



American Water Works Association  
**Pacific Northwest** Section

# Crossflow Recirculation – A Membrane System's Best Friend?

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# Agenda

1. Introduction
2. Treatment and Process
3. Water Quality Challenges
4. Cross Flow Recirculation
5. Design and Construction
6. Challenges with Oregon Health Authority
7. Project Status
8. Q&A

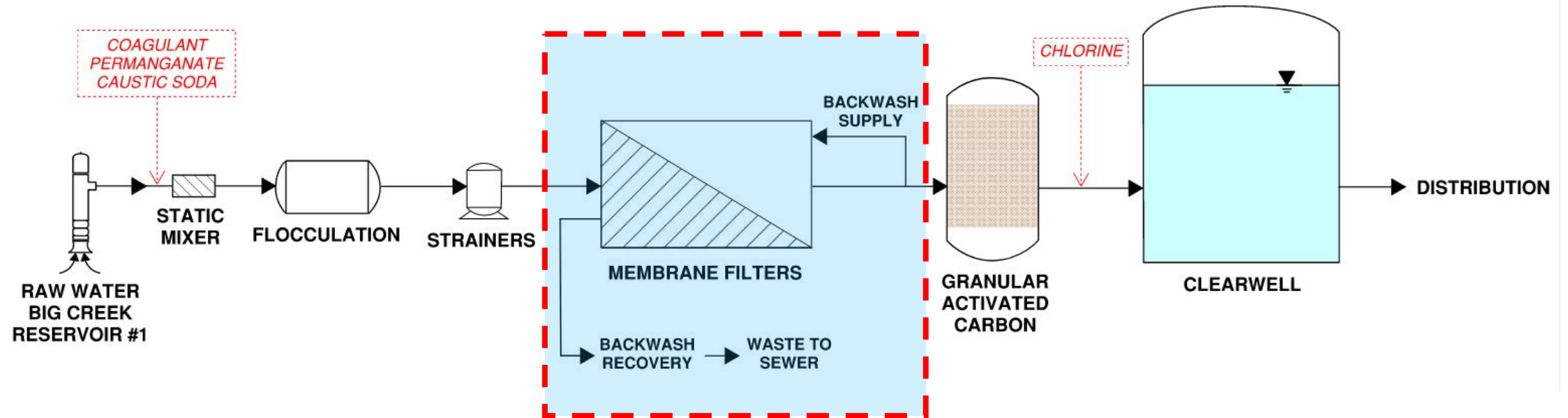


# Meet Newport, OR

- Population: 10,500
- Capacity: 7 MGD
- Serves residential, commercial customers and fish processing facilities
- Source: Big Creek Reservoirs
- Treatment: Membrane Filtration
- In operation since 2009



