

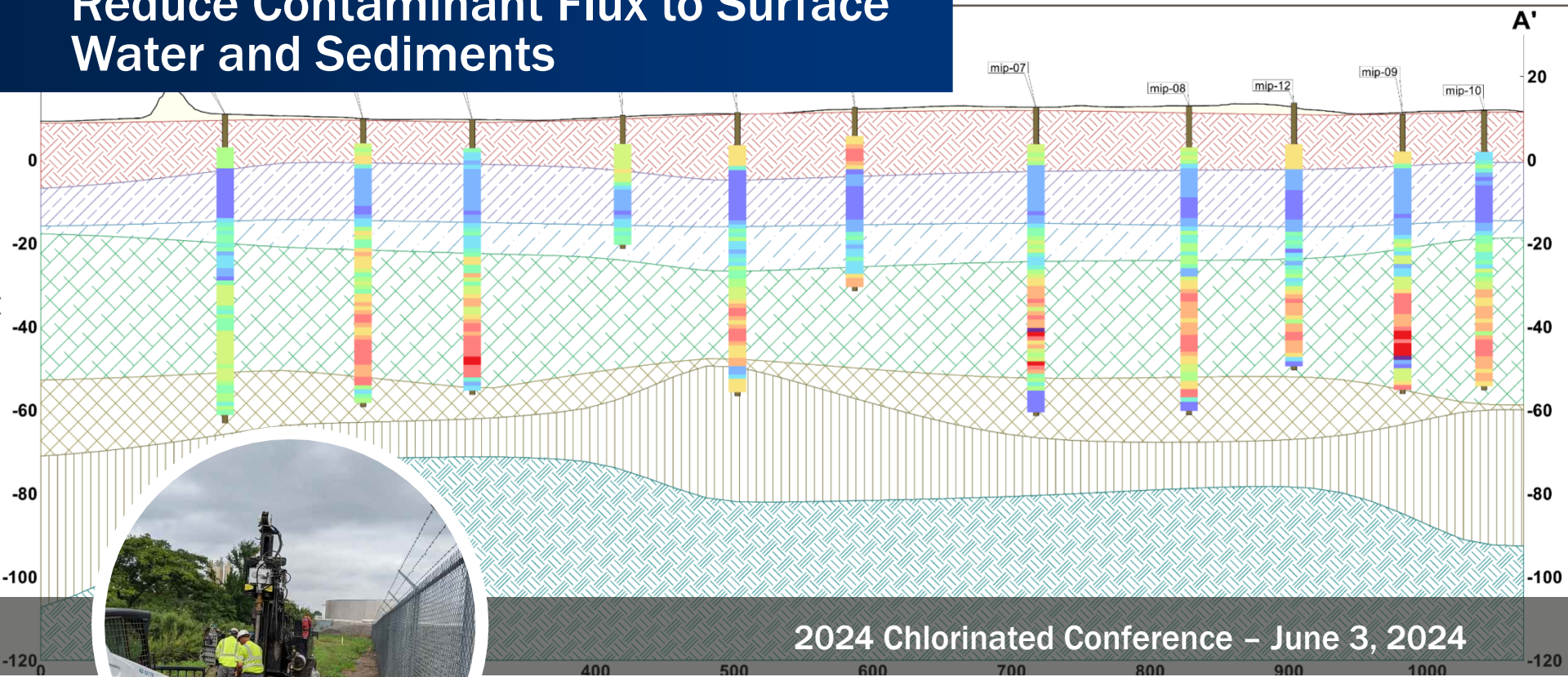


TETRA TECH



Mutch Associates, LLC
Environmental Engineers and Scientists

Targeted Remedy Implementation to Reduce Contaminant Flux to Surface Water and Sediments



