West Side WTP Bench and Pilot Study – Process Selection and Evaluation



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5/7/2026

Washington County Water Conservancy District (WCWCD)

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- 🏞️ Background
- 🧪 Bench Test and Process Selection
- ⚙️ Piloting Operations
- ✅ Compliance
- 📊 Summary

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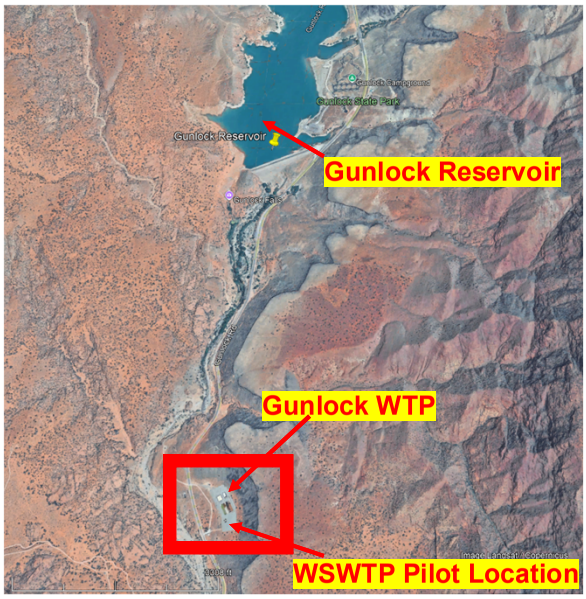
Background

Gunlock Reservoir is a reliable raw water source for a greenfield 15 MGD WTP

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Source Water - Gunlock Reservoir





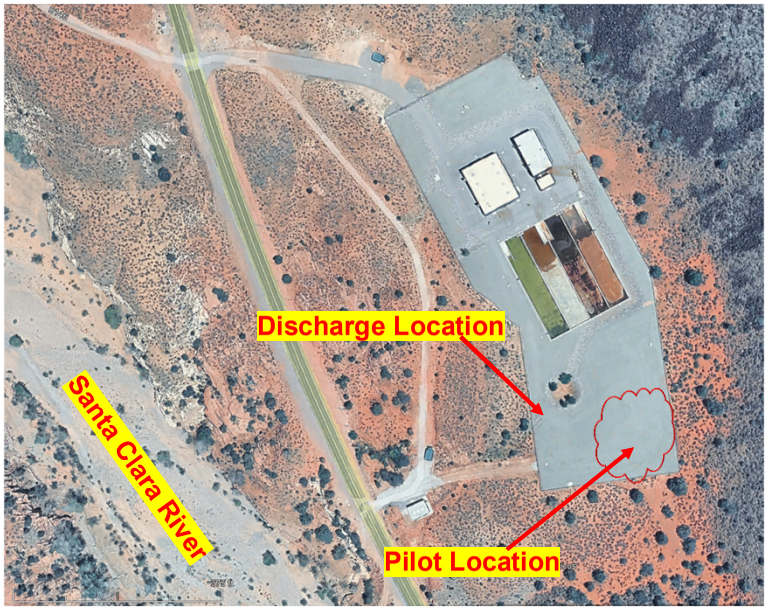


Hazen

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Pilot Location: Gunlock WTP







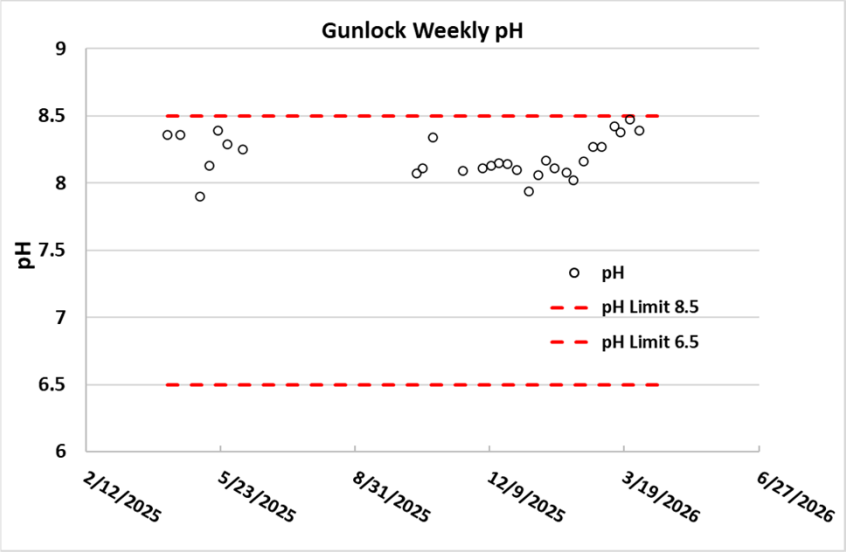


Hazen 5

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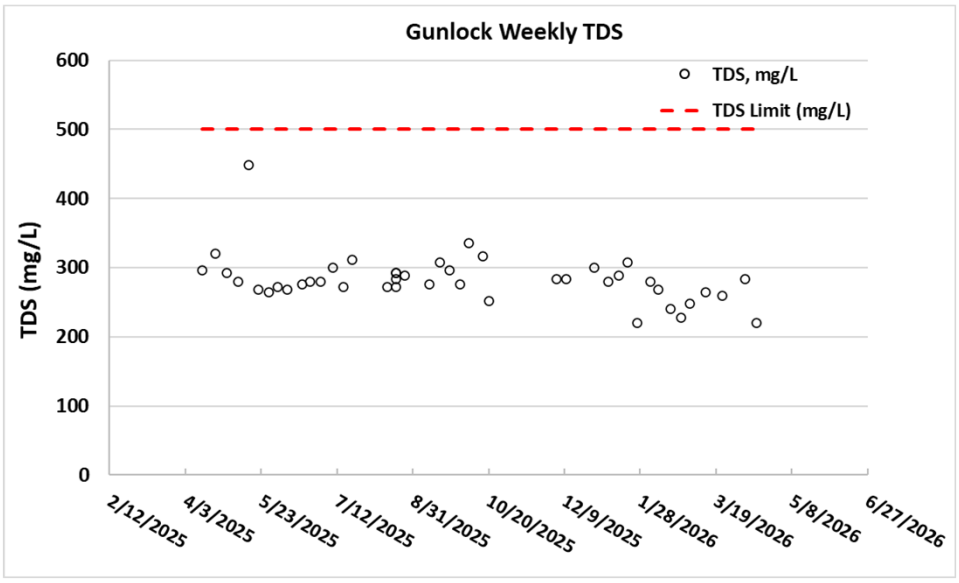
Gunlock Reservoir WQ – Weekly

pH ranges between 7.9 and 8.5, while TDS remains steady at approximately 300 ppm.



