	Lab ID	Labeled Analog	% Recovery (Limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
EP26A-WAT-BULK-01-091720	K2008580-001	13C2-4:2 FTS	247	No Qualifier
		13C2-PFDoDA	43	J+
		13C2-PFTeDA	17	R
		D3-MeFOSAA	33	UJ
		D5-EfFOSAA	29	J+
		D9-EtFOSE	37	J+
EP26A-WAT-BULK-01-091720	K2008580-002	13C2-8:2 FTS	34	UJ
		13C2-PFDA	20	J+
		13C2-PFDoDA	7	R
		13C2-PFTeDA	2	R
		13C2-PFUnDA	11	R
		13C4-PFOS	27	J+
		13C8-FOSA	12	R
		D3-MeFOSA	4	R
		D3-MeFOSAA	10	R
		D5-EfFOSAA	5	R
		D5-EtFOSA	2	R
		D7-MeFOSE	2	R
		D9-EtFOSE	1	R
EP19-WAT-BULK-01-091920	K2008580-003	13C2-4:2 FTS	247	No Qualifier
EP19-WAT-BULK-01-091920	K2008580-004	13C2-4:2 FTS	212	No Qualifier
		D9-EtFOSE	42	J+
EP27C-WAT-BOT-01-091520	K2008580-006	13C2-4:2 FTS	247	No Qualifier
		D9-EtFOSE	48	UJ
EP27C-WAT-MID-01-091520	K2008580-008	13C2-4:2 FTS	205	No Qualifier
		13C2-PFTeDA	38	J+

Sample ID	Lab ID	Labeled Analog	% Recovery (Limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
		D9-EtFOSE	35	J+
EP18-WAT-MID-01-091520	K2008580-009	13C2-PFTeDA	47	UJ
EP18-WAT-MID-01-091520	K2008580-010	13C2-4:2 FTS	245	No Qualifier
		13C2-PFTeDA	42	J+
		D9-EtFOSE	37	J+
EP20A-POWAT-01-091720	K2008580-014	13C2-8:2 FTS	40	J+
		13C2-PFDA	26	J+
		13C2-PFDoDA	6	R
		13C2-PFTeDA	4	R
		13C2-PFUnDA	11	R
		13C4-PFOS	43	J+
		13C8-FOSA	16	R
		D3-MeFOSA	5	R
		D3-MeFOSAA	8	R
		D5-EfFOSAA	5	R
		D5-EtFOSA	4	R
		D7-MeFOSE	4	R
		D9-EtFOSE	4	R
EP19-POWAT-01-092020	K2008580-015	13C2-PFTeDA	48	UJ

Laboratory control sample/Laboratory control sample duplicate (Section 5Bii): Results associated with low recoveries were nondetect and qualified as estimated (UJ) and detects associated with high recoveries were qualified as J+:

LCS/LCSD IDs (Batch)	Compound	LCS/LCSD % Recovery	Recovery Limits	Qualifiers
KQ2014429-01/ KQ2014429-02 (698189)	4:2 FTS	**137/**120	70-130	Associated results were nondetect. No qualifiers.
	6:2 FTS	**138/**125	70-130	
	PFBA	**134/**130	70-130	J+: EP26A-WAT-BULK-01-091720 (K2008580-002) EP19-WAT-BULK-01-091920 (K2008580-004) EP20A-POWAT-01-091720 (K2008580-014)
KQ2014429-01/ KQ2014429-02 (699503)	PFPeS	**166/153**	70-130	J+: EP26A-WAT-BULK-01-091720 (K2008580-002) EP19-WAT-BULK-01-091920 (K2008580-004) EP20A-POWAT-01-091720 (K2008580-014)
	PFTrDA	**139/**109	70-130	J+: EP26A-WAT-BULK-01-091720 (K2008580-002) EP20A-POWAT-01-091720 (K2008580-014)
KQ2014249-03	6:2 FTS	**184/**--	70-130	J+: EP27C-WAT-BOT-01-091520 (K2008580-005) EP27C-WAT-MID-01-091520 (K2008580-007) EP18-WAT-MID-01-091520 (K2008580-009) EP8-WAT-BULK-01-091620 (K2008580-013)
	8:2 FTS	**132/**--	70-130	J+: EP27C-WAT-MID-01-091520 (K2008580-007)
	PFNS	**68/**--	70-130	Associated results were nondetect and qualified UJ:

LCS/LCSD IDs (Batch)	Compound	LCS/LCSD % Recovery	Recovery Limits	Qualifiers
	PFDS	**61**/--	70-130	EP27C-WAT-BOT-01-091520 (K2008580-005) EP27C-WAT-MID-01-091520 (K2008580-007) EP18-WAT-MID-01-091520 (K2008580-009) EP8-WAT-BULK-01-091620 (K2008580-013)
KQ2014516-01/ KQ2014516-02 (698467)	10:2 FTS	120/**178**	70-130	Associated results were nondetect. No qualifiers.
	PFPeS	119/**145**	70-130	J+: EP15-WAT-MID-01-091920 (K2008580-012) EP19-POWAT-01-092020 (K2008580-015)
KQ2014275-01/ KQ2014275-02 (697977)	10:2 FTS	100/**140**	70-130	Associated results were nondetect. No qualifiers.

Laboratory control sample/Laboratory control sample duplicate RPDs (Section 5Bii): Detects associated with high RPDs were qualified as J+:

LCS/LCSD IDs (Batch)	Compound	RPD	RPD Limit	Qualifiers
KQ2014275-01/ KQ2014275-02 (697977)	10:2 FTS	33	30	Associated results were nondetect. No qualifiers.
KQ2014516-01/ KQ2014516-02 (698467)	10:2 FTS	39	30	Associated results were nondetect. No qualifiers.
	PFHpS	35	30	J+: EP15-WAT-MID-01-091920 (K2008580-012) EP19-POWAT-01-092020 (K2008580-015)

Any R qualifiers take precedence over other qualifiers.

MINNESOTA

Minnesota Department of Agriculture 651-201-6148
Minnesota Department of Health 651-201-5357
Minnesota Pollution Control Agency 651-757-2560

Laboratory data review checklist

Doc Type: Data Review

Instructions: The following is the informal checklist that should be used to review data for the Minnesota Department of Agriculture, Minnesota Pollution Control Agency, and Minnesota Department of Health. The information follows the general format of the National Functional Guidelines, which is the primary data review tool used in the U.S. Environmental Protection Agency's Contract Laboratory Program for Superfund analytical work. Refer to the appropriate guidance document for each agency for instructions.

Project information

Project name: Project 1007

Work order number/Lab report ID: K2008581 Report date (mm/dd/yyyy): 10/29/2020

Laboratory: ALS - Kelso, Washington Review date (mm/dd/yyyy): 11/27/2020

1. Chain of custody, preservation, and holding times

Questions			Yes	No	N/A	Comments
A.	Is there a chain of custody (COC) with the report?		☒	☐	☐	
B.	Is there a sample condition form with the report?		☒	☐	☐	Receipt form indicated a trip blank was received but was not listed on the COC.
C.	Were there samples preserved according to program requirements?		☒	☐	☐	
D.	Were samples received in the correct containers?		☒	☐	☐	
	i.	Was there enough sample volume/weight to complete all requested analyses?	☒	☐	☐	
	ii.	Was there enough sample collected to complete required batch QC?	☒	☐	☐	
E.	Were samples received within holding time for sample prep for all requested analyses?		☒	☐	☐	
F.	Are there notes about sample condition or holding time issues on the COC? Explain the data impact.		☒	☐	☐	
G.	Are there narration or data qualifiers with the report about sample condition or holding time issues? Explain the data impact.		☒	☐	☐	Two samples were re-extracted 22 days over holding time. See data qualification summary for qualifications.
H.	Are lab IDs cross-referenced correctly with the field IDs.		☒	☐	☐	Yes, but no sample summary table included in the report.

2. Calibration

Question		Yes	No	N/A	Comments
A.	Do the report narrative or data qualifiers indicate calibration problems for any analyses? If yes, explain the data impact.	☒	☐	☐	MN limits used for review. See data qualification summary for exceedances and qualifications.

3. Blanks

Question			Yes	No	N/A	Comments
A.	Do any of the analyses contain samples for field or trip blanks?		☒	☐	☐	Trip blank reported
	i.	If yes, are there target analytes present above the reporting limit in the blanks?	☐	☒	☐	The trip blank detects were less than the RL: PFOA 0.46 J ng/L EtFOSA 0.3 J ng/L 6:2 FTS 2.3 J ng/L
	ii.	If yes, are the same compounds also present in the samples? Explain possible data impact.	☒	☐	☐	See data qualification summary for discussion.
B.	Do method blanks for any analyses contain target analytes above the reporting limit?		☐	☒	☐	Blank detects were below the RL.
	i.	If yes, are the same compounds present in the samples?	☒	☐	☐	
	ii.	Is the amount of target analyte in the method blank more than 1/10th of that in the sample(s)? Explain the possible impact on sample results.	☒	☐	☐	See data qualification summary for summary of detects and qualifications.
C.	Do instrument blanks contain analytes above the reporting limit?		☐	☒	☐	Detects were below the RL. See data qualification summary for calibration blank detects and qualifications.

4. Surrogates or organic analysis

Question			Yes	No	N/A	Comments
A.	Are the lab recovery limits for surrogates specified on the report?		☒	☐	☐	MPCA limits used: 50% to 200%
B.	Are the surrogates outside lab QC limits? (These should have a data qualifier.)		☒	☐	☐	
	i.	If yes, are the surrogates above the lab QC limits?	☒	☐	☐	
	ii.	Below the lab QC limits?	☒	☐	☐	
	iii.	Were the affected samples re-analyzed? Discuss in the case narrative.	☐	☒	☐	

	iv.	Explain what this could mean for the affected samples. Include in narrative.	☒	☐	☐	See data qualification summary for summary of qualifications. Two results rejected due to severly low labeled analog recoveries.

5. Laboratory control sample/Laboratory control sample duplicate (LCS/LCSD)

Question			Yes	No	N/A	Comments
A.	Are there LCS/LCSD samples present for the reporting analyses?		☒	☐	☐	
B.	Are there LCS/LCSD compounds outside lab limits? If the LCS/LCSD fails, the LCS/LCSD and samples must be re-analyzed.		☒	☐	☐	MPCA PFAS water limits used: 70% to 130%.
	i.	If yes, are there compounds above the lab QC limits? If yes, an explanation is required. Include in narrative.	☒	☐	☐	
	ii.	Below the QC limits? If yes, an explanation is required. Include in narrative.	☒	☐	☐	See data qualification summary for summary of exceedances and qualifications.

6. Matrix spike/Matrix spike duplicate/Sample duplicate (MS/MSD/DUP)

Question				Yes	No	N/A	Comments
A.	Do the analytical methods used require an MS and/or MSD? If no, skip to 6.B.			☒	☐	☐	
	i.	Have the required matrix spikes been prepared and reported?		☐	☒	☐	None for this SDG.
	ii.	If no, is there and explanation in the report as to why?		☐	☒	☐	
	iii.	Did the lab process an alternate spiked sample (such as LCSD) instead?		☒	☐	☐	LCSDs
	iv.	Are the lab QC limits specified on the report?		☒	☐	☐	
	v.	Are there compounds outside the lab QC limits?		☐	☐	☒	
	vi.	If yes, did the lab re-run an MS/MSD?		☐	☐	☒	
		1.	Did the re-run MS/MSD pass? Discuss the case narrative.	☐	☐	☒	
		2.	Did the re-run MS/MSD fail? Discuss the case narrative.	☐	☐	☒	
		3.	Is the source sample also flagged for MS/MSD compounds outside the lab QC limits?	☐	☐	☒	
B.	Was a duplicate sample submitted for the analytical method(s)?			☒	☐	☐	LCSD FDs: RC17A-WAT-BULK-01-091920/RC17A-WAT-BULK-02-091920
	i.	Is the Relative Percentage Difference (RPD) within 20%* for the duplicate pair? If no, explain possible causes and data		☐	☒	☐	30% limit for PFAS (water). LCSD - See data qualification summary for

		impact. **Other RPDs may be acceptable. Check with regulatory agency.*				summary of exceedances and qualifications. FD RPDs ok

7. Method detection limits/Report limits

Question		Yes	No	N/A	Comments
A.	Are reporting limits clearly listed on the report for all analyses?	☒	☐	☐	
B.	Do the reporting limits meet the program required limits listed? If not, an explanation is required.	☐	☒	☐	Results for 11Cl-PF3OUdS, 9Cl-PF3ONS and ADONA were nondetect and reported to the RL, while other PFAS compound were reported to the method detection limit (MDL).

8. Sample information

Questions		Yes	No	N/A	Comments
A.	Are sample numbers cross-referenced correctly with the associated QC?	☒	☐	☐	
B.	Are soil samples reported in dry weight basis?	☐	☐	☒	
C.	Are percent moisture results reported?	☐	☐	☒	
D.	Are positive detections reported?	☒	☐	☐	
E.	Are sample analytes appropriately flagged if the QC failed?	☒	☐	☐	

9. Report narrative

Question		Yes	No	N/A	Comments
A.	Is a narrative provided with the laboratory report which describes all problems with the analyses and all corrective actions taken to address these problems?	☒	☐	☐	Numerous issues discussed in case narrative.

10. Additional comments about the lab report

Reviewed using MPCA Guidance on Perfluorochemicals Analysis (July 2020).

See attachedment for qualification.

Two results rejected due to severly low labeled analog recoveries.

Certification

By typing my name below, I certify the above statements to be true and correct, to the best of my knowledge, and that this information can be used for the purpose of processing this form.

Authorized Representative

Name: Lisa Smith Title: Environmental Chemist (CEAC)

(This document has been electronically signed.) Date (mm/dd/yyyy): 11/27/2020

Data Validation Qualifications for K2008581

Holding Times (Section 1G): Two samples were re-extracted 22 days over hold time. The results reported from the re-extractions were qualified as estimated (UJ/J-). The samples and analytes qualified are listed below.

Field Sample ID	Lab ID	Compounds
RC18-WAT-BULK-01-091720	K2008581-005	EtFOSA
RC18-WAT-BULK-01-091720	K2008581-005	NEtFOSE
RC18-WAT-BULK-01-091720	K2008581-005	NMeFOSE
RC18-WAT-BULK-01-091720	K2008581-005	PFDS
RC18-WAT-BULK-01-091720	K2008581-005	PFTrDA
RC18-POWAT-01-091720	K2008581-006	EtFOSA
RC18-POWAT-01-091720	K2008581-006	NEtFOSE
RC18-POWAT-01-091720	K2008581-006	NMeFOSE
RC18-POWAT-01-091720	K2008581-006	PFDS
RC18-POWAT-01-091720	K2008581-006	PFTrDA

Calibration (Section 2): Calibration noncompliances and the results qualified are summarized below.

Calibration (Date)	Analyte	%D or %R	Limit	Qualifiers
ICV KC2000533-08 (9/29/20)	11Cl-PF3OUdS	38.22 %D	±30 %D	Associated results were nondetect and qualified as estimated (UJ): EP1A-WAT-MID-01-091520 (K2008581-014) EP1A-WAT-BOT-01-091520 (K2008581-012) TRIP BLANK (K2008581-016)
ICV KC2000521-08 (9/29/20)	EtFOSAA	36.4 %D	±30 %D	Associated results were qualified as estimated (UJ/J): EP1A-WAT-BOT-01-091520 (K2008581-012) EP1A-WAT-MID-01-091520 (K2008581-014) TRIP BLANK (K2008581-016)
CCV KC2000537 10/07/20 05:53 698190	11Cl-PF3OUdS	132 %R	70-130%	Associated results were nondetect and were acceptable without qualification.
CCV KC2000521 10/01/20 18:00	8:2 FTS	138 %R	70-130%	Associated results were nondetect. No qualifiers.
CCV KC2000531 (10/6/20 23:25) 698189	PFBS	139 %R	70-130%	Results not reported from this CCV.
	PFOA	145 %R	70-130%	
	PFTrDA	136 %R	70-130%	
	PFTeDA	170 %R	70-130%	
	NEtFOSE	292 %R	70-130%	
	NMeFOSE	267 %R	70-130%	
	6:2 FTS	134 %R	70-130%	
CCV KC2000572 (10/23/20 5:52) 700484	PFTeDA	142 %R	70-130%	Results not reported from this CCV.
	EtFOSAA	185 %R	70-130%	

Calibration (Date)	Analyte	%D or %R	Limit	Qualifiers
	EtFOSA	143 %R	70-130%	Associated results were nondetect. No qualifiers.

Trip blank detections (Section 3Aii): The 6:2 FTS and EtFOSA detections were determined to be laboratory contamination per qualifications in the next section. PFOA detects for the samples were greater than 10 times the trip blank concentration and were acceptable without qualification.

Method blank and instrument blank detections (Section 3Bii and C): Detects within 10 times the blank concentrations were qualified B.

Method Blank ID	Prep Date	Compound	Blank Concentration (ng/L)	Results Qualified B
KQ2014249-04	9/29/20 9:47	6:2 FTS	4.3 J	EP1A-WAT-BOT-01-091520 (K2008581-012) EP1A-WAT-MID-01-091520 (K2008581-014) TRIP BLANK (K2008581-016)
		8:2 FTS	0.16 J	Associated results were nondetect.
KQ2014275-03	9/29/2020 12:47	PFHpA	0.98 J	EP1A-WAT-BOT-01-091520 (K2008581-013)
		MeFOSA	0.79 J	EP1A-WAT-MID-01-091520 (K2008581-015)
KQ2014290-03	9/29/2020 15:17	PFDoA	1.4 J	RC18-WAT-BULK-01-091720 (K2008581-005) RC18-POWAT-01-091720 (K2008581-006)
		MeFOSA	0.51 J	RC18-POWAT-01-091720 (K2008581-006)
		PFTeDA	2.6 J	RC18-WAT-BULK-01-091720 (K2008581-005) RC18-POWAT-01-091720 (K2008581-006)
		PFTrDA	3.6 J	No associated results.
KQ2014435-03	10/1/2020 9:03	EtFOSAA	1.3 J	EP17A-WAT-BULK-01-091920 (K2008581-007)
		NEtFOSE	0.16 J	RC17-WAT-BULK-02-091920 (K2008581-011)
		PFHpA	0.96 J	RC16A-WAT-BULK-01-091920 (K2008581-001) EP17A-WAT-BULK-01-091920 (K2008581-007) RC17A-WAT-BULK-01-091920 (K2008581-009) RC17-WAT-BULK-02-091920 (K2008581-011)
		PFTrDA	1.4 J	RC17A-WAT-BULK-01-091920 (K2008581-009)
KQ2014516-03	10/2/2020 7:03	MeFOSA	0.71 J	EP17A-WAT-BULK-01-091920 (K2008581-008)
		PFBA	0.53 J	Associated results were greater than 10 times the blank value. No qualifiers.
		PFHpA	0.73 J	RC16A-WAT-BULK-01-091920 (K2008581-002) EP17A-WAT-BULK-01-091920 (K2008581-008) RC17A-WAT-BULK-01-091920 (K2008581-010)
KQ2016108-03	10/22/2020 8:46	MeFOSA	0.62 J	No associated results.
		NEtFOSE	0.18 J	RC18-POWAT-01-091720 (K2008581-006)
		PFOA	0.99 J	No associated results.

CCB Blank ID	Date/Time	Compound	Blank Concentration (ng/L)	Results Qualified B

CCB Blank ID	Date/Time	Compound	Blank Concentration (ng/L)	Results Qualified B
KQ2014505-02	10/1/20 18:11	EtFOSA	0.60 J	TRIP BLANK (K2008581-016)
KQ2014704-02	10/2/20 14:32	PFOA	0.36 J	No associated results.
KQ2014730-02	10/5/20 21:16	MeFOSA	0.77 J	EP1A-WAT-MID-01-091520 (K2008581-015)
		EtFOSA	0.40 J	Associated results were nondetect.
KQ2014843-02	10/6/20 23:36	PFHpA	0.66 J	No associated results.
		PFTeDA	3.1 J	
		MeFOSA	0.58 J	
KQ2015031-02	10/8/20 10:29	PFHpA	0.67 J	RC16A-WAT-BULK-01-091920 (K2008581-001) EP17A-WAT-BULK-01-091920 (K2008581-007) RC17A-WAT-BULK-01-091920 (K2008581-009) RC17-WAT-BULK-02-091920 (K2008581-011) RC16A-WAT-BULK-01-091920 (K2008581-002) EP17A-WAT-BULK-01-091920 (K2008581-008) RC17A-WAT-BULK-01-091920 (K2008581-010)
		MeFOSA	0.62 J	EP17A-WAT-BULK-01-091920 (K2008581-008)
		EtFOSAA	0.92 J	EP17A-WAT-BULK-01-091920 (K2008581-007) RC17A-WAT-BULK-01-091920 (K2008581-010)
KQ2015208-02	10/9/20 15:39	MeFOSA	0.68 J	Associated results were nondetect.
KQ2016092-02	10/20/20 13:59	PFOA	0.37 J	Associated results were greater than 10 times the blank value. No qualifiers.
KQ2016454-02	10/23/20 06:03	PFOS	0.57 J	No associated results.
		PFOA	0.62 J	No associated results.

Labeled Analogs - surrogates (Section 4Bii): Results associated with low recoveries were qualified as estimated (UJ and J+), as these labeled analogs are used to quantitate the analyte of interest and an inverse relationship exists. Two results were rejected (R) due to severely low recoveries.

Sample ID	Lab ID	Labeled Analog	% Recovery (Limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
RC18-WAT-BULK-01-091720	K2008581-004	13C2-4:2 FTS	298	No Qualifier
		13C2-6:2 FTS	224	No Qualifier
		13C2-PFTeDA	38	J+
		D7-MeFOSE	46	UJ
		D9-EtFOSE	35	UJ
RC18-WAT-BULK-01-091720	K2008581-005	13C2-PFDoDA	36	J+
		13C2-PFTeDA	5	R
		D3-MeFOSA	43	UJ
		D3-MeFOSAA	27	UJ
		D5-EtFOSA	48	UJ
		D5-EtFOSAA	20	UJ
		D9-EtFOSE	40	UJ
RC18-POWAT-01-091720	K2008581-006	13C2-PFDoDA	39	J+
		13C2-PFTeDA	7	R

Sample ID	Lab ID	Labeled Analog	% Recovery (Limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
		D3-MeFOSA	44	J+
		D3-MeFOSAA	27	UJ
		D5-EtFOSAA	21	J+
EP17A-WAT-BULK-01-091920	K2008581-007	13C2-4:2 FTS	234	No Qualifier
RC17-WAT-BULK-02-091920	K2008581-011	13C2-4:2 FTS	228	No Qualifier
EP1A-WAT-BOT-01-091520	K2008581-013	13C2-PFTeDA	49	J+
		D9-EtFOSE	43	J+
EP1A-WAT-MID-01-091520	K2008581-014	13C2-PFTeDA	45	UJ
EP1A-WAT-MID-01-091520	K2008581-015	13C2-PFTeDA	38	J+
		D9-EtFOSE	35	J+

Laboratory control sample/Laboratory control sample duplicate (Section 5Bii): Results associated with low recoveries were nondetect and qualified as estimated (UJ) and detects associated with high recoveries were qualified as J+:

LCS/LCSD IDs (Batch)	Compound	LCS/LCSD % Recovery	Recovery Limits	Qualifiers
KQ2014290-01/ KQ2014290-02 (698190)	11Cl-PF3OUdS	73/**68**	70-130	Associated result results were nondetect and qualified UJ: RC18-WAT-BULK-01-091720 (K2008581-005) RC18-POWAT-01-091720 (K2008581-006)
KQ2014290-01/ KQ2014290-02 (699134)	MeFOSAA	122/**132**	70-130	Associated results were nondetect. No qualifiers.
	PFDoDA	**146/133**	70-130	J+: RC18-WAT-BULK-01-091720 (K2008581-005) RC18-POWAT-01-091720 (K2008581-006)
	PFUnDA	126/**131**	70-130	J+: RC18-WAT-BULK-01-091720 (K2008581-005)
	PFPeS	**143**/125	70-130	J+: RC18-POWAT-01-091720 (K2008581-006)
KQ2014290-01/ KQ2014290-02 (699503)	PFDS	**67/58**	70-130	No associated results.
	PFTrDA	**148/157**	70-130	
KQ2014249-03	6:2 FTS	**184/**--	70-130	J+: EP1A-WAT-BOT-01-091520 (K2008581-012) EP1A-WAT-MID-01-091520 (K2008581-014) TRIP BLANK (K2008581-016)
	8:2 FTS	**132/**--	70-130	Associated results were nondetect. No qualifiers.
	PFNS	**68/**--	70-130	Associated result results were nondetect and qualified UJ: EP1A-WAT-BOT-01-091520 (K2008581-012) EP1A-WAT-MID-01-091520 (K2008581-014) TRIP BLANK (K2008581-016)
	PFDS	**61/**--	70-130	
KQ2014516-01/ KQ2014516-02 (698467)	10:2 FTS	120/**178**	70-130	Associated results were nondetect. No qualifiers.
	PFPeS	119/**145**	70-130	J+: EP17A-WAT-BULK-01-091920 (K2008581-008)
KQ2014275-01/ KQ2014275-02 (697977)	10:2 FTS	100/**140**	70-130	Associated results were nondetect. No qualifiers.
KQ2014635-01/	PFDoDA	129/**149**	70-130	Associated results were nondetect. No qualifiers.

LCS/LCSD IDs (Batch)	Compound	LCS/LCSD % Recovery	Recovery Limits	Qualifiers
KQ2014635-02 (698705)	PFHpS	**132/136**	70-130	
	PFPeS	**146/141**	70-130	
	PFUnDA	125/**134**	70-130	
	PFOS	127/**132**	70-130	J+: RC16A-POWAT-01-092120 (K2008581-003)
KQ2014635-01/ KQ2014635-02 (698706)	11Cl-PF3OUdS	**143/142**	70-130	Associated results were nondetect. No qualifiers.
KQ2016108-01/ KQ2016108-02 (700485)	EtFOSA	**154/145**	70-130	Associated results were nondetect. No qualifiers.
	NMeFOSE	**137/153**	70-130	
	PFTeDA	**134**/124	70-130	
	NEtFOSE	**187/226**	70-130	J+: RC18-POWAT-01-091720 (K2008581-006)

Laboratory control sample/Laboratory control sample duplicate RPDs (Section 6Bi): Detects associated with high RPDs were qualified as J+:

LCS/LCSD IDs (Batch)	Compound	RPD	RPD Limit	Qualifiers
KQ2014275-01/ KQ2014275-02 (697977)	10:2 FTS	33	30	Associated results were nondetect. No qualifiers.
KQ2014516-01/ KQ2014516-02 (698467)	10:2 FTS	39	30	Associated results were nondetect. No qualifiers.
	PFHpS	35	30	J: EP17A-WAT-BULK-01-091920 (K2008581-008)

Any R qualifiers take precedence over other qualifiers.

MINNESOTA

Minnesota Department of Agriculture 651-201-6148
Minnesota Department of Health 651-201-5357
Minnesota Pollution Control Agency 651-757-2560

Laboratory data review checklist

Doc Type: Data Review

Instructions: The following is the informal checklist that should be used to review data for the Minnesota Department of Agriculture, Minnesota Pollution Control Agency, and Minnesota Department of Health. The information follows the general format of the National Functional Guidelines, which is the primary data review tool used in the U.S. Environmental Protection Agency's Contract Laboratory Program for Superfund analytical work. Refer to the appropriate guidance document for each agency for instructions.

Project information

Project name: Project 1007

Work order number/Lab report ID: K2008582 Report date (mm/dd/yyyy): 10/30/2020

Laboratory: ALS - Kelso, Washington Review date (mm/dd/yyyy): 11/28/2020

1. Chain of custody, preservation, and holding times

Questions			Yes	No	N/A	Comments
A.	Is there a chain of custody (COC) with the report?		☒	☐	☐	
B.	Is there a sample condition form with the report?		☒	☐	☐	Receipt form indicated a trip blank was received but not was listed on the COC.
C.	Were there samples preserved according to program requirements?		☒	☐	☐	
D.	Were samples received in the correct containers?		☒	☐	☐	
	i.	Was there enough sample volume/weight to complete all requested analyses?	☒	☐	☐	
	ii.	Was there enough sample collected to complete required batch QC?	☒	☐	☐	
E.	Were samples received within holding time for sample prep for all requested analyses?		☒	☐	☐	
F.	Are there notes about sample condition or holding time issues on the COC? Explain the data impact.		☒	☐	☐	
G.	Are there narration or data qualifiers with the report about sample condition or holding time issues? Explain the data impact.		☒	☐	☐	Seven samples were re-extracted 22 days over holding time. See data qualification summary for qualifications.
H.	Are lab IDs cross-referenced correctly with the field IDs.		☒	☐	☐	Yes, but no sample summary table included in the report.

2. Calibration

Question		Yes	No	N/A	Comments
A.	Do the report narrative or data qualifiers indicate calibration problems for any analyses? If yes, explain the data impact.	☒	☐	☐	MN limits used for review. See data qualification summary for exceedances and qualifications.

3. Blanks

Question			Yes	No	N/A	Comments
A.	Do any of the analyses contain samples for field or trip blanks?		☒	☐	☐	Trip blank reported
	i.	If yes, are there target analytes present above the reporting limit in the blanks?	☐	☒	☐	The trip blank detects were less than the RL: PFHpA 0.78 J ng/L PFTeDA 2.3 J ng/L
	ii.	If yes, are the same compounds also present in the samples? Explain possible data impact.	☒	☐	☐	See data qualification summary for discussion.
B.	Do method blanks for any analyses contain target analytes above the reporting limit?		☐	☒	☐	Blank detects were below the RL.
	i.	If yes, are the same compounds present in the samples?	☒	☐	☐	
	ii.	Is the amount of target analyte in the method blank more than 1/10th of that in the sample(s)? Explain the possible impact on sample results.	☒	☐	☐	See data qualification summary for summary of detects and qualifications.
C.	Do instrument blanks contain analytes above the reporting limit?		☐	☒	☐	Detects were below the RL. See data qualification summary for calibration blank detects and qualifications.

4. Surrogates or organic analysis

Question			Yes	No	N/A	Comments
A.	Are the lab recovery limits for surrogates specified on the report?		☒	☐	☐	MPCA limits used: 50% to 200%
B.	Are the surrogates outside lab QC limits? (These should have a data qualifier.)		☒	☐	☐	
	i.	If yes, are the surrogates above the lab QC limits?	☒	☐	☐	
	ii.	Below the lab QC limits?	☒	☐	☐	
	iii.	Were the affected samples re-analyzed? Discuss in the case narrative.	☐	☒	☐	
	iv.	Explain what this could mean for the affected samples. Include in narrative.	☒	☐	☐	See data qualification summary for summary of qualifications. Three results rejected due to severly low labeled analog recoveries.

5. Laboratory control sample/Laboratory control sample duplicate (LCS/LCSD)

Question			Yes	No	N/A	Comments
A.	Are there LCS/LCSD samples present for the reporting analyses?		☒	☐	☐	
B.	Are there LCS/LCSD compounds outside lab limits? If the LCS/LCSD fails, the LCS/LCSD and samples must be re-analyzed.		☒	☐	☐	MPCA PFAS water limits used: 70% to 130%.
	i.	If yes, are there compounds above the lab QC limits? If yes, an explanation is required. Include in narrative.	☒	☐	☐	
	ii.	Below the QC limits? If yes, an explanation is required. Include in narrative.	☒	☐	☐	See data qualification summary for summary of exceedances and qualifications.

6. Matrix spike/Matrix spike duplicate/Sample duplicate (MS/MSD/DUP)

Question				Yes	No	N/A	Comments
A.	Do the analytical methods used require an MS and/or MSD? If no, skip to 6.B.			☒	☐	☐	
	i.	Have the required matrix spikes been prepared and reported?		☐	☒	☐	None for this SDG.
	ii.	If no, is there and explanation in the report as to why?		☐	☒	☐	
	iii.	Did the lab process an alternate spiked sample (such as LCSD) instead?		☒	☐	☐	LCSDs
	iv.	Are the lab QC limits specified on the report?		☒	☐	☐	
	v.	Are there compounds outside the lab QC limits?		☐	☐	☒	
	vi.	If yes, did the lab re-run an MS/MSD?		☐	☐	☒	
		1.	Did the re-run MS/MSD pass? Discuss the case narrative.	☐	☐	☒	
		2.	Did the re-run MS/MSD fail? Discuss the case narrative.	☐	☐	☒	
		3.	Is the source sample also flagged for MS/MSD compounds outside the lab QC limits?	☐	☐	☒	
B.	Was a duplicate sample submitted for the analytical method(s)?			☒	☐	☐	LCSD
	i.	Is the Relative Percentage Difference (RPD) within 20%* for the duplicate pair? If no, explain possible causes and data impact. **Other RPDs may be acceptable. Check with regulatory agency.*		☒	☐	☐	30% limit for PFAS (water). LCSD - ok

7. Method detection limits/Report limits

Question		Yes	No	N/A	Comments
A.	Are reporting limits clearly listed on the report for all analyses?	☒	☐	☐	
B.	Do the reporting limits meet the program required limits listed? If not, an explanation is required.	☐	☒	☐	Results for 11Cl-PF3OUdS, 9Cl-PF3ONS and ADONA were nondetect and reported to the RL, while other PFAS compound were reported to the method detection limit (MDL).

8. Sample information

Questions		Yes	No	N/A	Comments
A.	Are sample numbers cross-referenced correctly with the associated QC?	☒	☐	☐	
B.	Are soil samples reported in dry weight basis?	☐	☐	☒	
C.	Are percent moisture results reported?	☐	☐	☒	
D.	Are positive detections reported?	☒	☐	☐	
E.	Are sample analytes appropriately flagged if the QC failed?	☒	☐	☐	

9. Report narrative

Question		Yes	No	N/A	Comments
A.	Is a narrative provided with the laboratory report which describes all problems with the analyses and all corrective actions taken to address these problems?	☒	☐	☐	Numerous issues discussed in case narrative.

10. Additional comments about the lab report

Reviewed using MPCA Guidance on Perfluorochemicals Analysis (July 2020).

See attachedment for qualification.

Three results rejected due to severly low labeled analog recoveries.

Certification

By typing my name below, I certify the above statements to be true and correct, to the best of my knowledge, and that this information can be used for the purpose of processing this form.

Authorized Representative

Name: Lisa Smith Title: Environmental Chemist (CEAC)

(This document has been electronically signed.) Date (mm/dd/yyyy): 11/28/2020

Data Validation Qualifications for K2008582

Holding Times (Section 1G): Seven samples samples were re-extracted 22 days over hold time. Nondetect results reported from the re-extractions were qualified UJ and detects were qualified as estimated biased low (J-). The samples and analytes qualified are listed below.

Field Sample ID	Lab ID	Compounds	Qualifier
WL15-WAT-MID-01-091620	K2008582-002	PFTrDA	UJ
WL15-WAT-MID-01-091620	K2008582-002	PFTeDA	UJ
WL15-WAT-MID-01-091620	K2008582-002	EtFOSA	UJ
WL15-WAT-MID-01-091620	K2008582-002	NMeFOSE	UJ
WL15-WAT-MID-01-091620	K2008582-002	NEtFOSE	UJ
WL15-WAT-MID-01-091620	K2008582-002	PFDS	UJ
WL6-WAT-BULK-01-091720	K2008582-004	PFTrDA	UJ
WL6-WAT-BULK-01-091720	K2008582-004	NEtFOSE	J-
WL6-WAT-BULK-01-091720	K2008582-004	NMeFOSE	UJ
WL6-WAT-BULK-01-091720	K2008582-004	PFTeDA	UJ
WL6-WAT-BULK-01-091720	K2008582-004	PFDS	UJ
WL6-WAT-BULK-01-091720	K2008582-004	EtFOSA	UJ
WL14-WAT-MID-01-091620	K2008582-008	NEtFOSE	UJ
WL14-WAT-MID-01-091620	K2008582-008	EtFOSA	UJ
WL14-WAT-MID-01-091620	K2008582-008	PFDS	UJ
WL14-WAT-MID-01-091620	K2008582-008	PFTeDA	UJ
WL14-WAT-MID-01-091620	K2008582-008	NMeFOSE	UJ
WL14-WAT-MID-01-091620	K2008582-008	PFTrDA	UJ
WL21-WAT-MID-01-091620	K2008582-010	PFTrDA	UJ
WL21-WAT-MID-01-091620	K2008582-010	PFTeDA	UJ
WL21-WAT-MID-01-091620	K2008582-010	EtFOSA	UJ
WL21-WAT-MID-01-091620	K2008582-010	NMeFOSE	UJ
WL21-WAT-MID-01-091620	K2008582-010	NEtFOSE	UJ
WL21-WAT-MID-01-091620	K2008582-010	PFDS	UJ
WL8A-WAT-MID-01-091620	K2008582-012	PFDS	UJ
WL8A-WAT-MID-01-091620	K2008582-012	NEtFOSE	UJ
WL8A-WAT-MID-01-091620	K2008582-012	NMeFOSE	UJ
WL8A-WAT-MID-01-091620	K2008582-012	EtFOSA	UJ
WL8A-WAT-MID-01-091620	K2008582-012	PFTeDA	UJ
WL8A-WAT-MID-01-091620	K2008582-012	PFTrDA	UJ
WL3-WAT-MID-01-091720	K2008582-006	PFTrDA	UJ
WL3-WAT-MID-01-091720	K2008582-006	PFTeDA	UJ
WL3-WAT-MID-01-091720	K2008582-006	EtFOSA	UJ
WL3-WAT-MID-01-091720	K2008582-006	NMeFOSE	UJ
WL3-WAT-MID-01-091720	K2008582-006	NEtFOSE	UJ
WL3-WAT-MID-01-091720	K2008582-006	PFDS	UJ
WL15A-WAT-MID-01-091620	K2008582-014	NEtFOSE	UJ
WL15A-WAT-MID-01-091620	K2008582-014	PFDS	UJ
WL15A-WAT-MID-01-091620	K2008582-014	PFTrDA	UJ

Field Sample ID	Lab ID	Compounds	Qualifier
WL15A-WAT-MID-01-091620	K2008582-014	PFTeDA	UJ
WL15A-WAT-MID-01-091620	K2008582-014	EtFOSA	UJ
WL15A-WAT-MID-01-091620	K2008582-014	NMeFOSE	UJ

Calibration (Section 2): Calibration noncompliances and the results qualified are summarized below.

Calibration (Date)	Analyte	%D or %R	Limit	Qualifiers
ICV KC2000533-08 (9/29/20)	11Cl-PF3OUdS	38.22 %D	±30 %D	Associated results were nondetect and qualified as estimated (UJ): WL15-WAT-MID-01-091620 (K2008582-001) WL14-WAT-MID-01-091620 (K2008582-007) WL21-WAT-MID-01-091620 (K2008582-009) WL8A-WAT-MID-01-091620 (K2008582-011) WL15A-WAT-MID-01-091620 (K2008582-013) VB3-WAT-BULK-01-091620 (K2008582-015) EP13-WAT-BULK-01-091620 (K2008582-016) WL9-WAT-BULK-091620 (K2008582-017)
ICV KC2000521-08 (9/29/20)	EtFOSAA	36.4 %D	±30 %D	Associated results were qualified as estimated (UJ/J): WL15-WAT-MID-01-091620 (K2008582-001) WL14-WAT-MID-01-091620 (K2008582-007) WL21-WAT-MID-01-091620 (K2008582-009) WL8A-WAT-MID-01-091620 (K2008582-011) WL15A-WAT-MID-01-091620 (K2008582-013) VB3-WAT-BULK-01-091620 (K2008582-015) EP13-WAT-BULK-01-091620 (K2008582-016) WL9-WAT-BULK-091620 (K2008582-017)
CCV KC2000537 10/07/20 05:53 698190	11Cl-PF3OUdS	132 %R	70-130%	Associated results were nondetect and were acceptable without qualification.
CCV KC2000521 10/01/20 18:00	8:2 FTS	138 %R	70-130%	Associated results were nondetect. No qualifiers.
CCV KC2000531 (10/6/20 23:25) 698189	PFBS	139 %R	70-130%	Results not reported from this CCV.
	PFOA	145 %R	70-130%	
	PFTrDA	136 %R	70-130%	
	PFTeDA	170 %R	70-130%	
	NEtFOSE	292 %R	70-130%	
	NMeFOSE	267 %R	70-130%	
	6:2 FTS	134 %R	70-130%	
CCV KC2000572 (10/23/20 5:52) 700484	PFTeDA	142 %R	70-130%	Associated results were nondetect. No qualifiers.
	EtFOSAA	185 %R	70-130%	Results not reported from this CCV.
	EtFOSA	143 %R	70-130%	

Trip blank detections (Section 3Aii): Detects within 10 times the blank concentrations were qualified B.

Blank ID	Compound	Blank Concentration (ng/L)	Results Qualified B
Trip Blank	PFHpA	0.78 J	WL15-WAT-MID-01-091620 (K2008582-001) WL14-WAT-MID-01-091620 (K2008582-007) WL21-WAT-MID-01-091620 (K2008582-009) WL8A-WAT-MID-01-091620 (K2008582-011) VB3-WAT-BULK-01-091620 (K2008582-015) EP13-WAT-BULK-01-091620 (K2008582-016)
Trip Blank	PFTeDA	2.3 J	WL6-WAT-BULK-01-091720 (K2008582-003) WL3-WAT-MID-01-091720 (K2008582-005) WL21-WAT-MID-01-091620 (K2008582-009) WL8A-WAT-MID-01-091620 (K2008582-011) WL15A-WAT-MID-01-091620 (K2008582-013) VB3-WAT-BULK-01-091620 (K2008582-015) EP13-WAT-BULK-01-091620 (K2008582-016)

Method blank and instrument blank detections (Section 3Bii and C): Detects within 10 times the blank concentrations were qualified B.

Method Blank ID	Prep Date	Compound	Blank Concentration (ng/L)	Results Qualified B
KQ2014249-04	9/29/20 9:47	6:2 FTS	4.3 J	WL15-WAT-MID-01-091620 (K2008582-001) WL14-WAT-MID-01-091620 (K2008582-007) WL21-WAT-MID-01-091620 (K2008582-009) WL8A-WAT-MID-01-091620 (K2008582-011) WL15A-WAT-MID-01-091620 (K2008582-013) VB3-WAT-BULK-01-091620 (K2008582-015) EP13-WAT-BULK-01-091620 (K2008582-016) WL9-WAT-BULK-091620 (K2008582-017)
		8:2 FTS	0.16 J	Associated results were nondetect.
KQ2014290-03	9/29/2020 15:17	PFDoA	1.4 J	WL6-WAT-BULK-01-091720 (K2008582-004) WL21-WAT-MID-01-091620 (K2008582-010) WL8A-WAT-MID-01-091620 (K2008582-012) WL15A-WAT-MID-01-091620 (K2008582-014)
		MeFOSA	0.51 J	WL21-WAT-MID-01-091620 (K2008582-010)
		PFTeDA	2.6 J	No associated results.
		PFTrDA	3.6 J	
KQ2016108-03	10/22/2020 8:46	MeFOSA	0.62 J	No associated results.
		NEtFOSE	0.18 J	WL6-WAT-BULK-01-091720 (K2008582-004)
		PFOA	0.99 J	No associated results.

CCB Blank ID	Date/Time	Compound	Blank Concentration (ng/L)	Results Qualified B
KQ2014505-02	10/1/20 18:11	EtFOSA	0.60 J	WL15-WAT-MID-01-091620 (K2008582-001)
KQ2014704-02	10/2/20 14:32	PFOA	0.36 J	No associated results.
KQ2014730-02	10/5/20 21:16	MeFOSA	0.77 J	Associated results were nondetect.
		EtFOSA	0.40 J	
KQ2014843-02	10/6/20 23:36	PFHpA	0.66 J	No associated results.
		PFTeDA	3.1 J	
		MeFOSA	0.58 J	
KQ2016092-02	10/20/20 13:59	PFOA	0.37 J	No associated results.
KQ2016454-02	10/23/20 06:03	PFOS	0.57 J	No associated results.
		PFOA	0.62 J	

Labeled Analogs - surrogates (Section 4Bii): Results associated with low recoveries were qualified as estimated (UJ and J+), as these labeled analogs are used to quantitate the analyte of interest and an inverse relationship exists. Three results were rejected (R) due to severely low recoveries.

Sample ID	Lab ID	Labeled Analog	% Recovery (Limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
WL15-WAT-MID-01-091620	K2008582-002	13C2-PFDoDA	44	UJ
		13C2-PFTeDA	22	UJ
		D3-MeFOSAA	29	UJ
		D5-EtFOSAA	24	UJ
		D9-EtFOSE	47	UJ
WL6-WAT-BULK-01-091720	K2008582-003	13C2-4:2 FTS	327	No Qualifier
		13C2-6:2 FTS	238	No Qualifier
		13C2-PFTeDA	45	J+
		D9-EtFOSE	40	UJ
WL6-WAT-BULK-01-091720	K2008582-004	13C2-PFDoDA	33	J+
		13C2-PFTeDA	21	UJ
		D3-MeFOSA	46	UJ
		D3-MeFOSAA	26	UJ
		D5-EtFOSAA	22	UJ
WL3-WAT-MID-01-091720	K2008582-005	13C2-4:2 FTS	298	No Qualifier
		13C2-6:2 FTS	237	No Qualifier
		D9-EtFOSE	47	J+
WL3-WAT-MID-01-091720	K2008582-006	13C2-PFDoDA	38	UJ
		13C2-PFTeDA	34	UJ
		D3-MeFOSAA	32	UJ
		D5-EtFOSAA	26	UJ
WL14-WAT-MID-01-091620	K2008582-008	13C2-PFDoDA	40	UJ
		13C2-PFTeDA	23	UJ
		D3-MeFOSAA	29	UJ
		D5-EtFOSAA	26	UJ
WL21-WAT-MID-01-091620	K2008582-009	13C2-PFTeDA	44	J+

Sample ID	Lab ID	Labeled Analog	% Recovery (Limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
WL21-WAT-MID-01-091620	K2008582-010	13C2-PFDoDA	34	J+
		13C2-PFTeDA	21	UJ
		13C2-PFUnDA	49	UJ
		13C8-FOSA	34	J+
		D3-MeFOSA	9	R
		D3-MeFOSAA	12	R
		D5-EtFOSAA	15	R
WL8A-WAT-MID-01-091620	K2008582-011	13C2-PFTeDA	46	J+
WL8A-WAT-MID-01-091620	K2008582-012	13C2-PFDoDA	32	J+
		13C2-PFTeDA	28	UJ
		D3-MeFOSA	41	UJ
		D3-MeFOSAA	24	UJ
		D5-EtFOSAA	20	UJ
WL15A-WAT-MID-01-091620	K2008582-014	13C2-PFDoDA	40	J+
		13C2-PFTeDA	25	UJ
		D3-MeFOSA	34	UJ
		D3-MeFOSAA	39	UJ
		D5-EtFOSAA	21	J+
WL9-WAT-BULK-091620	K2008582-017	13C2-PFTeDA	48	UJ
TRIP BLANK	K2008582-018	D9-EtFOSE	44	UJ

Laboratory control sample/Laboratory control sample duplicate (Section 5Bii): Results associated with low recoveries were nondetect and qualified as estimated (UJ) and detects associated with high recoveries were qualified as J+:

LCS/LCSD IDs (Batch)	Compound	LCS/LCSD % Recovery	Recovery Limits	Qualifiers
KQ2014290-01/ KQ2014290-02 (698190)	11Cl-PF3OUdS	73/**68**	70-130	Associated result results were nondetect and qualified UJ: WL15-WAT-MID-01-091620 (K2008582-002) WL6-WAT-BULK-01-091720 (K2008582-004) WL3-WAT-MID-01-091720 (K2008582-006) WL14-WAT-MID-01-091620 (K2008582-008) WL21-WAT-MID-01-091620 (K2008582-010) WL8A-WAT-MID-01-091620 (K2008582-012) WL15A-WAT-MID-01-091620 (K2008582-014)
KQ2014249-03 (698697)	6:2 FTS	**184**/--	70-130	J+: WL15-WAT-MID-01-091620 (K2008582-001) WL14-WAT-MID-01-091620 (K2008582-007) WL21-WAT-MID-01-091620 (K2008582-009) WL8A-WAT-MID-01-091620 (K2008582-011) WL15A-WAT-MID-01-091620 (K2008582-013) VB3-WAT-BULK-01-091620 (K2008582-015) EP13-WAT-BULK-01-091620 (K2008582-016) WL9-WAT-BULK-091620 (K2008582-017)
	8:2 FTS	**132**/--	70-130	Associated results were nondetect. No qualifiers.
	PFNS	**68**/--	70-130	Associated result results were nondetect and

LCS/LCSD IDs (Batch)	Compound	LCS/LCSD % Recovery	Recovery Limits	Qualifiers
	PFDS	**61**/--	70-130	qualified UJ: WL15-WAT-MID-01-091620 (K2008582-001) WL14-WAT-MID-01-091620 (K2008582-007) WL21-WAT-MID-01-091620 (K2008582-009) WL8A-WAT-MID-01-091620 (K2008582-011) WL15A-WAT-MID-01-091620 (K2008582-013) VB3-WAT-BULK-01-091620 (K2008582-015) EP13-WAT-BULK-01-091620 (K2008582-016) WL9-WAT-BULK-091620 (K2008582-017)
KQ2014290-01/ KQ2014290-02 (699134)	MeFOSAA	122/**132**	70-130	Associated results were nondetect. No qualifiers.
	PFDoDA	**146/133**	70-130	J+: WL6-WAT-BULK-01-091720 (K2008582-004) WL21-WAT-MID-01-091620 (K2008582-010) WL8A-WAT-MID-01-091620 (K2008582-012) WL15A-WAT-MID-01-091620 (K2008582-014)
	PFUnDA	126/**131**	70-130	J+: WL8A-WAT-MID-01-091620 (K2008582-012)
	PFPeS	**143**/125	70-130	J+: WL15-WAT-MID-01-091620 (K2008582-002) WL6-WAT-BULK-01-091720 (K2008582-004) WL3-WAT-MID-01-091720 (K2008582-006) WL21-WAT-MID-01-091620 (K2008582-010) WL8A-WAT-MID-01-091620 (K2008582-012) WL14-WAT-MID-01-091620 (K2008582-008) WL15A-WAT-MID-01-091620 (K2008582-014)
KQ2014290-01/ KQ2014290-02 (699503)	PFDS	**67/58**	70-130	No associated results.
	PFTrDA	**148/157**	70-130	
KQ2016108-01/ KQ2016108-02 (700485)	EtFOSA	**154/145**	70-130	Associated results were nondetect. No qualifiers.
	NMeFOSE	**137/153**	70-130	
	PFTeDA	**134**/124	70-130	
	NEtFOSE	**187/226**	70-130	J+: WL6-WAT-BULK-01-091720 (K2008582-004)

Any R qualifiers take precedence over other qualifiers. Results with both high bias (J+) and low bias (J-), should be qualified as estimated (J).

MINNESOTA

Minnesota Department of Agriculture 651-201-6148
Minnesota Department of Health 651-201-5357
Minnesota Pollution Control Agency 651-757-2560

Laboratory data review checklist

Doc Type: Data Review

Instructions: The following is the informal checklist that should be used to review data for the Minnesota Department of Agriculture, Minnesota Pollution Control Agency, and Minnesota Department of Health. The information follows the general format of the National Functional Guidelines, which is the primary data review tool used in the U.S. Environmental Protection Agency's Contract Laboratory Program for Superfund analytical work. Refer to the appropriate guidance document for each agency for instructions.

Project information

Project name: Project 1007

Work order number/Lab report ID: K2008583.01 Report date (mm/dd/yyyy): 11/13/2020

Laboratory: ALS - Kelso, Washington Review date (mm/dd/yyyy): 11/28/2020

1. Chain of custody, preservation, and holding times

Questions			Yes	No	N/A	Comments
A.	Is there a chain of custody (COC) with the report?		☒	☐	☐	
B.	Is there a sample condition form with the report?		☒	☐	☐	Receipt form indicated a trip blank was received but was not listed on the COC. Receipt form discusses issues with water samples (2 listed on COC were not received, and two additional samples were received that were not listed on COC).
C.	Were there samples preserved according to program requirements?		☒	☐	☐	
D.	Were samples received in the correct containers?		☒	☐	☐	
	i.	Was there enough sample volume/weight to complete all requested analyses?	☒	☐	☐	
	ii.	Was there enough sample collected to complete required batch QC?	☒	☐	☐	
E.	Were samples received within holding time for sample prep for all requested analyses?		☒	☐	☐	
F.	Are there notes about sample condition or holding time issues on the COC? Explain the data impact.		☐	☒	☐	
G.	Are there narration or data qualifiers with the report about sample condition or holding time issues? Explain the data impact.		☐	☒	☐	

H.	Are lab IDs cross-referenced correctly with the field IDs.	☒	☐	☐	Yes, but no sample summary table included in the report.

2. Calibration

Question		Yes	No	N/A	Comments
A.	Do the report narrative or data qualifiers indicate calibration problems for any analyses? If yes, explain the data impact.	☒	☐	☐	MN limits used for review. See data qualification summary for exceedances and qualifications.

3. Blanks

Question			Yes	No	N/A	Comments
A.	Do any of the analyses contain samples for field or trip blanks?		☒	☐	☐	Trip blank reported
	i.	If yes, are there target analytes present above the reporting limit in the blanks?	☐	☒	☐	The trip blank detects were less than the RL: PFHpA 1.1 J ng/L
	ii.	If yes, are the same compounds also present in the samples? Explain possible data impact.	☒	☐	☐	Associated results were greater than 10 times the blank concentration. No qualifiers.
B.	Do method blanks for any analyses contain target analytes above the reporting limit?		☐	☒	☐	Blank detects were below the RL.
	i.	If yes, are the same compounds present in the samples?	☒	☐	☐	
	ii.	Is the amount of target analyte in the method blank more than 1/10th of that in the sample(s)? Explain the possible impact on sample results.	☒	☐	☐	See data qualification summary for summary of detects and qualifications.
C.	Do instrument blanks contain analytes above the reporting limit?		☐	☒	☐	Detects were below the RL. See data qualification summary for calibration blank detects and qualifications.

4. Surrogates or organic analysis

Question			Yes	No	N/A	Comments
A.	Are the lab recovery limits for surrogates specified on the report?		☒	☐	☐	MPCA limits used: 50% to 200%
B.	Are the surrogates outside lab QC limits? (These should have a data qualifier.)		☒	☐	☐	
	i.	If yes, are the surrogates above the lab QC limits?	☒	☐	☐	
	ii.	Below the lab QC limits?	☒	☐	☐	
	iii.	Were the affected samples re-analyzed? Discuss in the case narrative.	☐	☒	☐	

	iv.	Explain what this could mean for the affected samples. Include in narrative.	☒	☐	☐	See data qualification summary for summary of qualifications.

5. Laboratory control sample/Laboratory control sample duplicate (LCS/LCSD)

Question			Yes	No	N/A	Comments
A.	Are there LCS/LCSD samples present for the reporting analyses?		☒	☐	☐	
B.	Are there LCS/LCSD compounds outside lab limits? If the LCS/LCSD fails, the LCS/LCSD and samples must be re-analyzed.		☒	☐	☐	MPCA PFAS water limits used: 70% to 130%.
	i.	If yes, are there compounds above the lab QC limits? If yes, an explanation is required. Include in narrative.	☒	☐	☐	See data qualification summary for summary of exceedances and qualifications.
	ii.	Below the QC limits? If yes, an explanation is required. Include in narrative.	☐	☒	☐	

6. Matrix spike/Matrix spike duplicate/Sample duplicate (MS/MSD/DUP)

Question				Yes	No	N/A	Comments
A.	Do the analytical methods used require an MS and/or MSD? If no, skip to 6.B.			☒	☐	☐	
	i.	Have the required matrix spikes been prepared and reported?		☐	☒	☐	None for this SDG.
	ii.	If no, is there and explanation in the report as to why?		☐	☒	☐	
	iii.	Did the lab process an alternate spiked sample (such as LCSD) instead?		☒	☐	☐	LCSDs
	iv.	Are the lab QC limits specified on the report?		☒	☐	☐	
	v.	Are there compounds outside the lab QC limits?		☐	☐	☒	
	vi.	If yes, did the lab re-run an MS/MSD?		☐	☐	☒	
		1.	Did the re-run MS/MSD pass? Discuss the case narrative.	☐	☐	☒	
		2.	Did the re-run MS/MSD fail? Discuss the case narrative.	☐	☐	☒	
		3.	Is the source sample also flagged for MS/MSD compounds outside the lab QC limits?	☐	☐	☒	
B.	Was a duplicate sample submitted for the analytical method(s)?			☒	☐	☐	LCSD
	i.	Is the Relative Percentage Difference (RPD) within 20%* for the duplicate pair? If no, explain possible causes and data impact.		☐	☒	☐	30% limit for PFAS (water). LCSD - See data qualification summary for summary of exceedances and qualifications.

		**Other RPDs may be acceptable. Check with regulatory agency.*				

7. Method detection limits/Report limits

Question		Yes	No	N/A	Comments
A.	Are reporting limits clearly listed on the report for all analyses?	☒	☐	☐	
B.	Do the reporting limits meet the program required limits listed? If not, an explanation is required.	☐	☒	☐	Results for 11Cl-PF3OUdS, 9Cl-PF3ONS and ADONA were nondetect and reported to the RL, while other PFAS compound were reported to the method detection limit (MDL).

8. Sample information

Questions		Yes	No	N/A	Comments
A.	Are sample numbers cross-referenced correctly with the associated QC?	☒	☐	☐	
B.	Are soil samples reported in dry weight basis?	☐	☐	☒	
C.	Are percent moisture results reported?	☐	☐	☒	
D.	Are positive detections reported?	☒	☐	☐	
E.	Are sample analytes appropriately flagged if the QC failed?	☒	☐	☐	

9. Report narrative

Question		Yes	No	N/A	Comments
A.	Is a narrative provided with the laboratory report which describes all problems with the analyses and all corrective actions taken to address these problems?	☒	☐	☐	Numerous issues discussed in case narrative.

10. Additional comments about the lab report

Reviewed using MPCA Guidance on Perfluorochemicals Analysis (July 2020).

See attachedment for qualification.

Certification

By typing my name below, I certify the above statements to be true and correct, to the best of my knowledge, and that this information can be used for the purpose of processing this form.

Authorized Representative

Name: Lisa Smith Title: Environmental Chemist (CEAC)

(This document has been electronically signed.) Date (mm/dd/yyyy): 11/28/2020

Data Validation Qualifications for K2008583.01

Calibration (Section 2): Calibration noncompliances and the results qualified are summarized below.

Calibration (Date)	Analyte	%D or %R	Limit	Qualifiers
CCV KC2000537 10/07/20 05:53 698190	11Cl-PF3OUdS	132 %R	70-130%	Associated results were nondetect and were acceptable without qualification.
CCV KC2000531 (10/6/20 23:25) 698189	PFBS	139 %R	70-130%	Results not reported from this CCV.
	PFOA	145 %R	70-130%	
	PFTrDA	136 %R	70-130%	Associated results were nondetect and were acceptable without qualification.
	NMeFOSE	267 %R	70-130%	
	PFTeDA	170 %R	70-130%	J+: RC6-WAT-BULK-01-091820 (K2008583-002)
	NEtFOSE	292 %R	70-130%	
	6:2 FTS	134 %R	70-130%	

Method blank and instrument blank detections (Section 3Bii and C): Detects within 10 times the blank concentrations were qualified B.

Method Blank ID	Prep Date	Compound	Blank Concentration (ng/L)	Results Qualified B
KQ2014429-03	10/1/20 7:40	EtFOSA	0.38 J	Associated results were nondetect.
		MeFOSA	0.75 J	
		NMeFOSE	1.1 J	
		NEtFOSE	0.93 J	RC6-WAT-BULK-01-091820 (K2008583-002)
		PFTeDA	3.7 J	
		PFBS	0.3 J	No associated results.
KQ2014435-03	10/1/20 9:03	EtFOSAA	1.3 J	RC6A-WAT-BULK-01-092020 (K2008583-003)
		NEtFOSE	0.16 J	RC6-WAT-BULK-01-091820 (K2008583-001)
		PFHpA	0.96 J	Associated results were greater than 10 times the blank concentration. No qualifiers.
		PFBA	0.53 J	
		PFHpA	0.73 J	
		PFTrDA	1.4 J	Associated results were nondetect.
		MeFOSA	0.71 J	

CCB Blank ID	Date/Time	Compound	Blank Concentration (ng/L)	Results Qualified B
KQ2014843-02	10/6/20 23:36	PFHpA	0.66 J	Associated results were greater than 10 times the blank concentration. No qualifiers.
		PFTeDA	3.1 J	RC6-WAT-BULK-01-091820 (K2008583-002)
		MeFOSA	0.58 J	Associated results were nondetect.

CCB Blank ID	Date/Time	Compound	Blank Concentration (ng/L)	Results Qualified B
KQ2015031-02	10/8/20 10:29	PFHpA	0.67 J	RC6A-WAT-BULK-01-092020 (K2008583-004) RC7-WAT-BULK-02-091920 (K2008583-009) RC7-WAT-BULK-01-091920 (K2008583-008) RC7-WAT-BULK-01-091920 (K2008583-007) RC6A-POWAT-01-092120 (K2008583-005) RC6A-POWAT-02-092120 (K2008583-006) RC22-WAT-BULK-01-091920 (K2008583-011)
		MeFOSA	0.62 J	RC7-WAT-BULK-02-091920 (K2008583-009)
		EtFOSAA	0.92 J	RC7-WAT-BULK-01-091920 (K2008583-007) RC7-WAT-BULK-01-091920 (K2008583-008) RC7-WAT-BULK-02-091920 (K2008583-009)
KQ2015208-02	10/9/20 15:39	MeFOSA	0.68 J	Associated results were nondetect.
KQ2016092-02	10/20/20 13:59	PFOA	0.37 J	No associated results.

Labeled Analogs - surrogates (Section 4Bii): Results associated with low recoveries were qualified as estimated (J+), as these labeled analogs are used to quantitate the analyte of interest and an inverse relationship exists.

Sample ID	Lab ID	Labeled Analog	% Recovery (Limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
RC6-WAT-BULK-01-091820	K2008583-002	13C2-4:2 FTS	207	No Qualifier
		D9-EtFOSE	36	J+
RC6A-WAT-BULK-01-092020	K2008583-003	13C2-4:2 FTS	233	No Qualifier
RC6A-POWAT-02-092120	K2008583-006	13C3-PFBS	44	J+
RC7-WAT-BULK-01-091920	K2008583-007	13C2-4:2 FTS	207	No Qualifier

Laboratory control sample/Laboratory control sample duplicate (Section 5Bi): Detects associated with high recoveries were qualified as J+:

LCS/LCSD IDs (Batch)	Compound	LCS/LCSD % Recovery	Recovery Limits	Qualifiers
KQ2014429-01/ KQ2014429-02 (698190)	4:2 FTS	**137**/120	70-130	Associated results were nondetect. No qualifiers.
	6:2 FTS	**138**/125	70-130	J+:
	PFBA	**134**/130	70-130	RC6-WAT-BULK-01-091820 (K2008583-002)
KQ2014429-01/ KQ2014429-02 (699503)	PFPeS	**166/153**	70-130	J+: RC6-WAT-BULK-01-091820 (K2008583-002)
	PFTrDA	**139**/109	70-130	Associated results were nondetect. No qualifiers.
KQ2014516-01/ KQ2014516-02 (698467)	10:2 FTS	120/**178**	70-130	Associated results were nondetect. No qualifiers.
	PFPeS	119/**145**	70-130	J+: RC6A-WAT-BULK-01-092020 (K2008583-004) RC7-WAT-BULK-01-091920 (K2008583-008) RC7-WAT-BULK-02-091920 (K2008583-009) RC7-POWAT-01-092020 (K2008583-010) RC22-WAT-BULK-01-091920 (K2008583-012)

LCS/LCSD IDs (Batch)	Compound	LCS/LCSD % Recovery	Recovery Limits	Qualifiers
KQ2014524-01/ KQ2014524-02 (698467)	PFPeS	130/**133**	70-130	J+: RC7-WAT-BULK-01-091920 (K2008583-007)
KQ2014635-01/ KQ2014635-02 (698705)	PFDoDA	129/**149**	70-130	Associated results were nondetect. No qualifiers.
	PFUnA	125/**134**	70-130	
	PFHpS	**132/136**	70-130	J+: RC6A-POWAT-01-092120 (K2008583-005) RC6A-POWAT-02-092120 (K2008583-006)
	PFOS	127/**132**	70-130	
	PFPeS	**146/141**	70-130	
KQ2014635-01/ KQ2014635-02 (698706)	11Cl-PF3OUdS	**143/142**	70-130	Associated results were nondetect. No qualifiers.

Laboratory control sample/Laboratory control sample duplicate RPDs (Section 6Bi): Detects associated with high RPDs were qualified as J:

LCS/LCSD IDs (Batch)	Compound	RPD	RPD Limit	Qualifiers
KQ2014516-01/ KQ2014516-02 (698467)	10:2 FTS	39	30	Associated results were nondetect. No qualifiers.
	PFHpS	35	30	J: RC6A-WAT-BULK-01-092020 (K2008583-004) RC7-WAT-BULK-02-091920 (K2008583-009) RC7-POWAT-01-092020 (K2008583-010) RC22-WAT-BULK-01-091920 (K2008583-012)

MINNESOTA

Minnesota Department of Agriculture 651-201-6148
Minnesota Department of Health 651-201-5357
Minnesota Pollution Control Agency 651-757-2560

Laboratory data review checklist

Doc Type: Data Review

Instructions: The following is the informal checklist that should be used to review data for the Minnesota Department of Agriculture, Minnesota Pollution Control Agency, and Minnesota Department of Health. The information follows the general format of the National Functional Guidelines, which is the primary data review tool used in the U.S. Environmental Protection Agency's Contract Laboratory Program for Superfund analytical work. Refer to the appropriate guidance document for each agency for instructions.

Project information

Project name: Project 1007

Work order number/Lab report ID: K2008624.01 Report date (mm/dd/yyyy): 11/12/2020

Laboratory: ALS - Kelso, Washington Review date (mm/dd/yyyy): 11/29/2020

1. Chain of custody, preservation, and holding times

Questions			Yes	No	N/A	Comments
A.	Is there a chain of custody (COC) with the report?		☒	☐	☐	
B.	Is there a sample condition form with the report?		☒	☐	☐	Receipt form indicates the collection date on the COC did not match the sample labels for one sample. The ID on the COC was used as it matched the date in the sample ID. COCs also include water samples not reported in this SDG.
C.	Were there samples preserved according to program requirements?		☒	☐	☐	
D.	Were samples received in the correct containers?		☒	☐	☐	
	i.	Was there enough sample volume/weight to complete all requested analyses?	☒	☐	☐	
	ii.	Was there enough sample collected to complete required batch QC?	☒	☐	☐	
E.	Were samples received within holding time for sample prep for all requested analyses?		☒	☐	☐	
F.	Are there notes about sample condition or holding time issues on the COC? Explain the data impact.		☐	☒	☐	
G.	Are there narration or data qualifiers with the report about sample condition or holding time issues? Explain the data impact.		☐	☒	☐	

H.	Are lab IDs cross-referenced correctly with the field IDs.	☒	☐	☐	Yes, but no sample summary table included in the report.

2. Calibration

Question		Yes	No	N/A	Comments
A.	Do the report narrative or data qualifiers indicate calibration problems for any analyses? If yes, explain the data impact.	☒	☐	☐	MN limits used during review. See data qualification summary for exceedances and qualifications.

3. Blanks

Question			Yes	No	N/A	Comments
A.	Do any of the analyses contain samples for field or trip blanks?		☐	☒	☐	
	i.	If yes, are there target analytes present above the reporting limit in the blanks?	☐	☐	☒	
	ii.	If yes, are the same compounds also present in the samples? Explain possible data impact.	☐	☐	☒	
B.	Do method blanks for any analyses contain target analytes above the reporting limit?		☐	☒	☐	Blank detects were below the RL.
	i.	If yes, are the same compounds present in the samples?	☒	☐	☐	
	ii.	Is the amount of target analyte in the method blank more than 1/10th of that in the sample(s)? Explain the possible impact on sample results.	☒	☐	☐	See data qualification summary for associated samples and qualifications.
C.	Do instrument blanks contain analytes above the reporting limit?		☐	☒	☐	Detects were below the RL. See data qualification summary for calibration blank detects and qualifications.

4. Surrogates or organic analysis

Question			Yes	No	N/A	Comments
A.	Are the lab recovery limits for surrogates specified on the report?		☒	☐	☐	MPCA limits used: 50% to 200%
B.	Are the surrogates outside lab QC limits? (These should have a data qualifier.)		☒	☐	☐	
	i.	If yes, are the surrogates above the lab QC limits?	☐	☒	☐	
	ii.	Below the lab QC limits?	☒	☐	☐	
	iii.	Were the affected samples re-analyzed? Discuss in the case narrative.	☐	☒	☐	

	iv.	Explain what this could mean for the affected samples. Include in narrative.	☒	☐	☐	See data qualification summary for exceedances and qualifications.

5. Laboratory control sample/Laboratory control sample duplicate (LCS/LCSD)

Question			Yes	No	N/A	Comments
A.	Are there LCS/LCSD samples present for the reporting analyses?		☒	☐	☐	
B.	Are there LCS/LCSD compounds outside lab limits? If the LCS/LCSD fails, the LCS/LCSD and samples must be re-analyzed.		☒	☐	☐	MPCA PFAS sed/other limits used: 50% to 150%.
	i.	If yes, are there compounds above the lab QC limits? If yes, an explanation is required. Include in narrative.	☒	☐	☐	KQ2014340-03: 10:2 FTS 178% KQ2014341-03: PFPeS 159% Associated results were nondetect. No qualifiers.
	ii.	Below the QC limits? If yes, an explanation is required. Include in narrative.	☐	☒	☐	

6. Matrix spike/Matrix spike duplicate/Sample duplicate (MS/MSD/DUP)

Question				Yes	No	N/A	Comments
A.	Do the analytical methods used require an MS and/or MSD? If no, skip to 6.B.			☒	☐	☐	
	i.	Have the required matrix spikes been prepared and reported?		☒	☐	☐	EP4-SED-0-6-03-092420 (K2008624-011) EP27B-SED-0-6-092420 (K2008624-021)
	ii.	If no, is there and explanation in the report as to why?		☐	☐	☒	
	iii.	Did the lab process an alternate spiked sample (such as LCSD) instead?		☐	☒	☐	
	iv.	Are the lab QC limits specified on the report?		☒	☐	☐	
	v.	Are there compounds outside the lab QC limits?		☒	☐	☐	EP4-SED-0-6-03-092420 (K2008624-011): 10:2 FTS 216%/209% EP27B-SED-0-6-092420 (K2008624-021): PFPeS: 176% (MSD %R ok) Associated results were nondetect. No qualifiers.
	vi.	If yes, did the lab re-run an MS/MSD?		☐	☐	☒	
		1.	Did the re-run MS/MSD pass? Discuss the case narrative.	☐	☐	☒	
		2.	Did the re-run MS/MSD fail? Discuss the case narrative.	☐	☐	☒	

		3.	Is the source sample also flagged for MS/MSD compounds outside the lab QC limits?	☐	☐	☒	
B.	Was a duplicate sample submitted for the analytical method(s)?			☒	☐	☐	MSDs FDs: EP4-SED-0-6-01-092420/EP4-SED-0-6-02-092420/EP4-SED-0-6-03-092420 RC13-SED-0-6-01-092320/RC13-SED-0-6-02-092320
	i.	Is the Relative Percentage Difference (RPD) within 20%* for the duplicate pair? If no, explain possible causes and data impact. **Other RPDs may be acceptable. Check with regulatory agency.*		☐	☒	☐	50% RPD limit for PFAS (sed). MS/MSD RPDs ok See data qualification summary for field duplicate exceedances and qualifications.

7. Method detection limits/Report limits

Question		Yes	No	N/A	Comments
A.	Are reporting limits clearly listed on the report for all analyses?	☒	☐	☐	
B.	Do the reporting limits meet the program required limits listed? If not, an explanation is required.	☐	☒	☐	Results for 11Cl-PF3OUdS, 9Cl-PF3ONS and ADONA were nondetect and reported to the RL, while other PFAS compound were reported to the method detection limit (MDL).

8. Sample information

Questions		Yes	No	N/A	Comments
A.	Are sample numbers cross-referenced correctly with the associated QC?	☒	☐	☐	
B.	Are soil samples reported in dry weight basis?	☒	☐	☐	
C.	Are percent moisture results reported?	☒	☐	☐	
D.	Are positive detections reported?	☒	☐	☐	
E.	Are sample analytes appropriately flagged if the QC failed?	☒	☐	☐	

9. Report narrative

Question		Yes	No	N/A	Comments
A.	Is a narrative provided with the laboratory report which describes all problems with the analyses and all corrective actions taken to address these problems?	☒	☐	☐	

10. Additional comments about the lab report

Reviewed using MPCA Guidance on Perfluorochemicals Analysis (July 2020).

See attachedment for qualification.

Certification

By typing my name below, I certify the above statements to be true and correct, to the best of my knowledge, and that this information can be used for the purpose of processing this form.

Authorized Representative

Name: Lisa Smith Title: Environmental Chemist (CEAC)

(This document has been electronically signed.) Date (mm/dd/yyyy): 11/29/2020

Data Validation Qualifications for K2008624.01

Calibration (Section 2): Calibration noncompliances and the results qualified are summarized below.

Calibration (Date)	Analyte	%D or %R	Limit	Qualifiers
ICV KC2000521-08 (9/29/20)	EtFOSAA	36.4 %D	±30 %D	Associated results were qualified as estimated (UJ/J): WL16-SED-0-6-01-092320 (K2008624-001) WL10A-SED-0-6-01-092220 (K2008624-002) WL13-SED-0-6-01-092520 (K2008624-003) WL8A-SED-0-6-01-092220 (K2008624-004) WL11-SED-0-6-01-092220 (K2008624-005) WL10-SED-0-6-01-092220 (K2008624-006) WL7-SED-0-6-01-092420 (K2008624-007) EP5-SED-0-6-01-092420 (K2008624-008) EP4-SED-0-6-01-092420 (K2008624-009) EP4-SED-0-6-02-092420 (K2008624-010) EP4-SED-0-6-03-092420 (K2008624-011) WL6-SED-0-6-01-092420 (K2008624-012) WL2-SED-0-6-01-092220 (K2008624-013) RC18A-SED-0-6-01-092320 (K2008624-014) RC17A-SED-0-6-01-092320 (K2008624-015) RC21A-SED-0-6-01-092220 (K2008624-016) RC21B-SED-0-6-01-092220 (K2008624-017) RC13-SED-0-6-02-092320 (K2008624-019) RC14-SED-0-6-01-092320 (K2008624-020))
ICV KC2000533-08 (9/29/20)	11Cl-PF3OUdS	38.22 %D	±30 %D	Associated results were nondetect and qualified as estimated (UJ): WL16-SED-0-6-01-092320 (K2008624-001) WL10A-SED-0-6-01-092220 (K2008624-002) WL13-SED-0-6-01-092520 (K2008624-003) WL8A-SED-0-6-01-092220 (K2008624-004) WL11-SED-0-6-01-092220 (K2008624-005) WL10-SED-0-6-01-092220 (K2008624-006) WL7-SED-0-6-01-092420 (K2008624-007) EP5-SED-0-6-01-092420 (K2008624-008) EP4-SED-0-6-01-092420 (K2008624-009) EP4-SED-0-6-02-092420 (K2008624-010) EP4-SED-0-6-03-092420 (K2008624-011) WL6-SED-0-6-01-092420 (K2008624-012) WL2-SED-0-6-01-092220 (K2008624-013) RC18A-SED-0-6-01-092320 (K2008624-014) RC17A-SED-0-6-01-092320 (K2008624-015) RC21A-SED-0-6-01-092220 (K2008624-016) RC21B-SED-0-6-01-092220 (K2008624-017) RC13-SED-0-6-01-092320 (K2008624-018) RC13-SED-0-6-02-092320 (K2008624-019) RC14-SED-0-6-01-092320 (K2008624-020)
CCV KC2000521 (10/02/20 21:07) 697957	8:2 FTS	139 %R	70-130%	Associated results were nondetect and were acceptable without qualification.
	10:2 FTS	196 %R	70-130%	

Method blank and instrument blank detections (Section 3Bii and C): Detects within 10 times the blank concentrations were qualified B.

Blank Sample ID	Analyte	Concentration (ng/g)	Results Qualified B
Method Blank KQ2014340-04	8:2 FTS	0.03 J	RC14-SED-0-6-01-092320 (K2008624-020)
	PFTeDA	0.25 J	WL16-SED-0-6-01-092320 (K2008624-001) WL10A-SED-0-6-01-092220 (K2008624-002) WL13-SED-0-6-01-092520 (K2008624-003) WL8A-SED-0-6-01-092220 (K2008624-004) WL11-SED-0-6-01-092220 (K2008624-005) WL10-SED-0-6-01-092220 (K2008624-006) WL7-SED-0-6-01-092420 (K2008624-007) EP5-SED-0-6-01-092420 (K2008624-008) EP4-SED-0-6-01-092420 (K2008624-009) EP4-SED-0-6-02-092420 (K2008624-010) EP4-SED-0-6-03-092420 (K2008624-011) WL6-SED-0-6-01-092420 (K2008624-012) WL2-SED-0-6-01-092220 (K2008624-013) RC18A-SED-0-6-01-092320 (K2008624-014) RC17A-SED-0-6-01-092320 (K2008624-015) RC21A-SED-0-6-01-092220 (K2008624-016) RC13-SED-0-6-01-092320 (K2008624-018) RC13-SED-0-6-02-092320 (K2008624-019) RC14-SED-0-6-01-092320 (K2008624-020)
	MeFOSA	0.11 J	WL16-SED-0-6-01-092320 (K2008624-001) WL13-SED-0-6-01-092520 (K2008624-003) WL11-SED-0-6-01-092220 (K2008624-005) WL10-SED-0-6-01-092220 (K2008624-006) EP4-SED-0-6-03-092420 (K2008624-011) RC17A-SED-0-6-01-092320 (K2008624-015) RC21B-SED-0-6-01-092220 (K2008624-017) RC13-SED-0-6-02-092320 (K2008624-019) RC14-SED-0-6-01-092320 (K2008624-020)
CCB KQ2014699-02 10/2/20 21:18	PFTeDA	0.35 J	WL16-SED-0-6-01-092320 (K2008624-001) WL10A-SED-0-6-01-092220 (K2008624-002) WL13-SED-0-6-01-092520 (K2008624-003) WL8A-SED-0-6-01-092220 (K2008624-004) WL11-SED-0-6-01-092220 (K2008624-005) WL10-SED-0-6-01-092220 (K2008624-006) WL7-SED-0-6-01-092420 (K2008624-007) EP5-SED-0-6-01-092420 (K2008624-008) EP4-SED-0-6-01-092420 (K2008624-009) EP4-SED-0-6-02-092420 (K2008624-010) EP4-SED-0-6-03-092420 (K2008624-011) WL6-SED-0-6-01-092420 (K2008624-012) WL2-SED-0-6-01-092220 (K2008624-013) RC18A-SED-0-6-01-092320 (K2008624-014) RC17A-SED-0-6-01-092320 (K2008624-015) RC21A-SED-0-6-01-092220 (K2008624-016) RC13-SED-0-6-01-092320 (K2008624-018) RC13-SED-0-6-02-092320 (K2008624-019) RC14-SED-0-6-01-092320 (K2008624-020)
	EtFOSA	0.16 J	Associated results were nondetect. No qualifiers.

Blank Sample ID	Analyte	Concentration (ng/g)	Results Qualified B
CCB KQ2015283-02 10/11/20 23:14	MeFOSA	0.25 J	WL16-SED-0-6-01-092320 (K2008624-001) WL13-SED-0-6-01-092520 (K2008624-003) WL11-SED-0-6-01-092220 (K2008624-005) WL10-SED-0-6-01-092220 (K2008624-006) EP4-SED-0-6-03-092420 (K2008624-011) RC17A-SED-0-6-01-092320 (K2008624-015) RC21B-SED-0-6-01-092220 (K2008624-017) RC13-SED-0-6-02-092320 (K2008624-019) RC14-SED-0-6-01-092320 (K2008624-020)
CCB KQ2015285-02 10/12/20 06:30	EtFOSA	0.15 J	Associated results were nondetect. No qualifiers.
	MeFOSA	0.18 J	EP27B-SED-0-6-092420 (K2008624-021)
	EtFOSAA	0.24 J	RC13-SED-0-6-01-092320 (K2008624-018) EP27B-SED-0-6-092420 (K2008624-021)
CCB KQ2015731-02 10/15/20 08:45	MeFOSA	0.086 J	Associated results were nondetect. No qualifiers.

Labeled Analogs - surrogates (Section 4Bii): Results associated with low recoveries were nondetect and qualified as estimated (UJ).

Sample ID	Lab ID	Labeled Analog	% Recovery (Limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
WL10A-SED-0-6-01-092220	K2008624-002	13C3-PFBS	42	UJ
WL6-SED-0-6-01-092420	K2008624-012	13C3-PFBS	45	UJ
RC13-SED-0-6-01-092320	K2008624-018	13C3-PFBS	46	UJ
RC13-SED-0-6-02-092320	K2008624-019	13C3-PFBS	42	UJ
RC14-SED-0-6-01-092320	K2008624-020	13C3-PFBS	48	UJ

Field duplicate results (Section 6Bi): Detects associated with high RPD were qualified as estimated (J):

Analyte	Parent Sample Result (ng/L)	Field Duplicate Result (ng/L)	Triplicate Result (ng/L)	RPD (%)
EP4-SED-0-6-01-092420/EP4-SED-0-6-02-092420/EP4-SED-0-6-03-092420:				
PFOS	4.9	2.7	4.1	56

MINNESOTA

Minnesota Department of Agriculture 651-201-6148
Minnesota Department of Health 651-201-5357
Minnesota Pollution Control Agency 651-757-2560

Laboratory data review checklist

Doc Type: Data Review

Instructions: The following is the informal checklist that should be used to review data for the Minnesota Department of Agriculture, Minnesota Pollution Control Agency, and Minnesota Department of Health. The information follows the general format of the National Functional Guidelines, which is the primary data review tool used in the U.S. Environmental Protection Agency's Contract Laboratory Program for Superfund analytical work. Refer to the appropriate guidance document for each agency for instructions.

Project information

Project name: Project 1007

Work order number/Lab report ID: K2008630 Report date (mm/dd/yyyy): 10/28/2020

Laboratory: ALS - Kelso, Washington Review date (mm/dd/yyyy): 11/29/2020

1. Chain of custody, preservation, and holding times

Questions			Yes	No	N/A	Comments
A.	Is there a chain of custody (COC) with the report?		☒	☐	☐	
B.	Is there a sample condition form with the report?		☒	☐	☐	A number of sediment samples are listed on the COCs that were not reported in this SDG. Receipt form discusses filter/unfilter labeling issues for sample WL11-POWAT-01-092220.
C.	Were there samples preserved according to program requirements?		☒	☐	☐	
D.	Were samples received in the correct containers?		☒	☐	☐	
	i.	Was there enough sample volume/weight to complete all requested analyses?	☒	☐	☐	
	ii.	Was there enough sample collected to complete required batch QC?	☒	☐	☐	
E.	Were samples received within holding time for sample prep for all requested analyses?		☒	☐	☐	
F.	Are there notes about sample condition or holding time issues on the COC? Explain the data impact.		☐	☒	☐	
G.	Are there narration or data qualifiers with the report about sample condition or holding time issues? Explain the data impact.		☐	☒	☐	
H.	Are lab IDs cross-referenced correctly with the field IDs.		☒	☐	☐	Yes, but no sample summary table included in the report.

2. Calibration

Question		Yes	No	N/A	Comments
A.	Do the report narrative or data qualifiers indicate calibration problems for any analyses? If yes, explain the data impact.	☒	☐	☐	MN limits used for review. See data qualification summary for exceedances. No qualifiers.

3. Blanks

Question			Yes	No	N/A	Comments
A.		Do any of the analyses contain samples for field or trip blanks?	☐	☒	☐	
	i.	If yes, are there target analytes present above the reporting limit in the blanks?	☐	☐	☒	
	ii.	If yes, are the same compounds also present in the samples? Explain possible data impact.	☐	☐	☒	
B.		Do method blanks for any analyses contain target analytes above the reporting limit?	☐	☒	☐	Blank detects were below the RL.
	i.	If yes, are the same compounds present in the samples?	☒	☐	☐	
	ii.	Is the amount of target analyte in the method blank more than 1/10th of that in the sample(s)? Explain the possible impact on sample results.	☒	☐	☐	See data qualification summary for summary of detects. No qualifiers.
C.		Do instrument blanks contain analytes above the reporting limit?	☐	☒	☐	Detects were below the RL. See data qualification summary for calibration blank detects and qualifications.

4. Surrogates or organic analysis

Question			Yes	No	N/A	Comments
A.		Are the lab recovery limits for surrogates specified on the report?	☒	☐	☐	MPCA limits used: 50% to 200%
B.		Are the surrogates outside lab QC limits? (These should have a data qualifier.)	☒	☐	☐	
	i.	If yes, are the surrogates above the lab QC limits?	☒	☐	☐	
	ii.	Below the lab QC limits?	☒	☐	☐	
	iii.	Were the affected samples re-analyzed? Discuss in the case narrative.	☐	☒	☐	
	iv.	Explain what this could mean for the affected samples. Include in narrative.	☒	☐	☐	See data qualification summary for summary of qualifications.

5. Laboratory control sample/Laboratory control sample duplicate (LCS/LCSD)

Question			Yes	No	N/A	Comments
A.	Are there LCS/LCSD samples present for the reporting analyses?		☒	☐	☐	
B.	Are there LCS/LCSD compounds outside lab limits? If the LCS/LCSD fails, the LCS/LCSD and samples must be re-analyzed.		☒	☐	☐	MPCA PFAS water limits used: 70% to 130%.
	i.	If yes, are there compounds above the lab QC limits? If yes, an explanation is required. Include in narrative.	☒	☐	☐	See data qualification summary for summary of exceedances and qualifications.
	ii.	Below the QC limits? If yes, an explanation is required. Include in narrative.	☐	☒	☐	

6. Matrix spike/Matrix spike duplicate/Sample duplicate (MS/MSD/DUP)

Question				Yes	No	N/A	Comments
A.	Do the analytical methods used require an MS and/or MSD? If no, skip to 6.B.			☒	☐	☐	
	i.	Have the required matrix spikes been prepared and reported?		☐	☒	☐	None for this SDG.
	ii.	If no, is there and explanation in the report as to why?		☐	☒	☐	
	iii.	Did the lab process an alternate spiked sample (such as LCSD) instead?		☒	☐	☐	LCSDs
	iv.	Are the lab QC limits specified on the report?		☒	☐	☐	
	v.	Are there compounds outside the lab QC limits?		☐	☐	☒	
	vi.	If yes, did the lab re-run an MS/MSD?		☐	☐	☒	
		1.	Did the re-run MS/MSD pass? Discuss the case narrative.	☐	☐	☒	
		2.	Did the re-run MS/MSD fail? Discuss the case narrative.	☐	☐	☒	
		3.	Is the source sample also flagged for MS/MSD compounds outside the lab QC limits?	☐	☐	☒	
B.	Was a duplicate sample submitted for the analytical method(s)?			☒	☐	☐	LCSDs FD: WL8A-POWAT-01-092220-F/WL8A-POWAT-02-092220-F/WL8A-POWAT-03-092220-F
	i.	Is the Relative Percentage Difference (RPD) within 20%* for the duplicate pair? If no, explain possible causes and data impact. **Other RPDs may be acceptable. Check with regulatory agency.*		☐	☒	☐	30% limit for PFAS (water). LCSD - See data qualification summary for summary of exceedances and qualifications. FD (30%RPD or ±RL): ok

7. Method detection limits/Report limits

Question		Yes	No	N/A	Comments
A.	Are reporting limits clearly listed on the report for all analyses?	☒	☐	☐	
B.	Do the reporting limits meet the program required limits listed? If not, an explanation is required.	☐	☒	☐	Results for 11Cl-PF3OUdS, 9Cl-PF3ONS and ADONA were nondetect and reported to the RL, while other PFAS compound were reported to the method detection limit (MDL).

8. Sample information

Questions		Yes	No	N/A	Comments
A.	Are sample numbers cross-referenced correctly with the associated QC?	☒	☐	☐	
B.	Are soil samples reported in dry weight basis?	☐	☐	☒	
C.	Are percent moisture results reported?	☐	☐	☒	
D.	Are positive detections reported?	☒	☐	☐	
E.	Are sample analytes appropriately flagged if the QC failed?	☒	☐	☐	

9. Report narrative

Question		Yes	No	N/A	Comments
A.	Is a narrative provided with the laboratory report which describes all problems with the analyses and all corrective actions taken to address these problems?	☒	☐	☐	Numerous issues discussed in case narrative.

10. Additional comments about the lab report

Reviewed using MPCA Guidance on Perfluorochemicals Analysis (July 2020).

See attachedment for qualification.

Certification

By typing my name below, I certify the above statements to be true and correct, to the best of my knowledge, and that this information can be used for the purpose of processing this form.

Authorized Representative

Name: Lisa Smith Title: Environmental Chemist (CEAC)

(This document has been electronically signed.) Date (mm/dd/yyyy): 11/29/2020

Data Validation Qualifications for K2008630

Calibration (Section 2): Calibration noncompliances are summarized below.

Calibration (Date) Batch	Analyte	%R	Limit	Qualifiers
CCV KC2000572 (10/26/20 15:44) 700785	PFHxS	136 %R	70-130%	Results not reported from this CCV.

Method blank and instrument blank detections (Section 3Bii and C): Detects within 10 times the blank concentrations were qualified B.

Method Blank ID	Prep Date	Compound	Blank Concentration (ng/L)	Results Qualified B
KQ2014746-03	10/7/2020 7:55	PFBA	0.42 J	Associated results were greater than 10 times the blank concentration. No qualifiers.
		PFHpA	0.63 J	
KQ2014877-03	10/7/2020 7:56	PFBA	0.53 J	Associated results were greater than 10 times the blank concentration. No qualifiers.

CCB Blank ID	Date/Time	Compound	Blank Concentration (ng/L)	Results Qualified B
KQ2015031-02	10/8/20 10:29	PFHpA	0.67 J	Associated results were greater than 10 times the blank concentration. No qualifiers.
		MeFOSA	0.62 J	Associated results were nondetect.
		EtFOSAA	0.92 J	WL11-WAT-BULK-01-092220 (K2008630-011)
KQ2015034-02	10/8/20 21:12	MeFOSA	0.63 J	Associated results were nondetect.
		EtFOSA	0.38 J	Associated results were nondetect.
		EtFOSE	0.18 J	Associated results were nondetect.
KQ2015208-02	10/9/20 15:39	MeFOSA	0.68 J	Associated results were nondetect.
KQ2016092-02	10/20/20 13:59	PFOA	0.37 J	No associated results.

Labeled Analogs - surrogates (Section 4Bii): Results associated with low recoveries were nondetect and qualified as estimated (UJ).

Sample ID	Lab ID	Labeled Analog	% Recovery (Limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
WL16-WAT-BULK-01-092320	K2008630-002	13C2-PFTeDA	47	UJ
WL16-POWAT-01-092320	K2008630-003	13C2-PFTeDA	48	UJ
WL13-POWAT-01-092520	K2008630-004	13C2-PFTeDA	35	UJ
WL10A-POWAT-01-092220	K2008630-006	13C2-PFTeDA	46	UJ
WL8A-POWAT-01-092220	K2008630-007	13C2-PFTeDA	43	UJ
WL8A-POWAT-03-092220	K2008630-009	13C2-PFTeDA	40	UJ

Sample ID	Lab ID	Labeled Analog	% Recovery (Limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
WL11-WAT-BULK-01-092220	K2008630-011	13C2-4:2 FTS	207	No Qualifier
WL11-WAT-BULK-01-092220	K2008630-012	13C2-PFTeDA	41	UJ
WL11-WAT-BULK-01-092220	K2008630-012	D3-MeFOSAA	45	UJ
WL7-POWAT-01-092420	K2008630-013	13C2-4:2 FTS	217	No Qualifier
WL7-POWAT-01-092420	K2008630-013	13C2-PFTeDA	44	UJ
WL7-POWAT-01-092420	K2008630-014	13C2-PFTeDA	45	UJ
WL6-POWAT-01-092420	K2008630-015	13C2-PFTeDA	46	UJ
WL6-POWAT-01-092420	K2008630-016	13C2-PFTeDA	46	UJ

Laboratory control sample/Laboratory control sample duplicate (Section 5Bi): Detects associated with high recoveries were qualified as J+:

LCS/LCSD IDs (Batch)	Compound	LCS/LCSD % Recovery	Recovery Limits	Qualifiers
KQ2014524-01/ KQ2014524-02 (698467)	PFPeS	130/**133**	70-130	J+: WL16-WAT-BULK-01-092320 (K2008630-001) WL11-WAT-BULK-01-092220 (K2008630-011)
KQ2014635-01/ KQ2014635-02 (698705)	PFDoDA	129/**149**	70-130	Associated results were nondetect. No qualifiers.
	PFUnA	125/**134**	70-130	
	PFOS	127/**132**	70-130	J+: WL16-WAT-BULK-01-092320 (K2008630-002) WL8A-POWAT-01-092220 (K2008630-007) WL8A-POWAT-02-092220 (K2008630-008) WL8A-POWAT-03-092220 (K2008630-009) WL11-POWAT-01-092220 (K2008630-010) WL11-WAT-BULK-01-092220 (K2008630-012)
	PFHpS	**132/136**	70-130	
	PFPeS	**146/141**	70-130	
KQ2014635-01/ KQ2014635-02 (698706)	11Cl-PF3OUdS	**143/142**	70-130	Associated results were nondetect. No qualifiers.
KQ2014746-01/ KQ2014746-02 (698706)	11Cl-PF3OUdS	**132/146**	70-130	Associated results were nondetect. No qualifiers.
KQ2014746-01/ KQ2014746-02 (698705)	8:2 FTS	**138/133**	70-130	Associated results were nondetect. No qualifiers.
	EtFOSAA	101/**133**	70-130	
	PFDoA	**138/143**	70-130	
	PFNS	123/**133**	70-130	
	PFUnA	125/**141**	70-130	
	PFOS	125/**132**	70-130	J+: WL13-POWAT-01-092520 (K2008630-005) WL7-POWAT-01-092420 (K2008630-014) WL6-POWAT-01-092420 (K2008630-016)
	PFPeS	**164/163**	70-130	
KQ2014783-01/ KQ2014783-02 (698706)	11Cl-PF3OUdS	**144/149**	70-130	Associated results were nondetect. No qualifiers.
KQ2014783-01/ KQ2014783-02	8:2 FTS	124/**142**	70-130	Associated results were nondetect. No qualifiers.
	EtFOSAA	106/**135**	70-130	
	PFDoA	**133/141**	70-130	
	PFNS	124/**134**	70-130	

LCS/LCSD IDs (Batch)	Compound	LCS/LCSD % Recovery	Recovery Limits	Qualifiers
	PFUnA	**135/143**	70-130	
	PFOS	**131/**110	70-130	J+:
	PFPeS	**155/159**	70-130	WL16-POWAT-01-092320 (K2008630-003) WL10A-POWAT-01-092220 (K2008630-006)
KQ2014877-01/ KQ2014877-02 (698780)	11Cl-PF3OUdS	**138/147**	70-130	Associated results were nondetect. No qualifiers.
KQ2014877-01/ KQ2014877-02 (698470)	PFNS	**136/139**	70-130	Associated results were nondetect. No qualifiers.
	PFHxS	119**/137**	70-130	J+:
	PFPeS	**135/**114	70-130	WL13-POWAT-01-092520 (K2008630-004) WL7-POWAT-01-092420 (K2008630-013) WL6-POWAT-01-092420 (K2008630-015)

Laboratory control sample/Laboratory control sample duplicate RPDs (Section 6Bi): Detects associated with high RPDs were qualified as J+:

LCS/LCSD IDs (Batch)	Compound	RPD	RPD Limit	Qualifiers
KQ2014877-01/ KQ2014877-02 (698780)	PFHpS	41	30	J+: WL13-POWAT-01-092520 (K2008630-004) WL7-POWAT-01-092420 (K2008630-013) WL6-POWAT-01-092420 (K2008630-015)

MINNESOTA

Minnesota Department of Agriculture 651-201-6148
Minnesota Department of Health 651-201-5357
Minnesota Pollution Control Agency 651-757-2560

Laboratory data review checklist

Doc Type: Data Review

Instructions: The following is the informal checklist that should be used to review data for the Minnesota Department of Agriculture, Minnesota Pollution Control Agency, and Minnesota Department of Health. The information follows the general format of the National Functional Guidelines, which is the primary data review tool used in the U.S. Environmental Protection Agency's Contract Laboratory Program for Superfund analytical work. Refer to the appropriate guidance document for each agency for instructions.

Project information

Project name: Project 1007

Work order number/Lab report ID: K2008635 Report date (mm/dd/yyyy): 10/27/2020

Laboratory: ALS - Kelso, Washington Review date (mm/dd/yyyy): 11/29/2020

1. Chain of custody, preservation, and holding times

Questions			Yes	No	N/A	Comments
A.	Is there a chain of custody (COC) with the report?		☒	☐	☐	
B.	Is there a sample condition form with the report?		☒	☐	☐	A number of sediment samples are listed on the COCs that were not reported in this SDG.
C.	Were there samples preserved according to program requirements?		☒	☐	☐	
D.	Were samples received in the correct containers?		☒	☐	☐	
	i.	Was there enough sample volume/weight to complete all requested analyses?	☒	☐	☐	
	ii.	Was there enough sample collected to complete required batch QC?	☒	☐	☐	
E.	Were samples received within holding time for sample prep for all requested analyses?		☒	☐	☐	
F.	Are there notes about sample condition or holding time issues on the COC? Explain the data impact.		☐	☒	☐	
G.	Are there narration or data qualifiers with the report about sample condition or holding time issues? Explain the data impact.		☐	☒	☐	
H.	Are lab IDs cross-referenced correctly with the field IDs.		☒	☐	☐	Yes, but no sample summary table included in the report.

2. Calibration

Question			Yes	No	N/A	Comments
A.	Do the report narrative or data qualifiers indicate calibration problems for any analyses? If yes, explain the data impact.		☐	☒	☐	MN limits used for review.

3. Blanks

Question			Yes	No	N/A	Comments
A.	Do any of the analyses contain samples for field or trip blanks?		☐	☒	☐	
	i.	If yes, are there target analytes present above the reporting limit in the blanks?	☐	☐	☒	
	ii.	If yes, are the same compounds also present in the samples? Explain possible data impact.	☐	☐	☒	
B.	Do method blanks for any analyses contain target analytes above the reporting limit?		☐	☒	☐	Blank detects were below the RL.
	i.	If yes, are the same compounds present in the samples?	☒	☐	☐	
	ii.	Is the amount of target analyte in the method blank more than 1/10th of that in the sample(s)? Explain the possible impact on sample results.	☐	☒	☐	See data qualification summary for summary of detects. No qualifiers.
C.	Do instrument blanks contain analytes above the reporting limit?		☐	☒	☐	Detects were below the RL. See data qualification summary for calibration blank detects and qualifications.

4. Surrogates or organic analysis

Question			Yes	No	N/A	Comments
A.	Are the lab recovery limits for surrogates specified on the report?		☒	☐	☐	MPCA limits used: 50% to 200%
B.	Are the surrogates outside lab QC limits? (These should have a data qualifier.)		☒	☐	☐	
	i.	If yes, are the surrogates above the lab QC limits?	☒	☐	☐	
	ii.	Below the lab QC limits?	☒	☐	☐	
	iii.	Were the affected samples re-analyzed? Discuss in the case narrative.	☐	☒	☐	
	iv.	Explain what this could mean for the affected samples. Include in narrative.	☒	☐	☐	See data qualification summary for summary of qualifications.

5. Laboratory control sample/Laboratory control sample duplicate (LCS/LCSD)

Question			Yes	No	N/A	Comments
A.	Are there LCS/LCSD samples present for the reporting analyses?		☒	☐	☐	
B.	Are there LCS/LCSD compounds outside lab limits? If the LCS/LCSD fails, the LCS/LCSD and samples must be re-analyzed.		☒	☐	☐	MPCA PFAS water limits used: 70% to 130%.
	i.	If yes, are there compounds above the lab QC limits? If yes, an explanation is required. Include in narrative.	☒	☐	☐	See data qualification summary for summary of exceedances and qualifications.
	ii.	Below the QC limits? If yes, an explanation is required. Include in narrative.	☐	☒	☐	

6. Matrix spike/Matrix spike duplicate/Sample duplicate (MS/MSD/DUP)

Question				Yes	No	N/A	Comments
A.	Do the analytical methods used require an MS and/or MSD? If no, skip to 6.B.			☒	☐	☐	
	i.	Have the required matrix spikes been prepared and reported?		☐	☒	☐	None for this SDG.
	ii.	If no, is there and explanation in the report as to why?		☐	☒	☐	
	iii.	Did the lab process an alternate spiked sample (such as LCSD) instead?		☒	☐	☐	LCSDs
	iv.	Are the lab QC limits specified on the report?		☒	☐	☐	
	v.	Are there compounds outside the lab QC limits?		☐	☐	☒	
	vi.	If yes, did the lab re-run an MS/MSD?		☐	☐	☒	
		1.	Did the re-run MS/MSD pass? Discuss the case narrative.	☐	☐	☒	
		2.	Did the re-run MS/MSD fail? Discuss the case narrative.	☐	☐	☒	
		3.	Is the source sample also flagged for MS/MSD compounds outside the lab QC limits?	☐	☐	☒	
B.	Was a duplicate sample submitted for the analytical method(s)?			☒	☐	☐	LCSDs
	i.	Is the Relative Percentage Difference (RPD) within 20%* for the duplicate pair? If no, explain possible causes and data impact. **Other RPDs may be acceptable. Check with regulatory agency.*		☐	☒	☐	30% limit for PFAS (water). LCSD - See data qualification summary for summary of exceedances and qualifications.

7. Method detection limits/Report limits

Question		Yes	No	N/A	Comments
A.	Are reporting limits clearly listed on the report for all analyses?	☒	☐	☐	
B.	Do the reporting limits meet the program required limits listed? If not, an explanation is required.	☐	☒	☐	Results for 11Cl-PF3OUdS, 9Cl-PF3ONS and ADONA were nondetect and reported to the RL, while other PFAS compound were reported to the method detection limit (MDL).

8. Sample information

Questions		Yes	No	N/A	Comments
A.	Are sample numbers cross-referenced correctly with the associated QC?	☒	☐	☐	
B.	Are soil samples reported in dry weight basis?	☐	☐	☒	
C.	Are percent moisture results reported?	☐	☐	☒	
D.	Are positive detections reported?	☒	☐	☐	
E.	Are sample analytes appropriately flagged if the QC failed?	☒	☐	☐	

9. Report narrative

Question		Yes	No	N/A	Comments
A.	Is a narrative provided with the laboratory report which describes all problems with the analyses and all corrective actions taken to address these problems?	☒	☐	☐	Numerous issues discussed in case narrative.

10. Additional comments about the lab report

Reviewed using MPCA Guidance on Perfluorochemicals Analysis (July 2020).

See attachedment for qualification.

Certification

By typing my name below, I certify the above statements to be true and correct, to the best of my knowledge, and that this information can be used for the purpose of processing this form.

Authorized Representative

Name: Lisa Smith Title: Environmental Chemist (CEAC)

(This document has been electronically signed.) Date (mm/dd/yyyy): 11/29/2020

Data Validation Qualifications for K2008635

Method blank and instrument blank detections (Section 3Bii and C): Detects within 10 times the blank concentrations were qualified B.

Method Blank ID	Prep Date	Compound	Blank Concentration (ng/L)	Results Qualified B
KQ2014746-03	10/7/2020 7:55	PFBA	0.42 J	Associated results were greater than 10 times the blank concentration. No qualifiers.
		PFHpA	0.63 J	
KQ2014877-03	10/7/2020 7:56	PFBA	0.53 J	Associated results were greater than 10 times the blank concentration. No qualifiers.

CCB Blank ID	Date/Time	Compound	Blank Concentration (ng/L)	Results Qualified B
KQ2015034-02	10/8/20 21:12	MeFOSA	0.63 J	EP5-WAT-BULK-01-092420 (K2008635-003)
		EtFOSA	0.38 J	Associated results were nondetect.
		EtFOSE	0.18 J	EP5-WAT-BULK-01-092420 (K2008635-003) EP4-WAT-BULK-01-092420 (K2008635-006)
KQ2015208-02	10/9/20 15:39	MeFOSA	0.68 J	EP5-WAT-BULK-01-092420 (K2008635-004)

Labeled Analogs - surrogates (Section 4Bii): Results associated with low recoveries were qualified as estimated (UJ and J+), as these labeled analogs are used to quantitate the analyte of interest and an inverse relationship exists.

Sample ID	Lab ID	Labeled Analog	% Recovery (Limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
EP23-WAT-BULK-01-092420	K2008635-001	13C2-PFTeDA	29	J+
EP23-WAT-BULK-01-092420	K2008635-002	13C2-PFTeDA	39	UJ
EP5-WAT-BULK-01-092420	K2008635-003	13C2-4:2 FTS	230	No Qualifier
EP5-WAT-BULK-01-092420	K2008635-003	13C2-PFTeDA	31	J+
EP5-WAT-BULK-01-092420	K2008635-004	13C2-PFTeDA	32	UJ
EP5-WAT-BULK-01-092420	K2008635-004	13C8-FOSA	24	J+
EP5-WAT-BULK-01-092420	K2008635-004	D3-MeFOSA	34	J+
EP5-WAT-BULK-01-092420	K2008635-004	D3-MeFOSAA	38	UJ
EP5-WAT-BULK-01-092420	K2008635-004	D5-EfFOSAA	43	UJ
EP5-WAT-BULK-01-092420	K2008635-004	D5-EtFOSA	27	UJ
EP5-WAT-BULK-01-092420	K2008635-004	D7-MeFOSE	27	J+
EP5-WAT-BULK-01-092420	K2008635-004	D9-EtFOSE	30	UJ
EP4-WAT-BULK-01-092420	K2008635-006	13C2-PFTeDA	26	J+
EP4-WAT-BULK-01-092420	K2008635-007	13C2-PFTeDA	33	UJ
EP4-WAT-BULK-01-092420	K2008635-007	D3-MeFOSAA	42	UJ
EP4-WAT-BULK-01-092420	K2008635-007	D5-EfFOSAA	49	UJ

Laboratory control sample/Laboratory control sample duplicate (Section 5Bi): Detects associated with high recoveries were qualified as J+:

LCS/LCSD IDs (Batch)	Compound	LCS/LCSD % Recovery	Recovery Limits	Qualifiers
KQ2014635-01/ KQ2014635-02 (698705)	PFDoDA	129/**149**	70-130	Associated results were nondetect. No qualifiers.
	PFUnA	125/**134**	70-130	
	PFHpS	**132/136**	70-130	
	PFOS	127/**132**	70-130	J+: WL2-POWAT-01-092220 (K2008635-009)
	PFPeS	**146/141**	70-130	
KQ2014635-01/ KQ2014635-02 (698706)	11Cl-PF3OUdS	**143/142**	70-130	Associated results were nondetect. No qualifiers.
KQ2014746-01/ KQ2014746-02 (698706)	11Cl-PF3OUdS	**132/146**	70-130	Associated results were nondetect. No qualifiers.
KQ2014746-01/ KQ2014746-02 (698705)	8:2 FTS	**138/133**	70-130	J+: EP4-WAT-BULK-01-092420 (K2008635-007)
	EtFOSAA	101/**133**	70-130	Associated results were nondetect. No qualifiers.
	PFDoA	**138/143**	70-130	
	PFNS	123/**133**	70-130	
	PFUnA	125/**141**	70-130	
	PFOS	125/**132**	70-130	J+: EP23-WAT-BULK-01-092420 (K2008635-002) EP5-WAT-BULK-01-092420 (K2008635-004) EP5-POWAT-01-092420 (K2008635-005) EP4-WAT-BULK-01-092420 (K2008635-007) EP4-POWAT-01-092420 (K2008635-008)
	PFPeS	**164/163**	70-130	
KQ2014877-01/ KQ2014877-02 (698780)	11Cl-PF3OUdS	**138/147**	70-130	Associated results were nondetect. No qualifiers.
KQ2014877-01/ KQ2014877-02 (698470)	PFNS	**136/139**	70-130	Associated results were nondetect. No qualifiers.
	PFHxS	119/**137**	70-130	J+: EP23-WAT-BULK-01-092420 (K2008635-001) EP5-WAT-BULK-01-092420 (K2008635-003) EP4-WAT-BULK-01-092420 (K2008635-006)
	PFPeS	**135**/114	70-130	

Laboratory control sample/Laboratory control sample duplicate RPDs (Section 6Bi): Detects associated with high RPDs were qualified as J:

LCS/LCSD IDs (Batch)	Compound	RPD	RPD Limit	Qualifiers
KQ2014877-01/ KQ2014877-02 (698780)	PFHpS	41	30	J: EP23-WAT-BULK-01-092420 (K2008635-001) EP5-WAT-BULK-01-092420 (K2008635-003) EP4-WAT-BULK-01-092420 (K2008635-006)

MINNESOTA

Minnesota Department of Agriculture 651-201-6148
Minnesota Department of Health 651-201-5357
Minnesota Pollution Control Agency 651-757-2560

Laboratory data review checklist

Doc Type: Data Review

Instructions: The following is the informal checklist that should be used to review data for the Minnesota Department of Agriculture, Minnesota Pollution Control Agency, and Minnesota Department of Health. The information follows the general format of the National Functional Guidelines, which is the primary data review tool used in the U.S. Environmental Protection Agency's Contract Laboratory Program for Superfund analytical work. Refer to the appropriate guidance document for each agency for instructions.

Project information

Project name: Project 1007

Work order number/Lab report ID: K2008636 Report date (mm/dd/yyyy): 10/26/2020

Laboratory: ALS - Kelso, Washington Review date (mm/dd/yyyy): 11/29/2020

1. Chain of custody, preservation, and holding times

Questions			Yes	No	N/A	Comments
A.	Is there a chain of custody (COC) with the report?		☒	☐	☐	
B.	Is there a sample condition form with the report?		☒	☐	☐	A number of sediment samples are listed on the COCs that were not reported in this SDG.
C.	Were there samples preserved according to program requirements?		☒	☐	☐	
D.	Were samples received in the correct containers?		☒	☐	☐	
	i.	Was there enough sample volume/weight to complete all requested analyses?	☒	☐	☐	
	ii.	Was there enough sample collected to complete required batch QC?	☒	☐	☐	
E.	Were samples received within holding time for sample prep for all requested analyses?		☒	☐	☐	
F.	Are there notes about sample condition or holding time issues on the COC? Explain the data impact.		☐	☒	☐	
G.	Are there narration or data qualifiers with the report about sample condition or holding time issues? Explain the data impact.		☐	☒	☐	
H.	Are lab IDs cross-referenced correctly with the field IDs.		☒	☐	☐	Yes, but no sample summary table included in the report.

2. Calibration

Question			Yes	No	N/A	Comments
A.	Do the report narrative or data qualifiers indicate calibration problems for any analyses? If yes, explain the data impact.		☐	☒	☐	MN limits used for review.

3. Blanks

Question			Yes	No	N/A	Comments
A.	Do any of the analyses contain samples for field or trip blanks?		☐	☒	☐	
	i.	If yes, are there target analytes present above the reporting limit in the blanks?	☐	☐	☒	
	ii.	If yes, are the same compounds also present in the samples? Explain possible data impact.	☐	☐	☒	
B.	Do method blanks for any analyses contain target analytes above the reporting limit?		☐	☒	☐	Blank detects were below the RL.
	i.	If yes, are the same compounds present in the samples?	☐	☒	☐	
	ii.	Is the amount of target analyte in the method blank more than 1/10th of that in the sample(s)? Explain the possible impact on sample results.	☐	☒	☐	See data qualification summary for summary of detects. No qualifiers.
C.	Do instrument blanks contain analytes above the reporting limit?		☐	☒	☐	Detects were below the RL. See data qualification summary for summary of detects. No qualifiers.

4. Surrogates or organic analysis

Question			Yes	No	N/A	Comments
A.	Are the lab recovery limits for surrogates specified on the report?		☒	☐	☐	MPCA limits used: 50% to 200%
B.	Are the surrogates outside lab QC limits? (These should have a data qualifier.)		☒	☐	☐	
	i.	If yes, are the surrogates above the lab QC limits?	☒	☐	☐	
	ii.	Below the lab QC limits?	☒	☐	☐	
	iii.	Were the affected samples re-analyzed? Discuss in the case narrative.	☐	☒	☐	
	iv.	Explain what this could mean for the affected samples. Include in narrative.	☒	☐	☐	See data qualification summary for summary of qualifications.

5. Laboratory control sample/Laboratory control sample duplicate (LCS/LCSD)

Question			Yes	No	N/A	Comments
A.	Are there LCS/LCSD samples present for the reporting analyses?		☒	☐	☐	
B.	Are there LCS/LCSD compounds outside lab limits? If the LCS/LCSD fails, the LCS/LCSD and samples must be re-analyzed.		☒	☐	☐	MPCA PFAS water limits used: 70% to 130%.
	i.	If yes, are there compounds above the lab QC limits? If yes, an explanation is required. Include in narrative.	☒	☐	☐	See data qualification summary for summary of exceedances and qualifications.
	ii.	Below the QC limits? If yes, an explanation is required. Include in narrative.	☐	☒	☐	

6. Matrix spike/Matrix spike duplicate/Sample duplicate (MS/MSD/DUP)

Question				Yes	No	N/A	Comments
A.	Do the analytical methods used require an MS and/or MSD? If no, skip to 6.B.			☒	☐	☐	
	i.	Have the required matrix spikes been prepared and reported?		☐	☒	☐	None for this SDG.
	ii.	If no, is there and explanation in the report as to why?		☐	☒	☐	
	iii.	Did the lab process an alternate spiked sample (such as LCSD) instead?		☒	☐	☐	LCSDs
	iv.	Are the lab QC limits specified on the report?		☒	☐	☐	
	v.	Are there compounds outside the lab QC limits?		☐	☐	☒	
	vi.	If yes, did the lab re-run an MS/MSD?		☐	☐	☒	
		1.	Did the re-run MS/MSD pass? Discuss the case narrative.	☐	☐	☒	
		2.	Did the re-run MS/MSD fail? Discuss the case narrative.	☐	☐	☒	
		3.	Is the source sample also flagged for MS/MSD compounds outside the lab QC limits?	☐	☐	☒	
B.	Was a duplicate sample submitted for the analytical method(s)?			☒	☐	☐	LCSDs
	i.	Is the Relative Percentage Difference (RPD) within 20%* for the duplicate pair? If no, explain possible causes and data impact. **Other RPDs may be acceptable. Check with regulatory agency.*		☐	☒	☐	30% limit for PFAS (water). LCSD - See data qualification summary for summary of exceedances and qualifications.

7. Method detection limits/Report limits

Question		Yes	No	N/A	Comments
A.	Are reporting limits clearly listed on the report for all analyses?	☒	☐	☐	
B.	Do the reporting limits meet the program required limits listed? If not, an explanation is required.	☐	☒	☐	Results for 11Cl-PF3OUdS, 9Cl-PF3ONS and ADONA were nondetect and reported to the RL, while other PFAS compound were reported to the method detection limit (MDL).

8. Sample information

Questions		Yes	No	N/A	Comments
A.	Are sample numbers cross-referenced correctly with the associated QC?	☒	☐	☐	
B.	Are soil samples reported in dry weight basis?	☐	☐	☒	
C.	Are percent moisture results reported?	☐	☐	☒	
D.	Are positive detections reported?	☒	☐	☐	
E.	Are sample analytes appropriately flagged if the QC failed?	☒	☐	☐	

9. Report narrative

Question		Yes	No	N/A	Comments
A.	Is a narrative provided with the laboratory report which describes all problems with the analyses and all corrective actions taken to address these problems?	☒	☐	☐	Numerous issues discussed in case narrative.

10. Additional comments about the lab report

Reviewed using MPCA Guidance on Perfluorochemicals Analysis (July 2020).

See attachedment for qualification.

Certification

By typing my name below, I certify the above statements to be true and correct, to the best of my knowledge, and that this information can be used for the purpose of processing this form.

Authorized Representative

Name: Lisa Smith Title: Environmental Chemist (CEAC)

(This document has been electronically signed.) Date (mm/dd/yyyy): 11/29/2020

Data Validation Qualifications for K2008636

Method blank and instrument blank detections (Section 3Bii and C): Detection in the associated blanks are listed below. Results did not require qualification.

Method Blank ID	Prep Date	Compound	Blank Concentration (ng/L)	Results Qualified B
KQ2014746-03	10/7/2020 7:55	PFBA	0.42 J	Associated results were greater than 10 times the blank concentration. No qualifiers.
		PFHpA	0.63 J	Associated results were nondetect or greater than 10 times the blank concentration. No qualifiers.
KQ2014877-03	10/7/2020 7:56	PFBA	0.53 J	Associated results were greater than 10 times the blank concentration. No qualifiers.

CCB Blank ID	Date/Time	Compound	Blank Concentration (ng/L)	Results Qualified B
KQ2015034-02	10/8/20 21:12	MeFOSA	0.63 J	Associated results were nondetect.
		EtFOSA	0.38 J	
		EtFOSE	0.18 J	
KQ2015208-02	10/9/20 15:39	MeFOSA	0.68 J	Associated results were nondetect.

Labeled Analogs - surrogates (Section 4Bii): Results associated with low recoveries were qualified as estimated (UJ and J+), as these labeled analogs are used to quantitate the analyte of interest and an inverse relationship exists.

Sample ID	Lab ID	Labeled Analog	% Recovery (Limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
RC13-POWAT-01-092320	K2008636-004	13C2-PFTeDA	34	UJ
RC13-POWAT-01-092320	K2008636-004	D3-MeFOSAA	39	UJ
RC13-POWAT-01-092320	K2008636-004	D5-EfFOSAA	48	UJ
RC14-POWAT-01-092320	K2008636-005	13C2-PFTeDA	47	UJ
EP27B-WAT-BULK-01-092420	K2008636-006	13C2-4:2 FTS	223	No Qualifier
EP27B-WAT-BULK-01-092420	K2008636-006	13C2-PFTeDA	31	J+
EP27B-WAT-BULK-01-092420	K2008636-007	13C2-PFTeDA	36	UJ
EP27B-POWAT-01-092420	K2008636-008	13C2-PFTeDA	32	UJ
EP27B-POWAT-01-092420	K2008636-008	D5-EfFOSAA	48	UJ
EP17C-WAT-BULK-01-092420	K2008636-009	13C2-4:2 FTS	210	UJ
EP17C-WAT-BULK-01-092420	K2008636-009	13C2-PFTeDA	40	J+
EP17C-WAT-BULK-01-092420	K2008636-010	13C2-PFTeDA	37	UJ
EP17C-WAT-BULK-01-092420	K2008636-010	D3-MeFOSAA	46	UJ
EP17C-WAT-BULK-01-092420	K2008636-010	D5-EfFOSAA	47	UJ
EP17C-POWAT-01-092420	K2008636-011	13C2-PFTeDA	48	UJ

Laboratory control sample/Laboratory control sample duplicate (Section 5Bi): Detects associated with high recoveries were qualified as J+:

LCS/LCSD IDs (Batch)	Compound	LCS/LCSD % Recovery	Recovery Limits	Qualifiers
KQ2014635-01/ KQ2014635-02 (698705)	PFDoDA	129/**149**	70-130	Associated results were nondetect. No qualifiers.
	PFUnA	125/**134**	70-130	
	PFPeS	**146/141**	70-130	
	PFHpS	**132/136**	70-130	
	PFOS	127/**132**	70-130	J+: RC21A-POWAT-01-092220 (K2008636-002) RC17A-POWAT-01-092320 (K2008636-003)
KQ2014635-01/ KQ2014635-02 (698706)	11Cl-PF3OUdS	**143/142**	70-130	Associated results were nondetect. No qualifiers.
KQ2014746-01/ KQ2014746-02 (698706)	11Cl-PF3OUdS	**132/146**	70-130	Associated results were nondetect. No qualifiers.
KQ2014746-01/ KQ2014746-02 (698705)	8:2 FTS	**138/133**	70-130	Associated results were nondetect. No qualifiers.
	EtFOSAA	101/**133**	70-130	Associated results were nondetect. No qualifiers.
	PFDoA	**138/143**	70-130	Associated results were nondetect. No qualifiers.
	PFNS	123/**133**	70-130	J+: EP27B-POWAT-01-092420 (K2008636-008)
	PFUnA	125/**141**	70-130	Associated results were nondetect. No qualifiers.
	PFOS	125/**132**	70-130	J+: RC18A-POWAT-01-092320 (K2008636-001) RC13-POWAT-01-092320 (K2008636-004) RC14-POWAT-01-092320 (K2008636-005) EP27B-WAT-BULK-01-092420 (K2008636-007) EP27B-POWAT-01-092420 (K2008636-008) EP17C-WAT-BULK-01-092420 (K2008636-010) EP17C-POWAT-01-092420 (K2008636-011)
	PFPeS	**164/163**	70-130	J+: EP27B-WAT-BULK-01-092420 (K2008636-007) EP27B-POWAT-01-092420 (K2008636-008) EP17C-WAT-BULK-01-092420 (K2008636-010) EP17C-POWAT-01-092420 (K2008636-011)
KQ2014877-01/ KQ2014877-02 (698780)	11Cl-PF3OUdS	**138/147**	70-130	Associated results were nondetect. No qualifiers.
KQ2014877-01/ KQ2014877-02 (698470)	PFNS	**136/139**	70-130	Associated results were nondetect. No qualifiers.
	PFHxS	119/**137**	70-130	J+: EP27B-WAT-BULK-01-092420 (K2008636-006) EP17C-WAT-BULK-01-092420 (K2008636-009)
	PFPeS	**135**/114	70-130	

Laboratory control sample/Laboratory control sample duplicate RPDs (Section 6Bi): Detects associated with high RPDs were qualified as J:

LCS/LCSD IDs (Batch)	Compound	RPD	RPD Limit	Qualifiers
KQ2014877-01/ KQ2014877-02 (698780)	PFHpS	41	30	J: EP27B-WAT-BULK-01-092420 (K2008636-006) EP17C-WAT-BULK-01-092420 (K2008636-009)

Appendix C-2

Tissue Data - SGS AXYS

MINNESOTA

Minnesota Department of Agriculture 651-201-6148
Minnesota Department of Health 651-201-5357
Minnesota Pollution Control Agency 651-757-2560

Laboratory data review checklist

Doc Type: Data Review

Instructions: The following is the informal checklist that should be used to review data for the Minnesota Department of Agriculture, Minnesota Pollution Control Agency, and Minnesota Department of Health. The information follows the general format of the National Functional Guidelines, which is the primary data review tool used in the U.S. Environmental Protection Agency's Contract Laboratory Program for Superfund analytical work. Refer to the appropriate guidance document for each agency for instructions.

Project information

Project name: Project 1007

Work order number/Lab report ID: DPWG74675 Report date (mm/dd/yyyy): 12/22/2020

Laboratory: SGS AXYS Review date (mm/dd/yyyy): 1/11/2021

1. Chain of custody, preservation, and holding times

Questions			Yes	No	N/A	Comments
A.	Is there a chain of custody (COC) with the report?		☒	☐	☐	Additional samples (not reported in this SDG) were listed on the COCs.
B.	Is there a sample condition form with the report?		☒	☐	☐	
C.	Were there samples preserved according to program requirements?		☒	☐	☐	
D.	Were samples received in the correct containers?		☒	☐	☐	
	i.	Was there enough sample volume/weight to complete all requested analyses?	☒	☐	☐	
	ii.	Was there enough sample collected to complete required batch QC?	☒	☐	☐	
E.	Were samples received within holding time for sample prep for all requested analyses?		☒	☐	☐	
F.	Are there notes about sample condition or holding time issues on the COC? Explain the data impact.		☐	☒	☐	
G.	Are there narration or data qualifiers with the report about sample condition or holding time issues? Explain the data impact.		☐	☒	☐	
H.	Are lab IDs cross-referenced correctly with the field IDs.		☒	☐	☐	

2. Calibration

Question		Yes	No	N/A	Comments
A.	Do the report narrative or data qualifiers indicate calibration problems for any analyses? If yes, explain the data impact.	☒	☐	☐	MN limits used. ICAL, ICV and CCV reviewed. See data qualifications summary for exceedances. No qualifiers.

3. Blanks

Question			Yes	No	N/A	Comments
A.	Do any of the analyses contain samples for field or trip blanks?		☐	☒	☐	
	i.	If yes, are there target analytes present above the reporting limit in the blanks?	☐	☐	☒	
	ii.	If yes, are the same compounds also present in the samples? Explain possible data impact.	☐	☐	☒	
B.	Do method blanks for any analyses contain target analytes above the reporting limit?		☒	☐	☐	
	i.	If yes, are the same compounds present in the samples?	☒	☐	☐	
	ii.	Is the amount of target analyte in the method blank more than 1/10th of that in the sample(s)? Explain the possible impact on sample results.	☒	☐	☐	See data qualifications summary for blank detections and qualifications.
C.	Do instrument blanks contain analytes above the reporting limit?		☐	☐	☒	

4. Surrogates or organic analysis

Question			Yes	No	N/A	Comments
A.	Are the lab recovery limits for surrogates specified on the report?		☒	☐	☐	MPCA limits used: 50% to 200%
B.	Are the surrogates outside lab QC limits? (These should have a data qualifier.)		☒	☐	☐	
	i.	If yes, are the surrogates above the lab QC limits?	☒	☐	☐	
	ii.	Below the lab QC limits?	☒	☐	☐	
	iii.	Were the affected samples re-analyzed? Discuss in the case narrative.	☐	☒	☐	
	iv.	Explain what this could mean for the affected samples. Include in narrative.	☒	☐	☐	See data qualifications summary for exceedances and qualifications. Twenty-eight results were rejected (R) due to a severely low labeled analog recovery.

5. Laboratory control sample/Laboratory control sample duplicate (LCS/LCSD)

Question			Yes	No	N/A	Comments
A.	Are there LCS/LCSD samples present for the reporting analyses?		☒	☐	☐	
B.	Are there LCS/LCSD compounds outside lab limits? If the LCS/LCSD fails, the LCS/LCSD and samples must be re-analyzed.		☒	☐	☐	MPCA PFAS other limits used: 50% to 150%.
	i.	If yes, are there compounds above the lab QC limits? If yes, an explanation is required. Include in narrative.	☒	☐	☐	See data qualifications summary for exceedances. No qualifiers.
	ii.	Below the QC limits? If yes, an explanation is required. Include in narrative.	☐	☒	☐	

6. Matrix spike/Matrix spike duplicate/Sample duplicate (MS/MSD/DUP)

Question				Yes	No	N/A	Comments
A.	Do the analytical methods used require an MS and/or MSD? If no, skip to 6.B.			☒	☐	☐	
	i.	Have the required matrix spikes been prepared and reported?		☐	☒	☐	
	ii.	If no, is there and explanation in the report as to why?		☐	☒	☐	
	iii.	Did the lab process an alternate spiked sample (such as LCSD) instead?		☒	☐	☐	LCSD
	iv.	Are the lab QC limits specified on the report?		☒	☐	☐	
	v.	Are there compounds outside the lab QC limits?		☐	☐	☒	
	vi.	If yes, did the lab re-run an MS/MSD?		☐	☐	☒	
		1.	Did the re-run MS/MSD pass? Discuss the case narrative.	☐	☐	☒	
		2.	Did the re-run MS/MSD fail? Discuss the case narrative.	☐	☐	☒	
		3.	Is the source sample also flagged for MS/MSD compounds outside the lab QC limits?	☐	☐	☒	
B.	Was a duplicate sample submitted for the analytical method(s)?			☒	☐	☐	LCSD
	i.	Is the Relative Percentage Difference (RPD) within 20%* for the duplicate pair? If no, explain possible causes and data impact. **Other RPDs may be acceptable. Check with regulatory agency.*		☒	☐	☐	MPCA limit: 50% RPD for tissue (other)

7. Method detection limits/Report limits

Question		Yes	No	N/A	Comments
A.	Are reporting limits clearly listed on the report for all analyses?	☒	☐	☐	
B.	Do the reporting limits meet the program required limits listed? If not, an explanation is required.	☒	☐	☐	Laboratory J flags indicating a concentration less than limit of quantification are to be retained during reporting.

8. Sample information

Questions		Yes	No	N/A	Comments
A.	Are sample numbers cross-referenced correctly with the associated QC?	☒	☐	☐	
B.	Are soil samples reported in dry weight basis?	☐	☐	☒	
C.	Are percent moisture results reported?	☐	☐	☒	
D.	Are positive detections reported?	☒	☐	☐	
E.	Are sample analytes appropriately flagged if the QC failed?	☒	☐	☐	

9. Report narrative

Question		Yes	No	N/A	Comments
A.	Is a narrative provided with the laboratory report which describes all problems with the analyses and all corrective actions taken to address these problems?	☒	☐	☐	

10. Additional comments about the lab report

Reviewed using MPCA Guidance on Perfluorochemicals Analysis (July 2020).

See attachment for qualification.

Twenty-eight results were rejected (R) due to a severely low labeled analog recovery.

Certification

By typing my name below, I certify the above statements to be true and correct, to the best of my knowledge, and that this information can be used for the purpose of processing this form.

Authorized Representative

Name: Lisa Smith Title: Environmental Chemist (CEAC)

(This document has been electronically signed.) Date (mm/dd/yyyy): 1/10/2021

Data Validation Qualifications for DPWG74675

Calibration (Section 2): Calibration noncompliances are summarized below.

Calibration Date	Analyte	%R	%R Limit	Qualifiers
18-Nov-2020 2:02	3:3 FTCA	0	70-130	Only PFOS dilutions reported from 11/18/20 analyses. No qualifiers.
18-Nov-2020 6:10	NFDHA	172	70-130	
18-Nov-2020 12:53	3:3 FTCA	0	70-130	
	NFDHA	148	70-130	
18-Nov-2020 19:24	3:3 FTCA	0.3	70-130	
	NFDHA	141	70-130	

Method blank detections (Section 3Bii): Detects within 10 times the method blank concentrations were qualified B.

Blank Sample ID	Analyte	Concentration (ng/L)	Results Qualified B
WG74149-101	PFUnA	0.106 J	EP21-PRED-FIL-FOUR-01-091820 (L33776-3) BP1-PRED-FIL-ONE-01-092020 (L33776-4) BP1-PRED-FIL-TWO-01-092020 (L33776-5) BP1-PRED-FIL-THREE-01-092020 (L33776-6) BP1-PRED-FIL-FOUR-01-092020 (L33776-7) BP1-PRED-FIL-FIVE-01-092020 (L33776-8) BP1-PRED-FIL-SIX-01-092020 (L33776-9) BP1-PRED-FIL-SEVEN-01-092020 (L33776-10) BP1-PRED-FIL-EIGHT-01-091920 (L33776-11) EP14-PRED-FIL-THREE-01-091820 (L33776-14) EP14-PRED-FIL-TWO-01-091820 (L33776-17) EP21-PRED-FIL-ONE-01-091720 (L33776-18)
	PFTrDA	0.187 J	EP21-PRED-FIL-THREE-01-091820 (L33776-1) EP21-PRED-PART-THREE-01-091820 (L33776-2) EP21-PRED-FIL-FOUR-01-091820 (L33776-3) BP1-PRED-FIL-TWO-01-092020 (L33776-5) BP1-PRED-FIL-THREE-01-092020 (L33776-6) BP1-PRED-FIL-FOUR-01-092020 (L33776-7) BP1-PRED-FIL-FIVE-01-092020 (L33776-8) BP1-PRED-FIL-SIX-01-092020 (L33776-9) BP1-PRED-FIL-SEVEN-01-092020 (L33776-10) BP1-PRED-FIL-EIGHT-01-091920 (L33776-11) BP1-PRED-PART-ONE-01-092020 (L33776-12) BP1-PRED-PART-SIX-01-092020 (L33776-13) EP14-PRED-FIL-THREE-01-091820 (L33776-14) EP14-PRED-PART-THREE-01-091820 (L33776-15) EP14-PRED-PART-TWO-01-091820 (L33776-16) EP14-PRED-FIL-TWO-01-091820 (L33776-17) EP21-PRED-FIL-ONE-01-091720 (L33776-18) EP21-PRED-FIL-TWO-01-091720 (L33776-19) EP27C-PRED-PART-ONE-01-091520 (L33776-20)

Labeled Analogs - surrogates (Section 4Bii): Results associated with low recoveries were qualified as estimated (UJ and J+), and detects associated with high recoveries were qualified as estimated biased low (J-), as these labeled analogs are used to quantitate the analyte of interest and an inverse relationship exists. Twenty-eight results were rejected (R) due to severely low labeled analog recoveries.

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
EP21-PRED-FIL-THREE-01-091820	L33776-1	D5-N-EtFOSA	38.6	UJ
EP21-PRED-FIL-THREE-01-091820	L33776-1	d7-NMe-FOSE	19.9	R
EP21-PRED-FIL-THREE-01-091820	L33776-1	d9-NEt-FOSE	27.2	UJ
EP21-PRED-PART-THREE-01-091820	L33776-2	D3-N-MeFOSA	37.6	UJ
EP21-PRED-PART-THREE-01-091820	L33776-2	D5-N-EtFOSA	23.1	UJ
EP21-PRED-PART-THREE-01-091820	L33776-2	D5-EtFOSAA	212	No Qualifier
EP21-PRED-PART-THREE-01-091820	L33776-2	d7-NMe-FOSE	2.87	R
EP21-PRED-PART-THREE-01-091820	L33776-2	d9-NEt-FOSE	12.7	R
EP21-PRED-PART-THREE-01-091820	L33776-2	13C3-HFPO-DA	47.6	UJ
EP21-PRED-FIL-FOUR-01-091820	L33776-3	D5-N-EtFOSA	43.5	UJ
EP21-PRED-FIL-FOUR-01-091820	L33776-3	d7-NMe-FOSE	10.6	R
EP21-PRED-FIL-FOUR-01-091820	L33776-3	d9-NEt-FOSE	19.9	R
BP1-PRED-FIL-ONE-01-092020	L33776-4	d7-NMe-FOSE	6.19	R
BP1-PRED-FIL-ONE-01-092020	L33776-4	d9-NEt-FOSE	25.5	UJ
BP1-PRED-FIL-TWO-01-092020	L33776-5	13C2-PFTeDA	28.3	UJ
BP1-PRED-FIL-TWO-01-092020	L33776-5	D3-N-MeFOSA	37.7	UJ
BP1-PRED-FIL-TWO-01-092020	L33776-5	D5-N-EtFOSA	41.1	UJ
BP1-PRED-FIL-THREE-01-092020	L33776-6	13C2-PFTeDA	15.5	R
BP1-PRED-FIL-THREE-01-092020	L33776-6	D3-N-MeFOSA	44.4	UJ
BP1-PRED-FIL-THREE-01-092020	L33776-6	D5-N-EtFOSA	48.2	UJ
BP1-PRED-FIL-THREE-01-092020	L33776-6	d7-NMe-FOSE	49.9	UJ
BP1-PRED-FIL-THREE-01-092020	L33776-6	d9-NEt-FOSE	45.6	UJ
BP1-PRED-FIL-FOUR-01-092020	L33776-7	D3-N-MeFOSA	44.6	UJ
BP1-PRED-FIL-FOUR-01-092020	L33776-7	d7-NMe-FOSE	25.7	UJ
BP1-PRED-FIL-FOUR-01-092020	L33776-7	d9-NEt-FOSE	27.6	UJ
BP1-PRED-FIL-FIVE-01-092020	L33776-8	d7-NMe-FOSE	9.62	R
BP1-PRED-FIL-FIVE-01-092020	L33776-8	d9-NEt-FOSE	21.7	J+
BP1-PRED-FIL-SIX-01-092020	L33776-9	d7-NMe-FOSE	12.5	R
BP1-PRED-FIL-SIX-01-092020	L33776-9	d9-NEt-FOSE	21.5	UJ
BP1-PRED-FIL-SEVEN-01-092020	L33776-10	13C2-PFTeDA	14.4	R
BP1-PRED-FIL-SEVEN-01-092020	L33776-10	D3-N-MeFOSA	45.1	UJ
BP1-PRED-FIL-SEVEN-01-092020	L33776-10	D5-N-EtFOSA	42.4	UJ

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
BP1-PRED-FIL-SEVEN-01-092020	L33776-10	d9-NEt-FOSE	42.3	UJ
BP1-PRED-FIL-EIGHT-01-091920	L33776-11	d7-NMe-FOSE	13.8	R
BP1-PRED-FIL-EIGHT-01-091920	L33776-11	d9-NEt-FOSE	18.1	R
BP1-PRED-PART-ONE-01-092020	L33776-12	13C2-4:2 FTS	224	No Qualifier
BP1-PRED-PART-ONE-01-092020	L33776-12	D3-N-MeFOSA	29.2	UJ
BP1-PRED-PART-ONE-01-092020	L33776-12	D5-N-EtFOSA	19.4	R
BP1-PRED-PART-ONE-01-092020	L33776-12	d9-NEt-FOSE	8.40	R
BP1-PRED-PART-ONE-01-092020	L33776-12	d7-NMe-FOSE	5.60	R
BP1-PRED-PART-ONE-01-092020	L33776-12	13C3-HFPO-DA	26.3	UJ
BP1-PRED-PART-SIX-01-092020	L33776-13	D3-N-MeFOSA	46.6	UJ
BP1-PRED-PART-SIX-01-092020	L33776-13	D5-N-EtFOSA	36.4	UJ
BP1-PRED-PART-SIX-01-092020	L33776-13	d9-NEt-FOSE	3.44	R
BP1-PRED-PART-SIX-01-092020	L33776-13	d7-NMe-FOSE	13.0	R
EP14-PRED-FIL-THREE-01-091820	L33776-14	D3-N-MeFOSA	49.3	UJ
EP14-PRED-FIL-THREE-01-091820	L33776-14	d9-NEt-FOSE	33.7	J+
EP14-PRED-FIL-THREE-01-091820	L33776-14	d7-NMe-FOSE	21.0	UJ
EP14-PRED-PART-THREE-01-091820	L33776-15	13C2-PFTeDA	30.4	J+
EP14-PRED-PART-THREE-01-091820	L33776-15	D3-N-MeFOSA	28.7	UJ
EP14-PRED-PART-THREE-01-091820	L33776-15	D5-N-EtFOSA	17.1	R
EP14-PRED-PART-THREE-01-091820	L33776-15	d9-NEt-FOSE	4.37	R
EP14-PRED-PART-THREE-01-091820	L33776-15	d7-NMe-FOSE	7.54	R
EP14-PRED-PART-TWO-01-091820	L33776-16	13C2-4:2 FTS	204	No Qualifier
EP14-PRED-PART-TWO-01-091820	L33776-16	D5-N-EtFOSA	42.8	UJ
EP14-PRED-PART-TWO-01-091820	L33776-16	D5-EtFOSAA	210	UJ
EP14-PRED-PART-TWO-01-091820	L33776-16	d9-NEt-FOSE	5.93	R
EP14-PRED-PART-TWO-01-091820	L33776-16	d7-NMe-FOSE	8.23	R
EP14-PRED-PART-TWO-01-091820	L33776-16	13C3-HFPO-DA	20.6	UJ
EP14-PRED-FIL-TWO-01-091820	L33776-17	D3-N-MeFOSA	46.3	UJ
EP14-PRED-FIL-TWO-01-091820	L33776-17	D5-N-EtFOSA	27.2	UJ
EP14-PRED-FIL-TWO-01-091820	L33776-17	d9-NEt-FOSE	5.04	R
EP14-PRED-FIL-TWO-01-091820	L33776-17	d7-NMe-FOSE	17.9	R
EP21-PRED-FIL-ONE-01-091720	L33776-18	13C2-PFTeDA	46.8	J+
EP21-PRED-FIL-ONE-01-091720	L33776-18	D3-N-MeFOSA	32.1	UJ
EP21-PRED-FIL-ONE-01-091720	L33776-18	D5-N-EtFOSA	32.6	UJ
EP21-PRED-FIL-ONE-01-091720	L33776-18	d9-NEt-FOSE	22.0	J+
EP21-PRED-FIL-ONE-01-091720	L33776-18	d7-NMe-FOSE	13.4	R

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
EP21-PRED-FIL-TWO-01-091720	L33776-19	d9-NEt-FOSE	9.0	R
EP21-PRED-FIL-TWO-01-091720	L33776-19	d7-NMe-FOSE	23.4	UJ
EP27C-PRED-PART-ONE-01-091520	L33776-20	13C2-PFTeDA	49.4	J+
EP27C-PRED-PART-ONE-01-091520	L33776-20	D3-N-MeFOSA	36.2	UJ
EP27C-PRED-PART-ONE-01-091520	L33776-20	D5-N-EtFOSA	26.1	UJ
EP27C-PRED-PART-ONE-01-091520	L33776-20	D5-EtFOSAA	250	J-
EP27C-PRED-PART-ONE-01-091520	L33776-20	d9-NEt-FOSE	3.96	R
EP27C-PRED-PART-ONE-01-091520	L33776-20	d7-NMe-FOSE	15.3	R

Laboratory control sample/Laboratory control sample duplicate (Section 5Bi): Results associated with high recoveries were nondetect and were acceptable without qualification.

LCS/LCSD IDs	Compound	LCS/LCSD %Recovery	Recovery Limits	Qualifiers
WG74149-102 (A)/ WG74149-103 (DUP WG74149-102)	N-MeFOSE	**170/178**	50-150	Associated results were nondetect. No qualifiers.
	5:3 FTCA	148/**154**	50-150	

Bold indicates an exceedance

10. Additional comments about lab report: For the results listed below, the peak was detected; however, it did not meet quantification criteria. These results were reported as maximum possible concentration and qualified as estimated (J):

Sample ID	Lab ID	Analyte
EP21-PRED-PART-THREE-01-091820	L33776-2	N-EtFOSE
EP21-PRED-FIL-FOUR-01-091820	L33776-3	N-EtFOSE
BP1-PRED-FIL-THREE-01-092020	L33776-6	PFDoA
BP1-PRED-FIL-FOUR-01-092020	L33776-7	PFTrDA
BP1-PRED-FIL-FIVE-01-092020	L33776-8	N-EtFOSE
BP1-PRED-FIL-SIX-01-092020	L33776-9	PFTeDA
BP1-PRED-FIL-SEVEN-01-092020	L33776-10	PFOA
BP1-PRED-FIL-EIGHT-01-091920	L33776-11	N-EtFOSE
BP1-PRED-PART-ONE-01-092020	L33776-12	N-EtFOSE
BP1-PRED-PART-SIX-01-092020	L33776-13	PFTeDA
BP1-PRED-PART-SIX-01-092020	L33776-13	N-EtFOSE
EP14-PRED-FIL-THREE-01-091820	L33776-14	N-EtFOSE
EP14-PRED-PART-THREE-01-091820	L33776-15	N-EtFOSE
EP14-PRED-PART-TWO-01-091820	L33776-16	N-EtFOSE

Sample ID	Lab ID	Analyte
EP14-PRED-FIL-TWO-01-091820	L33776-17	N-EtFOSE
EP21-PRED-FIL-ONE-01-091720	L33776-18	N-EtFOSE
EP27C-PRED-PART-ONE-01-091520	L33776-20	N-EtFOSE

Any R qualifiers take precedence over other qualifiers.

MINNESOTA

Minnesota Department of Agriculture 651-201-6148
Minnesota Department of Health 651-201-5357
Minnesota Pollution Control Agency 651-757-2560

Laboratory data review checklist

Doc Type: Data Review

Instructions: The following is the informal checklist that should be used to review data for the Minnesota Department of Agriculture, Minnesota Pollution Control Agency, and Minnesota Department of Health. The information follows the general format of the National Functional Guidelines, which is the primary data review tool used in the U.S. Environmental Protection Agency's Contract Laboratory Program for Superfund analytical work. Refer to the appropriate guidance document for each agency for instructions.

Project information

Project name: Project 1007

Work order number/Lab report ID: DPWG74676 Report date (mm/dd/yyyy): 12/4/2020

Laboratory: SGS AXYS Review date (mm/dd/yyyy): 12/10/2020

1. Chain of custody, preservation, and holding times

Questions			Yes	No	N/A	Comments
A.	Is there a chain of custody (COC) with the report?		☒	☐	☐	Additional samples (not reported in this SDG) were listed on the COCs.
B.	Is there a sample condition form with the report?		☒	☐	☐	
C.	Were there samples preserved according to program requirements?		☒	☐	☐	
D.	Were samples received in the correct containers?		☒	☐	☐	
	i.	Was there enough sample volume/weight to complete all requested analyses?	☒	☐	☐	
	ii.	Was there enough sample collected to complete required batch QC?	☒	☐	☐	
E.	Were samples received within holding time for sample prep for all requested analyses?		☐	☒	☐	
F.	Are there notes about sample condition or holding time issues on the COC? Explain the data impact.		☒	☐	☐	Sample receiving log indicates one sample was not received. Also, the bottle labels did not match the COC for one sample. No qualifiers.
G.	Are there narration or data qualifiers with the report about sample condition or holding time issues? Explain the data impact.		☐	☒	☐	
H.	Are lab IDs cross-referenced correctly with the field IDs.		☒	☐	☐	

2. Calibration

Question		Yes	No	N/A	Comments
A.	Do the report narrative or data qualifiers indicate calibration problems for any analyses? If yes, explain the data impact.	☒	☐	☐	MN limits used. ICAL, ICV and CCV reviewed. See data qualifications summary for exceedances. No qualifiers.

3. Blanks

Question			Yes	No	N/A	Comments
A.	Do any of the analyses contain samples for field or trip blanks?		☐	☒	☐	
	i.	If yes, are there target analytes present above the reporting limit in the blanks?	☐	☐	☒	
	ii.	If yes, are the same compounds also present in the samples? Explain possible data impact.	☐	☐	☒	
B.	Do method blanks for any analyses contain target analytes above the reporting limit?		☒	☐	☐	
	i.	If yes, are the same compounds present in the samples?	☒	☐	☐	
	ii.	Is the amount of target analyte in the method blank more than 1/10th of that in the sample(s)? Explain the possible impact on sample results.	☒	☐	☐	See data qualifications summary for blank detections and qualifications.
C.	Do instrument blanks contain analytes above the reporting limit?		☐	☐	☒	

4. Surrogates or organic analysis

Question			Yes	No	N/A	Comments
A.	Are the lab recovery limits for surrogates specified on the report?		☒	☐	☐	MPCA limits used: 50% to 200%
B.	Are the surrogates outside lab QC limits? (These should have a data qualifier.)		☒	☐	☐	
	i.	If yes, are the surrogates above the lab QC limits?	☒	☐	☐	
	ii.	Below the lab QC limits?	☒	☐	☐	
	iii.	Were the affected samples re-analyzed? Discuss in the case narrative.	☐	☒	☐	
	iv.	Explain what this could mean for the affected samples. Include in narrative.	☒	☐	☐	See data qualifications summary for exceedances and qualifications. Thirty-three results were rejected (R) due to severely low labeled analog recoveries.

5. Laboratory control sample/Laboratory control sample duplicate (LCS/LCSD)

Question			Yes	No	N/A	Comments
A.	Are there LCS/LCSD samples present for the reporting analyses?		☒	☐	☐	
B.	Are there LCS/LCSD compounds outside lab limits? If the LCS/LCSD fails, the LCS/LCSD and samples must be re-analyzed.		☒	☐	☐	MPCA PFAS tissue/other limits used: 50% to 150%.
	i.	If yes, are there compounds above the lab QC limits? If yes, an explanation is required. Include in narrative.	☒	☐	☐	5:3 FTCA 168%/164% Associated results were nondetect and were acceptable without qualification.
	ii.	Below the QC limits? If yes, an explanation is required. Include in narrative.	☐	☒	☐	

6. Matrix spike/Matrix spike duplicate/Sample duplicate (MS/MSD/DUP)

Question				Yes	No	N/A	Comments
A.	Do the analytical methods used require an MS and/or MSD? If no, skip to 6.B.			☒	☐	☐	
	i.	Have the required matrix spikes been prepared and reported?		☐	☒	☐	
	ii.	If no, is there and explanation in the report as to why?		☐	☒	☐	
	iii.	Did the lab process an alternate spiked sample (such as LCSD) instead?		☒	☐	☐	LCSD
	iv.	Are the lab QC limits specified on the report?		☒	☐	☐	
	v.	Are there compounds outside the lab QC limits?		☐	☐	☒	
	vi.	If yes, did the lab re-run an MS/MSD?		☐	☐	☒	
		1.	Did the re-run MS/MSD pass? Discuss the case narrative.	☐	☐	☒	
		2.	Did the re-run MS/MSD fail? Discuss the case narrative.	☐	☐	☒	
		3.	Is the source sample also flagged for MS/MSD compounds outside the lab QC limits?	☐	☐	☒	
B.	Was a duplicate sample submitted for the analytical method(s)?			☒	☐	☐	LCSD
	i.	Is the Relative Percentage Difference (RPD) within 20%* for the duplicate pair? If no, explain possible causes and data impact. **Other RPDs may be acceptable. Check with regulatory agency.*		☒	☐	☐	50% limit for PFAS (other/tissue)

7. Method detection limits/Report limits

Question		Yes	No	N/A	Comments
A.	Are reporting limits clearly listed on the report for all analyses?	☒	☐	☐	
B.	Do the reporting limits meet the program required limits listed? If not, an explanation is required.	☒	☐	☐	

8. Sample information

Questions		Yes	No	N/A	Comments
A.	Are sample numbers cross-referenced correctly with the associated QC?	☒	☐	☐	
B.	Are soil samples reported in dry weight basis?	☐	☐	☒	
C.	Are percent moisture results reported?	☐	☐	☒	
D.	Are positive detections reported?	☒	☐	☐	
E.	Are sample analytes appropriately flagged if the QC failed?	☒	☐	☐	

9. Report narrative

Question		Yes	No	N/A	Comments
A.	Is a narrative provided with the laboratory report which describes all problems with the analyses and all corrective actions taken to address these problems?	☒	☐	☐	

10. Additional comments about the lab report

Reviewed using MPCA Guidance on Perfluorochemicals Analysis (July 2020).

See attachment for qualification.

Thirty-three results were rejected (R) due to severely low labeled analog recoveries.

Certification

By typing my name below, I certify the above statements to be true and correct, to the best of my knowledge, and that this information can be used for the purpose of processing this form.

Authorized Representative

Name: Lisa Smith Title: Environmental Chemist (CEAC)

(This document has been electronically signed.) Date (mm/dd/yyyy): 12/10/2020

Data Validation Qualifications for DPWG74676

Calibration (Section 2): Calibration noncompliances are summarized below.

Calibration	Analyte	%R	%R Limits	Qualifiers
CCV 11/14/20 7:19	NFDHA	131	70-130%	Associated results were nondetect. No qualifiers.
CCV 11/14/20 13:11	3:3 FTCA	0%	70-130%	Only PFOS dilutions reported from this CCV. No qualifiers.
	PFHpS	0%	70-130%	
	PFDA	Not Reported	70-130%	
	PFDoA	Not Reported	70-130%	
	PFMPA	Not Reported	70-130%	
CCV 11/14/20 17:18	PFDA	Not Reported	70-130%	Only PFOS dilutions reported from this CCV. No qualifiers.
	PFDoA	Not Reported	70-130%	
	PFMPA	0%	70-130%	
	3:3 FTCA	0.2%	70-130%	

Method blank detections (Section 3Bii): Detects within 10 times the method blank concentrations were qualified B.

Blank Sample ID	Analyte	Concentration (ng/g)	Results Qualified B
WG74150-101 i	PFUnA	0.132 J	EP27C-PRED-FIL-ONE-01-091520(L33776-21 i) EP27C-PRED-FIL-TWO-01-091520(L33776-23 i) EP18-PRED-FIL-ONE-01-091520(L33776-26 i) EP18-PRED-FIL-TWO-01-091520(L33776-27 i) WL7-PRED-WHO-01-091720(L33776-31 i) WL6-PRED-WHO-ONE-01-091720(L33776-32 i) EP9A-PRED-FIL-TWO-01-091820(L33776-38 i) EP9A-PRED-FIL-THREE-01-091820(L33776-39 i) EP9A-PRED-FIL-FOUR-01-091820(L33776-40 i)
	PFTrDA	0.149 J	EP27C-PRED-FIL-ONE-01-091520(L33776-21 i) EP27C-PRED-PART-TWO-01-091520(L33776-24 i) EP18-PRED-PART-ONE-01-091520(L33776-25 i) EP18-PRED-FIL-ONE-01-091520(L33776-26 i) EP18-PRED-PART-TWO-01-091520(L33776-28 i) EP18C-PRED-PART-01-091620(L33776-29 i) EP18C-PRED-FIL-01-091620(L33776-30 i) WL7-PRED-WHO-01-091720(L33776-31 i) WL6-PRED-WHO-ONE-01-091720(L33776-32 i) WL6-PRED-WHO-TWO-01-091720(L33776-33 i) WL3-PRED-WHO-01-091720(L33776-34 i) WL5-PRED-WHO-01-091720(L33776-35 i) EP9A-PRED-FIL-ONE-01-091820(L33776-36 i)

Blank Sample ID	Analyte	Concentration (ng/g)	Results Qualified B
			EP9A-PRED-PART-ONE-01-091820(L33776-37 i) EP9A-PRED-FIL-TWO-01-091820(L33776-38 i) EP9A-PRED-FIL-THREE-01-091820(L33776-39 i) EP9A-PRED-FIL-FOUR-01-091820(L33776-40 i)
	PFOS	0.204 J	Sample concentrations were greater than 10 times the blank concentration. No qualifiers.
	6:2 FTS	0.717 J	EP27C-PRED-FIL-ONE-01-091520(L33776-21 i) EP27C-PRED-FIL-TWO-01-091520(L33776-23 i) EP27C-PRED-PART-TWO-01-091520(L33776-24 i) EP18-PRED-FIL-ONE-01-091520(L33776-26 i) EP18-PRED-FIL-TWO-01-091520(L33776-27 i) EP18-PRED-PART-TWO-01-091520(L33776-28 i) EP18C-PRED-PART-01-091620(L33776-29 i) WL7-PRED-WHO-01-091720(L33776-31 i) WL6-PRED-WHO-ONE-01-091720(L33776-32 i) WL6-PRED-WHO-TWO-01-091720(L33776-33 i) WL3-PRED-WHO-01-091720(L33776-34 i) WL5-PRED-WHO-01-091720(L33776-35 i) EP9A-PRED-FIL-ONE-01-091820(L33776-36 i) EP9A-PRED-PART-ONE-01-091820(L33776-37 i) EP9A-PRED-FIL-TWO-01-091820(L33776-38 i) EP9A-PRED-FIL-THREE-01-091820(L33776-39 i) EP9A-PRED-FIL-FOUR-01-091820(L33776-40 i)
	PFOSA	0.115 J	EP27C-PRED-FIL-ONE-01-091520(L33776-21 i) EP27C-PRED-FIL-TWO-01-091520(L33776-23 i) EP18-PRED-FIL-ONE-01-091520(L33776-26 i) EP18-PRED-FIL-TWO-01-091520(L33776-27 i) EP18C-PRED-FIL-01-091620(L33776-30 i) WL7-PRED-WHO-01-091720(L33776-31 i) WL6-PRED-WHO-ONE-01-091720(L33776-32 i) WL6-PRED-WHO-TWO-01-091720(L33776-33 i) WL3-PRED-WHO-01-091720(L33776-34 i) WL5-PRED-WHO-01-091720(L33776-35 i) EP9A-PRED-PART-ONE-01-091820(L33776-37 i) EP9A-PRED-FIL-TWO-01-091820(L33776-38 i) EP9A-PRED-FIL-THREE-01-091820(L33776-39 i) EP9A-PRED-FIL-FOUR-01-091820(L33776-40 i)

Labeled Analogs - surrogates (Section 4Bii): Results associated with low recoveries were qualified as estimated (UJ and J+), and detects associated with high recoveries were qualified as estimated biased low (J-), as these labeled analogs are used to quantitate the analyte of interest and an inverse relationship exists. Thirty-three results were rejected (R) due to severely low labeled analog recoveries.

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
EP27C-PRED-FIL-ONE-01-091520	L33776-21 i	13C2-PFTeDA	20.5	UJ
EP27C-PRED-FIL-ONE-01-091520	L33776-21 i	D3-N-MeFOSA	32.0	UJ
EP27C-PRED-FIL-ONE-01-091520	L33776-21 i	D5-N-EtFOSA	22.4	UJ
EP27C-PRED-FIL-ONE-01-091520	L33776-21 i	d7-NMe-FOSE	7.50	R

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
EP27C-PRED-FIL-ONE-01-091520	L33776-21 i	d9-NEt-FOSE	7.76	R
EP27C-PRED-FIL-TWO-01-091520	L33776-23 i	D5-N-EtFOSA	31.6	UJ
EP27C-PRED-FIL-TWO-01-091520	L33776-23 i	d7-NMe-FOSE	7.81	R
EP27C-PRED-FIL-TWO-01-091520	L33776-23 i	d9-NEt-FOSE	16.7	R
EP27C-PRED-FIL-ONE-01-091520	L33776-24 i	13C2-PFTeDA	39.4	J+
EP27C-PRED-FIL-ONE-01-091520	L33776-24 i	13C2-4:2 FTS	224	No Qualifier
EP27C-PRED-FIL-ONE-01-091520	L33776-24 i	D3-N-MeFOSA	37.8	UJ
EP27C-PRED-FIL-ONE-01-091520	L33776-24 i	D5-N-EtFOSA	33.5	UJ
EP27C-PRED-FIL-ONE-01-091520	L33776-24 i	D5-EtFOSAA	305	No Qualifier
EP27C-PRED-FIL-ONE-01-091520	L33776-24 i	d7-NMe-FOSE	6.42	R
EP27C-PRED-FIL-ONE-01-091520	L33776-24 i	d9-NEt-FOSE	18.5	R
EP18-PRED-PART-ONE-01-091520	L33776-25 i	13C2-4:2 FTS	220	No Qualifier
EP18-PRED-PART-ONE-01-091520	L33776-25 i	13C8-PFOSA	225	J-
EP18-PRED-PART-ONE-01-091520	L33776-25 i	D3-N-MeFOSA	18.9	R
EP18-PRED-PART-ONE-01-091520	L33776-25 i	D5-N-EtFOSA	35.6	UJ
EP18-PRED-PART-ONE-01-091520	L33776-25 i	D5-EtFOSAA	344	J-
EP18-PRED-PART-ONE-01-091520	L33776-25 i	d7-NMe-FOSE	23.0	UJ
EP18-PRED-PART-ONE-01-091520	L33776-25 i	d9-NEt-FOSE	8.88	R
EP18-PRED-FIL-ONE-01-091520	L33776-26 i	D5-N-EtFOSA	39.1	UJ
EP18-PRED-FIL-ONE-01-091520	L33776-26 i	D5-EtFOSAA	209	J-
EP18-PRED-FIL-ONE-01-091520	L33776-26 i	d7-NMe-FOSE	4.36	R
EP18-PRED-FIL-ONE-01-091520	L33776-26 i	d9-NEt-FOSE	33.3	UJ
EP18-PRED-FIL-TWO-01-091520	L33776-27 i	d7-NMe-FOSE	8.51	R
EP18-PRED-FIL-TWO-01-091520	L33776-27 i	d9-NEt-FOSE	41.1	UJ
EP18-PRED-PART-TWO-01-091520	L33776-28 i	13C2-4:2 FTS	223	No Qualifier
EP18-PRED-PART-TWO-01-091520	L33776-28 i	D3-N-MeFOSA	30.3	UJ
EP18-PRED-PART-TWO-01-091520	L33776-28 i	D5-N-EtFOSA	24.8	UJ
EP18-PRED-PART-TWO-01-091520	L33776-28 i	D5-EtFOSAA	315	J-
EP18-PRED-PART-TWO-01-091520	L33776-28 i	d7-NMe-FOSE	11.7	R
EP18-PRED-PART-TWO-01-091520	L33776-28 i	d9-NEt-FOSE	7.38	R
EP18C-PRED-PART-01-091620	L33776-29 i	13C2-4:2 FTS	235	No Qualifier
EP18C-PRED-PART-01-091620	L33776-29 i	D5-N-EtFOSA	47.1	UJ
EP18C-PRED-PART-01-091620	L33776-29 i	D5-EtFOSAA	381	J-
EP18C-PRED-PART-01-091620	L33776-29 i	d7-NMe-FOSE	3.96	R
EP18C-PRED-PART-01-091620	L33776-29 i	d9-NEt-FOSE	32.4	UJ
EP18C-PRED-PART-01-091620	L33776-29 i	13C3-HFPO-DA	49.5	UJ
EP18C-PRED-FIL-01-091620	L33776-30 i	D5-N-EtFOSA	35.5	UJ
EP18C-PRED-FIL-01-091620	L33776-30 i	D5-EtFOSAA	207	J-

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
EP18C-PRED-FIL-01-091620	L33776-30 i	d7-NMe-FOSE	4.51	R
EP18C-PRED-FIL-01-091620	L33776-30 i	d9-NEt-FOSE	26.8	UJ
WL7-PRED-WHO-01-091720	L33776-31 i	13C2-PFTeDA	41.7	J+
WL7-PRED-WHO-01-091720	L33776-31 i	13C2-4:2 FTS	223	No Qualifier
WL7-PRED-WHO-01-091720	L33776-31 i	D3-N-MeFOSA	38.5	UJ
WL7-PRED-WHO-01-091720	L33776-31 i	D5-N-EtFOSA	22.3	UJ
WL7-PRED-WHO-01-091720	L33776-31 i	d7-NMe-FOSE	5.72	R
WL7-PRED-WHO-01-091720	L33776-31 i	d9-NEt-FOSE	9.49	R
WL7-PRED-WHO-01-091720	L33776-31 i	13C3-HFPO-DA	23.7	UJ
WL6-PRED-WHO-ONE-01-091720	L33776-32 i	13C2-PFTeDA	30.4	UJ
WL6-PRED-WHO-ONE-01-091720	L33776-32 i	D3-N-MeFOSA	29.1	UJ
WL6-PRED-WHO-ONE-01-091720	L33776-32 i	D5-N-EtFOSA	17.7	R
WL6-PRED-WHO-ONE-01-091720	L33776-32 i	d7-NMe-FOSE	12.1	R
WL6-PRED-WHO-ONE-01-091720	L33776-32 i	d9-NEt-FOSE	6.9	R
WL6-PRED-WHO-TWO-01-091720	L33776-33 i	13C2-PFTeDA	19.1	R
WL6-PRED-WHO-TWO-01-091720	L33776-33 i	D3-N-MeFOSA	36.9	UJ
WL6-PRED-WHO-TWO-01-091720	L33776-33 i	D5-N-EtFOSA	22.5	UJ
WL6-PRED-WHO-TWO-01-091720	L33776-33 i	D5-EtFOSAA	265	J-
WL6-PRED-WHO-TWO-01-091720	L33776-33 i	d7-NMe-FOSE	9.30	R
WL6-PRED-WHO-TWO-01-091720	L33776-33 i	d9-NEt-FOSE	7.73	R
WL6-PRED-WHO-TWO-01-091720	L33776-33 i	13C3-HFPO-DA	44.9	UJ
WL3-PRED-WHO-01-091720	L33776-34 i	13C2-PFTeDA	29.2	J+
WL3-PRED-WHO-01-091720	L33776-34 i	13C2-4:2 FTS	236	No Qualifier
WL3-PRED-WHO-01-091720	L33776-34 i	D3-N-MeFOSA	29.0	UJ
WL3-PRED-WHO-01-091720	L33776-34 i	D5-N-EtFOSA	16.0	R
WL3-PRED-WHO-01-091720	L33776-34 i	D5-EtFOSAA	241	J-
WL3-PRED-WHO-01-091720	L33776-34 i	d7-NMe-FOSE	1.85	R
WL3-PRED-WHO-01-091720	L33776-34 i	d9-NEt-FOSE	5.93	R
WL5-PRED-WHO-01-091720	L33776-35 i	13C2-4:2 FTS	207	No Qualifier
WL5-PRED-WHO-01-091720	L33776-35 i	13C8-PFOSA	205	J-
WL5-PRED-WHO-01-091720	L33776-35 i	D5-N-EtFOSA	33.2	UJ
WL5-PRED-WHO-01-091720	L33776-35 i	D5-EtFOSAA	281	J-
WL5-PRED-WHO-01-091720	L33776-35 i	d7-NMe-FOSE	11.0	R
WL5-PRED-WHO-01-091720	L33776-35 i	d9-NEt-FOSE	5.17	R
EP9A-PRED-FIL-ONE-01-091820	L33776-36 i	13C2-PFTeDA	41.5	J+
EP9A-PRED-FIL-ONE-01-091820	L33776-36 i	D3-N-MeFOSA	42.0	UJ
EP9A-PRED-FIL-ONE-01-091820	L33776-36 i	D5-N-EtFOSA	31.0	UJ
EP9A-PRED-FIL-ONE-01-091820	L33776-36 i	d7-NMe-FOSE	49.3	UJ

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
EP9A-PRED-FIL-ONE-01-091820	L33776-36 i	d9-NEt-FOSE	30.1	UJ
EP9A-PRED-PART-ONE-01-091820	L33776-37 i	13C2-PFTeDA	32.6	J+
EP9A-PRED-PART-ONE-01-091820	L33776-37 i	13C2-4:2 FTS	231	No Qualifier
EP9A-PRED-PART-ONE-01-091820	L33776-37 i	13C2-6:2 FTS	200	J-
EP9A-PRED-PART-ONE-01-091820	L33776-37 i	D3-N-MeFOSA	31.8	UJ
EP9A-PRED-PART-ONE-01-091820	L33776-37 i	D5-N-EtFOSA	20.4	UJ
EP9A-PRED-PART-ONE-01-091820	L33776-37 i	D5-EtFOSAA	218	J-
EP9A-PRED-PART-ONE-01-091820	L33776-37 i	d7-NMe-FOSE	8.36	R
EP9A-PRED-PART-ONE-01-091820	L33776-37 i	d9-NEt-FOSE	7.86	R
EP9A-PRED-PART-ONE-01-091820	L33776-37 i	13C3-HFPO-DA	42.5	UJ
EP9A-PRED-FIL-TWO-01-091820	L33776-38 i	13C2-PFTeDA	12.1	R
EP9A-PRED-FIL-THREE-01-091820	L33776-39 i	D5-N-EtFOSA	47.1	UJ
EP9A-PRED-FIL-THREE-01-091820	L33776-39 i	d7-NMe-FOSE	9.28	R
EP9A-PRED-FIL-THREE-01-091820	L33776-39 i	d9-NEt-FOSE	25.1	UJ
EP9A-PRED-FIL-FOUR-01-091820	L33776-40 i	D5-N-EtFOSA	42.7	UJ
EP9A-PRED-FIL-FOUR-01-091820	L33776-40 i	d7-NMe-FOSE	9.31	R
EP9A-PRED-FIL-FOUR-01-091820	L33776-40 i	d9-NEt-FOSE	17.0	R

10. Additional comments about lab report: For the results listed below, the peak was detected; however, it did not meet quantification criteria. These results were reported as maximum possible concentration and qualified as estimated (J):

Sample ID	Lab ID	Analyte
EP27C-PRED-FIL-ONE-01-091520	L33776-21 i	N-EtFOSE
EP27C-PRED-PART-TWO-01-091520	L33776-24 i	PFTeDA
EP18-PRED-PART-ONE-01-091520	L33776-25 i	PFHpA
EP18-PRED-PART-ONE-01-091520	L33776-25 i	N-EtFOSE
EP18-PRED-FIL-ONE-01-091520	L33776-26 i	PFTrDA
EP18-PRED-PART-TWO-01-091520	L33776-28 i	N-EtFOSE
WL7-PRED-WHO-01-091720	L33776-31 i	PFTeDA
WL7-PRED-WHO-01-091720	L33776-31 i	N-EtFOSE
WL6-PRED-WHO-ONE-01-091720	L33776-32 i	N-EtFOSE
WL6-PRED-WHO-TWO-01-091720	L33776-33 i	N-EtFOSE
WL3-PRED-WHO-01-091720	L33776-34 i	N-EtFOSE
WL5-PRED-WHO-01-091720	L33776-35 i	N-EtFOSE
EP9A-PRED-PART-ONE-01-091820	L33776-37 i	EtFOSAA
EP9A-PRED-PART-ONE-01-091820	L33776-37 i	N-EtFOSE

Any R qualifiers take precedence over other qualifiers.

MINNESOTA

Minnesota Department of Agriculture 651-201-6148
Minnesota Department of Health 651-201-5357
Minnesota Pollution Control Agency 651-757-2560

Laboratory data review checklist

Doc Type: Data Review

Instructions: The following is the informal checklist that should be used to review data for the Minnesota Department of Agriculture, Minnesota Pollution Control Agency, and Minnesota Department of Health. The information follows the general format of the National Functional Guidelines, which is the primary data review tool used in the U.S. Environmental Protection Agency's Contract Laboratory Program for Superfund analytical work. Refer to the appropriate guidance document for each agency for instructions.

Project information

Project name: Project 1007

Work order number/Lab report ID: DPWG74677 Report date (mm/dd/yyyy): 12/2/2020

Laboratory: SGS AXYS Review date (mm/dd/yyyy): 12/21/2020

1. Chain of custody, preservation, and holding times

	Questions	Yes	No	N/A	Comments
A.	Is there a chain of custody (COC) with the report?	☒	☐	☐	Additional samples (not reported in this SDG) were listed on the COCs.
B.	Is there a sample condition form with the report?	☒	☐	☐	
C.	Were there samples preserved according to program requirements?	☒	☐	☐	
D.	Were samples received in the correct containers?	☒	☐	☐	
	i. Was there enough sample volume/weight to complete all requested analyses?	☒	☐	☐	
	ii. Was there enough sample collected to complete required batch QC?	☒	☐	☐	
E.	Were samples received within holding time for sample prep for all requested analyses?	☒	☐	☐	
F.	Are there notes about sample condition or holding time issues on the COC? Explain the data impact.	☐	☒	☐	
G.	Are there narration or data qualifiers with the report about sample condition or holding time issues? Explain the data impact.	☐	☒	☐	
H.	Are lab IDs cross-referenced correctly with the field IDs.	☒	☐	☐	

2. Calibration

Question			Yes	No	N/A	Comments
A.	Do the report narrative or data qualifiers indicate calibration problems for any analyses? If yes, explain the data impact.		☒	☐	☐	MN limits used. ICAL, ICV and CCV reviewed. See data qualifications summary for exceedances. No qualifiers.

3. Blanks

Question			Yes	No	N/A	Comments
A.	Do any of the analyses contain samples for field or trip blanks?		☐	☒	☐	
	i.	If yes, are there target analytes present above the reporting limit in the blanks?	☐	☐	☒	
	ii.	If yes, are the same compounds also present in the samples? Explain possible data impact.	☐	☐	☒	
B.	Do method blanks for any analyses contain target analytes above the reporting limit?		☒	☐	☐	
	i.	If yes, are the same compounds present in the samples?	☒	☐	☐	
	ii.	Is the amount of target analyte in the method blank more than 1/10th of that in the sample(s)? Explain the possible impact on sample results.	☒	☐	☐	See data qualifications summary for blank detections and qualifications.
C.	Do instrument blanks contain analytes above the reporting limit?		☐	☐	☒	

4. Surrogates or organic analysis

Question			Yes	No	N/A	Comments
A.	Are the lab recovery limits for surrogates specified on the report?		☒	☐	☐	MPCA limits used: 50% to 200%
B.	Are the surrogates outside lab QC limits? (These should have a data qualifier.)		☒	☐	☐	
	i.	If yes, are the surrogates above the lab QC limits?	☒	☐	☐	
	ii.	Below the lab QC limits?	☒	☐	☐	
	iii.	Were the affected samples re-analyzed? Discuss in the case narrative.	☐	☒	☐	
	iv.	Explain what this could mean for the affected samples. Include in narrative.	☒	☐	☐	See data qualifications summary for exceedances and qualifications. Forty results were rejected (R) due to severely low labeled analog recoveries.

5. Laboratory control sample/Laboratory control sample duplicate (LCS/LCSD)

Question			Yes	No	N/A	Comments
A.	Are there LCS/LCSD samples present for the reporting analyses?		☒	☐	☐	
B.	Are there LCS/LCSD compounds outside lab limits? If the LCS/LCSD fails, the LCS/LCSD and samples must be re-analyzed.		☒	☐	☐	MPCA PFAS tissue/other limits used: 50% to 150%.
	i.	If yes, are there compounds above the lab QC limits? If yes, an explanation is required. Include in narrative.	☒	☐	☐	N-MeFOSE 203%/155% 11Cl-PF3OUdS --/131% 5:3 FTCA --/164% Associated results were nondetect and were acceptable without qualification.
	ii.	Below the QC limits? If yes, an explanation is required. Include in narrative.	☐	☒	☐	

6. Matrix spike/Matrix spike duplicate/Sample duplicate (MS/MSD/DUP)

Question				Yes	No	N/A	Comments
A.	Do the analytical methods used require an MS and/or MSD? If no, skip to 6.B.			☒	☐	☐	
	i.	Have the required matrix spikes been prepared and reported?		☐	☒	☐	
	ii.	If no, is there and explanation in the report as to why?		☐	☒	☐	
	iii.	Did the lab process an alternate spiked sample (such as LCSD) instead?		☒	☐	☐	LCSD
	iv.	Are the lab QC limits specified on the report?		☒	☐	☐	
	v.	Are there compounds outside the lab QC limits?		☐	☐	☒	
	vi.	If yes, did the lab re-run an MS/MSD?		☐	☐	☒	
		1.	Did the re-run MS/MSD pass? Discuss the case narrative.	☐	☐	☒	
		2.	Did the re-run MS/MSD fail? Discuss the case narrative.	☐	☐	☒	
		3.	Is the source sample also flagged for MS/MSD compounds outside the lab QC limits?	☐	☐	☒	
B.	Was a duplicate sample submitted for the analytical method(s)?			☒	☐	☐	LCSD
	i.	Is the Relative Percentage Difference (RPD) within 20%* for the duplicate pair? If no, explain possible causes and data impact. **Other RPDs may be acceptable. Check*		☒	☐	☐	50% limit for PFAS (other/tissue)

		with regulatory agency.				

7. Method detection limits/Report limits

Question		Yes	No	N/A	Comments
A.	Are reporting limits clearly listed on the report for all analyses?	☒	☐	☐	
B.	Do the reporting limits meet the program required limits listed? If not, an explanation is required.	☒	☐	☐	

8. Sample information

Questions		Yes	No	N/A	Comments
A.	Are sample numbers cross-referenced correctly with the associated QC?	☒	☐	☐	
B.	Are soil samples reported in dry weight basis?	☐	☐	☒	
C.	Are percent moisture results reported?	☐	☐	☒	
D.	Are positive detections reported?	☒	☐	☐	
E.	Are sample analytes appropriately flagged if the QC failed?	☒	☐	☐	

9. Report narrative

Question		Yes	No	N/A	Comments
A.	Is a narrative provided with the laboratory report which describes all problems with the analyses and all corrective actions taken to address these problems?	☒	☐	☐	

10. Additional comments about the lab report

Reviewed using MPCA Guidance on Perfluorochemicals Analysis (July 2020).

See attachment for qualification.

Forty results were rejected (R) due to severely low labeled analog recoveries.

Certification

By typing my name below, I certify the above statements to be true and correct, to the best of my knowledge, and that this information can be used for the purpose of processing this form.

Authorized Representative

Name: Lisa Smith Title: Environmental Chemist (CEAC)

(This document has been electronically signed.) Date (mm/dd/yyyy): 12/21/2020

Data Validation Qualifications for DPWG74677

Calibration (Section 2): Calibration noncompliances are summarized below.

Calibration	Analyte	%R	%R Limits	Qualifiers
CCV 11/23/20 15:58	3:3 FTCA	58.4	70-130%	Only PFOS dilutions reported from this CCV. No qualifiers.
	PFDoA	Not Reported	70-130%	
	PFMPA	Not Reported	70-130%	
CCV 11/23/20 15:58	3:3 FTCA	0.1	70-130%	Only PFOS dilutions reported from this CCV. No qualifiers.
	PFDoA	Not Reported	70-130%	
	PFMPA	Not Reported	70-130%	

Method blank detections (Section 3Bii): Detects within 10 times the method blank concentrations were qualified B.

Blank Sample ID	Analyte	Concentration (ng/g)	Results Qualified B
WG74151-101	PFUnA	0.126 J	EP14-PRED-FIL-ONE-01-091820 (L33776-41) WL14-PRED-WHO-TWO-01-091620 (L33776-43) WL14-PRED-WHO-THREE-01-091620 (L33776-44) WL14-PRED-WHO-FOUR-01-091620 (L33776-45) EP21-FORE-FIL-ONE-01-091820 (L33784-1) EP21-FORE-FIL-THREE-01-091820 (L33784-3) EP21-FORE-PART-THREE-01-091820 (L33784-4) EP21-FORE-FIL-SEVEN-01-091820 (L33784-8) EP21-FORE-FIL-EIGHT-01-091820 (L33784-9) EP21-FORE-PART-SEVEN-01-091820 (L33784-10) EP21-FORE-FIL-NINE-01-091820 (L33784-11)
	PFTrDA	0.153 J	EP14-PRED-FIL-ONE-01-091820 (L33776-41) EP14-PRED-PART-ONE-01-091820 (L33776-42) WL14-PRED-WHO-TWO-01-091620 (L33776-43) WL14-PRED-WHO-THREE-01-091620 (L33776-44) WL14-PRED-WHO-FOUR-01-091620 (L33776-45) WL15A-PRED-WHO-ONE-01-091620 (L33776-46) WL15A-PRED-WHO-FOUR-01-091620 (L33776-47) WL15A-PRED-WHO-TWO-01-091620 (L33776-48) WL15A-PRED-WHO-THREE-01-091620 (L33776-49) EP21-FORE-FIL-ONE-01-091820 (L33784-1) EP21-FORE-FIL-THREE-01-091820 (L33784-3) EP21-FORE-PART-THREE-01-091820 (L33784-4) EP21-FORE-FIL-SEVEN-01-091820 (L33784-8) EP21-FORE-FIL-EIGHT-01-091820 (L33784-9) EP21-FORE-PART-SEVEN-01-091820 (L33784-10) EP21-FORE-FIL-NINE-01-091820 (L33784-11)

Labeled Analogs - surrogates (Section 4Bii): Results associated with low recoveries were qualified as estimated (UJ and J+), and detects associated with high recoveries were qualified as estimated biased low

(J-), as these labeled analogs are used to quantitate the analyte of interest and an inverse relationship exists. Forty results were rejected (R) due to severely low labeled analog recoveries.

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
EP14-PRED-FIL-ONE-01-091820	L33776-41	13C2-PFTeDA	45.6	J+
EP14-PRED-FIL-ONE-01-091820	L33776-41	D3-N-MeFOSA	46.9	UJ
EP14-PRED-FIL-ONE-01-091820	L33776-41	D5-N-EtFOSA	30.7	UJ
EP14-PRED-FIL-ONE-01-091820	L33776-41	d7-NMe-FOSE	6.54	R
EP14-PRED-FIL-ONE-01-091820	L33776-41	d9-NEt-FOSE	17.8	R
EP14-PRED-PART-ONE-01-091820	L33776-42	13C2-PFTeDA	43.3	J+
EP14-PRED-PART-ONE-01-091820	L33776-42	D5-N-EtFOSA	31.2	UJ
EP14-PRED-PART-ONE-01-091820	L33776-42	d7-NMe-FOSE	7.68	R
EP14-PRED-PART-ONE-01-091820	L33776-42	d9-NEt-FOSE	11.0	R
EP14-PRED-PART-ONE-01-091820	L33776-42	13C3-HFPO-DA	36.3	UJ
WL14-PRED-WHO-TWO-01-091620	L33776-43	d7-NMe-FOSE	8.03	R
WL14-PRED-WHO-TWO-01-091620	L33776-43	d9-NEt-FOSE	29.0	UJ
WL14-PRED-WHO-THREE-01-091620	L33776-44	D5-N-EtFOSA	47.7	UJ
WL14-PRED-WHO-THREE-01-091620	L33776-44	D5-EtFOSAA	233	J-
WL14-PRED-WHO-THREE-01-091620	L33776-44	d7-NMe-FOSE	5.82	R
WL14-PRED-WHO-THREE-01-091620	L33776-44	d9-NEt-FOSE	21.4	J+
WL14-PRED-WHO-FOUR-01-091620	L33776-45	D5-N-EtFOSA	43.8	UJ
WL14-PRED-WHO-FOUR-01-091620	L33776-45	D5-EtFOSAA	211	J-
WL14-PRED-WHO-FOUR-01-091620	L33776-45	d7-NMe-FOSE	9.38	R
WL14-PRED-WHO-FOUR-01-091620	L33776-45	d9-NEt-FOSE	21.0	J+
WL15A-PRED-WHO-ONE-01-091620	L33776-46	13C2-4:2 FTS	226	No Qualifier
WL15A-PRED-WHO-ONE-01-091620	L33776-46	D3-N-MeFOSA	49.5	UJ
WL15A-PRED-WHO-ONE-01-091620	L33776-46	D5-N-EtFOSA	31.6	UJ
WL15A-PRED-WHO-ONE-01-091620	L33776-46	D5-EtFOSAA	224	J-
WL15A-PRED-WHO-ONE-01-091620	L33776-46	d7-NMe-FOSE	5.13	R
WL15A-PRED-WHO-ONE-01-091620	L33776-46	d9-NEt-FOSE	13.6	R
WL15A-PRED-WHO-FOUR-01-091620	L33776-47	13C2-PFTeDA	44.6	J+
WL15A-PRED-WHO-FOUR-01-091620	L33776-47	D3-N-MeFOSA	31.2	UJ

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
WL15A-PRED-WHO-FOUR-01-091620	L33776-47	D5-N-EtFOSA	19.5	R
WL15A-PRED-WHO-FOUR-01-091620	L33776-47	d7-NMe-FOSE	3.52	R
WL15A-PRED-WHO-FOUR-01-091620	L33776-47	d9-NEt-FOSE	7.72	R
WL15A-PRED-WHO-TWO-01-091620	L33776-48	D3-N-MeFOSA	27.7	UJ
WL15A-PRED-WHO-TWO-01-091620	L33776-48	D5-N-EtFOSA	16.6	R
WL15A-PRED-WHO-TWO-01-091620	L33776-48	d7-NMe-FOSE	2.10	R
WL15A-PRED-WHO-TWO-01-091620	L33776-48	d9-NEt-FOSE	7.44	R
WL15A-PRED-WHO-THREE-01-091620	L33776-49	D3-N-MeFOSA	29.7	UJ
WL15A-PRED-WHO-THREE-01-091620	L33776-49	D5-N-EtFOSA	16.5	R
WL15A-PRED-WHO-THREE-01-091620	L33776-49	d7-NMe-FOSE	2.12	R
WL15A-PRED-WHO-THREE-01-091620	L33776-49	d9-NEt-FOSE	6.18	R
WL15A-PRED-WHO-THREE-01-091620	L33776-49	13C3-HFPO-DA	44.5	UJ
EP21-FORE-FIL-ONE-01-091820	L33784-1	D5-N-EtFOSA	34.4	UJ
EP21-FORE-FIL-ONE-01-091820	L33784-1	d7-NMe-FOSE	12.9	R
EP21-FORE-FIL-ONE-01-091820	L33784-1	d9-NEt-FOSE	14.8	R
EP21-FORE-FIL-TWO-01-091820	L33784-2	D3-N-MeFOSA	37.0	UJ
EP21-FORE-FIL-TWO-01-091820	L33784-2	D5-N-EtFOSA	27.2	UJ
EP21-FORE-FIL-TWO-01-091820	L33784-2	d7-NMe-FOSE	3.70	R
EP21-FORE-FIL-TWO-01-091820	L33784-2	d9-NEt-FOSE	10.5	R
EP21-FORE-FIL-THREE-01-091820	L33784-3	D3-N-MeFOSA	37.0	UJ
EP21-FORE-FIL-THREE-01-091820	L33784-3	D5-N-EtFOSA	34.3	UJ
EP21-FORE-FIL-THREE-01-091820	L33784-3	d7-NMe-FOSE	3.89	R
EP21-FORE-FIL-THREE-01-091820	L33784-3	d9-NEt-FOSE	18.9	R
EP21-FORE-PART-THREE-01-091820	L33784-4	13C2-4:2 FTS	203	No Qualifier
EP21-FORE-PART-THREE-01-091820	L33784-4	D3-N-MeFOSA	37.3	UJ
EP21-FORE-PART-THREE-01-091820	L33784-4	D5-N-EtFOSA	35.2	UJ
EP21-FORE-PART-THREE-01-091820	L33784-4	d7-NMe-FOSE	4.81	R
EP21-FORE-PART-THREE-01-091820	L33784-4	d9-NEt-FOSE	25.4	J+
EP21-FORE-FIL-FOUR-01-091820	L33784-5	D3-N-MeFOSA	37.6	UJ
EP21-FORE-FIL-FOUR-01-091820	L33784-5	D5-N-EtFOSA	35.4	UJ

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
EP21-FORE-FIL-FOUR-01-091820	L33784-5	d7-NMe-FOSE	3.18	R
EP21-FORE-FIL-FOUR-01-091820	L33784-5	d9-NEt-FOSE	8.36	R
EP21-FORE-FIL-FIVE-01-091820	L33784-6	D3-N-MeFOSA	44.6	UJ
EP21-FORE-FIL-FIVE-01-091820	L33784-6	D5-N-EtFOSA	37.0	UJ
EP21-FORE-FIL-FIVE-01-091820	L33784-6	d7-NMe-FOSE	2.57	R
EP21-FORE-FIL-FIVE-01-091820	L33784-6	d9-NEt-FOSE	14.1	R
EP21-FORE-FIL-SIX-01-091820	L33784-7	D3-N-MeFOSA	45.7	UJ
EP21-FORE-FIL-SIX-01-091820	L33784-7	D5-N-EtFOSA	41.9	UJ
EP21-FORE-FIL-SIX-01-091820	L33784-7	d7-NMe-FOSE	5.34	R
EP21-FORE-FIL-SIX-01-091820	L33784-7	d9-NEt-FOSE	12.7	R
EP21-FORE-FIL-SEVEN-01-091820	L33784-8	D5-N-EtFOSA	30.9	UJ
EP21-FORE-FIL-SEVEN-01-091820	L33784-8	d7-NMe-FOSE	5.15	R
EP21-FORE-FIL-SEVEN-01-091820	L33784-8	d9-NEt-FOSE	19.8	R
EP21-FORE-FIL-EIGHT-01-091820	L33784-9	13C2-PFTeDA	28.8	J+
EP21-FORE-FIL-EIGHT-01-091820	L33784-9	D3-N-MeFOSA	27.4	UJ
EP21-FORE-FIL-EIGHT-01-091820	L33784-9	D5-N-EtFOSA	15.8	R
EP21-FORE-FIL-EIGHT-01-091820	L33784-9	d7-NMe-FOSE	5.35	R
EP21-FORE-FIL-EIGHT-01-091820	L33784-9	d9-NEt-FOSE	4.25	R
EP21-FORE-PART-SEVEN-01-091820	L33784-10	13C2-PFTeDA	46.0	J+
EP21-FORE-PART-SEVEN-01-091820	L33784-10	D3-N-MeFOSA	24.1	UJ
EP21-FORE-PART-SEVEN-01-091820	L33784-10	D5-N-EtFOSA	15.7	R
EP21-FORE-PART-SEVEN-01-091820	L33784-10	d7-NMe-FOSE	6.07	R
EP21-FORE-PART-SEVEN-01-091820	L33784-10	d9-NEt-FOSE	5.96	R
EP21-FORE-FIL-NINE-01-091820	L33784-11	D5-N-EtFOSA	35.6	UJ
EP21-FORE-FIL-NINE-01-091820	L33784-11	d7-NMe-FOSE	12.7	R
EP21-FORE-FIL-NINE-01-091820	L33784-11	d9-NEt-FOSE	20.7	J+

10. Additional comments about lab report: For the results listed below, the peak was detected; however, it did not meet quantification criteria. These results were reported as maximum possible concentration and qualified as estimated (J):

Sample ID	Lab ID	Analyte
EP14-PRED-PART-ONE-01-091820	L33776-42	PFHpA
EP14-PRED-PART-ONE-01-091820	L33776-42	N-EtFOSE
WL14-PRED-WHO-THREE-01-091620	L33776-44	N-EtFOSE
WL14-PRED-WHO-FOUR-01-091620	L33776-45	N-EtFOSE
WL15A-PRED-WHO-ONE-01-091620	L33776-46	N-EtFOSE

Sample ID	Lab ID	Analyte
WL15A-PRED-WHO-FOUR-01-091620	L33776-47	PFOA
WL15A-PRED-WHO-FOUR-01-091620	L33776-47	N-EtFOSE
WL15A-PRED-WHO-TWO-01-091620	L33776-48	EtFOSAA
WL15A-PRED-WHO-TWO-01-091620	L33776-48	N-EtFOSE
WL15A-PRED-WHO-THREE-01-091620	L33776-49	N-EtFOSE
EP21-FORE-FIL-ONE-01-091820	L33784-1	N-EtFOSE
EP21-FORE-FIL-TWO-01-091820	L33784-2	PFTeDA
EP21-FORE-FIL-TWO-01-091820	L33784-2	N-EtFOSE
EP21-FORE-FIL-THREE-01-091820	L33784-3	PFTrDA
EP21-FORE-FIL-THREE-01-091820	L33784-3	MeFOSAA
EP21-FORE-FIL-THREE-01-091820	L33784-3	N-EtFOSE
EP21-FORE-PART-THREE-01-091820	L33784-4	PFHpA
EP21-FORE-PART-THREE-01-091820	L33784-4	MeFOSAA
EP21-FORE-PART-THREE-01-091820	L33784-4	N-EtFOSE
EP21-FORE-PART-THREE-01-091820	L33784-4	NFDHA
EP21-FORE-FIL-FOUR-01-091820	L33784-5	PFOA
EP21-FORE-FIL-FOUR-01-091820	L33784-5	N-EtFOSE
EP21-FORE-FIL-FIVE-01-091820	L33784-6	N-EtFOSE
EP21-FORE-FIL-SIX-01-091820	L33784-7	N-EtFOSE
EP21-FORE-FIL-SEVEN-01-091820	L33784-8	N-EtFOSE
EP21-FORE-FIL-EIGHT-01-091820	L33784-9	N-EtFOSE
EP21-FORE-PART-SEVEN-01-091820	L33784-10	N-EtFOSE
EP21-FORE-FIL-NINE-01-091820	L33784-11	N-EtFOSE

Any R qualifiers take precedence over other qualifiers.

MINNESOTA

Minnesota Department of Agriculture 651-201-6148
Minnesota Department of Health 651-201-5357
Minnesota Pollution Control Agency 651-757-2560

Laboratory data review checklist

Doc Type: Data Review

Instructions: The following is the informal checklist that should be used to review data for the Minnesota Department of Agriculture, Minnesota Pollution Control Agency, and Minnesota Department of Health. The information follows the general format of the National Functional Guidelines, which is the primary data review tool used in the U.S. Environmental Protection Agency's Contract Laboratory Program for Superfund analytical work. Refer to the appropriate guidance document for each agency for instructions.

Project information

Project name: Project 1007

Work order number/Lab report ID: DPWG74689 Report date (mm/dd/yyyy): 12/16/2020

Laboratory: SGS AXYS Review date (mm/dd/yyyy): 1/18/2021

1. Chain of custody, preservation, and holding times

Questions			Yes	No	N/A	Comments
A.	Is there a chain of custody (COC) with the report?		☒	☐	☐	Additional samples (not reported in this SDG) were listed on the COCs.
B.	Is there a sample condition form with the report?		☒	☐	☐	
C.	Were there samples preserved according to program requirements?		☒	☐	☐	
D.	Were samples received in the correct containers?		☒	☐	☐	
	i.	Was there enough sample volume/weight to complete all requested analyses?	☒	☐	☐	
	ii.	Was there enough sample collected to complete required batch QC?	☒	☐	☐	
E.	Were samples received within holding time for sample prep for all requested analyses?		☒	☐	☐	
F.	Are there notes about sample condition or holding time issues on the COC? Explain the data impact.		☐	☒	☐	
G.	Are there narration or data qualifiers with the report about sample condition or holding time issues? Explain the data impact.		☐	☒	☐	
H.	Are lab IDs cross-referenced correctly with the field IDs.		☒	☐	☐	

2. Calibration

Question		Yes	No	N/A	Comments
A.	Do the report narrative or data qualifiers indicate calibration problems for any analyses? If yes, explain the data impact.	☒	☐	☐	MN limits used. ICAL, ICV and CCV reviewed. See data qualifications summary for exceedances. No qualifiers.

3. Blanks

Question			Yes	No	N/A	Comments
A.	Do any of the analyses contain samples for field or trip blanks?		☐	☒	☐	
	i.	If yes, are there target analytes present above the reporting limit in the blanks?	☐	☐	☒	
	ii.	If yes, are the same compounds also present in the samples? Explain possible data impact.	☐	☐	☒	
B.	Do method blanks for any analyses contain target analytes above the reporting limit?		☒	☐	☐	
	i.	If yes, are the same compounds present in the samples?	☒	☐	☐	
	ii.	Is the amount of target analyte in the method blank more than 1/10th of that in the sample(s)? Explain the possible impact on sample results.	☒	☐	☐	See data qualifications summary for blank detections and qualifications.
C.	Do instrument blanks contain analytes above the reporting limit?		☐	☐	☒	

4. Surrogates or organic analysis

Question			Yes	No	N/A	Comments
A.	Are the lab recovery limits for surrogates specified on the report?		☒	☐	☐	MPCA limits used: 50% to 200%
B.	Are the surrogates outside lab QC limits? (These should have a data qualifier.)		☒	☐	☐	
	i.	If yes, are the surrogates above the lab QC limits?	☒	☐	☐	
	ii.	Below the lab QC limits?	☒	☐	☐	
	iii.	Were the affected samples re-analyzed? Discuss in the case narrative.	☐	☒	☐	
	iv.	Explain what this could mean for the affected samples. Include in narrative.	☒	☐	☐	See data qualifications summary for exceedances and qualifications. Forty-five results were rejected (R) due to a severely low labeled analog recovery.

5. Laboratory control sample/Laboratory control sample duplicate (LCS/LCSD)

Question			Yes	No	N/A	Comments
A.	Are there LCS/LCSD samples present for the reporting analyses?		☒	☐	☐	
B.	Are there LCS/LCSD compounds outside lab limits? If the LCS/LCSD fails, the LCS/LCSD and samples must be re-analyzed.		☒	☐	☐	MPCA PFAS other limits used: 50% to 150%.
	i.	If yes, are there compounds above the lab QC limits? If yes, an explanation is required. Include in narrative.	☒	☐	☐	See data qualifications summary for exceedances and qualifications.
	ii.	Below the QC limits? If yes, an explanation is required. Include in narrative.	☐	☒	☐	

6. Matrix spike/Matrix spike duplicate/Sample duplicate (MS/MSD/DUP)

Question				Yes	No	N/A	Comments
A.	Do the analytical methods used require an MS and/or MSD? If no, skip to 6.B.			☒	☐	☐	
	i.	Have the required matrix spikes been prepared and reported?		☐	☒	☐	
	ii.	If no, is there and explanation in the report as to why?		☐	☒	☐	
	iii.	Did the lab process an alternate spiked sample (such as LCSD) instead?		☒	☐	☐	LCSD
	iv.	Are the lab QC limits specified on the report?		☒	☐	☐	
	v.	Are there compounds outside the lab QC limits?		☐	☐	☒	
	vi.	If yes, did the lab re-run an MS/MSD?		☐	☐	☒	
		1.	Did the re-run MS/MSD pass? Discuss the case narrative.	☐	☐	☒	
		2.	Did the re-run MS/MSD fail? Discuss the case narrative.	☐	☐	☒	
		3.	Is the source sample also flagged for MS/MSD compounds outside the lab QC limits?	☐	☐	☒	
B.	Was a duplicate sample submitted for the analytical method(s)?			☒	☐	☐	LCSD
	i.	Is the Relative Percentage Difference (RPD) within 20%* for the duplicate pair? If no, explain possible causes and data impact. **Other RPDs may be acceptable. Check with regulatory agency.*		☒	☐	☐	MPCA limit: 50% RPD for tissue (other) LCSD: RPDs within limits.

7. Method detection limits/Report limits

Question		Yes	No	N/A	Comments
A.	Are reporting limits clearly listed on the report for all analyses?	☒	☐	☐	
B.	Do the reporting limits meet the program required limits listed? If not, an explanation is required.	☒	☐	☐	Laboratory J flags indicating a concentration less than limit of quantification are to be retained during reporting.

8. Sample information

Questions		Yes	No	N/A	Comments
A.	Are sample numbers cross-referenced correctly with the associated QC?	☒	☐	☐	
B.	Are soil samples reported in dry weight basis?	☐	☐	☒	
C.	Are percent moisture results reported?	☐	☐	☒	
D.	Are positive detections reported?	☒	☐	☐	
E.	Are sample analytes appropriately flagged if the QC failed?	☒	☐	☐	

9. Report narrative

Question		Yes	No	N/A	Comments
A.	Is a narrative provided with the laboratory report which describes all problems with the analyses and all corrective actions taken to address these problems?	☒	☐	☐	

10. Additional comments about the lab report

Reviewed using MPCA Guidance on Perfluorochemicals Analysis (July 2020).

See attachment for qualifications.

Forty-five results were rejected (R) due to a severely low labeled analog recovery.

Certification

By typing my name below, I certify the above statements to be true and correct, to the best of my knowledge, and that this information can be used for the purpose of processing this form.

Authorized Representative

Name: Lisa Smith Title: Environmental Chemist (CEAC)

(This document has been electronically signed.) Date (mm/dd/yyyy): 1/18/2021

Data Validation Qualifications for DPWG74689

Calibration (Section 2): Calibration noncompliances are summarized below.

Calibration Date	Analyte	%R	%R Limit	Qualifiers
24-Nov-2020 11:18	NFDHA	164	70-130	Only PFOS reported from 11/24/20. No qualifiers.

Method blank detections (Section 3Bii): Detects within 10 times the method blank concentrations were qualified B.

Blank Sample ID	Analyte	Concentration (ng/g)	Results Qualified B
WG74153-101	PFUnA	0.161 J	BP1-FORE-FIL-ONE-01-092020 (L33784-12) BP1-FORE-PART-ONE-01-092020 (L33784-13) BP1-FORE-FIL-TWO-01-092020 (L33784-14) BP1-FORE-PART-TWO-01-092020 (L33784-15) RC21A-FORE-WHO-01-092120 (L33784-17) RC18A-FORE-WHO-01-092120 (L33784-18) WL7-FORE-WHO-01-091720 (L33784-19) EP18-FORE-FIL-ONE-01-091520 (L33784-21) EP15-FORE-WHO-THREE-01-091820 (L33784-23) EP27C-FORE-FIL-ONE-01-091520 (L33784-24) EP1A-FORE-FIL-01-091520 (L33784-27) EP1A-FORE-WHO-01-091520 (L33784-29) EP9A-FORE-FIL-ONE-01-091820 (L33784-30) EP9A-FORE-PART-ONE-01-091820 (L33784-31)
	PFTrDA	0.155 J	BP1-FORE-FIL-ONE-01-092020 (L33784-12) BP1-FORE-PART-ONE-01-092020 (L33784-13) BP1-FORE-PART-TWO-01-092020 (L33784-15) BP1-FORE-WHO-THREE-01-091920 (L33784-16) RC21A-FORE-WHO-01-092120 (L33784-17) RC18A-FORE-WHO-01-092120 (L33784-18) WL7-FORE-WHO-01-091720 (L33784-19) EP18-FORE-PART-ONE-01-091520 (L33784-20) EP18-FORE-FIL-ONE-01-091520 (L33784-21) EP18-FORE-WHO-TWO-01-091520 (L33784-22) EP15-FORE-WHO-THREE-01-091820 (L33784-23) EP27C-FORE-PART-ONE-01-091520 (L33784-25) EP27C-FORE-WHO-TWO-01-091520 (L33784-26) EP1A-FORE-FIL-01-091520 (L33784-27) EP1A-FORE-PART-01-091520 (L33784-28) EP9A-FORE-FIL-ONE-01-091820 (L33784-30) EP9A-FORE-PART-ONE-01-091820 (L33784-31)
	PFOS	0.121 J	Sample concentrations were greater than ten times the blank concentration. No qualifiers.
	PFOSA	0.115 J	BP1-FORE-WHO-THREE-01-091920 (L33784-16) RC21A-FORE-WHO-01-092120 (L33784-17) WL7-FORE-WHO-01-091720 (L33784-19) EP15-FORE-WHO-THREE-01-091820 (L33784-23) EP9A-FORE-PART-ONE-01-091820 (L33784-31)

Labeled Analogs - surrogates (Section 4Bii): Results associated with low recoveries were qualified as estimated (UJ and J+), and detects associated with high recoveries were qualified as estimated biased low (J-), as these labeled analogs are used to quantitate the analyte of interest and an inverse relationship exists. Forty-five results were rejected (R) due to severely low labeled analog recoveries.

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
BP1-FORE-FIL-ONE-01-092020	L33784-12	D3-N-MeFOSA	37.8	UJ
BP1-FORE-FIL-ONE-01-092020	L33784-12	d7-NMe-FOSE	22.3	UJ
BP1-FORE-FIL-ONE-01-092020	L33784-12	d9-NEt-FOSE	29.0	UJ
BP1-FORE-PART-ONE-01-092020	L33784-13	13C2-PFTeDA	42.4	J+
BP1-FORE-PART-ONE-01-092020	L33784-13	D3-N-MeFOSA	20.3	UJ
BP1-FORE-PART-ONE-01-092020	L33784-13	D5-N-EtFOSA	17.2	R
BP1-FORE-PART-ONE-01-092020	L33784-13	d7-NMe-FOSE	1.73	R
BP1-FORE-PART-ONE-01-092020	L33784-13	d9-NEt-FOSE	5.99	R
BP1-FORE-FIL-TWO-01-092020	L33784-14	D3-N-MeFOSA	36.9	UJ
BP1-FORE-FIL-TWO-01-092020	L33784-14	D5-N-EtFOSA	44.1	UJ
BP1-FORE-FIL-TWO-01-092020	L33784-14	d7-NMe-FOSE	47.7	UJ
BP1-FORE-FIL-TWO-01-092020	L33784-14	d9-NEt-FOSE	40.8	UJ
BP1-FORE-PART-TWO-01-092020	L33784-15	13C2-PFTeDA	42.6	J+
BP1-FORE-PART-TWO-01-092020	L33784-15	D3-N-MeFOSA	19.4	R
BP1-FORE-PART-TWO-01-092020	L33784-15	D5-N-EtFOSA	20.7	UJ
BP1-FORE-PART-TWO-01-092020	L33784-15	d7-NMe-FOSE	1.84	R
BP1-FORE-PART-TWO-01-092020	L33784-15	d9-NEt-FOSE	5.30	R
BP1-FORE-PART-TWO-01-092020	L33784-15	13C3-HFPO-DA	40.1	UJ
BP1-FORE-WHO-THREE-01-091920	L33784-16	D3-N-MeFOSA	24.4	UJ
BP1-FORE-WHO-THREE-01-091920	L33784-16	D5-N-EtFOSA	27.8	UJ
BP1-FORE-WHO-THREE-01-091920	L33784-16	d7-NMe-FOSE	7.58	R
BP1-FORE-WHO-THREE-01-091920	L33784-16	d9-NEt-FOSE	5.61	R
BP1-FORE-WHO-THREE-01-091920	L33784-16	13C3-HFPO-DA	30.0	UJ
RC21A-FORE-WHO-01-092120	L33784-17	13C2-PFTeDA	23.8	J+
RC21A-FORE-WHO-01-092120	L33784-17	D3-N-MeFOSA	21.5	UJ
RC21A-FORE-WHO-01-092120	L33784-17	D5-N-EtFOSA	20.8	UJ
RC21A-FORE-WHO-01-092120	L33784-17	d7-NMe-FOSE	2.66	R
RC21A-FORE-WHO-01-092120	L33784-17	d9-NEt-FOSE	6.00	R
RC18A-FORE-WHO-01-092120	L33784-18	13C4-PFBA	5.34	R
RC18A-FORE-WHO-01-092120	L33784-18	13C5-PFPeA	35.9	UJ
RC18A-FORE-WHO-01-092120	L33784-18	13C2-PFTeDA	13.7	R
RC18A-FORE-WHO-01-092120	L33784-18	D3-N-MeFOSA	25.2	UJ
RC18A-FORE-WHO-01-092120	L33784-18	D5-N-EtFOSA	12.4	R
RC18A-FORE-WHO-01-092120	L33784-18	13C3-HFPO-DA	19.4	R
WL7-FORE-WHO-01-091720	L33784-19	13C2-PFTeDA	25.9	UJ

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
WL7-FORE-WHO-01-091720	L33784-19	D3-N-MeFOSA	18.2	R
WL7-FORE-WHO-01-091720	L33784-19	D5-N-EtFOSA	16.0	R
WL7-FORE-WHO-01-091720	L33784-19	d7-NMe-FOSE	11.1	R
WL7-FORE-WHO-01-091720	L33784-19	d9-NEt-FOSE	4.79	R
EP18-FORE-PART-ONE-01-091520	L33784-20	13C2-PFTeDA	36.6	J+
EP18-FORE-PART-ONE-01-091520	L33784-20	D3-N-MeFOSA	25.7	UJ
EP18-FORE-PART-ONE-01-091520	L33784-20	D5-N-EtFOSA	24.9	UJ
EP18-FORE-PART-ONE-01-091520	L33784-20	D5-EtFOSAA	316	J-
EP18-FORE-PART-ONE-01-091520	L33784-20	d7-NMe-FOSE	3.59	R
EP18-FORE-PART-ONE-01-091520	L33784-20	d9-NEt-FOSE	10.7	R
EP18-FORE-FIL-ONE-01-091520	L33784-21	13C5-PFPeA	273	No Qualifier
EP18-FORE-FIL-ONE-01-091520	L33784-21	13C3-PFBS	48.9	UJ
EP18-FORE-FIL-ONE-01-091520	L33784-21	D5-N-EtFOSA	39.6	UJ
EP18-FORE-FIL-ONE-01-091520	L33784-21	D5-EtFOSAA	216	J-
EP18-FORE-FIL-ONE-01-091520	L33784-21	d7-NMe-FOSE	5.77	R
EP18-FORE-FIL-ONE-01-091520	L33784-21	d9-NEt-FOSE	22.8	UJ
EP18-FORE-WHO-TWO-01-091520	L33784-22	13C2-4:2 FTS	202	No Qualifier
EP18-FORE-WHO-TWO-01-091520	L33784-22	D3-N-MeFOSA	46.2	UJ
EP18-FORE-WHO-TWO-01-091520	L33784-22	D5-N-EtFOSA	34.3	UJ
EP18-FORE-WHO-TWO-01-091520	L33784-22	D5-EtFOSAA	246	J-
EP18-FORE-WHO-TWO-01-091520	L33784-22	d7-NMe-FOSE	6.01	R
EP18-FORE-WHO-TWO-01-091520	L33784-22	d9-NEt-FOSE	17.9	R
EP18-FORE-WHO-TWO-01-091520	L33784-22	13C3-HFPO-DA	27.9	UJ
EP15-FORE-WHO-THREE-01-091820	L33784-23	13C2-PFTeDA	27.7	J+
EP15-FORE-WHO-THREE-01-091820	L33784-23	D3-N-MeFOSA	17.0	R
EP15-FORE-WHO-THREE-01-091820	L33784-23	D5-N-EtFOSA	11.0	R
EP15-FORE-WHO-THREE-01-091820	L33784-23	D5-EtFOSAA	201	No Qualifier
EP15-FORE-WHO-THREE-01-091820	L33784-23	d9-NEt-FOSE	3.26	R
EP27C-FORE-FIL-ONE-01-091520	L33784-24	13C2-PFTeDA	42.0	UJ
EP27C-FORE-FIL-ONE-01-091520	L33784-24	D3-N-MeFOSA	29.5	UJ
EP27C-FORE-FIL-ONE-01-091520	L33784-24	D5-N-EtFOSA	32.3	UJ
EP27C-FORE-FIL-ONE-01-091520	L33784-24	d7-NMe-FOSE	23.4	UJ
EP27C-FORE-FIL-ONE-01-091520	L33784-24	d9-NEt-FOSE	18.7	R
EP27C-FORE-PART-ONE-01-091520	L33784-25	13C2-PFTeDA	23.0	UJ
EP27C-FORE-PART-ONE-01-091520	L33784-25	D3-N-MeFOSA	28.2	UJ

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
EP27C-FORE-PART-ONE-01-091520	L33784-25	D5-N-EtFOSA	22.0	UJ
EP27C-FORE-PART-ONE-01-091520	L33784-25	D5-EtFOSAA	301	J-
EP27C-FORE-PART-ONE-01-091520	L33784-25	d7-NMe-FOSE	2.09	R
EP27C-FORE-PART-ONE-01-091520	L33784-25	d9-NEt-FOSE	5.70	R
EP27C-FORE-WHO-TWO-01-091520	L33784-26	13C2-PFTeDA	36.2	J+
EP27C-FORE-WHO-TWO-01-091520	L33784-26	D3-N-MeFOSA	25.4	UJ
EP27C-FORE-WHO-TWO-01-091520	L33784-26	D5-N-EtFOSA	19.3	R
EP27C-FORE-WHO-TWO-01-091520	L33784-26	D5-EtFOSAA	219	J-
EP27C-FORE-WHO-TWO-01-091520	L33784-26	d7-NMe-FOSE	2.39	R
EP27C-FORE-WHO-TWO-01-091520	L33784-26	d9-NEt-FOSE	8.16	R
EP1A-FORE-FIL-01-091520	L33784-27	D3-N-MeFOSA	47.3	UJ
EP1A-FORE-FIL-01-091520	L33784-27	D5-N-EtFOSA	36.5	UJ
EP1A-FORE-FIL-01-091520	L33784-27	d7-NMe-FOSE	14.8	R
EP1A-FORE-FIL-01-091520	L33784-27	d9-NEt-FOSE	15.3	R
EP1A-FORE-PART-01-091520	L33784-28	D3-N-MeFOSA	24.5	UJ
EP1A-FORE-PART-01-091520	L33784-28	D5-N-EtFOSA	29.8	UJ
EP1A-FORE-PART-01-091520	L33784-28	D5-EtFOSAA	234	J-
EP1A-FORE-PART-01-091520	L33784-28	d7-NMe-FOSE	8.17	R
EP1A-FORE-PART-01-091520	L33784-28	d9-NEt-FOSE	10.5	R
EP1A-FORE-WHO-01-091520	L33784-29	13C2-PFTeDA	34.2	UJ
EP1A-FORE-WHO-01-091520	L33784-29	D3-N-MeFOSA	22.4	UJ
EP1A-FORE-WHO-01-091520	L33784-29	D5-N-EtFOSA	18.6	R
EP1A-FORE-WHO-01-091520	L33784-29	d7-NMe-FOSE	12.1	R
EP1A-FORE-WHO-01-091520	L33784-29	d9-NEt-FOSE	3.92	R
EP9A-FORE-FIL-ONE-01-091820	L33784-30	13C2-PFTeDA	25.8	J+
EP9A-FORE-FIL-ONE-01-091820	L33784-30	D3-N-MeFOSA	36.0	UJ
EP9A-FORE-FIL-ONE-01-091820	L33784-30	D5-N-EtFOSA	15.0	R
EP9A-FORE-FIL-ONE-01-091820	L33784-30	d7-NMe-FOSE	2.50	R
EP9A-FORE-FIL-ONE-01-091820	L33784-30	d9-NEt-FOSE	6.77	R
EP9A-FORE-PART-ONE-01-091820	L33784-31	13C2-PFTeDA	27.6	J+
EP9A-FORE-PART-ONE-01-091820	L33784-31	13C2-4:2 FTS	211	No Qualifier
EP9A-FORE-PART-ONE-01-091820	L33784-31	D3-N-MeFOSA	23.1	UJ
EP9A-FORE-PART-ONE-01-091820	L33784-31	D5-N-EtFOSA	12.3	R

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
EP9A-FORE-PART-ONE-01-091820	L33784-31	d7-NMe-FOSE	1.36	R
EP9A-FORE-PART-ONE-01-091820	L33784-31	d9-NEt-FOSE	4.47	R
EP9A-FORE-PART-ONE-01-091820	L33784-31	13C3-HFPO-DA	43.9	UJ

Laboratory control sample/Laboratory control sample duplicate (Section 5Bi): Detections associated with high recoveries were qualified as estimated biased high (J+).

LCS/LCSD IDs	Compound	LCS/LCSD %Recovery	Recovery Limits	Qualifiers
WG74153-102 (A)/ WG74153-103 (DUP WG74153-102)	11Cl-PF3OUdS	141/**162**	50-150	Associated results were nondetect. No qualifiers.
	5:3 FTCA	**172/168**	50-150	
	9Cl-PF3ONS	135/**155**	50-150	
	N-MeFOSE	**168/216**	50-150	
	ADONA	139/**158**	50-150	Associated detects were qualified as estimated biased high (J+): EP18-FORE-WHO-TWO-01-091520 (L33784-22)

Bold indicates an exceedance

10. Additional comments about lab report: For the results listed below, the peak was detected; however, it did not meet quantification criteria. These results were reported as maximum possible concentration and qualified as estimated (J):

Sample ID	Lab ID	Analyte
BP1-FORE-FIL-ONE-01-092020	L33784-12	PFOA
BP1-FORE-PART-ONE-01-092020	L33784-13	PFTeDA
BP1-FORE-PART-ONE-01-092020	L33784-13	N-EtFOSE
BP1-FORE-FIL-TWO-01-092020	L33784-14	PFDoA
BP1-FORE-PART-TWO-01-092020	L33784-15	N-EtFOSE
BP1-FORE-WHO-THREE-01-091920	L33784-16	N-EtFOSE
RC21A-FORE-WHO-01-092120	L33784-17	N-EtFOSE
WL7-FORE-WHO-01-091720	L33784-19	PFTrDA
WL7-FORE-WHO-01-091720	L33784-19	6:2 FTS
WL7-FORE-WHO-01-091720	L33784-19	N-EtFOSE
WL7-FORE-WHO-01-091720	L33784-19	NFDHA
EP18-FORE-PART-ONE-01-091520	L33784-20	PFTrDA
EP18-FORE-PART-ONE-01-091520	L33784-20	N-EtFOSE
EP15-FORE-WHO-THREE-01-091820	L33784-23	N-EtFOSE
EP27C-FORE-FIL-ONE-01-091520	L33784-24	PFDoA

Sample ID	Lab ID	Analyte
EP27C-FORE-FIL-ONE-01-091520	L33784-24	N-EtFOSE
EP27C-FORE-PART-ONE-01-091520	L33784-25	PFTrDA
EP27C-FORE-PART-ONE-01-091520	L33784-25	N-EtFOSE
EP27C-FORE-WHO-TWO-01-091520	L33784-26	N-EtFOSE
EP1A-FORE-PART-01-091520	L33784-28	N-EtFOSE
EP1A-FORE-WHO-01-091520	L33784-29	N-EtFOSE
EP9A-FORE-FIL-ONE-01-091820	L33784-30	N-EtFOSE
EP9A-FORE-PART-ONE-01-091820	L33784-31	N-EtFOSE

The laboratory was unable to report results for samples listed below as the labeled analog recoveries were less than 1% and the results are unquantifiable.

Sample ID	Analytes
RC18A-FORE-WHO-01-092120 (L33784-18)	N-MeFOSE N-EtFOSE
EP15-FORE-WHO-THREE-01-091820 (L33784-23)	N-MeFOSE

Any R qualifiers take precedence over other qualifiers.

MINNESOTA

Minnesota Department of Agriculture 651-201-6148
Minnesota Department of Health 651-201-5357
Minnesota Pollution Control Agency 651-757-2560

Laboratory data review checklist

Doc Type: Data Review

Instructions: The following is the informal checklist that should be used to review data for the Minnesota Department of Agriculture, Minnesota Pollution Control Agency, and Minnesota Department of Health. The information follows the general format of the National Functional Guidelines, which is the primary data review tool used in the U.S. Environmental Protection Agency's Contract Laboratory Program for Superfund analytical work. Refer to the appropriate guidance document for each agency for instructions.

Project information

Project name: Project 1007

Work order number/Lab report ID: DPWG74690 Report date (mm/dd/yyyy): 12/2/2020

Laboratory: SGS AXYS Review date (mm/dd/yyyy): 12/13/2020

1. Chain of custody, preservation, and holding times

Questions			Yes	No	N/A	Comments
A.	Is there a chain of custody (COC) with the report?		☒	☐	☐	Additional samples (not reported in this SDG) were listed on the COCs.
B.	Is there a sample condition form with the report?		☒	☐	☐	
C.	Were there samples preserved according to program requirements?		☒	☐	☐	
D.	Were samples received in the correct containers?		☒	☐	☐	
	i.	Was there enough sample volume/weight to complete all requested analyses?	☒	☐	☐	
	ii.	Was there enough sample collected to complete required batch QC?	☒	☐	☐	
E.	Were samples received within holding time for sample prep for all requested analyses?		☐	☒	☐	
F.	Are there notes about sample condition or holding time issues on the COC? Explain the data impact.		☒	☐	☐	Bottle labels did not match the COC for one sample for those reported in this SDG. The sample was logged in using the ID on the COC.
G.	Are there narration or data qualifiers with the report about sample condition or holding time issues? Explain the data impact.		☐	☒	☐	
H.	Are lab IDs cross-referenced correctly with the field IDs.		☒	☐	☐	

2. Calibration

Question		Yes	No	N/A	Comments
A.	Do the report narrative or data qualifiers indicate calibration problems for any analyses? If yes, explain the data impact.	☒	☐	☐	MN limits used. ICAL, ICV and CCV reviewed. See data qualifications summary for exceedances. No qualifiers.

3. Blanks

Question			Yes	No	N/A	Comments
A.	Do any of the analyses contain samples for field or trip blanks?		☐	☒	☐	
	i.	If yes, are there target analytes present above the reporting limit in the blanks?	☐	☐	☒	
	ii.	If yes, are the same compounds also present in the samples? Explain possible data impact.	☐	☐	☒	
B.	Do method blanks for any analyses contain target analytes above the reporting limit?		☒	☐	☐	
	i.	If yes, are the same compounds present in the samples?	☒	☐	☐	
	ii.	Is the amount of target analyte in the method blank more than 1/10th of that in the sample(s)? Explain the possible impact on sample results.	☒	☐	☐	See data qualifications summary for blank detections and qualifications.
C.	Do instrument blanks contain analytes above the reporting limit?		☐	☐	☒	

4. Surrogates or organic analysis

Question			Yes	No	N/A	Comments
A.	Are the lab recovery limits for surrogates specified on the report?		☒	☐	☐	MPCA limits used: 50% to 200%
B.	Are the surrogates outside lab QC limits? (These should have a data qualifier.)		☒	☐	☐	
	i.	If yes, are the surrogates above the lab QC limits?	☒	☐	☐	
	ii.	Below the lab QC limits?	☒	☐	☐	
	iii.	Were the affected samples re-analyzed? Discuss in the case narrative.	☐	☒	☐	
	iv.	Explain what this could mean for the affected samples. Include in narrative.	☒	☐	☐	See data qualifications summary for exceedances and qualifications. Forty results were rejected (R) due to severely low labeled analog recoveries.

5. Laboratory control sample/Laboratory control sample duplicate (LCS/LCSD)

Question			Yes	No	N/A	Comments
A.	Are there LCS/LCSD samples present for the reporting analyses?		☒	☐	☐	
B.	Are there LCS/LCSD compounds outside lab limits? If the LCS/LCSD fails, the LCS/LCSD and samples must be re-analyzed.		☒	☐	☐	MPCA PFAS tissue/other limits used: 50% to 150%.
	i.	If yes, are there compounds above the lab QC limits? If yes, an explanation is required. Include in narrative.	☒	☐	☐	N-MeFOSE 196%/181% 5:3 FTCA 157%/177% Associated results were nondetect and were acceptable without qualification.
	ii.	Below the QC limits? If yes, an explanation is required. Include in narrative.	☐	☒	☐	

6. Matrix spike/Matrix spike duplicate/Sample duplicate (MS/MSD/DUP)

Question				Yes	No	N/A	Comments
A.	Do the analytical methods used require an MS and/or MSD? If no, skip to 6.B.			☒	☐	☐	
	i.	Have the required matrix spikes been prepared and reported?		☐	☒	☐	
	ii.	If no, is there and explanation in the report as to why?		☐	☒	☐	
	iii.	Did the lab process an alternate spiked sample (such as LCSD) instead?		☒	☐	☐	LCSD
	iv.	Are the lab QC limits specified on the report?		☒	☐	☐	
	v.	Are there compounds outside the lab QC limits?		☐	☐	☒	
	vi.	If yes, did the lab re-run an MS/MSD?		☐	☐	☒	
		1.	Did the re-run MS/MSD pass? Discuss the case narrative.	☐	☐	☒	
		2.	Did the re-run MS/MSD fail? Discuss the case narrative.	☐	☐	☒	
		3.	Is the source sample also flagged for MS/MSD compounds outside the lab QC limits?	☐	☐	☒	
B.	Was a duplicate sample submitted for the analytical method(s)?			☒	☐	☐	LCSD
	i.	Is the Relative Percentage Difference (RPD) within 20%* for the duplicate pair? If no, explain possible causes and data impact. **Other RPDs may be acceptable. Check*		☒	☐	☐	50% limit for PFAS (other/tissue)

		with regulatory agency.				

7. Method detection limits/Report limits

Question		Yes	No	N/A	Comments
A.	Are reporting limits clearly listed on the report for all analyses?	☒	☐	☐	
B.	Do the reporting limits meet the program required limits listed? If not, an explanation is required.	☒	☐	☐	

8. Sample information

Questions		Yes	No	N/A	Comments
A.	Are sample numbers cross-referenced correctly with the associated QC?	☒	☐	☐	
B.	Are soil samples reported in dry weight basis?	☐	☐	☒	
C.	Are percent moisture results reported?	☐	☐	☒	
D.	Are positive detections reported?	☒	☐	☐	
E.	Are sample analytes appropriately flagged if the QC failed?	☒	☐	☐	

9. Report narrative

Question		Yes	No	N/A	Comments
A.	Is a narrative provided with the laboratory report which describes all problems with the analyses and all corrective actions taken to address these problems?	☒	☐	☐	

10. Additional comments about the lab report

Reviewed using MPCA Guidance on Perfluorochemicals Analysis (July 2020).

See attachment for qualification.

Forty results were rejected (R) due to severely low labeled analog recoveries.

Certification

By typing my name below, I certify the above statements to be true and correct, to the best of my knowledge, and that this information can be used for the purpose of processing this form.

Authorized Representative

Name: Lisa Smith Title: Environmental Chemist (CEAC)

(This document has been electronically signed.) Date (mm/dd/yyyy): 12/13/2020

Data Validation Qualifications for DPWG74690

Calibration (Section 2): Calibration noncompliances are summarized below.

Calibration	Analyte	%R	%R Limits	Qualifiers
CCV 11/25/20 4:40	3:3 FTCA	0%	70-130%	Only PFOS dilutions reported from this CCV. No qualifiers.
CCV 11/25/20 8:34	3:3 FTCA	0.3%	70-130%	Only PFOS dilutions reported from this CCV. No qualifiers.
	PFMPA	0%	70-130%	
	NFDHA	149%	70-130%	

Method blank detections (Section 3Bii): Detects within 10 times the method blank concentrations were qualified B.

Blank Sample ID	Analyte	Concentration (ng/g)	Results Qualified B
WG74154-101	PFUnA	0.139 J	WL2-FORE-WHO-ONE-01-091720 (L33784-33) WL2-FORE-WHO-TWO-01-091720 (L33784-34) WL6-FORE-WHO-01-091720 (L33784-35) WL5-FORE-WHO-TWO-01-091720 (L33784-36) WL3-FORE-WHO-ONE-01-091720 (L33784-37) WL5-FORE-WHO-ONE-01-091720 (L33784-38) EP14-FORE-FIL-ONE-01-091820 (L33784-39) EP14-FORE-PART-ONE-01-091820 (L33784-40) EP14-FORE-FIL-TWO-01-091820 (L33784-41) WL8A-FORE-WHO-ONE-01-091620 (L33784-44) WL8A-FORE-WHO-TWO-01-091620 (L33784-45) WL21-FORE-WHO-ONE-01-091620 (L33784-46) WL14-FORE-WHO-ONE-01-091620 (L33784-48) WL14-FORE-WHO-TWO-01-091620 (L33784-49) WL15A-FORE-WHO-TWO-01-091620 (L33784-51)
	PFTrDA	0.170 J	All samples: EP9A-FORE-WHO-TWO-01-091820 (L33784-32) WL2-FORE-WHO-ONE-01-091720 (L33784-33) WL2-FORE-WHO-TWO-01-091720 (L33784-34) WL6-FORE-WHO-01-091720 (L33784-35) WL5-FORE-WHO-TWO-01-091720 (L33784-36) WL3-FORE-WHO-ONE-01-091720 (L33784-37) WL5-FORE-WHO-ONE-01-091720 (L33784-38) EP14-FORE-FIL-ONE-01-091820 (L33784-39) EP14-FORE-PART-ONE-01-091820 (L33784-40) EP14-FORE-FIL-TWO-01-091820 (L33784-41) EP14-FORE-PART-TWO-01-091820 (L33784-42) WL3-FORE-WHO-01-091720 (L33784-43) WL8A-FORE-WHO-ONE-01-091620 (L33784-44) WL8A-FORE-WHO-TWO-01-091620 (L33784-45) WL21-FORE-WHO-ONE-01-091620 (L33784-46) WL21-FORE-WHO-TWO-01-091620 (L33784-47) WL14-FORE-WHO-ONE-01-091620 (L33784-48) WL14-FORE-WHO-TWO-01-091620 (L33784-49)

Blank Sample ID	Analyte	Concentration (ng/g)	Results Qualified B
			WL15A-FORE-WHO-ONE-01-091620 (L33784-50) WL15A-FORE-WHO-TWO-01-091620 (L33784-51)
	PFOS	0.193 J	Sample concentrations were greater than 10 times the blank concentration. No qualifiers.

Labeled Analogs - surrogates (Section 4Bii): Results associated with low recoveries were qualified as estimated (UJ and J+), and detects associated with high recoveries were qualified as estimated biased low (J-), as these labeled analogs are used to quantitate the analyte of interest and an inverse relationship exists. Forty results were rejected (R) due to severely low labeled analog recoveries.

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
EP9A-FORE-WHO-TWO-01-091820	L33784-32	13C5-PFPeA	263	No Qualifier
EP9A-FORE-WHO-TWO-01-091820	L33784-32	D5-EtFOSAA	214	No Qualifier
EP9A-FORE-WHO-TWO-01-091820	L33784-32	d7-NMe-FOSE	8.28	R
EP9A-FORE-WHO-TWO-01-091820	L33784-32	d9-NEt-FOSE	32.4	UJ
WL2-FORE-WHO-ONE-01-091720	L33784-33	13C2-PFTeDA	31.8	J+
WL2-FORE-WHO-ONE-01-091720	L33784-33	D3-N-MeFOSA	32.0	UJ
WL2-FORE-WHO-ONE-01-091720	L33784-33	D5-N-EtFOSA	20.8	UJ
WL2-FORE-WHO-ONE-01-091720	L33784-33	D5-EtFOSAA	201	J-
WL2-FORE-WHO-ONE-01-091720	L33784-33	d7-NMe-FOSE	6.77	R
WL2-FORE-WHO-ONE-01-091720	L33784-33	d9-NEt-FOSE	5.87	R
WL2-FORE-WHO-TWO-01-091720	L33784-34	D3-N-MeFOSA	39.5	UJ
WL2-FORE-WHO-TWO-01-091720	L33784-34	D5-N-EtFOSA	35.1	UJ
WL2-FORE-WHO-TWO-01-091720	L33784-34	D5-EtFOSAA	46.3	J+
WL2-FORE-WHO-TWO-01-091720	L33784-34	d7-NMe-FOSE	4.73	R
WL2-FORE-WHO-TWO-01-091720	L33784-34	d9-NEt-FOSE	18.5	R
WL6-FORE-WHO-01-091720	L33784-35	13C2-PFTeDA	37.9	J+
WL6-FORE-WHO-01-091720	L33784-35	D3-N-MeFOSA	32.9	UJ
WL6-FORE-WHO-01-091720	L33784-35	D5-N-EtFOSA	27.5	UJ
WL6-FORE-WHO-01-091720	L33784-35	d7-NMe-FOSE	23.6	UJ
WL6-FORE-WHO-01-091720	L33784-35	d9-NEt-FOSE	6.73	R
WL5-FORE-WHO-TWO-01-091720	L33784-36	13C2-4:2 FTS	212	No Qualifier
WL5-FORE-WHO-TWO-01-091720	L33784-36	D3-N-MeFOSA	25.9	UJ
WL5-FORE-WHO-TWO-01-091720	L33784-36	D5-N-EtFOSA	19.0	R
WL5-FORE-WHO-TWO-01-091720	L33784-36	D5-EtFOSAA	238	J-
WL5-FORE-WHO-TWO-01-091720	L33784-36	d7-NMe-FOSE	13.4	R
WL5-FORE-WHO-TWO-01-091720	L33784-36	d9-NEt-FOSE	4.66	R
WL3-FORE-WHO-ONE-01-091720	L33784-37	D3-N-MeFOSA	38.7	UJ
WL3-FORE-WHO-ONE-01-091720	L33784-37	D5-N-EtFOSA	23.3	UJ
WL3-FORE-WHO-ONE-01-091720	L33784-37	D5-EtFOSAA	250	J-

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
WL3-FORE-WHO-ONE-01-091720	L33784-37	d7-NMe-FOSE	9.41	R
WL3-FORE-WHO-ONE-01-091720	L33784-37	d9-NEt-FOSE	5.20	R
WL5-FORE-WHO-ONE-01-091720	L33784-38	13C2-PFTeDA	32.4	J+
WL5-FORE-WHO-ONE-01-091720	L33784-38	D3-N-MeFOSA	26.3	UJ
WL5-FORE-WHO-ONE-01-091720	L33784-38	D5-N-EtFOSA	17.0	R
WL5-FORE-WHO-ONE-01-091720	L33784-38	D5-EtFOSAA	219	J-
WL5-FORE-WHO-ONE-01-091720	L33784-38	d7-NMe-FOSE	9.78	R
WL5-FORE-WHO-ONE-01-091720	L33784-38	d9-NEt-FOSE	6.40	R
EP14-FORE-FIL-ONE-01-091820	L33784-39	D5-N-EtFOSA	41.4	UJ
EP14-FORE-FIL-ONE-01-091820	L33784-39	d7-NMe-FOSE	12.0	R
EP14-FORE-FIL-ONE-01-091820	L33784-39	d9-NEt-FOSE	25.1	UJ
EP14-FORE-PART-ONE-01-091820	L33784-40	13C2-PFTeDA	32.3	J+
EP14-FORE-PART-ONE-01-091820	L33784-40	D3-N-MeFOSA	23.5	UJ
EP14-FORE-PART-ONE-01-091820	L33784-40	D5-N-EtFOSA	14.8	R
EP14-FORE-PART-ONE-01-091820	L33784-40	d7-NMe-FOSE	6.88	R
EP14-FORE-PART-ONE-01-091820	L33784-40	d9-NEt-FOSE	4.90	R
EP14-FORE-FIL-TWO-01-091820	L33784-41	D5-N-EtFOSA	39.6	UJ
EP14-FORE-FIL-TWO-01-091820	L33784-41	d7-NMe-FOSE	15.7	R
EP14-FORE-FIL-TWO-01-091820	L33784-41	d9-NEt-FOSE	24.6	UJ
EP14-FORE-PART-TWO-01-091820	L33784-42	13C2-4:2 FTS	209	No Qualifier
EP14-FORE-PART-TWO-01-091820	L33784-42	D3-N-MeFOSA	49.0	UJ
EP14-FORE-PART-TWO-01-091820	L33784-42	D5-N-EtFOSA	22.1	UJ
EP14-FORE-PART-TWO-01-091820	L33784-42	D5-EtFOSAA	208	J-
EP14-FORE-PART-TWO-01-091820	L33784-42	d7-NMe-FOSE	4.38	R
EP14-FORE-PART-TWO-01-091820	L33784-42	d9-NEt-FOSE	14.6	R
EP14-FORE-PART-TWO-01-091820	L33784-42	13C3-HFPO-DA	34.5	UJ
WL3-FORE-WHO-01-091720	L33784-43	13C2-PFTeDA	42.6	J+
WL3-FORE-WHO-01-091720	L33784-43	D3-N-MeFOSA	34.2	UJ
WL3-FORE-WHO-01-091720	L33784-43	D5-N-EtFOSA	19.1	R
WL3-FORE-WHO-01-091720	L33784-43	D5-EtFOSAA	202	J-
WL3-FORE-WHO-01-091720	L33784-43	d7-NMe-FOSE	5.40	R
WL3-FORE-WHO-01-091720	L33784-43	d9-NEt-FOSE	8.07	R
WL8A-FORE-WHO-ONE-01-091620	L33784-44	13C2-PFTeDA	25.7	J+
WL8A-FORE-WHO-ONE-01-091620	L33784-44	D3-N-MeFOSA	25.8	UJ
WL8A-FORE-WHO-ONE-01-091620	L33784-44	D5-N-EtFOSA	22.4	UJ
WL8A-FORE-WHO-ONE-01-091620	L33784-44	d7-NMe-FOSE	9.63	R
WL8A-FORE-WHO-ONE-01-091620	L33784-44	d9-NEt-FOSE	4.98	R
WL8A-FORE-WHO-TWO-01-091620	L33784-45	D3-N-MeFOSA	43.1	UJ

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
WL8A-FORE-WHO-TWO-01-091620	L33784-45	D5-N-EtFOSA	30.6	UJ
WL8A-FORE-WHO-TWO-01-091620	L33784-45	d7-NMe-FOSE	8.54	R
WL8A-FORE-WHO-TWO-01-091620	L33784-45	d9-NEt-FOSE	10.9	R
WL21-FORE-WHO-ONE-01-091620	L33784-46	13C2-4:2 FTS	255	No Qualifier
WL21-FORE-WHO-ONE-01-091620	L33784-46	D3-N-MeFOSA	36.8	UJ
WL21-FORE-WHO-ONE-01-091620	L33784-46	D5-N-EtFOSA	22.2	UJ
WL21-FORE-WHO-ONE-01-091620	L33784-46	d7-NMe-FOSE	3.23	R
WL21-FORE-WHO-ONE-01-091620	L33784-46	d9-NEt-FOSE	9.30	R
WL21-FORE-WHO-TWO-01-091620	L33784-47	13C2-PFTeDA	29.1	J+
WL21-FORE-WHO-TWO-01-091620	L33784-47	D3-N-MeFOSA	36.1	UJ
WL21-FORE-WHO-TWO-01-091620	L33784-47	D5-N-EtFOSA	16.4	R
WL21-FORE-WHO-TWO-01-091620	L33784-47	D5-EtFOSAA	216	J-
WL21-FORE-WHO-TWO-01-091620	L33784-47	d7-NMe-FOSE	2.65	R
WL21-FORE-WHO-TWO-01-091620	L33784-47	d9-NEt-FOSE	10.4	R
WL14-FORE-WHO-ONE-01-091620	L33784-48	D3-N-MeFOSA	40.0	UJ
WL14-FORE-WHO-ONE-01-091620	L33784-48	D5-N-EtFOSA	29.1	UJ
WL14-FORE-WHO-ONE-01-091620	L33784-48	d7-NMe-FOSE	3.65	R
WL14-FORE-WHO-ONE-01-091620	L33784-48	d9-NEt-FOSE	12.4	R
WL14-FORE-WHO-TWO-01-091620	L33784-49	D3-N-MeFOSA	40.3	UJ
WL14-FORE-WHO-TWO-01-091620	L33784-49	D5-N-EtFOSA	23.8	UJ
WL14-FORE-WHO-TWO-01-091620	L33784-49	D5-EtFOSAA	212	J-
WL14-FORE-WHO-TWO-01-091620	L33784-49	d7-NMe-FOSE	3.12	R
WL14-FORE-WHO-TWO-01-091620	L33784-49	d9-NEt-FOSE	14.9	R
WL15A-FORE-WHO-ONE-01-091620	L33784-50	13C2-PFTeDA	21.8	J+
WL15A-FORE-WHO-ONE-01-091620	L33784-50	D3-N-MeFOSA	32.8	UJ
WL15A-FORE-WHO-ONE-01-091620	L33784-50	D5-N-EtFOSA	20.1	UJ
WL15A-FORE-WHO-ONE-01-091620	L33784-50	D5-EtFOSAA	206	J-
WL15A-FORE-WHO-ONE-01-091620	L33784-50	d7-NMe-FOSE	11.8	R
WL15A-FORE-WHO-ONE-01-091620	L33784-50	d9-NEt-FOSE	6.32	R
WL15A-FORE-WHO-TWO-01-091620	L33784-51	13C2-PFTeDA	31.4	J+
WL15A-FORE-WHO-TWO-01-091620	L33784-51	D3-N-MeFOSA	24.7	UJ
WL15A-FORE-WHO-TWO-01-091620	L33784-51	D5-N-EtFOSA	16.0	UJ
WL15A-FORE-WHO-TWO-01-091620	L33784-51	d7-NMe-FOSE	9.19	R

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
WL15A-FORE-WHO-TWO-01-091620	L33784-51	d9-NEt-FOSE	5.47	R

10. Additional comments about lab report: For the results listed below, the peak was detected; however, it did not meet quantification criteria. These results were reported as maximum possible concentration and qualified as estimated (J):

Sample ID	Lab ID	Analyte
WL2-FORE-WHO-ONE-01-091720	L33784-33	PFTeDA
WL2-FORE-WHO-ONE-01-091720	L33784-33	N-EtFOSE
WL6-FORE-WHO-01-091720	L33784-35	N-EtFOSE
WL5-FORE-WHO-TWO-01-091720	L33784-36	PFHxS
WL5-FORE-WHO-TWO-01-091720	L33784-36	N-EtFOSE
WL3-FORE-WHO-ONE-01-091720	L33784-37	N-EtFOSE
WL5-FORE-WHO-ONE-01-091720	L33784-38	N-EtFOSE
WL3-FORE-WHO-01-091720	L33784-43	PFHxS
WL3-FORE-WHO-01-091720	L33784-43	N-EtFOSE
WL8A-FORE-WHO-ONE-01-091620	L33784-44	PFTrDA
WL8A-FORE-WHO-ONE-01-091620	L33784-44	N-EtFOSE
WL21-FORE-WHO-ONE-01-091620	L33784-46	PFDoA
WL21-FORE-WHO-ONE-01-091620	L33784-46	PFTeDA
WL21-FORE-WHO-ONE-01-091620	L33784-46	N-EtFOSE
WL21-FORE-WHO-TWO-01-091620	L33784-47	PFTeDA
WL21-FORE-WHO-TWO-01-091620	L33784-47	N-EtFOSE
WL14-FORE-WHO-TWO-01-091620	L33784-49	PFTeDA
WL15A-FORE-WHO-ONE-01-091620	L33784-50	PFDoA
WL15A-FORE-WHO-ONE-01-091620	L33784-50	PFTeDA
WL15A-FORE-WHO-ONE-01-091620	L33784-50	N-EtFOSE
WL15A-FORE-WHO-TWO-01-091620	L33784-51	PFTeDA
WL15A-FORE-WHO-TWO-01-091620	L33784-51	N-EtFOSE

Any R qualifiers take precedence over other qualifiers.

MINNESOTA

Minnesota Department of Agriculture 651-201-6148
Minnesota Department of Health 651-201-5357
Minnesota Pollution Control Agency 651-757-2560

Laboratory data review checklist

Doc Type: Data Review

Instructions: The following is the informal checklist that should be used to review data for the Minnesota Department of Agriculture, Minnesota Pollution Control Agency, and Minnesota Department of Health. The information follows the general format of the National Functional Guidelines, which is the primary data review tool used in the U.S. Environmental Protection Agency's Contract Laboratory Program for Superfund analytical work. Refer to the appropriate guidance document for each agency for instructions.

Project information

Project name: Project 1007

Work order number/Lab report ID: DPWG74712 Report date (mm/dd/yyyy): 12/7/2020

Laboratory: SGS AXYS Review date (mm/dd/yyyy): 12/13/2020

1. Chain of custody, preservation, and holding times

	Questions	Yes	No	N/A	Comments
A.	Is there a chain of custody (COC) with the report?	☒	☐	☐	Additional samples (not reported in this SDG) were listed on the COCs. A trip blank was received, but was not listed on the COC.
B.	Is there a sample condition form with the report?	☒	☐	☐	
C.	Were there samples preserved according to program requirements?	☒	☐	☐	
D.	Were samples received in the correct containers?	☒	☐	☐	
	i. Was there enough sample volume/weight to complete all requested analyses?	☒	☐	☐	
	ii. Was there enough sample collected to complete required batch QC?	☒	☐	☐	
E.	Were samples received within holding time for sample prep for all requested analyses?	☒	☐	☐	
F.	Are there notes about sample condition or holding time issues on the COC? Explain the data impact.	☐	☒	☐	
G.	Are there narration or data qualifiers with the report about sample condition or holding time issues? Explain the data impact.	☐	☒	☐	
H.	Are lab IDs cross-referenced correctly with the field IDs.	☒	☐	☐	

2. Calibration

Question			Yes	No	N/A	Comments
A.	Do the report narrative or data qualifiers indicate calibration problems for any analyses? If yes, explain the data impact.		☐	☒	☐	MN limits used. ICAL, ICV and CCV reviewed.

3. Blanks

Question			Yes	No	N/A	Comments
A.	Do any of the analyses contain samples for field or trip blanks?		☒	☐	☐	Trip Blank: 812443399253
	i.	If yes, are there target analytes present above the reporting limit in the blanks?	☐	☒	☐	
	ii.	If yes, are the same compounds also present in the samples? Explain possible data impact.	☐	☐	☒	
B.	Do method blanks for any analyses contain target analytes above the reporting limit?		☐	☒	☐	
	i.	If yes, are the same compounds present in the samples?	☐	☐	☒	
	ii.	Is the amount of target analyte in the method blank more than 1/10th of that in the sample(s)? Explain the possible impact on sample results.	☐	☐	☒	
C.	Do instrument blanks contain analytes above the reporting limit?		☐	☐	☒	

4. Surrogates or organic analysis

Question			Yes	No	N/A	Comments
A.	Are the lab recovery limits for surrogates specified on the report?		☒	☐	☐	MPCA limits used: 50% to 200%
B.	Are the surrogates outside lab QC limits? (These should have a data qualifier.)		☒	☐	☐	
	i.	If yes, are the surrogates above the lab QC limits?	☐	☒	☐	
	ii.	Below the lab QC limits?	☒	☐	☐	
	iii.	Were the affected samples re-analyzed? Discuss in the case narrative.	☐	☒	☐	
	iv.	Explain what this could mean for the affected samples. Include in narrative.	☒	☐	☐	See data qualifications summary for exceedances and qualifications. One result was rejected (R) due to a severely low labeled analog recovery.

5. Laboratory control sample/Laboratory control sample duplicate (LCS/LCSD)

Question			Yes	No	N/A	Comments
A.	Are there LCS/LCSD samples present for the reporting analyses?		☒	☐	☐	
B.	Are there LCS/LCSD compounds outside lab limits? If the LCS/LCSD fails, the LCS/LCSD and samples must be re-analyzed.		☐	☒	☐	MPCA PFAS water limits used: 70% to 130%.
	i.	If yes, are there compounds above the lab QC limits? If yes, an explanation is required. Include in narrative.	☐	☐	☒	
	ii.	Below the QC limits? If yes, an explanation is required. Include in narrative.	☐	☐	☒	

6. Matrix spike/Matrix spike duplicate/Sample duplicate (MS/MSD/DUP)

Question				Yes	No	N/A	Comments
A.	Do the analytical methods used require an MS and/or MSD? If no, skip to 6.B.			☒	☐	☐	
	i.	Have the required matrix spikes been prepared and reported?		☐	☒	☐	
	ii.	If no, is there and explanation in the report as to why?		☐	☒	☐	
	iii.	Did the lab process an alternate spiked sample (such as LCSD) instead?		☐	☒	☐	
	iv.	Are the lab QC limits specified on the report?		☒	☐	☐	
	v.	Are there compounds outside the lab QC limits?		☐	☐	☒	
	vi.	If yes, did the lab re-run an MS/MSD?		☐	☐	☒	
		1.	Did the re-run MS/MSD pass? Discuss the case narrative.	☐	☐	☒	
		2.	Did the re-run MS/MSD fail? Discuss the case narrative.	☐	☐	☒	
		3.	Is the source sample also flagged for MS/MSD compounds outside the lab QC limits?	☐	☐	☒	
B.	Was a duplicate sample submitted for the analytical method(s)?			☐	☒	☐	
	i.	Is the Relative Percentage Difference (RPD) within 20%* for the duplicate pair? If no, explain possible causes and data impact. **Other RPDs may be acceptable. Check with regulatory agency.*		☐	☐	☒	

7. Method detection limits/Report limits

Question		Yes	No	N/A	Comments
A.	Are reporting limits clearly listed on the report for all analyses?	☒	☐	☐	
B.	Do the reporting limits meet the program required limits listed? If not, an explanation is required.	☐	☒	☐	Reduced sample volumes used due to high sample concentrations.

8. Sample information

Questions		Yes	No	N/A	Comments
A.	Are sample numbers cross-referenced correctly with the associated QC?	☒	☐	☐	
B.	Are soil samples reported in dry weight basis?	☐	☐	☒	
C.	Are percent moisture results reported?	☐	☐	☒	
D.	Are positive detections reported?	☒	☐	☐	
E.	Are sample analytes appropriately flagged if the QC failed?	☒	☐	☐	

9. Report narrative

Question		Yes	No	N/A	Comments
A.	Is a narrative provided with the laboratory report which describes all problems with the analyses and all corrective actions taken to address these problems?	☒	☐	☐	

10. Additional comments about the lab report

Reviewed using MPCA Guidance on Perfluorochemicals Analysis (July 2020).

See attachment for qualification.

One result was rejected (R) due to a severely low labeled analog recovery.

Certification

By typing my name below, I certify the above statements to be true and correct, to the best of my knowledge, and that this information can be used for the purpose of processing this form.

Authorized Representative

Name: Lisa Smith Title: Environmental Chemist (CEAC)

(This document has been electronically signed.) Date (mm/dd/yyyy): 12/13/2020

Data Validation Qualifications for DPWG74712

Labeled Analogs - surrogates (Section 4Bii): Results associated with low recoveries were qualified as estimated (UJ and J+), as these labeled analogs are used to quantitate the analyte of interest and an inverse relationship exists. One result was rejected (R) due to a severely low labeled analog recovery.

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
VB3-FOAM-01-091620	L33798-4	13C5-PFPeA	45.6	J+
VB3-FOAM-01-091620	L33798-4	13C5-PFHxA	48	J+
VB3-FOAM-01-091620	L33798-4	13C4-PFHpA	49	J+
VB3-FOAM-01-091620	L33798-4	13C8-PFOA	44.7	J+
VB3-FOAM-01-091620	L33798-4	13C9-PFNA	45.8	J+
VB3-FOAM-01-091620	L33798-4	13C6-PFDA	40.5	J+
VB3-FOAM-01-091620	L33798-4	13C7-PFUnA	39	J+
VB3-FOAM-01-091620	L33798-4	13C2-PFDoA	30	J+
VB3-FOAM-01-091620	L33798-4	13C2-PFTeDA	17.4	R
VB3-FOAM-01-091620	L33798-4	13C3-PFBS	44.9	UJ
VB3-FOAM-01-091620	L33798-4	13C3-PFHxS	44.9	J+
VB3-FOAM-01-091620	L33798-4	13C8-PFOS	38	J+
VB3-FOAM-01-091620	L33798-4	13C2-6:2 FTS	31.7	UJ
VB3-FOAM-01-091620	L33798-4	13C2-8:2 FTS	30.6	UJ
VB3-FOAM-01-091620	L33798-4	13C8-PFOSA	43.2	J+
VB3-FOAM-01-091620	L33798-4	D3-N-MeFOSA	36.9	UJ
VB3-FOAM-01-091620	L33798-4	D5-N-EtFOSA	32.6	UJ
VB3-FOAM-01-091620	L33798-4	D3-MeFOSAA	27.9	J+
VB3-FOAM-01-091620	L33798-4	D5-EtFOSAA	41.3	J+
VB3-FOAM-01-091620	L33798-4	d7-NMe-FOSE	35.6	UJ
VB3-FOAM-01-091620	L33798-4	d9-NEt-FOSE	33.6	UJ
VB3-FOAM-01-091620	L33798-4	13C3-HFPO-DA	40.5	UJ

10. Additional comments about lab report: For the results listed below, the peak was detected; however, it did not meet quantification criteria. These results were reported as maximum possible concentration and qualified as estimated (J):

Sample ID	Lab ID	Analyte
VB3-FOAM-01-091620	L33798-4	EtFOSAA

MINNESOTA

Minnesota Department of Agriculture 651-201-6148
Minnesota Department of Health 651-201-5357
Minnesota Pollution Control Agency 651-757-2560

Laboratory data review checklist

Doc Type: Data Review

Instructions: The following is the informal checklist that should be used to review data for the Minnesota Department of Agriculture, Minnesota Pollution Control Agency, and Minnesota Department of Health. The information follows the general format of the National Functional Guidelines, which is the primary data review tool used in the U.S. Environmental Protection Agency's Contract Laboratory Program for Superfund analytical work. Refer to the appropriate guidance document for each agency for instructions.

Project information

Project name: Project 1007

Work order number/Lab report ID: DPWG74760 Report date (mm/dd/yyyy): 12/22/2020

Laboratory: SGS AXYS Review date (mm/dd/yyyy): 1/10/2021

1. Chain of custody, preservation, and holding times

Questions			Yes	No	N/A	Comments
A.	Is there a chain of custody (COC) with the report?		☒	☐	☐	Additional samples (not reported in this SDG) were listed on the COCs. A trip blank was received, but was not listed on the COC.
B.	Is there a sample condition form with the report?		☒	☐	☐	
C.	Were there samples preserved according to program requirements?		☒	☐	☐	
D.	Were samples received in the correct containers?		☒	☐	☐	
	i.	Was there enough sample volume/weight to complete all requested analyses?	☒	☐	☐	
	ii.	Was there enough sample collected to complete required batch QC?	☒	☐	☐	
E.	Were samples received within holding time for sample prep for all requested analyses?		☒	☐	☐	
F.	Are there notes about sample condition or holding time issues on the COC? Explain the data impact.		☐	☒	☐	
G.	Are there narration or data qualifiers with the report about sample condition or holding time issues? Explain the data impact.		☒	☐	☐	Case narrative indicates samples were received at greater than 4 °C. Sample receipt was acceptable since they were received within the MPCA requirement of <6 °C.
H.	Are lab IDs cross-referenced correctly with the field IDs.		☒	☐	☐	

2. Calibration

Question			Yes	No	N/A	Comments
A.	Do the report narrative or data qualifiers indicate calibration problems for any analyses? If yes, explain the data impact.		☐	☒	☐	MN limits used. ICAL, ICV and CCV reviewed.

3. Blanks

Question			Yes	No	N/A	Comments
A.	Do any of the analyses contain samples for field or trip blanks?		☒	☐	☐	Trip Blank: 812443399253 (L33798-1) reported in SDG DPWG74712
	i.	If yes, are there target analytes present above the reporting limit in the blanks?	☐	☒	☐	No detects
	ii.	If yes, are the same compounds also present in the samples? Explain possible data impact.	☐	☐	☒	
B.	Do method blanks for any analyses contain target analytes above the reporting limit?		☒	☐	☐	
	i.	If yes, are the same compounds present in the samples?	☒	☐	☐	
	ii.	Is the amount of target analyte in the method blank more than 1/10th of that in the sample(s)? Explain the possible impact on sample results.	☒	☐	☐	See data qualifications summary for blank detections and qualifications.
C.	Do instrument blanks contain analytes above the reporting limit?		☐	☐	☒	

4. Surrogates or organic analysis

Question			Yes	No	N/A	Comments
A.	Are the lab recovery limits for surrogates specified on the report?		☒	☐	☐	MPCA limits used: 50% to 200%
B.	Are the surrogates outside lab QC limits? (These should have a data qualifier.)		☒	☐	☐	
	i.	If yes, are the surrogates above the lab QC limits?	☒	☐	☐	
	ii.	Below the lab QC limits?	☒	☐	☐	
	iii.	Were the affected samples re-analyzed? Discuss in the case narrative.	☐	☒	☐	
	iv.	Explain what this could mean for the affected samples. Include in narrative.	☒	☐	☐	See data qualifications summary for exceedances and qualifications. Thrity-one results were rejected (R) due to a severely low labeled analog recovery.

5. Laboratory control sample/Laboratory control sample duplicate (LCS/LCSD)

Question			Yes	No	N/A	Comments
A.	Are there LCS/LCSD samples present for the reporting analyses?		☒	☐	☐	
B.	Are there LCS/LCSD compounds outside lab limits? If the LCS/LCSD fails, the LCS/LCSD and samples must be re-analyzed.		☒	☐	☐	MPCA PFAS other limits used: 50% to 150%.
	i.	If yes, are there compounds above the lab QC limits? If yes, an explanation is required. Include in narrative.	☒	☐	☐	See data qualifications summary for exceedances. No qualifiers.
	ii.	Below the QC limits? If yes, an explanation is required. Include in narrative.	☐	☒	☐	

6. Matrix spike/Matrix spike duplicate/Sample duplicate (MS/MSD/DUP)

Question				Yes	No	N/A	Comments
A.	Do the analytical methods used require an MS and/or MSD? If no, skip to 6.B.			☒	☐	☐	
	i.	Have the required matrix spikes been prepared and reported?		☐	☒	☐	
	ii.	If no, is there and explanation in the report as to why?		☐	☒	☐	
	iii.	Did the lab process an alternate spiked sample (such as LCSD) instead?		☒	☐	☐	LCSD
	iv.	Are the lab QC limits specified on the report?		☒	☐	☐	
	v.	Are there compounds outside the lab QC limits?		☐	☐	☒	
	vi.	If yes, did the lab re-run an MS/MSD?		☐	☐	☒	
		1.	Did the re-run MS/MSD pass? Discuss the case narrative.	☐	☐	☒	
		2.	Did the re-run MS/MSD fail? Discuss the case narrative.	☐	☐	☒	
		3.	Is the source sample also flagged for MS/MSD compounds outside the lab QC limits?	☐	☐	☒	
B.	Was a duplicate sample submitted for the analytical method(s)?			☒	☐	☐	LCSD
	i.	Is the Relative Percentage Difference (RPD) within 20%* for the duplicate pair? If no, explain possible causes and data impact. **Other RPDs may be acceptable. Check with regulatory agency.*		☒	☐	☐	MPCA limit: 50% RPD for tissue (other)

7. Method detection limits/Report limits

Question		Yes	No	N/A	Comments
A.	Are reporting limits clearly listed on the report for all analyses?	☒	☐	☐	
B.	Do the reporting limits meet the program required limits listed? If not, an explanation is required.	☒	☐	☐	Laboratory J flags indicating a concentration less than limit of quantification are to be retained during reporting.

8. Sample information

Questions		Yes	No	N/A	Comments
A.	Are sample numbers cross-referenced correctly with the associated QC?	☒	☐	☐	
B.	Are soil samples reported in dry weight basis?	☐	☐	☒	
C.	Are percent moisture results reported?	☐	☐	☒	
D.	Are positive detections reported?	☒	☐	☐	
E.	Are sample analytes appropriately flagged if the QC failed?	☒	☐	☐	

9. Report narrative

Question		Yes	No	N/A	Comments
A.	Is a narrative provided with the laboratory report which describes all problems with the analyses and all corrective actions taken to address these problems?	☒	☐	☐	

10. Additional comments about the lab report

Reviewed using MPCA Guidance on Perfluorochemicals Analysis (July 2020).

See attachment for qualification.

Thirty-one results were rejected (R) due to a severely low labeled analog recovery.

Certification

By typing my name below, I certify the above statements to be true and correct, to the best of my knowledge, and that this information can be used for the purpose of processing this form.

Authorized Representative

Name: Lisa Smith Title: Environmental Chemist (CEAC)

(This document has been electronically signed.) Date (mm/dd/yyyy): 1/10/2021

Data Validation Qualifications for DPWG74760

Method blank detections (Section 3Bii): Detects within 10 times the method blank concentrations were qualified B.

Blank Sample ID	Analyte	Concentration (ng/L)	Results Qualified B
WG74157-101	PFBA	0.653 J	EP27C-BOTF-WHO-01-091520 (L33786-1) EP1A-BOTF-WHO-01-091520 (L33786-2) RC7-BOTF-WHO-01-091820 (L33786-3) RC22-BOTF-WHO-01-091820 (L33786-4) RC18-BOTF-WHO-01-091920 (L33786-5) RC18A-CRAY-01-092120 (L33788-1) EP26A-CRAY-THREE-01-091720 (L33788-2) RC3A-CRAY-01-092020 (L33788-3) RC4A-CRAY-01-092520 (L33788-4) RC23-CRAY-FOUR-01-092420 (L33788-5) RC23-CRAY-ONE-01-092520 (L33788-6) RC23-CRAY-TWO-01-092520 (L33788-7) RC23-CRAY-THREE-01-092520 (L33788-8) RC14-CRAY-01-092120 (L33788-10 i) RC21A-CRAY-TWO-01-092120 (L33788-11) RC21-CRAY-ONE-01-092120 (L33788-12) RC21-CRAY-TWO-01-092120 (L33788-13) RC21-CRAY-THREE-01-092120 (L33788-14) RC21B-CRAY-01-092120 (L33788-15)
	PFUnA	0.118 J	EP27C-BOTF-WHO-01-091520 (L33786-1) EP1A-BOTF-WHO-01-091520 (L33786-2) RC18-BOTF-WHO-01-091920 (L33786-5) RC18A-CRAY-01-092120 (L33788-1) EP26A-CRAY-THREE-01-091720 (L33788-2) RC3A-CRAY-01-092020 (L33788-3) RC4A-CRAY-01-092520 (L33788-4) RC23-CRAY-TWO-01-092520 (L33788-7) RC23-CRAY-COMP-01-092520 (L33788-9) RC14-CRAY-01-092120 (L33788-10 i) RC21A-CRAY-TWO-01-092120 (L33788-11) RC21-CRAY-ONE-01-092120 (L33788-12) RC21-CRAY-TWO-01-092120 (L33788-13) RC21-CRAY-THREE-01-092120 (L33788-14) RC21B-CRAY-01-092120 (L33788-15)
	PFTrDA	0.153 J	EP1A-BOTF-WHO-01-091520 (L33786-2) RC7-BOTF-WHO-01-091820 (L33786-3) RC22-BOTF-WHO-01-091820 (L33786-4) RC18-BOTF-WHO-01-091920 (L33786-5) RC18A-CRAY-01-092120 (L33788-1) RC3A-CRAY-01-092020 (L33788-3) RC4A-CRAY-01-092520 (L33788-4) RC23-CRAY-FOUR-01-092420 (L33788-5) RC23-CRAY-ONE-01-092520 (L33788-6) RC23-CRAY-TWO-01-092520 (L33788-7) RC23-CRAY-THREE-01-092520 (L33788-8)

Blank Sample ID	Analyte	Concentration (ng/L)	Results Qualified B
			RC23-CRAY-COMP-01-092520 (L33788-9) RC14-CRAY-01-092120 (L33788-10 i) RC21A-CRAY-TWO-01-092120 (L33788-11) RC21-CRAY-ONE-01-092120 (L33788-12) RC21-CRAY-TWO-01-092120 (L33788-13) RC21-CRAY-THREE-01-092120 (L33788-14) RC21B-CRAY-01-092120 (L33788-15)
	PFOS	0.153 J	Samples concentrations were greater than 10 times the blank concentration. No qualifiers.
	PFOSA	0.109 J	

Labeled Analogs - surrogates (Section 4Bii): Results associated with low recoveries were qualified as estimated (UJ and J+), and detects associated with high recoveries were qualified as estimated biased low (J-), as these labeled analogs are used to quantitate the analyte of interest and an inverse relationship exists. Thirty-one results were rejected (R) due to severely low labeled analog recoveries.

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
EP27C-BOTF-WHO-01-091520	L33786-1	13C2-PFTeDA	34.2	UJ
EP27C-BOTF-WHO-01-091520	L33786-1	D3-N-MeFOSA	24.1	UJ
EP27C-BOTF-WHO-01-091520	L33786-1	D5-N-EtFOSA	18.2	UJ
EP27C-BOTF-WHO-01-091520	L33786-1	d7-NMe-FOSE	1.56	R
EP27C-BOTF-WHO-01-091520	L33786-1	d9-NEt-FOSE	7.16	R
EP27C-BOTF-WHO-01-091520	L33786-1	13C3-HFPO-DA	39.8	UJ
EP1A-BOTF-WHO-01-091520	L33786-2	13C2-PFTeDA	43.3	UJ
EP1A-BOTF-WHO-01-091520	L33786-2	D3-N-MeFOSA	29.5	UJ
EP1A-BOTF-WHO-01-091520	L33786-2	D5-N-EtFOSA	17.7	R
EP1A-BOTF-WHO-01-091520	L33786-2	d7-NMe-FOSE	4.35	R
EP1A-BOTF-WHO-01-091520	L33786-2	d9-NEt-FOSE	7.87	R
RC7-BOTF-WHO-01-091820	L33786-3	13C2-PFTeDA	38.3	J+
RC7-BOTF-WHO-01-091820	L33786-3	D3-N-MeFOSA	29.3	UJ
RC7-BOTF-WHO-01-091820	L33786-3	D5-N-EtFOSA	21.6	UJ
RC7-BOTF-WHO-01-091820	L33786-3	d7-NMe-FOSE	20.2	UJ
RC7-BOTF-WHO-01-091820	L33786-3	d9-NEt-FOSE	7.21	R
RC7-BOTF-WHO-01-091820	L33786-3	13C3-HFPO-DA	26.9	UJ
RC22-BOTF-WHO-01-091820	L33786-4	13C2-PFTeDA	38.4	J+
RC22-BOTF-WHO-01-091820	L33786-4	D3-N-MeFOSA	31.3	UJ
RC22-BOTF-WHO-01-091820	L33786-4	D5-N-EtFOSA	21.9	UJ
RC22-BOTF-WHO-01-091820	L33786-4	d7-NMe-FOSE	17.7	R
RC22-BOTF-WHO-01-091820	L33786-4	d9-NEt-FOSE	8.53	R
RC22-BOTF-WHO-01-091820	L33786-4	13C3-HFPO-DA	37.6	UJ

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
RC18-BOTF-WHO-01-091920	L33786-5	D3-N-MeFOSA	41.0	UJ
RC18-BOTF-WHO-01-091920	L33786-5	D5-N-EtFOSA	29.0	UJ
RC18-BOTF-WHO-01-091920	L33786-5	d7-NMe-FOSE	7.01	R
RC18-BOTF-WHO-01-091920	L33786-5	d9-NEt-FOSE	13.0	R
RC18-BOTF-WHO-01-091920	L33786-5	13C3-HFPO-DA	40.8	UJ
RC18A-CRAY-01-092120	L33788-1	D3-N-MeFOSA	40.3	UJ
RC18A-CRAY-01-092120	L33788-1	D5-N-EtFOSA	11.8	R
RC18A-CRAY-01-092120	L33788-1	d7-NMe-FOSE	8.58	R
RC18A-CRAY-01-092120	L33788-1	d9-NEt-FOSE	7.12	R
EP26A-CRAY-THREE-01-091720	L33788-2	D3-N-MeFOSA	40.1	UJ
EP26A-CRAY-THREE-01-091720	L33788-2	D5-N-EtFOSA	48.1	UJ
EP26A-CRAY-THREE-01-091720	L33788-2	d7-NMe-FOSE	24.6	UJ
EP26A-CRAY-THREE-01-091720	L33788-2	d9-NEt-FOSE	9.88	R
RC3A-CRAY-01-092020	L33788-3	d9-NEt-FOSE	19.9	R
RC4A-CRAY-01-092520	L33788-4	13C4-PFHpA	31.7	J+
RC4A-CRAY-01-092520	L33788-4	D3-N-MeFOSA	36.9	UJ
RC4A-CRAY-01-092520	L33788-4	D5-N-EtFOSA	43.2	UJ
RC4A-CRAY-01-092520	L33788-4	d7-NMe-FOSE	46.8	UJ
RC4A-CRAY-01-092520	L33788-4	d9-NEt-FOSE	9.59	R
RC23-CRAY-FOUR-01-092420	L33788-5	D3-N-MeFOSA	47.9	UJ
RC23-CRAY-FOUR-01-092420	L33788-5	d7-NMe-FOSE	46.7	UJ
RC23-CRAY-FOUR-01-092420	L33788-5	d9-NEt-FOSE	16.7	R
RC23-CRAY-ONE-01-092520	L33788-6	D3-N-MeFOSA	44.3	UJ
RC23-CRAY-ONE-01-092520	L33788-6	d9-NEt-FOSE	16.9	R
RC23-CRAY-TWO-01-092520	L33788-7	D3-N-MeFOSA	49.2	UJ
RC23-CRAY-TWO-01-092520	L33788-7	d7-NMe-FOSE	47.7	UJ
RC23-CRAY-TWO-01-092520	L33788-7	d9-NEt-FOSE	20.1	UJ
RC23-CRAY-THREE-01-092520	L33788-8	D3-N-MeFOSA	46.1	UJ
RC23-CRAY-THREE-01-092520	L33788-8	d7-NMe-FOSE	46.0	UJ
RC23-CRAY-THREE-01-092520	L33788-8	d9-NEt-FOSE	15.9	R
RC23-CRAY-COMP-01-092520	L33788-9	D3-N-MeFOSA	40.4	UJ
RC23-CRAY-COMP-01-092520	L33788-9	D5-N-EtFOSA	13.0	R
RC23-CRAY-COMP-01-092520	L33788-9	d7-NMe-FOSE	8.49	R
RC23-CRAY-COMP-01-092520	L33788-9	d9-NEt-FOSE	9.64	R
RC14-CRAY-01-092120	L33788-10 i	D3-N-MeFOSA	42.9	UJ
RC14-CRAY-01-092120	L33788-10 i	D5-N-EtFOSA	11.2	R
RC14-CRAY-01-092120	L33788-10 i	d7-NMe-FOSE	25.6	UJ
RC14-CRAY-01-092120	L33788-10 i	d9-NEt-FOSE	9.07	R

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
RC21A-CRAY-TWO-01-092120	L33788-11	D3-N-MeFOSA	49.6	UJ
RC21A-CRAY-TWO-01-092120	L33788-11	D5-N-EtFOSA	16.8	R
RC21A-CRAY-TWO-01-092120	L33788-11	d7-NMe-FOSE	25.3	UJ
RC21A-CRAY-TWO-01-092120	L33788-11	d9-NEt-FOSE	13.9	R
RC21-CRAY-ONE-01-092120	L33788-12	d9-NEt-FOSE	15.0	R
RC21-CRAY-TWO-01-092120	L33788-13	D3-N-MeFOSA	48.8	UJ
RC21-CRAY-TWO-01-092120	L33788-13	D5-N-EtFOSA	21.9	UJ
RC21-CRAY-TWO-01-092120	L33788-13	d7-NMe-FOSE	30.5	UJ
RC21-CRAY-TWO-01-092120	L33788-13	d9-NEt-FOSE	15.4	R
RC21-CRAY-THREE-01-092120	L33788-14	D3-N-MeFOSA	12.2	R
RC21-CRAY-THREE-01-092120	L33788-14	d7-NMe-FOSE	41.2	UJ
RC21-CRAY-THREE-01-092120	L33788-14	d9-NEt-FOSE	11.9	R
RC21B-CRAY-01-092120	L33788-15	13C4-PFBA	397	J-
RC21B-CRAY-01-092120	L33788-15	D3-N-MeFOSA	47.9	UJ
RC21B-CRAY-01-092120	L33788-15	D5-N-EtFOSA	21.1	UJ
RC21B-CRAY-01-092120	L33788-15	d9-NEt-FOSE	14.4	R

Laboratory control sample/Laboratory control sample duplicate (Section 5Bii): Results associated with high recoveries were nondetect and were acceptable without qualification.

LCS/LCSD IDs	Compound	LCS/LCSD %Recovery	Recovery Limits	Qualifiers
WG74157-102 (A)/ WG74157-103 (DUP WG74157-102)	5:3 FTCA	**173/174**	50-150	Associated results were nondetect. No qualifiers.
	11Cl-PF3OUdS	140/**157**	50-150	
	9Cl-PF3ONS	136/**159**	50-150	
	ADONA	137/**159**	50-150	
	N-MeFOSE	**162/163**	50-150	

Bold indicates an exceedance

10. Additional comments about lab report: For the results listed below, the peak was detected; however, it did not meet quantification criteria. These results were reported as maximum possible concentration and qualified as estimated (J):

Sample ID	Lab ID	Analyte
EP1A-BOTF-WHO-01-091520	L33786-2	N-EtFOSE
RC7-BOTF-WHO-01-091820	L33786-3	N-EtFOSE
RC22-BOTF-WHO-01-091820	L33786-4	N-EtFOSE
RC18A-CRAY-01-092120	L33788-1	N-EtFOSE
RC4A-CRAY-01-092520	L33788-4	MeFOSAA
RC4A-CRAY-01-092520	L33788-4	N-EtFOSE

Sample ID	Lab ID	Analyte
RC23-CRAY-FOUR-01-092420	L33788-5	PFNA
RC23-CRAY-TWO-01-092520	L33788-7	PFNA
RC23-CRAY-COMP-01-092520	L33788-9	N-EtFOSE
RC21A-CRAY-TWO-01-092120	L33788-11	PFBS
RC21-CRAY-TWO-01-092120	L33788-13	PFHxS

Any R qualifiers take precedence over other qualifiers.

MINNESOTA

Minnesota Department of Agriculture 651-201-6148
Minnesota Department of Health 651-201-5357
Minnesota Pollution Control Agency 651-757-2560

Laboratory data review checklist

Doc Type: Data Review

Instructions: The following is the informal checklist that should be used to review data for the Minnesota Department of Agriculture, Minnesota Pollution Control Agency, and Minnesota Department of Health. The information follows the general format of the National Functional Guidelines, which is the primary data review tool used in the U.S. Environmental Protection Agency's Contract Laboratory Program for Superfund analytical work. Refer to the appropriate guidance document for each agency for instructions.

Project information

Project name: Project 1007

Work order number/Lab report ID: DPWG74771 Report date (mm/dd/yyyy): 12/27/2020

Laboratory: SGS AXYS Review date (mm/dd/yyyy): 1/16/2021

1. Chain of custody, preservation, and holding times

Questions			Yes	No	N/A	Comments
A.	Is there a chain of custody (COC) with the report?		☒	☐	☐	Additional samples (not reported in this SDG) were listed on the COCs.
B.	Is there a sample condition form with the report?		☒	☐	☐	
C.	Were there samples preserved according to program requirements?		☒	☐	☐	
D.	Were samples received in the correct containers?		☒	☐	☐	
	i.	Was there enough sample volume/weight to complete all requested analyses?	☒	☐	☐	
	ii.	Was there enough sample collected to complete required batch QC?	☒	☐	☐	
E.	Were samples received within holding time for sample prep for all requested analyses?		☒	☐	☐	
F.	Are there notes about sample condition or holding time issues on the COC? Explain the data impact.		☐	☒	☐	
G.	Are there narration or data qualifiers with the report about sample condition or holding time issues? Explain the data impact.		☐	☒	☐	Case narrative indicates samples were received at greater than 4 °C. Sample receipt was acceptable since they were received within the MPCA requirement of <6 °C.

H.	Are lab IDs cross-referenced correctly with the field IDs.	☒	☐	☐	Sample WL15A-CRAY-EATEN-01-091620 (L33788-37) was not listed on the COC as it was a crayfish pulled from the fish sample WL15A-PRED-WHO-THREE-01-091620 that was reported in SDG DPWG74677 (L33776-49). Descrepancies between the sample ID on the COC and sample labels were noted for 3 samples.

2. Calibration

Question		Yes	No	N/A	Comments
A.	Do the report narrative or data qualifiers indicate calibration problems for any analyses? If yes, explain the data impact.	☒	☐	☐	MN limits used. ICAL, ICV and CCV reviewed. See data qualifications summary for exceedances. No qualifiers.

3. Blanks

Question			Yes	No	N/A	Comments
A.	Do any of the analyses contain samples for field or trip blanks?		☒	☐	☐	Login report indicates a trip blank L33798-1 was associated with the samples collected (reported in SDG DPWG74712)
	i.	If yes, are there target analytes present above the reporting limit in the blanks?	☐	☒	☐	The trip blank results were nondetect
	ii.	If yes, are the same compounds also present in the samples? Explain possible data impact.	☐	☐	☒	
B.	Do method blanks for any analyses contain target analytes above the reporting limit?		☒	☐	☐	
	i.	If yes, are the same compounds present in the samples?	☒	☐	☐	
	ii.	Is the amount of target analyte in the method blank more than $1/10^{th}$ of that in the sample(s)? Explain the possible impact on sample results.	☒	☐	☐	See data qualifications summary for blank detections and qualifications.
C.	Do instrument blanks contain analytes above the reporting limit?		☐	☐	☒	

4. Surrogates or organic analysis

Question			Yes	No	N/A	Comments
A.	Are the lab recovery limits for surrogates specified on the report?		☒	☐	☐	MPCA limits used: 50% to 200%
B.	Are the surrogates outside lab QC limits? (These should have a data qualifier.)		☒	☐	☐	
	i.	If yes, are the surrogates above the lab QC limits?	☒	☐	☐	

	ii.	Below the lab QC limits?	☒	☐	☐	
	iii.	Were the affected samples re-analyzed? Discuss in the case narrative.	☐	☒	☐	
	iv.	Explain what this could mean for the affected samples. Include in narrative.	☒	☐	☐	See data qualifications summary for exceedances and qualifications. Forty results were rejected (R) due to a severely low labeled analog recovery.

5. Laboratory control sample/Laboratory control sample duplicate (LCS/LCSD)

Question			Yes	No	N/A	Comments
A.	Are there LCS/LCSD samples present for the reporting analyses?		☒	☐	☐	
B.	Are there LCS/LCSD compounds outside lab limits? If the LCS/LCSD fails, the LCS/LCSD and samples must be re-analyzed.		☒	☐	☐	MPCA PFAS other limits used: 50% to 150%.
	i.	If yes, are there compounds above the lab QC limits? If yes, an explanation is required. Include in narrative.	☒	☐	☐	See data qualifications summary for exceedances. No qualifiers.
	ii.	Below the QC limits? If yes, an explanation is required. Include in narrative.	☐	☒	☐	

6. Matrix spike/Matrix spike duplicate/Sample duplicate (MS/MSD/DUP)

Question				Yes	No	N/A	Comments
A.	Do the analytical methods used require an MS and/or MSD? If no, skip to 6.B.			☒	☐	☐	
	i.	Have the required matrix spikes been prepared and reported?		☐	☒	☐	
	ii.	If no, is there and explanation in the report as to why?		☐	☒	☐	
	iii.	Did the lab process an alternate spiked sample (such as LCSD) instead?		☒	☐	☐	LCSD
	iv.	Are the lab QC limits specified on the report?		☒	☐	☐	
	v.	Are there compounds outside the lab QC limits?		☐	☐	☒	
	vi.	If yes, did the lab re-run an MS/MSD?		☐	☐	☒	
		1.	Did the re-run MS/MSD pass? Discuss the case narrative.	☐	☐	☒	
		2.	Did the re-run MS/MSD fail? Discuss the case narrative.	☐	☐	☒	
		3.	Is the source sample also flagged for MS/MSD compounds outside the lab QC limits?	☐	☐	☒	

B.	Was a duplicate sample submitted for the analytical method(s)?		☒	☐	☐	LCSD
	i.	Is the Relative Percentage Difference (RPD) within 20%* for the duplicate pair? If no, explain possible causes and data impact. **Other RPDs may be acceptable. Check with regulatory agency.*	☒	☐	☐	MPCA limit: 50% RPD for tissue (other)

7. Method detection limits/Report limits

Question		Yes	No	N/A	Comments
A.	Are reporting limits clearly listed on the report for all analyses?	☒	☐	☐	
B.	Do the reporting limits meet the program required limits listed? If not, an explanation is required.	☒	☐	☐	Laboratory J flags indicating a concentration less than limit of quantification are to be retained during reporting.

8. Sample information

Questions		Yes	No	N/A	Comments
A.	Are sample numbers cross-referenced correctly with the associated QC?	☒	☐	☐	
B.	Are soil samples reported in dry weight basis?	☐	☐	☒	
C.	Are percent moisture results reported?	☐	☐	☒	
D.	Are positive detections reported?	☒	☐	☐	
E.	Are sample analytes appropriately flagged if the QC failed?	☒	☐	☐	

9. Report narrative

Question		Yes	No	N/A	Comments
A.	Is a narrative provided with the laboratory report which describes all problems with the analyses and all corrective actions taken to address these problems?	☒	☐	☐	

10. Additional comments about the lab report

Reviewed using MPCA Guidance on Perfluorochemicals Analysis (July 2020).

See attachment for qualification.

Forty results were rejected (R) due to a severely low labeled analog recovery.

Certification

By typing my name below, I certify the above statements to be true and correct, to the best of my knowledge, and that this information can be used for the purpose of processing this form.

Authorized Representative

Name: Lisa Smith Title: Environmental Chemist (CEAC)

(This document has been electronically signed.) Date (mm/dd/yyyy): 1/16/2021

Data Validation Qualifications for DPWG74771

Calibration (Section 2): Calibration noncompliances are summarized below.

Calibration Date	Analyte	%R	%R Limit	Qualifiers
26-Nov-2020 11:59	NFDHA	147	70-130	Only PFOS and PFOSA dilutions reported from 11/26/20 analyses. No qualifiers.

Method blank detections (Section 3Bii): Detects within 10 times the method blank concentrations were qualified B.

Blank Sample ID	Analyte	Concentration (ng/g)	Results Qualified B
WG74155-101	PFBA	0.508 J	All results were within 10 times the blank concentration and qualified B.
	PFUnA	0.105 J	WL15A-FORE-WHO-THREE-01-091620 (L33784-52) WL15-FORE-WHO-ONE-01-091620 (L33784-54) WL15-FORE-WHO-TWO-01-091620 (L33784-55) WL15-FORE-WHO-THREE-01-091620 (L33784-56) RC16A-FORE-COMP-ONE-01-091920 (L33784-63) RC16A-FORE-COMP-TWO-01-091920 (L33784-64) RC17-FORE-COMP-ONE-01-091920 (L33784-65) RC17-FORE-COMP-TWO-01-091920 (L33784-66) RC18-FORE-COMP-01-091920 (L33784-67) EP15-FORE-WHO-ONE-01-091820 (L33784-70) WL15A-CRAY-EATEN-01-091620 (L33788-37)
	PFOS	0.153 J	Sample concentrations were greater than 10 times the blank concentration. No qualifiers.
	PFOSA	0.109 J	WL15A-FORE-WHO-THREE-01-091620 (L33784-52) WL15A-FORE-WHO-FOUR-01-091620 (L33784-53) WL15-FORE-WHO-ONE-01-091620 (L33784-54) WL15-FORE-WHO-TWO-01-091620 (L33784-55) WL15-FORE-WHO-THREE-01-091620 (L33784-56) RC16A-FORE-COMP-ONE-01-091920 (L33784-63) EP15-FORE-WHO-ONE-01-091820 (L33784-70) WL15A-CRAY-EATEN-01-091620 (L33788-37)

Labeled Analogs - surrogates (Section 4Bii): Results associated with low recoveries were qualified as estimated (UJ and J+), and detects associated with high recoveries were qualified as estimated biased low (J-), as these labeled analogs are used to quantitate the analyte of interest and an inverse relationship exists. Forty results were rejected (R) due to severely low labeled analog recoveries.

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
WL15A-FORE-WHO-THREE-01-091620	L33784-52	13C2-PFTeDA	30.9	J+

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
WL15A-FORE-WHO-THREE-01-091620	L33784-52	D3-N-MeFOSA	32.0	UJ
WL15A-FORE-WHO-THREE-01-091620	L33784-52	D5-N-EtFOSA	24.8	UJ
WL15A-FORE-WHO-THREE-01-091620	L33784-52	D5-EtFOSAA	218	J-
WL15A-FORE-WHO-THREE-01-091620	L33784-52	d7-NMe-FOSE	2.69	R
WL15A-FORE-WHO-THREE-01-091620	L33784-52	d9-NEt-FOSE	9.56	R
WL15A-FORE-WHO-FOUR-01-091620	L33784-53	13C2-PFTeDA	25.5	J+
WL15A-FORE-WHO-FOUR-01-091620	L33784-53	D3-N-MeFOSA	37.4	UJ
WL15A-FORE-WHO-FOUR-01-091620	L33784-53	D5-N-EtFOSA	23.1	UJ
WL15A-FORE-WHO-FOUR-01-091620	L33784-53	D5-EtFOSAA	224	J-
WL15A-FORE-WHO-FOUR-01-091620	L33784-53	d7-NMe-FOSE	2.58	R
WL15A-FORE-WHO-FOUR-01-091620	L33784-53	d9-NEt-FOSE	7.93	R
WL15-FORE-WHO-ONE-01-091620	L33784-54	13C2-PFTeDA	25.5	UJ
WL15-FORE-WHO-ONE-01-091620	L33784-54	D3-N-MeFOSA	33.2	UJ
WL15-FORE-WHO-ONE-01-091620	L33784-54	D5-N-EtFOSA	22.8	UJ
WL15-FORE-WHO-ONE-01-091620	L33784-54	D5-EtFOSAA	211	J-
WL15-FORE-WHO-ONE-01-091620	L33784-54	d7-NMe-FOSE	3.54	R
WL15-FORE-WHO-ONE-01-091620	L33784-54	d9-NEt-FOSE	7.16	R
WL15-FORE-WHO-TWO-01-091620	L33784-55	D3-N-MeFOSA	36.2	UJ
WL15-FORE-WHO-TWO-01-091620	L33784-55	D5-N-EtFOSA	26.8	UJ
WL15-FORE-WHO-TWO-01-091620	L33784-55	D5-EtFOSAA	201	J-
WL15-FORE-WHO-TWO-01-091620	L33784-55	d7-NMe-FOSE	2.87	R
WL15-FORE-WHO-TWO-01-091620	L33784-55	d9-NEt-FOSE	14.0	R
WL15-FORE-WHO-THREE-01-091620	L33784-56	13C2-PFTeDA	30.8	UJ
WL15-FORE-WHO-THREE-01-091620	L33784-56	D3-N-MeFOSA	35.8	UJ
WL15-FORE-WHO-THREE-01-091620	L33784-56	D5-N-EtFOSA	23.7	UJ
WL15-FORE-WHO-THREE-01-091620	L33784-56	D5-EtFOSAA	224	J-
WL15-FORE-WHO-THREE-01-091620	L33784-56	d7-NMe-FOSE	5.13	R
WL15-FORE-WHO-THREE-01-091620	L33784-56	d9-NEt-FOSE	8.47	R
RC3A-FORE-COMP-ONE-01-091920	L33784-57	D5-EtFOSAA	305	J-
RC3A-FORE-COMP-ONE-01-091920	L33784-57	d7-NMe-FOSE	6.02	R

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
RC3A-FORE-COMP-ONE-01-091920	L33784-57	d9-NEt-FOSE	23.6	J+
RC3A-FORE-COMP-ONE-01-091920	L33784-57	13C3-HFPO-DA	32.9	UJ
RC4A-FORE-COMP-091820	L33784-58	13C2-8:2 FTS	201	No Qualifier
RC4A-FORE-COMP-091820	L33784-58	D5-N-EtFOSA	39.4	J+
RC4A-FORE-COMP-091820	L33784-58	D5-EtFOSAA	359	J-
RC4A-FORE-COMP-091820	L33784-58	d7-NMe-FOSE	9.90	R
RC4A-FORE-COMP-091820	L33784-58	d9-NEt-FOSE	17.2	R
RC4A-FORE-COMP-091820	L33784-58	13C3-HFPO-DA	23.2	UJ
RC5-FORE-WHO-ONE-091820	L33784-59	D5-EtFOSAA	454	J-
RC5-FORE-WHO-ONE-091820	L33784-59	d7-NMe-FOSE	8.05	R
RC5-FORE-WHO-ONE-091820	L33784-59	d9-NEt-FOSE	24.6	UJ
RC5-FORE-WHO-ONE-091820	L33784-59	13C3-HFPO-DA	23.5	UJ
RC7-FORE-COMP-ONE-01-092020	L33784-60	13C2-PFTeDA	26.5	J+
RC7-FORE-COMP-ONE-01-092020	L33784-60	D3-N-MeFOSA	37.7	UJ
RC7-FORE-COMP-ONE-01-092020	L33784-60	D5-N-EtFOSA	26.2	UJ
RC7-FORE-COMP-ONE-01-092020	L33784-60	D5-EtFOSAA	320	J-
RC7-FORE-COMP-ONE-01-092020	L33784-60	d7-NMe-FOSE	3.21	R
RC7-FORE-COMP-ONE-01-092020	L33784-60	d9-NEt-FOSE	7.46	R
RC7-FORE-COMP-ONE-01-092020	L33784-60	13C3-HFPO-DA	19.2	R
RC22-FORE-COMP-TWO-091820	L33784-61	13C2-PFTeDA	36.6	J+
RC22-FORE-COMP-TWO-091820	L33784-61	13C2-8:2 FTS	203	No Qualifier
RC22-FORE-COMP-TWO-091820	L33784-61	13C8-PFOSA	219	J-
RC22-FORE-COMP-TWO-091820	L33784-61	D5-N-EtFOSA	46.6	UJ
RC22-FORE-COMP-TWO-091820	L33784-61	D5-EtFOSAA	297	J-
RC22-FORE-COMP-TWO-091820	L33784-61	d7-NMe-FOSE	3.14	R
RC22-FORE-COMP-TWO-091820	L33784-61	d9-NEt-FOSE	18.0	R
RC22-FORE-WHO-091820	L33784-62	13C2-4:2 FTS	227	No Qualifier
RC22-FORE-WHO-091820	L33784-62	13C2-8:2 FTS	202	No Qualifier
RC22-FORE-WHO-091820	L33784-62	13C8-PFOSA	315	J-
RC22-FORE-WHO-091820	L33784-62	D3-N-MeFOSA	31.4	UJ
RC22-FORE-WHO-091820	L33784-62	D5-N-EtFOSA	44.8	UJ
RC22-FORE-WHO-091820	L33784-62	D5-EtFOSAA	462	J-
RC22-FORE-WHO-091820	L33784-62	d7-NMe-FOSE	27.1	UJ
RC22-FORE-WHO-091820	L33784-62	d9-NEt-FOSE	14.2	R
RC22-FORE-WHO-091820	L33784-62	13C3-HFPO-DA	20.6	UJ
RC16A-FORE-COMP-ONE-01-091920	L33784-63	13C2-4:2 FTS	203	No Qualifier
RC16A-FORE-COMP-ONE-01-091920	L33784-63	D3-N-MeFOSA	42.6	UJ

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
RC16A-FORE-COMP-ONE-01-091920	L33784-63	D5-N-EtFOSA	28.9	UJ
RC16A-FORE-COMP-ONE-01-091920	L33784-63	d7-NMe-FOSE	4.57	R
RC16A-FORE-COMP-ONE-01-091920	L33784-63	d9-NEt-FOSE	13.2	R
RC16A-FORE-COMP-ONE-01-091920	L33784-63	13C3-HFPO-DA	42.8	UJ
RC16A-FORE-COMP-TWO-01-091920	L33784-64	13C2-PFTeDA	42.5	J+
RC16A-FORE-COMP-TWO-01-091920	L33784-64	13C2-4:2 FTS	201	No Qualifier
RC16A-FORE-COMP-TWO-01-091920	L33784-64	D3-N-MeFOSA	36.2	UJ
RC16A-FORE-COMP-TWO-01-091920	L33784-64	D5-N-EtFOSA	31.2	UJ
RC16A-FORE-COMP-TWO-01-091920	L33784-64	d7-NMe-FOSE	3.32	R
RC16A-FORE-COMP-TWO-01-091920	L33784-64	d9-NEt-FOSE	11.0	R
RC17-FORE-COMP-ONE-01-091920	L33784-65	D3-N-MeFOSA	41.4	UJ
RC17-FORE-COMP-ONE-01-091920	L33784-65	D5-N-EtFOSA	24.0	UJ
RC17-FORE-COMP-ONE-01-091920	L33784-65	d7-NMe-FOSE	4.50	R
RC17-FORE-COMP-ONE-01-091920	L33784-65	d9-NEt-FOSE	12.6	R
RC17-FORE-COMP-ONE-01-091920	L33784-65	13C3-HFPO-DA	41.1	UJ
RC17-FORE-COMP-TWO-01-091920	L33784-66	13C2-PFTeDA	41.4	UJ
RC17-FORE-COMP-TWO-01-091920	L33784-66	D3-N-MeFOSA	30.8	UJ
RC17-FORE-COMP-TWO-01-091920	L33784-66	D5-N-EtFOSA	18.5	R
RC17-FORE-COMP-TWO-01-091920	L33784-66	d7-NMe-FOSE	3.20	R
RC17-FORE-COMP-TWO-01-091920	L33784-66	d9-NEt-FOSE	7.27	R
RC18-FORE-COMP-01-091920	L33784-67	13C2-PFTeDA	31.5	J+
RC18-FORE-COMP-01-091920	L33784-67	D3-N-MeFOSA	33.9	UJ
RC18-FORE-COMP-01-091920	L33784-67	D5-N-EtFOSA	22.0	UJ
RC18-FORE-COMP-01-091920	L33784-67	d7-NMe-FOSE	3.10	R
RC18-FORE-COMP-01-091920	L33784-67	d9-NEt-FOSE	8.33	R
RC18-FORE-COMP-01-091920	L33784-67	13C3-HFPO-DA	42.3	UJ
EP17A-FORE-WHO-01-091920	L33784-68	13C5-PFPeA	275	No Qualifier
EP17A-FORE-WHO-01-091920	L33784-68	13C2-PFTeDA	20.6	UJ
EP17A-FORE-WHO-01-091920	L33784-68	13C3-PFBS	41.7	UJ
EP17A-FORE-WHO-01-091920	L33784-68	D5-N-EtFOSA	34.4	UJ
EP17A-FORE-WHO-01-091920	L33784-68	D5-EtFOSAA	268	J-

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
EP17A-FORE-WHO-01-091920	L33784-68	d7-NMe-FOSE	3.42	R
EP17A-FORE-WHO-01-091920	L33784-68	d9-NEt-FOSE	12.7	R
EP20-FORE-COMP-TWO-01-092020	L33784-69	D5-N-EtFOSA	41.3	UJ
EP20-FORE-COMP-TWO-01-092020	L33784-69	D5-EtFOSAA	229	J-
EP20-FORE-COMP-TWO-01-092020	L33784-69	d7-NMe-FOSE	3.51	R
EP20-FORE-COMP-TWO-01-092020	L33784-69	d9-NEt-FOSE	24.0	UJ
EP15-FORE-WHO-ONE-01-091820	L33784-70	13C2-PFTeDA	48.0	J+
EP15-FORE-WHO-ONE-01-091820	L33784-70	D3-N-MeFOSA	26.3	UJ
EP15-FORE-WHO-ONE-01-091820	L33784-70	D5-N-EtFOSA	17.2	R
EP15-FORE-WHO-ONE-01-091820	L33784-70	d7-NMe-FOSE	1.17	R
EP15-FORE-WHO-ONE-01-091820	L33784-70	d9-NEt-FOSE	6.62	R
WL15A-CRAY-EATEN-01-091620	L33788-37	13C5-PFPeA	335	No Qualifier
WL15A-CRAY-EATEN-01-091620	L33788-37	D3-N-MeFOSA	23.8	UJ
WL15A-CRAY-EATEN-01-091620	L33788-37	D5-N-EtFOSA	7.18	R
WL15A-CRAY-EATEN-01-091620	L33788-37	d7-NMe-FOSE	5.78	R
WL15A-CRAY-EATEN-01-091620	L33788-37	d9-NEt-FOSE	3.50	R

Laboratory control sample/Laboratory control sample duplicate (Section 5Bi): Results associated with high recoveries were nondetect and were acceptable without qualification.

LCS/LCSD IDs	Compound	LCS/LCSD %Recovery	Recovery Limits	Qualifiers
WG74155-102 (A)/ WG74155-103 (DUP WG74155-102)	11Cl-PF3OUdS	136/**177**	50-150	Associated results were nondetect. No qualifiers.
	5:3 FTCA	**171/168**	50-150	
	9Cl-PF3ONS	137/**183**	50-150	
	ADONA	136/**175**	50-150	
	N-MeFOSE	**181/199**	50-150	

Bold indicates an exceedance

10. Additional comments about lab report: For the results listed below, the peak was detected; however, it did not meet quantification criteria. These results were reported as maximum possible concentration and qualified as estimated (J):

Sample ID	Lab ID	Analyte
WL15A-FORE-WHO-THREE-01-091620	L33784-52	N-EtFOSE
WL15A-FORE-WHO-THREE-01-091620	L33784-52	NFDHA
WL15A-FORE-WHO-FOUR-01-091620	L33784-53	N-EtFOSE
WL15-FORE-WHO-ONE-01-091620	L33784-54	N-EtFOSE
WL15-FORE-WHO-THREE-01-091620	L33784-56	N-EtFOSE
RC3A-FORE-COMP-ONE-01-091920	L33784-57	N-EtFOSE
RC4A-FORE-COMP-091820	L33784-58	N-EtFOSE

Sample ID	Lab ID	Analyte
RC7-FORE-COMP-ONE-01-092020	L33784-60	N-EtFOSE
RC22-FORE-COMP-TWO-091820	L33784-61	N-EtFOSE
RC22-FORE-WHO-091820	L33784-62	N-EtFOSE
RC16A-FORE-COMP-TWO-01-091920	L33784-64	N-EtFOSE
RC17-FORE-COMP-ONE-01-091920	L33784-65	6:2 FTS
RC17-FORE-COMP-TWO-01-091920	L33784-66	N-EtFOSE
EP17A-FORE-WHO-01-091920	L33784-68	MeFOSAA
EP17A-FORE-WHO-01-091920	L33784-68	N-EtFOSE
EP15-FORE-WHO-ONE-01-091820	L33784-70	N-EtFOSE
WL15A-CRAY-EATEN-01-091620	L33788-37	N-EtFOSE

Any R qualifiers take precedence over other qualifiers.

MINNESOTA

Minnesota Department of Agriculture 651-201-6148
Minnesota Department of Health 651-201-5357
Minnesota Pollution Control Agency 651-757-2560

Laboratory data review checklist

Doc Type: Data Review

Instructions: The following is the informal checklist that should be used to review data for the Minnesota Department of Agriculture, Minnesota Pollution Control Agency, and Minnesota Department of Health. The information follows the general format of the National Functional Guidelines, which is the primary data review tool used in the U.S. Environmental Protection Agency's Contract Laboratory Program for Superfund analytical work. Refer to the appropriate guidance document for each agency for instructions.

Project information

Project name: Project 1007

Work order number/Lab report ID: DPWG74772 Report date (mm/dd/yyyy): 12/16/2020

Laboratory: SGS AXYS Review date (mm/dd/yyyy): 1/16/2021

1. Chain of custody, preservation, and holding times

Questions			Yes	No	N/A	Comments
A.	Is there a chain of custody (COC) with the report?		☒	☐	☐	Additional samples (not reported in this SDG) were listed on the COCs.
B.	Is there a sample condition form with the report?		☒	☐	☐	
C.	Were there samples preserved according to program requirements?		☒	☐	☐	
D.	Were samples received in the correct containers?		☒	☐	☐	
	i.	Was there enough sample volume/weight to complete all requested analyses?	☒	☐	☐	
	ii.	Was there enough sample collected to complete required batch QC?	☒	☐	☐	
E.	Were samples received within holding time for sample prep for all requested analyses?		☒	☐	☐	
F.	Are there notes about sample condition or holding time issues on the COC? Explain the data impact.		☐	☒	☐	
G.	Are there narration or data qualifiers with the report about sample condition or holding time issues? Explain the data impact.		☐	☒	☐	Case narrative indicates samples were received at greater than 4 °C. Sample receipt was acceptable since they were received within the MPCA requirement of <6 °C.
H.	Are lab IDs cross-referenced correctly with the field IDs.		☒	☐	☐	

2. Calibration

Question		Yes	No	N/A	Comments
A.	Do the report narrative or data qualifiers indicate calibration problems for any analyses? If yes, explain the data impact.	☒	☐	☐	MN limits used. ICAL, ICV and CCV reviewed. See data qualifications summary for exceedances and qualifiers.

3. Blanks

Question			Yes	No	N/A	Comments
A.	Do any of the analyses contain samples for field or trip blanks?		☒	☐	☐	Equipment Blanks: EQ-CATFOOD-01-100520 (L33799-1) EQ-CHICKEN-01-100520 (L33799-2) Login report indicates a trip blank L33798-1 was associated with the samples collected (reported in SDG DPWG74712)
	i.	If yes, are there target analytes present above the reporting limit in the blanks?	☒	☐	☐	EQ-CATFOOD-01-100520 (L33799-1): PFOS detect attributable to laboratory contamination. EQ-CHICKEN-01-100520 (L33799-2): N-EtFOSE 2.11 J ng/g Associated samples not provide. The equipment blank detection will be considered during ecological review of the results. The trip blank results were nondetect
	ii.	If yes, are the same compounds also present in the samples? Explain possible data impact.	☐	☐	☒	
B.	Do method blanks for any analyses contain target analytes above the reporting limit?		☒	☐	☐	
	i.	If yes, are the same compounds present in the samples?	☒	☐	☐	
	ii.	Is the amount of target analyte in the method blank more than 1/10th of that in the sample(s)? Explain the possible impact on sample results.	☒	☐	☐	See data qualifications summary for blank detections and qualifications.
C.	Do instrument blanks contain analytes above the reporting limit?		☐	☐	☒	

4. Surrogates or organic analysis

Question		Yes	No	N/A	Comments
A.	Are the lab recovery limits for surrogates specified on the report?	☒	☐	☐	MPCA limits used: 50% to 200%
B.	Are the surrogates outside lab QC limits? (These should have a data qualifier.)	☒	☐	☐	

	i.	If yes, are the surrogates above the lab QC limits?	☒	☐	☐	
	ii.	Below the lab QC limits?	☒	☐	☐	
	iii.	Were the affected samples re-analyzed? Discuss in the case narrative.	☐	☒	☐	
	iv.	Explain what this could mean for the affected samples. Include in narrative.	☒	☐	☐	See data qualifications summary for exceedances and qualifications. Twenty-eight results were rejected (R) due to a severely low labeled analog recovery.

5. Laboratory control sample/Laboratory control sample duplicate (LCS/LCSD)

Question			Yes	No	N/A	Comments
A.	Are there LCS/LCSD samples present for the reporting analyses?		☒	☐	☐	
B.	Are there LCS/LCSD compounds outside lab limits? If the LCS/LCSD fails, the LCS/LCSD and samples must be re-analyzed.		☒	☐	☐	MPCA PFAS other limits used: 50% to 150%.
	i.	If yes, are there compounds above the lab QC limits? If yes, an explanation is required. Include in narrative.	☒	☐	☐	See data qualifications summary for exceedances. No qualifiers.
	ii.	Below the QC limits? If yes, an explanation is required. Include in narrative.	☐	☒	☐	

6. Matrix spike/Matrix spike duplicate/Sample duplicate (MS/MSD/DUP)

Question				Yes	No	N/A	Comments
A.	Do the analytical methods used require an MS and/or MSD? If no, skip to 6.B.			☒	☐	☐	
	i.	Have the required matrix spikes been prepared and reported?		☐	☒	☐	
	ii.	If no, is there and explanation in the report as to why?		☐	☒	☐	
	iii.	Did the lab process an alternate spiked sample (such as LCSD) instead?		☒	☐	☐	LCSD
	iv.	Are the lab QC limits specified on the report?		☒	☐	☐	
	v.	Are there compounds outside the lab QC limits?		☐	☐	☒	
	vi.	If yes, did the lab re-run an MS/MSD?		☐	☐	☒	
		1.	Did the re-run MS/MSD pass? Discuss the case narrative.	☐	☐	☒	
		2.	Did the re-run MS/MSD fail? Discuss the case narrative.	☐	☐	☒	

		3.	Is the source sample also flagged for MS/MSD compounds outside the lab QC limits?	☐	☐	☒	
B.	Was a duplicate sample submitted for the analytical method(s)?			☒	☐	☐	LCSD
	i.		Is the Relative Percentage Difference (RPD) within 20%* for the duplicate pair? If no, explain possible causes and data impact. **Other RPDs may be acceptable. Check with regulatory agency.*	☒	☐	☐	MPCA limit: 50% RPD for tissue (other)

7. Method detection limits/Report limits

Question		Yes	No	N/A	Comments
A.	Are reporting limits clearly listed on the report for all analyses?	☒	☐	☐	
B.	Do the reporting limits meet the program required limits listed? If not, an explanation is required.	☒	☐	☐	Laboratory J flags indicating a concentration less than limit of quantification are to be retained during reporting.

8. Sample information

Questions		Yes	No	N/A	Comments
A.	Are sample numbers cross-referenced correctly with the associated QC?	☒	☐	☐	
B.	Are soil samples reported in dry weight basis?	☐	☐	☒	
C.	Are percent moisture results reported?	☐	☐	☒	
D.	Are positive detections reported?	☒	☐	☐	
E.	Are sample analytes appropriately flagged if the QC failed?	☒	☐	☐	

9. Report narrative

Question		Yes	No	N/A	Comments
A.	Is a narrative provided with the laboratory report which describes all problems with the analyses and all corrective actions taken to address these problems?	☒	☐	☐	

10. Additional comments about the lab report

Reviewed using MPCA Guidance on Perfluorochemicals Analysis (July 2020).

See attachment for qualification.

Twenty-eight results were rejected (R) due to a severely low labeled analog recovery.

Certification

By typing my name below, I certify the above statements to be true and correct, to the best of my knowledge, and that this information can be used for the purpose of processing this form.

Authorized Representative

Name: Lisa Smith Title: Environmental Chemist (CEAC)

(This document has been electronically signed.) Date (mm/dd/yyyy): 1/16/2021

Data Validation Qualifications for DPWG74772

Calibration (Section 2): Calibration noncompliances are summarized below.

Calibration Date	Analyte	%R	%R Limit	Qualifiers
12-Nov-2020 14:32	NFDHA	144	70-130	Associated results were nondetect. No qualifiers.
12-Nov-2020 19:58	NFDHA	143	70-130	
12-Nov-2020 19:58	NFDHA	143	70-130	
01-Dec-2020 16:57	NFDHA	60.7	70-130	Results qualified UJ: WL16-AMPH-01-092320 (L33792-16 N)

Method blank detections (Section 3Bii): Detects within 10 times the method blank concentrations were qualified B.

Blank Sample ID	Analyte	Concentration (ng/g)	Results Qualified B
WG74160-101	PFUnA	0.118 J	WL10A-AMPH-01-092120 (L33792-14) WL13-AMPH-ONE-01-092320 (L33792-15) WL16-AMPH-01-092320 (L33792-16 N) WL13-AMPH-TWO-01-092320 (L33808-4) EP17C-SNAIL-ONE-01-092420 (L33808-5) RC21A-CRAY-ONE-01-092120 (L33808-6) RC21A-CRAY-THREE-01-092120 (L33808-7) EP4-CRAY-ONE-01-092320 (L33808-8) EP17A-FORE-COMP-ONE-01-091920 (L33808-9) EP4-SNAIL-COMP-TWO-01-092420 (L33808-10) RC3A-AMPH-COMP-TWO-01-092420 (L33808-11)
	PFTrDA	0.122 J	WL10A-AMPH-01-092120 (L33792-14) WL13-AMPH-ONE-01-092320 (L33792-15) WL16-AMPH-01-092320 (L33792-16 N) EP9A-PRED-WHO-FIVE-01-091820 (L33808-1) BP1-PRED-PART-TWO-01-092020 (L33808-2) EP9A-PRED-WHO-SIX-01-091820 (L33808-3 N2i) WL13-AMPH-TWO-01-092320 (L33808-4) RC21A-CRAY-ONE-01-092120 (L33808-6) RC21A-CRAY-THREE-01-092120 (L33808-7) EP17A-FORE-COMP-ONE-01-091920 (L33808-9) RC3A-AMPH-COMP-TWO-01-092420 (L33808-11) EP9A-PRED-PART-TWO-01-091820 (L33808-12)
	PFOS	0.147 J	EQ-CATFOOD-01-100520 (L33799-1)
	PFOSA	0.106 J	WL13-AMPH-ONE-01-092320 (L33792-15) EP9A-PRED-WHO-FIVE-01-091820 (L33808-1) BP1-PRED-PART-TWO-01-092020 (L33808-2) EP9A-PRED-WHO-SIX-01-091820 (L33808-3 N2i) WL13-AMPH-TWO-01-092320 (L33808-4) EP9A-PRED-PART-TWO-01-091820 (L33808-12)

Labeled Analogs - surrogates (Section 4Bii): Results associated with low recoveries were qualified as estimated (UJ and J+), and detects associated with high recoveries were qualified as estimated biased low (J-), as these labeled analogs are used to quantitate the analyte of interest and an inverse relationship exists. Twenty-eight results were rejected (R) due to severely low labeled analog recoveries.

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
WL10A-AMPH-01-092120	L33792-14	D5-N-EtFOSA	14.6	R
WL10A-AMPH-01-092120	L33792-14	d7-NMe-FOSE	39.7	UJ
WL10A-AMPH-01-092120	L33792-14	d9-NEt-FOSE	4.77	R
WL13-AMPH-ONE-01-092320	L33792-15	13C2-PFTeDA	36.8	UJ
WL13-AMPH-ONE-01-092320	L33792-15	13C2-4:2 FTS	224	No Qualifier
WL13-AMPH-ONE-01-092320	L33792-15	13C2-6:2 FTS	213	No Qualifier
WL13-AMPH-ONE-01-092320	L33792-15	13C2-8:2 FTS	227	No Qualifier
WL13-AMPH-ONE-01-092320	L33792-15	D3-N-MeFOSA	21.6	UJ
WL13-AMPH-ONE-01-092320	L33792-15	D5-N-EtFOSA	17.1	R
WL13-AMPH-ONE-01-092320	L33792-15	d7-NMe-FOSE	2.29	R
WL13-AMPH-ONE-01-092320	L33792-15	d9-NEt-FOSE	9.45	R
WL16-AMPH-01-092320	L33792-16 N	D5-N-EtFOSA	17.1	R
WL16-AMPH-01-092320	L33792-16 N	d7-NMe-FOSE	25.2	UJ
WL16-AMPH-01-092320	L33792-16 N	d9-NEt-FOSE	6.64	R
EQ-CATFOOD-01-100520	L33799-1	D5-N-EtFOSA	14.8	R
EQ-CATFOOD-01-100520	L33799-1	d7-NMe-FOSE	26.7	UJ
EQ-CATFOOD-01-100520	L33799-1	d9-NEt-FOSE	17.9	R
EP9A-PRED-WHO-FIVE-01-091820	L33808-1	13C2-PFTeDA	18.5	R
EP9A-PRED-WHO-FIVE-01-091820	L33808-1	13C2-4:2 FTS	211	No Qualifier
EP9A-PRED-WHO-FIVE-01-091820	L33808-1	D3-N-MeFOSA	29.8	UJ
EP9A-PRED-WHO-FIVE-01-091820	L33808-1	D5-N-EtFOSA	14.9	R
EP9A-PRED-WHO-FIVE-01-091820	L33808-1	D5-EtFOSAA	215	J-
EP9A-PRED-WHO-FIVE-01-091820	L33808-1	d7-NMe-FOSE	1.36	R
EP9A-PRED-WHO-FIVE-01-091820	L33808-1	d9-NEt-FOSE	6.78	R
EP9A-PRED-WHO-FIVE-01-091820	L33808-1	13C3-HFPO-DA	24.3	UJ
BP1-PRED-PART-TWO-01-092020	L33808-2	13C2-4:2 FTS	219	No Qualifier
BP1-PRED-PART-TWO-01-092020	L33808-2	D3-N-MeFOSA	28.3	UJ
BP1-PRED-PART-TWO-01-092020	L33808-2	D5-N-EtFOSA	24.9	UJ
BP1-PRED-PART-TWO-01-092020	L33808-2	d7-NMe-FOSE	5.76	R
BP1-PRED-PART-TWO-01-092020	L33808-2	d9-NEt-FOSE	6.10	R
EP9A-PRED-WHO-SIX-01-091820	L33808-3 N2i	D5-N-EtFOSA	46.6	UJ
EP9A-PRED-WHO-SIX-01-091820	L33808-3 N2i	d7-NMe-FOSE	9.01	R
EP9A-PRED-WHO-SIX-01-091820	L33808-3 N2i	d9-NEt-FOSE	25.4	UJ
EP9A-PRED-WHO-SIX-01-091820	L33808-3 N2i	13C3-HFPO-DA	29.5	UJ
WL13-AMPH-TWO-01-092320	L33808-4	13C2-4:2 FTS	227	No Qualifier

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
WL13-AMPH-TWO-01-092320	L33808-4	13C2-6:2 FTS	221	No Qualifier
WL13-AMPH-TWO-01-092320	L33808-4	13C2-8:2 FTS	233	No Qualifier
WL13-AMPH-TWO-01-092320	L33808-4	D3-N-MeFOSA	32.2	UJ
WL13-AMPH-TWO-01-092320	L33808-4	D5-N-EtFOSA	43.9	UJ
WL13-AMPH-TWO-01-092320	L33808-4	d7-NMe-FOSE	11.3	R
WL13-AMPH-TWO-01-092320	L33808-4	d9-NEt-FOSE	16.0	R
EP17C-SNAIL-ONE-01-092420	L33808-5	13C2-PFTeDA	41.4	J+
EP17C-SNAIL-ONE-01-092420	L33808-5	D3-N-MeFOSA	28.6	UJ
EP17C-SNAIL-ONE-01-092420	L33808-5	D5-N-EtFOSA	33.5	UJ
EP17C-SNAIL-ONE-01-092420	L33808-5	d7-NMe-FOSE	29.3	UJ
EP17C-SNAIL-ONE-01-092420	L33808-5	d9-NEt-FOSE	10.5	R
RC21A-CRAY-ONE-01-092120	L33808-6	13C2-PFTeDA	30.6	J+
RC21A-CRAY-ONE-01-092120	L33808-6	D3-N-MeFOSA	26.2	UJ
RC21A-CRAY-ONE-01-092120	L33808-6	D5-N-EtFOSA	32.0	UJ
RC21A-CRAY-ONE-01-092120	L33808-6	d7-NMe-FOSE	32.7	UJ
RC21A-CRAY-ONE-01-092120	L33808-6	d9-NEt-FOSE	17.2	R
RC21A-CRAY-THREE-01-092120	L33808-7	D3-N-MeFOSA	46.5	UJ
RC21A-CRAY-THREE-01-092120	L33808-7	D5-N-EtFOSA	13.5	R
RC21A-CRAY-THREE-01-092120	L33808-7	d7-NMe-FOSE	25.2	UJ
RC21A-CRAY-THREE-01-092120	L33808-7	d9-NEt-FOSE	13.0	R
EP4-CRAY-ONE-01-092320	L33808-8	13C2-PFTeDA	49.2	UJ
EP4-CRAY-ONE-01-092320	L33808-8	D3-N-MeFOSA	37.2	UJ
EP4-CRAY-ONE-01-092320	L33808-8	D5-N-EtFOSA	41.4	UJ
EP4-CRAY-ONE-01-092320	L33808-8	d7-NMe-FOSE	27.3	UJ
EP4-CRAY-ONE-01-092320	L33808-8	d9-NEt-FOSE	10.6	R
EP17A-FORE-COMP-ONE-01-091920	L33808-9	13C2-PFTeDA	44.0	J+
EP17A-FORE-COMP-ONE-01-091920	L33808-9	13C2-4:2 FTS	201	No Qualifier
EP17A-FORE-COMP-ONE-01-091920	L33808-9	D3-N-MeFOSA	34.6	UJ
EP17A-FORE-COMP-ONE-01-091920	L33808-9	D5-N-EtFOSA	32.5	UJ
EP17A-FORE-COMP-ONE-01-091920	L33808-9	d7-NMe-FOSE	23.2	UJ
EP17A-FORE-COMP-ONE-01-091920	L33808-9	d9-NEt-FOSE	13.6	R
EP4-SNAIL-COMP-TWO-01-092420	L33808-10	D3-N-MeFOSA	32.2	UJ
EP4-SNAIL-COMP-TWO-01-092420	L33808-10	D5-N-EtFOSA	42.0	UJ
EP4-SNAIL-COMP-TWO-01-092420	L33808-10	d7-NMe-FOSE	38.6	UJ
EP4-SNAIL-COMP-TWO-01-092420	L33808-10	d9-NEt-FOSE	9.06	R

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
RC3A-AMPH-COMP-TWO-01-092420	L33808-11	13C2-4:2 FTS	208	No Qualifier
RC3A-AMPH-COMP-TWO-01-092420	L33808-11	13C2-6:2 FTS	228	No Qualifier
RC3A-AMPH-COMP-TWO-01-092420	L33808-11	13C2-8:2 FTS	248	No Qualifier
RC3A-AMPH-COMP-TWO-01-092420	L33808-11	D3-N-MeFOSA	46.1	UJ
RC3A-AMPH-COMP-TWO-01-092420	L33808-11	d7-NMe-FOSE	10.6	R
RC3A-AMPH-COMP-TWO-01-092420	L33808-11	d9-NEt-FOSE	14.8	R
EP9A-PRED-PART-TWO-01-091820	L33808-12	D5-N-EtFOSA	39.6	UJ
EP9A-PRED-PART-TWO-01-091820	L33808-12	D5-EtFOSAA	216	J-
EP9A-PRED-PART-TWO-01-091820	L33808-12	d7-NMe-FOSE	9.65	R
EP9A-PRED-PART-TWO-01-091820	L33808-12	d9-NEt-FOSE	38.9	UJ
EP9A-PRED-PART-TWO-01-091820	L33808-12	13C3-HFPO-DA	21.4	UJ

Laboratory control sample/Laboratory control sample duplicate (Section 5Bi): Results associated with high recoveries were nondetect and were acceptable without qualification.

LCS/LCSD IDs	Compound	LCS/LCSD %Recovery	Recovery Limits	Qualifiers
WG74160-102 (A)/ WG74160-103 (DUP WG74160-102)	5:3 FTCA	**160/161**	50-150	Associated results were nondetect. No qualifiers.
	N-MeFOSE	**183/206**	50-150	

Bold indicates an exceedance

10. Additional comments about lab report: For the results listed below, the peak was detected; however, it did not meet quantification criteria. These results were reported as maximum possible concentration and qualified as estimated (J):

Sample ID	Lab ID	Analyte
WL10A-AMPH-01-092120	L33792-14	N-EtFOSE
WL13-AMPH-ONE-01-092320	L33792-15	PFNA
WL13-AMPH-ONE-01-092320	L33792-15	PFTrDA
WL16-AMPH-01-092320	L33792-16 N	PFUnA
WL16-AMPH-01-092320	L33792-16 N	N-EtFOSE
EP9A-PRED-WHO-FIVE-01-091820	L33808-1	EtFOSAA
EP9A-PRED-WHO-FIVE-01-091820	L33808-1	N-EtFOSE
BP1-PRED-PART-TWO-01-092020	L33808-2	N-EtFOSE
WL13-AMPH-TWO-01-092320	L33808-4	EtFOSAA
EP4-SNAIL-COMP-TWO-01-092420	L33808-10	PFUnA
RC3A-AMPH-COMP-TWO-01-092420	L33808-11	PFNA

Sample ID	Lab ID	Analyte
RC3A-AMPH-COMP-TWO-01-092420	L33808-11	N-EtFOSE
EP9A-PRED-PART-TWO-01-091820	L33808-12	EtFOSAA

Any R qualifiers take precedence over other qualifiers.

MINNESOTA

Minnesota Department of Agriculture 651-201-6148
Minnesota Department of Health 651-201-5357
Minnesota Pollution Control Agency 651-757-2560

Laboratory data review checklist

Doc Type: Data Review

Instructions: The following is the informal checklist that should be used to review data for the Minnesota Department of Agriculture, Minnesota Pollution Control Agency, and Minnesota Department of Health. The information follows the general format of the National Functional Guidelines, which is the primary data review tool used in the U.S. Environmental Protection Agency's Contract Laboratory Program for Superfund analytical work. Refer to the appropriate guidance document for each agency for instructions.

Project information

Project name: Project 1007

Work order number/Lab report ID: DPWG74773 Report date (mm/dd/yyyy): 12/16/2020

Laboratory: SGS AXYS Review date (mm/dd/yyyy): 1/17/2021

1. Chain of custody, preservation, and holding times

	Questions	Yes	No	N/A	Comments
A.	Is there a chain of custody (COC) with the report?	☒	☐	☐	Additional samples (not reported in this SDG) were listed on the COCs.
B.	Is there a sample condition form with the report?	☒	☐	☐	
C.	Were there samples preserved according to program requirements?	☒	☐	☐	
D.	Were samples received in the correct containers?	☒	☐	☐	
	i. Was there enough sample volume/weight to complete all requested analyses?	☒	☐	☐	
	ii. Was there enough sample collected to complete required batch QC?	☒	☐	☐	
E.	Were samples received within holding time for sample prep for all requested analyses?	☒	☐	☐	
F.	Are there notes about sample condition or holding time issues on the COC? Explain the data impact.	☐	☒	☐	
G.	Are there narration or data qualifiers with the report about sample condition or holding time issues? Explain the data impact.	☐	☒	☐	
H.	Are lab IDs cross-referenced correctly with the field IDs.	☒	☐	☐	

2. Calibration

Question		Yes	No	N/A	Comments
A.	Do the report narrative or data qualifiers indicate calibration problems for any analyses? If yes, explain the data impact.	☒	☐	☐	MN limits used. ICAL, ICV and CCV reviewed. See data qualifications summary for exceedances. No qualifiers.

3. Blanks

Question			Yes	No	N/A	Comments
A.	Do any of the analyses contain samples for field or trip blanks?		☐	☒	☐	
	i.	If yes, are there target analytes present above the reporting limit in the blanks?	☐	☐	☒	
	ii.	If yes, are the same compounds also present in the samples? Explain possible data impact.	☐	☐	☒	
B.	Do method blanks for any analyses contain target analytes above the reporting limit?		☒	☐	☐	
	i.	If yes, are the same compounds present in the samples?	☒	☐	☐	
	ii.	Is the amount of target analyte in the method blank more than 1/10th of that in the sample(s)? Explain the possible impact on sample results.	☒	☐	☐	See data qualifications summary for blank detections and qualifications.
C.	Do instrument blanks contain analytes above the reporting limit?		☐	☐	☒	

4. Surrogates or organic analysis

Question			Yes	No	N/A	Comments
A.	Are the lab recovery limits for surrogates specified on the report?		☒	☐	☐	MPCA limits used: 50% to 200%
B.	Are the surrogates outside lab QC limits? (These should have a data qualifier.)		☒	☐	☐	
	i.	If yes, are the surrogates above the lab QC limits?	☒	☐	☐	
	ii.	Below the lab QC limits?	☒	☐	☐	
	iii.	Were the affected samples re-analyzed? Discuss in the case narrative.	☐	☒	☐	
	iv.	Explain what this could mean for the affected samples. Include in narrative.	☒	☐	☐	See data qualifications summary for exceedances and qualifications. Thirty-six results were rejected (R) due to a severely low labeled analog recovery.

5. Laboratory control sample/Laboratory control sample duplicate (LCS/LCSD)

Question			Yes	No	N/A	Comments
A.	Are there LCS/LCSD samples present for the reporting analyses?		☒	☐	☐	
B.	Are there LCS/LCSD compounds outside lab limits? If the LCS/LCSD fails, the LCS/LCSD and samples must be re-analyzed.		☒	☐	☐	MPCA PFAS other limits used: 50% to 150%.
	i.	If yes, are there compounds above the lab QC limits? If yes, an explanation is required. Include in narrative.	☒	☐	☐	See data qualifications summary for exceedances. No qualifiers.
	ii.	Below the QC limits? If yes, an explanation is required. Include in narrative.	☐	☒	☐	

6. Matrix spike/Matrix spike duplicate/Sample duplicate (MS/MSD/DUP)

Question				Yes	No	N/A	Comments
A.	Do the analytical methods used require an MS and/or MSD? If no, skip to 6.B.			☒	☐	☐	
	i.	Have the required matrix spikes been prepared and reported?		☐	☒	☐	
	ii.	If no, is there and explanation in the report as to why?		☐	☒	☐	
	iii.	Did the lab process an alternate spiked sample (such as LCSD) instead?		☒	☐	☐	LCSD
	iv.	Are the lab QC limits specified on the report?		☒	☐	☐	
	v.	Are there compounds outside the lab QC limits?		☐	☐	☒	
	vi.	If yes, did the lab re-run an MS/MSD?		☐	☐	☒	
		1.	Did the re-run MS/MSD pass? Discuss the case narrative.	☐	☐	☒	
		2.	Did the re-run MS/MSD fail? Discuss the case narrative.	☐	☐	☒	
		3.	Is the source sample also flagged for MS/MSD compounds outside the lab QC limits?	☐	☐	☒	
B.	Was a duplicate sample submitted for the analytical method(s)?			☒	☐	☐	LCSD
	i.	Is the Relative Percentage Difference (RPD) within 20%* for the duplicate pair? If no, explain possible causes and data impact. **Other RPDs may be acceptable. Check with regulatory agency.*		☒	☐	☐	MPCA limit: 50% RPD for tissue (other)

7. Method detection limits/Report limits

Question		Yes	No	N/A	Comments
A.	Are reporting limits clearly listed on the report for all analyses?	☒	☐	☐	
B.	Do the reporting limits meet the program required limits listed? If not, an explanation is required.	☒	☐	☐	Laboratory J flags indicating a concentration less than limit of quantification are to be retained during reporting.

8. Sample information

Questions		Yes	No	N/A	Comments
A.	Are sample numbers cross-referenced correctly with the associated QC?	☒	☐	☐	
B.	Are soil samples reported in dry weight basis?	☐	☐	☒	
C.	Are percent moisture results reported?	☐	☐	☒	
D.	Are positive detections reported?	☒	☐	☐	
E.	Are sample analytes appropriately flagged if the QC failed?	☒	☐	☐	

9. Report narrative

Question		Yes	No	N/A	Comments
A.	Is a narrative provided with the laboratory report which describes all problems with the analyses and all corrective actions taken to address these problems?	☒	☐	☐	Samples WL7-CRAY-TWO-01-092320, WL7-CRAY-FOUR-01-092320 and WL11-CRAY-01-092120 (SGS AXYS ID: L33788-28, -30 and -35, respectively) were instrumentally re-analyzed for possible sample carry-over impact on PFBA results. The re-analysis data confirmed that the analyte results for PFBA were affected and the results for PFBA were reported from the re-analysis data

10. Additional comments about the lab report

Reviewed using MPCA Guidance on Perfluorochemicals Analysis (July 2020).

See attachment for qualification.

Thirty-six results were rejected (R) due to a severely low labeled analog recovery.

Certification

By typing my name below, I certify the above statements to be true and correct, to the best of my knowledge, and that this information can be used for the purpose of processing this form.

Authorized Representative

Name: Lisa Smith Title: Environmental Chemist (CEAC)

(This document has been electronically signed.) Date (mm/dd/yyyy): 1/17/2021

Data Validation Qualifications for DPWG74773

Calibration (Section 2): Calibration noncompliances are summarized below.

Calibration Date	Analyte	%R	%R Limit	Qualifiers
08-Nov-2020 8:46	NFDHA	136	70-130	Associated results were nondetect. No qualifiers.
27-Nov-2020 18:58	3:3 FTCA	0.6	70-130	Only PFBA reported from 11/27/20.
	PFMPA	0.0	70-130	
27-Nov-2020 22:53	11Cl-PF3OUdS	0.0	70-130	
	3:3 FTCA	0.1	70-130	
	PFHpS	0.0	70-130	
	PFNA	69.3	70-130	

Method blank detections (Section 3Bii): Detects within 10 times the method blank concentrations were qualified B.

Blank Sample ID	Analyte	Concentration (ng/g)	Results Qualified B
WG74158-101	PFBA	0.612 J	RC17-CRAY-ONE-01-091920 (L33788-16) RC17A-CRAY-01-092120 (L33788-17) EP17C-CRAY-01-092420 (L33788-18) EP26A-CRAY-ONE-01-092520 (L33788-19) EP26A-CRAY-TWO-01-092520 (L33788-20) EP27B-CRAY-ONE-01-092420 (L33788-21) EP27B-CRAY-TWO-01-092420 (L33788-22) EP4-CRAY-TWO-01-092320 (L33788-23) EP5-CRAY-ONE-01-092420 (L33788-24) WL5-CRAY-01-091720 (L33788-25) WL7-CRAY-ONE-01-092320 (L33788-27) WL7-CRAY-TWO-01-092320 (L33788-28 i) WL7-CRAY-FOUR-01-092320 (L33788-30 i) WL8A-CRAY-01-092120 (L33788-31) WL10-CRAY-ONE-01-092120 (L33788-32) WL10-CRAY-TWO-01-092120 (L33788-33) WL10-CRAY-THREE-01-092120 (L33788-34) WL11-CRAY-01-092120 (L33788-35 i)
	PFUnA	0.135 J	All PFUnA sample results were qualified B.
	PFTrDA	0.198 J	RC17-CRAY-ONE-01-091920 (L33788-16) RC17A-CRAY-01-092120 (L33788-17) WL5-CRAY-01-091720 (L33788-25) WL7-CRAY-ONE-01-092320 (L33788-27) WL7-CRAY-TWO-01-092320 (L33788-28 i) WL7-CRAY-THREE-01-092320 (L33788-29) WL7-CRAY-FOUR-01-092320 (L33788-30 i) WL8A-CRAY-01-092120 (L33788-31) WL10-CRAY-THREE-01-092120 (L33788-34) WL11-CRAY-01-092120 (L33788-35 i)
	PFOS	0.142 J	Sample concentrations were greater than ten times the blank concentration. No qualifiers.

Blank Sample ID	Analyte	Concentration (ng/g)	Results Qualified B
	PFOSA	0.111 J	WL6-CRAY-01-092320 (L33788-26) WL7-CRAY-ONE-01-092320 (L33788-27) WL7-CRAY-TWO-01-092320 (L33788-28 i) WL8A-CRAY-01-092120 (L33788-31) WL10-CRAY-ONE-01-092120 (L33788-32) WL10-CRAY-TWO-01-092120 (L33788-33) WL10-CRAY-THREE-01-092120 (L33788-34) WL11-CRAY-01-092120 (L33788-35 i)

Labeled Analogs - surrogates (Section 4Bii): Results associated with low recoveries were qualified as estimated (UJ and J+), and detects associated with high recoveries were qualified as estimated biased low (J-), as these labeled analogs are used to quantitate the analyte of interest and an inverse relationship exists. Thirty-six results were rejected (R) due to severely low labeled analog recoveries.

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
RC17-CRAY-ONE-01-091920	L33788-16	D3-N-MeFOSA	47.0	UJ
RC17-CRAY-ONE-01-091920	L33788-16	D5-N-EtFOSA	12.8	R
RC17-CRAY-ONE-01-091920	L33788-16	d7-NMe-FOSE	7.85	R
RC17-CRAY-ONE-01-091920	L33788-16	d9-NEt-FOSE	14.2	R
RC17A-CRAY-01-092120	L33788-17	D3-N-MeFOSA	40.0	UJ
RC17A-CRAY-01-092120	L33788-17	D5-N-EtFOSA	8.95	R
RC17A-CRAY-01-092120	L33788-17	d7-NMe-FOSE	10.0	R
RC17A-CRAY-01-092120	L33788-17	d9-NEt-FOSE	7.54	R
RC17A-CRAY-01-092120	L33788-17	13C3-HFPO-DA	18.1	R
EP17C-CRAY-01-092420	L33788-18	D3-N-MeFOSA	4.39	R
EP17C-CRAY-01-092420	L33788-18	D5-N-EtFOSA	4.99	R
EP17C-CRAY-01-092420	L33788-18	d7-NMe-FOSE	33.2	UJ
EP17C-CRAY-01-092420	L33788-18	d9-NEt-FOSE	12.8	R
EP26A-CRAY-ONE-01-092520	L33788-19	D5-N-EtFOSA	21.9	UJ
EP26A-CRAY-ONE-01-092520	L33788-19	d7-NMe-FOSE	17.4	R
EP26A-CRAY-ONE-01-092520	L33788-19	d9-NEt-FOSE	16.8	R
EP26A-CRAY-TWO-01-092520	L33788-20	D3-N-MeFOSA	31.3	UJ
EP26A-CRAY-TWO-01-092520	L33788-20	D5-N-EtFOSA	35.2	UJ
EP26A-CRAY-TWO-01-092520	L33788-20	d7-NMe-FOSE	24.6	UJ
EP26A-CRAY-TWO-01-092520	L33788-20	d9-NEt-FOSE	6.65	R
EP27B-CRAY-ONE-01-092420	L33788-21	D3-N-MeFOSA	47.5	UJ
EP27B-CRAY-ONE-01-092420	L33788-21	d7-NMe-FOSE	36.1	UJ
EP27B-CRAY-ONE-01-092420	L33788-21	d9-NEt-FOSE	12.3	R
EP27B-CRAY-TWO-01-092420	L33788-22	D5-N-EtFOSA	26.3	UJ
EP27B-CRAY-TWO-01-092420	L33788-22	d7-NMe-FOSE	16.5	R

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
EP27B-CRAY-TWO-01-092420	L33788-22	d9-NEt-FOSE	19.6	R
EP4-CRAY-TWO-01-092320	L33788-23	13C2-PFTeDA	45.2	UJ
EP4-CRAY-TWO-01-092320	L33788-23	D3-N-MeFOSA	33.4	UJ
EP4-CRAY-TWO-01-092320	L33788-23	D5-N-EtFOSA	36.2	UJ
EP4-CRAY-TWO-01-092320	L33788-23	d7-NMe-FOSE	37.6	UJ
EP4-CRAY-TWO-01-092320	L33788-23	d9-NEt-FOSE	16.3	R
EP5-CRAY-ONE-01-092420	L33788-24	D3-N-MeFOSA	42.4	UJ
EP5-CRAY-ONE-01-092420	L33788-24	d7-NMe-FOSE	35.9	UJ
EP5-CRAY-ONE-01-092420	L33788-24	d9-NEt-FOSE	11.0	R
WL5-CRAY-01-091720	L33788-25	13C2-PFTeDA	46.1	J+
WL5-CRAY-01-091720	L33788-25	D3-N-MeFOSA	43.2	UJ
WL5-CRAY-01-091720	L33788-25	D5-N-EtFOSA	46.5	UJ
WL5-CRAY-01-091720	L33788-25	d7-NMe-FOSE	33.2	UJ
WL5-CRAY-01-091720	L33788-25	d9-NEt-FOSE	8.91	R
WL6-CRAY-01-092320	L33788-26	D3-N-MeFOSA	28.1	UJ
WL6-CRAY-01-092320	L33788-26	D5-N-EtFOSA	28.6	UJ
WL6-CRAY-01-092320	L33788-26	d7-NMe-FOSE	4.23	R
WL6-CRAY-01-092320	L33788-26	d9-NEt-FOSE	11.0	R
WL7-CRAY-ONE-01-092320	L33788-27	D3-N-MeFOSA	38.2	UJ
WL7-CRAY-ONE-01-092320	L33788-27	D5-N-EtFOSA	21.9	UJ
WL7-CRAY-ONE-01-092320	L33788-27	d7-NMe-FOSE	9.90	R
WL7-CRAY-ONE-01-092320	L33788-27	d9-NEt-FOSE	8.59	R
WL7-CRAY-TWO-01-092320	L33788-28 i	D3-N-MeFOSA	42.6	UJ
WL7-CRAY-TWO-01-092320	L33788-28 i	d7-NMe-FOSE	24.8	UJ
WL7-CRAY-TWO-01-092320	L33788-28 i	d9-NEt-FOSE	9.36	R
WL7-CRAY-THREE-01-092320	L33788-29	13C5-PFPeA	237	No Qualifier
WL7-CRAY-THREE-01-092320	L33788-29	13C2-PFTeDA	44.1	UJ
WL7-CRAY-THREE-01-092320	L33788-29	D3-N-MeFOSA	36.6	UJ
WL7-CRAY-THREE-01-092320	L33788-29	D5-N-EtFOSA	36.0	UJ
WL7-CRAY-THREE-01-092320	L33788-29	d7-NMe-FOSE	15.0	R
WL7-CRAY-THREE-01-092320	L33788-29	d9-NEt-FOSE	9.21	R
WL7-CRAY-FOUR-01-092320	L33788-30 i	D3-N-MeFOSA	25.8	UJ
WL7-CRAY-FOUR-01-092320	L33788-30 i	D5-N-EtFOSA	20.1	UJ
WL7-CRAY-FOUR-01-092320	L33788-30 i	d7-NMe-FOSE	4.68	R
WL7-CRAY-FOUR-01-092320	L33788-30 i	d9-NEt-FOSE	6.86	R
WL8A-CRAY-01-092120	L33788-31	D3-N-MeFOSA	45.0	UJ
WL8A-CRAY-01-092120	L33788-31	d7-NMe-FOSE	10.6	R
WL8A-CRAY-01-092120	L33788-31	d9-NEt-FOSE	13.8	R

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
WL10-CRAY-ONE-01-092120	L33788-32	D3-N-MeFOSA	41.7	UJ
WL10-CRAY-ONE-01-092120	L33788-32	D5-N-EtFOSA	45.0	UJ
WL10-CRAY-ONE-01-092120	L33788-32	d7-NMe-FOSE	31.8	UJ
WL10-CRAY-ONE-01-092120	L33788-32	d9-NEt-FOSE	12.3	R
WL10-CRAY-ONE-01-092120	L33788-32	13C3-HFPO-DA	27.6	UJ
WL10-CRAY-TWO-01-092120	L33788-33	D3-N-MeFOSA	43.5	UJ
WL10-CRAY-TWO-01-092120	L33788-33	D5-N-EtFOSA	41.9	UJ
WL10-CRAY-TWO-01-092120	L33788-33	d7-NMe-FOSE	23.2	UJ
WL10-CRAY-TWO-01-092120	L33788-33	d9-NEt-FOSE	11.2	R
WL10-CRAY-THREE-01-092120	L33788-34	D3-N-MeFOSA	36.5	UJ
WL10-CRAY-THREE-01-092120	L33788-34	D5-N-EtFOSA	25.1	UJ
WL10-CRAY-THREE-01-092120	L33788-34	d7-NMe-FOSE	4.78	R
WL10-CRAY-THREE-01-092120	L33788-34	d9-NEt-FOSE	8.02	R
WL10-CRAY-THREE-01-092120	L33788-34	13C3-HFPO-DA	32.5	UJ
WL11-CRAY-01-092120	L33788-35 i	D3-N-MeFOSA	38.0	UJ
WL11-CRAY-01-092120	L33788-35 i	D5-N-EtFOSA	39.5	UJ
WL11-CRAY-01-092120	L33788-35 i	d7-NMe-FOSE	7.35	R
WL11-CRAY-01-092120	L33788-35 i	d9-NEt-FOSE	17.1	R

Laboratory control sample/Laboratory control sample duplicate (Section 5Bi): Results associated with high recoveries were nondetect and were acceptable without qualification.

