MINNESOTA POLLUTION CONTROL AGENCY

Drinking Water Modeling Discussion

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3M PFC Settlement Subgroup 1 Meeting

February 19, 2020

Agenda

- Overview
- Model Construction
- Basis of costs
- Preliminary scenario results discussion and examples:
  - Sub-Regional (multiple large groundwater well fields)
  - Community-Specific
- Next Steps

Rules of engagement

- ❑ Parking lot
- ❑ Sticky notes

Overview

- Groundwater is the primary source of drinking water for the East Metro Area
- Water distribution
  - 8 communities with public water systems and 1 community connected to St. Paul Regional Water Services
  - Over 6,000 private wells across all 14 communities
- Water demand
  - Washington County population is expected to grow
  - 2040 maximum daily water demand: 52 million gallons per day

Overview – Objective of model

❑ Drinking Water Systems – Hydraulic Models

- Assess current water supply systems and potential integration
- Use provided and combined hydraulic models as tools for development of water supply alternatives
- Examine feasibility of these alternatives for 2020 through 2040 conditions.
- Use model to estimate additional infrastructure required
- Collaborate with groundwater modeling efforts for well placement

Model Construction

1. Abt initially gathered community profile information, including water supply plans, fall 2018
2. Wood followed up by engaging LGUs via SG-1 and SharePoint to gather/exchange model files beginning February 2019.
    - RFIs to set up phone calls, and followed up with emails, phone calls, and data exchange via SharePoint
3. Wood met 1:1 with LGUs in June, July, August, and October to discuss CPs and scenarios, but also reviewed models with communities that have supply systems
4. Additional Skype meetings were scheduled as needed for outstanding information requests or model review