Leading with Science®

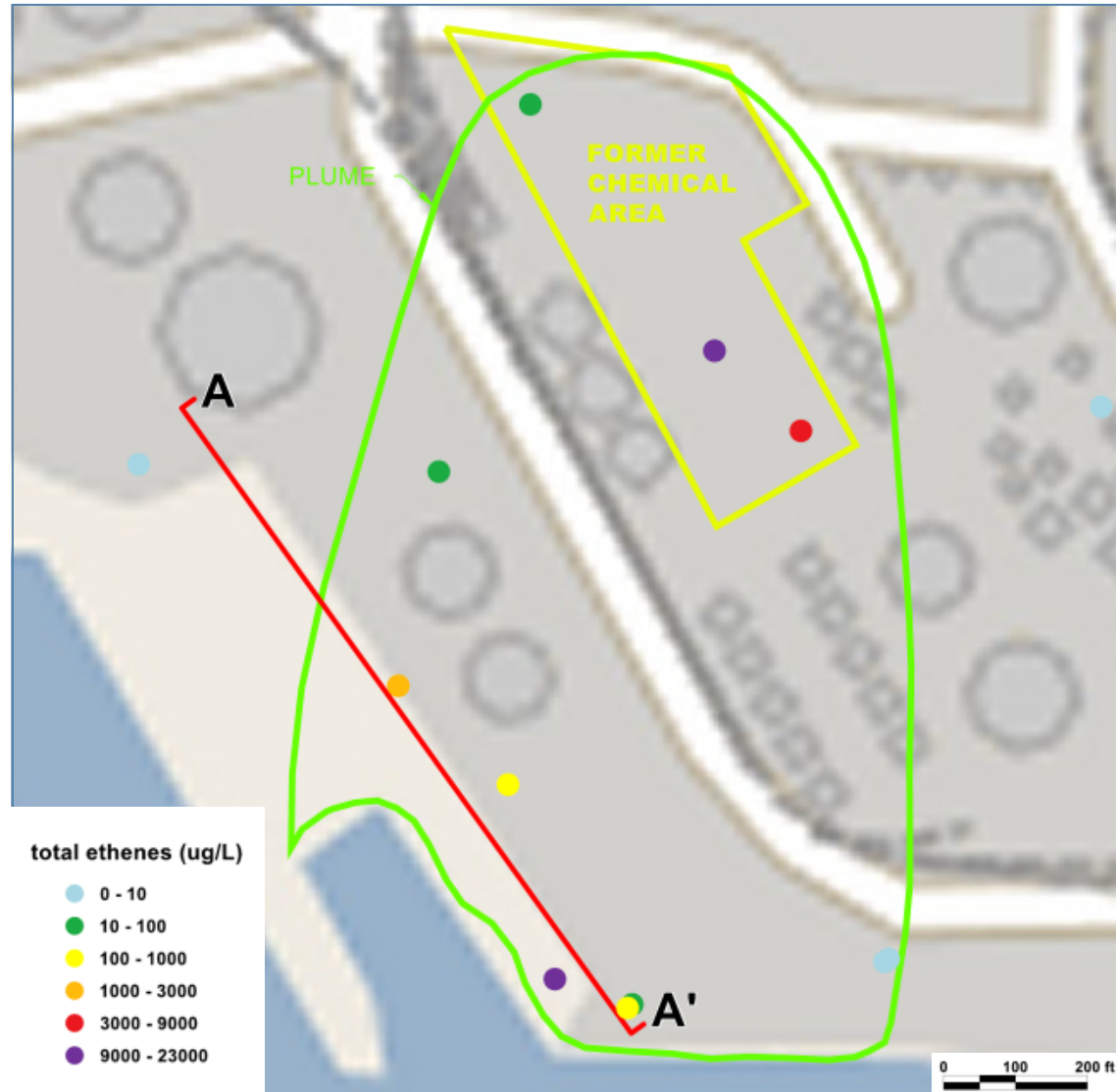
Site History



- Area was leased to a chemical company between 1961 through 1983
- Chemical company moved offsite 1983 and declared bankruptcy.
- State forced the land owner to remediate the site.
- Potential chlorinated DNAPL along with significant dissolved phase impacts.