Hazen 6

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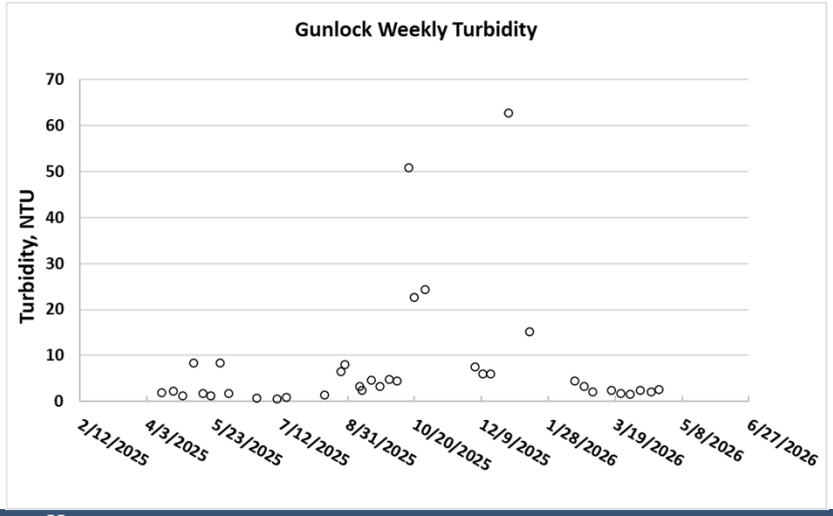


Hazen 7

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Gunlock Reservoir WQ - Weekly

Turbidity can be flashy, with TOC doubling after the Forsyth Fire in June 2025 and associated runoff in October.



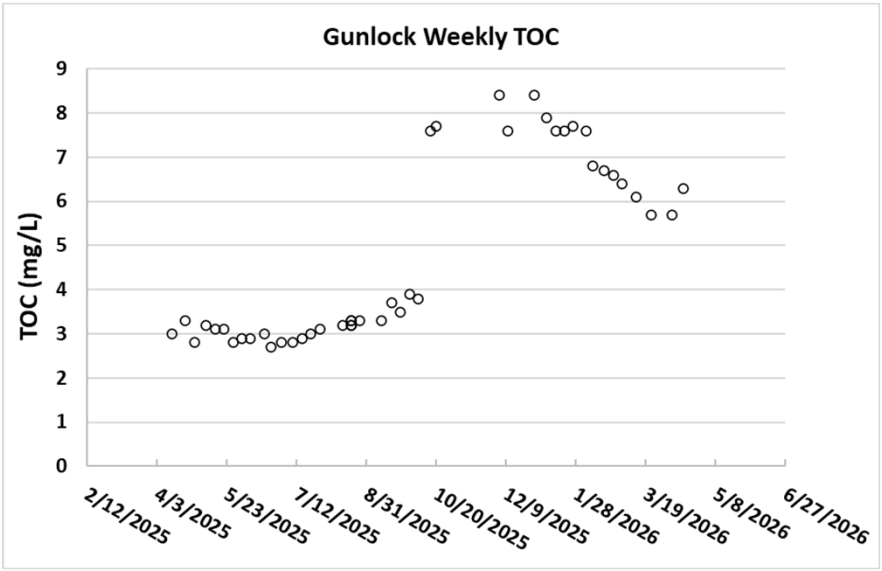




https://kslnewsradio.com/environment-outdoors/utah-firewatch/forsyth-fire-growth/2223624/