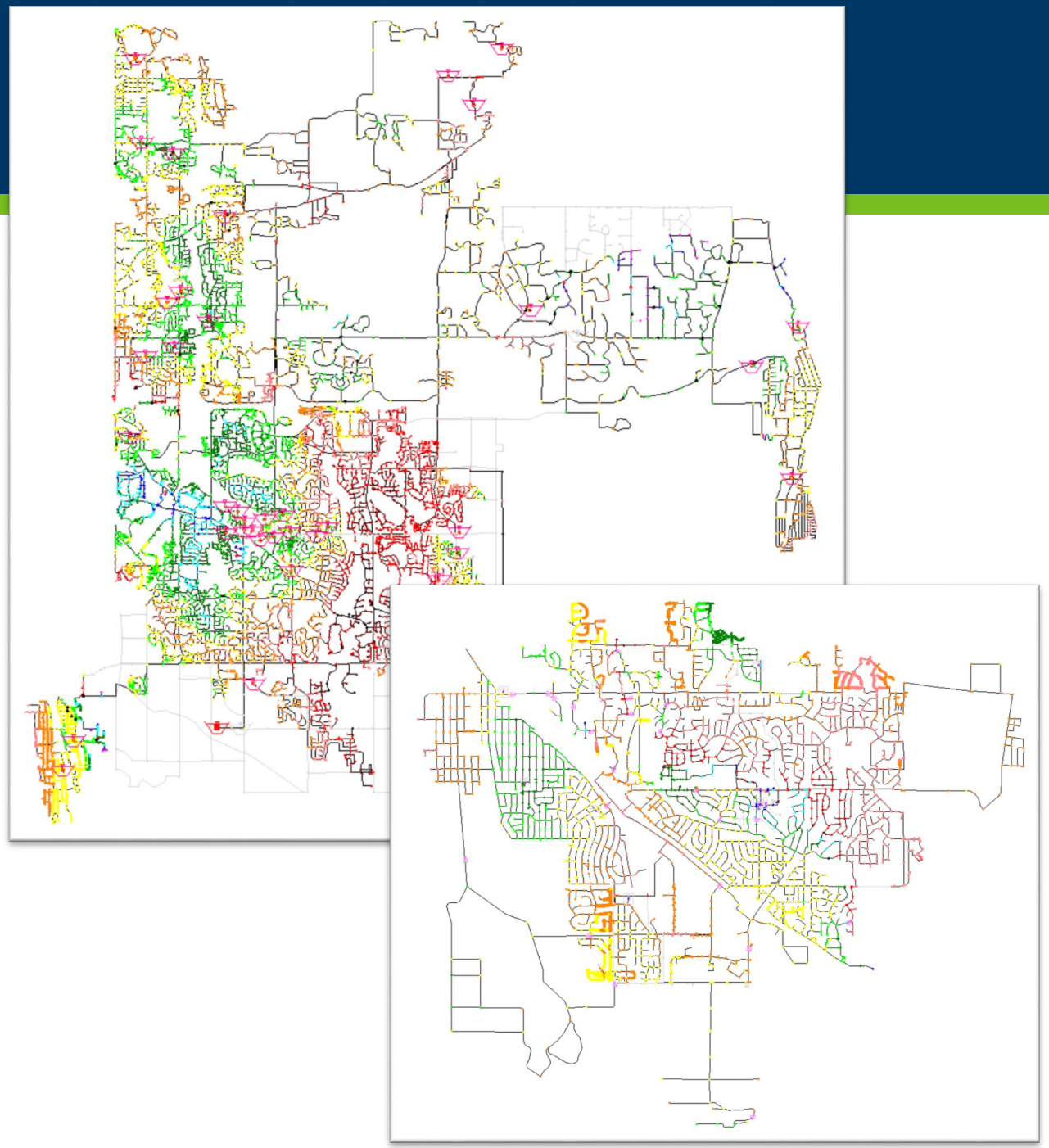
Model Construction

- Existing Models and Spatial Data Received
  - Cottage Grove – WaterCAD and GIS
  - Oakdale – WaterCAD and GIS
  - Newport – GIS
  - Lake Elmo – InfoWater/GIS
  - St. Paul Park – InfoWater/GIS
  - Woodbury – InfoWater/GIS Requested Additional Files
  - Lakeland – WaterCAD
  - Maplewood – GIS

Processed:
806 miles of pipe
50 municipal wells
25 tanks
6 booster pump stations

- Afton, Denmark, Grey Cloud Island, and Prairie Island Indian Community do not have existing municipal systems

Model Construction



- Community-Specific Models
  - ✓ All communities with municipal water supply systems
- Integrated Models
  - ✓ PIIC/West Lakeland/Lakeland
  - ✓ Oakdale/Lake Elmo & Woodbury
  - ✓ Grey Cloud Island/St. Paul Park & Cottage Grove
- Subregional Models
  - ✓ Northern Region – Woodbury, Oakdale, Lake Elmo, West Lakeland, PIIC, North Afton, Lakeland
  - ✓ Southern Region – Cottage Grove, St. Paul Park, Grey Cloud Island
- Regional Model for Surface Water Scenario

Model construction

- Feedback loop with communities to confirm model outputs
  - Are system pressure outputs in model consistent with known water system pressures in community or individual pressure zones?
  - If not:
    - Evaluated potential issues (equipment setpoints for pumps and pressure reducing valves, crossing water mains in GIS, may not be physically connected)
    - Some communities conducted pressure testing to aid in calibrating model
  - Feedback loop continued until models yielded acceptable results (±10 psi)

Model construciton

❑ Data Gaps

- Well and booster pump curves
- Real time data
- Well interference in Tamarack Well Field
- Viability of existing interconnects

❑ Limitations

- Steady state
- Seasonal fluctuations not accounted for
- Model simulations under summer operating conditions, which are worst-case

Basis of costs

- After evaluation costs were determine for each scenario
  - Assumptions on unit costs
- Cost Summary Table
  - Screening (high) level cost estimate
  - Capital costs, O&M Costs, cost per 1,000 gallons
  - Contingencies
  - Accounted for Inflation at 3% (NPV)

		Communities Served
		Components
		Water Provided
		Capital Cost (1000s)
		Annual O&M Cost (1000s)
Total 20 Year Costs	Undiscounted	Total 20 Year Cost (1000s)
		Operating Only Cost per 1,000 Gal
		Capital and Operating Cost per 1,000 Gal
	3% Inflation	Total 20 Year Costs (1000s) 3% Inflation

