When Membrane 1.0 isn't enough, time to change to Membrane 2.0!

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Parker County Special Utility District

South Central Membrane Association
2021 Virtual Conference

Solving Membrane Operation & Management Challenges

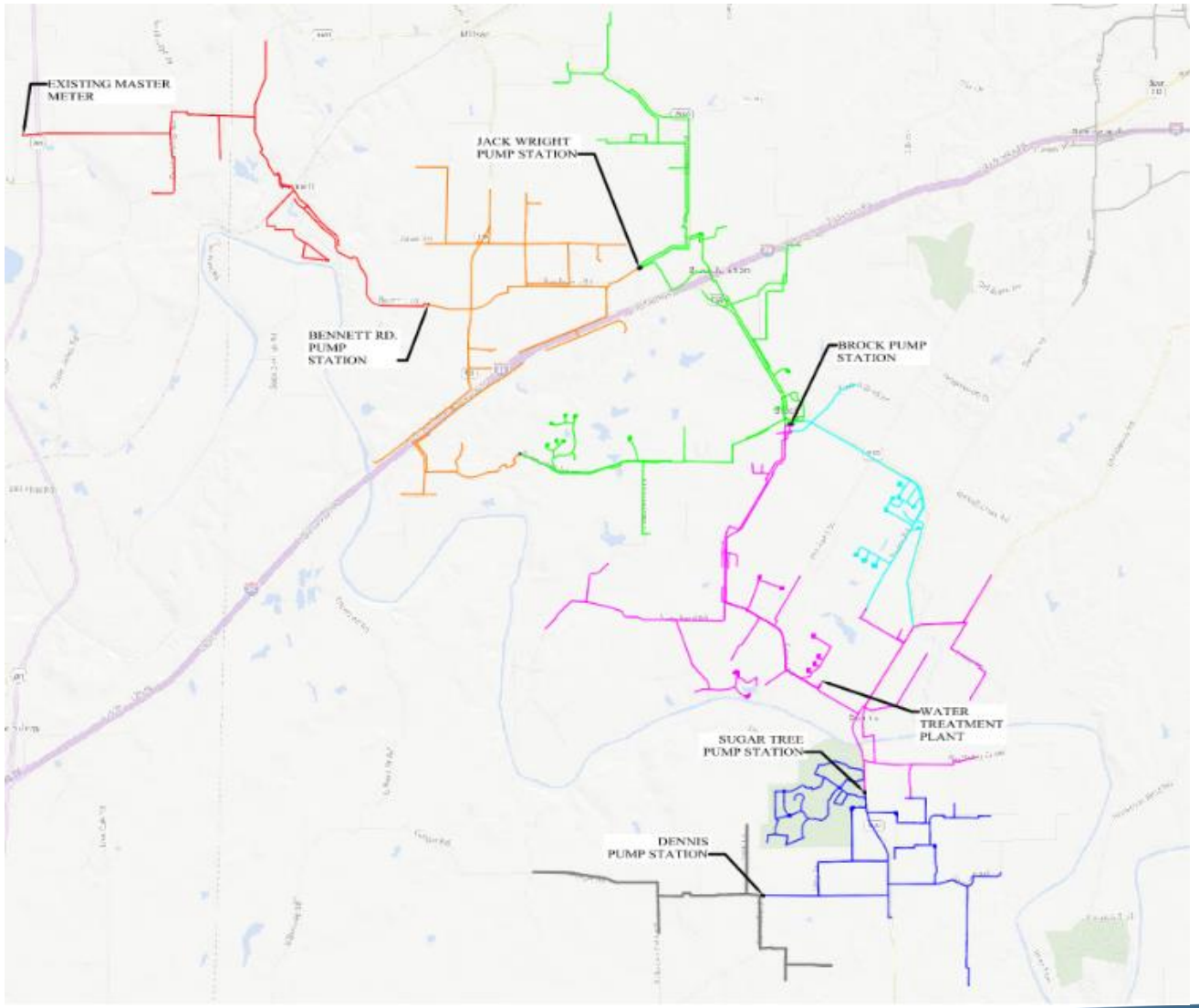
August 25th - 26th

Presentation Topics

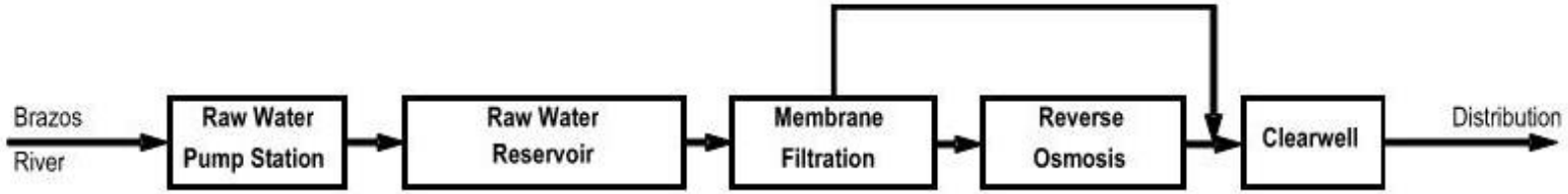
- Background on Parker County SUD Water System
- Historical Treatment Challenges
- Corrective Actions Considered