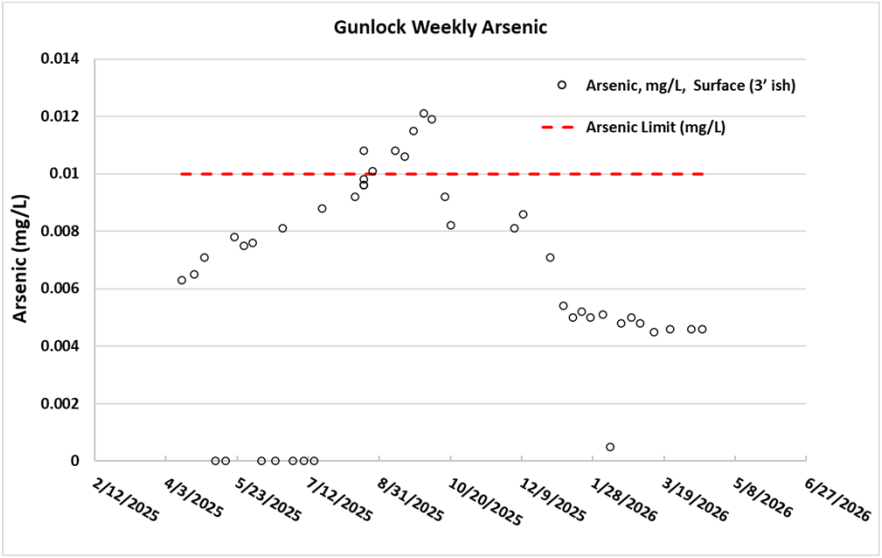
Hazen 8

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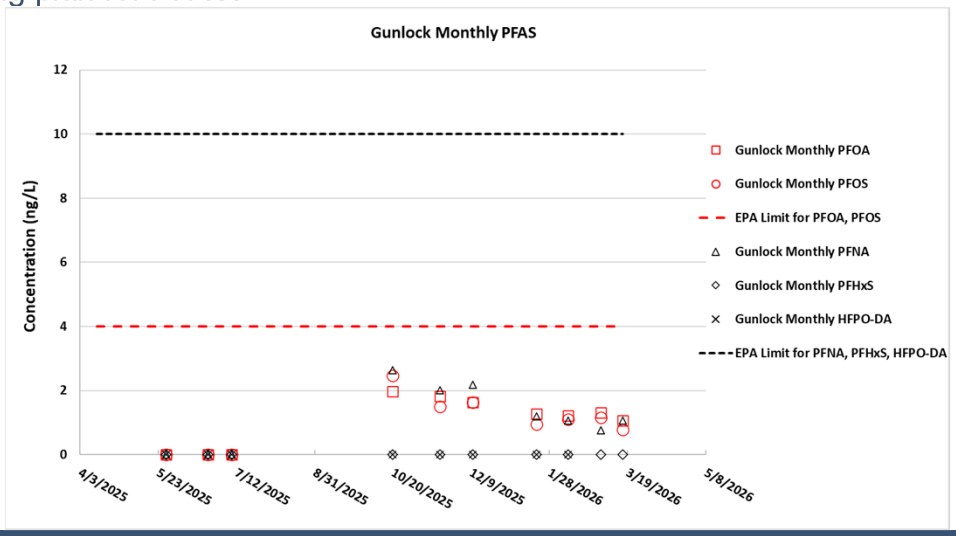
Groundwater used to supplement Gunlock Reservoir in late summer cause arsenic levels to fluctuate.



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Gunlock Reservoir WQ – Monthly

PFAS was detected due to wildfires and runoff in 2025 – Developed a watershed monitoring plan for PFAS.



Hazen

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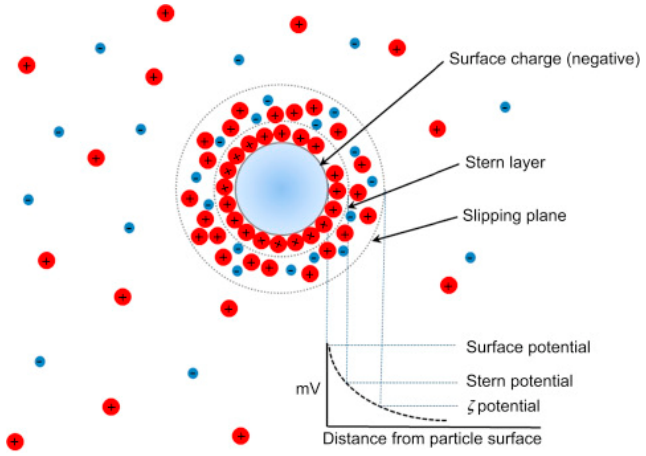
Bench Test and Process Selection

Zeta titration & jar test

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Zeta potential – Electrical Double Layer



Zeta potential (ζ [=] mV)	Colloid stability
0 to ±5	Rapid agglomeration
±10 to ±30	Incipient stability
±30 to ±40	Moderate stability
±40 to ±60	Good stability
>±60	Excellent stability

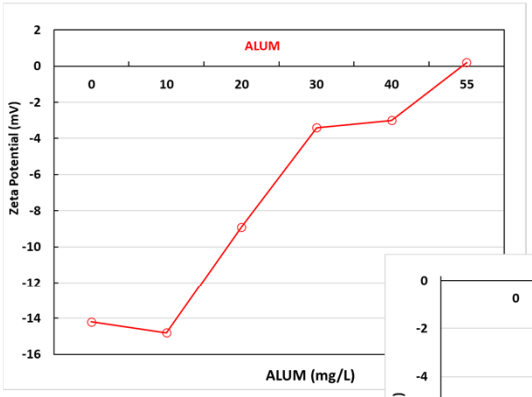
Zeta potential is the electric potential at the slipping plane relative to a point in the bulk medium.

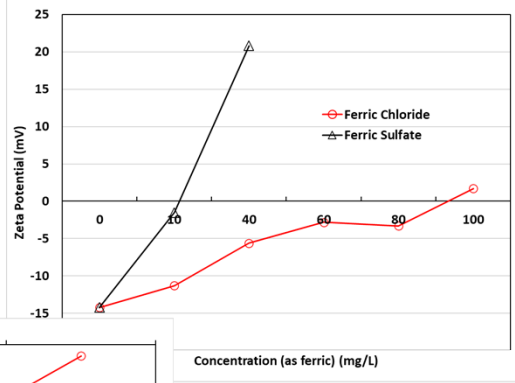
K. Pate, P. Safier, Advances in Chemical Mechanical Planarization (CMP) 2016, Pages 299-325

