

2024 Battelle Chlorinated Conference

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Design, Implementation, and Assessment of a Slurry Injection Pilot Study to Treat a Low Permeability Aquifer Contaminated with TCE

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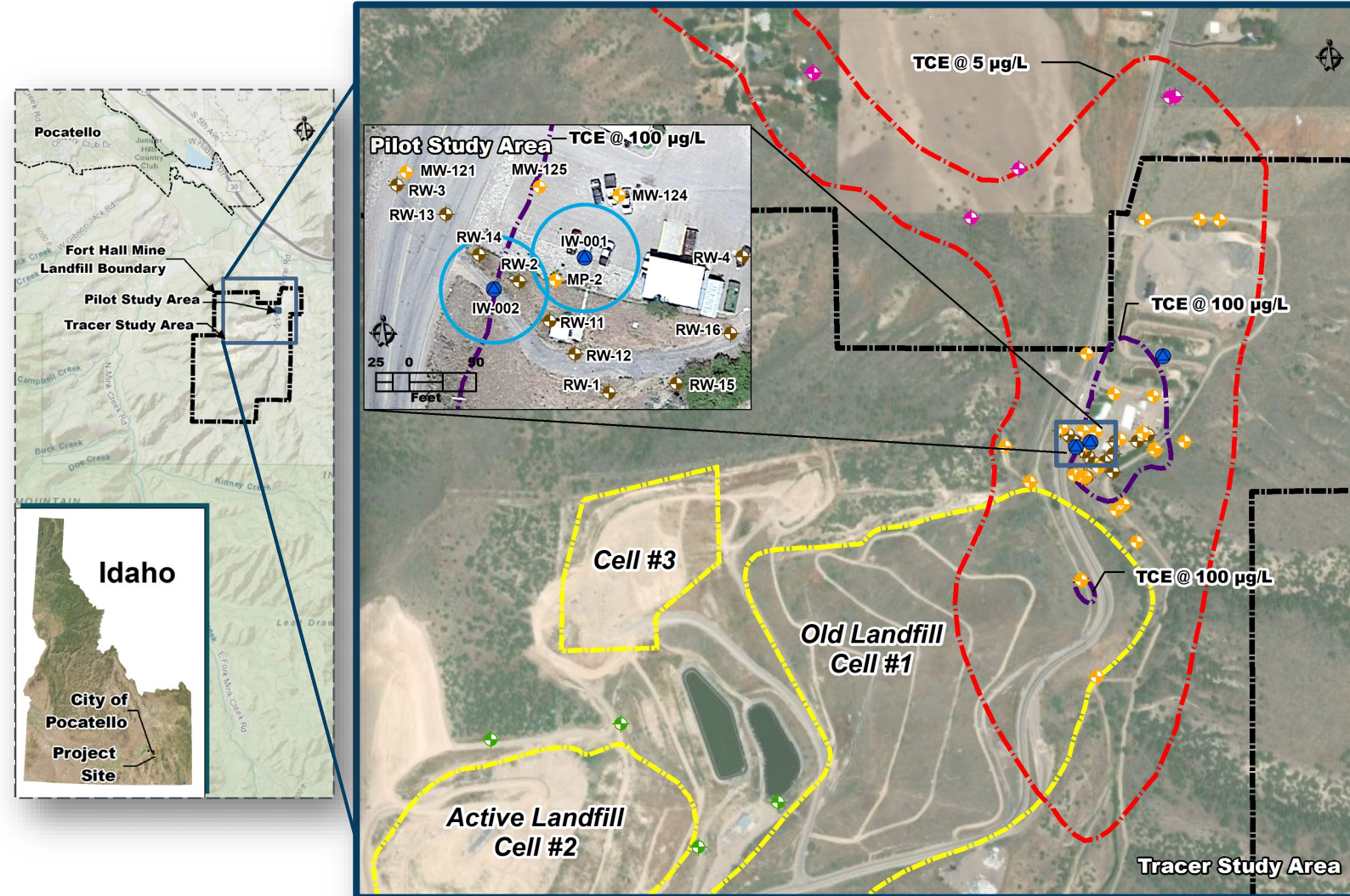


Site Background



Site Setting

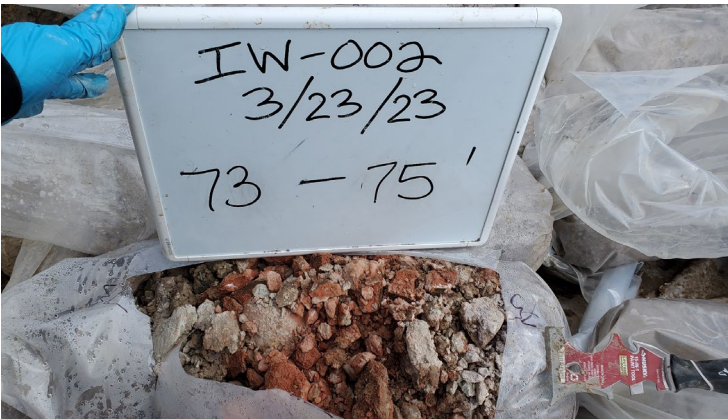
- Fort Hall Mine Landfill, ID
- PCE, TCE in groundwater
- Pump and treat since 2002
→ incomplete capture
- Groundwater monitoring program, treatment system O&M/ optimization, site characterization



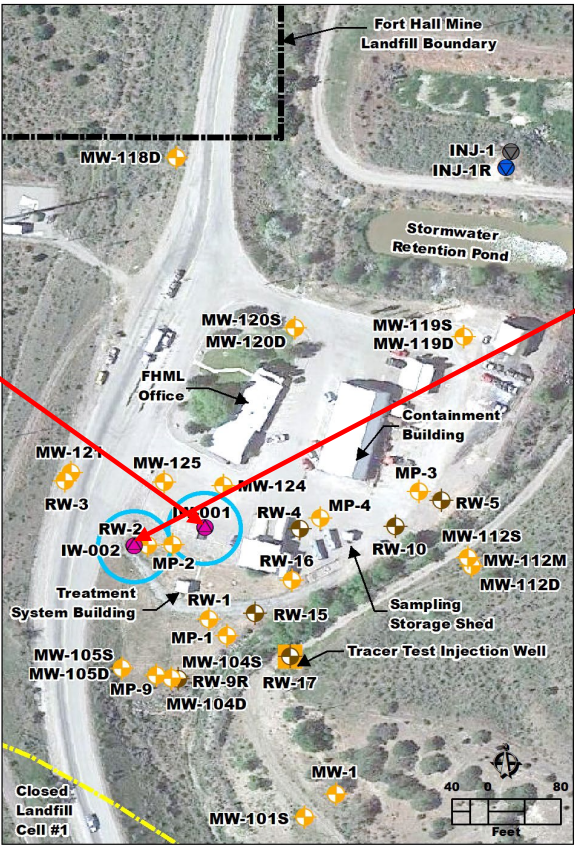
Drilling Program



MW-124 and 125:
60 to 90 feet bgs



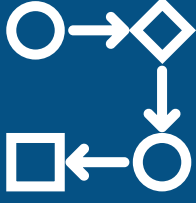
IW-001 and 002:
cased to 96 and 104
feet bgs