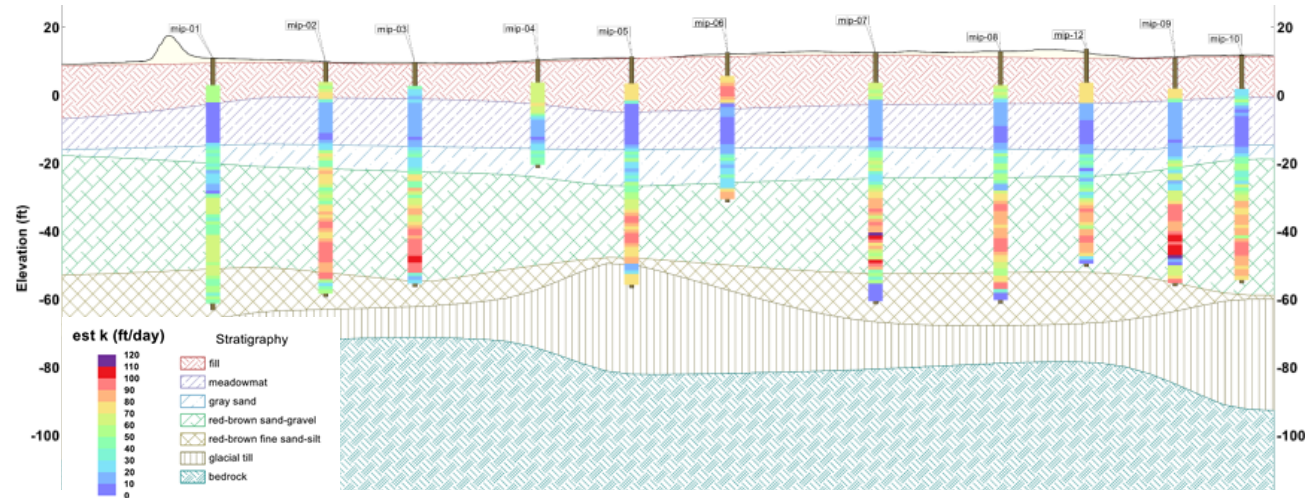
Remedial Options

- Groundwater reclassified due to saltwater intrusion, no groundwater standards.
- Receptor = Surface Water.
- Sediment and Surface Water -> Not Impacted.
- Evidence of increasing / probable increasing trends along the shoreline.
- Enhanced MNA proposed. PRB 900 feet long, based on plume width.