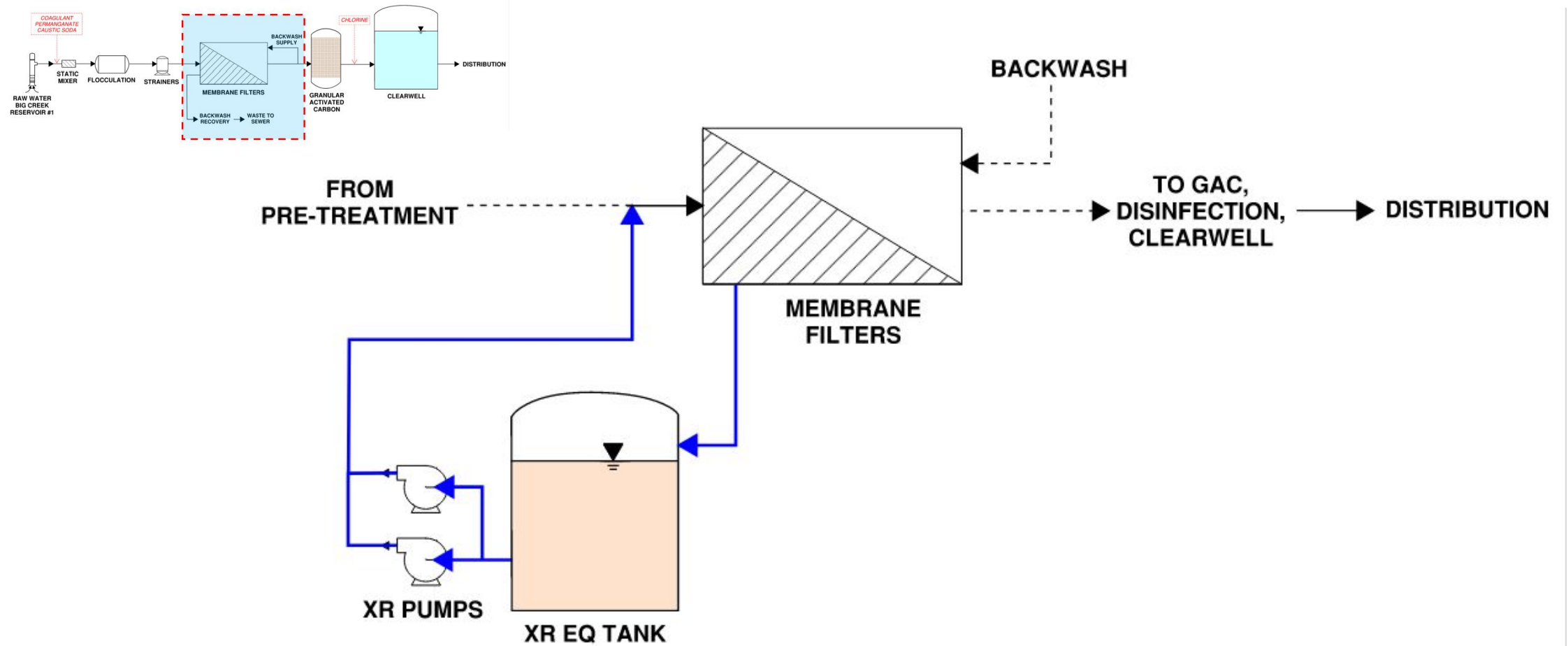
# Newport WTP Original Process Flow



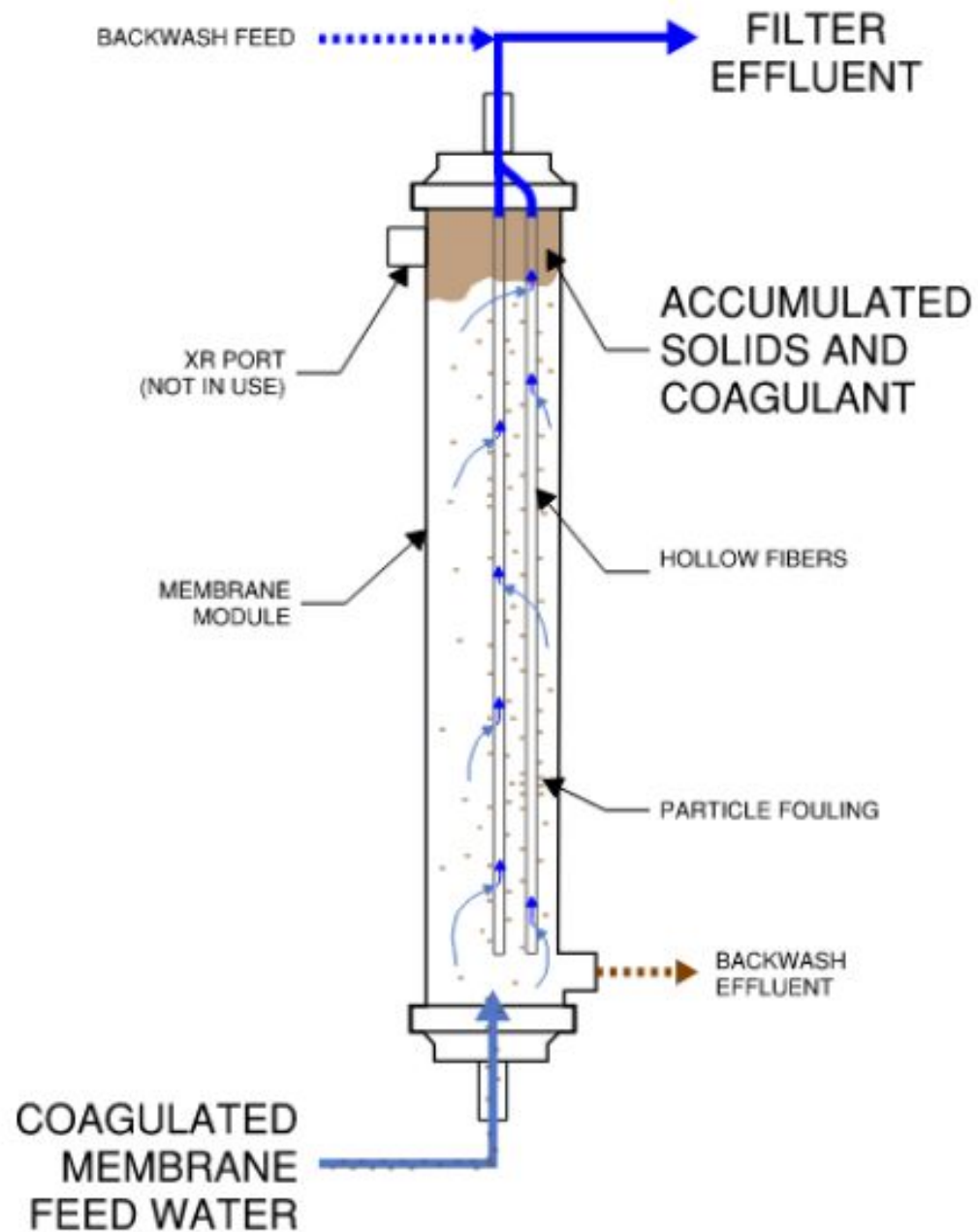
# Newport's Water Quality Challenges

- Summer 2020 – Unexpected reservoir stratification
  - Increase in organic matter and sediments
  - Higher coagulant doses and increased floc
  - Increasing membrane plugging
  - More frequent backwashing and maintenance cleaning of membranes
- Peak summer shortage and 13 days of heavy water restrictions
- Impacts on the local fishing and other industries, as well as homes and businesses
- Anticipate likely reoccurrence
- Original membrane plant design did not account for these unexpected organics loading events

