

Developing a Nimble Treatability Investigation Program from the Ground Up

May 8, 2025

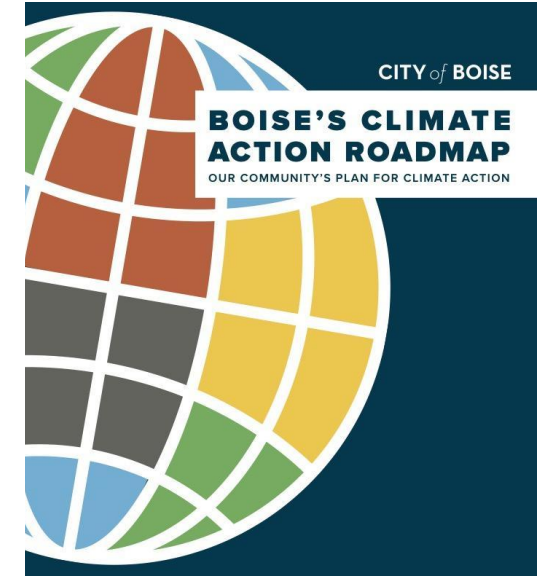
Erin Mackey, PhD, PE
Brown and Caldwell

Brandon Pechin
City of Boise



Water Renewal Services





The RWP is a **Multi-Benefit** Solution for Boise!



GOALS OF THE PILOT



Gather financial data to predict cost

Provide operator training

Understand and share water quality data

Support regulatory approvals

Increase stakeholder confidence

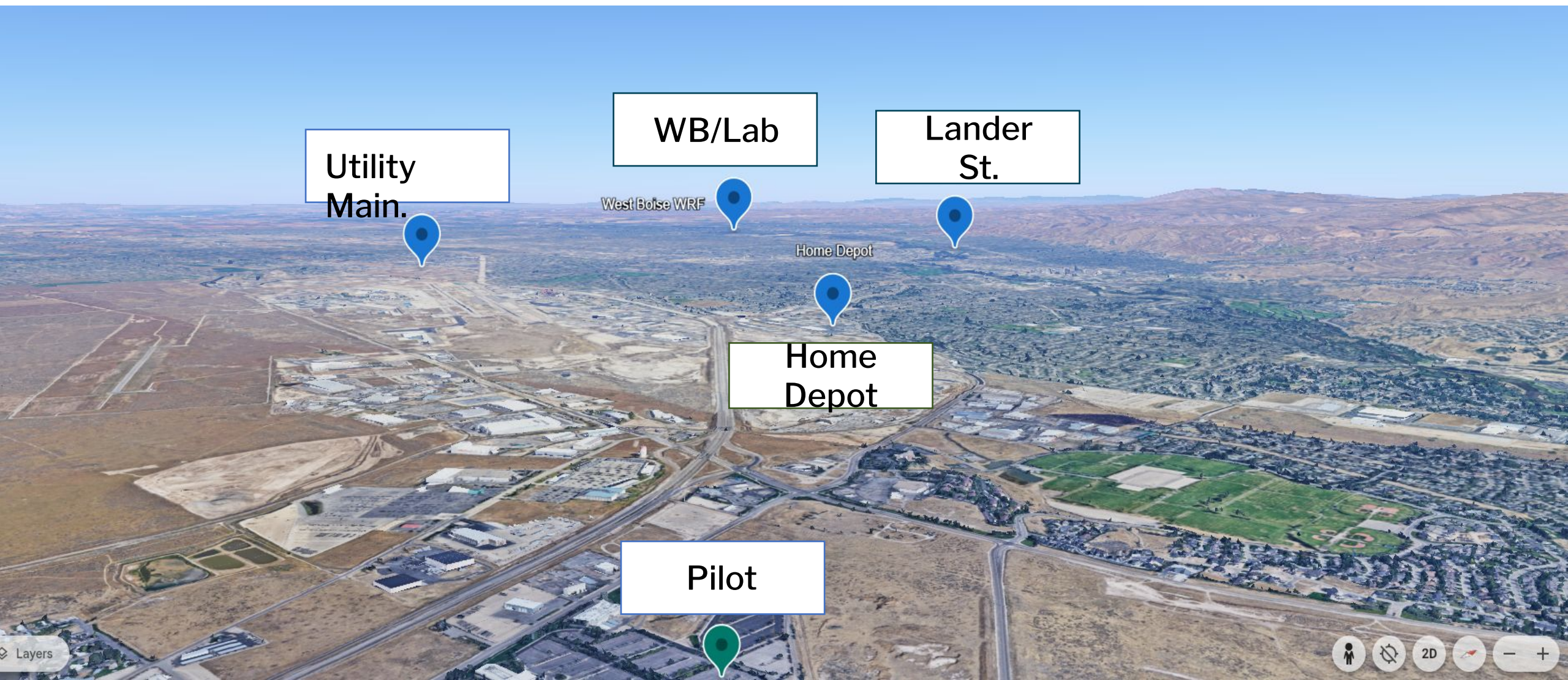
Inform facility design



Pilot Operations



Pilot Site





How do you begin with the end in mind when you are not sure where you are going?