Basis of costs

		Communities Served	- which communities receive water (via infrastructure)
		Components	- new wells, treatment plants, infrastructure necessary
		Water Provided	- water capacity that scenario is designed for
		Capital Cost (1000s)	- costs of new components and construction
		Annual O&M Cost (1000s)	- cost to maintain and operate the new components
Total 20 Year Costs	Undiscounted	Total 20 Year Cost (1000s)	- total (undiscounted) capital and O&M costs for 20 years
		Operating Only Cost per 1,000 Gal	- (undiscounted) O&M cost for 20 year per 1,000 gallons
		Capital and Operating Cost per 1,000 Gal	- total (undiscounted) capital and O&M cost for 20 year per 1,000 gallons
	3% Inflation	Total 20 Year Costs (1000s) 3% Inflation	- Net Present Value with 3% inflation applied to total capital and O&M costs for 20 years

Preliminary Scenario Results

Preliminary scenario results

Simulated Infrastructure Upgrades

- Utilized existing infrastructure where possible
- Sizing WTPs – sized for 2040 maximum daily demands
- Existing and Potential Interconnects – viable interconnects between:
  - Oakdale and Lake Elmo (2,000 gpm)
  - Oakdale and Woodbury (2,000 gpm)
  - Cottage Grove and St. Paul Park (1,200 gpm)
- New lines – Installed new parallel lines when hydraulic capacity of existing lines was insufficient
- Pumps – Added when necessary to boost water pressures
- Pressure reducing valves – added when necessary to reduce water pressures, or at pressure zone boundaries
- Tanks – Included in model when extra water storage required, or to help maintain water system pressures

Maximum Daily Demand
= Highest water usage day of year

Preliminary scenario results - examples

- Sub-Regional Scenario
  - Is clean water (PFAS free) available in substantial quantities in project area?
  - Long-term savings associated with PFAS free water would offset the infrastructure
- Cottage Grove (Community and Integrated Scenarios)
  - Evaluate potential interconnects with neighboring communities
  - Evaluate options for centralized treatment facilities

