Lessons Learned: A 20-Year Review of the Effectiveness of Containment Barrier Walls in the Pacific Northwest

June 4, 2024

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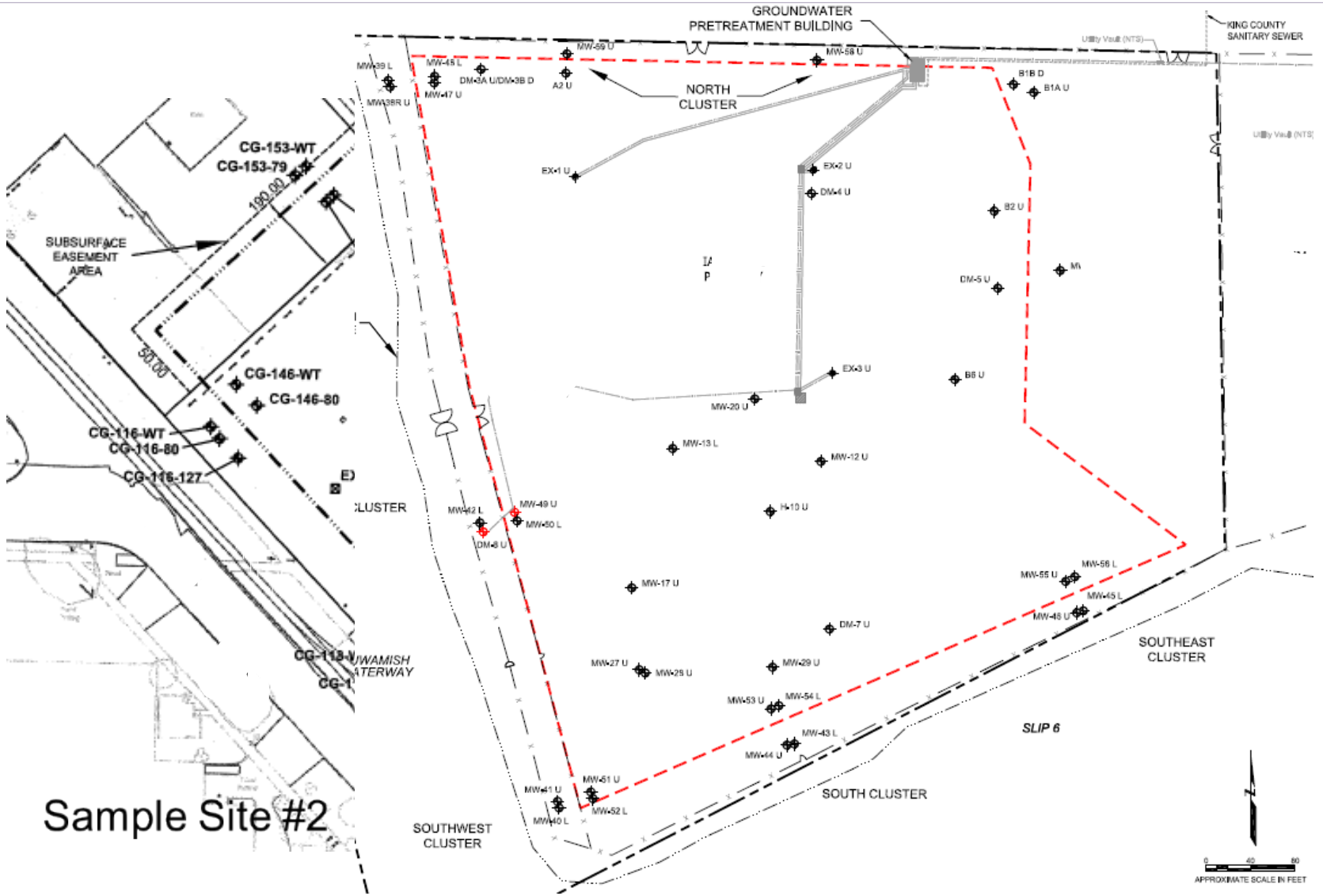
Battelle 2024 Chlorinated Conference

Session C4. Adaptive Site Management: Lessons Learned for Site Characterization and Remedy Performance Monitoring