LCS/LCSD IDs	Compound	LCS/LCSD %Recovery	Recovery Limits	Qualifiers
WG74158-102 (A)/ WG74158-103 (DUP WG74158-102)	N-MeFOSE	**156/160**	50-150	Associated results were nondetect. No qualifiers.
	5:3 FTCA	149/**165**	50-150	

Bold indicates an exceedance

10. Additional comments about lab report: For the results listed below, the peak was detected; however, it did not meet quantification criteria. These results were reported as maximum possible concentration and qualified as estimated (J):

Sample ID	Lab ID	Analyte
RC17-CRAY-ONE-01-091920	L33788-16	PFHxS
RC17A-CRAY-01-092120	L33788-17	N-EtFOSE
EP17C-CRAY-01-092420	L33788-18	PFTeDA
EP17C-CRAY-01-092420	L33788-18	PFPeS
EP17C-CRAY-01-092420	L33788-18	EtFOSAA
EP26A-CRAY-ONE-01-092520	L33788-19	PFBS
EP26A-CRAY-ONE-01-092520	L33788-19	PFHxS

Sample ID	Lab ID	Analyte
EP26A-CRAY-TWO-01-092520	L33788-20	N-EtFOSE
EP4-CRAY-TWO-01-092320	L33788-23	EtFOSAA
EP5-CRAY-ONE-01-092420	L33788-24	EtFOSAA
WL5-CRAY-01-091720	L33788-25	PFTeDA
WL5-CRAY-01-091720	L33788-25	N-EtFOSE
WL6-CRAY-01-092320	L33788-26	PFTeDA
WL7-CRAY-ONE-01-092320	L33788-27	EtFOSAA
WL7-CRAY-ONE-01-092320	L33788-27	N-EtFOSE
WL7-CRAY-THREE-01-092320	L33788-29	PFUnA
WL7-CRAY-THREE-01-092320	L33788-29	PFDoA
WL7-CRAY-FOUR-01-092320	L33788-30 i	PFTeDA
WL7-CRAY-FOUR-01-092320	L33788-30 i	EtFOSAA
WL7-CRAY-FOUR-01-092320	L33788-30 i	N-EtFOSE
WL8A-CRAY-01-092120	L33788-31	PFTeDA
WL10-CRAY-TWO-01-092120	L33788-33	PFNA
WL10-CRAY-TWO-01-092120	L33788-33	PFDoA
WL10-CRAY-THREE-01-092120	L33788-34	N-EtFOSE
WL11-CRAY-01-092120	L33788-35 i	PFTrDA
WL11-CRAY-01-092120	L33788-35 i	EtFOSAA

Any R qualifiers take precedence over other qualifiers.

MINNESOTA

Minnesota Department of Agriculture 651-201-6148
Minnesota Department of Health 651-201-5357
Minnesota Pollution Control Agency 651-757-2560

Laboratory data review checklist

Doc Type: Data Review

Instructions: The following is the informal checklist that should be used to review data for the Minnesota Department of Agriculture, Minnesota Pollution Control Agency, and Minnesota Department of Health. The information follows the general format of the National Functional Guidelines, which is the primary data review tool used in the U.S. Environmental Protection Agency's Contract Laboratory Program for Superfund analytical work. Refer to the appropriate guidance document for each agency for instructions.

Project information

Project name: Project 1007

Work order number/Lab report ID: DPWG74774 Report date (mm/dd/yyyy): 12/16/2020

Laboratory: SGS AXYS Review date (mm/dd/yyyy): 1/17/2021

1. Chain of custody, preservation, and holding times

Questions			Yes	No	N/A	Comments
A.	Is there a chain of custody (COC) with the report?		☒	☐	☐	Additional samples (not reported in this SDG) were listed on the COCs.
B.	Is there a sample condition form with the report?		☒	☐	☐	
C.	Were there samples preserved according to program requirements?		☒	☐	☐	
D.	Were samples received in the correct containers?		☒	☐	☐	
	i.	Was there enough sample volume/weight to complete all requested analyses?	☒	☐	☐	
	ii.	Was there enough sample collected to complete required batch QC?	☒	☐	☐	
E.	Were samples received within holding time for sample prep for all requested analyses?		☒	☐	☐	
F.	Are there notes about sample condition or holding time issues on the COC? Explain the data impact.		☐	☒	☐	
G.	Are there narration or data qualifiers with the report about sample condition or holding time issues? Explain the data impact.		☐	☒	☐	Case narrative indicates samples were received at greater than 4 °C. Sample receipt was acceptable since they were received within the MPCA requirement of <6 °C.
H.	Are lab IDs cross-referenced correctly with the field IDs.		☒	☐	☐	The laboratory indicated one sample ID on the COC did not match the sample label. The sample was logged in per COC.

2. Calibration

Question		Yes	No	N/A	Comments
A.	Do the report narrative or data qualifiers indicate calibration problems for any analyses? If yes, explain the data impact.	☒	☐	☐	MN limits used. ICAL, ICV and CCV reviewed. See data qualifications summary for exceedances. No qualifiers.

3. Blanks

Question			Yes	No	N/A	Comments
A.	Do any of the analyses contain samples for field or trip blanks?		☐	☒	☐	
	i.	If yes, are there target analytes present above the reporting limit in the blanks?	☐	☐	☒	
	ii.	If yes, are the same compounds also present in the samples? Explain possible data impact.	☐	☐	☒	
B.	Do method blanks for any analyses contain target analytes above the reporting limit?		☒	☐	☐	
	i.	If yes, are the same compounds present in the samples?	☒	☐	☐	
	ii.	Is the amount of target analyte in the method blank more than 1/10th of that in the sample(s)? Explain the possible impact on sample results.	☒	☐	☐	See data qualifications summary for blank detections and qualifications.
C.	Do instrument blanks contain analytes above the reporting limit?		☐	☐	☒	

4. Surrogates or organic analysis

Question			Yes	No	N/A	Comments
A.	Are the lab recovery limits for surrogates specified on the report?		☒	☐	☐	MPCA limits used: 50% to 200%
B.	Are the surrogates outside lab QC limits? (These should have a data qualifier.)		☒	☐	☐	
	i.	If yes, are the surrogates above the lab QC limits?	☒	☐	☐	
	ii.	Below the lab QC limits?	☒	☐	☐	
	iii.	Were the affected samples re-analyzed? Discuss in the case narrative.	☐	☒	☐	
	iv.	Explain what this could mean for the affected samples. Include in narrative.	☒	☐	☐	See data qualifications summary for exceedances and qualifications. Thirty-three results were rejected (R) due to a severely low labeled analog recovery.

5. Laboratory control sample/Laboratory control sample duplicate (LCS/LCSD)

Question			Yes	No	N/A	Comments
A.	Are there LCS/LCSD samples present for the reporting analyses?		☒	☐	☐	
B.	Are there LCS/LCSD compounds outside lab limits? If the LCS/LCSD fails, the LCS/LCSD and samples must be re-analyzed.		☒	☐	☐	MPCA PFAS other limits used: 50% to 150%.
	i.	If yes, are there compounds above the lab QC limits? If yes, an explanation is required. Include in narrative.	☒	☐	☐	See data qualifications summary for exceedances and qualifications.
	ii.	Below the QC limits? If yes, an explanation is required. Include in narrative.	☐	☒	☐	

6. Matrix spike/Matrix spike duplicate/Sample duplicate (MS/MSD/DUP)

Question				Yes	No	N/A	Comments
A.	Do the analytical methods used require an MS and/or MSD? If no, skip to 6.B.			☒	☐	☐	
	i.	Have the required matrix spikes been prepared and reported?		☐	☒	☐	
	ii.	If no, is there and explanation in the report as to why?		☐	☒	☐	
	iii.	Did the lab process an alternate spiked sample (such as LCSD) instead?		☒	☐	☐	LCSD
	iv.	Are the lab QC limits specified on the report?		☒	☐	☐	
	v.	Are there compounds outside the lab QC limits?		☐	☐	☒	
	vi.	If yes, did the lab re-run an MS/MSD?		☐	☐	☒	
		1.	Did the re-run MS/MSD pass? Discuss the case narrative.	☐	☐	☒	
		2.	Did the re-run MS/MSD fail? Discuss the case narrative.	☐	☐	☒	
		3.	Is the source sample also flagged for MS/MSD compounds outside the lab QC limits?	☐	☐	☒	
B.	Was a duplicate sample submitted for the analytical method(s)?			☒	☐	☐	LCSD
	i.	Is the Relative Percentage Difference (RPD) within 20%* for the duplicate pair? If no, explain possible causes and data impact. **Other RPDs may be acceptable. Check with regulatory agency.*		☐	☒	☐	MPCA limit: 50% RPD for tissue (other) LCSD: See data qualifications summary for exceedances and qualifications.

7. Method detection limits/Report limits

Question		Yes	No	N/A	Comments
A.	Are reporting limits clearly listed on the report for all analyses?	☒	☐	☐	
B.	Do the reporting limits meet the program required limits listed? If not, an explanation is required.	☐	☒	☐	Laboratory J flags indicating a concentration less than limit of quantification are to be retained during reporting. Five samples were analyzed with a sample size less of than 2 grams resulting in elevated reporting limits.

8. Sample information

Questions		Yes	No	N/A	Comments
A.	Are sample numbers cross-referenced correctly with the associated QC?	☒	☐	☐	
B.	Are soil samples reported in dry weight basis?	☐	☐	☒	
C.	Are percent moisture results reported?	☐	☐	☒	
D.	Are positive detections reported?	☒	☐	☐	
E.	Are sample analytes appropriately flagged if the QC failed?	☒	☐	☐	

9. Report narrative

Question		Yes	No	N/A	Comments
A.	Is a narrative provided with the laboratory report which describes all problems with the analyses and all corrective actions taken to address these problems?	☒	☐	☐	

10. Additional comments about the lab report

Reviewed using MPCA Guidance on Perfluorochemicals Analysis (July 2020).

See attachment for qualification.

Thirty-three results were rejected (R) due to a severely low labeled analog recovery.

Certification

By typing my name below, I certify the above statements to be true and correct, to the best of my knowledge, and that this information can be used for the purpose of processing this form.

Authorized Representative

Name: Lisa Smith Title: Environmental Chemist (CEAC)

(This document has been electronically signed.) Date (mm/dd/yyyy): 1/17/2021

Data Validation Qualifications for DPWG74774

Calibration (Section 2): Calibration noncompliances are summarized below.

Calibration Date	Analyte	%R	%R Limit	Qualifiers
13-Nov-2020 12:14	NFDHA	144	70-130	Associated results were nondetect. No qualifiers.
23-Nov-2020 15:58	3:3 FTCA	58.4	70-130	Only PFOS reported from 11/23/20.
	NFDHA	132	70-130	
23-Nov-2020 20:18	3:3 FTCA	0.1	70-130	

Method blank detections (Section 3Bii): Detects within 10 times the method blank concentrations were qualified B.

Blank Sample ID	Analyte	Concentration (ng/g)	Results Qualified B
WG74159-101	PFUnA	0.139 J	All PFUnA sample results were qualified B.
	PFTrDA	0.198 J	RC3A-SNAIL-COMP-01-092420 (L33791-1) RC4A-AMPH-COMP-01-091820 (L33792-1) RC5-AMPH-ONE-01-091820 (L33792-2) RC5-AMPH-TWO-01-092220 (L33792-3) RC6A-AMPH-01-092020 (L33792-4) RC3A-AMPH-COMP-ONE-01-091920 (L33792-5) RC7-AMPH-01-092220 (L33792-6) RC13-AMPH-01-092120 (L33792-7) RC16A-AMPH-01-091920 (L33792-8) RC17A-AMPH-01-092120 (L33792-9) RC18-AMPH-01-091520 (L33792-10) WL2-AMPH-01-092220 (L33792-12) WL8A-AMPH-01-092520 (L33792-13)
	PFOS	0.173 J	Sample concentrations were greater than ten times the blank concentration. No qualifiers.
	PFOSA	0.101 J	RC17A-AMPH-01-092120 (L33792-9) EP19-AMPH-01-091920 (L33792-11) WL8A-AMPH-01-092520 (L33792-13)

Labeled Analogs - surrogates (Section 4Bii): Results associated with low recoveries were qualified as estimated (UJ and J+), and detects associated with high recoveries were qualified as estimated biased low (J-), as these labeled analogs are used to quantitate the analyte of interest and an inverse relationship exists. Thirty-three results were rejected (R) due to severely low labeled analog recoveries.

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
WL14-CRAY-01-092320	L33788-36	13C2-PFTeDA	44.5	UJ
RC3A-SNAIL-COMP-01-092420	L33791-1	13C2-PFTeDA	32.6	J+
RC3A-SNAIL-COMP-01-092420	L33791-1	D3-N-MeFOSA	36.0	UJ
RC3A-SNAIL-COMP-01-092420	L33791-1	D5-N-EtFOSA	32.8	UJ
RC3A-SNAIL-COMP-01-092420	L33791-1	d7-NMe-FOSE	19.2	R

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
RC3A-SNAIL-COMP-01-092420	L33791-1	d9-NEt-FOSE	6.11	R
RC23-SNAIL-COMP-01-092420	L33791-2	13C2-PFTeDA	39.3	UJ
RC23-SNAIL-COMP-01-092420	L33791-2	d7-NMe-FOSE	38.3	UJ
RC23-SNAIL-COMP-01-092420	L33791-2	d9-NEt-FOSE	8.05	R
EP27B-SNAIL-ONE-01-092420	L33791-3	D3-N-MeFOSA	34.8	UJ
EP27B-SNAIL-ONE-01-092420	L33791-3	D5-N-EtFOSA	46.8	UJ
EP27B-SNAIL-ONE-01-092420	L33791-3	d7-NMe-FOSE	38.4	UJ
EP27B-SNAIL-ONE-01-092420	L33791-3	d9-NEt-FOSE	11.2	R
EP27B-SNAIL-TWO-01-092420	L33791-4	D3-N-MeFOSA	38.1	UJ
EP27B-SNAIL-TWO-01-092420	L33791-4	D5-N-EtFOSA	33.1	UJ
EP27B-SNAIL-TWO-01-092420	L33791-4	d7-NMe-FOSE	25.2	UJ
EP27B-SNAIL-TWO-01-092420	L33791-4	d9-NEt-FOSE	12.2	R
EP17C-SNAIL-TWO-01-092420	L33791-5	13C2-PFTeDA	23.8	J+
EP17C-SNAIL-TWO-01-092420	L33791-5	D3-N-MeFOSA	23.8	UJ
EP17C-SNAIL-TWO-01-092420	L33791-5	D5-N-EtFOSA	27.6	UJ
EP17C-SNAIL-TWO-01-092420	L33791-5	d7-NMe-FOSE	24.0	UJ
EP17C-SNAIL-TWO-01-092420	L33791-5	d9-NEt-FOSE	7.46	R
EP4-SNAIL-ONE-01-092420	L33791-6	D3-N-MeFOSA	41.8	UJ
EP4-SNAIL-ONE-01-092420	L33791-6	D5-N-EtFOSA	45.8	UJ
EP4-SNAIL-ONE-01-092420	L33791-6	d7-NMe-FOSE	34.0	UJ
EP4-SNAIL-ONE-01-092420	L33791-6	d9-NEt-FOSE	17.1	R
RC4A-AMPH-COMP-01-091820	L33792-1	13C2-PFTeDA	46.6	J+
RC4A-AMPH-COMP-01-091820	L33792-1	13C2-4:2 FTS	261	No Qualifier
RC4A-AMPH-COMP-01-091820	L33792-1	13C2-6:2 FTS	231	No Qualifier
RC4A-AMPH-COMP-01-091820	L33792-1	13C2-8:2 FTS	231	No Qualifier
RC4A-AMPH-COMP-01-091820	L33792-1	D3-N-MeFOSA	10.1	R
RC4A-AMPH-COMP-01-091820	L33792-1	D5-N-EtFOSA	27.5	UJ
RC4A-AMPH-COMP-01-091820	L33792-1	d7-NMe-FOSE	5.62	R
RC4A-AMPH-COMP-01-091820	L33792-1	d9-NEt-FOSE	5.12	R
RC5-AMPH-ONE-01-091820	L33792-2	13C2-PFTeDA	29.5	J+
RC5-AMPH-ONE-01-091820	L33792-2	D3-N-MeFOSA	30.7	UJ
RC5-AMPH-ONE-01-091820	L33792-2	D5-N-EtFOSA	19.5	R
RC5-AMPH-ONE-01-091820	L33792-2	d7-NMe-FOSE	20.3	UJ
RC5-AMPH-ONE-01-091820	L33792-2	d9-NEt-FOSE	6.44	R
RC5-AMPH-TWO-01-092220	L33792-3	13C2-PFTeDA	27.4	J+
RC5-AMPH-TWO-01-092220	L33792-3	D3-N-MeFOSA	24.5	UJ
RC5-AMPH-TWO-01-092220	L33792-3	D5-N-EtFOSA	23.9	UJ
RC5-AMPH-TWO-01-092220	L33792-3	d7-NMe-FOSE	22.4	UJ

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
RC5-AMPH-TWO-01-092220	L33792-3	d9-NEt-FOSE	5.47	R
RC6A-AMPH-01-092020	L33792-4	13C2-PFTeDA	20.2	J+
RC6A-AMPH-01-092020	L33792-4	D3-N-MeFOSA	18.0	R
RC6A-AMPH-01-092020	L33792-4	D5-N-EtFOSA	18.1	R
RC6A-AMPH-01-092020	L33792-4	d7-NMe-FOSE	19.1	R
RC6A-AMPH-01-092020	L33792-4	d9-NEt-FOSE	4.85	R
RC3A-AMPH-COMP-ONE-01-091920	L33792-5	13C2-PFTeDA	45.4	J+
RC3A-AMPH-COMP-ONE-01-091920	L33792-5	13C2-8:2 FTS	212	No Qualifier
RC3A-AMPH-COMP-ONE-01-091920	L33792-5	D3-N-MeFOSA	17.7	R
RC3A-AMPH-COMP-ONE-01-091920	L33792-5	D5-N-EtFOSA	7.62	R
RC3A-AMPH-COMP-ONE-01-091920	L33792-5	d7-NMe-FOSE	3.94	R
RC3A-AMPH-COMP-ONE-01-091920	L33792-5	d9-NEt-FOSE	5.45	R
RC7-AMPH-01-092220	L33792-6	13C2-PFTeDA	44.6	J+
RC7-AMPH-01-092220	L33792-6	D3-N-MeFOSA	42.1	UJ
RC7-AMPH-01-092220	L33792-6	D5-N-EtFOSA	37.6	UJ
RC7-AMPH-01-092220	L33792-6	d7-NMe-FOSE	37.3	UJ
RC7-AMPH-01-092220	L33792-6	d9-NEt-FOSE	12.1	R
RC13-AMPH-01-092120	L33792-7	13C2-PFTeDA	18.5	R
RC13-AMPH-01-092120	L33792-7	D3-N-MeFOSA	17.9	R
RC13-AMPH-01-092120	L33792-7	D5-N-EtFOSA	14.4	R
RC13-AMPH-01-092120	L33792-7	d7-NMe-FOSE	15.1	R
RC13-AMPH-01-092120	L33792-7	d9-NEt-FOSE	3.04	R
RC16A-AMPH-01-091920	L33792-8	13C2-4:2 FTS	206	No Qualifier
RC16A-AMPH-01-091920	L33792-8	13C2-8:2 FTS	219	No Qualifier
RC16A-AMPH-01-091920	L33792-8	D5-N-EtFOSA	49.6	UJ
RC16A-AMPH-01-091920	L33792-8	d7-NMe-FOSE	25.9	UJ
RC16A-AMPH-01-091920	L33792-8	d9-NEt-FOSE	37.3	UJ
RC17A-AMPH-01-092120	L33792-9	13C2-4:2 FTS	216	No Qualifier
RC17A-AMPH-01-092120	L33792-9	D5-N-EtFOSA	41.7	UJ
RC17A-AMPH-01-092120	L33792-9	d9-NEt-FOSE	23.0	UJ
RC18-AMPH-01-091520	L33792-10	D5-N-EtFOSA	38.8	UJ
RC18-AMPH-01-091520	L33792-10	d9-NEt-FOSE	19.6	R
EP19-AMPH-01-091920	L33792-11	13C2-4:2 FTS	206	No Qualifier
EP19-AMPH-01-091920	L33792-11	D5-N-EtFOSA	39.2	UJ
EP19-AMPH-01-091920	L33792-11	d9-NEt-FOSE	22.6	UJ

Sample ID	Lab ID	Labeled Analog	% Recovery (limits 50% to 200%)	Qualification of Associated non-Labeled Analyte
WL2-AMPH-01-092220	L33792-12	D5-N-EtFOSA	17.5	R
WL2-AMPH-01-092220	L33792-12	d7-NMe-FOSE	22.0	UJ
WL2-AMPH-01-092220	L33792-12	d9-NEt-FOSE	6.09	R
WL8A-AMPH-01-092520	L33792-13	13C2-4:2 FTS	244	No Qualifier
WL8A-AMPH-01-092520	L33792-13	13C2-6:2 FTS	248	No Qualifier
WL8A-AMPH-01-092520	L33792-13	13C2-8:2 FTS	238	No Qualifier
WL8A-AMPH-01-092520	L33792-13	D3-N-MeFOSA	12.8	R
WL8A-AMPH-01-092520	L33792-13	D5-N-EtFOSA	26.0	UJ
WL8A-AMPH-01-092520	L33792-13	d7-NMe-FOSE	8.91	R
WL8A-AMPH-01-092520	L33792-13	d9-NEt-FOSE	14.8	R

Laboratory control sample/Laboratory control sample duplicate (Section 5Bi): Detections associated with high recoveries were qualified as estimated biased high (J+).

LCS/LCSD IDs	Compound	LCS/LCSD %Recovery	Recovery Limits	Qualifiers
WG74159-102 (A)/ WG74159-103 (DUP WG74159-102)	N-MeFOSE	**262/173**	50-150	Associated results were nondetect. No qualifiers.
	5:3 FTCA	148/**162**	50-150	Associated samples detects were qualified as estimated biased high (J+): RC5-AMPH-ONE-01-091820 (L33792-2) RC13-AMPH-01-092120 (L33792-7)

Bold indicates an exceedance

Laboratory control sample/Laboratory control sample duplicate RPDs (Section 6Bi): Detections associated with high RPDs were qualified as estimated (J).

LCS/LCSD IDs	Compound	LCS/LCSD %RPD	RPD Limits	Qualifiers
WG74159-102 (A)/ WG74159-103 (DUP WG74159-102)	N-EtFOSE	**67.2**	50	Detects qualified as estimated (J): RC3A-SNAIL-COMP-01-092420 (L33791-1) RC23-SNAIL-COMP-01-092420 (L33791-2) RC5-AMPH-ONE-01-091820 (L33792-2) RC5-AMPH-TWO-01-092220 (L33792-3) RC6A-AMPH-01-092020 (L33792-4) RC3A-AMPH-COMP-ONE-01-091920 (L33792-5) RC13-AMPH-01-092120 (L33792-7) WL2-AMPH-01-092220 (L33792-12)

10. Additional comments about lab report: For the results listed below, the peak was detected; however, it did not meet quantification criteria. These results were reported as maximum possible

concentration and qualified as estimated (J):

Sample ID	Lab ID	Analyte
WL14-CRAY-01-092320	L33788-36	PFUnA
RC3A-SNAIL-COMP-01-092420	L33791-1	MeFOSAA
RC3A-SNAIL-COMP-01-092420	L33791-1	N-EtFOSE
RC23-SNAIL-COMP-01-092420	L33791-2	PFHxS
RC23-SNAIL-COMP-01-092420	L33791-2	N-EtFOSE
EP27B-SNAIL-ONE-01-092420	L33791-3	PFNA
EP27B-SNAIL-ONE-01-092420	L33791-3	PFUnA
RC4A-AMPH-COMP-01-091820	L33792-1	MeFOSAA
RC5-AMPH-ONE-01-091820	L33792-2	N-EtFOSE
RC5-AMPH-TWO-01-092220	L33792-3	N-EtFOSE
RC6A-AMPH-01-092020	L33792-4	PFTrDA
RC6A-AMPH-01-092020	L33792-4	N-EtFOSE
RC3A-AMPH-COMP-ONE-01-091920	L33792-5	N-EtFOSA
RC3A-AMPH-COMP-ONE-01-091920	L33792-5	N-EtFOSE
RC13-AMPH-01-092120	L33792-7	N-EtFOSE
RC16A-AMPH-01-091920	L33792-8	PFTeDA
RC17A-AMPH-01-092120	L33792-9	PFUnA
EP19-AMPH-01-091920	L33792-11	EtFOSAA
WL2-AMPH-01-092220	L33792-12	N-EtFOSE
WL8A-AMPH-01-092520	L33792-13	EtFOSAA

Any R qualifiers take precedence over other qualifiers.

Appendix D

Summary Statistics and ProUCL Documentation

Appendix D-1

Summary Statistics

Appendix D Table 1
Summary Statistics and Exposure Point Concentrations - Total Surface Water
Project 1007
Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
Eagle Point Lake											
PFCAs											
PFBA	ug/L	40 : 40	100%	5.96E-02	1.50E-01	1.13E-01	1.12E-01	1.18E-01	95% Student's-t UCL	1.18E-01	UCL
PFPeA	ug/L	41 : 42	98%	5.73E-03	1.20E-02	9.07E-03	8.80E-03	9.48E-03	95% KM (t) UCL	9.48E-03	UCL
PFHxA	ug/L	42 : 42	100%	5.01E-03	1.80E-02	1.16E-02	1.13E-02	1.24E-02	95% Student's-t UCL	1.24E-02	UCL
PFHpA	ug/L	42 : 42	100%	2.77E-03	1.50E-02	9.19E-03	8.96E-03	1.01E-02	95% Student's-t UCL	1.01E-02	UCL
PFOA	ug/L	42 : 42	100%	1.52E-02	1.50E-01	7.03E-02	7.04E-02	7.77E-02	95% Student's-t UCL	7.77E-02	UCL
PFNA	ug/L	40 : 42	95%	9.33E-04	4.10E-03	1.46E-03	1.28E-03	1.61E-03	95% KM (BCA) UCL	1.61E-03	UCL
PFDA	ug/L	38 : 42	90%	7.91E-04	6.60E-03	1.61E-03	1.42E-03	1.71E-03	KM H-UCL	1.71E-03	UCL
PFUnA	ug/L	1 : 42	2%	2.60E-03	2.60E-03	NC	NC	NC	--	2.60E-03	Maximum
PFDoA	ug/L	1 : 42	2%	2.80E-03	2.80E-03	NC	NC	NC	--	2.80E-03	Maximum
PFTrDA	ug/L	6 : 42	14%	1.40E-03	6.90E-03	3.00E-03	2.60E-03	1.14E-03	95% KM (t) UCL	1.14E-03	UCL
PFTeDA	ug/L	5 : 41	12%	2.30E-03	2.90E-03	2.60E-03	2.70E-03	9.70E-04	95% KM (t) UCL	9.70E-04	UCL
PFSAs											
PFBS	ug/L	41 : 42	98%	1.87E-03	7.10E-03	4.50E-03	4.38E-03	4.75E-03	95% KM (t) UCL	4.75E-03	UCL
PFPeS	ug/L	38 : 41	93%	9.78E-04	6.80E-03	3.35E-03	3.39E-03	3.59E-03	95% KM (t) UCL	3.59E-03	UCL
PFHxS	ug/L	42 : 42	100%	2.12E-03	1.40E-02	9.22E-03	8.75E-03	9.91E-03	95% Student's-t UCL	9.91E-03	UCL
PFHpS	ug/L	39 : 42	93%	9.52E-04	5.80E-03	2.63E-03	2.49E-03	2.84E-03	95% KM (t) UCL	2.84E-03	UCL
PFOS	ug/L	42 : 42	100%	1.38E-02	6.80E-01	2.46E-01	2.39E-01	3.19E-01	95% Chebyshev (Mean, Sd) UCL	3.19E-01	UCL
PFNS	ug/L	0 : 42	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDS	ug/L	0 : 42	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDoS	ug/L	0 : 29	0%	ND	ND	ND	ND	NC	--	ND	(b)
FOSA, FASE, FASAAs											
PFOSA	ug/L	30 : 42	71%	7.20E-04	4.68E-03	1.49E-03	1.17E-03	1.51E-03	95% KM (BCA) UCL	1.51E-03	UCL
N-EtFOSA	ug/L	0 : 40	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/L	2 : 42	5%	4.90E-04	5.00E-04	5.00E-04	5.00E-04	NC	--	5.0E-04	Maximum
N-EtFOSAA	ug/L	22 : 41	54%	7.90E-04	6.00E-03	1.90E-03	1.68E-03	1.73E-03	95% KM Adjusted Gamma UCL	1.7E-03	UCL
N-MeFOSAA	ug/L	0 : 42	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSE	ug/L	3 : 40	8%	1.50E-04	1.00E-03	4.50E-04	2.10E-04	NC	--	1.0E-03	Maximum
N-MeFOSE	ug/L	0 : 42	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/L	0 : 42	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/L	13 : 42	31%	6.30E-04	6.09E-02	8.68E-03	4.20E-03	4.00E-03	KM H-UCL	4.0E-03	UCL
8:2 FTS	ug/L	1 : 42	2%	2.00E-04	2.00E-04	NC	NC	NC	--	2.0E-04	Maximum
10:2 FTS	ug/L	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/L	0 : 42	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/L	0 : 42	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/L	0 : 42	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/L	0 : 42	0%	ND	ND	ND	ND	NC	--	ND	(b)

Appendix D Table 1
Summary Statistics and Exposure Point Concentrations - Total Surface Water
Project 1007
Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
Lake Elmo											
PFCAs											
PFBA	ug/L	31 : 31	100%	9.08E-02	1.02E+00	5.27E-01	6.19E-01	7.79E-01	95% Chebyshev (Mean, Sd) UCL	7.79E-01	UCL
PFPeA	ug/L	34 : 34	100%	6.37E-03	1.90E-02	1.30E-02	1.31E-02	1.41E-02	95% Student's-t UCL	1.41E-02	UCL
PFHxA	ug/L	34 : 34	100%	7.66E-03	2.20E-02	1.42E-02	1.42E-02	1.53E-02	95% Student's-t UCL	1.53E-02	UCL
PFHpA	ug/L	34 : 34	100%	4.61E-03	1.40E-02	7.15E-03	6.03E-03	7.85E-03	95% Modified-t UCL	7.85E-03	UCL
PFOA	ug/L	34 : 34	100%	5.13E-02	1.05E-01	7.08E-02	6.58E-02	7.45E-02	95% Modified-t UCL	7.45E-02	UCL
PFNA	ug/L	21 : 34	62%	6.50E-04	1.90E-03	1.09E-03	1.06E-03	1.07E-03	95% KM (t) UCL	1.07E-03	UCL
PFDA	ug/L	17 : 34	50%	5.04E-04	2.70E-03	1.40E-03	1.15E-03	1.27E-03	95% KM (t) UCL	1.27E-03	UCL
PFUnA	ug/L	0 : 34	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDoA	ug/L	0 : 34	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFTrDA	ug/L	2 : 34	6%	1.70E-03	1.70E-03	1.70E-03	1.70E-03	NC	--	1.70E-03	Maximum
PFTeDA	ug/L	1 : 34	3%	2.40E-03	2.40E-03	NC	NC	NC	--	2.40E-03	Maximum
PFSAs											
PFBS	ug/L	34 : 34	100%	1.25E-03	5.60E-03	3.58E-03	3.41E-03	3.86E-03	95% Student's-t UCL	3.86E-03	UCL
PFPeS	ug/L	34 : 34	100%	1.09E-03	6.00E-03	2.70E-03	2.32E-03	3.03E-03	95% Adjusted Gamma UCL	3.03E-03	UCL
PFHxS	ug/L	34 : 34	100%	5.86E-03	1.30E-02	8.00E-03	7.50E-03	8.52E-03	95% Student's-t UCL	8.52E-03	UCL
PFHpS	ug/L	32 : 34	94%	7.83E-04	4.40E-03	1.62E-03	1.21E-03	1.86E-03	95% KM (BCA) UCL	1.86E-03	UCL
PFOS	ug/L	34 : 34	100%	4.68E-02	4.82E-01	1.53E-01	1.05E-01	1.91E-01	95% H-UCL	1.91E-01	UCL
PFNS	ug/L	0 : 34	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDS	ug/L	0 : 34	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDoS	ug/L	0 : 28	0%	ND	ND	ND	ND	NC	--	ND	(b)
FOSA, FASE, FASAAs											
PFOSA	ug/L	16 : 34	47%	4.02E-04	2.83E-03	1.10E-03	9.16E-04	1.03E-03	95% KM (t) UCL	1.03E-03	UCL
N-EtFOSA	ug/L	0 : 34	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/L	0 : 34	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSAA	ug/L	6 : 34	18%	4.90E-04	2.23E-03	1.03E-03	8.89E-04	7.07E-04	95% KM (t) UCL	7.07E-04	UCL
N-MeFOSAA	ug/L	1 : 34	3%	2.33E-03	2.33E-03	NC	NC	NC	--	2.33E-03	Maximum
N-EtFOSE	ug/L	1 : 34	3%	1.50E-04	1.50E-04	NC	NC	NC	--	1.50E-04	Maximum
N-MeFOSE	ug/L	0 : 34	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/L	0 : 34	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/L	8 : 34	24%	5.60E-04	8.59E-02	1.68E-02	7.81E-03	NC	--	NC	(c)
8:2 FTS	ug/L	0 : 34	0%	ND	ND	ND	ND	NC	--	ND	(b)
10:2 FTS	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/L	0 : 34	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/L	0 : 34	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/L	0 : 34	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/L	0 : 34	0%	ND	ND	ND	ND	NC	--	ND	(b)

Appendix D Table 1
Summary Statistics and Exposure Point Concentrations - Total Surface Water
Project 1007
Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
Raleigh Creek - Upper											
PFCAs											
PFBA	ug/L	55 : 55	100%	8.70E-02	1.10E+00	4.21E-01	3.49E-01	4.82E-01	95% Approximate Gamma UCL	4.82E-01	UCL
PFPeA	ug/L	60 : 60	100%	7.80E-03	1.30E-01	3.95E-02	2.76E-02	4.82E-02	95% H-UCL	4.82E-02	UCL
PFHxA	ug/L	59 : 60	98%	9.45E-03	2.72E-01	8.45E-02	6.34E-02	9.92E-02	95% KM Approximate Gamma UCL	9.92E-02	UCL
PFHpA	ug/L	59 : 60	98%	4.70E-03	3.01E-01	7.55E-02	4.98E-02	9.17E-02	95% KM Approximate Gamma UCL	9.17E-02	UCL
PFOA	ug/L	60 : 60	100%	8.30E-03	2.45E+00	6.73E-01	5.18E-01	8.23E-01	95% Approximate Gamma UCL	8.23E-01	UCL
PFNA	ug/L	58 : 60	97%	1.15E-03	2.32E-02	5.79E-03	5.00E-03	6.79E-03	95% GROS Approximate Gamma UCL	6.79E-03	UCL
PFDA	ug/L	58 : 60	97%	1.83E-03	2.63E-02	8.41E-03	7.64E-03	9.53E-03	95% GROS Approximate Gamma UCL	9.53E-03	UCL
PFUnA	ug/L	5 : 60	8%	4.03E-04	8.47E-04	5.28E-04	4.73E-04	4.34E-04	KM Student's t	4.34E-04	UCL
PFDoA	ug/L	1 : 60	2%	4.42E-04	4.42E-04	NC	NC	NC	--	4.42E-04	Maximum
PFTrDA	ug/L	1 : 60	2%	2.10E-03	2.10E-03	NC	NC	NC	--	2.10E-03	Maximum
PFTeDA	ug/L	0 : 60	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFSAs											
PFBS	ug/L	59 : 60	98%	2.80E-03	7.87E-02	2.46E-02	1.87E-02	2.87E-02	95% KM Approximate Gamma UCL	2.87E-02	UCL
PFPeS	ug/L	59 : 60	98%	1.70E-03	9.95E-02	2.89E-02	2.10E-02	3.44E-02	95% KM Approximate Gamma UCL	3.44E-02	UCL
PFHxS	ug/L	59 : 60	98%	3.70E-03	2.42E-01	7.33E-02	5.80E-02	8.64E-02	95% KM Approximate Gamma UCL	8.64E-02	UCL
PFHpS	ug/L	58 : 60	97%	3.00E-03	1.10E-01	2.90E-02	2.22E-02	3.59E-02	KM H-UCL	3.59E-02	UCL
PFOS	ug/L	60 : 60	100%	5.60E-03	8.81E+00	2.17E+00	1.84E+00	3.04E+00	95% Chebyshev (Mean, Sd) UCL	3.04E+00	UCL
PFNS	ug/L	23 : 60	38%	3.80E-04	3.70E-03	1.26E-03	1.10E-03	9.16E-04	KM H-UCL	9.16E-04	UCL
PFDS	ug/L	15 : 60	25%	3.20E-04	1.79E-03	7.54E-04	6.44E-04	6.24E-04	95% KM Approximate Gamma UCL	6.24E-04	UCL
PFDoS	ug/L	1 : 47	2%	4.56E-04	4.56E-04	NC	NC	NC	--	4.56E-04	Maximum
FOSA, FASE, FASAAs											
PFOSA	ug/L	56 : 60	93%	6.30E-04	1.23E-01	2.87E-02	2.44E-02	3.26E-02	95% GROS Approximate Gamma UCL	3.26E-02	UCL
N-EtFOSA	ug/L	5 : 60	8%	1.17E-03	3.86E-03	2.64E-03	3.18E-03	NC	--	NC	(c)
N-MeFOSA	ug/L	0 : 60	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSAA	ug/L	55 : 60	92%	1.50E-03	4.78E-01	4.34E-02	1.61E-02	6.75E-02	KM H-UCL	6.75E-02	UCL
N-MeFOSAA	ug/L	5 : 60	8%	4.17E-04	1.24E-03	6.59E-04	5.66E-04	5.00E-04	95% KM (t) UCL	5.00E-04	UCL
N-EtFOSE	ug/L	4 : 60	7%	1.60E-04	1.82E-02	6.50E-03	3.82E-03	NC	--	NC	(c)
N-MeFOSE	ug/L	0 : 60	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/L	0 : 60	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/L	8 : 60	13%	9.00E-04	2.70E-02	9.49E-03	5.12E-03	3.15E-03	95% KM (t) UCL	3.15E-03	UCL
8:2 FTS	ug/L	0 : 60	0%	ND	ND	ND	ND	NC	--	ND	(b)
10:2 FTS	ug/L	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/L	2 : 60	3%	3.10E-04	4.80E-04	4.00E-04	4.00E-04	NC	--	4.80E-04	Maximum
ADONA	ug/L	0 : 60	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/L	0 : 60	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/L	0 : 60	0%	ND	ND	ND	ND	NC	--	ND	(b)

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Summary Statistics and Exposure Point Concentrations - Total Surface Water
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Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
Raleigh Creek - Other											
PFCAs											
PFBA	ug/L	42 : 42	100%	3.86E-02	3.32E-01	9.43E-02	8.69E-02	1.07E-01	95% Modified-t UCL	1.07E-01	UCL
PFPeA	ug/L	45 : 45	100%	3.03E-03	3.67E-02	7.23E-03	6.19E-03	8.63E-03	95% Modified-t UCL	8.63E-03	UCL
PFHxA	ug/L	39 : 45	87%	2.49E-03	6.43E-02	7.62E-03	4.49E-03	1.40E-02	95% KM (Chebyshev) UCL	1.40E-02	UCL
PFHpA	ug/L	45 : 45	100%	1.55E-03	6.17E-02	5.46E-03	2.22E-03	1.26E-02	95% Chebyshev (Mean, Sd) UCL	1.26E-02	UCL
PFOA	ug/L	45 : 45	100%	5.73E-03	5.20E-01	3.73E-02	7.92E-03	1.01E-01	95% Chebyshev (Mean, Sd) UCL	1.01E-01	UCL
PFNA	ug/L	27 : 45	60%	6.13E-04	4.24E-03	1.17E-03	8.27E-04	1.21E-03	95% KM (BCA) UCL	1.21E-03	UCL
PFDA	ug/L	9 : 45	20%	4.18E-04	3.95E-03	1.85E-03	1.26E-03	9.57E-04	95% KM (t) UCL	9.57E-04	UCL
PFUnA	ug/L	0 : 45	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDoA	ug/L	0 : 45	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFTrDA	ug/L	5 : 45	11%	1.60E-03	2.40E-03	2.00E-03	1.90E-03	6.93E-04	95% KM (t) UCL	6.93E-04	UCL
PFTeDA	ug/L	1 : 45	2%	4.60E-03	4.60E-03	NC	NC	NC	--	4.60E-03	Maximum
PFSAs											
PFBS	ug/L	45 : 45	100%	1.36E-03	1.91E-02	3.31E-03	2.62E-03	4.13E-03	95% Modified-t UCL	4.13E-03	UCL
PFPeS	ug/L	12 : 45	27%	3.99E-04	2.02E-02	4.70E-03	1.43E-03	3.28E-03	Gamma Adjusted KM-UCL	3.28E-03	UCL
PFHxS	ug/L	45 : 45	100%	2.31E-03	5.29E-02	6.19E-03	3.19E-03	1.27E-02	95% Chebyshev (Mean, Sd) UCL	1.27E-02	UCL
PFHpS	ug/L	8 : 45	18%	1.04E-03	1.56E-02	5.92E-03	4.14E-03	2.19E-03	95% KM (t) UCL	2.19E-03	UCL
PFOS	ug/L	45 : 45	100%	1.66E-03	1.23E+00	1.05E-01	3.27E-03	2.84E-01	95% Chebyshev (Mean, Sd) UCL	2.84E-01	UCL
PFNS	ug/L	0 : 45	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDS	ug/L	0 : 45	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDoS	ug/L	0 : 39	0%	ND	ND	ND	ND	NC	--	ND	(b)
FASAs											
PFOSA	ug/L	10 : 45	22%	3.71E-04	1.10E-02	4.39E-03	2.93E-03	1.91E-03	95% KM (t) UCL	1.91E-03	UCL
N-EtFOSA	ug/L	0 : 45	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/L	0 : 45	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSAA	ug/L	9 : 45	20%	7.20E-04	9.06E-03	3.76E-03	2.02E-03	1.59E-03	95% KM (t) UCL	1.59E-03	UCL
N-MeFOSAA	ug/L	0 : 45	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSE	ug/L	1 : 45	2%	1.40E-04	1.40E-04	NC	NC	NC	--	1.40E-04	Maximum
N-MeFOSE	ug/L	0 : 45	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/L	0 : 45	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/L	3 : 45	7%	1.50E-03	1.37E-02	6.15E-03	3.25E-03	NC	--	1.37E-02	Maximum
8:2 FTS	ug/L	0 : 45	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/L	0 : 45	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/L	0 : 45	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/L	0 : 45	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/L	0 : 45	0%	ND	ND	ND	ND	NC	--	ND	(b)

Appendix D Table 1
Summary Statistics and Exposure Point Concentrations - Total Surface Water
Project 1007
Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
West Lakeland											
PFCAs											
PFBA	ug/L	74 : 74	100%	1.36E-01	7.90E-01	3.85E-01	3.85E-01	4.06E-01	95% Student's-t UCL	4.06E-01	UCL
PFPeA	ug/L	72 : 82	88%	7.38E-03	1.80E-02	1.24E-02	1.27E-02	1.25E-02	KM H-UCL	1.25E-02	UCL
PFHxA	ug/L	82 : 82	100%	7.83E-03	1.90E-02	1.34E-02	1.32E-02	1.38E-02	95% Student's-t UCL	1.38E-02	UCL
PFHpA	ug/L	80 : 82	98%	5.70E-03	1.11E-02	7.78E-03	7.26E-03	8.03E-03	KM H-UCL	8.03E-03	UCL
PFOA	ug/L	82 : 82	100%	4.80E-02	1.10E-01	7.03E-02	7.03E-02	7.26E-02	95% Student's-t UCL	7.26E-02	UCL
PFNA	ug/L	60 : 82	73%	7.68E-04	2.77E-03	1.19E-03	1.04E-03	1.22E-03	95% KM (BCA) UCL	1.22E-03	UCL
PFDA	ug/L	33 : 82	40%	7.53E-04	5.75E-03	1.40E-03	1.20E-03	1.87E-03	99% KM (Chebyshev) UCL	1.87E-03	UCL
PFUnA	ug/L	1 : 82	1%	5.15E-04	5.15E-04	NC	NC	NC	--	5.15E-04	Maximum
PFDoA	ug/L	0 : 82	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFTrDA	ug/L	4 : 82	5%	1.30E-03	1.70E-03	1.50E-03	1.50E-03	1.95E-04	95% KM (t) UCL	1.95E-04	UCL
PFTeDA	ug/L	8 : 82	10%	2.10E-03	4.40E-03	2.90E-03	2.60E-03	5.57E-04	95% KM (t) UCL	5.57E-04	UCL
PFSAs											
PFBS	ug/L	72 : 82	88%	2.60E-03	5.61E-03	4.07E-03	4.10E-03	4.18E-03	95% KM (t) UCL	4.18E-03	UCL
PFPeS	ug/L	72 : 82	88%	1.82E-03	5.10E-03	2.93E-03	2.92E-03	3.12E-03	KM Student's t	3.12E-03	UCL
PFHxS	ug/L	82 : 82	100%	5.70E-03	1.30E-02	9.23E-03	9.51E-03	9.54E-03	95% Student's-t UCL	9.54E-03	UCL
PFHpS	ug/L	71 : 82	87%	7.58E-04	3.70E-03	1.87E-03	1.80E-03	2.00E-03	KM H-UCL	2.00E-03	UCL
PFOS	ug/L	82 : 82	100%	5.94E-02	7.48E-01	1.79E-01	1.57E-01	1.99E-01	95% Modified-t UCL	1.99E-01	UCL
PFNS	ug/L	0 : 82	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDS	ug/L	0 : 82	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDoS	ug/L	0 : 66	0%	ND	ND	ND	ND	NC	--	ND	(b)
FASAs											
PFOSA	ug/L	35 : 82	43%	6.90E-04	2.86E-03	1.13E-03	1.00E-03	1.89E-03	99% KM (Chebyshev) UCL	1.89E-03	UCL
N-EtFOSA	ug/L	1 : 82	1%	3.20E-04	3.20E-04	NC	NC	NC	--	3.20E-04	Maximum
N-MeFOSA	ug/L	0 : 82	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSAA	ug/L	18 : 82	22%	4.79E-04	9.07E-03	1.52E-03	9.30E-04	2.32E-03	99% KM (Chebyshev) UCL	2.32E-03	UCL
N-MeFOSAA	ug/L	0 : 82	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSE	ug/L	2 : 82	2%	1.40E-04	4.70E-04	3.10E-04	3.10E-04	NC	--	4.70E-04	Maximum
N-MeFOSE	ug/L	0 : 82	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/L	0 : 82	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/L	19 : 82	23%	2.90E-03	5.87E-02	1.63E-02	1.20E-02	NC	--	NC	(c)
8:2 FTS	ug/L	0 : 82	0%	ND	ND	ND	ND	NC	--	ND	(b)
10:2 FTS	ug/L	0 : 16	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/L	0 : 82	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/L	0 : 82	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/L	0 : 82	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/L	0 : 82	0%	ND	ND	ND	ND	NC	--	ND	(b)

Appendix D Table 1
Summary Statistics and Exposure Point Concentrations - Total Surface Water
Project 1007
Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
Other											
PFCAs											
PFBA	ug/L	41 : 42	98%	1.26E-02	4.98E+00	4.91E-01	1.69E-01	1.25E+00	95% KM (Chebyshev) UCL	1.25E+00	UCL
PFPeA	ug/L	43 : 47	91%	2.65E-03	6.00E-02	1.30E-02	8.70E-03	2.08E-02	95% KM (Chebyshev) UCL	2.08E-02	UCL
PFHxA	ug/L	41 : 47	87%	1.83E-03	7.30E-02	1.22E-02	5.30E-03	2.08E-02	95% KM (Chebyshev) UCL	2.08E-02	UCL
PFHpA	ug/L	44 : 47	94%	1.28E-03	1.70E-02	4.54E-03	2.28E-03	6.90E-03	95% KM (Chebyshev) UCL	6.90E-03	UCL
PFOA	ug/L	45 : 47	96%	7.80E-04	1.60E-01	3.19E-02	1.21E-02	5.43E-02	95% KM (Chebyshev) UCL	5.43E-02	UCL
PFNA	ug/L	16 : 47	34%	6.97E-04	3.30E-03	1.28E-03	9.45E-04	9.06E-04	KM H-UCL	9.06E-04	UCL
PFDA	ug/L	6 : 47	13%	4.00E-04	5.20E-03	2.68E-03	2.55E-03	9.77E-04	95% KM (t) UCL	9.77E-04	UCL
PFUnA	ug/L	0 : 47	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDoA	ug/L	1 : 47	2%	1.30E-03	1.30E-03	NC	NC	NC	--	1.30E-03	Maximum
PFTrDA	ug/L	1 : 47	2%	1.50E-03	1.50E-03	NC	NC	NC	--	1.50E-03	Maximum
PFTeDA	ug/L	1 : 47	2%	2.90E-03	2.90E-03	NC	NC	NC	--	2.90E-03	Maximum
PFSAs											
PFBS	ug/L	42 : 47	89%	8.54E-04	8.90E-03	3.16E-03	2.72E-03	4.56E-03	95% GROS Adjusted Gamma UCL	4.56E-03	UCL
PFPeS	ug/L	24 : 47	51%	4.55E-04	1.00E-02	2.18E-03	1.05E-03	2.55E-03	95% KM (Chebyshev) UCL	2.55E-03	UCL
PFHxS	ug/L	38 : 47	81%	9.58E-04	3.60E-02	5.19E-03	3.35E-03	7.91E-03	95% KM (Chebyshev) UCL	7.91E-03	UCL
PFHpS	ug/L	10 : 47	21%	1.10E-03	9.90E-03	3.49E-03	1.50E-03	NC	--	NC	(c)
PFNS	ug/L	1 : 47	2%	1.20E-03	1.20E-03	NC	NC	NC	--	1.20E-03	Maximum
PFOS	ug/L	44 : 47	94%	1.24E-03	3.30E-01	4.38E-02	7.03E-03	9.16E-02	95% KM (Chebyshev) UCL	9.16E-02	UCL
PFDS	ug/L	0 : 47	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDoS	ug/L	0 : 38	0%	ND	ND	ND	ND	NC	--	ND	(b)
FOSA, FASE, FASAAs											
PFOSA	ug/L	7 : 47	15%	7.61E-04	1.40E-03	9.92E-04	9.50E-04	5.45E-04	95% KM (t) UCL	5.45E-04	UCL
N-EtFOSA	ug/L	0 : 47	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/L	3 : 47	6%	4.60E-04	5.50E-04	5.00E-04	4.80E-04	NC	--	5.50E-04	Maximum
N-EtFOSAA	ug/L	1 : 47	2%	1.10E-03	1.10E-03	NC	NC	NC	--	1.10E-03	Maximum
N-MeFOSAA	ug/L	0 : 47	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSE	ug/L	0 : 47	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSE	ug/L	0 : 47	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/L	0 : 47	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/L	8 : 47	17%	8.16E-03	1.04E-01	2.99E-02	1.42E-02	NC	--	NC	(c)
8:2 FTS	ug/L	0 : 47	0%	ND	ND	ND	ND	NC	--	ND	(b)
10:2 FTS	ug/L	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/L	0 : 47	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/L	0 : 47	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/L	0 : 47	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/L	0 : 47	0%	ND	ND	ND	ND	NC	--	ND	(b)

Acronyms:
EPC - Exposure Point Concentration.
NC - Not Calculated.
ND - Not Detected.
UCL - Upper confidence limit.
ug/kg - Micrograms per kilograms.
USEPA - United States Environmental Protection Agency.
Notes:
(a) Upper Confidence Limit (UCL) on the arithmetic mean concentration calculated using USEPA ProUCL Version 5.1. The UCL suggested by ProUCL is used, unless otherwise noted. In cases where more than one UCL is suggested, the higher UCL is used. A sample size of at least eight is recommended for the calculation of UCLs. When fewer samples are available the ProUCL export is reviewed to assess whether the maximum or the recommended UCL is the appropriate EPC
(b) Chemical was not detected.
(c) A UCL was not calculated analyte in this location.

Appendix D Table 2

Summary Statistics and Exposure Point Concentrations - Dissolved Surface Water

Project 1007

Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
Eagle Point Lake											
PFCAs											
PFBA	ug/L	12 : 12	100%	1.10E-01	1.70E-01	1.40E-01	1.40E-01	1.49E-01	95% Student's-t UCL	1.49E-01	UCL
PFPeA	ug/L	12 : 12	100%	8.50E-03	1.40E-02	1.20E-02	1.20E-02	1.24E-02	95% Student's-t UCL	1.24E-02	UCL
PFHxA	ug/L	12 : 12	100%	9.10E-03	2.20E-02	1.40E-02	1.40E-02	1.58E-02	95% Student's-t UCL	1.58E-02	UCL
PFHpA	ug/L	12 : 12	100%	5.50E-03	1.40E-02	1.10E-02	1.20E-02	1.26E-02	95% Student's-t UCL	1.26E-02	UCL
PFOA	ug/L	12 : 12	100%	3.80E-02	1.60E-01	9.30E-02	8.40E-02	1.11E-01	95% Student's-t UCL	1.11E-01	UCL
PFNA	ug/L	9 : 12	75%	1.20E-03	6.30E-03	2.30E-03	1.80E-03	7.35E-03	95% GROS Adjusted Gamma UCL	6.30E-03	Maximum
PFDA	ug/L	5 : 12	42%	1.20E-03	1.10E-02	3.50E-03	1.50E-03	1.62E-02	95% KM Bootstrap t UCL	1.10E-02	Maximum
PFUnA	ug/L	0 : 11	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDoA	ug/L	0 : 11	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFTrDA	ug/L	9 : 12	75%	1.50E-03	3.20E-02	5.20E-03	1.90E-03	1.55E-02	95% KM (Chebyshev) UCL	1.55E-02	UCL
PFTeDA	ug/L	6 : 11	55%	3.70E-03	5.10E-03	4.30E-03	4.10E-03	4.38E-03	95% KM (t) UCL	4.38E-03	UCL
PFSAs											
PFBS	ug/L	12 : 12	100%	3.50E-03	7.30E-03	5.70E-03	5.60E-03	6.34E-03	95% Student's-t UCL	6.34E-03	UCL
PFPeS	ug/L	12 : 12	100%	2.90E-03	1.10E-02	5.70E-03	5.30E-03	6.84E-03	95% Student's-t UCL	6.84E-03	UCL
PFHxS	ug/L	12 : 12	100%	6.30E-03	3.00E-02	1.30E-02	1.00E-02	1.67E-02	95% Adjusted Gamma UCL	1.67E-02	UCL
PFHpS	ug/L	12 : 12	100%	1.50E-03	5.30E-03	3.40E-03	3.40E-03	3.98E-03	95% Student's-t UCL	3.98E-03	UCL
PFOS	ug/L	12 : 12	100%	1.10E-01	1.10E+00	3.10E-01	2.50E-01	4.70E-01	95% Adjusted Gamma UCL	4.70E-01	UCL
PFNS	ug/L	0 : 12	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDS	ug/L	0 : 12	0%	ND	ND	ND	ND	NC	--	ND	(b)
FOSA, FASE, FASAAs											
PFOSA	ug/L	11 : 11	100%	8.10E-04	1.90E-03	1.30E-03	1.20E-03	1.46E-03	95% Student's-t UCL	1.46E-03	UCL
N-EtFOSA	ug/L	0 : 11	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/L	6 : 11	55%	4.70E-04	8.10E-04	5.80E-04	5.20E-04	6.74E-04	95% KM (t) UCL	6.74E-04	UCL
N-EtFOSAA	ug/L	2 : 11	18%	5.10E-04	6.80E-04	6.00E-04	6.00E-04	NC	--	6.80E-04	Maximum
N-MeFOSAA	ug/L	0 : 11	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSE	ug/L	6 : 11	55%	2.10E-04	5.70E-04	3.10E-04	2.40E-04	4.10E-04	95% KM (t) UCL	4.10E-04	UCL
N-MeFOSE	ug/L	1 : 11	9%	3.20E-04	3.20E-04	NC	NC	NC	--	3.20E-04	Maximum
Fluortelomers											
4:2 FTS	ug/L	0 : 12	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/L	2 : 12	17%	6.70E-04	1.90E-03	1.30E-03	1.30E-03	NC	--	1.90E-03	Maximum
8:2 FTS	ug/L	1 : 12	8%	4.10E-04	4.10E-04	NC	NC	NC	--	4.10E-04	Maximum
10:2 FTS	ug/L	0 : 12	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/L	3 : 12	25%	3.20E-04	3.50E-04	3.40E-04	3.40E-04	NC	--	3.50E-04	Maximum
ADONA	ug/L	0 : 12	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/L	0 : 12	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/L	0 : 12	0%	ND	ND	ND	ND	NC	--	ND	(b)

Appendix D Table 2

Summary Statistics and Exposure Point Concentrations - Dissolved Surface Water

Project 1007

Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
Lake Elmo											
PFCAs											
PFBA	ug/L	6 : 6	100%	1.30E-01	8.10E-01	6.40E-01	7.50E-01	1.10E+00	95% Chebyshev (Mean, Sd) UCL	8.10E-01	Maximum
PFPeA	ug/L	6 : 6	100%	1.00E-02	2.20E-02	1.80E-02	2.00E-02	2.19E-02	95% Student's-t UCL	2.19E-02	UCL
PFHxA	ug/L	6 : 6	100%	1.60E-02	2.10E-02	1.90E-02	2.00E-02	2.05E-02	95% Student's-t UCL	2.05E-02	UCL
PFHpA	ug/L	6 : 6	100%	6.90E-03	1.30E-02	1.00E-02	1.10E-02	1.21E-02	95% Student's-t UCL	1.21E-02	UCL
PFOA	ug/L	6 : 6	100%	7.70E-02	1.00E-01	8.40E-02	8.20E-02	9.10E+00	95% Modified-t UCL	1.00E-01	Maximum
PFNA	ug/L	4 : 6	67%	1.40E-03	1.80E-03	1.70E-03	1.70E-03	1.84E-03	95% KM (t) UCL	1.80E-03	Maximum
PFDA	ug/L	1 : 6	17%	2.30E-03	2.30E-03	NC	NC	NC	--	2.30E-03	Maximum
PFUnA	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDoA	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFTrDA	ug/L	1 : 6	17%	1.80E-03	1.80E-03	NC	NC	NC	--	1.80E-03	Maximum
PFTeDA	ug/L	2 : 6	33%	3.20E-03	3.90E-03	3.60E-03	3.60E-03	NC	--	3.90E-03	Maximum
PFSAs											
PFBS	ug/L	6 : 6	100%	3.30E-03	5.00E-03	3.80E-03	3.70E-03	4.34E-03	95% Student's-t UCL	4.34E-03	UCL
PFPeS	ug/L	6 : 6	100%	3.80E-03	6.20E-03	4.50E-03	4.20E-03	5.24E-03	95% Student's-t UCL	5.24E-03	UCL
PFHxS	ug/L	6 : 6	100%	7.30E-03	1.20E-02	9.00E-03	8.40E-03	1.03E-02	95% Student's-t UCL	1.03E-02	UCL
PFHpS	ug/L	6 : 6	100%	1.10E-03	3.70E-03	1.90E-03	1.60E-03	3.32E-03	95% Adjusted Gamma UCL	3.32E-03	UCL
PFOS	ug/L	6 : 6	100%	6.40E-02	3.90E-01	1.30E-01	8.20E-02	3.57E-01	95% Chebyshev (Mean, Sd) UCL	3.57E-01	UCL
PFNS	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDS	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
FOSA, FASE, FASAAs											
PFOSA	ug/L	4 : 6	67%	5.40E-04	1.60E-03	8.80E-04	6.80E-04	1.37E-03	95% KM (t) UCL	1.37E-03	UCL
N-EtFOSA	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/L	2 : 6	33%	4.70E-04	4.70E-04	4.70E-04	4.70E-04	NC	--	4.70E-04	Maximum
N-EtFOSAA	ug/L	1 : 6	17%	1.00E-03	1.00E-03	NC	NC	NC	--	1.00E-03	Maximum
N-MeFOSAA	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSE	ug/L	2 : 6	33%	2.40E-04	2.70E-04	2.60E-04	2.60E-04	NC	--	2.70E-04	Maximum
N-MeFOSE	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
8:2 FTS	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
10:2 FTS	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)

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Summary Statistics and Exposure Point Concentrations - Dissolved Surface Water

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Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
Raleigh Creek - Upper											
PFCAs											
PFBA	ug/L	9 : 9	100%	8.70E-02	1.10E+00	5.50E-01	4.30E-01	7.61E-01	95% Student's-t UCL	7.61E-01	UCL
PFPeA	ug/L	9 : 9	100%	6.60E-03	6.70E-02	3.60E-02	2.70E-02	4.87E-02	95% Student's-t UCL	4.87E-02	UCL
PFHxA	ug/L	8 : 9	89%	3.00E-02	1.60E-01	9.30E-02	9.10E-02	1.18E-01	95% KM (t) UCL	1.18E-01	UCL
PFHpA	ug/L	9 : 9	100%	2.40E-03	8.40E-02	5.10E-02	5.50E-02	6.94E-02	95% Student's-t UCL	6.94E-02	UCL
PFOA	ug/L	9 : 9	100%	7.80E-03	6.50E-01	3.90E-01	4.20E-01	5.39E-01	95% Student's-t UCL	5.39E-01	UCL
PFNA	ug/L	8 : 9	89%	1.50E-03	6.10E-03	4.10E-03	4.40E-03	4.87E-03	95% KM (t) UCL	4.87E-03	UCL
PFDA	ug/L	8 : 9	89%	1.60E-03	1.20E-02	6.70E-03	6.90E-03	8.53E-03	95% KM (t) UCL	8.53E-03	UCL
PFUnA	ug/L	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDoA	ug/L	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFTrDA	ug/L	2 : 9	22%	1.30E-03	2.20E-03	1.80E-03	1.80E-03	NC	--	2.20E-03	Maximum
PFTeDA	ug/L	3 : 9	33%	2.70E-03	4.10E-03	3.40E-03	3.40E-03	NC	--	4.10E-03	Maximum
PFSAs											
PFBS	ug/L	9 : 9	100%	2.50E-03	2.90E-02	1.70E-02	1.60E-02	2.30E-02	95% Student's-t UCL	2.30E-02	UCL
PFPeS	ug/L	8 : 9	89%	1.00E-02	4.60E-02	2.90E-02	2.80E-02	3.65E-02	95% KM (t) UCL	3.65E-02	UCL
PFHxS	ug/L	9 : 9	100%	4.10E-03	7.00E-02	4.50E-02	4.80E-02	5.92E-02	95% Student's-t UCL	5.92E-02	UCL
PFHpS	ug/L	8 : 9	89%	3.70E-03	2.60E-02	1.60E-02	1.60E-02	2.00E-02	95% KM (t) UCL	2.00E-02	UCL
PFOS	ug/L	9 : 9	100%	4.10E-03	2.10E+00	1.20E+00	1.50E+00	1.61E+00	95% Student's-t UCL	1.61E+00	UCL
PFNS	ug/L	4 : 9	44%	1.10E-03	3.00E-03	1.70E-03	1.30E-03	NC	--	NC	(c)
PFDS	ug/L	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
FOSA, FASE, FASAAs											
PFOSA	ug/L	8 : 9	89%	1.50E-03	3.30E-02	1.80E-02	2.00E-02	2.31E-02	95% KM (t) UCL	2.31E-02	UCL
N-EtFOSA	ug/L	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/L	3 : 9	33%	4.90E-04	7.90E-04	6.80E-04	7.70E-04	NC	--	7.90E-04	Maximum
N-EtFOSAA	ug/L	7 : 9	78%	5.90E-03	1.80E-02	1.10E-02	1.10E-02	1.29E-02	95% KM (t) UCL	1.29E-02	UCL
N-MeFOSAA	ug/L	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSE	ug/L	2 : 9	22%	2.10E-04	3.00E-04	2.60E-04	2.60E-04	NC	--	3.00E-04	Maximum
N-MeFOSE	ug/L	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/L	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/L	2 : 9	22%	6.60E-04	6.90E-04	6.80E-04	6.80E-04	NC	--	6.90E-04	Maximum
8:2 FTS	ug/L	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
10:2 FTS	ug/L	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/L	1 : 9	11%	3.20E-04	3.20E-04	NC	NC	NC	--	3.20E-04	Maximum
ADONA	ug/L	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/L	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/L	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)

Appendix D Table 2

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Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
Raleigh Creek - Other											
PFCAs											
PFBA	ug/L	6 : 6	100%	8.60E-02	1.10E-01	9.30E-02	9.10E-02	1.00E-01	95% Modified-t UCL	1.00E-01	UCL
PFPeA	ug/L	6 : 6	100%	6.80E-03	7.80E-03	7.30E-03	7.30E-03	7.56E-03	95% Student's-t UCL	7.56E-03	UCL
PFHxA	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHpA	ug/L	6 : 6	100%	3.10E-03	4.60E-03	3.80E-03	3.90E-03	4.27E-03	95% Student's-t UCL	4.27E-03	UCL
PFOA	ug/L	6 : 6	100%	7.50E-03	9.30E-03	8.40E-03	8.50E-03	8.89E-03	95% Student's-t UCL	8.89E-03	UCL
PFNA	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDA	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFUnA	ug/L	1 : 6	17%	1.60E-03	1.60E-03	NC	NC	NC	--	1.60E-03	Maximum
PFDoA	ug/L	1 : 6	17%	3.80E-03	3.80E-03	NC	NC	NC	--	3.80E-03	Maximum
PFTrDA	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFTeDA	ug/L	0 : 5	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFSAs											
PFBS	ug/L	6 : 6	100%	2.50E-03	3.00E-03	2.70E-03	2.60E-03	2.81E-03	95% Student's-t UCL	2.81E-03	UCL
PFPeS	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxS	ug/L	6 : 6	100%	2.20E-03	3.80E-03	3.20E-03	3.40E-03	3.74E-03	95% Student's-t UCL	3.74E-03	UCL
PFHpS	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFOS	ug/L	6 : 6	100%	2.70E-03	6.50E-03	3.80E-03	3.40E-03	5.75E-03	95% Adjusted Gamma UCL	5.75E-03	UCL
PFNS	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDS	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
FOSA, FASE, FASAAs											
PFOSA	ug/L	1 : 6	17%	6.80E-04	6.80E-04	NC	NC	NC	--	6.80E-04	Maximum
N-EtFOSA	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSAA	ug/L	1 : 6	17%	8.10E-04	8.10E-04	NC	NC	NC	--	8.10E-04	Maximum
N-MeFOSAA	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSE	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSE	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
8:2 FTS	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
10:2 FTS	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/L	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)

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Summary Statistics and Exposure Point Concentrations - Dissolved Surface Water

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Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
West Lakeland											
PFCAs											
PFBA	ug/L	13 : 13	100%	3.40E-01	4.80E-01	4.20E-01	4.20E-01	4.42E-01	95% Student's-t UCL	4.42E-01	UCL
PFPeA	ug/L	13 : 13	100%	1.30E-02	1.60E-02	1.50E-02	1.50E-02	1.53E-02	95% Student's-t UCL	1.53E-02	UCL
PFHxA	ug/L	13 : 13	100%	1.40E-02	1.70E-02	1.50E-02	1.50E-02	1.55E-02	95% Student's-t UCL	1.55E-02	UCL
PFHpA	ug/L	13 : 13	100%	8.00E-03	1.10E-02	9.30E-03	9.10E-03	9.71E-03	95% Student's-t UCL	9.71E-03	UCL
PFOA	ug/L	13 : 13	100%	7.10E-02	8.80E-02	7.80E-02	7.80E-02	8.05E-02	95% Student's-t UCL	8.05E-02	UCL
PFNA	ug/L	6 : 13	46%	1.20E-03	1.60E-03	1.50E-03	1.50E-03	1.55E-03	95% KM (t) UCL	1.55E-03	UCL
PFDA	ug/L	11 : 13	85%	1.20E-03	2.20E-03	1.90E-03	2.00E-03	2.05E-03	KM H-UCL	2.05E-03	UCL
PFUnA	ug/L	1 : 13	8%	1.60E-03	1.60E-03	NC	NC	NC	--	1.60E-03	Maximum
PFDoA	ug/L	6 : 13	46%	1.90E-03	3.70E-03	2.70E-03	2.60E-03	NC	--	NC	(c)
PFTrDA	ug/L	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFTeDA	ug/L	0 : 10	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFSAs											
PFBS	ug/L	13 : 13	100%	3.60E-03	4.40E-03	4.10E-03	4.20E-03	4.23E-03	95% Student's-t UCL	4.23E-03	UCL
PFPeS	ug/L	13 : 13	100%	3.50E-03	5.90E-03	4.60E-03	4.40E-03	4.96E-03	95% Student's-t UCL	4.96E-03	UCL
PFHxS	ug/L	13 : 13	100%	9.60E-03	1.30E-02	1.10E-02	1.10E-02	1.13E-02	95% Student's-t UCL	1.13E-02	UCL
PFHpS	ug/L	13 : 13	100%	1.80E-03	2.90E-03	2.30E-03	2.40E-03	2.45E-03	95% Student's-t UCL	2.45E-03	UCL
PFOS	ug/L	13 : 13	100%	1.90E-01	3.10E-01	2.30E-01	2.30E-01	2.44E-01	95% Student's-t UCL	2.44E-01	UCL
PFNS	ug/L	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDS	ug/L	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
FOSA, FASE, FASAAs											
PFOSA	ug/L	13 : 13	100%	8.80E-04	1.40E-03	1.10E-03	9.80E-04	1.14E-03	95% Student's-t UCL	1.14E-03	UCL
N-EtFOSA	ug/L	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/L	1 : 12	8%	6.00E-04	6.00E-04	NC	NC	NC	--	6.00E-04	Maximum
N-EtFOSAA	ug/L	1 : 12	8%	1.60E-03	1.60E-03	NC	NC	NC	--	1.60E-03	Maximum
N-MeFOSAA	ug/L	0 : 12	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSE	ug/L	2 : 13	15%	1.40E-04	2.00E-04	1.70E-04	1.70E-04	NC	--	2.00E-04	Maximum
N-MeFOSE	ug/L	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/L	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/L	2 : 13	15%	6.40E-04	1.40E-03	1.00E-03	1.00E-03	NC	--	1.40E-03	Maximum
8:2 FTS	ug/L	1 : 13	8%	1.70E-04	1.70E-04	NC	NC	NC	--	1.70E-04	Maximum
10:2 FTS	ug/L	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/L	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/L	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/L	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/L	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)

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Summary Statistics and Exposure Point Concentrations - Dissolved Surface Water

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Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
Other											
PFCAs											
PFBA	ug/L	2 : 2	100%	1.50E-01	2.50E-01	2.00E-01	2.00E-01	NC	--	2.50E-01	Maximum
PFPeA	ug/L	2 : 2	100%	9.90E-03	1.20E-02	1.10E-02	1.10E-02	NC	--	1.20E-02	Maximum
PFHxA	ug/L	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHpA	ug/L	2 : 2	100%	3.50E-03	6.50E-03	5.00E-03	5.00E-03	NC	--	6.50E-03	Maximum
PFOA	ug/L	2 : 2	100%	1.40E-02	1.40E-02	1.40E-02	1.40E-02	NC	--	1.40E-02	Maximum
PFNA	ug/L	1 : 2	50%	1.30E-03	1.30E-03	NC	NC	NC	--	1.30E-03	Maximum
PFDA	ug/L	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFUnA	ug/L	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDoA	ug/L	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFTrDA	ug/L	2 : 2	100%	1.30E-03	1.70E-02	9.20E-03	9.20E-03	NC	--	1.70E-02	Maximum
PFTeDA	ug/L	1 : 1	100%	3.70E-03	3.70E-03	NC	NC	NC	--	3.70E-03	Maximum
PFSAs											
PFBS	ug/L	2 : 2	100%	2.60E-03	3.60E-03	3.10E-03	3.10E-03	NC	--	3.60E-03	Maximum
PFPeS	ug/L	1 : 2	50%	1.90E-03	1.90E-03	NC	NC	NC	--	1.90E-03	Maximum
PFHxS	ug/L	2 : 2	100%	1.70E-03	3.10E-03	2.40E-03	2.40E-03	NC	--	3.10E-03	Maximum
PFHpS	ug/L	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFOS	ug/L	2 : 2	100%	2.00E-03	1.90E-02	1.10E-02	1.10E-02	NC	--	1.90E-02	Maximum
PFNS	ug/L	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDS	ug/L	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
FASAs											
PFOSA	ug/L	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSA	ug/L	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/L	1 : 2	50%	4.60E-04	4.60E-04	NC	NC	NC	--	4.60E-04	Maximum
N-EtFOSAA	ug/L	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSAA	ug/L	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSE	ug/L	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSE	ug/L	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/L	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/L	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
8:2 FTS	ug/L	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
10:2 FTS	ug/L	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/L	1 : 2	50%	3.10E-04	3.10E-04	NC	NC	NC	--	3.10E-04	Maximum
ADONA	ug/L	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/L	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/L	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)

Acronyms:

EPC - Exposure Point Concentration.

NC - Not Calculated.

ND - Not Detected.

UCL - Upper confidence limit.

ug/kg - Micrograms per kilograms.

USEPA - United States Environmental Protection Agency.

Notes:

(a) Upper Confidence Limit (UCL) on the arithmetic mean concentration calculated using USEPA ProUCL Version 5.1. The UCL suggested by ProUCL is used, unless otherwise noted. In cases where more than one UCL is suggested, the higher UCL is used. A sample size of at least eight is recommended for the calculation of UCLs. When fewer samples are available the ProUCL export is reviewed to assess whether the maximum or the recommended UCL is the appropriate EPC

(b) Chemical was not detected.

(c) A UCL was not calculated analyte in this location.

Appendix D Table 3
Summary Statistics and Exposure Point Concentrations - Surface Sediment
Project 1007
Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
Eagle Point Lake											
PFCAs											
PFBA	ug/kg	23 : 36	64%	1.54E-01	2.38E+00	9.05E-01	7.71E-01	9.61E-01	95% KM Adjusted Gamma UCL	9.61E-01	UCL
PFPeA	ug/kg	8 : 36	22%	9.90E-02	9.00E-01	2.79E-01	2.02E-01	1.97E-01	95% KM Adjusted Gamma UCL	1.97E-01	UCL
PFHxA	ug/kg	22 : 36	61%	4.60E-02	1.50E+00	3.32E-01	2.51E-01	3.52E-01	95% KM Adjusted Gamma UCL	3.52E-01	UCL
PFHpA	ug/kg	20 : 36	56%	4.10E-02	1.10E+00	2.87E-01	2.69E-01	2.91E-01	95% KM Adjusted Gamma UCL	2.91E-01	UCL
PFOA	ug/kg	34 : 36	94%	1.95E-01	1.10E+01	3.14E+00	2.48E+00	5.33E+00	95% KM (Chebyshev) UCL	5.33E+00	UCL
PFNA	ug/kg	15 : 36	42%	4.00E-02	1.60E+00	2.31E-01	1.29E-01	3.29E-01	95% KM (Chebyshev) UCL	3.29E-01	UCL
PFDA	ug/kg	27 : 36	75%	4.60E-02	1.40E+00	4.45E-01	3.66E-01	4.99E-01	95% KM (t) UCL	4.99E-01	UCL
PFUnA	ug/kg	2 : 36	6%	2.54E-01	2.60E-01	2.57E-01	2.57E-01	NC	--	2.60E-01	Maximum
PFDoA	ug/kg	0 : 36	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFTrDA	ug/kg	0 : 36	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFTeDA	ug/kg	5 : 36	14%	2.70E-01	1.60E+00	7.00E-01	3.80E-01	2.31E-01	95% KM (t) UCL	2.31E-01	UCL
PFSAs											
PFBS	ug/kg	16 : 36	44%	9.20E-02	4.38E-01	2.10E-01	1.75E-01	1.74E-01	95% KM (t) UCL	1.74E-01	UCL
PFPeS	ug/kg	18 : 36	50%	1.14E-01	9.90E-01	3.49E-01	3.09E-01	2.95E-01	95% KM (t) UCL	2.95E-01	UCL
PFHxS	ug/kg	25 : 36	69%	4.90E-02	2.56E+00	8.74E-01	9.21E-01	9.02E-01	95% KM (t) UCL	9.02E-01	UCL
PFHpS	ug/kg	23 : 36	64%	4.20E-02	1.30E+00	4.60E-01	3.77E-01	4.46E-01	95% KM (t) UCL	4.46E-01	UCL
PFOS	ug/kg	36 : 36	100%	2.40E+00	1.45E+02	4.47E+01	3.69E+01	7.45E+01	95% Chebyshev (Mean, Sd) UCL	7.45E+01	UCL
PFNS	ug/kg	2 : 36	6%	1.14E-01	2.07E-01	1.61E-01	1.61E-01	NC	--	2.07E-01	Maximum
PFDS	ug/kg	3 : 36	8%	4.10E-02	2.73E-01	1.32E-01	8.10E-02	NC	--	2.73E-01	Maximum
PFDoS	ug/kg	0 : 28	0%	ND	ND	ND	ND	NC	--	ND	(b)
FOSA, FASE, FASAAs											
PFOSA	ug/kg	31 : 36	86%	4.20E-02	2.38E+00	7.87E-01	4.93E-01	9.71E-01	95% Gamma Adjusted KM-UCL	9.71E-01	UCL
N-EtFOSA	ug/kg	0 : 32	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/kg	12 : 36	33%	8.80E-02	2.51E-01	1.70E-01	1.74E-01	1.18E-01	95% KM (t) UCL	1.18E-01	UCL
N-EtFOSAA	ug/kg	29 : 36	81%	3.90E-02	3.30E+00	1.10E+00	6.50E-01	1.28E+00	95% Gamma Adjusted KM-UCL	1.28E+00	UCL
N-MeFOSAA	ug/kg	1 : 36	3%	9.00E-02	9.00E-02	NC	NC	NC	--	9.00E-02	Maximum
N-EtFOSE	ug/kg	1 : 36	3%	1.10E-01	1.10E-01	NC	NC	NC	--	1.10E-01	Maximum
N-MeFOSE	ug/kg	0 : 36	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/kg	0 : 36	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/kg	9 : 36	25%	1.57E-01	2.80E+00	9.74E-01	3.50E-01	5.58E-01	95% KM (t) UCL	5.58E-01	UCL
8:2 FTS	ug/kg	2 : 36	6%	3.60E-02	1.30E-01	8.30E-02	8.30E-02	NC	--	1.30E-01	Maximum
10:2 FTS	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/kg	0 : 36	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/kg	0 : 36	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/kg	0 : 36	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/kg	0 : 36	0%	ND	ND	ND	ND	NC	--	ND	(b)

Appendix D Table 3
Summary Statistics and Exposure Point Concentrations - Surface Sediment
Project 1007
Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
Lake Elmo											
PFCAs											
PFBA	ug/kg	3 : 8	38%	4.64E-01	5.21E+00	2.31E+00	1.25E+00	NC	--	5.21E+00	Maximum
PFPeA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxA	ug/kg	2 : 8	25%	1.26E-01	2.00E-01	1.63E-01	1.63E-01	NC	--	2.00E-01	Maximum
PFHpA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFOA	ug/kg	5 : 8	63%	9.50E-02	1.35E+00	4.10E-01	1.17E-01	5.94E-01	95% KM (t) UCL	5.94E-01	UCL
PFNA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFUnA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDoA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFTrDA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFTeDA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFSAs											
PFBS	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFPeS	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxS	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHpS	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFOS	ug/kg	8 : 8	100%	6.19E-01	4.97E+00	2.04E+00	1.11E+00	4.48E+00	95% Adjusted Gamma UCL	4.48E+00	UCL
PFNS	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDS	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDoS	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
FOSA, FASE, FASAAs											
PFOSA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSAA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSAA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSE	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSE	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/kg	1 : 8	13%	4.53E+00	4.53E+00	NC	NC	NC	--	4.53E+00	Maximum
8:2 FTS	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)

Appendix D Table 3
Summary Statistics and Exposure Point Concentrations - Surface Sediment
Project 1007
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Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
Raleigh Creek - Upper											
PFCAs											
PFBA	ug/kg	31 : 39	79%	3.11E-01	1.10E+01	1.54E+00	6.16E-01	2.95E+00	95% KM (Chebyshev) UCL	2.95E+00	UCL
PFPeA	ug/kg	14 : 39	36%	8.10E-02	8.90E-01	3.41E-01	3.06E-01	2.39E-01	95% KM (t) UCL	2.39E-01	UCL
PFHxA	ug/kg	26 : 39	67%	8.30E-02	4.10E+00	4.87E-01	1.87E-01	8.63E-01	95% KM (Chebyshev) UCL	8.63E-01	UCL
PFHpA	ug/kg	20 : 39	51%	8.80E-02	2.95E+00	4.70E-01	2.12E-01	3.88E-01	KM H-UCL	3.88E-01	UCL
PFOA	ug/kg	39 : 39	100%	8.00E-02	7.88E+01	4.71E+00	1.17E+00	6.69E+00	95% H-UCL	6.69E+00	UCL
PFNA	ug/kg	18 : 39	46%	4.10E-02	1.28E+00	2.92E-01	1.63E-01	2.71E-01	95% KM Adjusted Gamma UCL	2.71E-01	UCL
PFDA	ug/kg	34 : 39	87%	7.90E-02	8.80E+00	8.35E-01	4.22E-01	1.38E+00	95% Gamma Adjusted KM-UCL	1.38E+00	UCL
PFUnA	ug/kg	20 : 39	51%	7.10E-02	6.90E-01	2.72E-01	2.24E-01	2.39E-01	95% KM (t) UCL	2.39E-01	UCL
PFDoA	ug/kg	22 : 39	56%	5.60E-02	1.40E+00	3.99E-01	3.11E-01	3.67E-01	95% KM (t) UCL	3.67E-01	UCL
PFTrDA	ug/kg	9 : 39	23%	4.60E-02	3.77E-01	1.46E-01	1.41E-01	9.65E-02	95% KM (t) UCL	9.65E-02	UCL
PFTeDA	ug/kg	12 : 39	31%	4.50E-02	3.80E-01	1.98E-01	1.93E-01	1.24E-01	95% KM (t) UCL	1.24E-01	UCL
PFSAs											
PFBS	ug/kg	12 : 39	31%	4.00E-02	4.15E-01	1.59E-01	1.07E-01	1.25E-01	95% KM Adjusted Gamma UCL	1.25E-01	UCL
PFPeS	ug/kg	15 : 38	39%	6.30E-02	9.45E-01	2.53E-01	1.56E-01	2.07E-01	95% KM Adjusted Gamma UCL	2.07E-01	UCL
PFHxS	ug/kg	23 : 39	59%	8.10E-02	8.22E+00	8.42E-01	3.91E-01	6.88E-01	KM H-UCL	6.88E-01	UCL
PFHpS	ug/kg	23 : 39	59%	6.50E-02	2.15E+01	1.32E+00	2.05E-01	3.23E+00	95% KM (Chebyshev) UCL	3.23E+00	UCL
PFOS	ug/kg	39 : 39	100%	4.60E-01	1.61E+03	1.01E+02	2.75E+01	1.54E+02	95% Adjusted Gamma UCL	1.54E+02	UCL
PFNS	ug/kg	20 : 39	51%	7.80E-02	3.46E+00	5.28E-01	3.05E-01	5.76E-01	95% Gamma Adjusted KM-UCL	5.76E-01	UCL
PFDS	ug/kg	28 : 39	72%	8.00E-02	6.09E+00	1.11E+00	6.08E-01	1.37E+00	95% Gamma Adjusted KM-UCL	1.37E+00	UCL
PFDoS	ug/kg	18 : 30	60%	5.50E-02	2.51E+00	4.62E-01	1.71E-01	7.38E-01	95% KM (Chebyshev) UCL	7.38E-01	UCL
FOSA, FASE, FASAAs											
PFOSA	ug/kg	38 : 39	97%	1.80E-01	5.02E+01	5.12E+00	2.42E+00	8.63E+00	95% Gamma Adjusted KM-UCL	8.63E+00	UCL
N-EtFOSA	ug/kg	19 : 39	49%	1.06E-01	4.60E+00	7.37E-01	3.18E-01	5.03E-01	KM H-UCL	5.03E-01	UCL
N-MeFOSA	ug/kg	26 : 39	67%	9.50E-02	2.97E+00	4.17E-01	2.57E-01	4.16E-01	KM H-UCL	4.16E-01	UCL
N-EtFOSAA	ug/kg	39 : 39	100%	9.40E-02	2.34E+01	3.93E+00	2.30E+00	5.73E+00	95% Adjusted Gamma UCL	5.73E+00	UCL
N-MeFOSAA	ug/kg	17 : 39	44%	6.80E-02	8.32E-01	2.49E-01	1.59E-01			8.32E-01	Maximum
N-EtFOSE	ug/kg	7 : 39	18%	5.00E-01	1.48E+00	8.68E-01	8.54E-01	5.17E-01	95% KM (t) UCL	5.17E-01	UCL
N-MeFOSE	ug/kg	2 : 39	5%	8.30E-02	1.60E-01	1.20E-01	1.20E-01	NC	--	1.60E-01	Maximum
Fluortelomers											
4:2 FTS	ug/kg	0 : 39	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/kg	12 : 39	31%	1.60E-01	1.02E+01	1.49E+00	3.83E-01	5.68E-01	KM H-UCL	5.68E-01	UCL
8:2 FTS	ug/kg	2 : 39	5%	4.80E-02	5.60E-02	5.20E-02	5.20E-02	NC	--	5.60E-02	Maximum
10:2 FTS	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/kg	0 : 39	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/kg	0 : 39	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/kg	0 : 39	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/kg	0 : 39	0%	ND	ND	ND	ND	NC	--	ND	(b)

Appendix D Table 3
Summary Statistics and Exposure Point Concentrations - Surface Sediment
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Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
Raleigh Creek - Other											
PFCAs											
PFBA	ug/kg	7 : 22	32%	4.25E-01	1.16E+00	7.08E-01	6.27E-01	5.27E-01	95% KM (t) UCL	5.27E-01	UCL
PFPeA	ug/kg	4 : 22	18%	8.90E-02	3.40E-01	2.33E-01	2.51E-01	1.55E-01	95% KM (t) UCL	1.55E-01	UCL
PFHxA	ug/kg	6 : 22	27%	6.20E-02	5.00E-01	2.22E-01	1.14E-01	1.94E-01	95% Gamma Adjusted KM-UCL	1.94E-01	UCL
PFHpA	ug/kg	1 : 22	5%	8.30E-02	8.30E-02	NC	NC	NC	--	8.30E-02	Maximum
PFOA	ug/kg	18 : 22	82%	5.20E-02	8.57E-01	3.08E-01	2.90E-01	3.31E-01	95% KM (t) UCL	3.31E-01	UCL
PFNA	ug/kg	1 : 22	5%	8.40E-02	8.40E-02	NC	NC	NC	--	8.40E-02	Maximum
PFDA	ug/kg	9 : 22	41%	3.90E-02	2.14E-01	1.31E-01	1.03E-01	1.25E-01	95% KM (t) UCL	1.25E-01	UCL
PFUnA	ug/kg	7 : 22	32%	8.30E-02	2.70E-01	1.38E-01	1.04E-01			2.70E-01	Maximum
PFDoA	ug/kg	3 : 22	14%	7.50E-02	9.30E-02	8.40E-02	8.50E-02	NC	--	9.30E-02	Maximum
PFTrDA	ug/kg	0 : 22	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFTeDA	ug/kg	6 : 22	27%	2.60E-01	5.70E-01	4.10E-01	4.10E-01	2.16E-01	95% KM (t) UCL	2.16E-01	UCL
PFSAs											
PFBS	ug/kg	0 : 22	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFPeS	ug/kg	0 : 22	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxS	ug/kg	1 : 22	5%	8.60E-02	8.60E-02	NC	NC	NC	--	8.60E-02	Maximum
PFHpS	ug/kg	0 : 22	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFOS	ug/kg	21 : 22	95%	1.33E-01	1.40E+01	4.07E+00	2.70E+00	6.51E+00	95% Gamma Adjusted KM-UCL	6.51E+00	UCL
PFNS	ug/kg	1 : 22	5%	5.70E-02	5.70E-02	NC	NC	NC	--	5.70E-02	Maximum
PFDS	ug/kg	6 : 22	27%	1.03E-01	1.50E-01	1.31E-01	1.32E-01	9.82E-02	95% KM (t) UCL	9.82E-02	UCL
PFDoS	ug/kg	0 : 15	0%	ND	ND	ND	ND	NC	--	ND	(b)
FOSA, FASE, FASAAs											
PFOSA	ug/kg	15 : 22	68%	6.50E-02	5.57E-01	2.53E-01	1.90E-01	2.92E-01	95% GROS Adjusted Gamma UCL	2.92E-01	UCL
N-EtFOSA	ug/kg	0 : 22	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/kg	4 : 22	18%	9.70E-02	1.40E-01	1.10E-01	1.10E-01			1.40E-01	Maximum
N-EtFOSAA	ug/kg	12 : 22	55%	9.00E-02	1.40E+00	4.08E-01	1.85E-01	4.89E-01	95% Gamma Adjusted KM-UCL	4.89E-01	UCL
N-MeFOSAA	ug/kg	2 : 22	9%	4.20E-02	1.07E-01	7.45E-02	7.45E-02	NC	--	1.07E-01	Maximum
N-EtFOSE	ug/kg	0 : 22	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSE	ug/kg	0 : 22	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/kg	0 : 22	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/kg	4 : 22	18%	3.34E-01	1.76E+00	1.04E+00	1.02E+00			1.76E+00	Maximum
8:2 FTS	ug/kg	2 : 22	9%	4.00E-02	5.20E-02	4.60E-02	4.60E-02	NC	--	5.20E-02	Maximum
10:2 FTS	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/kg	0 : 22	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/kg	0 : 22	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/kg	0 : 22	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/kg	0 : 22	0%	ND	ND	ND	ND	NC	--	ND	(b)

Appendix D Table 3
Summary Statistics and Exposure Point Concentrations - Surface Sediment
Project 1007
Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
West Lakeland											
PFCAs											
PFBA	ug/kg	8 : 31	26%	1.71E-01	9.58E-01	5.03E-01	4.57E-01	3.74E-01	95% KM (t) UCL	3.74E-01	UCL
PFPeA	ug/kg	4 : 31	13%	2.40E-01	3.20E-01	2.80E-01	2.90E-01	1.22E-01	95% KM (t) UCL	1.22E-01	UCL
PFHxA	ug/kg	3 : 31	10%	4.70E-02	4.50E-01	2.90E-01	3.70E-01	NC	--	4.50E-01	Maximum
PFHpA	ug/kg	0 : 31	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFOA	ug/kg	23 : 31	74%	5.30E-02	4.70E-01	2.41E-01	2.60E-01	2.33E-01	95% KM (t) UCL	2.33E-01	UCL
PFNA	ug/kg	1 : 31	3%	1.10E-01	1.10E-01	NC	NC	NC	--	1.10E-01	Maximum
PFDA	ug/kg	3 : 31	10%	4.70E-02	7.70E-02	6.40E-02	6.80E-02	NC	--	7.70E-02	Maximum
PFUnA	ug/kg	2 : 31	6%	5.20E-02	7.40E-02	6.30E-02	6.30E-02	NC	--	7.40E-02	Maximum
PFDoA	ug/kg	0 : 31	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFTrDA	ug/kg	0 : 31	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFTeDA	ug/kg	10 : 31	32%	2.30E-01	5.40E-01	3.50E-01	3.50E-01	1.83E-01	95% KM (t) UCL	1.83E-01	UCL
PFSAs											
PFBS	ug/kg	0 : 31	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFPeS	ug/kg	0 : 31	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxS	ug/kg	1 : 31	3%	9.80E-02	9.80E-02	NC	NC	NC	--	9.80E-02	Maximum
PFHpS	ug/kg	0 : 31	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFOS	ug/kg	31 : 31	100%	2.87E-01	8.59E+00	2.07E+00	1.30E+00	2.68E+00	95% Adjusted Gamma UCL	2.68E+00	UCL
PFNS	ug/kg	0 : 31	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDS	ug/kg	1 : 31	3%	4.40E-02	4.40E-02	NC	NC	NC	--	4.40E-02	Maximum
PFDoS	ug/kg	0 : 21	0%	ND	ND	ND	ND	NC	--	ND	(b)
FOSA, FASE, FASAAs											
PFOSA	ug/kg	2 : 31	6%	7.90E-02	1.00E-01	9.00E-02	9.00E-02	NC	--	1.00E-01	Maximum
N-EtFOSA	ug/kg	0 : 30	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/kg	5 : 31	16%	7.40E-02	9.80E-02	8.80E-02	8.80E-02				
N-EtFOSAA	ug/kg	4 : 31	13%	8.10E-02	6.00E-01	3.44E-01	3.48E-01	1.48E-01	95% KM (t) UCL	1.48E-01	UCL
N-MeFOSAA	ug/kg	0 : 31	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSE	ug/kg	0 : 31	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSE	ug/kg	0 : 31	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/kg	0 : 31	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/kg	4 : 31	13%	2.01E-01	2.24E+00	1.10E+00	9.70E-01	4.27E-01	95% KM (t) UCL	4.27E-01	UCL
8:2 FTS	ug/kg	0 : 31	0%	ND	ND	ND	ND	NC	--	ND	(b)
10:2 FTS	ug/kg	0 : 10	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/kg	0 : 31	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/kg	0 : 31	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/kg	0 : 31	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/kg	0 : 31	0%	ND	ND	ND	ND	NC	--	ND	(b)

Appendix D Table 3
Summary Statistics and Exposure Point Concentrations - Surface Sediment
Project 1007
Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
Other											
PFCAs											
PFBA	ug/kg	8 : 13	62%	2.57E-01	3.61E+00	1.03E+00	5.67E-01	1.21E+00	95% KM (t) UCL	1.21E+00	UCL
PFPeA	ug/kg	2 : 13	15%	1.49E-01	1.91E-01	1.70E-01	1.70E-01	NC	--	1.91E-01	Maximum
PFHxA	ug/kg	2 : 13	15%	9.20E-02	1.17E-01	1.05E-01	1.05E-01	NC	--	1.17E-01	Maximum
PFHpA	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFOA	ug/kg	7 : 13	54%	6.20E-02	6.21E-01	2.61E-01	1.45E-01	2.69E-01	95% KM (t) UCL	2.69E-01	UCL
PFNA	ug/kg	2 : 13	15%	6.50E-02	9.60E-02	8.10E-02	8.10E-02	NC	--	9.60E-02	Maximum
PFDA	ug/kg	2 : 13	15%	1.16E-01	1.71E-01	1.44E-01	1.44E-01	NC	--	1.71E-01	Maximum
PFUnA	ug/kg	1 : 13	8%	9.80E-02	9.80E-02	NC	NC	NC	--	9.80E-02	Maximum
PFDoA	ug/kg	1 : 13	8%	5.60E-02	5.60E-02	NC	NC	NC	--	5.60E-02	Maximum
PFTrDA	ug/kg	1 : 13	8%	3.80E-02	3.80E-02	NC	NC	NC	--	3.80E-02	Maximum
PFTeDA	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFSAs											
PFBS	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFPeS	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxS	ug/kg	1 : 13	8%	3.80E-02	3.80E-02	NC	NC	NC	--	3.80E-02	Maximum
PFHpS	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFOS	ug/kg	10 : 13	77%	7.10E-02	2.32E+00	6.86E-01	3.04E-01	8.93E-01	95% KM (t) UCL	8.93E-01	UCL
PFNS	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDS	ug/kg	1 : 13	8%	6.30E-02	6.30E-02	NC	NC	NC	--	6.30E-02	Maximum
PFDoS	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
FOSA, FASE, FASAAs											
PFOSA	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSA	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSAA	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSAA	ug/kg	1 : 13	8%	8.10E-02	8.10E-02	NC	NC	NC	--	8.10E-02	Maximum
N-EtFOSE	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSE	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/kg	4 : 13	31%	3.02E-01	3.78E-01	3.49E-01	3.59E-01			3.78E-01	Maximum
8:2 FTS	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)

Acronyms:
EPC - Exposure Point Concentration.
NC - Not Calculated.
ND - Not Detected.
UCL - Upper confidence limit.
ug/kg - Micrograms per kilograms.
USEPA - United States Environmental Protection Agency.
Notes:
(a) Upper Confidence Limit (UCL) on the arithmetic mean concentration calculated using USEPA ProUCL Version 5.1. The UCL suggested by ProUCL is used, unless otherwise noted. In cases where more than one UCL is suggested, the higher UCL is used. A sample size of at least eight is recommended for the calculation of UCLs. When fewer samples are available the ProUCL export is reviewed to assess whether the maximum or the recommended UCL is the appropriate EPC
(b) Chemical was not detected.

Appendix D Table 4

Summary Statistics and Exposure Point Concentrations - Total Porewater

Project 1007

Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	EPC	Statistic
West Lakeland									
PFCAs									
PFBA	ug/L	3 : 3	100%	2.60E-01	4.30E-01	3.60E-01	4.00E-01	4.30E-01	Maximum (a)
PFPeA	ug/L	3 : 3	100%	1.00E-02	1.60E-02	1.40E-02	1.50E-02	1.60E-02	Maximum (a)
PFHxA	ug/L	3 : 3	100%	1.30E-02	1.80E-02	1.60E-02	1.60E-02	1.80E-02	Maximum (a)
PFHpA	ug/L	3 : 3	100%	6.30E-03	1.20E-02	1.00E-02	1.20E-02	1.20E-02	Maximum (a)
PFOA	ug/L	3 : 3	100%	5.20E-02	7.80E-02	6.90E-02	7.70E-02	7.80E-02	Maximum (a)
PFNA	ug/L	2 : 3	67%	1.30E-03	1.60E-03	1.50E-03	1.50E-03	1.60E-03	Maximum (a)
PFDA	ug/L	3 : 3	100%	1.30E-03	1.60E-03	1.40E-03	1.40E-03	1.60E-03	Maximum (a)
PFUnA	ug/L	0 : 3	0%	ND	ND	ND	ND	ND	(b)
PFDoA	ug/L	0 : 3	0%	ND	ND	ND	ND	ND	(b)
PFTrDA	ug/L	2 : 3	67%	1.60E-03	1.90E-03	1.80E-03	1.80E-03	1.90E-03	Maximum (a)
PFTeDA	ug/L	0 : 3	0%	ND	ND	ND	ND	ND	(b)
PFSAs									
PFBS	ug/L	3 : 3	100%	4.00E-03	5.30E-03	4.50E-03	4.20E-03	5.30E-03	Maximum (a)
PFPeS	ug/L	3 : 3	100%	3.00E-03	5.30E-03	4.10E-03	4.00E-03	5.30E-03	Maximum (a)
PFHxS	ug/L	3 : 3	100%	7.90E-03	9.80E-03	9.10E-03	9.50E-03	9.80E-03	Maximum (a)
PFHpS	ug/L	3 : 3	100%	1.20E-03	2.10E-03	1.70E-03	1.90E-03	NC	Maximum (a)
PFOS	ug/L	3 : 3	100%	1.60E-01	2.20E-01	1.90E-01	2.00E-01	2.20E-01	Maximum (a)
PFNS	ug/L	0 : 3	0%	ND	ND	ND	ND	ND	(b)
PFDS	ug/L	0 : 3	0%	ND	ND	ND	ND	ND	(b)
FOSA, FASE, FASAAs									
PFOSA	ug/L	2 : 3	67%	1.30E-03	1.60E-03	1.50E-03	1.50E-03	1.60E-03	Maximum (a)
N-EtFOSA	ug/L	0 : 3	0%	ND	ND	ND	ND	ND	(b)
N-MeFOSA	ug/L	0 : 3	0%	ND	ND	ND	ND	ND	(b)
N-EtFOSAA	ug/L	0 : 3	0%	ND	ND	ND	ND	ND	(b)
N-MeFOSAA	ug/L	0 : 3	0%	ND	ND	ND	ND	ND	(b)
N-EtFOSE	ug/L	0 : 3	0%	ND	ND	ND	ND	ND	ND (b)
N-MeFOSE	ug/L	0 : 3	0%	ND	ND	ND	ND	ND	ND (b)
Fluortelomers									
4:2 FTS	ug/L	0 : 3	0%	ND	ND	ND	ND	ND	ND (b)
6:2 FTS	ug/L	0 : 3	0%	ND	ND	ND	ND	ND	ND (b)
8:2 FTS	ug/L	0 : 3	0%	ND	ND	ND	ND	ND	ND (b)
10:2 FTS	ug/L	0 : 3	0%	ND	ND	ND	ND	ND	ND (b)
Replacement Chemistries									
HFPO-DA	ug/L	0 : 3	0%	ND	ND	ND	ND	ND	ND (b)
ADONA	ug/L	0 : 3	0%	ND	ND	ND	ND	ND	ND (b)
9CL-PF3ONS	ug/L	0 : 3	0%	ND	ND	ND	ND	ND	ND (b)
11CL-PF3OUDS	ug/L	0 : 3	0%	ND	ND	ND	ND	ND	ND (b)

Acronyms:

EPC - Exposure Point Concentration.

ND - Not Detected.

UCL - Upper confidence limit.

ug/kg - Micrograms per kilograms.

USEPA - United States Environmental Protection Agency.

Notes:

(a) Upper Confidence Limit (UCL) on the arithmetic mean concentration calculated using USEPA ProUCL Version 5.1. The UCL suggested by ProUCL is used, unless otherwise n In cases where more than one UCL is suggested, the higher UCL is used. A sample size of at least eight is recommended for the calculation of UCLs. When fewer samples are available the ProUCL export is reviewed to assess whether the maximum or the recommended UCL is the appropriate EPC

(b) Chemical was not detected.

Appendix D Table 5

Summary Statistics and Exposure Point Concentrations - Dissolved Porewater

Project 1007

Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
Eagle Point Lake									
PFCAs									
PFBA	ug/L	6 : 6	100%	8.60E-02	2.80E-01	2.23E-01	95% Student's-t UCL	2.23E-01	UCL
PFPeA	ug/L	6 : 6	100%	8.50E-03	2.60E-02	2.03E-02	95% Student's-t UCL	2.03E-02	UCL
PFHxA	ug/L	6 : 6	100%	1.20E-02	4.30E-02	3.30E-02	95% Student's-t UCL	3.30E-02	UCL
PFHpA	ug/L	6 : 6	100%	8.50E-03	3.10E-02	2.37E-02	95% Student's-t UCL	2.37E-02	UCL
PFOA	ug/L	6 : 6	100%	5.30E-02	2.40E-01	1.99E-01	95% Student's-t UCL	1.99E-01	UCL
PFNA	ug/L	6 : 6	100%	1.20E-03	5.60E-03	4.07E-03	95% Student's-t UCL	4.07E-03	UCL
PFDA	ug/L	5 : 6	83%	1.80E-03	8.10E-03	7.53E-03	95% KM (t) UCL	7.53E-03	UCL
PFUnA	ug/L	0 : 5	0%	ND	ND	NC	--	ND	(b)
PFDoA	ug/L	0 : 5	0%	ND	ND	NC	--	ND	(b)
PFTrDA	ug/L	2 : 6	33%	1.50E-03	2.20E-02	NC	--	2.20E-02	Maximum
PFTeDA	ug/L	0 : 5	0%	ND	ND	NC	--	ND	(b)
PFSAs									
PFBS	ug/L	6 : 6	100%	3.40E-03	1.30E-02	9.90E-03	95% Student's-t UCL	9.90E-03	UCL
PFPeS	ug/L	6 : 6	100%	0.0021	0.020	NC	--	NC	(c)
PFHxS	ug/L	6 : 6	100%	4.80E-03	2.50E-02	2.28E-02	95% Student's-t UCL	2.28E-02	UCL
PFHpS	ug/L	6 : 6	100%	0.0009	0.010	NC	--	NC	(c)
PFOS	ug/L	6 : 6	100%	8.00E-02	1.50E+00	1.14E+00	95% Student's-t UCL	1.14E+00	UCL
PFNS	ug/L	1 : 6	17%	2.40E-03	2.40E-03	2.14E+00	95% Student's-t UCL	2.40E-03	Maximum
PFDS	ug/L	0 : 6	0%	ND	ND	NC	--	ND	(b)
FOSA, FASE, FASAAs									
PFOSA	ug/L	4 : 5	80%	8.10E-04	1.50E-03	1.36E-03	95% KM (t) UCL	1.36E-03	UCL
N-EtFOSA	ug/L	0 : 5	0%	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/L	0 : 5	0%	ND	ND	NC	--	ND	(b)
N-EtFOSAA	ug/L	1 : 5	20%	1.30E-03	1.30E-03	NC	--	1.30E-03	Maximum
N-MeFOSAA	ug/L	0 : 5	0%	ND	ND	NC	--	ND	(b)
N-EtFOSE	ug/L	1 : 5	20%	0.00021	0.00021	NC	--	2.10E-04	Maximum
N-MeFOSE	ug/L	0 : 5	0%	ND	ND	NC	--	ND	(b)
Fluortelomers									
4:2 FTS	ug/L	0 : 6	0%	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/L	0 : 6	0%	ND	ND	NC	--	ND	(b)
8:2 FTS	ug/L	1 : 6	17%	0.00016	0.00016	NC	--	1.60E-04	Maximum
10:2 FTS	ug/L	0 : 6	0%	ND	ND	NC	--	ND	(b)
Replacement Chemistries									
HFPO-DA	ug/L	2 : 6	33%	0.00033	0.00034	NC	--	3.40E-04	Maximum
ADONA	ug/L	0 : 6	0%	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/L	0 : 6	0%	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/L	0 : 6	0%	ND	ND	NC	--	ND	(b)

Appendix D Table 5

Summary Statistics and Exposure Point Concentrations - Dissolved Porewater

Project 1007

Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
Raleigh Creek - Upper									
PFCAs									
PFBA	ug/L	6 : 6	100%	1.00E-01	8.60E-01	7.38E-01	95% Student's-t UCL	7.38E-01	UCL
PFPeA	ug/L	6 : 6	100%	8.70E-03	5.80E-02	5.01E-02	95% Student's-t UCL	5.01E-02	UCL
PFHxA	ug/L	5 : 6	83%	6.30E-02	1.30E-01	1.13E-01	95% KM (t) UCL	1.13E-01	UCL
PFHpA	ug/L	6 : 6	100%	2.50E-03	6.80E-02	6.96E-02	95% Student's-t UCL	6.80E-02	Maximum
PFOA	ug/L	6 : 6	100%	1.00E-02	5.70E-01	5.84E-01	95% Student's-t UCL	5.70E-01	Maximum
PFNA	ug/L	5 : 6	83%	3.10E-03	5.50E-03	4.95E-03	95% KM (t) UCL	4.95E-03	UCL
PFDA	ug/L	5 : 6	83%	4.70E-03	1.50E-02	1.23E-02	95% KM (t) UCL	1.23E-02	UCL
PFUnA	ug/L	1 : 6	17%	0.0018	0.0018	NC	--	1.80E-03	Maximum
PFDoA	ug/L	1 : 6	17%	0.0028	0.0028	NC	--	2.80E-03	Maximum
PFTrDA	ug/L	2 : 6	33%	1.60E-03	1.80E-03	NC	--	1.80E-03	Maximum
PFTeDA	ug/L	1 : 6	17%	4.00E-03	4.00E-03	NC	--	ND	(b)
PFSAs									
PFBS	ug/L	6 : 6	100%	3.20E-03	2.50E-02	2.26E-02	95% Student's-t UCL	2.26E-02	UCL
PFPeS	ug/L	5 : 6	83%	0.023	0.044	NC	--	NC	(c)
PFHxS	ug/L	6 : 6	100%	2.40E-03	5.90E-02	5.68E-02	95% Student's-t UCL	5.68E-02	UCL
PFHpS	ug/L	5 : 6	83%	0.010	0.020	NC	--	NC	(c)
PFOS	ug/L	6 : 6	100%	2.60E-02	2.10E+00	1.95E+00	95% Student's-t UCL	1.95E+00	UCL
PFNS	ug/L	4 : 6	67%	0.0007	0.0025	NC	--	NC	(c)
PFDS	ug/L	2 : 6	33%	4.80E-04	5.10E-04	NC	--	ND	(b)
FOSA, FASE, FASAAs									
PFOSA	ug/L	6 : 6	100%	1.00E-03	3.50E-02	3.00E-02	95% Hall's Bootstrap UCL	3.00E-02	UCL
N-EtFOSA	ug/L	0 : 6	0%	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/L	1 : 6	17%	0.00059	0.00059	NC	--	5.90E-04	Maximum
N-EtFOSAA	ug/L	5 : 6	83%	9.90E-03	4.50E-02	NC	--	4.50E-02	Maximum
N-MeFOSAA	ug/L	0 : 6	0%	ND	ND	NC	--	ND	(b)
N-EtFOSE	ug/L	1 : 6	17%	0.00014	0.00014	NC	--	1.40E-04	Maximum
N-MeFOSE	ug/L	0 : 6	0%	ND	ND	NC	--	ND	(b)
Fluortelomers									
4:2 FTS	ug/L	0 : 6	0%	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/L	1 : 6	17%	0.00066	0.00066	NC	--	6.60E-04	Maximum
8:2 FTS	ug/L	0 : 6	0%	ND	ND	NC	--	ND	(b)
10:2 FTS	ug/L	0 : 6	0%	ND	ND	NC	--	ND	(b)
Replacement Chemistries									
HFPO-DA	ug/L	1 : 6	17%	0.00031	0.00031	NC	--	3.10E-04	Maximum
ADONA	ug/L	0 : 6	0%	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/L	0 : 6	0%	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/L	0 : 6	0%	ND	ND	NC	--	ND	(b)

Appendix D Table 5

Summary Statistics and Exposure Point Concentrations - Dissolved Porewater

Project 1007

Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
Raleigh Creek - Other									
PFCAs									
PFBA	ug/L	7 : 7	100%	9.30E-02	1.00E-01	9.90E-02	95% Student's-t UCL	9.90E-02	UCL
PFPeA	ug/L	7 : 7	100%	6.60E-03	8.70E-03	8.39E-03	95% Student's-t UCL	8.39E-03	UCL
PFHxA	ug/L	0 : 7	0%	ND	ND	NC	--	ND	(b)
PFHpA	ug/L	7 : 7	100%	2.20E-03	5.30E-03	4.39E-03	95% Student's-t UCL	4.39E-03	UCL
PFOA	ug/L	7 : 7	100%	8.00E-03	1.20E-02	1.10E-02	95% Student's-t UCL	1.10E-02	UCL
PFNA	ug/L	2 : 7	29%	1.30E-03	1.50E-03	NC	--	1.50E-03	Maximum
PFDA	ug/L	1 : 7	14%	1.30E-03	1.30E-03	NC	--	1.30E-03	Maximum
PFUnA	ug/L	0 : 7	0%	ND	ND	NC	--	ND	(b)
PFDoA	ug/L	1 : 7	14%	0.0014	0.0014	NC	--	1.40E-03	Maximum
PFTrDA	ug/L	0 : 7	0%	ND	ND	NC	--	ND	(b)
PFTeDA	ug/L	0 : 6	0%	ND	ND	NC	--	ND	(b)
PFSAs									
PFBS	ug/L	7 : 7	100%	2.50E-03	3.10E-03	2.89E-03	95% Student's-t UCL	2.89E-03	UCL
PFPeS	ug/L	2 : 7	29%	0.0016	0.0017	NC	--	1.70E-03	Maximum
PFHxS	ug/L	7 : 7	100%	2.10E-03	4.00E-03	3.52E-03	95% Student's-t UCL	3.52E-03	UCL
PFHpS	ug/L	0 : 7	0%	ND	ND	NC	--	ND	(b)
PFOS	ug/L	7 : 7	100%	3.20E-03	5.20E-02	5.79E-02	95% Adjusted Gamma UCL	5.20E-02	Maximum
PFNS	ug/L	0 : 7	0%	ND	ND	NC	--	ND	(b)
PFDS	ug/L	0 : 7	0%	ND	ND	NC	--	ND	(b)
FOSA, FASE, FASAAs									
PFOSA	ug/L	4 : 7	57%	8.00E-04	2.70E-03	2.50E-03	95% KM (t) UCL	2.50E-03	UCL
N-EtFOSA	ug/L	0 : 7	0%	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/L	1 : 7	14%	0.0006	0.0006	NC	--	5.70E-04	Maximum
N-EtFOSAA	ug/L	2 : 7	29%	7.70E-04	1.20E-03	NC	--	1.20E-03	Maximum
N-MeFOSAA	ug/L	0 : 7	0%	ND	ND	NC	--	ND	(b)
N-EtFOSE	ug/L	2 : 7	29%	0.0002	0.0002	NC	--	2.40E-04	Maximum
N-MeFOSE	ug/L	0 : 7	0%	ND	ND	NC	--	ND	(b)
Fluortelomers									
4:2 FTS	ug/L	0 : 7	0%	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/L	0 : 7	0%	ND	ND	NC	--	ND	(b)
8:2 FTS	ug/L	0 : 7	0%	ND	ND	NC	--	ND	(b)
10:2 FTS	ug/L	0 : 7	0%	ND	ND	NC	--	ND	(b)
Replacement Chemistries									
HFPO-DA	ug/L	0 : 7	0%	ND	ND	NC	--	ND	(b)
ADONA	ug/L	0 : 7	0%	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/L	0 : 7	0%	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/L	0 : 7	0%	ND	ND	NC	--	ND	(b)

Appendix D Table 5

Summary Statistics and Exposure Point Concentrations - Dissolved Porewater

Project 1007

Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
West Lakeland									
PFCAs									
PFBA	ug/L	9 : 9	100%	2.30E-01	4.40E-01	4.15E-01	95% Student's-t UCL	4.15E-01	UCL
PFPeA	ug/L	9 : 9	100%	7.80E-03	1.50E-02	1.49E-02	95% Student's-t UCL	1.49E-02	UCL
PFHxA	ug/L	9 : 9	100%	9.50E-03	1.80E-02	1.62E-02	95% Student's-t UCL	1.62E-02	UCL
PFHpA	ug/L	9 : 9	100%	6.70E-03	1.20E-02	1.03E-02	95% Student's-t UCL	1.03E-02	UCL
PFOA	ug/L	9 : 9	100%	5.40E-02	8.90E-02	8.64E-02	95% Student's-t UCL	8.64E-02	UCL
PFNA	ug/L	5 : 9	56%	1.20E-03	2.10E-03	1.77E-03	95% KM (t) UCL	1.77E-03	UCL
PFDA	ug/L	5 : 9	56%	1.30E-03	1.50E-02	1.01E-02	95% KM (Chebyshev) UCL	1.01E-02	UCL
PFUnA	ug/L	1 : 9	11%	0.0018	0.0018	NC	--	1.80E-03	Maximum
PFDoA	ug/L	1 : 9	11%	0.0023	0.0023	NC	--	2.30E-03	Maximum
PFTrDA	ug/L	0 : 9	0%	ND	ND	NC	--	ND	(b)
PFTeDA	ug/L	0 : 8	0%	ND	ND	NC	--	ND	(b)
PFSAs									
PFBS	ug/L	9 : 9	100%	3.50E-03	6.20E-03	4.84E-03	95% Student's-t UCL	4.84E-03	UCL
PFPeS	ug/L	9 : 9	100%	0.0032	0.0081	NC	--	NC	(c)
PFHxS	ug/L	9 : 9	100%	5.70E-03	1.10E-02	1.02E-02	95% Student's-t UCL	1.02E-02	UCL
PFHpS	ug/L	8 : 9	89%	0.0015	0.0030	NC	--	NC	(c)
PFOS	ug/L	9 : 9	100%	8.30E-03	8.20E-01	5.60E-01	95% Adjusted Gamma UCL	5.60E-01	UCL
PFNS	ug/L	1 : 9	11%	0.0007	0.0007	NC	--	6.70E-04	Maximum
PFDS	ug/L	0 : 9	0%	ND	ND	NC	--	ND	(b)
FASAs									
PFOSA	ug/L	7 : 9	78%	9.90E-04	5.10E-03	3.86E-03	95% KM (Chebyshev) UCL	3.86E-03	UCL
N-EtFOSA	ug/L	0 : 9	0%	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/L	0 : 9	0%	ND	ND	NC	--	ND	(b)
N-EtFOSAA	ug/L	1 : 9	11%	1.20E-02	1.20E-02	NC	--	1.20E-02	Maximum
N-MeFOSAA	ug/L	0 : 9	0%	ND	ND	NC	--	ND	(b)
N-EtFOSE	ug/L	0 : 9	0%	ND	ND	NC	--	ND	(b)
N-MeFOSE	ug/L	0 : 9	0%	ND	ND	NC	--	ND	(b)
Fluortelomers									
4:2 FTS	ug/L	0 : 9	0%	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/L	0 : 9	0%	ND	ND	NC	--	ND	(b)
8:2 FTS	ug/L	0 : 9	0%	ND	ND	NC	--	ND	(b)
10:2 FTS	ug/L	0 : 9	0%	ND	ND	NC	--	ND	(b)
Replacement Chemistries									
HFPO-DA	ug/L	0 : 9	0%	ND	ND	NC	--	ND	(b)
ADONA	ug/L	0 : 9	0%	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/L	0 : 9	0%	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/L	0 : 9	0%	ND	ND	NC	--	ND	(b)

Acronyms:

EPC - Exposure Point Concentration.

NC - Not Calculated.

ND - Not Detected.

UCL - Upper confidence limit.

ug/kg - Micrograms per kilograms.

USEPA - United States Environmental Protection Agency.

Notes:

(a) Upper Confidence Limit (UCL) on the arithmetic mean concentration calculated using USEPA ProUCL Version 5.1. The UCL suggested by ProUCL is used, unless otherwise noted. In cases where more than one UCL is suggested, the higher UCL is used. A sample size of at least eight is recommended for the calculation of UCLs. When fewer samples are available the ProUCL export is reviewed to assess whether the maximum or the recommended UCL is the appropriate EPC

(b) Chemical was not detected.

(c) A UCL was not calculated analyte in this location.

Appendix D Table 6
Summary Statistics and Exposure Point Concentrations - Amphibian Tissue
Project 1007
Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
Raleigh Creek - Upper											
PFCAs											
PFBA	ug/kg	6 : 8	75%	3.77E-01	2.31E+00	1.30E+00	1.17E+00	1.57E+00	95% KM (t) UCL	1.57E+00	UCL
PFPeA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxA	ug/kg	1 : 8	13%	1.36E-01	1.36E-01	NC	NC	NC	--	1.36E-01	Maximum
PFHpA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFOA	ug/kg	6 : 8	75%	2.37E-01	6.62E-01	4.62E-01	4.57E-01	5.23E-01	95% KM (t) UCL	5.23E-01	UCL
PFNA	ug/kg	1 : 8	13%	1.18E-01	1.18E-01	NC	NC	NC	--	1.18E-01	Maximum
PFDA	ug/kg	8 : 8	100%	4.90E-01	2.26E+00	1.05E+00	6.53E-01	1.90E+00	95% H-UCL	1.90E+00	UCL
PFUnA	ug/kg	8 : 8	100%	1.16E-01	8.15E-01	3.42E-01	2.23E-01	5.21E-01	95% Student's-t UCL	5.21E-01	UCL
PFDoA	ug/kg	8 : 8	100%	3.02E-01	2.59E+00	9.21E-01	6.60E-01	1.90E+00	95% Adjusted Gamma UCL	1.90E+00	UCL
PFTrDA	ug/kg	8 : 8	100%	1.43E-01	6.72E-01	3.61E-01	3.37E-01	4.76E-01	95% Student's-t UCL	4.76E-01	UCL
PFTeDA	ug/kg	7 : 7	100%	1.71E-01	1.14E+00	4.05E-01	3.10E-01	8.57E-01	95% Adjusted Gamma UCL	8.57E-01	UCL
PFSAs											
PFBS	ug/kg	1 : 8	13%	1.97E-01	1.97E-01	NC	NC	NC	--	1.97E-01	Maximum
PFPeS	ug/kg	2 : 8	25%	1.71E-01	2.53E-01	2.12E-01	2.12E-01	NC	--	2.53E-01	Maximum
PFHxS	ug/kg	5 : 8	63%	1.57E-01	7.87E-01	4.29E-01	4.29E-01	4.87E-01	95% KM (t) UCL	4.87E-01	UCL
PFHpS	ug/kg	7 : 8	88%	1.79E-01	1.34E+00	5.27E-01	2.78E-01	1.47E+00	95% GROS Adjusted Gamma UCL	1.34E+00	Maximum
PFOS	ug/kg	8 : 8	100%	5.09E+01	7.37E+02	2.86E+02	1.56E+02	7.30E+02	95% Adjusted Gamma UCL	7.30E+02	UCL
PFNS	ug/kg	8 : 8	100%	1.81E-01	2.71E+00	8.74E-01	3.71E-01	2.50E+00	95% Chebyshev (Mean, Sd) UCL	2.50E+00	UCL
PFDS	ug/kg	8 : 8	100%	4.93E-01	7.83E+00	2.61E+00	1.38E+00	7.25E+00	95% Adjusted Gamma UCL	7.25E+00	UCL
PFDoS	ug/kg	5 : 8	63%	2.99E-01	1.39E+00	8.73E-01	1.15E+00	9.77E-01	95% KM (t) UCL	9.77E-01	UCL
FOSA, FASE, FASAAs											
PFOSA	ug/kg	8 : 8	100%	1.17E+00	3.38E+01	8.65E+00	4.40E+00	1.59E+01	95% Student's-t UCL	1.59E+01	UCL
N-EtFOSA	ug/kg	0 : 4	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/kg	0 : 4	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSAA	ug/kg	8 : 8	100%	3.54E-01	8.52E+00	3.14E+00	2.60E+00	4.89E+00	95% Student's-t UCL	4.89E+00	UCL
N-MeFOSAA	ug/kg	5 : 8	63%	1.09E-01	2.44E-01	1.52E-01	1.24E-01	1.66E-01	95% KM (t) UCL	1.66E-01	UCL
N-MeFOSE	ug/kg	0 : 3	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/kg	1 : 8	13%	3.39E+00	3.39E+00	3.39E+00	3.39E+00	NC	--	3.39E+00	Maximum
8:2 FTS	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
3:3 FTCA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
5:3 FTCA	ug/kg	2 : 8	25%	2.40E+00	4.74E+00	3.57E+00	3.57E+00	NC	--	4.74E+00	Maximum
7:3 FTCA	ug/kg	3 : 8	38%	3.74E+00	5.46E+00	4.73E+00	5.00E+00	NC	--	5.46E+00	Maximum
Replacement Chemistries											
HFPO-DA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro(2-ethoxyethane)sulfonic acid	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3,6-dioxaheptanoic acid	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3-methoxypropanoic acid	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-4-methoxybutanoic acid	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)

Appendix D Table 6
Summary Statistics and Exposure Point Concentrations - Amphibian Tissue
Project 1007
Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
Raleigh Creek - Other											
PFCAs											
PFBA	ug/kg	1 : 3	33%	9.51E-01	9.51E-01	NC	NC	NC	--	9.51E-01	Maximum
PFPeA	ug/kg	0 : 3	0%	ND	ND	NC	NC	NC	--	ND	(b)
PFHxA	ug/kg	0 : 3	0%	ND	ND	NC	NC	NC	--	ND	(b)
PFHpA	ug/kg	0 : 3	0%	ND	ND	NC	NC	NC	--	ND	(b)
PFOA	ug/kg	0 : 3	0%	ND	ND	NC	NC	NC	--	ND	(b)
PFNA	ug/kg	0 : 3	0%	ND	ND	NC	NC	NC	--	ND	(b)
PFDA	ug/kg	3 : 3	100%	1.97E-01	6.24E-01	4.50E-01	5.28E-01	NC	--	6.24E-01	Maximum
PFUnA	ug/kg	3 : 3	100%	1.38E-01	5.79E-01	3.05E-01	1.97E-01	NC	--	5.79E-01	Maximum
PFDoA	ug/kg	3 : 3	100%	1.57E-01	5.98E-01	3.19E-01	2.03E-01	NC	--	5.98E-01	Maximum
PFTrDA	ug/kg	3 : 3	100%	1.27E-01	3.39E-01	2.51E-01	2.87E-01	NC	--	3.39E-01	Maximum
PFTeDA	ug/kg	2 : 3	67%	1.77E-01	3.03E-01	2.40E-01	2.40E-01	NC	--	3.03E-01	Maximum
PFSAs											
PFBS	ug/kg	0 : 3	0%	ND	ND	NC	NC	NC	--	ND	(b)
PFPeS	ug/kg	0 : 3	0%	ND	ND	NC	NC	NC	--	ND	(b)
PFHxS	ug/kg	0 : 3	0%	ND	ND	NC	NC	NC	--	ND	(b)
PFHpS	ug/kg	0 : 3	0%	ND	ND	NC	NC	NC	--	ND	(b)
PFOS	ug/kg	3 : 3	100%	3.35E+00	4.32E+01	2.58E+01	3.08E+01	NC	--	4.32E+01	Maximum
PFNS	ug/kg	1 : 3	33%	1.01E-01	1.01E-01	1.01E-01	1.01E-01	NC	--	1.01E-01	Maximum
PFDS	ug/kg	2 : 3	67%	1.22E-01	2.32E-01	1.77E-01	1.77E-01	NC	--	2.32E-01	Maximum
PFDoS	ug/kg	0 : 3	0%	ND	ND	NC	NC	NC	--	ND	(b)
FOSA, FASE, FASAAs											
PFOSA	ug/kg	1 : 3	33%	1.37E-01	1.37E-01	NC	NC	NC	--	1.37E-01	Maximum
N-EtFOSA	ug/kg	0 : 3	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/kg	0 : 3	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSAA	ug/kg	1 : 3	33%	1.72E-01	1.72E-01	NC	NC	NC	--	1.72E-01	Maximum
N-MeFOSAA	ug/kg	0 : 3	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSE	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSE	ug/kg	0 : 3	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/kg	0 : 3	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/kg	0 : 3	0%	ND	ND	ND	ND	NC	--	ND	(b)
8:2 FTS	ug/kg	0 : 3	0%	ND	ND	ND	ND	NC	--	ND	(b)
3:3 FTCA	ug/kg	0 : 3	0%	ND	ND	ND	ND	NC	--	ND	(b)
5:3 FTCA	ug/kg	0 : 3	0%	ND	ND	ND	ND	NC	--	ND	(b)
7:3 FTCA	ug/kg	0 : 3	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/kg	0 : 3	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/kg	0 : 3	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/kg	0 : 3	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/kg	0 : 3	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro(2-ethoxyethane)sulfonic acid	ug/kg	0 : 3	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3,6-dioxaheptanoic acid	ug/kg	0 : 3	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3-methoxypropanoic acid	ug/kg	0 : 3	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-4-methoxybutanoic acid	ug/kg	0 : 3	0%	ND	ND	ND	ND	NC	--	ND	(b)

Appendix D Table 6
Summary Statistics and Exposure Point Concentrations - Amphibian Tissue
Project 1007
Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
West Lakeland											
PFCAs											
PFBA	ug/kg	5 : 6	83%	4.57E-01	1.16E+00	8.91E-01	1.10E+00	1.12E+00	95% KM (t) UCL	1.12E+00	UCL
PFPeA	ug/kg	0 : 6	0%	ND	ND	NC	NC	NC	--	ND	(b)
PFHxA	ug/kg	0 : 6	0%	ND	ND	NC	NC	NC	--	ND	(b)
PFHpA	ug/kg	0 : 6	0%	ND	ND	NC	NC	NC	--	ND	(b)
PFOA	ug/kg	4 : 6	67%	1.30E-01	3.04E-01	2.38E-01	2.58E-01	2.72E-01	95% KM (t) UCL	2.72E-01	UCL
PFNA	ug/kg	2 : 6	33%	1.53E-01	2.83E-01	2.18E-01	2.18E-01	NC	--	2.83E-01	Maximum
PFDA	ug/kg	6 : 6	100%	2.44E-01	2.57E+00	1.35E+00	1.39E+00	2.13E+00	95% Student's-t UCL	2.13E+00	UCL
PFUnA	ug/kg	6 : 6	100%	1.45E-01	4.89E-01	3.44E-01	4.12E-01	4.67E-01	95% Student's-t UCL	4.67E-01	UCL
PFDoA	ug/kg	6 : 6	100%	1.24E-01	3.14E-01	1.79E-01	1.62E-01	2.79E-01	95% Adjusted Gamma UCL	2.79E-01	UCL
PFTrDA	ug/kg	6 : 6	100%	9.80E-02	2.63E-01	1.84E-01	1.81E-01	2.45E-01	95% Student's-t UCL	2.45E-01	UCL
PFTeDA	ug/kg	3 : 6	50%	1.03E-01	1.50E-01	1.21E-01	1.10E-01	NC	--	1.50E-01	Maximum
PFSAs											
PFBS	ug/kg	0 : 6	0%	ND	ND	NC	NC	NC	--	ND	(b)
PFPeS	ug/kg	0 : 6	0%	ND	ND	NC	NC	NC	--	ND	(b)
PFHxS	ug/kg	0 : 6	0%	ND	ND	NC	NC	NC	--	ND	(b)
PFHpS	ug/kg	2 : 6	33%	1.00E-01	1.04E-01	1.02E-01	1.02E-01	NC	--	1.04E-01	Maximum
PFOS	ug/kg	6 : 6	100%	3.29E+01	1.37E+02	8.63E+01	9.72E+01	1.17E+02	95% Student's-t UCL	1.17E+02	UCL
PFNS	ug/kg	4 : 6	67%	1.44E-01	2.10E-01	1.68E-01	1.58E-01	1.81E-01	95% KM (t) UCL	1.81E-01	UCL
PFDS	ug/kg	2 : 6	33%	1.16E-01	2.34E-01	1.75E-01	1.75E-01	NC	--	2.34E-01	Maximum
PFDoS	ug/kg	0 : 6	0%	ND	ND	NC	NC	NC	--	ND	(b)
FOSA, FASE, FASAAs											
PFOSA	ug/kg	3 : 6	50%	4.69E-01	7.24E-01	6.34E-01	7.09E-01	NC	--	7.24E-01	Maximum
N-EtFOSA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/kg	0 : 5	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSAA	ug/kg	4 : 6	67%	1.23E-01	2.84E-01	1.97E-01	1.91E-01	2.27E-01	95% KM (t) UCL	2.27E-01	UCL
N-MeFOSAA	ug/kg	0 : 6	0%	ND	ND	NC	NC	NC	--	ND	(b)
N-MeFOSE	ug/kg	0 : 3	0%	ND	ND	NC	NC	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/kg	1 : 6	17%	1.58E+00	1.58E+00	NC	NC	NC	--	1.58E+00	Maximum
8:2 FTS	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
3:3 FTCA	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
5:3 FTCA	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
7:3 FTCA	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro(2-ethoxyethane)sulfonic acid	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3,6-dioxaheptanoic acid	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3-methoxypropanoic acid	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-4-methoxybutanoic acid	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)

Appendix D Table 6
Summary Statistics and Exposure Point Concentrations - Amphibian Tissue
Project 1007
Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
Eagle Point Lake											
PFCAs											
PFBA	ug/kg	1 : 1	100%	6.46E-01	6.46E-01	6.46E-01	6.46E-01	NC	--	6.46E-01	Maximum
PFPeA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHpA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFOA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFNA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDA	ug/kg	1 : 1	100%	5.29E-01	5.29E-01	5.29E-01	5.29E-01	NC	--	5.29E-01	Maximum
PFUnA	ug/kg	1 : 1	100%	1.25E-01	1.25E-01	1.25E-01	1.25E-01	NC	--	1.25E-01	Maximum
PFDoA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFTrDA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFTeDA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFSAs											
PFBS	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFPeS	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxS	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHpS	ug/kg	1 : 1	100%	1.09E-01	1.09E-01	1.09E-01	1.09E-01	NC	--	1.09E-01	Maximum
PFOS	ug/kg	1 : 1	100%	6.99E+01	6.99E+01	6.99E+01	6.99E+01	NC	--	6.99E+01	Maximum
PFNS	ug/kg	1 : 1	100%	1.06E-01	1.06E-01	1.06E-01	1.06E-01	NC	--	1.06E-01	Maximum
PFDS	ug/kg	1 : 1	100%	1.26E-01	1.26E-01	1.26E-01	1.26E-01	NC	--	1.26E-01	Maximum
PFDoS	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
FOSA, FASE, FASAAs											
PFOSA	ug/kg	1 : 1	100%	2.93E-01	2.93E-01	2.93E-01	2.93E-01	NC	--	2.93E-01	Maximum
N-EtFOSA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSAA	ug/kg	1 : 1	100%	3.97E-01	3.97E-01	3.97E-01	3.97E-01	NC	--	3.97E-01	UCL
N-MeFOSAA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSE	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSE	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
8:2 FTS	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
10:2 FTS	ug/kg									NA	
3:3 FTCA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
5:3 FTCA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
7:3 FTCA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro(2-ethoxyethane)sulfonic acid	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3,6-dioxaheptanoic acid	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3-methoxypropanoic acid	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-4-methoxybutanoic acid	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)

Acronyms:
EPC - Exposure Point Concentration.
NC - Not Calculated.
ND - Not Detected.
UCL - Upper confidence limit.
ug/kg - Micrograms per kilograms.
USEPA - United States Environmental Protection Agency.
Notes:
(a) Upper Confidence Limit (UCL) on the arithmetic mean concentration calculated using USEPA ProUCL Version 5.1. The UCL suggested by ProUCL is used, unless otherwise noted. In cases where more than one UCL is suggested, the higher UCL is used. A sample size of at least eight is recommended for the calculation of UCLs. When fewer samples are available the ProUCL export is reviewed to assess whether the maximum or the recommended UCL is the appropriate EPC
(c) Chemical was not detected.

Appendix D Table 7
Summary Statistics and Exposure Point Concentrations - Crayfish Tissue
Project 1007
Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
Eagle Point Lake											
PFCAs											
PFBA	ug/kg	9 : 9	100%	2.61E+00	4.24E+00	3.32E+00	3.27E+00	3.60E+00	95% Student's-t UCL	3.60E+00	UCL
PFPeA	ug/kg	6 : 9	67%	2.06E-01	2.61E-01	2.30E-01	2.28E-01	2.33E-01	95% KM (t) UCL	2.33E-01	UCL
PFHxA	ug/kg	9 : 9	100%	1.28E-01	2.62E-01	1.70E-01	1.54E-01	1.99E-01	95% Student's-t UCL	1.99E-01	UCL
PFHpA	ug/kg	9 : 9	100%	2.11E-01	4.92E-01	3.32E-01	3.10E-01	3.92E-01	95% Student's-t UCL	3.92E-01	UCL
PFOA	ug/kg	9 : 9	100%	6.80E-01	3.27E+00	1.78E+00	1.47E+00	2.31E+00	95% Student's-t UCL	2.31E+00	UCL
PFNA	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDA	ug/kg	9 : 9	100%	1.51E-01	5.12E-01	3.40E-01	3.72E-01	4.26E-01	95% Student's-t UCL	4.26E-01	UCL
PFUnA	ug/kg	9 : 9	100%	2.34E-01	4.32E-01	3.24E-01	3.28E-01	3.62E-01	95% Student's-t UCL	3.62E-01	UCL
PFDoA	ug/kg	9 : 9	100%	1.46E-01	3.44E-01	2.12E-01	1.88E-01	2.53E-01	95% Student's-t UCL	2.53E-01	UCL
PFTrDA	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFTeDA	ug/kg	1 : 9	11%	1.55E-01	1.55E-01	NC	NC	NC	--	1.55E-01	Maximum
PFSAs											
PFBS	ug/kg	9 : 9	100%	1.63E-01	3.99E-01	2.24E-01	1.86E-01	2.81E-01	95% Modified-t UCL	2.81E-01	UCL
PFPeS	ug/kg	9 : 9	100%	1.28E-01	2.99E-01	2.14E-01	2.04E-01	2.52E-01	95% Student's-t UCL	2.52E-01	UCL
PFHxS	ug/kg	9 : 9	100%	1.35E-01	3.16E-01	2.07E-01	2.16E-01	2.43E-01	95% Student's-t UCL	2.43E-01	UCL
PFHpS	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFOS	ug/kg	9 : 9	100%	1.27E+01	2.70E+01	2.06E+01	2.03E+01	2.33E+01	95% Student's-t UCL	2.33E+01	UCL
PFNS	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDS	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDoS	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
FOSA, FASE, FASAAs											
PFOSA	ug/kg	9 : 9	100%	3.11E+00	1.11E+01	8.36E+00	9.40E+00	9.83E+00	95% Student's-t UCL	9.83E+00	UCL
N-EtFOSA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSAA	ug/kg	9 : 9	100%	1.08E-01	3.99E-01	2.76E-01	2.94E-01	3.40E-01	95% Student's-t UCL	3.40E-01	UCL
N-MeFOSAA	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSE	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/kg	1 : 9	11%	3.17E+00	3.17E+00	3.17E+00	3.17E+00	NC	--	3.17E+00	Maximum
8:2 FTS	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
3:3 FTCA	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
5:3 FTCA	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
7:3 FTCA	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro(2-ethoxyethane)sulfonic acid	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3,6-dioxaheptanoic acid	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3-methoxypropanoic acid	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-4-methoxybutanoic acid	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)

Appendix D Table 7
Summary Statistics and Exposure Point Concentrations - Crayfish Tissue
Project 1007
Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
Raleigh Creek - Upper											
PFCAs											
PFBA	ug/kg	7 : 7	100%	3.14E+00	7.21E+00	5.08E+00	5.32E+00	6.06E+00	95% Student's-t UCL	6.06E+00	UCL
PFPeA	ug/kg	4 : 7	57%	2.76E-01	3.24E-01	2.95E-01	2.89E-01	2.95E-01	95% KM (t) UCL	2.95E-01	UCL
PFHxA	ug/kg	7 : 7	100%	2.16E-01	6.42E-01	3.93E-01	4.00E-01	5.22E-01	95% Student's-t UCL	5.22E-01	UCL
PFHpA	ug/kg	7 : 7	100%	2.35E-01	1.73E+00	1.13E+00	1.21E+00	1.55E+00	95% Student's-t UCL	1.55E+00	UCL
PFOA	ug/kg	7 : 7	100%	1.38E+00	1.34E+01	8.90E+00	8.86E+00	1.19E+01	95% Student's-t UCL	1.19E+01	UCL
PFNA	ug/kg	3 : 7	43%	1.00E-01	1.18E-01	1.07E-01	1.04E-01	NC	--	1.18E-01	Maximum
PFDA	ug/kg	7 : 7	100%	1.59E-01	2.09E+00	9.33E-01	7.62E-01	1.37E+00	95% Student's-t UCL	1.37E+00	UCL
PFUnA	ug/kg	7 : 7	100%	2.33E-01	1.84E+00	1.03E+00	1.18E+00	1.45E+00	95% Student's-t UCL	1.45E+00	UCL
PFDoA	ug/kg	7 : 7	100%	1.25E+00	2.36E+00	1.95E+00	2.07E+00	2.24E+00	95% Student's-t UCL	2.24E+00	UCL
PFTrDA	ug/kg	7 : 7	100%	1.41E-01	1.02E+00	4.75E-01	3.06E-01	7.21E-01	95% Student's-t UCL	7.21E-01	UCL
PFTeDA	ug/kg	7 : 7	100%	9.70E-02	8.13E-01	3.34E-01	1.93E-01	5.38E-01	95% Student's-t UCL	5.38E-01	UCL
PFSAs											
PFBS	ug/kg	7 : 7	100%	1.89E-01	1.63E+00	6.52E-01	4.52E-01	1.03E+00	95% Student's-t UCL	1.03E+00	UCL
PFPeS	ug/kg	6 : 7	86%	4.22E-01	1.26E+00	8.08E-01	8.00E-01	1.01E+00	95% KM (t) UCL	1.01E+00	UCL
PFHxS	ug/kg	7 : 7	100%	5.30E-01	3.12E+00	1.35E+00	9.84E-01	2.01E+00	95% Student's-t UCL	2.01E+00	UCL
PFHpS	ug/kg	7 : 7	100%	1.10E-01	5.69E-01	2.91E-01	2.35E-01	4.02E-01	95% Student's-t UCL	4.02E-01	UCL
PFOS	ug/kg	7 : 7	100%	2.62E+01	1.53E+02	7.81E+01	6.74E+01	1.07E+02	95% Student's-t UCL	1.07E+02	UCL
PFNS	ug/kg	6 : 7	86%	1.03E-01	2.67E-01	1.75E-01	1.80E-01	2.08E-01	95% KM (t) UCL	2.08E-01	UCL
PFDS	ug/kg	7 : 7	100%	2.43E-01	1.09E+00	6.49E-01	6.45E-01	8.43E-01	95% Student's-t UCL	8.43E-01	UCL
PFDoS	ug/kg	7 : 7	100%	1.16E-01	1.80E+00	4.95E-01	1.38E-01	1.56E+00	95% Chebyshev (Mean, Sd) UCL	1.56E+00	UCL
FOSA, FASE, FASAAs											
PFOSA	ug/kg	7 : 7	100%	5.65E+01	1.05E+02	8.18E+01	7.56E+01	9.50E+01	95% Student's-t UCL	9.50E+01	UCL
N-EtFOSA	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSAA	ug/kg	7 : 7	100%	1.41E+00	5.40E+00	2.48E+00	1.95E+00	4.31E+00	95% Adjusted Gamma UCL	4.31E+00	UCL
N-MeFOSAA	ug/kg	1 : 7	14%	1.94E-01	1.94E-01	NC	NC	NC	--	1.94E-01	Maximum
N-EtFOSE	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSE	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
8:2 FTS	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
3:3 FTCA	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
5:3 FTCA	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
7:3 FTCA	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro(2-ethoxyethane)sulfonic acid	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3,6-dioxaheptanoic acid	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3-methoxypropanoic acid	ug/kg	1 : 7	14%	6.24E-01	6.24E-01	6.24E-01	6.24E-01	NC	--	6.24E-01	Maximum
Perfluoro-4-methoxybutanoic acid	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)

Appendix D Table 7
Summary Statistics and Exposure Point Concentrations - Crayfish Tissue
Project 1007
Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
Raleigh Creek Other											
PFCAs											
PFBA	ug/kg	11 : 11	100%	1.13E+00	2.75E+00	1.71E+00	1.51E+00	1.98E+00	95% Student's-t UCL	1.98E+00	UCL
PFPeA	ug/kg	0 : 11	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxA	ug/kg	1 : 11	9%	1.83E-01	1.83E-01	NC	NC	NC	--	1.83E-01	Maximum
PFHpA	ug/kg	4 : 11	36%	1.16E-01	7.10E-01	2.81E-01	1.49E-01	3.78E-01	Gamma Adjusted KM-UCL	3.78E-01	UCL
PFOA	ug/kg	11 : 11	100%	4.35E-01	5.50E+00	1.77E+00	1.43E+00	2.75E+00	95% Adjusted Gamma UCL	2.75E+00	UCL
PFNA	ug/kg	11 : 11	100%	1.29E-01	6.76E-01	3.66E-01	3.14E-01	4.63E-01	95% Student's-t UCL	4.63E-01	UCL
PFDA	ug/kg	11 : 11	100%	2.40E-01	1.52E+00	6.99E-01	6.77E-01	8.84E-01	95% Student's-t UCL	8.84E-01	UCL
PFUnA	ug/kg	11 : 11	100%	2.42E-01	1.18E+00	5.53E-01	5.25E-01	6.93E-01	95% Student's-t UCL	6.93E-01	UCL
PFDoA	ug/kg	11 : 11	100%	3.33E-01	1.30E+00	7.13E-01	7.30E-01	8.64E-01	95% Student's-t UCL	8.64E-01	UCL
PFTrDA	ug/kg	11 : 11	100%	1.32E-01	6.58E-01	3.42E-01	3.31E-01	4.18E-01	95% Student's-t UCL	4.18E-01	UCL
PFTeDA	ug/kg	11 : 11	100%	1.34E-01	6.35E-01	3.30E-01	3.36E-01	4.01E-01	95% Student's-t UCL	4.01E-01	UCL
PFSAs											
PFBS	ug/kg	3 : 11	27%	1.73E-01	5.75E-01	3.16E-01	2.00E-01	NC	--	5.75E-01	Maximum
PFPeS	ug/kg	1 : 11	9%	3.72E-01	3.72E-01	3.72E-01	3.72E-01	NC	--	3.72E-01	Maximum
PFHxS	ug/kg	11 : 11	100%	1.08E-01	1.03E+00	3.10E-01	1.72E-01	5.37E-01	95% H-UCL	5.37E-01	UCL
PFHpS	ug/kg	1 : 11	9%	1.99E-01	1.99E-01	1.99E-01	1.99E-01	NC	--	1.99E-01	Maximum
PFOS	ug/kg	11 : 11	100%	2.29E+00	5.41E+01	1.70E+01	1.44E+01	2.47E+01	95% Student's-t UCL	2.47E+01	UCL
PFNS	ug/kg	0 : 11	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDS	ug/kg	5 : 11	45%	1.13E-01	3.05E-01	1.65E-01	1.30E-01	1.64E-01	95% KM (t) UCL	1.64E-01	UCL
PFDoS	ug/kg	1 : 11	9%	9.90E-02	9.90E-02	9.90E-02	9.90E-02	NC	--	9.90E-02	Maximum
FOSA, FASE, FASAAs											
PFOSA	ug/kg	11 : 11	100%	1.25E+00	1.21E+01	3.44E+00	1.95E+00	6.16E+00	95% H-UCL	6.16E+00	UCL
N-EtFOSA	ug/kg	0 : 5	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/kg	0 : 10	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSAA	ug/kg	1 : 11	9%	1.73E-01	1.73E-01	NC	NC	NC	--	1.73E-01	Maximum
N-MeFOSAA	ug/kg	0 : 11	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSE	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/kg	0 : 11	0%	ND	ND	NC	NC	NC	--	ND	(b)
6:2 FTS	ug/kg	1 : 11	9%	1.53E+00	1.53E+00	1.53E+00	1.53E+00	NC	--	1.53E+00	Maximum
8:2 FTS	ug/kg	0 : 11	0%	ND	ND	ND	ND	NC	--	ND	(b)
3:3 FTCA	ug/kg	0 : 11	0%	ND	ND	ND	ND	NC	--	ND	(b)
5:3 FTCA	ug/kg	0 : 11	0%	ND	ND	ND	ND	NC	--	ND	(b)
7:3 FTCA	ug/kg	0 : 11	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/kg	0 : 10	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/kg	0 : 11	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/kg	0 : 11	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/kg	0 : 11	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro(2-ethoxyethane)sulfonic acid	ug/kg	0 : 11	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3,6-dioxaheptanoic acid	ug/kg	0 : 11	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3-methoxypropanoic acid	ug/kg	0 : 11	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-4-methoxybutanoic acid	ug/kg	0 : 11	0%	ND	ND	ND	ND	NC	--	ND	(b)

Appendix D Table 7
Summary Statistics and Exposure Point Concentrations - Crayfish Tissue
Project 1007
Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
West Lakeland											
PFCAs											
PFBA	ug/kg	13 : 13	100%	6.85E-01	1.17E+01	4.76E+00	4.39E+00	6.15E+00	95% Student's-t UCL	6.15E+00	UCL
PFPeA	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxA	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHpA	ug/kg	10 : 13	77%	1.08E-01	3.31E-01	2.15E-01	1.99E-01	2.33E-01	95% KM (t) UCL	2.33E-01	UCL
PFOA	ug/kg	13 : 13	100%	1.89E+00	1.05E+01	4.99E+00	4.24E+00	6.32E+00	95% Student's-t UCL	6.32E+00	UCL
PFNA	ug/kg	12 : 13	92%	1.00E-01	3.51E-01	1.96E-01	1.75E-01	2.30E-01	95% KM (t) UCL	2.30E-01	UCL
PFDA	ug/kg	13 : 13	100%	3.28E-01	1.66E+00	1.04E+00	1.26E+00	1.28E+00	95% Student's-t UCL	1.28E+00	UCL
PFUnA	ug/kg	13 : 13	100%	1.21E-01	8.51E-01	3.80E-01	4.10E-01	4.79E-01	95% Student's-t UCL	4.79E-01	UCL
PFDoA	ug/kg	11 : 13	85%	1.00E-01	3.70E-01	2.04E-01	2.05E-01	2.36E-01	95% KM (t) UCL	2.36E-01	UCL
PFTrDA	ug/kg	9 : 13	69%	1.02E-01	2.42E-01	1.62E-01	1.55E-01	1.69E-01	95% KM (t) UCL	1.69E-01	UCL
PFTeDA	ug/kg	6 : 13	46%	9.70E-02	1.57E-01	1.21E-01	1.13E-01	1.19E-01	95% KM (t) UCL	1.19E-01	UCL
PFSAs											
PFBS	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFPeS	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxS	ug/kg	12 : 13	92%	1.44E-01	4.33E-01	2.28E-01	2.04E-01	2.61E-01	95% KM (t) UCL	2.61E-01	UCL
PFHpS	ug/kg	4 : 13	31%	1.10E-01	1.33E-01	1.16E-01	1.11E-01	1.08E-01	95% KM (t) UCL	1.08E-01	UCL
PFOS	ug/kg	13 : 13	100%	1.24E+01	9.79E+01	3.72E+01	3.16E+01	4.82E+01	95% Student's-t UCL	4.82E+01	UCL
PFNS	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDS	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDoS	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
FOSA, FASE, FASAAs											
PFOSA	ug/kg	13 : 13	100%	4.25E-01	1.55E+00	9.10E-01	8.28E-01	1.07E+00	95% Student's-t UCL	1.07E+00	UCL
N-EtFOSA	ug/kg	0 : 12	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSAA	ug/kg	6 : 13	46%	1.38E-01	7.89E-01	3.16E-01	2.31E-01	3.00E-01	95% KM (t) UCL	3.00E-01	UCL
N-MeFOSAA	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSE	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSE	ug/kg	0 : 5	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/kg	2 : 13	15%	3.99E-01	6.32E-01	5.16E-01	5.16E-01	NC	--	6.32E-01	Maximum
8:2 FTS	ug/kg	0 : 13	0%	ND	ND	NC	NC	NC	--	ND	(b)
3:3 FTCA	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
5:3 FTCA	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
7:3 FTCA	ug/kg	0 : 13	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/kg	0 : 13	0%	ND	ND	NC	NC	NC	--	ND	(b)
ADONA	ug/kg	0 : 13	0%	ND	ND	NC	NC	NC	--	ND	(b)
9CL-PF3ONS	ug/kg	0 : 13	0%	ND	ND	NC	NC	NC	--	ND	(b)
11CL-PF3OUDS	ug/kg	0 : 13	0%	ND	ND	NC	NC	NC	--	ND	(b)
Perfluoro(2-ethoxyethane)sulfonic acid	ug/kg	0 : 13	0%	ND	ND	NC	NC	NC	--	ND	(b)
Perfluoro-3,6-dioxaheptanoic acid	ug/kg	0 : 13	0%	ND	ND	NC	NC	NC	--	ND	(b)
Perfluoro-3-methoxypropanoic acid	ug/kg	0 : 13	0%	ND	ND	NC	NC	NC	--	ND	(b)
Perfluoro-4-methoxybutanoic acid	ug/kg	0 : 13	0%	ND	ND	NC	NC	NC	--	ND	(b)

Acronyms:
COPEC - Contaminant of Potential Ecological Concern.
EPC - Exposure Point Concentration.
NC - Not Calculated.
ND - Not Detected.
UCL - Upper confidence limit.
ug/kg - Micrograms per kilograms.
USEPA - United States Environmental Protection Agency.

Notes:
(a) Upper Confidence Limit (UCL) on the arithmetic mean concentration calculated using USEPA ProUCL Version 5.1. The UCL suggested by ProUCL is used, unless otherwise noted. In cases where more than one UCL is suggested, the higher UCL is used. A sample size of at least eight is recommended for the calculation of UCLs. When fewer samples are available the ProUCL export is reviewed to assess whether the maximum or the recommended UCL is the appropriate EPC
(c) Chemical was not detected.

Appendix D Table 8
Summary Statistics and Exposure Point Concentrations - Snail Tissue
Project 1007
Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (b)	UCL Basis	EPC	Statistic
Eagle Point Lake											
PFCAs											
PFBA	ug/kg	2 : 6	33%	4.01E-01	4.81E-01	4.41E-01	4.41E-01	NC	--	0.48	Maximum
PFPeA	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxA	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHpA	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFOA	ug/kg	6 : 6	100%	3.16E-01	2.10E+00	9.56E-01	5.32E-01	2.87E+00	95% Adjusted Gamma UCL	2.10	Maximum
PFNA	ug/kg	4 : 6	67%	1.37E-01	3.06E-01	2.02E-01	1.83E-01	2.35E-01	95% KM (t) UCL	0.24	UCL
PFDA	ug/kg	6 : 6	100%	1.10E+00	5.12E+00	2.09E+00	1.54E+00	4.71E+00	95% Adjusted Gamma UCL	4.71	UCL
PFUnA	ug/kg	6 : 6	100%	1.56E-01	5.66E-01	3.48E-01	3.38E-01	4.92E-01	95% Student's-t UCL	4.92E-01	UCL
PFDoA	ug/kg	3 : 6	50%	1.27E-01	2.71E-01	2.13E-01	2.41E-01	NC	--	2.71E-01	Maximum
PFTrDA	ug/kg	0 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFTeDA	ug/kg	2 6	33%	1.33E-01	1.94E-01	1.64E-01	1.64E-01	NC	--	0.19	Maximum
PFSAs											
PFBS	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFPeS	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxS	ug/kg	5 : 6	83%	1.10E-01	6.25E-01	3.89E-01	3.21E-01	5.31E-01	95% KM (t) UCL	0.53	UCL
PFHpS	ug/kg	3 : 6	50%	1.26E-01	3.50E-01	2.44E-01	2.57E-01	NC	--	3.50E-01	Maximum
PFOS	ug/kg	6 : 6	100%	2.97E+01	9.81E+01	5.80E+01	5.80E+01	7.69E+01	95% Student's-t UCL	7.69E+01	UCL
PFNS	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDS	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDoS	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
FOSA, FASE, FASAAs											
PFOSA	ug/kg	6 : 6	100%	3.98E+00	1.03E+01	6.06E+00	5.01E+00	8.10E+00	95% Student's-t UCL	8.10	UCL
N-EtFOSA	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSAA	ug/kg	6 : 6	100%	9.26E-01	2.06E+00	1.24E+00	1.14E+00	1.82E+00	95% Adjusted Gamma UCL	1.82	UCL
N-MeFOSAA	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSE	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
8:2 FTS	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
3:3 FTCA	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
5:3 FTCA	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
7:3 FTCA	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro(2-ethoxyethane)sulfonic acid	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3,6-dioxaheptanoic acid	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3-methoxypropanoic acid	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-4-methoxybutanoic acid	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)

Appendix D Table 8
Summary Statistics and Exposure Point Concentrations - Snail Tissue
Project 1007
Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (b)	UCL Basis	EPC	Statistic
Raleigh Creek - Upper											
PFCAs											
PFBA	ug/kg	2 : 2	100%	6.78E-01	1.68E+00	1.18E+00	1.18E+00	NC	--	1.68	Maximum
PFPeA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHpA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFOA	ug/kg	2 : 2	100%	4.66E-01	6.55E-01	5.61E-01	5.61E-01	NC	--	0.66	Maximum
PFNA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDA	ug/kg	2 : 2	100%	2.08E-01	1.45E+00	8.29E-01	8.29E-01	NC	--	1.45	Maximum
PFUnA	ug/kg	2 : 2	100%	1.40E-01	1.09E+00	6.15E-01	6.15E-01	NC	--	1.09	Maximum
PFDoA	ug/kg	2 : 2	100%	7.46E-01	7.88E-01	7.67E-01	7.67E-01	NC	--	0.79	Maximum
PFTrDA	ug/kg	1 : 2	50%	3.71E-01	3.71E-01	3.71E-01	3.71E-01	NC	--	0.37	Maximum
PFTeDA	ug/kg	1 : 2	50%	4.60E-01	4.60E-01	4.60E-01	4.60E-01	NC	--	0.46	Maximum
PFSAs											
PFBS	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFPeS	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxS	ug/kg	1 : 2	50%	2.67E-01	2.67E-01	2.67E-01	2.67E-01	NC	--	0.27	Maximum
PFHpS	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFOS	ug/kg	2 : 2	100%	1.07E+01	6.60E+01	3.84E+01	3.84E+01	NC	--	66.00	Maximum
PFNS	ug/kg	1 : 2	50%	6.29E-01	6.29E-01	6.29E-01	6.29E-01	NC	--	0.63	Maximum
PFDS	ug/kg	2 : 2	100%	1.02E+00	1.87E+00	1.45E+00	1.45E+00	NC	--	1.87	Maximum
PFDoS	ug/kg	1 : 2	50%	6.79E-01	6.79E-01	6.79E-01	6.79E-01	NC	--	0.68	Maximum
FOSA, FASE, FASAAs											
PFOSA	ug/kg	2 : 2	100%	2.36E+01	6.63E+01	4.50E+01	4.50E+01	NC	--	66.30	Maximum
N-EtFOSA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSAA	ug/kg	2 : 2	100%	5.71E+00	2.29E+01	1.43E+01	1.43E+01	NC	--	22.90	Maximum
N-MeFOSAA	ug/kg	2 : 2	100%	6.69E-01	7.84E-01	7.27E-01	7.27E-01	NC	--	0.78	Maximum
N-MeFOSE	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
8:2 FTS	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
3:3 FTCA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
5:3 FTCA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
7:3 FTCA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro(2-ethoxyethane)sulfonic acid	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3,6-dioxaheptanoic acid	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3-methoxypropanoic acid	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-4-methoxybutanoic acid	ug/kg	1 : 2	50%	1.37E-01	1.37E-01	1.37E-01	1.37E-01	NC	--	0.14	Maximum

Acronyms:
EPC - Exposure Point Concentration.
NC - Not Calculated.
ND - Not Detected.
UCL - Upper confidence limit.
ug/kg - Micrograms per kilograms.
USEPA - United States Environmental Protection Agency.

Notes:
(a) Upper Confidence Limit (UCL) on the arithmetic mean concentration calculated using USEPA ProUCL Version 5.1. The UCL suggested by ProUCL is used, unless otherwise noted. In cases where more than one UCL is suggested, the higher UCL is used. A sample size of at least eight is recommended for the calculation of UCLs. When fewer samples are available the ProUCL export is reviewed to assess whether the maximum or the recommended UCL is the appropriate EPC
(c) Chemical was not detected.

Appendix D Table 9
Summary Statistics and Exposure Point Concentrations - Bottom Fish Tissue
Project 1007
Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (b)	UCL Basis	EPC	Statistic
Eagle Point Lake											
PFCAs											
PFBA	ug/kg	2 : 2	100%	6.90E-01	8.09E-01	7.50E-01	7.50E-01	NC	--	0.81	Maximum
PFPeA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHpA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFOA	ug/kg	2 : 2	100%	1.26E-01	1.85E-01	1.56E-01	1.56E-01	NC	--	0.19	Maximum
PFNA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDA	ug/kg	2 : 2	100%	2.13E+00	2.78E+00	2.46E+00	2.46E+00	NC	--	2.78	Maximum
PFUnA	ug/kg	2 : 2	100%	6.87E-01	7.42E-01	7.15E-01	7.15E-01	NC	--	0.74	Maximum
PFDoA	ug/kg	2 : 2	100%	2.70E-01	3.84E-01	3.27E-01	3.27E-01	NC	--	0.38	Maximum
PFTrDA	ug/kg	1 : 2	50%	1.25E-01	1.25E-01	1.25E-01	1.25E-01	NC	--	0.13	Maximum
PFTeDA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFSAs											
PFBS	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFPeS	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxS	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHpS	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFOS	ug/kg	2 : 2	100%	1.12E+02	2.12E+02	1.62E+02	1.62E+02	NC	--	212.00	Maximum
PFNS	ug/kg	2 : 2	100%	3.71E-01	4.39E-01	4.05E-01	4.05E-01	NC	--	0.44	Maximum
PFDS	ug/kg	2 : 2	100%	2.50E-01	2.85E-01	2.68E-01	2.68E-01	NC	--	0.29	Maximum
PFDoS	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
FOSA, FASE, FASAAs											
PFOSA	ug/kg	2 : 2	100%	1.12E+00	2.65E+00	1.89E+00	1.89E+00	NC	--	2.65	Maximum
N-EtFOSA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSAA	ug/kg	1 : 2	50%	2.47E-01	2.47E-01	2.47E-01	2.47E-01	NC	--	0.25	Maximum
N-MeFOSAA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
8:2 FTS	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
3:3 FTCA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
5:3 FTCA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
7:3 FTCA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro(2-ethoxyethane)sulfonic acid	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3,6-dioxaheptanoic acid	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3-methoxypropanoic acid	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-4-methoxybutanoic acid	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)

Appendix D Table 9
Summary Statistics and Exposure Point Concentrations - Bottom Fish Tissue
Project 1007
Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (b)	UCL Basis	EPC	Statistic
Raleigh Creek - Upper											
PFCAs											
PFBA	ug/kg	2 : 2	100%	6.49E-01	9.05E-01	7.77E-01	7.77E-01	NC	--	0.91	Maximum
PFPeA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHpA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFOA	ug/kg	2 : 2	100%	4.14E-01	8.72E-01	6.43E-01	6.43E-01	NC	--	0.87	Maximum
PFNA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDA	ug/kg	2 : 2	100%	8.44E+00	8.85E+00	8.65E+00	8.65E+00	NC	--	8.85	Maximum
PFUnA	ug/kg	2 : 2	100%	2.50E+00	2.83E+00	2.67E+00	2.67E+00	NC	--	2.83	Maximum
PFDoA	ug/kg	2 : 2	100%	3.07E+00	3.26E+00	3.17E+00	3.17E+00	NC	--	3.26	Maximum
PFTrDA	ug/kg	2 : 2	100%	5.80E-01	6.58E-01	6.19E-01	6.19E-01	NC	--	0.66	Maximum
PFTeDA	ug/kg	2 : 2	100%	5.17E-01	5.85E-01	5.51E-01	5.51E-01	NC	--	0.59	Maximum
PFSAs											
PFBS	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFPeS	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxS	ug/kg	2 : 2	100%	1.20E-01	3.83E-01	2.52E-01	2.52E-01	NC	--	0.38	Maximum
PFHpS	ug/kg	2 : 2	100%	7.97E-01	1.30E+00	1.05E+00	1.05E+00	NC	--	1.30	Maximum
PFOS	ug/kg	2 : 2	100%	8.82E+02	9.18E+02	9.00E+02	9.00E+02	NC	--	918.00	Maximum
PFNS	ug/kg	2 : 2	100%	3.42E+00	3.91E+00	3.67E+00	3.67E+00	NC	--	3.91	Maximum
PFDS	ug/kg	2 : 2	100%	7.32E+00	8.02E+00	7.67E+00	7.67E+00	NC	--	8.02	Maximum
PFDoS	ug/kg	2 : 2	100%	7.00E-01	1.09E+00	8.95E-01	8.95E-01	NC	--	1.09	Maximum
FOSA, FASE, FASAAs											
PFOSA	ug/kg	2 : 2	100%	8.95E+01	1.55E+02	1.22E+02	1.22E+02	NC	--	155.00	Maximum
N-EtFOSA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSAA	ug/kg	2 : 2	100%	1.91E+00	2.25E+00	2.08E+00	2.08E+00	NC	--	2.25	Maximum
N-MeFOSAA	ug/kg	2 : 2	100%	1.17E-01	1.56E-01	1.37E-01	1.37E-01	NC	--	0.16	Maximum
N-MeFOSE	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
8:2 FTS	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
3:3 FTCA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
5:3 FTCA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
7:3 FTCA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro(2-ethoxyethane)sulfonic acid	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3,6-dioxaheptanoic acid	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3-methoxypropanoic acid	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-4-methoxybutanoic acid	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)

Appendix D Table 9
Summary Statistics and Exposure Point Concentrations - Bottom Fish Tissue
Project 1007
Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (b)	UCL Basis	EPC	Statistic
Raleigh Creek - Lower											
PFCAs											
PFBA	ug/kg	1 : 1	100%	6.41E-01	6.41E-01	6.41E-01	6.41E-01	NC	--	0.64	Maximum
PFPeA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHpA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFOA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFNA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFDA	ug/kg	1 : 1	100%	1.16E+00	1.16E+00	1.16E+00	1.16E+00	NC	--	1.16	Maximum
PFUnA	ug/kg	1 : 1	100%	1.18E+00	1.18E+00	1.18E+00	1.18E+00	NC	--	1.18	Maximum
PFDoA	ug/kg	1 : 1	100%	1.77E+00	1.77E+00	1.77E+00	1.77E+00	NC	--	1.77	Maximum
PFTrDA	ug/kg	1 : 1	100%	9.16E-01	9.16E-01	9.16E-01	9.16E-01	NC	--	0.92	Maximum
PFTeDA	ug/kg	1 : 1	100%	8.55E-01	8.55E-01	8.55E-01	8.55E-01	NC	--	0.86	Maximum
PFSAs											
PFBS	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFPeS	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxS	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHpS	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFOS	ug/kg	1 : 1	100%	5.87E+01	5.87E+01	5.87E+01	5.87E+01	NC	--	58.70	Maximum
PFNS	ug/kg	1 : 1	100%	6.52E-01	6.52E-01	6.52E-01	6.52E-01	NC	--	0.65	Maximum
PFDS	ug/kg	1 : 1	100%	2.88E+00	2.88E+00	2.88E+00	2.88E+00	NC	--	2.88	Maximum
PFDoS	ug/kg	1 : 1	100%	8.61E-01	8.61E-01	8.61E-01	8.61E-01	NC	--	0.86	Maximum
FOSA, FASE, FASAAs											
PFOSA	ug/kg	1 : 1	100%	1.63E+00	1.63E+00	1.63E+00	1.63E+00	NC	--	1.63	Maximum
N-EtFOSA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSAA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSAA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
8:2 FTS	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
3:3 FTCA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
5:3 FTCA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
7:3 FTCA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro(2-ethoxyethane)sulfonic acid	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3,6-dioxaheptanoic acid	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3-methoxypropanoic acid	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-4-methoxybutanoic acid	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)

Acronyms:
EPC - Exposure Point Concentration.
NC - Not Calculated.
ND - Not Detected.
UCL - Upper confidence limit.
ug/kg - Micrograms per kilograms.
USEPA - United States Environmental Protection Agency.

Notes:
(a) Upper Confidence Limit (UCL) on the arithmetic mean concentration calculated using USEPA ProUCL Version 5.1. The UCL suggested by ProUCL is used, unless otherwise noted. In cases where more than one UCL is suggested, the higher UCL is used. A sample size of at least eight is recommended for the calculation of UCLs. When fewer samples are available the ProUCL export is reviewed to assess whether the maximum or the recommended UCL is the appropriate EPC
(c) Chemical was not detected.

Appendix D Table 10
Summary Statistics and Exposure Point Concentrations - Forage Fish Tissue
Project 1007
Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
Eagle Point Lake											
PFCAs											
PFBA	ug/kg	1 : 8	13%	6.92E-01	6.92E-01	NC	NC	NC	--	6.92E-01	Maximum
PFPeA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxA	ug/kg	1 : 8	13%	1.26E-01	1.26E-01	NC	NC	NC	--	1.26E-01	Maximum
PFHpA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFOA	ug/kg	7 : 8	88%	1.66E-01	2.55E+00	1.10E+00	1.02E+00	1.56E+00	95% KM (t) UCL	1.56E+00	UCL
PFNA	ug/kg	7 : 8	88%	1.07E-01	2.87E+00	1.05E+00	1.11E+00	1.56E+00	95% KM (t) UCL	1.56E+00	UCL
PFDA	ug/kg	8 : 8	100%	4.05E+00	1.76E+01	1.17E+01	1.26E+01	1.52E+01	95% Student's-t UCL	1.52E+01	UCL
PFUnA	ug/kg	8 : 8	100%	5.98E-01	2.23E+00	1.73E+00	1.88E+00	2.12E+00	95% Student's-t UCL	2.12E+00	UCL
PFDoA	ug/kg	8 : 8	100%	1.31E-01	1.19E+00	6.03E-01	6.12E-01	8.10E-01	95% Student's-t UCL	8.10E-01	UCL
PFTrDA	ug/kg	7 : 8	88%	1.75E-01	5.10E-01	2.65E-01	2.30E-01	4.16E-01	95% GROS Adjusted Gamma UCL	4.16E-01	UCL
PFTeDA	ug/kg	4 : 8	50%	1.46E-01	4.47E-01	2.56E-01	2.15E-01	2.66E-01	95% KM (t) UCL	2.66E-01	UCL
PFSAs											
PFBS	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFPeS	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxS	ug/kg	6 : 8	75%	1.02E-01	1.43E+00	9.82E-01	1.12E+00	1.16E+00	95% KM (t) UCL	1.16E+00	UCL
PFHpS	ug/kg	8 : 8	100%	3.94E-01	3.99E+00	2.27E+00	2.75E+00	3.35E+00	95% Student's-t UCL	3.35E+00	UCL
PFOS	ug/kg	8 : 8	100%	5.49E+02	2.54E+03	1.63E+03	1.77E+03	2.10E+03	95% Student's-t UCL	2.10E+03	UCL
PFNS	ug/kg	8 : 8	100%	5.67E-01	5.09E+00	2.82E+00	3.06E+00	3.84E+00	95% Student's-t UCL	3.84E+00	UCL
PFDS	ug/kg	8 : 8	100%	1.83E-01	1.86E+00	1.05E+00	9.74E-01	1.39E+00	95% Student's-t UCL	1.39E+00	UCL
PFDoS	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
FOSA, FASE, FASAAs											
PFOSA	ug/kg	8 : 8	100%	1.61E+00	2.56E+01	9.29E+00	8.03E+00	1.45E+01	95% Student's-t UCL	1.45E+01	UCL
N-EtFOSA	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSAA	ug/kg	8 : 8	100%	4.55E-01	3.40E+00	1.23E+00	9.34E-01	1.86E+00	95% Student's-t UCL	1.86E+00	UCL
N-MeFOSAA	ug/kg	1 : 8	13%	2.67E-01	2.67E-01	NC	NC	NC	--	2.67E-01	Maximum
N-EtFOSE	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSE	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/kg	2 : 8	25%	2.39E+00	3.29E+00	2.84E+00	2.84E+00	NC	--	3.29E+00	Maximum
8:2 FTS	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
3:3 FTCA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
5:3 FTCA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
7:3 FTCA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/kg	0 :	#DIV/0!	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/kg	1 : 8	13%	8.33E-01	8.33E-01	NC	NC	NC	--	8.33E-01	Maximum
9CL-PF3ONS	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro(2-ethoxyethane)sulfonic acid	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3,6-dioxaheptanoic acid	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3-methoxypropanoic acid	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-4-methoxybutanoic acid	ug/kg	1 : 8	13%	1.13E-01	1.13E-01	NC	NC	NC	--	1.13E-01	Maximum

Appendix D Table 10
Summary Statistics and Exposure Point Concentrations - Forage Fish Tissue
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Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
Lake Elmo											
PFCAs											
PFBA	ug/kg	8 : 9	89%	4.39E-01	9.72E-01	6.66E-01	6.01E-01	7.56E-01	95% KM (t) UCL	7.56E-01	UCL
PFPeA	ug/kg	0 : 9	0%	ND	ND	NC	NC	NC	--	ND	(b)
PFHxA	ug/kg	0 : 9	0%	ND	ND	NC	NC	NC	--	ND	(b)
PFHpA	ug/kg	1 : 9	11%	2.34E-01	2.34E-01	NC	NC	NC	--	2.34E-01	Maximum
PFOA	ug/kg	9 : 9	100%	1.10E-01	2.49E+00	7.03E-01	2.93E-01	1.19E+00	95% Student's-t UCL	1.19E+00	UCL
PFNA	ug/kg	6 : 9	67%	1.15E-01	1.13E+00	3.52E-01	1.66E-01	8.60E-01	Gamma Adjusted KM-UCL	8.60E-01	UCL
PFDA	ug/kg	9 : 9	100%	1.84E+00	1.30E+01	4.70E+00	3.34E+00	8.54E+00	95% Adjusted Gamma UCL	8.54E+00	UCL
PFUnA	ug/kg	9 9	100%	5.08E-01	1.93E+00	9.91E-01	7.78E-01	1.32E+00	95% Student's-t UCL	1.32E+00	UCL
PFDoA	ug/kg	9 9	100%	3.40E-01	8.62E-01	5.64E-01	6.19E-01	6.73E-01	95% Student's-t UCL	6.73E-01	UCL
PFTrDA	ug/kg	9 : 9	100%	2.98E-01	6.12E-01	4.04E-01	3.62E-01	4.73E-01	95% Student's-t UCL	4.73E-01	UCL
PFTeDA	ug/kg	9 : 9	100%	2.21E-01	6.02E-01	4.28E-01	4.13E-01	5.15E-01	95% Student's-t UCL	5.15E-01	UCL
PFSAs											
PFBS	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFPeS	ug/kg	0 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxS	ug/kg	5 : 9	56%	1.02E-01	5.43E-01	2.56E-01	1.30E-01	2.91E-01	95% KM (t) UCL	2.91E-01	UCL
PFHpS	ug/kg	8 9	89%	1.68E-01	3.73E+00	9.29E-01	3.72E-01	2.58E+00	95% KM (Chebyshev) UCL	2.58E+00	UCL
PFOS	ug/kg	9 : 9	100%	2.70E+02	2.46E+03	8.03E+02	5.47E+02	1.42E+03	95% Adjusted Gamma UCL	1.42E+03	UCL
PFNS	ug/kg	9 9	100%	1.04E-01	2.37E+00	4.69E-01	1.66E-01	2.71E+00	95% Hall's Bootstrap UCL	2.37E+00	Maximum
PFDS	ug/kg	5 : 9	56%	1.21E-01	5.54E-01	2.36E-01	1.60E-01	2.70E-01	95% KM (t) UCL	2.70E-01	UCL
PFDoS	ug/kg	0 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
FOSA, FASE, FASAAs											
PFOSA	ug/kg	9 : 9	100%	1.26E-01	1.60E+01	2.00E+00	2.60E-01	6.95E+01	95% Hall's Bootstrap UCL	1.60E+01	Maximum
N-EtFOSA	ug/kg	0 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/kg	0 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSAA	ug/kg	2 : 9	22%	9.78E-02	7.07E-01	4.02E-01	4.02E-01	NA	--	7.07E-01	Maximum
N-MeFOSAA	ug/kg	1 : 9	11%	1.75E-01	1.75E-01	NC	NC	NC	--	1.75E-01	Maximum
N-EtFOSE	ug/kg	0 : 4	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSE	ug/kg	0 : 2	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
8:2 FTS	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
3:3 FTCA	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
5:3 FTCA	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
7:3 FTCA	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro(2-ethoxyethane)sulfonic acid	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3,6-dioxaheptanoic acid	ug/kg	1 : 9	11%	6.91E-01	6.91E-01	NC	NC	NC	--	6.91E-01	Maximum
Perfluoro-3-methoxypropanoic acid	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-4-methoxybutanoic acid	ug/kg	0 : 9	0%	ND	ND	ND	ND	NC	--	ND	(b)

Appendix D Table 10
Summary Statistics and Exposure Point Concentrations - Forage Fish Tissue
Project 1007
Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
Raleigh Creek Upper											
PFCAs										0.00E+00	UCL
PFBA	ug/kg	6 : 6	100%	5.53E-01	1.71E+00	9.11E-01	7.19E-01	1.28E+00	95% Student's-t UCL	1.28E+00	UCL
PFPeA	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxA	ug/kg	1 : 6	17%	2.73E-01	2.73E-01	NC	NC	NC	--	2.73E-01	Maximum
PFHpA	ug/kg	2 : 6	33%	3.39E-01	8.34E-01	5.87E-01	5.87E-01	NC	--	8.34E-01	Maximum
PFOA	ug/kg	6 : 6	100%	2.57E-01	6.34E+01	1.54E+01	2.62E+00	1.91E+02	95% Adjusted Gamma UCL	6.34E+01	Maximum
PFNA	ug/kg	5 : 6	83%	1.70E-01	3.00E+00	1.40E+00	1.47E+00	2.15E+00	95% KM (t) UCL	2.15E+00	UCL
PFDA	ug/kg	6 : 6	100%	1.39E+01	3.48E+01	2.37E+01	2.27E+01	2.93E+01	95% Student's-t UCL	2.93E+01	UCL
PFUnA	ug/kg	6 : 6	100%	2.56E+00	5.19E+00	3.58E+00	3.21E+00	4.47E+00	95% Student's-t UCL	4.47E+00	UCL
PFDoA	ug/kg	6 : 6	100%	2.21E+00	7.34E+00	4.73E+00	5.05E+00	6.51E+00	95% Student's-t UCL	6.51E+00	UCL
PFTrDA	ug/kg	6 : 6	100%	3.20E-01	1.93E+00	1.21E+00	1.38E+00	1.78E+00	95% Student's-t UCL	1.78E+00	UCL
PFTeDA	ug/kg	6 : 6	100%	2.64E-01	1.71E+00	8.88E-01	8.77E-01	1.29E+00	95% Student's-t UCL	1.29E+00	UCL
PFSAs											
PFBS	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFPeS	ug/kg	3 : 6	50%	1.83E-01	5.80E-01	3.32E-01	2.32E-01	NC	--	5.80E-01	Maximum
PFHxS	ug/kg	6 : 6	100%	1.26E-01	1.14E+01	4.06E+00	2.49E+00	7.88E+00	95% Student's-t UCL	7.88E+00	UCL
PFHpS	ug/kg	6 : 6	100%	2.28E+00	3.96E+01	1.90E+01	1.75E+01	3.30E+01	95% Student's-t UCL	3.30E+01	UCL
PFOS	ug/kg	6 : 6	100%	3.15E+03	6.35E+03	4.95E+03	5.18E+03	6.01E+03	95% Student's-t UCL	6.01E+03	UCL
PFNS	ug/kg	6 : 6	100%	8.86E+00	2.90E+01	1.71E+01	1.58E+01	2.29E+01	95% Student's-t UCL	2.29E+01	UCL
PFDS	ug/kg	6 : 6	100%	8.34E+00	5.20E+01	3.18E+01	3.77E+01	4.61E+01	95% Student's-t UCL	4.61E+01	UCL
PFDoS	ug/kg	6 : 6	100%	4.98E-01	2.66E+01	9.77E+00	8.15E+00	1.79E+01	95% Student's-t UCL	1.79E+01	UCL
FOSA, FASE, FASAAs											
PFOSA	ug/kg	6 : 6	100%	5.71E+01	4.05E+02	1.92E+02	1.32E+02	3.19E+02	95% Student's-t UCL	3.19E+02	UCL
N-EtFOSA	ug/kg	2 : 6	33%	2.95E-01	5.96E-01	4.46E-01	4.46E-01	NC	--	5.96E-01	Maximum
N-MeFOSA	ug/kg	1 : 6	17%	1.25E-01	1.25E-01	NC	NC	NC	--	1.25E-01	Maximum
N-EtFOSAA	ug/kg	6 : 6	100%	8.30E+00	3.80E+01	2.05E+01	1.91E+01	3.00E+01	95% Student's-t UCL	3.00E+01	UCL
N-MeFOSAA	ug/kg	6 : 6	100%	1.90E-01	5.85E-01	4.13E-01	4.66E-01	5.37E-01	95% Student's-t UCL	5.37E-01	UCL
N-EtFOSE	ug/kg	1 : 2	50%	1.50E+00	1.50E+00	NC	NC	NC	--	1.50E+00	Maximum
N-MeFOSE	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/kg	1 : 6	17%	3.02E+00	3.02E+00	NC	NC	NC	--	3.02E+00	Maximum
8:2 FTS	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
3:3 FTCA	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
5:3 FTCA	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
7:3 FTCA	ug/kg	1 : 6	17%	4.36E+00	4.36E+00	NC	NC	NC	--	4.36E+00	Maximum
Replacement Chemistries											
HFPO-DA	ug/kg	0 : 5	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro(2-ethoxyethane)sulfonic acid	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3,6-dioxaheptanoic acid	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3-methoxypropanoic acid	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-4-methoxybutanoic acid	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)

Appendix D Table 10
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Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
Raleigh Creek Other											
PFCAs											
PFBA	ug/kg	5 : 6	83%	4.99E-01	6.71E-01	6.05E-01	6.24E-01	6.57E-01	95% KM (t) UCL	6.57E-01	UCL
PFPeA	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxA	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHpA	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFOA	ug/kg	5 : 7	71%	1.03E-01	3.92E-01	1.94E-01	1.61E-01	2.46E-01	95% KM (t) UCL	2.46E-01	UCL
PFNA	ug/kg	5 : 7	71%	2.24E-01	5.80E-01	3.99E-01	3.97E-01	4.58E-01	95% KM (t) UCL	4.58E-01	UCL
PFDA	ug/kg	7 : 7	100%	5.39E-01	5.52E+00	2.45E+00	1.77E+00	3.88E+00	95% Student's-t UCL	3.88E+00	UCL
PFUnA	ug/kg	7 : 7	100%	4.55E-01	1.48E+00	8.19E-01	6.97E-01	1.12E+00	95% Student's-t UCL	1.12E+00	UCL
PFDoA	ug/kg	7 : 7	100%	1.31E-01	1.30E+00	6.96E-01	6.30E-01	9.71E-01	95% Student's-t UCL	9.71E-01	UCL
PFTrDA	ug/kg	6 : 7	86%	2.50E-01	4.81E-01	3.92E-01	4.02E-01	4.50E-01	95% KM (t) UCL	4.50E-01	UCL
PFTeDA	ug/kg	5 : 6	83%	2.96E-01	5.32E-01	4.10E-01	4.24E-01	4.87E-01	95% KM (t) UCL	4.87E-01	UCL
PFSAs											
PFBS	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFPeS	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxS	ug/kg	2 : 7	29%	3.18E-01	4.49E-01	3.84E-01	3.84E-01	NC	--	4.49E-01	Maximum
PFHpS	ug/kg	3 : 7	43%	1.25E-01	3.40E-01	2.15E-01	1.80E-01	NC	--	3.40E-01	Maximum
PFOS	ug/kg	7 : 7	100%	6.15E+00	4.82E+02	2.16E+02	2.14E+02	3.70E+02	95% Student's-t UCL	3.70E+02	UCL
PFNS	ug/kg	4 : 7	57%	4.75E-01	9.34E-01	6.87E-01	6.70E-01	7.06E-01	95% KM (t) UCL	7.06E-01	UCL
PFDS	ug/kg	7 : 7	100%	1.49E-01	1.58E+00	5.10E-01	2.17E-01	8.93E-01	95% Student's-t UCL	8.93E-01	UCL
PFDoS	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
FOSA, FASE, FASAAs											
PFOSA	ug/kg	6 : 7	86%	1.38E-01	7.85E+00	2.46E+00	2.03E+00	4.16E+00	95% KM (t) UCL	4.16E+00	UCL
N-EtFOSA	ug/kg	0 : 5	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSAA	ug/kg	4 : 7	57%	1.67E-01	9.75E-01	4.04E-01	2.36E-01	1.12E+00	Gamma Adjusted KM-UCL	9.75E-01	Maximum
N-MeFOSAA	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC		ND	(b)
N-EtFOSE	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSE	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/kg	1 : 7	14%	4.88E-01	4.88E-01	NC	NC	NC	--	4.88E-01	Maximum
8:2 FTS	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
3:3 FTCA	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
5:3 FTCA	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
7:3 FTCA	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/kg	0 : 6	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro(2-ethoxyethane)sulfonic acid	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3,6-dioxaheptanoic acid	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3-methoxypropanoic acid	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-4-methoxybutanoic acid	ug/kg	0 : 7	0%	ND	ND	ND	ND	NC	--	ND	(b)

Appendix D Table 10
Summary Statistics and Exposure Point Concentrations - Forage Fish Tissue
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Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (a)	UCL Basis	EPC	Statistic
West Lakeland											
PFCAs											
PFBA	ug/kg	20 : 21	95%	4.94E-01	9.07E-01	6.10E-01	5.90E-01	6.45E-01	95% KM (t) UCL	6.45E-01	UCL
PFPeA	ug/kg	0 : 21	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxA	ug/kg	0 : 21	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHpA	ug/kg	0 : 21	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFOA	ug/kg	21 : 21	100%	1.33E-01	1.11E+00	3.46E-01	2.72E-01	4.54E-01	95% Adjusted Gamma UCL	4.54E-01	UCL
PFNA	ug/kg	12 : 21	57%	1.25E-01	4.08E-01	1.98E-01	1.57E-01	2.00E-01	95% GROS Adjusted Gamma UCL	2.00E-01	UCL
PFDA	ug/kg	21 : 21	100%	2.00E+00	1.04E+01	5.27E+00	4.93E+00	6.13E+00	95% Student's-t UCL	6.13E+00	UCL
PFUnA	ug/kg	21 : 21	100%	5.34E-01	1.56E+00	9.39E-01	8.40E-01	1.08E+00	95% Adjusted Gamma UCL	1.08E+00	UCL
PFDoA	ug/kg	21 : 21	100%	1.75E-01	5.43E-01	2.83E-01	2.78E-01	3.16E-01	95% Student's-t UCL	3.16E-01	UCL
PFTrDA	ug/kg	21 : 21	100%	1.19E-01	3.96E-01	2.22E-01	2.10E-01	2.47E-01	95% Student's-t UCL	2.47E-01	UCL
PFTeDA	ug/kg	16 : 21	76%	9.90E-02	2.90E-01	1.54E-01	1.32E-01	1.60E-01	95% KM (t) UCL	1.60E-01	UCL
PFSAs											
PFBS	ug/kg	0 : 21	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFPeS	ug/kg	0 : 21	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxS	ug/kg	15 : 21	71%	1.04E-01	2.11E-01	1.38E-01	1.27E-01	1.40E-01	95% KM (t) UCL	1.40E-01	UCL
PFHpS	ug/kg	20 : 21	95%	1.26E-01	9.14E-01	4.50E-01	4.03E-01	5.08E-01	95% KM (t) UCL	5.08E-01	UCL
PFOS	ug/kg	21 : 21	100%	2.17E+02	1.56E+03	8.94E+02	9.73E+02	1.03E+03	95% Student's-t UCL	1.03E+03	UCL
PFNS	ug/kg	21 : 21	100%	1.72E-01	1.76E+00	7.47E-01	7.66E-01	8.86E-01	95% Student's-t UCL	8.86E-01	UCL
PFDS	ug/kg	19 : 21	90%	1.06E-01	4.95E-01	2.32E-01	2.12E-01	2.67E-01	95% KM Adjusted Gamma UCL	2.67E-01	UCL
PFDoS	ug/kg	0 : 21	0%	ND	ND	ND	ND	NC	--	ND	(b)
FOSA, FASE, FASAAs											
PFOSA	ug/kg	21 : 21	100%	5.70E-01	1.17E+00	8.38E-01	8.41E-01	8.98E-01	95% Student's-t UCL	8.98E-01	UCL
N-EtFOSA	ug/kg	0 : 16	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/kg	0 : 20	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSAA	ug/kg	21 : 21	100%	1.27E-01	5.92E-01	3.00E-01	2.66E-01	3.50E-01	95% Student's-t UCL	3.50E-01	UCL
N-MeFOSAA	ug/kg	0 : 21	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSE	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/kg	0 : 21	0%	ND	ND	NC	NC	NC	--	ND	(b)
6:2 FTS	ug/kg	5 : 21	24%	3.83E-01	5.01E+00	1.79E+00	1.32E+00	1.12E+00	95% KM (t) UCL	1.12E+00	UCL
8:2 FTS	ug/kg	0 : 21	0%	ND	ND	NC	NC	NC	--	ND	(b)
3:3 FTCA	ug/kg	0 : 21	0%	ND	ND	ND	ND	NC	--	ND	(b)
5:3 FTCA	ug/kg	0 : 21	0%	ND	ND	ND	ND	NC	--	ND	(b)
7:3 FTCA	ug/kg	0 : 21	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/kg	0 : 21	0%	ND	ND	NC	NC	NC	--	ND	(b)
ADONA	ug/kg	0 : 21	0%	ND	ND	NC	NC	NC	--	ND	(b)
9CL-PF3ONS	ug/kg	0 : 21	0%	ND	ND	NC	NC	NC	--	ND	(b)
11CL-PF3OUDS	ug/kg	0 : 21	0%	ND	ND	NC	NC	NC	--	ND	(b)
Perfluoro(2-ethoxyethane)sulfonic acid	ug/kg	0 : 21	0%	ND	ND	NC	NC	NC	--	ND	(b)
Perfluoro-3,6-dioxaheptanoic acid	ug/kg	2 : 21	10%	2.49E-01	8.18E-01	5.34E-01	5.34E-01	NC	--	8.18E-01	Maximum
Perfluoro-3-methoxypropanoic acid	ug/kg	0 : 21	0%	ND	ND	NC	NC	NC	--	ND	(b)
Perfluoro-4-methoxybutanoic acid	ug/kg	0 : 21	0%	ND	ND	NC	NC	NC	--	ND	(b)

Acronyms:
EPC - Exposure Point Concentration.
NC - Not Calculated.
ND - Not Detected.
UCL - Upper confidence limit.
ug/kg - Micrograms per kilograms.
USEPA - United States Environmental Protection Agency.

Notes:
(a) Upper Confidence Limit (UCL) on the arithmetic mean concentration calculated using USEPA ProUCL Version 5.1. The UCL suggested by ProUCL is used, unless otherwise noted. In cases where more than one UCL is suggested, the higher UCL is used. A sample size of at least eight is recommended for the calculation of UCLs. When fewer samples are available the ProUCL export is reviewed to assess whether the maximum or the recommended UCL is the appropriate EPC
(c) Chemical was not detected.

Appendix D Table 11
Summary Statistics and Exposure Point Concentrations - Predator Fish Tissue
Project 1007
Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (b)	UCL Basis	EPC	Statistic
Eagle Point Lake											
PFCAs											
PFBA	ug/kg	1 : 5	20%	4.41E-01	4.41E-01	NC	NC	NC	--	4.41E-01	Maximum
PFPeA	ug/kg	0 : 5	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxA	ug/kg	1 : 5	20%	1.16E-01	1.16E-01	NC	NC	NC	--	1.16E-01	Maximum
PFHpA	ug/kg	1 : 5	20%	1.03E-01	1.03E-01	NC	NC	NC	--	1.03E-01	Maximum
PFOA	ug/kg	5 : 5	100%	1.24E-01	2.77E-01	1.85E-01	1.77E-01	2.42E-01	95% Student's-t UCL	2.42E-01	UCL
PFNA	ug/kg	5 : 5	100%	1.14E-01	2.03E-01	1.77E-01	1.90E-01	2.11E-01	95% Student's-t UCL	2.03E-01	Maximum
PFDA	ug/kg	5 : 5	100%	1.74E+01	2.57E+01	2.02E+01	1.93E+01	2.33E+01	95% Student's-t UCL	2.33E+01	UCL
PFUnA	ug/kg	5 : 5	100%	2.35E+00	3.25E+00	2.79E+00	2.80E+00	3.10E+00	95% Student's-t UCL	3.10E+00	UCL
PFDoA	ug/kg	5 : 5	100%	4.80E-01	8.41E-01	6.98E-01	7.02E-01	8.30E-01	95% Student's-t UCL	8.30E-01	UCL
PFTrDA	ug/kg	5 : 5	100%	2.11E-01	2.83E-01	2.42E-01	2.48E-01	2.70E-01	95% Student's-t UCL	2.70E-01	UCL
PFTeDA	ug/kg	4 : 5	80%	1.01E-01	1.69E-01	1.26E-01	1.17E-01	1.49E-01	95% KM (t) UCL	1.49E-01	UCL
PFSAs											
PFBS	ug/kg	0 : 5	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFPeS	ug/kg	0 : 5	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxS	ug/kg	5 : 5	100%	9.50E-02	1.26E-01	1.07E-01	1.05E-01	1.19E-01	95% Student's-t UCL	1.19E-01	UCL
PFHpS	ug/kg	5 : 5	100%	9.23E-01	1.43E+00	1.17E+00	1.15E+00	1.35E+00	95% Student's-t UCL	1.35E+00	UCL
PFOS	ug/kg	5 : 5	100%	2.05E+03	2.64E+03	2.24E+03	2.14E+03	2.47E+03	95% Student's-t UCL	2.47E+03	UCL
PFNS	ug/kg	5 : 5	100%	3.94E+00	6.06E+00	4.86E+00	4.48E+00	5.74E+00	95% Student's-t UCL	5.74E+00	UCL
PFDS	ug/kg	5 : 5	100%	1.11E+00	2.18E+00	1.54E+00	1.37E+00	2.00E+00	95% Student's-t UCL	2.00E+00	UCL
PFDoS	ug/kg	1 : 5	20%	1.08E-01	1.08E-01	NC	NC	NC	--	1.08E-01	Maximum
FOSA, FASE, FASAAs											
PFOSA	ug/kg	5 : 5	100%	1.85E+00	3.33E+00	2.45E+00	2.22E+00	3.05E+00	95% Student's-t UCL	3.05E+00	UCL
N-EtFOSA	ug/kg	0 : 5	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/kg	0 : 5	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSAA	ug/kg	5 : 5	100%	5.32E-01	1.08E+00	6.76E-01	5.89E-01	9.07E-01	95% Modified-t UCL	9.07E-01	UCL
N-MeFOSAA	ug/kg	5 : 5	100%	1.35E-01	1.72E-01	1.59E-01	1.63E-01	1.72E-01	95% Student's-t UCL	1.72E-01	UCL
N-EtFOSE	ug/kg	0 : 3	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSE	ug/kg	0 : 1	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/kg	0 : 5	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/kg	5 : 5	100%	3.50E-01	2.26E+00	1.10E+00	5.08E-01	2.01E+00	95% Student's-t UCL	2.01E+00	UCL
8:2 FTS	ug/kg	0 : 5	0%	ND	ND	ND	ND	NC	--	ND	(b)
3:3 FTCA	ug/kg	0 : 5	0%	ND	ND	ND	ND	NC	--	ND	(b)
5:3 FTCA	ug/kg	0 : 5	0%	ND	ND	ND	ND	NC	--	ND	(b)
7:3 FTCA	ug/kg	0 : 5	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/kg	0 : 5	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/kg	0 : 5	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/kg	0 : 5	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/kg	0 : 5	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro(2-ethoxyethane)sulfonic acid	ug/kg	0 : 5	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3,6-dioxaheptanoic acid	ug/kg	0 : 5	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3-methoxypropanoic acid	ug/kg	0 : 5	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-4-methoxybutanoic acid	ug/kg	0 : 5	0%	ND	ND	ND	ND	NC	--	ND	(b)

Appendix D Table 11
Summary Statistics and Exposure Point Concentrations - Predator Fish Tissue
Project 1007
Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (b)	UCL Basis	EPC	Statistic
Lake Elmo											
PFCAs											
PFBA	ug/kg	2 : 8	25%	3.97E-01	4.92E-01	4.44E-01	4.44E-01	NC	--	4.92E-01	Maximum
PFPeA	ug/kg	0 : 8	0%	ND	ND	NC	NC	NC	--	ND	(b)
PFHxA	ug/kg	0 : 8	0%	ND	ND	NC	NC	NC	--	ND	(b)
PFHpA	ug/kg	1 : 8	13%	1.10E-01	1.10E-01	NC	NC	NC	--	1.10E-01	Maximum
PFOA	ug/kg	7 : 8	88%	1.14E-01	6.25E-01	2.53E-01	1.86E-01	3.54E-01	95% KM (t) UCL	3.54E-01	UCL
PFNA	ug/kg	6 : 8	75%	1.15E-01	6.42E-01	3.26E-01	2.83E-01	4.09E-01	95% KM (t) UCL	4.09E-01	UCL
PFDA	ug/kg	8 : 8	100%	5.82E+00	1.79E+01	9.41E+00	7.99E+00	1.21E+01	95% Student's-t UCL	1.21E+01	UCL
PFUnA	ug/kg	8 8	100%	1.43E+00	3.74E+00	2.28E+00	1.95E+00	3.17E+00	95% Adjusted Gamma UCL	3.17E+00	UCL
PFDoA	ug/kg	8 8	100%	8.46E-01	1.98E+00	1.21E+00	1.04E+00	1.50E+00	95% Student's-t UCL	1.50E+00	UCL
PFTrDA	ug/kg	8 : 8	100%	3.38E-01	1.09E+00	6.05E-01	5.25E-01	7.72E-01	95% Student's-t UCL	7.72E-01	UCL
PFTeDA	ug/kg	6 : 6	100%	3.64E-01	8.42E-01	5.79E-01	5.75E-01	7.35E-01	95% Student's-t UCL	7.35E-01	UCL
PFSAs											
PFBS	ug/kg	0 : 8	0%	ND	ND	NC	NC	NC	--	ND	(b)
PFPeS	ug/kg	0 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
PFHxS	ug/kg	3 : 8	38%	2.75E-01	3.62E-01	3.23E-01	3.32E-01	NC	--	3.62E-01	Maximum
PFHpS	ug/kg	8 8	100%	2.77E-01	1.53E+00	8.15E-01	8.61E-01	1.10E+00	95% Student's-t UCL	1.10E+00	UCL
PFOS	ug/kg	8 : 8	100%	7.42E+02	2.13E+03	1.20E+03	9.84E+02	1.65E+03	95% H-UCL	1.65E+03	UCL
PFNS	ug/kg	8 8	100%	3.68E-01	1.26E+00	6.03E-01	4.95E-01	9.20E-01	95% Adjusted Gamma UCL	9.20E-01	UCL
PFDS	ug/kg	8 : 8	100%	1.47E-01	4.59E-01	2.53E-01	2.10E-01	3.23E-01	95% Student's-t UCL	3.23E-01	UCL
PFDoS	ug/kg	0 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
FOSA, FASE, FASAAs											
PFOSA	ug/kg	8 : 8	100%	1.53E-01	6.43E-01	3.21E-01	1.88E-01	6.50E-01	95% Chebyshev (Mean, Sd) UCL	6.43E-01	Maximum
N-EtFOSA	ug/kg	0 7	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSA	ug/kg	0 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-EtFOSAA	ug/kg	4 : 8	50%	1.09E-01	2.04E-01	1.44E-01	1.31E-01	1.46E-01	95% KM (t) UCL	1.46E-01	UCL
N-MeFOSAA	ug/kg	3 : 8	38%	1.01E-01	1.73E-01	1.30E-01	1.17E-01	NC	--	1.73E-01	Maximum
N-EtFOSE	ug/kg	0 : 4	0%	ND	ND	ND	ND	NC	--	ND	(b)
N-MeFOSE	ug/kg	0 : 3	0%	ND	ND	ND	ND	NC	--	ND	(b)
Fluortelomers											
4:2 FTS	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
6:2 FTS	ug/kg	3 : 8	38%	4.13E-01	2.39E+00	1.08E+00	4.33E-01	NC	--	2.39E+00	Maximum
8:2 FTS	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
3:3 FTCA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
5:3 FTCA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
7:3 FTCA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
ADONA	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
9CL-PF3ONS	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
11CL-PF3OUDS	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro(2-ethoxyethane)sulfonic acid	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3,6-dioxaheptanoic acid	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-3-methoxypropanoic acid	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)
Perfluoro-4-methoxybutanoic acid	ug/kg	0 : 8	0%	ND	ND	ND	ND	NC	--	ND	(b)

Appendix D Table 11
Summary Statistics and Exposure Point Concentrations - Predator Fish Tissue
Project 1007
Minneapolis, Minnesota

Analyte	Units	Frequency of Detection	Percent Detected	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Median Detected Concentration	UCL (b)	UCL Basis	EPC	Statistic
West Lakeland											
PFCAs											
PFBA	ug/kg	3 : 12	25%	4.09E-01	5.76E-01	4.92E-01	4.90E-01	NC	--	5.76E-01	Maximum
PFPeA	ug/kg	0 : 12	0%	ND	ND	NC	NC	NC	--	ND	(b)
PFHxA	ug/kg	2 : 12	17%	1.05E-01	1.16E-01	1.11E-01	1.11E-01	NC	--	1.16E-01	Maximum
PFHpA	ug/kg	0 : 12	0%	ND	ND	NC	NC	NC	--	ND	(b)
PFOA	ug/kg	7 : 12	58%	1.00E-01	1.48E-01	1.33E-01	1.40E-01	1.30E-01	95% KM (t) UCL	1.30E-01	UCL
PFNA	ug/kg	3 : 12	25%	1.05E-01	2.10E-01	1.61E-01	1.67E-01	NC	--	2.10E-01	Maximum
PFDA	ug/kg	12 : 12	100%	4.54E+00	1.24E+01	7.86E+00	7.79E+00	8.99E+00	95% Student's-t UCL	8.99E+00	UCL
PFUnA	ug/kg	12 : 12	100%	8.55E-01	2.27E+00	1.50E+00	1.59E+00	1.74E+00	95% Student's-t UCL	1.74E+00	UCL
PFDoA	ug/kg	12 : 12	100%	2.19E-01	8.96E-01	5.01E-01	5.08E-01	6.04E-01	95% Student's-t UCL	6.04E-01	UCL
PFTrDA	ug/kg	12 : 12	100%	1.62E-01	5.46E-01	3.78E-01	3.84E-01	5.17E-01	95% H-UCL	5.17E-01	UCL
PFTeDA	ug/kg	10 : 11	91%	1.15E-01	2.82E-01	1.81E-01	1.60E-01	2.08E-01	95% KM (t) UCL	2.08E-01	UCL
PFSAs											
PFBS	ug/kg	0 : 12	0%	ND	ND	NC	NC	NC		ND	(b)
PFPeS	ug/kg	0 : 12	0%	ND	ND	NC	NC	NC	--	ND	(b)
PFHxS	ug/kg	4 : 12	33%	9.80E-02	1.22E-01	1.07E-01	1.04E-01	1.05E-01	95% KM (t) UCL	1.05E-01	UCL
PFHpS	ug/kg	12 : 12	100%	3.25E-01	8.11E-01	4.49E-01	3.80E-01	5.38E-01	95% Adjusted Gamma UCL	5.38E-01	UCL
PFOS	ug/kg	12 : 12	100%	6.50E+02	2.29E+03	1.20E+03	1.11E+03	1.44E+03	95% Student's-t UCL	1.44E+03	UCL
PFNS	ug/kg	12 : 12	100%	5.58E-01	3.58E+00	1.42E+00	1.17E+00	2.03E+00	95% Adjusted Gamma UCL	2.03E+00	UCL
PFDS	ug/kg	12 : 12	100%	1.81E-01	1.18E+00	4.98E-01	3.92E-01	6.48E-01	95% Student's-t UCL	6.48E-01	UCL
PFDoS	ug/kg	0 : 12	0%	ND	ND	NC	NC	NC	--	ND	(b)
FOSA, FASE, FASAAs											
PFOSA	ug/kg	12 : 12	100%	5.45E-01	9.80E-01	7.37E-01	7.15E-01	7.98E-01	95% Student's-t UCL	7.98E-01	UCL
N-EtFOSA	ug/kg	0 : 7	0%	ND	ND	NC	NC	NC	--	ND	(b)
N-MeFOSA	ug/kg	0 : 12	0%	ND	ND	NC	NC	NC	--	ND	(b)
N-EtFOSAA	ug/kg	12 : 12	100%	2.03E-01	5.94E-01	3.48E-01	3.41E-01	4.10E-01	95% Student's-t UCL	4.10E-01	UCL
N-MeFOSAA	ug/kg	3 : 12	25%	1.10E-01	1.71E-01	1.32E-01	1.14E-01	NC	--	1.71E-01	Maximum
N-EtFOSE	ug/kg	2 : 3	67%	1.08E+00	1.24E+00	1.16E+00	1.16E+00	NC	--	1.24E+00	Maximum
Fluortelomers											
4:2 FTS	ug/kg	0 : 12	0%	ND	ND	NC	NC	NC	--	ND	(b)
6:2 FTS	ug/kg	7 : 12	58%	4.36E-01	5.42E+00	2.44E+00	2.64E+00	2.51E+00	95% KM (t) UCL	2.51E+00	UCL
8:2 FTS	ug/kg	0 : 12	0%	ND	ND	NC	NC	NC	--	ND	(b)
3:3 FTCA	ug/kg	0 : 12	0%	ND	ND	NC	NC	NC	--	ND	(b)
5:3 FTCA	ug/kg	0 : 12	0%	ND	ND	NC	NC	NC	--	ND	(b)
7:3 FTCA	ug/kg	0 : 12	0%	ND	ND	NC	NC	NC	--	ND	(b)
Replacement Chemistries											
HFPO-DA	ug/kg	0 : 12	0%	ND	ND	NC	NC	NC	--	ND	(b)
ADONA	ug/kg	2 : 12	17%	4.69E-01	4.99E-01	4.84E-01	4.84E-01	NC	--	4.99E-01	Maximum
9CL-PF3ONS	ug/kg	0 : 12	0%	ND	ND	NC	NC	NC	--	ND	(b)
11CL-PF3OUDS	ug/kg	0 : 12	0%	ND	ND	NC	NC	NC	--	ND	(b)
Perfluoro(2-ethoxyethane)sulfonic acid	ug/kg	0 : 12	0%	ND	ND	NC	NC	NC	--	ND	(b)
Perfluoro-3,6-dioxaheptanoic acid	ug/kg	0 : 12	0%	ND	ND	NC	NC	NC	--	ND	(b)
Perfluoro-3-methoxypropanoic acid	ug/kg	0 : 12	0%	ND	ND	NC	NC	NC	--	ND	(b)
Perfluoro-4-methoxybutanoic acid	ug/kg	0 : 12	0%	ND	ND	NC	NC	NC	--	ND	(b)

Acronyms:
EPC - Exposure Point Concentration.
NC - Not Calculated.
ND - Not Detected.
UCL - Upper confidence limit.
ug/kg - Micrograms per kilograms.
USEPA - United States Environmental Protection Agency.

Notes:
(a) Upper Confidence Limit (UCL) on the arithmetic mean concentration calculated using USEPA ProUCL Version 5.1. The UCL suggested by ProUCL is used, unless otherwise noted. In cases where more than one UCL is suggested, the higher UCL is used. A sample size of at least eight is recommended for the calculation of UCLs. When fewer samples are available the ProUCL export is reviewed to assess whether the maximum or the recommended UCL is the appropriate EPC
(b) Chemical was not detected.

Appendix D-2
ProUCL Documentation

ProUCL Output
Eagle Point Lake
Total Surface Water

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/26/2021 10:40:04 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

PFBA|ug/L

General Statistics

Total Number of Observations	40	Number of Distinct Observations	26
		Number of Missing Observations	2
Minimum	0.0596	Mean	0.113
Maximum	0.15	Median	0.112
SD	0.0174	Std. Error of Mean	0.00275
Coefficient of Variation	0.154	Skewness	-0.669

Normal GOF Test

Shapiro Wilk Test Statistic	0.951	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.94	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.102	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.139	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.118	95% Adjusted-CLT UCL (Chen-1995)	0.117
		95% Modified-t UCL (Johnson-1978)	0.118

Gamma GOF Test

A-D Test Statistic	0.927	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.746	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.122	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.139	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	38.28	k star (bias corrected MLE)	35.43
Theta hat (MLE)	0.00296	Theta star (bias corrected MLE)	0.00319
nu hat (MLE)	3062	nu star (bias corrected)	2834
MLE Mean (bias corrected)	0.113	MLE Sd (bias corrected)	0.019
		Approximate Chi Square Value (0.05)	2711
Adjusted Level of Significance	0.044	Adjusted Chi Square Value	2707

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.118	95% Adjusted Gamma UCL (use when n<50)	0.118

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.882	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.94	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.138	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.139	Data appear Lognormal at 5% Significance Level	

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.82	Mean of logged Data	-2.192
Maximum of Logged Data	-1.897	SD of logged Data	0.171

Assuming Lognormal Distribution

95% H-UCL	0.119	90% Chebyshev (MVUE) UCL	0.123
95% Chebyshev (MVUE) UCL	0.127	97.5% Chebyshev (MVUE) UCL	0.133
99% Chebyshev (MVUE) UCL	0.144		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

ProUCL Output
Eagle Point Lake
Total Surface Water

Nonparametric Distribution Free UCLs

95% CLT UCL	0.118	95% Jackknife UCL	0.118
95% Standard Bootstrap UCL	0.118	95% Bootstrap-t UCL	0.118
95% Hall's Bootstrap UCL	0.118	95% Percentile Bootstrap UCL	0.118
95% BCA Bootstrap UCL	0.117		
90% Chebyshev(Mean, Sd) UCL	0.121	95% Chebyshev(Mean, Sd) UCL	0.125
97.5% Chebyshev(Mean, Sd) UCL	0.13	99% Chebyshev(Mean, Sd) UCL	0.141

Suggested UCL to Use

95% Student's-t UCL 0.118

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFPeA|ug/L

General Statistics

Total Number of Observations	42	Number of Distinct Observations	33
Number of Detects	41	Number of Non-Detects	1
Number of Distinct Detects	32	Number of Distinct Non-Detects	1
Minimum Detect	0.00573	Minimum Non-Detect	0.0113
Maximum Detect	0.012	Maximum Non-Detect	0.0113
Variance Detects	2.4663E-6	Percent Non-Detects	2.381%
Mean Detects	0.00907	SD Detects	0.00157
Median Detects	0.0088	CV Detects	0.173
Skewness Detects	-0.276	Kurtosis Detects	-0.557
Mean of Logged Detects	-4.719	SD of Logged Detects	0.183

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.955	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.941	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.098	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.137	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00907	KM Standard Error of Mean	2.4488E-4
KM SD	0.00155	95% KM (BCA) UCL	0.00944
95% KM (t) UCL	0.00948	95% KM (Percentile Bootstrap) UCL	0.00945
95% KM (z) UCL	0.00947	95% KM Bootstrap t UCL	0.00947
90% KM Chebyshev UCL	0.0098	95% KM Chebyshev UCL	0.0101
97.5% KM Chebyshev UCL	0.0106	99% KM Chebyshev UCL	0.0115

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.664	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.747	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.102	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.138	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	32.07	k star (bias corrected MLE)	29.74
Theta hat (MLE)	2.8276E-4	Theta star (bias corrected MLE)	3.0492E-4
nu hat (MLE)	2629	nu star (bias corrected)	2438
Mean (detects)	0.00907		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.00573	Mean	0.00909
Maximum	0.012	Median	0.00893
SD	0.00156	CV	0.171
k hat (MLE)	32.6	k star (bias corrected MLE)	30.29
Theta hat (MLE)	2.7881E-4	Theta star (bias corrected MLE)	3.0010E-4
nu hat (MLE)	2738	nu star (bias corrected)	2544
Adjusted Level of Significance (β)	0.0443		
Approximate Chi Square Value (N/A, α)	2428	Adjusted Chi Square Value (N/A, β)	2424
95% Gamma Approximate UCL (use when n>=50)	0.00952	95% Gamma Adjusted UCL (use when n<50)	0.00954

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00907	SD (KM)	0.00155
Variance (KM)	2.4024E-6	SE of Mean (KM)	2.4488E-4
k hat (KM)	34.21	k star (KM)	31.78
nu hat (KM)	2873	nu star (KM)	2669
theta hat (KM)	2.6502E-4	theta star (KM)	2.8526E-4
80% gamma percentile (KM)	0.0104	90% gamma percentile (KM)	0.0112
95% gamma percentile (KM)	0.0119	99% gamma percentile (KM)	0.0132

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (N/A, α)	2550	Adjusted Chi Square Value (N/A, β)	2546
95% Gamma Approximate KM-UCL (use when n>=50)	0.00949	95% Gamma Adjusted KM-UCL (use when n<50)	0.0095

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.935	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.941	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.103	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.137	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00906	Mean in Log Scale	-4.719
SD in Original Scale	0.00155	SD in Log Scale	0.181
95% t UCL (assumes normality of ROS data)	0.00946	95% Percentile Bootstrap UCL	0.00944
95% BCA Bootstrap UCL	0.00945	95% Bootstrap t UCL	0.00947
95% H-UCL (Log ROS)	0.00952		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-4.719	KM Geo Mean	0.00892
KM SD (logged)	0.18	95% Critical H Value (KM-Log)	1.71
KM Standard Error of Mean (logged)	0.0285	95% H-UCL (KM -Log)	0.00952
KM SD (logged)	0.18	95% Critical H Value (KM-Log)	1.71
KM Standard Error of Mean (logged)	0.0285		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00899	Mean in Log Scale	-4.73
SD in Original Scale	0.00164	SD in Log Scale	0.194
95% t UCL (Assumes normality)	0.00941	95% H-Stat UCL	0.00948

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.00948

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	42	Number of Distinct Observations	32
		Number of Missing Observations	0
Minimum	0.00501	Mean	0.0116
Maximum	0.018	Median	0.0113
SD	0.00324	Std. Error of Mean	4.9967E-4
Coefficient of Variation	0.28	Skewness	-0.0531

Normal GOF Test

Shapiro Wilk Test Statistic	0.921	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.942	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.089	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.135	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0124	95% Adjusted-CLT UCL (Chen-1995)	0.0124
		95% Modified-t UCL (Johnson-1978)	0.0124

Gamma GOF Test

A-D Test Statistic	0.456	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.748	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.1	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.136	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	11.87	k star (bias corrected MLE)	11.03
Theta hat (MLE)	9.7361E-4	Theta star (bias corrected MLE)	0.00105
nu hat (MLE)	996.7	nu star (bias corrected)	926.9
MLE Mean (bias corrected)	0.0116	MLE Sd (bias corrected)	0.00348
		Approximate Chi Square Value (0.05)	857.2
Adjusted Level of Significance	0.0443	Adjusted Chi Square Value	854.8

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0125	95% Adjusted Gamma UCL (use when n<50)	0.0125

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.903	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.942	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.105	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.135	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.296	Mean of logged Data	-4.504
Maximum of Logged Data	-4.017	SD of logged Data	0.306

Assuming Lognormal Distribution

95% H-UCL	0.0126	90% Chebyshev (MVUE) UCL	0.0133
95% Chebyshev (MVUE) UCL	0.014	97.5% Chebyshev (MVUE) UCL	0.0151
99% Chebyshev (MVUE) UCL	0.0171		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0124	95% Jackknife UCL	0.0124
95% Standard Bootstrap UCL	0.0124	95% Bootstrap-t UCL	0.0124
95% Hall's Bootstrap UCL	0.0124	95% Percentile Bootstrap UCL	0.0124
95% BCA Bootstrap UCL	0.0124		
90% Chebyshev(Mean, Sd) UCL	0.0131	95% Chebyshev(Mean, Sd) UCL	0.0137
97.5% Chebyshev(Mean, Sd) UCL	0.0147	99% Chebyshev(Mean, Sd) UCL	0.0165

ProUCL Output
Eagle Point Lake
Total Surface Water

Suggested UCL to Use

95% Student's-t UCL 0.0124

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

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General Statistics

Total Number of Observations	42	Number of Distinct Observations	34
		Number of Missing Observations	0
Minimum	0.00277	Mean	0.00919
Maximum	0.015	Median	0.00896
SD	0.0034	Std. Error of Mean	5.2503E-4
Coefficient of Variation	0.37	Skewness	0.034

Normal GOF Test

Shapiro Wilk Test Statistic	0.901	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.942	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.122	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.135	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0101	95% Adjusted-CLT UCL (Chen-1995)	0.0101
		95% Modified-t UCL (Johnson-1978)	0.0101

Gamma GOF Test

A-D Test Statistic	0.48	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.751	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.107	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.137	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	6.54	k star (bias corrected MLE)	6.089
Theta hat (MLE)	0.00141	Theta star (bias corrected MLE)	0.00151
nu hat (MLE)	549.4	nu star (bias corrected)	511.5
MLE Mean (bias corrected)	0.00919	MLE Sd (bias corrected)	0.00373
		Approximate Chi Square Value (0.05)	460
Adjusted Level of Significance	0.0443	Adjusted Chi Square Value	458.3

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0102	95% Adjusted Gamma UCL (use when n<50)	0.0103

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.886	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.942	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.11	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.135	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.889	Mean of logged Data	-4.768
Maximum of Logged Data	-4.2	SD of logged Data	0.422

Assuming Lognormal Distribution

95% H-UCL	0.0105	90% Chebyshev (MVUE) UCL	0.0111
95% Chebyshev (MVUE) UCL	0.012	97.5% Chebyshev (MVUE) UCL	0.0132
99% Chebyshev (MVUE) UCL	0.0155		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0101	95% Jackknife UCL	0.0101
95% Standard Bootstrap UCL	0.01	95% Bootstrap-t UCL	0.0101
95% Hall's Bootstrap UCL	0.0101	95% Percentile Bootstrap UCL	0.0101
95% BCA Bootstrap UCL	0.01		
90% Chebyshev(Mean, Sd) UCL	0.0108	95% Chebyshev(Mean, Sd) UCL	0.0115
97.5% Chebyshev(Mean, Sd) UCL	0.0125	99% Chebyshev(Mean, Sd) UCL	0.0144

Suggested UCL to Use

95% Student's-t UCL 0.0101

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOA|ug/L

General Statistics

Total Number of Observations	42	Number of Distinct Observations	41
		Number of Missing Observations	0
Minimum	0.0152	Mean	0.0703
Maximum	0.15	Median	0.0704
SD	0.0287	Std. Error of Mean	0.00442
Coefficient of Variation	0.408	Skewness	0.356

Normal GOF Test

Shapiro Wilk Test Statistic	0.935	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.942	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.0945	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.135	Data appear Normal at 5% Significance Level	

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0777	95% Adjusted-CLT UCL (Chen-1995)	0.0778
		95% Modified-t UCL (Johnson-1978)	0.0778

Gamma GOF Test

A-D Test Statistic	0.408	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.752	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.0936	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.137	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.269	k star (bias corrected MLE)	4.909
Theta hat (MLE)	0.0133	Theta star (bias corrected MLE)	0.0143
nu hat (MLE)	442.6	nu star (bias corrected)	412.3
MLE Mean (bias corrected)	0.0703	MLE Sd (bias corrected)	0.0317
		Approximate Chi Square Value (0.05)	366.3
Adjusted Level of Significance	0.0443	Adjusted Chi Square Value	364.7

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0791	95% Adjusted Gamma UCL (use when n<50)	0.0795

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.887	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.942	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.126	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.135	Data appear Lognormal at 5% Significance Level	

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.186	Mean of logged Data	-2.753
Maximum of Logged Data	-1.897	SD of logged Data	0.484

Assuming Lognormal Distribution

95% H-UCL	0.0826	90% Chebyshev (MVUE) UCL	0.0881
95% Chebyshev (MVUE) UCL	0.0957	97.5% Chebyshev (MVUE) UCL	0.106
99% Chebyshev (MVUE) UCL	0.127		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0776	95% Jackknife UCL	0.0777
95% Standard Bootstrap UCL	0.0775	95% Bootstrap-t UCL	0.0782
95% Hall's Bootstrap UCL	0.078	95% Percentile Bootstrap UCL	0.0773
95% BCA Bootstrap UCL	0.0775		
90% Chebyshev(Mean, Sd) UCL	0.0836	95% Chebyshev(Mean, Sd) UCL	0.0896
97.5% Chebyshev(Mean, Sd) UCL	0.0979	99% Chebyshev(Mean, Sd) UCL	0.114

Suggested UCL to Use

95% Student's-t UCL 0.0777

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFNA|ug/L

General Statistics

Total Number of Observations	42	Number of Distinct Observations	35
Number of Detects	40	Number of Non-Detects	2
Number of Distinct Detects	33	Number of Distinct Non-Detects	2
Minimum Detect	9.3300E-4	Minimum Non-Detect	7.6300E-4
Maximum Detect	0.0041	Maximum Non-Detect	0.00564
Variance Detects	3.2055E-7	Percent Non-Detects	4.762%
Mean Detects	0.00146	SD Detects	5.6617E-4
Median Detects	0.00128	CV Detects	0.387
Skewness Detects	2.959	Kurtosis Detects	11.66
Mean of Logged Detects	-6.578	SD of Logged Detects	0.298

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.719	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.94	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.241	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.139	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00145	KM Standard Error of Mean	8.8986E-5
KM SD	5.6262E-4	95% KM (BCA) UCL	0.00161
95% KM (t) UCL	0.00159	95% KM (Percentile Bootstrap) UCL	0.0016
95% KM (z) UCL	0.00159	95% KM Bootstrap t UCL	0.00169
90% KM Chebyshev UCL	0.00171	95% KM Chebyshev UCL	0.00183
97.5% KM Chebyshev UCL	0.002	99% KM Chebyshev UCL	0.00233

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.674	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.748	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.193	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.139	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	10.06	k star (bias corrected MLE)	9.326
Theta hat (MLE)	1.4529E-4	Theta star (bias corrected MLE)	1.5679E-4
nu hat (MLE)	805.1	nu star (bias corrected)	746.1
Mean (detects)	0.00146		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	9.3300E-4	Mean	0.00187
Maximum	0.01	Median	0.00134
SD	0.00192	CV	1.028
k hat (MLE)	2.631	k star (bias corrected MLE)	2.459
Theta hat (MLE)	7.1016E-4	Theta star (bias corrected MLE)	7.5986E-4
nu hat (MLE)	221	nu star (bias corrected)	206.6
Adjusted Level of Significance (β)	0.0443		
Approximate Chi Square Value (206.58, α)	174.3	Adjusted Chi Square Value (206.58, β)	173.3
95% Gamma Approximate UCL (use when n>=50)	0.00221	95% Gamma Adjusted UCL (use when n<50)	0.00223

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00145	SD (KM)	5.6262E-4
Variance (KM)	3.1654E-7	SE of Mean (KM)	8.8986E-5
k hat (KM)	6.597	k star (KM)	6.142
nu hat (KM)	554.2	nu star (KM)	515.9
theta hat (KM)	2.1904E-4	theta star (KM)	2.3528E-4
80% gamma percentile (KM)	0.0019	90% gamma percentile (KM)	0.00222
95% gamma percentile (KM)	0.00252	99% gamma percentile (KM)	0.00313

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (515.94, α)	464.3	Adjusted Chi Square Value (515.94, β)	462.5
95% Gamma Approximate KM-UCL (use when n>=50)	0.00161	95% Gamma Adjusted KM-UCL (use when n<50)	0.00161

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.891	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.94	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.166	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.139	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00144	Mean in Log Scale	-6.596
SD in Original Scale	5.6564E-4	SD in Log Scale	0.312
95% t UCL (assumes normality of ROS data)	0.00159	95% Percentile Bootstrap UCL	0.00159
95% BCA Bootstrap UCL	0.00163	95% Bootstrap t UCL	0.00167
95% H-UCL (Log ROS)	0.00156		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-6.593	KM Geo Mean	0.00137
KM SD (logged)	0.305	95% Critical H Value (KM-Log)	1.777
KM Standard Error of Mean (logged)	0.0483	95% H-UCL (KM -Log)	0.00156
KM SD (logged)	0.305	95% Critical H Value (KM-Log)	1.777
KM Standard Error of Mean (logged)	0.0483		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00147	Mean in Log Scale	-6.592
SD in Original Scale	6.1507E-4	SD in Log Scale	0.371
95% t UCL (Assumes normality)	0.00163	95% H-Stat UCL	0.00163

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.00159	KM H-UCL	0.00156
95% KM (BCA) UCL	0.00161		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	42	Number of Distinct Observations	35
Number of Detects	38	Number of Non-Detects	4
Number of Distinct Detects	31	Number of Distinct Non-Detects	4
Minimum Detect	7.9100E-4	Minimum Non-Detect	7.6300E-4
Maximum Detect	0.0066	Maximum Non-Detect	0.00564
Variance Detects	8.5353E-7	Percent Non-Detects	9.524%
Mean Detects	0.00161	SD Detects	9.2386E-4
Median Detects	0.00142	CV Detects	0.575
Skewness Detects	4.464	Kurtosis Detects	23.97
Mean of Logged Detects	-6.517	SD of Logged Detects	0.369

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.565	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.938	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.233	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.142	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00156	KM Standard Error of Mean	1.4007E-4
KM SD	8.9075E-4	95% KM (BCA) UCL	0.00182
95% KM (t) UCL	0.0018	95% KM (Percentile Bootstrap) UCL	0.00181
95% KM (z) UCL	0.00179	95% KM Bootstrap t UCL	0.00202
90% KM Chebyshev UCL	0.00198	95% KM Chebyshev UCL	0.00217
97.5% KM Chebyshev UCL	0.00243	99% KM Chebyshev UCL	0.00295

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.557	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.75	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.161	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.143	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	6.113	k star (bias corrected MLE)	5.648
Theta hat (MLE)	2.6303E-4	Theta star (bias corrected MLE)	2.8469E-4
nu hat (MLE)	464.6	nu star (bias corrected)	429.2
Mean (detects)	0.00161		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	7.9100E-4	Mean	0.00241
Maximum	0.01	Median	0.00152
SD	0.00264	CV	1.098
k hat (MLE)	1.785	k star (bias corrected MLE)	1.674
Theta hat (MLE)	0.00135	Theta star (bias corrected MLE)	0.00144
nu hat (MLE)	150	nu star (bias corrected)	140.6
Adjusted Level of Significance (β)	0.0443		
Approximate Chi Square Value (140.59, α)	114.2	Adjusted Chi Square Value (140.59, β)	113.3
95% Gamma Approximate UCL (use when n>=50)	0.00296	95% Gamma Adjusted UCL (use when n<50)	0.00299

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00156	SD (KM)	8.9075E-4
Variance (KM)	7.9343E-7	SE of Mean (KM)	1.4007E-4
k hat (KM)	3.065	k star (KM)	2.862
nu hat (KM)	257.5	nu star (KM)	240.4
theta hat (KM)	5.0880E-4	theta star (KM)	5.4490E-4
80% gamma percentile (KM)	0.00224	90% gamma percentile (KM)	0.0028
95% gamma percentile (KM)	0.00332	99% gamma percentile (KM)	0.00445

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (240.40, α)	205.5	Adjusted Chi Square Value (240.40, β)	204.4
95% Gamma Approximate KM-UCL (use when n>=50)	0.00182	95% Gamma Adjusted KM-UCL (use when n<50)	0.00183

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.891	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.938	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.126	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.142	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00155	Mean in Log Scale	-6.559
SD in Original Scale	9.0242E-4	SD in Log Scale	0.394
95% t UCL (assumes normality of ROS data)	0.00179	95% Percentile Bootstrap UCL	0.00181
95% BCA Bootstrap UCL	0.00192	95% Bootstrap t UCL	0.002
95% H-UCL (Log ROS)	0.00171		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-6.552	KM Geo Mean	0.00143
KM SD (logged)	0.38	95% Critical H Value (KM-Log)	1.82
KM Standard Error of Mean (logged)	0.0603	95% H-UCL (KM -Log)	0.00171
KM SD (logged)	0.38	95% Critical H Value (KM-Log)	1.82
KM Standard Error of Mean (logged)	0.0603		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00159	Mean in Log Scale	-6.555
SD in Original Scale	9.4275E-4	SD in Log Scale	0.473
95% t UCL (Assumes normality)	0.00184	95% H-Stat UCL	0.00183

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM Student's t	0.00168	KM H-UCL	0.00171

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	42	Number of Distinct Observations	38
Number of Detects	6	Number of Non-Detects	36
Number of Distinct Detects	6	Number of Distinct Non-Detects	32
Minimum Detect	0.0014	Minimum Non-Detect	3.6100E-4
Maximum Detect	0.0069	Maximum Non-Detect	0.00564
Variance Detects	4.0880E-6	Percent Non-Detects	85.71%
Mean Detects	0.003	SD Detects	0.00202
Median Detects	0.00255	CV Detects	0.674
Skewness Detects	1.875	Kurtosis Detects	3.93
Mean of Logged Detects	-5.962	SD of Logged Detects	0.578

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.781	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.314	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	7.9165E-4	KM Standard Error of Mean	2.0903E-4
KM SD	0.00119	95% KM (BCA) UCL	0.00113
95% KM (t) UCL	0.00114	95% KM (Percentile Bootstrap) UCL	0.00113
95% KM (z) UCL	0.00114	95% KM Bootstrap t UCL	0.00114
90% KM Chebyshev UCL	0.00142	95% KM Chebyshev UCL	0.0017
97.5% KM Chebyshev UCL	0.0021	99% KM Chebyshev UCL	0.00287

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.438	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.701	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.238	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.334	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.436	k star (bias corrected MLE)	1.829
Theta hat (MLE)	8.7301E-4	Theta star (bias corrected MLE)	0.00164
nu hat (MLE)	41.24	nu star (bias corrected)	21.95
Mean (detects)	0.003		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0014	Mean	0.009
Maximum	0.01	Median	0.01
SD	0.00258	CV	0.286
k hat (MLE)	5.816	k star (bias corrected MLE)	5.417
Theta hat (MLE)	0.00155	Theta star (bias corrected MLE)	0.00166
nu hat (MLE)	488.6	nu star (bias corrected)	455
Adjusted Level of Significance (β)	0.0443		
Approximate Chi Square Value (455.00, α)	406.5	Adjusted Chi Square Value (455.00, β)	404.9
95% Gamma Approximate UCL (use when n>=50)	0.0101	95% Gamma Adjusted UCL (use when n<50)	0.0101

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	7.9165E-4	SD (KM)	0.00119
Variance (KM)	1.4085E-6	SE of Mean (KM)	2.0903E-4
k hat (KM)	0.445	k star (KM)	0.429
nu hat (KM)	37.38	nu star (KM)	36.04
theta hat (KM)	0.00178	theta star (KM)	0.00185
80% gamma percentile (KM)	0.00129	90% gamma percentile (KM)	0.00221
95% gamma percentile (KM)	0.00321	99% gamma percentile (KM)	0.00571

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (36.04, α)	23.3	Adjusted Chi Square Value (36.04, β)	22.94
95% Gamma Approximate KM-UCL (use when n>=50)	0.00122	95% Gamma Adjusted KM-UCL (use when n<50)	0.00124

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.91	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.208	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	6.9722E-4	Mean in Log Scale	-7.795
SD in Original Scale	0.00119	SD in Log Scale	0.819
95% t UCL (assumes normality of ROS data)	0.00101	95% Percentile Bootstrap UCL	0.00102
95% BCA Bootstrap UCL	0.00114	95% Bootstrap t UCL	0.00128
95% H-UCL (Log ROS)	7.5961E-4		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-7.595	KM Geo Mean	5.0301E-4
KM SD (logged)	0.758	95% Critical H Value (KM-Log)	2.111
KM Standard Error of Mean (logged)	0.139	95% H-UCL (KM -Log)	8.6069E-4
KM SD (logged)	0.758	95% Critical H Value (KM-Log)	2.111
KM Standard Error of Mean (logged)	0.139		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00106	Mean in Log Scale	-7.384
SD in Original Scale	0.00129	SD in Log Scale	1
95% t UCL (Assumes normality)	0.0014	95% H-Stat UCL	0.00148

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

ProUCL Output
Eagle Point Lake
Total Surface Water

Suggested UCL to Use

95% KM (t) UCL 0.00114

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	41	Number of Distinct Observations	37
		Number of Missing Observations	1
Number of Detects	5	Number of Non-Detects	36
Number of Distinct Detects	5	Number of Distinct Non-Detects	32
Minimum Detect	0.0023	Minimum Non-Detect	3.6100E-4
Maximum Detect	0.0029	Maximum Non-Detect	0.00564
Variance Detects	6.7000E-8	Percent Non-Detects	87.8%
Mean Detects	0.00262	SD Detects	2.5884E-4
Median Detects	0.0027	CV Detects	0.0988
Skewness Detects	-0.363	Kurtosis Detects	-2.413
Mean of Logged Detects	-5.949	SD of Logged Detects	0.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.915	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.221	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	7.0327E-4	KM Standard Error of Mean	1.5861E-4
KM SD	8.1496E-4	95% KM (BCA) UCL	9.8679E-4
95% KM (t) UCL	9.7035E-4	95% KM (Percentile Bootstrap) UCL	9.7197E-4
95% KM (z) UCL	9.6417E-4	95% KM Bootstrap t UCL	7.9886E-4
90% KM Chebyshev UCL	0.00118	95% KM Chebyshev UCL	0.00139
97.5% KM Chebyshev UCL	0.00169	99% KM Chebyshev UCL	0.00228

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.357	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.678	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.244	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	125.7	k star (bias corrected MLE)	50.42
Theta hat (MLE)	2.0840E-5	Theta star (bias corrected MLE)	5.1962E-5
nu hat (MLE)	1257	nu star (bias corrected)	504.2
Mean (detects)	0.00262		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0023	Mean	0.0091
Maximum	0.01	Median	0.01
SD	0.00245	CV	0.269
k hat (MLE)	7.355	k star (bias corrected MLE)	6.833
Theta hat (MLE)	0.00124	Theta star (bias corrected MLE)	0.00133
nu hat (MLE)	603.1	nu star (bias corrected)	560.3
Adjusted Level of Significance (β)	0.0441		
Approximate Chi Square Value (560.32, α)	506.4	Adjusted Chi Square Value (560.32, β)	504.6
95% Gamma Approximate UCL (use when n>=50)	0.0101	95% Gamma Adjusted UCL (use when n<50)	0.0101

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	7.0327E-4	SD (KM)	8.1496E-4
Variance (KM)	6.6416E-7	SE of Mean (KM)	1.5861E-4
k hat (KM)	0.745	k star (KM)	0.706
nu hat (KM)	61.06	nu star (KM)	57.93
theta hat (KM)	9.4439E-4	theta star (KM)	9.9550E-4
80% gamma percentile (KM)	0.00116	90% gamma percentile (KM)	0.00176
95% gamma percentile (KM)	0.00239	99% gamma percentile (KM)	0.00388

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (57.93, α)	41.43	Adjusted Chi Square Value (57.93, β)	40.92
95% Gamma Approximate KM-UCL (use when n>=50)	9.8330E-4	95% Gamma Adjusted KM-UCL (use when n<50)	9.9555E-4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.91	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.233	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00174	Mean in Log Scale	-6.37
SD in Original Scale	3.5389E-4	SD in Log Scale	0.171
95% t UCL (assumes normality of ROS data)	0.00183	95% Percentile Bootstrap UCL	0.00184
95% BCA Bootstrap UCL	0.00185	95% Bootstrap t UCL	0.00187
95% H-UCL (Log ROS)	0.00182		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-7.627	KM Geo Mean	4.8716E-4
KM SD (logged)	0.71	95% Critical H Value (KM-Log)	2.064
KM Standard Error of Mean (logged)	0.138	95% H-UCL (KM -Log)	7.9031E-4
KM SD (logged)	0.71	95% Critical H Value (KM-Log)	2.064
KM Standard Error of Mean (logged)	0.138		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	9.7127E-4	Mean in Log Scale	-7.418
SD in Original Scale	9.6997E-4	SD in Log Scale	0.968
95% t UCL (Assumes normality)	0.00123	95% H-Stat UCL	0.00137

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	9.70E-04

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	42	Number of Distinct Observations	35
Number of Detects	41	Number of Non-Detects	1
Number of Distinct Detects	34	Number of Distinct Non-Detects	1
Minimum Detect	0.00187	Minimum Non-Detect	0.00564
Maximum Detect	0.0071	Maximum Non-Detect	0.00564
Variance Detects	9.1755E-7	Percent Non-Detects	2.381%
Mean Detects	0.0045	SD Detects	9.5789E-4
Median Detects	0.00438	CV Detects	0.213
Skewness Detects	-0.046	Kurtosis Detects	1.234
Mean of Logged Detects	-5.428	SD of Logged Detects	0.234

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.983	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.941	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.107	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.137	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0045	KM Standard Error of Mean	1.4845E-4
KM SD	9.4277E-4	95% KM (BCA) UCL	0.00475
95% KM (t) UCL	0.00475	95% KM (Percentile Bootstrap) UCL	0.00473
95% KM (z) UCL	0.00474	95% KM Bootstrap t UCL	0.00475
90% KM Chebyshev UCL	0.00494	95% KM Chebyshev UCL	0.00514
97.5% KM Chebyshev UCL	0.00542	99% KM Chebyshev UCL	0.00597

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.56	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.747	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.126	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.138	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	20.43	k star (bias corrected MLE)	18.95
Theta hat (MLE)	2.2038E-4	Theta star (bias corrected MLE)	2.3757E-4
nu hat (MLE)	1675	nu star (bias corrected)	1554
Mean (detects)	0.0045		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.00187	Mean	0.00463
Maximum	0.01	Median	0.00444
SD	0.00127	CV	0.274
k hat (MLE)	14.98	k star (bias corrected MLE)	13.92
Theta hat (MLE)	3.0930E-4	Theta star (bias corrected MLE)	3.3271E-4
nu hat (MLE)	1258	nu star (bias corrected)	1169
Adjusted Level of Significance (β)	0.0443		
Approximate Chi Square Value (N/A, α)	1091	Adjusted Chi Square Value (N/A, β)	1088
95% Gamma Approximate UCL (use when n>=50)	0.00496	95% Gamma Adjusted UCL (use when n<50)	0.00498

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0045	SD (KM)	9.4277E-4
Variance (KM)	8.8882E-7	SE of Mean (KM)	1.4845E-4
k hat (KM)	22.74	k star (KM)	21.13
nu hat (KM)	1910	nu star (KM)	1775
theta hat (KM)	1.9769E-4	theta star (KM)	2.1274E-4
80% gamma percentile (KM)	0.00529	90% gamma percentile (KM)	0.00579
95% gamma percentile (KM)	0.00622	99% gamma percentile (KM)	0.00708

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (N/A, α)	1678	Adjusted Chi Square Value (N/A, β)	1675
95% Gamma Approximate KM-UCL (use when n>=50)	0.00476	95% Gamma Adjusted KM-UCL (use when n<50)	0.00476

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.929	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.941	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.143	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.137	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00449	Mean in Log Scale	-5.429
SD in Original Scale	9.4706E-4	SD in Log Scale	0.231
95% t UCL (assumes normality of ROS data)	0.00474	95% Percentile Bootstrap UCL	0.00473
95% BCA Bootstrap UCL	0.00475	95% Bootstrap t UCL	0.00475
95% H-UCL (Log ROS)	0.0048		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.429	KM Geo Mean	0.00439
KM SD (logged)	0.231	95% Critical H Value (KM-Log)	1.732
KM Standard Error of Mean (logged)	0.0364	95% H-UCL (KM -Log)	0.0048
KM SD (logged)	0.231	95% Critical H Value (KM-Log)	1.732
KM Standard Error of Mean (logged)	0.0364		

ProUCL Output
Eagle Point Lake
Total Surface Water

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.00446	Mean in Log Scale	-5.439
SD in Original Scale	9.8105E-4	SD in Log Scale	0.241
95% t UCL (Assumes normality)	0.00472	95% H-Stat UCL	0.00478

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.00475

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFHxS|ug/L

General Statistics

Total Number of Observations	42	Number of Distinct Observations	38
		Number of Missing Observations	0
Minimum	0.00212	Mean	0.00922
Maximum	0.014	Median	0.00875
SD	0.00266	Std. Error of Mean	4.1015E-4
Coefficient of Variation	0.288	Skewness	-0.294

Normal GOF Test

Shapiro Wilk Test Statistic	0.928	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.942	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.0863	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.135	Data appear Normal at 5% Significance Level	

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.00991	95% Adjusted-CLT UCL (Chen-1995)	0.00987
		95% Modified-t UCL (Johnson-1978)	0.0099

Gamma GOF Test

A-D Test Statistic	0.651	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.748	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.108	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.136	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	9.847	k star (bias corrected MLE)	9.159
Theta hat (MLE)	9.3614E-4	Theta star (bias corrected MLE)	0.00101
nu hat (MLE)	827.1	nu star (bias corrected)	769.4
MLE Mean (bias corrected)	0.00922	MLE Sd (bias corrected)	0.00305
		Approximate Chi Square Value (0.05)	706
Adjusted Level of Significance	0.0443	Adjusted Chi Square Value	703.9

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.01	95% Adjusted Gamma UCL (use when n<50)	0.0101

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.841	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.942	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.136	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.135	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-6.156	Mean of logged Data	-4.738
Maximum of Logged Data	-4.269	SD of logged Data	0.354

Assuming Lognormal Distribution

95% H-UCL	0.0103	90% Chebyshev (MVUE) UCL	0.0109
95% Chebyshev (MVUE) UCL	0.0116	97.5% Chebyshev (MVUE) UCL	0.0126
99% Chebyshev (MVUE) UCL	0.0145		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00989	95% Jackknife UCL	0.00991
95% Standard Bootstrap UCL	0.00988	95% Bootstrap-t UCL	0.00988
95% Hall's Bootstrap UCL	0.00987	95% Percentile Bootstrap UCL	0.00989
95% BCA Bootstrap UCL	0.00987		
90% Chebyshev(Mean, Sd) UCL	0.0104	95% Chebyshev(Mean, Sd) UCL	0.011
97.5% Chebyshev(Mean, Sd) UCL	0.0118	99% Chebyshev(Mean, Sd) UCL	0.0133

Suggested UCL to Use

95% Student's-t UCL 0.00991

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFOS|ug/L

General Statistics

Total Number of Observations	42	Number of Distinct Observations	39
		Number of Missing Observations	0
Minimum	0.0138	Mean	0.246
Maximum	0.68	Median	0.239
SD	0.109	Std. Error of Mean	0.0169
Coefficient of Variation	0.446	Skewness	1.435

Normal GOF Test

Shapiro Wilk Test Statistic	0.876	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.942	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.187	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.135	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.274	95% Adjusted-CLT UCL (Chen-1995)	0.277
		95% Modified-t UCL (Johnson-1978)	0.275

Gamma GOF Test

A-D Test Statistic	1.487	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.753	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.178	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.137	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.259	k star (bias corrected MLE)	3.971
Theta hat (MLE)	0.0577	Theta star (bias corrected MLE)	0.0619
nu hat (MLE)	357.8	nu star (bias corrected)	333.6
MLE Mean (bias corrected)	0.246	MLE Sd (bias corrected)	0.123
		Approximate Chi Square Value (0.05)	292.3
Adjusted Level of Significance	0.0443	Adjusted Chi Square Value	290.9

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.28	95% Adjusted Gamma UCL (use when n<50)	0.282

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.77	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.942	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.219	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.135	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.283	Mean of logged Data	-1.526
Maximum of Logged Data	-0.386	SD of logged Data	0.593

Assuming Lognormal Distribution

95% H-UCL	0.311	90% Chebyshev (MVUE) UCL	0.334
95% Chebyshev (MVUE) UCL	0.368	97.5% Chebyshev (MVUE) UCL	0.415
99% Chebyshev (MVUE) UCL	0.508		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	0.273	95% Jackknife UCL	0.274
95% Standard Bootstrap UCL	0.273	95% Bootstrap-t UCL	0.278
95% Hall's Bootstrap UCL	0.285	95% Percentile Bootstrap UCL	0.274
95% BCA Bootstrap UCL	0.276		
90% Chebyshev(Mean, Sd) UCL	0.296	95% Chebyshev(Mean, Sd) UCL	0.319
97.5% Chebyshev(Mean, Sd) UCL	0.351	99% Chebyshev(Mean, Sd) UCL	0.414

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL 0.319

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOSA|ug/L

General Statistics

Total Number of Observations	42	Number of Distinct Observations	33
Number of Detects	30	Number of Non-Detects	12
Number of Distinct Detects	24	Number of Distinct Non-Detects	10
Minimum Detect	7.2000E-4	Minimum Non-Detect	7.1000E-4
Maximum Detect	0.00468	Maximum Non-Detect	0.00564
Variance Detects	6.8512E-7	Percent Non-Detects	28.57%
Mean Detects	0.00149	SD Detects	8.2772E-4
Median Detects	0.00117	CV Detects	0.554
Skewness Detects	2.341	Kurtosis Detects	6.746
Mean of Logged Detects	-6.612	SD of Logged Detects	0.434

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.742	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.927	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.268	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.159	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00128	KM Standard Error of Mean	1.2347E-4
KM SD	7.7728E-4	95% KM (BCA) UCL	0.00151
95% KM (t) UCL	0.00149	95% KM (Percentile Bootstrap) UCL	0.0015
95% KM (z) UCL	0.00149	95% KM Bootstrap t UCL	0.00158
90% KM Chebyshev UCL	0.00165	95% KM Chebyshev UCL	0.00182
97.5% KM Chebyshev UCL	0.00205	99% KM Chebyshev UCL	0.00251

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.55	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.747	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.217	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.16	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.926	k star (bias corrected MLE)	4.455
Theta hat (MLE)	3.0308E-4	Theta star (bias corrected MLE)	3.3507E-4
nu hat (MLE)	295.5	nu star (bias corrected)	267.3
Mean (detects)	0.00149		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	7.2000E-4	Mean	0.00392
Maximum	0.01	Median	0.00141
SD	0.00395	CV	1.007
k hat (MLE)	1.142	k star (bias corrected MLE)	1.076
Theta hat (MLE)	0.00344	Theta star (bias corrected MLE)	0.00364
nu hat (MLE)	95.94	nu star (bias corrected)	90.42
Adjusted Level of Significance (β)	0.0443		
Approximate Chi Square Value (90.42, α)	69.5	Adjusted Chi Square Value (90.42, β)	68.84
95% Gamma Approximate UCL (use when n>=50)	0.0051	95% Gamma Adjusted UCL (use when n<50)	0.00515

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00128	SD (KM)	7.7728E-4
Variance (KM)	6.0416E-7	SE of Mean (KM)	1.2347E-4
k hat (KM)	2.727	k star (KM)	2.548
nu hat (KM)	229	nu star (KM)	214
theta hat (KM)	4.7073E-4	theta star (KM)	5.0378E-4
80% gamma percentile (KM)	0.00187	90% gamma percentile (KM)	0.00236
95% gamma percentile (KM)	0.00283	99% gamma percentile (KM)	0.00384

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (214.00, α)	181.1	Adjusted Chi Square Value (214.00, β)	180.1
95% Gamma Approximate KM-UCL (use when n>=50)	0.00152	95% Gamma Adjusted KM-UCL (use when n<50)	0.00153

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.907	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.927	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.183	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.159	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00123	Mean in Log Scale	-6.866
SD in Original Scale	8.1859E-4	SD in Log Scale	0.559
95% t UCL (assumes normality of ROS data)	0.00144	95% Percentile Bootstrap UCL	0.00145
95% BCA Bootstrap UCL	0.00149	95% Bootstrap t UCL	0.00151
95% H-UCL (Log ROS)	0.00144		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-6.782	KM Geo Mean	0.00113
KM SD (logged)	0.461	95% Critical H Value (KM-Log)	1.871
KM Standard Error of Mean (logged)	0.0733	95% H-UCL (KM -Log)	0.00144
KM SD (logged)	0.461	95% Critical H Value (KM-Log)	1.871
KM Standard Error of Mean (logged)	0.0733		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00123	Mean in Log Scale	-6.931
SD in Original Scale	8.9134E-4	SD in Log Scale	0.697
95% t UCL (Assumes normality)	0.00146	95% H-Stat UCL	0.00156

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.00149	KM H-UCL	0.00144
95% KM (BCA) UCL	0.00151		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Eagle Point Lake
Total Surface Water

N-EtFOSAA|ug/L

General Statistics

Total Number of Observations	41	Number of Distinct Observations	35
		Number of Missing Observations	1
Number of Detects	22	Number of Non-Detects	19
Number of Distinct Detects	18	Number of Distinct Non-Detects	17
Minimum Detect	7.9000E-4	Minimum Non-Detect	7.1000E-4
Maximum Detect	0.006	Maximum Non-Detect	0.0113
Variance Detects	1.3591E-6	Percent Non-Detects	46.34%
Mean Detects	0.0019	SD Detects	0.00117
Median Detects	0.00168	CV Detects	0.612
Skewness Detects	2.3	Kurtosis Detects	6.724
Mean of Logged Detects	-6.395	SD of Logged Detects	0.498

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.774	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.911	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.229	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.184	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0014	KM Standard Error of Mean	1.6974E-4
KM SD	0.00104	95% KM (BCA) UCL	0.00168
95% KM (t) UCL	0.00168	95% KM (Percentile Bootstrap) UCL	0.00168
95% KM (z) UCL	0.00167	95% KM Bootstrap t UCL	0.00179
90% KM Chebyshev UCL	0.0019	95% KM Chebyshev UCL	0.00214
97.5% KM Chebyshev UCL	0.00246	99% KM Chebyshev UCL	0.00308

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.503	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.747	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.162	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.186	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.967	k star (bias corrected MLE)	3.456
Theta hat (MLE)	4.8003E-4	Theta star (bias corrected MLE)	5.5095E-4
nu hat (MLE)	174.5	nu star (bias corrected)	152.1
Mean (detects)	0.0019		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	7.9000E-4	Mean	0.00566
Maximum	0.01	Median	0.00362
SD	0.00417	CV	0.738
k hat (MLE)	1.424	k star (bias corrected MLE)	1.336
Theta hat (MLE)	0.00397	Theta star (bias corrected MLE)	0.00423
nu hat (MLE)	116.8	nu star (bias corrected)	109.6
Adjusted Level of Significance (β)	0.0441		
Approximate Chi Square Value (109.56, α)	86.4	Adjusted Chi Square Value (109.56, β)	85.65
95% Gamma Approximate UCL (use when n>=50)	0.00717	95% Gamma Adjusted UCL (use when n<50)	0.00723

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0014	SD (KM)	0.00104
Variance (KM)	1.0716E-6	SE of Mean (KM)	1.6974E-4
k hat (KM)	1.816	k star (KM)	1.7
nu hat (KM)	149	nu star (KM)	139.4
theta hat (KM)	7.6805E-4	theta star (KM)	8.2076E-4
80% gamma percentile (KM)	0.00213	90% gamma percentile (KM)	0.00282
95% gamma percentile (KM)	0.00349	99% gamma percentile (KM)	0.00498

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (139.39, α)	113.1	Adjusted Chi Square Value (139.39, β)	112.2
95% Gamma Approximate KM-UCL (use when n>=50)	0.00172	95% Gamma Adjusted KM-UCL (use when n<50)	0.00173

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.961	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.911	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.125	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.184	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00129	Mean in Log Scale	-6.9
SD in Original Scale	0.00108	SD in Log Scale	0.68
95% t UCL (assumes normality of ROS data)	0.00158	95% Percentile Bootstrap UCL	0.00159
95% BCA Bootstrap UCL	0.00166	95% Bootstrap t UCL	0.00169
95% H-UCL (Log ROS)	0.00158		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-6.757	KM Geo Mean	0.00116
KM SD (logged)	0.559	95% Critical H Value (KM-Log)	1.939
KM Standard Error of Mean (logged)	0.0923	95% H-UCL (KM -Log)	0.00161
KM SD (logged)	0.559	95% Critical H Value (KM-Log)	1.939
KM Standard Error of Mean (logged)	0.0923		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0014	Mean in Log Scale	-6.94
SD in Original Scale	0.00132	SD in Log Scale	0.873
95% t UCL (Assumes normality)	0.00175	95% H-Stat UCL	0.00192

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	0.00173	95% GROS Adjusted Gamma UCL	0.00723

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFHpS|ug/L

General Statistics

Total Number of Observations	42	Number of Distinct Observations	38
Number of Detects	39	Number of Non-Detects	3
Number of Distinct Detects	35	Number of Distinct Non-Detects	3
Minimum Detect	9.5200E-4	Minimum Non-Detect	7.6300E-4
Maximum Detect	0.0058	Maximum Non-Detect	0.00564
Variance Detects	1.2302E-6	Percent Non-Detects	7.143%
Mean Detects	0.00263	SD Detects	0.00111
Median Detects	0.00249	CV Detects	0.422
Skewness Detects	0.664	Kurtosis Detects	0.339
Mean of Logged Detects	-6.031	SD of Logged Detects	0.443

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.957	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.939	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.0907	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.14	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00254	KM Standard Error of Mean	1.7977E-4
KM SD	0.00114	95% KM (BCA) UCL	0.00282
95% KM (t) UCL	0.00284	95% KM (Percentile Bootstrap) UCL	0.00284
95% KM (z) UCL	0.00283	95% KM Bootstrap t UCL	0.00285
90% KM Chebyshev UCL	0.00308	95% KM Chebyshev UCL	0.00332
97.5% KM Chebyshev UCL	0.00366	99% KM Chebyshev UCL	0.00433

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.216	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.751	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.071	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.142	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	5.68	k star (bias corrected MLE)	5.26
Theta hat (MLE)	4.6328E-4	Theta star (bias corrected MLE)	5.0026E-4
nu hat (MLE)	443	nu star (bias corrected)	410.3
Mean (detects)	0.00263		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	9.5200E-4	Mean	0.00316
Maximum	0.01	Median	0.00263
SD	0.0022	CV	0.696
k hat (MLE)	3.079	k star (bias corrected MLE)	2.875
Theta hat (MLE)	0.00103	Theta star (bias corrected MLE)	0.0011
nu hat (MLE)	258.6	nu star (bias corrected)	241.5
Adjusted Level of Significance (β)	0.0443		
Approximate Chi Square Value (241.47, α)	206.5	Adjusted Chi Square Value (241.47, β)	205.3
95% Gamma Approximate UCL (use when n>=50)	0.00369	95% Gamma Adjusted UCL (use when n<50)	0.00371

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00254	SD (KM)	0.00114
Variance (KM)	1.2966E-6	SE of Mean (KM)	1.7977E-4
k hat (KM)	4.969	k star (KM)	4.63
nu hat (KM)	417.4	nu star (KM)	388.9
theta hat (KM)	5.1081E-4	theta star (KM)	5.4821E-4
80% gamma percentile (KM)	0.00344	90% gamma percentile (KM)	0.00412
95% gamma percentile (KM)	0.00474	99% gamma percentile (KM)	0.00605

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (388.92, α)	344.2	Adjusted Chi Square Value (388.92, β)	342.7
95% Gamma Approximate KM-UCL (use when n>=50)	0.00287	95% Gamma Adjusted KM-UCL (use when n<50)	0.00288

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.969	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.939	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0941	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.14	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00254	Mean in Log Scale	-6.082
SD in Original Scale	0.00114	SD in Log Scale	0.481
95% t UCL (assumes normality of ROS data)	0.00283	95% Percentile Bootstrap UCL	0.00284
95% BCA Bootstrap UCL	0.00286	95% Bootstrap t UCL	0.00284
95% H-UCL (Log ROS)	0.00295		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-6.087	KM Geo Mean	0.00227
KM SD (logged)	0.492	95% Critical H Value (KM-Log)	1.893
KM Standard Error of Mean (logged)	0.0778	95% H-UCL (KM -Log)	0.00297
KM SD (logged)	0.492	95% Critical H Value (KM-Log)	1.893
KM Standard Error of Mean (logged)	0.0778		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00253	Mean in Log Scale	-6.114
SD in Original Scale	0.00117	SD in Log Scale	0.582
95% t UCL (Assumes normality)	0.00283	95% H-Stat UCL	0.00313

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.00284

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFPeS|ug/L

General Statistics

Total Number of Observations	41	Number of Distinct Observations	36
		Number of Missing Observations	1
Number of Detects	38	Number of Non-Detects	3
Number of Distinct Detects	33	Number of Distinct Non-Detects	3
Minimum Detect	9.7800E-4	Minimum Non-Detect	7.6300E-4
Maximum Detect	0.0068	Maximum Non-Detect	0.00564
Variance Detects	1.7410E-6	Percent Non-Detects	7.317%
Mean Detects	0.00335	SD Detects	0.00132
Median Detects	0.00339	CV Detects	0.394
Skewness Detects	0.261	Kurtosis Detects	-0.416
Mean of Logged Detects	-5.786	SD of Logged Detects	0.436

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.954	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.938	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.135	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.142	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00321	KM Standard Error of Mean	2.2166E-4
KM SD	0.00139	95% KM (BCA) UCL	0.00356
95% KM (t) UCL	0.00359	95% KM (Percentile Bootstrap) UCL	0.00358
95% KM (z) UCL	0.00358	95% KM Bootstrap t UCL	0.0036
90% KM Chebyshev UCL	0.00388	95% KM Chebyshev UCL	0.00418
97.5% KM Chebyshev UCL	0.0046	99% KM Chebyshev UCL	0.00542

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.72	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.75	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.131	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.143	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	6.019	k star (bias corrected MLE)	5.561
Theta hat (MLE)	5.5584E-4	Theta star (bias corrected MLE)	6.0158E-4
nu hat (MLE)	457.4	nu star (bias corrected)	422.6
Mean (detects)	0.00335		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	9.7800E-4	Mean	0.00383
Maximum	0.01	Median	0.0034
SD	0.00217	CV	0.565
k hat (MLE)	3.866	k star (bias corrected MLE)	3.599
Theta hat (MLE)	9.9137E-4	Theta star (bias corrected MLE)	0.00106
nu hat (MLE)	317	nu star (bias corrected)	295.1
Adjusted Level of Significance (β)	0.0441		
Approximate Chi Square Value (295.13, α)	256.3	Adjusted Chi Square Value (295.13, β)	255
95% Gamma Approximate UCL (use when n>=50)	0.00441	95% Gamma Adjusted UCL (use when n<50)	0.00444

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00321	SD (KM)	0.00139
Variance (KM)	1.9204E-6	SE of Mean (KM)	2.2166E-4
k hat (KM)	5.379	k star (KM)	5.002
nu hat (KM)	441.1	nu star (KM)	410.2
theta hat (KM)	5.9749E-4	theta star (KM)	6.4257E-4
80% gamma percentile (KM)	0.00432	90% gamma percentile (KM)	0.00514
95% gamma percentile (KM)	0.00588	99% gamma percentile (KM)	0.00746

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (410.16, α)	364.2	Adjusted Chi Square Value (410.16, β)	362.6
95% Gamma Approximate KM-UCL (use when n>=50)	0.00362	95% Gamma Adjusted KM-UCL (use when n<50)	0.00364

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.945	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.938	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.147	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.142	Detected Data Not Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00323	Mean in Log Scale	-5.836
SD in Original Scale	0.00136	SD in Log Scale	0.472
95% t UCL (assumes normality of ROS data)	0.00358	95% Percentile Bootstrap UCL	0.00356
95% BCA Bootstrap UCL	0.00356	95% Bootstrap t UCL	0.00358
95% H-UCL (Log ROS)	0.00376		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.856	KM Geo Mean	0.00286
KM SD (logged)	0.518	95% Critical H Value (KM-Log)	1.909
KM Standard Error of Mean (logged)	0.0829	95% H-UCL (KM -Log)	0.00383
KM SD (logged)	0.518	95% Critical H Value (KM-Log)	1.909
KM Standard Error of Mean (logged)	0.0829		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00319	Mean in Log Scale	-5.889
SD in Original Scale	0.00142	SD in Log Scale	0.617
95% t UCL (Assumes normality)	0.00356	95% H-Stat UCL	0.00407

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.00359

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

6:2 FTS|ug/L

General Statistics

Total Number of Observations	42	Number of Distinct Observations	32
Number of Detects	13	Number of Non-Detects	29
Number of Distinct Detects	13	Number of Distinct Non-Detects	21
Minimum Detect	6.3000E-4	Minimum Non-Detect	0.0013
Maximum Detect	0.0609	Maximum Non-Detect	0.0406
Variance Detects	2.5163E-4	Percent Non-Detects	69.05%
Mean Detects	0.00868	SD Detects	0.0159
Median Detects	0.0042	CV Detects	1.828
Skewness Detects	3.471	Kurtosis Detects	12.29
Mean of Logged Detects	-5.413	SD of Logged Detects	1.041

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.447	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.424	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.234	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00357	KM Standard Error of Mean	0.00149
KM SD	0.00917	95% KM (BCA) UCL	0.00675
95% KM (t) UCL	0.00609	95% KM (Percentile Bootstrap) UCL	0.00644
95% KM (z) UCL	0.00603	95% KM Bootstrap t UCL	0.0116
90% KM Chebyshev UCL	0.00805	95% KM Chebyshev UCL	0.0101
97.5% KM Chebyshev UCL	0.0129	99% KM Chebyshev UCL	0.0184

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.329	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.764	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.284	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.244	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.881	k star (bias corrected MLE)	0.729
Theta hat (MLE)	0.00985	Theta star (bias corrected MLE)	0.0119
nu hat (MLE)	22.9	nu star (bias corrected)	18.95
Mean (detects)	0.00868		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	6.3000E-4	Mean	0.00959
Maximum	0.0609	Median	0.01
SD	0.0086	CV	0.897
k hat (MLE)	2.557	k star (bias corrected MLE)	2.39
Theta hat (MLE)	0.00375	Theta star (bias corrected MLE)	0.00401
nu hat (MLE)	214.8	nu star (bias corrected)	200.7
Adjusted Level of Significance (β)	0.0443		
Approximate Chi Square Value (200.75, α)	169	Adjusted Chi Square Value (200.75, β)	167.9
95% Gamma Approximate UCL (use when n>=50)	0.0114	95% Gamma Adjusted UCL (use when n<50)	0.0115

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00357	SD (KM)	0.00917
Variance (KM)	8.4118E-5	SE of Mean (KM)	0.00149
k hat (KM)	0.152	k star (KM)	0.157
nu hat (KM)	12.75	nu star (KM)	13.17
theta hat (KM)	0.0235	theta star (KM)	0.0228
80% gamma percentile (KM)	0.00403	90% gamma percentile (KM)	0.0107
95% gamma percentile (KM)	0.0195	99% gamma percentile (KM)	0.0449

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (13.17, α)	6.009	Adjusted Chi Square Value (13.17, β)	5.836
95% Gamma Approximate KM-UCL (use when n>=50)	0.00783	95% Gamma Adjusted KM-UCL (use when n<50)	0.00806

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.905	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.186	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00332	Mean in Log Scale	-6.551
SD in Original Scale	0.00932	SD in Log Scale	1.009
95% t UCL (assumes normality of ROS data)	0.00574	95% Percentile Bootstrap UCL	0.00619
95% BCA Bootstrap UCL	0.00784	95% Bootstrap t UCL	0.0135
95% H-UCL (Log ROS)	0.00345		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-6.417	KM Geo Mean	0.00163
KM SD (logged)	1.018	95% Critical H Value (KM-Log)	2.377
KM Standard Error of Mean (logged)	0.252	95% H-UCL (KM -Log)	0.004
KM SD (logged)	1.018	95% Critical H Value (KM-Log)	2.377
KM Standard Error of Mean (logged)	0.252		

ProUCL Output
Eagle Point Lake
Total Surface Water

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.00413	Mean in Log Scale	-6.153
SD in Original Scale	0.00957	SD in Log Scale	0.889
95% t UCL (Assumes normality)	0.00662	95% H-Stat UCL	0.00431

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL 0.004

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Lake Elmo
Total Surface Water

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/26/2021 10:48:18 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

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General Statistics

Total Number of Observations	31	Number of Distinct Observations	30
		Number of Missing Observations	4
Minimum	0.0908	Mean	0.527
Maximum	1.02	Median	0.619
SD	0.321	Std. Error of Mean	0.0576
Coefficient of Variation	0.608	Skewness	-0.235

Normal GOF Test

Shapiro Wilk Test Statistic	0.855	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.929	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.205	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.156	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.625	95% Adjusted-CLT UCL (Chen-1995)	0.62
		95% Modified-t UCL (Johnson-1978)	0.625

Gamma GOF Test

A-D Test Statistic	2.507	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.76	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.212	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.16	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.855	k star (bias corrected MLE)	1.697
Theta hat (MLE)	0.284	Theta star (bias corrected MLE)	0.311
nu hat (MLE)	115	nu star (bias corrected)	105.2
MLE Mean (bias corrected)	0.527	MLE Sd (bias corrected)	0.405
		Approximate Chi Square Value (0.05)	82.53
Adjusted Level of Significance	0.0413	Adjusted Chi Square Value	81.41

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.672	95% Adjusted Gamma UCL (use when n<50)	0.681

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.787	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.929	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.226	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.156	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.399	Mean of logged Data	-0.933
Maximum of Logged Data	0.0198	SD of logged Data	0.878

Assuming Lognormal Distribution

95% H-UCL	0.834	90% Chebyshev (MVUE) UCL	0.871
95% Chebyshev (MVUE) UCL	1.007	97.5% Chebyshev (MVUE) UCL	1.197
99% Chebyshev (MVUE) UCL	1.57		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

ProUCL Output
Lake Elmo
Total Surface Water

Nonparametric Distribution Free UCLs

95% CLT UCL	0.622	95% Jackknife UCL	0.625
95% Standard Bootstrap UCL	0.619	95% Bootstrap-t UCL	0.622
95% Hall's Bootstrap UCL	0.619	95% Percentile Bootstrap UCL	0.615
95% BCA Bootstrap UCL	0.611		
90% Chebyshev(Mean, Sd) UCL	0.7	95% Chebyshev(Mean, Sd) UCL	0.779
97.5% Chebyshev(Mean, Sd) UCL	0.887	99% Chebyshev(Mean, Sd) UCL	1.101

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL 0.779

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFPeA|ug/L

General Statistics

Total Number of Observations	34	Number of Distinct Observations	29
		Number of Missing Observations	1
Minimum	0.00637	Mean	0.013
Maximum	0.019	Median	0.0131
SD	0.00391	Std. Error of Mean	6.6994E-4
Coefficient of Variation	0.301	Skewness	-0.07

Normal GOF Test

Shapiro Wilk Test Statistic	0.931	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.933	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.13	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.15	Data appear Normal at 5% Significance Level	

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0141	95% Adjusted-CLT UCL (Chen-1995)	0.0141
		95% Modified-t UCL (Johnson-1978)	0.0141

Gamma GOF Test

A-D Test Statistic	0.794	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.748	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.136	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.151	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	10.5	k star (bias corrected MLE)	9.597
Theta hat (MLE)	0.00124	Theta star (bias corrected MLE)	0.00135
nu hat (MLE)	714.3	nu star (bias corrected)	652.6
MLE Mean (bias corrected)	0.013	MLE Sd (bias corrected)	0.00419
		Approximate Chi Square Value (0.05)	594.3
Adjusted Level of Significance	0.0422	Adjusted Chi Square Value	591.6

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0143	95% Adjusted Gamma UCL (use when n<50)	0.0143

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.921	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.933	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.143	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.15	Data appear Lognormal at 5% Significance Level	

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.056	Mean of logged Data	-4.392
Maximum of Logged Data	-3.963	SD of logged Data	0.324

ProUCL Output
Lake Elmo
Total Surface Water

Assuming Lognormal Distribution

95% H-UCL	0.0145	90% Chebyshev (MVUE) UCL	0.0152
95% Chebyshev (MVUE) UCL	0.0162	97.5% Chebyshev (MVUE) UCL	0.0176
99% Chebyshev (MVUE) UCL	0.0204		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0141	95% Jackknife UCL	0.0141
95% Standard Bootstrap UCL	0.0141	95% Bootstrap-t UCL	0.0141
95% Hall's Bootstrap UCL	0.014	95% Percentile Bootstrap UCL	0.0141
95% BCA Bootstrap UCL	0.014		
90% Chebyshev(Mean, Sd) UCL	0.015	95% Chebyshev(Mean, Sd) UCL	0.0159
97.5% Chebyshev(Mean, Sd) UCL	0.0172	99% Chebyshev(Mean, Sd) UCL	0.0197

Suggested UCL to Use

95% Student's-t UCL 0.0141

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFHxA|ug/L

General Statistics

Total Number of Observations	34	Number of Distinct Observations	31
		Number of Missing Observations	1
Minimum	0.00766	Mean	0.0142
Maximum	0.022	Median	0.0142
SD	0.00388	Std. Error of Mean	6.6482E-4
Coefficient of Variation	0.273	Skewness	0.409

Normal GOF Test

Shapiro Wilk Test Statistic	0.942	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.933	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.107	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.15	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0153	95% Adjusted-CLT UCL (Chen-1995)	0.0153
		95% Modified-t UCL (Johnson-1978)	0.0153

Gamma GOF Test

A-D Test Statistic	0.493	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.747	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.107	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.151	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	13.75	k star (bias corrected MLE)	12.56
Theta hat (MLE)	0.00103	Theta star (bias corrected MLE)	0.00113
nu hat (MLE)	935.2	nu star (bias corrected)	854
MLE Mean (bias corrected)	0.0142	MLE Sd (bias corrected)	0.004
		Approximate Chi Square Value (0.05)	787.2
Adjusted Level of Significance	0.0422	Adjusted Chi Square Value	784

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0154	95% Adjusted Gamma UCL (use when n<50)	0.0154

ProUCL Output
Lake Elmo
Total Surface Water

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.955	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.933	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.115	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.15	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.872	Mean of logged Data	-4.292
Maximum of Logged Data	-3.817	SD of logged Data	0.278

Assuming Lognormal Distribution

95% H-UCL	0.0155	90% Chebyshev (MVUE) UCL	0.0162
95% Chebyshev (MVUE) UCL	0.0172	97.5% Chebyshev (MVUE) UCL	0.0185
99% Chebyshev (MVUE) UCL	0.021		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0153	95% Jackknife UCL	0.0153
95% Standard Bootstrap UCL	0.0153	95% Bootstrap-t UCL	0.0154
95% Hall's Bootstrap UCL	0.0154	95% Percentile Bootstrap UCL	0.0152
95% BCA Bootstrap UCL	0.0153		
90% Chebyshev(Mean, Sd) UCL	0.0162	95% Chebyshev(Mean, Sd) UCL	0.0171
97.5% Chebyshev(Mean, Sd) UCL	0.0183	99% Chebyshev(Mean, Sd) UCL	0.0208

Suggested UCL to Use

95% Student's-t UCL 0.0153

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFHpA|ug/L

General Statistics

Total Number of Observations	34	Number of Distinct Observations	34
		Number of Missing Observations	1
Minimum	0.00461	Mean	0.00715
Maximum	0.014	Median	0.00603
SD	0.00235	Std. Error of Mean	4.0381E-4
Coefficient of Variation	0.329	Skewness	1.341

Normal GOF Test

Shapiro Wilk Test Statistic	0.844	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.933	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.234	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.15	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00784	95% Adjusted-CLT UCL (Chen-1995)	0.00792
		95% Modified-t UCL (Johnson-1978)	0.00785

Gamma GOF Test

A-D Test Statistic	1.436	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.748	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.225	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.151	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	11.28	k star (bias corrected MLE)	10.3
Theta hat (MLE)	6.3420E-4	Theta star (bias corrected MLE)	6.9425E-4
nu hat (MLE)	766.9	nu star (bias corrected)	700.5
MLE Mean (bias corrected)	0.00715	MLE Sd (bias corrected)	0.00223
		Approximate Chi Square Value (0.05)	640.1
Adjusted Level of Significance	0.0422	Adjusted Chi Square Value	637.3

ProUCL Output
Lake Elmo
Total Surface Water

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.00783	95% Adjusted Gamma UCL (use when n<50)	0.00786

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.905	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.933	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.214	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.15	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.38	Mean of logged Data	-4.985
Maximum of Logged Data	-4.269	SD of logged Data	0.294

Assuming Lognormal Distribution

95% H-UCL	0.00783	90% Chebyshev (MVUE) UCL	0.00823
95% Chebyshev (MVUE) UCL	0.00872	97.5% Chebyshev (MVUE) UCL	0.00941
99% Chebyshev (MVUE) UCL	0.0108		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00782	95% Jackknife UCL	0.00784
95% Standard Bootstrap UCL	0.00781	95% Bootstrap-t UCL	0.008
95% Hall's Bootstrap UCL	0.00791	95% Percentile Bootstrap UCL	0.00781
95% BCA Bootstrap UCL	0.00788		
90% Chebyshev(Mean, Sd) UCL	0.00836	95% Chebyshev(Mean, Sd) UCL	0.00891
97.5% Chebyshev(Mean, Sd) UCL	0.00967	99% Chebyshev(Mean, Sd) UCL	0.0112

Suggested UCL to Use

95% Student's-t UCL	0.00784	or 95% Modified-t UCL	0.00785

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOA|ug/L

General Statistics

Total Number of Observations	34	Number of Distinct Observations	29
		Number of Missing Observations	1
Minimum	0.0513	Mean	0.0708
Maximum	0.105	Median	0.0658
SD	0.0124	Std. Error of Mean	0.00213
Coefficient of Variation	0.176	Skewness	1.26

Normal GOF Test

Shapiro Wilk Test Statistic	0.853	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.933	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.246	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.15	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0744	95% Adjusted-CLT UCL (Chen-1995)	0.0748
		95% Modified-t UCL (Johnson-1978)	0.0745

Gamma GOF Test

A-D Test Statistic	1.815	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.745	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.23	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.151	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

ProUCL Output
Lake Elmo
Total Surface Water

Gamma Statistics

k hat (MLE)	37	k star (bias corrected MLE)	33.76
Theta hat (MLE)	0.00191	Theta star (bias corrected MLE)	0.0021
nu hat (MLE)	2516	nu star (bias corrected)	2295
MLE Mean (bias corrected)	0.0708	MLE Sd (bias corrected)	0.0122
		Approximate Chi Square Value (0.05)	2185
Adjusted Level of Significance	0.0422	Adjusted Chi Square Value	2180

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0744	95% Adjusted Gamma UCL (use when n<50)	0.0745

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.894	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.933	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.22	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.15	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.97	Mean of logged Data	-2.662
Maximum of Logged Data	-2.254	SD of logged Data	0.163

Assuming Lognormal Distribution

95% H-UCL	0.0743	90% Chebyshev (MVUE) UCL	0.0767
95% Chebyshev (MVUE) UCL	0.0794	97.5% Chebyshev (MVUE) UCL	0.0832
99% Chebyshev (MVUE) UCL	0.0906		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0743	95% Jackknife UCL	0.0744
95% Standard Bootstrap UCL	0.0743	95% Bootstrap-t UCL	0.075
95% Hall's Bootstrap UCL	0.0749	95% Percentile Bootstrap UCL	0.0745
95% BCA Bootstrap UCL	0.0747		
90% Chebyshev(Mean, Sd) UCL	0.0772	95% Chebyshev(Mean, Sd) UCL	0.0801
97.5% Chebyshev(Mean, Sd) UCL	0.0841	99% Chebyshev(Mean, Sd) UCL	0.092

Suggested UCL to Use

95% Student's-t UCL	0.0744	or 95% Modified-t UCL	0.0745

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFNA|ug/L

General Statistics

Total Number of Observations	34	Number of Distinct Observations	28
		Number of Missing Observations	1
Number of Detects	21	Number of Non-Detects	13
Number of Distinct Detects	19	Number of Distinct Non-Detects	9
Minimum Detect	6.5000E-4	Minimum Non-Detect	7.1900E-4
Maximum Detect	0.0019	Maximum Non-Detect	0.0041
Variance Detects	1.2344E-7	Percent Non-Detects	38.24%
Mean Detects	0.00109	SD Detects	3.5134E-4
Median Detects	0.00106	CV Detects	0.321
Skewness Detects	0.773	Kurtosis Detects	-0.193
Mean of Logged Detects	-6.865	SD of Logged Detects	0.31

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.924	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.908	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.146	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.188	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	9.6235E-4	KM Standard Error of Mean	6.2898E-5
KM SD	3.4079E-4	95% KM (BCA) UCL	0.00107
95% KM (t) UCL	0.00107	95% KM (Percentile Bootstrap) UCL	0.00107
95% KM (z) UCL	0.00107	95% KM Bootstrap t UCL	0.00108
90% KM Chebyshev UCL	0.00115	95% KM Chebyshev UCL	0.00124
97.5% KM Chebyshev UCL	0.00136	99% KM Chebyshev UCL	0.00159

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.378	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.743	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.118	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.189	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	10.87	k star (bias corrected MLE)	9.348
Theta hat (MLE)	1.0064E-4	Theta star (bias corrected MLE)	1.1701E-4
nu hat (MLE)	456.5	nu star (bias corrected)	392.6
Mean (detects)	0.00109		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	6.5000E-4	Mean	0.0045
Maximum	0.01	Median	0.0015
SD	0.0044	CV	0.978
k hat (MLE)	0.97	k star (bias corrected MLE)	0.904
Theta hat (MLE)	0.00464	Theta star (bias corrected MLE)	0.00497
nu hat (MLE)	65.99	nu star (bias corrected)	61.5
Adjusted Level of Significance (β)	0.0422		
Approximate Chi Square Value (61.50, α)	44.46	Adjusted Chi Square Value (61.50, β)	43.74
95% Gamma Approximate UCL (use when n>=50)	0.00622	95% Gamma Adjusted UCL (use when n<50)	0.00633

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	9.6235E-4	SD (KM)	3.4079E-4
Variance (KM)	1.1614E-7	SE of Mean (KM)	6.2898E-5
k hat (KM)	7.974	k star (KM)	7.29
nu hat (KM)	542.3	nu star (KM)	495.7
theta hat (KM)	1.2068E-4	theta star (KM)	1.3200E-4
80% gamma percentile (KM)	0.00124	90% gamma percentile (KM)	0.00144
95% gamma percentile (KM)	0.00161	99% gamma percentile (KM)	0.00198

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (495.74, α)	445.1	Adjusted Chi Square Value (495.74, β)	442.7
95% Gamma Approximate KM-UCL (use when n>=50)	0.00107	95% Gamma Adjusted KM-UCL (use when n<50)	0.00108

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.96	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.908	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.112	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.188	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	9.5052E-4	Mean in Log Scale	-7.012
SD in Original Scale	3.3922E-4	SD in Log Scale	0.323
95% t UCL (assumes normality of ROS data)	0.00105	95% Percentile Bootstrap UCL	0.00104
95% BCA Bootstrap UCL	0.00105	95% Bootstrap t UCL	0.00107
95% H-UCL (Log ROS)	0.00105		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-7	KM Geo Mean	9.1159E-4
KM SD (logged)	0.318	95% Critical H Value (KM-Log)	1.81
KM Standard Error of Mean (logged)	0.059	95% H-UCL (KM -Log)	0.00106
KM SD (logged)	0.318	95% Critical H Value (KM-Log)	1.81
KM Standard Error of Mean (logged)	0.059		

ProUCL Output
Lake Elmo
Total Surface Water

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	9.6321E-4	Mean in Log Scale	-7.11
SD in Original Scale	5.4058E-4	SD in Log Scale	0.598
95% t UCL (Assumes normality)	0.00112	95% H-Stat UCL	0.00121

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.00107

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFDA|ug/L

General Statistics

Total Number of Observations	34	Number of Distinct Observations	29
		Number of Missing Observations	1
Number of Detects	17	Number of Non-Detects	17
Number of Distinct Detects	17	Number of Distinct Non-Detects	12
Minimum Detect	5.0400E-4	Minimum Non-Detect	7.1900E-4
Maximum Detect	0.0027	Maximum Non-Detect	0.0042
Variance Detects	4.6375E-7	Percent Non-Detects	50%
Mean Detects	0.0014	SD Detects	6.8099E-4
Median Detects	0.00115	CV Detects	0.488
Skewness Detects	0.483	Kurtosis Detects	-0.913
Mean of Logged Detects	-6.694	SD of Logged Detects	0.517

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.938	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.892	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.171	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.207	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00106	KM Standard Error of Mean	1.2490E-4
KM SD	6.4853E-4	95% KM (BCA) UCL	0.00128
95% KM (t) UCL	0.00127	95% KM (Percentile Bootstrap) UCL	0.00126
95% KM (z) UCL	0.00126	95% KM Bootstrap t UCL	0.00131
90% KM Chebyshev UCL	0.00143	95% KM Chebyshev UCL	0.0016
97.5% KM Chebyshev UCL	0.00184	99% KM Chebyshev UCL	0.0023

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.277	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.742	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.119	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.21	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.328	k star (bias corrected MLE)	3.603
Theta hat (MLE)	3.2261E-4	Theta star (bias corrected MLE)	3.8748E-4
nu hat (MLE)	147.1	nu star (bias corrected)	122.5
Mean (detects)	0.0014		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	5.0400E-4	Mean	0.0057
Maximum	0.01	Median	0.00635
SD	0.00439	CV	0.771
k hat (MLE)	1.176	k star (bias corrected MLE)	1.092
Theta hat (MLE)	0.00484	Theta star (bias corrected MLE)	0.00522
nu hat (MLE)	79.97	nu star (bias corrected)	74.25
Adjusted Level of Significance (β)	0.0422		
Approximate Chi Square Value (74.25, α)	55.41	Adjusted Chi Square Value (74.25, β)	54.6
95% Gamma Approximate UCL (use when n>=50)	0.00764	95% Gamma Adjusted UCL (use when n<50)	0.00775

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00106	SD (KM)	6.4853E-4
Variance (KM)	4.2059E-7	SE of Mean (KM)	1.2490E-4
k hat (KM)	2.652	k star (KM)	2.438
nu hat (KM)	180.4	nu star (KM)	165.8
theta hat (KM)	3.9820E-4	theta star (KM)	4.3323E-4
80% gamma percentile (KM)	0.00154	90% gamma percentile (KM)	0.00196
95% gamma percentile (KM)	0.00236	99% gamma percentile (KM)	0.00322

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (165.78, α)	137	Adjusted Chi Square Value (165.78, β)	135.7
95% Gamma Approximate KM-UCL (use when n>=50)	0.00128	95% Gamma Adjusted KM-UCL (use when n<50)	0.00129

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.958	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.892	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.13	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.207	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00103	Mean in Log Scale	-7.026
SD in Original Scale	6.1782E-4	SD in Log Scale	0.527
95% t UCL (assumes normality of ROS data)	0.00121	95% Percentile Bootstrap UCL	0.0012
95% BCA Bootstrap UCL	0.00122	95% Bootstrap t UCL	0.00125
95% H-UCL (Log ROS)	0.00122		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-7.013	KM Geo Mean	8.9979E-4
KM SD (logged)	0.544	95% Critical H Value (KM-Log)	1.974
KM Standard Error of Mean (logged)	0.107	95% H-UCL (KM -Log)	0.00126
KM SD (logged)	0.544	95% Critical H Value (KM-Log)	1.974
KM Standard Error of Mean (logged)	0.107		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00113	Mean in Log Scale	-7.047
SD in Original Scale	7.6887E-4	SD in Log Scale	0.752
95% t UCL (Assumes normality)	0.00135	95% H-Stat UCL	0.00153

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.00127

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	34	Number of Distinct Observations	32
		Number of Missing Observations	1
Minimum	0.00125	Mean	0.00358
Maximum	0.0056	Median	0.00341
SD	9.8706E-4	Std. Error of Mean	1.6928E-4
Coefficient of Variation	0.276	Skewness	0.0939

Normal GOF Test

Shapiro Wilk Test Statistic	0.96	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.933	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.138	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.15	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.00386	95% Adjusted-CLT UCL (Chen-1995)	0.00386
		95% Modified-t UCL (Johnson-1978)	0.00386

Gamma GOF Test

A-D Test Statistic	0.674	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.747	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.136	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.151	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	12.06	k star (bias corrected MLE)	11.01
Theta hat (MLE)	2.9666E-4	Theta star (bias corrected MLE)	3.2479E-4
nu hat (MLE)	820	nu star (bias corrected)	749
MLE Mean (bias corrected)	0.00358	MLE Sd (bias corrected)	0.00108
		Approximate Chi Square Value (0.05)	686.5
Adjusted Level of Significance	0.0422	Adjusted Chi Square Value	683.5

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0039	95% Adjusted Gamma UCL (use when n<50)	0.00392

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.911	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.933	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.158	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.15	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-6.685	Mean of logged Data	-5.675
Maximum of Logged Data	-5.185	SD of logged Data	0.309

Assuming Lognormal Distribution

95% H-UCL	0.00397	90% Chebyshev (MVUE) UCL	0.00417
95% Chebyshev (MVUE) UCL	0.00444	97.5% Chebyshev (MVUE) UCL	0.0048
99% Chebyshev (MVUE) UCL	0.00552		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00386	95% Jackknife UCL	0.00386
95% Standard Bootstrap UCL	0.00385	95% Bootstrap-t UCL	0.00387
95% Hall's Bootstrap UCL	0.00386	95% Percentile Bootstrap UCL	0.00385
95% BCA Bootstrap UCL	0.00384		
90% Chebyshev(Mean, Sd) UCL	0.00409	95% Chebyshev(Mean, Sd) UCL	0.00432
97.5% Chebyshev(Mean, Sd) UCL	0.00463	99% Chebyshev(Mean, Sd) UCL	0.00526

Suggested UCL to Use

95% Student's-t UCL 0.00386

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Lake Elmo
Total Surface Water

PFHxS|ug/L

General Statistics

Total Number of Observations	34	Number of Distinct Observations	33
		Number of Missing Observations	1
Minimum	0.00586	Mean	0.008
Maximum	0.013	Median	0.0075
SD	0.0018	Std. Error of Mean	3.0862E-4
Coefficient of Variation	0.225	Skewness	1.256

Normal GOF Test

Shapiro Wilk Test Statistic	0.877	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.933	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.131	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.15	Data appear Normal at 5% Significance Level	

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00852	95% Adjusted-CLT UCL (Chen-1995)	0.00857
		95% Modified-t UCL (Johnson-1978)	0.00853

Gamma GOF Test

A-D Test Statistic	0.811	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.746	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.116	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.151	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	22.92	k star (bias corrected MLE)	20.92
Theta hat (MLE)	3.4881E-4	Theta star (bias corrected MLE)	3.8221E-4
nu hat (MLE)	1559	nu star (bias corrected)	1422
MLE Mean (bias corrected)	0.008	MLE Sd (bias corrected)	0.00175
		Approximate Chi Square Value (0.05)	1336
Adjusted Level of Significance	0.0422	Adjusted Chi Square Value	1332

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.00851	95% Adjusted Gamma UCL (use when n<50)	0.00854

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.928	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.933	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.105	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.15	Data appear Lognormal at 5% Significance Level	

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.14	Mean of logged Data	-4.851
Maximum of Logged Data	-4.343	SD of logged Data	0.207

Assuming Lognormal Distribution

95% H-UCL	0.00851	90% Chebyshev (MVUE) UCL	0.00885
95% Chebyshev (MVUE) UCL	0.00924	97.5% Chebyshev (MVUE) UCL	0.00978
99% Chebyshev (MVUE) UCL	0.0108		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0085	95% Jackknife UCL	0.00852
95% Standard Bootstrap UCL	0.00849	95% Bootstrap-t UCL	0.00861
95% Hall's Bootstrap UCL	0.00861	95% Percentile Bootstrap UCL	0.0085
95% BCA Bootstrap UCL	0.0086		
90% Chebyshev(Mean, Sd) UCL	0.00892	95% Chebyshev(Mean, Sd) UCL	0.00934
97.5% Chebyshev(Mean, Sd) UCL	0.00992	99% Chebyshev(Mean, Sd) UCL	0.0111

ProUCL Output
Lake Elmo
Total Surface Water

Suggested UCL to Use

95% Student's-t UCL 0.00852

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOS|ug/L

General Statistics

Total Number of Observations	34	Number of Distinct Observations	32
		Number of Missing Observations	1
Minimum	0.0468	Mean	0.153
Maximum	0.482	Median	0.105
SD	0.115	Std. Error of Mean	0.0197
Coefficient of Variation	0.752	Skewness	1.649

Normal GOF Test

Shapiro Wilk Test Statistic	0.786	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.933	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.234	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.15	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.186	95% Adjusted-CLT UCL (Chen-1995)	0.191
		95% Modified-t UCL (Johnson-1978)	0.187

Gamma GOF Test

A-D Test Statistic	1.145	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.757	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.193	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.153	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.427	k star (bias corrected MLE)	2.232
Theta hat (MLE)	0.063	Theta star (bias corrected MLE)	0.0685
nu hat (MLE)	165	nu star (bias corrected)	151.8
MLE Mean (bias corrected)	0.153	MLE Sd (bias corrected)	0.102
		Approximate Chi Square Value (0.05)	124.3
Adjusted Level of Significance	0.0422	Adjusted Chi Square Value	123.1

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.187	95% Adjusted Gamma UCL (use when n<50)	0.189

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.936	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.933	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.155	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.15	Data Not Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-3.062	Mean of logged Data	-2.098
Maximum of Logged Data	-0.73	SD of logged Data	0.648

Assuming Lognormal Distribution

95% H-UCL	0.191	90% Chebyshev (MVUE) UCL	0.204
95% Chebyshev (MVUE) UCL	0.228	97.5% Chebyshev (MVUE) UCL	0.262
99% Chebyshev (MVUE) UCL	0.329		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

ProUCL Output
Lake Elmo
Total Surface Water

Nonparametric Distribution Free UCLs

95% CLT UCL	0.185	95% Jackknife UCL	0.186
95% Standard Bootstrap UCL	0.185	95% Bootstrap-t UCL	0.195
95% Hall's Bootstrap UCL	0.192	95% Percentile Bootstrap UCL	0.185
95% BCA Bootstrap UCL	0.192		
90% Chebyshev(Mean, Sd) UCL	0.212	95% Chebyshev(Mean, Sd) UCL	0.239
97.5% Chebyshev(Mean, Sd) UCL	0.276	99% Chebyshev(Mean, Sd) UCL	0.349

Suggested UCL to Use

95% H-UCL 0.191

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

PFOSA|ug/L

General Statistics

Total Number of Observations	34	Number of Distinct Observations	29
		Number of Missing Observations	1
Number of Detects	16	Number of Non-Detects	18
Number of Distinct Detects	16	Number of Distinct Non-Detects	13
Minimum Detect	4.0200E-4	Minimum Non-Detect	7.1900E-4
Maximum Detect	0.00283	Maximum Non-Detect	0.0042
Variance Detects	3.8648E-7	Percent Non-Detects	52.94%
Mean Detects	0.0011	SD Detects	6.2168E-4
Median Detects	9.1600E-4	CV Detects	0.563
Skewness Detects	1.419	Kurtosis Detects	2.779
Mean of Logged Detects	-6.944	SD of Logged Detects	0.537

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.879	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.887	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.171	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.213	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	8.4968E-4	KM Standard Error of Mean	1.0478E-4
KM SD	5.3339E-4	95% KM (BCA) UCL	0.00104
95% KM (t) UCL	0.00103	95% KM (Percentile Bootstrap) UCL	0.00103
95% KM (z) UCL	0.00102	95% KM Bootstrap t UCL	0.00109
90% KM Chebyshev UCL	0.00116	95% KM Chebyshev UCL	0.00131
97.5% KM Chebyshev UCL	0.0015	99% KM Chebyshev UCL	0.00189

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.267	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.742	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.121	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.216	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.841	k star (bias corrected MLE)	3.162
Theta hat (MLE)	2.8765E-4	Theta star (bias corrected MLE)	3.4936E-4
nu hat (MLE)	122.9	nu star (bias corrected)	101.2
Mean (detects)	0.0011		

ProUCL Output
Lake Elmo
Total Surface Water

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	4.0200E-4	Mean	0.00581
Maximum	0.01	Median	0.01
SD	0.00453	CV	0.778
k hat (MLE)	1.03	k star (bias corrected MLE)	0.959
Theta hat (MLE)	0.00564	Theta star (bias corrected MLE)	0.00606
nu hat (MLE)	70.07	nu star (bias corrected)	65.22
Adjusted Level of Significance (β)	0.0422		
Approximate Chi Square Value (65.22, α)	47.63	Adjusted Chi Square Value (65.22, β)	46.89
95% Gamma Approximate UCL (use when n>=50)	0.00796	95% Gamma Adjusted UCL (use when n<50)	0.00809

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	8.4968E-4	SD (KM)	5.3339E-4
Variance (KM)	2.8450E-7	SE of Mean (KM)	1.0478E-4
k hat (KM)	2.538	k star (KM)	2.333
nu hat (KM)	172.6	nu star (KM)	158.7
theta hat (KM)	3.3484E-4	theta star (KM)	3.6415E-4
80% gamma percentile (KM)	0.00125	90% gamma percentile (KM)	0.00159
95% gamma percentile (KM)	0.00192	99% gamma percentile (KM)	0.00264

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (158.66, α)	130.5	Adjusted Chi Square Value (158.66, β)	129.3
95% Gamma Approximate KM-UCL (use when n>=50)	0.00103	95% Gamma Adjusted KM-UCL (use when n<50)	0.00104

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.973	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.123	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	8.3164E-4	Mean in Log Scale	-7.217
SD in Original Scale	5.0268E-4	SD in Log Scale	0.472
95% t UCL (assumes normality of ROS data)	9.7754E-4	95% Percentile Bootstrap UCL	9.7671E-4
95% BCA Bootstrap UCL	0.00101	95% Bootstrap t UCL	0.00102
95% H-UCL (Log ROS)	9.6061E-4		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-7.215	KM Geo Mean	7.3517E-4
KM SD (logged)	0.506	95% Critical H Value (KM-Log)	1.943
KM Standard Error of Mean (logged)	0.106	95% H-UCL (KM -Log)	9.9141E-4
KM SD (logged)	0.506	95% Critical H Value (KM-Log)	1.943
KM Standard Error of Mean (logged)	0.106		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	9.6188E-4	Mean in Log Scale	-7.193
SD in Original Scale	6.9984E-4	SD in Log Scale	0.705
95% t UCL (Assumes normality)	0.00117	95% H-Stat UCL	0.00125

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.00103

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	34	Number of Distinct Observations	28
		Number of Missing Observations	1
Number of Detects	6	Number of Non-Detects	28
Number of Distinct Detects	6	Number of Distinct Non-Detects	22
Minimum Detect	4.9000E-4	Minimum Non-Detect	3.6100E-4
Maximum Detect	0.00223	Maximum Non-Detect	0.0042
Variance Detects	3.8475E-7	Percent Non-Detects	82.35%
Mean Detects	0.00103	SD Detects	6.2028E-4
Median Detects	8.8900E-4	CV Detects	0.603
Skewness Detects	1.908	Kurtosis Detects	4.106
Mean of Logged Detects	-7.001	SD of Logged Detects	0.514

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.79	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.345	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data Not Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	5.5939E-4	KM Standard Error of Mean	8.6985E-5
KM SD	3.6660E-4	95% KM (BCA) UCL	7.0975E-4
95% KM (t) UCL	7.0660E-4	95% KM (Percentile Bootstrap) UCL	7.1173E-4
95% KM (z) UCL	7.0247E-4	95% KM Bootstrap t UCL	7.3797E-4
90% KM Chebyshev UCL	8.2034E-4	95% KM Chebyshev UCL	9.3855E-4
97.5% KM Chebyshev UCL	0.0011	99% KM Chebyshev UCL	0.00142

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.416	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.699	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.284	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.284	k star (bias corrected MLE)	2.253
Theta hat (MLE)	2.4004E-4	Theta star (bias corrected MLE)	4.5640E-4
nu hat (MLE)	51.41	nu star (bias corrected)	27.04
Mean (detects)	0.00103		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	4.9000E-4	Mean	0.00842
Maximum	0.01	Median	0.01
SD	0.00348	CV	0.413
k hat (MLE)	2.148	k star (bias corrected MLE)	1.978
Theta hat (MLE)	0.00392	Theta star (bias corrected MLE)	0.00425
nu hat (MLE)	146.1	nu star (bias corrected)	134.5
Adjusted Level of Significance (β)	0.0422		
Approximate Chi Square Value (134.53, α)	108.7	Adjusted Chi Square Value (134.53, β)	107.6
95% Gamma Approximate UCL (use when n>=50)	0.0104	95% Gamma Adjusted UCL (use when n<50)	0.0105

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	5.5939E-4	SD (KM)	3.6660E-4
Variance (KM)	1.3439E-7	SE of Mean (KM)	8.6985E-5
k hat (KM)	2.328	k star (KM)	2.142
nu hat (KM)	158.3	nu star (KM)	145.7
theta hat (KM)	2.4025E-4	theta star (KM)	2.6109E-4
80% gamma percentile (KM)	8.3069E-4	90% gamma percentile (KM)	0.00107
95% gamma percentile (KM)	0.0013	99% gamma percentile (KM)	0.0018

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (145.69, α)	118.8	Adjusted Chi Square Value (145.69, β)	117.6
95% Gamma Approximate KM-UCL (use when n>=50)	6.8603E-4	95% Gamma Adjusted KM-UCL (use when n<50)	6.9303E-4

ProUCL Output
Lake Elmo
Total Surface Water

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.934	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.254	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	4.4127E-4	Mean in Log Scale	-7.9
SD in Original Scale	3.7413E-4	SD in Log Scale	0.521
95% t UCL (assumes normality of ROS data)	5.4985E-4	95% Percentile Bootstrap UCL	5.4758E-4
95% BCA Bootstrap UCL	6.0002E-4	95% Bootstrap t UCL	6.5158E-4
95% H-UCL (Log ROS)	5.0673E-4		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-7.608	KM Geo Mean	4.9666E-4
KM SD (logged)	0.431	95% Critical H Value (KM-Log)	1.887
KM Standard Error of Mean (logged)	0.127	95% H-UCL (KM -Log)	6.2814E-4
KM SD (logged)	0.431	95% Critical H Value (KM-Log)	1.887
KM Standard Error of Mean (logged)	0.127		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	7.2074E-4	Mean in Log Scale	-7.537
SD in Original Scale	6.5729E-4	SD in Log Scale	0.733
95% t UCL (Assumes normality)	9.1151E-4	95% H-Stat UCL	9.1710E-4

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	7.07E-04

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFPeS|ug/L

General Statistics

Total Number of Observations	34	Number of Distinct Observations	33
		Number of Missing Observations	1
Minimum	0.00109	Mean	0.0027
Maximum	0.006	Median	0.00232
SD	0.00105	Std. Error of Mean	1.7951E-4
Coefficient of Variation	0.387	Skewness	1.211

Normal GOF Test

Shapiro Wilk Test Statistic	0.912	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.933	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.184	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.15	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00301	95% Adjusted-CLT UCL (Chen-1995)	0.00304
		95% Modified-t UCL (Johnson-1978)	0.00301

Gamma GOF Test

A-D Test Statistic	0.534	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.748	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.151	**Kolmogorov-Smimov Gamma GOF Test**
5% K-S Critical Value	0.151	Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

ProUCL Output
Lake Elmo
Total Surface Water

Gamma Statistics

k hat (MLE)	7.653	k star (bias corrected MLE)	6.997
Theta hat (MLE)	3.5314E-4	Theta star (bias corrected MLE)	3.8623E-4
nu hat (MLE)	520.4	nu star (bias corrected)	475.8
MLE Mean (bias corrected)	0.0027	MLE Sd (bias corrected)	0.00102
		Approximate Chi Square Value (0.05)	426.2
Adjusted Level of Significance	0.0422	Adjusted Chi Square Value	423.9

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	0.00302	95% Adjusted Gamma UCL (use when n<50)	0.00303

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.98	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.933	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.128	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.15	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-6.822	Mean of logged Data	-5.98
Maximum of Logged Data	-5.116	SD of logged Data	0.368

Assuming Lognormal Distribution

95% H-UCL	0.00305	90% Chebyshev (MVUE) UCL	0.00322
95% Chebyshev (MVUE) UCL	0.00346	97.5% Chebyshev (MVUE) UCL	0.00379
99% Chebyshev (MVUE) UCL	0.00444		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.003	95% Jackknife UCL	0.00301
95% Standard Bootstrap UCL	0.00299	95% Bootstrap-t UCL	0.00306
95% Hall's Bootstrap UCL	0.00305	95% Percentile Bootstrap UCL	0.00299
95% BCA Bootstrap UCL	0.00301		
90% Chebyshev(Mean, Sd) UCL	0.00324	95% Chebyshev(Mean, Sd) UCL	0.00349
97.5% Chebyshev(Mean, Sd) UCL	0.00382	99% Chebyshev(Mean, Sd) UCL	0.00449

Suggested UCL to Use

95% Adjusted Gamma UCL	0.00303

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFHpS|ug/L

General Statistics

Total Number of Observations	34	Number of Distinct Observations	29
		Number of Missing Observations	1
Number of Detects	32	Number of Non-Detects	2
Number of Distinct Detects	27	Number of Distinct Non-Detects	2
Minimum Detect	7.8300E-4	Minimum Non-Detect	7.4200E-4
Maximum Detect	0.0044	Maximum Non-Detect	7.5400E-4
Variance Detects	8.3157E-7	Percent Non-Detects	5.882%
Mean Detects	0.00162	SD Detects	9.1191E-4
Median Detects	0.00121	CV Detects	0.564
Skewness Detects	1.454	Kurtosis Detects	1.804
Mean of Logged Detects	-6.555	SD of Logged Detects	0.496

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.821	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.93	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.211	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.154	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00157	KM Standard Error of Mean	1.5591E-4
KM SD	8.9477E-4	95% KM (BCA) UCL	0.00186
95% KM (t) UCL	0.00183	95% KM (Percentile Bootstrap) UCL	0.00183
95% KM (z) UCL	0.00182	95% KM Bootstrap t UCL	0.00191
90% KM Chebyshev UCL	0.00203	95% KM Chebyshev UCL	0.00225
97.5% KM Chebyshev UCL	0.00254	99% KM Chebyshev UCL	0.00312

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.224	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.751	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.206	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.156	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.059	k star (bias corrected MLE)	3.699
Theta hat (MLE)	3.9848E-4	Theta star (bias corrected MLE)	4.3722E-4
nu hat (MLE)	259.7	nu star (bias corrected)	236.7
Mean (detects)	0.00162		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	7.8300E-4	Mean	0.00211
Maximum	0.01	Median	0.00135
SD	0.00219	CV	1.037
k hat (MLE)	1.938	k star (bias corrected MLE)	1.787
Theta hat (MLE)	0.00109	Theta star (bias corrected MLE)	0.00118
nu hat (MLE)	131.8	nu star (bias corrected)	121.5
Adjusted Level of Significance (β)	0.0422		
Approximate Chi Square Value (121.49, α)	97.04	Adjusted Chi Square Value (121.49, β)	95.96
95% Gamma Approximate UCL (use when n>=50)	0.00264	95% Gamma Adjusted UCL (use when n<50)	0.00267

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00157	SD (KM)	8.9477E-4
Variance (KM)	8.0061E-7	SE of Mean (KM)	1.5591E-4
k hat (KM)	3.062	k star (KM)	2.812
nu hat (KM)	208.2	nu star (KM)	191.2
theta hat (KM)	5.1133E-4	theta star (KM)	5.5690E-4
80% gamma percentile (KM)	0.00225	90% gamma percentile (KM)	0.00282
95% gamma percentile (KM)	0.00335	99% gamma percentile (KM)	0.0045

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (191.18, α)	160.2	Adjusted Chi Square Value (191.18, β)	158.8
95% Gamma Approximate KM-UCL (use when n>=50)	0.00187	95% Gamma Adjusted KM-UCL (use when n<50)	0.00189

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.907	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.93	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.192	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.154	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00155	Mean in Log Scale	-6.624
SD in Original Scale	9.2707E-4	SD in Log Scale	0.555
95% t UCL (assumes normality of ROS data)	0.00182	95% Percentile Bootstrap UCL	0.00183
95% BCA Bootstrap UCL	0.00185	95% Bootstrap t UCL	0.00186
95% H-UCL (Log ROS)	0.00188		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-6.594	KM Geo Mean	0.00137
KM SD (logged)	0.498	95% Critical H Value (KM-Log)	1.937
KM Standard Error of Mean (logged)	0.0867	95% H-UCL (KM -Log)	0.00183
KM SD (logged)	0.498	95% Critical H Value (KM-Log)	1.937
KM Standard Error of Mean (logged)	0.0867		

ProUCL Output
Lake Elmo
Total Surface Water

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.00154	Mean in Log Scale	-6.634
SD in Original Scale	9.3238E-4	SD in Log Scale	0.577
95% t UCL (Assumes normality)	0.00181	95% H-Stat UCL	0.0019

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.00183	KM H-UCL	0.00183
95% KM (BCA) UCL	0.00186		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Raleigh Creek - Upper
Total Surface Water

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/26/2021 11:06:18 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

PFBA|ug/L

General Statistics

Total Number of Observations	55	Number of Distinct Observations	52
		Number of Missing Observations	5
Minimum	0.087	Mean	0.421
Maximum	1.1	Median	0.349
SD	0.251	Std. Error of Mean	0.0339
Coefficient of Variation	0.598	Skewness	0.88

Normal GOF Test

Shapiro Wilk Test Statistic	0.899	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	8.9066E-5	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.17	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.119	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.477	95% Adjusted-CLT UCL (Chen-1995)	0.481
		95% Modified-t UCL (Johnson-1978)	0.478

Gamma GOF Test

A-D Test Statistic	0.667	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.758	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0934	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.121	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.978	k star (bias corrected MLE)	2.827
Theta hat (MLE)	0.141	Theta star (bias corrected MLE)	0.149
nu hat (MLE)	327.5	nu star (bias corrected)	311
MLE Mean (bias corrected)	0.421	MLE Sd (bias corrected)	0.25
		Approximate Chi Square Value (0.05)	271.1
Adjusted Level of Significance	0.0456	Adjusted Chi Square Value	270.1

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	0.482	95% Adjusted Gamma UCL (use when n<50)	0.484

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.967	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk P Value	0.26	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0898	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.119	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.442	Mean of logged Data	-1.043
Maximum of Logged Data	0.0953	SD of logged Data	0.612

Assuming Lognormal Distribution

95% H-UCL	0.5	90% Chebyshev (MVUE) UCL	0.536
95% Chebyshev (MVUE) UCL	0.587	97.5% Chebyshev (MVUE) UCL	0.658
99% Chebyshev (MVUE) UCL	0.797		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

ProUCL Output
Raleigh Creek - Upper
Total Surface Water

Nonparametric Distribution Free UCLs

95% CLT UCL	0.476	95% Jackknife UCL	0.477
95% Standard Bootstrap UCL	0.476	95% Bootstrap-t UCL	0.484
95% Hall's Bootstrap UCL	0.479	95% Percentile Bootstrap UCL	0.477
95% BCA Bootstrap UCL	0.483		
90% Chebyshev(Mean, Sd) UCL	0.522	95% Chebyshev(Mean, Sd) UCL	0.568
97.5% Chebyshev(Mean, Sd) UCL	0.632	99% Chebyshev(Mean, Sd) UCL	0.758

Suggested UCL to Use

95% Approximate Gamma UCL 0.482

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFPeA|ug/L

General Statistics

Total Number of Observations	60	Number of Distinct Observations	58
		Number of Missing Observations	0
Minimum	0.0078	Mean	0.0395
Maximum	0.13	Median	0.0276
SD	0.0293	Std. Error of Mean	0.00378
Coefficient of Variation	0.741	Skewness	1.324

Normal GOF Test

Shapiro Wilk Test Statistic	0.848	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	4.1437E-8	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.175	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.114	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0459	95% Adjusted-CLT UCL (Chen-1995)	0.0465
		95% Modified-t UCL (Johnson-1978)	0.046

Gamma GOF Test

A-D Test Statistic	0.775	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.762	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.12	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.116	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.152	k star (bias corrected MLE)	2.055
Theta hat (MLE)	0.0184	Theta star (bias corrected MLE)	0.0192
nu hat (MLE)	258.2	nu star (bias corrected)	246.6
MLE Mean (bias corrected)	0.0395	MLE Sd (bias corrected)	0.0276
		Approximate Chi Square Value (0.05)	211.3
Adjusted Level of Significance	0.046	Adjusted Chi Square Value	210.5

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0462	95% Adjusted Gamma UCL (use when n<50)	0.0463

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.962	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk P Value	0.131	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.0774	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.114	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.854	Mean of logged Data	-3.481
Maximum of Logged Data	-2.04	SD of logged Data	0.716

Assuming Lognormal Distribution

95% H-UCL	0.0482	90% Chebyshev (MVUE) UCL	0.0516
95% Chebyshev (MVUE) UCL	0.0571	97.5% Chebyshev (MVUE) UCL	0.0647
99% Chebyshev (MVUE) UCL	0.0796		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0458	95% Jackknife UCL	0.0459
95% Standard Bootstrap UCL	0.0458	95% Bootstrap-t UCL	0.0471
95% Hall's Bootstrap UCL	0.0468	95% Percentile Bootstrap UCL	0.0461
95% BCA Bootstrap UCL	0.0468		
90% Chebyshev(Mean, Sd) UCL	0.0509	95% Chebyshev(Mean, Sd) UCL	0.056
97.5% Chebyshev(Mean, Sd) UCL	0.0632	99% Chebyshev(Mean, Sd) UCL	0.0772

Suggested UCL to Use

95% H-UCL 0.0482

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

PFHxA|ug/L

General Statistics

Total Number of Observations	60	Number of Distinct Observations	58
Number of Detects	59	Number of Non-Detects	1
Number of Distinct Detects	57	Number of Distinct Non-Detects	1
Minimum Detect	0.00945	Minimum Non-Detect	0.0092
Maximum Detect	0.272	Maximum Non-Detect	0.0092
Variance Detects	0.00414	Percent Non-Detects	1.667%
Mean Detects	0.0845	SD Detects	0.0643
Median Detects	0.0634	CV Detects	0.761
Skewness Detects	1.113	Kurtosis Detects	0.483
Mean of Logged Detects	-2.769	SD of Logged Detects	0.815

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.873	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	1.3713E-6	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.173	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.115	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0832	KM Standard Error of Mean	0.00833
KM SD	0.064	95% KM (BCA) UCL	0.0969
95% KM (t) UCL	0.0972	95% KM (Percentile Bootstrap) UCL	0.0976
95% KM (z) UCL	0.0969	95% KM Bootstrap t UCL	0.0998
90% KM Chebyshev UCL	0.108	95% KM Chebyshev UCL	0.12
97.5% KM Chebyshev UCL	0.135	99% KM Chebyshev UCL	0.166

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.454	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.765	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.0861	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.117	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.825	k star (bias corrected MLE)	1.744
Theta hat (MLE)	0.0463	Theta star (bias corrected MLE)	0.0485
nu hat (MLE)	215.4	nu star (bias corrected)	205.8
Mean (detects)	0.0845		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.00945	Mean	0.0833
Maximum	0.272	Median	0.0622
SD	0.0645	CV	0.775
k hat (MLE)	1.74	k star (bias corrected MLE)	1.664
Theta hat (MLE)	0.0478	Theta star (bias corrected MLE)	0.05
nu hat (MLE)	208.8	nu star (bias corrected)	199.7
Adjusted Level of Significance (β)	0.046		
Approximate Chi Square Value (199.71, α)	168	Adjusted Chi Square Value (199.71, β)	167.3
95% Gamma Approximate UCL (use when n>=50)	0.099	95% Gamma Adjusted UCL (use when n<50)	0.0994

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0832	SD (KM)	0.064
Variance (KM)	0.00409	SE of Mean (KM)	0.00833
k hat (KM)	1.693	k star (KM)	1.62
nu hat (KM)	203.2	nu star (KM)	194.4
theta hat (KM)	0.0492	theta star (KM)	0.0514
80% gamma percentile (KM)	0.128	90% gamma percentile (KM)	0.17
95% gamma percentile (KM)	0.211	99% gamma percentile (KM)	0.304

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (194.39, α)	163.1	Adjusted Chi Square Value (194.39, β)	162.4
95% Gamma Approximate KM-UCL (use when n>=50)	0.0992	95% Gamma Adjusted KM-UCL (use when n<50)	0.0996

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.967	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	0.241	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0687	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.115	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0832	Mean in Log Scale	-2.805
SD in Original Scale	0.0645	SD in Log Scale	0.854
95% t UCL (assumes normality of ROS data)	0.0971	95% Percentile Bootstrap UCL	0.0968
95% BCA Bootstrap UCL	0.098	95% Bootstrap t UCL	0.0984
95% H-UCL (Log ROS)	0.111		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.801	KM Geo Mean	0.0607
KM SD (logged)	0.838	95% Critical H Value (KM-Log)	2.17
KM Standard Error of Mean (logged)	0.109	95% H-UCL (KM -Log)	0.109
KM SD (logged)	0.838	95% Critical H Value (KM-Log)	2.17
KM Standard Error of Mean (logged)	0.109		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0832	Mean in Log Scale	-2.813
SD in Original Scale	0.0646	SD in Log Scale	0.876
95% t UCL (Assumes normality)	0.0971	95% H-Stat UCL	0.113

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Approximate Gamma UCL	0.0992	95% GROS Approximate Gamma UCL	0.099

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	60	Number of Distinct Observations	60
Number of Detects	59	Number of Non-Detects	1
Number of Distinct Detects	59	Number of Distinct Non-Detects	1
Minimum Detect	0.0047	Minimum Non-Detect	0.00572
Maximum Detect	0.301	Maximum Non-Detect	0.00572
Variance Detects	0.00468	Percent Non-Detects	1.667%
Mean Detects	0.0755	SD Detects	0.0684
Median Detects	0.0498	CV Detects	0.906
Skewness Detects	1.541	Kurtosis Detects	1.992
Mean of Logged Detects	-2.984	SD of Logged Detects	0.953

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.827	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	4.2820E-9	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.165	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.115	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0743	KM Standard Error of Mean	0.00884
KM SD	0.0679	95% KM (BCA) UCL	0.0883
95% KM (t) UCL	0.0891	95% KM (Percentile Bootstrap) UCL	0.0894
95% KM (z) UCL	0.0889	95% KM Bootstrap t UCL	0.0929
90% KM Chebyshev UCL	0.101	95% KM Chebyshev UCL	0.113
97.5% KM Chebyshev UCL	0.13	99% KM Chebyshev UCL	0.162

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.339	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.771	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.0743	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.118	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.393	k star (bias corrected MLE)	1.333
Theta hat (MLE)	0.0542	Theta star (bias corrected MLE)	0.0566
nu hat (MLE)	164.3	nu star (bias corrected)	157.3
Mean (detects)	0.0755		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0047	Mean	0.0744
Maximum	0.301	Median	0.0495
SD	0.0684	CV	0.919
k hat (MLE)	1.354	k star (bias corrected MLE)	1.298
Theta hat (MLE)	0.055	Theta star (bias corrected MLE)	0.0574
nu hat (MLE)	162.5	nu star (bias corrected)	155.7
Adjusted Level of Significance (β)	0.046		
Approximate Chi Square Value (155.71, α)	127.9	Adjusted Chi Square Value (155.71, β)	127.2
95% Gamma Approximate UCL (use when n>=50)	0.0906	95% Gamma Adjusted UCL (use when n<50)	0.0911

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0743	SD (KM)	0.0679
Variance (KM)	0.00461	SE of Mean (KM)	0.00884
k hat (KM)	1.199	k star (KM)	1.15
nu hat (KM)	143.9	nu star (KM)	138
theta hat (KM)	0.062	theta star (KM)	0.0646
80% gamma percentile (KM)	0.118	90% gamma percentile (KM)	0.165
95% gamma percentile (KM)	0.212	99% gamma percentile (KM)	0.319

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (138.03, α)	111.9	Adjusted Chi Square Value (138.03, β)	111.3
95% Gamma Approximate KM-UCL (use when n>=50)	0.0917	95% Gamma Adjusted KM-UCL (use when n<50)	0.0922

ProUCL Output
Raleigh Creek - Upper
Total Surface Water

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.978	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	0.611	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0446	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.115	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0743	Mean in Log Scale	-3.021
SD in Original Scale	0.0684	SD in Log Scale	0.987
95% t UCL (assumes normality of ROS data)	0.0891	95% Percentile Bootstrap UCL	0.09
95% BCA Bootstrap UCL	0.0904	95% Bootstrap t UCL	0.0923
95% H-UCL (Log ROS)	0.107		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-3.023	KM Geo Mean	0.0486
KM SD (logged)	0.985	95% Critical H Value (KM-Log)	2.335
KM Standard Error of Mean (logged)	0.128	95% H-UCL (KM -Log)	0.107
KM SD (logged)	0.985	95% Critical H Value (KM-Log)	2.335
KM Standard Error of Mean (logged)	0.128		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0743	Mean in Log Scale	-3.031
SD in Original Scale	0.0685	SD in Log Scale	1.015
95% t UCL (Assumes normality)	0.0891	95% H-Stat UCL	0.111

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Approximate Gamma UCL	0.0917	95% GROS Approximate Gamma UCL	0.0906

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOA|ug/L

General Statistics

Total Number of Observations	60	Number of Distinct Observations	59
		Number of Missing Observations	0
Minimum	0.0083	Mean	0.673
Maximum	2.45	Median	0.518
SD	0.59	Std. Error of Mean	0.0762
Coefficient of Variation	0.876	Skewness	1.503

Normal GOF Test

Shapiro Wilk Test Statistic	0.834	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	7.0654E-9	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.185	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.114	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.801	95% Adjusted-CLT UCL (Chen-1995)	0.814
		95% Modified-t UCL (Johnson-1978)	0.803

Gamma GOF Test

A-D Test Statistic	0.257	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.773	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0718	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.117	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

ProUCL Output
Raleigh Creek - Upper
Total Surface Water

Gamma Statistics

k hat (MLE)	1.301	k star (bias corrected MLE)	1.247
Theta hat (MLE)	0.517	Theta star (bias corrected MLE)	0.54
nu hat (MLE)	156.1	nu star (bias corrected)	149.7
MLE Mean (bias corrected)	0.673	MLE Sd (bias corrected)	0.603
		Approximate Chi Square Value (0.05)	122.4
Adjusted Level of Significance	0.046	Adjusted Chi Square Value	121.8

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	0.823	95% Adjusted Gamma UCL (use when n<50)	0.827

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.93	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk P Value	0.00238	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.117	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.114	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.791	Mean of logged Data	-0.827
Maximum of Logged Data	0.896	SD of logged Data	1.089

Assuming Lognormal Distribution

95% H-UCL	1.129	90% Chebyshev (MVUE) UCL	1.178
95% Chebyshev (MVUE) UCL	1.358	97.5% Chebyshev (MVUE) UCL	1.609
99% Chebyshev (MVUE) UCL	2.101		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.799	95% Jackknife UCL	0.801
95% Standard Bootstrap UCL	0.8	95% Bootstrap-t UCL	0.82
95% Hall's Bootstrap UCL	0.818	95% Percentile Bootstrap UCL	0.797
95% BCA Bootstrap UCL	0.815		
90% Chebyshev(Mean, Sd) UCL	0.902	95% Chebyshev(Mean, Sd) UCL	1.005
97.5% Chebyshev(Mean, Sd) UCL	1.149	99% Chebyshev(Mean, Sd) UCL	1.431

Suggested UCL to Use

95% Approximate Gamma UCL	0.823

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFNA|ug/L

General Statistics

Total Number of Observations	60	Number of Distinct Observations	58
Number of Detects	58	Number of Non-Detects	2
Number of Distinct Detects	56	Number of Distinct Non-Detects	2
Minimum Detect	0.00115	Minimum Non-Detect	0.0039
Maximum Detect	0.0232	Maximum Non-Detect	0.00572
Variance Detects	1.6028E-5	Percent Non-Detects	3.333%
Mean Detects	0.00579	SD Detects	0.004
Median Detects	0.005	CV Detects	0.691
Skewness Detects	2.115	Kurtosis Detects	6.01
Mean of Logged Detects	-5.342	SD of Logged Detects	0.619

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.819	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	2.3835E-9	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.171	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.116	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0057	KM Standard Error of Mean	5.1340E-4
KM SD	0.00394	95% KM (BCA) UCL	0.00657
95% KM (t) UCL	0.00656	95% KM (Percentile Bootstrap) UCL	0.00659
95% KM (z) UCL	0.00655	95% KM Bootstrap t UCL	0.00682
90% KM Chebyshev UCL	0.00724	95% KM Chebyshev UCL	0.00794
97.5% KM Chebyshev UCL	0.00891	99% KM Chebyshev UCL	0.0108

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.525	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.759	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0883	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.118	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.779	k star (bias corrected MLE)	2.647
Theta hat (MLE)	0.00208	Theta star (bias corrected MLE)	0.00219
nu hat (MLE)	322.4	nu star (bias corrected)	307.1
Mean (detects)	0.00579		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.00115	Mean	0.00593
Maximum	0.0232	Median	0.00501
SD	0.00401	CV	0.676
k hat (MLE)	2.788	k star (bias corrected MLE)	2.66
Theta hat (MLE)	0.00213	Theta star (bias corrected MLE)	0.00223
nu hat (MLE)	334.5	nu star (bias corrected)	319.2
Adjusted Level of Significance (β)	0.046		
Approximate Chi Square Value (319.15, α)	278.8	Adjusted Chi Square Value (319.15, β)	277.8
95% Gamma Approximate UCL (use when n>=50)	0.00679	95% Gamma Adjusted UCL (use when n<50)	0.00681

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0057	SD (KM)	0.00394
Variance (KM)	1.5500E-5	SE of Mean (KM)	5.1340E-4
k hat (KM)	2.098	k star (KM)	2.004
nu hat (KM)	251.7	nu star (KM)	240.5
theta hat (KM)	0.00272	theta star (KM)	0.00285
80% gamma percentile (KM)	0.00854	90% gamma percentile (KM)	0.0111
95% gamma percentile (KM)	0.0135	99% gamma percentile (KM)	0.0189

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (240.49, α)	205.6	Adjusted Chi Square Value (240.49, β)	204.8
95% Gamma Approximate KM-UCL (use when n>=50)	0.00667	95% Gamma Adjusted KM-UCL (use when n<50)	0.0067

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.988	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	0.935	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.084	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.116	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0057	Mean in Log Scale	-5.357
SD in Original Scale	0.00397	SD in Log Scale	0.615
95% t UCL (assumes normality of ROS data)	0.00656	95% Percentile Bootstrap UCL	0.0066
95% BCA Bootstrap UCL	0.00666	95% Bootstrap t UCL	0.00671
95% H-UCL (Log ROS)	0.00667		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.359	KM Geo Mean	0.00471
KM SD (logged)	0.614	95% Critical H Value (KM-Log)	1.973
KM Standard Error of Mean (logged)	0.0806	95% H-UCL (KM -Log)	0.00666
KM SD (logged)	0.614	95% Critical H Value (KM-Log)	1.973
KM Standard Error of Mean (logged)	0.0806		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00568	Mean in Log Scale	-5.366
SD in Original Scale	0.00398	SD in Log Scale	0.623
95% t UCL (Assumes normality)	0.00654	95% H-Stat UCL	0.00666

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Approximate Gamma UCL	0.00667	95% GROS Approximate Gamma UCL	0.00679

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFDA|ug/L

General Statistics

Total Number of Observations	60	Number of Distinct Observations	59
Number of Detects	58	Number of Non-Detects	2
Number of Distinct Detects	57	Number of Distinct Non-Detects	2
Minimum Detect	0.00183	Minimum Non-Detect	0.0039
Maximum Detect	0.0263	Maximum Non-Detect	0.00572
Variance Detects	2.3626E-5	Percent Non-Detects	3.333%
Mean Detects	0.00841	SD Detects	0.00486
Median Detects	0.00764	CV Detects	0.578
Skewness Detects	1.505	Kurtosis Detects	3.032
Mean of Logged Detects	-4.93	SD of Logged Detects	0.563

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.886	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	9.4147E-6	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.136	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.116	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00824	KM Standard Error of Mean	6.2885E-4
KM SD	0.00483	95% KM (BCA) UCL	0.00927
95% KM (t) UCL	0.00929	95% KM (Percentile Bootstrap) UCL	0.00936
95% KM (z) UCL	0.00928	95% KM Bootstrap t UCL	0.0094
90% KM Chebyshev UCL	0.0101	95% KM Chebyshev UCL	0.011
97.5% KM Chebyshev UCL	0.0122	99% KM Chebyshev UCL	0.0145

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.262	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.756	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.0675	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.117	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.462	k star (bias corrected MLE)	3.294
Theta hat (MLE)	0.00243	Theta star (bias corrected MLE)	0.00255
nu hat (MLE)	401.6	nu star (bias corrected)	382.1
Mean (detects)	0.00841		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.00183	Mean	0.00846
Maximum	0.0263	Median	0.00767
SD	0.00479	CV	0.566
k hat (MLE)	3.564	k star (bias corrected MLE)	3.397
Theta hat (MLE)	0.00237	Theta star (bias corrected MLE)	0.00249
nu hat (MLE)	427.7	nu star (bias corrected)	407.6
Adjusted Level of Significance (β)	0.046		
Approximate Chi Square Value (407.64, α)	361.8	Adjusted Chi Square Value (407.64, β)	360.8
95% Gamma Approximate UCL (use when n>=50)	0.00953	95% Gamma Adjusted UCL (use when n<50)	0.00956

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00824	SD (KM)	0.00483
Variance (KM)	2.3291E-5	SE of Mean (KM)	6.2885E-4
k hat (KM)	2.916	k star (KM)	2.781
nu hat (KM)	349.9	nu star (KM)	333.8
theta hat (KM)	0.00283	theta star (KM)	0.00296
80% gamma percentile (KM)	0.0119	90% gamma percentile (KM)	0.0149
95% gamma percentile (KM)	0.0177	99% gamma percentile (KM)	0.0238

ProUCL Output
Raleigh Creek - Upper
Total Surface Water

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (333.75, α)	292.4	Adjusted Chi Square Value (333.75, β)	291.5
95% Gamma Approximate KM-UCL (use when n>=50)	0.00941	95% Gamma Adjusted KM-UCL (use when n<50)	0.00944

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.986	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	0.906	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.0817	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.116	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00824	Mean in Log Scale	-4.955
SD in Original Scale	0.00486	SD in Log Scale	0.569
95% t UCL (assumes normality of ROS data)	0.00929	95% Percentile Bootstrap UCL	0.0093
95% BCA Bootstrap UCL	0.00935	95% Bootstrap t UCL	0.00949
95% H-UCL (Log ROS)	0.00957		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-4.957	KM Geo Mean	0.00704
KM SD (logged)	0.57	95% Critical H Value (KM-Log)	1.939
KM Standard Error of Mean (logged)	0.0745	95% H-UCL (KM -Log)	0.00956
KM SD (logged)	0.57	95% Critical H Value (KM-Log)	1.939
KM Standard Error of Mean (logged)	0.0745		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00821	Mean in Log Scale	-4.967
SD in Original Scale	0.0049	SD in Log Scale	0.59
95% t UCL (Assumes normality)	0.00927	95% H-Stat UCL	0.00963

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Approximate Gamma UCL	0.00941	95% GROS Approximate Gamma UCL	0.00953

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	60	Number of Distinct Observations	50
Number of Detects	59	Number of Non-Detects	1
Number of Distinct Detects	49	Number of Distinct Non-Detects	1
Minimum Detect	0.0028	Minimum Non-Detect	0.00572
Maximum Detect	0.0787	Maximum Non-Detect	0.00572
Variance Detects	3.2737E-4	Percent Non-Detects	1.667%
Mean Detects	0.0246	SD Detects	0.0181
Median Detects	0.0187	CV Detects	0.737
Skewness Detects	1.337	Kurtosis Detects	1.03
Mean of Logged Detects	-3.957	SD of Logged Detects	0.727

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.843	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	3.0199E-8	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.177	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.115	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0242	KM Standard Error of Mean	0.00234
KM SD	0.018	95% KM (BCA) UCL	0.0279
95% KM (t) UCL	0.0281	95% KM (Percentile Bootstrap) UCL	0.0282
95% KM (z) UCL	0.0281	95% KM Bootstrap t UCL	0.0287
90% KM Chebyshev UCL	0.0312	95% KM Chebyshev UCL	0.0344
97.5% KM Chebyshev UCL	0.0388	99% KM Chebyshev UCL	0.0475

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.714	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.762	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0939	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.117	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.153	k star (bias corrected MLE)	2.055
Theta hat (MLE)	0.0114	Theta star (bias corrected MLE)	0.0119
nu hat (MLE)	254.1	nu star (bias corrected)	242.5
Mean (detects)	0.0246		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0028	Mean	0.0243
Maximum	0.0787	Median	0.0182
SD	0.018	CV	0.742
k hat (MLE)	2.146	k star (bias corrected MLE)	2.05
Theta hat (MLE)	0.0113	Theta star (bias corrected MLE)	0.0119
nu hat (MLE)	257.6	nu star (bias corrected)	246
Adjusted Level of Significance (β)	0.046		
Approximate Chi Square Value (246.03, α)	210.7	Adjusted Chi Square Value (246.03, β)	209.9
95% Gamma Approximate UCL (use when n>=50)	0.0284	95% Gamma Adjusted UCL (use when n<50)	0.0285

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0242	SD (KM)	0.018
Variance (KM)	3.2312E-4	SE of Mean (KM)	0.00234
k hat (KM)	1.815	k star (KM)	1.735
nu hat (KM)	217.8	nu star (KM)	208.3
theta hat (KM)	0.0133	theta star (KM)	0.014
80% gamma percentile (KM)	0.0369	90% gamma percentile (KM)	0.0487
95% gamma percentile (KM)	0.0601	99% gamma percentile (KM)	0.0856

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (208.26, α)	175.9	Adjusted Chi Square Value (208.26, β)	175.1
95% Gamma Approximate KM-UCL (use when n>=50)	0.0287	95% Gamma Adjusted KM-UCL (use when n<50)	0.0288

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.978	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	0.596	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0628	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.115	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0242	Mean in Log Scale	-3.981
SD in Original Scale	0.0181	SD in Log Scale	0.745
95% t UCL (assumes normality of ROS data)	0.0281	95% Percentile Bootstrap UCL	0.0281
95% BCA Bootstrap UCL	0.0283	95% Bootstrap t UCL	0.0288
95% H-UCL (Log ROS)	0.0302		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-3.982	KM Geo Mean	0.0187
KM SD (logged)	0.742	95% Critical H Value (KM-Log)	2.08
KM Standard Error of Mean (logged)	0.0968	95% H-UCL (KM -Log)	0.03
KM SD (logged)	0.742	95% Critical H Value (KM-Log)	2.08
KM Standard Error of Mean (logged)	0.0968		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0242	Mean in Log Scale	-3.988
SD in Original Scale	0.0182	SD in Log Scale	0.762
95% t UCL (Assumes normality)	0.0281	95% H-Stat UCL	0.0305

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

ProUCL Output
Raleigh Creek - Upper
Total Surface Water

Suggested UCL to Use

95% KM Approximate Gamma UCL 0.0287 95% GROS Approximate Gamma UCL 0.0284

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFHxS|ug/L

General Statistics

Total Number of Observations	60	Number of Distinct Observations	58
Number of Detects	59	Number of Non-Detects	1
Number of Distinct Detects	57	Number of Distinct Non-Detects	1
Minimum Detect	0.0037	Minimum Non-Detect	0.00572
Maximum Detect	0.242	Maximum Non-Detect	0.00572
Variance Detects	0.00329	Percent Non-Detects	1.667%
Mean Detects	0.0733	SD Detects	0.0573
Median Detects	0.058	CV Detects	0.782
Skewness Detects	1.478	Kurtosis Detects	1.663
Mean of Logged Detects	-2.901	SD of Logged Detects	0.803

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.833	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	8.5182E-9	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.211	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.115	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0721	KM Standard Error of Mean	0.00743
KM SD	0.0571	95% KM (BCA) UCL	0.0849
95% KM (t) UCL	0.0845	95% KM (Percentile Bootstrap) UCL	0.084
95% KM (z) UCL	0.0843	95% KM Bootstrap t UCL	0.0864
90% KM Chebyshev UCL	0.0944	95% KM Chebyshev UCL	0.104
97.5% KM Chebyshev UCL	0.118	99% KM Chebyshev UCL	0.146

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.562	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.764	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.115	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.117	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.893	k star (bias corrected MLE)	1.808
Theta hat (MLE)	0.0387	Theta star (bias corrected MLE)	0.0405
nu hat (MLE)	223.4	nu star (bias corrected)	213.3
Mean (detects)	0.0733		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0037	Mean	0.0722
Maximum	0.242	Median	0.0563
SD	0.0574	CV	0.795
k hat (MLE)	1.811	k star (bias corrected MLE)	1.732
Theta hat (MLE)	0.0399	Theta star (bias corrected MLE)	0.0417
nu hat (MLE)	217.4	nu star (bias corrected)	207.8
Adjusted Level of Significance (β)	0.046		
Approximate Chi Square Value (207.84, α)	175.5	Adjusted Chi Square Value (207.84, β)	174.7
95% Gamma Approximate UCL (use when n>=50)	0.0855	95% Gamma Adjusted UCL (use when n<50)	0.0859

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0721	SD (KM)	0.0571
Variance (KM)	0.00326	SE of Mean (KM)	0.00743
k hat (KM)	1.597	k star (KM)	1.528
nu hat (KM)	191.6	nu star (KM)	183.4
theta hat (KM)	0.0451	theta star (KM)	0.0472
80% gamma percentile (KM)	0.111	90% gamma percentile (KM)	0.15
95% gamma percentile (KM)	0.187	99% gamma percentile (KM)	0.27

ProUCL Output
Raleigh Creek - Upper
Total Surface Water

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (183.39, α)	153.1	Adjusted Chi Square Value (183.39, β)	152.4
95% Gamma Approximate KM-UCL (use when n>=50)	0.0864	95% Gamma Adjusted KM-UCL (use when n<50)	0.0868

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.972	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	0.383	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.0701	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.115	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0722	Mean in Log Scale	-2.931
SD in Original Scale	0.0574	SD in Log Scale	0.831
95% t UCL (assumes normality of ROS data)	0.0846	95% Percentile Bootstrap UCL	0.0848
95% BCA Bootstrap UCL	0.0865	95% Bootstrap t UCL	0.0862
95% H-UCL (Log ROS)	0.0952		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.946	KM Geo Mean	0.0526
KM SD (logged)	0.862	95% Critical H Value (KM-Log)	2.193
KM Standard Error of Mean (logged)	0.112	95% H-UCL (KM -Log)	0.0975
KM SD (logged)	0.862	95% Critical H Value (KM-Log)	2.193
KM Standard Error of Mean (logged)	0.112		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0721	Mean in Log Scale	-2.95
SD in Original Scale	0.0576	SD in Log Scale	0.883
95% t UCL (Assumes normality)	0.0845	95% H-Stat UCL	0.0997

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Approximate Gamma UCL	0.0864	95% GROS Approximate Gamma UCL	0.0855

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOS|ug/L

General Statistics

Total Number of Observations	60	Number of Distinct Observations	57
		Number of Missing Observations	0
Minimum	0.0056	Mean	2.166
Maximum	8.81	Median	1.84
SD	1.545	Std. Error of Mean	0.199
Coefficient of Variation	0.713	Skewness	1.872

Normal GOF Test

Shapiro Wilk Test Statistic	0.858	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	1.5768E-7	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.158	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.114	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2.499	95% Adjusted-CLT UCL (Chen-1995)	2.546
		95% Modified-t UCL (Johnson-1978)	2.507

Gamma GOF Test

A-D Test Statistic	2.274	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.77	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.18	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.117	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

ProUCL Output
Raleigh Creek - Upper
Total Surface Water

Gamma Statistics

k hat (MLE)	1.455	k star (bias corrected MLE)	1.393
Theta hat (MLE)	1.489	Theta star (bias corrected MLE)	1.555
nu hat (MLE)	174.6	nu star (bias corrected)	167.2
MLE Mean (bias corrected)	2.166	MLE Sd (bias corrected)	1.835
		Approximate Chi Square Value (0.05)	138.3
Adjusted Level of Significance	0.046	Adjusted Chi Square Value	137.6

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	2.619	95% Adjusted Gamma UCL (use when n<50)	2.631

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.717	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk P Value	6.217E-15	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.259	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.114	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.185	Mean of logged Data	0.391
Maximum of Logged Data	2.176	SD of logged Data	1.249

Assuming Lognormal Distribution

95% H-UCL	5.134	90% Chebyshev (MVUE) UCL	5.087
95% Chebyshev (MVUE) UCL	5.961	97.5% Chebyshev (MVUE) UCL	7.174
99% Chebyshev (MVUE) UCL	9.558		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	2.494	95% Jackknife UCL	2.499
95% Standard Bootstrap UCL	2.49	95% Bootstrap-t UCL	2.577
95% Hall's Bootstrap UCL	2.601	95% Percentile Bootstrap UCL	2.506
95% BCA Bootstrap UCL	2.557		
90% Chebyshev(Mean, Sd) UCL	2.764	95% Chebyshev(Mean, Sd) UCL	3.035
97.5% Chebyshev(Mean, Sd) UCL	3.412	99% Chebyshev(Mean, Sd) UCL	4.151