Pilot Study Design

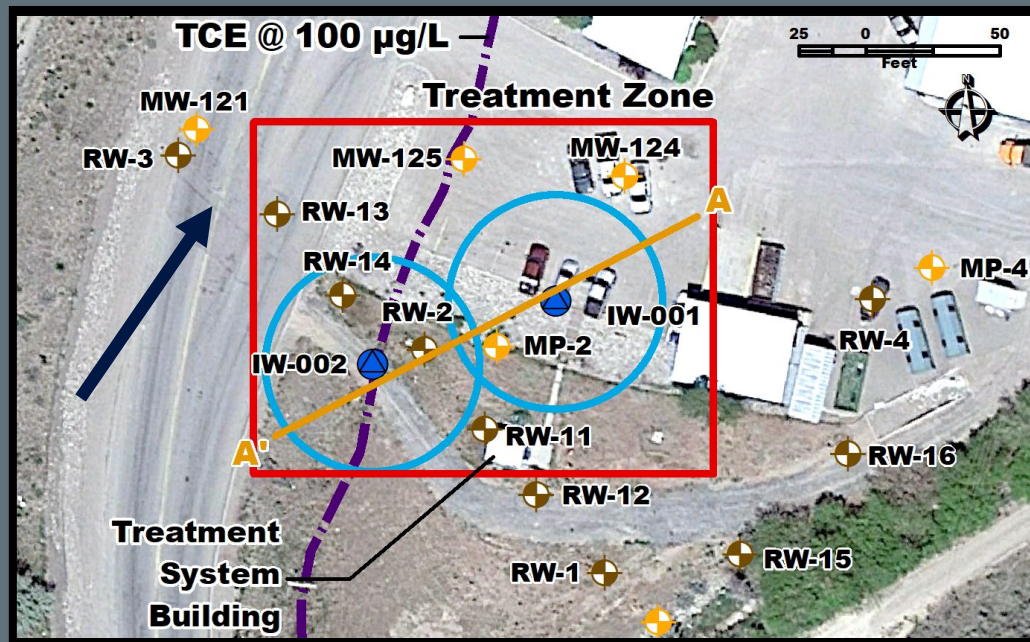


1. Objective 	2. Questions 	3. Procedures 	4. Data 
Evaluate operational parameters and <u>feasibility</u> of slurry injections to emplace reactive amendments	• Can target vertical zones be treated? • Can target quantities be injected?	• Slurry injections to emplace amendments via boreholes • Real-time downhole monitoring	• Delivered quantities • Operational pressures • Groundwater elevation, field parameters
Evaluate <u>performance</u> of slurry injections to enhance in situ remediation of COCs	• Does geochemistry change? • Do COC concentrations change? • What is the amendment longevity?	• Baseline and 1-year performance monitoring	• Water quality, geochemical, microbial, COC concentrations over time

Treatment Zone

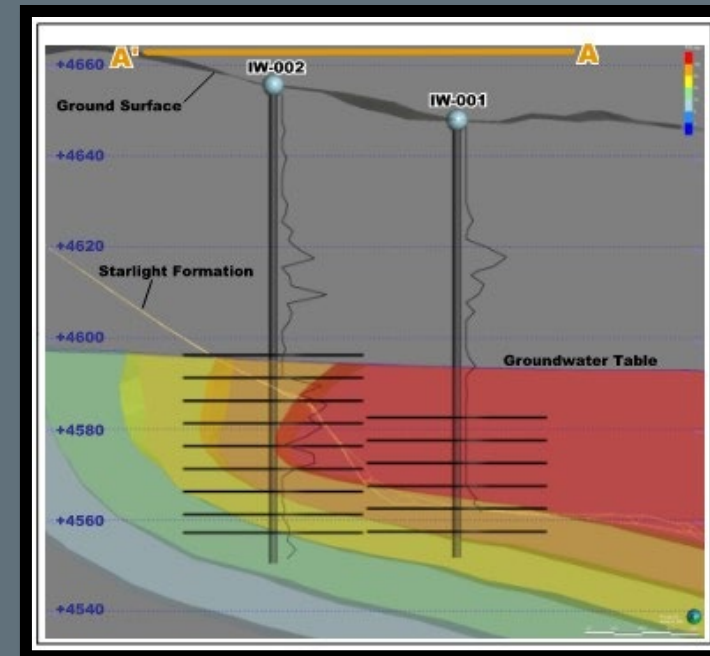
Lateral

- Groundwater flow
- Infrastructure
- Existing wells
- Drill rig clearance
- Traffic, landfill operations



