

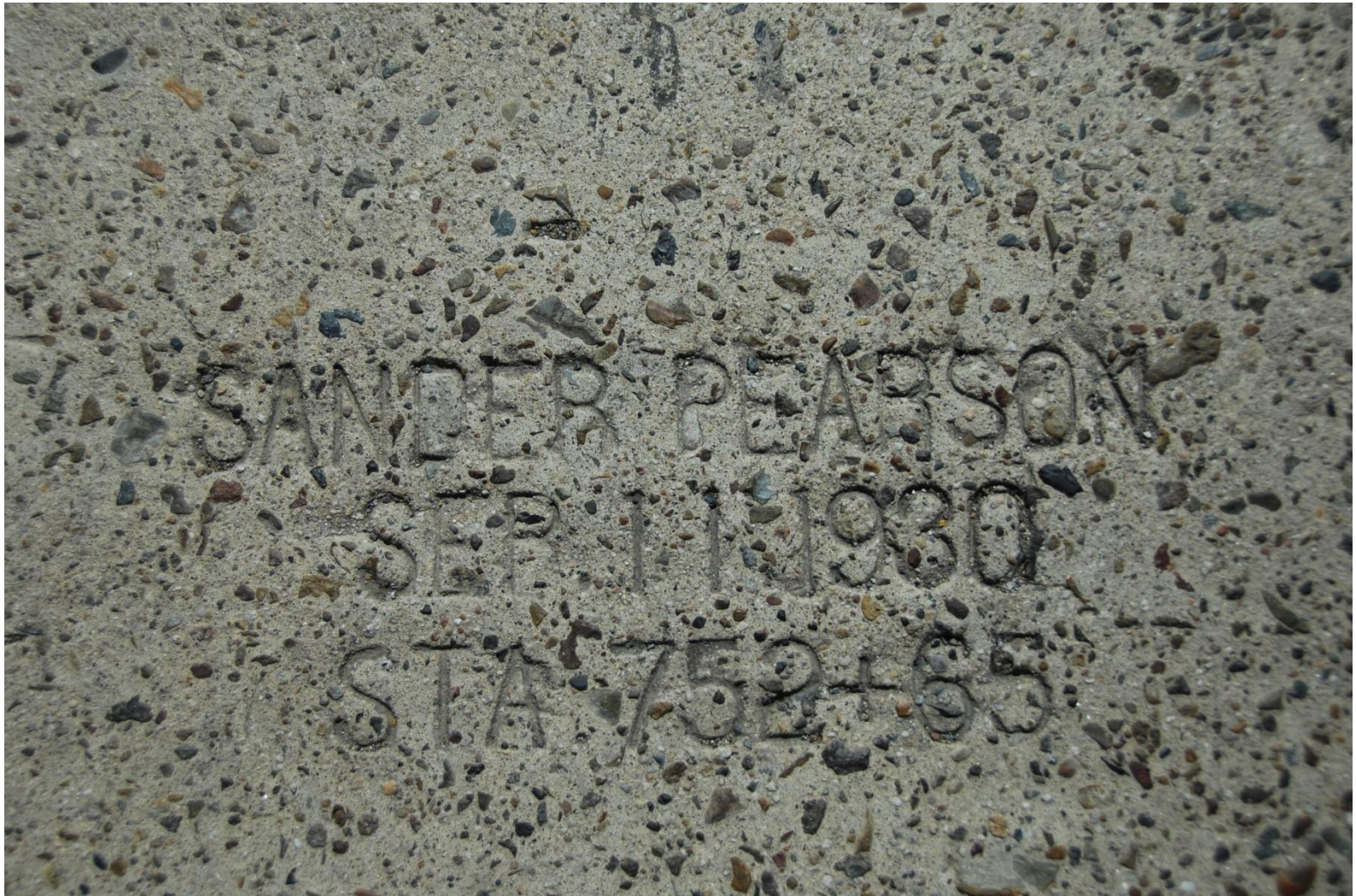


Pine Valley Trailer Park A Tale of Two (fractured rock) Aquifers

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Project Manager
SCS Engineers



History



History

- Gasoline Service Station from 1940s to 1986
- Most recently Hilltop Mobil, where cars stop to re-fill their radiators
- Two USTs and dispenser removed in 1992
- HMMD requested Site assessment

Today...

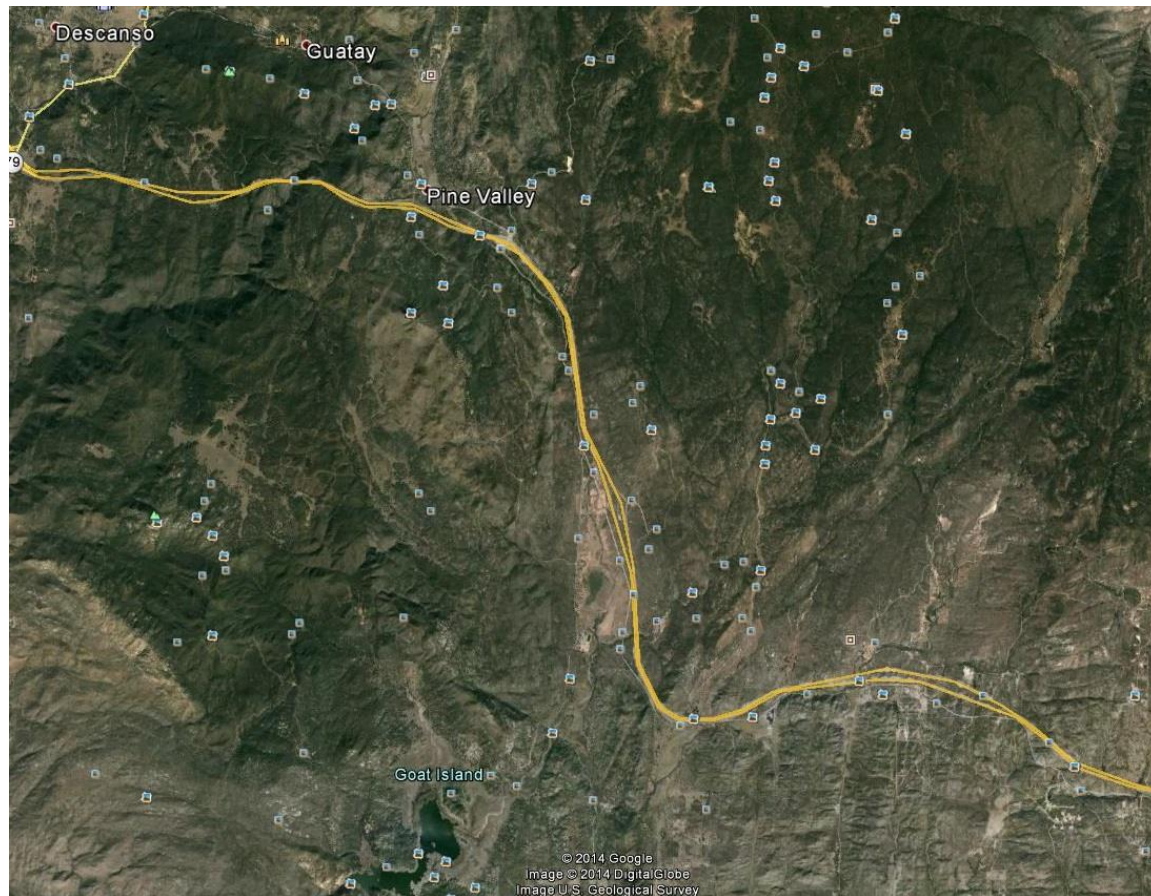


Assessment

- Excavate petroleum hydrocarbon-bearing soil in the vicinity of the former USTs and fuel dispenser.
- Groundwater Assessment
 - 17 Groundwater Monitoring Wells