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL 3.035

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFDS|ug/L

General Statistics

Total Number of Observations	60	Number of Distinct Observations	48
Number of Detects	15	Number of Non-Detects	45
Number of Distinct Detects	15	Number of Distinct Non-Detects	33
Minimum Detect	3.2000E-4	Minimum Non-Detect	3.6100E-4
Maximum Detect	0.00179	Maximum Non-Detect	0.00592
Variance Detects	2.2285E-7	Percent Non-Detects	75%
Mean Detects	7.5447E-4	SD Detects	4.7207E-4
Median Detects	6.4400E-4	CV Detects	0.626
Skewness Detects	1.502	Kurtosis Detects	1.427
Mean of Logged Detects	-7.339	SD of Logged Detects	0.543

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.787	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.881	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.278	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.22	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	5.4732E-4	KM Standard Error of Mean	5.5783E-5
KM SD	3.1673E-4	95% KM (BCA) UCL	6.4551E-4
95% KM (t) UCL	6.4054E-4	95% KM (Percentile Bootstrap) UCL	6.4373E-4
95% KM (z) UCL	6.3907E-4	95% KM Bootstrap t UCL	6.5666E-4
90% KM Chebyshev UCL	7.1467E-4	95% KM Chebyshev UCL	7.9047E-4
97.5% KM Chebyshev UCL	8.9568E-4	99% KM Chebyshev UCL	0.0011

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.701	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.742	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.215	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.223	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.499	k star (bias corrected MLE)	2.844
Theta hat (MLE)	2.1563E-4	Theta star (bias corrected MLE)	2.6532E-4
nu hat (MLE)	105	nu star (bias corrected)	85.31
Mean (detects)	7.5447E-4		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	3.2000E-4	Mean	0.00769
Maximum	0.01	Median	0.01
SD	0.00404	CV	0.526
k hat (MLE)	1.331	k star (bias corrected MLE)	1.275
Theta hat (MLE)	0.00578	Theta star (bias corrected MLE)	0.00603
nu hat (MLE)	159.7	nu star (bias corrected)	153
Adjusted Level of Significance (β)	0.046		
Approximate Chi Square Value (153.03, α)	125.4	Adjusted Chi Square Value (153.03, β)	124.8
95% Gamma Approximate UCL (use when n>=50)	0.00938	95% Gamma Adjusted UCL (use when n<50)	0.00943

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	5.4732E-4	SD (KM)	3.1673E-4
Variance (KM)	1.0032E-7	SE of Mean (KM)	5.5783E-5
k hat (KM)	2.986	k star (KM)	2.848
nu hat (KM)	358.3	nu star (KM)	341.7
theta hat (KM)	1.8329E-4	theta star (KM)	1.9218E-4
80% gamma percentile (KM)	7.8554E-4	90% gamma percentile (KM)	9.8210E-4
95% gamma percentile (KM)	0.00117	99% gamma percentile (KM)	0.00157

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (341.75, α)	299.9	Adjusted Chi Square Value (341.75, β)	299
95% Gamma Approximate KM-UCL (use when n>=50)	6.2366E-4	95% Gamma Adjusted KM-UCL (use when n<50)	6.2566E-4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.913	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.177	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	5.1556E-4	Mean in Log Scale	-7.657
SD in Original Scale	2.8146E-4	SD in Log Scale	0.38
95% t UCL (assumes normality of ROS data)	5.7628E-4	95% Percentile Bootstrap UCL	5.7877E-4
95% BCA Bootstrap UCL	6.0136E-4	95% Bootstrap t UCL	6.1058E-4
95% H-UCL (Log ROS)	5.5478E-4		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-7.62	KM Geo Mean	4.9037E-4
KM SD (logged)	0.431	95% Critical H Value (KM-Log)	1.851
KM Standard Error of Mean (logged)	0.0886	95% H-UCL (KM -Log)	5.9690E-4
KM SD (logged)	0.431	95% Critical H Value (KM-Log)	1.851
KM Standard Error of Mean (logged)	0.0886		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	8.8093E-4	Mean in Log Scale	-7.403
SD in Original Scale	8.4373E-4	SD in Log Scale	0.817
95% t UCL (Assumes normality)	0.00106	95% H-Stat UCL	0.00107

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Approximate Gamma UCL 6.24E-04 95% GROS Approximate Gamma UCL 0.00938

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOSA|ug/L

General Statistics

Total Number of Observations	60	Number of Distinct Observations	58
Number of Detects	56	Number of Non-Detects	4
Number of Distinct Detects	54	Number of Distinct Non-Detects	4
Minimum Detect	6.3000E-4	Minimum Non-Detect	0.0039
Maximum Detect	0.123	Maximum Non-Detect	0.00572
Variance Detects	4.7165E-4	Percent Non-Detects	6.667%
Mean Detects	0.0287	SD Detects	0.0217
Median Detects	0.0244	CV Detects	0.757
Skewness Detects	1.836	Kurtosis Detects	5.423
Mean of Logged Detects	-3.861	SD of Logged Detects	0.913

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.868	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	1.8293E-6	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.153	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.118	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0268	KM Standard Error of Mean	0.00285
KM SD	0.0219	95% KM (BCA) UCL	0.0314
95% KM (t) UCL	0.0316	95% KM (Percentile Bootstrap) UCL	0.0318
95% KM (z) UCL	0.0315	95% KM Bootstrap t UCL	0.0326
90% KM Chebyshev UCL	0.0354	95% KM Chebyshev UCL	0.0393
97.5% KM Chebyshev UCL	0.0447	99% KM Chebyshev UCL	0.0552

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.22	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.765	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.06	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.121	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.767	k star (bias corrected MLE)	1.684
Theta hat (MLE)	0.0162	Theta star (bias corrected MLE)	0.017
nu hat (MLE)	197.9	nu star (bias corrected)	188.6
Mean (detects)	0.0287		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	6.3000E-4	Mean	0.0274
Maximum	0.123	Median	0.0236
SD	0.0215	CV	0.783
k hat (MLE)	1.74	k star (bias corrected MLE)	1.664
Theta hat (MLE)	0.0158	Theta star (bias corrected MLE)	0.0165
nu hat (MLE)	208.8	nu star (bias corrected)	199.7
Adjusted Level of Significance (β)	0.046		
Approximate Chi Square Value (199.66, α)	168	Adjusted Chi Square Value (199.66, β)	167.3
95% Gamma Approximate UCL (use when n>=50)	0.0326	95% Gamma Adjusted UCL (use when n<50)	0.0327

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0268	SD (KM)	0.0219
Variance (KM)	4.7926E-4	SE of Mean (KM)	0.00285
k hat (KM)	1.504	k star (KM)	1.44
nu hat (KM)	180.4	nu star (KM)	172.8
theta hat (KM)	0.0179	theta star (KM)	0.0186
80% gamma percentile (KM)	0.0417	90% gamma percentile (KM)	0.0565
95% gamma percentile (KM)	0.0709	99% gamma percentile (KM)	0.103

ProUCL Output
Raleigh Creek - Upper
Total Surface Water

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (172.75, α)	143.4	Adjusted Chi Square Value (172.75, β)	142.7
95% Gamma Approximate KM-UCL (use when n>=50)	0.0323	95% Gamma Adjusted KM-UCL (use when n<50)	0.0325

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.922	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	0.00138	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.114	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.118	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.027	Mean in Log Scale	-3.977
SD in Original Scale	0.0219	SD in Log Scale	0.984
95% t UCL (assumes normality of ROS data)	0.0317	95% Percentile Bootstrap UCL	0.0318
95% BCA Bootstrap UCL	0.0324	95% Bootstrap t UCL	0.0327
95% H-UCL (Log ROS)	0.041		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-4.061	KM Geo Mean	0.0172
KM SD (logged)	1.16	95% Critical H Value (KM-Log)	2.643
KM Standard Error of Mean (logged)	0.153	95% H-UCL (KM -Log)	0.0503
KM SD (logged)	1.16	95% Critical H Value (KM-Log)	2.643
KM Standard Error of Mean (logged)	0.153		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0269	Mean in Log Scale	-4.009
SD in Original Scale	0.022	SD in Log Scale	1.045
95% t UCL (Assumes normality)	0.0317	95% H-Stat UCL	0.0436

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Approximate Gamma UCL	0.0323	95% GROS Approximate Gamma UCL	0.0326

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

N-EtFOSAA|ug/L

General Statistics

Total Number of Observations	60	Number of Distinct Observations	57
Number of Detects	55	Number of Non-Detects	5
Number of Distinct Detects	52	Number of Distinct Non-Detects	5
Minimum Detect	0.0015	Minimum Non-Detect	0.0039
Maximum Detect	0.478	Maximum Non-Detect	0.00572
Variance Detects	0.00552	Percent Non-Detects	8.333%
Mean Detects	0.0434	SD Detects	0.0743
Median Detects	0.0161	CV Detects	1.713
Skewness Detects	4.248	Kurtosis Detects	22.18
Mean of Logged Detects	-3.924	SD of Logged Detects	1.249

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.54	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.287	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.119	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.04	KM Standard Error of Mean	0.00931
KM SD	0.0714	95% KM (BCA) UCL	0.0575
95% KM (t) UCL	0.0555	95% KM (Percentile Bootstrap) UCL	0.0573
95% KM (z) UCL	0.0553	95% KM Bootstrap t UCL	0.0684
90% KM Chebyshev UCL	0.0679	95% KM Chebyshev UCL	0.0805
97.5% KM Chebyshev UCL	0.0981	99% KM Chebyshev UCL	0.133

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.797	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.792	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.171	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.125	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.76	k star (bias corrected MLE)	0.731
Theta hat (MLE)	0.0571	Theta star (bias corrected MLE)	0.0594
nu hat (MLE)	83.61	nu star (bias corrected)	80.38
Mean (detects)	0.0434		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0015	Mean	0.0406
Maximum	0.478	Median	0.0154
SD	0.0717	CV	1.766
k hat (MLE)	0.768	k star (bias corrected MLE)	0.741
Theta hat (MLE)	0.0528	Theta star (bias corrected MLE)	0.0548
nu hat (MLE)	92.19	nu star (bias corrected)	88.92
Adjusted Level of Significance (β)	0.046		
Approximate Chi Square Value (88.92, α)	68.18	Adjusted Chi Square Value (88.92, β)	67.73
95% Gamma Approximate UCL (use when n>=50)	0.053	95% Gamma Adjusted UCL (use when n<50)	0.0533

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.04	SD (KM)	0.0714
Variance (KM)	0.0051	SE of Mean (KM)	0.00931
k hat (KM)	0.313	k star (KM)	0.309
nu hat (KM)	37.57	nu star (KM)	37.03
theta hat (KM)	0.128	theta star (KM)	0.13
80% gamma percentile (KM)	0.0617	90% gamma percentile (KM)	0.117
95% gamma percentile (KM)	0.181	99% gamma percentile (KM)	0.346

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (37.03, α)	24.1	Adjusted Chi Square Value (37.03, β)	23.84
95% Gamma Approximate KM-UCL (use when n>=50)	0.0614	95% Gamma Adjusted KM-UCL (use when n<50)	0.0621

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.974	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	0.466	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.08	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.119	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.04	Mean in Log Scale	-4.093
SD in Original Scale	0.072	SD in Log Scale	1.322
95% t UCL (assumes normality of ROS data)	0.0555	95% Percentile Bootstrap UCL	0.0564
95% BCA Bootstrap UCL	0.0621	95% Bootstrap t UCL	0.0678
95% H-UCL (Log ROS)	0.0667		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-4.107	KM Geo Mean	0.0165
KM SD (logged)	1.336	95% Critical H Value (KM-Log)	2.988
KM Standard Error of Mean (logged)	0.175	95% H-UCL (KM -Log)	0.0675
KM SD (logged)	1.336	95% Critical H Value (KM-Log)	2.988
KM Standard Error of Mean (logged)	0.175		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.04	Mean in Log Scale	-4.105
SD in Original Scale	0.072	SD in Log Scale	1.341
95% t UCL (Assumes normality)	0.0555	95% H-Stat UCL	0.0684

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL 0.0675

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

N-MeFOSAA|ug/L

General Statistics

Total Number of Observations	60	Number of Distinct Observations	43
Number of Detects	5	Number of Non-Detects	55
Number of Distinct Detects	5	Number of Distinct Non-Detects	38
Minimum Detect	4.1700E-4	Minimum Non-Detect	3.6100E-4
Maximum Detect	0.00124	Maximum Non-Detect	0.00592
Variance Detects	1.1482E-7	Percent Non-Detects	91.67%
Mean Detects	6.5860E-4	SD Detects	3.3885E-4
Median Detects	5.6600E-4	CV Detects	0.515
Skewness Detects	1.81	Kurtosis Detects	3.441
Mean of Logged Detects	-7.412	SD of Logged Detects	0.443

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.783	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.317	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	4.3645E-4	KM Standard Error of Mean	3.7864E-5
KM SD	1.5696E-4	95% KM (BCA) UCL	5.0122E-4
95% KM (t) UCL	4.9973E-4	95% KM (Percentile Bootstrap) UCL	5.0274E-4
95% KM (z) UCL	4.9873E-4	95% KM Bootstrap t UCL	4.8492E-4
90% KM Chebyshev UCL	5.5005E-4	95% KM Chebyshev UCL	6.0150E-4
97.5% KM Chebyshev UCL	6.7292E-4	99% KM Chebyshev UCL	8.1320E-4

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.488	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.68	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.267	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.358	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	5.923	k star (bias corrected MLE)	2.503
Theta hat (MLE)	1.1119E-4	Theta star (bias corrected MLE)	2.6316E-4
nu hat (MLE)	59.23	nu star (bias corrected)	25.03
Mean (detects)	6.5860E-4		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	4.1700E-4	Mean	0.00922
Maximum	0.01	Median	0.01
SD	0.00261	CV	0.283
k hat (MLE)	3.428	k star (bias corrected MLE)	3.268
Theta hat (MLE)	0.00269	Theta star (bias corrected MLE)	0.00282
nu hat (MLE)	411.4	nu star (bias corrected)	392.2
Adjusted Level of Significance (β)	0.046		
Approximate Chi Square Value (392.16, α)	347.3	Adjusted Chi Square Value (392.16, β)	346.2
95% Gamma Approximate UCL (use when n>=50)	0.0104	95% Gamma Adjusted UCL (use when n<50)	0.0104

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	4.3645E-4	SD (KM)	1.5696E-4
Variance (KM)	2.4635E-8	SE of Mean (KM)	3.7864E-5
k hat (KM)	7.732	k star (KM)	7.357
nu hat (KM)	927.9	nu star (KM)	882.8
theta hat (KM)	5.6444E-5	theta star (KM)	5.9325E-5
80% gamma percentile (KM)	5.6298E-4	90% gamma percentile (KM)	6.5116E-4
95% gamma percentile (KM)	7.3035E-4	99% gamma percentile (KM)	8.9487E-4

ProUCL Output
Raleigh Creek - Upper
Total Surface Water

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (882.83, α)	814.9	Adjusted Chi Square Value (882.83, β)	813.3
95% Gamma Approximate KM-UCL (use when n>=50)	4.7285E-4	95% Gamma Adjusted KM-UCL (use when n<50)	4.7378E-4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.865	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.242	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	3.1497E-4	Mean in Log Scale	-8.136
SD in Original Scale	1.5564E-4	SD in Log Scale	0.353
95% t UCL (assumes normality of ROS data)	3.4855E-4	95% Percentile Bootstrap UCL	3.4882E-4
95% BCA Bootstrap UCL	3.6355E-4	95% Bootstrap t UCL	3.7117E-4
95% H-UCL (Log ROS)	3.3760E-4		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-7.778	KM Geo Mean	4.1892E-4
KM SD (logged)	0.259	95% Critical H Value (KM-Log)	1.71
KM Standard Error of Mean (logged)	0.0711	95% H-UCL (KM -Log)	4.5885E-4
KM SD (logged)	0.259	95% Critical H Value (KM-Log)	1.71
KM Standard Error of Mean (logged)	0.0711		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	9.7528E-4	Mean in Log Scale	-7.362
SD in Original Scale	9.1883E-4	SD in Log Scale	0.918
95% t UCL (Assumes normality)	0.00117	95% H-Stat UCL	0.00127

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	5.00E-04

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFPeS|ug/L

General Statistics

Total Number of Observations	60	Number of Distinct Observations	56
Number of Detects	59	Number of Non-Detects	1
Number of Distinct Detects	55	Number of Distinct Non-Detects	1
Minimum Detect	0.0017	Minimum Non-Detect	0.00572
Maximum Detect	0.0995	Maximum Non-Detect	0.00572
Variance Detects	5.5792E-4	Percent Non-Detects	1.667%
Mean Detects	0.0289	SD Detects	0.0236
Median Detects	0.021	CV Detects	0.816
Skewness Detects	1.358	Kurtosis Detects	1.261
Mean of Logged Detects	-3.881	SD of Logged Detects	0.889

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.85	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	7.2031E-8	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.172	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.115	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0285	KM Standard Error of Mean	0.00305
KM SD	0.0234	95% KM (BCA) UCL	0.0338
95% KM (t) UCL	0.0336	95% KM (Percentile Bootstrap) UCL	0.0334
95% KM (z) UCL	0.0335	95% KM Bootstrap t UCL	0.0344
90% KM Chebyshev UCL	0.0377	95% KM Chebyshev UCL	0.0418
97.5% KM Chebyshev UCL	0.0476	99% KM Chebyshev UCL	0.0589

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.305	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.767	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.0774	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.118	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.624	k star (bias corrected MLE)	1.552
Theta hat (MLE)	0.0178	Theta star (bias corrected MLE)	0.0186
nu hat (MLE)	191.6	nu star (bias corrected)	183.2
Mean (detects)	0.0289		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0017	Mean	0.0286
Maximum	0.0995	Median	0.021
SD	0.0235	CV	0.823
k hat (MLE)	1.619	k star (bias corrected MLE)	1.549
Theta hat (MLE)	0.0177	Theta star (bias corrected MLE)	0.0185
nu hat (MLE)	194.3	nu star (bias corrected)	185.9
Adjusted Level of Significance (β)	0.046		
Approximate Chi Square Value (185.88, α)	155.3	Adjusted Chi Square Value (185.88, β)	154.7
95% Gamma Approximate UCL (use when n>=50)	0.0342	95% Gamma Adjusted UCL (use when n<50)	0.0344

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0285	SD (KM)	0.0234
Variance (KM)	5.4969E-4	SE of Mean (KM)	0.00305
k hat (KM)	1.479	k star (KM)	1.416
nu hat (KM)	177.5	nu star (KM)	169.9
theta hat (KM)	0.0193	theta star (KM)	0.0201
80% gamma percentile (KM)	0.0444	90% gamma percentile (KM)	0.0603
95% gamma percentile (KM)	0.0757	99% gamma percentile (KM)	0.111

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (169.91, α)	140.8	Adjusted Chi Square Value (169.91, β)	140.1
95% Gamma Approximate KM-UCL (use when n>=50)	0.0344	95% Gamma Adjusted KM-UCL (use when n<50)	0.0346

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.97	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	0.316	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.0736	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.115	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0285	Mean in Log Scale	-3.907
SD in Original Scale	0.0236	SD in Log Scale	0.904
95% t UCL (assumes normality of ROS data)	0.0336	95% Percentile Bootstrap UCL	0.0335
95% BCA Bootstrap UCL	0.0341	95% Bootstrap t UCL	0.0342
95% H-UCL (Log ROS)	0.0393		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-3.911	KM Geo Mean	0.02
KM SD (logged)	0.906	95% Critical H Value (KM-Log)	2.238
KM Standard Error of Mean (logged)	0.118	95% H-UCL (KM -Log)	0.0393
KM SD (logged)	0.906	95% Critical H Value (KM-Log)	2.238
KM Standard Error of Mean (logged)	0.118		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0285	Mean in Log Scale	-3.914
SD in Original Scale	0.0237	SD in Log Scale	0.918
95% t UCL (Assumes normality)	0.0336	95% H-Stat UCL	0.0398

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

ProUCL Output
Raleigh Creek - Upper
Total Surface Water

Suggested UCL to Use

95% KM Approximate Gamma UCL	0.0344	95% GROS Approximate Gamma UCL	0.0342

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFHpS|ug/L

General Statistics

Total Number of Observations	60	Number of Distinct Observations	58
Number of Detects	58	Number of Non-Detects	2
Number of Distinct Detects	56	Number of Distinct Non-Detects	2
Minimum Detect	0.003	Minimum Non-Detect	0.0039
Maximum Detect	0.11	Maximum Non-Detect	0.00572
Variance Detects	5.7106E-4	Percent Non-Detects	3.333%
Mean Detects	0.029	SD Detects	0.0239
Median Detects	0.0222	CV Detects	0.823
Skewness Detects	1.971	Kurtosis Detects	3.767
Mean of Logged Detects	-3.81	SD of Logged Detects	0.748

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.772	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	1.130E-11	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.222	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.116	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0282	KM Standard Error of Mean	0.00309
KM SD	0.0237	95% KM (BCA) UCL	0.0337
95% KM (t) UCL	0.0334	95% KM (Percentile Bootstrap) UCL	0.0335
95% KM (z) UCL	0.0333	95% KM Bootstrap t UCL	0.035
90% KM Chebyshev UCL	0.0375	95% KM Chebyshev UCL	0.0417
97.5% KM Chebyshev UCL	0.0475	99% KM Chebyshev UCL	0.0589

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.924	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.763	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.126	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.118	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.994	k star (bias corrected MLE)	1.902
Theta hat (MLE)	0.0146	Theta star (bias corrected MLE)	0.0153
nu hat (MLE)	231.3	nu star (bias corrected)	220.7
Mean (detects)	0.029		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.003	Mean	0.0284
Maximum	0.11	Median	0.0221
SD	0.0237	CV	0.836
k hat (MLE)	1.964	k star (bias corrected MLE)	1.877
Theta hat (MLE)	0.0145	Theta star (bias corrected MLE)	0.0151
nu hat (MLE)	235.7	nu star (bias corrected)	225.3
Adjusted Level of Significance (β)	0.046		
Approximate Chi Square Value (225.26, α)	191.5	Adjusted Chi Square Value (225.26, β)	190.8
95% Gamma Approximate UCL (use when n>=50)	0.0334	95% Gamma Adjusted UCL (use when n<50)	0.0335

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0282	SD (KM)	0.0237
Variance (KM)	5.6336E-4	SE of Mean (KM)	0.00309
k hat (KM)	1.411	k star (KM)	1.351
nu hat (KM)	169.3	nu star (KM)	162.2
theta hat (KM)	0.02	theta star (KM)	0.0209
80% gamma percentile (KM)	0.0441	90% gamma percentile (KM)	0.0603
95% gamma percentile (KM)	0.0761	99% gamma percentile (KM)	0.112

ProUCL Output
Raleigh Creek - Upper
Total Surface Water

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (162.16, α)	133.7	Adjusted Chi Square Value (162.16, β)	133.1
95% Gamma Approximate KM-UCL (use when n>=50)	0.0342	95% Gamma Adjusted KM-UCL (use when n<50)	0.0344

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.977	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	0.566	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.0944	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.116	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0282	Mean in Log Scale	-3.863
SD in Original Scale	0.0239	SD in Log Scale	0.79
95% t UCL (assumes normality of ROS data)	0.0334	95% Percentile Bootstrap UCL	0.0337
95% BCA Bootstrap UCL	0.0342	95% Bootstrap t UCL	0.0345
95% H-UCL (Log ROS)	0.0357		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-3.872	KM Geo Mean	0.0208
KM SD (logged)	0.802	95% Critical H Value (KM-Log)	2.136
KM Standard Error of Mean (logged)	0.105	95% H-UCL (KM -Log)	0.0359
KM SD (logged)	0.802	95% Critical H Value (KM-Log)	2.136
KM Standard Error of Mean (logged)	0.105		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0282	Mean in Log Scale	-3.885
SD in Original Scale	0.024	SD in Log Scale	0.84
95% t UCL (Assumes normality)	0.0333	95% H-Stat UCL	0.0371

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	0.0359

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	60	Number of Distinct Observations	43
Number of Detects	5	Number of Non-Detects	55
Number of Distinct Detects	5	Number of Distinct Non-Detects	38
Minimum Detect	4.0300E-4	Minimum Non-Detect	3.6100E-4
Maximum Detect	8.4700E-4	Maximum Non-Detect	0.00592
Variance Detects	3.2864E-8	Percent Non-Detects	91.67%
Mean Detects	5.2760E-4	SD Detects	1.8128E-4
Median Detects	4.7300E-4	CV Detects	0.344
Skewness Detects	2.068	Kurtosis Detects	4.429
Mean of Logged Detects	-7.586	SD of Logged Detects	0.295

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.714	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.401	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	4.0391E-4	KM Standard Error of Mean	1.9598E-5
KM SD	8.4148E-5	95% KM (BCA) UCL	4.4049E-4
95% KM (t) UCL	4.3666E-4	95% KM (Percentile Bootstrap) UCL	4.3506E-4
95% KM (z) UCL	4.3614E-4	95% KM Bootstrap t UCL	4.2661E-4
90% KM Chebyshev UCL	4.6270E-4	95% KM Chebyshev UCL	4.8933E-4
97.5% KM Chebyshev UCL	5.2630E-4	99% KM Chebyshev UCL	5.9890E-4

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.743	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.679	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.394	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.357	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	13.11	k star (bias corrected MLE)	5.379
Theta hat (MLE)	4.0230E-5	Theta star (bias corrected MLE)	9.8082E-5
nu hat (MLE)	131.1	nu star (bias corrected)	53.79
Mean (detects)	5.2760E-4		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	4.0300E-4	Mean	0.00921
Maximum	0.01	Median	0.01
SD	0.00264	CV	0.287
k hat (MLE)	3.166	k star (bias corrected MLE)	3.019
Theta hat (MLE)	0.00291	Theta star (bias corrected MLE)	0.00305
nu hat (MLE)	379.9	nu star (bias corrected)	362.3
Adjusted Level of Significance (β)	0.046		
Approximate Chi Square Value (362.27, α)	319.2	Adjusted Chi Square Value (362.27, β)	318.2
95% Gamma Approximate UCL (use when n>=50)	0.0105	95% Gamma Adjusted UCL (use when n<50)	0.0105

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	4.0391E-4	SD (KM)	8.4148E-5
Variance (KM)	7.0808E-9	SE of Mean (KM)	1.9598E-5
k hat (KM)	23.04	k star (KM)	21.9
nu hat (KM)	2765	nu star (KM)	2628
theta hat (KM)	1.7531E-5	theta star (KM)	1.8444E-5
80% gamma percentile (KM)	4.7418E-4	90% gamma percentile (KM)	5.1771E-4
95% gamma percentile (KM)	5.5557E-4	99% gamma percentile (KM)	6.3132E-4

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (N/A, α)	2510	Adjusted Chi Square Value (N/A, β)	2507
95% Gamma Approximate KM-UCL (use when n>=50)	4.2291E-4	95% Gamma Adjusted KM-UCL (use when n<50)	4.2339E-4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.773	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.372	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data Not Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	3.2601E-4	Mean in Log Scale	-8.058
SD in Original Scale	9.2930E-5	SD in Log Scale	0.231
95% t UCL (assumes normality of ROS data)	3.4606E-4	95% Percentile Bootstrap UCL	3.4726E-4
95% BCA Bootstrap UCL	3.5156E-4	95% Bootstrap t UCL	3.5251E-4
95% H-UCL (Log ROS)	3.4235E-4		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-7.83	KM Geo Mean	3.9769E-4
KM SD (logged)	0.163	95% Critical H Value (KM-Log)	1.72
KM Standard Error of Mean (logged)	0.0423	95% H-UCL (KM -Log)	4.1804E-4
KM SD (logged)	0.163	95% Critical H Value (KM-Log)	1.72
KM Standard Error of Mean (logged)	0.0423		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	9.6431E-4	Mean in Log Scale	-7.377
SD in Original Scale	9.2041E-4	SD in Log Scale	0.916
95% t UCL (Assumes normality)	0.00116	95% H-Stat UCL	0.00124

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

ProUCL Output
Raleigh Creek - Upper
Total Surface Water

Suggested UCL to Use

KM Student's t 4.34E-04 KM H-UCL 4.1804E-4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFNS|ug/L

General Statistics

Total Number of Observations	60	Number of Distinct Observations	48
Number of Detects	23	Number of Non-Detects	37
Number of Distinct Detects	20	Number of Distinct Non-Detects	29
Minimum Detect	3.8000E-4	Minimum Non-Detect	3.6700E-4
Maximum Detect	0.0037	Maximum Non-Detect	0.00592
Variance Detects	5.5783E-7	Percent Non-Detects	61.67%
Mean Detects	0.00126	SD Detects	7.4688E-4
Median Detects	0.0011	CV Detects	0.593
Skewness Detects	2.159	Kurtosis Detects	5.115
Mean of Logged Detects	-6.804	SD of Logged Detects	0.495

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.751	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.914	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.304	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.18	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	8.0494E-4	KM Standard Error of Mean	9.6733E-5
KM SD	6.5763E-4	95% KM (BCA) UCL	9.8255E-4
95% KM (t) UCL	9.6659E-4	95% KM (Percentile Bootstrap) UCL	9.7368E-4
95% KM (z) UCL	9.6405E-4	95% KM Bootstrap t UCL	0.00102
90% KM Chebyshev UCL	0.0011	95% KM Chebyshev UCL	0.00123
97.5% KM Chebyshev UCL	0.00141	99% KM Chebyshev UCL	0.00177

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.115	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.749	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.235	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.182	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.116	k star (bias corrected MLE)	3.608
Theta hat (MLE)	3.0596E-4	Theta star (bias corrected MLE)	3.4902E-4
nu hat (MLE)	189.3	nu star (bias corrected)	166
Mean (detects)	0.00126		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	3.8000E-4	Mean	0.00665
Maximum	0.01	Median	0.01
SD	0.00431	CV	0.648
k hat (MLE)	1.292	k star (bias corrected MLE)	1.238
Theta hat (MLE)	0.00515	Theta star (bias corrected MLE)	0.00537
nu hat (MLE)	155	nu star (bias corrected)	148.6
Adjusted Level of Significance (β)	0.046		
Approximate Chi Square Value (148.57, α)	121.4	Adjusted Chi Square Value (148.57, β)	120.8
95% Gamma Approximate UCL (use when n>=50)	0.00814	95% Gamma Adjusted UCL (use when n<50)	0.00818

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	8.0494E-4	SD (KM)	6.5763E-4
Variance (KM)	4.3248E-7	SE of Mean (KM)	9.6733E-5
k hat (KM)	1.498	k star (KM)	1.434
nu hat (KM)	179.8	nu star (KM)	172.1
theta hat (KM)	5.3729E-4	theta star (KM)	5.6119E-4
80% gamma percentile (KM)	0.00125	90% gamma percentile (KM)	0.0017
95% gamma percentile (KM)	0.00213	99% gamma percentile (KM)	0.00311

ProUCL Output
Raleigh Creek - Upper
Total Surface Water

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (172.12, α)	142.8	Adjusted Chi Square Value (172.12, β)	142.1
95% Gamma Approximate KM-UCL (use when n>=50)	9.7034E-4	95% Gamma Adjusted KM-UCL (use when n<50)	9.7481E-4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.93	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.914	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.201	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.18	Detected Data Not Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	7.4935E-4	Mean in Log Scale	-7.413
SD in Original Scale	6.1981E-4	SD in Log Scale	0.618
95% t UCL (assumes normality of ROS data)	8.8307E-4	95% Percentile Bootstrap UCL	8.8584E-4
95% BCA Bootstrap UCL	9.1105E-4	95% Bootstrap t UCL	9.4767E-4
95% H-UCL (Log ROS)	8.5582E-4		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-7.347	KM Geo Mean	6.4436E-4
KM SD (logged)	0.62	95% Critical H Value (KM-Log)	1.977
KM Standard Error of Mean (logged)	0.0954	95% H-UCL (KM -Log)	9.1591E-4
KM SD (logged)	0.62	95% Critical H Value (KM-Log)	1.977
KM Standard Error of Mean (logged)	0.0954		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00107	Mean in Log Scale	-7.17
SD in Original Scale	8.9965E-4	SD in Log Scale	0.825
95% t UCL (Assumes normality)	0.00127	95% H-Stat UCL	0.00136

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM Student's t	7.6365E-4	KM H-UCL	9.16E-04

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

6:2 FTS|ug/L

General Statistics

Total Number of Observations	60	Number of Distinct Observations	41
Number of Detects	8	Number of Non-Detects	52
Number of Distinct Detects	8	Number of Distinct Non-Detects	34
Minimum Detect	9.0000E-4	Minimum Non-Detect	0.00131
Maximum Detect	0.027	Maximum Non-Detect	0.0213
Variance Detects	9.3643E-5	Percent Non-Detects	86.67%
Mean Detects	0.00949	SD Detects	0.00968
Median Detects	0.00512	CV Detects	1.02
Skewness Detects	1.279	Kurtosis Detects	0.13
Mean of Logged Detects	-5.143	SD of Logged Detects	1.106

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.796	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.273	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00212	KM Standard Error of Mean	6.1623E-4
KM SD	0.00442	95% KM (BCA) UCL	0.00365
95% KM (t) UCL	0.00315	95% KM (Percentile Bootstrap) UCL	0.00335
95% KM (z) UCL	0.00314	95% KM Bootstrap t UCL	0.00441
90% KM Chebyshev UCL	0.00397	95% KM Chebyshev UCL	0.00481
97.5% KM Chebyshev UCL	0.00597	99% KM Chebyshev UCL	0.00825

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.366	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.733	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.188	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.301	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.169	k star (bias corrected MLE)	0.814
Theta hat (MLE)	0.00812	Theta star (bias corrected MLE)	0.0117
nu hat (MLE)	18.7	nu star (bias corrected)	13.02
Mean (detects)	0.00949		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	9.0000E-4	Mean	0.00993
Maximum	0.027	Median	0.01
SD	0.00334	CV	0.336
k hat (MLE)	7.871	k star (bias corrected MLE)	7.488
Theta hat (MLE)	0.00126	Theta star (bias corrected MLE)	0.00133
nu hat (MLE)	944.5	nu star (bias corrected)	898.6
Adjusted Level of Significance (β)	0.046		
Approximate Chi Square Value (898.62, α)	830	Adjusted Chi Square Value (898.62, β)	828.4
95% Gamma Approximate UCL (use when n>=50)	0.0108	95% Gamma Adjusted UCL (use when n<50)	0.0108

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00212	SD (KM)	0.00442
Variance (KM)	1.9580E-5	SE of Mean (KM)	6.1623E-4
k hat (KM)	0.23	k star (KM)	0.23
nu hat (KM)	27.59	nu star (KM)	27.54
theta hat (KM)	0.00923	theta star (KM)	0.00924
80% gamma percentile (KM)	0.00298	90% gamma percentile (KM)	0.0064
95% gamma percentile (KM)	0.0105	99% gamma percentile (KM)	0.0217

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (27.54, α)	16.57	Adjusted Chi Square Value (27.54, β)	16.36
95% Gamma Approximate KM-UCL (use when n>=50)	0.00353	95% Gamma Adjusted KM-UCL (use when n<50)	0.00357

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.954	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.168	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0019	Mean in Log Scale	-7.06
SD in Original Scale	0.0045	SD in Log Scale	0.975
95% t UCL (assumes normality of ROS data)	0.00287	95% Percentile Bootstrap UCL	0.00294
95% BCA Bootstrap UCL	0.0033	95% Bootstrap t UCL	0.00485
95% H-UCL (Log ROS)	0.00186		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-6.729	KM Geo Mean	0.0012
KM SD (logged)	0.763	95% Critical H Value (KM-Log)	2.099
KM Standard Error of Mean (logged)	0.111	95% H-UCL (KM -Log)	0.00197
KM SD (logged)	0.763	95% Critical H Value (KM-Log)	2.099
KM Standard Error of Mean (logged)	0.111		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00334	Mean in Log Scale	-6.191
SD in Original Scale	0.00483	SD in Log Scale	0.851
95% t UCL (Assumes normality)	0.00438	95% H-Stat UCL	0.00374

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

ProUCL Output
Raleigh Creek - Upper
Total Surface Water

Suggested UCL to Use

95% KM (t) UCL 0.00315

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Raleigh Creek - Other
Total Surface Water

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/26/2021 11:31:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

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General Statistics

Total Number of Observations	42	Number of Distinct Observations	39
		Number of Missing Observations	3
Minimum	0.0386	Mean	0.0943
Maximum	0.332	Median	0.0869
SD	0.0456	Std. Error of Mean	0.00704
Coefficient of Variation	0.484	Skewness	3.896

Normal GOF Test

Shapiro Wilk Test Statistic	0.565	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.942	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.321	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.135	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.106	95% Adjusted-CLT UCL (Chen-1995)	0.11
		95% Modified-t UCL (Johnson-1978)	0.107

Gamma GOF Test

A-D Test Statistic	4.108	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.75	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.265	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.137	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	7.585	k star (bias corrected MLE)	7.059
Theta hat (MLE)	0.0124	Theta star (bias corrected MLE)	0.0134
nu hat (MLE)	637.1	nu star (bias corrected)	592.9
MLE Mean (bias corrected)	0.0943	MLE Sd (bias corrected)	0.0355
		Approximate Chi Square Value (0.05)	537.4
Adjusted Level of Significance	0.0443	Adjusted Chi Square Value	535.6

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.104	95% Adjusted Gamma UCL (use when n<50)	0.104

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.784	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.942	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.234	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.135	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-3.255	Mean of logged Data	-2.429
Maximum of Logged Data	-1.103	SD of logged Data	0.338

Assuming Lognormal Distribution

95% H-UCL	0.103	90% Chebyshev (MVUE) UCL	0.108
95% Chebyshev (MVUE) UCL	0.115	97.5% Chebyshev (MVUE) UCL	0.124
99% Chebyshev (MVUE) UCL	0.143		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	0.106	95% Jackknife UCL	0.106
95% Standard Bootstrap UCL	0.106	95% Bootstrap-t UCL	0.118
95% Hall's Bootstrap UCL	0.159	95% Percentile Bootstrap UCL	0.107
95% BCA Bootstrap UCL	0.111		
90% Chebyshev(Mean, Sd) UCL	0.115	95% Chebyshev(Mean, Sd) UCL	0.125
97.5% Chebyshev(Mean, Sd) UCL	0.138	99% Chebyshev(Mean, Sd) UCL	0.164

Suggested UCL to Use

95% Student's-t UCL 0.106 or 95% Modified-t UCL 0.107

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	45	Number of Distinct Observations	41
		Number of Missing Observations	0
Minimum	0.00303	Mean	0.00723
Maximum	0.0367	Median	0.00619
SD	0.0052	Std. Error of Mean	7.7524E-4
Coefficient of Variation	0.719	Skewness	4.696

Normal GOF Test

Shapiro Wilk Test Statistic	0.475	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.945	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.322	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.131	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00854	95% Adjusted-CLT UCL (Chen-1995)	0.00909
		95% Modified-t UCL (Johnson-1978)	0.00863

Gamma GOF Test

A-D Test Statistic	4.311	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.753	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.251	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.132	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.66	k star (bias corrected MLE)	4.364
Theta hat (MLE)	0.00155	Theta star (bias corrected MLE)	0.00166
nu hat (MLE)	419.4	nu star (bias corrected)	392.8
MLE Mean (bias corrected)	0.00723	MLE Sd (bias corrected)	0.00346
		Approximate Chi Square Value (0.05)	347.8
Adjusted Level of Significance	0.0447	Adjusted Chi Square Value	346.4

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.00817	95% Adjusted Gamma UCL (use when n<50)	0.0082

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.8	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.945	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.217	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.131	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.799	Mean of logged Data	-5.04
Maximum of Logged Data	-3.305	SD of logged Data	0.406

Assuming Lognormal Distribution

95% H-UCL	0.00786	90% Chebyshev (MVUE) UCL	0.00833
95% Chebyshev (MVUE) UCL	0.00892	97.5% Chebyshev (MVUE) UCL	0.00975
99% Chebyshev (MVUE) UCL	0.0114		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00851	95% Jackknife UCL	0.00854
95% Standard Bootstrap UCL	0.00851	95% Bootstrap-t UCL	0.011
95% Hall's Bootstrap UCL	0.0147	95% Percentile Bootstrap UCL	0.00856
95% BCA Bootstrap UCL	0.00908		
90% Chebyshev(Mean, Sd) UCL	0.00956	95% Chebyshev(Mean, Sd) UCL	0.0106
97.5% Chebyshev(Mean, Sd) UCL	0.0121	99% Chebyshev(Mean, Sd) UCL	0.0149

Suggested UCL to Use

95% Student's-t UCL	0.00854	or 95% Modified-t UCL	0.00863

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	45	Number of Distinct Observations	35
Number of Detects	39	Number of Non-Detects	6
Number of Distinct Detects	34	Number of Distinct Non-Detects	1
Minimum Detect	0.00249	Minimum Non-Detect	0.0092
Maximum Detect	0.0643	Maximum Non-Detect	0.0092
Variance Detects	1.2523E-4	Percent Non-Detects	13.33%
Mean Detects	0.00762	SD Detects	0.0112
Median Detects	0.00449	CV Detects	1.47
Skewness Detects	4.249	Kurtosis Detects	19.12
Mean of Logged Detects	-5.223	SD of Logged Detects	0.644

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.391	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.939	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.414	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.14	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00719	KM Standard Error of Mean	0.00156
KM SD	0.0103	95% KM (BCA) UCL	0.0103
95% KM (t) UCL	0.00981	95% KM (Percentile Bootstrap) UCL	0.01
95% KM (z) UCL	0.00976	95% KM Bootstrap t UCL	0.0159
90% KM Chebyshev UCL	0.0119	95% KM Chebyshev UCL	0.014
97.5% KM Chebyshev UCL	0.0169	99% KM Chebyshev UCL	0.0227

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	7.513	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.765	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.41	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.144	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.592	k star (bias corrected MLE)	1.486
Theta hat (MLE)	0.00478	Theta star (bias corrected MLE)	0.00512
nu hat (MLE)	124.2	nu star (bias corrected)	115.9
Mean (detects)	0.00762		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.00249	Mean	0.00798
Maximum	0.0643	Median	0.00456
SD	0.0104	CV	1.31
k hat (MLE)	1.784	k star (bias corrected MLE)	1.68
Theta hat (MLE)	0.00447	Theta star (bias corrected MLE)	0.00475
nu hat (MLE)	160.5	nu star (bias corrected)	151.2
Adjusted Level of Significance (β)	0.0447		
Approximate Chi Square Value (151.16, α)	123.7	Adjusted Chi Square Value (151.16, β)	122.9
95% Gamma Approximate UCL (use when n>=50)	0.00974	95% Gamma Adjusted UCL (use when n<50)	0.00981

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00719	SD (KM)	0.0103
Variance (KM)	1.0703E-4	SE of Mean (KM)	0.00156
k hat (KM)	0.483	k star (KM)	0.465
nu hat (KM)	43.43	nu star (KM)	41.87
theta hat (KM)	0.0149	theta star (KM)	0.0154
80% gamma percentile (KM)	0.0118	90% gamma percentile (KM)	0.0197
95% gamma percentile (KM)	0.0283	99% gamma percentile (KM)	0.0496

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (41.87, α)	28.03	Adjusted Chi Square Value (41.87, β)	27.66
95% Gamma Approximate KM-UCL (use when n>=50)	0.0107	95% Gamma Adjusted KM-UCL (use when n<50)	0.0109

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.639	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.939	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.369	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.14	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00728	Mean in Log Scale	-5.238
SD in Original Scale	0.0105	SD in Log Scale	0.612
95% t UCL (assumes normality of ROS data)	0.0099	95% Percentile Bootstrap UCL	0.0102
95% BCA Bootstrap UCL	0.0115	95% Bootstrap t UCL	0.0171
95% H-UCL (Log ROS)	0.00769		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.253	KM Geo Mean	0.00523
KM SD (logged)	0.6	95% Critical H Value (KM-Log)	1.982
KM Standard Error of Mean (logged)	0.0912	95% H-UCL (KM -Log)	0.0075
KM SD (logged)	0.6	95% Critical H Value (KM-Log)	1.982
KM Standard Error of Mean (logged)	0.0912		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00721	Mean in Log Scale	-5.245
SD in Original Scale	0.0105	SD in Log Scale	0.601
95% t UCL (Assumes normality)	0.00983	95% H-Stat UCL	0.00756

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 0.014

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	45	Number of Distinct Observations	39
		Number of Missing Observations	0
Minimum	0.00155	Mean	0.00546
Maximum	0.0617	Median	0.00222
SD	0.011	Std. Error of Mean	0.00164
Coefficient of Variation	2.013	Skewness	4.336

Normal GOF Test

Shapiro Wilk Test Statistic	0.37	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.945	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.391	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.131	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.00821	95% Adjusted-CLT UCL (Chen-1995)	0.00928
		95% Modified-t UCL (Johnson-1978)	0.00838

Gamma GOF Test

A-D Test Statistic	7.795	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.777	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.32	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.136	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.993	k star (bias corrected MLE)	0.942
Theta hat (MLE)	0.00549	Theta star (bias corrected MLE)	0.00579
nu hat (MLE)	89.41	nu star (bias corrected)	84.79
MLE Mean (bias corrected)	0.00546	MLE Sd (bias corrected)	0.00562
		Approximate Chi Square Value (0.05)	64.56
Adjusted Level of Significance	0.0447	Adjusted Chi Square Value	63.98

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.00717	95% Adjusted Gamma UCL (use when n<50)	0.00723

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.683	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.945	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.279	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.131	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-6.47	Mean of logged Data	-5.792
Maximum of Logged Data	-2.785	SD of logged Data	0.808

Assuming Lognormal Distribution

95% H-UCL	0.00551	90% Chebyshev (MVUE) UCL	0.00588
95% Chebyshev (MVUE) UCL	0.00665	97.5% Chebyshev (MVUE) UCL	0.00771
99% Chebyshev (MVUE) UCL	0.0098		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00815	95% Jackknife UCL	0.00821
95% Standard Bootstrap UCL	0.00811	95% Bootstrap-t UCL	0.016
95% Hall's Bootstrap UCL	0.0188	95% Percentile Bootstrap UCL	0.00832
95% BCA Bootstrap UCL	0.00982		
90% Chebyshev(Mean, Sd) UCL	0.0104	95% Chebyshev(Mean, Sd) UCL	0.0126
97.5% Chebyshev(Mean, Sd) UCL	0.0157	99% Chebyshev(Mean, Sd) UCL	0.0217

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	0.0126

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Raleigh Creek - Other
Total Surface Water

PFOA|ug/L

General Statistics

Total Number of Observations	45	Number of Distinct Observations	45
		Number of Missing Observations	0
Minimum	0.00573	Mean	0.0373
Maximum	0.52	Median	0.00792
SD	0.0974	Std. Error of Mean	0.0145
Coefficient of Variation	2.613	Skewness	4.105

Normal GOF Test

Shapiro Wilk Test Statistic	0.367	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.945	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.413	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.131	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0617	95% Adjusted-CLT UCL (Chen-1995)	0.0706
		95% Modified-t UCL (Johnson-1978)	0.0631

Gamma GOF Test

A-D Test Statistic	9.855	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.808	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.438	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.139	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.558	k star (bias corrected MLE)	0.536
Theta hat (MLE)	0.0668	Theta star (bias corrected MLE)	0.0695
nu hat (MLE)	50.24	nu star (bias corrected)	48.22
MLE Mean (bias corrected)	0.0373	MLE Sd (bias corrected)	0.0509
		Approximate Chi Square Value (0.05)	33.28
Adjusted Level of Significance	0.0447	Adjusted Chi Square Value	32.87

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.054	95% Adjusted Gamma UCL (use when n<50)	0.0547

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.61	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.945	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.384	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.131	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.162	Mean of logged Data	-4.409
Maximum of Logged Data	-0.654	SD of logged Data	1.113

Assuming Lognormal Distribution

95% H-UCL	0.0344	90% Chebyshev (MVUE) UCL	0.0354
95% Chebyshev (MVUE) UCL	0.0414	97.5% Chebyshev (MVUE) UCL	0.0497
99% Chebyshev (MVUE) UCL	0.0661		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0611	95% Jackknife UCL	0.0617
95% Standard Bootstrap UCL	0.0607	95% Bootstrap-t UCL	0.109
95% Hall's Bootstrap UCL	0.148	95% Percentile Bootstrap UCL	0.0641
95% BCA Bootstrap UCL	0.0717		
90% Chebyshev(Mean, Sd) UCL	0.0808	95% Chebyshev(Mean, Sd) UCL	0.101
97.5% Chebyshev(Mean, Sd) UCL	0.128	99% Chebyshev(Mean, Sd) UCL	0.182

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL 0.101

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	45	Number of Distinct Observations	41
Number of Detects	27	Number of Non-Detects	18
Number of Distinct Detects	26	Number of Distinct Non-Detects	16
Minimum Detect	6.1300E-4	Minimum Non-Detect	7.1500E-4
Maximum Detect	0.00424	Maximum Non-Detect	0.0042
Variance Detects	6.7592E-7	Percent Non-Detects	40%
Mean Detects	0.00117	SD Detects	8.2215E-4
Median Detects	8.2700E-4	CV Detects	0.7
Skewness Detects	2.734	Kurtosis Detects	7.783
Mean of Logged Detects	-6.886	SD of Logged Detects	0.477

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.623	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.923	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.282	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.167	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	9.9642E-4	KM Standard Error of Mean	1.0628E-4
KM SD	6.8121E-4	95% KM (BCA) UCL	0.00121
95% KM (t) UCL	0.00117	95% KM (Percentile Bootstrap) UCL	0.00119
95% KM (z) UCL	0.00117	95% KM Bootstrap t UCL	0.00133
90% KM Chebyshev UCL	0.00132	95% KM Chebyshev UCL	0.00146
97.5% KM Chebyshev UCL	0.00166	99% KM Chebyshev UCL	0.00205

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.482	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.75	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.228	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.169	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.747	k star (bias corrected MLE)	3.356
Theta hat (MLE)	3.1351E-4	Theta star (bias corrected MLE)	3.5011E-4
nu hat (MLE)	202.4	nu star (bias corrected)	181.2
Mean (detects)	0.00117		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	6.1300E-4	Mean	0.0047
Maximum	0.01	Median	0.0014
SD	0.00442	CV	0.939
k hat (MLE)	0.946	k star (bias corrected MLE)	0.897
Theta hat (MLE)	0.00498	Theta star (bias corrected MLE)	0.00524
nu hat (MLE)	85.11	nu star (bias corrected)	80.76
Adjusted Level of Significance (β)	0.0447		
Approximate Chi Square Value (80.76, α)	61.06	Adjusted Chi Square Value (80.76, β)	60.49
95% Gamma Approximate UCL (use when n>=50)	0.00622	95% Gamma Adjusted UCL (use when n<50)	0.00628

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	9.9642E-4	SD (KM)	6.8121E-4
Variance (KM)	4.6405E-7	SE of Mean (KM)	1.0628E-4
k hat (KM)	2.14	k star (KM)	2.012
nu hat (KM)	192.6	nu star (KM)	181.1
theta hat (KM)	4.6572E-4	theta star (KM)	4.9531E-4
80% gamma percentile (KM)	0.00149	90% gamma percentile (KM)	0.00194
95% gamma percentile (KM)	0.00236	99% gamma percentile (KM)	0.0033

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (181.05, α)	150.9	Adjusted Chi Square Value (181.05, β)	150
95% Gamma Approximate KM-UCL (use when n>=50)	0.0012	95% Gamma Adjusted KM-UCL (use when n<50)	0.0012

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.809	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.923	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.2	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.167	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	9.5129E-4	Mean in Log Scale	-7.096
SD in Original Scale	6.9501E-4	SD in Log Scale	0.466
95% t UCL (assumes normality of ROS data)	0.00113	95% Percentile Bootstrap UCL	0.00114
95% BCA Bootstrap UCL	0.00119	95% Bootstrap t UCL	0.00128
95% H-UCL (Log ROS)	0.00105		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-7.033	KM Geo Mean	8.8217E-4
KM SD (logged)	0.426	95% Critical H Value (KM-Log)	1.854
KM Standard Error of Mean (logged)	0.068	95% H-UCL (KM -Log)	0.00109
KM SD (logged)	0.426	95% Critical H Value (KM-Log)	1.854
KM Standard Error of Mean (logged)	0.068		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.001	Mean in Log Scale	-7.134
SD in Original Scale	7.9958E-4	SD in Log Scale	0.656
95% t UCL (Assumes normality)	0.0012	95% H-Stat UCL	0.00121

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.00117	KM H-UCL	0.00109
95% KM (BCA) UCL	0.00121		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFDA|ug/L

General Statistics

Total Number of Observations	45	Number of Distinct Observations	37
Number of Detects	9	Number of Non-Detects	36
Number of Distinct Detects	9	Number of Distinct Non-Detects	28
Minimum Detect	4.1800E-4	Minimum Non-Detect	3.6200E-4
Maximum Detect	0.00395	Maximum Non-Detect	0.0042
Variance Detects	1.7417E-6	Percent Non-Detects	80%
Mean Detects	0.00185	SD Detects	0.00132
Median Detects	0.00126	CV Detects	0.714
Skewness Detects	0.649	Kurtosis Detects	-1.392
Mean of Logged Detects	-6.546	SD of Logged Detects	0.777

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.868	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.227	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	7.1084E-4	KM Standard Error of Mean	1.4680E-4
KM SD	8.6339E-4	95% KM (BCA) UCL	9.4364E-4
95% KM (t) UCL	9.5749E-4	95% KM (Percentile Bootstrap) UCL	9.5851E-4
95% KM (z) UCL	9.5230E-4	95% KM Bootstrap t UCL	0.00107
90% KM Chebyshev UCL	0.00115	95% KM Chebyshev UCL	0.00135
97.5% KM Chebyshev UCL	0.00163	99% KM Chebyshev UCL	0.00217

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.423	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.729	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.21	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.282	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.134	k star (bias corrected MLE)	1.497
Theta hat (MLE)	8.6571E-4	Theta star (bias corrected MLE)	0.00123
nu hat (MLE)	38.41	nu star (bias corrected)	26.94
Mean (detects)	0.00185		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	4.1800E-4	Mean	0.00837
Maximum	0.01	Median	0.01
SD	0.00335	CV	0.4
k hat (MLE)	2.533	k star (bias corrected MLE)	2.378
Theta hat (MLE)	0.0033	Theta star (bias corrected MLE)	0.00352
nu hat (MLE)	227.9	nu star (bias corrected)	214.1
Adjusted Level of Significance (β)	0.0447		
Approximate Chi Square Value (214.06, α)	181.2	Adjusted Chi Square Value (214.06, β)	180.2
95% Gamma Approximate UCL (use when n>=50)	0.00989	95% Gamma Adjusted UCL (use when n<50)	0.00994

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	7.1084E-4	SD (KM)	8.6339E-4
Variance (KM)	7.4544E-7	SE of Mean (KM)	1.4680E-4
k hat (KM)	0.678	k star (KM)	0.647
nu hat (KM)	61.01	nu star (KM)	58.27
theta hat (KM)	0.00105	theta star (KM)	0.0011
80% gamma percentile (KM)	0.00117	90% gamma percentile (KM)	0.00182
95% gamma percentile (KM)	0.00249	99% gamma percentile (KM)	0.0041

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (58.27, α)	41.72	Adjusted Chi Square Value (58.27, β)	41.26
95% Gamma Approximate KM-UCL (use when n>=50)	9.9280E-4	95% Gamma Adjusted KM-UCL (use when n<50)	0.001

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.929	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.18	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	4.6402E-4	Mean in Log Scale	-8.673
SD in Original Scale	9.0112E-4	SD in Log Scale	1.222
95% t UCL (assumes normality of ROS data)	6.8973E-4	95% Percentile Bootstrap UCL	6.8970E-4
95% BCA Bootstrap UCL	7.7090E-4	95% Bootstrap t UCL	8.3419E-4
95% H-UCL (Log ROS)	5.8676E-4		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-7.591	KM Geo Mean	5.0485E-4
KM SD (logged)	0.674	95% Critical H Value (KM-Log)	2.049
KM Standard Error of Mean (logged)	0.116	95% H-UCL (KM -Log)	7.8050E-4
KM SD (logged)	0.674	95% Critical H Value (KM-Log)	2.049
KM Standard Error of Mean (logged)	0.116		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	8.6432E-4	Mean in Log Scale	-7.497
SD in Original Scale	9.4862E-4	SD in Log Scale	0.889
95% t UCL (Assumes normality)	0.0011	95% H-Stat UCL	0.00111

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 9.57E-04

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFTrDA|ug/L

General Statistics

Total Number of Observations	45	Number of Distinct Observations	35
Number of Detects	5	Number of Non-Detects	40
Number of Distinct Detects	4	Number of Distinct Non-Detects	31
Minimum Detect	0.0016	Minimum Non-Detect	3.6200E-4
Maximum Detect	0.0024	Maximum Non-Detect	0.0042
Variance Detects	8.7000E-8	Percent Non-Detects	88.89%
Mean Detects	0.00198	SD Detects	2.9496E-4
Median Detects	0.0019	CV Detects	0.149
Skewness Detects	0.323	Kurtosis Detects	0.63
Mean of Logged Detects	-6.234	SD of Logged Detects	0.149

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.966	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.207	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	5.4586E-4	KM Standard Error of Mean	8.7839E-5
KM SD	5.2115E-4	95% KM (BCA) UCL	N/A
95% KM (t) UCL	6.9345E-4	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	6.9035E-4	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	8.0938E-4	95% KM Chebyshev UCL	9.2875E-4
97.5% KM Chebyshev UCL	0.00109	99% KM Chebyshev UCL	0.00142

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.252	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.678	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.204	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	56.51	k star (bias corrected MLE)	22.74
Theta hat (MLE)	3.5035E-5	Theta star (bias corrected MLE)	8.7074E-5
nu hat (MLE)	565.1	nu star (bias corrected)	227.4
Mean (detects)	0.00198		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0016	Mean	0.00911
Maximum	0.01	Median	0.01
SD	0.00255	CV	0.28
k hat (MLE)	5.87	k star (bias corrected MLE)	5.493
Theta hat (MLE)	0.00155	Theta star (bias corrected MLE)	0.00166
nu hat (MLE)	528.3	nu star (bias corrected)	494.4
Adjusted Level of Significance (β)	0.0447		
Approximate Chi Square Value (494.39, α)	443.8	Adjusted Chi Square Value (494.39, β)	442.2
95% Gamma Approximate UCL (use when n>=50)	0.0101	95% Gamma Adjusted UCL (use when n<50)	0.0102

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	5.4586E-4	SD (KM)	5.2115E-4
Variance (KM)	2.7159E-7	SE of Mean (KM)	8.7839E-5
k hat (KM)	1.097	k star (KM)	1.039
nu hat (KM)	98.74	nu star (KM)	93.49
theta hat (KM)	4.9755E-4	theta star (KM)	5.2549E-4
80% gamma percentile (KM)	8.7576E-4	90% gamma percentile (KM)	0.00125
95% gamma percentile (KM)	0.00161	99% gamma percentile (KM)	0.00247

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (93.49, α)	72.19	Adjusted Chi Square Value (93.49, β)	71.57
95% Gamma Approximate KM-UCL (use when n>=50)	7.0691E-4	95% Gamma Adjusted KM-UCL (use when n<50)	7.1303E-4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.97	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.214	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	9.7270E-4	Mean in Log Scale	-6.988
SD in Original Scale	3.8600E-4	SD in Log Scale	0.302
95% t UCL (assumes normality of ROS data)	0.00107	95% Percentile Bootstrap UCL	0.00107
95% BCA Bootstrap UCL	0.00109	95% Bootstrap t UCL	0.00111
95% H-UCL (Log ROS)	0.00105		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-7.732	KM Geo Mean	4.3866E-4
KM SD (logged)	0.538	95% Critical H Value (KM-Log)	1.934
KM Standard Error of Mean (logged)	0.0907	95% H-UCL (KM -Log)	5.9324E-4
KM SD (logged)	0.538	95% Critical H Value (KM-Log)	1.934
KM Standard Error of Mean (logged)	0.0907		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	5.4706E-4	Mean in Log Scale	-7.833
SD in Original Scale	5.8894E-4	SD in Log Scale	0.705
95% t UCL (Assumes normality)	6.9457E-4	95% H-Stat UCL	6.3427E-4

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	6.93E-04

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFBS|ug/L

General Statistics

Total Number of Observations	45	Number of Distinct Observations	40
		Number of Missing Observations	0
Minimum	0.00136	Mean	0.00331
Maximum	0.0191	Median	0.00262
SD	0.00307	Std. Error of Mean	4.5730E-4
Coefficient of Variation	0.926	Skewness	4.268

Normal GOF Test

Shapiro Wilk Test Statistic	0.438	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.945	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.372	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.131	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00408	95% Adjusted-CLT UCL (Chen-1995)	0.00438
		95% Modified-t UCL (Johnson-1978)	0.00413

Gamma GOF Test

A-D Test Statistic	5.936	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.755	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.316	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.133	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

ProUCL Output
Raleigh Creek - Other
Total Surface Water

Gamma Statistics

k hat (MLE)	3.188	k star (bias corrected MLE)	2.99
Theta hat (MLE)	0.00104	Theta star (bias corrected MLE)	0.00111
nu hat (MLE)	286.9	nu star (bias corrected)	269.1
MLE Mean (bias corrected)	0.00331	MLE Sd (bias corrected)	0.00192
		Approximate Chi Square Value (0.05)	232.1
Adjusted Level of Significance	0.0447	Adjusted Chi Square Value	231

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.00384	95% Adjusted Gamma UCL (use when n<50)	0.00386

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.736	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.945	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.267	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.131	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-6.6	Mean of logged Data	-5.875
Maximum of Logged Data	-3.958	SD of logged Data	0.472

Assuming Lognormal Distribution

95% H-UCL	0.00359	90% Chebyshev (MVUE) UCL	0.00382
95% Chebyshev (MVUE) UCL	0.00413	97.5% Chebyshev (MVUE) UCL	0.00457
99% Chebyshev (MVUE) UCL	0.00542		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00407	95% Jackknife UCL	0.00408
95% Standard Bootstrap UCL	0.00406	95% Bootstrap-t UCL	0.0058
95% Hall's Bootstrap UCL	0.00751	95% Percentile Bootstrap UCL	0.0041
95% BCA Bootstrap UCL	0.00451		
90% Chebyshev(Mean, Sd) UCL	0.00469	95% Chebyshev(Mean, Sd) UCL	0.00531
97.5% Chebyshev(Mean, Sd) UCL	0.00617	99% Chebyshev(Mean, Sd) UCL	0.00786

Suggested UCL to Use

95% Student's-t UCL	0.00408	or 95% Modified-t UCL	0.00413

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFHxS|ug/L

General Statistics

Total Number of Observations	45	Number of Distinct Observations	42
		Number of Missing Observations	0
Minimum	0.00231	Mean	0.00619
Maximum	0.0529	Median	0.00319
SD	0.01	Std. Error of Mean	0.00149
Coefficient of Variation	1.619	Skewness	4.004

Normal GOF Test

Shapiro Wilk Test Statistic	0.384	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.945	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.397	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.131	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00869	95% Adjusted-CLT UCL (Chen-1995)	0.00959
		95% Modified-t UCL (Johnson-1978)	0.00884

ProUCL Output
Raleigh Creek - Other
Total Surface Water

Gamma GOF Test

A-D Test Statistic	8.921	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.771	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.366	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.135	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.342	k star (bias corrected MLE)	1.267
Theta hat (MLE)	0.00461	Theta star (bias corrected MLE)	0.00488
nu hat (MLE)	120.7	nu star (bias corrected)	114
MLE Mean (bias corrected)	0.00619	MLE Sd (bias corrected)	0.0055
		Approximate Chi Square Value (0.05)	90.38
Adjusted Level of Significance	0.0447	Adjusted Chi Square Value	89.68

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0078	95% Adjusted Gamma UCL (use when n<50)	0.00786

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.613	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.945	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.33	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.131	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-6.071	Mean of logged Data	-5.502
Maximum of Logged Data	-2.939	SD of logged Data	0.696

Assuming Lognormal Distribution

95% H-UCL	0.00645	90% Chebyshev (MVUE) UCL	0.00691
95% Chebyshev (MVUE) UCL	0.0077	97.5% Chebyshev (MVUE) UCL	0.0088
99% Chebyshev (MVUE) UCL	0.011		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00864	95% Jackknife UCL	0.00869
95% Standard Bootstrap UCL	0.00861	95% Bootstrap-t UCL	0.0135
95% Hall's Bootstrap UCL	0.018	95% Percentile Bootstrap UCL	0.00885
95% BCA Bootstrap UCL	0.0097		
90% Chebyshev(Mean, Sd) UCL	0.0107	95% Chebyshev(Mean, Sd) UCL	0.0127
97.5% Chebyshev(Mean, Sd) UCL	0.0155	99% Chebyshev(Mean, Sd) UCL	0.021

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	0.0127

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOS|ug/L

General Statistics

Total Number of Observations	45	Number of Distinct Observations	43
		Number of Missing Observations	0
Minimum	0.00166	Mean	0.105
Maximum	1.23	Median	0.00327
SD	0.276	Std. Error of Mean	0.0411
Coefficient of Variation	2.631	Skewness	2.992

Normal GOF Test

Shapiro Wilk Test Statistic	0.438	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.945	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.443	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.131	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.174	95% Adjusted-CLT UCL (Chen-1995)	0.192
		95% Modified-t UCL (Johnson-1978)	0.177

Gamma GOF Test

A-D Test Statistic	8.748	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.877	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.398	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.144	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.269	k star (bias corrected MLE)	0.266
Theta hat (MLE)	0.39	Theta star (bias corrected MLE)	0.394
nu hat (MLE)	24.23	nu star (bias corrected)	23.94
MLE Mean (bias corrected)	0.105	MLE Sd (bias corrected)	0.203
		Approximate Chi Square Value (0.05)	13.81
Adjusted Level of Significance	0.0447	Adjusted Chi Square Value	13.55

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.182	95% Adjusted Gamma UCL (use when n<50)	0.185

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.676	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.945	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.317	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.131	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-6.401	Mean of logged Data	-4.862
Maximum of Logged Data	0.207	SD of logged Data	1.978

Assuming Lognormal Distribution

95% H-UCL	0.163	90% Chebyshev (MVUE) UCL	0.11
95% Chebyshev (MVUE) UCL	0.138	97.5% Chebyshev (MVUE) UCL	0.177
99% Chebyshev (MVUE) UCL	0.254		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	0.173	95% Jackknife UCL	0.174
95% Standard Bootstrap UCL	0.172	95% Bootstrap-t UCL	0.22
95% Hall's Bootstrap UCL	0.173	95% Percentile Bootstrap UCL	0.175
95% BCA Bootstrap UCL	0.201		
90% Chebyshev(Mean, Sd) UCL	0.228	95% Chebyshev(Mean, Sd) UCL	0.284
97.5% Chebyshev(Mean, Sd) UCL	0.362	99% Chebyshev(Mean, Sd) UCL	0.514

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL 0.284

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	45	Number of Distinct Observations	36
Number of Detects	10	Number of Non-Detects	35
Number of Distinct Detects	10	Number of Distinct Non-Detects	27
Minimum Detect	3.7100E-4	Minimum Non-Detect	3.6300E-4
Maximum Detect	0.011	Maximum Non-Detect	0.0042
Variance Detects	1.2524E-5	Percent Non-Detects	77.78%
Mean Detects	0.00439	SD Detects	0.00354
Median Detects	0.00293	CV Detects	0.806
Skewness Detects	0.697	Kurtosis Detects	-0.525
Mean of Logged Detects	-5.879	SD of Logged Detects	1.175

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.908	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.237	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0013	KM Standard Error of Mean	3.6538E-4
KM SD	0.00231	95% KM (BCA) UCL	0.00193
95% KM (t) UCL	0.00191	95% KM (Percentile Bootstrap) UCL	0.00188
95% KM (z) UCL	0.0019	95% KM Bootstrap t UCL	0.0022
90% KM Chebyshev UCL	0.00239	95% KM Chebyshev UCL	0.00289
97.5% KM Chebyshev UCL	0.00358	99% KM Chebyshev UCL	0.00493

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.395	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.744	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.183	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.272	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.251	k star (bias corrected MLE)	0.942
Theta hat (MLE)	0.00351	Theta star (bias corrected MLE)	0.00466
nu hat (MLE)	25.01	nu star (bias corrected)	18.84
Mean (detects)	0.00439		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	3.7100E-4	Mean	0.00875
Maximum	0.011	Median	0.01
SD	0.00285	CV	0.326
k hat (MLE)	3.494	k star (bias corrected MLE)	3.276
Theta hat (MLE)	0.00251	Theta star (bias corrected MLE)	0.00267
nu hat (MLE)	314.5	nu star (bias corrected)	294.8
Adjusted Level of Significance (β)	0.0447		
Approximate Chi Square Value (294.84, α)	256.1	Adjusted Chi Square Value (294.84, β)	254.9
95% Gamma Approximate UCL (use when n>=50)	0.0101	95% Gamma Adjusted UCL (use when n<50)	0.0101

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0013	SD (KM)	0.00231
Variance (KM)	5.3192E-6	SE of Mean (KM)	3.6538E-4
k hat (KM)	0.317	k star (KM)	0.31
nu hat (KM)	28.49	nu star (KM)	27.93
theta hat (KM)	0.0041	theta star (KM)	0.00418
80% gamma percentile (KM)	0.00201	90% gamma percentile (KM)	0.00381
95% gamma percentile (KM)	0.00587	99% gamma percentile (KM)	0.0112

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (27.93, α)	16.87	Adjusted Chi Square Value (27.93, β)	16.58
95% Gamma Approximate KM-UCL (use when n>=50)	0.00215	95% Gamma Adjusted KM-UCL (use when n<50)	0.00219

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.868	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.249	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00109	Mean in Log Scale	-8.307
SD in Original Scale	0.0024	SD in Log Scale	1.518
95% t UCL (assumes normality of ROS data)	0.00169	95% Percentile Bootstrap UCL	0.00172
95% BCA Bootstrap UCL	0.00184	95% Bootstrap t UCL	0.00197
95% H-UCL (Log ROS)	0.00156		

ProUCL Output
Raleigh Creek - Other
Total Surface Water

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-7.426	KM Geo Mean	5.9577E-4
KM SD (logged)	1.01	95% Critical H Value (KM-Log)	2.383
KM Standard Error of Mean (logged)	0.164	95% H-UCL (KM -Log)	0.00143
KM SD (logged)	1.01	95% Critical H Value (KM-Log)	2.383
KM Standard Error of Mean (logged)	0.164		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.00147	Mean in Log Scale	-7.303
SD in Original Scale	0.00232	SD in Log Scale	1.143
95% t UCL (Assumes normality)	0.00205	95% H-Stat UCL	0.002

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.00191

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	45	Number of Distinct Observations	37
Number of Detects	9	Number of Non-Detects	36
Number of Distinct Detects	9	Number of Distinct Non-Detects	28
Minimum Detect	7.2000E-4	Minimum Non-Detect	3.6200E-4
Maximum Detect	0.00906	Maximum Non-Detect	0.0042
Variance Detects	9.1104E-6	Percent Non-Detects	80%
Mean Detects	0.00376	SD Detects	0.00302
Median Detects	0.00202	CV Detects	0.803
Skewness Detects	1.023	Kurtosis Detects	-0.535
Mean of Logged Detects	-5.874	SD of Logged Detects	0.822

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.821	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.273	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00109	KM Standard Error of Mean	2.9757E-4
KM SD	0.00186	95% KM (BCA) UCL	0.00162
95% KM (t) UCL	0.00159	95% KM (Percentile Bootstrap) UCL	0.00159
95% KM (z) UCL	0.00158	95% KM Bootstrap t UCL	0.00194
90% KM Chebyshev UCL	0.00199	95% KM Chebyshev UCL	0.00239
97.5% KM Chebyshev UCL	0.00295	99% KM Chebyshev UCL	0.00406

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.549	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.731	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.252	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.283	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.869	k star (bias corrected MLE)	1.32
Theta hat (MLE)	0.00201	Theta star (bias corrected MLE)	0.00285
nu hat (MLE)	33.65	nu star (bias corrected)	23.77
Mean (detects)	0.00376		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	7.2000E-4	Mean	0.00875
Maximum	0.01	Median	0.01
SD	0.00283	CV	0.324
k hat (MLE)	4.31	k star (bias corrected MLE)	4.037
Theta hat (MLE)	0.00203	Theta star (bias corrected MLE)	0.00217
nu hat (MLE)	387.9	nu star (bias corrected)	363.4
Adjusted Level of Significance (β)	0.0447		
Approximate Chi Square Value (363.37, α)	320.2	Adjusted Chi Square Value (363.37, β)	318.9
95% Gamma Approximate UCL (use when n>=50)	0.00993	95% Gamma Adjusted UCL (use when n<50)	0.00997

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00109	SD (KM)	0.00186
Variance (KM)	3.4593E-6	SE of Mean (KM)	2.9757E-4
k hat (KM)	0.346	k star (KM)	0.338
nu hat (KM)	31.18	nu star (KM)	30.43
theta hat (KM)	0.00316	theta star (KM)	0.00324
80% gamma percentile (KM)	0.00172	90% gamma percentile (KM)	0.00318
95% gamma percentile (KM)	0.00482	99% gamma percentile (KM)	0.00901

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (30.43, α)	18.84	Adjusted Chi Square Value (30.43, β)	18.53
95% Gamma Approximate KM-UCL (use when n>=50)	0.00177	95% Gamma Adjusted KM-UCL (use when n<50)	0.0018

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.919	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.212	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	9.1132E-4	Mean in Log Scale	-8.096
SD in Original Scale	0.00193	SD in Log Scale	1.257
95% t UCL (assumes normality of ROS data)	0.0014	95% Percentile Bootstrap UCL	0.00148
95% BCA Bootstrap UCL	0.0016	95% Bootstrap t UCL	0.00176
95% H-UCL (Log ROS)	0.00112		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-7.442	KM Geo Mean	5.8633E-4
KM SD (logged)	0.901	95% Critical H Value (KM-Log)	2.265
KM Standard Error of Mean (logged)	0.154	95% H-UCL (KM -Log)	0.0012
KM SD (logged)	0.901	95% Critical H Value (KM-Log)	2.265
KM Standard Error of Mean (logged)	0.154		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00125	Mean in Log Scale	-7.362
SD in Original Scale	0.0019	SD in Log Scale	1.066
95% t UCL (Assumes normality)	0.00172	95% H-Stat UCL	0.00166

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.00159

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	45	Number of Distinct Observations	38
Number of Detects	12	Number of Non-Detects	33
Number of Distinct Detects	12	Number of Distinct Non-Detects	26
Minimum Detect	3.9900E-4	Minimum Non-Detect	3.6500E-4
Maximum Detect	0.0202	Maximum Non-Detect	0.0042
Variance Detects	4.5308E-5	Percent Non-Detects	73.33%
Mean Detects	0.0047	SD Detects	0.00673
Median Detects	0.00143	CV Detects	1.431
Skewness Detects	1.829	Kurtosis Detects	2.221
Mean of Logged Detects	-6.246	SD of Logged Detects	1.395

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.678	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.277	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00157	KM Standard Error of Mean	5.9782E-4
KM SD	0.00383	95% KM (BCA) UCL	0.00275
95% KM (t) UCL	0.00258	95% KM (Percentile Bootstrap) UCL	0.00257
95% KM (z) UCL	0.00256	95% KM Bootstrap t UCL	0.00494
90% KM Chebyshev UCL	0.00337	95% KM Chebyshev UCL	0.00418
97.5% KM Chebyshev UCL	0.00531	99% KM Chebyshev UCL	0.00752

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.688	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.771	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.232	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.256	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.684	k star (bias corrected MLE)	0.568
Theta hat (MLE)	0.00688	Theta star (bias corrected MLE)	0.00828
nu hat (MLE)	16.41	nu star (bias corrected)	13.64
Mean (detects)	0.0047		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	3.9900E-4	Mean	0.00859
Maximum	0.0202	Median	0.01
SD	0.00412	CV	0.479
k hat (MLE)	1.902	k star (bias corrected MLE)	1.79
Theta hat (MLE)	0.00452	Theta star (bias corrected MLE)	0.0048
nu hat (MLE)	171.2	nu star (bias corrected)	161.1
Adjusted Level of Significance (β)	0.0447		
Approximate Chi Square Value (161.07, α)	132.7	Adjusted Chi Square Value (161.07, β)	131.9
95% Gamma Approximate UCL (use when n>=50)	0.0104	95% Gamma Adjusted UCL (use when n<50)	0.0105

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00157	SD (KM)	0.00383
Variance (KM)	1.4685E-5	SE of Mean (KM)	5.9782E-4
k hat (KM)	0.169	k star (KM)	0.172
nu hat (KM)	15.18	nu star (KM)	15.5
theta hat (KM)	0.00933	theta star (KM)	0.00914
80% gamma percentile (KM)	0.0019	90% gamma percentile (KM)	0.00473
95% gamma percentile (KM)	0.00841	99% gamma percentile (KM)	0.0188

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (15.50, α)	7.611	Adjusted Chi Square Value (15.50, β)	7.427
95% Gamma Approximate KM-UCL (use when n>=50)	0.00321	95% Gamma Adjusted KM-UCL (use when n<50)	0.00328

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.909	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.164	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00139	Mean in Log Scale	-8.135
SD in Original Scale	0.00393	SD in Log Scale	1.46
95% t UCL (assumes normality of ROS data)	0.00237	95% Percentile Bootstrap UCL	0.00246
95% BCA Bootstrap UCL	0.00284	95% Bootstrap t UCL	0.0048
95% H-UCL (Log ROS)	0.00162		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-7.378	KM Geo Mean	6.2466E-4
KM SD (logged)	0.993	95% Critical H Value (KM-Log)	2.365
KM Standard Error of Mean (logged)	0.161	95% H-UCL (KM -Log)	0.00146
KM SD (logged)	0.993	95% Critical H Value (KM-Log)	2.365
KM Standard Error of Mean (logged)	0.161		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00174	Mean in Log Scale	-7.281
SD in Original Scale	0.00386	SD in Log Scale	1.13
95% t UCL (Assumes normality)	0.0027	95% H-Stat UCL	0.00201

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

ı Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1) 0.00328

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFHpS|ug/L

General Statistics

Total Number of Observations	45	Number of Distinct Observations	36
Number of Detects	8	Number of Non-Detects	37
Number of Distinct Detects	8	Number of Distinct Non-Detects	29
Minimum Detect	0.00104	Minimum Non-Detect	3.6200E-4
Maximum Detect	0.0156	Maximum Non-Detect	0.0042
Variance Detects	3.1755E-5	Percent Non-Detects	82.22%
Mean Detects	0.00592	SD Detects	0.00564
Median Detects	0.00414	CV Detects	0.952
Skewness Detects	0.996	Kurtosis Detects	-0.452
Mean of Logged Detects	-5.605	SD of Logged Detects	1.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.836	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.245	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00136	KM Standard Error of Mean	4.9070E-4
KM SD	0.00307	95% KM (BCA) UCL	0.00215
95% KM (t) UCL	0.00219	95% KM (Percentile Bootstrap) UCL	0.00221
95% KM (z) UCL	0.00217	95% KM Bootstrap t UCL	0.00305
90% KM Chebyshev UCL	0.00284	95% KM Chebyshev UCL	0.0035
97.5% KM Chebyshev UCL	0.00443	99% KM Chebyshev UCL	0.00625

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.439	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.733	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.231	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.3	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.191	k star (bias corrected MLE)	0.828
Theta hat (MLE)	0.00497	Theta star (bias corrected MLE)	0.00715
nu hat (MLE)	19.05	nu star (bias corrected)	13.24
Mean (detects)	0.00592		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.00104	Mean	0.00927
Maximum	0.0156	Median	0.01
SD	0.00275	CV	0.296
k hat (MLE)	5.041	k star (bias corrected MLE)	4.719
Theta hat (MLE)	0.00184	Theta star (bias corrected MLE)	0.00197
nu hat (MLE)	453.7	nu star (bias corrected)	424.8
Adjusted Level of Significance (β)	0.0447		
Approximate Chi Square Value (424.75, α)	378	Adjusted Chi Square Value (424.75, β)	376.5
95% Gamma Approximate UCL (use when n>=50)	0.0104	95% Gamma Adjusted UCL (use when n<50)	0.0105

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00136	SD (KM)	0.00307
Variance (KM)	9.4495E-6	SE of Mean (KM)	4.9070E-4
k hat (KM)	0.197	k star (KM)	0.199
nu hat (KM)	17.74	nu star (KM)	17.89
theta hat (KM)	0.00692	theta star (KM)	0.00687
80% gamma percentile (KM)	0.00179	90% gamma percentile (KM)	0.00413
95% gamma percentile (KM)	0.00704	99% gamma percentile (KM)	0.0151

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (17.89, α)	9.309	Adjusted Chi Square Value (17.89, β)	9.103
95% Gamma Approximate KM-UCL (use when n>=50)	0.00262	95% Gamma Adjusted KM-UCL (use when n<50)	0.00268

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.881	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.226	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0011	Mean in Log Scale	-9.169
SD in Original Scale	0.00319	SD in Log Scale	1.845
95% t UCL (assumes normality of ROS data)	0.0019	95% Percentile Bootstrap UCL	0.00192
95% BCA Bootstrap UCL	0.00232	95% Bootstrap t UCL	0.00284
95% H-UCL (Log ROS)	0.0015		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-7.494	KM Geo Mean	5.5615E-4
KM SD (logged)	0.992	95% Critical H Value (KM-Log)	2.363
KM Standard Error of Mean (logged)	0.16	95% H-UCL (KM -Log)	0.0013
KM SD (logged)	0.992	95% Critical H Value (KM-Log)	2.363
KM Standard Error of Mean (logged)	0.16		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00155	Mean in Log Scale	-7.374
SD in Original Scale	0.0031	SD in Log Scale	1.161
95% t UCL (Assumes normality)	0.00233	95% H-Stat UCL	0.00193

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.00219

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
West Lakeland
Total Surface Water

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/26/2021 11:41:18 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

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General Statistics

Total Number of Observations	74	Number of Distinct Observations	60
		Number of Missing Observations	9
Minimum	0.136	Mean	0.385
Maximum	0.79	Median	0.385
SD	0.109	Std. Error of Mean	0.0127
Coefficient of Variation	0.284	Skewness	0.953

Normal GOF Test

Shapiro Wilk Test Statistic	0.919	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	6.6099E-5	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.161	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.103	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.406	95% Adjusted-CLT UCL (Chen-1995)	0.407
		95% Modified-t UCL (Johnson-1978)	0.406

Gamma GOF Test

A-D Test Statistic	1.947	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.75	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.143	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.104	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	12.55	k star (bias corrected MLE)	12.05
Theta hat (MLE)	0.0307	Theta star (bias corrected MLE)	0.0319
nu hat (MLE)	1858	nu star (bias corrected)	1784
MLE Mean (bias corrected)	0.385	MLE Sd (bias corrected)	0.111
		Approximate Chi Square Value (0.05)	1687
Adjusted Level of Significance	0.0468	Adjusted Chi Square Value	1685

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.407	95% Adjusted Gamma UCL (use when n<50)	0.408

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.931	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk P Value	5.4135E-4	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.162	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.103	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.995	Mean of logged Data	-0.995
Maximum of Logged Data	-0.236	SD of logged Data	0.294

Assuming Lognormal Distribution

95% H-UCL	0.41	90% Chebyshev (MVUE) UCL	0.426
95% Chebyshev (MVUE) UCL	0.444	97.5% Chebyshev (MVUE) UCL	0.47
99% Chebyshev (MVUE) UCL	0.519		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	0.406	95% Jackknife UCL	0.406
95% Standard Bootstrap UCL	0.406	95% Bootstrap-t UCL	0.408
95% Hall's Bootstrap UCL	0.408	95% Percentile Bootstrap UCL	0.407
95% BCA Bootstrap UCL	0.408		
90% Chebyshev(Mean, Sd) UCL	0.423	95% Chebyshev(Mean, Sd) UCL	0.44
97.5% Chebyshev(Mean, Sd) UCL	0.464	99% Chebyshev(Mean, Sd) UCL	0.511

Suggested UCL to Use

95% Student's-t UCL 0.406 or 95% Modified-t UCL 0.406

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFPeA|ug/L

General Statistics

Total Number of Observations	82	Number of Distinct Observations	39
		Number of Missing Observations	1
Number of Detects	72	Number of Non-Detects	10
Number of Distinct Detects	37	Number of Distinct Non-Detects	6
Minimum Detect	0.00738	Minimum Non-Detect	0.0111
Maximum Detect	0.018	Maximum Non-Detect	0.0116
Variance Detects	3.0531E-6	Percent Non-Detects	12.2%
Mean Detects	0.0124	SD Detects	0.00175
Median Detects	0.0127	CV Detects	0.141
Skewness Detects	-0.309	Kurtosis Detects	1.928
Mean of Logged Detects	-4.4	SD of Logged Detects	0.15

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.939	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	0.00244	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.138	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.104	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0121	KM Standard Error of Mean	2.1939E-4
KM SD	0.00191	95% KM (BCA) UCL	0.0124
95% KM (t) UCL	0.0124	95% KM (Percentile Bootstrap) UCL	0.0124
95% KM (z) UCL	0.0124	95% KM Bootstrap t UCL	0.0124
90% KM Chebyshev UCL	0.0127	95% KM Chebyshev UCL	0.013
97.5% KM Chebyshev UCL	0.0134	99% KM Chebyshev UCL	0.0142

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.634	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.749	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.157	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.105	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	47.53	k star (bias corrected MLE)	45.56
Theta hat (MLE)	2.6097E-4	Theta star (bias corrected MLE)	2.7226E-4
nu hat (MLE)	6844	nu star (bias corrected)	6560
Mean (detects)	0.0124		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.00738	Mean	0.0121
Maximum	0.018	Median	0.0125
SD	0.00179	CV	0.147
k hat (MLE)	44.79	k star (bias corrected MLE)	43.16
Theta hat (MLE)	2.7098E-4	Theta star (bias corrected MLE)	2.8122E-4
nu hat (MLE)	7346	nu star (bias corrected)	7079
Adjusted Level of Significance (β)	0.0471		
Approximate Chi Square Value (N/A, α)	6884	Adjusted Chi Square Value (N/A, β)	6881
95% Gamma Approximate UCL (use when n>=50)	0.0125	95% Gamma Adjusted UCL (use when n<50)	0.0125

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0121	SD (KM)	0.00191
Variance (KM)	3.6309E-6	SE of Mean (KM)	2.1939E-4
k hat (KM)	40.1	k star (KM)	38.64
nu hat (KM)	6577	nu star (KM)	6337
theta hat (KM)	3.0091E-4	theta star (KM)	3.1227E-4
80% gamma percentile (KM)	0.0137	90% gamma percentile (KM)	0.0146
95% gamma percentile (KM)	0.0154	99% gamma percentile (KM)	0.017

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (N/A, α)	6153	Adjusted Chi Square Value (N/A, β)	6150
95% Gamma Approximate KM-UCL (use when n>=50)	0.0124	95% Gamma Adjusted KM-UCL (use when n<50)	0.0124

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.905	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	9.3790E-6	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.166	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.104	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0121	Mean in Log Scale	-4.425
SD in Original Scale	0.00181	SD in Log Scale	0.155
95% t UCL (assumes normality of ROS data)	0.0125	95% Percentile Bootstrap UCL	0.0124
95% BCA Bootstrap UCL	0.0124	95% Bootstrap t UCL	0.0125
95% H-UCL (Log ROS)	0.0125		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-4.431	KM Geo Mean	0.0119
KM SD (logged)	0.167	95% Critical H Value (KM-Log)	1.693
KM Standard Error of Mean (logged)	0.0196	95% H-UCL (KM -Log)	0.0125
KM SD (logged)	0.167	95% Critical H Value (KM-Log)	1.693
KM Standard Error of Mean (logged)	0.0196		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0116	Mean in Log Scale	-4.494
SD in Original Scale	0.00275	SD in Log Scale	0.29
95% t UCL (Assumes normality)	0.0121	95% H-Stat UCL	0.0123

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.0124	KM H-UCL	0.0125
95% KM (BCA) UCL	0.0124		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFHxA|ug/L

General Statistics

Total Number of Observations	82	Number of Distinct Observations	50
		Number of Missing Observations	1
Minimum	0.00783	Mean	0.0134
Maximum	0.019	Median	0.0132
SD	0.00245	Std. Error of Mean	2.7050E-4
Coefficient of Variation	0.183	Skewness	-0.285

Normal GOF Test

Shapiro Wilk Test Statistic	0.959	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	0.0354	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.122	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.098	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

ProUCL Output
West Lakeland
Total Surface Water

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.0138	95% Adjusted-CLT UCL (Chen-1995)	0.0138
		95% Modified-t UCL (Johnson-1978)	0.0138

Gamma GOF Test

A-D Test Statistic	1.19	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.75	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.128	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.0983	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	28.18	k star (bias corrected MLE)	27.16
Theta hat (MLE)	4.7532E-4	Theta star (bias corrected MLE)	4.9323E-4
nu hat (MLE)	4622	nu star (bias corrected)	4454
MLE Mean (bias corrected)	0.0134	MLE Sd (bias corrected)	0.00257
		Approximate Chi Square Value (0.05)	4300
Adjusted Level of Significance	0.0471	Adjusted Chi Square Value	4298

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0139	95% Adjusted Gamma UCL (use when n<50)	0.0139

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.936	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk P Value	6.4811E-4	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.128	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.098	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.85	Mean of logged Data	-4.331
Maximum of Logged Data	-3.963	SD of logged Data	0.194

Assuming Lognormal Distribution

95% H-UCL	0.0139	90% Chebyshev (MVUE) UCL	0.0143
95% Chebyshev (MVUE) UCL	0.0147	97.5% Chebyshev (MVUE) UCL	0.0152
99% Chebyshev (MVUE) UCL	0.0163		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0138	95% Jackknife UCL	0.0138
95% Standard Bootstrap UCL	0.0139	95% Bootstrap-t UCL	0.0138
95% Hall's Bootstrap UCL	0.0138	95% Percentile Bootstrap UCL	0.0138
95% BCA Bootstrap UCL	0.0138		
90% Chebyshev(Mean, Sd) UCL	0.0142	95% Chebyshev(Mean, Sd) UCL	0.0146
97.5% Chebyshev(Mean, Sd) UCL	0.0151	99% Chebyshev(Mean, Sd) UCL	0.0161

Suggested UCL to Use

95% Student's-t UCL	0.0138	or 95% Modified-t UCL	0.0138

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

General Statistics

Total Number of Observations	82	Number of Distinct Observations	66
		Number of Missing Observations	1
Number of Detects	80	Number of Non-Detects	2
Number of Distinct Detects	64	Number of Distinct Non-Detects	2
Minimum Detect	0.0057	Minimum Non-Detect	0.00559
Maximum Detect	0.0111	Maximum Non-Detect	0.00568
Variance Detects	2.5608E-6	Percent Non-Detects	2.439%
Mean Detects	0.00778	SD Detects	0.0016
Median Detects	0.00726	CV Detects	0.206
Skewness Detects	0.544	Kurtosis Detects	-1.05
Mean of Logged Detects	-4.876	SD of Logged Detects	0.2

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.886	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	4.6112E-8	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.156	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.0991	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00773	KM Standard Error of Mean	1.7855E-4
KM SD	0.00161	95% KM (BCA) UCL	0.00801
95% KM (t) UCL	0.00802	95% KM (Percentile Bootstrap) UCL	0.00801
95% KM (z) UCL	0.00802	95% KM Bootstrap t UCL	0.00806
90% KM Chebyshev UCL	0.00826	95% KM Chebyshev UCL	0.00851
97.5% KM Chebyshev UCL	0.00884	99% KM Chebyshev UCL	0.0095

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.236	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.75	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.136	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.0994	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	25.03	k star (bias corrected MLE)	24.1
Theta hat (MLE)	3.1090E-4	Theta star (bias corrected MLE)	3.2291E-4
nu hat (MLE)	4004	nu star (bias corrected)	3855
Mean (detects)	0.00778		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0057	Mean	0.00784
Maximum	0.0111	Median	0.00728
SD	0.00162	CV	0.206
k hat (MLE)	24.64	k star (bias corrected MLE)	23.74
Theta hat (MLE)	3.1804E-4	Theta star (bias corrected MLE)	3.3000E-4
nu hat (MLE)	4040	nu star (bias corrected)	3894
Adjusted Level of Significance (β)	0.0471		
Approximate Chi Square Value (N/A, α)	3750	Adjusted Chi Square Value (N/A, β)	3747
95% Gamma Approximate UCL (use when n>=50)	0.00814	95% Gamma Adjusted UCL (use when n<50)	0.00814

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00773	SD (KM)	0.00161
Variance (KM)	2.5814E-6	SE of Mean (KM)	1.7855E-4
k hat (KM)	23.13	k star (KM)	22.29
nu hat (KM)	3794	nu star (KM)	3656
theta hat (KM)	3.3405E-4	theta star (KM)	3.4661E-4
80% gamma percentile (KM)	0.00906	90% gamma percentile (KM)	0.00988
95% gamma percentile (KM)	0.0106	99% gamma percentile (KM)	0.012

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (N/A, α)	3517	Adjusted Chi Square Value (N/A, β)	3514
95% Gamma Approximate KM-UCL (use when n>=50)	0.00803	95% Gamma Adjusted KM-UCL (use when n<50)	0.00804

ProUCL Output
West Lakeland
Total Surface Water

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.904	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	1.6632E-6	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.124	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0991	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0077	Mean in Log Scale	-4.888
SD in Original Scale	0.00165	SD in Log Scale	0.212
95% t UCL (assumes normality of ROS data)	0.00801	95% Percentile Bootstrap UCL	0.008
95% BCA Bootstrap UCL	0.00803	95% Bootstrap t UCL	0.00801
95% H-UCL (Log ROS)	0.00802		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-4.884	KM Geo Mean	0.00757
KM SD (logged)	0.202	95% Critical H Value (KM-Log)	1.704
KM Standard Error of Mean (logged)	0.0225	95% H-UCL (KM -Log)	0.00803
KM SD (logged)	0.202	95% Critical H Value (KM-Log)	1.704
KM Standard Error of Mean (logged)	0.0225		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00766	Mean in Log Scale	-4.9
SD in Original Scale	0.00176	SD in Log Scale	0.251
95% t UCL (Assumes normality)	0.00798	95% H-Stat UCL	0.00806

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.00802	KM H-UCL	0.00803
95% KM (BCA) UCL	0.00801		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOA|ug/L

General Statistics

Total Number of Observations	82	Number of Distinct Observations	74
		Number of Missing Observations	1
Minimum	0.048	Mean	0.0703
Maximum	0.11	Median	0.0703
SD	0.0125	Std. Error of Mean	0.00138
Coefficient of Variation	0.178	Skewness	0.273

Normal GOF Test

Shapiro Wilk Test Statistic	0.958	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	0.0342	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.0927	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.098	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0726	95% Adjusted-CLT UCL (Chen-1995)	0.0726
		95% Modified-t UCL (Johnson-1978)	0.0726

Gamma GOF Test

A-D Test Statistic	0.899	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.75	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0934	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.0983	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

ProUCL Output
West Lakeland
Total Surface Water

Gamma Statistics

k hat (MLE)	31.91	k star (bias corrected MLE)	30.75
Theta hat (MLE)	0.0022	Theta star (bias corrected MLE)	0.00228
nu hat (MLE)	5233	nu star (bias corrected)	5043
MLE Mean (bias corrected)	0.0703	MLE Sd (bias corrected)	0.0127
		Approximate Chi Square Value (0.05)	4879
Adjusted Level of Significance	0.0471	Adjusted Chi Square Value	4876

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0726	95% Adjusted Gamma UCL (use when n<50)	0.0727

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.959	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk P Value	0.0356	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.0907	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.098	Data appear Lognormal at 5% Significance Level	

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-3.037	Mean of logged Data	-2.671
Maximum of Logged Data	-2.207	SD of logged Data	0.179

Assuming Lognormal Distribution

95% H-UCL	0.0727	90% Chebyshev (MVUE) UCL	0.0745
95% Chebyshev (MVUE) UCL	0.0764	97.5% Chebyshev (MVUE) UCL	0.079
99% Chebyshev (MVUE) UCL	0.0842		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0725	95% Jackknife UCL	0.0726
95% Standard Bootstrap UCL	0.0725	95% Bootstrap-t UCL	0.0726
95% Hall's Bootstrap UCL	0.0726	95% Percentile Bootstrap UCL	0.0726
95% BCA Bootstrap UCL	0.0726		
90% Chebyshev(Mean, Sd) UCL	0.0744	95% Chebyshev(Mean, Sd) UCL	0.0763
97.5% Chebyshev(Mean, Sd) UCL	0.0789	99% Chebyshev(Mean, Sd) UCL	0.084

Suggested UCL to Use

95% Student's-t UCL 0.0726

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFNA|ug/L

General Statistics

Total Number of Observations	82	Number of Distinct Observations	74
		Number of Missing Observations	1
Number of Detects	60	Number of Non-Detects	22
Number of Distinct Detects	53	Number of Distinct Non-Detects	21
Minimum Detect	7.6800E-4	Minimum Non-Detect	7.2200E-4
Maximum Detect	0.00277	Maximum Non-Detect	0.00579
Variance Detects	1.8490E-7	Percent Non-Detects	26.83%
Mean Detects	0.00119	SD Detects	4.3000E-4
Median Detects	0.00104	CV Detects	0.361
Skewness Detects	1.709	Kurtosis Detects	3.039
Mean of Logged Detects	-6.783	SD of Logged Detects	0.309

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.815	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	6.735E-10	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.184	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.114	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00112	KM Standard Error of Mean	5.0857E-5
KM SD	4.2424E-4	95% KM (BCA) UCL	0.00122
95% KM (t) UCL	0.00121	95% KM (Percentile Bootstrap) UCL	0.00121
95% KM (z) UCL	0.00121	95% KM Bootstrap t UCL	0.00123
90% KM Chebyshev UCL	0.00128	95% KM Chebyshev UCL	0.00135
97.5% KM Chebyshev UCL	0.00144	99% KM Chebyshev UCL	0.00163

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.222	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.751	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.155	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.115	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	9.875	k star (bias corrected MLE)	9.392
Theta hat (MLE)	1.2076E-4	Theta star (bias corrected MLE)	1.2697E-4
nu hat (MLE)	1185	nu star (bias corrected)	1127
Mean (detects)	0.00119		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	7.6800E-4	Mean	0.00356
Maximum	0.01	Median	0.00121
SD	0.00394	CV	1.109
k hat (MLE)	1.028	k star (bias corrected MLE)	0.999
Theta hat (MLE)	0.00346	Theta star (bias corrected MLE)	0.00356
nu hat (MLE)	168.6	nu star (bias corrected)	163.8
Adjusted Level of Significance (β)	0.0471		
Approximate Chi Square Value (163.78, α)	135.2	Adjusted Chi Square Value (163.78, β)	134.7
95% Gamma Approximate UCL (use when n>=50)	0.00431	95% Gamma Adjusted UCL (use when n<50)	0.00432

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00112	SD (KM)	4.2424E-4
Variance (KM)	1.7998E-7	SE of Mean (KM)	5.0857E-5
k hat (KM)	7.029	k star (KM)	6.78
nu hat (KM)	1153	nu star (KM)	1112
theta hat (KM)	1.6002E-4	theta star (KM)	1.6589E-4
80% gamma percentile (KM)	0.00146	90% gamma percentile (KM)	0.0017
95% gamma percentile (KM)	0.00192	99% gamma percentile (KM)	0.00236

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (N/A, α)	1036	Adjusted Chi Square Value (N/A, β)	1034
95% Gamma Approximate KM-UCL (use when n>=50)	0.00121	95% Gamma Adjusted KM-UCL (use when n<50)	0.00121

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.9	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	3.9411E-5	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.145	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.114	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0011	Mean in Log Scale	-6.876
SD in Original Scale	4.1653E-4	SD in Log Scale	0.337
95% t UCL (assumes normality of ROS data)	0.00117	95% Percentile Bootstrap UCL	0.00117
95% BCA Bootstrap UCL	0.00118	95% Bootstrap t UCL	0.00118
95% H-UCL (Log ROS)	0.00117		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-6.847	KM Geo Mean	0.00106
KM SD (logged)	0.321	95% Critical H Value (KM-Log)	1.749
KM Standard Error of Mean (logged)	0.0385	95% H-UCL (KM -Log)	0.00119
KM SD (logged)	0.321	95% Critical H Value (KM-Log)	1.749
KM Standard Error of Mean (logged)	0.0385		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.0013	Mean in Log Scale	-6.801
SD in Original Scale	7.4105E-4	SD in Log Scale	0.57
95% t UCL (Assumes normality)	0.00144	95% H-Stat UCL	0.00147

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.00121	KM H-UCL	0.00119
95% KM (BCA) UCL	0.00122		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	82	Number of Distinct Observations	66
		Number of Missing Observations	1
Number of Detects	33	Number of Non-Detects	49
Number of Distinct Detects	28	Number of Distinct Non-Detects	38
Minimum Detect	7.5300E-4	Minimum Non-Detect	0
Maximum Detect	0.00575	Maximum Non-Detect	0.00579
Variance Detects	8.5106E-7	Percent Non-Detects	59.76%
Mean Detects	0.0014	SD Detects	9.2253E-4
Median Detects	0.0012	CV Detects	0.658
Skewness Detects	3.889	Kurtosis Detects	16.59

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.519	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.931	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.306	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.152	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	7.3800E-4	KM Standard Error of Mean	1.1388E-4
KM SD	9.1453E-4	95% KM (BCA) UCL	0.0012
95% KM (t) UCL	9.2749E-4	95% KM (Percentile Bootstrap) UCL	0.00116
95% KM (z) UCL	9.2532E-4	95% KM Bootstrap t UCL	9.3647E-4
90% KM Chebyshev UCL	0.00108	95% KM Chebyshev UCL	0.00123
97.5% KM Chebyshev UCL	0.00145	99% KM Chebyshev UCL	0.00187

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	3.117	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.748	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.235	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.154	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.989	k star (bias corrected MLE)	4.555
Theta hat (MLE)	2.8086E-4	Theta star (bias corrected MLE)	3.0758E-4
nu hat (MLE)	329.3	nu star (bias corrected)	300.7
Mean (detects)	0.0014		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	7.3800E-4	SD (KM)	9.1453E-4
Variance (KM)	8.3637E-7	SE of Mean (KM)	1.1388E-4
k hat (KM)	0.651	k star (KM)	0.636
nu hat (KM)	106.8	nu star (KM)	104.2
theta hat (KM)	0.00113	theta star (KM)	0.00116
80% gamma percentile (KM)	0.00122	90% gamma percentile (KM)	0.00189
95% gamma percentile (KM)	0.0026	99% gamma percentile (KM)	0.0043

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0471
Approximate Chi Square Value (104.22, α)	81.67	Adjusted Chi Square Value (104.22, β)	81.31
95% Gamma Approximate KM-UCL (use when n>=50)	9.4186E-4	95% Gamma Adjusted KM-UCL (use when n<50)	9.4598E-4

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	N/A	KM Geo Mean	N/A
KM SD (logged)	N/A	95% Critical H Value (KM-Log)	N/A
KM Standard Error of Mean (logged)	N/A	95% H-UCL (KM -Log)	N/A
KM SD (logged)	N/A	95% Critical H Value (KM-Log)	N/A
KM Standard Error of Mean (logged)	N/A		

DL/2 Statistics

Mean in Original Scale	0.00127	SD in Original Scale	0.00101
95% t UCL (Assumes normality)	0.00146		

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL 0.00187

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	82	Number of Distinct Observations	62
		Number of Missing Observations	1
Number of Detects	4	Number of Non-Detects	78
Number of Distinct Detects	4	Number of Distinct Non-Detects	58
Minimum Detect	0.0013	Minimum Non-Detect	0
Maximum Detect	0.0017	Maximum Non-Detect	0.00579
Variance Detects	3.3333E-8	Percent Non-Detects	95.12%
Mean Detects	0.0015	SD Detects	1.8257E-4
Median Detects	0.0015	CV Detects	0.122
Skewness Detects	-2.83E-15	Kurtosis Detects	-3.3

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.951	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.208	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.0079E-4	KM Standard Error of Mean	5.6495E-5
KM SD	3.7759E-4	95% KM (BCA) UCL	N/A
95% KM (t) UCL	1.9479E-4	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	1.9371E-4	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	2.7027E-4	95% KM Chebyshev UCL	3.4704E-4
97.5% KM Chebyshev UCL	4.5360E-4	99% KM Chebyshev UCL	6.6290E-4

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.282	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.656	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.243	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	89.48	k star (bias corrected MLE)	22.54
Theta hat (MLE)	1.6763E-5	Theta star (bias corrected MLE)	6.6555E-5
nu hat (MLE)	715.9	nu star (bias corrected)	180.3
Mean (detects)	0.0015		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.0079E-4	SD (KM)	3.7759E-4
Variance (KM)	1.4258E-7	SE of Mean (KM)	5.6495E-5
k hat (KM)	0.0713	k star (KM)	0.0768
nu hat (KM)	11.69	nu star (KM)	12.59
theta hat (KM)	0.00141	theta star (KM)	0.00131
80% gamma percentile (KM)	4.4173E-5	90% gamma percentile (KM)	2.3265E-4
95% gamma percentile (KM)	5.8474E-4	99% gamma percentile (KM)	0.00182

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0471
Approximate Chi Square Value (12.59, α)	5.619	Adjusted Chi Square Value (12.59, β)	5.535
95% Gamma Approximate KM-UCL (use when n>=50)	2.2586E-4	95% Gamma Adjusted KM-UCL (use when n<50)	2.2926E-4

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	N/A	KM Geo Mean	N/A
KM SD (logged)	N/A	95% Critical H Value (KM-Log)	N/A
KM Standard Error of Mean (logged)	N/A	95% H-UCL (KM -Log)	N/A
KM SD (logged)	N/A	95% Critical H Value (KM-Log)	N/A
KM Standard Error of Mean (logged)	N/A		

DL/2 Statistics

Mean in Original Scale	9.4384E-4	SD in Original Scale	9.5049E-4
95% t UCL (Assumes normality)	0.00112		

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 1.95E-04

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	82	Number of Distinct Observations	63
		Number of Missing Observations	1
Number of Detects	8	Number of Non-Detects	74
Number of Distinct Detects	6	Number of Distinct Non-Detects	58
Minimum Detect	0.0021	Minimum Non-Detect	0
Maximum Detect	0.0044	Maximum Non-Detect	0.00579
Variance Detects	7.5982E-7	Percent Non-Detects	90.24%
Mean Detects	0.00286	SD Detects	8.7168E-4
Median Detects	0.00255	CV Detects	0.305
Skewness Detects	1.155	Kurtosis Detects	-0.153

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.811	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.279	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	3.4635E-4	KM Standard Error of Mean	1.2668E-4
KM SD	9.6821E-4	95% KM (BCA) UCL	8.6499E-4
95% KM (t) UCL	5.5713E-4	95% KM (Percentile Bootstrap) UCL	7.9151E-4
95% KM (z) UCL	5.5471E-4	95% KM Bootstrap t UCL	5.1174E-4
90% KM Chebyshev UCL	7.2638E-4	95% KM Chebyshev UCL	8.9852E-4
97.5% KM Chebyshev UCL	0.00114	99% KM Chebyshev UCL	0.00161

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.673	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.715	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.257	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.294	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	13.95	k star (bias corrected MLE)	8.801
Theta hat (MLE)	2.0523E-4	Theta star (bias corrected MLE)	3.2526E-4
nu hat (MLE)	223.2	nu star (bias corrected)	140.8
Mean (detects)	0.00286		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	3.4635E-4	SD (KM)	9.6821E-4
Variance (KM)	9.3744E-7	SE of Mean (KM)	1.2668E-4
k hat (KM)	0.128	k star (KM)	0.131
nu hat (KM)	20.99	nu star (KM)	21.55
theta hat (KM)	0.00271	theta star (KM)	0.00264
80% gamma percentile (KM)	3.3449E-4	90% gamma percentile (KM)	0.001
95% gamma percentile (KM)	0.00195	99% gamma percentile (KM)	0.00478

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0471
Approximate Chi Square Value (21.55, α)	12	Adjusted Chi Square Value (21.55, β)	11.87
95% Gamma Approximate KM-UCL (use when n>=50)	6.2189E-4	95% Gamma Adjusted KM-UCL (use when n<50)	6.2858E-4

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	N/A	KM Geo Mean	N/A
KM SD (logged)	N/A	95% Critical H Value (KM-Log)	N/A
KM Standard Error of Mean (logged)	N/A	95% H-UCL (KM -Log)	N/A
KM SD (logged)	N/A	95% Critical H Value (KM-Log)	N/A
KM Standard Error of Mean (logged)	N/A		

DL/2 Statistics

Mean in Original Scale	0.00105	SD in Original Scale	0.00111
95% t UCL (Assumes normality)	0.00125		

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 5.57E-04

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFBS|ug/L

General Statistics

Total Number of Observations	82	Number of Distinct Observations	66
		Number of Missing Observations	1
Number of Detects	72	Number of Non-Detects	10
Number of Distinct Detects	57	Number of Distinct Non-Detects	9
Minimum Detect	0.0026	Minimum Non-Detect	0.00553
Maximum Detect	0.00561	Maximum Non-Detect	0.00579
Variance Detects	3.1035E-7	Percent Non-Detects	12.2%
Mean Detects	0.00407	SD Detects	5.5709E-4
Median Detects	0.0041	CV Detects	0.137
Skewness Detects	0.0729	Kurtosis Detects	0.405
Mean of Logged Detects	-5.513	SD of Logged Detects	0.14

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.99	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	0.966	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.0605	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.104	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00407	KM Standard Error of Mean	6.5332E-5
KM SD	5.5182E-4	95% KM (BCA) UCL	0.00418
95% KM (t) UCL	0.00418	95% KM (Percentile Bootstrap) UCL	0.00418
95% KM (z) UCL	0.00418	95% KM Bootstrap t UCL	0.00418
90% KM Chebyshev UCL	0.00427	95% KM Chebyshev UCL	0.00435
97.5% KM Chebyshev UCL	0.00448	99% KM Chebyshev UCL	0.00472

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.321	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.749	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0786	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.105	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	53.01	k star (bias corrected MLE)	50.81
Theta hat (MLE)	7.6801E-5	Theta star (bias corrected MLE)	8.0125E-5
nu hat (MLE)	7633	nu star (bias corrected)	7316
Mean (detects)	0.00407		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0026	Mean	0.00479
Maximum	0.01	Median	0.00417
SD	0.00202	CV	0.421
k hat (MLE)	8.201	k star (bias corrected MLE)	7.909
Theta hat (MLE)	5.8454E-4	Theta star (bias corrected MLE)	6.0611E-4
nu hat (MLE)	1345	nu star (bias corrected)	1297
Adjusted Level of Significance (β)	0.0471		
Approximate Chi Square Value (N/A, α)	1215	Adjusted Chi Square Value (N/A, β)	1213
95% Gamma Approximate UCL (use when n>=50)	0.00512	95% Gamma Adjusted UCL (use when n<50)	0.00513

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00407	SD (KM)	5.5182E-4
Variance (KM)	3.0451E-7	SE of Mean (KM)	6.5332E-5
k hat (KM)	54.39	k star (KM)	52.41
nu hat (KM)	8920	nu star (KM)	8595
theta hat (KM)	7.4824E-5	theta star (KM)	7.7653E-5
80% gamma percentile (KM)	0.00453	90% gamma percentile (KM)	0.0048
95% gamma percentile (KM)	0.00504	99% gamma percentile (KM)	0.00549

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (N/A, α)	8380	Adjusted Chi Square Value (N/A, β)	8377
95% Gamma Approximate KM-UCL (use when n>=50)	0.00417	95% Gamma Adjusted KM-UCL (use when n<50)	0.00418

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.984	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	0.794	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.088	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.104	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00407	Mean in Log Scale	-5.514
SD in Original Scale	5.2323E-4	SD in Log Scale	0.131
95% t UCL (assumes normality of ROS data)	0.00416	95% Percentile Bootstrap UCL	0.00416
95% BCA Bootstrap UCL	0.00416	95% Bootstrap t UCL	0.00416
95% H-UCL (Log ROS)	0.00417		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.514	KM Geo Mean	0.00403
KM SD (logged)	0.139	95% Critical H Value (KM-Log)	1.684
KM Standard Error of Mean (logged)	0.0164	95% H-UCL (KM -Log)	0.00418
KM SD (logged)	0.139	95% Critical H Value (KM-Log)	1.684
KM Standard Error of Mean (logged)	0.0164		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00392	Mean in Log Scale	-5.556
SD in Original Scale	6.6217E-4	SD in Log Scale	0.175
95% t UCL (Assumes normality)	0.00404	95% H-Stat UCL	0.00405

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.00418

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFHxS|ug/L

General Statistics

Total Number of Observations	82	Number of Distinct Observations	63
		Number of Missing Observations	1
Minimum	0.0057	Mean	0.00923
Maximum	0.013	Median	0.00951
SD	0.00168	Std. Error of Mean	1.8539E-4
Coefficient of Variation	0.182	Skewness	-0.122

Normal GOF Test

Shapiro Wilk Test Statistic	0.955	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	0.0181	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.098	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.098	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00954	95% Adjusted-CLT UCL (Chen-1995)	0.00953
		95% Modified-t UCL (Johnson-1978)	0.00954

Gamma GOF Test

A-D Test Statistic	1.326	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.75	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.115	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.0983	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	29.29	k star (bias corrected MLE)	28.23
Theta hat (MLE)	3.1505E-4	Theta star (bias corrected MLE)	3.2692E-4
nu hat (MLE)	4803	nu star (bias corrected)	4629
MLE Mean (bias corrected)	0.00923	MLE Sd (bias corrected)	0.00174
		Approximate Chi Square Value (0.05)	4472
Adjusted Level of Significance	0.0471	Adjusted Chi Square Value	4469

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.00955	95% Adjusted Gamma UCL (use when n<50)	0.00956

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.944	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk P Value	0.00279	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.122	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.098	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.167	Mean of logged Data	-4.703
Maximum of Logged Data	-4.343	SD of logged Data	0.189

Assuming Lognormal Distribution

95% H-UCL	0.00957	90% Chebyshev (MVUE) UCL	0.00981
95% Chebyshev (MVUE) UCL	0.0101	97.5% Chebyshev (MVUE) UCL	0.0104
99% Chebyshev (MVUE) UCL	0.0112		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

ProUCL Output
West Lakeland
Total Surface Water

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00953	95% Jackknife UCL	0.00954
95% Standard Bootstrap UCL	0.00953	95% Bootstrap-t UCL	0.00954
95% Hall's Bootstrap UCL	0.00954	95% Percentile Bootstrap UCL	0.00953
95% BCA Bootstrap UCL	0.00953		
90% Chebyshev(Mean, Sd) UCL	0.00978	95% Chebyshev(Mean, Sd) UCL	0.01
97.5% Chebyshev(Mean, Sd) UCL	0.0104	99% Chebyshev(Mean, Sd) UCL	0.0111

Suggested UCL to Use

95% Student's-t UCL 0.00954 or 95% Modified-t UCL 0.00954

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFOS|ug/L

General Statistics

Total Number of Observations	82	Number of Distinct Observations	63
		Number of Missing Observations	1
Minimum	0.0594	Mean	0.179
Maximum	0.748	Median	0.157
SD	0.105	Std. Error of Mean	0.0116
Coefficient of Variation	0.585	Skewness	3.909

Normal GOF Test

Shapiro Wilk Test Statistic	0.635	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.202	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.098	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.198	95% Adjusted-CLT UCL (Chen-1995)	0.203
		95% Modified-t UCL (Johnson-1978)	0.199

Gamma GOF Test

A-D Test Statistic	2.342	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.754	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.132	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.0988	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.12	k star (bias corrected MLE)	4.941
Theta hat (MLE)	0.035	Theta star (bias corrected MLE)	0.0362
nu hat (MLE)	839.6	nu star (bias corrected)	810.3
MLE Mean (bias corrected)	0.179	MLE Sd (bias corrected)	0.0805
		Approximate Chi Square Value (0.05)	745.2
Adjusted Level of Significance	0.0471	Adjusted Chi Square Value	744.1

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.195	95% Adjusted Gamma UCL (use when n<50)	0.195

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.933	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk P Value	3.1524E-4	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.105	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.098	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.823	Mean of logged Data	-1.821
Maximum of Logged Data	-0.29	SD of logged Data	0.421

Assuming Lognormal Distribution

95% H-UCL	0.192	90% Chebyshev (MVUE) UCL	0.202
95% Chebyshev (MVUE) UCL	0.214	97.5% Chebyshev (MVUE) UCL	0.23
99% Chebyshev (MVUE) UCL	0.262		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	0.198	95% Jackknife UCL	0.198
95% Standard Bootstrap UCL	0.198	95% Bootstrap-t UCL	0.21
95% Hall's Bootstrap UCL	0.303	95% Percentile Bootstrap UCL	0.198
95% BCA Bootstrap UCL	0.205		
90% Chebyshev(Mean, Sd) UCL	0.214	95% Chebyshev(Mean, Sd) UCL	0.229
97.5% Chebyshev(Mean, Sd) UCL	0.251	99% Chebyshev(Mean, Sd) UCL	0.294

Suggested UCL to Use

95% Student's-t UCL 0.198 or 95% Modified-t UCL 0.199

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOSA|ug/L

General Statistics

Total Number of Observations	82	Number of Distinct Observations	66
		Number of Missing Observations	1
Number of Detects	35	Number of Non-Detects	47
Number of Distinct Detects	29	Number of Distinct Non-Detects	39
Minimum Detect	6.9000E-4	Minimum Non-Detect	0
Maximum Detect	0.00286	Maximum Non-Detect	0.00579
Variance Detects	1.8185E-7	Percent Non-Detects	57.32%
Mean Detects	0.00113	SD Detects	4.2644E-4
Median Detects	0.001	CV Detects	0.378
Skewness Detects	2.456	Kurtosis Detects	7.611

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.758	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.934	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.229	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.148	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	7.9418E-4	KM Standard Error of Mean	1.0981E-4
KM SD	4.9855E-4	95% KM (BCA) UCL	9.6816E-4
95% KM (t) UCL	9.7689E-4	95% KM (Percentile Bootstrap) UCL	9.6296E-4
95% KM (z) UCL	9.7480E-4	95% KM Bootstrap t UCL	0.00106
90% KM Chebyshev UCL	0.00112	95% KM Chebyshev UCL	0.00127
97.5% KM Chebyshev UCL	0.00148	99% KM Chebyshev UCL	0.00189

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.343	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.748	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.173	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.149	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	9.961	k star (bias corrected MLE)	9.126
Theta hat (MLE)	1.1327E-4	Theta star (bias corrected MLE)	1.2363E-4
nu hat (MLE)	697.3	nu star (bias corrected)	638.8
Mean (detects)	0.00113		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	7.9418E-4	SD (KM)	4.9855E-4
Variance (KM)	2.4856E-7	SE of Mean (KM)	1.0981E-4
k hat (KM)	2.538	k star (KM)	2.453
nu hat (KM)	416.2	nu star (KM)	402.3
theta hat (KM)	3.1297E-4	theta star (KM)	3.2378E-4
80% gamma percentile (KM)	0.00116	90% gamma percentile (KM)	0.00147
95% gamma percentile (KM)	0.00177	99% gamma percentile (KM)	0.00242

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0471
Approximate Chi Square Value (402.27, α)	356.8	Adjusted Chi Square Value (402.27, β)	356
95% Gamma Approximate KM-UCL (use when n>=50)	8.9545E-4	95% Gamma Adjusted KM-UCL (use when n<50)	8.9736E-4

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	N/A	KM Geo Mean	N/A
KM SD (logged)	N/A	95% Critical H Value (KM-Log)	N/A
KM Standard Error of Mean (logged)	N/A	95% H-UCL (KM -Log)	N/A
KM SD (logged)	N/A	95% Critical H Value (KM-Log)	N/A
KM Standard Error of Mean (logged)	N/A		

DL/2 Statistics

Mean in Original Scale	9.9668E-4	SD in Original Scale	8.2449E-4
95% t UCL (Assumes normality)	0.00115		

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL 0.00189

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

N-EtFOSAA|ug/L

General Statistics

Total Number of Observations	82	Number of Distinct Observations	63
		Number of Missing Observations	1
Number of Detects	18	Number of Non-Detects	64
Number of Distinct Detects	18	Number of Distinct Non-Detects	45
Minimum Detect	4.7900E-4	Minimum Non-Detect	0
Maximum Detect	0.00907	Maximum Non-Detect	0.0116
Variance Detects	3.7828E-6	Percent Non-Detects	78.05%
Mean Detects	0.00152	SD Detects	0.00194
Median Detects	9.3000E-4	CV Detects	1.276
Skewness Detects	3.823	Kurtosis Detects	15.4

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.464	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.897	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.312	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.202	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	6.7302E-4	KM Standard Error of Mean	1.6581E-4
KM SD	0.00111	95% KM (BCA) UCL	0.00106
95% KM (t) UCL	9.4891E-4	95% KM (Percentile Bootstrap) UCL	9.8273E-4
95% KM (z) UCL	9.4575E-4	95% KM Bootstrap t UCL	0.00107
90% KM Chebyshev UCL	0.00117	95% KM Chebyshev UCL	0.0014
97.5% KM Chebyshev UCL	0.00171	99% KM Chebyshev UCL	0.00232

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.814	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.754	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.242	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.207	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.766	k star (bias corrected MLE)	1.509
Theta hat (MLE)	8.6351E-4	Theta star (bias corrected MLE)	0.00101
nu hat (MLE)	63.57	nu star (bias corrected)	54.31
Mean (detects)	0.00152		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	6.7302E-4	SD (KM)	0.00111
Variance (KM)	1.2321E-6	SE of Mean (KM)	1.6581E-4
k hat (KM)	0.368	k star (KM)	0.362
nu hat (KM)	60.29	nu star (KM)	59.42
theta hat (KM)	0.00183	theta star (KM)	0.00186
80% gamma percentile (KM)	0.00107	90% gamma percentile (KM)	0.00193
95% gamma percentile (KM)	0.00289	99% gamma percentile (KM)	0.00533

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0471
Approximate Chi Square Value (59.42, α)	42.7	Adjusted Chi Square Value (59.42, β)	42.44
95% Gamma Approximate KM-UCL (use when n>=50)	9.3665E-4	95% Gamma Adjusted KM-UCL (use when n<50)	9.4224E-4

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	N/A	KM Geo Mean	N/A
KM SD (logged)	N/A	95% Critical H Value (KM-Log)	N/A
KM Standard Error of Mean (logged)	N/A	95% H-UCL (KM -Log)	N/A
KM SD (logged)	N/A	95% Critical H Value (KM-Log)	N/A
KM Standard Error of Mean (logged)	N/A		

DL/2 Statistics

Mean in Original Scale	0.00151	SD in Original Scale	0.00191
95% t UCL (Assumes normality)	0.00186		

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL	0.00232

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFPeS|ug/L

General Statistics

Total Number of Observations	82	Number of Distinct Observations	70
		Number of Missing Observations	1
Number of Detects	72	Number of Non-Detects	10
Number of Distinct Detects	61	Number of Distinct Non-Detects	9
Minimum Detect	0.00182	Minimum Non-Detect	0.00553
Maximum Detect	0.0051	Maximum Non-Detect	0.00579
Variance Detects	4.9520E-7	Percent Non-Detects	12.2%
Mean Detects	0.00293	SD Detects	7.0371E-4
Median Detects	0.00292	CV Detects	0.24
Skewness Detects	0.498	Kurtosis Detects	-0.243
Mean of Logged Detects	-5.861	SD of Logged Detects	0.238

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.949	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	0.0138	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.119	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.104	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00293	KM Standard Error of Mean	8.2933E-5
KM SD	6.9880E-4	95% KM (BCA) UCL	0.00307
95% KM (t) UCL	0.00307	95% KM (Percentile Bootstrap) UCL	0.00307
95% KM (z) UCL	0.00307	95% KM Bootstrap t UCL	0.00307
90% KM Chebyshev UCL	0.00318	95% KM Chebyshev UCL	0.00329
97.5% KM Chebyshev UCL	0.00345	99% KM Chebyshev UCL	0.00376

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.784	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.75	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.109	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.105	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	18	k star (bias corrected MLE)	17.26
Theta hat (MLE)	1.6277E-4	Theta star (bias corrected MLE)	1.6976E-4
nu hat (MLE)	2593	nu star (bias corrected)	2486
Mean (detects)	0.00293		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.00182	Mean	0.00379
Maximum	0.01	Median	0.00301
SD	0.00242	CV	0.638
k hat (MLE)	3.924	k star (bias corrected MLE)	3.789
Theta hat (MLE)	9.6657E-4	Theta star (bias corrected MLE)	0.001
nu hat (MLE)	643.5	nu star (bias corrected)	621.3
Adjusted Level of Significance (β)	0.0471		
Approximate Chi Square Value (621.32, α)	564.5	Adjusted Chi Square Value (621.32, β)	563.5
95% Gamma Approximate UCL (use when n>=50)	0.00417	95% Gamma Adjusted UCL (use when n<50)	0.00418

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00293	SD (KM)	6.9880E-4
Variance (KM)	4.8833E-7	SE of Mean (KM)	8.2933E-5
k hat (KM)	17.59	k star (KM)	16.95
nu hat (KM)	2885	nu star (KM)	2780
theta hat (KM)	1.6662E-4	theta star (KM)	1.7287E-4
80% gamma percentile (KM)	0.00351	90% gamma percentile (KM)	0.00387
95% gamma percentile (KM)	0.00419	99% gamma percentile (KM)	0.00484

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (N/A, α)	2659	Adjusted Chi Square Value (N/A, β)	2657
95% Gamma Approximate KM-UCL (use when n>=50)	0.00306	95% Gamma Adjusted KM-UCL (use when n<50)	0.00307

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.959	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	0.0602	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.101	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.104	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00292	Mean in Log Scale	-5.861
SD in Original Scale	6.6106E-4	SD in Log Scale	0.224
95% t UCL (assumes normality of ROS data)	0.00304	95% Percentile Bootstrap UCL	0.00304
95% BCA Bootstrap UCL	0.00305	95% Bootstrap t UCL	0.00304
95% H-UCL (Log ROS)	0.00305		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.861	KM Geo Mean	0.00285
KM SD (logged)	0.237	95% Critical H Value (KM-Log)	1.716
KM Standard Error of Mean (logged)	0.0281	95% H-UCL (KM -Log)	0.00307
KM SD (logged)	0.237	95% Critical H Value (KM-Log)	1.716
KM Standard Error of Mean (logged)	0.0281		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00292	Mean in Log Scale	-5.861
SD in Original Scale	6.5988E-4	SD in Log Scale	0.223
95% t UCL (Assumes normality)	0.00304	95% H-Stat UCL	0.00305

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM Student's t	0.00312	KM H-UCL	0.00307

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	82	Number of Distinct Observations	67
		Number of Missing Observations	1
Number of Detects	71	Number of Non-Detects	11
Number of Distinct Detects	57	Number of Distinct Non-Detects	10
Minimum Detect	7.5800E-4	Minimum Non-Detect	0.00141
Maximum Detect	0.0037	Maximum Non-Detect	0.00579
Variance Detects	4.4943E-7	Percent Non-Detects	13.41%
Mean Detects	0.00187	SD Detects	6.7040E-4
Median Detects	0.0018	CV Detects	0.359
Skewness Detects	0.714	Kurtosis Detects	0.397
Mean of Logged Detects	-6.348	SD of Logged Detects	0.365

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.936	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	0.00171	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.13	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.105	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00186	KM Standard Error of Mean	7.9300E-5
KM SD	6.6781E-4	95% KM (BCA) UCL	0.00199
95% KM (t) UCL	0.00199	95% KM (Percentile Bootstrap) UCL	0.00198
95% KM (z) UCL	0.00199	95% KM Bootstrap t UCL	0.002
90% KM Chebyshev UCL	0.00209	95% KM Chebyshev UCL	0.0022
97.5% KM Chebyshev UCL	0.00235	99% KM Chebyshev UCL	0.00264

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.804	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.752	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.106	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.106	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	7.976	k star (bias corrected MLE)	7.648
Theta hat (MLE)	2.3398E-4	Theta star (bias corrected MLE)	2.4400E-4
nu hat (MLE)	1133	nu star (bias corrected)	1086
Mean (detects)	0.00187		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	7.5800E-4	Mean	0.00296
Maximum	0.01	Median	0.00185
SD	0.00286	CV	0.966
k hat (MLE)	1.87	k star (bias corrected MLE)	1.81
Theta hat (MLE)	0.00158	Theta star (bias corrected MLE)	0.00163
nu hat (MLE)	306.7	nu star (bias corrected)	296.8
Adjusted Level of Significance (β)	0.0471		
Approximate Chi Square Value (296.80, α)	257.9	Adjusted Chi Square Value (296.80, β)	257.2
95% Gamma Approximate UCL (use when n>=50)	0.0034	95% Gamma Adjusted UCL (use when n<50)	0.00341

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00186	SD (KM)	6.6781E-4
Variance (KM)	4.4597E-7	SE of Mean (KM)	7.9300E-5
k hat (KM)	7.718	k star (KM)	7.443
nu hat (KM)	1266	nu star (KM)	1221
theta hat (KM)	2.4039E-4	theta star (KM)	2.4924E-4
80% gamma percentile (KM)	0.00239	90% gamma percentile (KM)	0.00276
95% gamma percentile (KM)	0.0031	99% gamma percentile (KM)	0.00379

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (N/A, α)	1141	Adjusted Chi Square Value (N/A, β)	1139
95% Gamma Approximate KM-UCL (use when n>=50)	0.00199	95% Gamma Adjusted KM-UCL (use when n<50)	0.00199

ProUCL Output
West Lakeland
Total Surface Water

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.959	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	0.0626	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.13	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.105	Detected Data Not Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00184	Mean in Log Scale	-6.354
SD in Original Scale	6.3097E-4	SD in Log Scale	0.344
95% t UCL (assumes normality of ROS data)	0.00196	95% Percentile Bootstrap UCL	0.00195
95% BCA Bootstrap UCL	0.00196	95% Bootstrap t UCL	0.00196
95% H-UCL (Log ROS)	0.00197		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-6.355	KM Geo Mean	0.00174
KM SD (logged)	0.366	95% Critical H Value (KM-Log)	1.77
KM Standard Error of Mean (logged)	0.0435	95% H-UCL (KM -Log)	0.002
KM SD (logged)	0.366	95% Critical H Value (KM-Log)	1.77
KM Standard Error of Mean (logged)	0.0435		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00197	Mean in Log Scale	-6.3
SD in Original Scale	7.1406E-4	SD in Log Scale	0.39
95% t UCL (Assumes normality)	0.0021	95% H-Stat UCL	0.00214

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM Student's t	0.00194	KM H-UCL	0.002

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Other
Total Surface Water

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/26/2021 11:51:20 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Area- Other Media- Total Surface Water

PFBA|ug/L

General Statistics

Total Number of Observations	42	Number of Distinct Observations	39
		Number of Missing Observations	5
Number of Detects	41	Number of Non-Detects	1
Number of Distinct Detects	38	Number of Distinct Non-Detects	1
Minimum Detect	0.0126	Minimum Non-Detect	0.0257
Maximum Detect	4.98	Maximum Non-Detect	0.0257
Variance Detects	1.331	Percent Non-Detects	2.381%
Mean Detects	0.491	SD Detects	1.154
Median Detects	0.169	CV Detects	2.352
Skewness Detects	3.43	Kurtosis Detects	10.6
Mean of Logged Detects	-1.749	SD of Logged Detects	1.218

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.382	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.941	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.441	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.137	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.479	KM Standard Error of Mean	0.176
KM SD	1.128	95% KM (BCA) UCL	0.774
95% KM (t) UCL	0.776	95% KM (Percentile Bootstrap) UCL	0.801
95% KM (z) UCL	0.769	95% KM Bootstrap t UCL	0.983
90% KM Chebyshev UCL	1.008	95% KM Chebyshev UCL	1.247
97.5% KM Chebyshev UCL	1.58	99% KM Chebyshev UCL	2.233

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	5.102	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.804	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.316	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.145	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.597	k star (bias corrected MLE)	0.569
Theta hat (MLE)	0.822	Theta star (bias corrected MLE)	0.862
nu hat (MLE)	48.93	nu star (bias corrected)	46.68
Mean (detects)	0.491		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.479
Maximum	4.98	Median	0.163
SD	1.142	CV	2.383
k hat (MLE)	0.575	k star (bias corrected MLE)	0.55
Theta hat (MLE)	0.833	Theta star (bias corrected MLE)	0.871
nu hat (MLE)	48.32	nu star (bias corrected)	46.21
Adjusted Level of Significance (β)	0.0443		
Approximate Chi Square Value (46.21, α)	31.61	Adjusted Chi Square Value (46.21, β)	31.18
95% Gamma Approximate UCL (use when n>=50)	0.7	95% Gamma Adjusted UCL (use when n<50)	0.71

ProUCL Output
Other
Total Surface Water

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.479	SD (KM)	1.128
Variance (KM)	1.273	SE of Mean (KM)	0.176
k hat (KM)	0.18	k star (KM)	0.183
nu hat (KM)	15.16	nu star (KM)	15.41
theta hat (KM)	2.655	theta star (KM)	2.612
80% gamma percentile (KM)	0.602	90% gamma percentile (KM)	1.447
95% gamma percentile (KM)	2.524	99% gamma percentile (KM)	5.533

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (15.41, α)	7.548	Adjusted Chi Square Value (15.41, β)	7.352
95% Gamma Approximate KM-UCL (use when n>=50)	0.978	95% Gamma Adjusted KM-UCL (use when n<50)	1.005

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.887	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.941	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.193	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.137	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.479	Mean in Log Scale	-1.803
SD in Original Scale	1.142	SD in Log Scale	1.254
95% t UCL (assumes normality of ROS data)	0.776	95% Percentile Bootstrap UCL	0.799
95% BCA Bootstrap UCL	0.905	95% Bootstrap t UCL	0.943
95% H-UCL (Log ROS)	0.608		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.807	KM Geo Mean	0.164
KM SD (logged)	1.246	95% Critical H Value (KM-Log)	2.642
KM Standard Error of Mean (logged)	0.195	95% H-UCL (KM -Log)	0.596
KM SD (logged)	1.246	95% Critical H Value (KM-Log)	2.642
KM Standard Error of Mean (logged)	0.195		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.479	Mean in Log Scale	-1.811
SD in Original Scale	1.142	SD in Log Scale	1.268
95% t UCL (Assumes normality)	0.776	95% H-Stat UCL	0.62

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 1.247

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFPeA|ug/L

General Statistics

Total Number of Observations	47	Number of Distinct Observations	47
Number of Detects	43	Number of Non-Detects	4
Number of Distinct Detects	43	Number of Distinct Non-Detects	4
Minimum Detect	0.00265	Minimum Non-Detect	0.0014
Maximum Detect	0.06	Maximum Non-Detect	0.0128
Variance Detects	1.9274E-4	Percent Non-Detects	8.511%
Mean Detects	0.013	SD Detects	0.0139
Median Detects	0.0087	CV Detects	1.071
Skewness Detects	2.501	Kurtosis Detects	5.368
Mean of Logged Detects	-4.669	SD of Logged Detects	0.729

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.602	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.943	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.336	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.134	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0122	KM Standard Error of Mean	0.00198
KM SD	0.0134	95% KM (BCA) UCL	0.0157
95% KM (t) UCL	0.0155	95% KM (Percentile Bootstrap) UCL	0.0154
95% KM (z) UCL	0.0155	95% KM Bootstrap t UCL	0.0173
90% KM Chebyshev UCL	0.0182	95% KM Chebyshev UCL	0.0208
97.5% KM Chebyshev UCL	0.0246	99% KM Chebyshev UCL	0.0319

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	3.076	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.764	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.23	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.137	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.696	k star (bias corrected MLE)	1.593
Theta hat (MLE)	0.00765	Theta star (bias corrected MLE)	0.00814
nu hat (MLE)	145.8	nu star (bias corrected)	137
Mean (detects)	0.013		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.00265	Mean	0.0127
Maximum	0.06	Median	0.00902
SD	0.0133	CV	1.046
k hat (MLE)	1.827	k star (bias corrected MLE)	1.725
Theta hat (MLE)	0.00696	Theta star (bias corrected MLE)	0.00737
nu hat (MLE)	171.8	nu star (bias corrected)	162.1
Adjusted Level of Significance (β)	0.0449		
Approximate Chi Square Value (162.12, α)	133.7	Adjusted Chi Square Value (162.12, β)	132.9
95% Gamma Approximate UCL (use when n>=50)	0.0154	95% Gamma Adjusted UCL (use when n<50)	0.0155

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0122	SD (KM)	0.0134
Variance (KM)	1.7919E-4	SE of Mean (KM)	0.00198
k hat (KM)	0.833	k star (KM)	0.794
nu hat (KM)	78.34	nu star (KM)	74.68
theta hat (KM)	0.0147	theta star (KM)	0.0154
80% gamma percentile (KM)	0.02	90% gamma percentile (KM)	0.0298
95% gamma percentile (KM)	0.0397	99% gamma percentile (KM)	0.0633

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (74.68, α)	55.77	Adjusted Chi Square Value (74.68, β)	55.26
95% Gamma Approximate KM-UCL (use when n>=50)	0.0164	95% Gamma Adjusted KM-UCL (use when n<50)	0.0165

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.902	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.943	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.161	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.134	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0122	Mean in Log Scale	-4.752
SD in Original Scale	0.0135	SD in Log Scale	0.776
95% t UCL (assumes normality of ROS data)	0.0155	95% Percentile Bootstrap UCL	0.0157
95% BCA Bootstrap UCL	0.0164	95% Bootstrap t UCL	0.0169
95% H-UCL (Log ROS)	0.0148		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-4.766	KM Geo Mean	0.00851
KM SD (logged)	0.799	95% Critical H Value (KM-Log)	2.129
KM Standard Error of Mean (logged)	0.119	95% H-UCL (KM -Log)	0.015
KM SD (logged)	0.799	95% Critical H Value (KM-Log)	2.129
KM Standard Error of Mean (logged)	0.119		

ProUCL Output
Other
Total Surface Water

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.0121	Mean in Log Scale	-4.798
SD in Original Scale	0.0136	SD in Log Scale	0.877
95% t UCL (Assumes normality)	0.0155	95% H-Stat UCL	0.0161

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 0.0208

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFHxA|ug/L

General Statistics

Total Number of Observations	47	Number of Distinct Observations	45
Number of Detects	41	Number of Non-Detects	6
Number of Distinct Detects	41	Number of Distinct Non-Detects	4
Minimum Detect	0.00183	Minimum Non-Detect	6.9800E-4
Maximum Detect	0.073	Maximum Non-Detect	0.0092
Variance Detects	2.5458E-4	Percent Non-Detects	12.77%
Mean Detects	0.0122	SD Detects	0.016
Median Detects	0.0053	CV Detects	1.304
Skewness Detects	2.419	Kurtosis Detects	5.571
Mean of Logged Detects	-4.916	SD of Logged Detects	0.924

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.627	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.941	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.275	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.137	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0111	KM Standard Error of Mean	0.00223
KM SD	0.0151	95% KM (BCA) UCL	0.015
95% KM (t) UCL	0.0148	95% KM (Percentile Bootstrap) UCL	0.0149
95% KM (z) UCL	0.0147	95% KM Bootstrap t UCL	0.0164
90% KM Chebyshev UCL	0.0177	95% KM Chebyshev UCL	0.0208
97.5% KM Chebyshev UCL	0.025	99% KM Chebyshev UCL	0.0332

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	3.184	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.776	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.227	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.142	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.111	k star (bias corrected MLE)	1.046
Theta hat (MLE)	0.011	Theta star (bias corrected MLE)	0.0117
nu hat (MLE)	91.11	nu star (bias corrected)	85.77
Mean (detects)	0.0122		

ProUCL Output
Other
Total Surface Water

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.00183	Mean	0.012
Maximum	0.073	Median	0.00618
SD	0.0149	CV	1.246
k hat (MLE)	1.252	k star (bias corrected MLE)	1.186
Theta hat (MLE)	0.00955	Theta star (bias corrected MLE)	0.0101
nu hat (MLE)	117.7	nu star (bias corrected)	111.5
Adjusted Level of Significance (β)	0.0449		
Approximate Chi Square Value (111.48, α)	88.1	Adjusted Chi Square Value (111.48, β)	87.45
95% Gamma Approximate UCL (use when n>=50)	0.0151	95% Gamma Adjusted UCL (use when n<50)	0.0152

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0111	SD (KM)	0.0151
Variance (KM)	2.2673E-4	SE of Mean (KM)	0.00223
k hat (KM)	0.54	k star (KM)	0.519
nu hat (KM)	50.72	nu star (KM)	48.82
theta hat (KM)	0.0205	theta star (KM)	0.0213
80% gamma percentile (KM)	0.0182	90% gamma percentile (KM)	0.0297
95% gamma percentile (KM)	0.0419	99% gamma percentile (KM)	0.0719

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (48.82, α)	33.78	Adjusted Chi Square Value (48.82, β)	33.38
95% Gamma Approximate KM-UCL (use when n>=50)	0.016	95% Gamma Adjusted KM-UCL (use when n<50)	0.0162

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.883	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.941	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.175	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.137	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0111	Mean in Log Scale	-5.053
SD in Original Scale	0.0152	SD in Log Scale	0.977
95% t UCL (assumes normality of ROS data)	0.0148	95% Percentile Bootstrap UCL	0.0149
95% BCA Bootstrap UCL	0.0156	95% Bootstrap t UCL	0.0164
95% H-UCL (Log ROS)	0.0144		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.074	KM Geo Mean	0.00625
KM SD (logged)	1.001	95% Critical H Value (KM-Log)	2.332
KM Standard Error of Mean (logged)	0.15	95% H-UCL (KM -Log)	0.0146
KM SD (logged)	1.001	95% Critical H Value (KM-Log)	2.332
KM Standard Error of Mean (logged)	0.15		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0111	Mean in Log Scale	-5.093
SD in Original Scale	0.0152	SD in Log Scale	1.068
95% t UCL (Assumes normality)	0.0148	95% H-Stat UCL	0.0159

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 0.0208

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	47	Number of Distinct Observations	44
Number of Detects	44	Number of Non-Detects	3
Number of Distinct Detects	41	Number of Distinct Non-Detects	3
Minimum Detect	0.00128	Minimum Non-Detect	6.9800E-4
Maximum Detect	0.017	Maximum Non-Detect	0.00642
Variance Detects	1.6824E-5	Percent Non-Detects	6.383%
Mean Detects	0.00454	SD Detects	0.0041
Median Detects	0.00228	CV Detects	0.904
Skewness Detects	1.421	Kurtosis Detects	1.195
Mean of Logged Detects	-5.734	SD of Logged Detects	0.798

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.762	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.944	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.282	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.132	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00432	KM Standard Error of Mean	5.9284E-4
KM SD	0.00402	95% KM (BCA) UCL	0.00539
95% KM (t) UCL	0.00532	95% KM (Percentile Bootstrap) UCL	0.00532
95% KM (z) UCL	0.0053	95% KM Bootstrap t UCL	0.00556
90% KM Chebyshev UCL	0.0061	95% KM Chebyshev UCL	0.0069
97.5% KM Chebyshev UCL	0.00802	99% KM Chebyshev UCL	0.0102

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.942	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.766	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.245	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.136	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.623	k star (bias corrected MLE)	1.527
Theta hat (MLE)	0.0028	Theta star (bias corrected MLE)	0.00297
nu hat (MLE)	142.8	nu star (bias corrected)	134.4
Mean (detects)	0.00454		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.00128	Mean	0.00489
Maximum	0.017	Median	0.00237
SD	0.00419	CV	0.857
k hat (MLE)	1.614	k star (bias corrected MLE)	1.525
Theta hat (MLE)	0.00303	Theta star (bias corrected MLE)	0.0032
nu hat (MLE)	151.7	nu star (bias corrected)	143.4
Adjusted Level of Significance (β)	0.0449		
Approximate Chi Square Value (143.39, α)	116.7	Adjusted Chi Square Value (143.39, β)	116
95% Gamma Approximate UCL (use when n>=50)	0.006	95% Gamma Adjusted UCL (use when n<50)	0.00604

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00432	SD (KM)	0.00402
Variance (KM)	1.6126E-5	SE of Mean (KM)	5.9284E-4
k hat (KM)	1.157	k star (KM)	1.098
nu hat (KM)	108.8	nu star (KM)	103.2
theta hat (KM)	0.00373	theta star (KM)	0.00394
80% gamma percentile (KM)	0.0069	90% gamma percentile (KM)	0.00972
95% gamma percentile (KM)	0.0125	99% gamma percentile (KM)	0.019

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (103.17, α)	80.73	Adjusted Chi Square Value (103.17, β)	80.11
95% Gamma Approximate KM-UCL (use when n>=50)	0.00552	95% Gamma Adjusted KM-UCL (use when n<50)	0.00556

ProUCL Output
Other
Total Surface Water

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.856	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.944	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.214	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.132	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00431	Mean in Log Scale	-5.821
SD in Original Scale	0.00406	SD in Log Scale	0.86
95% t UCL (assumes normality of ROS data)	0.00531	95% Percentile Bootstrap UCL	0.00529
95% BCA Bootstrap UCL	0.00544	95% Bootstrap t UCL	0.00554
95% H-UCL (Log ROS)	0.00566		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.811	KM Geo Mean	0.00299
KM SD (logged)	0.829	95% Critical H Value (KM-Log)	2.158
KM Standard Error of Mean (logged)	0.123	95% H-UCL (KM -Log)	0.0055
KM SD (logged)	0.829	95% Critical H Value (KM-Log)	2.158
KM Standard Error of Mean (logged)	0.123		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00433	Mean in Log Scale	-5.829
SD in Original Scale	0.00406	SD in Log Scale	0.895
95% t UCL (Assumes normality)	0.00532	95% H-Stat UCL	0.00589

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	0.0069

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	47	Number of Distinct Observations	46
Number of Detects	45	Number of Non-Detects	2
Number of Distinct Detects	44	Number of Distinct Non-Detects	2
Minimum Detect	7.8000E-4	Minimum Non-Detect	6.9800E-4
Maximum Detect	0.16	Maximum Non-Detect	0.00642
Variance Detects	0.0014	Percent Non-Detects	4.255%
Mean Detects	0.0319	SD Detects	0.0374
Median Detects	0.0121	CV Detects	1.172
Skewness Detects	1.622	Kurtosis Detects	2.116
Mean of Logged Detects	-4.056	SD of Logged Detects	1.127

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.727	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.945	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.337	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.131	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0307	KM Standard Error of Mean	0.00542
KM SD	0.0367	95% KM (BCA) UCL	0.0405
95% KM (t) UCL	0.0398	95% KM (Percentile Bootstrap) UCL	0.0402
95% KM (z) UCL	0.0396	95% KM Bootstrap t UCL	0.0413
90% KM Chebyshev UCL	0.0469	95% KM Chebyshev UCL	0.0543
97.5% KM Chebyshev UCL	0.0645	99% KM Chebyshev UCL	0.0846

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	3.084	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.78	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.265	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.136	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.948	k star (bias corrected MLE)	0.9
Theta hat (MLE)	0.0337	Theta star (bias corrected MLE)	0.0355
nu hat (MLE)	85.36	nu star (bias corrected)	81.01
Mean (detects)	0.0319		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	7.8000E-4	Mean	0.031
Maximum	0.16	Median	0.0121
SD	0.0369	CV	1.189
k hat (MLE)	0.957	k star (bias corrected MLE)	0.91
Theta hat (MLE)	0.0324	Theta star (bias corrected MLE)	0.0341
nu hat (MLE)	89.99	nu star (bias corrected)	85.58
Adjusted Level of Significance (β)	0.0449		
Approximate Chi Square Value (85.58, α)	65.25	Adjusted Chi Square Value (85.58, β)	64.69
95% Gamma Approximate UCL (use when n>=50)	0.0407	95% Gamma Adjusted UCL (use when n<50)	0.041

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0307	SD (KM)	0.0367
Variance (KM)	0.00135	SE of Mean (KM)	0.00542
k hat (KM)	0.698	k star (KM)	0.668
nu hat (KM)	65.62	nu star (KM)	62.77
theta hat (KM)	0.0439	theta star (KM)	0.0459
80% gamma percentile (KM)	0.0505	90% gamma percentile (KM)	0.0778
95% gamma percentile (KM)	0.106	99% gamma percentile (KM)	0.174

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (62.77, α)	45.54	Adjusted Chi Square Value (62.77, β)	45.08
95% Gamma Approximate KM-UCL (use when n>=50)	0.0423	95% Gamma Adjusted KM-UCL (use when n<50)	0.0427

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.908	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.945	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.207	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.131	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0307	Mean in Log Scale	-4.155
SD in Original Scale	0.0371	SD in Log Scale	1.203
95% t UCL (assumes normality of ROS data)	0.0397	95% Percentile Bootstrap UCL	0.0399
95% BCA Bootstrap UCL	0.0412	95% Bootstrap t UCL	0.0412
95% H-UCL (Log ROS)	0.0509		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-4.165	KM Geo Mean	0.0155
KM SD (logged)	1.221	95% Critical H Value (KM-Log)	2.578
KM Standard Error of Mean (logged)	0.181	95% H-UCL (KM -Log)	0.052
KM SD (logged)	1.221	95% Critical H Value (KM-Log)	2.578
KM Standard Error of Mean (logged)	0.181		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0307	Mean in Log Scale	-4.175
SD in Original Scale	0.0371	SD in Log Scale	1.262
95% t UCL (Assumes normality)	0.0397	95% H-Stat UCL	0.0556

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 0.0543

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Other
Total Surface Water

PFNA|ug/L

General Statistics

Total Number of Observations	47	Number of Distinct Observations	43
Number of Detects	16	Number of Non-Detects	31
Number of Distinct Detects	16	Number of Distinct Non-Detects	29
Minimum Detect	6.9700E-4	Minimum Non-Detect	3.6700E-4
Maximum Detect	0.0033	Maximum Non-Detect	0.00642
Variance Detects	5.8855E-7	Percent Non-Detects	65.96%
Mean Detects	0.00128	SD Detects	7.6717E-4
Median Detects	9.4500E-4	CV Detects	0.6
Skewness Detects	1.81	Kurtosis Detects	2.424
Mean of Logged Detects	-6.786	SD of Logged Detects	0.475

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.721	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.887	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.311	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.213	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	7.8670E-4	KM Standard Error of Mean	1.1073E-4
KM SD	6.3743E-4	95% KM (BCA) UCL	9.6588E-4
95% KM (t) UCL	9.7258E-4	95% KM (Percentile Bootstrap) UCL	9.8164E-4
95% KM (z) UCL	9.6884E-4	95% KM Bootstrap t UCL	0.00105
90% KM Chebyshev UCL	0.00112	95% KM Chebyshev UCL	0.00127
97.5% KM Chebyshev UCL	0.00148	99% KM Chebyshev UCL	0.00189

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.369	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.742	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.246	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.216	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.206	k star (bias corrected MLE)	3.459
Theta hat (MLE)	3.0385E-4	Theta star (bias corrected MLE)	3.6946E-4
nu hat (MLE)	134.6	nu star (bias corrected)	110.7
Mean (detects)	0.00128		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	6.9700E-4	Mean	0.00703
Maximum	0.01	Median	0.01
SD	0.0042	CV	0.597
k hat (MLE)	1.425	k star (bias corrected MLE)	1.348
Theta hat (MLE)	0.00493	Theta star (bias corrected MLE)	0.00521
nu hat (MLE)	134	nu star (bias corrected)	126.8
Adjusted Level of Significance (β)	0.0449		
Approximate Chi Square Value (126.75, α)	101.7	Adjusted Chi Square Value (126.75, β)	101
95% Gamma Approximate UCL (use when n>=50)	0.00876	95% Gamma Adjusted UCL (use when n<50)	0.00882

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	7.8670E-4	SD (KM)	6.3743E-4
Variance (KM)	4.0632E-7	SE of Mean (KM)	1.1073E-4
k hat (KM)	1.523	k star (KM)	1.44
nu hat (KM)	143.2	nu star (KM)	135.4
theta hat (KM)	5.1648E-4	theta star (KM)	5.4626E-4
80% gamma percentile (KM)	0.00122	90% gamma percentile (KM)	0.00166
95% gamma percentile (KM)	0.00208	99% gamma percentile (KM)	0.00303

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (135.37, α)	109.5	Adjusted Chi Square Value (135.37, β)	108.8
95% Gamma Approximate KM-UCL (use when n>=50)	9.7266E-4	95% Gamma Adjusted KM-UCL (use when n<50)	9.7924E-4

ProUCL Output
Other
Total Surface Water

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.837	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.209	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	6.8949E-4	Mean in Log Scale	-7.515
SD in Original Scale	6.1809E-4	SD in Log Scale	0.628
95% t UCL (assumes normality of ROS data)	8.4084E-4	95% Percentile Bootstrap UCL	8.4205E-4
95% BCA Bootstrap UCL	8.7896E-4	95% Bootstrap t UCL	9.1097E-4
95% H-UCL (Log ROS)	7.9649E-4		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-7.36	KM Geo Mean	6.3596E-4
KM SD (logged)	0.601	95% Critical H Value (KM-Log)	1.96
KM Standard Error of Mean (logged)	0.119	95% H-UCL (KM -Log)	9.0633E-4
KM SD (logged)	0.601	95% Critical H Value (KM-Log)	1.96
KM Standard Error of Mean (logged)	0.119		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	9.9671E-4	Mean in Log Scale	-7.271
SD in Original Scale	8.8230E-4	SD in Log Scale	0.852
95% t UCL (Assumes normality)	0.00121	95% H-Stat UCL	0.00132

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM Student's t	7.6890E-4	KM H-UCL	9.06E-04

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	47	Number of Distinct Observations	43
Number of Detects	6	Number of Non-Detects	41
Number of Distinct Detects	6	Number of Distinct Non-Detects	38
Minimum Detect	4.0000E-4	Minimum Non-Detect	3.6000E-4
Maximum Detect	0.0052	Maximum Non-Detect	0.00642
Variance Detects	3.9923E-6	Percent Non-Detects	87.23%
Mean Detects	0.00268	SD Detects	0.002
Median Detects	0.00255	CV Detects	0.746
Skewness Detects	0.137	Kurtosis Detects	-2.263
Mean of Logged Detects	-6.27	SD of Logged Detects	1.019

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.914	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.205	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	6.8614E-4	KM Standard Error of Mean	1.7322E-4
KM SD	0.00104	95% KM (BCA) UCL	9.7732E-4
95% KM (t) UCL	9.7692E-4	95% KM (Percentile Bootstrap) UCL	9.6952E-4
95% KM (z) UCL	9.7107E-4	95% KM Bootstrap t UCL	0.001
90% KM Chebyshev UCL	0.00121	95% KM Chebyshev UCL	0.00144
97.5% KM Chebyshev UCL	0.00177	99% KM Chebyshev UCL	0.00241

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.313	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.707	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.23	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.337	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.583	k star (bias corrected MLE)	0.903
Theta hat (MLE)	0.00169	Theta star (bias corrected MLE)	0.00297
nu hat (MLE)	18.99	nu star (bias corrected)	10.83
Mean (detects)	0.00268		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	4.0000E-4	Mean	0.00907
Maximum	0.01	Median	0.01
SD	0.00256	CV	0.282
k hat (MLE)	4.529	k star (bias corrected MLE)	4.254
Theta hat (MLE)	0.002	Theta star (bias corrected MLE)	0.00213
nu hat (MLE)	425.7	nu star (bias corrected)	399.8
Adjusted Level of Significance (β)	0.0449		
Approximate Chi Square Value (399.85, α)	354.5	Adjusted Chi Square Value (399.85, β)	353.2
95% Gamma Approximate UCL (use when n>=50)	0.0102	95% Gamma Adjusted UCL (use when n<50)	0.0103

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	6.8614E-4	SD (KM)	0.00104
Variance (KM)	1.0885E-6	SE of Mean (KM)	1.7322E-4
k hat (KM)	0.433	k star (KM)	0.419
nu hat (KM)	40.66	nu star (KM)	39.4
theta hat (KM)	0.00159	theta star (KM)	0.00164
80% gamma percentile (KM)	0.00111	90% gamma percentile (KM)	0.00192
95% gamma percentile (KM)	0.00281	99% gamma percentile (KM)	0.00502

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (39.40, α)	26.02	Adjusted Chi Square Value (39.40, β)	25.67
95% Gamma Approximate KM-UCL (use when n>=50)	0.00104	95% Gamma Adjusted KM-UCL (use when n<50)	0.00105

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.914	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.227	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	3.8500E-4	Mean in Log Scale	-9.509
SD in Original Scale	0.00111	SD in Log Scale	1.34
95% t UCL (assumes normality of ROS data)	6.5558E-4	95% Percentile Bootstrap UCL	6.5814E-4
95% BCA Bootstrap UCL	7.4240E-4	95% Bootstrap t UCL	8.4694E-4
95% H-UCL (Log ROS)	3.1123E-4		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-7.688	KM Geo Mean	4.5845E-4
KM SD (logged)	0.67	95% Critical H Value (KM-Log)	2.011
KM Standard Error of Mean (logged)	0.113	95% H-UCL (KM -Log)	6.9974E-4
KM SD (logged)	0.67	95% Critical H Value (KM-Log)	2.011
KM Standard Error of Mean (logged)	0.113		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	9.2707E-4	Mean in Log Scale	-7.556
SD in Original Scale	0.00121	SD in Log Scale	0.978
95% t UCL (Assumes normality)	0.00122	95% H-Stat UCL	0.00118

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 9.77E-04

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Other
Total Surface Water

PFBS|ug/L

General Statistics

Total Number of Observations	47	Number of Distinct Observations	40
Number of Detects	42	Number of Non-Detects	5
Number of Distinct Detects	35	Number of Distinct Non-Detects	5
Minimum Detect	8.5400E-4	Minimum Non-Detect	6.9800E-4
Maximum Detect	0.0089	Maximum Non-Detect	0.00642
Variance Detects	2.5832E-6	Percent Non-Detects	10.64%
Mean Detects	0.00316	SD Detects	0.00161
Median Detects	0.00272	CV Detects	0.509
Skewness Detects	1.429	Kurtosis Detects	3.177
Mean of Logged Detects	-5.876	SD of Logged Detects	0.499

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.858	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.942	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.138	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.135	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00299	KM Standard Error of Mean	2.4501E-4
KM SD	0.00164	95% KM (BCA) UCL	0.00342
95% KM (t) UCL	0.0034	95% KM (Percentile Bootstrap) UCL	0.0034
95% KM (z) UCL	0.00339	95% KM Bootstrap t UCL	0.00346
90% KM Chebyshev UCL	0.00372	95% KM Chebyshev UCL	0.00405
97.5% KM Chebyshev UCL	0.00452	99% KM Chebyshev UCL	0.00542

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.447	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.752	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.101	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.137	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.389	k star (bias corrected MLE)	4.091
Theta hat (MLE)	7.1982E-4	Theta star (bias corrected MLE)	7.7219E-4
nu hat (MLE)	368.7	nu star (bias corrected)	343.7
Mean (detects)	0.00316		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	8.5400E-4	Mean	0.00389
Maximum	0.01	Median	0.00303
SD	0.00262	CV	0.673
k hat (MLE)	2.782	k star (bias corrected MLE)	2.619
Theta hat (MLE)	0.0014	Theta star (bias corrected MLE)	0.00148
nu hat (MLE)	261.5	nu star (bias corrected)	246.2
Adjusted Level of Significance (β)	0.0449		
Approximate Chi Square Value (246.15, α)	210.8	Adjusted Chi Square Value (246.15, β)	209.8
95% Gamma Approximate UCL (use when n>=50)	0.00454	95% Gamma Adjusted UCL (use when n<50)	0.00456

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00299	SD (KM)	0.00164
Variance (KM)	2.6838E-6	SE of Mean (KM)	2.4501E-4
k hat (KM)	3.321	k star (KM)	3.123
nu hat (KM)	312.1	nu star (KM)	293.5
theta hat (KM)	8.9901E-4	theta star (KM)	9.5595E-4
80% gamma percentile (KM)	0.00424	90% gamma percentile (KM)	0.00525
95% gamma percentile (KM)	0.00619	99% gamma percentile (KM)	0.00823

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (293.55, α)	254.9	Adjusted Chi Square Value (293.55, β)	253.7
95% Gamma Approximate KM-UCL (use when n>=50)	0.00344	95% Gamma Adjusted KM-UCL (use when n<50)	0.00345

ProUCL Output
Other
Total Surface Water

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.936	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.942	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.116	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.135	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00299	Mean in Log Scale	-5.952
SD in Original Scale	0.00162	SD in Log Scale	0.546
95% t UCL (assumes normality of ROS data)	0.00339	95% Percentile Bootstrap UCL	0.00339
95% BCA Bootstrap UCL	0.00343	95% Bootstrap t UCL	0.00343
95% H-UCL (Log ROS)	0.00352		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.971	KM Geo Mean	0.00255
KM SD (logged)	0.588	95% Critical H Value (KM-Log)	1.949
KM Standard Error of Mean (logged)	0.0884	95% H-UCL (KM -Log)	0.00359
KM SD (logged)	0.588	95% Critical H Value (KM-Log)	1.949
KM Standard Error of Mean (logged)	0.0884		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00297	Mean in Log Scale	-6.004
SD in Original Scale	0.00167	SD in Log Scale	0.695
95% t UCL (Assumes normality)	0.00338	95% H-Stat UCL	0.00387

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	0.00345	95% GROS Adjusted Gamma UCL	0.00456

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFHxS|ug/L

General Statistics

Total Number of Observations	47	Number of Distinct Observations	46
Number of Detects	38	Number of Non-Detects	9
Number of Distinct Detects	37	Number of Distinct Non-Detects	9
Minimum Detect	9.5800E-4	Minimum Non-Detect	3.6300E-4
Maximum Detect	0.036	Maximum Non-Detect	0.00642
Variance Detects	3.3920E-5	Percent Non-Detects	19.15%
Mean Detects	0.00519	SD Detects	0.00582
Median Detects	0.00335	CV Detects	1.123
Skewness Detects	4.268	Kurtosis Detects	21.8
Mean of Logged Detects	-5.545	SD of Logged Detects	0.676

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.539	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.938	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.269	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.142	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00439	KM Standard Error of Mean	8.0602E-4
KM SD	0.00544	95% KM (BCA) UCL	0.00606
95% KM (t) UCL	0.00575	95% KM (Percentile Bootstrap) UCL	0.00583
95% KM (z) UCL	0.00572	95% KM Bootstrap t UCL	0.00685
90% KM Chebyshev UCL	0.00681	95% KM Chebyshev UCL	0.00791
97.5% KM Chebyshev UCL	0.00943	99% KM Chebyshev UCL	0.0124

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.247	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.76	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.237	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.145	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.916	k star (bias corrected MLE)	1.782
Theta hat (MLE)	0.00271	Theta star (bias corrected MLE)	0.00291
nu hat (MLE)	145.6	nu star (bias corrected)	135.4
Mean (detects)	0.00519		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	9.5800E-4	Mean	0.00611
Maximum	0.036	Median	0.00348
SD	0.00556	CV	0.911
k hat (MLE)	2.025	k star (bias corrected MLE)	1.91
Theta hat (MLE)	0.00302	Theta star (bias corrected MLE)	0.0032
nu hat (MLE)	190.4	nu star (bias corrected)	179.5
Adjusted Level of Significance (β)	0.0449		
Approximate Chi Square Value (179.53, α)	149.5	Adjusted Chi Square Value (179.53, β)	148.7
95% Gamma Approximate UCL (use when n>=50)	0.00733	95% Gamma Adjusted UCL (use when n<50)	0.00738

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00439	SD (KM)	0.00544
Variance (KM)	2.9626E-5	SE of Mean (KM)	8.0602E-4
k hat (KM)	0.652	k star (KM)	0.625
nu hat (KM)	61.28	nu star (KM)	58.7
theta hat (KM)	0.00674	theta star (KM)	0.00704
80% gamma percentile (KM)	0.00724	90% gamma percentile (KM)	0.0113
95% gamma percentile (KM)	0.0156	99% gamma percentile (KM)	0.0259

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (58.70, α)	42.09	Adjusted Chi Square Value (58.70, β)	41.64
95% Gamma Approximate KM-UCL (use when n>=50)	0.00613	95% Gamma Adjusted KM-UCL (use when n<50)	0.0062

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.923	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.938	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.2	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.142	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00447	Mean in Log Scale	-5.757
SD in Original Scale	0.00544	SD in Log Scale	0.776
95% t UCL (assumes normality of ROS data)	0.0058	95% Percentile Bootstrap UCL	0.00589
95% BCA Bootstrap UCL	0.0065	95% Bootstrap t UCL	0.00716
95% H-UCL (Log ROS)	0.00543		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.894	KM Geo Mean	0.00276
KM SD (logged)	1.018	95% Critical H Value (KM-Log)	2.351
KM Standard Error of Mean (logged)	0.154	95% H-UCL (KM -Log)	0.00659
KM SD (logged)	1.018	95% Critical H Value (KM-Log)	2.351
KM Standard Error of Mean (logged)	0.154		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00439	Mean in Log Scale	-5.894
SD in Original Scale	0.0055	SD in Log Scale	1.04
95% t UCL (Assumes normality)	0.00574	95% H-Stat UCL	0.00681

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 0.00791

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Other
Total Surface Water

PFOS|ug/L

General Statistics

Total Number of Observations	47	Number of Distinct Observations	45
Number of Detects	44	Number of Non-Detects	3
Number of Distinct Detects	42	Number of Distinct Non-Detects	3
Minimum Detect	0.00124	Minimum Non-Detect	6.9800E-4
Maximum Detect	0.33	Maximum Non-Detect	0.00642
Variance Detects	0.00663	Percent Non-Detects	6.383%
Mean Detects	0.0438	SD Detects	0.0814
Median Detects	0.00703	CV Detects	1.857
Skewness Detects	2.358	Kurtosis Detects	5.201
Mean of Logged Detects	-4.558	SD of Logged Detects	1.645

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.576	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.944	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.397	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.132	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0411	KM Standard Error of Mean	0.0116
KM SD	0.0785	95% KM (BCA) UCL	0.0615
95% KM (t) UCL	0.0606	95% KM (Percentile Bootstrap) UCL	0.0607
95% KM (z) UCL	0.0602	95% KM Bootstrap t UCL	0.0708
90% KM Chebyshev UCL	0.0759	95% KM Chebyshev UCL	0.0916
97.5% KM Chebyshev UCL	0.113	99% KM Chebyshev UCL	0.156

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	3.824	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.825	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.286	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.142	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.451	k star (bias corrected MLE)	0.436
Theta hat (MLE)	0.0971	Theta star (bias corrected MLE)	0.101
nu hat (MLE)	39.71	nu star (bias corrected)	38.34
Mean (detects)	0.0438		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.00124	Mean	0.0417
Maximum	0.33	Median	0.0094
SD	0.0791	CV	1.899
k hat (MLE)	0.465	k star (bias corrected MLE)	0.449
Theta hat (MLE)	0.0897	Theta star (bias corrected MLE)	0.0928
nu hat (MLE)	43.67	nu star (bias corrected)	42.22
Adjusted Level of Significance (β)	0.0449		
Approximate Chi Square Value (42.22, α)	28.32	Adjusted Chi Square Value (42.22, β)	27.96
95% Gamma Approximate UCL (use when n>=50)	0.0621	95% Gamma Adjusted UCL (use when n<50)	0.0629

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0411	SD (KM)	0.0785
Variance (KM)	0.00617	SE of Mean (KM)	0.0116
k hat (KM)	0.274	k star (KM)	0.271
nu hat (KM)	25.76	nu star (KM)	25.45
theta hat (KM)	0.15	theta star (KM)	0.152
80% gamma percentile (KM)	0.0613	90% gamma percentile (KM)	0.123
95% gamma percentile (KM)	0.194	99% gamma percentile (KM)	0.383

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (25.45, α)	14.96	Adjusted Chi Square Value (25.45, β)	14.7
95% Gamma Approximate KM-UCL (use when n>=50)	0.07	95% Gamma Adjusted KM-UCL (use when n<50)	0.0712

ProUCL Output
Other
Total Surface Water

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.881	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.944	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.164	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.132	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0411	Mean in Log Scale	-4.749
SD in Original Scale	0.0794	SD in Log Scale	1.78
95% t UCL (assumes normality of ROS data)	0.0605	95% Percentile Bootstrap UCL	0.0608
95% BCA Bootstrap UCL	0.0653	95% Bootstrap t UCL	0.0695
95% H-UCL (Log ROS)	0.1		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-4.704	KM Geo Mean	0.00906
KM SD (logged)	1.678	95% Critical H Value (KM-Log)	3.153
KM Standard Error of Mean (logged)	0.248	95% H-UCL (KM -Log)	0.0809
KM SD (logged)	1.678	95% Critical H Value (KM-Log)	3.153
KM Standard Error of Mean (logged)	0.248		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0411	Mean in Log Scale	-4.728
SD in Original Scale	0.0794	SD in Log Scale	1.741
95% t UCL (Assumes normality)	0.0606	95% H-Stat UCL	0.0925

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	0.0916

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOSA|ug/L

General Statistics

Total Number of Observations	47	Number of Distinct Observations	44
Number of Detects	7	Number of Non-Detects	40
Number of Distinct Detects	7	Number of Distinct Non-Detects	37
Minimum Detect	7.6100E-4	Minimum Non-Detect	3.6000E-4
Maximum Detect	0.0014	Maximum Non-Detect	0.00642
Variance Detects	5.4754E-8	Percent Non-Detects	85.11%
Mean Detects	9.9171E-4	SD Detects	2.3399E-4
Median Detects	9.5000E-4	CV Detects	0.236
Skewness Detects	0.967	Kurtosis Detects	-0.00197
Mean of Logged Detects	-6.938	SD of Logged Detects	0.225

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.904	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.2	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	4.7152E-4	KM Standard Error of Mean	4.4012E-5
KM SD	2.5691E-4	95% KM (BCA) UCL	5.4661E-4
95% KM (t) UCL	5.4540E-4	95% KM (Percentile Bootstrap) UCL	5.4482E-4
95% KM (z) UCL	5.4391E-4	95% KM Bootstrap t UCL	5.3641E-4
90% KM Chebyshev UCL	6.0356E-4	95% KM Chebyshev UCL	6.6337E-4
97.5% KM Chebyshev UCL	7.4638E-4	99% KM Chebyshev UCL	9.0944E-4

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.316	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.707	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.184	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.311	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	22.56	k star (bias corrected MLE)	12.99
Theta hat (MLE)	4.3953E-5	Theta star (bias corrected MLE)	7.6353E-5
nu hat (MLE)	315.9	nu star (bias corrected)	181.8
Mean (detects)	9.9171E-4		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	7.6100E-4	Mean	0.00866
Maximum	0.01	Median	0.01
SD	0.00324	CV	0.375
k hat (MLE)	2.612	k star (bias corrected MLE)	2.46
Theta hat (MLE)	0.00331	Theta star (bias corrected MLE)	0.00352
nu hat (MLE)	245.6	nu star (bias corrected)	231.2
Adjusted Level of Significance (β)	0.0449		
Approximate Chi Square Value (231.22, α)	197	Adjusted Chi Square Value (231.22, β)	196
95% Gamma Approximate UCL (use when n>=50)	0.0102	95% Gamma Adjusted UCL (use when n<50)	0.0102

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	4.7152E-4	SD (KM)	2.5691E-4
Variance (KM)	6.6001E-8	SE of Mean (KM)	4.4012E-5
k hat (KM)	3.369	k star (KM)	3.168
nu hat (KM)	316.6	nu star (KM)	297.8
theta hat (KM)	1.3998E-4	theta star (KM)	1.4885E-4
80% gamma percentile (KM)	6.6820E-4	90% gamma percentile (KM)	8.2676E-4
95% gamma percentile (KM)	9.7431E-4	99% gamma percentile (KM)	0.00129

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (297.77, α)	258.8	Adjusted Chi Square Value (297.77, β)	257.7
95% Gamma Approximate KM-UCL (use when n>=50)	5.4253E-4	95% Gamma Adjusted KM-UCL (use when n<50)	5.4494E-4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.931	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.166	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	4.5368E-4	Mean in Log Scale	-7.788
SD in Original Scale	2.4562E-4	SD in Log Scale	0.381
95% t UCL (assumes normality of ROS data)	5.1382E-4	95% Percentile Bootstrap UCL	5.1420E-4
95% BCA Bootstrap UCL	5.2535E-4	95% Bootstrap t UCL	5.3867E-4
95% H-UCL (Log ROS)	4.9380E-4		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-7.754	KM Geo Mean	4.2895E-4
KM SD (logged)	0.387	95% Critical H Value (KM-Log)	1.814
KM Standard Error of Mean (logged)	0.0665	95% H-UCL (KM -Log)	5.1285E-4
KM SD (logged)	0.387	95% Critical H Value (KM-Log)	1.814
KM Standard Error of Mean (logged)	0.0665		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	7.2498E-4	Mean in Log Scale	-7.62
SD in Original Scale	7.6448E-4	SD in Log Scale	0.828
95% t UCL (Assumes normality)	9.1217E-4	95% H-Stat UCL	8.9900E-4

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 5.45E-04

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Other
Total Surface Water

PFPeS|ug/L

General Statistics

Total Number of Observations	47	Number of Distinct Observations	45
Number of Detects	24	Number of Non-Detects	23
Number of Distinct Detects	23	Number of Distinct Non-Detects	22
Minimum Detect	4.5500E-4	Minimum Non-Detect	3.6500E-4
Maximum Detect	0.01	Maximum Non-Detect	0.00642
Variance Detects	4.8016E-6	Percent Non-Detects	48.94%
Mean Detects	0.00218	SD Detects	0.00219
Median Detects	0.00105	CV Detects	1.007
Skewness Detects	2.362	Kurtosis Detects	6.441
Mean of Logged Detects	-6.466	SD of Logged Detects	0.784

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.701	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.916	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.249	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.177	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00137	KM Standard Error of Mean	2.7069E-4
KM SD	0.00178	95% KM (BCA) UCL	0.00188
95% KM (t) UCL	0.00182	95% KM (Percentile Bootstrap) UCL	0.00182
95% KM (z) UCL	0.00181	95% KM Bootstrap t UCL	0.00211
90% KM Chebyshev UCL	0.00218	95% KM Chebyshev UCL	0.00255
97.5% KM Chebyshev UCL	0.00306	99% KM Chebyshev UCL	0.00406

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.507	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.76	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.246	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.181	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.633	k star (bias corrected MLE)	1.456
Theta hat (MLE)	0.00133	Theta star (bias corrected MLE)	0.00149
nu hat (MLE)	78.37	nu star (bias corrected)	69.91
Mean (detects)	0.00218		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	4.5500E-4	Mean	0.00601
Maximum	0.01	Median	0.01
SD	0.00425	CV	0.707
k hat (MLE)	1.276	k star (bias corrected MLE)	1.209
Theta hat (MLE)	0.00471	Theta star (bias corrected MLE)	0.00497
nu hat (MLE)	120	nu star (bias corrected)	113.6
Adjusted Level of Significance (β)	0.0449		
Approximate Chi Square Value (113.64, α)	90.03	Adjusted Chi Square Value (113.64, β)	89.36
95% Gamma Approximate UCL (use when n>=50)	0.00758	95% Gamma Adjusted UCL (use when n<50)	0.00764

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00137	SD (KM)	0.00178
Variance (KM)	3.1790E-6	SE of Mean (KM)	2.7069E-4
k hat (KM)	0.588	k star (KM)	0.565
nu hat (KM)	55.28	nu star (KM)	53.09
theta hat (KM)	0.00232	theta star (KM)	0.00242
80% gamma percentile (KM)	0.00225	90% gamma percentile (KM)	0.0036
95% gamma percentile (KM)	0.00503	99% gamma percentile (KM)	0.00849

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (53.09, α)	37.35	Adjusted Chi Square Value (53.09, β)	36.93
95% Gamma Approximate KM-UCL (use when n>=50)	0.00194	95% Gamma Adjusted KM-UCL (use when n<50)	0.00197

ProUCL Output
Other
Total Surface Water

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.896	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.916	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.225	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.177	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00128	Mean in Log Scale	-7.245
SD in Original Scale	0.00181	SD in Log Scale	1.012
95% t UCL (assumes normality of ROS data)	0.00172	95% Percentile Bootstrap UCL	0.00172
95% BCA Bootstrap UCL	0.00183	95% Bootstrap t UCL	0.00198
95% H-UCL (Log ROS)	0.00169		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-7.087	KM Geo Mean	8.3614E-4
KM SD (logged)	0.897	95% Critical H Value (KM-Log)	2.225
KM Standard Error of Mean (logged)	0.14	95% H-UCL (KM -Log)	0.00168
KM SD (logged)	0.897	95% Critical H Value (KM-Log)	2.225
KM Standard Error of Mean (logged)	0.14		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0015	Mean in Log Scale	-7.03
SD in Original Scale	0.00182	SD in Log Scale	1.02
95% t UCL (Assumes normality)	0.00195	95% H-Stat UCL	0.00212

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	0.00255

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Eagle Point Lake
Dissolved Surface Water

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/26/2021 9:25:28 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

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General Statistics

Total Number of Observations	12	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.11	Mean	0.14
Maximum	0.17	Median	0.135
SD	0.0165	Std. Error of Mean	0.00477
Coefficient of Variation	0.118	Skewness	0.145

Normal GOF Test

Shapiro Wilk Test Statistic	0.931	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.228	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.149	95% Adjusted-CLT UCL (Chen-1995)	0.148
		95% Modified-t UCL (Johnson-1978)	0.149

Gamma GOF Test

A-D Test Statistic	0.534	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.731	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.229	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.245	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	78.05	k star (bias corrected MLE)	58.59
Theta hat (MLE)	0.00179	Theta star (bias corrected MLE)	0.00239
nu hat (MLE)	1873	nu star (bias corrected)	1406
MLE Mean (bias corrected)	0.14	MLE Sd (bias corrected)	0.0183
		Approximate Chi Square Value (0.05)	1320
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	1307

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.149	95% Adjusted Gamma UCL (use when n<50)	0.151

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.928	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.216	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.207	Mean of logged Data	-1.973
Maximum of Logged Data	-1.772	SD of logged Data	0.119

Assuming Lognormal Distribution

95% H-UCL	0.149	90% Chebyshev (MVUE) UCL	0.154
95% Chebyshev (MVUE) UCL	0.161	97.5% Chebyshev (MVUE) UCL	0.17
99% Chebyshev (MVUE) UCL	0.188		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.148	95% Jackknife UCL	0.149
95% Standard Bootstrap UCL	0.147	95% Bootstrap-t UCL	0.149
95% Hall's Bootstrap UCL	0.148	95% Percentile Bootstrap UCL	0.148
95% BCA Bootstrap UCL	0.147		
90% Chebyshev(Mean, Sd) UCL	0.154	95% Chebyshev(Mean, Sd) UCL	0.161
97.5% Chebyshev(Mean, Sd) UCL	0.17	99% Chebyshev(Mean, Sd) UCL	0.187

Suggested UCL to Use

95% Student's-t UCL 0.149

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFPeA|ug/L

General Statistics

Total Number of Observations	12	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	0.0085	Mean	0.0118
Maximum	0.014	Median	0.012
SD	0.00123	Std. Error of Mean	3.5600E-4
Coefficient of Variation	0.105	Skewness	-1.472

Normal GOF Test

Shapiro Wilk Test Statistic	0.668	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.4	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0124	95% Adjusted-CLT UCL (Chen-1995)	0.0122
		95% Modified-t UCL (Johnson-1978)	0.0124

Gamma GOF Test

A-D Test Statistic	2.217	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.731	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.413	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.245	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	89	k star (bias corrected MLE)	66.81
Theta hat (MLE)	1.3248E-4	Theta star (bias corrected MLE)	1.7650E-4
nu hat (MLE)	2136	nu star (bias corrected)	1603
MLE Mean (bias corrected)	0.0118	MLE Sd (bias corrected)	0.00144
		Approximate Chi Square Value (0.05)	1511
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	1498

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0125	95% Adjusted Gamma UCL (use when n<50)	0.0126

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.635	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.414	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.243	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.768	Mean of logged Data	-4.446
Maximum of Logged Data	-4.269	SD of logged Data	0.114

Assuming Lognormal Distribution

95% H-UCL	0.0126	90% Chebyshev (MVUE) UCL	0.013
95% Chebyshev (MVUE) UCL	0.0135	97.5% Chebyshev (MVUE) UCL	0.0142
99% Chebyshev (MVUE) UCL	0.0157		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0124	95% Jackknife UCL	0.0124
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A		
90% Chebyshev(Mean, Sd) UCL	0.0129	95% Chebyshev(Mean, Sd) UCL	0.0133
97.5% Chebyshev(Mean, Sd) UCL	0.014	99% Chebyshev(Mean, Sd) UCL	0.0153

Suggested UCL to Use

95% Student's-t UCL	0.0124	or 95% Modified-t UCL	0.0124

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFHxA|ug/L

General Statistics

Total Number of Observations	12	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.0091	Mean	0.0139
Maximum	0.022	Median	0.014
SD	0.00369	Std. Error of Mean	0.00107
Coefficient of Variation	0.265	Skewness	0.75

Normal GOF Test

Shapiro Wilk Test Statistic	0.923	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.175	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0158	95% Adjusted-CLT UCL (Chen-1995)	0.0159
		95% Modified-t UCL (Johnson-1978)	0.0159

Gamma GOF Test

A-D Test Statistic	0.4	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.731	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.208	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.245	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	16.18	k star (bias corrected MLE)	12.19
Theta hat (MLE)	8.6054E-4	Theta star (bias corrected MLE)	0.00114
nu hat (MLE)	388.4	nu star (bias corrected)	292.6
MLE Mean (bias corrected)	0.0139	MLE Sd (bias corrected)	0.00399
		Approximate Chi Square Value (0.05)	254
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	248.5

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.016	95% Adjusted Gamma UCL (use when n<50)	0.0164

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.944	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.223	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.699	Mean of logged Data	-4.305
Maximum of Logged Data	-3.817	SD of logged Data	0.26

Assuming Lognormal Distribution

95% H-UCL	0.0162	90% Chebyshev (MVUE) UCL	0.0171
95% Chebyshev (MVUE) UCL	0.0185	97.5% Chebyshev (MVUE) UCL	0.0205
99% Chebyshev (MVUE) UCL	0.0244		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0157	95% Jackknife UCL	0.0158
95% Standard Bootstrap UCL	0.0156	95% Bootstrap-t UCL	0.0161
95% Hall's Bootstrap UCL	0.0165	95% Percentile Bootstrap UCL	0.0157
95% BCA Bootstrap UCL	0.0158		
90% Chebyshev(Mean, Sd) UCL	0.0171	95% Chebyshev(Mean, Sd) UCL	0.0186
97.5% Chebyshev(Mean, Sd) UCL	0.0206	99% Chebyshev(Mean, Sd) UCL	0.0245

Suggested UCL to Use

95% Student's-t UCL 0.0158

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFHpA|ug/L

General Statistics

Total Number of Observations	12	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.0055	Mean	0.0113
Maximum	0.014	Median	0.012
SD	0.00252	Std. Error of Mean	7.2639E-4
Coefficient of Variation	0.222	Skewness	-1.076

Normal GOF Test

Shapiro Wilk Test Statistic	0.895	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.187	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0126	95% Adjusted-CLT UCL (Chen-1995)	0.0123
		95% Modified-t UCL (Johnson-1978)	0.0126

Gamma GOF Test

A-D Test Statistic	0.621	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.732	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.209	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.245	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	17.82	k star (bias corrected MLE)	13.42
Theta hat (MLE)	6.3640E-4	Theta star (bias corrected MLE)	8.4502E-4
nu hat (MLE)	427.7	nu star (bias corrected)	322.1
MLE Mean (bias corrected)	0.0113	MLE Sd (bias corrected)	0.0031
		Approximate Chi Square Value (0.05)	281.5
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	275.7

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.013	95% Adjusted Gamma UCL (use when n<50)	0.0132

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.818	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.209	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level	

Data appear Approximate Lognormal at 5% Significance Level

ProUCL Output
Eagle Point Lake
Dissolved Surface Water

Lognormal Statistics

Minimum of Logged Data	-5.203	Mean of logged Data	-4.508
Maximum of Logged Data	-4.269	SD of logged Data	0.265

Assuming Lognormal Distribution

95% H-UCL	0.0133	90% Chebyshev (MVUE) UCL	0.014
95% Chebyshev (MVUE) UCL	0.0152	97.5% Chebyshev (MVUE) UCL	0.0169
99% Chebyshev (MVUE) UCL	0.0201		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0125	95% Jackknife UCL	0.0126
95% Standard Bootstrap UCL	0.0125	95% Bootstrap-t UCL	0.0125
95% Hall's Bootstrap UCL	0.0124	95% Percentile Bootstrap UCL	0.0125
95% BCA Bootstrap UCL	0.0124		
90% Chebyshev(Mean, Sd) UCL	0.0135	95% Chebyshev(Mean, Sd) UCL	0.0145
97.5% Chebyshev(Mean, Sd) UCL	0.0159	99% Chebyshev(Mean, Sd) UCL	0.0186

Suggested UCL to Use

95% Student's-t UCL 0.0126

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFOA|ug/L

General Statistics

Total Number of Observations	12	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	0.038	Mean	0.0933
Maximum	0.16	Median	0.084
SD	0.0336	Std. Error of Mean	0.00971
Coefficient of Variation	0.361	Skewness	0.475

Normal GOF Test

Shapiro Wilk Test Statistic	0.958	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.175	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.111	95% Adjusted-CLT UCL (Chen-1995)	0.111
		95% Modified-t UCL (Johnson-1978)	0.111

Gamma GOF Test

A-D Test Statistic	0.282	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.731	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.145	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.246	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	8.026	k star (bias corrected MLE)	6.075
Theta hat (MLE)	0.0116	Theta star (bias corrected MLE)	0.0154
nu hat (MLE)	192.6	nu star (bias corrected)	145.8
MLE Mean (bias corrected)	0.0933	MLE Sd (bias corrected)	0.0378
		Approximate Chi Square Value (0.05)	118.9
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	115.2

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.114	95% Adjusted Gamma UCL (use when n<50)	0.118

ProUCL Output
Eagle Point Lake
Dissolved Surface Water

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.954	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.152	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-3.27	Mean of logged Data	-2.436
Maximum of Logged Data	-1.833	SD of logged Data	0.384

Assuming Lognormal Distribution

95% H-UCL	0.119	90% Chebyshev (MVUE) UCL	0.125
95% Chebyshev (MVUE) UCL	0.139	97.5% Chebyshev (MVUE) UCL	0.159
99% Chebyshev (MVUE) UCL	0.198		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.109	95% Jackknife UCL	0.111
95% Standard Bootstrap UCL	0.109	95% Bootstrap-t UCL	0.112
95% Hall's Bootstrap UCL	0.112	95% Percentile Bootstrap UCL	0.109
95% BCA Bootstrap UCL	0.109		
90% Chebyshev(Mean, Sd) UCL	0.122	95% Chebyshev(Mean, Sd) UCL	0.136
97.5% Chebyshev(Mean, Sd) UCL	0.154	99% Chebyshev(Mean, Sd) UCL	0.19

Suggested UCL to Use

95% Student's-t UCL 0.111

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFNA|ug/L

General Statistics

Total Number of Observations	12	Number of Distinct Observations	9
Number of Detects	9	Number of Non-Detects	3
Number of Distinct Detects	7	Number of Distinct Non-Detects	2
Minimum Detect	0.0012	Minimum Non-Detect	0.0041
Maximum Detect	0.0063	Maximum Non-Detect	0.0043
Variance Detects	2.4403E-6	Percent Non-Detects	25%
Mean Detects	0.00226	SD Detects	0.00156
Median Detects	0.0018	CV Detects	0.693
Skewness Detects	2.677	Kurtosis Detects	7.573
Mean of Logged Detects	-6.227	SD of Logged Detects	0.486

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.619	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.352	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00213	KM Standard Error of Mean	4.0596E-4
KM SD	0.00131	95% KM (BCA) UCL	0.00294
95% KM (t) UCL	0.00286	95% KM (Percentile Bootstrap) UCL	0.00287
95% KM (z) UCL	0.0028	95% KM Bootstrap t UCL	0.00411
90% KM Chebyshev UCL	0.00335	95% KM Chebyshev UCL	0.0039
97.5% KM Chebyshev UCL	0.00466	99% KM Chebyshev UCL	0.00617

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.998	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.725	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.274	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.28	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.941	k star (bias corrected MLE)	2.701
Theta hat (MLE)	5.7237E-4	Theta star (bias corrected MLE)	8.3501E-4
nu hat (MLE)	70.93	nu star (bias corrected)	48.62
Mean (detects)	0.00226		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0012	Mean	0.00419
Maximum	0.01	Median	0.002
SD	0.00375	CV	0.894
k hat (MLE)	1.589	k star (bias corrected MLE)	1.247
Theta hat (MLE)	0.00264	Theta star (bias corrected MLE)	0.00336
nu hat (MLE)	38.13	nu star (bias corrected)	29.93
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (29.93, α)	18.44	Adjusted Chi Square Value (29.93, β)	17.08
95% Gamma Approximate UCL (use when n>=50)	0.0068	95% Gamma Adjusted UCL (use when n<50)	0.00735

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00213	SD (KM)	0.00131
Variance (KM)	1.7098E-6	SE of Mean (KM)	4.0596E-4
k hat (KM)	2.651	k star (KM)	2.044
nu hat (KM)	63.63	nu star (KM)	49.06
theta hat (KM)	8.0303E-4	theta star (KM)	0.00104
80% gamma percentile (KM)	0.00318	90% gamma percentile (KM)	0.00412
95% gamma percentile (KM)	0.00502	99% gamma percentile (KM)	0.007

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (49.06, α)	33.98	Adjusted Chi Square Value (49.06, β)	32.07
95% Gamma Approximate KM-UCL (use when n>=50)	0.00307	95% Gamma Adjusted KM-UCL (use when n<50)	0.00326

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.808	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.234	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00215	Mean in Log Scale	-6.249
SD in Original Scale	0.00135	SD in Log Scale	0.425
95% t UCL (assumes normality of ROS data)	0.00285	95% Percentile Bootstrap UCL	0.00289
95% BCA Bootstrap UCL	0.0033	95% Bootstrap t UCL	0.00417
95% H-UCL (Log ROS)	0.00275		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-6.263	KM Geo Mean	0.00191
KM SD (logged)	0.416	95% Critical H Value (KM-Log)	2.044
KM Standard Error of Mean (logged)	0.133	95% H-UCL (KM -Log)	0.00269
KM SD (logged)	0.416	95% Critical H Value (KM-Log)	2.044
KM Standard Error of Mean (logged)	0.133		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00222	Mean in Log Scale	-6.209
SD in Original Scale	0.00133	SD in Log Scale	0.416
95% t UCL (Assumes normality)	0.00291	95% H-Stat UCL	0.00283

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	0.00326	95% GROS Adjusted Gamma UCL	0.00735

Warning: Recommended UCL exceeds the maximum observation

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

ProUCL Output
Eagle Point Lake
Dissolved Surface Water

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	12	Number of Distinct Observations	8
Number of Detects	5	Number of Non-Detects	7
Number of Distinct Detects	5	Number of Distinct Non-Detects	3
Minimum Detect	0.0012	Minimum Non-Detect	0.0042
Maximum Detect	0.011	Maximum Non-Detect	0.0045
Variance Detects	1.7688E-5	Percent Non-Detects	58.33%
Mean Detects	0.00354	SD Detects	0.00421
Median Detects	0.0015	CV Detects	1.188
Skewness Detects	2.146	Kurtosis Detects	4.65
Mean of Logged Detects	-6.052	SD of Logged Detects	0.91

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.654	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.388	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00245	KM Standard Error of Mean	8.7743E-4
KM SD	0.00263	95% KM (BCA) UCL	0.004
95% KM (t) UCL	0.00403	95% KM (Percentile Bootstrap) UCL	0.00401
95% KM (z) UCL	0.0039	95% KM Bootstrap t UCL	0.0162
90% KM Chebyshev UCL	0.00508	95% KM Chebyshev UCL	0.00628
97.5% KM Chebyshev UCL	0.00793	99% KM Chebyshev UCL	0.0112

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.755	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.688	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.319	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.362	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.366	k star (bias corrected MLE)	0.68
Theta hat (MLE)	0.00259	Theta star (bias corrected MLE)	0.00521
nu hat (MLE)	13.66	nu star (bias corrected)	6.799
Mean (detects)	0.00354		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0012	Mean	0.00731
Maximum	0.011	Median	0.01
SD	0.00418	CV	0.572
k hat (MLE)	1.877	k star (bias corrected MLE)	1.464
Theta hat (MLE)	0.00389	Theta star (bias corrected MLE)	0.00499
nu hat (MLE)	45.06	nu star (bias corrected)	35.13
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (35.13, α)	22.57	Adjusted Chi Square Value (35.13, β)	21.04
95% Gamma Approximate UCL (use when n>=50)	0.0114	95% Gamma Adjusted UCL (use when n<50)	0.0122

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00245	SD (KM)	0.00263
Variance (KM)	6.9146E-6	SE of Mean (KM)	8.7743E-4
k hat (KM)	0.87	k star (KM)	0.708
nu hat (KM)	20.87	nu star (KM)	16.99
theta hat (KM)	0.00282	theta star (KM)	0.00346
80% gamma percentile (KM)	0.00403	90% gamma percentile (KM)	0.00614
95% gamma percentile (KM)	0.00831	99% gamma percentile (KM)	0.0135

ProUCL Output
Eagle Point Lake
Dissolved Surface Water

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (16.99, α)	8.662	Adjusted Chi Square Value (16.99, β)	7.77
95% Gamma Approximate KM-UCL (use when n>=50)	0.00481	95% Gamma Adjusted KM-UCL (use when n<50)	0.00536

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.794	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.29	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00257	Mean in Log Scale	-6.237
SD in Original Scale	0.00275	SD in Log Scale	0.672
95% t UCL (assumes normality of ROS data)	0.004	95% Percentile Bootstrap UCL	0.00395
95% BCA Bootstrap UCL	0.00488	95% Bootstrap t UCL	0.00765
95% H-UCL (Log ROS)	0.00396		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-6.277	KM Geo Mean	0.00188
KM SD (logged)	0.602	95% Critical H Value (KM-Log)	2.273
KM Standard Error of Mean (logged)	0.228	95% H-UCL (KM -Log)	0.0034
KM SD (logged)	0.602	95% Critical H Value (KM-Log)	2.273
KM Standard Error of Mean (logged)	0.228		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00272	Mean in Log Scale	-6.111
SD in Original Scale	0.00264	SD in Log Scale	0.552
95% t UCL (Assumes normality)	0.00408	95% H-Stat UCL	0.00373

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL 0.0162 ɜ Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1) 0.00536

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	12	Number of Distinct Observations	9
Number of Detects	9	Number of Non-Detects	3
Number of Distinct Detects	7	Number of Distinct Non-Detects	2
Minimum Detect	0.0015	Minimum Non-Detect	0.0041
Maximum Detect	0.032	Maximum Non-Detect	0.0043
Variance Detects	1.0100E-4	Percent Non-Detects	25%
Mean Detects	0.00521	SD Detects	0.0101
Median Detects	0.0019	CV Detects	1.929
Skewness Detects	2.995	Kurtosis Detects	8.978
Mean of Logged Detects	-5.981	SD of Logged Detects	0.965

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.417	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.503	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00437	KM Standard Error of Mean	0.00255
KM SD	0.00833	95% KM (BCA) UCL	0.00939
95% KM (t) UCL	0.00896	95% KM (Percentile Bootstrap) UCL	0.00938
95% KM (z) UCL	0.00857	95% KM Bootstrap t UCL	0.0859
90% KM Chebyshev UCL	0.012	95% KM Chebyshev UCL	0.0155
97.5% KM Chebyshev UCL	0.0203	99% KM Chebyshev UCL	0.0298

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.357	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.749	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.492	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.289	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.818	k star (bias corrected MLE)	0.619
Theta hat (MLE)	0.00637	Theta star (bias corrected MLE)	0.00842
nu hat (MLE)	14.72	nu star (bias corrected)	11.15
Mean (detects)	0.00521		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0015	Mean	0.00641
Maximum	0.032	Median	0.00215
SD	0.00884	CV	1.379
k hat (MLE)	0.986	k star (bias corrected MLE)	0.795
Theta hat (MLE)	0.0065	Theta star (bias corrected MLE)	0.00806
nu hat (MLE)	23.65	nu star (bias corrected)	19.07
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (19.07, α)	10.17	Adjusted Chi Square Value (19.07, β)	9.193
95% Gamma Approximate UCL (use when n>=50)	0.012	95% Gamma Adjusted UCL (use when n<50)	0.0133

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00437	SD (KM)	0.00833
Variance (KM)	6.9459E-5	SE of Mean (KM)	0.00255
k hat (KM)	0.275	k star (KM)	0.262
nu hat (KM)	6.61	nu star (KM)	6.291
theta hat (KM)	0.0159	theta star (KM)	0.0167
80% gamma percentile (KM)	0.00646	90% gamma percentile (KM)	0.0131
95% gamma percentile (KM)	0.0209	99% gamma percentile (KM)	0.0415

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.29, α)	1.79	Adjusted Chi Square Value (6.29, β)	1.449
95% Gamma Approximate KM-UCL (use when n>=50)	0.0154	95% Gamma Adjusted KM-UCL (use when n<50)	0.019

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.543	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.428	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00447	Mean in Log Scale	-6.018
SD in Original Scale	0.00868	SD in Log Scale	0.837
95% t UCL (assumes normality of ROS data)	0.00897	95% Percentile Bootstrap UCL	0.00946
95% BCA Bootstrap UCL	0.012	95% Bootstrap t UCL	0.0817
95% H-UCL (Log ROS)	0.00671		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-6.06	KM Geo Mean	0.00233
KM SD (logged)	0.803	95% Critical H Value (KM-Log)	2.576
KM Standard Error of Mean (logged)	0.248	95% H-UCL (KM -Log)	0.00602
KM SD (logged)	0.803	95% Critical H Value (KM-Log)	2.576
KM Standard Error of Mean (logged)	0.248		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00444	Mean in Log Scale	-6.025
SD in Original Scale	0.00868	SD in Log Scale	0.827
95% t UCL (Assumes normality)	0.00894	95% H-Stat UCL	0.00653

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

ProUCL Output
Eagle Point Lake
Dissolved Surface Water

Suggested UCL to Use

95% KM (Chebyshev) UCL 0.0155

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFTeDA|ug/L

General Statistics

Total Number of Observations	11	Number of Distinct Observations	8
		Number of Missing Observations	1
Number of Detects	6	Number of Non-Detects	5
Number of Distinct Detects	5	Number of Distinct Non-Detects	4
Minimum Detect	0.0037	Minimum Non-Detect	0.0041
Maximum Detect	0.0051	Maximum Non-Detect	0.0045
Variance Detects	3.3767E-7	Percent Non-Detects	45.45%
Mean Detects	0.00428	SD Detects	5.8109E-4
Median Detects	0.0041	CV Detects	0.136
Skewness Detects	0.696	Kurtosis Detects	-1.572
Mean of Logged Detects	-5.46	SD of Logged Detects	0.133

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.866	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.29	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00409	KM Standard Error of Mean	1.5899E-4
KM SD	4.5868E-4	95% KM (BCA) UCL	0.00439
95% KM (t) UCL	0.00438	95% KM (Percentile Bootstrap) UCL	0.00436
95% KM (z) UCL	0.00435	95% KM Bootstrap t UCL	0.00445
90% KM Chebyshev UCL	0.00457	95% KM Chebyshev UCL	0.00478
97.5% KM Chebyshev UCL	0.00508	99% KM Chebyshev UCL	0.00567

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.479	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.697	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.291	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	67.42	k star (bias corrected MLE)	33.82
Theta hat (MLE)	6.3530E-5	Theta star (bias corrected MLE)	1.2664E-4
nu hat (MLE)	809.1	nu star (bias corrected)	405.9
Mean (detects)	0.00428		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0037	Mean	0.00688
Maximum	0.01	Median	0.0051
SD	0.00301	CV	0.438
k hat (MLE)	5.548	k star (bias corrected MLE)	4.096
Theta hat (MLE)	0.00124	Theta star (bias corrected MLE)	0.00168
nu hat (MLE)	122.1	nu star (bias corrected)	90.1
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (90.10, α)	69.22	Adjusted Chi Square Value (90.10, β)	66.24
95% Gamma Approximate UCL (use when n>=50)	0.00896	95% Gamma Adjusted UCL (use when n<50)	0.00936

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00409	SD (KM)	4.5868E-4
Variance (KM)	2.1039E-7	SE of Mean (KM)	1.5899E-4
k hat (KM)	79.58	k star (KM)	57.94
nu hat (KM)	1751	nu star (KM)	1275
theta hat (KM)	5.1417E-5	theta star (KM)	7.0624E-5
80% gamma percentile (KM)	0.00454	90% gamma percentile (KM)	0.00479
95% gamma percentile (KM)	0.00501	99% gamma percentile (KM)	0.00545

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (N/A, α)	1193	Adjusted Chi Square Value (N/A, β)	1180
95% Gamma Approximate KM-UCL (use when n>=50)	0.00437	95% Gamma Adjusted KM-UCL (use when n<50)	0.00442

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.878	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.275	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0041	Mean in Log Scale	-5.501
SD in Original Scale	4.7162E-4	SD in Log Scale	0.108
95% t UCL (assumes normality of ROS data)	0.00436	95% Percentile Bootstrap UCL	0.00435
95% BCA Bootstrap UCL	0.0044	95% Bootstrap t UCL	0.00466
95% H-UCL (Log ROS)	0.00437		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.505	KM Geo Mean	0.00407
KM SD (logged)	0.106	95% Critical H Value (KM-Log)	1.791
KM Standard Error of Mean (logged)	0.037	95% H-UCL (KM -Log)	0.00434
KM SD (logged)	0.106	95% Critical H Value (KM-Log)	1.791
KM Standard Error of Mean (logged)	0.037		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00331	Mean in Log Scale	-5.773
SD in Original Scale	0.00119	SD in Log Scale	0.371
95% t UCL (Assumes normality)	0.00396	95% H-Stat UCL	0.00423

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.00438

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFBS|ug/L

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	0.0035	Mean	0.00571
Maximum	0.0073	Median	0.0056
SD	0.00122	Std. Error of Mean	3.5236E-4
Coefficient of Variation	0.214	Skewness	-0.23

Normal GOF Test

Shapiro Wilk Test Statistic	0.945	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.148	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00634	95% Adjusted-CLT UCL (Chen-1995)	0.00626
		95% Modified-t UCL (Johnson-1978)	0.00634

Gamma GOF Test

A-D Test Statistic	0.312	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.732	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.155	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.245	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	22.34	k star (bias corrected MLE)	16.81
Theta hat (MLE)	2.5554E-4	Theta star (bias corrected MLE)	3.3959E-4
nu hat (MLE)	536.1	nu star (bias corrected)	403.4
MLE Mean (bias corrected)	0.00571	MLE Sd (bias corrected)	0.00139
		Approximate Chi Square Value (0.05)	357.9
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	351.3

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.00644	95% Adjusted Gamma UCL (use when n<50)	0.00656

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.934	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.144	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.655	Mean of logged Data	-5.188
Maximum of Logged Data	-4.92	SD of logged Data	0.226

Assuming Lognormal Distribution

95% H-UCL	0.0065	90% Chebyshev (MVUE) UCL	0.00684
95% Chebyshev (MVUE) UCL	0.00735	97.5% Chebyshev (MVUE) UCL	0.00806
99% Chebyshev (MVUE) UCL	0.00945		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00629	95% Jackknife UCL	0.00634
95% Standard Bootstrap UCL	0.00626	95% Bootstrap-t UCL	0.00634
95% Hall's Bootstrap UCL	0.00626	95% Percentile Bootstrap UCL	0.00628
95% BCA Bootstrap UCL	0.00623		
90% Chebyshev(Mean, Sd) UCL	0.00677	95% Chebyshev(Mean, Sd) UCL	0.00724
97.5% Chebyshev(Mean, Sd) UCL	0.00791	99% Chebyshev(Mean, Sd) UCL	0.00921

Suggested UCL to Use

95% Student's-t UCL 0.00634

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFHxS|ug/L

General Statistics

Total Number of Observations	12	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	0.0063	Mean	0.0127
Maximum	0.03	Median	0.01
SD	0.00628	Std. Error of Mean	0.00181
Coefficient of Variation	0.495	Skewness	2.129

Normal GOF Test

Shapiro Wilk Test Statistic	0.765	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.248	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

ProUCL Output
Eagle Point Lake
Dissolved Surface Water

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.0159	95% Adjusted-CLT UCL (Chen-1995)	0.0168
		95% Modified-t UCL (Johnson-1978)	0.0161

Gamma GOF Test

A-D Test Statistic	0.686	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.732	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.247	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.246	Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	6.041	k star (bias corrected MLE)	4.586
Theta hat (MLE)	0.0021	Theta star (bias corrected MLE)	0.00276
nu hat (MLE)	145	nu star (bias corrected)	110.1
MLE Mean (bias corrected)	0.0127	MLE Sd (bias corrected)	0.00592
		Approximate Chi Square Value (0.05)	86.86
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	83.72

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	0.0161	95% Adjusted Gamma UCL (use when n<50)	0.0167

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.91	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.229	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.067	Mean of logged Data	-4.453
Maximum of Logged Data	-3.507	SD of logged Data	0.407

Assuming Lognormal Distribution

95% H-UCL	0.0162	90% Chebyshev (MVUE) UCL	0.017
95% Chebyshev (MVUE) UCL	0.0191	97.5% Chebyshev (MVUE) UCL	0.0219
99% Chebyshev (MVUE) UCL	0.0275		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0157	95% Jackknife UCL	0.0159
95% Standard Bootstrap UCL	0.0155	95% Bootstrap-t UCL	0.0186
95% Hall's Bootstrap UCL	0.0281	95% Percentile Bootstrap UCL	0.0158
95% BCA Bootstrap UCL	0.017		
90% Chebyshev(Mean, Sd) UCL	0.0181	95% Chebyshev(Mean, Sd) UCL	0.0206
97.5% Chebyshev(Mean, Sd) UCL	0.024	99% Chebyshev(Mean, Sd) UCL	0.0307

Suggested UCL to Use

95% Adjusted Gamma UCL	0.0167

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOS|ug/L

General Statistics

Total Number of Observations	12	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	0.11	Mean	0.305
Maximum	1.1	Median	0.25
SD	0.265	Std. Error of Mean	0.0765
Coefficient of Variation	0.869	Skewness	2.838

ProUCL Output
Eagle Point Lake
Dissolved Surface Water

Normal GOF Test

Shapiro Wilk Test Statistic	0.634	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.311	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.442	95% Adjusted-CLT UCL (Chen-1995)	0.498
		95% Modified-t UCL (Johnson-1978)	0.453

Gamma GOF Test

A-D Test Statistic	0.763	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.74	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.221	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.248	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.573	k star (bias corrected MLE)	1.985
Theta hat (MLE)	0.119	Theta star (bias corrected MLE)	0.154
nu hat (MLE)	61.75	nu star (bias corrected)	47.65
MLE Mean (bias corrected)	0.305	MLE Sd (bias corrected)	0.216
		Approximate Chi Square Value (0.05)	32.8
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	30.93

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	0.443	95% Adjusted Gamma UCL (use when n<50)	0.47

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.909	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.171	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.207	Mean of logged Data	-1.394
Maximum of Logged Data	0.0953	SD of logged Data	0.607

Assuming Lognormal Distribution

95% H-UCL	0.452	90% Chebyshev (MVUE) UCL	0.452
95% Chebyshev (MVUE) UCL	0.524	97.5% Chebyshev (MVUE) UCL	0.624
99% Chebyshev (MVUE) UCL	0.82		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.431	95% Jackknife UCL	0.442
95% Standard Bootstrap UCL	0.428	95% Bootstrap-t UCL	0.679
95% Hall's Bootstrap UCL	0.997	95% Percentile Bootstrap UCL	0.444
95% BCA Bootstrap UCL	0.478		
90% Chebyshev(Mean, Sd) UCL	0.535	95% Chebyshev(Mean, Sd) UCL	0.638
97.5% Chebyshev(Mean, Sd) UCL	0.783	99% Chebyshev(Mean, Sd) UCL	1.066

Suggested UCL to Use

95% Adjusted Gamma UCL 0.47

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	11	Number of Distinct Observations	8
		Number of Missing Observations	1
Minimum	8.1000E-4	Mean	0.00127
Maximum	0.0019	Median	0.0012
SD	3.4485E-4	Std. Error of Mean	1.0398E-4
Coefficient of Variation	0.272	Skewness	0.297

Normal GOF Test

Shapiro Wilk Test Statistic	0.952	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.144	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00146	95% Adjusted-CLT UCL (Chen-1995)	0.00145
		95% Modified-t UCL (Johnson-1978)	0.00146

Gamma GOF Test

A-D Test Statistic	0.278	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.729	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.147	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.255	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	14.69	k star (bias corrected MLE)	10.74
Theta hat (MLE)	8.6276E-5	Theta star (bias corrected MLE)	1.1796E-4
nu hat (MLE)	323.1	nu star (bias corrected)	236.4
MLE Mean (bias corrected)	0.00127	MLE Sd (bias corrected)	3.8664E-4
		Approximate Chi Square Value (0.05)	201.8
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	196.6

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.00148	95% Adjusted Gamma UCL (use when n<50)	0.00152

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.951	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.14	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-7.118	Mean of logged Data	-6.705
Maximum of Logged Data	-6.266	SD of logged Data	0.277

Assuming Lognormal Distribution

95% H-UCL	0.00151	90% Chebyshev (MVUE) UCL	0.00159
95% Chebyshev (MVUE) UCL	0.00173	97.5% Chebyshev (MVUE) UCL	0.00193
99% Chebyshev (MVUE) UCL	0.00233		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00144	95% Jackknife UCL	0.00146
95% Standard Bootstrap UCL	0.00143	95% Bootstrap-t UCL	0.00147
95% Hall's Bootstrap UCL	0.00145	95% Percentile Bootstrap UCL	0.00143
95% BCA Bootstrap UCL	0.00145		
90% Chebyshev(Mean, Sd) UCL	0.00158	95% Chebyshev(Mean, Sd) UCL	0.00172
97.5% Chebyshev(Mean, Sd) UCL	0.00192	99% Chebyshev(Mean, Sd) UCL	0.0023

Suggested UCL to Use

95% Student's-t UCL	0.00146

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Eagle Point Lake
Dissolved Surface Water

PFHpS|ug/L

General Statistics

Total Number of Observations	12	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	0.0015	Mean	0.00336
Maximum	0.0053	Median	0.00335
SD	0.00119	Std. Error of Mean	3.4432E-4
Coefficient of Variation	0.355	Skewness	0.253

Normal GOF Test

Shapiro Wilk Test Statistic	0.956	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.154	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00398	95% Adjusted-CLT UCL (Chen-1995)	0.00395
		95% Modified-t UCL (Johnson-1978)	0.00398

Gamma GOF Test

A-D Test Statistic	0.238	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.731	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.137	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.246	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	8.206	k star (bias corrected MLE)	6.21
Theta hat (MLE)	4.0924E-4	Theta star (bias corrected MLE)	5.4078E-4
nu hat (MLE)	196.9	nu star (bias corrected)	149
MLE Mean (bias corrected)	0.00336	MLE Sd (bias corrected)	0.00135
		Approximate Chi Square Value (0.05)	121.8
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	118.1

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.00411	95% Adjusted Gamma UCL (use when n<50)	0.00424

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.956	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.118	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-6.502	Mean of logged Data	-5.758
Maximum of Logged Data	-5.24	SD of logged Data	0.378

Assuming Lognormal Distribution

95% H-UCL	0.00426	90% Chebyshev (MVUE) UCL	0.00448
95% Chebyshev (MVUE) UCL	0.00499	97.5% Chebyshev (MVUE) UCL	0.00569
99% Chebyshev (MVUE) UCL	0.00707		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00392	95% Jackknife UCL	0.00398
95% Standard Bootstrap UCL	0.00391	95% Bootstrap-t UCL	0.00399
95% Hall's Bootstrap UCL	0.00393	95% Percentile Bootstrap UCL	0.00388
95% BCA Bootstrap UCL	0.00388		
90% Chebyshev(Mean, Sd) UCL	0.00439	95% Chebyshev(Mean, Sd) UCL	0.00486
97.5% Chebyshev(Mean, Sd) UCL	0.00551	99% Chebyshev(Mean, Sd) UCL	0.00678

Suggested UCL to Use

95% Student's-t UCL	0.00398

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFPeS|ug/L

General Statistics

Total Number of Observations	12	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	0.0029	Mean	0.00573
Maximum	0.011	Median	0.0053
SD	0.00214	Std. Error of Mean	6.1820E-4
Coefficient of Variation	0.374	Skewness	1.377

Normal GOF Test

Shapiro Wilk Test Statistic	0.886	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.238	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00684	95% Adjusted-CLT UCL (Chen-1995)	0.00701
		95% Modified-t UCL (Johnson-1978)	0.00688

Gamma GOF Test

A-D Test Statistic	0.37	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.731	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.192	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.246	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	8.871	k star (bias corrected MLE)	6.709
Theta hat (MLE)	6.4631E-4	Theta star (bias corrected MLE)	8.5460E-4
nu hat (MLE)	212.9	nu star (bias corrected)	161
MLE Mean (bias corrected)	0.00573	MLE Sd (bias corrected)	0.00221
		Approximate Chi Square Value (0.05)	132.7
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	128.8

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.00696	95% Adjusted Gamma UCL (use when n<50)	0.00717

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.964	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.176	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.843	Mean of logged Data	-5.219
Maximum of Logged Data	-4.51	SD of logged Data	0.349

Assuming Lognormal Distribution

95% H-UCL	0.00708	90% Chebyshev (MVUE) UCL	0.00747
95% Chebyshev (MVUE) UCL	0.00827	97.5% Chebyshev (MVUE) UCL	0.00937
99% Chebyshev (MVUE) UCL	0.0115		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00675	95% Jackknife UCL	0.00684
95% Standard Bootstrap UCL	0.00669	95% Bootstrap-t UCL	0.00733
95% Hall's Bootstrap UCL	0.00863	95% Percentile Bootstrap UCL	0.00678
95% BCA Bootstrap UCL	0.00693		
90% Chebyshev(Mean, Sd) UCL	0.00759	95% Chebyshev(Mean, Sd) UCL	0.00843
97.5% Chebyshev(Mean, Sd) UCL	0.00959	99% Chebyshev(Mean, Sd) UCL	0.0119

Suggested UCL to Use

95% Student's-t UCL	0.00684

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Eagle Point Lake
Dissolved Surface Water

N-MeFOSA|ug/L

General Statistics

Total Number of Observations	11	Number of Distinct Observations	8
		Number of Missing Observations	1
Number of Detects	6	Number of Non-Detects	5
Number of Distinct Detects	5	Number of Distinct Non-Detects	3
Minimum Detect	4.7000E-4	Minimum Non-Detect	0.0041
Maximum Detect	8.1000E-4	Maximum Non-Detect	0.0043
Variance Detects	1.8030E-8	Percent Non-Detects	45.45%
Mean Detects	5.7500E-4	SD Detects	1.3428E-4
Median Detects	5.2000E-4	CV Detects	0.234
Skewness Detects	1.304	Kurtosis Detects	0.998
Mean of Logged Detects	-7.482	SD of Logged Detects	0.217

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.829	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.26	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	5.7500E-4	KM Standard Error of Mean	5.4818E-5
KM SD	1.2258E-4	95% KM (BCA) UCL	6.5857E-4
95% KM (t) UCL	6.7436E-4	95% KM (Percentile Bootstrap) UCL	6.6500E-4
95% KM (z) UCL	6.6517E-4	95% KM Bootstrap t UCL	8.4227E-4
90% KM Chebyshev UCL	7.3945E-4	95% KM Chebyshev UCL	8.1395E-4
97.5% KM Chebyshev UCL	9.1734E-4	99% KM Chebyshev UCL	0.00112

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.523	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.697	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.287	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	24.36	k star (bias corrected MLE)	12.29
Theta hat (MLE)	2.3600E-5	Theta star (bias corrected MLE)	4.6773E-5
nu hat (MLE)	292.4	nu star (bias corrected)	147.5
Mean (detects)	5.7500E-4		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	4.7000E-4	Mean	0.00486
Maximum	0.01	Median	8.1000E-4
SD	0.00492	CV	1.013
k hat (MLE)	0.712	k star (bias corrected MLE)	0.578
Theta hat (MLE)	0.00683	Theta star (bias corrected MLE)	0.0084
nu hat (MLE)	15.66	nu star (bias corrected)	12.72
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (12.72, α)	5.704	Adjusted Chi Square Value (12.72, β)	4.959
95% Gamma Approximate UCL (use when n>=50)	0.0108	95% Gamma Adjusted UCL (use when n<50)	0.0125

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	5.7500E-4	SD (KM)	1.2258E-4
Variance (KM)	1.5025E-8	SE of Mean (KM)	5.4818E-5
k hat (KM)	22	k star (KM)	16.06
nu hat (KM)	484.1	nu star (KM)	353.4
theta hat (KM)	2.6130E-5	theta star (KM)	3.5794E-5
80% gamma percentile (KM)	6.9097E-4	90% gamma percentile (KM)	7.6481E-4
95% gamma percentile (KM)	8.2951E-4	99% gamma percentile (KM)	9.6020E-4

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (353.41, α)	310.8	Adjusted Chi Square Value (353.41, β)	304.3
95% Gamma Approximate KM-UCL (use when n>=50)	6.5373E-4	95% Gamma Adjusted KM-UCL (use when n<50)	6.6772E-4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.851	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.269	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	5.7125E-4	Mean in Log Scale	-7.482
SD in Original Scale	1.0506E-4	SD in Log Scale	0.173
95% t UCL (assumes normality of ROS data)	6.2866E-4	95% Percentile Bootstrap UCL	6.2558E-4
95% BCA Bootstrap UCL	6.3884E-4	95% Bootstrap t UCL	6.4634E-4
95% H-UCL (Log ROS)	6.3215E-4		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-7.482	KM Geo Mean	5.6324E-4
KM SD (logged)	0.199	95% Critical H Value (KM-Log)	1.859
KM Standard Error of Mean (logged)	0.0888	95% H-UCL (KM -Log)	6.4555E-4
KM SD (logged)	0.199	95% Critical H Value (KM-Log)	1.859
KM Standard Error of Mean (logged)	0.0888		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00127	Mean in Log Scale	-6.884
SD in Original Scale	8.0236E-4	SD in Log Scale	0.704
95% t UCL (Assumes normality)	0.00171	95% H-Stat UCL	0.00228

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 6.74E-04

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

N-EtFOSE|ug/L

General Statistics

Total Number of Observations	11	Number of Distinct Observations	10
		Number of Missing Observations	1
Number of Detects	6	Number of Non-Detects	5
Number of Distinct Detects	6	Number of Distinct Non-Detects	4
Minimum Detect	2.1000E-4	Minimum Non-Detect	0.0041
Maximum Detect	5.7000E-4	Maximum Non-Detect	0.0045
Variance Detects	1.9627E-8	Percent Non-Detects	45.45%
Mean Detects	3.0667E-4	SD Detects	1.4010E-4
Median Detects	2.4000E-4	CV Detects	0.457
Skewness Detects	1.77	Kurtosis Detects	2.846
Mean of Logged Detects	-8.16	SD of Logged Detects	0.389

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.757	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.324	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	3.0667E-4	KM Standard Error of Mean	5.7194E-5
KM SD	1.2789E-4	95% KM (BCA) UCL	4.0375E-4
95% KM (t) UCL	4.1033E-4	95% KM (Percentile Bootstrap) UCL	4.0333E-4
95% KM (z) UCL	4.0074E-4	95% KM Bootstrap t UCL	9.8905E-4
90% KM Chebyshev UCL	4.7825E-4	95% KM Chebyshev UCL	5.5597E-4
97.5% KM Chebyshev UCL	6.6384E-4	99% KM Chebyshev UCL	8.7574E-4

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.663	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.324	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	7.262	k star (bias corrected MLE)	3.742
Theta hat (MLE)	4.2227E-5	Theta star (bias corrected MLE)	8.1946E-5
nu hat (MLE)	87.15	nu star (bias corrected)	44.91
Mean (detects)	3.0667E-4		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	2.1000E-4	Mean	0.00471
Maximum	0.01	Median	5.7000E-4
SD	0.00506	CV	1.074
k hat (MLE)	0.53	k star (bias corrected MLE)	0.446
Theta hat (MLE)	0.00889	Theta star (bias corrected MLE)	0.0106
nu hat (MLE)	11.67	nu star (bias corrected)	9.819
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (9.82, α)	3.829	Adjusted Chi Square Value (9.82, β)	3.243
95% Gamma Approximate UCL (use when n>=50)	0.0121	95% Gamma Adjusted UCL (use when n<50)	0.0143

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	3.0667E-4	SD (KM)	1.2789E-4
Variance (KM)	1.6356E-8	SE of Mean (KM)	5.7194E-5
k hat (KM)	5.75	k star (KM)	4.242
nu hat (KM)	126.5	nu star (KM)	93.33
theta hat (KM)	5.3333E-5	theta star (KM)	7.2286E-5
80% gamma percentile (KM)	4.1996E-4	90% gamma percentile (KM)	5.0618E-4
95% gamma percentile (KM)	5.8533E-4	99% gamma percentile (KM)	7.5389E-4

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (93.33, α)	72.05	Adjusted Chi Square Value (93.33, β)	69.01
95% Gamma Approximate KM-UCL (use when n>=50)	3.9724E-4	95% Gamma Adjusted KM-UCL (use when n<50)	4.1475E-4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.818	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.301	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2.9819E-4	Mean in Log Scale	-8.16
SD in Original Scale	1.0271E-4	SD in Log Scale	0.289
95% t UCL (assumes normality of ROS data)	3.5432E-4	95% Percentile Bootstrap UCL	3.5072E-4
95% BCA Bootstrap UCL	3.6520E-4	95% Bootstrap t UCL	4.0255E-4
95% H-UCL (Log ROS)	3.5577E-4		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-8.16	KM Geo Mean	2.8581E-4
KM SD (logged)	0.356	95% Critical H Value (KM-Log)	2.005
KM Standard Error of Mean (logged)	0.159	95% H-UCL (KM -Log)	3.8145E-4
KM SD (logged)	0.356	95% Critical H Value (KM-Log)	2.005
KM Standard Error of Mean (logged)	0.159		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00114	Mean in Log Scale	-7.245
SD in Original Scale	9.6368E-4	SD in Log Scale	1.087
95% t UCL (Assumes normality)	0.00167	95% H-Stat UCL	0.00382

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

ProUCL Output
Eagle Point Lake
Dissolved Surface Water

Suggested UCL to Use

95% KM (t) UCL 4.10E-04

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Lake Elmo
Dissolved Surface Water

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/26/2021 9:50:21 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

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General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.13	Mean	0.642
Maximum	0.81	Median	0.745
SD	0.255	Std. Error of Mean	0.104
Coefficient of Variation	0.398	Skewness	-2.259

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.667	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.362	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.852	95% Adjusted-CLT UCL (Chen-1995)	0.71
		95% Modified-t UCL (Johnson-1978)	0.836

Gamma GOF Test

A-D Test Statistic	1.309	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.7	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.424	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.334	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.616	k star (bias corrected MLE)	1.919
Theta hat (MLE)	0.177	Theta star (bias corrected MLE)	0.334
nu hat (MLE)	43.39	nu star (bias corrected)	23.03
MLE Mean (bias corrected)	0.642	MLE Sd (bias corrected)	0.463
		Approximate Chi Square Value (0.05)	13.11
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	10.52

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1.127	95% Adjusted Gamma UCL (use when n<50)	1.405

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.581	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.429	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.04	Mean of logged Data	-0.588
Maximum of Logged Data	-0.211	SD of logged Data	0.714

Assuming Lognormal Distribution

95% H-UCL	2.001	90% Chebyshev (MVUE) UCL	1.277
95% Chebyshev (MVUE) UCL	1.546	97.5% Chebyshev (MVUE) UCL	1.92
99% Chebyshev (MVUE) UCL	2.654		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

ProUCL Output
Lake Elmo
Dissolved Surface Water

Nonparametric Distribution Free UCLs

95% CLT UCL	0.813	95% Jackknife UCL	0.852
95% Standard Bootstrap UCL	0.8	95% Bootstrap-t UCL	0.789
95% Hall's Bootstrap UCL	0.734	95% Percentile Bootstrap UCL	0.763
95% BCA Bootstrap UCL	0.752		
90% Chebyshev(Mean, Sd) UCL	0.954	95% Chebyshev(Mean, Sd) UCL	1.096
97.5% Chebyshev(Mean, Sd) UCL	1.293	99% Chebyshev(Mean, Sd) UCL	1.679

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL 1.096

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

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General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.01	Mean	0.0183
Maximum	0.022	Median	0.0195
SD	0.00432	Std. Error of Mean	0.00176
Coefficient of Variation	0.236	Skewness	-1.881

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.801	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.303	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0219	95% Adjusted-CLT UCL (Chen-1995)	0.0198
		95% Modified-t UCL (Johnson-1978)	0.0217

Gamma GOF Test

A-D Test Statistic	0.786	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.698	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.337	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.332	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	16.5	k star (bias corrected MLE)	8.362
Theta hat (MLE)	0.00111	Theta star (bias corrected MLE)	0.00219
nu hat (MLE)	198	nu star (bias corrected)	100.3
MLE Mean (bias corrected)	0.0183	MLE Sd (bias corrected)	0.00634
		Approximate Chi Square Value (0.05)	78.23
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	71.21

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0235	95% Adjusted Gamma UCL (use when n<50)	0.0258

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.728	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.35	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

ProUCL Output
Lake Elmo
Dissolved Surface Water

Lognormal Statistics

Minimum of Logged Data	-4.605	Mean of logged Data	-4.03
Maximum of Logged Data	-3.817	SD of logged Data	0.291

Assuming Lognormal Distribution

95% H-UCL	0.0247	90% Chebyshev (MVUE) UCL	0.025
95% Chebyshev (MVUE) UCL	0.0279	97.5% Chebyshev (MVUE) UCL	0.0321
99% Chebyshev (MVUE) UCL	0.0402		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0212	95% Jackknife UCL	0.0219
95% Standard Bootstrap UCL	0.021	95% Bootstrap-t UCL	0.0207
95% Hall's Bootstrap UCL	0.0202	95% Percentile Bootstrap UCL	0.0207
95% BCA Bootstrap UCL	0.0203		
90% Chebyshev(Mean, Sd) UCL	0.0236	95% Chebyshev(Mean, Sd) UCL	0.026
97.5% Chebyshev(Mean, Sd) UCL	0.0293	99% Chebyshev(Mean, Sd) UCL	0.0359

Suggested UCL to Use

95% Student's-t UCL 0.0219

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFHxA|ug/L

General Statistics

Total Number of Observations	6	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	0.016	Mean	0.019
Maximum	0.021	Median	0.0195
SD	0.00179	Std. Error of Mean	7.3030E-4
Coefficient of Variation	0.0942	Skewness	-0.943

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.933	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.212	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0205	95% Adjusted-CLT UCL (Chen-1995)	0.0199
		95% Modified-t UCL (Johnson-1978)	0.0204

Gamma GOF Test

A-D Test Statistic	0.335	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.696	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.231	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	129.2	k star (bias corrected MLE)	64.72
Theta hat (MLE)	1.4704E-4	Theta star (bias corrected MLE)	2.9358E-4
nu hat (MLE)	1551	nu star (bias corrected)	776.6
MLE Mean (bias corrected)	0.019	MLE Sd (bias corrected)	0.00236
		Approximate Chi Square Value (0.05)	712.9
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	690.7

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0207	95% Adjusted Gamma UCL (use when n<50)	0.0214

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.916	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.214	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.135	Mean of logged Data	-3.967
Maximum of Logged Data	-3.863	SD of logged Data	0.0976

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	0.0213
95% Chebyshev (MVUE) UCL	0.0223	97.5% Chebyshev (MVUE) UCL	0.0237
99% Chebyshev (MVUE) UCL	0.0265		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0202	95% Jackknife UCL	0.0205
95% Standard Bootstrap UCL	0.0201	95% Bootstrap-t UCL	0.0202
95% Hall's Bootstrap UCL	0.0199	95% Percentile Bootstrap UCL	0.02
95% BCA Bootstrap UCL	0.0198		
90% Chebyshev(Mean, Sd) UCL	0.0212	95% Chebyshev(Mean, Sd) UCL	0.0222
97.5% Chebyshev(Mean, Sd) UCL	0.0236	99% Chebyshev(Mean, Sd) UCL	0.0263

Suggested UCL to Use

95% Student's-t UCL	0.0205

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

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General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.0069	Mean	0.0103
Maximum	0.013	Median	0.0105
SD	0.0022	Std. Error of Mean	8.9963E-4
Coefficient of Variation	0.214	Skewness	-0.48

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.981	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.125	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0121	95% Adjusted-CLT UCL (Chen-1995)	0.0116
		95% Modified-t UCL (Johnson-1978)	0.0121

ProUCL Output
Lake Elmo
Dissolved Surface Water

Gamma GOF Test

A-D Test Statistic	0.209	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.697	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.153	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	24.17	k star (bias corrected MLE)	12.2
Theta hat (MLE)	4.2607E-4	Theta star (bias corrected MLE)	8.4438E-4
nu hat (MLE)	290.1	nu star (bias corrected)	146.4
MLE Mean (bias corrected)	0.0103	MLE Sd (bias corrected)	0.00295
		Approximate Chi Square Value (0.05)	119.4
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	110.6

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0126	95% Adjusted Gamma UCL (use when n<50)	0.0136

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.953	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.151	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.976	Mean of logged Data	-4.596
Maximum of Logged Data	-4.343	SD of logged Data	0.229

Assuming Lognormal Distribution

95% H-UCL	0.0129	90% Chebyshev (MVUE) UCL	0.0132
95% Chebyshev (MVUE) UCL	0.0145	97.5% Chebyshev (MVUE) UCL	0.0163
99% Chebyshev (MVUE) UCL	0.0199		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0118	95% Jackknife UCL	0.0121
95% Standard Bootstrap UCL	0.0117	95% Bootstrap-t UCL	0.012
95% Hall's Bootstrap UCL	0.0115	95% Percentile Bootstrap UCL	0.0117
95% BCA Bootstrap UCL	0.0113		
90% Chebyshev(Mean, Sd) UCL	0.013	95% Chebyshev(Mean, Sd) UCL	0.0142
97.5% Chebyshev(Mean, Sd) UCL	0.0159	99% Chebyshev(Mean, Sd) UCL	0.0193

Suggested UCL to Use

95% Student's-t UCL 0.0121

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

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General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.077	Mean	0.0837
Maximum	0.1	Median	0.0815
SD	0.00829	Std. Error of Mean	0.00338
Coefficient of Variation	0.099	Skewness	2.075

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

ProUCL Output
Lake Elmo
Dissolved Surface Water

Normal GOF Test

Shapiro Wilk Test Statistic	0.746	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.365	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0905	95% Adjusted-CLT UCL (Chen-1995)	0.0923
		95% Modified-t UCL (Johnson-1978)	0.091

Gamma GOF Test

A-D Test Statistic	0.77	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.696	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.359	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.332	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	132.8	k star (bias corrected MLE)	66.53
Theta hat (MLE)	6.2982E-4	Theta star (bias corrected MLE)	0.00126
nu hat (MLE)	1594	nu star (bias corrected)	798.4
MLE Mean (bias corrected)	0.0837	MLE Sd (bias corrected)	0.0103
		Approximate Chi Square Value (0.05)	733.8
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	711.2

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.091	95% Adjusted Gamma UCL (use when n<50)	0.0939

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.771	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.351	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.564	Mean of logged Data	-2.485
Maximum of Logged Data	-2.303	SD of logged Data	0.0932

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	0.0932
95% Chebyshev (MVUE) UCL	0.0975	97.5% Chebyshev (MVUE) UCL	0.104
99% Chebyshev (MVUE) UCL	0.115		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0892	95% Jackknife UCL	0.0905
95% Standard Bootstrap UCL	0.0889	95% Bootstrap-t UCL	0.101
95% Hall's Bootstrap UCL	0.115	95% Percentile Bootstrap UCL	0.0895
95% BCA Bootstrap UCL	0.0907		
90% Chebyshev(Mean, Sd) UCL	0.0938	95% Chebyshev(Mean, Sd) UCL	0.0984
97.5% Chebyshev(Mean, Sd) UCL	0.105	99% Chebyshev(Mean, Sd) UCL	0.117

Suggested UCL to Use

95% Student's-t UCL	0.0905	or 95% Modified-t UCL	0.091

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	6	Number of Distinct Observations	5
Number of Detects	4	Number of Non-Detects	2
Number of Distinct Detects	3	Number of Distinct Non-Detects	2
Minimum Detect	0.0014	Minimum Non-Detect	0.0041
Maximum Detect	0.0018	Maximum Non-Detect	0.0042
Variance Detects	3.6667E-8	Percent Non-Detects	33.33%
Mean Detects	0.00165	SD Detects	1.9149E-4
Median Detects	0.0017	CV Detects	0.116
Skewness Detects	-0.855	Kurtosis Detects	-1.289
Mean of Logged Detects	-6.412	SD of Logged Detects	0.12

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.865	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.283	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00165	KM Standard Error of Mean	9.5743E-5
KM SD	1.6583E-4	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.00184	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.00181	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.00194	95% KM Chebyshev UCL	0.00207
97.5% KM Chebyshev UCL	0.00225	99% KM Chebyshev UCL	0.0026

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.429	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.656	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.315	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	95.17	k star (bias corrected MLE)	23.96
Theta hat (MLE)	1.7338E-5	Theta star (bias corrected MLE)	6.8868E-5
nu hat (MLE)	761.4	nu star (bias corrected)	191.7
Mean (detects)	0.00165		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0014	Mean	0.00443
Maximum	0.01	Median	0.0018
SD	0.00431	CV	0.973
k hat (MLE)	1.421	k star (bias corrected MLE)	0.822
Theta hat (MLE)	0.00312	Theta star (bias corrected MLE)	0.00539
nu hat (MLE)	17.06	nu star (bias corrected)	9.862
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (9.86, α)	3.856	Adjusted Chi Square Value (9.86, β)	2.627
95% Gamma Approximate UCL (use when n>=50)	0.0113	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00165	SD (KM)	1.6583E-4
Variance (KM)	2.7500E-8	SE of Mean (KM)	9.5743E-5
k hat (KM)	99	k star (KM)	49.61
nu hat (KM)	1188	nu star (KM)	595.3
theta hat (KM)	1.6667E-5	theta star (KM)	3.3259E-5
80% gamma percentile (KM)	0.00184	90% gamma percentile (KM)	0.00196
95% gamma percentile (KM)	0.00205	99% gamma percentile (KM)	0.00224

ProUCL Output
Lake Elmo
Dissolved Surface Water

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (595.33, α)	539.7	Adjusted Chi Square Value (595.33, β)	520.4
95% Gamma Approximate KM-UCL (use when n>=50)	0.00182	95% Gamma Adjusted KM-UCL (use when n<50)	0.00189

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.862	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.28	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00165	Mean in Log Scale	-6.412
SD in Original Scale	1.4839E-4	SD in Log Scale	0.0927
95% t UCL (assumes normality of ROS data)	0.00177	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A	95% Bootstrap t UCL	N/A
95% H-UCL (Log ROS)	N/A		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-6.412	KM Geo Mean	0.00164
KM SD (logged)	0.104	95% Critical H Value (KM-Log)	1.946
KM Standard Error of Mean (logged)	0.0598	95% H-UCL (KM -Log)	0.00181
KM SD (logged)	0.104	95% Critical H Value (KM-Log)	1.946
KM Standard Error of Mean (logged)	0.0598		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00179	Mean in Log Scale	-6.334
SD in Original Scale	2.6536E-4	SD in Log Scale	0.153
95% t UCL (Assumes normality)	0.00201	95% H-Stat UCL	0.00206

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.00184

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	6	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	0.0033	Mean	0.00382
Maximum	0.005	Median	0.00365
SD	6.3692E-4	Std. Error of Mean	2.6002E-4
Coefficient of Variation	0.167	Skewness	1.597

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.804	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.281	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00434	95% Adjusted-CLT UCL (Chen-1995)	0.00443
		95% Modified-t UCL (Johnson-1978)	0.00437

ProUCL Output
Lake Elmo
Dissolved Surface Water

Gamma GOF Test

A-D Test Statistic	0.58	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.697	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.268	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	47.48	k star (bias corrected MLE)	23.85
Theta hat (MLE)	8.0377E-5	Theta star (bias corrected MLE)	1.6001E-4
nu hat (MLE)	569.8	nu star (bias corrected)	286.2
MLE Mean (bias corrected)	0.00382	MLE Sd (bias corrected)	7.8147E-4
		Approximate Chi Square Value (0.05)	248.1
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	235.1

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0044	95% Adjusted Gamma UCL (use when n<50)	0.00465

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.834	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.251	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.714	Mean of logged Data	-5.579
Maximum of Logged Data	-5.298	SD of logged Data	0.156

Assuming Lognormal Distribution

95% H-UCL	0.0044	90% Chebyshev (MVUE) UCL	0.00454
95% Chebyshev (MVUE) UCL	0.00487	97.5% Chebyshev (MVUE) UCL	0.00533
99% Chebyshev (MVUE) UCL	0.00623		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00424	95% Jackknife UCL	0.00434
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A		
90% Chebyshev(Mean, Sd) UCL	0.0046	95% Chebyshev(Mean, Sd) UCL	0.00495
97.5% Chebyshev(Mean, Sd) UCL	0.00544	99% Chebyshev(Mean, Sd) UCL	0.0064

Suggested UCL to Use

95% Student's-t UCL 0.00434

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFHxS|ug/L

General Statistics

Total Number of Observations	6	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	0.0073	Mean	0.00895
Maximum	0.012	Median	0.0084
SD	0.00162	Std. Error of Mean	6.6320E-4
Coefficient of Variation	0.182	Skewness	1.629

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

ProUCL Output
Lake Elmo
Dissolved Surface Water

Normal GOF Test

Shapiro Wilk Test Statistic	0.836	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.276	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0103	95% Adjusted-CLT UCL (Chen-1995)	0.0105
		95% Modified-t UCL (Johnson-1978)	0.0104

Gamma GOF Test

A-D Test Statistic	0.517	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.697	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.274	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	40.41	k star (bias corrected MLE)	20.32
Theta hat (MLE)	2.2149E-4	Theta star (bias corrected MLE)	4.4056E-4
nu hat (MLE)	484.9	nu star (bias corrected)	243.8
MLE Mean (bias corrected)	0.00895	MLE Sd (bias corrected)	0.00199
		Approximate Chi Square Value (0.05)	208.6
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	196.8

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0105	95% Adjusted Gamma UCL (use when n<50)	0.0111

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.88	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.259	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.92	Mean of logged Data	-4.729
Maximum of Logged Data	-4.423	SD of logged Data	0.169

Assuming Lognormal Distribution

95% H-UCL	0.0104	90% Chebyshev (MVUE) UCL	0.0108
95% Chebyshev (MVUE) UCL	0.0116	97.5% Chebyshev (MVUE) UCL	0.0128
99% Chebyshev (MVUE) UCL	0.0151		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.01	95% Jackknife UCL	0.0103
95% Standard Bootstrap UCL	0.00993	95% Bootstrap-t UCL	0.0118
95% Hall's Bootstrap UCL	0.0165	95% Percentile Bootstrap UCL	0.0102
95% BCA Bootstrap UCL	0.0103		
90% Chebyshev(Mean, Sd) UCL	0.0109	95% Chebyshev(Mean, Sd) UCL	0.0118
97.5% Chebyshev(Mean, Sd) UCL	0.0131	99% Chebyshev(Mean, Sd) UCL	0.0155

Suggested UCL to Use

95% Student's-t UCL	0.0103

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.064	Mean	0.131
Maximum	0.39	Median	0.082
SD	0.127	Std. Error of Mean	0.0519
Coefficient of Variation	0.971	Skewness	2.419

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.57	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.454	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.236	95% Adjusted-CLT UCL (Chen-1995)	0.271
		95% Modified-t UCL (Johnson-1978)	0.244

Gamma GOF Test

A-D Test Statistic	1.209	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.704	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.437	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.336	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.203	k star (bias corrected MLE)	1.213
Theta hat (MLE)	0.0595	Theta star (bias corrected MLE)	0.108
nu hat (MLE)	26.44	nu star (bias corrected)	14.55
MLE Mean (bias corrected)	0.131	MLE Sd (bias corrected)	0.119
		Approximate Chi Square Value (0.05)	6.952
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	5.173

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.274	95% Adjusted Gamma UCL (use when n<50)	0.369

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.677	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.399	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.749	Mean of logged Data	-2.276
Maximum of Logged Data	-0.942	SD of logged Data	0.665

Assuming Lognormal Distribution

95% H-UCL	0.32	90% Chebyshev (MVUE) UCL	0.223
95% Chebyshev (MVUE) UCL	0.268	97.5% Chebyshev (MVUE) UCL	0.331
99% Chebyshev (MVUE) UCL	0.454		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	0.216	95% Jackknife UCL	0.236
95% Standard Bootstrap UCL	0.21	95% Bootstrap-t UCL	1.137
95% Hall's Bootstrap UCL	0.947	95% Percentile Bootstrap UCL	0.233
95% BCA Bootstrap UCL	0.285		
90% Chebyshev(Mean, Sd) UCL	0.287	95% Chebyshev(Mean, Sd) UCL	0.357
97.5% Chebyshev(Mean, Sd) UCL	0.455	99% Chebyshev(Mean, Sd) UCL	0.648

ProUCL Output
Lake Elmo
Dissolved Surface Water

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL 0.357

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOSA|ug/L

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
Number of Detects	4	Number of Non-Detects	2
Number of Distinct Detects	4	Number of Distinct Non-Detects	2
Minimum Detect	5.4000E-4	Minimum Non-Detect	0.0042
Maximum Detect	0.0016	Maximum Non-Detect	0.0043
Variance Detects	2.3963E-7	Percent Non-Detects	33.33%
Mean Detects	8.7500E-4	SD Detects	4.8952E-4
Median Detects	6.8000E-4	CV Detects	0.559
Skewness Detects	1.851	Kurtosis Detects	3.503
Mean of Logged Detects	-7.138	SD of Logged Detects	0.483

Note: Sample size is small (e.g., <10), If data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.772	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.366	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	8.7500E-4	KM Standard Error of Mean	2.4476E-4
KM SD	4.2394E-4	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.00137	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.00128	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.00161	95% KM Chebyshev UCL	0.00194
97.5% KM Chebyshev UCL	0.0024	99% KM Chebyshev UCL	0.00331

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.528	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.659	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.352	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.396	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	5.305	k star (bias corrected MLE)	1.493
Theta hat (MLE)	1.6494E-4	Theta star (bias corrected MLE)	5.8610E-4
nu hat (MLE)	42.44	nu star (bias corrected)	11.94
Mean (detects)	8.7500E-4		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	5.4000E-4	Mean	0.00392
Maximum	0.01	Median	0.00117
SD	0.00473	CV	1.207
k hat (MLE)	0.791	k star (bias corrected MLE)	0.507
Theta hat (MLE)	0.00495	Theta star (bias corrected MLE)	0.00773
nu hat (MLE)	9.491	nu star (bias corrected)	6.079
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (6.08, α)	1.68	Adjusted Chi Square Value (6.08, β)	0.979
95% Gamma Approximate UCL (use when n>=50)	0.0142	95% Gamma Adjusted UCL (use when n<50)	N/A

ProUCL Output
Lake Elmo
Dissolved Surface Water

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	8.7500E-4	SD (KM)	4.2394E-4
Variance (KM)	1.7973E-7	SE of Mean (KM)	2.4476E-4
k hat (KM)	4.26	k star (KM)	2.241
nu hat (KM)	51.12	nu star (KM)	26.89
theta hat (KM)	2.0540E-4	theta star (KM)	3.9043E-4
80% gamma percentile (KM)	0.00129	90% gamma percentile (KM)	0.00166
95% gamma percentile (KM)	0.002	99% gamma percentile (KM)	0.00276

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (26.89, α)	16.07	Adjusted Chi Square Value (26.89, β)	13.15
95% Gamma Approximate KM-UCL (use when n>=50)	0.00146	95% Gamma Adjusted KM-UCL (use when n<50)	0.00179

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.849	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.319	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	8.4798E-4	Mean in Log Scale	-7.138
SD in Original Scale	3.8149E-4	SD in Log Scale	0.374
95% t UCL (assumes normality of ROS data)	0.00116	95% Percentile Bootstrap UCL	0.00113
95% BCA Bootstrap UCL	0.00119	95% Bootstrap t UCL	0.00161
95% H-UCL (Log ROS)	0.00126		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-7.138	KM Geo Mean	7.9395E-4
KM SD (logged)	0.418	95% Critical H Value (KM-Log)	2.453
KM Standard Error of Mean (logged)	0.242	95% H-UCL (KM -Log)	0.00137
KM SD (logged)	0.418	95% Critical H Value (KM-Log)	2.453
KM Standard Error of Mean (logged)	0.242		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00129	Mean in Log Scale	-6.81
SD in Original Scale	7.4880E-4	SD in Log Scale	0.631
95% t UCL (Assumes normality)	0.00191	95% H-Stat UCL	0.00312

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.00137

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFPeS|ug/L

General Statistics

Total Number of Observations	6	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	0.0038	Mean	0.00448
Maximum	0.0062	Median	0.00415
SD	9.2177E-4	Std. Error of Mean	3.7631E-4
Coefficient of Variation	0.206	Skewness	1.66

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.806	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.245	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

ProUCL Output
Lake Elmo
Dissolved Surface Water

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.00524	95% Adjusted-CLT UCL (Chen-1995)	0.00537
		95% Modified-t UCL (Johnson-1978)	0.00528

Gamma GOF Test

A-D Test Statistic	0.532	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.697	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.236	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	32.04	k star (bias corrected MLE)	16.13
Theta hat (MLE)	1.3994E-4	Theta star (bias corrected MLE)	2.7794E-4
nu hat (MLE)	384.5	nu star (bias corrected)	193.6
MLE Mean (bias corrected)	0.00448	MLE Sd (bias corrected)	0.00112
		Approximate Chi Square Value (0.05)	162.4
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	152

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.00534	95% Adjusted Gamma UCL (use when n<50)	0.00571

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.841	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.222	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.573	Mean of logged Data	-5.423
Maximum of Logged Data	-5.083	SD of logged Data	0.189

Assuming Lognormal Distribution

95% H-UCL	0.00534	90% Chebyshev (MVUE) UCL	0.00551
95% Chebyshev (MVUE) UCL	0.00598	97.5% Chebyshev (MVUE) UCL	0.00663
99% Chebyshev (MVUE) UCL	0.00791		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0051	95% Jackknife UCL	0.00524
95% Standard Bootstrap UCL	0.00504	95% Bootstrap-t UCL	0.00644
95% Hall's Bootstrap UCL	0.00791	95% Percentile Bootstrap UCL	0.0051
95% BCA Bootstrap UCL	0.0052		
90% Chebyshev(Mean, Sd) UCL	0.00561	95% Chebyshev(Mean, Sd) UCL	0.00612
97.5% Chebyshev(Mean, Sd) UCL	0.00683	99% Chebyshev(Mean, Sd) UCL	0.00823

Suggested UCL to Use

95% Student's-t UCL	0.00524

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFHpS|ug/L

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.0011	Mean	0.00185
Maximum	0.0037	Median	0.0016
SD	9.4181E-4	Std. Error of Mean	3.8449E-4
Coefficient of Variation	0.509	Skewness	2.046

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

ProUCL Output
Lake Elmo
Dissolved Surface Water

Normal GOF Test

Shapiro Wilk Test Statistic	0.755	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.355	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00262	95% Adjusted-CLT UCL (Chen-1995)	0.00283
		95% Modified-t UCL (Johnson-1978)	0.00268

Gamma GOF Test

A-D Test Statistic	0.547	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.306	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	6.147	k star (bias corrected MLE)	3.185
Theta hat (MLE)	3.0095E-4	Theta star (bias corrected MLE)	5.8090E-4
nu hat (MLE)	73.77	nu star (bias corrected)	38.22
MLE Mean (bias corrected)	0.00185	MLE Sd (bias corrected)	0.00104
		Approximate Chi Square Value (0.05)	25.06
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	21.29

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	0.00282	95% Adjusted Gamma UCL (use when n<50)	0.00332

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.88	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.28	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-6.812	Mean of logged Data	-6.376
Maximum of Logged Data	-5.599	SD of logged Data	0.421

Assuming Lognormal Distribution

95% H-UCL	0.00295	90% Chebyshev (MVUE) UCL	0.00277
95% Chebyshev (MVUE) UCL	0.0032	97.5% Chebyshev (MVUE) UCL	0.00379
99% Chebyshev (MVUE) UCL	0.00496		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00248	95% Jackknife UCL	0.00262
95% Standard Bootstrap UCL	0.00243	95% Bootstrap-t UCL	0.00369
95% Hall's Bootstrap UCL	0.00529	95% Percentile Bootstrap UCL	0.00253
95% BCA Bootstrap UCL	0.00265		
90% Chebyshev(Mean, Sd) UCL	0.003	95% Chebyshev(Mean, Sd) UCL	0.00353
97.5% Chebyshev(Mean, Sd) UCL	0.00425	99% Chebyshev(Mean, Sd) UCL	0.00568

Suggested UCL to Use

95% Adjusted Gamma UCL	0.00332

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Raleigh Creek - Upper
Dissolved Surface Water

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/26/2021 10:10:00 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

PFBA|ug/L

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	0.087	Mean	0.545
Maximum	1.1	Median	0.43
SD	0.349	Std. Error of Mean	0.116
Coefficient of Variation	0.64	Skewness	0.37

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.934	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.194	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.761	95% Adjusted-CLT UCL (Chen-1995)	0.752
		95% Modified-t UCL (Johnson-1978)	0.764

Gamma GOF Test

A-D Test Statistic	0.275	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.729	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.158	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.282	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.247	k star (bias corrected MLE)	1.572
Theta hat (MLE)	0.243	Theta star (bias corrected MLE)	0.347
nu hat (MLE)	40.45	nu star (bias corrected)	28.3
MLE Mean (bias corrected)	0.545	MLE Sd (bias corrected)	0.435
		Approximate Chi Square Value (0.05)	17.16
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	15.36

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.899	95% Adjusted Gamma UCL (use when n<50)	1.005

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.926	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.16	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.442	Mean of logged Data	-0.845
Maximum of Logged Data	0.0953	SD of logged Data	0.805

Assuming Lognormal Distribution

95% H-UCL	1.327	90% Chebyshev (MVUE) UCL	1.039
95% Chebyshev (MVUE) UCL	1.253	97.5% Chebyshev (MVUE) UCL	1.549
99% Chebyshev (MVUE) UCL	2.131		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

ProUCL Output
Raleigh Creek - Upper
Dissolved Surface Water

Nonparametric Distribution Free UCLs

95% CLT UCL	0.736	95% Jackknife UCL	0.761
95% Standard Bootstrap UCL	0.725	95% Bootstrap-t UCL	0.774
95% Hall's Bootstrap UCL	0.723	95% Percentile Bootstrap UCL	0.722
95% BCA Bootstrap UCL	0.741		
90% Chebyshev(Mean, Sd) UCL	0.894	95% Chebyshev(Mean, Sd) UCL	1.052
97.5% Chebyshev(Mean, Sd) UCL	1.271	99% Chebyshev(Mean, Sd) UCL	1.702

Suggested UCL to Use

95% Student's-t UCL 0.761

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.0066	Mean	0.0361
Maximum	0.067	Median	0.027
SD	0.0205	Std. Error of Mean	0.00682
Coefficient of Variation	0.567	Skewness	0.339

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.913	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.227	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0487	95% Adjusted-CLT UCL (Chen-1995)	0.0481
		95% Modified-t UCL (Johnson-1978)	0.0489

Gamma GOF Test

A-D Test Statistic	0.383	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.727	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.189	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.282	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.849	k star (bias corrected MLE)	1.973
Theta hat (MLE)	0.0127	Theta star (bias corrected MLE)	0.0183
nu hat (MLE)	51.28	nu star (bias corrected)	35.52
MLE Mean (bias corrected)	0.0361	MLE Sd (bias corrected)	0.0257
		Approximate Chi Square Value (0.05)	22.88
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	20.77

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.056	95% Adjusted Gamma UCL (use when n<50)	0.0617

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.888	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.221	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.021	Mean of logged Data	-3.508
Maximum of Logged Data	-2.703	SD of logged Data	0.713

Assuming Lognormal Distribution

95% H-UCL	0.0752	90% Chebyshev (MVUE) UCL	0.0647
95% Chebyshev (MVUE) UCL	0.077	97.5% Chebyshev (MVUE) UCL	0.0942
99% Chebyshev (MVUE) UCL	0.128		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0473	95% Jackknife UCL	0.0487
95% Standard Bootstrap UCL	0.0468	95% Bootstrap-t UCL	0.0508
95% Hall's Bootstrap UCL	0.047	95% Percentile Bootstrap UCL	0.0471
95% BCA Bootstrap UCL	0.0468		
90% Chebyshev(Mean, Sd) UCL	0.0565	95% Chebyshev(Mean, Sd) UCL	0.0658
97.5% Chebyshev(Mean, Sd) UCL	0.0787	99% Chebyshev(Mean, Sd) UCL	0.104

Suggested UCL to Use

95% Student's-t UCL 0.0487

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
Number of Detects	8	Number of Non-Detects	1
Number of Distinct Detects	8	Number of Distinct Non-Detects	1
Minimum Detect	0.03	Minimum Non-Detect	0.0092
Maximum Detect	0.16	Maximum Non-Detect	0.0092
Variance Detects	0.00265	Percent Non-Detects	11.11%
Mean Detects	0.0928	SD Detects	0.0515
Median Detects	0.0905	CV Detects	0.555
Skewness Detects	0.0764	Kurtosis Detects	-1.902
Mean of Logged Detects	-2.544	SD of Logged Detects	0.651

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.912	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.164	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0835	KM Standard Error of Mean	0.0187
KM SD	0.0524	95% KM (BCA) UCL	0.111
95% KM (t) UCL	0.118	95% KM (Percentile Bootstrap) UCL	0.111
95% KM (z) UCL	0.114	95% KM Bootstrap t UCL	0.118
90% KM Chebyshev UCL	0.14	95% KM Chebyshev UCL	0.165
97.5% KM Chebyshev UCL	0.2	99% KM Chebyshev UCL	0.269

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.357	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.191	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.296	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.163	k star (bias corrected MLE)	2.06
Theta hat (MLE)	0.0293	Theta star (bias corrected MLE)	0.045
nu hat (MLE)	50.6	nu star (bias corrected)	32.96
Mean (detects)	0.0928		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0836
Maximum	0.16	Median	0.071
SD	0.0555	CV	0.664
k hat (MLE)	1.868	k star (bias corrected MLE)	1.319
Theta hat (MLE)	0.0447	Theta star (bias corrected MLE)	0.0633
nu hat (MLE)	33.62	nu star (bias corrected)	23.75
Adjusted Level of Significance (β)	0.0231		
Approximate Chi Square Value (23.75, α)	13.66	Adjusted Chi Square Value (23.75, β)	12.07
95% Gamma Approximate UCL (use when n>=50)	0.145	95% Gamma Adjusted UCL (use when n<50)	0.164

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0835	SD (KM)	0.0524
Variance (KM)	0.00275	SE of Mean (KM)	0.0187
k hat (KM)	2.534	k star (KM)	1.763
nu hat (KM)	45.61	nu star (KM)	31.74
theta hat (KM)	0.0329	theta star (KM)	0.0473
80% gamma percentile (KM)	0.127	90% gamma percentile (KM)	0.167
95% gamma percentile (KM)	0.206	99% gamma percentile (KM)	0.293

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (31.74, α)	19.86	Adjusted Chi Square Value (31.74, β)	17.91
95% Gamma Approximate KM-UCL (use when n>=50)	0.133	95% Gamma Adjusted KM-UCL (use when n<50)	0.148

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.906	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.198	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0842	Mean in Log Scale	-2.72
SD in Original Scale	0.0545	SD in Log Scale	0.805
95% t UCL (assumes normality of ROS data)	0.118	95% Percentile Bootstrap UCL	0.114
95% BCA Bootstrap UCL	0.111	95% Bootstrap t UCL	0.117
95% H-UCL (Log ROS)	0.203		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.782	KM Geo Mean	0.0619
KM SD (logged)	0.885	95% Critical H Value (KM-Log)	2.989
KM Standard Error of Mean (logged)	0.315	95% H-UCL (KM -Log)	0.233
KM SD (logged)	0.885	95% Critical H Value (KM-Log)	2.989
KM Standard Error of Mean (logged)	0.315		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.083	Mean in Log Scale	-2.859
SD in Original Scale	0.0564	SD in Log Scale	1.125
95% t UCL (Assumes normality)	0.118	95% H-Stat UCL	0.438

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.118

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	0.0024	Mean	0.0509
Maximum	0.084	Median	0.055
SD	0.0298	Std. Error of Mean	0.00995
Coefficient of Variation	0.586	Skewness	-0.484

ProUCL Output
Raleigh Creek - Upper
Dissolved Surface Water

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.915	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.151	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.0694	95% Adjusted-CLT UCL (Chen-1995)	0.0656
		95% Modified-t UCL (Johnson-1978)	0.0692

Gamma GOF Test

A-D Test Statistic	0.645	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.734	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.244	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.284	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.586	k star (bias corrected MLE)	1.132
Theta hat (MLE)	0.0321	Theta star (bias corrected MLE)	0.045
nu hat (MLE)	28.55	nu star (bias corrected)	20.37
MLE Mean (bias corrected)	0.0509	MLE Sd (bias corrected)	0.0479
		Approximate Chi Square Value (0.05)	11.12
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	9.714

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0933	95% Adjusted Gamma UCL (use when n<50)	0.107

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.762	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.266	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-6.032	Mean of logged Data	-3.324
Maximum of Logged Data	-2.477	SD of logged Data	1.149

Assuming Lognormal Distribution

95% H-UCL	0.298	90% Chebyshev (MVUE) UCL	0.138
95% Chebyshev (MVUE) UCL	0.172	97.5% Chebyshev (MVUE) UCL	0.219
99% Chebyshev (MVUE) UCL	0.311		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0673	95% Jackknife UCL	0.0694
95% Standard Bootstrap UCL	0.0666	95% Bootstrap-t UCL	0.0671
95% Hall's Bootstrap UCL	0.0649	95% Percentile Bootstrap UCL	0.0659
95% BCA Bootstrap UCL	0.0641		
90% Chebyshev(Mean, Sd) UCL	0.0808	95% Chebyshev(Mean, Sd) UCL	0.0943
97.5% Chebyshev(Mean, Sd) UCL	0.113	99% Chebyshev(Mean, Sd) UCL	0.15

Suggested UCL to Use

95% Student's-t UCL 0.0694

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

ProUCL Output
Raleigh Creek - Upper
Dissolved Surface Water

PFOA|ug/L

General Statistics

Total Number of Observations	9	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.0078	Mean	0.394
Maximum	0.65	Median	0.42
SD	0.233	Std. Error of Mean	0.0777
Coefficient of Variation	0.591	Skewness	-0.566

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.895	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.194	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.539	95% Adjusted-CLT UCL (Chen-1995)	0.506
		95% Modified-t UCL (Johnson-1978)	0.536

Gamma GOF Test

A-D Test Statistic	0.866	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.738	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.301	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.285	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.273	k star (bias corrected MLE)	0.923
Theta hat (MLE)	0.31	Theta star (bias corrected MLE)	0.427
nu hat (MLE)	22.92	nu star (bias corrected)	16.61
MLE Mean (bias corrected)	0.394	MLE Sd (bias corrected)	0.41
		Approximate Chi Square Value (0.05)	8.398
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	7.2

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.78	95% Adjusted Gamma UCL (use when n<50)	0.91

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.692	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.3	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.854	Mean of logged Data	-1.372
Maximum of Logged Data	-0.431	SD of logged Data	1.413

Assuming Lognormal Distribution

95% H-UCL	5.669	90% Chebyshev (MVUE) UCL	1.42
95% Chebyshev (MVUE) UCL	1.802	97.5% Chebyshev (MVUE) UCL	2.332
99% Chebyshev (MVUE) UCL	3.374		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.522	95% Jackknife UCL	0.539
95% Standard Bootstrap UCL	0.516	95% Bootstrap-t UCL	0.518
95% Hall's Bootstrap UCL	0.496	95% Percentile Bootstrap UCL	0.51
95% BCA Bootstrap UCL	0.494		
90% Chebyshev(Mean, Sd) UCL	0.627	95% Chebyshev(Mean, Sd) UCL	0.733
97.5% Chebyshev(Mean, Sd) UCL	0.879	99% Chebyshev(Mean, Sd) UCL	1.167

Suggested UCL to Use

ProUCL Output
Raleigh Creek - Upper
Dissolved Surface Water

95% Student's-t UCL 0.539

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
Number of Detects	8	Number of Non-Detects	1
Number of Distinct Detects	8	Number of Distinct Non-Detects	1
Minimum Detect	0.0015	Minimum Non-Detect	0.0041
Maximum Detect	0.0061	Maximum Non-Detect	0.0041
Variance Detects	2.1284E-6	Percent Non-Detects	11.11%
Mean Detects	0.00406	SD Detects	0.00146
Median Detects	0.00435	CV Detects	0.359
Skewness Detects	-0.663	Kurtosis Detects	0.206
Mean of Logged Detects	-5.582	SD of Logged Detects	0.453

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.949	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.206	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0039	KM Standard Error of Mean	5.1742E-4
KM SD	0.0014	95% KM (BCA) UCL	0.00469
95% KM (t) UCL	0.00487	95% KM (Percentile Bootstrap) UCL	0.00471
95% KM (z) UCL	0.00475	95% KM Bootstrap t UCL	0.00474
90% KM Chebyshev UCL	0.00546	95% KM Chebyshev UCL	0.00616
97.5% KM Chebyshev UCL	0.00714	99% KM Chebyshev UCL	0.00905

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.488	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.718	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.26	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.295	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	6.738	k star (bias corrected MLE)	4.295
Theta hat (MLE)	6.0289E-4	Theta star (bias corrected MLE)	9.4591E-4
nu hat (MLE)	107.8	nu star (bias corrected)	68.72
Mean (detects)	0.00406		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0015	Mean	0.00472
Maximum	0.01	Median	0.0046
SD	0.0024	CV	0.509
k hat (MLE)	4.398	k star (bias corrected MLE)	3.006
Theta hat (MLE)	0.00107	Theta star (bias corrected MLE)	0.00157
nu hat (MLE)	79.16	nu star (bias corrected)	54.11
Adjusted Level of Significance (β)	0.0231		
Approximate Chi Square Value (54.11, α)	38.21	Adjusted Chi Square Value (54.11, β)	35.41
95% Gamma Approximate UCL (use when n>=50)	0.00669	95% Gamma Adjusted UCL (use when n<50)	0.00722

Estimates of Gamma Parameters using KM Estimates

ProUCL Output
Raleigh Creek - Upper
Dissolved Surface Water

Mean (KM)	0.0039	SD (KM)	0.0014
Variance (KM)	1.9648E-6	SE of Mean (KM)	5.1742E-4
k hat (KM)	7.756	k star (KM)	5.245
nu hat (KM)	139.6	nu star (KM)	94.4
theta hat (KM)	5.0332E-4	theta star (KM)	7.4431E-4
80% gamma percentile (KM)	0.00522	90% gamma percentile (KM)	0.00618
95% gamma percentile (KM)	0.00706	99% gamma percentile (KM)	0.00891

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (94.40, α)	73	Adjusted Chi Square Value (94.40, β)	69.04
95% Gamma Approximate KM-UCL (use when n>=50)	0.00505	95% Gamma Adjusted KM-UCL (use when n<50)	0.00534

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.86	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.281	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00389	Mean in Log Scale	-5.629
SD in Original Scale	0.00146	SD in Log Scale	0.446
95% t UCL (assumes normality of ROS data)	0.00479	95% Percentile Bootstrap UCL	0.00463
95% BCA Bootstrap UCL	0.00462	95% Bootstrap t UCL	0.00473
95% H-UCL (Log ROS)	0.0056		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.63	KM Geo Mean	0.00359
KM SD (logged)	0.441	95% Critical H Value (KM-Log)	2.176
KM Standard Error of Mean (logged)	0.166	95% H-UCL (KM -Log)	0.00556
KM SD (logged)	0.441	95% Critical H Value (KM-Log)	2.176
KM Standard Error of Mean (logged)	0.166		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00384	Mean in Log Scale	-5.65
SD in Original Scale	0.00152	SD in Log Scale	0.47
95% t UCL (Assumes normality)	0.00478	95% H-Stat UCL	0.00566

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.00487

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFDA|ug/L

General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
Number of Detects	8	Number of Non-Detects	1
Number of Distinct Detects	7	Number of Distinct Non-Detects	1
Minimum Detect	0.0016	Minimum Non-Detect	0.0041
Maximum Detect	0.012	Maximum Non-Detect	0.0041
Variance Detects	1.3390E-5	Percent Non-Detects	11.11%
Mean Detects	0.00669	SD Detects	0.00366
Median Detects	0.0069	CV Detects	0.547
Skewness Detects	0.103	Kurtosis Detects	-0.883
Mean of Logged Detects	-5.184	SD of Logged Detects	0.696

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.954	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.162	**Lilliefors GOF Test**

5% Lilliefors Critical Value	0.283	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00618	KM Standard Error of Mean	0.00126
KM SD	0.00354	95% KM (BCA) UCL	0.00822
95% KM (t) UCL	0.00853	95% KM (Percentile Bootstrap) UCL	0.00826
95% KM (z) UCL	0.00826	95% KM Bootstrap t UCL	0.00858
90% KM Chebyshev UCL	0.00997	95% KM Chebyshev UCL	0.0117
97.5% KM Chebyshev UCL	0.0141	99% KM Chebyshev UCL	0.0187

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.299	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.722	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.162	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.296	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.985	k star (bias corrected MLE)	1.949
Theta hat (MLE)	0.00224	Theta star (bias corrected MLE)	0.00343
nu hat (MLE)	47.77	nu star (bias corrected)	31.19
Mean (detects)	0.00669		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0016	Mean	0.00706
Maximum	0.012	Median	0.0075
SD	0.0036	CV	0.51
k hat (MLE)	3.17	k star (bias corrected MLE)	2.187
Theta hat (MLE)	0.00223	Theta star (bias corrected MLE)	0.00323
nu hat (MLE)	57.05	nu star (bias corrected)	39.37
Adjusted Level of Significance (β)	0.0231		
Approximate Chi Square Value (39.37, α)	26	Adjusted Chi Square Value (39.37, β)	23.73
95% Gamma Approximate UCL (use when n>=50)	0.0107	95% Gamma Adjusted UCL (use when n<50)	0.0117

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00618	SD (KM)	0.00354
Variance (KM)	1.2521E-5	SE of Mean (KM)	0.00126
k hat (KM)	3.048	k star (KM)	2.106
nu hat (KM)	54.87	nu star (KM)	37.91
theta hat (KM)	0.00203	theta star (KM)	0.00293
80% gamma percentile (KM)	0.00919	90% gamma percentile (KM)	0.0119
95% gamma percentile (KM)	0.0144	99% gamma percentile (KM)	0.02

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (37.91, α)	24.81	Adjusted Chi Square Value (37.91, β)	22.6
95% Gamma Approximate KM-UCL (use when n>=50)	0.00944	95% Gamma Adjusted KM-UCL (use when n<50)	0.0104

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.909	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.192	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0062	Mean in Log Scale	-5.283
SD in Original Scale	0.00372	SD in Log Scale	0.715
95% t UCL (assumes normality of ROS data)	0.00851	95% Percentile Bootstrap UCL	0.00817
95% BCA Bootstrap UCL	0.00804	95% Bootstrap t UCL	0.00868
95% H-UCL (Log ROS)	0.0128		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.297	KM Geo Mean	0.00501
KM SD (logged)	0.696	95% Critical H Value (KM-Log)	2.611
KM Standard Error of Mean (logged)	0.251	95% H-UCL (KM -Log)	0.0121
KM SD (logged)	0.696	95% Critical H Value (KM-Log)	2.611
KM Standard Error of Mean (logged)	0.251		

ProUCL Output
Raleigh Creek - Upper
Dissolved Surface Water

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.00617	Mean in Log Scale	-5.296
SD in Original Scale	0.00376	SD in Log Scale	0.732
95% t UCL (Assumes normality)	0.0085	95% H-Stat UCL	0.0131

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.00853

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFBS|ug/L

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	0.0025	Mean	0.0174
Maximum	0.029	Median	0.016
SD	0.00904	Std. Error of Mean	0.00301
Coefficient of Variation	0.521	Skewness	-0.162

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.954	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.135	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.023	95% Adjusted-CLT UCL (Chen-1995)	0.0221
		95% Modified-t UCL (Johnson-1978)	0.0229

Gamma GOF Test

A-D Test Statistic	0.358	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.727	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.145	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.282	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.765	k star (bias corrected MLE)	1.917
Theta hat (MLE)	0.00628	Theta star (bias corrected MLE)	0.00905
nu hat (MLE)	49.77	nu star (bias corrected)	34.51
MLE Mean (bias corrected)	0.0174	MLE Sd (bias corrected)	0.0125
		Approximate Chi Square Value (0.05)	22.08
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	20

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0271	95% Adjusted Gamma UCL (use when n<50)	0.0299

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.843	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.194	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.991	Mean of logged Data	-4.245
Maximum of Logged Data	-3.54	SD of logged Data	0.765

Assuming Lognormal Distribution

95% H-UCL	0.0403	90% Chebyshev (MVUE) UCL	0.033
95% Chebyshev (MVUE) UCL	0.0396	97.5% Chebyshev (MVUE) UCL	0.0487
99% Chebyshev (MVUE) UCL	0.0666		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0223	95% Jackknife UCL	0.023
95% Standard Bootstrap UCL	0.0221	95% Bootstrap-t UCL	0.0227
95% Hall's Bootstrap UCL	0.0219	95% Percentile Bootstrap UCL	0.0219
95% BCA Bootstrap UCL	0.0219		
90% Chebyshev(Mean, Sd) UCL	0.0264	95% Chebyshev(Mean, Sd) UCL	0.0305
97.5% Chebyshev(Mean, Sd) UCL	0.0362	99% Chebyshev(Mean, Sd) UCL	0.0473

Suggested UCL to Use

95% Student's-t UCL 0.023

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFHxS|ug/L

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	0.0041	Mean	0.0452
Maximum	0.07	Median	0.048
SD	0.0225	Std. Error of Mean	0.00751
Coefficient of Variation	0.498	Skewness	-0.729

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.919	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.18	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0592	95% Adjusted-CLT UCL (Chen-1995)	0.0556
		95% Modified-t UCL (Johnson-1978)	0.0589

Gamma GOF Test

A-D Test Statistic	0.734	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.729	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.264	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.282	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.297	k star (bias corrected MLE)	1.605
Theta hat (MLE)	0.0197	Theta star (bias corrected MLE)	0.0282
nu hat (MLE)	41.35	nu star (bias corrected)	28.9
MLE Mean (bias corrected)	0.0452	MLE Sd (bias corrected)	0.0357
		Approximate Chi Square Value (0.05)	17.63
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	15.8

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0741	95% Adjusted Gamma UCL (use when n<50)	0.0827

ProUCL Output
Raleigh Creek - Upper
Dissolved Surface Water

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.743	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.28	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.497	Mean of logged Data	-3.329
Maximum of Logged Data	-2.659	SD of logged Data	0.908

Assuming Lognormal Distribution

95% H-UCL	0.143	90% Chebyshev (MVUE) UCL	0.0989
95% Chebyshev (MVUE) UCL	0.121	97.5% Chebyshev (MVUE) UCL	0.151
99% Chebyshev (MVUE) UCL	0.21		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0576	95% Jackknife UCL	0.0592
95% Standard Bootstrap UCL	0.0568	95% Bootstrap-t UCL	0.0572
95% Hall's Bootstrap UCL	0.0561	95% Percentile Bootstrap UCL	0.0566
95% BCA Bootstrap UCL	0.0553		
90% Chebyshev(Mean, Sd) UCL	0.0678	95% Chebyshev(Mean, Sd) UCL	0.078
97.5% Chebyshev(Mean, Sd) UCL	0.0922	99% Chebyshev(Mean, Sd) UCL	0.12

Suggested UCL to Use

95% Student's-t UCL 0.0592

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFOS|ug/L

General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.0041	Mean	1.155
Maximum	2.1	Median	1.5
SD	0.739	Std. Error of Mean	0.246
Coefficient of Variation	0.64	Skewness	-0.378

Note: Sample size is small (e.g., <10), If data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.923	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.235	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.613	95% Adjusted-CLT UCL (Chen-1995)	1.527
		95% Modified-t UCL (Johnson-1978)	1.608

Gamma GOF Test

A-D Test Statistic	0.926	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.747	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.284	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.288	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

ProUCL Output
Raleigh Creek - Upper
Dissolved Surface Water

k hat (MLE)	0.885	k star (bias corrected MLE)	0.664
Theta hat (MLE)	1.305	Theta star (bias corrected MLE)	1.74
nu hat (MLE)	15.92	nu star (bias corrected)	11.95
MLE Mean (bias corrected)	1.155	MLE Sd (bias corrected)	1.417
		Approximate Chi Square Value (0.05)	5.194
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	4.293

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	2.657	95% Adjusted Gamma UCL (use when n<50)	3.214

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.653	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.299	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.497	Mean of logged Data	-0.518
Maximum of Logged Data	0.742	SD of logged Data	1.967

Assuming Lognormal Distribution

95% H-UCL	206.1	90% Chebyshev (MVUE) UCL	7.928
95% Chebyshev (MVUE) UCL	10.31	97.5% Chebyshev (MVUE) UCL	13.61
99% Chebyshev (MVUE) UCL	20.1		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.56	95% Jackknife UCL	1.613
95% Standard Bootstrap UCL	1.546	95% Bootstrap-t UCL	1.559
95% Hall's Bootstrap UCL	1.503	95% Percentile Bootstrap UCL	1.529
95% BCA Bootstrap UCL	1.484		
90% Chebyshev(Mean, Sd) UCL	1.894	95% Chebyshev(Mean, Sd) UCL	2.228
97.5% Chebyshev(Mean, Sd) UCL	2.693	99% Chebyshev(Mean, Sd) UCL	3.605

Suggested UCL to Use

95% Student's-t UCL 1.613

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFOSA|ug/L

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
Number of Detects	8	Number of Non-Detects	1
Number of Distinct Detects	8	Number of Distinct Non-Detects	1
Minimum Detect	0.0015	Minimum Non-Detect	0.0041
Maximum Detect	0.033	Maximum Non-Detect	0.0041
Variance Detects	1.0560E-4	Percent Non-Detects	11.11%
Mean Detects	0.0181	SD Detects	0.0103
Median Detects	0.0195	CV Detects	0.569
Skewness Detects	-0.412	Kurtosis Detects	-0.264
Mean of Logged Detects	-4.308	SD of Logged Detects	1.021

Note: Sample size is small (e.g., <10), If data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.962	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.17	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0162	KM Standard Error of Mean	0.00372
KM SD	0.0105	95% KM (BCA) UCL	0.0221
95% KM (t) UCL	0.0231	95% KM (Percentile Bootstrap) UCL	0.0221
95% KM (z) UCL	0.0223	95% KM Bootstrap t UCL	0.023
90% KM Chebyshev UCL	0.0274	95% KM Chebyshev UCL	0.0325
97.5% KM Chebyshev UCL	0.0395	99% KM Chebyshev UCL	0.0533

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.609	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.285	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.298	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.851	k star (bias corrected MLE)	1.24
Theta hat (MLE)	0.00976	Theta star (bias corrected MLE)	0.0146
nu hat (MLE)	29.61	nu star (bias corrected)	19.84
Mean (detects)	0.0181		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0015	Mean	0.0172
Maximum	0.033	Median	0.019
SD	0.00998	CV	0.581
k hat (MLE)	1.962	k star (bias corrected MLE)	1.382
Theta hat (MLE)	0.00875	Theta star (bias corrected MLE)	0.0124
nu hat (MLE)	35.31	nu star (bias corrected)	24.88
Adjusted Level of Significance (β)	0.0231		
Approximate Chi Square Value (24.88, α)	14.52	Adjusted Chi Square Value (24.88, β)	12.88
95% Gamma Approximate UCL (use when n>=50)	0.0294	95% Gamma Adjusted UCL (use when n<50)	0.0332

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0162	SD (KM)	0.0105
Variance (KM)	1.0923E-4	SE of Mean (KM)	0.00372
k hat (KM)	2.409	k star (KM)	1.68
nu hat (KM)	43.37	nu star (KM)	30.24
theta hat (KM)	0.00673	theta star (KM)	0.00965
80% gamma percentile (KM)	0.0248	90% gamma percentile (KM)	0.0329
95% gamma percentile (KM)	0.0407	99% gamma percentile (KM)	0.0582

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (30.24, α)	18.69	Adjusted Chi Square Value (30.24, β)	16.8
95% Gamma Approximate KM-UCL (use when n>=50)	0.0263	95% Gamma Adjusted KM-UCL (use when n<50)	0.0292

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.79	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.317	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0164	Mean in Log Scale	-4.485
SD in Original Scale	0.0109	SD in Log Scale	1.094
95% t UCL (assumes normality of ROS data)	0.0231	95% Percentile Bootstrap UCL	0.022
95% BCA Bootstrap UCL	0.0217	95% Bootstrap t UCL	0.023
95% H-UCL (Log ROS)	0.0778		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-4.552	KM Geo Mean	0.0106
KM SD (logged)	1.134	95% Critical H Value (KM-Log)	3.545
KM Standard Error of Mean (logged)	0.404	95% H-UCL (KM -Log)	0.0832
KM SD (logged)	1.134	95% Critical H Value (KM-Log)	3.545
KM Standard Error of Mean (logged)	0.404		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0163	Mean in Log Scale	-4.517

SD in Original Scale	0.011	SD in Log Scale	1.143
95% t UCL (Assumes normality)	0.0231	95% H-Stat UCL	0.0886

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.0231

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

N-EtFOSAA|ug/L

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
Number of Detects	7	Number of Non-Detects	2
Number of Distinct Detects	7	Number of Distinct Non-Detects	2
Minimum Detect	0.0059	Minimum Non-Detect	0.0041
Maximum Detect	0.018	Maximum Non-Detect	0.0043
Variance Detects	2.0080E-5	Percent Non-Detects	22.22%
Mean Detects	0.0114	SD Detects	0.00448
Median Detects	0.011	CV Detects	0.395
Skewness Detects	0.313	Kurtosis Detects	-0.985
Mean of Logged Detects	-4.549	SD of Logged Detects	0.416

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.945	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.157	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00974	KM Standard Error of Mean	0.00171
KM SD	0.00474	95% KM (BCA) UCL	0.0125
95% KM (t) UCL	0.0129	95% KM (Percentile Bootstrap) UCL	0.0124
95% KM (z) UCL	0.0126	95% KM Bootstrap t UCL	0.013
90% KM Chebyshev UCL	0.0149	95% KM Chebyshev UCL	0.0172
97.5% KM Chebyshev UCL	0.0204	99% KM Chebyshev UCL	0.0267

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.249	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.709	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.172	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.313	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	7.183	k star (bias corrected MLE)	4.2
Theta hat (MLE)	0.00158	Theta star (bias corrected MLE)	0.0027
nu hat (MLE)	100.6	nu star (bias corrected)	58.8
Mean (detects)	0.0114		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0059	Mean	0.0111
Maximum	0.018	Median	0.01
SD	0.00393	CV	0.355
k hat (MLE)	8.972	k star (bias corrected MLE)	6.056
Theta hat (MLE)	0.00123	Theta star (bias corrected MLE)	0.00183
nu hat (MLE)	161.5	nu star (bias corrected)	109

ProUCL Output
Raleigh Creek - Upper
Dissolved Surface Water

Adjusted Level of Significance (β)	0.0231		
Approximate Chi Square Value (109.00, α)	85.9	Adjusted Chi Square Value (109.00, β)	81.59
95% Gamma Approximate UCL (use when n>=50)	0.014	95% Gamma Adjusted UCL (use when n<50)	0.0148

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00974	SD (KM)	0.00474
Variance (KM)	2.2489E-5	SE of Mean (KM)	0.00171
k hat (KM)	4.222	k star (KM)	2.889
nu hat (KM)	76	nu star (KM)	52
theta hat (KM)	0.00231	theta star (KM)	0.00337
80% gamma percentile (KM)	0.014	90% gamma percentile (KM)	0.0174
95% gamma percentile (KM)	0.0207	99% gamma percentile (KM)	0.0277

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (52.00, α)	36.44	Adjusted Chi Square Value (52.00, β)	33.71
95% Gamma Approximate KM-UCL (use when n>=50)	0.0139	95% Gamma Adjusted KM-UCL (use when n<50)	0.015

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.943	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.161	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00968	Mean in Log Scale	-4.776
SD in Original Scale	0.00511	SD in Log Scale	0.576
95% t UCL (assumes normality of ROS data)	0.0128	95% Percentile Bootstrap UCL	0.0125
95% BCA Bootstrap UCL	0.0125	95% Bootstrap t UCL	0.0134
95% H-UCL (Log ROS)	0.0162		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-4.76	KM Geo Mean	0.00857
KM SD (logged)	0.52	95% Critical H Value (KM-Log)	2.26
KM Standard Error of Mean (logged)	0.187	95% H-UCL (KM -Log)	0.0149
KM SD (logged)	0.52	95% Critical H Value (KM-Log)	2.26
KM Standard Error of Mean (logged)	0.187		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0093	Mean in Log Scale	-4.908
SD in Original Scale	0.00563	SD in Log Scale	0.799
95% t UCL (Assumes normality)	0.0128	95% H-Stat UCL	0.0225

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.0129

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
Number of Detects	8	Number of Non-Detects	1
Number of Distinct Detects	8	Number of Distinct Non-Detects	1
Minimum Detect	0.0037	Minimum Non-Detect	0.0041
Maximum Detect	0.026	Maximum Non-Detect	0.0041
Variance Detects	5.7043E-5	Percent Non-Detects	11.11%
Mean Detects	0.0163	SD Detects	0.00755
Median Detects	0.0155	CV Detects	0.464
Skewness Detects	-0.329	Kurtosis Detects	-0.6
Mean of Logged Detects	-4.258	SD of Logged Detects	0.636

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.959	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.151	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0149	KM Standard Error of Mean	0.00276
KM SD	0.00774	95% KM (BCA) UCL	0.0189
95% KM (t) UCL	0.02	95% KM (Percentile Bootstrap) UCL	0.0192
95% KM (z) UCL	0.0194	95% KM Bootstrap t UCL	0.0198
90% KM Chebyshev UCL	0.0231	95% KM Chebyshev UCL	0.0269
97.5% KM Chebyshev UCL	0.0321	99% KM Chebyshev UCL	0.0423

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.371	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.719	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.207	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.296	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.746	k star (bias corrected MLE)	2.425
Theta hat (MLE)	0.00434	Theta star (bias corrected MLE)	0.00671
nu hat (MLE)	59.94	nu star (bias corrected)	38.79
Mean (detects)	0.0163		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0037	Mean	0.0156
Maximum	0.026	Median	0.015
SD	0.00737	CV	0.473
k hat (MLE)	3.885	k star (bias corrected MLE)	2.664
Theta hat (MLE)	0.00401	Theta star (bias corrected MLE)	0.00584
nu hat (MLE)	69.93	nu star (bias corrected)	47.95
Adjusted Level of Significance (β)	0.0231		
Approximate Chi Square Value (47.95, α)	33.06	Adjusted Chi Square Value (47.95, β)	30.47
95% Gamma Approximate UCL (use when n>=50)	0.0226	95% Gamma Adjusted UCL (use when n<50)	0.0245

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0149	SD (KM)	0.00774
Variance (KM)	5.9953E-5	SE of Mean (KM)	0.00276
k hat (KM)	3.686	k star (KM)	2.532
nu hat (KM)	66.36	nu star (KM)	45.57
theta hat (KM)	0.00403	theta star (KM)	0.00587
80% gamma percentile (KM)	0.0216	90% gamma percentile (KM)	0.0274
95% gamma percentile (KM)	0.0328	99% gamma percentile (KM)	0.0446

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (45.57, α)	31.08	Adjusted Chi Square Value (45.57, β)	28.58
95% Gamma Approximate KM-UCL (use when n>=50)	0.0218	95% Gamma Adjusted KM-UCL (use when n<50)	0.0237

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.859	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.243	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.015	Mean in Log Scale	-4.373
SD in Original Scale	0.008	SD in Log Scale	0.688
95% t UCL (assumes normality of ROS data)	0.02	95% Percentile Bootstrap UCL	0.0192
95% BCA Bootstrap UCL	0.0192	95% Bootstrap t UCL	0.0199
95% H-UCL (Log ROS)	0.03		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-4.407	KM Geo Mean	0.0122

KM SD (logged)	0.701	95% Critical H Value (KM-Log)	2.621
KM Standard Error of Mean (logged)	0.25	95% H-UCL (KM -Log)	0.0299
KM SD (logged)	0.701	95% Critical H Value (KM-Log)	2.621
KM Standard Error of Mean (logged)	0.25		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.0147	Mean in Log Scale	-4.473
SD in Original Scale	0.00851	SD in Log Scale	0.876
95% t UCL (Assumes normality)	0.02	95% H-Stat UCL	0.0421

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.02

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFPeS|ug/L

General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
Number of Detects	8	Number of Non-Detects	1
Number of Distinct Detects	7	Number of Distinct Non-Detects	1
Minimum Detect	0.01	Minimum Non-Detect	0.0041
Maximum Detect	0.046	Maximum Non-Detect	0.0041
Variance Detects	2.0913E-4	Percent Non-Detects	11.11%
Mean Detects	0.0294	SD Detects	0.0145
Median Detects	0.028	CV Detects	0.492
Skewness Detects	0.014	Kurtosis Detects	-1.895
Mean of Logged Detects	-3.656	SD of Logged Detects	0.569

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.897	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.202	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0266	KM Standard Error of Mean	0.00535
KM SD	0.015	95% KM (BCA) UCL	0.034
95% KM (t) UCL	0.0365	95% KM (Percentile Bootstrap) UCL	0.0348
95% KM (z) UCL	0.0354	95% KM Bootstrap t UCL	0.0367
90% KM Chebyshev UCL	0.0426	95% KM Chebyshev UCL	0.0499
97.5% KM Chebyshev UCL	0.06	99% KM Chebyshev UCL	0.0798

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.356	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.719	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.212	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.295	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.066	k star (bias corrected MLE)	2.625
Theta hat (MLE)	0.00722	Theta star (bias corrected MLE)	0.0112
nu hat (MLE)	65.06	nu star (bias corrected)	42
Mean (detects)	0.0294		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0272
Maximum	0.046	Median	0.024
SD	0.015	CV	0.551
k hat (MLE)	3.335	k star (bias corrected MLE)	2.297
Theta hat (MLE)	0.00816	Theta star (bias corrected MLE)	0.0119
nu hat (MLE)	60.02	nu star (bias corrected)	41.35
Adjusted Level of Significance (β)	0.0231		
Approximate Chi Square Value (41.35, α)	27.61	Adjusted Chi Square Value (41.35, β)	25.27
95% Gamma Approximate UCL (use when n>=50)	0.0408	95% Gamma Adjusted UCL (use when n<50)	0.0446

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0266	SD (KM)	0.015
Variance (KM)	2.2575E-4	SE of Mean (KM)	0.00535
k hat (KM)	3.126	k star (KM)	2.158
nu hat (KM)	56.28	nu star (KM)	38.85
theta hat (KM)	0.0085	theta star (KM)	0.0123
80% gamma percentile (KM)	0.0394	90% gamma percentile (KM)	0.0508
95% gamma percentile (KM)	0.0615	99% gamma percentile (KM)	0.0853

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (38.85, α)	25.57	Adjusted Chi Square Value (38.85, β)	23.33
95% Gamma Approximate KM-UCL (use when n>=50)	0.0404	95% Gamma Adjusted KM-UCL (use when n<50)	0.0442

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.91	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.189	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0268	Mean in Log Scale	-3.808
SD in Original Scale	0.0155	SD in Log Scale	0.702
95% t UCL (assumes normality of ROS data)	0.0365	95% Percentile Bootstrap UCL	0.0354
95% BCA Bootstrap UCL	0.0343	95% Bootstrap t UCL	0.0373
95% H-UCL (Log ROS)	0.0544		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-3.86	KM Geo Mean	0.0211
KM SD (logged)	0.766	95% Critical H Value (KM-Log)	2.745
KM Standard Error of Mean (logged)	0.273	95% H-UCL (KM -Log)	0.0594
KM SD (logged)	0.766	95% Critical H Value (KM-Log)	2.745
KM Standard Error of Mean (logged)	0.273		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0263	Mean in Log Scale	-3.937
SD in Original Scale	0.0163	SD in Log Scale	0.999
95% t UCL (Assumes normality)	0.0364	95% H-Stat UCL	0.101

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.0365

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Raleigh Creek - Other
Dissolved Porewater

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/26/2021 12:58:41 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

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General Statistics

Total Number of Observations	7	Number of Distinct Observations	3
		Number of Missing Observations	0
Minimum	0.093	Mean	0.0964
Maximum	0.1	Median	0.096
SD	0.00351	Std. Error of Mean	0.00132
Coefficient of Variation	0.0363	Skewness	0.0849

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.756	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.274	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.099	95% Adjusted-CLT UCL (Chen-1995)	0.0987
		95% Modified-t UCL (Johnson-1978)	0.099

Gamma GOF Test

A-D Test Statistic	0.872	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.708	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.293	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.311	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	883.9	k star (bias corrected MLE)	505.2
Theta hat (MLE)	1.0910E-4	Theta star (bias corrected MLE)	1.9088E-4
nu hat (MLE)	12374	nu star (bias corrected)	7072
MLE Mean (bias corrected)	0.0964	MLE Sd (bias corrected)	0.00429
		Approximate Chi Square Value (0.05)	6878
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	6819

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0992	95% Adjusted Gamma UCL (use when n<50)	0.1

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.757	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.274	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.375	Mean of logged Data	-2.34
Maximum of Logged Data	-2.303	SD of logged Data	0.0363

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	0.1
95% Chebyshev (MVUE) UCL	0.102	97.5% Chebyshev (MVUE) UCL	0.105
99% Chebyshev (MVUE) UCL	0.11		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

ProUCL Output
Raleigh Creek - Other
Dissolved Porewater

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0986	95% Jackknife UCL	0.099
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A		
90% Chebyshev(Mean, Sd) UCL	0.1	95% Chebyshev(Mean, Sd) UCL	0.102
97.5% Chebyshev(Mean, Sd) UCL	0.105	99% Chebyshev(Mean, Sd) UCL	0.11

Suggested UCL to Use

95% Student's-t UCL 0.099

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFPeA|ug/L

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.0066	Mean	0.0078
Maximum	0.0087	Median	0.0082
SD	7.9791E-4	Std. Error of Mean	3.0158E-4
Coefficient of Variation	0.102	Skewness	-0.537

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.905	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.263	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00839	95% Adjusted-CLT UCL (Chen-1995)	0.00823
		95% Modified-t UCL (Johnson-1978)	0.00838

Gamma GOF Test

A-D Test Statistic	0.441	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.708	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.282	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.311	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	108	k star (bias corrected MLE)	61.8
Theta hat (MLE)	7.2232E-5	Theta star (bias corrected MLE)	1.2621E-4
nu hat (MLE)	1512	nu star (bias corrected)	865.2
MLE Mean (bias corrected)	0.0078	MLE Sd (bias corrected)	9.9220E-4
		Approximate Chi Square Value (0.05)	797.9
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	778.3

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.00846	95% Adjusted Gamma UCL (use when n<50)	0.00867

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.898	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.27	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.021	Mean of logged Data	-4.858
Maximum of Logged Data	-4.744	SD of logged Data	0.105

Assuming Lognormal Distribution

95% H-UCL	0.00846	90% Chebyshev (MVUE) UCL	0.00873
95% Chebyshev (MVUE) UCL	0.00915	97.5% Chebyshev (MVUE) UCL	0.00973
99% Chebyshev (MVUE) UCL	0.0109		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0083	95% Jackknife UCL	0.00839
95% Standard Bootstrap UCL	0.00827	95% Bootstrap-t UCL	0.00827
95% Hall's Bootstrap UCL	0.00816	95% Percentile Bootstrap UCL	0.00826
95% BCA Bootstrap UCL	0.00821		
90% Chebyshev(Mean, Sd) UCL	0.0087	95% Chebyshev(Mean, Sd) UCL	0.00911
97.5% Chebyshev(Mean, Sd) UCL	0.00968	99% Chebyshev(Mean, Sd) UCL	0.0108

Suggested UCL to Use

95% Student's-t UCL 0.00839

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

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General Statistics

Total Number of Observations	7	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.0022	Mean	0.0037
Maximum	0.0053	Median	0.0035
SD	9.4340E-4	Std. Error of Mean	3.5657E-4
Coefficient of Variation	0.255	Skewness	0.248

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.934	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.232	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00439	95% Adjusted-CLT UCL (Chen-1995)	0.00432
		95% Modified-t UCL (Johnson-1978)	0.0044

Gamma GOF Test

A-D Test Statistic	0.403	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.707	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.253	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.312	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	17.16	k star (bias corrected MLE)	9.902
Theta hat (MLE)	2.1559E-4	Theta star (bias corrected MLE)	3.7365E-4
nu hat (MLE)	240.3	nu star (bias corrected)	138.6
MLE Mean (bias corrected)	0.0037	MLE Sd (bias corrected)	0.00118
		Approximate Chi Square Value (0.05)	112.4
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	105.3

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.00456	95% Adjusted Gamma UCL (use when n<50)	0.00487

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.916	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.275	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-6.119	Mean of logged Data	-5.629
Maximum of Logged Data	-5.24	SD of logged Data	0.267

Assuming Lognormal Distribution

95% H-UCL	0.0047	90% Chebyshev (MVUE) UCL	0.00483
95% Chebyshev (MVUE) UCL	0.00534	97.5% Chebyshev (MVUE) UCL	0.00605
99% Chebyshev (MVUE) UCL	0.00744		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00429	95% Jackknife UCL	0.00439
95% Standard Bootstrap UCL	0.00424	95% Bootstrap-t UCL	0.00455
95% Hall's Bootstrap UCL	0.00493	95% Percentile Bootstrap UCL	0.00424
95% BCA Bootstrap UCL	0.00426		
90% Chebyshev(Mean, Sd) UCL	0.00477	95% Chebyshev(Mean, Sd) UCL	0.00525
97.5% Chebyshev(Mean, Sd) UCL	0.00593	99% Chebyshev(Mean, Sd) UCL	0.00725

Suggested UCL to Use

95% Student's-t UCL	0.00439

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOA|ug/L

General Statistics

Total Number of Observations	7	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	0.008	Mean	0.00994
Maximum	0.012	Median	0.01
SD	0.00146	Std. Error of Mean	5.5328E-4
Coefficient of Variation	0.147	Skewness	0.0557

Note: Sample size is small (e.g., <10), If data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.936	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.211	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.011	95% Adjusted-CLT UCL (Chen-1995)	0.0109
		95% Modified-t UCL (Johnson-1978)	0.011

Gamma GOF Test

A-D Test Statistic	0.342	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.708	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.225	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.311	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

ProUCL Output
Raleigh Creek - Other
Dissolved Porewater

Gamma Statistics

k hat (MLE)	53.4	k star (bias corrected MLE)	30.61
Theta hat (MLE)	1.8621E-4	Theta star (bias corrected MLE)	3.2486E-4
nu hat (MLE)	747.5	nu star (bias corrected)	428.5
MLE Mean (bias corrected)	0.00994	MLE Sd (bias corrected)	0.0018
		Approximate Chi Square Value (0.05)	381.5
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	368

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0112	95% Adjusted Gamma UCL (use when n<50)	0.0116

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.935	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.205	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.828	Mean of logged Data	-4.62
Maximum of Logged Data	-4.423	SD of logged Data	0.148

Assuming Lognormal Distribution

95% H-UCL	0.0112	90% Chebyshev (MVUE) UCL	0.0116
95% Chebyshev (MVUE) UCL	0.0124	97.5% Chebyshev (MVUE) UCL	0.0134
99% Chebyshev (MVUE) UCL	0.0155		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0109	95% Jackknife UCL	0.011
95% Standard Bootstrap UCL	0.0108	95% Bootstrap-t UCL	0.0111
95% Hall's Bootstrap UCL	0.0108	95% Percentile Bootstrap UCL	0.0107
95% BCA Bootstrap UCL	0.0108		
90% Chebyshev(Mean, Sd) UCL	0.0116	95% Chebyshev(Mean, Sd) UCL	0.0124
97.5% Chebyshev(Mean, Sd) UCL	0.0134	99% Chebyshev(Mean, Sd) UCL	0.0154

Suggested UCL to Use

95% Student's-t UCL	0.011

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFBS|ug/L

General Statistics

Total Number of Observations	7	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	0.0025	Mean	0.00276
Maximum	0.0031	Median	0.0027
SD	1.8127E-4	Std. Error of Mean	6.8512E-5
Coefficient of Variation	0.0657	Skewness	0.897

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.888	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.264	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00289	95% Adjusted-CLT UCL (Chen-1995)	0.00289
		95% Modified-t UCL (Johnson-1978)	0.00289

ProUCL Output
Raleigh Creek - Other
Dissolved Porewater

Gamma GOF Test

A-D Test Statistic	0.506	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.708	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.248	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.311	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	276.2	k star (bias corrected MLE)	157.9
Theta hat (MLE)	9.9808E-6	Theta star (bias corrected MLE)	1.7456E-5
nu hat (MLE)	3867	nu star (bias corrected)	2211
MLE Mean (bias corrected)	0.00276	MLE Sd (bias corrected)	2.1938E-4
		Approximate Chi Square Value (0.05)	2103
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	2071

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0029	95% Adjusted Gamma UCL (use when n<50)	0.00294

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.899	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.252	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.991	Mean of logged Data	-5.895
Maximum of Logged Data	-5.776	SD of logged Data	0.0647

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	0.00296
95% Chebyshev (MVUE) UCL	0.00305	97.5% Chebyshev (MVUE) UCL	0.00318
99% Chebyshev (MVUE) UCL	0.00343		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00287	95% Jackknife UCL	0.00289
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A		
90% Chebyshev(Mean, Sd) UCL	0.00296	95% Chebyshev(Mean, Sd) UCL	0.00306
97.5% Chebyshev(Mean, Sd) UCL	0.00318	99% Chebyshev(Mean, Sd) UCL	0.00344

Suggested UCL to Use

95% Student's-t UCL 0.00289

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.0021	Mean	0.00297
Maximum	0.004	Median	0.0029
SD	7.4992E-4	Std. Error of Mean	2.8344E-4
Coefficient of Variation	0.252	Skewness	0.454

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

ProUCL Output
Raleigh Creek - Other
Dissolved Porewater

Normal GOF Test

Shapiro Wilk Test Statistic	0.911	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.178	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00352	95% Adjusted-CLT UCL (Chen-1995)	0.00349
		95% Modified-t UCL (Johnson-1978)	0.00353

Gamma GOF Test

A-D Test Statistic	0.304	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.707	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.19	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.312	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	18.71	k star (bias corrected MLE)	10.78
Theta hat (MLE)	1.5885E-4	Theta star (bias corrected MLE)	2.7554E-4
nu hat (MLE)	261.9	nu star (bias corrected)	151
MLE Mean (bias corrected)	0.00297	MLE Sd (bias corrected)	9.0485E-4
		Approximate Chi Square Value (0.05)	123.6
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	116.1

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.00363	95% Adjusted Gamma UCL (use when n<50)	0.00386

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.933	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.17	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-6.166	Mean of logged Data	-5.846
Maximum of Logged Data	-5.521	SD of logged Data	0.25

Assuming Lognormal Distribution

95% H-UCL	0.00369	90% Chebyshev (MVUE) UCL	0.00381
95% Chebyshev (MVUE) UCL	0.0042	97.5% Chebyshev (MVUE) UCL	0.00473
99% Chebyshev (MVUE) UCL	0.00577		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00344	95% Jackknife UCL	0.00352
95% Standard Bootstrap UCL	0.00341	95% Bootstrap-t UCL	0.00373
95% Hall's Bootstrap UCL	0.00366	95% Percentile Bootstrap UCL	0.00341
95% BCA Bootstrap UCL	0.00341		
90% Chebyshev(Mean, Sd) UCL	0.00382	95% Chebyshev(Mean, Sd) UCL	0.00421
97.5% Chebyshev(Mean, Sd) UCL	0.00474	99% Chebyshev(Mean, Sd) UCL	0.00579

Suggested UCL to Use

95% Student's-t UCL	0.00352

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	7	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.0032	Mean	0.0157
Maximum	0.052	Median	0.0051
SD	0.0188	Std. Error of Mean	0.00712
Coefficient of Variation	1.202	Skewness	1.566

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.74	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.312	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.0295	95% Adjusted-CLT UCL (Chen-1995)	0.0319
		95% Modified-t UCL (Johnson-1978)	0.0302

Gamma GOF Test

A-D Test Statistic	0.683	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.728	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.292	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.32	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.993	k star (bias corrected MLE)	0.663
Theta hat (MLE)	0.0158	Theta star (bias corrected MLE)	0.0236
nu hat (MLE)	13.91	nu star (bias corrected)	9.28
MLE Mean (bias corrected)	0.0157	MLE Sd (bias corrected)	0.0192
		Approximate Chi Square Value (0.05)	3.497
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	2.514

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	0.0416	95% Adjusted Gamma UCL (use when n<50)	0.0579

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.844	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.256	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.745	Mean of logged Data	-4.737
Maximum of Logged Data	-2.957	SD of logged Data	1.126

Assuming Lognormal Distribution

95% H-UCL	0.107	90% Chebyshev (MVUE) UCL	0.0333
95% Chebyshev (MVUE) UCL	0.0417	97.5% Chebyshev (MVUE) UCL	0.0534
99% Chebyshev (MVUE) UCL	0.0765		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0274	95% Jackknife UCL	0.0295
95% Standard Bootstrap UCL	0.0266	95% Bootstrap-t UCL	0.0877
95% Hall's Bootstrap UCL	0.109	95% Percentile Bootstrap UCL	0.0282
95% BCA Bootstrap UCL	0.0315		
90% Chebyshev(Mean, Sd) UCL	0.037	95% Chebyshev(Mean, Sd) UCL	0.0467
97.5% Chebyshev(Mean, Sd) UCL	0.0601	99% Chebyshev(Mean, Sd) UCL	0.0865

ProUCL Output
Raleigh Creek - Other
Dissolved Porewater

Suggested UCL to Use

95% Adjusted Gamma UCL 0.0579

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	7	Number of Distinct Observations	5
Number of Detects	4	Number of Non-Detects	3
Number of Distinct Detects	4	Number of Distinct Non-Detects	1
Minimum Detect	8.0000E-4	Minimum Non-Detect	0.0044
Maximum Detect	0.0027	Maximum Non-Detect	0.0044
Variance Detects	7.1583E-7	Percent Non-Detects	42.86%
Mean Detects	0.00168	SD Detects	8.4607E-4
Median Detects	0.0016	CV Detects	0.505
Skewness Detects	0.368	Kurtosis Detects	-2.103
Mean of Logged Detects	-6.496	SD of Logged Detects	0.539

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.965	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.213	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00168	KM Standard Error of Mean	4.2303E-4
KM SD	7.3272E-4	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.0025	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.00237	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.00294	95% KM Chebyshev UCL	0.00352
97.5% KM Chebyshev UCL	0.00432	99% KM Chebyshev UCL	0.00588

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.236	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.659	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.21	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.396	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.949	k star (bias corrected MLE)	1.404
Theta hat (MLE)	3.3845E-4	Theta star (bias corrected MLE)	0.00119
nu hat (MLE)	39.59	nu star (bias corrected)	11.23
Mean (detects)	0.00168		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	8.0000E-4	Mean	0.00524
Maximum	0.01	Median	0.0027
SD	0.00449	CV	0.856
k hat (MLE)	1.291	k star (bias corrected MLE)	0.833
Theta hat (MLE)	0.00406	Theta star (bias corrected MLE)	0.0063
nu hat (MLE)	18.07	nu star (bias corrected)	11.66
Adjusted Level of Significance (β)	0.0158		
Approximate Chi Square Value (11.66, α)	5.003	Adjusted Chi Square Value (11.66, β)	3.772
95% Gamma Approximate UCL (use when n>=50)	0.0122	95% Gamma Adjusted UCL (use when n<50)	N/A

ProUCL Output
Raleigh Creek - Other
Dissolved Porewater

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00168	SD (KM)	7.3272E-4
Variance (KM)	5.3688E-7	SE of Mean (KM)	4.2303E-4
k hat (KM)	5.226	k star (KM)	3.081
nu hat (KM)	73.16	nu star (KM)	43.14
theta hat (KM)	3.2052E-4	theta star (KM)	5.4358E-4
80% gamma percentile (KM)	0.00238	90% gamma percentile (KM)	0.00295
95% gamma percentile (KM)	0.00349	99% gamma percentile (KM)	0.00464

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (43.14, α)	29.08	Adjusted Chi Square Value (43.14, β)	25.65
95% Gamma Approximate KM-UCL (use when n>=50)	0.00248	95% Gamma Adjusted KM-UCL (use when n<50)	0.00282

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.973	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.199	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00166	Mean in Log Scale	-6.496
SD in Original Scale	7.5609E-4	SD in Log Scale	0.48
95% t UCL (assumes normality of ROS data)	0.00221	95% Percentile Bootstrap UCL	0.0021
95% BCA Bootstrap UCL	0.00214	95% Bootstrap t UCL	0.00225
95% H-UCL (Log ROS)	0.00272		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-6.496	KM Geo Mean	0.00151
KM SD (logged)	0.467	95% Critical H Value (KM-Log)	2.392
KM Standard Error of Mean (logged)	0.27	95% H-UCL (KM -Log)	0.00266
KM SD (logged)	0.467	95% Critical H Value (KM-Log)	2.392
KM Standard Error of Mean (logged)	0.27		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0019	Mean in Log Scale	-6.335
SD in Original Scale	6.6081E-4	SD in Log Scale	0.431
95% t UCL (Assumes normality)	0.00239	95% H-Stat UCL	0.00293

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.0025

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
West Lakeland
Dissolved Surface Water

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/26/2021 10:30:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Area- WL Media- Filtered Surfce Water

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General Statistics

Total Number of Observations	13	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	0.34	Mean	0.42
Maximum	0.48	Median	0.42
SD	0.0453	Std. Error of Mean	0.0126
Coefficient of Variation	0.108	Skewness	-0.178

Normal GOF Test

Shapiro Wilk Test Statistic	0.93	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.196	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.442	95% Adjusted-CLT UCL (Chen-1995)	0.44
		95% Modified-t UCL (Johnson-1978)	0.442

Gamma GOF Test

A-D Test Statistic	0.431	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.732	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.205	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.236	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	91.47	k star (bias corrected MLE)	70.41
Theta hat (MLE)	0.00459	Theta star (bias corrected MLE)	0.00596
nu hat (MLE)	2378	nu star (bias corrected)	1831
MLE Mean (bias corrected)	0.42	MLE Sd (bias corrected)	0.0501
		Approximate Chi Square Value (0.05)	1732
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	1719

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.444	95% Adjusted Gamma UCL (use when n<50)	0.447

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.93	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.195	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.079	Mean of logged Data	-0.873
Maximum of Logged Data	-0.734	SD of logged Data	0.11

Assuming Lognormal Distribution

95% H-UCL	0.444	90% Chebyshev (MVUE) UCL	0.458
95% Chebyshev (MVUE) UCL	0.476	97.5% Chebyshev (MVUE) UCL	0.5
99% Chebyshev (MVUE) UCL	0.547		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

ProUCL Output
West Lakeland
Dissolved Surface Water

Nonparametric Distribution Free UCLs

95% CLT UCL	0.441	95% Jackknife UCL	0.442
95% Standard Bootstrap UCL	0.44	95% Bootstrap-t UCL	0.441
95% Hall's Bootstrap UCL	0.439	95% Percentile Bootstrap UCL	0.44
95% BCA Bootstrap UCL	0.438		
90% Chebyshev(Mean, Sd) UCL	0.458	95% Chebyshev(Mean, Sd) UCL	0.475
97.5% Chebyshev(Mean, Sd) UCL	0.498	99% Chebyshev(Mean, Sd) UCL	0.545

Suggested UCL to Use

95% Student's-t UCL 0.442

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

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General Statistics

Total Number of Observations	13	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	0.013	Mean	0.0148
Maximum	0.016	Median	0.015
SD	0.00117	Std. Error of Mean	3.2332E-4
Coefficient of Variation	0.0789	Skewness	-0.594

Normal GOF Test

Shapiro Wilk Test Statistic	0.826	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.271	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.234	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0153	95% Adjusted-CLT UCL (Chen-1995)	0.0152
		95% Modified-t UCL (Johnson-1978)	0.0153

Gamma GOF Test

A-D Test Statistic	1.01	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.732	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.282	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.236	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	168.6	k star (bias corrected MLE)	129.8
Theta hat (MLE)	8.7590E-5	Theta star (bias corrected MLE)	1.1382E-4
nu hat (MLE)	4384	nu star (bias corrected)	3374
MLE Mean (bias corrected)	0.0148	MLE Sd (bias corrected)	0.0013
		Approximate Chi Square Value (0.05)	3240
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	3221

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0154	95% Adjusted Gamma UCL (use when n<50)	0.0155

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.817	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.283	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.234	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.343	Mean of logged Data	-4.218
Maximum of Logged Data	-4.135	SD of logged Data	0.0808

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	0.0158
95% Chebyshev (MVUE) UCL	0.0162	97.5% Chebyshev (MVUE) UCL	0.0168
99% Chebyshev (MVUE) UCL	0.0181		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0153	95% Jackknife UCL	0.0153
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A		
90% Chebyshev(Mean, Sd) UCL	0.0157	95% Chebyshev(Mean, Sd) UCL	0.0162
97.5% Chebyshev(Mean, Sd) UCL	0.0168	99% Chebyshev(Mean, Sd) UCL	0.018

Suggested UCL to Use

95% Student's-t UCL	0.0153	or 95% Modified-t UCL	0.0153

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

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General Statistics

Total Number of Observations	13	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	0.014	Mean	0.015
Maximum	0.017	Median	0.015
SD	9.1287E-4	Std. Error of Mean	2.5318E-4
Coefficient of Variation	0.0609	Skewness	0.777

Normal GOF Test

Shapiro Wilk Test Statistic	0.856	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.269	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.234	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0155	95% Adjusted-CLT UCL (Chen-1995)	0.0155
		95% Modified-t UCL (Johnson-1978)	0.0155

Gamma GOF Test

A-D Test Statistic	0.864	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.732	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.262	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.236	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	299.3	k star (bias corrected MLE)	230.3
Theta hat (MLE)	5.0121E-5	Theta star (bias corrected MLE)	6.5143E-5
nu hat (MLE)	7781	nu star (bias corrected)	5987
MLE Mean (bias corrected)	0.015	MLE Sd (bias corrected)	9.8851E-4
		Approximate Chi Square Value (0.05)	5808
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	5783

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0155	95% Adjusted Gamma UCL (use when n<50)	0.0155

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.861	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.258	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.234	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

ProUCL Output
West Lakeland
Dissolved Surface Water

Lognormal Statistics

Minimum of Logged Data	-4.269	Mean of logged Data	-4.201
Maximum of Logged Data	-4.075	SD of logged Data	0.0599

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	0.0157
95% Chebyshev (MVUE) UCL	0.0161	97.5% Chebyshev (MVUE) UCL	0.0166
99% Chebyshev (MVUE) UCL	0.0175		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0154	95% Jackknife UCL	0.0155
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A		
90% Chebyshev(Mean, Sd) UCL	0.0158	95% Chebyshev(Mean, Sd) UCL	0.0161
97.5% Chebyshev(Mean, Sd) UCL	0.0166	99% Chebyshev(Mean, Sd) UCL	0.0175

Suggested UCL to Use

95% Student's-t UCL	0.0155	or 95% Modified-t UCL	0.0155

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	13	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	0.008	Mean	0.00925
Maximum	0.011	Median	0.0091
SD	9.1707E-4	Std. Error of Mean	2.5435E-4
Coefficient of Variation	0.0991	Skewness	0.937

Normal GOF Test

Shapiro Wilk Test Statistic	0.887	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.216	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.234	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00971	95% Adjusted-CLT UCL (Chen-1995)	0.00974
		95% Modified-t UCL (Johnson-1978)	0.00972

Gamma GOF Test

A-D Test Statistic	0.589	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.732	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.205	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.236	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	115.1	k star (bias corrected MLE)	88.61
Theta hat (MLE)	8.0383E-5	Theta star (bias corrected MLE)	1.0444E-4
nu hat (MLE)	2993	nu star (bias corrected)	2304
MLE Mean (bias corrected)	0.00925	MLE Sd (bias corrected)	9.8308E-4
		Approximate Chi Square Value (0.05)	2193
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	2178

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.00972	95% Adjusted Gamma UCL (use when n<50)	0.00979

ProUCL Output
West Lakeland
Dissolved Surface Water

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.91	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.198	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.828	Mean of logged Data	-4.687
Maximum of Logged Data	-4.51	SD of logged Data	0.0961

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	0.00999
95% Chebyshev (MVUE) UCL	0.0103	97.5% Chebyshev (MVUE) UCL	0.0108
99% Chebyshev (MVUE) UCL	0.0117		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00967	95% Jackknife UCL	0.00971
95% Standard Bootstrap UCL	0.00966	95% Bootstrap-t UCL	0.00985
95% Hall's Bootstrap UCL	0.0101	95% Percentile Bootstrap UCL	0.00966
95% BCA Bootstrap UCL	0.00972		
90% Chebyshev(Mean, Sd) UCL	0.01	95% Chebyshev(Mean, Sd) UCL	0.0104
97.5% Chebyshev(Mean, Sd) UCL	0.0108	99% Chebyshev(Mean, Sd) UCL	0.0118

Suggested UCL to Use

95% Student's-t UCL 0.00971

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOA|ug/L

General Statistics

Total Number of Observations	13	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	0.071	Mean	0.0779
Maximum	0.088	Median	0.078
SD	0.00519	Std. Error of Mean	0.00144
Coefficient of Variation	0.0666	Skewness	0.522

Normal GOF Test

Shapiro Wilk Test Statistic	0.947	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.123	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.234	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0805	95% Adjusted-CLT UCL (Chen-1995)	0.0805
		95% Modified-t UCL (Johnson-1978)	0.0805

Gamma GOF Test

A-D Test Statistic	0.255	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.732	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.109	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.236	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	248.3	k star (bias corrected MLE)	191
Theta hat (MLE)	3.1388E-4	Theta star (bias corrected MLE)	4.0794E-4
nu hat (MLE)	6455	nu star (bias corrected)	4966
MLE Mean (bias corrected)	0.0779	MLE Sd (bias corrected)	0.00564
		Approximate Chi Square Value (0.05)	4804
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	4781

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0806	95% Adjusted Gamma UCL (use when n<50)	0.0809

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.954	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.114	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.645	Mean of logged Data	-2.554
Maximum of Logged Data	-2.43	SD of logged Data	0.0659

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	0.0822
95% Chebyshev (MVUE) UCL	0.0841	97.5% Chebyshev (MVUE) UCL	0.0868
99% Chebyshev (MVUE) UCL	0.0921		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0803	95% Jackknife UCL	0.0805
95% Standard Bootstrap UCL	0.0802	95% Bootstrap-t UCL	0.0808
95% Hall's Bootstrap UCL	0.0812	95% Percentile Bootstrap UCL	0.0803
95% BCA Bootstrap UCL	0.0804		
90% Chebyshev(Mean, Sd) UCL	0.0822	95% Chebyshev(Mean, Sd) UCL	0.0842
97.5% Chebyshev(Mean, Sd) UCL	0.0869	99% Chebyshev(Mean, Sd) UCL	0.0922

Suggested UCL to Use

95% Student's-t UCL 0.0805

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFNA|ug/L

General Statistics

Total Number of Observations	13	Number of Distinct Observations	9
Number of Detects	6	Number of Non-Detects	7
Number of Distinct Detects	4	Number of Distinct Non-Detects	5
Minimum Detect	0.0012	Minimum Non-Detect	0.004
Maximum Detect	0.0016	Maximum Non-Detect	0.0051
Variance Detects	1.9000E-8	Percent Non-Detects	53.85%
Mean Detects	0.00145	SD Detects	1.3784E-4
Median Detects	0.0015	CV Detects	0.0951
Skewness Detects	-1.375	Kurtosis Detects	2.355
Mean of Logged Detects	-6.54	SD of Logged Detects	0.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.857	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.308	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00145	KM Standard Error of Mean	5.6273E-5
KM SD	1.2583E-4	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.00155	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.00154	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.00162	95% KM Chebyshev UCL	0.0017
97.5% KM Chebyshev UCL	0.0018	99% KM Chebyshev UCL	0.00201

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.599	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.696	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.326	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	124.2	k star (bias corrected MLE)	62.21
Theta hat (MLE)	1.1675E-5	Theta star (bias corrected MLE)	2.3309E-5
nu hat (MLE)	1490	nu star (bias corrected)	746.5
Mean (detects)	0.00145		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0012	Mean	0.00605
Maximum	0.01	Median	0.01
SD	0.00444	CV	0.733
k hat (MLE)	1.422	k star (bias corrected MLE)	1.145
Theta hat (MLE)	0.00426	Theta star (bias corrected MLE)	0.00529
nu hat (MLE)	36.96	nu star (bias corrected)	29.77
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (29.77, α)	18.31	Adjusted Chi Square Value (29.77, β)	17.04
95% Gamma Approximate UCL (use when n>=50)	0.00984	95% Gamma Adjusted UCL (use when n<50)	0.0106

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00145	SD (KM)	1.2583E-4
Variance (KM)	1.5833E-8	SE of Mean (KM)	5.6273E-5
k hat (KM)	132.8	k star (KM)	102.2
nu hat (KM)	3453	nu star (KM)	2657
theta hat (KM)	1.0920E-5	theta star (KM)	1.4188E-5
80% gamma percentile (KM)	0.00157	90% gamma percentile (KM)	0.00164
95% gamma percentile (KM)	0.00169	99% gamma percentile (KM)	0.0018

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (N/A, α)	2538	Adjusted Chi Square Value (N/A, β)	2522
95% Gamma Approximate KM-UCL (use when n>=50)	0.00152	95% Gamma Adjusted KM-UCL (use when n<50)	0.00153

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.834	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.314	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00145	Mean in Log Scale	-6.54
SD in Original Scale	1.0028E-4	SD in Log Scale	0.0721
95% t UCL (assumes normality of ROS data)	0.0015	95% Percentile Bootstrap UCL	0.00149
95% BCA Bootstrap UCL	0.00148	95% Bootstrap t UCL	0.00149
95% H-UCL (Log ROS)	N/A		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-6.54	KM Geo Mean	0.00144
KM SD (logged)	0.0914	95% Critical H Value (KM-Log)	N/A
KM Standard Error of Mean (logged)	0.0409	95% H-UCL (KM -Log)	N/A
KM SD (logged)	0.0914	95% Critical H Value (KM-Log)	N/A
KM Standard Error of Mean (logged)	0.0409		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00182	Mean in Log Scale	-6.331
SD in Original Scale	3.9027E-4	SD in Log Scale	0.219
95% t UCL (Assumes normality)	0.00201	95% H-Stat UCL	0.00205

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.00155

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	13	Number of Distinct Observations	8
Number of Detects	11	Number of Non-Detects	2
Number of Distinct Detects	7	Number of Distinct Non-Detects	1
Minimum Detect	0.0012	Minimum Non-Detect	0.0041
Maximum Detect	0.0022	Maximum Non-Detect	0.0041
Variance Detects	1.0473E-7	Percent Non-Detects	15.38%
Mean Detects	0.00185	SD Detects	3.2362E-4
Median Detects	0.002	CV Detects	0.174
Skewness Detects	-1.382	Kurtosis Detects	0.828
Mean of Logged Detects	-6.307	SD of Logged Detects	0.199

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.786	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.31	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.251	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00185	KM Standard Error of Mean	9.7574E-5
KM SD	3.0856E-4	95% KM (BCA) UCL	0.00199
95% KM (t) UCL	0.00203	95% KM (Percentile Bootstrap) UCL	0.00199
95% KM (z) UCL	0.00202	95% KM Bootstrap t UCL	0.00199
90% KM Chebyshev UCL	0.00215	95% KM Chebyshev UCL	0.00228
97.5% KM Chebyshev UCL	0.00246	99% KM Chebyshev UCL	0.00283

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.328	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.729	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.322	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.255	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	30.6	k star (bias corrected MLE)	22.31
Theta hat (MLE)	6.0613E-5	Theta star (bias corrected MLE)	8.3116E-5
nu hat (MLE)	673.1	nu star (bias corrected)	490.9
Mean (detects)	0.00185		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0012	Mean	0.00311
Maximum	0.01	Median	0.002
SD	0.00307	CV	0.989
k hat (MLE)	1.996	k star (bias corrected MLE)	1.587
Theta hat (MLE)	0.00156	Theta star (bias corrected MLE)	0.00196
nu hat (MLE)	51.9	nu star (bias corrected)	41.26
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (41.26, α)	27.54	Adjusted Chi Square Value (41.26, β)	25.95
95% Gamma Approximate UCL (use when n>=50)	0.00466	95% Gamma Adjusted UCL (use when n<50)	0.00494

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00185	SD (KM)	3.0856E-4
Variance (KM)	9.5207E-8	SE of Mean (KM)	9.7574E-5
k hat (KM)	36.13	k star (KM)	27.84
nu hat (KM)	939.3	nu star (KM)	723.8
theta hat (KM)	5.1337E-5	theta star (KM)	6.6615E-5
80% gamma percentile (KM)	0.00214	90% gamma percentile (KM)	0.00232
95% gamma percentile (KM)	0.00247	99% gamma percentile (KM)	0.00277

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (723.83, α)	662.4	Adjusted Chi Square Value (723.83, β)	654
95% Gamma Approximate KM-UCL (use when n>=50)	0.00203	95% Gamma Adjusted KM-UCL (use when n<50)	0.00205

ProUCL Output
West Lakeland
Dissolved Surface Water

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.747	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.315	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.251	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00185	Mean in Log Scale	-6.307
SD in Original Scale	3.0265E-4	SD in Log Scale	0.185
95% t UCL (assumes normality of ROS data)	0.002	95% Percentile Bootstrap UCL	0.00197
95% BCA Bootstrap UCL	0.00196	95% Bootstrap t UCL	0.00198
95% H-UCL (Log ROS)	0.00204		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-6.307	KM Geo Mean	0.00182
KM SD (logged)	0.189	95% Critical H Value (KM-Log)	1.822
KM Standard Error of Mean (logged)	0.0599	95% H-UCL (KM -Log)	0.00205
KM SD (logged)	0.189	95% Critical H Value (KM-Log)	1.822
KM Standard Error of Mean (logged)	0.0599		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00188	Mean in Log Scale	-6.289
SD in Original Scale	3.0440E-4	SD in Log Scale	0.186
95% t UCL (Assumes normality)	0.00204	95% H-Stat UCL	0.00208

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.00203	KM H-UCL	0.00205
95% KM (BCA) UCL	0.00199		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFBS|ug/L

General Statistics

Total Number of Observations	13	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.0036	Mean	0.00411
Maximum	0.0044	Median	0.0042
SD	2.5646E-4	Std. Error of Mean	7.1128E-5
Coefficient of Variation	0.0624	Skewness	-1.011

Normal GOF Test

Shapiro Wilk Test Statistic	0.856	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.256	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.234	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00423	95% Adjusted-CLT UCL (Chen-1995)	0.0042
		95% Modified-t UCL (Johnson-1978)	0.00423

Gamma GOF Test

A-D Test Statistic	0.92	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.732	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.265	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.236	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

ProUCL Output
West Lakeland
Dissolved Surface Water

Gamma Statistics

k hat (MLE)	267.3	k star (bias corrected MLE)	205.7
Theta hat (MLE)	1.5366E-5	Theta star (bias corrected MLE)	1.9971E-5
nu hat (MLE)	6950	nu star (bias corrected)	5348
MLE Mean (bias corrected)	0.00411	MLE Sd (bias corrected)	2.8642E-4
		Approximate Chi Square Value (0.05)	5179
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	5155

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.00424	95% Adjusted Gamma UCL (use when n<50)	0.00426

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.846	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.261	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.234	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.627	Mean of logged Data	-5.497
Maximum of Logged Data	-5.426	SD of logged Data	0.0643

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	0.00433
95% Chebyshev (MVUE) UCL	0.00443	97.5% Chebyshev (MVUE) UCL	0.00457
99% Chebyshev (MVUE) UCL	0.00484		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00422	95% Jackknife UCL	0.00423
95% Standard Bootstrap UCL	0.00422	95% Bootstrap-t UCL	0.00421
95% Hall's Bootstrap UCL	0.0042	95% Percentile Bootstrap UCL	0.00421
95% BCA Bootstrap UCL	0.00419		
90% Chebyshev(Mean, Sd) UCL	0.00432	95% Chebyshev(Mean, Sd) UCL	0.00442
97.5% Chebyshev(Mean, Sd) UCL	0.00455	99% Chebyshev(Mean, Sd) UCL	0.00482

Suggested UCL to Use

95% Student's-t UCL	0.00423	or 95% Modified-t UCL	0.00423

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFHxS|ug/L

General Statistics

Total Number of Observations	13	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.0096	Mean	0.0108
Maximum	0.013	Median	0.011
SD	0.00105	Std. Error of Mean	2.9107E-4
Coefficient of Variation	0.0973	Skewness	0.812

Normal GOF Test

Shapiro Wilk Test Statistic	0.881	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.234	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.234	Data Not Normal at 5% Significance Level	

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0113	95% Adjusted-CLT UCL (Chen-1995)	0.0113
		95% Modified-t UCL (Johnson-1978)	0.0113

Gamma GOF Test

A-D Test Statistic	0.698	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.732	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.244	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.236	Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	118.7	k star (bias corrected MLE)	91.36
Theta hat (MLE)	9.0860E-5	Theta star (bias corrected MLE)	1.1805E-4
nu hat (MLE)	3086	nu star (bias corrected)	2375
MLE Mean (bias corrected)	0.0108	MLE Sd (bias corrected)	0.00113
		Approximate Chi Square Value (0.05)	2263
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	2247

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0113	95% Adjusted Gamma UCL (use when n<50)	0.0114

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.89	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.236	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data Not Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.646	Mean of logged Data	-4.534
Maximum of Logged Data	-4.343	SD of logged Data	0.0948

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	0.0116
95% Chebyshev (MVUE) UCL	0.012	97.5% Chebyshev (MVUE) UCL	0.0126
99% Chebyshev (MVUE) UCL	0.0136		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0113	95% Jackknife UCL	0.0113
95% Standard Bootstrap UCL	0.0113	95% Bootstrap-t UCL	0.0114
95% Hall's Bootstrap UCL	0.0114	95% Percentile Bootstrap UCL	0.0113
95% BCA Bootstrap UCL	0.0113		
90% Chebyshev(Mean, Sd) UCL	0.0117	95% Chebyshev(Mean, Sd) UCL	0.0121
97.5% Chebyshev(Mean, Sd) UCL	0.0126	99% Chebyshev(Mean, Sd) UCL	0.0137

Suggested UCL to Use

95% Student's-t UCL 0.0113

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOS|ug/L

General Statistics

Total Number of Observations	13	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.19	Mean	0.228
Maximum	0.31	Median	0.23
SD	0.0321	Std. Error of Mean	0.0089
Coefficient of Variation	0.141	Skewness	1.235

Normal GOF Test

Shapiro Wilk Test Statistic	0.896	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.174	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

ProUCL Output
West Lakeland
Dissolved Surface Water

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.244	95% Adjusted-CLT UCL (Chen-1995)	0.246
		95% Modified-t UCL (Johnson-1978)	0.245

Gamma GOF Test

A-D Test Statistic	0.343	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.732	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.151	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.236	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	58.91	k star (bias corrected MLE)	45.37
Theta hat (MLE)	0.00388	Theta star (bias corrected MLE)	0.00504
nu hat (MLE)	1532	nu star (bias corrected)	1180
MLE Mean (bias corrected)	0.228	MLE Sd (bias corrected)	0.0339
		Approximate Chi Square Value (0.05)	1101
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	1090

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.245	95% Adjusted Gamma UCL (use when n<50)	0.247

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.932	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.154	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.661	Mean of logged Data	-1.485
Maximum of Logged Data	-1.171	SD of logged Data	0.134

Assuming Lognormal Distribution

95% H-UCL	0.245	90% Chebyshev (MVUE) UCL	0.254
95% Chebyshev (MVUE) UCL	0.265	97.5% Chebyshev (MVUE) UCL	0.281
99% Chebyshev (MVUE) UCL	0.313		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.243	95% Jackknife UCL	0.244
95% Standard Bootstrap UCL	0.242	95% Bootstrap-t UCL	0.249
95% Hall's Bootstrap UCL	0.258	95% Percentile Bootstrap UCL	0.243
95% BCA Bootstrap UCL	0.244		
90% Chebyshev(Mean, Sd) UCL	0.255	95% Chebyshev(Mean, Sd) UCL	0.267
97.5% Chebyshev(Mean, Sd) UCL	0.284	99% Chebyshev(Mean, Sd) UCL	0.317

Suggested UCL to Use

95% Student's-t UCL	0.244

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOSA|ug/L

General Statistics

Total Number of Observations	13	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	8.8000E-4	Mean	0.00105
Maximum	0.0014	Median	9.8000E-4
SD	1.6963E-4	Std. Error of Mean	4.7048E-5
Coefficient of Variation	0.161	Skewness	0.929

ProUCL Output
West Lakeland
Dissolved Surface Water

Normal GOF Test

Shapiro Wilk Test Statistic	0.867	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.24	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data Not Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00114	95% Adjusted-CLT UCL (Chen-1995)	0.00114
		95% Modified-t UCL (Johnson-1978)	0.00114

Gamma GOF Test

A-D Test Statistic	0.724	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.733	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.232	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.236	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	44.68	k star (bias corrected MLE)	34.42
Theta hat (MLE)	2.3585E-5	Theta star (bias corrected MLE)	3.0614E-5
nu hat (MLE)	1162	nu star (bias corrected)	895
MLE Mean (bias corrected)	0.00105	MLE Sd (bias corrected)	1.7962E-4
		Approximate Chi Square Value (0.05)	826.6
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	817.2

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.00114	95% Adjusted Gamma UCL (use when n<50)	0.00115

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.885	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.221	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-7.036	Mean of logged Data	-6.867
Maximum of Logged Data	-6.571	SD of logged Data	0.154

Assuming Lognormal Distribution

95% H-UCL	0.00114	90% Chebyshev (MVUE) UCL	0.00119
95% Chebyshev (MVUE) UCL	0.00125	97.5% Chebyshev (MVUE) UCL	0.00133
99% Chebyshev (MVUE) UCL	0.0015		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00113	95% Jackknife UCL	0.00114
95% Standard Bootstrap UCL	0.00113	95% Bootstrap-t UCL	0.00116
95% Hall's Bootstrap UCL	0.00114	95% Percentile Bootstrap UCL	0.00113
95% BCA Bootstrap UCL	0.00114		
90% Chebyshev(Mean, Sd) UCL	0.00119	95% Chebyshev(Mean, Sd) UCL	0.00126
97.5% Chebyshev(Mean, Sd) UCL	0.00135	99% Chebyshev(Mean, Sd) UCL	0.00152

Suggested UCL to Use

95% Student's-t UCL	0.00114

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	13	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	0.0035	Mean	0.0046
Maximum	0.0059	Median	0.0044
SD	7.2342E-4	Std. Error of Mean	2.0064E-4
Coefficient of Variation	0.157	Skewness	0.598

Normal GOF Test

Shapiro Wilk Test Statistic	0.934	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.224	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.00496	95% Adjusted-CLT UCL (Chen-1995)	0.00497
		95% Modified-t UCL (Johnson-1978)	0.00496

Gamma GOF Test

A-D Test Statistic	0.365	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.733	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.213	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.236	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	45.25	k star (bias corrected MLE)	34.86
Theta hat (MLE)	1.0167E-4	Theta star (bias corrected MLE)	1.3197E-4
nu hat (MLE)	1176	nu star (bias corrected)	906.3
MLE Mean (bias corrected)	0.0046	MLE Sd (bias corrected)	7.7914E-4
		Approximate Chi Square Value (0.05)	837.4
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	828

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.00498	95% Adjusted Gamma UCL (use when n<50)	0.00504

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.955	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.201	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.655	Mean of logged Data	-5.393
Maximum of Logged Data	-5.133	SD of logged Data	0.154

Assuming Lognormal Distribution

95% H-UCL	0.00499	90% Chebyshev (MVUE) UCL	0.00519
95% Chebyshev (MVUE) UCL	0.00546	97.5% Chebyshev (MVUE) UCL	0.00583
99% Chebyshev (MVUE) UCL	0.00656		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00493	95% Jackknife UCL	0.00496
95% Standard Bootstrap UCL	0.00492	95% Bootstrap-t UCL	0.005
95% Hall's Bootstrap UCL	0.00499	95% Percentile Bootstrap UCL	0.00492
95% BCA Bootstrap UCL	0.00495		
90% Chebyshev(Mean, Sd) UCL	0.0052	95% Chebyshev(Mean, Sd) UCL	0.00547
97.5% Chebyshev(Mean, Sd) UCL	0.00585	99% Chebyshev(Mean, Sd) UCL	0.0066

Suggested UCL to Use

95% Student's-t UCL	0.00496

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	13	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.0018	Mean	0.00226
Maximum	0.0029	Median	0.0024
SD	3.7758E-4	Std. Error of Mean	1.0472E-4
Coefficient of Variation	0.167	Skewness	-0.0748

Normal GOF Test

Shapiro Wilk Test Statistic	0.882	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.197	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.234	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00245	95% Adjusted-CLT UCL (Chen-1995)	0.00243
		95% Modified-t UCL (Johnson-1978)	0.00245

Gamma GOF Test

A-D Test Statistic	0.798	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.733	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.211	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.236	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	37.93	k star (bias corrected MLE)	29.23
Theta hat (MLE)	5.9628E-5	Theta star (bias corrected MLE)	7.7381E-5
nu hat (MLE)	986.1	nu star (bias corrected)	759.9
MLE Mean (bias corrected)	0.00226	MLE Sd (bias corrected)	4.1833E-4
		Approximate Chi Square Value (0.05)	696.9
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	688.3

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.00247	95% Adjusted Gamma UCL (use when n<50)	0.0025

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.864	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.204	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level	

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-6.32	Mean of logged Data	-6.105
Maximum of Logged Data	-5.843	SD of logged Data	0.171