Vertical

- Groundwater elevation
- Contamination
- Packer length
- 60-90 feet bgs



Amendments



Carbon



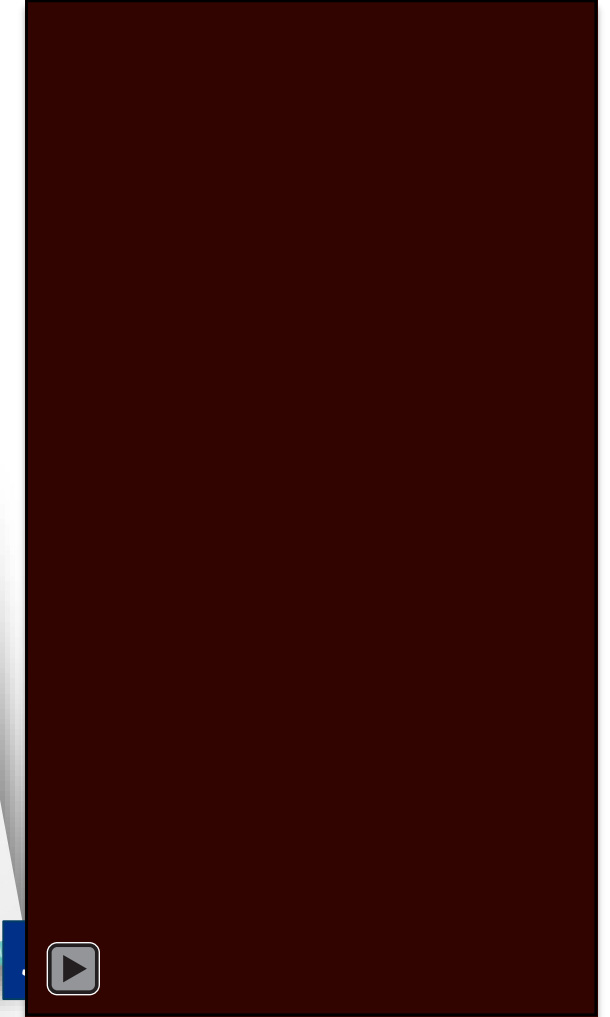
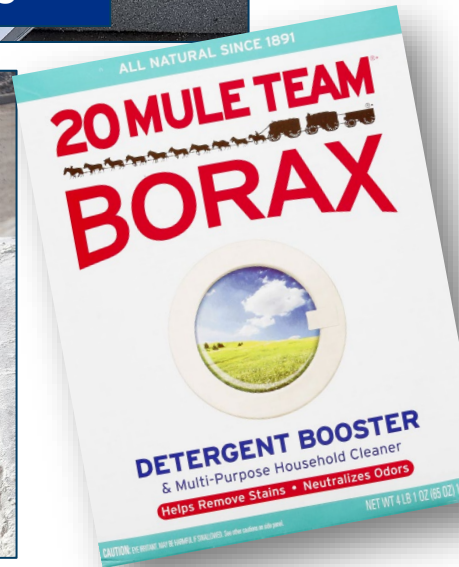
Microbial Cultures



Microscale zero valent iron (ZVI)



Guar



Delivery

1. Drillers grouted closed casing
2. FRx notched through PVC at each injection depth
3. FRx injected amendment slurry through the notch between packers

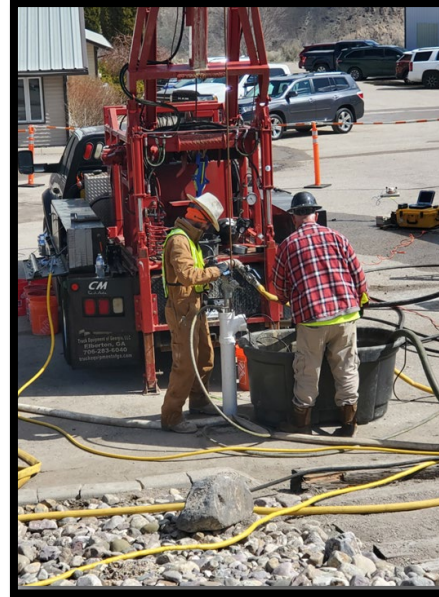
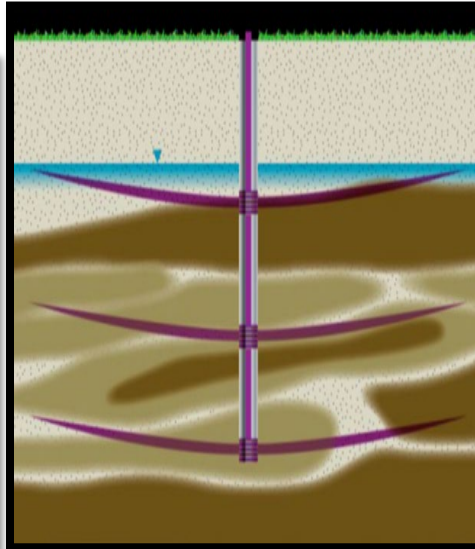
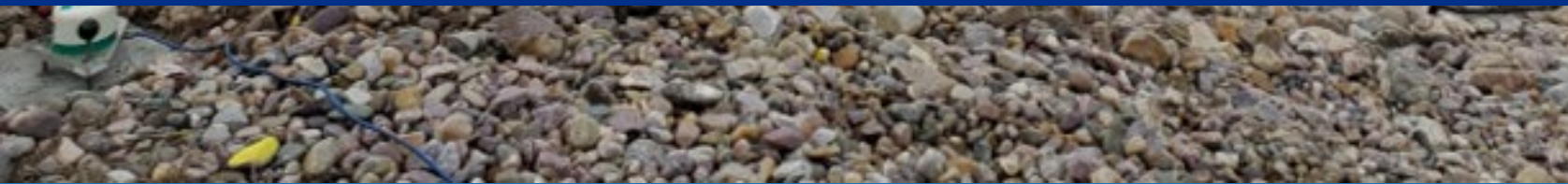


Photo Credit: FRx



Implementation



Injection Area



Injection Results

All design mass was delivered.

- 2 weeks
- 2 boreholes
- 16 injections
- 388,000 lbs ZVI
- 8,800 lbs Provect-OB
- 8,400 lbs QR75
- 52 L KB-1 culture



Lessons Learned: Slurry Injection Feasibility

Adaptive design & implementation is key.

Cased borehole method prevented overburden collapse.

Custom micro-ZVI blend worked well.

Tiltmeter analysis proved difficult in this geology.

The technology was feasible for delivering the design dose.