Denver, Colorado

Sample Site Introduction



Sample Site #1

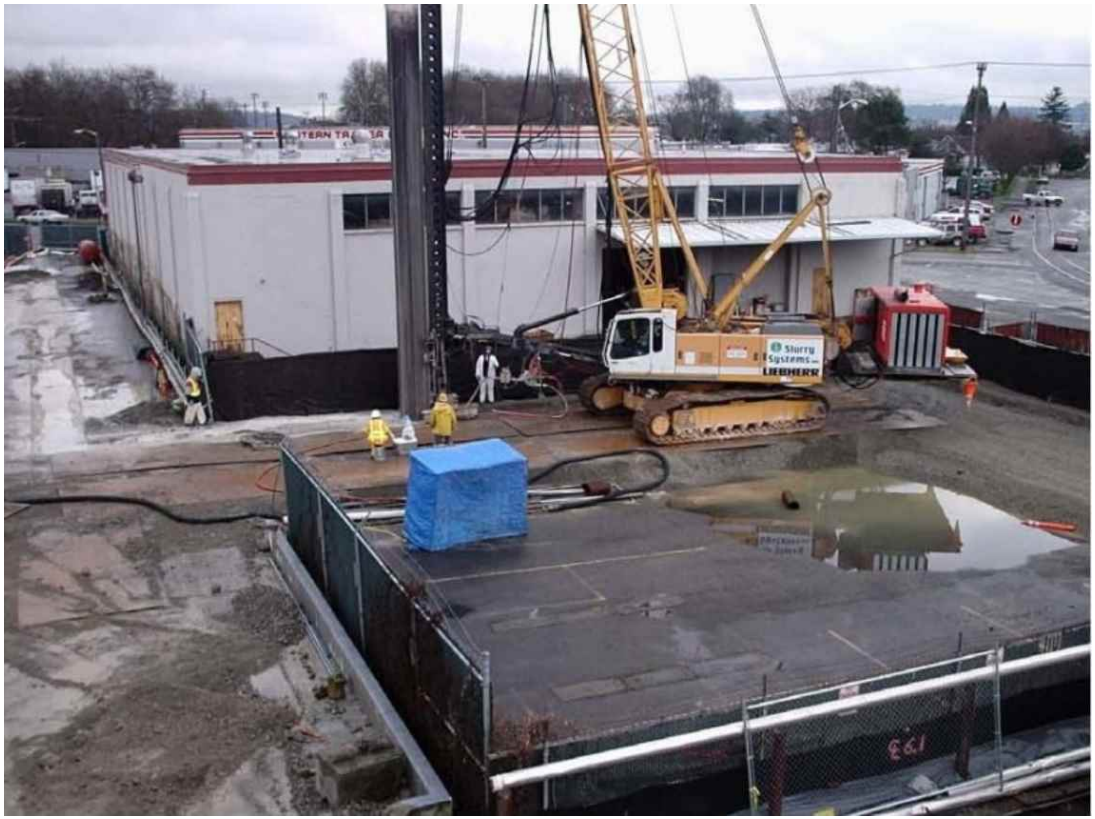
- Former TSD Facility
- Chlorinated Solvents with DNAPL to 90-feet below ground surface
- Site capped with a combination of Micro-silica and asphalt
- Vacant site, never redeveloped
- Hydraulic control flow rate ~5 gpm
- Water treated via air-stripping with emissions controls

Sample Site #2

- Former Vanillin Production Facility
- Primary COCs: Toluene, Caustic & Metals
- Site capped with asphalt
- Redeveloped for industrial tenant use with stormwater drainage system
- Site is tidally influenced by adjacent water body and variable pumping rates
- Water treated via carbon and discharged to POTW

Commonalities Between Barrier Wall Example Sites

- Vibratory Beam installed barrier walls
- Walls constructed from Attapulgite clay and slag cement
- Average thickness of 6-inches
- Both walls installed between 2002 and 2003
- Includes hydraulic control via low flow groundwater extraction governed by a minimum inward hydraulic gradient standard