Assuming Lognormal Distribution

95% H-UCL	0.00248	90% Chebyshev (MVUE) UCL	0.00258
95% Chebyshev (MVUE) UCL	0.00273	97.5% Chebyshev (MVUE) UCL	0.00293
99% Chebyshev (MVUE) UCL	0.00333		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00243	95% Jackknife UCL	0.00245
95% Standard Bootstrap UCL	0.00242	95% Bootstrap-t UCL	0.00244
95% Hall's Bootstrap UCL	0.00243	95% Percentile Bootstrap UCL	0.00242
95% BCA Bootstrap UCL	0.00242		
90% Chebyshev(Mean, Sd) UCL	0.00258	95% Chebyshev(Mean, Sd) UCL	0.00272
97.5% Chebyshev(Mean, Sd) UCL	0.00292	99% Chebyshev(Mean, Sd) UCL	0.0033

ProUCL Output
West Lakeland
Dissolved Surface Water

Suggested UCL to Use

95% Student's-t UCL 0.00245

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.13/5/2021 1:43:57 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

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General Statistics

Total Number of Observations	36	Number of Distinct Observations	35
Number of Detects	23	Number of Non-Detects	13
Number of Distinct Detects	23	Number of Distinct Non-Detects	12
Minimum Detect	0.154	Minimum Non-Detect	0.272
Maximum Detect	2.38	Maximum Non-Detect	4.2
Variance Detects	0.495	Percent Non-Detects	36.11%
Mean Detects	0.905	SD Detects	0.703
Median Detects	0.771	CV Detects	0.777
Skewness Detects	0.975	Kurtosis Detects	-0.0634
Mean of Logged Detects	-0.428	SD of Logged Detects	0.881

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.867	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.914	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.198	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.18	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.723	KM Standard Error of Mean	0.115
KM SD	0.642	95% KM (BCA) UCL	0.919
95% KM (t) UCL	0.918	95% KM (Percentile Bootstrap) UCL	0.908
95% KM (z) UCL	0.912	95% KM Bootstrap t UCL	0.95
90% KM Chebyshev UCL	1.069	95% KM Chebyshev UCL	1.226
97.5% KM Chebyshev UCL	1.444	99% KM Chebyshev UCL	1.871

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.446	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.758	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.132	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.185	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.671	k star (bias corrected MLE)	1.482
Theta hat (MLE)	0.542	Theta star (bias corrected MLE)	0.611
nu hat (MLE)	76.85	nu star (bias corrected)	68.16
Mean (detects)	0.905		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.154	Mean	0.705
Maximum	2.38	Median	0.54
SD	0.628	CV	0.892
k hat (MLE)	1.571	k star (bias corrected MLE)	1.459
Theta hat (MLE)	0.449	Theta star (bias corrected MLE)	0.483
nu hat (MLE)	113.1	nu star (bias corrected)	105
Adjusted Level of Significance (β)	0.0428		
Approximate Chi Square Value (105.04, α)	82.39	Adjusted Chi Square Value (105.04, β)	81.48
95% Gamma Approximate UCL (use when n>=50)	0.899	95% Gamma Adjusted UCL (use when n<50)	0.909

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.723	SD (KM)	0.642
Variance (KM)	0.413	SE of Mean (KM)	0.115
k hat (KM)	1.265	k star (KM)	1.178
nu hat (KM)	91.06	nu star (KM)	84.8
theta hat (KM)	0.571	theta star (KM)	0.613
80% gamma percentile (KM)	1.146	90% gamma percentile (KM)	1.598
95% gamma percentile (KM)	2.044	99% gamma percentile (KM)	3.068

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (84.80, α)	64.58	Adjusted Chi Square Value (84.80, β)	63.78
95% Gamma Approximate KM-UCL (use when n>=50)	0.949	95% Gamma Adjusted KM-UCL (use when n<50)	0.961

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.927	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.914	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.133	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.18	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.706	Mean in Log Scale	-0.67
SD in Original Scale	0.623	SD in Log Scale	0.797
95% t UCL (assumes normality of ROS data)	0.881	95% Percentile Bootstrap UCL	0.874
95% BCA Bootstrap UCL	0.897	95% Bootstrap t UCL	0.925
95% H-UCL (Log ROS)	0.942		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.711	KM Geo Mean	0.491
KM SD (logged)	0.892	95% Critical H Value (KM-Log)	2.265
KM Standard Error of Mean (logged)	0.168	95% H-UCL (KM -Log)	1.029
KM SD (logged)	0.892	95% Critical H Value (KM-Log)	2.265
KM Standard Error of Mean (logged)	0.168		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.797	Mean in Log Scale	-0.593
SD in Original Scale	0.666	SD in Log Scale	0.914
95% t UCL (Assumes normality)	0.985	95% H-Stat UCL	1.195

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	0.961	95% GROS Adjusted Gamma UCL	0.909

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	36	Number of Distinct Observations	31
Number of Detects	8	Number of Non-Detects	28
Number of Distinct Detects	8	Number of Distinct Non-Detects	24
Minimum Detect	0.099	Minimum Non-Detect	0.0736
Maximum Detect	0.9	Maximum Non-Detect	2.7
Variance Detects	0.0679	Percent Non-Detects	77.78%
Mean Detects	0.279	SD Detects	0.261
Median Detects	0.202	CV Detects	0.933
Skewness Detects	2.429	Kurtosis Detects	6.297
Mean of Logged Detects	-1.527	SD of Logged Detects	0.691

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.672	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.343	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.136	KM Standard Error of Mean	0.0306
KM SD	0.154	95% KM (BCA) UCL	0.193
95% KM (t) UCL	0.188	95% KM (Percentile Bootstrap) UCL	0.191
95% KM (z) UCL	0.186	95% KM Bootstrap t UCL	0.237
90% KM Chebyshev UCL	0.228	95% KM Chebyshev UCL	0.269
97.5% KM Chebyshev UCL	0.327	99% KM Chebyshev UCL	0.44

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.608	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.724	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.244	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.297	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.142	k star (bias corrected MLE)	1.422
Theta hat (MLE)	0.13	Theta star (bias corrected MLE)	0.196
nu hat (MLE)	34.28	nu star (bias corrected)	22.76
Mean (detects)	0.279		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0702
Maximum	0.9	Median	0.01
SD	0.163	CV	2.315
k hat (MLE)	0.51	k star (bias corrected MLE)	0.486
Theta hat (MLE)	0.138	Theta star (bias corrected MLE)	0.144
nu hat (MLE)	36.75	nu star (bias corrected)	35.02
Adjusted Level of Significance (β)	0.0428		
Approximate Chi Square Value (35.02, α)	22.48	Adjusted Chi Square Value (35.02, β)	22.02
95% Gamma Approximate UCL (use when n>=50)	0.109	95% Gamma Adjusted UCL (use when n<50)	0.112

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.136	SD (KM)	0.154
Variance (KM)	0.0238	SE of Mean (KM)	0.0306
k hat (KM)	0.777	k star (KM)	0.731
nu hat (KM)	55.93	nu star (KM)	52.61
theta hat (KM)	0.175	theta star (KM)	0.186
80% gamma percentile (KM)	0.223	90% gamma percentile (KM)	0.338
95% gamma percentile (KM)	0.456	99% gamma percentile (KM)	0.736

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (52.61, α)	36.95	Adjusted Chi Square Value (52.61, β)	36.35
95% Gamma Approximate KM-UCL (use when n>=50)	0.194	95% Gamma Adjusted KM-UCL (use when n<50)	0.197

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.904	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.195	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0984	Mean in Log Scale	-2.76
SD in Original Scale	0.153	SD in Log Scale	0.789
95% t UCL (assumes normality of ROS data)	0.141	95% Percentile Bootstrap UCL	0.143
95% BCA Bootstrap UCL	0.168	95% Bootstrap t UCL	0.204
95% H-UCL (Log ROS)	0.115		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.247	KM Geo Mean	0.106
KM SD (logged)	0.582	95% Critical H Value (KM-Log)	1.973
KM Standard Error of Mean (logged)	0.123	95% H-UCL (KM -Log)	0.152
KM SD (logged)	0.582	95% Critical H Value (KM-Log)	1.973
KM Standard Error of Mean (logged)	0.123		

ProUCL Output
Eagle Point Lake
Surface Sediment

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.232	Mean in Log Scale	-2.053
SD in Original Scale	0.3	SD in Log Scale	1.038
95% t UCL (Assumes normality)	0.317	95% H-Stat UCL	0.337

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	0.197	95% GROS Adjusted Gamma UCL	0.112

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_PFHxA|ug/kg

General Statistics

Total Number of Observations	36	Number of Distinct Observations	34
Number of Detects	22	Number of Non-Detects	14
Number of Distinct Detects	22	Number of Distinct Non-Detects	12
Minimum Detect	0.046	Minimum Non-Detect	0.0368
Maximum Detect	1.5	Maximum Non-Detect	2.7
Variance Detects	0.0912	Percent Non-Detects	38.89%
Mean Detects	0.332	SD Detects	0.302
Median Detects	0.251	CV Detects	0.908
Skewness Detects	2.923	Kurtosis Detects	10.91
Mean of Logged Detects	-1.392	SD of Logged Detects	0.792

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.699	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.911	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.214	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.184	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.245	KM Standard Error of Mean	0.0489
KM SD	0.273	95% KM (BCA) UCL	0.327
95% KM (t) UCL	0.327	95% KM (Percentile Bootstrap) UCL	0.332
95% KM (z) UCL	0.325	95% KM Bootstrap t UCL	0.373
90% KM Chebyshev UCL	0.391	95% KM Chebyshev UCL	0.458
97.5% KM Chebyshev UCL	0.55	99% KM Chebyshev UCL	0.731

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.397	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.757	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.122	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.188	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.866	k star (bias corrected MLE)	1.642
Theta hat (MLE)	0.178	Theta star (bias corrected MLE)	0.202
nu hat (MLE)	82.11	nu star (bias corrected)	72.25
Mean (detects)	0.332		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.225
Maximum	1.5	Median	0.152
SD	0.275	CV	1.22
k hat (MLE)	0.739	k star (bias corrected MLE)	0.696
Theta hat (MLE)	0.305	Theta star (bias corrected MLE)	0.324
nu hat (MLE)	53.17	nu star (bias corrected)	50.08
Adjusted Level of Significance (β)	0.0428		
Approximate Chi Square Value (50.08, α)	34.83	Adjusted Chi Square Value (50.08, β)	34.25
95% Gamma Approximate UCL (use when n>=50)	0.324	95% Gamma Adjusted UCL (use when n<50)	0.33

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.245	SD (KM)	0.273
Variance (KM)	0.0747	SE of Mean (KM)	0.0489
k hat (KM)	0.801	k star (KM)	0.752
nu hat (KM)	57.64	nu star (KM)	54.17
theta hat (KM)	0.306	theta star (KM)	0.325
80% gamma percentile (KM)	0.401	90% gamma percentile (KM)	0.604
95% gamma percentile (KM)	0.811	99% gamma percentile (KM)	1.304

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (54.17, α)	38.26	Adjusted Chi Square Value (54.17, β)	37.66
95% Gamma Approximate KM-UCL (use when n>=50)	0.346	95% Gamma Adjusted KM-UCL (use when n<50)	0.352

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.965	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.911	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.127	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.184	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.237	Mean in Log Scale	-1.869
SD in Original Scale	0.266	SD in Log Scale	0.936
95% t UCL (assumes normality of ROS data)	0.312	95% Percentile Bootstrap UCL	0.312
95% BCA Bootstrap UCL	0.351	95% Bootstrap t UCL	0.353
95% H-UCL (Log ROS)	0.345		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.919	KM Geo Mean	0.147
KM SD (logged)	1.042	95% Critical H Value (KM-Log)	2.43
KM Standard Error of Mean (logged)	0.192	95% H-UCL (KM -Log)	0.387
KM SD (logged)	1.042	95% Critical H Value (KM-Log)	2.43
KM Standard Error of Mean (logged)	0.192		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.322	Mean in Log Scale	-1.769
SD in Original Scale	0.348	SD in Log Scale	1.271
95% t UCL (Assumes normality)	0.42	95% H-Stat UCL	0.684

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	0.352	95% GROS Adjusted Gamma UCL	0.33

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	36	Number of Distinct Observations	33
Number of Detects	20	Number of Non-Detects	16
Number of Distinct Detects	20	Number of Distinct Non-Detects	14
Minimum Detect	0.041	Minimum Non-Detect	0.0368
Maximum Detect	1.1	Maximum Non-Detect	2.7
Variance Detects	0.0538	Percent Non-Detects	44.44%
Mean Detects	0.287	SD Detects	0.232
Median Detects	0.269	CV Detects	0.809
Skewness Detects	2.329	Kurtosis Detects	7.73
Mean of Logged Detects	-1.539	SD of Logged Detects	0.835

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.778	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.905	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.207	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.192	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.208	KM Standard Error of Mean	0.0404
KM SD	0.216	95% KM (BCA) UCL	0.277
95% KM (t) UCL	0.276	95% KM (Percentile Bootstrap) UCL	0.277
95% KM (z) UCL	0.275	95% KM Bootstrap t UCL	0.308
90% KM Chebyshev UCL	0.329	95% KM Chebyshev UCL	0.384
97.5% KM Chebyshev UCL	0.46	99% KM Chebyshev UCL	0.61

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.433	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.754	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.12	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.196	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.876	k star (bias corrected MLE)	1.628
Theta hat (MLE)	0.153	Theta star (bias corrected MLE)	0.176
nu hat (MLE)	75.05	nu star (bias corrected)	65.13
Mean (detects)	0.287		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.188
Maximum	1.1	Median	0.133
SD	0.21	CV	1.118
k hat (MLE)	0.8	k star (bias corrected MLE)	0.752
Theta hat (MLE)	0.235	Theta star (bias corrected MLE)	0.25
nu hat (MLE)	57.6	nu star (bias corrected)	54.14
Adjusted Level of Significance (β)	0.0428		
Approximate Chi Square Value (54.14, α)	38.23	Adjusted Chi Square Value (54.14, β)	37.62
95% Gamma Approximate UCL (use when n>=50)	0.266	95% Gamma Adjusted UCL (use when n<50)	0.27

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.208	SD (KM)	0.216
Variance (KM)	0.0466	SE of Mean (KM)	0.0404
k hat (KM)	0.929	k star (KM)	0.87
nu hat (KM)	66.87	nu star (KM)	62.64
theta hat (KM)	0.224	theta star (KM)	0.239
80% gamma percentile (KM)	0.338	90% gamma percentile (KM)	0.496
95% gamma percentile (KM)	0.655	99% gamma percentile (KM)	1.029

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (62.64, α)	45.43	Adjusted Chi Square Value (62.64, β)	44.76
95% Gamma Approximate KM-UCL (use when n>=50)	0.287	95% Gamma Adjusted KM-UCL (use when n<50)	0.291

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.928	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.905	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.15	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.192	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.195	Mean in Log Scale	-2.052
SD in Original Scale	0.203	SD in Log Scale	0.937
95% t UCL (assumes normality of ROS data)	0.252	95% Percentile Bootstrap UCL	0.254
95% BCA Bootstrap UCL	0.268	95% Bootstrap t UCL	0.279
95% H-UCL (Log ROS)	0.287		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.069	KM Geo Mean	0.126
KM SD (logged)	1.033	95% Critical H Value (KM-Log)	2.42
KM Standard Error of Mean (logged)	0.197	95% H-UCL (KM -Log)	0.328
KM SD (logged)	1.033	95% Critical H Value (KM-Log)	2.42
KM Standard Error of Mean (logged)	0.197		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.307	Mean in Log Scale	-1.809
SD in Original Scale	0.313	SD in Log Scale	1.276
95% t UCL (Assumes normality)	0.396	95% H-Stat UCL	0.664

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	0.291	95% GROS Adjusted Gamma UCL	0.27

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_PFHpS|ug/kg

General Statistics

Total Number of Observations	36	Number of Distinct Observations	33
Number of Detects	23	Number of Non-Detects	13
Number of Distinct Detects	22	Number of Distinct Non-Detects	12
Minimum Detect	0.042	Minimum Non-Detect	0.0368
Maximum Detect	1.3	Maximum Non-Detect	1.6
Variance Detects	0.104	Percent Non-Detects	36.11%
Mean Detects	0.46	SD Detects	0.322
Median Detects	0.377	CV Detects	0.702
Skewness Detects	0.933	Kurtosis Detects	0.847
Mean of Logged Detects	-1.095	SD of Logged Detects	0.934

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.92	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.914	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.152	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.18	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.347	KM Standard Error of Mean	0.0586
KM SD	0.323	95% KM (BCA) UCL	0.441
95% KM (t) UCL	0.446	95% KM (Percentile Bootstrap) UCL	0.441
95% KM (z) UCL	0.444	95% KM Bootstrap t UCL	0.456
90% KM Chebyshev UCL	0.523	95% KM Chebyshev UCL	0.603
97.5% KM Chebyshev UCL	0.713	99% KM Chebyshev UCL	0.931

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.46	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.758	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.144	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.184	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.721	k star (bias corrected MLE)	1.525
Theta hat (MLE)	0.267	Theta star (bias corrected MLE)	0.301
nu hat (MLE)	79.14	nu star (bias corrected)	70.15
Mean (detects)	0.46		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.337
Maximum	1.3	Median	0.265
SD	0.312	CV	0.926
k hat (MLE)	0.984	k star (bias corrected MLE)	0.92
Theta hat (MLE)	0.342	Theta star (bias corrected MLE)	0.366
nu hat (MLE)	70.85	nu star (bias corrected)	66.28
Adjusted Level of Significance (β)	0.0428		
Approximate Chi Square Value (66.28, α)	48.54	Adjusted Chi Square Value (66.28, β)	47.85
95% Gamma Approximate UCL (use when n>=50)	0.46	95% Gamma Adjusted UCL (use when n<50)	0.467

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.347	SD (KM)	0.323
Variance (KM)	0.105	SE of Mean (KM)	0.0586
k hat (KM)	1.153	k star (KM)	1.076
nu hat (KM)	83.04	nu star (KM)	77.45
theta hat (KM)	0.301	theta star (KM)	0.323
80% gamma percentile (KM)	0.556	90% gamma percentile (KM)	0.786
95% gamma percentile (KM)	1.014	99% gamma percentile (KM)	1.542

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (77.45, α)	58.18	Adjusted Chi Square Value (77.45, β)	57.42
95% Gamma Approximate KM-UCL (use when n>=50)	0.462	95% Gamma Adjusted KM-UCL (use when n<50)	0.469

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.903	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.914	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.183	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.18	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.334	Mean in Log Scale	-1.563
SD in Original Scale	0.309	SD in Log Scale	1.047
95% t UCL (assumes normality of ROS data)	0.421	95% Percentile Bootstrap UCL	0.42
95% BCA Bootstrap UCL	0.434	95% Bootstrap t UCL	0.439
95% H-UCL (Log ROS)	0.558		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.658	KM Geo Mean	0.19
KM SD (logged)	1.225	95% Critical H Value (KM-Log)	2.65
KM Standard Error of Mean (logged)	0.225	95% H-UCL (KM -Log)	0.698
KM SD (logged)	1.225	95% Critical H Value (KM-Log)	2.65
KM Standard Error of Mean (logged)	0.225		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.387	Mean in Log Scale	-1.538
SD in Original Scale	0.327	SD in Log Scale	1.307
95% t UCL (Assumes normality)	0.479	95% H-Stat UCL	0.927

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.446

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Eagle Point Lake
Surface Sediment

Conc_PFOA|ug/kg

General Statistics

Total Number of Observations	36	Number of Distinct Observations	35
Number of Detects	34	Number of Non-Detects	2
Number of Distinct Detects	33	Number of Distinct Non-Detects	2
Minimum Detect	0.195	Minimum Non-Detect	0.0762
Maximum Detect	11	Maximum Non-Detect	1.6
Variance Detects	10.56	Percent Non-Detects	5.556%
Mean Detects	3.139	SD Detects	3.25
Median Detects	2.48	CV Detects	1.035
Skewness Detects	0.966	Kurtosis Detects	-0.128
Mean of Logged Detects	0.406	SD of Logged Detects	1.363

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.831	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.933	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.237	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.15	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2.978	KM Standard Error of Mean	0.538
KM SD	3.182	95% KM (BCA) UCL	3.885
95% KM (t) UCL	3.888	95% KM (Percentile Bootstrap) UCL	3.914
95% KM (z) UCL	3.864	95% KM Bootstrap t UCL	3.963
90% KM Chebyshev UCL	4.593	95% KM Chebyshev UCL	5.325
97.5% KM Chebyshev UCL	6.34	99% KM Chebyshev UCL	8.335

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.386	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.785	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.203	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.157	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.804	k star (bias corrected MLE)	0.752
Theta hat (MLE)	3.907	Theta star (bias corrected MLE)	4.173
nu hat (MLE)	54.64	nu star (bias corrected)	51.15
Mean (detects)	3.139		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	2.982
Maximum	11	Median	1.627
SD	3.225	CV	1.082
k hat (MLE)	0.708	k star (bias corrected MLE)	0.668
Theta hat (MLE)	4.21	Theta star (bias corrected MLE)	4.465
nu hat (MLE)	51	nu star (bias corrected)	48.08
Adjusted Level of Significance (β)	0.0428		
Approximate Chi Square Value (48.08, α)	33.17	Adjusted Chi Square Value (48.08, β)	32.6
95% Gamma Approximate UCL (use when n>=50)	4.323	95% Gamma Adjusted UCL (use when n<50)	4.397

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2.978	SD (KM)	3.182
Variance (KM)	10.13	SE of Mean (KM)	0.538
k hat (KM)	0.876	k star (KM)	0.821
nu hat (KM)	63.07	nu star (KM)	59.14
theta hat (KM)	3.4	theta star (KM)	3.626
80% gamma percentile (KM)	4.86	90% gamma percentile (KM)	7.196
95% gamma percentile (KM)	9.57	99% gamma percentile (KM)	15.17

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (59.14, α)	42.46	Adjusted Chi Square Value (59.14, β)	41.82
95% Gamma Approximate KM-UCL (use when n>=50)	4.148	95% Gamma Adjusted KM-UCL (use when n<50)	4.212

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.883	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.933	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.173	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.15	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2.98	Mean in Log Scale	0.282
SD in Original Scale	3.226	SD in Log Scale	1.446
95% t UCL (assumes normality of ROS data)	3.888	95% Percentile Bootstrap UCL	3.871
95% BCA Bootstrap UCL	3.965	95% Bootstrap t UCL	4.016
95% H-UCL (Log ROS)	7.732		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.283	KM Geo Mean	1.327
KM SD (logged)	1.414	95% Critical H Value (KM-Log)	2.893
KM Standard Error of Mean (logged)	0.24	95% H-UCL (KM -Log)	7.208
KM SD (logged)	1.414	95% Critical H Value (KM-Log)	2.893
KM Standard Error of Mean (logged)	0.24		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	2.988	Mean in Log Scale	0.286
SD in Original Scale	3.22	SD in Log Scale	1.461
95% t UCL (Assumes normality)	3.895	95% H-Stat UCL	8.028

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 5.325

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_PFNA|ug/kg

General Statistics

Total Number of Observations	36	Number of Distinct Observations	31
Number of Detects	15	Number of Non-Detects	21
Number of Distinct Detects	15	Number of Distinct Non-Detects	18
Minimum Detect	0.04	Minimum Non-Detect	0.0368
Maximum Detect	1.6	Maximum Non-Detect	2.7
Variance Detects	0.146	Percent Non-Detects	58.33%
Mean Detects	0.231	SD Detects	0.382
Median Detects	0.129	CV Detects	1.653
Skewness Detects	3.776	Kurtosis Detects	14.47
Mean of Logged Detects	-1.921	SD of Logged Detects	0.783

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.396	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.437	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.131	KM Standard Error of Mean	0.0455
KM SD	0.258	95% KM (BCA) UCL	0.223
95% KM (t) UCL	0.208	95% KM (Percentile Bootstrap) UCL	0.215
95% KM (z) UCL	0.206	95% KM Bootstrap t UCL	0.38
90% KM Chebyshev UCL	0.267	95% KM Chebyshev UCL	0.329
97.5% KM Chebyshev UCL	0.415	99% KM Chebyshev UCL	0.583

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.244	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.759	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.324	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.227	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.239	k star (bias corrected MLE)	1.035
Theta hat (MLE)	0.186	Theta star (bias corrected MLE)	0.223
nu hat (MLE)	37.16	nu star (bias corrected)	31.06
Mean (detects)	0.231		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.103
Maximum	1.6	Median	0.01
SD	0.265	CV	2.571
k hat (MLE)	0.537	k star (bias corrected MLE)	0.511
Theta hat (MLE)	0.192	Theta star (bias corrected MLE)	0.202
nu hat (MLE)	38.65	nu star (bias corrected)	36.77
Adjusted Level of Significance (β)	0.0428		
Approximate Chi Square Value (36.77, α)	23.89	Adjusted Chi Square Value (36.77, β)	23.41
95% Gamma Approximate UCL (use when n>=50)	0.159	95% Gamma Adjusted UCL (use when n<50)	0.162

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.131	SD (KM)	0.258
Variance (KM)	0.0667	SE of Mean (KM)	0.0455
k hat (KM)	0.257	k star (KM)	0.254
nu hat (KM)	18.51	nu star (KM)	18.3
theta hat (KM)	0.509	theta star (KM)	0.515
80% gamma percentile (KM)	0.191	90% gamma percentile (KM)	0.393
95% gamma percentile (KM)	0.631	99% gamma percentile (KM)	1.263

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (18.30, α)	9.609	Adjusted Chi Square Value (18.30, β)	9.322
95% Gamma Approximate KM-UCL (use when n>=50)	0.249	95% Gamma Adjusted KM-UCL (use when n<50)	0.257

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.787	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.231	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.121	Mean in Log Scale	-2.69
SD in Original Scale	0.259	SD in Log Scale	0.886
95% t UCL (assumes normality of ROS data)	0.194	95% Percentile Bootstrap UCL	0.206
95% BCA Bootstrap UCL	0.254	95% Bootstrap t UCL	0.396
95% H-UCL (Log ROS)	0.141		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.564	KM Geo Mean	0.077
KM SD (logged)	0.836	95% Critical H Value (KM-Log)	2.207
KM Standard Error of Mean (logged)	0.159	95% H-UCL (KM -Log)	0.149
KM SD (logged)	0.836	95% Critical H Value (KM-Log)	2.207
KM Standard Error of Mean (logged)	0.159		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.25	Mean in Log Scale	-2.224
SD in Original Scale	0.369	SD in Log Scale	1.3
95% t UCL (Assumes normality)	0.354	95% H-Stat UCL	0.46

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 0.329

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Eagle Point Lake
Surface Sediment

Conc_PFDA|ug/kg

General Statistics

Total Number of Observations	36	Number of Distinct Observations	35
Number of Detects	27	Number of Non-Detects	9
Number of Distinct Detects	27	Number of Distinct Non-Detects	8
Minimum Detect	0.046	Minimum Non-Detect	0.0762
Maximum Detect	1.4	Maximum Non-Detect	1.6
Variance Detects	0.108	Percent Non-Detects	25%
Mean Detects	0.445	SD Detects	0.329
Median Detects	0.366	CV Detects	0.739
Skewness Detects	0.875	Kurtosis Detects	1.027
Mean of Logged Detects	-1.159	SD of Logged Detects	0.942

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.911	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.923	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.13	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.167	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.4	KM Standard Error of Mean	0.0587
KM SD	0.322	95% KM (BCA) UCL	0.496
95% KM (t) UCL	0.499	95% KM (Percentile Bootstrap) UCL	0.497
95% KM (z) UCL	0.496	95% KM Bootstrap t UCL	0.506
90% KM Chebyshev UCL	0.576	95% KM Chebyshev UCL	0.656
97.5% KM Chebyshev UCL	0.766	99% KM Chebyshev UCL	0.984

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.758	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.762	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.152	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.171	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.582	k star (bias corrected MLE)	1.431
Theta hat (MLE)	0.281	Theta star (bias corrected MLE)	0.311
nu hat (MLE)	85.42	nu star (bias corrected)	77.26
Mean (detects)	0.445		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.046	Mean	0.39
Maximum	1.4	Median	0.323
SD	0.307	CV	0.787
k hat (MLE)	1.465	k star (bias corrected MLE)	1.361
Theta hat (MLE)	0.267	Theta star (bias corrected MLE)	0.287
nu hat (MLE)	105.4	nu star (bias corrected)	97.99
Adjusted Level of Significance (β)	0.0428		
Approximate Chi Square Value (97.99, α)	76.16	Adjusted Chi Square Value (97.99, β)	75.28
95% Gamma Approximate UCL (use when n>=50)	0.502	95% Gamma Adjusted UCL (use when n<50)	0.508

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.4	SD (KM)	0.322
Variance (KM)	0.103	SE of Mean (KM)	0.0587
k hat (KM)	1.545	k star (KM)	1.435
nu hat (KM)	111.2	nu star (KM)	103.3
theta hat (KM)	0.259	theta star (KM)	0.279
80% gamma percentile (KM)	0.622	90% gamma percentile (KM)	0.842
95% gamma percentile (KM)	1.057	99% gamma percentile (KM)	1.544

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (103.29, α)	80.84	Adjusted Chi Square Value (103.29, β)	79.94
95% Gamma Approximate KM-UCL (use when n>=50)	0.511	95% Gamma Adjusted KM-UCL (use when n<50)	0.517

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.909	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.923	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.178	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.167	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.381	Mean in Log Scale	-1.344
SD in Original Scale	0.31	SD in Log Scale	0.955
95% t UCL (assumes normality of ROS data)	0.468	95% Percentile Bootstrap UCL	0.472
95% BCA Bootstrap UCL	0.466	95% Bootstrap t UCL	0.486
95% H-UCL (Log ROS)	0.599		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.359	KM Geo Mean	0.257
KM SD (logged)	1.045	95% Critical H Value (KM-Log)	2.434
KM Standard Error of Mean (logged)	0.194	95% H-UCL (KM -Log)	0.681
KM SD (logged)	1.045	95% Critical H Value (KM-Log)	2.434
KM Standard Error of Mean (logged)	0.194		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.439	Mean in Log Scale	-1.221
SD in Original Scale	0.318	SD in Log Scale	1.051
95% t UCL (Assumes normality)	0.529	95% H-Stat UCL	0.79

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.499

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_PFTeDA|ug/kg

General Statistics

Total Number of Observations	36	Number of Distinct Observations	32
Number of Detects	5	Number of Non-Detects	31
Number of Distinct Detects	5	Number of Distinct Non-Detects	28
Minimum Detect	0.27	Minimum Non-Detect	0.0368
Maximum Detect	1.6	Maximum Non-Detect	1.6
Variance Detects	0.331	Percent Non-Detects	86.11%
Mean Detects	0.702	SD Detects	0.576
Median Detects	0.38	CV Detects	0.82
Skewness Detects	1.229	Kurtosis Detects	0.277
Mean of Logged Detects	-0.61	SD of Logged Detects	0.784

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.821	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.312	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.134	KM Standard Error of Mean	0.0573
KM SD	0.303	95% KM (BCA) UCL	0.241
95% KM (t) UCL	0.231	95% KM (Percentile Bootstrap) UCL	0.227
95% KM (z) UCL	0.228	95% KM Bootstrap t UCL	0.274
90% KM Chebyshev UCL	0.306	95% KM Chebyshev UCL	0.384
97.5% KM Chebyshev UCL	0.492	99% KM Chebyshev UCL	0.704

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.478	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.684	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.314	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.36	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.101	k star (bias corrected MLE)	0.974
Theta hat (MLE)	0.334	Theta star (bias corrected MLE)	0.721
nu hat (MLE)	21.01	nu star (bias corrected)	9.736
Mean (detects)	0.702		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.106
Maximum	1.6	Median	0.01
SD	0.311	CV	2.932
k hat (MLE)	0.369	k star (bias corrected MLE)	0.357
Theta hat (MLE)	0.288	Theta star (bias corrected MLE)	0.297
nu hat (MLE)	26.56	nu star (bias corrected)	25.68
Adjusted Level of Significance (β)	0.0428		
Approximate Chi Square Value (25.68, α)	15.14	Adjusted Chi Square Value (25.68, β)	14.77
95% Gamma Approximate UCL (use when n>=50)	0.18	95% Gamma Adjusted UCL (use when n<50)	0.185

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.134	SD (KM)	0.303
Variance (KM)	0.0917	SE of Mean (KM)	0.0573
k hat (KM)	0.195	k star (KM)	0.197
nu hat (KM)	14.05	nu star (KM)	14.21
theta hat (KM)	0.685	theta star (KM)	0.678
80% gamma percentile (KM)	0.175	90% gamma percentile (KM)	0.405
95% gamma percentile (KM)	0.692	99% gamma percentile (KM)	1.484

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (14.21, α)	6.718	Adjusted Chi Square Value (14.21, β)	6.484
95% Gamma Approximate KM-UCL (use when n>=50)	0.283	95% Gamma Adjusted KM-UCL (use when n<50)	0.293

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.87	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.276	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.119	Mean in Log Scale	-3.292
SD in Original Scale	0.307	SD in Log Scale	1.166
95% t UCL (assumes normality of ROS data)	0.206	95% Percentile Bootstrap UCL	0.212
95% BCA Bootstrap UCL	0.242	95% Bootstrap t UCL	0.432
95% H-UCL (Log ROS)	0.122		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.903	KM Geo Mean	0.0549
KM SD (logged)	0.99	95% Critical H Value (KM-Log)	2.371
KM Standard Error of Mean (logged)	0.19	95% H-UCL (KM -Log)	0.133
KM SD (logged)	0.99	95% Critical H Value (KM-Log)	2.371
KM Standard Error of Mean (logged)	0.19		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.179	Mean in Log Scale	-2.772
SD in Original Scale	0.335	SD in Log Scale	1.29
95% t UCL (Assumes normality)	0.273	95% H-Stat UCL	0.261

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.231

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_PFBS|ug/kg

General Statistics

Total Number of Observations	36	Number of Distinct Observations	33
Number of Detects	16	Number of Non-Detects	20
Number of Distinct Detects	16	Number of Distinct Non-Detects	17
Minimum Detect	0.092	Minimum Non-Detect	0.0368
Maximum Detect	0.438	Maximum Non-Detect	4.2
Variance Detects	0.00993	Percent Non-Detects	55.56%
Mean Detects	0.21	SD Detects	0.0997
Median Detects	0.175	CV Detects	0.474
Skewness Detects	1.023	Kurtosis Detects	0.324
Mean of Logged Detects	-1.657	SD of Logged Detects	0.45

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.899	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.193	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.137	KM Standard Error of Mean	0.0219
KM SD	0.112	95% KM (BCA) UCL	0.173
95% KM (t) UCL	0.174	95% KM (Percentile Bootstrap) UCL	0.173
95% KM (z) UCL	0.173	95% KM Bootstrap t UCL	0.178
90% KM Chebyshev UCL	0.203	95% KM Chebyshev UCL	0.233
97.5% KM Chebyshev UCL	0.274	99% KM Chebyshev UCL	0.355

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.37	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.741	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.159	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.216	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	5.297	k star (bias corrected MLE)	4.345
Theta hat (MLE)	0.0397	Theta star (bias corrected MLE)	0.0484
nu hat (MLE)	169.5	nu star (bias corrected)	139.1
Mean (detects)	0.21		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.123
Maximum	0.438	Median	0.106
SD	0.109	CV	0.887
k hat (MLE)	1.011	k star (bias corrected MLE)	0.946
Theta hat (MLE)	0.122	Theta star (bias corrected MLE)	0.13
nu hat (MLE)	72.82	nu star (bias corrected)	68.09
Adjusted Level of Significance (β)	0.0428		
Approximate Chi Square Value (68.09, α)	50.1	Adjusted Chi Square Value (68.09, β)	49.39
95% Gamma Approximate UCL (use when n>=50)	0.167	95% Gamma Adjusted UCL (use when n<50)	0.169

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.137	SD (KM)	0.112
Variance (KM)	0.0126	SE of Mean (KM)	0.0219
k hat (KM)	1.494	k star (KM)	1.388
nu hat (KM)	107.6	nu star (KM)	99.92
theta hat (KM)	0.0917	theta star (KM)	0.0987
80% gamma percentile (KM)	0.214	90% gamma percentile (KM)	0.291
95% gamma percentile (KM)	0.366	99% gamma percentile (KM)	0.537

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (99.92, α)	77.86	Adjusted Chi Square Value (99.92, β)	76.98
95% Gamma Approximate KM-UCL (use when n>=50)	0.176	95% Gamma Adjusted KM-UCL (use when n<50)	0.178

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.966	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.887	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.141	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.213	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.141	Mean in Log Scale	-2.134
SD in Original Scale	0.0934	SD in Log Scale	0.58
95% t UCL (assumes normality of ROS data)	0.167	95% Percentile Bootstrap UCL	0.167
95% BCA Bootstrap UCL	0.168	95% Bootstrap t UCL	0.174
95% H-UCL (Log ROS)	0.17		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.347	KM Geo Mean	0.0957
KM SD (logged)	0.872	95% Critical H Value (KM-Log)	2.244
KM Standard Error of Mean (logged)	0.172	95% H-UCL (KM -Log)	0.195
KM SD (logged)	0.872	95% Critical H Value (KM-Log)	2.244
KM Standard Error of Mean (logged)	0.172		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.303	Mean in Log Scale	-1.962
SD in Original Scale	0.419	SD in Log Scale	1.321
95% t UCL (Assumes normality)	0.421	95% H-Stat UCL	0.625

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.174

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_PFPeS|ug/kg

General Statistics

Total Number of Observations	36	Number of Distinct Observations	32
Number of Detects	18	Number of Non-Detects	18
Number of Distinct Detects	18	Number of Distinct Non-Detects	15
Minimum Detect	0.114	Minimum Non-Detect	0.037
Maximum Detect	0.99	Maximum Non-Detect	1.6
Variance Detects	0.0454	Percent Non-Detects	50%
Mean Detects	0.349	SD Detects	0.213
Median Detects	0.309	CV Detects	0.611
Skewness Detects	1.659	Kurtosis Detects	3.841
Mean of Logged Detects	-1.21	SD of Logged Detects	0.575

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.861	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.897	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.172	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.202	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.224	KM Standard Error of Mean	0.0416
KM SD	0.221	95% KM (BCA) UCL	0.301
95% KM (t) UCL	0.295	95% KM (Percentile Bootstrap) UCL	0.292
95% KM (z) UCL	0.293	95% KM Bootstrap t UCL	0.305
90% KM Chebyshev UCL	0.349	95% KM Chebyshev UCL	0.406
97.5% KM Chebyshev UCL	0.484	99% KM Chebyshev UCL	0.638

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.2	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.745	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0997	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.205	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.355	k star (bias corrected MLE)	2.833
Theta hat (MLE)	0.104	Theta star (bias corrected MLE)	0.123
nu hat (MLE)	120.8	nu star (bias corrected)	102
Mean (detects)	0.349		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.203
Maximum	0.99	Median	0.147
SD	0.217	CV	1.069
k hat (MLE)	0.687	k star (bias corrected MLE)	0.648
Theta hat (MLE)	0.295	Theta star (bias corrected MLE)	0.313
nu hat (MLE)	49.46	nu star (bias corrected)	46.67
Adjusted Level of Significance (β)	0.0428		
Approximate Chi Square Value (46.67, α)	31.99	Adjusted Chi Square Value (46.67, β)	31.44
95% Gamma Approximate UCL (use when n>=50)	0.296	95% Gamma Adjusted UCL (use when n<50)	0.301

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.224	SD (KM)	0.221
Variance (KM)	0.0489	SE of Mean (KM)	0.0416
k hat (KM)	1.03	k star (KM)	0.963
nu hat (KM)	74.18	nu star (KM)	69.33
theta hat (KM)	0.218	theta star (KM)	0.233
80% gamma percentile (KM)	0.362	90% gamma percentile (KM)	0.522
95% gamma percentile (KM)	0.682	99% gamma percentile (KM)	1.054

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (69.33, α)	51.17	Adjusted Chi Square Value (69.33, β)	50.46
95% Gamma Approximate KM-UCL (use when n>=50)	0.304	95% Gamma Adjusted KM-UCL (use when n<50)	0.308

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.98	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.897	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0803	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.202	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.227	Mean in Log Scale	-1.776
SD in Original Scale	0.196	SD in Log Scale	0.763
95% t UCL (assumes normality of ROS data)	0.283	95% Percentile Bootstrap UCL	0.282
95% BCA Bootstrap UCL	0.296	95% Bootstrap t UCL	0.3
95% H-UCL (Log ROS)	0.298		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.039	KM Geo Mean	0.13
KM SD (logged)	1.107	95% Critical H Value (KM-Log)	2.506
KM Standard Error of Mean (logged)	0.208	95% H-UCL (KM -Log)	0.384
KM SD (logged)	1.107	95% Critical H Value (KM-Log)	2.506
KM Standard Error of Mean (logged)	0.208		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.288	Mean in Log Scale	-1.858
SD in Original Scale	0.258	SD in Log Scale	1.303
95% t UCL (Assumes normality)	0.361	95% H-Stat UCL	0.668

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

ProUCL Output
Eagle Point Lake
Surface Sediment

Suggested UCL to Use

95% KM (t) UCL 0.295

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_PFHxS|ug/kg

General Statistics

Total Number of Observations	36	Number of Distinct Observations	35
Number of Detects	25	Number of Non-Detects	11
Number of Distinct Detects	25	Number of Distinct Non-Detects	10
Minimum Detect	0.049	Minimum Non-Detect	0.0716
Maximum Detect	2.56	Maximum Non-Detect	2.7
Variance Detects	0.499	Percent Non-Detects	30.56%
Mean Detects	0.874	SD Detects	0.706
Median Detects	0.921	CV Detects	0.808
Skewness Detects	0.567	Kurtosis Detects	-0.333
Mean of Logged Detects	-0.688	SD of Logged Detects	1.288

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.922	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.918	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.135	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.173	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.699	KM Standard Error of Mean	0.121
KM SD	0.675	95% KM (BCA) UCL	0.909
95% KM (t) UCL	0.902	95% KM (Percentile Bootstrap) UCL	0.898
95% KM (z) UCL	0.897	95% KM Bootstrap t UCL	0.93
90% KM Chebyshev UCL	1.06	95% KM Chebyshev UCL	1.224
97.5% KM Chebyshev UCL	1.452	99% KM Chebyshev UCL	1.898

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.87	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.772	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.169	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.179	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.038	k star (bias corrected MLE)	0.94
Theta hat (MLE)	0.843	Theta star (bias corrected MLE)	0.93
nu hat (MLE)	51.88	nu star (bias corrected)	46.99
Mean (detects)	0.874		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.049	Mean	0.695
Maximum	2.56	Median	0.503
SD	0.651	CV	0.937
k hat (MLE)	1.051	k star (bias corrected MLE)	0.982
Theta hat (MLE)	0.662	Theta star (bias corrected MLE)	0.708
nu hat (MLE)	75.68	nu star (bias corrected)	70.71
Adjusted Level of Significance (β)	0.0428		
Approximate Chi Square Value (70.71, α)	52.35	Adjusted Chi Square Value (70.71, β)	51.63
95% Gamma Approximate UCL (use when n>=50)	0.939	95% Gamma Adjusted UCL (use when n<50)	0.952

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.699	SD (KM)	0.675
Variance (KM)	0.456	SE of Mean (KM)	0.121
k hat (KM)	1.071	k star (KM)	1
nu hat (KM)	77.12	nu star (KM)	72.03
theta hat (KM)	0.652	theta star (KM)	0.698
80% gamma percentile (KM)	1.124	90% gamma percentile (KM)	1.608
95% gamma percentile (KM)	2.093	99% gamma percentile (KM)	3.216

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (72.03, α)	53.49	Adjusted Chi Square Value (72.03, β)	52.76
95% Gamma Approximate KM-UCL (use when n>=50)	0.941	95% Gamma Adjusted KM-UCL (use when n<50)	0.954

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.866	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.918	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.201	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.173	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.663	Mean in Log Scale	-1.049
SD in Original Scale	0.67	SD in Log Scale	1.248
95% t UCL (assumes normality of ROS data)	0.852	95% Percentile Bootstrap UCL	0.839
95% BCA Bootstrap UCL	0.857	95% Bootstrap t UCL	0.887
95% H-UCL (Log ROS)	1.344		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.097	KM Geo Mean	0.334
KM SD (logged)	1.388	95% Critical H Value (KM-Log)	2.859
KM Standard Error of Mean (logged)	0.258	95% H-UCL (KM -Log)	1.712
KM SD (logged)	1.388	95% Critical H Value (KM-Log)	2.859
KM Standard Error of Mean (logged)	0.258		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.752	Mean in Log Scale	-0.917
SD in Original Scale	0.653	SD in Log Scale	1.375
95% t UCL (Assumes normality)	0.935	95% H-Stat UCL	1.993

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.902

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_PFOS|ug/kg

General Statistics

Total Number of Observations	36	Number of Distinct Observations	36
		Number of Missing Observations	0
Minimum	2.4	Mean	44.72
Maximum	145	Median	36.85
SD	40.93	Std. Error of Mean	6.821
Coefficient of Variation	0.915	Skewness	0.7

Normal GOF Test

Shapiro Wilk Test Statistic	0.869	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.935	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.229	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.145	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	56.24	95% Adjusted-CLT UCL (Chen-1995)	56.79
		95% Modified-t UCL (Johnson-1978)	56.37

Gamma GOF Test

A-D Test Statistic	1.132	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.778	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.191	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.151	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.956	k star (bias corrected MLE)	0.895
Theta hat (MLE)	46.77	Theta star (bias corrected MLE)	49.97
nu hat (MLE)	68.83	nu star (bias corrected)	64.43
MLE Mean (bias corrected)	44.72	MLE Sd (bias corrected)	47.27
		Approximate Chi Square Value (0.05)	46.96
Adjusted Level of Significance	0.0428	Adjusted Chi Square Value	46.28

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	61.35	95% Adjusted Gamma UCL (use when n<50)	62.25

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.905	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.935	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.153	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.145	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.875	Mean of logged Data	3.193
Maximum of Logged Data	4.977	SD of logged Data	1.258

Assuming Lognormal Distribution

95% H-UCL	95.26	90% Chebyshev (MVUE) UCL	91.75
95% Chebyshev (MVUE) UCL	109.9	97.5% Chebyshev (MVUE) UCL	135
99% Chebyshev (MVUE) UCL	184.3		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	55.94	95% Jackknife UCL	56.24
95% Standard Bootstrap UCL	55.93	95% Bootstrap-t UCL	56.64
95% Hall's Bootstrap UCL	56.86	95% Percentile Bootstrap UCL	55.8
95% BCA Bootstrap UCL	57.06		
90% Chebyshev(Mean, Sd) UCL	65.18	95% Chebyshev(Mean, Sd) UCL	74.45
97.5% Chebyshev(Mean, Sd) UCL	87.32	99% Chebyshev(Mean, Sd) UCL	112.6

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL 74.45

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_PFOSA|ug/kg

General Statistics

Total Number of Observations	36	Number of Distinct Observations	34
Number of Detects	31	Number of Non-Detects	5
Number of Distinct Detects	30	Number of Distinct Non-Detects	5
Minimum Detect	0.042	Minimum Non-Detect	0.0395
Maximum Detect	2.38	Maximum Non-Detect	1.3
Variance Detects	0.537	Percent Non-Detects	13.89%
Mean Detects	0.787	SD Detects	0.733
Median Detects	0.493	CV Detects	0.931
Skewness Detects	0.8	Kurtosis Detects	-0.542
Mean of Logged Detects	-0.843	SD of Logged Detects	1.257

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.862	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.929	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.176	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.156	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.7	KM Standard Error of Mean	0.121
KM SD	0.71	95% KM (BCA) UCL	0.885
95% KM (t) UCL	0.904	95% KM (Percentile Bootstrap) UCL	0.903
95% KM (z) UCL	0.899	95% KM Bootstrap t UCL	0.936
90% KM Chebyshev UCL	1.063	95% KM Chebyshev UCL	1.227
97.5% KM Chebyshev UCL	1.456	99% KM Chebyshev UCL	1.904

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.801	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.777	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.154	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.163	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.96	k star (bias corrected MLE)	0.889
Theta hat (MLE)	0.82	Theta star (bias corrected MLE)	0.886
nu hat (MLE)	59.53	nu star (bias corrected)	55.11
Mean (detects)	0.787		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.695
Maximum	2.38	Median	0.358
SD	0.719	CV	1.035
k hat (MLE)	0.749	k star (bias corrected MLE)	0.705
Theta hat (MLE)	0.928	Theta star (bias corrected MLE)	0.986
nu hat (MLE)	53.91	nu star (bias corrected)	50.75
Adjusted Level of Significance (β)	0.0428		
Approximate Chi Square Value (50.75, α)	35.39	Adjusted Chi Square Value (50.75, β)	34.81
95% Gamma Approximate UCL (use when n>=50)	0.997	95% Gamma Adjusted UCL (use when n<50)	1.013

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.7	SD (KM)	0.71
Variance (KM)	0.504	SE of Mean (KM)	0.121
k hat (KM)	0.972	k star (KM)	0.91
nu hat (KM)	69.99	nu star (KM)	65.49
theta hat (KM)	0.72	theta star (KM)	0.769
80% gamma percentile (KM)	1.134	90% gamma percentile (KM)	1.649
95% gamma percentile (KM)	2.168	99% gamma percentile (KM)	3.381

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (65.49, α)	47.87	Adjusted Chi Square Value (65.49, β)	47.18
95% Gamma Approximate KM-UCL (use when n>=50)	0.957	95% Gamma Adjusted KM-UCL (use when n<50)	0.971

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.914	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.929	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.17	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.156	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.693	Mean in Log Scale	-1.091
SD in Original Scale	0.72	SD in Log Scale	1.366
95% t UCL (assumes normality of ROS data)	0.895	95% Percentile Bootstrap UCL	0.89
95% BCA Bootstrap UCL	0.911	95% Bootstrap t UCL	0.912
95% H-UCL (Log ROS)	1.641		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.08	KM Geo Mean	0.34
KM SD (logged)	1.343	95% Critical H Value (KM-Log)	2.8
KM Standard Error of Mean (logged)	0.232	95% H-UCL (KM -Log)	1.579
KM SD (logged)	1.343	95% Critical H Value (KM-Log)	2.8
KM Standard Error of Mean (logged)	0.232		

ProUCL Output
Eagle Point Lake
Surface Sediment

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.713	Mean in Log Scale	-1.047
SD in Original Scale	0.712	SD in Log Scale	1.385
95% t UCL (Assumes normality)	0.913	95% H-Stat UCL	1.786

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

ı Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1) 0.971

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	36	Number of Distinct Observations	35
Number of Detects	29	Number of Non-Detects	7
Number of Distinct Detects	28	Number of Distinct Non-Detects	7
Minimum Detect	0.039	Minimum Non-Detect	0.0368
Maximum Detect	3.3	Maximum Non-Detect	1.6
Variance Detects	0.954	Percent Non-Detects	19.44%
Mean Detects	1.096	SD Detects	0.977
Median Detects	0.65	CV Detects	0.892
Skewness Detects	0.78	Kurtosis Detects	-0.6
Mean of Logged Detects	-0.475	SD of Logged Detects	1.26

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.882	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.926	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.193	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.161	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.919	KM Standard Error of Mean	0.161
KM SD	0.943	95% KM (BCA) UCL	1.199
95% KM (t) UCL	1.19	95% KM (Percentile Bootstrap) UCL	1.196
95% KM (z) UCL	1.183	95% KM Bootstrap t UCL	1.231
90% KM Chebyshev UCL	1.401	95% KM Chebyshev UCL	1.62
97.5% KM Chebyshev UCL	1.924	99% KM Chebyshev UCL	2.52

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.377	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.774	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0956	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.167	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.017	k star (bias corrected MLE)	0.935
Theta hat (MLE)	1.077	Theta star (bias corrected MLE)	1.172
nu hat (MLE)	58.98	nu star (bias corrected)	54.22
Mean (detects)	1.096		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.913
Maximum	3.3	Median	0.542
SD	0.955	CV	1.046
k hat (MLE)	0.682	k star (bias corrected MLE)	0.643
Theta hat (MLE)	1.339	Theta star (bias corrected MLE)	1.418
nu hat (MLE)	49.09	nu star (bias corrected)	46.33
Adjusted Level of Significance (β)	0.0428		
Approximate Chi Square Value (46.33, α)	31.71	Adjusted Chi Square Value (46.33, β)	31.16
95% Gamma Approximate UCL (use when n>=50)	1.333	95% Gamma Adjusted UCL (use when n<50)	1.357

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.919	SD (KM)	0.943
Variance (KM)	0.889	SE of Mean (KM)	0.161
k hat (KM)	0.95	k star (KM)	0.889
nu hat (KM)	68.37	nu star (KM)	64.01
theta hat (KM)	0.967	theta star (KM)	1.033
80% gamma percentile (KM)	1.491	90% gamma percentile (KM)	2.177
95% gamma percentile (KM)	2.869	99% gamma percentile (KM)	4.491

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (64.01, α)	46.6	Adjusted Chi Square Value (64.01, β)	45.93
95% Gamma Approximate KM-UCL (use when n>=50)	1.262	95% Gamma Adjusted KM-UCL (use when n<50)	1.28

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.929	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.926	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.124	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.161	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.909	Mean in Log Scale	-0.832
SD in Original Scale	0.956	SD in Log Scale	1.396
95% t UCL (assumes normality of ROS data)	1.178	95% Percentile Bootstrap UCL	1.182
95% BCA Bootstrap UCL	1.206	95% Bootstrap t UCL	1.232
95% H-UCL (Log ROS)	2.27		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.868	KM Geo Mean	0.42
KM SD (logged)	1.457	95% Critical H Value (KM-Log)	2.95
KM Standard Error of Mean (logged)	0.255	95% H-UCL (KM -Log)	2.51
KM SD (logged)	1.457	95% Critical H Value (KM-Log)	2.95
KM Standard Error of Mean (logged)	0.255		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.94	Mean in Log Scale	-0.82
SD in Original Scale	0.942	SD in Log Scale	1.511
95% t UCL (Assumes normality)	1.205	95% H-Stat UCL	2.982

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

ı Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1) 1.28

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	36	Number of Distinct Observations	34
Number of Detects	12	Number of Non-Detects	24
Number of Distinct Detects	12	Number of Distinct Non-Detects	22
Minimum Detect	0.088	Minimum Non-Detect	0.0423
Maximum Detect	0.251	Maximum Non-Detect	4.2
Variance Detects	0.00326	Percent Non-Detects	66.67%
Mean Detects	0.17	SD Detects	0.0571
Median Detects	0.174	CV Detects	0.337
Skewness Detects	0.0456	Kurtosis Detects	-1.232
Mean of Logged Detects	-1.832	SD of Logged Detects	0.362

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.936	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.128	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0948	KM Standard Error of Mean	0.0137
KM SD	0.0709	95% KM (BCA) UCL	0.118
95% KM (t) UCL	0.118	95% KM (Percentile Bootstrap) UCL	0.117
95% KM (z) UCL	0.117	95% KM Bootstrap t UCL	0.119
90% KM Chebyshev UCL	0.136	95% KM Chebyshev UCL	0.154
97.5% KM Chebyshev UCL	0.18	99% KM Chebyshev UCL	0.231

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.312	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.731	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.159	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.245	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	8.946	k star (bias corrected MLE)	6.765
Theta hat (MLE)	0.0189	Theta star (bias corrected MLE)	0.0251
nu hat (MLE)	214.7	nu star (bias corrected)	162.4
Mean (detects)	0.17		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.088
Maximum	0.251	Median	0.0711
SD	0.0687	CV	0.781
k hat (MLE)	1.921	k star (bias corrected MLE)	1.779
Theta hat (MLE)	0.0458	Theta star (bias corrected MLE)	0.0495
nu hat (MLE)	138.3	nu star (bias corrected)	128.1
Adjusted Level of Significance (β)	0.0428		
Approximate Chi Square Value (128.11, α)	103	Adjusted Chi Square Value (128.11, β)	101.9
95% Gamma Approximate UCL (use when n>=50)	0.109	95% Gamma Adjusted UCL (use when n<50)	0.111

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0948	SD (KM)	0.0709
Variance (KM)	0.00503	SE of Mean (KM)	0.0137
k hat (KM)	1.787	k star (KM)	1.657
nu hat (KM)	128.7	nu star (KM)	119.3
theta hat (KM)	0.053	theta star (KM)	0.0572
80% gamma percentile (KM)	0.145	90% gamma percentile (KM)	0.193
95% gamma percentile (KM)	0.239	99% gamma percentile (KM)	0.342

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (119.31, α)	95.09	Adjusted Chi Square Value (119.31, β)	94.11
95% Gamma Approximate KM-UCL (use when n>=50)	0.119	95% Gamma Adjusted KM-UCL (use when n<50)	0.12

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.929	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.166	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.101	Mean in Log Scale	-2.421
SD in Original Scale	0.0593	SD in Log Scale	0.492
95% t UCL (assumes normality of ROS data)	0.118	95% Percentile Bootstrap UCL	0.117
95% BCA Bootstrap UCL	0.121	95% Bootstrap t UCL	0.122
95% H-UCL (Log ROS)	0.118		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.608	KM Geo Mean	0.0737
KM SD (logged)	0.685	95% Critical H Value (KM-Log)	2.062
KM Standard Error of Mean (logged)	0.133	95% H-UCL (KM -Log)	0.118
KM SD (logged)	0.685	95% Critical H Value (KM-Log)	2.062
KM Standard Error of Mean (logged)	0.133		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.24	Mean in Log Scale	-2.33
SD in Original Scale	0.42	SD in Log Scale	1.29
95% t UCL (Assumes normality)	0.359	95% H-Stat UCL	0.405

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.118

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	36	Number of Distinct Observations	35
Number of Detects	9	Number of Non-Detects	27
Number of Distinct Detects	9	Number of Distinct Non-Detects	26
Minimum Detect	0.157	Minimum Non-Detect	0.133
Maximum Detect	2.8	Maximum Non-Detect	4.2
Variance Detects	0.907	Percent Non-Detects	75%
Mean Detects	0.974	SD Detects	0.952
Median Detects	0.35	CV Detects	0.978
Skewness Detects	0.999	Kurtosis Detects	-0.17
Mean of Logged Detects	-0.518	SD of Logged Detects	1.084

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.832	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.299	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data Not Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.377	KM Standard Error of Mean	0.107
KM SD	0.584	95% KM (BCA) UCL	0.566
95% KM (t) UCL	0.558	95% KM (Percentile Bootstrap) UCL	0.561
95% KM (z) UCL	0.553	95% KM Bootstrap t UCL	0.676
90% KM Chebyshev UCL	0.698	95% KM Chebyshev UCL	0.843
97.5% KM Chebyshev UCL	1.044	99% KM Chebyshev UCL	1.44

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.57	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.741	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.284	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.286	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.155	k star (bias corrected MLE)	0.844
Theta hat (MLE)	0.843	Theta star (bias corrected MLE)	1.153
nu hat (MLE)	20.8	nu star (bias corrected)	15.2
Mean (detects)	0.974		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.251
Maximum	2.8	Median	0.01
SD	0.622	CV	2.477
k hat (MLE)	0.311	k star (bias corrected MLE)	0.304
Theta hat (MLE)	0.806	Theta star (bias corrected MLE)	0.826
nu hat (MLE)	22.42	nu star (bias corrected)	21.89
Adjusted Level of Significance (β)	0.0428		
Approximate Chi Square Value (21.89, α)	12.25	Adjusted Chi Square Value (21.89, β)	11.93
95% Gamma Approximate UCL (use when n>=50)	0.448	95% Gamma Adjusted UCL (use when n<50)	0.461

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.377	SD (KM)	0.584
Variance (KM)	0.341	SE of Mean (KM)	0.107
k hat (KM)	0.417	k star (KM)	0.401
nu hat (KM)	30.05	nu star (KM)	28.88
theta hat (KM)	0.904	theta star (KM)	0.941
80% gamma percentile (KM)	0.609	90% gamma percentile (KM)	1.066
95% gamma percentile (KM)	1.567	99% gamma percentile (KM)	2.826

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (28.88, α)	17.61	Adjusted Chi Square Value (28.88, β)	17.21
95% Gamma Approximate KM-UCL (use when n>=50)	0.619	95% Gamma Adjusted KM-UCL (use when n<50)	0.633

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.894	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.244	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.298	Mean in Log Scale	-2.135
SD in Original Scale	0.603	SD in Log Scale	1.125
95% t UCL (assumes normality of ROS data)	0.468	95% Percentile Bootstrap UCL	0.468
95% BCA Bootstrap UCL	0.538	95% Bootstrap t UCL	0.645
95% H-UCL (Log ROS)	0.36		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.503	KM Geo Mean	0.222
KM SD (logged)	0.824	95% Critical H Value (KM-Log)	2.195
KM Standard Error of Mean (logged)	0.163	95% H-UCL (KM -Log)	0.424
KM SD (logged)	0.824	95% Critical H Value (KM-Log)	2.195
KM Standard Error of Mean (logged)	0.163		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.506	Mean in Log Scale	-1.278
SD in Original Scale	0.661	SD in Log Scale	1.034
95% t UCL (Assumes normality)	0.692	95% H-Stat UCL	0.726

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.558

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Lake Elmo
Surface Sediment

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.13/5/2021 1:58:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
Number of Detects	5	Number of Non-Detects	3
Number of Distinct Detects	5	Number of Distinct Non-Detects	3
Minimum Detect	0.095	Minimum Non-Detect	0.0752
Maximum Detect	1.35	Maximum Non-Detect	0.0792
Variance Detects	0.289	Percent Non-Detects	37.5%
Mean Detects	0.41	SD Detects	0.538
Median Detects	0.117	CV Detects	1.313
Skewness Detects	2.004	Kurtosis Detects	4.032
Mean of Logged Detects	-1.471	SD of Logged Detects	1.129

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.694	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.327	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.284	KM Standard Error of Mean	0.163
KM SD	0.413	95% KM (BCA) UCL	0.574
95% KM (t) UCL	0.594	95% KM (Percentile Bootstrap) UCL	0.563
95% KM (z) UCL	0.553	95% KM Bootstrap t UCL	4.589
90% KM Chebyshev UCL	0.775	95% KM Chebyshev UCL	0.997
97.5% KM Chebyshev UCL	1.305	99% KM Chebyshev UCL	1.91

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.641	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.691	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.351	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.364	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.997	k star (bias corrected MLE)	0.532
Theta hat (MLE)	0.411	Theta star (bias corrected MLE)	0.77
nu hat (MLE)	9.967	nu star (bias corrected)	5.32
Mean (detects)	0.41		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.26
Maximum	1.35	Median	0.105
SD	0.456	CV	1.756
k hat (MLE)	0.49	k star (bias corrected MLE)	0.39
Theta hat (MLE)	0.53	Theta star (bias corrected MLE)	0.667
nu hat (MLE)	7.847	nu star (bias corrected)	6.238
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (6.24, α)	1.763	Adjusted Chi Square Value (6.24, β)	1.228
95% Gamma Approximate UCL (use when n>=50)	0.92	95% Gamma Adjusted UCL (use when n<50)	1.32

ProUCL Output
Lake Elmo
Surface Sediment

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.284	SD (KM)	0.413
Variance (KM)	0.171	SE of Mean (KM)	0.163
k hat (KM)	0.473	k star (KM)	0.379
nu hat (KM)	7.566	nu star (KM)	6.062
theta hat (KM)	0.601	theta star (KM)	0.75
80% gamma percentile (KM)	0.456	90% gamma percentile (KM)	0.811
95% gamma percentile (KM)	1.204	99% gamma percentile (KM)	2.197

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.06, α)	1.672	Adjusted Chi Square Value (6.06, β)	1.156
95% Gamma Approximate KM-UCL (use when n>=50)	1.031	95% Gamma Adjusted KM-UCL (use when n<50)	1.491

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.824	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.325	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.26	Mean in Log Scale	-2.59
SD in Original Scale	0.456	SD in Log Scale	1.763
95% t UCL (assumes normality of ROS data)	0.566	95% Percentile Bootstrap UCL	0.569
95% BCA Bootstrap UCL	0.739	95% Bootstrap t UCL	2.011
95% H-UCL (Log ROS)	13.61		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.89	KM Geo Mean	0.151
KM SD (logged)	0.964	95% Critical H Value (KM-Log)	3.338
KM Standard Error of Mean (logged)	0.381	95% H-UCL (KM -Log)	0.811
KM SD (logged)	0.964	95% Critical H Value (KM-Log)	3.338
KM Standard Error of Mean (logged)	0.381		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.271	Mean in Log Scale	-2.139
SD in Original Scale	0.45	SD in Log Scale	1.256
95% t UCL (Assumes normality)	0.572	95% H-Stat UCL	1.801

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.594

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.619	Mean	2.045
Maximum	4.97	Median	1.11
SD	1.74	Std. Error of Mean	0.615
Coefficient of Variation	0.851	Skewness	1.111

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

ProUCL Output
Lake Elmo
Surface Sediment

Normal GOF Test

Shapiro Wilk Test Statistic	0.778	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.327	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	3.21	95% Adjusted-CLT UCL (Chen-1995)	3.315
		95% Modified-t UCL (Johnson-1978)	3.251

Gamma GOF Test

A-D Test Statistic	0.669	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.31	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.298	Data Not Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.832	k star (bias corrected MLE)	1.228
Theta hat (MLE)	1.116	Theta star (bias corrected MLE)	1.665
nu hat (MLE)	29.31	nu star (bias corrected)	19.65
MLE Mean (bias corrected)	2.045	MLE Sd (bias corrected)	1.845
		Approximate Chi Square Value (0.05)	10.59
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	8.96

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	3.793	95% Adjusted Gamma UCL (use when n<50)	4.484

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.871	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.273	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.48	Mean of logged Data	0.418
Maximum of Logged Data	1.603	SD of logged Data	0.804

Assuming Lognormal Distribution

95% H-UCL	5.156	90% Chebyshev (MVUE) UCL	3.734
95% Chebyshev (MVUE) UCL	4.52	97.5% Chebyshev (MVUE) UCL	5.61
99% Chebyshev (MVUE) UCL	7.753		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	3.057	95% Jackknife UCL	3.21
95% Standard Bootstrap UCL	3.001	95% Bootstrap-t UCL	4.891
95% Hall's Bootstrap UCL	3.629	95% Percentile Bootstrap UCL	3.044
95% BCA Bootstrap UCL	3.172		
90% Chebyshev(Mean, Sd) UCL	3.89	95% Chebyshev(Mean, Sd) UCL	4.726
97.5% Chebyshev(Mean, Sd) UCL	5.887	99% Chebyshev(Mean, Sd) UCL	8.166

Suggested UCL to Use

95% Adjusted Gamma UCL 4.484

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Raleigh Creek - Upper
Surface Sediment

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.13/5/2021 2:13:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

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General Statistics

Total Number of Observations	39	Number of Distinct Observations	37
Number of Detects	31	Number of Non-Detects	8
Number of Distinct Detects	30	Number of Distinct Non-Detects	7
Minimum Detect	0.311	Minimum Non-Detect	0.289
Maximum Detect	11	Maximum Non-Detect	1.5
Variance Detects	6.638	Percent Non-Detects	20.51%
Mean Detects	1.544	SD Detects	2.576
Median Detects	0.616	CV Detects	1.669
Skewness Detects	3.279	Kurtosis Detects	10.31
Mean of Logged Detects	-0.148	SD of Logged Detects	0.903

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.471	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.929	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.337	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.156	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.312	KM Standard Error of Mean	0.376
KM SD	2.307	95% KM (BCA) UCL	1.941
95% KM (t) UCL	1.945	95% KM (Percentile Bootstrap) UCL	1.945
95% KM (z) UCL	1.93	95% KM Bootstrap t UCL	3.445
90% KM Chebyshev UCL	2.439	95% KM Chebyshev UCL	2.949
97.5% KM Chebyshev UCL	3.658	99% KM Chebyshev UCL	5.05

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	3.578	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.776	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.291	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.162	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.992	k star (bias corrected MLE)	0.918
Theta hat (MLE)	1.556	Theta star (bias corrected MLE)	1.682
nu hat (MLE)	61.52	nu star (bias corrected)	56.9
Mean (detects)	1.544		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.249
Maximum	11	Median	0.566
SD	2.365	CV	1.893
k hat (MLE)	0.573	k star (bias corrected MLE)	0.546
Theta hat (MLE)	2.179	Theta star (bias corrected MLE)	2.286
nu hat (MLE)	44.73	nu star (bias corrected)	42.62
Adjusted Level of Significance (β)	0.0437		
Approximate Chi Square Value (42.62, α)	28.66	Adjusted Chi Square Value (42.62, β)	28.2
95% Gamma Approximate UCL (use when n>=50)	1.858	95% Gamma Adjusted UCL (use when n<50)	1.888

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.312	SD (KM)	2.307
Variance (KM)	5.321	SE of Mean (KM)	0.376
k hat (KM)	0.324	k star (KM)	0.316
nu hat (KM)	25.23	nu star (KM)	24.63
theta hat (KM)	4.056	theta star (KM)	4.156
80% gamma percentile (KM)	2.036	90% gamma percentile (KM)	3.845
95% gamma percentile (KM)	5.904	99% gamma percentile (KM)	11.22

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (24.63, α)	14.33	Adjusted Chi Square Value (24.63, β)	14.02
95% Gamma Approximate KM-UCL (use when n>=50)	2.255	95% Gamma Adjusted KM-UCL (use when n<50)	2.305

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.818	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.929	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.212	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.156	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.295	Mean in Log Scale	-0.391
SD in Original Scale	2.345	SD in Log Scale	0.989
95% t UCL (assumes normality of ROS data)	1.928	95% Percentile Bootstrap UCL	1.972
95% BCA Bootstrap UCL	2.176	95% Bootstrap t UCL	3.258
95% H-UCL (Log ROS)	1.618		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.314	KM Geo Mean	0.73
KM SD (logged)	0.874	95% Critical H Value (KM-Log)	2.262
KM Standard Error of Mean (logged)	0.144	95% H-UCL (KM -Log)	1.474
KM SD (logged)	0.874	95% Critical H Value (KM-Log)	2.262
KM Standard Error of Mean (logged)	0.144		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.304	Mean in Log Scale	-0.365
SD in Original Scale	2.341	SD in Log Scale	0.965
95% t UCL (Assumes normality)	1.936	95% H-Stat UCL	1.601

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 2.949

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	39	Number of Distinct Observations	36
Number of Detects	14	Number of Non-Detects	25
Number of Distinct Detects	14	Number of Distinct Non-Detects	23
Minimum Detect	0.081	Minimum Non-Detect	0.071
Maximum Detect	0.89	Maximum Non-Detect	1.6
Variance Detects	0.0403	Percent Non-Detects	64.1%
Mean Detects	0.341	SD Detects	0.201
Median Detects	0.306	CV Detects	0.589
Skewness Detects	1.577	Kurtosis Detects	3.65
Mean of Logged Detects	-1.23	SD of Logged Detects	0.589

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.88	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.874	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.176	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.226	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.184	KM Standard Error of Mean	0.0323
KM SD	0.181	95% KM (BCA) UCL	0.243
95% KM (t) UCL	0.239	95% KM (Percentile Bootstrap) UCL	0.24
95% KM (z) UCL	0.238	95% KM Bootstrap t UCL	0.258
90% KM Chebyshev UCL	0.281	95% KM Chebyshev UCL	0.325
97.5% KM Chebyshev UCL	0.386	99% KM Chebyshev UCL	0.505

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.181	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.741	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.103	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.23	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.431	k star (bias corrected MLE)	2.743
Theta hat (MLE)	0.0993	Theta star (bias corrected MLE)	0.124
nu hat (MLE)	96.07	nu star (bias corrected)	76.82
Mean (detects)	0.341		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.135
Maximum	0.89	Median	0.01
SD	0.197	CV	1.454
k hat (MLE)	0.522	k star (bias corrected MLE)	0.499
Theta hat (MLE)	0.259	Theta star (bias corrected MLE)	0.271
nu hat (MLE)	40.74	nu star (bias corrected)	38.94
Adjusted Level of Significance (β)	0.0437		
Approximate Chi Square Value (38.94, α)	25.65	Adjusted Chi Square Value (38.94, β)	25.22
95% Gamma Approximate UCL (use when n>=50)	0.205	95% Gamma Adjusted UCL (use when n<50)	0.209

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.184	SD (KM)	0.181
Variance (KM)	0.0326	SE of Mean (KM)	0.0323
k hat (KM)	1.044	k star (KM)	0.98
nu hat (KM)	81.4	nu star (KM)	76.47
theta hat (KM)	0.177	theta star (KM)	0.188
80% gamma percentile (KM)	0.297	90% gamma percentile (KM)	0.427
95% gamma percentile (KM)	0.557	99% gamma percentile (KM)	0.858

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (76.47, α)	57.33	Adjusted Chi Square Value (76.47, β)	56.67
95% Gamma Approximate KM-UCL (use when n>=50)	0.246	95% Gamma Adjusted KM-UCL (use when n<50)	0.249

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.98	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.135	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.168	Mean in Log Scale	-2.171
SD in Original Scale	0.177	SD in Log Scale	0.829
95% t UCL (assumes normality of ROS data)	0.216	95% Percentile Bootstrap UCL	0.216
95% BCA Bootstrap UCL	0.223	95% Bootstrap t UCL	0.233
95% H-UCL (Log ROS)	0.217		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.037	KM Geo Mean	0.13
KM SD (logged)	0.775	95% Critical H Value (KM-Log)	2.161
KM Standard Error of Mean (logged)	0.14	95% H-UCL (KM -Log)	0.231
KM SD (logged)	0.775	95% Critical H Value (KM-Log)	2.161
KM Standard Error of Mean (logged)	0.14		

ProUCL Output
Raleigh Creek - Upper
Surface Sediment

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.243	Mean in Log Scale	-1.898
SD in Original Scale	0.244	SD in Log Scale	1.001
95% t UCL (Assumes normality)	0.309	95% H-Stat UCL	0.365

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.239

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	39	Number of Distinct Observations	37
Number of Detects	26	Number of Non-Detects	13
Number of Distinct Detects	26	Number of Distinct Non-Detects	11
Minimum Detect	0.083	Minimum Non-Detect	0.0662
Maximum Detect	4.1	Maximum Non-Detect	1.6
Variance Detects	0.671	Percent Non-Detects	33.33%
Mean Detects	0.487	SD Detects	0.819
Median Detects	0.187	CV Detects	1.684
Skewness Detects	3.795	Kurtosis Detects	16.08
Mean of Logged Detects	-1.362	SD of Logged Detects	1.019

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.51	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.92	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.311	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.17	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.372	KM Standard Error of Mean	0.113
KM SD	0.683	95% KM (BCA) UCL	0.608
95% KM (t) UCL	0.562	95% KM (Percentile Bootstrap) UCL	0.566
95% KM (z) UCL	0.558	95% KM Bootstrap t UCL	0.854
90% KM Chebyshev UCL	0.71	95% KM Chebyshev UCL	0.863
97.5% KM Chebyshev UCL	1.076	99% KM Chebyshev UCL	1.493

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.727	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.777	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.195	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.177	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.91	k star (bias corrected MLE)	0.831
Theta hat (MLE)	0.535	Theta star (bias corrected MLE)	0.586
nu hat (MLE)	47.32	nu star (bias corrected)	43.19
Mean (detects)	0.487		

ProUCL Output
Raleigh Creek - Upper
Surface Sediment

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.344
Maximum	4.1	Median	0.115
SD	0.698	CV	2.032
k hat (MLE)	0.545	k star (bias corrected MLE)	0.52
Theta hat (MLE)	0.631	Theta star (bias corrected MLE)	0.661
nu hat (MLE)	42.49	nu star (bias corrected)	40.56
Adjusted Level of Significance (β)	0.0437		
Approximate Chi Square Value (40.56, α)	26.96	Adjusted Chi Square Value (40.56, β)	26.53
95% Gamma Approximate UCL (use when n>=50)	0.517	95% Gamma Adjusted UCL (use when n<50)	0.525

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.372	SD (KM)	0.683
Variance (KM)	0.467	SE of Mean (KM)	0.113
k hat (KM)	0.297	k star (KM)	0.291
nu hat (KM)	23.14	nu star (KM)	22.7
theta hat (KM)	1.254	theta star (KM)	1.279
80% gamma percentile (KM)	0.566	90% gamma percentile (KM)	1.102
95% gamma percentile (KM)	1.719	99% gamma percentile (KM)	3.331

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (22.70, α)	12.86	Adjusted Chi Square Value (22.70, β)	12.57
95% Gamma Approximate KM-UCL (use when n>=50)	0.657	95% Gamma Adjusted KM-UCL (use when n<50)	0.672

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.894	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.92	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.171	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.17	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.353	Mean in Log Scale	-1.847
SD in Original Scale	0.693	SD in Log Scale	1.186
95% t UCL (assumes normality of ROS data)	0.54	95% Percentile Bootstrap UCL	0.561
95% BCA Bootstrap UCL	0.667	95% Bootstrap t UCL	0.851
95% H-UCL (Log ROS)	0.528		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.676	KM Geo Mean	0.187
KM SD (logged)	1.016	95% Critical H Value (KM-Log)	2.42
KM Standard Error of Mean (logged)	0.175	95% H-UCL (KM -Log)	0.467
KM SD (logged)	1.016	95% Critical H Value (KM-Log)	2.42
KM Standard Error of Mean (logged)	0.175		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.432	Mean in Log Scale	-1.565
SD in Original Scale	0.695	SD in Log Scale	1.211
95% t UCL (Assumes normality)	0.62	95% H-Stat UCL	0.733

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 0.863

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	39	Number of Distinct Observations	35
Number of Detects	20	Number of Non-Detects	19
Number of Distinct Detects	20	Number of Distinct Non-Detects	15
Minimum Detect	0.088	Minimum Non-Detect	0.0662
Maximum Detect	2.95	Maximum Non-Detect	1.6
Variance Detects	0.433	Percent Non-Detects	48.72%
Mean Detects	0.47	SD Detects	0.658
Median Detects	0.212	CV Detects	1.401
Skewness Detects	3.125	Kurtosis Detects	11.17
Mean of Logged Detects	-1.312	SD of Logged Detects	1.001

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.598	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.905	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.281	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.192	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.305	KM Standard Error of Mean	0.0855
KM SD	0.505	95% KM (BCA) UCL	0.466
95% KM (t) UCL	0.449	95% KM (Percentile Bootstrap) UCL	0.45
95% KM (z) UCL	0.446	95% KM Bootstrap t UCL	0.573
90% KM Chebyshev UCL	0.562	95% KM Chebyshev UCL	0.678
97.5% KM Chebyshev UCL	0.839	99% KM Chebyshev UCL	1.156

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.05	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.767	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.202	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.199	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.033	k star (bias corrected MLE)	0.912
Theta hat (MLE)	0.455	Theta star (bias corrected MLE)	0.516
nu hat (MLE)	41.33	nu star (bias corrected)	36.46
Mean (detects)	0.47		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.261
Maximum	2.95	Median	0.097
SD	0.518	CV	1.987
k hat (MLE)	0.46	k star (bias corrected MLE)	0.442
Theta hat (MLE)	0.567	Theta star (bias corrected MLE)	0.59
nu hat (MLE)	35.87	nu star (bias corrected)	34.44
Adjusted Level of Significance (β)	0.0437		
Approximate Chi Square Value (34.44, α)	22.02	Adjusted Chi Square Value (34.44, β)	21.62
95% Gamma Approximate UCL (use when n>=50)	0.408	95% Gamma Adjusted UCL (use when n<50)	0.415

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.305	SD (KM)	0.505
Variance (KM)	0.255	SE of Mean (KM)	0.0855
k hat (KM)	0.364	k star (KM)	0.353
nu hat (KM)	28.42	nu star (KM)	27.56
theta hat (KM)	0.837	theta star (KM)	0.863
80% gamma percentile (KM)	0.484	90% gamma percentile (KM)	0.88
95% gamma percentile (KM)	1.322	99% gamma percentile (KM)	2.451

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (27.56, α)	16.59	Adjusted Chi Square Value (27.56, β)	16.25
95% Gamma Approximate KM-UCL (use when n>=50)	0.507	95% Gamma Adjusted KM-UCL (use when n<50)	0.517

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.91	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.905	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.175	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.192	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.274	Mean in Log Scale	-2.138
SD in Original Scale	0.51	SD in Log Scale	1.23
95% t UCL (assumes normality of ROS data)	0.412	95% Percentile Bootstrap UCL	0.422
95% BCA Bootstrap UCL	0.479	95% Bootstrap t UCL	0.562
95% H-UCL (Log ROS)	0.429		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.838	KM Geo Mean	0.159
KM SD (logged)	1.001	95% Critical H Value (KM-Log)	2.403
KM Standard Error of Mean (logged)	0.179	95% H-UCL (KM -Log)	0.388
KM SD (logged)	1.001	95% Critical H Value (KM-Log)	2.403
KM Standard Error of Mean (logged)	0.179		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.381	Mean in Log Scale	-1.699
SD in Original Scale	0.521	SD in Log Scale	1.277
95% t UCL (Assumes normality)	0.521	95% H-Stat UCL	0.729

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL 0.388

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_PFHpS|ug/kg

General Statistics

Total Number of Observations	39	Number of Distinct Observations	35
Number of Detects	23	Number of Non-Detects	16
Number of Distinct Detects	22	Number of Distinct Non-Detects	14
Minimum Detect	0.065	Minimum Non-Detect	0.0662
Maximum Detect	21.5	Maximum Non-Detect	1.2
Variance Detects	19.66	Percent Non-Detects	41.03%
Mean Detects	1.32	SD Detects	4.434
Median Detects	0.205	CV Detects	3.359
Skewness Detects	4.68	Kurtosis Detects	22.18
Mean of Logged Detects	-1.229	SD of Logged Detects	1.322

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.288	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.914	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.437	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.18	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.817	KM Standard Error of Mean	0.554
KM SD	3.385	95% KM (BCA) UCL	1.902
95% KM (t) UCL	1.752	95% KM (Percentile Bootstrap) UCL	1.89
95% KM (z) UCL	1.729	95% KM Bootstrap t UCL	10.13
90% KM Chebyshev UCL	2.48	95% KM Chebyshev UCL	3.233
97.5% KM Chebyshev UCL	4.278	99% KM Chebyshev UCL	6.332

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	3.431	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.82	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.355	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.194	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.432	k star (bias corrected MLE)	0.404
Theta hat (MLE)	3.059	Theta star (bias corrected MLE)	3.265
nu hat (MLE)	19.85	nu star (bias corrected)	18.59
Mean (detects)	1.32		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.783
Maximum	21.5	Median	0.082
SD	3.436	CV	4.391
k hat (MLE)	0.292	k star (bias corrected MLE)	0.287
Theta hat (MLE)	2.677	Theta star (bias corrected MLE)	2.727
nu hat (MLE)	22.8	nu star (bias corrected)	22.38
Adjusted Level of Significance (β)	0.0437		
Approximate Chi Square Value (22.38, α)	12.62	Adjusted Chi Square Value (22.38, β)	12.33
95% Gamma Approximate UCL (use when n>=50)	1.387	95% Gamma Adjusted UCL (use when n<50)	1.42

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.817	SD (KM)	3.385
Variance (KM)	11.46	SE of Mean (KM)	0.554
k hat (KM)	0.0583	k star (KM)	0.0709
nu hat (KM)	4.547	nu star (KM)	5.531
theta hat (KM)	14.02	theta star (KM)	11.53
80% gamma percentile (KM)	0.301	90% gamma percentile (KM)	1.781
95% gamma percentile (KM)	4.708	99% gamma percentile (KM)	15.31

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.53, α)	1.405	Adjusted Chi Square Value (5.53, β)	1.325
95% Gamma Approximate KM-UCL (use when n>=50)	3.217	95% Gamma Adjusted KM-UCL (use when n<50)	3.41

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.853	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.914	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.18	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.18	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.798	Mean in Log Scale	-2.086
SD in Original Scale	3.433	SD in Log Scale	1.508
95% t UCL (assumes normality of ROS data)	1.725	95% Percentile Bootstrap UCL	1.885
95% BCA Bootstrap UCL	2.571	95% Bootstrap t UCL	10.96
95% H-UCL (Log ROS)	0.816		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.769	KM Geo Mean	0.171
KM SD (logged)	1.225	95% Critical H Value (KM-Log)	2.675
KM Standard Error of Mean (logged)	0.205	95% H-UCL (KM -Log)	0.615
KM SD (logged)	1.225	95% Critical H Value (KM-Log)	2.675
KM Standard Error of Mean (logged)	0.205		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.845	Mean in Log Scale	-1.8
SD in Original Scale	3.426	SD in Log Scale	1.431
95% t UCL (Assumes normality)	1.769	95% H-Stat UCL	0.911

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

ProUCL Output
Raleigh Creek - Upper
Surface Sediment

Suggested UCL to Use

95% KM (Chebyshev) UCL 3.233

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_PFOA|ug/kg

General Statistics

Total Number of Observations	39	Number of Distinct Observations	39
		Number of Missing Observations	0
Minimum	0.08	Mean	4.714
Maximum	78.8	Median	1.17
SD	12.97	Std. Error of Mean	2.077
Coefficient of Variation	2.752	Skewness	5.256

Normal GOF Test

Shapiro Wilk Test Statistic	0.354	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.939	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.36	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.14	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	8.216	95% Adjusted-CLT UCL (Chen-1995)	9.998
		95% Modified-t UCL (Johnson-1978)	8.507

Gamma GOF Test

A-D Test Statistic	2.918	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.809	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.208	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.149	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.537	k star (bias corrected MLE)	0.512
Theta hat (MLE)	8.786	Theta star (bias corrected MLE)	9.2
nu hat (MLE)	41.85	nu star (bias corrected)	39.96
MLE Mean (bias corrected)	4.714	MLE Sd (bias corrected)	6.586
		Approximate Chi Square Value (0.05)	26.48
Adjusted Level of Significance	0.0437	Adjusted Chi Square Value	26.05

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	7.114	95% Adjusted Gamma UCL (use when n<50)	7.233

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.965	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.939	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.102	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.14	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.526	Mean of logged Data	0.379
Maximum of Logged Data	4.367	SD of logged Data	1.344

Assuming Lognormal Distribution

95% H-UCL	6.686	90% Chebyshev (MVUE) UCL	6.271
95% Chebyshev (MVUE) UCL	7.544	97.5% Chebyshev (MVUE) UCL	9.311
99% Chebyshev (MVUE) UCL	12.78		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

ProUCL Output
Raleigh Creek - Upper
Surface Sediment

Nonparametric Distribution Free UCLs

95% CLT UCL	8.13	95% Jackknife UCL	8.216
95% Standard Bootstrap UCL	8.216	95% Bootstrap-t UCL	19.42
95% Hall's Bootstrap UCL	19.97	95% Percentile Bootstrap UCL	8.459
95% BCA Bootstrap UCL	10.94		
90% Chebyshev(Mean, Sd) UCL	10.95	95% Chebyshev(Mean, Sd) UCL	13.77
97.5% Chebyshev(Mean, Sd) UCL	17.69	99% Chebyshev(Mean, Sd) UCL	25.38

Suggested UCL to Use

95% H-UCL 6.686

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Conc_PFNA|ug/kg

General Statistics

Total Number of Observations	39	Number of Distinct Observations	37
Number of Detects	18	Number of Non-Detects	21
Number of Distinct Detects	18	Number of Distinct Non-Detects	19
Minimum Detect	0.041	Minimum Non-Detect	0.0355
Maximum Detect	1.28	Maximum Non-Detect	1.5
Variance Detects	0.0979	Percent Non-Detects	53.85%
Mean Detects	0.292	SD Detects	0.313
Median Detects	0.163	CV Detects	1.073
Skewness Detects	2.083	Kurtosis Detects	5.098
Mean of Logged Detects	-1.688	SD of Logged Detects	0.972

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.752	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.897	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.237	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.202	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.174	KM Standard Error of Mean	0.0421
KM SD	0.245	95% KM (BCA) UCL	0.25
95% KM (t) UCL	0.245	95% KM (Percentile Bootstrap) UCL	0.244
95% KM (z) UCL	0.244	95% KM Bootstrap t UCL	0.281
90% KM Chebyshev UCL	0.301	95% KM Chebyshev UCL	0.358
97.5% KM Chebyshev UCL	0.437	99% KM Chebyshev UCL	0.593

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.553	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.762	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.162	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.208	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.238	k star (bias corrected MLE)	1.069
Theta hat (MLE)	0.235	Theta star (bias corrected MLE)	0.273
nu hat (MLE)	44.56	nu star (bias corrected)	38.47
Mean (detects)	0.292		

ProUCL Output
Raleigh Creek - Upper
Surface Sediment

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.144
Maximum	1.28	Median	0.0251
SD	0.252	CV	1.749
k hat (MLE)	0.524	k star (bias corrected MLE)	0.501
Theta hat (MLE)	0.275	Theta star (bias corrected MLE)	0.287
nu hat (MLE)	40.87	nu star (bias corrected)	39.06
Adjusted Level of Significance (β)	0.0437		
Approximate Chi Square Value (39.06, α)	25.74	Adjusted Chi Square Value (39.06, β)	25.32
95% Gamma Approximate UCL (use when n>=50)	0.218	95% Gamma Adjusted UCL (use when n<50)	0.222

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.174	SD (KM)	0.245
Variance (KM)	0.0599	SE of Mean (KM)	0.0421
k hat (KM)	0.508	k star (KM)	0.486
nu hat (KM)	39.61	nu star (KM)	37.9
theta hat (KM)	0.343	theta star (KM)	0.359
80% gamma percentile (KM)	0.286	90% gamma percentile (KM)	0.475
95% gamma percentile (KM)	0.677	99% gamma percentile (KM)	1.175

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (37.90, α)	24.8	Adjusted Chi Square Value (37.90, β)	24.38
95% Gamma Approximate KM-UCL (use when n>=50)	0.266	95% Gamma Adjusted KM-UCL (use when n<50)	0.271

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.961	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.897	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.111	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.202	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.159	Mean in Log Scale	-2.505
SD in Original Scale	0.244	SD in Log Scale	1.064
95% t UCL (assumes normality of ROS data)	0.225	95% Percentile Bootstrap UCL	0.226
95% BCA Bootstrap UCL	0.244	95% Bootstrap t UCL	0.264
95% H-UCL (Log ROS)	0.221		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.327	KM Geo Mean	0.0976
KM SD (logged)	0.967	95% Critical H Value (KM-Log)	2.363
KM Standard Error of Mean (logged)	0.18	95% H-UCL (KM -Log)	0.226
KM SD (logged)	0.967	95% Critical H Value (KM-Log)	2.363
KM Standard Error of Mean (logged)	0.18		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.224	Mean in Log Scale	-2.205
SD in Original Scale	0.28	SD in Log Scale	1.195
95% t UCL (Assumes normality)	0.299	95% H-Stat UCL	0.375

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	0.271	95% GROS Adjusted Gamma UCL	0.222

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	39	Number of Distinct Observations	36
Number of Detects	34	Number of Non-Detects	5
Number of Distinct Detects	32	Number of Distinct Non-Detects	4
Minimum Detect	0.079	Minimum Non-Detect	0.9
Maximum Detect	8.8	Maximum Non-Detect	1.5
Variance Detects	2.227	Percent Non-Detects	12.82%
Mean Detects	0.835	SD Detects	1.492
Median Detects	0.422	CV Detects	1.787
Skewness Detects	4.88	Kurtosis Detects	26.24
Mean of Logged Detects	-0.787	SD of Logged Detects	1.014

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.443	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.933	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.306	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.15	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.783	KM Standard Error of Mean	0.226
KM SD	1.384	95% KM (BCA) UCL	1.231
95% KM (t) UCL	1.163	95% KM (Percentile Bootstrap) UCL	1.17
95% KM (z) UCL	1.154	95% KM Bootstrap t UCL	1.746
90% KM Chebyshev UCL	1.46	95% KM Chebyshev UCL	1.766
97.5% KM Chebyshev UCL	2.192	99% KM Chebyshev UCL	3.028

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.255	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.778	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.129	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.156	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.957	k star (bias corrected MLE)	0.892
Theta hat (MLE)	0.873	Theta star (bias corrected MLE)	0.936
nu hat (MLE)	65.06	nu star (bias corrected)	60.65
Mean (detects)	0.835		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0175	Mean	0.764
Maximum	8.8	Median	0.376
SD	1.405	CV	1.839
k hat (MLE)	0.912	k star (bias corrected MLE)	0.859
Theta hat (MLE)	0.838	Theta star (bias corrected MLE)	0.89
nu hat (MLE)	71.11	nu star (bias corrected)	66.97
Adjusted Level of Significance (β)	0.0437		
Approximate Chi Square Value (66.97, α)	49.14	Adjusted Chi Square Value (66.97, β)	48.54
95% Gamma Approximate UCL (use when n>=50)	1.042	95% Gamma Adjusted UCL (use when n<50)	1.055

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.783	SD (KM)	1.384
Variance (KM)	1.914	SE of Mean (KM)	0.226
k hat (KM)	0.32	k star (KM)	0.313
nu hat (KM)	24.98	nu star (KM)	24.39
theta hat (KM)	2.445	theta star (KM)	2.504
80% gamma percentile (KM)	1.212	90% gamma percentile (KM)	2.297
95% gamma percentile (KM)	3.534	99% gamma percentile (KM)	6.732

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (24.39, α)	14.15	Adjusted Chi Square Value (24.39, β)	13.84
95% Gamma Approximate KM-UCL (use when n>=50)	1.35	95% Gamma Adjusted KM-UCL (use when n<50)	1.38

ProUCL Output
Raleigh Creek - Upper
Surface Sediment

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.964	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.933	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0856	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.15	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.775	Mean in Log Scale	-0.819
SD in Original Scale	1.4	SD in Log Scale	0.953
95% t UCL (assumes normality of ROS data)	1.153	95% Percentile Bootstrap UCL	1.21
95% BCA Bootstrap UCL	1.467	95% Bootstrap t UCL	1.847
95% H-UCL (Log ROS)	0.999		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.827	KM Geo Mean	0.437
KM SD (logged)	0.975	95% Critical H Value (KM-Log)	2.373
KM Standard Error of Mean (logged)	0.165	95% H-UCL (KM -Log)	1.024
KM SD (logged)	0.975	95% Critical H Value (KM-Log)	2.373
KM Standard Error of Mean (logged)	0.165		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.802	Mean in Log Scale	-0.759
SD in Original Scale	1.394	SD in Log Scale	0.95
95% t UCL (Assumes normality)	1.178	95% H-Stat UCL	1.056

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

ı Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1) 1.38

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	39	Number of Distinct Observations	37
Number of Detects	20	Number of Non-Detects	19
Number of Distinct Detects	20	Number of Distinct Non-Detects	17
Minimum Detect	0.071	Minimum Non-Detect	0.0662
Maximum Detect	0.69	Maximum Non-Detect	1.5
Variance Detects	0.0346	Percent Non-Detects	48.72%
Mean Detects	0.272	SD Detects	0.186
Median Detects	0.224	CV Detects	0.685
Skewness Detects	0.837	Kurtosis Detects	-0.268
Mean of Logged Detects	-1.54	SD of Logged Detects	0.722

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.898	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.905	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.164	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.192	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.188	KM Standard Error of Mean	0.0301
KM SD	0.171	95% KM (BCA) UCL	0.243
95% KM (t) UCL	0.239	95% KM (Percentile Bootstrap) UCL	0.236
95% KM (z) UCL	0.238	95% KM Bootstrap t UCL	0.255
90% KM Chebyshev UCL	0.279	95% KM Chebyshev UCL	0.319
97.5% KM Chebyshev UCL	0.376	99% KM Chebyshev UCL	0.488

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.416	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.751	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.153	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.196	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.27	k star (bias corrected MLE)	1.963
Theta hat (MLE)	0.12	Theta star (bias corrected MLE)	0.138
nu hat (MLE)	90.81	nu star (bias corrected)	78.52
Mean (detects)	0.272		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.156
Maximum	0.69	Median	0.0964
SD	0.182	CV	1.168
k hat (MLE)	0.664	k star (bias corrected MLE)	0.63
Theta hat (MLE)	0.234	Theta star (bias corrected MLE)	0.247
nu hat (MLE)	51.81	nu star (bias corrected)	49.16
Adjusted Level of Significance (β)	0.0437		
Approximate Chi Square Value (49.16, α)	34.07	Adjusted Chi Square Value (49.16, β)	33.57
95% Gamma Approximate UCL (use when n>=50)	0.225	95% Gamma Adjusted UCL (use when n<50)	0.228

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.188	SD (KM)	0.171
Variance (KM)	0.0293	SE of Mean (KM)	0.0301
k hat (KM)	1.207	k star (KM)	1.131
nu hat (KM)	94.15	nu star (KM)	88.24
theta hat (KM)	0.156	theta star (KM)	0.166
80% gamma percentile (KM)	0.3	90% gamma percentile (KM)	0.42
95% gamma percentile (KM)	0.54	99% gamma percentile (KM)	0.815

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (88.24, α)	67.59	Adjusted Chi Square Value (88.24, β)	66.87
95% Gamma Approximate KM-UCL (use when n>=50)	0.246	95% Gamma Adjusted KM-UCL (use when n<50)	0.248

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.947	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.905	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.129	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.192	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.169	Mean in Log Scale	-2.218
SD in Original Scale	0.171	SD in Log Scale	0.931
95% t UCL (assumes normality of ROS data)	0.215	95% Percentile Bootstrap UCL	0.216
95% BCA Bootstrap UCL	0.221	95% Bootstrap t UCL	0.224
95% H-UCL (Log ROS)	0.238		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.008	KM Geo Mean	0.134
KM SD (logged)	0.778	95% Critical H Value (KM-Log)	2.163
KM Standard Error of Mean (logged)	0.137	95% H-UCL (KM -Log)	0.239
KM SD (logged)	0.778	95% Critical H Value (KM-Log)	2.163
KM Standard Error of Mean (logged)	0.137		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.227	Mean in Log Scale	-2.032
SD in Original Scale	0.221	SD in Log Scale	1.11
95% t UCL (Assumes normality)	0.287	95% H-Stat UCL	0.383

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

ProUCL Output
Raleigh Creek - Upper
Surface Sediment

Suggested UCL to Use

95% KM (t) UCL 0.239

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	39	Number of Distinct Observations	35
Number of Detects	22	Number of Non-Detects	17
Number of Distinct Detects	22	Number of Distinct Non-Detects	14
Minimum Detect	0.056	Minimum Non-Detect	0.0723
Maximum Detect	1.4	Maximum Non-Detect	1.5
Variance Detects	0.111	Percent Non-Detects	43.59%
Mean Detects	0.399	SD Detects	0.333
Median Detects	0.311	CV Detects	0.833
Skewness Detects	1.579	Kurtosis Detects	2.753
Mean of Logged Detects	-1.234	SD of Logged Detects	0.833

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.844	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.911	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.151	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.184	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.279	KM Standard Error of Mean	0.0523
KM SD	0.302	95% KM (BCA) UCL	0.379
95% KM (t) UCL	0.367	95% KM (Percentile Bootstrap) UCL	0.372
95% KM (z) UCL	0.365	95% KM Bootstrap t UCL	0.385
90% KM Chebyshev UCL	0.436	95% KM Chebyshev UCL	0.507
97.5% KM Chebyshev UCL	0.605	99% KM Chebyshev UCL	0.799

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.321	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.758	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.113	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.188	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.732	k star (bias corrected MLE)	1.526
Theta hat (MLE)	0.231	Theta star (bias corrected MLE)	0.262
nu hat (MLE)	76.2	nu star (bias corrected)	67.14
Mean (detects)	0.399		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.253
Maximum	1.4	Median	0.139
SD	0.306	CV	1.209
k hat (MLE)	0.637	k star (bias corrected MLE)	0.605
Theta hat (MLE)	0.397	Theta star (bias corrected MLE)	0.418
nu hat (MLE)	49.72	nu star (bias corrected)	47.22
Adjusted Level of Significance (β)	0.0437		
Approximate Chi Square Value (47.22, α)	32.45	Adjusted Chi Square Value (47.22, β)	31.97
95% Gamma Approximate UCL (use when n>=50)	0.369	95% Gamma Adjusted UCL (use when n<50)	0.374

ProUCL Output
Raleigh Creek - Upper
Surface Sediment

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.279	SD (KM)	0.302
Variance (KM)	0.0911	SE of Mean (KM)	0.0523
k hat (KM)	0.854	k star (KM)	0.806
nu hat (KM)	66.62	nu star (KM)	62.83
theta hat (KM)	0.327	theta star (KM)	0.346
80% gamma percentile (KM)	0.456	90% gamma percentile (KM)	0.677
95% gamma percentile (KM)	0.902	99% gamma percentile (KM)	1.435

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (62.83, α)	45.6	Adjusted Chi Square Value (62.83, β)	45.02
95% Gamma Approximate KM-UCL (use when n>=50)	0.384	95% Gamma Adjusted KM-UCL (use when n<50)	0.389

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.978	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.911	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.1	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.184	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.267	Mean in Log Scale	-1.794
SD in Original Scale	0.294	SD in Log Scale	0.965
95% t UCL (assumes normality of ROS data)	0.346	95% Percentile Bootstrap UCL	0.343
95% BCA Bootstrap UCL	0.37	95% Bootstrap t UCL	0.371
95% H-UCL (Log ROS)	0.384		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.796	KM Geo Mean	0.166
KM SD (logged)	1.014	95% Critical H Value (KM-Log)	2.417
KM Standard Error of Mean (logged)	0.179	95% H-UCL (KM -Log)	0.413
KM SD (logged)	1.014	95% Critical H Value (KM-Log)	2.417
KM Standard Error of Mean (logged)	0.179		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.325	Mean in Log Scale	-1.703
SD in Original Scale	0.316	SD in Log Scale	1.195
95% t UCL (Assumes normality)	0.411	95% H-Stat UCL	0.62

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.367

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	39	Number of Distinct Observations	34
Number of Detects	9	Number of Non-Detects	30
Number of Distinct Detects	9	Number of Distinct Non-Detects	25
Minimum Detect	0.046	Minimum Non-Detect	0.0355
Maximum Detect	0.377	Maximum Non-Detect	1.6
Variance Detects	0.00966	Percent Non-Detects	76.92%
Mean Detects	0.146	SD Detects	0.0983
Median Detects	0.141	CV Detects	0.674
Skewness Detects	1.772	Kurtosis Detects	4.113
Mean of Logged Detects	-2.102	SD of Logged Detects	0.629

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.821	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.261	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.073	KM Standard Error of Mean	0.014
KM SD	0.0704	95% KM (BCA) UCL	0.0985
95% KM (t) UCL	0.0965	95% KM (Percentile Bootstrap) UCL	0.0962
95% KM (z) UCL	0.096	95% KM Bootstrap t UCL	0.109
90% KM Chebyshev UCL	0.115	95% KM Chebyshev UCL	0.134
97.5% KM Chebyshev UCL	0.16	99% KM Chebyshev UCL	0.212

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.327	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.727	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.181	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.281	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.981	k star (bias corrected MLE)	2.061
Theta hat (MLE)	0.0489	Theta star (bias corrected MLE)	0.0708
nu hat (MLE)	53.66	nu star (bias corrected)	37.1
Mean (detects)	0.146		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.045
Maximum	0.377	Median	0.01
SD	0.0736	CV	1.636
k hat (MLE)	0.733	k star (bias corrected MLE)	0.694
Theta hat (MLE)	0.0614	Theta star (bias corrected MLE)	0.0648
nu hat (MLE)	57.19	nu star (bias corrected)	54.12
Adjusted Level of Significance (β)	0.0437		
Approximate Chi Square Value (54.12, α)	38.22	Adjusted Chi Square Value (54.12, β)	37.69
95% Gamma Approximate UCL (use when n>=50)	0.0637	95% Gamma Adjusted UCL (use when n<50)	0.0646

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.073	SD (KM)	0.0704
Variance (KM)	0.00495	SE of Mean (KM)	0.014
k hat (KM)	1.075	k star (KM)	1.01
nu hat (KM)	83.87	nu star (KM)	78.75
theta hat (KM)	0.0679	theta star (KM)	0.0723
80% gamma percentile (KM)	0.117	90% gamma percentile (KM)	0.168
95% gamma percentile (KM)	0.218	99% gamma percentile (KM)	0.334

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (78.75, α)	59.31	Adjusted Chi Square Value (78.75, β)	58.64
95% Gamma Approximate KM-UCL (use when n>=50)	0.0969	95% Gamma Adjusted KM-UCL (use when n<50)	0.098

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.959	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.164	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0571	Mean in Log Scale	-3.236
SD in Original Scale	0.0681	SD in Log Scale	0.771
95% t UCL (assumes normality of ROS data)	0.0755	95% Percentile Bootstrap UCL	0.0764
95% BCA Bootstrap UCL	0.0828	95% Bootstrap t UCL	0.0869
95% H-UCL (Log ROS)	0.0694		

ProUCL Output
Raleigh Creek - Upper
Surface Sediment

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.877	KM Geo Mean	0.0563
KM SD (logged)	0.635	95% Critical H Value (KM-Log)	2.028
KM Standard Error of Mean (logged)	0.138	95% H-UCL (KM -Log)	0.0849
KM SD (logged)	0.635	95% Critical H Value (KM-Log)	2.028
KM Standard Error of Mean (logged)	0.138		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.2	Mean in Log Scale	-2.436
SD in Original Scale	0.26	SD in Log Scale	1.28
95% t UCL (Assumes normality)	0.27	95% H-Stat UCL	0.351

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.0965

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	39	Number of Distinct Observations	37
Number of Detects	12	Number of Non-Detects	27
Number of Distinct Detects	12	Number of Distinct Non-Detects	25
Minimum Detect	0.045	Minimum Non-Detect	0.0355
Maximum Detect	0.38	Maximum Non-Detect	1.6
Variance Detects	0.0157	Percent Non-Detects	69.23%
Mean Detects	0.198	SD Detects	0.125
Median Detects	0.193	CV Detects	0.632
Skewness Detects	0.0898	Kurtosis Detects	-1.529
Mean of Logged Detects	-1.876	SD of Logged Detects	0.819

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.906	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.154	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0935	KM Standard Error of Mean	0.0183
KM SD	0.103	95% KM (BCA) UCL	0.127
95% KM (t) UCL	0.124	95% KM (Percentile Bootstrap) UCL	0.125
95% KM (z) UCL	0.124	95% KM Bootstrap t UCL	0.132
90% KM Chebyshev UCL	0.148	95% KM Chebyshev UCL	0.173
97.5% KM Chebyshev UCL	0.208	99% KM Chebyshev UCL	0.275

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.57	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.741	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.174	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.248	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.097	k star (bias corrected MLE)	1.628
Theta hat (MLE)	0.0945	Theta star (bias corrected MLE)	0.122
nu hat (MLE)	50.33	nu star (bias corrected)	39.08
Mean (detects)	0.198		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0697
Maximum	0.38	Median	0.01
SD	0.11	CV	1.582
k hat (MLE)	0.594	k star (bias corrected MLE)	0.566
Theta hat (MLE)	0.117	Theta star (bias corrected MLE)	0.123
nu hat (MLE)	46.36	nu star (bias corrected)	44.12
Adjusted Level of Significance (β)	0.0437		
Approximate Chi Square Value (44.12, α)	29.89	Adjusted Chi Square Value (44.12, β)	29.43
95% Gamma Approximate UCL (use when n>=50)	0.103	95% Gamma Adjusted UCL (use when n<50)	0.105

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0935	SD (KM)	0.103
Variance (KM)	0.0107	SE of Mean (KM)	0.0183
k hat (KM)	0.82	k star (KM)	0.774
nu hat (KM)	63.92	nu star (KM)	60.34
theta hat (KM)	0.114	theta star (KM)	0.121
80% gamma percentile (KM)	0.153	90% gamma percentile (KM)	0.229
95% gamma percentile (KM)	0.307	99% gamma percentile (KM)	0.491

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (60.34, α)	43.48	Adjusted Chi Square Value (60.34, β)	42.91
95% Gamma Approximate KM-UCL (use when n>=50)	0.13	95% Gamma Adjusted KM-UCL (use when n<50)	0.131

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.864	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.19	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0779	Mean in Log Scale	-3.196
SD in Original Scale	0.106	SD in Log Scale	1.041
95% t UCL (assumes normality of ROS data)	0.107	95% Percentile Bootstrap UCL	0.106
95% BCA Bootstrap UCL	0.112	95% Bootstrap t UCL	0.116
95% H-UCL (Log ROS)	0.106		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.785	KM Geo Mean	0.0618
KM SD (logged)	0.81	95% Critical H Value (KM-Log)	2.196
KM Standard Error of Mean (logged)	0.146	95% H-UCL (KM -Log)	0.114
KM SD (logged)	0.81	95% Critical H Value (KM-Log)	2.196
KM Standard Error of Mean (logged)	0.146		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.152	Mean in Log Scale	-2.639
SD in Original Scale	0.215	SD in Log Scale	1.167
95% t UCL (Assumes normality)	0.21	95% H-Stat UCL	0.231

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.124

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	39	Number of Distinct Observations	32
Number of Detects	12	Number of Non-Detects	27
Number of Distinct Detects	10	Number of Distinct Non-Detects	22
Minimum Detect	0.04	Minimum Non-Detect	0.0355
Maximum Detect	0.415	Maximum Non-Detect	1.6
Variance Detects	0.0173	Percent Non-Detects	69.23%
Mean Detects	0.159	SD Detects	0.132
Median Detects	0.107	CV Detects	0.827
Skewness Detects	1.142	Kurtosis Detects	-0.247
Mean of Logged Detects	-2.133	SD of Logged Detects	0.796

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.798	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.301	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0883	KM Standard Error of Mean	0.019
KM SD	0.0989	95% KM (BCA) UCL	0.123
95% KM (t) UCL	0.12	95% KM (Percentile Bootstrap) UCL	0.123
95% KM (z) UCL	0.12	95% KM Bootstrap t UCL	0.135
90% KM Chebyshev UCL	0.145	95% KM Chebyshev UCL	0.171
97.5% KM Chebyshev UCL	0.207	99% KM Chebyshev UCL	0.278

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.611	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.743	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.236	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.249	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.842	k star (bias corrected MLE)	1.437
Theta hat (MLE)	0.0865	Theta star (bias corrected MLE)	0.111
nu hat (MLE)	44.21	nu star (bias corrected)	34.49
Mean (detects)	0.159		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0611
Maximum	0.415	Median	0.01
SD	0.0995	CV	1.63
k hat (MLE)	0.659	k star (bias corrected MLE)	0.625
Theta hat (MLE)	0.0927	Theta star (bias corrected MLE)	0.0977
nu hat (MLE)	51.37	nu star (bias corrected)	48.75
Adjusted Level of Significance (β)	0.0437		
Approximate Chi Square Value (48.75, α)	33.73	Adjusted Chi Square Value (48.75, β)	33.23
95% Gamma Approximate UCL (use when n>=50)	0.0883	95% Gamma Adjusted UCL (use when n<50)	0.0896

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0883	SD (KM)	0.0989
Variance (KM)	0.00978	SE of Mean (KM)	0.019
k hat (KM)	0.798	k star (KM)	0.753
nu hat (KM)	62.21	nu star (KM)	58.76
theta hat (KM)	0.111	theta star (KM)	0.117
80% gamma percentile (KM)	0.145	90% gamma percentile (KM)	0.218
95% gamma percentile (KM)	0.293	99% gamma percentile (KM)	0.471

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (58.76, α)	42.14	Adjusted Chi Square Value (58.76, β)	41.58
95% Gamma Approximate KM-UCL (use when n>=50)	0.123	95% Gamma Adjusted KM-UCL (use when n<50)	0.125

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.921	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.186	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0703	Mean in Log Scale	-3.165
SD in Original Scale	0.0944	SD in Log Scale	0.92
95% t UCL (assumes normality of ROS data)	0.0958	95% Percentile Bootstrap UCL	0.0964
95% BCA Bootstrap UCL	0.104	95% Bootstrap t UCL	0.107
95% H-UCL (Log ROS)	0.091		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.785	KM Geo Mean	0.0617
KM SD (logged)	0.738	95% Critical H Value (KM-Log)	2.123
KM Standard Error of Mean (logged)	0.149	95% H-UCL (KM -Log)	0.104
KM SD (logged)	0.738	95% Critical H Value (KM-Log)	2.123
KM Standard Error of Mean (logged)	0.149		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.214	Mean in Log Scale	-2.319
SD in Original Scale	0.261	SD in Log Scale	1.26
95% t UCL (Assumes normality)	0.284	95% H-Stat UCL	0.379

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	0.125	95% GROS Adjusted Gamma UCL	0.0896

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_PFHxS|ug/kg

General Statistics

Total Number of Observations	39	Number of Distinct Observations	36
Number of Detects	23	Number of Non-Detects	16
Number of Distinct Detects	23	Number of Distinct Non-Detects	13
Minimum Detect	0.081	Minimum Non-Detect	0.0723
Maximum Detect	8.22	Maximum Non-Detect	1.6
Variance Detects	2.971	Percent Non-Detects	41.03%
Mean Detects	0.842	SD Detects	1.724
Median Detects	0.391	CV Detects	2.048
Skewness Detects	3.943	Kurtosis Detects	16.72
Mean of Logged Detects	-1.04	SD of Logged Detects	1.182

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.45	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.914	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.376	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.18	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.558	KM Standard Error of Mean	0.221
KM SD	1.343	95% KM (BCA) UCL	0.965
95% KM (t) UCL	0.93	95% KM (Percentile Bootstrap) UCL	0.961
95% KM (z) UCL	0.92	95% KM Bootstrap t UCL	1.829
90% KM Chebyshev UCL	1.219	95% KM Chebyshev UCL	1.519
97.5% KM Chebyshev UCL	1.935	99% KM Chebyshev UCL	2.752

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.649	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.787	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.224	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.189	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.697	k star (bias corrected MLE)	0.635
Theta hat (MLE)	1.207	Theta star (bias corrected MLE)	1.325
nu hat (MLE)	32.07	nu star (bias corrected)	29.22
Mean (detects)	0.842		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.511
Maximum	8.22	Median	0.12
SD	1.372	CV	2.686
k hat (MLE)	0.394	k star (bias corrected MLE)	0.381
Theta hat (MLE)	1.296	Theta star (bias corrected MLE)	1.341
nu hat (MLE)	30.74	nu star (bias corrected)	29.71
Adjusted Level of Significance (β)	0.0437		
Approximate Chi Square Value (29.71, α)	18.26	Adjusted Chi Square Value (29.71, β)	17.91
95% Gamma Approximate UCL (use when n>=50)	0.831	95% Gamma Adjusted UCL (use when n<50)	0.848

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.558	SD (KM)	1.343
Variance (KM)	1.804	SE of Mean (KM)	0.221
k hat (KM)	0.172	k star (KM)	0.176
nu hat (KM)	13.45	nu star (KM)	13.75
theta hat (KM)	3.234	theta star (KM)	3.164
80% gamma percentile (KM)	0.683	90% gamma percentile (KM)	1.68
95% gamma percentile (KM)	2.965	99% gamma percentile (KM)	6.58

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (13.75, α)	6.401	Adjusted Chi Square Value (13.75, β)	6.203
95% Gamma Approximate KM-UCL (use when n>=50)	1.198	95% Gamma Adjusted KM-UCL (use when n<50)	1.236

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.922	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.914	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.122	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.18	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.529	Mean in Log Scale	-1.812
SD in Original Scale	1.366	SD in Log Scale	1.416
95% t UCL (assumes normality of ROS data)	0.898	95% Percentile Bootstrap UCL	0.928
95% BCA Bootstrap UCL	1.143	95% Bootstrap t UCL	1.945
95% H-UCL (Log ROS)	0.871		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.536	KM Geo Mean	0.215
KM SD (logged)	1.161	95% Critical H Value (KM-Log)	2.594
KM Standard Error of Mean (logged)	0.201	95% H-UCL (KM -Log)	0.688
KM SD (logged)	1.161	95% Critical H Value (KM-Log)	2.594
KM Standard Error of Mean (logged)	0.201		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.619	Mean in Log Scale	-1.454
SD in Original Scale	1.354	SD in Log Scale	1.37
95% t UCL (Assumes normality)	0.984	95% H-Stat UCL	1.129

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL 0.688

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Raleigh Creek - Upper
Surface Sediment

Conc_PFOS|ug/kg

General Statistics

Total Number of Observations	39	Number of Distinct Observations	37
		Number of Missing Observations	0
Minimum	0.46	Mean	101.1
Maximum	1610	Median	27.5
SD	256.8	Std. Error of Mean	41.12
Coefficient of Variation	2.541	Skewness	5.616

Normal GOF Test

Shapiro Wilk Test Statistic	0.356	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.939	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.348	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.14	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	170.4	95% Adjusted-CLT UCL (Chen-1995)	208.2
		95% Modified-t UCL (Johnson-1978)	176.5

Gamma GOF Test

A-D Test Statistic	1.277	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.809	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.135	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.149	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.546	k star (bias corrected MLE)	0.521
Theta hat (MLE)	185.1	Theta star (bias corrected MLE)	194
nu hat (MLE)	42.59	nu star (bias corrected)	40.64
MLE Mean (bias corrected)	101.1	MLE Sd (bias corrected)	140
		Approximate Chi Square Value (0.05)	27.03
Adjusted Level of Significance	0.0437	Adjusted Chi Square Value	26.6

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	151.9	95% Adjusted Gamma UCL (use when n<50)	154.4

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.967	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.939	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.106	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.14	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.777	Mean of logged Data	3.468
Maximum of Logged Data	7.384	SD of logged Data	1.585

Assuming Lognormal Distribution

95% H-UCL	253.8	90% Chebyshev (MVUE) UCL	211.3
95% Chebyshev (MVUE) UCL	259.2	97.5% Chebyshev (MVUE) UCL	325.8
99% Chebyshev (MVUE) UCL	456.5		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	168.7	95% Jackknife UCL	170.4
95% Standard Bootstrap UCL	169.2	95% Bootstrap-t UCL	329.8
95% Hall's Bootstrap UCL	416.8	95% Percentile Bootstrap UCL	176.9
95% BCA Bootstrap UCL	219.8		
90% Chebyshev(Mean, Sd) UCL	224.4	95% Chebyshev(Mean, Sd) UCL	280.3
97.5% Chebyshev(Mean, Sd) UCL	357.8	99% Chebyshev(Mean, Sd) UCL	510.2

ProUCL Output
Raleigh Creek - Upper
Surface Sediment

Suggested UCL to Use

95% Adjusted Gamma UCL 154.4

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_PFNS|ug/kg

General Statistics

Total Number of Observations	39	Number of Distinct Observations	36
Number of Detects	20	Number of Non-Detects	19
Number of Distinct Detects	20	Number of Distinct Non-Detects	16
Minimum Detect	0.078	Minimum Non-Detect	0.0723
Maximum Detect	3.46	Maximum Non-Detect	1.5
Variance Detects	0.562	Percent Non-Detects	48.72%
Mean Detects	0.528	SD Detects	0.749
Median Detects	0.305	CV Detects	1.419
Skewness Detects	3.45	Kurtosis Detects	13.47
Mean of Logged Detects	-1.181	SD of Logged Detects	1.004

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.571	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.905	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.274	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.192	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.332	KM Standard Error of Mean	0.0956
KM SD	0.572	95% KM (BCA) UCL	0.52
95% KM (t) UCL	0.493	95% KM (Percentile Bootstrap) UCL	0.504
95% KM (z) UCL	0.489	95% KM Bootstrap t UCL	0.636
90% KM Chebyshev UCL	0.619	95% KM Chebyshev UCL	0.749
97.5% KM Chebyshev UCL	0.929	99% KM Chebyshev UCL	1.283

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.745	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.767	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.152	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.199	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.057	k star (bias corrected MLE)	0.932
Theta hat (MLE)	0.499	Theta star (bias corrected MLE)	0.567
nu hat (MLE)	42.29	nu star (bias corrected)	37.28
Mean (detects)	0.528		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.286
Maximum	3.46	Median	0.092
SD	0.59	CV	2.066
k hat (MLE)	0.433	k star (bias corrected MLE)	0.417
Theta hat (MLE)	0.66	Theta star (bias corrected MLE)	0.686
nu hat (MLE)	33.75	nu star (bias corrected)	32.49
Adjusted Level of Significance (β)	0.0437		
Approximate Chi Square Value (32.49, α)	20.46	Adjusted Chi Square Value (32.49, β)	20.08
95% Gamma Approximate UCL (use when n>=50)	0.453	95% Gamma Adjusted UCL (use when n<50)	0.462

ProUCL Output
Raleigh Creek - Upper
Surface Sediment

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.332	SD (KM)	0.572
Variance (KM)	0.327	SE of Mean (KM)	0.0956
k hat (KM)	0.337	k star (KM)	0.329
nu hat (KM)	26.32	nu star (KM)	25.63
theta hat (KM)	0.984	theta star (KM)	1.011
80% gamma percentile (KM)	0.52	90% gamma percentile (KM)	0.968
95% gamma percentile (KM)	1.475	99% gamma percentile (KM)	2.778

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (25.63, α)	15.1	Adjusted Chi Square Value (25.63, β)	14.78
95% Gamma Approximate KM-UCL (use when n>=50)	0.564	95% Gamma Adjusted KM-UCL (use when n<50)	0.576

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.945	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.905	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.127	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.192	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.301	Mean in Log Scale	-2.093
SD in Original Scale	0.582	SD in Log Scale	1.274
95% t UCL (assumes normality of ROS data)	0.458	95% Percentile Bootstrap UCL	0.466
95% BCA Bootstrap UCL	0.558	95% Bootstrap t UCL	0.643
95% H-UCL (Log ROS)	0.489		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.766	KM Geo Mean	0.171
KM SD (logged)	1.016	95% Critical H Value (KM-Log)	2.42
KM Standard Error of Mean (logged)	0.178	95% H-UCL (KM -Log)	0.427
KM SD (logged)	1.016	95% Critical H Value (KM-Log)	2.42
KM Standard Error of Mean (logged)	0.178		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.373	Mean in Log Scale	-1.767
SD in Original Scale	0.583	SD in Log Scale	1.285
95% t UCL (Assumes normality)	0.531	95% H-Stat UCL	0.693

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

ı Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1) 0.576

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_PFDS|ug/kg

General Statistics

Total Number of Observations	39	Number of Distinct Observations	39
Number of Detects	28	Number of Non-Detects	11
Number of Distinct Detects	28	Number of Distinct Non-Detects	11
Minimum Detect	0.08	Minimum Non-Detect	0.0723
Maximum Detect	6.09	Maximum Non-Detect	1.5
Variance Detects	2.115	Percent Non-Detects	28.21%
Mean Detects	1.109	SD Detects	1.454
Median Detects	0.608	CV Detects	1.311
Skewness Detects	2.391	Kurtosis Detects	5.531
Mean of Logged Detects	-0.525	SD of Logged Detects	1.148

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.667	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.924	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.263	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.164	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.844	KM Standard Error of Mean	0.21
KM SD	1.287	95% KM (BCA) UCL	1.21
95% KM (t) UCL	1.199	95% KM (Percentile Bootstrap) UCL	1.194
95% KM (z) UCL	1.19	95% KM Bootstrap t UCL	1.412
90% KM Chebyshev UCL	1.475	95% KM Chebyshev UCL	1.761
97.5% KM Chebyshev UCL	2.158	99% KM Chebyshev UCL	2.937

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.78	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.777	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.159	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.171	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.927	k star (bias corrected MLE)	0.851
Theta hat (MLE)	1.197	Theta star (bias corrected MLE)	1.303
nu hat (MLE)	51.9	nu star (bias corrected)	47.68
Mean (detects)	1.109		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.801
Maximum	6.09	Median	0.34
SD	1.323	CV	1.651
k hat (MLE)	0.468	k star (bias corrected MLE)	0.449
Theta hat (MLE)	1.712	Theta star (bias corrected MLE)	1.784
nu hat (MLE)	36.51	nu star (bias corrected)	35.03
Adjusted Level of Significance (β)	0.0437		
Approximate Chi Square Value (35.03, α)	22.49	Adjusted Chi Square Value (35.03, β)	22.1
95% Gamma Approximate UCL (use when n>=50)	1.248	95% Gamma Adjusted UCL (use when n<50)	1.271

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.844	SD (KM)	1.287
Variance (KM)	1.656	SE of Mean (KM)	0.21
k hat (KM)	0.43	k star (KM)	0.414
nu hat (KM)	33.57	nu star (KM)	32.32
theta hat (KM)	1.961	theta star (KM)	2.037
80% gamma percentile (KM)	1.368	90% gamma percentile (KM)	2.369
95% gamma percentile (KM)	3.465	99% gamma percentile (KM)	6.209

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (32.32, α)	20.33	Adjusted Chi Square Value (32.32, β)	19.95
95% Gamma Approximate KM-UCL (use when n>=50)	1.342	95% Gamma Adjusted KM-UCL (use when n<50)	1.368

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.965	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.924	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.11	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.164	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.828	Mean in Log Scale	-1.073
SD in Original Scale	1.308	SD in Log Scale	1.37
95% t UCL (assumes normality of ROS data)	1.181	95% Percentile Bootstrap UCL	1.184
95% BCA Bootstrap UCL	1.313	95% Bootstrap t UCL	1.401
95% H-UCL (Log ROS)	1.65		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1	KM Geo Mean	0.368
KM SD (logged)	1.29	95% Critical H Value (KM-Log)	2.759
KM Standard Error of Mean (logged)	0.217	95% H-UCL (KM -Log)	1.507
KM SD (logged)	1.29	95% Critical H Value (KM-Log)	2.759
KM Standard Error of Mean (logged)	0.217		

ProUCL Output
Raleigh Creek - Upper
Surface Sediment

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.862	Mean in Log Scale	-1.024
SD in Original Scale	1.298	SD in Log Scale	1.442
95% t UCL (Assumes normality)	1.212	95% H-Stat UCL	2.028

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

ı Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1) 1.368

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_PFDoS|ug/kg

General Statistics

Total Number of Observations	30	Number of Distinct Observations	29
		Number of Missing Observations	9
Number of Detects	18	Number of Non-Detects	12
Number of Distinct Detects	18	Number of Distinct Non-Detects	11
Minimum Detect	0.055	Minimum Non-Detect	0.0386
Maximum Detect	2.51	Maximum Non-Detect	0.0799
Variance Detects	0.442	Percent Non-Detects	40%
Mean Detects	0.462	SD Detects	0.665
Median Detects	0.171	CV Detects	1.441
Skewness Detects	2.353	Kurtosis Detects	5.302
Mean of Logged Detects	-1.456	SD of Logged Detects	1.112

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.633	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.897	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.323	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.202	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.296	KM Standard Error of Mean	0.102
KM SD	0.54	95% KM (BCA) UCL	0.487
95% KM (t) UCL	0.468	95% KM (Percentile Bootstrap) UCL	0.477
95% KM (z) UCL	0.463	95% KM Bootstrap t UCL	0.681
90% KM Chebyshev UCL	0.6	95% KM Chebyshev UCL	0.738
97.5% KM Chebyshev UCL	0.93	99% KM Chebyshev UCL	1.306

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.393	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.773	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.293	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.211	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.861	k star (bias corrected MLE)	0.755
Theta hat (MLE)	0.536	Theta star (bias corrected MLE)	0.612
nu hat (MLE)	30.99	nu star (bias corrected)	27.16
Mean (detects)	0.462		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.281
Maximum	2.51	Median	0.097
SD	0.557	CV	1.982
k hat (MLE)	0.447	k star (bias corrected MLE)	0.425
Theta hat (MLE)	0.628	Theta star (bias corrected MLE)	0.662
nu hat (MLE)	26.82	nu star (bias corrected)	25.47
Adjusted Level of Significance (β)	0.041		
Approximate Chi Square Value (25.47, α)	14.97	Adjusted Chi Square Value (25.47, β)	14.51
95% Gamma Approximate UCL (use when n>=50)	0.478	95% Gamma Adjusted UCL (use when n<50)	0.493

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.296	SD (KM)	0.54
Variance (KM)	0.292	SE of Mean (KM)	0.102
k hat (KM)	0.299	k star (KM)	0.291
nu hat (KM)	17.95	nu star (KM)	17.48
theta hat (KM)	0.988	theta star (KM)	1.014
80% gamma percentile (KM)	0.45	90% gamma percentile (KM)	0.875
95% gamma percentile (KM)	1.365	99% gamma percentile (KM)	2.643

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (17.48, α)	9.019	Adjusted Chi Square Value (17.48, β)	8.669
95% Gamma Approximate KM-UCL (use when n>=50)	0.573	95% Gamma Adjusted KM-UCL (use when n<50)	0.596

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.893	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.897	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.232	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.202	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.285	Mean in Log Scale	-2.467
SD in Original Scale	0.555	SD in Log Scale	1.532
95% t UCL (assumes normality of ROS data)	0.457	95% Percentile Bootstrap UCL	0.462
95% BCA Bootstrap UCL	0.564	95% Bootstrap t UCL	0.705
95% H-UCL (Log ROS)	0.684		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.107	KM Geo Mean	0.122
KM SD (logged)	1.162	95% Critical H Value (KM-Log)	2.688
KM Standard Error of Mean (logged)	0.224	95% H-UCL (KM -Log)	0.427
KM SD (logged)	1.162	95% Critical H Value (KM-Log)	2.688
KM Standard Error of Mean (logged)	0.224		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.291	Mean in Log Scale	-2.209
SD in Original Scale	0.552	SD in Log Scale	1.273
95% t UCL (Assumes normality)	0.462	95% H-Stat UCL	0.483

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 0.738

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	39	Number of Distinct Observations	39
Number of Detects	38	Number of Non-Detects	1
Number of Distinct Detects	38	Number of Distinct Non-Detects	1
Minimum Detect	0.18	Minimum Non-Detect	0.0758
Maximum Detect	50.2	Maximum Non-Detect	0.0758
Variance Detects	76.18	Percent Non-Detects	2.564%
Mean Detects	5.12	SD Detects	8.728
Median Detects	2.42	CV Detects	1.705
Skewness Detects	4.096	Kurtosis Detects	19.78
Mean of Logged Detects	0.841	SD of Logged Detects	1.277

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.537	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.938	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.291	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.142	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	4.991	KM Standard Error of Mean	1.386
KM SD	8.539	95% KM (BCA) UCL	7.736
95% KM (t) UCL	7.327	95% KM (Percentile Bootstrap) UCL	7.484
95% KM (z) UCL	7.27	95% KM Bootstrap t UCL	9.575
90% KM Chebyshev UCL	9.148	95% KM Chebyshev UCL	11.03
97.5% KM Chebyshev UCL	13.64	99% KM Chebyshev UCL	18.78

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.937	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.788	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.14	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.149	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.755	k star (bias corrected MLE)	0.713
Theta hat (MLE)	6.778	Theta star (bias corrected MLE)	7.178
nu hat (MLE)	57.41	nu star (bias corrected)	54.21
Mean (detects)	5.12		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	4.989
Maximum	50.2	Median	2.38
SD	8.651	CV	1.734
k hat (MLE)	0.671	k star (bias corrected MLE)	0.637
Theta hat (MLE)	7.431	Theta star (bias corrected MLE)	7.834
nu hat (MLE)	52.37	nu star (bias corrected)	49.67
Adjusted Level of Significance (β)	0.0437		
Approximate Chi Square Value (49.67, α)	34.49	Adjusted Chi Square Value (49.67, β)	33.99
95% Gamma Approximate UCL (use when n>=50)	7.185	95% Gamma Adjusted UCL (use when n<50)	7.291

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	4.991	SD (KM)	8.539
Variance (KM)	72.91	SE of Mean (KM)	1.386
k hat (KM)	0.342	k star (KM)	0.332
nu hat (KM)	26.65	nu star (KM)	25.93
theta hat (KM)	14.61	theta star (KM)	15.01
80% gamma percentile (KM)	7.828	90% gamma percentile (KM)	14.52
95% gamma percentile (KM)	22.08	99% gamma percentile (KM)	41.47

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (25.93, α)	15.33	Adjusted Chi Square Value (25.93, β)	15
95% Gamma Approximate KM-UCL (use when n>=50)	8.444	95% Gamma Adjusted KM-UCL (use when n<50)	8.626

ProUCL Output
Raleigh Creek - Upper
Surface Sediment

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.982	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.938	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.082	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.142	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	4.991	Mean in Log Scale	0.758
SD in Original Scale	8.65	SD in Log Scale	1.365
95% t UCL (assumes normality of ROS data)	7.326	95% Percentile Bootstrap UCL	7.557
95% BCA Bootstrap UCL	8.747	95% Bootstrap t UCL	9.883
95% H-UCL (Log ROS)	10.19		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.754	KM Geo Mean	2.125
KM SD (logged)	1.357	95% Critical H Value (KM-Log)	2.845
KM Standard Error of Mean (logged)	0.22	95% H-UCL (KM -Log)	9.973
KM SD (logged)	1.357	95% Critical H Value (KM-Log)	2.845
KM Standard Error of Mean (logged)	0.22		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	4.99	Mean in Log Scale	0.736
SD in Original Scale	8.651	SD in Log Scale	1.422
95% t UCL (Assumes normality)	7.325	95% H-Stat UCL	11.29

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

ı Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1) 8.626

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_N-EtFOSA|ug/kg

General Statistics

Total Number of Observations	39	Number of Distinct Observations	35
Number of Detects	19	Number of Non-Detects	20
Number of Distinct Detects	19	Number of Distinct Non-Detects	17
Minimum Detect	0.106	Minimum Non-Detect	0.0966
Maximum Detect	4.6	Maximum Non-Detect	1.6
Variance Detects	1.29	Percent Non-Detects	51.28%
Mean Detects	0.737	SD Detects	1.136
Median Detects	0.318	CV Detects	1.542
Skewness Detects	2.763	Kurtosis Detects	7.759
Mean of Logged Detects	-0.958	SD of Logged Detects	1.045

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.578	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.901	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.346	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.197	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.44	KM Standard Error of Mean	0.138
KM SD	0.831	95% KM (BCA) UCL	0.696
95% KM (t) UCL	0.673	95% KM (Percentile Bootstrap) UCL	0.695
95% KM (z) UCL	0.667	95% KM Bootstrap t UCL	1.065
90% KM Chebyshev UCL	0.854	95% KM Chebyshev UCL	1.041
97.5% KM Chebyshev UCL	1.301	99% KM Chebyshev UCL	1.811

ProUCL Output
Raleigh Creek - Upper
Surface Sediment

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.524	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.773	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.242	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.205	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.896	k star (bias corrected MLE)	0.79
Theta hat (MLE)	0.822	Theta star (bias corrected MLE)	0.933
nu hat (MLE)	34.05	nu star (bias corrected)	30.01
Mean (detects)	0.737		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.373
Maximum	4.6	Median	0.111
SD	0.861	CV	2.309
k hat (MLE)	0.39	k star (bias corrected MLE)	0.377
Theta hat (MLE)	0.956	Theta star (bias corrected MLE)	0.989
nu hat (MLE)	30.43	nu star (bias corrected)	29.42
Adjusted Level of Significance (β)	0.0437		
Approximate Chi Square Value (29.42, α)	18.04	Adjusted Chi Square Value (29.42, β)	17.69
95% Gamma Approximate UCL (use when n>=50)	0.608	95% Gamma Adjusted UCL (use when n<50)	0.62

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.44	SD (KM)	0.831
Variance (KM)	0.69	SE of Mean (KM)	0.138
k hat (KM)	0.281	k star (KM)	0.277
nu hat (KM)	21.94	nu star (KM)	21.58
theta hat (KM)	1.566	theta star (KM)	1.592
80% gamma percentile (KM)	0.661	90% gamma percentile (KM)	1.311
95% gamma percentile (KM)	2.067	99% gamma percentile (KM)	4.053

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (21.58, α)	12.03	Adjusted Chi Square Value (21.58, β)	11.74
95% Gamma Approximate KM-UCL (use when n>=50)	0.79	95% Gamma Adjusted KM-UCL (use when n<50)	0.809

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.9	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.901	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.163	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.197	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.409	Mean in Log Scale	-1.749
SD in Original Scale	0.847	SD in Log Scale	1.142
95% t UCL (assumes normality of ROS data)	0.637	95% Percentile Bootstrap UCL	0.647
95% BCA Bootstrap UCL	0.763	95% Bootstrap t UCL	1.035
95% H-UCL (Log ROS)	0.537		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.496	KM Geo Mean	0.224
KM SD (logged)	0.947	95% Critical H Value (KM-Log)	2.341
KM Standard Error of Mean (logged)	0.167	95% H-UCL (KM -Log)	0.503
KM SD (logged)	0.947	95% Critical H Value (KM-Log)	2.341
KM Standard Error of Mean (logged)	0.167		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.502	Mean in Log Scale	-1.367
SD in Original Scale	0.839	SD in Log Scale	1.082
95% t UCL (Assumes normality)	0.729	95% H-Stat UCL	0.71

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

ProUCL Output
Raleigh Creek - Upper
Surface Sediment

Suggested UCL to Use

KM H-UCL 0.503

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_N-MeFOSA|ug/kg

General Statistics

Total Number of Observations	39	Number of Distinct Observations	37
Number of Detects	26	Number of Non-Detects	13
Number of Distinct Detects	25	Number of Distinct Non-Detects	12
Minimum Detect	0.095	Minimum Non-Detect	0.0444
Maximum Detect	2.97	Maximum Non-Detect	1.5
Variance Detects	0.346	Percent Non-Detects	33.33%
Mean Detects	0.417	SD Detects	0.588
Median Detects	0.257	CV Detects	1.409
Skewness Detects	3.651	Kurtosis Detects	15
Mean of Logged Detects	-1.329	SD of Logged Detects	0.856

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.538	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.92	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.31	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.17	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.298	KM Standard Error of Mean	0.0823
KM SD	0.502	95% KM (BCA) UCL	0.475
95% KM (t) UCL	0.437	95% KM (Percentile Bootstrap) UCL	0.447
95% KM (z) UCL	0.433	95% KM Bootstrap t UCL	0.623
90% KM Chebyshev UCL	0.545	95% KM Chebyshev UCL	0.657
97.5% KM Chebyshev UCL	0.812	99% KM Chebyshev UCL	1.117

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.512	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.768	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.208	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.175	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.239	k star (bias corrected MLE)	1.121
Theta hat (MLE)	0.337	Theta star (bias corrected MLE)	0.372
nu hat (MLE)	64.41	nu star (bias corrected)	58.31
Mean (detects)	0.417		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.282
Maximum	2.97	Median	0.121
SD	0.515	CV	1.827
k hat (MLE)	0.55	k star (bias corrected MLE)	0.525
Theta hat (MLE)	0.512	Theta star (bias corrected MLE)	0.537
nu hat (MLE)	42.92	nu star (bias corrected)	40.95
Adjusted Level of Significance (β)	0.0437		
Approximate Chi Square Value (40.95, α)	27.28	Adjusted Chi Square Value (40.95, β)	26.84
95% Gamma Approximate UCL (use when n>=50)	0.423	95% Gamma Adjusted UCL (use when n<50)	0.43

ProUCL Output
Raleigh Creek - Upper
Surface Sediment

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.298	SD (KM)	0.502
Variance (KM)	0.252	SE of Mean (KM)	0.0823
k hat (KM)	0.351	k star (KM)	0.341
nu hat (KM)	27.4	nu star (KM)	26.63
theta hat (KM)	0.848	theta star (KM)	0.872
80% gamma percentile (KM)	0.47	90% gamma percentile (KM)	0.863
95% gamma percentile (KM)	1.306	99% gamma percentile (KM)	2.439

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (26.63, α)	15.86	Adjusted Chi Square Value (26.63, β)	15.54
95% Gamma Approximate KM-UCL (use when n>=50)	0.5	95% Gamma Adjusted KM-UCL (use when n<50)	0.51

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.911	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.92	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.129	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.17	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.294	Mean in Log Scale	-1.938
SD in Original Scale	0.509	SD in Log Scale	1.133
95% t UCL (assumes normality of ROS data)	0.431	95% Percentile Bootstrap UCL	0.44
95% BCA Bootstrap UCL	0.527	95% Bootstrap t UCL	0.599
95% H-UCL (Log ROS)	0.438		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.892	KM Geo Mean	0.151
KM SD (logged)	1.077	95% Critical H Value (KM-Log)	2.492
KM Standard Error of Mean (logged)	0.178	95% H-UCL (KM -Log)	0.416
KM SD (logged)	1.077	95% Critical H Value (KM-Log)	2.492
KM Standard Error of Mean (logged)	0.178		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.311	Mean in Log Scale	-1.869
SD in Original Scale	0.513	SD in Log Scale	1.138
95% t UCL (Assumes normality)	0.449	95% H-Stat UCL	0.473

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL 0.416

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_N-EtFOSAA|ug/kg

General Statistics

Total Number of Observations	39	Number of Distinct Observations	36
		Number of Missing Observations	0
Minimum	0.094	Mean	3.931
Maximum	23.4	Median	2.3
SD	5.318	Std. Error of Mean	0.852
Coefficient of Variation	1.353	Skewness	2.192

Normal GOF Test

Shapiro Wilk Test Statistic	0.704	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.939	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.291	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.14	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	5.366	95% Adjusted-CLT UCL (Chen-1995)	5.651
		95% Modified-t UCL (Johnson-1978)	5.416

Gamma GOF Test

A-D Test Statistic	0.652	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.796	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.132	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.148	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.678	k star (bias corrected MLE)	0.643
Theta hat (MLE)	5.794	Theta star (bias corrected MLE)	6.11
nu hat (MLE)	52.92	nu star (bias corrected)	50.18
MLE Mean (bias corrected)	3.931	MLE Sd (bias corrected)	4.901
		Approximate Chi Square Value (0.05)	34.91
Adjusted Level of Significance	0.0437	Adjusted Chi Square Value	34.41

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	5.649	95% Adjusted Gamma UCL (use when n<50)	5.732

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.948	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.939	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.136	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.14	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.364	Mean of logged Data	0.474
Maximum of Logged Data	3.153	SD of logged Data	1.501

Assuming Lognormal Distribution

95% H-UCL	10.4	90% Chebyshev (MVUE) UCL	9.07
95% Chebyshev (MVUE) UCL	11.06	97.5% Chebyshev (MVUE) UCL	13.82
99% Chebyshev (MVUE) UCL	19.23		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	5.331	95% Jackknife UCL	5.366
95% Standard Bootstrap UCL	5.279	95% Bootstrap-t UCL	5.913
95% Hall's Bootstrap UCL	5.736	95% Percentile Bootstrap UCL	5.391
95% BCA Bootstrap UCL	5.662		
90% Chebyshev(Mean, Sd) UCL	6.485	95% Chebyshev(Mean, Sd) UCL	7.643
97.5% Chebyshev(Mean, Sd) UCL	9.249	99% Chebyshev(Mean, Sd) UCL	12.4

Suggested UCL to Use

95% Adjusted Gamma UCL 5.732

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_N-EtFOSE|ug/kg

General Statistics

Total Number of Observations	39	Number of Distinct Observations	35
Number of Detects	7	Number of Non-Detects	32
Number of Distinct Detects	7	Number of Distinct Non-Detects	28
Minimum Detect	0.5	Minimum Non-Detect	0.265
Maximum Detect	1.48	Maximum Non-Detect	1.6
Variance Detects	0.138	Percent Non-Detects	82.05%
Mean Detects	0.868	SD Detects	0.372
Median Detects	0.854	CV Detects	0.429
Skewness Detects	0.573	Kurtosis Detects	-0.778
Mean of Logged Detects	-0.222	SD of Logged Detects	0.432

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.898	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.225	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.42	KM Standard Error of Mean	0.0575
KM SD	0.287	95% KM (BCA) UCL	0.525
95% KM (t) UCL	0.517	95% KM (Percentile Bootstrap) UCL	0.517
95% KM (z) UCL	0.514	95% KM Bootstrap t UCL	0.506
90% KM Chebyshev UCL	0.592	95% KM Chebyshev UCL	0.671
97.5% KM Chebyshev UCL	0.779	99% KM Chebyshev UCL	0.992

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.409	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.709	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.244	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.313	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	6.445	k star (bias corrected MLE)	3.778
Theta hat (MLE)	0.135	Theta star (bias corrected MLE)	0.23
nu hat (MLE)	90.24	nu star (bias corrected)	52.9
Mean (detects)	0.868		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.215
Maximum	1.48	Median	0.0641
SD	0.354	CV	1.648
k hat (MLE)	0.528	k star (bias corrected MLE)	0.505
Theta hat (MLE)	0.406	Theta star (bias corrected MLE)	0.425
nu hat (MLE)	41.22	nu star (bias corrected)	39.38
Adjusted Level of Significance (β)	0.0437		
Approximate Chi Square Value (39.38, α)	26.01	Adjusted Chi Square Value (39.38, β)	25.58
95% Gamma Approximate UCL (use when n>=50)	0.325	95% Gamma Adjusted UCL (use when n<50)	0.33

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.42	SD (KM)	0.287
Variance (KM)	0.0826	SE of Mean (KM)	0.0575
k hat (KM)	2.134	k star (KM)	1.987
nu hat (KM)	166.4	nu star (KM)	155
theta hat (KM)	0.197	theta star (KM)	0.211
80% gamma percentile (KM)	0.629	90% gamma percentile (KM)	0.818
95% gamma percentile (KM)	0.998	99% gamma percentile (KM)	1.398

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (154.98, α)	127.2	Adjusted Chi Square Value (154.98, β)	126.2
95% Gamma Approximate KM-UCL (use when n>=50)	0.512	95% Gamma Adjusted KM-UCL (use when n<50)	0.516

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.895	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.225	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.372	Mean in Log Scale	-1.15
SD in Original Scale	0.283	SD in Log Scale	0.506
95% t UCL (assumes normality of ROS data)	0.448	95% Percentile Bootstrap UCL	0.447
95% BCA Bootstrap UCL	0.468	95% Bootstrap t UCL	0.484
95% H-UCL (Log ROS)	0.421		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.019	KM Geo Mean	0.361
KM SD (logged)	0.495	95% Critical H Value (KM-Log)	1.914
KM Standard Error of Mean (logged)	0.109	95% H-UCL (KM -Log)	0.476
KM SD (logged)	0.495	95% Critical H Value (KM-Log)	1.914
KM Standard Error of Mean (logged)	0.109		

ProUCL Output
Raleigh Creek - Upper
Surface Sediment

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.433	Mean in Log Scale	-1.049
SD in Original Scale	0.307	SD in Log Scale	0.651
95% t UCL (Assumes normality)	0.516	95% H-Stat UCL	0.537

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.517

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFPeS|ug/kg

General Statistics

Total Number of Observations	38	Number of Distinct Observations	36
		Number of Missing Observations	1
Number of Detects	15	Number of Non-Detects	23
Number of Distinct Detects	15	Number of Distinct Non-Detects	21
Minimum Detect	0.063	Minimum Non-Detect	0.0357
Maximum Detect	0.945	Maximum Non-Detect	1.2
Variance Detects	0.0551	Percent Non-Detects	60.53%
Mean Detects	0.253	SD Detects	0.235
Median Detects	0.156	CV Detects	0.926
Skewness Detects	2.218	Kurtosis Detects	5.094
Mean of Logged Detects	-1.652	SD of Logged Detects	0.725

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.719	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.881	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.273	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.22	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.134	KM Standard Error of Mean	0.0323
KM SD	0.183	95% KM (BCA) UCL	0.193
95% KM (t) UCL	0.188	95% KM (Percentile Bootstrap) UCL	0.189
95% KM (z) UCL	0.187	95% KM Bootstrap t UCL	0.239
90% KM Chebyshev UCL	0.231	95% KM Chebyshev UCL	0.274
97.5% KM Chebyshev UCL	0.335	99% KM Chebyshev UCL	0.455

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.753	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.748	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.221	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.225	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.938	k star (bias corrected MLE)	1.595
Theta hat (MLE)	0.131	Theta star (bias corrected MLE)	0.159
nu hat (MLE)	58.13	nu star (bias corrected)	47.84
Mean (detects)	0.253		

ProUCL Output
Raleigh Creek - Upper
Surface Sediment

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.108
Maximum	0.945	Median	0.01
SD	0.187	CV	1.736
k hat (MLE)	0.542	k star (bias corrected MLE)	0.516
Theta hat (MLE)	0.199	Theta star (bias corrected MLE)	0.209
nu hat (MLE)	41.17	nu star (bias corrected)	39.25
Adjusted Level of Significance (β)	0.0434		
Approximate Chi Square Value (39.25, α)	25.9	Adjusted Chi Square Value (39.25, β)	25.45
95% Gamma Approximate UCL (use when n>=50)	0.164	95% Gamma Adjusted UCL (use when n<50)	0.167

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.134	SD (KM)	0.183
Variance (KM)	0.0334	SE of Mean (KM)	0.0323
k hat (KM)	0.535	k star (KM)	0.51
nu hat (KM)	40.64	nu star (KM)	38.77
theta hat (KM)	0.25	theta star (KM)	0.262
80% gamma percentile (KM)	0.22	90% gamma percentile (KM)	0.36
95% gamma percentile (KM)	0.51	99% gamma percentile (KM)	0.877

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (38.77, α)	25.5	Adjusted Chi Square Value (38.77, β)	25.06
95% Gamma Approximate KM-UCL (use when n>=50)	0.203	95% Gamma Adjusted KM-UCL (use when n<50)	0.207

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.946	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.171	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.122	Mean in Log Scale	-2.699
SD in Original Scale	0.181	SD in Log Scale	1.005
95% t UCL (assumes normality of ROS data)	0.172	95% Percentile Bootstrap UCL	0.172
95% BCA Bootstrap UCL	0.193	95% Bootstrap t UCL	0.221
95% H-UCL (Log ROS)	0.166		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.54	KM Geo Mean	0.0789
KM SD (logged)	0.926	95% Critical H Value (KM-Log)	2.311
KM Standard Error of Mean (logged)	0.172	95% H-UCL (KM -Log)	0.172
KM SD (logged)	0.926	95% Critical H Value (KM-Log)	2.311
KM Standard Error of Mean (logged)	0.172		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.173	Mean in Log Scale	-2.421
SD in Original Scale	0.219	SD in Log Scale	1.152
95% t UCL (Assumes normality)	0.233	95% H-Stat UCL	0.281

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	0.207	95% GROS Adjusted Gamma UCL	0.167

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	39	Number of Distinct Observations	32
Number of Detects	12	Number of Non-Detects	27
Number of Distinct Detects	12	Number of Distinct Non-Detects	21
Minimum Detect	0.16	Minimum Non-Detect	0.238
Maximum Detect	10.2	Maximum Non-Detect	1.6
Variance Detects	7.969	Percent Non-Detects	69.23%
Mean Detects	1.491	SD Detects	2.823
Median Detects	0.383	CV Detects	1.893
Skewness Detects	3.142	Kurtosis Detects	10.28
Mean of Logged Detects	-0.47	SD of Logged Detects	1.194

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.505	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.319	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.61	KM Standard Error of Mean	0.271
KM SD	1.612	95% KM (BCA) UCL	1.123
95% KM (t) UCL	1.066	95% KM (Percentile Bootstrap) UCL	1.102
95% KM (z) UCL	1.055	95% KM Bootstrap t UCL	2.374
90% KM Chebyshev UCL	1.422	95% KM Chebyshev UCL	1.789
97.5% KM Chebyshev UCL	2.3	99% KM Chebyshev UCL	3.302

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.26	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.77	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.291	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.256	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.696	k star (bias corrected MLE)	0.577
Theta hat (MLE)	2.144	Theta star (bias corrected MLE)	2.583
nu hat (MLE)	16.69	nu star (bias corrected)	13.85
Mean (detects)	1.491		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.466
Maximum	10.2	Median	0.01
SD	1.669	CV	3.584
k hat (MLE)	0.273	k star (bias corrected MLE)	0.269
Theta hat (MLE)	1.708	Theta star (bias corrected MLE)	1.733
nu hat (MLE)	21.27	nu star (bias corrected)	20.97
Adjusted Level of Significance (β)	0.0437		
Approximate Chi Square Value (20.97, α)	11.57	Adjusted Chi Square Value (20.97, β)	11.29
95% Gamma Approximate UCL (use when n>=50)	0.844	95% Gamma Adjusted UCL (use when n<50)	0.865

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.61	SD (KM)	1.612
Variance (KM)	2.599	SE of Mean (KM)	0.271
k hat (KM)	0.143	k star (KM)	0.149
nu hat (KM)	11.18	nu star (KM)	11.65
theta hat (KM)	4.258	theta star (KM)	4.085
80% gamma percentile (KM)	0.662	90% gamma percentile (KM)	1.809
95% gamma percentile (KM)	3.362	99% gamma percentile (KM)	7.872

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (11.65, α)	5	Adjusted Chi Square Value (11.65, β)	4.828
95% Gamma Approximate KM-UCL (use when n>=50)	1.423	95% Gamma Adjusted KM-UCL (use when n<50)	1.473

ProUCL Output
Raleigh Creek - Upper
Surface Sediment

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.872	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.225	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.557	Mean in Log Scale	-1.562
SD in Original Scale	1.646	SD in Log Scale	1.034
95% t UCL (assumes normality of ROS data)	1.001	95% Percentile Bootstrap UCL	1.046
95% BCA Bootstrap UCL	1.375	95% Bootstrap t UCL	2.553
95% H-UCL (Log ROS)	0.539		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.233	KM Geo Mean	0.291
KM SD (logged)	0.849	95% Critical H Value (KM-Log)	2.236
KM Standard Error of Mean (logged)	0.171	95% H-UCL (KM -Log)	0.568
KM SD (logged)	0.849	95% Critical H Value (KM-Log)	2.236
KM Standard Error of Mean (logged)	0.171		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.666	Mean in Log Scale	-1.173
SD in Original Scale	1.631	SD in Log Scale	0.994
95% t UCL (Assumes normality)	1.106	95% H-Stat UCL	0.746

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	0.568

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.13/5/2021 2:37:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

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General Statistics

Total Number of Observations	22	Number of Distinct Observations	19
Number of Detects	7	Number of Non-Detects	15
Number of Distinct Detects	7	Number of Distinct Non-Detects	12
Minimum Detect	0.425	Minimum Non-Detect	0.153
Maximum Detect	1.16	Maximum Non-Detect	1.5
Variance Detects	0.0647	Percent Non-Detects	68.18%
Mean Detects	0.708	SD Detects	0.254
Median Detects	0.627	CV Detects	0.36
Skewness Detects	0.869	Kurtosis Detects	0.33
Mean of Logged Detects	-0.399	SD of Logged Detects	0.349

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.93	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.196	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.388	KM Standard Error of Mean	0.0811
KM SD	0.308	95% KM (BCA) UCL	0.578
95% KM (t) UCL	0.527	95% KM (Percentile Bootstrap) UCL	0.543
95% KM (z) UCL	0.521	95% KM Bootstrap t UCL	0.518
90% KM Chebyshev UCL	0.631	95% KM Chebyshev UCL	0.741
97.5% KM Chebyshev UCL	0.894	99% KM Chebyshev UCL	1.195

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.232	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.709	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.173	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.312	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	9.592	k star (bias corrected MLE)	5.576
Theta hat (MLE)	0.0738	Theta star (bias corrected MLE)	0.127
nu hat (MLE)	134.3	nu star (bias corrected)	78.07
Mean (detects)	0.708		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0993	Mean	0.375
Maximum	1.16	Median	0.252
SD	0.293	CV	0.782
k hat (MLE)	1.95	k star (bias corrected MLE)	1.714
Theta hat (MLE)	0.192	Theta star (bias corrected MLE)	0.219
nu hat (MLE)	85.8	nu star (bias corrected)	75.44
Adjusted Level of Significance (β)	0.0386		
Approximate Chi Square Value (75.44, α)	56.43	Adjusted Chi Square Value (75.44, β)	55.2
95% Gamma Approximate UCL (use when n>=50)	0.501	95% Gamma Adjusted UCL (use when n<50)	0.512

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.388	SD (KM)	0.308
Variance (KM)	0.0948	SE of Mean (KM)	0.0811
k hat (KM)	1.585	k star (KM)	1.399
nu hat (KM)	69.72	nu star (KM)	61.55
theta hat (KM)	0.245	theta star (KM)	0.277
80% gamma percentile (KM)	0.604	90% gamma percentile (KM)	0.822
95% gamma percentile (KM)	1.034	99% gamma percentile (KM)	1.515

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (61.55, α)	44.51	Adjusted Chi Square Value (61.55, β)	43.42
95% Gamma Approximate KM-UCL (use when n>=50)	0.536	95% Gamma Adjusted KM-UCL (use when n<50)	0.549

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.969	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.15	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.443	Mean in Log Scale	-0.926
SD in Original Scale	0.241	SD in Log Scale	0.459
95% t UCL (assumes normality of ROS data)	0.531	95% Percentile Bootstrap UCL	0.529
95% BCA Bootstrap UCL	0.542	95% Bootstrap t UCL	0.575
95% H-UCL (Log ROS)	0.535		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.245	KM Geo Mean	0.288
KM SD (logged)	0.755	95% Critical H Value (KM-Log)	2.266
KM Standard Error of Mean (logged)	0.202	95% H-UCL (KM -Log)	0.556
KM SD (logged)	0.755	95% Critical H Value (KM-Log)	2.266
KM Standard Error of Mean (logged)	0.202		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.456	Mean in Log Scale	-1.078
SD in Original Scale	0.31	SD in Log Scale	0.848
95% t UCL (Assumes normality)	0.57	95% H-Stat UCL	0.758

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.527

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	22	Number of Distinct Observations	19
Number of Detects	4	Number of Non-Detects	18
Number of Distinct Detects	4	Number of Distinct Non-Detects	15
Minimum Detect	0.089	Minimum Non-Detect	0.0764
Maximum Detect	0.34	Maximum Non-Detect	1.5
Variance Detects	0.0133	Percent Non-Detects	81.82%
Mean Detects	0.233	SD Detects	0.115
Median Detects	0.251	CV Detects	0.495
Skewness Detects	-0.586	Kurtosis Detects	-2.178
Mean of Logged Detects	-1.58	SD of Logged Detects	0.613

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.929	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.249	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.116	KM Standard Error of Mean	0.0229
KM SD	0.081	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.155	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.154	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.185	95% KM Chebyshev UCL	0.216
97.5% KM Chebyshev UCL	0.259	99% KM Chebyshev UCL	0.344

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.35	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.659	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.282	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.396	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.256	k star (bias corrected MLE)	1.231
Theta hat (MLE)	0.0547	Theta star (bias corrected MLE)	0.189
nu hat (MLE)	34.05	nu star (bias corrected)	9.846
Mean (detects)	0.233		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0565
Maximum	0.34	Median	0.01
SD	0.0986	CV	1.746
k hat (MLE)	0.604	k star (bias corrected MLE)	0.552
Theta hat (MLE)	0.0935	Theta star (bias corrected MLE)	0.102
nu hat (MLE)	26.58	nu star (bias corrected)	24.29
Adjusted Level of Significance (β)	0.0386		
Approximate Chi Square Value (24.29, α)	14.07	Adjusted Chi Square Value (24.29, β)	13.49
95% Gamma Approximate UCL (use when n>=50)	0.0975	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.116	SD (KM)	0.081
Variance (KM)	0.00657	SE of Mean (KM)	0.0229
k hat (KM)	2.046	k star (KM)	1.797
nu hat (KM)	90.02	nu star (KM)	79.08
theta hat (KM)	0.0567	theta star (KM)	0.0645
80% gamma percentile (KM)	0.176	90% gamma percentile (KM)	0.231
95% gamma percentile (KM)	0.284	99% gamma percentile (KM)	0.403

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (79.08, α)	59.59	Adjusted Chi Square Value (79.08, β)	58.33
95% Gamma Approximate KM-UCL (use when n>=50)	0.154	95% Gamma Adjusted KM-UCL (use when n<50)	0.157

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.89	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.247	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0791	Mean in Log Scale	-2.884
SD in Original Scale	0.0879	SD in Log Scale	0.748
95% t UCL (assumes normality of ROS data)	0.111	95% Percentile Bootstrap UCL	0.113
95% BCA Bootstrap UCL	0.121	95% Bootstrap t UCL	0.149
95% H-UCL (Log ROS)	0.107		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.305	KM Geo Mean	0.0997
KM SD (logged)	0.482	95% Critical H Value (KM-Log)	1.98
KM Standard Error of Mean (logged)	0.139	95% H-UCL (KM -Log)	0.138
KM SD (logged)	0.482	95% Critical H Value (KM-Log)	1.98
KM Standard Error of Mean (logged)	0.139		

ProUCL Output
Raleigh Creek - Other Surface Sediment

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.226	Mean in Log Scale	-1.968
SD in Original Scale	0.236	SD in Log Scale	0.97
95% t UCL (Assumes normality)	0.312	95% H-Stat UCL	0.383

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.155

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	22	Number of Distinct Observations	20
Number of Detects	6	Number of Non-Detects	16
Number of Distinct Detects	6	Number of Distinct Non-Detects	14
Minimum Detect	0.062	Minimum Non-Detect	0.0382
Maximum Detect	0.5	Maximum Non-Detect	1.5
Variance Detects	0.0404	Percent Non-Detects	72.73%
Mean Detects	0.222	SD Detects	0.201
Median Detects	0.114	CV Detects	0.904
Skewness Detects	0.94	Kurtosis Detects	-1.771
Mean of Logged Detects	-1.846	SD of Logged Detects	0.891

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.748	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.356	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.107	KM Standard Error of Mean	0.037
KM SD	0.138	95% KM (BCA) UCL	0.189
95% KM (t) UCL	0.171	95% KM (Percentile Bootstrap) UCL	0.167
95% KM (z) UCL	0.168	95% KM Bootstrap t UCL	0.315
90% KM Chebyshev UCL	0.218	95% KM Chebyshev UCL	0.269
97.5% KM Chebyshev UCL	0.339	99% KM Chebyshev UCL	0.476

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.671	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.707	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.325	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.337	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.606	k star (bias corrected MLE)	0.914
Theta hat (MLE)	0.138	Theta star (bias corrected MLE)	0.243
nu hat (MLE)	19.27	nu star (bias corrected)	10.97
Mean (detects)	0.222		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0703
Maximum	0.5	Median	0.01
SD	0.137	CV	1.95
k hat (MLE)	0.575	k star (bias corrected MLE)	0.527
Theta hat (MLE)	0.122	Theta star (bias corrected MLE)	0.133
nu hat (MLE)	25.3	nu star (bias corrected)	23.19
Adjusted Level of Significance (β)	0.0386		
Approximate Chi Square Value (23.19, α)	13.23	Adjusted Chi Square Value (23.19, β)	12.67
95% Gamma Approximate UCL (use when n>=50)	0.123	95% Gamma Adjusted UCL (use when n<50)	0.129

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.107	SD (KM)	0.138
Variance (KM)	0.0192	SE of Mean (KM)	0.037
k hat (KM)	0.602	k star (KM)	0.55
nu hat (KM)	26.48	nu star (KM)	24.2
theta hat (KM)	0.178	theta star (KM)	0.195
80% gamma percentile (KM)	0.177	90% gamma percentile (KM)	0.285
95% gamma percentile (KM)	0.399	99% gamma percentile (KM)	0.677

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (24.20, α)	14	Adjusted Chi Square Value (24.20, β)	13.42
95% Gamma Approximate KM-UCL (use when n>=50)	0.186	95% Gamma Adjusted KM-UCL (use when n<50)	0.194

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.846	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.277	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0774	Mean in Log Scale	-3.37
SD in Original Scale	0.134	SD in Log Scale	1.145
95% t UCL (assumes normality of ROS data)	0.127	95% Percentile Bootstrap UCL	0.129
95% BCA Bootstrap UCL	0.143	95% Bootstrap t UCL	0.259
95% H-UCL (Log ROS)	0.133		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.679	KM Geo Mean	0.0687
KM SD (logged)	0.801	95% Critical H Value (KM-Log)	2.322
KM Standard Error of Mean (logged)	0.23	95% H-UCL (KM -Log)	0.142
KM SD (logged)	0.801	95% Critical H Value (KM-Log)	2.322
KM Standard Error of Mean (logged)	0.23		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.228	Mean in Log Scale	-2.288
SD in Original Scale	0.275	SD in Log Scale	1.315
95% t UCL (Assumes normality)	0.329	95% H-Stat UCL	0.578

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

ı Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1) 0.194

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	22	Number of Distinct Observations	21
Number of Detects	18	Number of Non-Detects	4
Number of Distinct Detects	17	Number of Distinct Non-Detects	4
Minimum Detect	0.052	Minimum Non-Detect	0.0737
Maximum Detect	0.857	Maximum Non-Detect	0.0781
Variance Detects	0.0317	Percent Non-Detects	18.18%
Mean Detects	0.308	SD Detects	0.178
Median Detects	0.29	CV Detects	0.577
Skewness Detects	1.683	Kurtosis Detects	4.595
Mean of Logged Detects	-1.331	SD of Logged Detects	0.604

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.868	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.897	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.143	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.202	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.262	KM Standard Error of Mean	0.0406
KM SD	0.185	95% KM (BCA) UCL	0.331
95% KM (t) UCL	0.331	95% KM (Percentile Bootstrap) UCL	0.331
95% KM (z) UCL	0.328	95% KM Bootstrap t UCL	0.348
90% KM Chebyshev UCL	0.383	95% KM Chebyshev UCL	0.439
97.5% KM Chebyshev UCL	0.515	99% KM Chebyshev UCL	0.666

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.274	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.745	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.103	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.205	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.393	k star (bias corrected MLE)	2.864
Theta hat (MLE)	0.0909	Theta star (bias corrected MLE)	0.108
nu hat (MLE)	122.1	nu star (bias corrected)	103.1
Mean (detects)	0.308		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0422	Mean	0.26
Maximum	0.857	Median	0.23
SD	0.191	CV	0.737
k hat (MLE)	1.723	k star (bias corrected MLE)	1.519
Theta hat (MLE)	0.151	Theta star (bias corrected MLE)	0.171
nu hat (MLE)	75.83	nu star (bias corrected)	66.82
Adjusted Level of Significance (β)	0.0386		
Approximate Chi Square Value (66.82, α)	49.01	Adjusted Chi Square Value (66.82, β)	47.87
95% Gamma Approximate UCL (use when n>=50)	0.354	95% Gamma Adjusted UCL (use when n<50)	0.363

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.262	SD (KM)	0.185
Variance (KM)	0.0342	SE of Mean (KM)	0.0406
k hat (KM)	2	k star (KM)	1.757
nu hat (KM)	87.98	nu star (KM)	77.32
theta hat (KM)	0.131	theta star (KM)	0.149
80% gamma percentile (KM)	0.398	90% gamma percentile (KM)	0.525
95% gamma percentile (KM)	0.647	99% gamma percentile (KM)	0.92

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (77.32, α)	58.06	Adjusted Chi Square Value (77.32, β)	56.82
95% Gamma Approximate KM-UCL (use when n>=50)	0.348	95% Gamma Adjusted KM-UCL (use when n<50)	0.356

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.944	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.897	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.117	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.202	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.267	Mean in Log Scale	-1.541
SD in Original Scale	0.183	SD in Log Scale	0.709
95% t UCL (assumes normality of ROS data)	0.334	95% Percentile Bootstrap UCL	0.329
95% BCA Bootstrap UCL	0.348	95% Bootstrap t UCL	0.356
95% H-UCL (Log ROS)	0.388		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.627	KM Geo Mean	0.197
KM SD (logged)	0.822	95% Critical H Value (KM-Log)	2.348
KM Standard Error of Mean (logged)	0.18	95% H-UCL (KM -Log)	0.42
KM SD (logged)	0.822	95% Critical H Value (KM-Log)	2.348
KM Standard Error of Mean (logged)	0.18		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.259	Mean in Log Scale	-1.685
SD in Original Scale	0.192	SD in Log Scale	0.94
95% t UCL (Assumes normality)	0.33	95% H-Stat UCL	0.482

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.331

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_PFDA|ug/kg

General Statistics

Total Number of Observations	22	Number of Distinct Observations	17
Number of Detects	9	Number of Non-Detects	13
Number of Distinct Detects	8	Number of Distinct Non-Detects	9
Minimum Detect	0.039	Minimum Non-Detect	0.0737
Maximum Detect	0.214	Maximum Non-Detect	1.5
Variance Detects	0.0038	Percent Non-Detects	59.09%
Mean Detects	0.131	SD Detects	0.0617
Median Detects	0.103	CV Detects	0.471
Skewness Detects	0.00136	Kurtosis Detects	-1.648
Mean of Logged Detects	-2.154	SD of Logged Detects	0.557

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.902	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.236	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0946	KM Standard Error of Mean	0.0174
KM SD	0.0635	95% KM (BCA) UCL	0.138
95% KM (t) UCL	0.125	95% KM (Percentile Bootstrap) UCL	0.13
95% KM (z) UCL	0.123	95% KM Bootstrap t UCL	0.127
90% KM Chebyshev UCL	0.147	95% KM Chebyshev UCL	0.171
97.5% KM Chebyshev UCL	0.203	99% KM Chebyshev UCL	0.268

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.477	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.724	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.251	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.28	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.28	k star (bias corrected MLE)	2.927
Theta hat (MLE)	0.0306	Theta star (bias corrected MLE)	0.0448
nu hat (MLE)	77.03	nu star (bias corrected)	52.69
Mean (detects)	0.131		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0289	Mean	0.0906
Maximum	0.214	Median	0.0817
SD	0.0594	CV	0.656
k hat (MLE)	2.534	k star (bias corrected MLE)	2.219
Theta hat (MLE)	0.0357	Theta star (bias corrected MLE)	0.0408
nu hat (MLE)	111.5	nu star (bias corrected)	97.63
Adjusted Level of Significance (β)	0.0386		
Approximate Chi Square Value (97.63, α)	75.84	Adjusted Chi Square Value (97.63, β)	74.41
95% Gamma Approximate UCL (use when n>=50)	0.117	95% Gamma Adjusted UCL (use when n<50)	0.119

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0946	SD (KM)	0.0635
Variance (KM)	0.00403	SE of Mean (KM)	0.0174
k hat (KM)	2.219	k star (KM)	1.947
nu hat (KM)	97.64	nu star (KM)	85.66
theta hat (KM)	0.0426	theta star (KM)	0.0486
80% gamma percentile (KM)	0.142	90% gamma percentile (KM)	0.185
95% gamma percentile (KM)	0.226	99% gamma percentile (KM)	0.318

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (85.66, α)	65.33	Adjusted Chi Square Value (85.66, β)	64
95% Gamma Approximate KM-UCL (use when n>=50)	0.124	95% Gamma Adjusted KM-UCL (use when n<50)	0.127

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.893	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.232	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0917	Mean in Log Scale	-2.557
SD in Original Scale	0.0565	SD in Log Scale	0.584
95% t UCL (assumes normality of ROS data)	0.112	95% Percentile Bootstrap UCL	0.112
95% BCA Bootstrap UCL	0.113	95% Bootstrap t UCL	0.117
95% H-UCL (Log ROS)	0.12		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.583	KM Geo Mean	0.0755
KM SD (logged)	0.668	95% Critical H Value (KM-Log)	2.168
KM Standard Error of Mean (logged)	0.184	95% H-UCL (KM -Log)	0.13
KM SD (logged)	0.668	95% Critical H Value (KM-Log)	2.168
KM Standard Error of Mean (logged)	0.184		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.264	Mean in Log Scale	-1.92
SD in Original Scale	0.266	SD in Log Scale	1.164
95% t UCL (Assumes normality)	0.362	95% H-Stat UCL	0.59

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.125

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	22	Number of Distinct Observations	22
Number of Detects	6	Number of Non-Detects	16
Number of Distinct Detects	6	Number of Distinct Non-Detects	16
Minimum Detect	0.26	Minimum Non-Detect	0.0382
Maximum Detect	0.57	Maximum Non-Detect	1.1
Variance Detects	0.00998	Percent Non-Detects	72.73%
Mean Detects	0.408	SD Detects	0.0999
Median Detects	0.405	CV Detects	0.245
Skewness Detects	0.284	Kurtosis Detects	1.966
Mean of Logged Detects	-0.922	SD of Logged Detects	0.254

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.935	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.247	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.144	KM Standard Error of Mean	0.0416
KM SD	0.174	95% KM (BCA) UCL	0.214
95% KM (t) UCL	0.216	95% KM (Percentile Bootstrap) UCL	0.211
95% KM (z) UCL	0.212	95% KM Bootstrap t UCL	0.187
90% KM Chebyshev UCL	0.269	95% KM Chebyshev UCL	0.325
97.5% KM Chebyshev UCL	0.404	99% KM Chebyshev UCL	0.558

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.362	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.697	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.24	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	19.42	k star (bias corrected MLE)	9.82
Theta hat (MLE)	0.021	Theta star (bias corrected MLE)	0.0416
nu hat (MLE)	233	nu star (bias corrected)	117.8
Mean (detects)	0.408		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0847	Mean	0.176
Maximum	0.57	Median	0.0847
SD	0.154	CV	0.875
k hat (MLE)	1.918	k star (bias corrected MLE)	1.687
Theta hat (MLE)	0.0919	Theta star (bias corrected MLE)	0.104
nu hat (MLE)	84.4	nu star (bias corrected)	74.23
Adjusted Level of Significance (β)	0.0386		
Approximate Chi Square Value (74.23, α)	55.38	Adjusted Chi Square Value (74.23, β)	54.17
95% Gamma Approximate UCL (use when n>=50)	0.236	95% Gamma Adjusted UCL (use when n<50)	0.242

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.144	SD (KM)	0.174
Variance (KM)	0.0303	SE of Mean (KM)	0.0416
k hat (KM)	0.683	k star (KM)	0.62
nu hat (KM)	30.06	nu star (KM)	27.29
theta hat (KM)	0.211	theta star (KM)	0.232
80% gamma percentile (KM)	0.237	90% gamma percentile (KM)	0.372
95% gamma percentile (KM)	0.512	99% gamma percentile (KM)	0.85

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (27.29, α)	16.38	Adjusted Chi Square Value (27.29, β)	15.75
95% Gamma Approximate KM-UCL (use when n>=50)	0.24	95% Gamma Adjusted KM-UCL (use when n<50)	0.249

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.927	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.261	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.232	Mean in Log Scale	-1.559
SD in Original Scale	0.121	SD in Log Scale	0.421
95% t UCL (assumes normality of ROS data)	0.276	95% Percentile Bootstrap UCL	0.276
95% BCA Bootstrap UCL	0.282	95% Bootstrap t UCL	0.298
95% H-UCL (Log ROS)	0.274		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.595	KM Geo Mean	0.0746
KM SD (logged)	1.066	95% Critical H Value (KM-Log)	2.675
KM Standard Error of Mean (logged)	0.255	95% H-UCL (KM -Log)	0.245
KM SD (logged)	1.066	95% Critical H Value (KM-Log)	2.675
KM Standard Error of Mean (logged)	0.255		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.16	Mean in Log Scale	-2.584
SD in Original Scale	0.196	SD in Log Scale	1.224
95% t UCL (Assumes normality)	0.232	95% H-Stat UCL	0.347

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.216

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_PFOS|ug/kg

General Statistics

Total Number of Observations	22	Number of Distinct Observations	21
Number of Detects	21	Number of Non-Detects	1
Number of Distinct Detects	20	Number of Distinct Non-Detects	1
Minimum Detect	0.133	Minimum Non-Detect	0.0745
Maximum Detect	14	Maximum Non-Detect	0.0745
Variance Detects	20.78	Percent Non-Detects	4.545%
Mean Detects	4.075	SD Detects	4.558
Median Detects	2.7	CV Detects	1.119
Skewness Detects	1.288	Kurtosis Detects	0.501
Mean of Logged Detects	0.629	SD of Logged Detects	1.436

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.797	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.908	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.194	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.188	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	3.893	KM Standard Error of Mean	0.967
KM SD	4.425	95% KM (BCA) UCL	5.556
95% KM (t) UCL	5.556	95% KM (Percentile Bootstrap) UCL	5.553
95% KM (z) UCL	5.483	95% KM Bootstrap t UCL	6.005
90% KM Chebyshev UCL	6.793	95% KM Chebyshev UCL	8.107
97.5% KM Chebyshev UCL	9.93	99% KM Chebyshev UCL	13.51

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.384	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.782	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.122	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.197	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.769	k star (bias corrected MLE)	0.691
Theta hat (MLE)	5.3	Theta star (bias corrected MLE)	5.899
nu hat (MLE)	32.29	nu star (bias corrected)	29.01
Mean (detects)	4.075		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	3.89
Maximum	14	Median	2.5
SD	4.532	CV	1.165
k hat (MLE)	0.634	k star (bias corrected MLE)	0.577
Theta hat (MLE)	6.14	Theta star (bias corrected MLE)	6.736
nu hat (MLE)	27.88	nu star (bias corrected)	25.41
Adjusted Level of Significance (β)	0.0386		
Approximate Chi Square Value (25.41, α)	14.92	Adjusted Chi Square Value (25.41, β)	14.33
95% Gamma Approximate UCL (use when n>=50)	6.623	95% Gamma Adjusted UCL (use when n<50)	6.9

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	3.893	SD (KM)	4.425
Variance (KM)	19.58	SE of Mean (KM)	0.967
k hat (KM)	0.774	k star (KM)	0.699
nu hat (KM)	34.05	nu star (KM)	30.74
theta hat (KM)	5.03	theta star (KM)	5.572
80% gamma percentile (KM)	6.4	90% gamma percentile (KM)	9.776
95% gamma percentile (KM)	13.26	99% gamma percentile (KM)	21.58

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (30.74, α)	19.08	Adjusted Chi Square Value (30.74, β)	18.39
95% Gamma Approximate KM-UCL (use when n>=50)	6.273	95% Gamma Adjusted KM-UCL (use when n<50)	6.507

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.947	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.908	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.128	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.188	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	3.892	Mean in Log Scale	0.468
SD in Original Scale	4.53	SD in Log Scale	1.591
95% t UCL (assumes normality of ROS data)	5.554	95% Percentile Bootstrap UCL	5.538
95% BCA Bootstrap UCL	5.956	95% Bootstrap t UCL	6.133
95% H-UCL (Log ROS)	19.03		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.482	KM Geo Mean	1.62
KM SD (logged)	1.525	95% Critical H Value (KM-Log)	3.383
KM Standard Error of Mean (logged)	0.333	95% H-UCL (KM -Log)	15.96
KM SD (logged)	1.525	95% Critical H Value (KM-Log)	3.383
KM Standard Error of Mean (logged)	0.333		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	3.891	Mean in Log Scale	0.451
SD in Original Scale	4.531	SD in Log Scale	1.631
95% t UCL (Assumes normality)	5.553	95% H-Stat UCL	21.06

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

ProUCL Output
Raleigh Creek - Other
Surface Sediment

Suggested UCL to Use

Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1) 6.507

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_PFDS|ug/kg

General Statistics

Total Number of Observations	22	Number of Distinct Observations	17
Number of Detects	6	Number of Non-Detects	16
Number of Distinct Detects	5	Number of Distinct Non-Detects	12
Minimum Detect	0.103	Minimum Non-Detect	0.0382
Maximum Detect	0.15	Maximum Non-Detect	1.5
Variance Detects	3.2187E-4	Percent Non-Detects	72.73%
Mean Detects	0.131	SD Detects	0.0179
Median Detects	0.132	CV Detects	0.137
Skewness Detects	-0.563	Kurtosis Detects	-0.178
Mean of Logged Detects	-2.038	SD of Logged Detects	0.142

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.923	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.184	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0755	KM Standard Error of Mean	0.0132
KM SD	0.0468	95% KM (BCA) UCL	0.107
95% KM (t) UCL	0.0982	95% KM (Percentile Bootstrap) UCL	0.104
95% KM (z) UCL	0.0972	95% KM Bootstrap t UCL	0.0904
90% KM Chebyshev UCL	0.115	95% KM Chebyshev UCL	0.133
97.5% KM Chebyshev UCL	0.158	99% KM Chebyshev UCL	0.207

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.32	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.697	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.199	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	61.27	k star (bias corrected MLE)	30.75
Theta hat (MLE)	0.00214	Theta star (bias corrected MLE)	0.00427
nu hat (MLE)	735.3	nu star (bias corrected)	369
Mean (detects)	0.131		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0694	Mean	0.0998
Maximum	0.15	Median	0.0861
SD	0.0254	CV	0.254
k hat (MLE)	17.59	k star (bias corrected MLE)	15.22
Theta hat (MLE)	0.00567	Theta star (bias corrected MLE)	0.00656
nu hat (MLE)	774.1	nu star (bias corrected)	669.9
Adjusted Level of Significance (β)	0.0386		
Approximate Chi Square Value (669.86, α)	610.8	Adjusted Chi Square Value (669.86, β)	606.6
95% Gamma Approximate UCL (use when n>=50)	0.109	95% Gamma Adjusted UCL (use when n<50)	0.11

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0755	SD (KM)	0.0468
Variance (KM)	0.00219	SE of Mean (KM)	0.0132
k hat (KM)	2.601	k star (KM)	2.276
nu hat (KM)	114.4	nu star (KM)	100.2
theta hat (KM)	0.029	theta star (KM)	0.0331
80% gamma percentile (KM)	0.111	90% gamma percentile (KM)	0.142
95% gamma percentile (KM)	0.172	99% gamma percentile (KM)	0.237

ProUCL Output
Raleigh Creek - Other
Surface Sediment

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (100.16, α)	78.07	Adjusted Chi Square Value (100.16, β)	76.62
95% Gamma Approximate KM-UCL (use when n>=50)	0.0968	95% Gamma Adjusted KM-UCL (use when n<50)	0.0986

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.912	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.183	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.103	Mean in Log Scale	-2.299
SD in Original Scale	0.023	SD in Log Scale	0.211
95% t UCL (assumes normality of ROS data)	0.111	95% Percentile Bootstrap UCL	0.111
95% BCA Bootstrap UCL	0.112	95% Bootstrap t UCL	0.113
95% H-UCL (Log ROS)	0.111		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.774	KM Geo Mean	0.0624
KM SD (logged)	0.607	95% Critical H Value (KM-Log)	2.102
KM Standard Error of Mean (logged)	0.172	95% H-UCL (KM -Log)	0.0991
KM SD (logged)	0.607	95% Critical H Value (KM-Log)	2.102
KM Standard Error of Mean (logged)	0.172		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.25	Mean in Log Scale	-2.1
SD in Original Scale	0.273	SD in Log Scale	1.288
95% t UCL (Assumes normality)	0.35	95% H-Stat UCL	0.653

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.0982

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_PFOSA|ug/kg

General Statistics

Total Number of Observations	22	Number of Distinct Observations	22
Number of Detects	15	Number of Non-Detects	7
Number of Distinct Detects	15	Number of Distinct Non-Detects	7
Minimum Detect	0.065	Minimum Non-Detect	0.0737
Maximum Detect	0.557	Maximum Non-Detect	1.4
Variance Detects	0.0248	Percent Non-Detects	31.82%
Mean Detects	0.253	SD Detects	0.158
Median Detects	0.19	CV Detects	0.624
Skewness Detects	0.756	Kurtosis Detects	-0.859
Mean of Logged Detects	-1.565	SD of Logged Detects	0.65

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.872	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.881	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.273	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.22	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.206	KM Standard Error of Mean	0.0358
KM SD	0.155	95% KM (BCA) UCL	0.271
95% KM (t) UCL	0.267	95% KM (Percentile Bootstrap) UCL	0.266
95% KM (z) UCL	0.265	95% KM Bootstrap t UCL	0.28
90% KM Chebyshev UCL	0.313	95% KM Chebyshev UCL	0.362
97.5% KM Chebyshev UCL	0.43	99% KM Chebyshev UCL	0.562

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.544	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.745	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.205	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.223	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.807	k star (bias corrected MLE)	2.29
Theta hat (MLE)	0.09	Theta star (bias corrected MLE)	0.11
nu hat (MLE)	84.2	nu star (bias corrected)	68.69
Mean (detects)	0.253		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0149	Mean	0.19
Maximum	0.557	Median	0.162
SD	0.163	CV	0.858
k hat (MLE)	1.081	k star (bias corrected MLE)	0.964
Theta hat (MLE)	0.176	Theta star (bias corrected MLE)	0.198
nu hat (MLE)	47.57	nu star (bias corrected)	42.42
Adjusted Level of Significance (β)	0.0386		
Approximate Chi Square Value (42.42, α)	28.48	Adjusted Chi Square Value (42.42, β)	27.63
95% Gamma Approximate UCL (use when n>=50)	0.284	95% Gamma Adjusted UCL (use when n<50)	0.292

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.206	SD (KM)	0.155
Variance (KM)	0.024	SE of Mean (KM)	0.0358
k hat (KM)	1.764	k star (KM)	1.554
nu hat (KM)	77.61	nu star (KM)	68.36
theta hat (KM)	0.117	theta star (KM)	0.132
80% gamma percentile (KM)	0.317	90% gamma percentile (KM)	0.425
95% gamma percentile (KM)	0.53	99% gamma percentile (KM)	0.765

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (68.36, α)	50.33	Adjusted Chi Square Value (68.36, β)	49.18
95% Gamma Approximate KM-UCL (use when n>=50)	0.279	95% Gamma Adjusted KM-UCL (use when n<50)	0.286

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.94	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.165	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.2	Mean in Log Scale	-1.876
SD in Original Scale	0.153	SD in Log Scale	0.746
95% t UCL (assumes normality of ROS data)	0.256	95% Percentile Bootstrap UCL	0.253
95% BCA Bootstrap UCL	0.261	95% Bootstrap t UCL	0.27
95% H-UCL (Log ROS)	0.292		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.857	KM Geo Mean	0.156
KM SD (logged)	0.743	95% Critical H Value (KM-Log)	2.252
KM Standard Error of Mean (logged)	0.172	95% H-UCL (KM -Log)	0.296
KM SD (logged)	0.743	95% Critical H Value (KM-Log)	2.252
KM Standard Error of Mean (logged)	0.172		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.238	Mean in Log Scale	-1.852
SD in Original Scale	0.203	SD in Log Scale	0.999
95% t UCL (Assumes normality)	0.312	95% H-Stat UCL	0.453

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	0.286	95% GROS Adjusted Gamma UCL	0.292

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	22	Number of Distinct Observations	18
Number of Detects	12	Number of Non-Detects	10
Number of Distinct Detects	11	Number of Distinct Non-Detects	8
Minimum Detect	0.09	Minimum Non-Detect	0.0382
Maximum Detect	1.4	Maximum Non-Detect	1.4
Variance Detects	0.168	Percent Non-Detects	45.45%
Mean Detects	0.408	SD Detects	0.41
Median Detects	0.185	CV Detects	1.004
Skewness Detects	1.464	Kurtosis Detects	1.876
Mean of Logged Detects	-1.344	SD of Logged Detects	0.986

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.795	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.258	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.273	KM Standard Error of Mean	0.0819
KM SD	0.348	95% KM (BCA) UCL	0.417
95% KM (t) UCL	0.414	95% KM (Percentile Bootstrap) UCL	0.406
95% KM (z) UCL	0.408	95% KM Bootstrap t UCL	0.455
90% KM Chebyshev UCL	0.519	95% KM Chebyshev UCL	0.63
97.5% KM Chebyshev UCL	0.785	99% KM Chebyshev UCL	1.088

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.731	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.751	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.245	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.251	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.254	k star (bias corrected MLE)	0.996
Theta hat (MLE)	0.326	Theta star (bias corrected MLE)	0.41
nu hat (MLE)	30.11	nu star (bias corrected)	23.91
Mean (detects)	0.408		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.25
Maximum	1.4	Median	0.096
SD	0.353	CV	1.414
k hat (MLE)	0.574	k star (bias corrected MLE)	0.526
Theta hat (MLE)	0.435	Theta star (bias corrected MLE)	0.475
nu hat (MLE)	25.25	nu star (bias corrected)	23.14
Adjusted Level of Significance (β)	0.0386		
Approximate Chi Square Value (23.14, α)	13.2	Adjusted Chi Square Value (23.14, β)	12.64
95% Gamma Approximate UCL (use when n>=50)	0.438	95% Gamma Adjusted UCL (use when n<50)	0.457

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.273	SD (KM)	0.348
Variance (KM)	0.121	SE of Mean (KM)	0.0819
k hat (KM)	0.616	k star (KM)	0.562
nu hat (KM)	27.09	nu star (KM)	24.73
theta hat (KM)	0.444	theta star (KM)	0.486
80% gamma percentile (KM)	0.45	90% gamma percentile (KM)	0.721
95% gamma percentile (KM)	1.006	99% gamma percentile (KM)	1.7

ProUCL Output
Raleigh Creek - Other
Surface Sediment

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (24.73, α)	14.4	Adjusted Chi Square Value (24.73, β)	13.82
95% Gamma Approximate KM-UCL (use when n>=50)	0.469	95% Gamma Adjusted KM-UCL (use when n<50)	0.489

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.878	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.219	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.255	Mean in Log Scale	-2.093
SD in Original Scale	0.347	SD in Log Scale	1.217
95% t UCL (assumes normality of ROS data)	0.382	95% Percentile Bootstrap UCL	0.379
95% BCA Bootstrap UCL	0.405	95% Bootstrap t UCL	0.461
95% H-UCL (Log ROS)	0.558		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.009	KM Geo Mean	0.134
KM SD (logged)	1.171	95% Critical H Value (KM-Log)	2.828
KM Standard Error of Mean (logged)	0.284	95% H-UCL (KM -Log)	0.548
KM SD (logged)	1.171	95% Critical H Value (KM-Log)	2.828
KM Standard Error of Mean (logged)	0.284		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.338	Mean in Log Scale	-1.782
SD in Original Scale	0.361	SD in Log Scale	1.332
95% t UCL (Assumes normality)	0.471	95% H-Stat UCL	1

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

ı Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1) 0.489

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
West Lakeland
Surface Sediment

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.13/5/2021 2:45:40 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Conc_PFBA|ug/kg

General Statistics

Total Number of Observations	31	Number of Distinct Observations	25
Number of Detects	8	Number of Non-Detects	23
Number of Distinct Detects	8	Number of Distinct Non-Detects	17
Minimum Detect	0.171	Minimum Non-Detect	0.266
Maximum Detect	0.958	Maximum Non-Detect	1.3
Variance Detects	0.0618	Percent Non-Detects	74.19%
Mean Detects	0.503	SD Detects	0.249
Median Detects	0.457	CV Detects	0.494
Skewness Detects	0.773	Kurtosis Detects	0.42
Mean of Logged Detects	-0.801	SD of Logged Detects	0.528

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.947	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.191	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.292	KM Standard Error of Mean	0.0484
KM SD	0.213	95% KM (BCA) UCL	0.435
95% KM (t) UCL	0.374	95% KM (Percentile Bootstrap) UCL	0.412
95% KM (z) UCL	0.371	95% KM Bootstrap t UCL	0.388
90% KM Chebyshev UCL	0.437	95% KM Chebyshev UCL	0.503
97.5% KM Chebyshev UCL	0.594	99% KM Chebyshev UCL	0.774

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.206	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.719	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.145	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.295	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.553	k star (bias corrected MLE)	2.929
Theta hat (MLE)	0.11	Theta star (bias corrected MLE)	0.172
nu hat (MLE)	72.84	nu star (bias corrected)	46.86
Mean (detects)	0.503		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.217
Maximum	0.958	Median	0.0654
SD	0.231	CV	1.068
k hat (MLE)	0.978	k star (bias corrected MLE)	0.905
Theta hat (MLE)	0.221	Theta star (bias corrected MLE)	0.239
nu hat (MLE)	60.63	nu star (bias corrected)	56.09
Adjusted Level of Significance (β)	0.0413		
Approximate Chi Square Value (56.09, α)	39.88	Adjusted Chi Square Value (56.09, β)	39.12
95% Gamma Approximate UCL (use when n>=50)	0.305	95% Gamma Adjusted UCL (use when n<50)	0.31

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.292	SD (KM)	0.213
Variance (KM)	0.0452	SE of Mean (KM)	0.0484
k hat (KM)	1.884	k star (KM)	1.723
nu hat (KM)	116.8	nu star (KM)	106.8
theta hat (KM)	0.155	theta star (KM)	0.169
80% gamma percentile (KM)	0.444	90% gamma percentile (KM)	0.588
95% gamma percentile (KM)	0.726	99% gamma percentile (KM)	1.035

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (106.83, α)	83.98	Adjusted Chi Square Value (106.83, β)	82.85
95% Gamma Approximate KM-UCL (use when n>=50)	0.371	95% Gamma Adjusted KM-UCL (use when n<50)	0.376

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.966	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.178	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.27	Mean in Log Scale	-1.482
SD in Original Scale	0.194	SD in Log Scale	0.552
95% t UCL (assumes normality of ROS data)	0.329	95% Percentile Bootstrap UCL	0.332
95% BCA Bootstrap UCL	0.349	95% Bootstrap t UCL	0.36
95% H-UCL (Log ROS)	0.322		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.415	KM Geo Mean	0.243
KM SD (logged)	0.551	95% Critical H Value (KM-Log)	1.969
KM Standard Error of Mean (logged)	0.126	95% H-UCL (KM -Log)	0.345
KM SD (logged)	0.551	95% Critical H Value (KM-Log)	1.969
KM Standard Error of Mean (logged)	0.126		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.368	Mean in Log Scale	-1.219
SD in Original Scale	0.238	SD in Log Scale	0.687
95% t UCL (Assumes normality)	0.441	95% H-Stat UCL	0.486

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.374

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_PFPeA|ug/kg

General Statistics

Total Number of Observations	31	Number of Distinct Observations	25
Number of Detects	4	Number of Non-Detects	27
Number of Distinct Detects	4	Number of Distinct Non-Detects	21
Minimum Detect	0.24	Minimum Non-Detect	0.0509
Maximum Detect	0.32	Maximum Non-Detect	1.3
Variance Detects	0.00109	Percent Non-Detects	87.1%
Mean Detects	0.283	SD Detects	0.033
Median Detects	0.285	CV Detects	0.117
Skewness Detects	-0.437	Kurtosis Detects	1.166
Mean of Logged Detects	-1.269	SD of Logged Detects	0.119

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.98	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.22	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.088	KM Standard Error of Mean	0.0198
KM SD	0.0857	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.122	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.121	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.147	95% KM Chebyshev UCL	0.174
97.5% KM Chebyshev UCL	0.212	99% KM Chebyshev UCL	0.285

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.251	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.656	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.229	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	95.03	k star (bias corrected MLE)	23.92
Theta hat (MLE)	0.00297	Theta star (bias corrected MLE)	0.0118
nu hat (MLE)	760.2	nu star (bias corrected)	191.4
Mean (detects)	0.283		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0685	Mean	0.147
Maximum	0.32	Median	0.123
SD	0.0599	CV	0.408
k hat (MLE)	7.859	k star (bias corrected MLE)	7.12
Theta hat (MLE)	0.0187	Theta star (bias corrected MLE)	0.0206
nu hat (MLE)	487.2	nu star (bias corrected)	441.4
Adjusted Level of Significance (β)	0.0413		
Approximate Chi Square Value (441.41, α)	393.7	Adjusted Chi Square Value (441.41, β)	391.2
95% Gamma Approximate UCL (use when n>=50)	0.164	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.088	SD (KM)	0.0857
Variance (KM)	0.00734	SE of Mean (KM)	0.0198
k hat (KM)	1.054	k star (KM)	0.973
nu hat (KM)	65.35	nu star (KM)	60.36
theta hat (KM)	0.0835	theta star (KM)	0.0904
80% gamma percentile (KM)	0.142	90% gamma percentile (KM)	0.204
95% gamma percentile (KM)	0.266	99% gamma percentile (KM)	0.411

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (60.36, α)	43.49	Adjusted Chi Square Value (60.36, β)	42.69
95% Gamma Approximate KM-UCL (use when n>=50)	0.122	95% Gamma Adjusted KM-UCL (use when n<50)	0.124

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.969	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.238	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.173	Mean in Log Scale	-1.783
SD in Original Scale	0.047	SD in Log Scale	0.228
95% t UCL (assumes normality of ROS data)	0.187	95% Percentile Bootstrap UCL	0.187
95% BCA Bootstrap UCL	0.19	95% Bootstrap t UCL	0.194
95% H-UCL (Log ROS)	0.186		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.705	KM Geo Mean	0.0669
KM SD (logged)	0.628	95% Critical H Value (KM-Log)	2.035
KM Standard Error of Mean (logged)	0.145	95% H-UCL (KM -Log)	0.103
KM SD (logged)	0.628	95% Critical H Value (KM-Log)	2.035
KM Standard Error of Mean (logged)	0.145		

ProUCL Output
West Lakeland
Surface Sediment

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.194	Mean in Log Scale	-2.091
SD in Original Scale	0.2	SD in Log Scale	0.932
95% t UCL (Assumes normality)	0.255	95% H-Stat UCL	0.284

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.122

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_PFOA|ug/kg

General Statistics

Total Number of Observations	31	Number of Distinct Observations	29
Number of Detects	23	Number of Non-Detects	8
Number of Distinct Detects	21	Number of Distinct Non-Detects	8
Minimum Detect	0.053	Minimum Non-Detect	0.0689
Maximum Detect	0.47	Maximum Non-Detect	0.0835
Variance Detects	0.0138	Percent Non-Detects	25.81%
Mean Detects	0.241	SD Detects	0.118
Median Detects	0.26	CV Detects	0.488
Skewness Detects	0.228	Kurtosis Detects	-0.649
Mean of Logged Detects	-1.564	SD of Logged Detects	0.585

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.964	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.914	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.116	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.18	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.193	KM Standard Error of Mean	0.0236
KM SD	0.129	95% KM (BCA) UCL	0.234
95% KM (t) UCL	0.233	95% KM (Percentile Bootstrap) UCL	0.232
95% KM (z) UCL	0.232	95% KM Bootstrap t UCL	0.234
90% KM Chebyshev UCL	0.264	95% KM Chebyshev UCL	0.296
97.5% KM Chebyshev UCL	0.34	99% KM Chebyshev UCL	0.428

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.415	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.749	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.147	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.182	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.685	k star (bias corrected MLE)	3.233
Theta hat (MLE)	0.0654	Theta star (bias corrected MLE)	0.0746
nu hat (MLE)	169.5	nu star (bias corrected)	148.7
Mean (detects)	0.241		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0527	Mean	0.193
Maximum	0.47	Median	0.19
SD	0.131	CV	0.679
k hat (MLE)	2.004	k star (bias corrected MLE)	1.832
Theta hat (MLE)	0.0961	Theta star (bias corrected MLE)	0.105
nu hat (MLE)	124.3	nu star (bias corrected)	113.6
Adjusted Level of Significance (β)	0.0413		
Approximate Chi Square Value (113.57, α)	89.97	Adjusted Chi Square Value (113.57, β)	88.81
95% Gamma Approximate UCL (use when n>=50)	0.243	95% Gamma Adjusted UCL (use when n<50)	0.246

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.193	SD (KM)	0.129
Variance (KM)	0.0166	SE of Mean (KM)	0.0236
k hat (KM)	2.241	k star (KM)	2.045
nu hat (KM)	138.9	nu star (KM)	126.8
theta hat (KM)	0.086	theta star (KM)	0.0942
80% gamma percentile (KM)	0.288	90% gamma percentile (KM)	0.373
95% gamma percentile (KM)	0.454	99% gamma percentile (KM)	0.633

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (126.81, α)	101.8	Adjusted Chi Square Value (126.81, β)	100.6
95% Gamma Approximate KM-UCL (use when n>=50)	0.24	95% Gamma Adjusted KM-UCL (use when n<50)	0.243

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.935	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.914	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.167	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.18	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.196	Mean in Log Scale	-1.858
SD in Original Scale	0.127	SD in Log Scale	0.712
95% t UCL (assumes normality of ROS data)	0.235	95% Percentile Bootstrap UCL	0.234
95% BCA Bootstrap UCL	0.235	95% Bootstrap t UCL	0.238
95% H-UCL (Log ROS)	0.265		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.917	KM Geo Mean	0.147
KM SD (logged)	0.776	95% Critical H Value (KM-Log)	2.177
KM Standard Error of Mean (logged)	0.143	95% H-UCL (KM -Log)	0.27
KM SD (logged)	0.776	95% Critical H Value (KM-Log)	2.177
KM Standard Error of Mean (logged)	0.143		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.189	Mean in Log Scale	-2.008
SD in Original Scale	0.135	SD in Log Scale	0.915
95% t UCL (Assumes normality)	0.23	95% H-Stat UCL	0.301

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.233

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	31	Number of Distinct Observations	30
Number of Detects	10	Number of Non-Detects	21
Number of Distinct Detects	9	Number of Distinct Non-Detects	21
Minimum Detect	0.23	Minimum Non-Detect	0.0254
Maximum Detect	0.54	Maximum Non-Detect	0.118
Variance Detects	0.0104	Percent Non-Detects	67.74%
Mean Detects	0.352	SD Detects	0.102
Median Detects	0.345	CV Detects	0.29
Skewness Detects	0.594	Kurtosis Detects	-0.274
Mean of Logged Detects	-1.081	SD of Logged Detects	0.287

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.939	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.155	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.131	KM Standard Error of Mean	0.0307
KM SD	0.162	95% KM (BCA) UCL	0.198
95% KM (t) UCL	0.183	95% KM (Percentile Bootstrap) UCL	0.188
95% KM (z) UCL	0.181	95% KM Bootstrap t UCL	0.186
90% KM Chebyshev UCL	0.223	95% KM Chebyshev UCL	0.265
97.5% KM Chebyshev UCL	0.323	99% KM Chebyshev UCL	0.436

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.234	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.118	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	13.62	k star (bias corrected MLE)	9.599
Theta hat (MLE)	0.0258	Theta star (bias corrected MLE)	0.0367
nu hat (MLE)	272.4	nu star (bias corrected)	192
Mean (detects)	0.352		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0498	Mean	0.147
Maximum	0.54	Median	0.0498
SD	0.154	CV	1.047
k hat (MLE)	1.213	k star (bias corrected MLE)	1.117
Theta hat (MLE)	0.121	Theta star (bias corrected MLE)	0.132
nu hat (MLE)	75.18	nu star (bias corrected)	69.24
Adjusted Level of Significance (β)	0.0413		
Approximate Chi Square Value (69.24, α)	51.09	Adjusted Chi Square Value (69.24, β)	50.22
95% Gamma Approximate UCL (use when n>=50)	0.2	95% Gamma Adjusted UCL (use when n<50)	0.203

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.131	SD (KM)	0.162
Variance (KM)	0.0263	SE of Mean (KM)	0.0307
k hat (KM)	0.649	k star (KM)	0.608
nu hat (KM)	40.26	nu star (KM)	37.7
theta hat (KM)	0.201	theta star (KM)	0.215
80% gamma percentile (KM)	0.216	90% gamma percentile (KM)	0.339
95% gamma percentile (KM)	0.468	99% gamma percentile (KM)	0.78

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (37.70, α)	24.64	Adjusted Chi Square Value (37.70, β)	24.05
95% Gamma Approximate KM-UCL (use when n>=50)	0.2	95% Gamma Adjusted KM-UCL (use when n<50)	0.205

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.954	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.119	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.201	Mean in Log Scale	-1.733
SD in Original Scale	0.119	SD in Log Scale	0.483
95% t UCL (assumes normality of ROS data)	0.238	95% Percentile Bootstrap UCL	0.236
95% BCA Bootstrap UCL	0.249	95% Bootstrap t UCL	0.247
95% H-UCL (Log ROS)	0.235		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.837	KM Geo Mean	0.0586
KM SD (logged)	1.221	95% Critical H Value (KM-Log)	2.699
KM Standard Error of Mean (logged)	0.231	95% H-UCL (KM -Log)	0.226
KM SD (logged)	1.221	95% Critical H Value (KM-Log)	2.699
KM Standard Error of Mean (logged)	0.231		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.138	Mean in Log Scale	-2.635
SD in Original Scale	0.161	SD in Log Scale	1.133
95% t UCL (Assumes normality)	0.187	95% H-Stat UCL	0.233

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.183

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_PFOS|ug/kg

General Statistics

Total Number of Observations	31	Number of Distinct Observations	30
		Number of Missing Observations	0
Minimum	0.287	Mean	2.073
Maximum	8.59	Median	1.3
SD	1.835	Std. Error of Mean	0.33
Coefficient of Variation	0.885	Skewness	2.108

Normal GOF Test

Shapiro Wilk Test Statistic	0.769	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.929	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.204	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.156	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2.633	95% Adjusted-CLT UCL (Chen-1995)	2.749
		95% Modified-t UCL (Johnson-1978)	2.653

Gamma GOF Test

A-D Test Statistic	0.701	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.76	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.147	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.16	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.853	k star (bias corrected MLE)	1.695
Theta hat (MLE)	1.119	Theta star (bias corrected MLE)	1.223
nu hat (MLE)	114.9	nu star (bias corrected)	105.1
MLE Mean (bias corrected)	2.073	MLE Sd (bias corrected)	1.592
		Approximate Chi Square Value (0.05)	82.45
Adjusted Level of Significance	0.0413	Adjusted Chi Square Value	81.34

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	2.643	95% Adjusted Gamma UCL (use when n<50)	2.679

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.982	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.929	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.106	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.156	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.248	Mean of logged Data	0.436
Maximum of Logged Data	2.151	SD of logged Data	0.763

Assuming Lognormal Distribution

95% H-UCL	2.794	90% Chebyshev (MVUE) UCL	2.963
95% Chebyshev (MVUE) UCL	3.38	97.5% Chebyshev (MVUE) UCL	3.959
99% Chebyshev (MVUE) UCL	5.095		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2.615	95% Jackknife UCL	2.633
95% Standard Bootstrap UCL	2.616	95% Bootstrap-t UCL	2.838
95% Hall's Bootstrap UCL	2.938	95% Percentile Bootstrap UCL	2.634
95% BCA Bootstrap UCL	2.76		
90% Chebyshev(Mean, Sd) UCL	3.062	95% Chebyshev(Mean, Sd) UCL	3.51
97.5% Chebyshev(Mean, Sd) UCL	4.131	99% Chebyshev(Mean, Sd) UCL	5.352

Suggested UCL to Use

95% Adjusted Gamma UCL 2.679

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_N-EtFOSAA|ug/kg

General Statistics

Total Number of Observations	31	Number of Distinct Observations	26
Number of Detects	4	Number of Non-Detects	27
Number of Distinct Detects	4	Number of Distinct Non-Detects	22
Minimum Detect	0.081	Minimum Non-Detect	0.0254
Maximum Detect	0.6	Maximum Non-Detect	1.3
Variance Detects	0.0841	Percent Non-Detects	87.1%
Mean Detects	0.344	SD Detects	0.29
Median Detects	0.348	CV Detects	0.843
Skewness Detects	-0.0049	Kurtosis Detects	-5.96
Mean of Logged Detects	-1.451	SD of Logged Detects	1.082

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.76	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.302	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0822	KM Standard Error of Mean	0.0385
KM SD	0.16	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.148	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.146	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.198	95% KM Chebyshev UCL	0.25
97.5% KM Chebyshev UCL	0.323	99% KM Chebyshev UCL	0.466

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.617	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.663	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.336	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.4	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.445	k star (bias corrected MLE)	0.528
Theta hat (MLE)	0.238	Theta star (bias corrected MLE)	0.652
nu hat (MLE)	11.56	nu star (bias corrected)	4.224
Mean (detects)	0.344		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0531
Maximum	0.6	Median	0.01
SD	0.146	CV	2.753
k hat (MLE)	0.503	k star (bias corrected MLE)	0.476
Theta hat (MLE)	0.106	Theta star (bias corrected MLE)	0.112
nu hat (MLE)	31.17	nu star (bias corrected)	29.48
Adjusted Level of Significance (β)	0.0413		
Approximate Chi Square Value (29.48, α)	18.09	Adjusted Chi Square Value (29.48, β)	17.59
95% Gamma Approximate UCL (use when n>=50)	0.0866	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0822	SD (KM)	0.16
Variance (KM)	0.0255	SE of Mean (KM)	0.0385
k hat (KM)	0.265	k star (KM)	0.261
nu hat (KM)	16.43	nu star (KM)	16.17
theta hat (KM)	0.31	theta star (KM)	0.315
80% gamma percentile (KM)	0.121	90% gamma percentile (KM)	0.246
95% gamma percentile (KM)	0.393	99% gamma percentile (KM)	0.782

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (16.17, α)	8.083	Adjusted Chi Square Value (16.17, β)	7.766
95% Gamma Approximate KM-UCL (use when n>=50)	0.164	95% Gamma Adjusted KM-UCL (use when n<50)	0.171

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.79	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.303	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0508	Mean in Log Scale	-4.88
SD in Original Scale	0.147	SD in Log Scale	1.583
95% t UCL (assumes normality of ROS data)	0.0957	95% Percentile Bootstrap UCL	0.0956
95% BCA Bootstrap UCL	0.123	95% Bootstrap t UCL	0.305
95% H-UCL (Log ROS)	0.067		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-3.26	KM Geo Mean	0.0384
KM SD (logged)	0.935	95% Critical H Value (KM-Log)	2.349
KM Standard Error of Mean (logged)	0.23	95% H-UCL (KM -Log)	0.0888
KM SD (logged)	0.935	95% Critical H Value (KM-Log)	2.349
KM Standard Error of Mean (logged)	0.23		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.22	Mean in Log Scale	-2.315
SD in Original Scale	0.257	SD in Log Scale	1.307
95% t UCL (Assumes normality)	0.299	95% H-Stat UCL	0.454

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.148

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
West Lakeland
Surface Sediment

6:2 FTS|ug/kg

General Statistics

Total Number of Observations	31	Number of Distinct Observations	25
Number of Detects	4	Number of Non-Detects	27
Number of Distinct Detects	4	Number of Distinct Non-Detects	21
Minimum Detect	0.201	Minimum Non-Detect	0.0917
Maximum Detect	2.24	Maximum Non-Detect	1.3
Variance Detects	0.762	Percent Non-Detects	87.1%
Mean Detects	1.095	SD Detects	0.873
Median Detects	0.97	CV Detects	0.797
Skewness Detects	0.727	Kurtosis Detects	0.157
Mean of Logged Detects	-0.235	SD of Logged Detects	1.029

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.973	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.184	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.263	KM Standard Error of Mean	0.0968
KM SD	0.433	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.427	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.422	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.553	95% KM Chebyshev UCL	0.685
97.5% KM Chebyshev UCL	0.867	99% KM Chebyshev UCL	1.226

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.199	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.662	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.175	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.399	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.682	k star (bias corrected MLE)	0.587
Theta hat (MLE)	0.651	Theta star (bias corrected MLE)	1.866
nu hat (MLE)	13.45	nu star (bias corrected)	4.697
Mean (detects)	1.095		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.151
Maximum	2.24	Median	0.01
SD	0.461	CV	3.062
k hat (MLE)	0.322	k star (bias corrected MLE)	0.313
Theta hat (MLE)	0.467	Theta star (bias corrected MLE)	0.482
nu hat (MLE)	19.99	nu star (bias corrected)	19.39
Adjusted Level of Significance (β)	0.0413		
Approximate Chi Square Value (19.39, α)	10.4	Adjusted Chi Square Value (19.39, β)	10.03
95% Gamma Approximate UCL (use when n>=50)	0.281	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.263	SD (KM)	0.433
Variance (KM)	0.188	SE of Mean (KM)	0.0968
k hat (KM)	0.368	k star (KM)	0.354
nu hat (KM)	22.81	nu star (KM)	21.94
theta hat (KM)	0.714	theta star (KM)	0.743
80% gamma percentile (KM)	0.417	90% gamma percentile (KM)	0.757
95% gamma percentile (KM)	1.138	99% gamma percentile (KM)	2.109

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (21.94, α)	12.29	Adjusted Chi Square Value (21.94, β)	11.89
95% Gamma Approximate KM-UCL (use when n>=50)	0.469	95% Gamma Adjusted KM-UCL (use when n<50)	0.485

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.967	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.203	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.201	Mean in Log Scale	-2.487
SD in Original Scale	0.447	SD in Log Scale	1.054
95% t UCL (assumes normality of ROS data)	0.337	95% Percentile Bootstrap UCL	0.358
95% BCA Bootstrap UCL	0.404	95% Bootstrap t UCL	0.629
95% H-UCL (Log ROS)	0.234		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.867	KM Geo Mean	0.155
KM SD (logged)	0.821	95% Critical H Value (KM-Log)	2.224
KM Standard Error of Mean (logged)	0.274	95% H-UCL (KM -Log)	0.302
KM SD (logged)	0.821	95% Critical H Value (KM-Log)	2.224
KM Standard Error of Mean (logged)	0.274		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.399	Mean in Log Scale	-1.337
SD in Original Scale	0.438	SD in Log Scale	0.907
95% t UCL (Assumes normality)	0.533	95% H-Stat UCL	0.582

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.427

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Other
Surface Sediment

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.13/5/2021 3:00:37 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Conc_PFBA|ug/kg

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
Number of Detects	8	Number of Non-Detects	5
Number of Distinct Detects	8	Number of Distinct Non-Detects	5
Minimum Detect	0.257	Minimum Non-Detect	0.152
Maximum Detect	3.61	Maximum Non-Detect	0.321
Variance Detects	1.301	Percent Non-Detects	38.46%
Mean Detects	1.031	SD Detects	1.141
Median Detects	0.567	CV Detects	1.107
Skewness Detects	2.025	Kurtosis Detects	4.299
Mean of Logged Detects	-0.401	SD of Logged Detects	0.952

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.737	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.249	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.721	KM Standard Error of Mean	0.275
KM SD	0.925	95% KM (BCA) UCL	1.274
95% KM (t) UCL	1.21	95% KM (Percentile Bootstrap) UCL	1.204
95% KM (z) UCL	1.173	95% KM Bootstrap t UCL	1.981
90% KM Chebyshev UCL	1.545	95% KM Chebyshev UCL	1.918
97.5% KM Chebyshev UCL	2.436	99% KM Chebyshev UCL	3.453

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.486	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.731	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.19	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.3	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.3	k star (bias corrected MLE)	0.896
Theta hat (MLE)	0.793	Theta star (bias corrected MLE)	1.151
nu hat (MLE)	20.8	nu star (bias corrected)	14.34
Mean (detects)	1.031		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.638
Maximum	3.61	Median	0.283
SD	1.013	CV	1.587
k hat (MLE)	0.417	k star (bias corrected MLE)	0.372
Theta hat (MLE)	1.532	Theta star (bias corrected MLE)	1.717
nu hat (MLE)	10.83	nu star (bias corrected)	9.667
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (9.67, α)	3.734	Adjusted Chi Square Value (9.67, β)	3.227
95% Gamma Approximate UCL (use when n>=50)	1.652	95% Gamma Adjusted UCL (use when n<50)	1.912

ProUCL Output
Other
Surface Sediment

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.721	SD (KM)	0.925
Variance (KM)	0.856	SE of Mean (KM)	0.275
k hat (KM)	0.608	k star (KM)	0.519
nu hat (KM)	15.8	nu star (KM)	13.49
theta hat (KM)	1.186	theta star (KM)	1.39
80% gamma percentile (KM)	1.186	90% gamma percentile (KM)	1.936
95% gamma percentile (KM)	2.734	99% gamma percentile (KM)	4.689

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (13.49, α)	6.224	Adjusted Chi Square Value (13.49, β)	5.535
95% Gamma Approximate KM-UCL (use when n>=50)	1.563	95% Gamma Adjusted KM-UCL (use when n<50)	1.758

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.907	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.191	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.701	Mean in Log Scale	-0.955
SD in Original Scale	0.974	SD in Log Scale	1.072
95% t UCL (assumes normality of ROS data)	1.182	95% Percentile Bootstrap UCL	1.185
95% BCA Bootstrap UCL	1.372	95% Bootstrap t UCL	2.038
95% H-UCL (Log ROS)	1.715		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.835	KM Geo Mean	0.434
KM SD (logged)	0.907	95% Critical H Value (KM-Log)	2.69
KM Standard Error of Mean (logged)	0.276	95% H-UCL (KM -Log)	1.324
KM SD (logged)	0.907	95% Critical H Value (KM-Log)	2.69
KM Standard Error of Mean (logged)	0.276		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.689	Mean in Log Scale	-1.015
SD in Original Scale	0.981	SD in Log Scale	1.104
95% t UCL (Assumes normality)	1.174	95% H-Stat UCL	1.749

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 1.21

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_PFOA|ug/kg

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
Number of Detects	7	Number of Non-Detects	6
Number of Distinct Detects	7	Number of Distinct Non-Detects	6
Minimum Detect	0.062	Minimum Non-Detect	0.038
Maximum Detect	0.621	Maximum Non-Detect	0.0888
Variance Detects	0.0588	Percent Non-Detects	46.15%
Mean Detects	0.261	SD Detects	0.243
Median Detects	0.145	CV Detects	0.93
Skewness Detects	1.06	Kurtosis Detects	-0.992
Mean of Logged Detects	-1.716	SD of Logged Detects	0.926

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.767	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.286	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.165	KM Standard Error of Mean	0.0586
KM SD	0.195	95% KM (BCA) UCL	0.254
95% KM (t) UCL	0.269	95% KM (Percentile Bootstrap) UCL	0.256
95% KM (z) UCL	0.261	95% KM Bootstrap t UCL	0.476
90% KM Chebyshev UCL	0.341	95% KM Chebyshev UCL	0.42
97.5% KM Chebyshev UCL	0.531	99% KM Chebyshev UCL	0.748

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.52	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.214	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.317	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.488	k star (bias corrected MLE)	0.946
Theta hat (MLE)	0.175	Theta star (bias corrected MLE)	0.276
nu hat (MLE)	20.83	nu star (bias corrected)	13.24
Mean (detects)	0.261		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.145
Maximum	0.621	Median	0.062
SD	0.215	CV	1.484
k hat (MLE)	0.558	k star (bias corrected MLE)	0.481
Theta hat (MLE)	0.26	Theta star (bias corrected MLE)	0.302
nu hat (MLE)	14.51	nu star (bias corrected)	12.5
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (12.50, α)	5.556	Adjusted Chi Square Value (12.50, β)	4.912
95% Gamma Approximate UCL (use when n>=50)	0.326	95% Gamma Adjusted UCL (use when n<50)	0.369

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.165	SD (KM)	0.195
Variance (KM)	0.038	SE of Mean (KM)	0.0586
k hat (KM)	0.714	k star (KM)	0.6
nu hat (KM)	18.56	nu star (KM)	15.61
theta hat (KM)	0.231	theta star (KM)	0.274
80% gamma percentile (KM)	0.272	90% gamma percentile (KM)	0.428
95% gamma percentile (KM)	0.593	99% gamma percentile (KM)	0.99

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (15.61, α)	7.685	Adjusted Chi Square Value (15.61, β)	6.907
95% Gamma Approximate KM-UCL (use when n>=50)	0.335	95% Gamma Adjusted KM-UCL (use when n<50)	0.372

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.899	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.188	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.156	Mean in Log Scale	-2.521
SD in Original Scale	0.208	SD in Log Scale	1.144
95% t UCL (assumes normality of ROS data)	0.259	95% Percentile Bootstrap UCL	0.261
95% BCA Bootstrap UCL	0.28	95% Bootstrap t UCL	0.489
95% H-UCL (Log ROS)	0.431		

ProUCL Output
Other
Surface Sediment

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.303	KM Geo Mean	0.1
KM SD (logged)	0.915	95% Critical H Value (KM-Log)	2.703
KM Standard Error of Mean (logged)	0.287	95% H-UCL (KM -Log)	0.31
KM SD (logged)	0.915	95% Critical H Value (KM-Log)	2.703
KM Standard Error of Mean (logged)	0.287		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.157	Mean in Log Scale	-2.465
SD in Original Scale	0.207	SD in Log Scale	1.085
95% t UCL (Assumes normality)	0.26	95% H-Stat UCL	0.392

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.269

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc_PFOS|ug/kg

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
Number of Detects	10	Number of Non-Detects	3
Number of Distinct Detects	10	Number of Distinct Non-Detects	3
Minimum Detect	0.071	Minimum Non-Detect	0.0739
Maximum Detect	2.32	Maximum Non-Detect	0.0888
Variance Detects	0.551	Percent Non-Detects	23.08%
Mean Detects	0.686	SD Detects	0.742
Median Detects	0.304	CV Detects	1.082
Skewness Detects	1.368	Kurtosis Detects	1.336
Mean of Logged Detects	-0.961	SD of Logged Detects	1.182

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.817	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.25	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.544	KM Standard Error of Mean	0.196
KM SD	0.67	95% KM (BCA) UCL	0.899
95% KM (t) UCL	0.893	95% KM (Percentile Bootstrap) UCL	0.86
95% KM (z) UCL	0.866	95% KM Bootstrap t UCL	1.117
90% KM Chebyshev UCL	1.131	95% KM Chebyshev UCL	1.398
97.5% KM Chebyshev UCL	1.767	99% KM Chebyshev UCL	2.493

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.44	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.749	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.236	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.274	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.989	k star (bias corrected MLE)	0.759
Theta hat (MLE)	0.693	Theta star (bias corrected MLE)	0.904
nu hat (MLE)	19.79	nu star (bias corrected)	15.18
Mean (detects)	0.686		

ProUCL Output
Other
Surface Sediment

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.53
Maximum	2.32	Median	0.18
SD	0.708	CV	1.336
k hat (MLE)	0.538	k star (bias corrected MLE)	0.465
Theta hat (MLE)	0.985	Theta star (bias corrected MLE)	1.139
nu hat (MLE)	13.99	nu star (bias corrected)	12.1
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (12.10, α)	5.29	Adjusted Chi Square Value (12.10, β)	4.664
95% Gamma Approximate UCL (use when n>=50)	1.212	95% Gamma Adjusted UCL (use when n<50)	1.374

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.544	SD (KM)	0.67
Variance (KM)	0.449	SE of Mean (KM)	0.196
k hat (KM)	0.66	k star (KM)	0.559
nu hat (KM)	17.15	nu star (KM)	14.52
theta hat (KM)	0.825	theta star (KM)	0.974
80% gamma percentile (KM)	0.896	90% gamma percentile (KM)	1.437
95% gamma percentile (KM)	2.008	99% gamma percentile (KM)	3.398

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (14.52, α)	6.932	Adjusted Chi Square Value (14.52, β)	6.199
95% Gamma Approximate KM-UCL (use when n>=50)	1.14	95% Gamma Adjusted KM-UCL (use when n<50)	1.275

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.94	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.197	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.538	Mean in Log Scale	-1.447
SD in Original Scale	0.701	SD in Log Scale	1.379
95% t UCL (assumes normality of ROS data)	0.885	95% Percentile Bootstrap UCL	0.867
95% BCA Bootstrap UCL	0.93	95% Bootstrap t UCL	1.153
95% H-UCL (Log ROS)	2.494		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.35	KM Geo Mean	0.259
KM SD (logged)	1.213	95% Critical H Value (KM-Log)	3.23
KM Standard Error of Mean (logged)	0.355	95% H-UCL (KM -Log)	1.676
KM SD (logged)	1.213	95% Critical H Value (KM-Log)	3.23
KM Standard Error of Mean (logged)	0.355		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.537	Mean in Log Scale	-1.48
SD in Original Scale	0.702	SD in Log Scale	1.422
95% t UCL (Assumes normality)	0.884	95% H-Stat UCL	2.776

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.893

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Eagle Point Lake
Dissolved Porewater

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/26/2021 12:33:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

PFBA|ug/L

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.086	Mean	0.171
Maximum	0.28	Median	0.165
SD	0.0628	Std. Error of Mean	0.0257
Coefficient of Variation	0.368	Skewness	0.811

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.91	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.276	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.223	95% Adjusted-CLT UCL (Chen-1995)	0.222
		95% Modified-t UCL (Johnson-1978)	0.224

Gamma GOF Test

A-D Test Statistic	0.379	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.229	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	8.827	k star (bias corrected MLE)	4.525
Theta hat (MLE)	0.0194	Theta star (bias corrected MLE)	0.0378
nu hat (MLE)	105.9	nu star (bias corrected)	54.29
MLE Mean (bias corrected)	0.171	MLE Sd (bias corrected)	0.0804
		Approximate Chi Square Value (0.05)	38.36
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	33.59

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.242	95% Adjusted Gamma UCL (use when n<50)	0.276

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.924	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.257	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.453	Mean of logged Data	-1.824
Maximum of Logged Data	-1.273	SD of logged Data	0.379

Assuming Lognormal Distribution

95% H-UCL	0.259	90% Chebyshev (MVUE) UCL	0.251
95% Chebyshev (MVUE) UCL	0.287	97.5% Chebyshev (MVUE) UCL	0.337
99% Chebyshev (MVUE) UCL	0.435		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

ProUCL Output
Eagle Point Lake
Dissolved Porewater

Nonparametric Distribution Free UCLs

95% CLT UCL	0.213	95% Jackknife UCL	0.223
95% Standard Bootstrap UCL	0.209	95% Bootstrap-t UCL	0.23
95% Hall's Bootstrap UCL	0.321	95% Percentile Bootstrap UCL	0.208
95% BCA Bootstrap UCL	0.218		
90% Chebyshev(Mean, Sd) UCL	0.248	95% Chebyshev(Mean, Sd) UCL	0.283
97.5% Chebyshev(Mean, Sd) UCL	0.331	99% Chebyshev(Mean, Sd) UCL	0.426

Suggested UCL to Use

95% Student's-t UCL 0.223

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFPeA|ug/L

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.0085	Mean	0.0154
Maximum	0.026	Median	0.0145
SD	0.00594	Std. Error of Mean	0.00242
Coefficient of Variation	0.385	Skewness	1.17

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.922	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.228	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.0203	95% Adjusted-CLT UCL (Chen-1995)	0.0206
		95% Modified-t UCL (Johnson-1978)	0.0205

Gamma GOF Test

A-D Test Statistic	0.229	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.176	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	8.752	k star (bias corrected MLE)	4.487
Theta hat (MLE)	0.00176	Theta star (bias corrected MLE)	0.00344
nu hat (MLE)	105	nu star (bias corrected)	53.84
MLE Mean (bias corrected)	0.0154	MLE Sd (bias corrected)	0.00728
		Approximate Chi Square Value (0.05)	37.99
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	33.24

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0219	95% Adjusted Gamma UCL (use when n<50)	0.025

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.982	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.171	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.768	Mean of logged Data	-4.231
Maximum of Logged Data	-3.65	SD of logged Data	0.371

Assuming Lognormal Distribution

95% H-UCL	0.0231	90% Chebyshev (MVUE) UCL	0.0224
95% Chebyshev (MVUE) UCL	0.0256	97.5% Chebyshev (MVUE) UCL	0.03
99% Chebyshev (MVUE) UCL	0.0386		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0194	95% Jackknife UCL	0.0203
95% Standard Bootstrap UCL	0.0189	95% Bootstrap-t UCL	0.0227
95% Hall's Bootstrap UCL	0.0448	95% Percentile Bootstrap UCL	0.0193
95% BCA Bootstrap UCL	0.02		
90% Chebyshev(Mean, Sd) UCL	0.0227	95% Chebyshev(Mean, Sd) UCL	0.026
97.5% Chebyshev(Mean, Sd) UCL	0.0306	99% Chebyshev(Mean, Sd) UCL	0.0395

Suggested UCL to Use

95% Student's-t UCL 0.0203

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFHxA|ug/L

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.012	Mean	0.0237
Maximum	0.043	Median	0.0195
SD	0.0114	Std. Error of Mean	0.00465
Coefficient of Variation	0.481	Skewness	1.127

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.899	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.259	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.033	95% Adjusted-CLT UCL (Chen-1995)	0.0336
		95% Modified-t UCL (Johnson-1978)	0.0334

Gamma GOF Test

A-D Test Statistic	0.285	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.223	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.756	k star (bias corrected MLE)	2.989
Theta hat (MLE)	0.00411	Theta star (bias corrected MLE)	0.00792
nu hat (MLE)	69.08	nu star (bias corrected)	35.87
MLE Mean (bias corrected)	0.0237	MLE Sd (bias corrected)	0.0137
		Approximate Chi Square Value (0.05)	23.17
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	19.56

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0366	95% Adjusted Gamma UCL (use when n<50)	0.0434

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.966	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.193	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.423	Mean of logged Data	-3.833
Maximum of Logged Data	-3.147	SD of logged Data	0.456

Assuming Lognormal Distribution

95% H-UCL	0.0403	90% Chebyshev (MVUE) UCL	0.0367
95% Chebyshev (MVUE) UCL	0.0427	97.5% Chebyshev (MVUE) UCL	0.051
99% Chebyshev (MVUE) UCL	0.0673		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0313	95% Jackknife UCL	0.033
95% Standard Bootstrap UCL	0.0308	95% Bootstrap-t UCL	0.0467
95% Hall's Bootstrap UCL	0.0916	95% Percentile Bootstrap UCL	0.0312
95% BCA Bootstrap UCL	0.0328		
90% Chebyshev(Mean, Sd) UCL	0.0376	95% Chebyshev(Mean, Sd) UCL	0.0439
97.5% Chebyshev(Mean, Sd) UCL	0.0527	99% Chebyshev(Mean, Sd) UCL	0.0699

Suggested UCL to Use

95% Student's-t UCL 0.033

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFHpA|ug/L

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.0085	Mean	0.0174
Maximum	0.031	Median	0.016
SD	0.0077	Std. Error of Mean	0.00314
Coefficient of Variation	0.442	Skewness	1.128

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.931	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.202	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0237	95% Adjusted-CLT UCL (Chen-1995)	0.0241
		95% Modified-t UCL (Johnson-1978)	0.024

Gamma GOF Test

A-D Test Statistic	0.193	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.145	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	6.565	k star (bias corrected MLE)	3.393
Theta hat (MLE)	0.00265	Theta star (bias corrected MLE)	0.00513
nu hat (MLE)	78.78	nu star (bias corrected)	40.72
MLE Mean (bias corrected)	0.0174	MLE Sd (bias corrected)	0.00945
		Approximate Chi Square Value (0.05)	27.1
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	23.16

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0262	95% Adjusted Gamma UCL (use when n<50)	0.0306

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.991	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.144	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.768	Mean of logged Data	-4.128
Maximum of Logged Data	-3.474	SD of logged Data	0.433

Assuming Lognormal Distribution

95% H-UCL	0.0286	90% Chebyshev (MVUE) UCL	0.0266
95% Chebyshev (MVUE) UCL	0.0308	97.5% Chebyshev (MVUE) UCL	0.0366
99% Chebyshev (MVUE) UCL	0.048		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0226	95% Jackknife UCL	0.0237
95% Standard Bootstrap UCL	0.0222	95% Bootstrap-t UCL	0.0267
95% Hall's Bootstrap UCL	0.0537	95% Percentile Bootstrap UCL	0.0223
95% BCA Bootstrap UCL	0.0231		
90% Chebyshev(Mean, Sd) UCL	0.0268	95% Chebyshev(Mean, Sd) UCL	0.0311
97.5% Chebyshev(Mean, Sd) UCL	0.037	99% Chebyshev(Mean, Sd) UCL	0.0487

Suggested UCL to Use

95% Student's-t UCL	0.0237

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.053	Mean	0.142
Maximum	0.24	Median	0.145
SD	0.0689	Std. Error of Mean	0.0281
Coefficient of Variation	0.485	Skewness	0.0891

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.973	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.154	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.199	95% Adjusted-CLT UCL (Chen-1995)	0.19
		95% Modified-t UCL (Johnson-1978)	0.199

Gamma GOF Test

A-D Test Statistic	0.245	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.699	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.218	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.387	k star (bias corrected MLE)	2.304

ProUCL Output
Eagle Point Lake
Dissolved Porewater

Theta hat (MLE)	0.0324	Theta star (bias corrected MLE)	0.0617
nu hat (MLE)	52.64	nu star (bias corrected)	27.65
MLE Mean (bias corrected)	0.142	MLE Sd (bias corrected)	0.0937
		Approximate Chi Square Value (0.05)	16.66
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	13.67

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.236	95% Adjusted Gamma UCL (use when n<50)	0.288

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.941	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.239	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.937	Mean of logged Data	-2.069
Maximum of Logged Data	-1.427	SD of logged Data	0.562

Assuming Lognormal Distribution

95% H-UCL	0.299	90% Chebyshev (MVUE) UCL	0.243
95% Chebyshev (MVUE) UCL	0.287	97.5% Chebyshev (MVUE) UCL	0.349
99% Chebyshev (MVUE) UCL	0.471		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.188	95% Jackknife UCL	0.199
95% Standard Bootstrap UCL	0.184	95% Bootstrap-t UCL	0.199
95% Hall's Bootstrap UCL	0.199	95% Percentile Bootstrap UCL	0.185
95% BCA Bootstrap UCL	0.186		
90% Chebyshev(Mean, Sd) UCL	0.227	95% Chebyshev(Mean, Sd) UCL	0.265
97.5% Chebyshev(Mean, Sd) UCL	0.318	99% Chebyshev(Mean, Sd) UCL	0.422

Suggested UCL to Use

95% Student's-t UCL 0.199

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	6	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	0.0012	Mean	0.00272
Maximum	0.0056	Median	0.0025
SD	0.00164	Std. Error of Mean	6.7152E-4
Coefficient of Variation	0.605	Skewness	1.15

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.891	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.195	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00407	95% Adjusted-CLT UCL (Chen-1995)	0.00416
		95% Modified-t UCL (Johnson-1978)	0.00412

Gamma GOF Test

A-D Test Statistic	0.287	**Anderson-Darling Gamma GOF Test**

5% A-D Critical Value	0.701	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.21	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.334	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.502	k star (bias corrected MLE)	1.862
Theta hat (MLE)	7.7568E-4	Theta star (bias corrected MLE)	0.00146
nu hat (MLE)	42.03	nu star (bias corrected)	22.35
MLE Mean (bias corrected)	0.00272	MLE Sd (bias corrected)	0.00199
		Approximate Chi Square Value (0.05)	12.6
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	10.06

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.00482	95% Adjusted Gamma UCL (use when n<50)	0.00603

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.929	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.2	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-6.725	Mean of logged Data	-6.058
Maximum of Logged Data	-5.185	SD of logged Data	0.601

Assuming Lognormal Distribution

95% H-UCL	0.00611	90% Chebyshev (MVUE) UCL	0.0047
95% Chebyshev (MVUE) UCL	0.0056	97.5% Chebyshev (MVUE) UCL	0.00686
99% Chebyshev (MVUE) UCL	0.00932		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00382	95% Jackknife UCL	0.00407
95% Standard Bootstrap UCL	0.00373	95% Bootstrap-t UCL	0.00467
95% Hall's Bootstrap UCL	0.009	95% Percentile Bootstrap UCL	0.00372
95% BCA Bootstrap UCL	0.00398		
90% Chebyshev(Mean, Sd) UCL	0.00473	95% Chebyshev(Mean, Sd) UCL	0.00564
97.5% Chebyshev(Mean, Sd) UCL	0.00691	99% Chebyshev(Mean, Sd) UCL	0.0094

Suggested UCL to Use

95% Student's-t UCL 0.00407

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFDA|ug/L

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
Number of Detects	5	Number of Non-Detects	1
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	0.0018	Minimum Non-Detect	0.0045
Maximum Detect	0.0081	Maximum Non-Detect	0.0045
Variance Detects	9.7170E-6	Percent Non-Detects	16.67%
Mean Detects	0.00548	SD Detects	0.00312
Median Detects	0.0071	CV Detects	0.569
Skewness Detects	-0.561	Kurtosis Detects	-3.132
Mean of Logged Detects	-5.389	SD of Logged Detects	0.728

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.789	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.298	**Lilliefors GOF Test**	

5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00492	KM Standard Error of Mean	0.0013
KM SD	0.00284	95% KM (BCA) UCL	0.00697
95% KM (t) UCL	0.00753	95% KM (Percentile Bootstrap) UCL	0.0071
95% KM (z) UCL	0.00705	95% KM Bootstrap t UCL	0.0073
90% KM Chebyshev UCL	0.00881	95% KM Chebyshev UCL	0.0106
97.5% KM Chebyshev UCL	0.013	99% KM Chebyshev UCL	0.0178

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.668	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.683	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.343	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.36	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.901	k star (bias corrected MLE)	1.294
Theta hat (MLE)	0.00189	Theta star (bias corrected MLE)	0.00424
nu hat (MLE)	29.01	nu star (bias corrected)	12.94
Mean (detects)	0.00548		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0018	Mean	0.00623
Maximum	0.01	Median	0.00755
SD	0.00334	CV	0.536
k hat (MLE)	2.928	k star (bias corrected MLE)	1.575
Theta hat (MLE)	0.00213	Theta star (bias corrected MLE)	0.00396
nu hat (MLE)	35.14	nu star (bias corrected)	18.9
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (18.90, α)	10.05	Adjusted Chi Square Value (18.90, β)	7.825
95% Gamma Approximate UCL (use when n>=50)	0.0117	95% Gamma Adjusted UCL (use when n<50)	0.0151

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00492	SD (KM)	0.00284
Variance (KM)	8.0797E-6	SE of Mean (KM)	0.0013
k hat (KM)	2.992	k star (KM)	1.607
nu hat (KM)	35.9	nu star (KM)	19.28
theta hat (KM)	0.00164	theta star (KM)	0.00306
80% gamma percentile (KM)	0.00755	90% gamma percentile (KM)	0.0101
95% gamma percentile (KM)	0.0125	99% gamma percentile (KM)	0.018

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (19.28, α)	10.33	Adjusted Chi Square Value (19.28, β)	8.068
95% Gamma Approximate KM-UCL (use when n>=50)	0.00918	95% Gamma Adjusted KM-UCL (use when n<50)	0.0118

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.786	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.328	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00496	Mean in Log Scale	-5.501
SD in Original Scale	0.00307	SD in Log Scale	0.706
95% t UCL (assumes normality of ROS data)	0.00748	95% Percentile Bootstrap UCL	0.00685
95% BCA Bootstrap UCL	0.00692	95% Bootstrap t UCL	0.00736
95% H-UCL (Log ROS)	0.0144		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.52	KM Geo Mean	0.00401
KM SD (logged)	0.665	95% Critical H Value (KM-Log)	3.072
KM Standard Error of Mean (logged)	0.305	95% H-UCL (KM -Log)	0.0125
KM SD (logged)	0.665	95% Critical H Value (KM-Log)	3.072
KM Standard Error of Mean (logged)	0.305		

ProUCL Output
Eagle Point Lake
Dissolved Porewater

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.00494	Mean in Log Scale	-5.507
SD in Original Scale	0.00308	SD in Log Scale	0.712
95% t UCL (Assumes normality)	0.00748	95% H-Stat UCL	0.0145

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.00753

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFBS|ug/L

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.0034	Mean	0.0073
Maximum	0.013	Median	0.00685
SD	0.00316	Std. Error of Mean	0.00129
Coefficient of Variation	0.433	Skewness	1.172

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.892	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.283	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.0099	95% Adjusted-CLT UCL (Chen-1995)	0.0101
		95% Modified-t UCL (Johnson-1978)	0.01

Gamma GOF Test

A-D Test Statistic	0.352	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.228	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	6.719	k star (bias corrected MLE)	3.471
Theta hat (MLE)	0.00109	Theta star (bias corrected MLE)	0.0021
nu hat (MLE)	80.63	nu star (bias corrected)	41.65
MLE Mean (bias corrected)	0.0073	MLE Sd (bias corrected)	0.00392
		Approximate Chi Square Value (0.05)	27.86
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	23.86

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0109	95% Adjusted Gamma UCL (use when n<50)	0.0127

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.94	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.224	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.684	Mean of logged Data	-4.996
Maximum of Logged Data	-4.343	SD of logged Data	0.432

Assuming Lognormal Distribution

95% H-UCL	0.012	90% Chebyshev (MVUE) UCL	0.0112
95% Chebyshev (MVUE) UCL	0.0129	97.5% Chebyshev (MVUE) UCL	0.0153
99% Chebyshev (MVUE) UCL	0.0201		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00942	95% Jackknife UCL	0.0099
95% Standard Bootstrap UCL	0.00927	95% Bootstrap-t UCL	0.0108
95% Hall's Bootstrap UCL	0.0228	95% Percentile Bootstrap UCL	0.00935
95% BCA Bootstrap UCL	0.00978		
90% Chebyshev(Mean, Sd) UCL	0.0112	95% Chebyshev(Mean, Sd) UCL	0.0129
97.5% Chebyshev(Mean, Sd) UCL	0.0154	99% Chebyshev(Mean, Sd) UCL	0.0201

Suggested UCL to Use

95% Student's-t UCL 0.0099

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFHxS|ug/L

General Statistics

Total Number of Observations	6	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	0.0048	Mean	0.0161
Maximum	0.025	Median	0.016
SD	0.00814	Std. Error of Mean	0.00332
Coefficient of Variation	0.505	Skewness	-0.164

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.93	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.195	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0228	95% Adjusted-CLT UCL (Chen-1995)	0.0214
		95% Modified-t UCL (Johnson-1978)	0.0228

Gamma GOF Test

A-D Test Statistic	0.295	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.7	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.192	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.334	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.701	k star (bias corrected MLE)	1.961
Theta hat (MLE)	0.00436	Theta star (bias corrected MLE)	0.00823
nu hat (MLE)	44.41	nu star (bias corrected)	23.54
MLE Mean (bias corrected)	0.0161	MLE Sd (bias corrected)	0.0115
		Approximate Chi Square Value (0.05)	13.5
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	10.85

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0281	95% Adjusted Gamma UCL (use when n<50)	0.035

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.901	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level	

Lilliefors Test Statistic	0.18	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.339	Mean of logged Data	-4.268
Maximum of Logged Data	-3.689	SD of logged Data	0.632

Assuming Lognormal Distribution

95% H-UCL	0.0397	90% Chebyshev (MVUE) UCL	0.0292
95% Chebyshev (MVUE) UCL	0.0349	97.5% Chebyshev (MVUE) UCL	0.0429
99% Chebyshev (MVUE) UCL	0.0586		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0216	95% Jackknife UCL	0.0228
95% Standard Bootstrap UCL	0.0211	95% Bootstrap-t UCL	0.0227
95% Hall's Bootstrap UCL	0.0227	95% Percentile Bootstrap UCL	0.0208
95% BCA Bootstrap UCL	0.0208		
90% Chebyshev(Mean, Sd) UCL	0.0261	95% Chebyshev(Mean, Sd) UCL	0.0306
97.5% Chebyshev(Mean, Sd) UCL	0.0369	99% Chebyshev(Mean, Sd) UCL	0.0492

Suggested UCL to Use

95% Student's-t UCL	0.0228

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFOS|ug/L

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.08	Mean	0.705
Maximum	1.5	Median	0.7
SD	0.53	Std. Error of Mean	0.216
Coefficient of Variation	0.752	Skewness	0.38

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.958	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.157	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.141	95% Adjusted-CLT UCL (Chen-1995)	1.097
		95% Modified-t UCL (Johnson-1978)	1.147

Gamma GOF Test

A-D Test Statistic	0.241	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.708	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.224	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.337	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.498	k star (bias corrected MLE)	0.86
Theta hat (MLE)	0.471	Theta star (bias corrected MLE)	0.82
nu hat (MLE)	17.98	nu star (bias corrected)	10.32

MLE Mean (bias corrected)	0.705	MLE Sd (bias corrected)	0.76
		Approximate Chi Square Value (0.05)	4.144
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	2.857

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1.756	95% Adjusted Gamma UCL (use when n<50)	2.547

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.922	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.218	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.526	Mean of logged Data	-0.719
Maximum of Logged Data	0.405	SD of logged Data	1.085

Assuming Lognormal Distribution

95% H-UCL	7.499	90% Chebyshev (MVUE) UCL	1.775
95% Chebyshev (MVUE) UCL	2.229	97.5% Chebyshev (MVUE) UCL	2.859
99% Chebyshev (MVUE) UCL	4.098		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.061	95% Jackknife UCL	1.141
95% Standard Bootstrap UCL	1.028	95% Bootstrap-t UCL	1.22
95% Hall's Bootstrap UCL	1.056	95% Percentile Bootstrap UCL	1.052
95% BCA Bootstrap UCL	1.038		
90% Chebyshev(Mean, Sd) UCL	1.354	95% Chebyshev(Mean, Sd) UCL	1.648
97.5% Chebyshev(Mean, Sd) UCL	2.056	99% Chebyshev(Mean, Sd) UCL	2.858

Suggested UCL to Use

95% Student's-t UCL 1.141

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOSA|ug/L

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	1
Number of Detects	4	Number of Non-Detects	1
Number of Distinct Detects	4	Number of Distinct Non-Detects	1
Minimum Detect	8.1000E-4	Minimum Non-Detect	0.0045
Maximum Detect	0.0015	Maximum Non-Detect	0.0045
Variance Detects	1.0977E-7	Percent Non-Detects	20%
Mean Detects	0.00101	SD Detects	3.3131E-4
Median Detects	8.5500E-4	CV Detects	0.33
Skewness Detects	1.953	Kurtosis Detects	3.837
Mean of Logged Detects	-6.938	SD of Logged Detects	0.292

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.707	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.397	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00101	KM Standard Error of Mean	1.6566E-4
KM SD	2.8692E-4	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.00136	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.00128	95% KM Bootstrap t UCL	N/A

90% KM Chebyshev UCL	0.0015	95% KM Chebyshev UCL	0.00173
97.5% KM Chebyshev UCL	0.00204	99% KM Chebyshev UCL	0.00265

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.734	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.657	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.408	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.395	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	14.52	k star (bias corrected MLE)	3.795
Theta hat (MLE)	6.9238E-5	Theta star (bias corrected MLE)	2.6479E-4
nu hat (MLE)	116.1	nu star (bias corrected)	30.36
Mean (detects)	0.00101		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	8.1000E-4	Mean	0.0028
Maximum	0.01	Median	8.8000E-4
SD	0.00403	CV	1.438
k hat (MLE)	0.974	k star (bias corrected MLE)	0.523
Theta hat (MLE)	0.00288	Theta star (bias corrected MLE)	0.00536
nu hat (MLE)	9.741	nu star (bias corrected)	5.23
Adjusted Level of Significance (β)	0.0086		
Approximate Chi Square Value (5.23, α)	1.26	Adjusted Chi Square Value (5.23, β)	0.599
95% Gamma Approximate UCL (use when n>=50)	0.0116	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00101	SD (KM)	2.8692E-4
Variance (KM)	8.2325E-8	SE of Mean (KM)	1.6566E-4
k hat (KM)	12.27	k star (KM)	5.041
nu hat (KM)	122.7	nu star (KM)	50.41
theta hat (KM)	8.1915E-5	theta star (KM)	1.9937E-4
80% gamma percentile (KM)	0.00135	90% gamma percentile (KM)	0.0016
95% gamma percentile (KM)	0.00184	99% gamma percentile (KM)	0.00233

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (50.41, α)	35.11	Adjusted Chi Square Value (50.41, β)	29.63
95% Gamma Approximate KM-UCL (use when n>=50)	0.00144	95% Gamma Adjusted KM-UCL (use when n<50)	0.00171

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.732	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.381	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	9.9812E-4	Mean in Log Scale	-6.938
SD in Original Scale	2.8734E-4	SD in Log Scale	0.253
95% t UCL (assumes normality of ROS data)	0.00127	95% Percentile Bootstrap UCL	0.00123
95% BCA Bootstrap UCL	0.00127	95% Bootstrap t UCL	0.00236
95% H-UCL (Log ROS)	0.00134		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-6.938	KM Geo Mean	9.7059E-4
KM SD (logged)	0.253	95% Critical H Value (KM-Log)	2.301
KM Standard Error of Mean (logged)	0.146	95% H-UCL (KM -Log)	0.00134
KM SD (logged)	0.253	95% Critical H Value (KM-Log)	2.301
KM Standard Error of Mean (logged)	0.146		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00125	Mean in Log Scale	-6.769
SD in Original Scale	6.2636E-4	SD in Log Scale	0.453
95% t UCL (Assumes normality)	0.00185	95% H-Stat UCL	0.0024

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

ProUCL Output
Eagle Point Lake
Dissolved Porewater

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.00136	KM H-UCL	0.00134
95% KM (BCA) UCL	N/A		

Warning: One or more Recommended UCL(s) not available!

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Raleigh Creek - Upper
Dissolved Porewater

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/26/2021 12:52:16 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

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General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.1	Mean	0.513
Maximum	0.86	Median	0.57
SD	0.273	Std. Error of Mean	0.111
Coefficient of Variation	0.532	Skewness	-0.492

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.968	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.206	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.738	95% Adjusted-CLT UCL (Chen-1995)	0.673
		95% Modified-t UCL (Johnson-1978)	0.734

Gamma GOF Test

A-D Test Statistic	0.408	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.702	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.28	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.335	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.721	k star (bias corrected MLE)	1.472
Theta hat (MLE)	0.189	Theta star (bias corrected MLE)	0.349
nu hat (MLE)	32.66	nu star (bias corrected)	17.66
MLE Mean (bias corrected)	0.513	MLE Sd (bias corrected)	0.423
		Approximate Chi Square Value (0.05)	9.146
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	7.046

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.991	95% Adjusted Gamma UCL (use when n<50)	1.287

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.847	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.289	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.303	Mean of logged Data	-0.862
Maximum of Logged Data	-0.151	SD of logged Data	0.788

Assuming Lognormal Distribution

95% H-UCL	1.94	90% Chebyshev (MVUE) UCL	1.063
95% Chebyshev (MVUE) UCL	1.298	97.5% Chebyshev (MVUE) UCL	1.625
99% Chebyshev (MVUE) UCL	2.267		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

ProUCL Output
Raleigh Creek - Upper
Dissolved Porewater

Nonparametric Distribution Free UCLs

95% CLT UCL	0.697	95% Jackknife UCL	0.738
95% Standard Bootstrap UCL	0.681	95% Bootstrap-t UCL	0.696
95% Hall's Bootstrap UCL	0.667	95% Percentile Bootstrap UCL	0.683
95% BCA Bootstrap UCL	0.66		
90% Chebyshev(Mean, Sd) UCL	0.848	95% Chebyshev(Mean, Sd) UCL	0.999
97.5% Chebyshev(Mean, Sd) UCL	1.209	99% Chebyshev(Mean, Sd) UCL	1.622

Suggested UCL to Use

95% Student's-t UCL 0.738

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

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General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.0087	Mean	0.0366
Maximum	0.058	Median	0.0385
SD	0.0164	Std. Error of Mean	0.0067
Coefficient of Variation	0.448	Skewness	-0.785

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.948	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.2	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0501	95% Adjusted-CLT UCL (Chen-1995)	0.0453
		95% Modified-t UCL (Johnson-1978)	0.0498

Gamma GOF Test

A-D Test Statistic	0.556	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.7	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.279	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.334	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.741	k star (bias corrected MLE)	1.981
Theta hat (MLE)	0.00979	Theta star (bias corrected MLE)	0.0185
nu hat (MLE)	44.89	nu star (bias corrected)	23.78
MLE Mean (bias corrected)	0.0366	MLE Sd (bias corrected)	0.026
		Approximate Chi Square Value (0.05)	13.68
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	11.02

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0636	95% Adjusted Gamma UCL (use when n<50)	0.079

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.787	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.317	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

ProUCL Output
Raleigh Creek - Upper
Dissolved Porewater

Lognormal Statistics

Minimum of Logged Data	-4.744	Mean of logged Data	-3.447
Maximum of Logged Data	-2.847	SD of logged Data	0.669

Assuming Lognormal Distribution

95% H-UCL	0.1	90% Chebyshev (MVUE) UCL	0.0693
95% Chebyshev (MVUE) UCL	0.0834	97.5% Chebyshev (MVUE) UCL	0.103
99% Chebyshev (MVUE) UCL	0.142		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0476	95% Jackknife UCL	0.0501
95% Standard Bootstrap UCL	0.0466	95% Bootstrap-t UCL	0.0474
95% Hall's Bootstrap UCL	0.0465	95% Percentile Bootstrap UCL	0.0462
95% BCA Bootstrap UCL	0.045		
90% Chebyshev(Mean, Sd) UCL	0.0567	95% Chebyshev(Mean, Sd) UCL	0.0658
97.5% Chebyshev(Mean, Sd) UCL	0.0784	99% Chebyshev(Mean, Sd) UCL	0.103

Suggested UCL to Use

95% Student's-t UCL 0.0501

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

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General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
Number of Detects	5	Number of Non-Detects	1
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	0.063	Minimum Non-Detect	0.0092
Maximum Detect	0.13	Maximum Non-Detect	0.0092
Variance Detects	6.5180E-4	Percent Non-Detects	16.67%
Mean Detects	0.0926	SD Detects	0.0255
Median Detects	0.094	CV Detects	0.276
Skewness Detects	0.556	Kurtosis Detects	0.248
Mean of Logged Detects	-2.41	SD of Logged Detects	0.276

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.971	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.186	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0787	KM Standard Error of Mean	0.0171
KM SD	0.0374	95% KM (BCA) UCL	0.102
95% KM (t) UCL	0.113	95% KM (Percentile Bootstrap) UCL	0.103
95% KM (z) UCL	0.107	95% KM Bootstrap t UCL	0.101
90% KM Chebyshev UCL	0.13	95% KM Chebyshev UCL	0.153
97.5% KM Chebyshev UCL	0.185	99% KM Chebyshev UCL	0.249

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.196	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.679	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.157	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	16.66	k star (bias corrected MLE)	6.797
Theta hat (MLE)	0.00556	Theta star (bias corrected MLE)	0.0136
nu hat (MLE)	166.6	nu star (bias corrected)	67.97
Mean (detects)	0.0926		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0342	Mean	0.0829
Maximum	0.13	Median	0.085
SD	0.033	CV	0.399
k hat (MLE)	6.387	k star (bias corrected MLE)	3.305
Theta hat (MLE)	0.013	Theta star (bias corrected MLE)	0.0251
nu hat (MLE)	76.65	nu star (bias corrected)	39.66
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (39.66, α)	26.23	Adjusted Chi Square Value (39.66, β)	22.37
95% Gamma Approximate UCL (use when n>=50)	0.125	95% Gamma Adjusted UCL (use when n<50)	0.147

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0787	SD (KM)	0.0374
Variance (KM)	0.0014	SE of Mean (KM)	0.0171
k hat (KM)	4.422	k star (KM)	2.322
nu hat (KM)	53.07	nu star (KM)	27.87
theta hat (KM)	0.0178	theta star (KM)	0.0339
80% gamma percentile (KM)	0.116	90% gamma percentile (KM)	0.148
95% gamma percentile (KM)	0.178	99% gamma percentile (KM)	0.245

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (27.87, α)	16.82	Adjusted Chi Square Value (27.87, β)	13.82
95% Gamma Approximate KM-UCL (use when n>=50)	0.13	95% Gamma Adjusted KM-UCL (use when n<50)	0.159

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.987	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.165	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0845	Mean in Log Scale	-2.529
SD in Original Scale	0.0303	SD in Log Scale	0.383
95% t UCL (assumes normality of ROS data)	0.109	95% Percentile Bootstrap UCL	0.104
95% BCA Bootstrap UCL	0.104	95% Bootstrap t UCL	0.112
95% H-UCL (Log ROS)	0.129		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.79	KM Geo Mean	0.0614
KM SD (logged)	0.879	95% Critical H Value (KM-Log)	3.708
KM Standard Error of Mean (logged)	0.401	95% H-UCL (KM -Log)	0.388
KM SD (logged)	0.879	95% Critical H Value (KM-Log)	3.708
KM Standard Error of Mean (logged)	0.401		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0779	Mean in Log Scale	-2.905
SD in Original Scale	0.0426	SD in Log Scale	1.238
95% t UCL (Assumes normality)	0.113	95% H-Stat UCL	1.826

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.113

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Raleigh Creek - Upper
Dissolved Porewater

PFHpA|ug/L

General Statistics

Total Number of Observations	6	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	0.0025	Mean	0.0494
Maximum	0.068	Median	0.059
SD	0.0246	Std. Error of Mean	0.01
Coefficient of Variation	0.497	Skewness	-1.856

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.774	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.319	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0696	95% Adjusted-CLT UCL (Chen-1995)	0.0578
		95% Modified-t UCL (Johnson-1978)	0.0683

Gamma GOF Test

A-D Test Statistic	1.178	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.708	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.376	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.337	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.524	k star (bias corrected MLE)	0.873
Theta hat (MLE)	0.0324	Theta star (bias corrected MLE)	0.0566
nu hat (MLE)	18.29	nu star (bias corrected)	10.48
MLE Mean (bias corrected)	0.0494	MLE Sd (bias corrected)	0.0529
		Approximate Chi Square Value (0.05)	4.244
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	2.937

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.122	95% Adjusted Gamma UCL (use when n<50)	0.176

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.599	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.402	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.991	Mean of logged Data	-3.37
Maximum of Logged Data	-2.688	SD of logged Data	1.294

Assuming Lognormal Distribution

95% H-UCL	1.561	90% Chebyshev (MVUE) UCL	0.165
95% Chebyshev (MVUE) UCL	0.21	97.5% Chebyshev (MVUE) UCL	0.272
99% Chebyshev (MVUE) UCL	0.395		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0659	95% Jackknife UCL	0.0696
95% Standard Bootstrap UCL	0.0644	95% Bootstrap-t UCL	0.0632
95% Hall's Bootstrap UCL	0.0592	95% Percentile Bootstrap UCL	0.0625
95% BCA Bootstrap UCL	0.0603		
90% Chebyshev(Mean, Sd) UCL	0.0795	95% Chebyshev(Mean, Sd) UCL	0.0931
97.5% Chebyshev(Mean, Sd) UCL	0.112	99% Chebyshev(Mean, Sd) UCL	0.149

ProUCL Output
Raleigh Creek - Upper
Dissolved Porewater

Suggested UCL to Use

95% Student's-t UCL 0.0696

Recommended UCL exceeds the maximum observation

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFOA|ug/L

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.01	Mean	0.413
Maximum	0.57	Median	0.49
SD	0.208	Std. Error of Mean	0.0849
Coefficient of Variation	0.503	Skewness	-1.961

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.765	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.292	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.584	95% Adjusted-CLT UCL (Chen-1995)	0.48
		95% Modified-t UCL (Johnson-1978)	0.573

Gamma GOF Test

A-D Test Statistic	1.298	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.712	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.421	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.34	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.181	k star (bias corrected MLE)	0.702
Theta hat (MLE)	0.35	Theta star (bias corrected MLE)	0.589
nu hat (MLE)	14.18	nu star (bias corrected)	8.422
MLE Mean (bias corrected)	0.413	MLE Sd (bias corrected)	0.493
		Approximate Chi Square Value (0.05)	2.982
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	1.943

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1.167	95% Adjusted Gamma UCL (use when n<50)	1.792

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.574	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.431	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.605	Mean of logged Data	-1.363
Maximum of Logged Data	-0.562	SD of logged Data	1.594

Assuming Lognormal Distribution

95% H-UCL	76.99	90% Chebyshev (MVUE) UCL	1.837
95% Chebyshev (MVUE) UCL	2.374	97.5% Chebyshev (MVUE) UCL	3.119
99% Chebyshev (MVUE) UCL	4.583		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.553	95% Jackknife UCL	0.584
95% Standard Bootstrap UCL	0.538	95% Bootstrap-t UCL	0.525
95% Hall's Bootstrap UCL	0.495	95% Percentile Bootstrap UCL	0.52
95% BCA Bootstrap UCL	0.505		
90% Chebyshev(Mean, Sd) UCL	0.668	95% Chebyshev(Mean, Sd) UCL	0.783
97.5% Chebyshev(Mean, Sd) UCL	0.944	99% Chebyshev(Mean, Sd) UCL	1.258

Suggested UCL to Use

95% Student's-t UCL 0.584

Recommended UCL exceeds the maximum observation

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFNA|ug/L

General Statistics

Total Number of Observations	6	Number of Distinct Observations	5
Number of Detects	5	Number of Non-Detects	1
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	0.0031	Minimum Non-Detect	0.0043
Maximum Detect	0.0055	Maximum Non-Detect	0.0043
Variance Detects	7.8200E-7	Percent Non-Detects	16.67%
Mean Detects	0.00432	SD Detects	8.8431E-4
Median Detects	0.0043	CV Detects	0.205
Skewness Detects	-0.0908	Kurtosis Detects	0.555
Mean of Logged Detects	-5.462	SD of Logged Detects	0.212

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.995	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.159	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00419	KM Standard Error of Mean	3.7861E-4
KM SD	7.9839E-4	95% KM (BCA) UCL	0.00477
95% KM (t) UCL	0.00495	95% KM (Percentile Bootstrap) UCL	0.00477
95% KM (z) UCL	0.00481	95% KM Bootstrap t UCL	0.00492
90% KM Chebyshev UCL	0.00533	95% KM Chebyshev UCL	0.00584
97.5% KM Chebyshev UCL	0.00656	99% KM Chebyshev UCL	0.00796

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.191	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.679	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.165	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	28.69	k star (bias corrected MLE)	11.61
Theta hat (MLE)	1.5059E-4	Theta star (bias corrected MLE)	3.7216E-4
nu hat (MLE)	286.9	nu star (bias corrected)	116.1
Mean (detects)	0.00432		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0031	Mean	0.00527
Maximum	0.01	Median	0.0045
SD	0.00245	CV	0.465
k hat (MLE)	7.025	k star (bias corrected MLE)	3.623
Theta hat (MLE)	7.4974E-4	Theta star (bias corrected MLE)	0.00145
nu hat (MLE)	84.3	nu star (bias corrected)	43.48
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (43.48, α)	29.36	Adjusted Chi Square Value (43.48, β)	25.25
95% Gamma Approximate UCL (use when n>=50)	0.0078	95% Gamma Adjusted UCL (use when n<50)	0.00907

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00419	SD (KM)	7.9839E-4
Variance (KM)	6.3743E-7	SE of Mean (KM)	3.7861E-4
k hat (KM)	27.56	k star (KM)	13.89
nu hat (KM)	330.8	nu star (KM)	166.7
theta hat (KM)	1.5207E-4	theta star (KM)	3.0171E-4
80% gamma percentile (KM)	0.0051	90% gamma percentile (KM)	0.00568
95% gamma percentile (KM)	0.0062	99% gamma percentile (KM)	0.00724

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (166.72, α)	137.9	Adjusted Chi Square Value (166.72, β)	128.4
95% Gamma Approximate KM-UCL (use when n>=50)	0.00507	95% Gamma Adjusted KM-UCL (use when n<50)	0.00544

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.98	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.19	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00418	Mean in Log Scale	-5.495
SD in Original Scale	8.6260E-4	SD in Log Scale	0.206
95% t UCL (assumes normality of ROS data)	0.00489	95% Percentile Bootstrap UCL	0.00472
95% BCA Bootstrap UCL	0.00477	95% Bootstrap t UCL	0.00505
95% H-UCL (Log ROS)	0.00508		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.493	KM Geo Mean	0.00411
KM SD (logged)	0.194	95% Critical H Value (KM-Log)	2.06
KM Standard Error of Mean (logged)	0.0931	95% H-UCL (KM -Log)	0.00501
KM SD (logged)	0.194	95% Critical H Value (KM-Log)	2.06
KM Standard Error of Mean (logged)	0.0931		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00396	Mean in Log Scale	-5.575
SD in Original Scale	0.00119	SD in Log Scale	0.336
95% t UCL (Assumes normality)	0.00494	95% H-Stat UCL	0.00566

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.00495

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
Number of Detects	5	Number of Non-Detects	1
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	0.0047	Minimum Non-Detect	0.0043
Maximum Detect	0.015	Maximum Non-Detect	0.0043
Variance Detects	1.3865E-5	Percent Non-Detects	16.67%
Mean Detects	0.0098	SD Detects	0.00372
Median Detects	0.0094	CV Detects	0.38
Skewness Detects	0.0718	Kurtosis Detects	1.171
Mean of Logged Detects	-4.692	SD of Logged Detects	0.425

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.975	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.205	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00888	KM Standard Error of Mean	0.00167
KM SD	0.00367	95% KM (BCA) UCL	0.0113
95% KM (t) UCL	0.0123	95% KM (Percentile Bootstrap) UCL	0.0114
95% KM (z) UCL	0.0116	95% KM Bootstrap t UCL	0.0121
90% KM Chebyshev UCL	0.0139	95% KM Chebyshev UCL	0.0162
97.5% KM Chebyshev UCL	0.0193	99% KM Chebyshev UCL	0.0255

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.276	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.68	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.244	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.358	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	7.701	k star (bias corrected MLE)	3.214
Theta hat (MLE)	0.00127	Theta star (bias corrected MLE)	0.00305
nu hat (MLE)	77.01	nu star (bias corrected)	32.14
Mean (detects)	0.0098		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0047	Mean	0.00983
Maximum	0.015	Median	0.0097
SD	0.00333	CV	0.339
k hat (MLE)	9.205	k star (bias corrected MLE)	4.713
Theta hat (MLE)	0.00107	Theta star (bias corrected MLE)	0.00209
nu hat (MLE)	110.5	nu star (bias corrected)	56.56
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (56.56, α)	40.28	Adjusted Chi Square Value (56.56, β)	35.37
95% Gamma Approximate UCL (use when n>=50)	0.0138	95% Gamma Adjusted UCL (use when n<50)	0.0157

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00888	SD (KM)	0.00367
Variance (KM)	1.3445E-5	SE of Mean (KM)	0.00167
k hat (KM)	5.869	k star (KM)	3.046
nu hat (KM)	70.43	nu star (KM)	36.55
theta hat (KM)	0.00151	theta star (KM)	0.00292
80% gamma percentile (KM)	0.0126	90% gamma percentile (KM)	0.0157
95% gamma percentile (KM)	0.0186	99% gamma percentile (KM)	0.0247

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (36.55, α)	23.71	Adjusted Chi Square Value (36.55, β)	20.06
95% Gamma Approximate KM-UCL (use when n>=50)	0.0137	95% Gamma Adjusted KM-UCL (use when n<50)	0.0162

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.935	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.272	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0087	Mean in Log Scale	-4.866
SD in Original Scale	0.00428	SD in Log Scale	0.572
95% t UCL (assumes normality of ROS data)	0.0122	95% Percentile Bootstrap UCL	0.0114
95% BCA Bootstrap UCL	0.0114	95% Bootstrap t UCL	0.0122
95% H-UCL (Log ROS)	0.0187		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-4.818	KM Geo Mean	0.00808
KM SD (logged)	0.448	95% Critical H Value (KM-Log)	2.517
KM Standard Error of Mean (logged)	0.204	95% H-UCL (KM -Log)	0.0148
KM SD (logged)	0.448	95% Critical H Value (KM-Log)	2.517
KM Standard Error of Mean (logged)	0.204		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00853	Mean in Log Scale	-4.933
SD in Original Scale	0.00457	SD in Log Scale	0.704
95% t UCL (Assumes normality)	0.0123	95% H-Stat UCL	0.0251

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.0123

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFBS|ug/L

General Statistics

Total Number of Observations	6	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	0.0032	Mean	0.0165
Maximum	0.025	Median	0.0175
SD	0.00732	Std. Error of Mean	0.00299
Coefficient of Variation	0.443	Skewness	-1.304

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.885	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.304	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0226	95% Adjusted-CLT UCL (Chen-1995)	0.0198
		95% Modified-t UCL (Johnson-1978)	0.0223

ProUCL Output
Raleigh Creek - Upper
Dissolved Porewater

Gamma GOF Test

A-D Test Statistic	0.799	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.701	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.384	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.334	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.266	k star (bias corrected MLE)	1.744
Theta hat (MLE)	0.00506	Theta star (bias corrected MLE)	0.00948
nu hat (MLE)	39.2	nu star (bias corrected)	20.93
MLE Mean (bias corrected)	0.0165	MLE Sd (bias corrected)	0.0125
		Approximate Chi Square Value (0.05)	11.54
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	9.13

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.03	95% Adjusted Gamma UCL (use when n<50)	0.0379

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.707	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.402	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.745	Mean of logged Data	-4.263
Maximum of Logged Data	-3.689	SD of logged Data	0.744

Assuming Lognormal Distribution

95% H-UCL	0.0558	90% Chebyshev (MVUE) UCL	0.0336
95% Chebyshev (MVUE) UCL	0.0408	97.5% Chebyshev (MVUE) UCL	0.0508
99% Chebyshev (MVUE) UCL	0.0705		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0215	95% Jackknife UCL	0.0226
95% Standard Bootstrap UCL	0.0209	95% Bootstrap-t UCL	0.021
95% Hall's Bootstrap UCL	0.0203	95% Percentile Bootstrap UCL	0.0207
95% BCA Bootstrap UCL	0.02		
90% Chebyshev(Mean, Sd) UCL	0.0255	95% Chebyshev(Mean, Sd) UCL	0.0296
97.5% Chebyshev(Mean, Sd) UCL	0.0352	99% Chebyshev(Mean, Sd) UCL	0.0463

Suggested UCL to Use

95% Student's-t UCL 0.0226

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFHxS|ug/L

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.0024	Mean	0.0397
Maximum	0.059	Median	0.0465
SD	0.0208	Std. Error of Mean	0.00848
Coefficient of Variation	0.523	Skewness	-1.417

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

ProUCL Output
Raleigh Creek - Upper
Dissolved Porewater

Normal GOF Test

Shapiro Wilk Test Statistic	0.867	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.285	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0568	95% Adjusted-CLT UCL (Chen-1995)	0.0484
		95% Modified-t UCL (Johnson-1978)	0.056

Gamma GOF Test

A-D Test Statistic	0.921	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.707	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.341	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.337	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.595	k star (bias corrected MLE)	0.908
Theta hat (MLE)	0.0249	Theta star (bias corrected MLE)	0.0437
nu hat (MLE)	19.14	nu star (bias corrected)	10.9
MLE Mean (bias corrected)	0.0397	MLE Sd (bias corrected)	0.0417
		Approximate Chi Square Value (0.05)	4.513
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	3.154

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.096	95% Adjusted Gamma UCL (use when n<50)	0.137

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.657	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.354	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-6.032	Mean of logged Data	-3.571
Maximum of Logged Data	-2.83	SD of logged Data	1.228

Assuming Lognormal Distribution

95% H-UCL	0.89	90% Chebyshev (MVUE) UCL	0.123
95% Chebyshev (MVUE) UCL	0.157	97.5% Chebyshev (MVUE) UCL	0.203
99% Chebyshev (MVUE) UCL	0.293		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0537	95% Jackknife UCL	0.0568
95% Standard Bootstrap UCL	0.0524	95% Bootstrap-t UCL	0.0524
95% Hall's Bootstrap UCL	0.0492	95% Percentile Bootstrap UCL	0.0513
95% BCA Bootstrap UCL	0.0502		
90% Chebyshev(Mean, Sd) UCL	0.0652	95% Chebyshev(Mean, Sd) UCL	0.0767
97.5% Chebyshev(Mean, Sd) UCL	0.0927	99% Chebyshev(Mean, Sd) UCL	0.124

Suggested UCL to Use

95% Student's-t UCL 0.0568

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

ProUCL Output
Raleigh Creek - Upper
Dissolved Porewater
PFOS|ug/L

General Statistics

Total Number of Observations	6	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	0.026	Mean	1.338
Maximum	2.1	Median	1.5
SD	0.749	Std. Error of Mean	0.306
Coefficient of Variation	0.56	Skewness	-1.165

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.893	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.231	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.954	95% Adjusted-CLT UCL (Chen-1995)	1.685
		95% Modified-t UCL (Johnson-1978)	1.93

Gamma GOF Test

A-D Test Statistic	0.991	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.714	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.387	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.34	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.073	k star (bias corrected MLE)	0.648
Theta hat (MLE)	1.246	Theta star (bias corrected MLE)	2.065
nu hat (MLE)	12.88	nu star (bias corrected)	7.774
MLE Mean (bias corrected)	1.338	MLE Sd (bias corrected)	1.662
		Approximate Chi Square Value (0.05)	2.605
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	1.655

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	3.992	95% Adjusted Gamma UCL (use when n<50)	6.282

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.631	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.413	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-3.65	Mean of logged Data	-0.242
Maximum of Logged Data	0.742	SD of logged Data	1.688

Assuming Lognormal Distribution

95% H-UCL	462.3	90% Chebyshev (MVUE) UCL	6.414
95% Chebyshev (MVUE) UCL	8.318	97.5% Chebyshev (MVUE) UCL	10.96
99% Chebyshev (MVUE) UCL	16.15		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.841	95% Jackknife UCL	1.954
95% Standard Bootstrap UCL	1.794	95% Bootstrap-t UCL	1.804
95% Hall's Bootstrap UCL	1.71	95% Percentile Bootstrap UCL	1.783
95% BCA Bootstrap UCL	1.683		
90% Chebyshev(Mean, Sd) UCL	2.255	95% Chebyshev(Mean, Sd) UCL	2.67
97.5% Chebyshev(Mean, Sd) UCL	3.247	99% Chebyshev(Mean, Sd) UCL	4.38

ProUCL Output
Raleigh Creek - Upper
Dissolved Porewater

Suggested UCL to Use

95% Student's-t UCL 1.954

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFOSA|ug/L

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.001	Mean	0.0252
Maximum	0.035	Median	0.029
SD	0.0124	Std. Error of Mean	0.00505
Coefficient of Variation	0.491	Skewness	-2.004

Note: Sample size is small (e.g., <10), If data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.764	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.328	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0353	95% Adjusted-CLT UCL (Chen-1995)	0.0291
		95% Modified-t UCL (Johnson-1978)	0.0347

Gamma GOF Test

A-D Test Statistic	1.272	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.709	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.442	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.338	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.402	k star (bias corrected MLE)	0.812
Theta hat (MLE)	0.018	Theta star (bias corrected MLE)	0.031
nu hat (MLE)	16.82	nu star (bias corrected)	9.746
MLE Mean (bias corrected)	0.0252	MLE Sd (bias corrected)	0.0279
		Approximate Chi Square Value (0.05)	3.783
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	2.569

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0648	95% Adjusted Gamma UCL (use when n<50)	0.0955

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.58	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.444	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-6.908	Mean of logged Data	-4.079
Maximum of Logged Data	-3.352	SD of logged Data	1.391

Assuming Lognormal Distribution

95% H-UCL	1.352	90% Chebyshev (MVUE) UCL	0.0921
95% Chebyshev (MVUE) UCL	0.118	97.5% Chebyshev (MVUE) UCL	0.154
99% Chebyshev (MVUE) UCL	0.224		

ProUCL Output
Raleigh Creek - Upper
Dissolved Porewater

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0335	95% Jackknife UCL	0.0353
95% Standard Bootstrap UCL	0.0327	95% Bootstrap-t UCL	0.0324
95% Hall's Bootstrap UCL	0.03	95% Percentile Bootstrap UCL	0.0315
95% BCA Bootstrap UCL	0.0305		
90% Chebyshev(Mean, Sd) UCL	0.0403	95% Chebyshev(Mean, Sd) UCL	0.0472
97.5% Chebyshev(Mean, Sd) UCL	0.0567	99% Chebyshev(Mean, Sd) UCL	0.0754

Suggested UCL to Use

95% Hall's Bootstrap UCL	0.03

In Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or 99% Chebyshev (Mean, Sd) UCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

ProUCL Output
Raleigh Creek - Other
Dissolved Porewater

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/26/2021 12:58:41 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Area- RC O Media- Filtered Porewater

PFBA|ug/L

General Statistics

Total Number of Observations	7	Number of Distinct Observations	3
		Number of Missing Observations	0
Minimum	0.093	Mean	0.0964
Maximum	0.1	Median	0.096
SD	0.00351	Std. Error of Mean	0.00132
Coefficient of Variation	0.0363	Skewness	0.0849

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.756	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.274	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.099	95% Adjusted-CLT UCL (Chen-1995)	0.0987
		95% Modified-t UCL (Johnson-1978)	0.099

Gamma GOF Test

A-D Test Statistic	0.872	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.708	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.293	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.311	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	883.9	k star (bias corrected MLE)	505.2
Theta hat (MLE)	1.0910E-4	Theta star (bias corrected MLE)	1.9088E-4
nu hat (MLE)	12374	nu star (bias corrected)	7072
MLE Mean (bias corrected)	0.0964	MLE Sd (bias corrected)	0.00429
		Approximate Chi Square Value (0.05)	6878
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	6819

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0992	95% Adjusted Gamma UCL (use when n<50)	0.1

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.757	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.274	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.375	Mean of logged Data	-2.34
Maximum of Logged Data	-2.303	SD of logged Data	0.0363

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	0.1
95% Chebyshev (MVUE) UCL	0.102	97.5% Chebyshev (MVUE) UCL	0.105
99% Chebyshev (MVUE) UCL	0.11		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

ProUCL Output
Raleigh Creek - Other
Dissolved Porewater

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0986	95% Jackknife UCL	0.099
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A		
90% Chebyshev(Mean, Sd) UCL	0.1	95% Chebyshev(Mean, Sd) UCL	0.102
97.5% Chebyshev(Mean, Sd) UCL	0.105	99% Chebyshev(Mean, Sd) UCL	0.11

Suggested UCL to Use

95% Student's-t UCL 0.099

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFPeA|ug/L

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.0066	Mean	0.0078
Maximum	0.0087	Median	0.0082
SD	7.9791E-4	Std. Error of Mean	3.0158E-4
Coefficient of Variation	0.102	Skewness	-0.537

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.905	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.263	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00839	95% Adjusted-CLT UCL (Chen-1995)	0.00823
		95% Modified-t UCL (Johnson-1978)	0.00838

Gamma GOF Test

A-D Test Statistic	0.441	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.708	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.282	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.311	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	108	k star (bias corrected MLE)	61.8
Theta hat (MLE)	7.2232E-5	Theta star (bias corrected MLE)	1.2621E-4
nu hat (MLE)	1512	nu star (bias corrected)	865.2
MLE Mean (bias corrected)	0.0078	MLE Sd (bias corrected)	9.9220E-4
		Approximate Chi Square Value (0.05)	797.9
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	778.3

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.00846	95% Adjusted Gamma UCL (use when n<50)	0.00867

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.898	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.27	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.021	Mean of logged Data	-4.858
Maximum of Logged Data	-4.744	SD of logged Data	0.105

Assuming Lognormal Distribution

95% H-UCL	0.00846	90% Chebyshev (MVUE) UCL	0.00873
95% Chebyshev (MVUE) UCL	0.00915	97.5% Chebyshev (MVUE) UCL	0.00973
99% Chebyshev (MVUE) UCL	0.0109		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0083	95% Jackknife UCL	0.00839
95% Standard Bootstrap UCL	0.00827	95% Bootstrap-t UCL	0.00827
95% Hall's Bootstrap UCL	0.00816	95% Percentile Bootstrap UCL	0.00826
95% BCA Bootstrap UCL	0.00821		
90% Chebyshev(Mean, Sd) UCL	0.0087	95% Chebyshev(Mean, Sd) UCL	0.00911
97.5% Chebyshev(Mean, Sd) UCL	0.00968	99% Chebyshev(Mean, Sd) UCL	0.0108

Suggested UCL to Use

95% Student's-t UCL 0.00839

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFHpA|ug/L

General Statistics

Total Number of Observations	7	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.0022	Mean	0.0037
Maximum	0.0053	Median	0.0035
SD	9.4340E-4	Std. Error of Mean	3.5657E-4
Coefficient of Variation	0.255	Skewness	0.248

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.934	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.232	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00439	95% Adjusted-CLT UCL (Chen-1995)	0.00432
		95% Modified-t UCL (Johnson-1978)	0.0044

Gamma GOF Test

A-D Test Statistic	0.403	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.707	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.253	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.312	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	17.16	k star (bias corrected MLE)	9.902
Theta hat (MLE)	2.1559E-4	Theta star (bias corrected MLE)	3.7365E-4
nu hat (MLE)	240.3	nu star (bias corrected)	138.6
MLE Mean (bias corrected)	0.0037	MLE Sd (bias corrected)	0.00118
		Approximate Chi Square Value (0.05)	112.4
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	105.3

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.00456	95% Adjusted Gamma UCL (use when n<50)	0.00487

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.916	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.275	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-6.119	Mean of logged Data	-5.629
Maximum of Logged Data	-5.24	SD of logged Data	0.267

Assuming Lognormal Distribution

95% H-UCL	0.0047	90% Chebyshev (MVUE) UCL	0.00483
95% Chebyshev (MVUE) UCL	0.00534	97.5% Chebyshev (MVUE) UCL	0.00605
99% Chebyshev (MVUE) UCL	0.00744		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00429	95% Jackknife UCL	0.00439
95% Standard Bootstrap UCL	0.00424	95% Bootstrap-t UCL	0.00455
95% Hall's Bootstrap UCL	0.00493	95% Percentile Bootstrap UCL	0.00424
95% BCA Bootstrap UCL	0.00426		
90% Chebyshev(Mean, Sd) UCL	0.00477	95% Chebyshev(Mean, Sd) UCL	0.00525
97.5% Chebyshev(Mean, Sd) UCL	0.00593	99% Chebyshev(Mean, Sd) UCL	0.00725

Suggested UCL to Use

95% Student's-t UCL	0.00439

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOA|ug/L

General Statistics

Total Number of Observations	7	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	0.008	Mean	0.00994
Maximum	0.012	Median	0.01
SD	0.00146	Std. Error of Mean	5.5328E-4
Coefficient of Variation	0.147	Skewness	0.0557

Note: Sample size is small (e.g., <10), If data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.936	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.211	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.011	95% Adjusted-CLT UCL (Chen-1995)	0.0109
		95% Modified-t UCL (Johnson-1978)	0.011

Gamma GOF Test

A-D Test Statistic	0.342	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.708	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.225	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.311	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

ProUCL Output
Raleigh Creek - Other
Dissolved Porewater

Gamma Statistics

k hat (MLE)	53.4	k star (bias corrected MLE)	30.61
Theta hat (MLE)	1.8621E-4	Theta star (bias corrected MLE)	3.2486E-4
nu hat (MLE)	747.5	nu star (bias corrected)	428.5
MLE Mean (bias corrected)	0.00994	MLE Sd (bias corrected)	0.0018
		Approximate Chi Square Value (0.05)	381.5
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	368

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0112	95% Adjusted Gamma UCL (use when n<50)	0.0116

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.935	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.205	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.828	Mean of logged Data	-4.62
Maximum of Logged Data	-4.423	SD of logged Data	0.148

Assuming Lognormal Distribution

95% H-UCL	0.0112	90% Chebyshev (MVUE) UCL	0.0116
95% Chebyshev (MVUE) UCL	0.0124	97.5% Chebyshev (MVUE) UCL	0.0134
99% Chebyshev (MVUE) UCL	0.0155		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0109	95% Jackknife UCL	0.011
95% Standard Bootstrap UCL	0.0108	95% Bootstrap-t UCL	0.0111
95% Hall's Bootstrap UCL	0.0108	95% Percentile Bootstrap UCL	0.0107
95% BCA Bootstrap UCL	0.0108		
90% Chebyshev(Mean, Sd) UCL	0.0116	95% Chebyshev(Mean, Sd) UCL	0.0124
97.5% Chebyshev(Mean, Sd) UCL	0.0134	99% Chebyshev(Mean, Sd) UCL	0.0154

Suggested UCL to Use

95% Student's-t UCL 0.011

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFBS|ug/L

General Statistics

Total Number of Observations	7	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	0.0025	Mean	0.00276
Maximum	0.0031	Median	0.0027
SD	1.8127E-4	Std. Error of Mean	6.8512E-5
Coefficient of Variation	0.0657	Skewness	0.897

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.888	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.264	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00289	95% Adjusted-CLT UCL (Chen-1995)	0.00289
		95% Modified-t UCL (Johnson-1978)	0.00289

ProUCL Output
Raleigh Creek - Other
Dissolved Porewater

Gamma GOF Test

A-D Test Statistic	0.506	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.708	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.248	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.311	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	276.2	k star (bias corrected MLE)	157.9
Theta hat (MLE)	9.9808E-6	Theta star (bias corrected MLE)	1.7456E-5
nu hat (MLE)	3867	nu star (bias corrected)	2211
MLE Mean (bias corrected)	0.00276	MLE Sd (bias corrected)	2.1938E-4
		Approximate Chi Square Value (0.05)	2103
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	2071

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0029	95% Adjusted Gamma UCL (use when n<50)	0.00294

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.899	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.252	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.991	Mean of logged Data	-5.895
Maximum of Logged Data	-5.776	SD of logged Data	0.0647

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	0.00296
95% Chebyshev (MVUE) UCL	0.00305	97.5% Chebyshev (MVUE) UCL	0.00318
99% Chebyshev (MVUE) UCL	0.00343		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00287	95% Jackknife UCL	0.00289
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A		
90% Chebyshev(Mean, Sd) UCL	0.00296	95% Chebyshev(Mean, Sd) UCL	0.00306
97.5% Chebyshev(Mean, Sd) UCL	0.00318	99% Chebyshev(Mean, Sd) UCL	0.00344

Suggested UCL to Use

95% Student's-t UCL 0.00289

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFHxS|ug/L

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.0021	Mean	0.00297
Maximum	0.004	Median	0.0029
SD	7.4992E-4	Std. Error of Mean	2.8344E-4
Coefficient of Variation	0.252	Skewness	0.454

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

ProUCL Output
Raleigh Creek - Other
Dissolved Porewater

Normal GOF Test

Shapiro Wilk Test Statistic	0.911	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.178	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00352	95% Adjusted-CLT UCL (Chen-1995)	0.00349
		95% Modified-t UCL (Johnson-1978)	0.00353

Gamma GOF Test

A-D Test Statistic	0.304	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.707	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.19	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.312	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	18.71	k star (bias corrected MLE)	10.78
Theta hat (MLE)	1.5885E-4	Theta star (bias corrected MLE)	2.7554E-4
nu hat (MLE)	261.9	nu star (bias corrected)	151
MLE Mean (bias corrected)	0.00297	MLE Sd (bias corrected)	9.0485E-4
		Approximate Chi Square Value (0.05)	123.6
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	116.1

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.00363	95% Adjusted Gamma UCL (use when n<50)	0.00386

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.933	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.17	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-6.166	Mean of logged Data	-5.846
Maximum of Logged Data	-5.521	SD of logged Data	0.25

Assuming Lognormal Distribution

95% H-UCL	0.00369	90% Chebyshev (MVUE) UCL	0.00381
95% Chebyshev (MVUE) UCL	0.0042	97.5% Chebyshev (MVUE) UCL	0.00473
99% Chebyshev (MVUE) UCL	0.00577		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00344	95% Jackknife UCL	0.00352
95% Standard Bootstrap UCL	0.00341	95% Bootstrap-t UCL	0.00373
95% Hall's Bootstrap UCL	0.00366	95% Percentile Bootstrap UCL	0.00341
95% BCA Bootstrap UCL	0.00341		
90% Chebyshev(Mean, Sd) UCL	0.00382	95% Chebyshev(Mean, Sd) UCL	0.00421
97.5% Chebyshev(Mean, Sd) UCL	0.00474	99% Chebyshev(Mean, Sd) UCL	0.00579

Suggested UCL to Use

95% Student's-t UCL	0.00352

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	7	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.0032	Mean	0.0157
Maximum	0.052	Median	0.0051
SD	0.0188	Std. Error of Mean	0.00712
Coefficient of Variation	1.202	Skewness	1.566

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.74	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.312	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.0295	95% Adjusted-CLT UCL (Chen-1995)	0.0319
		95% Modified-t UCL (Johnson-1978)	0.0302

Gamma GOF Test

A-D Test Statistic	0.683	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.728	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.292	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.32	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.993	k star (bias corrected MLE)	0.663
Theta hat (MLE)	0.0158	Theta star (bias corrected MLE)	0.0236
nu hat (MLE)	13.91	nu star (bias corrected)	9.28
MLE Mean (bias corrected)	0.0157	MLE Sd (bias corrected)	0.0192
		Approximate Chi Square Value (0.05)	3.497
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	2.514

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	0.0416	95% Adjusted Gamma UCL (use when n<50)	0.0579

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.844	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.256	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.745	Mean of logged Data	-4.737
Maximum of Logged Data	-2.957	SD of logged Data	1.126

Assuming Lognormal Distribution

95% H-UCL	0.107	90% Chebyshev (MVUE) UCL	0.0333
95% Chebyshev (MVUE) UCL	0.0417	97.5% Chebyshev (MVUE) UCL	0.0534
99% Chebyshev (MVUE) UCL	0.0765		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0274	95% Jackknife UCL	0.0295
95% Standard Bootstrap UCL	0.0266	95% Bootstrap-t UCL	0.0877
95% Hall's Bootstrap UCL	0.109	95% Percentile Bootstrap UCL	0.0282
95% BCA Bootstrap UCL	0.0315		
90% Chebyshev(Mean, Sd) UCL	0.037	95% Chebyshev(Mean, Sd) UCL	0.0467
97.5% Chebyshev(Mean, Sd) UCL	0.0601	99% Chebyshev(Mean, Sd) UCL	0.0865

ProUCL Output
Raleigh Creek - Other
Dissolved Porewater

Suggested UCL to Use

95% Adjusted Gamma UCL 0.0579

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	7	Number of Distinct Observations	5
Number of Detects	4	Number of Non-Detects	3
Number of Distinct Detects	4	Number of Distinct Non-Detects	1
Minimum Detect	8.0000E-4	Minimum Non-Detect	0.0044
Maximum Detect	0.0027	Maximum Non-Detect	0.0044
Variance Detects	7.1583E-7	Percent Non-Detects	42.86%
Mean Detects	0.00168	SD Detects	8.4607E-4
Median Detects	0.0016	CV Detects	0.505
Skewness Detects	0.368	Kurtosis Detects	-2.103
Mean of Logged Detects	-6.496	SD of Logged Detects	0.539

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.965	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.213	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00168	KM Standard Error of Mean	4.2303E-4
KM SD	7.3272E-4	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.0025	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.00237	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.00294	95% KM Chebyshev UCL	0.00352
97.5% KM Chebyshev UCL	0.00432	99% KM Chebyshev UCL	0.00588

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.236	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.659	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.21	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.396	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.949	k star (bias corrected MLE)	1.404
Theta hat (MLE)	3.3845E-4	Theta star (bias corrected MLE)	0.00119
nu hat (MLE)	39.59	nu star (bias corrected)	11.23
Mean (detects)	0.00168		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	8.0000E-4	Mean	0.00524
Maximum	0.01	Median	0.0027
SD	0.00449	CV	0.856
k hat (MLE)	1.291	k star (bias corrected MLE)	0.833
Theta hat (MLE)	0.00406	Theta star (bias corrected MLE)	0.0063
nu hat (MLE)	18.07	nu star (bias corrected)	11.66
Adjusted Level of Significance (β)	0.0158		
Approximate Chi Square Value (11.66, α)	5.003	Adjusted Chi Square Value (11.66, β)	3.772
95% Gamma Approximate UCL (use when n>=50)	0.0122	95% Gamma Adjusted UCL (use when n<50)	N/A

ProUCL Output
Raleigh Creek - Other
Dissolved Porewater

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00168	SD (KM)	7.3272E-4
Variance (KM)	5.3688E-7	SE of Mean (KM)	4.2303E-4
k hat (KM)	5.226	k star (KM)	3.081
nu hat (KM)	73.16	nu star (KM)	43.14
theta hat (KM)	3.2052E-4	theta star (KM)	5.4358E-4
80% gamma percentile (KM)	0.00238	90% gamma percentile (KM)	0.00295
95% gamma percentile (KM)	0.00349	99% gamma percentile (KM)	0.00464

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (43.14, α)	29.08	Adjusted Chi Square Value (43.14, β)	25.65
95% Gamma Approximate KM-UCL (use when n>=50)	0.00248	95% Gamma Adjusted KM-UCL (use when n<50)	0.00282

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.973	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.199	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00166	Mean in Log Scale	-6.496
SD in Original Scale	7.5609E-4	SD in Log Scale	0.48
95% t UCL (assumes normality of ROS data)	0.00221	95% Percentile Bootstrap UCL	0.0021
95% BCA Bootstrap UCL	0.00214	95% Bootstrap t UCL	0.00225
95% H-UCL (Log ROS)	0.00272		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-6.496	KM Geo Mean	0.00151
KM SD (logged)	0.467	95% Critical H Value (KM-Log)	2.392
KM Standard Error of Mean (logged)	0.27	95% H-UCL (KM -Log)	0.00266
KM SD (logged)	0.467	95% Critical H Value (KM-Log)	2.392
KM Standard Error of Mean (logged)	0.27		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0019	Mean in Log Scale	-6.335
SD in Original Scale	6.6081E-4	SD in Log Scale	0.431
95% t UCL (Assumes normality)	0.00239	95% H-Stat UCL	0.00293

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.0025

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
West Lakeland
Dissolved Porewater

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/26/2021 1:09:55 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.23	Mean	0.369
Maximum	0.44	Median	0.38
SD	0.0739	Std. Error of Mean	0.0246
Coefficient of Variation	0.2	Skewness	-1.085

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.865	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.23	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.415	95% Adjusted-CLT UCL (Chen-1995)	0.4
		95% Modified-t UCL (Johnson-1978)	0.413

Gamma GOF Test

A-D Test Statistic	0.674	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.257	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	24.07	k star (bias corrected MLE)	16.12
Theta hat (MLE)	0.0153	Theta star (bias corrected MLE)	0.0229
nu hat (MLE)	433.3	nu star (bias corrected)	290.2
MLE Mean (bias corrected)	0.369	MLE Sd (bias corrected)	0.0919
		Approximate Chi Square Value (0.05)	251.8
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	244.2

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.425	95% Adjusted Gamma UCL (use when n<50)	0.438

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.826	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.272	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.47	Mean of logged Data	-1.018
Maximum of Logged Data	-0.821	SD of logged Data	0.226

Assuming Lognormal Distribution

95% H-UCL	0.432	90% Chebyshev (MVUE) UCL	0.453
95% Chebyshev (MVUE) UCL	0.491	97.5% Chebyshev (MVUE) UCL	0.544
99% Chebyshev (MVUE) UCL	0.647		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

ProUCL Output
West Lakeland
Dissolved Porewater

95% CLT UCL	0.409	95% Jackknife UCL	0.415
95% Standard Bootstrap UCL	0.407	95% Bootstrap-t UCL	0.407
95% Hall's Bootstrap UCL	0.4	95% Percentile Bootstrap UCL	0.406
95% BCA Bootstrap UCL	0.398		
90% Chebyshev(Mean, Sd) UCL	0.443	95% Chebyshev(Mean, Sd) UCL	0.476
97.5% Chebyshev(Mean, Sd) UCL	0.523	99% Chebyshev(Mean, Sd) UCL	0.614

Suggested UCL to Use

95% Student's-t UCL 0.415

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFPeA|ug/L

General Statistics

Total Number of Observations	9	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	0.0078	Mean	0.0133
Maximum	0.015	Median	0.014
SD	0.0026	Std. Error of Mean	8.6738E-4
Coefficient of Variation	0.195	Skewness	-1.673

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.699	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.382	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0149	95% Adjusted-CLT UCL (Chen-1995)	0.0142
		95% Modified-t UCL (Johnson-1978)	0.0148

Gamma GOF Test

A-D Test Statistic	1.413	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.721	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.402	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	23.69	k star (bias corrected MLE)	15.87
Theta hat (MLE)	5.6195E-4	Theta star (bias corrected MLE)	8.3899E-4
nu hat (MLE)	426.4	nu star (bias corrected)	285.6
MLE Mean (bias corrected)	0.0133	MLE Sd (bias corrected)	0.00334
		Approximate Chi Square Value (0.05)	247.4
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	239.9

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0154	95% Adjusted Gamma UCL (use when n<50)	0.0158

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.673	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.4	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.854	Mean of logged Data	-4.34
Maximum of Logged Data	-4.2	SD of logged Data	0.231

Assuming Lognormal Distribution

95% H-UCL	0.0157	90% Chebyshev (MVUE) UCL	0.0164
95% Chebyshev (MVUE) UCL	0.0178	97.5% Chebyshev (MVUE) UCL	0.0198
99% Chebyshev (MVUE) UCL	0.0236		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0147	95% Jackknife UCL	0.0149
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A		
90% Chebyshev(Mean, Sd) UCL	0.0159	95% Chebyshev(Mean, Sd) UCL	0.0171
97.5% Chebyshev(Mean, Sd) UCL	0.0187	99% Chebyshev(Mean, Sd) UCL	0.0219

Suggested UCL to Use

95% Student's-t UCL	0.0149	or 95% Modified-t UCL	0.0148

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.0095	Mean	0.0145
Maximum	0.018	Median	0.015
SD	0.00281	Std. Error of Mean	9.3541E-4
Coefficient of Variation	0.194	Skewness	-0.682

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.926	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.207	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0162	95% Adjusted-CLT UCL (Chen-1995)	0.0158
		95% Modified-t UCL (Johnson-1978)	0.0162

Gamma GOF Test

A-D Test Statistic	0.445	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.231	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	27.09	k star (bias corrected MLE)	18.13
Theta hat (MLE)	5.3526E-4	Theta star (bias corrected MLE)	7.9961E-4
nu hat (MLE)	487.6	nu star (bias corrected)	326.4
MLE Mean (bias corrected)	0.0145	MLE Sd (bias corrected)	0.00341
		Approximate Chi Square Value (0.05)	285.5
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	277.5

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0166	95% Adjusted Gamma UCL (use when n<50)	0.0171

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.893	**Shapiro Wilk Lognormal GOF Test**

5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.246	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.656	Mean of logged Data	-4.252
Maximum of Logged Data	-4.017	SD of logged Data	0.21

Assuming Lognormal Distribution

95% H-UCL	0.0168	90% Chebyshev (MVUE) UCL	0.0176
95% Chebyshev (MVUE) UCL	0.019	97.5% Chebyshev (MVUE) UCL	0.0209
99% Chebyshev (MVUE) UCL	0.0247		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.016	95% Jackknife UCL	0.0162
95% Standard Bootstrap UCL	0.016	95% Bootstrap-t UCL	0.0159
95% Hall's Bootstrap UCL	0.0159	95% Percentile Bootstrap UCL	0.0159
95% BCA Bootstrap UCL	0.0158		
90% Chebyshev(Mean, Sd) UCL	0.0173	95% Chebyshev(Mean, Sd) UCL	0.0186
97.5% Chebyshev(Mean, Sd) UCL	0.0203	99% Chebyshev(Mean, Sd) UCL	0.0238

Suggested UCL to Use

95% Student's-t UCL 0.0162

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.0067	Mean	0.0093
Maximum	0.012	Median	0.009
SD	0.00162	Std. Error of Mean	5.3929E-4
Coefficient of Variation	0.174	Skewness	0.175

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.98	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.129	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0103	95% Adjusted-CLT UCL (Chen-1995)	0.0102
		95% Modified-t UCL (Johnson-1978)	0.0103

Gamma GOF Test

A-D Test Statistic	0.182	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.136	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	36.77	k star (bias corrected MLE)	24.59
Theta hat (MLE)	2.5294E-4	Theta star (bias corrected MLE)	3.7826E-4
nu hat (MLE)	661.8	nu star (bias corrected)	442.5

ProUCL Output
West Lakeland
Dissolved Porewater

MLE Mean (bias corrected)	0.0093	MLE Sd (bias corrected)	0.00188
		Approximate Chi Square Value (0.05)	394.8
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	385.2

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0104	95% Adjusted Gamma UCL (use when n<50)	0.0107

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.979	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.132	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.006	Mean of logged Data	-4.691
Maximum of Logged Data	-4.423	SD of logged Data	0.176

Assuming Lognormal Distribution

95% H-UCL	0.0105	90% Chebyshev (MVUE) UCL	0.0109
95% Chebyshev (MVUE) UCL	0.0117	97.5% Chebyshev (MVUE) UCL	0.0127
99% Chebyshev (MVUE) UCL	0.0148		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0102	95% Jackknife UCL	0.0103
95% Standard Bootstrap UCL	0.0101	95% Bootstrap-t UCL	0.0104
95% Hall's Bootstrap UCL	0.0103	95% Percentile Bootstrap UCL	0.0101
95% BCA Bootstrap UCL	0.0102		
90% Chebyshev(Mean, Sd) UCL	0.0109	95% Chebyshev(Mean, Sd) UCL	0.0117
97.5% Chebyshev(Mean, Sd) UCL	0.0127	99% Chebyshev(Mean, Sd) UCL	0.0147

Suggested UCL to Use

95% Student's-t UCL 0.0103

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.054	Mean	0.0779
Maximum	0.089	Median	0.081
SD	0.0138	Std. Error of Mean	0.00458
Coefficient of Variation	0.177	Skewness	-1.325

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.75	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.339	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0864	95% Adjusted-CLT UCL (Chen-1995)	0.0833
		95% Modified-t UCL (Johnson-1978)	0.0861

Gamma GOF Test

A-D Test Statistic	1.187	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.721	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.361	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.279	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	31.1	k star (bias corrected MLE)	20.81
Theta hat (MLE)	0.0025	Theta star (bias corrected MLE)	0.00374
nu hat (MLE)	559.8	nu star (bias corrected)	374.5
MLE Mean (bias corrected)	0.0779	MLE Sd (bias corrected)	0.0171
		Approximate Chi Square Value (0.05)	330.7
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	322

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0882	95% Adjusted Gamma UCL (use when n<50)	0.0906

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.718	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.364	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.274	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.919	Mean of logged Data	-2.569
Maximum of Logged Data	-2.419	SD of logged Data	0.198

Assuming Lognormal Distribution

95% H-UCL	0.0893	90% Chebyshev (MVUE) UCL	0.0935
95% Chebyshev (MVUE) UCL	0.1	97.5% Chebyshev (MVUE) UCL	0.11
99% Chebyshev (MVUE) UCL	0.129		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0854	95% Jackknife UCL	0.0864
95% Standard Bootstrap UCL	0.0849	95% Bootstrap-t UCL	0.0846
95% Hall's Bootstrap UCL	0.0834	95% Percentile Bootstrap UCL	0.0843
95% BCA Bootstrap UCL	0.0836		
90% Chebyshev(Mean, Sd) UCL	0.0916	95% Chebyshev(Mean, Sd) UCL	0.0979
97.5% Chebyshev(Mean, Sd) UCL	0.107	99% Chebyshev(Mean, Sd) UCL	0.123

Suggested UCL to Use

95% Student's-t UCL	0.0864	or 95% Modified-t UCL	0.0861

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	6
Number of Detects	5	Number of Non-Detects	4
Number of Distinct Detects	3	Number of Distinct Non-Detects	3
Minimum Detect	0.0012	Minimum Non-Detect	0.004
Maximum Detect	0.0021	Maximum Non-Detect	0.0044
Variance Detects	1.5300E-7	Percent Non-Detects	44.44%
Mean Detects	0.00144	SD Detects	3.9115E-4
Median Detects	0.0012	CV Detects	0.272
Skewness Detects	1.714	Kurtosis Detects	2.664
Mean of Logged Detects	-6.569	SD of Logged Detects	0.245

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.735	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.33	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00144	KM Standard Error of Mean	1.7493E-4
KM SD	3.4986E-4	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.00177	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.00173	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.00196	95% KM Chebyshev UCL	0.0022
97.5% KM Chebyshev UCL	0.00253	99% KM Chebyshev UCL	0.00318

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.733	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.679	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.36	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.357	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	19.57	k star (bias corrected MLE)	7.96
Theta hat (MLE)	7.3590E-5	Theta star (bias corrected MLE)	1.8089E-4
nu hat (MLE)	195.7	nu star (bias corrected)	79.6
Mean (detects)	0.00144		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0012	Mean	0.00524
Maximum	0.01	Median	0.0021
SD	0.00452	CV	0.862
k hat (MLE)	1.263	k star (bias corrected MLE)	0.916
Theta hat (MLE)	0.00415	Theta star (bias corrected MLE)	0.00573
nu hat (MLE)	22.73	nu star (bias corrected)	16.49
Adjusted Level of Significance (β)	0.0231		
Approximate Chi Square Value (16.49, α)	8.307	Adjusted Chi Square Value (16.49, β)	7.117
95% Gamma Approximate UCL (use when n>=50)	0.0104	95% Gamma Adjusted UCL (use when n<50)	0.0121

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00144	SD (KM)	3.4986E-4
Variance (KM)	1.2240E-7	SE of Mean (KM)	1.7493E-4
k hat (KM)	16.94	k star (KM)	11.37
nu hat (KM)	304.9	nu star (KM)	204.6
theta hat (KM)	8.5000E-5	theta star (KM)	1.2667E-4
80% gamma percentile (KM)	0.00178	90% gamma percentile (KM)	0.00201
95% gamma percentile (KM)	0.00221	99% gamma percentile (KM)	0.00261

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (204.63, α)	172.5	Adjusted Chi Square Value (204.63, β)	166.3
95% Gamma Approximate KM-UCL (use when n>=50)	0.00171	95% Gamma Adjusted KM-UCL (use when n<50)	0.00177

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.754	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.338	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00143	Mean in Log Scale	-6.569
SD in Original Scale	2.9018E-4	SD in Log Scale	0.184
95% t UCL (assumes normality of ROS data)	0.00161	95% Percentile Bootstrap UCL	0.00158
95% BCA Bootstrap UCL	0.00163	95% Bootstrap t UCL	0.00177
95% H-UCL (Log ROS)	0.00161		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-6.569	KM Geo Mean	0.0014
KM SD (logged)	0.219	95% Critical H Value (KM-Log)	1.927
KM Standard Error of Mean (logged)	0.11	95% H-UCL (KM -Log)	0.00167
KM SD (logged)	0.219	95% Critical H Value (KM-Log)	1.927
KM Standard Error of Mean (logged)	0.11		

DL/2 Statistics

DL/2 Normal **DL/2 Log-Transformed**

Mean in Original Scale	0.00174	Mean in Log Scale	-6.385
SD in Original Scale	4.5788E-4	SD in Log Scale	0.28
95% t UCL (Assumes normality)	0.00203	95% H-Stat UCL	0.00214

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.00177

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
Number of Detects	5	Number of Non-Detects	4
Number of Distinct Detects	5	Number of Distinct Non-Detects	3
Minimum Detect	0.0013	Minimum Non-Detect	0.0042
Maximum Detect	0.015	Maximum Non-Detect	0.0044
Variance Detects	3.5512E-5	Percent Non-Detects	44.44%
Mean Detects	0.00438	SD Detects	0.00596
Median Detects	0.0016	CV Detects	1.361
Skewness Detects	2.195	Kurtosis Detects	4.845
Mean of Logged Detects	-5.961	SD of Logged Detects	1.021

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.621	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.417	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0032	KM Standard Error of Mean	0.00158
KM SD	0.0042	95% KM (BCA) UCL	0.00632
95% KM (t) UCL	0.00613	95% KM (Percentile Bootstrap) UCL	0.00602
95% KM (z) UCL	0.00579	95% KM Bootstrap t UCL	0.0441
90% KM Chebyshev UCL	0.00793	95% KM Chebyshev UCL	0.0101
97.5% KM Chebyshev UCL	0.013	99% KM Chebyshev UCL	0.0189

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.859	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.691	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.365	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.364	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.079	k star (bias corrected MLE)	0.565
Theta hat (MLE)	0.00406	Theta star (bias corrected MLE)	0.00776
nu hat (MLE)	10.79	nu star (bias corrected)	5.647
Mean (detects)	0.00438		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0013	Mean	0.00688
Maximum	0.015	Median	0.01
SD	0.00515	CV	0.749

ProUCL Output
West Lakeland
Dissolved Porewater

k hat (MLE)	1.463	k star (bias corrected MLE)	1.05
Theta hat (MLE)	0.0047	Theta star (bias corrected MLE)	0.00655
nu hat (MLE)	26.34	nu star (bias corrected)	18.89
Adjusted Level of Significance (β)	0.0231		
Approximate Chi Square Value (18.89, α)	10.04	Adjusted Chi Square Value (18.89, β)	8.71
95% Gamma Approximate UCL (use when n>=50)	0.0129	95% Gamma Adjusted UCL (use when n<50)	0.0149

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0032	SD (KM)	0.0042
Variance (KM)	1.7642E-5	SE of Mean (KM)	0.00158
k hat (KM)	0.58	k star (KM)	0.461
nu hat (KM)	10.45	nu star (KM)	8.298
theta hat (KM)	0.00551	theta star (KM)	0.00694
80% gamma percentile (KM)	0.00523	90% gamma percentile (KM)	0.0088
95% gamma percentile (KM)	0.0127	99% gamma percentile (KM)	0.0222

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (8.30, α)	2.909	Adjusted Chi Square Value (8.30, β)	2.28
95% Gamma Approximate KM-UCL (use when n>=50)	0.00913	95% Gamma Adjusted KM-UCL (use when n<50)	0.0116

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.755	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.296	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00329	Mean in Log Scale	-6.108
SD in Original Scale	0.00442	SD in Log Scale	0.767
95% t UCL (assumes normality of ROS data)	0.00603	95% Percentile Bootstrap UCL	0.00619
95% BCA Bootstrap UCL	0.0076	95% Bootstrap t UCL	0.0201
95% H-UCL (Log ROS)	0.00629		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-6.157	KM Geo Mean	0.00212
KM SD (logged)	0.737	95% Critical H Value (KM-Log)	2.689
KM Standard Error of Mean (logged)	0.291	95% H-UCL (KM -Log)	0.0056
KM SD (logged)	0.737	95% Critical H Value (KM-Log)	2.689
KM Standard Error of Mean (logged)	0.291		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00339	Mean in Log Scale	-6.042
SD in Original Scale	0.00437	SD in Log Scale	0.728
95% t UCL (Assumes normality)	0.0061	95% H-Stat UCL	0.00617

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 0.0101

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFBS|ug/L

General Statistics

Total Number of Observations	9	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.0035	Mean	0.00436
Maximum	0.0062	Median	0.0041
SD	7.7960E-4	Std. Error of Mean	2.5987E-4
Coefficient of Variation	0.179	Skewness	1.841

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

ProUCL Output
West Lakeland
Dissolved Porewater

Normal GOF Test

Shapiro Wilk Test Statistic	0.817	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.266	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level	

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00484	95% Adjusted-CLT UCL (Chen-1995)	0.00495
		95% Modified-t UCL (Johnson-1978)	0.00487

Gamma GOF Test

A-D Test Statistic	0.575	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.233	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	40.06	k star (bias corrected MLE)	26.78
Theta hat (MLE)	1.0873E-4	Theta star (bias corrected MLE)	1.6265E-4
nu hat (MLE)	721	nu star (bias corrected)	482
MLE Mean (bias corrected)	0.00436	MLE Sd (bias corrected)	8.4168E-4
		Approximate Chi Square Value (0.05)	432.1
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	422.1

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.00486	95% Adjusted Gamma UCL (use when n<50)	0.00497

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.878	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.229	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.655	Mean of logged Data	-5.449
Maximum of Logged Data	-5.083	SD of logged Data	0.163

Assuming Lognormal Distribution

95% H-UCL	0.00486	90% Chebyshev (MVUE) UCL	0.00506
95% Chebyshev (MVUE) UCL	0.00538	97.5% Chebyshev (MVUE) UCL	0.00583
99% Chebyshev (MVUE) UCL	0.00671		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00478	95% Jackknife UCL	0.00484
95% Standard Bootstrap UCL	0.00476	95% Bootstrap-t UCL	0.00524
95% Hall's Bootstrap UCL	0.00675	95% Percentile Bootstrap UCL	0.00481
95% BCA Bootstrap UCL	0.00496		
90% Chebyshev(Mean, Sd) UCL	0.00514	95% Chebyshev(Mean, Sd) UCL	0.00549
97.5% Chebyshev(Mean, Sd) UCL	0.00598	99% Chebyshev(Mean, Sd) UCL	0.00694

Suggested UCL to Use

95% Student's-t UCL 0.00484

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFHxS|ug/L

General Statistics

Total Number of Observations	9	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.0057	Mean	0.00909

Maximum	0.011	Median	0.0093
SD	0.00184	Std. Error of Mean	6.1361E-4
Coefficient of Variation	0.203	Skewness	-0.634

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.902	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.184	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0102	95% Adjusted-CLT UCL (Chen-1995)	0.00996
		95% Modified-t UCL (Johnson-1978)	0.0102

Gamma GOF Test

A-D Test Statistic	0.449	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.196	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	24.67	k star (bias corrected MLE)	16.52
Theta hat (MLE)	3.6838E-4	Theta star (bias corrected MLE)	5.5009E-4
nu hat (MLE)	444.1	nu star (bias corrected)	297.4
MLE Mean (bias corrected)	0.00909	MLE Sd (bias corrected)	0.00224
		Approximate Chi Square Value (0.05)	258.5
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	250.8

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0105	95% Adjusted Gamma UCL (use when n<50)	0.0108

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.88	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.206	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.167	Mean of logged Data	-4.721
Maximum of Logged Data	-4.51	SD of logged Data	0.221

Assuming Lognormal Distribution

95% H-UCL	0.0106	90% Chebyshev (MVUE) UCL	0.0111
95% Chebyshev (MVUE) UCL	0.012	97.5% Chebyshev (MVUE) UCL	0.0133
99% Chebyshev (MVUE) UCL	0.0158		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0101	95% Jackknife UCL	0.0102
95% Standard Bootstrap UCL	0.01	95% Bootstrap-t UCL	0.0102
95% Hall's Bootstrap UCL	0.00997	95% Percentile Bootstrap UCL	0.01
95% BCA Bootstrap UCL	0.00988		
90% Chebyshev(Mean, Sd) UCL	0.0109	95% Chebyshev(Mean, Sd) UCL	0.0118
97.5% Chebyshev(Mean, Sd) UCL	0.0129	99% Chebyshev(Mean, Sd) UCL	0.0152

Suggested UCL to Use

95% Student's-t UCL 0.0102

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be

reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFOS|ug/L

General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.0083	Mean	0.245
Maximum	0.82	Median	0.22
SD	0.227	Std. Error of Mean	0.0758
Coefficient of Variation	0.927	Skewness	2.376

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.689	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.381	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.386	95% Adjusted-CLT UCL (Chen-1995)	0.434
		95% Modified-t UCL (Johnson-1978)	0.396

Gamma GOF Test

A-D Test Statistic	0.84	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.738	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.278	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.285	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.306	k star (bias corrected MLE)	0.945
Theta hat (MLE)	0.188	Theta star (bias corrected MLE)	0.26
nu hat (MLE)	23.51	nu star (bias corrected)	17.01
MLE Mean (bias corrected)	0.245	MLE Sd (bias corrected)	0.252
		Approximate Chi Square Value (0.05)	8.676
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	7.456

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	0.481	95% Adjusted Gamma UCL (use when n<50)	0.56

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.752	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.346	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.791	Mean of logged Data	-1.834
Maximum of Logged Data	-0.198	SD of logged Data	1.224

Assuming Lognormal Distribution

95% H-UCL	1.717	90% Chebyshev (MVUE) UCL	0.679
95% Chebyshev (MVUE) UCL	0.851	97.5% Chebyshev (MVUE) UCL	1.09
99% Chebyshev (MVUE) UCL	1.56		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.37	95% Jackknife UCL	0.386
95% Standard Bootstrap UCL	0.363	95% Bootstrap-t UCL	0.555
95% Hall's Bootstrap UCL	0.965	95% Percentile Bootstrap UCL	0.381
95% BCA Bootstrap UCL	0.464		
90% Chebyshev(Mean, Sd) UCL	0.473	95% Chebyshev(Mean, Sd) UCL	0.576
97.5% Chebyshev(Mean, Sd) UCL	0.719	99% Chebyshev(Mean, Sd) UCL	1

ProUCL Output
West Lakeland
Dissolved Porewater

Suggested UCL to Use

95% Adjusted Gamma UCL 0.56

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOSA|ug/L

General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
Number of Detects	7	Number of Non-Detects	2
Number of Distinct Detects	6	Number of Distinct Non-Detects	2
Minimum Detect	9.9000E-4	Minimum Non-Detect	0.0042
Maximum Detect	0.0051	Maximum Non-Detect	0.0044
Variance Detects	2.2878E-6	Percent Non-Detects	22.22%
Mean Detects	0.00191	SD Detects	0.00151
Median Detects	0.0013	CV Detects	0.791
Skewness Detects	2.033	Kurtosis Detects	4.01
Mean of Logged Detects	-6.451	SD of Logged Detects	0.613

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.689	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.372	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00179	KM Standard Error of Mean	4.7440E-4
KM SD	0.00128	95% KM (BCA) UCL	0.00259
95% KM (t) UCL	0.00268	95% KM (Percentile Bootstrap) UCL	0.00253
95% KM (z) UCL	0.00258	95% KM Bootstrap t UCL	0.00746
90% KM Chebyshev UCL	0.00322	95% KM Chebyshev UCL	0.00386
97.5% KM Chebyshev UCL	0.00476	99% KM Chebyshev UCL	0.00652

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.87	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.713	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.368	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.314	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.757	k star (bias corrected MLE)	1.67
Theta hat (MLE)	6.9390E-4	Theta star (bias corrected MLE)	0.00115
nu hat (MLE)	38.59	nu star (bias corrected)	23.39
Mean (detects)	0.00191		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	9.9000E-4	Mean	0.00371
Maximum	0.01	Median	0.0013
SD	0.0038	CV	1.024
k hat (MLE)	1.266	k star (bias corrected MLE)	0.918
Theta hat (MLE)	0.00293	Theta star (bias corrected MLE)	0.00404
nu hat (MLE)	22.79	nu star (bias corrected)	16.52
Adjusted Level of Significance (β)	0.0231		
Approximate Chi Square Value (16.52, α)	8.333	Adjusted Chi Square Value (16.52, β)	7.141
95% Gamma Approximate UCL (use when n>=50)	0.00736	95% Gamma Adjusted UCL (use when n<50)	0.00858

Estimates of Gamma Parameters using KM Estimates

ProUCL Output
West Lakeland
Dissolved Porewater

Mean (KM)	0.00179	SD (KM)	0.00128
Variance (KM)	1.6435E-6	SE of Mean (KM)	4.7440E-4
k hat (KM)	1.96	k star (KM)	1.381
nu hat (KM)	35.28	nu star (KM)	24.85
theta hat (KM)	9.1568E-4	theta star (KM)	0.0013
80% gamma percentile (KM)	0.0028	90% gamma percentile (KM)	0.00382
95% gamma percentile (KM)	0.00481	99% gamma percentile (KM)	0.00706

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (24.85, α)	14.5	Adjusted Chi Square Value (24.85, β)	12.86
95% Gamma Approximate KM-UCL (use when n>=50)	0.00308	95% Gamma Adjusted KM-UCL (use when n<50)	0.00347

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.79	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.338	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00179	Mean in Log Scale	-6.482
SD in Original Scale	0.00133	SD in Log Scale	0.535
95% t UCL (assumes normality of ROS data)	0.00262	95% Percentile Bootstrap UCL	0.00256
95% BCA Bootstrap UCL	0.00291	95% Bootstrap t UCL	0.00678
95% H-UCL (Log ROS)	0.00272		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-6.495	KM Geo Mean	0.00151
KM SD (logged)	0.53	95% Critical H Value (KM-Log)	2.279
KM Standard Error of Mean (logged)	0.202	95% H-UCL (KM -Log)	0.00267
KM SD (logged)	0.53	95% Critical H Value (KM-Log)	2.279
KM Standard Error of Mean (logged)	0.202		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00197	Mean in Log Scale	-6.383
SD in Original Scale	0.00131	SD in Log Scale	0.548
95% t UCL (Assumes normality)	0.00278	95% H-Stat UCL	0.00308

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 0.00386

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Raleigh Creek Upper
Amphibian Tissue

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/19/2021 10:25:25 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	7
Number of Detects	6	Number of Non-Detects	2
Number of Distinct Detects	6	Number of Distinct Non-Detects	2
Minimum Detect	0.377	Minimum Non-Detect	0.374
Maximum Detect	2.31	Maximum Non-Detect	0.377
Variance Detects	0.483	Percent Non-Detects	25%
Mean Detects	1.301	SD Detects	0.695
Median Detects	1.165	CV Detects	0.534
Skewness Detects	0.3	Kurtosis Detects	-0.576
Mean of Logged Detects	0.115	SD of Logged Detects	0.639

Note: Sample size is small (e.g., <10), If data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.974	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.168	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.069	KM Standard Error of Mean	0.264
KM SD	0.68	95% KM (BCA) UCL	1.489
95% KM (t) UCL	1.568	95% KM (Percentile Bootstrap) UCL	1.491
95% KM (z) UCL	1.503	95% KM Bootstrap t UCL	1.637
90% KM Chebyshev UCL	1.86	95% KM Chebyshev UCL	2.218
97.5% KM Chebyshev UCL	2.715	99% KM Chebyshev UCL	3.691

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.215	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.701	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.171	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.334	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.547	k star (bias corrected MLE)	1.885
Theta hat (MLE)	0.367	Theta star (bias corrected MLE)	0.69
nu hat (MLE)	42.57	nu star (bias corrected)	22.62
Mean (detects)	1.301		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.978
Maximum	2.31	Median	0.964
SD	0.838	CV	0.857
k hat (MLE)	0.594	k star (bias corrected MLE)	0.454
Theta hat (MLE)	1.648	Theta star (bias corrected MLE)	2.153
nu hat (MLE)	9.497	nu star (bias corrected)	7.269
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (7.27, α)	2.319	Adjusted Chi Square Value (7.27, β)	1.677
95% Gamma Approximate UCL (use when n>=50)	3.065	95% Gamma Adjusted UCL (use when n<50)	4.239

ProUCL Output
Raleigh Creek Upper
Amphibian Tissue

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.069	SD (KM)	0.68
Variance (KM)	0.463	SE of Mean (KM)	0.264
k hat (KM)	2.469	k star (KM)	1.627
nu hat (KM)	39.51	nu star (KM)	26.03
theta hat (KM)	0.433	theta star (KM)	0.657
80% gamma percentile (KM)	1.639	90% gamma percentile (KM)	2.184
95% gamma percentile (KM)	2.711	99% gamma percentile (KM)	3.894

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (26.03, α)	15.4	Adjusted Chi Square Value (26.03, β)	13.38
95% Gamma Approximate KM-UCL (use when n>=50)	1.807	95% Gamma Adjusted KM-UCL (use when n<50)	2.08

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.939	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.217	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.035	Mean in Log Scale	-0.272
SD in Original Scale	0.766	SD in Log Scale	0.899
95% t UCL (assumes normality of ROS data)	1.548	95% Percentile Bootstrap UCL	1.473
95% BCA Bootstrap UCL	1.484	95% Bootstrap t UCL	1.67
95% H-UCL (Log ROS)	3.359		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.159	KM Geo Mean	0.853
KM SD (logged)	0.694	95% Critical H Value (KM-Log)	2.723
KM Standard Error of Mean (logged)	0.269	95% H-UCL (KM -Log)	2.217
KM SD (logged)	0.694	95% Critical H Value (KM-Log)	2.723
KM Standard Error of Mean (logged)	0.269		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.023	Mean in Log Scale	-0.332
SD in Original Scale	0.781	SD in Log Scale	0.989
95% t UCL (Assumes normality)	1.546	95% H-Stat UCL	4.164

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 1.568

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
Number of Detects	6	Number of Non-Detects	2
Number of Distinct Detects	6	Number of Distinct Non-Detects	2
Minimum Detect	0.237	Minimum Non-Detect	0.0935
Maximum Detect	0.662	Maximum Non-Detect	0.0943
Variance Detects	0.0296	Percent Non-Detects	25%
Mean Detects	0.462	SD Detects	0.172
Median Detects	0.457	CV Detects	0.373
Skewness Detects	-0.0301	Kurtosis Detects	-1.637
Mean of Logged Detects	-0.838	SD of Logged Detects	0.406

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.932	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.19	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.37	KM Standard Error of Mean	0.0812
KM SD	0.21	95% KM (BCA) UCL	0.486
95% KM (t) UCL	0.523	95% KM (Percentile Bootstrap) UCL	0.489
95% KM (z) UCL	0.503	95% KM Bootstrap t UCL	0.502
90% KM Chebyshev UCL	0.613	95% KM Chebyshev UCL	0.724
97.5% KM Chebyshev UCL	0.877	99% KM Chebyshev UCL	1.177

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.273	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.2	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	7.897	k star (bias corrected MLE)	4.06
Theta hat (MLE)	0.0585	Theta star (bias corrected MLE)	0.114
nu hat (MLE)	94.77	nu star (bias corrected)	48.72
Mean (detects)	0.462		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.102	Mean	0.372
Maximum	0.662	Median	0.371
SD	0.221	CV	0.595
k hat (MLE)	2.534	k star (bias corrected MLE)	1.667
Theta hat (MLE)	0.147	Theta star (bias corrected MLE)	0.223
nu hat (MLE)	40.55	nu star (bias corrected)	26.68
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (26.68, α)	15.9	Adjusted Chi Square Value (26.68, β)	13.84
95% Gamma Approximate UCL (use when n>=50)	0.623	95% Gamma Adjusted UCL (use when n<50)	0.716

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.37	SD (KM)	0.21
Variance (KM)	0.0439	SE of Mean (KM)	0.0812
k hat (KM)	3.109	k star (KM)	2.026
nu hat (KM)	49.74	nu star (KM)	32.42
theta hat (KM)	0.119	theta star (KM)	0.182
80% gamma percentile (KM)	0.553	90% gamma percentile (KM)	0.717
95% gamma percentile (KM)	0.873	99% gamma percentile (KM)	1.22

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (32.42, α)	20.41	Adjusted Chi Square Value (32.42, β)	18.04
95% Gamma Approximate KM-UCL (use when n>=50)	0.587	95% Gamma Adjusted KM-UCL (use when n<50)	0.664

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.931	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.171	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.386	Mean in Log Scale	-1.088
SD in Original Scale	0.202	SD in Log Scale	0.577
95% t UCL (assumes normality of ROS data)	0.521	95% Percentile Bootstrap UCL	0.5
95% BCA Bootstrap UCL	0.5	95% Bootstrap t UCL	0.529
95% H-UCL (Log ROS)	0.685		

ProUCL Output
Raleigh Creek Upper
Amphibian Tissue

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.221	KM Geo Mean	0.295
KM SD (logged)	0.737	95% Critical H Value (KM-Log)	2.813
KM Standard Error of Mean (logged)	0.285	95% H-UCL (KM -Log)	0.847
KM SD (logged)	0.737	95% Critical H Value (KM-Log)	2.813
KM Standard Error of Mean (logged)	0.285		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.358	Mean in Log Scale	-1.393
SD in Original Scale	0.241	SD in Log Scale	1.084
95% t UCL (Assumes normality)	0.519	95% H-Stat UCL	1.981

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.523

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.49	Mean	1.053
Maximum	2.26	Median	0.653
SD	0.697	Std. Error of Mean	0.246
Coefficient of Variation	0.662	Skewness	1.091

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.786	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.32	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.519	95% Adjusted-CLT UCL (Chen-1995)	1.559
		95% Modified-t UCL (Johnson-1978)	1.535

Gamma GOF Test

A-D Test Statistic	0.758	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.721	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.308	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.296	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.073	k star (bias corrected MLE)	2.004
Theta hat (MLE)	0.343	Theta star (bias corrected MLE)	0.525
nu hat (MLE)	49.17	nu star (bias corrected)	32.06
MLE Mean (bias corrected)	1.053	MLE Sd (bias corrected)	0.744
		Approximate Chi Square Value (0.05)	20.12
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	17.77

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1.677	95% Adjusted Gamma UCL (use when n<50)	1.9

ProUCL Output
Raleigh Creek Upper
Amphibian Tissue

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.837	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.279	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.713	Mean of logged Data	-0.12
Maximum of Logged Data	0.815	SD of logged Data	0.605

Assuming Lognormal Distribution

95% H-UCL	1.904	90% Chebyshev (MVUE) UCL	1.712
95% Chebyshev (MVUE) UCL	2.018	97.5% Chebyshev (MVUE) UCL	2.442
99% Chebyshev (MVUE) UCL	3.275		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.458	95% Jackknife UCL	1.519
95% Standard Bootstrap UCL	1.433	95% Bootstrap-t UCL	2.074
95% Hall's Bootstrap UCL	1.596	95% Percentile Bootstrap UCL	1.467
95% BCA Bootstrap UCL	1.515		
90% Chebyshev(Mean, Sd) UCL	1.792	95% Chebyshev(Mean, Sd) UCL	2.126
97.5% Chebyshev(Mean, Sd) UCL	2.591	99% Chebyshev(Mean, Sd) UCL	3.504

Suggested UCL to Use

95% H-UCL 1.904

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.116	Mean	0.342
Maximum	0.815	Median	0.223
SD	0.268	Std. Error of Mean	0.0948
Coefficient of Variation	0.785	Skewness	1.211

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.799	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.249	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.521	95% Adjusted-CLT UCL (Chen-1995)	0.541
		95% Modified-t UCL (Johnson-1978)	0.528

Gamma GOF Test

A-D Test Statistic	0.513	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.723	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.216	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.297	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

ProUCL Output
Raleigh Creek Upper
Amphibian Tissue

Gamma Statistics

k hat (MLE)	2.207	k star (bias corrected MLE)	1.463
Theta hat (MLE)	0.155	Theta star (bias corrected MLE)	0.234
nu hat (MLE)	35.31	nu star (bias corrected)	23.4
MLE Mean (bias corrected)	0.342	MLE Sd (bias corrected)	0.282
		Approximate Chi Square Value (0.05)	13.39
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	11.53

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.597	95% Adjusted Gamma UCL (use when n<50)	0.694

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.909	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.187	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.154	Mean of logged Data	-1.317
Maximum of Logged Data	-0.205	SD of logged Data	0.725

Assuming Lognormal Distribution

95% H-UCL	0.747	90% Chebyshev (MVUE) UCL	0.597
95% Chebyshev (MVUE) UCL	0.716	97.5% Chebyshev (MVUE) UCL	0.88
99% Chebyshev (MVUE) UCL	1.204		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.498	95% Jackknife UCL	0.521
95% Standard Bootstrap UCL	0.486	95% Bootstrap-t UCL	0.832
95% Hall's Bootstrap UCL	1.401	95% Percentile Bootstrap UCL	0.498
95% BCA Bootstrap UCL	0.527		
90% Chebyshev(Mean, Sd) UCL	0.626	95% Chebyshev(Mean, Sd) UCL	0.755
97.5% Chebyshev(Mean, Sd) UCL	0.934	99% Chebyshev(Mean, Sd) UCL	1.285

Suggested UCL to Use

95% Student's-t UCL	0.521

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.302	Mean	0.921
Maximum	2.59	Median	0.66
SD	0.784	Std. Error of Mean	0.277
Coefficient of Variation	0.851	Skewness	1.747

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.768	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.348	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.446	95% Adjusted-CLT UCL (Chen-1995)	1.559
		95% Modified-t UCL (Johnson-1978)	1.474

Gamma GOF Test

A-D Test Statistic	0.523	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.724	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.289	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.297	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.132	k star (bias corrected MLE)	1.416
Theta hat (MLE)	0.432	Theta star (bias corrected MLE)	0.65
nu hat (MLE)	34.11	nu star (bias corrected)	22.65
MLE Mean (bias corrected)	0.921	MLE Sd (bias corrected)	0.774
		Approximate Chi Square Value (0.05)	12.83
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	11

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1.626	95% Adjusted Gamma UCL (use when n<50)	1.895

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.925	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.241	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.197	Mean of logged Data	-0.335
Maximum of Logged Data	0.952	SD of logged Data	0.721

Assuming Lognormal Distribution

95% H-UCL	1.98	90% Chebyshev (MVUE) UCL	1.588
95% Chebyshev (MVUE) UCL	1.903	97.5% Chebyshev (MVUE) UCL	2.34
99% Chebyshev (MVUE) UCL	3.198		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.376	95% Jackknife UCL	1.446
95% Standard Bootstrap UCL	1.347	95% Bootstrap-t UCL	2.817
95% Hall's Bootstrap UCL	4.248	95% Percentile Bootstrap UCL	1.366
95% BCA Bootstrap UCL	1.546		
90% Chebyshev(Mean, Sd) UCL	1.752	95% Chebyshev(Mean, Sd) UCL	2.128
97.5% Chebyshev(Mean, Sd) UCL	2.651	99% Chebyshev(Mean, Sd) UCL	3.677

Suggested UCL to Use

95% Adjusted Gamma UCL	1.895

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.143	Mean	0.361
Maximum	0.672	Median	0.337
SD	0.172	Std. Error of Mean	0.0608
Coefficient of Variation	0.476	Skewness	0.634

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

ProUCL Output
Raleigh Creek Upper
Amphibian Tissue

Normal GOF Test

Shapiro Wilk Test Statistic	0.961	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.139	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.476	95% Adjusted-CLT UCL (Chen-1995)	0.475
		95% Modified-t UCL (Johnson-1978)	0.478

Gamma GOF Test

A-D Test Statistic	0.177	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.719	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.147	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.295	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.842	k star (bias corrected MLE)	3.11
Theta hat (MLE)	0.0745	Theta star (bias corrected MLE)	0.116
nu hat (MLE)	77.48	nu star (bias corrected)	49.76
MLE Mean (bias corrected)	0.361	MLE Sd (bias corrected)	0.205
		Approximate Chi Square Value (0.05)	34.56
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	31.39

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.52	95% Adjusted Gamma UCL (use when n<50)	0.572

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.968	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.181	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.945	Mean of logged Data	-1.126
Maximum of Logged Data	-0.397	SD of logged Data	0.509

Assuming Lognormal Distribution

95% H-UCL	0.583	90% Chebyshev (MVUE) UCL	0.561
95% Chebyshev (MVUE) UCL	0.651	97.5% Chebyshev (MVUE) UCL	0.775
99% Chebyshev (MVUE) UCL	1.02		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.461	95% Jackknife UCL	0.476
95% Standard Bootstrap UCL	0.454	95% Bootstrap-t UCL	0.5
95% Hall's Bootstrap UCL	0.529	95% Percentile Bootstrap UCL	0.458
95% BCA Bootstrap UCL	0.471		
90% Chebyshev(Mean, Sd) UCL	0.543	95% Chebyshev(Mean, Sd) UCL	0.626
97.5% Chebyshev(Mean, Sd) UCL	0.74	99% Chebyshev(Mean, Sd) UCL	0.965

Suggested UCL to Use

95% Student's-t UCL 0.476

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	1
Minimum	0.171	Mean	0.405
Maximum	1.14	Median	0.31
SD	0.334	Std. Error of Mean	0.126
Coefficient of Variation	0.824	Skewness	2.336

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.678	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.347	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.65	95% Adjusted-CLT UCL (Chen-1995)	0.732
		95% Modified-t UCL (Johnson-1978)	0.669

Gamma GOF Test

A-D Test Statistic	0.677	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.713	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.287	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.314	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.694	k star (bias corrected MLE)	1.634
Theta hat (MLE)	0.15	Theta star (bias corrected MLE)	0.248
nu hat (MLE)	37.71	nu star (bias corrected)	22.88
MLE Mean (bias corrected)	0.405	MLE Sd (bias corrected)	0.317
		Approximate Chi Square Value (0.05)	13
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	10.82

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	0.713	95% Adjusted Gamma UCL (use when n<50)	0.857

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.875	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.247	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.766	Mean of logged Data	-1.1
Maximum of Logged Data	0.131	SD of logged Data	0.618

Assuming Lognormal Distribution

95% H-UCL	0.799	90% Chebyshev (MVUE) UCL	0.666
95% Chebyshev (MVUE) UCL	0.791	97.5% Chebyshev (MVUE) UCL	0.964
99% Chebyshev (MVUE) UCL	1.305		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.613	95% Jackknife UCL	0.65
95% Standard Bootstrap UCL	0.595	95% Bootstrap-t UCL	1.2
95% Hall's Bootstrap UCL	1.646	95% Percentile Bootstrap UCL	0.635
95% BCA Bootstrap UCL	0.682		
90% Chebyshev(Mean, Sd) UCL	0.784	95% Chebyshev(Mean, Sd) UCL	0.955
97.5% Chebyshev(Mean, Sd) UCL	1.193	99% Chebyshev(Mean, Sd) UCL	1.66

ProUCL Output
Raleigh Creek Upper
Amphibian Tissue

Suggested UCL to Use

95% Adjusted Gamma UCL 0.857

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
Number of Detects	5	Number of Non-Detects	3
Number of Distinct Detects	5	Number of Distinct Non-Detects	3
Minimum Detect	0.157	Minimum Non-Detect	0.0935
Maximum Detect	0.787	Maximum Non-Detect	0.121
Variance Detects	0.0675	Percent Non-Detects	37.5%
Mean Detects	0.429	SD Detects	0.26
Median Detects	0.429	CV Detects	0.606
Skewness Detects	0.414	Kurtosis Detects	-1.22
Mean of Logged Detects	-1.018	SD of Logged Detects	0.679