- Advanced Membrane Filter Pilot Testing Observations
- Project Path Forward and Next Steps
- Final Thoughts

Background on Parker County SUD Water System

- Rural Water System
- Currently approx. 1,900 connections
- Surface Water (Brazos River) and Groundwater (Upper Trinity)
- 1.0 MGD Treated Surface Water
- 0.4 MGD Wholesale Water Purchase (Mineral Wells)



Background on Parker County SUD Water System



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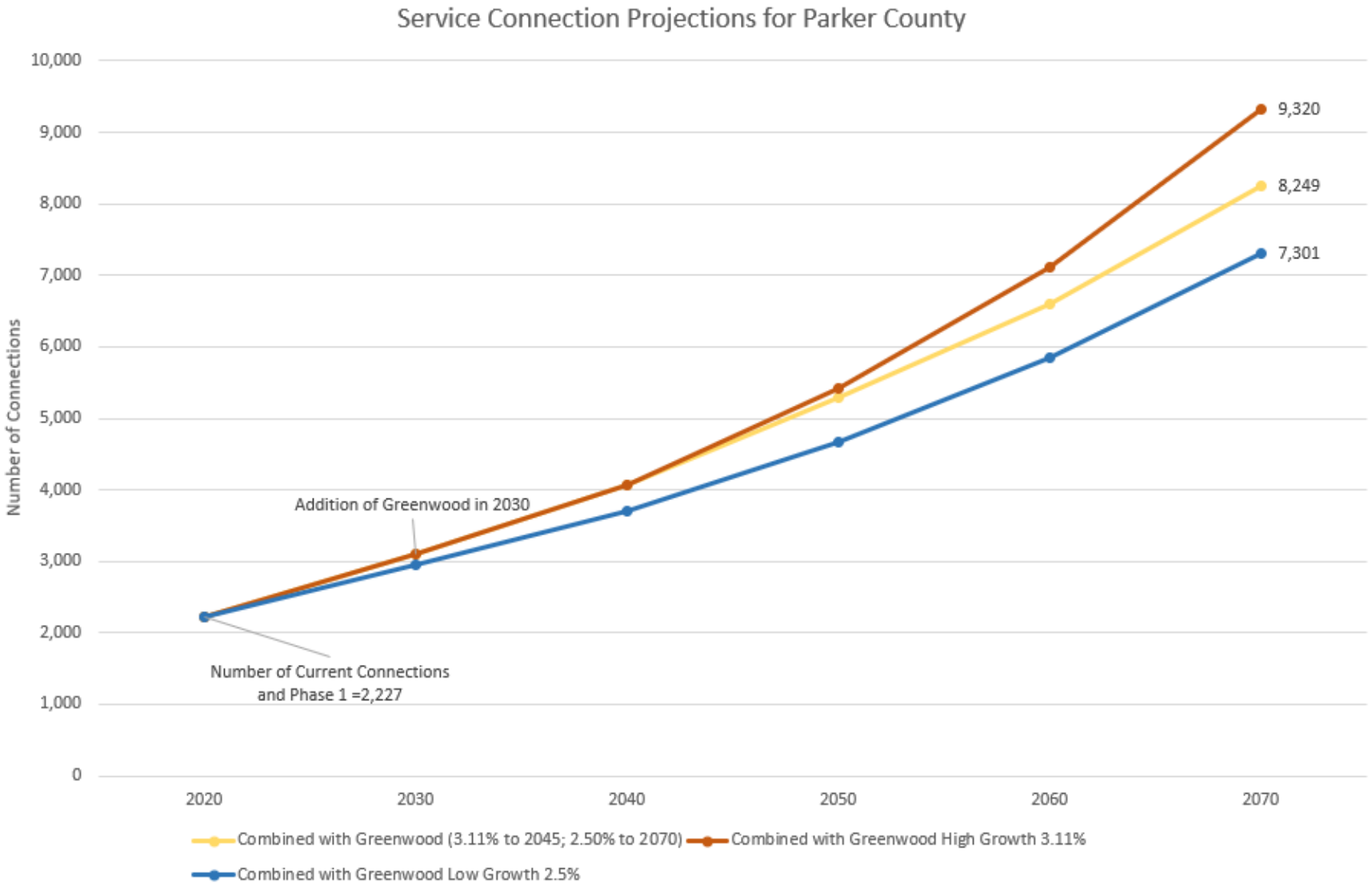