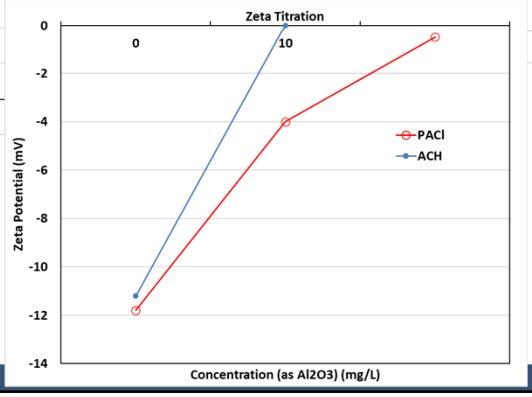
Hazen 13

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Seasonal Zeta Titration



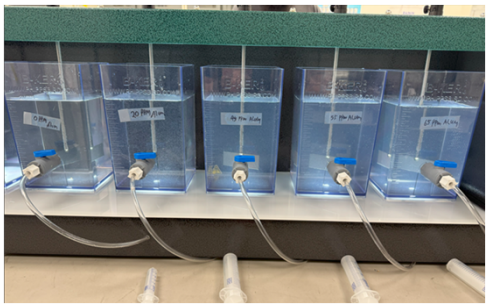


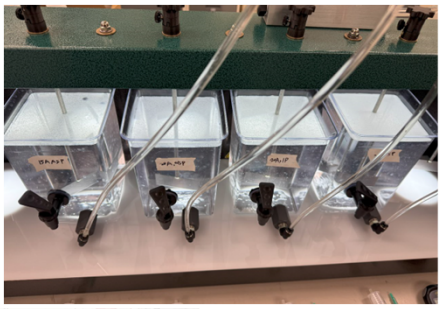


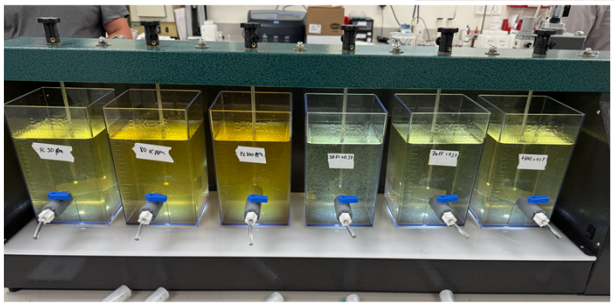
Hazen 14

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Seasonal Jar test

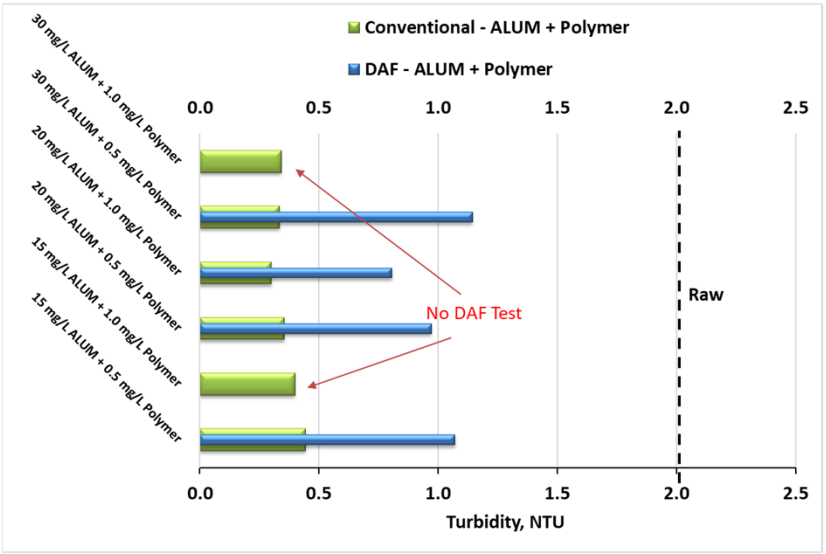






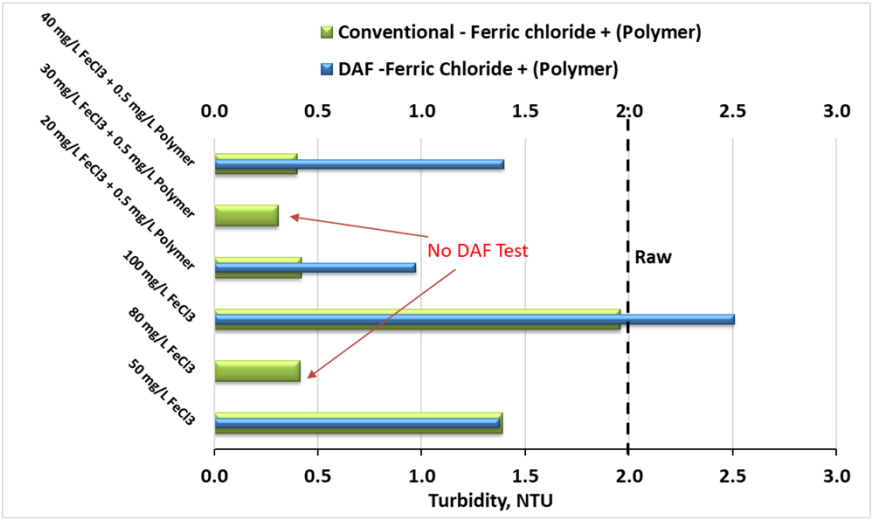
15

Jar test Example



ALUM in DAF outperforms sedimentation, while ferric shows opposite trends.

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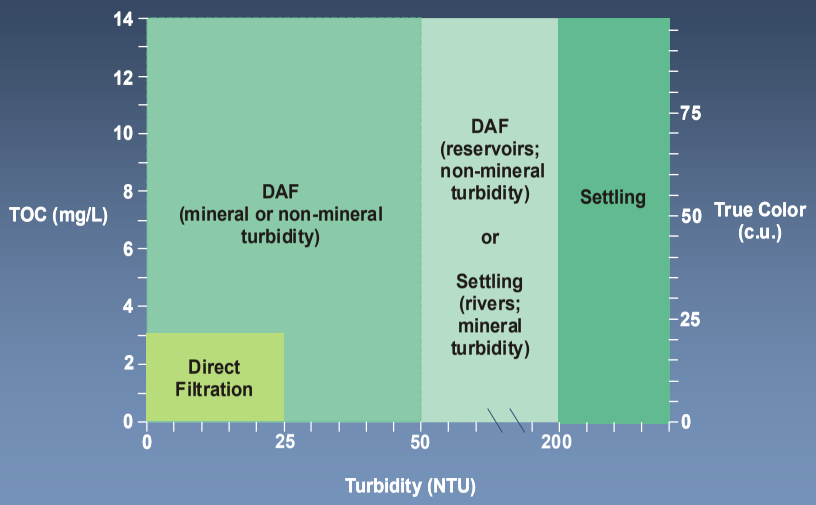


TOC removal varied from 23% to 30% (Graphs not shown here).