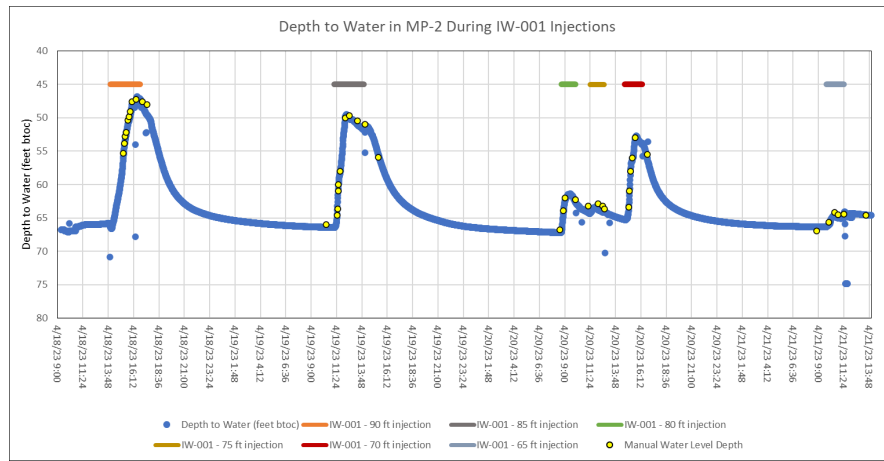


Monitoring

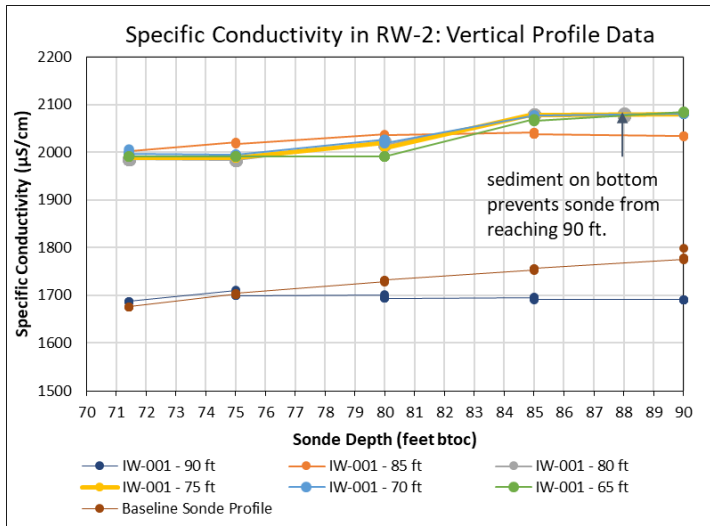


Process Monitoring

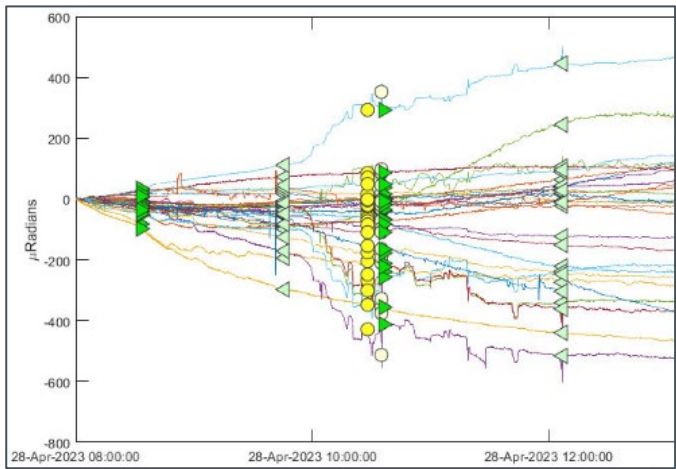
Water Level Elevation



Water Quality Parameters

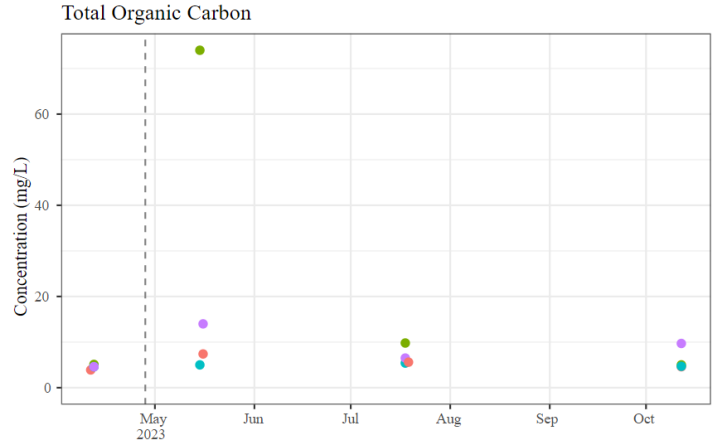
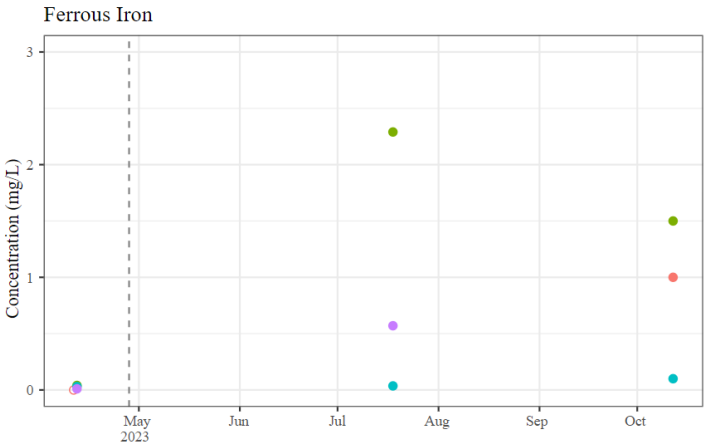
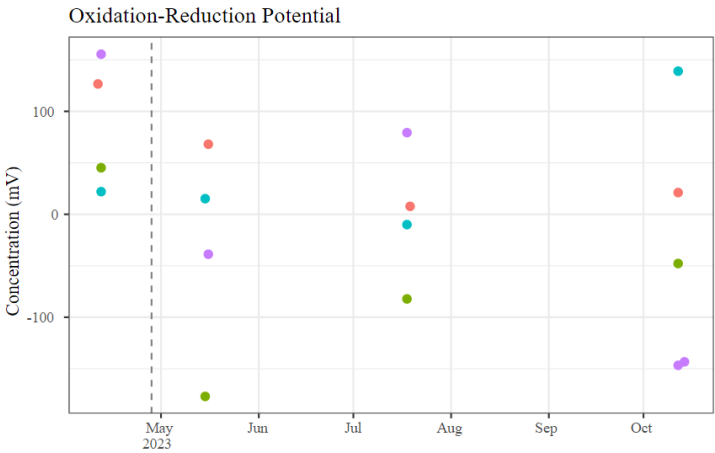
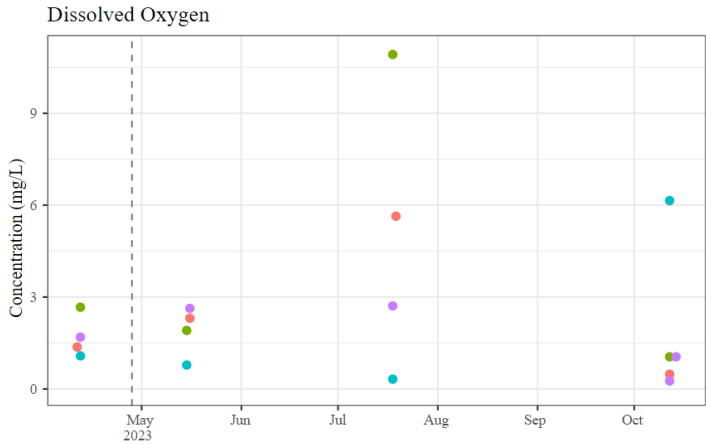
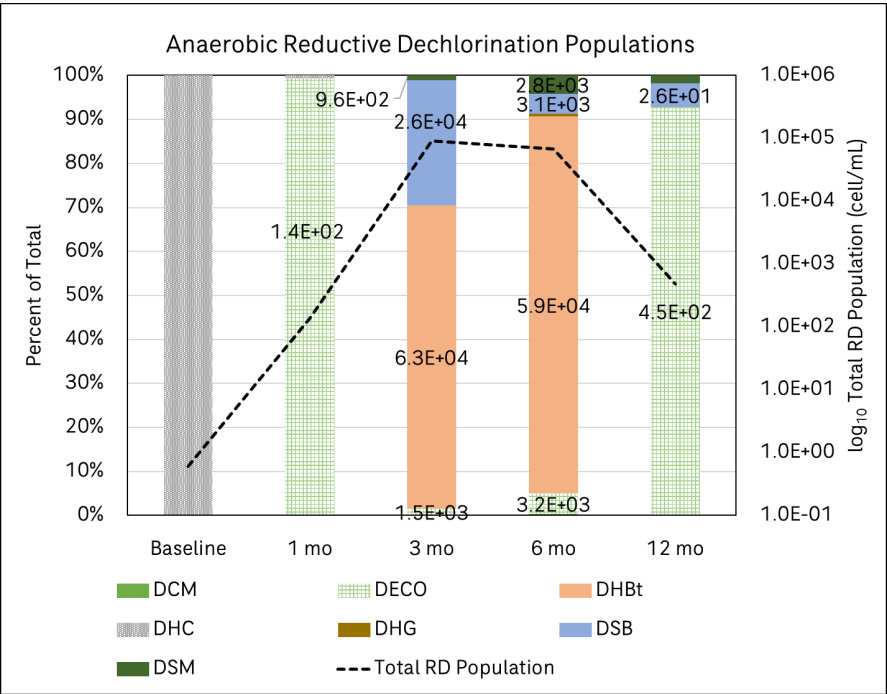