Historical Treatment Challenges

Flux
Design – 52 gfd
Actual - <25 gfd

Only Permeate Storage to Complete 1 Low or High pH Clean for 1 Train

No strong oxidant pretreatment

Paper Capacity – 1.0 MGD

Actual Capacity – 0.6 MGD

Significant Mn Concentration Due to Internal Plant Recycle

No coagulant or other pretreatment

2 MF trains
1 RO train

Corrective Actions Considered

Improve Pretreatment

- Implement strong oxidant in raw water (ClO_2, $KMnO_4$, H_2O_2)
- Implement coagulant (iron- or aluminum-based coagulant)
- Implement clarification pretreatment

Improve Operational Flexibility

- Install 2nd RO train
- Install additional RO permeate storage
- Maintain total chlorine through RO to reduce biofouling

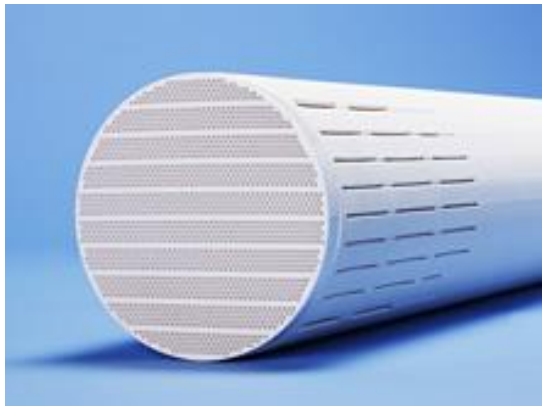
Increase MF Capacity

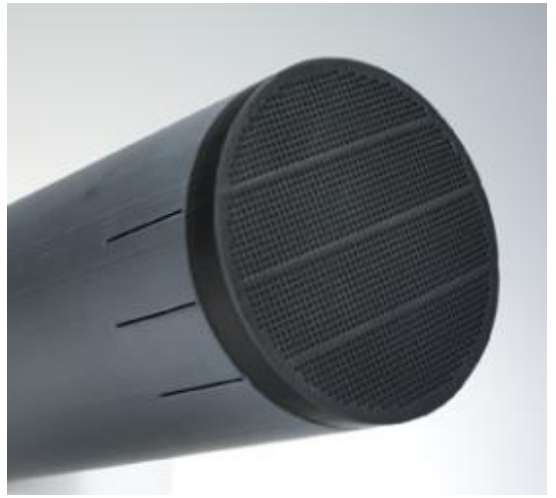
- Increase sustained flux in existing MF trains
- Install additional MF trains
- Test performance of more advanced MF technology