Preliminary scenario results - examples

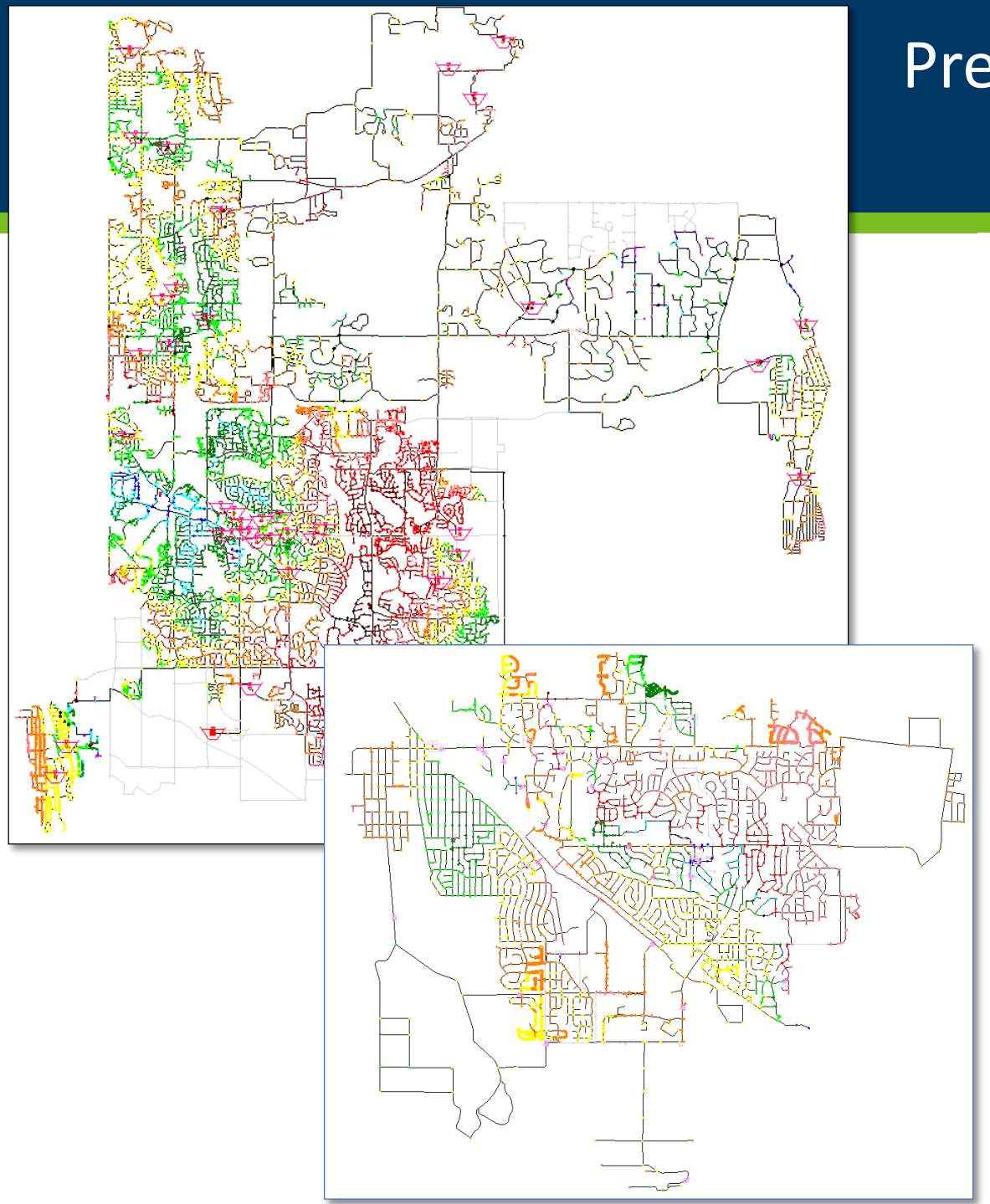
Sub-Regional Scenario

- Is clean water (PFAS free) available in substantial quantities in project area?
  - Long-term savings associated with PFAS free water would offset the infrastructure cost
- 3 wells fields evaluated in south half of project area
  - Southwest of Cottage Grove – water supply replacement for Cottage Grove/St. Paul Park/Grey Cloud Island
  - West side of Afton/Denmark border – water supply replacement for Woodbury and northern communities
  - Southwest of Woodbury – water supply replacements for Woodbury and northern communities

Groundwater modeling indicated:

- **Water supply was available**
- **PFAS treatment required under either (drought, wet, or normal conditions) for 2 of 3 wells fields**
- **Well field on Afton/Denmark border did not require treatment**

Preliminary scenario results - examples
Sub-regional scenario



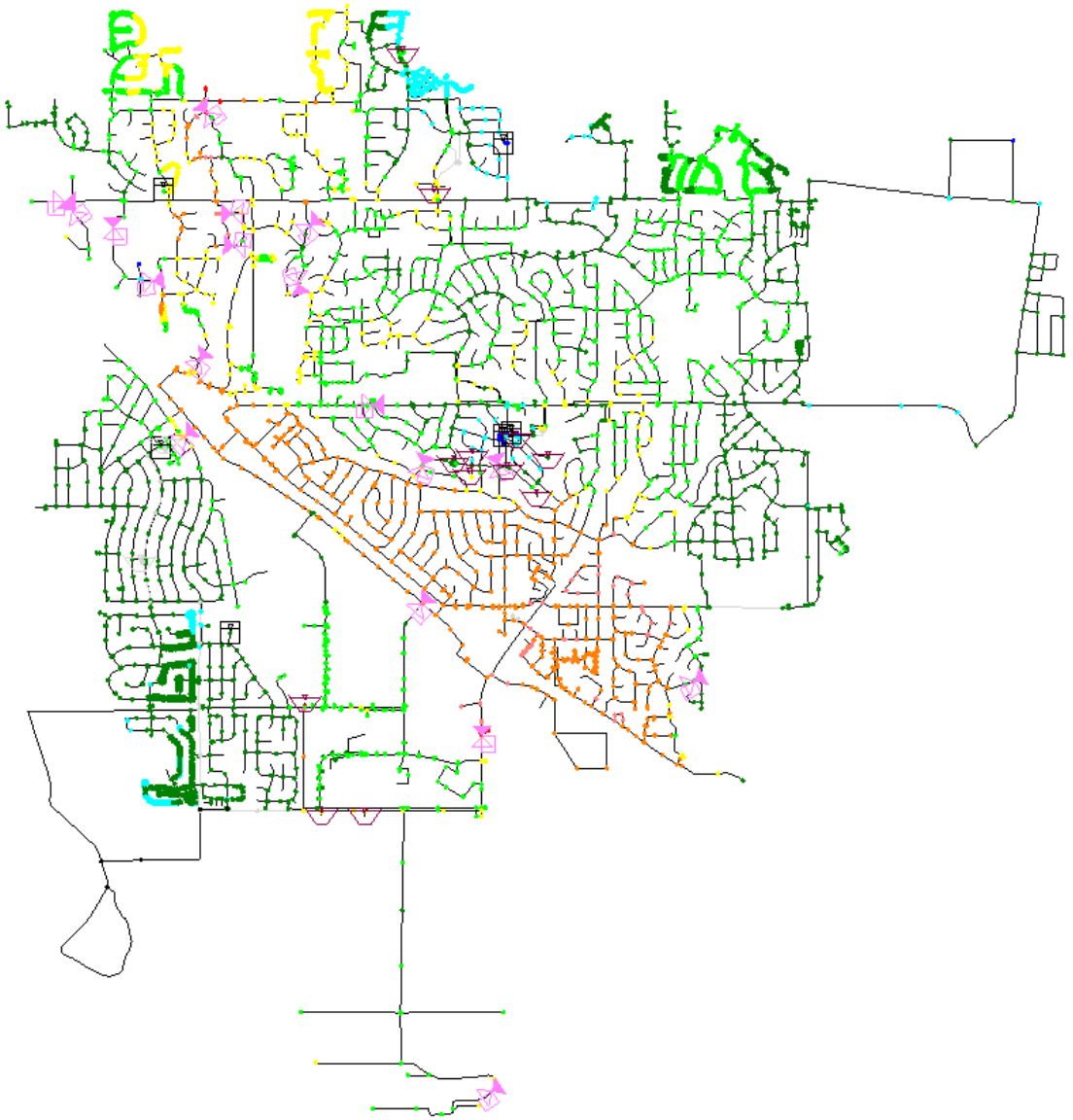
- Northern wells fields (2) considerations:
  - Large diameter transmission lines routed to large diameter distribution lines within Woodbury to help regulate pressures
  - Required multiple interconnects and booster pump stations at Woodbury/Oakdale, Woodbury/Lake Elmo, Lake Elmo/West Lakeland boundaries
  - West Lakelands system would route flow to Lakeland
- Southern well field (1) considerations:
  - Install additional interconnects between St. Paul Park and Cottage Grove
  - Upsize existing Cottage Grove Booster Pump Station
  - Additional PRVs within Cottage Grove for low-lying areas
  - New distribution lines in Grey Cloud Island