Flexibility, collaboration, balance

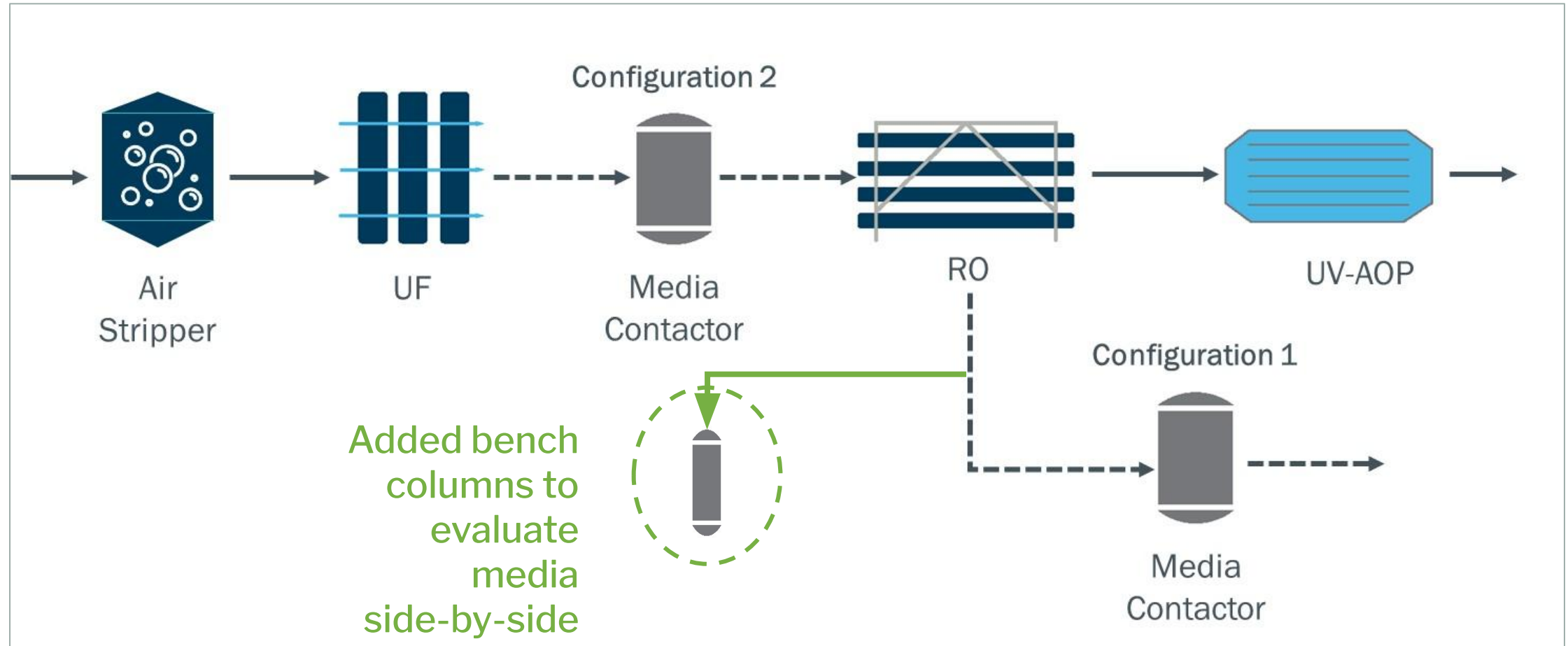


Start with the
information you have
and “trim the sails” as
you go

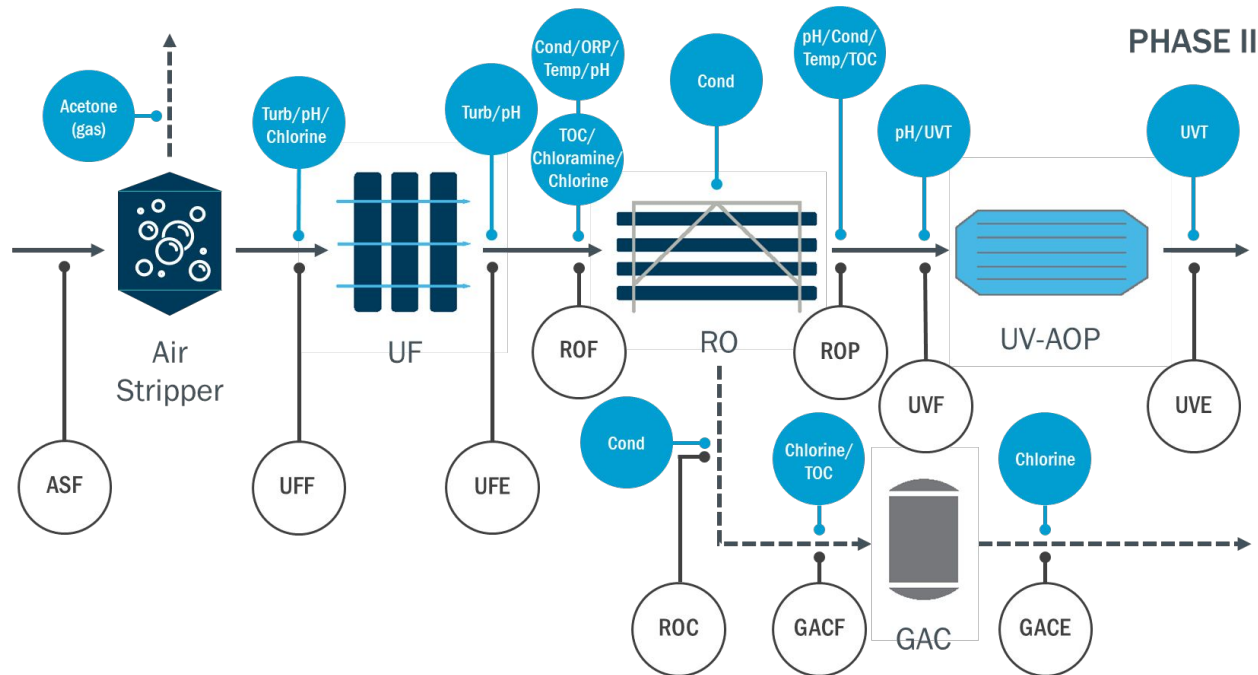
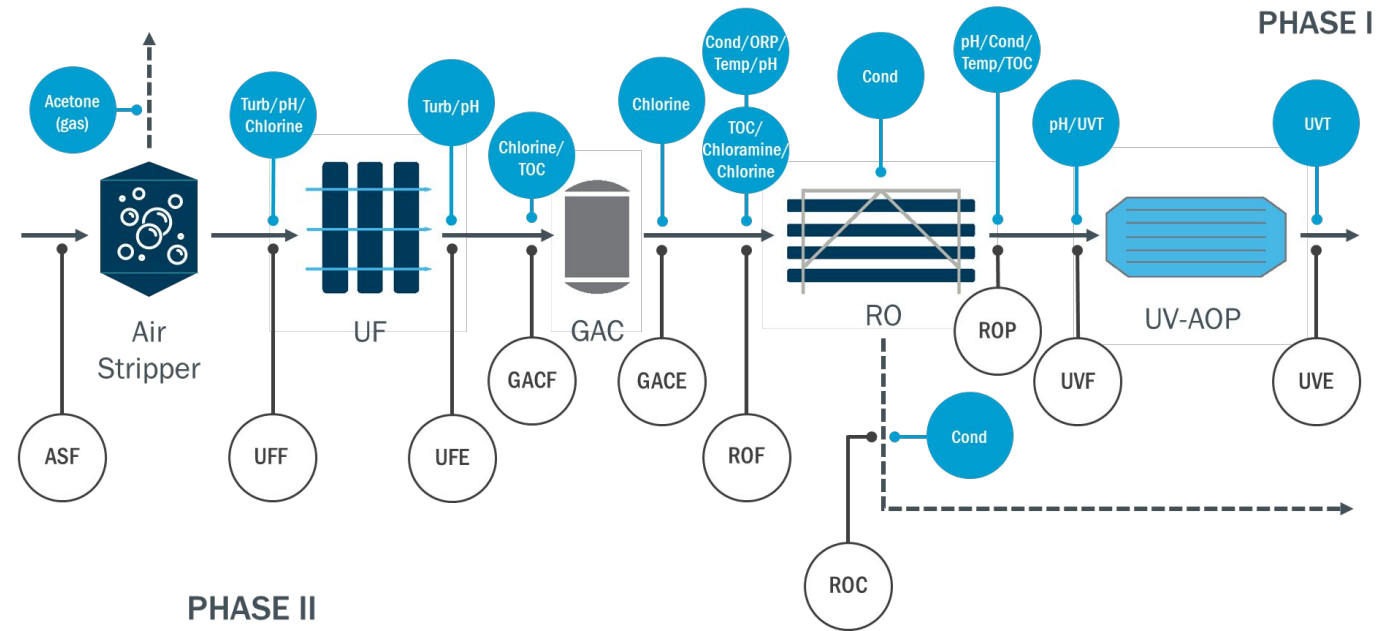
- Design: Spring 2022
- Startup: May 2023
- Phase 1: June-November 2023
- Reconfigure & add bench testing
- Phase 2: January-May 2024