Hazen 17

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Treatment Process Selection Guidelines (Maximum)

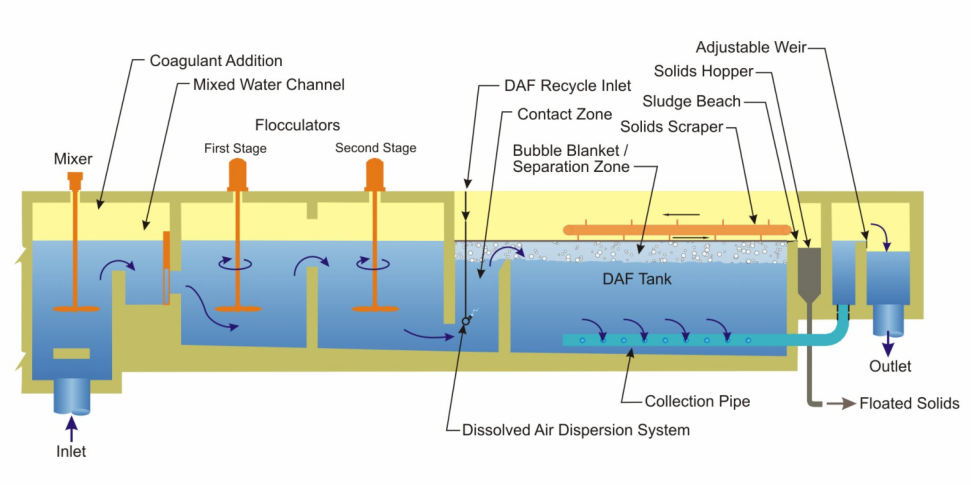


Valade et al., Sept 2007, DAF Conference, Korea

Hazen

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Process Elements of a DAF Tank



Hazen

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Hazen innovates DAF

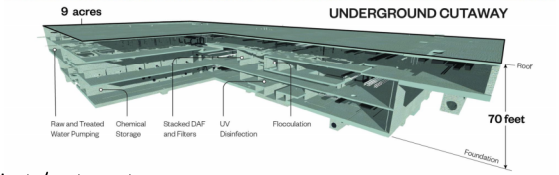
Hazen 75 YEARS

Stacked Dissolved Air Filtration/Flotation (DAFF) - NYC's First Water Filtration Plant: 290-mgd Croton WTP in 2015









https://www.hazenandsawyer.com/projects/croton-wtp

Hazen

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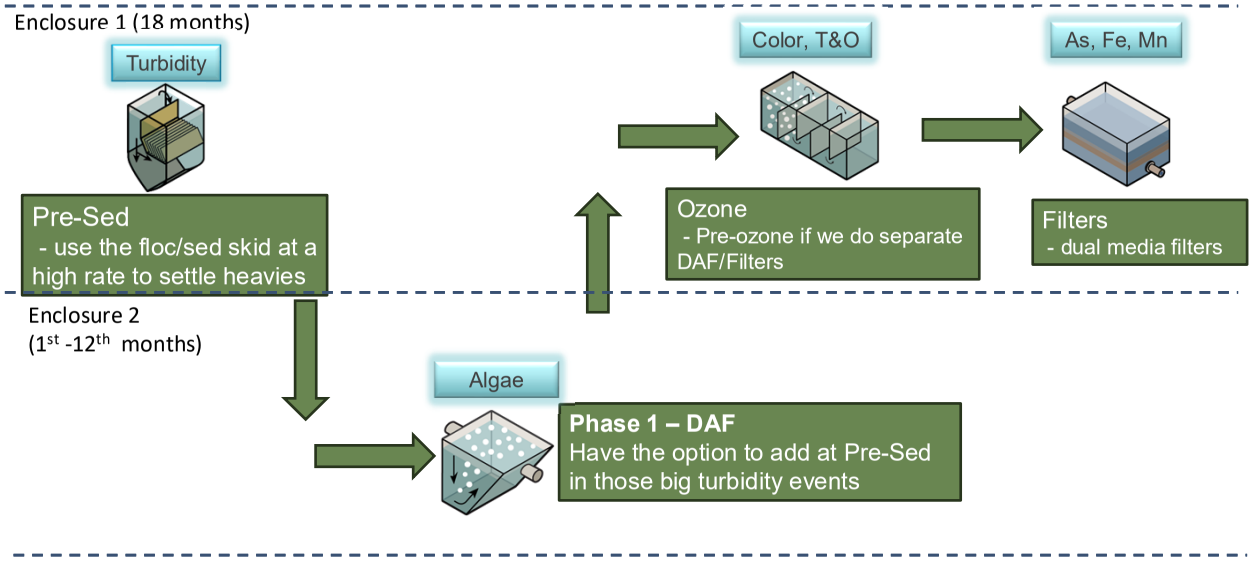
Piloting Operations

Phase I is ongoing

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Phase 1 Pilot Test Treatment Configuration - Ongoing

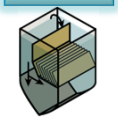


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Phase 2 Pilot Test Treatment Configuration – November 2026

Enclosure 1 (18 months)

Turbidity

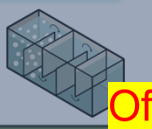


Convert Pre-Sed to Floc/Sed

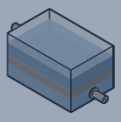
- Use the floc/sed skid at 0.25 gpm/sf to provide enough flow to the UF skid

Color, T&O

As, Fe, Mn



Offline

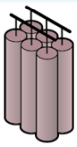


Ozone
- intermediate ozone if we do separate DAF/Filters

Filters
- dual media filters

Enclosure 3
(Possible 13th -18th months)

Algae



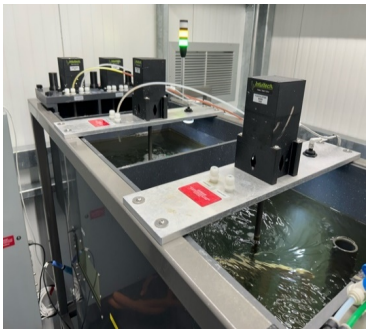
Phase 2 – UF
- Membranes could be beneficial given the flashy source

As, Fe, Mn, Color, T&O

GAC
- (not piloted)

Mn removal
- (not piloted)