CSM

- Residuum to 15 feet
- Fractured granitic rock below that
 - Plutonic emplacement



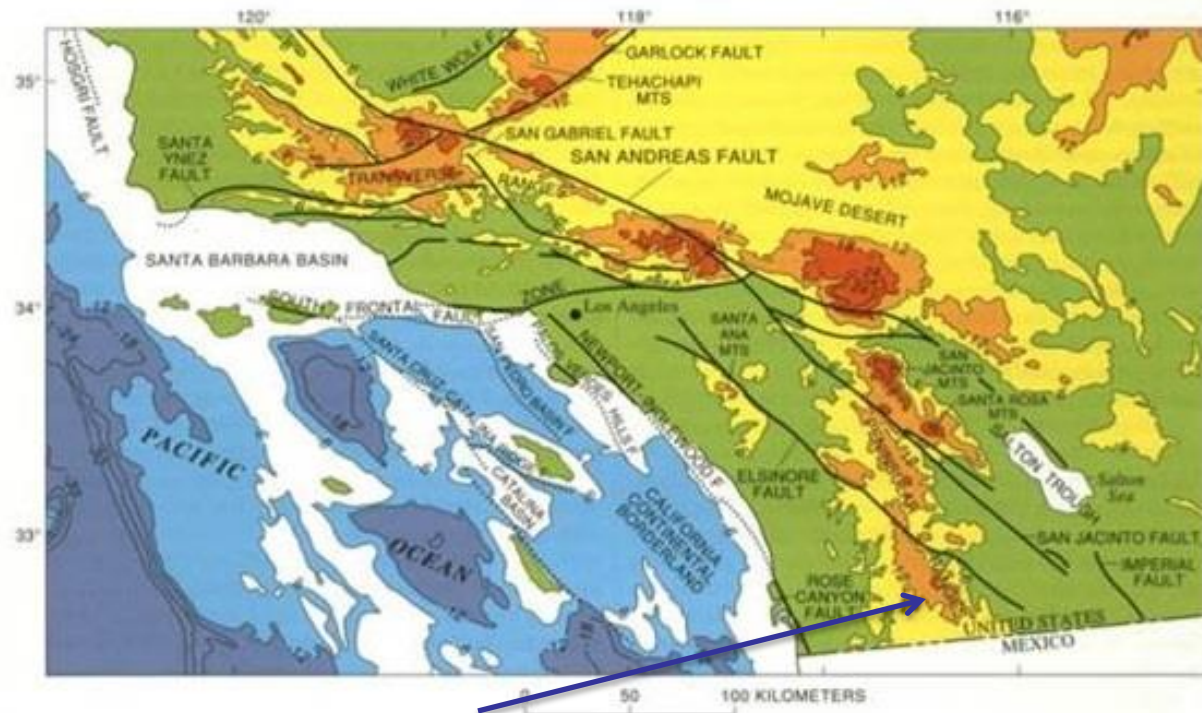
CSM

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 - Stress-release



CSM

- Residuum to 15 feet
- Fractured granitic rock below that
 - Plutonic emplacement
 - Stress-release
 - Tectonic stress