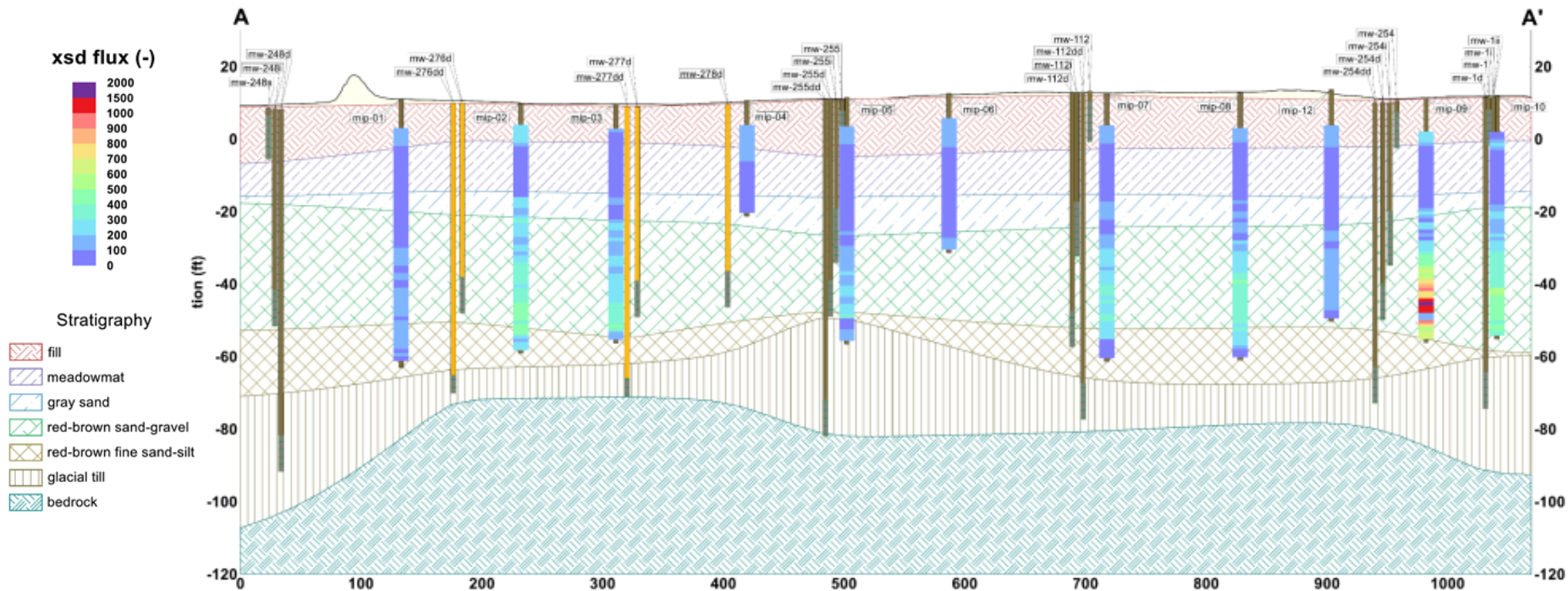


Red-Brown Sand-Gravel

- Prior investigations observed a potentially limited sand and gravel zone within the Till.
- Higher CVOCs found in this zone.
- Review of prior MIP data and boring logs identified a red-brown sand-gravel zone with elevated hydraulic conductivity, potentially more extensive than previously thought.