Corrective Actions Considered

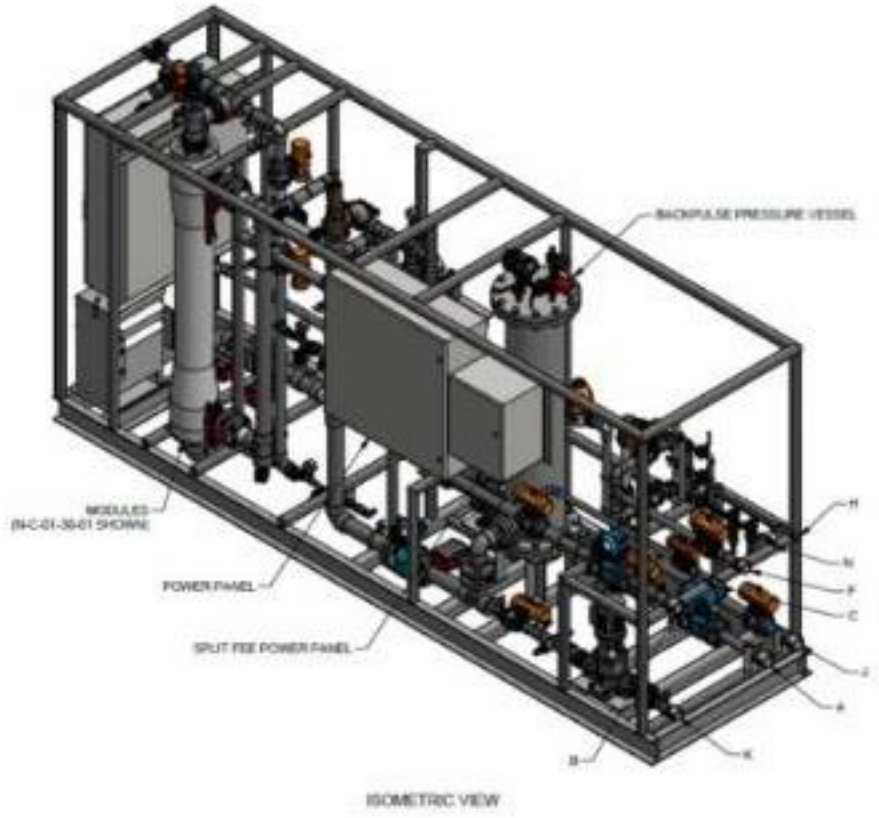
Evaluation of Potential Advanced Membrane Technologies

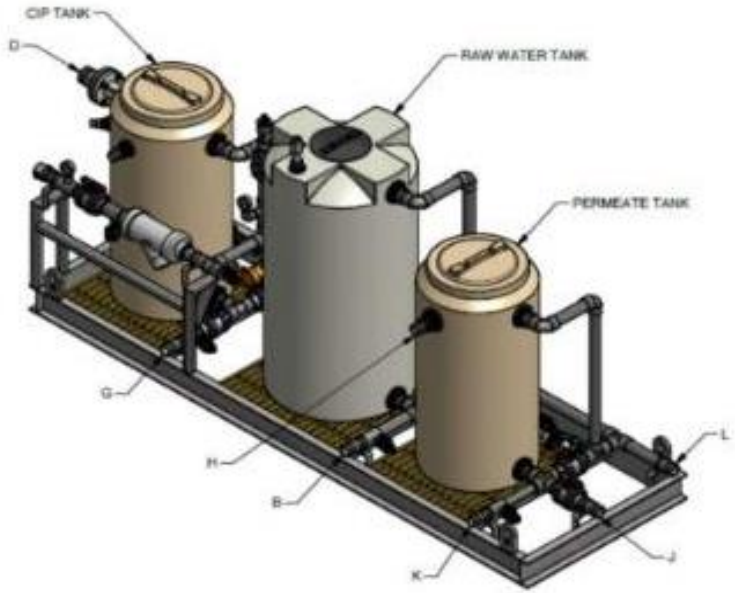
- Consideration of Ceramic Options
  - "Monolithic" Ceramic Membranes
    - Flux – 150-250 gfd
    - Challenge Testing Not Yet Approved by TCEQ (potentially up to 6.5-log LRV)
    - No surface installations yet in Texas
  - "Segmented" Ceramic Membranes
    - Flux – 100-150 gfd
    - Challenge Testing Approved by TCEQ – 5.31-log LRV
    - Two full-scale surface installations in Texas