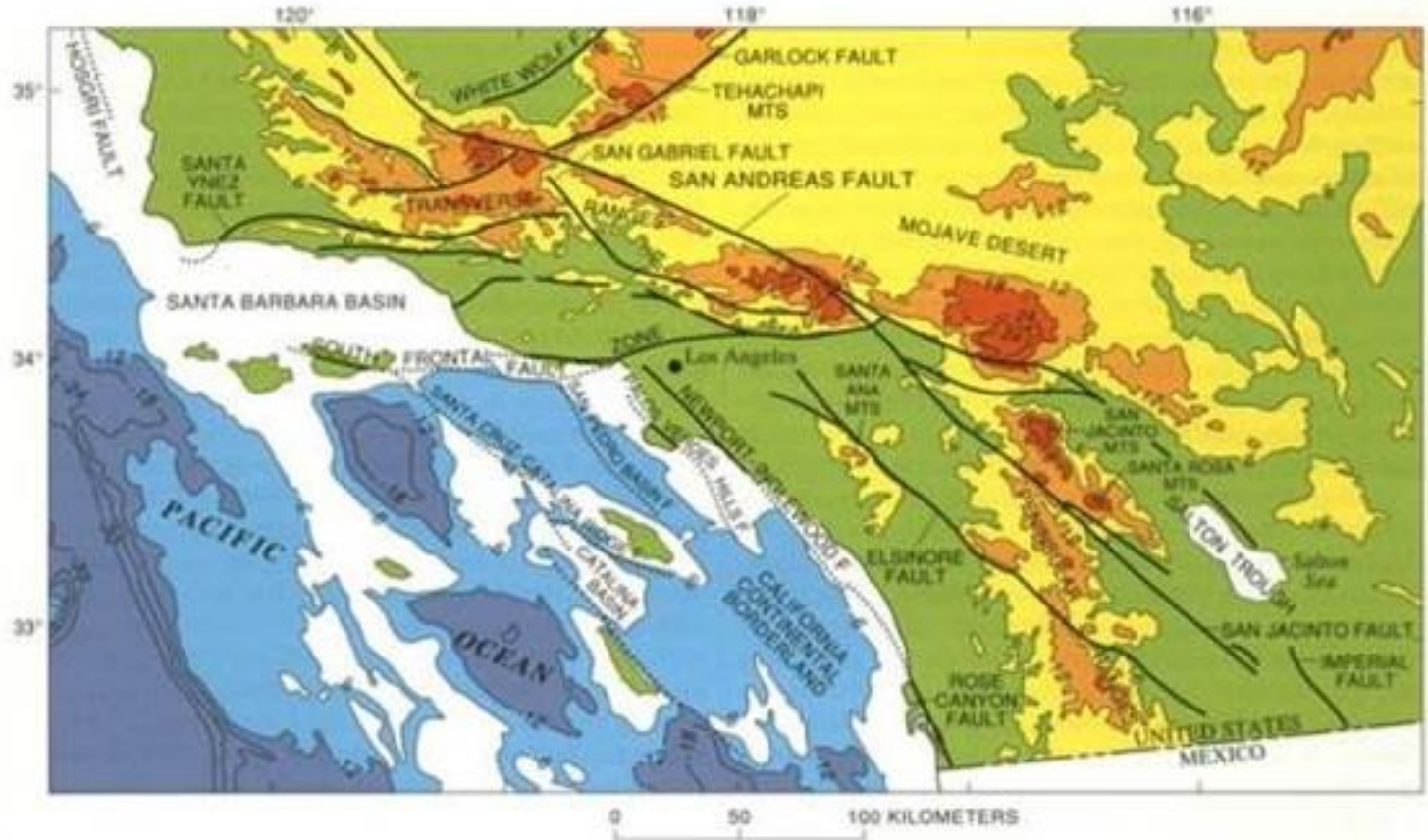
Guatay

Fracture Assessment



Fracture Assessment

- Tectonic Stress Fractures



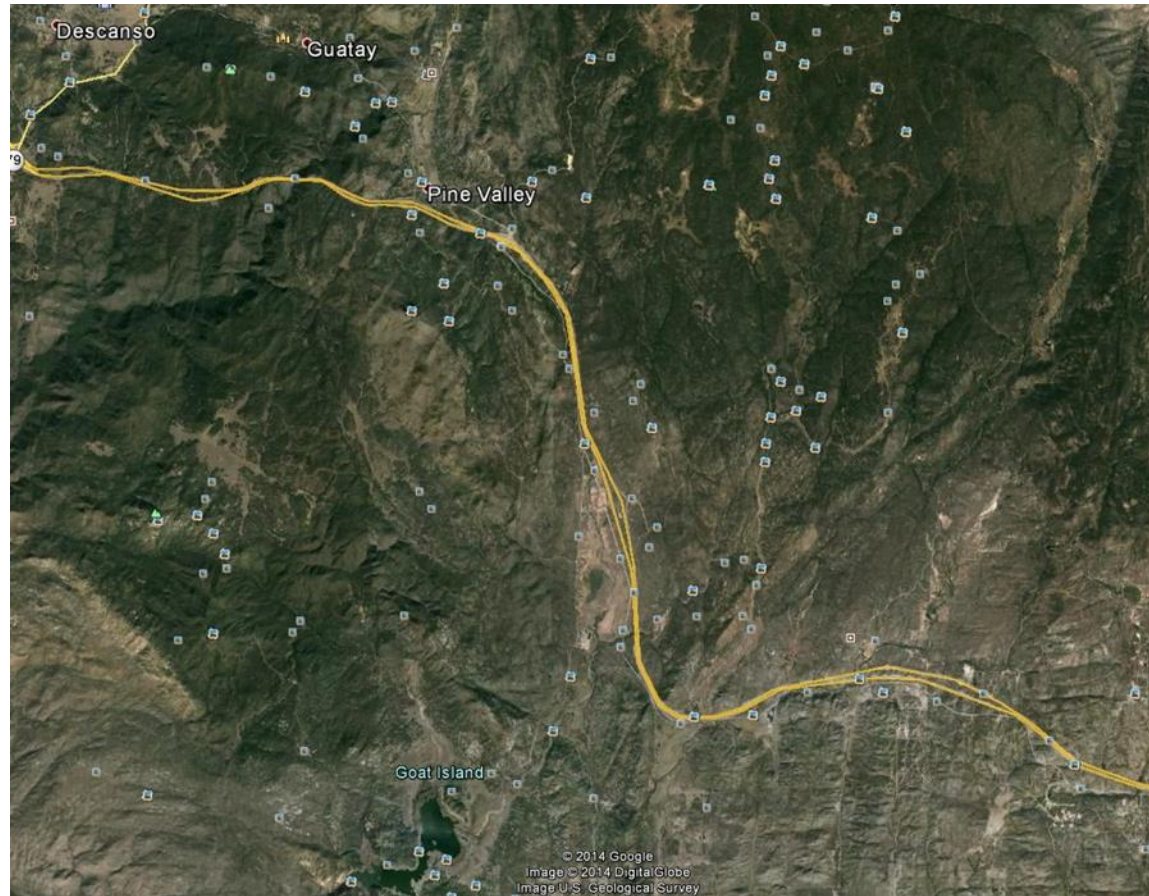
Fracture Assessment

- Fracture trace analysis



Fracture Assessment

- Pluton Emplacement Fractures



Fracture Assessment

- Fracture measurements at A, B, and C



Fracture Assessment

- Fracture measurements at A, B, and C

Outcrop	Orientation
A	E-W/88N
	E-W/89S
	E-W/84S
	N88W to N87E/vertical
	N83W/vertical
	N87W/vertical
	N80W/80NE
	E-W/vertical
	N60E/55SE
B	N80E/40SE
	N85E/42SE
C	N85W/vertical to N70W/80N

Fracture Assessment

- Field fracture measurements

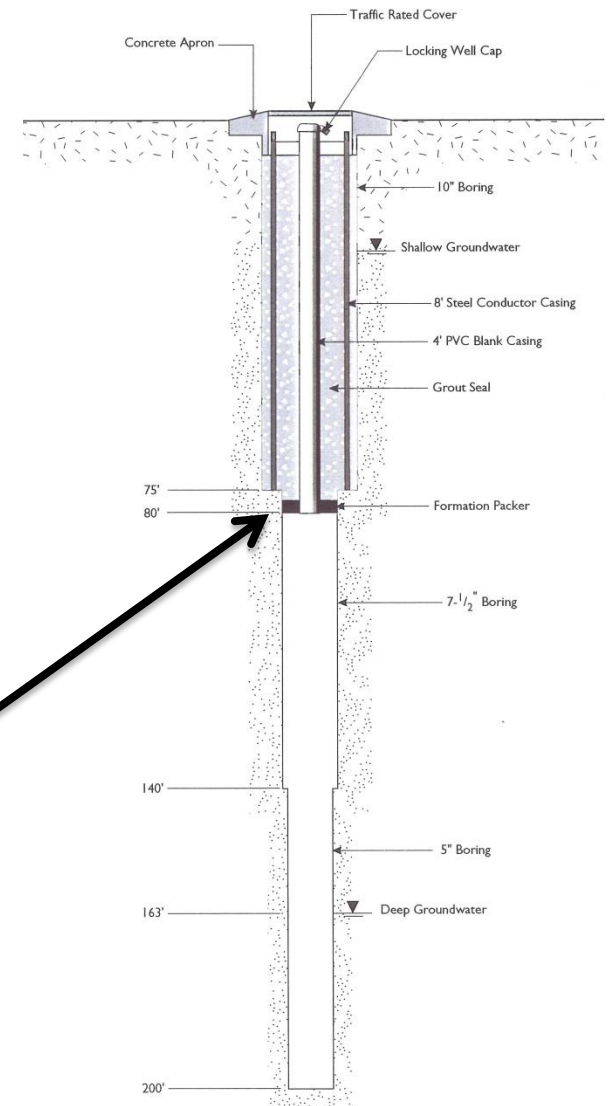


CSM

- Residuum to 15 feet
- Fractured granitic rock to 15 kilometers+:
 - Cuyamaca gabbro
 - Quartz monzonite and granodiorite
 - Granite pegmatites
- Groundwater:
 - Shallow groundwater at 25 to 30 feet

Do No Harm!

- MW-11
 - Cored to 75 feet, observed fractures closed or mineral-filled
 - Installed steel conductor to 75 feet
 - Drilled to 200 feet
 - Installed PVC casing with formation packer to 80 feet
 - Got rid of well as soon as possible!