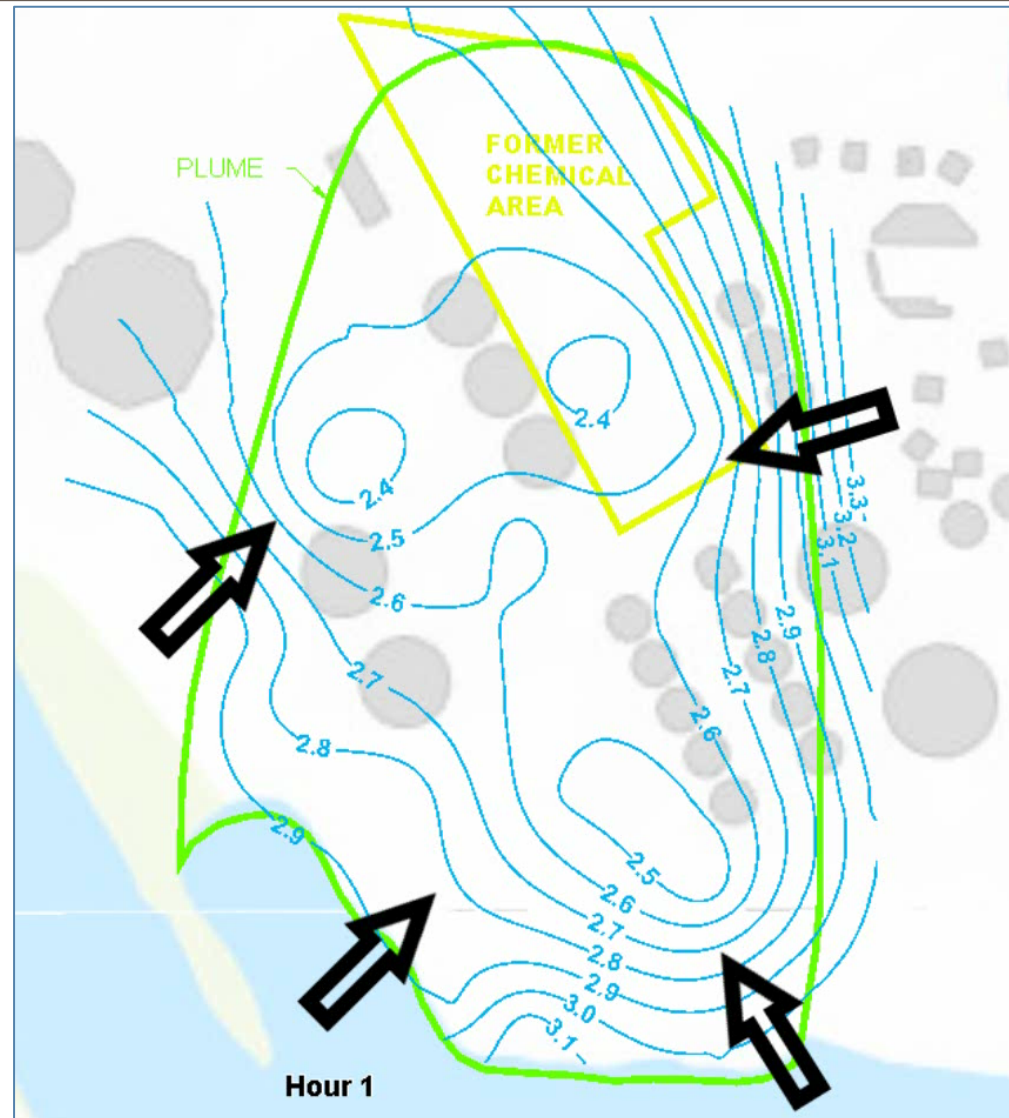
MIP Flux



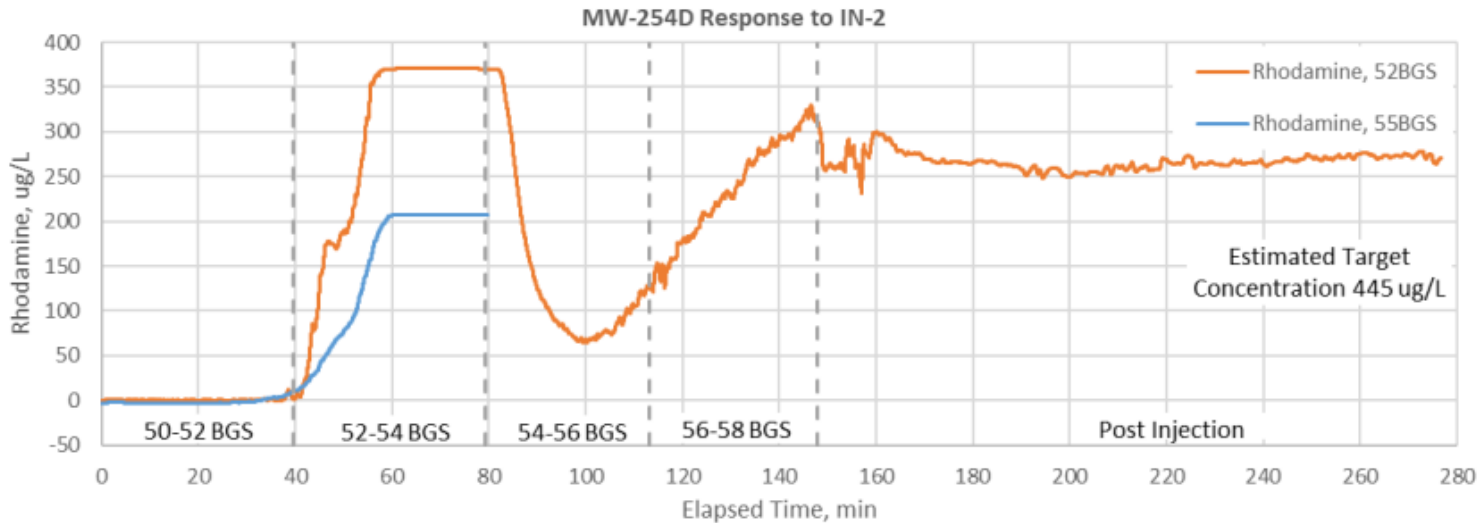
- Product of MIP estimated hydraulic conductivity and XDS readings highlights areas of increased mass flux.
- To support a targeted enhanced MNA remedy, connection of this high flux zone to the source area was needed.

Tidal Groundwater Flow

- Groundwater levels in the red-brown sand-gravel are tidally influenced (upwards 2 ft daily flux) and generally flat gradient.
- Pressure transducers were used to collect water levels over 7 days.
- Measured water levels were converted to freshwater head to correct for salinity.
- Likely area of localized groundwater discharge to surface water observed 42% of the time.