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Hazen 24

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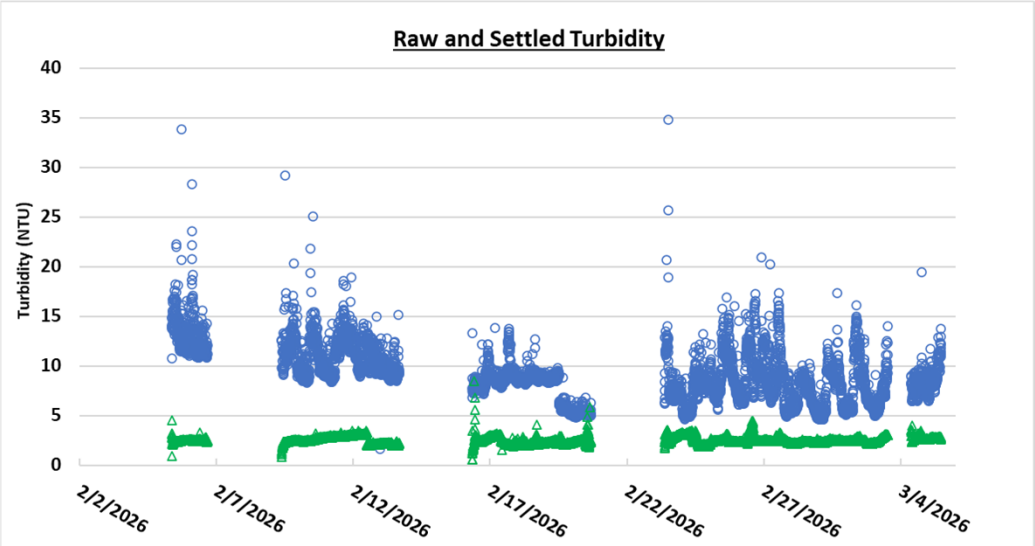
DAF

Ferric VS aluminum-based (ALUM, ACH, PACl) coagulants + Polymer

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Due to mechanical issues with the DAF skid, ALUM + polymer achieved only limited turbidity removal.

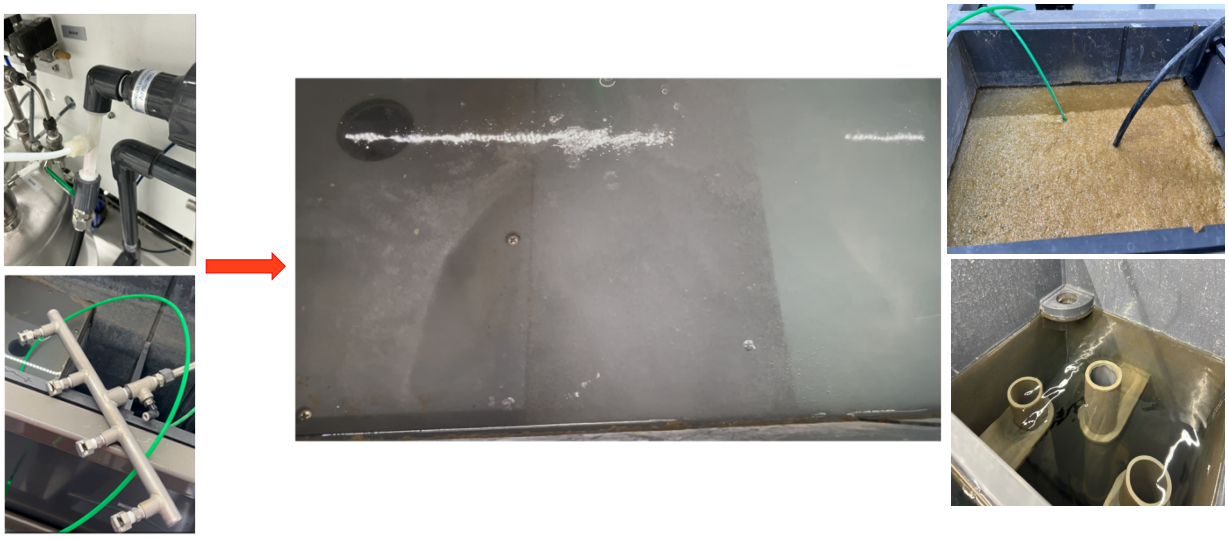


Hazen

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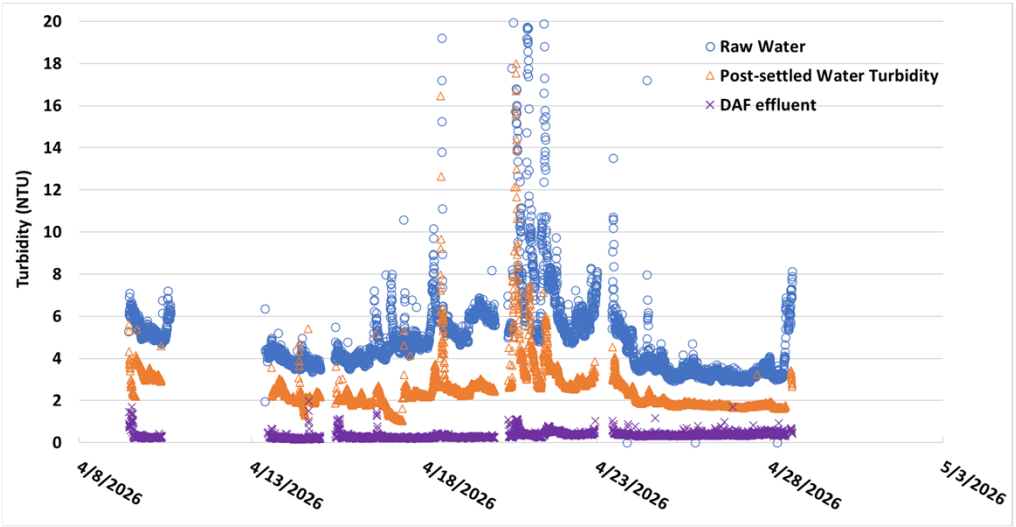
DAF Adjustment significantly improved white water efficiency



Hazen 27

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PACl, ACH with low polymer dose drive clarified turbidity below 0.3 NTU