System Performance

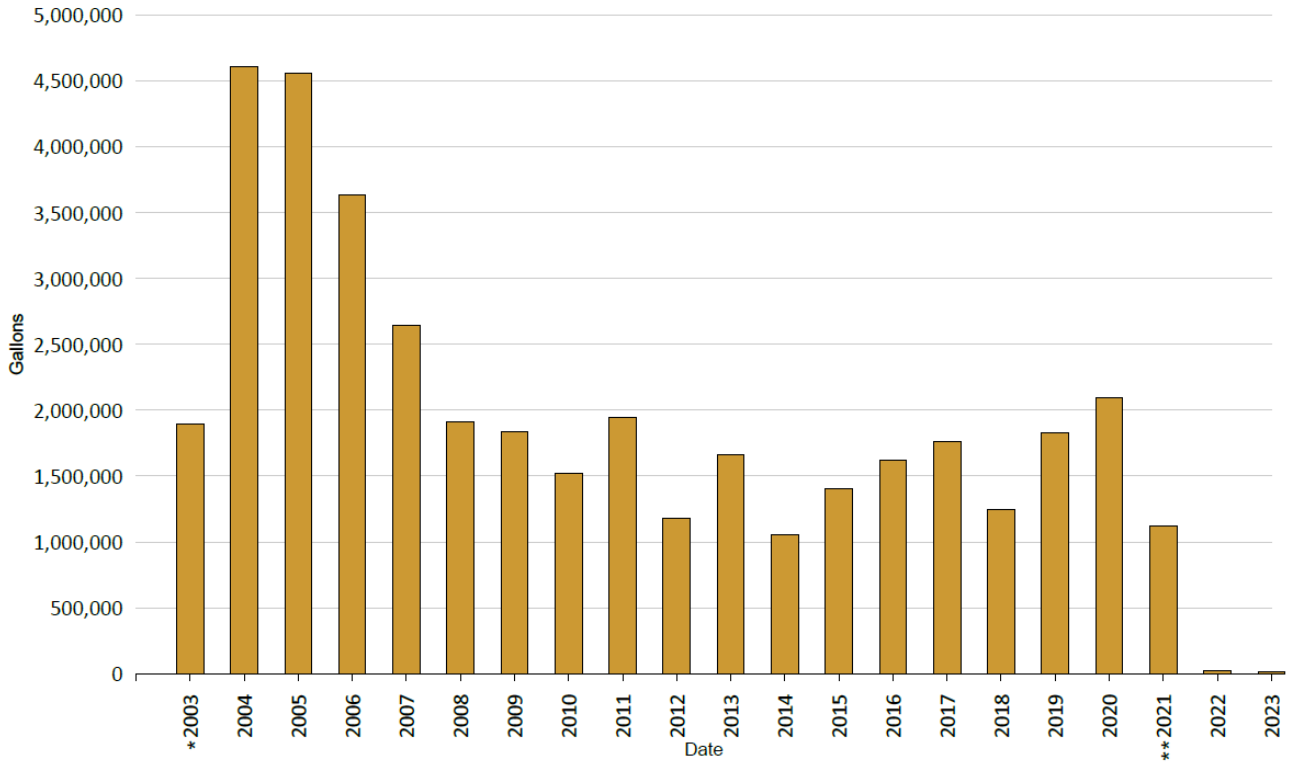
- Both systems functioned as designed, maintaining project-specific inward hydraulic gradient requirements with minimal pumping
- Cut off downgradient migration of contaminants, allowing for reduction of COCs in downgradient plume
- Sample Site #1:
  - Reductions in groundwater monitoring program costs
  - Downgradient vapor intrusion mitigation systems all shut down
  - Minimal interruption to rail operation during wall install
- Sample Site #2:
  - Large decrease in source concentrations due to bioremediation
  - Half property completely remediated and now STEM high school, other half allowing for ongoing remediation and continued industrial use (tenant income).

Lessons Learned: Performance Monitoring

- Groundwater gradient observations
- Specific capacity testing of pumping wells
- Routine groundwater monitoring
- Barrier wall and cap inspections
- Routine equipment maintenance

Lessons Learned: Pumping Over Time

- Using chemistry to your advantage to reduce fouling and other O&M tasks
- Maintaining larger gradients may reduce total pumping volumes to maintain required gradients for tidally influenced sites



Lessons Learned: Groundwater Conditions

- Containment cells may shift site conditions (e.g. ORP, Redox, etc) impacting natural attenuation
- Both sample sites were anaerobic (reducing) and remained in this state following wall installation