Note: Sample size is small (e.g., <10), If data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.944	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.204	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.303	KM Standard Error of Mean	0.0969
KM SD	0.245	95% KM (BCA) UCL	0.449
95% KM (t) UCL	0.487	95% KM (Percentile Bootstrap) UCL	0.454
95% KM (z) UCL	0.462	95% KM Bootstrap t UCL	0.491
90% KM Chebyshev UCL	0.594	95% KM Chebyshev UCL	0.725
97.5% KM Chebyshev UCL	0.908	99% KM Chebyshev UCL	1.267

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.271	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.683	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.228	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.359	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.085	k star (bias corrected MLE)	1.367
Theta hat (MLE)	0.139	Theta star (bias corrected MLE)	0.313
nu hat (MLE)	30.85	nu star (bias corrected)	13.67
Mean (detects)	0.429		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.272
Maximum	0.787	Median	0.182
SD	0.292	CV	1.077
k hat (MLE)	0.585	k star (bias corrected MLE)	0.449
Theta hat (MLE)	0.464	Theta star (bias corrected MLE)	0.605
nu hat (MLE)	9.362	nu star (bias corrected)	7.185
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (7.18, α)	2.273	Adjusted Chi Square Value (7.18, β)	1.639
95% Gamma Approximate UCL (use when n>=50)	0.859	95% Gamma Adjusted UCL (use when n<50)	1.191

ProUCL Output
Raleigh Creek Upper
Amphibian Tissue

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.303	SD (KM)	0.245
Variance (KM)	0.0601	SE of Mean (KM)	0.0969
k hat (KM)	1.527	k star (KM)	1.038
nu hat (KM)	24.44	nu star (KM)	16.61
theta hat (KM)	0.198	theta star (KM)	0.292
80% gamma percentile (KM)	0.486	90% gamma percentile (KM)	0.691
95% gamma percentile (KM)	0.896	99% gamma percentile (KM)	1.369

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (16.61, α)	8.393	Adjusted Chi Square Value (16.61, β)	6.968
95% Gamma Approximate KM-UCL (use when n>=50)	0.599	95% Gamma Adjusted KM-UCL (use when n<50)	0.722

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.937	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.2	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.289	Mean in Log Scale	-1.707
SD in Original Scale	0.275	SD in Log Scale	1.08
95% t UCL (assumes normality of ROS data)	0.473	95% Percentile Bootstrap UCL	0.442
95% BCA Bootstrap UCL	0.456	95% Bootstrap t UCL	0.577
95% H-UCL (Log ROS)	1.43		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.525	KM Geo Mean	0.218
KM SD (logged)	0.812	95% Critical H Value (KM-Log)	2.978
KM Standard Error of Mean (logged)	0.321	95% H-UCL (KM -Log)	0.754
KM SD (logged)	0.812	95% Critical H Value (KM-Log)	2.978
KM Standard Error of Mean (logged)	0.321		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.287	Mean in Log Scale	-1.752
SD in Original Scale	0.277	SD in Log Scale	1.138
95% t UCL (Assumes normality)	0.473	95% H-Stat UCL	1.679

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.487

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
Number of Detects	7	Number of Non-Detects	1
Number of Distinct Detects	7	Number of Distinct Non-Detects	1
Minimum Detect	0.179	Minimum Non-Detect	0.121
Maximum Detect	1.34	Maximum Non-Detect	0.121
Variance Detects	0.228	Percent Non-Detects	12.5%
Mean Detects	0.527	SD Detects	0.478
Median Detects	0.278	CV Detects	0.906
Skewness Detects	1.25	Kurtosis Detects	-0.29
Mean of Logged Detects	-0.956	SD of Logged Detects	0.821

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.752	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level

Lilliefors Test Statistic	0.329	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.476	KM Standard Error of Mean	0.166
KM SD	0.435	95% KM (BCA) UCL	0.748
95% KM (t) UCL	0.791	95% KM (Percentile Bootstrap) UCL	0.739
95% KM (z) UCL	0.749	95% KM Bootstrap t UCL	1.703
90% KM Chebyshev UCL	0.974	95% KM Chebyshev UCL	1.2
97.5% KM Chebyshev UCL	1.513	99% KM Chebyshev UCL	2.128

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.704	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.718	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.264	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.316	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.736	k star (bias corrected MLE)	1.087
Theta hat (MLE)	0.303	Theta star (bias corrected MLE)	0.485
nu hat (MLE)	24.3	nu star (bias corrected)	15.22
Mean (detects)	0.527		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.462
Maximum	1.34	Median	0.254
SD	0.478	CV	1.035
k hat (MLE)	0.912	k star (bias corrected MLE)	0.653
Theta hat (MLE)	0.507	Theta star (bias corrected MLE)	0.708
nu hat (MLE)	14.59	nu star (bias corrected)	10.45
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (10.45, α)	4.225	Adjusted Chi Square Value (10.45, β)	3.283
95% Gamma Approximate UCL (use when n>=50)	1.143	95% Gamma Adjusted UCL (use when n<50)	1.471

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.476	SD (KM)	0.435
Variance (KM)	0.189	SE of Mean (KM)	0.166
k hat (KM)	1.199	k star (KM)	0.833
nu hat (KM)	19.18	nu star (KM)	13.32
theta hat (KM)	0.397	theta star (KM)	0.572
80% gamma percentile (KM)	0.776	90% gamma percentile (KM)	1.147
95% gamma percentile (KM)	1.523	99% gamma percentile (KM)	2.407

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (13.32, α)	6.11	Adjusted Chi Square Value (13.32, β)	4.93
95% Gamma Approximate KM-UCL (use when n>=50)	1.038	95% Gamma Adjusted KM-UCL (use when n<50)	1.287

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.844	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.225	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.468	Mean in Log Scale	-1.203
SD in Original Scale	0.473	SD in Log Scale	1.034
95% t UCL (assumes normality of ROS data)	0.784	95% Percentile Bootstrap UCL	0.743
95% BCA Bootstrap UCL	0.793	95% Bootstrap t UCL	1.645
95% H-UCL (Log ROS)	2.02		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.1	KM Geo Mean	0.333
KM SD (logged)	0.808	95% Critical H Value (KM-Log)	2.969
KM Standard Error of Mean (logged)	0.308	95% H-UCL (KM -Log)	1.141
KM SD (logged)	0.808	95% Critical H Value (KM-Log)	2.969
KM Standard Error of Mean (logged)	0.308		

ProUCL Output
Raleigh Creek Upper
Amphibian Tissue

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.469	Mean in Log Scale	-1.187
SD in Original Scale	0.472	SD in Log Scale	1.003
95% t UCL (Assumes normality)	0.785	95% H-Stat UCL	1.854

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	1.287	95% GROS Adjusted Gamma UCL	1.471

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOS|ug/kg

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	50.9	Mean	285.9
Maximum	737	Median	156
SD	276.3	Std. Error of Mean	97.68
Coefficient of Variation	0.966	Skewness	1.118

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.786	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.302	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	471	95% Adjusted-CLT UCL (Chen-1995)	487.9
		95% Modified-t UCL (Johnson-1978)	477.4

Gamma GOF Test

A-D Test Statistic	0.462	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.731	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.248	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.3	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.332	k star (bias corrected MLE)	0.916
Theta hat (MLE)	214.6	Theta star (bias corrected MLE)	312.1
nu hat (MLE)	21.32	nu star (bias corrected)	14.66
MLE Mean (bias corrected)	285.9	MLE Sd (bias corrected)	298.8
		Approximate Chi Square Value (0.05)	7.023
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	5.741

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	596.7	95% Adjusted Gamma UCL (use when n<50)	730

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.928	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.192	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.93	Mean of logged Data	5.236
Maximum of Logged Data	6.603	SD of logged Data	0.987

Assuming Lognormal Distribution

95% H-UCL	1085	90% Chebyshev (MVUE) UCL	584.5
95% Chebyshev (MVUE) UCL	721.3	97.5% Chebyshev (MVUE) UCL	911.2
99% Chebyshev (MVUE) UCL	1284		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	446.6	95% Jackknife UCL	471
95% Standard Bootstrap UCL	434.2	95% Bootstrap-t UCL	763.7
95% Hall's Bootstrap UCL	622.6	95% Percentile Bootstrap UCL	447.8
95% BCA Bootstrap UCL	462.7		
90% Chebyshev(Mean, Sd) UCL	579	95% Chebyshev(Mean, Sd) UCL	711.7
97.5% Chebyshev(Mean, Sd) UCL	895.9	99% Chebyshev(Mean, Sd) UCL	1258

Suggested UCL to Use

95% Adjusted Gamma UCL 730

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFNS|ug/kg

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.181	Mean	0.874
Maximum	2.71	Median	0.371
SD	1.057	Std. Error of Mean	0.374
Coefficient of Variation	1.209	Skewness	1.42

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.667	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.401	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.582	95% Adjusted-CLT UCL (Chen-1995)	1.69
		95% Modified-t UCL (Johnson-1978)	1.614

Gamma GOF Test

A-D Test Statistic	0.963	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.735	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.343	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.301	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.021	k star (bias corrected MLE)	0.722
Theta hat (MLE)	0.856	Theta star (bias corrected MLE)	1.211
nu hat (MLE)	16.34	nu star (bias corrected)	11.55
MLE Mean (bias corrected)	0.874	MLE Sd (bias corrected)	1.029
		Approximate Chi Square Value (0.05)	4.931
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	3.895

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	2.048	95% Adjusted Gamma UCL (use when n<50)	2.592

ProUCL Output
Raleigh Creek Upper
Amphibian Tissue

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.82	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.277	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.709	Mean of logged Data	-0.698
Maximum of Logged Data	0.997	SD of logged Data	1.069

Assuming Lognormal Distribution

95% H-UCL	3.775	90% Chebyshev (MVUE) UCL	1.727
95% Chebyshev (MVUE) UCL	2.147	97.5% Chebyshev (MVUE) UCL	2.73
99% Chebyshev (MVUE) UCL	3.875		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.489	95% Jackknife UCL	1.582
95% Standard Bootstrap UCL	1.433	95% Bootstrap-t UCL	6.285
95% Hall's Bootstrap UCL	6.985	95% Percentile Bootstrap UCL	1.462
95% BCA Bootstrap UCL	1.662		
90% Chebyshev(Mean, Sd) UCL	1.996	95% Chebyshev(Mean, Sd) UCL	2.503
97.5% Chebyshev(Mean, Sd) UCL	3.208	99% Chebyshev(Mean, Sd) UCL	4.593

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	2.503

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFDS|ug/kg

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.493	Mean	2.607
Maximum	7.83	Median	1.375
SD	2.908	Std. Error of Mean	1.028
Coefficient of Variation	1.115	Skewness	1.394

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.722	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.361	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	4.555	95% Adjusted-CLT UCL (Chen-1995)	4.839
		95% Modified-t UCL (Johnson-1978)	4.639

Gamma GOF Test

A-D Test Statistic	0.666	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.734	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.272	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.301	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

ProUCL Output
Raleigh Creek Upper
Amphibian Tissue

Gamma Statistics

k hat (MLE)	1.14	k star (bias corrected MLE)	0.796
Theta hat (MLE)	2.287	Theta star (bias corrected MLE)	3.276
nu hat (MLE)	18.24	nu star (bias corrected)	12.74
MLE Mean (bias corrected)	2.607	MLE Sd (bias corrected)	2.922
		Approximate Chi Square Value (0.05)	5.716
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	4.582

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	5.81	95% Adjusted Gamma UCL (use when n<50)	7.247

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.891	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.203	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.707	Mean of logged Data	0.46
Maximum of Logged Data	2.058	SD of logged Data	1.035

Assuming Lognormal Distribution

95% H-UCL	10.68	90% Chebyshev (MVUE) UCL	5.248
95% Chebyshev (MVUE) UCL	6.504	97.5% Chebyshev (MVUE) UCL	8.247
99% Chebyshev (MVUE) UCL	11.67		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	4.298	95% Jackknife UCL	4.555
95% Standard Bootstrap UCL	4.206	95% Bootstrap-t UCL	12.11
95% Hall's Bootstrap UCL	16.91	95% Percentile Bootstrap UCL	4.239
95% BCA Bootstrap UCL	4.793		
90% Chebyshev(Mean, Sd) UCL	5.691	95% Chebyshev(Mean, Sd) UCL	7.088
97.5% Chebyshev(Mean, Sd) UCL	9.027	99% Chebyshev(Mean, Sd) UCL	12.84

Suggested UCL to Use

95% Adjusted Gamma UCL 7.247

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFDoS|ug/kg

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
Number of Detects	5	Number of Non-Detects	3
Number of Distinct Detects	5	Number of Distinct Non-Detects	3
Minimum Detect	0.299	Minimum Non-Detect	0.0935
Maximum Detect	1.39	Maximum Non-Detect	0.0976
Variance Detects	0.275	Percent Non-Detects	37.5%
Mean Detects	0.873	SD Detects	0.524
Median Detects	1.15	CV Detects	0.601
Skewness Detects	-0.476	Kurtosis Detects	-3.101
Mean of Logged Detects	-0.341	SD of Logged Detects	0.772

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.806	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.302	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.58	KM Standard Error of Mean	0.209
KM SD	0.529	95% KM (BCA) UCL	0.863
95% KM (t) UCL	0.977	95% KM (Percentile Bootstrap) UCL	0.9
95% KM (z) UCL	0.924	95% KM Bootstrap t UCL	0.964
90% KM Chebyshev UCL	1.208	95% KM Chebyshev UCL	1.492
97.5% KM Chebyshev UCL	1.886	99% KM Chebyshev UCL	2.661

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.709	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.683	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.348	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.36	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.595	k star (bias corrected MLE)	1.171
Theta hat (MLE)	0.336	Theta star (bias corrected MLE)	0.745
nu hat (MLE)	25.95	nu star (bias corrected)	11.71
Mean (detects)	0.873		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.549
Maximum	1.39	Median	0.307
SD	0.597	CV	1.087
k hat (MLE)	0.477	k star (bias corrected MLE)	0.382
Theta hat (MLE)	1.151	Theta star (bias corrected MLE)	1.439
nu hat (MLE)	7.635	nu star (bias corrected)	6.105
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (6.11, α)	1.694	Adjusted Chi Square Value (6.11, β)	1.174
95% Gamma Approximate UCL (use when n>=50)	1.979	95% Gamma Adjusted UCL (use when n<50)	2.857

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.58	SD (KM)	0.529
Variance (KM)	0.28	SE of Mean (KM)	0.209
k hat (KM)	1.204	k star (KM)	0.836
nu hat (KM)	19.27	nu star (KM)	13.38
theta hat (KM)	0.482	theta star (KM)	0.694
80% gamma percentile (KM)	0.946	90% gamma percentile (KM)	1.396
95% gamma percentile (KM)	1.853	99% gamma percentile (KM)	2.929

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (13.38, α)	6.148	Adjusted Chi Square Value (13.38, β)	4.964
95% Gamma Approximate KM-UCL (use when n>=50)	1.263	95% Gamma Adjusted KM-UCL (use when n<50)	1.564

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.762	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.333	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.586	Mean in Log Scale	-1.047
SD in Original Scale	0.56	SD in Log Scale	1.135
95% t UCL (assumes normality of ROS data)	0.961	95% Percentile Bootstrap UCL	0.906
95% BCA Bootstrap UCL	0.92	95% Bootstrap t UCL	1.022
95% H-UCL (Log ROS)	3.368		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.102	KM Geo Mean	0.332
KM SD (logged)	1.123	95% Critical H Value (KM-Log)	3.736
KM Standard Error of Mean (logged)	0.444	95% H-UCL (KM -Log)	3.052
KM SD (logged)	1.123	95% Critical H Value (KM-Log)	3.736
KM Standard Error of Mean (logged)	0.444		

ProUCL Output
Raleigh Creek Upper
Amphibian Tissue

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.563	Mean in Log Scale	-1.355
SD in Original Scale	0.583	SD in Log Scale	1.516
95% t UCL (Assumes normality)	0.953	95% H-Stat UCL	12.65

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.977

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	1.17	Mean	8.649
Maximum	33.8	Median	4.4
SD	10.77	Std. Error of Mean	3.808
Coefficient of Variation	1.245	Skewness	2.259

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.707	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.281	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	15.86	95% Adjusted-CLT UCL (Chen-1995)	18.16
		95% Modified-t UCL (Johnson-1978)	16.37

Gamma GOF Test

A-D Test Statistic	0.364	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.735	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.189	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.301	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.032	k star (bias corrected MLE)	0.728
Theta hat (MLE)	8.383	Theta star (bias corrected MLE)	11.88
nu hat (MLE)	16.51	nu star (bias corrected)	11.65
MLE Mean (bias corrected)	8.649	MLE Sd (bias corrected)	10.14
		Approximate Chi Square Value (0.05)	4.998
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	3.953

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	20.16	95% Adjusted Gamma UCL (use when n<50)	25.49

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.953	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.139	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.157	Mean of logged Data	1.6
Maximum of Logged Data	3.52	SD of logged Data	1.124

Assuming Lognormal Distribution

95% H-UCL	45.58	90% Chebyshev (MVUE) UCL	18.51
95% Chebyshev (MVUE) UCL	23.12	97.5% Chebyshev (MVUE) UCL	29.51
99% Chebyshev (MVUE) UCL	42.06		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	14.91	95% Jackknife UCL	15.86
95% Standard Bootstrap UCL	14.46	95% Bootstrap-t UCL	26.96
95% Hall's Bootstrap UCL	37.48	95% Percentile Bootstrap UCL	15.05
95% BCA Bootstrap UCL	17.56		
90% Chebyshev(Mean, Sd) UCL	20.07	95% Chebyshev(Mean, Sd) UCL	25.25
97.5% Chebyshev(Mean, Sd) UCL	32.43	99% Chebyshev(Mean, Sd) UCL	46.54

Suggested UCL to Use

95% Student's-t UCL 15.86

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.354	Mean	3.135
Maximum	8.52	Median	2.595
SD	2.616	Std. Error of Mean	0.925
Coefficient of Variation	0.835	Skewness	1.29

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.876	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.245	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	4.887	95% Adjusted-CLT UCL (Chen-1995)	5.107
		95% Modified-t UCL (Johnson-1978)	4.958

Gamma GOF Test

A-D Test Statistic	0.379	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.73	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.25	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.299	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.4	k star (bias corrected MLE)	0.958
Theta hat (MLE)	2.239	Theta star (bias corrected MLE)	3.271
nu hat (MLE)	22.4	nu star (bias corrected)	15.33
MLE Mean (bias corrected)	3.135	MLE Sd (bias corrected)	3.202
		Approximate Chi Square Value (0.05)	7.495
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	6.162

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	6.414	95% Adjusted Gamma UCL (use when n<50)	7.802

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.89	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.303	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.283	Data Not Lognormal at 5% Significance Level	

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.038	Mean of logged Data	0.745
Maximum of Logged Data	2.142	SD of logged Data	1.08

Assuming Lognormal Distribution

95% H-UCL	16.59	90% Chebyshev (MVUE) UCL	7.419
95% Chebyshev (MVUE) UCL	9.231	97.5% Chebyshev (MVUE) UCL	11.75
99% Chebyshev (MVUE) UCL	16.68		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	4.656	95% Jackknife UCL	4.887
95% Standard Bootstrap UCL	4.541	95% Bootstrap-t UCL	5.837
95% Hall's Bootstrap UCL	14.81	95% Percentile Bootstrap UCL	4.696
95% BCA Bootstrap UCL	4.795		
90% Chebyshev(Mean, Sd) UCL	5.91	95% Chebyshev(Mean, Sd) UCL	7.167
97.5% Chebyshev(Mean, Sd) UCL	8.912	99% Chebyshev(Mean, Sd) UCL	12.34

Suggested UCL to Use

95% Student's-t UCL 4.887

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
Number of Detects	5	Number of Non-Detects	3
Number of Distinct Detects	5	Number of Distinct Non-Detects	3
Minimum Detect	0.109	Minimum Non-Detect	0.0935
Maximum Detect	0.244	Maximum Non-Detect	0.0976
Variance Detects	0.00304	Percent Non-Detects	37.5%
Mean Detects	0.152	SD Detects	0.0552
Median Detects	0.124	CV Detects	0.363
Skewness Detects	1.591	Kurtosis Detects	2.261
Mean of Logged Detects	-1.928	SD of Logged Detects	0.325

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.819	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.295	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.13	KM Standard Error of Mean	0.0191
KM SD	0.0483	95% KM (BCA) UCL	0.164
95% KM (t) UCL	0.166	95% KM (Percentile Bootstrap) UCL	0.162
95% KM (z) UCL	0.162	95% KM Bootstrap t UCL	0.209
90% KM Chebyshev UCL	0.187	95% KM Chebyshev UCL	0.213
97.5% KM Chebyshev UCL	0.249	99% KM Chebyshev UCL	0.32

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.48	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.679	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.312	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.358	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	11.15	k star (bias corrected MLE)	4.592
Theta hat (MLE)	0.0137	Theta star (bias corrected MLE)	0.0331
nu hat (MLE)	111.5	nu star (bias corrected)	45.92
Mean (detects)	0.152		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0248	Mean	0.104
Maximum	0.244	Median	0.115
SD	0.078	CV	0.747
k hat (MLE)	1.653	k star (bias corrected MLE)	1.117
Theta hat (MLE)	0.0632	Theta star (bias corrected MLE)	0.0935
nu hat (MLE)	26.45	nu star (bias corrected)	17.87
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (17.87, α)	9.294	Adjusted Chi Square Value (17.87, β)	7.781
95% Gamma Approximate UCL (use when n>=50)	0.201	95% Gamma Adjusted UCL (use when n<50)	0.24

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.13	SD (KM)	0.0483
Variance (KM)	0.00233	SE of Mean (KM)	0.0191
k hat (KM)	7.274	k star (KM)	4.63
nu hat (KM)	116.4	nu star (KM)	74.08
theta hat (KM)	0.0179	theta star (KM)	0.0281
80% gamma percentile (KM)	0.177	90% gamma percentile (KM)	0.211
95% gamma percentile (KM)	0.243	99% gamma percentile (KM)	0.31

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (74.08, α)	55.26	Adjusted Chi Square Value (74.08, β)	51.16
95% Gamma Approximate KM-UCL (use when n>=50)	0.175	95% Gamma Adjusted KM-UCL (use when n<50)	0.188

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.872	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.288	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.118	Mean in Log Scale	-2.256
SD in Original Scale	0.0631	SD in Log Scale	0.515
95% t UCL (assumes normality of ROS data)	0.16	95% Percentile Bootstrap UCL	0.154
95% BCA Bootstrap UCL	0.16	95% Bootstrap t UCL	0.177
95% H-UCL (Log ROS)	0.19		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.094	KM Geo Mean	0.123
KM SD (logged)	0.314	95% Critical H Value (KM-Log)	2.076
KM Standard Error of Mean (logged)	0.124	95% H-UCL (KM -Log)	0.166
KM SD (logged)	0.314	95% Critical H Value (KM-Log)	2.076
KM Standard Error of Mean (logged)	0.124		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.113	Mean in Log Scale	-2.347
SD in Original Scale	0.0684	SD in Log Scale	0.629
95% t UCL (Assumes normality)	0.159	95% H-Stat UCL	0.216

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

ProUCL Output
Raleigh Creek Upper
Amphibian Tissue

Suggested UCL to Use

95% KM (t) UCL 0.166

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
West Lakeland
Amphibian Tissue

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/17/2021 3:22:39 PM
From File	AM Input_a.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

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General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
Number of Detects	5	Number of Non-Detects	1
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	0.457	Minimum Non-Detect	0.376
Maximum Detect	1.16	Maximum Non-Detect	0.376
Variance Detects	0.116	Percent Non-Detects	16.67%
Mean Detects	0.891	SD Detects	0.341
Median Detects	1.1	CV Detects	0.382
Skewness Detects	-0.671	Kurtosis Detects	-2.832
Mean of Logged Detects	-0.186	SD of Logged Detects	0.44

Note: Sample size is small (e.g., <10), If data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.784	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.33	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.805	KM Standard Error of Mean	0.154
KM SD	0.338	95% KM (BCA) UCL	1.026
95% KM (t) UCL	1.116	95% KM (Percentile Bootstrap) UCL	1.038
95% KM (z) UCL	1.059	95% KM Bootstrap t UCL	1.072
90% KM Chebyshev UCL	1.268	95% KM Chebyshev UCL	1.477
97.5% KM Chebyshev UCL	1.768	99% KM Chebyshev UCL	2.339

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.67	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.68	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.361	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.358	Detected Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	7.222	k star (bias corrected MLE)	3.022
Theta hat (MLE)	0.123	Theta star (bias corrected MLE)	0.295
nu hat (MLE)	72.22	nu star (bias corrected)	30.22
Mean (detects)	0.891		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.253	Mean	0.784
Maximum	1.16	Median	0.844
SD	0.401	CV	0.511
k hat (MLE)	3.684	k star (bias corrected MLE)	1.953
Theta hat (MLE)	0.213	Theta star (bias corrected MLE)	0.402
nu hat (MLE)	44.21	nu star (bias corrected)	23.44
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (23.44, α)	13.42	Adjusted Chi Square Value (23.44, β)	10.79
95% Gamma Approximate UCL (use when n>=50)	1.37	95% Gamma Adjusted UCL (use when n<50)	1.704

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.805	SD (KM)	0.338
Variance (KM)	0.114	SE of Mean (KM)	0.154
k hat (KM)	5.678	k star (KM)	2.95
nu hat (KM)	68.14	nu star (KM)	35.4
theta hat (KM)	0.142	theta star (KM)	0.273
80% gamma percentile (KM)	1.151	90% gamma percentile (KM)	1.433
95% gamma percentile (KM)	1.698	99% gamma percentile (KM)	2.271

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (35.40, α)	22.79	Adjusted Chi Square Value (35.40, β)	19.22
95% Gamma Approximate KM-UCL (use when n>=50)	1.251	95% Gamma Adjusted KM-UCL (use when n<50)	1.483

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.789	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.339	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.792	Mean in Log Scale	-0.357
SD in Original Scale	0.389	SD in Log Scale	0.574
95% t UCL (assumes normality of ROS data)	1.112	95% Percentile Bootstrap UCL	1.031
95% BCA Bootstrap UCL	1.033	95% Bootstrap t UCL	1.09
95% H-UCL (Log ROS)	1.701		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.318	KM Geo Mean	0.727
KM SD (logged)	0.465	95% Critical H Value (KM-Log)	2.556
KM Standard Error of Mean (logged)	0.212	95% H-UCL (KM -Log)	1.378
KM SD (logged)	0.465	95% Critical H Value (KM-Log)	2.556
KM Standard Error of Mean (logged)	0.212		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.774	Mean in Log Scale	-0.434
SD in Original Scale	0.418	SD in Log Scale	0.723
95% t UCL (Assumes normality)	1.118	95% H-Stat UCL	2.396

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 1.116

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
Number of Detects	4	Number of Non-Detects	2
Number of Distinct Detects	4	Number of Distinct Non-Detects	2
Minimum Detect	0.13	Minimum Non-Detect	0.0939
Maximum Detect	0.304	Maximum Non-Detect	0.0948
Variance Detects	0.0058	Percent Non-Detects	33.33%
Mean Detects	0.238	SD Detects	0.0762
Median Detects	0.258	CV Detects	0.321
Skewness Detects	-1.352	Kurtosis Detects	1.872
Mean of Logged Detects	-1.486	SD of Logged Detects	0.381

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.902	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.268	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.19	KM Standard Error of Mean	0.0408
KM SD	0.0865	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.272	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.257	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.312	95% KM Chebyshev UCL	0.367
97.5% KM Chebyshev UCL	0.444	99% KM Chebyshev UCL	0.595

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.445	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.31	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.395	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	10.44	k star (bias corrected MLE)	2.778
Theta hat (MLE)	0.0227	Theta star (bias corrected MLE)	0.0855
nu hat (MLE)	83.56	nu star (bias corrected)	22.22
Mean (detects)	0.238		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0698	Mean	0.182
Maximum	0.304	Median	0.186
SD	0.105	CV	0.577
k hat (MLE)	3.059	k star (bias corrected MLE)	1.641
Theta hat (MLE)	0.0594	Theta star (bias corrected MLE)	0.111
nu hat (MLE)	36.71	nu star (bias corrected)	19.69
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (19.69, α)	10.62	Adjusted Chi Square Value (19.69, β)	8.326
95% Gamma Approximate UCL (use when n>=50)	0.337	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.19	SD (KM)	0.0865
Variance (KM)	0.00748	SE of Mean (KM)	0.0408
k hat (KM)	4.806	k star (KM)	2.514
nu hat (KM)	57.68	nu star (KM)	30.17
theta hat (KM)	0.0395	theta star (KM)	0.0754
80% gamma percentile (KM)	0.276	90% gamma percentile (KM)	0.35
95% gamma percentile (KM)	0.419	99% gamma percentile (KM)	0.571

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (30.17, α)	18.63	Adjusted Chi Square Value (30.17, β)	15.45
95% Gamma Approximate KM-UCL (use when n>=50)	0.307	95% Gamma Adjusted KM-UCL (use when n<50)	0.37

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.841	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.316	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.188	Mean in Log Scale	-1.799
SD in Original Scale	0.097	SD in Log Scale	0.568
95% t UCL (assumes normality of ROS data)	0.268	95% Percentile Bootstrap UCL	0.25
95% BCA Bootstrap UCL	0.243	95% Bootstrap t UCL	0.275
95% H-UCL (Log ROS)	0.396		

ProUCL Output
West Lakeland
Amphibian Tissue

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.779	KM Geo Mean	0.169
KM SD (logged)	0.495	95% Critical H Value (KM-Log)	2.625
KM Standard Error of Mean (logged)	0.233	95% H-UCL (KM -Log)	0.341
KM SD (logged)	0.495	95% Critical H Value (KM-Log)	2.625
KM Standard Error of Mean (logged)	0.233		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.174	Mean in Log Scale	-2.009
SD in Original Scale	0.115	SD in Log Scale	0.862
95% t UCL (Assumes normality)	0.268	95% H-Stat UCL	0.797

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.272

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.244	Mean	1.347
Maximum	2.57	Median	1.385
SD	0.953	Std. Error of Mean	0.389
Coefficient of Variation	0.707	Skewness	3.78E-04

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.929	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.191	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2.131	95% Adjusted-CLT UCL (Chen-1995)	1.987
		95% Modified-t UCL (Johnson-1978)	2.131

Gamma GOF Test

A-D Test Statistic	0.398	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.707	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.218	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.337	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.672	k star (bias corrected MLE)	0.947
Theta hat (MLE)	0.806	Theta star (bias corrected MLE)	1.422
nu hat (MLE)	20.07	nu star (bias corrected)	11.37
MLE Mean (bias corrected)	1.347	MLE Sd (bias corrected)	1.384
		Approximate Chi Square Value (0.05)	4.813
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	3.397

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	3.182	95% Adjusted Gamma UCL (use when n<50)	4.508

ProUCL Output
West Lakeland
Amphibian Tissue

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.867	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.234	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.411	Mean of logged Data	-0.0297
Maximum of Logged Data	0.944	SD of logged Data	0.996

Assuming Lognormal Distribution

95% H-UCL	9.936	90% Chebyshev (MVUE) UCL	3.158
95% Chebyshev (MVUE) UCL	3.937	97.5% Chebyshev (MVUE) UCL	5.02
99% Chebyshev (MVUE) UCL	7.147		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.987	95% Jackknife UCL	2.131
95% Standard Bootstrap UCL	1.926	95% Bootstrap-t UCL	2.083
95% Hall's Bootstrap UCL	1.968	95% Percentile Bootstrap UCL	1.95
95% BCA Bootstrap UCL	1.893		
90% Chebyshev(Mean, Sd) UCL	2.514	95% Chebyshev(Mean, Sd) UCL	3.043
97.5% Chebyshev(Mean, Sd) UCL	3.776	99% Chebyshev(Mean, Sd) UCL	5.217

Suggested UCL to Use

95% Student's-t UCL 2.131

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.116	Mean	0.342
Maximum	0.815	Median	0.223
SD	0.268	Std. Error of Mean	0.0948
Coefficient of Variation	0.785	Skewness	1.211

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.799	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.249	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.521	95% Adjusted-CLT UCL (Chen-1995)	0.541
		95% Modified-t UCL (Johnson-1978)	0.528

Gamma GOF Test

A-D Test Statistic	0.513	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.723	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.216	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.297	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

ProUCL Output
West Lakeland
Amphibian Tissue

Gamma Statistics

k hat (MLE)	2.207	k star (bias corrected MLE)	1.463
Theta hat (MLE)	0.155	Theta star (bias corrected MLE)	0.234
nu hat (MLE)	35.31	nu star (bias corrected)	23.4
MLE Mean (bias corrected)	0.342	MLE Sd (bias corrected)	0.282
		Approximate Chi Square Value (0.05)	13.39
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	11.53

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.597	95% Adjusted Gamma UCL (use when n<50)	0.694

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.909	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.187	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.154	Mean of logged Data	-1.317
Maximum of Logged Data	-0.205	SD of logged Data	0.725

Assuming Lognormal Distribution

95% H-UCL	0.747	90% Chebyshev (MVUE) UCL	0.597
95% Chebyshev (MVUE) UCL	0.716	97.5% Chebyshev (MVUE) UCL	0.88
99% Chebyshev (MVUE) UCL	1.204		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.498	95% Jackknife UCL	0.521
95% Standard Bootstrap UCL	0.486	95% Bootstrap-t UCL	0.832
95% Hall's Bootstrap UCL	1.401	95% Percentile Bootstrap UCL	0.498
95% BCA Bootstrap UCL	0.527		
90% Chebyshev(Mean, Sd) UCL	0.626	95% Chebyshev(Mean, Sd) UCL	0.755
97.5% Chebyshev(Mean, Sd) UCL	0.934	99% Chebyshev(Mean, Sd) UCL	1.285

Suggested UCL to Use

95% Student's-t UCL	0.521

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.302	Mean	0.921
Maximum	2.59	Median	0.66
SD	0.784	Std. Error of Mean	0.277
Coefficient of Variation	0.851	Skewness	1.747

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.768	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.348	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.446	95% Adjusted-CLT UCL (Chen-1995)	1.559
		95% Modified-t UCL (Johnson-1978)	1.474

ProUCL Output
West Lakeland
Amphibian Tissue

Gamma GOF Test

A-D Test Statistic	0.523	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.724	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.289	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.297	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.132	k star (bias corrected MLE)	1.416
Theta hat (MLE)	0.432	Theta star (bias corrected MLE)	0.65
nu hat (MLE)	34.11	nu star (bias corrected)	22.65
MLE Mean (bias corrected)	0.921	MLE Sd (bias corrected)	0.774
		Approximate Chi Square Value (0.05)	12.83
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	11

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1.626	95% Adjusted Gamma UCL (use when n<50)	1.895

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.925	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.241	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.197	Mean of logged Data	-0.335
Maximum of Logged Data	0.952	SD of logged Data	0.721

Assuming Lognormal Distribution

95% H-UCL	1.98	90% Chebyshev (MVUE) UCL	1.588
95% Chebyshev (MVUE) UCL	1.903	97.5% Chebyshev (MVUE) UCL	2.34
99% Chebyshev (MVUE) UCL	3.198		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.376	95% Jackknife UCL	1.446
95% Standard Bootstrap UCL	1.347	95% Bootstrap-t UCL	2.817
95% Hall's Bootstrap UCL	4.248	95% Percentile Bootstrap UCL	1.366
95% BCA Bootstrap UCL	1.546		
90% Chebyshev(Mean, Sd) UCL	1.752	95% Chebyshev(Mean, Sd) UCL	2.128
97.5% Chebyshev(Mean, Sd) UCL	2.651	99% Chebyshev(Mean, Sd) UCL	3.677

Suggested UCL to Use

95% Adjusted Gamma UCL	1.895

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.098	Mean	0.184
Maximum	0.263	Median	0.181
SD	0.0746	Std. Error of Mean	0.0304
Coefficient of Variation	0.406	Skewness	0.0137

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.852	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.234	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

ProUCL Output
West Lakeland
Amphibian Tissue

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.245	95% Adjusted-CLT UCL (Chen-1995)	0.234
		95% Modified-t UCL (Johnson-1978)	0.245

Gamma GOF Test

A-D Test Statistic	0.493	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.25	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	6.824	k star (bias corrected MLE)	3.523
Theta hat (MLE)	0.0269	Theta star (bias corrected MLE)	0.0521
nu hat (MLE)	81.89	nu star (bias corrected)	42.28
MLE Mean (bias corrected)	0.184	MLE Sd (bias corrected)	0.0979
		Approximate Chi Square Value (0.05)	28.37
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	24.34

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.274	95% Adjusted Gamma UCL (use when n<50)	0.319

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.867	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.24	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.323	Mean of logged Data	-1.77
Maximum of Logged Data	-1.336	SD of logged Data	0.433

Assuming Lognormal Distribution

95% H-UCL	0.303	90% Chebyshev (MVUE) UCL	0.282
95% Chebyshev (MVUE) UCL	0.326	97.5% Chebyshev (MVUE) UCL	0.387
99% Chebyshev (MVUE) UCL	0.507		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.234	95% Jackknife UCL	0.245
95% Standard Bootstrap UCL	0.229	95% Bootstrap-t UCL	0.243
95% Hall's Bootstrap UCL	0.217	95% Percentile Bootstrap UCL	0.232
95% BCA Bootstrap UCL	0.229		
90% Chebyshev(Mean, Sd) UCL	0.275	95% Chebyshev(Mean, Sd) UCL	0.316
97.5% Chebyshev(Mean, Sd) UCL	0.374	99% Chebyshev(Mean, Sd) UCL	0.487

Suggested UCL to Use

95% Student's-t UCL 0.245

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	32.9	Mean	86.25
Maximum	137	Median	97.2
SD	37.83	Std. Error of Mean	15.44
Coefficient of Variation	0.439	Skewness	-0.317

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

ProUCL Output
West Lakeland
Amphibian Tissue

Normal GOF Test

Shapiro Wilk Test Statistic	0.933	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.252	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	117.4	95% Adjusted-CLT UCL (Chen-1995)	109.5
		95% Modified-t UCL (Johnson-1978)	117

Gamma GOF Test

A-D Test Statistic	0.439	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.305	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.026	k star (bias corrected MLE)	2.624
Theta hat (MLE)	17.16	Theta star (bias corrected MLE)	32.87
nu hat (MLE)	60.31	nu star (bias corrected)	31.49
MLE Mean (bias corrected)	86.25	MLE Sd (bias corrected)	53.24
		Approximate Chi Square Value (0.05)	19.67
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	16.38

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	138.1	95% Adjusted Gamma UCL (use when n<50)	165.8

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.883	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.309	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.493	Mean of logged Data	4.354
Maximum of Logged Data	4.92	SD of logged Data	0.531

Assuming Lognormal Distribution

95% H-UCL	170.7	90% Chebyshev (MVUE) UCL	144.1
95% Chebyshev (MVUE) UCL	169.8	97.5% Chebyshev (MVUE) UCL	205.4
99% Chebyshev (MVUE) UCL	275.5		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	111.7	95% Jackknife UCL	117.4
95% Standard Bootstrap UCL	109.5	95% Bootstrap-t UCL	115.3
95% Hall's Bootstrap UCL	107.3	95% Percentile Bootstrap UCL	110.5
95% BCA Bootstrap UCL	106.4		
90% Chebyshev(Mean, Sd) UCL	132.6	95% Chebyshev(Mean, Sd) UCL	153.6
97.5% Chebyshev(Mean, Sd) UCL	182.7	99% Chebyshev(Mean, Sd) UCL	239.9

Suggested UCL to Use

95% Student's-t UCL 117.4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.181	Mean	0.874
Maximum	2.71	Median	0.371
SD	1.057	Std. Error of Mean	0.374
Coefficient of Variation	1.209	Skewness	1.42

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.667	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.401	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.582	95% Adjusted-CLT UCL (Chen-1995)	1.69
		95% Modified-t UCL (Johnson-1978)	1.614

Gamma GOF Test

A-D Test Statistic	0.963	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.735	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.343	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.301	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.021	k star (bias corrected MLE)	0.722
Theta hat (MLE)	0.856	Theta star (bias corrected MLE)	1.211
nu hat (MLE)	16.34	nu star (bias corrected)	11.55
MLE Mean (bias corrected)	0.874	MLE Sd (bias corrected)	1.029
		Approximate Chi Square Value (0.05)	4.931
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	3.895

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	2.048	95% Adjusted Gamma UCL (use when n<50)	2.592

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.82	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.277	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.709	Mean of logged Data	-0.698
Maximum of Logged Data	0.997	SD of logged Data	1.069

Assuming Lognormal Distribution

95% H-UCL	3.775	90% Chebyshev (MVUE) UCL	1.727
95% Chebyshev (MVUE) UCL	2.147	97.5% Chebyshev (MVUE) UCL	2.73
99% Chebyshev (MVUE) UCL	3.875		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.489	95% Jackknife UCL	1.582
95% Standard Bootstrap UCL	1.433	95% Bootstrap-t UCL	6.285
95% Hall's Bootstrap UCL	6.985	95% Percentile Bootstrap UCL	1.462
95% BCA Bootstrap UCL	1.662		
90% Chebyshev(Mean, Sd) UCL	1.996	95% Chebyshev(Mean, Sd) UCL	2.503
97.5% Chebyshev(Mean, Sd) UCL	3.208	99% Chebyshev(Mean, Sd) UCL	4.593

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL 2.503

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
Number of Detects	4	Number of Non-Detects	2
Number of Distinct Detects	4	Number of Distinct Non-Detects	2
Minimum Detect	0.123	Minimum Non-Detect	0.0939
Maximum Detect	0.284	Maximum Non-Detect	0.0948
Variance Detects	0.0044	Percent Non-Detects	33.33%
Mean Detects	0.197	SD Detects	0.0664
Median Detects	0.191	CV Detects	0.336
Skewness Detects	0.55	Kurtosis Detects	1.456
Mean of Logged Detects	-1.667	SD of Logged Detects	0.343

Note: Sample size is small (e.g., <10), If data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.966	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.245	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.163	KM Standard Error of Mean	0.0319
KM SD	0.0676	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.227	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.215	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.258	95% KM Chebyshev UCL	0.302
97.5% KM Chebyshev UCL	0.362	99% KM Chebyshev UCL	0.48

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.25	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.206	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.395	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	11.69	k star (bias corrected MLE)	3.089
Theta hat (MLE)	0.0169	Theta star (bias corrected MLE)	0.0639
nu hat (MLE)	93.52	nu star (bias corrected)	24.71
Mean (detects)	0.197		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0374	Mean	0.144
Maximum	0.284	Median	0.154
SD	0.0973	CV	0.676
k hat (MLE)	2.012	k star (bias corrected MLE)	1.117
Theta hat (MLE)	0.0715	Theta star (bias corrected MLE)	0.129
nu hat (MLE)	24.15	nu star (bias corrected)	13.41
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (13.41, α)	6.168	Adjusted Chi Square Value (13.41, β)	4.515
95% Gamma Approximate UCL (use when n>=50)	0.313	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.163	SD (KM)	0.0676
Variance (KM)	0.00458	SE of Mean (KM)	0.0319
k hat (KM)	5.792	k star (KM)	3.007
nu hat (KM)	69.5	nu star (KM)	36.08
theta hat (KM)	0.0281	theta star (KM)	0.0541
80% gamma percentile (KM)	0.232	90% gamma percentile (KM)	0.289
95% gamma percentile (KM)	0.341	99% gamma percentile (KM)	0.456

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (36.08, α)	23.34	Adjusted Chi Square Value (36.08, β)	19.72
95% Gamma Approximate KM-UCL (use when n>=50)	0.252	95% Gamma Adjusted KM-UCL (use when n<50)	0.298

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.977	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.22	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.156	Mean in Log Scale	-1.979
SD in Original Scale	0.0818	SD in Log Scale	0.553
95% t UCL (assumes normality of ROS data)	0.223	95% Percentile Bootstrap UCL	0.21
95% BCA Bootstrap UCL	0.208	95% Bootstrap t UCL	0.242
95% H-UCL (Log ROS)	0.319		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.9	KM Geo Mean	0.15
KM SD (logged)	0.409	95% Critical H Value (KM-Log)	2.434
KM Standard Error of Mean (logged)	0.193	95% H-UCL (KM -Log)	0.254
KM SD (logged)	0.409	95% Critical H Value (KM-Log)	2.434
KM Standard Error of Mean (logged)	0.193		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.147	Mean in Log Scale	-2.129
SD in Original Scale	0.093	SD in Log Scale	0.764
95% t UCL (Assumes normality)	0.224	95% H-Stat UCL	0.503

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.227

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Eagle Point Lake
Crayfish Tissue

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/12/2021 3:59:18 PM
From File	FWM_ProUCL_Input_c.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	2.61	Mean	3.323
Maximum	4.24	Median	3.27
SD	0.443	Std. Error of Mean	0.148
Coefficient of Variation	0.133	Skewness	0.762

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.912	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.245	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	3.598	95% Adjusted-CLT UCL (Chen-1995)	3.606
		95% Modified-t UCL (Johnson-1978)	3.604

Gamma GOF Test

A-D Test Statistic	0.469	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.72	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.226	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	65.19	k star (bias corrected MLE)	43.54
Theta hat (MLE)	0.051	Theta star (bias corrected MLE)	0.0763
nu hat (MLE)	1174	nu star (bias corrected)	783.7
MLE Mean (bias corrected)	3.323	MLE Sd (bias corrected)	0.504
		Approximate Chi Square Value (0.05)	719.7
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	706.7

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	3.619	95% Adjusted Gamma UCL (use when n<50)	3.685

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.929	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.221	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.959	Mean of logged Data	1.193
Maximum of Logged Data	1.445	SD of logged Data	0.131

Assuming Lognormal Distribution

95% H-UCL	3.623	90% Chebyshev (MVUE) UCL	3.759
95% Chebyshev (MVUE) UCL	3.956	97.5% Chebyshev (MVUE) UCL	4.23
99% Chebyshev (MVUE) UCL	4.768		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

ProUCL Output
Eagle Point Lake
Crayfish Tissue

Nonparametric Distribution Free UCLs

95% CLT UCL	3.566	95% Jackknife UCL	3.598
95% Standard Bootstrap UCL	3.55	95% Bootstrap-t UCL	3.69
95% Hall's Bootstrap UCL	4.157	95% Percentile Bootstrap UCL	3.568
95% BCA Bootstrap UCL	3.597		
90% Chebyshev(Mean, Sd) UCL	3.766	95% Chebyshev(Mean, Sd) UCL	3.967
97.5% Chebyshev(Mean, Sd) UCL	4.246	99% Chebyshev(Mean, Sd) UCL	4.793

Suggested UCL to Use

95% Student's-t UCL 3.598

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
Number of Detects	6	Number of Non-Detects	3
Number of Distinct Detects	6	Number of Distinct Non-Detects	3
Minimum Detect	0.206	Minimum Non-Detect	0.193
Maximum Detect	0.261	Maximum Non-Detect	0.2
Variance Detects	4.0147E-4	Percent Non-Detects	33.33%
Mean Detects	0.23	SD Detects	0.02
Median Detects	0.228	CV Detects	0.0872
Skewness Detects	0.561	Kurtosis Detects	-0.387
Mean of Logged Detects	-1.474	SD of Logged Detects	0.0862

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.964	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.185	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.217	KM Standard Error of Mean	0.00834
KM SD	0.0228	95% KM (BCA) UCL	0.232
95% KM (t) UCL	0.233	95% KM (Percentile Bootstrap) UCL	0.231
95% KM (z) UCL	0.231	95% KM Bootstrap t UCL	0.232
90% KM Chebyshev UCL	0.242	95% KM Chebyshev UCL	0.254
97.5% KM Chebyshev UCL	0.27	99% KM Chebyshev UCL	0.3

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.213	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.696	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.196	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	160.3	k star (bias corrected MLE)	80.28
Theta hat (MLE)	0.00143	Theta star (bias corrected MLE)	0.00286
nu hat (MLE)	1924	nu star (bias corrected)	963.4
Mean (detects)	0.23		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.179	Mean	0.213
Maximum	0.261	Median	0.215
SD	0.0301	CV	0.141
k hat (MLE)	56.31	k star (bias corrected MLE)	37.61
Theta hat (MLE)	0.00378	Theta star (bias corrected MLE)	0.00565
nu hat (MLE)	1014	nu star (bias corrected)	677
Adjusted Level of Significance (β)	0.0231		
Approximate Chi Square Value (677.01, α)	617.6	Adjusted Chi Square Value (677.01, β)	605.6
95% Gamma Approximate UCL (use when n>=50)	0.233	95% Gamma Adjusted UCL (use when n<50)	0.238

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.217	SD (KM)	0.0228
Variance (KM)	5.2180E-4	SE of Mean (KM)	0.00834
k hat (KM)	90.61	k star (KM)	60.48
nu hat (KM)	1631	nu star (KM)	1089
theta hat (KM)	0.0024	theta star (KM)	0.0036
80% gamma percentile (KM)	0.241	90% gamma percentile (KM)	0.254
95% gamma percentile (KM)	0.265	99% gamma percentile (KM)	0.288

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (N/A, α)	1013	Adjusted Chi Square Value (N/A, β)	997.6
95% Gamma Approximate KM-UCL (use when n>=50)	0.234	95% Gamma Adjusted KM-UCL (use when n<50)	0.237

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.971	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.178	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.214	Mean in Log Scale	-1.55
SD in Original Scale	0.0285	SD in Log Scale	0.133
95% t UCL (assumes normality of ROS data)	0.232	95% Percentile Bootstrap UCL	0.228
95% BCA Bootstrap UCL	0.229	95% Bootstrap t UCL	0.233
95% H-UCL (Log ROS)	0.233		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.531	KM Geo Mean	0.216
KM SD (logged)	0.103	95% Critical H Value (KM-Log)	1.824
KM Standard Error of Mean (logged)	0.0376	95% H-UCL (KM -Log)	0.232
KM SD (logged)	0.103	95% Critical H Value (KM-Log)	1.824
KM Standard Error of Mean (logged)	0.0376		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.186	Mean in Log Scale	-1.755
SD in Original Scale	0.0675	SD in Log Scale	0.427
95% t UCL (Assumes normality)	0.228	95% H-Stat UCL	0.263

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.233

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.128	Mean	0.17
Maximum	0.262	Median	0.154
SD	0.0468	Std. Error of Mean	0.0156
Coefficient of Variation	0.276	Skewness	1.222

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.849	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.223	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.199	95% Adjusted-CLT UCL (Chen-1995)	0.202
		95% Modified-t UCL (Johnson-1978)	0.2

Gamma GOF Test

A-D Test Statistic	0.504	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.199	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	16.67	k star (bias corrected MLE)	11.19
Theta hat (MLE)	0.0102	Theta star (bias corrected MLE)	0.0152
nu hat (MLE)	300.1	nu star (bias corrected)	201.4
MLE Mean (bias corrected)	0.17	MLE Sd (bias corrected)	0.0507
		Approximate Chi Square Value (0.05)	169.6
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	163.4

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.202	95% Adjusted Gamma UCL (use when n<50)	0.209

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.89	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.182	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.056	Mean of logged Data	-1.804
Maximum of Logged Data	-1.339	SD of logged Data	0.254

Assuming Lognormal Distribution

95% H-UCL	0.203	90% Chebyshev (MVUE) UCL	0.213
95% Chebyshev (MVUE) UCL	0.232	97.5% Chebyshev (MVUE) UCL	0.259
99% Chebyshev (MVUE) UCL	0.313		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.195	95% Jackknife UCL	0.199
95% Standard Bootstrap UCL	0.194	95% Bootstrap-t UCL	0.228
95% Hall's Bootstrap UCL	0.352	95% Percentile Bootstrap UCL	0.197
95% BCA Bootstrap UCL	0.201		
90% Chebyshev(Mean, Sd) UCL	0.217	95% Chebyshev(Mean, Sd) UCL	0.238
97.5% Chebyshev(Mean, Sd) UCL	0.267	99% Chebyshev(Mean, Sd) UCL	0.325

ProUCL Output
Eagle Point Lake
Crayfish Tissue

Suggested UCL to Use

95% Student's-t UCL 0.199

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	0.211	Mean	0.332
Maximum	0.492	Median	0.31
SD	0.0963	Std. Error of Mean	0.0321
Coefficient of Variation	0.29	Skewness	0.6

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.932	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.146	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.392	95% Adjusted-CLT UCL (Chen-1995)	0.392
		95% Modified-t UCL (Johnson-1978)	0.393

Gamma GOF Test

A-D Test Statistic	0.253	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.16	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	13.83	k star (bias corrected MLE)	9.296
Theta hat (MLE)	0.024	Theta star (bias corrected MLE)	0.0357
nu hat (MLE)	249	nu star (bias corrected)	167.3
MLE Mean (bias corrected)	0.332	MLE Sd (bias corrected)	0.109
		Approximate Chi Square Value (0.05)	138.4
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	132.9

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.401	95% Adjusted Gamma UCL (use when n<50)	0.418

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.958	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.147	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.556	Mean of logged Data	-1.14
Maximum of Logged Data	-0.709	SD of logged Data	0.286

Assuming Lognormal Distribution

95% H-UCL	0.408	90% Chebyshev (MVUE) UCL	0.427
95% Chebyshev (MVUE) UCL	0.47	97.5% Chebyshev (MVUE) UCL	0.53
99% Chebyshev (MVUE) UCL	0.648		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

ProUCL Output
Eagle Point Lake
Crayfish Tissue

Nonparametric Distribution Free UCLs

95% CLT UCL	0.385	95% Jackknife UCL	0.392
95% Standard Bootstrap UCL	0.381	95% Bootstrap-t UCL	0.414
95% Hall's Bootstrap UCL	0.413	95% Percentile Bootstrap UCL	0.383
95% BCA Bootstrap UCL	0.387		
90% Chebyshev(Mean, Sd) UCL	0.428	95% Chebyshev(Mean, Sd) UCL	0.472
97.5% Chebyshev(Mean, Sd) UCL	0.532	99% Chebyshev(Mean, Sd) UCL	0.651

Suggested UCL to Use

95% Student's-t UCL 0.392

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	0.68	Mean	1.777
Maximum	3.27	Median	1.47
SD	0.867	Std. Error of Mean	0.289
Coefficient of Variation	0.488	Skewness	0.581

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.938	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.194	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	2.314	95% Adjusted-CLT UCL (Chen-1995)	2.312
		95% Modified-t UCL (Johnson-1978)	2.323

Gamma GOF Test

A-D Test Statistic	0.238	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.723	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.167	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.28	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.675	k star (bias corrected MLE)	3.191
Theta hat (MLE)	0.38	Theta star (bias corrected MLE)	0.557
nu hat (MLE)	84.15	nu star (bias corrected)	57.44
MLE Mean (bias corrected)	1.777	MLE Sd (bias corrected)	0.995
		Approximate Chi Square Value (0.05)	41.01
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	38.11

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	2.488	95% Adjusted Gamma UCL (use when n<50)	2.678

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.967	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.138	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.386	Mean of logged Data	0.464
Maximum of Logged Data	1.185	SD of logged Data	0.509

Assuming Lognormal Distribution

95% H-UCL	2.708	90% Chebyshev (MVUE) UCL	2.701
95% Chebyshev (MVUE) UCL	3.118	97.5% Chebyshev (MVUE) UCL	3.696
99% Chebyshev (MVUE) UCL	4.831		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2.252	95% Jackknife UCL	2.314
95% Standard Bootstrap UCL	2.23	95% Bootstrap-t UCL	2.436
95% Hall's Bootstrap UCL	2.331	95% Percentile Bootstrap UCL	2.24
95% BCA Bootstrap UCL	2.263		
90% Chebyshev(Mean, Sd) UCL	2.644	95% Chebyshev(Mean, Sd) UCL	3.036
97.5% Chebyshev(Mean, Sd) UCL	3.581	99% Chebyshev(Mean, Sd) UCL	4.652

Suggested UCL to Use

95% Student's-t UCL 2.314

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	0.151	Mean	0.34
Maximum	0.512	Median	0.372
SD	0.139	Std. Error of Mean	0.0463
Coefficient of Variation	0.409	Skewness	-0.0781

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.903	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.181	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.426	95% Adjusted-CLT UCL (Chen-1995)	0.415
		95% Modified-t UCL (Johnson-1978)	0.426

Gamma GOF Test

A-D Test Statistic	0.449	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.723	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.196	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.28	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	6.026	k star (bias corrected MLE)	4.092
Theta hat (MLE)	0.0564	Theta star (bias corrected MLE)	0.0831
nu hat (MLE)	108.5	nu star (bias corrected)	73.65
MLE Mean (bias corrected)	0.34	MLE Sd (bias corrected)	0.168
		Approximate Chi Square Value (0.05)	54.89
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	51.48

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.456	95% Adjusted Gamma UCL (use when n<50)	0.486

ProUCL Output
Eagle Point Lake
Crayfish Tissue

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.9	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.206	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.89	Mean of logged Data	-1.164
Maximum of Logged Data	-0.669	SD of logged Data	0.453

Assuming Lognormal Distribution

95% H-UCL	0.491	90% Chebyshev (MVUE) UCL	0.498
95% Chebyshev (MVUE) UCL	0.57	97.5% Chebyshev (MVUE) UCL	0.668
99% Chebyshev (MVUE) UCL	0.862		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.416	95% Jackknife UCL	0.426
95% Standard Bootstrap UCL	0.411	95% Bootstrap-t UCL	0.428
95% Hall's Bootstrap UCL	0.401	95% Percentile Bootstrap UCL	0.413
95% BCA Bootstrap UCL	0.409		
90% Chebyshev(Mean, Sd) UCL	0.479	95% Chebyshev(Mean, Sd) UCL	0.542
97.5% Chebyshev(Mean, Sd) UCL	0.629	99% Chebyshev(Mean, Sd) UCL	0.801

Suggested UCL to Use

95% Student's-t UCL 0.426

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.234	Mean	0.324
Maximum	0.432	Median	0.328
SD	0.0622	Std. Error of Mean	0.0207
Coefficient of Variation	0.192	Skewness	0.114

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.96	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.164	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.362	95% Adjusted-CLT UCL (Chen-1995)	0.359
		95% Modified-t UCL (Johnson-1978)	0.362

Gamma GOF Test

A-D Test Statistic	0.264	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.155	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

ProUCL Output
Eagle Point Lake
Crayfish Tissue

Gamma Statistics

k hat (MLE)	29.84	k star (bias corrected MLE)	19.97
Theta hat (MLE)	0.0108	Theta star (bias corrected MLE)	0.0162
nu hat (MLE)	537.2	nu star (bias corrected)	359.5
MLE Mean (bias corrected)	0.324	MLE Sd (bias corrected)	0.0725
		Approximate Chi Square Value (0.05)	316.5
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	308

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.368	95% Adjusted Gamma UCL (use when n<50)	0.378

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.955	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.15	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.452	Mean of logged Data	-1.145
Maximum of Logged Data	-0.839	SD of logged Data	0.196

Assuming Lognormal Distribution

95% H-UCL	0.37	90% Chebyshev (MVUE) UCL	0.388
95% Chebyshev (MVUE) UCL	0.416	97.5% Chebyshev (MVUE) UCL	0.457
99% Chebyshev (MVUE) UCL	0.535		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.358	95% Jackknife UCL	0.362
95% Standard Bootstrap UCL	0.355	95% Bootstrap-t UCL	0.359
95% Hall's Bootstrap UCL	0.361	95% Percentile Bootstrap UCL	0.356
95% BCA Bootstrap UCL	0.355		
90% Chebyshev(Mean, Sd) UCL	0.386	95% Chebyshev(Mean, Sd) UCL	0.414
97.5% Chebyshev(Mean, Sd) UCL	0.453	99% Chebyshev(Mean, Sd) UCL	0.53

Suggested UCL to Use

95% Student's-t UCL	0.362

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	0.146	Mean	0.212
Maximum	0.344	Median	0.188
SD	0.0658	Std. Error of Mean	0.0219
Coefficient of Variation	0.31	Skewness	1.175

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.868	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.276	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data Not Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.253	95% Adjusted-CLT UCL (Chen-1995)	0.258
		95% Modified-t UCL (Johnson-1978)	0.255

ProUCL Output
Eagle Point Lake
Crayfish Tissue

Gamma GOF Test

A-D Test Statistic	0.48	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.258	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	13.27	k star (bias corrected MLE)	8.917
Theta hat (MLE)	0.016	Theta star (bias corrected MLE)	0.0238
nu hat (MLE)	238.8	nu star (bias corrected)	160.5
MLE Mean (bias corrected)	0.212	MLE Sd (bias corrected)	0.0711
		Approximate Chi Square Value (0.05)	132.2
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	126.8

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.258	95% Adjusted Gamma UCL (use when n<50)	0.269

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.916	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.239	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.924	Mean of logged Data	-1.588
Maximum of Logged Data	-1.067	SD of logged Data	0.285

Assuming Lognormal Distribution

95% H-UCL	0.26	90% Chebyshev (MVUE) UCL	0.273
95% Chebyshev (MVUE) UCL	0.3	97.5% Chebyshev (MVUE) UCL	0.338
99% Chebyshev (MVUE) UCL	0.413		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.248	95% Jackknife UCL	0.253
95% Standard Bootstrap UCL	0.247	95% Bootstrap-t UCL	0.274
95% Hall's Bootstrap UCL	0.26	95% Percentile Bootstrap UCL	0.247
95% BCA Bootstrap UCL	0.255		
90% Chebyshev(Mean, Sd) UCL	0.278	95% Chebyshev(Mean, Sd) UCL	0.308
97.5% Chebyshev(Mean, Sd) UCL	0.349	99% Chebyshev(Mean, Sd) UCL	0.43

Suggested UCL to Use

95% Student's-t UCL	0.253

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	0.163	Mean	0.224
Maximum	0.399	Median	0.186
SD	0.0891	Std. Error of Mean	0.0297
Coefficient of Variation	0.398	Skewness	1.615

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

ProUCL Output
Eagle Point Lake
Crayfish Tissue

Normal GOF Test

Shapiro Wilk Test Statistic	0.67	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.395	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.279	95% Adjusted-CLT UCL (Chen-1995)	0.289
		95% Modified-t UCL (Johnson-1978)	0.281

Gamma GOF Test

A-D Test Statistic	1.401	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.722	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.38	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	9.01	k star (bias corrected MLE)	6.081
Theta hat (MLE)	0.0248	Theta star (bias corrected MLE)	0.0368
nu hat (MLE)	162.2	nu star (bias corrected)	109.5
MLE Mean (bias corrected)	0.224	MLE Sd (bias corrected)	0.0907
		Approximate Chi Square Value (0.05)	86.31
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	81.98

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.284	95% Adjusted Gamma UCL (use when n<50)	0.298

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.714	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.36	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.814	Mean of logged Data	-1.555
Maximum of Logged Data	-0.919	SD of logged Data	0.336

Assuming Lognormal Distribution

95% H-UCL	0.285	90% Chebyshev (MVUE) UCL	0.297
95% Chebyshev (MVUE) UCL	0.331	97.5% Chebyshev (MVUE) UCL	0.379
99% Chebyshev (MVUE) UCL	0.471		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	0.272	95% Jackknife UCL	0.279
95% Standard Bootstrap UCL	0.269	95% Bootstrap-t UCL	0.585
95% Hall's Bootstrap UCL	0.697	95% Percentile Bootstrap UCL	0.27
95% BCA Bootstrap UCL	0.282		
90% Chebyshev(Mean, Sd) UCL	0.313	95% Chebyshev(Mean, Sd) UCL	0.353
97.5% Chebyshev(Mean, Sd) UCL	0.409	99% Chebyshev(Mean, Sd) UCL	0.519

Suggested UCL to Use

95% Student's-t UCL	0.279	or 95% Modified-t UCL	0.281

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	0.128	Mean	0.214
Maximum	0.299	Median	0.204
SD	0.062	Std. Error of Mean	0.0207
Coefficient of Variation	0.29	Skewness	-0.0279

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.932	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.182	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.252	95% Adjusted-CLT UCL (Chen-1995)	0.247
		95% Modified-t UCL (Johnson-1978)	0.252

Gamma GOF Test

A-D Test Statistic	0.339	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.722	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.206	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	12.67	k star (bias corrected MLE)	8.524
Theta hat (MLE)	0.0169	Theta star (bias corrected MLE)	0.0251
nu hat (MLE)	228.1	nu star (bias corrected)	153.4
MLE Mean (bias corrected)	0.214	MLE Sd (bias corrected)	0.0732
		Approximate Chi Square Value (0.05)	125.8
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	120.5

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.261	95% Adjusted Gamma UCL (use when n<50)	0.272

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.928	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.198	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.056	Mean of logged Data	-1.583
Maximum of Logged Data	-1.207	SD of logged Data	0.305

Assuming Lognormal Distribution

95% H-UCL	0.267	90% Chebyshev (MVUE) UCL	0.28
95% Chebyshev (MVUE) UCL	0.309	97.5% Chebyshev (MVUE) UCL	0.351
99% Chebyshev (MVUE) UCL	0.432		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.248	95% Jackknife UCL	0.252
95% Standard Bootstrap UCL	0.246	95% Bootstrap-t UCL	0.253
95% Hall's Bootstrap UCL	0.245	95% Percentile Bootstrap UCL	0.247
95% BCA Bootstrap UCL	0.247		
90% Chebyshev(Mean, Sd) UCL	0.276	95% Chebyshev(Mean, Sd) UCL	0.304
97.5% Chebyshev(Mean, Sd) UCL	0.343	99% Chebyshev(Mean, Sd) UCL	0.419

ProUCL Output
Eagle Point Lake
Crayfish Tissue

Suggested UCL to Use

95% Student's-t UCL 0.252

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	0.135	Mean	0.207
Maximum	0.316	Median	0.216
SD	0.0585	Std. Error of Mean	0.0195
Coefficient of Variation	0.283	Skewness	0.445

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.931	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.156	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.243	95% Adjusted-CLT UCL (Chen-1995)	0.242
		95% Modified-t UCL (Johnson-1978)	0.243

Gamma GOF Test

A-D Test Statistic	0.348	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.17	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	14.02	k star (bias corrected MLE)	9.424
Theta hat (MLE)	0.0147	Theta star (bias corrected MLE)	0.0219
nu hat (MLE)	252.4	nu star (bias corrected)	169.6
MLE Mean (bias corrected)	0.207	MLE Sd (bias corrected)	0.0673
		Approximate Chi Square Value (0.05)	140.5
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	134.9

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.249	95% Adjusted Gamma UCL (use when n<50)	0.26

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.93	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.166	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.002	Mean of logged Data	-1.613
Maximum of Logged Data	-1.152	SD of logged Data	0.287

Assuming Lognormal Distribution

95% H-UCL	0.254	90% Chebyshev (MVUE) UCL	0.266
95% Chebyshev (MVUE) UCL	0.293	97.5% Chebyshev (MVUE) UCL	0.331
99% Chebyshev (MVUE) UCL	0.404		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.239	95% Jackknife UCL	0.243
95% Standard Bootstrap UCL	0.236	95% Bootstrap-t UCL	0.248
95% Hall's Bootstrap UCL	0.245	95% Percentile Bootstrap UCL	0.239
95% BCA Bootstrap UCL	0.237		
90% Chebyshev(Mean, Sd) UCL	0.265	95% Chebyshev(Mean, Sd) UCL	0.292
97.5% Chebyshev(Mean, Sd) UCL	0.328	99% Chebyshev(Mean, Sd) UCL	0.401

ProUCL Output
Eagle Point Lake
Crayfish Tissue

Suggested UCL to Use

95% Student's-t UCL 0.243

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	12.7	Mean	20.62
Maximum	27	Median	20.3
SD	4.283	Std. Error of Mean	1.428
Coefficient of Variation	0.208	Skewness	-0.0992

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.91	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.199	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	23.28	95% Adjusted-CLT UCL (Chen-1995)	22.92
		95% Modified-t UCL (Johnson-1978)	23.27

Gamma GOF Test

A-D Test Statistic	0.502	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.212	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	24.42	k star (bias corrected MLE)	16.35
Theta hat (MLE)	0.845	Theta star (bias corrected MLE)	1.261
nu hat (MLE)	439.5	nu star (bias corrected)	294.3
MLE Mean (bias corrected)	20.62	MLE Sd (bias corrected)	5.1
		Approximate Chi Square Value (0.05)	255.6
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	248

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	23.75	95% Adjusted Gamma UCL (use when n<50)	24.48

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.887	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.234	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.542	Mean of logged Data	3.006
Maximum of Logged Data	3.296	SD of logged Data	0.221

Assuming Lognormal Distribution

95% H-UCL	24.06	90% Chebyshev (MVUE) UCL	25.21
95% Chebyshev (MVUE) UCL	27.28	97.5% Chebyshev (MVUE) UCL	30.15
99% Chebyshev (MVUE) UCL	35.79		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

ProUCL Output
Eagle Point Lake
Crayfish Tissue

Nonparametric Distribution Free UCLs

95% CLT UCL	22.97	95% Jackknife UCL	23.28
95% Standard Bootstrap UCL	22.86	95% Bootstrap-t UCL	23.64
95% Hall's Bootstrap UCL	24.18	95% Percentile Bootstrap UCL	22.9
95% BCA Bootstrap UCL	22.9		
90% Chebyshev(Mean, Sd) UCL	24.91	95% Chebyshev(Mean, Sd) UCL	26.85
97.5% Chebyshev(Mean, Sd) UCL	29.54	99% Chebyshev(Mean, Sd) UCL	34.83

Suggested UCL to Use

95% Student's-t UCL 23.28

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	3.11	Mean	8.361
Maximum	11.1	Median	9.4
SD	2.362	Std. Error of Mean	0.787
Coefficient of Variation	0.282	Skewness	-1.443

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.874	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.226	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	9.825	95% Adjusted-CLT UCL (Chen-1995)	9.251
		95% Modified-t UCL (Johnson-1978)	9.762

Gamma GOF Test

A-D Test Statistic	0.812	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.722	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.239	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	9.72	k star (bias corrected MLE)	6.554
Theta hat (MLE)	0.86	Theta star (bias corrected MLE)	1.276
nu hat (MLE)	175	nu star (bias corrected)	118
MLE Mean (bias corrected)	8.361	MLE Sd (bias corrected)	3.266
		Approximate Chi Square Value (0.05)	93.9
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	89.37

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	10.51	95% Adjusted Gamma UCL (use when n<50)	11.04

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.746	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.254	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level	

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.135	Mean of logged Data	2.071
Maximum of Logged Data	2.407	SD of logged Data	0.381

Assuming Lognormal Distribution

95% H-UCL	11.34	90% Chebyshev (MVUE) UCL	11.72
95% Chebyshev (MVUE) UCL	13.19	97.5% Chebyshev (MVUE) UCL	15.24
99% Chebyshev (MVUE) UCL	19.26		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	9.656	95% Jackknife UCL	9.825
95% Standard Bootstrap UCL	9.591	95% Bootstrap-t UCL	9.485
95% Hall's Bootstrap UCL	9.379	95% Percentile Bootstrap UCL	9.483
95% BCA Bootstrap UCL	9.318		
90% Chebyshev(Mean, Sd) UCL	10.72	95% Chebyshev(Mean, Sd) UCL	11.79
97.5% Chebyshev(Mean, Sd) UCL	13.28	99% Chebyshev(Mean, Sd) UCL	16.19

Suggested UCL to Use

95% Student's-t UCL 9.825

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	0.108	Mean	0.276
Maximum	0.399	Median	0.294
SD	0.105	Std. Error of Mean	0.0349
Coefficient of Variation	0.38	Skewness	-0.388

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.93	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.161	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.34	95% Adjusted-CLT UCL (Chen-1995)	0.328
		95% Modified-t UCL (Johnson-1978)	0.34

Gamma GOF Test

A-D Test Statistic	0.402	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.722	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.214	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.28	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	6.374	k star (bias corrected MLE)	4.324
Theta hat (MLE)	0.0432	Theta star (bias corrected MLE)	0.0637
nu hat (MLE)	114.7	nu star (bias corrected)	77.83
MLE Mean (bias corrected)	0.276	MLE Sd (bias corrected)	0.133
		Approximate Chi Square Value (0.05)	58.5
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	54.98

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.367	95% Adjusted Gamma UCL (use when n<50)	0.39

ProUCL Output
Eagle Point Lake
Crayfish Tissue

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.891	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.232	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.226	Mean of logged Data	-1.369
Maximum of Logged Data	-0.919	SD of logged Data	0.453

Assuming Lognormal Distribution

95% H-UCL	0.4	90% Chebyshev (MVUE) UCL	0.406
95% Chebyshev (MVUE) UCL	0.463	97.5% Chebyshev (MVUE) UCL	0.544
99% Chebyshev (MVUE) UCL	0.701		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.333	95% Jackknife UCL	0.34
95% Standard Bootstrap UCL	0.329	95% Bootstrap-t UCL	0.337
95% Hall's Bootstrap UCL	0.324	95% Percentile Bootstrap UCL	0.329
95% BCA Bootstrap UCL	0.326		
90% Chebyshev(Mean, Sd) UCL	0.38	95% Chebyshev(Mean, Sd) UCL	0.428
97.5% Chebyshev(Mean, Sd) UCL	0.494	99% Chebyshev(Mean, Sd) UCL	0.623

Suggested UCL to Use

95% Student's-t UCL 0.34

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

ProUCL Output
Raleigh Creek - Upper
Crayfish Tissue

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/12/2021 3:51:08 PM
From File	FWM_ProUCL_Input_a.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

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General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	3.14	Mean	5.083
Maximum	7.21	Median	5.32
SD	1.324	Std. Error of Mean	0.501
Coefficient of Variation	0.261	Skewness	0.163

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.969	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.17	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	6.056	95% Adjusted-CLT UCL (Chen-1995)	5.939
		95% Modified-t UCL (Johnson-1978)	6.061

Gamma GOF Test

A-D Test Statistic	0.246	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.707	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.177	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.312	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	16.55	k star (bias corrected MLE)	9.554
Theta hat (MLE)	0.307	Theta star (bias corrected MLE)	0.532
nu hat (MLE)	231.7	nu star (bias corrected)	133.7
MLE Mean (bias corrected)	5.083	MLE Sd (bias corrected)	1.644
		Approximate Chi Square Value (0.05)	108
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	101.1

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	6.293	95% Adjusted Gamma UCL (use when n<50)	6.727

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.962	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.182	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.144	Mean of logged Data	1.595
Maximum of Logged Data	1.975	SD of logged Data	0.271

Assuming Lognormal Distribution

95% H-UCL	6.48	90% Chebyshev (MVUE) UCL	6.654
95% Chebyshev (MVUE) UCL	7.363	97.5% Chebyshev (MVUE) UCL	8.348
99% Chebyshev (MVUE) UCL	10.28		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

ProUCL Output
Raleigh Creek - Upper
Crayfish Tissue

Nonparametric Distribution Free UCLs

95% CLT UCL	5.906	95% Jackknife UCL	6.056
95% Standard Bootstrap UCL	5.85	95% Bootstrap-t UCL	6.095
95% Hall's Bootstrap UCL	6.066	95% Percentile Bootstrap UCL	5.861
95% BCA Bootstrap UCL	5.81		
90% Chebyshev(Mean, Sd) UCL	6.585	95% Chebyshev(Mean, Sd) UCL	7.265
97.5% Chebyshev(Mean, Sd) UCL	8.209	99% Chebyshev(Mean, Sd) UCL	10.06

Suggested UCL to Use

95% Student's-t UCL 6.056

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
Number of Detects	4	Number of Non-Detects	3
Number of Distinct Detects	4	Number of Distinct Non-Detects	3
Minimum Detect	0.276	Minimum Non-Detect	0.19
Maximum Detect	0.324	Maximum Non-Detect	0.2
Variance Detects	5.2033E-4	Percent Non-Detects	42.86%
Mean Detects	0.295	SD Detects	0.0228
Median Detects	0.289	CV Detects	0.0775
Skewness Detects	0.801	Kurtosis Detects	-1.557
Mean of Logged Detects	-1.225	SD of Logged Detects	0.0764

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.877	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.279	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.25	KM Standard Error of Mean	0.0235
KM SD	0.0538	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.295	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.288	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.32	95% KM Chebyshev UCL	0.352
97.5% KM Chebyshev UCL	0.396	99% KM Chebyshev UCL	0.483

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.405	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.313	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	226.3	k star (bias corrected MLE)	56.74
Theta hat (MLE)	0.0013	Theta star (bias corrected MLE)	0.00519
nu hat (MLE)	1810	nu star (bias corrected)	454
Mean (detects)	0.295		

ProUCL Output
Raleigh Creek - Upper
Crayfish Tissue

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.23	Mean	0.267
Maximum	0.324	Median	0.276
SD	0.0379	CV	0.142
k hat (MLE)	58.49	k star (bias corrected MLE)	33.52
Theta hat (MLE)	0.00456	Theta star (bias corrected MLE)	0.00796
nu hat (MLE)	818.9	nu star (bias corrected)	469.3
Adjusted Level of Significance (β)	0.0158		
Approximate Chi Square Value (469.29, α)	420.1	Adjusted Chi Square Value (469.29, β)	405.9
95% Gamma Approximate UCL (use when n>=50)	0.298	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.25	SD (KM)	0.0538
Variance (KM)	0.0029	SE of Mean (KM)	0.0235
k hat (KM)	21.52	k star (KM)	12.39
nu hat (KM)	301.3	nu star (KM)	173.5
theta hat (KM)	0.0116	theta star (KM)	0.0201
80% gamma percentile (KM)	0.307	90% gamma percentile (KM)	0.344
95% gamma percentile (KM)	0.377	99% gamma percentile (KM)	0.444

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (173.51, α)	144	Adjusted Chi Square Value (173.51, β)	135.9
95% Gamma Approximate KM-UCL (use when n>=50)	0.301	95% Gamma Adjusted KM-UCL (use when n<50)	0.319

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.879	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.28	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.269	Mean in Log Scale	-1.32
SD in Original Scale	0.0355	SD in Log Scale	0.13
95% t UCL (assumes normality of ROS data)	0.295	95% Percentile Bootstrap UCL	0.291
95% BCA Bootstrap UCL	0.292	95% Bootstrap t UCL	0.295
95% H-UCL (Log ROS)	0.298		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.412	KM Geo Mean	0.244
KM SD (logged)	0.222	95% Critical H Value (KM-Log)	2.03
KM Standard Error of Mean (logged)	0.0967	95% H-UCL (KM -Log)	0.3
KM SD (logged)	0.222	95% Critical H Value (KM-Log)	2.03
KM Standard Error of Mean (logged)	0.0967		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.21	Mean in Log Scale	-1.698
SD in Original Scale	0.107	SD in Log Scale	0.593
95% t UCL (Assumes normality)	0.288	95% H-Stat UCL	0.416

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.295

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.216	Mean	0.393
Maximum	0.642	Median	0.4
SD	0.176	Std. Error of Mean	0.0664
Coefficient of Variation	0.448	Skewness	0.447

Note: Sample size is small (e.g., <10), If data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.878	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.22	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.522	95% Adjusted-CLT UCL (Chen-1995)	0.514
		95% Modified-t UCL (Johnson-1978)	0.523

Gamma GOF Test

A-D Test Statistic	0.435	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.71	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.236	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.313	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.809	k star (bias corrected MLE)	3.415
Theta hat (MLE)	0.0676	Theta star (bias corrected MLE)	0.115
nu hat (MLE)	81.32	nu star (bias corrected)	47.8
MLE Mean (bias corrected)	0.393	MLE Sd (bias corrected)	0.212
		Approximate Chi Square Value (0.05)	32.93
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	29.26

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.57	95% Adjusted Gamma UCL (use when n<50)	0.641

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.882	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.215	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.532	Mean of logged Data	-1.024
Maximum of Logged Data	-0.443	SD of logged Data	0.458

Assuming Lognormal Distribution

95% H-UCL	0.622	90% Chebyshev (MVUE) UCL	0.597
95% Chebyshev (MVUE) UCL	0.69	97.5% Chebyshev (MVUE) UCL	0.819
99% Chebyshev (MVUE) UCL	1.071		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.502	95% Jackknife UCL	0.522
95% Standard Bootstrap UCL	0.495	95% Bootstrap-t UCL	0.548
95% Hall's Bootstrap UCL	0.531	95% Percentile Bootstrap UCL	0.493
95% BCA Bootstrap UCL	0.501		
90% Chebyshev(Mean, Sd) UCL	0.592	95% Chebyshev(Mean, Sd) UCL	0.682
97.5% Chebyshev(Mean, Sd) UCL	0.807	99% Chebyshev(Mean, Sd) UCL	1.053

ProUCL Output
Raleigh Creek - Upper
Crayfish Tissue

Suggested UCL to Use

95% Student's-t UCL 0.522

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFHpA|ug/kg

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.235	Mean	1.131
Maximum	1.73	Median	1.21
SD	0.577	Std. Error of Mean	0.218
Coefficient of Variation	0.51	Skewness	-0.451

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.905	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.221	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.554	95% Adjusted-CLT UCL (Chen-1995)	1.45
		95% Modified-t UCL (Johnson-1978)	1.548

Gamma GOF Test

A-D Test Statistic	0.454	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.712	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.226	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.314	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.057	k star (bias corrected MLE)	1.842
Theta hat (MLE)	0.37	Theta star (bias corrected MLE)	0.614
nu hat (MLE)	42.8	nu star (bias corrected)	25.79
MLE Mean (bias corrected)	1.131	MLE Sd (bias corrected)	0.833
		Approximate Chi Square Value (0.05)	15.22
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	12.83

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1.916	95% Adjusted Gamma UCL (use when n<50)	2.272

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.839	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.203	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.448	Mean of logged Data	-0.0497
Maximum of Logged Data	0.548	SD of logged Data	0.719

Assuming Lognormal Distribution

95% H-UCL	2.929	90% Chebyshev (MVUE) UCL	2.15
95% Chebyshev (MVUE) UCL	2.588	97.5% Chebyshev (MVUE) UCL	3.198
99% Chebyshev (MVUE) UCL	4.394		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

ProUCL Output
Raleigh Creek - Upper
Crayfish Tissue

Nonparametric Distribution Free UCLs

95% CLT UCL	1.489	95% Jackknife UCL	1.554
95% Standard Bootstrap UCL	1.468	95% Bootstrap-t UCL	1.507
95% Hall's Bootstrap UCL	1.41	95% Percentile Bootstrap UCL	1.461
95% BCA Bootstrap UCL	1.425		
90% Chebyshev(Mean, Sd) UCL	1.785	95% Chebyshev(Mean, Sd) UCL	2.081
97.5% Chebyshev(Mean, Sd) UCL	2.492	99% Chebyshev(Mean, Sd) UCL	3.3

Suggested UCL to Use

95% Student's-t UCL 1.554

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFOA|ug/kg

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	1.38	Mean	8.901
Maximum	13.4	Median	8.86
SD	4.034	Std. Error of Mean	1.525
Coefficient of Variation	0.453	Skewness	-1.03

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.918	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.204	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	11.86	95% Adjusted-CLT UCL (Chen-1995)	10.78
		95% Modified-t UCL (Johnson-1978)	11.77

Gamma GOF Test

A-D Test Statistic	0.704	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.712	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.304	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.314	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3	k star (bias corrected MLE)	1.809
Theta hat (MLE)	2.967	Theta star (bias corrected MLE)	4.919
nu hat (MLE)	42	nu star (bias corrected)	25.33
MLE Mean (bias corrected)	8.901	MLE Sd (bias corrected)	6.617
		Approximate Chi Square Value (0.05)	14.87
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	12.51

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	15.17	95% Adjusted Gamma UCL (use when n<50)	18.02

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.725	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.346	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.304	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

ProUCL Output
Raleigh Creek - Upper
Crayfish Tissue

Lognormal Statistics

Minimum of Logged Data	0.322	Mean of logged Data	2.01
Maximum of Logged Data	2.595	SD of logged Data	0.779

Assuming Lognormal Distribution

95% H-UCL	27.13	90% Chebyshev (MVUE) UCL	18.16
95% Chebyshev (MVUE) UCL	22.03	97.5% Chebyshev (MVUE) UCL	27.4
99% Chebyshev (MVUE) UCL	37.96		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	11.41	95% Jackknife UCL	11.86
95% Standard Bootstrap UCL	11.25	95% Bootstrap-t UCL	11.39
95% Hall's Bootstrap UCL	11.03	95% Percentile Bootstrap UCL	11.15
95% BCA Bootstrap UCL	10.73		
90% Chebyshev(Mean, Sd) UCL	13.48	95% Chebyshev(Mean, Sd) UCL	15.55
97.5% Chebyshev(Mean, Sd) UCL	18.42	99% Chebyshev(Mean, Sd) UCL	24.07

Suggested UCL to Use

95% Student's-t UCL 11.86

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFDA|ug/kg

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.159	Mean	0.933
Maximum	2.09	Median	0.762
SD	0.6	Std. Error of Mean	0.227
Coefficient of Variation	0.643	Skewness	1.152

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.909	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.197	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.373	95% Adjusted-CLT UCL (Chen-1995)	1.411
		95% Modified-t UCL (Johnson-1978)	1.39

Gamma GOF Test

A-D Test Statistic	0.335	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.714	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.233	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.314	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.465	k star (bias corrected MLE)	1.504
Theta hat (MLE)	0.378	Theta star (bias corrected MLE)	0.62
nu hat (MLE)	34.51	nu star (bias corrected)	21.05
MLE Mean (bias corrected)	0.933	MLE Sd (bias corrected)	0.761
		Approximate Chi Square Value (0.05)	11.63
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	9.589

ProUCL Output
Raleigh Creek - Upper
Crayfish Tissue

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1.689	95% Adjusted Gamma UCL (use when n<50)	2.048

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.892	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.284	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.839	Mean of logged Data	-0.286
Maximum of Logged Data	0.737	SD of logged Data	0.791

Assuming Lognormal Distribution

95% H-UCL	2.823	90% Chebyshev (MVUE) UCL	1.854
95% Chebyshev (MVUE) UCL	2.252	97.5% Chebyshev (MVUE) UCL	2.805
99% Chebyshev (MVUE) UCL	3.891		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.306	95% Jackknife UCL	1.373
95% Standard Bootstrap UCL	1.279	95% Bootstrap-t UCL	1.597
95% Hall's Bootstrap UCL	3.795	95% Percentile Bootstrap UCL	1.299
95% BCA Bootstrap UCL	1.404		
90% Chebyshev(Mean, Sd) UCL	1.613	95% Chebyshev(Mean, Sd) UCL	1.921
97.5% Chebyshev(Mean, Sd) UCL	2.349	99% Chebyshev(Mean, Sd) UCL	3.189

Suggested UCL to Use

95% Student's-t UCL	1.373

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFUnA|ug/kg

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.233	Mean	1.033
Maximum	1.84	Median	1.18
SD	0.565	Std. Error of Mean	0.214
Coefficient of Variation	0.547	Skewness	-0.256

Note: Sample size is small (e.g., <10), If data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.95	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.174	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.448	95% Adjusted-CLT UCL (Chen-1995)	1.362
		95% Modified-t UCL (Johnson-1978)	1.444

Gamma GOF Test

A-D Test Statistic	0.458	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.713	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.236	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.314	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

ProUCL Output
Raleigh Creek - Upper
Crayfish Tissue

Gamma Statistics

k hat (MLE)	2.73	k star (bias corrected MLE)	1.655
Theta hat (MLE)	0.378	Theta star (bias corrected MLE)	0.624
nu hat (MLE)	38.22	nu star (bias corrected)	23.17
MLE Mean (bias corrected)	1.033	MLE Sd (bias corrected)	0.803
		Approximate Chi Square Value (0.05)	13.22
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	11.02

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1.81	95% Adjusted Gamma UCL (use when n<50)	2.171

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.864	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.267	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.457	Mean of logged Data	-0.162
Maximum of Logged Data	0.61	SD of logged Data	0.754

Assuming Lognormal Distribution

95% H-UCL	2.876	90% Chebyshev (MVUE) UCL	2.004
95% Chebyshev (MVUE) UCL	2.424	97.5% Chebyshev (MVUE) UCL	3.007
99% Chebyshev (MVUE) UCL	4.152		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.384	95% Jackknife UCL	1.448
95% Standard Bootstrap UCL	1.365	95% Bootstrap-t UCL	1.431
95% Hall's Bootstrap UCL	1.349	95% Percentile Bootstrap UCL	1.341
95% BCA Bootstrap UCL	1.325		
90% Chebyshev(Mean, Sd) UCL	1.674	95% Chebyshev(Mean, Sd) UCL	1.964
97.5% Chebyshev(Mean, Sd) UCL	2.367	99% Chebyshev(Mean, Sd) UCL	3.158

Suggested UCL to Use

95% Student's-t UCL	1.448

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFDoA|ug/kg

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	1.25	Mean	1.946
Maximum	2.36	Median	2.07
SD	0.402	Std. Error of Mean	0.152
Coefficient of Variation	0.207	Skewness	-0.798

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.915	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.193	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2.241	95% Adjusted-CLT UCL (Chen-1995)	2.147
		95% Modified-t UCL (Johnson-1978)	2.233

ProUCL Output
Raleigh Creek - Upper
Crayfish Tissue

Gamma GOF Test

A-D Test Statistic	0.393	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.707	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.218	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.311	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	24.36	k star (bias corrected MLE)	14.02
Theta hat (MLE)	0.0799	Theta star (bias corrected MLE)	0.139
nu hat (MLE)	341.1	nu star (bias corrected)	196.2
MLE Mean (bias corrected)	1.946	MLE Sd (bias corrected)	0.52
		Approximate Chi Square Value (0.05)	164.8
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	156.1

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	2.317	95% Adjusted Gamma UCL (use when n<50)	2.446

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.883	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.214	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.223	Mean of logged Data	0.645
Maximum of Logged Data	0.859	SD of logged Data	0.227

Assuming Lognormal Distribution

95% H-UCL	2.362	90% Chebyshev (MVUE) UCL	2.45
95% Chebyshev (MVUE) UCL	2.677	97.5% Chebyshev (MVUE) UCL	2.992
99% Chebyshev (MVUE) UCL	3.612		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2.196	95% Jackknife UCL	2.241
95% Standard Bootstrap UCL	2.178	95% Bootstrap-t UCL	2.192
95% Hall's Bootstrap UCL	2.139	95% Percentile Bootstrap UCL	2.16
95% BCA Bootstrap UCL	2.151		
90% Chebyshev(Mean, Sd) UCL	2.401	95% Chebyshev(Mean, Sd) UCL	2.608
97.5% Chebyshev(Mean, Sd) UCL	2.894	99% Chebyshev(Mean, Sd) UCL	3.457

Suggested UCL to Use

95% Student's-t UCL	2.241

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFTrDA|ug/kg

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.141	Mean	0.475
Maximum	1.02	Median	0.306
SD	0.334	Std. Error of Mean	0.126
Coefficient of Variation	0.704	Skewness	0.8

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

ProUCL Output
Raleigh Creek - Upper
Crayfish Tissue

Normal GOF Test

Shapiro Wilk Test Statistic	0.89	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.265	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.721	95% Adjusted-CLT UCL (Chen-1995)	0.724
		95% Modified-t UCL (Johnson-1978)	0.727

Gamma GOF Test

A-D Test Statistic	0.306	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.714	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.23	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.315	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.381	k star (bias corrected MLE)	1.456
Theta hat (MLE)	0.2	Theta star (bias corrected MLE)	0.326
nu hat (MLE)	33.34	nu star (bias corrected)	20.38
MLE Mean (bias corrected)	0.475	MLE Sd (bias corrected)	0.394
		Approximate Chi Square Value (0.05)	11.13
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	9.142

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.87	95% Adjusted Gamma UCL (use when n<50)	1.059

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.95	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.187	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.959	Mean of logged Data	-0.969
Maximum of Logged Data	0.0198	SD of logged Data	0.735

Assuming Lognormal Distribution

95% H-UCL	1.22	90% Chebyshev (MVUE) UCL	0.875
95% Chebyshev (MVUE) UCL	1.055	97.5% Chebyshev (MVUE) UCL	1.306
99% Chebyshev (MVUE) UCL	1.799		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.683	95% Jackknife UCL	0.721
95% Standard Bootstrap UCL	0.667	95% Bootstrap-t UCL	0.909
95% Hall's Bootstrap UCL	0.717	95% Percentile Bootstrap UCL	0.68
95% BCA Bootstrap UCL	0.717		
90% Chebyshev(Mean, Sd) UCL	0.854	95% Chebyshev(Mean, Sd) UCL	1.026
97.5% Chebyshev(Mean, Sd) UCL	1.265	99% Chebyshev(Mean, Sd) UCL	1.733

Suggested UCL to Use

95% Student's-t UCL 0.721

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.097	Mean	0.334
Maximum	0.813	Median	0.193
SD	0.277	Std. Error of Mean	0.105
Coefficient of Variation	0.828	Skewness	1.14

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.83	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.267	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.538	95% Adjusted-CLT UCL (Chen-1995)	0.555
		95% Modified-t UCL (Johnson-1978)	0.545

Gamma GOF Test

A-D Test Statistic	0.412	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.716	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.244	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.315	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.919	k star (bias corrected MLE)	1.192
Theta hat (MLE)	0.174	Theta star (bias corrected MLE)	0.281
nu hat (MLE)	26.86	nu star (bias corrected)	16.68
MLE Mean (bias corrected)	0.334	MLE Sd (bias corrected)	0.306
		Approximate Chi Square Value (0.05)	8.447
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	6.754

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.661	95% Adjusted Gamma UCL (use when n<50)	0.826

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.929	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.202	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.333	Mean of logged Data	-1.378
Maximum of Logged Data	-0.207	SD of logged Data	0.802

Assuming Lognormal Distribution

95% H-UCL	0.979	90% Chebyshev (MVUE) UCL	0.631
95% Chebyshev (MVUE) UCL	0.767	97.5% Chebyshev (MVUE) UCL	0.957
99% Chebyshev (MVUE) UCL	1.329		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.507	95% Jackknife UCL	0.538
95% Standard Bootstrap UCL	0.496	95% Bootstrap-t UCL	0.916
95% Hall's Bootstrap UCL	1.342	95% Percentile Bootstrap UCL	0.502
95% BCA Bootstrap UCL	0.532		
90% Chebyshev(Mean, Sd) UCL	0.648	95% Chebyshev(Mean, Sd) UCL	0.791
97.5% Chebyshev(Mean, Sd) UCL	0.988	99% Chebyshev(Mean, Sd) UCL	1.376

ProUCL Output
Raleigh Creek - Upper
Crayfish Tissue

Suggested UCL to Use

95% Student's-t UCL 0.538

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.189	Mean	0.652
Maximum	1.63	Median	0.452
SD	0.508	Std. Error of Mean	0.192
Coefficient of Variation	0.779	Skewness	1.357

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.871	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.224	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.025	95% Adjusted-CLT UCL (Chen-1995)	1.073
		95% Modified-t UCL (Johnson-1978)	1.041

Gamma GOF Test

A-D Test Statistic	0.237	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.715	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.176	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.315	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.124	k star (bias corrected MLE)	1.309
Theta hat (MLE)	0.307	Theta star (bias corrected MLE)	0.498
nu hat (MLE)	29.73	nu star (bias corrected)	18.32
MLE Mean (bias corrected)	0.652	MLE Sd (bias corrected)	0.57
		Approximate Chi Square Value (0.05)	9.625
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	7.797

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1.241	95% Adjusted Gamma UCL (use when n<50)	1.532

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.961	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.149	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.666	Mean of logged Data	-0.682
Maximum of Logged Data	0.489	SD of logged Data	0.776

Assuming Lognormal Distribution

95% H-UCL	1.822	90% Chebyshev (MVUE) UCL	1.225
95% Chebyshev (MVUE) UCL	1.486	97.5% Chebyshev (MVUE) UCL	1.848
99% Chebyshev (MVUE) UCL	2.559		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

ProUCL Output
Raleigh Creek - Upper
Crayfish Tissue

Nonparametric Distribution Free UCLs

95% CLT UCL	0.967	95% Jackknife UCL	1.025
95% Standard Bootstrap UCL	0.934	95% Bootstrap-t UCL	1.378
95% Hall's Bootstrap UCL	2.514	95% Percentile Bootstrap UCL	0.988
95% BCA Bootstrap UCL	1.036		
90% Chebyshev(Mean, Sd) UCL	1.227	95% Chebyshev(Mean, Sd) UCL	1.488
97.5% Chebyshev(Mean, Sd) UCL	1.85	99% Chebyshev(Mean, Sd) UCL	2.561

Suggested UCL to Use

95% Student's-t UCL 1.025

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
Number of Detects	6	Number of Non-Detects	1
Number of Distinct Detects	6	Number of Distinct Non-Detects	1
Minimum Detect	0.422	Minimum Non-Detect	0.0957
Maximum Detect	1.26	Maximum Non-Detect	0.0957
Variance Detects	0.107	Percent Non-Detects	14.29%
Mean Detects	0.808	SD Detects	0.327
Median Detects	0.8	CV Detects	0.404
Skewness Detects	0.187	Kurtosis Detects	-1.35
Mean of Logged Detects	-0.287	SD of Logged Detects	0.432

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.952	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.17	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.706	KM Standard Error of Mean	0.154
KM SD	0.372	95% KM (BCA) UCL	0.932
95% KM (t) UCL	1.006	95% KM (Percentile Bootstrap) UCL	0.948
95% KM (z) UCL	0.96	95% KM Bootstrap t UCL	0.993
90% KM Chebyshev UCL	1.169	95% KM Chebyshev UCL	1.378
97.5% KM Chebyshev UCL	1.669	99% KM Chebyshev UCL	2.239

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.251	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.196	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	6.902	k star (bias corrected MLE)	3.562
Theta hat (MLE)	0.117	Theta star (bias corrected MLE)	0.227
nu hat (MLE)	82.83	nu star (bias corrected)	42.75
Mean (detects)	0.808		

ProUCL Output
Raleigh Creek - Upper
Crayfish Tissue

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.132	Mean	0.712
Maximum	1.26	Median	0.753
SD	0.393	CV	0.552
k hat (MLE)	2.716	k star (bias corrected MLE)	1.647
Theta hat (MLE)	0.262	Theta star (bias corrected MLE)	0.432
nu hat (MLE)	38.02	nu star (bias corrected)	23.06
Adjusted Level of Significance (β)	0.0158		
Approximate Chi Square Value (23.06, α)	13.14	Adjusted Chi Square Value (23.06, β)	10.94
95% Gamma Approximate UCL (use when n>=50)	1.249	95% Gamma Adjusted UCL (use when n<50)	1.499

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.706	SD (KM)	0.372
Variance (KM)	0.138	SE of Mean (KM)	0.154
k hat (KM)	3.604	k star (KM)	2.154
nu hat (KM)	50.45	nu star (KM)	30.16
theta hat (KM)	0.196	theta star (KM)	0.328
80% gamma percentile (KM)	1.048	90% gamma percentile (KM)	1.35
95% gamma percentile (KM)	1.637	99% gamma percentile (KM)	2.27

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (30.16, α)	18.62	Adjusted Chi Square Value (30.16, β)	15.94
95% Gamma Approximate KM-UCL (use when n>=50)	1.144	95% Gamma Adjusted KM-UCL (use when n<50)	1.336

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.941	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.174	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.729	Mean in Log Scale	-0.442
SD in Original Scale	0.365	SD in Log Scale	0.569
95% t UCL (assumes normality of ROS data)	0.997	95% Percentile Bootstrap UCL	0.946
95% BCA Bootstrap UCL	0.936	95% Bootstrap t UCL	1.031
95% H-UCL (Log ROS)	1.384		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.581	KM Geo Mean	0.559
KM SD (logged)	0.808	95% Critical H Value (KM-Log)	3.175
KM Standard Error of Mean (logged)	0.334	95% H-UCL (KM -Log)	2.207
KM SD (logged)	0.808	95% Critical H Value (KM-Log)	3.175
KM Standard Error of Mean (logged)	0.334		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.7	Mean in Log Scale	-0.68
SD in Original Scale	0.414	SD in Log Scale	1.113
95% t UCL (Assumes normality)	1.004	95% H-Stat UCL	5.837

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	1.006

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.53	Mean	1.349
Maximum	3.12	Median	0.984
SD	0.898	Std. Error of Mean	0.339
Coefficient of Variation	0.666	Skewness	1.486

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.857	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.229	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2.009	95% Adjusted-CLT UCL (Chen-1995)	2.111
		95% Modified-t UCL (Johnson-1978)	2.04

Gamma GOF Test

A-D Test Statistic	0.271	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.712	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.204	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.314	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.139	k star (bias corrected MLE)	1.889
Theta hat (MLE)	0.43	Theta star (bias corrected MLE)	0.714
nu hat (MLE)	43.94	nu star (bias corrected)	26.44
MLE Mean (bias corrected)	1.349	MLE Sd (bias corrected)	0.982
		Approximate Chi Square Value (0.05)	15.72
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	13.29

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	2.269	95% Adjusted Gamma UCL (use when n<50)	2.684

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.968	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.167	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.635	Mean of logged Data	0.132
Maximum of Logged Data	1.138	SD of logged Data	0.612

Assuming Lognormal Distribution

95% H-UCL	2.699	90% Chebyshev (MVUE) UCL	2.267
95% Chebyshev (MVUE) UCL	2.689	97.5% Chebyshev (MVUE) UCL	3.275
99% Chebyshev (MVUE) UCL	4.426		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.907	95% Jackknife UCL	2.009
95% Standard Bootstrap UCL	1.874	95% Bootstrap-t UCL	2.636
95% Hall's Bootstrap UCL	4.022	95% Percentile Bootstrap UCL	1.888
95% BCA Bootstrap UCL	2.097		
90% Chebyshev(Mean, Sd) UCL	2.367	95% Chebyshev(Mean, Sd) UCL	2.829
97.5% Chebyshev(Mean, Sd) UCL	3.469	99% Chebyshev(Mean, Sd) UCL	4.727

ProUCL Output
Raleigh Creek - Upper
Crayfish Tissue

Suggested UCL to Use

95% Student's-t UCL 2.009

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.11	Mean	0.291
Maximum	0.569	Median	0.235
SD	0.152	Std. Error of Mean	0.0574
Coefficient of Variation	0.523	Skewness	1.014

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.933	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.214	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.402	95% Adjusted-CLT UCL (Chen-1995)	0.409
		95% Modified-t UCL (Johnson-1978)	0.406

Gamma GOF Test

A-D Test Statistic	0.191	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.71	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.178	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.313	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.437	k star (bias corrected MLE)	2.631
Theta hat (MLE)	0.0655	Theta star (bias corrected MLE)	0.11
nu hat (MLE)	62.11	nu star (bias corrected)	36.83
MLE Mean (bias corrected)	0.291	MLE Sd (bias corrected)	0.179
		Approximate Chi Square Value (0.05)	23.94
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	20.85

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.447	95% Adjusted Gamma UCL (use when n<50)	0.513

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.984	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.158	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.207	Mean of logged Data	-1.353
Maximum of Logged Data	-0.564	SD of logged Data	0.53

Assuming Lognormal Distribution

95% H-UCL	0.514	90% Chebyshev (MVUE) UCL	0.467
95% Chebyshev (MVUE) UCL	0.546	97.5% Chebyshev (MVUE) UCL	0.657
99% Chebyshev (MVUE) UCL	0.874		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

ProUCL Output
Raleigh Creek - Upper
Crayfish Tissue

Nonparametric Distribution Free UCLs

95% CLT UCL	0.385	95% Jackknife UCL	0.402
95% Standard Bootstrap UCL	0.379	95% Bootstrap-t UCL	0.435
95% Hall's Bootstrap UCL	0.539	95% Percentile Bootstrap UCL	0.383
95% BCA Bootstrap UCL	0.397		
90% Chebyshev(Mean, Sd) UCL	0.463	95% Chebyshev(Mean, Sd) UCL	0.541
97.5% Chebyshev(Mean, Sd) UCL	0.649	99% Chebyshev(Mean, Sd) UCL	0.862

Suggested UCL to Use

95% Student's-t UCL 0.402

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	26.2	Mean	78.14
Maximum	153	Median	67.4
SD	39.69	Std. Error of Mean	15
Coefficient of Variation	0.508	Skewness	1.003

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.927	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.215	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	107.3	95% Adjusted-CLT UCL (Chen-1995)	108.9
		95% Modified-t UCL (Johnson-1978)	108.2

Gamma GOF Test

A-D Test Statistic	0.258	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.71	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.179	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.313	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.437	k star (bias corrected MLE)	2.631
Theta hat (MLE)	17.61	Theta star (bias corrected MLE)	29.7
nu hat (MLE)	62.12	nu star (bias corrected)	36.83
MLE Mean (bias corrected)	78.14	MLE Sd (bias corrected)	48.18
		Approximate Chi Square Value (0.05)	23.94
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	20.86

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	120.2	95% Adjusted Gamma UCL (use when n<50)	138

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.95	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.217	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.266	Mean of logged Data	4.242
Maximum of Logged Data	5.03	SD of logged Data	0.543

ProUCL Output
Raleigh Creek - Upper
Crayfish Tissue

Assuming Lognormal Distribution

95% H-UCL	141.9	90% Chebyshev (MVUE) UCL	127.5
95% Chebyshev (MVUE) UCL	149.6	97.5% Chebyshev (MVUE) UCL	180.2
99% Chebyshev (MVUE) UCL	240.5		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	102.8	95% Jackknife UCL	107.3
95% Standard Bootstrap UCL	101.5	95% Bootstrap-t UCL	117
95% Hall's Bootstrap UCL	188.8	95% Percentile Bootstrap UCL	101
95% BCA Bootstrap UCL	105.4		
90% Chebyshev(Mean, Sd) UCL	123.1	95% Chebyshev(Mean, Sd) UCL	143.5
97.5% Chebyshev(Mean, Sd) UCL	171.8	99% Chebyshev(Mean, Sd) UCL	227.4

Suggested UCL to Use

95% Student's-t UCL 107.3

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
Number of Detects	6	Number of Non-Detects	1
Number of Distinct Detects	6	Number of Distinct Non-Detects	1
Minimum Detect	0.103	Minimum Non-Detect	0.1
Maximum Detect	0.267	Maximum Non-Detect	0.1
Variance Detects	0.00303	Percent Non-Detects	14.29%
Mean Detects	0.175	SD Detects	0.0551
Median Detects	0.18	CV Detects	0.314
Skewness Detects	0.613	Kurtosis Detects	1.362
Mean of Logged Detects	-1.783	SD of Logged Detects	0.32

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.93	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.264	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.165	KM Standard Error of Mean	0.0221
KM SD	0.0535	95% KM (BCA) UCL	0.2
95% KM (t) UCL	0.208	95% KM (Percentile Bootstrap) UCL	0.2
95% KM (z) UCL	0.201	95% KM Bootstrap t UCL	0.213
90% KM Chebyshev UCL	0.231	95% KM Chebyshev UCL	0.261
97.5% KM Chebyshev UCL	0.303	99% KM Chebyshev UCL	0.385

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.328	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.233	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	12.15	k star (bias corrected MLE)	6.188
Theta hat (MLE)	0.0144	Theta star (bias corrected MLE)	0.0283
nu hat (MLE)	145.9	nu star (bias corrected)	74.26
Mean (detects)	0.175		

ProUCL Output
Raleigh Creek - Upper
Crayfish Tissue

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0596	Mean	0.159
Maximum	0.267	Median	0.179
SD	0.0666	CV	0.42
k hat (MLE)	5.665	k star (bias corrected MLE)	3.332
Theta hat (MLE)	0.028	Theta star (bias corrected MLE)	0.0477
nu hat (MLE)	79.31	nu star (bias corrected)	46.65
Adjusted Level of Significance (β)	0.0158		
Approximate Chi Square Value (46.65, α)	31.98	Adjusted Chi Square Value (46.65, β)	28.36
95% Gamma Approximate UCL (use when n>=50)	0.232	95% Gamma Adjusted UCL (use when n<50)	0.261

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.165	SD (KM)	0.0535
Variance (KM)	0.00286	SE of Mean (KM)	0.0221
k hat (KM)	9.469	k star (KM)	5.506
nu hat (KM)	132.6	nu star (KM)	77.09
theta hat (KM)	0.0174	theta star (KM)	0.0299
80% gamma percentile (KM)	0.219	90% gamma percentile (KM)	0.258
95% gamma percentile (KM)	0.294	99% gamma percentile (KM)	0.37

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (77.09, α)	57.86	Adjusted Chi Square Value (77.09, β)	52.86
95% Gamma Approximate KM-UCL (use when n>=50)	0.219	95% Gamma Adjusted KM-UCL (use when n<50)	0.24

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.947	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.244	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.161	Mean in Log Scale	-1.894
SD in Original Scale	0.0625	SD in Log Scale	0.415
95% t UCL (assumes normality of ROS data)	0.207	95% Percentile Bootstrap UCL	0.197
95% BCA Bootstrap UCL	0.196	95% Bootstrap t UCL	0.21
95% H-UCL (Log ROS)	0.242		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.857	KM Geo Mean	0.156
KM SD (logged)	0.326	95% Critical H Value (KM-Log)	2.247
KM Standard Error of Mean (logged)	0.135	95% H-UCL (KM -Log)	0.222
KM SD (logged)	0.326	95% Critical H Value (KM-Log)	2.247
KM Standard Error of Mean (logged)	0.135		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.157	Mean in Log Scale	-1.956
SD in Original Scale	0.0691	SD in Log Scale	0.543
95% t UCL (Assumes normality)	0.208	95% H-Stat UCL	0.289

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.208

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.243	Mean	0.649
Maximum	1.09	Median	0.645
SD	0.264	Std. Error of Mean	0.0996
Coefficient of Variation	0.406	Skewness	0.2

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.981	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.149	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.843	95% Adjusted-CLT UCL (Chen-1995)	0.821
		95% Modified-t UCL (Johnson-1978)	0.844

Gamma GOF Test

A-D Test Statistic	0.261	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.71	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.2	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.313	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	6.077	k star (bias corrected MLE)	3.568
Theta hat (MLE)	0.107	Theta star (bias corrected MLE)	0.182
nu hat (MLE)	85.08	nu star (bias corrected)	49.95
MLE Mean (bias corrected)	0.649	MLE Sd (bias corrected)	0.344
		Approximate Chi Square Value (0.05)	34.72
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	30.93

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.934	95% Adjusted Gamma UCL (use when n<50)	1.049

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.927	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.226	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.415	Mean of logged Data	-0.516
Maximum of Logged Data	0.0862	SD of logged Data	0.473

Assuming Lognormal Distribution

95% H-UCL	1.061	90% Chebyshev (MVUE) UCL	1.009
95% Chebyshev (MVUE) UCL	1.169	97.5% Chebyshev (MVUE) UCL	1.391
99% Chebyshev (MVUE) UCL	1.827		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.813	95% Jackknife UCL	0.843
95% Standard Bootstrap UCL	0.8	95% Bootstrap-t UCL	0.847
95% Hall's Bootstrap UCL	0.875	95% Percentile Bootstrap UCL	0.809
95% BCA Bootstrap UCL	0.805		
90% Chebyshev(Mean, Sd) UCL	0.948	95% Chebyshev(Mean, Sd) UCL	1.084
97.5% Chebyshev(Mean, Sd) UCL	1.272	99% Chebyshev(Mean, Sd) UCL	1.641

ProUCL Output
Raleigh Creek - Upper
Crayfish Tissue

Suggested UCL to Use

95% Student's-t UCL 0.843

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	56.5	Mean	81.8
Maximum	105	Median	75.6
SD	17.96	Std. Error of Mean	6.788
Coefficient of Variation	0.22	Skewness	0.209

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.925	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.206	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	94.99	95% Adjusted-CLT UCL (Chen-1995)	93.54
		95% Modified-t UCL (Johnson-1978)	95.08

Gamma GOF Test

A-D Test Statistic	0.31	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.707	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.194	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.311	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	23.96	k star (bias corrected MLE)	13.79
Theta hat (MLE)	3.414	Theta star (bias corrected MLE)	5.933
nu hat (MLE)	335.5	nu star (bias corrected)	193
MLE Mean (bias corrected)	81.8	MLE Sd (bias corrected)	22.03
		Approximate Chi Square Value (0.05)	161.9
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	153.3

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	97.54	95% Adjusted Gamma UCL (use when n<50)	103

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.937	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.174	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.034	Mean of logged Data	4.383
Maximum of Logged Data	4.654	SD of logged Data	0.223

Assuming Lognormal Distribution

95% H-UCL	98.77	90% Chebyshev (MVUE) UCL	102.5
95% Chebyshev (MVUE) UCL	111.9	97.5% Chebyshev (MVUE) UCL	124.9
99% Chebyshev (MVUE) UCL	150.4		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

ProUCL Output
Raleigh Creek - Upper
Crayfish Tissue

Nonparametric Distribution Free UCLs

95% CLT UCL	92.97	95% Jackknife UCL	94.99
95% Standard Bootstrap UCL	92.12	95% Bootstrap-t UCL	96.2
95% Hall's Bootstrap UCL	96.68	95% Percentile Bootstrap UCL	92.67
95% BCA Bootstrap UCL	93.2		
90% Chebyshev(Mean, Sd) UCL	102.2	95% Chebyshev(Mean, Sd) UCL	111.4
97.5% Chebyshev(Mean, Sd) UCL	124.2	99% Chebyshev(Mean, Sd) UCL	149.3

Suggested UCL to Use

95% Student's-t UCL 94.99

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	1.41	Mean	2.479
Maximum	5.4	Median	1.95
SD	1.428	Std. Error of Mean	0.54
Coefficient of Variation	0.576	Skewness	1.816

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.769	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.327	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	3.527	95% Adjusted-CLT UCL (Chen-1995)	3.762
		95% Modified-t UCL (Johnson-1978)	3.589

Gamma GOF Test

A-D Test Statistic	0.582	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.71	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.301	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.313	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.656	k star (bias corrected MLE)	2.756
Theta hat (MLE)	0.532	Theta star (bias corrected MLE)	0.899
nu hat (MLE)	65.18	nu star (bias corrected)	38.58
MLE Mean (bias corrected)	2.479	MLE Sd (bias corrected)	1.493
		Approximate Chi Square Value (0.05)	25.35
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	22.17

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	3.771	95% Adjusted Gamma UCL (use when n<50)	4.313

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.873	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.271	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.344	Mean of logged Data	0.796
Maximum of Logged Data	1.686	SD of logged Data	0.479

ProUCL Output
Raleigh Creek - Upper
Crayfish Tissue

Assuming Lognormal Distribution

95% H-UCL	3.992	90% Chebyshev (MVUE) UCL	3.779
95% Chebyshev (MVUE) UCL	4.383	97.5% Chebyshev (MVUE) UCL	5.222
99% Chebyshev (MVUE) UCL	6.87		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	3.366	95% Jackknife UCL	3.527
95% Standard Bootstrap UCL	3.292	95% Bootstrap-t UCL	6.629
95% Hall's Bootstrap UCL	8.858	95% Percentile Bootstrap UCL	3.353
95% BCA Bootstrap UCL	3.741		
90% Chebyshev(Mean, Sd) UCL	4.098	95% Chebyshev(Mean, Sd) UCL	4.831
97.5% Chebyshev(Mean, Sd) UCL	5.85	99% Chebyshev(Mean, Sd) UCL	7.849

Suggested UCL to Use

95% Adjusted Gamma UCL 4.313

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Raleigh Creek - Other
Crayfish Tissue

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.13/8/2021 2:52:13 PM
From File	ProUCL_Input_CR_a.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

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General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	1.13	Mean	1.708
Maximum	2.75	Median	1.51
SD	0.488	Std. Error of Mean	0.147
Coefficient of Variation	0.286	Skewness	1.118

Normal GOF Test

Shapiro Wilk Test Statistic	0.892	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.203	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.975	95% Adjusted-CLT UCL (Chen-1995)	2.003
		95% Modified-t UCL (Johnson-1978)	1.983

Gamma GOF Test

A-D Test Statistic	0.438	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.729	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.194	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.255	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	15.03	k star (bias corrected MLE)	10.99
Theta hat (MLE)	0.114	Theta star (bias corrected MLE)	0.155
nu hat (MLE)	330.8	nu star (bias corrected)	241.9
MLE Mean (bias corrected)	1.708	MLE Sd (bias corrected)	0.515
		Approximate Chi Square Value (0.05)	206.9
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	201.6

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1.997	95% Adjusted Gamma UCL (use when n<50)	2.05

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.943	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.177	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.122	Mean of logged Data	0.502
Maximum of Logged Data	1.012	SD of logged Data	0.266

Assuming Lognormal Distribution

95% H-UCL	2.011	90% Chebyshev (MVUE) UCL	2.119
95% Chebyshev (MVUE) UCL	2.306	97.5% Chebyshev (MVUE) UCL	2.565
99% Chebyshev (MVUE) UCL	3.075		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

ProUCL Output
Raleigh Creek - Other
Crayfish Tissue

Nonparametric Distribution Free UCLs

95% CLT UCL	1.95	95% Jackknife UCL	1.975
95% Standard Bootstrap UCL	1.935	95% Bootstrap-t UCL	2.076
95% Hall's Bootstrap UCL	2.034	95% Percentile Bootstrap UCL	1.953
95% BCA Bootstrap UCL	1.981		
90% Chebyshev(Mean, Sd) UCL	2.15	95% Chebyshev(Mean, Sd) UCL	2.35
97.5% Chebyshev(Mean, Sd) UCL	2.627	99% Chebyshev(Mean, Sd) UCL	3.172

Suggested UCL to Use

95% Student's-t UCL 1.975

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFDA|ug/kg

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	0.24	Mean	0.699
Maximum	1.52	Median	0.677
SD	0.339	Std. Error of Mean	0.102
Coefficient of Variation	0.486	Skewness	1.256

Normal GOF Test

Shapiro Wilk Test Statistic	0.891	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.237	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.251	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.884	95% Adjusted-CLT UCL (Chen-1995)	0.908
		95% Modified-t UCL (Johnson-1978)	0.891

Gamma GOF Test

A-D Test Statistic	0.331	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.732	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.185	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.256	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.82	k star (bias corrected MLE)	3.566
Theta hat (MLE)	0.145	Theta star (bias corrected MLE)	0.196
nu hat (MLE)	106.1	nu star (bias corrected)	78.46
MLE Mean (bias corrected)	0.699	MLE Sd (bias corrected)	0.37
		Approximate Chi Square Value (0.05)	59.05
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	56.32

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.928	95% Adjusted Gamma UCL (use when n<50)	0.973

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.946	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.181	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.427	Mean of logged Data	-0.466
Maximum of Logged Data	0.419	SD of logged Data	0.5

Assuming Lognormal Distribution

95% H-UCL	1.003	90% Chebyshev (MVUE) UCL	1.027
95% Chebyshev (MVUE) UCL	1.173	97.5% Chebyshev (MVUE) UCL	1.377
99% Chebyshev (MVUE) UCL	1.778		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.867	95% Jackknife UCL	0.884
95% Standard Bootstrap UCL	0.858	95% Bootstrap-t UCL	0.928
95% Hall's Bootstrap UCL	1.208	95% Percentile Bootstrap UCL	0.87
95% BCA Bootstrap UCL	0.897		
90% Chebyshev(Mean, Sd) UCL	1.006	95% Chebyshev(Mean, Sd) UCL	1.145
97.5% Chebyshev(Mean, Sd) UCL	1.338	99% Chebyshev(Mean, Sd) UCL	1.717

Suggested UCL to Use

95% Student's-t UCL 0.884

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFDoA|ug/kg

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	0.333	Mean	0.713
Maximum	1.3	Median	0.73
SD	0.278	Std. Error of Mean	0.0837
Coefficient of Variation	0.39	Skewness	0.717

Normal GOF Test

Shapiro Wilk Test Statistic	0.96	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.106	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.251	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.864	95% Adjusted-CLT UCL (Chen-1995)	0.87
		95% Modified-t UCL (Johnson-1978)	0.868

Gamma GOF Test

A-D Test Statistic	0.151	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.73	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.12	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.256	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	7.286	k star (bias corrected MLE)	5.359
Theta hat (MLE)	0.0978	Theta star (bias corrected MLE)	0.133
nu hat (MLE)	160.3	nu star (bias corrected)	117.9
MLE Mean (bias corrected)	0.713	MLE Sd (bias corrected)	0.308
		Approximate Chi Square Value (0.05)	93.83
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	90.34

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.896	95% Adjusted Gamma UCL (use when n<50)	0.93

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.981	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.139	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.1	Mean of logged Data	-0.409
Maximum of Logged Data	0.262	SD of logged Data	0.399

Assuming Lognormal Distribution

95% H-UCL	0.932	90% Chebyshev (MVUE) UCL	0.975
95% Chebyshev (MVUE) UCL	1.093	97.5% Chebyshev (MVUE) UCL	1.258
99% Chebyshev (MVUE) UCL	1.58		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.85	95% Jackknife UCL	0.864
95% Standard Bootstrap UCL	0.845	95% Bootstrap-t UCL	0.89
95% Hall's Bootstrap UCL	0.911	95% Percentile Bootstrap UCL	0.851
95% BCA Bootstrap UCL	0.856		
90% Chebyshev(Mean, Sd) UCL	0.964	95% Chebyshev(Mean, Sd) UCL	1.078
97.5% Chebyshev(Mean, Sd) UCL	1.236	99% Chebyshev(Mean, Sd) UCL	1.546

Suggested UCL to Use

95% Student's-t UCL	0.864

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFDS|ug/kg

General Statistics

Total Number of Observations	11	Number of Distinct Observations	9
Number of Detects	5	Number of Non-Detects	6
Number of Distinct Detects	5	Number of Distinct Non-Detects	4
Minimum Detect	0.113	Minimum Non-Detect	0.0966
Maximum Detect	0.305	Maximum Non-Detect	0.0995
Variance Detects	0.00648	Percent Non-Detects	54.55%
Mean Detects	0.165	SD Detects	0.0805
Median Detects	0.13	CV Detects	0.487
Skewness Detects	1.925	Kurtosis Detects	3.742
Mean of Logged Detects	-1.875	SD of Logged Detects	0.411

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.744	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.312	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.128	KM Standard Error of Mean	0.02
KM SD	0.0594	95% KM (BCA) UCL	0.161
95% KM (t) UCL	0.164	95% KM (Percentile Bootstrap) UCL	0.162
95% KM (z) UCL	0.161	95% KM Bootstrap t UCL	0.221
90% KM Chebyshev UCL	0.188	95% KM Chebyshev UCL	0.215
97.5% KM Chebyshev UCL	0.253	99% KM Chebyshev UCL	0.327

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.607	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.68	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.281	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.358	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	6.754	k star (bias corrected MLE)	2.835
Theta hat (MLE)	0.0245	Theta star (bias corrected MLE)	0.0583
nu hat (MLE)	67.54	nu star (bias corrected)	28.35
Mean (detects)	0.165		

ProUCL Output
Raleigh Creek - Other
Crayfish Tissue

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0806
Maximum	0.305	Median	0.01
SD	0.0958	CV	1.188
k hat (MLE)	0.712	k star (bias corrected MLE)	0.579
Theta hat (MLE)	0.113	Theta star (bias corrected MLE)	0.139
nu hat (MLE)	15.67	nu star (bias corrected)	12.73
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (12.73, α)	5.711	Adjusted Chi Square Value (12.73, β)	4.966
95% Gamma Approximate UCL (use when n>=50)	0.18	95% Gamma Adjusted UCL (use when n<50)	0.207

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.128	SD (KM)	0.0594
Variance (KM)	0.00353	SE of Mean (KM)	0.02
k hat (KM)	4.631	k star (KM)	3.428
nu hat (KM)	101.9	nu star (KM)	75.42
theta hat (KM)	0.0276	theta star (KM)	0.0373
80% gamma percentile (KM)	0.18	90% gamma percentile (KM)	0.22
95% gamma percentile (KM)	0.258	99% gamma percentile (KM)	0.34

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (75.42, α)	56.42	Adjusted Chi Square Value (75.42, β)	53.75
95% Gamma Approximate KM-UCL (use when n>=50)	0.171	95% Gamma Adjusted KM-UCL (use when n<50)	0.179

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.816	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.256	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0994	Mean in Log Scale	-2.563
SD in Original Scale	0.0815	SD in Log Scale	0.725
95% t UCL (assumes normality of ROS data)	0.144	95% Percentile Bootstrap UCL	0.142
95% BCA Bootstrap UCL	0.16	95% Bootstrap t UCL	0.174
95% H-UCL (Log ROS)	0.178		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.127	KM Geo Mean	0.119
KM SD (logged)	0.338	95% Critical H Value (KM-Log)	1.987
KM Standard Error of Mean (logged)	0.114	95% H-UCL (KM -Log)	0.156
KM SD (logged)	0.338	95% Critical H Value (KM-Log)	1.987
KM Standard Error of Mean (logged)	0.114		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.102	Mean in Log Scale	-2.498
SD in Original Scale	0.0793	SD in Log Scale	0.65
95% t UCL (Assumes normality)	0.145	95% H-Stat UCL	0.166

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.164

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	11	Number of Distinct Observations	10
Number of Detects	4	Number of Non-Detects	7
Number of Distinct Detects	4	Number of Distinct Non-Detects	6
Minimum Detect	0.116	Minimum Non-Detect	0.0957
Maximum Detect	0.71	Maximum Non-Detect	0.0995
Variance Detects	0.0826	Percent Non-Detects	63.64%
Mean Detects	0.281	SD Detects	0.287
Median Detects	0.149	CV Detects	1.023
Skewness Detects	1.946	Kurtosis Detects	3.804
Mean of Logged Detects	-1.585	SD of Logged Detects	0.85

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.704	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.391	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.163	KM Standard Error of Mean	0.0608
KM SD	0.175	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.273	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.263	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.345	95% KM Chebyshev UCL	0.428
97.5% KM Chebyshev UCL	0.543	99% KM Chebyshev UCL	0.768

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.648	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.662	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.368	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.399	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.732	k star (bias corrected MLE)	0.6
Theta hat (MLE)	0.162	Theta star (bias corrected MLE)	0.469
nu hat (MLE)	13.86	nu star (bias corrected)	4.797
Mean (detects)	0.281		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.109
Maximum	0.71	Median	0.01
SD	0.208	CV	1.921
k hat (MLE)	0.495	k star (bias corrected MLE)	0.42
Theta hat (MLE)	0.219	Theta star (bias corrected MLE)	0.258
nu hat (MLE)	10.88	nu star (bias corrected)	9.247
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (9.25, α)	3.477	Adjusted Chi Square Value (9.25, β)	2.924
95% Gamma Approximate UCL (use when n>=50)	0.289	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.163	SD (KM)	0.175
Variance (KM)	0.0305	SE of Mean (KM)	0.0608
k hat (KM)	0.873	k star (KM)	0.696
nu hat (KM)	19.21	nu star (KM)	15.3
theta hat (KM)	0.187	theta star (KM)	0.234
80% gamma percentile (KM)	0.268	90% gamma percentile (KM)	0.41
95% gamma percentile (KM)	0.556	99% gamma percentile (KM)	0.906

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (15.30, α)	7.472	Adjusted Chi Square Value (15.30, β)	6.6
95% Gamma Approximate KM-UCL (use when n>=50)	0.334	95% Gamma Adjusted KM-UCL (use when n<50)	0.378

ProUCL Output
Raleigh Creek - Other
Crayfish Tissue

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.79	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.318	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.109	Mean in Log Scale	-3.456
SD in Original Scale	0.208	SD in Log Scale	1.58
95% t UCL (assumes normality of ROS data)	0.223	95% Percentile Bootstrap UCL	0.222
95% BCA Bootstrap UCL	0.275	95% Bootstrap t UCL	0.485
95% H-UCL (Log ROS)	0.898		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.07	KM Geo Mean	0.126
KM SD (logged)	0.575	95% Critical H Value (KM-Log)	2.279
KM Standard Error of Mean (logged)	0.2	95% H-UCL (KM -Log)	0.226
KM SD (logged)	0.575	95% Critical H Value (KM-Log)	2.279
KM Standard Error of Mean (logged)	0.2		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.133	Mean in Log Scale	-2.497
SD in Original Scale	0.196	SD in Log Scale	0.86
95% t UCL (Assumes normality)	0.241	95% H-Stat UCL	0.251

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	N/A	₃ Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	0.378

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFHxS|ug/kg

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	0.108	Mean	0.31
Maximum	1.03	Median	0.172
SD	0.282	Std. Error of Mean	0.085
Coefficient of Variation	0.911	Skewness	2.012

Normal GOF Test

Shapiro Wilk Test Statistic	0.719	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.312	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.464	95% Adjusted-CLT UCL (Chen-1995)	0.505
		95% Modified-t UCL (Johnson-1978)	0.472

Gamma GOF Test

A-D Test Statistic	0.895	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.739	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.309	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.259	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

ProUCL Output
Raleigh Creek - Other
Crayfish Tissue

Gamma Statistics

k hat (MLE)	1.982	k star (bias corrected MLE)	1.502
Theta hat (MLE)	0.156	Theta star (bias corrected MLE)	0.206
nu hat (MLE)	43.61	nu star (bias corrected)	33.05
MLE Mean (bias corrected)	0.31	MLE Sd (bias corrected)	0.253
		Approximate Chi Square Value (0.05)	20.9
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	19.34

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.489	95% Adjusted Gamma UCL (use when n<50)	0.529

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.869	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.28	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.251	Data Not Lognormal at 5% Significance Level	

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.226	Mean of logged Data	-1.446
Maximum of Logged Data	0.0296	SD of logged Data	0.718

Assuming Lognormal Distribution

95% H-UCL	0.537	90% Chebyshev (MVUE) UCL	0.496
95% Chebyshev (MVUE) UCL	0.587	97.5% Chebyshev (MVUE) UCL	0.712
99% Chebyshev (MVUE) UCL	0.959		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.449	95% Jackknife UCL	0.464
95% Standard Bootstrap UCL	0.443	95% Bootstrap-t UCL	0.693
95% Hall's Bootstrap UCL	1.011	95% Percentile Bootstrap UCL	0.458
95% BCA Bootstrap UCL	0.512		
90% Chebyshev(Mean, Sd) UCL	0.565	95% Chebyshev(Mean, Sd) UCL	0.68
97.5% Chebyshev(Mean, Sd) UCL	0.841	99% Chebyshev(Mean, Sd) UCL	1.156

Suggested UCL to Use

95% H-UCL	0.537

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

PFNA|ug/kg

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	0.129	Mean	0.366
Maximum	0.676	Median	0.314
SD	0.178	Std. Error of Mean	0.0538
Coefficient of Variation	0.488	Skewness	0.637

Normal GOF Test

Shapiro Wilk Test Statistic	0.921	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.228	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.251	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.463	95% Adjusted-CLT UCL (Chen-1995)	0.465
		95% Modified-t UCL (Johnson-1978)	0.465

ProUCL Output
Raleigh Creek - Other
Crayfish Tissue

Gamma GOF Test

A-D Test Statistic	0.262	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.732	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.175	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.256	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.613	k star (bias corrected MLE)	3.416
Theta hat (MLE)	0.0792	Theta star (bias corrected MLE)	0.107
nu hat (MLE)	101.5	nu star (bias corrected)	75.14
MLE Mean (bias corrected)	0.366	MLE Sd (bias corrected)	0.198
		Approximate Chi Square Value (0.05)	56.18
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	53.51

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.489	95% Adjusted Gamma UCL (use when n<50)	0.513

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.965	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.143	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.048	Mean of logged Data	-1.119
Maximum of Logged Data	-0.392	SD of logged Data	0.507

Assuming Lognormal Distribution

95% H-UCL	0.528	90% Chebyshev (MVUE) UCL	0.539
95% Chebyshev (MVUE) UCL	0.617	97.5% Chebyshev (MVUE) UCL	0.725
99% Chebyshev (MVUE) UCL	0.937		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.454	95% Jackknife UCL	0.463
95% Standard Bootstrap UCL	0.451	95% Bootstrap-t UCL	0.475
95% Hall's Bootstrap UCL	0.456	95% Percentile Bootstrap UCL	0.448
95% BCA Bootstrap UCL	0.465		
90% Chebyshev(Mean, Sd) UCL	0.527	95% Chebyshev(Mean, Sd) UCL	0.6
97.5% Chebyshev(Mean, Sd) UCL	0.701	99% Chebyshev(Mean, Sd) UCL	0.9

Suggested UCL to Use

95% Student's-t UCL	0.463

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	0.435	Mean	1.77
Maximum	5.5	Median	1.43
SD	1.33	Std. Error of Mean	0.401
Coefficient of Variation	0.751	Skewness	2.517

Normal GOF Test

Shapiro Wilk Test Statistic	0.707	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.297	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2.497	95% Adjusted-CLT UCL (Chen-1995)	2.755
		95% Modified-t UCL (Johnson-1978)	2.548

ProUCL Output
Raleigh Creek - Other
Crayfish Tissue

Gamma GOF Test

A-D Test Statistic	0.566	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.734	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.205	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.257	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.856	k star (bias corrected MLE)	2.138
Theta hat (MLE)	0.62	Theta star (bias corrected MLE)	0.828
nu hat (MLE)	62.84	nu star (bias corrected)	47.03
MLE Mean (bias corrected)	1.77	MLE Sd (bias corrected)	1.211
		Approximate Chi Square Value (0.05)	32.3
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	30.32

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	2.578	95% Adjusted Gamma UCL (use when n<50)	2.747

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.934	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.179	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.832	Mean of logged Data	0.386
Maximum of Logged Data	1.705	SD of logged Data	0.619

Assuming Lognormal Distribution

95% H-UCL	2.818	90% Chebyshev (MVUE) UCL	2.754
95% Chebyshev (MVUE) UCL	3.211	97.5% Chebyshev (MVUE) UCL	3.844
99% Chebyshev (MVUE) UCL	5.089		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2.43	95% Jackknife UCL	2.497
95% Standard Bootstrap UCL	2.419	95% Bootstrap-t UCL	3.266
95% Hall's Bootstrap UCL	5.318	95% Percentile Bootstrap UCL	2.461
95% BCA Bootstrap UCL	2.906		
90% Chebyshev(Mean, Sd) UCL	2.973	95% Chebyshev(Mean, Sd) UCL	3.518
97.5% Chebyshev(Mean, Sd) UCL	4.274	99% Chebyshev(Mean, Sd) UCL	5.759

Suggested UCL to Use

95% Adjusted Gamma UCL	2.747

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	2.29	Mean	16.96
Maximum	54.1	Median	14.4
SD	14.21	Std. Error of Mean	4.285
Coefficient of Variation	0.838	Skewness	1.942

Normal GOF Test

Shapiro Wilk Test Statistic	0.817	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.245	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

ProUCL Output
Raleigh Creek - Other
Crayfish Tissue

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	24.73	95% Adjusted-CLT UCL (Chen-1995)	26.69
		95% Modified-t UCL (Johnson-1978)	25.15

Gamma GOF Test

A-D Test Statistic	0.2	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.74	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.146	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.259	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.801	k star (bias corrected MLE)	1.37
Theta hat (MLE)	9.418	Theta star (bias corrected MLE)	12.38
nu hat (MLE)	39.62	nu star (bias corrected)	30.15
MLE Mean (bias corrected)	16.96	MLE Sd (bias corrected)	14.49
		Approximate Chi Square Value (0.05)	18.61
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	17.15

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	27.48	95% Adjusted Gamma UCL (use when n<50)	29.83

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.975	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.15	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.829	Mean of logged Data	2.528
Maximum of Logged Data	3.991	SD of logged Data	0.86

Assuming Lognormal Distribution

95% H-UCL	38.19	90% Chebyshev (MVUE) UCL	31.58
95% Chebyshev (MVUE) UCL	38.01	97.5% Chebyshev (MVUE) UCL	46.94
99% Chebyshev (MVUE) UCL	64.47		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	24.01	95% Jackknife UCL	24.73
95% Standard Bootstrap UCL	23.6	95% Bootstrap-t UCL	30.38
95% Hall's Bootstrap UCL	59.26	95% Percentile Bootstrap UCL	24.19
95% BCA Bootstrap UCL	26.69		
90% Chebyshev(Mean, Sd) UCL	29.82	95% Chebyshev(Mean, Sd) UCL	35.64
97.5% Chebyshev(Mean, Sd) UCL	43.72	99% Chebyshev(Mean, Sd) UCL	59.59

Suggested UCL to Use

95% Student's-t UCL	24.73

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	1.25	Mean	3.435
Maximum	12.1	Median	1.95
SD	3.427	Std. Error of Mean	1.033
Coefficient of Variation	0.997	Skewness	2.038

ProUCL Output
Raleigh Creek - Other
Crayfish Tissue

Normal GOF Test

Shapiro Wilk Test Statistic	0.686	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.344	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.251	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	5.308	95% Adjusted-CLT UCL (Chen-1995)	5.813
		95% Modified-t UCL (Johnson-1978)	5.414

Gamma GOF Test

A-D Test Statistic	1.045	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.741	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.297	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.259	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.74	k star (bias corrected MLE)	1.326
Theta hat (MLE)	1.975	Theta star (bias corrected MLE)	2.591
nu hat (MLE)	38.28	nu star (bias corrected)	29.17
MLE Mean (bias corrected)	3.435	MLE Sd (bias corrected)	2.984
		Approximate Chi Square Value (0.05)	17.84
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	16.41

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	5.617	95% Adjusted Gamma UCL (use when n<50)	6.106

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.84	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.246	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level	

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.223	Mean of logged Data	0.92
Maximum of Logged Data	2.493	SD of logged Data	0.757

Assuming Lognormal Distribution

95% H-UCL	6.164	90% Chebyshev (MVUE) UCL	5.547
95% Chebyshev (MVUE) UCL	6.592	97.5% Chebyshev (MVUE) UCL	8.044
99% Chebyshev (MVUE) UCL	10.89		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	5.135	95% Jackknife UCL	5.308
95% Standard Bootstrap UCL	5.062	95% Bootstrap-t UCL	8.885
95% Hall's Bootstrap UCL	11.52	95% Percentile Bootstrap UCL	5.18
95% BCA Bootstrap UCL	5.788		
90% Chebyshev(Mean, Sd) UCL	6.535	95% Chebyshev(Mean, Sd) UCL	7.939
97.5% Chebyshev(Mean, Sd) UCL	9.887	99% Chebyshev(Mean, Sd) UCL	13.72

Suggested UCL to Use

95% H-UCL	6.164

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

ProUCL Output
Raleigh Creek - Other
Crayfish Tissue
PFTeDA\ug/kg

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	0.134	Mean	0.33
Maximum	0.635	Median	0.336
SD	0.13	Std. Error of Mean	0.0393
Coefficient of Variation	0.395	Skewness	1.091

Normal GOF Test

Shapiro Wilk Test Statistic	0.902	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.268	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data Not Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.401	95% Adjusted-CLT UCL (Chen-1995)	0.408
		95% Modified-t UCL (Johnson-1978)	0.403

Gamma GOF Test

A-D Test Statistic	0.419	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.731	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.217	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.256	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	7.221	k star (bias corrected MLE)	5.312
Theta hat (MLE)	0.0457	Theta star (bias corrected MLE)	0.0621
nu hat (MLE)	158.9	nu star (bias corrected)	116.9
MLE Mean (bias corrected)	0.33	MLE Sd (bias corrected)	0.143
		Approximate Chi Square Value (0.05)	92.91
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	89.43

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.415	95% Adjusted Gamma UCL (use when n<50)	0.431

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.939	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.203	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.01	Mean of logged Data	-1.181
Maximum of Logged Data	-0.454	SD of logged Data	0.403

Assuming Lognormal Distribution

95% H-UCL	0.433	90% Chebyshev (MVUE) UCL	0.453
95% Chebyshev (MVUE) UCL	0.508	97.5% Chebyshev (MVUE) UCL	0.585
99% Chebyshev (MVUE) UCL	0.736		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.394	95% Jackknife UCL	0.401
95% Standard Bootstrap UCL	0.391	95% Bootstrap-t UCL	0.423
95% Hall's Bootstrap UCL	0.579	95% Percentile Bootstrap UCL	0.393
95% BCA Bootstrap UCL	0.404		
90% Chebyshev(Mean, Sd) UCL	0.448	95% Chebyshev(Mean, Sd) UCL	0.501
97.5% Chebyshev(Mean, Sd) UCL	0.575	99% Chebyshev(Mean, Sd) UCL	0.721

ProUCL Output
Raleigh Creek - Other
Crayfish Tissue

Suggested UCL to Use

95% Student's-t UCL 0.401

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	0.132	Mean	0.342
Maximum	0.658	Median	0.331
SD	0.138	Std. Error of Mean	0.0416
Coefficient of Variation	0.404	Skewness	0.967

Normal GOF Test

Shapiro Wilk Test Statistic	0.94	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.17	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.418	95% Adjusted-CLT UCL (Chen-1995)	0.424
		95% Modified-t UCL (Johnson-1978)	0.42

Gamma GOF Test

A-D Test Statistic	0.227	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.731	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.14	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.256	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	6.773	k star (bias corrected MLE)	4.986
Theta hat (MLE)	0.0505	Theta star (bias corrected MLE)	0.0686
nu hat (MLE)	149	nu star (bias corrected)	109.7
MLE Mean (bias corrected)	0.342	MLE Sd (bias corrected)	0.153
		Approximate Chi Square Value (0.05)	86.52
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	83.17

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.434	95% Adjusted Gamma UCL (use when n<50)	0.451

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.966	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.168	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.025	Mean of logged Data	-1.148
Maximum of Logged Data	-0.419	SD of logged Data	0.419

Assuming Lognormal Distribution

95% H-UCL	0.456	90% Chebyshev (MVUE) UCL	0.475
95% Chebyshev (MVUE) UCL	0.535	97.5% Chebyshev (MVUE) UCL	0.618
99% Chebyshev (MVUE) UCL	0.782		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.411	95% Jackknife UCL	0.418
95% Standard Bootstrap UCL	0.406	95% Bootstrap-t UCL	0.433
95% Hall's Bootstrap UCL	0.511	95% Percentile Bootstrap UCL	0.409
95% BCA Bootstrap UCL	0.419		
90% Chebyshev(Mean, Sd) UCL	0.467	95% Chebyshev(Mean, Sd) UCL	0.524
97.5% Chebyshev(Mean, Sd) UCL	0.602	99% Chebyshev(Mean, Sd) UCL	0.756

Suggested UCL to Use

95% Student's-t UCL 0.418

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	0.242	Mean	0.553
Maximum	1.18	Median	0.525
SD	0.256	Std. Error of Mean	0.0771
Coefficient of Variation	0.462	Skewness	1.445

Normal GOF Test

Shapiro Wilk Test Statistic	0.883	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.185	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.251	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.693	95% Adjusted-CLT UCL (Chen-1995)	0.715
		95% Modified-t UCL (Johnson-1978)	0.698

Gamma GOF Test

A-D Test Statistic	0.251	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.731	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.137	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.256	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.811	k star (bias corrected MLE)	4.287
Theta hat (MLE)	0.0951	Theta star (bias corrected MLE)	0.129
nu hat (MLE)	127.8	nu star (bias corrected)	94.3
MLE Mean (bias corrected)	0.553	MLE Sd (bias corrected)	0.267
		Approximate Chi Square Value (0.05)	72.91
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	69.85

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.715	95% Adjusted Gamma UCL (use when n<50)	0.746

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.973	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.144	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.419	Mean of logged Data	-0.681
Maximum of Logged Data	0.166	SD of logged Data	0.439

Assuming Lognormal Distribution

95% H-UCL	0.746	90% Chebyshev (MVUE) UCL	0.775
95% Chebyshev (MVUE) UCL	0.876	97.5% Chebyshev (MVUE) UCL	1.016
99% Chebyshev (MVUE) UCL	1.292		

ProUCL Output
Raleigh Creek - Other
Crayfish Tissue

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.68	95% Jackknife UCL	0.693
95% Standard Bootstrap UCL	0.674	95% Bootstrap-t UCL	0.757
95% Hall's Bootstrap UCL	1.328	95% Percentile Bootstrap UCL	0.682
95% BCA Bootstrap UCL	0.716		
90% Chebyshev(Mean, Sd) UCL	0.784	95% Chebyshev(Mean, Sd) UCL	0.889
97.5% Chebyshev(Mean, Sd) UCL	1.034	99% Chebyshev(Mean, Sd) UCL	1.32

Suggested UCL to Use

95% Student's-t UCL	0.693

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
West Lakeland
Crayfish Tissue

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/18/2021 8:13:47 AM
From File	CR Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

PFBA|ug/kg

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	0
Minimum	0.685	Mean	4.758
Maximum	11.7	Median	4.39
SD	2.819	Std. Error of Mean	0.782
Coefficient of Variation	0.593	Skewness	1.003

Normal GOF Test

Shapiro Wilk Test Statistic	0.915	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.17	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	6.152	95% Adjusted-CLT UCL (Chen-1995)	6.277
		95% Modified-t UCL (Johnson-1978)	6.188

Gamma GOF Test

A-D Test Statistic	0.503	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.741	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.237	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.239	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.603	k star (bias corrected MLE)	2.053
Theta hat (MLE)	1.828	Theta star (bias corrected MLE)	2.317
nu hat (MLE)	67.67	nu star (bias corrected)	53.39
MLE Mean (bias corrected)	4.758	MLE Sd (bias corrected)	3.321
		Approximate Chi Square Value (0.05)	37.6
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	35.72

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	6.756	95% Adjusted Gamma UCL (use when n<50)	7.111

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.892	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.279	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data Not Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.378	Mean of logged Data	1.356
Maximum of Logged Data	2.46	SD of logged Data	0.744

Assuming Lognormal Distribution

95% H-UCL	8.624	90% Chebyshev (MVUE) UCL	8.225
95% Chebyshev (MVUE) UCL	9.693	97.5% Chebyshev (MVUE) UCL	11.73
99% Chebyshev (MVUE) UCL	15.73		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	6.044	95% Jackknife UCL	6.152
95% Standard Bootstrap UCL	6	95% Bootstrap-t UCL	6.485
95% Hall's Bootstrap UCL	7.214	95% Percentile Bootstrap UCL	6.076
95% BCA Bootstrap UCL	6.237		
90% Chebyshev(Mean, Sd) UCL	7.104	95% Chebyshev(Mean, Sd) UCL	8.167
97.5% Chebyshev(Mean, Sd) UCL	9.642	99% Chebyshev(Mean, Sd) UCL	12.54

Suggested UCL to Use

95% Student's-t UCL 6.152

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
Number of Detects	10	Number of Non-Detects	3
Number of Distinct Detects	10	Number of Distinct Non-Detects	3
Minimum Detect	0.108	Minimum Non-Detect	0.0957
Maximum Detect	0.331	Maximum Non-Detect	0.0985
Variance Detects	0.00747	Percent Non-Detects	23.08%
Mean Detects	0.215	SD Detects	0.0864
Median Detects	0.199	CV Detects	0.403
Skewness Detects	0.346	Kurtosis Detects	-1.625
Mean of Logged Detects	-1.615	SD of Logged Detects	0.414

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.885	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.191	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.187	KM Standard Error of Mean	0.0256
KM SD	0.0876	95% KM (BCA) UCL	0.23
95% KM (t) UCL	0.233	95% KM (Percentile Bootstrap) UCL	0.226
95% KM (z) UCL	0.229	95% KM Bootstrap t UCL	0.241
90% KM Chebyshev UCL	0.264	95% KM Chebyshev UCL	0.299
97.5% KM Chebyshev UCL	0.347	99% KM Chebyshev UCL	0.442

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.413	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.728	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.194	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.267	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	6.766	k star (bias corrected MLE)	4.803
Theta hat (MLE)	0.0317	Theta star (bias corrected MLE)	0.0447
nu hat (MLE)	135.3	nu star (bias corrected)	96.05
Mean (detects)	0.215		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0482	Mean	0.176
Maximum	0.331	Median	0.151
SD	0.105	CV	0.593
k hat (MLE)	2.586	k star (bias corrected MLE)	2.041
Theta hat (MLE)	0.0681	Theta star (bias corrected MLE)	0.0863
nu hat (MLE)	67.24	nu star (bias corrected)	53.06
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (53.06, α)	37.33	Adjusted Chi Square Value (53.06, β)	35.45
95% Gamma Approximate UCL (use when n>=50)	0.25	95% Gamma Adjusted UCL (use when n<50)	0.264

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.187	SD (KM)	0.0876
Variance (KM)	0.00768	SE of Mean (KM)	0.0256
k hat (KM)	4.561	k star (KM)	3.56
nu hat (KM)	118.6	nu star (KM)	92.56
theta hat (KM)	0.041	theta star (KM)	0.0526
80% gamma percentile (KM)	0.262	90% gamma percentile (KM)	0.32
95% gamma percentile (KM)	0.374	99% gamma percentile (KM)	0.491

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (92.56, α)	71.37	Adjusted Chi Square Value (92.56, β)	68.72
95% Gamma Approximate KM-UCL (use when n>=50)	0.243	95% Gamma Adjusted KM-UCL (use when n<50)	0.252

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.917	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.176	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.182	Mean in Log Scale	-1.84
SD in Original Scale	0.0967	SD in Log Scale	0.559
95% t UCL (assumes normality of ROS data)	0.23	95% Percentile Bootstrap UCL	0.224
95% BCA Bootstrap UCL	0.23	95% Bootstrap t UCL	0.237
95% H-UCL (Log ROS)	0.264		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.784	KM Geo Mean	0.168
KM SD (logged)	0.462	95% Critical H Value (KM-Log)	2.069
KM Standard Error of Mean (logged)	0.135	95% H-UCL (KM -Log)	0.247
KM SD (logged)	0.462	95% Critical H Value (KM-Log)	2.069
KM Standard Error of Mean (logged)	0.135		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.176	Mean in Log Scale	-1.94
SD in Original Scale	0.104	SD in Log Scale	0.714
95% t UCL (Assumes normality)	0.228	95% H-Stat UCL	0.304

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.233

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	0
Minimum	1.89	Mean	4.991
Maximum	10.5	Median	4.24
SD	2.686	Std. Error of Mean	0.745
Coefficient of Variation	0.538	Skewness	0.959

Normal GOF Test

Shapiro Wilk Test Statistic	0.891	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.208	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.234	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	6.319	95% Adjusted-CLT UCL (Chen-1995)	6.428
		95% Modified-t UCL (Johnson-1978)	6.352

Gamma GOF Test

A-D Test Statistic	0.356	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.737	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.155	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.238	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.1	k star (bias corrected MLE)	3.205
Theta hat (MLE)	1.217	Theta star (bias corrected MLE)	1.557
nu hat (MLE)	106.6	nu star (bias corrected)	83.34
MLE Mean (bias corrected)	4.991	MLE Sd (bias corrected)	2.788
		Approximate Chi Square Value (0.05)	63.3
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	60.82

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	6.571	95% Adjusted Gamma UCL (use when n<50)	6.839

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.963	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.125	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.637	Mean of logged Data	1.481
Maximum of Logged Data	2.351	SD of logged Data	0.522

Assuming Lognormal Distribution

95% H-UCL	6.948	90% Chebyshev (MVUE) UCL	7.2
95% Chebyshev (MVUE) UCL	8.206	97.5% Chebyshev (MVUE) UCL	9.602
99% Chebyshev (MVUE) UCL	12.34		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	6.216	95% Jackknife UCL	6.319
95% Standard Bootstrap UCL	6.184	95% Bootstrap-t UCL	6.72
95% Hall's Bootstrap UCL	6.473	95% Percentile Bootstrap UCL	6.256
95% BCA Bootstrap UCL	6.422		
90% Chebyshev(Mean, Sd) UCL	7.226	95% Chebyshev(Mean, Sd) UCL	8.238
97.5% Chebyshev(Mean, Sd) UCL	9.644	99% Chebyshev(Mean, Sd) UCL	12.4

Suggested UCL to Use

95% Student's-t UCL 6.319

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFNA|ug/kg

General Statistics

Total Number of Observations	13	Number of Distinct Observations	11
Number of Detects	12	Number of Non-Detects	1
Number of Distinct Detects	11	Number of Distinct Non-Detects	1
Minimum Detect	0.1	Minimum Non-Detect	0.1
Maximum Detect	0.351	Maximum Non-Detect	0.1
Variance Detects	0.00666	Percent Non-Detects	7.69%
Mean Detects	0.196	SD Detects	0.0816
Median Detects	0.175	CV Detects	0.416
Skewness Detects	1.124	Kurtosis Detects	0.398
Mean of Logged Detects	-1.7	SD of Logged Detects	0.387

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.86	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.241	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.189	KM Standard Error of Mean	0.023
KM SD	0.0794	95% KM (BCA) UCL	0.225
95% KM (t) UCL	0.23	95% KM (Percentile Bootstrap) UCL	0.226
95% KM (z) UCL	0.227	95% KM Bootstrap t UCL	0.246
90% KM Chebyshev UCL	0.258	95% KM Chebyshev UCL	0.289
97.5% KM Chebyshev UCL	0.332	99% KM Chebyshev UCL	0.418

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.436	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.731	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.191	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.246	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	7.164	k star (bias corrected MLE)	5.429
Theta hat (MLE)	0.0274	Theta star (bias corrected MLE)	0.0362
nu hat (MLE)	171.9	nu star (bias corrected)	130.3
Mean (detects)	0.196		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.041	Mean	0.184
Maximum	0.351	Median	0.158
SD	0.0892	CV	0.484
k hat (MLE)	4.204	k star (bias corrected MLE)	3.285
Theta hat (MLE)	0.0438	Theta star (bias corrected MLE)	0.0561
nu hat (MLE)	109.3	nu star (bias corrected)	85.41
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (85.41, α)	65.11	Adjusted Chi Square Value (85.41, β)	62.59
95% Gamma Approximate UCL (use when n>=50)	0.242	95% Gamma Adjusted UCL (use when n<50)	0.252

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.189	SD (KM)	0.0794
Variance (KM)	0.0063	SE of Mean (KM)	0.023
k hat (KM)	5.664	k star (KM)	4.408
nu hat (KM)	147.3	nu star (KM)	114.6
theta hat (KM)	0.0333	theta star (KM)	0.0428
80% gamma percentile (KM)	0.257	90% gamma percentile (KM)	0.309
95% gamma percentile (KM)	0.357	99% gamma percentile (KM)	0.458

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (114.61, α)	90.9	Adjusted Chi Square Value (114.61, β)	87.89
95% Gamma Approximate KM-UCL (use when n>=50)	0.238	95% Gamma Adjusted KM-UCL (use when n<50)	0.246

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.945	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.168	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.187	Mean in Log Scale	-1.772
SD in Original Scale	0.0855	SD in Log Scale	0.453
95% t UCL (assumes normality of ROS data)	0.229	95% Percentile Bootstrap UCL	0.228
95% BCA Bootstrap UCL	0.233	95% Bootstrap t UCL	0.246
95% H-UCL (Log ROS)	0.247		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.746	KM Geo Mean	0.174
KM SD (logged)	0.39	95% Critical H Value (KM-Log)	1.993
KM Standard Error of Mean (logged)	0.113	95% H-UCL (KM -Log)	0.236
KM SD (logged)	0.39	95% Critical H Value (KM-Log)	1.993
KM Standard Error of Mean (logged)	0.113		

ProUCL Output
West Lakeland
Crayfish Tissue

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.185	Mean in Log Scale	-1.799
SD in Original Scale	0.0881	SD in Log Scale	0.516
95% t UCL (Assumes normality)	0.229	95% H-Stat UCL	0.26

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.23

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFDA|ug/kg

General Statistics

Total Number of Observations	13	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	0.328	Mean	1.037
Maximum	1.66	Median	1.26
SD	0.482	Std. Error of Mean	0.134
Coefficient of Variation	0.465	Skewness	-0.249

Normal GOF Test

Shapiro Wilk Test Statistic	0.901	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.217	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	1.275	95% Adjusted-CLT UCL (Chen-1995)	1.247
		95% Modified-t UCL (Johnson-1978)	1.273

Gamma GOF Test

A-D Test Statistic	0.673	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.737	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.253	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.238	Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.965	k star (bias corrected MLE)	3.101
Theta hat (MLE)	0.261	Theta star (bias corrected MLE)	0.334
nu hat (MLE)	103.1	nu star (bias corrected)	80.63
MLE Mean (bias corrected)	1.037	MLE Sd (bias corrected)	0.589
		Approximate Chi Square Value (0.05)	60.94
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	58.5

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1.372	95% Adjusted Gamma UCL (use when n<50)	1.429

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.867	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.254	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data Not Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.115	Mean of logged Data	-0.0954
Maximum of Logged Data	0.507	SD of logged Data	0.573

Assuming Lognormal Distribution

95% H-UCL	1.542	90% Chebyshev (MVUE) UCL	1.577
95% Chebyshev (MVUE) UCL	1.813	97.5% Chebyshev (MVUE) UCL	2.14
99% Chebyshev (MVUE) UCL	2.783		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.257	95% Jackknife UCL	1.275
95% Standard Bootstrap UCL	1.248	95% Bootstrap-t UCL	1.273
95% Hall's Bootstrap UCL	1.233	95% Percentile Bootstrap UCL	1.257
95% BCA Bootstrap UCL	1.241		
90% Chebyshev(Mean, Sd) UCL	1.438	95% Chebyshev(Mean, Sd) UCL	1.62
97.5% Chebyshev(Mean, Sd) UCL	1.872	99% Chebyshev(Mean, Sd) UCL	2.367

Suggested UCL to Use

95% Student's-t UCL 1.275

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFUnA|ug/kg

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	0
Minimum	0.121	Mean	0.38
Maximum	0.851	Median	0.41
SD	0.201	Std. Error of Mean	0.0557
Coefficient of Variation	0.529	Skewness	0.953

Normal GOF Test

Shapiro Wilk Test Statistic	0.928	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.164	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.234	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.479	95% Adjusted-CLT UCL (Chen-1995)	0.487
		95% Modified-t UCL (Johnson-1978)	0.482

Gamma GOF Test

A-D Test Statistic	0.236	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.737	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.164	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.238	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.907	k star (bias corrected MLE)	3.057
Theta hat (MLE)	0.0973	Theta star (bias corrected MLE)	0.124
nu hat (MLE)	101.6	nu star (bias corrected)	79.47
MLE Mean (bias corrected)	0.38	MLE Sd (bias corrected)	0.217
		Approximate Chi Square Value (0.05)	59.93
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	57.52

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.504	95% Adjusted Gamma UCL (use when n<50)	0.525

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.969	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.186	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.112	Mean of logged Data	-1.101
Maximum of Logged Data	-0.161	SD of logged Data	0.553

Assuming Lognormal Distribution

95% H-UCL	0.548	90% Chebyshev (MVUE) UCL	0.564
95% Chebyshev (MVUE) UCL	0.646	97.5% Chebyshev (MVUE) UCL	0.76
99% Chebyshev (MVUE) UCL	0.984		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.472	95% Jackknife UCL	0.479
95% Standard Bootstrap UCL	0.466	95% Bootstrap-t UCL	0.506
95% Hall's Bootstrap UCL	0.523	95% Percentile Bootstrap UCL	0.469
95% BCA Bootstrap UCL	0.487		
90% Chebyshev(Mean, Sd) UCL	0.547	95% Chebyshev(Mean, Sd) UCL	0.623
97.5% Chebyshev(Mean, Sd) UCL	0.728	99% Chebyshev(Mean, Sd) UCL	0.935

Suggested UCL to Use

95% Student's-t UCL 0.479

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFDoA|ug/kg

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
Number of Detects	11	Number of Non-Detects	2
Number of Distinct Detects	11	Number of Distinct Non-Detects	2
Minimum Detect	0.1	Minimum Non-Detect	0.0985
Maximum Detect	0.37	Maximum Non-Detect	0.217
Variance Detects	0.00758	Percent Non-Detects	15.38%
Mean Detects	0.204	SD Detects	0.0871
Median Detects	0.205	CV Detects	0.427
Skewness Detects	0.777	Kurtosis Detects	0.0463
Mean of Logged Detects	-1.673	SD of Logged Detects	0.428

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.916	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.185	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.251	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.192	KM Standard Error of Mean	0.0245
KM SD	0.083	95% KM (BCA) UCL	0.236
95% KM (t) UCL	0.236	95% KM (Percentile Bootstrap) UCL	0.234
95% KM (z) UCL	0.232	95% KM Bootstrap t UCL	0.243
90% KM Chebyshev UCL	0.265	95% KM Chebyshev UCL	0.299
97.5% KM Chebyshev UCL	0.345	99% KM Chebyshev UCL	0.435

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.279	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.731	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.131	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.256	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	6.239	k star (bias corrected MLE)	4.598
Theta hat (MLE)	0.0327	Theta star (bias corrected MLE)	0.0443
nu hat (MLE)	137.3	nu star (bias corrected)	101.2
Mean (detects)	0.204		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0481	Mean	0.188
Maximum	0.37	Median	0.178
SD	0.0911	CV	0.485
k hat (MLE)	4.262	k star (bias corrected MLE)	3.33
Theta hat (MLE)	0.044	Theta star (bias corrected MLE)	0.0564
nu hat (MLE)	110.8	nu star (bias corrected)	86.58
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (86.58, α)	66.13	Adjusted Chi Square Value (86.58, β)	63.59
95% Gamma Approximate UCL (use when n>=50)	0.246	95% Gamma Adjusted UCL (use when n<50)	0.256

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.192	SD (KM)	0.083
Variance (KM)	0.00689	SE of Mean (KM)	0.0245
k hat (KM)	5.348	k star (KM)	4.165
nu hat (KM)	139	nu star (KM)	108.3
theta hat (KM)	0.0359	theta star (KM)	0.0461
80% gamma percentile (KM)	0.263	90% gamma percentile (KM)	0.318
95% gamma percentile (KM)	0.368	99% gamma percentile (KM)	0.475

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (108.29, α)	85.28	Adjusted Chi Square Value (108.29, β)	82.37
95% Gamma Approximate KM-UCL (use when n>=50)	0.244	95% Gamma Adjusted KM-UCL (use when n<50)	0.252

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.949	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.127	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.251	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.189	Mean in Log Scale	-1.768
SD in Original Scale	0.0886	SD in Log Scale	0.478
95% t UCL (assumes normality of ROS data)	0.233	95% Percentile Bootstrap UCL	0.229
95% BCA Bootstrap UCL	0.234	95% Bootstrap t UCL	0.244
95% H-UCL (Log ROS)	0.255		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.741	KM Geo Mean	0.175
KM SD (logged)	0.425	95% Critical H Value (KM-Log)	2.028
KM Standard Error of Mean (logged)	0.126	95% H-UCL (KM -Log)	0.246
KM SD (logged)	0.425	95% Critical H Value (KM-Log)	2.028
KM Standard Error of Mean (logged)	0.126		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.185	Mean in Log Scale	-1.818
SD in Original Scale	0.0931	SD in Log Scale	0.552
95% t UCL (Assumes normality)	0.231	95% H-Stat UCL	0.267

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.236

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
West Lakeland
Crayfish Tissue

PFTrDA|ug/kg

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
Number of Detects	9	Number of Non-Detects	4
Number of Distinct Detects	9	Number of Distinct Non-Detects	4
Minimum Detect	0.102	Minimum Non-Detect	0.0966
Maximum Detect	0.242	Maximum Non-Detect	0.217
Variance Detects	0.00208	Percent Non-Detects	30.77%
Mean Detects	0.162	SD Detects	0.0456
Median Detects	0.155	CV Detects	0.281
Skewness Detects	0.718	Kurtosis Detects	-0.0627
Mean of Logged Detects	-1.854	SD of Logged Detects	0.276

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.927	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.218	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.144	KM Standard Error of Mean	0.0137
KM SD	0.0459	95% KM (BCA) UCL	0.167
95% KM (t) UCL	0.169	95% KM (Percentile Bootstrap) UCL	0.167
95% KM (z) UCL	0.167	95% KM Bootstrap t UCL	0.174
90% KM Chebyshev UCL	0.186	95% KM Chebyshev UCL	0.204
97.5% KM Chebyshev UCL	0.23	99% KM Chebyshev UCL	0.281

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.28	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.18	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	14.82	k star (bias corrected MLE)	9.955
Theta hat (MLE)	0.0109	Theta star (bias corrected MLE)	0.0163
nu hat (MLE)	266.8	nu star (bias corrected)	179.2
Mean (detects)	0.162		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0732	Mean	0.139
Maximum	0.242	Median	0.14
SD	0.0538	CV	0.388
k hat (MLE)	7.147	k star (bias corrected MLE)	5.549
Theta hat (MLE)	0.0194	Theta star (bias corrected MLE)	0.025
nu hat (MLE)	185.8	nu star (bias corrected)	144.3
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (144.28, α)	117.5	Adjusted Chi Square Value (144.28, β)	114.1
95% Gamma Approximate UCL (use when n>=50)	0.17	95% Gamma Adjusted UCL (use when n<50)	0.175

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.144	SD (KM)	0.0459
Variance (KM)	0.00211	SE of Mean (KM)	0.0137
k hat (KM)	9.902	k star (KM)	7.668
nu hat (KM)	257.5	nu star (KM)	199.4
theta hat (KM)	0.0146	theta star (KM)	0.0188
80% gamma percentile (KM)	0.185	90% gamma percentile (KM)	0.214
95% gamma percentile (KM)	0.239	99% gamma percentile (KM)	0.292

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (199.38, α)	167.7	Adjusted Chi Square Value (199.38, β)	163.6
95% Gamma Approximate KM-UCL (use when n>=50)	0.172	95% Gamma Adjusted KM-UCL (use when n<50)	0.176

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.961	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.17	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.141	Mean in Log Scale	-2.014
SD in Original Scale	0.0504	SD in Log Scale	0.349
95% t UCL (assumes normality of ROS data)	0.166	95% Percentile Bootstrap UCL	0.164
95% BCA Bootstrap UCL	0.166	95% Bootstrap t UCL	0.171
95% H-UCL (Log ROS)	0.173		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.982	KM Geo Mean	0.138
KM SD (logged)	0.303	95% Critical H Value (KM-Log)	1.912
KM Standard Error of Mean (logged)	0.0912	95% H-UCL (KM -Log)	0.17
KM SD (logged)	0.303	95% Critical H Value (KM-Log)	1.912
KM Standard Error of Mean (logged)	0.0912		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.132	Mean in Log Scale	-2.15
SD in Original Scale	0.0619	SD in Log Scale	0.552
95% t UCL (Assumes normality)	0.162	95% H-Stat UCL	0.192

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.169

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFTeDA|ug/kg

General Statistics

Total Number of Observations	13	Number of Distinct Observations	12
Number of Detects	6	Number of Non-Detects	7
Number of Distinct Detects	6	Number of Distinct Non-Detects	6
Minimum Detect	0.097	Minimum Non-Detect	0.0966
Maximum Detect	0.157	Maximum Non-Detect	0.217
Variance Detects	5.24E-04	Percent Non-Detects	53.85%
Mean Detects	0.121	SD Detects	0.0229
Median Detects	0.113	CV Detects	0.19
Skewness Detects	0.917	Kurtosis Detects	-0.454
Mean of Logged Detects	-2.13	SD of Logged Detects	0.183

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.907	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.245	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.109	KM Standard Error of Mean	0.00599
KM SD	0.019	95% KM (BCA) UCL	0.119
95% KM (t) UCL	0.119	95% KM (Percentile Bootstrap) UCL	0.119
95% KM (z) UCL	0.118	95% KM Bootstrap t UCL	0.129
90% KM Chebyshev UCL	0.127	95% KM Chebyshev UCL	0.135
97.5% KM Chebyshev UCL	0.146	99% KM Chebyshev UCL	0.168

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.343	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.697	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.233	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	35.23	k star (bias corrected MLE)	17.72
Theta hat (MLE)	0.00342	Theta star (bias corrected MLE)	0.0068
nu hat (MLE)	422.7	nu star (bias corrected)	212.7
Mean (detects)	0.121		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0586	Mean	0.0961
Maximum	0.157	Median	0.094
SD	0.029	CV	0.301
k hat (MLE)	12.7	k star (bias corrected MLE)	9.824
Theta hat (MLE)	0.00757	Theta star (bias corrected MLE)	0.00978
nu hat (MLE)	330.3	nu star (bias corrected)	255.4
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (255.41, α)	219.4	Adjusted Chi Square Value (255.41, β)	214.7
95% Gamma Approximate UCL (use when n>=50)	0.112	95% Gamma Adjusted UCL (use when n<50)	0.114

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.109	SD (KM)	0.019
Variance (KM)	3.5913E-4	SE of Mean (KM)	0.00599
k hat (KM)	32.86	k star (KM)	25.33
nu hat (KM)	854.4	nu star (KM)	658.5
theta hat (KM)	0.00331	theta star (KM)	0.00429
80% gamma percentile (KM)	0.126	90% gamma percentile (KM)	0.137
95% gamma percentile (KM)	0.146	99% gamma percentile (KM)	0.165

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (658.55, α)	600	Adjusted Chi Square Value (658.55, β)	592
95% Gamma Approximate KM-UCL (use when n>=50)	0.119	95% Gamma Adjusted KM-UCL (use when n<50)	0.121

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.93	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.219	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0994	Mean in Log Scale	-2.338
SD in Original Scale	0.0259	SD in Log Scale	0.244
95% t UCL (assumes normality of ROS data)	0.112	95% Percentile Bootstrap UCL	0.112
95% BCA Bootstrap UCL	0.113	95% Bootstrap t UCL	0.115
95% H-UCL (Log ROS)	0.113		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.233	KM Geo Mean	0.107
KM SD (logged)	0.156	95% Critical H Value (KM-Log)	1.799
KM Standard Error of Mean (logged)	0.0494	95% H-UCL (KM -Log)	0.118
KM SD (logged)	0.156	95% Critical H Value (KM-Log)	1.799
KM Standard Error of Mean (logged)	0.0494		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0867	Mean in Log Scale	-2.543
SD in Original Scale	0.0391	SD in Log Scale	0.465
95% t UCL (Assumes normality)	0.106	95% H-Stat UCL	0.116

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.119

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
West Lakeland
Crayfish Tissue

PFHxS|ug/kg

General Statistics

Total Number of Observations	13	Number of Distinct Observations	11
Number of Detects	12	Number of Non-Detects	1
Number of Distinct Detects	10	Number of Distinct Non-Detects	1
Minimum Detect	0.144	Minimum Non-Detect	0.0985
Maximum Detect	0.433	Maximum Non-Detect	0.0985
Variance Detects	0.00664	Percent Non-Detects	7.69%
Mean Detects	0.228	SD Detects	0.0815
Median Detects	0.204	CV Detects	0.358
Skewness Detects	1.504	Kurtosis Detects	2.86
Mean of Logged Detects	-1.529	SD of Logged Detects	0.323

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.859	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.2	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.218	KM Standard Error of Mean	0.0239
KM SD	0.0825	95% KM (BCA) UCL	0.26
95% KM (t) UCL	0.261	95% KM (Percentile Bootstrap) UCL	0.256
95% KM (z) UCL	0.257	95% KM Bootstrap t UCL	0.273
90% KM Chebyshev UCL	0.29	95% KM Chebyshev UCL	0.322
97.5% KM Chebyshev UCL	0.367	99% KM Chebyshev UCL	0.456

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.402	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.73	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.177	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.245	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	10.02	k star (bias corrected MLE)	7.574
Theta hat (MLE)	0.0227	Theta star (bias corrected MLE)	0.0301
nu hat (MLE)	240.6	nu star (bias corrected)	181.8
Mean (detects)	0.228		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0684	Mean	0.216
Maximum	0.433	Median	0.204
SD	0.0897	CV	0.416
k hat (MLE)	6.111	k star (bias corrected MLE)	4.752
Theta hat (MLE)	0.0353	Theta star (bias corrected MLE)	0.0454
nu hat (MLE)	158.9	nu star (bias corrected)	123.6
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (123.55, α)	98.88	Adjusted Chi Square Value (123.55, β)	95.74
95% Gamma Approximate UCL (use when n>=50)	0.269	95% Gamma Adjusted UCL (use when n<50)	0.278

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.218	SD (KM)	0.0825
Variance (KM)	0.00681	SE of Mean (KM)	0.0239
k hat (KM)	6.976	k star (KM)	5.417
nu hat (KM)	181.4	nu star (KM)	140.9
theta hat (KM)	0.0312	theta star (KM)	0.0402
80% gamma percentile (KM)	0.29	90% gamma percentile (KM)	0.343
95% gamma percentile (KM)	0.391	99% gamma percentile (KM)	0.492

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (140.85, α)	114.4	Adjusted Chi Square Value (140.85, β)	111
95% Gamma Approximate KM-UCL (use when n>=50)	0.268	95% Gamma Adjusted KM-UCL (use when n<50)	0.276

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.935	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.157	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.218	Mean in Log Scale	-1.59
SD in Original Scale	0.0858	SD in Log Scale	0.378
95% t UCL (assumes normality of ROS data)	0.26	95% Percentile Bootstrap UCL	0.256
95% BCA Bootstrap UCL	0.263	95% Bootstrap t UCL	0.273
95% H-UCL (Log ROS)	0.272		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.59	KM Geo Mean	0.204
KM SD (logged)	0.364	95% Critical H Value (KM-Log)	1.968
KM Standard Error of Mean (logged)	0.105	95% H-UCL (KM -Log)	0.268
KM SD (logged)	0.364	95% Critical H Value (KM-Log)	1.968
KM Standard Error of Mean (logged)	0.105		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.214	Mean in Log Scale	-1.643
SD in Original Scale	0.0924	SD in Log Scale	0.514
95% t UCL (Assumes normality)	0.26	95% H-Stat UCL	0.303

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.261

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFHpS|ug/kg

General Statistics

Total Number of Observations	13	Number of Distinct Observations	11
Number of Detects	4	Number of Non-Detects	9
Number of Distinct Detects	3	Number of Distinct Non-Detects	8
Minimum Detect	0.11	Minimum Non-Detect	0.0943
Maximum Detect	0.133	Maximum Non-Detect	0.217
Variance Detects	1.2867E-4	Percent Non-Detects	69.23%
Mean Detects	0.116	SD Detects	0.0113
Median Detects	0.111	CV Detects	0.0978
Skewness Detects	1.99	Kurtosis Detects	3.964
Mean of Logged Detects	-2.158	SD of Logged Detects	0.0935

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.661	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.42	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.102	KM Standard Error of Mean	0.0039
KM SD	0.0117	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.108	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.108	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.113	95% KM Chebyshev UCL	0.119
97.5% KM Chebyshev UCL	0.126	99% KM Chebyshev UCL	0.14

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.873	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.657	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.443	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.394	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	148.1	k star (bias corrected MLE)	37.19
Theta hat (MLE)	7.8332E-4	Theta star (bias corrected MLE)	0.00312
nu hat (MLE)	1185	nu star (bias corrected)	297.5
Mean (detects)	0.116		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0716	Mean	0.0915
Maximum	0.133	Median	0.0796
SD	0.0184	CV	0.201
k hat (MLE)	29.6	k star (bias corrected MLE)	22.82
Theta hat (MLE)	0.00309	Theta star (bias corrected MLE)	0.00401
nu hat (MLE)	769.6	nu star (bias corrected)	593.3
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (593.30, α)	537.8	Adjusted Chi Square Value (593.30, β)	530.3
95% Gamma Approximate UCL (use when n>=50)	0.101	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.102	SD (KM)	0.0117
Variance (KM)	1.3681E-4	SE of Mean (KM)	0.0039
k hat (KM)	75.35	k star (KM)	58.02
nu hat (KM)	1959	nu star (KM)	1508
theta hat (KM)	0.00135	theta star (KM)	0.00175
80% gamma percentile (KM)	0.113	90% gamma percentile (KM)	0.119
95% gamma percentile (KM)	0.124	99% gamma percentile (KM)	0.135

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (N/A, α)	1419	Adjusted Chi Square Value (N/A, β)	1407
95% Gamma Approximate KM-UCL (use when n>=50)	0.108	95% Gamma Adjusted KM-UCL (use when n<50)	0.109

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.664	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.418	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0949	Mean in Log Scale	-2.367
SD in Original Scale	0.016	SD in Log Scale	0.157
95% t UCL (assumes normality of ROS data)	0.103	95% Percentile Bootstrap UCL	0.102
95% BCA Bootstrap UCL	0.103	95% Bootstrap t UCL	0.105
95% H-UCL (Log ROS)	0.103		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.293	KM Geo Mean	0.101
KM SD (logged)	0.107	95% Critical H Value (KM-Log)	1.767
KM Standard Error of Mean (logged)	0.0356	95% H-UCL (KM -Log)	0.107
KM SD (logged)	0.107	95% Critical H Value (KM-Log)	1.767
KM Standard Error of Mean (logged)	0.0356		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0741	Mean in Log Scale	-2.692
SD in Original Scale	0.0338	SD in Log Scale	0.433
95% t UCL (Assumes normality)	0.0908	95% H-Stat UCL	0.0959

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

ProUCL Output
West Lakeland
Crayfish Tissue

Suggested UCL to Use

95% KM (t) UCL	0.108	KM H-UCL	0.107
95% KM (BCA) UCL	N/A		

Warning: One or more Recommended UCL(s) not available!

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOS|ug/kg

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	0
Minimum	12.4	Mean	37.19
Maximum	97.9	Median	31.6
SD	22.27	Std. Error of Mean	6.177
Coefficient of Variation	0.599	Skewness	1.698

Normal GOF Test

Shapiro Wilk Test Statistic	0.851	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.172	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.234	Data appear Normal at 5% Significance Level	

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	48.2	95% Adjusted-CLT UCL (Chen-1995)	50.46
		95% Modified-t UCL (Johnson-1978)	48.69

Gamma GOF Test

A-D Test Statistic	0.253	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.738	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.12	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.238	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.518	k star (bias corrected MLE)	2.757
Theta hat (MLE)	10.57	Theta star (bias corrected MLE)	13.49
nu hat (MLE)	91.47	nu star (bias corrected)	71.69
MLE Mean (bias corrected)	37.19	MLE Sd (bias corrected)	22.4
		Approximate Chi Square Value (0.05)	53.2
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	50.93

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	50.12	95% Adjusted Gamma UCL (use when n<50)	52.35

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.968	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.137	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.518	Mean of logged Data	3.467
Maximum of Logged Data	4.584	SD of logged Data	0.57

Assuming Lognormal Distribution

95% H-UCL	54.15	90% Chebyshev (MVUE) UCL	55.41
95% Chebyshev (MVUE) UCL	63.67	97.5% Chebyshev (MVUE) UCL	75.12
99% Chebyshev (MVUE) UCL	97.63		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	47.35	95% Jackknife UCL	48.2
95% Standard Bootstrap UCL	46.89	95% Bootstrap-t UCL	52.38
95% Hall's Bootstrap UCL	96.64	95% Percentile Bootstrap UCL	47.48
95% BCA Bootstrap UCL	50.88		
90% Chebyshev(Mean, Sd) UCL	55.72	95% Chebyshev(Mean, Sd) UCL	64.12
97.5% Chebyshev(Mean, Sd) UCL	75.77	99% Chebyshev(Mean, Sd) UCL	98.65

Suggested UCL to Use

95% Student's-t UCL 48.2

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOSA|ug/kg

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	0
Minimum	0.425	Mean	0.91
Maximum	1.55	Median	0.828
SD	0.332	Std. Error of Mean	0.0921
Coefficient of Variation	0.365	Skewness	0.628

Normal GOF Test

Shapiro Wilk Test Statistic	0.95	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.135	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.234	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.074	95% Adjusted-CLT UCL (Chen-1995)	1.078
		95% Modified-t UCL (Johnson-1978)	1.076

Gamma GOF Test

A-D Test Statistic	0.185	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.735	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.0966	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.237	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	8.164	k star (bias corrected MLE)	6.331
Theta hat (MLE)	0.111	Theta star (bias corrected MLE)	0.144
nu hat (MLE)	212.3	nu star (bias corrected)	164.6
MLE Mean (bias corrected)	0.91	MLE Sd (bias corrected)	0.361
		Approximate Chi Square Value (0.05)	135.9
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	132.2

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1.101	95% Adjusted Gamma UCL (use when n<50)	1.132

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.974	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.116	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.856	Mean of logged Data	-0.157
Maximum of Logged Data	0.438	SD of logged Data	0.373

Assuming Lognormal Distribution

95% H-UCL	1.133	90% Chebyshev (MVUE) UCL	1.198
95% Chebyshev (MVUE) UCL	1.328	97.5% Chebyshev (MVUE) UCL	1.508
99% Chebyshev (MVUE) UCL	1.863		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.061	95% Jackknife UCL	1.074
95% Standard Bootstrap UCL	1.054	95% Bootstrap-t UCL	1.113
95% Hall's Bootstrap UCL	1.121	95% Percentile Bootstrap UCL	1.053
95% BCA Bootstrap UCL	1.067		
90% Chebyshev(Mean, Sd) UCL	1.186	95% Chebyshev(Mean, Sd) UCL	1.311
97.5% Chebyshev(Mean, Sd) UCL	1.485	99% Chebyshev(Mean, Sd) UCL	1.826

Suggested UCL to Use

95% Student's-t UCL 1.074

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

N-EtFOSAA|ug/kg

General Statistics

Total Number of Observations	13	Number of Distinct Observations	11
Number of Detects	6	Number of Non-Detects	7
Number of Distinct Detects	6	Number of Distinct Non-Detects	5
Minimum Detect	0.138	Minimum Non-Detect	0.0957
Maximum Detect	0.789	Maximum Non-Detect	0.1
Variance Detects	0.0619	Percent Non-Detects	53.85%
Mean Detects	0.316	SD Detects	0.249
Median Detects	0.231	CV Detects	0.787
Skewness Detects	1.793	Kurtosis Detects	3.336
Mean of Logged Detects	-1.362	SD of Logged Detects	0.677

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.776	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.263	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.197	KM Standard Error of Mean	0.0575
KM SD	0.189	95% KM (BCA) UCL	0.299
95% KM (t) UCL	0.3	95% KM (Percentile Bootstrap) UCL	0.296
95% KM (z) UCL	0.292	95% KM Bootstrap t UCL	0.423
90% KM Chebyshev UCL	0.37	95% KM Chebyshev UCL	0.448
97.5% KM Chebyshev UCL	0.557	99% KM Chebyshev UCL	0.77

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.478	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.703	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.267	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.335	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.531	k star (bias corrected MLE)	1.377
Theta hat (MLE)	0.125	Theta star (bias corrected MLE)	0.23
nu hat (MLE)	30.37	nu star (bias corrected)	16.52
Mean (detects)	0.316		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.151
Maximum	0.789	Median	0.01
SD	0.226	CV	1.493
k hat (MLE)	0.518	k star (bias corrected MLE)	0.45
Theta hat (MLE)	0.292	Theta star (bias corrected MLE)	0.336
nu hat (MLE)	13.47	nu star (bias corrected)	11.69
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (11.69, α)	5.026	Adjusted Chi Square Value (11.69, β)	4.419
95% Gamma Approximate UCL (use when n>=50)	0.352	95% Gamma Adjusted UCL (use when n<50)	0.4

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.197	SD (KM)	0.189
Variance (KM)	0.0359	SE of Mean (KM)	0.0575
k hat (KM)	1.087	k star (KM)	0.887
nu hat (KM)	28.25	nu star (KM)	23.06
theta hat (KM)	0.182	theta star (KM)	0.222
80% gamma percentile (KM)	0.321	90% gamma percentile (KM)	0.468
95% gamma percentile (KM)	0.617	99% gamma percentile (KM)	0.966

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (23.06, α)	13.14	Adjusted Chi Square Value (23.06, β)	12.08
95% Gamma Approximate KM-UCL (use when n>=50)	0.346	95% Gamma Adjusted KM-UCL (use when n<50)	0.377

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.884	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.248	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.164	Mean in Log Scale	-2.477
SD in Original Scale	0.217	SD in Log Scale	1.183
95% t UCL (assumes normality of ROS data)	0.272	95% Percentile Bootstrap UCL	0.262
95% BCA Bootstrap UCL	0.307	95% Bootstrap t UCL	0.372
95% H-UCL (Log ROS)	0.5		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.892	KM Geo Mean	0.151
KM SD (logged)	0.646	95% Critical H Value (KM-Log)	2.296
KM Standard Error of Mean (logged)	0.196	95% H-UCL (KM -Log)	0.285
KM SD (logged)	0.646	95% Critical H Value (KM-Log)	2.296
KM Standard Error of Mean (logged)	0.196		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.172	Mean in Log Scale	-2.254
SD in Original Scale	0.212	SD in Log Scale	0.964
95% t UCL (Assumes normality)	0.277	95% H-Stat UCL	0.363

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.3

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Eagle Point Lake
Snail Tissue

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/12/2021 4:04:41 PM
From File	FWM_ProUCL_Input_d.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

PFOA|ug/kg

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.316	Mean	0.956
Maximum	2.1	Median	0.532
SD	0.787	Std. Error of Mean	0.321
Coefficient of Variation	0.823	Skewness	0.975

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.767	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.357	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.603	95% Adjusted-CLT UCL (Chen-1995)	1.621
		95% Modified-t UCL (Johnson-1978)	1.625

Gamma GOF Test

A-D Test Statistic	0.661	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.704	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.334	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.336	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.983	k star (bias corrected MLE)	1.102
Theta hat (MLE)	0.482	Theta star (bias corrected MLE)	0.867
nu hat (MLE)	23.79	nu star (bias corrected)	13.23
MLE Mean (bias corrected)	0.956	MLE Sd (bias corrected)	0.911
		Approximate Chi Square Value (0.05)	6.047
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	4.415

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	2.091	95% Adjusted Gamma UCL (use when n<50)	2.865

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.849	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.291	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.152	Mean of logged Data	-0.318
Maximum of Logged Data	0.742	SD of logged Data	0.791

Assuming Lognormal Distribution

95% H-UCL	3.369	90% Chebyshev (MVUE) UCL	1.836
95% Chebyshev (MVUE) UCL	2.243	97.5% Chebyshev (MVUE) UCL	2.809
99% Chebyshev (MVUE) UCL	3.921		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

ProUCL Output
Eagle Point Lake
Snail Tissue

Nonparametric Distribution Free UCLs

95% CLT UCL	1.484	95% Jackknife UCL	1.603
95% Standard Bootstrap UCL	1.441	95% Bootstrap-t UCL	4.96
95% Hall's Bootstrap UCL	8.129	95% Percentile Bootstrap UCL	1.462
95% BCA Bootstrap UCL	1.519		
90% Chebyshev(Mean, Sd) UCL	1.92	95% Chebyshev(Mean, Sd) UCL	2.357
97.5% Chebyshev(Mean, Sd) UCL	2.963	99% Chebyshev(Mean, Sd) UCL	4.153

Suggested UCL to Use

95% Adjusted Gamma UCL 2.865

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
Number of Detects	4	Number of Non-Detects	2
Number of Distinct Detects	4	Number of Distinct Non-Detects	2
Minimum Detect	0.137	Minimum Non-Detect	0.098
Maximum Detect	0.306	Maximum Non-Detect	0.0995
Variance Detects	0.0054	Percent Non-Detects	33.33%
Mean Detects	0.202	SD Detects	0.0735
Median Detects	0.183	CV Detects	0.363
Skewness Detects	1.34	Kurtosis Detects	1.95
Mean of Logged Detects	-1.644	SD of Logged Detects	0.341

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.906	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.273	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.168	KM Standard Error of Mean	0.0337
KM SD	0.0715	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.235	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.223	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.269	95% KM Chebyshev UCL	0.314
97.5% KM Chebyshev UCL	0.378	99% KM Chebyshev UCL	0.503

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.291	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.238	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.395	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	11.14	k star (bias corrected MLE)	2.952
Theta hat (MLE)	0.0182	Theta star (bias corrected MLE)	0.0685
nu hat (MLE)	89.12	nu star (bias corrected)	23.61
Mean (detects)	0.202		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0263	Mean	0.144
Maximum	0.306	Median	0.153
SD	0.107	CV	0.747
k hat (MLE)	1.502	k star (bias corrected MLE)	0.862
Theta hat (MLE)	0.0956	Theta star (bias corrected MLE)	0.167
nu hat (MLE)	18.03	nu star (bias corrected)	10.35
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (10.35, α)	4.161	Adjusted Chi Square Value (10.35, β)	2.87
95% Gamma Approximate UCL (use when n>=50)	0.357	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.168	SD (KM)	0.0715
Variance (KM)	0.00512	SE of Mean (KM)	0.0337
k hat (KM)	5.483	k star (KM)	2.852
nu hat (KM)	65.79	nu star (KM)	34.23
theta hat (KM)	0.0306	theta star (KM)	0.0587
80% gamma percentile (KM)	0.24	90% gamma percentile (KM)	0.3
95% gamma percentile (KM)	0.357	99% gamma percentile (KM)	0.479

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (34.23, α)	21.85	Adjusted Chi Square Value (34.23, β)	18.36
95% Gamma Approximate KM-UCL (use when n>=50)	0.262	95% Gamma Adjusted KM-UCL (use when n<50)	0.312

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.961	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.222	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.16	Mean in Log Scale	-1.961
SD in Original Scale	0.0871	SD in Log Scale	0.558
95% t UCL (assumes normality of ROS data)	0.231	95% Percentile Bootstrap UCL	0.219
95% BCA Bootstrap UCL	0.226	95% Bootstrap t UCL	0.251
95% H-UCL (Log ROS)	0.329		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.87	KM Geo Mean	0.154
KM SD (logged)	0.401	95% Critical H Value (KM-Log)	2.417
KM Standard Error of Mean (logged)	0.189	95% H-UCL (KM -Log)	0.258
KM SD (logged)	0.401	95% Critical H Value (KM-Log)	2.417
KM Standard Error of Mean (logged)	0.189		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.151	Mean in Log Scale	-2.099
SD in Original Scale	0.0973	SD in Log Scale	0.753
95% t UCL (Assumes normality)	0.231	95% H-Stat UCL	0.499

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.235

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	1.1	Mean	2.085
Maximum	5.12	Median	1.535
SD	1.52	Std. Error of Mean	0.621
Coefficient of Variation	0.729	Skewness	2.221

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.688	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.358	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	3.335	95% Adjusted-CLT UCL (Chen-1995)	3.707
		95% Modified-t UCL (Johnson-1978)	3.429

Gamma GOF Test

A-D Test Statistic	0.692	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.701	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.294	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.334	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.371	k star (bias corrected MLE)	1.797
Theta hat (MLE)	0.619	Theta star (bias corrected MLE)	1.161
nu hat (MLE)	40.45	nu star (bias corrected)	21.56
MLE Mean (bias corrected)	2.085	MLE Sd (bias corrected)	1.556
		Approximate Chi Square Value (0.05)	12.01
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	9.541

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	3.743	95% Adjusted Gamma UCL (use when n<50)	4.712

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.832	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.256	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.0953	Mean of logged Data	0.579
Maximum of Logged Data	1.633	SD of logged Data	0.557

Assuming Lognormal Distribution

95% H-UCL	4.169	90% Chebyshev (MVUE) UCL	3.407
95% Chebyshev (MVUE) UCL	4.033	97.5% Chebyshev (MVUE) UCL	4.901
99% Chebyshev (MVUE) UCL	6.606		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	3.106	95% Jackknife UCL	3.335
95% Standard Bootstrap UCL	2.972	95% Bootstrap-t UCL	7.137
95% Hall's Bootstrap UCL	7.43	95% Percentile Bootstrap UCL	3.163
95% BCA Bootstrap UCL	3.403		
90% Chebyshev(Mean, Sd) UCL	3.947	95% Chebyshev(Mean, Sd) UCL	4.79
97.5% Chebyshev(Mean, Sd) UCL	5.96	99% Chebyshev(Mean, Sd) UCL	8.26

ProUCL Output
Eagle Point Lake
Snail Tissue

Suggested UCL to Use

95% Adjusted Gamma UCL 4.712

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.156	Mean	0.348
Maximum	0.566	Median	0.338
SD	0.175	Std. Error of Mean	0.0712
Coefficient of Variation	0.501	Skewness	0.123

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.877	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.256	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.492	95% Adjusted-CLT UCL (Chen-1995)	0.469
		95% Modified-t UCL (Johnson-1978)	0.492

Gamma GOF Test

A-D Test Statistic	0.468	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.699	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.261	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.421	k star (bias corrected MLE)	2.321
Theta hat (MLE)	0.0788	Theta star (bias corrected MLE)	0.15
nu hat (MLE)	53.05	nu star (bias corrected)	27.86
MLE Mean (bias corrected)	0.348	MLE Sd (bias corrected)	0.229
		Approximate Chi Square Value (0.05)	16.82
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	13.82

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.577	95% Adjusted Gamma UCL (use when n<50)	0.702

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.883	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.252	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.858	Mean of logged Data	-1.172
Maximum of Logged Data	-0.569	SD of logged Data	0.544

Assuming Lognormal Distribution

95% H-UCL	0.7	90% Chebyshev (MVUE) UCL	0.582
95% Chebyshev (MVUE) UCL	0.687	97.5% Chebyshev (MVUE) UCL	0.833
99% Chebyshev (MVUE) UCL	1.12		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

ProUCL Output
Eagle Point Lake
Snail Tissue

Nonparametric Distribution Free UCLs

95% CLT UCL	0.465	95% Jackknife UCL	0.492
95% Standard Bootstrap UCL	0.455	95% Bootstrap-t UCL	0.514
95% Hall's Bootstrap UCL	0.419	95% Percentile Bootstrap UCL	0.451
95% BCA Bootstrap UCL	0.454		
90% Chebyshev(Mean, Sd) UCL	0.562	95% Chebyshev(Mean, Sd) UCL	0.659
97.5% Chebyshev(Mean, Sd) UCL	0.793	99% Chebyshev(Mean, Sd) UCL	1.057

Suggested UCL to Use

95% Student's-t UCL	0.492

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
Number of Detects	5	Number of Non-Detects	1
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	0.11	Minimum Non-Detect	0.0962
Maximum Detect	0.625	Maximum Non-Detect	0.0962
Variance Detects	0.0464	Percent Non-Detects	16.67%
Mean Detects	0.389	SD Detects	0.215
Median Detects	0.321	CV Detects	0.554
Skewness Detects	-0.0705	Kurtosis Detects	-1.717
Mean of Logged Detects	-1.109	SD of Logged Detects	0.7

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.913	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.224	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.34	KM Standard Error of Mean	0.0945
KM SD	0.207	95% KM (BCA) UCL	0.471
95% KM (t) UCL	0.531	95% KM (Percentile Bootstrap) UCL	0.477
95% KM (z) UCL	0.496	95% KM Bootstrap t UCL	0.56
90% KM Chebyshev UCL	0.624	95% KM Chebyshev UCL	0.752
97.5% KM Chebyshev UCL	0.93	99% KM Chebyshev UCL	1.28

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.357	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.682	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.235	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.359	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.19	k star (bias corrected MLE)	1.409
Theta hat (MLE)	0.122	Theta star (bias corrected MLE)	0.276
nu hat (MLE)	31.9	nu star (bias corrected)	14.09
Mean (detects)	0.389		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.326
Maximum	0.625	Median	0.311
SD	0.247	CV	0.758
k hat (MLE)	1.011	k star (bias corrected MLE)	0.616
Theta hat (MLE)	0.322	Theta star (bias corrected MLE)	0.529
nu hat (MLE)	12.13	nu star (bias corrected)	7.398
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (7.40, α)	2.391	Adjusted Chi Square Value (7.40, β)	1.495
95% Gamma Approximate UCL (use when n>=50)	1.008	95% Gamma Adjusted UCL (use when n<50)	1.612

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.34	SD (KM)	0.207
Variance (KM)	0.0428	SE of Mean (KM)	0.0945
k hat (KM)	2.703	k star (KM)	1.462
nu hat (KM)	32.43	nu star (KM)	17.55
theta hat (KM)	0.126	theta star (KM)	0.233
80% gamma percentile (KM)	0.528	90% gamma percentile (KM)	0.713
95% gamma percentile (KM)	0.894	99% gamma percentile (KM)	1.302

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (17.55, α)	9.065	Adjusted Chi Square Value (17.55, β)	6.977
95% Gamma Approximate KM-UCL (use when n>=50)	0.659	95% Gamma Adjusted KM-UCL (use when n<50)	0.856

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.885	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.248	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.334	Mean in Log Scale	-1.391
SD in Original Scale	0.235	SD in Log Scale	0.932
95% t UCL (assumes normality of ROS data)	0.527	95% Percentile Bootstrap UCL	0.471
95% BCA Bootstrap UCL	0.502	95% Bootstrap t UCL	0.584
95% H-UCL (Log ROS)	1.933		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.314	KM Geo Mean	0.269
KM SD (logged)	0.733	95% Critical H Value (KM-Log)	3.27
KM Standard Error of Mean (logged)	0.335	95% H-UCL (KM -Log)	1.026
KM SD (logged)	0.733	95% Critical H Value (KM-Log)	3.27
KM Standard Error of Mean (logged)	0.335		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.332	Mean in Log Scale	-1.43
SD in Original Scale	0.238	SD in Log Scale	1.005
95% t UCL (Assumes normality)	0.528	95% H-Stat UCL	2.551

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.531

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	29.7	Mean	58.02
Maximum	98.1	Median	57.95
SD	22.96	Std. Error of Mean	9.372
Coefficient of Variation	0.396	Skewness	0.957

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.918	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.282	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	76.9	95% Adjusted-CLT UCL (Chen-1995)	77.35
		95% Modified-t UCL (Johnson-1978)	77.51

Gamma GOF Test

A-D Test Statistic	0.296	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.231	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	7.907	k star (bias corrected MLE)	4.065
Theta hat (MLE)	7.337	Theta star (bias corrected MLE)	14.27
nu hat (MLE)	94.89	nu star (bias corrected)	48.78
MLE Mean (bias corrected)	58.02	MLE Sd (bias corrected)	28.78
		Approximate Chi Square Value (0.05)	33.74
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	29.3

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	83.86	95% Adjusted Gamma UCL (use when n<50)	96.58

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.958	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.22	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.391	Mean of logged Data	3.996
Maximum of Logged Data	4.586	SD of logged Data	0.397

Assuming Lognormal Distribution

95% H-UCL	90.22	90% Chebyshev (MVUE) UCL	86.23
95% Chebyshev (MVUE) UCL	99	97.5% Chebyshev (MVUE) UCL	116.7
99% Chebyshev (MVUE) UCL	151.5		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	73.43	95% Jackknife UCL	76.9
95% Standard Bootstrap UCL	71.65	95% Bootstrap-t UCL	82.36
95% Hall's Bootstrap UCL	104.3	95% Percentile Bootstrap UCL	72.35
95% BCA Bootstrap UCL	75.87		
90% Chebyshev(Mean, Sd) UCL	86.13	95% Chebyshev(Mean, Sd) UCL	98.87
97.5% Chebyshev(Mean, Sd) UCL	116.5	99% Chebyshev(Mean, Sd) UCL	151.3

ProUCL Output
Eagle Point Lake
Snail Tissue

Suggested UCL to Use

95% Student's-t UCL 76.9

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	3.98	Mean	6.058
Maximum	10.3	Median	5.01
SD	2.477	Std. Error of Mean	1.011
Coefficient of Variation	0.409	Skewness	1.272

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.832	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.328	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	8.096	95% Adjusted-CLT UCL (Chen-1995)	8.283
		95% Modified-t UCL (Johnson-1978)	8.183

Gamma GOF Test

A-D Test Statistic	0.504	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.323	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	8.29	k star (bias corrected MLE)	4.256
Theta hat (MLE)	0.731	Theta star (bias corrected MLE)	1.423
nu hat (MLE)	99.48	nu star (bias corrected)	51.07
MLE Mean (bias corrected)	6.058	MLE Sd (bias corrected)	2.937
		Approximate Chi Square Value (0.05)	35.66
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	31.08

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	8.677	95% Adjusted Gamma UCL (use when n<50)	9.956

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.88	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.298	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.381	Mean of logged Data	1.74
Maximum of Logged Data	2.332	SD of logged Data	0.372

Assuming Lognormal Distribution

95% H-UCL	9.042	90% Chebyshev (MVUE) UCL	8.781
95% Chebyshev (MVUE) UCL	10.03	97.5% Chebyshev (MVUE) UCL	11.75
99% Chebyshev (MVUE) UCL	15.15		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	7.722	95% Jackknife UCL	8.096
95% Standard Bootstrap UCL	7.588	95% Bootstrap-t UCL	13.56
95% Hall's Bootstrap UCL	20.64	95% Percentile Bootstrap UCL	7.697
95% BCA Bootstrap UCL	7.99		
90% Chebyshev(Mean, Sd) UCL	9.092	95% Chebyshev(Mean, Sd) UCL	10.47
97.5% Chebyshev(Mean, Sd) UCL	12.37	99% Chebyshev(Mean, Sd) UCL	16.12

Suggested UCL to Use

95% Student's-t UCL 8.096

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.926	Mean	1.244
Maximum	2.06	Median	1.135
SD	0.415	Std. Error of Mean	0.169
Coefficient of Variation	0.333	Skewness	2.071

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.744	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.356	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.585	95% Adjusted-CLT UCL (Chen-1995)	1.675
		95% Modified-t UCL (Johnson-1978)	1.608

Gamma GOF Test

A-D Test Statistic	0.656	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.325	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	13.48	k star (bias corrected MLE)	6.853
Theta hat (MLE)	0.0922	Theta star (bias corrected MLE)	0.181
nu hat (MLE)	161.8	nu star (bias corrected)	82.24
MLE Mean (bias corrected)	1.244	MLE Sd (bias corrected)	0.475
		Approximate Chi Square Value (0.05)	62.34
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	56.12

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1.64	95% Adjusted Gamma UCL (use when n<50)	1.822

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.824	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.307	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

ProUCL Output
Eagle Point Lake
Snail Tissue

Lognormal Statistics

Minimum of Logged Data	-0.0769	Mean of logged Data	0.18
Maximum of Logged Data	0.723	SD of logged Data	0.285

Assuming Lognormal Distribution

95% H-UCL	1.651	90% Chebyshev (MVUE) UCL	1.671
95% Chebyshev (MVUE) UCL	1.866	97.5% Chebyshev (MVUE) UCL	2.138
99% Chebyshev (MVUE) UCL	2.672		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.522	95% Jackknife UCL	1.585
95% Standard Bootstrap UCL	1.494	95% Bootstrap-t UCL	2.081
95% Hall's Bootstrap UCL	2.794	95% Percentile Bootstrap UCL	1.543
95% BCA Bootstrap UCL	1.601		
90% Chebyshev(Mean, Sd) UCL	1.751	95% Chebyshev(Mean, Sd) UCL	1.981
97.5% Chebyshev(Mean, Sd) UCL	2.301	99% Chebyshev(Mean, Sd) UCL	2.928

Suggested UCL to Use

95% Adjusted Gamma UCL 1.822

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Eagle Point Lake
Forage Fish Tissue

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/12/2021 4:15:38 PM
From File	FWM_ProUCL_Input_e.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
Number of Detects	7	Number of Non-Detects	1
Number of Distinct Detects	7	Number of Distinct Non-Detects	1
Minimum Detect	0.166	Minimum Non-Detect	0.0985
Maximum Detect	2.55	Maximum Non-Detect	0.0985
Variance Detects	0.725	Percent Non-Detects	12.5%
Mean Detects	1.099	SD Detects	0.852
Median Detects	1.02	CV Detects	0.775
Skewness Detects	0.662	Kurtosis Detects	0.0729
Mean of Logged Detects	-0.292	SD of Logged Detects	1.084

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.912	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.236	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.974	KM Standard Error of Mean	0.309
KM SD	0.808	95% KM (BCA) UCL	1.469
95% KM (t) UCL	1.559	95% KM (Percentile Bootstrap) UCL	1.472
95% KM (z) UCL	1.482	95% KM Bootstrap t UCL	1.712
90% KM Chebyshev UCL	1.901	95% KM Chebyshev UCL	2.32
97.5% KM Chebyshev UCL	2.902	99% KM Chebyshev UCL	4.046

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.469	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.722	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.26	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.317	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.435	k star (bias corrected MLE)	0.915
Theta hat (MLE)	0.766	Theta star (bias corrected MLE)	1.201
nu hat (MLE)	20.09	nu star (bias corrected)	12.81
Mean (detects)	1.099		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.963
Maximum	2.55	Median	0.986
SD	0.878	CV	0.911
k hat (MLE)	0.753	k star (bias corrected MLE)	0.554
Theta hat (MLE)	1.279	Theta star (bias corrected MLE)	1.738
nu hat (MLE)	12.05	nu star (bias corrected)	8.868
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (8.87, α)	3.247	Adjusted Chi Square Value (8.87, β)	2.449
95% Gamma Approximate UCL (use when n>=50)	2.631	95% Gamma Adjusted UCL (use when n<50)	3.488

ProUCL Output
Eagle Point Lake
Forage Fish Tissue

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.974	SD (KM)	0.808
Variance (KM)	0.654	SE of Mean (KM)	0.309
k hat (KM)	1.453	k star (KM)	0.991
nu hat (KM)	23.24	nu star (KM)	15.86
theta hat (KM)	0.671	theta star (KM)	0.983
80% gamma percentile (KM)	1.569	90% gamma percentile (KM)	2.248
95% gamma percentile (KM)	2.928	99% gamma percentile (KM)	4.507

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (15.86, α)	7.863	Adjusted Chi Square Value (15.86, β)	6.492
95% Gamma Approximate KM-UCL (use when n>=50)	1.965	95% Gamma Adjusted KM-UCL (use when n<50)	2.38

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.842	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.303	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.969	Mean in Log Scale	-0.608
SD in Original Scale	0.87	SD in Log Scale	1.344
95% t UCL (assumes normality of ROS data)	1.552	95% Percentile Bootstrap UCL	1.468
95% BCA Bootstrap UCL	1.496	95% Bootstrap t UCL	1.719
95% H-UCL (Log ROS)	12.03		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.546	KM Geo Mean	0.58
KM SD (logged)	1.153	95% Critical H Value (KM-Log)	3.813
KM Standard Error of Mean (logged)	0.44	95% H-UCL (KM -Log)	5.939
KM SD (logged)	1.153	95% Critical H Value (KM-Log)	3.813
KM Standard Error of Mean (logged)	0.44		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.968	Mean in Log Scale	-0.632
SD in Original Scale	0.872	SD in Log Scale	1.39
95% t UCL (Assumes normality)	1.552	95% H-Stat UCL	14.37

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 1.559

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
Number of Detects	7	Number of Non-Detects	1
Number of Distinct Detects	7	Number of Distinct Non-Detects	1
Minimum Detect	0.107	Minimum Non-Detect	0.0985
Maximum Detect	2.87	Maximum Non-Detect	0.0985
Variance Detects	0.875	Percent Non-Detects	12.5%
Mean Detects	1.047	SD Detects	0.936
Median Detects	1.108	CV Detects	0.894
Skewness Detects	1.249	Kurtosis Detects	2.285
Mean of Logged Detects	-0.463	SD of Logged Detects	1.27

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

ProUCL Output
Eagle Point Lake
Forage Fish Tissue

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.862	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.279	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.928	KM Standard Error of Mean	0.332
KM SD	0.869	95% KM (BCA) UCL	1.479
95% KM (t) UCL	1.557	95% KM (Percentile Bootstrap) UCL	1.457
95% KM (z) UCL	1.474	95% KM Bootstrap t UCL	1.85
90% KM Chebyshev UCL	1.923	95% KM Chebyshev UCL	2.374
97.5% KM Chebyshev UCL	3	99% KM Chebyshev UCL	4.229

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.478	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.726	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.219	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.319	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.12	k star (bias corrected MLE)	0.735
Theta hat (MLE)	0.935	Theta star (bias corrected MLE)	1.424
nu hat (MLE)	15.68	nu star (bias corrected)	10.29
Mean (detects)	1.047		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.917
Maximum	2.87	Median	0.912
SD	0.941	CV	1.026
k hat (MLE)	0.679	k star (bias corrected MLE)	0.507
Theta hat (MLE)	1.351	Theta star (bias corrected MLE)	1.807
nu hat (MLE)	10.86	nu star (bias corrected)	8.12
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (8.12, α)	2.805	Adjusted Chi Square Value (8.12, β)	2.078
95% Gamma Approximate UCL (use when n>=50)	2.655	95% Gamma Adjusted UCL (use when n<50)	3.584

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.928	SD (KM)	0.869
Variance (KM)	0.755	SE of Mean (KM)	0.332
k hat (KM)	1.141	k star (KM)	0.797
nu hat (KM)	18.26	nu star (KM)	12.74
theta hat (KM)	0.813	theta star (KM)	1.165
80% gamma percentile (KM)	1.517	90% gamma percentile (KM)	2.259
95% gamma percentile (KM)	3.015	99% gamma percentile (KM)	4.802

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (12.74, α)	5.721	Adjusted Chi Square Value (12.74, β)	4.588
95% Gamma Approximate KM-UCL (use when n>=50)	2.067	95% Gamma Adjusted KM-UCL (use when n<50)	2.578

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.842	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.254	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.92	Mean in Log Scale	-0.832
SD in Original Scale	0.937	SD in Log Scale	1.571
95% t UCL (assumes normality of ROS data)	1.548	95% Percentile Bootstrap UCL	1.41
95% BCA Bootstrap UCL	1.555	95% Bootstrap t UCL	1.815
95% H-UCL (Log ROS)	28.02		

ProUCL Output
Eagle Point Lake
Forage Fish Tissue

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.695	KM Geo Mean	0.499
KM SD (logged)	1.259	95% Critical H Value (KM-Log)	4.092
KM Standard Error of Mean (logged)	0.481	95% H-UCL (KM -Log)	7.724
KM SD (logged)	1.259	95% Critical H Value (KM-Log)	4.092
KM Standard Error of Mean (logged)	0.481		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.922	Mean in Log Scale	-0.782
SD in Original Scale	0.935	SD in Log Scale	1.481
95% t UCL (Assumes normality)	1.548	95% H-Stat UCL	18.89

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 1.557

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	4.05	Mean	11.71
Maximum	17.6	Median	12.59
SD	5.164	Std. Error of Mean	1.826
Coefficient of Variation	0.441	Skewness	-0.343

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.91	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.198	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	15.16	95% Adjusted-CLT UCL (Chen-1995)	14.47
		95% Modified-t UCL (Johnson-1978)	15.13

Gamma GOF Test

A-D Test Statistic	0.425	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.719	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.23	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.295	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.724	k star (bias corrected MLE)	3.036
Theta hat (MLE)	2.478	Theta star (bias corrected MLE)	3.856
nu hat (MLE)	75.58	nu star (bias corrected)	48.57
MLE Mean (bias corrected)	11.71	MLE Sd (bias corrected)	6.718
		Approximate Chi Square Value (0.05)	33.57
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	30.45

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	16.93	95% Adjusted Gamma UCL (use when n<50)	18.67

ProUCL Output
Eagle Point Lake
Forage Fish Tissue

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.887	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.222	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.399	Mean of logged Data	2.351
Maximum of Logged Data	2.868	SD of logged Data	0.535

Assuming Lognormal Distribution

95% H-UCL	19.72	90% Chebyshev (MVUE) UCL	18.68
95% Chebyshev (MVUE) UCL	21.76	97.5% Chebyshev (MVUE) UCL	26.05
99% Chebyshev (MVUE) UCL	34.45		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	14.71	95% Jackknife UCL	15.16
95% Standard Bootstrap UCL	14.53	95% Bootstrap-t UCL	14.93
95% Hall's Bootstrap UCL	14.07	95% Percentile Bootstrap UCL	14.44
95% BCA Bootstrap UCL	14.3		
90% Chebyshev(Mean, Sd) UCL	17.18	95% Chebyshev(Mean, Sd) UCL	19.66
97.5% Chebyshev(Mean, Sd) UCL	23.11	99% Chebyshev(Mean, Sd) UCL	29.87

Suggested UCL to Use

95% Student's-t UCL 15.16

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
Number of Detects	7	Number of Non-Detects	1
Number of Distinct Detects	7	Number of Distinct Non-Detects	1
Minimum Detect	0.175	Minimum Non-Detect	0.1
Maximum Detect	0.51	Maximum Non-Detect	0.1
Variance Detects	0.013	Percent Non-Detects	12.5%
Mean Detects	0.265	SD Detects	0.114
Median Detects	0.23	CV Detects	0.432
Skewness Detects	2.106	Kurtosis Detects	4.83
Mean of Logged Detects	-1.391	SD of Logged Detects	0.356

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.746	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.318	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.244	KM Standard Error of Mean	0.0431
KM SD	0.113	95% KM (BCA) UCL	0.315
95% KM (t) UCL	0.326	95% KM (Percentile Bootstrap) UCL	0.313
95% KM (z) UCL	0.315	95% KM Bootstrap t UCL	0.376
90% KM Chebyshev UCL	0.373	95% KM Chebyshev UCL	0.432
97.5% KM Chebyshev UCL	0.513	99% KM Chebyshev UCL	0.673

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.611	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.709	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.263	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.312	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	8.286	k star (bias corrected MLE)	4.83
Theta hat (MLE)	0.0319	Theta star (bias corrected MLE)	0.0548
nu hat (MLE)	116	nu star (bias corrected)	67.63
Mean (detects)	0.265		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0505	Mean	0.238
Maximum	0.51	Median	0.215
SD	0.13	CV	0.547
k hat (MLE)	3.397	k star (bias corrected MLE)	2.206
Theta hat (MLE)	0.07	Theta star (bias corrected MLE)	0.108
nu hat (MLE)	54.35	nu star (bias corrected)	35.3
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (35.30, α)	22.71	Adjusted Chi Square Value (35.30, β)	20.19
95% Gamma Approximate UCL (use when n>=50)	0.37	95% Gamma Adjusted UCL (use when n<50)	0.416

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.244	SD (KM)	0.113
Variance (KM)	0.0127	SE of Mean (KM)	0.0431
k hat (KM)	4.674	k star (KM)	3.004
nu hat (KM)	74.78	nu star (KM)	48.07
theta hat (KM)	0.0522	theta star (KM)	0.0812
80% gamma percentile (KM)	0.348	90% gamma percentile (KM)	0.433
95% gamma percentile (KM)	0.512	99% gamma percentile (KM)	0.683

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (48.07, α)	33.16	Adjusted Chi Square Value (48.07, β)	30.05
95% Gamma Approximate KM-UCL (use when n>=50)	0.354	95% Gamma Adjusted KM-UCL (use when n<50)	0.39

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.857	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.243	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.245	Mean in Log Scale	-1.496
SD in Original Scale	0.119	SD in Log Scale	0.444
95% t UCL (assumes normality of ROS data)	0.325	95% Percentile Bootstrap UCL	0.32
95% BCA Bootstrap UCL	0.33	95% Bootstrap t UCL	0.382
95% H-UCL (Log ROS)	0.361		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.505	KM Geo Mean	0.222
KM SD (logged)	0.431	95% Critical H Value (KM-Log)	2.242
KM Standard Error of Mean (logged)	0.165	95% H-UCL (KM -Log)	0.351
KM SD (logged)	0.431	95% Critical H Value (KM-Log)	2.242
KM Standard Error of Mean (logged)	0.165		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.238	Mean in Log Scale	-1.592
SD in Original Scale	0.13	SD in Log Scale	0.656
95% t UCL (Assumes normality)	0.325	95% H-Stat UCL	0.486

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

ProUCL Output
Eagle Point Lake
Forage Fish Tissue

Suggested UCL to Use

95% KM Adjusted Gamma UCL	0.39	95% GROS Adjusted Gamma UCL	0.416

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	7
Number of Detects	4	Number of Non-Detects	4
Number of Distinct Detects	4	Number of Distinct Non-Detects	4
Minimum Detect	0.146	Minimum Non-Detect	0.1
Maximum Detect	0.447	Maximum Non-Detect	0.146
Variance Detects	0.0186	Percent Non-Detects	50%
Mean Detects	0.256	SD Detects	0.136
Median Detects	0.215	CV Detects	0.533
Skewness Detects	1.331	Kurtosis Detects	1.277
Mean of Logged Detects	-1.462	SD of Logged Detects	0.5

Note: Sample size is small (e.g., <10), If data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.88	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.241	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.178	KM Standard Error of Mean	0.0466
KM SD	0.114	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.266	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.255	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.318	95% KM Chebyshev UCL	0.381
97.5% KM Chebyshev UCL	0.469	99% KM Chebyshev UCL	0.642

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.324	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.659	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.263	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.396	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	5.261	k star (bias corrected MLE)	1.482
Theta hat (MLE)	0.0486	Theta star (bias corrected MLE)	0.173
nu hat (MLE)	42.09	nu star (bias corrected)	11.86
Mean (detects)	0.256		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.133
Maximum	0.447	Median	0.078
SD	0.159	CV	1.195
k hat (MLE)	0.608	k star (bias corrected MLE)	0.463
Theta hat (MLE)	0.219	Theta star (bias corrected MLE)	0.287
nu hat (MLE)	9.722	nu star (bias corrected)	7.409
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (7.41, α)	2.398	Adjusted Chi Square Value (7.41, β)	1.741
95% Gamma Approximate UCL (use when n>=50)	0.411	95% Gamma Adjusted UCL (use when n<50)	N/A

ProUCL Output
Eagle Point Lake
Forage Fish Tissue

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.178	SD (KM)	0.114
Variance (KM)	0.013	SE of Mean (KM)	0.0466
k hat (KM)	2.426	k star (KM)	1.6
nu hat (KM)	38.82	nu star (KM)	25.59
theta hat (KM)	0.0733	theta star (KM)	0.111
80% gamma percentile (KM)	0.273	90% gamma percentile (KM)	0.365
95% gamma percentile (KM)	0.454	99% gamma percentile (KM)	0.653

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (25.59, α)	15.07	Adjusted Chi Square Value (25.59, β)	13.07
95% Gamma Approximate KM-UCL (use when n>=50)	0.302	95% Gamma Adjusted KM-UCL (use when n<50)	0.348

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.938	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.229	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.152	Mean in Log Scale	-2.247
SD in Original Scale	0.142	SD in Log Scale	0.901
95% t UCL (assumes normality of ROS data)	0.247	95% Percentile Bootstrap UCL	0.236
95% BCA Bootstrap UCL	0.251	95% Bootstrap t UCL	0.335
95% H-UCL (Log ROS)	0.47		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.882	KM Geo Mean	0.152
KM SD (logged)	0.52	95% Critical H Value (KM-Log)	2.389
KM Standard Error of Mean (logged)	0.212	95% H-UCL (KM -Log)	0.279
KM SD (logged)	0.52	95% Critical H Value (KM-Log)	2.389
KM Standard Error of Mean (logged)	0.212		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.16	Mean in Log Scale	-2.111
SD in Original Scale	0.136	SD in Log Scale	0.775
95% t UCL (Assumes normality)	0.251	95% H-Stat UCL	0.382

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.266

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
Number of Detects	6	Number of Non-Detects	2
Number of Distinct Detects	6	Number of Distinct Non-Detects	2
Minimum Detect	0.102	Minimum Non-Detect	0.0976
Maximum Detect	1.425	Maximum Non-Detect	0.0985
Variance Detects	0.236	Percent Non-Detects	25%
Mean Detects	0.982	SD Detects	0.486
Median Detects	1.115	CV Detects	0.495
Skewness Detects	-1.413	Kurtosis Detects	2.001
Mean of Logged Detects	-0.275	SD of Logged Detects	1.005

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

ProUCL Output
Eagle Point Lake
Forage Fish Tissue

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.86	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.233	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.761	KM Standard Error of Mean	0.21
KM SD	0.542	95% KM (BCA) UCL	1.093
95% KM (t) UCL	1.159	95% KM (Percentile Bootstrap) UCL	1.075
95% KM (z) UCL	1.107	95% KM Bootstrap t UCL	1.086
90% KM Chebyshev UCL	1.391	95% KM Chebyshev UCL	1.677
97.5% KM Chebyshev UCL	2.073	99% KM Chebyshev UCL	2.851

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.861	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.704	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.34	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.336	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.099	k star (bias corrected MLE)	1.161
Theta hat (MLE)	0.468	Theta star (bias corrected MLE)	0.846
nu hat (MLE)	25.19	nu star (bias corrected)	13.93
Mean (detects)	0.982		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.102	Mean	0.798
Maximum	1.425	Median	0.894
SD	0.534	CV	0.67
k hat (MLE)	1.65	k star (bias corrected MLE)	1.115
Theta hat (MLE)	0.483	Theta star (bias corrected MLE)	0.716
nu hat (MLE)	26.4	nu star (bias corrected)	17.83
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (17.83, α)	9.271	Adjusted Chi Square Value (17.83, β)	7.76
95% Gamma Approximate UCL (use when n>=50)	1.534	95% Gamma Adjusted UCL (use when n<50)	1.833

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.761	SD (KM)	0.542
Variance (KM)	0.294	SE of Mean (KM)	0.21
k hat (KM)	1.968	k star (KM)	1.314
nu hat (KM)	31.49	nu star (KM)	21.02
theta hat (KM)	0.387	theta star (KM)	0.579
80% gamma percentile (KM)	1.194	90% gamma percentile (KM)	1.638
95% gamma percentile (KM)	2.073	99% gamma percentile (KM)	3.065

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (21.02, α)	11.6	Adjusted Chi Square Value (21.02, β)	9.883
95% Gamma Approximate KM-UCL (use when n>=50)	1.378	95% Gamma Adjusted KM-UCL (use when n<50)	1.618

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.673	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.374	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.764	Mean in Log Scale	-0.759
SD in Original Scale	0.576	SD in Log Scale	1.235
95% t UCL (assumes normality of ROS data)	1.15	95% Percentile Bootstrap UCL	1.064
95% BCA Bootstrap UCL	1.061	95% Bootstrap t UCL	1.107
95% H-UCL (Log ROS)	6.575		

ProUCL Output
Eagle Point Lake
Forage Fish Tissue

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.788	KM Geo Mean	0.455
KM SD (logged)	1.192	95% Critical H Value (KM-Log)	3.914
KM Standard Error of Mean (logged)	0.462	95% H-UCL (KM -Log)	5.394
KM SD (logged)	1.192	95% Critical H Value (KM-Log)	3.914
KM Standard Error of Mean (logged)	0.462		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.749	Mean in Log Scale	-0.96
SD in Original Scale	0.596	SD in Log Scale	1.527
95% t UCL (Assumes normality)	1.148	95% H-Stat UCL	19.74

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 1.159

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOS|ug/kg

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	549	Mean	1630
Maximum	2540	Median	1765
SD	707.9	Std. Error of Mean	250.3
Coefficient of Variation	0.434	Skewness	-0.313

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.939	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.175	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	2104	95% Adjusted-CLT UCL (Chen-1995)	2012
		95% Modified-t UCL (Johnson-1978)	2100

Gamma GOF Test

A-D Test Statistic	0.383	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.719	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.211	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.295	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.859	k star (bias corrected MLE)	3.12
Theta hat (MLE)	335.4	Theta star (bias corrected MLE)	522.3
nu hat (MLE)	77.75	nu star (bias corrected)	49.93
MLE Mean (bias corrected)	1630	MLE Sd (bias corrected)	922.7
		Approximate Chi Square Value (0.05)	34.7
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	31.52

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	2345	95% Adjusted Gamma UCL (use when n<50)	2582

ProUCL Output
Eagle Point Lake
Forage Fish Tissue

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.898	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.206	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	6.308	Mean of logged Data	7.29
Maximum of Logged Data	7.84	SD of logged Data	0.529

Assuming Lognormal Distribution

95% H-UCL	2725	90% Chebyshev (MVUE) UCL	2591
95% Chebyshev (MVUE) UCL	3016	97.5% Chebyshev (MVUE) UCL	3605
99% Chebyshev (MVUE) UCL	4763		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2042	95% Jackknife UCL	2104
95% Standard Bootstrap UCL	2020	95% Bootstrap-t UCL	2055
95% Hall's Bootstrap UCL	1969	95% Percentile Bootstrap UCL	2013
95% BCA Bootstrap UCL	1990		
90% Chebyshev(Mean, Sd) UCL	2381	95% Chebyshev(Mean, Sd) UCL	2721
97.5% Chebyshev(Mean, Sd) UCL	3193	99% Chebyshev(Mean, Sd) UCL	4120

Suggested UCL to Use

95% Student's-t UCL 2104

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFDS|ug/kg

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.183	Mean	1.052
Maximum	1.859	Median	0.974
SD	0.508	Std. Error of Mean	0.18
Coefficient of Variation	0.483	Skewness	-0.0544

Note: Sample size is small (e.g., <10), If data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.97	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.168	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.393	95% Adjusted-CLT UCL (Chen-1995)	1.344
		95% Modified-t UCL (Johnson-1978)	1.392

Gamma GOF Test

A-D Test Statistic	0.464	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.226	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.296	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

ProUCL Output
Eagle Point Lake
Forage Fish Tissue

Gamma Statistics

k hat (MLE)	3.264	k star (bias corrected MLE)	2.124
Theta hat (MLE)	0.322	Theta star (bias corrected MLE)	0.496
nu hat (MLE)	52.23	nu star (bias corrected)	33.98
MLE Mean (bias corrected)	1.052	MLE Sd (bias corrected)	0.722
		Approximate Chi Square Value (0.05)	21.65
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	19.2

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1.652	95% Adjusted Gamma UCL (use when n<50)	1.863

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.814	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.272	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level	

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.698	Mean of logged Data	-0.11
Maximum of Logged Data	0.62	SD of logged Data	0.707

Assuming Lognormal Distribution

95% H-UCL	2.4	90% Chebyshev (MVUE) UCL	1.956
95% Chebyshev (MVUE) UCL	2.339	97.5% Chebyshev (MVUE) UCL	2.871
99% Chebyshev (MVUE) UCL	3.915		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.348	95% Jackknife UCL	1.393
95% Standard Bootstrap UCL	1.329	95% Bootstrap-t UCL	1.414
95% Hall's Bootstrap UCL	1.439	95% Percentile Bootstrap UCL	1.329
95% BCA Bootstrap UCL	1.327		
90% Chebyshev(Mean, Sd) UCL	1.592	95% Chebyshev(Mean, Sd) UCL	1.836
97.5% Chebyshev(Mean, Sd) UCL	2.175	99% Chebyshev(Mean, Sd) UCL	2.841

Suggested UCL to Use

95% Student's-t UCL 1.393

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFOSA|ug/kg

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	1.61	Mean	9.29
Maximum	25.6	Median	8.028
SD	7.743	Std. Error of Mean	2.738
Coefficient of Variation	0.833	Skewness	1.465

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.874	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.224	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	14.48	95% Adjusted-CLT UCL (Chen-1995)	15.31
		95% Modified-t UCL (Johnson-1978)	14.71

Gamma GOF Test

A-D Test Statistic	0.161	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.727	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.122	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.298	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.713	k star (bias corrected MLE)	1.154
Theta hat (MLE)	5.425	Theta star (bias corrected MLE)	8.052
nu hat (MLE)	27.4	nu star (bias corrected)	18.46
MLE Mean (bias corrected)	9.29	MLE Sd (bias corrected)	8.649
		Approximate Chi Square Value (0.05)	9.723
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	8.17

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	17.64	95% Adjusted Gamma UCL (use when n<50)	20.99

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.98	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.146	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.476	Mean of logged Data	1.909
Maximum of Logged Data	3.243	SD of logged Data	0.899

Assuming Lognormal Distribution

95% H-UCL	29.77	90% Chebyshev (MVUE) UCL	18.71
95% Chebyshev (MVUE) UCL	22.89	97.5% Chebyshev (MVUE) UCL	28.69
99% Chebyshev (MVUE) UCL	40.09		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	13.79	95% Jackknife UCL	14.48
95% Standard Bootstrap UCL	13.48	95% Bootstrap-t UCL	18.33
95% Hall's Bootstrap UCL	37.23	95% Percentile Bootstrap UCL	13.75
95% BCA Bootstrap UCL	15.09		
90% Chebyshev(Mean, Sd) UCL	17.5	95% Chebyshev(Mean, Sd) UCL	21.22
97.5% Chebyshev(Mean, Sd) UCL	26.39	99% Chebyshev(Mean, Sd) UCL	36.53

Suggested UCL to Use

95% Student's-t UCL 14.48

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

N-EtFOSAA|ug/kg

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.455	Mean	1.226
Maximum	3.4	Median	0.934
SD	0.948	Std. Error of Mean	0.335
Coefficient of Variation	0.773	Skewness	2.085

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

ProUCL Output
Eagle Point Lake
Forage Fish Tissue

Normal GOF Test

Shapiro Wilk Test Statistic	0.764	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.269	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level	

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.862	95% Adjusted-CLT UCL (Chen-1995)	2.042
		95% Modified-t UCL (Johnson-1978)	1.903

Gamma GOF Test

A-D Test Statistic	0.374	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.722	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.176	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.297	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.687	k star (bias corrected MLE)	1.762
Theta hat (MLE)	0.456	Theta star (bias corrected MLE)	0.696
nu hat (MLE)	42.99	nu star (bias corrected)	28.2
MLE Mean (bias corrected)	1.226	MLE Sd (bias corrected)	0.924
		Approximate Chi Square Value (0.05)	17.08
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	14.94

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	2.024	95% Adjusted Gamma UCL (use when n<50)	2.315

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.954	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.147	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.787	Mean of logged Data	0.00646
Maximum of Logged Data	1.224	SD of logged Data	0.636

Assuming Lognormal Distribution

95% H-UCL	2.305	90% Chebyshev (MVUE) UCL	2.017
95% Chebyshev (MVUE) UCL	2.388	97.5% Chebyshev (MVUE) UCL	2.903
99% Chebyshev (MVUE) UCL	3.915		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.778	95% Jackknife UCL	1.862
95% Standard Bootstrap UCL	1.748	95% Bootstrap-t UCL	2.575
95% Hall's Bootstrap UCL	3.962	95% Percentile Bootstrap UCL	1.817
95% BCA Bootstrap UCL	2.006		
90% Chebyshev(Mean, Sd) UCL	2.232	95% Chebyshev(Mean, Sd) UCL	2.688
97.5% Chebyshev(Mean, Sd) UCL	3.32	99% Chebyshev(Mean, Sd) UCL	4.563

Suggested UCL to Use

95% Student's-t UCL 1.862

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Eagle Point Lake
Forage Fish Tissue

PFHpS (ug/kg)

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.394	Mean	2.266
Maximum	3.994	Median	2.753
SD	1.613	Std. Error of Mean	0.57
Coefficient of Variation	0.712	Skewness	-0.342

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.811	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.248	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	3.347	95% Adjusted-CLT UCL (Chen-1995)	3.131
		95% Modified-t UCL (Johnson-1978)	3.336

Gamma GOF Test

A-D Test Statistic	0.976	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.73	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.266	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.3	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.382	k star (bias corrected MLE)	0.947
Theta hat (MLE)	1.64	Theta star (bias corrected MLE)	2.394
nu hat (MLE)	22.11	nu star (bias corrected)	15.15
MLE Mean (bias corrected)	2.266	MLE Sd (bias corrected)	2.329
		Approximate Chi Square Value (0.05)	7.366
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	6.047

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	4.661	95% Adjusted Gamma UCL (use when n<50)	5.678

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.739	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.288	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.931	Mean of logged Data	0.415
Maximum of Logged Data	1.385	SD of logged Data	1.099

Assuming Lognormal Distribution

95% H-UCL	12.72	90% Chebyshev (MVUE) UCL	5.467
95% Chebyshev (MVUE) UCL	6.813	97.5% Chebyshev (MVUE) UCL	8.68
99% Chebyshev (MVUE) UCL	12.35		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	3.205	95% Jackknife UCL	3.347
95% Standard Bootstrap UCL	3.145	95% Bootstrap-t UCL	3.225
95% Hall's Bootstrap UCL	2.943	95% Percentile Bootstrap UCL	3.16
95% BCA Bootstrap UCL	3.086		
90% Chebyshev(Mean, Sd) UCL	3.978	95% Chebyshev(Mean, Sd) UCL	4.753
97.5% Chebyshev(Mean, Sd) UCL	5.829	99% Chebyshev(Mean, Sd) UCL	7.942

ProUCL Output
Eagle Point Lake
Forage Fish Tissue

Suggested UCL to Use

95% Student's-t UCL 3.347

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFNS|ug/kg

General Statistics

Total Number of Observations	8	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.567	Mean	2.82
Maximum	5.09	Median	3.056
SD	1.521	Std. Error of Mean	0.538
Coefficient of Variation	0.54	Skewness	0.0432

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.956	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.167	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	3.839	95% Adjusted-CLT UCL (Chen-1995)	3.714
		95% Modified-t UCL (Johnson-1978)	3.841

Gamma GOF Test

A-D Test Statistic	0.356	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.722	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.232	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.296	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.943	k star (bias corrected MLE)	1.923
Theta hat (MLE)	0.958	Theta star (bias corrected MLE)	1.467
nu hat (MLE)	47.09	nu star (bias corrected)	30.76
MLE Mean (bias corrected)	2.82	MLE Sd (bias corrected)	2.034
		Approximate Chi Square Value (0.05)	19.09
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	16.81

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	4.544	95% Adjusted Gamma UCL (use when n<50)	5.161

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.889	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.248	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.567	Mean of logged Data	0.857
Maximum of Logged Data	1.627	SD of logged Data	0.714

Assuming Lognormal Distribution

95% H-UCL	6.418	90% Chebyshev (MVUE) UCL	5.189
95% Chebyshev (MVUE) UCL	6.212	97.5% Chebyshev (MVUE) UCL	7.631
99% Chebyshev (MVUE) UCL	10.42		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	3.705	95% Jackknife UCL	3.839
95% Standard Bootstrap UCL	3.633	95% Bootstrap-t UCL	3.85
95% Hall's Bootstrap UCL	3.808	95% Percentile Bootstrap UCL	3.656
95% BCA Bootstrap UCL	3.652		
90% Chebyshev(Mean, Sd) UCL	4.434	95% Chebyshev(Mean, Sd) UCL	5.165
97.5% Chebyshev(Mean, Sd) UCL	6.179	99% Chebyshev(Mean, Sd) UCL	8.172

Suggested UCL to Use

95% Student's-t UCL 3.839

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFUnA|ug/kg

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.598	Mean	1.729
Maximum	2.23	Median	1.879
SD	0.582	Std. Error of Mean	0.206
Coefficient of Variation	0.336	Skewness	-1.307

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.835	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.275	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2.119	95% Adjusted-CLT UCL (Chen-1995)	1.966
		95% Modified-t UCL (Johnson-1978)	2.103

Gamma GOF Test

A-D Test Statistic	0.828	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.718	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.322	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.295	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	6.914	k star (bias corrected MLE)	4.404
Theta hat (MLE)	0.25	Theta star (bias corrected MLE)	0.393
nu hat (MLE)	110.6	nu star (bias corrected)	70.47
MLE Mean (bias corrected)	1.729	MLE Sd (bias corrected)	0.824
		Approximate Chi Square Value (0.05)	52.14
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	48.18

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	2.337	95% Adjusted Gamma UCL (use when n<50)	2.53

ProUCL Output
Eagle Point Lake
Forage Fish Tissue

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.753	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.332	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.514	Mean of logged Data	0.474
Maximum of Logged Data	0.802	SD of logged Data	0.457

Assuming Lognormal Distribution

95% H-UCL	2.645	90% Chebyshev (MVUE) UCL	2.618
95% Chebyshev (MVUE) UCL	3.007	97.5% Chebyshev (MVUE) UCL	3.548
99% Chebyshev (MVUE) UCL	4.609		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2.068	95% Jackknife UCL	2.119
95% Standard Bootstrap UCL	2.052	95% Bootstrap-t UCL	2.017
95% Hall's Bootstrap UCL	1.981	95% Percentile Bootstrap UCL	2.026
95% BCA Bootstrap UCL	1.977		
90% Chebyshev(Mean, Sd) UCL	2.346	95% Chebyshev(Mean, Sd) UCL	2.626
97.5% Chebyshev(Mean, Sd) UCL	3.014	99% Chebyshev(Mean, Sd) UCL	3.776

Suggested UCL to Use

95% Student's-t UCL 2.119

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.131	Mean	0.603
Maximum	1.19	Median	0.612
SD	0.308	Std. Error of Mean	0.109
Coefficient of Variation	0.511	Skewness	0.54

Note: Sample size is small (e.g., <10), If data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.951	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.21	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.81	95% Adjusted-CLT UCL (Chen-1995)	0.805
		95% Modified-t UCL (Johnson-1978)	0.813

Gamma GOF Test

A-D Test Statistic	0.367	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.72	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.207	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.296	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

ProUCL Output
Eagle Point Lake
Forage Fish Tissue

Gamma Statistics

k hat (MLE)	3.477	k star (bias corrected MLE)	2.256
Theta hat (MLE)	0.174	Theta star (bias corrected MLE)	0.267
nu hat (MLE)	55.63	nu star (bias corrected)	36.1
MLE Mean (bias corrected)	0.603	MLE Sd (bias corrected)	0.402
		Approximate Chi Square Value (0.05)	23.35
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	20.79

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.933	95% Adjusted Gamma UCL (use when n<50)	1.047

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.883	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.245	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.033	Mean of logged Data	-0.656
Maximum of Logged Data	0.174	SD of logged Data	0.654

Assuming Lognormal Distribution

95% H-UCL	1.233	90% Chebyshev (MVUE) UCL	1.062
95% Chebyshev (MVUE) UCL	1.26	97.5% Chebyshev (MVUE) UCL	1.536
99% Chebyshev (MVUE) UCL	2.077		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.783	95% Jackknife UCL	0.81
95% Standard Bootstrap UCL	0.77	95% Bootstrap-t UCL	0.83
95% Hall's Bootstrap UCL	0.902	95% Percentile Bootstrap UCL	0.773
95% BCA Bootstrap UCL	0.79		
90% Chebyshev(Mean, Sd) UCL	0.93	95% Chebyshev(Mean, Sd) UCL	1.078
97.5% Chebyshev(Mean, Sd) UCL	1.284	99% Chebyshev(Mean, Sd) UCL	1.688

Suggested UCL to Use

95% Student's-t UCL 0.81

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

ProUCL Output
Lake Elmo
Forage Fish Tissue

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/22/2021 3:03:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
Number of Detects	8	Number of Non-Detects	1
Number of Distinct Detects	8	Number of Distinct Non-Detects	1
Minimum Detect	0.439	Minimum Non-Detect	0.39
Maximum Detect	0.972	Maximum Non-Detect	0.39
Variance Detects	0.0328	Percent Non-Detects	11.11%
Mean Detects	0.666	SD Detects	0.181
Median Detects	0.601	CV Detects	0.272
Skewness Detects	0.93	Kurtosis Detects	-0.106
Mean of Logged Detects	-0.437	SD of Logged Detects	0.26

Note: Sample size is small (e.g., <10), If data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.862	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.261	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.635	KM Standard Error of Mean	0.0648
KM SD	0.182	95% KM (BCA) UCL	0.731
95% KM (t) UCL	0.756	95% KM (Percentile Bootstrap) UCL	0.742
95% KM (z) UCL	0.742	95% KM Bootstrap t UCL	0.83
90% KM Chebyshev UCL	0.83	95% KM Chebyshev UCL	0.918
97.5% KM Chebyshev UCL	1.04	99% KM Chebyshev UCL	1.28

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.559	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.716	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.245	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.294	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	16.63	k star (bias corrected MLE)	10.48
Theta hat (MLE)	0.04	Theta star (bias corrected MLE)	0.0635
nu hat (MLE)	266.1	nu star (bias corrected)	167.7
Mean (detects)	0.666		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.29	Mean	0.624
Maximum	0.972	Median	0.598
SD	0.211	CV	0.338
k hat (MLE)	9.314	k star (bias corrected MLE)	6.283
Theta hat (MLE)	0.067	Theta star (bias corrected MLE)	0.0993
nu hat (MLE)	167.6	nu star (bias corrected)	113.1
Adjusted Level of Significance (β)	0.0231		
Approximate Chi Square Value (113.10, α)	89.55	Adjusted Chi Square Value (113.10, β)	85.13
95% Gamma Approximate UCL (use when n>=50)	0.788	95% Gamma Adjusted UCL (use when n<50)	0.829

ProUCL Output
Lake Elmo
Forage Fish Tissue

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.635	SD (KM)	0.182
Variance (KM)	0.0331	SE of Mean (KM)	0.0648
k hat (KM)	12.21	k star (KM)	8.212
nu hat (KM)	219.7	nu star (KM)	147.8
theta hat (KM)	0.052	theta star (KM)	0.0774
80% gamma percentile (KM)	0.81	90% gamma percentile (KM)	0.931
95% gamma percentile (KM)	1.038	99% gamma percentile (KM)	1.261

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (147.82, α)	120.7	Adjusted Chi Square Value (147.82, β)	115.6
95% Gamma Approximate KM-UCL (use when n>=50)	0.778	95% Gamma Adjusted KM-UCL (use when n<50)	0.813

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.904	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.226	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.63	Mean in Log Scale	-0.506
SD in Original Scale	0.2	SD in Log Scale	0.319
95% t UCL (assumes normality of ROS data)	0.754	95% Percentile Bootstrap UCL	0.735
95% BCA Bootstrap UCL	0.747	95% Bootstrap t UCL	0.814
95% H-UCL (Log ROS)	0.798		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.493	KM Geo Mean	0.611
KM SD (logged)	0.279	95% Critical H Value (KM-Log)	1.988
KM Standard Error of Mean (logged)	0.0993	95% H-UCL (KM -Log)	0.772
KM SD (logged)	0.279	95% Critical H Value (KM-Log)	1.988
KM Standard Error of Mean (logged)	0.0993		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.614	Mean in Log Scale	-0.57
SD in Original Scale	0.231	SD in Log Scale	0.467
95% t UCL (Assumes normality)	0.757	95% H-Stat UCL	0.907

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.756

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	0.11	Mean	0.703
Maximum	2.492	Median	0.293
SD	0.791	Std. Error of Mean	0.264
Coefficient of Variation	1.126	Skewness	1.783

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.758	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.274	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level	

Data appear Approximate Normal at 5% Significance Level

ProUCL Output
Lake Elmo
Forage Fish Tissue

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	1.193	95% Adjusted-CLT UCL (Chen-1995)	1.304
		95% Modified-t UCL (Johnson-1978)	1.219

Gamma GOF Test

A-D Test Statistic	0.489	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.741	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.245	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.286	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.16	k star (bias corrected MLE)	0.848
Theta hat (MLE)	0.606	Theta star (bias corrected MLE)	0.829
nu hat (MLE)	20.89	nu star (bias corrected)	15.26
MLE Mean (bias corrected)	0.703	MLE Sd (bias corrected)	0.763
		Approximate Chi Square Value (0.05)	7.442
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	6.326

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1.441	95% Adjusted Gamma UCL (use when n<50)	1.695

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.944	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.202	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.206	Mean of logged Data	-0.842
Maximum of Logged Data	0.913	SD of logged Data	1.023

Assuming Lognormal Distribution

95% H-UCL	2.394	90% Chebyshev (MVUE) UCL	1.387
95% Chebyshev (MVUE) UCL	1.71	97.5% Chebyshev (MVUE) UCL	2.159
99% Chebyshev (MVUE) UCL	3.041		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.137	95% Jackknife UCL	1.193
95% Standard Bootstrap UCL	1.109	95% Bootstrap-t UCL	2.057
95% Hall's Bootstrap UCL	2.97	95% Percentile Bootstrap UCL	1.128
95% BCA Bootstrap UCL	1.258		
90% Chebyshev(Mean, Sd) UCL	1.494	95% Chebyshev(Mean, Sd) UCL	1.852
97.5% Chebyshev(Mean, Sd) UCL	2.35	99% Chebyshev(Mean, Sd) UCL	3.327

Suggested UCL to Use

95% Student's-t UCL	1.193

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
Number of Detects	6	Number of Non-Detects	3
Number of Distinct Detects	6	Number of Distinct Non-Detects	2
Minimum Detect	0.115	Minimum Non-Detect	0.0943
Maximum Detect	1.13	Maximum Non-Detect	0.098
Variance Detects	0.158	Percent Non-Detects	33.33%
Mean Detects	0.352	SD Detects	0.397
Median Detects	0.166	CV Detects	1.129
Skewness Detects	2.078	Kurtosis Detects	4.335
Mean of Logged Detects	-1.439	SD of Logged Detects	0.893

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.688	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.338	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.266	KM Standard Error of Mean	0.117
KM SD	0.32	95% KM (BCA) UCL	0.475
95% KM (t) UCL	0.483	95% KM (Percentile Bootstrap) UCL	0.468
95% KM (z) UCL	0.458	95% KM Bootstrap t UCL	1.734
90% KM Chebyshev UCL	0.616	95% KM Chebyshev UCL	0.775
97.5% KM Chebyshev UCL	0.995	99% KM Chebyshev UCL	1.428

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.688	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.709	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.337	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.338	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.413	k star (bias corrected MLE)	0.817
Theta hat (MLE)	0.249	Theta star (bias corrected MLE)	0.43
nu hat (MLE)	16.95	nu star (bias corrected)	9.809
Mean (detects)	0.352		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.238
Maximum	1.13	Median	0.12
SD	0.357	CV	1.502
k hat (MLE)	0.586	k star (bias corrected MLE)	0.465
Theta hat (MLE)	0.406	Theta star (bias corrected MLE)	0.512
nu hat (MLE)	10.55	nu star (bias corrected)	8.366
Adjusted Level of Significance (β)	0.0231		
Approximate Chi Square Value (8.37, α)	2.949	Adjusted Chi Square Value (8.37, β)	2.314
95% Gamma Approximate UCL (use when n>=50)	0.675	95% Gamma Adjusted UCL (use when n<50)	0.86

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.266	SD (KM)	0.32
Variance (KM)	0.102	SE of Mean (KM)	0.117
k hat (KM)	0.692	k star (KM)	0.535
nu hat (KM)	12.45	nu star (KM)	9.632
theta hat (KM)	0.385	theta star (KM)	0.497
80% gamma percentile (KM)	0.438	90% gamma percentile (KM)	0.709
95% gamma percentile (KM)	0.997	99% gamma percentile (KM)	1.7

ProUCL Output
Lake Elmo
Forage Fish Tissue

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (9.63, α)	3.713	Adjusted Chi Square Value (9.63, β)	2.979
95% Gamma Approximate KM-UCL (use when n>=50)	0.69	95% Gamma Adjusted KM-UCL (use when n<50)	0.86

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.835	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.298	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.243	Mean in Log Scale	-2.202
SD in Original Scale	0.354	SD in Log Scale	1.356
95% t UCL (assumes normality of ROS data)	0.462	95% Percentile Bootstrap UCL	0.452
95% BCA Bootstrap UCL	0.523	95% Bootstrap t UCL	1.119
95% H-UCL (Log ROS)	1.961		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.746	KM Geo Mean	0.174
KM SD (logged)	0.795	95% Critical H Value (KM-Log)	2.803
KM Standard Error of Mean (logged)	0.29	95% H-UCL (KM -Log)	0.526
KM SD (logged)	0.795	95% Critical H Value (KM-Log)	2.803
KM Standard Error of Mean (logged)	0.29		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.251	Mean in Log Scale	-1.969
SD in Original Scale	0.349	SD in Log Scale	1.063
95% t UCL (Assumes normality)	0.467	95% H-Stat UCL	0.875

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL 1.734 ɜ Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1) 0.86

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	1.84	Mean	4.701
Maximum	13	Median	3.336
SD	3.806	Std. Error of Mean	1.269
Coefficient of Variation	0.81	Skewness	1.684

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.76	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.305	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	7.06	95% Adjusted-CLT UCL (Chen-1995)	7.549
		95% Modified-t UCL (Johnson-1978)	7.179

ProUCL Output
Lake Elmo
Forage Fish Tissue

Gamma GOF Test

A-D Test Statistic	0.649	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.729	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.271	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.282	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.341	k star (bias corrected MLE)	1.635
Theta hat (MLE)	2.008	Theta star (bias corrected MLE)	2.875
nu hat (MLE)	42.14	nu star (bias corrected)	29.43
MLE Mean (bias corrected)	4.701	MLE Sd (bias corrected)	3.677
		Approximate Chi Square Value (0.05)	18.05
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	16.19

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	7.667	95% Adjusted Gamma UCL (use when n<50)	8.544

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.891	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.232	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.61	Mean of logged Data	1.319
Maximum of Logged Data	2.565	SD of logged Data	0.675

Assuming Lognormal Distribution

95% H-UCL	8.69	90% Chebyshev (MVUE) UCL	7.714
95% Chebyshev (MVUE) UCL	9.141	97.5% Chebyshev (MVUE) UCL	11.12
99% Chebyshev (MVUE) UCL	15.01		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	6.788	95% Jackknife UCL	7.06
95% Standard Bootstrap UCL	6.696	95% Bootstrap-t UCL	12.29
95% Hall's Bootstrap UCL	17.63	95% Percentile Bootstrap UCL	6.824
95% BCA Bootstrap UCL	7.37		
90% Chebyshev(Mean, Sd) UCL	8.507	95% Chebyshev(Mean, Sd) UCL	10.23
97.5% Chebyshev(Mean, Sd) UCL	12.62	99% Chebyshev(Mean, Sd) UCL	17.32

Suggested UCL to Use

95% Adjusted Gamma UCL 8.544

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	0.298	Mean	0.404
Maximum	0.612	Median	0.362
SD	0.111	Std. Error of Mean	0.037
Coefficient of Variation	0.274	Skewness	0.968

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

ProUCL Output
Lake Elmo
Forage Fish Tissue

Normal GOF Test

Shapiro Wilk Test Statistic	0.861	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.246	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.473	95% Adjusted-CLT UCL (Chen-1995)	0.478
		95% Modified-t UCL (Johnson-1978)	0.475

Gamma GOF Test

A-D Test Statistic	0.547	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.223	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	16.39	k star (bias corrected MLE)	11
Theta hat (MLE)	0.0247	Theta star (bias corrected MLE)	0.0367
nu hat (MLE)	295	nu star (bias corrected)	198
MLE Mean (bias corrected)	0.404	MLE Sd (bias corrected)	0.122
		Approximate Chi Square Value (0.05)	166.5
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	160.4

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.481	95% Adjusted Gamma UCL (use when n<50)	0.499

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.891	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.206	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.211	Mean of logged Data	-0.937
Maximum of Logged Data	-0.491	SD of logged Data	0.258

Assuming Lognormal Distribution

95% H-UCL	0.485	90% Chebyshev (MVUE) UCL	0.508
95% Chebyshev (MVUE) UCL	0.555	97.5% Chebyshev (MVUE) UCL	0.621
99% Chebyshev (MVUE) UCL	0.75		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.465	95% Jackknife UCL	0.473
95% Standard Bootstrap UCL	0.462	95% Bootstrap-t UCL	0.5
95% Hall's Bootstrap UCL	0.462	95% Percentile Bootstrap UCL	0.464
95% BCA Bootstrap UCL	0.474		
90% Chebyshev(Mean, Sd) UCL	0.515	95% Chebyshev(Mean, Sd) UCL	0.565
97.5% Chebyshev(Mean, Sd) UCL	0.635	99% Chebyshev(Mean, Sd) UCL	0.772

Suggested UCL to Use

95% Student's-t UCL 0.473

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	0.221	Mean	0.428
Maximum	0.602	Median	0.413
SD	0.139	Std. Error of Mean	0.0464
Coefficient of Variation	0.325	Skewness	-0.17

Note: Sample size is small (e.g., <10), If data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.913	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.164	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.515	95% Adjusted-CLT UCL (Chen-1995)	0.502
		95% Modified-t UCL (Johnson-1978)	0.514

Gamma GOF Test

A-D Test Statistic	0.423	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.722	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.187	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	9.503	k star (bias corrected MLE)	6.409
Theta hat (MLE)	0.0451	Theta star (bias corrected MLE)	0.0668
nu hat (MLE)	171.1	nu star (bias corrected)	115.4
MLE Mean (bias corrected)	0.428	MLE Sd (bias corrected)	0.169
		Approximate Chi Square Value (0.05)	91.57
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	87.11

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.54	95% Adjusted Gamma UCL (use when n<50)	0.567

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.891	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.213	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.51	Mean of logged Data	-0.902
Maximum of Logged Data	-0.508	SD of logged Data	0.36

Assuming Lognormal Distribution

95% H-UCL	0.564	90% Chebyshev (MVUE) UCL	0.586
95% Chebyshev (MVUE) UCL	0.656	97.5% Chebyshev (MVUE) UCL	0.754
99% Chebyshev (MVUE) UCL	0.947		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.505	95% Jackknife UCL	0.515
95% Standard Bootstrap UCL	0.503	95% Bootstrap-t UCL	0.51
95% Hall's Bootstrap UCL	0.498	95% Percentile Bootstrap UCL	0.496
95% BCA Bootstrap UCL	0.497		
90% Chebyshev(Mean, Sd) UCL	0.568	95% Chebyshev(Mean, Sd) UCL	0.631
97.5% Chebyshev(Mean, Sd) UCL	0.718	99% Chebyshev(Mean, Sd) UCL	0.89

ProUCL Output
Lake Elmo
Forage Fish Tissue

Suggested UCL to Use

95% Student's-t UCL 0.515

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
Number of Detects	5	Number of Non-Detects	4
Number of Distinct Detects	5	Number of Distinct Non-Detects	3
Minimum Detect	0.102	Minimum Non-Detect	0.0943
Maximum Detect	0.543	Maximum Non-Detect	0.098
Variance Detects	0.0395	Percent Non-Detects	44.44%
Mean Detects	0.256	SD Detects	0.199
Median Detects	0.13	CV Detects	0.777
Skewness Detects	0.937	Kurtosis Detects	-1.374
Mean of Logged Detects	-1.605	SD of Logged Detects	0.766

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.811	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.336	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.184	KM Standard Error of Mean	0.0577
KM SD	0.155	95% KM (BCA) UCL	0.281
95% KM (t) UCL	0.291	95% KM (Percentile Bootstrap) UCL	0.281
95% KM (z) UCL	0.279	95% KM Bootstrap t UCL	0.969
90% KM Chebyshev UCL	0.357	95% KM Chebyshev UCL	0.436
97.5% KM Chebyshev UCL	0.544	99% KM Chebyshev UCL	0.758

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.577	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.684	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.348	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.36	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.223	k star (bias corrected MLE)	1.023
Theta hat (MLE)	0.115	Theta star (bias corrected MLE)	0.25
nu hat (MLE)	22.23	nu star (bias corrected)	10.23
Mean (detects)	0.256		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.147
Maximum	0.543	Median	0.102
SD	0.191	CV	1.304
k hat (MLE)	0.606	k star (bias corrected MLE)	0.478
Theta hat (MLE)	0.242	Theta star (bias corrected MLE)	0.306
nu hat (MLE)	10.91	nu star (bias corrected)	8.607
Adjusted Level of Significance (β)	0.0231		
Approximate Chi Square Value (8.61, α)	3.091	Adjusted Chi Square Value (8.61, β)	2.437
95% Gamma Approximate UCL (use when n>=50)	0.408	95% Gamma Adjusted UCL (use when n<50)	0.517

ProUCL Output
Lake Elmo
Forage Fish Tissue

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.184	SD (KM)	0.155
Variance (KM)	0.024	SE of Mean (KM)	0.0577
k hat (KM)	1.411	k star (KM)	1.015
nu hat (KM)	25.4	nu star (KM)	18.27
theta hat (KM)	0.13	theta star (KM)	0.181
80% gamma percentile (KM)	0.296	90% gamma percentile (KM)	0.422
95% gamma percentile (KM)	0.548	99% gamma percentile (KM)	0.841

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (18.27, α)	9.585	Adjusted Chi Square Value (18.27, β)	8.292
95% Gamma Approximate KM-UCL (use when n>=50)	0.351	95% Gamma Adjusted KM-UCL (use when n<50)	0.405

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.832	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.314	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.153	Mean in Log Scale	-2.561
SD in Original Scale	0.186	SD in Log Scale	1.271
95% t UCL (assumes normality of ROS data)	0.268	95% Percentile Bootstrap UCL	0.26
95% BCA Bootstrap UCL	0.28	95% Bootstrap t UCL	0.514
95% H-UCL (Log ROS)	0.986		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.941	KM Geo Mean	0.144
KM SD (logged)	0.634	95% Critical H Value (KM-Log)	2.504
KM Standard Error of Mean (logged)	0.236	95% H-UCL (KM -Log)	0.308
KM SD (logged)	0.634	95% Critical H Value (KM-Log)	2.504
KM Standard Error of Mean (logged)	0.236		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.164	Mean in Log Scale	-2.237
SD in Original Scale	0.178	SD in Log Scale	0.925
95% t UCL (Assumes normality)	0.274	95% H-Stat UCL	0.448

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.291

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	270	Mean	803.2
Maximum	2460	Median	546.8
SD	666.9	Std. Error of Mean	222.3
Coefficient of Variation	0.83	Skewness	2.324

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

ProUCL Output
Lake Elmo
Forage Fish Tissue

Normal GOF Test

Shapiro Wilk Test Statistic	0.704	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.292	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1217	95% Adjusted-CLT UCL (Chen-1995)	1353
		95% Modified-t UCL (Johnson-1978)	1245

Gamma GOF Test

A-D Test Statistic	0.642	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.728	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.265	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.282	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.534	k star (bias corrected MLE)	1.763
Theta hat (MLE)	317	Theta star (bias corrected MLE)	455.6
nu hat (MLE)	45.61	nu star (bias corrected)	31.74
MLE Mean (bias corrected)	803.2	MLE Sd (bias corrected)	604.9
		Approximate Chi Square Value (0.05)	19.86
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	17.91

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1283	95% Adjusted Gamma UCL (use when n<50)	1423

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.918	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.227	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.598	Mean of logged Data	6.479
Maximum of Logged Data	7.808	SD of logged Data	0.636

Assuming Lognormal Distribution

95% H-UCL	1400	90% Chebyshev (MVUE) UCL	1281
95% Chebyshev (MVUE) UCL	1510	97.5% Chebyshev (MVUE) UCL	1827
99% Chebyshev (MVUE) UCL	2450		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1169	95% Jackknife UCL	1217
95% Standard Bootstrap UCL	1149	95% Bootstrap-t UCL	2017
95% Hall's Bootstrap UCL	2752	95% Percentile Bootstrap UCL	1203
95% BCA Bootstrap UCL	1392		
90% Chebyshev(Mean, Sd) UCL	1470	95% Chebyshev(Mean, Sd) UCL	1772
97.5% Chebyshev(Mean, Sd) UCL	2192	99% Chebyshev(Mean, Sd) UCL	3015

Suggested UCL to Use

95% Adjusted Gamma UCL 1423

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
Number of Detects	5	Number of Non-Detects	4
Number of Distinct Detects	5	Number of Distinct Non-Detects	4
Minimum Detect	0.121	Minimum Non-Detect	0.0943
Maximum Detect	0.554	Maximum Non-Detect	0.099
Variance Detects	0.0333	Percent Non-Detects	44.44%
Mean Detects	0.236	SD Detects	0.183
Median Detects	0.16	CV Detects	0.774
Skewness Detects	1.972	Kurtosis Detects	3.959
Mean of Logged Detects	-1.629	SD of Logged Detects	0.631

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.729	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.33	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.173	KM Standard Error of Mean	0.0524
KM SD	0.141	95% KM (BCA) UCL	0.264
95% KM (t) UCL	0.27	95% KM (Percentile Bootstrap) UCL	0.259
95% KM (z) UCL	0.259	95% KM Bootstrap t UCL	0.473
90% KM Chebyshev UCL	0.33	95% KM Chebyshev UCL	0.401
97.5% KM Chebyshev UCL	0.5	99% KM Chebyshev UCL	0.694

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.578	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.683	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.261	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.36	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.874	k star (bias corrected MLE)	1.283
Theta hat (MLE)	0.082	Theta star (bias corrected MLE)	0.184
nu hat (MLE)	28.74	nu star (bias corrected)	12.83
Mean (detects)	0.236		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.135
Maximum	0.554	Median	0.121
SD	0.176	CV	1.296
k hat (MLE)	0.642	k star (bias corrected MLE)	0.502
Theta hat (MLE)	0.211	Theta star (bias corrected MLE)	0.27
nu hat (MLE)	11.56	nu star (bias corrected)	9.041
Adjusted Level of Significance (β)	0.0231		
Approximate Chi Square Value (9.04, α)	3.352	Adjusted Chi Square Value (9.04, β)	2.664
95% Gamma Approximate UCL (use when n>=50)	0.365	95% Gamma Adjusted UCL (use when n<50)	0.46

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.173	SD (KM)	0.141
Variance (KM)	0.0198	SE of Mean (KM)	0.0524
k hat (KM)	1.513	k star (KM)	1.083
nu hat (KM)	27.24	nu star (KM)	19.5
theta hat (KM)	0.114	theta star (KM)	0.16
80% gamma percentile (KM)	0.276	90% gamma percentile (KM)	0.39
95% gamma percentile (KM)	0.504	99% gamma percentile (KM)	0.765

ProUCL Output
Lake Elmo
Forage Fish Tissue

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (19.50, α)	10.48	Adjusted Chi Square Value (19.50, β)	9.118
95% Gamma Approximate KM-UCL (use when n>=50)	0.322	95% Gamma Adjusted KM-UCL (use when n<50)	0.37

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.837	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.227	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.146	Mean in Log Scale	-2.412
SD in Original Scale	0.167	SD in Log Scale	1.03
95% t UCL (assumes normality of ROS data)	0.25	95% Percentile Bootstrap UCL	0.241
95% BCA Bootstrap UCL	0.273	95% Bootstrap t UCL	0.375
95% H-UCL (Log ROS)	0.509		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.954	KM Geo Mean	0.142
KM SD (logged)	0.556	95% Critical H Value (KM-Log)	2.332
KM Standard Error of Mean (logged)	0.207	95% H-UCL (KM -Log)	0.262
KM SD (logged)	0.556	95% Critical H Value (KM-Log)	2.332
KM Standard Error of Mean (logged)	0.207		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.153	Mean in Log Scale	-2.249
SD in Original Scale	0.162	SD in Log Scale	0.86
95% t UCL (Assumes normality)	0.253	95% H-Stat UCL	0.373

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.27

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	0.126	Mean	1.997
Maximum	16	Median	0.26
SD	5.252	Std. Error of Mean	1.751
Coefficient of Variation	2.629	Skewness	2.999

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.404	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.512	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	5.253	95% Adjusted-CLT UCL (Chen-1995)	6.746
		95% Modified-t UCL (Johnson-1978)	5.544

ProUCL Output
Lake Elmo
Forage Fish Tissue

Gamma GOF Test

A-D Test Statistic	2.263	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.79	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.502	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.298	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.394	k star (bias corrected MLE)	0.336
Theta hat (MLE)	5.075	Theta star (bias corrected MLE)	5.936
nu hat (MLE)	7.085	nu star (bias corrected)	6.057
MLE Mean (bias corrected)	1.997	MLE Sd (bias corrected)	3.443
		Approximate Chi Square Value (0.05)	1.669
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	1.231

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	7.249	95% Adjusted Gamma UCL (use when n<50)	9.829

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.625	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.404	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.071	Mean of logged Data	-0.984
Maximum of Logged Data	2.773	SD of logged Data	1.451

Assuming Lognormal Distribution

95% H-UCL	9.806	90% Chebyshev (MVUE) UCL	2.215
95% Chebyshev (MVUE) UCL	2.817	97.5% Chebyshev (MVUE) UCL	3.652
99% Chebyshev (MVUE) UCL	5.294		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	4.877	95% Jackknife UCL	5.253
95% Standard Bootstrap UCL	4.692	95% Bootstrap-t UCL	151.6
95% Hall's Bootstrap UCL	69.5	95% Percentile Bootstrap UCL	5.493
95% BCA Bootstrap UCL	7.223		
90% Chebyshev(Mean, Sd) UCL	7.249	95% Chebyshev(Mean, Sd) UCL	9.628
97.5% Chebyshev(Mean, Sd) UCL	12.93	99% Chebyshev(Mean, Sd) UCL	19.41

Suggested UCL to Use

95% Hall's Bootstrap UCL 69.5

Recommended UCL exceeds the maximum observation

In Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or 99% Chebyshev (Mean, Sd) UCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	0.508	Mean	0.991
Maximum	1.93	Median	0.778
SD	0.529	Std. Error of Mean	0.176
Coefficient of Variation	0.534	Skewness	0.955

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

ProUCL Output
Lake Elmo
Forage Fish Tissue

Normal GOF Test

Shapiro Wilk Test Statistic	0.856	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.212	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.319	95% Adjusted-CLT UCL (Chen-1995)	1.341
		95% Modified-t UCL (Johnson-1978)	1.328

Gamma GOF Test

A-D Test Statistic	0.446	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.724	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.183	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.28	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.405	k star (bias corrected MLE)	3.011
Theta hat (MLE)	0.225	Theta star (bias corrected MLE)	0.329
nu hat (MLE)	79.28	nu star (bias corrected)	54.19
MLE Mean (bias corrected)	0.991	MLE Sd (bias corrected)	0.571
		Approximate Chi Square Value (0.05)	38.28
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	35.47

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1.403	95% Adjusted Gamma UCL (use when n<50)	1.514

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.905	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.153	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.678	Mean of logged Data	-0.127
Maximum of Logged Data	0.658	SD of logged Data	0.505

Assuming Lognormal Distribution

95% H-UCL	1.492	90% Chebyshev (MVUE) UCL	1.491
95% Chebyshev (MVUE) UCL	1.72	97.5% Chebyshev (MVUE) UCL	2.038
99% Chebyshev (MVUE) UCL	2.662		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.281	95% Jackknife UCL	1.319
95% Standard Bootstrap UCL	1.262	95% Bootstrap-t UCL	1.49
95% Hall's Bootstrap UCL	1.397	95% Percentile Bootstrap UCL	1.262
95% BCA Bootstrap UCL	1.31		
90% Chebyshev(Mean, Sd) UCL	1.52	95% Chebyshev(Mean, Sd) UCL	1.76
97.5% Chebyshev(Mean, Sd) UCL	2.093	99% Chebyshev(Mean, Sd) UCL	2.746

Suggested UCL to Use

95% Student's-t UCL 1.319

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	0.34	Mean	0.564
Maximum	0.862	Median	0.619
SD	0.175	Std. Error of Mean	0.0582
Coefficient of Variation	0.309	Skewness	0.177

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.932	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.178	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.673	95% Adjusted-CLT UCL (Chen-1995)	0.664
		95% Modified-t UCL (Johnson-1978)	0.673

Gamma GOF Test

A-D Test Statistic	0.397	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.722	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.216	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	11.3	k star (bias corrected MLE)	7.607
Theta hat (MLE)	0.05	Theta star (bias corrected MLE)	0.0742
nu hat (MLE)	203.4	nu star (bias corrected)	136.9
MLE Mean (bias corrected)	0.564	MLE Sd (bias corrected)	0.205
		Approximate Chi Square Value (0.05)	110.9
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	106

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.697	95% Adjusted Gamma UCL (use when n<50)	0.729

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.919	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.22	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.078	Mean of logged Data	-0.617
Maximum of Logged Data	-0.148	SD of logged Data	0.323

Assuming Lognormal Distribution

95% H-UCL	0.718	90% Chebyshev (MVUE) UCL	0.749
95% Chebyshev (MVUE) UCL	0.832	97.5% Chebyshev (MVUE) UCL	0.948
99% Chebyshev (MVUE) UCL	1.175		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.66	95% Jackknife UCL	0.673
95% Standard Bootstrap UCL	0.653	95% Bootstrap-t UCL	0.679
95% Hall's Bootstrap UCL	0.665	95% Percentile Bootstrap UCL	0.651
95% BCA Bootstrap UCL	0.657		
90% Chebyshev(Mean, Sd) UCL	0.739	95% Chebyshev(Mean, Sd) UCL	0.818
97.5% Chebyshev(Mean, Sd) UCL	0.928	99% Chebyshev(Mean, Sd) UCL	1.143

ProUCL Output
Lake Elmo
Forage Fish Tissue

Suggested UCL to Use

95% Student's-t UCL 0.673

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
Number of Detects	8	Number of Non-Detects	1
Number of Distinct Detects	8	Number of Distinct Non-Detects	1
Minimum Detect	0.168	Minimum Non-Detect	0.0943
Maximum Detect	3.73	Maximum Non-Detect	0.0943
Variance Detects	1.539	Percent Non-Detects	11.11%
Mean Detects	0.929	SD Detects	1.241
Median Detects	0.372	CV Detects	1.335
Skewness Detects	2.098	Kurtosis Detects	4.213
Mean of Logged Detects	-0.661	SD of Logged Detects	1.069

Note: Sample size is small (e.g., <10), If data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.67	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.374	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.836	KM Standard Error of Mean	0.401
KM SD	1.125	95% KM (BCA) UCL	1.57
95% KM (t) UCL	1.582	95% KM (Percentile Bootstrap) UCL	1.547
95% KM (z) UCL	1.496	95% KM Bootstrap t UCL	5.18
90% KM Chebyshev UCL	2.039	95% KM Chebyshev UCL	2.584
97.5% KM Chebyshev UCL	3.34	99% KM Chebyshev UCL	4.826

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.781	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.736	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.309	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.302	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.985	k star (bias corrected MLE)	0.699
Theta hat (MLE)	0.944	Theta star (bias corrected MLE)	1.33
nu hat (MLE)	15.75	nu star (bias corrected)	11.18
Mean (detects)	0.929		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.827
Maximum	3.73	Median	0.289
SD	1.2	CV	1.451
k hat (MLE)	0.669	k star (bias corrected MLE)	0.52
Theta hat (MLE)	1.236	Theta star (bias corrected MLE)	1.59
nu hat (MLE)	12.04	nu star (bias corrected)	9.361
Adjusted Level of Significance (β)	0.0231		
Approximate Chi Square Value (9.36, α)	3.546	Adjusted Chi Square Value (9.36, β)	2.833
95% Gamma Approximate UCL (use when n>=50)	2.183	95% Gamma Adjusted UCL (use when n<50)	2.732

ProUCL Output
Lake Elmo
Forage Fish Tissue

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.836	SD (KM)	1.125
Variance (KM)	1.266	SE of Mean (KM)	0.401
k hat (KM)	0.553	k star (KM)	0.442
nu hat (KM)	9.947	nu star (KM)	7.965
theta hat (KM)	1.514	theta star (KM)	1.89
80% gamma percentile (KM)	1.363	90% gamma percentile (KM)	2.319
95% gamma percentile (KM)	3.355	99% gamma percentile (KM)	5.934

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (7.96, α)	2.715	Adjusted Chi Square Value (7.96, β)	2.112
95% Gamma Approximate KM-UCL (use when n>=50)	2.454	95% Gamma Adjusted KM-UCL (use when n<50)	3.154

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.878	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.236	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.83	Mean in Log Scale	-0.946
SD in Original Scale	1.198	SD in Log Scale	1.317
95% t UCL (assumes normality of ROS data)	1.573	95% Percentile Bootstrap UCL	1.491
95% BCA Bootstrap UCL	1.813	95% Bootstrap t UCL	5.085
95% H-UCL (Log ROS)	5.893		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.85	KM Geo Mean	0.428
KM SD (logged)	1.084	95% Critical H Value (KM-Log)	3.428
KM Standard Error of Mean (logged)	0.386	95% H-UCL (KM -Log)	2.859
KM SD (logged)	1.084	95% Critical H Value (KM-Log)	3.428
KM Standard Error of Mean (logged)	0.386		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.831	Mean in Log Scale	-0.927
SD in Original Scale	1.197	SD in Log Scale	1.279
95% t UCL (Assumes normality)	1.573	95% H-Stat UCL	5.211

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 2.584

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFNS|ug/kg

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	0.104	Mean	0.469
Maximum	2.37	Median	0.166
SD	0.73	Std. Error of Mean	0.243
Coefficient of Variation	1.555	Skewness	2.756

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

ProUCL Output
Lake Elmo
Forage Fish Tissue

Normal GOF Test

Shapiro Wilk Test Statistic	0.551	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.337	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.922	95% Adjusted-CLT UCL (Chen-1995)	1.108
		95% Modified-t UCL (Johnson-1978)	0.959

Gamma GOF Test

A-D Test Statistic	1.187	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.745	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.341	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.287	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.96	k star (bias corrected MLE)	0.714
Theta hat (MLE)	0.489	Theta star (bias corrected MLE)	0.657
nu hat (MLE)	17.27	nu star (bias corrected)	12.85
MLE Mean (bias corrected)	0.469	MLE Sd (bias corrected)	0.555
		Approximate Chi Square Value (0.05)	5.791
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	4.83

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1.041	95% Adjusted Gamma UCL (use when n<50)	1.249

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.801	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.307	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.274	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.263	Mean of logged Data	-1.361
Maximum of Logged Data	0.863	SD of logged Data	1.002

Assuming Lognormal Distribution

95% H-UCL	1.336	90% Chebyshev (MVUE) UCL	0.802
95% Chebyshev (MVUE) UCL	0.987	97.5% Chebyshev (MVUE) UCL	1.243
99% Chebyshev (MVUE) UCL	1.748		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	0.869	95% Jackknife UCL	0.922
95% Standard Bootstrap UCL	0.846	95% Bootstrap-t UCL	2.743
95% Hall's Bootstrap UCL	2.713	95% Percentile Bootstrap UCL	0.892
95% BCA Bootstrap UCL	1.176		
90% Chebyshev(Mean, Sd) UCL	1.199	95% Chebyshev(Mean, Sd) UCL	1.529
97.5% Chebyshev(Mean, Sd) UCL	1.988	99% Chebyshev(Mean, Sd) UCL	2.889

Suggested UCL to Use

95% Hall's Bootstrap UCL	2.713

Recommended UCL exceeds the maximum observation

In Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or 99% Chebyshev (Mean, Sd) UCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Raleigh Creek - Upper
Forage Fish Tissue

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/12/2021 3:55:09 PM
From File	FWM_ProUCL_Input_b.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Area - URC Meadia- FO

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General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.553	Mean	0.911
Maximum	1.71	Median	0.719
SD	0.451	Std. Error of Mean	0.184
Coefficient of Variation	0.495	Skewness	1.406

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.828	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.272	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.282	95% Adjusted-CLT UCL (Chen-1995)	1.327
		95% Modified-t UCL (Johnson-1978)	1.3

Gamma GOF Test

A-D Test Statistic	0.46	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.245	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.84	k star (bias corrected MLE)	3.031
Theta hat (MLE)	0.156	Theta star (bias corrected MLE)	0.301
nu hat (MLE)	70.09	nu star (bias corrected)	36.38
MLE Mean (bias corrected)	0.911	MLE Sd (bias corrected)	0.523
		Approximate Chi Square Value (0.05)	23.57
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	19.93

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1.406	95% Adjusted Gamma UCL (use when n<50)	1.662

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.888	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.217	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.592	Mean of logged Data	-0.181
Maximum of Logged Data	0.536	SD of logged Data	0.443

Assuming Lognormal Distribution

95% H-UCL	1.511	90% Chebyshev (MVUE) UCL	1.394
95% Chebyshev (MVUE) UCL	1.616	97.5% Chebyshev (MVUE) UCL	1.924
99% Chebyshev (MVUE) UCL	2.529		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

ProUCL Output
Raleigh Creek - Upper
Forage Fish Tissue

Nonparametric Distribution Free UCLs

95% CLT UCL	1.214	95% Jackknife UCL	1.282
95% Standard Bootstrap UCL	1.193	95% Bootstrap-t UCL	2.135
95% Hall's Bootstrap UCL	2.834	95% Percentile Bootstrap UCL	1.202
95% BCA Bootstrap UCL	1.332		
90% Chebyshev(Mean, Sd) UCL	1.463	95% Chebyshev(Mean, Sd) UCL	1.714
97.5% Chebyshev(Mean, Sd) UCL	2.061	99% Chebyshev(Mean, Sd) UCL	2.743

Suggested UCL to Use

95% Student's-t UCL 1.282

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.257	Mean	15.37
Maximum	63.4	Median	2.615
SD	25.06	Std. Error of Mean	10.23
Coefficient of Variation	1.63	Skewness	1.908

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.707	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.338	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	35.99	95% Adjusted-CLT UCL (Chen-1995)	40.72
		95% Modified-t UCL (Johnson-1978)	37.32

Gamma GOF Test

A-D Test Statistic	0.391	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.75	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.246	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.352	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.409	k star (bias corrected MLE)	0.316
Theta hat (MLE)	37.6	Theta star (bias corrected MLE)	48.72
nu hat (MLE)	4.907	nu star (bias corrected)	3.787
MLE Mean (bias corrected)	15.37	MLE Sd (bias corrected)	27.37
		Approximate Chi Square Value (0.05)	0.639
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	0.305

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	91.06	95% Adjusted Gamma UCL (use when n<50)	191

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.939	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.198	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.359	Mean of logged Data	1.129
Maximum of Logged Data	4.149	SD of logged Data	2.173

Assuming Lognormal Distribution

95% H-UCL	108435	90% Chebyshev (MVUE) UCL	50.34
95% Chebyshev (MVUE) UCL	66.15	97.5% Chebyshev (MVUE) UCL	88.1
99% Chebyshev (MVUE) UCL	131.2		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	32.2	95% Jackknife UCL	35.99
95% Standard Bootstrap UCL	30.58	95% Bootstrap-t UCL	198.9
95% Hall's Bootstrap UCL	150.8	95% Percentile Bootstrap UCL	32.54
95% BCA Bootstrap UCL	39.39		
90% Chebyshev(Mean, Sd) UCL	46.07	95% Chebyshev(Mean, Sd) UCL	59.97
97.5% Chebyshev(Mean, Sd) UCL	79.27	99% Chebyshev(Mean, Sd) UCL	117.2

Suggested UCL to Use

95% Adjusted Gamma UCL 191

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
Number of Detects	5	Number of Non-Detects	1
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	0.17	Minimum Non-Detect	0.0962
Maximum Detect	3	Maximum Non-Detect	0.0962
Variance Detects	1.294	Percent Non-Detects	16.67%
Mean Detects	1.401	SD Detects	1.137
Median Detects	1.47	CV Detects	0.812
Skewness Detects	0.438	Kurtosis Detects	-0.809
Mean of Logged Detects	-0.0796	SD of Logged Detects	1.165

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.954	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.192	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.183	KM Standard Error of Mean	0.478
KM SD	1.048	95% KM (BCA) UCL	1.84
95% KM (t) UCL	2.148	95% KM (Percentile Bootstrap) UCL	1.91
95% KM (z) UCL	1.97	95% KM Bootstrap t UCL	2.291
90% KM Chebyshev UCL	2.619	95% KM Chebyshev UCL	3.269
97.5% KM Chebyshev UCL	4.172	99% KM Chebyshev UCL	5.944

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.261	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.688	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.235	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.363	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.342	k star (bias corrected MLE)	0.67
Theta hat (MLE)	1.044	Theta star (bias corrected MLE)	2.09
nu hat (MLE)	13.42	nu star (bias corrected)	6.702
Mean (detects)	1.401		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.169
Maximum	3	Median	0.972
SD	1.165	CV	0.997
k hat (MLE)	0.621	k star (bias corrected MLE)	0.422
Theta hat (MLE)	1.883	Theta star (bias corrected MLE)	2.773
nu hat (MLE)	7.452	nu star (bias corrected)	5.059
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (5.06, α)	1.18	Adjusted Chi Square Value (5.06, β)	0.637
95% Gamma Approximate UCL (use when n>=50)	5.014	95% Gamma Adjusted UCL (use when n<50)	9.283

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.183	SD (KM)	1.048
Variance (KM)	1.099	SE of Mean (KM)	0.478
k hat (KM)	1.274	k star (KM)	0.748
nu hat (KM)	15.29	nu star (KM)	8.979
theta hat (KM)	0.929	theta star (KM)	1.582
80% gamma percentile (KM)	1.94	90% gamma percentile (KM)	2.924
95% gamma percentile (KM)	3.932	99% gamma percentile (KM)	6.326

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (8.98, α)	3.314	Adjusted Chi Square Value (8.98, β)	2.2
95% Gamma Approximate KM-UCL (use when n>=50)	3.206	95% Gamma Adjusted KM-UCL (use when n<50)	4.829

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.926	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.255	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.176	Mean in Log Scale	-0.565
SD in Original Scale	1.157	SD in Log Scale	1.58
95% t UCL (assumes normality of ROS data)	2.128	95% Percentile Bootstrap UCL	1.935
95% BCA Bootstrap UCL	2.018	95% Bootstrap t UCL	2.311
95% H-UCL (Log ROS)	155.1		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.457	KM Geo Mean	0.633
KM SD (logged)	1.271	95% Critical H Value (KM-Log)	5.063
KM Standard Error of Mean (logged)	0.58	95% H-UCL (KM -Log)	25.23
KM SD (logged)	1.271	95% Critical H Value (KM-Log)	5.063
KM Standard Error of Mean (logged)	0.58		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.175	Mean in Log Scale	-0.572
SD in Original Scale	1.158	SD in Log Scale	1.594
95% t UCL (Assumes normality)	2.128	95% H-Stat UCL	169.1

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 2.148

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	13.9	Mean	23.67
Maximum	34.8	Median	22.7
SD	6.794	Std. Error of Mean	2.774
Coefficient of Variation	0.287	Skewness	0.434

Note: Sample size is small (e.g., <10), If data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.936	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.225	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	29.26	95% Adjusted-CLT UCL (Chen-1995)	28.75
		95% Modified-t UCL (Johnson-1978)	29.34

Gamma GOF Test

A-D Test Statistic	0.351	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.248	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	14.15	k star (bias corrected MLE)	7.186
Theta hat (MLE)	1.672	Theta star (bias corrected MLE)	3.293
nu hat (MLE)	169.8	nu star (bias corrected)	86.24
MLE Mean (bias corrected)	23.67	MLE Sd (bias corrected)	8.828
		Approximate Chi Square Value (0.05)	65.83
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	59.43

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	31	95% Adjusted Gamma UCL (use when n<50)	34.34

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.93	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.271	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.632	Mean of logged Data	3.128
Maximum of Logged Data	3.55	SD of logged Data	0.298

Assuming Lognormal Distribution

95% H-UCL	32.11	90% Chebyshev (MVUE) UCL	32.34
95% Chebyshev (MVUE) UCL	36.26	97.5% Chebyshev (MVUE) UCL	41.7
99% Chebyshev (MVUE) UCL	52.38		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	28.23	95% Jackknife UCL	29.26
95% Standard Bootstrap UCL	27.75	95% Bootstrap-t UCL	30.27
95% Hall's Bootstrap UCL	34.76	95% Percentile Bootstrap UCL	27.8
95% BCA Bootstrap UCL	27.9		
90% Chebyshev(Mean, Sd) UCL	31.99	95% Chebyshev(Mean, Sd) UCL	35.76
97.5% Chebyshev(Mean, Sd) UCL	40.99	99% Chebyshev(Mean, Sd) UCL	51.26

ProUCL Output
Raleigh Creek - Upper
Forage Fish Tissue

Suggested UCL to Use

95% Student's-t UCL 29.26

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.32	Mean	1.214
Maximum	1.93	Median	1.38
SD	0.69	Std. Error of Mean	0.282
Coefficient of Variation	0.568	Skewness	-0.409

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.881	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.246	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.781	95% Adjusted-CLT UCL (Chen-1995)	1.626
		95% Modified-t UCL (Johnson-1978)	1.773

Gamma GOF Test

A-D Test Statistic	0.489	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.702	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.274	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.335	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.7	k star (bias corrected MLE)	1.461
Theta hat (MLE)	0.449	Theta star (bias corrected MLE)	0.83
nu hat (MLE)	32.4	nu star (bias corrected)	17.54
MLE Mean (bias corrected)	1.214	MLE Sd (bias corrected)	1.004
		Approximate Chi Square Value (0.05)	9.056
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	6.968

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	2.35	95% Adjusted Gamma UCL (use when n<50)	3.054

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.851	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.253	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.139	Mean of logged Data	-0.00294
Maximum of Logged Data	0.658	SD of logged Data	0.754

Assuming Lognormal Distribution

95% H-UCL	4.072	90% Chebyshev (MVUE) UCL	2.404
95% Chebyshev (MVUE) UCL	2.925	97.5% Chebyshev (MVUE) UCL	3.648
99% Chebyshev (MVUE) UCL	5.068		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

ProUCL Output
Raleigh Creek - Upper
Forage Fish Tissue

Nonparametric Distribution Free UCLs

95% CLT UCL	1.677	95% Jackknife UCL	1.781
95% Standard Bootstrap UCL	1.64	95% Bootstrap-t UCL	1.766
95% Hall's Bootstrap UCL	1.529	95% Percentile Bootstrap UCL	1.637
95% BCA Bootstrap UCL	1.6		
90% Chebyshev(Mean, Sd) UCL	2.058	95% Chebyshev(Mean, Sd) UCL	2.441
97.5% Chebyshev(Mean, Sd) UCL	2.972	99% Chebyshev(Mean, Sd) UCL	4.015

Suggested UCL to Use

95% Student's-t UCL 1.781

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFTeDA|ug/kg

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.264	Mean	0.888
Maximum	1.71	Median	0.877
SD	0.484	Std. Error of Mean	0.198
Coefficient of Variation	0.546	Skewness	0.762

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.948	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.234	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.286	95% Adjusted-CLT UCL (Chen-1995)	1.279
		95% Modified-t UCL (Johnson-1978)	1.296

Gamma GOF Test

A-D Test Statistic	0.254	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.7	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.199	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.334	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.625	k star (bias corrected MLE)	1.924
Theta hat (MLE)	0.245	Theta star (bias corrected MLE)	0.461
nu hat (MLE)	43.5	nu star (bias corrected)	23.08
MLE Mean (bias corrected)	0.888	MLE Sd (bias corrected)	0.64
		Approximate Chi Square Value (0.05)	13.15
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	10.55

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1.558	95% Adjusted Gamma UCL (use when n<50)	1.942

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.941	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.226	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

ProUCL Output
Raleigh Creek - Upper
Forage Fish Tissue

Lognormal Statistics

Minimum of Logged Data	-1.332	Mean of logged Data	-0.263
Maximum of Logged Data	0.536	SD of logged Data	0.627

Assuming Lognormal Distribution

95% H-UCL	2.148	90% Chebyshev (MVUE) UCL	1.592
95% Chebyshev (MVUE) UCL	1.905	97.5% Chebyshev (MVUE) UCL	2.339
99% Chebyshev (MVUE) UCL	3.191		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.213	95% Jackknife UCL	1.286
95% Standard Bootstrap UCL	1.192	95% Bootstrap-t UCL	1.327
95% Hall's Bootstrap UCL	1.549	95% Percentile Bootstrap UCL	1.199
95% BCA Bootstrap UCL	1.219		
90% Chebyshev(Mean, Sd) UCL	1.481	95% Chebyshev(Mean, Sd) UCL	1.749
97.5% Chebyshev(Mean, Sd) UCL	2.122	99% Chebyshev(Mean, Sd) UCL	2.855

Suggested UCL to Use

95% Student's-t UCL 1.286

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFHxS|ug/kg

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.126	Mean	4.063
Maximum	11.4	Median	2.494
SD	4.642	Std. Error of Mean	1.895
Coefficient of Variation	1.143	Skewness	0.865

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.862	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.258	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	7.882	95% Adjusted-CLT UCL (Chen-1995)	7.896
		95% Modified-t UCL (Johnson-1978)	7.994

Gamma GOF Test

A-D Test Statistic	0.338	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.731	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.194	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.347	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.583	k star (bias corrected MLE)	0.403
Theta hat (MLE)	6.965	Theta star (bias corrected MLE)	10.09
nu hat (MLE)	7.001	nu star (bias corrected)	4.834
MLE Mean (bias corrected)	4.063	MLE Sd (bias corrected)	6.402
		Approximate Chi Square Value (0.05)	1.076
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	0.57

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	18.25	95% Adjusted Gamma UCL (use when n<50)	34.47

ProUCL Output
Raleigh Creek - Upper
Forage Fish Tissue

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.901	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.216	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.071	Mean of logged Data	0.338
Maximum of Logged Data	2.434	SD of logged Data	1.912

Assuming Lognormal Distribution

95% H-UCL	4784	90% Chebyshev (MVUE) UCL	15.69
95% Chebyshev (MVUE) UCL	20.49	97.5% Chebyshev (MVUE) UCL	27.16
99% Chebyshev (MVUE) UCL	40.24		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	7.181	95% Jackknife UCL	7.882
95% Standard Bootstrap UCL	6.982	95% Bootstrap-t UCL	12.98
95% Hall's Bootstrap UCL	9.557	95% Percentile Bootstrap UCL	7.019
95% BCA Bootstrap UCL	7.655		
90% Chebyshev(Mean, Sd) UCL	9.749	95% Chebyshev(Mean, Sd) UCL	12.32
97.5% Chebyshev(Mean, Sd) UCL	15.9	99% Chebyshev(Mean, Sd) UCL	22.92

Suggested UCL to Use

95% Student's-t UCL 7.882

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOS|ug/kg

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	3150	Mean	4950
Maximum	6350	Median	5175
SD	1288	Std. Error of Mean	525.8
Coefficient of Variation	0.26	Skewness	-0.418

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.928	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.201	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	6009	95% Adjusted-CLT UCL (Chen-1995)	5719
		95% Modified-t UCL (Johnson-1978)	5994

Gamma GOF Test

A-D Test Statistic	0.327	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.23	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

ProUCL Output
Raleigh Creek - Upper
Forage Fish Tissue

Gamma Statistics

k hat (MLE)	16.25	k star (bias corrected MLE)	8.238
Theta hat (MLE)	304.6	Theta star (bias corrected MLE)	600.9
nu hat (MLE)	195	nu star (bias corrected)	98.85
MLE Mean (bias corrected)	4950	MLE Sd (bias corrected)	1725
		Approximate Chi Square Value (0.05)	76.91
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	69.95

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	6362	95% Adjusted Gamma UCL (use when n<50)	6995

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.913	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.216	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.055	Mean of logged Data	8.476
Maximum of Logged Data	8.756	SD of logged Data	0.28

Assuming Lognormal Distribution

95% H-UCL	6565	90% Chebyshev (MVUE) UCL	6656
95% Chebyshev (MVUE) UCL	7425	97.5% Chebyshev (MVUE) UCL	8493
99% Chebyshev (MVUE) UCL	10591		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	5815	95% Jackknife UCL	6009
95% Standard Bootstrap UCL	5752	95% Bootstrap-t UCL	5929
95% Hall's Bootstrap UCL	5560	95% Percentile Bootstrap UCL	5730
95% BCA Bootstrap UCL	5658		
90% Chebyshev(Mean, Sd) UCL	6527	95% Chebyshev(Mean, Sd) UCL	7242
97.5% Chebyshev(Mean, Sd) UCL	8233	99% Chebyshev(Mean, Sd) UCL	10181

Suggested UCL to Use

95% Student's-t UCL 6009

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFDS|ug/kg

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	8.34	Mean	31.79
Maximum	52	Median	37.7
SD	17.34	Std. Error of Mean	7.08
Coefficient of Variation	0.546	Skewness	-0.555

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.896	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.245	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

ProUCL Output
Raleigh Creek - Upper
Forage Fish Tissue

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	46.06	95% Adjusted-CLT UCL (Chen-1995)	41.72
		95% Modified-t UCL (Johnson-1978)	45.79

Gamma GOF Test

A-D Test Statistic	0.565	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.702	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.312	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.335	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.809	k star (bias corrected MLE)	1.516
Theta hat (MLE)	11.32	Theta star (bias corrected MLE)	20.97
nu hat (MLE)	33.71	nu star (bias corrected)	18.19
MLE Mean (bias corrected)	31.79	MLE Sd (bias corrected)	25.82
		Approximate Chi Square Value (0.05)	9.528
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	7.376

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	60.69	95% Adjusted Gamma UCL (use when n<50)	78.39

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.832	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.318	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.121	Mean of logged Data	3.271
Maximum of Logged Data	3.951	SD of logged Data	0.745

Assuming Lognormal Distribution

95% H-UCL	104.7	90% Chebyshev (MVUE) UCL	62.85
95% Chebyshev (MVUE) UCL	76.39	97.5% Chebyshev (MVUE) UCL	95.19
99% Chebyshev (MVUE) UCL	132.1		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	43.44	95% Jackknife UCL	46.06
95% Standard Bootstrap UCL	42.46	95% Bootstrap-t UCL	43.77
95% Hall's Bootstrap UCL	40.01	95% Percentile Bootstrap UCL	42.28
95% BCA Bootstrap UCL	41.45		
90% Chebyshev(Mean, Sd) UCL	53.03	95% Chebyshev(Mean, Sd) UCL	62.65
97.5% Chebyshev(Mean, Sd) UCL	76.01	99% Chebyshev(Mean, Sd) UCL	102.2

Suggested UCL to Use

95% Student's-t UCL	46.06

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	57.1	Mean	192.3
Maximum	405	Median	131.5
SD	154.2	Std. Error of Mean	62.96
Coefficient of Variation	0.802	Skewness	0.796

Note: Sample size is small (e.g., <10), If data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.818	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.285	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	319.2	95% Adjusted-CLT UCL (Chen-1995)	317.7
		95% Modified-t UCL (Johnson-1978)	322.6

Gamma GOF Test

A-D Test Statistic	0.444	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.705	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.223	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.336	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.881	k star (bias corrected MLE)	1.052
Theta hat (MLE)	102.2	Theta star (bias corrected MLE)	182.8
nu hat (MLE)	22.58	nu star (bias corrected)	12.62
MLE Mean (bias corrected)	192.3	MLE Sd (bias corrected)	187.5
		Approximate Chi Square Value (0.05)	5.639
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	4.076

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	430.4	95% Adjusted Gamma UCL (use when n<50)	595.5

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.889	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.199	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.045	Mean of logged Data	4.97
Maximum of Logged Data	6.004	SD of logged Data	0.844

Assuming Lognormal Distribution

95% H-UCL	802.8	90% Chebyshev (MVUE) UCL	387.9
95% Chebyshev (MVUE) UCL	476.8	97.5% Chebyshev (MVUE) UCL	600.2
99% Chebyshev (MVUE) UCL	842.5		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	295.9	95% Jackknife UCL	319.2
95% Standard Bootstrap UCL	286.5	95% Bootstrap-t UCL	530.7
95% Hall's Bootstrap UCL	1249	95% Percentile Bootstrap UCL	292
95% BCA Bootstrap UCL	297.5		
90% Chebyshev(Mean, Sd) UCL	381.2	95% Chebyshev(Mean, Sd) UCL	466.7
97.5% Chebyshev(Mean, Sd) UCL	585.5	99% Chebyshev(Mean, Sd) UCL	818.7

ProUCL Output
Raleigh Creek - Upper
Forage Fish Tissue

Suggested UCL to Use

95% Student's-t UCL 319.2

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

N-EtFOSAA|ug/kg

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	8.3	Mean	20.48
Maximum	38	Median	19.1
SD	11.56	Std. Error of Mean	4.718
Coefficient of Variation	0.564	Skewness	0.533

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.902	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.258	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	29.99	95% Adjusted-CLT UCL (Chen-1995)	29.34
		95% Modified-t UCL (Johnson-1978)	30.16

Gamma GOF Test

A-D Test Statistic	0.388	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.7	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.26	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.334	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.662	k star (bias corrected MLE)	1.942
Theta hat (MLE)	5.594	Theta star (bias corrected MLE)	10.55
nu hat (MLE)	43.94	nu star (bias corrected)	23.3
MLE Mean (bias corrected)	20.48	MLE Sd (bias corrected)	14.7
		Approximate Chi Square Value (0.05)	13.32
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	10.7

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	35.84	95% Adjusted Gamma UCL (use when n<50)	44.62

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.919	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.235	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.116	Mean of logged Data	2.877
Maximum of Logged Data	3.638	SD of logged Data	0.596

Assuming Lognormal Distribution

95% H-UCL	45.72	90% Chebyshev (MVUE) UCL	35.48
95% Chebyshev (MVUE) UCL	42.25	97.5% Chebyshev (MVUE) UCL	51.65
99% Chebyshev (MVUE) UCL	70.11		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

ProUCL Output
Raleigh Creek - Upper
Forage Fish Tissue

Nonparametric Distribution Free UCLs

95% CLT UCL	28.24	95% Jackknife UCL	29.99
95% Standard Bootstrap UCL	27.84	95% Bootstrap-t UCL	33.15
95% Hall's Bootstrap UCL	26.69	95% Percentile Bootstrap UCL	27.8
95% BCA Bootstrap UCL	27.83		
90% Chebyshev(Mean, Sd) UCL	34.64	95% Chebyshev(Mean, Sd) UCL	41.05
97.5% Chebyshev(Mean, Sd) UCL	49.95	99% Chebyshev(Mean, Sd) UCL	67.42

Suggested UCL to Use

95% Student's-t UCL 29.99

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

N-MeFOSAA|ug/kg

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.19	Mean	0.413
Maximum	0.585	Median	0.466
SD	0.151	Std. Error of Mean	0.0615
Coefficient of Variation	0.365	Skewness	-0.661

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.917	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.224	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.537	95% Adjusted-CLT UCL (Chen-1995)	0.497
		95% Modified-t UCL (Johnson-1978)	0.534

Gamma GOF Test

A-D Test Statistic	0.454	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.271	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	7.36	k star (bias corrected MLE)	3.791
Theta hat (MLE)	0.0561	Theta star (bias corrected MLE)	0.109
nu hat (MLE)	88.32	nu star (bias corrected)	45.49
MLE Mean (bias corrected)	0.413	MLE Sd (bias corrected)	0.212
		Approximate Chi Square Value (0.05)	31.02
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	26.78

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.606	95% Adjusted Gamma UCL (use when n<50)	0.702

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.871	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.277	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.661	Mean of logged Data	-0.953
Maximum of Logged Data	-0.536	SD of logged Data	0.433

ProUCL Output
Raleigh Creek - Upper
Forage Fish Tissue

Assuming Lognormal Distribution

95% H-UCL	0.684	90% Chebyshev (MVUE) UCL	0.637
95% Chebyshev (MVUE) UCL	0.737	97.5% Chebyshev (MVUE) UCL	0.875
99% Chebyshev (MVUE) UCL	1.147		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.514	95% Jackknife UCL	0.537
95% Standard Bootstrap UCL	0.502	95% Bootstrap-t UCL	0.519
95% Hall's Bootstrap UCL	0.483	95% Percentile Bootstrap UCL	0.505
95% BCA Bootstrap UCL	0.492		
90% Chebyshev(Mean, Sd) UCL	0.598	95% Chebyshev(Mean, Sd) UCL	0.681
97.5% Chebyshev(Mean, Sd) UCL	0.797	99% Chebyshev(Mean, Sd) UCL	1.025

Suggested UCL to Use

95% Student's-t UCL 0.537

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/22/2021 11:37:36 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

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General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
Number of Detects	5	Number of Non-Detects	1
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	0.499	Minimum Non-Detect	0.392
Maximum Detect	0.671	Maximum Non-Detect	0.392
Variance Detects	0.00422	Percent Non-Detects	16.67%
Mean Detects	0.605	SD Detects	0.065
Median Detects	0.624	CV Detects	0.107
Skewness Detects	-1.312	Kurtosis Detects	2.21
Mean of Logged Detects	-0.508	SD of Logged Detects	0.113

Note: Sample size is small (e.g., <10), If data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.904	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.246	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.569	KM Standard Error of Mean	0.0435
KM SD	0.0954	95% KM (BCA) UCL	0.628
95% KM (t) UCL	0.657	95% KM (Percentile Bootstrap) UCL	0.631
95% KM (z) UCL	0.641	95% KM Bootstrap t UCL	0.618
90% KM Chebyshev UCL	0.7	95% KM Chebyshev UCL	0.759
97.5% KM Chebyshev UCL	0.841	99% KM Chebyshev UCL	1.003

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.414	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.678	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.255	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	101.5	k star (bias corrected MLE)	40.73
Theta hat (MLE)	0.00596	Theta star (bias corrected MLE)	0.0148
nu hat (MLE)	1015	nu star (bias corrected)	407.3
Mean (detects)	0.605		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.457	Mean	0.58
Maximum	0.671	Median	0.61
SD	0.0838	CV	0.145
k hat (MLE)	54.22	k star (bias corrected MLE)	27.22
Theta hat (MLE)	0.0107	Theta star (bias corrected MLE)	0.0213
nu hat (MLE)	650.6	nu star (bias corrected)	326.6
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (326.64, α)	285.8	Adjusted Chi Square Value (326.64, β)	271.9
95% Gamma Approximate UCL (use when n>=50)	0.663	95% Gamma Adjusted UCL (use when n<50)	0.697

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.569	SD (KM)	0.0954
Variance (KM)	0.0091	SE of Mean (KM)	0.0435
k hat (KM)	35.61	k star (KM)	17.92
nu hat (KM)	427.3	nu star (KM)	215
theta hat (KM)	0.016	theta star (KM)	0.0318
80% gamma percentile (KM)	0.678	90% gamma percentile (KM)	0.747
95% gamma percentile (KM)	0.807	99% gamma percentile (KM)	0.928

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (215.01, α)	182.1	Adjusted Chi Square Value (215.01, β)	171.1
95% Gamma Approximate KM-UCL (use when n>=50)	0.672	95% Gamma Adjusted KM-UCL (use when n<50)	0.716

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.878	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.266	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.581	Mean in Log Scale	-0.552
SD in Original Scale	0.0827	SD in Log Scale	0.149
95% t UCL (assumes normality of ROS data)	0.649	95% Percentile Bootstrap UCL	0.631
95% BCA Bootstrap UCL	0.626	95% Bootstrap t UCL	0.638
95% H-UCL (Log ROS)	0.665		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.579	KM Geo Mean	0.56
KM SD (logged)	0.184	95% Critical H Value (KM-Log)	2.047
KM Standard Error of Mean (logged)	0.0842	95% H-UCL (KM -Log)	0.675
KM SD (logged)	0.184	95% Critical H Value (KM-Log)	2.047
KM Standard Error of Mean (logged)	0.0842		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.537	Mean in Log Scale	-0.695
SD in Original Scale	0.177	SD in Log Scale	0.469
95% t UCL (Assumes normality)	0.682	95% H-Stat UCL	0.954

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.657

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
Number of Detects	5	Number of Non-Detects	2
Number of Distinct Detects	5	Number of Distinct Non-Detects	2
Minimum Detect	0.103	Minimum Non-Detect	0.0957
Maximum Detect	0.392	Maximum Non-Detect	0.0966
Variance Detects	0.0134	Percent Non-Detects	28.57%
Mean Detects	0.194	SD Detects	0.116
Median Detects	0.161	CV Detects	0.598
Skewness Detects	1.773	Kurtosis Detects	3.338
Mean of Logged Detects	-1.759	SD of Logged Detects	0.518

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.81	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.31	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.166	KM Standard Error of Mean	0.0415
KM SD	0.0982	95% KM (BCA) UCL	0.233
95% KM (t) UCL	0.246	95% KM (Percentile Bootstrap) UCL	0.233
95% KM (z) UCL	0.234	95% KM Bootstrap t UCL	0.336
90% KM Chebyshev UCL	0.29	95% KM Chebyshev UCL	0.347
97.5% KM Chebyshev UCL	0.425	99% KM Chebyshev UCL	0.579

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.387	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.681	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.248	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.358	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.394	k star (bias corrected MLE)	1.891
Theta hat (MLE)	0.0441	Theta star (bias corrected MLE)	0.102
nu hat (MLE)	43.94	nu star (bias corrected)	18.91
Mean (detects)	0.194		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.141
Maximum	0.392	Median	0.122
SD	0.13	CV	0.923
k hat (MLE)	0.945	k star (bias corrected MLE)	0.635
Theta hat (MLE)	0.15	Theta star (bias corrected MLE)	0.222
nu hat (MLE)	13.22	nu star (bias corrected)	8.89
Adjusted Level of Significance (β)	0.0158		
Approximate Chi Square Value (8.89, α)	3.261	Adjusted Chi Square Value (8.89, β)	2.321
95% Gamma Approximate UCL (use when n>=50)	0.385	95% Gamma Adjusted UCL (use when n<50)	0.541

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.166	SD (KM)	0.0982
Variance (KM)	0.00964	SE of Mean (KM)	0.0415
k hat (KM)	2.849	k star (KM)	1.723
nu hat (KM)	39.89	nu star (KM)	24.13
theta hat (KM)	0.0582	theta star (KM)	0.0962
80% gamma percentile (KM)	0.253	90% gamma percentile (KM)	0.334
95% gamma percentile (KM)	0.412	99% gamma percentile (KM)	0.588

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (24.13, α)	13.95	Adjusted Chi Square Value (24.13, β)	11.68
95% Gamma Approximate KM-UCL (use when n>=50)	0.287	95% Gamma Adjusted KM-UCL (use when n<50)	0.343

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.924	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.221	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.151	Mean in Log Scale	-2.145
SD in Original Scale	0.119	SD in Log Scale	0.783
95% t UCL (assumes normality of ROS data)	0.239	95% Percentile Bootstrap UCL	0.225
95% BCA Bootstrap UCL	0.242	95% Bootstrap t UCL	0.306
95% H-UCL (Log ROS)	0.431		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.927	KM Geo Mean	0.146
KM SD (logged)	0.473	95% Critical H Value (KM-Log)	2.405
KM Standard Error of Mean (logged)	0.2	95% H-UCL (KM -Log)	0.259
KM SD (logged)	0.473	95% Critical H Value (KM-Log)	2.405
KM Standard Error of Mean (logged)	0.2		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.152	Mean in Log Scale	-2.124
SD in Original Scale	0.118	SD in Log Scale	0.753
95% t UCL (Assumes normality)	0.239	95% H-Stat UCL	0.403

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.246

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
Number of Detects	5	Number of Non-Detects	2
Number of Distinct Detects	5	Number of Distinct Non-Detects	2
Minimum Detect	0.224	Minimum Non-Detect	0.0957
Maximum Detect	0.58	Maximum Non-Detect	0.0966
Variance Detects	0.0226	Percent Non-Detects	28.57%
Mean Detects	0.399	SD Detects	0.15
Median Detects	0.397	CV Detects	0.377
Skewness Detects	0.0502	Kurtosis Detects	-2.179
Mean of Logged Detects	-0.98	SD of Logged Detects	0.4

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.948	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.184	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.312	KM Standard Error of Mean	0.0752
KM SD	0.178	95% KM (BCA) UCL	0.43
95% KM (t) UCL	0.458	95% KM (Percentile Bootstrap) UCL	0.422
95% KM (z) UCL	0.436	95% KM Bootstrap t UCL	0.417
90% KM Chebyshev UCL	0.538	95% KM Chebyshev UCL	0.64
97.5% KM Chebyshev UCL	0.782	99% KM Chebyshev UCL	1.061

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.261	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.68	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.208	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.358	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	8.291	k star (bias corrected MLE)	3.45
Theta hat (MLE)	0.0481	Theta star (bias corrected MLE)	0.116
nu hat (MLE)	82.91	nu star (bias corrected)	34.5
Mean (detects)	0.399		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0652	Mean	0.304
Maximum	0.58	Median	0.281
SD	0.204	CV	0.672
k hat (MLE)	1.884	k star (bias corrected MLE)	1.172
Theta hat (MLE)	0.161	Theta star (bias corrected MLE)	0.259
nu hat (MLE)	26.38	nu star (bias corrected)	16.41
Adjusted Level of Significance (β)	0.0158		
Approximate Chi Square Value (16.41, α)	8.25	Adjusted Chi Square Value (16.41, β)	6.582
95% Gamma Approximate UCL (use when n>=50)	0.604	95% Gamma Adjusted UCL (use when n<50)	0.757

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.312	SD (KM)	0.178
Variance (KM)	0.0317	SE of Mean (KM)	0.0752
k hat (KM)	3.08	k star (KM)	1.855
nu hat (KM)	43.12	nu star (KM)	25.97
theta hat (KM)	0.101	theta star (KM)	0.168
80% gamma percentile (KM)	0.472	90% gamma percentile (KM)	0.618
95% gamma percentile (KM)	0.759	99% gamma percentile (KM)	1.072

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (25.97, α)	15.36	Adjusted Chi Square Value (25.97, β)	12.96
95% Gamma Approximate KM-UCL (use when n>=50)	0.528	95% Gamma Adjusted KM-UCL (use when n<50)	0.626

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.944	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.183	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.323	Mean in Log Scale	-1.278
SD in Original Scale	0.179	SD in Log Scale	0.604
95% t UCL (assumes normality of ROS data)	0.454	95% Percentile Bootstrap UCL	0.426
95% BCA Bootstrap UCL	0.435	95% Bootstrap t UCL	0.477
95% H-UCL (Log ROS)	0.648		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.371	KM Geo Mean	0.254
KM SD (logged)	0.687	95% Critical H Value (KM-Log)	2.873
KM Standard Error of Mean (logged)	0.29	95% H-UCL (KM -Log)	0.72
KM SD (logged)	0.687	95% Critical H Value (KM-Log)	2.873
KM Standard Error of Mean (logged)	0.29		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.299	Mean in Log Scale	-1.567
SD in Original Scale	0.211	SD in Log Scale	1.054
95% t UCL (Assumes normality)	0.453	95% H-Stat UCL	1.91

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.458

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.539	Mean	2.446
Maximum	5.52	Median	1.77
SD	1.949	Std. Error of Mean	0.737
Coefficient of Variation	0.797	Skewness	0.903

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.859	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.265	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	3.877	95% Adjusted-CLT UCL (Chen-1995)	3.926
		95% Modified-t UCL (Johnson-1978)	3.919

Gamma GOF Test

A-D Test Statistic	0.315	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.717	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.18	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.316	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.798	k star (bias corrected MLE)	1.123
Theta hat (MLE)	1.36	Theta star (bias corrected MLE)	2.179
nu hat (MLE)	25.17	nu star (bias corrected)	15.72
MLE Mean (bias corrected)	2.446	MLE Sd (bias corrected)	2.309
		Approximate Chi Square Value (0.05)	7.763
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	6.154

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	4.952	95% Adjusted Gamma UCL (use when n<50)	6.248

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.936	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.162	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.618	Mean of logged Data	0.591
Maximum of Logged Data	1.708	SD of logged Data	0.875

Assuming Lognormal Distribution

95% H-UCL	8.784	90% Chebyshev (MVUE) UCL	4.952
95% Chebyshev (MVUE) UCL	6.073	97.5% Chebyshev (MVUE) UCL	7.629
99% Chebyshev (MVUE) UCL	10.68		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	3.658	95% Jackknife UCL	3.877
95% Standard Bootstrap UCL	3.559	95% Bootstrap-t UCL	5.668
95% Hall's Bootstrap UCL	14.42	95% Percentile Bootstrap UCL	3.657
95% BCA Bootstrap UCL	3.763		
90% Chebyshev(Mean, Sd) UCL	4.656	95% Chebyshev(Mean, Sd) UCL	5.657
97.5% Chebyshev(Mean, Sd) UCL	7.046	99% Chebyshev(Mean, Sd) UCL	9.775

Suggested UCL to Use

95% Student's-t UCL 3.877

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
Number of Detects	6	Number of Non-Detects	1
Number of Distinct Detects	6	Number of Distinct Non-Detects	1
Minimum Detect	0.25	Minimum Non-Detect	0.0971
Maximum Detect	0.481	Maximum Non-Detect	0.0971
Variance Detects	0.00659	Percent Non-Detects	14.29%
Mean Detects	0.392	SD Detects	0.0812
Median Detects	0.402	CV Detects	0.207
Skewness Detects	-1.095	Kurtosis Detects	1.558
Mean of Logged Detects	-0.957	SD of Logged Detects	0.233

Note: Sample size is small (e.g., <10), If data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.93	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.207	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.35	KM Standard Error of Mean	0.0513
KM SD	0.124	95% KM (BCA) UCL	0.42
95% KM (t) UCL	0.45	95% KM (Percentile Bootstrap) UCL	0.424
95% KM (z) UCL	0.434	95% KM Bootstrap t UCL	0.418
90% KM Chebyshev UCL	0.504	95% KM Chebyshev UCL	0.574
97.5% KM Chebyshev UCL	0.671	99% KM Chebyshev UCL	0.861

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.381	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.697	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.228	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	24.2	k star (bias corrected MLE)	12.21
Theta hat (MLE)	0.0162	Theta star (bias corrected MLE)	0.0321
nu hat (MLE)	290.4	nu star (bias corrected)	146.5
Mean (detects)	0.392		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.218	Mean	0.367
Maximum	0.481	Median	0.389
SD	0.0992	CV	0.27
k hat (MLE)	13.97	k star (bias corrected MLE)	8.081
Theta hat (MLE)	0.0263	Theta star (bias corrected MLE)	0.0455
nu hat (MLE)	195.6	nu star (bias corrected)	113.1
Adjusted Level of Significance (β)	0.0158		
Approximate Chi Square Value (113.13, α)	89.57	Adjusted Chi Square Value (113.13, β)	83.26
95% Gamma Approximate UCL (use when n>=50)	0.464	95% Gamma Adjusted UCL (use when n<50)	0.499

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.35	SD (KM)	0.124
Variance (KM)	0.0154	SE of Mean (KM)	0.0513
k hat (KM)	7.97	k star (KM)	4.649
nu hat (KM)	111.6	nu star (KM)	65.09
theta hat (KM)	0.0439	theta star (KM)	0.0753
80% gamma percentile (KM)	0.474	90% gamma percentile (KM)	0.567
95% gamma percentile (KM)	0.653	99% gamma percentile (KM)	0.833

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (65.09, α)	47.53	Adjusted Chi Square Value (65.09, β)	43.03
95% Gamma Approximate KM-UCL (use when n>=50)	0.479	95% Gamma Adjusted KM-UCL (use when n<50)	0.529

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.874	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.251	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.368	Mean in Log Scale	-1.034
SD in Original Scale	0.0977	SD in Log Scale	0.294
95% t UCL (assumes normality of ROS data)	0.44	95% Percentile Bootstrap UCL	0.425
95% BCA Bootstrap UCL	0.415	95% Bootstrap t UCL	0.428
95% H-UCL (Log ROS)	0.484		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.153	KM Geo Mean	0.316
KM SD (logged)	0.52	95% Critical H Value (KM-Log)	2.504
KM Standard Error of Mean (logged)	0.215	95% H-UCL (KM -Log)	0.615
KM SD (logged)	0.52	95% Critical H Value (KM-Log)	2.504
KM Standard Error of Mean (logged)	0.215		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.343	Mean in Log Scale	-1.252
SD in Original Scale	0.15	SD in Log Scale	0.81
95% t UCL (Assumes normality)	0.453	95% H-Stat UCL	1.136

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.45

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
Number of Detects	5	Number of Non-Detects	1
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	0.296	Minimum Non-Detect	0.0971
Maximum Detect	0.532	Maximum Non-Detect	0.0971
Variance Detects	0.00903	Percent Non-Detects	16.67%
Mean Detects	0.41	SD Detects	0.095
Median Detects	0.424	CV Detects	0.232
Skewness Detects	0.0325	Kurtosis Detects	-1.464
Mean of Logged Detects	-0.913	SD of Logged Detects	0.237

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.969	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.179	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.358	KM Standard Error of Mean	0.064
KM SD	0.14	95% KM (BCA) UCL	0.447
95% KM (t) UCL	0.487	95% KM (Percentile Bootstrap) UCL	0.449
95% KM (z) UCL	0.463	95% KM Bootstrap t UCL	0.444
90% KM Chebyshev UCL	0.55	95% KM Chebyshev UCL	0.637
97.5% KM Chebyshev UCL	0.757	99% KM Chebyshev UCL	0.994

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.234	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.679	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.198	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	22.72	k star (bias corrected MLE)	9.222
Theta hat (MLE)	0.0181	Theta star (bias corrected MLE)	0.0445
nu hat (MLE)	227.2	nu star (bias corrected)	92.22
Mean (detects)	0.41		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.189	Mean	0.373
Maximum	0.532	Median	0.381
SD	0.124	CV	0.332
k hat (MLE)	9.497	k star (bias corrected MLE)	4.86
Theta hat (MLE)	0.0393	Theta star (bias corrected MLE)	0.0768
nu hat (MLE)	114	nu star (bias corrected)	58.32
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (58.32, α)	41.76	Adjusted Chi Square Value (58.32, β)	36.76
95% Gamma Approximate UCL (use when n>=50)	0.521	95% Gamma Adjusted UCL (use when n<50)	0.592

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.358	SD (KM)	0.14
Variance (KM)	0.0196	SE of Mean (KM)	0.064
k hat (KM)	6.528	k star (KM)	3.375
nu hat (KM)	78.34	nu star (KM)	40.5
theta hat (KM)	0.0548	theta star (KM)	0.106
80% gamma percentile (KM)	0.504	90% gamma percentile (KM)	0.619
95% gamma percentile (KM)	0.727	99% gamma percentile (KM)	0.958

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (40.50, α)	26.92	Adjusted Chi Square Value (40.50, β)	23
95% Gamma Approximate KM-UCL (use when n>=50)	0.539	95% Gamma Adjusted KM-UCL (use when n<50)	0.63

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.962	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.192	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.378	Mean in Log Scale	-1.016
SD in Original Scale	0.116	SD in Log Scale	0.328
95% t UCL (assumes normality of ROS data)	0.473	95% Percentile Bootstrap UCL	0.449
95% BCA Bootstrap UCL	0.445	95% Bootstrap t UCL	0.47
95% H-UCL (Log ROS)	0.534		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.15	KM Geo Mean	0.317
KM SD (logged)	0.563	95% Critical H Value (KM-Log)	2.795
KM Standard Error of Mean (logged)	0.257	95% H-UCL (KM -Log)	0.75
KM SD (logged)	0.563	95% Critical H Value (KM-Log)	2.795
KM Standard Error of Mean (logged)	0.257		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.35	Mean in Log Scale	-1.265
SD in Original Scale	0.17	SD in Log Scale	0.888
95% t UCL (Assumes normality)	0.49	95% H-Stat UCL	1.844

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.487

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	6.15	Mean	215.6
Maximum	482	Median	214
SD	210.3	Std. Error of Mean	79.48
Coefficient of Variation	0.975	Skewness	0.102

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.838	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.264	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	370	95% Adjusted-CLT UCL (Chen-1995)	349.6
		95% Modified-t UCL (Johnson-1978)	370.5

Gamma GOF Test

A-D Test Statistic	0.779	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.748	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.278	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.326	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.551	k star (bias corrected MLE)	0.41
Theta hat (MLE)	391	Theta star (bias corrected MLE)	525.5
nu hat (MLE)	7.718	nu star (bias corrected)	5.743
MLE Mean (bias corrected)	215.6	MLE Sd (bias corrected)	336.6
		Approximate Chi Square Value (0.05)	1.51
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	0.95

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	819.8	95% Adjusted Gamma UCL (use when n<50)	1303

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.772	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.279	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.816	Mean of logged Data	4.238
Maximum of Logged Data	6.178	SD of logged Data	2.061

Assuming Lognormal Distribution

95% H-UCL	199058	90% Chebyshev (MVUE) UCL	1007
95% Chebyshev (MVUE) UCL	1317	97.5% Chebyshev (MVUE) UCL	1748
99% Chebyshev (MVUE) UCL	2594		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	346.3	95% Jackknife UCL	370
95% Standard Bootstrap UCL	335.5	95% Bootstrap-t UCL	379.7
95% Hall's Bootstrap UCL	310.2	95% Percentile Bootstrap UCL	341.5
95% BCA Bootstrap UCL	342		
90% Chebyshev(Mean, Sd) UCL	454	95% Chebyshev(Mean, Sd) UCL	562
97.5% Chebyshev(Mean, Sd) UCL	711.9	99% Chebyshev(Mean, Sd) UCL	1006

Suggested UCL to Use

95% Student's-t UCL 370

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.149	Mean	0.51
Maximum	1.58	Median	0.217
SD	0.521	Std. Error of Mean	0.197
Coefficient of Variation	1.022	Skewness	1.778

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.755	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.285	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.893	95% Adjusted-CLT UCL (Chen-1995)	0.976
		95% Modified-t UCL (Johnson-1978)	0.915

Gamma GOF Test

A-D Test Statistic	0.602	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.722	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.299	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.317	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.445	k star (bias corrected MLE)	0.921
Theta hat (MLE)	0.353	Theta star (bias corrected MLE)	0.554
nu hat (MLE)	20.23	nu star (bias corrected)	12.89
MLE Mean (bias corrected)	0.51	MLE Sd (bias corrected)	0.532
		Approximate Chi Square Value (0.05)	5.821
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	4.469

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1.13	95% Adjusted Gamma UCL (use when n<50)	1.472

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.86	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.268	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.904	Mean of logged Data	-1.057
Maximum of Logged Data	0.457	SD of logged Data	0.913

Assuming Lognormal Distribution

95% H-UCL	1.909	90% Chebyshev (MVUE) UCL	0.999
95% Chebyshev (MVUE) UCL	1.229	97.5% Chebyshev (MVUE) UCL	1.549
99% Chebyshev (MVUE) UCL	2.178		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.834	95% Jackknife UCL	0.893
95% Standard Bootstrap UCL	0.816	95% Bootstrap-t UCL	1.411
95% Hall's Bootstrap UCL	1.909	95% Percentile Bootstrap UCL	0.847
95% BCA Bootstrap UCL	0.917		
90% Chebyshev(Mean, Sd) UCL	1.102	95% Chebyshev(Mean, Sd) UCL	1.369
97.5% Chebyshev(Mean, Sd) UCL	1.741	99% Chebyshev(Mean, Sd) UCL	2.471

Suggested UCL to Use

95% Student's-t UCL 0.893

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
Number of Detects	6	Number of Non-Detects	1
Number of Distinct Detects	6	Number of Distinct Non-Detects	1
Minimum Detect	0.138	Minimum Non-Detect	0.0966
Maximum Detect	7.85	Maximum Non-Detect	0.0966
Variance Detects	7.991	Percent Non-Detects	14.29%
Mean Detects	2.459	SD Detects	2.827
Median Detects	2.025	CV Detects	1.149
Skewness Detects	1.758	Kurtosis Detects	3.613
Mean of Logged Detects	0.132	SD of Logged Detects	1.583

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.792	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.325	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data Not Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2.122	KM Standard Error of Mean	1.047
KM SD	2.528	95% KM (BCA) UCL	3.991
95% KM (t) UCL	4.156	95% KM (Percentile Bootstrap) UCL	3.712
95% KM (z) UCL	3.844	95% KM Bootstrap t UCL	5.771
90% KM Chebyshev UCL	5.262	95% KM Chebyshev UCL	6.684
97.5% KM Chebyshev UCL	8.659	99% KM Chebyshev UCL	12.54

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.395	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.72	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.243	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.343	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.776	k star (bias corrected MLE)	0.499
Theta hat (MLE)	3.168	Theta star (bias corrected MLE)	4.925
nu hat (MLE)	9.317	nu star (bias corrected)	5.992
Mean (detects)	2.459		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	2.109
Maximum	7.85	Median	1.95
SD	2.742	CV	1.3
k hat (MLE)	0.493	k star (bias corrected MLE)	0.377
Theta hat (MLE)	4.278	Theta star (bias corrected MLE)	5.595
nu hat (MLE)	6.904	nu star (bias corrected)	5.278
Adjusted Level of Significance (β)	0.0158		
Approximate Chi Square Value (5.28, α)	1.283	Adjusted Chi Square Value (5.28, β)	0.784
95% Gamma Approximate UCL (use when n>=50)	8.679	95% Gamma Adjusted UCL (use when n<50)	14.2

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2.122	SD (KM)	2.528
Variance (KM)	6.391	SE of Mean (KM)	1.047
k hat (KM)	0.704	k star (KM)	0.498
nu hat (KM)	9.862	nu star (KM)	6.969
theta hat (KM)	3.012	theta star (KM)	4.263
80% gamma percentile (KM)	3.484	90% gamma percentile (KM)	5.746
95% gamma percentile (KM)	8.164	99% gamma percentile (KM)	14.11

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.97, α)	2.153	Adjusted Chi Square Value (6.97, β)	1.438
95% Gamma Approximate KM-UCL (use when n>=50)	6.867	95% Gamma Adjusted KM-UCL (use when n<50)	10.28

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.879	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.299	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2.112	Mean in Log Scale	-0.412
SD in Original Scale	2.74	SD in Log Scale	2.04
95% t UCL (assumes normality of ROS data)	4.124	95% Percentile Bootstrap UCL	3.972
95% BCA Bootstrap UCL	4.5	95% Bootstrap t UCL	5.745
95% H-UCL (Log ROS)	1629		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.22	KM Geo Mean	0.802
KM SD (logged)	1.593	95% Critical H Value (KM-Log)	5.471
KM Standard Error of Mean (logged)	0.66	95% H-UCL (KM -Log)	100.1
KM SD (logged)	1.593	95% Critical H Value (KM-Log)	5.471
KM Standard Error of Mean (logged)	0.66		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	2.115	Mean in Log Scale	-0.319
SD in Original Scale	2.737	SD in Log Scale	1.876
95% t UCL (Assumes normality)	4.125	95% H-Stat UCL	547.7

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 4.156

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	7	Number of Distinct Observations	6
Number of Detects	4	Number of Non-Detects	3
Number of Distinct Detects	4	Number of Distinct Non-Detects	2
Minimum Detect	0.167	Minimum Non-Detect	0.0966
Maximum Detect	0.975	Maximum Non-Detect	0.098
Variance Detects	0.147	Percent Non-Detects	42.86%
Mean Detects	0.404	SD Detects	0.384
Median Detects	0.236	CV Detects	0.951
Skewness Detects	1.914	Kurtosis Detects	3.689
Mean of Logged Detects	-1.183	SD of Logged Detects	0.801

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.732	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.379	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.272	KM Standard Error of Mean	0.128
KM SD	0.294	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.521	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.483	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.656	95% KM Chebyshev UCL	0.831
97.5% KM Chebyshev UCL	1.072	99% KM Chebyshev UCL	1.547

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.562	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.661	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.349	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.398	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.963	k star (bias corrected MLE)	0.657
Theta hat (MLE)	0.206	Theta star (bias corrected MLE)	0.614
nu hat (MLE)	15.7	nu star (bias corrected)	5.26
Mean (detects)	0.404		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.235
Maximum	0.975	Median	0.167
SD	0.343	CV	1.462
k hat (MLE)	0.525	k star (bias corrected MLE)	0.395
Theta hat (MLE)	0.447	Theta star (bias corrected MLE)	0.594
nu hat (MLE)	7.348	nu star (bias corrected)	5.532
Adjusted Level of Significance (β)	0.0158		
Approximate Chi Square Value (5.53, α)	1.406	Adjusted Chi Square Value (5.53, β)	0.873
95% Gamma Approximate UCL (use when n>=50)	0.924	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.272	SD (KM)	0.294
Variance (KM)	0.0862	SE of Mean (KM)	0.128
k hat (KM)	0.858	k star (KM)	0.586
nu hat (KM)	12.01	nu star (KM)	8.197
theta hat (KM)	0.317	theta star (KM)	0.464
80% gamma percentile (KM)	0.448	90% gamma percentile (KM)	0.711
95% gamma percentile (KM)	0.987	99% gamma percentile (KM)	1.656

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (8.20, α)	2.85	Adjusted Chi Square Value (8.20, β)	1.988
95% Gamma Approximate KM-UCL (use when n>=50)	0.782	95% Gamma Adjusted KM-UCL (use when n<50)	1.121

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.841	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.3	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.245	Mean in Log Scale	-2.166
SD in Original Scale	0.336	SD in Log Scale	1.37
95% t UCL (assumes normality of ROS data)	0.491	95% Percentile Bootstrap UCL	0.477
95% BCA Bootstrap UCL	0.591	95% Bootstrap t UCL	0.917
95% H-UCL (Log ROS)	4.268		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.678	KM Geo Mean	0.187
KM SD (logged)	0.775	95% Critical H Value (KM-Log)	3.09
KM Standard Error of Mean (logged)	0.338	95% H-UCL (KM -Log)	0.671
KM SD (logged)	0.775	95% Critical H Value (KM-Log)	3.09
KM Standard Error of Mean (logged)	0.338		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.251	Mean in Log Scale	-1.973
SD in Original Scale	0.331	SD in Log Scale	1.136
95% t UCL (Assumes normality)	0.495	95% H-Stat UCL	1.764

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL N/A ɜ Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1) 1.121

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
West Lakeland
Forage Fish Tissue

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/22/2021 3:39:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

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General Statistics

Total Number of Observations	21	Number of Distinct Observations	20
Number of Detects	20	Number of Non-Detects	1
Number of Distinct Detects	19	Number of Distinct Non-Detects	1
Minimum Detect	0.494	Minimum Non-Detect	0.392
Maximum Detect	0.907	Maximum Non-Detect	0.392
Variance Detects	0.0126	Percent Non-Detects	4.76%
Mean Detects	0.61	SD Detects	0.112
Median Detects	0.59	CV Detects	0.184
Skewness Detects	1.284	Kurtosis Detects	1.381
Mean of Logged Detects	-0.508	SD of Logged Detects	0.171

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.864	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.905	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.15	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.192	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.6	KM Standard Error of Mean	0.0261
KM SD	0.117	95% KM (BCA) UCL	0.642
95% KM (t) UCL	0.645	95% KM (Percentile Bootstrap) UCL	0.644
95% KM (z) UCL	0.643	95% KM Bootstrap t UCL	0.654
90% KM Chebyshev UCL	0.678	95% KM Chebyshev UCL	0.714
97.5% KM Chebyshev UCL	0.763	99% KM Chebyshev UCL	0.86

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.736	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.74	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.152	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.193	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	34.54	k star (bias corrected MLE)	29.39
Theta hat (MLE)	0.0177	Theta star (bias corrected MLE)	0.0208
nu hat (MLE)	1382	nu star (bias corrected)	1176
Mean (detects)	0.61		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.369	Mean	0.599
Maximum	0.907	Median	0.572
SD	0.122	CV	0.203
k hat (MLE)	26.73	k star (bias corrected MLE)	22.94
Theta hat (MLE)	0.0224	Theta star (bias corrected MLE)	0.0261
nu hat (MLE)	1123	nu star (bias corrected)	963.5
Adjusted Level of Significance (β)	0.0383		
Approximate Chi Square Value (963.50, α)	892.5	Adjusted Chi Square Value (963.50, β)	887.2
95% Gamma Approximate UCL (use when n>=50)	0.647	95% Gamma Adjusted UCL (use when n<50)	0.65

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.6	SD (KM)	0.117
Variance (KM)	0.0136	SE of Mean (KM)	0.0261
k hat (KM)	26.52	k star (KM)	22.77
nu hat (KM)	1114	nu star (KM)	956.2
theta hat (KM)	0.0226	theta star (KM)	0.0264
80% gamma percentile (KM)	0.703	90% gamma percentile (KM)	0.766
95% gamma percentile (KM)	0.821	99% gamma percentile (KM)	0.931

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (956.18, α)	885.4	Adjusted Chi Square Value (956.18, β)	880.2
95% Gamma Approximate KM-UCL (use when n>=50)	0.648	95% Gamma Adjusted KM-UCL (use when n<50)	0.652

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.901	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.905	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.15	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.192	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.6	Mean in Log Scale	-0.528
SD in Original Scale	0.119	SD in Log Scale	0.19
95% t UCL (assumes normality of ROS data)	0.645	95% Percentile Bootstrap UCL	0.643
95% BCA Bootstrap UCL	0.652	95% Bootstrap t UCL	0.654
95% H-UCL (Log ROS)	0.647		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.529	KM Geo Mean	0.589
KM SD (logged)	0.186	95% Critical H Value (KM-Log)	1.764
KM Standard Error of Mean (logged)	0.0417	95% H-UCL (KM -Log)	0.646
KM SD (logged)	0.186	95% Critical H Value (KM-Log)	1.764
KM Standard Error of Mean (logged)	0.0417		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.591	Mean in Log Scale	-0.562
SD in Original Scale	0.142	SD in Log Scale	0.296
95% t UCL (Assumes normality)	0.644	95% H-Stat UCL	0.673

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.645

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	21	Number of Distinct Observations	20
		Number of Missing Observations	0
Minimum	0.133	Mean	0.346
Maximum	1.11	Median	0.272
SD	0.271	Std. Error of Mean	0.0592
Coefficient of Variation	0.785	Skewness	2.21

Normal GOF Test

Shapiro Wilk Test Statistic	0.69	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.908	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.239	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.188	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

ProUCL Output
West Lakeland
Forage Fish Tissue

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.448	95% Adjusted-CLT UCL (Chen-1995)	0.474
		95% Modified-t UCL (Johnson-1978)	0.453

Gamma GOF Test

A-D Test Statistic	1.065	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.751	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.164	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.191	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.683	k star (bias corrected MLE)	2.332
Theta hat (MLE)	0.129	Theta star (bias corrected MLE)	0.148
nu hat (MLE)	112.7	nu star (bias corrected)	97.93
MLE Mean (bias corrected)	0.346	MLE Sd (bias corrected)	0.226
		Approximate Chi Square Value (0.05)	76.1
Adjusted Level of Significance	0.0383	Adjusted Chi Square Value	74.62

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	0.445	95% Adjusted Gamma UCL (use when n<50)	0.454

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.908	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.908	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.12	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.188	Data appear Lognormal at 5% Significance Level	

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.017	Mean of logged Data	-1.26
Maximum of Logged Data	0.104	SD of logged Data	0.594

Assuming Lognormal Distribution

95% H-UCL	0.446	90% Chebyshev (MVUE) UCL	0.472
95% Chebyshev (MVUE) UCL	0.535	97.5% Chebyshev (MVUE) UCL	0.621
99% Chebyshev (MVUE) UCL	0.79		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.443	95% Jackknife UCL	0.448
95% Standard Bootstrap UCL	0.441	95% Bootstrap-t UCL	0.556
95% Hall's Bootstrap UCL	0.969	95% Percentile Bootstrap UCL	0.455
95% BCA Bootstrap UCL	0.485		
90% Chebyshev(Mean, Sd) UCL	0.523	95% Chebyshev(Mean, Sd) UCL	0.604
97.5% Chebyshev(Mean, Sd) UCL	0.716	99% Chebyshev(Mean, Sd) UCL	0.935

Suggested UCL to Use

95% Adjusted Gamma UCL 0.454

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	21	Number of Distinct Observations	18
Number of Detects	12	Number of Non-Detects	9
Number of Distinct Detects	12	Number of Distinct Non-Detects	6
Minimum Detect	0.125	Minimum Non-Detect	0.0962
Maximum Detect	0.408	Maximum Non-Detect	0.1
Variance Detects	0.00859	Percent Non-Detects	42.86%
Mean Detects	0.198	SD Detects	0.0927
Median Detects	0.157	CV Detects	0.467
Skewness Detects	1.473	Kurtosis Detects	1.217
Mean of Logged Detects	-1.699	SD of Logged Detects	0.401

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.783	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.248	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.155	KM Standard Error of Mean	0.0192
KM SD	0.084	95% KM (BCA) UCL	0.187
95% KM (t) UCL	0.188	95% KM (Percentile Bootstrap) UCL	0.187
95% KM (z) UCL	0.186	95% KM Bootstrap t UCL	0.207
90% KM Chebyshev UCL	0.212	95% KM Chebyshev UCL	0.238
97.5% KM Chebyshev UCL	0.274	99% KM Chebyshev UCL	0.345

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.895	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.732	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.239	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.246	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	6.285	k star (bias corrected MLE)	4.77
Theta hat (MLE)	0.0316	Theta star (bias corrected MLE)	0.0416
nu hat (MLE)	150.8	nu star (bias corrected)	114.5
Mean (detects)	0.198		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.12
Maximum	0.408	Median	0.131
SD	0.116	CV	0.963
k hat (MLE)	0.836	k star (bias corrected MLE)	0.748
Theta hat (MLE)	0.144	Theta star (bias corrected MLE)	0.16
nu hat (MLE)	35.11	nu star (bias corrected)	31.42
Adjusted Level of Significance (β)	0.0383		
Approximate Chi Square Value (31.42, α)	19.62	Adjusted Chi Square Value (31.42, β)	18.9
95% Gamma Approximate UCL (use when n>=50)	0.192	95% Gamma Adjusted UCL (use when n<50)	0.2

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.155	SD (KM)	0.084
Variance (KM)	0.00706	SE of Mean (KM)	0.0192
k hat (KM)	3.386	k star (KM)	2.934
nu hat (KM)	142.2	nu star (KM)	123.2
theta hat (KM)	0.0457	theta star (KM)	0.0527
80% gamma percentile (KM)	0.221	90% gamma percentile (KM)	0.276
95% gamma percentile (KM)	0.327	99% gamma percentile (KM)	0.437

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (123.22, α)	98.59	Adjusted Chi Square Value (123.22, β)	96.9
95% Gamma Approximate KM-UCL (use when n>=50)	0.193	95% Gamma Adjusted KM-UCL (use when n<50)	0.197