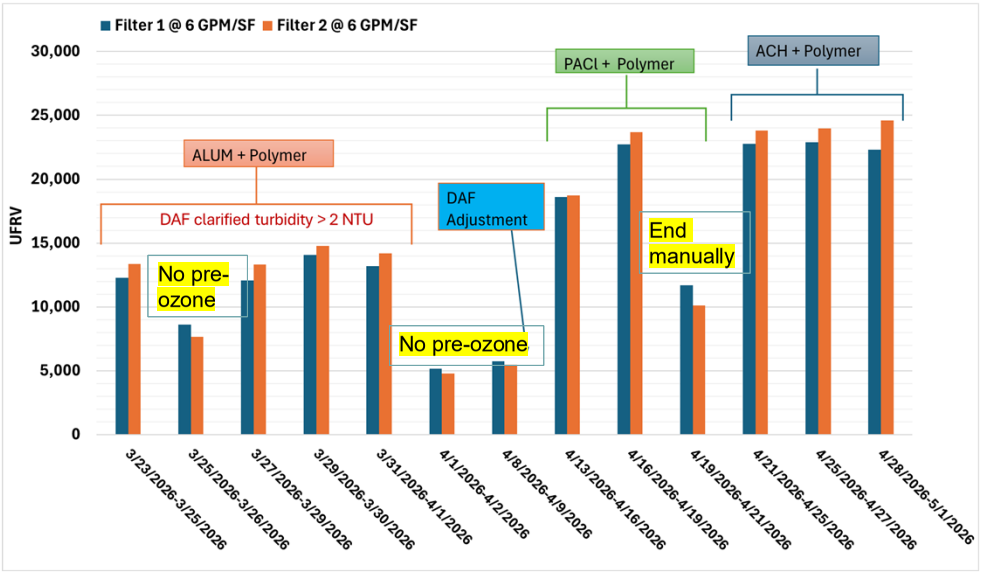
Note:

1. 3 ppm PACl (as Al_2O_3) + 1 ppm polymer (4/9/26 - 4/19/26); 2 ppm as ACH + 1 ppm polymer (4/21/26 - 4/28/26)
2. Pre-ozone – 0.5 ppm after 1 minute contact time.
3. Raw water turbidity spiked on 4/20/26 did not cause process upset.

Hazen 28

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UFRV – 6 GPM/SF



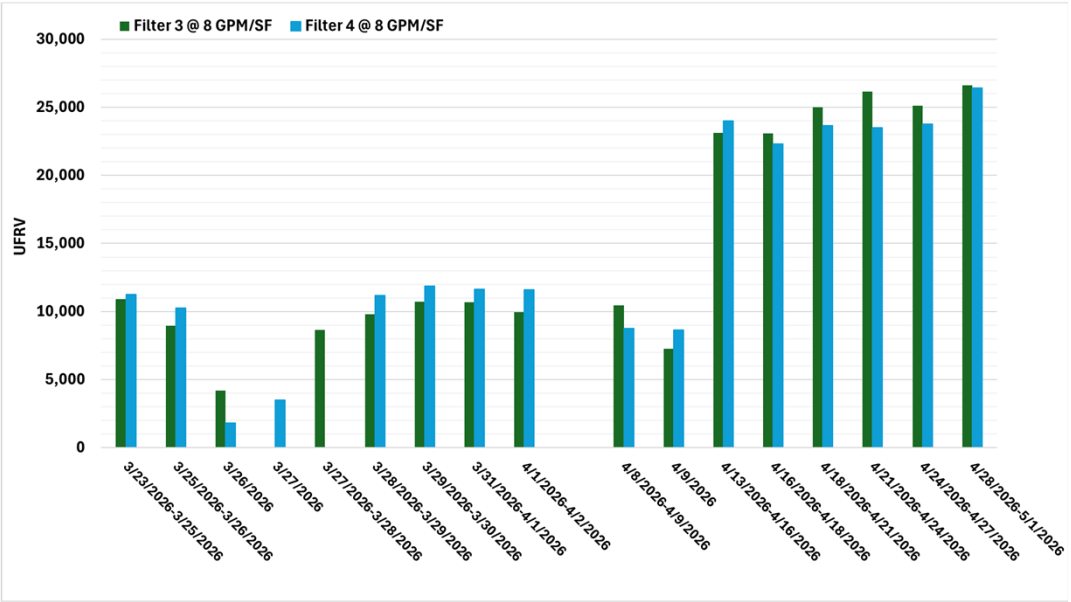
Note:

1. Filter run was reset on 4/9/26 due to power cycle of the skid.
2. Ended run early for PACl + polymer on 4/21/26 to start a new run with ACH + polymer.

Hazen 29

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UFRV – 8 GPM/SF



Note:
ALUM + Polymer will be re-tested after DAF adjustment.