Tiltmeter Geophysics



Performance Monitoring

- Water quality
- Geochemistry/redox
- Microbial

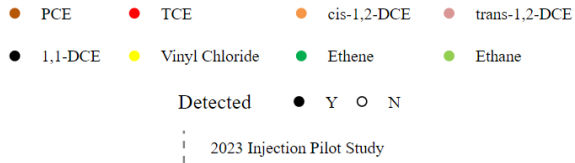
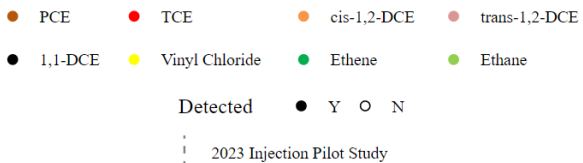
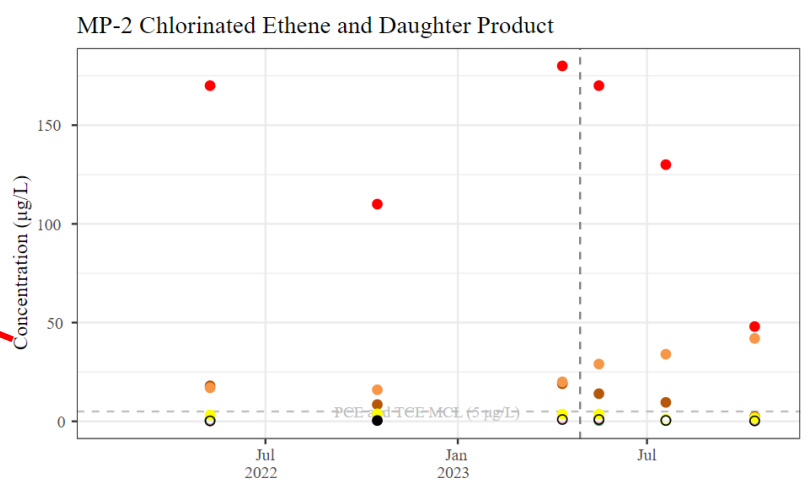
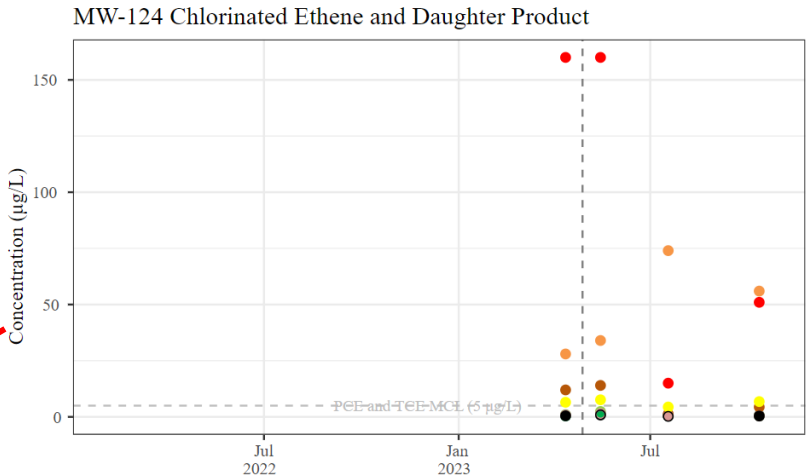
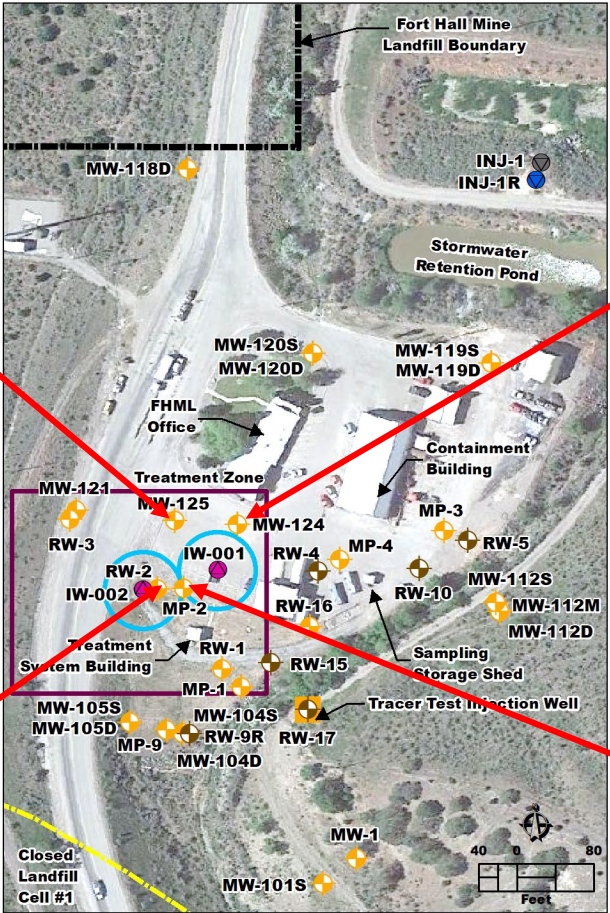
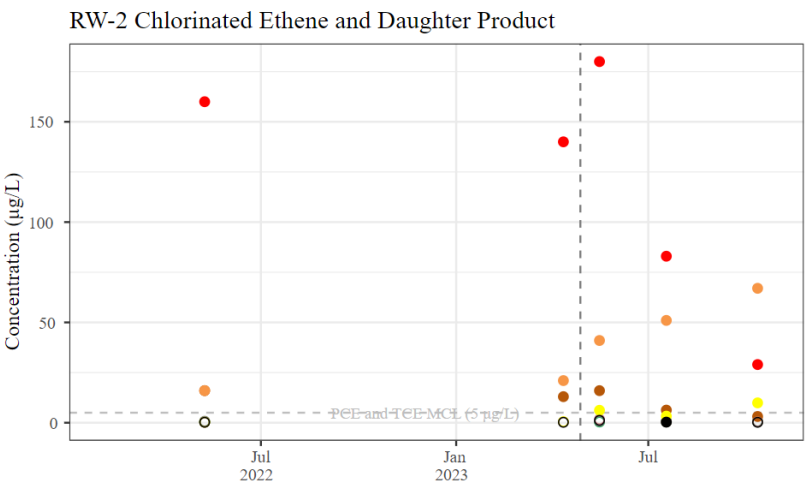
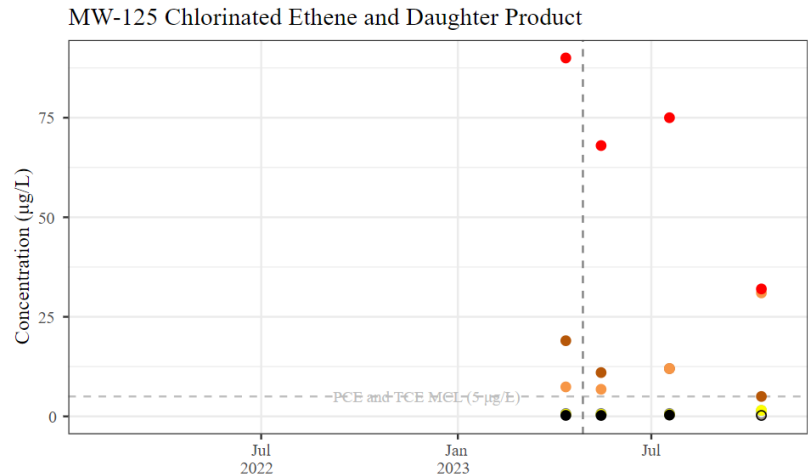