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.849	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.22	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.141	Mean in Log Scale	-2.146
SD in Original Scale	0.0966	SD in Log Scale	0.615
95% t UCL (assumes normality of ROS data)	0.178	95% Percentile Bootstrap UCL	0.176
95% BCA Bootstrap UCL	0.184	95% Bootstrap t UCL	0.195
95% H-UCL (Log ROS)	0.189		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.974	KM Geo Mean	0.139
KM SD (logged)	0.431	95% Critical H Value (KM-Log)	1.929
KM Standard Error of Mean (logged)	0.0981	95% H-UCL (KM -Log)	0.183
KM SD (logged)	0.431	95% Critical H Value (KM-Log)	1.929
KM Standard Error of Mean (logged)	0.0981		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.134	Mean in Log Scale	-2.264
SD in Original Scale	0.102	SD in Log Scale	0.732
95% t UCL (Assumes normality)	0.173	95% H-Stat UCL	0.196

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	0.197	95% GROS Adjusted Gamma UCL	0.2

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFDA|ug/kg

General Statistics

Total Number of Observations	21	Number of Distinct Observations	21
		Number of Missing Observations	0
Minimum	2	Mean	5.269
Maximum	10.4	Median	4.93
SD	2.295	Std. Error of Mean	0.501
Coefficient of Variation	0.436	Skewness	0.868

Normal GOF Test

Shapiro Wilk Test Statistic	0.925	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.908	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.122	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.188	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	6.133	95% Adjusted-CLT UCL (Chen-1995)	6.194
		95% Modified-t UCL (Johnson-1978)	6.148

Gamma GOF Test

A-D Test Statistic	0.243	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.745	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0856	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.19	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.855	k star (bias corrected MLE)	5.051

Theta hat (MLE)	0.9	Theta star (bias corrected MLE)	1.043
nu hat (MLE)	245.9	nu star (bias corrected)	212.1
MLE Mean (bias corrected)	5.269	MLE Sd (bias corrected)	2.344
		Approximate Chi Square Value (0.05)	179.4
Adjusted Level of Significance	0.0383	Adjusted Chi Square Value	177.1

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	6.229	95% Adjusted Gamma UCL (use when n<50)	6.31

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.981	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.908	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.0699	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.188	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.693	Mean of logged Data	1.574
Maximum of Logged Data	2.342	SD of logged Data	0.431

Assuming Lognormal Distribution

95% H-UCL	6.379	90% Chebyshev (MVUE) UCL	6.801
95% Chebyshev (MVUE) UCL	7.494	97.5% Chebyshev (MVUE) UCL	8.457
99% Chebyshev (MVUE) UCL	10.35		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	6.093	95% Jackknife UCL	6.133
95% Standard Bootstrap UCL	6.037	95% Bootstrap-t UCL	6.291
95% Hall's Bootstrap UCL	6.207	95% Percentile Bootstrap UCL	6.115
95% BCA Bootstrap UCL	6.212		
90% Chebyshev(Mean, Sd) UCL	6.771	95% Chebyshev(Mean, Sd) UCL	7.452
97.5% Chebyshev(Mean, Sd) UCL	8.397	99% Chebyshev(Mean, Sd) UCL	10.25

Suggested UCL to Use

95% Student's-t UCL 6.133

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	21	Number of Distinct Observations	20
		Number of Missing Observations	0
Minimum	0.119	Mean	0.222
Maximum	0.396	Median	0.21
SD	0.067	Std. Error of Mean	0.0146
Coefficient of Variation	0.302	Skewness	0.82

Normal GOF Test

Shapiro Wilk Test Statistic	0.95	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.908	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.135	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.188	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.247	95% Adjusted-CLT UCL (Chen-1995)	0.249
		95% Modified-t UCL (Johnson-1978)	0.247

Gamma GOF Test

A-D Test Statistic	0.209	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.743	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.098	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.189	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

ProUCL Output
West Lakeland
Forage Fish Tissue

Gamma Statistics

k hat (MLE)	12.08	k star (bias corrected MLE)	10.38
Theta hat (MLE)	0.0184	Theta star (bias corrected MLE)	0.0214
nu hat (MLE)	507.2	nu star (bias corrected)	436.1
MLE Mean (bias corrected)	0.222	MLE Sd (bias corrected)	0.0688
		Approximate Chi Square Value (0.05)	388.7
Adjusted Level of Significance	0.0383	Adjusted Chi Square Value	385.2

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.249	95% Adjusted Gamma UCL (use when n<50)	0.251

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.986	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.908	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.109	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.188	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.129	Mean of logged Data	-1.548
Maximum of Logged Data	-0.926	SD of logged Data	0.297

Assuming Lognormal Distribution

95% H-UCL	0.251	90% Chebyshev (MVUE) UCL	0.265
95% Chebyshev (MVUE) UCL	0.285	97.5% Chebyshev (MVUE) UCL	0.313
99% Chebyshev (MVUE) UCL	0.367		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.246	95% Jackknife UCL	0.247
95% Standard Bootstrap UCL	0.244	95% Bootstrap-t UCL	0.25
95% Hall's Bootstrap UCL	0.25	95% Percentile Bootstrap UCL	0.245
95% BCA Bootstrap UCL	0.246		
90% Chebyshev(Mean, Sd) UCL	0.266	95% Chebyshev(Mean, Sd) UCL	0.285
97.5% Chebyshev(Mean, Sd) UCL	0.313	99% Chebyshev(Mean, Sd) UCL	0.367

Suggested UCL to Use

95% Student's-t UCL 0.247

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	21	Number of Distinct Observations	19
Number of Detects	16	Number of Non-Detects	5
Number of Distinct Detects	16	Number of Distinct Non-Detects	3
Minimum Detect	0.099	Minimum Non-Detect	0.0957
Maximum Detect	0.29	Maximum Non-Detect	0.098
Variance Detects	0.00279	Percent Non-Detects	23.81%
Mean Detects	0.154	SD Detects	0.0528
Median Detects	0.132	CV Detects	0.344
Skewness Detects	1.415	Kurtosis Detects	1.69
Mean of Logged Detects	-1.921	SD of Logged Detects	0.307

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.853	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.887	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.205	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.213	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.14	KM Standard Error of Mean	0.0115
KM SD	0.051	95% KM (BCA) UCL	0.161
95% KM (t) UCL	0.16	95% KM (Percentile Bootstrap) UCL	0.16
95% KM (z) UCL	0.159	95% KM Bootstrap t UCL	0.168
90% KM Chebyshev UCL	0.174	95% KM Chebyshev UCL	0.19
97.5% KM Chebyshev UCL	0.212	99% KM Chebyshev UCL	0.254

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.634	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.739	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.185	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.215	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	10.72	k star (bias corrected MLE)	8.754
Theta hat (MLE)	0.0143	Theta star (bias corrected MLE)	0.0176
nu hat (MLE)	343.1	nu star (bias corrected)	280.1
Mean (detects)	0.154		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0384	Mean	0.129
Maximum	0.29	Median	0.124
SD	0.0646	CV	0.502
k hat (MLE)	3.881	k star (bias corrected MLE)	3.358
Theta hat (MLE)	0.0332	Theta star (bias corrected MLE)	0.0384
nu hat (MLE)	163	nu star (bias corrected)	141
Adjusted Level of Significance (β)	0.0383		
Approximate Chi Square Value (141.04, α)	114.6	Adjusted Chi Square Value (141.04, β)	112.8
95% Gamma Approximate UCL (use when n>=50)	0.159	95% Gamma Adjusted UCL (use when n<50)	0.161

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.14	SD (KM)	0.051
Variance (KM)	0.0026	SE of Mean (KM)	0.0115
k hat (KM)	7.515	k star (KM)	6.473
nu hat (KM)	315.6	nu star (KM)	271.9
theta hat (KM)	0.0186	theta star (KM)	0.0216
80% gamma percentile (KM)	0.183	90% gamma percentile (KM)	0.213
95% gamma percentile (KM)	0.241	99% gamma percentile (KM)	0.298

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (271.87, α)	234.7	Adjusted Chi Square Value (271.87, β)	232
95% Gamma Approximate KM-UCL (use when n>=50)	0.162	95% Gamma Adjusted KM-UCL (use when n<50)	0.164

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.924	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.17	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.134	Mean in Log Scale	-2.092
SD in Original Scale	0.0582	SD in Log Scale	0.414
95% t UCL (assumes normality of ROS data)	0.156	95% Percentile Bootstrap UCL	0.155
95% BCA Bootstrap UCL	0.157	95% Bootstrap t UCL	0.161
95% H-UCL (Log ROS)	0.161		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.022	KM Geo Mean	0.132
KM SD (logged)	0.316	95% Critical H Value (KM-Log)	1.844
KM Standard Error of Mean (logged)	0.0713	95% H-UCL (KM -Log)	0.159
KM SD (logged)	0.316	95% Critical H Value (KM-Log)	1.844
KM Standard Error of Mean (logged)	0.0713		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.129	Mean in Log Scale	-2.184
SD in Original Scale	0.0648	SD in Log Scale	0.552
95% t UCL (Assumes normality)	0.153	95% H-Stat UCL	0.168

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

ProUCL Output
West Lakeland
Forage Fish Tissue

Suggested UCL to Use

95% KM (t) UCL 0.16

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	21	Number of Distinct Observations	18
Number of Detects	15	Number of Non-Detects	6
Number of Distinct Detects	14	Number of Distinct Non-Detects	4
Minimum Detect	0.104	Minimum Non-Detect	0.098
Maximum Detect	0.211	Maximum Non-Detect	0.0995
Variance Detects	0.00107	Percent Non-Detects	28.57%
Mean Detects	0.138	SD Detects	0.0328
Median Detects	0.127	CV Detects	0.237
Skewness Detects	1.034	Kurtosis Detects	0.148
Mean of Logged Detects	-2.001	SD of Logged Detects	0.221

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.872	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.214	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.127	KM Standard Error of Mean	0.00732
KM SD	0.0324	95% KM (BCA) UCL	0.139
95% KM (t) UCL	0.14	95% KM (Percentile Bootstrap) UCL	0.139
95% KM (z) UCL	0.139	95% KM Bootstrap t UCL	0.143
90% KM Chebyshev UCL	0.149	95% KM Chebyshev UCL	0.159
97.5% KM Chebyshev UCL	0.173	99% KM Chebyshev UCL	0.2

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.657	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.735	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.198	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.221	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	21.1	k star (bias corrected MLE)	16.93
Theta hat (MLE)	0.00656	Theta star (bias corrected MLE)	0.00818
nu hat (MLE)	633.1	nu star (bias corrected)	507.8
Mean (detects)	0.138		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.06	Mean	0.119
Maximum	0.211	Median	0.112
SD	0.0425	CV	0.358
k hat (MLE)	8.087	k star (bias corrected MLE)	6.963
Theta hat (MLE)	0.0147	Theta star (bias corrected MLE)	0.017
nu hat (MLE)	339.7	nu star (bias corrected)	292.5
Adjusted Level of Significance (β)	0.0383		
Approximate Chi Square Value (292.46, α)	253.9	Adjusted Chi Square Value (292.46, β)	251.1
95% Gamma Approximate UCL (use when n>=50)	0.137	95% Gamma Adjusted UCL (use when n<50)	0.138

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.127	SD (KM)	0.0324
Variance (KM)	0.00105	SE of Mean (KM)	0.00732
k hat (KM)	15.34	k star (KM)	13.18
nu hat (KM)	644.3	nu star (KM)	553.6
theta hat (KM)	0.00827	theta star (KM)	0.00963
80% gamma percentile (KM)	0.155	90% gamma percentile (KM)	0.173
95% gamma percentile (KM)	0.189	99% gamma percentile (KM)	0.222

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (553.55, α)	500	Adjusted Chi Square Value (553.55, β)	496.1
95% Gamma Approximate KM-UCL (use when n>=50)	0.141	95% Gamma Adjusted KM-UCL (use when n<50)	0.142

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.904	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.881	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.184	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.22	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.122	Mean in Log Scale	-2.152
SD in Original Scale	0.0387	SD in Log Scale	0.309
95% t UCL (assumes normality of ROS data)	0.136	95% Percentile Bootstrap UCL	0.135
95% BCA Bootstrap UCL	0.138	95% Bootstrap t UCL	0.138
95% H-UCL (Log ROS)	0.138		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.093	KM Geo Mean	0.123
KM SD (logged)	0.232	95% Critical H Value (KM-Log)	1.789
KM Standard Error of Mean (logged)	0.0524	95% H-UCL (KM -Log)	0.139
KM SD (logged)	0.232	95% Critical H Value (KM-Log)	1.789
KM Standard Error of Mean (logged)	0.0524		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.113	Mean in Log Scale	-2.289
SD in Original Scale	0.0495	SD in Log Scale	0.502
95% t UCL (Assumes normality)	0.132	95% H-Stat UCL	0.144

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.14

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOS|ug/kg

General Statistics

Total Number of Observations	21	Number of Distinct Observations	20
		Number of Missing Observations	0
Minimum	217	Mean	893.7
Maximum	1560	Median	973
SD	368	Std. Error of Mean	80.31
Coefficient of Variation	0.412	Skewness	-0.377

Normal GOF Test

Shapiro Wilk Test Statistic	0.957	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.908	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.131	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.188	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

ProUCL Output
West Lakeland
Forage Fish Tissue

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	1032	95% Adjusted-CLT UCL (Chen-1995)	1019
		95% Modified-t UCL (Johnson-1978)	1031

Gamma GOF Test

A-D Test Statistic	0.916	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.746	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.178	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.19	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.475	k star (bias corrected MLE)	3.868
Theta hat (MLE)	199.7	Theta star (bias corrected MLE)	231.1
nu hat (MLE)	188	nu star (bias corrected)	162.5
MLE Mean (bias corrected)	893.7	MLE Sd (bias corrected)	454.4
		Approximate Chi Square Value (0.05)	134
Adjusted Level of Significance	0.0383	Adjusted Chi Square Value	132

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1084	95% Adjusted Gamma UCL (use when n<50)	1100

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.856	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.908	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.214	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.188	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.38	Mean of logged Data	6.68
Maximum of Logged Data	7.352	SD of logged Data	0.548

Assuming Lognormal Distribution

95% H-UCL	1186	90% Chebyshev (MVUE) UCL	1261
95% Chebyshev (MVUE) UCL	1417	97.5% Chebyshev (MVUE) UCL	1633
99% Chebyshev (MVUE) UCL	2057		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1026	95% Jackknife UCL	1032
95% Standard Bootstrap UCL	1023	95% Bootstrap-t UCL	1025
95% Hall's Bootstrap UCL	1015	95% Percentile Bootstrap UCL	1022
95% BCA Bootstrap UCL	1014		
90% Chebyshev(Mean, Sd) UCL	1135	95% Chebyshev(Mean, Sd) UCL	1244
97.5% Chebyshev(Mean, Sd) UCL	1395	99% Chebyshev(Mean, Sd) UCL	1693

Suggested UCL to Use

95% Student's-t UCL 1032

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

General Statistics

Total Number of Observations	21	Number of Distinct Observations	20
Number of Detects	19	Number of Non-Detects	2
Number of Distinct Detects	18	Number of Distinct Non-Detects	2
Minimum Detect	0.106	Minimum Non-Detect	0.0957
Maximum Detect	0.495	Maximum Non-Detect	0.0995
Variance Detects	0.00956	Percent Non-Detects	9.52%
Mean Detects	0.232	SD Detects	0.0978
Median Detects	0.212	CV Detects	0.422
Skewness Detects	1.605	Kurtosis Detects	2.751
Mean of Logged Detects	-1.534	SD of Logged Detects	0.377

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.828	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.901	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.259	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.197	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.219	KM Standard Error of Mean	0.0222
KM SD	0.0989	95% KM (BCA) UCL	0.259
95% KM (t) UCL	0.257	95% KM (Percentile Bootstrap) UCL	0.255
95% KM (z) UCL	0.255	95% KM Bootstrap t UCL	0.272
90% KM Chebyshev UCL	0.285	95% KM Chebyshev UCL	0.315
97.5% KM Chebyshev UCL	0.357	99% KM Chebyshev UCL	0.439

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.693	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.742	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.204	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.199	Detected Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	7.181	k star (bias corrected MLE)	6.082
Theta hat (MLE)	0.0322	Theta star (bias corrected MLE)	0.0381
nu hat (MLE)	272.9	nu star (bias corrected)	231.1
Mean (detects)	0.232		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0575	Mean	0.215
Maximum	0.495	Median	0.21
SD	0.107	CV	0.496
k hat (MLE)	4.228	k star (bias corrected MLE)	3.656
Theta hat (MLE)	0.0508	Theta star (bias corrected MLE)	0.0588
nu hat (MLE)	177.6	nu star (bias corrected)	153.5
Adjusted Level of Significance (β)	0.0383		
Approximate Chi Square Value (153.54, α)	125.9	Adjusted Chi Square Value (153.54, β)	124
95% Gamma Approximate UCL (use when n>=50)	0.262	95% Gamma Adjusted UCL (use when n<50)	0.266

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.219	SD (KM)	0.0989
Variance (KM)	0.00978	SE of Mean (KM)	0.0222
k hat (KM)	4.884	k star (KM)	4.218
nu hat (KM)	205.1	nu star (KM)	177.2
theta hat (KM)	0.0448	theta star (KM)	0.0518
80% gamma percentile (KM)	0.3	90% gamma percentile (KM)	0.361
95% gamma percentile (KM)	0.418	99% gamma percentile (KM)	0.538

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (177.17, α)	147.4	Adjusted Chi Square Value (177.17, β)	145.3
95% Gamma Approximate KM-UCL (use when n>=50)	0.263	95% Gamma Adjusted KM-UCL (use when n<50)	0.267

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.941	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.901	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.182	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.197	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.218	Mean in Log Scale	-1.616
SD in Original Scale	0.102	SD in Log Scale	0.442
95% t UCL (assumes normality of ROS data)	0.257	95% Percentile Bootstrap UCL	0.256
95% BCA Bootstrap UCL	0.259	95% Bootstrap t UCL	0.273
95% H-UCL (Log ROS)	0.265		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.612	KM Geo Mean	0.2
KM SD (logged)	0.423	95% Critical H Value (KM-Log)	1.923
KM Standard Error of Mean (logged)	0.0948	95% H-UCL (KM -Log)	0.262
KM SD (logged)	0.423	95% Critical H Value (KM-Log)	1.923
KM Standard Error of Mean (logged)	0.0948		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.214	Mean in Log Scale	-1.676
SD in Original Scale	0.108	SD in Log Scale	0.573
95% t UCL (Assumes normality)	0.255	95% H-Stat UCL	0.287

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	0.267	95% GROS Adjusted Gamma UCL	0.266

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	21	Number of Distinct Observations	21
		Number of Missing Observations	0
Minimum	0.57	Mean	0.838
Maximum	1.17	Median	0.841
SD	0.159	Std. Error of Mean	0.0346
Coefficient of Variation	0.189	Skewness	0.031

Normal GOF Test

Shapiro Wilk Test Statistic	0.977	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.908	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.125	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.188	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.898	95% Adjusted-CLT UCL (Chen-1995)	0.896
		95% Modified-t UCL (Johnson-1978)	0.898

Gamma GOF Test

A-D Test Statistic	0.285	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.742	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.145	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.189	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

ProUCL Output
West Lakeland
Forage Fish Tissue

Gamma Statistics

k hat (MLE)	28.4	k star (bias corrected MLE)	24.37
Theta hat (MLE)	0.0295	Theta star (bias corrected MLE)	0.0344
nu hat (MLE)	1193	nu star (bias corrected)	1024
MLE Mean (bias corrected)	0.838	MLE Sd (bias corrected)	0.17
		Approximate Chi Square Value (0.05)	950.3
Adjusted Level of Significance	0.0383	Adjusted Chi Square Value	944.9

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.903	95% Adjusted Gamma UCL (use when n<50)	0.908

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.966	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.908	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.149	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.188	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.562	Mean of logged Data	-0.194
Maximum of Logged Data	0.157	SD of logged Data	0.195

Assuming Lognormal Distribution

95% H-UCL	0.907	90% Chebyshev (MVUE) UCL	0.947
95% Chebyshev (MVUE) UCL	0.995	97.5% Chebyshev (MVUE) UCL	1.063
99% Chebyshev (MVUE) UCL	1.196		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.895	95% Jackknife UCL	0.898
95% Standard Bootstrap UCL	0.896	95% Bootstrap-t UCL	0.898
95% Hall's Bootstrap UCL	0.898	95% Percentile Bootstrap UCL	0.892
95% BCA Bootstrap UCL	0.895		
90% Chebyshev(Mean, Sd) UCL	0.942	95% Chebyshev(Mean, Sd) UCL	0.989
97.5% Chebyshev(Mean, Sd) UCL	1.055	99% Chebyshev(Mean, Sd) UCL	1.183

Suggested UCL to Use

95% Student's-t UCL 0.898

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	21	Number of Distinct Observations	20
		Number of Missing Observations	0
Minimum	0.127	Mean	0.3
Maximum	0.592	Median	0.266
SD	0.133	Std. Error of Mean	0.029
Coefficient of Variation	0.443	Skewness	0.763

Normal GOF Test

Shapiro Wilk Test Statistic	0.921	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.908	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.187	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.188	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.35	95% Adjusted-CLT UCL (Chen-1995)	0.353
		95% Modified-t UCL (Johnson-1978)	0.351

ProUCL Output
West Lakeland
Forage Fish Tissue

Gamma GOF Test

A-D Test Statistic	0.377	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.745	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.132	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.19	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.516	k star (bias corrected MLE)	4.76
Theta hat (MLE)	0.0544	Theta star (bias corrected MLE)	0.063
nu hat (MLE)	231.7	nu star (bias corrected)	199.9
MLE Mean (bias corrected)	0.3	MLE Sd (bias corrected)	0.137
		Approximate Chi Square Value (0.05)	168.2
Adjusted Level of Significance	0.0383	Adjusted Chi Square Value	166

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.356	95% Adjusted Gamma UCL (use when n<50)	0.361

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.954	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.908	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.104	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.188	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.064	Mean of logged Data	-1.298
Maximum of Logged Data	-0.524	SD of logged Data	0.448

Assuming Lognormal Distribution

95% H-UCL	0.367	90% Chebyshev (MVUE) UCL	0.391
95% Chebyshev (MVUE) UCL	0.432	97.5% Chebyshev (MVUE) UCL	0.489
99% Chebyshev (MVUE) UCL	0.601		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.348	95% Jackknife UCL	0.35
95% Standard Bootstrap UCL	0.345	95% Bootstrap-t UCL	0.357
95% Hall's Bootstrap UCL	0.354	95% Percentile Bootstrap UCL	0.35
95% BCA Bootstrap UCL	0.353		
90% Chebyshev(Mean, Sd) UCL	0.387	95% Chebyshev(Mean, Sd) UCL	0.426
97.5% Chebyshev(Mean, Sd) UCL	0.481	99% Chebyshev(Mean, Sd) UCL	0.588

Suggested UCL to Use

95% Student's-t UCL 0.35

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Eagle Point Lake
Predator Fish Tissue

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/12/2021 4:19:34 PM
From File	FWM_ProUCL_Input_f.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

PFOA

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	0.124	Mean	0.185
Maximum	0.277	Median	0.177
SD	0.0599	Std. Error of Mean	0.0268
Coefficient of Variation	0.324	Skewness	0.968

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.938	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.181	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.242	95% Adjusted-CLT UCL (Chen-1995)	0.241
		95% Modified-t UCL (Johnson-1978)	0.244

Gamma GOF Test

A-D Test Statistic	0.219	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.679	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.186	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	12.67	k star (bias corrected MLE)	5.202
Theta hat (MLE)	0.0146	Theta star (bias corrected MLE)	0.0355
nu hat (MLE)	126.7	nu star (bias corrected)	52.02
MLE Mean (bias corrected)	0.185	MLE Sd (bias corrected)	0.081
		Approximate Chi Square Value (0.05)	36.45
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	30.85

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.264	95% Adjusted Gamma UCL (use when n<50)	0.311

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.975	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.16	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.084	Mean of logged Data	-1.729
Maximum of Logged Data	-1.283	SD of logged Data	0.313

Assuming Lognormal Distribution

95% H-UCL	0.272	90% Chebyshev (MVUE) UCL	0.262
95% Chebyshev (MVUE) UCL	0.297	97.5% Chebyshev (MVUE) UCL	0.345
99% Chebyshev (MVUE) UCL	0.44		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

ProUCL Output
Eagle Point Lake
Predator Fish Tissue

Nonparametric Distribution Free UCLs

95% CLT UCL	0.229	95% Jackknife UCL	0.242
95% Standard Bootstrap UCL	0.223	95% Bootstrap-t UCL	0.267
95% Hall's Bootstrap UCL	0.257	95% Percentile Bootstrap UCL	0.227
95% BCA Bootstrap UCL	0.23		
90% Chebyshev(Mean, Sd) UCL	0.265	95% Chebyshev(Mean, Sd) UCL	0.301
97.5% Chebyshev(Mean, Sd) UCL	0.352	99% Chebyshev(Mean, Sd) UCL	0.451

Suggested UCL to Use

95% Student's-t UCL 0.242

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFNA

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	0.114	Mean	0.177
Maximum	0.203	Median	0.19
SD	0.0357	Std. Error of Mean	0.016
Coefficient of Variation	0.201	Skewness	-2.083

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.701	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.416	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.211	95% Adjusted-CLT UCL (Chen-1995)	0.188
		95% Modified-t UCL (Johnson-1978)	0.209

Gamma GOF Test

A-D Test Statistic	0.962	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.679	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.44	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.357	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	25.15	k star (bias corrected MLE)	10.19
Theta hat (MLE)	0.00705	Theta star (bias corrected MLE)	0.0174
nu hat (MLE)	251.5	nu star (bias corrected)	101.9
MLE Mean (bias corrected)	0.177	MLE Sd (bias corrected)	0.0556
		Approximate Chi Square Value (0.05)	79.63
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	71.05

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.227	95% Adjusted Gamma UCL (use when n<50)	0.255

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.669	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.429	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.168	Mean of logged Data	-1.749
Maximum of Logged Data	-1.595	SD of logged Data	0.236

Assuming Lognormal Distribution

95% H-UCL	0.234	90% Chebyshev (MVUE) UCL	0.234
95% Chebyshev (MVUE) UCL	0.259	97.5% Chebyshev (MVUE) UCL	0.295
99% Chebyshev (MVUE) UCL	0.364		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	0.204	95% Jackknife UCL	0.211
95% Standard Bootstrap UCL	0.201	95% Bootstrap-t UCL	0.201
95% Hall's Bootstrap UCL	0.19	95% Percentile Bootstrap UCL	0.196
95% BCA Bootstrap UCL	0.194		
90% Chebyshev(Mean, Sd) UCL	0.225	95% Chebyshev(Mean, Sd) UCL	0.247
97.5% Chebyshev(Mean, Sd) UCL	0.277	99% Chebyshev(Mean, Sd) UCL	0.336

Suggested UCL to Use

95% Student's-t UCL	0.211	or 95% Modified-t UCL	0.209

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFDA

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	17.36	Mean	20.22
Maximum	25.68	Median	19.28
SD	3.202	Std. Error of Mean	1.432
Coefficient of Variation	0.158	Skewness	1.717

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.829	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.326	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	23.27	95% Adjusted-CLT UCL (Chen-1995)	23.75
		95% Modified-t UCL (Johnson-1978)	23.45

Gamma GOF Test

A-D Test Statistic	0.499	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.678	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.312	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	54.61	k star (bias corrected MLE)	21.98
Theta hat (MLE)	0.37	Theta star (bias corrected MLE)	0.92
nu hat (MLE)	546.1	nu star (bias corrected)	219.8
MLE Mean (bias corrected)	20.22	MLE Sd (bias corrected)	4.313
		Approximate Chi Square Value (0.05)	186.5
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	173

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	23.83	95% Adjusted Gamma UCL (use when n<50)	25.69

ProUCL Output
Eagle Point Lake
Predator Fish Tissue

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.865	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.303	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.854	Mean of logged Data	2.997
Maximum of Logged Data	3.246	SD of logged Data	0.148

Assuming Lognormal Distribution

95% H-UCL	23.68	90% Chebyshev (MVUE) UCL	24.23
95% Chebyshev (MVUE) UCL	26.05	97.5% Chebyshev (MVUE) UCL	28.57
99% Chebyshev (MVUE) UCL	33.53		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	22.57	95% Jackknife UCL	23.27
95% Standard Bootstrap UCL	22.35	95% Bootstrap-t UCL	26.65
95% Hall's Bootstrap UCL	34.52	95% Percentile Bootstrap UCL	22.63
95% BCA Bootstrap UCL	23.16		
90% Chebyshev(Mean, Sd) UCL	24.51	95% Chebyshev(Mean, Sd) UCL	26.46
97.5% Chebyshev(Mean, Sd) UCL	29.16	99% Chebyshev(Mean, Sd) UCL	34.47

Suggested UCL to Use

95% Student's-t UCL 23.27

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFTrDA

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	0.211	Mean	0.242
Maximum	0.283	Median	0.248
SD	0.0285	Std. Error of Mean	0.0127
Coefficient of Variation	0.117	Skewness	0.479

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.944	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.195	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.27	95% Adjusted-CLT UCL (Chen-1995)	0.266
		95% Modified-t UCL (Johnson-1978)	0.27

Gamma GOF Test

A-D Test Statistic	0.281	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.678	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.207	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

ProUCL Output
Eagle Point Lake
Predator Fish Tissue

Gamma Statistics

k hat (MLE)	91.98	k star (bias corrected MLE)	36.93
Theta hat (MLE)	0.00264	Theta star (bias corrected MLE)	0.00656
nu hat (MLE)	919.8	nu star (bias corrected)	369.3
MLE Mean (bias corrected)	0.242	MLE Sd (bias corrected)	0.0399
		Approximate Chi Square Value (0.05)	325.7
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	307.6

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.275	95% Adjusted Gamma UCL (use when n<50)	0.291

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.95	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.191	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.557	Mean of logged Data	-1.423
Maximum of Logged Data	-1.262	SD of logged Data	0.116

Assuming Lognormal Distribution

95% H-UCL	0.274	90% Chebyshev (MVUE) UCL	0.28
95% Chebyshev (MVUE) UCL	0.297	97.5% Chebyshev (MVUE) UCL	0.321
99% Chebyshev (MVUE) UCL	0.368		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.263	95% Jackknife UCL	0.27
95% Standard Bootstrap UCL	0.261	95% Bootstrap-t UCL	0.278
95% Hall's Bootstrap UCL	0.263	95% Percentile Bootstrap UCL	0.262
95% BCA Bootstrap UCL	0.264		
90% Chebyshev(Mean, Sd) UCL	0.281	95% Chebyshev(Mean, Sd) UCL	0.298
97.5% Chebyshev(Mean, Sd) UCL	0.322	99% Chebyshev(Mean, Sd) UCL	0.369

Suggested UCL to Use

95% Student's-t UCL 0.27

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFTeDA

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
Number of Detects	4	Number of Non-Detects	1
Number of Distinct Detects	4	Number of Distinct Non-Detects	1
Minimum Detect	0.101	Minimum Non-Detect	0.0971
Maximum Detect	0.169	Maximum Non-Detect	0.0971
Variance Detects	8.9620E-4	Percent Non-Detects	20%
Mean Detects	0.126	SD Detects	0.0299
Median Detects	0.117	CV Detects	0.238
Skewness Detects	1.526	Kurtosis Detects	2.543
Mean of Logged Detects	-2.092	SD of Logged Detects	0.223

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.871	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.306	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.12	KM Standard Error of Mean	0.0134
KM SD	0.0259	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.149	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.142	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.16	95% KM Chebyshev UCL	0.178
97.5% KM Chebyshev UCL	0.204	99% KM Chebyshev UCL	0.253

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.379	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.293	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	25.86	k star (bias corrected MLE)	6.633
Theta hat (MLE)	0.00487	Theta star (bias corrected MLE)	0.019
nu hat (MLE)	206.9	nu star (bias corrected)	53.06
Mean (detects)	0.126		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0557	Mean	0.112
Maximum	0.169	Median	0.112
SD	0.0407	CV	0.364
k hat (MLE)	8.455	k star (bias corrected MLE)	3.515
Theta hat (MLE)	0.0132	Theta star (bias corrected MLE)	0.0318
nu hat (MLE)	84.55	nu star (bias corrected)	35.15
Adjusted Level of Significance (β)	0.0086		
Approximate Chi Square Value (35.15, α)	22.59	Adjusted Chi Square Value (35.15, β)	18.32
95% Gamma Approximate UCL (use when n>=50)	0.174	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.12	SD (KM)	0.0259
Variance (KM)	6.6987E-4	SE of Mean (KM)	0.0134
k hat (KM)	21.53	k star (KM)	8.745
nu hat (KM)	215.3	nu star (KM)	87.45
theta hat (KM)	0.00558	theta star (KM)	0.0137
80% gamma percentile (KM)	0.152	90% gamma percentile (KM)	0.174
95% gamma percentile (KM)	0.194	99% gamma percentile (KM)	0.234

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (87.45, α)	66.89	Adjusted Chi Square Value (87.45, β)	59.08
95% Gamma Approximate KM-UCL (use when n>=50)	0.157	95% Gamma Adjusted KM-UCL (use when n<50)	0.178

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.911	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.276	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.114	Mean in Log Scale	-2.209
SD in Original Scale	0.0363	SD in Log Scale	0.324
95% t UCL (assumes normality of ROS data)	0.149	95% Percentile Bootstrap UCL	0.137
95% BCA Bootstrap UCL	0.139	95% Bootstrap t UCL	0.154
95% H-UCL (Log ROS)	0.172		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.14	KM Geo Mean	0.118
KM SD (logged)	0.197	95% Critical H Value (KM-Log)	2.193
KM Standard Error of Mean (logged)	0.102	95% H-UCL (KM -Log)	0.149
KM SD (logged)	0.197	95% Critical H Value (KM-Log)	2.193
KM Standard Error of Mean (logged)	0.102		

ProUCL Output
Eagle Point Lake
Predator Fish Tissue

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.11	Mean in Log Scale	-2.279
SD in Original Scale	0.0432	SD in Log Scale	0.46
95% t UCL (Assumes normality)	0.152	95% H-Stat UCL	0.218

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.149

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFHxS

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	0.095	Mean	0.107
Maximum	0.126	Median	0.105
SD	0.0123	Std. Error of Mean	0.00549
Coefficient of Variation	0.115	Skewness	1.1

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.925	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.194	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.119	95% Adjusted-CLT UCL (Chen-1995)	0.119
		95% Modified-t UCL (Johnson-1978)	0.119

Gamma GOF Test

A-D Test Statistic	0.275	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.678	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.181	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	99.05	k star (bias corrected MLE)	39.75
Theta hat (MLE)	0.00108	Theta star (bias corrected MLE)	0.00269
nu hat (MLE)	990.5	nu star (bias corrected)	397.5
MLE Mean (bias corrected)	0.107	MLE Sd (bias corrected)	0.017
		Approximate Chi Square Value (0.05)	352.3
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	333.5

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.121	95% Adjusted Gamma UCL (use when n<50)	0.128

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.943	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.175	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.354	Mean of logged Data	-2.24
Maximum of Logged Data	-2.069	SD of logged Data	0.111

Assuming Lognormal Distribution

95% H-UCL	0.12	90% Chebyshev (MVUE) UCL	0.123
95% Chebyshev (MVUE) UCL	0.13	97.5% Chebyshev (MVUE) UCL	0.14
99% Chebyshev (MVUE) UCL	0.16		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.116	95% Jackknife UCL	0.119
95% Standard Bootstrap UCL	0.115	95% Bootstrap-t UCL	0.126
95% Hall's Bootstrap UCL	0.128	95% Percentile Bootstrap UCL	0.116
95% BCA Bootstrap UCL	0.116		
90% Chebyshev(Mean, Sd) UCL	0.123	95% Chebyshev(Mean, Sd) UCL	0.131
97.5% Chebyshev(Mean, Sd) UCL	0.141	99% Chebyshev(Mean, Sd) UCL	0.162

Suggested UCL to Use

95% Student's-t UCL 0.119

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOS

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	2047	Mean	2242
Maximum	2636	Median	2136
SD	235.5	Std. Error of Mean	105.3
Coefficient of Variation	0.105	Skewness	1.606

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.836	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.274	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2466	95% Adjusted-CLT UCL (Chen-1995)	2496
		95% Modified-t UCL (Johnson-1978)	2479

Gamma GOF Test

A-D Test Statistic	0.49	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.678	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.291	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	120.3	k star (bias corrected MLE)	48.26
Theta hat (MLE)	18.63	Theta star (bias corrected MLE)	46.46
nu hat (MLE)	1203	nu star (bias corrected)	482.6
MLE Mean (bias corrected)	2242	MLE Sd (bias corrected)	322.7
		Approximate Chi Square Value (0.05)	432.7
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	411.7

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	2501	95% Adjusted Gamma UCL (use when n<50)	2628

ProUCL Output
Eagle Point Lake
Predator Fish Tissue

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.855	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.271	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.624	Mean of logged Data	7.711
Maximum of Logged Data	7.877	SD of logged Data	0.101

Assuming Lognormal Distribution

95% H-UCL	2486	90% Chebyshev (MVUE) UCL	2544
95% Chebyshev (MVUE) UCL	2681	97.5% Chebyshev (MVUE) UCL	2871
99% Chebyshev (MVUE) UCL	3244		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2415	95% Jackknife UCL	2466
95% Standard Bootstrap UCL	2398	95% Bootstrap-t UCL	3099
95% Hall's Bootstrap UCL	3532	95% Percentile Bootstrap UCL	2418
95% BCA Bootstrap UCL	2446		
90% Chebyshev(Mean, Sd) UCL	2558	95% Chebyshev(Mean, Sd) UCL	2701
97.5% Chebyshev(Mean, Sd) UCL	2900	99% Chebyshev(Mean, Sd) UCL	3290

Suggested UCL to Use

95% Student's-t UCL 2466

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFDS

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	1.108	Mean	1.543
Maximum	2.182	Median	1.366
SD	0.476	Std. Error of Mean	0.213
Coefficient of Variation	0.309	Skewness	0.625

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.881	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.245	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.997	95% Adjusted-CLT UCL (Chen-1995)	1.957
		95% Modified-t UCL (Johnson-1978)	2.007

Gamma GOF Test

A-D Test Statistic	0.396	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.679	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.237	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

ProUCL Output
Eagle Point Lake
Predator Fish Tissue

Gamma Statistics

k hat (MLE)	13.65	k star (bias corrected MLE)	5.593
Theta hat (MLE)	0.113	Theta star (bias corrected MLE)	0.276
nu hat (MLE)	136.5	nu star (bias corrected)	55.93
MLE Mean (bias corrected)	1.543	MLE Sd (bias corrected)	0.652
		Approximate Chi Square Value (0.05)	39.74
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	33.87

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	2.171	95% Adjusted Gamma UCL (use when n<50)	2.547

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.893	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.21	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.102	Mean of logged Data	0.396
Maximum of Logged Data	0.78	SD of logged Data	0.302

Assuming Lognormal Distribution

95% H-UCL	2.237	90% Chebyshev (MVUE) UCL	2.164
95% Chebyshev (MVUE) UCL	2.446	97.5% Chebyshev (MVUE) UCL	2.837
99% Chebyshev (MVUE) UCL	3.606		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.893	95% Jackknife UCL	1.997
95% Standard Bootstrap UCL	1.847	95% Bootstrap-t UCL	2.686
95% Hall's Bootstrap UCL	3.118	95% Percentile Bootstrap UCL	1.864
95% BCA Bootstrap UCL	1.906		
90% Chebyshev(Mean, Sd) UCL	2.182	95% Chebyshev(Mean, Sd) UCL	2.471
97.5% Chebyshev(Mean, Sd) UCL	2.873	99% Chebyshev(Mean, Sd) UCL	3.662

Suggested UCL to Use

95% Student's-t UCL 1.997

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOSA

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	1.849	Mean	2.454
Maximum	3.326	Median	2.219
SD	0.621	Std. Error of Mean	0.278
Coefficient of Variation	0.253	Skewness	0.716

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.913	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.247	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	3.045	95% Adjusted-CLT UCL (Chen-1995)	3.005
		95% Modified-t UCL (Johnson-1978)	3.06

Gamma GOF Test

A-D Test Statistic	0.321	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.679	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.245	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	20.4	k star (bias corrected MLE)	8.293
Theta hat (MLE)	0.12	Theta star (bias corrected MLE)	0.296
nu hat (MLE)	204	nu star (bias corrected)	82.93
MLE Mean (bias corrected)	2.454	MLE Sd (bias corrected)	0.852
		Approximate Chi Square Value (0.05)	62.94
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	55.38

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	3.233	95% Adjusted Gamma UCL (use when n<50)	3.674

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.931	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.221	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.615	Mean of logged Data	0.873
Maximum of Logged Data	1.202	SD of logged Data	0.246

Assuming Lognormal Distribution

95% H-UCL	3.27	90% Chebyshev (MVUE) UCL	3.261
95% Chebyshev (MVUE) UCL	3.627	97.5% Chebyshev (MVUE) UCL	4.135
99% Chebyshev (MVUE) UCL	5.133		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2.91	95% Jackknife UCL	3.045
95% Standard Bootstrap UCL	2.854	95% Bootstrap-t UCL	3.99
95% Hall's Bootstrap UCL	6.832	95% Percentile Bootstrap UCL	2.877
95% BCA Bootstrap UCL	2.919		
90% Chebyshev(Mean, Sd) UCL	3.287	95% Chebyshev(Mean, Sd) UCL	3.664
97.5% Chebyshev(Mean, Sd) UCL	4.188	99% Chebyshev(Mean, Sd) UCL	5.216

Suggested UCL to Use

95% Student's-t UCL 3.045

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

N-EtFOSAA

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	0.532	Mean	0.676
Maximum	1.077	Median	0.589
SD	0.226	Std. Error of Mean	0.101
Coefficient of Variation	0.335	Skewness	2.16

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

ProUCL Output
Eagle Point Lake
Predator Fish Tissue

Normal GOF Test

Shapiro Wilk Test Statistic	0.66	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.431	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.891	95% Adjusted-CLT UCL (Chen-1995)	0.946
		95% Modified-t UCL (Johnson-1978)	0.907

Gamma GOF Test

A-D Test Statistic	0.941	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.679	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.435	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.357	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	13.96	k star (bias corrected MLE)	5.717
Theta hat (MLE)	0.0484	Theta star (bias corrected MLE)	0.118
nu hat (MLE)	139.6	nu star (bias corrected)	57.17
MLE Mean (bias corrected)	0.676	MLE Sd (bias corrected)	0.283
		Approximate Chi Square Value (0.05)	40.79
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	34.84

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.947	95% Adjusted Gamma UCL (use when n<50)	1.109

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.702	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.414	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.631	Mean of logged Data	-0.428
Maximum of Logged Data	0.0745	SD of logged Data	0.285

Assuming Lognormal Distribution

95% H-UCL	0.951	90% Chebyshev (MVUE) UCL	0.929
95% Chebyshev (MVUE) UCL	1.046	97.5% Chebyshev (MVUE) UCL	1.207
99% Chebyshev (MVUE) UCL	1.524		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	0.842	95% Jackknife UCL	0.891
95% Standard Bootstrap UCL	0.821	95% Bootstrap-t UCL	2.883
95% Hall's Bootstrap UCL	2.188	95% Percentile Bootstrap UCL	0.869
95% BCA Bootstrap UCL	0.882		
90% Chebyshev(Mean, Sd) UCL	0.979	95% Chebyshev(Mean, Sd) UCL	1.116
97.5% Chebyshev(Mean, Sd) UCL	1.307	99% Chebyshev(Mean, Sd) UCL	1.681

Suggested UCL to Use

95% Student's-t UCL	0.891	or 95% Modified-t UCL	0.907

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	0.135	Mean	0.159
Maximum	0.172	Median	0.163
SD	0.0142	Std. Error of Mean	0.00637
Coefficient of Variation	0.0898	Skewness	-1.557

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.864	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.285	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.172	95% Adjusted-CLT UCL (Chen-1995)	0.164
		95% Modified-t UCL (Johnson-1978)	0.172

Gamma GOF Test

A-D Test Statistic	0.502	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.678	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.295	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	145.8	k star (bias corrected MLE)	58.44
Theta hat (MLE)	0.00109	Theta star (bias corrected MLE)	0.00272
nu hat (MLE)	1458	nu star (bias corrected)	584.4
MLE Mean (bias corrected)	0.159	MLE Sd (bias corrected)	0.0208
		Approximate Chi Square Value (0.05)	529.3
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	506.1

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.175	95% Adjusted Gamma UCL (use when n<50)	0.183

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.842	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.3	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.004	Mean of logged Data	-1.844
Maximum of Logged Data	-1.76	SD of logged Data	0.0941

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	0.179
95% Chebyshev (MVUE) UCL	0.188	97.5% Chebyshev (MVUE) UCL	0.2
99% Chebyshev (MVUE) UCL	0.225		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.169	95% Jackknife UCL	0.172
95% Standard Bootstrap UCL	0.168	95% Bootstrap-t UCL	0.168
95% Hall's Bootstrap UCL	0.165	95% Percentile Bootstrap UCL	0.167
95% BCA Bootstrap UCL	0.166		
90% Chebyshev(Mean, Sd) UCL	0.178	95% Chebyshev(Mean, Sd) UCL	0.186
97.5% Chebyshev(Mean, Sd) UCL	0.198	99% Chebyshev(Mean, Sd) UCL	0.222

ProUCL Output
Eagle Point Lake
Predator Fish Tissue

Suggested UCL to Use

95% Student's-t UCL 0.172

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFUnA|ug/kg

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	2.346	Mean	2.788
Maximum	3.248	Median	2.804
SD	0.323	Std. Error of Mean	0.145
Coefficient of Variation	0.116	Skewness	0.135

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.959	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.237	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	3.096	95% Adjusted-CLT UCL (Chen-1995)	3.035
		95% Modified-t UCL (Johnson-1978)	3.097

Gamma GOF Test

A-D Test Statistic	0.282	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.678	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.217	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	92.5	k star (bias corrected MLE)	37.13
Theta hat (MLE)	0.0301	Theta star (bias corrected MLE)	0.0751
nu hat (MLE)	925	nu star (bias corrected)	371.3
MLE Mean (bias corrected)	2.788	MLE Sd (bias corrected)	0.457
		Approximate Chi Square Value (0.05)	327.7
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	309.5

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	3.159	95% Adjusted Gamma UCL (use when n<50)	3.344

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.959	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.22	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.853	Mean of logged Data	1.02
Maximum of Logged Data	1.178	SD of logged Data	0.117

Assuming Lognormal Distribution

95% H-UCL	3.148	90% Chebyshev (MVUE) UCL	3.224
95% Chebyshev (MVUE) UCL	3.421	97.5% Chebyshev (MVUE) UCL	3.695
99% Chebyshev (MVUE) UCL	4.234		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	3.025	95% Jackknife UCL	3.096
95% Standard Bootstrap UCL	3	95% Bootstrap-t UCL	3.097
95% Hall's Bootstrap UCL	3.097	95% Percentile Bootstrap UCL	2.989
95% BCA Bootstrap UCL	2.996		
90% Chebyshev(Mean, Sd) UCL	3.221	95% Chebyshev(Mean, Sd) UCL	3.418
97.5% Chebyshev(Mean, Sd) UCL	3.69	99% Chebyshev(Mean, Sd) UCL	4.226

Suggested UCL to Use

95% Student's-t UCL 3.096

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFDoA|ug/kg

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	0.48	Mean	0.698
Maximum	0.841	Median	0.702
SD	0.138	Std. Error of Mean	0.0618
Coefficient of Variation	0.198	Skewness	-1.051

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.928	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.241	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.83	95% Adjusted-CLT UCL (Chen-1995)	0.769
		95% Modified-t UCL (Johnson-1978)	0.825

Gamma GOF Test

A-D Test Statistic	0.368	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.679	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.262	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	28.37	k star (bias corrected MLE)	11.48
Theta hat (MLE)	0.0246	Theta star (bias corrected MLE)	0.0608
nu hat (MLE)	283.7	nu star (bias corrected)	114.8
MLE Mean (bias corrected)	0.698	MLE Sd (bias corrected)	0.206
		Approximate Chi Square Value (0.05)	91.06
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	81.83

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.88	95% Adjusted Gamma UCL (use when n<50)	0.979

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.885	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.278	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

ProUCL Output
Eagle Point Lake
Predator Fish Tissue

Lognormal Statistics

Minimum of Logged Data	-0.734	Mean of logged Data	-0.377
Maximum of Logged Data	-0.174	SD of logged Data	0.217

Assuming Lognormal Distribution

95% H-UCL	0.894	90% Chebyshev (MVUE) UCL	0.902
95% Chebyshev (MVUE) UCL	0.994	97.5% Chebyshev (MVUE) UCL	1.122
99% Chebyshev (MVUE) UCL	1.373		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.8	95% Jackknife UCL	0.83
95% Standard Bootstrap UCL	0.79	95% Bootstrap-t UCL	0.803
95% Hall's Bootstrap UCL	0.786	95% Percentile Bootstrap UCL	0.782
95% BCA Bootstrap UCL	0.765		
90% Chebyshev(Mean, Sd) UCL	0.883	95% Chebyshev(Mean, Sd) UCL	0.967
97.5% Chebyshev(Mean, Sd) UCL	1.084	99% Chebyshev(Mean, Sd) UCL	1.313

Suggested UCL to Use

95% Student's-t UCL	0.83

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

PFHpS|ug/kg

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	0.923	Mean	1.173
Maximum	1.428	Median	1.15
SD	0.184	Std. Error of Mean	0.0822
Coefficient of Variation	0.157	Skewness	0.0678

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.979	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.198	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	1.348	95% Adjusted-CLT UCL (Chen-1995)	1.311
		95% Modified-t UCL (Johnson-1978)	1.349

Gamma GOF Test

A-D Test Statistic	0.23	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.678	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.204	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	50.21	k star (bias corrected MLE)	20.22
Theta hat (MLE)	0.0234	Theta star (bias corrected MLE)	0.058
nu hat (MLE)	502.1	nu star (bias corrected)	202.2
MLE Mean (bias corrected)	1.173	MLE Sd (bias corrected)	0.261
		Approximate Chi Square Value (0.05)	170.3
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	157.4

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1.393	95% Adjusted Gamma UCL (use when n<50)	1.507

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.974	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.222	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.0805	Mean of logged Data	0.15
Maximum of Logged Data	0.356	SD of logged Data	0.159

Assuming Lognormal Distribution

95% H-UCL	1.393	90% Chebyshev (MVUE) UCL	1.423
95% Chebyshev (MVUE) UCL	1.537	97.5% Chebyshev (MVUE) UCL	1.694
99% Chebyshev (MVUE) UCL	2.003		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.308	95% Jackknife UCL	1.348
95% Standard Bootstrap UCL	1.293	95% Bootstrap-t UCL	1.355
95% Hall's Bootstrap UCL	1.403	95% Percentile Bootstrap UCL	1.292
95% BCA Bootstrap UCL	1.297		
90% Chebyshev(Mean, Sd) UCL	1.42	95% Chebyshev(Mean, Sd) UCL	1.531
97.5% Chebyshev(Mean, Sd) UCL	1.686	99% Chebyshev(Mean, Sd) UCL	1.991

Suggested UCL to Use

95% Student's-t UCL	1.348

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	3.939	Mean	4.859
Maximum	6.058	Median	4.482
SD	0.922	Std. Error of Mean	0.412
Coefficient of Variation	0.19	Skewness	0.549

Note: Sample size is small (e.g., <10), If data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.895	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.259	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	5.739	95% Adjusted-CLT UCL (Chen-1995)	5.646
		95% Modified-t UCL (Johnson-1978)	5.755

Gamma GOF Test

A-D Test Statistic	0.381	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.678	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.263	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

ProUCL Output
Eagle Point Lake
Predator Fish Tissue

Gamma Statistics

k hat (MLE)	35.68	k star (bias corrected MLE)	14.41
Theta hat (MLE)	0.136	Theta star (bias corrected MLE)	0.337
nu hat (MLE)	356.8	nu star (bias corrected)	144.1
MLE Mean (bias corrected)	4.859	MLE Sd (bias corrected)	1.28
		Approximate Chi Square Value (0.05)	117.3
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	106.8

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	5.967	95% Adjusted Gamma UCL (use when n<50)	6.558

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.907	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.24	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.371	Mean of logged Data	1.567
Maximum of Logged Data	1.801	SD of logged Data	0.186

Assuming Lognormal Distribution

95% H-UCL	5.971	90% Chebyshev (MVUE) UCL	6.072
95% Chebyshev (MVUE) UCL	6.622	97.5% Chebyshev (MVUE) UCL	7.385
99% Chebyshev (MVUE) UCL	8.884		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	5.538	95% Jackknife UCL	5.739
95% Standard Bootstrap UCL	5.453	95% Bootstrap-t UCL	6.909
95% Hall's Bootstrap UCL	13.39	95% Percentile Bootstrap UCL	5.508
95% BCA Bootstrap UCL	5.508		
90% Chebyshev(Mean, Sd) UCL	6.097	95% Chebyshev(Mean, Sd) UCL	6.657
97.5% Chebyshev(Mean, Sd) UCL	7.435	99% Chebyshev(Mean, Sd) UCL	8.962

Suggested UCL to Use

95% Student's-t UCL	5.739

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	0.35	Mean	1.102
Maximum	2.261	Median	0.508
SD	0.95	Std. Error of Mean	0.425
Coefficient of Variation	0.862	Skewness	0.63

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.767	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.334	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2.008	95% Adjusted-CLT UCL (Chen-1995)	1.929
		95% Modified-t UCL (Johnson-1978)	2.028

ProUCL Output
Eagle Point Lake
Predator Fish Tissue

Gamma GOF Test

A-D Test Statistic	0.658	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.686	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.327	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.361	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.646	k star (bias corrected MLE)	0.792
Theta hat (MLE)	0.67	Theta star (bias corrected MLE)	1.392
nu hat (MLE)	16.46	nu star (bias corrected)	7.916
MLE Mean (bias corrected)	1.102	MLE Sd (bias corrected)	1.238
		Approximate Chi Square Value (0.05)	2.686
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	1.546

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	3.247	95% Adjusted Gamma UCL (use when n<50)	5.64

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.799	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.284	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.049	Mean of logged Data	-0.237
Maximum of Logged Data	0.816	SD of logged Data	0.919

Assuming Lognormal Distribution

95% H-UCL	9.771	90% Chebyshev (MVUE) UCL	2.382
95% Chebyshev (MVUE) UCL	2.969	97.5% Chebyshev (MVUE) UCL	3.783
99% Chebyshev (MVUE) UCL	5.382		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.801	95% Jackknife UCL	2.008
95% Standard Bootstrap UCL	1.721	95% Bootstrap-t UCL	9.71
95% Hall's Bootstrap UCL	17.82	95% Percentile Bootstrap UCL	1.785
95% BCA Bootstrap UCL	1.829		
90% Chebyshev(Mean, Sd) UCL	2.377	95% Chebyshev(Mean, Sd) UCL	2.954
97.5% Chebyshev(Mean, Sd) UCL	3.755	99% Chebyshev(Mean, Sd) UCL	5.33

Suggested UCL to Use

95% Student's-t UCL	2.008

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
Lake Elmo
Predator Fish Tissue

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/22/2021 4:27:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
Number of Detects	7	Number of Non-Detects	1
Number of Distinct Detects	7	Number of Distinct Non-Detects	1
Minimum Detect	0.114	Minimum Non-Detect	0.0943
Maximum Detect	0.625	Maximum Non-Detect	0.0943
Variance Detects	0.0333	Percent Non-Detects	12.50%
Mean Detects	0.253	SD Detects	0.183
Median Detects	0.186	CV Detects	0.722
Skewness Detects	1.706	Kurtosis Detects	3.069
Mean of Logged Detects	-1.56	SD of Logged Detects	0.631

Note: Sample size is small (e.g., <10), If data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.794	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.238	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.233	KM Standard Error of Mean	0.0636
KM SD	0.167	95% KM (BCA) UCL	0.345
95% KM (t) UCL	0.354	95% KM (Percentile Bootstrap) UCL	0.339
95% KM (z) UCL	0.338	95% KM Bootstrap t UCL	0.47
90% KM Chebyshev UCL	0.424	95% KM Chebyshev UCL	0.51
97.5% KM Chebyshev UCL	0.63	99% KM Chebyshev UCL	0.866

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.451	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.713	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.214	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.314	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.855	k star (bias corrected MLE)	1.727
Theta hat (MLE)	0.0886	Theta star (bias corrected MLE)	0.146
nu hat (MLE)	39.97	nu star (bias corrected)	24.17
Mean (detects)	0.253		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.222
Maximum	0.625	Median	0.158
SD	0.19	CV	0.852
k hat (MLE)	1.283	k star (bias corrected MLE)	0.885
Theta hat (MLE)	0.173	Theta star (bias corrected MLE)	0.251
nu hat (MLE)	20.52	nu star (bias corrected)	14.16
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (14.16, α)	6.681	Adjusted Chi Square Value (14.16, β)	5.437
95% Gamma Approximate UCL (use when n>=50)	0.471	95% Gamma Adjusted UCL (use when n<50)	0.579

ProUCL Output
Lake Elmo
Predator Fish Tissue

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.233	SD (KM)	0.167
Variance (KM)	0.0277	SE of Mean (KM)	0.0636
k hat (KM)	1.957	k star (KM)	1.306
nu hat (KM)	31.31	nu star (KM)	20.9
theta hat (KM)	0.119	theta star (KM)	0.178
80% gamma percentile (KM)	0.366	90% gamma percentile (KM)	0.502
95% gamma percentile (KM)	0.636	99% gamma percentile (KM)	0.941

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (20.90, α)	11.52	Adjusted Chi Square Value (20.90, β)	9.806
95% Gamma Approximate KM-UCL (use when n>=50)	0.423	95% Gamma Adjusted KM-UCL (use when n<50)	0.497

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.897	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.2	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.227	Mean in Log Scale	-1.755
SD in Original Scale	0.184	SD in Log Scale	0.803
95% t UCL (assumes normality of ROS data)	0.35	95% Percentile Bootstrap UCL	0.332
95% BCA Bootstrap UCL	0.374	95% Bootstrap t UCL	0.449
95% H-UCL (Log ROS)	0.585		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.66	KM Geo Mean	0.19
KM SD (logged)	0.608	95% Critical H Value (KM-Log)	2.548
KM Standard Error of Mean (logged)	0.232	95% H-UCL (KM -Log)	0.41
KM SD (logged)	0.608	95% Critical H Value (KM-Log)	2.548
KM Standard Error of Mean (logged)	0.232		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.227	Mean in Log Scale	-1.747
SD in Original Scale	0.184	SD in Log Scale	0.788
95% t UCL (Assumes normality)	0.35	95% H-Stat UCL	0.568

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.354

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
Number of Detects	6	Number of Non-Detects	2
Number of Distinct Detects	6	Number of Distinct Non-Detects	2
Minimum Detect	0.115	Minimum Non-Detect	0.0943
Maximum Detect	0.642	Maximum Non-Detect	0.1
Variance Detects	0.0428	Percent Non-Detects	25%
Mean Detects	0.326	SD Detects	0.207
Median Detects	0.283	CV Detects	0.634
Skewness Detects	0.652	Kurtosis Detects	-1.008
Mean of Logged Detects	-1.302	SD of Logged Detects	0.677

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

ProUCL Output
Lake Elmo
Predator Fish Tissue

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.926	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.201	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.268	KM Standard Error of Mean	0.0743
KM SD	0.192	95% KM (BCA) UCL	0.379
95% KM (t) UCL	0.409	95% KM (Percentile Bootstrap) UCL	0.387
95% KM (z) UCL	0.391	95% KM Bootstrap t UCL	0.501
90% KM Chebyshev UCL	0.491	95% KM Chebyshev UCL	0.592
97.5% KM Chebyshev UCL	0.733	99% KM Chebyshev UCL	1.008

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.237	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.702	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.172	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.335	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.899	k star (bias corrected MLE)	1.561
Theta hat (MLE)	0.113	Theta star (bias corrected MLE)	0.209
nu hat (MLE)	34.79	nu star (bias corrected)	18.73
Mean (detects)	0.326		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.247
Maximum	0.642	Median	0.183
SD	0.228	CV	0.922
k hat (MLE)	0.811	k star (bias corrected MLE)	0.59
Theta hat (MLE)	0.305	Theta star (bias corrected MLE)	0.419
nu hat (MLE)	12.97	nu star (bias corrected)	9.442
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (9.44, α)	3.596	Adjusted Chi Square Value (9.44, β)	2.745
95% Gamma Approximate UCL (use when n>=50)	0.649	95% Gamma Adjusted UCL (use when n<50)	0.851

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.268	SD (KM)	0.192
Variance (KM)	0.0369	SE of Mean (KM)	0.0743
k hat (KM)	1.955	k star (KM)	1.305
nu hat (KM)	31.28	nu star (KM)	20.88
theta hat (KM)	0.137	theta star (KM)	0.206
80% gamma percentile (KM)	0.421	90% gamma percentile (KM)	0.579
95% gamma percentile (KM)	0.733	99% gamma percentile (KM)	1.084

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (20.88, α)	11.5	Adjusted Chi Square Value (20.88, β)	9.791
95% Gamma Approximate KM-UCL (use when n>=50)	0.487	95% Gamma Adjusted KM-UCL (use when n<50)	0.572

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.955	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.147	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.257	Mean in Log Scale	-1.733
SD in Original Scale	0.217	SD in Log Scale	0.983
95% t UCL (assumes normality of ROS data)	0.402	95% Percentile Bootstrap UCL	0.378
95% BCA Bootstrap UCL	0.4	95% Bootstrap t UCL	0.49
95% H-UCL (Log ROS)	1.007		

ProUCL Output
Lake Elmo
Predator Fish Tissue

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.567	KM Geo Mean	0.209
KM SD (logged)	0.705	95% Critical H Value (KM-Log)	2.745
KM Standard Error of Mean (logged)	0.273	95% H-UCL (KM -Log)	0.556
KM SD (logged)	0.705	95% Critical H Value (KM-Log)	2.745
KM Standard Error of Mean (logged)	0.273		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.257	Mean in Log Scale	-1.733
SD in Original Scale	0.217	SD in Log Scale	0.982
95% t UCL (Assumes normality)	0.402	95% H-Stat UCL	1.004

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.409

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFDA|ug/kg

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	5.816	Mean	9.413
Maximum	17.88	Median	7.986
SD	4.021	Std. Error of Mean	1.422
Coefficient of Variation	0.427	Skewness	1.623

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.82	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.273	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	12.11	95% Adjusted-CLT UCL (Chen-1995)	12.62
		95% Modified-t UCL (Johnson-1978)	12.24

Gamma GOF Test

A-D Test Statistic	0.493	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.717	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.244	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.295	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	7.732	k star (bias corrected MLE)	4.916
Theta hat (MLE)	1.218	Theta star (bias corrected MLE)	1.915
nu hat (MLE)	123.7	nu star (bias corrected)	78.65
MLE Mean (bias corrected)	9.413	MLE Sd (bias corrected)	4.246
		Approximate Chi Square Value (0.05)	59.22
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	54.97

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	12.5	95% Adjusted Gamma UCL (use when n<50)	13.47

ProUCL Output
Lake Elmo
Predator Fish Tissue

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.91	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.221	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.761	Mean of logged Data	2.176
Maximum of Logged Data	2.884	SD of logged Data	0.372

Assuming Lognormal Distribution

95% H-UCL	12.78	90% Chebyshev (MVUE) UCL	13.07
95% Chebyshev (MVUE) UCL	14.75	97.5% Chebyshev (MVUE) UCL	17.08
99% Chebyshev (MVUE) UCL	21.66		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	11.75	95% Jackknife UCL	12.11
95% Standard Bootstrap UCL	11.6	95% Bootstrap-t UCL	16.47
95% Hall's Bootstrap UCL	25.48	95% Percentile Bootstrap UCL	11.68
95% BCA Bootstrap UCL	12.43		
90% Chebyshev(Mean, Sd) UCL	13.68	95% Chebyshev(Mean, Sd) UCL	15.61
97.5% Chebyshev(Mean, Sd) UCL	18.29	99% Chebyshev(Mean, Sd) UCL	23.56

Suggested UCL to Use

95% Student's-t UCL 12.11

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.338	Mean	0.605
Maximum	1.086	Median	0.525
SD	0.249	Std. Error of Mean	0.0882
Coefficient of Variation	0.412	Skewness	1.061

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.907	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.19	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.772	95% Adjusted-CLT UCL (Chen-1995)	0.785
		95% Modified-t UCL (Johnson-1978)	0.778

Gamma GOF Test

A-D Test Statistic	0.275	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.717	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.184	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.295	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

ProUCL Output
Lake Elmo
Predator Fish Tissue

Gamma Statistics

k hat (MLE)	7.446	k star (bias corrected MLE)	4.737
Theta hat (MLE)	0.0812	Theta star (bias corrected MLE)	0.128
nu hat (MLE)	119.1	nu star (bias corrected)	75.8
MLE Mean (bias corrected)	0.605	MLE Sd (bias corrected)	0.278
		Approximate Chi Square Value (0.05)	56.74
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	52.59

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.808	95% Adjusted Gamma UCL (use when n<50)	0.872

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.962	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.16	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.084	Mean of logged Data	-0.571
Maximum of Logged Data	0.0824	SD of logged Data	0.39

Assuming Lognormal Distribution

95% H-UCL	0.84	90% Chebyshev (MVUE) UCL	0.854
95% Chebyshev (MVUE) UCL	0.968	97.5% Chebyshev (MVUE) UCL	1.126
99% Chebyshev (MVUE) UCL	1.436		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.75	95% Jackknife UCL	0.772
95% Standard Bootstrap UCL	0.742	95% Bootstrap-t UCL	0.838
95% Hall's Bootstrap UCL	0.804	95% Percentile Bootstrap UCL	0.746
95% BCA Bootstrap UCL	0.77		
90% Chebyshev(Mean, Sd) UCL	0.87	95% Chebyshev(Mean, Sd) UCL	0.989
97.5% Chebyshev(Mean, Sd) UCL	1.156	99% Chebyshev(Mean, Sd) UCL	1.482

Suggested UCL to Use

95% Student's-t UCL 0.772

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	2
Minimum	0.364	Mean	0.579
Maximum	0.842	Median	0.575
SD	0.19	Std. Error of Mean	0.0776
Coefficient of Variation	0.328	Skewness	0.229

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.934	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.18	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.735	95% Adjusted-CLT UCL (Chen-1995)	0.714
		95% Modified-t UCL (Johnson-1978)	0.736

ProUCL Output
Lake Elmo
Predator Fish Tissue

Gamma GOF Test

A-D Test Statistic	0.298	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.207	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	10.91	k star (bias corrected MLE)	5.565
Theta hat (MLE)	0.053	Theta star (bias corrected MLE)	0.104
nu hat (MLE)	130.9	nu star (bias corrected)	66.78
MLE Mean (bias corrected)	0.579	MLE Sd (bias corrected)	0.245
		Approximate Chi Square Value (0.05)	48.98
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	43.52

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.789	95% Adjusted Gamma UCL (use when n<50)	0.888

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.933	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.202	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.009	Mean of logged Data	-0.594
Maximum of Logged Data	-0.171	SD of logged Data	0.337

Assuming Lognormal Distribution

95% H-UCL	0.826	90% Chebyshev (MVUE) UCL	0.818
95% Chebyshev (MVUE) UCL	0.926	97.5% Chebyshev (MVUE) UCL	1.076
99% Chebyshev (MVUE) UCL	1.371		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.706	95% Jackknife UCL	0.735
95% Standard Bootstrap UCL	0.697	95% Bootstrap-t UCL	0.757
95% Hall's Bootstrap UCL	0.681	95% Percentile Bootstrap UCL	0.696
95% BCA Bootstrap UCL	0.696		
90% Chebyshev(Mean, Sd) UCL	0.811	95% Chebyshev(Mean, Sd) UCL	0.917
97.5% Chebyshev(Mean, Sd) UCL	1.063	99% Chebyshev(Mean, Sd) UCL	1.35

Suggested UCL to Use

95% Student's-t UCL 0.735

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	742.1	Mean	1198
Maximum	2125	Median	983.9
SD	527.9	Std. Error of Mean	186.6
Coefficient of Variation	0.441	Skewness	1.326

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

ProUCL Output
Lake Elmo
Predator Fish Tissue

Normal GOF Test

Shapiro Wilk Test Statistic	0.758	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.353	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1551	95% Adjusted-CLT UCL (Chen-1995)	1598
		95% Modified-t UCL (Johnson-1978)	1566

Gamma GOF Test

A-D Test Statistic	0.85	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.717	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.327	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.295	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	7.13	k star (bias corrected MLE)	4.54
Theta hat (MLE)	168	Theta star (bias corrected MLE)	263.9
nu hat (MLE)	114.1	nu star (bias corrected)	72.63
MLE Mean (bias corrected)	1198	MLE Sd (bias corrected)	562.2
		Approximate Chi Square Value (0.05)	54.01
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	49.97

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1611	95% Adjusted Gamma UCL (use when n<50)	1741

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.827	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.302	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	6.609	Mean of logged Data	7.017
Maximum of Logged Data	7.661	SD of logged Data	0.387

Assuming Lognormal Distribution

95% H-UCL	1653	90% Chebyshev (MVUE) UCL	1682
95% Chebyshev (MVUE) UCL	1905	97.5% Chebyshev (MVUE) UCL	2214
99% Chebyshev (MVUE) UCL	2822		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1505	95% Jackknife UCL	1551
95% Standard Bootstrap UCL	1488	95% Bootstrap-t UCL	2625
95% Hall's Bootstrap UCL	4155	95% Percentile Bootstrap UCL	1506
95% BCA Bootstrap UCL	1539		
90% Chebyshev(Mean, Sd) UCL	1758	95% Chebyshev(Mean, Sd) UCL	2011
97.5% Chebyshev(Mean, Sd) UCL	2363	99% Chebyshev(Mean, Sd) UCL	3055

Suggested UCL to Use

95% Student's-t UCL	1551	or 95% Modified-t UCL	1566
or 95% H-UCL	1653		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.147	Mean	0.253
Maximum	0.459	Median	0.21
SD	0.105	Std. Error of Mean	0.037
Coefficient of Variation	0.413	Skewness	1.357

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.843	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.284	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.323	95% Adjusted-CLT UCL (Chen-1995)	0.333
		95% Modified-t UCL (Johnson-1978)	0.326

Gamma GOF Test

A-D Test Statistic	0.505	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.717	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.275	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.295	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	7.898	k star (bias corrected MLE)	5.02
Theta hat (MLE)	0.0321	Theta star (bias corrected MLE)	0.0504
nu hat (MLE)	126.4	nu star (bias corrected)	80.31
MLE Mean (bias corrected)	0.253	MLE Sd (bias corrected)	0.113
		Approximate Chi Square Value (0.05)	60.67
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	56.36

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.335	95% Adjusted Gamma UCL (use when n<50)	0.361

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.918	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.253	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.915	Mean of logged Data	-1.438
Maximum of Logged Data	-0.778	SD of logged Data	0.372

Assuming Lognormal Distribution

95% H-UCL	0.344	90% Chebyshev (MVUE) UCL	0.352
95% Chebyshev (MVUE) UCL	0.397	97.5% Chebyshev (MVUE) UCL	0.46
99% Chebyshev (MVUE) UCL	0.584		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.314	95% Jackknife UCL	0.323
95% Standard Bootstrap UCL	0.309	95% Bootstrap-t UCL	0.421
95% Hall's Bootstrap UCL	0.704	95% Percentile Bootstrap UCL	0.312
95% BCA Bootstrap UCL	0.323		
90% Chebyshev(Mean, Sd) UCL	0.364	95% Chebyshev(Mean, Sd) UCL	0.414
97.5% Chebyshev(Mean, Sd) UCL	0.484	99% Chebyshev(Mean, Sd) UCL	0.621

ProUCL Output
Lake Elmo
Predator Fish Tissue

Suggested UCL to Use

95% Student's-t UCL 0.323

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.153	Mean	0.321
Maximum	0.643	Median	0.188
SD	0.214	Std. Error of Mean	0.0756
Coefficient of Variation	0.666	Skewness	0.748

Note: Sample size is small (e.g., <10), If data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.752	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.354	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.464	95% Adjusted-CLT UCL (Chen-1995)	0.467
		95% Modified-t UCL (Johnson-1978)	0.468

Gamma GOF Test

A-D Test Statistic	1.008	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.722	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.35	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.297	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.82	k star (bias corrected MLE)	1.846
Theta hat (MLE)	0.114	Theta star (bias corrected MLE)	0.174
nu hat (MLE)	45.13	nu star (bias corrected)	29.54
MLE Mean (bias corrected)	0.321	MLE Sd (bias corrected)	0.236
		Approximate Chi Square Value (0.05)	18.13
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	15.91

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.523	95% Adjusted Gamma UCL (use when n<50)	0.596

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.767	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.324	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.878	Mean of logged Data	-1.324
Maximum of Logged Data	-0.442	SD of logged Data	0.641

Assuming Lognormal Distribution

95% H-UCL	0.616	90% Chebyshev (MVUE) UCL	0.537
95% Chebyshev (MVUE) UCL	0.636	97.5% Chebyshev (MVUE) UCL	0.773
99% Chebyshev (MVUE) UCL	1.044		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	0.445	95% Jackknife UCL	0.464
95% Standard Bootstrap UCL	0.438	95% Bootstrap-t UCL	0.521
95% Hall's Bootstrap UCL	0.397	95% Percentile Bootstrap UCL	0.439
95% BCA Bootstrap UCL	0.446		
90% Chebyshev(Mean, Sd) UCL	0.548	95% Chebyshev(Mean, Sd) UCL	0.65
97.5% Chebyshev(Mean, Sd) UCL	0.793	99% Chebyshev(Mean, Sd) UCL	1.073

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL 0.65

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
Number of Detects	4	Number of Non-Detects	4
Number of Distinct Detects	4	Number of Distinct Non-Detects	4
Minimum Detect	0.109	Minimum Non-Detect	0.0917
Maximum Detect	0.204	Maximum Non-Detect	0.1
Variance Detects	0.00172	Percent Non-Detects	50%
Mean Detects	0.144	SD Detects	0.0415
Median Detects	0.131	CV Detects	0.289
Skewness Detects	1.61	Kurtosis Detects	2.96
Mean of Logged Detects	-1.968	SD of Logged Detects	0.267

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.846	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.343	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.118	KM Standard Error of Mean	0.0149
KM SD	0.0364	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.146	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.142	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.162	95% KM Chebyshev UCL	0.182
97.5% KM Chebyshev UCL	0.21	99% KM Chebyshev UCL	0.266

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.43	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.335	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	17.95	k star (bias corrected MLE)	4.655
Theta hat (MLE)	0.00801	Theta star (bias corrected MLE)	0.0309
nu hat (MLE)	143.6	nu star (bias corrected)	37.24
Mean (detects)	0.144		

ProUCL Output
Lake Elmo
Predator Fish Tissue

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0317	Mean	0.0877
Maximum	0.204	Median	0.0705
SD	0.0658	CV	0.75
k hat (MLE)	1.96	k star (bias corrected MLE)	1.308
Theta hat (MLE)	0.0448	Theta star (bias corrected MLE)	0.067
nu hat (MLE)	31.36	nu star (bias corrected)	20.94
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (20.94, α)	11.54	Adjusted Chi Square Value (20.94, β)	9.827
95% Gamma Approximate UCL (use when n>=50)	0.159	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.118	SD (KM)	0.0364
Variance (KM)	0.00132	SE of Mean (KM)	0.0149
k hat (KM)	10.47	k star (KM)	6.629
nu hat (KM)	167.6	nu star (KM)	106.1
theta hat (KM)	0.0112	theta star (KM)	0.0178
80% gamma percentile (KM)	0.154	90% gamma percentile (KM)	0.179
95% gamma percentile (KM)	0.202	99% gamma percentile (KM)	0.249

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (106.07, α)	83.3	Adjusted Chi Square Value (106.07, β)	78.2
95% Gamma Approximate KM-UCL (use when n>=50)	0.15	95% Gamma Adjusted KM-UCL (use when n<50)	0.16

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.894	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.313	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.103	Mean in Log Scale	-2.373
SD in Original Scale	0.0514	SD in Log Scale	0.467
95% t UCL (assumes normality of ROS data)	0.137	95% Percentile Bootstrap UCL	0.131
95% BCA Bootstrap UCL	0.136	95% Bootstrap t UCL	0.15
95% H-UCL (Log ROS)	0.156		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.178	KM Geo Mean	0.113
KM SD (logged)	0.267	95% Critical H Value (KM-Log)	2.017
KM Standard Error of Mean (logged)	0.109	95% H-UCL (KM -Log)	0.144
KM SD (logged)	0.267	95% Critical H Value (KM-Log)	2.017
KM Standard Error of Mean (logged)	0.109		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.096	Mean in Log Scale	-2.5
SD in Original Scale	0.0579	SD in Log Scale	0.596
95% t UCL (Assumes normality)	0.135	95% H-Stat UCL	0.173

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.146

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	1.426	Mean	2.276
Maximum	3.742	Median	1.95
SD	0.876	Std. Error of Mean	0.31
Coefficient of Variation	0.385	Skewness	1.202

Note: Sample size is small (e.g., <10), If data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.791	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.316	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2.863	95% Adjusted-CLT UCL (Chen-1995)	2.926
		95% Modified-t UCL (Johnson-1978)	2.885

Gamma GOF Test

A-D Test Statistic	0.713	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.716	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.284	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.294	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	8.965	k star (bias corrected MLE)	5.687
Theta hat (MLE)	0.254	Theta star (bias corrected MLE)	0.4
nu hat (MLE)	143.4	nu star (bias corrected)	90.99
MLE Mean (bias corrected)	2.276	MLE Sd (bias corrected)	0.954
		Approximate Chi Square Value (0.05)	69.99
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	65.35

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	2.959	95% Adjusted Gamma UCL (use when n<50)	3.169

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.861	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.261	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.355	Mean of logged Data	0.766
Maximum of Logged Data	1.32	SD of logged Data	0.348

Assuming Lognormal Distribution

95% H-UCL	3.021	90% Chebyshev (MVUE) UCL	3.109
95% Chebyshev (MVUE) UCL	3.491	97.5% Chebyshev (MVUE) UCL	4.02
99% Chebyshev (MVUE) UCL	5.06		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2.786	95% Jackknife UCL	2.863
95% Standard Bootstrap UCL	2.769	95% Bootstrap-t UCL	4.075
95% Hall's Bootstrap UCL	7.26	95% Percentile Bootstrap UCL	2.77
95% BCA Bootstrap UCL	2.85		
90% Chebyshev(Mean, Sd) UCL	3.206	95% Chebyshev(Mean, Sd) UCL	3.627
97.5% Chebyshev(Mean, Sd) UCL	4.211	99% Chebyshev(Mean, Sd) UCL	5.359

ProUCL Output
Lake Elmo
Predator Fish Tissue

Suggested UCL to Use

95% Adjusted Gamma UCL 3.169

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.846	Mean	1.21
Maximum	1.981	Median	1.038
SD	0.436	Std. Error of Mean	0.154
Coefficient of Variation	0.36	Skewness	1.184

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.809	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.238	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.502	95% Adjusted-CLT UCL (Chen-1995)	1.533
		95% Modified-t UCL (Johnson-1978)	1.513

Gamma GOF Test

A-D Test Statistic	0.635	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.715	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.207	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.294	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	10.16	k star (bias corrected MLE)	6.434
Theta hat (MLE)	0.119	Theta star (bias corrected MLE)	0.188
nu hat (MLE)	162.6	nu star (bias corrected)	102.9
MLE Mean (bias corrected)	1.21	MLE Sd (bias corrected)	0.477
		Approximate Chi Square Value (0.05)	80.53
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	75.53

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1.547	95% Adjusted Gamma UCL (use when n<50)	1.65

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.854	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.188	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.168	Mean of logged Data	0.141
Maximum of Logged Data	0.683	SD of logged Data	0.327

Assuming Lognormal Distribution

95% H-UCL	1.574	90% Chebyshev (MVUE) UCL	1.627
95% Chebyshev (MVUE) UCL	1.818	97.5% Chebyshev (MVUE) UCL	2.082
99% Chebyshev (MVUE) UCL	2.602		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

ProUCL Output
Lake Elmo
Predator Fish Tissue

Nonparametric Distribution Free UCLs

95% CLT UCL	1.464	95% Jackknife UCL	1.502
95% Standard Bootstrap UCL	1.451	95% Bootstrap-t UCL	1.916
95% Hall's Bootstrap UCL	2.985	95% Percentile Bootstrap UCL	1.469
95% BCA Bootstrap UCL	1.539		
90% Chebyshev(Mean, Sd) UCL	1.673	95% Chebyshev(Mean, Sd) UCL	1.882
97.5% Chebyshev(Mean, Sd) UCL	2.173	99% Chebyshev(Mean, Sd) UCL	2.744

ProUCL Output
Lake Elmo
Predator Fish Tissue

Suggested UCL to Use

95% Student's-t UCL 1.502

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFHpS|ug/kg

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.277	Mean	0.815
Maximum	1.53	Median	0.861
SD	0.429	Std. Error of Mean	0.152
Coefficient of Variation	0.526	Skewness	0.296

Note: Sample size is small (e.g., <10), If data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.945	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.195	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.102	95% Adjusted-CLT UCL (Chen-1995)	1.081
		95% Modified-t UCL (Johnson-1978)	1.105

Gamma GOF Test

A-D Test Statistic	0.336	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.72	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.204	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.296	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.658	k star (bias corrected MLE)	2.37
Theta hat (MLE)	0.223	Theta star (bias corrected MLE)	0.344
nu hat (MLE)	58.53	nu star (bias corrected)	37.92
MLE Mean (bias corrected)	0.815	MLE Sd (bias corrected)	0.529
		Approximate Chi Square Value (0.05)	24.82
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	22.17

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1.245	95% Adjusted Gamma UCL (use when n<50)	1.393

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.927	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.199	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.282	Mean of logged Data	-0.348
Maximum of Logged Data	0.425	SD of logged Data	0.599

Assuming Lognormal Distribution

95% H-UCL	1.499	90% Chebyshev (MVUE) UCL	1.355
95% Chebyshev (MVUE) UCL	1.595	97.5% Chebyshev (MVUE) UCL	1.928
99% Chebyshev (MVUE) UCL	2.584		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.064	95% Jackknife UCL	1.102
95% Standard Bootstrap UCL	1.053	95% Bootstrap-t UCL	1.127
95% Hall's Bootstrap UCL	1.066	95% Percentile Bootstrap UCL	1.046
95% BCA Bootstrap UCL	1.075		
90% Chebyshev(Mean, Sd) UCL	1.269	95% Chebyshev(Mean, Sd) UCL	1.475
97.5% Chebyshev(Mean, Sd) UCL	1.761	99% Chebyshev(Mean, Sd) UCL	2.323

Suggested UCL to Use

95% Student's-t UCL 1.102

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFNS|ug/kg

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.368	Mean	0.603
Maximum	1.263	Median	0.495
SD	0.307	Std. Error of Mean	0.109
Coefficient of Variation	0.509	Skewness	1.743

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.782	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.291	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.809	95% Adjusted-CLT UCL (Chen-1995)	0.853
		95% Modified-t UCL (Johnson-1978)	0.82

Gamma GOF Test

A-D Test Statistic	0.593	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.718	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.244	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.295	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.706	k star (bias corrected MLE)	3.649
Theta hat (MLE)	0.106	Theta star (bias corrected MLE)	0.165
nu hat (MLE)	91.29	nu star (bias corrected)	58.39
MLE Mean (bias corrected)	0.603	MLE Sd (bias corrected)	0.316
		Approximate Chi Square Value (0.05)	41.82
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	38.3

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	0.842	95% Adjusted Gamma UCL (use when n<50)	0.92

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.872	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.216	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

ProUCL Output
Lake Elmo
Predator Fish Tissue

Lognormal Statistics

Minimum of Logged Data	-0.999	Mean of logged Data	-0.595
Maximum of Logged Data	0.234	SD of logged Data	0.43

Assuming Lognormal Distribution

95% H-UCL	0.87	90% Chebyshev (MVUE) UCL	0.871
95% Chebyshev (MVUE) UCL	0.996	97.5% Chebyshev (MVUE) UCL	1.168
99% Chebyshev (MVUE) UCL	1.507		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.782	95% Jackknife UCL	0.809
95% Standard Bootstrap UCL	0.77	95% Bootstrap-t UCL	1.12
95% Hall's Bootstrap UCL	1.687	95% Percentile Bootstrap UCL	0.798
95% BCA Bootstrap UCL	0.851		
90% Chebyshev(Mean, Sd) UCL	0.929	95% Chebyshev(Mean, Sd) UCL	1.077
97.5% Chebyshev(Mean, Sd) UCL	1.281	99% Chebyshev(Mean, Sd) UCL	1.684

Suggested UCL to Use

95% Adjusted Gamma UCL 0.92

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL Output
West Lakeland
Predator Fish Tissue

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/19/2021 5:20:00 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

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General Statistics

Total Number of Observations	12	Number of Distinct Observations	9
Number of Detects	7	Number of Non-Detects	5
Number of Distinct Detects	7	Number of Distinct Non-Detects	3
Minimum Detect	0.1	Minimum Non-Detect	0.0985
Maximum Detect	0.148	Maximum Non-Detect	0.1
Variance Detects	3.22E-04	Percent Non-Detects	41.67%
Mean Detects	0.133	SD Detects	0.0179
Median Detects	0.14	CV Detects	0.135
Skewness Detects	-1.242	Kurtosis Detects	0.534
Mean of Logged Detects	-2.028	SD of Logged Detects	0.146

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.845	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.229	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.118	KM Standard Error of Mean	0.00658
KM SD	0.0211	95% KM (BCA) UCL	0.13
95% KM (t) UCL	0.13	95% KM (Percentile Bootstrap) UCL	0.129
95% KM (z) UCL	0.129	95% KM Bootstrap t UCL	0.129
90% KM Chebyshev UCL	0.138	95% KM Chebyshev UCL	0.147
97.5% KM Chebyshev UCL	0.16	99% KM Chebyshev UCL	0.184

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.609	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.708	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.247	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.311	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	58.02	k star (bias corrected MLE)	33.25
Theta hat (MLE)	0.00229	Theta star (bias corrected MLE)	0.00399
nu hat (MLE)	812.2	nu star (bias corrected)	465.5
Mean (detects)	0.133		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0862	Mean	0.116
Maximum	0.148	Median	0.109
SD	0.0248	CV	0.214
k hat (MLE)	23.9	k star (bias corrected MLE)	17.98
Theta hat (MLE)	0.00486	Theta star (bias corrected MLE)	0.00645
nu hat (MLE)	573.6	nu star (bias corrected)	431.5
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (431.53, α)	384.4	Adjusted Chi Square Value (431.53, β)	377.6
95% Gamma Approximate UCL (use when n>=50)	0.13	95% Gamma Adjusted UCL (use when n<50)	0.133

ProUCL Output
West Lakeland
Predator Fish Tissue

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.118	SD (KM)	0.0211
Variance (KM)	4.4548E-4	SE of Mean (KM)	0.00658
k hat (KM)	31.5	k star (KM)	23.68
nu hat (KM)	756	nu star (KM)	568.3
theta hat (KM)	0.00376	theta star (KM)	0.005
80% gamma percentile (KM)	0.138	90% gamma percentile (KM)	0.151
95% gamma percentile (KM)	0.161	99% gamma percentile (KM)	0.182

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (568.33, α)	514	Adjusted Chi Square Value (568.33, β)	506.1
95% Gamma Approximate KM-UCL (use when n>=50)	0.131	95% Gamma Adjusted KM-UCL (use when n<50)	0.133

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.823	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.244	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.116	Mean in Log Scale	-2.171
SD in Original Scale	0.0243	SD in Log Scale	0.209
95% t UCL (assumes normality of ROS data)	0.129	95% Percentile Bootstrap UCL	0.128
95% BCA Bootstrap UCL	0.127	95% Bootstrap t UCL	0.131
95% H-UCL (Log ROS)	0.131		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.149	KM Geo Mean	0.117
KM SD (logged)	0.176	95% Critical H Value (KM-Log)	1.825
KM Standard Error of Mean (logged)	0.0549	95% H-UCL (KM -Log)	0.13
KM SD (logged)	0.176	95% Critical H Value (KM-Log)	1.825
KM Standard Error of Mean (logged)	0.0549		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0981	Mean in Log Scale	-2.435
SD in Original Scale	0.0448	SD in Log Scale	0.514
95% t UCL (Assumes normality)	0.121	95% H-Stat UCL	0.14

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.13

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFDA|ug/kg

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	4.54	Mean	7.857
Maximum	12.4	Median	7.79
SD	2.184	Std. Error of Mean	0.631
Coefficient of Variation	0.278	Skewness	0.776

Normal GOF Test

Shapiro Wilk Test Statistic	0.898	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.291	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

ProUCL Output
West Lakeland
Predator Fish Tissue

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	8.989	95% Adjusted-CLT UCL (Chen-1995)	9.045
		95% Modified-t UCL (Johnson-1978)	9.013

Gamma GOF Test

A-D Test Statistic	0.559	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.731	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.254	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.245	Data Not Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	14.6	k star (bias corrected MLE)	11.01
Theta hat (MLE)	0.538	Theta star (bias corrected MLE)	0.714
nu hat (MLE)	350.4	nu star (bias corrected)	264.1
MLE Mean (bias corrected)	7.857	MLE Sd (bias corrected)	2.368
		Approximate Chi Square Value (0.05)	227.5
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	222.3

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	9.122	95% Adjusted Gamma UCL (use when n<50)	9.335

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.929	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.242	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.513	Mean of logged Data	2.027
Maximum of Logged Data	2.518	SD of logged Data	0.275

Assuming Lognormal Distribution

95% H-UCL	9.234	90% Chebyshev (MVUE) UCL	9.746
95% Chebyshev (MVUE) UCL	10.6	97.5% Chebyshev (MVUE) UCL	11.79
99% Chebyshev (MVUE) UCL	14.12		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	8.894	95% Jackknife UCL	8.989
95% Standard Bootstrap UCL	8.805	95% Bootstrap-t UCL	9.344
95% Hall's Bootstrap UCL	10.43	95% Percentile Bootstrap UCL	8.869
95% BCA Bootstrap UCL	8.985		
90% Chebyshev(Mean, Sd) UCL	9.748	95% Chebyshev(Mean, Sd) UCL	10.61
97.5% Chebyshev(Mean, Sd) UCL	11.79	99% Chebyshev(Mean, Sd) UCL	14.13

Suggested UCL to Use

95% Student's-t UCL 8.989

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	0.855	Mean	1.499
Maximum	2.27	Median	1.59
SD	0.471	Std. Error of Mean	0.136
Coefficient of Variation	0.314	Skewness	0.103

ProUCL Output
West Lakeland
Predator Fish Tissue

Normal GOF Test

Shapiro Wilk Test Statistic	0.937	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.173	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.743	95% Adjusted-CLT UCL (Chen-1995)	1.727
		95% Modified-t UCL (Johnson-1978)	1.744

Gamma GOF Test

A-D Test Statistic	0.405	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.73	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.205	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.245	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	10.54	k star (bias corrected MLE)	7.963
Theta hat (MLE)	0.142	Theta star (bias corrected MLE)	0.188
nu hat (MLE)	253.1	nu star (bias corrected)	191.1
MLE Mean (bias corrected)	1.499	MLE Sd (bias corrected)	0.531
		Approximate Chi Square Value (0.05)	160.1
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	155.8

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1.789	95% Adjusted Gamma UCL (use when n<50)	1.839

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.929	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.207	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.157	Mean of logged Data	0.357
Maximum of Logged Data	0.82	SD of logged Data	0.33

Assuming Lognormal Distribution

95% H-UCL	1.832	90% Chebyshev (MVUE) UCL	1.935
95% Chebyshev (MVUE) UCL	2.131	97.5% Chebyshev (MVUE) UCL	2.403
99% Chebyshev (MVUE) UCL	2.939		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.723	95% Jackknife UCL	1.743
95% Standard Bootstrap UCL	1.705	95% Bootstrap-t UCL	1.757
95% Hall's Bootstrap UCL	1.716	95% Percentile Bootstrap UCL	1.71
95% BCA Bootstrap UCL	1.705		
90% Chebyshev(Mean, Sd) UCL	1.907	95% Chebyshev(Mean, Sd) UCL	2.092
97.5% Chebyshev(Mean, Sd) UCL	2.348	99% Chebyshev(Mean, Sd) UCL	2.852

Suggested UCL to Use

95% Student's-t UCL	1.743

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	12	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	0.219	Mean	0.501
Maximum	0.896	Median	0.508
SD	0.199	Std. Error of Mean	0.0576
Coefficient of Variation	0.398	Skewness	0.267

Normal GOF Test

Shapiro Wilk Test Statistic	0.95	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.148	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Data appear Normal at 5% Significance Level	

ProUCL Output
West Lakeland
Predator Fish Tissue

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.604	95% Adjusted-CLT UCL (Chen-1995)	0.6
		95% Modified-t UCL (Johnson-1978)	0.605

Gamma GOF Test

A-D Test Statistic	0.373	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.732	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.189	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.246	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	6.275	k star (bias corrected MLE)	4.762
Theta hat (MLE)	0.0799	Theta star (bias corrected MLE)	0.105
nu hat (MLE)	150.6	nu star (bias corrected)	114.3
MLE Mean (bias corrected)	0.501	MLE Sd (bias corrected)	0.23
		Approximate Chi Square Value (0.05)	90.6
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	87.39

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.632	95% Adjusted Gamma UCL (use when n<50)	0.655

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.925	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.194	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.519	Mean of logged Data	-0.773
Maximum of Logged Data	-0.11	SD of logged Data	0.439

Assuming Lognormal Distribution

95% H-UCL	0.669	90% Chebyshev (MVUE) UCL	0.7
95% Chebyshev (MVUE) UCL	0.788	97.5% Chebyshev (MVUE) UCL	0.911
99% Chebyshev (MVUE) UCL	1.153		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.596	95% Jackknife UCL	0.604
95% Standard Bootstrap UCL	0.593	95% Bootstrap-t UCL	0.609
95% Hall's Bootstrap UCL	0.604	95% Percentile Bootstrap UCL	0.595
95% BCA Bootstrap UCL	0.599		
90% Chebyshev(Mean, Sd) UCL	0.674	95% Chebyshev(Mean, Sd) UCL	0.752
97.5% Chebyshev(Mean, Sd) UCL	0.861	99% Chebyshev(Mean, Sd) UCL	1.074

Suggested UCL to Use

95% Student's-t UCL	0.604

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	0.162	Mean	0.378
Maximum	0.546	Median	0.384
SD	0.155	Std. Error of Mean	0.0449
Coefficient of Variation	0.411	Skewness	-0.173

Normal GOF Test

Shapiro Wilk Test Statistic	0.848	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.243	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.459	95% Adjusted-CLT UCL (Chen-1995)	0.449
		95% Modified-t UCL (Johnson-1978)	0.458

Gamma GOF Test

A-D Test Statistic	0.746	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.732	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.247	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.246	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.6	k star (bias corrected MLE)	4.256
Theta hat (MLE)	0.0675	Theta star (bias corrected MLE)	0.0888
nu hat (MLE)	134.4	nu star (bias corrected)	102.1
MLE Mean (bias corrected)	0.378	MLE Sd (bias corrected)	0.183
		Approximate Chi Square Value (0.05)	79.82
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	76.81

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.484	95% Adjusted Gamma UCL (use when n<50)	0.503

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.855	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.232	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level	

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.82	Mean of logged Data	-1.065
Maximum of Logged Data	-0.605	SD of logged Data	0.467

Assuming Lognormal Distribution

95% H-UCL	0.517	90% Chebyshev (MVUE) UCL	0.538
95% Chebyshev (MVUE) UCL	0.609	97.5% Chebyshev (MVUE) UCL	0.708
99% Chebyshev (MVUE) UCL	0.902		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.452	95% Jackknife UCL	0.459
95% Standard Bootstrap UCL	0.447	95% Bootstrap-t UCL	0.457
95% Hall's Bootstrap UCL	0.442	95% Percentile Bootstrap UCL	0.449
95% BCA Bootstrap UCL	0.447		
90% Chebyshev(Mean, Sd) UCL	0.513	95% Chebyshev(Mean, Sd) UCL	0.574
97.5% Chebyshev(Mean, Sd) UCL	0.658	99% Chebyshev(Mean, Sd) UCL	0.825

ProUCL Output
West Lakeland
Predator Fish Tissue

Suggested UCL to Use

95% Student's-t UCL	0.459	or 95% Modified-t UCL	0.458
or 95% H-UCL	0.517		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

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General Statistics

Total Number of Observations	11	Number of Distinct Observations	10
		Number of Missing Observations	1
Number of Detects	10	Number of Non-Detects	1
Number of Distinct Detects	9	Number of Distinct Non-Detects	1
Minimum Detect	0.115	Minimum Non-Detect	0.1
Maximum Detect	0.282	Maximum Non-Detect	0.1
Variance Detects	0.00383	Percent Non-Detects	9.09%
Mean Detects	0.181	SD Detects	0.0619
Median Detects	0.16	CV Detects	0.342
Skewness Detects	0.831	Kurtosis Detects	-0.897
Mean of Logged Detects	-1.759	SD of Logged Detects	0.324

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.856	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.226	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.173	KM Standard Error of Mean	0.0193
KM SD	0.0606	95% KM (BCA) UCL	0.204
95% KM (t) UCL	0.208	95% KM (Percentile Bootstrap) UCL	0.205
95% KM (z) UCL	0.205	95% KM Bootstrap t UCL	0.217
90% KM Chebyshev UCL	0.231	95% KM Chebyshev UCL	0.257
97.5% KM Chebyshev UCL	0.294	99% KM Chebyshev UCL	0.365

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.549	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.203	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.267	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	10.36	k star (bias corrected MLE)	7.316
Theta hat (MLE)	0.0175	Theta star (bias corrected MLE)	0.0247
nu hat (MLE)	207.1	nu star (bias corrected)	146.3
Mean (detects)	0.181		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0567	Mean	0.17
Maximum	0.282	Median	0.158
SD	0.0696	CV	0.411
k hat (MLE)	6.001	k star (bias corrected MLE)	4.425
Theta hat (MLE)	0.0282	Theta star (bias corrected MLE)	0.0383
nu hat (MLE)	132	nu star (bias corrected)	97.35
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (97.35, α)	75.59	Adjusted Chi Square Value (97.35, β)	72.47
95% Gamma Approximate UCL (use when n>=50)	0.218	95% Gamma Adjusted UCL (use when n<50)	0.228

ProUCL Output
West Lakeland
Predator Fish Tissue

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.173	SD (KM)	0.0606
Variance (KM)	0.00367	SE of Mean (KM)	0.0193
k hat (KM)	8.194	k star (KM)	6.02
nu hat (KM)	180.3	nu star (KM)	132.4
theta hat (KM)	0.0212	theta star (KM)	0.0288
80% gamma percentile (KM)	0.228	90% gamma percentile (KM)	0.268
95% gamma percentile (KM)	0.304	99% gamma percentile (KM)	0.379

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (132.43, α)	106.8	Adjusted Chi Square Value (132.43, β)	103.1
95% Gamma Approximate KM-UCL (use when n>=50)	0.215	95% Gamma Adjusted KM-UCL (use when n<50)	0.223

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.899	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.182	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.171	Mean in Log Scale	-1.831
SD in Original Scale	0.0663	SD in Log Scale	0.389
95% t UCL (assumes normality of ROS data)	0.208	95% Percentile Bootstrap UCL	0.204
95% BCA Bootstrap UCL	0.207	95% Bootstrap t UCL	0.22
95% H-UCL (Log ROS)	0.222		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.809	KM Geo Mean	0.164
KM SD (logged)	0.332	95% Critical H Value (KM-Log)	1.981
KM Standard Error of Mean (logged)	0.106	95% H-UCL (KM -Log)	0.213
KM SD (logged)	0.332	95% Critical H Value (KM-Log)	1.981
KM Standard Error of Mean (logged)	0.106		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.169	Mean in Log Scale	-1.872
SD in Original Scale	0.0707	SD in Log Scale	0.483
95% t UCL (Assumes normality)	0.208	95% H-Stat UCL	0.24

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.208

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	12	Number of Distinct Observations	9
Number of Detects	4	Number of Non-Detects	8
Number of Distinct Detects	4	Number of Distinct Non-Detects	5
Minimum Detect	0.098	Minimum Non-Detect	0.0976
Maximum Detect	0.122	Maximum Non-Detect	0.1
Variance Detects	1.10E-04	Percent Non-Detects	66.67%
Mean Detects	0.107	SD Detects	0.0105
Median Detects	0.104	CV Detects	0.0984
Skewness Detects	1.614	Kurtosis Detects	3.009
Mean of Logged Detects	-2.241	SD of Logged Detects	0.095

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.839	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.353	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.101	KM Standard Error of Mean	0.00225
KM SD	0.00674	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.105	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.104	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.108	95% KM Chebyshev UCL	0.111
97.5% KM Chebyshev UCL	0.115	99% KM Chebyshev UCL	0.123

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.49	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.362	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	144.6	k star (bias corrected MLE)	36.31
Theta hat (MLE)	7.3840E-4	Theta star (bias corrected MLE)	0.00294
nu hat (MLE)	1157	nu star (bias corrected)	290.5
Mean (detects)	0.107		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0797	Mean	0.0934
Maximum	0.122	Median	0.0902
SD	0.0122	CV	0.13
k hat (MLE)	68.67	k star (bias corrected MLE)	51.56
Theta hat (MLE)	0.00136	Theta star (bias corrected MLE)	0.00181
nu hat (MLE)	1648	nu star (bias corrected)	1237
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (N/A, α)	1157	Adjusted Chi Square Value (N/A, β)	1145
95% Gamma Approximate UCL (use when n>=50)	0.0999	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.101	SD (KM)	0.00674
Variance (KM)	4.5489E-5	SE of Mean (KM)	0.00225
k hat (KM)	223.2	k star (KM)	167.5
nu hat (KM)	5357	nu star (KM)	4019
theta hat (KM)	4.5143E-4	theta star (KM)	6.0170E-4
80% gamma percentile (KM)	0.107	90% gamma percentile (KM)	0.111
95% gamma percentile (KM)	0.114	99% gamma percentile (KM)	0.12

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (N/A, α)	3873	Adjusted Chi Square Value (N/A, β)	3851
95% Gamma Approximate KM-UCL (use when n>=50)	0.105	95% Gamma Adjusted KM-UCL (use when n<50)	0.105

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.856	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.344	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0944	Mean in Log Scale	-2.366
SD in Original Scale	0.0113	SD in Log Scale	0.114
95% t UCL (assumes normality of ROS data)	0.1	95% Percentile Bootstrap UCL	0.0995
95% BCA Bootstrap UCL	0.101	95% Bootstrap t UCL	0.103
95% H-UCL (Log ROS)	0.1		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.297	KM Geo Mean	0.101
KM SD (logged)	0.062	95% Critical H Value (KM-Log)	N/A
KM Standard Error of Mean (logged)	0.0207	95% H-UCL (KM -Log)	N/A
KM SD (logged)	0.062	95% Critical H Value (KM-Log)	N/A
KM Standard Error of Mean (logged)	0.0207		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0685	Mean in Log Scale	-2.752
SD in Original Scale	0.0287	SD in Log Scale	0.381
95% t UCL (Assumes normality)	0.0834	95% H-Stat UCL	0.0864

DL/2 is not a recommended method, provided for comparisons and historical reasons

ProUCL Output
West Lakeland
Predator Fish Tissue

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.105

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFHpS|ug/kg

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	0.325	Mean	0.449
Maximum	0.811	Median	0.38
SD	0.141	Std. Error of Mean	0.0408
Coefficient of Variation	0.314	Skewness	1.73

Normal GOF Test

Shapiro Wilk Test Statistic	0.796	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.244	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.523	95% Adjusted-CLT UCL (Chen-1995)	0.538
		95% Modified-t UCL (Johnson-1978)	0.526

Gamma GOF Test

A-D Test Statistic	0.794	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.731	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.242	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.245	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	13.51	k star (bias corrected MLE)	10.18
Theta hat (MLE)	0.0333	Theta star (bias corrected MLE)	0.0441
nu hat (MLE)	324.1	nu star (bias corrected)	244.4
MLE Mean (bias corrected)	0.449	MLE Sd (bias corrected)	0.141
		Approximate Chi Square Value (0.05)	209.2
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	204.3

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	0.525	95% Adjusted Gamma UCL (use when n<50)	0.538

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.862	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.228	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.124	Mean of logged Data	-0.837
Maximum of Logged Data	-0.209	SD of logged Data	0.274

Assuming Lognormal Distribution

95% H-UCL	0.526	90% Chebyshev (MVUE) UCL	0.555
95% Chebyshev (MVUE) UCL	0.603	97.5% Chebyshev (MVUE) UCL	0.671
99% Chebyshev (MVUE) UCL	0.803		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.516	95% Jackknife UCL	0.523
95% Standard Bootstrap UCL	0.513	95% Bootstrap-t UCL	0.569
95% Hall's Bootstrap UCL	0.575	95% Percentile Bootstrap UCL	0.519
95% BCA Bootstrap UCL	0.539		
90% Chebyshev(Mean, Sd) UCL	0.572	95% Chebyshev(Mean, Sd) UCL	0.627
97.5% Chebyshev(Mean, Sd) UCL	0.704	99% Chebyshev(Mean, Sd) UCL	0.855

ProUCL Output
West Lakeland
Predator Fish Tissue

Suggested UCL to Use

95% Adjusted Gamma UCL 0.538

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOS|ug/kg

General Statistics

Total Number of Observations	12	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	650	Mean	1196
Maximum	2290	Median	1105
SD	461.2	Std. Error of Mean	133.1
Coefficient of Variation	0.386	Skewness	1.309

Normal GOF Test

Shapiro Wilk Test Statistic	0.868	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.281	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1435	95% Adjusted-CLT UCL (Chen-1995)	1469
		95% Modified-t UCL (Johnson-1978)	1444

Gamma GOF Test

A-D Test Statistic	0.501	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.731	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.239	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.246	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	8.353	k star (bias corrected MLE)	6.32
Theta hat (MLE)	143.2	Theta star (bias corrected MLE)	189.3
nu hat (MLE)	200.5	nu star (bias corrected)	151.7
MLE Mean (bias corrected)	1196	MLE Sd (bias corrected)	475.9
		Approximate Chi Square Value (0.05)	124.2
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	120.4

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1461	95% Adjusted Gamma UCL (use when n<50)	1507

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.938	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.216	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	6.477	Mean of logged Data	7.026
Maximum of Logged Data	7.736	SD of logged Data	0.359

Assuming Lognormal Distribution

95% H-UCL	1487	90% Chebyshev (MVUE) UCL	1569
95% Chebyshev (MVUE) UCL	1739	97.5% Chebyshev (MVUE) UCL	1975
99% Chebyshev (MVUE) UCL	2439		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1415	95% Jackknife UCL	1435
95% Standard Bootstrap UCL	1402	95% Bootstrap-t UCL	1578
95% Hall's Bootstrap UCL	2641	95% Percentile Bootstrap UCL	1409
95% BCA Bootstrap UCL	1461		
90% Chebyshev(Mean, Sd) UCL	1596	95% Chebyshev(Mean, Sd) UCL	1777
97.5% Chebyshev(Mean, Sd) UCL	2028	99% Chebyshev(Mean, Sd) UCL	2521

ProUCL Output
West Lakeland
Predator Fish Tissue

Suggested UCL to Use

95% Student's-t UCL 1435

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFNS|ug/kg

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	0.558	Mean	1.419
Maximum	3.58	Median	1.17
SD	0.896	Std. Error of Mean	0.259
Coefficient of Variation	0.631	Skewness	1.731

Normal GOF Test

Shapiro Wilk Test Statistic	0.787	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.267	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.883	95% Adjusted-CLT UCL (Chen-1995)	1.982
		95% Modified-t UCL (Johnson-1978)	1.905

Gamma GOF Test

A-D Test Statistic	0.577	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.737	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.207	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.247	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.623	k star (bias corrected MLE)	2.773
Theta hat (MLE)	0.392	Theta star (bias corrected MLE)	0.512
nu hat (MLE)	86.96	nu star (bias corrected)	66.55
MLE Mean (bias corrected)	1.419	MLE Sd (bias corrected)	0.852
		Approximate Chi Square Value (0.05)	48.78
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	46.46

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1.936	95% Adjusted Gamma UCL (use when n<50)	2.032

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.94	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.172	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.583	Mean of logged Data	0.205
Maximum of Logged Data	1.275	SD of logged Data	0.536

Assuming Lognormal Distribution

95% H-UCL	2.018	90% Chebyshev (MVUE) UCL	2.066
95% Chebyshev (MVUE) UCL	2.368	97.5% Chebyshev (MVUE) UCL	2.787
99% Chebyshev (MVUE) UCL	3.61		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.844	95% Jackknife UCL	1.883
95% Standard Bootstrap UCL	1.825	95% Bootstrap-t UCL	2.495
95% Hall's Bootstrap UCL	4.619	95% Percentile Bootstrap UCL	1.865
95% BCA Bootstrap UCL	1.939		
90% Chebyshev(Mean, Sd) UCL	2.194	95% Chebyshev(Mean, Sd) UCL	2.546
97.5% Chebyshev(Mean, Sd) UCL	3.033	99% Chebyshev(Mean, Sd) UCL	3.991

ProUCL Output
West Lakeland
Predator Fish Tissue

Suggested UCL to Use

95% Adjusted Gamma UCL 2.032

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFDS|ug/kg

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	0.181	Mean	0.498
Maximum	1.18	Median	0.392
SD	0.29	Std. Error of Mean	0.0838
Coefficient of Variation	0.583	Skewness	1.347

Normal GOF Test

Shapiro Wilk Test Statistic	0.874	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.223	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.648	95% Adjusted-CLT UCL (Chen-1995)	0.671
		95% Modified-t UCL (Johnson-1978)	0.654

Gamma GOF Test

A-D Test Statistic	0.307	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.737	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.185	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.247	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.719	k star (bias corrected MLE)	2.845
Theta hat (MLE)	0.134	Theta star (bias corrected MLE)	0.175
nu hat (MLE)	89.25	nu star (bias corrected)	68.27
MLE Mean (bias corrected)	0.498	MLE Sd (bias corrected)	0.295
		Approximate Chi Square Value (0.05)	50.25
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	47.9

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.676	95% Adjusted Gamma UCL (use when n<50)	0.71

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.971	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.151	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.709	Mean of logged Data	-0.838
Maximum of Logged Data	0.166	SD of logged Data	0.548

Assuming Lognormal Distribution

95% H-UCL	0.723	90% Chebyshev (MVUE) UCL	0.738
95% Chebyshev (MVUE) UCL	0.847	97.5% Chebyshev (MVUE) UCL	0.999
99% Chebyshev (MVUE) UCL	1.298		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.636	95% Jackknife UCL	0.648
95% Standard Bootstrap UCL	0.631	95% Bootstrap-t UCL	0.725
95% Hall's Bootstrap UCL	0.754	95% Percentile Bootstrap UCL	0.639
95% BCA Bootstrap UCL	0.669		
90% Chebyshev(Mean, Sd) UCL	0.749	95% Chebyshev(Mean, Sd) UCL	0.863
97.5% Chebyshev(Mean, Sd) UCL	1.021	99% Chebyshev(Mean, Sd) UCL	1.332

ProUCL Output
West Lakeland
Predator Fish Tissue

Suggested UCL to Use

95% Student's-t UCL 0.648

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PFOSA|ug/kg

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	0.545	Mean	0.737
Maximum	0.98	Median	0.715
SD	0.117	Std. Error of Mean	0.0338
Coefficient of Variation	0.159	Skewness	0.557

Normal GOF Test

Shapiro Wilk Test Statistic	0.958	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.158	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.798	95% Adjusted-CLT UCL (Chen-1995)	0.798
		95% Modified-t UCL (Johnson-1978)	0.798

Gamma GOF Test

A-D Test Statistic	0.275	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.73	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.152	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.245	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	44.15	k star (bias corrected MLE)	33.17
Theta hat (MLE)	0.0167	Theta star (bias corrected MLE)	0.0222
nu hat (MLE)	1060	nu star (bias corrected)	796
MLE Mean (bias corrected)	0.737	MLE Sd (bias corrected)	0.128
		Approximate Chi Square Value (0.05)	731.5
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	722.1

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.802	95% Adjusted Gamma UCL (use when n<50)	0.812

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.971	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.139	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.607	Mean of logged Data	-0.317
Maximum of Logged Data	-0.0202	SD of logged Data	0.157

Assuming Lognormal Distribution

95% H-UCL	0.804	90% Chebyshev (MVUE) UCL	0.837
95% Chebyshev (MVUE) UCL	0.883	97.5% Chebyshev (MVUE) UCL	0.946
99% Chebyshev (MVUE) UCL	1.07		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.792	95% Jackknife UCL	0.798
95% Standard Bootstrap UCL	0.79	95% Bootstrap-t UCL	0.803
95% Hall's Bootstrap UCL	0.808	95% Percentile Bootstrap UCL	0.79
95% BCA Bootstrap UCL	0.794		
90% Chebyshev(Mean, Sd) UCL	0.838	95% Chebyshev(Mean, Sd) UCL	0.884
97.5% Chebyshev(Mean, Sd) UCL	0.948	99% Chebyshev(Mean, Sd) UCL	1.073

ProUCL Output
West Lakeland
Predator Fish Tissue

Suggested UCL to Use

95% Student's-t UCL 0.798

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

N-EtFOSAA|ug/kg

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	0.203	Mean	0.348
Maximum	0.594	Median	0.341
SD	0.119	Std. Error of Mean	0.0344
Coefficient of Variation	0.342	Skewness	0.82

Normal GOF Test

Shapiro Wilk Test Statistic	0.928	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.174	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.41	95% Adjusted-CLT UCL (Chen-1995)	0.413
		95% Modified-t UCL (Johnson-1978)	0.411

Gamma GOF Test

A-D Test Statistic	0.248	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.73	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.137	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.245	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	9.89	k star (bias corrected MLE)	7.473
Theta hat (MLE)	0.0352	Theta star (bias corrected MLE)	0.0466
nu hat (MLE)	237.4	nu star (bias corrected)	179.3
MLE Mean (bias corrected)	0.348	MLE Sd (bias corrected)	0.127
		Approximate Chi Square Value (0.05)	149.4
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	145.2

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.418	95% Adjusted Gamma UCL (use when n<50)	0.43

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.965	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.124	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.595	Mean of logged Data	-1.107
Maximum of Logged Data	-0.521	SD of logged Data	0.333

Assuming Lognormal Distribution

95% H-UCL	0.425	90% Chebyshev (MVUE) UCL	0.449
95% Chebyshev (MVUE) UCL	0.495	97.5% Chebyshev (MVUE) UCL	0.559
99% Chebyshev (MVUE) UCL	0.684		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.405	95% Jackknife UCL	0.41
95% Standard Bootstrap UCL	0.403	95% Bootstrap-t UCL	0.42
95% Hall's Bootstrap UCL	0.444	95% Percentile Bootstrap UCL	0.402
95% BCA Bootstrap UCL	0.412		
90% Chebyshev(Mean, Sd) UCL	0.451	95% Chebyshev(Mean, Sd) UCL	0.498
97.5% Chebyshev(Mean, Sd) UCL	0.563	99% Chebyshev(Mean, Sd) UCL	0.69

ProUCL Output
West Lakeland
Predator Fish Tissue

Suggested UCL to Use

95% Student's-t UCL 0.41

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

6:2 FTS|ug/kg

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
Number of Detects	7	Number of Non-Detects	5
Number of Distinct Detects	7	Number of Distinct Non-Detects	5
Minimum Detect	0.436	Minimum Non-Detect	0.347
Maximum Detect	5.42	Maximum Non-Detect	0.359
Variance Detects	3.435	Percent Non-Detects	41.67%
Mean Detects	2.444	SD Detects	1.853
Median Detects	2.64	CV Detects	0.758
Skewness Detects	0.545	Kurtosis Detects	-0.875
Mean of Logged Detects	0.568	SD of Logged Detects	0.944

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.924	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.203	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.57	KM Standard Error of Mean	0.52
KM SD	1.669	95% KM (BCA) UCL	2.474
95% KM (t) UCL	2.505	95% KM (Percentile Bootstrap) UCL	2.439
95% KM (z) UCL	2.426	95% KM Bootstrap t UCL	2.892
90% KM Chebyshev UCL	3.132	95% KM Chebyshev UCL	3.839
97.5% KM Chebyshev UCL	4.821	99% KM Chebyshev UCL	6.749

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.293	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.719	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.212	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.316	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.682	k star (bias corrected MLE)	1.057
Theta hat (MLE)	1.453	Theta star (bias corrected MLE)	2.313
nu hat (MLE)	23.55	nu star (bias corrected)	14.79
Mean (detects)	2.444		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.43
Maximum	5.42	Median	0.579
SD	1.856	CV	1.298
k hat (MLE)	0.346	k star (bias corrected MLE)	0.315
Theta hat (MLE)	4.129	Theta star (bias corrected MLE)	4.535
nu hat (MLE)	8.311	nu star (bias corrected)	7.567
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (7.57, α)	2.487	Adjusted Chi Square Value (7.57, β)	2.066
95% Gamma Approximate UCL (use when n>=50)	4.351	95% Gamma Adjusted UCL (use when n<50)	5.238

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.57	SD (KM)	1.669
Variance (KM)	2.786	SE of Mean (KM)	0.52
k hat (KM)	0.885	k star (KM)	0.719
nu hat (KM)	21.24	nu star (KM)	17.26
theta hat (KM)	1.775	theta star (KM)	2.183
80% gamma percentile (KM)	2.579	90% gamma percentile (KM)	3.917
95% gamma percentile (KM)	5.293	99% gamma percentile (KM)	8.571

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (17.26, α)	8.859	Adjusted Chi Square Value (17.26, β)	7.956
95% Gamma Approximate KM-UCL (use when n>=50)	3.059	95% Gamma Adjusted KM-UCL (use when n<50)	3.407

ProUCL Output
West Lakeland
Predator Fish Tissue

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.931	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.237	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.488	Mean in Log Scale	-0.46
SD in Original Scale	1.808	SD in Log Scale	1.449
95% t UCL (assumes normality of ROS data)	2.425	95% Percentile Bootstrap UCL	2.298
95% BCA Bootstrap UCL	2.483	95% Bootstrap t UCL	2.883
95% H-UCL (Log ROS)	9.452		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.11	KM Geo Mean	0.896
KM SD (logged)	1.043	95% Critical H Value (KM-Log)	2.994
KM Standard Error of Mean (logged)	0.325	95% H-UCL (KM -Log)	3.96
KM SD (logged)	1.043	95% Critical H Value (KM-Log)	2.994
KM Standard Error of Mean (logged)	0.325		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.499	Mean in Log Scale	-0.391
SD in Original Scale	1.799	SD in Log Scale	1.375
95% t UCL (Assumes normality)	2.432	95% H-Stat UCL	7.87

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	2.505

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Appendix E

Project 1007-Specific Bioaccumulation Factors Used in the BERA

Appendix E Table 1
Calculation of Amphibian Tissue - Total Surface Water Bioaccumulation Factors
Project 1007
Minneapolis, Minnesota

	Amphibian Tissue Samples (a)								
Area	Sample Name	Sample Date	CAS	Analyte	Detected Tissue Concentration (ug/kg)	Qualifier	Surface Water Geomean (ug/L) (b)	Decision to Calculate BAF?	Calculation of Amphibian to Surface Water BAF (AM/SW) (c)
Eagle Point Lake	EP19-AMPH-01-091920	9/19/2020	27619-97-2	6:2 FTS	0.352	U	0.0045	No - ND in Amphibian Tissue	NC
Eagle Point Lake	EP19-AMPH-01-091920	9/19/2020	2991-50-6	N-EtFOSAA	0.397	J	0.0015	Yes - Detected in Tissue and Surface Water	271
Eagle Point Lake	EP19-AMPH-01-091920	9/19/2020	1691-99-2	N-EtFOSE	0.73	UJ	0.000316	No - ND in Amphibian Tissue	NC
Eagle Point Lake	EP19-AMPH-01-091920	9/19/2020	375-22-4	PFBA	0.646	J	0.11	Yes - Detected in Tissue and Surface Water	5.8
Eagle Point Lake	EP19-AMPH-01-091920	9/19/2020	375-73-5	PFBS	0.0976	U	0.0044	No - ND in Amphibian Tissue	NC
Eagle Point Lake	EP19-AMPH-01-091920	9/19/2020	335-76-2	PFDA	0.529		0.0015	Yes - Detected in Tissue and Surface Water	358
Eagle Point Lake	EP19-AMPH-01-091920	9/19/2020	307-55-1	PFDoA	0.0976	U	0.0028	No - ND in Amphibian Tissue	NC
Eagle Point Lake	EP19-AMPH-01-091920	9/19/2020	375-85-9	PFHpA	0.0976	U	0.00850	No - ND in Amphibian Tissue	NC
Eagle Point Lake	EP19-AMPH-01-091920	9/19/2020	375-92-8	PFHpS	0.109	J	0.0024	Yes - Detected in Tissue and Surface Water	45
Eagle Point Lake	EP19-AMPH-01-091920	9/19/2020	307-24-4	PFHxA	0.0976	U	0.0111	No - ND in Amphibian Tissue	NC
Eagle Point Lake	EP19-AMPH-01-091920	9/19/2020	355-46-4	PFHxS	0.0976	U	0.0088	No - ND in Amphibian Tissue	NC
Eagle Point Lake	EP19-AMPH-01-091920	9/19/2020	375-95-1	PFNA	0.0976	U	0.0014	No - ND in Amphibian Tissue	NC
Eagle Point Lake	EP19-AMPH-01-091920	9/19/2020	335-67-1	PFOA	0.0976	U	0.0637	No - ND in Amphibian Tissue	NC
Eagle Point Lake	EP19-AMPH-01-091920	9/19/2020	1763-23-1	PFOS	69.9		0.22	Yes - Detected in Tissue and Surface Water	321
Eagle Point Lake	EP19-AMPH-01-091920	9/19/2020	754-91-6	PFOSA	0.293	BJ	0.0012	Yes - Detected in Tissue and Surface Water	245
Eagle Point Lake	EP19-AMPH-01-091920	9/19/2020	2706-90-3	PFPeA	0.195	U	0.00893	No - ND in Amphibian Tissue	NC
Eagle Point Lake	EP19-AMPH-01-091920	9/19/2020	2706-91-4	PFPeS	0.098	U	0.0031	No - ND in Amphibian Tissue	NC
Eagle Point Lake	EP19-AMPH-01-091920	9/19/2020	376-06-7	PFTeDA	0.0976	U	0.0026	No - ND in Amphibian Tissue	NC
Eagle Point Lake	EP19-AMPH-01-091920	9/19/2020	72629-94-8	PFTrDA	0.0976	U	0.0026	No - ND in Amphibian Tissue	NC
Eagle Point Lake	EP19-AMPH-01-091920	9/19/2020	2058-94-8	PFUnA	0.125	BJ	0.0026	Yes - Detected in Tissue and Surface Water	48
Raleigh Creek - other	RC18-AMPH-01-091520	9/15/2020	27619-97-2	6:2 FTS	0.347	U	0.0041	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC17A-AMPH-01-092120	9/21/2020	27619-97-2	6:2 FTS	0.353	U	0.0041	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC16A-AMPH-01-091920	9/19/2020	27619-97-2	6:2 FTS	0.632	U	0.0041	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC18-AMPH-01-091520	9/15/2020	2991-50-6	N-EtFOSAA	0.172	J	0.0028	Yes - Detected in Tissue and Surface Water	61
Raleigh Creek - other	RC17A-AMPH-01-092120	9/21/2020	2991-50-6	N-EtFOSAA	0.098	U	0.0028	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC16A-AMPH-01-091920	9/19/2020	2991-50-6	N-EtFOSAA	0.175	U	0.0028	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC17A-AMPH-01-092120	9/21/2020	1691-99-2	N-EtFOSE	0.733	UJ	0.00014	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC16A-AMPH-01-091920	9/19/2020	1691-99-2	N-EtFOSE	1.31	UJ	0.00014	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC18-AMPH-01-091520	9/15/2020	375-22-4	PFBA	0.385	U	0.0881	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC17A-AMPH-01-092120	9/21/2020	375-22-4	PFBA	0.392	U	0.0881	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC16A-AMPH-01-091920	9/19/2020	375-22-4	PFBA	0.951	J	0.0881	Yes - Detected in Tissue and Surface Water	11
Raleigh Creek - other	RC18-AMPH-01-091520	9/15/2020	375-73-5	PFBS	0.0962	U	0.0028	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC17A-AMPH-01-092120	9/21/2020	375-73-5	PFBS	0.098	U	0.0028	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC16A-AMPH-01-091920	9/19/2020	375-73-5	PFBS	0.175	U	0.0028	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC18-AMPH-01-091520	9/15/2020	335-76-2	PFDA	0.528		0.0014	Yes - Detected in Tissue and Surface Water	368
Raleigh Creek - other	RC17A-AMPH-01-092120	9/21/2020	335-76-2	PFDA	0.197	J	0.0014	Yes - Detected in Tissue and Surface Water	137
Raleigh Creek - other	RC16A-AMPH-01-091920	9/19/2020	335-76-2	PFDA	0.624	J	0.0014	Yes - Detected in Tissue and Surface Water	435
Raleigh Creek - other	RC18-AMPH-01-091520	9/15/2020	307-55-1	PFDoA	0.157	J	ND	No - ND in Surface Water	NC
Raleigh Creek - other	RC17A-AMPH-01-092120	9/21/2020	307-55-1	PFDoA	0.203	J	ND	No - ND in Surface Water	NC
Raleigh Creek - other	RC16A-AMPH-01-091920	9/19/2020	307-55-1	PFDoA	0.598	J	ND	No - ND in Surface Water	NC
Raleigh Creek - other	RC18-AMPH-01-091520	9/15/2020	375-85-9	PFHpA	0.0962	U	0.0031	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC17A-AMPH-01-092120	9/21/2020	375-85-9	PFHpA	0.098	U	0.0031	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC16A-AMPH-01-091920	9/19/2020	375-85-9	PFHpA	0.175	U	0.0031	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC18-AMPH-01-091520	9/15/2020	375-92-8	PFHpS	0.0962	U	0.0037	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC17A-AMPH-01-092120	9/21/2020	375-92-8	PFHpS	0.098	U	0.0037	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC16A-AMPH-01-091920	9/19/2020	375-92-8	PFHpS	0.175	U	0.0037	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC18-AMPH-01-091520	9/15/2020	307-24-4	PFHxA	0.0962	U	0.0054	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC17A-AMPH-01-092120	9/21/2020	307-24-4	PFHxA	0.098	U	0.0054	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC16A-AMPH-01-091920	9/19/2020	307-24-4	PFHxA	0.175	U	0.0054	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC18-AMPH-01-091520	9/15/2020	355-46-4	PFHxS	0.0962	U	0.0041	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC17A-AMPH-01-092120	9/21/2020	355-46-4	PFHxS	0.098	U	0.0041	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC16A-AMPH-01-091920	9/19/2020	355-46-4	PFHxS	0.175	U	0.0041	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC18-AMPH-01-091520	9/15/2020	375-95-1	PFNA	0.0962	U	0.0010	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC17A-AMPH-01-092120	9/21/2020	375-95-1	PFNA	0.098	U	0.0010	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC16A-AMPH-01-091920	9/19/2020	375-95-1	PFNA	0.175	U	0.0010	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC18-AMPH-01-091520	9/15/2020	335-67-1	PFOA	0.0962	U	0.0122	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC17A-AMPH-01-092120	9/21/2020	335-67-1	PFOA	0.098	U	0.0122	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC16A-AMPH-01-091920	9/19/2020	335-67-1	PFOA	0.175	U	0.0122	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC18-AMPH-01-091520	9/15/2020	1763-23-1	PFOS	43.2		0.0077	Yes - Detected in Tissue and Surface Water	5588
Raleigh Creek - other	RC17A-AMPH-01-092120	9/21/2020	1763-23-1	PFOS	30.8		0.0077	Yes - Detected in Tissue and Surface Water	3984
Raleigh Creek - other	RC16A-AMPH-01-091920	9/19/2020	1763-23-1	PFOS	3.35		0.0077	Yes - Detected in Tissue and Surface Water	433
Raleigh Creek - other	RC18-AMPH-01-091520	9/15/2020	754-91-6	PFOSA	0.0962	U	0.0028	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC17A-AMPH-01-092120	9/21/2020	754-91-6	PFOSA	0.137	BJ	0.0028	Yes - Detected in Tissue and Surface Water	49
Raleigh Creek - other	RC16A-AMPH-01-091920	9/19/2020	754-91-6	PFOSA	0.175	U	0.0028	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC18-AMPH-01-091520	9/15/2020	2706-90-3	PFPeA	0.192	U	0.0065	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC17A-AMPH-01-092120	9/21/2020	2706-90-3	PFPeA	0.196	U	0.0065	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC16A-AMPH-01-091920	9/19/2020	2706-90-3	PFPeA	0.351	U	0.0065	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC18-AMPH-01-091520	9/15/2020	2706-91-4	PFPeS	0.0966	U	0.0019	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC17A-AMPH-01-092120	9/21/2020	2706-91-4	PFPeS	0.0985	U	0.0019	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC16A-AMPH-01-091920	9/19/2020	2706-91-4	PFPeS	0.176	U	0.0019	No - ND in Amphibian Tissue	NC

Appendix E Table 1
Calculation of Amphibian Tissue - Total Surface Water Bioaccumulation Factors
Project 1007
Minneapolis, Minnesota

	Amphibian Tissue Samples (a)								
Area	Sample Name	Sample Date	CAS	Analyte	Detected Tissue Concentration (ug/kg)	Qualifier	Surface Water Geomean (ug/L) (b)	Decision to Calculate BAF?	Calculation of Amphibian to Surface Water BAF (AM/SW) (c)
Raleigh Creek - other	RC18-AMPH-01-091520	9/15/2020	376-06-7	PFTeDA	0.0962	U	0.0046	No - ND in Amphibian Tissue	NC
Raleigh Creek - other	RC17A-AMPH-01-092120	9/21/2020	376-06-7	PFTeDA	0.177	J	0.0046	Yes - Detected in Tissue and Surface Water	38
Raleigh Creek - other	RC16A-AMPH-01-091920	9/19/2020	376-06-7	PFTeDA	0.303	J	0.0046	Yes - Detected in Tissue and Surface Water	66
Raleigh Creek - other	RC18-AMPH-01-091520	9/15/2020	72629-94-8	PFTrDA	0.127	BJ	0.0020	Yes - Detected in Tissue and Surface Water	65
Raleigh Creek - other	RC17A-AMPH-01-092120	9/21/2020	72629-94-8	PFTrDA	0.287	BJ	0.0020	Yes - Detected in Tissue and Surface Water	146
Raleigh Creek - other	RC16A-AMPH-01-091920	9/19/2020	72629-94-8	PFTrDA	0.339	BJ	0.0020	Yes - Detected in Tissue and Surface Water	173
Raleigh Creek - other	RC18-AMPH-01-091520	9/15/2020	2058-94-8	PFUnA	0.197	BJ	ND	No - ND in Surface Water	NC
Raleigh Creek - other	RC17A-AMPH-01-092120	9/21/2020	2058-94-8	PFUnA	0.138	BJ	ND	No - ND in Surface Water	NC
Raleigh Creek - other	RC16A-AMPH-01-091920	9/19/2020	2058-94-8	PFUnA	0.579	BJ	ND	No - ND in Surface Water	NC
Raleigh Creek - upper	RC4A-AMPH-COMP-01-091820	9/18/2020	27619-97-2	6:2 FTS	0.345	U	0.0058	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC7-AMPH-01-092220	9/22/2020	27619-97-2	6:2 FTS	0.337	U	0.0058	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC13-AMPH-01-092120	9/21/2020	27619-97-2	6:2 FTS	0.34	U	0.0058	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC5-AMPH-ONE-01-091820	9/18/2020	27619-97-2	6:2 FTS	0.347	U	0.0058	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC5-AMPH-TWO-01-092220	9/22/2020	27619-97-2	6:2 FTS	3.39		0.0058	Yes - Detected in Tissue and Surface Water	581
Raleigh Creek - upper	RC3A-AMPH-COMP-ONE-01-091920	9/19/2020	27619-97-2	6:2 FTS	0.437	U	0.0058	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC3A-AMPH-COMP-TWO-01-092420	9/24/2020	27619-97-2	6:2 FTS	0.335	U	0.0058	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC6A-AMPH-01-092020	9/20/2020	27619-97-2	6:2 FTS	0.352	U	0.0058	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC4A-AMPH-COMP-01-091820	9/18/2020	2991-50-6	N-EtFOSAA	2.46		0.0198	Yes - Detected in Tissue and Surface Water	124
Raleigh Creek - upper	RC7-AMPH-01-092220	9/22/2020	2991-50-6	N-EtFOSAA	0.505		0.0198	Yes - Detected in Tissue and Surface Water	26
Raleigh Creek - upper	RC13-AMPH-01-092120	9/21/2020	2991-50-6	N-EtFOSAA	0.354	J	0.0198	Yes - Detected in Tissue and Surface Water	18
Raleigh Creek - upper	RC5-AMPH-ONE-01-091820	9/18/2020	2991-50-6	N-EtFOSAA	4.91		0.0198	Yes - Detected in Tissue and Surface Water	248
Raleigh Creek - upper	RC5-AMPH-TWO-01-092220	9/22/2020	2991-50-6	N-EtFOSAA	8.52		0.0198	Yes - Detected in Tissue and Surface Water	431
Raleigh Creek - upper	RC3A-AMPH-COMP-ONE-01-091920	9/19/2020	2991-50-6	N-EtFOSAA	2.73		0.0198	Yes - Detected in Tissue and Surface Water	138
Raleigh Creek - upper	RC3A-AMPH-COMP-TWO-01-092420	9/24/2020	2991-50-6	N-EtFOSAA	3.17		0.0198	Yes - Detected in Tissue and Surface Water	160
Raleigh Creek - upper	RC6A-AMPH-01-092020	9/20/2020	2991-50-6	N-EtFOSAA	2.43		0.0198	Yes - Detected in Tissue and Surface Water	123
Raleigh Creek - upper	RC4A-AMPH-COMP-01-091820	9/18/2020	2355-31-9	N-MeFOSAA	0.121	J	0.0006	Yes - Detected in Tissue and Surface Water	200
Raleigh Creek - upper	RC7-AMPH-01-092220	9/22/2020	2355-31-9	N-MeFOSAA	0.0935	U	0.0006	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC13-AMPH-01-092120	9/21/2020	2355-31-9	N-MeFOSAA	0.0943	U	0.0006	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC5-AMPH-ONE-01-091820	9/18/2020	2355-31-9	N-MeFOSAA	0.109	J	0.0006	Yes - Detected in Tissue and Surface Water	181
Raleigh Creek - upper	RC5-AMPH-TWO-01-092220	9/22/2020	2355-31-9	N-MeFOSAA	0.124	J	0.0006	Yes - Detected in Tissue and Surface Water	205
Raleigh Creek - upper	RC3A-AMPH-COMP-ONE-01-091920	9/19/2020	2355-31-9	N-MeFOSAA	0.244	J	0.0006	Yes - Detected in Tissue and Surface Water	404
Raleigh Creek - upper	RC3A-AMPH-COMP-TWO-01-092420	9/24/2020	2355-31-9	N-MeFOSAA	0.163	J	0.0006	Yes - Detected in Tissue and Surface Water	270
Raleigh Creek - upper	RC6A-AMPH-01-092020	9/20/2020	2355-31-9	N-MeFOSAA	0.0976	U	0.0006	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC4A-AMPH-COMP-01-091820	9/18/2020	375-22-4	PFBA	1.86		0.352	Yes - Detected in Tissue and Surface Water	5.3
Raleigh Creek - upper	RC7-AMPH-01-092220	9/22/2020	375-22-4	PFBA	0.374	U	0.352	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC13-AMPH-01-092120	9/21/2020	375-22-4	PFBA	0.377	U	0.352	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC5-AMPH-ONE-01-091820	9/18/2020	375-22-4	PFBA	0.929	J	0.352	Yes - Detected in Tissue and Surface Water	2.6
Raleigh Creek - upper	RC5-AMPH-TWO-01-092220	9/22/2020	375-22-4	PFBA	2.31		0.352	Yes - Detected in Tissue and Surface Water	6.6
Raleigh Creek - upper	RC3A-AMPH-COMP-ONE-01-091920	9/19/2020	375-22-4	PFBA	1.33	J	0.352	Yes - Detected in Tissue and Surface Water	3.8
Raleigh Creek - upper	RC3A-AMPH-COMP-TWO-01-092420	9/24/2020	375-22-4	PFBA	0.377	J	0.352	Yes - Detected in Tissue and Surface Water	1.1
Raleigh Creek - upper	RC6A-AMPH-01-092020	9/20/2020	375-22-4	PFBA	0.999	J	0.352	Yes - Detected in Tissue and Surface Water	2.8
Raleigh Creek - upper	RC4A-AMPH-COMP-01-091820	9/18/2020	375-73-5	PFBS	0.0957	U	0.0191	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC7-AMPH-01-092220	9/22/2020	375-73-5	PFBS	0.0935	U	0.0191	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC13-AMPH-01-092120	9/21/2020	375-73-5	PFBS	0.0943	U	0.0191	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC5-AMPH-ONE-01-091820	9/18/2020	375-73-5	PFBS	0.0962	U	0.0191	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC5-AMPH-TWO-01-092220	9/22/2020	375-73-5	PFBS	0.197	J	0.0191	Yes - Detected in Tissue and Surface Water	10
Raleigh Creek - upper	RC3A-AMPH-COMP-ONE-01-091920	9/19/2020	375-73-5	PFBS	0.121	U	0.0191	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC3A-AMPH-COMP-TWO-01-092420	9/24/2020	375-73-5	PFBS	0.093	U	0.0191	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC6A-AMPH-01-092020	9/20/2020	375-73-5	PFBS	0.0976	U	0.0191	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC4A-AMPH-COMP-01-091820	9/18/2020	335-76-2	PFDA	0.592		0.0072	Yes - Detected in Tissue and Surface Water	82
Raleigh Creek - upper	RC7-AMPH-01-092220	9/22/2020	335-76-2	PFDA	0.607		0.0072	Yes - Detected in Tissue and Surface Water	84
Raleigh Creek - upper	RC13-AMPH-01-092120	9/21/2020	335-76-2	PFDA	0.698		0.0072	Yes - Detected in Tissue and Surface Water	97
Raleigh Creek - upper	RC5-AMPH-ONE-01-091820	9/18/2020	335-76-2	PFDA	1.94		0.0072	Yes - Detected in Tissue and Surface Water	268
Raleigh Creek - upper	RC5-AMPH-TWO-01-092220	9/22/2020	335-76-2	PFDA	2.26		0.0072	Yes - Detected in Tissue and Surface Water	313
Raleigh Creek - upper	RC3A-AMPH-COMP-ONE-01-091920	9/19/2020	335-76-2	PFDA	0.49		0.0072	Yes - Detected in Tissue and Surface Water	68
Raleigh Creek - upper	RC3A-AMPH-COMP-TWO-01-092420	9/24/2020	335-76-2	PFDA	0.555		0.0072	Yes - Detected in Tissue and Surface Water	77
Raleigh Creek - upper	RC6A-AMPH-01-092020	9/20/2020	335-76-2	PFDA	1.28		0.0072	Yes - Detected in Tissue and Surface Water	177
Raleigh Creek - upper	RC4A-AMPH-COMP-01-091820	9/18/2020	307-55-1	PFDoA	0.625		0.0004	Yes - Detected in Tissue and Surface Water	1414
Raleigh Creek - upper	RC7-AMPH-01-092220	9/22/2020	307-55-1	PFDoA	0.302	J	0.0004	Yes - Detected in Tissue and Surface Water	683
Raleigh Creek - upper	RC13-AMPH-01-092120	9/21/2020	307-55-1	PFDoA	0.727		0.0004	Yes - Detected in Tissue and Surface Water	1645
Raleigh Creek - upper	RC5-AMPH-ONE-01-091820	9/18/2020	307-55-1	PFDoA	1.59		0.0004	Yes - Detected in Tissue and Surface Water	3597
Raleigh Creek - upper	RC5-AMPH-TWO-01-092220	9/22/2020	307-55-1	PFDoA	2.59		0.0004	Yes - Detected in Tissue and Surface Water	5860
Raleigh Creek - upper	RC3A-AMPH-COMP-ONE-01-091920	9/19/2020	307-55-1	PFDoA	0.694		0.0004	Yes - Detected in Tissue and Surface Water	1570
Raleigh Creek - upper	RC3A-AMPH-COMP-TWO-01-092420	9/24/2020	307-55-1	PFDoA	0.448		0.0004	Yes - Detected in Tissue and Surface Water	1014
Raleigh Creek - upper	RC6A-AMPH-01-092020	9/20/2020	307-55-1	PFDoA	0.39	J	0.0004	Yes - Detected in Tissue and Surface Water	882

Appendix E Table 1
Calculation of Amphibian Tissue - Total Surface Water Bioaccumulation Factors
Project 1007
Minneapolis, Minnesota

	Amphibian Tissue Samples (a)								
Area	Sample Name	Sample Date	CAS	Analyte	Detected Tissue Concentration (ug/kg)	Qualifier	Surface Water Geomean (ug/L) (b)	Decision to Calculate BAF?	Calculation of Amphibian to Surface Water BAF (AM/SW) (c)
Raleigh Creek - upper	RC4A-AMPH-COMP-01-091820	9/18/2020	375-85-9	PFHpA	0.0957	U	0.051	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC7-AMPH-01-092220	9/22/2020	375-85-9	PFHpA	0.0935	U	0.051	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC13-AMPH-01-092120	9/21/2020	375-85-9	PFHpA	0.0943	U	0.051	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC5-AMPH-ONE-01-091820	9/18/2020	375-85-9	PFHpA	0.0962	U	0.051	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC5-AMPH-TWO-01-092220	9/22/2020	375-85-9	PFHpA	0.0971	U	0.051	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC3A-AMPH-COMP-ONE-01-091920	9/19/2020	375-85-9	PFHpA	0.121	U	0.051	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC3A-AMPH-COMP-TWO-01-092420	9/24/2020	375-85-9	PFHpA	0.093	U	0.051	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC6A-AMPH-01-092020	9/20/2020	375-85-9	PFHpA	0.0976	U	0.051	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC4A-AMPH-COMP-01-091820	9/18/2020	375-92-8	PFHpS	0.179	J	0.0221	Yes - Detected in Tissue and Surface Water	8.1
Raleigh Creek - upper	RC7-AMPH-01-092220	9/22/2020	375-92-8	PFHpS	0.23	J	0.0221	Yes - Detected in Tissue and Surface Water	10
Raleigh Creek - upper	RC13-AMPH-01-092120	9/21/2020	375-92-8	PFHpS	0.278	J	0.0221	Yes - Detected in Tissue and Surface Water	13
Raleigh Creek - upper	RC5-AMPH-ONE-01-091820	9/18/2020	375-92-8	PFHpS	1.34		0.0221	Yes - Detected in Tissue and Surface Water	61
Raleigh Creek - upper	RC5-AMPH-TWO-01-092220	9/22/2020	375-92-8	PFHpS	1.08		0.0221	Yes - Detected in Tissue and Surface Water	49
Raleigh Creek - upper	RC3A-AMPH-COMP-ONE-01-091920	9/19/2020	375-92-8	PFHpS	0.121	U	0.0221	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC3A-AMPH-COMP-TWO-01-092420	9/24/2020	375-92-8	PFHpS	0.194	J	0.0221	Yes - Detected in Tissue and Surface Water	8.8
Raleigh Creek - upper	RC6A-AMPH-01-092020	9/20/2020	375-92-8	PFHpS	0.387	J	0.0221	Yes - Detected in Tissue and Surface Water	17
Raleigh Creek - upper	RC4A-AMPH-COMP-01-091820	9/18/2020	307-24-4	PFHxA	0.0957	U	0.0627	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC7-AMPH-01-092220	9/22/2020	307-24-4	PFHxA	0.0935	U	0.0627	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC13-AMPH-01-092120	9/21/2020	307-24-4	PFHxA	0.0943	U	0.0627	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC5-AMPH-ONE-01-091820	9/18/2020	307-24-4	PFHxA	0.0962	U	0.0627	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC5-AMPH-TWO-01-092220	9/22/2020	307-24-4	PFHxA	0.136	J	0.0627	Yes - Detected in Tissue and Surface Water	2.2
Raleigh Creek - upper	RC3A-AMPH-COMP-ONE-01-091920	9/19/2020	307-24-4	PFHxA	0.121	U	0.0627	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC3A-AMPH-COMP-TWO-01-092420	9/24/2020	307-24-4	PFHxA	0.093	U	0.0627	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC6A-AMPH-01-092020	9/20/2020	307-24-4	PFHxA	0.0976	U	0.0627	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC4A-AMPH-COMP-01-091820	9/18/2020	355-46-4	PFHxS	0.157	J	0.0550	Yes - Detected in Tissue and Surface Water	2.9
Raleigh Creek - upper	RC7-AMPH-01-092220	9/22/2020	355-46-4	PFHxS	0.0935	U	0.0550	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC13-AMPH-01-092120	9/21/2020	355-46-4	PFHxS	0.0943	U	0.0550	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC5-AMPH-ONE-01-091820	9/18/2020	355-46-4	PFHxS	0.429		0.0550	Yes - Detected in Tissue and Surface Water	7.8
Raleigh Creek - upper	RC5-AMPH-TWO-01-092220	9/22/2020	355-46-4	PFHxS	0.787		0.0550	Yes - Detected in Tissue and Surface Water	14
Raleigh Creek - upper	RC3A-AMPH-COMP-ONE-01-091920	9/19/2020	355-46-4	PFHxS	0.121	U	0.0550	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC3A-AMPH-COMP-TWO-01-092420	9/24/2020	355-46-4	PFHxS	0.206	J	0.0550	Yes - Detected in Tissue and Surface Water	3.7
Raleigh Creek - upper	RC6A-AMPH-01-092020	9/20/2020	355-46-4	PFHxS	0.564		0.0550	Yes - Detected in Tissue and Surface Water	10
Raleigh Creek - upper	RC4A-AMPH-COMP-01-091820	9/18/2020	375-95-1	PFNA	0.0957	U	0.0048	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC7-AMPH-01-092220	9/22/2020	375-95-1	PFNA	0.0935	U	0.0048	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC13-AMPH-01-092120	9/21/2020	375-95-1	PFNA	0.0943	U	0.0048	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC5-AMPH-ONE-01-091820	9/18/2020	375-95-1	PFNA	0.0962	U	0.0048	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC5-AMPH-TWO-01-092220	9/22/2020	375-95-1	PFNA	0.0971	U	0.0048	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC3A-AMPH-COMP-ONE-01-091920	9/19/2020	375-95-1	PFNA	0.121	U	0.0048	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC3A-AMPH-COMP-TWO-01-092420	9/24/2020	375-95-1	PFNA	0.118	J	0.0048	Yes - Detected in Tissue and Surface Water	25
Raleigh Creek - upper	RC6A-AMPH-01-092020	9/20/2020	375-95-1	PFNA	0.0976	U	0.0048	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC4A-AMPH-COMP-01-091820	9/18/2020	335-67-1	PFOA	0.662		0.438	Yes - Detected in Tissue and Surface Water	1.5
Raleigh Creek - upper	RC7-AMPH-01-092220	9/22/2020	335-67-1	PFOA	0.0935	U	0.438	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC13-AMPH-01-092120	9/21/2020	335-67-1	PFOA	0.0943	U	0.438	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC5-AMPH-ONE-01-091820	9/18/2020	335-67-1	PFOA	0.312	J	0.438	Yes - Detected in Tissue and Surface Water	0.7
Raleigh Creek - upper	RC5-AMPH-TWO-01-092220	9/22/2020	335-67-1	PFOA	0.645		0.438	Yes - Detected in Tissue and Surface Water	1.5
Raleigh Creek - upper	RC3A-AMPH-COMP-ONE-01-091920	9/19/2020	335-67-1	PFOA	0.237	J	0.438	Yes - Detected in Tissue and Surface Water	0.5
Raleigh Creek - upper	RC3A-AMPH-COMP-TWO-01-092420	9/24/2020	335-67-1	PFOA	0.485		0.438	Yes - Detected in Tissue and Surface Water	1.1
Raleigh Creek - upper	RC6A-AMPH-01-092020	9/20/2020	335-67-1	PFOA	0.429		0.438	Yes - Detected in Tissue and Surface Water	1.0
Raleigh Creek - upper	RC4A-AMPH-COMP-01-091820	9/18/2020	1763-23-1	PFOS	96.9		1.48	Yes - Detected in Tissue and Surface Water	66
Raleigh Creek - upper	RC7-AMPH-01-092220	9/22/2020	1763-23-1	PFOS	159		1.48	Yes - Detected in Tissue and Surface Water	107
Raleigh Creek - upper	RC13-AMPH-01-092120	9/21/2020	1763-23-1	PFOS	153		1.48	Yes - Detected in Tissue and Surface Water	103
Raleigh Creek - upper	RC5-AMPH-ONE-01-091820	9/18/2020	1763-23-1	PFOS	688		1.48	Yes - Detected in Tissue and Surface Water	465
Raleigh Creek - upper	RC5-AMPH-TWO-01-092220	9/22/2020	1763-23-1	PFOS	737		1.48	Yes - Detected in Tissue and Surface Water	498
Raleigh Creek - upper	RC3A-AMPH-COMP-ONE-01-091920	9/19/2020	1763-23-1	PFOS	50.9		1.48	Yes - Detected in Tissue and Surface Water	34
Raleigh Creek - upper	RC3A-AMPH-COMP-TWO-01-092420	9/24/2020	1763-23-1	PFOS	78.7		1.48	Yes - Detected in Tissue and Surface Water	53
Raleigh Creek - upper	RC6A-AMPH-01-092020	9/20/2020	1763-23-1	PFOS	324		1.48	Yes - Detected in Tissue and Surface Water	219
Raleigh Creek - upper	RC4A-AMPH-COMP-01-091820	9/18/2020	754-91-6	PFOSA	33.8		0.0211	Yes - Detected in Tissue and Surface Water	1605
Raleigh Creek - upper	RC7-AMPH-01-092220	9/22/2020	754-91-6	PFOSA	1.17		0.0211	Yes - Detected in Tissue and Surface Water	56
Raleigh Creek - upper	RC13-AMPH-01-092120	9/21/2020	754-91-6	PFOSA	1.28		0.0211	Yes - Detected in Tissue and Surface Water	61
Raleigh Creek - upper	RC5-AMPH-ONE-01-091820	9/18/2020	754-91-6	PFOSA	11.2		0.0211	Yes - Detected in Tissue and Surface Water	532
Raleigh Creek - upper	RC5-AMPH-TWO-01-092220	9/22/2020	754-91-6	PFOSA	5.03		0.0211	Yes - Detected in Tissue and Surface Water	239
Raleigh Creek - upper	RC3A-AMPH-COMP-ONE-01-091920	9/19/2020	754-91-6	PFOSA	3.61		0.0211	Yes - Detected in Tissue and Surface Water	171
Raleigh Creek - upper	RC3A-AMPH-COMP-TWO-01-092420	9/24/2020	754-91-6	PFOSA	3.77		0.0211	Yes - Detected in Tissue and Surface Water	179
Raleigh Creek - upper	RC6A-AMPH-01-092020	9/20/2020	754-91-6	PFOSA	9.33		0.0211	Yes - Detected in Tissue and Surface Water	443

Appendix E Table 1
Calculation of Amphibian Tissue - Total Surface Water Bioaccumulation Factors
Project 1007
Minneapolis, Minnesota

	Amphibian Tissue Samples (a)								
Area	Sample Name	Sample Date	CAS	Analyte	Detected Tissue Concentration (ug/kg)	Qualifier	Surface Water Geomean (ug/L) (b)	Decision to Calculate BAF?	Calculation of Amphibian to Surface Water BAF (AM/SW) (c)
Raleigh Creek - upper	RC4A-AMPH-COMP-01-091820	9/18/2020	2706-90-3	PFPeA	0.191	U	0.031	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC7-AMPH-01-092220	9/22/2020	2706-90-3	PFPeA	0.187	U	0.031	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC13-AMPH-01-092120	9/21/2020	2706-90-3	PFPeA	0.189	U	0.031	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC5-AMPH-ONE-01-091820	9/18/2020	2706-90-3	PFPeA	0.192	U	0.031	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC5-AMPH-TWO-01-092220	9/22/2020	2706-90-3	PFPeA	0.194	U	0.031	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC3A-AMPH-COMP-ONE-01-091920	9/19/2020	2706-90-3	PFPeA	0.242	U	0.031	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC3A-AMPH-COMP-TWO-01-092420	9/24/2020	2706-90-3	PFPeA	0.186	U	0.031	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC6A-AMPH-01-092020	9/20/2020	2706-90-3	PFPeA	0.195	U	0.031	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC4A-AMPH-COMP-01-091820	9/18/2020	2706-91-4	PFPeS	0.0962	U	0.0206	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC7-AMPH-01-092220	9/22/2020	2706-91-4	PFPeS	0.0939	U	0.0206	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC13-AMPH-01-092120	9/21/2020	2706-91-4	PFPeS	0.0948	U	0.0206	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC5-AMPH-ONE-01-091820	9/18/2020	2706-91-4	PFPeS	0.0966	U	0.0206	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC5-AMPH-TWO-01-092220	9/22/2020	2706-91-4	PFPeS	0.253	J	0.0206	Yes - Detected in Tissue and Surface Water	12
Raleigh Creek - upper	RC3A-AMPH-COMP-ONE-01-091920	9/19/2020	2706-91-4	PFPeS	0.122	U	0.0206	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC3A-AMPH-COMP-TWO-01-092420	9/24/2020	2706-91-4	PFPeS	0.0935	U	0.0206	No - ND in Amphibian Tissue	NC
Raleigh Creek - upper	RC6A-AMPH-01-092020	9/20/2020	2706-91-4	PFPeS	0.171	J	0.0206	Yes - Detected in Tissue and Surface Water	8.3
Raleigh Creek - upper	RC4A-AMPH-COMP-01-091820	9/18/2020	376-06-7	PFTeDA	0.316	J+	ND	No - ND in Surface Water	NC
Raleigh Creek - upper	RC7-AMPH-01-092220	9/22/2020	376-06-7	PFTeDA	0.201	J+	ND	No - ND in Surface Water	NC
Raleigh Creek - upper	RC5-AMPH-ONE-01-091820	9/18/2020	376-06-7	PFTeDA	0.31	J+	ND	No - ND in Surface Water	NC
Raleigh Creek - upper	RC5-AMPH-TWO-01-092220	9/22/2020	376-06-7	PFTeDA	1.14	J+	ND	No - ND in Surface Water	NC
Raleigh Creek - upper	RC3A-AMPH-COMP-ONE-01-091920	9/19/2020	376-06-7	PFTeDA	0.414	J+	ND	No - ND in Surface Water	NC
Raleigh Creek - upper	RC3A-AMPH-COMP-TWO-01-092420	9/24/2020	376-06-7	PFTeDA	0.284	J	ND	No - ND in Surface Water	NC
Raleigh Creek - upper	RC6A-AMPH-01-092020	9/20/2020	376-06-7	PFTeDA	0.171	J+	ND	No - ND in Surface Water	NC
Raleigh Creek - upper	RC4A-AMPH-COMP-01-091820	9/18/2020	72629-94-8	PFTrDA	0.355	BJ	0.0021	Yes - Detected in Tissue and Surface Water	169
Raleigh Creek - upper	RC7-AMPH-01-092220	9/22/2020	72629-94-8	PFTrDA	0.143	BJ	0.0021	Yes - Detected in Tissue and Surface Water	68
Raleigh Creek - upper	RC13-AMPH-01-092120	9/21/2020	72629-94-8	PFTrDA	0.297	BJ	0.0021	Yes - Detected in Tissue and Surface Water	141
Raleigh Creek - upper	RC5-AMPH-ONE-01-091820	9/18/2020	72629-94-8	PFTrDA	0.414	B	0.0021	Yes - Detected in Tissue and Surface Water	197
Raleigh Creek - upper	RC5-AMPH-TWO-01-092220	9/22/2020	72629-94-8	PFTrDA	0.672	B	0.0021	Yes - Detected in Tissue and Surface Water	320
Raleigh Creek - upper	RC3A-AMPH-COMP-ONE-01-091920	9/19/2020	72629-94-8	PFTrDA	0.507	B	0.0021	Yes - Detected in Tissue and Surface Water	241
Raleigh Creek - upper	RC3A-AMPH-COMP-TWO-01-092420	9/24/2020	72629-94-8	PFTrDA	0.318	BJ	0.0021	Yes - Detected in Tissue and Surface Water	151
Raleigh Creek - upper	RC6A-AMPH-01-092020	9/20/2020	72629-94-8	PFTrDA	0.181	BJ	0.0021	Yes - Detected in Tissue and Surface Water	86
Raleigh Creek - upper	RC4A-AMPH-COMP-01-091820	9/18/2020	2058-94-8	PFUnA	0.165	BJ	0.0005	Yes - Detected in Tissue and Surface Water	325
Raleigh Creek - upper	RC7-AMPH-01-092220	9/22/2020	2058-94-8	PFUnA	0.188	BJ	0.0005	Yes - Detected in Tissue and Surface Water	370
Raleigh Creek - upper	RC13-AMPH-01-092120	9/21/2020	2058-94-8	PFUnA	0.349	BJ	0.0005	Yes - Detected in Tissue and Surface Water	688
Raleigh Creek - upper	RC5-AMPH-ONE-01-091820	9/18/2020	2058-94-8	PFUnA	0.699	B	0.0005	Yes - Detected in Tissue and Surface Water	1377
Raleigh Creek - upper	RC5-AMPH-TWO-01-092220	9/22/2020	2058-94-8	PFUnA	0.815	B	0.0005	Yes - Detected in Tissue and Surface Water	1606
Raleigh Creek - upper	RC3A-AMPH-COMP-ONE-01-091920	9/19/2020	2058-94-8	PFUnA	0.144	BJ	0.0005	Yes - Detected in Tissue and Surface Water	284
Raleigh Creek - upper	RC3A-AMPH-COMP-TWO-01-092420	9/24/2020	2058-94-8	PFUnA	0.116	BJ	0.0005	Yes - Detected in Tissue and Surface Water	229
Raleigh Creek - upper	RC6A-AMPH-01-092020	9/20/2020	2058-94-8	PFUnA	0.257	BJ	0.0005	Yes - Detected in Tissue and Surface Water	506
West Lakeland	WL2-AMPH-01-092220	9/22/2020	27619-97-2	6:2 FTS	0.35	U	0.0121	No - ND in Amphibian Tissue	NC
West Lakeland	WL8A-AMPH-01-092520	9/25/2020	27619-97-2	6:2 FTS	0.345	U	0.0121	No - ND in Amphibian Tissue	NC
West Lakeland	WL16-AMPH-01-092320	9/23/2020	27619-97-2	6:2 FTS	1.58		0.0121	Yes - Detected in Tissue and Surface Water	131
West Lakeland	WL10A-AMPH-01-092120	9/21/2020	27619-97-2	6:2 FTS	0.342	U	0.0121	No - ND in Amphibian Tissue	NC
West Lakeland	WL13-AMPH-ONE-01-092320	9/23/2020	27619-97-2	6:2 FTS	0.352	U	0.0121	No - ND in Amphibian Tissue	NC
West Lakeland	WL13-AMPH-TWO-01-092320	9/23/2020	27619-97-2	6:2 FTS	0.353	U	0.0121	No - ND in Amphibian Tissue	NC
West Lakeland	WL2-AMPH-01-092220	9/22/2020	2991-50-6	N-EtFOSAA	0.184	J	0.0011	Yes - Detected in Tissue and Surface Water	164
West Lakeland	WL8A-AMPH-01-092520	9/25/2020	2991-50-6	N-EtFOSAA	0.198	J	0.0011	Yes - Detected in Tissue and Surface Water	177
West Lakeland	WL16-AMPH-01-092320	9/23/2020	2991-50-6	N-EtFOSAA	0.0939	U	0.0011	No - ND in Amphibian Tissue	NC
West Lakeland	WL10A-AMPH-01-092120	9/21/2020	2991-50-6	N-EtFOSAA	0.0948	U	0.0011	No - ND in Amphibian Tissue	NC
West Lakeland	WL13-AMPH-ONE-01-092320	9/23/2020	2991-50-6	N-EtFOSAA	0.284	J	0.0011	Yes - Detected in Tissue and Surface Water	254
West Lakeland	WL13-AMPH-TWO-01-092320	9/23/2020	2991-50-6	N-EtFOSAA	0.123	J	0.0011	Yes - Detected in Tissue and Surface Water	110
West Lakeland	WL2-AMPH-01-092220	9/22/2020	375-22-4	PFBA	0.587	J	0.370	Yes - Detected in Tissue and Surface Water	1.6
West Lakeland	WL8A-AMPH-01-092520	9/25/2020	375-22-4	PFBA	1.15	J	0.370	Yes - Detected in Tissue and Surface Water	3.1
West Lakeland	WL16-AMPH-01-092320	9/23/2020	375-22-4	PFBA	0.376	U	0.370	No - ND in Amphibian Tissue	NC
West Lakeland	WL10A-AMPH-01-092120	9/21/2020	375-22-4	PFBA	0.457	J	0.370	Yes - Detected in Tissue and Surface Water	1.2
West Lakeland	WL13-AMPH-ONE-01-092320	9/23/2020	375-22-4	PFBA	1.1	J	0.370	Yes - Detected in Tissue and Surface Water	3.0
West Lakeland	WL13-AMPH-TWO-01-092320	9/23/2020	375-22-4	PFBA	1.16	J	0.370	Yes - Detected in Tissue and Surface Water	3.1
West Lakeland	WL2-AMPH-01-092220	9/22/2020	375-73-5	PFBS	0.0971	U	0.0040	No - ND in Amphibian Tissue	NC
West Lakeland	WL8A-AMPH-01-092520	9/25/2020	375-73-5	PFBS	0.0957	U	0.0040	No - ND in Amphibian Tissue	NC
West Lakeland	WL16-AMPH-01-092320	9/23/2020	375-73-5	PFBS	0.0939	U	0.0040	No - ND in Amphibian Tissue	NC
West Lakeland	WL10A-AMPH-01-092120	9/21/2020	375-73-5	PFBS	0.0948	U	0.0040	No - ND in Amphibian Tissue	NC
West Lakeland	WL13-AMPH-ONE-01-092320	9/23/2020	375-73-5	PFBS	0.0976	U	0.0040	No - ND in Amphibian Tissue	NC
West Lakeland	WL13-AMPH-TWO-01-092320	9/23/2020	375-73-5	PFBS	0.098	U	0.0040	No - ND in Amphibian Tissue	NC
West Lakeland	WL2-AMPH-01-092220	9/22/2020	335-76-2	PFDA	1.15		0.0013	Yes - Detected in Tissue and Surface Water	910
West Lakeland	WL8A-AMPH-01-092520	9/25/2020	335-76-2	PFDA	2.57		0.0013	Yes - Detected in Tissue and Surface Water	2034
West Lakeland	WL16-AMPH-01-092320	9/23/2020	335-76-2	PFDA	0.33	J	0.0013	Yes - Detected in Tissue and Surface Water	261
West Lakeland	WL10A-AMPH-01-092120	9/21/2020	335-76-2	PFDA	0.244	J	0.0013	Yes - Detected in Tissue and Surface Water	193
West Lakeland	WL13-AMPH-ONE-01-092320	9/23/2020	335-76-2	PFDA	2.17		0.0013	Yes - Detected in Tissue and Surface Water	1718
West Lakeland	WL13-AMPH-TWO-01-092320	9/23/2020	335-76-2	PFDA	1.62		0.0013	Yes - Detected in Tissue and Surface Water	1282

Appendix E Table 1
Calculation of Amphibian Tissue - Total Surface Water Bioaccumulation Factors
Project 1007
Minneapolis, Minnesota

	Amphibian Tissue Samples (a)								
Area	Sample Name	Sample Date	CAS	Analyte	Detected Tissue Concentration (ug/kg)	Qualifier	Surface Water Geomean (ug/L) (b)	Decision to Calculate BAF?	Calculation of Amphibian to Surface Water BAF (AM/SW) (c)
West Lakeland	WL2-AMPH-01-092220	9/22/2020	307-55-1	PFDoA	0.314	J	ND	No - ND in Surface Water	NC
West Lakeland	WL8A-AMPH-01-092520	9/25/2020	307-55-1	PFDoA	0.159	J	ND	No - ND in Surface Water	NC
West Lakeland	WL16-AMPH-01-092320	9/23/2020	307-55-1	PFDoA	0.124	J	ND	No - ND in Surface Water	NC
West Lakeland	WL10A-AMPH-01-092120	9/21/2020	307-55-1	PFDoA	0.165	J	ND	No - ND in Surface Water	NC
West Lakeland	WL13-AMPH-ONE-01-092320	9/23/2020	307-55-1	PFDoA	0.175	J	ND	No - ND in Surface Water	NC
West Lakeland	WL13-AMPH-TWO-01-092320	9/23/2020	307-55-1	PFDoA	0.134	J	ND	No - ND in Surface Water	NC
West Lakeland	WL2-AMPH-01-092220	9/22/2020	375-85-9	PFHpA	0.0971	U	0.00760	No - ND in Amphibian Tissue	NC
West Lakeland	WL8A-AMPH-01-092520	9/25/2020	375-85-9	PFHpA	0.0957	U	0.00760	No - ND in Amphibian Tissue	NC
West Lakeland	WL16-AMPH-01-092320	9/23/2020	375-85-9	PFHpA	0.0939	U	0.00760	No - ND in Amphibian Tissue	NC
West Lakeland	WL10A-AMPH-01-092120	9/21/2020	375-85-9	PFHpA	0.0948	U	0.00760	No - ND in Amphibian Tissue	NC
West Lakeland	WL13-AMPH-ONE-01-092320	9/23/2020	375-85-9	PFHpA	0.0976	U	0.00760	No - ND in Amphibian Tissue	NC
West Lakeland	WL13-AMPH-TWO-01-092320	9/23/2020	375-85-9	PFHpA	0.098	U	0.00760	No - ND in Amphibian Tissue	NC
West Lakeland	WL2-AMPH-01-092220	9/22/2020	375-92-8	PFHpS	0.104	J	0.0018	Yes - Detected in Tissue and Surface Water	59
West Lakeland	WL8A-AMPH-01-092520	9/25/2020	375-92-8	PFHpS	0.0957	U	0.0018	No - ND in Amphibian Tissue	NC
West Lakeland	WL16-AMPH-01-092320	9/23/2020	375-92-8	PFHpS	0.0939	U	0.0018	No - ND in Amphibian Tissue	NC
West Lakeland	WL10A-AMPH-01-092120	9/21/2020	375-92-8	PFHpS	0.0948	U	0.0018	No - ND in Amphibian Tissue	NC
West Lakeland	WL13-AMPH-ONE-01-092320	9/23/2020	375-92-8	PFHpS	0.1	J	0.0018	Yes - Detected in Tissue and Surface Water	57
West Lakeland	WL13-AMPH-TWO-01-092320	9/23/2020	375-92-8	PFHpS	0.098	U	0.0018	No - ND in Amphibian Tissue	NC
West Lakeland	WL2-AMPH-01-092220	9/22/2020	307-24-4	PFHxA	0.0971	U	0.0132	No - ND in Amphibian Tissue	NC
West Lakeland	WL8A-AMPH-01-092520	9/25/2020	307-24-4	PFHxA	0.0957	U	0.0132	No - ND in Amphibian Tissue	NC
West Lakeland	WL16-AMPH-01-092320	9/23/2020	307-24-4	PFHxA	0.0939	U	0.0132	No - ND in Amphibian Tissue	NC
West Lakeland	WL10A-AMPH-01-092120	9/21/2020	307-24-4	PFHxA	0.0948	U	0.0132	No - ND in Amphibian Tissue	NC
West Lakeland	WL13-AMPH-ONE-01-092320	9/23/2020	307-24-4	PFHxA	0.0976	U	0.0132	No - ND in Amphibian Tissue	NC
West Lakeland	WL13-AMPH-TWO-01-092320	9/23/2020	307-24-4	PFHxA	0.098	U	0.0132	No - ND in Amphibian Tissue	NC
West Lakeland	WL2-AMPH-01-092220	9/22/2020	355-46-4	PFHxS	0.0971	U	0.0091	No - ND in Amphibian Tissue	NC
West Lakeland	WL8A-AMPH-01-092520	9/25/2020	355-46-4	PFHxS	0.0957	U	0.0091	No - ND in Amphibian Tissue	NC
West Lakeland	WL16-AMPH-01-092320	9/23/2020	355-46-4	PFHxS	0.0939	U	0.0091	No - ND in Amphibian Tissue	NC
West Lakeland	WL10A-AMPH-01-092120	9/21/2020	355-46-4	PFHxS	0.0948	U	0.0091	No - ND in Amphibian Tissue	NC
West Lakeland	WL13-AMPH-ONE-01-092320	9/23/2020	355-46-4	PFHxS	0.0976	U	0.0091	No - ND in Amphibian Tissue	NC
West Lakeland	WL13-AMPH-TWO-01-092320	9/23/2020	355-46-4	PFHxS	0.098	U	0.0091	No - ND in Amphibian Tissue	NC
West Lakeland	WL2-AMPH-01-092220	9/22/2020	375-95-1	PFNA	0.0971	U	0.0011	No - ND in Amphibian Tissue	NC
West Lakeland	WL8A-AMPH-01-092520	9/25/2020	375-95-1	PFNA	0.283	J	0.0011	Yes - Detected in Tissue and Surface Water	250
West Lakeland	WL16-AMPH-01-092320	9/23/2020	375-95-1	PFNA	0.0939	U	0.0011	No - ND in Amphibian Tissue	NC
West Lakeland	WL10A-AMPH-01-092120	9/21/2020	375-95-1	PFNA	0.0948	U	0.0011	No - ND in Amphibian Tissue	NC
West Lakeland	WL13-AMPH-ONE-01-092320	9/23/2020	375-95-1	PFNA	0.153	J	0.0011	Yes - Detected in Tissue and Surface Water	135
West Lakeland	WL13-AMPH-TWO-01-092320	9/23/2020	375-95-1	PFNA	0.098	U	0.0011	No - ND in Amphibian Tissue	NC
West Lakeland	WL2-AMPH-01-092220	9/22/2020	335-67-1	PFOA	0.13	J	0.0692	Yes - Detected in Tissue and Surface Water	1.9
West Lakeland	WL8A-AMPH-01-092520	9/25/2020	335-67-1	PFOA	0.241	J	0.0692	Yes - Detected in Tissue and Surface Water	3.5
West Lakeland	WL16-AMPH-01-092320	9/23/2020	335-67-1	PFOA	0.0939	U	0.0692	No - ND in Amphibian Tissue	NC
West Lakeland	WL10A-AMPH-01-092120	9/21/2020	335-67-1	PFOA	0.0948	U	0.0692	No - ND in Amphibian Tissue	NC
West Lakeland	WL13-AMPH-ONE-01-092320	9/23/2020	335-67-1	PFOA	0.275	J	0.0692	Yes - Detected in Tissue and Surface Water	4.0
West Lakeland	WL13-AMPH-TWO-01-092320	9/23/2020	335-67-1	PFOA	0.304	J	0.0692	Yes - Detected in Tissue and Surface Water	4.4
West Lakeland	WL2-AMPH-01-092220	9/22/2020	1763-23-1	PFOS	100		0.162	Yes - Detected in Tissue and Surface Water	618
West Lakeland	WL8A-AMPH-01-092520	9/25/2020	1763-23-1	PFOS	137		0.162	Yes - Detected in Tissue and Surface Water	847
West Lakeland	WL16-AMPH-01-092320	9/23/2020	1763-23-1	PFOS	51.2		0.162	Yes - Detected in Tissue and Surface Water	316
West Lakeland	WL10A-AMPH-01-092120	9/21/2020	1763-23-1	PFOS	32.9		0.162	Yes - Detected in Tissue and Surface Water	203
West Lakeland	WL13-AMPH-ONE-01-092320	9/23/2020	1763-23-1	PFOS	102		0.162	Yes - Detected in Tissue and Surface Water	630
West Lakeland	WL13-AMPH-TWO-01-092320	9/23/2020	1763-23-1	PFOS	94.4		0.162	Yes - Detected in Tissue and Surface Water	583
West Lakeland	WL2-AMPH-01-092220	9/22/2020	754-91-6	PFOSA	0.0971	U	0.0011	No - ND in Amphibian Tissue	NC
West Lakeland	WL8A-AMPH-01-092520	9/25/2020	754-91-6	PFOSA	0.724	B	0.0011	Yes - Detected in Tissue and Surface Water	675
West Lakeland	WL16-AMPH-01-092320	9/23/2020	754-91-6	PFOSA	0.0939	U	0.0011	No - ND in Amphibian Tissue	NC
West Lakeland	WL10A-AMPH-01-092120	9/21/2020	754-91-6	PFOSA	0.0948	U	0.0011	No - ND in Amphibian Tissue	NC
West Lakeland	WL13-AMPH-ONE-01-092320	9/23/2020	754-91-6	PFOSA	0.709	B	0.0011	Yes - Detected in Tissue and Surface Water	661
West Lakeland	WL13-AMPH-TWO-01-092320	9/23/2020	754-91-6	PFOSA	0.469	B	0.0011	Yes - Detected in Tissue and Surface Water	437
West Lakeland	WL2-AMPH-01-092220	9/22/2020	2706-90-3	PFPeA	0.194	U	0.012	No - ND in Amphibian Tissue	NC
West Lakeland	WL8A-AMPH-01-092520	9/25/2020	2706-90-3	PFPeA	0.191	U	0.0123	No - ND in Amphibian Tissue	NC
West Lakeland	WL16-AMPH-01-092320	9/23/2020	2706-90-3	PFPeA	0.188	U	0.0123	No - ND in Amphibian Tissue	NC
West Lakeland	WL10A-AMPH-01-092120	9/21/2020	2706-90-3	PFPeA	0.19	U	0.0123	No - ND in Amphibian Tissue	NC
West Lakeland	WL13-AMPH-ONE-01-092320	9/23/2020	2706-90-3	PFPeA	0.195	U	0.0123	No - ND in Amphibian Tissue	NC
West Lakeland	WL13-AMPH-TWO-01-092320	9/23/2020	2706-90-3	PFPeA	0.196	U	0.0123	No - ND in Amphibian Tissue	NC
West Lakeland	WL2-AMPH-01-092220	9/22/2020	2706-91-4	PFPeS	0.0976	U	0.0028	No - ND in Amphibian Tissue	NC
West Lakeland	WL8A-AMPH-01-092520	9/25/2020	2706-91-4	PFPeS	0.0962	U	0.0028	No - ND in Amphibian Tissue	NC
West Lakeland	WL16-AMPH-01-092320	9/23/2020	2706-91-4	PFPeS	0.0944	U	0.0028	No - ND in Amphibian Tissue	NC
West Lakeland	WL10A-AMPH-01-092120	9/21/2020	2706-91-4	PFPeS	0.0953	U	0.0028	No - ND in Amphibian Tissue	NC
West Lakeland	WL13-AMPH-ONE-01-092320	9/23/2020	2706-91-4	PFPeS	0.098	U	0.0028	No - ND in Amphibian Tissue	NC
West Lakeland	WL13-AMPH-TWO-01-092320	9/23/2020	2706-91-4	PFPeS	0.0985	U	0.0028	No - ND in Amphibian Tissue	NC

Appendix E Table 1
Calculation of Amphibian Tissue - Total Surface Water Bioaccumulation Factors
Project 1007
Minneapolis, Minnesota

	Amphibian Tissue Samples (a)								
Area	Sample Name	Sample Date	CAS	Analyte	Detected Tissue Concentration (ug/kg)	Qualifier	Surface Water Geomean (ug/L) (b)	Decision to Calculate BAF?	Calculation of Amphibian to Surface Water BAF (AM/SW) (c)
West Lakeland	WL2-AMPH-01-092220	9/22/2020	376-06-7	PFTeDA	0.11	J	0.0028	Yes - Detected in Tissue and Surface Water	40
West Lakeland	WL8A-AMPH-01-092520	9/25/2020	376-06-7	PFTeDA	0.0957	U	0.0028	No - ND in Amphibian Tissue	NC
West Lakeland	WL16-AMPH-01-092320	9/23/2020	376-06-7	PFTeDA	0.15	J	0.0028	Yes - Detected in Tissue and Surface Water	54
West Lakeland	WL10A-AMPH-01-092120	9/21/2020	376-06-7	PFTeDA	0.103	J	0.0028	Yes - Detected in Tissue and Surface Water	37
West Lakeland	WL13-AMPH-ONE-01-092320	9/23/2020	376-06-7	PFTeDA	0.0976	UJ	0.0028	No - ND in Amphibian Tissue	NC
West Lakeland	WL13-AMPH-TWO-01-092320	9/23/2020	376-06-7	PFTeDA	0.098	U	0.0028	No - ND in Amphibian Tissue	NC
West Lakeland	WL2-AMPH-01-092220	9/22/2020	72629-94-8	PFTrDA	0.225	BJ	0.0015	Yes - Detected in Tissue and Surface Water	151
West Lakeland	WL8A-AMPH-01-092520	9/25/2020	72629-94-8	PFTrDA	0.118	BJ	0.0015	Yes - Detected in Tissue and Surface Water	79
West Lakeland	WL16-AMPH-01-092320	9/23/2020	72629-94-8	PFTrDA	0.261	BJ	0.0015	Yes - Detected in Tissue and Surface Water	175
West Lakeland	WL10A-AMPH-01-092120	9/21/2020	72629-94-8	PFTrDA	0.098	BJ	0.0015	Yes - Detected in Tissue and Surface Water	66
West Lakeland	WL13-AMPH-ONE-01-092320	9/23/2020	72629-94-8	PFTrDA	0.263	BJ	0.0015	Yes - Detected in Tissue and Surface Water	176
West Lakeland	WL13-AMPH-TWO-01-092320	9/23/2020	72629-94-8	PFTrDA	0.137	BJ	0.0015	Yes - Detected in Tissue and Surface Water	92
West Lakeland	WL2-AMPH-01-092220	9/22/2020	2058-94-8	PFUnA	0.428	B	0.0005	Yes - Detected in Tissue and Surface Water	831
West Lakeland	WL8A-AMPH-01-092520	9/25/2020	2058-94-8	PFUnA	0.443	B	0.0005	Yes - Detected in Tissue and Surface Water	860
West Lakeland	WL16-AMPH-01-092320	9/23/2020	2058-94-8	PFUnA	0.164	BJ	0.0005	Yes - Detected in Tissue and Surface Water	318
West Lakeland	WL10A-AMPH-01-092120	9/21/2020	2058-94-8	PFUnA	0.145	BJ	0.0005	Yes - Detected in Tissue and Surface Water	282
West Lakeland	WL13-AMPH-ONE-01-092320	9/23/2020	2058-94-8	PFUnA	0.489	B	0.0005	Yes - Detected in Tissue and Surface Water	950
West Lakeland	WL13-AMPH-TWO-01-092320	9/23/2020	2058-94-8	PFUnA	0.395	B	0.0005	Yes - Detected in Tissue and Surface Water	767

Notes:
AM - Amphibian Tissue Concentration.
BAF - Bioaccumulation Factor.
CAS - Chemical Abstract Service number.
NC - Not calculated.
ND - Not detected.
SW - Surface Water (total phase).
ug/L - micrograms per liter (ug/L).
ug/kg - microgram per kilogram
+ - Result may be biased high.
B - Analyte was present in a blank.
J - Estimated concentration.
U - Concentration is less than the laboratory reportable limit.

(a) BAFs were calculated for analytes that were detected in Lake Elmo and Eagle Point Lake surface water (total phase) and were included in the food web model. All amphibian tissue samples collected in each area were included in the calculation.
(b) Geometric means (geomeans) of detected surface water concentrations (total phase) were calculated for each analyte per area.
(c) BAFs were calculated for each analyte per amphibian tissue sample per area by dividing the detected concentration in amphibian tissue by the total surface water geometric mean calculated for that area.

Appendix E Table 2
Calculation of Crayfish Tissue - Total Surface Water Bioaccumulation Factors
Project 1007
Minneapolis, Minnesota

	Crayfish Tissue Samples (a)								
Area	Sample Name	Sample Date	CAS	Analyte	Detected Tissue Concentration (ug/kg)	Qualifier	Surface Water Geomean (ug/L) (b)	Decision to Calculate BAF?	Calculation of Crayfish to Surface Water BAF (CR/SW) (c)
Eagle Point Lake	EP4-CRAY-ONE-01-092320	9/23/2020	27619-97-2	6:2 FTS	0.35	U	0.0045	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP4-CRAY-TWO-01-092320	9/23/2020	27619-97-2	6:2 FTS	3.17		0.0045	Yes - Detected in Tissue and Surface Water	711
Eagle Point Lake	EP17C-CRAY-01-092420	9/24/2020	27619-97-2	6:2 FTS	0.361	U	0.0045	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP26A-CRAY-THREE-01-091720	9/17/2020	27619-97-2	6:2 FTS	0.35	U	0.0045	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP26A-CRAY-ONE-01-092520	9/25/2020	27619-97-2	6:2 FTS	0.359	U	0.0045	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP26A-CRAY-TWO-01-092520	9/25/2020	27619-97-2	6:2 FTS	0.348	U	0.0045	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP27B-CRAY-ONE-01-092420	9/24/2020	27619-97-2	6:2 FTS	0.359	U	0.0045	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP5-CRAY-ONE-01-092420	9/24/2020	27619-97-2	6:2 FTS	0.361	U	0.0045	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP27B-CRAY-TWO-01-092420	9/24/2020	27619-97-2	6:2 FTS	0.357	U	0.0045	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP4-CRAY-ONE-01-092320	9/23/2020	2991-50-6	N-EtFOSAA	0.399		0.0015	Yes - Detected in Tissue and Surface Water	272
Eagle Point Lake	EP4-CRAY-TWO-01-092320	9/23/2020	2991-50-6	N-EtFOSAA	0.153	J	0.0015	Yes - Detected in Tissue and Surface Water	104
Eagle Point Lake	EP17C-CRAY-01-092420	9/24/2020	2991-50-6	N-EtFOSAA	0.362	J	0.0015	Yes - Detected in Tissue and Surface Water	247
Eagle Point Lake	EP26A-CRAY-THREE-01-091720	9/17/2020	2991-50-6	N-EtFOSAA	0.299	J	0.0015	Yes - Detected in Tissue and Surface Water	204
Eagle Point Lake	EP26A-CRAY-ONE-01-092520	9/25/2020	2991-50-6	N-EtFOSAA	0.195	J	0.0015	Yes - Detected in Tissue and Surface Water	133
Eagle Point Lake	EP26A-CRAY-TWO-01-092520	9/25/2020	2991-50-6	N-EtFOSAA	0.396		0.0015	Yes - Detected in Tissue and Surface Water	270
Eagle Point Lake	EP27B-CRAY-ONE-01-092420	9/24/2020	2991-50-6	N-EtFOSAA	0.294	J	0.0015	Yes - Detected in Tissue and Surface Water	200
Eagle Point Lake	EP5-CRAY-ONE-01-092420	9/24/2020	2991-50-6	N-EtFOSAA	0.274	J	0.0015	Yes - Detected in Tissue and Surface Water	187
Eagle Point Lake	EP27B-CRAY-TWO-01-092420	9/24/2020	2991-50-6	N-EtFOSAA	0.108	J	0.0015	Yes - Detected in Tissue and Surface Water	74
Eagle Point Lake	EP4-CRAY-ONE-01-092320	9/23/2020	375-22-4	PFBA	3.02		0.11	Yes - Detected in Tissue and Surface Water	27
Eagle Point Lake	EP4-CRAY-TWO-01-092320	9/23/2020	375-22-4	PFBA	3.21	B	0.11	Yes - Detected in Tissue and Surface Water	29
Eagle Point Lake	EP17C-CRAY-01-092420	9/24/2020	375-22-4	PFBA	2.61	B	0.11	Yes - Detected in Tissue and Surface Water	23
Eagle Point Lake	EP26A-CRAY-THREE-01-091720	9/17/2020	375-22-4	PFBA	3.65	B	0.11	Yes - Detected in Tissue and Surface Water	33
Eagle Point Lake	EP26A-CRAY-ONE-01-092520	9/25/2020	375-22-4	PFBA	3.36	B	0.11	Yes - Detected in Tissue and Surface Water	30
Eagle Point Lake	EP26A-CRAY-TWO-01-092520	9/25/2020	375-22-4	PFBA	3.29	B	0.11	Yes - Detected in Tissue and Surface Water	29
Eagle Point Lake	EP5-CRAY-ONE-01-092420	9/24/2020	375-22-4	PFBA	3.27	B	0.11	Yes - Detected in Tissue and Surface Water	29
Eagle Point Lake	EP27B-CRAY-ONE-01-092420	9/24/2020	375-22-4	PFBA	3.26	B	0.11	Yes - Detected in Tissue and Surface Water	29
Eagle Point Lake	EP27B-CRAY-TWO-01-092420	9/24/2020	375-22-4	PFBA	4.24	B	0.11	Yes - Detected in Tissue and Surface Water	38
Eagle Point Lake	EP4-CRAY-ONE-01-092320	9/23/2020	375-73-5	PFBS	0.172	J	0.0044	Yes - Detected in Tissue and Surface Water	39
Eagle Point Lake	EP4-CRAY-TWO-01-092320	9/23/2020	375-73-5	PFBS	0.187	J	0.0044	Yes - Detected in Tissue and Surface Water	43
Eagle Point Lake	EP17C-CRAY-01-092420	9/24/2020	375-73-5	PFBS	0.163	J	0.0044	Yes - Detected in Tissue and Surface Water	37
Eagle Point Lake	EP26A-CRAY-THREE-01-091720	9/17/2020	375-73-5	PFBS	0.399		0.0044	Yes - Detected in Tissue and Surface Water	91
Eagle Point Lake	EP26A-CRAY-ONE-01-092520	9/25/2020	375-73-5	PFBS	0.183	J	0.0044	Yes - Detected in Tissue and Surface Water	42
Eagle Point Lake	EP26A-CRAY-TWO-01-092520	9/25/2020	375-73-5	PFBS	0.358	J	0.0044	Yes - Detected in Tissue and Surface Water	82
Eagle Point Lake	EP5-CRAY-ONE-01-092420	9/24/2020	375-73-5	PFBS	0.167	J	0.0044	Yes - Detected in Tissue and Surface Water	38
Eagle Point Lake	EP27B-CRAY-ONE-01-092420	9/24/2020	375-73-5	PFBS	0.197	J	0.0044	Yes - Detected in Tissue and Surface Water	45
Eagle Point Lake	EP27B-CRAY-TWO-01-092420	9/24/2020	375-73-5	PFBS	0.186	J	0.0044	Yes - Detected in Tissue and Surface Water	42
Eagle Point Lake	EP4-CRAY-ONE-01-092320	9/23/2020	335-76-2	PFDA	0.199	J	0.0015	Yes - Detected in Tissue and Surface Water	135
Eagle Point Lake	EP4-CRAY-TWO-01-092320	9/23/2020	335-76-2	PFDA	0.252	J	0.0015	Yes - Detected in Tissue and Surface Water	170
Eagle Point Lake	EP17C-CRAY-01-092420	9/24/2020	335-76-2	PFDA	0.151	J	0.0015	Yes - Detected in Tissue and Surface Water	102
Eagle Point Lake	EP26A-CRAY-THREE-01-091720	9/17/2020	335-76-2	PFDA	0.512		0.0015	Yes - Detected in Tissue and Surface Water	346
Eagle Point Lake	EP26A-CRAY-ONE-01-092520	9/25/2020	335-76-2	PFDA	0.5		0.0015	Yes - Detected in Tissue and Surface Water	338
Eagle Point Lake	EP26A-CRAY-TWO-01-092520	9/25/2020	335-76-2	PFDA	0.456		0.0015	Yes - Detected in Tissue and Surface Water	308
Eagle Point Lake	EP27B-CRAY-ONE-01-092420	9/24/2020	335-76-2	PFDA	0.372	J	0.0015	Yes - Detected in Tissue and Surface Water	252
Eagle Point Lake	EP5-CRAY-ONE-01-092420	9/24/2020	335-76-2	PFDA	0.21	J	0.0015	Yes - Detected in Tissue and Surface Water	142
Eagle Point Lake	EP27B-CRAY-TWO-01-092420	9/24/2020	335-76-2	PFDA	0.407		0.0015	Yes - Detected in Tissue and Surface Water	275
Eagle Point Lake	EP4-CRAY-ONE-01-092320	9/23/2020	307-55-1	PFDoA	0.168	J	0.0028	Yes - Detected in Tissue and Surface Water	60
Eagle Point Lake	EP4-CRAY-TWO-01-092320	9/23/2020	307-55-1	PFDoA	0.188	J	0.0028	Yes - Detected in Tissue and Surface Water	67
Eagle Point Lake	EP17C-CRAY-01-092420	9/24/2020	307-55-1	PFDoA	0.344	J	0.0028	Yes - Detected in Tissue and Surface Water	123
Eagle Point Lake	EP26A-CRAY-THREE-01-091720	9/17/2020	307-55-1	PFDoA	0.178	J	0.0028	Yes - Detected in Tissue and Surface Water	64
Eagle Point Lake	EP26A-CRAY-ONE-01-092520	9/25/2020	307-55-1	PFDoA	0.161	J	0.0028	Yes - Detected in Tissue and Surface Water	58
Eagle Point Lake	EP26A-CRAY-TWO-01-092520	9/25/2020	307-55-1	PFDoA	0.146	J	0.0028	Yes - Detected in Tissue and Surface Water	52
Eagle Point Lake	EP27B-CRAY-ONE-01-092420	9/24/2020	307-55-1	PFDoA	0.252	J	0.0028	Yes - Detected in Tissue and Surface Water	90
Eagle Point Lake	EP5-CRAY-ONE-01-092420	9/24/2020	307-55-1	PFDoA	0.28	J	0.0028	Yes - Detected in Tissue and Surface Water	100
Eagle Point Lake	EP27B-CRAY-TWO-01-092420	9/24/2020	307-55-1	PFDoA	0.194	J	0.0028	Yes - Detected in Tissue and Surface Water	69
Eagle Point Lake	EP4-CRAY-ONE-01-092320	9/23/2020	375-85-9	PFHpA	0.305	J	0.0085	Yes - Detected in Tissue and Surface Water	36
Eagle Point Lake	EP4-CRAY-TWO-01-092320	9/23/2020	375-85-9	PFHpA	0.211	J	0.0085	Yes - Detected in Tissue and Surface Water	25
Eagle Point Lake	EP17C-CRAY-01-092420	9/24/2020	375-85-9	PFHpA	0.247	J	0.0085	Yes - Detected in Tissue and Surface Water	29
Eagle Point Lake	EP26A-CRAY-THREE-01-091720	9/17/2020	375-85-9	PFHpA	0.461		0.0085	Yes - Detected in Tissue and Surface Water	54
Eagle Point Lake	EP26A-CRAY-ONE-01-092520	9/25/2020	375-85-9	PFHpA	0.248	J	0.0085	Yes - Detected in Tissue and Surface Water	29
Eagle Point Lake	EP26A-CRAY-TWO-01-092520	9/25/2020	375-85-9	PFHpA	0.373	J	0.0085	Yes - Detected in Tissue and Surface Water	44
Eagle Point Lake	EP5-CRAY-ONE-01-092420	9/24/2020	375-85-9	PFHpA	0.34	J	0.0085	Yes - Detected in Tissue and Surface Water	40
Eagle Point Lake	EP27B-CRAY-ONE-01-092420	9/24/2020	375-85-9	PFHpA	0.31	J	0.0085	Yes - Detected in Tissue and Surface Water	36
Eagle Point Lake	EP27B-CRAY-TWO-01-092420	9/24/2020	375-85-9	PFHpA	0.492		0.0085	Yes - Detected in Tissue and Surface Water	58

Appendix E Table 2
Calculation of Crayfish Tissue - Total Surface Water Bioaccumulation Factors
Project 1007
Minneapolis, Minnesota

	Crayfish Tissue Samples (a)								
Area	Sample Name	Sample Date	CAS	Analyte	Detected Tissue Concentration (ug/kg)	Qualifier	Surface Water Geomean (ug/L) (b)	Decision to Calculate BAF?	Calculation of Crayfish to Surface Water BAF (CR/SW) (c)
Eagle Point Lake	EP4-CRAY-ONE-01-092320	9/23/2020	375-92-8	PFHpS	0.0971	U	0.0024	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP4-CRAY-TWO-01-092320	9/23/2020	375-92-8	PFHpS	0.0957	U	0.0024	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP17C-CRAY-01-092420	9/24/2020	375-92-8	PFHpS	0.1	U	0.0024	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP26A-CRAY-THREE-01-091720	9/17/2020	375-92-8	PFHpS	0.0971	U	0.0024	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP26A-CRAY-ONE-01-092520	9/25/2020	375-92-8	PFHpS	0.0995	U	0.0024	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP26A-CRAY-TWO-01-092520	9/25/2020	375-92-8	PFHpS	0.0966	U	0.0024	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP5-CRAY-ONE-01-092420	9/24/2020	375-92-8	PFHpS	0.1	U	0.0024	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP27B-CRAY-ONE-01-092420	9/24/2020	375-92-8	PFHpS	0.0995	U	0.0024	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP27B-CRAY-TWO-01-092420	9/24/2020	375-92-8	PFHpS	0.099	U	0.0024	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP4-CRAY-ONE-01-092320	9/23/2020	307-24-4	PFHxA	0.181	J	0.011	Yes - Detected in Tissue and Surface Water	16
Eagle Point Lake	EP4-CRAY-TWO-01-092320	9/23/2020	307-24-4	PFHxA	0.154	J	0.011	Yes - Detected in Tissue and Surface Water	14
Eagle Point Lake	EP17C-CRAY-01-092420	9/24/2020	307-24-4	PFHxA	0.15	J	0.011	Yes - Detected in Tissue and Surface Water	14
Eagle Point Lake	EP26A-CRAY-THREE-01-091720	9/17/2020	307-24-4	PFHxA	0.262	J	0.011	Yes - Detected in Tissue and Surface Water	24
Eagle Point Lake	EP26A-CRAY-ONE-01-092520	9/25/2020	307-24-4	PFHxA	0.128	J	0.011	Yes - Detected in Tissue and Surface Water	12
Eagle Point Lake	EP26A-CRAY-TWO-01-092520	9/25/2020	307-24-4	PFHxA	0.163	J	0.011	Yes - Detected in Tissue and Surface Water	15
Eagle Point Lake	EP27B-CRAY-ONE-01-092420	9/24/2020	307-24-4	PFHxA	0.228	J	0.011	Yes - Detected in Tissue and Surface Water	21
Eagle Point Lake	EP5-CRAY-ONE-01-092420	9/24/2020	307-24-4	PFHxA	0.133	J	0.011	Yes - Detected in Tissue and Surface Water	12
Eagle Point Lake	EP27B-CRAY-TWO-01-092420	9/24/2020	307-24-4	PFHxA	0.128	J	0.011	Yes - Detected in Tissue and Surface Water	12
Eagle Point Lake	EP4-CRAY-ONE-01-092320	9/23/2020	355-46-4	PFHxS	0.153	J	0.0088	Yes - Detected in Tissue and Surface Water	17
Eagle Point Lake	EP4-CRAY-TWO-01-092320	9/23/2020	355-46-4	PFHxS	0.243	J	0.0088	Yes - Detected in Tissue and Surface Water	28
Eagle Point Lake	EP17C-CRAY-01-092420	9/24/2020	355-46-4	PFHxS	0.22	J	0.0088	Yes - Detected in Tissue and Surface Water	25
Eagle Point Lake	EP26A-CRAY-THREE-01-091720	9/17/2020	355-46-4	PFHxS	0.216	J	0.0088	Yes - Detected in Tissue and Surface Water	25
Eagle Point Lake	EP26A-CRAY-ONE-01-092520	9/25/2020	355-46-4	PFHxS	0.135	J	0.0088	Yes - Detected in Tissue and Surface Water	15
Eagle Point Lake	EP26A-CRAY-TWO-01-092520	9/25/2020	355-46-4	PFHxS	0.316	J	0.0088	Yes - Detected in Tissue and Surface Water	36
Eagle Point Lake	EP5-CRAY-ONE-01-092420	9/24/2020	355-46-4	PFHxS	0.199	J	0.0088	Yes - Detected in Tissue and Surface Water	23
Eagle Point Lake	EP27B-CRAY-ONE-01-092420	9/24/2020	355-46-4	PFHxS	0.138	J	0.0088	Yes - Detected in Tissue and Surface Water	16
Eagle Point Lake	EP27B-CRAY-TWO-01-092420	9/24/2020	355-46-4	PFHxS	0.239	J	0.0088	Yes - Detected in Tissue and Surface Water	27
Eagle Point Lake	EP4-CRAY-ONE-01-092320	9/23/2020	375-95-1	PFNA	0.0971	U	0.0014	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP4-CRAY-TWO-01-092320	9/23/2020	375-95-1	PFNA	0.0957	U	0.0014	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP17C-CRAY-01-092420	9/24/2020	375-95-1	PFNA	0.1	U	0.0014	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP26A-CRAY-THREE-01-091720	9/17/2020	375-95-1	PFNA	0.0971	U	0.0014	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP26A-CRAY-ONE-01-092520	9/25/2020	375-95-1	PFNA	0.0995	U	0.0014	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP26A-CRAY-TWO-01-092520	9/25/2020	375-95-1	PFNA	0.0966	U	0.0014	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP5-CRAY-ONE-01-092420	9/24/2020	375-95-1	PFNA	0.1	U	0.0014	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP27B-CRAY-ONE-01-092420	9/24/2020	375-95-1	PFNA	0.0995	U	0.0014	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP27B-CRAY-TWO-01-092420	9/24/2020	375-95-1	PFNA	0.099	U	0.0014	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP4-CRAY-ONE-01-092320	9/23/2020	335-67-1	PFOA	1.17		0.064	Yes - Detected in Tissue and Surface Water	18
Eagle Point Lake	EP4-CRAY-TWO-01-092320	9/23/2020	335-67-1	PFOA	1.07		0.064	Yes - Detected in Tissue and Surface Water	17
Eagle Point Lake	EP17C-CRAY-01-092420	9/24/2020	335-67-1	PFOA	1.23		0.064	Yes - Detected in Tissue and Surface Water	19
Eagle Point Lake	EP26A-CRAY-THREE-01-091720	9/17/2020	335-67-1	PFOA	2.75		0.064	Yes - Detected in Tissue and Surface Water	43
Eagle Point Lake	EP26A-CRAY-ONE-01-092520	9/25/2020	335-67-1	PFOA	0.68		0.064	Yes - Detected in Tissue and Surface Water	11
Eagle Point Lake	EP26A-CRAY-TWO-01-092520	9/25/2020	335-67-1	PFOA	2.34		0.064	Yes - Detected in Tissue and Surface Water	37
Eagle Point Lake	EP27B-CRAY-ONE-01-092420	9/24/2020	335-67-1	PFOA	1.47		0.064	Yes - Detected in Tissue and Surface Water	23
Eagle Point Lake	EP5-CRAY-ONE-01-092420	9/24/2020	335-67-1	PFOA	2.01		0.064	Yes - Detected in Tissue and Surface Water	32
Eagle Point Lake	EP27B-CRAY-TWO-01-092420	9/24/2020	335-67-1	PFOA	3.27		0.064	Yes - Detected in Tissue and Surface Water	51
Eagle Point Lake	EP4-CRAY-ONE-01-092320	9/23/2020	1763-23-1	PFOS	19		0.22	Yes - Detected in Tissue and Surface Water	87
Eagle Point Lake	EP4-CRAY-TWO-01-092320	9/23/2020	1763-23-1	PFOS	21.5		0.22	Yes - Detected in Tissue and Surface Water	99
Eagle Point Lake	EP17C-CRAY-01-092420	9/24/2020	1763-23-1	PFOS	12.7		0.22	Yes - Detected in Tissue and Surface Water	58
Eagle Point Lake	EP26A-CRAY-THREE-01-091720	9/17/2020	1763-23-1	PFOS	26.5		0.22	Yes - Detected in Tissue and Surface Water	122
Eagle Point Lake	EP26A-CRAY-ONE-01-092520	9/25/2020	1763-23-1	PFOS	19.8		0.22	Yes - Detected in Tissue and Surface Water	91
Eagle Point Lake	EP26A-CRAY-TWO-01-092520	9/25/2020	1763-23-1	PFOS	20.3		0.22	Yes - Detected in Tissue and Surface Water	93
Eagle Point Lake	EP27B-CRAY-ONE-01-092420	9/24/2020	1763-23-1	PFOS	20.3		0.22	Yes - Detected in Tissue and Surface Water	93
Eagle Point Lake	EP5-CRAY-ONE-01-092420	9/24/2020	1763-23-1	PFOS	18.5		0.22	Yes - Detected in Tissue and Surface Water	85
Eagle Point Lake	EP27B-CRAY-TWO-01-092420	9/24/2020	1763-23-1	PFOS	27		0.22	Yes - Detected in Tissue and Surface Water	124
Eagle Point Lake	EP4-CRAY-ONE-01-092320	9/23/2020	754-91-6	PFOSA	9.4		0.0012	Yes - Detected in Tissue and Surface Water	7849
Eagle Point Lake	EP4-CRAY-TWO-01-092320	9/23/2020	754-91-6	PFOSA	11.1		0.0012	Yes - Detected in Tissue and Surface Water	9269
Eagle Point Lake	EP17C-CRAY-01-092420	9/24/2020	754-91-6	PFOSA	9.6		0.0012	Yes - Detected in Tissue and Surface Water	8016
Eagle Point Lake	EP26A-CRAY-THREE-01-091720	9/17/2020	754-91-6	PFOSA	9.58		0.0012	Yes - Detected in Tissue and Surface Water	7999
Eagle Point Lake	EP26A-CRAY-ONE-01-092520	9/25/2020	754-91-6	PFOSA	7.91		0.0012	Yes - Detected in Tissue and Surface Water	6605
Eagle Point Lake	EP26A-CRAY-TWO-01-092520	9/25/2020	754-91-6	PFOSA	10		0.0012	Yes - Detected in Tissue and Surface Water	8350
Eagle Point Lake	EP5-CRAY-ONE-01-092420	9/24/2020	754-91-6	PFOSA	6.96		0.0012	Yes - Detected in Tissue and Surface Water	5812
Eagle Point Lake	EP27B-CRAY-ONE-01-092420	9/24/2020	754-91-6	PFOSA	7.59		0.0012	Yes - Detected in Tissue and Surface Water	6338
Eagle Point Lake	EP27B-CRAY-TWO-01-092420	9/24/2020	754-91-6	PFOSA	3.11		0.0012	Yes - Detected in Tissue and Surface Water	2597

Appendix E Table 2
Calculation of Crayfish Tissue - Total Surface Water Bioaccumulation Factors
Project 1007
Minneapolis, Minnesota

	Crayfish Tissue Samples (a)								
Area	Sample Name	Sample Date	CAS	Analyte	Detected Tissue Concentration (ug/kg)	Qualifier	Surface Water Geomean (ug/L) (b)	Decision to Calculate BAF?	Calculation of Crayfish to Surface Water BAF (CR/SW) (c)
Eagle Point Lake	EP4-CRAY-ONE-01-092320	9/23/2020	2706-90-3	PFPeA	0.241	J	0.0089	Yes - Detected in Tissue and Surface Water	27
Eagle Point Lake	EP4-CRAY-TWO-01-092320	9/23/2020	2706-90-3	PFPeA	0.22	J	0.0089	Yes - Detected in Tissue and Surface Water	25
Eagle Point Lake	EP17C-CRAY-01-092420	9/24/2020	2706-90-3	PFPeA	0.2	U	0.0089	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP26A-CRAY-THREE-01-091720	9/17/2020	2706-90-3	PFPeA	0.261	J	0.0089	Yes - Detected in Tissue and Surface Water	29
Eagle Point Lake	EP26A-CRAY-ONE-01-092520	9/25/2020	2706-90-3	PFPeA	0.206	J	0.0089	Yes - Detected in Tissue and Surface Water	23
Eagle Point Lake	EP26A-CRAY-TWO-01-092520	9/25/2020	2706-90-3	PFPeA	0.193	U	0.0089	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP27B-CRAY-ONE-01-092420	9/24/2020	2706-90-3	PFPeA	0.215	J	0.0089	Yes - Detected in Tissue and Surface Water	24
Eagle Point Lake	EP5-CRAY-ONE-01-092420	9/24/2020	2706-90-3	PFPeA	0.235	J	0.0089	Yes - Detected in Tissue and Surface Water	26
Eagle Point Lake	EP27B-CRAY-TWO-01-092420	9/24/2020	2706-90-3	PFPeA	0.198	U	0.0089	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP4-CRAY-ONE-01-092320	9/23/2020	2706-91-4	PFPeS	0.181	J	0.0031	Yes - Detected in Tissue and Surface Water	59
Eagle Point Lake	EP4-CRAY-TWO-01-092320	9/23/2020	2706-91-4	PFPeS	0.267	J	0.0031	Yes - Detected in Tissue and Surface Water	87
Eagle Point Lake	EP17C-CRAY-01-092420	9/24/2020	2706-91-4	PFPeS	0.128	J	0.0031	Yes - Detected in Tissue and Surface Water	42
Eagle Point Lake	EP26A-CRAY-THREE-01-091720	9/17/2020	2706-91-4	PFPeS	0.299	J	0.0031	Yes - Detected in Tissue and Surface Water	97
Eagle Point Lake	EP26A-CRAY-ONE-01-092520	9/25/2020	2706-91-4	PFPeS	0.253	J	0.0031	Yes - Detected in Tissue and Surface Water	82
Eagle Point Lake	EP26A-CRAY-TWO-01-092520	9/25/2020	2706-91-4	PFPeS	0.275	J	0.0031	Yes - Detected in Tissue and Surface Water	90
Eagle Point Lake	EP27B-CRAY-ONE-01-092420	9/24/2020	2706-91-4	PFPeS	0.204	J	0.0031	Yes - Detected in Tissue and Surface Water	66
Eagle Point Lake	EP5-CRAY-ONE-01-092420	9/24/2020	2706-91-4	PFPeS	0.175	J	0.0031	Yes - Detected in Tissue and Surface Water	57
Eagle Point Lake	EP27B-CRAY-TWO-01-092420	9/24/2020	2706-91-4	PFPeS	0.141	J	0.0031	Yes - Detected in Tissue and Surface Water	46
Eagle Point Lake	EP4-CRAY-ONE-01-092320	9/23/2020	376-06-7	PFTeDA	0.0971	UJ	0.0026	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP4-CRAY-TWO-01-092320	9/23/2020	376-06-7	PFTeDA	0.0957	UJ	0.0026	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP17C-CRAY-01-092420	9/24/2020	376-06-7	PFTeDA	0.155	J	0.0026	Yes - Detected in Tissue and Surface Water	59
Eagle Point Lake	EP26A-CRAY-THREE-01-091720	9/17/2020	376-06-7	PFTeDA	0.0971	U	0.0026	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP26A-CRAY-ONE-01-092520	9/25/2020	376-06-7	PFTeDA	0.0995	U	0.0026	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP26A-CRAY-TWO-01-092520	9/25/2020	376-06-7	PFTeDA	0.0966	U	0.0026	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP5-CRAY-ONE-01-092420	9/24/2020	376-06-7	PFTeDA	0.1	U	0.0026	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP27B-CRAY-ONE-01-092420	9/24/2020	376-06-7	PFTeDA	0.0995	U	0.0026	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP27B-CRAY-TWO-01-092420	9/24/2020	376-06-7	PFTeDA	0.099	U	0.0026	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP4-CRAY-ONE-01-092320	9/23/2020	72629-94-8	PFTrDA	0.0971	U	0.0026	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP4-CRAY-TWO-01-092320	9/23/2020	72629-94-8	PFTrDA	0.0957	U	0.0026	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP17C-CRAY-01-092420	9/24/2020	72629-94-8	PFTrDA	0.1	U	0.0026	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP26A-CRAY-THREE-01-091720	9/17/2020	72629-94-8	PFTrDA	0.0971	U	0.0026	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP26A-CRAY-ONE-01-092520	9/25/2020	72629-94-8	PFTrDA	0.0995	U	0.0026	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP26A-CRAY-TWO-01-092520	9/25/2020	72629-94-8	PFTrDA	0.0966	U	0.0026	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP5-CRAY-ONE-01-092420	9/24/2020	72629-94-8	PFTrDA	0.1	U	0.0026	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP27B-CRAY-ONE-01-092420	9/24/2020	72629-94-8	PFTrDA	0.0995	U	0.0026	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP27B-CRAY-TWO-01-092420	9/24/2020	72629-94-8	PFTrDA	0.099	U	0.0026	No - ND in Crayfish Tissue	NC
Eagle Point Lake	EP4-CRAY-ONE-01-092320	9/23/2020	2058-94-8	PFUnA	0.234	BJ	0.0026	Yes - Detected in Tissue and Surface Water	90
Eagle Point Lake	EP4-CRAY-TWO-01-092320	9/23/2020	2058-94-8	PFUnA	0.248	BJ	0.0026	Yes - Detected in Tissue and Surface Water	95
Eagle Point Lake	EP17C-CRAY-01-092420	9/24/2020	2058-94-8	PFUnA	0.361	BJ	0.0026	Yes - Detected in Tissue and Surface Water	139
Eagle Point Lake	EP26A-CRAY-THREE-01-091720	9/17/2020	2058-94-8	PFUnA	0.313	BJ	0.0026	Yes - Detected in Tissue and Surface Water	120
Eagle Point Lake	EP26A-CRAY-ONE-01-092520	9/25/2020	2058-94-8	PFUnA	0.432	B	0.0026	Yes - Detected in Tissue and Surface Water	166
Eagle Point Lake	EP26A-CRAY-TWO-01-092520	9/25/2020	2058-94-8	PFUnA	0.283	BJ	0.0026	Yes - Detected in Tissue and Surface Water	109
Eagle Point Lake	EP27B-CRAY-ONE-01-092420	9/24/2020	2058-94-8	PFUnA	0.328	BJ	0.0026	Yes - Detected in Tissue and Surface Water	126
Eagle Point Lake	EP5-CRAY-ONE-01-092420	9/24/2020	2058-94-8	PFUnA	0.354	BJ	0.0026	Yes - Detected in Tissue and Surface Water	136
Eagle Point Lake	EP27B-CRAY-TWO-01-092420	9/24/2020	2058-94-8	PFUnA	0.361	BJ	0.0026	Yes - Detected in Tissue and Surface Water	139
Raleigh Creek - other	RC21-CRAY-TWO-01-092120	9/21/2020	27619-97-2	6:2 FTS	0.359	U	0.0041	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21A-CRAY-ONE-01-092120	9/21/2020	27619-97-2	6:2 FTS	0.35	U	0.0041	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21A-CRAY-THREE-01-092120	9/21/2020	27619-97-2	6:2 FTS	1.53		0.0041	Yes - Detected in Tissue and Surface Water	377
Raleigh Creek - other	RC21A-CRAY-TWO-01-092120	9/21/2020	27619-97-2	6:2 FTS	0.352	U	0.0041	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC17-CRAY-ONE-01-091920	9/19/2020	27619-97-2	6:2 FTS	0.357	U	0.0041	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC17A-CRAY-01-092120	9/21/2020	27619-97-2	6:2 FTS	0.348	U	0.0041	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC18A-CRAY-01-092120	9/21/2020	27619-97-2	6:2 FTS	0.359	U	0.0041	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21B-CRAY-01-092120	9/21/2020	27619-97-2	6:2 FTS	0.357	U	0.0041	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21-CRAY-ONE-01-092120	9/21/2020	27619-97-2	6:2 FTS	0.345	U	0.0041	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21-CRAY-THREE-01-092120	9/21/2020	27619-97-2	6:2 FTS	0.348	U	0.0041	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC14-CRAY-01-092120	9/21/2020	27619-97-2	6:2 FTS	0.35	U	0.0041	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21-CRAY-TWO-01-092120	9/21/2020	2991-50-6	N-EtFOSAA	0.0995	U	0.0028	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21A-CRAY-ONE-01-092120	9/21/2020	2991-50-6	N-EtFOSAA	0.0971	U	0.0028	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21A-CRAY-THREE-01-092120	9/21/2020	2991-50-6	N-EtFOSAA	0.098	U	0.0028	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21A-CRAY-TWO-01-092120	9/21/2020	2991-50-6	N-EtFOSAA	0.0976	U	0.0028	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC17-CRAY-ONE-01-091920	9/19/2020	2991-50-6	N-EtFOSAA	0.099	U	0.0028	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC17A-CRAY-01-092120	9/21/2020	2991-50-6	N-EtFOSAA	0.0966	U	0.0028	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC18A-CRAY-01-092120	9/21/2020	2991-50-6	N-EtFOSAA	0.0995	U	0.0028	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21B-CRAY-01-092120	9/21/2020	2991-50-6	N-EtFOSAA	0.099	U	0.0028	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21-CRAY-ONE-01-092120	9/21/2020	2991-50-6	N-EtFOSAA	0.173	J	0.0028	Yes - Detected in Tissue and Surface Water	62
Raleigh Creek - other	RC21-CRAY-THREE-01-092120	9/21/2020	2991-50-6	N-EtFOSAA	0.0966	U	0.0028	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC14-CRAY-01-092120	9/21/2020	2991-50-6	N-EtFOSAA	0.0971	U	0.0028	No - ND in Crayfish Tissue	NC

Appendix E Table 2
Calculation of Crayfish Tissue - Total Surface Water Bioaccumulation Factors
Project 1007
Minneapolis, Minnesota

	Crayfish Tissue Samples (a)								
Area	Sample Name	Sample Date	CAS	Analyte	Detected Tissue Concentration (ug/kg)	Qualifier	Surface Water Geomean (ug/L) (b)	Decision to Calculate BAF?	Calculation of Crayfish to Surface Water BAF (CR/SW) (c)
Raleigh Creek - other	RC21-CRAY-TWO-01-092120	9/21/2020	375-22-4	PFBA	2.28	B	0.088	Yes - Detected in Tissue and Surface Water	26
Raleigh Creek - other	RC21A-CRAY-ONE-01-092120	9/21/2020	375-22-4	PFBA	2.75		0.088	Yes - Detected in Tissue and Surface Water	31
Raleigh Creek - other	RC21A-CRAY-THREE-01-092120	9/21/2020	375-22-4	PFBA	1.41	J	0.088	Yes - Detected in Tissue and Surface Water	16
Raleigh Creek - other	RC21A-CRAY-TWO-01-092120	9/21/2020	375-22-4	PFBA	1.51	BJ	0.088	Yes - Detected in Tissue and Surface Water	17
Raleigh Creek - other	RC14-CRAY-01-092120	9/21/2020	375-22-4	PFBA	1.76	B	0.088	Yes - Detected in Tissue and Surface Water	20
Raleigh Creek - other	RC17-CRAY-ONE-01-091920	9/19/2020	375-22-4	PFBA	1.13	BJ	0.088	Yes - Detected in Tissue and Surface Water	13
Raleigh Creek - other	RC17A-CRAY-01-092120	9/21/2020	375-22-4	PFBA	1.63	B	0.088	Yes - Detected in Tissue and Surface Water	18
Raleigh Creek - other	RC18A-CRAY-01-092120	9/21/2020	375-22-4	PFBA	2.14	B	0.088	Yes - Detected in Tissue and Surface Water	24
Raleigh Creek - other	RC21B-CRAY-01-092120	9/21/2020	375-22-4	PFBA	1.3	BJ-	0.088	Yes - Detected in Tissue and Surface Water	15
Raleigh Creek - other	RC21-CRAY-ONE-01-092120	9/21/2020	375-22-4	PFBA	1.46	BJ	0.088	Yes - Detected in Tissue and Surface Water	17
Raleigh Creek - other	RC21-CRAY-THREE-01-092120	9/21/2020	375-22-4	PFBA	1.42	BJ	0.088	Yes - Detected in Tissue and Surface Water	16
Raleigh Creek - other	RC21-CRAY-TWO-01-092120	9/21/2020	375-73-5	PFBS	0.0995	U	0.0028	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21A-CRAY-ONE-01-092120	9/21/2020	375-73-5	PFBS	0.575		0.0028	Yes - Detected in Tissue and Surface Water	205
Raleigh Creek - other	RC21A-CRAY-THREE-01-092120	9/21/2020	375-73-5	PFBS	0.098	U	0.0028	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21A-CRAY-TWO-01-092120	9/21/2020	375-73-5	PFBS	0.173	J	0.0028	Yes - Detected in Tissue and Surface Water	62
Raleigh Creek - other	RC17-CRAY-ONE-01-091920	9/19/2020	375-73-5	PFBS	0.099	U	0.0028	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC17A-CRAY-01-092120	9/21/2020	375-73-5	PFBS	0.0966	U	0.0028	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC18A-CRAY-01-092120	9/21/2020	375-73-5	PFBS	0.0995	U	0.0028	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21B-CRAY-01-092120	9/21/2020	375-73-5	PFBS	0.099	U	0.0028	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21-CRAY-ONE-01-092120	9/21/2020	375-73-5	PFBS	0.2	J	0.0028	Yes - Detected in Tissue and Surface Water	71
Raleigh Creek - other	RC21-CRAY-THREE-01-092120	9/21/2020	375-73-5	PFBS	0.0966	U	0.0028	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC14-CRAY-01-092120	9/21/2020	375-73-5	PFBS	0.0971	U	0.0028	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21-CRAY-TWO-01-092120	9/21/2020	335-76-2	PFDA	0.24	J	0.0014	Yes - Detected in Tissue and Surface Water	167
Raleigh Creek - other	RC21A-CRAY-ONE-01-092120	9/21/2020	335-76-2	PFDA	0.709		0.0014	Yes - Detected in Tissue and Surface Water	494
Raleigh Creek - other	RC21A-CRAY-THREE-01-092120	9/21/2020	335-76-2	PFDA	0.677		0.0014	Yes - Detected in Tissue and Surface Water	472
Raleigh Creek - other	RC21A-CRAY-TWO-01-092120	9/21/2020	335-76-2	PFDA	0.639		0.0014	Yes - Detected in Tissue and Surface Water	445
Raleigh Creek - other	RC17-CRAY-ONE-01-091920	9/19/2020	335-76-2	PFDA	0.835		0.0014	Yes - Detected in Tissue and Surface Water	582
Raleigh Creek - other	RC17A-CRAY-01-092120	9/21/2020	335-76-2	PFDA	0.508		0.0014	Yes - Detected in Tissue and Surface Water	354
Raleigh Creek - other	RC18A-CRAY-01-092120	9/21/2020	335-76-2	PFDA	0.839		0.0014	Yes - Detected in Tissue and Surface Water	585
Raleigh Creek - other	RC21B-CRAY-01-092120	9/21/2020	335-76-2	PFDA	0.548		0.0014	Yes - Detected in Tissue and Surface Water	382
Raleigh Creek - other	RC21-CRAY-ONE-01-092120	9/21/2020	335-76-2	PFDA	1.52		0.0014	Yes - Detected in Tissue and Surface Water	1059
Raleigh Creek - other	RC21-CRAY-THREE-01-092120	9/21/2020	335-76-2	PFDA	0.321	J	0.0014	Yes - Detected in Tissue and Surface Water	224
Raleigh Creek - other	RC14-CRAY-01-092120	9/21/2020	335-76-2	PFDA	0.85		0.0014	Yes - Detected in Tissue and Surface Water	592
Raleigh Creek - other	RC21-CRAY-TWO-01-092120	9/21/2020	375-85-9	PFHpA	0.177	J	0.0031	Yes - Detected in Tissue and Surface Water	58
Raleigh Creek - other	RC21A-CRAY-ONE-01-092120	9/21/2020	375-85-9	PFHpA	0.71		0.0031	Yes - Detected in Tissue and Surface Water	233
Raleigh Creek - other	RC21A-CRAY-THREE-01-092120	9/21/2020	375-85-9	PFHpA	0.098	U	0.0031	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21A-CRAY-TWO-01-092120	9/21/2020	375-85-9	PFHpA	0.116	J	0.0031	Yes - Detected in Tissue and Surface Water	38
Raleigh Creek - other	RC17-CRAY-ONE-01-091920	9/19/2020	375-85-9	PFHpA	0.099	U	0.0031	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC17A-CRAY-01-092120	9/21/2020	375-85-9	PFHpA	0.121	J	0.0031	Yes - Detected in Tissue and Surface Water	40
Raleigh Creek - other	RC18A-CRAY-01-092120	9/21/2020	375-85-9	PFHpA	0.0995	U	0.0031	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21B-CRAY-01-092120	9/21/2020	375-85-9	PFHpA	0.099	U	0.0031	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21-CRAY-ONE-01-092120	9/21/2020	375-85-9	PFHpA	0.0957	U	0.0031	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21-CRAY-THREE-01-092120	9/21/2020	375-85-9	PFHpA	0.0966	U	0.0031	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC14-CRAY-01-092120	9/21/2020	375-85-9	PFHpA	0.0971	U	0.0031	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21-CRAY-TWO-01-092120	9/21/2020	375-92-8	PFHpS	0.0995	U	0.0037	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21A-CRAY-ONE-01-092120	9/21/2020	375-92-8	PFHpS	0.199	J	0.0037	Yes - Detected in Tissue and Surface Water	54
Raleigh Creek - other	RC21A-CRAY-THREE-01-092120	9/21/2020	375-92-8	PFHpS	0.098	U	0.0037	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21A-CRAY-TWO-01-092120	9/21/2020	375-92-8	PFHpS	0.0976	U	0.0037	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC17-CRAY-ONE-01-091920	9/19/2020	375-92-8	PFHpS	0.099	U	0.0037	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC17A-CRAY-01-092120	9/21/2020	375-92-8	PFHpS	0.0966	U	0.0037	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC18A-CRAY-01-092120	9/21/2020	375-92-8	PFHpS	0.0995	U	0.0037	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21B-CRAY-01-092120	9/21/2020	375-92-8	PFHpS	0.099	U	0.0037	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21-CRAY-ONE-01-092120	9/21/2020	375-92-8	PFHpS	0.0957	U	0.0037	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21-CRAY-THREE-01-092120	9/21/2020	375-92-8	PFHpS	0.0966	U	0.0037	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC14-CRAY-01-092120	9/21/2020	375-92-8	PFHpS	0.0971	U	0.0037	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21-CRAY-TWO-01-092120	9/21/2020	307-24-4	PFHxA	0.0995	U	0.0054	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21A-CRAY-ONE-01-092120	9/21/2020	307-24-4	PFHxA	0.183	J	0.0054	Yes - Detected in Tissue and Surface Water	34
Raleigh Creek - other	RC21A-CRAY-THREE-01-092120	9/21/2020	307-24-4	PFHxA	0.098	U	0.0054	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21A-CRAY-TWO-01-092120	9/21/2020	307-24-4	PFHxA	0.0976	U	0.0054	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC17-CRAY-ONE-01-091920	9/19/2020	307-24-4	PFHxA	0.099	U	0.0054	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC17A-CRAY-01-092120	9/21/2020	307-24-4	PFHxA	0.0966	U	0.0054	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC18A-CRAY-01-092120	9/21/2020	307-24-4	PFHxA	0.0995	U	0.0054	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21B-CRAY-01-092120	9/21/2020	307-24-4	PFHxA	0.128	U	0.0054	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21-CRAY-ONE-01-092120	9/21/2020	307-24-4	PFHxA	0.0957	U	0.0054	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21-CRAY-THREE-01-092120	9/21/2020	307-24-4	PFHxA	0.0966	U	0.0054	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC14-CRAY-01-092120	9/21/2020	307-24-4	PFHxA	0.0971	U	0.0054	No - ND in Crayfish Tissue	NC

Appendix E Table 2
Calculation of Crayfish Tissue - Total Surface Water Bioaccumulation Factors
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Minneapolis, Minnesota

	Crayfish Tissue Samples (a)								
Area	Sample Name	Sample Date	CAS	Analyte	Detected Tissue Concentration (ug/kg)	Qualifier	Surface Water Geomean (ug/L) (b)	Decision to Calculate BAF?	Calculation of Crayfish to Surface Water BAF (CR/SW) (c)
Raleigh Creek - other	RC21-CRAY-TWO-01-092120	9/21/2020	355-46-4	PFHxS	0.161	J	0.0041	Yes - Detected in Tissue and Surface Water	39
Raleigh Creek - other	RC21A-CRAY-ONE-01-092120	9/21/2020	355-46-4	PFHxS	0.603		0.0041	Yes - Detected in Tissue and Surface Water	148
Raleigh Creek - other	RC21A-CRAY-THREE-01-092120	9/21/2020	355-46-4	PFHxS	0.147	J	0.0041	Yes - Detected in Tissue and Surface Water	36
Raleigh Creek - other	RC21A-CRAY-TWO-01-092120	9/21/2020	355-46-4	PFHxS	0.172	J	0.0041	Yes - Detected in Tissue and Surface Water	42
Raleigh Creek - other	RC17-CRAY-ONE-01-091920	9/19/2020	355-46-4	PFHxS	1.03	J	0.0041	Yes - Detected in Tissue and Surface Water	253
Raleigh Creek - other	RC17A-CRAY-01-092120	9/21/2020	355-46-4	PFHxS	0.144	J	0.0041	Yes - Detected in Tissue and Surface Water	35
Raleigh Creek - other	RC18A-CRAY-01-092120	9/21/2020	355-46-4	PFHxS	0.338	J	0.0041	Yes - Detected in Tissue and Surface Water	83
Raleigh Creek - other	RC21B-CRAY-01-092120	9/21/2020	355-46-4	PFHxS	0.108	J	0.0041	Yes - Detected in Tissue and Surface Water	26
Raleigh Creek - other	RC21-CRAY-ONE-01-092120	9/21/2020	355-46-4	PFHxS	0.388		0.0041	Yes - Detected in Tissue and Surface Water	95
Raleigh Creek - other	RC21-CRAY-THREE-01-092120	9/21/2020	355-46-4	PFHxS	0.133	J	0.0041	Yes - Detected in Tissue and Surface Water	33
Raleigh Creek - other	RC14-CRAY-01-092120	9/21/2020	355-46-4	PFHxS	0.181	J	0.0041	Yes - Detected in Tissue and Surface Water	44
Raleigh Creek - other	RC21-CRAY-TWO-01-092120	9/21/2020	375-95-1	PFNA	0.129	J	0.0010	Yes - Detected in Tissue and Surface Water	126
Raleigh Creek - other	RC21A-CRAY-ONE-01-092120	9/21/2020	375-95-1	PFNA	0.192	J	0.0010	Yes - Detected in Tissue and Surface Water	188
Raleigh Creek - other	RC21A-CRAY-THREE-01-092120	9/21/2020	375-95-1	PFNA	0.416		0.0010	Yes - Detected in Tissue and Surface Water	407
Raleigh Creek - other	RC21A-CRAY-TWO-01-092120	9/21/2020	375-95-1	PFNA	0.314	J	0.0010	Yes - Detected in Tissue and Surface Water	307
Raleigh Creek - other	RC17-CRAY-ONE-01-091920	9/19/2020	375-95-1	PFNA	0.269	J	0.0010	Yes - Detected in Tissue and Surface Water	263
Raleigh Creek - other	RC17A-CRAY-01-092120	9/21/2020	375-95-1	PFNA	0.324	J	0.0010	Yes - Detected in Tissue and Surface Water	317
Raleigh Creek - other	RC18A-CRAY-01-092120	9/21/2020	375-95-1	PFNA	0.565		0.0010	Yes - Detected in Tissue and Surface Water	553
Raleigh Creek - other	RC21B-CRAY-01-092120	9/21/2020	375-95-1	PFNA	0.297	J	0.0010	Yes - Detected in Tissue and Surface Water	291
Raleigh Creek - other	RC21-CRAY-ONE-01-092120	9/21/2020	375-95-1	PFNA	0.676		0.0010	Yes - Detected in Tissue and Surface Water	661
Raleigh Creek - other	RC21-CRAY-THREE-01-092120	9/21/2020	375-95-1	PFNA	0.234	J	0.0010	Yes - Detected in Tissue and Surface Water	229
Raleigh Creek - other	RC14-CRAY-01-092120	9/21/2020	375-95-1	PFNA	0.605		0.0010	Yes - Detected in Tissue and Surface Water	592
Raleigh Creek - other	RC21-CRAY-TWO-01-092120	9/21/2020	335-67-1	PFOA	0.435		0.012	Yes - Detected in Tissue and Surface Water	36
Raleigh Creek - other	RC21A-CRAY-ONE-01-092120	9/21/2020	335-67-1	PFOA	5.5		0.012	Yes - Detected in Tissue and Surface Water	452
Raleigh Creek - other	RC21A-CRAY-THREE-01-092120	9/21/2020	335-67-1	PFOA	1.77		0.012	Yes - Detected in Tissue and Surface Water	145
Raleigh Creek - other	RC21A-CRAY-TWO-01-092120	9/21/2020	335-67-1	PFOA	0.948		0.012	Yes - Detected in Tissue and Surface Water	78
Raleigh Creek - other	RC17-CRAY-ONE-01-091920	9/19/2020	335-67-1	PFOA	1.19		0.012	Yes - Detected in Tissue and Surface Water	98
Raleigh Creek - other	RC17A-CRAY-01-092120	9/21/2020	335-67-1	PFOA	1.15		0.012	Yes - Detected in Tissue and Surface Water	94
Raleigh Creek - other	RC18A-CRAY-01-092120	9/21/2020	335-67-1	PFOA	2.15		0.012	Yes - Detected in Tissue and Surface Water	177
Raleigh Creek - other	RC21B-CRAY-01-092120	9/21/2020	335-67-1	PFOA	1.43		0.012	Yes - Detected in Tissue and Surface Water	117
Raleigh Creek - other	RC21-CRAY-ONE-01-092120	9/21/2020	335-67-1	PFOA	1.98		0.012	Yes - Detected in Tissue and Surface Water	163
Raleigh Creek - other	RC21-CRAY-THREE-01-092120	9/21/2020	335-67-1	PFOA	1.25		0.012	Yes - Detected in Tissue and Surface Water	103
Raleigh Creek - other	RC14-CRAY-01-092120	9/21/2020	335-67-1	PFOA	1.67		0.012	Yes - Detected in Tissue and Surface Water	137
Raleigh Creek - other	RC21-CRAY-TWO-01-092120	9/21/2020	1763-23-1	PFOS	2.29		0.0077	Yes - Detected in Tissue and Surface Water	296
Raleigh Creek - other	RC21A-CRAY-ONE-01-092120	9/21/2020	1763-23-1	PFOS	54.1		0.0077	Yes - Detected in Tissue and Surface Water	6998
Raleigh Creek - other	RC21A-CRAY-THREE-01-092120	9/21/2020	1763-23-1	PFOS	19.6		0.0077	Yes - Detected in Tissue and Surface Water	2535
Raleigh Creek - other	RC21A-CRAY-TWO-01-092120	9/21/2020	1763-23-1	PFOS	17.3		0.0077	Yes - Detected in Tissue and Surface Water	2238
Raleigh Creek - other	RC17-CRAY-ONE-01-091920	9/19/2020	1763-23-1	PFOS	14.4		0.0077	Yes - Detected in Tissue and Surface Water	1863
Raleigh Creek - other	RC17A-CRAY-01-092120	9/21/2020	1763-23-1	PFOS	9.01		0.0077	Yes - Detected in Tissue and Surface Water	1165
Raleigh Creek - other	RC18A-CRAY-01-092120	9/21/2020	1763-23-1	PFOS	18.6		0.0077	Yes - Detected in Tissue and Surface Water	2406
Raleigh Creek - other	RC21B-CRAY-01-092120	9/21/2020	1763-23-1	PFOS	7.36		0.0077	Yes - Detected in Tissue and Surface Water	952
Raleigh Creek - other	RC21-CRAY-ONE-01-092120	9/21/2020	1763-23-1	PFOS	26.3		0.0077	Yes - Detected in Tissue and Surface Water	3402
Raleigh Creek - other	RC21-CRAY-THREE-01-092120	9/21/2020	1763-23-1	PFOS	4.74		0.0077	Yes - Detected in Tissue and Surface Water	613
Raleigh Creek - other	RC14-CRAY-01-092120	9/21/2020	1763-23-1	PFOS	12.9		0.0077	Yes - Detected in Tissue and Surface Water	1669
Raleigh Creek - other	RC21-CRAY-TWO-01-092120	9/21/2020	754-91-6	PFOSA	4.48		0.0028	Yes - Detected in Tissue and Surface Water	1601
Raleigh Creek - other	RC21A-CRAY-ONE-01-092120	9/21/2020	754-91-6	PFOSA	7.48		0.0028	Yes - Detected in Tissue and Surface Water	2673
Raleigh Creek - other	RC21A-CRAY-THREE-01-092120	9/21/2020	754-91-6	PFOSA	1.25		0.0028	Yes - Detected in Tissue and Surface Water	447
Raleigh Creek - other	RC17-CRAY-ONE-01-091920	9/19/2020	754-91-6	PFOSA	1.48		0.0028	Yes - Detected in Tissue and Surface Water	529
Raleigh Creek - other	RC17A-CRAY-01-092120	9/21/2020	754-91-6	PFOSA	1.26		0.0028	Yes - Detected in Tissue and Surface Water	450
Raleigh Creek - other	RC21A-CRAY-TWO-01-092120	9/21/2020	754-91-6	PFOSA	2.14		0.0028	Yes - Detected in Tissue and Surface Water	765
Raleigh Creek - other	RC18A-CRAY-01-092120	9/21/2020	754-91-6	PFOSA	1.95		0.0028	Yes - Detected in Tissue and Surface Water	697
Raleigh Creek - other	RC21B-CRAY-01-092120	9/21/2020	754-91-6	PFOSA	1.69		0.0028	Yes - Detected in Tissue and Surface Water	604
Raleigh Creek - other	RC21-CRAY-ONE-01-092120	9/21/2020	754-91-6	PFOSA	12.1		0.0028	Yes - Detected in Tissue and Surface Water	4324
Raleigh Creek - other	RC21-CRAY-THREE-01-092120	9/21/2020	754-91-6	PFOSA	2.42		0.0028	Yes - Detected in Tissue and Surface Water	865
Raleigh Creek - other	RC14-CRAY-01-092120	9/21/2020	754-91-6	PFOSA	1.54		0.0028	Yes - Detected in Tissue and Surface Water	550
Raleigh Creek - other	RC21-CRAY-TWO-01-092120	9/21/2020	2706-90-3	PFPeA	0.199	U	0.0065	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21A-CRAY-ONE-01-092120	9/21/2020	2706-90-3	PFPeA	0.194	U	0.0065	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21A-CRAY-THREE-01-092120	9/21/2020	2706-90-3	PFPeA	0.196	U	0.0065	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21A-CRAY-TWO-01-092120	9/21/2020	2706-90-3	PFPeA	0.195	U	0.0065	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC17-CRAY-ONE-01-091920	9/19/2020	2706-90-3	PFPeA	0.198	U	0.0065	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC17A-CRAY-01-092120	9/21/2020	2706-90-3	PFPeA	0.193	U	0.0065	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC18A-CRAY-01-092120	9/21/2020	2706-90-3	PFPeA	0.199	U	0.0065	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21B-CRAY-01-092120	9/21/2020	2706-90-3	PFPeA	0.198	U	0.0065	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21-CRAY-ONE-01-092120	9/21/2020	2706-90-3	PFPeA	0.191	U	0.0065	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21-CRAY-THREE-01-092120	9/21/2020	2706-90-3	PFPeA	0.193	U	0.0065	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC14-CRAY-01-092120	9/21/2020	2706-90-3	PFPeA	0.194	U	0.0065	No - ND in Crayfish Tissue	NC

Appendix E Table 2
Calculation of Crayfish Tissue - Total Surface Water Bioaccumulation Factors
Project 1007
Minneapolis, Minnesota

	Crayfish Tissue Samples (a)								
Area	Sample Name	Sample Date	CAS	Analyte	Detected Tissue Concentration (ug/kg)	Qualifier	Surface Water Geomean (ug/L) (b)	Decision to Calculate BAF?	Calculation of Crayfish to Surface Water BAF (CR/SW) (c)
Raleigh Creek - other	RC21-CRAY-TWO-01-092120	9/21/2020	2706-91-4	PFPeS	0.1	U	0.0019	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21A-CRAY-ONE-01-092120	9/21/2020	2706-91-4	PFPeS	0.372	J	0.0019	Yes - Detected in Tissue and Surface Water	192
Raleigh Creek - other	RC21A-CRAY-THREE-01-092120	9/21/2020	2706-91-4	PFPeS	0.0985	U	0.0019	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21A-CRAY-TWO-01-092120	9/21/2020	2706-91-4	PFPeS	0.098	U	0.0019	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC17-CRAY-ONE-01-091920	9/19/2020	2706-91-4	PFPeS	0.0995	U	0.0019	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC17A-CRAY-01-092120	9/21/2020	2706-91-4	PFPeS	0.0971	U	0.0019	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC18A-CRAY-01-092120	9/21/2020	2706-91-4	PFPeS	0.1	U	0.0019	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21B-CRAY-01-092120	9/21/2020	2706-91-4	PFPeS	0.0995	U	0.0019	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21-CRAY-ONE-01-092120	9/21/2020	2706-91-4	PFPeS	0.0962	U	0.0019	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21-CRAY-THREE-01-092120	9/21/2020	2706-91-4	PFPeS	0.0971	U	0.0019	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC14-CRAY-01-092120	9/21/2020	2706-91-4	PFPeS	0.0976	U	0.0019	No - ND in Crayfish Tissue	NC
Raleigh Creek - other	RC21-CRAY-TWO-01-092120	9/21/2020	376-06-7	PFTeDA	0.134	J	0.0046	Yes - Detected in Tissue and Surface Water	29
Raleigh Creek - other	RC21A-CRAY-ONE-01-092120	9/21/2020	376-06-7	PFTeDA	0.346	J+	0.0046	Yes - Detected in Tissue and Surface Water	75
Raleigh Creek - other	RC21A-CRAY-THREE-01-092120	9/21/2020	376-06-7	PFTeDA	0.345	J	0.0046	Yes - Detected in Tissue and Surface Water	75
Raleigh Creek - other	RC21A-CRAY-TWO-01-092120	9/21/2020	376-06-7	PFTeDA	0.336	J	0.0046	Yes - Detected in Tissue and Surface Water	73
Raleigh Creek - other	RC17-CRAY-ONE-01-091920	9/19/2020	376-06-7	PFTeDA	0.295	J	0.0046	Yes - Detected in Tissue and Surface Water	64
Raleigh Creek - other	RC17A-CRAY-01-092120	9/21/2020	376-06-7	PFTeDA	0.337	J	0.0046	Yes - Detected in Tissue and Surface Water	73
Raleigh Creek - other	RC18A-CRAY-01-092120	9/21/2020	376-06-7	PFTeDA	0.445		0.0046	Yes - Detected in Tissue and Surface Water	97
Raleigh Creek - other	RC21B-CRAY-01-092120	9/21/2020	376-06-7	PFTeDA	0.285	J	0.0046	Yes - Detected in Tissue and Surface Water	62
Raleigh Creek - other	RC21-CRAY-ONE-01-092120	9/21/2020	376-06-7	PFTeDA	0.635		0.0046	Yes - Detected in Tissue and Surface Water	138
Raleigh Creek - other	RC21-CRAY-THREE-01-092120	9/21/2020	376-06-7	PFTeDA	0.195	J	0.0046	Yes - Detected in Tissue and Surface Water	42
Raleigh Creek - other	RC14-CRAY-01-092120	9/21/2020	376-06-7	PFTeDA	0.273	J	0.0046	Yes - Detected in Tissue and Surface Water	59
Raleigh Creek - other	RC21-CRAY-TWO-01-092120	9/21/2020	72629-94-8	PFTrDA	0.132	BJ	0.0020	Yes - Detected in Tissue and Surface Water	67
Raleigh Creek - other	RC21A-CRAY-ONE-01-092120	9/21/2020	72629-94-8	PFTrDA	0.344	BJ	0.0020	Yes - Detected in Tissue and Surface Water	175
Raleigh Creek - other	RC21A-CRAY-THREE-01-092120	9/21/2020	72629-94-8	PFTrDA	0.331	BJ	0.0020	Yes - Detected in Tissue and Surface Water	169
Raleigh Creek - other	RC17-CRAY-ONE-01-091920	9/19/2020	72629-94-8	PFTrDA	0.316	BJ	0.0020	Yes - Detected in Tissue and Surface Water	161
Raleigh Creek - other	RC17A-CRAY-01-092120	9/21/2020	72629-94-8	PFTrDA	0.362	BJ	0.0020	Yes - Detected in Tissue and Surface Water	184
Raleigh Creek - other	RC21A-CRAY-TWO-01-092120	9/21/2020	72629-94-8	PFTrDA	0.405	B	0.0020	Yes - Detected in Tissue and Surface Water	206
Raleigh Creek - other	RC18A-CRAY-01-092120	9/21/2020	72629-94-8	PFTrDA	0.458	B	0.0020	Yes - Detected in Tissue and Surface Water	233
Raleigh Creek - other	RC21B-CRAY-01-092120	9/21/2020	72629-94-8	PFTrDA	0.25	BJ	0.0020	Yes - Detected in Tissue and Surface Water	127
Raleigh Creek - other	RC21-CRAY-ONE-01-092120	9/21/2020	72629-94-8	PFTrDA	0.658	B	0.0020	Yes - Detected in Tissue and Surface Water	335
Raleigh Creek - other	RC21-CRAY-THREE-01-092120	9/21/2020	72629-94-8	PFTrDA	0.209	BJ	0.0020	Yes - Detected in Tissue and Surface Water	106
Raleigh Creek - other	RC14-CRAY-01-092120	9/21/2020	72629-94-8	PFTrDA	0.298	BJ	0.0020	Yes - Detected in Tissue and Surface Water	152
Raleigh Creek - upper	RC3A-CRAY-01-092020	9/20/2020	27619-97-2	6:2 FTS	0.361	U	0.0058	No - ND in Crayfish Tissue	NC
Raleigh Creek - upper	RC23-CRAY-FOUR-01-092420	9/24/2020	27619-97-2	6:2 FTS	0.355	U	0.0058	No - ND in Crayfish Tissue	NC
Raleigh Creek - upper	RC23-CRAY-COMP-01-092520	9/25/2020	27619-97-2	6:2 FTS	0.359	U	0.0058	No - ND in Crayfish Tissue	NC
Raleigh Creek - upper	RC23-CRAY-ONE-01-092520	9/25/2020	27619-97-2	6:2 FTS	0.353	U	0.0058	No - ND in Crayfish Tissue	NC
Raleigh Creek - upper	RC23-CRAY-THREE-01-092520	9/25/2020	27619-97-2	6:2 FTS	0.35	U	0.0058	No - ND in Crayfish Tissue	NC
Raleigh Creek - upper	RC23-CRAY-TWO-01-092520	9/25/2020	27619-97-2	6:2 FTS	0.343	U	0.0058	No - ND in Crayfish Tissue	NC
Raleigh Creek - upper	RC4A-CRAY-01-092520	9/25/2020	27619-97-2	6:2 FTS	0.343	U	0.0058	No - ND in Crayfish Tissue	NC
Raleigh Creek - upper	RC3A-CRAY-01-092020	9/20/2020	2991-50-6	N-EtFOSAA	3.27		0.020	Yes - Detected in Tissue and Surface Water	165
Raleigh Creek - upper	RC23-CRAY-FOUR-01-092420	9/24/2020	2991-50-6	N-EtFOSAA	1.41		0.020	Yes - Detected in Tissue and Surface Water	71
Raleigh Creek - upper	RC23-CRAY-COMP-01-092520	9/25/2020	2991-50-6	N-EtFOSAA	1.5		0.020	Yes - Detected in Tissue and Surface Water	76
Raleigh Creek - upper	RC23-CRAY-ONE-01-092520	9/25/2020	2991-50-6	N-EtFOSAA	1.95		0.020	Yes - Detected in Tissue and Surface Water	99
Raleigh Creek - upper	RC23-CRAY-THREE-01-092520	9/25/2020	2991-50-6	N-EtFOSAA	1.75		0.020	Yes - Detected in Tissue and Surface Water	89
Raleigh Creek - upper	RC23-CRAY-TWO-01-092520	9/25/2020	2991-50-6	N-EtFOSAA	2.07		0.020	Yes - Detected in Tissue and Surface Water	105
Raleigh Creek - upper	RC4A-CRAY-01-092520	9/25/2020	2991-50-6	N-EtFOSAA	5.4		0.020	Yes - Detected in Tissue and Surface Water	273
Raleigh Creek - upper	RC23-CRAY-TWO-01-092520	9/25/2020	1691-99-2	N-EtFOSE	0.712	UJ	0.0014	No - ND in Crayfish Tissue	NC
Raleigh Creek - upper	RC23-CRAY-FOUR-01-092420	9/24/2020	2355-31-9	N-MeFOSAA	0.0985	U	0.00060	No - ND in Crayfish Tissue	NC
Raleigh Creek - upper	RC3A-CRAY-01-092020	9/20/2020	2355-31-9	N-MeFOSAA	0.1	U	0.00060	No - ND in Crayfish Tissue	NC
Raleigh Creek - upper	RC23-CRAY-COMP-01-092520	9/25/2020	2355-31-9	N-MeFOSAA	0.0995	U	0.00060	No - ND in Crayfish Tissue	NC
Raleigh Creek - upper	RC23-CRAY-ONE-01-092520	9/25/2020	2355-31-9	N-MeFOSAA	0.098	U	0.00060	No - ND in Crayfish Tissue	NC
Raleigh Creek - upper	RC23-CRAY-THREE-01-092520	9/25/2020	2355-31-9	N-MeFOSAA	0.0971	U	0.00060	No - ND in Crayfish Tissue	NC
Raleigh Creek - upper	RC23-CRAY-TWO-01-092520	9/25/2020	2355-31-9	N-MeFOSAA	0.0952	U	0.00060	No - ND in Crayfish Tissue	NC
Raleigh Creek - upper	RC4A-CRAY-01-092520	9/25/2020	2355-31-9	N-MeFOSAA	0.194	J	0.00060	Yes - Detected in Tissue and Surface Water	321
Raleigh Creek - upper	RC3A-CRAY-01-092020	9/20/2020	375-22-4	PFBA	3.14	B	0.35	Yes - Detected in Tissue and Surface Water	8.9
Raleigh Creek - upper	RC23-CRAY-FOUR-01-092420	9/24/2020	375-22-4	PFBA	5.73	B	0.35	Yes - Detected in Tissue and Surface Water	16
Raleigh Creek - upper	RC23-CRAY-COMP-01-092520	9/25/2020	375-22-4	PFBA	7.21		0.35	Yes - Detected in Tissue and Surface Water	20
Raleigh Creek - upper	RC23-CRAY-ONE-01-092520	9/25/2020	375-22-4	PFBA	5.68	B	0.35	Yes - Detected in Tissue and Surface Water	16
Raleigh Creek - upper	RC23-CRAY-THREE-01-092520	9/25/2020	375-22-4	PFBA	4.2	B	0.35	Yes - Detected in Tissue and Surface Water	12
Raleigh Creek - upper	RC23-CRAY-TWO-01-092520	9/25/2020	375-22-4	PFBA	4.3	B	0.35	Yes - Detected in Tissue and Surface Water	12
Raleigh Creek - upper	RC4A-CRAY-01-092520	9/25/2020	375-22-4	PFBA	5.32	B	0.35	Yes - Detected in Tissue and Surface Water	15

Appendix E Table 2
Calculation of Crayfish Tissue - Total Surface Water Bioaccumulation Factors
Project 1007
Minneapolis, Minnesota

	Crayfish Tissue Samples (a)								
Area	Sample Name	Sample Date	CAS	Analyte	Detected Tissue Concentration (ug/kg)	Qualifier	Surface Water Geomean (ug/L) (b)	Decision to Calculate BAF?	Calculation of Crayfish to Surface Water BAF (CR/SW) (c)
Raleigh Creek - upper	RC3A-CRAY-01-092020	9/20/2020	375-73-5	PFBS	0.951		0.019	Yes - Detected in Tissue and Surface Water	50
Raleigh Creek - upper	RC23-CRAY-FOUR-01-092420	9/24/2020	375-73-5	PFBS	0.421		0.019	Yes - Detected in Tissue and Surface Water	22
Raleigh Creek - upper	RC23-CRAY-COMP-01-092520	9/25/2020	375-73-5	PFBS	0.452		0.019	Yes - Detected in Tissue and Surface Water	24
Raleigh Creek - upper	RC23-CRAY-ONE-01-092520	9/25/2020	375-73-5	PFBS	0.703		0.019	Yes - Detected in Tissue and Surface Water	37
Raleigh Creek - upper	RC23-CRAY-THREE-01-092520	9/25/2020	375-73-5	PFBS	0.216	J	0.019	Yes - Detected in Tissue and Surface Water	11
Raleigh Creek - upper	RC23-CRAY-TWO-01-092520	9/25/2020	375-73-5	PFBS	0.189	J	0.019	Yes - Detected in Tissue and Surface Water	9.9
Raleigh Creek - upper	RC4A-CRAY-01-092520	9/25/2020	375-73-5	PFBS	1.63		0.019	Yes - Detected in Tissue and Surface Water	85
Raleigh Creek - upper	RC3A-CRAY-01-092020	9/20/2020	335-76-2	PFDA	0.159	J	0.0072	Yes - Detected in Tissue and Surface Water	22
Raleigh Creek - upper	RC23-CRAY-FOUR-01-092420	9/24/2020	335-76-2	PFDA	0.721		0.0072	Yes - Detected in Tissue and Surface Water	100
Raleigh Creek - upper	RC23-CRAY-COMP-01-092520	9/25/2020	335-76-2	PFDA	1.19		0.0072	Yes - Detected in Tissue and Surface Water	165
Raleigh Creek - upper	RC23-CRAY-ONE-01-092520	9/25/2020	335-76-2	PFDA	2.09		0.0072	Yes - Detected in Tissue and Surface Water	289
Raleigh Creek - upper	RC23-CRAY-THREE-01-092520	9/25/2020	335-76-2	PFDA	0.762		0.0072	Yes - Detected in Tissue and Surface Water	105
Raleigh Creek - upper	RC23-CRAY-TWO-01-092520	9/25/2020	335-76-2	PFDA	0.649		0.0072	Yes - Detected in Tissue and Surface Water	90
Raleigh Creek - upper	RC4A-CRAY-01-092520	9/25/2020	335-76-2	PFDA	0.959		0.0072	Yes - Detected in Tissue and Surface Water	133
Raleigh Creek - upper	RC3A-CRAY-01-092020	9/20/2020	307-55-1	PFDoA	1.25		0.00044	Yes - Detected in Tissue and Surface Water	2828
Raleigh Creek - upper	RC23-CRAY-FOUR-01-092420	9/24/2020	307-55-1	PFDoA	2.32		0.00044	Yes - Detected in Tissue and Surface Water	5249
Raleigh Creek - upper	RC23-CRAY-COMP-01-092520	9/25/2020	307-55-1	PFDoA	1.74		0.00044	Yes - Detected in Tissue and Surface Water	3937
Raleigh Creek - upper	RC23-CRAY-ONE-01-092520	9/25/2020	307-55-1	PFDoA	2.36		0.00044	Yes - Detected in Tissue and Surface Water	5339
Raleigh Creek - upper	RC23-CRAY-THREE-01-092520	9/25/2020	307-55-1	PFDoA	2.18		0.00044	Yes - Detected in Tissue and Surface Water	4932
Raleigh Creek - upper	RC23-CRAY-TWO-01-092520	9/25/2020	307-55-1	PFDoA	1.7		0.00044	Yes - Detected in Tissue and Surface Water	3846
Raleigh Creek - upper	RC4A-CRAY-01-092520	9/25/2020	307-55-1	PFDoA	2.07		0.00044	Yes - Detected in Tissue and Surface Water	4683
Raleigh Creek - upper	RC3A-CRAY-01-092020	9/20/2020	375-85-9	PFHpA	0.689		0.051	Yes - Detected in Tissue and Surface Water	14
Raleigh Creek - upper	RC23-CRAY-FOUR-01-092420	9/24/2020	375-85-9	PFHpA	1.6		0.051	Yes - Detected in Tissue and Surface Water	32
Raleigh Creek - upper	RC23-CRAY-COMP-01-092520	9/25/2020	375-85-9	PFHpA	1.73		0.051	Yes - Detected in Tissue and Surface Water	34
Raleigh Creek - upper	RC23-CRAY-ONE-01-092520	9/25/2020	375-85-9	PFHpA	1.67		0.051	Yes - Detected in Tissue and Surface Water	33
Raleigh Creek - upper	RC23-CRAY-THREE-01-092520	9/25/2020	375-85-9	PFHpA	0.78		0.051	Yes - Detected in Tissue and Surface Water	15
Raleigh Creek - upper	RC23-CRAY-TWO-01-092520	9/25/2020	375-85-9	PFHpA	1.21		0.051	Yes - Detected in Tissue and Surface Water	24
Raleigh Creek - upper	RC4A-CRAY-01-092520	9/25/2020	375-85-9	PFHpA	0.235	J+	0.051	Yes - Detected in Tissue and Surface Water	4.6
Raleigh Creek - upper	RC3A-CRAY-01-092020	9/20/2020	375-92-8	PFHpS	0.11	J	0.022	Yes - Detected in Tissue and Surface Water	5.0
Raleigh Creek - upper	RC23-CRAY-FOUR-01-092420	9/24/2020	375-92-8	PFHpS	0.235	J	0.022	Yes - Detected in Tissue and Surface Water	11
Raleigh Creek - upper	RC23-CRAY-COMP-01-092520	9/25/2020	375-92-8	PFHpS	0.389	J	0.022	Yes - Detected in Tissue and Surface Water	18
Raleigh Creek - upper	RC23-CRAY-ONE-01-092520	9/25/2020	375-92-8	PFHpS	0.32	J	0.022	Yes - Detected in Tissue and Surface Water	14
Raleigh Creek - upper	RC23-CRAY-THREE-01-092520	9/25/2020	375-92-8	PFHpS	0.196	J	0.022	Yes - Detected in Tissue and Surface Water	8.9
Raleigh Creek - upper	RC23-CRAY-TWO-01-092520	9/25/2020	375-92-8	PFHpS	0.215	J	0.022	Yes - Detected in Tissue and Surface Water	9.7
Raleigh Creek - upper	RC4A-CRAY-01-092520	9/25/2020	375-92-8	PFHpS	0.569		0.022	Yes - Detected in Tissue and Surface Water	26
Raleigh Creek - upper	RC3A-CRAY-01-092020	9/20/2020	307-24-4	PFHxA	0.216	J	0.063	Yes - Detected in Tissue and Surface Water	3.4
Raleigh Creek - upper	RC23-CRAY-FOUR-01-092420	9/24/2020	307-24-4	PFHxA	0.4		0.063	Yes - Detected in Tissue and Surface Water	6.4
Raleigh Creek - upper	RC23-CRAY-COMP-01-092520	9/25/2020	307-24-4	PFHxA	0.642		0.063	Yes - Detected in Tissue and Surface Water	10
Raleigh Creek - upper	RC23-CRAY-ONE-01-092520	9/25/2020	307-24-4	PFHxA	0.424		0.063	Yes - Detected in Tissue and Surface Water	6.8
Raleigh Creek - upper	RC23-CRAY-THREE-01-092520	9/25/2020	307-24-4	PFHxA	0.221	J	0.063	Yes - Detected in Tissue and Surface Water	3.5
Raleigh Creek - upper	RC23-CRAY-TWO-01-092520	9/25/2020	307-24-4	PFHxA	0.25	J	0.063	Yes - Detected in Tissue and Surface Water	4.0
Raleigh Creek - upper	RC4A-CRAY-01-092520	9/25/2020	307-24-4	PFHxA	0.595		0.063	Yes - Detected in Tissue and Surface Water	9.5
Raleigh Creek - upper	RC3A-CRAY-01-092020	9/20/2020	355-46-4	PFHxS	0.53		0.055	Yes - Detected in Tissue and Surface Water	9.6
Raleigh Creek - upper	RC23-CRAY-FOUR-01-092420	9/24/2020	355-46-4	PFHxS	0.984		0.055	Yes - Detected in Tissue and Surface Water	18
Raleigh Creek - upper	RC23-CRAY-COMP-01-092520	9/25/2020	355-46-4	PFHxS	1.51		0.055	Yes - Detected in Tissue and Surface Water	27
Raleigh Creek - upper	RC23-CRAY-ONE-01-092520	9/25/2020	355-46-4	PFHxS	1.77		0.055	Yes - Detected in Tissue and Surface Water	32
Raleigh Creek - upper	RC23-CRAY-THREE-01-092520	9/25/2020	355-46-4	PFHxS	0.683		0.055	Yes - Detected in Tissue and Surface Water	12
Raleigh Creek - upper	RC23-CRAY-TWO-01-092520	9/25/2020	355-46-4	PFHxS	0.847		0.055	Yes - Detected in Tissue and Surface Water	15
Raleigh Creek - upper	RC4A-CRAY-01-092520	9/25/2020	355-46-4	PFHxS	3.12		0.055	Yes - Detected in Tissue and Surface Water	57
Raleigh Creek - upper	RC3A-CRAY-01-092020	9/20/2020	375-95-1	PFNA	0.1	U	0.0048	No - ND in Crayfish Tissue	NC
Raleigh Creek - upper	RC23-CRAY-FOUR-01-092420	9/24/2020	375-95-1	PFNA	0.118	J	0.0048	Yes - Detected in Tissue and Surface Water	25
Raleigh Creek - upper	RC23-CRAY-COMP-01-092520	9/25/2020	375-95-1	PFNA	0.104	J	0.0048	Yes - Detected in Tissue and Surface Water	22
Raleigh Creek - upper	RC23-CRAY-ONE-01-092520	9/25/2020	375-95-1	PFNA	0.098	U	0.0048	No - ND in Crayfish Tissue	NC
Raleigh Creek - upper	RC23-CRAY-THREE-01-092520	9/25/2020	375-95-1	PFNA	0.0971	U	0.0048	No - ND in Crayfish Tissue	NC
Raleigh Creek - upper	RC23-CRAY-TWO-01-092520	9/25/2020	375-95-1	PFNA	0.1	J	0.0048	Yes - Detected in Tissue and Surface Water	21
Raleigh Creek - upper	RC4A-CRAY-01-092520	9/25/2020	375-95-1	PFNA	0.0952	U	0.0048	No - ND in Crayfish Tissue	NC
Raleigh Creek - upper	RC3A-CRAY-01-092020	9/20/2020	335-67-1	PFOA	1.38		0.44	Yes - Detected in Tissue and Surface Water	3.2
Raleigh Creek - upper	RC23-CRAY-FOUR-01-092420	9/24/2020	335-67-1	PFOA	11.5		0.44	Yes - Detected in Tissue and Surface Water	26
Raleigh Creek - upper	RC23-CRAY-COMP-01-092520	9/25/2020	335-67-1	PFOA	13.4		0.44	Yes - Detected in Tissue and Surface Water	31
Raleigh Creek - upper	RC23-CRAY-ONE-01-092520	9/25/2020	335-67-1	PFOA	12.1		0.44	Yes - Detected in Tissue and Surface Water	28
Raleigh Creek - upper	RC23-CRAY-THREE-01-092520	9/25/2020	335-67-1	PFOA	7.76		0.44	Yes - Detected in Tissue and Surface Water	18
Raleigh Creek - upper	RC23-CRAY-TWO-01-092520	9/25/2020	335-67-1	PFOA	7.31		0.44	Yes - Detected in Tissue and Surface Water	17
Raleigh Creek - upper	RC4A-CRAY-01-092520	9/25/2020	335-67-1	PFOA	8.86		0.44	Yes - Detected in Tissue and Surface Water	20

Appendix E Table 2
Calculation of Crayfish Tissue - Total Surface Water Bioaccumulation Factors
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	Crayfish Tissue Samples (a)								
Area	Sample Name	Sample Date	CAS	Analyte	Detected Tissue Concentration (ug/kg)	Qualifier	Surface Water Geomean (ug/L) (b)	Decision to Calculate BAF?	Calculation of Crayfish to Surface Water BAF (CR/SW) (c)
Raleigh Creek - upper	RC23-CRAY-FOUR-01-092420	9/24/2020	1763-23-1	PFOS	57.2		1.48	Yes - Detected in Tissue and Surface Water	39
Raleigh Creek - upper	RC3A-CRAY-01-092020	9/20/2020	1763-23-1	PFOS	26.2		1.48	Yes - Detected in Tissue and Surface Water	18
Raleigh Creek - upper	RC23-CRAY-COMP-01-092520	9/25/2020	1763-23-1	PFOS	92.6		1.48	Yes - Detected in Tissue and Surface Water	63
Raleigh Creek - upper	RC23-CRAY-ONE-01-092520	9/25/2020	1763-23-1	PFOS	88.9		1.48	Yes - Detected in Tissue and Surface Water	60
Raleigh Creek - upper	RC23-CRAY-THREE-01-092520	9/25/2020	1763-23-1	PFOS	67.4		1.48	Yes - Detected in Tissue and Surface Water	46
Raleigh Creek - upper	RC23-CRAY-TWO-01-092520	9/25/2020	1763-23-1	PFOS	61.7		1.48	Yes - Detected in Tissue and Surface Water	42
Raleigh Creek - upper	RC4A-CRAY-01-092520	9/25/2020	1763-23-1	PFOS	153		1.48	Yes - Detected in Tissue and Surface Water	103
Raleigh Creek - upper	RC3A-CRAY-01-092020	9/20/2020	754-91-6	PFOSA	104		0.021	Yes - Detected in Tissue and Surface Water	4940
Raleigh Creek - upper	RC23-CRAY-FOUR-01-092420	9/24/2020	754-91-6	PFOSA	87.4		0.021	Yes - Detected in Tissue and Surface Water	4151
Raleigh Creek - upper	RC23-CRAY-COMP-01-092520	9/25/2020	754-91-6	PFOSA	70.6		0.021	Yes - Detected in Tissue and Surface Water	3353
Raleigh Creek - upper	RC23-CRAY-ONE-01-092520	9/25/2020	754-91-6	PFOSA	73.5		0.021	Yes - Detected in Tissue and Surface Water	3491
Raleigh Creek - upper	RC23-CRAY-THREE-01-092520	9/25/2020	754-91-6	PFOSA	105		0.021	Yes - Detected in Tissue and Surface Water	4987
Raleigh Creek - upper	RC23-CRAY-TWO-01-092520	9/25/2020	754-91-6	PFOSA	75.6		0.021	Yes - Detected in Tissue and Surface Water	3591
Raleigh Creek - upper	RC4A-CRAY-01-092520	9/25/2020	754-91-6	PFOSA	56.5		0.021	Yes - Detected in Tissue and Surface Water	2684
Raleigh Creek - upper	RC3A-CRAY-01-092020	9/20/2020	2706-90-3	PFPeA	0.2	U	0.031	No - ND in Crayfish Tissue	NC
Raleigh Creek - upper	RC23-CRAY-FOUR-01-092420	9/24/2020	2706-90-3	PFPeA	0.276	J	0.031	Yes - Detected in Tissue and Surface Water	9.0
Raleigh Creek - upper	RC23-CRAY-COMP-01-092520	9/25/2020	2706-90-3	PFPeA	0.324	J	0.031	Yes - Detected in Tissue and Surface Water	11
Raleigh Creek - upper	RC23-CRAY-ONE-01-092520	9/25/2020	2706-90-3	PFPeA	0.277	J	0.031	Yes - Detected in Tissue and Surface Water	9.0
Raleigh Creek - upper	RC23-CRAY-THREE-01-092520	9/25/2020	2706-90-3	PFPeA	0.194	U	0.031	No - ND in Crayfish Tissue	NC
Raleigh Creek - upper	RC23-CRAY-TWO-01-092520	9/25/2020	2706-90-3	PFPeA	0.19	U	0.031	No - ND in Crayfish Tissue	NC
Raleigh Creek - upper	RC4A-CRAY-01-092520	9/25/2020	2706-90-3	PFPeA	0.301	J	0.031	Yes - Detected in Tissue and Surface Water	9.8
Raleigh Creek - upper	RC3A-CRAY-01-092020	9/20/2020	2706-91-4	PFPeS	1.08		0.021	Yes - Detected in Tissue and Surface Water	52
Raleigh Creek - upper	RC23-CRAY-FOUR-01-092420	9/24/2020	2706-91-4	PFPeS	0.753		0.021	Yes - Detected in Tissue and Surface Water	37
Raleigh Creek - upper	RC23-CRAY-COMP-01-092520	9/25/2020	2706-91-4	PFPeS	0.846		0.021	Yes - Detected in Tissue and Surface Water	41
Raleigh Creek - upper	RC23-CRAY-ONE-01-092520	9/25/2020	2706-91-4	PFPeS	1.26		0.021	Yes - Detected in Tissue and Surface Water	61
Raleigh Creek - upper	RC23-CRAY-THREE-01-092520	9/25/2020	2706-91-4	PFPeS	0.488		0.021	Yes - Detected in Tissue and Surface Water	24
Raleigh Creek - upper	RC23-CRAY-TWO-01-092520	9/25/2020	2706-91-4	PFPeS	0.422		0.021	Yes - Detected in Tissue and Surface Water	20
Raleigh Creek - upper	RC4A-CRAY-01-092520	9/25/2020	2706-91-4	PFPeS	0.0957	U	0.021	No - ND in Crayfish Tissue	NC
Raleigh Creek - upper	RC3A-CRAY-01-092020	9/20/2020	376-06-7	PFTeDA	0.623		ND	No - ND in Surface Water	NC
Raleigh Creek - upper	RC23-CRAY-FOUR-01-092420	9/24/2020	376-06-7	PFTeDA	0.193	J	ND	No - ND in Surface Water	NC
Raleigh Creek - upper	RC23-CRAY-COMP-01-092520	9/25/2020	376-06-7	PFTeDA	0.16	J	ND	No - ND in Surface Water	NC
Raleigh Creek - upper	RC23-CRAY-ONE-01-092520	9/25/2020	376-06-7	PFTeDA	0.323	J	ND	No - ND in Surface Water	NC
Raleigh Creek - upper	RC23-CRAY-THREE-01-092520	9/25/2020	376-06-7	PFTeDA	0.132	J	ND	No - ND in Surface Water	NC
Raleigh Creek - upper	RC23-CRAY-TWO-01-092520	9/25/2020	376-06-7	PFTeDA	0.097	J	ND	No - ND in Surface Water	NC
Raleigh Creek - upper	RC4A-CRAY-01-092520	9/25/2020	376-06-7	PFTeDA	0.813		ND	No - ND in Surface Water	NC
Raleigh Creek - upper	RC3A-CRAY-01-092020	9/20/2020	72629-94-8	PFTrDA	0.805	B	0.0021	Yes - Detected in Tissue and Surface Water	383
Raleigh Creek - upper	RC23-CRAY-FOUR-01-092420	9/24/2020	72629-94-8	PFTrDA	0.306	BJ	0.0021	Yes - Detected in Tissue and Surface Water	146
Raleigh Creek - upper	RC23-CRAY-COMP-01-092520	9/25/2020	72629-94-8	PFTrDA	0.204	BJ	0.0021	Yes - Detected in Tissue and Surface Water	97
Raleigh Creek - upper	RC23-CRAY-ONE-01-092520	9/25/2020	72629-94-8	PFTrDA	0.578	B	0.0021	Yes - Detected in Tissue and Surface Water	275
Raleigh Creek - upper	RC23-CRAY-THREE-01-092520	9/25/2020	72629-94-8	PFTrDA	0.272	BJ	0.0021	Yes - Detected in Tissue and Surface Water	130
Raleigh Creek - upper	RC23-CRAY-TWO-01-092520	9/25/2020	72629-94-8	PFTrDA	0.141	BJ	0.0021	Yes - Detected in Tissue and Surface Water	67
Raleigh Creek - upper	RC4A-CRAY-01-092520	9/25/2020	72629-94-8	PFTrDA	1.02	B	0.0021	Yes - Detected in Tissue and Surface Water	486
Raleigh Creek - upper	RC23-CRAY-FOUR-01-092420	9/24/2020	2058-94-8	PFUnA	1.27		0.00051	Yes - Detected in Tissue and Surface Water	2502
Raleigh Creek - upper	RC3A-CRAY-01-092020	9/20/2020	2058-94-8	PFUnA	0.233	BJ	0.00051	Yes - Detected in Tissue and Surface Water	459
Raleigh Creek - upper	RC23-CRAY-COMP-01-092520	9/25/2020	2058-94-8	PFUnA	1.18	B	0.00051	Yes - Detected in Tissue and Surface Water	2325
Raleigh Creek - upper	RC23-CRAY-ONE-01-092520	9/25/2020	2058-94-8	PFUnA	1.84		0.00051	Yes - Detected in Tissue and Surface Water	3625
Raleigh Creek - upper	RC23-CRAY-THREE-01-092520	9/25/2020	2058-94-8	PFUnA	1.38		0.00051	Yes - Detected in Tissue and Surface Water	2719
Raleigh Creek - upper	RC23-CRAY-TWO-01-092520	9/25/2020	2058-94-8	PFUnA	0.94	B	0.00051	Yes - Detected in Tissue and Surface Water	1852
Raleigh Creek - upper	RC4A-CRAY-01-092520	9/25/2020	2058-94-8	PFUnA	0.386	B	0.00051	Yes - Detected in Tissue and Surface Water	760
West Lakeland	WL5-CRAY-01-091720	9/17/2020	27619-97-2	6:2 FTS	0.352	U	0.012	No - ND in Crayfish Tissue	NC
West Lakeland	WL6-CRAY-01-092320	9/23/2020	27619-97-2	6:2 FTS	0.348	U	0.012	No - ND in Crayfish Tissue	NC
West Lakeland	WL7-CRAY-FOUR-01-092320	9/23/2020	27619-97-2	6:2 FTS	0.34	U	0.012	No - ND in Crayfish Tissue	NC
West Lakeland	WL7-CRAY-ONE-01-092320	9/23/2020	27619-97-2	6:2 FTS	0.348	U	0.012	No - ND in Crayfish Tissue	NC
West Lakeland	WL7-CRAY-THREE-01-092320	9/23/2020	27619-97-2	6:2 FTS	0.359	U	0.012	No - ND in Crayfish Tissue	NC
West Lakeland	WL7-CRAY-TWO-01-092320	9/23/2020	27619-97-2	6:2 FTS	0.632	J	0.012	Yes - Detected in Tissue and Surface Water	52
West Lakeland	WL8A-CRAY-01-092120	9/21/2020	27619-97-2	6:2 FTS	0.345	U	0.012	No - ND in Crayfish Tissue	NC
West Lakeland	WL14-CRAY-01-092320	9/23/2020	27619-97-2	6:2 FTS	0.784	U	0.012	No - ND in Crayfish Tissue	NC
West Lakeland	WL10-CRAY-ONE-01-092120	9/21/2020	27619-97-2	6:2 FTS	0.355	U	0.012	No - ND in Crayfish Tissue	NC
West Lakeland	WL10-CRAY-THREE-01-092120	9/21/2020	27619-97-2	6:2 FTS	0.361	U	0.012	No - ND in Crayfish Tissue	NC
West Lakeland	WL10-CRAY-TWO-01-092120	9/21/2020	27619-97-2	6:2 FTS	0.357	U	0.012	No - ND in Crayfish Tissue	NC
West Lakeland	WL11-CRAY-01-092120	9/21/2020	27619-97-2	6:2 FTS	0.348	U	0.012	No - ND in Crayfish Tissue	NC
West Lakeland	WL15A-CRAY-EATEN-01-091620	9/16/2020	27619-97-2	6:2 FTS	0.399	J	0.012	Yes - Detected in Tissue and Surface Water	33

Appendix E Table 2
Calculation of Crayfish Tissue - Total Surface Water Bioaccumulation Factors
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Minneapolis, Minnesota

	Crayfish Tissue Samples (a)								
Area	Sample Name	Sample Date	CAS	Analyte	Detected Tissue Concentration (ug/kg)	Qualifier	Surface Water Geomean (ug/L) (b)	Decision to Calculate BAF?	Calculation of Crayfish to Surface Water BAF (CR/SW) (c)
West Lakeland	WL5-CRAY-01-091720	9/17/2020	2991-50-6	N-EtFOSAA	0.789		0.0011	Yes - Detected in Tissue and Surface Water	705
West Lakeland	WL6-CRAY-01-092320	9/23/2020	2991-50-6	N-EtFOSAA	0.0966	U	0.0011	No - ND in Crayfish Tissue	NC
West Lakeland	WL7-CRAY-FOUR-01-092320	9/23/2020	2991-50-6	N-EtFOSAA	0.148	J	0.0011	Yes - Detected in Tissue and Surface Water	132
West Lakeland	WL7-CRAY-ONE-01-092320	9/23/2020	2991-50-6	N-EtFOSAA	0.138	J	0.0011	Yes - Detected in Tissue and Surface Water	123
West Lakeland	WL7-CRAY-THREE-01-092320	9/23/2020	2991-50-6	N-EtFOSAA	0.36	J	0.0011	Yes - Detected in Tissue and Surface Water	322
West Lakeland	WL7-CRAY-TWO-01-092320	9/23/2020	2991-50-6	N-EtFOSAA	0.0985	U	0.0011	No - ND in Crayfish Tissue	NC
West Lakeland	WL8A-CRAY-01-092120	9/21/2020	2991-50-6	N-EtFOSAA	0.0957	U	0.0011	No - ND in Crayfish Tissue	NC
West Lakeland	WL14-CRAY-01-092320	9/23/2020	2991-50-6	N-EtFOSAA	0.298	J	0.0011	Yes - Detected in Tissue and Surface Water	266
West Lakeland	WL10-CRAY-ONE-01-092120	9/21/2020	2991-50-6	N-EtFOSAA	0.0985	U	0.0011	No - ND in Crayfish Tissue	NC
West Lakeland	WL10-CRAY-THREE-01-092120	9/21/2020	2991-50-6	N-EtFOSAA	0.1	U	0.0011	No - ND in Crayfish Tissue	NC
West Lakeland	WL10-CRAY-TWO-01-092120	9/21/2020	2991-50-6	N-EtFOSAA	0.099	U	0.0011	No - ND in Crayfish Tissue	NC
West Lakeland	WL11-CRAY-01-092120	9/21/2020	2991-50-6	N-EtFOSAA	0.163	J	0.0011	Yes - Detected in Tissue and Surface Water	146
West Lakeland	WL15A-CRAY-EATEN-01-091620	9/16/2020	2991-50-6	N-EtFOSAA	0.0966	U	0.0011	No - ND in Crayfish Tissue	NC
West Lakeland	WL14-CRAY-01-092320	9/23/2020	1691-99-2	N-EtFOSE	1.63	U	0.00026	No - ND in Crayfish Tissue	NC
West Lakeland	WL5-CRAY-01-091720	9/17/2020	375-22-4	PFBA	5.24	B	0.37	Yes - Detected in Tissue and Surface Water	14
West Lakeland	WL6-CRAY-01-092320	9/23/2020	375-22-4	PFBA	7.43		0.37	Yes - Detected in Tissue and Surface Water	20
West Lakeland	WL7-CRAY-FOUR-01-092320	9/23/2020	375-22-4	PFBA	4.19	B	0.37	Yes - Detected in Tissue and Surface Water	11
West Lakeland	WL7-CRAY-ONE-01-092320	9/23/2020	375-22-4	PFBA	6.05	B	0.37	Yes - Detected in Tissue and Surface Water	16
West Lakeland	WL7-CRAY-THREE-01-092320	9/23/2020	375-22-4	PFBA	11.7		0.37	Yes - Detected in Tissue and Surface Water	32
West Lakeland	WL8A-CRAY-01-092120	9/21/2020	375-22-4	PFBA	3.95	B	0.37	Yes - Detected in Tissue and Surface Water	11
West Lakeland	WL14-CRAY-01-092320	9/23/2020	375-22-4	PFBA	5.66		0.37	Yes - Detected in Tissue and Surface Water	15
West Lakeland	WL7-CRAY-TWO-01-092320	9/23/2020	375-22-4	PFBA	1.58	B	0.37	Yes - Detected in Tissue and Surface Water	4.3
West Lakeland	WL10-CRAY-ONE-01-092120	9/21/2020	375-22-4	PFBA	1.73	B	0.37	Yes - Detected in Tissue and Surface Water	4.7
West Lakeland	WL10-CRAY-THREE-01-092120	9/21/2020	375-22-4	PFBA	5.04	B	0.37	Yes - Detected in Tissue and Surface Water	14
West Lakeland	WL10-CRAY-TWO-01-092120	9/21/2020	375-22-4	PFBA	4.39	B	0.37	Yes - Detected in Tissue and Surface Water	12
West Lakeland	WL11-CRAY-01-092120	9/21/2020	375-22-4	PFBA	0.685	BJ	0.37	Yes - Detected in Tissue and Surface Water	1.9
West Lakeland	WL15A-CRAY-EATEN-01-091620	9/16/2020	375-22-4	PFBA	4.21		0.37	Yes - Detected in Tissue and Surface Water	11
West Lakeland	WL5-CRAY-01-091720	9/17/2020	375-73-5	PFBS	0.0976	U	0.0040	No - ND in Crayfish Tissue	NC
West Lakeland	WL6-CRAY-01-092320	9/23/2020	375-73-5	PFBS	0.0966	U	0.0040	No - ND in Crayfish Tissue	NC
West Lakeland	WL7-CRAY-FOUR-01-092320	9/23/2020	375-73-5	PFBS	0.0943	U	0.0040	No - ND in Crayfish Tissue	NC
West Lakeland	WL7-CRAY-ONE-01-092320	9/23/2020	375-73-5	PFBS	0.0966	U	0.0040	No - ND in Crayfish Tissue	NC
West Lakeland	WL7-CRAY-THREE-01-092320	9/23/2020	375-73-5	PFBS	0.0995	U	0.0040	No - ND in Crayfish Tissue	NC
West Lakeland	WL8A-CRAY-01-092120	9/21/2020	375-73-5	PFBS	0.0957	U	0.0040	No - ND in Crayfish Tissue	NC
West Lakeland	WL14-CRAY-01-092320	9/23/2020	375-73-5	PFBS	0.217	U	0.0040	No - ND in Crayfish Tissue	NC
West Lakeland	WL7-CRAY-TWO-01-092320	9/23/2020	375-73-5	PFBS	0.0985	U	0.0040	No - ND in Crayfish Tissue	NC
West Lakeland	WL10-CRAY-ONE-01-092120	9/21/2020	375-73-5	PFBS	0.0985	U	0.0040	No - ND in Crayfish Tissue	NC
West Lakeland	WL10-CRAY-THREE-01-092120	9/21/2020	375-73-5	PFBS	0.1	U	0.0040	No - ND in Crayfish Tissue	NC
West Lakeland	WL10-CRAY-TWO-01-092120	9/21/2020	375-73-5	PFBS	0.099	U	0.0040	No - ND in Crayfish Tissue	NC
West Lakeland	WL11-CRAY-01-092120	9/21/2020	375-73-5	PFBS	0.0966	U	0.0040	No - ND in Crayfish Tissue	NC
West Lakeland	WL15A-CRAY-EATEN-01-091620	9/16/2020	375-73-5	PFBS	0.0966	U	0.0040	No - ND in Crayfish Tissue	NC
West Lakeland	WL5-CRAY-01-091720	9/17/2020	335-76-2	PFDA	1.66		0.0013	Yes - Detected in Tissue and Surface Water	1314
West Lakeland	WL6-CRAY-01-092320	9/23/2020	335-76-2	PFDA	1.63		0.0013	Yes - Detected in Tissue and Surface Water	1290
West Lakeland	WL7-CRAY-FOUR-01-092320	9/23/2020	335-76-2	PFDA	1.5		0.0013	Yes - Detected in Tissue and Surface Water	1187
West Lakeland	WL7-CRAY-ONE-01-092320	9/23/2020	335-76-2	PFDA	1.26		0.0013	Yes - Detected in Tissue and Surface Water	997
West Lakeland	WL7-CRAY-THREE-01-092320	9/23/2020	335-76-2	PFDA	0.72		0.0013	Yes - Detected in Tissue and Surface Water	570
West Lakeland	WL7-CRAY-TWO-01-092320	9/23/2020	335-76-2	PFDA	1.31		0.0013	Yes - Detected in Tissue and Surface Water	1037
West Lakeland	WL8A-CRAY-01-092120	9/21/2020	335-76-2	PFDA	1.31		0.0013	Yes - Detected in Tissue and Surface Water	1037
West Lakeland	WL14-CRAY-01-092320	9/23/2020	335-76-2	PFDA	0.827	J	0.0013	Yes - Detected in Tissue and Surface Water	655
West Lakeland	WL10-CRAY-ONE-01-092120	9/21/2020	335-76-2	PFDA	0.328	J	0.0013	Yes - Detected in Tissue and Surface Water	260
West Lakeland	WL10-CRAY-THREE-01-092120	9/21/2020	335-76-2	PFDA	0.438		0.0013	Yes - Detected in Tissue and Surface Water	347
West Lakeland	WL10-CRAY-TWO-01-092120	9/21/2020	335-76-2	PFDA	0.377	J	0.0013	Yes - Detected in Tissue and Surface Water	298
West Lakeland	WL11-CRAY-01-092120	9/21/2020	335-76-2	PFDA	0.746		0.0013	Yes - Detected in Tissue and Surface Water	591
West Lakeland	WL15A-CRAY-EATEN-01-091620	9/16/2020	335-76-2	PFDA	1.37		0.0013	Yes - Detected in Tissue and Surface Water	1084
West Lakeland	WL5-CRAY-01-091720	9/17/2020	375-85-9	PFHpA	0.0976	U	0.0076	No - ND in Crayfish Tissue	NC
West Lakeland	WL6-CRAY-01-092320	9/23/2020	375-85-9	PFHpA	0.129	J	0.0076	Yes - Detected in Tissue and Surface Water	17
West Lakeland	WL7-CRAY-FOUR-01-092320	9/23/2020	375-85-9	PFHpA	0.151	J	0.0076	Yes - Detected in Tissue and Surface Water	20
West Lakeland	WL7-CRAY-ONE-01-092320	9/23/2020	375-85-9	PFHpA	0.139	J	0.0076	Yes - Detected in Tissue and Surface Water	18
West Lakeland	WL7-CRAY-THREE-01-092320	9/23/2020	375-85-9	PFHpA	0.325	J	0.0076	Yes - Detected in Tissue and Surface Water	43
West Lakeland	WL8A-CRAY-01-092120	9/21/2020	375-85-9	PFHpA	0.0957	U	0.0076	No - ND in Crayfish Tissue	NC
West Lakeland	WL14-CRAY-01-092320	9/23/2020	375-85-9	PFHpA	0.331	J	0.0076	Yes - Detected in Tissue and Surface Water	44
West Lakeland	WL7-CRAY-TWO-01-092320	9/23/2020	375-85-9	PFHpA	0.0985	U	0.0076	No - ND in Crayfish Tissue	NC
West Lakeland	WL10-CRAY-ONE-01-092120	9/21/2020	375-85-9	PFHpA	0.21	J	0.0076	Yes - Detected in Tissue and Surface Water	28
West Lakeland	WL10-CRAY-THREE-01-092120	9/21/2020	375-85-9	PFHpA	0.321	J	0.0076	Yes - Detected in Tissue and Surface Water	42
West Lakeland	WL10-CRAY-TWO-01-092120	9/21/2020	375-85-9	PFHpA	0.187	J	0.0076	Yes - Detected in Tissue and Surface Water	25
West Lakeland	WL11-CRAY-01-092120	9/21/2020	375-85-9	PFHpA	0.245	J	0.0076	Yes - Detected in Tissue and Surface Water	32
West Lakeland	WL15A-CRAY-EATEN-01-091620	9/16/2020	375-85-9	PFHpA	0.108	J	0.0076	Yes - Detected in Tissue and Surface Water	14

Appendix E Table 2
Calculation of Crayfish Tissue - Total Surface Water Bioaccumulation Factors
Project 1007
Minneapolis, Minnesota

	Crayfish Tissue Samples (a)								
Area	Sample Name	Sample Date	CAS	Analyte	Detected Tissue Concentration (ug/kg)	Qualifier	Surface Water Geomean (ug/L) (b)	Decision to Calculate BAF?	Calculation of Crayfish to Surface Water BAF (CR/SW) (c)
West Lakeland	WL5-CRAY-01-091720	9/17/2020	375-92-8	PFHpS	0.0976	U	0.0018	No - ND in Crayfish Tissue	NC
West Lakeland	WL6-CRAY-01-092320	9/23/2020	375-92-8	PFHpS	0.133	J	0.0018	Yes - Detected in Tissue and Surface Water	76
West Lakeland	WL7-CRAY-FOUR-01-092320	9/23/2020	375-92-8	PFHpS	0.0943	U	0.0018	No - ND in Crayfish Tissue	NC
West Lakeland	WL7-CRAY-ONE-01-092320	9/23/2020	375-92-8	PFHpS	0.0966	U	0.0018	No - ND in Crayfish Tissue	NC
West Lakeland	WL7-CRAY-THREE-01-092320	9/23/2020	375-92-8	PFHpS	0.0995	U	0.0018	No - ND in Crayfish Tissue	NC
West Lakeland	WL8A-CRAY-01-092120	9/21/2020	375-92-8	PFHpS	0.11	J	0.0018	Yes - Detected in Tissue and Surface Water	63
West Lakeland	WL14-CRAY-01-092320	9/23/2020	375-92-8	PFHpS	0.217	U	0.0018	No - ND in Crayfish Tissue	NC
West Lakeland	WL7-CRAY-TWO-01-092320	9/23/2020	375-92-8	PFHpS	0.11	J	0.0018	Yes - Detected in Tissue and Surface Water	63
West Lakeland	WL10-CRAY-ONE-01-092120	9/21/2020	375-92-8	PFHpS	0.0985	U	0.0018	No - ND in Crayfish Tissue	NC
West Lakeland	WL10-CRAY-THREE-01-092120	9/21/2020	375-92-8	PFHpS	0.1	U	0.0018	No - ND in Crayfish Tissue	NC
West Lakeland	WL10-CRAY-TWO-01-092120	9/21/2020	375-92-8	PFHpS	0.099	U	0.0018	No - ND in Crayfish Tissue	NC
West Lakeland	WL11-CRAY-01-092120	9/21/2020	375-92-8	PFHpS	0.0966	U	0.0018	No - ND in Crayfish Tissue	NC
West Lakeland	WL15A-CRAY-EATEN-01-091620	9/16/2020	375-92-8	PFHpS	0.111	J	0.0018	Yes - Detected in Tissue and Surface Water	63
West Lakeland	WL5-CRAY-01-091720	9/17/2020	307-24-4	PFHxA	0.0976	U	0.013	No - ND in Crayfish Tissue	NC
West Lakeland	WL6-CRAY-01-092320	9/23/2020	307-24-4	PFHxA	0.0966	U	0.013	No - ND in Crayfish Tissue	NC
West Lakeland	WL7-CRAY-FOUR-01-092320	9/23/2020	307-24-4	PFHxA	0.0943	U	0.013	No - ND in Crayfish Tissue	NC
West Lakeland	WL7-CRAY-ONE-01-092320	9/23/2020	307-24-4	PFHxA	0.0966	U	0.013	No - ND in Crayfish Tissue	NC
West Lakeland	WL7-CRAY-THREE-01-092320	9/23/2020	307-24-4	PFHxA	0.0995	U	0.013	No - ND in Crayfish Tissue	NC
West Lakeland	WL7-CRAY-TWO-01-092320	9/23/2020	307-24-4	PFHxA	0.0985	U	0.013	No - ND in Crayfish Tissue	NC
West Lakeland	WL8A-CRAY-01-092120	9/21/2020	307-24-4	PFHxA	0.0957	U	0.013	No - ND in Crayfish Tissue	NC
West Lakeland	WL14-CRAY-01-092320	9/23/2020	307-24-4	PFHxA	0.217	U	0.013	No - ND in Crayfish Tissue	NC
West Lakeland	WL10-CRAY-ONE-01-092120	9/21/2020	307-24-4	PFHxA	0.0985	U	0.013	No - ND in Crayfish Tissue	NC
West Lakeland	WL10-CRAY-THREE-01-092120	9/21/2020	307-24-4	PFHxA	0.1	U	0.013	No - ND in Crayfish Tissue	NC
West Lakeland	WL10-CRAY-TWO-01-092120	9/21/2020	307-24-4	PFHxA	0.099	U	0.013	No - ND in Crayfish Tissue	NC
West Lakeland	WL11-CRAY-01-092120	9/21/2020	307-24-4	PFHxA	0.0966	U	0.013	No - ND in Crayfish Tissue	NC
West Lakeland	WL15A-CRAY-EATEN-01-091620	9/16/2020	307-24-4	PFHxA	0.0966	U	0.013	No - ND in Crayfish Tissue	NC
West Lakeland	WL5-CRAY-01-091720	9/17/2020	355-46-4	PFHxS	0.196	J	0.0091	Yes - Detected in Tissue and Surface Water	22
West Lakeland	WL6-CRAY-01-092320	9/23/2020	355-46-4	PFHxS	0.299	J	0.0091	Yes - Detected in Tissue and Surface Water	33
West Lakeland	WL7-CRAY-FOUR-01-092320	9/23/2020	355-46-4	PFHxS	0.204	J	0.0091	Yes - Detected in Tissue and Surface Water	22
West Lakeland	WL7-CRAY-ONE-01-092320	9/23/2020	355-46-4	PFHxS	0.272	J	0.0091	Yes - Detected in Tissue and Surface Water	30
West Lakeland	WL7-CRAY-THREE-01-092320	9/23/2020	355-46-4	PFHxS	0.144	J	0.0091	Yes - Detected in Tissue and Surface Water	16
West Lakeland	WL8A-CRAY-01-092120	9/21/2020	355-46-4	PFHxS	0.433		0.0091	Yes - Detected in Tissue and Surface Water	48
West Lakeland	WL14-CRAY-01-092320	9/23/2020	355-46-4	PFHxS	0.266	J	0.0091	Yes - Detected in Tissue and Surface Water	29
West Lakeland	WL7-CRAY-TWO-01-092320	9/23/2020	355-46-4	PFHxS	0.221	J	0.0091	Yes - Detected in Tissue and Surface Water	24
West Lakeland	WL10-CRAY-ONE-01-092120	9/21/2020	355-46-4	PFHxS	0.0985	U	0.0091	No - ND in Crayfish Tissue	NC
West Lakeland	WL10-CRAY-THREE-01-092120	9/21/2020	355-46-4	PFHxS	0.144	J	0.0091	Yes - Detected in Tissue and Surface Water	16
West Lakeland	WL10-CRAY-TWO-01-092120	9/21/2020	355-46-4	PFHxS	0.155	J	0.0091	Yes - Detected in Tissue and Surface Water	17
West Lakeland	WL11-CRAY-01-092120	9/21/2020	355-46-4	PFHxS	0.197	J	0.0091	Yes - Detected in Tissue and Surface Water	22
West Lakeland	WL15A-CRAY-EATEN-01-091620	9/16/2020	355-46-4	PFHxS	0.204	J	0.0091	Yes - Detected in Tissue and Surface Water	22
West Lakeland	WL5-CRAY-01-091720	9/17/2020	375-95-1	PFNA	0.196	J	0.0011	Yes - Detected in Tissue and Surface Water	173
West Lakeland	WL6-CRAY-01-092320	9/23/2020	375-95-1	PFNA	0.351	J	0.0011	Yes - Detected in Tissue and Surface Water	310
West Lakeland	WL7-CRAY-FOUR-01-092320	9/23/2020	375-95-1	PFNA	0.248	J	0.0011	Yes - Detected in Tissue and Surface Water	219
West Lakeland	WL7-CRAY-ONE-01-092320	9/23/2020	375-95-1	PFNA	0.158	J	0.0011	Yes - Detected in Tissue and Surface Water	139
West Lakeland	WL7-CRAY-THREE-01-092320	9/23/2020	375-95-1	PFNA	0.158	J	0.0011	Yes - Detected in Tissue and Surface Water	139
West Lakeland	WL8A-CRAY-01-092120	9/21/2020	375-95-1	PFNA	0.149	J	0.0011	Yes - Detected in Tissue and Surface Water	132
West Lakeland	WL14-CRAY-01-092320	9/23/2020	375-95-1	PFNA	0.348	J	0.0011	Yes - Detected in Tissue and Surface Water	307
West Lakeland	WL7-CRAY-TWO-01-092320	9/23/2020	375-95-1	PFNA	0.198	J	0.0011	Yes - Detected in Tissue and Surface Water	175
West Lakeland	WL10-CRAY-ONE-01-092120	9/21/2020	375-95-1	PFNA	0.1	J	0.0011	Yes - Detected in Tissue and Surface Water	88
West Lakeland	WL10-CRAY-THREE-01-092120	9/21/2020	375-95-1	PFNA	0.1	U	0.0011	No - ND in Crayfish Tissue	NC
West Lakeland	WL10-CRAY-TWO-01-092120	9/21/2020	375-95-1	PFNA	0.125	J	0.0011	Yes - Detected in Tissue and Surface Water	110
West Lakeland	WL11-CRAY-01-092120	9/21/2020	375-95-1	PFNA	0.192	J	0.0011	Yes - Detected in Tissue and Surface Water	170
West Lakeland	WL15A-CRAY-EATEN-01-091620	9/16/2020	375-95-1	PFNA	0.132	J	0.0011	Yes - Detected in Tissue and Surface Water	117
West Lakeland	WL5-CRAY-01-091720	9/17/2020	335-67-1	PFOA	3.81		0.069	Yes - Detected in Tissue and Surface Water	55
West Lakeland	WL6-CRAY-01-092320	9/23/2020	335-67-1	PFOA	10.5		0.069	Yes - Detected in Tissue and Surface Water	152
West Lakeland	WL7-CRAY-FOUR-01-092320	9/23/2020	335-67-1	PFOA	6.59		0.069	Yes - Detected in Tissue and Surface Water	95
West Lakeland	WL7-CRAY-ONE-01-092320	9/23/2020	335-67-1	PFOA	4.36		0.069	Yes - Detected in Tissue and Surface Water	63
West Lakeland	WL7-CRAY-THREE-01-092320	9/23/2020	335-67-1	PFOA	4.24		0.069	Yes - Detected in Tissue and Surface Water	61
West Lakeland	WL7-CRAY-TWO-01-092320	9/23/2020	335-67-1	PFOA	1.89		0.069	Yes - Detected in Tissue and Surface Water	27
West Lakeland	WL8A-CRAY-01-092120	9/21/2020	335-67-1	PFOA	4.89		0.069	Yes - Detected in Tissue and Surface Water	71
West Lakeland	WL14-CRAY-01-092320	9/23/2020	335-67-1	PFOA	8.97		0.069	Yes - Detected in Tissue and Surface Water	130
West Lakeland	WL10-CRAY-ONE-01-092120	9/21/2020	335-67-1	PFOA	2.34		0.069	Yes - Detected in Tissue and Surface Water	34
West Lakeland	WL10-CRAY-THREE-01-092120	9/21/2020	335-67-1	PFOA	3.12		0.069	Yes - Detected in Tissue and Surface Water	45
West Lakeland	WL10-CRAY-TWO-01-092120	9/21/2020	335-67-1	PFOA	3.14		0.069	Yes - Detected in Tissue and Surface Water	45
West Lakeland	WL11-CRAY-01-092120	9/21/2020	335-67-1	PFOA	7.9		0.069	Yes - Detected in Tissue and Surface Water	114
West Lakeland	WL15A-CRAY-EATEN-01-091620	9/16/2020	335-67-1	PFOA	3.13		0.069	Yes - Detected in Tissue and Surface Water	45

Appendix E Table 2
Calculation of Crayfish Tissue - Total Surface Water Bioaccumulation Factors
Project 1007
Minneapolis, Minnesota

	Crayfish Tissue Samples (a)								
Area	Sample Name	Sample Date	CAS	Analyte	Detected Tissue Concentration (ug/kg)	Qualifier	Surface Water Geomean (ug/L) (b)	Decision to Calculate BAF?	Calculation of Crayfish to Surface Water BAF (CR/SW) (c)
West Lakeland	WL5-CRAY-01-091720	9/17/2020	1763-23-1	PFOS	45.2		0.16	Yes - Detected in Tissue and Surface Water	279
West Lakeland	WL6-CRAY-01-092320	9/23/2020	1763-23-1	PFOS	47.4		0.16	Yes - Detected in Tissue and Surface Water	293
West Lakeland	WL7-CRAY-FOUR-01-092320	9/23/2020	1763-23-1	PFOS	39.8		0.16	Yes - Detected in Tissue and Surface Water	246
West Lakeland	WL7-CRAY-ONE-01-092320	9/23/2020	1763-23-1	PFOS	31.6		0.16	Yes - Detected in Tissue and Surface Water	195
West Lakeland	WL7-CRAY-THREE-01-092320	9/23/2020	1763-23-1	PFOS	29.6		0.16	Yes - Detected in Tissue and Surface Water	183
West Lakeland	WL7-CRAY-TWO-01-092320	9/23/2020	1763-23-1	PFOS	52.3		0.16	Yes - Detected in Tissue and Surface Water	323
West Lakeland	WL8A-CRAY-01-092120	9/21/2020	1763-23-1	PFOS	41.3		0.16	Yes - Detected in Tissue and Surface Water	255
West Lakeland	WL14-CRAY-01-092320	9/23/2020	1763-23-1	PFOS	30.7		0.16	Yes - Detected in Tissue and Surface Water	190
West Lakeland	WL10-CRAY-ONE-01-092120	9/21/2020	1763-23-1	PFOS	14		0.16	Yes - Detected in Tissue and Surface Water	87
West Lakeland	WL10-CRAY-THREE-01-092120	9/21/2020	1763-23-1	PFOS	17.9		0.16	Yes - Detected in Tissue and Surface Water	111
West Lakeland	WL10-CRAY-TWO-01-092120	9/21/2020	1763-23-1	PFOS	12.4		0.16	Yes - Detected in Tissue and Surface Water	77
West Lakeland	WL11-CRAY-01-092120	9/21/2020	1763-23-1	PFOS	23.4		0.16	Yes - Detected in Tissue and Surface Water	145
West Lakeland	WL15A-CRAY-EATEN-01-091620	9/16/2020	1763-23-1	PFOS	97.9		0.16	Yes - Detected in Tissue and Surface Water	605
West Lakeland	WL5-CRAY-01-091720	9/17/2020	754-91-6	PFOSA	1.55		0.0011	Yes - Detected in Tissue and Surface Water	1446
West Lakeland	WL6-CRAY-01-092320	9/23/2020	754-91-6	PFOSA	0.503	B	0.0011	Yes - Detected in Tissue and Surface Water	469
West Lakeland	WL7-CRAY-FOUR-01-092320	9/23/2020	754-91-6	PFOSA	1.16		0.0011	Yes - Detected in Tissue and Surface Water	1082
West Lakeland	WL7-CRAY-ONE-01-092320	9/23/2020	754-91-6	PFOSA	0.68	B	0.0011	Yes - Detected in Tissue and Surface Water	634
West Lakeland	WL7-CRAY-THREE-01-092320	9/23/2020	754-91-6	PFOSA	1.45		0.0011	Yes - Detected in Tissue and Surface Water	1352
West Lakeland	WL8A-CRAY-01-092120	9/21/2020	754-91-6	PFOSA	0.72	B	0.0011	Yes - Detected in Tissue and Surface Water	672
West Lakeland	WL14-CRAY-01-092320	9/23/2020	754-91-6	PFOSA	1.02		0.0011	Yes - Detected in Tissue and Surface Water	951
West Lakeland	WL7-CRAY-TWO-01-092320	9/23/2020	754-91-6	PFOSA	0.896	B	0.0011	Yes - Detected in Tissue and Surface Water	836
West Lakeland	WL10-CRAY-ONE-01-092120	9/21/2020	754-91-6	PFOSA	0.822	B	0.0011	Yes - Detected in Tissue and Surface Water	767
West Lakeland	WL10-CRAY-THREE-01-092120	9/21/2020	754-91-6	PFOSA	1.03	B	0.0011	Yes - Detected in Tissue and Surface Water	961
West Lakeland	WL10-CRAY-TWO-01-092120	9/21/2020	754-91-6	PFOSA	0.74	B	0.0011	Yes - Detected in Tissue and Surface Water	690
West Lakeland	WL11-CRAY-01-092120	9/21/2020	754-91-6	PFOSA	0.828	B	0.0011	Yes - Detected in Tissue and Surface Water	772
West Lakeland	WL15A-CRAY-EATEN-01-091620	9/16/2020	754-91-6	PFOSA	0.425	B	0.0011	Yes - Detected in Tissue and Surface Water	396
West Lakeland	WL5-CRAY-01-091720	9/17/2020	2706-90-3	PFPeA	0.195	U	0.012	No - ND in Crayfish Tissue	NC
West Lakeland	WL6-CRAY-01-092320	9/23/2020	2706-90-3	PFPeA	0.193	U	0.012	No - ND in Crayfish Tissue	NC
West Lakeland	WL7-CRAY-FOUR-01-092320	9/23/2020	2706-90-3	PFPeA	0.189	U	0.012	No - ND in Crayfish Tissue	NC
West Lakeland	WL7-CRAY-ONE-01-092320	9/23/2020	2706-90-3	PFPeA	0.193	U	0.012	No - ND in Crayfish Tissue	NC
West Lakeland	WL7-CRAY-THREE-01-092320	9/23/2020	2706-90-3	PFPeA	0.199	UJ	0.012	No - ND in Crayfish Tissue	NC
West Lakeland	WL7-CRAY-TWO-01-092320	9/23/2020	2706-90-3	PFPeA	0.197	U	0.012	No - ND in Crayfish Tissue	NC
West Lakeland	WL8A-CRAY-01-092120	9/21/2020	2706-90-3	PFPeA	0.191	U	0.012	No - ND in Crayfish Tissue	NC
West Lakeland	WL14-CRAY-01-092320	9/23/2020	2706-90-3	PFPeA	0.435	U	0.012	No - ND in Crayfish Tissue	NC
West Lakeland	WL10-CRAY-ONE-01-092120	9/21/2020	2706-90-3	PFPeA	0.197	U	0.012	No - ND in Crayfish Tissue	NC
West Lakeland	WL10-CRAY-THREE-01-092120	9/21/2020	2706-90-3	PFPeA	0.2	U	0.012	No - ND in Crayfish Tissue	NC
West Lakeland	WL10-CRAY-TWO-01-092120	9/21/2020	2706-90-3	PFPeA	0.198	U	0.012	No - ND in Crayfish Tissue	NC
West Lakeland	WL11-CRAY-01-092120	9/21/2020	2706-90-3	PFPeA	0.193	U	0.012	No - ND in Crayfish Tissue	NC
West Lakeland	WL15A-CRAY-EATEN-01-091620	9/16/2020	2706-90-3	PFPeA	0.193	U	0.012	No - ND in Crayfish Tissue	NC
West Lakeland	WL5-CRAY-01-091720	9/17/2020	2706-91-4	PFPeS	0.098	U	0.0028	No - ND in Crayfish Tissue	NC
West Lakeland	WL6-CRAY-01-092320	9/23/2020	2706-91-4	PFPeS	0.0971	U	0.0028	No - ND in Crayfish Tissue	NC
West Lakeland	WL7-CRAY-FOUR-01-092320	9/23/2020	2706-91-4	PFPeS	0.0948	U	0.0028	No - ND in Crayfish Tissue	NC
West Lakeland	WL7-CRAY-ONE-01-092320	9/23/2020	2706-91-4	PFPeS	0.0971	U	0.0028	No - ND in Crayfish Tissue	NC
West Lakeland	WL7-CRAY-THREE-01-092320	9/23/2020	2706-91-4	PFPeS	0.1	U	0.0028	No - ND in Crayfish Tissue	NC
West Lakeland	WL7-CRAY-TWO-01-092320	9/23/2020	2706-91-4	PFPeS	0.099	U	0.0028	No - ND in Crayfish Tissue	NC
West Lakeland	WL8A-CRAY-01-092120	9/21/2020	2706-91-4	PFPeS	0.0962	U	0.0028	No - ND in Crayfish Tissue	NC
West Lakeland	WL14-CRAY-01-092320	9/23/2020	2706-91-4	PFPeS	0.218	U	0.0028	No - ND in Crayfish Tissue	NC
West Lakeland	WL10-CRAY-ONE-01-092120	9/21/2020	2706-91-4	PFPeS	0.099	U	0.0028	No - ND in Crayfish Tissue	NC
West Lakeland	WL10-CRAY-THREE-01-092120	9/21/2020	2706-91-4	PFPeS	0.101	U	0.0028	No - ND in Crayfish Tissue	NC
West Lakeland	WL10-CRAY-TWO-01-092120	9/21/2020	2706-91-4	PFPeS	0.0995	U	0.0028	No - ND in Crayfish Tissue	NC
West Lakeland	WL11-CRAY-01-092120	9/21/2020	2706-91-4	PFPeS	0.0971	U	0.0028	No - ND in Crayfish Tissue	NC
West Lakeland	WL15A-CRAY-EATEN-01-091620	9/16/2020	2706-91-4	PFPeS	0.0971	U	0.0028	No - ND in Crayfish Tissue	NC
West Lakeland	WL5-CRAY-01-091720	9/17/2020	376-06-7	PFTeDA	0.157	J+	0.0028	Yes - Detected in Tissue and Surface Water	57
West Lakeland	WL6-CRAY-01-092320	9/23/2020	376-06-7	PFTeDA	0.097	J	0.0028	Yes - Detected in Tissue and Surface Water	35
West Lakeland	WL7-CRAY-FOUR-01-092320	9/23/2020	376-06-7	PFTeDA	0.116	J	0.0028	Yes - Detected in Tissue and Surface Water	42
West Lakeland	WL7-CRAY-ONE-01-092320	9/23/2020	376-06-7	PFTeDA	0.139	J	0.0028	Yes - Detected in Tissue and Surface Water	50
West Lakeland	WL7-CRAY-THREE-01-092320	9/23/2020	376-06-7	PFTeDA	0.0995	UJ	0.0028	No - ND in Crayfish Tissue	NC
West Lakeland	WL8A-CRAY-01-092120	9/21/2020	376-06-7	PFTeDA	0.109	J	0.0028	Yes - Detected in Tissue and Surface Water	39
West Lakeland	WL14-CRAY-01-092320	9/23/2020	376-06-7	PFTeDA	0.217	UJ	0.0028	No - ND in Crayfish Tissue	NC
West Lakeland	WL7-CRAY-TWO-01-092320	9/23/2020	376-06-7	PFTeDA	0.0985	U	0.0028	No - ND in Crayfish Tissue	NC
West Lakeland	WL10-CRAY-ONE-01-092120	9/21/2020	376-06-7	PFTeDA	0.0985	U	0.0028	No - ND in Crayfish Tissue	NC
West Lakeland	WL10-CRAY-THREE-01-092120	9/21/2020	376-06-7	PFTeDA	0.1	U	0.0028	No - ND in Crayfish Tissue	NC
West Lakeland	WL10-CRAY-TWO-01-092120	9/21/2020	376-06-7	PFTeDA	0.099	U	0.0028	No - ND in Crayfish Tissue	NC
West Lakeland	WL11-CRAY-01-092120	9/21/2020	376-06-7	PFTeDA	0.0966	U	0.0028	No - ND in Crayfish Tissue	NC
West Lakeland	WL15A-CRAY-EATEN-01-091620	9/16/2020	376-06-7	PFTeDA	0.105	J	0.0028	Yes - Detected in Tissue and Surface Water	38

Appendix E Table 2
Calculation of Crayfish Tissue - Total Surface Water Bioaccumulation Factors
Project 1007
Minneapolis, Minnesota

	Crayfish Tissue Samples (a)								
Area	Sample Name	Sample Date	CAS	Analyte	Detected Tissue Concentration (ug/kg)	Qualifier	Surface Water Geomean (ug/L) (b)	Decision to Calculate BAF?	Calculation of Crayfish to Surface Water BAF (CR/SW) (c)
West Lakeland	WL5-CRAY-01-091720	9/17/2020	72629-94-8	PFTrDA	0.224	BJ	0.0015	Yes - Detected in Tissue and Surface Water	150
West Lakeland	WL6-CRAY-01-092320	9/23/2020	72629-94-8	PFTrDA	0.0966	U	0.0015	No - ND in Crayfish Tissue	NC
West Lakeland	WL7-CRAY-FOUR-01-092320	9/23/2020	72629-94-8	PFTrDA	0.155	BJ	0.0015	Yes - Detected in Tissue and Surface Water	104
West Lakeland	WL7-CRAY-ONE-01-092320	9/23/2020	72629-94-8	PFTrDA	0.242	BJ	0.0015	Yes - Detected in Tissue and Surface Water	162
West Lakeland	WL7-CRAY-THREE-01-092320	9/23/2020	72629-94-8	PFTrDA	0.162	BJ	0.0015	Yes - Detected in Tissue and Surface Water	109
West Lakeland	WL8A-CRAY-01-092120	9/21/2020	72629-94-8	PFTrDA	0.14	BJ	0.0015	Yes - Detected in Tissue and Surface Water	94
West Lakeland	WL14-CRAY-01-092320	9/23/2020	72629-94-8	PFTrDA	0.217	U	0.0015	No - ND in Crayfish Tissue	NC
West Lakeland	WL7-CRAY-TWO-01-092320	9/23/2020	72629-94-8	PFTrDA	0.117	BJ	0.0015	Yes - Detected in Tissue and Surface Water	78
West Lakeland	WL10-CRAY-ONE-01-092120	9/21/2020	72629-94-8	PFTrDA	0.0985	U	0.0015	No - ND in Crayfish Tissue	NC
West Lakeland	WL10-CRAY-THREE-01-092120	9/21/2020	72629-94-8	PFTrDA	0.148	BJ	0.0015	Yes - Detected in Tissue and Surface Water	99
West Lakeland	WL10-CRAY-TWO-01-092120	9/21/2020	72629-94-8	PFTrDA	0.099	U	0.0015	No - ND in Crayfish Tissue	NC
West Lakeland	WL11-CRAY-01-092120	9/21/2020	72629-94-8	PFTrDA	0.102	BJ	0.0015	Yes - Detected in Tissue and Surface Water	68
West Lakeland	WL15A-CRAY-EATEN-01-091620	9/16/2020	72629-94-8	PFTrDA	0.169	J	0.0015	Yes - Detected in Tissue and Surface Water	113
West Lakeland	WL5-CRAY-01-091720	9/17/2020	2058-94-8	PFUnA	0.851	B	0.00052	Yes - Detected in Tissue and Surface Water	1652
West Lakeland	WL6-CRAY-01-092320	9/23/2020	2058-94-8	PFUnA	0.415	B	0.00052	Yes - Detected in Tissue and Surface Water	806
West Lakeland	WL7-CRAY-FOUR-01-092320	9/23/2020	2058-94-8	PFUnA	0.47	B	0.00052	Yes - Detected in Tissue and Surface Water	913
West Lakeland	WL7-CRAY-ONE-01-092320	9/23/2020	2058-94-8	PFUnA	0.606	B	0.00052	Yes - Detected in Tissue and Surface Water	1177
West Lakeland	WL7-CRAY-THREE-01-092320	9/23/2020	2058-94-8	PFUnA	0.294	BJ	0.00052	Yes - Detected in Tissue and Surface Water	571
West Lakeland	WL7-CRAY-TWO-01-092320	9/23/2020	2058-94-8	PFUnA	0.475	B	0.00052	Yes - Detected in Tissue and Surface Water	922
West Lakeland	WL8A-CRAY-01-092120	9/21/2020	2058-94-8	PFUnA	0.435	B	0.00052	Yes - Detected in Tissue and Surface Water	845
West Lakeland	WL14-CRAY-01-092320	9/23/2020	2058-94-8	PFUnA	0.273	BJ	0.00052	Yes - Detected in Tissue and Surface Water	530
West Lakeland	WL10-CRAY-ONE-01-092120	9/21/2020	2058-94-8	PFUnA	0.121	BJ	0.00052	Yes - Detected in Tissue and Surface Water	235
West Lakeland	WL10-CRAY-THREE-01-092120	9/21/2020	2058-94-8	PFUnA	0.176	BJ	0.00052	Yes - Detected in Tissue and Surface Water	342
West Lakeland	WL10-CRAY-TWO-01-092120	9/21/2020	2058-94-8	PFUnA	0.173	BJ	0.00052	Yes - Detected in Tissue and Surface Water	336
West Lakeland	WL11-CRAY-01-092120	9/21/2020	2058-94-8	PFUnA	0.242	BJ	0.00052	Yes - Detected in Tissue and Surface Water	470
West Lakeland	WL15A-CRAY-EATEN-01-091620	9/16/2020	2058-94-8	PFUnA	0.41	B	0.00052	Yes - Detected in Tissue and Surface Water	796

Notes:

BAF - Bioaccumulation Factor.
CAS - Chemical Abstract Service number.
CR - Crayfish Tissue Concentration.
NC - Not calculated.
ND - Not detected.
SW - Surface Water (total phase).
ug/L - micrograms per liter (ug/L).
ug/kg - microgram per kilogram
+ - Result may be biased high.
- - Result may be biased low.
B - Analyte was present in a blank.
J - Estimated concentration.
U - Concentration is less than the laboratory reportable limit.

(a) BAFs were calculated for analytes that were detected in Lake Elmo and Eagle Point Lake surface water (total phase)and were included in the food web model. All crayfish tissue samples collected in each area were included in the calculation.
(b) Geometric means (geomeans) of detected surface water concentrations (total phase) were calculated for each analyte per area.
(c) BAFs were calculated for each analyte per crayfish tissue sample per area by dividing the detected concentration in crayfish tissue by the total surface water geomean calculated for that area.

Appendix E Table 3
Calculated BAFs for Amphibian and Crayfish
Project 1007
Minneapolis, Minnesota

	Amphibian Tissue - Surface Water BAFs		Crayfish Tissue - Surface Water BAFs	
Analyte	**Geomean of AM/SW BAF (a)**	**Areas of Individual AM/SW BAFs included in Geomean BAF (b)**	**Geomean of CR/SW BAF (a)**	**Areas of Individual CR/SW BAFs included in Geomean BAF (b)**
6:2 FTS	131	West Lakeland Area	87	Raleigh Creek - Other & West Lakeland Area
N-EtFOSAA	185	Eagle Point Lake & West Lakeland Area	194	Eagle Point Lake & West Lakeland Area
PFBA	2.7	Raleigh Creek - Upper & West Lakeland Area (c)	12	Raleigh Creek - Upper & West Lakeland Area (c)
PFBS	10.3	Raleigh Creek - Upper	48	Eagle Point Lake & West Lakeland Area
PFDA	689	Eagle Point Lake & West Lakeland Area	436	Eagle Point Lake & West Lakeland Area
PFHpA	NC	ND in Amphibian Tissue	31	Eagle Point Lake & West Lakeland Area
PFHpS	54	Eagle Point Lake & West Lakeland Area	66	West Lakeland Area
PFHxA	2.2	Raleigh Creek - Upper	15	Eagle Point Lake
PFHxS	6.6	Raleigh Creek - Upper	23	Eagle Point Lake & West Lakeland Area
PFNA	184	West Lakeland Area	161	West Lakeland Area
PFOA	3.3	West Lakeland Area	43	Eagle Point Lake & West Lakeland Area
PFOS	454	Eagle Point Lake & West Lakeland Area	145	Eagle Point Lake & West Lakeland Area
PFOSA	468	Eagle Point Lake & West Lakeland Area	1895	Eagle Point Lake & West Lakeland Area
PFPeA	NC	ND in Amphibian Tissue	26	Eagle Point Lake
PFPeS	10.1	Raleigh Creek - Upper	67	Eagle Point Lake
PFDoA	1618	Raleigh Creek - Upper	73	Eagle Point Lake
PFUnA	473	Raleigh Creek - Upper, Eagle Point Lake, West Lakeland Area	327	Eagle Point Lake & West Lakeland Area
PFTeDA	46	Raleigh Creek - Other, West Lakeland Area	45	Eagle Point Lake & West Lakeland Area
PFTrDA	132	Raleigh Creek - Upper, Raleigh Creek - Other, West Lakeland Area	105	West Lakeland Area
N-EtFOSE	NC	ND in Amphibian Tissue	NC	ND in Crayfish Tissue
N-MeFOSAA	241	Raleigh Creek - Upper	321	Raleigh Creek - Upper

Notes:
AM - Amphibian Tissue Concentration.
BAF - Bioaccumulation Factor. Calculated as tissue divided by surface water concentration.
CR - Crayfish Tissue Concentration.
Geomean - Geometric Mean.
NC - Not calculated.
ND - Not detected.
SW - Surface Water (total phase).

(a) The geomean of individual AM/SW BAFs and CR/SW BAFs calculated for the areas indicated.
Individual AM/SW and CR/SW BAFs calculated for each tissue sample are presented in Tables 1 and 2 of Appendix E.
(b) Total surface water concentrations detected in Lake Elmo are comparable to Eagle Point Lake and West Lakeland. Therefore, individual BAFs were selected from Eagle Point Lake and West Lakeland, when available, for the calculation of the geomean BAF per analyte. Individual BAFs for Raleigh Creek - upper and Raleigh Creek - other were used when insufficient individual BAFs were available.
(c) The geomean BAFs for PFBA were calculated based on individual BAFs from Raleigh Creek - Upper and West Lakeland Areas for which surface water concentrations were comparable to Lake Elmo.

Appendix F

Abiotic Media Screening Tables

Appendix F Table 1
Ecological Screening Values for Surface Water and Sediment
Project 1007
Minneapolis, Minnesota

		Surface Water ESVs						Sediment ESVs			
Analyte	**CAS #**	**Aquatic Life (chronic) (µg/L)**		**Aquatic Life (acute) (µg/L)**		**Wildlife (µg/L)**		**Benthic Aquatic Life (µg/kg)**		**Wildlife (µg/kg)**	
Short-chain PFCAs											
PFBA	375-22-4	470	[2]	4200	[2]	660	[3]	--		1600	[3]
PFPeA	2706-90-3	140	[2]	1000	[2]	660	[3, 7]	--		1600	[3, 7]
PFHxA	307-24-4	2300	[2]	8800	[2]	210	[3]	--		1800	[3]
PFHpA	375-85-9	870	[2]	7800	[2]	210	[3, 12]	--		1800	[3, 12]
Long-chain PFCAs											
PFOA	335-67-1	537	[1]	53000	[2]	4.4	[3]	--		6	[3]
PFNA	375-95-1	120	[2]	900	[2]	2.2	[3]	--		10	[3]
PFDA	335-76-2	140	[2]	1000	[2]	2.2	[3, 9]	--		10	[3, 9]
PFUNA	2058-94-8	49	[2]	440	[2]	2.2	[3, 10]	--		10	[3, 9]
PFDoA	307-55-1	72	[2]	640	[2]	2.2	[3, 9]	--		10	[3, 9]
PFTrDA	72629-94-8	72	[2, 11]	640	[2, 11]	2.2	[3, 10]	--		10	[3, 9]
PFTeDA	376-06-7	72	[2, 11]	640	[2, 11]	2.2	[3, 10]	--		10	[3, 9]
Short-chain PFSAs											
PFBS	375-73-5	3400	[2]	17000	[2]	640	[3]	--		730	[3]
PFPeS	2706-91-4	3400	[2, 8]	17000	[2, 8]	640	[2, 8]	--		730	[3, 8]
Long-chain PFSAs											
PFHxS	355-46-4	0.56	[1, 5]	570	[2, 5]	0.075	[3, 5]	220	[4, 5]	1.4	[3, 5]
PFHpS	375-92-8	0.56	[1, 5]	570	[2, 5]	0.075	[3, 5]	220	[4, 5]	1.4	[3, 5]
PFOS	1763-23-1	0.56	[1]	570	[2]	0.075	[3]	220	[4]	1.4	[3]
PFNS	68259-12-1	0.56	[1, 5]	570	[2, 5]	0.075	[3, 5]	220	[4, 5]	1.4	[3, 5]
PFDS	335-77-3	0.56	[1, 5]	570	[2, 5]	0.075	[3, 5]	220	[4, 5]	1.4	[3, 5]
PFDoS	79780-39-5	0.56	[1, 5]	570	[2, 5]	0.075	[3, 5]	220	[4, 5]	1.4	[3, 5]
Fluortelomers											
4:2 FTS	757124-72-4	3400	[2, 8]	17000	[2, 8]	640	[2, 8]	--		730	[3, 8]
6:2 FTS	27619-97-2	537	[1, 6]	53000	[2, 6]	4.4	[1, 6]	220	[4, 5]	6	[3, 6]
8:2 FTS	39108-34-4	0.56	[1, 5]	570	[2, 5]	0.075	[3, 5]	220	[4, 5]	1.4	[3, 5]
10:2 FTS	120226-60-0	0.56	[1, 5]	570	[2, 5]	0.075	[3, 5]	220	[4, 5]	1.4	[3, 5]
3:3 FTCA	1169706-83-5	470	[2, 7]	4200	[2, 7]	660	[3, 7]	--		1600	[3, 7]
5:3 FTCA	1799325-94-2	2300	[2, 12]	8800	[2, 12]	210	[3, 12]	--		1800	[3, 12]
7:3 FTCA	812-70-4	537	[1, 6]	53000	[2, 6]	4.4	[1, 6]	220	[4, 5]	1.4	[3, 5]
FOSA, FASE, FASAAs											
PFOSA	754-91-6	0.56	[1, 5]	570	[2, 5]	0.075	[3, 5]	220	[4, 5]	1.4	[3, 5]
N-MeFOSA	31506-32-8	0.56	[1, 5]	570	[2, 5]	0.075	[3, 5]	220	[4, 5]	1.4	[3, 5]
N-EtFOSA	4151-50-2	0.56	[1, 5]	570	[2, 5]	0.075	[3, 5]	220	[4, 5]	1.4	[3, 5]
N-MeFOSAA	2355-31-9	0.56	[1, 5]	570	[2, 5]	0.075	[3, 5]	220	[4, 5]	1.4	[3, 5]
N-EtFOSAA	2991-50-6	0.56	[1, 5]	570	[2, 5]	0.075	[3, 5]	220	[4, 5]	1.4	[3, 5]
N-MeFOSE	24448-09-7	0.56	[1, 5]	570	[2, 5]	0.075	[3, 5]	220	[4, 5]	1.4	[3, 5]
N-EtFOSE	1691-99-2	0.56	[1, 5]	570	[2, 5]	0.075	[3, 5]	220	[4, 5]	1.4	[3, 5]

Appendix F Table 1
Ecological Screening Values for Surface Water and Sediment
Project 1007
Minneapolis, Minnesota

		Surface Water ESVs						Sediment ESVs			
Analyte	**CAS #**	**Aquatic Life (chronic) (µg/L)**		**Aquatic Life (acute) (µg/L)**		**Wildlife (µg/L)**		**Benthic Aquatic Life (µg/kg)**		**Wildlife (µg/kg)**	
Replacement Chemistries											
HFPO-DA	13252-13-6	2300	[2, 12]	8800	[2, 12]	210	[3, 12]	--		1800	[3, 12]
ADONA	919005-14-4	537	[1, 6]	53000	[2, 6]	4.4	[1, 6]	220	[4, 5]	6	[3, 6]
9CL-PF3ONS	756426-58-1	0.56	[1, 5]	570	[2, 5]	0.075	[3, 5]	220	[4, 5]	1.4	[3, 5]
11CL-PF3OUDS	763051-92-9	49	[2, 14]	440	[2, 14]	0.075	[3, 5]	220	[4, 5]	1.4	[3, 5]
PFEESA	113507-82-7	140	[2, 13]	1000	[2, 13]	640	[2, 8]	--		730	[3, 8]
NFDHA	151772-58-6	140	[2, 13]	1000	[2, 13]	640	[2, 8]	--		730	[3, 8]
PFMPA	377-73-1	140	[2, 13]	1000	[2, 13]	640	[2, 8]	--		730	[3, 8]
PFMBA	863090-89-5	140	[2, 13]	1000	[2, 13]	640	[2, 8]	--		730	[3, 8]

Notes:
µg/kg - micrograms per kilogram
µg/L - micrograms per liter
-- No Ecological Screening Value
CAS - Chemical Abstracts Service
ESV - Ecological Screening Value
Surrogate ESVs were selected when PFAS-specific ESVS were not available. Surrogates were selected based on carbon chain length and PFAS classification.

1 - Hazardous Concentration 1% (HC1) (Conder, et al., 2020).
2 - Chronic recommended water quality (RWQ) risk-based screening level (RBSL)(Divine, et al., 2020).
3 - Aquatic risk-based screening level for wildlife. Selected level is the lowest of the values derived by Devine, et al (2020) for the muskrat, little brown bat, river otter, mink, red-winged blackbird, tree swallow, and brown pelican.
4 - No toxic effects level for benthic invertebrates (NPCA, 2008).
5 - PFOS (long-chain PFSA) used as a surrogate.
6 - PFOA (long-chain PFCA) used as a surrogate.
7 - PFBA (short-chain PFCA) used as a surrogate.
8 - PFBS (short-chain PFSA) used as a surrogate.
9 - PFNA (long-chain PFCA) used as a surrogate.
10 - PFDA (long-chain PFCA) used as a surrogate.
11 - PFDoA (long-chain PFCA) used as a surrogate.
12 - PFHxA (short-chain PFCA) used as a surrogate.
13 - PFPeA (short-chain PFCA) used as a surrogate.
14 - PFUNA (long-chain PFCA) used as a surrogate.

Sources:
Conder, J., Arblaster, J., Larson, E., Brown, J., Higgins, C. 2020. Guidance for Assessing the Ecological Risks of PFAS to Threatened and Endangered Species at Aqueous Film Forming Foam-Impacted Sites. SERDP Project ER18-1614.
Divine, C., Frenchmeyer, M., Dally, K., Osborn, E., Anderson, P., Zodrow, J. 2020. Approach for Assessing PFAS Risk to Threatened and Endangered Species. Final Report. SERDP Project ER18-1653. March.
Norwegian Pollution Control Authority (NPCA). 2008. Screening of Polyfluorinated Compounds at Four Fire Training Facilities in Norway. (TA-2444/2008).

Appendix F Table 2a
Comparison of PFAS Surface Water Concentrations to Ecological Screening Values - Raleigh Creek - Upper
Project 1007
Minneapolis, Minnesota

			Detected Concentrations				Surface Water ESVs (ug/L)									
Analyte	FOD	Percent Detected	Minimum (ug/L)	Mean (ug/L)	Maximum (ug/L)	Location of Maximum Concentration	Aquatic Life (chronic)		Wildlife		Maximum > Aquatic Life ESV?	Maximum > Wildlife ESV?	BERA EPC (ug/L)	BERA EPC > Aquatic Life ESV?	BERA EPC > Wildlife ESV?	Findings
TOTAL RECOVERABLE PHASE RESULTS																
Short-chain PFCAs																
PFBA	55 : 55	100%	0.087	0.42	1.1	RC4	470	[2]	660	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeA	60 : 60	100%	0.0078	0.040	0.13	RC3	140	[2]	660	[3, 7]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHxA	59 : 60	98%	0.0095 J	0.085	0.27	RC3	2300	[2]	210	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpA	59 : 60	98%	0.0047 B	0.076	0.30	RC3	870	[2]	210	[3, 12]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFCAs																
PFOA	60 : 60	100%	0.0083	0.67	2.5	RC3	537	[1]	4.4	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFNA	58 : 60	97%	0.0012 J	0.0058	0.023	RC3	120	[2]	2.2	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDA	58 : 60	97%	0.0018	0.0084	0.026	RC3	140	[2]	2.2	[3, 9]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFUNA	5 : 60	8%	0.00040 J	0.00053	0.00085 J	RC3	49	[2]	2.2	[3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDoA	1 : 60	2%	0.00044 J	0.00044	0.00044 J	RC3	72	[2]	2.2	[3, 9]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFTrDA	1 : 60	2%	0.0021 J	0.0021	0.0021 J	RC13	72	[2, 11]	2.2	[3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFTeDA	0 : 60	0%	ND	ND	ND	--	72	[2, 11]	2.2	[3, 10]	--	--	NC	--	--	Not Detected
Short-chain PFSAs																
PFBS	59 : 60	98%	0.0028 J	0.025	0.079	RC3	3400	[2]	640	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeS	59 : 60	98%	0.0017 J+	0.029	0.100	RC3	3400	[2, 8]	640	[2, 8]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFSAs																
PFHxS	59 : 60	98%	0.0037 J	0.073	0.24	RC3	0.56	[1, 5]	0.075	[3, 5]	No	MAX > Wildlife ESV	0.0864	No	EPC > Wildlife ESV	EPC Exceeds Wildlife ESV
PFHpS	58 : 60	97%	0.0030 J	0.029	0.11	RC3	0.56	[1, 5]	0.075	[3, 5]	No	MAX > Wildlife ESV	0.0359	No	No	EPC Does Not Exeed ESVs
PFOS	60 : 60	100%	0.0056	2.2	8.8	RC3	0.56	[1]	0.075	[3]	MAX > Aquatic Life ESV	MAX > Wildlife ESV	3.0	EPC > Aquatic Life ESV	EPC > Wildlife ESV	EPC Exceeds ESVs
PFNS	23 : 60	38%	0.00038 J	0.0013	0.0037 J	RC23	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDS	15 : 60	25%	0.00032 J	0.00075	0.0018 J	RC3	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDoS	1 : 47	2%	0.00046 J	0.00046	0.00046 J	RC3	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
Fluortelomers																
4:2 FTS	0 : 60	0%	ND	ND	ND	--	3400	[2, 8]	640	[2, 8]	--	--	NC	--	--	Not Detected
6:2 FTS	8 : 60	13%	0.00090 J	0.0095	0.027 BJ	RC3	537	[1, 6]	4.4	[1, 6]	No	No	NC	--	--	Max Does Not Exceed ESVs
8:2 FTS	0 : 60	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
10:2 FTS	0 : 13	0%	ND	ND	ND	--	0.56		0.075		--	--	NC	--	--	Not Detected
FOSA, FASE, FASAAs																
PFOSA	56 : 60	93%	0.00063 J	0.029	0.123	RC3	0.56	[1, 5]	0.075	[3, 5]	No	MAX > Wildlife ESV	0.033	No	No	EPC Does Not Exeed ESVs
N-MeFOSA	0 : 60	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSA	5 : 60	8%	0.00117 J-	0.0026	0.0039 J	RC3	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSAA	5 : 60	8%	0.000417 J	0.00066	0.0012 J	RC3	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-EtFOSAA	55 : 60	92%	0.0015 J+	0.043	0.48	RC3	0.56	[1, 5]	0.075	[3, 5]	No	MAX > Wildlife ESV	0.068	No	No	EPC Does Not Exeed ESVs
N-MeFOSE	0 : 60	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSE	4 : 60	7%	0.00016 BJ+	0.0065	0.018	RC3	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
Replacement Chemistries																
HFPO-DA	2 : 60	3%	0.00031 J	0.00040	0.00048 J	RC5	2300	[2, 12]	210	[3, 12]	No	No	NC	--	--	Max Does Not Exceed ESVs
ADONA	0 : 60	0%	ND	ND	ND	--	537	[1, 6]	4.4	[1, 6]	--	--	NC	--	--	Not Detected
9CL-PF3ONS	0 : 60	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
11CL-PF3OUDS	0 : 60	0%	ND	ND	ND	--	49	[2, 14]	0.075	[3, 5]	--	--	NC	--	--	Not Detected

Appendix F Table 2a
Comparison of PFAS Surface Water Concentrations to Ecological Screening Values - Raleigh Creek - Upper
Project 1007
Minneapolis, Minnesota

			Detected Concentrations				Surface Water ESVs (ug/L)									
Analyte	FOD	Percent Detected	Minimum (ug/L)	Mean (ug/L)	Maximum (ug/L)	Location of Maximum Concentration	Aquatic Life (chronic)		Wildlife		Maximum > Aquatic Life ESV?	Maximum > Wildlife ESV?	BERA EPC (ug/L)	BERA EPC > Aquatic Life ESV?	BERA EPC > Wildlife ESV?	Findings
DISSOLVED PHASE RESULTS																
Short-chain PFCAs																
PFBA	9 : 9	100%	0.087	0.55	1.1 J+	RC4	470	[2]	660	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeA	9 : 9	100%	0.0066	0.036	0.067	RC4	140	[2]	660	[3, 7]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHxA	8 : 9	89%	0.030	0.093	0.16	RC4	2300	[2]	210	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpA	9 : 9	100%	0.0024 J	0.051	0.084	RC5	870	[2]	210	[3, 12]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFCAs																
PFOA	9 : 9	100%	0.0078	0.39	0.65	RC4	537	[1]	4.4	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFNA	8 : 9	89%	0.0015 J	0.0041	0.0061	RC23	120	[2]	2.2	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDA	8 : 9	89%	0.0016 J	0.0067	0.012	RC23	140	[2]	2.2	[3, 9]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFUNA	0 : 9	0%	ND	ND	ND	--	49	[2]	2.2	[3, 10]	--	--	NC	--	--	Not Detected
PFDoA	0 : 9	0%	ND	ND	ND	--	72	[2]	2.2	[3, 9]	--	--	NC	--	--	Not Detected
PFTrDA	2 : 9	22%	0.0013 J+	0.0018	0.0022 J+	RC3A	72	[2, 11]	2.2	[3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFTeDA	3 : 9	33%	0.0027 BJ+	0.0034	0.0041 BJ+	RC3A	72	[2, 11]	2.2	[3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
Short-chain PFSAs																
PFBS	9 : 9	100%	0.0025 J	0.017	0.029	RC4	3400	[2]	640	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeS	8 : 9	89%	0.01 J+	0.029	0.046 J+	RC4A RC5	3400	[2, 8]	640	[2, 8]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFSAs																
PFHxS	9 : 9	100%	0.0041 J	0.045	0.07	RC5	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpS	8 : 9	89%	0.0037 J	0.016	0.026 J+	RC23	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFOS	9 : 9	100%	0.0041 J+	1.2	2.1	RC23	0.56	[1]	0.075	[3]	MAX > Aquatic Life ESV	MAX > Wildlife ESV	1.6	EPC > Aquatic Life ESV	EPC > Wildlife ESV	EPC Exceeds ESVs
PFNS	4 : 9	44%	0.0011 J	0.0017	0.003 J	RC23	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDS	0 : 9	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
Fluortelomers																
4:2 FTS	0 : 9	0%	ND	ND	ND	--	3400	[2, 8]	640	[2, 8]	--	--	NC	--	--	Not Detected
6:2 FTS	2 : 9	22%	0.00066 J+	0.00068	0.00069 J+	RC5	537	[1, 6]	4.4	[1, 6]	No	No	NC	--	--	Max Does Not Exceed ESVs
8:2 FTS	0 : 9	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
10:2 FTS	0 : 9	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
FOSA, FASE, FASAAs																
PFOSA	8 : 9	89%	0.0015 J	0.018	0.033	RC6A	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSA	3 : 9	33%	0.00049	0.00068	0.00079 BJ	RC23	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-EtFOSA	0 : 9	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-MeFOSAA	0 : 9	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSAA	7 : 9	78%	0.0059	0.011	0.018	RC6A	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSE	0 : 9	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSE	2 : 9	22%	0.00021 BJ+	0.00026	0.0003 J+	RC5	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
Replacement Chemistries																
HFPO-DA	1 : 9	11%	0.00032 J	0.00032	0.00032 J	RC5	2300	[2, 12]	210	[3, 12]	No	No	NC	--	--	Max Does Not Exceed ESVs
ADONA	0 : 9	0%	ND	ND	ND	--	537	[1, 6]	4.4	[1, 6]	--	--	NC	--	--	Not Detected
9CL-PF3ONS	0 : 9	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
11CL-PF3OUDS	0 : 9	0%	ND	ND	ND	--	49	[2, 14]	0.075	[3, 5]	--	--	NC	--	--	Not Detected

Notes:
-- Not Available/Applicable.
ug/L - micrograms per liter.
B - Analyte was present in a blank.
EPC - Exposure Point Concentration (see Appendix D for EPC calculations; if sufficient samples are available, the EPC is an upper confidence limit (UCL); maximum detected concentration is the EPC if a UCL cannot be calculated).
ESV - Ecological Screening Value (see Appendix F Table 1 for ESVs).
FOD - Frequency of Detection: Total number of detects - Total number of samples.
J - Analyte positively detected but value is an approximate concentration.
J+ - The chemical was positively identified; however, the associated numerical value is a high estimated concentration.
J- - The chemical was positively identified; however, the associated numerical value is a low estimated concentration.
NC - Not Calculated.
ND - Not Detected.