Clean Water Injection Pilot Test

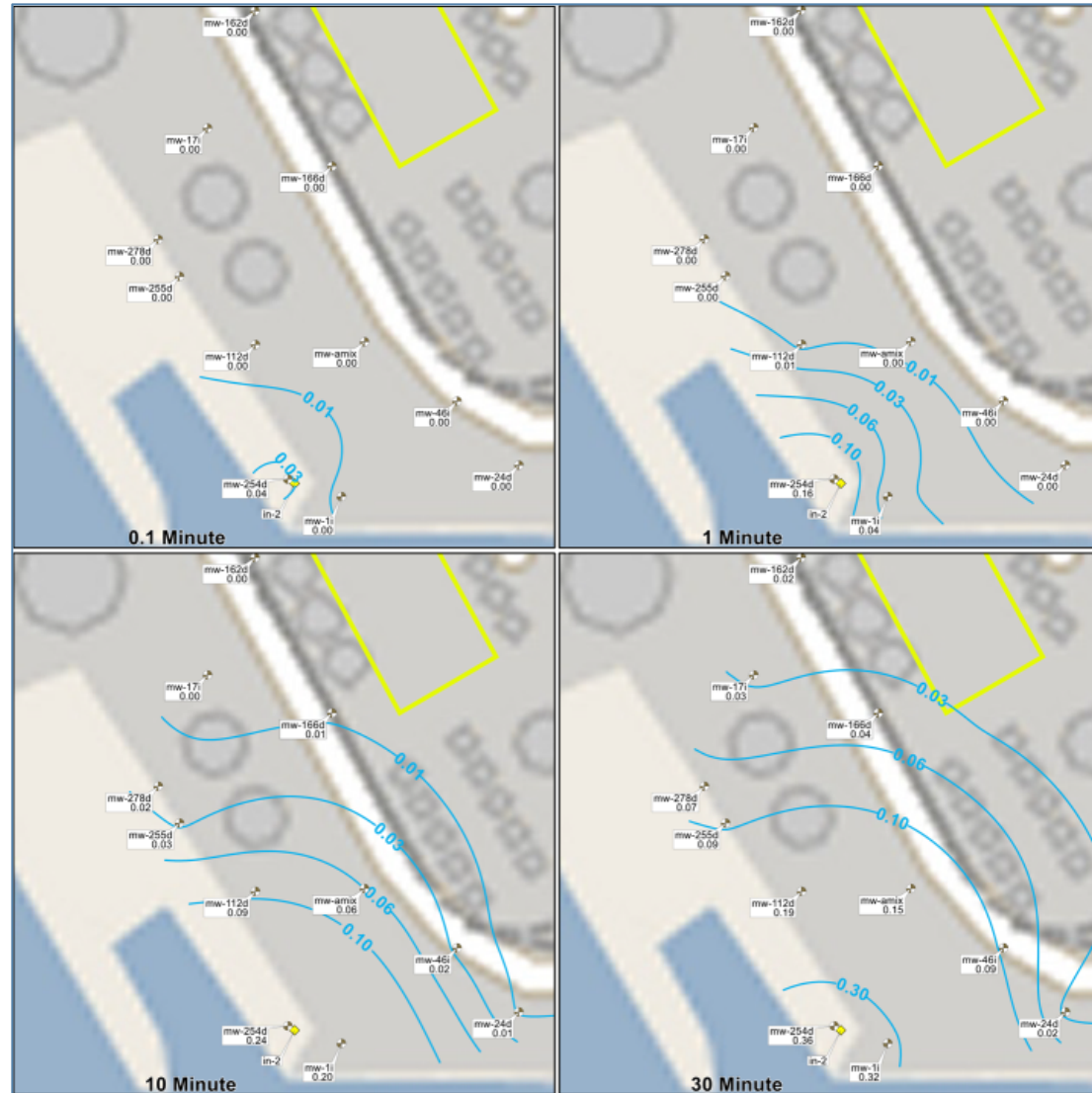


- Designed to simulate actual injection (top-down, 2 ft intervals).
- Injection boring located 16 ft from MW-254D.
- Rhodamine added to anoxic water to determine injection response.
- Rhodamine logged real-time.