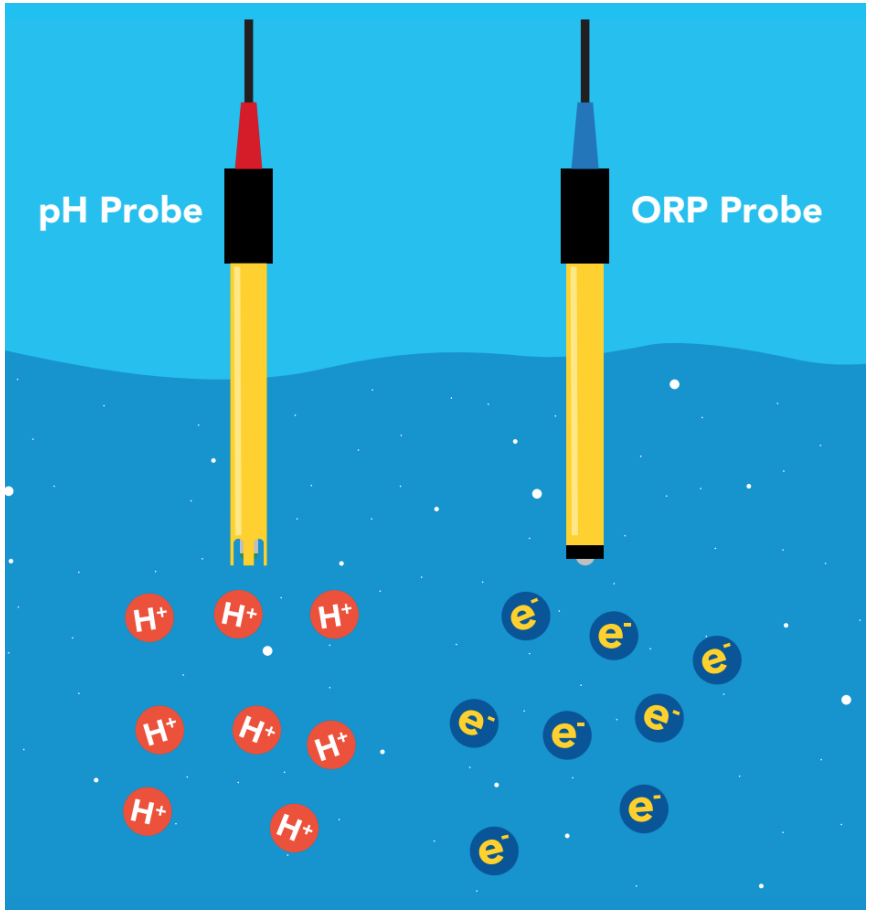
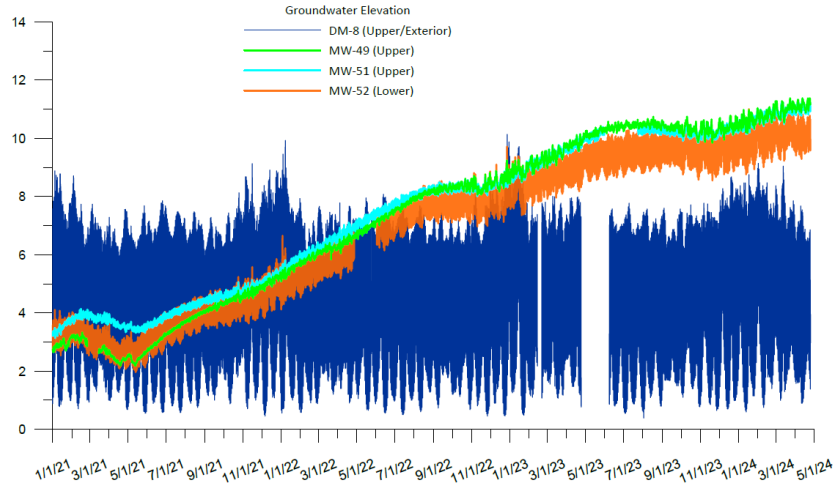