Source Footnotes -
1 - Hazardous Concentration 1% (HC1) (Conder, et al., 2020a).
2 - Chronic recommended water quality (RWQ) risk-based screening level (RBSL)(Divine, et al., 2020).
3 - Aquatic risk-based screening level for wildlife. Selected level is the lowest of the values derived by Devine, et al (2020) for the muskrat, little brown bat, river otter, mink, red-winged blackbird, tree swallow, and brown pelican.
Surrogate footnotes 5, 6, 7, 8, 9, 10, 12 and 14 are provided on Appendix F Table 1.

Appendix F Table 2b
Comparison of PFAS Surface Water Concentrations to Ecological Screening Values - Raleigh Creek - Other
Project 1007
Minneapolis, Minnesota

			Detected Concentrations				Surface Water ESVs (ug/L)							
Analyte	FOD	Percent Detected	Minimum (ug/L)	Mean (ug/L)	Maximum (ug/L)	Location of Maximum Concentration	Aquatic Life (chronic)	Wildlife	Maximum > Aquatic Life ESV?	Maximum > Wildlife ESV?	BERA EPC (ug/L)	BERA EPC > Aquatic Life ESV?	BERA EPC > Wildlife ESV?	Findings
TOTAL RECOVERABLE PHASE RESULTS														
Short-chain PFCAs														
PFBA	42 : 42	100%	0.039 J-	0.094	0.33	RC21A	470 [2]	660 [3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeA	45 : 45	100%	0.0030 J-	0.0072	0.037	RC21A	140 [2]	660 [3, 7]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHxA	39 : 45	87%	0.0025 J-	0.0076	0.064	RC21A	2300 [2]	210 [3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpA	45 : 45	100%	0.0016 J	0.0055	0.062	RC21A	870 [2]	210 [3, 12]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFCAs														
PFOA	45 : 45	100%	0.0057 J-	0.037	0.52	RC21A	537 [1]	4.4 [3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFNA	27 : 45	60%	0.00061 J	0.0012	0.0042	RC21A	120 [2]	2.2 [3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDA	9 : 45	20%	0.00042 J-	0.0019	0.0040	RC21A	140 [2]	2.2 [3, 9]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFUNA	0 : 45	0%	ND	ND	ND	--	49 [2]	2.2 [3, 10]	--	--	NC	--	--	Not Detected
PFDoA	0 : 45	0%	ND	ND	ND	--	72 [2]	2.2 [3, 9]	--	--	NC	--	--	Not Detected
PFTrDA	5 : 45	11%	0.0016 J	0.0020	0.0024 J	RC21A	72 [2, 11]	2.2 [3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFTeDA	1 : 45	2%	0.0046 J+	0.0046	0.0046 J+	RC18	72 [2, 11]	2.2 [3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
Short-chain PFSAs														
PFBS	45 : 45	100%	0.0014 J-	0.00331	0.0191	RC21A	3400 [2]	640 [3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeS	12 : 45	27%	0.00040 J-	0.0047	0.0202	RC21A	3400 [2, 8]	640 [2, 8]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFSAs														
PFHxS	45 : 45	100%	0.0023 J-	0.0062	0.053	RC21A	0.56 [1, 5]	0.075 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpS	8 : 45	18%	0.0010 J	0.0059	0.016	RC21A	0.56 [1, 5]	0.075 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFOS	45 : 45	100%	0.0017 J	0.11	1.2	RC21A	0.56 [1]	0.075 [3]	MAX > Aquatic Life ESV	MAX > Wildlife ESV	0.28	No	EPC > Wildlife ESV	EPC Exceeds Wildlife ESV
PFNS	0 : 45	0%	ND	ND	ND	--	0.56 [1, 5]	0.075 [3, 5]	--	--	NC	--	--	Not Detected
PFDS	0 : 45	0%	ND	ND	ND	--	0.56 [1, 5]	0.075 [3, 5]	--	--	NC	--	--	Not Detected
PFDoS	0 : 39	0%	ND	ND	ND	--	0.56 [1, 5]	0.075 [3, 5]	--	--	NC	--	--	Not Detected
Fluortelomers														
4:2 FTS	0 : 45	0%	ND	ND	ND	--	3400 [2, 8]	640 [2, 8]	--	--	NC	--	--	Not Detected
6:2 FTS	3 : 45	7%	0.0015 J-	0.0062	0.014 J	RC17	537 [1, 6]	4.4 [1, 6]	No	No	NC	--	--	Max Does Not Exceed ESVs
8:2 FTS	0 : 45	0%	ND	ND	ND	--	0.56 [1, 5]	0.075 [3, 5]	--	--	NC	--	--	Not Detected
10:2 FTS	0 : 6	0%	ND	ND	ND	--	0.56 [1, 5]	0.075 [3, 5]	--	--	NC	--	--	Not Detected
FOSA, FASE, FASAAs														
PFOSA	10 : 45	22%	0.00037 J-	0.0044	0.011	RC21A	0.56 [1, 5]	0.075 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSA	0 : 45	0%	ND	ND	ND	--	0.56 [1, 5]	0.075 [3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSA	0 : 45	0%	ND	ND	ND	--	0.56 [1, 5]	0.075 [3, 5]	--	--	NC	--	--	Not Detected
N-MeFOSAA	0 : 45	0%	ND	ND	ND	--	0.56 [1, 5]	0.075 [3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSAA	9 : 45	20%	0.00072 J-	0.0038	0.0091 J-	RC21A	0.56 [1, 5]	0.075 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSE	0 : 45	0%	ND	ND	ND	--	0.56 [1, 5]	0.075 [3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSE	1 : 45	2%	0.00014 BJ	0.00014	0.00014 BJ	RC17	0.56 [1, 5]	0.075 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
Replacement Chemistries														
HFPO-DA	0 : 45	0%	ND	ND	ND	--	2300 [2, 12]	210 [3, 12]	--	--	NC	--	--	Not Detected
ADONA	0 : 45	0%	ND	ND	ND	--	537 [1, 6]	4.4 [1, 6]	--	--	NC	--	--	Not Detected
9CL-PF3ONS	0 : 45	0%	ND	ND	ND	--	0.56 [1, 5]	0.075 [3, 5]	--	--	NC	--	--	Not Detected
11CL-PF3OUDS	0 : 45	0%	ND	ND	ND	--	49 [2, 14]	0.075 [3, 5]	--	--	NC	--	--	Not Detected

Appendix F Table 2b
Comparison of PFAS Surface Water Concentrations to Ecological Screening Values - Raleigh Creek - Other
Project 1007
Minneapolis, Minnesota

			Detected Concentrations				Surface Water ESVs (ug/L)							
Analyte	FOD	Percent Detected	Minimum (ug/L)	Mean (ug/L)	Maximum (ug/L)	Location of Maximum Concentration	Aquatic Life (chronic)	Wildlife	Maximum > Aquatic Life ESV?	Maximum > Wildlife ESV?	BERA EPC (ug/L)	BERA EPC > Aquatic Life ESV?	BERA EPC > Wildlife ESV?	Findings
DISSOLVED PHASE RESULTS														
Short-chain PFCAs														
PFBA	6 : 6	100%	0.086	0.093	0.11	RC18	470 [2]	660 [3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeA	6 : 6	100%	0.0068	0.0073	0.0078	RC16A	140 [2]	660 [3, 7]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHxA	0 : 6	0%	ND	ND	ND	--	2300 [2]	210 [3]	--	--	NC	--	--	Not Detected
PFHpA	6 : 6	100%	0.0031 BJ	0.0038	0.0046 B	RC16A	870 [2]	210 [3, 12]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFCAs														
PFOA	6 : 6	100%	0.0075	0.0084	0.0093	RC18	537 [1]	4.4 [3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFNA	0 : 6	0%	ND	ND	ND	--	120 [2]	2.2 [3]	--	--	NC	--	--	Not Detected
PFDA	0 : 6	0%	ND	ND	ND	--	140 [2]	2.2 [3, 9]	--	--	NC	--	--	Not Detected
PFUNA	1 : 6	17%	0.0016 J+	0.0016	0.0016 J+	RC18	49 [2]	2.2 [3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDoA	1 : 6	17%	0.0038 BJ+	0.0038	0.0038 BJ+	RC18	72 [2]	2.2 [3, 9]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFTrDA	0 : 6	0%	ND	ND	ND	--	72 [2, 11]	2.2 [3, 10]	--	--	NC	--	--	Not Detected
PFTeDA	0 : 5	0%	ND	ND	ND	--	72 [2, 11]	2.2 [3, 10]	--	--	NC	--	--	Not Detected
Short-chain PFSAs														
PFBS	6 : 6	100%	0.0025 J	0.0027	0.003 J	RC18	3400 [2]	640 [3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeS	0 : 6	0%	ND	ND	ND	--	3400 [2, 8]	640 [2, 8]	--	--	NC	--	--	Not Detected
Long-chain PFSAs														
PFHxS	6 : 6	100%	0.0022 J	0.0032	0.0038 J	RC18	0.56 [1, 5]	0.075 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpS	0 : 6	0%	ND	ND	ND	--	0.56 [1, 5]	0.075 [3, 5]	--	--	NC	--	--	Not Detected
PFOS	6 : 6	100%	0.0027 J	0.0038	0.0065	RC18	0.56 [1]	0.075 [3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFNS	0 : 6	0%	ND	ND	ND	--	0.56 [1, 5]	0.075 [3, 5]	--	--	NC	--	--	Not Detected
PFDS	0 : 6	0%	ND	ND	ND	--	0.56 [1, 5]	0.075 [3, 5]	--	--	NC	--	--	Not Detected
Fluortelomers														
4:2 FTS	0 : 6	0%	ND	ND	ND	--	3400 [2, 8]	640 [2, 8]	--	--	NC	--	--	Not Detected
6:2 FTS	0 : 6	0%	ND	ND	ND	--	537 [1, 6]	4.4 [1, 6]	--	--	NC	--	--	Not Detected
8:2 FTS	0 : 6	0%	ND	ND	ND	--	0.56 [1, 5]	0.075 [3, 5]	--	--	NC	--	--	Not Detected
10:2 FTS	0 : 6	0%	ND	ND	ND	--	0.56 [1, 5]	0.075 [3, 5]	--	--	NC	--	--	Not Detected
FOSA, FASE, FASAAs														
PFOSA	1 : 6	17%	0.00068 J	0.00068	0.00068 J	RC16A	0.56 [1, 5]	0.075 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSA	0 : 6	0%	ND	ND	ND	--	0.56 [1, 5]	0.075 [3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSA	0 : 6	0%	ND	ND	ND	--	0.56 [1, 5]	0.075 [3, 5]	--	--	NC	--	--	Not Detected
N-MeFOSAA	0 : 6	0%	ND	ND	ND	--	0.56 [1, 5]	0.075 [3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSAA	1 : 6	17%	0.00081 BJ	0.00081	0.00081 BJ	RC17	0.56 [1, 5]	0.075 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSE	0 : 6	0%	ND	ND	ND	--	0.56 [1, 5]	0.075 [3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSE	0 : 6	0%	ND	ND	ND	--	0.56 [1, 5]	0.075 [3, 5]	--	--	NC	--	--	Not Detected
Replacement Chemistries														
HFPO-DA	0 : 6	0%	ND	ND	ND	--	2300 [2, 12]	210 [3, 12]	--	--	NC	--	--	Not Detected
ADONA	0 : 6	0%	ND	ND	ND	--	537 [1, 6]	4.4 [1, 6]	--	--	NC	--	--	Not Detected
9CL-PF3ONS	0 : 6	0%	ND	ND	ND	--	0.56 [1, 5]	0.075 [3, 5]	--	--	NC	--	--	Not Detected
11CL-PF3OUDS	0 : 6	0%	ND	ND	ND	--	49 [2, 14]	0.075 [3, 5]	--	--	NC	--	--	Not Detected

Notes:
-- Not Available/Applicable.
ug/L - micrograms per liter.
B - Analyte was present in a blank.
EPC - Exposure Point Concentration (see Appendix D for EPC calculations; if sufficient samples are available, the EPC is an upper confidence limit (UCL); maximum detected concentration is the EPC if a UCL cannot be calculated).
ESV - Ecological Screening Value (see Appendix F Table 1 for ESVs).
FOD - Frequency of Detection: Total number of detects - Total number of samples.
J - Analyte positively detected but value is an approximate concentration.
J+ - The chemical was positively identified; however, the associated numerical value is a high estimated concentration.
J- - The chemical was positively identified; however, the associated numerical value is a low estimated concentration.
NC - Not Calculated.
ND - Not Detected.

Source Footnotes -
1 - Hazardous Concentration 1% (HC1) (Conder, et al., 2020a).
2 - Chronic recommended water quality (RWQ) risk-based screening level (RBSL)(Divine, et al., 2020).
3 - Aquatic risk-based screening level for wildlife. Selected level is the lowest of the values derived by Devine, et al (2020) for the muskrat, little brown bat, river otter, mink, red-winged blackbird, tree swallow, and brown pelican.
Surrogate footnotes 5, 6, 7, 8, 9, 10, 12 and 14 are provided on Appendix F Table 1.

Appendix F Table 2c
Comparison of PFAS Surface Water Concentrations to Ecological Screening Values - Eagle Point Lake
Project 1007
Minneapolis, Minnesota

			Detected Concentrations				Surface Water ESVs (ug/L)									
Analyte	FOD	Percent Detected	Minimum (ug/L)	Mean (ug/L)	Maximum (ug/L)	Location of Maximum Concentration	Aquatic Life (chronic)		Wildlife		Maximum > Aquatic Life ESV?	Maximum > Wildlife ESV?	BERA EPC (ug/L)	BERA EPC > Aquatic Life ESV?	BERA EPC > Wildlife ESV?	Findings
TOTAL RECOVERABLE PHASE RESULTS																
Short-chain PFCAs																
PFBA	40 : 40	100%	0.0596	0.113	0.15	EP26A	470	[2]	660	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeA	41 : 42	98%	0.00573 J-	0.00907	0.012	EP17A	140	[2]	660	[3, 7]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHxA	42 : 42	100%	0.00501 J-	0.0116	0.018	EP18	2300	[2]	210	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpA	42 : 42	100%	0.00277	0.00919	0.015	EP27A	870	[2]	210	[3, 12]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFCAs																
PFOA	42 : 42	100%	0.0152 J-	0.0703	0.15 J+	EP26A	537	[1]	4.4	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFNA	40 : 42	95%	0.000933 J	0.00146	0.0041 J	EP26A	120	[2]	2.2	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDA	38 : 42	90%	0.000791 J	0.00161	0.0066	EP26A	140	[2]	2.2	[3, 9]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFUNA	1 : 42	2%	0.0026 J	0.0026	0.0026 J	EP26A	49	[2]	2.2	[3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDoA	1 : 42	2%	0.0028 J+	0.0028	0.0028 J+	EP26A	72	[2]	2.2	[3, 9]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFTrDA	6 : 42	14%	0.0014 J	0.003	0.0069	EP26A	72	[2, 11]	2.2	[3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFTeDA	5 : 41	12%	0.0023 J	0.0026	0.0029 J+	EP27A	72	[2, 11]	2.2	[3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
Short-chain PFSAs																
PFBS	41 : 42	98%	0.00187	0.0045	0.0071	EP26A	3400	[2]	640	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeS	38 : 41	93%	0.000978 J	0.00335	0.0068	EP26A	3400	[2, 8]	640	[2, 8]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFSAs																
PFHxS	42 : 42	100%	0.00212 J	0.00922	0.014 J-	EP8	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpS	39 : 42	93%	0.000952 J	0.00263	0.0058	EP26A	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFOS	42 : 42	100%	0.0138	0.246	0.68	EP26A	0.56	[1]	0.075	[3]	MAX > Aquatic Life ESV	MAX > Wildlife ESV	0.32	No	EPC > Wildlife ESV	EPC Exceeds Wildlife ESV
PFNS	0 : 42	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
PFDS	0 : 42	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
PFDoS	0 : 29	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
Fluortelomers																
4:2 FTS	0 : 42	0%	ND	ND	ND	--	3400	[2, 8]	640	[2, 8]	--	--	NC	--	--	Not Detected
6:2 FTS	13 : 42	31%	0.00063 J	0.00868	0.0609 B	EP18	537	[1, 6]	4.4	[1, 6]	No	No	NC	--	--	Max Does Not Exceed ESVs
8:2 FTS	1 : 42	2%	0.0002 BJ+	0.0002	0.0002 BJ+	EP27A	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
10:2 FTS	0 : 13	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
FOSA, FASE, FASAAs																
PFOSA	30 : 42	71%	0.00072 J	0.00149	0.00468 J-	EP17A	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSA	2 : 42	5%	0.00049 BJ	0.0005	0.0005 BJ	EP26A	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-EtFOSA	0 : 40	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-MeFOSAA	0 : 42	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSAA	22 : 41	54%	0.00079 J	0.0019	0.006 J+	EP26A	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSE	0 : 42	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSE	3 : 40	8%	0.00015 BJ	0.00045	0.001 J+	EP26A	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
Replacement Chemistries																
HFPO-DA	0 : 42	0%	ND	ND	ND	--	2300	[2, 12]	210	[3, 12]	--	--	NC	--	--	Not Detected
ADONA	0 : 42	0%	ND	ND	ND	--	537	[1, 6]	4.4	[1, 6]	--	--	NC	--	--	Not Detected
9CL-PF3ONS	0 : 42	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
11CL-PF3OUDS	0 : 42	0%	ND	ND	ND	--	49	[2, 14]	0.075	[3, 5]	--	--	NC	--	--	Not Detected

Appendix F Table 2c
Comparison of PFAS Surface Water Concentrations to Ecological Screening Values - Eagle Point Lake
Project 1007
Minneapolis, Minnesota

			Detected Concentrations				Surface Water ESVs (ug/L)									
Analyte	FOD	Percent Detected	Minimum (ug/L)	Mean (ug/L)	Maximum (ug/L)	Location of Maximum Concentration	Aquatic Life (chronic)		Wildlife		Maximum > Aquatic Life ESV?	Maximum > Wildlife ESV?	BERA EPC (ug/L)	BERA EPC > Aquatic Life ESV?	BERA EPC > Wildlife ESV?	Findings
DISSOLVED PHASE RESULTS																
Short-chain PFCAs																
PFBA	12 : 12	100%	0.11	0.14	0.17	EP18	470	[2]	660	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeA	12 : 12	100%	0.0085	0.012	0.014	EP4	140	[2]	660	[3, 7]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHxA	12 : 12	100%	0.0091 J	0.014	0.022	EP4	2300	[2]	210	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpA	12 : 12	100%	0.0055 B	0.011	0.014	EP18 EP26A EP27C	870	[2]	210	[3, 12]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFCAs																
PFOA	12 : 12	100%	0.038	0.093	0.16	EP18	537	[1]	4.4	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFNA	9 : 12	75%	0.0012 J	0.0023	0.0063	EP26A	120	[2]	2.2	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDA	5 : 12	42%	0.0012 J	0.0035	0.011 J+	EP26A	140	[2]	2.2	[3, 9]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFUNA	0 : 11	0%	ND	ND	ND	--	49	[2]	2.2	[3, 10]	--	--	NC	--	--	Not Detected
PFDoA	0 : 11	0%	ND	ND	ND	--	72	[2]	2.2	[3, 9]	--	--	NC	--	--	Not Detected
PFTrDA	9 : 12	75%	0.0015 J	0.0052	0.032 J+	EP26A	72	[2, 11]	2.2	[3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFTeDA	6 : 11	55%	0.0037 J+	0.0043	0.0051 J+	EP18	72	[2, 11]	2.2	[3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
Short-chain PFSAs																
PFBS	12 : 12	100%	0.0035 J	0.0057	0.0073	EP18	3400	[2]	640	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeS	12 : 12	100%	0.0029 J+	0.0057	0.011	EP4	3400	[2, 8]	640	[2, 8]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFSAs																
PFHxS	12 : 12	100%	0.0063	0.013	0.03	EP4	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpS	12 : 12	100%	0.0015 J	0.0034	0.0053	EP26A	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFOS	12 : 12	100%	0.11	0.31	1.1 J+	EP26A	0.56	[1]	0.075	[3]	MAX > Aquatic Life ESV	MAX > Wildlife ESV	0.47	No	EPC > Wildlife ESV	EPC Exceeds Wildlife ESV
PFNS	0 : 12	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
PFDS	0 : 12	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
Fluortelomers																
4:2 FTS	0 : 12	0%	ND	ND	ND	--	3400	[2, 8]	640	[2, 8]	--	--	NC	--	--	Not Detected
6:2 FTS	2 : 12	17%	0.00067 J	0.0013	0.0019 J	EP4	537	[1, 6]	4.4	[1, 6]	No	No	NC	--	--	Max Does Not Exceed ESVs
8:2 FTS	1 : 12	8%	0.00041 J+	0.00041	0.00041 J+	EP4	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
10:2 FTS	0 : 12	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
FOSA, FASE, FASAAs																
PFOSA	11 : 11	100%	0.00081 J	0.0013	0.0019 J	EP27A	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSA	6 : 11	55%	0.00047 BJ	0.00058	0.00081 BJ	EP18	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-EtFOSA	0 : 11	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-MeFOSAA	0 : 11	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSAA	2 : 11	18%	0.00051 J	0.0006	0.00068 J	EP19	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSE	1 : 11	9%	0.00032 J+	0.00032	0.00032 J+	EP5	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-EtFOSE	6 : 11	55%	0.00021 J+	0.00031	0.00057 J+	EP27A	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
Replacement Chemistries																
HFPO-DA	3 : 12	25%	0.00032 J	0.00034	0.00035 J	EP17A	2300	[2, 12]	210	[3, 12]	No	No	NC	--	--	Max Does Not Exceed ESVs
ADONA	0 : 12	0%	ND	ND	ND	--	537	[1, 6]	4.4	[1, 6]	--	--	NC	--	--	Not Detected
9CL-PF3ONS	0 : 12	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
11CL-PF3OUDS	0 : 12	0%	ND	ND	ND	--	49	[2, 14]	0.075	[3, 5]	--	--	NC	--	--	Not Detected

Notes:
-- Not Available/Applicable.
ug/L - micrograms per liter.
B - Analyte was present in a blank.
EPC - Exposure Point Concentration (see Appendix D for EPC calculations; if sufficient samples are available, the EPC is an upper confidence limit (UCL); maximum detected concentration is the EPC if a UCL cannot be calculated).
ESV - Ecological Screening Value (see Appendix F Table 1 for ESVs).
FOD - Frequency of Detection: Total number of detects - Total number of samples.
J - Analyte positively detected but value is an approximate concentration.
J+ - The chemical was positively identified; however, the associated numerical value is a high estimated concentration.
J- - The chemical was positively identified; however, the associated numerical value is a low estimated concentration.
NC - Not Calculated.
ND - Not Detected.

Source Footnotes -
1 - Hazardous Concentration 1% (HC1) (Conder, et al., 2020a).
2 - Chronic recommended water quality (RWQ) risk-based screening level (RBSL)(Divine, et al., 2020).
3 - Aquatic risk-based screening level for wildlife. Selected level is the lowest of the values derived by Devine, et al (2020) for the muskrat, little brown bat, river otter, mink, red-winged blackbird, tree swallow, and brown pelican.
Surrogate footnotes 5, 6, 7, 8, 9, 10, 12 and 14 are provided on Appendix F Table 1.

Appendix F Table 2d
Comparison of PFAS Surface Water Concentrations to Ecological Screening Values - Lake Elmo
Project 1007
Minneapolis, Minnesota

			Detected Concentrations				Surface Water ESVs (ug/L)									
Analyte	FOD	Percent Detected	Minimum (ug/L)	Mean (ug/L)	Maximum (ug/L)	Location of Maximum Concentration	Aquatic Life (chronic)		Wildlife		Maximum > Aquatic Life ESV?	Maximum > Wildlife ESV?	BERA EPC (ug/L)	BERA EPC > Aquatic Life ESV?	BERA EPC > Wildlife ESV?	Findings
TOTAL RECOVERABLE PHASE RESULTS																
Short-chain PFCAs																
PFBA	31 : 31	100%	0.091	0.53	1.0 J	EP21A	470	[2]	660	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeA	34 : 34	100%	0.0064	0.013	0.019	EP9A EP21A EP23	140	[2]	660	[3, 7]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHxA	34 : 34	100%	0.0077	0.014	0.022	EP9A EP21A EP14	2300	[2]	210	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpA	34 : 34	100%	0.0046	0.0072	0.014	EP20	870	[2]	210	[3, 12]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFCAs																
PFOA	34 : 34	100%	0.051	0.071	0.11 J-	EP20	537	[1]	4.4	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFNA	21 : 34	62%	0.00065 J	0.0011	0.0019 J	EP20	120	[2]	2.2	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDA	17 : 34	50%	0.00050 J-	0.0014	0.0027 J	EP20	140	[2]	2.2	[3, 9]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFUNA	0 : 34	0%	ND	ND	ND	--	49	[2]	2.2	[3, 10]	--	--	NC	--	--	Not Detected
PFDoA	0 : 34	0%	ND	ND	ND	--	72	[2]	2.2	[3, 9]	--	--	NC	--	--	Not Detected
PFTrDA	2 : 34	6%	0.0017 BJJ	0.0017	0.0017 BJJ	EP15 EP23	72	[2, 11]	2.2	[3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFTeDA	1 : 34	3%	0.0024 J+	0.0024	0.0024 J+	EP23	72	[2, 11]	2.2	[3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
Short-chain PFSAs																
PFBS	34 : 34	100%	0.0013 J	0.0036	0.0056	EP20	3400	[2]	640	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeS	34 : 34	100%	0.0011 J	0.0027	0.006 J+	EP20	3400	[2, 8]	640	[2, 8]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFSAs																
PFHxS	34 : 34	100%	0.0059	0.0080	0.013 J-	EP20	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpS	32 : 34	94%	0.00078 J	0.0016	0.0044	EP20	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFOS	34 : 34	100%	0.047	0.15	0.48	EP20	0.56	[1]	0.075	[3]	No	MAX > Wildlife ESV	0.19	No	EPC > Wildlife ESV	EPC Exceeds Wildlife ESV
PFNS	0 : 34	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
PFDS	0 : 34	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
PFDoS	0 : 28	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
Fluortelomers																
4:2 FTS	0 : 34	0%	ND	ND	ND	--	3400	[2, 8]	640	[2, 8]	--	--	NC	--	--	Not Detected
6:2 FTS	8 : 34	24%	0.00056 J	0.017	0.086 B	EP21A	537	[1, 6]	4.4	[1, 6]	No	No	NC	--	--	Max Does Not Exceed ESVs
8:2 FTS	0 : 34	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
10:2 FTS	0 : 6	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
FOSA, FASE, FASAAs																
PFOSA	16 : 34	47%	0.00040 BJ-	0.0011	0.0028	EP20	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSA	0 : 34	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSA	0 : 34	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-MeFOSAA	1 : 34	3%	0.0023 J-	0.0023	0.0023 J-	EP21A	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-EtFOSAA	6 : 34	18%	0.00049 UJ	0.0010	0.0022	EP20	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSE	0 : 34	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSE	1 : 34	3%	0.00015 BJ	0.00015	0.00015 BJ	EP9A	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
Replacement Chemistries																
HFPO-DA	0 : 34	0%	ND	ND	ND	--	2300	[2, 12]	210	[3, 12]	--	--	NC	--	--	Not Detected
ADONA	0 : 34	0%	ND	ND	ND	--	537	[1, 6]	4.4	[1, 6]	--	--	NC	--	--	Not Detected
9CL-PF3ONS	0 : 34	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
11CL-PF3OUDS	0 : 34	0%	ND	ND	ND	--	49	[2, 14]	0.075	[3, 5]	--	--	NC	--	--	Not Detected

Appendix F Table 2d
Comparison of PFAS Surface Water Concentrations to Ecological Screening Values - Lake Elmo
Project 1007
Minneapolis, Minnesota

			Detected Concentrations				Surface Water ESVs (ug/L)									
Analyte	FOD	Percent Detected	Minimum (ug/L)	Mean (ug/L)	Maximum (ug/L)	Location of Maximum Concentration	Aquatic Life (chronic)		Wildlife		Maximum > Aquatic Life ESV?	Maximum > Wildlife ESV?	BERA EPC (ug/L)	BERA EPC > Aquatic Life ESV?	BERA EPC > Wildlife ESV?	Findings
DISSOLVED PHASE RESULTS																
Short-chain PFCAs																
PFBA	6 : 6	100%	0.13	0.64	0.81	EP15	470	[2]	660	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeA	6 : 6	100%	0.010	0.018	0.022	EP9A	140	[2]	660	[3, 7]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHxA	6 : 6	100%	0.016	0.019	0.021	EP21A	2300	[2]	210	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpA	6 : 6	100%	0.0069	0.01	0.013	EP20	870	[2]	210	[3, 12]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFCAs																
PFOA	6 : 6	100%	0.077	0.084	0.1	EP20	537	[1]	4.4	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFNA	4 : 6	67%	0.0014 J	0.0017	0.0018 J	EP21A EP9A	120	[2]	2.2	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDA	1 : 6	17%	0.0023 J	0.0023	0.0023 J	EP20	140	[2]	2.2	[3, 9]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFUNA	0 : 6	0%	ND	ND	ND	--	49	[2]	2.2	[3, 10]	--	--	NC	--	--	Not Detected
PFDoA	0 : 6	0%	ND	ND	ND	--	72	[2]	2.2	[3, 9]	--	--	NC	--	--	Not Detected
PFTrDA	1 : 6	17%	0.0018 J+	0.0018	0.0018 J+	EP21A	72	[2, 11]	2.2	[3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFTeDA	2 : 6	33%	0.0032 BJ+	0.0036	0.0039 BJ+	EP21A	72	[2, 11]	2.2	[3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
Short-chain PFSAs																
PFBS	6 : 6	100%	0.0033 J	0.0038	0.005	EP20	3400	[2]	640	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeS	6 : 6	100%	0.0038 J+	0.0045	0.0062 J+	EP20	3400	[2, 8]	640	[2, 8]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFSAs																
PFHxS	6 : 6	100%	0.0073	0.009	0.012	EP20	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpS	6 : 6	100%	0.0011 J+	0.0019	0.0037 J+	EP20	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFOS	6 : 6	100%	0.064	0.13	0.39	EP20	0.56	[1]	0.075	[3]	No	MAX > Wildlife ESV	0.357	No	EPC > Wildlife ESV	EPC Exceeds Wildlife ESV
PFNS	0 : 6	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
PFDS	0 : 6	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
Fluortelomers																
4:2 FTS	0 : 6	0%	ND	ND	ND	--	3400	[2, 8]	640	[2, 8]	--	--	NC	--	--	Not Detected
6:2 FTS	0 : 6	0%	ND	ND	ND	--	537	[1, 6]	4.4	[1, 6]	--	--	NC	--	--	Not Detected
8:2 FTS	0 : 6	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
10:2 FTS	0 : 6	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
FOSA, FASE, FASAAs																
PFOSA	4 : 6	67%	0.00054 J	0.00088	0.0016 J	EP20	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSA	2 : 6	33%	0.00047 BJ	0.00047	0.00047 BJ	EP9A EP14	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-EtFOSA	0 : 6	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-MeFOSAA	0 : 6	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSAA	1 : 6	17%	0.001 J	0.001	0.001 J	EP20	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSE	0 : 6	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSE	2 : 6	33%	0.00024 BJ+	0.00026	0.00027 BJ+	EP9A	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
Replacement Chemistries																
HFPO-DA	0 : 6	0%	ND	ND	ND	--	2300	[2, 12]	210	[3, 12]	--	--	NC	--	--	Not Detected
ADONA	0 : 6	0%	ND	ND	ND	--	537	[1, 6]	4.4	[1, 6]	--	--	NC	--	--	Not Detected
9CL-PF3ONS	0 : 6	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
11CL-PF3OUDS	0 : 6	0%	ND	ND	ND	--	49	[2, 14]	0.075	[3, 5]	--	--	NC	--	--	Not Detected

Notes:
-- Not Available/Applicable.
ug/L - micrograms per liter.
B - Analyte was present in a blank.
EPC - Exposure Point Concentration (see Appendix D for EPC calculations; if sufficient samples are available, the EPC is an upper confidence limit (UCL); maximum detected concentration is the EPC if a UCL cannot be calculated).
ESV - Ecological Screening Value (see Appendix F Table 1 for ESVs).
FOD - Frequency of Detection: Total number of detects - Total number of samples.
J - Analyte positively detected but value is an approximate concentration.
J+ - The chemical was positively identified; however, the associated numerical value is a high estimated concentration.
J- - The chemical was positively identified; however, the associated numerical value is a low estimated concentration.
NC - Not Calculated.
ND - Not Detected.

Source Footnotes -
1 - Hazardous Concentration 1% (HC1) (Conder, et al., 2020a).
2 - Chronic recommended water quality (RWQ) risk-based screening level (RBSL)(Divine, et al., 2020).
3 - Aquatic risk-based screening level for wildlife. Selected level is the lowest of the values derived by Devine, et al (2020) for the muskrat, little brown bat, river otter, mink, red-winged blackbird, tree swallow, and brown pelican.
Surrogate footnotes 5, 6, 7, 8, 9, 10, 12 and 14 are provided on Appendix F Table 1.

Appendix F Table 2e
Comparison of PFAS Surface Water Concentrations to Ecological Screening Values - West Lakeland Area
Project 1007
Minneapolis, Minnesota

			Detected Concentrations				Surface Water ESVs (ug/L)									
Analyte	FOD	Percent Detected	Minimum (ug/L)	Mean (ug/L)	Maximum (ug/L)	Location of Maximum Concentration	Aquatic Life (chronic)		Wildlife		Maximum > Aquatic Life ESV?	Maximum > Wildlife ESV?	BERA EPC (ug/L)	BERA EPC > Aquatic Life ESV?	BERA EPC > Wildlife ESV?	Findings
TOTAL RECOVERABLE PHASE RESULTS																
Short-chain PFCAs																
PFBA	74 : 74	100%	0.14	0.39	0.79	EP11	470	[2]	660	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeA	72 : 82	88%	0.0074	0.012	0.018	EP13	140	[2]	660	[3, 7]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHxA	82 : 82	100%	0.0078 J	0.013	0.019	EP16	2300	[2]	210	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpA	80 : 82	98%	0.0057	0.0078	0.0111	EP16	870	[2]	210	[3, 12]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFCAs																
PFOA	82 : 82	100%	0.048	0.0703	0.11	WL6	537	[1]	4.4	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFNA	60 : 82	73%	0.00077 J	0.0012	0.0028	WL15	120	[2]	2.2	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDA	33 : 82	40%	0.00075 J-	0.0014	0.0058	EP16	140	[2]	2.2	[3, 9]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFUNA	1 : 82	1%	0.00052 J	0.00052	0.0005 J	EP16	49	[2]	2.2	[3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDoA	0 : 82	0%	ND	ND	ND	--	72	[2]	2.2	[3, 9]	--	--	NC	--	--	Not Detected
PFTrDA	4 : 82	5%	0.0013 J	0.0015	0.0017 J	WL6	72	[2, 11]	2.2	[3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFTeDA	8 : 82	10%	0.0021 J+	0.0029	0.0044 B	WL3	72	[2, 11]	2.2	[3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
Short-chain PFSAs																
PFBS	72 : 82	88%	0.0026	0.00407	0.00561 J-	WL6	3400	[2]	640	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeS	72 : 82	88%	0.00182	0.00293	0.0051	WL3	3400	[2, 8]	640	[2, 8]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFSAs																
PFHxS	82 : 82	100%	0.0057	0.00923	0.013	WL11	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpS	71 : 82	87%	0.000758 J	0.00187	0.0037 J	WL6	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFOS	82 : 82	100%	0.059	0.179	0.748	EP16	0.56	[1]	0.075	[3]	MAX > Aquatic Life ESV	MAX > Wildlife ESV	0.20	No	EPC > Wildlife ESV	EPC Exceeds Wildlife ESV
PFNS	0 : 82	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
PFDS	0 : 82	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
PFDoS	0 : 66	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
Fluortelomers																
4:2 FTS	0 : 82	0%	ND	ND	ND	--	3400	[2, 8]	640	[2, 8]	--	--	NC	--	--	Not Detected
6:2 FTS	19 : 82	23%	0.0029 BJ+	0.0163	0.059 J	WL5	537	[1, 6]	4.4	[1, 6]	No	No	NC	--	--	Max Does Not Exceed ESVs
8:2 FTS	0 : 82	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
10:2 FTS	0 : 16	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
FOSA, FASE, FASAAs																
PFOSA	35 : 82	43%	0.00069 J	0.00113	0.00286 B	EP16	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSA	0 : 82	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSA	1 : 82	1%	0.00032 BJ	0.00032	0.00032 BJ	WL15	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSAA	0 : 82	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSAA	18 : 82	22%	0.00048 J	0.0015	0.0091	EP16	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSE	0 : 82	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSE	2 : 82	2%	0.00014 J+	0.00031	0.00047 J+	WL3	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
Replacement Chemistries																
HFPO-DA	0 : 82	0%	ND	ND	ND	--	2300	[2, 12]	210	[3, 12]	--	--	NC	--	--	Not Detected
ADONA	0 : 82	0%	ND	ND	ND	--	537	[1, 6]	4.4	[1, 6]	--	--	NC	--	--	Not Detected
9CL-PF3ONS	0 : 82	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
11CL-PF3OUDS	0 : 82	0%	ND	ND	ND	--	49	[2, 14]	0.075	[3, 5]	--	--	NC	--	--	Not Detected

Appendix F Table 2e
Comparison of PFAS Surface Water Concentrations to Ecological Screening Values - West Lakeland Area
Project 1007
Minneapolis, Minnesota

			Detected Concentrations				Surface Water ESVs (ug/L)									
Analyte	FOD	Percent Detected	Minimum (ug/L)	Mean (ug/L)	Maximum (ug/L)	Location of Maximum Concentration	Aquatic Life (chronic)		Wildlife		Maximum > Aquatic Life ESV?	Maximum > Wildlife ESV?	BERA EPC (ug/L)	BERA EPC > Aquatic Life ESV?	BERA EPC > Wildlife ESV?	Findings
DISSOLVED PHASE RESULTS																
Short-chain PFCAs																
PFBA	13 : 13	100%	0.34	0.42	0.48	WL21	470	[2]	660	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeA	13 : 13	100%	0.013	0.015	0.016	WL2, WL15 WL7, WL6	140	[2]	660	[3, 7]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHxA	13 : 13	100%	0.014	0.015	0.017	WL11	2300	[2]	210	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpA	13 : 13	100%	0.008	0.0093	0.011	PS00174 S016-073	870	[2]	210	[3, 12]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFCAs																
PFOA	13 : 13	100%	0.071	0.078	0.088	WL15	537	[1]	4.4	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFNA	6 : 13	46%	0.0012 J	0.0015	0.0016 J	WL15	120	[2]	2.2	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDA	11 : 13	85%	0.0012 J	0.0019	0.0022 J	WL15	140	[2]	2.2	[3, 9]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFUNA	1 : 13	8%	0.0016 J+	0.0016	0.0016 J+	WL8	49	[2]	2.2	[3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDoA	6 : 13	46%	0.0019 BJ+	0.0027	0.0037 BJ+	WL8	72	[2]	2.2	[3, 9]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFTrDA	0 : 13	0%	ND	ND	ND	--	72	[2, 11]	2.2	[3, 10]	--	--	NC	--	--	Not Detected
PFTeDA	0 : 10	0%	ND	ND	ND	--	72	[2, 11]	2.2	[3, 10]	--	--	NC	--	--	Not Detected
Short-chain PFSAs																
PFBS	13 : 13	100%	0.0036 J	0.0041	0.0044	WL15	3400	[2]	640	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeS	13 : 13	100%	0.0035 J+	0.0046	0.0059 J+	WL6	3400	[2, 8]	640	[2, 8]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFSAs																
PFHxS	13 : 13	100%	0.0096	0.011	0.013	WL6	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpS	13 : 13	100%	0.0018 J	0.0023	0.0029 J	WL15	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFOS	13 : 13	100%	0.19 J+	0.23	0.31	WL15	0.56	[1]	0.075	[3]	No	MAX > Wildlife ESV	0.244	No	EPC > Wildlife ESV	EPC Exceeds Wildlife ESV
PFNS	0 : 13	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
PFDS	0 : 13	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
Fluortelomers																
4:2 FTS	0 : 13	0%	ND	ND	ND	--	3400	[2, 8]	640	[2, 8]	--	--	NC	--	--	Not Detected
6:2 FTS	2 : 13	15%	0.00064 J	0.001	0.0014 J	WL15	537	[1, 6]	4.4	[1, 6]	No	No	NC	--	--	Max Does Not Exceed ESVs
8:2 FTS	1 : 13	8%	0.00017 J	0.00017	0.00017 J	WL6	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
10:2 FTS	0 : 13	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
FOSA, FASE, FASAAs																
PFOSA	13 : 13	100%	0.00088 J	0.0011	0.0014 J+	WL21	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSA	1 : 12	8%	0.0006 BJ	0.0006	0.0006 BJ	WL2	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-EtFOSA	0 : 13	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-MeFOSAA	0 : 12	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSAA	1 : 12	8%	0.0016 J+	0.0016	0.0016 J+	WL15	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSE	0 : 13	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSE	2 : 13	15%	0.00014 BJ	0.00017	0.0002 J	WL16	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
Replacement Chemistries																
HFPO-DA	0 : 13	0%	ND	ND	ND	--	2300	[2, 12]	210	[3, 12]	--	--	NC	--	--	Not Detected
ADONA	0 : 13	0%	ND	ND	ND	--	537	[1, 6]	4.4	[1, 6]	--	--	NC	--	--	Not Detected
9CL-PF3ONS	0 : 13	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
11CL-PF3OUDS	0 : 13	0%	ND	ND	ND	--	49	[2, 14]	0.075	[3, 5]	--	--	NC	--	--	Not Detected

Notes:
-- Not Available/Applicable.
ug/L - micrograms per liter.
B - Analyte was present in a blank.
EPC - Exposure Point Concentration (see Appendix D for EPC calculations; if sufficient samples are available, the EPC is an upper confidence limit (UCL); maximum detected concentration is the EPC if a UCL cannot be calculated).
ESV - Ecological Screening Value (see Appendix F Table 1 for ESVs).
FOD - Frequency of Detection: Total number of detects - Total number of samples.
J - Analyte positively detected but value is an approximate concentration.
J+ - The chemical was positively identified; however, the associated numerical value is a high estimated concentration.
J- - The chemical was positively identified; however, the associated numerical value is a low estimated concentration.
NC - Not Calculated.
ND - Not Detected.

Source Footnotes -
1 - Hazardous Concentration 1% (HC1) (Conder, et al., 2020a).
2 - Chronic recommended water quality (RWQ) risk-based screening level (RBSL)(Divine, et al., 2020).
3 - Aquatic risk-based screening level for wildlife. Selected level is the lowest of the values derived by Devine, et al (2020) for the muskrat, little brown bat, river otter, mink, red-winged blackbird, tree swallow, and brown pelican.
Surrogate footnotes 5, 6, 7, 8, 9, 10, 12 and 14 are provided on Appendix F Table 1.

Appendix F Table 2f
Comparison of PFAS Surface Water Concentrations to Ecological Screening Values - Other Areas
Project 1007
Minneapolis, Minnesota

			Detected Concentrations				Surface Water ESVs (ug/L)									
Analyte	FOD	Percent Detected	Minimum (ug/L)	Mean (ug/L)	Maximum (ug/L)	Location of Maximum Concentration	Aquatic Life (chronic)		Wildlife		Maximum > Aquatic Life ESV?	Maximum > Wildlife ESV?	BERA EPC (ug/L)	BERA EPC > Aquatic Life ESV?	BERA EPC > Wildlife ESV?	Findings
TOTAL RECOVERABLE PHASE RESULTS																
Short-chain PFCAs																
PFBA	41 : 42	98%	0.013	0.49	5.0 J	EP24	470	[2]	660	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeA	43 : 47	91%	0.0027 J	0.013	0.060	EP24	140	[2]	660	[3, 7]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHxA	41 : 47	87%	0.0018 J	0.0122	0.073	EP24	2300	[2]	210	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpA	44 : 47	94%	0.0013 J	0.0045	0.017	EP24	870	[2]	210	[3, 12]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFCAs																
PFOA	45 : 47	96%	0.00078 J	0.032	0.16	RC3CUL	537	[1]	4.4	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFNA	16 : 47	34%	0.00070 J	0.0013	0.0033 J	OD2	120	[2]	2.2	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDA	6 : 47	13%	0.00040 J-	0.0027	0.0052	OD2	140	[2]	2.2	[3, 9]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFUNA	0 : 47	0%	ND	ND	ND	--	49	[2]	2.2	[3, 10]	--	--	NC	--	--	Not Detected
PFDoA	1 : 47	2%	0.0013 J	0.0013	0.0013 J	OD2	72	[2]	2.2	[3, 9]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFTrDA	1 : 47	2%	0.0015 J	0.0015	0.0015 J	BP1	72	[2, 11]	2.2	[3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFTeDA	1 : 47	2%	0.0029 BJ	0.0029	0.0029 BJ	VB3	72	[2, 11]	2.2	[3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
Short-chain PFSAs																
PFBS	42 : 47	89%	0.00085 J-	0.0032	0.0089	RC3CUL	3400	[2]	640	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeS	24 : 47	51%	0.00046 J-	0.0022	0.010	RC3CUL	3400	[2, 8]	640	[2, 8]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFSAs																Not Detected
PFHxS	38 : 47	81%	0.00096 J-	0.0052	0.036 J+	RC3CUL	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpS	10 : 47	21%	0.0011 J	0.0035	0.0099	RC3CUL	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFOS	44 : 47	94%	0.00124 J	0.0438	0.33	RC3CUL	0.56	[1]	0.075	[3]	No	MAX > Wildlife ESV	0.092	No	EPC > Wildlife ESV	EPC Exceeds Wildlife ESV
PFNS	1 : 47	2%	0.0012 J	0.0012	0.0012 J	OD2	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDS	0 : 47	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
PFDoS	0 : 38	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
Fluortelomers																Not Detected
4:2 FTS	0 : 47	0%	ND	ND	ND	--	3400	[2, 8]	640	[2, 8]	--	--	NC	--	--	Not Detected
6:2 FTS	8 : 47	17%	0.0082 BJ-	0.030	0.10 B	FP1	537	[1, 6]	4.4	[1, 6]	No	No	NC	--	--	Max Does Not Exceed ESVs
8:2 FTS	0 : 47	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
10:2 FTS	0 : 9	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
FOSA, FASE, FASAAs																
PFOSA	7 : 47	15%	0.00076 J-	0.00099	0.0014 J	OD2	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSA	3 : 47	6%	0.00046 J	0.00050	0.00055 BJ	EP24	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-EtFOSA	0 : 47	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-MeFOSAA	0 : 47	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSAA	1 : 47	2%	0.0011 J	0.0011	0.0011 J	RC3CUL	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSE	0 : 47	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSE	0 : 47	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
Replacement Chemistries																
HFPO-DA	0 : 47	0%	ND	ND	ND	--	2300	[2, 12]	210	[3, 12]	--	--	NC	--	--	Not Detected
ADONA	0 : 47	0%	ND	ND	ND	--	537	[1, 6]	4.4	[1, 6]	--	--	NC	--	--	Not Detected
9CL-PF3ONS	0 : 47	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
11CL-PF3OUDS	0 : 47	0%	ND	ND	ND	--	49	[2, 14]	0.075	[3, 5]	--	--	NC	--	--	Not Detected

Appendix F Table 2f
Comparison of PFAS Surface Water Concentrations to Ecological Screening Values - Other Areas
Project 1007
Minneapolis, Minnesota

			Detected Concentrations				Surface Water ESVs (ug/L)									
Analyte	FOD	Percent Detected	Minimum (ug/L)	Mean (ug/L)	Maximum (ug/L)	Location of Maximum Concentration	Aquatic Life (chronic)		Wildlife		Maximum > Aquatic Life ESV?	Maximum > Wildlife ESV?	BERA EPC (ug/L)	BERA EPC > Aquatic Life ESV?	BERA EPC > Wildlife ESV?	Findings
DISSOLVED PHASE RESULTS																
Short-chain PFCAs																
PFBA	2 : 2	100%	0.15 J+	0.2	0.25	VB3	470	[2]	660	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeA	2 : 2	100%	0.0099	0.011	0.012	VB3	140	[2]	660	[3, 7]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHxA	0 : 2	0%	ND	ND	ND	--	2300	[2]	210	[3]	--	--	NC	--	--	Not Detected
PFHpA	2 : 2	100%	0.0035 J	0.005	0.0065 B	BP1	870	[2]	210	[3, 12]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFCAs																
PFOA	2 : 2	100%	0.014 J+	0.014	0.014 J+	BP1VB3	537	[1]	4.4	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFNA	1 : 2	50%	0.0013 J	0.0013	0.0013 J	BP1	120	[2]	2.2	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDA	0 : 2	0%	ND	ND	ND	--	140	[2]	2.2	[3, 9]	--	--	NC	--	--	Not Detected
PFUNA	0 : 2	0%	ND	ND	ND	--	49	[2]	2.2	[3, 10]	--	--	NC	--	--	Not Detected
PFDoA	0 : 2	0%	ND	ND	ND	--	72	[2]	2.2	[3, 9]	--	--	NC	--	--	Not Detected
PFTrDA	2 : 2	100%	0.0013 J+	0.0092	0.017 BJ+	VB3	72	[2, 11]	2.2	[3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFTeDA	1 : 1	100%	0.0037 BJ+	0.0037	0.0037 BJ+	BP1	72	[2, 11]	2.2	[3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
Short-chain PFSAs																
PFBS	2 : 2	100%	0.0026 J	0.0031	0.0036 J+	BP1	3400	[2]	640	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeS	1 : 2	50%	0.0019 J+	0.0019	0.0019 J+	VB3	3400	[2, 8]	640	[2, 8]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFSAs																
PFHxS	2 : 2	100%	0.0017 J	0.0024	0.0031 J	VB3	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpS	0 : 2	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
PFOS	2 : 2	100%	0.002 J	0.011	0.019	VB3	0.56	[1]	0.075	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFNS	0 : 2	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
PFDS	0 : 2	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
Fluortelomers																
4:2 FTS	0 : 2	0%	ND	ND	ND	--	3400	[2, 8]	640	[2, 8]	--	--	NC	--	--	Not Detected
6:2 FTS	0 : 2	0%	ND	ND	ND	--	537	[1, 6]	4.4	[1, 6]	--	--	NC	--	--	Not Detected
8:2 FTS	0 : 2	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
10:2 FTS	0 : 2	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
FOSA, FASE, FASAAs																Not Detected
PFOSA	0 : 2	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-MeFOSA	1 : 2	50%	0.00046 BJ	0.00046	0.00046 BJ	BP1	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-EtFOSA	0 : 2	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-MeFOSAA	0 : 2	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSAA	0 : 2	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-MeFOSE	0 : 2	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSE	0 : 2	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
Replacement Chemistries																
HFPO-DA	1 : 2	50%	0.00031 J	0.00031	0.00031 J	BP1	2300	[2, 12]	210	[3, 12]	No	No	NC	--	--	Max Does Not Exceed ESVs
ADONA	0 : 2	0%	ND	ND	ND	--	537	[1, 6]	4.4	[1, 6]	--	--	NC	--	--	Not Detected
9CL-PF3ONS	0 : 2	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
11CL-PF3OUDS	0 : 2	0%	ND	ND	ND	--	49	[2, 14]	0.075	[3, 5]	--	--	NC	--	--	Not Detected

Notes:
-- Not Available/Applicable.
ug/L - micrograms per liter.
B - Analyte was present in a blank.
EPC - Exposure Point Concentration (see Appendix D for EPC calculations; if sufficient samples are available, the EPC is an upper confidence limit (UCL); maximum detected concentration is the EPC if a UCL cannot be calculated).
ESV - Ecological Screening Value (see Appendix F Table 1 for ESVs).
FOD - Frequency of Detection: Total number of detects - Total number of samples.
J - Analyte positively detected but value is an approximate concentration.
J+ - The chemical was positively identified; however, the associated numerical value is a high estimated concentration.
J- - The chemical was positively identified; however, the associated numerical value is a low estimated concentration.
NC - Not Calculated.
ND - Not Detected.

Source Footnotes -
1 - Hazardous Concentration 1% (HC1) (Conder, et al., 2020a).
2 - Chronic recommended water quality (RWQ) risk-based screening level (RBSL)(Divine, et al., 2020).
3 - Aquatic risk-based screening level for wildlife. Selected level is the lowest of the values derived by Devine, et al (2020) for the muskrat, little brown bat, river otter, mink, red-winged blackbird, tree swallow, and brown pelican.
Surrogate footnotes 5, 6, 7, 8, 9, 10, 12 and 14 are provided on Appendix F Table 1.

Appendix F Table 3a
Comparison of PFAS Sediment Concentrations to Ecological Screening Values - Raleigh Creek - Upper
Project 1007
Minneapolis, Minnesota

			Detected Concentrations				Sediment ESVs (ug/kg)								
Analyte	FOD	Percent Detected	Minimum (ug/kg)	Mean (ug/kg)	Maximum (ug/kg)	Location of Maximum Concentration	Benthic Aquatic Life	Wildlife	Maximum > Aquatic Life ESV?	Maximum > Wildlife ESV?	BERA EPC (ug/kg)	BERA EPC > Aquatic Life ESV?	BERA EPC > Wildlife ESV?	Findings
Short-chain PFCAs														
PFBA	31 : 39	79%	0.31	1.5	11	RC3A	--	1600 [3]	No ESV	No	0.5	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFPeA	14 : 39	36%	0.081 J	0.34	0.89	RC3A	--	1600 [3, 7]	No ESV	No	0.16	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFHxA	26 : 39	67%	0.083 J-	0.49	4.1	RC3A	--	1800 [3]	No ESV	No	0.19	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFHpA	20 : 39	51%	0.088 J	0.47	3.0	RC3A	--	1800 [3, 12]	No ESV	No	#N/A	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
Long-chain PFCAs														
PFOA	39 : 39	100%	0.080	4.7	79	RC3A	--	6 [3]	No ESV	MAX > Wildlife ESV	#N/A	No ESV	#N/A	No Benthic Aquatic ESV EPC Exceeds Wildlife ESV
PFNA	18 : 39	46%	0.041 J	0.29	1.3	RC3A	--	10 [3]	No ESV	No	#N/A	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFDA	34 : 39	87%	0.079	0.84	8.8	RC3A	--	10 [3, 9]	No ESV	No	1.4	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFUNA	20 : 39	51%	0.071 J	0.27	0.69 J+	RC23	--	10 [3, 9]	No ESV	No	0.24	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFDoA	22 : 39	56%	0.056 J	0.40	1.4 J-	RC6	--	10 [3, 9]	No ESV	No	0.37	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFTrDA	9 : 39	23%	0.046 J	0.15	0.38 J-	RC6	--	10 [3, 9]	No ESV	No	0.10	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFTeDA	12 : 39	31%	0.045 J	0.20	0.38 BJ	RC3A	--	10 [3, 9]	No ESV	No	0.12	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
Short-chain PFSAs														
PFBS	12 : 39	31%	0.040 J	0.16	0.42	RC3A	--	730 [3]	No ESV	No	0.13	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFPeS	15 : 38	39%	0.063 J	0.25	0.95	RC3A	--	730 [3, 8]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
Long-chain PFSAs														
PFHxS	23 : 39	59%	0.081	0.84	8.2	RC3A	220 [4, 5]	1.4 [3, 5]	No	MAX > Wildlife ESV	0.69	--	No	EPC Does Not Exceed Wildlife ESV
PFHpS	23 : 39	59%	0.065 J	1.3	22	RC3A	220 [4, 5]	1.4 [3, 5]	No	MAX > Wildlife ESV	3.2	--	EPC > Wildlife ESV	EPC Exceeds Wildlife ESV
PFOS	39 : 39	100%	0.46 J	101	1610	RC3A	220 [4]	1.4 [3]	MAX > Aquatic Life ESV	MAX > Wildlife ESV	154	No	EPC > Wildlife ESV	EPC Exceeds Wildlife ESV
PFNS	20 : 39	51%	0.078 J	0.53	3.5	RC3A	220 [4, 5]	1.4 [3, 5]	No	MAX > Wildlife ESV	0.58	--	No	EPC Does Not Exceed Wildlife ESV
PFDS	28 : 39	72%	0.080 J-	1.1	6.1	RC3A	220 [4, 5]	1.4 [3, 5]	No	MAX > Wildlife ESV	1.4	--	No	EPC Does Not Exceed Wildlife ESV
PFDoS	18 : 30	60%	0.055 J	0.46	2.5 J-	RC6	220 [4, 5]	1.4 [3, 5]	No	MAX > Wildlife ESV	0.74	--	No	EPC Does Not Exceed Wildlife ESV
Fluortelomers														
4:2 FTS	0 : 39	0%	ND	ND	ND	--	--	730 [3, 8]	--	--	NC	--	--	Not Detected
6:2 FTS	12 : 39	31%	0.16 J	1.5	10	RC23	220 [4, 5]	6 [3, 6]	No	MAX > Wildlife ESV	0.57	--	No	EPC Does Not Exceed Wildlife ESV
8:2 FTS	2 : 39	5%	0.048 J	0.052	0.056 J	RC3A	220 [4, 5]	1.4 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
10:2 FTS	0 : 9	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
FOSA, FASE, FASAAs														
PFOSA	38 : 39	97%	0.18 J	5.1	50 J-	RC3A	220 [4, 5]	1.4 [3, 5]	No	MAX > Wildlife ESV	8.6	--	EPC > Wildlife ESV	EPC Exceeds Wildlife ESV
N-MeFOSA	26 : 39	67%	0.095 J	0.42	3.0 J	RC3A	220 [4, 5]	1.4 [3, 5]	No	MAX > Wildlife ESV	0.42	--	No	EPC Does Not Exceed Wildlife ESV
N-EtFOSA	19 : 39	49%	0.11 J	0.74	4.6 J-	RC3	220 [4, 5]	1.4 [3, 5]	No	MAX > Wildlife ESV	0.50	--	No	EPC Does Not Exceed Wildlife ESV
N-MeFOSAA	17 : 39	44%	0.068 J	0.25	0.83	RC4	220 [4, 5]	1.4 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-EtFOSAA	39 : 39	100%	0.094	3.9	23 J-	RC6	220 [4, 5]	1.4 [3, 5]	No	MAX > Wildlife ESV	5.7	--	EPC > Wildlife ESV	EPC Exceeds Wildlife ESV
N-MeFOSE	2 : 39	5%	0.083 J	0.12	0.16 J	RC22	220 [4, 5]	1.4 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-EtFOSE	7 : 39	18%	0.50 J	0.87	1.5 J	RC3	220 [4, 5]	1.4 [3, 5]	No	MAX > Wildlife ESV	0.52	--	No	EPC Does Not Exceed Wildlife ESV

Appendix F Table 3a
Comparison of PFAS Sediment Concentrations to Ecological Screening Values - Raleigh Creek - Upper
Project 1007
Minneapolis, Minnesota

			Detected Concentrations				Sediment ESVs (ug/kg)								
Analyte	**FOD**	**Percent Detected**	**Minimum (ug/kg)**	**Mean (ug/kg)**	**Maximum (ug/kg)**	**Location of Maximum Concentration**	**Benthic Aquatic Life**	**Wildlife**	**Maximum > Aquatic Life ESV?**	**Maximum > Wildlife ESV?**	**BERA EPC (ug/kg)**	**BERA EPC > Aquatic Life ESV?**	**BERA EPC > Wildlife ESV?**	**Findings**
Replacement Chemistries														
HFPO-DA	0 : 39	0%	ND	ND	ND	--	--	1800 [3, 12]	--	--	NC	--	--	Not Detected
ADONA	0 : 39	0%	ND	ND	ND	--	220 [4, 5]	6 [3, 6]	--	--	NC	--	--	Not Detected
9CL-PF3ONS	0 : 39	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
11CL-PF3OUDS	0 : 39	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected

Notes:
-- Not Available/Applicable.
ug/kg - micrograms per kilogram.
B - Analyte was present in a blank.
EPC - Exposure Point Concentration (see Appendix D for EPC calculations; if sufficient samples are available, the EPC is an upper confidence limit (UCL); maximum detected concentration is the EPC if a UCL cannot be calculated).
ESV - Ecological Screening Value (see Appendix F Table 1 for ESVs).
FOD - Frequency of Detection: Total number of detects - Total number of samples.
J - Analyte positively detected but value is an approximate concentration.
J+ - The chemical was positively identified; however, the associated numerical value is a high estimated concentration.
J- - The chemical was positively identified; however, the associated numerical value is a low estimated concentration.
NC - Not Calculated.
ND - Not Detected.

Source Footnotes -
3 - Aquatic risk-based screening level for wildlife. Selected level is the lowest of the values derived by Devine, et al (2020) for the muskrat, little brown bat, river otter, mink, red-winged blackbird, tree swallow, and brown pelican.
4 - No toxic effects level for benthic invertebrates (NPCA, 2008).
Surrogate footnotes 5, 6, 7, 8, 9, and 12 are provided on Appendix F Table 1.

Appendix F Table 3b
Comparison of PFAS Sediment Concentrations to Ecological Screening Values - Raleigh Creek - Other
Project 1007
Minneapolis, Minnesota

			Detected Concentrations				Sediment ESVs (ug/kg)							
Analyte	**FOD**	**Percent Detected**	**Minimum (ug/kg)**	**Mean (ug/kg)**	**Maximum (ug/kg)**	**Location of Maximum Concentration**	**Benthic Aquatic Life**	**Wildlife**	**Maximum > Aquatic Life ESV?**	**Maximum > Wildlife ESV?**	**BERA EPC (ug/kg)**	**BERA EPC > Aquatic Life ESV?**	**BERA EPC > Wildlife ESV?**	**Findings**
Short-chain PFCAs														
PFBA	7 : 22	32%	0.43 J-	0.71	1.2 J-	RC17	--	1600 [3]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFPeA	4 : 22	18%	0.089 J	0.23	0.34 J	RC21A	--	1600 [3, 7]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFHxA	6 : 22	27%	0.062 J	0.22	0.50 J	RC21A	--	1800 [3]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFHpA	1 : 22	5%	0.083 J-	0.083	0.083 J-	RC17	--	1800 [3, 12]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
Long-chain PFCAs														
PFOA	18 : 22	82%	0.052 J	0.31	0.86 J-	RC17	--	6 [3]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFNA	1 : 22	5%	0.084 J-	0.084	0.084 J-	RC17	--	10 [3]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFDA	9 : 22	41%	0.039 J	0.13	0.21 J-	RC17	--	10 [3, 9]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFUNA	7 : 22	32%	0.083 J-	0.14	0.27 J	RC16A	--	10 [3, 9]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFDoA	3 : 22	14%	0.075 J	0.084	0.093 J-	RC17	--	10 [3, 9]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFTrDA	0 : 22	0%	ND	ND	ND	--	--	10 [3, 9]	--	--	NC	--	--	Not Detected
PFTeDA	6 : 22	27%	0.26 BJ	0.41	0.57 BJ	RC18A	--	10 [3, 9]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
Short-chain PFSAs														
PFBS	0 : 22	0%	ND	ND	ND	--	--	730 [3]	No ESV	--	NC	No ESV	--	Not Detected
PFPeS	0 : 22	0%	ND	ND	ND	--	--	730 [3, 8]	No ESV	--	NC	No ESV	--	Not Detected
Long-chain PFSAs														
PFHxS	1 : 22	5%	0.086 J	0.086	0.086 J	RC18	220 [4, 5]	1.4 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpS	0 : 22	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
PFOS	21 : 22	95%	0.13	4.1	14	RC18 RC18A	220 [4]	1.4 [3]	No	MAX > Wildlife ESV	6.5	--	EPC > Wildlife ESV	EPC Exceeds Wildlife ESV
PFNS	1 : 22	5%	0.057 J	0.057	0.057 J	RC18A	220 [4, 5]	1.4 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDS	6 : 22	27%	0.10 J-	0.13	0.15 J-	RC18 RC17	220 [4, 5]	1.4 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDoS	0 : 15	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	No	No	--	--	EPC > Wildlife ESV	Not Detected
Fluortelomers														
4:2 FTS	0 : 22	0%	ND	ND	ND	--	--	730 [3, 8]	No ESV	--	NC	No ESV	--	Not Detected
6:2 FTS	4 : 22	18%	0.33 BJ	1.0	1.8 B	RC18A	220 [4, 5]	6 [3, 6]	No	No	NC	--	--	Max Does Not Exceed ESVs
8:2 FTS	2 : 22	9%	0.040 BJ	0.046	0.052 J	RC16A	220 [4, 5]	1.4 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
10:2 FTS	0 : 7	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
FOSA, FASE, FASAAs														
PFOSA	15 : 22	68%	0.065 BJ	0.25	0.56	RC18A	220 [4, 5]	1.4 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSA	4 : 22	18%	0.097 BJ	0.11	0.14 BJ	RC14	220 [4, 5]	1.4 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-EtFOSA	0 : 22	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
N-MeFOSAA	2 : 22	9%	0.042 J	0.075	0.11 J	RC16A	220 [4, 5]	1.4 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-EtFOSAA	12 : 22	55%	0.090 J-	0.41	1.4 J	RC21A	220 [4, 5]	1.4 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSE	0 : 22	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSE	0 : 22	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected

Appendix F Table 3b
Comparison of PFAS Sediment Concentrations to Ecological Screening Values - Raleigh Creek - Other
Project 1007
Minneapolis, Minnesota

			Detected Concentrations				Sediment ESVs (ug/kg)							
Analyte	**FOD**	**Percent Detected**	**Minimum (ug/kg)**	**Mean (ug/kg)**	**Maximum (ug/kg)**	**Location of Maximum Concentration**	**Benthic Aquatic Life**	**Wildlife**	**Maximum > Aquatic Life ESV?**	**Maximum > Wildlife ESV?**	**BERA EPC (ug/kg)**	**BERA EPC > Aquatic Life ESV?**	**BERA EPC > Wildlife ESV?**	**Findings**
Replacement Chemistries														
HFPO-DA	0 : 22	0%	ND	ND	ND	--	--	1800 [3, 12]	No ESV	--	NC	No ESV	--	Not Detected
ADONA	0 : 22	0%	ND	ND	ND	--	220 [4, 5]	6 [3, 6]	--	--	NC	--	--	Not Detected
9CL-PF3ONS	0 : 22	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
11CL-PF3OUDS	0 : 22	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected

Notes:
-- Not Available/Applicable.
ug/kg - micrograms per kilogram.
B - Analyte was present in a blank.
EPC - Exposure Point Concentration (see Appendix D for EPC calculations; if sufficient samples are available, the EPC is an upper confidence limit (UCL); maximum detected concentration is the EPC if a UCL cannot be calculated).
ESV - Ecological Screening Value (see Appendix F Table 1 for ESVs).
FOD - Frequency of Detection: Total number of detects - Total number of samples.
J - Analyte positively detected but value is an approximate concentration.
J+ - The chemical was positively identified; however, the associated numerical value is a high estimated concentration.
J- - The chemical was positively identified; however, the associated numerical value is a low estimated concentration.
NC - Not Calculated.
ND - Not Detected.

Source Footnotes -
3 - Aquatic risk-based screening level for wildlife. Selected level is the lowest of the values derived by Devine, et al (2020) for the muskrat, little brown bat, river otter, mink, red-winged blackbird, tree swallow, and brown pelican.
4 - No toxic effects level for benthic invertebrates (NPCA, 2008).
Surrogate footnotes 5, 6, 7, 8, 9, and 12 are provided on Appendix F Table 1.

Appendix F Table 3c
Comparison of PFAS Sediment Concentrations to Ecological Screening Values - Eagle Point Lake
Project 1007
Minneapolis, Minnesota

			Detected Concentrations				Sediment ESVs (ug/kg)							
Analyte	FOD	Percent Detected	Minimum (ug/kg)	Mean (ug/kg)	Maximum (ug/kg)	Location of Maximum Concentration	Benthic Aquatic Life	Wildlife	Maximum > Aquatic Life ESV?	Maximum > Wildlife ESV?	BERA EPC (ug/kg)	BERA EPC > Aquatic Life ESV?	BERA EPC > Wildlife ESV?	Findings
Short-chain PFCAs														
PFBA	23 : 36	64%	0.15 J-	0.91	2.4 J-	EP26A	--	1600 [3]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFPeA	8 : 36	22%	0.10 J-	0.28	0.90 BJ	EP27C	--	1600 [3, 7]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFHxA	22 : 36	61%	0.046 J	0.33	1.5 J	EP27C	--	1800 [3]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFHpA	20 : 36	56%	0.041 BJ-	0.29	1.1 J	EP27C	--	1800 [3, 12]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
Long-chain PFCAs														
PFOA	34 : 36	94%	0.20	3.1	11	EP27C	--	6 [3]	No ESV	MAX > Wildlife ESV	#N/A	No ESV	#N/A	No Benthic Aquatic ESV EPC Does Not Exceed Wildlife ESV
PFNA	15 : 36	42%	0.040 J	0.23	1.6 BJ	EP27C	--	10 [3]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFDA	27 : 36	75%	0.046 BJ-	0.45	1.4 BJ	EP27C	--	10 [3, 9]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFUNA	2 : 36	6%	0.25 J	0.26	0.26 J	EP5	--	10 [3, 9]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFDoA	0 : 36	0%	ND	ND	ND	--	--	10 [3, 9]	--	--	NC	--	--	Not Detected
PFTrDA	0 : 36	0%	ND	ND	ND	--	--	10 [3, 9]	--	--	NC	--	--	Not Detected
PFTeDA	5 : 36	14%	0.27 BJ	0.70	1.6 BJ	EP27C	--	10 [3, 9]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
Short-chain PFSAs														
PFBS	16 : 36	44%	0.092 J	0.21	0.44 J-	EP18	--	730 [3]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFPeS	18 : 36	50%	0.11 J-	0.35	1.0 J	EP27C	--	730 [3, 8]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
Long-chain PFSAs														
PFHxS	25 : 36	69%	0.049 J-	0.87	2.6 J-	EP26C	220 [4, 5]	1.4 [3, 5]	No	MAX > Wildlife ESV	0.90	--	No	EPC Does Not Exceed Wildlife ESV
PFHpS	23 : 36	64%	0.042 J-	0.46	1.3 J-	EP26C	220 [4, 5]	1.4 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFOS	36 : 36	100%	2.4	45	145 J-	EP26C	220 [4]	1.4 [3]	No	MAX > Wildlife ESV	74	--	EPC > Wildlife ESV	EPC Exceeds Wildlife ESV
PFNS	2 : 36	6%	0.11 J-	0.16	0.21 J	EP17A	220 [4, 5]	1.4 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDS	3 : 36	8%	0.041 J	0.13	0.27 J	EP17A	220 [4, 5]	1.4 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDoS	0 : 28	0%	ND	ND	ND	--	220 [1, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
Fluortelomers														
4:2 FTS	0 : 36	0%	ND	ND	ND	--	-- [2, 8]	730 [3, 8]	--	--	NC	--	--	Not Detected
6:2 FTS	9 : 36	25%	0.16 J-	0.97	2.8 J-	EP27B	220 [4, 5]	6 [3, 6]	No	No	NC	--	--	Max Does Not Exceed ESVs
8:2 FTS	2 : 36	6%	0.036 J	0.083	0.13 J	EP27C	220 [4, 5]	1.4 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
10:2 FTS	0 : 8	0%	ND	ND	ND	--	220	1.4 [3, 5]	--	--	NC	--	--	Not Detected
FOSA, FASE, FASAAs														
PFOSA	31 : 36	86%	0.042 J-	0.79	2.4 J-	EP18	220 [4, 5]	1.4 [3, 5]	No	MAX > Wildlife ESV	0.97	--	No	EPC Does Not Exceed Wildlife ESV
N-MeFOSA	12 : 36	33%	0.088 J	0.17	0.25 J	EP26B	220 [4, 5]	1.4 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-EtFOSA	0 : 32	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
N-MeFOSAA	1 : 36	3%	0.090 J	0.090	0.090 J	EP17A	220 [4, 5]	1.4 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-EtFOSAA	29 : 36	81%	0.039 J-	1.1	3.3 J	EP27C	220 [4, 5]	1.4 [3, 5]	No	MAX > Wildlife ESV	1.3	--	No	EPC Does Not Exceed Wildlife ESV
N-MeFOSE	0 : 36	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSE	1 : 36	3%	0.11 J	0.11	0.11 J	EP26A	220 [4, 5]	1.4 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs

Appendix F Table 3c
Comparison of PFAS Sediment Concentrations to Ecological Screening Values - Eagle Point Lake
Project 1007
Minneapolis, Minnesota

			Detected Concentrations				Sediment ESVs (ug/kg)							
Analyte	**FOD**	**Percent Detected**	**Minimum (ug/kg)**	**Mean (ug/kg)**	**Maximum (ug/kg)**	**Location of Maximum Concentration**	**Benthic Aquatic Life**	**Wildlife**	**Maximum > Aquatic Life ESV?**	**Maximum > Wildlife ESV?**	**BERA EPC (ug/kg)**	**BERA EPC > Aquatic Life ESV?**	**BERA EPC > Wildlife ESV?**	**Findings**
Replacement Chemistries														
HFPO-DA	0 : 36	0%	ND	ND	ND	--	--	1800 [3, 12]	--	--	NC	--	--	Not Detected
ADONA	0 : 36	0%	ND	ND	ND	--	220 [4, 5]	6 [3, 6]	--	--	NC	--	--	Not Detected
9CL-PF3ONS	0 : 36	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
11CL-PF3OUDS	0 : 36	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected

Notes:
-- Not Available/Applicable.
ug/kg - micrograms per kilogram.
B - Analyte was present in a blank.
EPC - Exposure Point Concentration (see Appendix D for EPC calculations; if sufficient samples are available, the EPC is an upper confidence limit (UCL); maximum detected concentration is the EPC if a UCL cannot be calculated).
ESV - Ecological Screening Value (see Appendix F Table 1 for ESVs).
FOD - Frequency of Detection: Total number of detects - Total number of samples.
J - Analyte positively detected but value is an approximate concentration.
J+ - The chemical was positively identified; however, the associated numerical value is a high estimated concentration.
J- - The chemical was positively identified; however, the associated numerical value is a low estimated concentration.
NC - Not Calculated.
ND - Not Detected.

Source Footnotes -
3 - Aquatic risk-based screening level for wildlife. Selected level is the lowest of the values derived by Devine, et al (2020) for the muskrat, little brown bat, river otter, mink, red-winged blackbird, tree swallow, and brown pelican.
4 - No toxic effects level for benthic invertebrates (NPCA, 2008).
Surrogate footnotes 5, 6, 7, 8, 9, and 12 are provided on Appendix F Table 1.

Appendix F Table 3d
Comparison of PFAS Sediment Concentrations to Ecological Screening Values - Lake Elmo
Project 1007
Minneapolis, Minnesota

			Detected Concentrations				Sediment ESVs (ug/kg)							
Analyte	FOD	Percent Detected	Minimum (ug/kg)	Mean (ug/kg)	Maximum (ug/kg)	Location of Maximum Concentration	Benthic Aquatic Life	Wildlife	Maximum > Aquatic Life ESV?	Maximum > Wildlife ESV?	BERA EPC (ug/kg)	BERA EPC > Aquatic Life ESV?	BERA EPC > Wildlife ESV?	Findings
Short-chain PFCAs														
PFBA	3 : 8	38%	0.46 J-	2.3	5.2	EP15	--	1600 [3]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife
PFPeA	0 : 8	0%	ND	ND	ND	--	--	1600 [3, 7]	--	--	NC	--	--	Not Detected
PFHxA	2 : 8	25%	0.13 J	0.16	0.20 J	EP9	--	1800 [3]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife
PFHpA	0 : 8	0%	ND	ND	ND	--	--	1800 [3, 12]	--	--	NC	--	--	Not Detected
Long-chain PFCAs														
PFOA	5 : 8	63%	0.10 J-	0.41	1.4	EP9	--	6 [3]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife
PFNA	0 : 8	0%	ND	ND	ND	--	--	10 [3]	--	--	NC	--	--	Not Detected
PFDA	0 : 8	0%	ND	ND	ND	--	--	10 [3, 9]	--	--	NC	--	--	Not Detected
PFUNA	0 : 8	0%	ND	ND	ND	--	--	10 [3, 9]	--	--	NC	--	--	Not Detected
PFDoA	0 : 8	0%	ND	ND	ND	--	--	10 [3, 9]	--	--	NC	--	--	Not Detected
PFTrDA	0 : 8	0%	ND	ND	ND	--	--	10 [3, 9]	--	--	NC	--	--	Not Detected
PFTeDA	0 : 8	0%	ND	ND	ND	--	--	10 [3, 9]	--	--	NC	--	--	Not Detected
Short-chain PFSAs														
PFBS	0 : 8	0%	ND	ND	ND	--	--	730 [3]	--	--	NC	--	--	Not Detected
PFPeS	0 : 8	0%	ND	ND	ND	--	--	730 [3, 8]	--	--	NC	--	--	Not Detected
Long-chain PFSAs														
PFHxS	0 : 8	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
PFHpS	0 : 8	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
PFOS	8 : 8	100%	0.62 J-	2.0	5.0	EP9	220 [4]	1.4 [3]	No	MAX > Wildlife ESV	4.48	--	EPC > Wildlife ESV	EPC Exceeds Wildlife ESV
PFNS	0 : 8	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
PFDS	0 : 8	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
PFDoS	0 : 8	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
Fluortelomers														
4:2 FTS	0 : 8	0%	ND	ND	ND	--	--	730 [3, 8]	--	--	NC	--	--	Not Detected
6:2 FTS	1 : 8	13%	4.5	4.5	4.5	EP15	220 [4, 5]	6 [3, 6]	No	No	NC	--	--	Max Does Not Exceed ESVs
8:2 FTS	0 : 8	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
FOSA, FASE, FASAAs														
PFOSA	0 : 8	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
N-MeFOSA	0 : 8	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSA	0 : 8	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
N-MeFOSAA	0 : 8	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSAA	0 : 8	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
N-MeFOSE	0 : 8	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSE	0 : 8	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
Replacement Chemistries														
HFPO-DA	0 : 8	0%	ND	ND	ND	--	--	1800 [3, 12]	--	--	NC	--	--	Not Detected
ADONA	0 : 8	0%	ND	ND	ND	--	220 [4, 5]	6 [3, 6]	--	--	NC	--	--	Not Detected
9CL-PF3ONS	0 : 8	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
11CL-PF3OUDS	0 : 8	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected

Notes:
-- Not Available/Applicable.
ug/kg - micrograms per kilogram.
B - Analyte was present in a blank.
EPC - Exposure Point Concentration (see Appendix D for EPC calculations; if sufficient samples are available, the EPC is an upper confidence limit (UCL); maximum detected concentration is the EPC if a UCL cannot be calculated).
ESV - Ecological Screening Value (see Appendix F Table 1 for ESVs).
FOD - Frequency of Detection: Total number of detects - Total number of samples.
J - Analyte positively detected but value is an approximate concentration.
J+ - The chemical was positively identified; however, the associated numerical value is a high estimated concentration.
J- - The chemical was positively identified; however, the associated numerical value is a low estimated concentration.
NC - Not Calculated.
ND - Not Detected.

Source Footnotes -
3 - Aquatic risk-based screening level for wildlife. Selected level is the lowest of the values derived by Devine, et al (2020) for the muskrat, little brown bat, river otter, mink, red-winged blackbird, tree swallow, and brown pelican.
4 - No toxic effects level for benthic invertebrates (NPCA, 2008).
Surrogate footnotes 5, 6, 7, 8, 9, and 12 are provided on Appendix F Table 1.

Appendix F Table 3e
Comparison of PFAS Sediment Concentrations to Ecological Screening Values - West Lakeland Area
Project 1007
Minneapolis, Minnesota

			Detected Concentrations				Sediment ESVs (ug/kg)							
Analyte	**FOD**	**Percent Detected**	**Minimum (ug/kg)**	**Mean (ug/kg)**	**Maximum (ug/kg)**	**Location of Maximum Concentration**	**Benthic Aquatic Life**	**Wildlife**	**Maximum > Aquatic Life ESV?**	**Maximum > Wildlife ESV?**	**BERA EPC (ug/kg)**	**BERA EPC > Aquatic Life ESV?**	**BERA EPC > Wildlife ESV?**	**Findings**
Short-chain PFCAs														
PFBA	8 : 31	26%	0.17 J-	0.50	0.96 J	EP13	--	1600 [3]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFPeA	4 : 31	13%	0.24 J	0.28	0.32 J	WL10A	--	1600 [3, 7]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFHxA	3 : 31	10%	0.05 J-	0.29	0.45 J	WL2	--	1800 [3]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFHpA	0 : 31	0%	ND	ND	ND	--	--	1800 [3, 12]	--	--	NC	--	--	Not Detected
Long-chain PFCAs														
PFOA	23 : 31	74%	0.053 J-	0.24	0.47 J	WL11	--	6 [3]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFNA	1 : 31	3%	0.11 J	0.11	0.11 J	WL2	--	10 [3]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFDA	3 : 31	10%	0.047 J-	0.064	0.077 J	EP16	--	10 [3, 9]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFUNA	2 : 31	6%	0.052 J-	0.063	0.074 J	WL2	--	10 [3, 9]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
PFDoA	0 : 31	0%	ND	ND	ND	--	--	10 [3, 9]	--	--	NC	--	--	Not Detected
PFTrDA	0 : 31	0%	ND	ND	ND	--	--	10 [3, 9]	--	--	NC	--	--	Not Detected
PFTeDA	10 : 31	32%	0.23 BJ	0.35	0.54 BJ	WL10A	--	10 [3, 9]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife ESV
Short-chain PFSAs														
PFBS	0 : 31	0%	ND	ND	ND	--	--	730 [3]	--	--	NC	--	--	Not Detected
PFPeS	0 : 31	0%	ND	ND	ND	--	--	730 [3, 8]	--	--	NC	--	--	Not Detected
Long-chain PFSAs														
PFHxS	1 : 31	3%	0.10 J-	0.10	0.10 J-	WL21	220 [4, 5]	1.4 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpS	0 : 31	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
PFOS	31 : 31	100%	0.29	2.1	8.6 J-	WL21	220 [4]	1.4 [3]	No	MAX > Wildlife ESV	2.7	--	EPC > Wildlife ESV	EPC Exceeds Wildlife ESV
PFNS	0 : 31	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
PFDS	1 : 31	3%	0.044 J-	0.044	0.044 J-	WL21	220 [4, 5]	1.4 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDoS	0 : 21	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
Fluortelomers														
4:2 FTS	0 : 31	0%	ND	ND	ND	--	--	730 [3, 8]	--	--	NC	--	--	Not Detected
6:2 FTS	4 : 31	13%	0.20 J-	1.1	2.2 J	EP13	220 [4, 5]	6 [3, 6]	No	No	NC	--	--	Max Does Not Exceed ESVs
8:2 FTS	0 : 31	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
10:2 FTS	0 : 10	0%	ND	ND	ND	--	220 [4, 5]	1.4	--	--	NC	--	--	Not Detected
FOSA, FASE, FASAAs														
PFOSA	2 : 31	6%	0.079 J-	0.090	0.10 J	WL5	220 [4, 5]	1.4 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSA	5 : 31	16%	0.074 BJ	0.088	0.10 BJ	WL11	220 [4, 5]	1.4 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-EtFOSA	0 : 30	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
N-MeFOSAA	0 : 31	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSAA	4 : 31	13%	0.081 J	0.34	0.60 J	WL10A	220 [4, 5]	1.4 [3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSE	0 : 31	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSE	0 : 31	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected

Appendix F Table 3e
Comparison of PFAS Sediment Concentrations to Ecological Screening Values - West Lakeland Area
Project 1007
Minneapolis, Minnesota

			Detected Concentrations				Sediment ESVs (ug/kg)							
Analyte	**FOD**	**Percent Detected**	**Minimum (ug/kg)**	**Mean (ug/kg)**	**Maximum (ug/kg)**	**Location of Maximum Concentration**	**Benthic Aquatic Life**	**Wildlife**	**Maximum > Aquatic Life ESV?**	**Maximum > Wildlife ESV?**	**BERA EPC (ug/kg)**	**BERA EPC > Aquatic Life ESV?**	**BERA EPC > Wildlife ESV?**	**Findings**
Replacement Chemistries														
HFPO-DA	0 : 31	0%	ND	ND	ND	--	--	1800 [3, 12]	--	--	NC	--	--	Not Detected
ADONA	0 : 31	0%	ND	ND	ND	--	220 [4, 5]	6 [3, 6]	--	--	NC	--	--	Not Detected
9CL-PF3ONS	0 : 31	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
11CL-PF3OUDS	0 : 31	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected

Notes:
-- Not Available/Applicable.
ug/kg - micrograms per kilogram.
B - Analyte was present in a blank.
EPC - Exposure Point Concentration (see Appendix D for EPC calculations; if sufficient samples are available, the EPC is an upper confidence limit (UCL); maximum detected concentration is the EPC if a UCL cannot be calculated).
ESV - Ecological Screening Value (see Appendix F Table 1 for ESVs).
FOD - Frequency of Detection: Total number of detects - Total number of samples.
J - Analyte positively detected but value is an approximate concentration.
J+ - The chemical was positively identified; however, the associated numerical value is a high estimated concentration.
J- - The chemical was positively identified; however, the associated numerical value is a low estimated concentration.
NC - Not Calculated.
ND - Not Detected.

Source Footnotes -
3 - Aquatic risk-based screening level for wildlife. Selected level is the lowest of the values derived by Devine, et al (2020) for the muskrat, little brown bat, river otter, mink, red-winged blackbird, tree swallow, and brown pelican.
4 - No toxic effects level for benthic invertebrates (NPCA, 2008).
Surrogate footnotes 5, 6, 7, 8, 9, and 12 are provided on Appendix F Table 1.

Appendix F Table 3f
Comparison of PFAS Sediment Concentrations to Ecological Screening Values - Other Areas
Project 1007
Minneapolis, Minnesota

			Detected Concentrations				Sediment ESVs (ug/kg)								
Analyte	FOD	Percent Detected	Minimum (ug/kg)	Mean (ug/kg)	Maximum (ug/kg)	Location of Maximum Concentration	Benthic Aquatic Life		Wildlife		Maximum > Aquatic Life ESV?	Maximum > Wildlife ESV?	BERA EPC (ug/kg)	BERA EPC > Aquatic Life ESV?	BERA EPC > Wildlife ESV?	Findings
Short-chain PFCAs																
PFBA	8 : 13	62%	0.26 J	1.0	3.6 J-	EP24	--		1600	[3]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife
PFPeA	2 : 13	15%	0.15 J	0.17	0.19 J-	VB3	--		1600	[3, 7]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife
PFHxA	2 : 13	15%	0.092 J	0.11	0.12 J-	VB3	--		1800	[3]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife
PFHpA	0 : 13	0%	ND	ND	ND	--	--		1800	[3, 12]	--	--	NC	--	--	Not Detected
Long-chain PFCAs																
PFOA	7 : 13	54%	0.062 J	0.26	0.62	RC19	--		6	[3]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife
PFNA	2 : 13	15%	0.065 J	0.081	0.096 J	RC19	--		10	[3]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife
PFDA	2 : 13	15%	0.12 J	0.14	0.17	FC2	--		10	[3, 9]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife
PFUNA	1 : 13	8%	0.098 J	0.098	0.098 J	FC2	--		10	[3, 9]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife
PFDoA	1 : 13	8%	0.056 J	0.056	0.056 J	FC2	--		10	[3, 9]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife
PFTrDA	1 : 13	8%	0.038 J	0.038	0.038 J	FC2	--		10	[3, 9]	No ESV	No	NC	No ESV	--	No Benthic Aquatic ESV Max Does Not Exceed Wildlife
PFTeDA	0 : 13	0%	ND	ND	ND	--	--		10	[3, 9]	--	--	NC	--	--	Not Detected
Short-chain PFSAs																
PFBS	0 : 13	0%	ND	ND	ND	--	--		730	[3]	--	--	NC	--	--	Not Detected
PFPeS	0 : 13	0%	ND	ND	ND	--	--		730	[3, 8]	--	--	NC	--	--	Not Detected
Long-chain PFSAs																
PFHxS	1 : 13	8%	0.038 J	0.038	0.038 J	FC2	220	[4, 5]	1.4	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpS	0 : 13	0%	ND	ND	ND	--	220	[4, 5]	1.4	[3, 5]	--	--	NC	--	--	Not Detected
PFOS	10 : 13	77%	0.071 BJ	0.69	2.3 B	FC2	220	[4]	1.4	[3]	No	MAX > Wildlife ESV	0.89	--	No	EPC Does Not Exceed Wildlife ESV
PFNS	0 : 13	0%	ND	ND	ND	--	220	[4, 5]	1.4	[3, 5]	--	--	NC	--	--	Not Detected
PFDS	1 : 13	8%	0.063 J	0.063	0.063 J	FC2	220	[4, 5]	1.4	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDoS	0 : 13	0%	ND	ND	ND	--	220	[4, 5]	1.4	[3, 5]	--	--	NC	--	--	Not Detected
Fluortelomers																
4:2 FTS	0 : 13	0%	ND	ND	ND	--	--		730	[3, 8]	--	--	NC	--	--	Not Detected
6:2 FTS	4 : 13	31%	0.30 BJ	0.35	0.38 BJ	VB3	220	[4, 5]	6	[3, 6]	No	No	NC	--	--	Max Does Not Exceed ESVs
8:2 FTS	0 : 13	0%	ND	ND	ND	--	220	[4, 5]	1.4	[3, 5]	--	--	NC	--	--	Not Detected
FOSA, FASE, FASAAs																
PFOSA	0 : 13	0%	ND	ND	ND	--	220	[4, 5]	1.4	[3, 5]	--	--	NC	--	--	Not Detected
N-MeFOSA	0 : 13	0%	ND	ND	ND	--	220	[4, 5]	1.4	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSA	0 : 13	0%	ND	ND	ND	--	220	[4, 5]	1.4	[3, 5]	--	--	NC	--	--	Not Detected
N-MeFOSAA	1 : 13	8%	0.081 J-	0.081	0.081 J-	VB1	220	[4, 5]	1.4	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-EtFOSAA	0 : 13	0%	ND	ND	ND	--	220	[4, 5]	1.4	[3, 5]	--	--	NC	--	--	Not Detected
N-MeFOSE	0 : 13	0%	ND	ND	ND	--	220	[4, 5]	1.4	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSE	0 : 13	0%	ND	ND	ND	--	220	[4, 5]	1.4	[3, 5]	--	--	NC	--	--	Not Detected

Appendix F Table 3f
Comparison of PFAS Sediment Concentrations to Ecological Screening Values - Other Areas
Project 1007
Minneapolis, Minnesota

			Detected Concentrations				Sediment ESVs (ug/kg)								
Analyte	**FOD**	**Percent Detected**	**Minimum (ug/kg)**	**Mean (ug/kg)**	**Maximum (ug/kg)**	**Location of Maximum Concentration**	**Benthic Aquatic Life**	**Wildlife**	**Maximum > Aquatic Life ESV?**	**Maximum > Wildlife ESV?**	**BERA EPC (ug/kg)**	**BERA EPC > Aquatic Life ESV?**	**BERA EPC > Wildlife ESV?**	**Findings**
Replacement Chemistries														
HFPO-DA	0 : 13	0%	ND	ND	ND	--	--	1800 [3, 12]	--	--	NC	--	--	Not Detected
ADONA	0 : 13	0%	ND	ND	ND	--	220 [4, 5]	6 [3, 6]	--	--	NC	--	--	Not Detected
9CL-PF3ONS	0 : 13	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected
11CL-PF3OUDS	0 : 13	0%	ND	ND	ND	--	220 [4, 5]	1.4 [3, 5]	--	--	NC	--	--	Not Detected

Notes:
-- Not Available/Applicable.
ug/kg - micrograms per kilogram.
B - Analyte was present in a blank.
EPC - Exposure Point Concentration (see Appendix D for EPC calculations; if sufficient samples are available, the EPC is an upper confidence limit (UCL); maximum detected concentration is the EPC if a UCL cannot be calculated).
ESV - Ecological Screening Value (see Appendix F Table 1 for ESVs).
FOD - Frequency of Detection: Total number of detects - Total number of samples.
J - Analyte positively detected but value is an approximate concentration.
J+ - The chemical was positively identified; however, the associated numerical value is a high estimated concentration.
J- - The chemical was positively identified; however, the associated numerical value is a low estimated concentration.
NC - Not Calculated.
ND - Not Detected.

Source Footnotes -
3 - Aquatic risk-based screening level for wildlife. Selected level is the lowest of the values derived by Devine, et al (2020) for the muskrat, little brown bat, river otter, mink, red-winged blackbird, tree swallow, and brown pelican.
4 - No toxic effects level for benthic invertebrates (NPCA, 2008).
Surrogate footnotes 5, 6, 7, 8, 9, and 12 are provided on Appendix F Table 1.

Appendix F Table 4a
Comparison of PFAS Porewater Concentrations to Ecological Screening Values - Raleigh Creek - Upper
Project 1007
Minneapolis, Minnesota

			Detected Concentrations				Surface Water ESVs (ug/L)									
Analyte	FOD	Percent Detected	Minimum (ug/L)	Mean (ug/L)	Maximum (ug/L)	Location of Maximum Concentration	Aquatic Life (chronic)		Wildlife		Maximum > Aquatic Life ESV?	Maximum > Wildlife ESV?	BERA EPC (ug/L)	BERA EPC > Aquatic Life ESV?	BERA EPC > Wildlife ESV?	Findings
DISSOLVED PHASE RESULTS																
Short-chain PFCAs																
PFBA	6 : 6	100%	0.10	0.51	0.86 J+	RC4	470	[2]	660	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeA	6 : 6	100%	0.0087	0.037	0.058	RC4	140	[2]	660	[3, 7]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHxA	5 : 6	83%	0.063	0.093	0.13	RC4	2300	[2]	210	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpA	6 : 6	100%	0.0025 J	0.049	0.068	RC4	870	[2]	210	[3, 12]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFCAs																
PFOA	6 : 6	100%	0.01	0.41	0.57	RC7	537	[1]	4.4	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFNA	5 : 6	83%	0.0031 J	0.0043	0.0055	RC7	120	[2]	2.2	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDA	5 : 6	83%	0.0047	0.0098	0.015	RC7	140	[2]	2.2	[3, 9]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFUNA	1 : 6	17%	0.0018 J+	0.0018	0.0018 J+	RC5	49	[2]	2.2	[3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDoA	1 : 6	17%	0.0028 BJ+	0.0028	0.0028 BJ+	RC5	72	[2]	2.2	[3, 9]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFTrDA	2 : 6	33%	0.0016 J	0.0017	0.0018 J+	RC4	72	[2, 11]	2.2	[3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFTeDA	1 : 6	17%	0.004 BJ+	0.004	0.004 BJ+	RC4	72	[2, 11]	2.2	[3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
Short-chain PFSAs																
PFBS	6 : 6	100%	0.0032 J	0.017	0.025 J+	RC4	3400	[2]	640	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeS	5 : 6	83%	0.023 J+	0.031	0.044 J+	RC4	3400	[2, 8]	640	[2, 8]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFSAs																
PFHxS	6 : 6	100%	0.0024 J	0.04	0.059	RC4	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpS	5 : 6	83%	0.0098	0.016	0.02 J+	RC6A	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFOS	6 : 6	100%	0.026 J+	1.3	2.1	RC3A	0.56	[1]	0.075	[3]	MAX > Aquatic Life ESV	MAX > Wildlife ESV	2.0	EPC > Aquatic Life ESV	EPC > Wildlife ESV	EPC Exceeds ESVs
PFNS	4 : 6	67%	0.00071 J	0.0013	0.0025 J	RC6A	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDS	2 : 6	33%	0.00048 J	0.0005	0.00051 J-	RC5	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
Fluortelomers																
4:2 FTS	0 : 6	0%	ND	ND	ND	--	3400	[2, 8]	640	[2, 8]	--	--	NC	--	--	Not Detected
6:2 FTS	1 : 6	17%	0.00066 J+	0.00066	0.00066 J+	RC4	537		4.4		No	No	NC	--	--	Max Does Not Exceed ESVs
8:2 FTS	0 : 6	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
10:2 FTS	0 : 6	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
FOSA, FASE, FASAAs																
PFOSA	6 : 6	100%	0.001 J	0.025	0.035	RC5	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSA	1 : 6	17%	0.00059 BJ+	0.00059	0.00059 BJ+	RC5	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-EtFOSA	0 : 6	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-MeFOSAA	0 : 6	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSAA	5 : 6	83%	0.0099	0.02	0.045	RC3A	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSE	0 : 6	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSE	1 : 6	17%	0.00014 J	0.00014	0.00014 J	RC6A	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
Replacement Chemistries																
HFPO-DA	1 : 6	17%	0.00031 J	0.00031	0.00031 J	RC13	2300	[2, 12]	210	[3, 12]	No	No	NC	--	--	Max Does Not Exceed ESVs
ADONA	0 : 6	0%	ND	ND	ND	--	537	[1, 6]	4.4	[1, 6]	--	--	NC	--	--	Not Detected
9CL-PF3ONS	0 : 6	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
11CL-PF3OUDS	0 : 6	0%	ND	ND	ND	--	49	[2, 14]	0.075	[3, 5]	--	--	NC	--	--	Not Detected

Notes:
-- Not Available/Applicable.
ug/L - micrograms per liter.
B - Analyte was present in a blank.
EPC - Exposure Point Concentration (see Appendix D for EPC calculations; if sufficient samples are available, the EPC is an upper confidence limit (UCL); maximum detected concentration is the EPC if a UCL cannot be calculated).
ESV - Ecological Screening Value (see Appendix F Table 1 for ESVs).
FOD - Frequency of Detection: Total number of detects - Total number of samples.
J - Analyte positively detected but value is an approximate concentration.
J+ - The chemical was positively identified; however, the associated numerical value is a high estimated concentration.
J- - The chemical was positively identified; however, the associated numerical value is a low estimated concentration.
NC - Not Calculated.
ND - Not Detected.

Source Footnotes -
1 - Hazardous Concentration 1% (HC1) (Conder, et al., 2020a).
2 - Chronic recommended water quality (RWQ) risk-based screening level (RBSL)(Divine, et al., 2020).
3 - Aquatic risk-based screening level for wildlife. Selected level is the lowest of the values derived by Devine, et al (2020) for the muskrat, little brown bat, river otter, mink, red-winged blackbird, tree swallow, and brown pelican.
Surrogate footnotes 5, 6, 7, 8, 9, 10, 11, 12 and 14 are provided on Appendix F Table 1.

Appendix F Table 4b
Comparison of PFAS Porewater Concentrations to Ecological Screening Values - Raleigh Creek - Other
Project 1007
Minneapolis, Minnesota

			Detected Concentrations				Surface Water ESVs (ug/L)									
Analyte	FOD	Percent Detected	Minimum (ug/L)	Mean (ug/L)	Maximum (ug/L)	Location of Maximum Concentration	Aquatic Life (chronic)		Wildlife		Maximum > Aquatic Life ESV?	Maximum > Wildlife ESV?	BERA EPC (ug/L)	BERA EPC > Aquatic Life ESV?	BERA EPC > Wildlife ESV?	Findings
DISSOLVED PHASE RESULTS																
Short-chain PFCAs																
PFBA	7 : 7	100%	0.093	0.096	0.10	RC14 RC17A RC18A	470	[2]	660	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeA	7 : 7	100%	0.0066	0.0078	0.0087	RC14	140	[2]	660	[3, 7]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHxA	0 : 7	0%	ND	ND	ND	--	2300	[2]	210	[3]	--	--	NC	--	--	Not Detected
PFHpA	7 : 7	100%	0.0022 J	0.0037	0.0053	RC14	870	[2]	210	[3, 12]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFCAs																
PFOA	7 : 7	100%	0.008	0.0099	0.012	RC14	537	[1]	4.4	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFNA	2 : 7	29%	0.0013 J	0.0014	0.0015 J	RC14	120	[2]	2.2	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDA	1 : 7	14%	0.0013 J	0.0013	0.0013 J	RC18	140	[2]	2.2	[3, 9]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFUNA	0 : 7	0%	ND	ND	ND	--	49	[2]	2.2	[3, 10]	--	--	NC	--	--	Not Detected
PFDoA	1 : 7	14%	0.0014 BJ+	0.0014	0.0014 BJ+	RC18	72	[2]	2.2	[3, 9]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFTrDA	0 : 7	0%	ND	ND	ND	--	72	[2, 11]	2.2	[3, 10]	--	--	NC	--	--	Not Detected
PFTeDA	0 : 6	0%	ND	ND	ND	--	72	[2, 11]	2.2	[3, 10]	--	--	NC	--	--	Not Detected
Short-chain PFSAs																
PFBS	7 : 7	100%	0.0025 J	0.0028	0.0031 J	RC18A	3400	[2]	640	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeS	2 : 7	29%	0.0016 J+	0.0017	0.0017 J+	RC18	3400	[2, 8]	640	[2, 8]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFSAs																
PFHxS	7 : 7	100%	0.0021 J	0.003	0.004 J	RC17	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpS	0 : 7	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
PFOS	7 : 7	100%	0.0032 J+	0.016	0.052 J+	RC18A	0.56	[1]	0.075	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFNS	0 : 7	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
PFDS	0 : 7	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
Fluortelomers																
4:2 FTS	0 : 7	0%	ND	ND	ND	--	3400	[2, 8]	640	[2, 8]	--	--	NC	--	--	Not Detected
6:2 FTS	0 : 7	0%	ND	ND	ND	--	537	[1, 6]	4.4	[1, 6]	--	--	NC	--	--	Not Detected
8:2 FTS	0 : 7	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
10:2 FTS	0 : 7	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
FOSA, FASE, FASAAs																
PFOSA	4 : 7	57%	0.0008 J	0.0017	0.0027 J	RC18	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSA	1 : 7	14%	0.00057 BJ+	0.00057	0.00057 BJ+	RC18	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-EtFOSA	0 : 7	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-MeFOSAA	0 : 7	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSAA	2 : 7	29%	0.00077 J	0.00099	0.0012 J+	RC18	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSE	0 : 7	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSE	2 : 7	29%	0.00022 BJ	0.00023	0.00024 J	RC17A	0.56	[1, 5]	0.075	[1, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
Replacement Chemistries																
HFPO-DA	0 : 7	0%	ND	ND	ND	--	2300	[2, 12]	210	[2, 12]	--	--	NC	--	--	Not Detected
ADONA	0 : 7	0%	ND	ND	ND	--	537	[1, 6]	4.4	[1, 6]	--	--	NC	--	--	Not Detected
9CL-PF3ONS	0 : 7	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[1, 5]	--	--	NC	--	--	Not Detected
11CL-PF3OUDS	0 : 7	0%	ND	ND	ND	--	49	[2, 14]	0.075	[2, 14]	--	--	NC	--	--	Not Detected

Notes:
-- Not Available/Applicable.
ug/L - micrograms per liter.
B - Analyte was present in a blank.
EPC - Exposure Point Concentration (see Appendix D for EPC calculations; if sufficient samples are available, the EPC is an upper confidence limit (UCL); maximum detected concentration is the EPC if a UCL cannot be calculated).
ESV - Ecological Screening Value (see Appendix F Table 1 for ESVs).
FOD - Frequency of Detection: Total number of detects - Total number of samples.
J - Analyte positively detected but value is an approximate concentration.
J+ - The chemical was positively identified; however, the associated numerical value is a high estimated concentration.
J- - The chemical was positively identified; however, the associated numerical value is a low estimated concentration.
NC - Not Calculated.
ND - Not Detected.

Source Footnotes -
1 - Hazardous Concentration 1% (HC1) (Conder, et al., 2020a).
2 - Chronic recommended water quality (RWQ) risk-based screening level (RBSL)(Divine, et al., 2020).
3 - Aquatic risk-based screening level for wildlife. Selected level is the lowest of the values derived by Devine, et al (2020) for the muskrat, little brown bat, river otter, mink, red-winged blackbird, tree swallow, and brown pelican.
Surrogate footnotes 5, 6, 7, 8, 9, 10, 11, 12 and 14 are provided on Appendix F Table 1.

Appendix F Table 4c
Comparison of PFAS Porewater Concentrations to Ecological Screening Values - Eagle Point Lake
Project 1007
Minneapolis, Minnesota

			Detected Concentrations				Surface Water ESVs (ug/L)									
Analyte	FOD	Percent Detected	Minimum (ug/L)	Mean (ug/L)	Maximum (ug/L)	Location of Maximum Concentration	Aquatic Life (chronic)		Wildlife		Maximum > Aquatic Life ESV?	Maximum > Wildlife ESV?	BERA EPC (ug/L)	BERA EPC > Aquatic Life ESV?	BERA EPC > Wildlife ESV?	Findings
DISSOLVED PHASE RESULTS																
Short-chain PFCAs																
PFBA	6 : 6	100%	0.086	0.17	0.28	EP17A	470	[2]	660	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeA	6 : 6	100%	0.0085	0.015	0.026	EP17A	140	[2]	660	[3, 7]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHxA	6 : 6	100%	0.012	0.024	0.043	EP17A	2300	[2]	210	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpA	6 : 6	100%	0.0085	0.017	0.031	EP17A	870	[2]	210	[3, 12]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFCAs																
PFOA	6 : 6	100%	0.053	0.14	0.24	EP17A	537	[1]	4.4	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFNA	6 : 6	100%	0.0012 J	0.0027	0.0056	EP26A	120	[2]	2.2	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDA	5 : 6	83%	0.0018 J	0.0055	0.0081 J+	EP26A	140	[2]	2.2	[3, 9]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFUNA	0 : 5	0%	ND	ND	ND	--	49	[2]	2.2	[3, 10]	--	--	NC	--	--	Not Detected
PFDoA	0 : 5	0%	ND	ND	ND	--	72	[2]	2.2	[3, 9]	--	--	NC	--	--	Not Detected
PFTrDA	2 : 6	33%	0.0015 J	0.012	0.022 J+	EP26A	72	[2, 11]	2.2	[3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFTeDA	0 : 5	0%	ND	ND	ND	--	72	[2, 11]	2.2	[3, 10]	--	--	NC	--	--	Not Detected
Short-chain PFSAs																
PFBS	6 : 6	100%	0.0034 J	0.0073	0.013	EP17A	3400	[2]	640	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeS	6 : 6	100%	0.0021 J+	0.009	0.02 J+	EP17A	3400	[2, 8]	640	[2, 8]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFSAs																
PFHxS	6 : 6	100%	0.0048	0.016	0.025	EP17C EP27B	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpS	6 : 6	100%	0.00093 J	0.0054	0.010	EP27A	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFOS	6 : 6	100%	0.08 J+	0.71	1.5	EP19	0.56	[1]	0.075	[3]	MAX > Aquatic Life ESV	MAX > Wildlife ESV	1.1	EPC > Aquatic Life ESV	EPC > Wildlife ESV	EPC Exceeds Wildlife ESV
PFNS	1 : 6	17%	0.0024 J+	0.0024	0.0024 J+	EP27A	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDS	0 : 6	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
Fluortelomers																
4:2 FTS	0 : 6	0%	ND	ND	ND	--	3400	[2, 8]	640	[2, 8]	--	--	NC	--	--	Not Detected
6:2 FTS	0 : 6	0%	ND	ND	ND	--	537	[1, 6]	4.4	[1, 6]	--	--	NC	--	--	Not Detected
8:2 FTS	1 : 6	17%	0.00016 J+	0.00016	0.00016 J+	EP26A	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
10:2 FTS	0 : 6	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
FOSA, FASE, FASAAs																
PFOSA	4 : 5	80%	0.00081 J	0.001	0.0015 J	EP17A	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSA	0 : 5	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSA	0 : 5	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-MeFOSAA	0 : 5	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSAA	1 : 5	20%	0.0013 BJ	0.0013	0.0013 BJ	EP19	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSE	0 : 5	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSE	1 : 5	20%	0.00021 J	0.00021	0.00021 J	EP27A	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
Replacement Chemistries														No	No	
HFPO-DA	2 : 6	33%	0.00033 J	0.00034	0.00034 J	EP4	2300	[2, 12]	210	[3, 12]	No	No	NC	--	--	Max Does Not Exceed ESVs
ADONA	0 : 6	0%	ND	ND	ND	--	537	[1, 6]	4.4	[1, 6]	--	--	NC	--	--	Not Detected
9CL-PF3ONS	0 : 6	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
11CL-PF3OUDS	0 : 6	0%	ND	ND	ND	--	49	[2, 14]	0.075	[3, 5]	--	--	NC	--	--	Not Detected

Notes:
-- Not Available/Applicable.
ug/L - micrograms per liter.
B - Analyte was present in a blank.
EPC - Exposure Point Concentration (see Appendix D for EPC calculations; if sufficient samples are available, the EPC is an upper confidence limit (UCL); maximum detected concentration is the EPC if a UCL cannot be calculated).
ESV - Ecological Screening Value (see Appendix F Table 1 for ESVs).
FOD - Frequency of Detection: Total number of detects - Total number of samples.
J - Analyte positively detected but value is an approximate concentration.
J+ - The chemical was positively identified; however, the associated numerical value is a high estimated concentration.
J- - The chemical was positively identified; however, the associated numerical value is a low estimated concentration.
NC - Not Calculated.
ND - Not Detected.

Source Footnotes -
1 - Hazardous Concentration 1% (HC1) (Conder, et al., 2020a).
2 - Chronic recommended water quality (RWQ) risk-based screening level (RBSL)(Divine, et al., 2020).
3 - Aquatic risk-based screening level for wildlife. Selected level is the lowest of the values derived by Devine, et al (2020) for the muskrat, little brown bat, river otter, mink, red-winged blackbird, tree swallow, and brown pelican.
Surrogate footnotes 5, 6, 7, 8, 9, 10, 11, 12 and 14 are provided on Appendix F Table 1.

Appendix F Table 4d
Comparison of PFAS Porewater Concentrations to Ecological Screening Values - West Lakeland Area
Project 1007
Minneapolis, Minnesota

			Detected Concentrations				Surface Water ESVs (ug/L)									
Analyte	FOD	Percent Detected	Minimum (ug/L)	Mean (ug/L)	Maximum (ug/L)	Location of Maximum Concentration	Aquatic Life (chronic)		Wildlife		Maximum > Aquatic Life ESV?	Maximum > Wildlife ESV?	BERA EPC (ug/L)	BERA EPC > Aquatic Life ESV?	BERA EPC > Wildlife ESV?	Findings
TOTAL RECOVERABLE PHASE RESULTS																
Short-chain PFCAs																
PFBA	3 : 3	100%	0.26	0.36	0.43	WL7	470	[2]	660	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeA	3 : 3	100%	0.01	0.014	0.016	WL7	140	[2]	660	[3, 7]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHxA	3 : 3	100%	0.013	0.016	0.018	WL7	2300	[2]	210	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpA	3 : 3	100%	0.0063	0.01	0.012	WL13 WL7	870	[2]	210	[3, 12]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFCAs																
PFOA	3 : 3	100%	0.052	0.069	0.078	WL13	537	[1]	4.4	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFNA	2 : 3	67%	0.0013 J	0.0015	0.0016 J	WL6	120	[2]	2.2	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDA	3 : 3	100%	0.0013 J	0.0014	0.0016 J	WL7	140	[2]	2.2	[3, 9]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFUNA	0 : 3	0%	ND	ND	ND	--	49	[2]	2.2	[3, 10]	--	--	NC	--	--	Not Detected
PFDoA	0 : 3	0%	ND	ND	ND	--	72	[2]	2.2	[3, 9]	--	--	NC	--	--	Not Detected
PFTrDA	2 : 3	67%	0.0016 J	0.0018	0.0019 J	WL13	72	[2, 11]	2.2	[3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFTeDA	0 : 3	0%	ND	ND	ND	--	72	[2, 11]	2.2	[3, 10]	--	--	NC	--	--	Not Detected
Short-chain PFSAs																
PFBS	3 : 3	100%	0.004 J	0.0045	0.0053	WL7	3400	[2]	640	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeS	3 : 3	100%	0.003 J+	0.0041	0.0053 J+	WL7	3400	[2, 8]	640	[2, 8]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFSAs																
PFHxS	3 : 3	100%	0.0079 J+	0.0091	0.0098 J+	WL7	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpS	3 : 3	100%	0.0012 J	0.0017	0.0021 J	WL7	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFOS	3 : 3	100%	0.16	0.19	0.22	WL13	0.56	[1]	0.075	[3]	No	MAX > Wildlife ESV	MAX	EPC is MAX	EPC is MAX	EPC Exceeds Wildlife ESV
PFNS	0 : 3	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
PFDS	0 : 3	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
Fluortelomers																
4:2 FTS	0 : 3	0%	ND	ND	ND	--	3400	[2, 8]	640	[2, 8]	--	--	NC	--	--	Not Detected
6:2 FTS	0 : 3	0%	ND	ND	ND	--	537	[1, 6]	4.4	[1, 6]	--	--	NC	--	--	Not Detected
8:2 FTS	0 : 3	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
10:2 FTS	0 : 3	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
FOSA, FASE, FASAAs																
PFOSA	2 : 3	67%	0.0013 J	0.0015	0.0016 J	WL7	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSA	0 : 3	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSA	0 : 3	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-MeFOSAA	0 : 3	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSAA	0 : 3	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-MeFOSE	0 : 3	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSE	0 : 3	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
Replacement Chemistries																
HFPO-DA	0 : 3	0%	ND	ND	ND	--	2300	[2, 12]	210	[3, 12]	--	--	NC	--	--	Not Detected
ADONA	0 : 3	0%	ND	ND	ND	--	537	[1, 6]	4.4	[1, 6]	--	--	NC	--	--	Not Detected
9CL-PF3ONS	0 : 3	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
11CL-PF3OUDS	0 : 3	0%	ND	ND	ND	--	49	[2, 14]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
DISSOLVED PHASE RESULTS																
Short-chain PFCAs																
PFBA	9 : 9	100%	0.23	0.37	0.44	WL10AWL16	470	[2]	660	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeA	9 : 9	100%	0.0078	0.013	0.015	WL5 WL7 WL10A WL13	140	[2]	660	[3, 7]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHxA	9 : 9	100%	0.0095	0.015	0.018	WL10A	2300	[2]	210	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpA	9 : 9	100%	0.0067	0.0093	0.012	WL11	870	[2]	210	[3, 12]	No	No	NC	--	--	Max Does Not Exceed ESVs

Appendix F Table 4d
Comparison of PFAS Porewater Concentrations to Ecological Screening Values - West Lakeland Area
Project 1007
Minneapolis, Minnesota

			Detected Concentrations				Surface Water ESVs (ug/L)									
Analyte	FOD	Percent Detected	Minimum (ug/L)	Mean (ug/L)	Maximum (ug/L)	Location of Maximum Concentration	Aquatic Life (chronic)		Wildlife		Maximum > Aquatic Life ESV?	Maximum > Wildlife ESV?	BERA EPC (ug/L)	BERA EPC > Aquatic Life ESV?	BERA EPC > Wildlife ESV?	Findings
DISSOLVED PHASE RESULTS (continued)																
Long-chain PFCAs																
PFOA	9 : 9	100%	0.054	0.078	0.089	WL5 WL13	537	[1]	4.4	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFNA	5 : 9	56%	0.0012 J	0.0014	0.0021 J	WL5	120	[2]	2.2	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDA	5 : 9	56%	0.0013 J	0.0044	0.015	WL5	140	[2]	2.2	[3, 9]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFUNA	1 : 9	11%	0.0018 J+	0.0018	0.0018 J+	WL5	49	[2]	2.2	[3, 10]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDoA	1 : 9	11%	0.0023 BJ+	0.0023	0.0023 BJ+	WL5	72	[2]	2.2	[3, 9]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFTrDA	0 : 9	0%	ND	ND	ND	--	72	[2, 11]	2.2	[3, 10]	--	--	NC	--	--	Not Detected
PFTeDA	0 : 8	0%	ND	ND	ND	--	72	[2, 11]	2.2	[3, 10]	--	--	NC	--	--	Not Detected
Short-chain PFSAs																
PFBS	9 : 9	100%	0.0035 J	0.0044	0.0062	WL2	3400	[2]	640	[3]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFPeS	9 : 9	100%	0.0032 J+	0.0051	0.0081 J+	WL2	3400	[2, 8]	640	[2, 8]	No	No	NC	--	--	Max Does Not Exceed ESVs
Long-chain PFSAs																
PFHxS	9 : 9	100%	0.0057	0.0091	0.011	WL7 WL10A WL13	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFHpS	8 : 9	89%	0.0015 J	0.0025	0.003 J	WL10A	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFOS	9 : 9	100%	0.0083 J+	0.25	0.82	WL5	0.56	[1]	0.075	[3]	MAX > Aquatic Life ESV	MAX > Wildlife ESV	0.56	No	EPC > Wildlife ESV	EPC Exceeds Wildlife ESV
PFNS	1 : 9	11%	0.00067 J	0.00067	0.00067 J	WL8	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
PFDS	0 : 9	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
Fluortelomers																
4:2 FTS	0 : 9	0%	ND	ND	ND	--	3400	[2, 8]	640	[2, 8]	--	--	NC	--	--	Not Detected
6:2 FTS	0 : 9	0%	ND	ND	ND	--	537	[1, 6]	4.4	[1, 6]	--	--	NC	--	--	Not Detected
8:2 FTS	0 : 9	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
10:2 FTS	0 : 9	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
FOSA, FASE, FASAAs																
PFOSA	7 : 9	78%	0.00099 J	0.0019	0.0051	WL5	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSA	0 : 9	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSA	0 : 9	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-MeFOSAA	0 : 9	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSAA	1 : 9	11%	0.012 J+	0.012	0.012 J+	WL5	0.56	[1, 5]	0.075	[3, 5]	No	No	NC	--	--	Max Does Not Exceed ESVs
N-MeFOSE	0 : 9	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
N-EtFOSE	0 : 9	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
Replacement Chemistries																
HFPO-DA	0 : 9	0%	ND	ND	ND	--	2300	[2, 12]	210	[3, 12]	--	--	NC	--	--	Not Detected
ADONA	0 : 9	0%	ND	ND	ND	--	537	[1, 6]	4.4	[1, 6]	--	--	NC	--	--	Not Detected
9CL-PF3ONS	0 : 9	0%	ND	ND	ND	--	0.56	[1, 5]	0.075	[3, 5]	--	--	NC	--	--	Not Detected
11CL-PF3OUDS	0 : 9	0%	ND	ND	ND	--	49	[2, 14]	0.075	[3, 5]	--	--	NC	--	--	Not Detected

Notes:
-- Not Available/Applicable.
ug/L - micrograms per liter.
B - Analyte was present in a blank.
EPC - Exposure Point Concentration (see Appendix D for EPC calculations; if sufficient samples are available, the EPC is an upper confidence limit (UCL); maximum detected concentration is the EPC if a UCL cannot be calculated).
ESV - Ecological Screening Value (see Appendix F Table 1 for ESVs).
FOD - Frequency of Detection: Total number of detects - Total number of samples.
J - Analyte positively detected but value is an approximate concentration.
J+ - The chemical was positively identified; however, the associated numerical value is a high estimated concentration.
J- - The chemical was positively identified; however, the associated numerical value is a low estimated concentration.
NC - Not Calculated.
ND - Not Detected.

Source Footnotes -
1 - Hazardous Concentration 1% (HC1) (Conder, et al., 2020a).
2 - Chronic recommended water quality (RWQ) risk-based screening level (RBSL)(Divine, et al., 2020).
3 - Aquatic risk-based screening level for wildlife. Selected level is the lowest of the values derived by Devine, et al (2020) for the muskrat, little brown bat, river otter, mink, red-winged blackbird, tree swallow, and brown pelican.
Surrogate footnotes 5, 6, 7, 8, 9, 10, 11, 12 and 14 are provided on Appendix F Table 1.

Appendix F Table 5
Sample-by-Sample Comparison of Foam Data to ESVs
Project 1007
Minneapolis, Minnesota

	Aquatic Life Surface Water ESVs (ug/L)				Raleigh Creek - upper RC5 2/24/2020	Raleigh Creek - upper RC5 9/20/2020	Raleigh Creek - upper RC7 8/12/2019	Raleigh Creek - upper RC7 8/14/2019	Raleigh Creek - upper RC7A 2/24/2020	Raleigh Creek - upper RC12 8/14/2019	Raleigh Creek - upper RC12 4/28/2020
Analyte	**Chronic**		**Acute**								
Short-chain PFCAs											
PFBA	470	[2]	4200	[2]	0.51	1.24 J	< 0.311 U	< 32 U	< 3.18 U	< 32 U	0.501 J
PFPeA	140	[2]	1000	[2]	0.0438 J	< 0.392 U	< 0.155 U	< 16 U	< 1.59 U	< 16 U	< 0.141 U
PFHxA	2300	[2]	8800	[2]	0.0924 J	0.372 J	< 0.0777 U	< 8 U	< 0.796 U	< 8 U	0.124 J
PFHpA	870	[2]	7800	[2]	0.0905	0.877	< 0.0777 U	< 8 U	< 0.796 U	< 8 U	0.155
Long-chain PFCAs											
PFOA	537	[1]	53000	[2]	1.24	141	0.658	175	5.21	16.2 J	9.11
PFNA	120	[2]	900	[2]	0.0394	7.42	< 0.0777 U	14.7 J	< 0.796 U	11.1 J	0.653
PFDA	140	[2]	1000	[2]	0.378	19.8	1.62	96.5	8.2	72.8	2.52
PFUnA	49	[2]	440	[2]	0.0217 J	0.311 J	1.93	< 8 U	1.8	< 8 U	0.158
PFDoA	72	[2]	640	[2]	< 0.0108 U	< 0.196 U	1.17	< 8 U	< 0.796 U	< 8 U	0.0748 J
PFTrDA	72	[2, 11]	640	[2, 11]	< 0.0108 U	< 0.196 U	< 0.0777 U	< 8 U	< 0.796 U	< 8 U	< 0.07 U
PFTeDA	72	[2, 11]	640	[2, 11]	< 0.0108 U	< 0.196 U	< 0.0777 U	< 8 U	< 0.796 U	< 8 U	< 0.07 U
Short-chain PFSAs											
PFBS	3400	[2]	17000	[2]	0.0205 J	< 0.196 U	< 0.0777 U	< 8 U	< 0.796 U	< 8 U	< 0.07 U
PFPeS	3400	[2, 8]	17000	[2, 8]	0.0233	< 0.197 U	< 0.0777 U	< 8 U	< 0.796 U	< 8 U	< 0.07 U
Long-chain PFSAs											
PFHxS	0.56	[1, 5]	570	[2, 5]	0.0752	2.9	< 0.0777 U	< 8 U	< 0.796 U	< 8 U	0.371
PFHpS	0.56	[1, 5]	570	[2, 5]	0.0788	26.4	< 0.0777 U	24.9	< 0.796 U	< 8 U	1.91
PFOS	0.56	[1]	570	[2]	30.7	4410	40.1	13800	531	10500	391
PFNS	0.56	[1, 5]	570	[2, 5]	0.0416	1.66	1.1	12.6 J	2.95	< 8 U	0.364
PFDS	0.56	[1, 5]	570	[2, 5]	0.0155 J	0.472 J	3.1	< 8 U	3.16	< 8 U	0.221 J
PFDoS	0.56	[1, 5]	570	[2, 5]	< 0.0108 U	< 0.196 U	< 0.0777 U	< 8 U	< 0.796 U	< 8 U	< 0.07 U
Fluortelomers											
4:2 FTS	3400	[2, 8]	17000	[2, 8]	< 0.0432 U	< 0.784 U	< 0.311 U	< 32 U	< 3.18 U	< 32 U	< 0.281 U
6:2 FTS	537		53000		< 0.0389 U	4.45	< 0.28 U	592	< 2.87 U	361 J	< 0.253 U
8:2 FTS	0.56	[1, 5]	570	[2, 5]	< 0.0432 U	< 0.784 U	< 0.311 U	< 32 U	< 3.18 U	< 32 U	< 0.281 U
FOSA, FASE, FASAAs											
PFOSA	0.56	[1, 5]	570	[2, 5]	2.96	42.2	18.8	270	103	71.1	3.79
N-MeFOSA	0.56	[1, 5]	570	[2, 5]	0.0131 J	< 0.225 U	2.12	< 9.2 U	5.31	< 9.2 U	< 0.08 U
N-EtFOSA	0.56	[1, 5]	570	[2, 5]	0.204	< 0.49 U	5.5	< 20 U	54.1	< 20 U	< 0.176 U
N-MeFOSAA	0.56	[1, 5]	570	[2, 5]	0.0274	0.715 J	1.18	< 8 U	1.32 J	< 8 U	< 0.07 U
N-EtFOSAA	0.56	[1, 5]	570	[2, 5]	4.01	22.2	94.5	263	96.4	168	7.7
N-MeFOSE	0.56	[1, 5]	570	[2, 5]	< 0.108 U	< 1.96 U	< 0.777 U	< 80 U	< 7.96 U	< 80 U	< 0.703 U
N-EtFOSE	0.56	[1, 5]	570	[2, 5]	< 0.0811 U	< 1.47 U	< 0.583 U	< 60 U	< 5.97 U	< 60 U	< 0.527 U
Replacement Chemistries											
HFPO-DA	2300	[2, 12]	8800	[2, 12]	< 0.0411 U	< 0.745 U	< 0.311 U	< 32 U	< 3.02 U	< 32 U	< 0.267 U
ADONA	537	[1, 6]	53000	[2, 6]	< 0.0432 U	< 0.784 U	< 0.311 U	< 32 U	< 3.18 U	< 32 U	< 0.281 U
9Cl-PF3ONS	0.56	[1, 5]	570	[2, 5]	< 0.0432 U	< 0.786 U	< 0.311 U	< 32 U	< 3.18 U	< 32 U	< 0.281 U
11Cl-PF3OUdS	49	[2, 14]	440	[2, 14]	< 0.0432 U	< 0.785 U	< 0.311 U	< 32 U	< 3.18 U	< 32 U	< 0.281 U

Notes:
ug/L - micrograms per liter
ESV - Ecological Screening Value
J - Analyte positively detected but value is an approximate concentration.
J+ - The chemical was positively identified; however, the associated numerical value is a high estimated concentration.
J- - The chemical was positively identified; however, the associated numerical value is a low estimated concentration.
U - Concentration is less than the laboratory reportable limit.
detected concentration exceeds the chronic ESV
detected concentration exceeds the chronic and acute ESVs
Source Footnotes -
1 - Hazardous Concentration 1% (HC1) (Conder, et al., 2020).
PFOS Hazardous Concentration 5% (HC5) is 5.85 ug/L.
2 - Recommended water quality (RWQ) risk-based screening level (RBSL)(Divine, et al., 2020).
Surrogate footnotes 5, 6, 8, 11, 12, and 14 are provided on Appendix F Table 1.

Appendix F Table 5
Sample-by-Sample Comparison of Foam Data to ESVs
Project 1007
Minneapolis, Minnesota

	Aquatic Life Surface Water ESVs (ug/L)				Raleigh Creek - other RC16 4/7/2020	Raleigh Creek - other RC21 2/24/2020	Raleigh Creek - other RC21 4/23/2020	Raleigh Creek - other RC21 7/22/2020	Raleigh Creek - other RC17 8/14/2019	Raleigh Creek - other RC17A 8/14/2019	Raleigh Creek - other RC18A 5/5/2020	Eagle Point Lake EP18 7/6/2020
Analyte	**Chronic**		**Acute**									
Short-chain PFCAs												
PFBA	470	[2]	4200	[2]	0.0995	0.103	0.0793	0.13 J-	< 8 U	< 0.316 U	0.0963	0.137
PFPeA	140	[2]	1000	[2]	< 0.0117 U	< 0.00872 U	< 0.011 U	< 0.0162 UJ	< 4 U	< 0.158 U	< 0.013 U	< 0.0187 U
PFHxA	2300	[2]	8800	[2]	< 0.00584 U	0.0174 J	0.00651 J	0.0179 J-	< 2 U	< 0.0791 U	0.007 J	0.0102 J
PFHpA	870	[2]	7800	[2]	< 0.00584 U	0.0599	0.00617 J	0.0244 J-	< 2 U	< 0.0791 U	< 0.006 U	0.0101 J
Long-chain PFCAs												
PFOA	537	[1]	53000	[2]	0.117	6.79	0.212	0.499 J-	3.75 J	0.504	0.165	0.591
PFNA	120	[2]	900	[2]	0.352	7.31	0.184	0.26 J-	< 2 U	0.332	0.312	0.263
PFDA	140	[2]	1000	[2]	0.475	2.88	0.139	2.48 J-	31.5	5.26	0.697	0.301
PFUnA	49	[2]	440	[2]	0.153	0.196	0.03	0.619 J-	3.63 J	0.401	0.375	0.204
PFDoA	72	[2]	640	[2]	0.037	0.0237	0.00968 J	0.164 J-	< 2 U	< 0.0791 U	0.149	0.054
PFTrDA	72	[2, 11]	640	[2, 11]	0.00678 J	0.00653 J	< 0.005 U	0.0232 J-	< 2 U	< 0.0791 U	0.0292	0.0173 J
PFTeDA	72	[2, 11]	640	[2, 11]	< 0.00584 U	< 0.00436 U	< 0.005 U	0.0113 J	< 2 U	< 0.0791 U	0.0128 J	< 0.00936 UJ
Short-chain PFSAs												
PFBS	3400	[2]	17000	[2]	< 0.00584 U	0.00471 J	< 0.005 U	< 0.00811 UJ	< 2 U	< 0.0791 U	< 0.006 U	< 0.00936 U
PFPeS	3400	[2, 8]	17000	[2, 8]	< 0.00584 U	< 0.00436 U	< 0.005 U	< 0.00811 UJ	< 2 U	< 0.0791 U	< 0.006 U	< 0.00936 U
Long-chain PFSAs												
PFHxS	0.56	[1, 5]	570	[2, 5]	0.0144 J	1.13	0.0353	0.0347 J-	< 2 U	< 0.0791 U	0.026	0.0154 J
PFHpS	0.56	[1, 5]	570	[2, 5]	0.0164	0.642	0.00909 J	0.219 J-	< 2 U	0.243	0.0153	0.0523
PFOS	0.56	[1]	570	[2]	3.67	56.4	1.57	147 J-	2750	595	8.22	13.3
PFNS	0.56	[1, 5]	570	[2, 5]	< 0.00584 U	< 0.00436 U	< 0.005 U	0.536 J-	3.17 J	0.582	0.0211 J	< 0.00936 U
PFDS	0.56	[1, 5]	570	[2, 5]	< 0.00584 U	< 0.00436 U	< 0.005 U	0.339 J-	< 2 U	0.147 J	0.0452	0.0212 J
PFDoS	0.56	[1, 5]	570	[2, 5]	< 0.00584 U	< 0.00436 U	< 0.005 U	< 0.00811 UJ	< 2 U	< 0.0791 U	< 0.006 U	< 0.00936 U
Fluortelomers												
4:2 FTS	3400	[2, 8]	17000	[2, 8]	< 0.0234 U	< 0.0174 U	< 0.023 U	< 0.0324 UJ	< 8 U	< 0.316 U	< 0.026 U	< 0.0374 U
6:2 FTS	537		53000		< 0.021 U	< 0.0157 U	0.0561 J	< 0.0292 UJ	< 7.2 U	< 0.285 U	< 0.024 U	< 0.0337 U
8:2 FTS	0.56	[1, 5]	570	[2, 5]	< 0.0234 U	< 0.0174 U	< 0.023 U	< 0.0324 UJ	< 8 U	< 0.316 U	< 0.026 U	< 0.0374 U
FOSA, FASE, FASAAs												
PFOSA	0.56	[1, 5]	570	[2, 5]	0.0521	0.214	0.0143	3.93 J-	51	8.78	0.0946	0.0393 J
N-MeFOSA	0.56	[1, 5]	570	[2, 5]	< 0.00672 U	< 0.00501 U	< 0.006 U	< 0.00932 UJ	< 2.3 U	< 0.0909 U	< 0.007 U	< 0.0108 U
N-EtFOSA	0.56	[1, 5]	570	[2, 5]	< 0.0146 U	< 0.0109 U	< 0.014 U	0.0208 J-	< 5 U	0.211 J	< 0.016 U	< 0.0234 U
N-MeFOSAA	0.56	[1, 5]	570	[2, 5]	0.0511	0.0315	0.0147	0.132 J-	2.1 J	0.216	0.0814	0.0132 J
N-EtFOSAA	0.56	[1, 5]	570	[2, 5]	0.0727	0.136	0.0259	14.1 J-	92.5	10.6	0.324	0.0915
N-MeFOSE	0.56	[1, 5]	570	[2, 5]	< 0.0584 U	< 0.0436 U	< 0.057 U	< 0.0811 UJ	< 20 U	< 0.791 U	< 0.066 U	< 0.0936 U
N-EtFOSE	0.56	[1, 5]	570	[2, 5]	< 0.0438 U	< 0.0327 U	< 0.043 U	< 0.0608 UJ	< 15 U	< 0.593 U	< 0.049 U	< 0.0702 U
Replacement Chemistries												
HFPO-DA	2300	[2, 12]	8800	[2, 12]	< 0.0222 U	< 0.0166 U	< 0.021 U	< 0.0308 UJ	< 8 U	< 0.316 U	< 0.025 U	< 0.0356 U
ADONA	537	[1, 6]	53000	[2, 6]	< 0.0234 U	< 0.0174 U	< 0.023 U	< 0.0324 UJ	< 8 U	< 0.316 U	< 0.026 U	< 0.0374 U
9Cl-PF3ONS	0.56	[1, 5]	570	[2, 5]	< 0.0234 U	< 0.0174 U	< 0.023 U	< 0.0324 UJ	< 8 U	< 0.316 U	< 0.026 U	< 0.0374 U
11Cl-PF3OUdS	49	[2, 14]	440	[2, 14]	< 0.0234 U	< 0.0174 U	< 0.023 U	< 0.0324 UJ	< 8 U	< 0.316 U	< 0.026 U	< 0.0374 U

Notes:
ug/L - micrograms per liter
ESV - Ecological Screening Value
J - Analyte positively detected but value is an approximate concentration.
J+ - The chemical was positively identified; however, the associated numerical value is a high estimated concentration.
J- - The chemical was positively identified; however, the associated numerical value is a low estimated concentration.
U - Concentration is less than the laboratory reportable limit.
detected concentration exceeds the chronic ESV
detected concentration exceeds the chronic and acute ESVs
Source Footnotes -
1 - Hazardous Concentration 1% (HC1) (Conder, et al., 2020).
PFOS Hazardous Concentration 5% (HC5) is 5.85 ug/L.
2 - Recommended water quality (RWQ) risk-based screening level (RBSL)(Divine, et al., 2020).
Surrogate footnotes 5, 6, 8, 11, 12, and 14 are provided on Appendix F Table 1.

Appendix F Table 5
Sample-by-Sample Comparison of Foam Data to ESVs
Project 1007
Minneapolis, Minnesota

	Aquatic Life Surface Water ESVs (ug/L)				Lake Elmo EP21A 4/23/2020	Lake Elmo EP21B 5/5/2020	Lake Elmo EP21B (duplicate) 5/5/2020	West Lakeland EP16 7/29/2020	West Lakeland WL6 2/25/2020	West Lakeland WL6 9/17/2020	West Lakeland WL11 5/5/2020
Analyte	**Chronic**		**Acute**								
Short-chain PFCAs											
PFBA	470	[2]	4200	[2]	0.897 J	0.839 J	0.83	0.722 J-	< 3.17 U	< 7.48 U	0.431
PFPeA	140	[2]	1000	[2]	< 0.223 U	< 0.22 U	< 0.199 U	0.0248 J-	< 1.58 U	< 3.74 U	< 0.019 U
PFHxA	2300	[2]	8800	[2]	< 0.111 U	< 0.11 U	< 0.099 U	0.0255 J-	< 0.792 U	< 1.87 U	0.0221 J
PFHpA	870	[2]	7800	[2]	< 0.111 U	< 0.11 U	< 0.099 U	0.0266 J-	< 0.792 U	< 1.87 U	0.0202 J
Long-chain PFCAs											
PFOA	537	[1]	53000	[2]	0.521	1.05	1.07	0.372 J-	1.54 J	9.48	1.25
PFNA	120	[2]	900	[2]	0.26	0.999	1	0.0359 J	2.73	22.7	0.169
PFDA	140	[2]	1000	[2]	2.11	10.8	10.4	2.58 J	15.3	143	0.489
PFUnA	49	[2]	440	[2]	0.331	0.952	1.1	2.33 J	0.846 J	4.65 J	0.0323
PFDoA	72	[2]	640	[2]	< 0.111 U	0.125 J	0.144 J	0.784 J	< 0.792 U	< 1.87 U	< 0.009 U
PFTrDA	72	[2, 11]	640	[2, 11]	< 0.111 U	< 0.11 U	< 0.099 U		< 0.792 U	< 1.87 U	< 0.009 U
PFTeDA	72	[2, 11]	640	[2, 11]	< 0.111 U	< 0.11 U	< 0.099 U	0.0616 J-	< 0.792 U	< 1.87 U	< 0.009 U
Short-chain PFSAs											
PFBS	3400	[2]	17000	[2]	< 0.111 U	< 0.11 U	< 0.099 U	0.00643 J-	< 0.792 U	< 1.87 U	< 0.009 U
PFPeS	3400	[2, 8]	17000	[2, 8]	< 0.111 U	< 0.11 U	< 0.099 U	< 0.00637 UJ	< 0.792 U	< 1.88 U	< 0.009 U
Long-chain PFSAs											
PFHxS	0.56	[1, 5]	570	[2, 5]	< 0.111 U	< 0.11 U	< 0.099 U	0.0227 J-	< 0.792 U	< 1.87 U	0.0576
PFHpS	0.56	[1, 5]	570	[2, 5]	0.15 J	0.503	0.498	0.0208 J-	1.65	10.6	0.257
PFOS	0.56	[1]	570	[2]	216	904	862	57 J	1630	20700	87.1
PFNS	0.56	[1, 5]	570	[2, 5]	< 0.111 U	< 0.11 U	< 0.099 U	0.543 J-	< 0.792 U	5.63 J	0.0288 J
PFDS	0.56	[1, 5]	570	[2, 5]	< 0.111 U	< 0.11 U	< 0.099 U	0.266 J-	< 0.792 U	< 1.87 U	< 0.009 U
PFDoS	0.56	[1, 5]	570	[2, 5]	< 0.111 U	< 0.11 U	< 0.099 U	< 0.00634 UJ	< 0.792 U	< 1.87 U	< 0.009 U
Fluortelomers											
4:2 FTS	3400	[2, 8]	17000	[2, 8]	< 0.445 U	< 0.44 U	< 0.398 U	< 0.0254 UJ	< 3.17 U	< 7.48 U	< 0.039 U
6:2 FTS	537		53000		< 0.401 U	< 0.396 U	< 0.358 U	< 0.0229 UJ	< 2.85 U	< 6.74 U	< 0.035 U
8:2 FTS	0.56	[1, 5]	570	[2, 5]	< 0.445 U	< 0.44 U	< 0.398 U	< 0.0254 UJ	< 3.17 U	< 7.48 U	< 0.039 U
FOSA, FASE, FASAAs											
PFOSA	0.56	[1, 5]	570	[2, 5]	0.463	0.737	0.692	2.44 J	8.57	33	0.225
N-MeFOSA	0.56	[1, 5]	570	[2, 5]	< 0.128 U	< 0.127 U	< 0.114 U	< 0.00729 UJ	< 0.911 U	< 2.15 U	< 0.011 U
N-EtFOSA	0.56	[1, 5]	570	[2, 5]	< 0.278 U	< 0.275 U	< 0.249 U	0.0233 J	< 1.98 U	< 4.67 U	< 0.024 U
N-MeFOSAA	0.56	[1, 5]	570	[2, 5]	< 0.111 U	0.365	0.358	0.201 J	< 0.792 U	3.81 J	0.0131 J
N-EtFOSAA	0.56	[1, 5]	570	[2, 5]	1.3	3.12	2.81	15.5 J-	8.4	128	0.553
N-MeFOSE	0.56	[1, 5]	570	[2, 5]	< 1.11 U	< 1.1 U	< 0.995 U	< 0.0634 UJ	< 7.92 U	< 18.7 U	< 0.099 U
N-EtFOSE	0.56	[1, 5]	570	[2, 5]	< 0.835 U	< 0.825 U	< 0.747 U	< 0.0474 UJ	< 5.94 U	< 14 U	< 0.074 U
Replacement Chemistries											
HFPO-DA	2300	[2, 12]	8800	[2, 12]	< 0.423 U	< 0.418 U	< 0.378 U	< 0.0241 UJ	< 3.01 U	< 7.1 U	< 0.037 U
ADONA	537	[1, 6]	53000	[2, 6]	< 0.445 U	< 0.44 U	< 0.398 U	< 0.0254 UJ	< 3.17 U	< 7.48 U	< 0.039 U
9Cl-PF3ONS	0.56	[1, 5]	570	[2, 5]	< 0.445 U	< 0.44 U	< 0.398 U	< 0.0254 UJ	< 3.17 U	< 7.5 U	< 0.039 U
11Cl-PF3OUdS	49	[2, 14]	440	[2, 14]	< 0.445 U	< 0.44 U	< 0.398 U	< 0.0254 UJ	< 3.17 U	< 7.49 U	< 0.039 U

Notes:
ug/L - micrograms per liter
ESV - Ecological Screening Value
J - Analyte positively detected but value is an approximate concentration.
J+ - The chemical was positively identified; however, the associated numerical value is a high estimated concentration.
J- - The chemical was positively identified; however, the associated numerical value is a low estimated concentration.
U - Concentration is less than the laboratory reportable limit.
detected concentration exceeds the chronic ESV
detected concentration exceeds the chronic and acute ESVs
Source Footnotes -
1 - Hazardous Concentration 1% (HC1) (Conder, et al., 2020).
PFOS Hazardous Concentration 5% (HC5) is 5.85 ug/L.
2 - Recommended water quality (RWQ) risk-based screening level (RBSL)(Divine, et al., 2020).
Surrogate footnotes 5, 6, 8, 11, 12, and 14 are provided on Appendix F Table 1.

Appendix F Table 5
Sample-by-Sample Comparison of Foam Data to ESVs
Project 1007
Minneapolis, Minnesota

	Aquatic Life Surface Water ESVs (ug/L)				Other EP25 5/11/2020	Other GL1 6/29/2020	Other FP1 7/31/2020	Other VB1 4/7/2020	Other VB3 4/7/2020	Other VB3 9/16/2020	Other FC2 6/29/2020
Analyte	**Chronic**		**Acute**								
Short-chain PFCAs											
PFBA	470	[2]	4200	[2]	4.9	0.123 J-	0.0659 J-	0.127	0.252	0.498	0.179 J-
PFPeA	140	[2]	1000	[2]	0.0701	< 0.0163 UJ	< 0.00623 UJ	0.0128 J	< 0.0217 U	0.0506 J+	0.0194 J-
PFHxA	2300	[2]	8800	[2]	0.0586	0.00989 J-	0.00642 J-	0.0135 J	< 0.0108 U	0.013 J+	0.062 J-
PFHpA	870	[2]	7800	[2]	0.0153	0.0122 J-	0.00825 J-	< 0.00588 U	0.0239 J	0.0232 J+	0.0367 J-
Long-chain PFCAs											
PFOA	537	[1]	53000	[2]	0.481	0.04 J-	0.365 J-	0.0845	2.42	4.19 J+	1.21 J-
PFNA	120	[2]	900	[2]	0.106	0.0585 J-	0.662 J-	0.0398	0.317	0.317 J+	2.1 J-
PFDA	140	[2]	1000	[2]	0.155	0.256 J-	0.514 J-	0.0687	0.0648	0.0846 J+	3.32 J-
PFUnA	49	[2]	440	[2]	0.084	0.321 J-	0.192 J-	0.0581	0.0689	0.11 J+	0.658 J
PFDoA	72	[2]	640	[2]	0.0117 J	0.0578 J	0.0175 J	0.0301	0.0141 J	0.0199 J+	0.122 J
PFTrDA	72	[2, 11]	640	[2, 11]	< 0.006 U	0.0152 J-	0.00575 J-	< 0.00588 U	< 0.0108 U	< 0.0101 U	0.0188 J-
PFTeDA	72	[2, 11]	640	[2, 11]	< 0.006 U	< 0.00813 UJ	< 0.00312 UJ	0.00595 J	< 0.0125 U		0.0108 J
Short-chain PFSAs											
PFBS	3400	[2]	17000	[2]	< 0.006 U	< 0.00813 UJ	< 0.00312 UJ	< 0.00588 U	< 0.0108 U	< 0.0097 UJ	< 0.00591 UJ
PFPeS	3400	[2, 8]	17000	[2, 8]	< 0.006 U	< 0.00813 UJ	< 0.00313 UJ	< 0.00588 U	< 0.0108 U	< 0.00975 U	< 0.00591 UJ
Long-chain PFSAs											
PFHxS	0.56	[1, 5]	570	[2, 5]	< 0.006 U	< 0.00813 UJ	0.0291 J-	0.0163 J	0.218	0.232 J+	0.0459 J-
PFHpS	0.56	[1, 5]	570	[2, 5]	< 0.006 U	< 0.00813 UJ	0.0515 J-	0.0105 J	0.7	0.46	0.181 J-
PFOS	0.56	[1]	570	[2]	1.11	1.68 J-	12 J-	2.55	103	97.6 J+	50.8 J-
PFNS	0.56	[1, 5]	570	[2, 5]	< 0.006 U	< 0.00813 UJ	0.00312 J-	< 0.00588 U	< 0.0108 U	< 0.0097 U	< 0.0187 UJ
PFDS	0.56	[1, 5]	570	[2, 5]	< 0.006 U	0.0156 J-	0.00556 J-	0.0194	< 0.0108 U	< 0.0097 U	0.0487 J-
PFDoS	0.56	[1, 5]	570	[2, 5]	< 0.006 U	< 0.00813 UJ	< 0.00312 UJ	< 0.00588 U	< 0.0108 U	< 0.0097 U	< 0.00591 UJ
Fluortelomers											
4:2 FTS	3400	[2, 8]	17000	[2, 8]	< 0.025 U	< 0.0325 UJ	< 0.0125 UJ	< 0.0235 U	< 0.0433 U	< 0.0388 U	< 0.0236 UJ
6:2 FTS	537		53000		< 0.022 U	< 0.0293 UJ	< 0.0112 UJ	< 0.0212 U	< 0.039 U	< 0.035 UJ	< 0.0213 UJ
8:2 FTS	0.56	[1, 5]	570	[2, 5]	< 0.025 U	< 0.0325 UJ	< 0.0125 UJ	< 0.0235 U	< 0.0433 U	< 0.0388 UJ	0.0317 J-
FOSA, FASE, FASAAs											
PFOSA	0.56	[1, 5]	570	[2, 5]	0.00793 J	0.0101 J-	0.0583 J-	0.123	0.0113 J	0.0122 J+	0.545 J-
N-MeFOSA	0.56	[1, 5]	570	[2, 5]	< 0.007 U	< 0.00935 UJ	< 0.00358 UJ	0.0175	< 0.0125 U	< 0.0112 UJ	< 0.0068 UJ
N-EtFOSA	0.56	[1, 5]	570	[2, 5]	< 0.015 U	< 0.0203 UJ	< 0.00779 UJ	< 0.0147 U	< 0.0271 U	< 0.0242 UJ	< 0.0148 UJ
N-MeFOSAA	0.56	[1, 5]	570	[2, 5]	0.0153	0.0488 J-	0.0322 J	0.415	0.0168 J	0.0146 J+	0.626 J-
N-EtFOSAA	0.56	[1, 5]	570	[2, 5]	0.0235	0.151 J-	0.0968 J-	0.287	0.0205 J	0.0385 J+	0.826 J-
N-MeFOSE	0.56	[1, 5]	570	[2, 5]	< 0.063 U	< 0.0813 UJ	< 0.0312 UJ	0.119 J	< 0.108 U	< 0.097 UJ	< 0.0591 UJ
N-EtFOSE	0.56	[1, 5]	570	[2, 5]	< 0.047 U	< 0.061 UJ	< 0.0233 UJ	< 0.0441 U	< 0.0812 U	< 0.0726 UJ	< 0.0443 UJ
Replacement Chemistries											
HFPO-DA	2300	[2, 12]	8800	[2, 12]	< 0.024 U	< 0.0309 UJ	< 0.0118 UJ	< 0.0224 U	< 0.0411 U	< 0.0369 UJ	< 0.0225 UJ
ADONA	537	[1, 6]	53000	[2, 6]	< 0.025 U	< 0.0325 UJ	< 0.0125 UJ	< 0.0235 U	< 0.0433 U	< 0.0388 U	< 0.0236 UJ
9Cl-PF3ONS	0.56	[1, 5]	570	[2, 5]	< 0.025 U	< 0.0325 UJ	< 0.0125 UJ	< 0.0235 U	< 0.0433 U	< 0.0389 U	< 0.0236 UJ
11Cl-PF3OUdS	49	[2, 14]	440	[2, 14]	< 0.025 U	< 0.0325 UJ	< 0.0125 UJ	< 0.0235 U	< 0.0433 U	< 0.0388 U	< 0.0236 UJ

Notes:
ug/L - micrograms per liter
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detected concentration exceeds the chronic ESV
detected concentration exceeds the chronic and acute ESVs
Source Footnotes -
1 - Hazardous Concentration 1% (HC1) (Conder, et al., 2020).
PFOS Hazardous Concentration 5% (HC5) is 5.85 ug/L.
2 - Recommended water quality (RWQ) risk-based screening level (RBSL)(Divine, et al., 2020).
Surrogate footnotes 5, 6, 8, 11, 12, and 14 are provided on Appendix F Table 1.

Appendix G

Food Web Model – Raleigh Creek-Upper

Appendix G Food Web Model – Raleigh Creek - Upper
Table 1. Wildlife Exposure Parameters
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Parameter	Parameter Definition	Units	Birds				Mammals		
			Avian Consumer (Herbivore)	Avian Consumer (Invertivore)	Avian Consumer (Omnivore / Invertivore)	Avian Consumer (Piscivore)	Mammalian Consumer (Herbivore)	Mammalian Consumer (Invertivore)	Mammalian Consumer (Omnivore / Invertivore)
			Wood Duck	**Tree Swallow**	**Spotted Sandpiper**	**Great Blue Heron**	**Muskrat**	**Little Brown Bat**	**Raccoon**
			Aix sponsa	*Tachycineta bicolor*	*Actitis macularius*	*Ardea herodias*	*Ondatra zibethicus*	*Myotis lucifugus*	*Procyon lotor*
BW	Body Weight	kg	0.70	0.020	0.043	2.4	1.6	0.0085	8.6
FIR_{dw}	Daily Food Ingestion Rate (dry matter) [1]	kg, dw/day	0.041	0.012	0.0076	0.11	0.14	0.0016	0.050
FIR_{ww}	Daily Food Ingestion Rate (wet matter) [2]	kg, ww/day	0.13	0.035	0.023	0.43	0.54	0.0049	0.20
P_{veg}	Proportion of Diet - Vegetation	kg diet item, ww/kg diet, ww	0.90	0.17	--	--	0.80	--	0.45
IR_{veg}	Vegetation Ingestion Rate [4]	kg ww/day	0.11	0.0060	--	--	0.43	--	0.090
P_{bi}	Proportion of Diet - Benthic Invertebrates	kg diet item, ww/kg diet, ww	0.050	0.26	0.80	0.15	0.10	--	0.40
IR_{bi}	Benthic Invertebrate Ingestion Rate [4]	kg ww/day	0.0064	0.0092	0.018	0.065	0.054	--	0.080
P_{ai}	Proportion of Diet - Aquatic Invertebrates	kg diet item, ww/kg diet, ww	0.050	0.57	0.15	--	0.10	1.0	0.050
IR_{ai}	Aquatic Invertebrate Ingestion Rate [4]	kg ww/day	0.0064	0.020	0.0034	--	0.054	0.0049	0.010
P_{am}	Proportion of Diet - Amphibians	kg diet item, ww/kg diet, ww	--	--	--	0.050	--	--	0.050
IR_{am}	Amphibian Ingestion Rate [4]	kg ww/day	--	--	--	0.022	--	--	0.010
P_{ff}	Proportion of Diet - Forage Fish	kg diet item, ww/kg diet, ww	--	--	0.050	0.80	--	--	0.050
IR_{ff}	Forage Fish Ingestion Rate [4]	kg ww/day	--	--	0.0011	0.35	--	--	0.010
P_{pf}	Proportion of Diet - Predatory Fish	kg diet item, ww/kg diet, ww	--	--	--	--	--	--	--
IR_{pf}	Predatory Fish Ingestion Rate [4]	kg ww/day	--	--	--	--	--	--	--
P_s	Proportion of Diet - Sediment	kg sediment, dw/kg diet, dw	0.24	--	0.073	0.0040	0.020	--	0.094
IR_S	Sediment Ingestion Rate [5]	kg dw/day	0.0098	--	0.00055	0.00043	0.0027	--	0.0047
IR_W	Water Ingestion Rate [6]	L/day or kg/day	0.041	0.0040	0.054	0.11	0.88	0.0010	0.41
HR	Home Range	acres	776	194	5.0	11	0.32	74	385
SUF	Seasonal Use Factor [5]	proportion	1	1	1	1	1	1	1
AUF_{RC}	Area Use Factor for Raleigh Creek - Upper [3]	proportion	0.027	0.11	1.0	1.0	1.0	0.28	0.055

Notes:
References for all species-specific exposure factors are provided in Table 2.
1 - Dry weight food ingestion rate (FIR) is applied to concentrations of PFAS in sediment, generally reported on dry weight basis.
2 - Wet weight FIR is applied to tissue data, generally reported on fresh or wet weight basis.
3 - AUF values for receptors were calculated by dividing the size of the exposure area by the home range. If the home range is smaller than the exposure area, an AUF of 1 was used. Site Use Factor (SUF) of 1 was selected for all receptors.
4 - Dietary ingestion rates were calculated by multiplying the receptor- and tissue-specific proportion of diet by the receptor-specific FIR_{ww}.
5 - IR_S were calculated by multiplying the receptor-specific P_S by the receptor-specific FIR_{dw}.
6 - IR_W is reported in L/day or kg/day because 1 L of water has weight of 1 kg

Abbreviations:
dw - dry weight
kg - kilogram
L - liters
RC - Raleigh Creek
ww - wet weight

Exposure Areas (Acres):
RC - Upper = 21

Appendix G Food Web Model – Raleigh Creek - Upper
Table 2. Information Sources for Wildlife Exposure Parameters
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Receptor Type	Feeding Guild	Species	Parameter	Definition	Value	Units	Reference	Notes
Bird	Herbivore	Wood Duck	BW	Body Weight	0.70	kg	NC WRC (2019)	Lowest reported body weight (converted to kg)
Bird	Herbivore	Wood Duck	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.041	kg, dw/day	Nagy (2001)	Calculated using DW allometric equation for omnivorous birds: FIR (dw) = 0.67 x BW ^ 0.627
Bird	Herbivore	Wood Duck	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.13	kg, ww/day	Nagy (2001)	Calculated using WW allometric equation for omnivorous birds: FIR (ww) = 2.094 x BW ^ 0.627
Bird	Herbivore	Wood Duck	P_{veg}	Proportion of Diet - Vegetation	0.90	kg diet item, ww/kg diet, ww	MN DNR (2020)	Consume acorns, weed seeds, berries, plants and insects; assume majority is vegetation (https://www.dnr.state.mn.us/birds/woodduck.html)
Bird	Herbivore	Wood Duck	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.05	kg diet item, ww/kg diet, ww	MN DNR (2020)	Consume acorns, weed seeds, berries, plants and insects; assume majority is vegetation (https://www.dnr.state.mn.us/birds/woodduck.html)
Bird	Herbivore	Wood Duck	P_{ai}	Proportion of Diet - Aquatic Invertebrates	0.05	kg diet item, ww/kg diet, ww	MN DNR (2020)	Consume acorns, weed seeds, berries, plants and insects; assume majority is vegetation (https://www.dnr.state.mn.us/birds/woodduck.html)
Bird	Herbivore	Wood Duck	P_{am}	Proportion of Diet - Amphibians	--	kg diet item, ww/kg diet, ww	MN DNR (2020)	Assumed not to be consumed based on reported diet contents.
Bird	Herbivore	Wood Duck	P_{ff}	Proportion of Diet - Forage Fish	--	kg diet item, ww/kg diet, ww	MN DNR (2020)	Assumed not to be consumed based on reported diet contents.
Bird	Herbivore	Wood Duck	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww	MN DNR (2020)	Assumed not to be consumed based on reported diet contents.
Bird	Herbivore	Wood Duck	P_{s}	Proportion of Diet - Sediment	0.24	kg sediment, dw/kg diet, dw	USEPA (1993)	Sediment ingestion in wood duck (USEPA, 1993).
Bird	Herbivore	Wood Duck	IR_{W}	Daily Water Ingestion	0.041	L water/day	USEPA (1993)	Mallard used as a surrogate; IR L/day= IR 0.058 (L/kg)*BW (kg)
Bird	Herbivore	Wood Duck	HR	Home Range	776	acres	CDFW (2021)	In Minnesota, breeding female wood ducks remained within 1 km (0.6 mi) of the nest during 70% of their time away (Gilmer et al. 1978, as cited in CDFW 2021); therefore, home range was calculated as area from nest using 1 km as radius.
Bird	Invertivore	Tree Swallow	BW	Body Weight	0.020	kg	Nagy (2001)	Measured value for tree swallow.
Bird	Invertivore	Tree Swallow	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.012	kg, dw/day	Nagy (2001)	Measured value for tree swallow (dry matter intake).
Bird	Invertivore	Tree Swallow	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.035	kg, ww/day	Nagy (2001)	Measured value for tree swallow (fresh matter intake).
Bird	Invertivore	Tree Swallow	P_{veg}	Proportion of Diet - Vegetation	0.17	kg diet item, ww/kg diet, ww	Beal (1918); USACHPPM (2004)	Estimated proportion of plant material.
Bird	Invertivore	Tree Swallow	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.26	kg diet item, ww/kg diet, ww	Beal (1918); USACHPPM (2004)	Estimated based on proportion of non-flying insects.
Bird	Invertivore	Tree Swallow	P_{ai}	Proportion of Diet - Aquatic Invertebrates	0.57	kg diet item, ww/kg diet, ww	Beal (1918); USACHPPM (2004)	Estimated based on proportion of flying (emergent aquatic) insects.
Bird	Invertivore	Tree Swallow	P_{am}	Proportion of Diet - Amphibians	--	kg diet item, ww/kg diet, ww	USACHPPM (2004)	Assumed not to be consumed.
Bird	Invertivore	Tree Swallow	P_{ff}	Proportion of Diet - Forage Fish	--	kg diet item, ww/kg diet, ww	USACHPPM (2004)	Assumed not to be consumed.
Bird	Invertivore	Tree Swallow	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww	USACHPPM (2004)	Assumed not to be consumed.
Bird	Invertivore	Tree Swallow	P_{s}	Proportion of Diet - Sediment	--	kg sediment, dw/kg diet, dw	Divine et al. (2020)	Assumed negligible based on feedng strategy.
Bird	Invertivore	Tree Swallow	IR_{W}	Daily Water Ingestion	0.0040	L water/day	USEPA (1993)	IR L/day= IR (L/kg)*BW (kg)
Bird	Invertivore	Tree Swallow	HR	Home Range	194	acres	Custer et al. (2019)	Tree swallows feed within approximately 0.5 km of their nest boxes (Stapleton and Robertson 2006, as cited in Custer et al. 2019); therefore, home range was calculated as area from nest using 0.5 km as radius.
Bird	Invertivore	Spotted sandpiper	BW	Body Weight	0.043	kg	USEPA (1993)	Average values reported for adult male and female spotted sandpipers (USEPA 1993).
Bird	Invertivore	Spotted sandpiper	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.0076	kg, dw/day	Nagy (2001)	Calculated using DW allometric equation for insectivore birds: FIR (dw) = 0.54 x BW ^ 0.705
Bird	Invertivore	Spotted sandpiper	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.0230	kg, ww/day	Nagy (2001)	Calculated using WW allometric equation for insectivore birds: FIR (ww) = 1.633 x BW ^ 0.705
Bird	Invertivore	Spotted sandpiper	P_{veg}	Proportion of Diet - Vegetation	--	kg diet item, ww/kg diet, ww	USEPA (1993)	Assumed not to be consumed.
Bird	Invertivore	Spotted sandpiper	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.80	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated based on USEPA (1993: Adult flying insects comprise the bulk of the diet; however, crustaceans, leeches, molluscs, small fish, and carrion also are eaten.
Bird	Invertivore	Spotted sandpiper	P_{ai}	Proportion of Diet - Aquatic Invertebrates	0.15	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated based on USEPA (1993: Adult flying insects comprise the bulk of the diet; however, crustaceans, leeches, molluscs, small fish, and carrion also are eaten.
Bird	Invertevore	Spotted sandpiper	P_{am}	Proportion of Diet - Amphibians	--	kg diet item, ww/kg diet, ww	USEPA (1993)	Assumed not to be consumed based on reported diet contents.
Bird	Invertivore	Spotted sandpiper	P_{ff}	Proportion of Diet - Forage Fish	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Assumed only to consume small fish.
Bird	Invertivore	Spotted sandpiper	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww	USEPA (1993)	Assumed not to be consumed.
Bird	Invertivore	Spotted sandpiper	P_{s}	Proportion of Diet - Sediment	0.073	kg sediment, dw/kg diet, dw	USEPA (1993)	Soil/sediment estimated in Least sandpiper diet (USEPA, 1993).
Bird	Invertivore	Spotted sandpiper	IR_{W}	Daily Water Ingestion	0.054	L water/day	USEPA (1993)	IR L/day= IR (L/kg)*BW (kg); Sandpiper used as surrogate
Bird	Invertivore	Spotted sandpiper	HR	Home Range	5.0	acres	CDFW (2021)	In New York, 3 individually marked breeding females fed and displayed over areas of 1.06,1.8, and 3.2 ha (2.5, 4.5 and 8.0 acres), with an average home range of 2.02 ha (5 acres) (Hays 1972, as cited in CDFW 2021).

Appendix G Food Web Model – Raleigh Creek - Upper
Table 2. Information Sources for Wildlife Exposure Parameters
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Receptor Type	Feeding Guild	Species	Parameter	Definition	Value	Units	Reference	Notes
Bird	Piscivore	Great Blue Heron	BW	Body Weight	2.4	kg	USEPA (1993)	
Bird	Piscivore	Great Blue Heron	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.11	kg, dw/day	USEPA (1993)	Calculated from the ww-based FIR, assuming an 75% moisture content of food (i.e., 0.25 g, dw/g, ww).
Bird	Piscivore	Great Blue Heron	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.43	kg, ww/day	USEPA (1993)	FIR kg/day= WW FIR (kg/kg-day)*BW (kg) with FIR (kg/kg-day) of 0.18 from USEPA (1993)
Bird	Piscivore	Great Blue Heron	P_{veg}	Proportion of Diet - Vegetation	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents; consult additional literature for more information.
Bird	Piscivore	Great Blue Heron	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.15	kg diet item, ww/kg diet, ww	USEPA (1993)	Fish are the preferred prey, but great blues also eat amphibians, reptiles, crustaceans, insects, birds, and Mammals
Bird	Piscivore	Great Blue Heron	P_{ai}	Proportion of Diet - Aquatic Invertebrates	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents
Bird	Piscivore	Great Blue Heron	P_{am}	Proportion of Diet - Amphibians	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Fish are the preferred prey, but great blues also eat amphibians, reptiles, crustaceans, insects, birds, and Mammals
Bird	Piscivore	Great Blue Heron	P_{ff}	Proportion of Diet - Forage Fish	0.80	kg diet item, ww/kg diet, ww	USEPA (1993)	Fish are the preferred prey, but great blues also eat amphibians, reptiles, crustaceans, insects, birds, and mammals
Bird	Piscivore	Great Blue Heron	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents; consult additional literature for more information.
Bird	Piscivore	Great Blue Heron	P_{s}	Proportion of Diet - Sediment	0.0040	kg sediment, dw/kg diet, dw	USEPA (1993)	Assumed to be approximately 20% of the value assumed for the Mallard, which was obtained from Table 4-4 in USEPA (1993)
Bird	Piscivore	Great Blue Heron	IR_{W}	Daily Water Ingestion	0.11	L water/day	USEPA (1993)	IR L/day= IR (L/kg)*BW (kg)
Bird	Piscivore	Great Blue Heron	HR	Home Range	11	acres	USEPA (1993)	Average of Fall and Winter homeranges
Mammal	Herbivore	Muskrat	BW	Body Weight	1.6	kg	MN DNR (2020)	Average of all adult body weights in MN (https://www.dnr.state.mn.us/Mammals/muskrat.html)
Mammal	Herbivore	Muskrat	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.14	kg, dw/day	USEPA (1993)	Calculated from the ww-based FIR, assuming an 75% moisture content of food (i.e., 0.25 g, dw/g, ww).
Mammal	Herbivore	Muskrat	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.54	kg, ww/day	USEPA (1993)	FIR kg/day= WW FIR (kg/kg-day)*BW (kg) with FIR (kg/kg-day) of 0.34 from USEPA (1993)
Mammal	Herbivore	Muskrat	P_{veg}	Proportion of Diet - Vegetation	0.80	kg diet item, ww/kg diet, ww	USEPA (1993)	Primarily herbivorous.
Mammal	Herbivore	Muskrat	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.10	kg diet item, ww/kg diet, ww	USEPA (1993)	Primarily herbivorous.
Mammal	Herbivore	Muskrat	P_{ai}	Proportion of Diet - Aquatic Invertebrates	0.10	kg diet item, ww/kg diet, ww	USEPA (1993)	Primarily herbivorous.
Mammal	Herbivore	Muskrat	P_{am}	Proportion of Diet - Amphibians	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents.
Mammal	Herbivore	Muskrat	P_{ff}	Proportion of Diet - Forage Fish	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents.
Mammal	Herbivore	Muskrat	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents.
Mammal	Herbivore	Muskrat	P_{s}	Proportion of Diet - Sediment	0.020	kg sediment, dw/kg diet, dw	USEPA (1993)	Meadow Vole used as a surrogate
Mammal	Herbivore	Muskrat	IR_{W}	Daily Water Ingestion	0.88	L water/day	USEPA (1993)	Max reported; IR L/day= IR (L/kg)*BW (kg)
Mammal	Herbivore	Muskrat	HR	Home Range	0.32	acres	USEPA (1993)	Average HR reported (0.13 ha) converted to acres.
Mammal	Invertivore	Little Brown Bat	BW	Body Weight	0.0085	kg	MN DNR (2020)	Average of adult little brown bats in Minnesota (https://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=AMACC01010)
Mammal	Invertivore	Little Brown Bat	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.0016	kg, dw/day	Nagy (2001)	Measured value for little brown bat (dry matter intake).
Mammal	Invertivore	Little Brown Bat	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.0049	kg, ww/day	Nagy (2001)	Measured value for little brown bat (fresh matter intake).
Mammal	Invertivore	Little Brown Bat	P_{veg}	Proportion of Diet - Vegetation	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on strict aerial insect diet.
Mammal	Invertivore	Little Brown Bat	P_{bi}	Proportion of Diet - Benthic Invertebrates	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on strict aerial insect diet.
Mammal	Invertivore	Little Brown Bat	P_{ai}	Proportion of Diet - Aquatic Invertebrates	1.0	kg diet item, ww/kg diet, ww	Fenton and Barclay (1980); cited in Sample et al. (1997)	Based on strict aerial insect diet, i.e., aquatic (emergent aerial) insects.
Mammal	Invertivore	Little Brown Bat	P_{am}	Proportion of Diet - Amphibians	--	kg diet item, ww/kg diet, ww	Sample et al. (1997)	Assumed not to be consumed based on strict aerial insect diet.
Mammal	Invertivore	Little Brown Bat	P_{ff}	Proportion of Diet - Forage Fish	--	kg diet item, ww/kg diet, ww	Sample et al. (1997)	Assumed not to be consumed based on strict aerial insect diet.
Mammal	Invertivore	Little Brown Bat	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww	Sample et al. (1997)	Assumed not to be consumed based on strict aerial insect diet.
Mammal	Invertivore	Little Brown Bat	P_{so}	Proportion of Diet - Sediment	--	kg sediment, dw/kg diet, dw	Sample et al. (1997)	Assumed negligible based on feeding strategy.
Mammal	Invertivore	Little Brown Bat	IR_{W}	Daily Water Ingestion	0.001	L water/day	USEPA (1993)	IR L/day= IR (L/kg)*BW (kg)
Mammal	Invertivore	Little Brown Bat	HR	Home Range	74	acres	Henry et al. (2002); Divine et al. (2020)	Home-range size of pregnant little brown bat on Grosse-Ile, Quebec, Canada, summers of 1999 and 2000 (Henry et al. 2002, as cited in Divine et al. 2020).

Appendix G Food Web Model – Raleigh Creek - Upper
Table 2. Information Sources for Wildlife Exposure Parameters
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Receptor Type	Feeding Guild	Species	Parameter	Definition	Value	Units	Reference	Notes
Mammal	Omnivore	Raccoon	BW	Body Weight	8.6	kg	MN DNR (2020)	Average of adult raccoon in Minnesota (https://www.dnr.state.mn.us/Mammals/raccoon.html)
Mammal	Omnivore	Raccoon	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.05	kg, dw/day	Nagy (2001)	Calculated from the ww-based FIR, assuming an 75% moisture content of food (i.e., 0.25 g, dw/g, ww).
Mammal	Omnivore	Raccoon	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.20	kg, dw/day	Nagy (2001)	Calculated using DW allometric equation for omnivorous Mammals: FIR (dw) = 0.432 x BW ^ 0.678
Mammal	Omnivore	Raccoon	P_{veg}	Proportion of Diet - Vegetation	0.45	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from listed diet of vegetation in USEPA (1993)
Mammal	Omnivore	Raccoon	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.40	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from listed diet of crayfish and portion of invertebrates in USEPA (1993)
Mammal	Omnivore	Raccoon	P_{ai}	Proportion of Diet - Aquatic Invertebrates	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from portion of invertebrates diet in USEPA (1993)
Mammal	Omnivore	Raccoon	P_{am}	Proportion of Diet - Amphibians	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from portion of amphibians diet in USEPA (1993)
Mammal	Omnivore	Raccoon	P_{ff}	Proportion of Diet - Forage Fish	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from portion of fish and rodents diet in USEPA (1993)
Mammal	Omnivore	Raccoon	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww	USEPA (1993)	Assumed not to be consumed based on reported diet contents; consult additional literature for more information.
Mammal	Omnivore	Raccoon	P_{s}	Proportion of Diet - Sediment	0.094	kg sediment, dw/kg diet, dw	USEPA (1993)	Estimated percent soil in diet (dw)
Mammal	Omnivore	Raccoon	IR_{W}	Daily Water Ingestion	0.41	L water/day	USEPA (1993)	Max reported; IR L/day= IR (L/kg)*BW (kg); River Otter used as surrogate
Mammal	Omnivore	Raccoon	HR	Home Range	385	acres	USEPA (1993)	Based on the average home range of both sexes within Michigan riparian habitat.

Abbreviations:
dw - dry weight
kg - kilogram
L - liters
ww - wet weight

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Appendix G Food Web Model – Raleigh Creek - Upper
Table 3. Bioaccumulation Parameters
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	Literature-based Aquatic Plant Bioaccumulation Parameters							
	Water to Aquatic Plant BAF (L water / kg tissue)				Water to Aquatic Invertebrate BAF (L water / kg tissue)			
Analyte	Value (tissue dw)	Value (tissue ww)[a]	Reference	Notes	Aquatic/Benthic Invert. Value (tissue dw)[b]	Aquatic/Benthic Invert. Value (tissue ww)[c]	Reference	Notes
PFCAs								
PFBA	19	2.8	Divine et al. (2020); Zodrow et al. (2020)	Geomean	298	54	Zodrow et al. (2020) (Surrogate - PFBS)	
PFPeA	191	27.7	Surrogate - PFHxA		298	54	Surrogate - PFBS	
PFHxA	191	27.7	Divine et al. (2020); Zodrow et al. (2020)	Geomean	2238	403	Divine et al. (2020); Zodrow et al. (2020)	Geomean
PFHpA	228	33.06	Surrogate - PFOA		351	63	Divine et al. (2020)	Geomean
PFOA	228	33	Divine et al. (2020); Zodrow et al. (2020)	Geomean	379	68	Divine et al. (2020); Zodrow et al. (2020)	Geomean
PFNA	5,188	752	Divine et al. (2020); Zodrow et al. (2020)	Geomean	983	177	Divine et al. (2020); Zodrow et al. (2020)	Geomean
PFDA	12,360	1,792	Divine et al. (2020)	Geomean	707	127	Divine et al. (2020)	Geomean
PFUnA	12,360	1,792	Surrogate - PFDA		707	127	Surrogate - PFDA	
PFDoA	12,360	1,792	Surrogate - PFDA		707	127	Surrogate - PFDA	
PFTrDA	12,360	1,792	Surrogate - PFDA		707	127	Surrogate - PFDA	
PFTeDA	12,360	1,792	Surrogate - PFDA		707	127	Surrogate - PFDA	
PFSAs								
PFBS	8.0	1.2	Divine et al. (2020); Zodrow et al. (2020)	Geomean	298	54	Divine et al. (2020); Zodrow et al. (2020)	Geomean
PFPeS	8.0	1.2	Surrogate - PFBS		1327	239	Surrogate - PFHxS	
PFHxS	12	1.7	Divine et al. (2020)	Geomean	1327	239	Divine et al. (2020)	Geomean
PFHpS	228	33	Surrogate - PFOA		1549	279	Surrogate - PFOS	
PFOS	1,305	189	Divine et al. (2020); Zodrow et al. (2020)	Geomean	1549	279	Divine et al. (2020); Zodrow et al. (2020)	Geomean
PFNS	1,305	189	Surrogate - PFOS		1549	279	Surrogate - PFOS	
PFDS	1,305	189	Surrogate - PFOS		1549	279	Surrogate - PFOS	
PFDoS	1,305	189	Surrogate - PFOS		1549	279	Surrogate - PFOS	
FOSA, FASE, FASAAs								
PFOSA	1,305	189	Surrogate - PFOS		1549	279	Surrogate - PFOS	
N-EtFOSAA	1,305	189	Surrogate - PFOS		1549	279	Surrogate - PFOS	
N-MeFOSAA	1,305	189	Surrogate - PFOS		1549	279	Surrogate - PFOS	
Fluortelomers								
6:2 FTS	12	1.7	Surrogate - PFHxS		1327	239	Surrogate - PFHxS	
5:3 FTCA	19	2.8	Surrogate - PFBA		2238	403	Surrogate - PFHxA	
7:3 FTCA	228	33.1	Surrogate - PFOA		379	68	Surrogate - PFOA	

PFAS Abbreviations:
FASAA - perrfluoroalkane sulfonamido acetic acids
FASE - perfluoroalkane sulfonamido ethanols
FOSA - perfluorooctane sulfonamides
N-EtFOSAA - N-Ethylperfluorooctane sulfonamidoacetic acid
N-MeFOSAA - N-Methylperfluorooctane sulfonamidoacetic acid
PFAS - Per- and polyfluoroalkyl substances
PFBA - Perfluorobutanoic acid
PFBS - Perfluorobutanesulfonic acid
PFCA - Perfluoroalkyl carboxylic acids
PFDA - Perfluorodecanoic acid
PFDoA - Perfluorododecanoic acid
PFDoS - Perfluorododecane sulfonic acid
PFDS - Perfluorodecane sulfonic acid
PFHpA - Perfluoroheptanoic acid
PFHpS - Perfluoroheptane sulfonic acid
PFHxA - Perfluorohexanoic acid

PFAS Abbreviations Cont.:
PFHxS - Perfluorohexanesulfonic acid
PFNA - Perfluorononanoic acid
PFNS - Perfluoroonoane sulfonic acid
PFOA - Perfluorooctanoic acid
PFOS - Perfluorooctanesulfonic acid
PFOSA - Perfluorooctane sulfonamide
PFPeA - Perfluoropentanoic acid
PFPeS - Perfluoropentane sulfonic acid
PFSA- perfluoroalkane sulfonic acids
PFTeDA - Perfluorotetradecanoic acid
PFTrDA - Perfluorotridecanoic acid
PFUnA - Perfluoroundecanoic acid
5:3 FTCA - 5:3 Fluorotelomer carboxylic acid
6:2 FTS - 6:2 Fluorotelomer sulfonic acid
7:3 FTCA - 7:3 Fluorotelomer carboxylic acid

Addditional Abbreviations:
BAF - Bioaccumulation Factor
dw - dry weight
kg - kilogram
L - liter
UF - uptake factor

Notes:
a: Converted to ww tissue using 85.5% moisture content (average of algae [84%] and aquatic macrophytes [87%]; Table 4-2 EPA 1993)
b: Converted to ww tissue using 82% moisture content (bivalves (without shell); Table 4-1 EPA 1993)

c: Aquatic/Benthic Invert Values are based on filter-feeding benthic invertebrates (oyster, mussel, gastropod, snail, other bivalves) and were selected to represent aquatic invertebrates (including aerial insects) exposed to PFAS in water. Filter-feeding benthic invertebrates are expected to have exposure to contaminants in the water column similar to other aquatic invertebrate species and expected to have lower exposure to sediments.

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Appendix G Food Web Model – Raleigh Creek - Upper
Table 4 Toxicity Reference Values for Birds
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Analyte	TRVs for Birds (µg/kg-day)							
	NOAEL	Basis	Reference	Additional Details	LOAEL	Basis	Reference	Additional Details
PFCAs								
PFBA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFPeA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFHxA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFHpA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFOA	1,000	No effect on growth (body weight) of 1-day old chickens; exposed to PFOA/PFDA/PFOS mixture	Conder et al. (2020)	Yeueng et al. 2009	10,000	Application of a NOAEL-to-LOAEL adjustment factor of 10	Adjustment factor consistent with Divine et al. (2020), Zodrow et al. (2020), and USEPA (2005)	--
PFNA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFDA	1,000	No effect on growth (body weight) of 1-day old chickens; exposed to PFOA/PFDA/PFOS mixture	Conder et al. (2020)	Yeueng et al. 2009	10,000	Application of a NOAEL-to-LOAEL adjustment factor of 10	Adjustment factor consistent with Divine et al. (2020), Zodrow et al. (2020), and USEPA (2005)	--
PFUnA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFDoA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFTrDA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFTeDA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFSAs								
PFBS	92,000	No effect on survival and reproduction in Bobwhite Quail	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Gallagher et al. 2005)	153,000	Lowest bounded LOAEL (Effect on growth in Bobwhite Quail)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Gallagher et al. 2003a)
PFPeS	92,000	Surrogate - PFBS	--	--	153,000	Surrogate - PFBS	--	--
PFHxS	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
PFHpS	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
PFOS	79.0	No effect on reproduction and survival in Bobwhite Quail	Divine et al. (2020) & Zodrow et al. (2020)	Gallagher et al. 2003c (Derived by applying UF of 10 to selected lowest LOAEL)	790	Lowest bounded LOAEL (Effect on reproduction and survival in Bobwhite Quail; exposure included during sensitive life stage, i.e., egg-laying)	Divine et al. (2020) & Zodrow et al. (2020)	Gallagher et al. 2003c (Lowest LOAEL selected due to limited available avian data & study based on sensitive life stage)
PFNS	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
PFDS	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
PFDoS	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
FOSA, FASE, FASAAs								
PFOSA	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
N-EtFOSAA	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
N-MeFOSAA	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--

Appendix G Food Web Model – Raleigh Creek - Upper
Table 4 Toxicity Reference Values for Birds
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Analyte	TRVs for Birds (µg/kg-day)							
	NOAEL	Basis	Reference	Additional Details	LOAEL	Basis	Reference	Additional Details
Fluortelomers								
6:2 FTS	1000	Surrogate - PFOA	--	--	10000	Surrogate - PFOA	--	--
5:3 FTCA	92,000	Surrogate - PFBS	--	--	153,000	Surrogate - PFBS	--	--
7:3 FTCA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--

Notes:
TRVs were selected from the following hierarchy due to preference for EcoSSL TRV-derivation approach (USEPA 2005) and that Zodrow et al. (2020) has been peer reviewed:

1. Divine et al. (2020) and/or Zodrow et al. (2020)
2. Condor et al. (2020)

Abbreviations:
See Table 3 for PFAS abbreviations
µg/kg-day - micrograms per kilogram body weight per day
EcoSSL - Ecological Soil Screening Level
LOAEL - lowest observed adverse effects level
NOAEL - no observed adverse effects level
TRV - toxicity reference value
USEPA - United States Environmental Protection Agency

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Appendix G Food Web Model – Raleigh Creek - Upper
Table 5 Toxicity Reference Values for Mammals
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Analyte	TRVs for Mammals (µg/kg-day)							
	NOAEL	Basis	Reference	Additional Details	LOAEL	Basis	Reference	Additional Details
PFCAs								
PFBA	73,000	No effect on growth or reproduction	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (four studies)	175,000	Lowest bounded LOAEL (Effect on reproduction)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Das et al. 2008)
PFPeA	84,000	Surrogate - PFHxA	--	--	175,000	Surrogate - PFHxA	--	--
PFHxA	84,000	No effect on growth, reproduction, or survivial	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (geometric mean of 6 studies)	175,000	Lowest bounded LOAEL (Effect on reproduction & survival in mice)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Iwai and Hoberman 2014)
PFHpA	300	Surrogate - PFOA	--	--	600	Surrogate - PFOA	--	--
PFOA	300	No effect on growth, reproduction, or survival	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (two studies)	600	Lowest bounded LOAEL (Effect on reproduction & survival in mice)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Abbott et al. 2007)
PFNA	830	No effect on reproduction (# live pups) in mice	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Wolf et al. 2010)	1,100	Lowest bounded LOAEL (decreased reproduction in mice)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Wolf et al. 2010)
PFDA	100	No effect on growth (fetal body weight per litter) in pregnant mice	Conder et al. (2020)	Harris and Birnbaum (1989)	6,400	23% control-adjusted decrease in growth (fetal body weight per litter) in pregnant mice	Conder et al. (2020)	Harris and Birnbaum (1989)
PFUnA	300	No effect on growth (body weight in adults and pups) in rats	Conder et al. (2020)	Takahashi et al. (2014)	1,000	13-19% control-adjusted decrease in growth (body weight of pups) in rats	Conder et al. (2020)	Takahashi et al. (2014)
PFDoA	500	No effect on growth (body weight in adults and pups) in rats	Conder et al. (2020)	Kato et al. (2015)	2,500	20-40% control-adjusted decrease in growth (body weight in adults and pups) in rats	Conder et al. (2020)	Kato et al. (2015)
PFTrDA	500	Surrogate - PFDoDA	--	--	2,500	Surrogate - PFDoDA	--	--
PFTeDA	3,000	No effect on growth (body weight in adults and pups) in rats	Conder et al. (2020)	Hirata-Koizumi et al. (2015)	10,000	8-18% control-adjusted decrease in growth (body weight of pups) in rats	Conder et al. (2020)	Hirata-Koizumi et al. (2015)
PFSAs								
PFBS	50,000	No effect on reproduction in mice	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Feng et al. 2017)	200,000	Lowest bounded LOAEL (Effect on reproduction in mice)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Feng et al. 2017)
PFPeS	50,000	Surrogate - PFBS	--	--	200,000	Surrogate - PFBS	--	--
PFHxS	300	No effect on reproduction (litter size) in mice	Conder et al. (2020)	Chang et al. (2018)	1,000	14% control-adjusted decrease in reproduction (litter size) in mice	Conder et al. (2020)	Chang et al. (2018)
PFHpS	300	Surrogate - PFHxS	--	--	1,000	Surrogate - PFHxS	--	--
PFOS	100	No effect on growth, reproduction, or survivial	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (multiple studies)	170	Lowest bounded LOAEL (Effect on reproduction in mice)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Fair et al. 2011)
PFNS	100	Surrogate - PFOS	--	--	170	Surrogate - PFOS	--	--
PFDS	100	Surrogate - PFOS	--	--	170	Surrogate - PFOS	--	--
PFDoS	100	Surrogate - PFOS	--	--	170	Surrogate - PFOS	--	--
FOSA, FASE, FASAAs								
PFOSA	100	Surrogate - PFOS	--	--	170	Surrogate - PFOS	--	--
N-EtFOSAA	100	Surrogate - PFOS	--	--	170	Surrogate - PFOS	--	--
N-MeFOSAA	100	Surrogate - PFOS	--	--	170	Surrogate - PFOS	--	--

Appendix G Food Web Model – Raleigh Creek - Upper
Table 5 Toxicity Reference Values for Mammals
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Analyte	TRVs for Mammals (µg/kg-day)							
	NOAEL	Basis	Reference	Additional Details	LOAEL	Basis	Reference	Additional Details
Fluortelomers								
6:2 FTS	300	Surrogate - PFHxS	--	--	1,000	Surrogate - PFHxS	--	--
5:3 FTCA	73,000	Surrogate - PFBA	--	--	175,000	Surrogate - PFBA	--	--
7:3 FTCA	300	Surrogate - PFOA	--	--	600	Surrogate - PFOA	--	--

Notes:
TRVs were selected from the following hierarchy due to preference for EcoSSL TRV-derivation approach (USEPA 2005) and that Zodrow et al. (2020) has been peer reviewed:

1. Divine et al. (2020) and/or Zodrow et al. (2020)
2. Condor et al. (2020)

Abbreviations:
See Table 3 for PFAS abbreviations
µg/kg-day - micrograms per kilogram body weight per day
EcoSSL - Ecological Soil Screening Level
LOAEL - lowest observed adverse effects level
NOAEL - no observed adverse effects level
TRV - toxicity reference value
USEPA - United States Environmental Protection Agency

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Appendix G Food Web Model – Raleigh Creek - Upper
Table 6. Exposure Point Concentrations
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Analyte	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Aquatic Plant EPC (µg/kg, ww)		Aquatic Invertebrate (µg/kg, ww)		Benthic Invertebrate (µg/kg, ww)		Amphibian (µg/kg, ww)		Forage Fish (µg/kg, ww)	
			EPC	Basis	EPC	Basis	EPC	Basis	EPC	Basis	EPC	Basis
PFCAs												
PFBA	2.9	0.48	1.3	Calculated	25.9	Calculated	6.1	UCL	1.6	UCL	1.3	UCL
PFPeA	0.24	0.048	1.3	Calculated	2.6	Calculated	0.30	UCL	ND		ND	
PFHxA	0.86	0.10	2.7	Calculated	40.0	Calculated	0.52	UCL	0.14	Maximum	0.27	Maximum
PFHpA	0.39	0.092	3.0	Calculated	5.8	Calculated	1.6	UCL	ND		0.83	Maximum
PFOA	6.7	0.82	27.2	Calculated	56.1	Calculated	11.9	UCL	0.52	UCL	63.4	Maximum
PFNA	0.27	0.0068	5.1	Calculated	1.2	Calculated	0.12	Maximum	0.12	Maximum	2.1	UCL
PFDA	1.4	0.010	17.1	Calculated	1.2	Calculated	1.4	UCL	1.9	UCL	29.3	UCL
PFUnA	0.24	0.00043	0.78	Calculated	0.06	Calculated	1.4	UCL	0.52	UCL	4.5	UCL
PFDoA	0.37	0.00044	0.79	Calculated	0.056	Calculated	2.2	UCL	1.9	UCL	6.5	UCL
PFTrDA	0.10	0.0021	3.8	Calculated	0.27	Calculated	0.72	UCL	0.48	UCL	1.8	UCL
PFTeDA	0.12	ND	NC	Calculated	NC	Calculated	0.54	UCL	0.86	UCL	1.3	UCL
PFSAs												
PFBS	0.13	0.029	0.033	Calculated	1.5	Calculated	1.0	UCL	0.20	Maximum	ND	(c)
PFPeS	0.21	0.034	0.040	Calculated	8.2	Calculated	1.0	UCL	0.25	Maximum	0.58	Maximum
PFHxS	0.69	0.086	0.15	Calculated	20.6	Calculated	2.0	UCL	0.49	UCL	7.9	UCL
PFHpS	3.2	0.036	1.2	Calculated	10.0	Calculated	0.40	UCL	1.3	Maximum	33.0	UCL
PFOS	154	3.0	574	Calculated	846	Calculated	107	UCL	730	UCL	6009	UCL
PFNS	0.58	0.00092	0.17	Calculated	0.26	Calculated	0.21	UCL	2.50	UCL	22.9	UCL
PFDS	1.4	0.00062	0.12	Calculated	0.17	Calculated	0.84	UCL	7.2	UCL	46.1	UCL
PFDoS	0.74	0.00046	0.09	Calculated	0.13	Calculated	1.6	UCL	0.98	UCL	17.9	UCL
FOSA, FASE, FASAAs												
PFOSA	8.6	0.033	6.2	Calculated	9.1	Calculated	95.0	UCL	15.9	UCL	319	UCL
N-EtFOSAA	5.7	0.068	12.8	Calculated	18.8	Calculated	4.3	UCL	4.9	UCL	30.0	UCL
N-MeFOSAA	0.83	0.00050	0.09	Calculated	0.14	Calculated	0.19	Maximum	0.17	UCL	0.54	UCL
Fluortelomers												
6:2 FTS	0.57	0.0032	0.0055	Calculated	0.75	Calculated	ND		3.4	Maximum	3.0	Maximum
5:3 FTCA	NA	NA	NC	Calculated	NC	Calculated	ND		4.7	Maximum	ND	
7:3 FTCA	NA	NA	NC	Calculated	NC	Calculated	ND		5.5	Maximum	4.4	Maximum

Notes:
EPCs were selected as the lower of the selected UCL and maximum detected concentration (see Appendix D)
Site-specific empirical data were selected over modeled values when available:
Benthic invertebrates = crayfish
Amphibians = green frogs and tadpoles
Forage fish = golden shiner, fathead minnows, mudminnow, stickleback, and green sunfish
When empirical data were lacking, tissue EPCs were calculated by multiplying the surface water EPC by the analyte- and tissue-specific bioaccumulation parameter (see Table 3).

Abbreviations:
See Table 3 for PFAS abbreviations
µg - micrograms
dw - dry weight
EPC - exposure point concentration
kg - kilogram
L - liters
NC - not calculated
ND - not detected
UCL - upper confidence limit of the arithmetic mean
ww - wet weight

Appendix G Food Web Model – Raleigh Creek - Upper
Table 7. Potential Risks to the Wood Duck
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Raleigh Creek - Upper	
Assumptions for the Wood Duck	
Body Weight (kg)	0.70
Seasonal Use Factor	1
Site-Specific Area Use Factor	0.027
Sediment Ingestion Rate (kg_{dw}/day)	0.0098
Water Ingestion Rate (kg/day)	0.041
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.0064
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.0064
Plant Ingestion Rate (kg_{ww}/day)	0.11

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_s = Incidental ingestion rate of sediment (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_s= Concentration of PFAS in sediment (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations					Potential Daily Dose (ug/kg_{bw}/day)						NOAEL-based TRV (µg/kg_{bw}/day)	NOAEL-based HQ	LOAEL-based TRV (µg/kg_{bw}/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Aquatic Invertebrate EPC (µg/kg, ww)	Plant EPC (µg/kg, ww)	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Benthic Invertebrate	Aquatic Invertebrate	Plant	Sediment	Surface Water	Total				
PFCAs															
PFBA	6.1E+00	2.6E+01	1.3E+00	2.9E+00	4.8E-01	1.5E-03	6.4E-03	5.9E-03	1.1E-03	7.6E-04	1.6E-02	1.0E+03	1.6E-05	1.0E+04	1.6E-06
PFPeA	3.0E-01	2.6E+00	1.3E+00	2.4E-01	4.8E-02	7.3E-05	6.4E-04	5.9E-03	9.0E-05	7.6E-05	6.8E-03	1.0E+03	6.8E-06	1.0E+04	6.8E-07
PFHxA	5.2E-01	4.0E+01	2.7E+00	8.6E-01	9.9E-02	1.3E-04	9.8E-03	1.2E-02	3.3E-04	1.6E-04	2.3E-02	1.0E+03	2.3E-05	1.0E+04	2.3E-06
PFHpA	1.6E+00	5.8E+00	3.0E+00	3.9E-01	9.2E-02	3.8E-04	1.4E-03	1.3E-02	1.5E-04	1.4E-04	1.6E-02	1.0E+03	1.6E-05	1.0E+04	1.6E-06
PFOA	1.2E+01	5.6E+01	2.7E+01	6.7E+00	8.2E-01	2.9E-03	1.4E-02	1.2E-01	2.5E-03	1.3E-03	1.4E-01	1.0E+03	1.4E-04	1.0E+04	1.4E-05
PFNA	1.2E-01	1.2E+00	5.1E+00	2.7E-01	6.8E-03	2.9E-05	3.0E-04	2.3E-02	1.0E-04	1.1E-05	2.3E-02	1.0E+03	2.3E-05	1.0E+04	2.3E-06
PFDA	1.4E+00	1.2E+00	1.7E+01	1.4E+00	9.5E-03	3.4E-04	3.0E-04	7.6E-02	5.2E-04	1.5E-05	7.7E-02	1.0E+03	7.7E-05	1.0E+04	7.7E-06
PFUnA	1.4E+00	5.5E-02	7.8E-01	2.4E-01	4.3E-04	3.6E-04	1.4E-05	3.4E-03	9.0E-05	6.8E-07	3.9E-03	1.0E+03	3.9E-06	1.0E+04	3.9E-07
PFDoA	2.2E+00	5.6E-02	7.9E-01	3.7E-01	4.4E-04	5.5E-04	1.4E-05	3.5E-03	1.4E-04	6.9E-07	4.2E-03	1.0E+03	4.2E-06	1.0E+04	4.2E-07
PFTrDA	7.2E-01	2.7E-01	3.8E+00	9.7E-02	2.1E-03	1.8E-04	6.6E-05	1.7E-02	3.6E-05	3.3E-06	1.7E-02	1.0E+03	1.7E-05	1.0E+04	1.7E-06
PFTeDA	5.4E-01	NC	NC	1.2E-01	ND	1.3E-04	NC	NC	4.7E-05	NC	1.8E-04	1.0E+03	1.8E-07	1.0E+04	1.8E-08
PFSAs															
PFBS	1.0E+00	1.5E+00	3.3E-02	1.3E-01	2.9E-02	2.5E-04	3.8E-04	1.5E-04	4.7E-05	4.5E-05	8.7E-04	9.2E+04	9.5E-09	1.5E+05	5.7E-09
PFPeS	1.0E+00	8.2E+00	4.0E-02	2.1E-01	3.4E-02	2.5E-04	2.0E-03	1.8E-04	7.8E-05	5.4E-05	2.6E-03	9.2E+04	2.8E-08	1.5E+05	1.7E-08
PFHxS	2.0E+00	2.1E+01	1.5E-01	6.9E-01	8.6E-02	4.9E-04	5.1E-03	6.7E-04	2.6E-04	1.4E-04	6.6E-03	7.9E+01	8.4E-05	7.9E+02	8.4E-06
PFHpS	4.0E-01	1.0E+01	1.2E+00	3.2E+00	3.6E-02	9.9E-05	2.5E-03	5.3E-03	1.2E-03	5.6E-05	9.1E-03	7.9E+01	1.2E-04	7.9E+02	1.2E-05
PFOS	1.1E+02	8.5E+02	5.7E+02	1.5E+02	3.0E+00	2.6E-02	2.1E-01	2.5E+00	5.8E-02	4.8E-03	2.8E+00	7.9E+01	3.6E-02	7.9E+02	3.6E-03
PFNS	2.1E-01	2.6E-01	1.7E-01	5.8E-01	9.2E-04	5.1E-05	6.3E-05	7.7E-04	2.2E-04	1.4E-06	1.1E-03	7.9E+01	1.4E-05	7.9E+02	1.4E-06
PFDS	8.4E-01	1.7E-01	1.2E-01	1.4E+00	6.2E-04	2.1E-04	4.3E-05	5.2E-04	5.2E-04	9.8E-07	1.3E-03	7.9E+01	1.6E-05	7.9E+02	1.6E-06
PFDoS	1.6E+00	1.3E-01	8.6E-02	7.4E-01	4.6E-04	3.8E-04	3.1E-05	3.8E-04	2.8E-04	7.2E-07	1.1E-03	7.9E+01	1.4E-05	7.9E+02	1.4E-06
FOSA, FASE, FASAAs															
PFOSA	9.5E+01	9.1E+00	6.2E+00	8.6E+00	3.3E-02	2.3E-02	2.2E-03	2.7E-02	3.3E-03	5.1E-05	5.6E-02	7.9E+01	7.1E-04	7.9E+02	7.1E-05
N-EtFOSAA	4.3E+00	1.9E+01	1.3E+01	5.7E+00	6.8E-02	1.1E-03	4.6E-03	5.7E-02	2.2E-03	1.1E-04	6.5E-02	7.9E+01	8.2E-04	7.9E+02	8.2E-05
N-MeFOSAA	1.9E-01	1.4E-01	9.5E-02	8.3E-01	5.0E-04	4.8E-05	3.4E-05	4.2E-04	3.1E-04	7.8E-07	8.2E-04	7.9E+01	1.0E-05	7.9E+02	1.0E-06
Fluortelomers															
6:2 FTS	ND	7.5E-01	5.5E-03	5.7E-01	3.2E-03	NC	1.9E-04	2.4E-05	2.1E-04	4.9E-06	4.3E-04	1.0E+03	4.3E-07	1.0E+04	4.3E-08
5:3 FTCA	ND	NC	NC	NA	NA	NC	NC	NC	NC	NC	NC	9.2E+04	NC	1.5E+05	NC
7:3 FTCA	ND	NC	NC	NA	NA	NC	NC	NC	NC	NC	NC	1.0E+03	NC	1.0E+04	NC

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
UCL - upper confidence limit of the arithmetic mean
ww - wet weight

Appendix G Food Web Model – Raleigh Creek - Upper
Table 8. Potential Risks to the Tree Swallow
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Raleigh Creek - Upper	
Assumptions for the Tree Swallow	
Body Weight (kg)	0.020
Seasonal Use Factor	1
Site-Specific Area Use Factor	0.11
Water Ingestion Rate (kg/day)	0.0040
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.0092
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.020
Plant Ingestion Rate (kg_{ww}/day)	0.0060

Total Daily Dose = $\frac{\Sigma([IR_f \times C_f] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations				Potential Daily Dose (ug/kg_{bw}/day)					NOAEL-based TRV ($\mu g/kg_{bw}$/day)	NOAEL-based HQ	LOAEL-based TRV ($\mu g/kg_{bw}$/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Aquatic Invertebrate EPC (µg/kg, ww)	Plant EPC (µg/kg, ww)	Surface Water EPC (µg/L)	Benthic Invertebrate	Aquatic Invertebrate	Plant	Surface Water	Total				
PFCAs													
PFBA	6.1E+00	2.6E+01	1.3E+00	4.8E-01	3.0E-01	2.8E+00	4.3E-02	1.0E-02	3.1E+00	1.0E+03	3.1E-03	1.0E+04	3.1E-04
PFPeA	3.0E-01	2.6E+00	1.3E+00	4.8E-02	1.4E-02	2.8E-01	4.3E-02	1.0E-03	3.4E-01	1.0E+03	3.4E-04	1.0E+04	3.4E-05
PFHxA	5.2E-01	4.0E+01	2.7E+00	9.9E-02	2.6E-02	4.3E+00	8.8E-02	2.1E-03	4.4E+00	1.0E+03	4.4E-03	1.0E+04	4.4E-04
PFHpA	1.6E+00	5.8E+00	3.0E+00	9.2E-02	7.6E-02	6.2E-01	9.7E-02	2.0E-03	8.0E-01	1.0E+03	8.0E-04	1.0E+04	8.0E-05
PFOA	1.2E+01	5.6E+01	2.7E+01	8.2E-01	5.8E-01	6.0E+00	8.7E-01	1.8E-02	7.5E+00	1.0E+03	7.5E-03	1.0E+04	7.5E-04
PFNA	1.2E-01	1.2E+00	5.1E+00	6.8E-03	5.8E-03	1.3E-01	1.6E-01	1.5E-04	3.0E-01	1.0E+03	3.0E-04	1.0E+04	3.0E-05
PFDA	1.4E+00	1.2E+00	1.7E+01	9.5E-03	6.7E-02	1.3E-01	5.5E-01	2.0E-04	7.5E-01	1.0E+03	7.5E-04	1.0E+04	7.5E-05
PFUnA	1.4E+00	5.5E-02	7.8E-01	4.3E-04	7.1E-02	5.9E-03	2.5E-02	9.3E-06	1.0E-01	1.0E+03	1.0E-04	1.0E+04	1.0E-05
PFDoA	2.2E+00	5.6E-02	7.9E-01	4.4E-04	1.1E-01	6.0E-03	2.5E-02	9.5E-06	1.4E-01	1.0E+03	1.4E-04	1.0E+04	1.4E-05
PFTrDA	7.2E-01	2.7E-01	3.8E+00	2.1E-03	3.5E-02	2.9E-02	1.2E-01	4.5E-05	1.8E-01	1.0E+03	1.8E-04	1.0E+04	1.8E-05
PFTeDA	5.4E-01	NC	NC	ND	2.6E-02	NC	NC	NC	2.6E-02	1.0E+03	2.6E-05	1.0E+04	2.6E-06
PFSAs													
PFBS	1.0E+00	1.5E+00	3.3E-02	2.9E-02	5.0E-02	1.7E-01	1.1E-03	6.2E-04	2.2E-01	9.2E+04	2.4E-06	1.5E+05	1.4E-06
PFPeS	1.0E+00	8.2E+00	4.0E-02	3.4E-02	4.9E-02	8.8E-01	1.3E-03	7.4E-04	9.3E-01	9.2E+04	1.0E-05	1.5E+05	6.1E-06
PFHxS	2.0E+00	2.1E+01	1.5E-01	8.6E-02	9.9E-02	2.2E+00	4.8E-03	1.9E-03	2.3E+00	7.9E+01	2.9E-02	7.9E+02	2.9E-03
PFHpS	4.0E-01	1.0E+01	1.2E+00	3.6E-02	2.0E-02	1.1E+00	3.8E-02	7.7E-04	1.1E+00	7.9E+01	1.4E-02	7.9E+02	1.4E-03
PFOS	1.1E+02	8.5E+02	5.7E+02	3.0E+00	5.3E+00	9.1E+01	1.8E+01	6.5E-02	1.1E+02	7.9E+01	**1.5E+00**	7.9E+02	1.5E-01
PFNS	2.1E-01	2.6E-01	1.7E-01	9.2E-04	1.0E-02	2.7E-02	5.6E-03	2.0E-05	4.3E-02	7.9E+01	5.5E-04	7.9E+02	5.5E-05
PFDS	8.4E-01	1.7E-01	1.2E-01	6.2E-04	4.1E-02	1.9E-02	3.8E-03	1.3E-05	6.4E-02	7.9E+01	8.1E-04	7.9E+02	8.1E-05
PFDoS	1.6E+00	1.3E-01	8.6E-02	4.6E-04	7.6E-02	1.4E-02	2.8E-03	9.8E-06	9.3E-02	7.9E+01	1.2E-03	7.9E+02	1.2E-04
FOSA, FASE, FASAAs													
PFOSA	9.5E+01	9.1E+00	6.2E+00	3.3E-02	4.7E+00	9.8E-01	2.0E-01	7.0E-04	5.8E+00	7.9E+01	7.4E-02	7.9E+02	7.4E-03
N-EtFOSAA	4.3E+00	1.9E+01	1.3E+01	6.8E-02	2.1E-01	2.0E+00	4.1E-01	1.4E-03	2.6E+00	7.9E+01	3.3E-02	7.9E+02	3.3E-03
N-MeFOSAA	1.9E-01	1.4E-01	9.5E-02	5.0E-04	9.5E-03	1.5E-02	3.0E-03	1.1E-05	2.8E-02	7.9E+01	3.5E-04	7.9E+02	3.5E-05
Fluortelomers													
6:2 FTS	ND	7.5E-01	5.5E-03	3.2E-03	NC	8.1E-02	1.8E-04	6.8E-05	8.1E-02	1.0E+03	8.1E-05	1.0E+04	8.1E-06
5:3 FTCA	ND	NC	NC	NA	NC	NC	NC	NC	NC	9.2E+04	NC	1.5E+05	NC
7:3 FTCA	ND	NC	NC	NA	NC	NC	NC	NC	NC	1.0E+03	NC	1.0E+04	NC

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:

See Table 3 for PFAS abbreviations
µg - microgram
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
UCL - upper confidence limit of the arithmetic mean
ww - wet weight

Appendix G Food Web Model – Raleigh Creek - Upper
Table 9. Potential Risks to the Spotted Sandpiper
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Raleigh Creek - Upper	
Assumptions for the Spotted Sandpiper	
Body Weight (kg)	0.043
Seasonal Use Factor	1
Site-Specific Area Use Factor	1
Sediment Ingestion Rate (kg_{dw}/day)	0.00055
Water Ingestion Rate (kg/day)	0.054
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.0184
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.0034
Forage Fish Ingestion Rate (kg_{ww}/day)	0.0011

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_s = Incidental ingestion rate of sediment (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_s= Concentration of PFAS in sediment (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations					Potential Daily Dose (ug/kg_{bw}/day)						NOAEL-based TRV ($\mu g/kg_{bw}$/day)	NOAEL-based HQ	LOAEL-based TRV ($\mu g/kg_{bw}$/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Aquatic Invertebrate EPC (µg/kg, ww)	Forage Fish EPC (µg/kg, ww)	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Benthic Invertebrate	Aquatic Invertebrate	Forage Fish	Sediment	Surface Water	Total				
PFCAs															
PFBA	6.1E+00	2.6E+01	1.3E+00	2.9E+00	4.8E-01	2.6E+00	2.1E+00	3.5E-02	3.8E-02	6.2E-01	5.4E+00	1.0E+03	5.4E-03	1.0E+04	5.4E-04
PFPeA	3.0E-01	2.6E+00	ND	2.4E-01	4.8E-02	1.3E-01	2.1E-01	NC	3.1E-03	6.2E-02	4.0E-01	1.0E+03	4.0E-04	1.0E+04	4.0E-05
PFHxA	5.2E-01	4.0E+01	2.7E-01	8.6E-01	9.9E-02	2.3E-01	3.2E+00	7.4E-03	1.1E-02	1.3E-01	3.6E+00	1.0E+03	3.6E-03	1.0E+04	3.6E-04
PFHpA	1.6E+00	5.8E+00	8.3E-01	3.9E-01	9.2E-02	6.7E-01	4.7E-01	2.3E-02	5.1E-03	1.2E-01	1.3E+00	1.0E+03	1.3E-03	1.0E+04	1.3E-04
PFOA	1.2E+01	5.6E+01	6.3E+01	6.7E+00	8.2E-01	5.1E+00	4.6E+00	1.7E+00	8.7E-02	1.1E+00	1.3E+01	1.0E+03	1.3E-02	1.0E+04	1.3E-03
PFNA	1.2E-01	1.2E+00	2.1E+00	2.7E-01	6.8E-03	5.1E-02	9.7E-02	5.8E-02	3.5E-03	8.7E-03	2.2E-01	1.0E+03	2.2E-04	1.0E+04	2.2E-05
PFDA	1.4E+00	1.2E+00	2.9E+01	1.4E+00	9.5E-03	5.9E-01	9.8E-02	7.9E-01	1.8E-02	1.2E-02	1.5E+00	1.0E+03	1.5E-03	1.0E+04	1.5E-04
PFUnA	1.4E+00	5.5E-02	4.5E+00	2.4E-01	4.3E-04	6.3E-01	4.5E-03	1.2E-01	3.1E-03	5.6E-04	7.5E-01	1.0E+03	7.5E-04	1.0E+04	7.5E-05
PFDoA	2.2E+00	5.6E-02	6.5E+00	3.7E-01	4.4E-04	9.7E-01	4.6E-03	1.8E-01	4.8E-03	5.7E-04	1.2E+00	1.0E+03	1.2E-03	1.0E+04	1.2E-04
PFTrDA	7.2E-01	2.7E-01	1.8E+00	9.7E-02	2.1E-03	3.1E-01	2.2E-02	4.8E-02	1.3E-03	2.7E-03	3.9E-01	1.0E+03	3.9E-04	1.0E+04	3.9E-05
PFTeDA	5.4E-01	NC	1.3E+00	1.2E-01	ND	2.3E-01	NC	3.5E-02	1.6E-03	NC	2.7E-01	1.0E+03	2.7E-04	1.0E+04	2.7E-05
PFSAs															
PFBS	1.0E+00	1.5E+00	ND	1.3E-01	2.9E-02	4.4E-01	1.2E-01	NC	1.6E-03	3.7E-02	6.1E-01	9.2E+04	6.6E-06	1.5E+05	4.0E-06
PFPeS	1.0E+00	8.2E+00	5.8E-01	2.1E-01	3.4E-02	4.3E-01	6.7E-01	1.6E-02	2.7E-03	4.4E-02	1.2E+00	9.2E+04	1.3E-05	1.5E+05	7.6E-06
PFHxS	2.0E+00	2.1E+01	7.9E+00	6.9E-01	8.6E-02	8.7E-01	1.7E+00	2.1E-01	9.0E-03	1.1E-01	2.9E+00	7.9E+01	3.6E-02	7.9E+02	3.6E-03
PFHpS	4.0E-01	1.0E+01	3.3E+01	3.2E+00	3.6E-02	1.7E-01	8.1E-01	8.9E-01	4.2E-02	4.6E-02	2.0E+00	7.9E+01	2.5E-02	7.9E+02	2.5E-03
PFOS	1.1E+02	8.5E+02	6.0E+03	1.5E+02	3.0E+00	4.6E+01	6.9E+01	1.6E+02	2.0E+00	3.9E+00	2.8E+02	7.9E+01	**3.6E+00**	7.9E+02	3.6E-01
PFNS	2.1E-01	2.6E-01	2.3E+01	5.8E-01	9.2E-04	9.0E-02	2.1E-02	6.2E-01	7.5E-03	1.2E-03	7.4E-01	7.9E+01	9.3E-03	7.9E+02	9.3E-04
PFDS	8.4E-01	1.7E-01	4.6E+01	1.4E+00	6.2E-04	3.6E-01	1.4E-02	1.2E+00	1.8E-02	8.0E-04	1.6E+00	7.9E+01	2.1E-02	7.9E+02	2.1E-03
PFDoS	1.6E+00	1.3E-01	1.8E+01	7.4E-01	4.6E-04	6.7E-01	1.0E-02	4.8E-01	9.6E-03	5.8E-04	1.2E+00	7.9E+01	1.5E-02	7.9E+02	1.5E-03
FOSA, FASE, FASAAs															
PFOSA	9.5E+01	9.1E+00	3.2E+02	8.6E+00	3.3E-02	4.1E+01	7.4E-01	8.6E+00	1.1E-01	4.2E-02	5.1E+01	7.9E+01	6.4E-01	7.9E+02	6.4E-02
N-EtFOSAA	4.3E+00	1.9E+01	3.0E+01	5.7E+00	6.8E-02	1.9E+00	1.5E+00	8.1E-01	7.5E-02	8.6E-02	4.4E+00	7.9E+01	5.5E-02	7.9E+02	5.5E-03
N-MeFOSAA	1.9E-01	1.4E-01	5.4E-01	8.3E-01	5.0E-04	8.4E-02	1.1E-02	1.5E-02	1.1E-02	6.4E-04	1.2E-01	7.9E+01	1.5E-03	7.9E+02	1.5E-04
Fluortelomers															
6:2 FTS	ND	7.5E-01	3.0E+00	5.7E-01	3.2E-03	NC	6.1E-02	8.2E-02	7.4E-03	4.0E-03	1.5E-01	1.0E+03	1.5E-04	1.0E+04	1.5E-05
5:3 FTCA	ND	NC	ND	NA	NA	NC	NC	NC	NC	NC	NC	9.2E+04	NC	1.5E+05	NC
7:3 FTCA	ND	NC	4.4	NA	NA	NC	NC	0.117779	NC	NC	0.1	1.0E+03	1.2E-04	1.0E+04	1.2E-05

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:

See Table 3 for PFAS abbreviations
µg - microgram
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
UCL - upper confidence limit of the arithmetic mean
ww - wet weight

Appendix G Food Web Model – Raleigh Creek - Upper
Table 10. Potential Risks to the Great Blue Heron
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Raleigh Creek - Upper	
Assumptions for the Great Blue Heron	
Body Weight (kg)	2.4
Seasonal Use Factor	1
Site-Specific Area Use Factor	1.0
Sediment Ingestion Rate (kg_{dw}/day)	0.00043
Water Ingestion Rate (kg/day)	0.11
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.065
Amphibian Ingestion Rate (kg_{ww}/day)	0.022
Forage Fish Ingestion Rate (kg_{ww}/day)	0.35

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_s = Incidental ingestion rate of sediment (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_s = Concentration of PFAS in sediment (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations					Potential Daily Dose (ug/kg_{bw}/day)						NOAEL-based TRV ($\mu g/kg_{bw}$/day)	NOAEL-based HQ	LOAEL-based TRV ($\mu g/kg_{bw}$/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Amphibian EPC (µg/kg, ww)	Forage Fish EPC (µg/kg, ww)	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Benthic Invertebrate	Amphibian	Forage Fish	Sediment	Surface Water	Total				
PFCAs															
PFBA	6.1E+00	1.6E+00	1.3E+00	2.9E+00	4.8E-01	1.6E-01	1.4E-02	1.8E-01	5.3E-04	2.2E-02	3.8E-01	1.0E+03	3.8E-04	1.0E+04	3.8E-05
PFPeA	3.0E-01	ND	ND	2.4E-01	4.8E-02	8.0E-03	NC	NC	4.3E-05	2.2E-03	1.0E-02	1.0E+03	1.0E-05	1.0E+04	1.0E-06
PFHxA	5.2E-01	1.4E-01	2.7E-01	8.6E-01	9.9E-02	1.4E-02	1.2E-03	3.9E-02	1.6E-04	4.5E-03	5.9E-02	1.0E+03	5.9E-05	1.0E+04	5.9E-06
PFHpA	1.6E+00	ND	8.3E-01	3.9E-01	9.2E-02	4.2E-02	NC	1.2E-01	7.0E-05	4.1E-03	1.7E-01	1.0E+03	1.7E-04	1.0E+04	1.7E-05
PFOA	1.2E+01	5.2E-01	6.3E+01	6.7E+00	8.2E-01	3.2E-01	4.7E-03	9.1E+00	1.2E-03	3.7E-02	9.5E+00	1.0E+03	9.5E-03	1.0E+04	9.5E-04
PFNA	1.2E-01	1.2E-01	2.1E+00	2.7E-01	6.8E-03	3.2E-03	1.1E-03	3.1E-01	4.9E-05	3.1E-04	3.1E-01	1.0E+03	3.1E-04	1.0E+04	3.1E-05
PFDA	1.4E+00	1.9E+00	2.9E+01	1.4E+00	9.5E-03	3.7E-02	1.7E-02	4.2E+00	2.5E-04	4.3E-04	4.3E+00	1.0E+03	4.3E-03	1.0E+04	4.3E-04
PFUnA	1.4E+00	5.2E-01	4.5E+00	2.4E-01	4.3E-04	3.9E-02	4.7E-03	6.4E-01	4.3E-05	2.0E-05	6.9E-01	1.0E+03	6.9E-04	1.0E+04	6.9E-05
PFDoA	2.2E+00	1.9E+00	6.5E+00	3.7E-01	4.4E-04	6.1E-02	1.7E-02	9.4E-01	6.6E-05	2.0E-05	1.0E+00	1.0E+03	1.0E-03	1.0E+04	1.0E-04
PFTrDA	7.2E-01	4.8E-01	1.8E+00	9.7E-02	2.1E-03	1.9E-02	4.3E-03	2.6E-01	1.7E-05	9.5E-05	2.8E-01	1.0E+03	2.8E-04	1.0E+04	2.8E-05
PFTeDA	5.4E-01	8.6E-01	1.3E+00	1.2E-01	ND	1.5E-02	7.7E-03	1.9E-01	2.2E-05	NC	2.1E-01	1.0E+03	2.1E-04	1.0E+04	2.1E-05
PFSAs															
PFBS	1.0E+00	2.0E-01	ND	1.3E-01	2.9E-02	2.8E-02	1.8E-03	NC	2.3E-05	1.3E-03	3.1E-02	9.2E+04	3.3E-07	1.5E+05	2.0E-07
PFPeS	1.0E+00	2.5E-01	5.8E-01	2.1E-01	3.4E-02	2.7E-02	2.3E-03	8.4E-02	3.7E-05	1.5E-03	1.1E-01	9.2E+04	1.2E-06	1.5E+05	7.5E-07
PFHxS	2.0E+00	4.9E-01	7.9E+00	6.9E-01	8.6E-02	5.4E-02	4.4E-03	1.1E+00	1.2E-04	3.9E-03	1.2E+00	7.9E+01	1.5E-02	7.9E+02	1.5E-03
PFHpS	4.0E-01	1.3E+00	3.3E+01	3.2E+00	3.6E-02	1.1E-02	1.2E-02	4.8E+00	5.8E-04	1.6E-03	4.8E+00	7.9E+01	6.1E-02	7.9E+02	6.1E-03
PFOS	1.1E+02	7.3E+02	6.0E+03	1.5E+02	3.0E+00	2.9E+00	6.6E+00	8.7E+02	2.8E-02	1.4E-01	8.7E+02	7.9E+01	**1.1E+01**	7.9E+02	**1.1E+00**
PFNS	2.1E-01	2.5E+00	2.3E+01	5.8E-01	9.2E-04	5.6E-03	2.3E-02	3.3E+00	1.0E-04	4.1E-05	3.3E+00	7.9E+01	4.2E-02	7.9E+02	4.2E-03
PFDS	8.4E-01	7.2E+00	4.6E+01	1.4E+00	6.2E-04	2.3E-02	6.5E-02	6.6E+00	2.5E-04	2.8E-05	6.7E+00	7.9E+01	8.5E-02	7.9E+02	8.5E-03
PFDoS	1.6E+00	9.8E-01	1.8E+01	7.4E-01	4.6E-04	4.2E-02	8.8E-03	2.6E+00	1.3E-04	2.1E-05	2.6E+00	7.9E+01	3.3E-02	7.9E+02	3.3E-03
FOSA, FASE, FASAAs															
PFOSA	9.5E+01	1.6E+01	3.2E+02	8.6E+00	3.3E-02	2.6E+00	1.4E-01	4.6E+01	1.6E-03	1.5E-03	4.9E+01	7.9E+01	6.2E-01	7.9E+02	6.2E-02
N-EtFOSAA	4.3E+00	4.9E+00	3.0E+01	5.7E+00	6.8E-02	1.2E-01	4.4E-02	4.3E+00	1.0E-03	3.0E-03	4.5E+00	7.9E+01	5.7E-02	7.9E+02	5.7E-03
N-MeFOSAA	1.9E-01	1.7E-01	5.4E-01	8.3E-01	5.0E-04	5.2E-03	1.5E-03	7.7E-02	1.5E-04	2.2E-05	8.4E-02	7.9E+01	1.1E-03	7.9E+02	1.1E-04
Fluortelomers															
6:2 FTS	ND	3.4E+00	3.0E+00	5.7E-01	3.2E-03	NC	3.1E-02	4.3E-01	1.0E-04	1.4E-04	4.7E-01	1.0E+03	4.7E-04	1.0E+04	4.7E-05
5:3 FTCA	ND	4.7	ND	NA	NA	NC	0.0	NC	NC	NC	0.0	9.2E+04	4.6E-07	1.5E+05	2.8E-07
7:3 FTCA	ND	5.5	4.4	NA	NA	NC	0.0	0.62784	NC	NC	0.7	1.0E+03	6.8E-04	1.0E+04	6.8E-05

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:

See Table 3 for PFAS abbreviations
µg - microgram
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
UCL - upper confidence limit of the arithmetic mean
ww - wet weight

Appendix G Food Web Model – Raleigh Creek - Upper
Table 11. Potential Risks to the Muskrat
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Raleigh Creek - Upper	
Assumptions for the Muskrat	
Body Weight (kg)	1.6
Seasonal Use Factor	1
Site-Specific Area Use Factor	1.0
Sediment Ingestion Rate (kg_{dw}/day)	0.0027
Water Ingestion Rate (kg/day)	0.88
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.054
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.054
Plant Ingestion Rate (kg_{ww}/day)	0.43

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_s = Incidental ingestion rate of sediment (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_s= Concentration of PFAS in sediment (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations					Potential Daily Dose (ug/kg_{bw}/day)						NOAEL-based TRV ($\mu g/kg_{bw}$/day)	NOAEL-based HQ	LOAEL-based TRV ($\mu g/kg_{bw}$/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Aquatic Invertebrate EPC (µg/kg, ww)	Plant EPC (µg/kg, ww)	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Benthic Invertebrate	Aquatic Invertebrate	Plant	Sediment	Surface Water	Total				
PFCAs															
PFBA	6.1E+00	2.6E+01	1.3E+00	2.9E+00	4.8E-01	2.1E-01	8.8E-01	3.6E-01	5.0E-03	2.7E-01	1.7E+00	73,000	2.4E-05	1.8E+05	9.8E-06
PFPeA	3.0E-01	2.6E+00	1.3E+00	2.4E-01	4.8E-02	1.0E-02	8.8E-02	3.6E-01	4.1E-04	2.7E-02	4.9E-01	8.4E+04	5.8E-06	1.8E+05	2.8E-06
PFHxA	5.2E-01	4.0E+01	2.7E+00	8.6E-01	9.9E-02	1.8E-02	1.4E+00	7.5E-01	1.5E-03	5.5E-02	2.2E+00	8.4E+04	2.6E-05	1.8E+05	1.2E-05
PFHpA	1.6E+00	5.8E+00	3.0E+00	3.9E-01	9.2E-02	5.3E-02	2.0E-01	8.2E-01	6.6E-04	5.1E-02	1.1E+00	3.0E+02	3.8E-03	6.0E+02	1.9E-03
PFOA	1.19E+01	5.61E+01	2.72E+01	6.69E+00	8.23E-01	4.03E-01	1.91E+00	7.40E+00	1.14E-02	4.57E-01	1.02E+01	3.00E+02	3.4E-02	6.00E+02	1.7E-02
PFNA	1.2E-01	1.2E+00	5.1E+00	2.7E-01	6.8E-03	4.0E-03	4.1E-02	1.4E+00	4.6E-04	3.8E-03	1.4E+00	8.3E+02	1.7E-03	1.1E+03	1.3E-03
PFDA	1.4E+00	1.2E+00	1.7E+01	1.4E+00	9.5E-03	4.7E-02	4.1E-02	4.6E+00	2.3E-03	5.3E-03	4.7E+00	1.0E+02	4.7E-02	6.4E+03	7.4E-04
PFUnA	1.4E+00	5.5E-02	7.8E-01	2.4E-01	4.3E-04	4.9E-02	1.9E-03	2.1E-01	4.1E-04	2.4E-04	2.6E-01	3.0E+02	8.8E-04	1.0E+03	2.6E-04
PFDoA	2.2E+00	5.6E-02	7.9E-01	3.7E-01	4.4E-04	7.6E-02	1.9E-03	2.2E-01	6.2E-04	2.5E-04	2.9E-01	5.0E+02	5.9E-04	2.5E+03	1.2E-04
PFTrDA	7.2E-01	2.7E-01	3.8E+00	9.7E-02	2.1E-03	2.5E-02	9.1E-03	1.0E+00	1.6E-04	1.2E-03	1.1E+00	5.0E+02	2.1E-03	2.5E+03	4.2E-04
PFTeDA	5.4E-01	NC	NC	1.2E-01	ND	1.8E-02	NC	NC	2.1E-04	NC	1.9E-02	3.0E+03	6.2E-06	1.0E+04	1.9E-06
PFSAs															
PFBS	1.0E+00	1.5E+00	3.3E-02	1.3E-01	2.9E-02	3.5E-02	5.2E-02	9.1E-03	2.1E-04	1.6E-02	1.1E-01	5.0E+04	2.2E-06	2.0E+05	5.6E-07
PFPeS	1.0E+00	8.2E+00	4.0E-02	2.1E-01	3.4E-02	3.4E-02	2.8E-01	1.1E-02	3.5E-04	1.9E-02	3.4E-01	5.0E+04	6.9E-06	2.0E+05	1.7E-06
PFHxS	2.0E+00	2.1E+01	1.5E-01	6.9E-01	8.6E-02	6.8E-02	7.0E-01	4.1E-02	1.2E-03	4.8E-02	8.6E-01	3.0E+02	2.9E-03	1.0E+03	8.6E-04
PFHpS	4.0E-01	1.0E+01	1.2E+00	3.2E+00	3.6E-02	1.4E-02	3.4E-01	3.2E-01	5.5E-03	2.0E-02	7.0E-01	3.0E+02	2.3E-03	1.0E+03	7.0E-04
PFOS	1.1E+02	8.5E+02	5.7E+02	1.5E+02	3.0E+00	3.6E+00	2.9E+01	1.6E+02	2.6E-01	1.7E+00	1.9E+02	1.0E+02	**1.9E+00**	1.7E+02	**1.1E+00**
PFNS	2.1E-01	2.6E-01	1.7E-01	5.8E-01	9.2E-04	7.1E-03	8.7E-03	4.7E-02	9.8E-04	5.1E-04	6.4E-02	1.0E+02	6.4E-04	1.7E+02	3.8E-04
PFDS	8.4E-01	1.7E-01	1.2E-01	1.4E+00	6.2E-04	2.9E-02	5.9E-03	3.2E-02	2.3E-03	3.5E-04	6.9E-02	1.0E+02	6.9E-04	1.7E+02	4.1E-04
PFDoS	1.6E+00	1.3E-01	8.6E-02	7.4E-01	4.6E-04	5.3E-02	4.3E-03	2.3E-02	1.3E-03	2.5E-04	8.2E-02	1.0E+02	8.2E-04	1.7E+02	4.8E-04
FOSA, FASE, FASAAs															
PFOSA	9.50E+01	9.09E+00	6.17E+00	8.63E+00	3.26E-02	3.23E+00	3.09E-01	1.68E+00	1.47E-02	1.81E-02	5.25E+00	1.00E+02	5.2E-02	1.70E+02	3.1E-02
N-EtFOSAA	4.3E+00	1.9E+01	1.3E+01	5.7E+00	6.8E-02	1.5E-01	6.4E-01	3.5E+00	9.7E-03	3.7E-02	4.3E+00	1.0E+02	4.3E-02	1.7E+02	2.5E-02
N-MeFOSAA	1.9E-01	1.4E-01	9.5E-02	8.3E-01	5.0E-04	6.6E-03	4.7E-03	2.6E-02	1.4E-03	2.8E-04	3.9E-02	1.0E+02	3.9E-04	1.7E+02	2.3E-04
Fluortelomers															
6:2 FTS	ND	7.5E-01	5.5E-03	5.7E-01	3.2E-03	NC	2.6E-02	1.5E-03	9.7E-04	1.7E-03	3.0E-02	3.0E+02	9.9E-05	1.0E+03	3.0E-05
5:3 FTCA	ND	NC	NC	NA	NA	NC	NC	NC	NC	NC	NC	7.3E+04	NC	1.8E+05	NC
7:3 FTCA	ND	NC	NC	NA	NA	NC	NC	NC	NC	NC	NC	3.0E+02	NC	6.0E+02	NC

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
UCL - upper confidence limit of the arithmetic mean
ww - wet weight

Appendix G Food Web Model – Raleigh Creek - Upper
Table 12. Potential Risks to the Little Brown Bat
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Raleigh Creek - Upper	
Assumptions for the Little Brown Bat	
Body Weight (kg)	0.0085
Seasonal Use Factor	1
Site-Specific Area Use Factor	0.28
Water Ingestion Rate (kg/day)	0.0010
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.0049

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)
AUF = Area use factor (ratio of the receptor's home range relative to the size of

SUPPORTING CALCULATIONS

Analyte	Media Concentrations		Potential Daily Dose (ug/kg_{bw}/day)			NOAEL-based TRV ($\mu g/kg_{bw}$/day)	NOAEL-based HQ	LOAEL-based TRV ($\mu g/kg_{bw}$/day)	LOAEL-based HQ
	Aquatic Invertebrate EPC (µg/kg, ww)	Surface Water EPC (µg/L)	Aquatic Invertebrate	Surface Water	Total				
PFCAs									
PFBA	2.6E+01	4.8E-01	4.2E+00	1.6E-02	4.2E+00	7.3E+04	5.8E-05	1.8E+05	2.4E-05
PFPeA	2.6E+00	4.8E-02	4.2E-01	1.6E-03	4.2E-01	8.4E+04	5.0E-06	1.8E+05	2.4E-06
PFHxA	4.0E+01	9.9E-02	6.5E+00	3.3E-03	6.5E+00	8.4E+04	7.7E-05	1.8E+05	3.7E-05
PFHpA	5.8E+00	9.2E-02	9.4E-01	3.1E-03	9.4E-01	3.0E+02	3.1E-03	6.0E+02	1.6E-03
PFOA	5.6E+01	8.2E-01	9.1E+00	2.7E-02	9.1E+00	3.0E+02	3.0E-02	6.0E+02	1.5E-02
PFNA	1.2E+00	6.8E-03	1.9E-01	2.3E-04	1.9E-01	8.3E+02	2.3E-04	1.1E+03	1.8E-04
PFDA	1.2E+00	9.5E-03	2.0E-01	3.2E-04	2.0E-01	1.0E+02	2.0E-03	6.4E+03	3.1E-05
PFUnA	5.5E-02	4.3E-04	8.9E-03	1.4E-05	9.0E-03	3.0E+02	3.0E-05	1.0E+03	9.0E-06
PFDoA	5.6E-02	4.4E-04	9.1E-03	1.5E-05	9.1E-03	5.0E+02	1.8E-05	2.5E+03	3.6E-06
PFTrDA	2.7E-01	2.1E-03	4.3E-02	7.0E-05	4.3E-02	5.0E+02	8.7E-05	2.5E+03	1.7E-05
PFTeDA	NC	ND	NC	NC	NC	3.0E+03	NC	1.0E+04	NC
PFSAs									
PFBS	1.5E+00	2.9E-02	2.5E-01	9.6E-04	2.5E-01	5.0E+04	5.0E-06	2.0E+05	1.3E-06
PFPeS	8.2E+00	3.4E-02	1.3E+00	1.1E-03	1.3E+00	5.0E+04	2.7E-05	2.0E+05	6.7E-06
PFHxS	2.1E+01	8.6E-02	3.3E+00	2.9E-03	3.3E+00	3.0E+02	1.1E-02	1.0E+03	3.3E-03
PFHpS	1.0E+01	3.6E-02	1.6E+00	1.2E-03	1.6E+00	3.0E+02	5.4E-03	1.0E+03	1.6E-03
PFOS	8.5E+02	3.0E+00	1.4E+02	1.0E-01	1.4E+02	1.0E+02	**1.4E+00**	1.7E+02	8.1E-01
PFNS	2.6E-01	9.2E-04	4.1E-02	3.1E-05	4.1E-02	1.0E+02	4.1E-04	1.7E+02	2.4E-04
PFDS	1.7E-01	6.2E-04	2.8E-02	2.1E-05	2.8E-02	1.0E+02	2.8E-04	1.7E+02	1.7E-04
PFDoS	1.3E-01	4.6E-04	2.1E-02	1.5E-05	2.1E-02	1.0E+02	2.1E-04	1.7E+02	1.2E-04
FOSA, FASE, FASAAs									
PFOSA	9.1E+00	3.3E-02	1.5E+00	1.1E-03	1.5E+00	1.0E+02	1.5E-02	1.7E+02	8.7E-03
N-EtFOSAA	1.9E+01	6.8E-02	3.0E+00	2.3E-03	3.0E+00	1.0E+02	3.0E-02	1.7E+02	1.8E-02
N-MeFOSAA	1.4E-01	5.0E-04	2.3E-02	1.7E-05	2.3E-02	1.0E+02	2.3E-04	1.7E+02	1.3E-04
Fluortelomers									
6:2 FTS	0.8	0.0	0.12183284	0.0001	0.1	3.0E+02	4.1E-04	1.0E+03	1.2E-04
5:3 FTCA	NC	NA	NC	NC	NC	7.3E+04	NC	1.8E+05	NC
7:3 FTCA	NC	NA	NC	NC	NC	3.0E+02	NC	6.0E+02	NC

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
UCL - upper confidence limit of the arithmetic mean
ww - wet weight

Appendix G Food Web Model – Raleigh Creek - Upper
Table 13. Potential Risks to the Raccoon
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Raleigh Creek - Upper	
Assumptions for the Raccoon	
Body Weight (kg)	8.6
Seasonal Use Factor	1
Site-Specific Area Use Factor	0.055
Sediment Ingestion Rate (kg_{dw}/day)	0.0047
Water Ingestion Rate (kg/day)	0.41
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.080
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.010
Plant Ingestion Rate (kg_{ww}/day)	0.090
Amphibian Ingestion Rate (kg_{ww}/day)	0.010
Forage Fish Ingestion Rate (kg_{ww}/day)	0.010

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_s = Incidental ingestion rate of sediment (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_s= Concentration of PFAS in sediment (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations							Potential Daily Dose (ug/kg_{bw}/day)								NOAEL-based TRV ($\mu g/kg_{bw}$/day)	NOAEL-based HQ	LOAEL-based TRV ($\mu g/kg_{bw}$/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Aquatic Invertebrate EPC (µg/kg, ww)	Plant EPC (µg/kg, ww)	Amphibian EPC (µg/kg, ww)	Forage Fish EPC (µg/kg, ww)	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Benthic Invertebrate	Aquatic Invertebrate	Plant	Ampibian	Forage Fish	Sediment	Surface Water	Total				
PFCAs																			
PFBA	6.1E+00	2.6E+01	1.3E+00	1.6E+00	1.3E+00	2.9E+00	4.8E-01	3.1E-03	1.6E-03	7.6E-04	1.0E-04	8.2E-05	8.8E-05	1.3E-03	7.0E-03	7.3E+04	9.6E-08	1.8E+05	4.0E-08
PFPeA	3.0E-01	2.6E+00	1.3E+00	ND	ND	2.4E-01	4.8E-02	1.5E-04	1.6E-04	7.7E-04	NC	NC	7.2E-06	1.3E-04	1.2E-03	8.4E+04	1.4E-08	1.8E+05	6.9E-09
PFHxA	5.2E-01	4.0E+01	2.7E+00	1.4E-01	2.7E-01	8.6E-01	9.9E-02	2.7E-04	2.5E-03	1.6E-03	8.7E-06	1.7E-05	2.6E-05	2.6E-04	4.7E-03	8.4E+04	5.6E-08	1.8E+05	2.7E-08
PFHpA	1.6E+00	5.8E+00	3.0E+00	ND	8.3E-01	3.9E-01	9.2E-02	7.9E-04	3.7E-04	1.7E-03	NC	5.3E-05	1.2E-05	2.4E-04	3.2E-03	3.0E+02	1.1E-05	6.0E+02	5.3E-06
PFOA	1.2E+01	5.6E+01	2.7E+01	5.2E-01	6.3E+01	6.7E+00	8.2E-01	6.0E-03	3.6E-03	1.6E-02	3.3E-05	4.0E-03	2.0E-04	2.1E-03	3.2E-02	3.0E+02	1.1E-04	6.0E+02	5.3E-05
PFNA	1.2E-01	1.2E+00	5.1E+00	1.2E-01	2.1E+00	2.7E-01	6.8E-03	6.0E-05	7.7E-05	2.9E-03	7.5E-06	1.4E-04	8.1E-06	1.8E-05	3.2E-03	8.3E+02	3.9E-06	1.1E+03	2.9E-06
PFDA	1.4E+00	1.2E+00	1.7E+01	1.9E+00	2.9E+01	1.4E+00	9.5E-03	7.0E-04	7.7E-05	9.8E-03	1.2E-04	1.9E-03	4.1E-05	2.5E-05	1.3E-02	1.0E+02	1.3E-04	6.4E+03	2.0E-06
PFUnA	1.4E+00	5.5E-02	7.8E-01	5.2E-01	4.5E+00	2.4E-01	4.3E-04	7.4E-04	3.5E-06	4.5E-04	3.3E-05	2.8E-04	7.2E-06	1.1E-06	1.5E-03	3.0E+02	5.0E-06	1.0E+03	1.5E-06
PFDoA	2.2E+00	5.6E-02	7.9E-01	1.9E+00	6.5E+00	3.7E-01	4.4E-04	1.1E-03	3.6E-06	4.5E-04	1.2E-04	4.1E-04	1.1E-05	1.1E-06	2.1E-03	5.0E+02	4.3E-06	2.5E+03	8.6E-07
PFTrDA	7.2E-01	2.7E-01	3.8E+00	4.8E-01	1.8E+00	9.7E-02	2.1E-03	3.7E-04	1.7E-05	2.2E-03	3.0E-05	1.1E-04	2.9E-06	5.5E-06	2.7E-03	5.0E+02	5.4E-06	2.5E+03	1.1E-06
PFTeDA	5.4E-01	NC	NC	8.6E-01	1.3E+00	1.2E-01	ND	2.7E-04	NC	NC	5.5E-05	8.2E-05	3.7E-06	NC	4.1E-04	3.0E+03	1.4E-07	1.0E+04	4.1E-08
PFSAs																			
PFBS	1.0E+00	1.5E+00	3.3E-02	2.0E-01	ND	1.3E-01	2.9E-02	5.2E-04	9.8E-05	1.9E-05	1.3E-05	NC	3.7E-06	7.5E-05	7.3E-04	5.0E+04	1.5E-08	2.0E+05	3.7E-09
PFPeS	1.0E+00	8.2E+00	4.0E-02	2.5E-01	5.8E-01	2.1E-01	3.4E-02	5.1E-04	5.2E-04	2.3E-05	1.6E-05	3.7E-05	6.2E-06	8.9E-05	1.2E-03	5.0E+04	2.4E-08	2.0E+05	6.0E-09
PFHxS	2.0E+00	2.1E+01	1.5E-01	4.9E-01	7.9E+00	6.9E-01	8.6E-02	1.0E-03	1.3E-03	8.6E-05	3.1E-05	5.0E-04	2.1E-05	2.2E-04	3.2E-03	3.0E+02	1.1E-05	1.0E+03	3.2E-06
PFHpS	4.0E-01	1.0E+01	1.2E+00	1.3E+00	3.3E+01	3.2E+00	3.6E-02	2.0E-04	6.4E-04	6.8E-04	8.5E-05	2.1E-03	9.7E-05	9.3E-05	3.9E-03	3.0E+02	1.3E-05	1.0E+03	3.9E-06
PFOS	1.1E+02	8.5E+02	5.7E+02	7.3E+02	6.0E+03	1.5E+02	3.0E+00	5.5E-02	5.4E-02	3.3E-01	4.7E-02	3.8E-01	4.6E-03	7.9E-03	8.8E-01	1.0E+02	8.8E-03	1.7E+02	5.2E-03
PFNS	2.1E-01	2.6E-01	1.7E-01	2.5E+00	2.3E+01	5.8E-01	9.2E-04	1.1E-04	1.6E-05	9.9E-05	1.6E-04	1.5E-03	1.7E-05	2.4E-06	1.9E-03	1.0E+02	1.9E-05	1.7E+02	1.1E-05
PFDS	8.4E-01	1.7E-01	1.2E-01	7.2E+00	4.6E+01	1.4E+00	6.2E-04	4.3E-04	1.1E-05	6.8E-05	4.6E-04	2.9E-03	4.1E-05	1.6E-06	3.9E-03	1.0E+02	3.9E-05	1.7E+02	2.3E-05
PFDoS	1.6E+00	1.3E-01	8.6E-02	9.8E-01	1.8E+01	7.4E-01	4.6E-04	7.9E-04	8.1E-06	4.9E-05	6.2E-05	1.1E-03	2.2E-05	1.2E-06	2.1E-03	1.0E+02	2.1E-05	1.7E+02	1.2E-05
FOSA, FASE, FASAAs																			
PFOSA	9.5E+01	9.1E+00	6.2E+00	1.6E+01	3.2E+02	8.6E+00	3.3E-02	4.8E-02	5.8E-04	3.5E-03	1.0E-03	2.0E-02	2.6E-04	8.5E-05	7.4E-02	1.0E+02	7.4E-04	1.7E+02	4.4E-04
N-EtFOSAA	4.3E+00	1.9E+01	1.3E+01	4.9E+00	3.0E+01	5.7E+00	6.8E-02	2.2E-03	1.2E-03	7.3E-03	3.1E-04	1.9E-03	1.7E-04	1.8E-04	1.3E-02	1.0E+02	1.3E-04	1.7E+02	7.8E-05
N-MeFOSAA	1.9E-01	1.4E-01	9.5E-02	1.7E-01	5.4E-01	8.3E-01	5.0E-04	9.9E-05	8.9E-06	5.4E-05	1.1E-05	3.4E-05	2.5E-05	1.3E-06	2.3E-04	1.0E+02	2.3E-06	1.7E+02	1.4E-06
Fluortelomers																			
6:2 FTS	ND	7.5E-01	5.5E-03	3.4E+00	3.0E+00	5.7E-01	3.2E-03	NC	4.8E-05	3.1E-06	2.2E-04	1.9E-04	1.7E-05	8.2E-06	4.8E-04	3.0E+02	1.6E-06	1.0E+03	4.8E-07
5:3 FTCA	ND	NC	NC	4.7E+00	ND	NA	NA	NC	NC	NC	3.0E-04	NC	NC	NC	3.0E-04	7.3E+04	4.1E-09	1.8E+05	1.7E-09
7:3 FTCA	ND	NC	NC	5.5E+00	4.4E+00	NA	NA	NC	NC	NC	3.5E-04	2.8E-04	NC	NC	6.3E-04	3.0E+02	2.1E-06	6.0E+02	1.0E-06

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
UCL - upper confidence limit of the arithmetic mean
ww - wet weight

Appendix G Food Web Model – Raleigh Creek - Upper
Table 14. Summary of Potential Risks to Wildlife at Raleigh Creek - Upper
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Analyte	Hazard Quotients for Potential PFAS Exposure													
	Wood Duck		Tree Swallow		Spotted Sandpiper		Great Blue Heron		Muskrat		Little Brown Bat		Raccoon	
	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ
PFCAs														
PFBA	1.6E-05	1.6E-06	3.1E-03	3.1E-04	5.4E-03	5.4E-04	3.8E-04	3.8E-05	2.4E-05	9.8E-06	5.8E-05	2.4E-05	9.6E-08	4.0E-08
PFPeA	6.8E-06	6.8E-07	3.4E-04	3.4E-05	4.0E-04	4.0E-05	1.0E-05	1.0E-06	5.8E-06	2.8E-06	5.0E-06	2.4E-06	1.4E-08	6.9E-09
PFHxA	2.3E-05	2.3E-06	4.4E-03	4.4E-04	3.6E-03	3.6E-04	5.9E-05	5.9E-06	2.6E-05	1.2E-05	7.7E-05	3.7E-05	5.6E-08	2.7E-08
PFHpA	1.6E-05	1.6E-06	8.0E-04	8.0E-05	1.3E-03	1.3E-04	1.7E-04	1.7E-05	3.8E-03	1.9E-03	3.1E-03	1.6E-03	1.1E-05	5.3E-06
PFOA	1.4E-04	1.4E-05	7.5E-03	7.5E-04	1.3E-02	1.3E-03	9.5E-03	9.5E-04	3.4E-02	1.7E-02	3.0E-02	1.5E-02	1.1E-04	5.3E-05
PFNA	2.3E-05	2.3E-06	3.0E-04	3.0E-05	2.2E-04	2.2E-05	3.1E-04	3.1E-05	1.7E-03	1.3E-03	2.3E-04	1.8E-04	3.9E-06	2.9E-06
PFDA	7.7E-05	7.7E-06	7.5E-04	7.5E-05	1.5E-03	1.5E-04	4.3E-03	4.3E-04	4.7E-02	7.4E-04	2.0E-03	3.1E-05	1.3E-04	2.0E-06
PFUnA	3.9E-06	3.9E-07	1.0E-04	1.0E-05	7.5E-04	7.5E-05	6.9E-04	6.9E-05	8.8E-04	2.6E-04	3.0E-05	9.0E-06	5.0E-06	1.5E-06
PFDoA	4.2E-06	4.2E-07	1.4E-04	1.4E-05	1.2E-03	1.2E-04	1.0E-03	1.0E-04	5.9E-04	1.2E-04	1.8E-05	3.6E-06	4.3E-06	8.6E-07
PFTrDA	1.7E-05	1.7E-06	1.8E-04	1.8E-05	3.9E-04	3.9E-05	2.8E-04	2.8E-05	2.1E-03	4.2E-04	8.7E-05	1.7E-05	5.4E-06	1.1E-06
PFTeDA	1.8E-07	1.8E-08	2.6E-05	2.6E-06	2.7E-04	2.7E-05	2.1E-04	2.1E-05	6.2E-06	1.9E-06	NC	NC	1.4E-07	4.1E-08
PFSAs														
PFBS	9.5E-09	5.7E-09	2.4E-06	1.4E-06	6.6E-06	4.0E-06	3.3E-07	2.0E-07	2.2E-06	5.6E-07	5.0E-06	1.3E-06	1.5E-08	3.7E-09
PFPeS	2.8E-08	1.7E-08	1.0E-05	6.1E-06	1.3E-05	7.6E-06	1.2E-06	7.5E-07	6.9E-06	1.7E-06	2.7E-05	6.7E-06	2.4E-08	6.0E-09
PFHxS	8.4E-05	8.4E-06	2.9E-02	2.9E-03	3.6E-02	3.6E-03	1.5E-02	1.5E-03	2.9E-03	8.6E-04	1.1E-02	3.3E-03	1.1E-05	3.2E-06
PFHpS	1.2E-04	1.2E-05	1.4E-02	1.4E-03	2.5E-02	2.5E-03	6.1E-02	6.1E-03	2.3E-03	7.0E-04	5.4E-03	1.6E-03	1.3E-05	3.9E-06
PFOS	3.6E-02	3.6E-03	**1.5E+00**	1.5E-01	**3.6E+00**	3.6E-01	**1.1E+01**	**1.1E+00**	**1.9E+00**	**1.1E+00**	**1.4E+00**	8.1E-01	8.8E-03	5.2E-03
PFNS	1.4E-05	1.4E-06	5.5E-04	5.5E-05	9.3E-03	9.3E-04	4.2E-02	4.2E-03	6.4E-04	3.8E-04	4.1E-04	2.4E-04	1.9E-05	1.1E-05
PFDS	1.6E-05	1.6E-06	8.1E-04	8.1E-05	2.1E-02	2.1E-03	8.5E-02	8.5E-03	6.9E-04	4.1E-04	2.8E-04	1.7E-04	3.9E-05	2.3E-05
PFDoS	1.4E-05	1.4E-06	1.2E-03	1.2E-04	1.5E-02	1.5E-03	3.3E-02	3.3E-03	8.2E-04	4.8E-04	2.1E-04	1.2E-04	2.1E-05	1.2E-05
FOSA, FASE, FASAAs														
PFOSA	7.12E-04	7.12E-05	7.39E-02	7.39E-03	6.40E-01	6.40E-02	6.16E-01	6.16E-02	5.25E-02	3.09E-02	1.47E-02	8.66E-03	7.42E-04	4.37E-04
N-EtFOSAA	8.2E-04	8.2E-05	3.3E-02	3.3E-03	5.5E-02	5.5E-03	5.7E-02	5.7E-03	4.3E-02	2.5E-02	3.0E-02	1.8E-02	1.3E-04	7.8E-05
N-MeFOSAA	1.0E-05	1.0E-06	3.5E-04	3.5E-05	1.5E-03	1.5E-04	1.1E-03	1.1E-04	3.9E-04	2.3E-04	2.3E-04	1.3E-04	2.3E-06	1.4E-06
Fluortelomers														
6:2 FTS	4.3E-07	4.3E-08	8.1E-05	8.1E-06	1.5E-04	1.5E-05	4.7E-04	4.7E-05	9.9E-05	3.0E-05	4.1E-04	1.2E-04	1.6E-06	4.8E-07
5:3 FTCA	NC	NC	NC	NC	NC	NC	4.6E-07	2.8E-07	NC	NC	NC	NC	4.1E-09	1.7E-09
7:3 FTCA	NC	NC	NC	NC	1.2E-04	1.2E-05	6.8E-04	6.8E-05	NC	NC	NC	NC	2.1E-06	1.0E-06

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
NC - Not Calculated
NOAEL - No Observed Adverse Effects Level

Appendix G Food Web Model – Raleigh Creek - Upper
Figure 1 - Total Daily Intake of PFAS
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

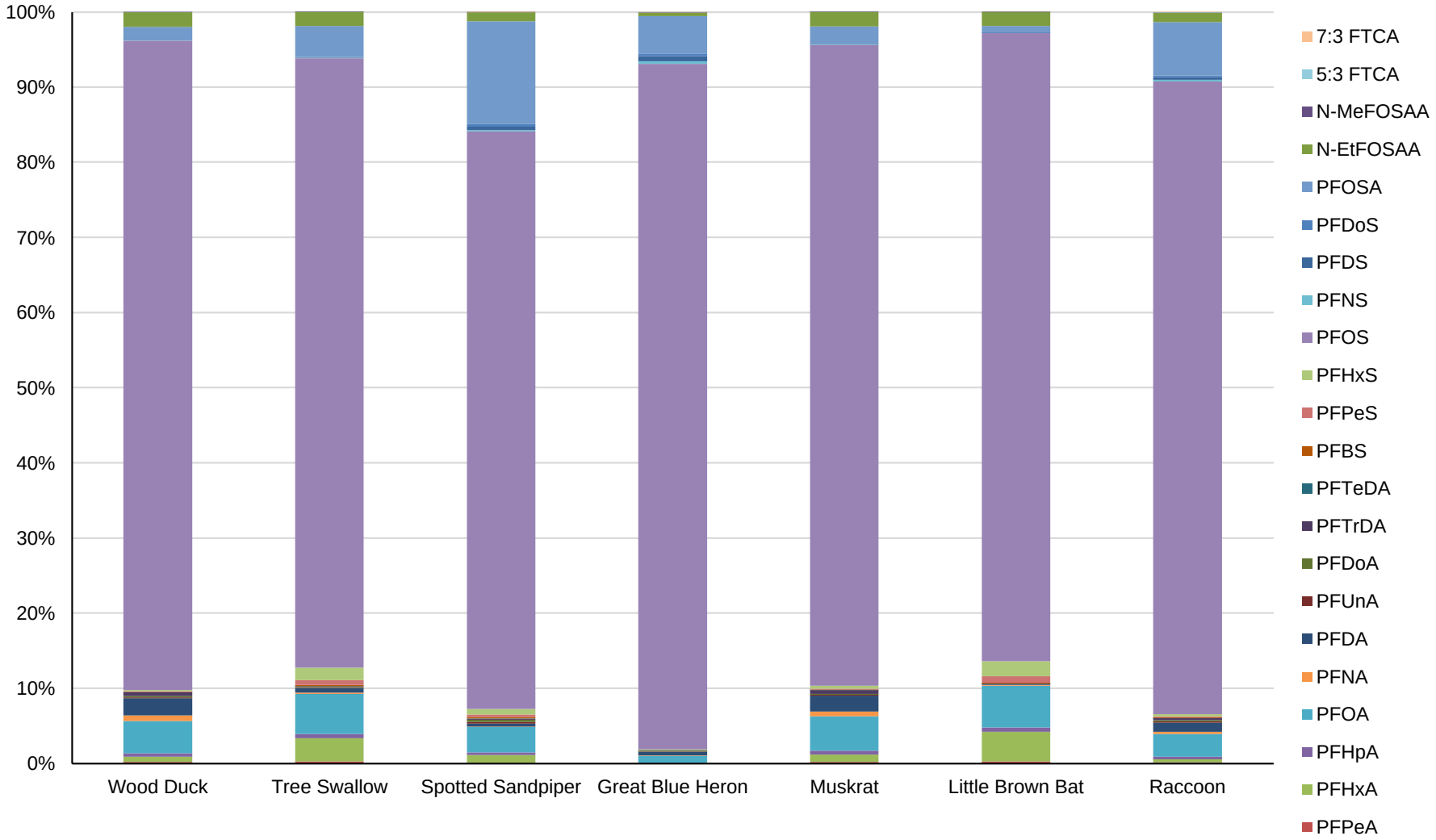

Figure 1: Total Daily Intake of PFAS - Aquatic-life Dependent Wildlife at Raleigh Creek - Upper

Appendix H

Food Web Model – Raleigh Creek-Other

Appendix H Food Web Model – Raleigh Creek – Other
Table 1. Wildlife Exposure Parameters
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Parameter	Parameter Definition	Units	Birds				Mammals		
			Avian Consumer (Herbivore)	Avian Consumer (Invertivore)	Avian Consumer (Omnivore / Invertivore)	Avian Consumer (Piscivore)	Mammalian Consumer (Herbivore)	Mammalian Consumer (Invertivore)	Mammalian Consumer (Omnivore / Invertivore)
			Wood Duck	**Tree Swallow**	**Spotted Sandpiper**	**Great Blue Heron**	**Muskrat**	**Little Brown Bat**	**Raccoon**
			Aix sponsa	*Tachycineta bicolor*	*Actitis macularius*	*Ardea herodias*	*Ondatra zibethicus*	*Myotis lucifugus*	*Procyon lotor*
BW	Body Weight	kg	0.70	0.020	0.043	2.4	1.6	0.0085	8.6
FIR_{dw}	Daily Food Ingestion Rate (dry matter) [1]	kg, dw/day	0.041	0.012	0.0076	0.11	0.14	0.0016	0.050
FIR_{ww}	Daily Food Ingestion Rate (wet matter) [2]	kg, ww/day	0.13	0.035	0.023	0.43	0.54	0.0049	0.20
P_{veg}	Proportion of Diet - Vegetation	kg diet item, ww/kg diet, ww	0.90	0.17	--	--	0.80	--	0.45
IR_{veg}	Vegetation Ingestion Rate [4]	kg ww/day	0.11	0.0060	--	--	0.43	--	0.090
P_{bi}	Proportion of Diet - Benthic Invertebrates	kg diet item, ww/kg diet, ww	0.050	0.26	0.80	0.15	0.10	--	0.40
IR_{bi}	Benthic Invertebrate Ingestion Rate [4]	kg ww/day	0.0064	0.0092	0.018	0.065	0.054	--	0.080
P_{ai}	Proportion of Diet - Aquatic Invertebrates	kg diet item, ww/kg diet, ww	0.050	0.57	0.15	--	0.10	1.0	0.050
IR_{ai}	Aquatic Invertebrate Ingestion Rate [4]	kg ww/day	0.0064	0.020	0.0034	--	0.054	0.0049	0.010
P_{am}	Proportion of Diet - Amphibians	kg diet item, ww/kg diet, ww	--	--	--	0.050	--	--	0.050
IR_{am}	Amphibian Ingestion Rate [4]	kg ww/day	--	--	--	0.022	--	--	0.010
P_{ff}	Proportion of Diet - Forage Fish	kg diet item, ww/kg diet, ww	--	--	0.050	0.80	--	--	0.050
IR_{ff}	Forage Fish Ingestion Rate [4]	kg ww/day	--	--	0.0011	0.35	--	--	0.010
P_{pf}	Proportion of Diet - Predatory Fish	kg diet item, ww/kg diet, ww	--	--	--	--	--	--	--
IR_{pf}	Predatory Fish Ingestion Rate [4]	kg ww/day	--	--	--	--	--	--	--
P_s	Proportion of Diet - Sediment	kg sediment, dw/kg diet, dw	0.24	--	0.073	0.0040	0.020	--	0.094
IR_S	Sediment Ingestion Rate [5]	kg dw/day	0.0098	--	0.00055	0.00043	0.0027	--	0.0047
IR_W	Water Ingestion Rate [6]	L/day or kg/day	0.041	0.0040	0.054	0.11	0.88	0.0010	0.41
HR	Home Range	acres	776	194	5.0	11	0.32	74	385
AUF_{RC}	Area Use Factor for Raleigh Creek - Other [3]	proportion	0.0077	0.031	1.0	0.55	1.0	0.081	0.016

Notes:
References for all species-specific exposure factors are provided in Table 2.
1 - Dry weight food ingestion rate (FIR) is applied to concentrations of PFAS in sediment, generally reported on dry weight basis.
2 - Wet weight FIR is applied to tissue data, generally reported on fresh or wet weight basis.
3 - AUF values for receptors were calculated by dividing the size of the exposure area by the home range. If the home range is smaller than the exposure area, an AUF of 1 was used. Site Use Factor (SUF) of 1 was selected for all receptors.
4 - Dietary ingestion rates were calculated by multiplying the receptor- and tissue-specific proportion of diet by the receptor-specific FIR_{ww}.
5 - IR_S were calculated by multiplying the receptor-specific P_S by the receptor-specific FIR_{dw}.
6 - DWI is reported in L/day or kg/day because 1 L of water has weight of 1 kg

Abbreviations:
dw - dry weight
kg - kilogram
L - liters
RC - Raleigh Creek
ww - wet weight

Exposure Areas (Acres):
RC - Other = 6

Appendix H Food Web Model – Raleigh Creek – Other
Table 2. Information Sources for Wildlife Exposure Parameters
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Receptor Type	Feeding Guild	Species	Parameter	Definition	Value	Units	Reference	Notes
Bird	Herbivore	Wood Duck	BW	Body Weight	0.70	kg	NC WRC (2019)	Lowest reported body weight (converted to kg)
Bird	Herbivore	Wood Duck	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.041	kg, dw/day	Nagy (2001)	Calculated using DW allometric equation for omnivorous birds: FIR (dw) = 0.67 x BW ^ 0.627
Bird	Herbivore	Wood Duck	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.13	kg, ww/day	Nagy (2001)	Calculated using WW allometric equation for omnivorous birds: FIR (ww) = 2.094 x BW ^ 0.627
Bird	Herbivore	Wood Duck	P_{veg}	Proportion of Diet - Vegetation	0.90	kg diet item, ww/kg diet, ww	MN DNR (2020)	Consume acorns, weed seeds, berries, plants and insects; assume majority is vegetation (https://www.dnr.state.mn.us/birds/woodduck.html)
Bird	Herbivore	Wood Duck	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.05	kg diet item, ww/kg diet, ww	MN DNR (2020)	Consume acorns, weed seeds, berries, plants and insects; assume majority is vegetation (https://www.dnr.state.mn.us/birds/woodduck.html)
Bird	Herbivore	Wood Duck	P_{ai}	Proportion of Diet - Aquatic Invertebrates	0.05	kg diet item, ww/kg diet, ww	MN DNR (2020)	Consume acorns, weed seeds, berries, plants and insects; assume majority is vegetation (https://www.dnr.state.mn.us/birds/woodduck.html)
Bird	Herbivore	Wood Duck	P_{am}	Proportion of Diet - Amphibians	--	kg diet item, ww/kg diet, ww	MN DNR (2020)	Assumed not to be consumed based on reported diet contents.
Bird	Herbivore	Wood Duck	P_{ff}	Proportion of Diet - Forage Fish	--	kg diet item, ww/kg diet, ww	MN DNR (2020)	Assumed not to be consumed based on reported diet contents.
Bird	Herbivore	Wood Duck	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww	MN DNR (2020)	Assumed not to be consumed based on reported diet contents.
Bird	Herbivore	Wood Duck	P_{s}	Proportion of Diet - Sediment	0.24	kg sediment, dw/kg diet, dw	USEPA (1993)	Sediment ingestion in wood duck (USEPA, 1993).
Bird	Herbivore	Wood Duck	IR_{W}	Daily Water Ingestion	0.041	L water/day	USEPA (1993)	Mallard used as a surrogate; IR L/day= IR 0.058 (L/kg)*BW (kg)
Bird	Herbivore	Wood Duck	HR	Home Range	776	acres	CDFW (2021)	In Minnesota, breeding female wood ducks remained within 1 km (0.6 mi) of the nest during 70% of their time away (Gilmer et al. 1978, as cited in CDFW 2021); therefore, home range was calculated as area from nest using 1 km as radius.
Bird	Invertivore	Tree Swallow	BW	Body Weight	0.020	kg	Nagy (2001)	Measured value for tree swallow.
Bird	Invertivore	Tree Swallow	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.012	kg, dw/day	Nagy (2001)	Measured value for tree swallow (dry matter intake).
Bird	Invertivore	Tree Swallow	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.035	kg, ww/day	Nagy (2001)	Measured value for tree swallow (fresh matter intake).
Bird	Invertivore	Tree Swallow	P_{veg}	Proportion of Diet - Vegetation	0.17	kg diet item, ww/kg diet, ww	Beal (1918); USACHPPM (2004)	Estimated proportion of plant material.
Bird	Invertivore	Tree Swallow	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.26	kg diet item, ww/kg diet, ww	Beal (1918); USACHPPM (2004)	Estimated based on proportion of non-flying insects.
Bird	Invertivore	Tree Swallow	P_{ai}	Proportion of Diet - Aquatic Invertebrates	0.57	kg diet item, ww/kg diet, ww	Beal (1918); USACHPPM (2004)	Estimated based on proportion of flying (emergent aquatic) insects.
Bird	Invertivore	Tree Swallow	P_{am}	Proportion of Diet - Amphibians	--	kg diet item, ww/kg diet, ww	USACHPPM (2004)	Assumed not to be consumed.
Bird	Invertivore	Tree Swallow	P_{ff}	Proportion of Diet - Forage Fish	--	kg diet item, ww/kg diet, ww	USACHPPM (2004)	Assumed not to be consumed.
Bird	Invertivore	Tree Swallow	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww	USACHPPM (2004)	Assumed not to be consumed.
Bird	Invertivore	Tree Swallow	P_{s}	Proportion of Diet - Sediment	--	kg sediment, dw/kg diet, dw	Divine et al. (2020)	Assumed negligible based on feedng strategy.
Bird	Invertivore	Tree Swallow	IR_{W}	Daily Water Ingestion	0.0040	L water/day	USEPA (1993)	IR L/day= IR (L/kg)*BW (kg)
Bird	Invertivore	Tree Swallow	HR	Home Range	194	acres	Custer et al. (2019)	Tree swallows feed within approximately 0.5 km of their nest boxes (Stapleton and Robertson 2006, as cited in Custer et al. 2019); therefore, home range was calculated as area from nest using 0.5 km as radius.
Bird	Invertivore	Spotted sandpiper	BW	Body Weight	0.043	kg	USEPA (1993)	Average values reported for adult male and female spotted sandpipers (USEPA 1993).
Bird	Invertivore	Spotted sandpiper	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.0076	kg, dw/day	Nagy (2001)	Calculated using DW allometric equation for insectivore birds: FIR (dw) = 0.54 x BW ^ 0.705
Bird	Invertivore	Spotted sandpiper	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.0230	kg, ww/day	Nagy (2001)	Calculated using WW allometric equation for insectivore birds: FIR (ww) = 1.633 x BW ^ 0.705
Bird	Invertivore	Spotted sandpiper	P_{veg}	Proportion of Diet - Vegetation	--	kg diet item, ww/kg diet, ww	USEPA (1993)	Assumed not to be consumed.
Bird	Invertivore	Spotted sandpiper	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.80	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated based on USEPA (1993: Adult flying insects comprise the bulk of the diet; however, crustaceans, leeches, molluscs, small fish, and carrion also are eaten.
Bird	Invertivore	Spotted sandpiper	P_{ai}	Proportion of Diet - Aquatic Invertebrates	0.15	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated based on USEPA (1993: Adult flying insects comprise the bulk of the diet; however, crustaceans, leeches, molluscs, small fish, and carrion also are eaten.
Bird	Invertivore	Spotted sandpiper	P_{am}	Proportion of Diet - Amphibians	--	kg diet item, ww/kg diet, ww	USEPA (1993)	Assumed not to be consumed based on reported diet contents.
Bird	Invertivore	Spotted sandpiper	P_{ff}	Proportion of Diet - Forage Fish	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Assumed only to consume small fish.
Bird	Invertivore	Spotted sandpiper	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww	USEPA (1993)	Assumed not to be consumed.
Bird	Invertivore	Spotted sandpiper	P_{s}	Proportion of Diet - Sediment	0.073	kg sediment, dw/kg diet, dw	USEPA (1993)	Soil/sediment estimated in Least sandpiper diet (USEPA, 1993).
Bird	Invertivore	Spotted sandpiper	IR_{W}	Daily Water Ingestion	0.054	L water/day	USEPA (1993)	IR L/day= IR (L/kg)*BW (kg); Sandpiper used as surrogate

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Receptor Type	Feeding Guild	Species	Parameter	Definition	Value	Units	Reference	Notes
Bird	Invertivore	Spotted sandpiper	HR	Home Range	5.0	acres	CDFW (2021)	In New York, 3 individually marked breeding females fed and displayed over areas of 1.06,1.8, and 3.2 ha (2.5, 4.5 and 8.0 acres), with an average home range of 2.02 ha (5 acres) (Hays 1972, as cited in CDFW 2021).
Bird	Piscivore	Great Blue Heron	BW	Body Weight	2.4	kg	USEPA (1993)	
Bird	Piscivore	Great Blue Heron	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.11	kg, dw/day	USEPA (1993)	Calculated from the ww-based FIR, assuming an 75% moisture content of food (i.e., 0.25 g, dw/g, ww).
Bird	Piscivore	Great Blue Heron	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.43	kg, ww/day	USEPA (1993)	FIR kg/day= WW FIR (kg/kg-day)*BW (kg) with FIR (kg/kg-day) of 0.18 from USEPA (1993)
Bird	Piscivore	Great Blue Heron	P_{veg}	Proportion of Diet - Vegetation	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents; consult additional literature for more information.
Bird	Piscivore	Great Blue Heron	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.15	kg diet item, ww/kg diet, ww	USEPA (1993)	Fish are the preferred prey, but great blues also eat amphibians, reptiles, crustaceans, insects, birds, and Mammals
Bird	Piscivore	Great Blue Heron	P_{ai}	Proportion of Diet - Aquatic Invertebrates	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents
Bird	Piscivore	Great Blue Heron	P_{am}	Proportion of Diet - Amphibians	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Fish are the preferred prey, but great blues also eat amphibians, reptiles, crustaceans, insects, birds, and Mammals
Bird	Piscivore	Great Blue Heron	P_{ff}	Proportion of Diet - Forage Fish	0.80	kg diet item, ww/kg diet, ww	USEPA (1993)	Fish are the preferred prey, but great blues also eat amphibians, reptiles, crustaceans, insects, birds, and mammals
Bird	Piscivore	Great Blue Heron	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents; consult additional literature for more information.
Bird	Piscivore	Great Blue Heron	P_{s}	Proportion of Diet - Sediment	0.0040	kg sediment, dw/kg diet, dw	USEPA (1993)	Assumed to be approximately 20% of the value assumed for the Mallard, which was obtained from Table 4-4 in USEPA (1993)
Bird	Piscivore	Great Blue Heron	IR_{W}	Daily Water Ingestion	0.11	L water/day	USEPA (1993)	IR L/day= IR (L/kg)*BW (kg)
Bird	Piscivore	Great Blue Heron	HR	Home Range	11	acres	USEPA (1993)	Average of Fall and Winter homeranges
Mammal	Herbivore	Muskrat	BW	Body Weight	1.6	kg	MN DNR (2020)	Average of all adult body weights in MN (https://www.dnr.state.mn.us/Mammals/muskrat.html)
Mammal	Herbivore	Muskrat	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.14	kg, dw/day	USEPA (1993)	Calculated from the ww-based FIR, assuming an 75% moisture content of food (i.e., 0.25 g, dw/g, ww).
Mammal	Herbivore	Muskrat	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.54	kg, ww/day	USEPA (1993)	FIR kg/day= WW FIR (kg/kg-day)*BW (kg) with FIR (kg/kg-day) of 0.34 from USEPA (1993)
Mammal	Herbivore	Muskrat	P_{veg}	Proportion of Diet - Vegetation	0.80	kg diet item, ww/kg diet, ww	USEPA (1993)	Primarily herbivorous.
Mammal	Herbivore	Muskrat	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.10	kg diet item, ww/kg diet, ww	USEPA (1993)	Primarily herbivorous.
Mammal	Herbivore	Muskrat	P_{ai}	Proportion of Diet - Aquatic Invertebrates	0.10	kg diet item, ww/kg diet, ww	USEPA (1993)	Primarily herbivorous.
Mammal	Herbivore	Muskrat	P_{am}	Proportion of Diet - Amphibians	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents.
Mammal	Herbivore	Muskrat	P_{ff}	Proportion of Diet - Forage Fish	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents.
Mammal	Herbivore	Muskrat	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents.
Mammal	Herbivore	Muskrat	P_{s}	Proportion of Diet - Sediment	0.020	kg sediment, dw/kg diet, dw	USEPA (1993)	Meadow Vole used as a surrogate
Mammal	Herbivore	Muskrat	IR_{W}	Daily Water Ingestion	0.88	L water/day	USEPA (1993)	Max reported; IR L/day= IR (L/kg)*BW (kg)
Mammal	Herbivore	Muskrat	HR	Home Range	0.32	acres	USEPA (1993)	Average HR reported (0.13 ha) converted to acres.
Mammal	Invertivore	Little Brown Bat	BW	Body Weight	0.0085	kg	MN DNR (2020)	Average of adult little brown bats in Minnesota (https://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=AMACC01010)
Mammal	Invertivore	Little Brown Bat	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.0016	kg, dw/day	Nagy (2001)	Measured value for little brown bat (dry matter intake).
Mammal	Invertivore	Little Brown Bat	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.0049	kg, ww/day	Nagy (2001)	Measured value for little brown bat (fresh matter intake).
Mammal	Invertivore	Little Brown Bat	P_{veg}	Proportion of Diet - Vegetation	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on strict aerial insect diet.
Mammal	Invertivore	Little Brown Bat	P_{bi}	Proportion of Diet - Benthic Invertebrates	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on strict aerial insect diet.
Mammal	Invertivore	Little Brown Bat	P_{ai}	Proportion of Diet - Aquatic Invertebrates	1.0	kg diet item, ww/kg diet, ww	Fenton and Barclay (1980); cited in Sample et al. (1997)	Based on strict aerial insect diet, i.e., aquatic (emergent aerial) insects.
Mammal	Invertivore	Little Brown Bat	P_{am}	Proportion of Diet - Amphibians	--	kg diet item, ww/kg diet, ww	Sample et al. (1997)	Assumed not to be consumed based on strict aerial insect diet.
Mammal	Invertivore	Little Brown Bat	P_{ff}	Proportion of Diet - Forage Fish	--	kg diet item, ww/kg diet, ww	Sample et al. (1997)	Assumed not to be consumed based on strict aerial insect diet.

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Receptor Type	Feeding Guild	Species	Parameter	Definition	Value	Units	Reference	Notes
Mammal	Invertivore	Little Brown Bat	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww	Sample et al. (1997)	Assumed not to be consumed based on strict aerial insect diet.
Mammal	Invertivore	Little Brown Bat	P_{so}	Proportion of Diet - Sediment	--	kg sediment, dw/kg diet, dw	Sample et al. (1997)	Assumed negligible based on feeding strategy.
Mammal	Invertivore	Little Brown Bat	IR_W	Daily Water Ingestion	0.001	L water/day	USEPA (1993)	IR L/day= IR (L/kg)*BW (kg)
Mammal	Invertivore	Little Brown Bat	HR	Home Range	74	acres	Henry et al. (2002); Divine et al. (2020)	Home-range size of pregnant little brown bat on Grosse-Ile, Quebec, Canada, summers of 1999 and 2000 (Henry et al. 2002, as cited in Divine et al. 2020).
Mammal	Omnivore	Raccoon	BW	Body Weight	8.6	kg	MN DNR (2020)	Average of adult raccoon in Minnesota (https://www.dnr.state.mn.us/Mammals/raccoon.html)
Mammal	Omnivore	Raccoon	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.05	kg, dw/day	Nagy (2001)	Calculated from the ww-based FIR, assuming an 75% moisture content of food (i.e., 0.25 g, dw/g, ww).
Mammal	Omnivore	Raccoon	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.20	kg, dw/day	Nagy (2001)	Calculated using DW allometric equation for omnivorous Mammals: FIR (dw) = 0.432 x BW ^ 0.678
Mammal	Omnivore	Raccoon	P_{veg}	Proportion of Diet - Vegetation	0.45	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from listed diet of vegetation in USEPA (1993)
Mammal	Omnivore	Raccoon	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.40	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from listed diet of crayfish and portion of invertebrates in USEPA (1993)
Mammal	Omnivore	Raccoon	P_{ai}	Proportion of Diet - Aquatic Invertebrates	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from portion of invertebrates diet in USEPA (1993)
Mammal	Omnivore	Raccoon	P_{am}	Proportion of Diet - Amphibians	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from portion of amphibians diet in USEPA (1993)
Mammal	Omnivore	Raccoon	P_{ff}	Proportion of Diet - Forage Fish	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from portion of fish and rodents diet in USEPA (1993)
Mammal	Omnivore	Raccoon	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww	USEPA (1993)	Assumed not to be consumed based on reported diet contents; consult additional literature for more information.
Mammal	Omnivore	Raccoon	P_s	Proportion of Diet - Sediment	0.094	kg sediment, dw/kg diet, dw	USEPA (1993)	Estimated percent soil in diet (dw)
Mammal	Omnivore	Raccoon	IR_W	Daily Water Ingestion	0.41	L water/day	USEPA (1993)	Max reported; IR L/day= IR (L/kg)*BW (kg); River Otter used as surrogate
Mammal	Omnivore	Raccoon	HR	Home Range	385	acres	USEPA (1993)	Based on the average home range of both sexes within Michigan riparian habitat.

Abbreviations:
dw - dry weight
kg - kilogram
L - liters
ww - wet weight

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Table 3. Bioaccumulation Parameters
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	Literature-based Aquatic Bioaccumulation Parameters							
	Water to Aquatic Plant BAF (L water / kg tissue)				Water to Aquatic Invertebrate BAF (L water / kg tissue)			
Analyte	Value (tissue dw)	Value (tissue ww)[a]	Reference	Notes	Aquatic/Benthic Invert. Value (tissue dw)[b]	Aquatic/Benthic Invert. Value (tissue ww)[c]	Reference	Notes
PFCAs								
PFBA	19	2.8	Divine et al. (2020); Zodrow et al. (2020)	Geomean	298	54	Zodrow et al. (2020) (Surrogate - PFBS)	
PFHxA	191	27.7	Divine et al. (2020); Zodrow et al. (2020)	Geomean	2238	403	Divine et al. (2020); Zodrow et al. (2020)	Geomean
PFHpA	228	33.06	Surrogate - PFOA		351	63	Divine et al. (2020)	Geomean
PFOA	228	33	Divine et al. (2020); Zodrow et al. (2020)	Geomean	379	68	Divine et al. (2020); Zodrow et al. (2020)	Geomean
PFNA	5,188	752	Divine et al. (2020); Zodrow et al. (2020)	Geomean	983	177	Divine et al. (2020); Zodrow et al. (2020)	Geomean
PFDA	12,360	1,792	Divine et al. (2020)	Geomean	707	127	Divine et al. (2020)	Geomean
PFUnA	12,360	1,792	Surrogate - PFDA		707	127	Surrogate - PFDA	
PFDoA	12,360	1,792	Surrogate - PFDA		707	127	Surrogate - PFDA	
PFTrDA	12,360	1,792	Surrogate - PFDA		707	127	Surrogate - PFDA	
PFTeDA	12,360	1,792	Surrogate - PFDA		707	127	Surrogate - PFDA	
PFSAs								
PFBS	8.0	1.2	Divine et al. (2020); Zodrow et al. (2020)	Geomean	298	54	Divine et al. (2020); Zodrow et al. (2020)	Geomean
PFPeS	8.0	1.2	Surrogate - PFBS		1327	239	Surrogate - PFHxS	
PFHxS	12	1.7	Divine et al. (2020)	Geomean	1327	239	Divine et al. (2020)	Geomean
PFHpS	228	33	Surrogate - PFOA		1549	279	Surrogate - PFOS	
PFOS	1,305	189	Divine et al. (2020); Zodrow et al. (2020)	Geomean	1549	279	Divine et al. (2020); Zodrow et al. (2020)	Geomean
PFNS	1,305	189	Surrogate - PFOS		1549	279	Surrogate - PFOS	
PFDS	1,305	189	Surrogate - PFOS		1549	279	Surrogate - PFOS	
PFDoS	1,305	189	Surrogate - PFOS		1549	279	Surrogate - PFOS	
FOSA, FASE, FASAAs								
PFOSA	1,305	189	Surrogate - PFOS		1549	279	Surrogate - PFOS	
N-EtFOSAA	1,305	189	Surrogate - PFOS		1549	279	Surrogate - PFOS	
Fluortelomers								
6:2 FTS	12	1.7	Surrogate - PFHxS		1327	239	Surrogate - PFHxS	

PFAS Abbreviations:
FASAA - perrfluoroalkane sulfonamido acetic acids
FASE - perfluoroalkane sulfonamido ethanols
FOSA - perfluorooctane sulfonamides
N-EtFOSAA - N-Ethylperfluorooctane sulfonamidoacetic acid
PFAS - Per- and polyfluoroalkyl substances
PFBA - Perfluorobutanoic acid
PFBS - Perfluorobutanesulfonic acid
PFCA - Perfluoroalkyl carboxylic acids
PFDA - Perfluorodecanoic acid
PFDoA - Perfluorododecanoic acid
PFDoS - Perfluorododecane sulfonic acid
PFDS - Perfluorodecane sulfonic acid
PFHpA - Perfluoroheptanoic acid
PFHpS - Perfluoroheptane sulfonic acid

PFAS Abbreviations Cont.:
PFHxA - Perfluorohexanoic acid
6:2 FTS - 6:2 Fluorotelomer sulfonic acid
PFHxS - Perfluorohexanesulfonic acid
PFNA - Perfluorononanoic acid
PFNS - Perfluoroonoane sulfonic acid
PFOA - Perfluorooctanoic acid
PFOS - Perfluorooctanesulfonic acid
PFOSA - Perfluorooctane sulfonamide
PFPeS - Perfluoropentane sulfonic acid
PFSA- perfluoroalkane sulfonic acids
PFTeDA - Perfluorotetradecanoic acid
PFTrDA - Perfluorotridecanoic acid
PFUnA - Perfluoroundecanoic acid

Addditional Abbreviations:
BAF - Bioaccumulation Factor
dw - dry weight
kg - kilogram
L - liter
ww - wet weight

Notes:
a: Converted to ww tissue using 85.5% moisture content (average of algae [84%] and aquatic macrophytes [87%]; Table 4-2 EPA 1993)
b: Converted to ww tissue using 82% moisture content (bivalves (without shell); Table 4-1 EPA 1993)
c: Aquatic/Benthic Invert Values are based on filter-feeding benthic invertebrates (oyster, mussel, gastropod, snail, other bivalves) and were selected to represent aquatic invertebrates (including aerial insects) exposed to PFAS in water. Filter-feeding benthic invertebrates are expected to have exposure to

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Appendix H Food Web Model – Raleigh Creek – Other
Table 4 Toxicity Reference Values for Birds
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Analyte	TRVs for Birds (µg/kg-day)							
	NOAEL	Basis	Reference	Additional Details	LOAEL	Basis	Reference	Additional Details
PFCAs								
PFBA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFHxA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFHpA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFOA	1,000	No effect on growth (body weight) of 1-day old chickens; exposed to PFOA/PFDA/PFOS mixture	Conder et al. (2020)	Yeueng et al. 2009	10,000	Application of a NOAEL-to-LOAEL adjustment factor of 10	Adjustment factor consistent with Divine et al. (2020), Zodrow et al. (2020), and USEPA (2005)	--
PFNA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFDA	1,000	No effect on growth (body weight) of 1-day old chickens; exposed to PFOA/PFDA/PFOS mixture	Conder et al. (2020)	Yeueng et al. 2009	10,000	Application of a NOAEL-to-LOAEL adjustment factor of 10	Adjustment factor consistent with Divine et al. (2020), Zodrow et al. (2020), and USEPA (2005)	--
PFUnA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFDoA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFTrDA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFTeDA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFSAs								
PFBS	92,000	No effect on survival and reproduction in Bobwhite Quail	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Gallagher et al. 2005)	153,000	Lowest bounded LOAEL (Effect on growth in Bobwhite Quail)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Gallagher et al. 2003a)
PFPeS	92,000	Surrogate - PFBS	--	--	153,000	Surrogate - PFBS	--	--
PFHxS	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
PFHpS	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
PFOS	79.0	No effect on reproduction and survival in Bobwhite Quail	Divine et al. (2020) & Zodrow et al. (2020)	Gallagher et al. 2003c (Derived by applying UF of 10 to selected lowest LOAEL)	790	Lowest bounded LOAEL (Effect on reproduction and survival in Bobwhite Quail; exposure included during sensitive life stage, i.e., egg-laying)	Divine et al. (2020) & Zodrow et al. (2020)	Gallagher et al. 2003c (Lowest LOAEL selected due to limited available avian data & study based on sensitive life stage)
PFNS	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
PFDS	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
PFDoS	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
FOSA, FASE, FASAAs								
PFOSA	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
N-EtFOSAA	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
Fluortelomers								
6:2 FTS	1000	Surrogate - PFOA	--	--	10000	Surrogate - PFOA	--	--

Notes:
TRVs were selected from the following hierarchy due to preference for EcoSSL TRV-derivation approach (USEPA 2005) and that Zodrow et al. (2020) has been peer reviewed:

1. Divine et al. (2020) and/or Zodrow et al. (2020)
2. Condor et al. (2020)

Abbreviations:
See Table 3 for PFAS abbreviations
µg/kg-day - micrograms per kilogram body weight per day
EcoSSL - Ecological Soil Screening Level
LOAEL - lowest observed adverse effects level
NOAEL - no observed adverse effects level
TRV - toxicity reference value
USEPA - United States Environmental Protection Agency

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Appendix H Food Web Model – Raleigh Creek – Other
Table 5 Toxicity Reference Values for Mammals
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Analyte	TRVs for Mammals (µg/kg-day)							
	NOAEL	Basis	Reference	Additional Details	LOAEL	Basis	Reference	Additional Details
PFCAs								
PFBA	73,000	No effect on growth or reproduction	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (four studies)	175,000	Lowest bounded LOAEL (Effect on reproduction)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Das et al. 2008)
PFHxA	84,000	No effect on growth, reproduction, or survivial	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (geometric mean of 6 studies)	175,000	Lowest bounded LOAEL (Effect on reproduction & survival in mice)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Iwai and Hoberman 2014)
PFHpA	300	Surrogate - PFOA	--	--	600	Surrogate - PFOA	--	--
PFOA	300	No effect on growth, reproduction, or survival	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (two studies)	600	Lowest bounded LOAEL (Effect on reproduction & survival in mice)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Abbott et al. 2007)
PFNA	830	No effect on reproduction (# live pups) in mice	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Wolf et al. 2010)	1,100	Lowest bounded LOAEL (decreased reproduction in mice)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Wolf et al. 2010)
PFDA	100	No effect on growth (fetal body weight per litter) in pregnant mice	Conder et al. (2020)	Harris and Birnbaum (1989)	6,400	23% control-adjusted decrease in growth (fetal body weight per litter) in pregnant mice	Conder et al. (2020)	Harris and Birnbaum (1989)
PFUnA	300	No effect on growth (body weight in adults and pups) in rats	Conder et al. (2020)	Takahashi et al. (2014)	1,000	13-19% control-adjusted decrease in growth (body weight of pups) in rats	Conder et al. (2020)	Takahashi et al. (2014)
PFDoA	500	No effect on growth (body weight in adults and pups) in rats	Conder et al. (2020)	Kato et al. (2015)	2,500	20-40% control-adjusted decrease in growth (body weight in adults and pups) in rats	Conder et al. (2020)	Kato et al. (2015)
PFTrDA	500	Surrogate - PFDoDA	--	--	2,500	Surrogate - PFDoDA	--	--
PFTeDA	3,000	No effect on growth (body weight in adults and pups) in rats	Conder et al. (2020)	Hirata-Koizumi et al. (2015)	10,000	8-18% control-adjusted decrease in growth (body weight of pups) in rats	Conder et al. (2020)	Hirata-Koizumi et al. (2015)
PFSAs								
PFBS	50,000	No effect on reproduction in mice	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Feng et al. 2017)	200,000	Lowest bounded LOAEL (Effect on reproduction in mice)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Feng et al. 2017)
PFPeS	50,000	Surrogate - PFBS	--	--	200,000	Surrogate - PFBS	--	--
PFHxS	300	No effect on reproduction (litter size) in mice	Conder et al. (2020)	Chang et al. (2018)	1,000	14% control-adjusted decrease in reproduction (litter size) in mice	Conder et al. (2020)	Chang et al. (2018)
PFHpS	300	Surrogate - PFHxS	--	--	1,000	Surrogate - PFHxS	--	--
PFOS	100	No effect on growth, reproduction, or survivial	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (multiple studies)	170	Lowest bounded LOAEL (Effect on reproduction in mice)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Fair et al. 2011)
PFNS	100	Surrogate - PFOS	--	--	170	Surrogate - PFOS	--	--
PFDS	100	Surrogate - PFOS	--	--	170	Surrogate - PFOS	--	--
PFDoS	100	Surrogate - PFOS	--	--	170	Surrogate - PFOS	--	--

Appendix H Food Web Model – Raleigh Creek – Other
Table 5 Toxicity Reference Values for Mammals
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Analyte	TRVs for Mammals (µg/kg-day)							
	NOAEL	Basis	Reference	Additional Details	LOAEL	Basis	Reference	Additional Details
FOSA, FASE, FASAAs								
PFOSA	100	Surrogate - PFOS	--	--	170	Surrogate - PFOS	--	--
N-EtFOSAA	100	Surrogate - PFOS	--	--	170	Surrogate - PFOS	--	--
Fluortelomers								
6:2 FTS	300	Surrogate - PFHxS	--	--	1,000	Surrogate - PFHxS	--	--

Notes:
TRVs were selected from the following hierarchy due to preference for EcoSSL TRV-derivation approach (USEPA 2005) and that Zodrow et al. (2020) has been peer reviewed:

1. Divine et al. (2020) and/or Zodrow et al. (2020)
2. Condor et al. (2020)

Abbreviations:
See Table 3 for PFAS abbreviations
µg/kg-day - micrograms per kilogram body weight per day
EcoSSL - Ecological Soil Screening Level
LOAEL - lowest observed adverse effects level
NOAEL - no observed adverse effects level
TRV - toxicity reference value
USEPA - United States Environmental Protection Agency

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Appendix H Food Web Model – Raleigh Creek – Other
Table 6. Exposure Point Concentrations
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Analyte	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Aquatic Plant EPC (µg/kg, ww)		Aquatic Invertebrate (µg/kg, ww)		Benthic Invertebrate (µg/kg, ww)		Amphibian (µg/kg, ww)		Forage Fish (µg/kg, ww)	
			EPC	Basis	EPC	Basis	EPC	Basis	EPC	Basis	EPC	Basis
PFCAs												
PFBA	0.53	0.11	0.29	Calculated	5.7	Calculated	2.0	UCL	0.95	Maximum	0.66	UCL
PFHxA	0.19	0.014	0.39	Calculated	5.6	Calculated	0.18	Maximum	ND		ND	
PFHpA	0.083	0.013	0.42	Calculated	0.80	Calculated	0.38	UCL	ND		ND	
PFOA	0.33	0.10	3.3	Calculated	6.9	Calculated	2.7	UCL	ND		0.25	UCL
PFNA	0.084	0.0012	0.91	Calculated	0.21	Calculated	0.46	UCL	ND		0.46	UCL
PFDA	0.13	0.0010	1.7	Calculated	0.12	Calculated	0.88	UCL	0.62	Maximum	3.9	UCL
PFUnA	0.27	ND	NC		NC		0.69	UCL	0.58	Maximum	1.1	UCL
PFDoA	0.09	ND	NC		NC		0.86	UCL	0.60	Maximum	0.97	UCL
PFTrDA	ND	0.00069	1.2	Calculated	0.088	Calculated	0.42	UCL	0.34	Maximum	0.45	UCL
PFTeDA	0.22	0.0046	8.2	Calculated	0.59	Calculated	0.40	UCL	0.30	Maximum	0.49	UCL
PFSAs												
PFBS	ND	0.0041	0.0048	Calculated	0.22	Calculated	0.58	Maximum	ND		ND	
PFPeS	ND	0.0033	0.0038	Calculated	0.78	Calculated	0.37	Maximum	ND		ND	
PFHxS	0.086	0.013	0.022	Calculated	3.0	Calculated	0.54	UCL	ND		0.45	Maximum
PFHpS	ND	0.0022	0.072	Calculated	0.61	Calculated	0.20	Maximum	ND		0.34	Maximum
PFOS	6.5	0.28	53.7	Calculated	79.2	Calculated	24.7	UCL	43.2	Maximum	370	UCL
PFNS	0.057	ND	NC		NC		ND		0.10	Maximum	0.71	UCL
PFDS	0.098	ND	NC		NC		0.16	UCL	0.23	Maximum	0.89	UCL
PFDoS	ND	ND	NC		NC		0.10	Maximum	ND		ND	
FOSA, FASE, FASAAs												
PFOSA	0.29	0.0019	0.36	Calculated	0.53	Calculated	6.2	UCL	0.14	Maximum	4.2	UCL
N-EtFOSAA	0.49	0.0016	0.30	Calculated	0.44	Calculated	0.17	Maximum	0.17	Maximum	0.98	Maximum
Fluortelomers												
6:2 FTS	1.8	0.014	0.024	Calculated	3.3	Calculated	1.5	Maximum	ND		0.49	Maximum

Notes:
EPCs were selected as the lower of the selected UCL and maximum detected concentration (see Appendix D)
Site-specific empirical data were selected over modeled values when available:
Benthic invertebrates = crayfish
Amphibians = green frogs and tadpoles
Forage fish = mudminnow, green sunfish, darter, and red ear sunfish
When empirical data were lacking, tissue EPCs were calculated by multiplying the surface water EPC by the analyte- and tissue-specific bioaccumulation parameter (see Table 3).

Additional Abbreviations:
See Table 3 for PFAS abbreviations
µg - micrograms
UCL - upper confidence limit of the arithmetic mean
dw - dry weight
EPC - exposure point concentration
kg - kilogram
L - liters
ww - wet weight

Appendix H Food Web Model – Raleigh Creek – Other
Table 7. Potential Risks to the Wood Duck
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Raleigh Creek - Other	
Assumptions for the Wood Duck	
Body Weight (kg)	0.70
Seasonal Use Factor	1
Site-Specific Area Use Factor	0.0077
Sediment Ingestion Rate (kg_{dw}/day)	0.0098
Water Ingestion Rate (kg/day)	0.041
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.0064
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.0064
Plant Ingestion Rate (kg_{ww}/day)	0.11

Total Daily Dose = $\frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_s = Incidental ingestion rate of sediment (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_s= Concentration of PFAS in sediment (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations					Potential Daily Dose (ug/kg_{bw}/day)						NOAEL-based TRV (µg/kg_{bw}/day)	NOAEL-based HQ	LOAEL-based TRV (µg/kg_{bw}/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Aquatic Invertebrate EPC (µg/kg, ww)	Plant EPC (µg/kg, ww)	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Benthic Invertebrate	Aquatic Invertebrate	Plant	Sediment	Surface Water	Total				
PFCAs															
PFBA	2.0E+00	5.7E+00	2.9E-01	5.3E-01	1.1E-01	1.4E-04	4.0E-04	3.7E-04	5.7E-05	4.8E-05	1.0E-03	1.0E+03	1.0E-06	1.0E+04	1.0E-07
PFHxA	1.8E-01	5.6E+00	3.9E-01	1.9E-01	1.4E-02	1.3E-05	4.0E-04	4.9E-04	2.1E-05	6.3E-06	9.3E-04	1.0E+03	9.3E-07	1.0E+04	9.3E-08
PFHpA	3.8E-01	8.0E-01	4.2E-01	8.3E-02	1.3E-02	2.7E-05	5.6E-05	5.3E-04	9.0E-06	5.7E-06	6.2E-04	1.0E+03	6.2E-07	1.0E+04	6.2E-08
PFOA	2.7E+00	6.9E+00	3.3E+00	3.3E-01	1.0E-01	1.9E-04	4.8E-04	4.2E-03	3.6E-05	4.5E-05	5.0E-03	1.0E+03	5.0E-06	1.0E+04	5.0E-07
PFNA	4.6E-01	2.1E-01	9.1E-01	8.4E-02	1.2E-03	3.3E-05	1.5E-05	1.2E-03	9.1E-06	5.4E-07	1.2E-03	1.0E+03	1.2E-06	1.0E+04	1.2E-07
PFDA	8.8E-01	1.2E-01	1.7E+00	1.3E-01	9.6E-04	6.2E-05	8.6E-06	2.2E-03	1.3E-05	4.3E-07	2.3E-03	1.0E+03	2.3E-06	1.0E+04	2.3E-07
PFUnA	6.9E-01	NC	NC	2.7E-01	ND	4.9E-05	NC	NC	2.9E-05	NC	7.8E-05	1.0E+03	7.8E-08	1.0E+04	7.8E-09
PFDoA	8.6E-01	NC	NC	9.3E-02	ND	6.1E-05	NC	NC	1.0E-05	NC	7.1E-05	1.0E+03	7.1E-08	1.0E+04	7.1E-09
PFTrDA	4.2E-01	8.8E-02	1.2E+00	ND	6.9E-04	2.9E-05	6.2E-06	1.6E-03	NC	3.1E-07	1.6E-03	1.0E+03	1.6E-06	1.0E+04	1.6E-07
PFTeDA	4.0E-01	5.9E-01	8.2E+00	2.2E-01	4.6E-03	2.8E-05	4.1E-05	1.0E-02	2.3E-05	2.1E-06	1.1E-02	1.0E+03	1.1E-05	1.0E+04	1.1E-06
PFSAs															
PFBS	5.8E-01	2.2E-01	4.8E-03	ND	4.1E-03	4.0E-05	1.6E-05	6.1E-06	NC	1.9E-06	6.4E-05	9.2E+04	6.9E-10	1.5E+05	4.2E-10
PFPeS	3.7E-01	7.8E-01	3.8E-03	ND	3.3E-03	2.6E-05	5.5E-05	4.8E-06	NC	1.5E-06	8.8E-05	9.2E+04	9.5E-10	1.5E+05	5.7E-10
PFHxS	5.4E-01	3.0E+00	2.2E-02	8.6E-02	1.3E-02	3.8E-05	2.1E-04	2.8E-05	9.3E-06	5.7E-06	2.9E-04	7.9E+01	3.7E-06	7.9E+02	3.7E-07
PFHpS	2.0E-01	6.1E-01	7.2E-02	ND	2.2E-03	1.4E-05	4.3E-05	9.2E-05	NC	9.8E-07	1.5E-04	7.9E+01	1.9E-06	7.9E+02	1.9E-07
PFOS	2.5E+01	7.9E+01	5.4E+01	6.5E+00	2.8E-01	1.7E-03	5.6E-03	6.8E-02	7.0E-04	1.3E-04	7.6E-02	7.9E+01	9.6E-04	7.9E+02	9.6E-05
PFNS	ND	NC	NC	5.7E-02	ND	NC	NC	NC	6.2E-06	NC	6.2E-06	7.9E+01	7.8E-08	7.9E+02	7.8E-09
PFDS	1.6E-01	NC	NC	9.8E-02	ND	1.2E-05	NC	NC	1.1E-05	NC	2.2E-05	7.9E+01	2.8E-07	7.9E+02	2.8E-08
PFDoS	9.9E-02	NC	NC	ND	ND	7.0E-06	NC	NC	NC	NC	7.0E-06	7.9E+01	8.8E-08	7.9E+02	8.8E-09
FOSA, FASE, FASAAs															
PFOSA	6.2E+00	5.3E-01	3.6E-01	2.9E-01	1.9E-03	4.3E-04	3.7E-05	4.6E-04	3.2E-05	8.6E-07	9.6E-04	7.9E+01	1.2E-05	7.9E+02	1.2E-06
N-EtFOSAA	1.7E-01	4.4E-01	3.0E-01	4.9E-01	1.6E-03	1.2E-05	3.1E-05	3.8E-04	5.3E-05	7.1E-07	4.8E-04	7.9E+01	6.0E-06	7.9E+02	6.0E-07
Fluortelomers															
6:2 FTS	1.5E+00	3.3E+00	2.4E-02	1.8E+00	1.4E-02	1.1E-04	2.3E-04	3.0E-05	1.9E-04	6.1E-06	5.6E-04	1.0E+03	5.6E-07	1.0E+04	5.6E-08

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
UCL - upper confidence limit of the arithmetic mean
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
ww - wet weight

Appendix H Food Web Model – Raleigh Creek – Other
Table 8. Potential Risks to the Tree Swallow
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Raleigh Creek - Other	
Assumptions for the Tree Swallow	
Body Weight (kg)	0.020
Seasonal Use Factor	1
Site-Specific Area Use Factor	0.031
Water Ingestion Rate (kg/day)	0.0040
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.0092
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.020
Plant Ingestion Rate (kg_{ww}/day)	0.0060

Total Daily Dose = $\frac{\Sigma([IR_f \times C_f] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations				Potential Daily Dose (ug/kg_{bw}/day)					NOAEL-based TRV ($\mu g/kg_{bw}$/day)	NOAEL-based HQ	LOAEL-based TRV ($\mu g/kg_{bw}$/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Aquatic Invertebrate EPC (µg/kg, ww)	Plant EPC (µg/kg, ww)	Surface Water EPC (µg/L)	Benthic Invertebrate	Aquatic Invertebrate	Plant	Surface Water	Total				
PFCAs													
PFBA	2.0E+00	5.7E+00	2.9E-01	1.1E-01	2.8E-02	1.8E-01	2.7E-03	6.6E-04	2.1E-01	1.0E+03	2.1E-04	1.0E+04	2.1E-05
PFHxA	1.8E-01	5.6E+00	3.9E-01	1.4E-02	2.6E-03	1.7E-01	3.6E-03	8.6E-05	1.8E-01	1.0E+03	1.8E-04	1.0E+04	1.8E-05
PFHpA	3.8E-01	8.0E-01	4.2E-01	1.3E-02	5.3E-03	2.4E-02	3.8E-03	7.7E-05	3.4E-02	1.0E+03	3.4E-05	1.0E+04	3.4E-06
PFOA	2.7E+00	6.9E+00	3.3E+00	1.0E-01	3.8E-02	2.1E-01	3.1E-02	6.2E-04	2.8E-01	1.0E+03	2.8E-04	1.0E+04	2.8E-05
PFNA	4.6E-01	2.1E-01	9.1E-01	1.2E-03	6.5E-03	6.6E-03	8.3E-03	7.4E-06	2.1E-02	1.0E+03	2.1E-05	1.0E+04	2.1E-06
PFDA	8.8E-01	1.2E-01	1.7E+00	9.6E-04	1.2E-02	3.7E-03	1.6E-02	5.9E-06	3.2E-02	1.0E+03	3.2E-05	1.0E+04	3.2E-06
PFUnA	6.9E-01	NC	NC	ND	9.7E-03	NC	NC	NC	9.7E-03	1.0E+03	9.7E-06	1.0E+04	9.7E-07
PFDoA	8.6E-01	NC	NC	ND	1.2E-02	NC	NC	NC	1.2E-02	1.0E+03	1.2E-05	1.0E+04	1.2E-06
PFTrDA	4.2E-01	8.8E-02	1.2E+00	6.9E-04	5.9E-03	2.7E-03	1.1E-02	4.2E-06	2.0E-02	1.0E+03	2.0E-05	1.0E+04	2.0E-06
PFTeDA	4.0E-01	5.9E-01	8.2E+00	4.6E-03	5.6E-03	1.8E-02	7.6E-02	2.8E-05	9.9E-02	1.0E+03	9.9E-05	1.0E+04	9.9E-06
PFSAs													
PFBS	5.8E-01	2.2E-01	4.8E-03	4.1E-03	8.1E-03	6.8E-03	4.4E-05	2.5E-05	1.5E-02	9.2E+04	1.6E-07	1.5E+05	9.8E-08
PFPeS	3.7E-01	7.8E-01	3.8E-03	3.3E-03	5.2E-03	2.4E-02	3.5E-05	2.0E-05	2.9E-02	9.2E+04	3.2E-07	1.5E+05	1.9E-07
PFHxS	5.4E-01	3.0E+00	2.2E-02	1.3E-02	7.5E-03	9.3E-02	2.0E-04	7.8E-05	1.0E-01	7.9E+01	1.3E-03	7.9E+02	1.3E-04
PFHpS	2.0E-01	6.1E-01	7.2E-02	2.2E-03	2.8E-03	1.9E-02	6.6E-04	1.3E-05	2.2E-02	7.9E+01	2.8E-04	7.9E+02	2.8E-05
PFOS	2.5E+01	7.9E+01	5.4E+01	2.8E-01	3.5E-01	2.4E+00	4.9E-01	1.7E-03	3.3E+00	7.9E+01	4.1E-02	7.9E+02	4.1E-03
PFNS	ND	NC	NC	ND	NC	NC	NC	NC	NC	7.9E+01	NC	7.9E+02	NC
PFDS	1.6E-01	NC	NC	ND	2.3E-03	NC	NC	NC	2.3E-03	7.9E+01	2.9E-05	7.9E+02	2.9E-06
PFDoS	9.9E-02	NC	NC	ND	1.4E-03	NC	NC	NC	1.4E-03	7.9E+01	1.8E-05	7.9E+02	1.8E-06
FOSA, FASE, FASAAs													
PFOSA	6.2E+00	5.3E-01	3.6E-01	1.9E-03	8.6E-02	1.6E-02	3.3E-03	1.2E-05	1.1E-01	7.9E+01	1.3E-03	7.9E+02	1.3E-04
N-EtFOSAA	1.7E-01	4.4E-01	3.0E-01	1.6E-03	2.4E-03	1.4E-02	2.8E-03	9.7E-06	1.9E-02	7.9E+01	2.4E-04	7.9E+02	2.4E-05
Fluortelomers													
6:2 FTS	1.5E+00	3.3E+00	2.4E-02	1.4E-02	2.1E-02	1.0E-01	2.2E-04	8.4E-05	1.2E-01	1.0E+03	1.2E-04	1.0E+04	1.2E-05

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
UCL - upper confidence limit of the arithmetic mean
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
ww - wet weight

Appendix H Food Web Model – Raleigh Creek – Other
Table 9. Potential Risks to the Spotted Sandpiper
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Raleigh Creek - Other	
Assumptions for the Spotted Sandpiper	
Body Weight (kg)	0.043
Seasonal Use Factor	1
Site-Specific Area Use Factor	1.0
Sediment Ingestion Rate (kg_{dw}/day)	0.00055
Water Ingestion Rate (kg/day)	0.054
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.0184
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.0034
Forage Fish Ingestion Rate (kg_{ww}/day)	0.0011

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_s = Incidental ingestion rate of sediment (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_s = Concentration of PFAS in sediment (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations					Potential Daily Dose (ug/kg_{bw}/day)						NOAEL-based TRV ($\mu g/kg_{bw}$/day)	NOAEL-based HQ	LOAEL-based TRV ($\mu g/kg_{bw}$/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Aquatic Invertebrate EPC (µg/kg, ww)	Forage Fish EPC (µg/kg, ww)	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Benthic Invertebrate	Aquatic Invertebrate	Forage Fish	Sediment	Surface Water	Total				
PFCAs															
PFBA	2.0E+00	5.7E+00	6.6E-01	5.3E-01	1.1E-01	8.5E-01	4.7E-01	1.8E-02	6.9E-03	1.4E-01	1.5E+00	1.0E+03	1.5E-03	1.0E+04	1.5E-04
PFHxA	1.8E-01	5.6E+00	ND	1.9E-01	1.4E-02	7.9E-02	4.6E-01	NC	2.5E-03	1.8E-02	5.6E-01	1.0E+03	5.6E-04	1.0E+04	5.6E-05
PFHpA	3.8E-01	8.0E-01	ND	8.3E-02	1.3E-02	1.6E-01	6.5E-02	NC	1.1E-03	1.6E-02	2.5E-01	1.0E+03	2.5E-04	1.0E+04	2.5E-05
PFOA	2.7E+00	6.9E+00	2.5E-01	3.3E-01	1.0E-01	1.2E+00	5.6E-01	6.6E-03	4.3E-03	1.3E-01	1.9E+00	1.0E+03	1.9E-03	1.0E+04	1.9E-04
PFNA	4.6E-01	2.1E-01	4.6E-01	8.4E-02	1.2E-03	2.0E-01	1.7E-02	1.2E-02	1.1E-03	1.5E-03	2.3E-01	1.0E+03	2.3E-04	1.0E+04	2.3E-05
PFDA	8.8E-01	1.2E-01	3.9E+00	1.3E-01	9.6E-04	3.8E-01	9.9E-03	1.0E-01	1.6E-03	1.2E-03	5.0E-01	1.0E+03	5.0E-04	1.0E+04	5.0E-05
PFUnA	6.9E-01	NC	1.1E+00	2.7E-01	ND	3.0E-01	NC	3.0E-02	3.5E-03	NC	3.3E-01	1.0E+03	3.3E-04	1.0E+04	3.3E-05
PFDoA	8.6E-01	NC	9.7E-01	9.3E-02	ND	3.7E-01	NC	2.6E-02	1.2E-03	NC	4.0E-01	1.0E+03	4.0E-04	1.0E+04	4.0E-05
PFTrDA	4.2E-01	8.8E-02	4.5E-01	ND	6.9E-04	1.8E-01	7.2E-03	1.2E-02	NC	8.9E-04	2.0E-01	1.0E+03	2.0E-04	1.0E+04	2.0E-05
PFTeDA	4.0E-01	5.9E-01	4.9E-01	2.2E-01	4.6E-03	1.7E-01	4.7E-02	1.3E-02	2.8E-03	5.9E-03	2.4E-01	1.0E+03	2.4E-04	1.0E+04	2.4E-05
PFSAs															
PFBS	5.8E-01	2.2E-01	ND	ND	4.1E-03	2.5E-01	1.8E-02	NC	NC	5.3E-03	2.7E-01	9.2E+04	3.0E-06	1.5E+05	1.8E-06
PFPeS	3.7E-01	7.8E-01	ND	ND	3.3E-03	1.6E-01	6.3E-02	NC	NC	4.2E-03	2.3E-01	9.2E+04	2.5E-06	1.5E+05	1.5E-06
PFHxS	5.4E-01	3.0E+00	4.5E-01	8.6E-02	1.3E-02	2.3E-01	2.5E-01	1.2E-02	1.1E-03	1.6E-02	5.1E-01	7.9E+01	6.4E-03	7.9E+02	6.4E-04
PFHpS	2.0E-01	6.1E-01	3.4E-01	ND	2.2E-03	8.6E-02	4.9E-02	9.2E-03	NC	2.8E-03	1.5E-01	7.9E+01	1.9E-03	7.9E+02	1.9E-04
PFOS	2.5E+01	7.9E+01	3.7E+02	6.5E+00	2.8E-01	1.1E+01	6.4E+00	1.0E+01	8.5E-02	3.6E-01	2.8E+01	7.9E+01	3.5E-01	7.9E+02	3.5E-02
PFNS	ND	NC	7.1E-01	5.7E-02	ND	NC	NC	1.9E-02	7.4E-04	NC	2.0E-02	7.9E+01	2.5E-04	7.9E+02	2.5E-05
PFDS	1.6E-01	NC	8.9E-01	9.8E-02	ND	7.1E-02	NC	2.4E-02	1.3E-03	NC	9.6E-02	7.9E+01	1.2E-03	7.9E+02	1.2E-04
PFDoS	9.9E-02	NC	ND	ND	ND	4.3E-02	NC	NC	NC	NC	4.3E-02	7.9E+01	5.4E-04	7.9E+02	5.4E-05
FOSA, FASE, FASAAs															
PFOSA	6.2E+00	5.3E-01	4.2E+00	2.9E-01	1.9E-03	2.7E+00	4.3E-02	1.1E-01	3.8E-03	2.4E-03	2.8E+00	7.9E+01	3.6E-02	7.9E+02	3.6E-03
N-EtFOSAA	1.7E-01	4.4E-01	9.8E-01	4.9E-01	1.6E-03	7.5E-02	3.6E-02	2.6E-02	6.4E-03	2.0E-03	1.5E-01	7.9E+01	1.8E-03	7.9E+02	1.8E-04
Fluortelomers															
6:2 FTS	1.5E+00	3.3E+00	4.9E-01	1.8E+00	1.4E-02	6.6E-01	2.7E-01	1.3E-02	2.3E-02	1.8E-02	9.8E-01	1.0E+03	9.8E-04	1.0E+04	9.8E-05

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
UCL - upper confidence limit of the arithmetic mean
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
ww - wet weight

Appendix H Food Web Model – Raleigh Creek – Other
Table 10. Potential Risks to the Great Blue Heron
Ecological Risk Assessment Food Web Model

Project 1007
Minneapolis, Minnesota

Site: Raleigh Creek - Other	
Assumptions for the Great Blue Heron	
Body Weight (kg)	2.4
Seasonal Use Factor	1
Site-Specific Area Use Factor	0.55
Sediment Ingestion Rate (kg_{dw}/day)	0.00043
Water Ingestion Rate (kg/day)	0.11
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.065
Amphibian Ingestion Rate (kg_{ww}/day)	0.022
Forage Fish Ingestion Rate (kg_{ww}/day)	0.35

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_s = Incidental ingestion rate of sediment (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_s= Concentration of PFAS in sediment (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations					Potential Daily Dose (ug/kg_{bw}/day)						NOAEL-based TRV ($\mu g/kg_{bw}$/day)	NOAEL-based HQ	LOAEL-based TRV ($\mu g/kg_{bw}$/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Amphibian EPC (µg/kg, ww)	Forage Fish EPC (µg/kg, ww)	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Benthic Invertebrate	Amphibian	Forage Fish	Sediment	Surface Water	Total				
PFCAs															
PFBA	2.0E+00	9.5E-01	6.6E-01	5.3E-01	1.1E-01	2.9E-02	4.7E-03	5.2E-02	5.2E-05	2.6E-03	8.8E-02	1.0E+03	8.8E-05	1.0E+04	8.8E-06
PFHxA	1.8E-01	ND	ND	1.9E-01	1.4E-02	2.7E-03	NC	NC	1.9E-05	3.4E-04	3.1E-03	1.0E+03	3.1E-06	1.0E+04	3.1E-07
PFHpA	3.8E-01	ND	ND	8.3E-02	1.3E-02	5.6E-03	NC	NC	8.1E-06	3.1E-04	5.9E-03	1.0E+03	5.9E-06	1.0E+04	5.9E-07
PFOA	2.7E+00	ND	2.5E-01	3.3E-01	1.0E-01	4.0E-02	NC	1.9E-02	3.2E-05	2.5E-03	6.2E-02	1.0E+03	6.2E-05	1.0E+04	6.2E-06
PFNA	4.6E-01	ND	4.6E-01	8.4E-02	1.2E-03	6.8E-03	NC	3.6E-02	8.2E-06	3.0E-05	4.3E-02	1.0E+03	4.3E-05	1.0E+04	4.3E-06
PFDA	8.8E-01	6.2E-01	3.9E+00	1.3E-01	9.6E-04	1.3E-02	3.1E-03	3.0E-01	1.2E-05	2.4E-05	3.2E-01	1.0E+03	3.2E-04	1.0E+04	3.2E-05
PFUnA	6.9E-01	5.8E-01	1.1E+00	2.7E-01	ND	1.0E-02	2.8E-03	8.8E-02	2.7E-05	NC	1.0E-01	1.0E+03	1.0E-04	1.0E+04	1.0E-05
PFDoA	8.6E-01	6.0E-01	9.7E-01	9.3E-02	ND	1.3E-02	2.9E-03	7.6E-02	9.1E-06	NC	9.2E-02	1.0E+03	9.2E-05	1.0E+04	9.2E-06
PFTrDA	4.2E-01	3.4E-01	4.5E-01	ND	6.9E-04	6.2E-03	1.7E-03	3.5E-02	NC	1.7E-05	4.3E-02	1.0E+03	4.3E-05	1.0E+04	4.3E-06
PFTeDA	4.0E-01	3.0E-01	4.9E-01	2.2E-01	4.6E-03	5.9E-03	1.5E-03	3.8E-02	2.1E-05	1.1E-04	4.6E-02	1.0E+03	4.6E-05	1.0E+04	4.6E-06
PFSAs															
PFBS	5.8E-01	ND	ND	ND	4.1E-03	8.5E-03	NC	NC	NC	1.0E-04	8.6E-03	9.2E+04	9.3E-08	1.5E+05	5.6E-08
PFPeS	3.7E-01	ND	ND	ND	3.3E-03	5.5E-03	NC	NC	NC	8.1E-05	5.6E-03	9.2E+04	6.0E-08	1.5E+05	3.6E-08
PFHxS	5.4E-01	ND	4.5E-01	8.6E-02	1.3E-02	7.9E-03	NC	3.5E-02	8.4E-06	3.1E-04	4.3E-02	7.9E+01	5.5E-04	7.9E+02	5.5E-05
PFHpS	2.0E-01	ND	3.4E-01	ND	2.2E-03	2.9E-03	NC	2.7E-02	NC	5.4E-05	3.0E-02	7.9E+01	3.8E-04	7.9E+02	3.8E-05
PFOS	2.5E+01	4.3E+01	3.7E+02	6.5E+00	2.8E-01	3.6E-01	2.1E-01	2.9E+01	6.4E-04	7.0E-03	3.0E+01	7.9E+01	3.8E-01	7.9E+02	3.8E-02
PFNS	ND	1.0E-01	7.1E-01	5.7E-02	ND	NC	5.0E-04	5.5E-02	5.6E-06	NC	5.6E-02	7.9E+01	7.1E-04	7.9E+02	7.1E-05
PFDS	1.6E-01	2.3E-01	8.9E-01	9.8E-02	ND	2.4E-03	1.1E-03	7.0E-02	9.6E-06	NC	7.4E-02	7.9E+01	9.3E-04	7.9E+02	9.3E-05
PFDoS	9.9E-02	ND	ND	ND	ND	1.5E-03	NC	NC	NC	NC	1.5E-03	7.9E+01	1.8E-05	7.9E+02	1.8E-06
FOSA, FASE, FASAAs															
PFOSA	6.2E+00	1.4E-01	4.2E+00	2.9E-01	1.9E-03	9.1E-02	6.7E-04	3.3E-01	2.9E-05	4.7E-05	4.2E-01	7.9E+01	5.3E-03	7.9E+02	5.3E-04
N-EtFOSAA	1.7E-01	1.7E-01	9.8E-01	4.9E-01	1.6E-03	2.5E-03	8.4E-04	7.7E-02	4.8E-05	3.9E-05	8.0E-02	7.9E+01	1.0E-03	7.9E+02	1.0E-04
Fluortelomers															
6:2 FTS	1.5E+00	ND	4.9E-01	1.8E+00	1.4E-02	2.3E-02	NC	3.8E-02	1.7E-04	3.4E-04	6.1E-02	1.0E+03	6.1E-05	1.0E+04	6.1E-06

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
UCL - upper confidence limit of the arithmetic mean
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
ww - wet weight

Appendix H Food Web Model – Raleigh Creek – Other
Table 11. Potential Risks to the Muskrat
Ecological Risk Assessment Food Web Model

Project 1007
Minneapolis, Minnesota

Site: Raleigh Creek - Other	
Assumptions for the Muskrat	
Body Weight (kg)	1.6
Seasonal Use Factor	1
Site-Specific Area Use Factor	1.0
Sediment Ingestion Rate (kg_{dw}/day)	0.0027
Water Ingestion Rate (kg/day)	0.88
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.054
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.054
Plant Ingestion Rate (kg_{ww}/day)	0.43

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_s = Incidental ingestion rate of sediment (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_s= Concentration of PFAS in sediment (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations					Potential Daily Dose (ug/kg_{bw}/day)						NOAEL-based TRV ($\mu g/kg_{bw}$/day)	NOAEL-based HQ	LOAEL-based TRV ($\mu g/kg_{bw}$/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Aquatic Invertebrate EPC (µg/kg, ww)	Plant EPC (µg/kg, ww)	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Benthic Invertebrate	Aquatic Invertebrate	Plant	Sediment	Surface Water	Total				
PFCAs															
PFBA	2.0E+00	5.7E+00	2.9E-01	5.3E-01	1.1E-01	6.7E-02	2.0E-01	8.0E-02	9.0E-04	5.9E-02	4.0E-01	7.3E+04	5.5E-06	1.8E+05	2.3E-06
PFHxA	1.8E-01	5.6E+00	3.9E-01	1.9E-01	1.4E-02	6.2E-03	1.9E-01	1.1E-01	3.3E-04	7.8E-03	3.1E-01	8.4E+04	3.7E-06	1.8E+05	1.8E-06
PFHpA	3.8E-01	8.0E-01	4.2E-01	8.3E-02	1.3E-02	1.3E-02	2.7E-02	1.1E-01	1.4E-04	7.0E-03	1.6E-01	3.0E+02	5.3E-04	6.0E+02	2.7E-04
PFOA	2.7E+00	6.9E+00	3.3E+00	3.3E-01	1.0E-01	9.3E-02	2.3E-01	9.1E-01	5.6E-04	5.6E-02	1.3E+00	3.0E+02	4.3E-03	6.0E+02	2.2E-03
PFNA	4.6E-01	2.1E-01	9.1E-01	8.4E-02	1.2E-03	1.6E-02	7.3E-03	2.5E-01	1.4E-04	6.7E-04	2.7E-01	8.3E+02	3.3E-04	1.1E+03	2.5E-04
PFDA	8.8E-01	1.2E-01	1.7E+00	1.3E-01	9.6E-04	3.0E-02	4.1E-03	4.7E-01	2.1E-04	5.3E-04	5.0E-01	1.0E+02	5.0E-03	6.4E+03	7.8E-05
PFUnA	6.9E-01	NC	NC	2.7E-01	ND	2.4E-02	NC	NC	4.6E-04	NC	2.4E-02	3.0E+02	8.0E-05	1.0E+03	2.4E-05
PFDoA	8.6E-01	NC	NC	9.3E-02	ND	2.9E-02	NC	NC	1.6E-04	NC	3.0E-02	5.0E+02	5.9E-05	2.5E+03	1.2E-05
PFTrDA	4.2E-01	8.8E-02	1.2E+00	ND	6.9E-04	1.4E-02	3.0E-03	3.4E-01	NC	3.8E-04	3.6E-01	5.0E+02	7.1E-04	2.5E+03	1.4E-04
PFTeDA	4.0E-01	5.9E-01	8.2E+00	2.2E-01	4.6E-03	1.4E-02	2.0E-02	2.2E+00	3.7E-04	2.6E-03	2.3E+00	3.0E+03	7.6E-04	1.0E+04	2.3E-04
PFSAs															
PFBS	5.8E-01	2.2E-01	4.8E-03	ND	4.1E-03	2.0E-02	7.5E-03	1.3E-03	NC	2.3E-03	3.1E-02	5.0E+04	6.1E-07	2.0E+05	1.5E-07
PFPeS	3.7E-01	7.8E-01	3.8E-03	ND	3.3E-03	1.3E-02	2.7E-02	1.0E-03	NC	1.8E-03	4.2E-02	5.0E+04	8.4E-07	2.0E+05	2.1E-07
PFHxS	5.4E-01	3.0E+00	2.2E-02	8.6E-02	1.3E-02	1.8E-02	1.0E-01	6.0E-03	1.5E-04	7.0E-03	1.3E-01	3.0E+02	4.5E-04	1.0E+03	1.3E-04
PFHpS	2.0E-01	6.1E-01	7.2E-02	ND	2.2E-03	6.8E-03	2.1E-02	2.0E-02	NC	1.2E-03	4.8E-02	3.0E+02	1.6E-04	1.0E+03	4.8E-05
PFOS	2.5E+01	7.9E+01	5.4E+01	6.5E+00	2.8E-01	8.4E-01	2.7E+00	1.5E+01	1.1E-02	1.6E-01	1.8E+01	1.0E+02	1.8E-01	1.7E+02	1.1E-01
PFNS	ND	NC	NC	5.7E-02	ND	NC	NC	NC	9.7E-05	NC	9.7E-05	1.0E+02	9.7E-07	1.7E+02	5.7E-07
PFDS	1.6E-01	NC	NC	9.8E-02	ND	5.6E-03	NC	NC	1.7E-04	NC	5.7E-03	1.0E+02	5.7E-05	1.7E+02	3.4E-05
PFDoS	9.9E-02	NC	NC	ND	ND	3.4E-03	NC	NC	NC	NC	3.4E-03	1.0E+02	3.4E-05	1.7E+02	2.0E-05
FOSA, FASE, FASAAs															
PFOSA	6.2E+00	5.3E-01	3.6E-01	2.9E-01	1.9E-03	2.1E-01	1.8E-02	9.8E-02	5.0E-04	1.1E-03	3.3E-01	1.0E+02	3.3E-03	1.7E+02	1.9E-03
N-EtFOSAA	1.7E-01	4.4E-01	3.0E-01	4.9E-01	1.6E-03	5.9E-03	1.5E-02	8.2E-02	8.3E-04	8.8E-04	1.0E-01	1.0E+02	1.0E-03	1.7E+02	6.1E-04
Fluortelomers															
6:2 FTS	1.5E+00	3.3E+00	2.4E-02	1.8E+00	1.4E-02	5.2E-02	1.1E-01	6.5E-03	3.0E-03	7.6E-03	1.8E-01	3.0E+02	6.0E-04	1.0E+03	1.8E-04

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
UCL - upper confidence limit of the arithmetic mean
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
ww - wet weight

Appendix H Food Web Model – Raleigh Creek – Other
Table 12. Potential Risks to the Little Brown Bat
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Raleigh Creek - Other	
Assumptions for the Little Brown Bat	
Body Weight (kg)	0.0085
Seasonal Use Factor	1
Site-Specific Area Use Factor	0.081
Water Ingestion Rate (kg/day)	0.0010
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.0049

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)
AUF = Area use factor (ratio of the receptor's home range relative to the size of

SUPPORTING CALCULATIONS

Analyte	Media Concentrations		Potential Daily Dose (ug/kg_{bw}/day)			NOAEL-based TRV ($\mu g/kg_{bw}$/day)	NOAEL-based HQ	LOAEL-based TRV ($\mu g/kg_{bw}$/day)	LOAEL-based HQ
	Aquatic Invertebrate EPC (µg/kg, ww)	Surface Water EPC (µg/L)	Aquatic Invertebrate	Surface Water	Total				
PFCAs									
PFBA	5.7E+00	1.1E-01	2.7E-01	1.0E-03	2.7E-01	7.3E+04	3.7E-06	1.8E+05	1.5E-06
PFHxA	5.6E+00	1.4E-02	2.6E-01	1.3E-04	2.6E-01	8.4E+04	3.1E-06	1.8E+05	1.5E-06
PFHpA	8.0E-01	1.3E-02	3.7E-02	1.2E-04	3.7E-02	3.0E+02	1.2E-04	6.0E+02	6.2E-05
PFOA	6.9E+00	1.0E-01	3.2E-01	9.6E-04	3.2E-01	3.0E+02	1.1E-03	6.0E+02	5.3E-04
PFNA	2.1E-01	1.2E-03	9.9E-03	1.2E-05	9.9E-03	8.3E+02	1.2E-05	1.1E+03	9.0E-06
PFDA	1.2E-01	9.6E-04	5.6E-03	9.1E-06	5.6E-03	1.0E+02	5.6E-05	6.4E+03	8.8E-07
PFUnA	NC	ND	NC	NC	NC	3.0E+02	NC	1.0E+03	NC
PFDoA	NC	ND	NC	NC	NC	5.0E+02	NC	2.5E+03	NC
PFTrDA	8.8E-02	6.9E-04	4.1E-03	6.6E-06	4.1E-03	5.0E+02	8.2E-06	2.5E+03	1.6E-06
PFTeDA	5.9E-01	4.6E-03	2.7E-02	4.4E-05	2.7E-02	3.0E+03	9.0E-06	1.0E+04	2.7E-06
PFSAs									
PFBS	2.2E-01	4.1E-03	1.0E-02	3.9E-05	1.0E-02	5.0E+04	2.1E-07	2.0E+05	5.1E-08
PFPeS	7.8E-01	3.3E-03	3.6E-02	3.1E-05	3.6E-02	5.0E+04	7.3E-07	2.0E+05	1.8E-07
PFHxS	3.0E+00	1.3E-02	1.4E-01	1.2E-04	1.4E-01	3.0E+02	4.7E-04	1.0E+03	1.4E-04
PFHpS	6.1E-01	2.2E-03	2.8E-02	2.1E-05	2.8E-02	3.0E+02	9.4E-05	1.0E+03	2.8E-05
PFOS	7.9E+01	2.8E-01	3.7E+00	2.7E-03	3.7E+00	1.0E+02	3.7E-02	1.7E+02	2.2E-02
PFNS	NC	ND	NC	NC	NC	1.0E+02	NC	1.7E+02	NC
PFDS	NC	ND	NC	NC	NC	1.0E+02	NC	1.7E+02	NC
PFDoS	NC	ND	NC	NC	NC	1.0E+02	NC	1.7E+02	NC
FOSA, FASE, FASAAs									
PFOSA	5.3E-01	1.9E-03	2.5E-02	1.8E-05	2.5E-02	1.0E+02	2.5E-04	1.7E+02	1.5E-04
N-EtFOSAA	4.4E-01	1.6E-03	2.1E-02	1.5E-05	2.1E-02	1.0E+02	2.1E-04	1.7E+02	1.2E-04
Fluortelomers									
6:2 FTS	3.3E+00	1.4E-02	1.5E-01	1.3E-04	1.5E-01	3.0E+02	5.1E-04	1.0E+03	1.5E-04

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
UCL - upper confidence limit of the arithmetic mean
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
ww - wet weight

Appendix H Food Web Model – Raleigh Creek – Other
Table 13. Potential Risks to the Raccoon
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Raleigh Creek - Other	
Assumptions for the Raccoon	
Body Weight (kg)	8.6
Seasonal Use Factor	1
Site-Specific Area Use Factor	0.016
Sediment Ingestion Rate (kg_{dw}/day)	0.0047
Water Ingestion Rate (kg/day)	0.41
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.080
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.010
Plant Ingestion Rate (kg_{ww}/day)	0.090
Amphibian Ingestion Rate (kg_{ww}/day)	0.010
Forage Fish Ingestion Rate (kg_{ww}/day)	0.010

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_s = Incidental ingestion rate of sediment (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_s = Concentration of PFAS in sediment (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations							Potential Daily Dose (ug/kg_{bw}/day)								NOAEL-based TRV ($\mu g/kg_{bw}$/day)	NOAEL-based HQ	LOAEL-based TRV ($\mu g/kg_{bw}$/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Aquatic Invertebrate EPC (µg/kg, ww)	Plant EPC (µg/kg, ww)	Amphibian EPC (µg/kg, ww)	Forage Fish EPC (µg/kg, ww)	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Benthic Invertebrate	Aquatic Invertebrate	Plant	Ampibian	Forage Fish	Sediment	Surface Water	Total				
PFCAs																			
PFBA	2.0E+00	5.7E+00	2.9E-01	9.5E-01	6.6E-01	5.3E-01	1.1E-01	2.9E-04	1.0E-04	4.8E-05	1.7E-05	1.2E-05	4.5E-06	7.9E-05	5.5E-04	7.3E+04	7.6E-09	1.8E+05	3.2E-09
PFHxA	1.8E-01	5.6E+00	3.9E-01	ND	ND	1.9E-01	1.4E-02	2.7E-05	1.0E-04	6.4E-05	NC	NC	1.7E-06	1.0E-05	2.0E-04	8.4E+04	2.4E-09	1.8E+05	1.2E-09
PFHpA	3.8E-01	8.0E-01	4.2E-01	ND	ND	8.3E-02	1.3E-02	5.5E-05	1.4E-05	6.8E-05	NC	NC	7.1E-07	9.4E-06	1.5E-04	3.0E+02	4.9E-07	6.0E+02	2.5E-07
PFOA	2.7E+00	6.9E+00	3.3E+00	ND	2.5E-01	3.3E-01	1.0E-01	4.0E-04	1.3E-04	5.5E-04	NC	4.5E-06	2.8E-06	7.5E-05	1.2E-03	3.0E+02	3.9E-06	6.0E+02	1.9E-06
PFNA	4.6E-01	2.1E-01	9.1E-01	ND	4.6E-01	8.4E-02	1.2E-03	6.7E-05	3.9E-06	1.5E-04	NC	8.3E-06	7.2E-07	9.0E-07	2.3E-04	8.3E+02	2.8E-07	1.1E+03	2.1E-07
PFDA	8.8E-01	1.2E-01	1.7E+00	6.2E-01	3.9E+00	1.3E-01	9.6E-04	1.3E-04	2.2E-06	2.8E-04	1.1E-05	7.1E-05	1.1E-06	7.1E-07	5.0E-04	1.0E+02	5.0E-06	6.4E+03	7.7E-08
PFUnA	6.9E-01	NC	NC	5.8E-01	1.1E+00	2.7E-01	ND	1.0E-04	NC	NC	1.1E-05	2.0E-05	2.3E-06	NC	1.3E-04	3.0E+02	4.5E-07	1.0E+03	1.3E-07
PFDoA	8.6E-01	NC	NC	6.0E-01	9.7E-01	9.3E-02	ND	1.3E-04	NC	NC	1.1E-05	1.8E-05	8.0E-07	NC	1.6E-04	5.0E+02	3.1E-07	2.5E+03	6.2E-08
PFTrDA	4.2E-01	8.8E-02	1.2E+00	3.4E-01	4.5E-01	ND	6.9E-04	6.1E-05	1.6E-06	2.0E-04	6.2E-06	8.2E-06	NC	5.2E-07	2.8E-04	5.0E+02	5.6E-07	2.5E+03	1.1E-07
PFTeDA	4.0E-01	5.9E-01	8.2E+00	3.0E-01	4.9E-01	2.2E-01	4.6E-03	5.8E-05	1.1E-05	1.4E-03	5.5E-06	8.9E-06	1.8E-06	3.4E-06	1.4E-03	3.0E+03	4.8E-07	1.0E+04	1.4E-07
PFSAs																			
PFBS	5.8E-01	2.2E-01	4.8E-03	ND	ND	ND	4.1E-03	8.4E-05	4.0E-06	7.9E-07	NC	NC	NC	3.1E-06	9.2E-05	5.0E+04	1.8E-09	2.0E+05	4.6E-10
PFPeS	3.7E-01	7.8E-01	3.8E-03	ND	ND	ND	3.3E-03	5.4E-05	1.4E-05	6.2E-07	NC	NC	NC	2.4E-06	7.2E-05	5.0E+04	1.4E-09	2.0E+05	3.6E-10
PFHxS	5.4E-01	3.0E+00	2.2E-02	ND	4.5E-01	8.6E-02	1.3E-02	7.8E-05	5.5E-05	3.6E-06	NC	8.2E-06	7.4E-07	9.4E-06	1.6E-04	3.0E+02	5.2E-07	1.0E+03	1.6E-07
PFHpS	2.0E-01	6.1E-01	7.2E-02	ND	3.4E-01	ND	2.2E-03	2.9E-05	1.1E-05	1.2E-05	NC	6.2E-06	NC	1.6E-06	6.0E-05	3.0E+02	2.0E-07	1.0E+03	6.0E-08
PFOS	2.5E+01	7.9E+01	5.4E+01	4.3E+01	3.7E+02	6.5E+00	2.8E-01	3.6E-03	1.4E-03	8.8E-03	7.9E-04	6.7E-03	5.6E-05	2.1E-04	2.2E-02	1.0E+02	2.2E-04	1.7E+02	1.3E-04
PFNS	ND	NC	NC	1.0E-01	7.1E-01	5.7E-02	ND	NC	NC	NC	1.8E-06	1.3E-05	4.9E-07	NC	1.5E-05	1.0E+02	1.5E-07	1.7E+02	8.9E-08
PFDS	1.6E-01	NC	NC	2.3E-01	8.9E-01	9.8E-02	ND	2.4E-05	NC	NC	4.2E-06	1.6E-05	8.4E-07	NC	4.5E-05	1.0E+02	4.5E-07	1.7E+02	2.7E-07
PFDoS	9.9E-02	NC	NC	ND	ND	ND	ND	1.4E-05	NC	NC	NC	NC	NC	NC	1.4E-05	1.0E+02	1.4E-07	1.7E+02	8.5E-08
FOSA, FASE, FASAAs																			
PFOSA	6.2E+00	5.3E-01	3.6E-01	1.4E-01	4.2E+00	2.9E-01	1.9E-03	9.0E-04	9.7E-06	5.9E-05	2.5E-06	7.6E-05	2.5E-06	1.4E-06	1.0E-03	1.0E+02	1.0E-05	1.7E+02	6.2E-06
N-EtFOSAA	1.7E-01	4.4E-01	3.0E-01	1.7E-01	9.8E-01	4.9E-01	1.6E-03	2.5E-05	8.1E-06	4.9E-05	3.1E-06	1.8E-05	4.2E-06	1.2E-06	1.1E-04	1.0E+02	1.1E-06	1.7E+02	6.4E-07
Fluortelomers																			
6:2 FTS	1.5E+00	3.3E+00	2.4E-02	ND	4.9E-01	1.8E+00	1.4E-02	2.2E-04	6.0E-05	3.9E-06	NC	8.9E-06	1.5E-05	1.0E-05	3.2E-04	3.0E+02	1.1E-06	1.0E+03	3.2E-07

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
UCL - upper confidence limit of the arithmetic mean
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
ww - wet weight

Appendix H Food Web Model – Raleigh Creek – Other
Table 14. Summary of Potential Risks to Wildlife at Raleigh Creek - Other
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Analyte	Hazard Quotients for Potential PFAS Exposure													
	Wood Duck		Tree Swallow		Spotted Sandpiper		Great Blue Heron		Muskrat		Little Brown Bat		Raccoon	
	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ
PFCAs														
PFBA	1.0E-06	1.0E-07	2.1E-04	2.1E-05	1.5E-03	1.5E-04	8.8E-05	8.8E-06	5.5E-06	2.3E-06	3.7E-06	1.5E-06	7.6E-09	3.2E-09
PFHxA	9.3E-07	9.3E-08	1.8E-04	1.8E-05	5.6E-04	5.6E-05	3.1E-06	3.1E-07	3.7E-06	1.8E-06	3.1E-06	1.5E-06	2.4E-09	1.2E-09
PFHpA	6.2E-07	6.2E-08	3.4E-05	3.4E-06	2.5E-04	2.5E-05	5.9E-06	5.9E-07	5.3E-04	2.7E-04	1.2E-04	6.2E-05	4.9E-07	2.5E-07
PFOA	5.0E-06	5.0E-07	2.8E-04	2.8E-05	1.9E-03	1.9E-04	6.2E-05	6.2E-06	4.3E-03	2.2E-03	1.1E-03	5.3E-04	3.9E-06	1.9E-06
PFNA	1.2E-06	1.2E-07	2.1E-05	2.1E-06	2.3E-04	2.3E-05	4.3E-05	4.3E-06	3.3E-04	2.5E-04	1.2E-05	9.0E-06	2.8E-07	2.1E-07
PFDA	2.3E-06	2.3E-07	3.2E-05	3.2E-06	5.0E-04	5.0E-05	3.2E-04	3.2E-05	5.0E-03	7.8E-05	5.6E-05	8.8E-07	5.0E-06	7.7E-08
PFUnA	7.8E-08	7.8E-09	9.7E-06	9.7E-07	3.3E-04	3.3E-05	1.0E-04	1.0E-05	8.0E-05	2.4E-05	NC	NC	4.5E-07	1.3E-07
PFDoA	7.1E-08	7.1E-09	1.2E-05	1.2E-06	4.0E-04	4.0E-05	9.2E-05	9.2E-06	5.9E-05	1.2E-05	NC	NC	3.1E-07	6.2E-08
PFTrDA	1.6E-06	1.6E-07	2.0E-05	2.0E-06	2.0E-04	2.0E-05	4.3E-05	4.3E-06	7.1E-04	1.4E-04	8.2E-06	1.6E-06	5.6E-07	1.1E-07
PFTeDA	1.1E-05	1.1E-06	9.9E-05	9.9E-06	2.4E-04	2.4E-05	4.6E-05	4.6E-06	7.6E-04	2.3E-04	9.0E-06	2.7E-06	4.8E-07	1.4E-07
PFSAs														
PFBS	6.9E-10	4.2E-10	1.6E-07	9.8E-08	3.0E-06	1.8E-06	9.3E-08	5.6E-08	6.1E-07	1.5E-07	2.1E-07	5.1E-08	1.8E-09	4.6E-10
PFPeS	9.5E-10	5.7E-10	3.2E-07	1.9E-07	2.5E-06	1.5E-06	6.0E-08	3.6E-08	8.4E-07	2.1E-07	7.3E-07	1.8E-07	1.4E-09	3.6E-10
PFHxS	3.7E-06	3.7E-07	1.3E-03	1.3E-04	6.4E-03	6.4E-04	5.5E-04	5.5E-05	4.5E-04	1.3E-04	4.7E-04	1.4E-04	5.2E-07	1.6E-07
PFHpS	1.9E-06	1.9E-07	2.8E-04	2.8E-05	1.9E-03	1.9E-04	3.8E-04	3.8E-05	1.6E-04	4.8E-05	9.4E-05	2.8E-05	2.0E-07	6.0E-08
PFOS	9.6E-04	9.6E-05	4.1E-02	4.1E-03	3.5E-01	3.5E-02	3.8E-01	3.8E-02	1.8E-01	1.1E-01	3.7E-02	2.2E-02	2.2E-04	1.3E-04
PFNS	7.8E-08	7.8E-09	NC	NC	2.5E-04	2.5E-05	7.1E-04	7.1E-05	9.7E-07	5.7E-07	NC	NC	1.5E-07	8.9E-08
PFDS	2.8E-07	2.8E-08	2.9E-05	2.9E-06	1.2E-03	1.2E-04	9.3E-04	9.3E-05	5.7E-05	3.4E-05	NC	NC	4.5E-07	2.7E-07
PFDoS	8.8E-08	8.8E-09	1.8E-05	1.8E-06	5.4E-04	5.4E-05	1.8E-05	1.8E-06	3.4E-05	2.0E-05	NC	NC	1.4E-07	8.5E-08
FOSA, FASE, FASAAs														
PFOSA	1.2E-05	1.2E-06	1.3E-03	1.3E-04	3.6E-02	3.6E-03	5.3E-03	5.3E-04	3.3E-03	1.9E-03	2.5E-04	1.5E-04	1.0E-05	6.2E-06
N-EtFOSAA	6.0E-06	6.0E-07	2.4E-04	2.4E-05	1.8E-03	1.8E-04	1.0E-03	1.0E-04	1.0E-03	6.1E-04	2.1E-04	1.2E-04	1.1E-06	6.4E-07
Fluortelomers														
6:2 FTS	5.6E-07	5.6E-08	1.2E-04	1.2E-05	9.8E-04	9.8E-05	6.1E-05	6.1E-06	6.0E-04	1.8E-04	5.1E-04	1.5E-04	1.1E-06	3.2E-07

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
NC - Not Calculated
NOAEL - No Observed Adverse Effects Level

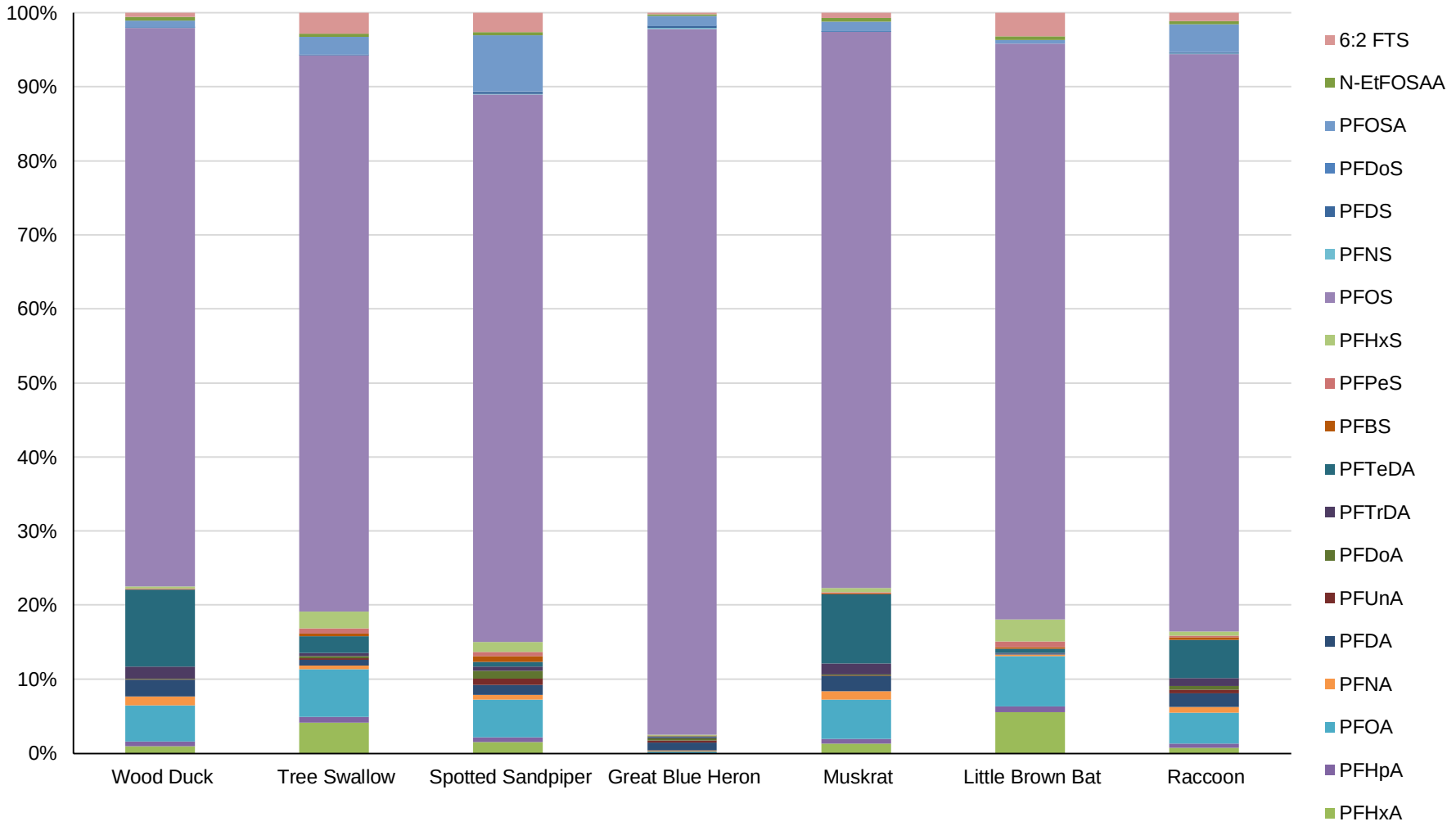

Figure 1: Total Daily Intake of PFAS - Aquatic-life Dependent Wildlife at Raleigh Creek - Other

Appendix I

Food Web Model – Eagle Point Lake

Appendix I Food Web Model – Eagle Point Lake
Table 1. Wildlife Exposure Parameters
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Parameter	Parameter Definition	Units	Birds					Mammals			
			Avian Consumer (Herbivore)	Avian Consumer (Invertivore)	Avian Consumer (Omnivore / Invertivore)	Avian Consumer (Piscivore)	Avian Consumer (Piscivore)	Mammalian Consumer (Herbivore)	Mammalian Consumer (Invertivore)	Mammalian Consumer (Omnivore / Invertivore)	Mammalian Consumer (Piscivore)
			Wood Duck	**Tree Swallow**	**Spotted Sandpiper**	**Great Blue Heron**	**Bald Eagle**	**Muskrat**	**Little Brown Bat**	**Mink**	**River Otter**
			Aix sponsa	*Tachycineta bicolor*	*Actitis macularius*	*Ardea herodias*	*Haliaeetus leucocephalus*	*Ondatra zibethicus*	*Myotis lucifugus*	*Neovison vison*	*Lontra canadensis*
BW	Body Weight	kg	0.70	0.020	0.043	2.4	4.15	1.6	0.0085	1.4	7.7
FIR_{dw}	Daily Food Ingestion Rate (dry matter) [1]	kg, dw/day	0.041	0.012	0.0076	0.11	0.12	0.14	0.0016	0.054	0.28
FIR_{ww}	Daily Food Ingestion Rate (wet matter) [2]	kg, ww/day	0.13	0.035	0.023	0.43	0.50	0.54	0.0049	0.22	0.78
P_{veg}	Proportion of Diet - Vegetation	kg diet item, ww/kg diet, ww	0.90	0.17	--	--	--	0.80	--	0.050	--
IR_{veg}	Vegetation Ingestion Rate [4]	kg ww/day	0.11	0.0060	--	--	--	0.43	--	0.011	--
P_{bi}	Proportion of Diet - Benthic Invertebrates	kg diet item, ww/kg diet, ww	0.050	0.26	0.80	0.15	--	0.10	--	0.10	0.15
IR_{bi}	Benthic Invertebrate Ingestion Rate [4]	kg ww/day	0.0064	0.0092	0.018	0.065	--	0.054	--	0.022	0.12
P_{ai}	Proportion of Diet - Aquatic Invertebrates	kg diet item, ww/kg diet, ww	0.050	0.57	0.15	--	--	0.10	1.0	0.10	--
IR_{ai}	Aquatic Invertebrate Ingestion Rate [4]	kg ww/day	0.0064	0.020	0.0034	--	--	0.054	0.0049	0.022	--
P_{am}	Proportion of Diet - Amphibians	kg diet item, ww/kg diet, ww	--	--	--	0.050	--	--	--	0.050	0.050
IR_{am}	Amphibian Ingestion Rate [4]	kg ww/day	--	--	--	0.022	--	--	--	0.011	0.039
P_{ff}	Proportion of Diet - Forage Fish	kg diet item, ww/kg diet, ww	--	--	0.050	0.80	0.45	--	--	0.20	0.35
IR_{ff}	Forage Fish Ingestion Rate [4]	kg ww/day	--	--	0.0011	0.35	0.22	--	--	0.044	0.27
P_{pf}	Proportion of Diet - Predatory Fish	kg diet item, ww/kg diet, ww	--	--	--	--	0.55	--	--	0.50	0.45
IR_{pf}	Predatory Fish Ingestion Rate [4]	kg ww/day	--	--	--	--	0.27	--	--	0.11	0.35
P_s	Proportion of Diet - Sediment	kg sediment, dw/kg diet, dw	0.24	--	0.073	0.0040	--	0.020	--	0.030	--
IR_S	Sediment Ingestion Rate [5]	kg dw/day	0.0098	--	0.00055	0.00043	--	0.0027	--	0.0016	--
IR_W	Water Ingestion Rate [6]	L/day or kg/day	0.041	0.0040	0.054	0.11	0.15	0.88	0.0010	0.055	0.41
HR	Home Range	acres	776	194	5.0	11	4646	0.32	74	19	2842
AUF_{EPL}	Area Use Factor for Eagle Point Lake [3]	proportion	0.21	0.82	1.0	1.0	0.034	1.0	1.0	1.0	0.056

Notes:
References for all species-specific exposure factors are provided in Table 2.
1 - Dry weight food ingestion rate (FIR) is applied to concentrations of PFAS in sediment, generally reported on dry weight basis.
2 - Wet weight FIR is applied to tissue data, generally reported on fresh or wet weight basis.
3 - AUF values for receptors were calculated by dividing the size of the exposure area by the home range. If the home range is smaller than the exposure area, an AUF of 1 was used. Site Use Factor (SUF) of 1 was selected for all receptors.
4 - Dietary ingestion rates were calculated by multiplying the receptor- and tissue-specific proportion of diet by the receptor-specific FIR_{ww}.
5 - IR_S were calculated by multiplying the receptor-specific P_S by the receptor-specific FIR_{dw}.
6 - IR_W is reported in L/day or kg/day because 1 L of water has weight of 1 kg

Abbreviations:
dw - dry weight
EPL - Eagle Point Lake
kg - kilogram
L - liters
ww - wet weight

Exposure Areas (Acres):
EPL = 160

Appendix I Food Web Model – Eagle Point Lake
Table 2. Information Sources for Wildlife Exposure Parameters
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Receptor Type	Feeding Guild	Species	Parameter	Definition	Value	Units	Reference	Notes
Bird	Herbivore	Wood Duck	BW	Body Weight	0.70	kg	NC WRC (2019)	Lowest reported body weight (converted to kg)
Bird	Herbivore	Wood Duck	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.041	kg, dw/day	Nagy (2001)	Calculated using DW allometric equation for omnivorous birds: FIR (dw) = 0.67 x BW ^ 0.627
Bird	Herbivore	Wood Duck	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.13	kg, ww/day	Nagy (2001)	Calculated using WW allometric equation for omnivorous birds: FIR (ww) = 2.094 x BW ^ 0.627
Bird	Herbivore	Wood Duck	P_{veg}	Proportion of Diet - Vegetation	0.90	kg diet item, ww/kg diet, ww	MN DNR (2020)	Consume acorns, weed seeds, berries, plants and insects; assume majority is vegetation (https://www.dnr.state.mn.us/birds/woodduck.html)
Bird	Herbivore	Wood Duck	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.05	kg diet item, ww/kg diet, ww	MN DNR (2020)	Consume acorns, weed seeds, berries, plants and insects; assume majority is vegetation (https://www.dnr.state.mn.us/birds/woodduck.html)
Bird	Herbivore	Wood Duck	P_{ai}	Proportion of Diet - Aquatic Invertebrates	0.05	kg diet item, ww/kg diet, ww	MN DNR (2020)	Consume acorns, weed seeds, berries, plants and insects; assume majority is vegetation (https://www.dnr.state.mn.us/birds/woodduck.html)
Bird	Herbivore	Wood Duck	P_{am}	Proportion of Diet - Amphibians	--	kg diet item, ww/kg diet, ww	MN DNR (2020)	Assumed not to be consumed based on reported diet contents.
Bird	Herbivore	Wood Duck	P_{ff}	Proportion of Diet - Forage Fish	--	kg diet item, ww/kg diet, ww	MN DNR (2020)	Assumed not to be consumed based on reported diet contents.
Bird	Herbivore	Wood Duck	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww	MN DNR (2020)	Assumed not to be consumed based on reported diet contents.
Bird	Herbivore	Wood Duck	P_{s}	Proportion of Diet - Sediment	0.24	kg sediment, dw/kg diet, dw	USEPA (1993)	Sediment ingestion in wood duck (USEPA, 1993).
Bird	Herbivore	Wood Duck	IR_{W}	Daily Water Ingestion	0.041	L water/day	USEPA (1993)	Mallard used as a surrogate; IR L/day= IR 0.058 (L/kg)*BW (kg)
Bird	Herbivore	Wood Duck	HR	Home Range	776	acres	CDFW (2021)	In Minnesota, breeding female wood ducks remained within 1 km (0.6 mi) of the nest during 70% of their time away (Gilmer et al. 1978, as cited in CDFW 2021); therefore, home range was calculated as area from nest using 1 km as radius.
Bird	Invertivore	Tree Swallow	BW	Body Weight	0.020	kg	Nagy (2001)	Measured value for tree swallow.
Bird	Invertivore	Tree Swallow	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.012	kg, dw/day	Nagy (2001)	Measured value for tree swallow (dry matter intake).
Bird	Invertivore	Tree Swallow	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.035	kg, ww/day	Nagy (2001)	Measured value for tree swallow (fresh matter intake).
Bird	Invertivore	Tree Swallow	P_{veg}	Proportion of Diet - Vegetation	0.17	kg diet item, ww/kg diet, ww	Beal (1918); USACHPPM (2004)	Estimated proportion of plant material.
Bird	Invertivore	Tree Swallow	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.26	kg diet item, ww/kg diet, ww	Beal (1918); USACHPPM (2004)	Estimated based on proportion of non-flying insects.
Bird	Invertivore	Tree Swallow	P_{ai}	Proportion of Diet - Aquatic Invertebrates	0.57	kg diet item, ww/kg diet, ww	Beal (1918); USACHPPM (2004)	Estimated based on proportion of flying (emergent aquatic) insects.
Bird	Invertivore	Tree Swallow	P_{am}	Proportion of Diet - Amphibians	--	kg diet item, ww/kg diet, ww	USACHPPM (2004)	Assumed not to be consumed.
Bird	Invertivore	Tree Swallow	P_{ff}	Proportion of Diet - Forage Fish	--	kg diet item, ww/kg diet, ww	USACHPPM (2004)	Assumed not to be consumed.
Bird	Invertivore	Tree Swallow	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww	USACHPPM (2004)	Assumed not to be consumed.
Bird	Invertivore	Tree Swallow	P_{s}	Proportion of Diet - Sediment	--	kg sediment, dw/kg diet, dw	Divine et al. (2020)	Assumed negligible based on feedng strategy.
Bird	Invertivore	Tree Swallow	IR_{W}	Daily Water Ingestion	0.0040	L water/day	USEPA (1993)	IR L/day= IR (L/kg)*BW (kg)
Bird	Invertivore	Tree Swallow	HR	Home Range	194	acres	Custer et al. (2019)	Tree swallows feed within approximately 0.5 km of their nest boxes (Stapleton and Robertson 2006, as cited in Custer et al. 2019); therefore, home range was calculated as area from nest using 0.5 km as radius.
Bird	Invertivore	Spotted sandpiper	BW	Body Weight	0.043	kg	USEPA (1993)	Average values reported for adult male and female spotted sandpipers (USEPA 1993).
Bird	Invertivore	Spotted sandpiper	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.0076	kg, dw/day	Nagy (2001)	Calculated using DW allometric equation for insectivore birds: FIR (dw) = 0.54 x BW ^ 0.705
Bird	Invertivore	Spotted sandpiper	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.0230	kg, ww/day	Nagy (2001)	Calculated using WW allometric equation for insectivore birds: FIR (ww) = 1.633 x BW ^ 0.705
Bird	Invertivore	Spotted sandpiper	P_{veg}	Proportion of Diet - Vegetation	--	kg diet item, ww/kg diet, ww	USEPA (1993)	Assumed not to be consumed.
Bird	Invertivore	Spotted sandpiper	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.80	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated based on USEPA (1993: Adult flying insects comprise the bulk of the diet; however, crustaceans, leeches, molluscs, small fish, and carrion also are eaten.
Bird	Invertivore	Spotted sandpiper	P_{ai}	Proportion of Diet - Aquatic Invertebrates	0.15	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated based on USEPA (1993: Adult flying insects comprise the bulk of the diet; however, crustaceans, leeches, molluscs, small fish, and carrion also are eaten.
Bird	Invertivore	Spotted sandpiper	P_{am}	Proportion of Diet - Amphibians	--	kg diet item, ww/kg diet, ww	USEPA (1993)	Assumed not to be consumed based on reported diet contents.
Bird	Invertivore	Spotted sandpiper	P_{ff}	Proportion of Diet - Forage Fish	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Assumed only to consume small fish.
Bird	Invertivore	Spotted sandpiper	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww	USEPA (1993)	Assumed not to be consumed.
Bird	Invertivore	Spotted sandpiper	P_{s}	Proportion of Diet - Sediment	0.073	kg sediment, dw/kg diet, dw	USEPA (1993)	Soil/sediment estimated in Least sandpiper diet (USEPA, 1993).
Bird	Invertivore	Spotted sandpiper	IR_{W}	Daily Water Ingestion	0.054	L water/day	USEPA (1993)	IR L/day= IR (L/kg)*BW (kg); Sandpiper used as surrogate
Bird	Invertivore	Spotted sandpiper	HR	Home Range	5.0	acres	CDFW (2021)	In New York, 3 individually marked breeding females fed and displayed over areas of 1.06,1.8, and 3.2 ha (2.5, 4.5 and 8.0 acres), with an average home range of 2.02 ha (5 acres) (Hays 1972, as cited in CDFW 2021).