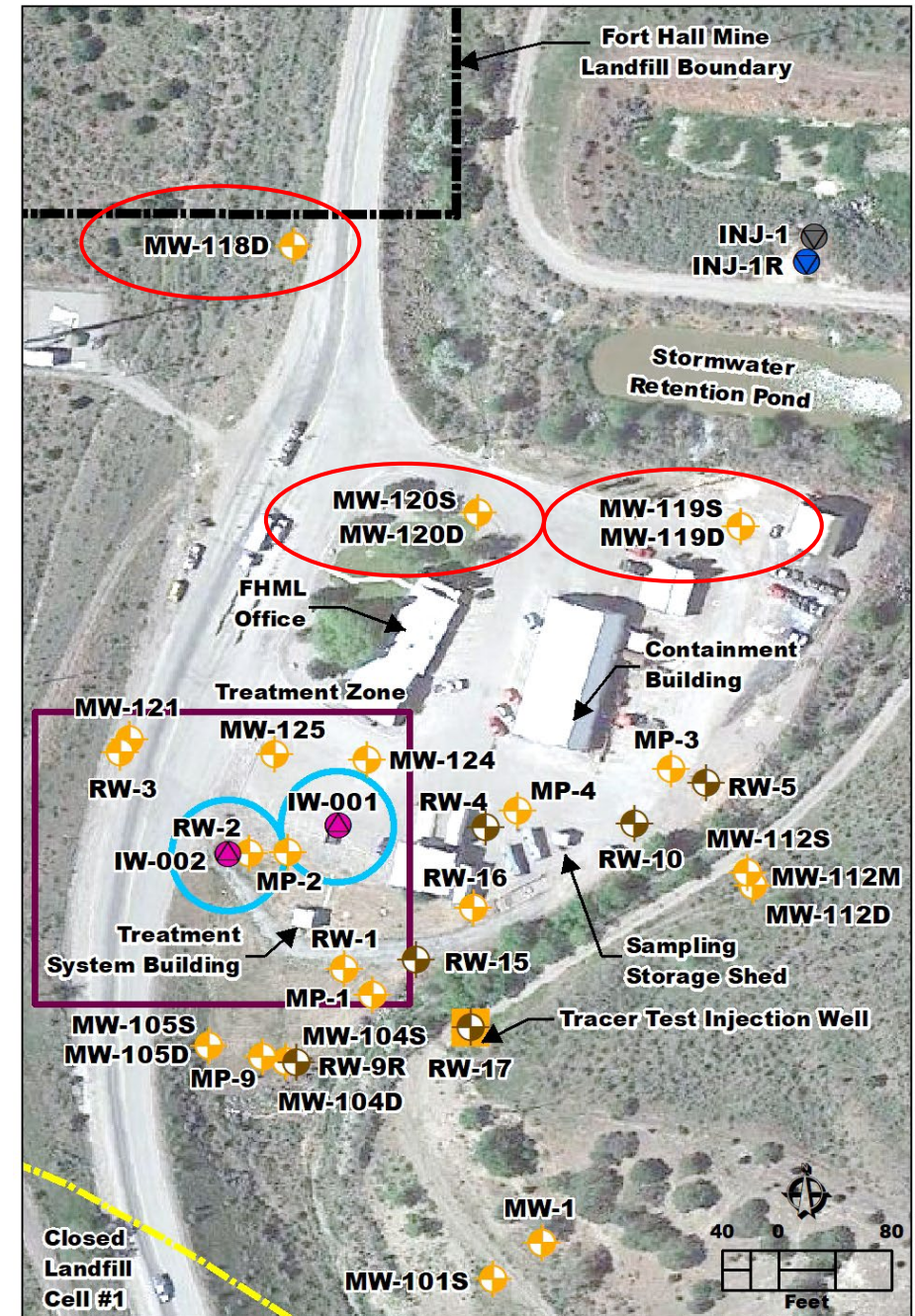
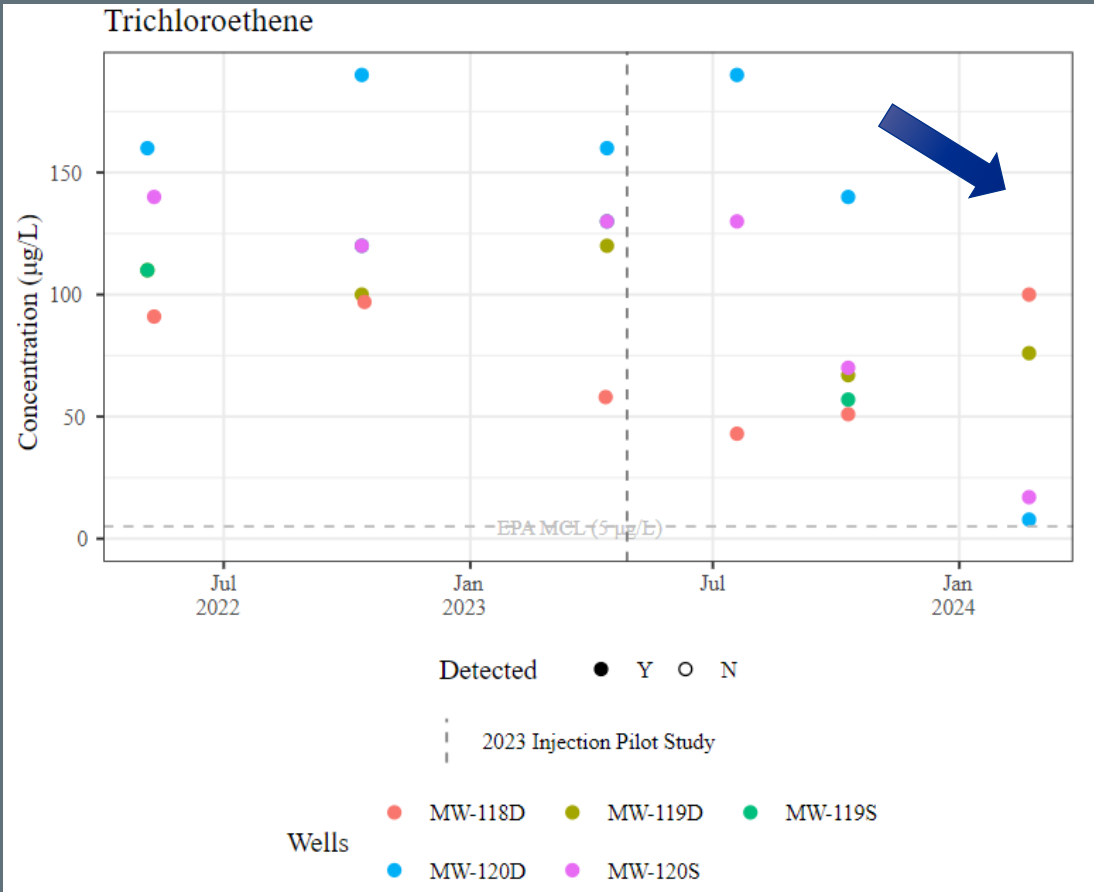
● MP-2 ● MW-124 ● MW-125 ● RW-2