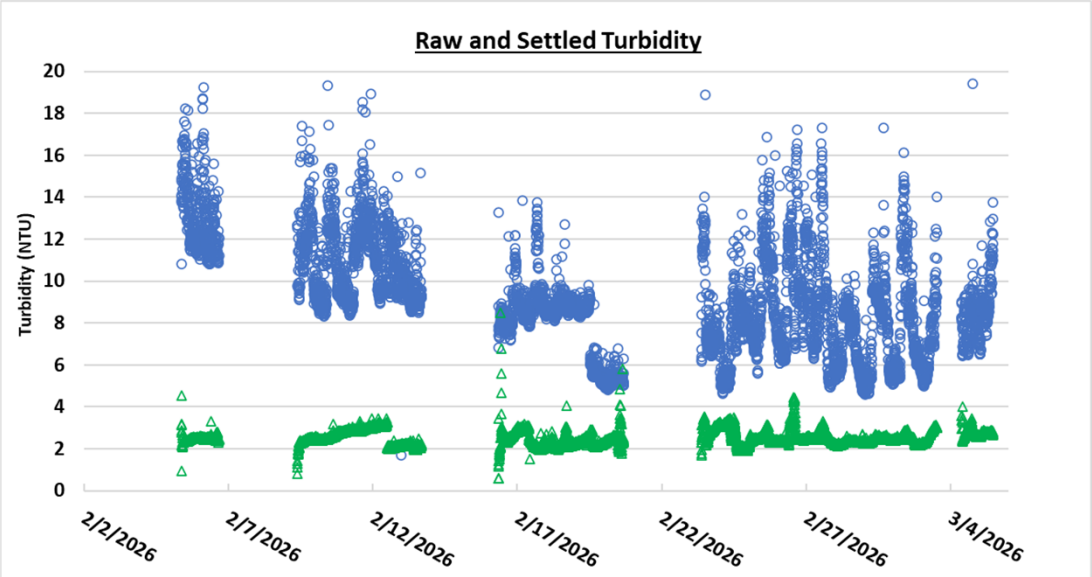
Hazen 30

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Conventional C/F - Ferric

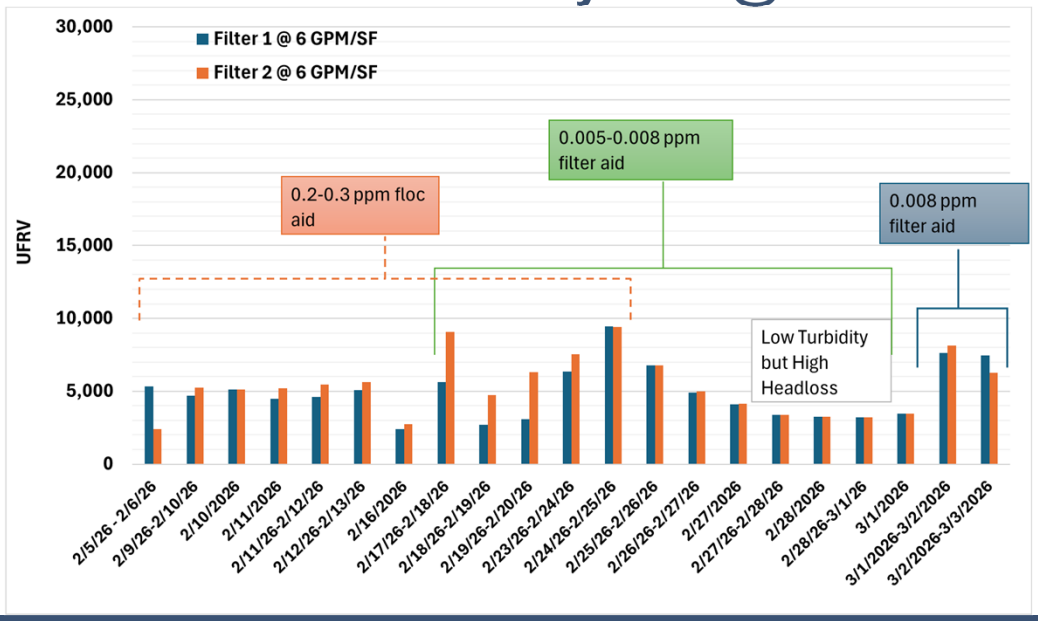
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Conventional C/F with ferric + polymer



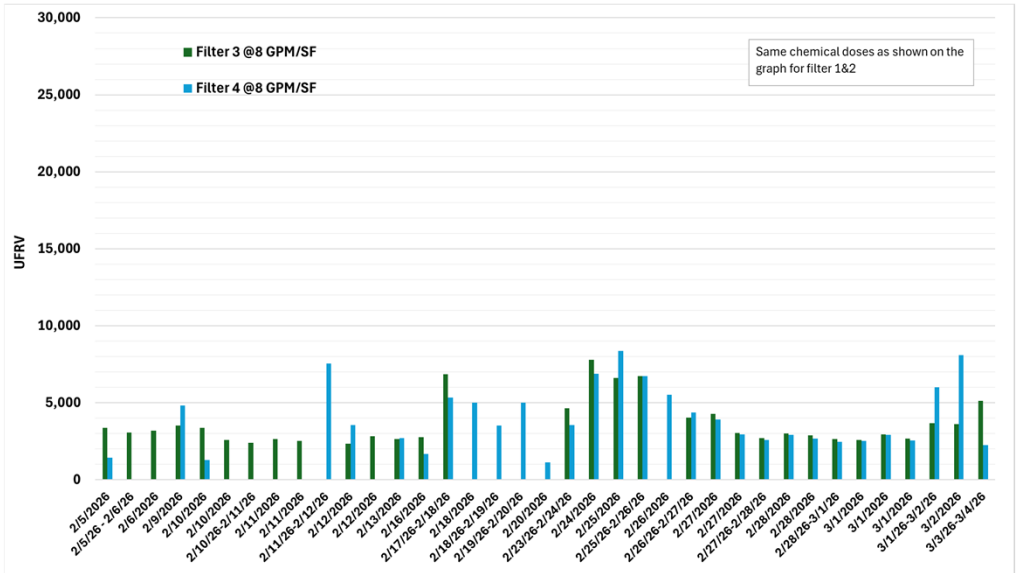
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UFRV – Ferric + Different Polymers @ 6 GPM/SF



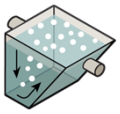
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UFRV – Ferric + Different Polymers @ 8 GPM/SF



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UFRV comparison



Up to 27,000



Up to 9,000

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Compliance

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- Currently operating under a general discharge permit (UTG640055) with daily sampling requirements;
- An individual permit application is in progress to reduce the sampling burden (much harder to obtain than a general permit).

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Summary

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- Gunlock Reservoir serves as a reliable raw water source for the new 15 MGD WTP.
- DAF outperforms conventional treatment, achieving >26,000 UFRV.
- Aluminum-based coagulants (ALUM, ACH, PACl) show high effectiveness and resilience to turbidity spikes.
- Pre-ozonation before DAF notably enhances filterability.

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Next Steps

Phase I

- Select coagulant: ALUM, ACH, or PACl?
- Enhance TOC removal
- Conduct SDS testing

Phase II

- UF implementation in November 2026

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Acknowledgements

Key Contact Name	Organization	Project Role
Randy Johnson	WCWCD	Project Manager
Jordan Jones	WCWCD	Water Treatment Manager
Dave Jessop	WCWCD	Operations Manager
Brie Thompson	WCWCD	Associate General Manager, Operations
Corey Cram	WCWCD	Associate General Manager, New Projects
Brandon Robinson	WCWCD	Water Quality Scientist
Lindsey Hall	WCWCD	Water Quality Scientist
Jeremy Williams	Hazen and Sawyer	Project Manager
Michael Bundy	Hazen and Sawyer	Project Engineer
Erik Obluda	Hazen and Sawyer	Pilot Operations
Brooklyn Hall	Hazen and Sawyer	Pilot Support
Rock Xu	Hazen and Sawyer	Technical Advisor

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