CSM

- Fractured granitic rock



30'

38'

CSM

- Fractured granitic rock

38'



48'

CSM.v2

- Residuum to 15 feet
- Fractured granitic rock to 15 kilometers+:
 - Cuyamaca gabbro
 - Quartz monzonite and granodiorite
 - Granite pegmatites
- Groundwater-***Two Aquifers:***
 - Shallow groundwater at 25 to 30 feet
 - Deeper (regional) groundwater at ~160 feet
 - Subhorizontal (stress relief) fracture at about 30 - location of impacted groundwater

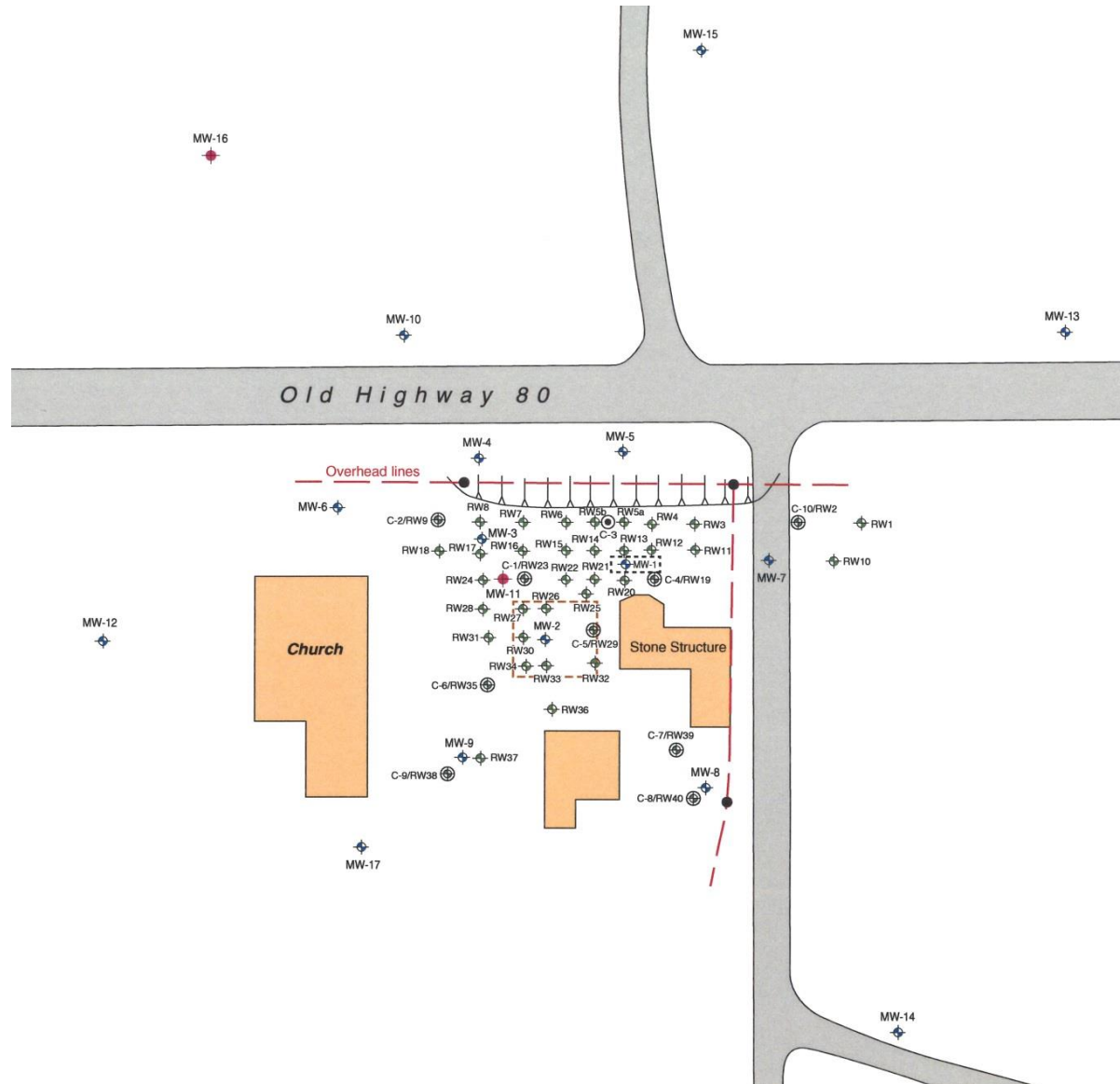
CAP

- Final (revised) version February 2001
 - Install multiple wells for ORC application-DEH wanted monitoring wells not be used for ORC application
 - ***Included provision for more aggressive FP removal***