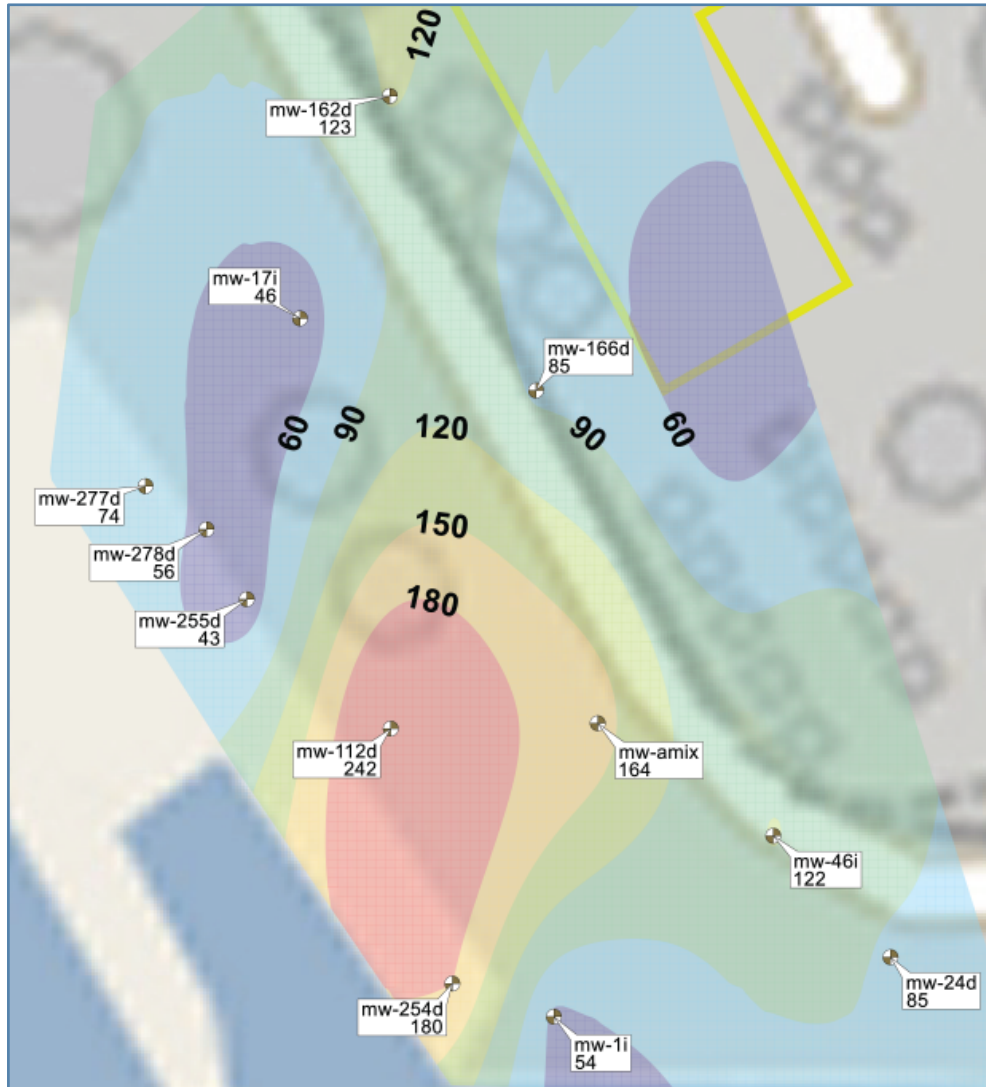


Injection Displacement Propagation

- Aquifer testing to support concept of a higher permeability conduit between the Chemical Area and the waterfront in the vicinity of MW-254D.
- Pressure transducers installed in red-brown sand-gravel zone wells during the clean water injection pilot test.
- Injection displacement propagation over the first 30 minutes of the injection event suggest a slightly asymmetric pattern of displacement, with faster propagation towards the Chemical Area.



Directional Hydraulic Conductivity



- Pressure transducer data was analyzed via Theis method and Hsieh cross-hole technique to determine directional hydraulic conductivity.
- Directional hydraulic conductivity represents the integrated conductivity of the aquifer between the test well and the observation well.
- Results indicate a high permeability pathway exists between the Chemical Area and the waterfront in the vicinity of MW-254D.

Proposed PRB Location



- A barrier length of 224 feet was designed to intercept the high mass flux zone discharging to surface water, upgradient of MW-254D.
- With a 16 ft ROI, MW-254D would be downgradient of the PRB to monitor long-term performance.

PRB Implementation

- PRB installed late 2021
- Electron donor: Evonik EHC-L
- Bioaugmentation culture: Aptim SDC-9
- Magnesium hydroxide buffer.
- Injection water treated with Newman Zone OS prior to use.
- Sonic drill rig direct injection.
- Target red-brown sand-gravel zone 35 to 65 ft bgs.
- 14 ft injection point spacing.
- Injected top-down in 2 ft vertical intervals.
- Approximately 1 day per location.