Advanced Membrane Filter Pilot Observations





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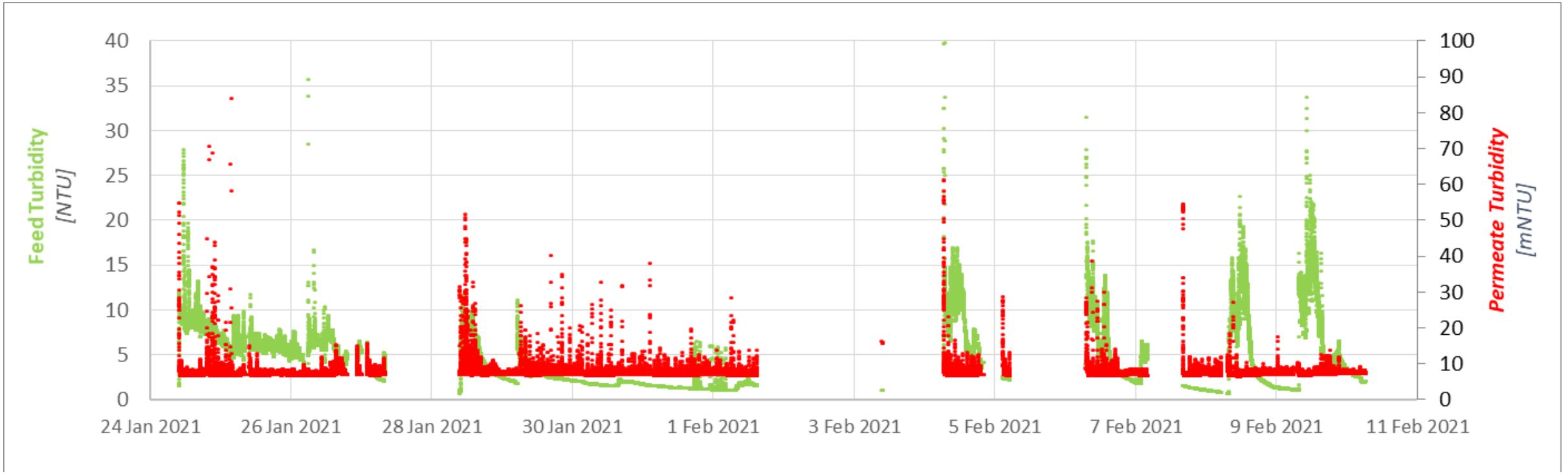

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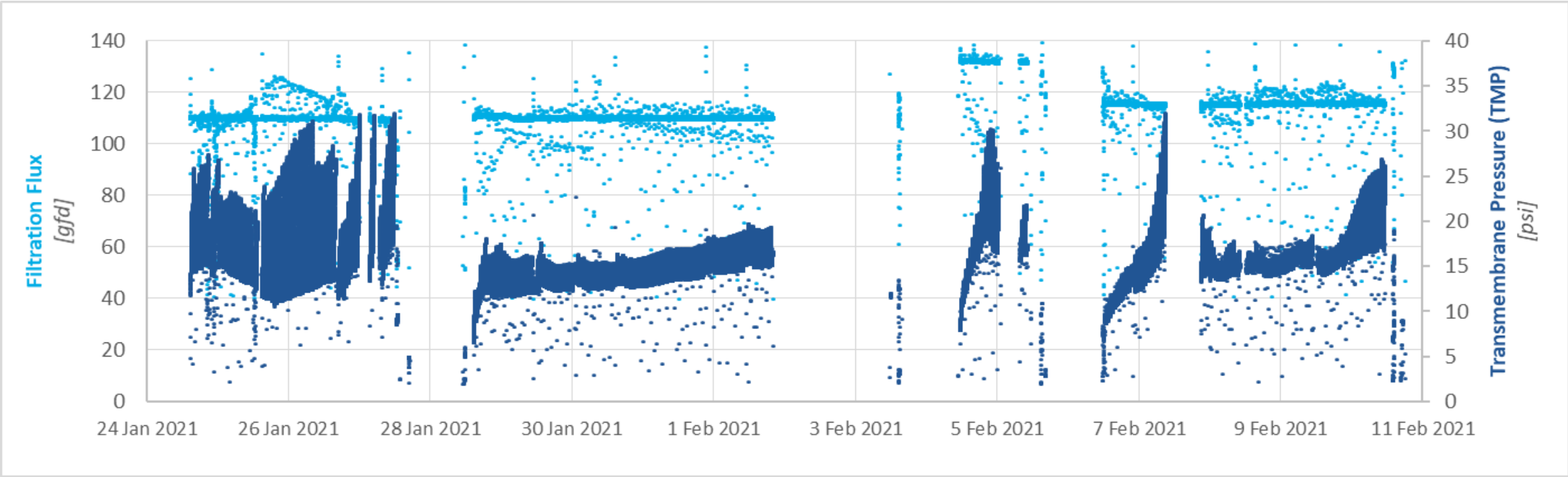