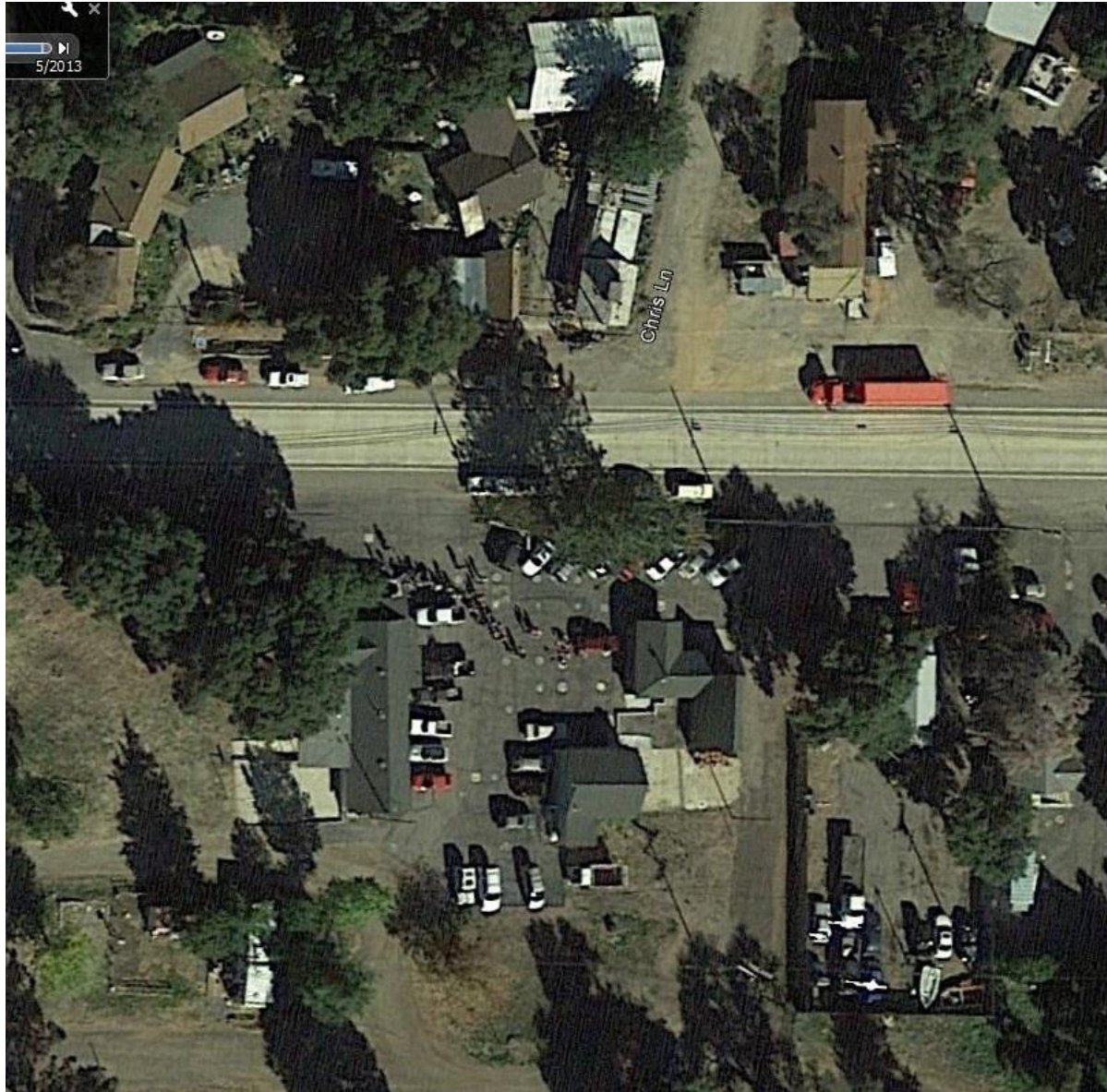
CAP

- Remediation Well Installation
 - 41 remediation wells installed
 - First 10 cored to test the CSM-relatively horizontal fracture at about 30 feet

CAP



CAP



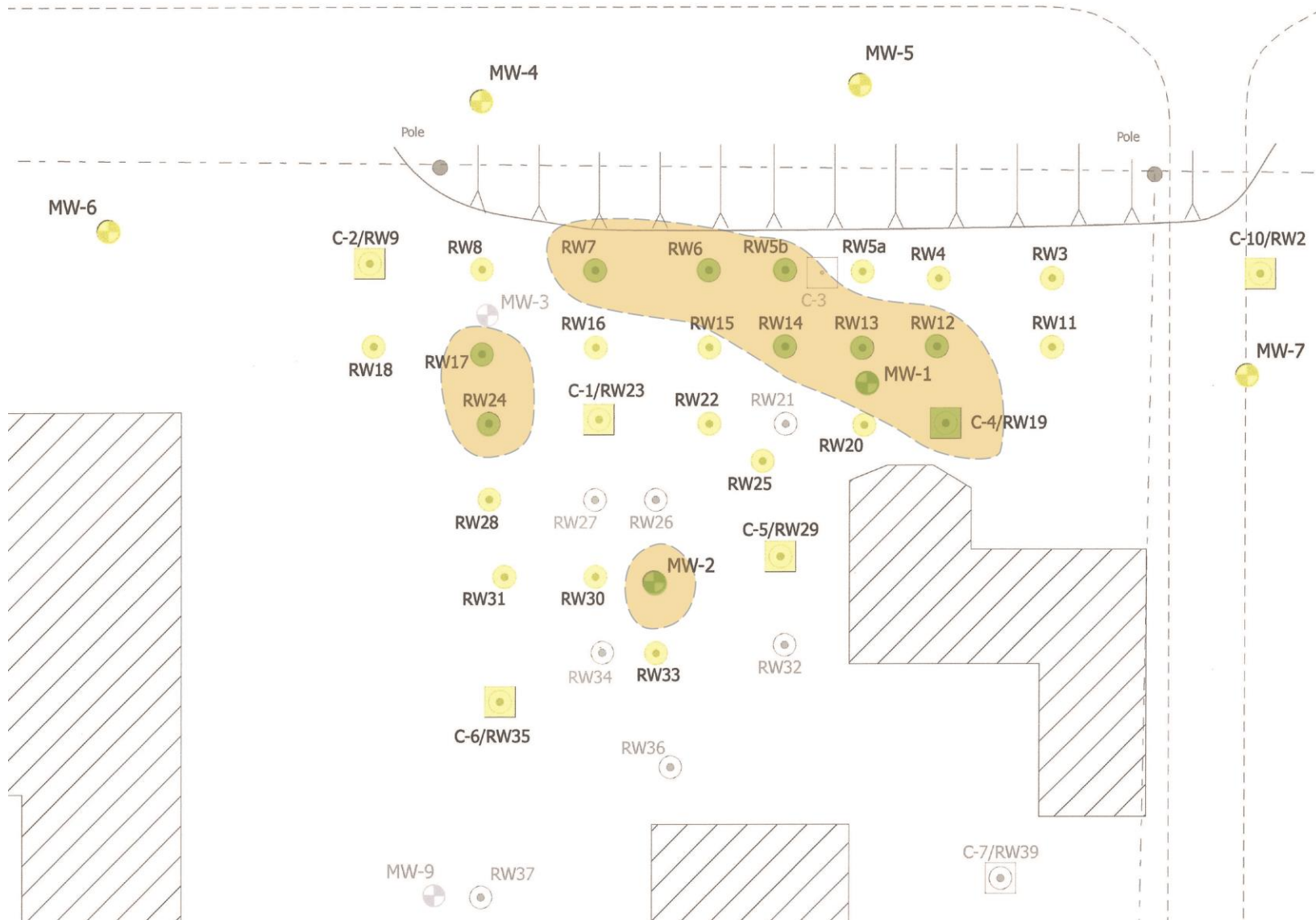
CSM.v3

- Remediation Well Installation
 - 41 remediation wells installed
 - First 10 cored to test the CSM-relatively horizontal fracture at about 30 feet
- Result:
 - CSM amended: Hydrocarbons generally in first open fracture below groundwater piezometric surface, regardless of fracture orientation
 - FP in multiple wells

CAP

- ORC Application
 - ROWD
 - Socks installed in remediation wells
 - Removed after about 6 months
- Free Product Removal
 - Passive product bailers (installed before ORC)
- Result:
 - Free product in 11 wells, not effectively addressed by ORC
 - <300 pounds removed by bailers
 - Submitted workplan for HVDPE pilot test