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Receptor Type	Feeding Guild	Species	Parameter	Definition	Value	Units	Reference	Notes
Bird	Piscivore	Great Blue Heron	BW	Body Weight	2.4	kg	USEPA (1993)	
Bird	Piscivore	Great Blue Heron	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.11	kg, dw/day	USEPA (1993)	Calculated from the ww-based FIR, assuming an 75% moisture content of food (i.e., 0.25 g, dw/g, ww).
Bird	Piscivore	Great Blue Heron	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.43	kg, ww/day	USEPA (1993)	FIR kg/day= WW FIR (kg/kg-day)*BW (kg) with FIR (kg/kg-day) of 0.18 from USEPA (1993)
Bird	Piscivore	Great Blue Heron	P_{veg}	Proportion of Diet - Vegetation	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents; consult additional literature for more information.
Bird	Piscivore	Great Blue Heron	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.15	kg diet item, ww/kg diet, ww	USEPA (1993)	Fish are the preferred prey, but great blues also eat amphibians, reptiles, crustaceans, insects, birds, and Mammals
Bird	Piscivore	Great Blue Heron	P_{ai}	Proportion of Diet - Aquatic Invertebrates	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents
Bird	Piscivore	Great Blue Heron	P_{am}	Proportion of Diet - Amphibians	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Fish are the preferred prey, but great blues also eat amphibians, reptiles, crustaceans, insects, birds, and Mammals
Bird	Piscivore	Great Blue Heron	P_{ff}	Proportion of Diet - Forage Fish	0.80	kg diet item, ww/kg diet, ww	USEPA (1993)	Fish are the preferred prey, but great blues also eat amphibians, reptiles, crustaceans, insects, birds, and mammals
Bird	Piscivore	Great Blue Heron	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents; consult additional literature for more information.
Bird	Piscivore	Great Blue Heron	P_{s}	Proportion of Diet - Sediment	0.0040	kg sediment, dw/kg diet, dw	USEPA (1993)	Assumed to be approximately 20% of the value assumed for the Mallard, which was obtained from Table 4-4 in USEPA (1993)
Bird	Piscivore	Great Blue Heron	IR_{W}	Daily Water Ingestion	0.11	L water/day	USEPA (1993)	IR L/day= IR (L/kg)*BW (kg)
Bird	Piscivore	Great Blue Heron	HR	Home Range	11	acres	USEPA (1993)	Average of Fall and Winter homeranges
Bird	Piscivore	Bald Eagle	BW	Body Weight	4.15	kg	USEPA (1993)	Average of adult male and female bald eagles from Alaska and Florida.
Bird	Piscivore	Bald Eagle	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.12	kg, dw/day	USEPA (1993)	Calculated from the ww-based FIR, assuming an 75% moisture content of food (i.e., 0.25 g, dw/g, ww).
Bird	Piscivore	Bald Eagle	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.50	kg, ww/day	USEPA (1993)	FIR kg/day= WW FIR (kg/kg-day)*BW (kg) with FIR (kg/kg-day) of 0.12 (free-flying in Washington and Connecticut) from USEPA (1993)
Bird	Piscivore	Bald Eagle	P_{veg}	Proportion of Diet - Vegetation	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents.
Bird	Piscivore	Bald Eagle	P_{bi}	Proportion of Diet - Benthic Invertebrates	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents.
Bird	Piscivore	Bald Eagle	P_{ai}	Proportion of Diet - Aquatic Invertebrates	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents.
Bird	Piscivore	Bald Eagle	P_{am}	Proportion of Diet - Amphibians	--	kg diet item, ww/kg diet, ww	USEPA (1993)	Assumed not to be consumed based on reported diet contents.
Bird	Piscivore	Bald Eagle	P_{ff}	Proportion of Diet - Forage Fish	0.45	kg diet item, ww/kg diet, ww	USEPA (1993)	Based on forage fish (bullhead, sucker) percent occurance in pellets from Maine Inland River Habitat.
Bird	Piscivore	Bald Eagle	P_{pf}	Proportion of Diet - Predatory Fish	0.55	kg diet item, ww/kg diet, ww	USEPA (1993)	Based on predatory fish (pickerel, bass, perch) and 'other fish' percent occurance in pellets from Maine Inland River Habitat, as well as conservatively assuming the percetn occurances from birds and mammals.
Bird	Piscivore	Bald Eagle	P_{s}	Proportion of Diet - Sediment	--	kg sediment, dw/kg diet, dw		Assumed negligible based on feedng strategy.
Bird	Piscivore	Bald Eagle	IR_{W}	Daily Water Ingestion	0.15	L water/day	USEPA (1993)	IR L/day= IR 0.036 (L/kg)*BW (kg)
Bird	Piscivore	Bald Eagle	HR	Home Range	4646	acres	USEPA (1993)	Mean Winter home range of adults (both sexes) in Missouri lake habitat.
Mammal	Herbivore	Muskrat	BW	Body Weight	1.6	kg	MN DNR (2020)	Average of all adult body weights in MN (https://www.dnr.state.mn.us/Mammals/muskrat.html)
Mammal	Herbivore	Muskrat	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.14	kg, dw/day	USEPA (1993)	Calculated from the ww-based FIR, assuming an 75% moisture content of food (i.e., 0.25 g, dw/g, ww).
Mammal	Herbivore	Muskrat	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.54	kg, ww/day	USEPA (1993)	FIR kg/day= WW FIR (kg/kg-day)*BW (kg) with FIR (kg/kg-day) of 0.34 from USEPA (1993)
Mammal	Herbivore	Muskrat	P_{veg}	Proportion of Diet - Vegetation	0.80	kg diet item, ww/kg diet, ww	USEPA (1993)	Primarily herbivorous.
Mammal	Herbivore	Muskrat	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.10	kg diet item, ww/kg diet, ww	USEPA (1993)	Primarily herbivorous.
Mammal	Herbivore	Muskrat	P_{ai}	Proportion of Diet - Aquatic Invertebrates	0.10	kg diet item, ww/kg diet, ww	USEPA (1993)	Primarily herbivorous.
Mammal	Herbivore	Muskrat	P_{am}	Proportion of Diet - Amphibians	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents.
Mammal	Herbivore	Muskrat	P_{ff}	Proportion of Diet - Forage Fish	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents.
Mammal	Herbivore	Muskrat	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents.
Mammal	Herbivore	Muskrat	P_{s}	Proportion of Diet - Sediment	0.020	kg sediment, dw/kg diet, dw	USEPA (1993)	Meadow Vole used as a surrogate
Mammal	Herbivore	Muskrat	IR_{W}	Daily Water Ingestion	0.88	L water/day	USEPA (1993)	Max reported; IR L/day= IR (L/kg)*BW (kg)
Mammal	Herbivore	Muskrat	HR	Home Range	0.32	acres	USEPA (1993)	Average HR reported (0.13 ha) converted to acres.

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Mammal	Invertivore	Little Brown Bat	BW	Body Weight	0.0085	kg	MN DNR (2020)	Average of adult little brown bats in Minnesota (https://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=AMACC01010)
Mammal	Invertivore	Little Brown Bat	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.0016	kg, dw/day	Nagy (2001)	Measured value for little brown bat (dry matter intake).
Mammal	Invertivore	Little Brown Bat	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.0049	kg, ww/day	Nagy (2001)	Measured value for little brown bat (fresh matter intake).
Mammal	Invertivore	Little Brown Bat	P_{veg}	Proportion of Diet - Vegetation	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on strict aerial insect diet.
Mammal	Invertivore	Little Brown Bat	P_{bi}	Proportion of Diet - Benthic Invertebrates	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on strict aerial insect diet.
Mammal	Invertivore	Little Brown Bat	P_{ai}	Proportion of Diet - Aquatic Invertebrates	1.0	kg diet item, ww/kg diet, ww	Fenton and Barclay (1980); cited in Sample et al. (1997)	Based on strict aerial insect diet, i.e., aquatic (emergent aerial) insects.
Mammal	Invertivore	Little Brown Bat	P_{am}	Proportion of Diet - Amphibians	--	kg diet item, ww/kg diet, ww	Sample et al. (1997)	Assumed not to be consumed based on strict aerial insect diet.
Mammal	Invertivore	Little Brown Bat	P_{ff}	Proportion of Diet - Forage Fish	--	kg diet item, ww/kg diet, ww	Sample et al. (1997)	Assumed not to be consumed based on strict aerial insect diet.
Mammal	Invertivore	Little Brown Bat	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww	Sample et al. (1997)	Assumed not to be consumed based on strict aerial insect diet.
Mammal	Invertivore	Little Brown Bat	P_{so}	Proportion of Diet - Sediment	--	kg sediment, dw/kg diet, dw	Sample et al. (1997)	Assumed negligible based on feeding strategy.
Mammal	Invertivore	Little Brown Bat	IR_W	Daily Water Ingestion	0.001	L water/day	USEPA (1993)	IR L/day= IR (L/kg)*BW (kg)
Mammal	Invertivore	Little Brown Bat	HR	Home Range	74	acres	Henry et al. (2002); Divine et al. (2020)	Home-range size of pregnant little brown bat on Grosse-Ile, Quebec, Canada, summers of 1999 and 2000 (Henry et al. 2002, as cited in Divine et al. 2020).
Mammal	Omnivore	Mink	BW	Body Weight	1.4	kg	MN DNR (2020)	Average of adult mink in Minnesota (https://www.dnr.state.mn.us/Mammals/mink.html)
Mammal	Omnivore	Mink	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.054	kg, dw/day	USEPA (1993)	Calculated from the ww-based FIR, assuming an 75% moisture content of food (i.e., 0.25 g, dw/g, ww).
Mammal	Omnivore	Mink	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.22	kg, ww/day	USEPA (1993)	FIR kg/day= WW FIR (kg/kg-day)*BW (kg) with FIR (kg/kg-day) of 0.16 (average, adults) from USEPA (1993)
Mammal	Omnivore	Mink	P_{veg}	Proportion of Diet - Vegetation	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Based on data for year round riverine habitats in USEPA (1993)
Mammal	Omnivore	Mink	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.10	kg diet item, ww/kg diet, ww	USEPA (1993)	Based on data for year round riverine habitats in USEPA (1993)
Mammal	Omnivore	Mink	P_{ai}	Proportion of Diet - Aquatic Invertebrates	0.10	kg diet item, ww/kg diet, ww	USEPA (1993)	Based on data for year round riverine habitats in USEPA (1993)
Mammal	Omnivore	Mink	P_{am}	Proportion of Diet - Amphibians	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Based on data for year round riverine habitats in USEPA (1993)
Mammal	Omnivore	Mink	P_{ff}	Proportion of Diet - Forage Fish	0.20	kg diet item, ww/kg diet, ww	USEPA (1993)	Based on data for year round riverine habitats in USEPA (1993)
Mammal	Omnivore	Mink	P_{pf}	Proportion of Diet - Predatory Fish	0.50	kg diet item, ww/kg diet, ww	USEPA (1993)	Based on data for year round riverine habitats in USEPA (1993)
Mammal	Omnivore	Mink	P_s	Proportion of Diet - Sediment	0.030	kg sediment, dw/kg diet, dw	Sample et al. (1997)	Weasel used as a surrogate
Mammal	Omnivore	Mink	IR_W	Daily Water Ingestion	0.055	L water/day	USEPA (1993)	Max reported; IR L/day= IR (L/kg)*BW (kg)
Mammal	Omnivore	Mink	HR	Home Range	19	acres	USEPA (1993)	Home range reported between 1 and 5 km along shorelines, or as low as 7.8 hectares in riverine areas with dense vegetation. 7.8 ha applied.

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Receptor Type	Feeding Guild	Species	Parameter	Definition	Value	Units	Reference	Notes
Mammal	Piscivore	River Otter	BW	Body Weight	7.7	kg	MN DNR (2020)	Average of adult body weights in MN (https://www.dnr.state.mn.us/mammals/riverotter.html)
Mammal	Piscivore	River Otter	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.28	kg, dw/day	Nagy (2001)	Calculated using DW allometric equation for carnivorous Mammals: FIR (dw) = 0.153 x BW ^ 0.834
Mammal	Piscivore	River Otter	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.78	kg, ww/day	Nagy (2001)	Calculated using WW allometric equation for carnivorous Mammals: FIR (ww) = 0.348 x BW ^ 0.859
Mammal	Piscivore	River Otter	P_{veg}	Proportion of Diet - Vegetation	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents
Mammal	Piscivore	River Otter	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.15	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from listed diet items; but higher percent in streams and lake habitats
Mammal	Piscivore	River Otter	P_{ai}	Proportion of Diet - Aquatic Invertebrates	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents
Mammal	Piscivore	River Otter	P_{am}	Proportion of Diet - Amphibians	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from listed diet items reported as amphibians, frogs, salamander, reptiles, and snake
Mammal	Piscivore	River Otter	P_{ff}	Proportion of Diet - Forage Fish	0.35	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from listed diet items based on fish species (rather than size)
Mammal	Piscivore	River Otter	P_{pf}	Proportion of Diet - Predatory Fish	0.45	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from listed diet items based on fish species (rather than size)
Mammal	Piscivore	River Otter	P_{s}	Proportion of Diet - Sediment	--	kg sediment, dw/kg diet, dw		Based on feeding habits assumed to not eat any sediment
Mammal	Piscivore	River Otter	IR_{W}	Daily Water Ingestion	0.41	L water/day	USEPA (1993)	Max reported; IR L/day= IR (L/kg)*BW (kg); River Otter used as surrogate
Mammal	Piscivore	River Otter	HR	Home Range	2842	acres	USEPA (1993)	Based on the average home range of Missouri marsh and streams.

Abbreviations:
dw - dry weight
kg - kilogram
L - liters
ww - wet weight

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Mammal	Piscivore	River Otter	BW	Body Weight	7.7	kg	MN DNR (2020)	Average of adult body weights in MN (https://www.dnr.state.mn.us/mammals/riverotter.html)
Mammal	Piscivore	River Otter	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.28	kg, dw/day	Nagy (2001)	Calculated using DW allometric equation for carnivorous Mammals: FIR (dw) = 0.153 x BW ^ 0.834
Mammal	Piscivore	River Otter	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.78	kg, ww/day	Nagy (2001)	Calculated using WW allometric equation for carnivorous Mammals: FIR (ww) = 0.348 x BW ^ 0.859
Mammal	Piscivore	River Otter	P_{veg}	Proportion of Diet - Vegetation	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents
Mammal	Piscivore	River Otter	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.15	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from listed diet items; but higher percent in streams and lake habitats
Mammal	Piscivore	River Otter	P_{ai}	Proportion of Diet - Aquatic Invertebrates	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents
Mammal	Piscivore	River Otter	P_{am}	Proportion of Diet - Amphibians	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from listed diet items reported as amphibians, frogs, salamander, reptiles, and snake
Mammal	Piscivore	River Otter	P_{ff}	Proportion of Diet - Forage Fish	0.35	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from listed diet items based on fish species (rather than size)
Mammal	Piscivore	River Otter	P_{pf}	Proportion of Diet - Predatory Fish	0.45	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from listed diet items based on fish species (rather than size)
Mammal	Piscivore	River Otter	P_{s}	Proportion of Diet - Sediment	--	kg sediment, dw/kg diet, dw		Based on feeding habits assumed to not eat any sediment
Mammal	Piscivore	River Otter	IR_{W}	Daily Water Ingestion	0.41	L water/day	USEPA (1993)	Max reported; IR L/day= IR (L/kg)*BW (kg); River Otter used as surrogate
Mammal	Piscivore	River Otter	HR	Home Range	2842	acres	USEPA (1993)	Based on the average home range of Missouri marsh and streams.

Abbreviations:
dw - dry weight
kg - kilogram
L - liters
ww - wet weight

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Table 3. Bioaccumulation Parameters
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	Literature-based Bioaccumulation Parameters								Site-Specific Bioaccumulation Parameters [d]
	Water to Aquatic Plant BAF (L water / kg tissue)				Water to Aquatic Invertebrate BAF (L water / kg tissue)				Surface Water to Tissue BAF (L water / kg tissue ww)
Analyte	Value (tissue dw)	Value (tissue ww)[a]	Reference	Notes	Aquatic/Benthic Invert. Value (tissue dw)[b]	Aquatic/Benthic Invert. Value (tissue ww)[c]	Reference	Notes	Amphibian
PFCAs									
PFBA	19	2.8	Divine et al. (2020); Zodrow et al. (2020)	Geomean	298	54	Zodrow et al. (2020) (Surrogate - PFBS)		2.7
PFPeA	191	27.7	Surrogate - PFHxA		298	54	Surrogate - PFBS		NC
PFHxA	191	27.7	Divine et al. (2020); Zodrow et al. (2020)	Geomean	2238	403	Divine et al. (2020); Zodrow et al. (2020)	Geomean	2.2
PFHpA	228	33.06	Surrogate - PFOA		351	63	Divine et al. (2020)	Geomean	NC
PFOA	228	33	Divine et al. (2020); Zodrow et al. (2020)	Geomean	379	68	Divine et al. (2020); Zodrow et al. (2020)	Geomean	3.3
PFNA	5,188	752	Divine et al. (2020); Zodrow et al. (2020)	Geomean	983	177	Divine et al. (2020); Zodrow et al. (2020)	Geomean	184
PFDA	12,360	1,792	Divine et al. (2020)	Geomean	707	127	Divine et al. (2020)	Geomean	689
PFUnA	12,360	1,792	Surrogate - PFDA		707	127	Surrogate - PFDA		473
PFDoA	12,360	1,792	Surrogate - PFDA		707	127	Surrogate - PFDA		1618
PFTrDA	12,360	1,792	Surrogate - PFDA		707	127	Surrogate - PFDA		132
PFTeDA	12,360	1,792	Surrogate - PFDA		707	127	Surrogate - PFDA		45.9
PFSAs									
PFBS	8.0	1.2	Divine et al. (2020); Zodrow et al. (2020)	Geomean	298	54	Divine et al. (2020); Zodrow et al. (2020)	Geomean	10.3
PFPeS	8.0	1.2	Surrogate - PFBS		1327	239	Surrogate - PFHxS		10.1
PFHxS	12	1.7	Divine et al. (2020)	Geomean	1327	239	Divine et al. (2020)	Geomean	6.6
PFHpS	228	33	Surrogate - PFOA		1549	279	Surrogate - PFOS		53.6
PFOS	1,305	189	Divine et al. (2020); Zodrow et al. (2020)	Geomean	1549	279	Divine et al. (2020); Zodrow et al. (2020)	Geomean	454
PFNS	1,305	189	Surrogate - PFOS		1549	279	Surrogate - PFOS		NC
PFDS	1,305	189	Surrogate - PFOS		1549	279	Surrogate - PFOS		NC
FOSA, FASE, FASAAs									
PFOSA	1,305	189	Surrogate - PFOS		1549	279	Surrogate - PFOS		468
N-EtFOSAA	1,305	189	Surrogate - PFOS		1549	279	Surrogate - PFOS		185
N-MeFOSAA	1,305	189	Surrogate - PFOS		1549	279	Surrogate - PFOS		241
Fluortelomers									
6:2 FTS	12	1.7	Surrogate - PFHxS		1327	239	Surrogate - PFHxS		131

PFAS Abbreviations:
FASAA - perrfluoroalkane sulfonamido acetic acids
FASE - perfluoroalkane sulfonamido ethanols
FOSA - perfluorooctane sulfonamides
N-EtFOSAA - N-Ethylperfluorooctane sulfonamidoacetic acid
N-MeFOSAA - N-Methylperfluorooctane sulfonamidoacetic acid
PFAS - Per- and polyfluoroalkyl substances
PFBA - Perfluorobutanoic acid
PFBS - Perfluorobutanesulfonic acid
PFCA - Perfluoroalkyl carboxylic acids
PFDA - Perfluorodecanoic acid
PFDoA - Perfluorododecanoic acid
PFDS - Perfluorodecane sulfonic acid
PFHpA - Perfluoroheptanoic acid
PFHpS - Perfluoroheptane sulfonic acid

PFAS Abbreviations Cont.:
6:2 FTS - 6:2 Fluorotelomer sulfonic acid
PFHxA - Perfluorohexanoic acid
PFHxS - Perfluorohexanesulfonic acid
PFNA - Perfluorononanoic acid
PFNS - Perfluoroonoane sulfonic acid
PFOA - Perfluorooctanoic acid
PFOS - Perfluorooctanesulfonic acid
PFOSA - Perfluorooctane sulfonamide
PFPeA - Perfluoropentanoic acid
PFPeS - Perfluoropentane sulfonic acid
PFSA- Perfluoroalkane sulfonic acids
PFTeDA - Perfluorotetradecanoic acid
PFTrDA - Perfluorotridecanoic acid
PFUnA - Perfluoroundecanoic acid

Addditional Abbreviations:
BAF - Bioaccumulation Factor
dw - dry weight
kg - kilogram
L - liter
NC - not calculated
ww - wet weight

Notes:
a: Converted to ww tissue using 85.5% moisture content (average of algae [84%] and aquatic macrophytes [87%]; Table 4-2 EPA 1993)
b: Converted to ww tissue using 82% moisture content (bivalves (without shell); Table 4-1 EPA 1993)
c: Aquatic/Benthic Invert Values are based on filter-feeding benthic invertebrates (oyster, mussel, gastropod, snail, other bivalves) and were selected to represent aquatic invertebrates (including aerial insects) exposed to PFAS in water. Filter-feeding benthic invertebrates are expected to have exposure to contaminants in the water column similar to other aquatic invertebrate species
d: See Appendix E for BAFs derived using Project 1007 tissue and surface water data.

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Appendix I Food Web Model – Eagle Point Lake
Table 4. Toxicity Reference Values for Birds
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Analyte	TRVs for Birds (µg/kg-day)							
	NOAEL	Basis	Reference	Additional Details	LOAEL	Basis	Reference	Additional Details
PFCAs								
PFBA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFPeA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFHxA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFHpA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFOA	1,000	No effect on growth (body weight) of 1-day old chickens; exposed to PFOA/PFDA/PFOS mixture	Conder et al. (2020)	Yeueng et al. 2009	10,000	Application of a NOAEL-to-LOAEL adjustment factor of 10	Adjustment factor consistent with Divine et al. (2020), Zodrow et al. (2020), and USEPA (2005)	--
PFNA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFDA	1,000	No effect on growth (body weight) of 1-day old chickens; exposed to PFOA/PFDA/PFOS mixture	Conder et al. (2020)	Yeueng et al. 2009	10,000	Application of a NOAEL-to-LOAEL adjustment factor of 10	Adjustment factor consistent with Divine et al. (2020), Zodrow et al. (2020), and USEPA (2005)	--
PFUnA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFDoA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFTrDA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFTeDA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFSAs								
PFBS	92,000	No effect on survival and reproduction in Bobwhite Quail	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Gallagher et al. 2005)	153,000	Lowest bounded LOAEL (Effect on growth in Bobwhite Quail)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Gallagher et al. 2003a)
PFPeS	92,000	Surrogate - PFBS	--	--	153,000	Surrogate - PFBS	--	--
PFHxS	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
PFHpS	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
PFOS	79.0	No effect on reproduction and survival in Bobwhite Quail	Divine et al. (2020) & Zodrow et al. (2020)	Gallagher et al. 2003c (Derived by applying UF of 10 to selected lowest LOAEL)	790	Lowest bounded LOAEL (Effect on reproduction and survival in Bobwhite Quail; exposure included during sensitive life stage, i.e., egg-laying)	Divine et al. (2020) & Zodrow et al. (2020)	Gallagher et al. 2003c (Lowest LOAEL selected due to limited available avian data & study based on sensitive life stage)
PFNS	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
PFDS	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--

Appendix I Food Web Model – Eagle Point Lake
Table 4 Toxicity Reference Values for Birds
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Analyte	TRVs for Birds (µg/kg-day)							
	NOAEL	Basis	Reference	Additional Details	LOAEL	Basis	Reference	Additional Details
FOSA, FASE, FASAAs								
PFOSA	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
N-EtFOSAA	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
N-MeFOSAA	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
Fluortelomers								
6:2 FTS	1000	Surrogate - PFOA	--	--	10000	Surrogate - PFOA	--	--

Notes:
TRVs were selected from the following hierarchy due to preference for EcoSSL TRV-derivation approach (USEPA 2005) and that Zodrow et al. (2020) has been peer reviewed:

1. Divine et al. (2020) and/or Zodrow et al. (2020)
2. Condor et al. (2020)

Abbreviations:
See Table 3 for PFAS abbreviations
µg/kg-day - micrograms per kilogram body weight per day
EcoSSL - Ecological Soil Screening Level
LOAEL - lowest observed adverse effects level
NOAEL - no observed adverse effects level
TRV - toxicity reference value
USEPA - United States Environmental Protection Agency

References:

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Appendix I Food Web Model – Eagle Point Lake
Table 5. Toxicity Reference Values for Mammals Ecological Risk Assessment Food Web
Model Project 1007
Minneapolis, Minnesota

Analyte	TRVs for Mammals (µg/kg-day)							
	NOAEL	Basis	Reference	Additional Details	LOAEL	Basis	Reference	Additional Details
PFCAs								
PFBA	73,000	No effect on growth or reproduction	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (four studies)	175,000	Lowest bounded LOAEL (Effect on reproduction)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Das et al. 2008)
PFPeA	84,000	Surrogate - PFHxA	--	--	175,000	Surrogate - PFHxA	--	--
PFHxA	84,000	No effect on growth, reproduction, or survivial	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (geometric mean of 6 studies)	175,000	Lowest bounded LOAEL (Effect on reproduction & survival in mice)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Iwai and Hoberman 2014)
PFHpA	300	Surrogate - PFOA	--	--	600	Surrogate - PFOA	--	--
PFOA	300	No effect on growth, reproduction, or survival	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (two studies)	600	Lowest bounded LOAEL (Effect on reproduction & survival in mice)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Abbott et al. 2007)
PFNA	830	No effect on reproduction (# live pups) in mice	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Wolf et al. 2010)	1,100	Lowest bounded LOAEL (decreased reproduction in mice)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Wolf et al. 2010)
PFDA	100	No effect on growth (fetal body weight per litter) in pregnant mice	Conder et al. (2020)	Harris and Birnbaum (1989)	6,400	23% control-adjusted decrease in growth (fetal body weight per litter) in pregnant mice	Conder et al. (2020)	Harris and Birnbaum (1989)
PFUnA	300	No effect on growth (body weight in adults and pups) in rats	Conder et al. (2020)	Takahashi et al. (2014)	1,000	13-19% control-adjusted decrease in growth (body weight of pups) in rats	Conder et al. (2020)	Takahashi et al. (2014)
PFDoA	500	No effect on growth (body weight in adults and pups) in rats	Conder et al. (2020)	Kato et al. (2015)	2,500	20-40% control-adjusted decrease in growth (body weight in adults and pups) in rats	Conder et al. (2020)	Kato et al. (2015)
PFTrDA	500	Surrogate - PFDoDA	--	--	2,500	Surrogate - PFDoDA	--	--
PFTeDA	3,000	No effect on growth (body weight in adults and pups) in rats	Conder et al. (2020)	Hirata-Koizumi et al. (2015)	10,000	8-18% control-adjusted decrease in growth (body weight of pups) in rats	Conder et al. (2020)	Hirata-Koizumi et al. (2015)
PFSAs								
PFBS	50,000	No effect on reproduction in mice	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Feng et al. 2017)	200,000	Lowest bounded LOAEL (Effect on reproduction in mice)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Feng et al. 2017)
PFPeS	50,000	Surrogate - PFBS	--	--	200,000	Surrogate - PFBS	--	--
PFHxS	300	No effect on reproduction (litter size) in mice	Conder et al. (2020)	Chang et al. (2018)	1,000	14% control-adjusted decrease in reproduction (litter size) in mice	Conder et al. (2020)	Chang et al. (2018)
PFHpS	300	Surrogate - PFHxS	--	--	1,000	Surrogate - PFHxS	--	--
PFOS	100	No effect on growth, reproduction, or survivial	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (multiple studies)	170	Lowest bounded LOAEL (Effect on reproduction in mice)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Fair et al. 2011)
PFNS	100	Surrogate - PFOS	--	--	170	Surrogate - PFOS	--	--
PFDS	100	Surrogate - PFOS	--	--	170	Surrogate - PFOS	--	--

Appendix I Food Web Model – Eagle Point Lake
Table 5 Toxicity Reference Values for Mammals
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Analyte	TRVs for Mammals (µg/kg-day)							
	NOAEL	Basis	Reference	Additional Details	LOAEL	Basis	Reference	Additional Details
FOSA, FASE, FASAAs								
PFOSA	100	Surrogate - PFOS	--	--	170	Surrogate - PFOS	--	--
N-EtFOSAA	100	Surrogate - PFOS	--	--	170	Surrogate - PFOS	--	--
N-MeFOSAA	100	Surrogate - PFOS	--	--	170	Surrogate - PFOS	--	--
Fluortelomers								
6:2 FTS	300	Surrogate - PFHxS	--	--	1,000	Surrogate - PFHxS	--	--

Notes:
TRVs were selected from the following hierarchy due to preference for EcoSSL TRV-derivation approach (USEPA 2005) and that Zodrow et al. (2020) has been peer reviewed:

1. Divine et al. (2020) and/or Zodrow et al. (2020)
2. Condor et al. (2020)

Abbreviations:
See Table 3 for PFAS abbreviations
µg/kg-day - micrograms per kilogram body weight per day
EcoSSL - Ecological Soil Screening Level
LOAEL - lowest observed adverse effects level
NOAEL - no observed adverse effects level
TRV - toxicity reference value
USEPA - United States Environmental Protection Agency

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Appendix I Food Web Model – Eagle Point Lake
Table 6. Exposure Point Concentrations
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Analyte	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Aquatic Plant EPC (µg/kg, ww)		Aquatic Invertebrate (µg/kg, ww)		Benthic Invertebrate (µg/kg, ww)		Amphibian (µg/kg, ww)		Forage Fish (µg/kg, ww)		Predatory Fish (µg/kg, ww)	
			EPC	Basis	EPC	Basis	EPC	Basis	EPC	Basis	EPC	Basis	EPC	Basis
PFCAs														
PFBA	0.96	0.12	0.33	Calculated	6.3	Calculated	3.6	UCL	0.32	Calculated	0.69	Maximum	0.44	Maximum
PFPeA	0.20	0.0095	0.26	Calculated	0.51	Calculated	0.23	UCL	NC		ND		ND	
PFHxA	0.35	0.012	0.34	Calculated	5.0	Calculated	0.20	UCL	0.027	Calculated	0.13	Maximum	0.12	Maximum
PFHpA	0.29	0.010	0.33	Calculated	0.64	Calculated	0.39	UCL	NC		ND		0.10	Maximum
PFOA	5.3	0.078	2.6	Calculated	5.3	Calculated	2.3	UCL	0.25	Calculated	1.6	UCL	0.24	UCL
PFNA	0.33	0.0016	1.2	Calculated	0.28	Calculated	ND		0.30	Calculated	1.6	UCL	0.20	Maximum
PFDA	0.50	0.0017	3.1	Calculated	0.22	Calculated	0.43	UCL	1.2	Calculated	15.2	UCL	23.3	UCL
PFUnA	0.26	0.0026	4.7	Calculated	0.33	Calculated	0.36	UCL	1.2	Calculated	2.1	UCL	3.1	UCL
PFDoA	ND	0.0028	5.0	Calculated	0.36	Calculated	0.25	UCL	4.5	Calculated	0.81	UCL	0.83	UCL
PFTrDA	ND	0.0011	2.0	Calculated	0.15	Calculated	ND		0.15	Calculated	0.42	UCL	0.27	UCL
PFTeDA	0.23	0.0010	1.7	Calculated	0.12	Calculated	0.16	Maximum	0.045	Calculated	0.27	UCL	0.15	UCL
PFSAs														
PFBS	0.17	0.0048	0.0055	Calculated	0.25	Calculated	0.28	UCL	0.049	Calculated	ND		0.12	UCL
PFPeS	0.30	0.0036	0.0042	Calculated	0.86	Calculated	0.25	UCL	0.036	Calculated	ND		ND	
PFHxS	0.90	0.010	0.017	Calculated	2.4	Calculated	0.24	UCL	0.065	Calculated	1.2	UCL	0.12	UCL
PFHpS	0.45	0.0028	0.094	Calculated	0.79	Calculated	ND		0.15	Calculated	3.3	UCL	1.3	UCL
PFOS	74.5	0.32	60.4	Calculated	88.9	Calculated	23.3	UCL	145	Calculated	2104	UCL	2466	UCL
PFNS	0.21	ND	NC	Calculated	NC	Calculated	ND		NC		3.8	UCL	5.7	UCL
PFDS	0.27	ND	NC	Calculated	NC	Calculated	ND		NC		1.4	UCL	2.0	UCL
FOSA, FASE, FASAAs														
PFOSA	0.97	0.0015	0.29	Calculated	0.42	Calculated	9.8	UCL	0.71	Calculated	14.5	UCL	3.0	UCL
N-EtFOSAA	1.3	0.0017	0.33	Calculated	0.48	Calculated	0.34	UCL	0.32	Calculated	1.9	UCL	0.91	UCL
N-MeFOSAA	0.090	ND	NC	Calculated	NC	Calculated	ND		NC		0.27	Maximum	0.17	UCL
Fluortelomers														
6:2 FTS	0.56	0.0040	0.0070	Calculated	0.96	Calculated	3.2	Maximum	0.52	Calculated	3.3	Maximum	2.0	UCL

Notes:
EPCs were selected as the lower of the selected UCL and maximum detected concentration (see Appendix D)
Site-specific empirical data were selected over modeled values when available:
Benthic invertebrates = crayfish
Amphibians = only one green frog was collected from this area so amphibian concentrations were estimated from surface water
Forage fish = mudminnow, green sunfish, crappie, and bluegill
Predatory fish = largemouth bass
When empirical data were lacking, tissue EPCs were calculated by multiplying the surface water EPC by the analyte- and tissue-specific bioaccumulation parameter (see Table 3).

Additional Abbreviations:
See Table 3 for PFAS abbreviations
µg - micrograms
UCL - upper confidence limit of the arithmetic mean
dw - dry weight
EPC - exposure point concentration
kg - kilogram
L - liters
ww - wet weight

Appendix I Food Web Model – Eagle Point Lake
Table 7. Potential Risks to the Wood Duck
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Eagle Point Lake	
Assumptions for the Wood Duck	
Body Weight (kg)	0.70
Seasonal Use Factor	1
Site-Specific Area Use Factor	0.21
Sediment Ingestion Rate (kg_{dw}/day)	0.0098
Water Ingestion Rate (kg/day)	0.041
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.0064
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.0064
Plant Ingestion Rate (kg_{ww}/day)	0.11

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_s = Incidental ingestion rate of sediment (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_s= Concentration of PFAS in sediment (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations					Potential Daily Dose (ug/kg_{bw}/day)						NOAEL-based TRV (µg/kg_{bw}/day)	NOAEL-based HQ	LOAEL-based TRV (µg/kg_{bw}/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Aquatic Invertebrate EPC (µg/kg, ww)	Plant EPC (µg/kg, ww)	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Benthic Invertebrate	Aquatic Invertebrate	Plant	Sediment	Surface Water	Total				
PFCAs															
PFBA	3.6E+00	6.3E+00	3.3E-01	9.6E-01	1.2E-01	6.7E-03	1.2E-02	1.1E-02	2.8E-03	1.4E-03	3.4E-02	1.0E+03	3.4E-05	1.0E+04	3.4E-06
PFPeA	2.3E-01	5.1E-01	2.6E-01	2.0E-01	9.5E-03	4.4E-04	9.5E-04	8.9E-03	5.7E-04	1.1E-04	1.1E-02	1.0E+03	1.1E-05	1.0E+04	1.1E-06
PFHxA	2.0E-01	5.0E+00	3.4E-01	3.5E-01	1.2E-02	3.7E-04	9.4E-03	1.2E-02	1.0E-03	1.5E-04	2.2E-02	1.0E+03	2.2E-05	1.0E+04	2.2E-06
PFHpA	3.9E-01	6.4E-01	3.3E-01	2.9E-01	1.0E-02	7.3E-04	1.2E-03	1.1E-02	8.4E-04	1.2E-04	1.4E-02	1.0E+03	1.4E-05	1.0E+04	1.4E-06
PFOA	2.3E+00	5.3E+00	2.6E+00	5.3E+00	7.8E-02	4.3E-03	9.9E-03	8.7E-02	1.5E-02	9.3E-04	1.2E-01	1.0E+03	1.2E-04	1.0E+04	1.2E-05
PFNA	ND	2.8E-01	1.2E+00	3.3E-01	1.6E-03	NC	5.3E-04	4.1E-02	9.5E-04	1.9E-05	4.2E-02	1.0E+03	4.2E-05	1.0E+04	4.2E-06
PFDA	4.3E-01	2.2E-01	3.1E+00	5.0E-01	1.7E-03	8.0E-04	4.1E-04	1.0E-01	1.4E-03	2.0E-05	1.1E-01	1.0E+03	1.1E-04	1.0E+04	1.1E-05
PFUnA	3.6E-01	3.3E-01	4.7E+00	2.6E-01	2.6E-03	6.8E-04	6.2E-04	1.6E-01	7.5E-04	3.1E-05	1.6E-01	1.0E+03	1.6E-04	1.0E+04	1.6E-05
PFDoA	2.5E-01	3.6E-01	5.0E+00	ND	2.8E-03	4.7E-04	6.7E-04	1.7E-01	NC	3.3E-05	1.7E-01	1.0E+03	1.7E-04	1.0E+04	1.7E-05
PFTrDA	ND	1.5E-01	2.0E+00	ND	1.1E-03	NC	2.7E-04	6.9E-02	NC	1.4E-05	6.9E-02	1.0E+03	6.9E-05	1.0E+04	6.9E-06
PFTeDA	1.6E-01	1.2E-01	1.7E+00	2.3E-01	9.7E-04	2.9E-04	2.3E-04	5.9E-02	6.7E-04	1.2E-05	6.0E-02	1.0E+03	6.0E-05	1.0E+04	6.0E-06
PFSAs															
PFBS	2.8E-01	2.5E-01	5.5E-03	1.7E-01	4.8E-03	5.3E-04	4.8E-04	1.9E-04	5.0E-04	5.7E-05	1.7E-03	9.2E+04	1.9E-08	1.5E+05	1.1E-08
PFPeS	2.5E-01	8.6E-01	4.2E-03	3.0E-01	3.6E-03	4.7E-04	1.6E-03	1.4E-04	8.5E-04	4.3E-05	3.1E-03	9.2E+04	3.4E-08	1.5E+05	2.0E-08
PFHxS	2.4E-01	2.4E+00	1.7E-02	9.0E-01	9.9E-03	4.6E-04	4.4E-03	5.8E-04	2.6E-03	1.2E-04	8.2E-03	7.9E+01	1.0E-04	7.9E+02	1.0E-05
PFHpS	ND	7.9E-01	9.4E-02	4.5E-01	2.8E-03	NC	1.5E-03	3.2E-03	1.3E-03	3.4E-05	6.0E-03	7.9E+01	7.6E-05	7.9E+02	7.6E-06
PFOS	2.3E+01	8.9E+01	6.0E+01	7.4E+01	3.2E-01	4.4E-02	1.7E-01	2.0E+00	2.1E-01	3.8E-03	2.5E+00	7.9E+01	3.1E-02	7.9E+02	3.1E-03
PFNS	ND	NC	NC	2.1E-01	ND	NC	NC	NC	6.0E-04	NC	6.0E-04	7.9E+01	7.5E-06	7.9E+02	7.5E-07
PFDS	ND	NC	NC	2.7E-01	ND	NC	NC	NC	7.9E-04	NC	7.9E-04	7.9E+01	1.0E-05	7.9E+02	1.0E-06
FOSA, FASE, FASAAs															
PFOSA	9.8E+00	4.2E-01	2.9E-01	9.7E-01	1.5E-03	1.8E-02	7.9E-04	9.6E-03	2.8E-03	1.8E-05	3.2E-02	7.9E+01	4.0E-04	7.9E+02	4.0E-05
N-EtFOSAA	3.4E-01	4.8E-01	3.3E-01	1.3E+00	1.7E-03	6.4E-04	9.0E-04	1.1E-02	3.7E-03	2.1E-05	1.6E-02	7.9E+01	2.1E-04	7.9E+02	2.1E-05
N-MeFOSAA	ND	NC	NC	9.0E-02	ND	NC	NC	NC	2.6E-04	NC	2.6E-04	7.9E+01	3.3E-06	7.9E+02	3.3E-07
Fluortelomers															
6:2 FTS	3.2E+00	9.6E-01	7.0E-03	5.6E-01	4.0E-03	5.9E-03	1.8E-03	2.3E-04	1.6E-03	4.8E-05	9.6E-03	1.0E+03	9.6E-06	1.0E+04	9.6E-07

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:

See Table 3 for PFAS abbreviations
µg - microgram
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
UCL - upper confidence limit of the arithmetic mean
ww - wet weight

Appendix I Food Web Model – Eagle Point Lake
Table 8. Potential Risks to the Tree Swallow
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Eagle Point Lake	
Assumptions for the Tree Swallow	
Body Weight (kg)	0.02
Seasonal Use Factor	1
Site-Specific Area Use Factor	0.82
Water Ingestion Rate (kg/day)	0.0040
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.0092
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.020
Plant Ingestion Rate (kg_{ww}/day)	0.0060

Total Daily Dose = $\frac{\Sigma([IR_f \times C_f] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations				Potential Daily Dose (ug/kg_{bw}/day)					NOAEL-based TRV ($\mu g/kg_{bw}$/day)	NOAEL-based HQ	LOAEL-based TRV ($\mu g/kg_{bw}$/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Aquatic Invertebrate EPC (µg/kg, ww)	Plant EPC (µg/kg, ww)	Surface Water EPC (µg/L)	Benthic Invertebrate	Aquatic Invertebrate	Plant	Surface Water	Total				
PFCAs													
PFBA	3.6E+00	6.3E+00	3.3E-01	1.2E-01	1.3E+00	5.2E+00	7.9E-02	1.9E-02	6.6E+00	1.0E+03	6.6E-03	1.0E+04	6.6E-04
PFPeA	2.3E-01	5.1E-01	2.6E-01	9.5E-03	8.7E-02	4.2E-01	6.4E-02	1.5E-03	5.7E-01	1.0E+03	5.7E-04	1.0E+04	5.7E-05
PFHxA	2.0E-01	5.0E+00	3.4E-01	1.2E-02	7.4E-02	4.1E+00	8.4E-02	2.0E-03	4.3E+00	1.0E+03	4.3E-03	1.0E+04	4.3E-04
PFHpA	3.9E-01	6.4E-01	3.3E-01	1.0E-02	1.5E-01	5.2E-01	8.2E-02	1.6E-03	7.5E-01	1.0E+03	7.5E-04	1.0E+04	7.5E-05
PFOA	2.3E+00	5.3E+00	2.6E+00	7.8E-02	8.6E-01	4.3E+00	6.3E-01	1.3E-02	5.8E+00	1.0E+03	5.8E-03	1.0E+04	5.8E-04
PFNA	ND	2.8E-01	1.2E+00	1.6E-03	NC	2.3E-01	3.0E-01	2.6E-04	5.3E-01	1.0E+03	5.3E-04	1.0E+04	5.3E-05
PFDA	4.3E-01	2.2E-01	3.1E+00	1.7E-03	1.6E-01	1.8E-01	7.5E-01	2.8E-04	1.1E+00	1.0E+03	1.1E-03	1.0E+04	1.1E-04
PFUnA	3.6E-01	3.3E-01	4.7E+00	2.6E-03	1.4E-01	2.7E-01	1.1E+00	4.2E-04	1.5E+00	1.0E+03	1.5E-03	1.0E+04	1.5E-04
PFDoA	2.5E-01	3.6E-01	5.0E+00	2.8E-03	9.5E-02	2.9E-01	1.2E+00	4.6E-04	1.6E+00	1.0E+03	1.6E-03	1.0E+04	1.6E-04
PFTrDA	ND	1.5E-01	2.0E+00	1.1E-03	NC	1.2E-01	5.0E-01	1.9E-04	NC	1.0E+03	NC	1.0E+04	NC
PFTeDA	1.6E-01	1.2E-01	1.7E+00	9.7E-04	5.8E-02	1.0E-01	4.2E-01	1.6E-04	5.8E-01	1.0E+03	5.8E-04	1.0E+04	5.8E-05
PFSAs													
PFBS	2.8E-01	2.5E-01	5.5E-03	4.8E-03	1.0E-01	2.1E-01	1.3E-03	7.8E-04	3.2E-01	9.2E+04	3.4E-06	1.5E+05	2.1E-06
PFPeS	2.5E-01	8.6E-01	4.2E-03	3.6E-03	9.4E-02	7.0E-01	1.0E-03	5.9E-04	8.0E-01	9.2E+04	8.7E-06	1.5E+05	5.2E-06
PFHxS	2.4E-01	2.4E+00	1.7E-02	9.9E-03	9.1E-02	1.9E+00	4.2E-03	1.6E-03	2.0E+00	7.9E+01	2.6E-02	7.9E+02	2.6E-03
PFHpS	ND	7.9E-01	9.4E-02	2.8E-03	NC	6.5E-01	2.3E-02	4.6E-04	6.7E-01	7.9E+01	8.5E-03	7.9E+02	8.5E-04
PFOS	2.3E+01	8.9E+01	6.0E+01	3.2E-01	8.7E+00	7.3E+01	1.5E+01	5.2E-02	9.6E+01	7.9E+01	**1.2E+00**	7.9E+02	1.2E-01
PFNS	ND	NC	NC	ND	NC	NC	NC	NC	NC	7.9E+01	NC	7.9E+02	NC
PFDS	ND	NC	NC	ND	NC	NC	NC	NC	NC	7.9E+01	NC	7.9E+02	NC
FOSA, FASE, FASAAs													
PFOSA	9.8E+00	4.2E-01	2.9E-01	1.5E-03	3.7E+00	3.4E-01	7.0E-02	2.5E-04	4.1E+00	7.9E+01	5.2E-02	7.9E+02	5.2E-03
N-EtFOSAA	3.4E-01	4.8E-01	3.3E-01	1.7E-03	1.3E-01	4.0E-01	8.0E-02	2.8E-04	6.0E-01	7.9E+01	7.6E-03	7.9E+02	7.6E-04
N-MeFOSAA	ND	NC	NC	ND	NC	NC	NC	NC	NC	7.9E+01	NC	7.9E+02	NC
Fluortelomers													
6:2 FTS	3.2E+00	9.6E-01	7.0E-03	4.0E-03	1.2E+00	7.8E-01	1.7E-03	6.5E-04	2.0E+00	1.0E+03	2.0E-03	1.0E+04	2.0E-04

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
UCL - upper confidence limit of the arithmetic mean
ww - wet weight

Appendix I Food Web Model – Eagle Point Lake
Table 9. Potential Risks to the Spotted Sandpiper
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Eagle Point Lake	
Assumptions for the Spotted Sandpiper	
Body Weight (kg)	0.043
Seasonal Use Factor	1
Site-Specific Area Use Factor	1
Sediment Ingestion Rate (kg_{dw}/day)	0.00055
Water Ingestion Rate (kg/day)	0.054
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.0184
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.0034
Forage Fish Ingestion Rate (kg_{ww}/day)	0.0011

Total Daily Dose = $\frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_s = Incidental ingestion rate of sediment (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_s= Concentration of PFAS in sediment (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations					Potential Daily Dose (ug/kg_{bw}/day)						NOAEL-based TRV (µg/kg_{bw}/day)	NOAEL-based HQ	LOAEL-based TRV (µg/kg_{bw}/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Aquatic Invertebrate EPC (µg/kg, ww)	Forage Fish EPC (µg/kg, ww)	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Benthic Invertebrate	Aquatic Invertebrate	Forage Fish	Sediment	Surface Water	Total				
PFCAs															
PFBA	3.60E+00	6.33E+00	6.92E-01	9.61E-01	1.18E-01	1.56E+00	5.13E-01	1.87E-02	1.25E-02	1.51E-01	2.25E+00	1.00E+03	2.25E-03	1.00E+04	2.25E-04
PFPeA	2.33E-01	5.09E-01	ND	1.97E-01	9.48E-03	1.01E-01	4.12E-02	NC	2.57E-03	1.21E-02	1.57E-01	1.00E+03	1.57E-04	1.00E+04	1.57E-05
PFHxA	1.99E-01	5.00E+00	1.26E-01	3.52E-01	1.24E-02	8.60E-02	4.05E-01	3.40E-03	4.59E-03	1.59E-02	5.15E-01	1.00E+03	5.15E-04	1.00E+04	5.15E-05
PFHpA	3.92E-01	6.38E-01	ND	2.91E-01	1.01E-02	1.69E-01	5.17E-02	NC	3.80E-03	1.29E-02	2.38E-01	1.00E+03	2.38E-04	1.00E+04	2.38E-05
PFOA	2.31E+00	5.30E+00	1.56E+00	5.33E+00	7.77E-02	1.00E+00	4.30E-01	4.21E-02	6.94E-02	9.95E-02	1.64E+00	1.00E+03	1.64E-03	1.00E+04	1.64E-04
PFNA	ND	2.85E-01	1.56E+00	3.29E-01	1.61E-03	NC	2.31E-02	4.21E-02	4.29E-03	2.06E-03	7.15E-02	1.00E+03	7.15E-05	1.00E+04	7.15E-06
PFDA	4.26E-01	2.18E-01	1.52E+01	4.99E-01	1.71E-03	1.84E-01	1.76E-02	4.10E-01	6.51E-03	2.19E-03	6.20E-01	1.00E+03	6.20E-04	1.00E+04	6.20E-05
PFUnA	3.62E-01	3.31E-01	2.12E+00	2.60E-01	2.60E-03	1.56E-01	2.68E-02	5.73E-02	3.39E-03	3.33E-03	2.47E-01	1.00E+03	2.47E-04	1.00E+04	2.47E-05
PFDoA	2.53E-01	3.56E-01	8.10E-01	ND	2.80E-03	1.09E-01	2.89E-02	2.19E-02	NC	3.58E-03	1.64E-01	1.00E+03	1.64E-04	1.00E+04	1.64E-05
PFTrDA	ND	1.45E-01	4.16E-01	ND	1.14E-03	NC	1.18E-02	1.12E-02	NC	1.46E-03	2.45E-02	1.00E+03	2.45E-05	1.00E+04	2.45E-06
PFTeDA	1.55E-01	1.23E-01	2.66E-01	2.31E-01	9.70E-04	6.70E-02	1.00E-02	7.19E-03	3.01E-03	1.24E-03	8.84E-02	1.00E+03	8.84E-05	1.00E+04	8.84E-06
PFSAs															
PFBS	2.81E-01	2.55E-01	ND	1.74E-01	4.75E-03	1.21E-01	2.06E-02	NC	2.27E-03	6.08E-03	1.50E-01	9.20E+04	1.64E-06	1.53E+05	9.83E-07
PFPeS	2.52E-01	8.58E-01	ND	2.95E-01	3.59E-03	1.09E-01	6.95E-02	NC	3.85E-03	4.60E-03	1.87E-01	9.20E+04	2.03E-06	1.53E+05	1.22E-06
PFHxS	2.43E-01	2.37E+00	1.16E+00	9.02E-01	9.91E-03	1.05E-01	1.92E-01	3.13E-02	1.18E-02	1.27E-02	3.53E-01	7.90E+01	4.46E-03	7.90E+02	4.46E-04
PFHpS	ND	7.92E-01	3.35E+00	4.46E-01	2.84E-03	NC	6.42E-02	9.04E-02	5.82E-03	3.64E-03	1.64E-01	7.90E+01	2.08E-03	7.90E+02	2.08E-04
PFOS	2.33E+01	8.89E+01	2.10E+03	7.45E+01	3.19E-01	1.01E+01	7.21E+00	5.68E+01	9.71E-01	4.08E-01	7.55E+01	7.90E+01	9.56E-01	7.90E+02	9.56E-02
PFNS	ND	NC	3.84E+00	2.07E-01	ND	NC	NC	1.04E-01	2.70E-03	NC	1.06E-01	7.90E+01	1.35E-03	7.90E+02	1.35E-04
PFDS	ND	NC	1.39E+00	2.73E-01	ND	NC	NC	3.76E-02	3.56E-03	NC	4.12E-02	7.90E+01	5.21E-04	7.90E+02	5.21E-05
FOSA, FASE, FASAAs															
PFOSA	9.83E+00	4.21E-01	1.45E+01	9.71E-01	1.51E-03	4.25E+00	3.41E-02	3.91E-01	1.27E-02	1.93E-03	4.69E+00	7.90E+01	5.93E-02	7.90E+02	5.93E-03
N-EtFOSAA	3.40E-01	4.82E-01	1.86E+00	1.28E+00	1.73E-03	1.47E-01	3.91E-02	5.03E-02	1.67E-02	2.21E-03	2.55E-01	7.90E+01	3.23E-03	7.90E+02	3.23E-04
N-MeFOSAA	ND	NC	2.67E-01	9.00E-02	ND	NC	NC	7.21E-03	1.17E-03	NC	8.39E-03	7.90E+01	1.06E-04	7.90E+02	1.06E-05
Fluortelomers															
6:2 FTS	3.17E+00	9.55E-01	3.29E+00	5.58E-01	4.00E-03	1.37E+00	7.74E-02	8.89E-02	7.28E-03	5.12E-03	1.55E+00	1.00E+03	1.55E-03	1.00E+04	1.55E-04

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:

See Table 3 for PFAS abbreviations
µg - microgram
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
UCL - upper confidence limit of the arithmetic mean
ww - wet weight

Appendix I Food Web Model – Eagle Point Lake
Table 10. Potential Risks to the Great Blue Heron
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Eagle Point Lake	
Assumptions for the Great Blue Heron	
Body Weight (kg)	2.4
Seasonal Use Factor	1
Site-Specific Area Use Factor	1.0
Sediment Ingestion Rate (kg_{dw}/day)	0.00043
Water Ingestion Rate (kg/day)	0.11
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.065
Amphibian Ingestion Rate (kg_{ww}/day)	0.022
Forage Fish Ingestion Rate (kg_{ww}/day)	0.35

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_s = Incidental ingestion rate of sediment (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_s= Concentration of PFAS in sediment (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations					Potential Daily Dose (ug/kg_{bw}/day)						NOAEL-based TRV (µg/kg_{bw}/day)	NOAEL-based HQ	LOAEL-based TRV (µg/kg_{bw}/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Amphibian EPC (µg/kg, ww)	Forage Fish EPC (µg/kg, ww)	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Benthic Invertebrate	Amphibian	Forage Fish	Sediment	Surface Water	Total				
PFCAs															
PFBA	3.6E+00	3.2E-01	6.9E-01	9.6E-01	1.2E-01	9.7E-02	2.9E-03	1.0E-01	1.7E-04	5.3E-03	2.1E-01	1.0E+03	2.1E-04	1.0E+04	2.1E-05
PFPeA	2.3E-01	NC	ND	2.0E-01	9.5E-03	6.3E-03	NC	NC	3.5E-05	4.3E-04	6.8E-03	1.0E+03	6.8E-06	1.0E+04	6.8E-07
PFHxA	2.0E-01	2.7E-02	1.3E-01	3.5E-01	1.2E-02	5.4E-03	2.4E-04	1.8E-02	6.3E-05	5.6E-04	2.4E-02	1.0E+03	2.4E-05	1.0E+04	2.4E-06
PFHpA	3.9E-01	NC	ND	2.9E-01	1.0E-02	1.1E-02	NC	NC	5.2E-05	4.5E-04	1.1E-02	1.0E+03	1.1E-05	1.0E+04	1.1E-06
PFOA	2.3E+00	2.5E-01	1.6E+00	5.3E+00	7.8E-02	6.2E-02	2.3E-03	2.2E-01	9.6E-04	3.5E-03	2.9E-01	1.0E+03	2.9E-04	1.0E+04	2.9E-05
PFNA	ND	3.0E-01	1.6E+00	3.3E-01	1.6E-03	NC	2.7E-03	2.2E-01	5.9E-05	7.2E-05	2.3E-01	1.0E+03	2.3E-04	1.0E+04	2.3E-05
PFDA	4.3E-01	1.2E+00	1.5E+01	5.0E-01	1.7E-03	1.2E-02	1.1E-02	2.2E+00	9.0E-05	7.7E-05	2.2E+00	1.0E+03	2.2E-03	1.0E+04	2.2E-04
PFUnA	3.6E-01	1.2E+00	2.1E+00	2.6E-01	2.6E-03	9.8E-03	1.1E-02	3.1E-01	4.7E-05	1.2E-04	3.3E-01	1.0E+03	3.3E-04	1.0E+04	3.3E-05
PFDoA	2.5E-01	4.5E+00	8.1E-01	ND	2.8E-03	6.8E-03	4.1E-02	1.2E-01	NC	1.3E-04	1.6E-01	1.0E+03	1.6E-04	1.0E+04	1.6E-05
PFTrDA	ND	1.5E-01	4.2E-01	ND	1.1E-03	NC	NC	6.0E-02	NC	5.1E-05	6.0E-02	1.0E+03	6.0E-05	1.0E+04	6.0E-06
PFTeDA	1.6E-01	4.5E-02	2.7E-01	2.3E-01	9.7E-04	4.2E-03	NC	3.8E-02	4.2E-05	4.4E-05	4.3E-02	1.0E+03	4.3E-05	1.0E+04	4.3E-06
PFSAs															
PFBS	2.8E-01	4.9E-02	ND	1.7E-01	4.8E-03	7.6E-03	4.4E-04	NC	3.1E-05	2.1E-04	8.3E-03	9.2E+04	9.0E-08	1.5E+05	5.4E-08
PFPeS	2.5E-01	3.6E-02	ND	3.0E-01	3.6E-03	6.8E-03	3.3E-04	NC	5.3E-05	1.6E-04	7.3E-03	9.2E+04	8.0E-08	1.5E+05	4.8E-08
PFHxS	2.4E-01	6.5E-02	1.2E+00	9.0E-01	9.9E-03	6.6E-03	5.9E-04	1.7E-01	1.6E-04	4.5E-04	1.7E-01	7.9E+01	2.2E-03	7.9E+02	2.2E-04
PFHpS	ND	1.5E-01	3.3E+00	4.5E-01	2.8E-03	NC	1.4E-03	4.8E-01	8.0E-05	1.3E-04	4.8E-01	7.9E+01	6.1E-03	7.9E+02	6.1E-04
PFOS	2.3E+01	1.4E+02	2.1E+03	7.4E+01	3.2E-01	6.3E-01	1.3E+00	3.0E+02	1.3E-02	1.4E-02	3.0E+02	7.9E+01	**3.9E+00**	7.9E+02	3.9E-01
PFNS	ND	NC	3.8E+00	2.1E-01	ND	NC	NC	5.5E-01	3.7E-05	NC	5.5E-01	7.9E+01	7.0E-03	7.9E+02	7.0E-04
PFDS	ND	NC	1.4E+00	2.7E-01	ND	NC	NC	2.0E-01	4.9E-05	NC	2.0E-01	7.9E+01	2.5E-03	7.9E+02	2.5E-04
FOSA, FASE, FASAAs															
PFOSA	9.8E+00	7.1E-01	1.4E+01	9.7E-01	1.5E-03	2.7E-01	6.4E-03	2.1E+00	1.7E-04	6.8E-05	2.4E+00	7.9E+01	3.0E-02	7.9E+02	3.0E-03
N-EtFOSAA	3.4E-01	3.2E-01	1.9E+00	1.3E+00	1.7E-03	9.2E-03	2.9E-03	2.7E-01	2.3E-04	7.8E-05	2.8E-01	7.9E+01	3.6E-03	7.9E+02	3.6E-04
N-MeFOSAA	ND	NC	2.7E-01	9.0E-02	ND	NC	NC	3.8E-02	1.6E-05	NC	3.8E-02	7.9E+01	4.9E-04	7.9E+02	4.9E-05
Fluortelomers															
6:2 FTS	3.2E+00	5.2E-01	3.3E+00	5.6E-01	4.0E-03	8.6E-02	4.7E-03	4.7E-01	1.0E-04	1.8E-04	5.6E-01	1.0E+03	5.6E-04	1.0E+04	5.6E-05

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:

See Table 3 for PFAS abbreviations
µg - microgram
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
UCL - upper confidence limit of the arithmetic mean
ww - wet weight

Appendix I Food Web Model – Eagle Point Lake
Table 11. Potential Risks to the Bald Eagle
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Eagle Point Lake	
Assumptions for the Bald Eagle	
Body Weight (kg)	4.2
Seasonal Use Factor	1
Site-Specific Area Use Factor	0.034
Water Ingestion Rate (kg/day)	0.15
Predatory Fish Ingestion Rate (kg_{ww}/day)	0.27
Forage Fish Ingestion Rate (kg_{ww}/day)	0.22

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations			Potential Daily Dose (ug/kg_{bw}/day)				NOAEL-based TRV ($\mu g/kg_{bw}$/day)	NOAEL-based HQ	LOAEL-based TRV ($\mu g/kg_{bw}$/day)	LOAEL-based HQ
	Predatory Fish (µg/kg, ww)	Forage Fish EPC (µg/kg, ww)	Surface Water EPC (µg/L)	Predatory Fish	Forage Fish	Surface Water	Total				
PFCAs											
PFBA	4.4E-01	6.9E-01	1.2E-01	1.0E-03	1.3E-03	1.5E-04	2.4E-03	1.0E+03	2.4E-06	1.0E+04	2.4E-07
PFPeA	ND	ND	9.5E-03	NC	NC	1.2E-05	1.2E-05	1.0E+03	1.2E-08	1.0E+04	1.2E-09
PFHxA	1.2E-01	1.3E-01	1.2E-02	2.6E-04	2.3E-04	1.5E-05	5.1E-04	1.0E+03	5.1E-07	1.0E+04	5.1E-08
PFHpA	1.0E-01	ND	1.0E-02	2.3E-04	NC	1.3E-05	2.5E-04	1.0E+03	2.5E-07	1.0E+04	2.5E-08
PFOA	2.4E-01	1.6E+00	7.8E-02	5.5E-04	2.9E-03	9.6E-05	3.5E-03	1.0E+03	3.5E-06	1.0E+04	3.5E-07
PFNA	2.0E-01	1.6E+00	1.6E-03	4.6E-04	2.9E-03	2.0E-06	3.4E-03	1.0E+03	3.4E-06	1.0E+04	3.4E-07
PFDA	2.3E+01	1.5E+01	1.7E-03	5.3E-02	2.8E-02	2.1E-06	8.1E-02	1.0E+03	8.1E-05	1.0E+04	8.1E-06
PFUnA	3.1E+00	2.1E+00	2.6E-03	7.0E-03	3.9E-03	3.2E-06	1.1E-02	1.0E+03	1.1E-05	1.0E+04	1.1E-06
PFDoA	8.3E-01	8.1E-01	2.8E-03	1.9E-03	1.5E-03	3.5E-06	3.4E-03	1.0E+03	3.4E-06	1.0E+04	3.4E-07
PFTrDA	2.7E-01	4.2E-01	1.1E-03	6.1E-04	7.7E-04	1.4E-06	1.4E-03	1.0E+03	1.4E-06	1.0E+04	1.4E-07
PFTeDA	1.5E-01	2.7E-01	9.7E-04	3.4E-04	4.9E-04	1.2E-06	8.3E-04	1.0E+03	8.3E-07	1.0E+04	8.3E-08
PFSAs											
PFBS	1.2E-01	ND	4.8E-03	2.7E-04	NC	5.9E-06	2.8E-04	9.2E+04	3.0E-09	1.5E+05	1.8E-09
PFPeS	ND	ND	3.6E-03	NC	NC	4.5E-06	4.5E-06	9.2E+04	4.8E-11	1.5E+05	2.9E-11
PFHxS	1.2E-01	1.2E+00	9.9E-03	2.7E-04	2.2E-03	1.2E-05	2.4E-03	7.9E+01	3.1E-05	7.9E+02	3.1E-06
PFHpS	1.3E+00	3.3E+00	2.8E-03	3.1E-03	6.2E-03	3.5E-06	9.3E-03	7.9E+01	1.2E-04	7.9E+02	1.2E-05
PFOS	2.5E+03	2.1E+03	3.2E-01	5.6E+00	3.9E+00	4.0E-04	9.5E+00	7.9E+01	1.2E-01	7.9E+02	1.2E-02
PFNS	5.7E+00	3.8E+00	ND	1.3E-02	7.1E-03	NC	2.0E-02	7.9E+01	2.6E-04	7.9E+02	2.6E-05
PFDS	2.0E+00	1.4E+00	ND	4.5E-03	2.6E-03	NC	7.1E-03	7.9E+01	9.0E-05	7.9E+02	9.0E-06
FOSA, FASE, FASAAs											
PFOSA	3.0E+00	1.4E+01	1.5E-03	6.9E-03	2.7E-02	1.9E-06	3.4E-02	7.9E+01	4.3E-04	7.9E+02	4.3E-05
N-EtFOSAA	9.1E-01	1.9E+00	1.7E-03	2.1E-03	3.5E-03	2.1E-06	5.5E-03	7.9E+01	7.0E-05	7.9E+02	7.0E-06
N-MeFOSAA	1.7E-01	2.7E-01	ND	3.9E-04	5.0E-04	NC	8.9E-04	7.9E+01	1.1E-05	7.9E+02	1.1E-06
Fluortelomers											
6:2 FTS	2.0E+00	3.3E+00	4.0E-03	4.6E-03	6.1E-03	5.0E-06	1.1E-02	1.0E+03	1.1E-05	1.0E+04	1.1E-06

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
UCL - upper confidence limit of the arithmetic mean
ww - wet weight

Appendix I Food Web Model – Eagle Point Lake
Table 12. Potential Risks to the Muskrat
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Eagle Point Lake	
Assumptions for the Muskrat	
Body Weight (kg)	1.6
Seasonal Use Factor	1
Site-Specific Area Use Factor	1.0
Sediment Ingestion Rate (kg_{dw}/day)	0.0027
Water Ingestion Rate (kg/day)	0.88
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.054
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.054
Plant Ingestion Rate (kg_{ww}/day)	0.43

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_s = Incidental ingestion rate of sediment (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_s= Concentration of PFAS in sediment (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations					Potential Daily Dose (ug/kg_{bw}/day)						NOAEL-based TRV (µg/kg_{bw}/day)	NOAEL-based HQ	LOAEL-based TRV (µg/kg_{bw}/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Aquatic Invertebrate EPC (µg/kg, ww)	Plant EPC (µg/kg, ww)	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Benthic Invertebrate	Aquatic Invertebrate	Plant	Sediment	Surface Water	Total				
PFCAs															
PFBA	3.6E+00	6.3E+00	3.3E-01	9.6E-01	1.2E-01	1.2E-01	2.2E-01	8.8E-02	1.6E-03	6.5E-02	4.9E-01	7.3E+04	6.8E-06	1.8E+05	2.8E-06
PFPeA	2.3E-01	5.1E-01	2.6E-01	2.0E-01	9.5E-03	7.9E-03	1.7E-02	7.1E-02	3.3E-04	5.3E-03	1.0E-01	8.4E+04	1.2E-06	1.8E+05	5.8E-07
PFHxA	2.0E-01	5.0E+00	3.4E-01	3.5E-01	1.2E-02	6.8E-03	1.7E-01	9.3E-02	6.0E-04	6.9E-03	2.8E-01	8.4E+04	3.3E-06	1.8E+05	1.6E-06
PFHpA	3.9E-01	6.4E-01	3.3E-01	2.9E-01	1.0E-02	1.3E-02	2.2E-02	9.1E-02	4.9E-04	5.6E-03	1.3E-01	3.0E+02	4.4E-04	6.0E+02	2.2E-04
PFOA	2.3E+00	5.3E+00	2.6E+00	5.3E+00	7.8E-02	7.9E-02	1.8E-01	7.0E-01	9.1E-03	4.3E-02	1.0E+00	3.0E+02	3.4E-03	6.0E+02	1.7E-03
PFNA	ND	2.8E-01	1.2E+00	3.3E-01	1.6E-03	NC	9.7E-03	3.3E-01	5.6E-04	8.9E-04	3.4E-01	8.3E+02	4.1E-04	1.1E+03	3.1E-04
PFDA	4.3E-01	2.2E-01	3.1E+00	5.0E-01	1.7E-03	1.4E-02	7.4E-03	8.3E-01	8.5E-04	9.5E-04	8.6E-01	1.0E+02	8.6E-03	6.4E+03	1.3E-04
PFUnA	3.6E-01	3.3E-01	4.7E+00	2.6E-01	2.6E-03	1.2E-02	1.1E-02	1.3E+00	4.4E-04	1.4E-03	1.3E+00	3.0E+02	4.3E-03	1.0E+03	1.3E-03
PFDoA	2.5E-01	3.6E-01	5.0E+00	ND	2.8E-03	8.6E-03	1.2E-02	1.4E+00	NC	1.6E-03	1.4E+00	5.0E+02	2.8E-03	2.5E+03	5.5E-04
PFTrDA	ND	1.5E-01	2.0E+00	ND	1.1E-03	NC	4.9E-03	5.6E-01	NC	6.3E-04	5.6E-01	5.0E+02	1.1E-03	2.5E+03	2.2E-04
PFTeDA	1.6E-01	1.2E-01	1.7E+00	2.3E-01	9.7E-04	5.3E-03	4.2E-03	4.7E-01	3.9E-04	5.4E-04	4.8E-01	3.0E+03	1.6E-04	1.0E+04	4.8E-05
PFSAs															
PFBS	2.8E-01	2.5E-01	5.5E-03	1.7E-01	4.8E-03	9.6E-03	8.7E-03	1.5E-03	3.0E-04	2.6E-03	2.3E-02	5.0E+04	4.5E-07	2.0E+05	1.1E-07
PFPeS	2.5E-01	8.6E-01	4.2E-03	3.0E-01	3.6E-03	8.6E-03	2.9E-02	1.1E-03	5.0E-04	2.0E-03	4.1E-02	5.0E+04	8.3E-07	2.0E+05	2.1E-07
PFHxS	2.4E-01	2.4E+00	1.7E-02	9.0E-01	9.9E-03	8.3E-03	8.0E-02	4.7E-03	1.5E-03	5.5E-03	1.0E-01	3.0E+02	3.3E-04	1.0E+03	1.0E-04
PFHpS	ND	7.9E-01	9.4E-02	4.5E-01	2.8E-03	NC	2.7E-02	2.6E-02	7.6E-04	1.6E-03	5.5E-02	3.0E+02	1.8E-04	1.0E+03	5.5E-05
PFOS	2.3E+01	8.9E+01	6.0E+01	7.4E+01	3.2E-01	7.9E-01	3.0E+00	1.6E+01	1.3E-01	1.8E-01	2.1E+01	1.0E+02	2.1E-01	1.7E+02	1.2E-01
PFNS	ND	NC	NC	2.1E-01	ND	NC	NC	NC	3.5E-04	NC	3.5E-04	1.0E+02	3.5E-06	1.7E+02	2.1E-06
PFDS	ND	NC	NC	2.7E-01	ND	NC	NC	NC	4.6E-04	NC	4.6E-04	1.0E+02	4.6E-06	1.7E+02	2.7E-06
FOSA, FASE, FASAAs															
PFOSA	9.8E+00	4.2E-01	2.9E-01	9.7E-01	1.5E-03	3.3E-01	1.4E-02	7.8E-02	1.7E-03	8.4E-04	4.3E-01	1.0E+02	4.3E-03	1.7E+02	2.5E-03
N-EtFOSAA	3.4E-01	4.8E-01	3.3E-01	1.3E+00	1.7E-03	1.2E-02	1.6E-02	8.9E-02	2.2E-03	9.6E-04	1.2E-01	1.0E+02	1.2E-03	1.7E+02	7.1E-04
N-MeFOSAA	ND	NC	NC	9.0E-02	ND	NC	NC	NC	1.5E-04	NC	1.5E-04	1.0E+02	1.5E-06	1.7E+02	9.0E-07
Fluortelomers															
6:2 FTS	3.2E+00	9.6E-01	7.0E-03	5.6E-01	4.0E-03	1.1E-01	3.2E-02	1.9E-03	9.5E-04	2.2E-03	1.5E-01	3.0E+02	4.8E-04	1.0E+03	1.5E-04

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:

See Table 3 for PFAS abbreviations	LOAEL - lowest observed adverse effects level
µg - microgram	NC - not calculated
BW - body weight	ND - not detected
dw - dry weight	NOAEL - no observed adverse effects level
EPC - exposure point concentration	TRV - toxicity reference value
HQ - hazard quotient (Dose/TRV)	UCL - upper confidence limit of the arithmetic mean
kg - kilogram	ww - wet weight
L - liter	

Appendix I Food Web Model – Eagle Point Lake
Table 13. Potential Risks to the Little Brown Bat
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Eagle Point Lake	
Assumptions for the Little Brown Bat	
Body Weight (kg)	0.0085
Seasonal Use Factor	1
Site-Specific Area Use Factor	1.0
Water Ingestion Rate (kg/day)	0.0010
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.0049

Total Daily Dose = $\frac{\Sigma([IR_f \times C_f] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)
AUF = Area use factor (ratio of the receptor's home range relative to the size of

SUPPORTING CALCULATIONS

Analyte	Media Concentrations		Potential Daily Dose (ug/kg_{bw}/day)			NOAEL-based TRV ($\mu g/kg_{bw}$/day)	NOAEL-based HQ	LOAEL-based TRV ($\mu g/kg_{bw}$/day)	LOAEL-based HQ
	Aquatic Invertebrate EPC (µg/kg, ww)	Surface Water EPC (µg/L)	Aquatic Invertebrate	Surface Water	Total				
PFCAs									
PFBA	6.3E+00	1.2E-01	3.6E+00	1.4E-02	3.6E+00	7.3E+04	5.0E-05	1.8E+05	2.1E-05
PFPeA	5.1E-01	9.5E-03	2.9E-01	1.1E-03	2.9E-01	8.4E+04	3.5E-06	1.8E+05	1.7E-06
PFHxA	5.0E+00	1.2E-02	2.9E+00	1.5E-03	2.9E+00	8.4E+04	3.4E-05	1.8E+05	1.6E-05
PFHpA	6.4E-01	1.0E-02	3.6E-01	1.2E-03	3.7E-01	3.0E+02	1.2E-03	6.0E+02	6.1E-04
PFOA	5.3E+00	7.8E-02	3.0E+00	9.1E-03	3.0E+00	3.0E+02	1.0E-02	6.0E+02	5.1E-03
PFNA	2.8E-01	1.6E-03	1.6E-01	1.9E-04	1.6E-01	8.3E+02	2.0E-04	1.1E+03	1.5E-04
PFDA	2.2E-01	1.7E-03	1.2E-01	2.0E-04	1.2E-01	1.0E+02	1.2E-03	6.4E+03	1.9E-05
PFUnA	3.3E-01	2.6E-03	1.9E-01	3.1E-04	1.9E-01	3.0E+02	6.3E-04	1.0E+03	1.9E-04
PFDoA	3.6E-01	2.8E-03	2.0E-01	3.3E-04	2.0E-01	5.0E+02	4.1E-04	2.5E+03	8.1E-05
PFTrDA	1.5E-01	1.1E-03	8.3E-02	1.3E-04	8.3E-02	5.0E+02	1.7E-04	2.5E+03	3.3E-05
PFTeDA	1.2E-01	9.7E-04	7.0E-02	1.1E-04	7.1E-02	3.0E+03	2.4E-05	1.0E+04	7.1E-06
PFSAs									
PFBS	2.5E-01	4.8E-03	1.5E-01	5.6E-04	1.5E-01	5.0E+04	2.9E-06	2.0E+05	7.3E-07
PFPeS	8.6E-01	3.6E-03	4.9E-01	4.2E-04	4.9E-01	5.0E+04	9.8E-06	2.0E+05	2.4E-06
PFHxS	2.4E+00	9.9E-03	1.4E+00	1.2E-03	1.4E+00	3.0E+02	4.5E-03	1.0E+03	1.4E-03
PFHpS	7.9E-01	2.8E-03	4.5E-01	3.3E-04	4.5E-01	3.0E+02	1.5E-03	1.0E+03	4.5E-04
PFOS	8.9E+01	3.2E-01	5.1E+01	3.8E-02	5.1E+01	1.0E+02	5.1E-01	1.7E+02	3.0E-01
PFNS	NC	ND	NC	NC	NC	1.0E+02	NC	1.7E+02	NC
PFDS	NC	ND	NC	NC	NC	1.0E+02	NC	1.7E+02	NC
FOSA, FASE, FASAAs									
PFOSA	4.2E-01	1.5E-03	2.4E-01	1.8E-04	2.4E-01	1.0E+02	2.4E-03	1.7E+02	1.4E-03
N-EtFOSAA	4.8E-01	1.7E-03	2.8E-01	2.0E-04	2.8E-01	1.0E+02	2.8E-03	1.7E+02	1.6E-03
N-MeFOSAA	NC	ND	NC	NC	NC	1.0E+02	NC	1.7E+02	NC
Fluortelomers									
6:2 FTS	9.6E-01	4.0E-03	5.5E-01	4.7E-04	5.5E-01	3.0E+02	1.8E-03	1.0E+03	5.5E-04

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
UCL - upper confidence limit of the arithmetic mean
ww - wet weight

Appendix I Food Web Model – Eagle Point Lake
Table 14. Potential Risks to the Mink
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Eagle Point Lake	
Assumptions for the Mink	
Body Weight (kg)	1.4
Seasonal Use Factor	1
Site-Specific Area Use Factor	1.0
Sediment Ingestion Rate (kg_{dw}/day)	0.0016
Water Ingestion Rate (kg/day)	0.055
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.022
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.022
Plant Ingestion Rate (kg_{ww}/day)	0.011
Amphibian Ingestion Rate (kg_{ww}/day)	0.011
Forage Fish Ingestion Rate (kg_{ww}/day)	0.044
Predatory Fish Ingestion Rate (kg_{ww}/day)	0.11

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_s = Incidental ingestion rate of sediment (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_s= Concentration of PFAS in sediment (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

	Media Concentrations								Potential Daily Dose (ug/kg_{bw}/day)											
Analyte	**Benthic Invertebrate EPC (µg/kg, ww)**	**Aquatic Invertebrate EPC (µg/kg, ww)**	**Plant EPC (µg/kg, ww)**	**Amphibian EPC (µg/kg, ww)**	**Forage Fish EPC (µg/kg, ww)**	**Predatory Fish EPC (µg/kg, ww)**	**Sediment EPC (µg/kg, dw)**	**Surface Water EPC (µg/L)**	**Benthic Invertebrate**	**Aquatic Invertebrate**	**Plant**	**Amphibian**	**Forage Fish**	**Predatory Fish**	**Sediment**	**Surface Water**	**Total**	**NOAEL-based TRV ($\mu g/kg_{bw}$/day)**	**NOAEL-based HQ**	**LOAEL-based TRV ($\mu g/kg_{bw}$/day)**	**LOAEL-based HQ**
PFCAs																					
PFBA	3.6E+00	6.3E+00	3.3E-01	3.2E-01	6.9E-01	4.4E-01	9.6E-01	1.2E-01	5.8E-02	1.0E-01	2.6E-03	2.6E-03	2.2E-02	3.5E-02	1.2E-03	4.8E-03	2.3E-01	7.3E+04	3.1E-06	1.8E+05	1.3E-06
PFPeA	2.3E-01	5.1E-01	2.6E-01	NC	ND	ND	2.0E-01	9.5E-03	3.7E-03	8.1E-03	2.1E-03	NC	NC	NC	2.4E-04	3.8E-04	1.5E-02	8.4E+04	1.7E-07	1.8E+05	8.3E-08
PFHxA	2.0E-01	5.0E+00	3.4E-01	2.7E-02	1.3E-01	1.2E-01	3.5E-01	1.2E-02	3.2E-03	8.0E-02	2.7E-03	2.2E-04	4.0E-03	9.3E-03	4.2E-04	5.0E-04	1.0E-01	8.4E+04	1.2E-06	1.8E+05	5.7E-07
PFHpA	3.9E-01	6.4E-01	3.3E-01	NC	ND	1.0E-01	2.9E-01	1.0E-02	6.3E-03	1.0E-02	2.7E-03	NC	NC	8.2E-03	3.5E-04	4.1E-04	2.8E-02	3.0E+02	9.4E-05	6.0E+02	4.7E-05
PFOA	2.3E+00	5.3E+00	2.6E+00	2.5E-01	1.6E+00	2.4E-01	5.3E+00	7.8E-02	3.7E-02	8.5E-02	2.1E-02	2.0E-03	5.0E-02	1.9E-02	6.4E-03	3.1E-03	2.2E-01	3.0E+02	7.4E-04	6.0E+02	3.7E-04
PFNA	ND	2.8E-01	1.2E+00	3.0E-01	1.6E+00	2.0E-01	3.3E-01	1.6E-03	NC	4.6E-03	9.7E-03	2.4E-03	5.0E-02	1.6E-02	3.9E-04	6.5E-05	8.3E-02	8.3E+02	1.0E-04	1.1E+03	7.6E-05
PFDA	4.3E-01	2.2E-01	3.1E+00	1.2E+00	1.5E+01	2.3E+01	5.0E-01	1.7E-03	6.8E-03	3.5E-03	2.5E-02	9.4E-03	4.9E-01	1.9E+00	6.0E-04	6.9E-05	2.4E+00	1.0E+02	2.4E-02	6.4E+03	3.7E-04
PFUnA	3.6E-01	3.3E-01	4.7E+00	1.2E+00	2.1E+00	3.1E+00	2.6E-01	2.6E-03	5.8E-03	5.3E-03	3.7E-02	9.8E-03	6.8E-02	2.5E-01	3.1E-04	1.1E-04	3.7E-01	3.0E+02	1.2E-03	1.0E+03	3.7E-04
PFDoA	2.5E-01	3.6E-01	5.0E+00	4.5E+00	8.1E-01	8.3E-01	ND	2.8E-03	4.0E-03	5.7E-03	4.0E-02	3.6E-02	2.6E-02	6.6E-02	NC	1.1E-04	1.8E-01	5.0E+02	3.6E-04	2.5E+03	7.1E-05
PFTrDA	ND	1.5E-01	2.0E+00	1.5E-01	4.2E-01	2.7E-01	ND	1.1E-03	NC	2.3E-03	1.6E-02	NC	1.3E-02	2.2E-02	NC	4.6E-05	5.4E-02	5.0E+02	1.1E-04	2.5E+03	2.1E-05
PFTeDA	1.6E-01	1.2E-01	1.7E+00	4.5E-02	2.7E-01	1.5E-01	2.3E-01	9.7E-04	2.5E-03	2.0E-03	1.4E-02	NC	8.5E-03	1.2E-02	2.8E-04	3.9E-05	3.9E-02	3.0E+03	1.3E-05	1.0E+04	3.9E-06
PFSAs																					
PFBS	2.8E-01	2.5E-01	5.5E-03	4.9E-02	ND	1.2E-01	1.7E-01	4.8E-03	4.5E-03	4.1E-03	4.4E-05	3.9E-04	NC	9.5E-03	2.1E-04	1.9E-04	1.9E-02	5.0E+04	3.8E-07	2.0E+05	9.5E-08
PFPeS	2.5E-01	8.6E-01	4.2E-03	3.6E-02	ND	ND	3.0E-01	3.6E-03	4.0E-03	1.4E-02	3.3E-05	2.9E-04	NC	NC	3.5E-04	1.5E-04	1.9E-02	5.0E+04	3.7E-07	2.0E+05	9.3E-08
PFHxS	2.4E-01	2.4E+00	1.7E-02	6.5E-02	1.2E+00	1.2E-01	9.0E-01	9.9E-03	3.9E-03	3.8E-02	1.4E-04	5.2E-04	3.7E-02	9.5E-03	1.1E-03	4.0E-04	9.1E-02	3.0E+02	3.0E-04	1.0E+03	9.1E-05
PFHpS	ND	7.9E-01	9.4E-02	1.5E-01	3.3E+00	1.3E+00	4.5E-01	2.8E-03	NC	1.3E-02	7.5E-04	1.2E-03	1.1E-01	1.1E-01	5.4E-04	1.1E-04	2.3E-01	3.0E+02	7.7E-04	1.0E+03	2.3E-04
PFOS	2.3E+01	8.9E+01	6.0E+01	1.4E+02	2.1E+03	2.5E+03	7.4E+01	3.2E-01	3.7E-01	1.4E+00	4.8E-01	1.2E+00	6.7E+01	2.0E+02	8.9E-02	1.3E-02	2.7E+02	1.0E+02	**2.7E+00**	1.7E+02	**1.6E+00**
PFNS	ND	NC	NC	NC	3.8E+00	5.7E+00	2.1E-01	ND	NC	NC	NC	NC	1.2E-01	4.6E-01	2.5E-04	NC	5.8E-01	1.0E+02	5.8E-03	1.7E+02	3.4E-03
PFDS	ND	NC	NC	NC	1.4E+00	2.0E+00	2.7E-01	ND	NC	NC	NC	NC	4.5E-02	1.6E-01	3.3E-04	NC	2.0E-01	1.0E+02	2.0E-03	1.7E+02	1.2E-03
FOSA, FASE, FASAAs																					
PFOSA	9.8E+00	4.2E-01	2.9E-01	7.1E-01	1.4E+01	3.0E+00	9.7E-01	1.5E-03	1.6E-01	6.7E-03	2.3E-03	5.6E-03	4.6E-01	2.4E-01	1.2E-03	6.1E-05	8.8E-01	1.0E+02	8.8E-03	1.7E+02	5.2E-03
N-EtFOSAA	3.4E-01	4.8E-01	3.3E-01	3.2E-01	1.9E+00	9.1E-01	1.3E+00	1.7E-03	5.4E-03	7.7E-03	2.6E-03	2.6E-03	6.0E-02	7.3E-02	1.5E-03	7.0E-05	1.5E-01	1.0E+02	1.5E-03	1.7E+02	8.9E-04
N-MeFOSAA	ND	NC	NC	NC	2.7E-01	1.7E-01	9.0E-02	ND	NC	NC	NC	NC	8.5E-03	1.4E-02	1.1E-04	NC	2.2E-02	1.0E+02	2.2E-04	1.7E+02	1.3E-04
Fluortelomers																					
6:2 FTS	3.2E+00	9.6E-01	7.0E-03	5.2E-01	3.3E+00	2.0E+00	5.6E-01	4.0E-03	5.1E-02	1.5E-02	5.6E-05	4.2E-03	1.1E-01	1.6E-01	6.7E-04	1.6E-04	3.4E-01	3.0E+02	1.1E-03	1.0E+03	3.4E-04

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:

See Table 3 for PFAS abbreviations	LOAEL - lowest observed adverse effects level
µg - microgram	NC - not calculated
BW - body weight	ND - not detected
dw - dry weight	NOAEL - no observed adverse effects level
EPC - exposure point concentration	TRV - toxicity reference value
HQ - hazard quotient (Dose/TRV)	UCL - upper confidence limit of the arithmetic mean
kg - kilogram	ww - wet weight
L - liter	

Appendix I Food Web Model – Eagle Point Lake
Table 15. Potential Risks to the River Otter
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Eagle Point Lake	
Assumptions for the River Otter	
Body Weight (kg)	7.7
Seasonal Use Factor	1
Site-Specific Area Use Factor	0.056
Water Ingestion Rate (kg/day)	0.41
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.12
Amphibian Ingestion Rate (kg_{ww}/day)	0.039
Forage Fish Ingestion Rate (kg_{ww}/day)	0.27
Predatory Fish Ingestion Rate (kg_{ww}/day)	0.35

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations					Potential Daily Dose (ug/kg_{bw}/day)						NOAEL-based TRV ($\mu g/kg_{bw}$/day)	NOAEL-based HQ	LOAEL-based TRV ($\mu g/kg_{bw}$/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Amphibian EPC (µg/kg, ww)	Forage Fish EPC (µg/kg, ww)	Predatory Fish EPC (µg/kg, ww)	Surface Water EPC (µg/L)	Benthic Invertebrate	Amphibian	Forage Fish	Predatory Fish	Surface Water	Total				
PFCAs															
PFBA	3.6E+00	3.2E-01	6.9E-01	4.4E-01	1.2E-01	3.1E-03	9.2E-05	1.4E-03	1.1E-03	3.5E-04	6.1E-03	7.3E+04	8.3E-08	1.8E+05	3.5E-08
PFPeA	2.3E-01	NC	ND	ND	9.5E-03	2.0E-04	NC	NC	NC	2.8E-05	2.3E-04	8.4E+04	2.7E-09	1.8E+05	1.3E-09
PFHxA	2.0E-01	2.7E-02	1.3E-01	1.2E-01	1.2E-02	1.7E-04	7.7E-06	2.5E-04	3.0E-04	3.7E-05	7.7E-04	8.4E+04	9.1E-09	1.8E+05	4.4E-09
PFHpA	3.9E-01	NC	ND	1.0E-01	1.0E-02	3.4E-04	NC	NC	2.7E-04	3.0E-05	6.3E-04	3.0E+02	2.1E-06	6.0E+02	1.1E-06
PFOA	2.3E+00	2.5E-01	1.6E+00	2.4E-01	7.8E-02	2.0E-03	7.3E-05	3.1E-03	6.2E-04	2.3E-04	6.0E-03	3.0E+02	2.0E-05	6.0E+02	1.0E-05
PFNA	ND	3.0E-01	1.6E+00	2.0E-01	1.6E-03	NC	8.5E-05	3.1E-03	5.2E-04	4.8E-06	3.7E-03	8.3E+02	4.5E-06	1.1E+03	3.4E-06
PFDA	4.3E-01	1.2E+00	1.5E+01	2.3E+01	1.7E-03	3.7E-04	3.4E-04	3.0E-02	6.0E-02	5.1E-06	9.1E-02	1.0E+02	9.1E-04	6.4E+03	1.4E-05
PFUnA	3.6E-01	1.2E+00	2.1E+00	3.1E+00	2.6E-03	3.1E-04	3.5E-04	4.3E-03	8.0E-03	7.8E-06	1.3E-02	3.0E+02	4.3E-05	1.0E+03	1.3E-05
PFDoA	2.5E-01	4.5E+00	8.1E-01	8.3E-01	2.8E-03	2.2E-04	1.3E-03	1.6E-03	2.1E-03	8.4E-06	5.3E-03	5.0E+02	1.1E-05	2.5E+03	2.1E-06
PFTrDA	ND	1.5E-01	4.2E-01	2.7E-01	1.1E-03	NC	NC	8.3E-04	7.0E-04	3.4E-06	1.5E-03	5.0E+02	3.1E-06	2.5E+03	6.1E-07
PFTeDA	1.6E-01	4.5E-02	2.7E-01	1.5E-01	9.7E-04	1.3E-04	NC	5.3E-04	3.8E-04	2.9E-06	1.1E-03	3.0E+03	3.5E-07	1.0E+04	1.1E-07
PFSAs															
PFBS	2.8E-01	4.9E-02	ND	1.2E-01	4.8E-03	2.4E-04	1.4E-05	NC	3.1E-04	1.4E-05	5.8E-04	5.0E+04	1.2E-08	2.0E+05	2.9E-09
PFPeS	2.5E-01	3.6E-02	ND	ND	3.6E-03	2.2E-04	1.0E-05	NC	NC	1.1E-05	2.4E-04	5.0E+04	4.8E-09	2.0E+05	1.2E-09
PFHxS	2.4E-01	6.5E-02	1.2E+00	1.2E-01	9.9E-03	2.1E-04	1.9E-05	2.3E-03	3.1E-04	3.0E-05	2.9E-03	3.0E+02	9.6E-06	1.0E+03	2.9E-06
PFHpS	ND	1.5E-01	3.3E+00	1.3E+00	2.8E-03	NC	4.4E-05	6.7E-03	3.5E-03	8.5E-06	1.0E-02	3.0E+02	3.4E-05	1.0E+03	1.0E-05
PFOS	2.3E+01	1.4E+02	2.1E+03	2.5E+03	3.2E-01	2.0E-02	4.2E-02	4.2E+00	6.4E+00	9.6E-04	1.1E+01	1.0E+02	1.1E-01	1.7E+02	6.3E-02
PFNS	ND	NC	3.8E+00	5.7E+00	ND	NC	NC	7.7E-03	1.5E-02	NC	2.3E-02	1.0E+02	2.3E-04	1.7E+02	1.3E-04
PFDS	ND	NC	1.4E+00	2.0E+00	ND	NC	NC	2.8E-03	5.2E-03	NC	7.9E-03	1.0E+02	7.9E-05	1.7E+02	4.7E-05
FOSA, FASE, FASAAs															
PFOSA	9.8E+00	7.1E-01	1.4E+01	3.0E+00	1.5E-03	8.4E-03	2.0E-04	2.9E-02	7.9E-03	4.5E-06	4.6E-02	1.0E+02	4.6E-04	1.7E+02	2.7E-04
N-EtFOSAA	3.4E-01	3.2E-01	1.9E+00	9.1E-01	1.7E-03	2.9E-04	9.2E-05	3.7E-03	2.3E-03	5.2E-06	6.5E-03	1.0E+02	6.5E-05	1.7E+02	3.8E-05
N-MeFOSAA	ND	NC	2.7E-01	1.7E-01	ND	NC	NC	5.4E-04	4.4E-04	NC	9.8E-04	1.0E+02	9.8E-06	1.7E+02	5.8E-06
Fluortelomers															
6:2 FTS	3.2E+00	5.2E-01	3.3E+00	2.0E+00	4.0E-03	2.7E-03	1.5E-04	6.6E-03	5.2E-03	1.2E-05	1.5E-02	3.0E+02	4.9E-05	1.0E+03	1.5E-05

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:

See Table 3 for PFAS abbreviations
µg - microgram
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
UCL - upper confidence limit of the arithmetic mean
ww - wet weight

Appendix I Food Web Model – Eagle Point Lake
Table 16. Summary of Potential Risks to Wildlife at Eagle Point Lake
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Analyte	Hazard Quotients for Potential PFAS Exposure																	
	Wood Duck		Tree Swallow		Spotted Sandpiper		Great Blue Heron		Bald Eagle		Muskrat		Little Brown Bat		Mink		River Otter	
	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ
PFCAs																		
PFBA	3.4E-05	3.4E-06	6.6E-03	6.6E-04	2.3E-03	2.3E-04	2.1E-04	2.1E-05	2.4E-06	2.4E-07	6.8E-06	2.8E-06	5.0E-05	2.1E-05	3.1E-06	1.3E-06	8.3E-08	3.5E-08
PFPeA	1.1E-05	1.1E-06	5.7E-04	5.7E-05	1.6E-04	1.6E-05	6.8E-06	6.8E-07	1.2E-08	1.2E-09	1.2E-06	5.8E-07	3.5E-06	1.7E-06	1.7E-07	8.3E-08	2.7E-09	1.3E-09
PFHxA	2.2E-05	2.2E-06	4.3E-03	4.3E-04	5.1E-04	5.1E-05	2.4E-05	2.4E-06	5.1E-07	5.1E-08	3.3E-06	1.6E-06	3.4E-05	1.6E-05	1.2E-06	5.7E-07	9.1E-09	4.4E-09
PFHpA	1.4E-05	1.4E-06	7.5E-04	7.5E-05	2.4E-04	2.4E-05	1.1E-05	1.1E-06	2.5E-07	2.5E-08	4.4E-04	2.2E-04	1.2E-03	6.1E-04	9.4E-05	4.7E-05	2.1E-06	1.1E-06
PFOA	1.2E-04	1.2E-05	5.8E-03	5.8E-04	1.6E-03	1.6E-04	2.9E-04	2.9E-05	3.5E-06	3.5E-07	3.4E-03	1.7E-03	1.0E-02	5.1E-03	7.4E-04	3.7E-04	2.0E-05	1.0E-05
PFNA	4.2E-05	4.2E-06	5.3E-04	5.3E-05	7.1E-05	7.1E-06	2.3E-04	2.3E-05	3.4E-06	3.4E-07	4.1E-04	3.1E-04	2.0E-04	1.5E-04	1.0E-04	7.6E-05	4.5E-06	3.4E-06
PFDA	1.1E-04	1.1E-05	1.1E-03	1.1E-04	6.2E-04	6.2E-05	2.2E-03	2.2E-04	8.1E-05	8.1E-06	8.6E-03	1.3E-04	1.2E-03	1.9E-05	2.4E-02	3.7E-04	9.1E-04	1.4E-05
PFUnA	1.6E-04	1.6E-05	1.5E-03	1.5E-04	2.5E-04	2.5E-05	3.3E-04	3.3E-05	1.1E-05	1.1E-06	4.3E-03	1.3E-03	6.3E-04	1.9E-04	1.2E-03	3.7E-04	4.3E-05	1.3E-05
PFDoA	1.7E-04	1.7E-05	1.6E-03	1.6E-04	1.6E-04	1.6E-05	1.6E-04	1.6E-05	3.4E-06	3.4E-07	2.8E-03	5.5E-04	4.1E-04	8.1E-05	3.6E-04	7.1E-05	1.1E-05	2.1E-06
PFTrDA	6.9E-05	6.9E-06	NC	NC	2.4E-05	2.4E-06	6.0E-05	6.0E-06	1.4E-06	1.4E-07	1.1E-03	2.2E-04	1.7E-04	3.3E-05	1.1E-04	2.1E-05	3.1E-06	6.1E-07
PFTeDA	6.0E-05	6.0E-06	5.8E-04	5.8E-05	8.8E-05	8.8E-06	4.3E-05	4.3E-06	8.3E-07	8.3E-08	1.6E-04	4.8E-05	2.4E-05	7.1E-06	1.3E-05	3.9E-06	3.5E-07	1.1E-07
PFSAs																		
PFBS	1.9E-08	1.1E-08	3.4E-06	2.1E-06	1.6E-06	9.8E-07	9.0E-08	5.4E-08	3.0E-09	1.8E-09	4.5E-07	1.1E-07	2.9E-06	7.3E-07	3.8E-07	9.5E-08	1.2E-08	2.9E-09
PFPeS	3.4E-08	2.0E-08	8.7E-06	5.2E-06	2.0E-06	1.2E-06	8.0E-08	4.8E-08	4.8E-11	2.9E-11	8.3E-07	2.1E-07	9.8E-06	2.4E-06	3.7E-07	9.3E-08	4.8E-09	1.2E-09
PFHxS	1.0E-04	1.0E-05	2.6E-02	2.6E-03	4.5E-03	4.5E-04	2.2E-03	2.2E-04	3.1E-05	3.1E-06	3.3E-04	1.0E-04	4.5E-03	1.4E-03	3.0E-04	9.1E-05	9.6E-06	2.9E-06
PFHpS	7.6E-05	7.6E-06	8.5E-03	8.5E-04	2.1E-03	2.1E-04	6.1E-03	6.1E-04	1.2E-04	1.2E-05	1.8E-04	5.5E-05	1.5E-03	4.5E-04	7.7E-04	2.3E-04	3.4E-05	1.0E-05
PFOS	3.1E-02	3.1E-03	**1.2E+00**	1.2E-01	9.6E-01	9.6E-02	**3.9E+00**	3.9E-01	1.2E-01	1.2E-02	2.1E-01	1.2E-01	5.1E-01	3.0E-01	**2.7E+00**	**1.6E+00**	1.1E-01	6.3E-02
PFNS	7.5E-06	7.5E-07	NC	NC	1.3E-03	1.3E-04	7.0E-03	7.0E-04	2.6E-04	2.6E-05	3.5E-06	2.1E-06	NC	NC	5.8E-03	3.4E-03	2.3E-04	1.3E-04
PFDS	1.0E-05	1.0E-06	NC	NC	5.2E-04	5.2E-05	2.5E-03	2.5E-04	9.0E-05	9.0E-06	4.6E-06	2.7E-06	NC	NC	2.0E-03	1.2E-03	7.9E-05	4.7E-05
FOSA, FASE, FASAAs																		
PFOSA	4.0E-04	4.0E-05	5.2E-02	5.2E-03	5.9E-02	5.9E-03	3.0E-02	3.0E-03	4.3E-04	4.3E-05	4.3E-03	2.5E-03	2.4E-03	1.4E-03	8.8E-03	5.2E-03	4.6E-04	2.7E-04
N-EtFOSAA	2.1E-04	2.1E-05	7.6E-03	7.6E-04	3.2E-03	3.2E-04	3.6E-03	3.6E-04	7.0E-05	7.0E-06	1.2E-03	7.1E-04	2.8E-03	1.6E-03	1.5E-03	8.9E-04	6.5E-05	3.8E-05
N-MeFOSAA	3.3E-06	3.3E-07	NC	NC	1.1E-04	1.1E-05	4.9E-04	4.9E-05	1.1E-05	1.1E-06	1.5E-06	9.0E-07	NC	NC	2.2E-04	1.3E-04	9.8E-06	5.8E-06
Fluortelomers																		
6:2 FTS	9.6E-06	9.6E-07	2.0E-03	2.0E-04	1.5E-03	1.5E-04	5.6E-04	5.6E-05	1.1E-05	1.1E-06	4.8E-04	1.5E-04	1.8E-03	5.5E-04	1.1E-03	3.4E-04	4.9E-05	1.5E-05

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
NC - Not Calculated
NOAEL - No Observed Adverse Effects Level

Appendix I Food Web Model – Eagle Point Lake
Figure 1 - Total Daily Intake of PFAS
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

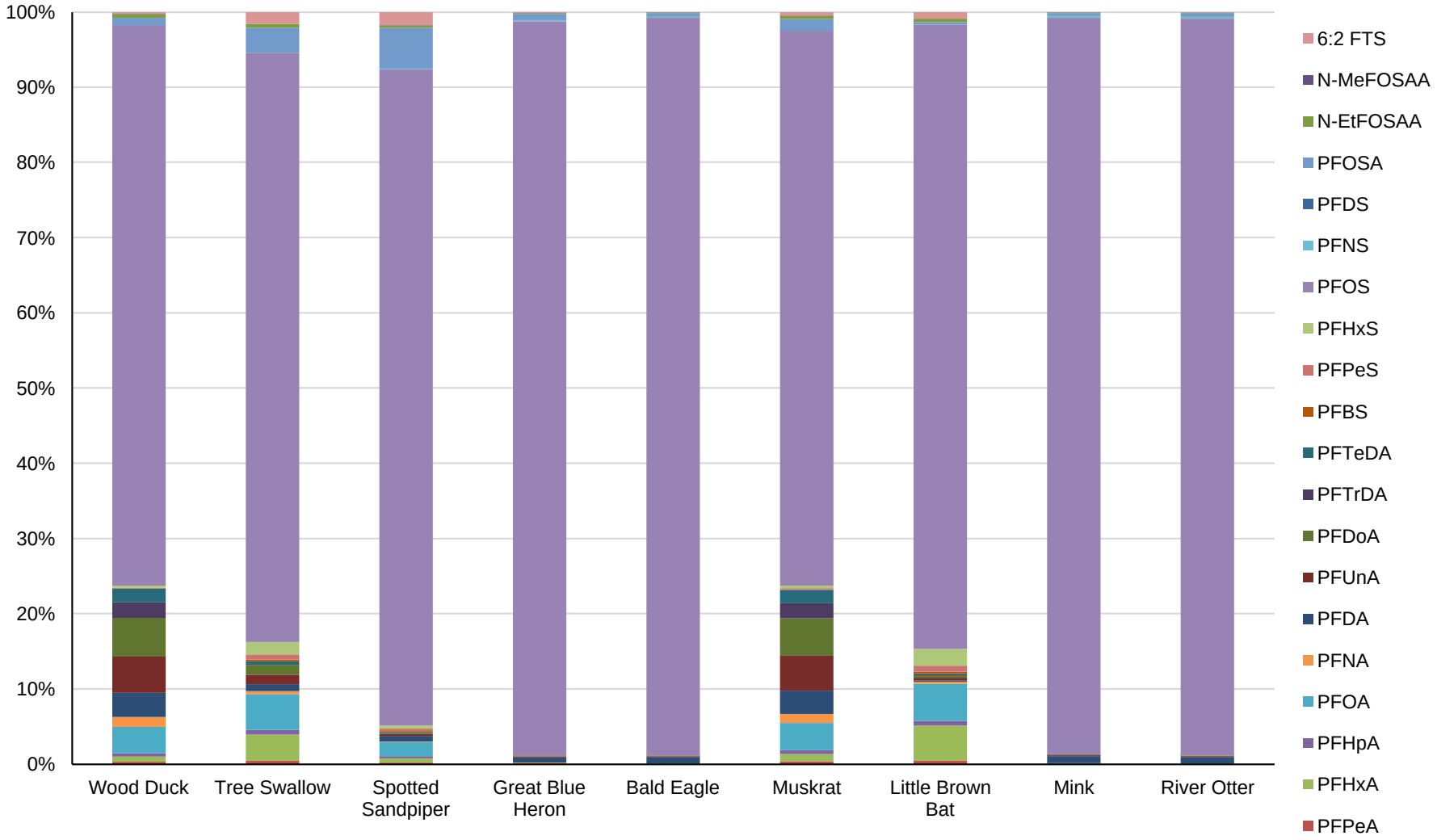

Figure 1: Total Daily Intake of PFAS - Aquatic-life Dependent Wildlife at Eagle Point Lake

Appendix J

Food Web Model – Lake Elmo

Appendix J Food Web Model – Lake Elmo
Table 1. Wildlife Exposure Parameters
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Parameter	Parameter Definition	Units	Birds					Mammals			
			Avian Consumer (Herbivore)	Avian Consumer (Invertivore)	Avian Consumer (Omnivore / Invertivore)	Avian Consumer (Piscivore)	Avian Consumer (Piscivore)	Mammalian Consumer (Herbivore)	Mammalian Consumer (Invertivore)	Mammalian Consumer (Omnivore / Invertivore)	Mammalian Consumer (Piscivore)
			Wood Duck	**Tree Swallow**	**Spotted Sandpiper**	**Great Blue Heron**	**Bald Eagle**	**Muskrat**	**Little Brown Bat**	**Mink**	**River Otter**
			Aix sponsa	*Tachycineta bicolor*	*Actitis macularius*	*Ardea herodias*	*Haliaeetus leucocephalus*	*Ondatra zibethicus*	*Myotis lucifugus*	*Neovison vison*	*Lontra canadensis*
BW	Body Weight	kg	0.70	0.020	0.043	2.4	4.15	1.6	0.0085	1.4	7.7
FIR_{dw}	Daily Food Ingestion Rate (dry matter) [1]	kg, dw/day	0.041	0.012	0.0076	0.11	0.12	0.14	0.0016	0.054	0.28
FIR_{ww}	Daily Food Ingestion Rate (wet matter) [2]	kg, ww/day	0.13	0.035	0.023	0.43	0.50	0.54	0.0049	0.22	0.78
P_{veg}	Proportion of Diet - Vegetation	kg diet item, ww/kg diet, ww	0.90	0.17	--	--	--	0.80	--	0.050	--
IR_{veg}	Vegetation Ingestion Rate [4]	kg ww/day	0.11	0.0060	--	--	--	0.43	--	0.011	--
P_{bi}	Proportion of Diet - Benthic Invertebrates	kg diet item, ww/kg diet, ww	0.050	0.26	0.80	0.15	--	0.10	--	0.10	0.15
IR_{bi}	Benthic Invertebrate Ingestion Rate [4]	kg ww/day	0.0064	0.0092	0.018	0.065	--	0.054	--	0.022	0.12
P_{ai}	Proportion of Diet - Aquatic Invertebrates	kg diet item, ww/kg diet, ww	0.050	0.57	0.15	--	--	0.10	1.0	0.10	--
IR_{ai}	Aquatic Invertebrate Ingestion Rate [4]	kg ww/day	0.0064	0.020	0.0034	--	--	0.054	0.0049	0.022	--
P_{am}	Proportion of Diet - Amphibians	kg diet item, ww/kg diet, ww	--	--	--	0.050	--	--	--	0.050	0.050
IR_{am}	Amphibian Ingestion Rate [4]	kg ww/day	--	--	--	0.022	--	--	--	0.011	0.039
P_{ff}	Proportion of Diet - Forage Fish	kg diet item, ww/kg diet, ww	--	--	0.050	0.80	0.45	--	--	0.20	0.35
IR_{ff}	Forage Fish Ingestion Rate [4]	kg ww/day	--	--	0.0011	0.35	0.22	--	--	0.044	0.27
P_{pf}	Proportion of Diet - Predatory Fish	kg diet item, ww/kg diet, ww	--	--	--	--	0.55	--	--	0.50	0.45
IR_{pf}	Predatory Fish Ingestion Rate [4]	kg ww/day	--	--	--	--	0.27	--	--	0.11	0.35
P_s	Proportion of Diet - Sediment	kg sediment, dw/kg diet, dw	0.24	--	0.073	0.0040	--	0.020	--	0.030	--
IR_S	Sediment Ingestion Rate [5]	kg dw/day	0.0098	--	0.00055	0.00043	--	0.0027	--	0.0016	--
IR_W	Water Ingestion Rate [6]	L/day or kg/day	0.041	0.0040	0.054	0.11	0.15	0.88	0.0010	0.055	0.41
HR	Home Range	acres	776	194	5.0	11	4646	0.32	74	19	2842
AUF_{LE}	Area Use Factor for Lake Elmo [3]	proportion	0.37	1.0	1.0	1.0	0.061	1.0	1.0	1.0	0.10

Notes:
References for all species-specific exposure factors are provided in Table 2.
1 - Dry weight food ingestion rate (FIR) is applied to concentrations of PFAS in sediment, generally reported on dry weight basis.
2 - Wet weight FIR is applied to tissue data, generally reported on fresh or wet weight basis.
3 - AUF values for receptors were calculated by dividing the size of the exposure area by the home range. If the home range is smaller than the exposure area, an AUF of 1 was used. Site Use Factor (SUF) of 1 was selected for all receptors.
4 - Dietary ingestion rates were calculated by multiplying the receptor- and tissue-specific proportion of diet by the receptor-specific FIR_{ww}.
5 - IR_S were calculated by multiplying the receptor-specific P_S by the receptor-specific FIR_{dw}.
6 - IR_W is reported in L/day or kg/day because 1 L of water has weight of 1 kg

Abbreviations:
dw - dry weight
kg - kilogram
L - liters
LE - Lake Elmo
ww - wet weight

Exposure Areas (Acres):
LE = 284

Appendix J Food Web Model – Lake Elmo
Table 2. Information Sources for Wildlife Exposure Parameters
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Receptor Type	Feeding Guild	Species	Parameter	Definition	Value	Units	Reference	Notes
Bird	Herbivore	Wood Duck	BW	Body Weight	0.70	kg	NC WRC (2019)	Lowest reported body weight (converted to kg)
Bird	Herbivore	Wood Duck	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.041	kg, dw/day	Nagy (2001)	Calculated using DW allometric equation for omnivorous birds: FIR (dw) = 0.67 x BW ^ 0.627
Bird	Herbivore	Wood Duck	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.13	kg, ww/day	Nagy (2001)	Calculated using WW allometric equation for omnivorous birds: FIR (ww) = 2.094 x BW ^ 0.627
Bird	Herbivore	Wood Duck	P_{veg}	Proportion of Diet - Vegetation	0.90	kg diet item, ww/kg diet, ww	MN DNR (2020)	Consume acorns, weed seeds, berries, plants and insects; assume majority is vegetation (https://www.dnr.state.mn.us/birds/woodduck.html)
Bird	Herbivore	Wood Duck	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.05	kg diet item, ww/kg diet, ww	MN DNR (2020)	Consume acorns, weed seeds, berries, plants and insects; assume majority is vegetation (https://www.dnr.state.mn.us/birds/woodduck.html)
Bird	Herbivore	Wood Duck	P_{ai}	Proportion of Diet - Aquatic Invertebrates	0.05	kg diet item, ww/kg diet, ww	MN DNR (2020)	Consume acorns, weed seeds, berries, plants and insects; assume majority is vegetation (https://www.dnr.state.mn.us/birds/woodduck.html)
Bird	Herbivore	Wood Duck	P_{am}	Proportion of Diet - Amphibians	--	kg diet item, ww/kg diet, ww	MN DNR (2020)	Assumed not to be consumed based on reported diet contents.
Bird	Herbivore	Wood Duck	P_{ff}	Proportion of Diet - Forage Fish	--	kg diet item, ww/kg diet, ww	MN DNR (2020)	Assumed not to be consumed based on reported diet contents.
Bird	Herbivore	Wood Duck	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww	MN DNR (2020)	Assumed not to be consumed based on reported diet contents.
Bird	Herbivore	Wood Duck	P_{s}	Proportion of Diet - Sediment	0.24	kg sediment, dw/kg diet, dw	USEPA (1993)	Sediment ingestion in wood duck (USEPA, 1993).
Bird	Herbivore	Wood Duck	IR_{W}	Daily Water Ingestion	0.041	L water/day	USEPA (1993)	Mallard used as a surrogate; IR L/day= IR 0.058 (L/kg)*BW (kg)
Bird	Herbivore	Wood Duck	HR	Home Range	776	acres	CDFW (2021)	In Minnesota, breeding female wood ducks remained within 1 km (0.6 mi) of the nest during 70% of their time away (Gilmer et al. 1978, as cited in CDFW 2021); therefore, home range was calculated as area from nest using 1 km as radius.
Bird	Invertivore	Tree Swallow	BW	Body Weight	0.020	kg	Nagy (2001)	Measured value for tree swallow.
Bird	Invertivore	Tree Swallow	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.012	kg, dw/day	Nagy (2001)	Measured value for tree swallow (dry matter intake).
Bird	Invertivore	Tree Swallow	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.035	kg, ww/day	Nagy (2001)	Measured value for tree swallow (fresh matter intake).
Bird	Invertivore	Tree Swallow	P_{veg}	Proportion of Diet - Vegetation	0.17	kg diet item, ww/kg diet, ww	Beal (1918); USACHPPM (2004)	Estimated proportion of plant material.
Bird	Invertivore	Tree Swallow	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.26	kg diet item, ww/kg diet, ww	Beal (1918); USACHPPM (2004)	Estimated based on proportion of non-flying insects.
Bird	Invertivore	Tree Swallow	P_{ai}	Proportion of Diet - Aquatic Invertebrates	0.57	kg diet item, ww/kg diet, ww	Beal (1918); USACHPPM (2004)	Estimated based on proportion of flying (emergent aquatic) insects.
Bird	Invertivore	Tree Swallow	P_{am}	Proportion of Diet - Amphibians	--	kg diet item, ww/kg diet, ww	USACHPPM (2004)	Assumed not to be consumed.
Bird	Invertivore	Tree Swallow	P_{ff}	Proportion of Diet - Forage Fish	--	kg diet item, ww/kg diet, ww	USACHPPM (2004)	Assumed not to be consumed.
Bird	Invertivore	Tree Swallow	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww	USACHPPM (2004)	Assumed not to be consumed.
Bird	Invertivore	Tree Swallow	P_{s}	Proportion of Diet - Sediment	--	kg sediment, dw/kg diet, dw	Divine et al. (2020)	Assumed negligible based on feedng strategy.
Bird	Invertivore	Tree Swallow	IR_{W}	Daily Water Ingestion	0.0040	L water/day	USEPA (1993)	IR L/day= IR (L/kg)*BW (kg)
Bird	Invertivore	Tree Swallow	HR	Home Range	194	acres	Custer et al. (2019)	Tree swallows feed within approximately 0.5 km of their nest boxes (Stapleton and Robertson 2006, as cited in Custer et al. 2019); therefore, home range was calculated as area from nest using 0.5 km as radius.
Bird	Invertivore	Spotted sandpiper	BW	Body Weight	0.043	kg	USEPA (1993)	Average values reported for adult male and female spotted sandpipers (USEPA 1993).
Bird	Invertivore	Spotted sandpiper	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.0076	kg, dw/day	Nagy (2001)	Calculated using DW allometric equation for insectivore birds: FIR (dw) = 0.54 x BW ^ 0.705
Bird	Invertivore	Spotted sandpiper	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.0230	kg, ww/day	Nagy (2001)	Calculated using WW allometric equation for insectivore birds: FIR (ww) = 1.633 x BW ^ 0.705
Bird	Invertivore	Spotted sandpiper	P_{veg}	Proportion of Diet - Vegetation	--	kg diet item, ww/kg diet, ww	USEPA (1993)	Assumed not to be consumed.
Bird	Invertivore	Spotted sandpiper	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.80	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated based on USEPA (1993: Adult flying insects comprise the bulk of the diet; however, crustaceans, leeches, molluscs, small fish, and carrion also are eaten.
Bird	Invertivore	Spotted sandpiper	P_{ai}	Proportion of Diet - Aquatic Invertebrates	0.15	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated based on USEPA (1993: Adult flying insects comprise the bulk of the diet; however, crustaceans, leeches, molluscs, small fish, and carrion also are eaten.
Bird	Invertivore	Spotted sandpiper	P_{am}	Proportion of Diet - Amphibians	--	kg diet item, ww/kg diet, ww	USEPA (1993)	Assumed not to be consumed based on reported diet contents.
Bird	Invertivore	Spotted sandpiper	P_{ff}	Proportion of Diet - Forage Fish	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Assumed only to consume small fish.
Bird	Invertivore	Spotted sandpiper	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww	USEPA (1993)	Assumed not to be consumed.
Bird	Invertivore	Spotted sandpiper	P_{s}	Proportion of Diet - Sediment	0.073	kg sediment, dw/kg diet, dw	USEPA (1993)	Soil/sediment estimated in Least sandpiper diet (USEPA, 1993).
Bird	Invertivore	Spotted sandpiper	IR_{W}	Daily Water Ingestion	0.054	L water/day	USEPA (1993)	IR L/day= IR (L/kg)*BW (kg); Sandpiper used as surrogate
Bird	Invertivore	Spotted sandpiper	HR	Home Range	5.0	acres	CDFW (2021)	In New York, 3 individually marked breeding females fed and displayed over areas of 1.06,1.8, and 3.2 ha (2.5, 4.5 and 8.0 acres), with an average home range of 2.02 ha (5 acres) (Hays 1972, as cited in CDFW 2021).

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Table 2. Information Sources for Wildlife Exposure Parameters
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Receptor Type	Feeding Guild	Species	Parameter	Definition	Value	Units	Reference	Notes
Bird	Piscivore	Great Blue Heron	BW	Body Weight	2.4	kg	USEPA (1993)	
Bird	Piscivore	Great Blue Heron	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.11	kg, dw/day	USEPA (1993)	Calculated from the ww-based FIR, assuming an 75% moisture content of food (i.e., 0.25 g, dw/g, ww).
Bird	Piscivore	Great Blue Heron	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.43	kg, ww/day	USEPA (1993)	FIR kg/day= WW FIR (kg/kg-day)*BW (kg) with FIR (kg/kg-day) of 0.18 from USEPA (1993)
Bird	Piscivore	Great Blue Heron	P_{veg}	Proportion of Diet - Vegetation	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents; consult additional literature for more information.
Bird	Piscivore	Great Blue Heron	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.15	kg diet item, ww/kg diet, ww	USEPA (1993)	Fish are the preferred prey, but great blues also eat amphibians, reptiles, crustaceans, insects, birds, and Mammals
Bird	Piscivore	Great Blue Heron	P_{ai}	Proportion of Diet - Aquatic Invertebrates	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents
Bird	Piscivore	Great Blue Heron	P_{am}	Proportion of Diet - Amphibians	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Fish are the preferred prey, but great blues also eat amphibians, reptiles, crustaceans, insects, birds, and Mammals
Bird	Piscivore	Great Blue Heron	P_{ff}	Proportion of Diet - Forage Fish	0.80	kg diet item, ww/kg diet, ww	USEPA (1993)	Fish are the preferred prey, but great blues also eat amphibians, reptiles, crustaceans, insects, birds, and mammals
Bird	Piscivore	Great Blue Heron	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents; consult additional literature for more information.
Bird	Piscivore	Great Blue Heron	P_{s}	Proportion of Diet - Sediment	0.0040	kg sediment, dw/kg diet, dw	USEPA (1993)	Assumed to be approximately 20% of the value assumed for the Mallard, which was obtained from Table 4-4 in USEPA (1993)
Bird	Piscivore	Great Blue Heron	IR_{W}	Daily Water Ingestion	0.11	L water/day	USEPA (1993)	IR L/day= IR (L/kg)*BW (kg)
Bird	Piscivore	Great Blue Heron	HR	Home Range	11	acres	USEPA (1993)	Average of Fall and Winter homeranges
Bird	Piscivore	Bald Eagle	BW	Body Weight	4.15	kg	USEPA (1993)	Average of adult male and female bald eagles from Alaska and Florida.
Bird	Piscivore	Bald Eagle	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.12	kg, dw/day	USEPA (1993)	Calculated from the ww-based FIR, assuming an 75% moisture content of food (i.e., 0.25 g, dw/g, ww).
Bird	Piscivore	Bald Eagle	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.50	kg, ww/day	USEPA (1993)	FIR kg/day= WW FIR (kg/kg-day)*BW (kg) with FIR (kg/kg-day) of 0.12 (free-flying in Washington and Connecticut) from USEPA (1993)
Bird	Piscivore	Bald Eagle	P_{veg}	Proportion of Diet - Vegetation	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents.
Bird	Piscivore	Bald Eagle	P_{bi}	Proportion of Diet - Benthic Invertebrates	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents.
Bird	Piscivore	Bald Eagle	P_{ai}	Proportion of Diet - Aquatic Invertebrates	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents.
Bird	Piscivore	Bald Eagle	P_{am}	Proportion of Diet - Amphibians	--	kg diet item, ww/kg diet, ww	USEPA (1993)	Assumed not to be consumed based on reported diet contents.
Bird	Piscivore	Bald Eagle	P_{ff}	Proportion of Diet - Forage Fish	0.45	kg diet item, ww/kg diet, ww	USEPA (1993)	Based on forage fish (bullhead, sucker) percent occurance in pellets from Maine Inland River Habitat.
Bird	Piscivore	Bald Eagle	P_{pf}	Proportion of Diet - Predatory Fish	0.55	kg diet item, ww/kg diet, ww	USEPA (1993)	Based on predatory fish (pickerel, bass, perch) and 'other fish' percent occurance in pellets from Maine Inland River Habitat, as well as conservatively assuming the percetn occurances from birds and mammals.
Bird	Piscivore	Bald Eagle	P_{s}	Proportion of Diet - Sediment	--	kg sediment, dw/kg diet, dw		Assumed negligible based on feedng strategy.
Bird	Piscivore	Bald Eagle	IR_{W}	Daily Water Ingestion	0.15	L water/day	USEPA (1993)	IR L/day= IR 0.036 (L/kg)*BW (kg)
Bird	Piscivore	Bald Eagle	HR	Home Range	4646	acres	USEPA (1993)	Mean Winter home range of adults (both sexes) in Missouri lake habitat.
Mammal	Herbivore	Muskrat	BW	Body Weight	1.6	kg	MN DNR (2020)	Average of all adult body weights in MN (https://www.dnr.state.mn.us/Mammals/muskrat.html)
Mammal	Herbivore	Muskrat	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.14	kg, dw/day	USEPA (1993)	Calculated from the ww-based FIR, assuming an 75% moisture content of food (i.e., 0.25 g, dw/g, ww).
Mammal	Herbivore	Muskrat	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.54	kg, ww/day	USEPA (1993)	FIR kg/day= WW FIR (kg/kg-day)*BW (kg) with FIR (kg/kg-day) of 0.34 from USEPA (1993)
Mammal	Herbivore	Muskrat	P_{veg}	Proportion of Diet - Vegetation	0.80	kg diet item, ww/kg diet, ww	USEPA (1993)	Primarily herbivorous.
Mammal	Herbivore	Muskrat	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.10	kg diet item, ww/kg diet, ww	USEPA (1993)	Primarily herbivorous.
Mammal	Herbivore	Muskrat	P_{ai}	Proportion of Diet - Aquatic Invertebrates	0.10	kg diet item, ww/kg diet, ww	USEPA (1993)	Primarily herbivorous.
Mammal	Herbivore	Muskrat	P_{am}	Proportion of Diet - Amphibians	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents.
Mammal	Herbivore	Muskrat	P_{ff}	Proportion of Diet - Forage Fish	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents.
Mammal	Herbivore	Muskrat	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents.
Mammal	Herbivore	Muskrat	P_{s}	Proportion of Diet - Sediment	0.020	kg sediment, dw/kg diet, dw	USEPA (1993)	Meadow Vole used as a surrogate
Mammal	Herbivore	Muskrat	IR_{W}	Daily Water Ingestion	0.88	L water/day	USEPA (1993)	Max reported; IR L/day= IR (L/kg)*BW (kg)
Mammal	Herbivore	Muskrat	HR	Home Range	0.32	acres	USEPA (1993)	Average HR reported (0.13 ha) converted to acres.

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Receptor Type	Feeding Guild	Species	Parameter	Definition	Value	Units	Reference	Notes
Mammal	Invertivore	Little Brown Bat	BW	Body Weight	0.0085	kg	MN DNR (2020)	Average of adult little brown bats in Minnesota (https://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=AMACC01010)
Mammal	Invertivore	Little Brown Bat	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.0016	kg, dw/day	Nagy (2001)	Measured value for little brown bat (dry matter intake).
Mammal	Invertivore	Little Brown Bat	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.0049	kg, ww/day	Nagy (2001)	Measured value for little brown bat (fresh matter intake).
Mammal	Invertivore	Little Brown Bat	P_{veg}	Proportion of Diet - Vegetation	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on strict aerial insect diet.
Mammal	Invertivore	Little Brown Bat	P_{bi}	Proportion of Diet - Benthic Invertebrates	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on strict aerial insect diet.
Mammal	Invertivore	Little Brown Bat	P_{ai}	Proportion of Diet - Aquatic Invertebrates	1.0	kg diet item, ww/kg diet, ww	Fenton and Barclay (1980); cited in Sample et al. (1997)	Based on strict aerial insect diet, i.e., aquatic (emergent aerial) insects.
Mammal	Invertivore	Little Brown Bat	P_{am}	Proportion of Diet - Amphibians	--	kg diet item, ww/kg diet, ww	Sample et al. (1997)	Assumed not to be consumed based on strict aerial insect diet.
Mammal	Invertivore	Little Brown Bat	P_{ff}	Proportion of Diet - Forage Fish	--	kg diet item, ww/kg diet, ww	Sample et al. (1997)	Assumed not to be consumed based on strict aerial insect diet.
Mammal	Invertivore	Little Brown Bat	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww	Sample et al. (1997)	Assumed not to be consumed based on strict aerial insect diet.
Mammal	Invertivore	Little Brown Bat	P_{so}	Proportion of Diet - Sediment	--	kg sediment, dw/kg diet, dw	Sample et al. (1997)	Assumed negligible based on feeding strategy.
Mammal	Invertivore	Little Brown Bat	IR_W	Daily Water Ingestion	0.001	L water/day	USEPA (1993)	IR L/day= IR (L/kg)*BW (kg)
Mammal	Invertivore	Little Brown Bat	HR	Home Range	74	acres	Henry et al. (2002); Divine et al. (2020)	Home-range size of pregnant little brown bat on Grosse-Ile, Quebec, Canada, summers of 1999 and 2000 (Henry et al. 2002, as cited in Divine et al. 2020).
Mammal	Omnivore	Mink	BW	Body Weight	1.4	kg	MN DNR (2020)	Average of adult mink in Minnesota (https://www.dnr.state.mn.us/Mammals/mink.html)
Mammal	Omnivore	Mink	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.054	kg, dw/day	USEPA (1993)	Calculated from the ww-based FIR, assuming an 75% moisture content of food (i.e., 0.25 g, dw/g, ww).
Mammal	Omnivore	Mink	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.22	kg, ww/day	USEPA (1993)	FIR kg/day= WW FIR (kg/kg-day)*BW (kg) with FIR (kg/kg-day) of 0.16 (average, adults) from USEPA (1993)
Mammal	Omnivore	Mink	P_{veg}	Proportion of Diet - Vegetation	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Based on data for year round riverine habitats in USEPA (1993)
Mammal	Omnivore	Mink	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.10	kg diet item, ww/kg diet, ww	USEPA (1993)	Based on data for year round riverine habitats in USEPA (1993)
Mammal	Omnivore	Mink	P_{ai}	Proportion of Diet - Aquatic Invertebrates	0.10	kg diet item, ww/kg diet, ww	USEPA (1993)	Based on data for year round riverine habitats in USEPA (1993)
Mammal	Omnivore	Mink	P_{am}	Proportion of Diet - Amphibians	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Based on data for year round riverine habitats in USEPA (1993)
Mammal	Omnivore	Mink	P_{ff}	Proportion of Diet - Forage Fish	0.20	kg diet item, ww/kg diet, ww	USEPA (1993)	Based on data for year round riverine habitats in USEPA (1993)
Mammal	Omnivore	Mink	P_{pf}	Proportion of Diet - Predatory Fish	0.50	kg diet item, ww/kg diet, ww	USEPA (1993)	Based on data for year round riverine habitats in USEPA (1993)
Mammal	Omnivore	Mink	P_s	Proportion of Diet - Sediment	0.030	kg sediment, dw/kg diet, dw	Sample et al. (1997)	Weasel used as a surrogate
Mammal	Omnivore	Mink	IR_W	Daily Water Ingestion	0.055	L water/day	USEPA (1993)	Max reported; IR L/day= IR (L/kg)*BW (kg)
Mammal	Omnivore	Mink	HR	Home Range	19	acres	USEPA (1993)	Home range reported between 1 and 5 km along shorelines, or as low as 7.8 hectares in riverine areas with dense vegetation. 7.8 ha applied.

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Receptor Type	Feeding Guild	Species	Parameter	Definition	Value	Units	Reference	Notes
Mammal	Piscivore	River Otter	BW	Body Weight	7.7	kg	MN DNR (2020)	Average of adult body weights in MN (https://www.dnr.state.mn.us/mammals/riverotter.html)
Mammal	Piscivore	River Otter	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.28	kg, dw/day	Nagy (2001)	Calculated using DW allometric equation for carnivorous Mammals: FIR (dw) = 0.153 x BW ^ 0.834
Mammal	Piscivore	River Otter	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.78	kg, ww/day	Nagy (2001)	Calculated using WW allometric equation for carnivorous Mammals: FIR (ww) = 0.348 x BW ^ 0.859
Mammal	Piscivore	River Otter	P_{veg}	Proportion of Diet - Vegetation	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents
Mammal	Piscivore	River Otter	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.15	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from listed diet items; but higher percent in streams and lake habitats
Mammal	Piscivore	River Otter	P_{ai}	Proportion of Diet - Aquatic Invertebrates	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents
Mammal	Piscivore	River Otter	P_{am}	Proportion of Diet - Amphibians	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from listed diet items reported as amphibians, frogs, salamander, reptiles, and snake
Mammal	Piscivore	River Otter	P_{ff}	Proportion of Diet - Forage Fish	0.35	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from listed diet items based on fish species (rather than size)
Mammal	Piscivore	River Otter	P_{pf}	Proportion of Diet - Predatory Fish	0.45	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from listed diet items based on fish species (rather than size)
Mammal	Piscivore	River Otter	P_{s}	Proportion of Diet - Sediment	--	kg sediment, dw/kg diet, dw		Based on feeding habits assumed to not eat any sediment
Mammal	Piscivore	River Otter	IR_{W}	Daily Water Ingestion	0.41	L water/day	USEPA (1993)	Max reported; IR L/day= IR (L/kg)*BW (kg); River Otter used as surrogate
Mammal	Piscivore	River Otter	HR	Home Range	2842	acres	USEPA (1993)	Based on the average home range of Missouri marsh and streams.
Mammal	Omnivore	Raccoon	BW	Body Weight	8.6	kg	MN DNR (2020)	Average of adult raccoon in Minnesota (https://www.dnr.state.mn.us/Mammals/raccoon.html)
Mammal	Omnivore	Raccoon	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.05	kg, dw/day	Nagy (2001)	Calculated from the ww-based FIR, assuming an 75% moisture content of food (i.e., 0.25 g, dw/g, ww).
Mammal	Omnivore	Raccoon	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.20	kg, dw/day	Nagy (2001)	Calculated using DW allometric equation for omnivorous Mammals: FIR (dw) = 0.432 x BW ^ 0.678
Mammal	Omnivore	Raccoon	P_{veg}	Proportion of Diet - Vegetation	0.45	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from listed diet of vegetation in USEPA (1993)
Mammal	Omnivore	Raccoon	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.40	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from listed diet of crayfish and portion of invertebrates in USEPA (1993)
Mammal	Omnivore	Raccoon	P_{ai}	Proportion of Diet - Aquatic Invertebrates	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from portion of invertebrates diet in USEPA (1993)
Mammal	Omnivore	Raccoon	P_{am}	Proportion of Diet - Amphibians	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from portion of amphibians diet in USEPA (1993)
Mammal	Omnivore	Raccoon	P_{ff}	Proportion of Diet - Forage Fish	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from portion of fish and rodents diet in USEPA (1993)
Mammal	Omnivore	Raccoon	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww	USEPA (1993)	Assumed not to be consumed based on reported diet contents; consult additional literature for more information.
Mammal	Omnivore	Raccoon	P_{s}	Proportion of Diet - Sediment	0.094	kg sediment, dw/kg diet, dw	USEPA (1993)	Estimated percent soil in diet (dw)
Mammal	Omnivore	Raccoon	IR_{W}	Daily Water Ingestion	0.41	L water/day	USEPA (1993)	Max reported; IR L/day= IR (L/kg)*BW (kg); River Otter used as surrogate
Mammal	Omnivore	Raccoon	HR	Home Range	385	acres	USEPA (1993)	Based on the average home range of both sexes within Michigan riparian habitat.

Abbreviations:
dw - dry weight
kg - kilogram
L - liters
ww - wet weight

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Mammal	Piscivore	River Otter	BW	Body Weight	7.7	kg	MN DNR (2020)	Average of adult body weights in MN (https://www.dnr.state.mn.us/mammals/riverotter.html)
Mammal	Piscivore	River Otter	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.28	kg, dw/day	Nagy (2001)	Calculated using DW allometric equation for carnivorous Mammals: FIR (dw) = 0.153 x BW ^ 0.834
Mammal	Piscivore	River Otter	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.78	kg, ww/day	Nagy (2001)	Calculated using WW allometric equation for carnivorous Mammals: FIR (ww) = 0.348 x BW ^ 0.859
Mammal	Piscivore	River Otter	P_{veg}	Proportion of Diet - Vegetation	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents
Mammal	Piscivore	River Otter	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.15	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from listed diet items; but higher percent in streams and lake habitats
Mammal	Piscivore	River Otter	P_{ai}	Proportion of Diet - Aquatic Invertebrates	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents
Mammal	Piscivore	River Otter	P_{am}	Proportion of Diet - Amphibians	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from listed diet items reported as amphibians, frogs, salamander, reptiles, and snake
Mammal	Piscivore	River Otter	P_{ff}	Proportion of Diet - Forage Fish	0.35	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from listed diet items based on fish species (rather than size)
Mammal	Piscivore	River Otter	P_{pf}	Proportion of Diet - Predatory Fish	0.45	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from listed diet items based on fish species (rather than size)
Mammal	Piscivore	River Otter	P_{s}	Proportion of Diet - Sediment	--	kg sediment, dw/kg diet, dw		Based on feeding habits assumed to not eat any sediment
Mammal	Piscivore	River Otter	IR_{W}	Daily Water Ingestion	0.41	L water/day	USEPA (1993)	Max reported; IR L/day= IR (L/kg)*BW (kg); River Otter used as surrogate
Mammal	Piscivore	River Otter	HR	Home Range	2842	acres	USEPA (1993)	Based on the average home range of Missouri marsh and streams.

Abbreviations:
dw - dry weight
kg - kilogram
L - liters
ww - wet weight

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Appendix J Food Web Model – Lake Elmo
Table 3. Bioaccumulation Parameters
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

	Literature-based Aquatic Plant Bioaccumulation Parameters								Site-Specific Bioaccumulation Parameters [d]	
	Water to Aquatic Plant BAF (L water / kg tissue)				Water to Aquatic Invertebrate BAF (L water / kg tissue)				Surface Water to Tissue BAF (L water / kg tissue ww)	
Analyte	Value (tissue dw)	Value (tissue ww)[a]	Reference	Notes	Aquatic/Benthic Invert. Value (tissue dw)[b]	Aquatic/Benthic Invert. Value (tissue ww)[c]	Reference	Notes	Amphibian	Benthic Invertebrate (crayfish)
PFCAs										
PFBA	19	2.8	Divine et al. (2020); Zodrow et al. (2020)	Geomean	298	54	Zodrow et al. (2020) (Surrogate - PFBS)		2.7	11.6
PFHpA	228	33.06	Surrogate - PFOA		351	63	Divine et al. (2020)	Geomean	NC	31.1
PFOA	228	33	Divine et al. (2020); Zodrow et al. (2020)	Geomean	379	68	Divine et al. (2020); Zodrow et al. (2020)	Geomean	3.3	43.4
PFNA	5,188	752	Divine et al. (2020); Zodrow et al. (2020)	Geomean	983	177	Divine et al. (2020); Zodrow et al. (2020)	Geomean	184	161
PFDA	12,360	1,792	Divine et al. (2020)	Geomean	707	127	Divine et al. (2020)	Geomean	689	436
PFUnA	12,360	1,792	Surrogate - PFDA		707	127	Surrogate - PFDA		473	327
PFDoA	12,360	1,792	Surrogate - PFDA		707	127	Surrogate - PFDA		1618	73.0
PFTrDA	12,360	1,792	Surrogate - PFDA		707	127	Surrogate - PFDA		132	105
PFTeDA	12,360	1,792	Surrogate - PFDA		707	127	Surrogate - PFDA		45.9	45.1
PFSAs										
PFHxS	12	1.7	Divine et al. (2020)	Geomean	1327	239	Divine et al. (2020)	Geomean	6.6	23.4
PFHpS	228	33	Surrogate - PFOA		1549	279	Surrogate - PFOS		53.6	66.0
PFOS	1,305	189	Divine et al. (2020); Zodrow et al. (2020)	Geomean	1549	279	Divine et al. (2020); Zodrow et al. (2020)	Geomean	454	145
PFNS	1,305	189	Surrogate - PFOS		1549	279	Surrogate - PFOS		NC	NC
PFDS	1,305	189	Surrogate - PFOS		1549	279	Surrogate - PFOS		NC	NC
FOSA, FASE, FASAAs										
PFOSA	1,305	189	Surrogate - PFOS		1549	279	Surrogate - PFOS		468	1895
N-EtFOSAA	1,305	189	Surrogate - PFOS		1549	279	Surrogate - PFOS		185	194
N-MeFOSAA	1,305	189	Surrogate - PFOS		1549	279	Surrogate - PFOS		241	321
Fluortelomers										
6:2 FTS	12	1.7	Surrogate - PFHxS		1327	239	Surrogate - PFHxS		131	87.0

PFAS Abbreviations:
FASAA - perrfluoroalkane sulfonamido acetic acids
FASE - perfluoroalkane sulfonamido ethanols
FOSA - perfluorooctane sulfonamides
N-EtFOSAA - N-Ethylperfluorooctane sulfonamidoacetic acid
N-MeFOSAA - N-Methylperfluorooctane sulfonamidoacetic acid
PFAS - Per- and polyfluoroalkyl substances
PFBA - Perfluorobutanoic acid
PFCA - Perfluoroalkyl carboxylic acids
PFDA - Perfluorodecanoic acid
PFDoA - Perfluorododecanoic acid
PFDS - Perfluorodecane sulfonic acid
PFHpA - Perfluoroheptanoic acid

PFAS Abbreviations Cont.:
PFHpS - Perfluoroheptane sulfonic acid
6:2 FTS - 6:2 Fluorotelomer sulfonic acid
PFHxS - Perfluorohexanesulfonic acid
PFNA - Perfluorononanoic acid
PFNS - Perfluoroonoane sulfonic acid
PFOA - Perfluorooctanoic acid
PFOS - Perfluorooctanesulfonic acid
PFOSA - Perfluorooctane sulfonamide
PFSA- perfluoroalkane sulfonic acids
PFTeDA - Perfluorotetradecanoic acid
PFTrDA - Perfluorotridecanoic acid
PFUnA - Perfluoroundecanoic acid

Addditional Abbreviations:
BAF - Bioaccumulation Factor
dw - dry weight
kg - kilogram
L - liter
ww - wet weight

Notes:
a: Converted to ww tissue using 85.5% moisture content (average of algae [84%] and aquatic macrophytes [87%]; Table 4-2 EPA 1993)
b: Converted to ww tissue using 82% moisture content (bivalves (without shell); Table 4-1 EPA 1993)
c: Aquatic/Benthic Invert Values are based on filter-feeding benthic invertebrates (oyster, mussel, gastropod, snail, other bivalves) and were selected to represent aquatic invertebrates (including aerial insects) exposed to PFAS in water. Filter-feeding benthic invertebrates are expected to have exposure to contaminants in the water column similar to other aquatic
d: See Appendix E for BAFs derived using Project 1007 tissue and surface water data.

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Appendix J Food Web Model – Lake Elmo
Table 4. Toxicity Reference Values for Birds
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Analyte	TRVs for Birds (µg/kg-day)							
	NOAEL	Basis	Reference	Additional Details	LOAEL	Basis	Reference	Additional Details
PFCAs								
PFBA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFHpA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFOA	1,000	No effect on growth (body weight) of 1-day old chickens; exposed to PFOA/PFDA/PFOS mixture	Conder et al. (2020)	Yeueng et al. 2009	10,000	Application of a NOAEL-to-LOAEL adjustment factor of 10	Adjustment factor consistent with Divine et al. (2020), Zodrow et al. (2020), and USEPA (2005)	--
PFNA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFDA	1,000	No effect on growth (body weight) of 1-day old chickens; exposed to PFOA/PFDA/PFOS mixture	Conder et al. (2020)	Yeueng et al. 2009	10,000	Application of a NOAEL-to-LOAEL adjustment factor of 10	Adjustment factor consistent with Divine et al. (2020), Zodrow et al. (2020), and USEPA (2005)	--
PFUnA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFDoA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFTrDA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFTeDA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFSAs								
PFHxS	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
PFHpS	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
PFOS	79.0	No effect on reproduction and survival in Bobwhite Quail	Divine et al. (2020) & Zodrow et al. (2020)	Gallagher et al. 2003c (Derived by applying UF of 10 to selected lowest LOAEL)	790	Lowest bounded LOAEL (Effect on reproduction and survival in Bobwhite Quail; exposure included during sensitive life stage, i.e., egg-laying)	Divine et al. (2020) & Zodrow et al. (2020)	Gallagher et al. 2003c (Lowest LOAEL selected due to limited available avian data & study based on sensitive life stage)
PFNS	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
PFDS	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
FOSA, FASE, FASAAs								
PFOSA	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
N-EtFOSAA	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
N-MeFOSAA	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
Fluortelomers								
6:2 FTS	1000	Surrogate - PFOA	--	--	10000	Surrogate - PFOA	--	--

Notes:
TRVs were selected from the following hierarchy due to preference for EcoSSL TRV-derivation approach (USEPA 2005) and that Zodrow et al. (2020) has been peer reviewed:

1. Divine et al. (2020) and/or Zodrow et al. (2020)
2. Condor et al. (2020)

Abbreviations:
See Table 3 for PFAS abbreviations
µg/kg-day - micrograms per kilogram body weight per day
EcoSSL - Ecological Soil Screening Level
LOAEL - lowest observed adverse effects level
NOAEL - no observed adverse effects level
TRV - toxicity reference value
USEPA - United States Environmental Protection Agency

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Appendix J Food Web Model – Lake Elmo
Table 5. Toxicity Reference Values for Mammals
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Analyte	TRVs for Mammals (µg/kg-day)							
	NOAEL	Basis	Reference	Additional Details	LOAEL	Basis	Reference	Additional Details
PFCAs								
PFBA	73,000	No effect on growth or reproduction	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (four studies)	175,000	Lowest bounded LOAEL (Effect on reproduction)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Das et al. 2008)
PFHpA	300	Surrogate - PFOA	--	--	600	Surrogate - PFOA	--	--
PFOA	300	No effect on growth, reproduction, or survival	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (two studies)	600	Lowest bounded LOAEL (Effect on reproduction & survival in mice)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Abbott et al. 2007)
PFNA	830	No effect on reproduction (# live pups) in mice	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Wolf et al. 2010)	1,100	Lowest bounded LOAEL (decreased reproduction in mice)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Wolf et al. 2010)
PFDA	100	No effect on growth (fetal body weight per litter) in pregnant mice	Conder et al. (2020)	Harris and Birnbaum (1989)	6,400	23% control-adjusted decrease in growth (fetal body weight per litter) in pregnant mice	Conder et al. (2020)	Harris and Birnbaum (1989)
PFUnA	300	No effect on growth (body weight in adults and pups) in rats	Conder et al. (2020)	Takahashi et al. (2014)	1,000	13-19% control-adjusted decrease in growth (body weight of pups) in rats	Conder et al. (2020)	Takahashi et al. (2014)
PFDoA	500	No effect on growth (body weight in adults and pups) in rats	Conder et al. (2020)	Kato et al. (2015)	2,500	20-40% control-adjusted decrease in growth (body weight in adults and pups) in rats	Conder et al. (2020)	Kato et al. (2015)
PFTrDA	500	Surrogate - PFDoDA	--	--	2,500	Surrogate - PFDoDA	--	--
PFTeDA	3,000	No effect on growth (body weight in adults and pups) in rats	Conder et al. (2020)	Hirata-Koizumi et al. (2015)	10,000	8-18% control-adjusted decrease in growth (body weight of pups) in rats	Conder et al. (2020)	Hirata-Koizumi et al. (2015)
PFSAs								
PFHxS	300	No effect on reproduction (litter size) in mice	Conder et al. (2020)	Chang et al. (2018)	1,000	14% control-adjusted decrease in reproduction (litter size) in mice	Conder et al. (2020)	Chang et al. (2018)
PFHpS	300	Surrogate - PFHxS	--	--	1,000	Surrogate - PFHxS	--	--
PFOS	100	No effect on growth, reproduction, or survivial	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (multiple studies)	170	Lowest bounded LOAEL (Effect on reproduction in mice)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Fair et al. 2011)
PFNS	100	Surrogate - PFOS	--	--	170	Surrogate - PFOS	--	--
PFDS	100	Surrogate - PFOS	--	--	170	Surrogate - PFOS	--	--

Appendix J Food Web Model – Lake Elmo
Table 5 Toxicity Reference Values for Mammals
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Analyte	TRVs for Mammals (µg/kg-day)							
	NOAEL	Basis	Reference	Additional Details	LOAEL	Basis	Reference	Additional Details
FOSA, FASE, FASAAs								
PFOSA	100	Surrogate - PFOS	--	--	170	Surrogate - PFOS	--	--
N-EtFOSAA	100	Surrogate - PFOS	--	--	170	Surrogate - PFOS	--	--
N-MeFOSAA	100	Surrogate - PFOS	--	--	170	Surrogate - PFOS	--	--
Fluortelomers								
6:2 FTS	300	Surrogate - PFHxS	--	--	1,000	Surrogate - PFHxS	--	--

Notes:
TRVs were selected from the following hierarchy due to preference for EcoSSL TRV-derivation approach (USEPA 2005) and that Zodrow et al. (2020) has been peer reviewed:

1. Divine et al. (2020) and/or Zodrow et al. (2020)
2. Condor et al. (2020)

Abbreviations:
See Table 3 for PFAS abbreviations
µg/kg-day - micrograms per kilogram body weight per day
EcoSSL - Ecological Soil Screening Level
LOAEL - lowest observed adverse effects level
NOAEL - no observed adverse effects level
TRV - toxicity reference value
USEPA - United States Environmental Protection Agency

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Appendix J Food Web Model – Lake Elmo
Table 6. Exposure Point Concentrations
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Analyte	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Aquatic Plant EPC (µg/kg, ww)		Aquatic Invertebrate (µg/kg, ww)		Benthic Invertebrate (µg/kg, ww)		Amphibian (µg/kg, ww)		Forage Fish (µg/kg, ww)		Predatory Fish (µg/kg, ww)	
			EPC	Basis	EPC	Basis	EPC	Basis	EPC	Basis	EPC	Basis	EPC	Basis
PFCAs														
PFBA	5.2	0.78	2.1	Calculated	41.8	Calculated	9.0	Calculated	2.1	Calculated	0.76	UCL	0.49	Maximum
PFHpA	ND	0.0079	0.26	Calculated	0.50	Calculated	0.24	Calculated	NC		0.23	Maximum	0.11	Maximum
PFOA	0.59	0.075	2.5	Calculated	5.1	Calculated	3.2	Calculated	0.24	Calculated	1.2	UCL	0.35	UCL
PFNA	ND	0.0011	0.80	Calculated	0.19	Calculated	0.17	Calculated	0.20	Calculated	0.86	UCL	0.41	UCL
PFDA	ND	0.0013	2.3	Calculated	0.16	Calculated	0.55	Calculated	0.87	Calculated	8.5	UCL	12.1	UCL
PFUnA	ND	ND	NC	Calculated	NC	Calculated	NC		NC		1.3	UCL	3.2	UCL
PFDoA	ND	ND	NC	Calculated	NC	Calculated	NC		NC		0.67	UCL	1.5	UCL
PFTrDA	ND	0.0017	3.0	Calculated	0.22	Calculated	0.18	Calculated	0.23	Calculated	0.47	UCL	0.77	UCL
PFTeDA	ND	0.0024	4.30	Calculated	0.31	Calculated	0.11	Calculated	0.11	Calculated	0.52	UCL	0.74	UCL
PFSAs														
PFHxS	ND	0.0085	0.015	Calculated	2.0	Calculated	0.20	Calculated	0.056	Calculated	0.29	UCL	0.36	Maximum
PFHpS	ND	0.0019	0.061	Calculated	0.52	Calculated	0.12	Calculated	0.10	Calculated	2.6	UCL	1.1	UCL
PFOS	4.5	0.19	36.1	Calculated	53.3	Calculated	27.8	Calculated	86.7	Calculated	1423	UCL	1653	UCL
PFNS	ND	ND	NC	Calculated	NC	Calculated	NC		NC		2.4	Maximum	0.92	UCL
PFDS	ND	ND	NC	Calculated	NC	Calculated	NC		NC		0.27	UCL	0.32	UCL
FOSA, FASE, FASAAs														
PFOSA	ND	0.0010	0.19	Calculated	0.29	Calculated	2.0	Calculated	0.48	Calculated	16.0	Maximum	0.64	Maximum
N-EtFOSAA	ND	0.00071	0.13	Calculated	0.20	Calculated	0.14	Calculated	0.13	Calculated	0.71	Maximum	0.15	UCL
N-MeFOSAA	ND	0.0023	0.44	Calculated	0.65	Calculated	0.75	Calculated	0.56		0.18	Maximum	0.17	Maximum
Fluortelomers														
6:2 FTS	4.5	0.086	0.15	Calculated	20.5	Calculated	7.5	Calculated	11.2	Calculated	ND		2.4	Maximum

Notes:
EPCs were selected as the lower of the selected UCL and maximum detected concentration (see Appendix D)
Site-specific empirical data were selected over modeled values when available:
- Benthic invertebrates = not collected
- Amphibians = not collected
- Forage fish = black crappie, bluegill, and cisco
- Predatory fish = largemouth bass and northern pike

When empirical data were lacking, tissue EPCs were calculated by multiplying the surface water EPC by the analyte- and tissue-specific bioaccumulation parameter (see Table 3).

Additional Abbreviations:
See Table 3 for PFAS abbreviations
µg - micrograms
dw - dry weight
EPC - exposure point concentration
kg - kilogram
L - liters
NA - not available
NC - not calculated
ND - not detected
UCL - upper confidence limit of the arithmetic mean
ww - wet weight

Appendix J Food Web Model – Lake Elmo
Table 7. Potential Risks to the Wood Duck
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Lake Elmo	
Assumptions for the Wood Duck	
Body Weight (kg)	0.70
Seasonal Use Factor	1
Site-Specific Area Use Factor	0.37
Sediment Ingestion Rate (kg_{dw}/day)	0.0098
Water Ingestion Rate (kg/day)	0.041
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.0064
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.0064
Plant Ingestion Rate (kg_{ww}/day)	0.11

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_s = Incidental ingestion rate of sediment (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_s= Concentration of PFAS in sediment (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations					Potential Daily Dose (ug/kg_{bw}/day)						NOAEL-based TRV ($\mu g/kg_{bw}$/day)	NOAEL-based HQ	LOAEL-based TRV ($\mu g/kg_{bw}$/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Aquatic Invertebrate EPC (µg/kg, ww)	Plant EPC (µg/kg, ww)	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Benthic Invertebrate	Aquatic Invertebrate	Plant	Sediment	Surface Water	Total				
PFCAs															
PFBA	9.0E+00	4.2E+01	2.1E+00	5.2E+00	7.8E-01	3.0E-02	1.4E-01	1.3E-01	2.7E-02	1.7E-02	3.4E-01	1.0E+03	3.4E-04	1.0E+04	3.4E-05
PFHpA	2.4E-01	5.0E-01	2.6E-01	ND	7.9E-03	8.1E-04	1.7E-03	1.6E-02	NC	1.7E-04	1.8E-02	1.0E+03	1.8E-05	1.0E+04	1.8E-06
PFOA	3.2E+00	5.1E+00	2.5E+00	5.9E-01	7.5E-02	1.1E-02	1.7E-02	1.5E-01	3.0E-03	1.6E-03	1.8E-01	1.0E+03	1.8E-04	1.0E+04	1.8E-05
PFNA	1.7E-01	1.9E-01	8.0E-01	ND	1.1E-03	5.7E-04	6.3E-04	4.8E-02	NC	2.3E-05	4.9E-02	1.0E+03	4.9E-05	1.0E+04	4.9E-06
PFDA	5.5E-01	1.6E-01	2.3E+00	ND	1.3E-03	1.8E-03	5.4E-04	1.4E-01	NC	2.7E-05	1.4E-01	1.0E+03	1.4E-04	1.0E+04	1.4E-05
PFUnA	NC	NC	NC	ND	ND	NC	NC	NC	NC	NC	NC	1.0E+03	NC	1.0E+04	NC
PFDoA	NC	NC	NC	ND	ND	NC	NC	NC	NC	NC	NC	1.0E+03	NC	1.0E+04	NC
PFTrDA	1.8E-01	2.2E-01	3.0E+00	ND	1.7E-03	5.9E-04	7.2E-04	1.8E-01	NC	3.6E-05	1.8E-01	1.0E+03	1.8E-04	1.0E+04	1.8E-05
PFTeDA	1.1E-01	3.1E-01	4.3E+00	ND	2.4E-03	3.6E-04	1.0E-03	2.6E-01	NC	5.1E-05	2.6E-01	1.0E+03	2.6E-04	1.0E+04	2.6E-05
PFSAs															
PFHxS	2.0E-01	2.0E+00	1.5E-02	ND	8.5E-03	6.6E-04	6.8E-03	8.9E-04	NC	1.8E-04	8.5E-03	7.9E+01	1.1E-04	7.9E+02	1.1E-05
PFHpS	1.2E-01	5.2E-01	6.1E-02	ND	1.9E-03	4.1E-04	1.7E-03	3.7E-03	NC	3.9E-05	5.9E-03	7.9E+01	7.4E-05	7.9E+02	7.4E-06
PFOS	2.8E+01	5.3E+01	3.6E+01	4.5E+00	1.9E-01	9.2E-02	1.8E-01	2.2E+00	2.3E-02	4.1E-03	2.5E+00	7.9E+01	3.1E-02	7.9E+02	3.1E-03
PFNS	NC	NC	NC	ND	ND	NC	NC	NC	NC	NC	NC	7.9E+01	NC	7.9E+02	NC
PFDS	NC	NC	NC	ND	ND	NC	NC	NC	NC	NC	NC	7.9E+01	NC	7.9E+02	NC
FOSA, FASE, FASAAs															
PFOSA	2.0E+00	2.9E-01	1.9E-01	ND	1.0E-03	6.5E-03	9.6E-04	1.2E-02	NC	2.2E-05	1.9E-02	7.9E+01	2.4E-04	7.9E+02	2.4E-05
N-EtFOSAA	1.4E-01	2.0E-01	1.3E-01	ND	7.1E-04	4.6E-04	6.6E-04	8.0E-03	NC	1.5E-05	9.1E-03	7.9E+01	1.2E-04	7.9E+02	1.2E-05
N-MeFOSAA	7.5E-01	6.5E-01	4.4E-01	ND	2.3E-03	2.5E-03	2.2E-03	2.6E-02	NC	4.9E-05	3.1E-02	7.9E+01	3.9E-04	7.9E+02	3.9E-05
Fluortelomers															
6:2 FTS	7.5E+00	2.1E+01	1.5E-01	4.5E+00	8.6E-02	2.5E-02	6.8E-02	9.0E-03	2.3E-02	1.8E-03	1.3E-01	1.0E+03	1.3E-04	1.0E+04	1.3E-05

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
UCL - upper confidence limit of the arithmetic mean
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
ww - wet weight

Appendix J Food Web Model – Lake Elmo
Table 8. Potential Risks to the Tree Swallow
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Lake Elmo	
Assumptions for the Tree Swallow	
Body Weight (kg)	0.02
Seasonal Use Factor	1
Site-Specific Area Use Factor	1
Water Ingestion Rate (kg/day)	0.0040
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.0092
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.020
Plant Ingestion Rate (kg_{ww}/day)	0.0060

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations				Potential Daily Dose (ug/kg_{bw}/day)					NOAEL-based TRV (µg/kg_{bw}/day)	NOAEL-based HQ	LOAEL-based TRV (µg/kg_{bw}/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Aquatic Invertebrate EPC (µg/kg, ww)	Plant EPC (µg/kg, ww)	Surface Water EPC (µg/L)	Benthic Invertebrate	Aquatic Invertebrate	Plant	Surface Water	Total				
PFCAs													
PFBA	9.0E+00	4.2E+01	2.1E+00	7.8E-01	4.1E+00	4.2E+01	6.4E-01	1.5E-01	4.6E+01	1.0E+03	4.6E-02	1.0E+04	4.6E-03
PFHpA	2.4E-01	5.0E-01	2.6E-01	7.9E-03	1.1E-01	4.9E-01	7.7E-02	1.6E-03	6.8E-01	1.0E+03	6.8E-04	1.0E+04	6.8E-05
PFOA	3.2E+00	5.1E+00	2.5E+00	7.5E-02	1.5E+00	5.0E+00	7.3E-01	1.5E-02	7.3E+00	1.0E+03	7.3E-03	1.0E+04	7.3E-04
PFNA	1.7E-01	1.9E-01	8.0E-01	1.1E-03	7.8E-02	1.9E-01	2.4E-01	2.1E-04	5.0E-01	1.0E+03	5.0E-04	1.0E+04	5.0E-05
PFDA	5.5E-01	1.6E-01	2.3E+00	1.3E-03	2.5E-01	1.6E-01	6.7E-01	2.5E-04	1.1E+00	1.0E+03	1.1E-03	1.0E+04	1.1E-04
PFUnA	NC	NC	NC	ND	NC	NC	NC	NC	NC	1.0E+03	NC	1.0E+04	NC
PFDoA	NC	NC	NC	ND	NC	NC	NC	NC	NC	1.0E+03	NC	1.0E+04	NC
PFTrDA	1.8E-01	2.2E-01	3.0E+00	1.7E-03	8.1E-02	2.1E-01	9.0E-01	3.4E-04	1.2E+00	1.0E+03	1.2E-03	1.0E+04	1.2E-04
PFTeDA	1.1E-01	3.1E-01	4.3E+00	2.4E-03	4.9E-02	3.0E-01	1.3E+00	4.8E-04	1.6E+00	1.0E+03	1.6E-03	1.0E+04	1.6E-04
PFSAs													
PFHxS	2.0E-01	2.0E+00	1.5E-02	8.5E-03	9.0E-02	2.0E+00	4.4E-03	1.7E-03	2.1E+00	7.9E+01	2.7E-02	7.9E+02	2.7E-03
PFHpS	1.2E-01	5.2E-01	6.1E-02	1.9E-03	5.6E-02	5.2E-01	1.8E-02	3.7E-04	5.9E-01	7.9E+01	7.5E-03	7.9E+02	7.5E-04
PFOS	2.8E+01	5.3E+01	3.6E+01	1.9E-01	1.3E+01	5.3E+01	1.1E+01	3.8E-02	7.6E+01	7.9E+01	9.6E-01	7.9E+02	9.6E-02
PFNS	NC	NC	NC	ND	NC	NC	NC	NC	NC	7.9E+01	NC	7.9E+02	NC
PFDS	NC	NC	NC	ND	NC	NC	NC	NC	NC	7.9E+01	NC	7.9E+02	NC
FOSA, FASE, FASAAs													
PFOSA	2.0E+00	2.9E-01	1.9E-01	1.0E-03	8.8E-01	2.9E-01	5.8E-02	2.0E-04	1.2E+00	7.9E+01	1.6E-02	7.9E+02	1.6E-03
N-EtFOSAA	1.4E-01	2.0E-01	1.3E-01	7.1E-04	6.2E-02	2.0E-01	4.0E-02	1.4E-04	3.0E-01	7.9E+01	3.8E-03	7.9E+02	3.8E-04
N-MeFOSAA	7.5E-01	6.5E-01	4.4E-01	2.3E-03	3.4E-01	6.5E-01	1.3E-01	4.6E-04	1.1E+00	7.9E+01	1.4E-02	7.9E+02	1.4E-03
Fluortelomers													
6:2 FTS	7.5E+00	2.1E+01	1.5E-01	8.6E-02	3.4E+00	2.0E+01	4.4E-02	1.7E-02	2.4E+01	1.0E+03	2.4E-02	1.0E+04	2.4E-03

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
UCL - upper confidence limit of the arithmetic mean
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
ww - wet weight

Appendix J Food Web Model – Lake Elmo
Table 9. Potential Risks to the Spotted Sandpiper
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Lake Elmo	
Assumptions for the Spotted Sandpiper	
Body Weight (kg)	0.043
Seasonal Use Factor	1
Site-Specific Area Use Factor	1
Sediment Ingestion Rate (kg_{dw}/day)	0.00055
Water Ingestion Rate (kg/day)	0.054
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.0184
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.0034
Forage Fish Ingestion Rate (kg_{ww}/day)	0.0011

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_S \times C_S] + [IR_W \times C_W]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_s = Incidental ingestion rate of sediment (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_s= Concentration of PFAS in sediment (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations					Potential Daily Dose (ug/kg_{bw}/day)						NOAEL-based TRV (ug/kg_{bw}/day)	NOAEL-based HQ	LOAEL-based TRV (ug/kg_{bw}/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Aquatic Invertebrate EPC (µg/kg, ww)	Forage Fish EPC (µg/kg, ww)	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Benthic Invertebrate	Aquatic Invertebrate	Forage Fish	Sediment	Surface Water	Total				
PFCAs															
PFBA	9.0E+00	4.2E+01	7.6E-01	5.2E+00	7.8E-01	3.9E+00	3.4E+00	2.0E-02	6.8E-02	1.0E+00	8.4E+00	1.0E+03	8.4E-03	1.0E+04	8.4E-04
PFHpA	2.4E-01	5.0E-01	2.3E-01	ND	7.9E-03	1.1E-01	4.0E-02	6.3E-03	NC	1.0E-02	1.6E-01	1.0E+03	1.6E-04	1.0E+04	1.6E-05
PFOA	3.2E+00	5.1E+00	1.2E+00	5.9E-01	7.5E-02	1.4E+00	4.1E-01	3.2E-02	7.7E-03	9.5E-02	1.9E+00	1.0E+03	1.9E-03	1.0E+04	1.9E-04
PFNA	1.7E-01	1.9E-01	8.6E-01	ND	1.1E-03	7.5E-02	1.5E-02	2.3E-02	NC	1.4E-03	1.1E-01	1.0E+03	1.1E-04	1.0E+04	1.1E-05
PFDA	5.5E-01	1.6E-01	8.5E+00	ND	1.3E-03	2.4E-01	1.3E-02	2.3E-01	NC	1.6E-03	4.8E-01	1.0E+03	4.8E-04	1.0E+04	4.8E-05
PFUnA	NC	NC	1.3E+00	ND	ND	NC	NC	3.6E-02	NC	NC	3.6E-02	1.0E+03	3.6E-05	1.0E+04	3.6E-06
PFDoA	NC	NC	6.7E-01	ND	ND	NC	NC	1.8E-02	NC	NC	1.8E-02	1.0E+03	1.8E-05	1.0E+04	1.8E-06
PFTrDA	1.8E-01	2.2E-01	4.7E-01	ND	1.7E-03	7.7E-02	1.8E-02	1.3E-02	NC	2.2E-03	1.1E-01	1.0E+03	1.1E-04	1.0E+04	1.1E-05
PFTeDA	1.1E-01	3.1E-01	5.2E-01	ND	2.4E-03	4.7E-02	2.5E-02	1.4E-02	NC	3.1E-03	8.8E-02	1.0E+03	8.8E-05	1.0E+04	8.8E-06
PFSAs															
PFHxS	2.0E-01	2.0E+00	2.9E-01	ND	8.5E-03	8.6E-02	1.6E-01	7.9E-03	NC	1.1E-02	2.7E-01	7.9E+01	3.4E-03	7.9E+02	3.4E-04
PFHpS	1.2E-01	5.2E-01	2.6E+00	ND	1.9E-03	5.3E-02	4.2E-02	7.0E-02	NC	2.4E-03	1.7E-01	7.9E+01	2.1E-03	7.9E+02	2.1E-04
PFOS	2.8E+01	5.3E+01	1.4E+03	4.5E+00	1.9E-01	1.2E+01	4.3E+00	3.8E+01	5.8E-02	2.4E-01	5.5E+01	7.9E+01	7.0E-01	7.9E+02	7.0E-02
PFNS	NC	NC	2.4E+00	ND	ND	NC	NC	6.4E-02	NC	NC	6.4E-02	7.9E+01	8.1E-04	7.9E+02	8.1E-05
PFDS	NC	NC	2.7E-01	ND	ND	NC	NC	7.3E-03	NC	NC	7.3E-03	7.9E+01	9.2E-05	7.9E+02	9.2E-06
FOSA, FASE, FASAAs															
PFOSA	2.0E+00	2.9E-01	1.6E+01	ND	1.0E-03	8.4E-01	2.3E-02	4.3E-01	NC	1.3E-03	1.3E+00	7.9E+01	1.6E-02	7.9E+02	1.6E-03
N-EtFOSAA	1.4E-01	2.0E-01	7.1E-01	ND	7.1E-04	5.9E-02	1.6E-02	1.9E-02	NC	9.0E-04	9.5E-02	7.9E+01	1.2E-03	7.9E+02	1.2E-04
N-MeFOSAA	7.5E-01	6.5E-01	1.8E-01	ND	2.3E-03	3.2E-01	5.3E-02	4.7E-03	NC	3.0E-03	3.8E-01	7.9E+01	4.9E-03	7.9E+02	4.9E-04
Fluortelomers															
6:2 FTS	7.5E+00	2.1E+01	ND	4.5E+00	8.6E-02	3.2E+00	1.7E+00	NC	5.9E-02	1.1E-01	5.1E+00	1.0E+03	5.1E-03	1.0E+04	5.1E-04

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
UCL - upper confidence limit of the arithmetic mean
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
ww - wet weight

Appendix J Food Web Model – Lake Elmo
Table 10. Potential Risks to the Great Blue Heron
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Lake Elmo	
Assumptions for the Great Blue Heron	
Body Weight (kg)	2.4
Seasonal Use Factor	1
Site-Specific Area Use Factor	1.0
Sediment Ingestion Rate (kg_{dw}/day)	0.00043
Water Ingestion Rate (kg/day)	0.11
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.065
Amphibian Ingestion Rate (kg_{ww}/day)	0.022
Forage Fish Ingestion Rate (kg_{ww}/day)	0.35

Total Daily Dose = $\frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_s = Incidental ingestion rate of sediment (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_s= Concentration of PFAS in sediment (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations					Potential Daily Dose (ug/kg_{bw}/day)						NOAEL-based TRV ($\mu g/kg_{bw}$/day)	NOAEL-based HQ	LOAEL-based TRV ($\mu g/kg_{bw}$/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Amphibian EPC (µg/kg, ww)	Forage Fish EPC (µg/kg, ww)	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Benthic Invertebrate	Amphibian	Forage Fish	Sediment	Surface Water	Total				
PFCAs															
PFBA	9.0E+00	2.1E+00	7.6E-01	5.2E+00	7.8E-01	2.4E-01	1.9E-02	1.1E-01	9.4E-04	3.5E-02	4.1E-01	1.0E+03	4.1E-04	1.0E+04	4.1E-05
PFHpA	2.4E-01	NC	2.3E-01	ND	7.9E-03	6.6E-03	NC	3.4E-02	NC	3.5E-04	4.1E-02	1.0E+03	4.1E-05	1.0E+04	4.1E-06
PFOA	3.2E+00	2.4E-01	1.2E+00	5.9E-01	7.5E-02	8.7E-02	2.2E-03	1.7E-01	1.1E-04	3.4E-03	2.6E-01	1.0E+03	2.6E-04	1.0E+04	2.6E-05
PFNA	1.7E-01	2.0E-01	8.6E-01	ND	1.1E-03	4.7E-03	1.8E-03	1.2E-01	NC	4.8E-05	1.3E-01	1.0E+03	1.3E-04	1.0E+04	1.3E-05
PFDA	5.5E-01	8.7E-01	8.5E+00	ND	1.3E-03	1.5E-02	7.9E-03	1.2E+00	NC	5.7E-05	1.3E+00	1.0E+03	1.3E-03	1.0E+04	1.3E-04
PFUnA	NC	NC	1.3E+00	ND	ND	NC	NC	1.9E-01	NC	NC	1.9E-01	1.0E+03	1.9E-04	1.0E+04	1.9E-05
PFDoA	NC	NC	6.7E-01	ND	ND	NC	NC	9.7E-02	NC	NC	9.7E-02	1.0E+03	9.7E-05	1.0E+04	9.7E-06
PFTrDA	1.8E-01	2.3E-01	4.7E-01	ND	1.7E-03	4.8E-03	2.0E-03	6.8E-02	NC	7.7E-05	7.5E-02	1.0E+03	7.5E-05	1.0E+04	7.5E-06
PFTeDA	1.1E-01	1.1E-01	5.2E-01	ND	2.4E-03	2.9E-03	9.9E-04	7.4E-02	NC	1.1E-04	7.8E-02	1.0E+03	7.8E-05	1.0E+04	7.8E-06
PFSAs															
PFHxS	2.0E-01	5.6E-02	2.9E-01	ND	8.5E-03	5.4E-03	5.0E-04	4.2E-02	NC	3.8E-04	4.8E-02	7.9E+01	6.1E-04	7.9E+02	6.1E-05
PFHpS	1.2E-01	1.0E-01	2.6E+00	ND	1.9E-03	3.3E-03	9.0E-04	3.7E-01	NC	8.4E-05	3.8E-01	7.9E+01	4.8E-03	7.9E+02	4.8E-04
PFOS	2.8E+01	8.7E+01	1.4E+03	4.5E+00	1.9E-01	7.5E-01	7.8E-01	2.0E+02	8.1E-04	8.6E-03	2.1E+02	7.9E+01	**2.6E+00**	7.9E+02	2.6E-01
PFNS	NC	NC	2.4E+00	ND	ND	NC	NC	3.4E-01	NC	NC	3.4E-01	7.9E+01	4.3E-03	7.9E+02	4.3E-04
PFDS	NC	NC	2.7E-01	ND	ND	NC	NC	3.9E-02	NC	NC	3.9E-02	7.9E+01	4.9E-04	7.9E+02	4.9E-05
FOSA, FASE, FASAAs															
PFOSA	2.0E+00	4.8E-01	1.6E+01	ND	1.0E-03	5.3E-02	4.3E-03	2.3E+00	NC	4.6E-05	2.4E+00	7.9E+01	3.0E-02	7.9E+02	3.0E-03
N-EtFOSAA	1.4E-01	1.3E-01	7.1E-01	ND	7.1E-04	3.7E-03	1.2E-03	1.0E-01	NC	3.2E-05	1.1E-01	7.9E+01	1.4E-03	7.9E+02	1.4E-04
N-MeFOSAA	7.5E-01	5.6E-01	1.8E-01	ND	2.3E-03	2.0E-02	NC	2.5E-02	NC	1.0E-04	4.6E-02	7.9E+01	5.8E-04	7.9E+02	5.8E-05
Fluortelomers															
6:2 FTS	7.5E+00	1.1E+01	ND	4.5E+00	8.6E-02	2.0E-01	1.0E-01	NC	8.2E-04	3.9E-03	3.1E-01	1.0E+03	3.1E-04	1.0E+04	3.1E-05

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
UCL - upper confidence limit of the arithmetic mean
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
ww - wet weight

Appendix J Food Web Model – Lake Elmo
Table 11. Potential Risks to the Bald Eagle
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Lake Elmo	
Assumptions for the Bald Eagle	
Body Weight (kg)	4.2
Seasonal Use Factor	1
Site-Specific Area Use Factor	0.061
Water Ingestion Rate (kg/day)	0.15
Predatory Fish Ingestion Rate (kg_{ww}/day)	0.27
Forage Fish Ingestion Rate (kg_{ww}/day)	0.22

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations			Potential Daily Dose (ug/kg_{bw}/day)				NOAEL-based TRV ($\mu g/kg_{bw}$/day)	NOAEL-based HQ	LOAEL-based TRV ($\mu g/kg_{bw}$/day)	LOAEL-based HQ
	Predatory Fish (µg/kg, ww)	Forage Fish EPC (µg/kg, ww)	Surface Water EPC (µg/L)	Predatory Fish	Forage Fish	Surface Water	Total				
PFCAs											
PFBA	4.9E-01	7.6E-01	7.8E-01	2.0E-03	2.5E-03	1.7E-03	6.2E-03	1.0E+03	6.2E-06	1.0E+04	6.2E-07
PFHpA	1.1E-01	2.3E-01	7.9E-03	4.4E-04	7.7E-04	1.7E-05	1.2E-03	1.0E+03	1.2E-06	1.0E+04	1.2E-07
PFOA	3.5E-01	1.2E+00	7.5E-02	1.4E-03	3.9E-03	1.6E-04	5.5E-03	1.0E+03	5.5E-06	1.0E+04	5.5E-07
PFNA	4.1E-01	8.6E-01	1.1E-03	1.7E-03	2.8E-03	2.4E-06	4.5E-03	1.0E+03	4.5E-06	1.0E+04	4.5E-07
PFDA	1.2E+01	8.5E+00	1.3E-03	4.9E-02	2.8E-02	2.8E-06	7.7E-02	1.0E+03	7.7E-05	1.0E+04	7.7E-06
PFUnA	3.2E+00	1.3E+00	ND	1.3E-02	4.4E-03	NC	1.7E-02	1.0E+03	1.7E-05	1.0E+04	1.7E-06
PFDoA	1.5E+00	6.7E-01	ND	6.1E-03	2.2E-03	NC	8.3E-03	1.0E+03	8.3E-06	1.0E+04	8.3E-07
PFTrDA	7.7E-01	4.7E-01	1.7E-03	3.1E-03	1.6E-03	3.7E-06	4.7E-03	1.0E+03	4.7E-06	1.0E+04	4.7E-07
PFTeDA	7.4E-01	5.2E-01	2.4E-03	3.0E-03	1.7E-03	5.3E-06	4.7E-03	1.0E+03	4.7E-06	1.0E+04	4.7E-07
PFSAs											
PFHxS	3.6E-01	2.9E-01	8.5E-03	1.5E-03	9.6E-04	1.9E-05	2.4E-03	7.9E+01	3.1E-05	7.9E+02	3.1E-06
PFHpS	1.1E+00	2.6E+00	1.9E-03	4.4E-03	8.5E-03	4.1E-06	1.3E-02	7.9E+01	1.6E-04	7.9E+02	1.6E-05
PFOS	1.7E+03	1.4E+03	1.9E-01	6.7E+00	4.7E+00	4.2E-04	1.1E+01	7.9E+01	1.4E-01	7.9E+02	1.4E-02
PFNS	9.2E-01	2.4E+00	ND	3.7E-03	7.8E-03	NC	1.2E-02	7.9E+01	1.5E-04	7.9E+02	1.5E-05
PFDS	3.2E-01	2.7E-01	ND	1.3E-03	8.9E-04	NC	2.2E-03	7.9E+01	2.8E-05	7.9E+02	2.8E-06
FOSA, FASE, FASAAs											
PFOSA	6.4E-01	1.6E+01	1.0E-03	2.6E-03	5.3E-02	2.3E-06	5.5E-02	7.9E+01	7.0E-04	7.9E+02	7.0E-05
N-EtFOSAA	1.5E-01	7.1E-01	7.1E-04	5.9E-04	2.3E-03	1.6E-06	2.9E-03	7.9E+01	3.7E-05	7.9E+02	3.7E-06
N-MeFOSAA	1.7E-01	1.8E-01	2.3E-03	7.0E-04	5.8E-04	5.1E-06	1.3E-03	7.9E+01	1.6E-05	7.9E+02	1.6E-06
Fluortelomers											
6:2 FTS	2.4E+00	ND	8.6E-02	9.6E-03	NC	1.9E-04	9.8E-03	1.0E+03	9.8E-06	1.0E+04	9.8E-07

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
UCL - upper confidence limit of the arithmetic mean
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
ww - wet weight

Appendix J Food Web Model – Lake Elmo
Table 12. Potential Risks to the Muskrat
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Lake Elmo	
Assumptions for the Muskrat	
Body Weight (kg)	1.6
Seasonal Use Factor	1
Site-Specific Area Use Factor	1.0
Sediment Ingestion Rate (kg_{dw}/day)	0.0027
Water Ingestion Rate (kg/day)	0.88
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.054
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.054
Plant Ingestion Rate (kg_{ww}/day)	0.43

Total Daily Dose = $\frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_s = Incidental ingestion rate of sediment (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_s= Concentration of PFAS in sediment (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations					Potential Daily Dose (ug/kg_{bw}/day)						NOAEL-based TRV ($\mu g/kg_{bw}$/day)	NOAEL-based HQ	LOAEL-based TRV ($\mu g/kg_{bw}$/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Aquatic Invertebrate EPC (µg/kg, ww)	Plant EPC (µg/kg, ww)	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Benthic Invertebrate	Aquatic Invertebrate	Plant	Sediment	Surface Water	Total				
PFCAs															
PFBA	9.0E+00	4.2E+01	2.1E+00	5.2E+00	7.8E-01	3.1E-01	1.4E+00	5.8E-01	8.9E-03	4.3E-01	2.8E+00	7.3E+04	3.8E-05	1.8E+05	1.6E-05
PFHpA	2.4E-01	5.0E-01	2.6E-01	ND	7.9E-03	8.3E-03	1.7E-02	7.1E-02	NC	4.4E-03	1.0E-01	3.0E+02	3.3E-04	6.0E+02	1.7E-04
PFOA	3.2E+00	5.1E+00	2.5E+00	5.9E-01	7.5E-02	1.1E-01	1.7E-01	6.7E-01	1.0E-03	4.1E-02	9.9E-01	3.0E+02	3.3E-03	6.0E+02	1.7E-03
PFNA	1.7E-01	1.9E-01	8.0E-01	ND	1.1E-03	5.9E-03	6.4E-03	2.2E-01	NC	5.9E-04	2.3E-01	8.3E+02	2.8E-04	1.1E+03	2.1E-04
PFDA	5.5E-01	1.6E-01	2.3E+00	ND	1.3E-03	1.9E-02	5.5E-03	6.2E-01	NC	7.0E-04	6.4E-01	1.0E+02	6.4E-03	6.4E+03	1.0E-04
PFUnA	NC	NC	NC	ND	ND	NC	NC	NC	NC	NC	NC	3.0E+02	NC	1.0E+03	NC
PFDoA	NC	NC	NC	ND	ND	NC	NC	NC	NC	NC	NC	5.0E+02	NC	2.5E+03	NC
PFTrDA	1.8E-01	2.2E-01	3.0E+00	ND	1.7E-03	6.1E-03	7.4E-03	8.3E-01	NC	9.4E-04	8.4E-01	5.0E+02	1.7E-03	2.5E+03	3.4E-04
PFTeDA	1.1E-01	3.1E-01	4.3E+00	ND	2.4E-03	3.7E-03	1.0E-02	1.2E+00	NC	1.3E-03	1.2E+00	3.0E+03	4.0E-04	1.0E+04	1.2E-04
PFSAs															
PFHxS	2.0E-01	2.0E+00	1.5E-02	ND	8.5E-03	6.8E-03	6.9E-02	4.0E-03	NC	4.7E-03	8.5E-02	3.0E+02	2.8E-04	1.0E+03	8.5E-05
PFHpS	1.2E-01	5.2E-01	6.1E-02	ND	1.9E-03	4.2E-03	1.8E-02	1.7E-02	NC	1.0E-03	4.0E-02	3.0E+02	1.3E-04	1.0E+03	4.0E-05
PFOS	2.8E+01	5.3E+01	3.6E+01	4.5E+00	1.9E-01	9.4E-01	1.8E+00	9.8E+00	7.6E-03	1.1E-01	1.3E+01	1.0E+02	1.3E-01	1.7E+02	7.5E-02
PFNS	NC	NC	NC	ND	ND	NC	NC	NC	NC	NC	NC	1.0E+02	NC	1.7E+02	NC
PFDS	NC	NC	NC	ND	ND	NC	NC	NC	NC	NC	NC	1.0E+02	NC	1.7E+02	NC
FOSA, FASE, FASAAs															
PFOSA	2.0E+00	2.9E-01	1.9E-01	ND	1.0E-03	6.6E-02	9.8E-03	5.3E-02	NC	5.7E-04	1.3E-01	1.0E+02	1.3E-03	1.7E+02	7.6E-04
N-EtFOSAA	1.4E-01	2.0E-01	1.3E-01	ND	7.1E-04	4.7E-03	6.7E-03	3.6E-02	NC	3.9E-04	4.8E-02	1.0E+02	4.8E-04	1.7E+02	2.8E-04
N-MeFOSAA	7.5E-01	6.5E-01	4.4E-01	ND	2.3E-03	2.5E-02	2.2E-02	1.2E-01	NC	1.3E-03	1.7E-01	1.0E+02	1.7E-03	1.7E+02	9.9E-04
Fluortelomers															
6:2 FTS	7.5E+00	2.1E+01	1.5E-01	4.5E+00	8.6E-02	2.5E-01	7.0E-01	4.1E-02	7.7E-03	4.8E-02	1.0E+00	3.0E+02	3.5E-03	1.0E+03	1.0E-03

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
UCL - upper confidence limit of the arithmetic mean
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
ww - wet weight

Appendix J Food Web Model – Lake Elmo
Table 13. Potential Risks to the Little Brown Bat
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Lake Elmo	
Assumptions for the Little Brown Bat	
Body Weight (kg)	0.0085
Seasonal Use Factor	1
Site-Specific Area Use Factor	1.0
Water Ingestion Rate (kg/day)	0.0010
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.0049

Total Daily Dose = $\frac{\Sigma([IR_f \times C_f] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)
AUF = Area use factor (ratio of the receptor's home range relative to the size of

SUPPORTING CALCULATIONS

Analyte	Media Concentrations		Potential Daily Dose (ug/kg_{bw}/day)			NOAEL-based TRV ($\mu g/kg_{bw}$/day)	NOAEL-based HQ	LOAEL-based TRV ($\mu g/kg_{bw}$/day)	LOAEL-based HQ
	Aquatic Invertebrate EPC (µg/kg, ww)	Surface Water EPC (µg/L)	Aquatic Invertebrate	Surface Water	Total				
PFCAs									
PFBA	4.2E+01	7.8E-01	2.4E+01	9.2E-02	2.4E+01	7.3E+04	3.3E-04	1.8E+05	1.4E-04
PFHpA	5.0E-01	7.9E-03	2.8E-01	9.2E-04	2.8E-01	3.0E+02	9.5E-04	6.0E+02	4.7E-04
PFOA	5.1E+00	7.5E-02	2.9E+00	8.8E-03	2.9E+00	3.0E+02	9.7E-03	6.0E+02	4.8E-03
PFNA	1.9E-01	1.1E-03	1.1E-01	1.3E-04	1.1E-01	8.3E+02	1.3E-04	1.1E+03	9.8E-05
PFDA	1.6E-01	1.3E-03	9.2E-02	1.5E-04	9.2E-02	1.0E+02	9.2E-04	6.4E+03	1.4E-05
PFUnA	NC	ND	NC	NC	NC	3.0E+02	NC	1.0E+03	NC
PFDoA	NC	ND	NC	NC	NC	5.0E+02	NC	2.5E+03	NC
PFTrDA	2.2E-01	1.7E-03	1.2E-01	2.0E-04	1.2E-01	5.0E+02	2.5E-04	2.5E+03	4.9E-05
PFTeDA	3.1E-01	2.4E-03	1.7E-01	2.8E-04	1.7E-01	3.0E+03	5.8E-05	1.0E+04	1.7E-05
PFSAs									
PFHxS	2.0E+00	8.5E-03	1.2E+00	1.0E-03	1.2E+00	3.0E+02	3.9E-03	1.0E+03	1.2E-03
PFHpS	5.2E-01	1.9E-03	3.0E-01	2.2E-04	3.0E-01	3.0E+02	9.9E-04	1.0E+03	3.0E-04
PFOS	5.3E+01	1.9E-01	3.0E+01	2.2E-02	3.0E+01	1.0E+02	3.0E-01	1.7E+02	1.8E-01
PFNS	NC	ND	NC	NC	NC	1.0E+02	NC	1.7E+02	NC
PFDS	NC	ND	NC	NC	NC	1.0E+02	NC	1.7E+02	NC
FOSA, FASE, FASAAs									
PFOSA	2.9E-01	1.0E-03	1.6E-01	1.2E-04	1.6E-01	1.0E+02	1.6E-03	1.7E+02	9.6E-04
N-EtFOSAA	2.0E-01	7.1E-04	1.1E-01	8.3E-05	1.1E-01	1.0E+02	1.1E-03	1.7E+02	6.6E-04
N-MeFOSAA	6.5E-01	2.3E-03	3.7E-01	2.7E-04	3.7E-01	1.0E+02	3.7E-03	1.7E+02	2.2E-03
Fluortelomers									
6:2 FTS	2.1E+01	8.6E-02	1.2E+01	1.0E-02	1.2E+01	3.0E+02	3.9E-02	1.0E+03	1.2E-02

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
UCL - upper confidence limit of the arithmetic mean
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
ww - wet weight

Appendix J Food Web Model – Lake Elmo
Table 14. Potential Risks to the Mink
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Lake Elmo	
Assumptions for the Mink	
Body Weight (kg)	1.4
Seasonal Use Factor	1
Site-Specific Area Use Factor	1.0
Sediment Ingestion Rate (kg_{dw}/day)	0.0016
Water Ingestion Rate (kg/day)	0.055
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.022
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.022
Plant Ingestion Rate (kg_{ww}/day)	0.011
Amphibian Ingestion Rate (kg_{ww}/day)	0.011
Forage Fish Ingestion Rate (kg_{ww}/day)	0.044
Predatory Fish Ingestion Rate (kg_{ww}/day)	0.11

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_s = Incidental ingestion rate of sediment (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_s = Concentration of PFAS in sediment (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations								Potential Daily Dose (ug/kg_{bw}/day)									NOAEL-based TRV (ug/kg_{bw}/day)	NOAEL-based HQ	LOAEL-based TRV (ug/kg_{bw}/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Aquatic Invertebrate EPC (µg/kg, ww)	Plant EPC (µg/kg, ww)	Amphibian EPC (µg/kg, ww)	Forage Fish EPC (µg/kg, ww)	Predatory Fish EPC (µg/kg, ww)	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Benthic Invertebrate	Aquatic Invertebrate	Plant	Ampibian	Forage Fish	Predatory Fish	Sediment	Surface Water	Total				
PFCAs																					
PFBA	9.0E+00	4.2E+01	2.1E+00	2.1E+00	7.6E-01	4.9E-01	5.2E+00	7.8E-01	1.4E-01	6.7E-01	1.7E-02	1.7E-02	2.4E-02	3.9E-02	6.3E-03	3.2E-02	9.5E-01	7.3E+04	1.3E-05	1.8E+05	5.4E-06
PFHpA	2.4E-01	5.0E-01	2.6E-01	NC	2.3E-01	1.1E-01	ND	7.9E-03	3.9E-03	7.9E-03	2.1E-03	NC	7.5E-03	8.8E-03	NC	3.2E-04	3.1E-02	3.0E+02	1.0E-04	6.0E+02	5.1E-05
PFOA	3.2E+00	5.1E+00	2.5E+00	2.4E-01	1.2E+00	3.5E-01	5.9E-01	7.5E-02	5.2E-02	8.1E-02	2.0E-02	1.9E-03	3.8E-02	2.8E-02	7.1E-04	3.0E-03	2.2E-01	3.0E+02	7.5E-04	6.0E+02	3.7E-04
PFNA	1.7E-01	1.9E-01	8.0E-01	2.0E-01	8.6E-01	4.1E-01	ND	1.1E-03	2.8E-03	3.0E-03	6.4E-03	1.6E-03	2.8E-02	3.3E-02	NC	4.3E-05	7.4E-02	8.3E+02	8.9E-05	1.1E+03	6.7E-05
PFDA	5.5E-01	1.6E-01	2.3E+00	8.7E-01	8.5E+00	1.2E+01	ND	1.3E-03	8.9E-03	2.6E-03	1.8E-02	7.0E-03	2.7E-01	9.7E-01	NC	5.1E-05	1.3E+00	1.0E+02	1.3E-02	6.4E+03	2.0E-04
PFUnA	NC	NC	NC	NC	1.3E+00	3.2E+00	ND	ND	NC	NC	NC	NC	4.2E-02	2.5E-01	NC	NC	3.0E-01	3.0E+02	9.9E-04	1.0E+03	3.0E-04
PFDoA	NC	NC	NC	NC	6.7E-01	1.5E+00	ND	ND	NC	NC	NC	NC	2.2E-02	1.2E-01	NC	NC	1.4E-01	5.0E+02	2.8E-04	2.5E+03	5.7E-05
PFTrDA	1.8E-01	2.2E-01	3.0E+00	2.3E-01	4.7E-01	7.7E-01	ND	1.7E-03	2.9E-03	3.5E-03	2.4E-02	1.8E-03	1.5E-02	6.2E-02	NC	6.9E-05	1.1E-01	5.0E+02	2.2E-04	2.5E+03	4.4E-05
PFTeDA	1.1E-01	3.1E-01	4.3E+00	1.1E-01	5.2E-01	7.4E-01	ND	2.4E-03	1.7E-03	4.9E-03	3.4E-02	8.8E-04	1.6E-02	5.9E-02	NC	9.7E-05	1.2E-01	3.0E+03	3.9E-05	1.0E+04	1.2E-05
PFSAs																					
PFHxS	2.0E-01	2.0E+00	1.5E-02	5.6E-02	2.9E-01	3.6E-01	ND	8.5E-03	3.2E-03	3.3E-02	1.2E-04	4.5E-04	9.3E-03	2.9E-02	NC	3.4E-04	7.5E-02	3.0E+02	2.5E-04	1.0E+03	7.5E-05
PFHpS	1.2E-01	5.2E-01	6.1E-02	1.0E-01	2.6E+00	1.1E+00	ND	1.9E-03	2.0E-03	8.3E-03	4.9E-04	8.0E-04	8.3E-02	8.8E-02	NC	7.5E-05	1.8E-01	3.0E+02	6.1E-04	1.0E+03	1.8E-04
PFOS	2.8E+01	5.3E+01	3.6E+01	8.7E+01	1.4E+03	1.7E+03	4.5E+00	1.9E-01	4.4E-01	8.5E-01	2.9E-01	6.9E-01	4.6E+01	1.3E+02	5.4E-03	7.7E-03	1.8E+02	1.0E+02	**1.8E+00**	1.7E+02	**1.1E+00**
PFNS	NC	NC	NC	NC	2.4E+00	9.2E-01	ND	ND	NC	NC	NC	NC	7.6E-02	7.4E-02	NC	NC	1.5E-01	1.0E+02	1.5E-03	1.7E+02	8.8E-04
PFDS	NC	NC	NC	NC	2.7E-01	3.2E-01	ND	ND	NC	NC	NC	NC	8.6E-03	2.6E-02	NC	NC	3.4E-02	1.0E+02	3.4E-04	1.7E+02	2.0E-04
FOSA, FASE, FASAAs																					
PFOSA	2.0E+00	2.9E-01	1.9E-01	4.8E-01	1.6E+01	6.4E-01	ND	1.0E-03	3.1E-02	4.6E-03	1.6E-03	3.9E-03	5.1E-01	5.1E-02	NC	4.2E-05	6.0E-01	1.0E+02	6.0E-03	1.7E+02	3.6E-03
N-EtFOSAA	1.4E-01	2.0E-01	1.3E-01	1.3E-01	7.1E-01	1.5E-01	ND	7.1E-04	2.2E-03	3.2E-03	1.1E-03	1.0E-03	2.3E-02	1.2E-02	NC	2.9E-05	4.2E-02	1.0E+02	4.2E-04	1.7E+02	2.5E-04
N-MeFOSAA	7.5E-01	6.5E-01	4.4E-01	5.6E-01	1.8E-01	1.7E-01	ND	2.3E-03	1.2E-02	1.0E-02	3.5E-03	NC	5.6E-03	1.4E-02	NC	9.4E-05	4.5E-02	1.0E+02	4.5E-04	1.7E+02	2.7E-04
Fluortelomers																					
6:2 FTS	7.5E+00	2.1E+01	1.5E-01	1.1E+01	ND	2.4E+00	4.5E+00	8.6E-02	1.2E-01	3.3E-01	1.2E-03	9.0E-02	NC	1.9E-01	5.4E-03	3.5E-03	7.4E-01	3.0E+02	2.5E-03	1.0E+03	7.4E-04

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
UCL - upper confidence limit of the arithmetic mean
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
ww - wet weight

Appendix J Food Web Model – Lake Elmo
Table 15. Potential Risks to the River Otter
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: Lake Elmo	
Assumptions for the River Otter	
Body Weight (kg)	7.7
Seasonal Use Factor	1
Site-Specific Area Use Factor	0.10
Water Ingestion Rate (kg/day)	0.41
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.12
Amphibian Ingestion Rate (kg_{ww}/day)	0.039
Forage Fish Ingestion Rate (kg_{ww}/day)	0.27
Predatory Fish Ingestion Rate (kg_{ww}/day)	0.35

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations					Potential Daily Dose (ug/kg_{bw}/day)						NOAEL-based TRV (ug/kg_{bw}/day)	NOAEL-based HQ	LOAEL-based TRV (ug/kg_{bw}/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Amphibian EPC (µg/kg, ww)	Forage Fish EPC (µg/kg, ww)	Predatory Fish EPC (µg/kg, ww)	Surface Water EPC (µg/L)	Benthic Invertebrate	Amphibian	Forage Fish	Predatory Fish	Surface Water	Total				
PFCAs															
PFBA	9.0E+00	2.1E+00	7.6E-01	4.9E-01	7.8E-01	1.4E-02	1.1E-03	2.7E-03	2.3E-03	4.1E-03	2.4E-02	7.3E+04	3.3E-07	1.8E+05	1.4E-07
PFHpA	2.4E-01	NC	2.3E-01	1.1E-01	7.9E-03	3.7E-04	NC	8.3E-04	5.0E-04	4.2E-05	1.8E-03	3.0E+02	5.8E-06	6.0E+02	2.9E-06
PFOA	3.2E+00	2.4E-01	1.2E+00	3.5E-01	7.5E-02	4.9E-03	1.2E-04	4.2E-03	1.6E-03	4.0E-04	1.1E-02	3.0E+02	3.8E-05	6.0E+02	1.9E-05
PFNA	1.7E-01	2.0E-01	8.6E-01	4.1E-01	1.1E-03	2.6E-04	1.0E-04	3.1E-03	1.9E-03	5.7E-06	5.3E-03	8.3E+02	6.4E-06	1.1E+03	4.8E-06
PFDA	5.5E-01	8.7E-01	8.5E+00	1.2E+01	1.3E-03	8.4E-04	4.5E-04	3.0E-02	5.5E-02	6.8E-06	8.7E-02	1.0E+02	8.7E-04	6.4E+03	1.4E-05
PFUnA	NC	NC	1.3E+00	3.2E+00	ND	NC	NC	4.7E-03	1.5E-02	NC	1.9E-02	3.0E+02	6.4E-05	1.0E+03	1.9E-05
PFDoA	NC	NC	6.7E-01	1.5E+00	ND	NC	NC	2.4E-03	6.9E-03	NC	9.3E-03	5.0E+02	1.9E-05	2.5E+03	3.7E-06
PFTrDA	1.8E-01	2.3E-01	4.7E-01	7.7E-01	1.7E-03	2.7E-04	1.1E-04	1.7E-03	3.5E-03	9.0E-06	5.6E-03	5.0E+02	1.1E-05	2.5E+03	2.2E-06
PFTeDA	1.1E-01	1.1E-01	5.2E-01	7.4E-01	2.4E-03	1.7E-04	5.6E-05	1.8E-03	3.4E-03	1.3E-05	5.4E-03	3.0E+03	1.8E-06	1.0E+04	5.4E-07
PFSAs															
PFHxS	2.0E-01	5.6E-02	2.9E-01	3.6E-01	8.5E-03	3.0E-04	2.8E-05	1.0E-03	1.7E-03	4.5E-05	3.1E-03	3.0E+02	1.0E-05	1.0E+03	3.1E-06
PFHpS	1.2E-01	1.0E-01	2.6E+00	1.1E+00	1.9E-03	1.9E-04	5.1E-05	9.2E-03	5.0E-03	9.9E-06	1.4E-02	3.0E+02	4.8E-05	1.0E+03	1.4E-05
PFOS	2.8E+01	8.7E+01	1.4E+03	1.7E+03	1.9E-01	4.2E-02	4.4E-02	5.1E+00	7.6E+00	1.0E-03	1.3E+01	1.0E+02	1.3E-01	1.7E+02	7.5E-02
PFNS	NC	NC	2.4E+00	9.2E-01	ND	NC	NC	8.4E-03	4.2E-03	NC	1.3E-02	1.0E+02	1.3E-04	1.7E+02	7.4E-05
PFDS	NC	NC	2.7E-01	3.2E-01	ND	NC	NC	9.6E-04	1.5E-03	NC	2.4E-03	1.0E+02	2.4E-05	1.7E+02	1.4E-05
FOSA, FASE, FASAAs															
PFOSA	2.0E+00	4.8E-01	1.6E+01	6.4E-01	1.0E-03	3.0E-03	2.5E-04	5.7E-02	2.9E-03	5.5E-06	6.3E-02	1.0E+02	6.3E-04	1.7E+02	3.7E-04
N-EtFOSAA	1.4E-01	1.3E-01	7.1E-01	1.5E-01	7.1E-04	2.1E-04	6.7E-05	2.5E-03	6.7E-04	3.8E-06	3.5E-03	1.0E+02	3.5E-05	1.7E+02	2.0E-05
N-MeFOSAA	7.5E-01	5.6E-01	1.8E-01	1.7E-01	2.3E-03	1.1E-03	NC	6.2E-04	7.9E-04	1.2E-05	2.6E-03	1.0E+02	2.6E-05	1.7E+02	1.5E-05
Fluortelomers															
6:2 FTS	7.5E+00	1.1E+01	ND	2.4E+00	8.6E-02	1.1E-02	5.7E-03	NC	1.1E-02	4.6E-04	2.9E-02	3.0E+02	9.5E-05	1.0E+03	2.9E-05

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
UCL - upper confidence limit of the arithmetic mean
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
ww - wet weight

Appendix J Food Web Model – Lake Elmo
Table 16. Summary of Potential Risks to Wildlife at Lake Elmo
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Analyte	Hazard Quotients for Potential PFAS Exposure																	
	Wood Duck		Tree Swallow		Spotted Sandpiper		Great Blue Heron		Bald Eagle		Muskrat		Little Brown Bat		Mink		River Otter	
	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ
PFCAs																		
PFBA	3.4E-04	3.4E-05	4.6E-02	4.6E-03	8.4E-03	8.4E-04	4.1E-04	4.1E-05	6.2E-06	6.2E-07	3.8E-05	1.6E-05	3.3E-04	1.4E-04	1.3E-05	5.4E-06	3.3E-07	1.4E-07
PFHpA	1.8E-05	1.8E-06	6.8E-04	6.8E-05	1.6E-04	1.6E-05	4.1E-05	4.1E-06	1.2E-06	1.2E-07	3.3E-04	1.7E-04	9.5E-04	4.7E-04	1.0E-04	5.1E-05	5.8E-06	2.9E-06
PFOA	1.8E-04	1.8E-05	7.3E-03	7.3E-04	1.9E-03	1.9E-04	2.6E-04	2.6E-05	5.5E-06	5.5E-07	3.3E-03	1.7E-03	9.7E-03	4.8E-03	7.5E-04	3.7E-04	3.8E-05	1.9E-05
PFNA	4.9E-05	4.9E-06	5.0E-04	5.0E-05	1.1E-04	1.1E-05	1.3E-04	1.3E-05	4.5E-06	4.5E-07	2.8E-04	2.1E-04	1.3E-04	9.8E-05	8.9E-05	6.7E-05	6.4E-06	4.8E-06
PFDA	1.4E-04	1.4E-05	1.1E-03	1.1E-04	4.8E-04	4.8E-05	1.3E-03	1.3E-04	7.7E-05	7.7E-06	6.4E-03	1.0E-04	9.2E-04	1.4E-05	1.3E-02	2.0E-04	8.7E-04	1.4E-05
PFUnA	NC	NC	NC	NC	3.6E-05	3.6E-06	1.9E-04	1.9E-05	1.7E-05	1.7E-06	NC	NC	NC	NC	9.9E-04	3.0E-04	6.4E-05	1.9E-05
PFDoA	NC	NC	NC	NC	1.8E-05	1.8E-06	9.7E-05	9.7E-06	8.3E-06	8.3E-07	NC	NC	NC	NC	2.8E-04	5.7E-05	1.9E-05	3.7E-06
PFTrDA	1.8E-04	1.8E-05	1.2E-03	1.2E-04	1.1E-04	1.1E-05	7.5E-05	7.5E-06	4.7E-06	4.7E-07	1.7E-03	3.4E-04	2.5E-04	4.9E-05	2.2E-04	4.4E-05	1.1E-05	2.2E-06
PFTeDA	2.6E-04	2.6E-05	1.6E-03	1.6E-04	8.8E-05	8.8E-06	7.8E-05	7.8E-06	4.7E-06	4.7E-07	4.0E-04	1.2E-04	5.8E-05	1.7E-05	3.9E-05	1.2E-05	1.8E-06	5.4E-07
PFSAs																		
PFHxS	1.1E-04	1.1E-05	2.7E-02	2.7E-03	3.4E-03	3.4E-04	6.1E-04	6.1E-05	3.1E-05	3.1E-06	2.8E-04	8.5E-05	3.9E-03	1.2E-03	2.5E-04	7.5E-05	1.0E-05	3.1E-06
PFHpS	7.4E-05	7.4E-06	7.5E-03	7.5E-04	2.1E-03	2.1E-04	4.8E-03	4.8E-04	1.6E-04	1.6E-05	1.3E-04	4.0E-05	9.9E-04	3.0E-04	6.1E-04	1.8E-04	4.8E-05	1.4E-05
PFOS	3.1E-02	3.1E-03	9.6E-01	9.6E-02	7.0E-01	7.0E-02	**2.6E+00**	2.6E-01	1.4E-01	1.4E-02	1.3E-01	7.5E-02	3.0E-01	1.8E-01	**1.8E+00**	**1.1E+00**	1.3E-01	7.5E-02
PFNS	NC	NC	NC	NC	8.1E-04	8.1E-05	4.3E-03	4.3E-04	1.5E-04	1.5E-05	NC	NC	NC	NC	1.5E-03	8.8E-04	1.3E-04	7.4E-05
PFDS	NC	NC	NC	NC	9.2E-05	9.2E-06	4.9E-04	4.9E-05	2.8E-05	2.8E-06	NC	NC	NC	NC	3.4E-04	2.0E-04	2.4E-05	1.4E-05
FOSA, FASE, FASAAs																		
PFOSA	2.4E-04	2.4E-05	1.6E-02	1.6E-03	1.6E-02	1.6E-03	3.0E-02	3.0E-03	7.0E-04	7.0E-05	1.3E-03	7.6E-04	1.6E-03	9.6E-04	6.0E-03	3.6E-03	6.3E-04	3.7E-04
N-EtFOSAA	1.2E-04	1.2E-05	3.8E-03	3.8E-04	1.2E-03	1.2E-04	1.4E-03	1.4E-04	3.7E-05	3.7E-06	4.8E-04	2.8E-04	1.1E-03	6.6E-04	4.2E-04	2.5E-04	3.5E-05	2.0E-05
N-MeFOSAA	3.9E-04	3.9E-05	1.4E-02	1.4E-03	4.9E-03	4.9E-04	5.8E-04	5.8E-05	1.6E-05	1.6E-06	1.7E-03	9.9E-04	3.7E-03	2.2E-03	4.5E-04	2.7E-04	2.6E-05	1.5E-05
Fluortelomers																		
6:2 FTS	1.3E-04	1.3E-05	2.4E-02	2.4E-03	5.1E-03	5.1E-04	3.1E-04	3.1E-05	9.8E-06	9.8E-07	3.5E-03	1.0E-03	3.9E-02	1.2E-02	2.5E-03	7.4E-04	9.5E-05	2.9E-05

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
NC - Not Calculated
NOAEL - No Observed Adverse Effects Level

Appendix J Food Web Model – Lake Elmo
Figure 1 - Total Daily Intake of PFAS
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

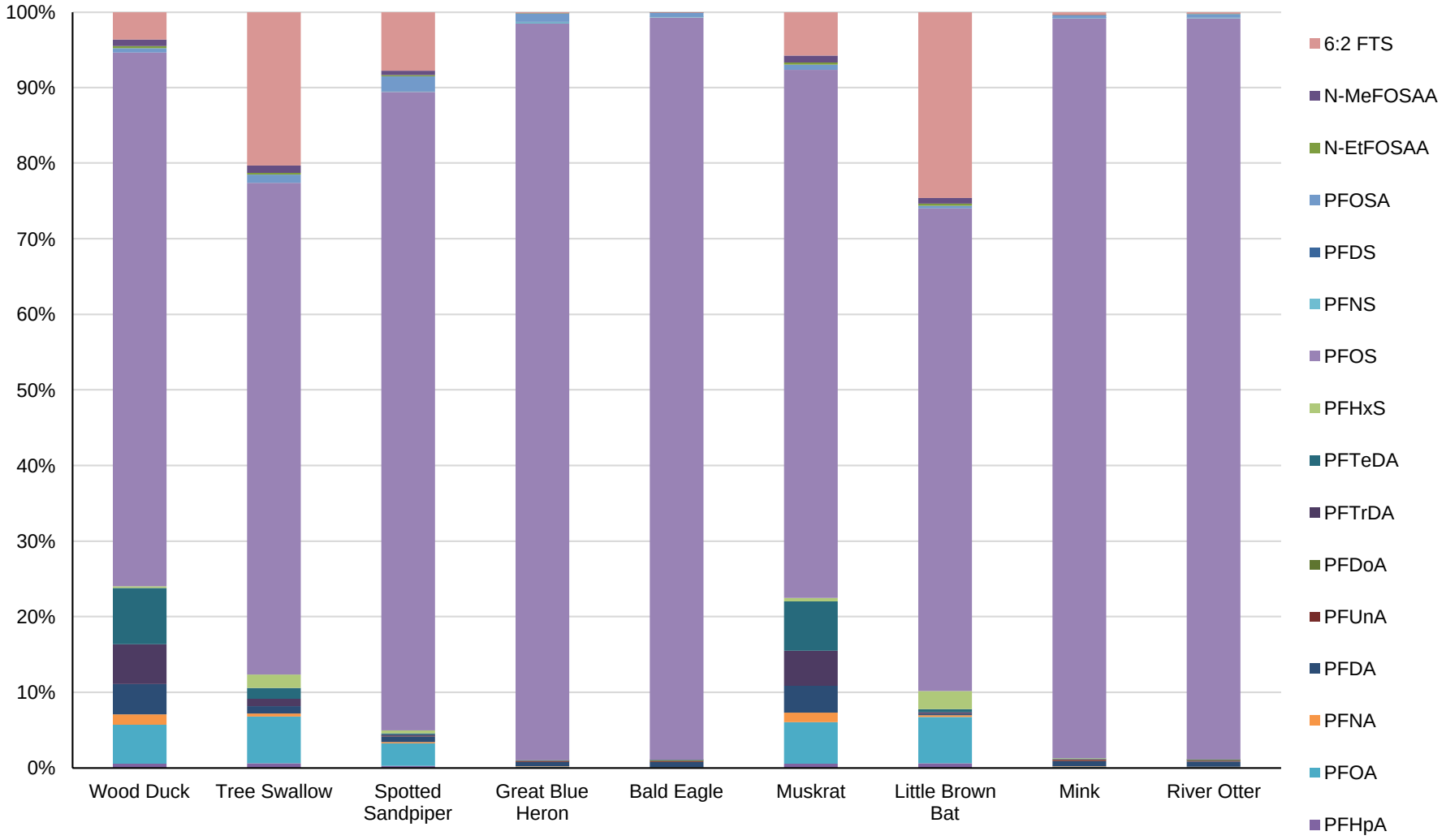

Figure 1: Total Daily Intake of PFAS - Aquatic-life Dependent Wildlife at Lake Elmo

Appendix K

Food Web Model – West Lakeland Area

Appendix K Food Web Model – West Lakeland Area

Table 1. Wildlife Exposure Parameters
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Parameter	Parameter Definition		Units	Birds				Mammals			
				Avian Consumer (Herbivore)	Avian Consumer (Invertivore)	Avian Consumer (Omnivore / Invertivore)	Avian Consumer (Piscivore)	Mammalian Consumer (Herbivore)	Mammalian Consumer (Invertivore)	Mammalian Consumer (Omnivore / Invertivore)	Mammalian Consumer (Piscivore)
				Wood Duck	**Tree Swallow**	**Spotted Sandpiper**	**Great Blue Heron**	**Muskrat**	**Little Brown Bat**	**Mink**	**River Otter**
				Aix sponsa	*Tachycineta bicolor*	*Actitis macularius*	*Ardea herodias*	*Ondatra zibethicus*	*Myotis lucifugus*	*Neovison vison*	*Lontra canadensis*
BW	Body Weight		kg	0.70	0.020	0.043	2.4	1.6	0.0085	1.4	7.7
FIR_{dw}	Daily Food Ingestion Rate (dry matter)	[1]	kg, dw/day	0.041	0.012	0.0076	0.11	0.14	0.0016	0.054	0.28
FIR_{ww}	Daily Food Ingestion Rate (wet matter)	[2]	kg, ww/day	0.13	0.035	0.023	0.43	0.54	0.0049	0.22	0.78
P_{veg}	Proportion of Diet - Vegetation		kg diet item, ww/kg diet, ww	0.90	0.17	--	--	0.80	--	0.05	--
IR_{veg}	Vegetation Ingestion Rate	[4]	kg ww/day	0.11	0.0060	--	--	0.43	--	0.011	--
P_{bi}	Proportion of Diet - Benthic Invertebrates		kg diet item, ww/kg diet, ww	0.050	0.26	0.80	0.15	0.10	--	0.10	0.15
IR_{bi}	Benthic Invertebrate Ingestion Rate	[4]	kg ww/day	0.0064	0.0092	0.018	0.065	0.054	--	0.022	0.12
P_{ai}	Proportion of Diet - Aquatic Invertebrates		kg diet item, ww/kg diet, ww	0.050	0.57	0.15	--	0.10	1.0	0.10	--
IR_{ai}	Aquatic Invertebrate Ingestion Rate	[4]	kg ww/day	0.0064	0.020	0.0034	--	0.054	0.0049	0.022	--
P_{am}	Proportion of Diet - Amphibians		kg diet item, ww/kg diet, ww	--	--	--	0.050	--	--	0.050	0.050
IR_{am}	Amphibian Ingestion Rate	[4]	kg ww/day	--	--	--	0.022	--	--	0.011	0.039
P_{ff}	Proportion of Diet - Forage Fish	[7]	kg diet item, ww/kg diet, ww	--	--	0.050	0.80	--	--	0.20	0.35
IR_{ff}	Forage Fish Ingestion Rate	[4]	kg ww/day	--	--	0.0011	0.35	--	--	0.04	0.27
P_{pf}	Proportion of Diet - Predatory Fish	[7]	kg diet item, ww/kg diet, ww	--	--	--	--	--	--	0.50	0.45
IR_{pf}	Predatory Fish Ingestion Rate	[4]	kg ww/day	--	--	--	--	--	--	0.11	0.35
P_s	Proportion of Diet - Sediment		kg sediment, dw/kg diet, dw	0.24	--	0.073	0.0040	0.020	--	0.030	--
IR_S	Sediment Ingestion Rate	[5]	kg dw/day	0.0098	--	0.00055	0.00043	0.0027	--	0.0016	--
IR_W	Water Ingestion Rate	[6]	L/day or kg/day	0.041	0.0040	0.054	0.11	0.88	0.0010	0.055	0.41
HR	Home Range		acres	776	194	5.0	11	0.32	74	19	2842
AUF_{WLA}	Area Use Factor for West Lakeland Area	[3]	proportion	0.15	0.60	1.0	1.0	1.0	1.0	1.0	0.041

Notes:
References for all species-specific exposure factors are provided in Table 2.
1 - Dry weight food ingestion rate (FIR) is applied to concentrations of PFAS in sediment, generally reported on dry weight basis.
2 - Wet weight FIR is applied to tissue data, generally reported on fresh or wet weight basis.
3 - AUF values for receptors were calculated by dividing the size of the exposure area by the home range. If the home range is smaller than the exposure area, an AUF of 1 was used. Site Use Factor (SUF) of 1 was selected for all receptors.
4 - Dietary ingestion rates were calculated by multiplying the receptor- and tissue-specific proportion of diet by the receptor-specific FIR_{ww}.
5 - IR_S were calculated by multiplying the receptor-specific P_S by the receptor-specific FIR_{dw}.
6 - IR_W is reported in L/day or kg/day because 1 L of water has weight of 1 kg
7 - Proportion of diet was modified to include predatory fish, which were collected from WLA. Forage and predatory fish proportions consistent with Eagle Point Lake and Lake Elmo.

Abbreviations:
dw - dry weight
kg - kilogram
L - liters
WLA - West Lakeland Area
ww - wet weight

Exposure Areas (Acres):
WLA = 116

Appendix K Food Web Model – West Lakeland Area
Table 2. Information Sources for Wildlife Exposure Parameters
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Receptor Type	Feeding Guild	Species	Parameter	Definition	Value	Units	Reference	Notes
Bird	Herbivore	Wood Duck	BW	Body Weight	0.70	kg	NC WRC (2019)	Lowest reported body weight (converted to kg)
Bird	Herbivore	Wood Duck	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.041	kg, dw/day	Nagy (2001)	Calculated using DW allometric equation for omnivorous birds: FIR (dw) = 0.67 x BW ^ 0.627
Bird	Herbivore	Wood Duck	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.13	kg, ww/day	Nagy (2001)	Calculated using WW allometric equation for omnivorous birds: FIR (ww) = 2.094 x BW ^ 0.627
Bird	Herbivore	Wood Duck	P_{veg}	Proportion of Diet - Vegetation	0.90	kg diet item, ww/kg diet, ww	MN DNR (2020)	Consume acorns, weed seeds, berries, plants and insects; assume majority is vegetation (https://www.dnr.state.mn.us/birds/woodduck.html)
Bird	Herbivore	Wood Duck	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.05	kg diet item, ww/kg diet, ww	MN DNR (2020)	Consume acorns, weed seeds, berries, plants and insects; assume majority is vegetation (https://www.dnr.state.mn.us/birds/woodduck.html)
Bird	Herbivore	Wood Duck	P_{ai}	Proportion of Diet - Aquatic Invertebrates	0.05	kg diet item, ww/kg diet, ww	MN DNR (2020)	Consume acorns, weed seeds, berries, plants and insects; assume majority is vegetation (https://www.dnr.state.mn.us/birds/woodduck.html)
Bird	Herbivore	Wood Duck	P_{am}	Proportion of Diet - Amphibians	--	kg diet item, ww/kg diet, ww	MN DNR (2020)	Assumed not to be consumed based on reported diet contents.
Bird	Herbivore	Wood Duck	P_{ff}	Proportion of Diet - Forage Fish	--	kg diet item, ww/kg diet, ww	MN DNR (2020)	Assumed not to be consumed based on reported diet contents.
Bird	Herbivore	Wood Duck	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww	MN DNR (2020)	Assumed not to be consumed based on reported diet contents.
Bird	Herbivore	Wood Duck	P_{s}	Proportion of Diet - Sediment	0.24	kg sediment, dw/kg diet, dw	USEPA (1993)	Sediment ingestion in wood duck (USEPA, 1993).
Bird	Herbivore	Wood Duck	IR_{W}	Daily Water Ingestion	0.041	L water/day	USEPA (1993)	Mallard used as a surrogate; IR L/day= IR 0.058 (L/kg)*BW (kg)
Bird	Herbivore	Wood Duck	HR	Home Range	776	acres	CDFW (2021)	In Minnesota, breeding female wood ducks remained within 1 km (0.6 mi) of the nest during 70% of their time away (Gilmer et al. 1978, as cited in CDFW 2021); therefore, home range was calculated as area from nest using 1 km as radius.
Bird	Invertivore	Tree Swallow	BW	Body Weight	0.020	kg	Nagy (2001)	Measured value for tree swallow.
Bird	Invertivore	Tree Swallow	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.012	kg, dw/day	Nagy (2001)	Measured value for tree swallow (dry matter intake).
Bird	Invertivore	Tree Swallow	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.035	kg, ww/day	Nagy (2001)	Measured value for tree swallow (fresh matter intake).
Bird	Invertivore	Tree Swallow	P_{veg}	Proportion of Diet - Vegetation	0.17	kg diet item, ww/kg diet, ww	Beal (1918); USACHPPM (2004)	Estimated proportion of plant material.
Bird	Invertivore	Tree Swallow	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.26	kg diet item, ww/kg diet, ww	Beal (1918); USACHPPM (2004)	Estimated based on proportion of non-flying insects.
Bird	Invertivore	Tree Swallow	P_{ai}	Proportion of Diet - Aquatic Invertebrates	0.57	kg diet item, ww/kg diet, ww	Beal (1918); USACHPPM (2004)	Estimated based on proportion of flying (emergent aquatic) insects.
Bird	Invertivore	Tree Swallow	P_{am}	Proportion of Diet - Amphibians	--	kg diet item, ww/kg diet, ww	USACHPPM (2004)	Assumed not to be consumed.
Bird	Invertivore	Tree Swallow	P_{ff}	Proportion of Diet - Forage Fish	--	kg diet item, ww/kg diet, ww	USACHPPM (2004)	Assumed not to be consumed.
Bird	Invertivore	Tree Swallow	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww	USACHPPM (2004)	Assumed not to be consumed.
Bird	Invertivore	Tree Swallow	P_{s}	Proportion of Diet - Sediment	--	kg sediment, dw/kg diet, dw	Divine et al. (2020)	Assumed negligible based on feedng strategy.
Bird	Invertivore	Tree Swallow	IR_{W}	Daily Water Ingestion	0.0040	L water/day	USEPA (1993)	IR L/day= IR (L/kg)*BW (kg)
Bird	Invertivore	Tree Swallow	HR	Home Range	194	acres	Custer et al. (2019)	Tree swallows feed within approximately 0.5 km of their nest boxes (Stapleton and Robertson 2006, as cited in Custer et al. 2019); therefore, home range was calculated as area from nest using 0.5 km as radius.
Bird	Invertivore	Spotted sandpiper	BW	Body Weight	0.043	kg	USEPA (1993)	Average values reported for adult male and female spotted sandpipers (USEPA 1993).
Bird	Invertivore	Spotted sandpiper	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.0076	kg, dw/day	Nagy (2001)	Calculated using DW allometric equation for insectivore birds: FIR (dw) = 0.54 x BW ^ 0.705
Bird	Invertivore	Spotted sandpiper	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.0230	kg, ww/day	Nagy (2001)	Calculated using WW allometric equation for insectivore birds: FIR (ww) = 1.633 x BW ^ 0.705
Bird	Invertivore	Spotted sandpiper	P_{veg}	Proportion of Diet - Vegetation	--	kg diet item, ww/kg diet, ww	USEPA (1993)	Assumed not to be consumed.
Bird	Invertivore	Spotted sandpiper	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.80	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated based on USEPA (1993: Adult flying insects comprise the bulk of the diet; however, crustaceans, leeches, molluscs, small fish, and carrion also are eaten.
Bird	Invertivore	Spotted sandpiper	P_{ai}	Proportion of Diet - Aquatic Invertebrates	0.15	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated based on USEPA (1993: Adult flying insects comprise the bulk of the diet; however, crustaceans, leeches, molluscs, small fish, and carrion also are eaten.
Bird	Invertivore	Spotted sandpiper	P_{am}	Proportion of Diet - Amphibians	--	kg diet item, ww/kg diet, ww	USEPA (1993)	Assumed not to be consumed based on reported diet contents.
Bird	Invertivore	Spotted sandpiper	P_{ff}	Proportion of Diet - Forage Fish	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Assumed only to consume small fish.
Bird	Invertivore	Spotted sandpiper	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww	USEPA (1993)	Assumed not to be consumed.
Bird	Invertivore	Spotted sandpiper	P_{s}	Proportion of Diet - Sediment	0.073	kg sediment, dw/kg diet, dw	USEPA (1993)	Soil/sediment estimated in Least sandpiper diet (USEPA, 1993).
Bird	Invertivore	Spotted sandpiper	IR_{W}	Daily Water Ingestion	0.054	L water/day	USEPA (1993)	IR L/day= IR (L/kg)*BW (kg); Sandpiper used as surrogate
Bird	Invertivore	Spotted sandpiper	HR	Home Range	5.0	acres	CDFW (2021)	In New York, 3 individually marked breeding females fed and displayed over areas of 1.06,1.8, and 3.2 ha (2.5, 4.5 and 8.0 acres), with an average home range of 2.02 ha (5 acres) (Hays 1972, as cited in CDFW 2021).

Appendix K Food Web Model – West Lakeland Area
Table 2. Information Sources for Wildlife Exposure Parameters
Ecological Risk Assessment Food Web Model
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Minneapolis, Minnesota

Receptor Type	Feeding Guild	Species	Parameter	Definition	Value	Units	Reference	Notes
Bird	Piscivore	Great Blue Heron	BW	Body Weight	2.4	kg	USEPA (1993)	
Bird	Piscivore	Great Blue Heron	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.11	kg, dw/day	USEPA (1993)	Calculated from the ww-based FIR, assuming an 75% moisture content of food (i.e., 0.25 g, dw/g, ww).
Bird	Piscivore	Great Blue Heron	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.43	kg, ww/day	USEPA (1993)	FIR kg/day= WW FIR (kg/kg-day)*BW (kg) with FIR (kg/kg-day) of 0.18 from USEPA (1993)
Bird	Piscivore	Great Blue Heron	P_{veg}	Proportion of Diet - Vegetation	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents; consult additional literature for more information.
Bird	Piscivore	Great Blue Heron	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.15	kg diet item, ww/kg diet, ww	USEPA (1993)	Fish are the preferred prey, but great blues also eat amphibians, reptiles, crustaceans, insects, birds, and Mammals
Bird	Piscivore	Great Blue Heron	P_{ai}	Proportion of Diet - Aquatic Invertebrates	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents
Bird	Piscivore	Great Blue Heron	P_{am}	Proportion of Diet - Amphibians	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Fish are the preferred prey, but great blues also eat amphibians, reptiles, crustaceans, insects, birds, and Mammals
Bird	Piscivore	Great Blue Heron	P_{ff}	Proportion of Diet - Forage Fish	0.80	kg diet item, ww/kg diet, ww	USEPA (1993)	Fish are the preferred prey, but great blues also eat amphibians, reptiles, crustaceans, insects, birds, and mammals
Bird	Piscivore	Great Blue Heron	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents; consult additional literature for more information.
Bird	Piscivore	Great Blue Heron	P_{s}	Proportion of Diet - Sediment	0.0040	kg sediment, dw/kg diet, dw	USEPA (1993)	Assumed to be approximately 20% of the value assumed for the Mallard, which was obtained from Table 4-4 in USEPA (1993)
Bird	Piscivore	Great Blue Heron	IR_{W}	Daily Water Ingestion	0.11	L water/day	USEPA (1993)	IR L/day= IR (L/kg)*BW (kg)
Bird	Piscivore	Great Blue Heron	HR	Home Range	11	acres	USEPA (1993)	Average of Fall and Winter home ranges (4.5 ha)
Mammal	Herbivore	Muskrat	BW	Body Weight	1.6	kg	MN DNR (2020)	Average of all adult body weights in MN (https://www.dnr.state.mn.us/Mammals/muskrat.html)
Mammal	Herbivore	Muskrat	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.14	kg, dw/day	USEPA (1993)	Calculated from the ww-based FIR, assuming an 75% moisture content of food (i.e., 0.25 g, dw/g, ww).
Mammal	Herbivore	Muskrat	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.54	kg, ww/day	USEPA (1993)	FIR kg/day= WW FIR (kg/kg-day)*BW (kg) with FIR (kg/kg-day) of 0.34 from USEPA (1993)
Mammal	Herbivore	Muskrat	P_{veg}	Proportion of Diet - Vegetation	0.80	kg diet item, ww/kg diet, ww	USEPA (1993)	Primarily herbivorous.
Mammal	Herbivore	Muskrat	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.10	kg diet item, ww/kg diet, ww	USEPA (1993)	Primarily herbivorous.
Mammal	Herbivore	Muskrat	P_{ai}	Proportion of Diet - Aquatic Invertebrates	0.10	kg diet item, ww/kg diet, ww	USEPA (1993)	Primarily herbivorous.
Mammal	Herbivore	Muskrat	P_{am}	Proportion of Diet - Amphibians	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents.
Mammal	Herbivore	Muskrat	P_{ff}	Proportion of Diet - Forage Fish	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents.
Mammal	Herbivore	Muskrat	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents.
Mammal	Herbivore	Muskrat	P_{s}	Proportion of Diet - Sediment	0.020	kg sediment, dw/kg diet, dw	USEPA (1993)	Meadow Vole used as a surrogate
Mammal	Herbivore	Muskrat	IR_{W}	Daily Water Ingestion	0.88	L water/day	USEPA (1993)	Max reported; IR L/day= IR (L/kg)*BW (kg)
Mammal	Herbivore	Muskrat	HR	Home Range	0.32	acres	USEPA (1993)	Average HR reported (0.13 ha) converted to acres.
Mammal	Invertivore	Little Brown Bat	BW	Body Weight	0.0085	kg	MN DNR (2020)	Average of adult little brown bats in Minnesota (https://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=AMACC01010)
Mammal	Invertivore	Little Brown Bat	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.0016	kg, dw/day	Nagy (2001)	Measured value for little brown bat (dry matter intake).
Mammal	Invertivore	Little Brown Bat	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.0049	kg, ww/day	Nagy (2001)	Measured value for little brown bat (fresh matter intake).
Mammal	Invertivore	Little Brown Bat	P_{veg}	Proportion of Diet - Vegetation	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on strict aerial insect diet.
Mammal	Invertivore	Little Brown Bat	P_{bi}	Proportion of Diet - Benthic Invertebrates	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on strict aerial insect diet.
Mammal	Invertivore	Little Brown Bat	P_{ai}	Proportion of Diet - Aquatic Invertebrates	1.0	kg diet item, ww/kg diet, ww	Fenton and Barclay (1980); cited in Sample et al. (1997)	Based on strict aerial insect diet, i.e., aquatic (emergent aerial) insects.
Mammal	Invertivore	Little Brown Bat	P_{am}	Proportion of Diet - Amphibians	--	kg diet item, ww/kg diet, ww	Sample et al. (1997)	Assumed not to be consumed based on strict aerial insect diet.
Mammal	Invertivore	Little Brown Bat	P_{ff}	Proportion of Diet - Forage Fish	--	kg diet item, ww/kg diet, ww	Sample et al. (1997)	Assumed not to be consumed based on strict aerial insect diet.
Mammal	Invertivore	Little Brown Bat	P_{pf}	Proportion of Diet - Predatory Fish	--	kg diet item, ww/kg diet, ww	Sample et al. (1997)	Assumed not to be consumed based on strict aerial insect diet.
Mammal	Invertivore	Little Brown Bat	P_{so}	Proportion of Diet - Sediment	--	kg sediment, dw/kg diet, dw	Sample et al. (1997)	Assumed negligible based on feeding strategy.
Mammal	Invertivore	Little Brown Bat	IR_{W}	Daily Water Ingestion	0.001	L water/day	USEPA (1993)	IR L/day= IR (L/kg)*BW (kg)
Mammal	Invertivore	Little Brown Bat	HR	Home Range	74	acres	Henry et al. (2002); Divine et al. (2020)	Home-range size of pregnant little brown bat on Grosse-Ile, Quebec, Canada, summers of 1999 and 2000 (Henry et al. 2002, as cited in Divine et al. 2020).

Appendix K Food Web Model – West Lakeland Area
Table 2. Information Sources for Wildlife Exposure Parameters
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Receptor Type	Feeding Guild	Species	Parameter	Definition	Value	Units	Reference	Notes
Mammal	Omnivore	Mink	BW	Body Weight	1.4	kg	MN DNR (2020)	Average of adult mink in Minnesota (https://www.dnr.state.mn.us/Mammals/mink.html)
Mammal	Omnivore	Mink	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.054	kg, dw/day	USEPA (1993)	Calculated from the ww-based FIR, assuming an 75% moisture content of food (i.e., 0.25 g, dw/g, ww).
Mammal	Omnivore	Mink	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.22	kg, ww/day	USEPA (1993)	FIR kg/day= WW FIR (kg/kg-day)*BW (kg) with FIR (kg/kg-day) of 0.16 (average, adults) from USEPA (1993)
Mammal	Omnivore	Mink	P_{veg}	Proportion of Diet - Vegetation	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Based on data for year round riverine habitats in USEPA (1993)
Mammal	Omnivore	Mink	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.10	kg diet item, ww/kg diet, ww	USEPA (1993)	Based on data for year round riverine habitats in USEPA (1993)
Mammal	Omnivore	Mink	P_{ai}	Proportion of Diet - Aquatic Invertebrates	0.10	kg diet item, ww/kg diet, ww	USEPA (1993)	Based on data for year round riverine habitats in USEPA (1993)
Mammal	Omnivore	Mink	P_{am}	Proportion of Diet - Amphibians	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Based on data for year round riverine habitats in USEPA (1993)
Mammal	Omnivore	Mink	P_{ff}	Proportion of Diet - Forage Fish	0.20	kg diet item, ww/kg diet, ww	USEPA (1993)	Based on data for year round riverine habitats in USEPA (1993)
Mammal	Omnivore	Mink	P_{pf}	Proportion of Diet - Predatory Fish	0.50	kg diet item, ww/kg diet, ww	USEPA (1993)	Based on data for year round riverine habitats in USEPA (1993)
Mammal	Omnivore	Mink	P_{s}	Proportion of Diet - Sediment	0.030	kg sediment, dw/kg diet, dw	Sample et al. (1997)	Weasel used as a surrogate
Mammal	Omnivore	Mink	IR_{W}	Daily Water Ingestion	0.055	L water/day	USEPA (1993)	Max reported; IR L/day= IR (L/kg)*BW (kg)
Mammal	Omnivore	Mink	HR	Home Range	19	acres	USEPA (1993)	Home range reported between 1 and 5 km along shorelines, or as low as 7.8 hectares in riverine areas with dense vegetation. 7.8 ha applied.
Mammal	Piscivore	River Otter	BW	Body Weight	7.7	kg	MN DNR (2020)	Average of adult body weights in MN (https://www.dnr.state.mn.us/mammals/riverotter.html)
Mammal	Piscivore	River Otter	FIR_{dw}	Daily Food Ingestion Rate (dry matter)	0.28	kg, dw/day	Nagy (2001)	Calculated using DW allometric equation for carnivorous Mammals: FIR (dw) = 0.153 x BW ^ 0.834
Mammal	Piscivore	River Otter	FIR_{ww}	Daily Food Ingestion Rate (wet matter)	0.78	kg, ww/day	Nagy (2001)	Calculated using WW allometric equation for carnivorous Mammals: FIR (ww) = 0.348 x BW ^ 0.859
Mammal	Piscivore	River Otter	P_{veg}	Proportion of Diet - Vegetation	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents
Mammal	Piscivore	River Otter	P_{bi}	Proportion of Diet - Benthic Invertebrates	0.15	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from listed diet items; but higher percent in streams and lake habitats
Mammal	Piscivore	River Otter	P_{ai}	Proportion of Diet - Aquatic Invertebrates	--	kg diet item, ww/kg diet, ww		Assumed not to be consumed based on reported diet contents
Mammal	Piscivore	River Otter	P_{am}	Proportion of Diet - Amphibians	0.05	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from listed diet items reported as amphibians, frogs, salamander, reptiles, and snake
Mammal	Piscivore	River Otter	P_{ff}	Proportion of Diet - Forage Fish	0.35	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from listed diet items based on fish species (rather than size).
Mammal	Piscivore	River Otter	P_{pf}	Proportion of Diet - Predatory Fish	0.45	kg diet item, ww/kg diet, ww	USEPA (1993)	Estimated from listed diet items based on fish species (rather than size).
Mammal	Piscivore	River Otter	P_{s}	Proportion of Diet - Sediment	--	kg sediment, dw/kg diet, dw		Based on feeding habits assumed to not eat any sediment
Mammal	Piscivore	River Otter	IR_{W}	Daily Water Ingestion	0.41	L water/day	USEPA (1993)	Max reported; IR L/day= IR (L/kg)*BW (kg); River Otter used as surrogate
Mammal	Piscivore	River Otter	HR	Home Range	2842	acres	USEPA (1993)	Based on the average home range of Missouri marsh and streams.

Abbreviations:
dw - dry weight
kg - kilogram
L - liters
ww - wet weight

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Appendix K Food Web Model – West Lakeland Area

Table 3. Bioaccumulation Parameters
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

	Literature-based Aquatic Bioaccumulation Parameters							
	Water to Aquatic Plant BAF (L water / kg tissue)				Water to Aquatic Invertebrate BAF (L water / kg tissue)			
Analyte	Value (tissue dw)	Value (tissue ww) [a]	Reference	Notes	Aquatic/Benthic Invert. Value (tissue dw) [b]	Aquatic/Benthic Invert. Value (tissue ww) [c]	Reference	Notes
PFCAs								
PFBA	19	2.8	Divine et al. (2020); Zodrow et al. (2020)	Geomean	298	54	Zodrow et al. (2020) (Surrogate - PFBS)	
PFHxA	191	27.7	Divine et al. (2020); Zodrow et al. (2020)	Geomean	2238	403	Divine et al. (2020); Zodrow et al. (2020)	Geomean
PFHpA	228	33.06	Surrogate - PFOA		351	63	Divine et al. (2020)	Geomean
PFOA	228	33	Divine et al. (2020); Zodrow et al. (2020)	Geomean	379	68	Divine et al. (2020); Zodrow et al. (2020)	Geomean
PFNA	5,188	752	Divine et al. (2020); Zodrow et al. (2020)	Geomean	983	177	Divine et al. (2020); Zodrow et al. (2020)	Geomean
PFDA	12,360	1,792	Divine et al. (2020)	Geomean	707	127	Divine et al. (2020)	Geomean
PFUnA	12,360	1,792	Surrogate - PFDA		707	127	Surrogate - PFDA	
PFDoA	12,360	1,792	Surrogate - PFDA		707	127	Surrogate - PFDA	
PFTrDA	12,360	1,792	Surrogate - PFDA		707	127	Surrogate - PFDA	
PFTeDA	12,360	1,792	Surrogate - PFDA		707	127	Surrogate - PFDA	
PFSAs								
PFHxS	12	1.7	Divine et al. (2020)	Geomean	1327	239	Divine et al. (2020)	Geomean
PFHpS	228	33	Surrogate - PFOA		1549	279	Surrogate - PFOS	
PFOS	1,305	189	Divine et al. (2020); Zodrow et al. (2020)	Geomean	1549	279	Divine et al. (2020); Zodrow et al. (2020)	Geomean
PFNS	1,305	189	Surrogate - PFOS		1549	279	Surrogate - PFOS	
PFDS	1,305	189	Surrogate - PFOS		1549	279	Surrogate - PFOS	
FOSA, FASE, FASAAs								
PFOSA	1,305	189	Surrogate - PFOS		1549	279	Surrogate - PFOS	
N-EtFOSAA	1,305	189	Surrogate - PFOS		1549	279	Surrogate - PFOS	
N-MeFOSAA	1,305	189	Surrogate - PFOS		1549	279	Surrogate - PFOS	
N-EtFOSE	1,305	189	Surrogate - PFOS		1549	279	Surrogate - PFOS	
Fluortelomers								
6:2 FTS	12	1.7	Surrogate - PFHxS		1327	239	Surrogate - PFHxS	
Replacement Chemistries								
ADONA	228	33.1	Surrogate - PFOA		1327	239	Surrogate - PFHxS	
NFDHA	19	2.8	Surrogate - PFBA		298	54	Surrogate - PFBS	

PFAS Abbreviations:
FASAA - perrfluoroalkane sulfonamido acetic acids
FASE - perfluoroalkane sulfonamido ethanols
FOSA - perfluorooctane sulfonamides
N-EtFOSAA - N-Ethylperfluorooctane sulfonamidoacetic acid
N-EtFOSE - N-Ethyl perfluoroctane sulfonamido ethanol
NFDHA - Nonafluoro-3,6-dioxaheptanoic acid
N-MeFOSAA - N-Methylperfluorooctane sulfonamidoacetic acid
PFBA - Perfluorobutanoic acid
PFCA - Perfluoroalkyl carboxylic acids
PFDA - Perfluorodecanoic acid
PFDoA - Perfluorododecanoic acid
PFDS - Perfluorodecane sulfonic acid
PFHpA - Perfluoroheptanoic acid

PFAS Abbreviations Cont.:
PFHpS - Perfluoroheptane sulfonic acid
PFHxA - Perfluorohexanoic acid
PFHxS - Perfluorohexanesulfonic acid
PFNA - Perfluorononanoic acid
PFNS - Perfluoroonoane sulfonic acid
PFOA - Perfluorooctanoic acid
PFOS - Perfluorooctanesulfonic acid
PFOSA - Perfluorooctane sulfonamide
PFSA- perfluoroalkane sulfonic acids
PFTeDA - Perfluorotetradecanoic acid
PFTrDA - Perfluorotridecanoic acid
PFUnA - Perfluoroundecanoic acid
6:2 FTS - 6:2 Fluorotelomer sulfonic acid

Addditional Abbreviations:
BAF - Bioaccumulation Factor
dw - dry weight
kg - kilogram
L - liter
ww - wet weight

a - Converted to ww tissue using 85.5% moisture content (average of algae [84%] and aquatic macrophytes [87%]; Table 4-2 EPA 1993)
b - Aquatic/Benthic Invert Values are based on filter-feeding benthic invertebrates (oyster, mussel, gastropod, snail, other bivalves) and were selected to represent aquatic invertebrates (including aerial insects) exposed to PFAS in water. Filter-feeding benthic invertebrates are expected to have exposure to
c - Converted to ww tissue using 82% moisture content (bivalves (without shell); Table 4-1 EPA 1993)

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Divine C., J. Zodrow, M. Frenchmeyer, K. Dally, E. Osborn, and P. Anderson. 2020. Final Report: Approach for Assessing PFAS Risk to Threatened and Endangered Species. SERDP Project ER18-1653. March 2020.

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Appendix K Food Web Model – West Lakeland Area
Table 4. Toxicity Reference Values for Birds
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Analyte	TRVs for Birds (µg/kg-day)							
	NOAEL	Basis	Reference	Additional Details	LOAEL	Basis	Reference	Additional Details
PFCAs								
PFBA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFHxA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFHpA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFOA	1,000	No effect on growth (body weight) of 1-day old chickens; exposed to PFOA/PFDA/PFOS mixture	Conder et al. (2020)	Yeueng et al. 2009	10,000	Application of a NOAEL-to-LOAEL adjustment factor of 10	Adjustment factor consistent with Divine et al. (2020), Zodrow et al. (2020), and USEPA (2005)	--
PFNA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFDA	1,000	No effect on growth (body weight) of 1-day old chickens; exposed to PFOA/PFDA/PFOS mixture	Conder et al. (2020)	Yeueng et al. 2009	10,000	Application of a NOAEL-to-LOAEL adjustment factor of 10	Adjustment factor consistent with Divine et al. (2020), Zodrow et al. (2020), and USEPA (2005)	--
PFUnA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFDoA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFTrDA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFTeDA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
PFSAs								
PFHxS	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
PFHpS	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
PFOS	79.0	No effect on reproduction and survival in Bobwhite Quail	Divine et al. (2020) & Zodrow et al. (2020)	Gallagher et al. 2003c (Derived by applying UF of 10 to selected lowest LOAEL)	790	Lowest bounded LOAEL (Effect on reproduction and survival in Bobwhite Quail; exposure included during sensitive life stage, i.e., egg-laying)	Divine et al. (2020) & Zodrow et al. (2020)	Gallagher et al. 2003c (Lowest LOAEL selected due to limited available avian data & study based on sensitive life stage)
PFNS	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
PFDS	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
FOSA, FASE, FASAAs								
PFOSA	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
N-EtFOSAA	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
N-MeFOSAA	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--
N-EtFOSE	79.0	Surrogate - PFOS	--	--	790	Surrogate - PFOS	--	--

Appendix K Food Web Model – West Lakeland Area
Table 4. Toxicity Reference Values for Birds
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Analyte	TRVs for Birds (µg/kg-day)							
	NOAEL	Basis	Reference	Additional Details	LOAEL	Basis	Reference	Additional Details
Fluortelomers								
6:2 FTS	1000	Surrogate - PFOA	--	--	10000	Surrogate - PFOA	--	--
Replacement Chemistries								
ADONA	1,000	Surrogate - PFOA	--	--	10,000	Surrogate - PFOA	--	--
NFDHA	92,000	Surrogate - PFBS	--	--	153,000	Surrogate - PFBS	--	--

Notes:
TRVs were selected from the following hierarchy due to preference for EcoSSL TRV-derivation approach (USEPA 2005) and that Zodrow et al. (2020) has been peer reviewed:

1. Divine et al. (2020) and/or Zodrow et al. (2020)
2. Condor et al. (2020)

Abbreviations:
See Table 3 for PFAS abbreviations
µg/kg-day - micrograms per kilogram body weight per day
EcoSSL - Ecological Soil Screening Level
LOAEL - lowest observed adverse effects level
NOAEL - no observed adverse effects level
TRV - toxicity reference value
USEPA - United States Environmental Protection Agency

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Appendix K Food Web Model – West Lakeland Area
Table 5. Toxicity Reference Values for Mammals
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Analyte	TRVs for Mammals (µg/kg-day)							
	NOAEL	Basis	Reference	Additional Details	LOAEL	Basis	Reference	Additional Details
PFCAs								
PFBA	73,000	No effect on growth or reproduction	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (four studies)	175,000	Lowest bounded LOAEL (Effect on reproduction)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Das et al. 2008)
PFHxA	84,000	No effect on growth, reproduction, or survivial	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (geometric mean of 6 studies)	175,000	Lowest bounded LOAEL (Effect on reproduction & survival in mice)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Iwai and Hoberman 2014)
PFHpA	300	Surrogate - PFOA	--	--	600	Surrogate - PFOA	--	--
PFOA	300	No effect on growth, reproduction, or survival	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (two studies)	600	Lowest bounded LOAEL (Effect on reproduction & survival in mice)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Abbott et al. 2007)
PFNA	830	No effect on reproduction (# live pups) in mice	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Wolf et al. 2010)	1,100	Lowest bounded LOAEL (decreased reproduction in mice)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Wolf et al. 2010)
PFDA	100	No effect on growth (fetal body weight per litter) in pregnant mice	Conder et al. (2020)	Harris and Birnbaum (1989)	6,400	23% control-adjusted decrease in growth (fetal body weight per litter) in pregnant mice	Conder et al. (2020)	Harris and Birnbaum (1989)
PFUnA	300	No effect on growth (body weight in adults and pups) in rats	Conder et al. (2020)	Takahashi et al. (2014)	1,000	13-19% control-adjusted decrease in growth (body weight of pups) in rats	Conder et al. (2020)	Takahashi et al. (2014)
PFDoA	500	No effect on growth (body weight in adults and pups) in rats	Conder et al. (2020)	Kato et al. (2015)	2,500	20-40% control-adjusted decrease in growth (body weight in adults and pups) in rats	Conder et al. (2020)	Kato et al. (2015)
PFTrDA	500	Surrogate - PFDoDA	--	--	2,500	Surrogate - PFDoDA	--	--
PFTeDA	3,000	No effect on growth (body weight in adults and pups) in rats	Conder et al. (2020)	Hirata-Koizumi et al. (2015)	10,000	8-18% control-adjusted decrease in growth (body weight of pups) in rats	Conder et al. (2020)	Hirata-Koizumi et al. (2015)
PFSAs								
PFHxS	300	No effect on reproduction (litter size) in mice	Conder et al. (2020)	Chang et al. (2018)	1,000	14% control-adjusted decrease in reproduction (litter size) in mice	Conder et al. (2020)	Chang et al. (2018)
PFHpS	300	Surrogate - PFHxS	--	--	1,000	Surrogate - PFHxS	--	--
PFOS	100	No effect on growth, reproduction, or survivial	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (multiple studies)	170	Lowest bounded LOAEL (Effect on reproduction in mice)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (Fair et al. 2011)
PFNS	100	Surrogate - PFOS	--	--	170	Surrogate - PFOS	--	--
PFDS	100	Surrogate - PFOS	--	--	170	Surrogate - PFOS	--	--
FOSA, FASE, FASAAs								
PFOSA	100	Surrogate - PFOS	--	--	170	Surrogate - PFOS	--	--
N-EtFOSAA	100	Surrogate - PFOS	--	--	170	Surrogate - PFOS	--	--
N-MeFOSAA	100	Surrogate - PFOS	--	--	170	Surrogate - PFOS	--	--
N-EtFOSE	100	No effect on growth or reproduction	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (3M 1999)	1,000	Lowest bounded LOAEL (Effect on reproduction and growth in rabbit)	Divine et al. (2020) & Zodrow et al. (2020)	EcoSSL Approach (3M 1999)

Appendix K Food Web Model – West Lakeland Area
Table 5. Toxicity Reference Values for Mammals
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Analyte	TRVs for Mammals (µg/kg-day)							
	NOAEL	Basis	Reference	Additional Details	LOAEL	Basis	Reference	Additional Details
Fluortelomers								
6:2 FTS	300	Surrogate - PFHxS	--	--	1,000	Surrogate - PFHxS	--	--
Replacement Chemistries								
ADONA	300	Surrogate - PFOA	--	--	600	Surrogate - PFOA	--	--
NFDHA	73,000	Surrogate - PFBA	--	--	175,000	Surrogate - PFBA	--	--

Notes:
TRVs were selected from the following hierarchy due to preference for EcoSSL TRV-derivation approach (USEPA 2005) and that Zodrow et al. (2020) has been peer reviewed:

1. Divine et al. (2020) and/or Zodrow et al. (2020)
2. Condor et al. (2020)

Abbreviations:
See Table 3 for PFAS abbreviations
µg/kg-day - micrograms per kilogram body weight per day
EcoSSL - Ecological Soil Screening Level
LOAEL - lowest observed adverse effects level
NOAEL - no observed adverse effects level
TRV - toxicity reference value
USEPA - United States Environmental Protection Agency

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Appendix K Food Web Model – West Lakeland Area
Table 6. Exposure Point Concentrations
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Analyte	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Aquatic Plant EPC (µg/kg, ww)		Aquatic Invertebrate (µg/kg, ww)		Benthic Invertebrate (µg/kg, ww)		Amphibian (µg/kg, ww)		Forage Fish (µg/kg, ww)		Predatory Fish (µg/kg, ww)	
			EPC	Basis	EPC	Basis	EPC	Basis	EPC	Basis	EPC	Basis	EPC	Basis
PFCAs														
PFBA	0.37	0.41	1.1	Calculated	21.8	Calculated	6.2	UCL	1.1	UCL	0.65	UCL	0.58	Maximum
PFHxA	0.45	0.014	0.38	Calculated	5.6	Calculated	ND		ND		ND		0.12	Maximum
PFHpA	ND	0.0080	0.27	Calculated	0.51	Calculated	0.23	UCL	ND		ND		ND	
PFOA	0.23	0.073	2.4	Calculated	5.0	Calculated	6.3	UCL	0.27	UCL	0.45	UCL	0.13	UCL
PFNA	0.11	0.0012	0.92	Calculated	0.22	Calculated	0.23	UCL	0.28	Maximum	0.20	UCL	0.21	Maximum
PFDA	0.077	0.0019	3.4	Calculated	0.24	Calculated	1.3	UCL	2.1	UCL	6.1	UCL	9.0	UCL
PFUnA	0.074	0.00052	0.92	Calculated	0.066	Calculated	0.48	UCL	0.47	UCL	1.1	UCL	1.7	UCL
PFDoA	ND	ND	NC		NC		0.24	UCL	0.28	UCL	0.32	UCL	0.60	UCL
PFTrDA	ND	0.00019	0.35	Calculated	0.025	Calculated	0.17	UCL	0.25	UCL	0.25	UCL	0.52	UCL
PFTeDA	0.18	0.00056	1.00	Calculated	0.071	Calculated	0.12	UCL	0.15	Maximum	0.16	UCL	0.21	UCL
PFSAs														
PFHxS	0.10	0.01	0.017	Calculated	2.3	Calculated	0.26	UCL	ND		0.14	UCL	0.11	UCL
PFHpS	ND	0.0020	0.066	Calculated	0.56	Calculated	0.11	UCL	0.10	Maximum	0.51	UCL	0.54	UCL
PFOS	2.7	0.20	37.7	Calculated	55.5	Calculated	48.2	UCL	117	UCL	1032	UCL	1435	UCL
PFNS	ND	ND	NC		NC		ND		0.18	UCL	0.89	UCL	2.0	UCL
PFDS	0.044	ND	NC		NC		ND		0.23	Maximum	0.27	UCL	0.65	UCL
FOSA, FASE, FASAAs														
PFOSA	0.10	0.0019	0.36	Calculated	0.53	Calculated	1.1	UCL	0.72	Maximum	0.90	UCL	0.80	UCL
N-EtFOSAA	0.15	0.0023	0.44	Calculated	0.65	Calculated	0.30	UCL	0.23	UCL	0.35	UCL	0.41	UCL
N-MeFOSAA	ND	ND	NC		NC		ND		ND		ND		0.17	Maximum
N-EtFOSE	ND	0.00047	0.089	Calculated	0.13	Calculated	ND		NA		NA		1.2	Maximum
Fluortelomers														
6:2 FTS	0.43	0.059	0.10	Calculated	14.0	Calculated	0.63	Maximum	1.6	Maximum	1.1	UCL	2.5	UCL
Replacement Chemistries														
ADONA	ND	ND	NC		NC		ND		ND		ND		0.50	Maximum
NFDHA	NA	NA	NC		NC		ND		ND		0.82	Maximum	ND	

Notes:
EPCs were selected as the lower of the selected UCL and maximum detected concentration (see Appendix D)
Site-specific empirical data were selected over modeled values when available:
- Benthic invertebrates = crayfish
- Amphibians = green frogs and tadpoles
- Forage fish = bluegill and green sunfish
- Predatory fish = largemouth bass

When empirical data were lacking, tissue EPCs were calculated by multiplying the surface water EPC by the analyte- and tissue-specific bioacummulation parameter (see Table 3).

Additional Abbreviations:
See Table 3 for PFAS abbreviations
µg - micrograms
dw - dry weight
EPC - exposure point concentration
kg - kilogram
L - liters
NA - not available
NC - not calculated
ND - not detected
UCL - upper confidence limit of the arithmetic mean
ww - wet weight

Appendix K Food Web Model – West Lakeland Area
Table 7. Potential Risks to the Wood Duck
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: West Lakeland Area	
Assumptions for the Wood Duck	
Body Weight (kg)	0.70
Seasonal Use Factor	1
Site-Specific Area Use Factor	0.15
Sediment Ingestion Rate (kg_{dw}/day)	0.0098
Water Ingestion Rate (kg/day)	0.041
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.0064
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.0064
Plant Ingestion Rate (kg_{ww}/day)	0.11

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_s = Incidental ingestion rate of sediment (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_s = Concentration of PFAS in sediment (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations					Potential Daily Dose (ug/kg_{bw}/day)						NOAEL-based TRV ($\mu g/kg_{bw}$/day)	NOAEL-based HQ	LOAEL-based TRV ($\mu g/kg_{bw}$/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Aquatic Invertebrate EPC (µg/kg, ww)	Plant EPC (µg/kg, ww)	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Benthic Invertebrate	Aquatic Invertebrate	Plant	Sediment	Surface Water	Total				
PFCAs															
PFBA	6.2E+00	2.2E+01	1.1E+00	3.7E-01	4.1E-01	8.4E-03	3.0E-02	2.7E-02	7.8E-04	3.5E-03	7.0E-02	1.0E+03	7.0E-05	1.0E+04	7.0E-06
PFHxA	ND	5.6E+00	3.8E-01	4.5E-01	1.4E-02	NC	7.6E-03	9.4E-03	9.4E-04	1.2E-04	1.8E-02	1.0E+03	1.8E-05	1.0E+04	1.8E-06
PFHpA	2.3E-01	5.1E-01	2.7E-01	ND	8.0E-03	3.2E-04	6.9E-04	6.5E-03	NC	7.0E-05	7.6E-03	1.0E+03	7.6E-06	1.0E+04	7.6E-07
PFOA	6.3E+00	5.0E+00	2.4E+00	2.3E-01	7.3E-02	8.6E-03	6.7E-03	5.9E-02	4.9E-04	6.3E-04	7.5E-02	1.0E+03	7.5E-05	1.0E+04	7.5E-06
PFNA	2.3E-01	2.2E-01	9.2E-01	1.1E-01	1.2E-03	3.1E-04	2.9E-04	2.2E-02	2.3E-04	1.1E-05	2.3E-02	1.0E+03	2.3E-05	1.0E+04	2.3E-06
PFDA	1.3E+00	2.4E-01	3.4E+00	7.7E-02	1.9E-03	1.7E-03	3.2E-04	8.2E-02	1.6E-04	1.6E-05	8.4E-02	1.0E+03	8.4E-05	1.0E+04	8.4E-06
PFUnA	4.8E-01	6.6E-02	9.2E-01	7.4E-02	5.2E-04	6.5E-04	8.9E-05	2.3E-02	1.5E-04	4.5E-06	2.3E-02	1.0E+03	2.3E-05	1.0E+04	2.3E-06
PFDoA	2.4E-01	NC	NC	ND	ND	3.2E-04	NC	NC	NC	NC	3.2E-04	1.0E+03	3.2E-07	1.0E+04	3.2E-08
PFTrDA	1.7E-01	2.5E-02	3.5E-01	ND	1.9E-04	2.3E-04	3.4E-05	8.5E-03	NC	1.7E-06	8.8E-03	1.0E+03	8.8E-06	1.0E+04	8.8E-07
PFTeDA	1.2E-01	7.1E-02	1.0E+00	1.8E-01	5.6E-04	1.6E-04	9.6E-05	2.4E-02	3.8E-04	4.8E-06	2.5E-02	1.0E+03	2.5E-05	1.0E+04	2.5E-06
PFSAs															
PFHxS	2.6E-01	2.3E+00	1.7E-02	9.8E-02	9.5E-03	3.5E-04	3.1E-03	4.1E-04	2.0E-04	8.3E-05	4.1E-03	7.9E+01	5.2E-05	7.9E+02	5.2E-06
PFHpS	1.1E-01	5.6E-01	6.6E-02	ND	2.0E-03	1.5E-04	7.6E-04	1.6E-03	NC	1.7E-05	2.5E-03	7.9E+01	3.2E-05	7.9E+02	3.2E-06
PFOS	4.8E+01	5.5E+01	3.8E+01	2.7E+00	2.0E-01	6.6E-02	7.5E-02	9.2E-01	5.6E-03	1.7E-03	1.1E+00	7.9E+01	1.4E-02	7.9E+02	1.4E-03
PFNS	ND	NC	NC	ND	ND	NC	NC	NC	NC	NC	NC	7.9E+01	NC	7.9E+02	NC
PFDS	ND	NC	NC	4.4E-02	ND	NC	NC	NC	9.2E-05	NC	9.2E-05	7.9E+01	1.2E-06	7.9E+02	1.2E-07
FOSA, FASE, FASAAs															
PFOSA	1.1E+00	5.3E-01	3.6E-01	1.0E-01	1.9E-03	1.5E-03	7.2E-04	8.8E-03	2.1E-04	1.6E-05	1.1E-02	7.9E+01	1.4E-04	7.9E+02	1.4E-05
N-EtFOSAA	3.0E-01	6.5E-01	4.4E-01	1.5E-01	2.3E-03	4.1E-04	8.8E-04	1.1E-02	3.1E-04	2.0E-05	1.2E-02	7.9E+01	1.6E-04	7.9E+02	1.6E-05
N-MeFOSAA	ND	NC	NC	ND	ND	NC	NC	NC	NC	NC	NC	7.9E+01	NC	7.9E+02	NC
N-EtFOSE	ND	1.3E-01	8.9E-02	ND	4.7E-04	NC	1.8E-04	2.2E-03	NC	4.1E-06	2.4E-03	7.9E+01	3.0E-05	7.9E+02	3.0E-06
Fluortelomers															
6:2 FTS	6.3E-01	1.4E+01	1.0E-01	4.3E-01	5.9E-02	8.6E-04	1.9E-02	2.5E-03	8.9E-04	5.1E-04	2.4E-02	1.0E+03	2.4E-05	1.0E+04	2.4E-06
Replacement Chemistries															
ADONA	ND	NC	NC	ND	ND	NC	NC	NC	NC	NC	NC	1.0E+03	NC	1.0E+04	NC
NFDHA	ND	NC	NC	NA	NA	NC	NC	NC	NC	NC	NC	9.2E+04	NC	1.5E+05	NC

Notes:
HQs above 1 are bolded and highlighted.

Additional Abbreviations:

See Table 3 for PFAS abbreviations
µg - microgram
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
UCL - upper confidence limit of the arithmetic mean
ww - wet weight

Appendix K Food Web Model – West Lakeland Area
Table 8. Potential Risks to the Tree Swallow
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: West Lakeland Area	
Assumptions for the Tree Swallow	
Body Weight (kg)	0.02
Seasonal Use Factor	1
Site-Specific Area Use Factor	0.60
Water Ingestion Rate (kg/day)	0.0040
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.0092
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.020
Plant Ingestion Rate (kg_{ww}/day)	0.0060

Total Daily Dose = $\frac{\Sigma([IR_f \times C_f] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations				Potential Daily Dose (ug/kg_{bw}/day)					NOAEL-based TRV (ug/kg_{bw}/day)	NOAEL-based HQ	LOAEL-based TRV (ug/kg_{bw}/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Aquatic Invertebrate EPC (µg/kg, ww)	Plant EPC (µg/kg, ww)	Surface Water EPC (µg/L)	Benthic Invertebrate	Aquatic Invertebrate	Plant	Surface Water	Total				
PFCAs													
PFBA	6.2E+00	2.2E+01	1.1E+00	4.1E-01	1.7E+00	1.3E+01	2.0E-01	4.8E-02	1.5E+01	1.0E+03	1.5E-02	1.0E+04	1.5E-03
PFHxA	ND	5.6E+00	3.8E-01	1.4E-02	NC	3.3E+00	6.8E-02	1.6E-03	3.4E+00	1.0E+03	3.4E-03	1.0E+04	3.4E-04
PFHpA	2.3E-01	5.1E-01	2.7E-01	8.0E-03	6.3E-02	3.0E-01	4.7E-02	9.5E-04	4.1E-01	1.0E+03	4.1E-04	1.0E+04	4.1E-05
PFOA	6.3E+00	5.0E+00	2.4E+00	7.3E-02	1.7E+00	2.9E+00	4.3E-01	8.6E-03	5.1E+00	1.0E+03	5.1E-03	1.0E+04	5.1E-04
PFNA	2.3E-01	2.2E-01	9.2E-01	1.2E-03	6.2E-02	1.3E-01	1.6E-01	1.4E-04	3.5E-01	1.0E+03	3.5E-04	1.0E+04	3.5E-05
PFDA	1.3E+00	2.4E-01	3.4E+00	1.9E-03	3.5E-01	1.4E-01	5.9E-01	2.2E-04	1.1E+00	1.0E+03	1.1E-03	1.0E+04	1.1E-04
PFUnA	4.8E-01	6.6E-02	9.2E-01	5.2E-04	1.3E-01	3.9E-02	1.6E-01	6.1E-05	3.3E-01	1.0E+03	3.3E-04	1.0E+04	3.3E-05
PFDoA	2.4E-01	NC	NC	ND	6.4E-02	NC	NC	NC	6.4E-02	1.0E+03	6.4E-05	1.0E+04	6.4E-06
PFTrDA	1.7E-01	2.5E-02	3.5E-01	1.9E-04	4.6E-02	1.5E-02	6.2E-02	2.3E-05	1.2E-01	1.0E+03	1.2E-04	1.0E+04	1.2E-05
PFTeDA	1.2E-01	7.1E-02	1.0E+00	5.6E-04	3.2E-02	4.2E-02	1.8E-01	6.6E-05	2.5E-01	1.0E+03	2.5E-04	1.0E+04	2.5E-05
PFSAs													
PFHxS	2.6E-01	2.3E+00	1.7E-02	9.5E-03	7.1E-02	1.4E+00	2.9E-03	1.1E-03	1.4E+00	7.9E+01	1.8E-02	7.9E+02	1.8E-03
PFHpS	1.1E-01	5.6E-01	6.6E-02	2.0E-03	2.9E-02	3.3E-01	1.2E-02	2.4E-04	3.7E-01	7.9E+01	4.7E-03	7.9E+02	4.7E-04
PFOS	4.8E+01	5.5E+01	3.8E+01	2.0E-01	1.3E+01	3.3E+01	6.7E+00	2.4E-02	5.3E+01	7.9E+01	6.7E-01	7.9E+02	6.7E-02
PFNS	ND	NC	NC	ND	NC	NC	NC	NC	NC	7.9E+01	NC	7.9E+02	NC
PFDS	ND	NC	NC	ND	NC	NC	NC	NC	NC	7.9E+01	NC	7.9E+02	NC
FOSA, FASE, FASAAs													
PFOSA	1.1E+00	5.3E-01	3.6E-01	1.9E-03	2.9E-01	3.1E-01	6.3E-02	2.2E-04	6.7E-01	7.9E+01	8.4E-03	7.9E+02	8.4E-04
N-EtFOSAA	3.0E-01	6.5E-01	4.4E-01	2.3E-03	8.1E-02	3.8E-01	7.8E-02	2.7E-04	5.4E-01	7.9E+01	6.9E-03	7.9E+02	6.9E-04
N-MeFOSAA	ND	NC	NC	ND	NC	NC	NC	NC	NC	7.9E+01	NC	7.9E+02	NC
N-EtFOSE	ND	1.3E-01	8.9E-02	4.7E-04	NC	7.8E-02	1.6E-02	5.6E-05	9.4E-02	7.9E+01	1.2E-03	7.9E+02	1.2E-04
Fluortelomers													
6:2 FTS	6.3E-01	1.4E+01	1.0E-01	5.9E-02	1.7E-01	8.3E+00	1.8E-02	7.0E-03	8.5E+00	1.0E+03	8.5E-03	1.0E+04	8.5E-04
Replacement Chemistries													
ADONA	ND	NC	NC	ND	NC	NC	NC	NC	NC	1.0E+03	NC	1.0E+04	NC
NFDHA	ND	NC	NC	NA	NC	NC	NC	NC	NC	9.2E+04	NC	1.5E+05	NC

Notes:
HQs above 1 are bolded and highlighted.

Additional Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
UCL - upper confidence limit of the arithmetic mean
ww - wet weight

Appendix K Food Web Model – West Lakeland Area
Table 9. Potential Risks to the Spotted Sandpiper
Ecological Risk Assessment Food Web Model

Project 1007
Minneapolis, Minnesota

Site: West Lakeland Area	
Assumptions for the Spotted Sandpiper	
Body Weight (kg)	0.043
Seasonal Use Factor	1
Site-Specific Area Use Factor	1.0
Sediment Ingestion Rate (kg_{dw}/day)	0.00055
Water Ingestion Rate (kg/day)	0.054
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.0184
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.0034
Forage Fish Ingestion Rate (kg_{ww}/day)	0.0011

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_s = Incidental ingestion rate of sediment (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_s= Concentration of PFAS in sediment (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations					Potential Daily Dose (ug/kg_{bw}/day)						NOAEL-based TRV (µg/kg_{bw}/day)	NOAEL-based HQ	LOAEL-based TRV (µg/kg_{bw}/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Aquatic Invertebrate EPC (µg/kg, ww)	Forage Fish EPC (µg/kg, ww)	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Benthic Invertebrate	Aquatic Invertebrate	Forage Fish	Sediment	Surface Water	Total				
PFCAs															
PFBA	6.2E+00	2.2E+01	6.5E-01	3.7E-01	4.1E-01	2.7E+00	1.8E+00	1.7E-02	4.9E-03	5.2E-01	5.0E+00	1.0E+03	5.0E-03	1.0E+04	5.0E-04
PFHxA	ND	5.6E+00	ND	4.5E-01	1.4E-02	NC	4.5E-01	NC	5.9E-03	1.8E-02	4.7E-01	1.0E+03	4.7E-04	1.0E+04	4.7E-05
PFHpA	2.3E-01	5.1E-01	ND	ND	8.0E-03	1.0E-01	4.1E-02	NC	NC	1.0E-02	1.5E-01	1.0E+03	1.5E-04	1.0E+04	1.5E-05
PFOA	6.3E+00	5.0E+00	4.5E-01	2.3E-01	7.3E-02	2.7E+00	4.0E-01	1.2E-02	3.0E-03	9.3E-02	3.2E+00	1.0E+03	3.2E-03	1.0E+04	3.2E-04
PFNA	2.3E-01	2.2E-01	2.0E-01	1.1E-01	1.2E-03	9.9E-02	1.7E-02	5.4E-03	1.4E-03	1.6E-03	1.3E-01	1.0E+03	1.3E-04	1.0E+04	1.3E-05
PFDA	1.3E+00	2.4E-01	6.1E+00	7.7E-02	1.9E-03	5.5E-01	1.9E-02	1.7E-01	1.0E-03	2.4E-03	7.4E-01	1.0E+03	7.4E-04	1.0E+04	7.4E-05
PFUnA	4.8E-01	6.6E-02	1.1E+00	7.4E-02	5.2E-04	2.1E-01	5.3E-03	2.9E-02	9.7E-04	6.6E-04	2.4E-01	1.0E+03	2.4E-04	1.0E+04	2.4E-05
PFDoA	2.4E-01	NC	3.2E-01	ND	ND	1.0E-01	NC	8.5E-03	NC	NC	1.1E-01	1.0E+03	1.1E-04	1.0E+04	1.1E-05
PFTrDA	1.7E-01	2.5E-02	2.5E-01	ND	1.9E-04	7.3E-02	2.0E-03	6.7E-03	NC	2.5E-04	8.2E-02	1.0E+03	8.2E-05	1.0E+04	8.2E-06
PFTeDA	1.2E-01	7.1E-02	1.6E-01	1.8E-01	5.6E-04	5.1E-02	5.7E-03	4.3E-03	2.4E-03	7.1E-04	6.5E-02	1.0E+03	6.5E-05	1.0E+04	6.5E-06
PFSAs															
PFHxS	2.6E-01	2.3E+00	1.4E-01	9.8E-02	9.5E-03	1.1E-01	1.8E-01	3.8E-03	1.3E-03	1.2E-02	3.1E-01	7.9E+01	4.0E-03	7.9E+02	4.0E-04
PFHpS	1.1E-01	5.6E-01	5.1E-01	ND	2.0E-03	4.7E-02	4.5E-02	1.4E-02	NC	2.6E-03	1.1E-01	7.9E+01	1.4E-03	7.9E+02	1.4E-04
PFOS	4.8E+01	5.5E+01	1.0E+03	2.7E+00	2.0E-01	2.1E+01	4.5E+00	2.8E+01	3.5E-02	2.5E-01	5.3E+01	7.9E+01	6.8E-01	7.9E+02	6.8E-02
PFNS	ND	NC	8.9E-01	ND	ND	NC	NC	2.4E-02	NC	NC	2.4E-02	7.9E+01	3.0E-04	7.9E+02	3.0E-05
PFDS	ND	NC	2.7E-01	4.4E-02	ND	NC	NC	7.2E-03	5.7E-04	NC	7.8E-03	7.9E+01	9.9E-05	7.9E+02	9.9E-06
FOSA, FASE, FASAAs															
PFOSA	1.1E+00	5.3E-01	9.0E-01	1.0E-01	1.9E-03	4.6E-01	4.3E-02	2.4E-02	1.3E-03	2.4E-03	5.3E-01	7.9E+01	6.8E-03	7.9E+02	6.8E-04
N-EtFOSAA	3.0E-01	6.5E-01	3.5E-01	1.5E-01	2.3E-03	1.3E-01	5.2E-02	9.5E-03	1.9E-03	3.0E-03	2.0E-01	7.9E+01	2.5E-03	7.9E+02	2.5E-04
N-MeFOSAA	ND	NC	ND	ND	ND	NC	NC	NC	NC	NC	NC	7.9E+01	NC	7.9E+02	NC
N-EtFOSE	ND	1.3E-01	NA	ND	4.7E-04	NC	1.1E-02	NC	NC	6.0E-04	1.1E-02	7.9E+01	1.4E-04	7.9E+02	1.4E-05
Fluortelomers															
6:2 FTS	6.3E-01	1.4E+01	1.1E+00	4.3E-01	5.9E-02	2.7E-01	1.1E+00	3.0E-02	5.6E-03	7.5E-02	1.5E+00	1.0E+03	1.5E-03	1.0E+04	1.5E-04
Replacement Chemistries															
ADONA	ND	NC	ND	ND	ND	NC	NC	NC	NC	NC	NC	1.0E+03	NC	1.0E+04	NC
NFDHA	ND	NC	8.2E-01	NA	NA	NC	NC	2.2E-02	NC	NC	2.2E-02	9.2E+04	2.4E-07	1.5E+05	1.4E-07

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
UCL - upper confidence limit of the arithmetic mean
ww - wet weight

Appendix K Food Web Model – West Lakeland Area
Table 10. Potential Risks to the Great Blue Heron
Ecological Risk Assessment Food Web Model

Project 1007
Minneapolis, Minnesota

Site: West Lakeland Area	
Assumptions for the Great Blue Heron	
Body Weight (kg)	2.4
Seasonal Use Factor	1
Site-Specific Area Use Factor	1.0
Sediment Ingestion Rate (kg_{dw}/day)	0.00043
Water Ingestion Rate (kg/day)	0.11
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.065
Amphibian Ingestion Rate (kg_{ww}/day)	0.022
Forage Fish Ingestion Rate (kg_{ww}/day)	0.35

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_s = Incidental ingestion rate of sediment (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_s= Concentration of PFAS in sediment (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations					Potential Daily Dose (ug/kg_{bw}/day)						NOAEL-based TRV (µg/kg_{bw}/day)	NOAEL-based HQ	LOAEL-based TRV (µg/kg_{bw}/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Amphibian EPC (µg/kg, ww)	Forage Fish EPC (µg/kg, ww)	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Benthic Invertebrate	Amphibian	Forage Fish	Sediment	Surface Water	Total				
PFCAs															
PFBA	6.2E+00	1.1E+00	6.5E-01	3.7E-01	4.1E-01	1.7E-01	1.0E-02	9.3E-02	6.7E-05	1.8E-02	2.9E-01	1.0E+03	2.9E-04	1.0E+04	2.9E-05
PFHxA	ND	ND	ND	4.5E-01	1.4E-02	NC	NC	NC	8.1E-05	6.2E-04	7.0E-04	1.0E+03	7.0E-07	1.0E+04	7.0E-08
PFHpA	2.3E-01	ND	ND	ND	8.0E-03	6.3E-03	NC	NC	NC	3.6E-04	6.7E-03	1.0E+03	6.7E-06	1.0E+04	6.7E-07
PFOA	6.3E+00	2.7E-01	4.5E-01	2.3E-01	7.3E-02	1.7E-01	2.4E-03	6.5E-02	4.2E-05	3.3E-03	2.4E-01	1.0E+03	2.4E-04	1.0E+04	2.4E-05
PFNA	2.3E-01	2.8E-01	2.0E-01	1.1E-01	1.2E-03	6.2E-03	2.5E-03	2.9E-02	2.0E-05	5.5E-05	3.8E-02	1.0E+03	3.8E-05	1.0E+04	3.8E-06
PFDA	1.3E+00	2.1E+00	6.1E+00	7.7E-02	1.9E-03	3.4E-02	1.9E-02	8.8E-01	1.4E-05	8.4E-05	9.4E-01	1.0E+03	9.4E-04	1.0E+04	9.4E-05
PFUnA	4.8E-01	4.7E-01	1.1E+00	7.4E-02	5.2E-04	1.3E-02	4.2E-03	1.6E-01	1.3E-05	2.3E-05	1.7E-01	1.0E+03	1.7E-04	1.0E+04	1.7E-05
PFDoA	2.4E-01	2.8E-01	3.2E-01	ND	ND	6.4E-03	2.5E-03	4.6E-02	NC	NC	5.4E-02	1.0E+03	5.4E-05	1.0E+04	5.4E-06
PFTrDA	1.7E-01	2.5E-01	2.5E-01	ND	1.9E-04	4.6E-03	2.2E-03	3.6E-02	NC	8.8E-06	4.2E-02	1.0E+03	4.2E-05	1.0E+04	4.2E-06
PFTeDA	1.2E-01	1.5E-01	1.6E-01	1.8E-01	5.6E-04	3.2E-03	1.4E-03	2.3E-02	3.3E-05	2.5E-05	2.8E-02	1.0E+03	2.8E-05	1.0E+04	2.8E-06
PFSAs															
PFHxS	2.6E-01	ND	1.4E-01	9.8E-02	9.5E-03	7.0E-03	NC	2.0E-02	1.8E-05	4.3E-04	2.8E-02	7.9E+01	3.5E-04	7.9E+02	3.5E-05
PFHpS	1.1E-01	1.0E-01	5.1E-01	ND	2.0E-03	2.9E-03	9.4E-04	7.3E-02	NC	9.0E-05	7.7E-02	7.9E+01	9.8E-04	7.9E+02	9.8E-05
PFOS	4.8E+01	1.2E+02	1.0E+03	2.7E+00	2.0E-01	1.3E+00	1.1E+00	1.5E+02	4.8E-04	9.0E-03	1.5E+02	7.9E+01	**1.9E+00**	7.9E+02	1.9E-01
PFNS	ND	1.8E-01	8.9E-01	ND	ND	NC	1.6E-03	1.3E-01	NC	NC	1.3E-01	7.9E+01	1.6E-03	7.9E+02	1.6E-04
PFDS	ND	2.3E-01	2.7E-01	4.4E-02	ND	NC	2.1E-03	3.8E-02	7.9E-06	NC	4.1E-02	7.9E+01	5.1E-04	7.9E+02	5.1E-05
FOSA, FASE, FASAAs															
PFOSA	1.1E+00	7.2E-01	9.0E-01	1.0E-01	1.9E-03	2.9E-02	6.5E-03	1.3E-01	1.8E-05	8.5E-05	1.6E-01	7.9E+01	2.1E-03	7.9E+02	2.1E-04
N-EtFOSAA	3.0E-01	2.3E-01	3.5E-01	1.5E-01	2.3E-03	8.1E-03	2.0E-03	5.0E-02	2.7E-05	1.0E-04	6.1E-02	7.9E+01	7.7E-04	7.9E+02	7.7E-05
N-MeFOSAA	ND	ND	ND	ND	ND	NC	NC	NC	NC	NC	NC	7.9E+01	NC	7.9E+02	NC
N-EtFOSE	ND	NA	NA	ND	4.7E-04	NC	NC	NC	NC	2.1E-05	2.1E-05	7.9E+01	2.7E-07	7.9E+02	2.7E-08
Fluortelomers															
6:2 FTS	6.3E-01	1.6E+00	1.1E+00	4.3E-01	5.9E-02	1.7E-02	1.4E-02	1.6E-01	7.7E-05	2.6E-03	1.9E-01	1.0E+03	1.9E-04	1.0E+04	1.9E-05
Replacement Chemistries															
ADONA	ND	ND	ND	ND	ND	NC	NC	NC	NC	NC	NC	1.0E+03	NC	1.0E+04	NC
NFDHA	ND	ND	8.2E-01	NA	NA	NC	NC	1.2E-01	NC	NC	1.2E-01	9.2E+04	1.3E-06	1.5E+05	7.7E-07

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
UCL - upper confidence limit of the arithmetic mean
ww - wet weight

Appendix K Food Web Model – West Lakeland Area
Table 11. Potential Risks to the Muskrat
Ecological Risk Assessment Food Web Model

Project 1007
Minneapolis, Minnesota

Site: West Lakeland Area	
Assumptions for the Muskrat	
Body Weight (kg)	1.6
Seasonal Use Factor	1
Site-Specific Area Use Factor	1.0
Sediment Ingestion Rate (kg_{dw}/day)	0.0027
Water Ingestion Rate (kg/day)	0.88
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.054
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.054
Plant Ingestion Rate (kg_{ww}/day)	0.43

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_s = Incidental ingestion rate of sediment (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_s= Concentration of PFAS in sediment (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations					Potential Daily Dose (ug/kg_{bw}/day)						NOAEL-based TRV (µg/kg_{bw}/day)	NOAEL-based HQ	LOAEL-based TRV (µg/kg_{bw}/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Aquatic Invertebrate EPC (µg/kg, ww)	Plant EPC (µg/kg, ww)	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Benthic Invertebrate	Aquatic Invertebrate	Plant	Sediment	Surface Water	Total				
PFCAs															
PFBA	6.2E+00	2.2E+01	1.1E+00	3.7E-01	4.1E-01	2.1E-01	7.4E-01	3.0E-01	6.4E-04	2.3E-01	1.5E+00	7.3E+04	2.0E-05	1.8E+05	8.5E-06
PFHxA	ND	5.6E+00	3.8E-01	4.5E-01	1.4E-02	NC	1.9E-01	1.0E-01	7.7E-04	7.7E-03	3.0E-01	8.4E+04	3.6E-06	1.8E+05	1.7E-06
PFHpA	2.3E-01	5.1E-01	2.7E-01	ND	8.0E-03	7.9E-03	1.7E-02	7.2E-02	NC	4.5E-03	1.0E-01	3.0E+02	3.4E-04	6.0E+02	1.7E-04
PFOA	6.3E+00	5.0E+00	2.4E+00	2.3E-01	7.3E-02	2.1E-01	1.7E-01	6.5E-01	4.0E-04	4.0E-02	1.1E+00	3.0E+02	3.6E-03	6.0E+02	1.8E-03
PFNA	2.3E-01	2.2E-01	9.2E-01	1.1E-01	1.2E-03	7.8E-03	7.3E-03	2.5E-01	1.9E-04	6.8E-04	2.7E-01	8.3E+02	3.2E-04	1.1E+03	2.4E-04
PFDA	1.3E+00	2.4E-01	3.4E+00	7.7E-02	1.9E-03	4.3E-02	8.1E-03	9.1E-01	1.3E-04	1.0E-03	9.6E-01	1.0E+02	9.6E-03	6.4E+03	1.5E-04
PFUnA	4.8E-01	6.6E-02	9.2E-01	7.4E-02	5.2E-04	1.6E-02	2.2E-03	2.5E-01	1.3E-04	2.9E-04	2.7E-01	3.0E+02	9.0E-04	1.0E+03	2.7E-04
PFDoA	2.4E-01	NC	NC	ND	ND	8.0E-03	NC	NC	NC	NC	8.0E-03	5.0E+02	1.6E-05	2.5E+03	3.2E-06
PFTrDA	1.7E-01	2.5E-02	3.5E-01	ND	1.9E-04	5.7E-03	8.4E-04	9.5E-02	NC	1.1E-04	1.0E-01	5.0E+02	2.0E-04	2.5E+03	4.1E-05
PFTeDA	1.2E-01	7.1E-02	1.0E+00	1.8E-01	5.6E-04	4.0E-03	2.4E-03	2.7E-01	3.1E-04	3.1E-04	2.8E-01	3.0E+03	9.3E-05	1.0E+04	2.8E-05
PFSAs															
PFHxS	2.6E-01	2.3E+00	1.7E-02	9.8E-02	9.5E-03	8.9E-03	7.7E-02	4.5E-03	1.7E-04	5.3E-03	9.6E-02	3.0E+02	3.2E-04	1.0E+03	9.6E-05
PFHpS	1.1E-01	5.6E-01	6.6E-02	ND	2.0E-03	3.7E-03	1.9E-02	1.8E-02	NC	1.1E-03	4.2E-02	3.0E+02	1.4E-04	1.0E+03	4.2E-05
PFOS	4.8E+01	5.5E+01	3.8E+01	2.7E+00	2.0E-01	1.6E+00	1.9E+00	1.0E+01	4.6E-03	1.1E-01	1.4E+01	1.0E+02	1.4E-01	1.7E+02	8.2E-02
PFNS	ND	NC	NC	ND	ND	NC	NC	NC	NC	NC	NC	1.0E+02	NC	1.7E+02	NC
PFDS	ND	NC	NC	4.4E-02	ND	NC	NC	NC	NC	NC	NC	1.0E+02	NC	1.7E+02	NC
FOSA, FASE, FASAAs															
PFOSA	1.1E+00	5.3E-01	3.6E-01	1.0E-01	1.9E-03	3.7E-02	1.8E-02	9.7E-02	1.7E-04	1.0E-03	1.5E-01	1.0E+02	1.5E-03	1.7E+02	9.0E-04
N-EtFOSAA	3.0E-01	6.5E-01	4.4E-01	1.5E-01	2.3E-03	1.0E-02	2.2E-02	1.2E-01	2.5E-04	1.3E-03	1.5E-01	1.0E+02	1.5E-03	1.7E+02	9.0E-04
N-MeFOSAA	ND	NC	NC	ND	ND	NC	NC	NC	NC	NC	NC	1.0E+02	NC	1.7E+02	NC
N-EtFOSE	ND	1.3E-01	8.9E-02	ND	4.7E-04	NC	4.5E-03	2.4E-02	NC	2.6E-04	2.9E-02	1.0E+02	2.9E-04	1.0E+03	2.9E-05
Fluortelomers															
6:2 FTS	6.3E-01	1.4E+01	1.0E-01	4.3E-01	5.9E-02	2.1E-02	4.8E-01	2.8E-02	7.3E-04	3.3E-02	5.6E-01	3.0E+02	1.9E-03	1.0E+03	5.6E-04
Replacement Chemistries															
ADONA	ND	NC	NC	ND	ND	NC	NC	NC	NC	NC	NC	3.0E+02	NC	6.0E+02	NC
NFDHA	ND	NC	NC	NA	NA	NC	NC	NC	NC	NC	NC	7.3E+04	NC	1.8E+05	NC

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
UCL - upper confidence limit of the arithmetic mean
ww - wet weight

Appendix K Food Web Model – West Lakeland Area
Table 12. Potential Risks to the Little Brown Bat
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: West Lakeland Area	
Assumptions for the Little Brown Bat	
Body Weight (kg)	0.0085
Seasonal Use Factor	1
Site-Specific Area Use Factor	1.0
Water Ingestion Rate (kg/day)	0.0010
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.0049

Total Daily Dose = $\frac{\Sigma([IR_f \times C_f] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)
AUF = Area use factor (ratio of the receptor's home range relative to the size of

SUPPORTING CALCULATIONS

Analyte	Media Concentrations		Potential Daily Dose (ug/kg_{bw}/day)			NOAEL-based TRV ($\mu g/kg_{bw}$/day)	NOAEL-based HQ	LOAEL-based TRV ($\mu g/kg_{bw}$/day)	LOAEL-based HQ
	Aquatic Invertebrate EPC (µg/kg, ww)	Surface Water EPC (µg/L)	Aquatic Invertebrate	Surface Water	Total				
PFCAs									
PFBA	2.2E+01	4.1E-01	1.2E+01	4.8E-02	1.2E+01	7.3E+04	1.7E-04	1.8E+05	7.1E-05
PFHxA	5.6E+00	1.4E-02	3.2E+00	1.6E-03	3.2E+00	8.4E+04	3.8E-05	1.8E+05	1.8E-05
PFHpA	5.1E-01	8.0E-03	2.9E-01	9.4E-04	2.9E-01	3.0E+02	9.7E-04	6.0E+02	4.8E-04
PFOA	5.0E+00	7.3E-02	2.8E+00	8.5E-03	2.8E+00	3.0E+02	9.4E-03	6.0E+02	4.7E-03
PFNA	2.2E-01	1.2E-03	1.2E-01	1.4E-04	1.2E-01	8.3E+02	1.5E-04	1.1E+03	1.1E-04
PFDA	2.4E-01	1.9E-03	1.4E-01	2.2E-04	1.4E-01	1.0E+02	1.4E-03	6.4E+03	2.1E-05
PFUnA	6.6E-02	5.2E-04	3.7E-02	6.1E-05	3.7E-02	3.0E+02	1.2E-04	1.0E+03	3.7E-05
PFDoA	NC	ND	NC	NC	NC	5.0E+02	NC	2.5E+03	NC
PFTrDA	2.5E-02	1.9E-04	1.4E-02	2.3E-05	1.4E-02	5.0E+02	2.8E-05	2.5E+03	5.7E-06
PFTeDA	7.1E-02	5.6E-04	4.0E-02	6.6E-05	4.1E-02	3.0E+03	1.4E-05	1.0E+04	4.1E-06
PFSAs									
PFHxS	2.3E+00	9.5E-03	1.3E+00	1.1E-03	1.3E+00	3.0E+02	4.3E-03	1.0E+03	1.3E-03
PFHpS	5.6E-01	2.0E-03	3.2E-01	2.4E-04	3.2E-01	3.0E+02	1.1E-03	1.0E+03	3.2E-04
PFOS	5.5E+01	2.0E-01	3.2E+01	2.3E-02	3.2E+01	1.0E+02	3.2E-01	1.7E+02	1.9E-01
PFNS	NC	ND	NC	NC	NC	1.0E+02	NC	1.7E+02	NC
PFDS	NC	ND	NC	NC	NC	1.0E+02	NC	1.7E+02	NC
FOSA, FASE, FASAAs									
PFOSA	5.3E-01	1.9E-03	3.0E-01	2.2E-04	3.0E-01	1.0E+02	3.0E-03	1.7E+02	1.8E-03
N-EtFOSAA	6.5E-01	2.3E-03	3.7E-01	2.7E-04	3.7E-01	1.0E+02	3.7E-03	1.7E+02	2.2E-03
N-MeFOSAA	NC	ND	NC	NC	NC	1.0E+02	NC	1.7E+02	NC
N-EtFOSE	1.3E-01	4.7E-04	7.5E-02	5.5E-05	7.5E-02	1.0E+02	7.5E-04	1.0E+03	7.5E-05
Fluortelomers									
6:2 FTS	1.4E+01	5.9E-02	8.0E+00	6.9E-03	8.0E+00	3.0E+02	2.7E-02	1.0E+03	8.0E-03
Replacement Chemistries									
ADONA	NC	ND	NC	NC	NC	3.0E+02	NC	6.0E+02	NC
NFDHA	NC	NA	NC	NC	NC	7.3E+04	NC	1.8E+05	NC

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
UCL - upper confidence limit of the arithmetic mean
ww - wet weight

Appendix K Food Web Model – West Lakeland Area
Table 13. Potential Risks to the Mink
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: West Lakeland Area	
Assumptions for the Mink	
Body Weight (kg)	1.4
Seasonal Use Factor	1
Site-Specific Area Use Factor	1.0
Sediment Ingestion Rate (kg_{dw}/day)	0.0016
Water Ingestion Rate (kg/day)	0.055
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.022
Aquatic Invert. Ingestion Rate (kg_{ww}/day)	0.022
Plant Ingestion Rate (kg_{ww}/day)	0.011
Amphibian Ingestion Rate (kg_{ww}/day)	0.011
Forage Fish Ingestion Rate (kg_{ww}/day)	4.4E-02
Predatory Fish Ingestion Rate (kg_{ww}/day)	1.1E-01

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_s = Incidental ingestion rate of sediment (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_s= Concentration of PFAS in sediment (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations								Potential Daily Dose (ug/kg_{bw}/day)									NOAEL-based TRV (ug/kg_{bw}/day)	NOAEL-based HQ	LOAEL-based TRV (ug/kg_{bw}/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Aquatic Invertebrate EPC (µg/kg, ww)	Plant EPC (µg/kg, ww)	Amphibian EPC (µg/kg, ww)	Forage Fish EPC (µg/kg, ww)	Predatory Fish EPC (µg/kg, ww)	Sediment EPC (µg/kg, dw)	Surface Water EPC (µg/L)	Benthic Invertebrate	Aquatic Invertebrate	Plant	Amphibian	Forage Fish	Predatory Fish	Sediment	Surface Water	Total				
PFCAs																					
PFBA	6.2E+00	2.2E+01	1.1E+00	1.1E+00	6.5E-01	5.8E-01	3.7E-01	4.1E-01	9.8E-02	3.5E-01	8.9E-03	8.9E-03	2.1E-02	4.6E-02	4.5E-04	1.6E-02	5.5E-01	7.3E+04	7.5E-06	1.8E+05	3.1E-06
PFHxA	ND	5.6E+00	3.8E-01	ND	ND	1.2E-01	4.5E-01	1.4E-02	NC	8.9E-02	3.1E-03	NC	NC	9.3E-03	5.4E-04	5.6E-04	1.0E-01	8.4E+04	1.2E-06	1.8E+05	5.9E-07
PFHpA	2.3E-01	5.1E-01	2.7E-01	ND	ND	ND	ND	8.0E-03	3.7E-03	8.1E-03	2.1E-03	NC	NC	NC	NC	3.2E-04	1.4E-02	3.0E+02	4.8E-05	6.0E+02	2.4E-05
PFOA	6.3E+00	5.0E+00	2.4E+00	2.7E-01	4.5E-01	1.3E-01	2.3E-01	7.3E-02	1.0E-01	7.9E-02	1.9E-02	2.2E-03	1.5E-02	1.0E-02	2.8E-04	2.9E-03	2.3E-01	3.0E+02	7.7E-04	6.0E+02	3.8E-04
PFNA	2.3E-01	2.2E-01	9.2E-01	2.8E-01	2.0E-01	2.1E-01	1.1E-01	1.2E-03	3.7E-03	3.5E-03	7.3E-03	2.3E-03	6.4E-03	1.7E-02	1.3E-04	4.9E-05	4.0E-02	8.3E+02	4.8E-05	1.1E+03	3.6E-05
PFDA	1.3E+00	2.4E-01	3.4E+00	2.1E+00	6.1E+00	9.0E+00	7.7E-02	1.9E-03	2.0E-02	3.8E-03	2.7E-02	1.7E-02	2.0E-01	7.2E-01	9.2E-05	7.6E-05	9.8E-01	1.0E+02	9.8E-03	6.4E+03	1.5E-04
PFUnA	4.8E-01	6.6E-02	9.2E-01	4.7E-01	1.1E+00	1.7E+00	7.4E-02	5.2E-04	7.7E-03	1.0E-03	7.4E-03	3.7E-03	3.5E-02	1.4E-01	8.9E-05	2.1E-05	1.9E-01	3.0E+02	6.5E-04	1.0E+03	1.9E-04
PFDoA	2.4E-01	NC	NC	2.8E-01	3.2E-01	6.0E-01	ND	ND	3.8E-03	NC	NC	2.2E-03	1.0E-02	4.8E-02	NC	NC	6.4E-02	5.0E+02	1.3E-04	2.5E+03	2.6E-05
PFTrDA	1.7E-01	2.5E-02	3.5E-01	2.5E-01	2.5E-01	5.2E-01	ND	1.9E-04	2.7E-03	4.0E-04	2.8E-03	2.0E-03	7.9E-03	4.1E-02	NC	7.9E-06	5.7E-02	5.0E+02	1.1E-04	2.5E+03	2.3E-05
PFTeDA	1.2E-01	7.1E-02	1.0E+00	1.5E-01	1.6E-01	2.1E-01	1.8E-01	5.6E-04	1.9E-03	1.1E-03	8.0E-03	1.2E-03	5.1E-03	1.7E-02	2.2E-04	2.3E-05	3.4E-02	3.0E+03	1.1E-05	1.0E+04	3.4E-06
PFSAs																					
PFHxS	2.6E-01	2.3E+00	1.7E-02	ND	1.4E-01	1.1E-01	9.8E-02	9.5E-03	4.2E-03	3.6E-02	1.3E-04	NC	4.5E-03	8.4E-03	1.2E-04	3.9E-04	5.4E-02	3.0E+02	1.8E-04	1.0E+03	5.4E-05
PFHpS	1.1E-01	5.6E-01	6.6E-02	1.0E-01	5.1E-01	5.4E-01	ND	2.0E-03	1.7E-03	8.9E-03	5.3E-04	8.3E-04	1.6E-02	4.3E-02	NC	8.1E-05	7.1E-02	3.0E+02	2.4E-04	1.0E+03	7.1E-05
PFOS	4.8E+01	5.5E+01	3.8E+01	1.2E+02	1.0E+03	1.4E+03	2.7E+00	2.0E-01	7.7E-01	8.9E-01	3.0E-01	9.4E-01	3.3E+01	1.1E+02	3.2E-03	8.0E-03	1.5E+02	1.0E+02	**1.5E+00**	1.7E+02	8.9E-01
PFNS	ND	NC	NC	1.8E-01	8.9E-01	2.0E+00	ND	ND	NC	NC	NC	1.4E-03	2.8E-02	1.6E-01	NC	NC	1.9E-01	1.0E+02	1.9E-03	1.7E+02	1.1E-03
PFDS	ND	NC	NC	2.3E-01	2.7E-01	6.5E-01	4.4E-02	ND	NC	NC	NC	1.9E-03	8.5E-03	5.2E-02	5.3E-05	NC	6.2E-02	1.0E+02	6.2E-04	1.7E+02	3.7E-04
FOSA, FASE, FASAAs																					
PFOSA	1.1E+00	5.3E-01	3.6E-01	7.2E-01	9.0E-01	8.0E-01	1.0E-01	1.9E-03	1.7E-02	8.4E-03	2.9E-03	5.8E-03	2.9E-02	6.4E-02	1.2E-04	7.6E-05	1.3E-01	1.0E+02	1.3E-03	1.7E+02	7.5E-04
N-EtFOSAA	3.0E-01	6.5E-01	4.4E-01	2.3E-01	3.5E-01	4.1E-01	1.5E-01	2.3E-03	4.8E-03	1.0E-02	3.5E-03	1.8E-03	1.1E-02	3.3E-02	1.8E-04	9.4E-05	6.5E-02	1.0E+02	6.5E-04	1.7E+02	3.8E-04
N-MeFOSAA	ND	NC	NC	ND	ND	1.7E-01	ND	ND	NC	NC	NC	NC	NC	1.4E-02	NC	NC	1.4E-02	1.0E+02	1.4E-04	1.7E+02	8.0E-05
N-EtFOSE	ND	1.3E-01	8.9E-02	NA	NA	1.2E+00	ND	4.7E-04	NC	2.1E-03	7.1E-04	NC	NC	9.9E-02	NC	1.9E-05	1.0E-01	1.0E+02	1.0E-03	1.0E+03	1.0E-04
Fluortelomers																					
6:2 FTS	6.3E-01	1.4E+01	1.0E-01	1.6E+00	1.1E+00	2.5E+00	4.3E-01	5.9E-02	1.0E-02	2.2E-01	8.2E-04	1.3E-02	3.6E-02	2.0E-01	5.1E-04	2.4E-03	4.9E-01	3.0E+02	1.6E-03	1.0E+03	4.9E-04
Replacement Chemistries																					
ADONA	ND	NC	NC	ND	ND	5.0E-01	ND	ND	NC	NC	NC	NC	NC	4.0E-02	NC	NC	4.0E-02	3.0E+02	1.3E-04	6.0E+02	6.7E-05
NFDHA	ND	NC	NC	ND	8.2E-01	ND	NA	NA	NC	NC	NC	NC	2.6E-02	NC	NC	NC	2.6E-02	7.3E+04	3.6E-07	1.8E+05	1.5E-07

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
UCL - upper confidence limit of the arithmetic mean
ww - wet weight

Appendix K Food Web Model – West Lakeland Area
Table 14. Potential Risks to the River Otter
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Site: West Lakeland Area	
Assumptions for the River Otter	
Body Weight (kg)	7.7
Seasonal Use Factor	1
Site-Specific Area Use Factor	1.0
Water Ingestion Rate (kg/day)	0.41
Benthic Invert. Ingestion Rate (kg_{ww}/day)	0.12
Amphibian Ingestion Rate (kg_{ww}/day)	0.039
Forage Fish Ingestion Rate (kg_{ww}/day)	0.27
Predatory Fish Ingestion Rate (kg_{ww}/day)	0.35

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_w \times C_w]) \times SUF \times AUF}{\text{Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_w = Ingestion rate of water (L/day)
C_f = Concentration of PFAS in food (ug/kg)
C_w = Concentration of PFAS in water (ug/L)
SUF = Seasonal Use Factor (fraction of time receptor spends within exposure area)

SUPPORTING CALCULATIONS

Analyte	Media Concentrations					Potential Daily Dose (ug/kg_{bw}/day)						NOAEL-based TRV ($\mu g/kg_{bw}$/day)	NOAEL-based HQ	LOAEL-based TRV ($\mu g/kg_{bw}$/day)	LOAEL-based HQ
	Benthic Invertebrate EPC (µg/kg, ww)	Amphibian EPC (µg/kg, ww)	Forage Fish EPC (µg/kg, ww)	Predatory Fish EPC (µg/kg, ww)	Surface Water EPC (µg/L)	Benthic Invertebrate	Amphibian	Forage Fish	Predatory Fish	Surface Water	Total				
PFCAs															
PFBA	6.2E+00	1.1E+00	6.5E-01	5.8E-01	4.1E-01	9.4E-02	5.7E-03	2.3E-02	2.6E-02	2.2E-02	1.7E-01	7.3E+04	2.3E-06	1.8E+05	9.8E-07
PFHxA	ND	ND	ND	1.2E-01	1.4E-02	NC	NC	NC	5.3E-03	7.3E-04	6.0E-03	8.4E+04	7.2E-08	1.8E+05	3.5E-08
PFHpA	2.3E-01	ND	ND	ND	8.0E-03	3.6E-03	NC	NC	NC	4.3E-04	4.0E-03	3.0E+02	1.3E-05	6.0E+02	6.6E-06
PFOA	6.3E+00	2.7E-01	4.5E-01	1.3E-01	7.3E-02	9.7E-02	1.4E-03	1.6E-02	6.0E-03	3.9E-03	1.2E-01	3.0E+02	4.1E-04	6.0E+02	2.1E-04
PFNA	2.3E-01	2.8E-01	2.0E-01	2.1E-01	1.2E-03	3.5E-03	1.4E-03	7.1E-03	9.6E-03	6.5E-05	2.2E-02	8.3E+02	2.6E-05	1.1E+03	2.0E-05
PFDA	1.3E+00	2.1E+00	6.1E+00	9.0E+00	1.9E-03	1.9E-02	1.1E-02	2.2E-01	4.1E-01	1.0E-04	6.6E-01	1.0E+02	6.6E-03	6.4E+03	1.0E-04
PFUnA	4.8E-01	4.7E-01	1.1E+00	1.7E+00	5.2E-04	7.3E-03	2.4E-03	3.9E-02	8.0E-02	2.7E-05	1.3E-01	3.0E+02	4.3E-04	1.0E+03	1.3E-04
PFDoA	2.4E-01	2.8E-01	3.2E-01	6.0E-01	ND	3.6E-03	1.4E-03	1.1E-02	2.8E-02	NC	4.4E-02	5.0E+02	8.8E-05	2.5E+03	1.8E-05
PFTrDA	1.7E-01	2.5E-01	2.5E-01	5.2E-01	1.9E-04	2.6E-03	1.2E-03	8.8E-03	2.4E-02	1.0E-05	3.6E-02	5.0E+02	7.3E-05	2.5E+03	1.5E-05
PFTeDA	1.2E-01	1.5E-01	1.6E-01	2.1E-01	5.6E-04	1.8E-03	7.6E-04	5.7E-03	9.5E-03	3.0E-05	1.8E-02	3.0E+03	5.9E-06	1.0E+04	1.8E-06
PFSAs															
PFHxS	2.6E-01	ND	1.4E-01	1.1E-01	9.5E-03	4.0E-03	NC	5.0E-03	4.8E-03	5.1E-04	1.4E-02	3.0E+02	4.8E-05	1.0E+03	1.4E-05
PFHpS	1.1E-01	1.0E-01	5.1E-01	5.4E-01	2.0E-03	1.6E-03	5.3E-04	1.8E-02	2.5E-02	1.1E-04	4.5E-02	3.0E+02	1.5E-04	1.0E+03	4.5E-05
PFOS	4.8E+01	1.2E+02	1.0E+03	1.4E+03	2.0E-01	7.4E-01	6.0E-01	3.7E+01	6.6E+01	1.1E-02	1.0E+02	1.0E+02	1.0E+00	1.7E+02	6.1E-01
PFNS	ND	1.8E-01	8.9E-01	2.0E+00	ND	NC	9.2E-04	3.2E-02	9.3E-02	NC	1.3E-01	1.0E+02	1.3E-03	1.7E+02	7.4E-04
PFDS	ND	2.3E-01	2.7E-01	6.5E-01	ND	NC	1.2E-03	9.5E-03	3.0E-02	NC	4.0E-02	1.0E+02	4.0E-04	1.7E+02	2.4E-04
FOSA, FASE, FASAAs															
PFOSA	1.1E+00	7.2E-01	9.0E-01	8.0E-01	1.9E-03	1.6E-02	3.7E-03	3.2E-02	3.7E-02	1.0E-04	8.9E-02	1.0E+02	8.9E-04	1.7E+02	5.2E-04
N-EtFOSAA	3.0E-01	2.3E-01	3.5E-01	4.1E-01	2.3E-03	4.6E-03	1.2E-03	1.2E-02	1.9E-02	1.2E-04	3.7E-02	1.0E+02	3.7E-04	1.7E+02	2.2E-04
N-MeFOSAA	ND	ND	ND	1.7E-01	ND	NC	NC	NC	7.8E-03	NC	7.8E-03	1.0E+02	7.8E-05	1.7E+02	4.6E-05
N-EtFOSE	ND	NA	NA	1.2E+00	4.7E-04	NC	NC	NC	5.7E-02	2.5E-05	5.7E-02	1.0E+02	5.7E-04	1.0E+03	5.7E-05
Fluortelomers															
6:2 FTS	6.3E-01	1.6E+00	1.1E+00	2.5E+00	5.9E-02	9.7E-03	8.0E-03	4.0E-02	1.1E-01	3.1E-03	1.8E-01	3.0E+02	5.8E-04	1.0E+03	1.8E-04
Replacement Chemistries															
ADONA	ND	ND	ND	5.0E-01	ND	NC	NC	NC	2.3E-02	NC	2.3E-02	3.0E+02	7.6E-05	6.0E+02	3.8E-05
NFDHA	ND	ND	8.2E-01	ND	NA	NC	NC	2.9E-02	NC	NC	2.9E-02	7.3E+04	4.0E-07	1.8E+05	1.7E-07

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
µg - microgram
BW - body weight
dw - dry weight
EPC - exposure point concentration
HQ - hazard quotient (Dose/TRV)
kg - kilogram
L - liter
LOAEL - lowest observed adverse effects level
NC - not calculated
ND - not detected
NOAEL - no observed adverse effects level
TRV - toxicity reference value
UCL - upper confidence limit of the arithmetic mean
ww - wet weight

Appendix K Food Web Model – West Lakeland Area
Table 15. Summary of Potential Risks to Wildlife at West Lakeland Area
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

Analyte	Hazard Quotients for Potential PFAS Exposure															
	Wood Duck		Tree Swallow		Spotted Sandpiper		Great Blue Heron		Muskrat		Little Brown Bat		Mink		River Otter	
	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ
PFCAs																
PFBA	7.0E-05	7.0E-06	1.5E-02	1.5E-03	5.0E-03	5.0E-04	2.9E-04	2.9E-05	2.0E-05	8.5E-06	1.7E-04	7.1E-05	7.5E-06	3.1E-06	9.5E-08	4.0E-08
PFHxA	1.8E-05	1.8E-06	3.4E-03	3.4E-04	4.7E-04	4.7E-05	7.0E-07	7.0E-08	3.6E-06	1.7E-06	3.8E-05	1.8E-05	1.2E-06	5.9E-07	2.9E-09	1.4E-09
PFHpA	7.6E-06	7.6E-07	4.1E-04	4.1E-05	1.5E-04	1.5E-05	6.7E-06	6.7E-07	3.4E-04	1.7E-04	9.7E-04	4.8E-04	4.8E-05	2.4E-05	5.4E-07	2.7E-07
PFOA	7.5E-05	7.5E-06	5.1E-03	5.1E-04	3.2E-03	3.2E-04	2.4E-04	2.4E-05	3.6E-03	1.8E-03	9.4E-03	4.7E-03	7.7E-04	3.8E-04	1.7E-05	8.4E-06
PFNA	2.3E-05	2.3E-06	3.5E-04	3.5E-05	1.3E-04	1.3E-05	3.8E-05	3.8E-06	3.2E-04	2.4E-04	1.5E-04	1.1E-04	4.8E-05	3.6E-05	1.1E-06	8.1E-07
PFDA	8.4E-05	8.4E-06	1.1E-03	1.1E-04	7.4E-04	7.4E-05	9.4E-04	9.4E-05	9.6E-03	1.5E-04	1.4E-03	2.1E-05	9.8E-03	1.5E-04	2.7E-04	4.2E-06
PFUnA	2.3E-05	2.3E-06	3.3E-04	3.3E-05	2.4E-04	2.4E-05	1.7E-04	1.7E-05	9.0E-04	2.7E-04	1.2E-04	3.7E-05	6.5E-04	1.9E-04	1.7E-05	5.2E-06
PFDoA	3.2E-07	3.2E-08	6.4E-05	6.4E-06	1.1E-04	1.1E-05	5.4E-05	5.4E-06	1.6E-05	3.2E-06	NC	NC	1.3E-04	2.6E-05	3.6E-06	7.2E-07
PFTrDA	8.8E-06	8.8E-07	1.2E-04	1.2E-05	8.2E-05	8.2E-06	4.2E-05	4.2E-06	2.0E-04	4.1E-05	2.8E-05	5.7E-06	1.1E-04	2.3E-05	3.0E-06	5.9E-07
PFTeDA	2.5E-05	2.5E-06	2.5E-04	2.5E-05	6.5E-05	6.5E-06	2.8E-05	2.8E-06	9.3E-05	2.8E-05	1.4E-05	4.1E-06	1.1E-05	3.4E-06	2.4E-07	7.3E-08
PFSAs																
PFHxS	5.2E-05	5.2E-06	1.8E-02	1.8E-03	4.0E-03	4.0E-04	3.5E-04	3.5E-05	3.2E-04	9.6E-05	4.3E-03	1.3E-03	1.8E-04	5.4E-05	1.9E-06	5.8E-07
PFHpS	3.2E-05	3.2E-06	4.7E-03	4.7E-04	1.4E-03	1.4E-04	9.8E-04	9.8E-05	1.4E-04	4.2E-05	1.1E-03	3.2E-04	2.4E-04	7.1E-05	6.1E-06	1.8E-06
PFOS	1.4E-02	1.4E-03	6.7E-01	6.7E-02	6.8E-01	6.8E-02	**1.9E+00**	1.9E-01	1.4E-01	8.2E-02	3.2E-01	1.9E-01	**1.5E+00**	8.9E-01	4.2E-02	2.5E-02
PFNS	NC	NC	NC	NC	3.0E-04	3.0E-05	1.6E-03	1.6E-04	NC	NC	NC	NC	1.9E-03	1.1E-03	5.1E-05	3.0E-05
PFDS	1.2E-06	1.2E-07	NC	NC	9.9E-05	9.9E-06	5.1E-04	5.1E-05	NC	NC	NC	NC	6.2E-04	3.7E-04	1.6E-05	9.7E-06
FOSA, FASE, FASAAs																
PFOSA	1.4E-04	1.4E-05	8.4E-03	8.4E-04	6.8E-03	6.8E-04	2.1E-03	2.1E-04	1.5E-03	9.0E-04	3.0E-03	1.8E-03	1.3E-03	7.5E-04	3.6E-05	2.1E-05
N-EtFOSAA	1.6E-04	1.6E-05	6.9E-03	6.9E-04	2.5E-03	2.5E-04	7.7E-04	7.7E-05	1.5E-03	9.0E-04	3.7E-03	2.2E-03	6.5E-04	3.8E-04	1.5E-05	8.9E-06
N-MeFOSAA	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	1.4E-04	8.0E-05	3.2E-06	1.9E-06
N-EtFOSE	3.0E-05	3.0E-06	1.2E-03	1.2E-04	1.4E-04	1.4E-05	2.7E-07	2.7E-08	2.9E-04	2.9E-05	7.5E-04	7.5E-05	1.0E-03	1.0E-04	2.3E-05	2.3E-06
Fluortelomers																
6:2 FTS	2.4E-05	2.4E-06	8.5E-03	8.5E-04	1.5E-03	1.5E-04	1.9E-04	1.9E-05	1.9E-03	5.6E-04	2.7E-02	8.0E-03	1.6E-03	4.9E-04	2.4E-05	7.2E-06
Replacement Chemistries																
ADONA	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	1.3E-04	6.7E-05	3.1E-06	1.6E-06
NFDHA	NC	NC	NC	NC	2.4E-07	1.4E-07	1.3E-06	7.7E-07	NC	NC	NC	NC	3.6E-07	1.5E-07	1.6E-08	6.8E-09

Notes:
HQs above 1 are bolded and highlighted.

Abbreviations:
See Table 3 for PFAS abbreviations
HQ - Hazard Quotient (Dose/TRV)
LOAEL - lowest observed adverse effects level
NC - not calculated
NOAEL - no observed adverse effects level

Appendix K Food Web Model – West Lakeland Area
Figure 1 - Total Daily Intake of PFAS
Ecological Risk Assessment Food Web Model
Project 1007
Minneapolis, Minnesota

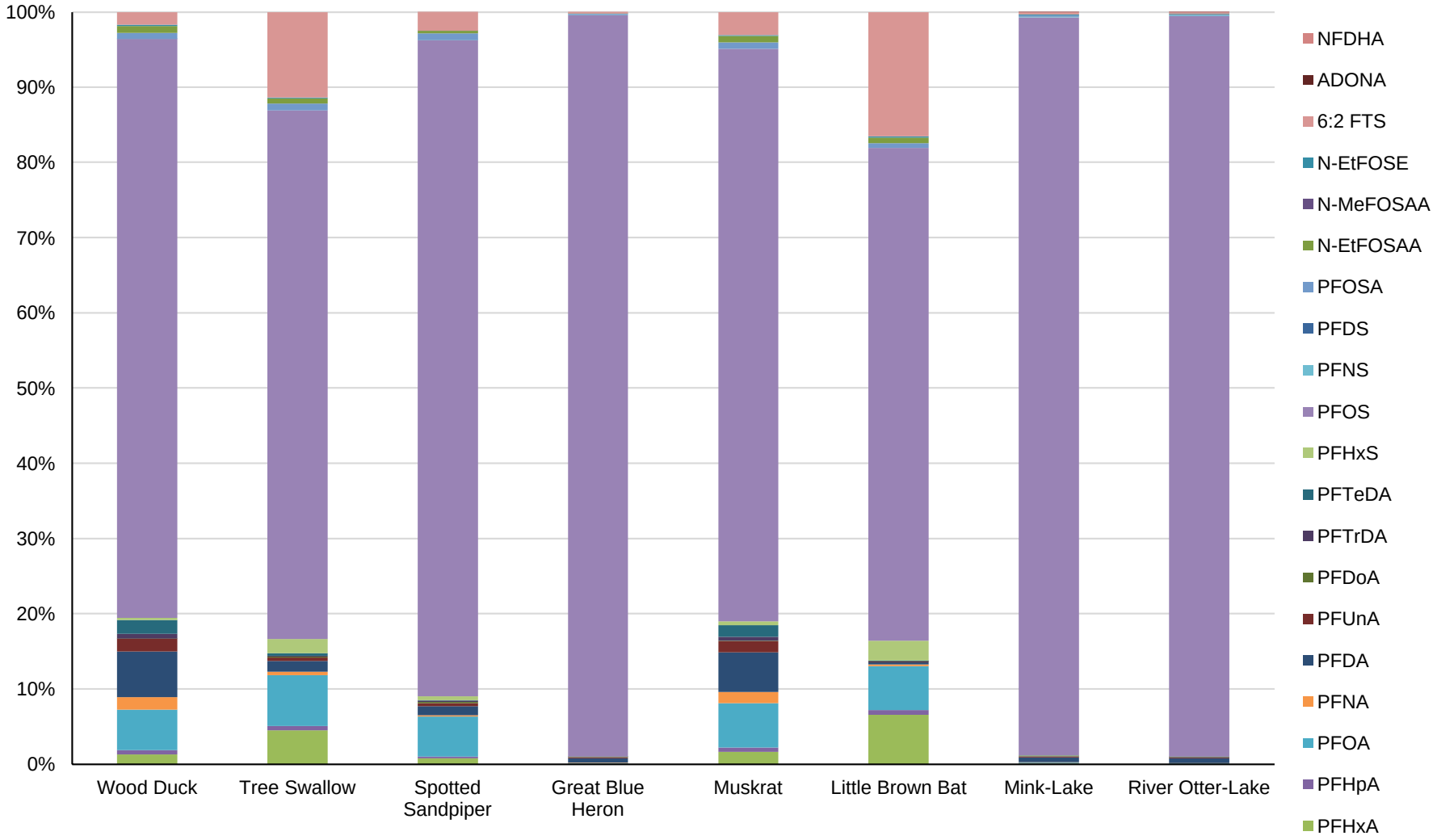

Figure 1: Total Daily Intake of PFAS - Aquatic-life Dependent Wildlife at West Lakeland Area