1. The pilot train is a UF/RO/UV-AOP train with a few twists

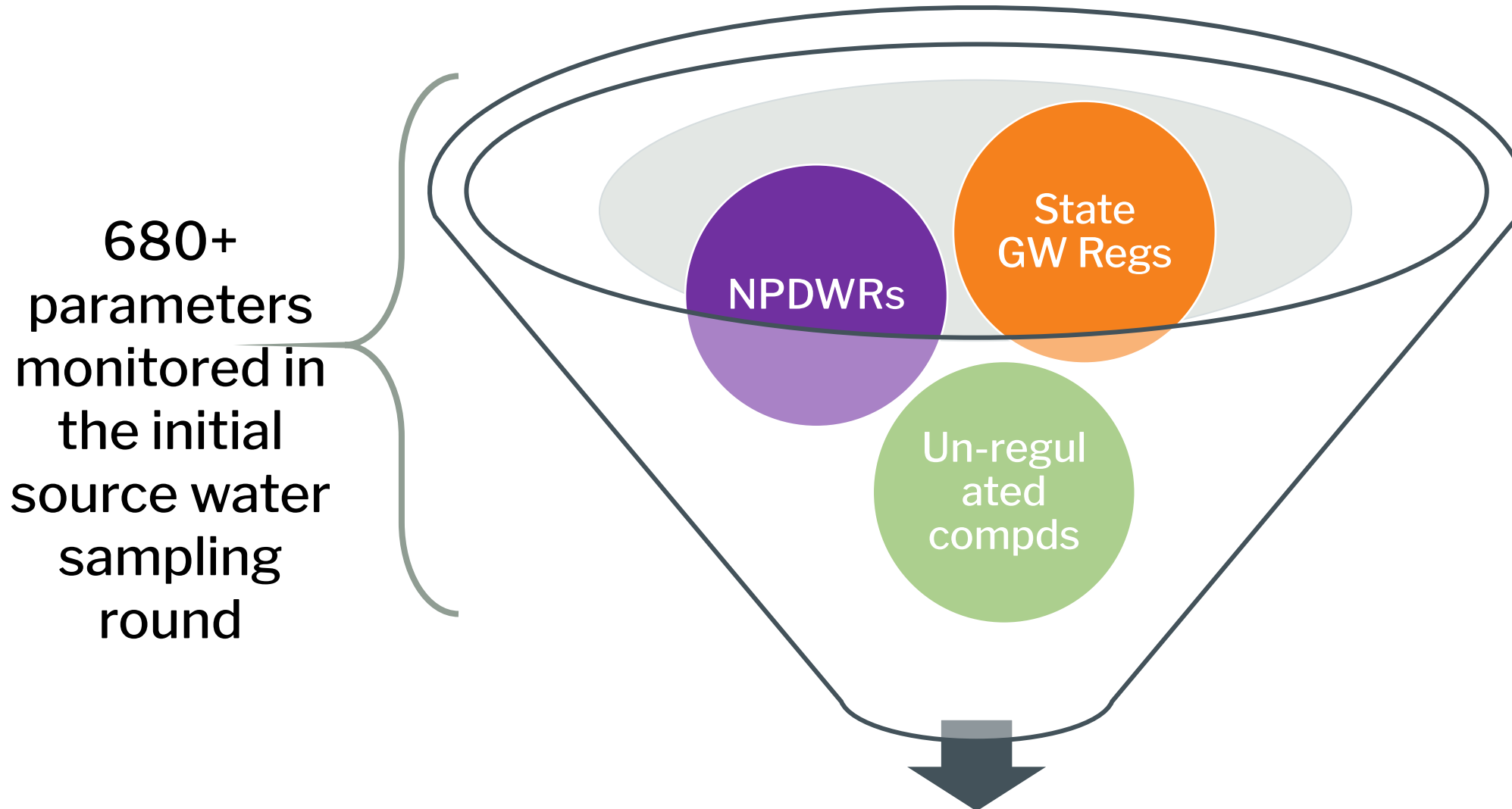


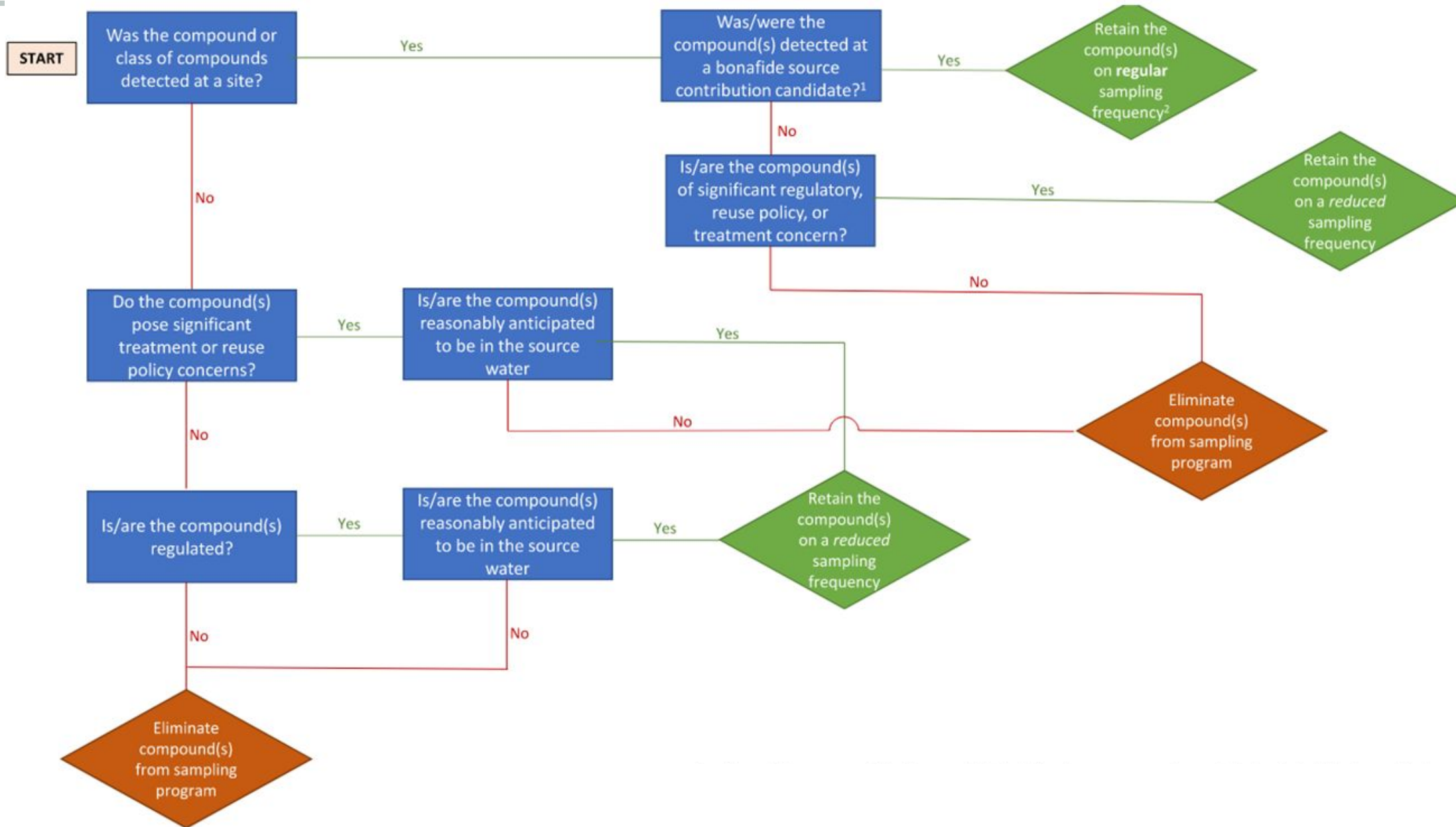
2. We wanted a robust dataset, but what is really important?