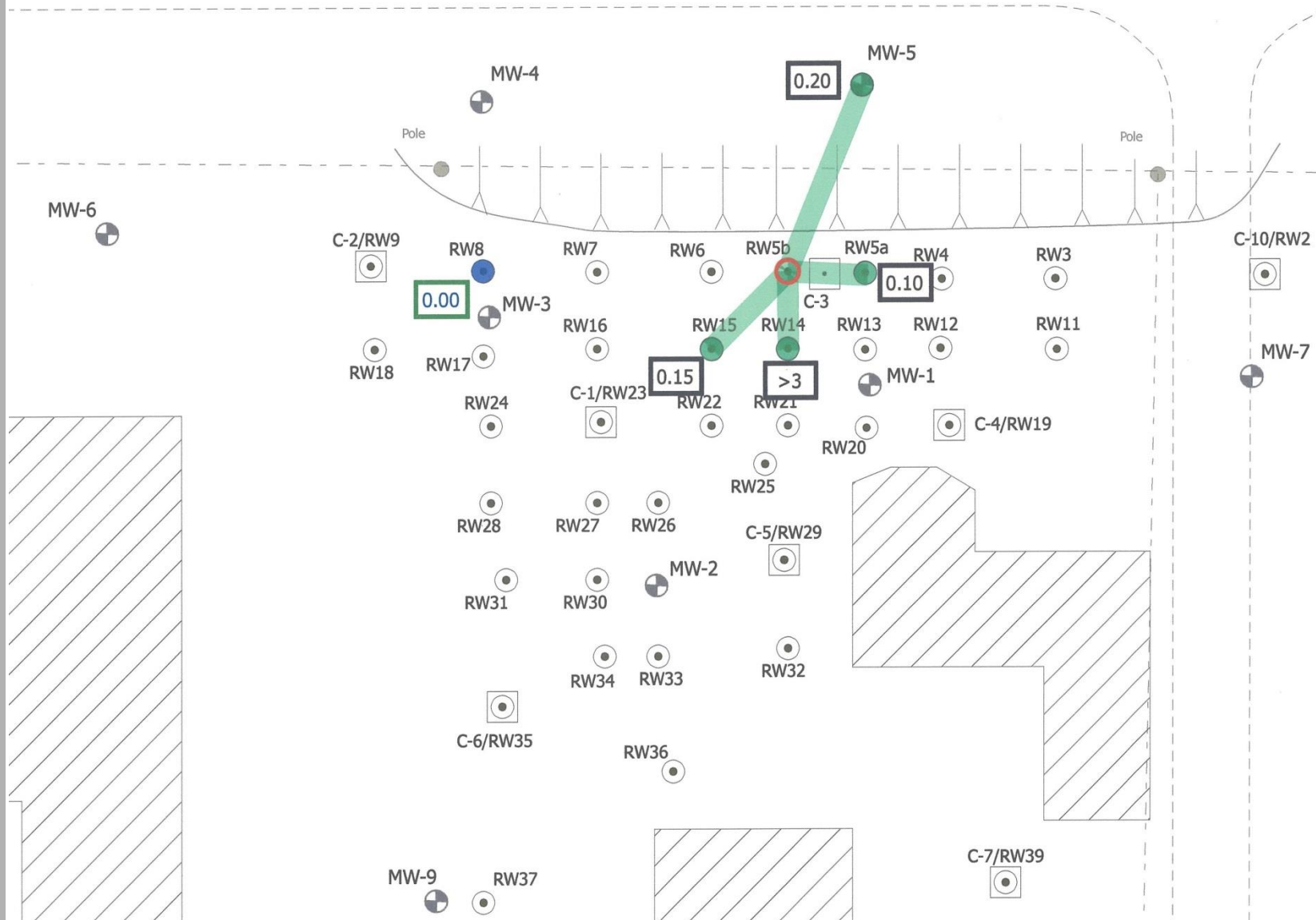
Free Product



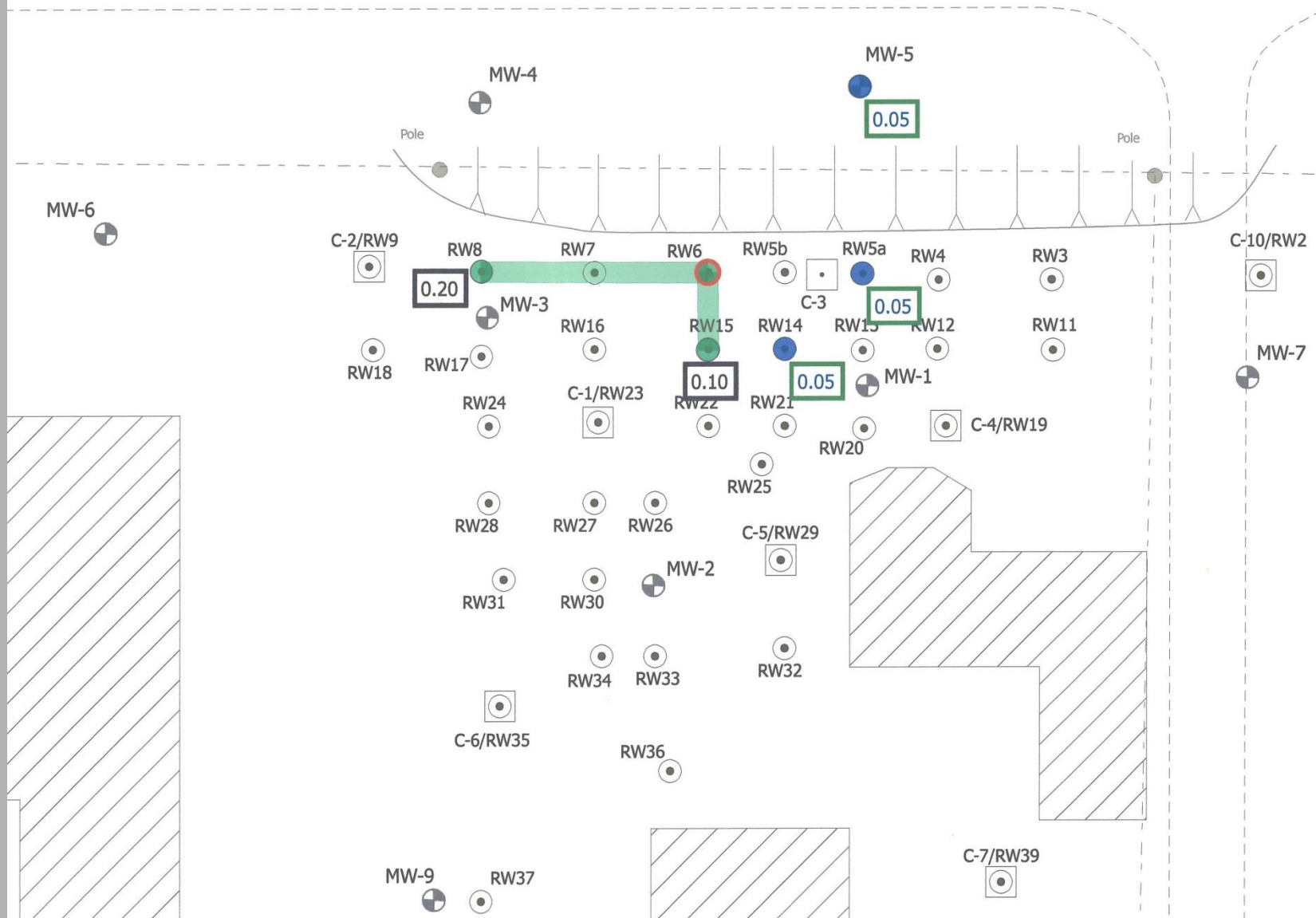
CAP

- HVDPE:
 - 7-day pilot test

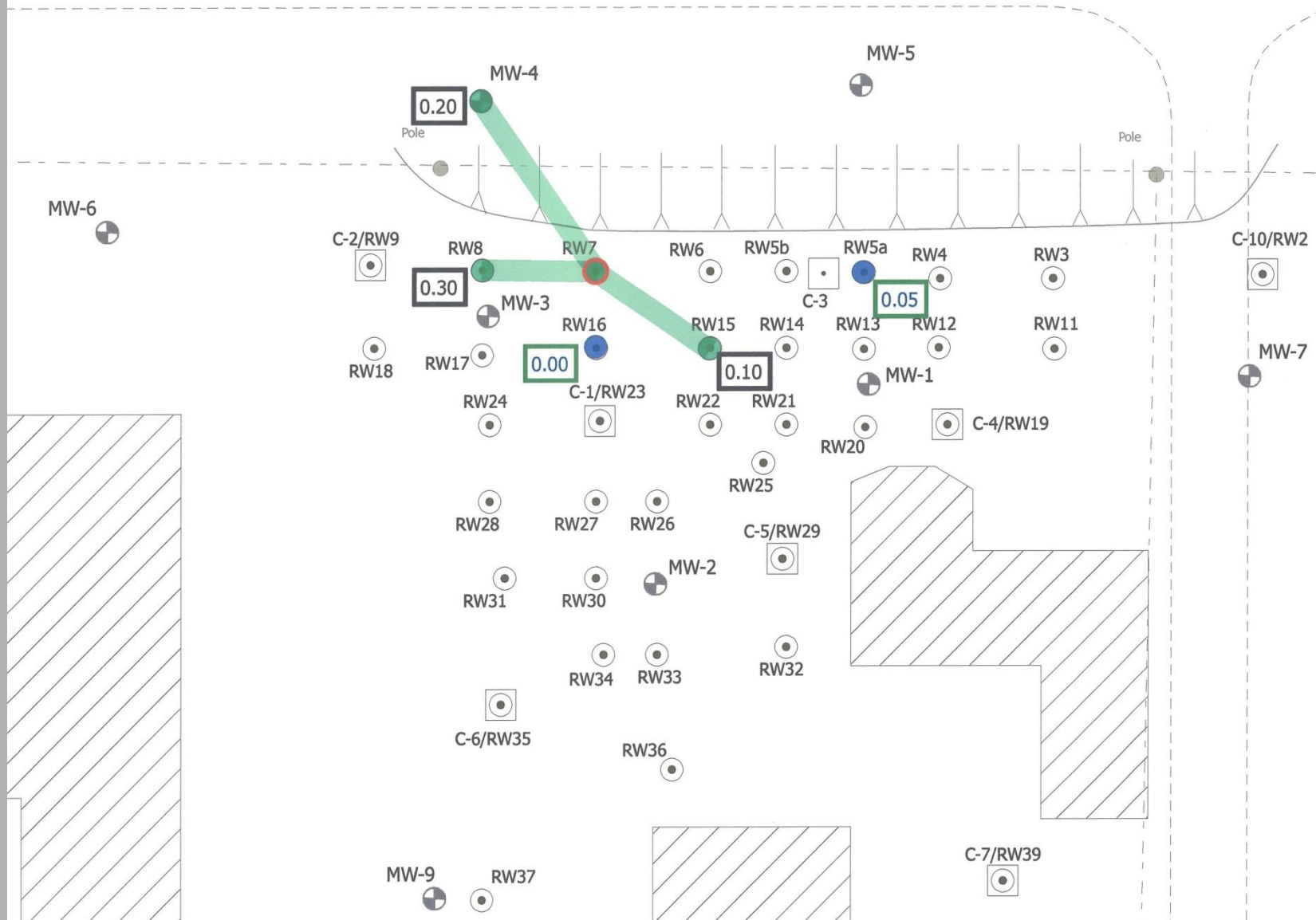