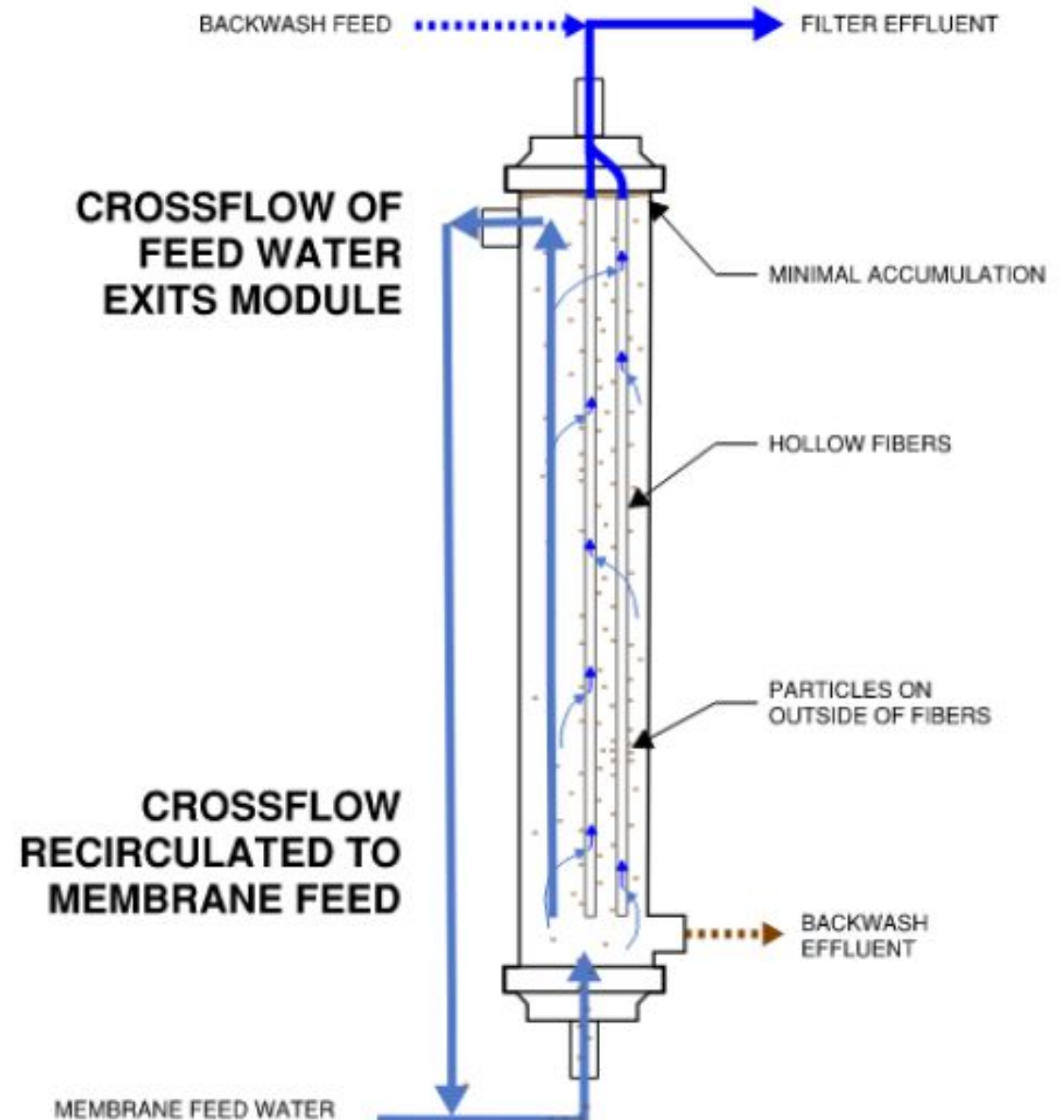
# Zoom in on Crossflow Recirculation



## DEAD END FILTRATION



## CROSSFLOW RECIRCULATION





# Dead End versus Cross Flow

## DEAD-END FILTRATION

### PROS

- ✓ Lower energy
- ✓ No recirculation (lower capital)
- ✓ Smaller footprint

### CONS

- ✗ More frequent back washing
- ✗ Continuous buildup on membrane
- ✗ More frequent chemical cleaning □ Higher O&M costs, more downtime
- ✗ Decreasing membrane flux

## CROSS FLOW RECIRCULATION

### PROS

- ✓ Reduce plugging
- ✓ More consistent system flux & TMP
- ✓ Reduced biofouling

### CONS

- ✗ Recirculation needed
- ✗ Higher energy required
- ✗ More wear on the membrane fibers