What is the most effective treatment train for the Jasper facility?

There was a lot to look for and eliminate







PWQM: Parameter Comparison

Select Locations, Analyte, and Date Ranges for Effective Comparisons

CITY of BOISE

Brown and Caldwell

Select Location for Plot 1

- ☒ UFE
- ☒ ROF
- ☐ ROP
- ☒ UVF
- ☒ UVE

Select Analyte for Plot 1

- General WQ
 - ☐ Alkalinity, Total (as CaCO₃) (MG/L)
 - ☐ Ammonia (as N) (MG/L)
 - ☐ Ammonia (as N) (UG/L)
 - ☐ Biochemical oxygen demand (BOD₅) (MG/L)
 - ☐ Boron (MG/L)
 - ☐ Boron (UG/L)

Select Location for Plot 2

- ☐ ROP
- ☒ UVF
- ☒ UVE
- ☐ ROC
- ☐ GMF

Select Analyte for Plot 2

- General WQ
 - ☐ Alkalinity, Total (as CaCO₃) (MG/L)
 - ☐ Ammonia (as N) (MG/L)
 - ☐ Ammonia (as N) (UG/L)
 - ☐ Biochemical oxygen demand (BOD₅) (MG/L)
 - ☐ Boron (MG/L)
 - ☐ Boron (UG/L)

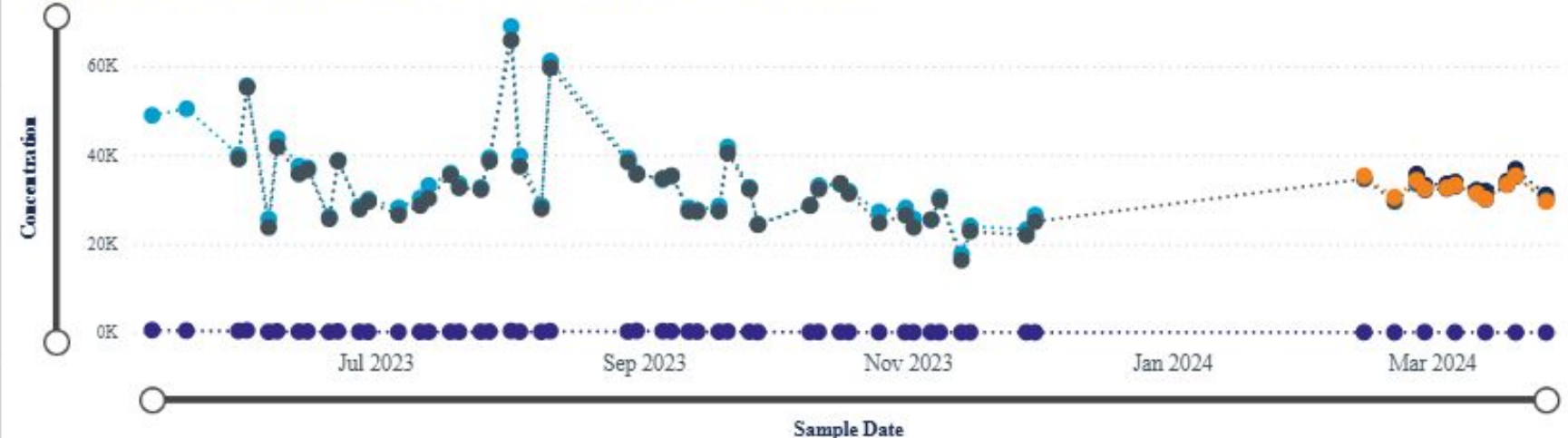
Note-

Values that are non-detect are shown at their method

Fluoride (MG/L) Concentrations at Locations: ASF, UFF, UFE, ROF, UVF, UVE, GMIE2, GME2, CF, C1, C2, TF, T1, T2