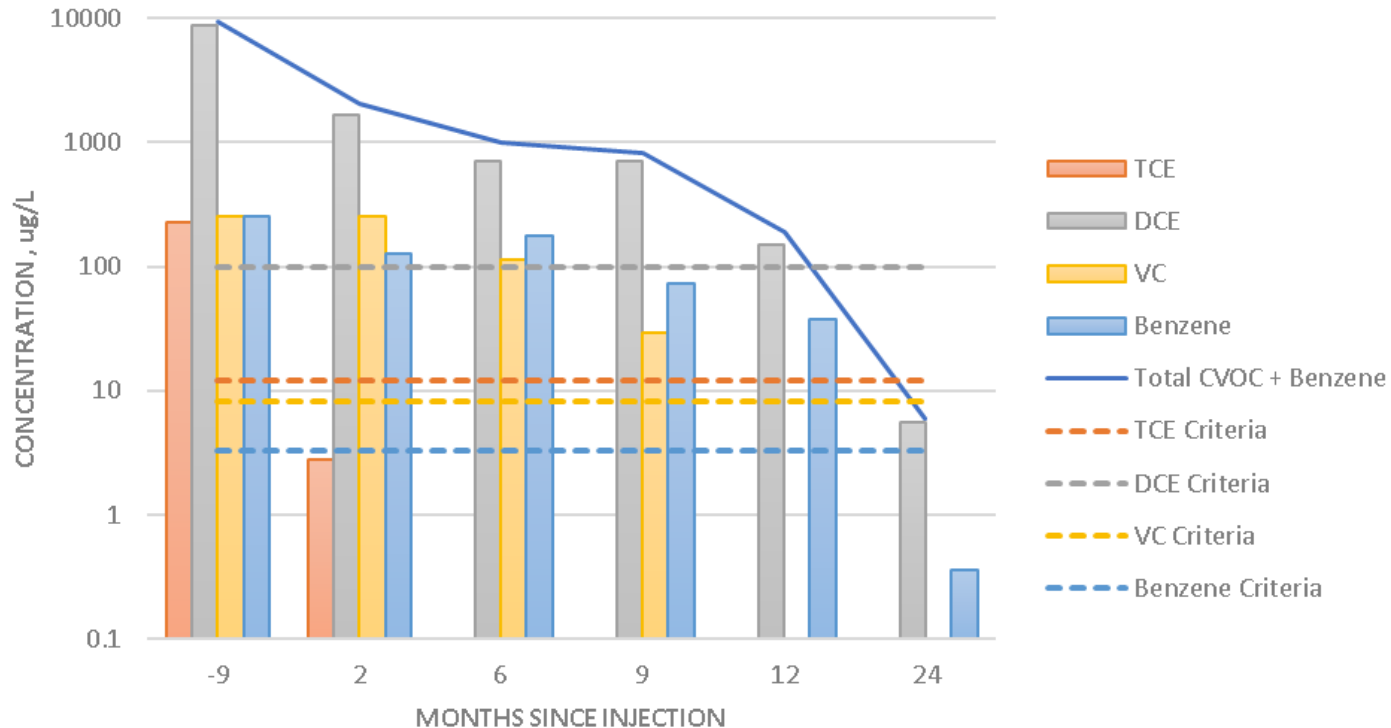


Smoke?



- One morning, “smoke” was noted coming from a pallet of EHC Liquid Reagent Mix.
- Material stored onsite for 20 days, over which 9 inches rain occurred, with 8.5 inches in a single day.
- Dissolution of the EHC Liquid Mix Reagent is an exothermic reaction.
- Small volume of water absorbed into bags, not able to dissipate heat created elevated temperatures.
- While no damage or risk of damage occurred, Client’s perception was different.
- EHC Liquid Reagent Mix should be kept dry until ready for use.

PRB Performance



- Contaminant mass flux to surface water has been reduced by 99.9% (24 months post injection).
- Reduction is benzene observed.
- Long-term remedy performance to be determined by sediment porewater sampling.

Questions?

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