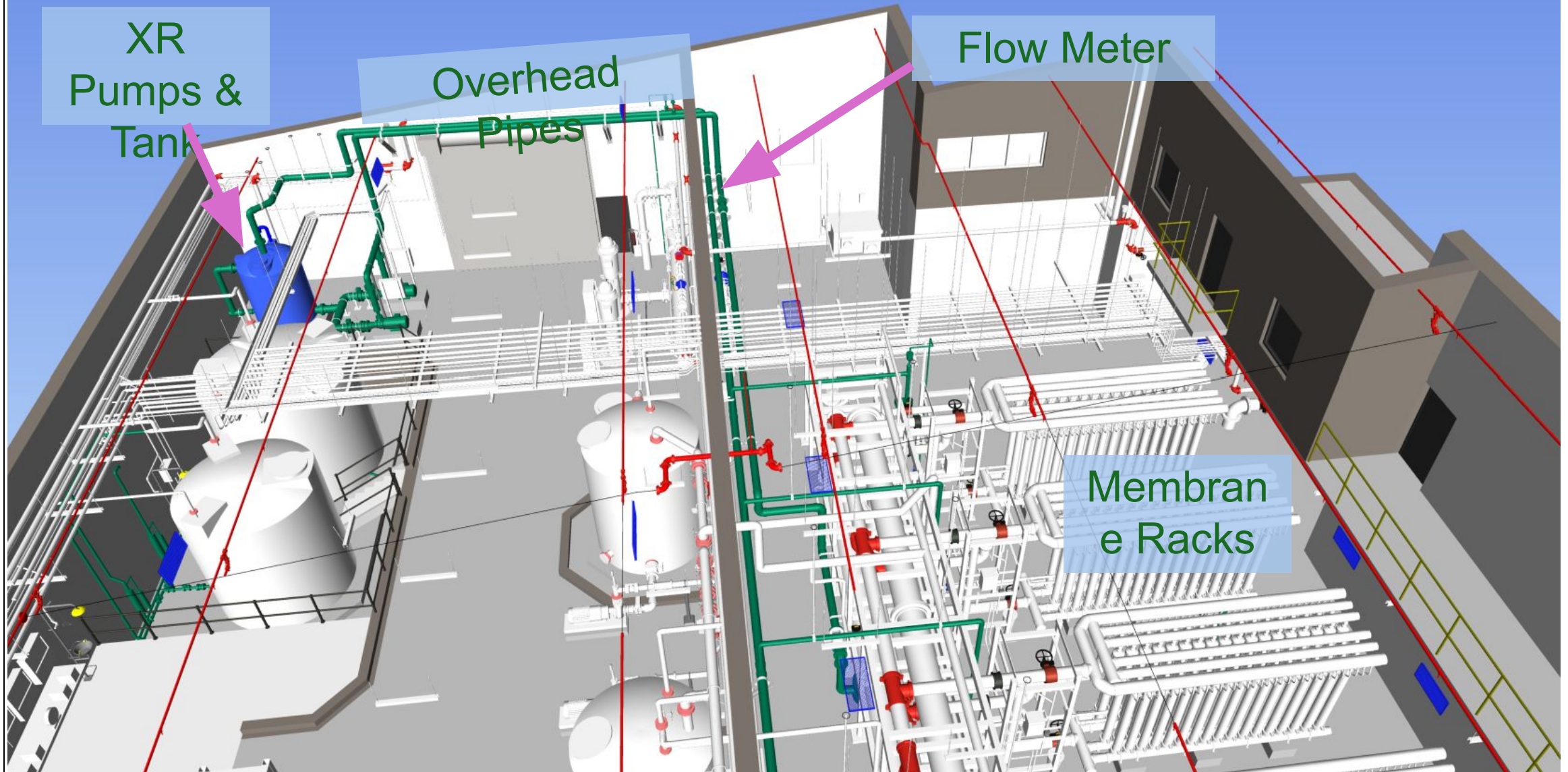


# Design Considerations



- Design Phase 2022 - 2023
- 630 gpm crossflow pumps (1+1) w/ VFD
- 1100-gal equalization tank
- Tie in location on feed line
- Use of existing hangars and conduit
- “Swing” rack tie in
  - (backwash recovery vs primary)
- On-rack installation of crossflow system
- Upgrade membrane solenoid controls
- Design Crowded building
- 3D scanning and modeling

# 3D Scanning and model





# Crossflow System Construction


- Emery & Sons, LLC – Contractor
- Aria Filtra® Supplied pumps and tank
- Crossflow tie in
  - CML feed pipe, could not hot tap
  - Custom flanged pipe spool
    - Epoxy lined and coated
- Use existing pipe trapeze supports and conduit
- 3d model may reduce RFIs
  - No pipe clashes
- Commissioning went well






# OHA DWS New Requirements

1. Limit to 3 gpm/module with crossflow recirculation
2. SCADA Calculations and Reporting
  - a) Continuous Log Removal Value ( $LRV_{\text{ambient}}$ ) report every 15 minutes on each rack
  - b) Direct integrity test
  - c) Upper pressure decay control limit
3. Shutdown membranes:
  - a)  $LRV_{\text{ambient}} < 4.0$  log removal
  - b) TMP
  - c) Direct Integrity test
4. Provide variables and constants for above calculations in SCADA for viewing
5. Update the O&M Manual with Crossflow System
6. New Reporting Form



PUBLIC HEALTH DIVISION  
Drinking Water Services  
Tina Kotek, Governor



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16 August 2023

[Contact]  
[Address]  
[CityStateZip]

*Sent via email and snailmail*

Re: **Implementing  $LRV_{\text{ambient}}$  indicator of membrane filter performance**  
**Introducing new membrane filtration monitoring [form](#)**  
**[PWSName] ([PWSShort])**

Dear [Contact]:

The Oregon Health Authority, Drinking Water Services (DWS) is furthering implementation of a new requirement to include a log removal value reflective of current – or “ambient” – operating conditions ( $LRV_{\text{ambient}}$ ). DWS previously relied only on a filter’s pressure decay rate from a membrane direct integrity test (DIT), sometimes called an air-hold test. However, this newly required performance metric is directly relatable to the *Cryptosporidium* log removal credit (LRC) granted to a membrane filter and is calculated continuously. It is expressed in terms of a log removal value (e.g., 4.0-log removal value = 99.99% removal).  $LRV_{\text{ambient}}$  is both more representative of current conditions and is expressed in the same units as the *Cryptosporidium* removal credit granted to the membrane filter (e.g., 4.0 log credit).

# Current Project Status

- Construction completed June 2024
- System performed well during remainder of Summer 2024
- Summer 2025 system performance to be confirmed





# Conclusion

- Source water can change. Providing flexibility and options during design should be considered for future proofing your system.
- Crossflow recirculation may benefit your plant.
- OHA may require additional operational changes.





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# Thank You!

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