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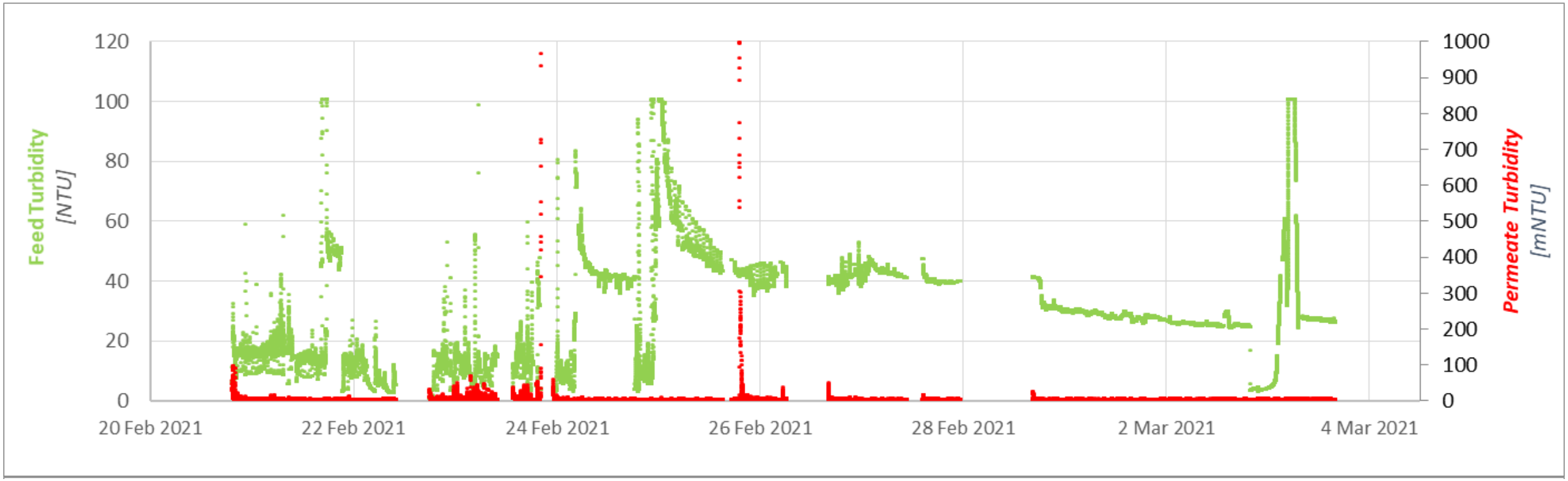