Preliminary scenario results - examples

Community-specific scenario - conceptual projects submitted by local governments, including:

- 2 new public water systems (Prairie Island Indian Community and West Lakeland)
- 1 community connected to St. Paul Regional Water Services (Maplewood)
- 8 communities with a mix of modifying current public water system, connecting residences on private wells to the public water system, and treatment on private wells (Cottage Grove, Lake Elmo, Lakeland & Lakeland Shores, Oakdale, St. Paul Park, and Woodbury)
- 3 communities with only treatment on private wells (Afton, Denmark, Grey Cloud Island)
- 1 community no improvements needed (Newport)

Preliminary scenario results - examples
Cottage Grove Options



- Install centralized water treatment plants (WTPs) and extending water mains to neighborhoods that have PFAS impact non-municipal wells
- Install POET systems for private wells and non-community public water system wells
- Infrastructure upgrades identified –
  - Raw Water Lines
  - Upgrading Cottage Grove's existing booster pump station
  - Pressure reducing valves on lines to low-lying areas
  - Evaluated new loops to incorporate east and southwest Cottage Grove
  - Operations remain similar

Preliminary scenario results – examples
Draft Numbers

- Cottage Grove Community-Specific alternatives

COMMUNITY SCENARIO	Alternative 1	Alternative 2	Alternative 3*
Wells 1 and 2 (PFAS and low flow)	New Low Zone WTP to serve only Wells 1 & 2	Low Zone WTP	Abandon
Well 10	Low Zone WTP	Low Zone WTP	Low Zone WTP
Wells 3,4,5,6,7,8,9	Intermediate Zone WTP	Intermediate Zone WTP	Intermediate Zone WTP
Wells 11 and 12	High Zone WTP	Intermediate Zone WTP	Intermediate Zone WTP
INTEGRATED SCENARIO	**Alternative 3** with an additional well routed to Intermediate Zone WTP for treatment and used to supply		
	Cottage Grove to St. Paul Park with treated potable water		

*Most cost effective alternative considering capital and O&M over 20 years

Questions?

Thank you!

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Water Design Center

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