HVDPE Pilot Test



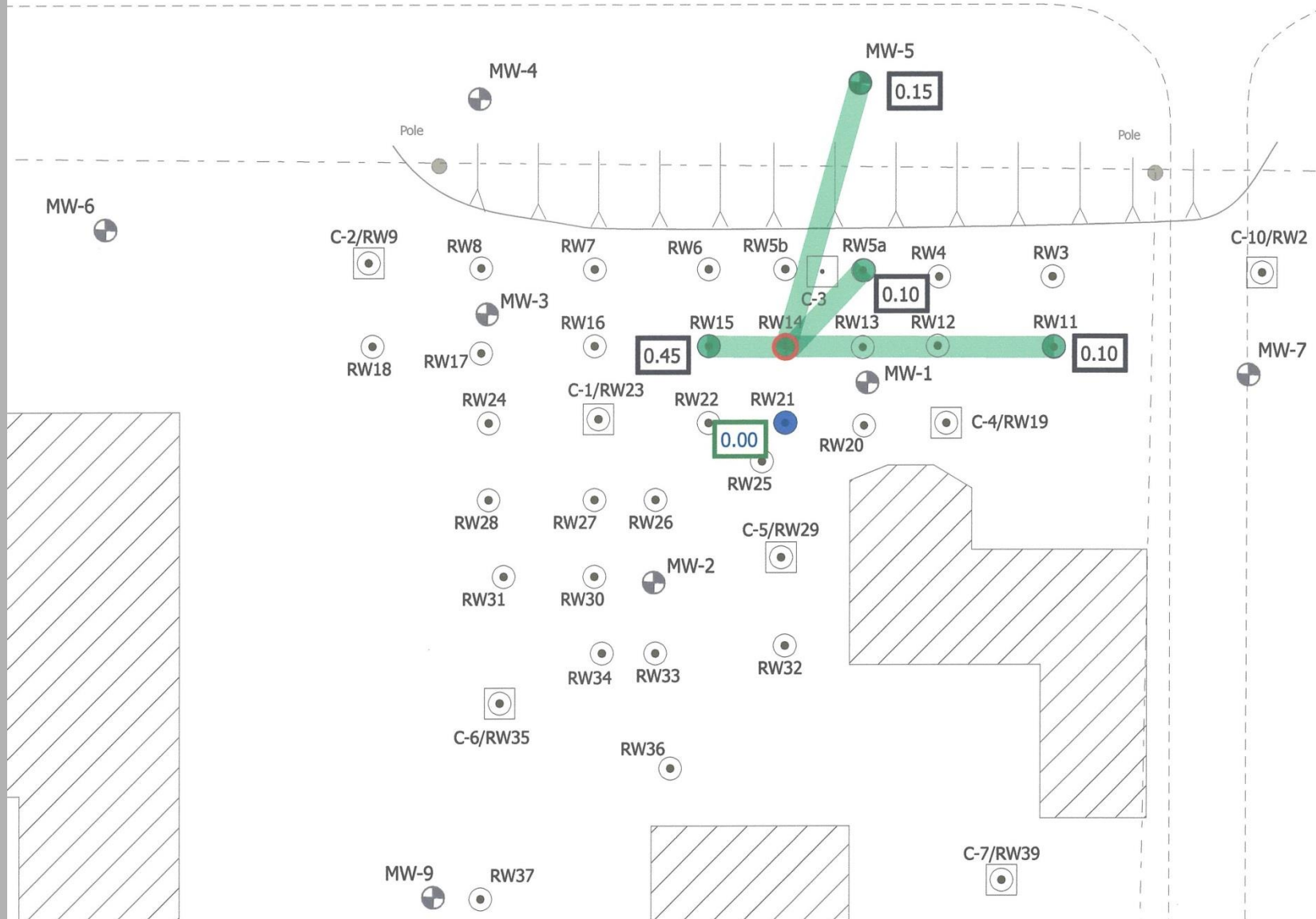
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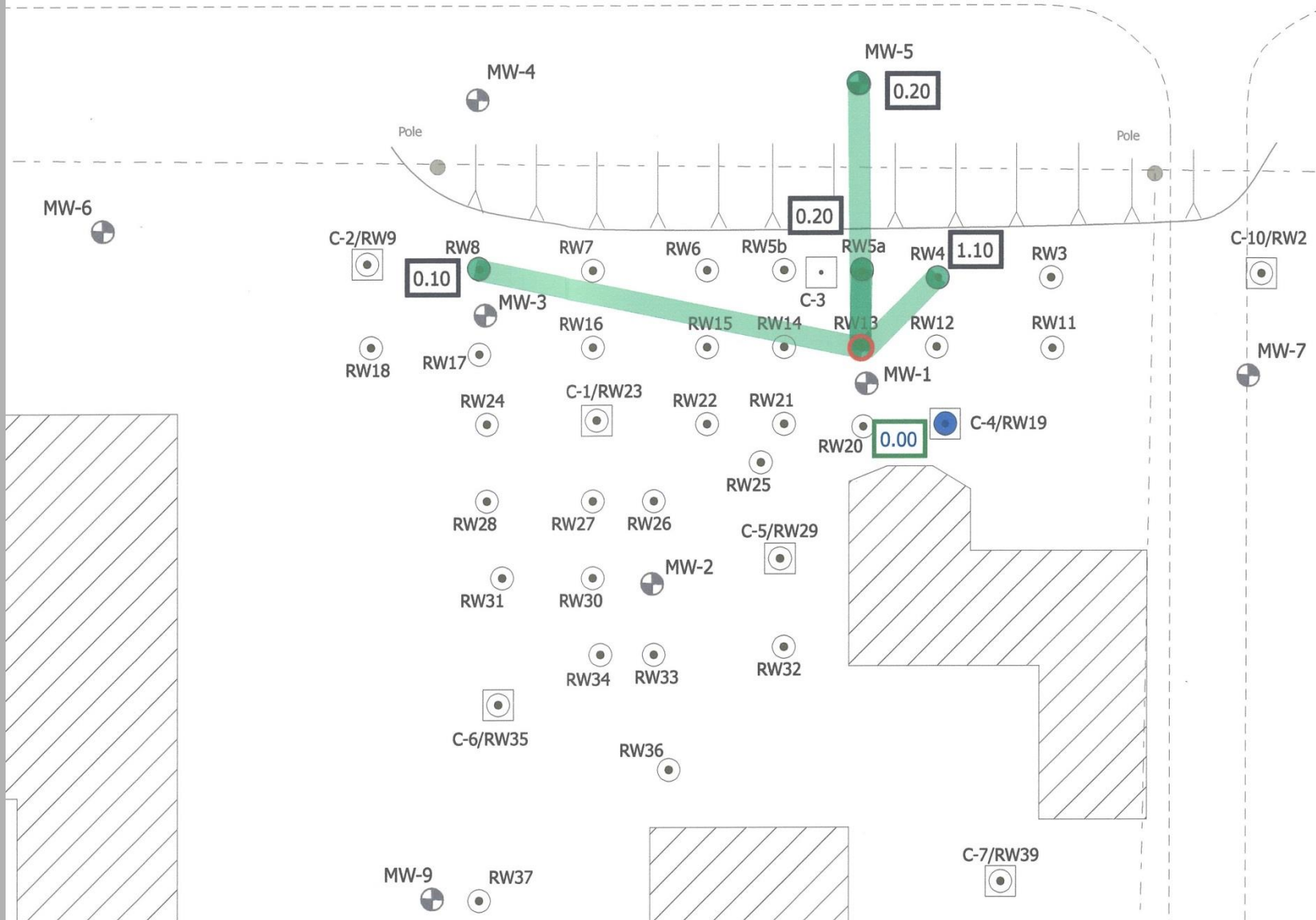