*Photo from Atlas Scientific Environmental Robotics

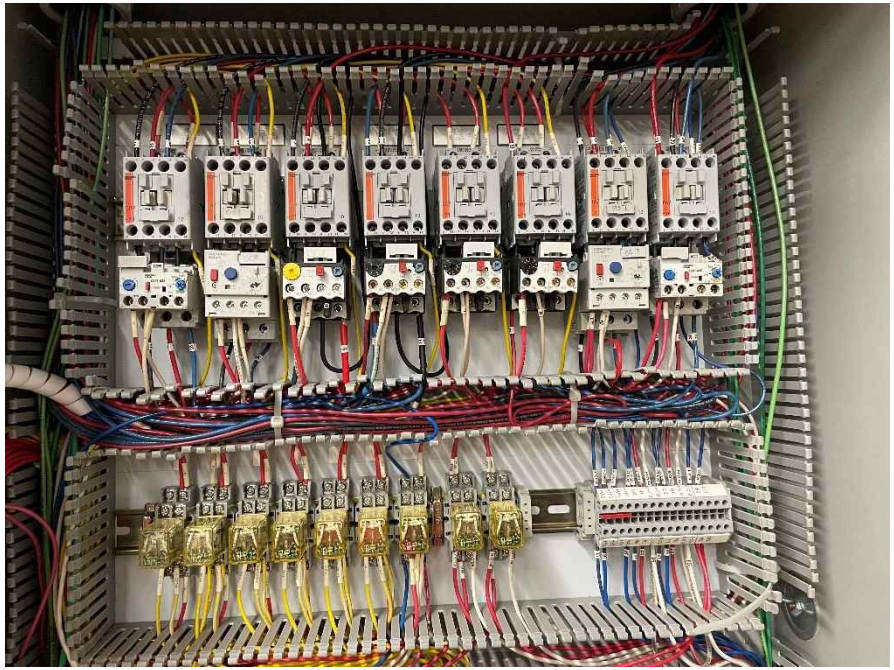
Pumping Cessation Pilot Study

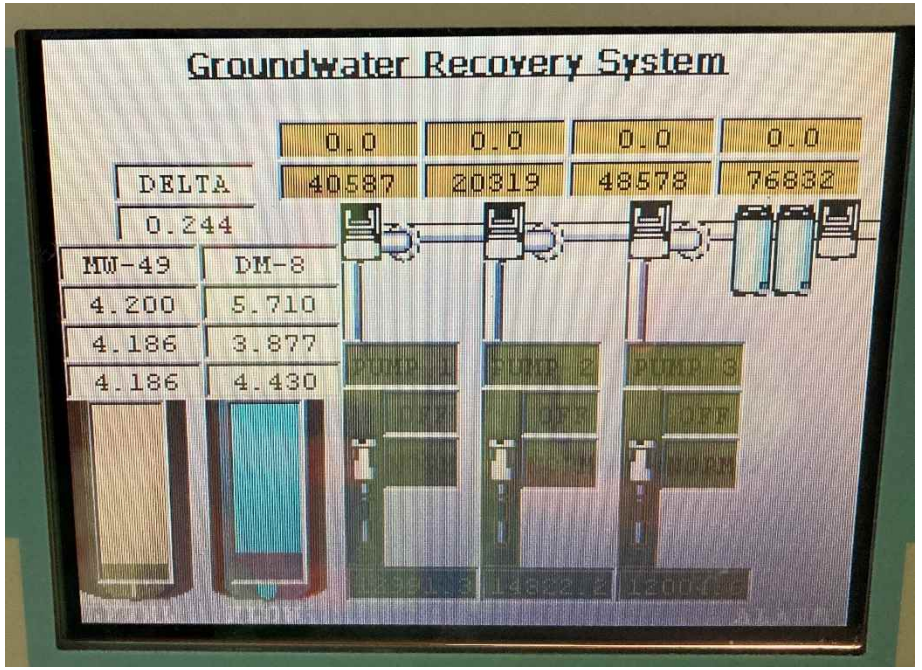
- Sample Site #2
  - Concentrations interior of wall have significantly decreased
  - Pumping was ceased in May 2021 and has remained off
  - Water levels internal to containment cell have equilibrated with deep aquifer (increased in elevation)
  - Cross-wall gradient is currently outward
- Water level changes throughout pilot study consistent with modeling
- Goal: Determine how system responds to pumping cessation for final remedy design.



Lessons Learned

- Electrical surge protection for sensitive equipment
- Quality system controls (e.g. PLC) up front saves money in the long run





Design Considerations

- Future Site Use
  - Design for proposed loading
  - Future remedial efforts
- Well thought out pre-design investigations
  - Chemistry & Hydrology for CSM

Questions & Discussion

Contact Information

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