Calcium (UG/L) Concentrations at Locations: UFF, ASF, ROF, UFE, UVE

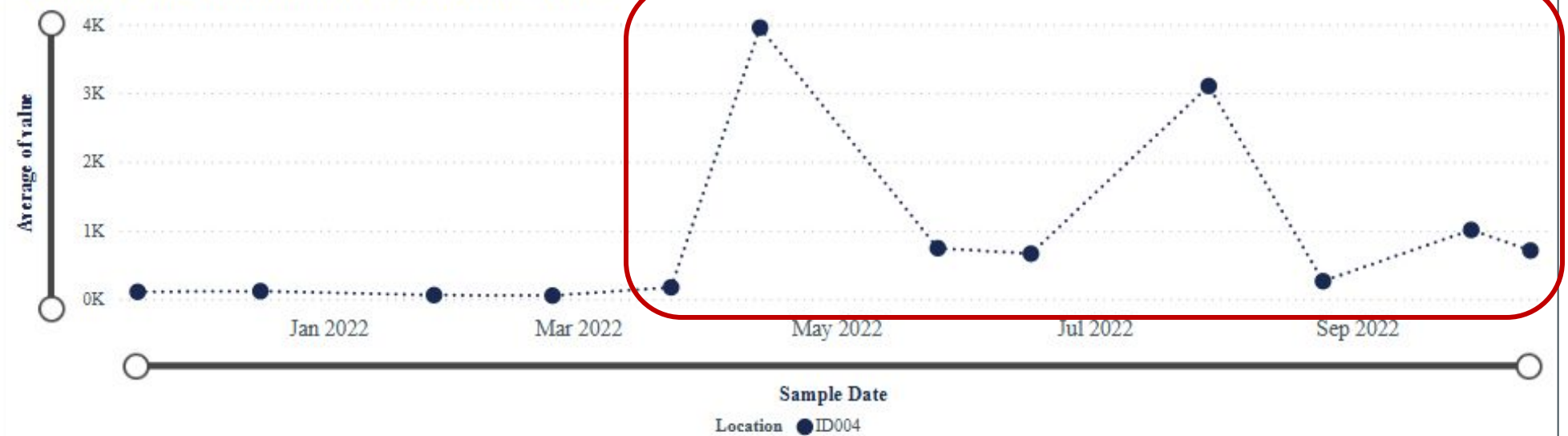


3. Phase 1 tells us some things

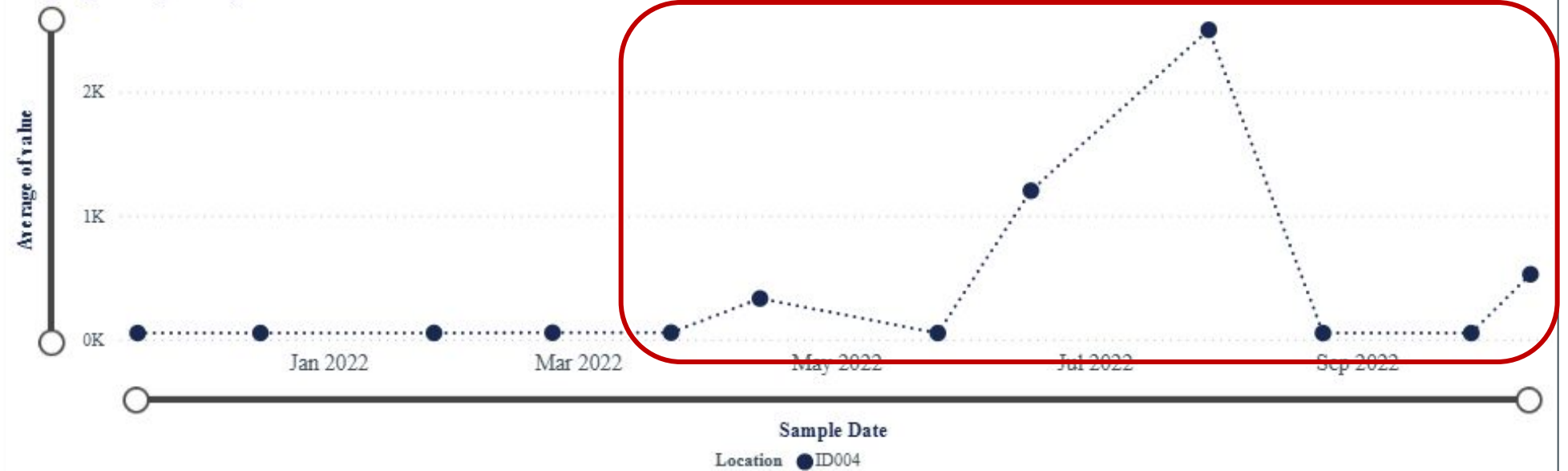


As data rolled in, we knew a side-stream bio treatment test would be needed

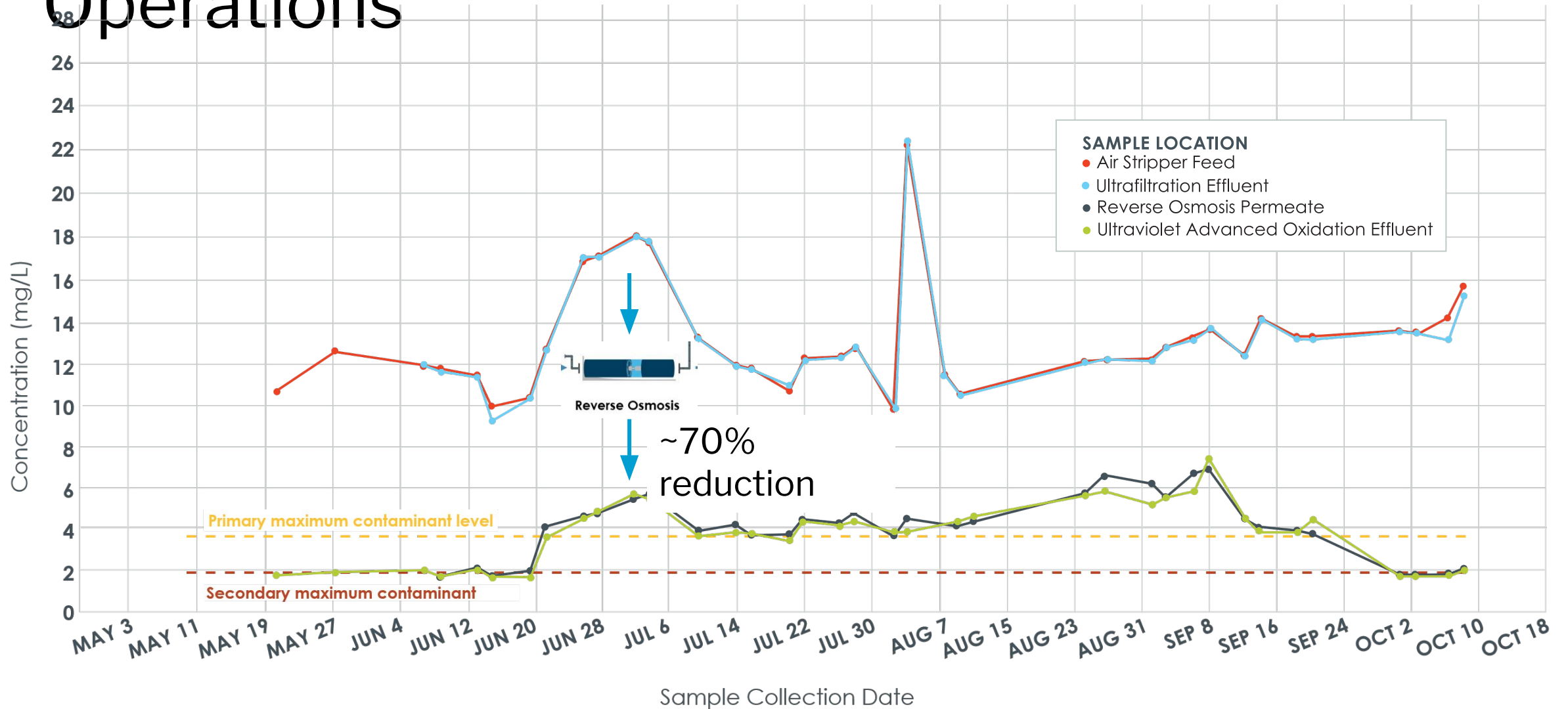
Acetone (UG/L) Concentrations at Locations: ID004



Isopropanol (UG/L) Concentrations at Locations: ID004



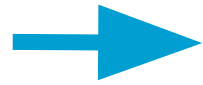
Fluoride Will Drive How We Manage Operations