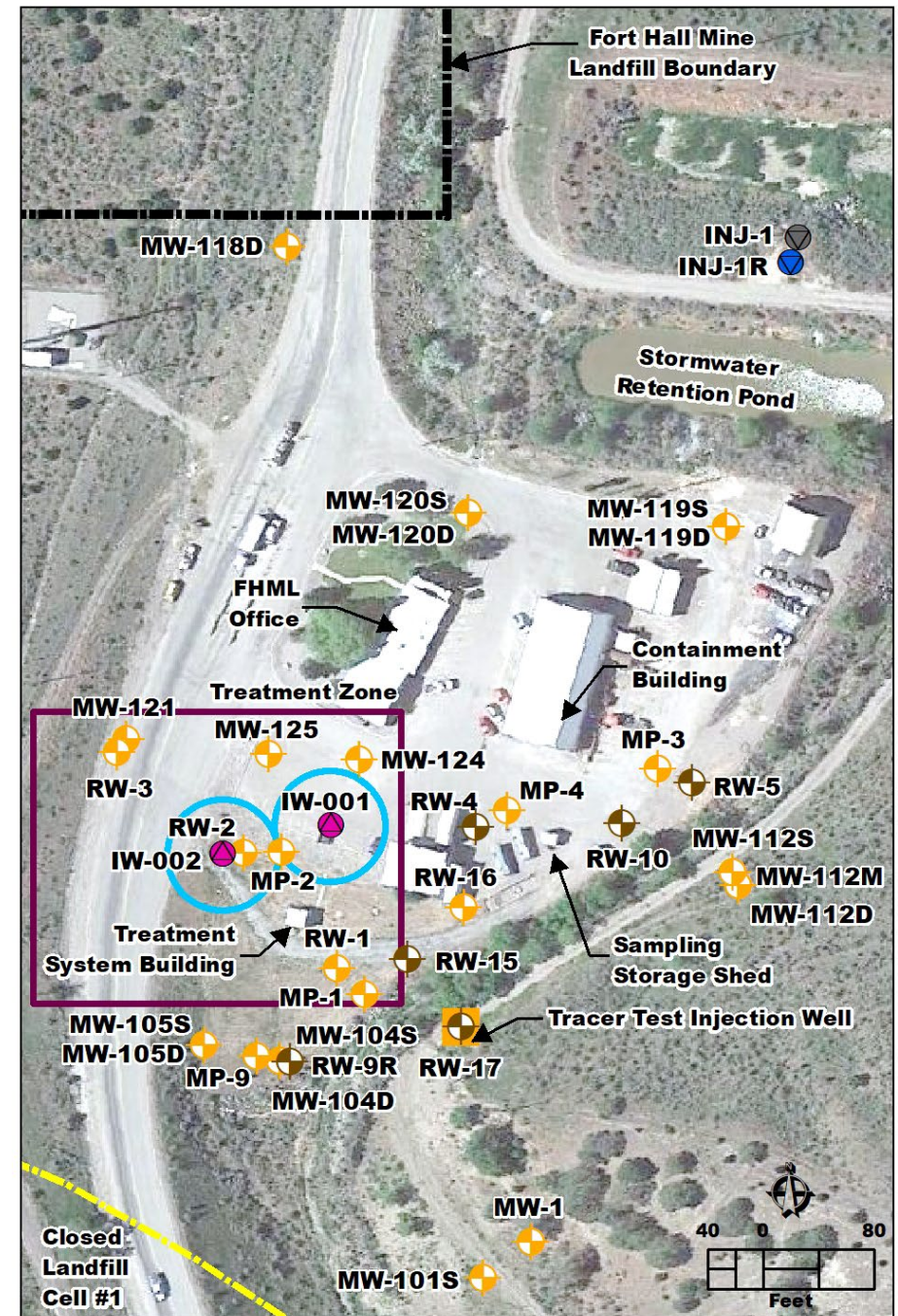
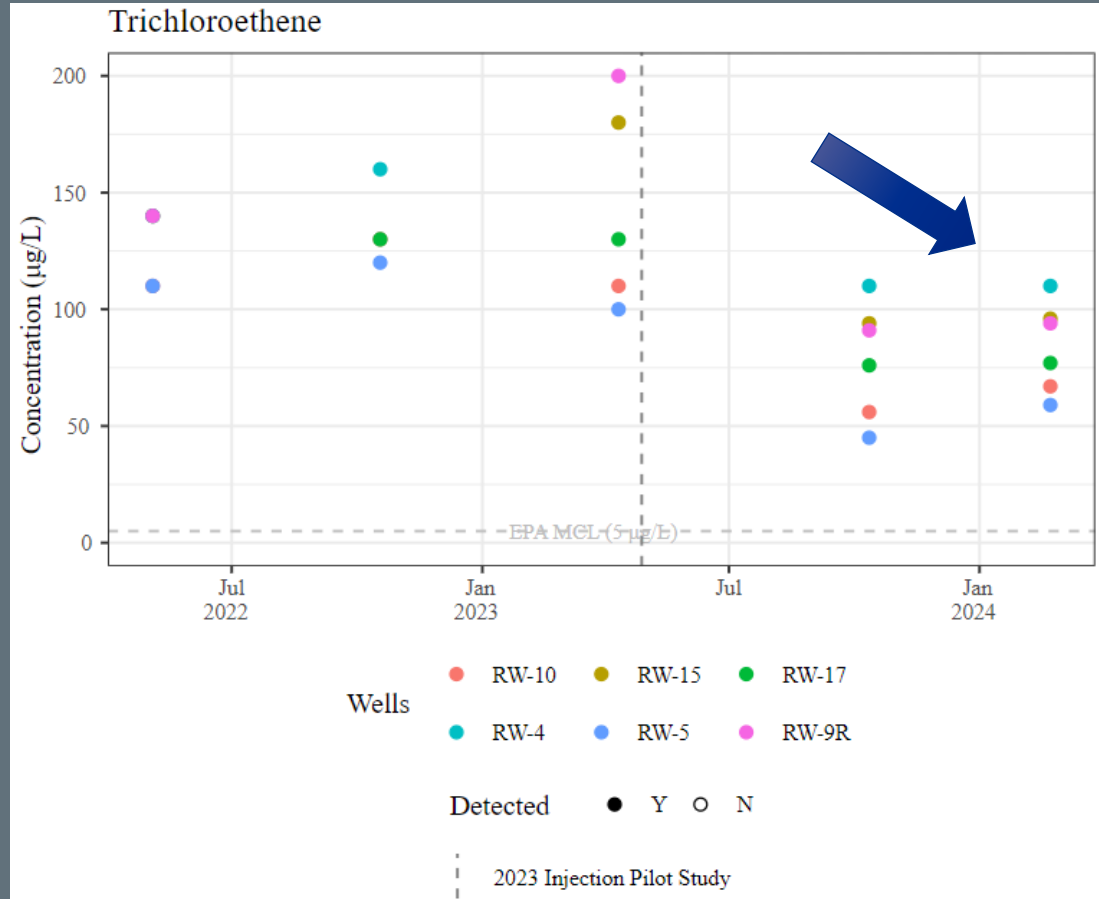
Detected ● Y ○ N