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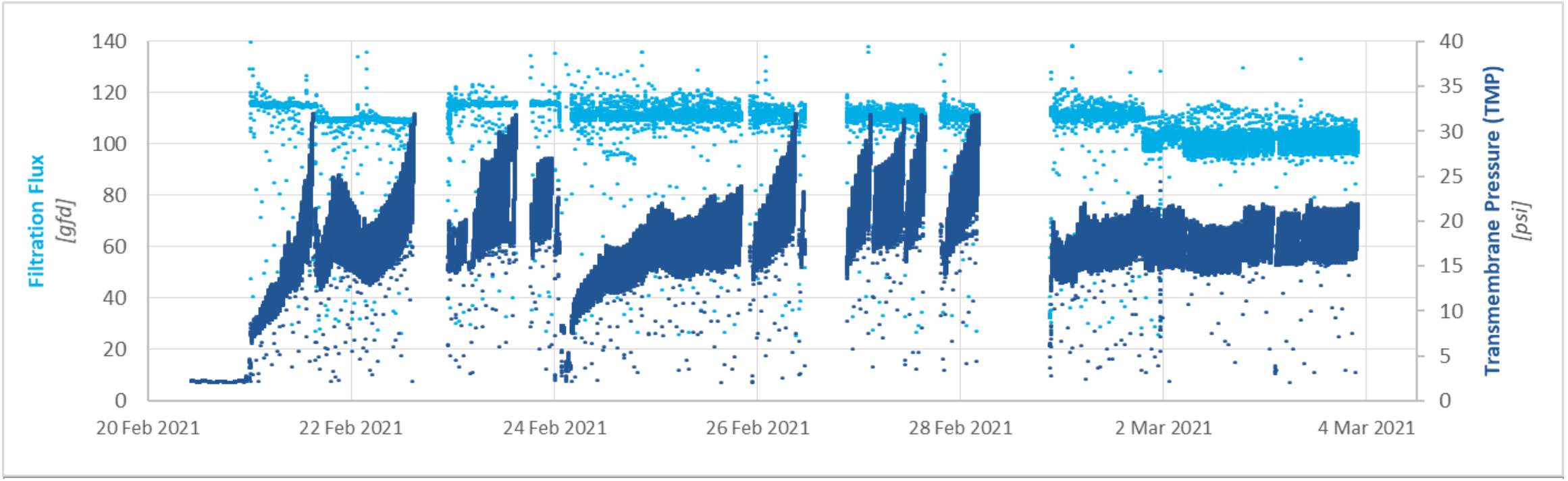

Advanced Membrane Filter Pilot Observations

Final Observations

- Filtered Water Turbidity – Consistently < 0.03 NTU regardless of raw water turbidity
- Flux – Sustained at 100-115 gfd, without strong oxidant in raw water (significant colloids and organics)
  - Anticipated Future Pretreated Flux (with strong oxidant) – 125-150 gfd
- Backwash Requirements
  - Backwash rate approx. 2.5x design flow, for 30-60 second bursts
- Transmembrane Pressure (TMP) vs Feed Pressure
  - TMP range comparable to polymeric MF systems
  - Feed pressure range also comparable to polymeric MF systems

Summary – Opportunity for Both New Systems and Retrofits

Project Path Forward and Next Steps

- Now
  1. Coordinate with TCEQ to work toward obtaining exception approval for ceramic MF system in future Phase II WTP improvements project
  2. Implement new ClO2 system, new RO Train #2, new coagulant addition, and new operational improvements as part of Phase I WTP improvements
     - Restore original 1.0 MGD WTP capacity and expand to 2.0 MGD
- Future
  1. Upgrade membrane filtration system to ceramic technology and further expand WTP to 3.0 MGD in future Phase II WTP improvements project

Final Thoughts

- The District's original MF system could not sustain full-scale performance observed during initial 2010 pilot testing (25 gfd vs 52 gfd)
  - Even with additional modules installed, WTP could not produce the 1.0 MGD it was originally rated for
- With increasing growth in the service area, the District's WTP needs to be expanded to 2.0 MGD today, 3.0 MGD tomorrow, and even further beyond
  - The existing WTP cannot be expanded beyond 3.0 MGD if continuing to use the existing MF technology
- Pilot testing of a new segmented ceramic MF system reflected an achievable flux of 100-150 gfd, or 3-4x the capacity in the same footprint
  - A future ceramic MF system also comes with a longer full replacement membrane warranty, upwards of 20+ years

Questions?