Pilot modifications for Fluoride

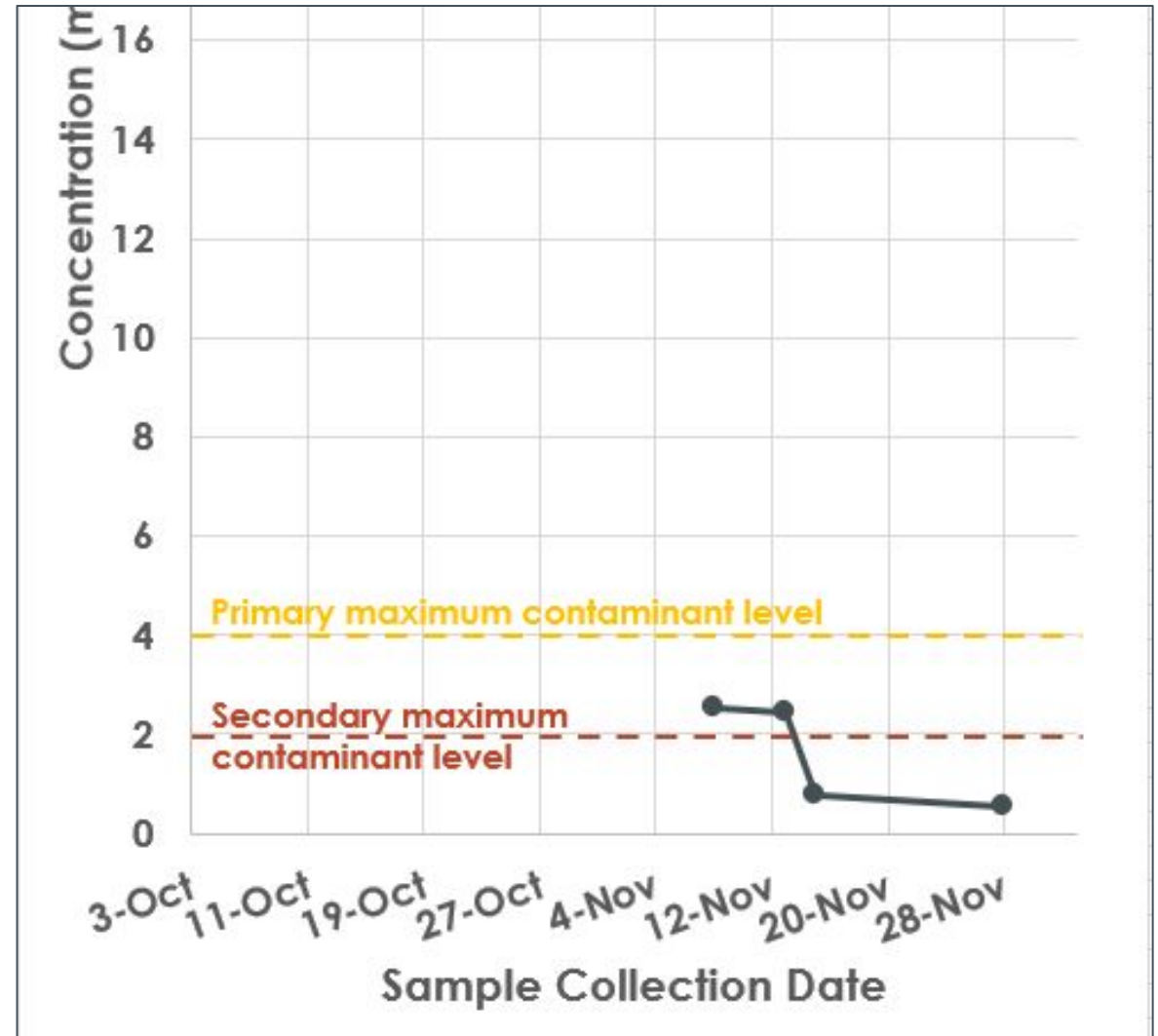
- New RO Membranes

Autopsy
confirmed
damage

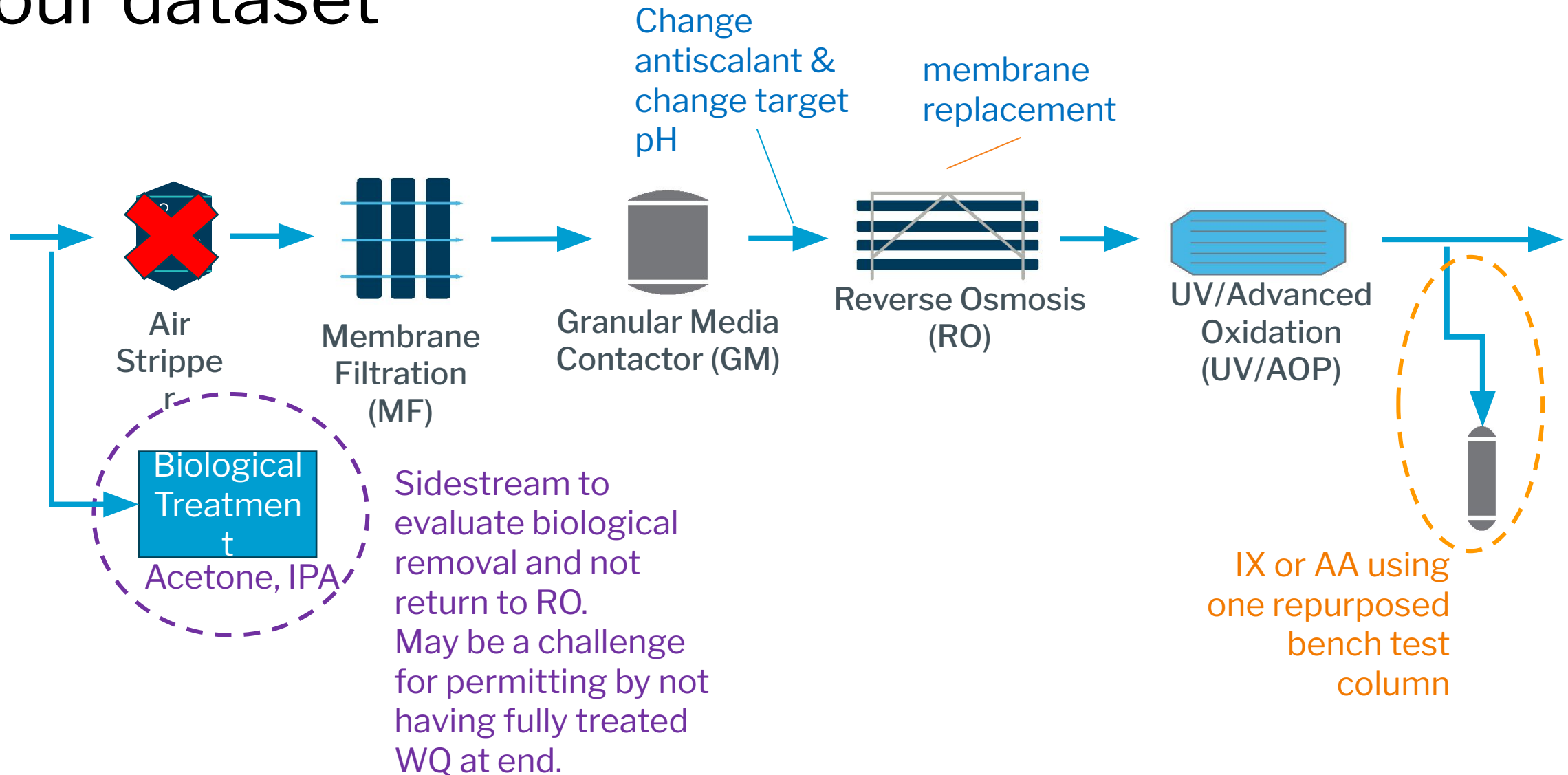


Hydranautics
CPA7-LD-4040

- Modified pH adjustment
- Increased recovery
- New anti-scalant formulation
- Recovery increased to 82%
- Side-stream activated alumina testing to investigate polishing