2023 Injection Pilot Study

COCs: Treatment Area







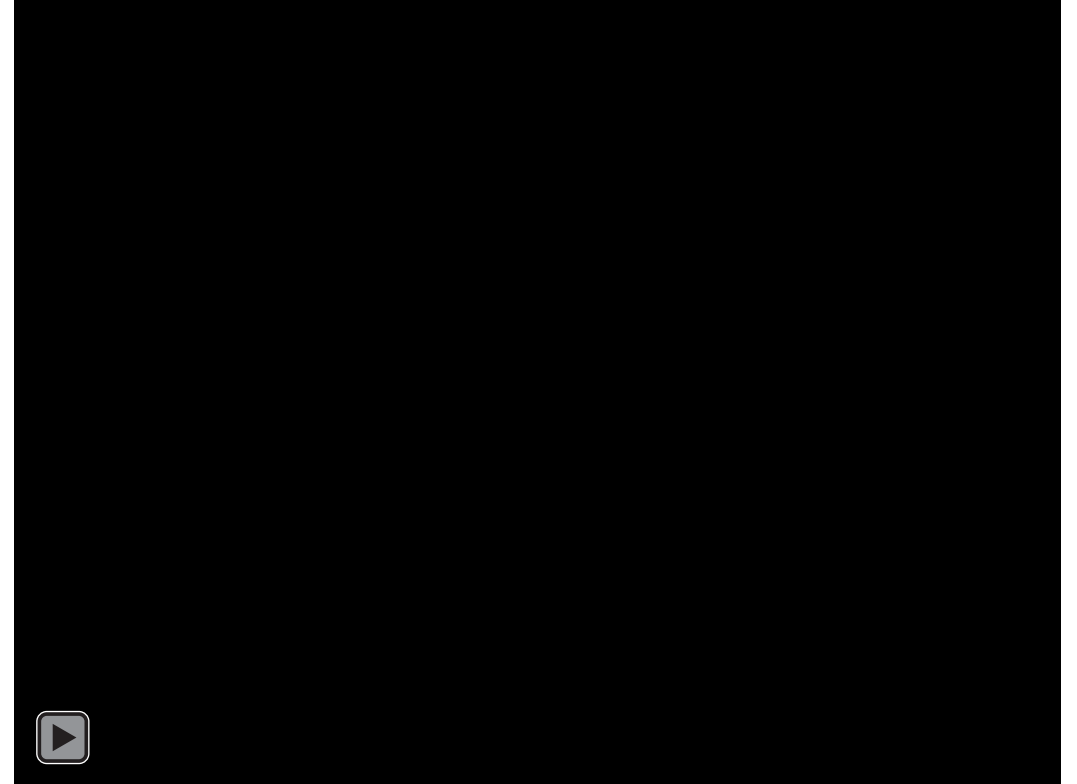
Conclusions: Slurry Injection Performance

Geochemical and microbial changes were observed.

TOC concentrations are low.

TCE has decreased in treatment zone, downgradient, and recovery wells.

Tiltmeter analysis, CSIA, and 12-month analytical data are still under analysis.



Thank you!



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