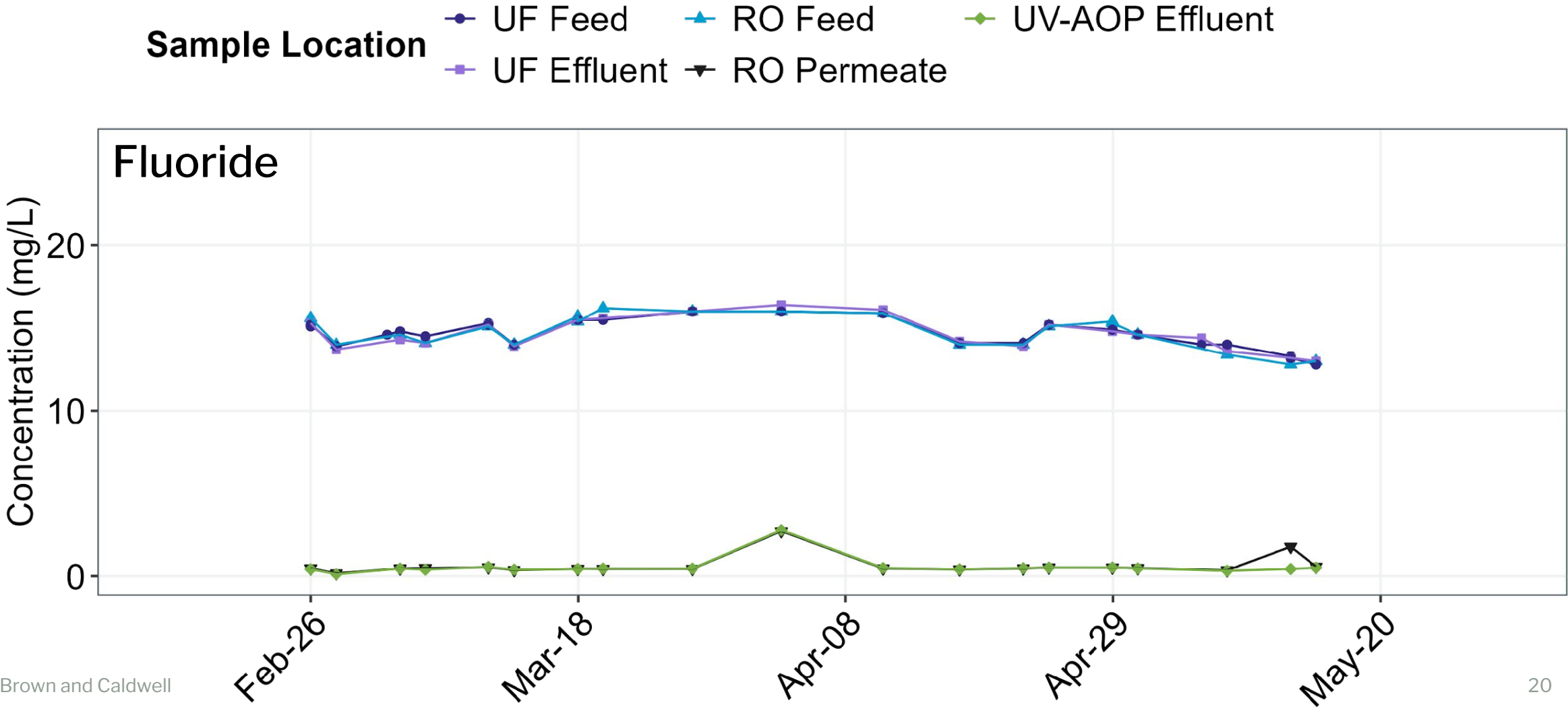
Phase 2: we make some changes to enhance our dataset



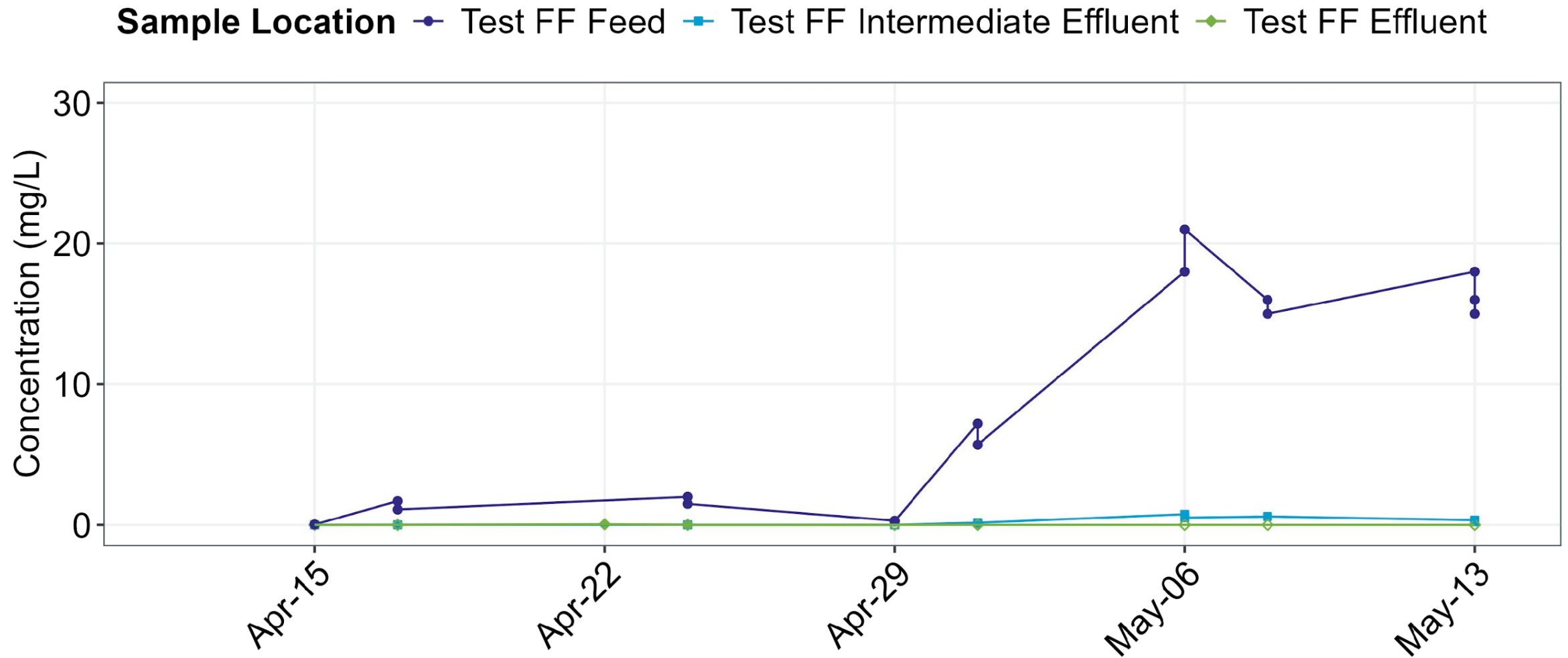
Pilots within the pilot, more field testing & logging



New Approach Maintained High Water Quality

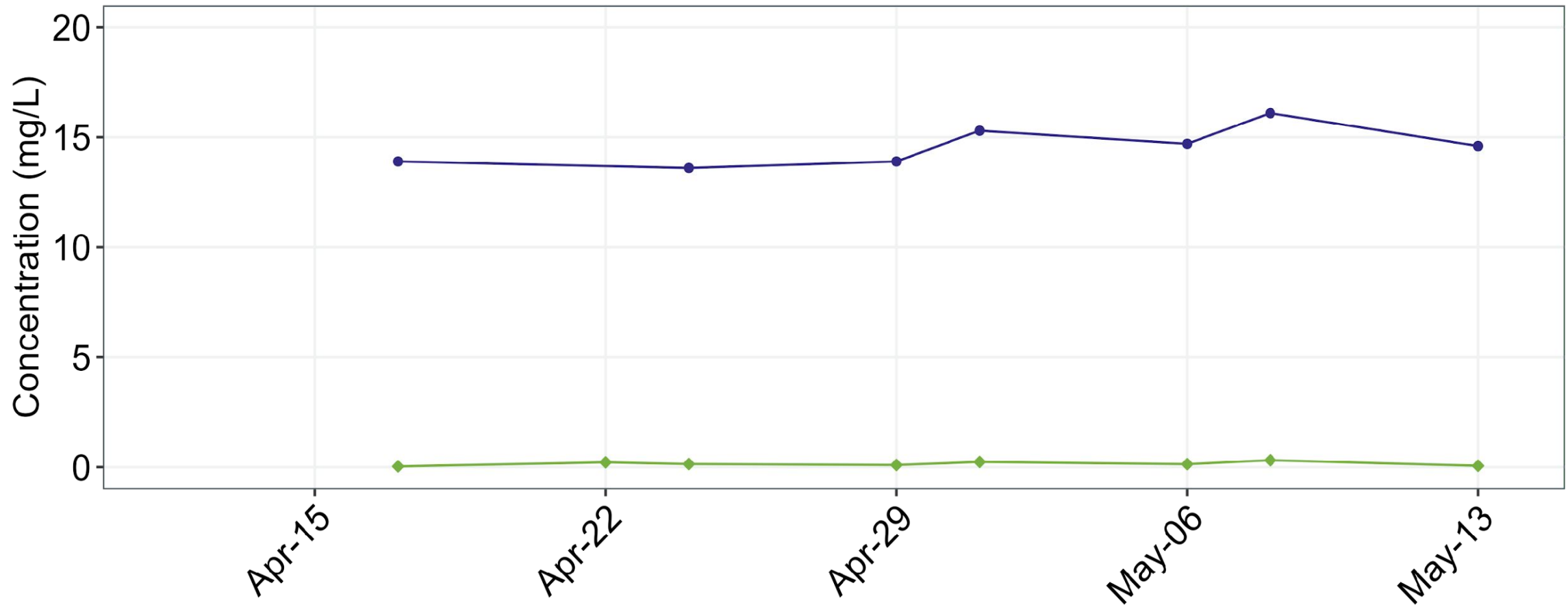


Results: FF completely removed acetone

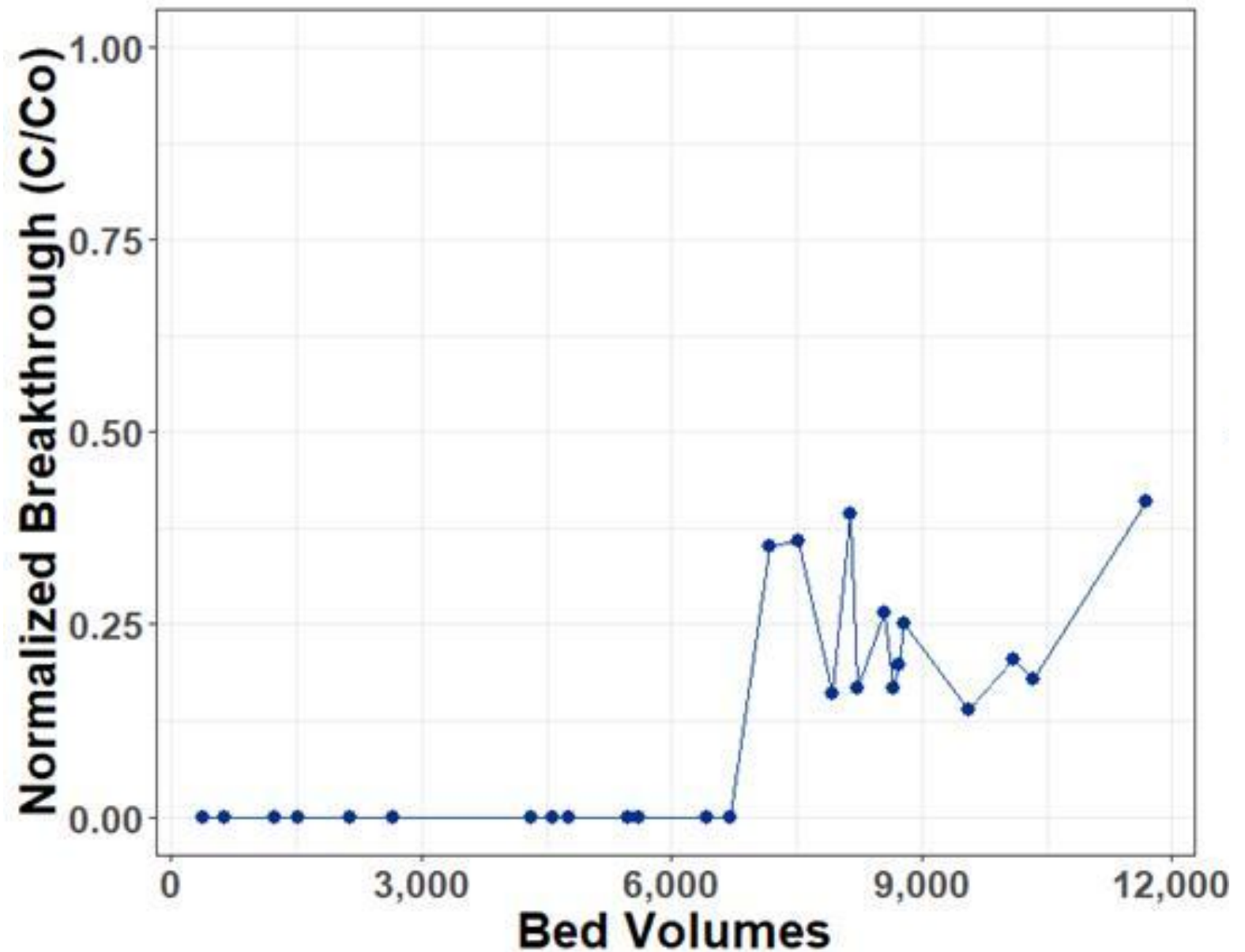


Results: and ammonia was completely nitrified

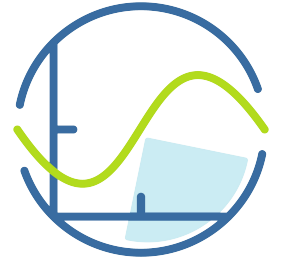
Sample Location ● Test FF Feed ■ Test FF Intermediate Effluent ◆ Test FF Effluent



Activated Alumina Polished the Remaining Fluoride



Take-Home – Results



- Baseline pilot train demonstrated consistent, high-quality treated water
 - Met all MCLs and SMCLs + PFAS and other organic constituents
- Adjustment of the sampling protocol allowed us to “find” what we needed to look for while narrowing the field to save \$100ks in analytical costs
- Adding additional systems and eliminating others allowed us to enhance the data quality and type as we learned

Lessons Learned



City of Boise Perspective

- Workload

- Someone must own it
- It takes more than you think
- Ask for help

- Challenges

- Access to power
- Access to discharge
- Access to fresh water
- Tools, equipment extra hands

- Touring

- Hands on experience
 - Refine your messaging
 - Opportunity for Ops
 - Share the talking time.
 - Build trust with stakeholders

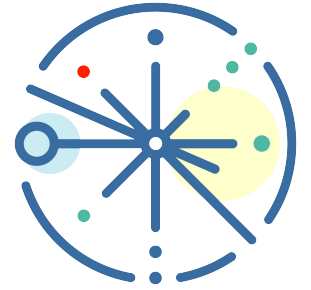
- Interns

- Love the help, And.



Take-Home – Lessons Learned

- Work hand-in-hand to “innovate”
 - Being flexible allowed us to respond to what we learned as we went and enhance the dataset to support design
- Plan ahead for how to make changes
- Be mindful of the need to accommodate multiple uses
- Be realistic about time and resources



QUESTIONS?

*Invested in 7,000 hours
of workforce development*



*Treated >5 million+
gallons water*



*Collected 40,000+
analytes*



*Tested for hundreds
of constituents*



Conducted 50+ tours



Hosted 600+ people



Thank you.

Questions?

Brown AND **Caldwell** :