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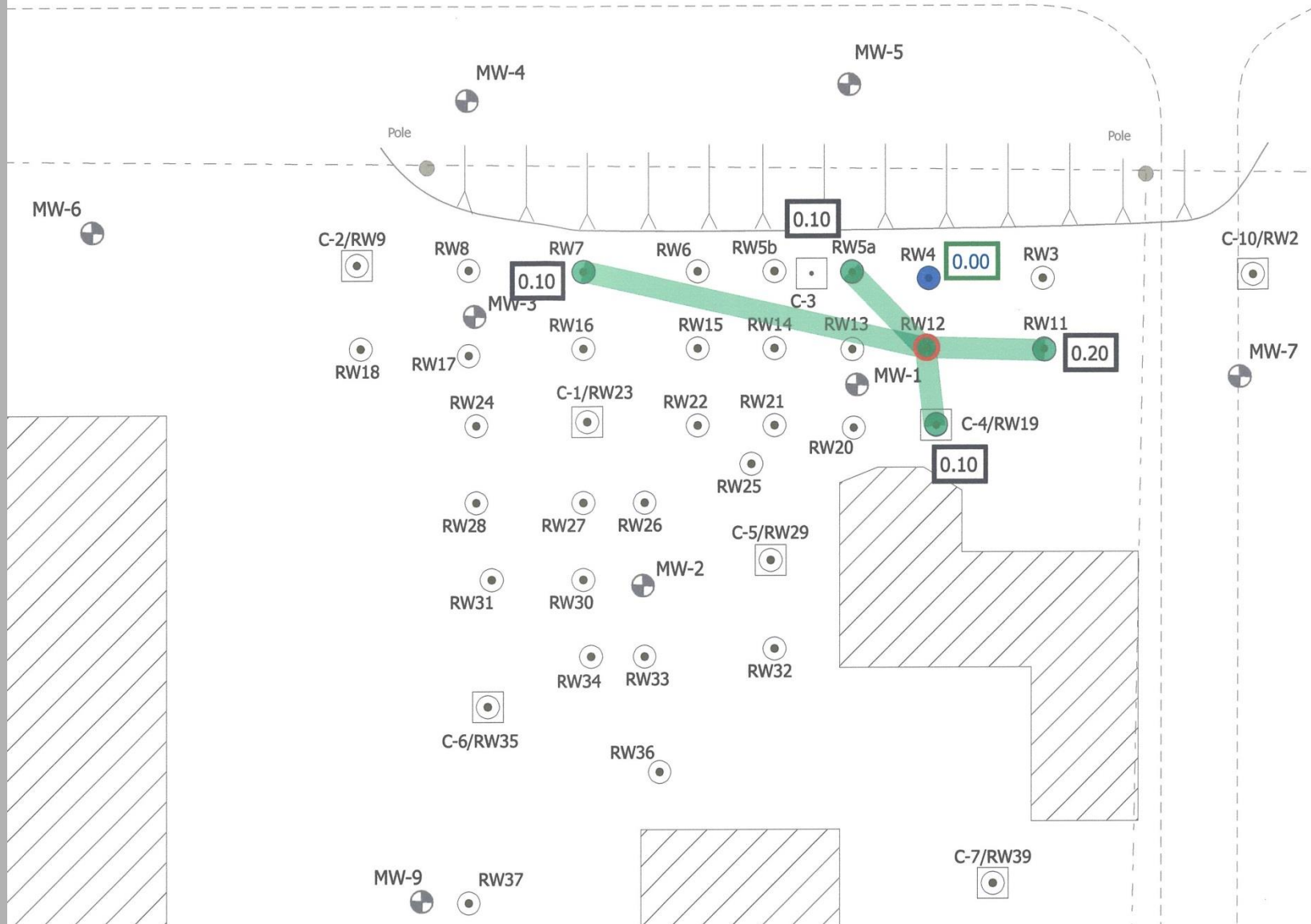
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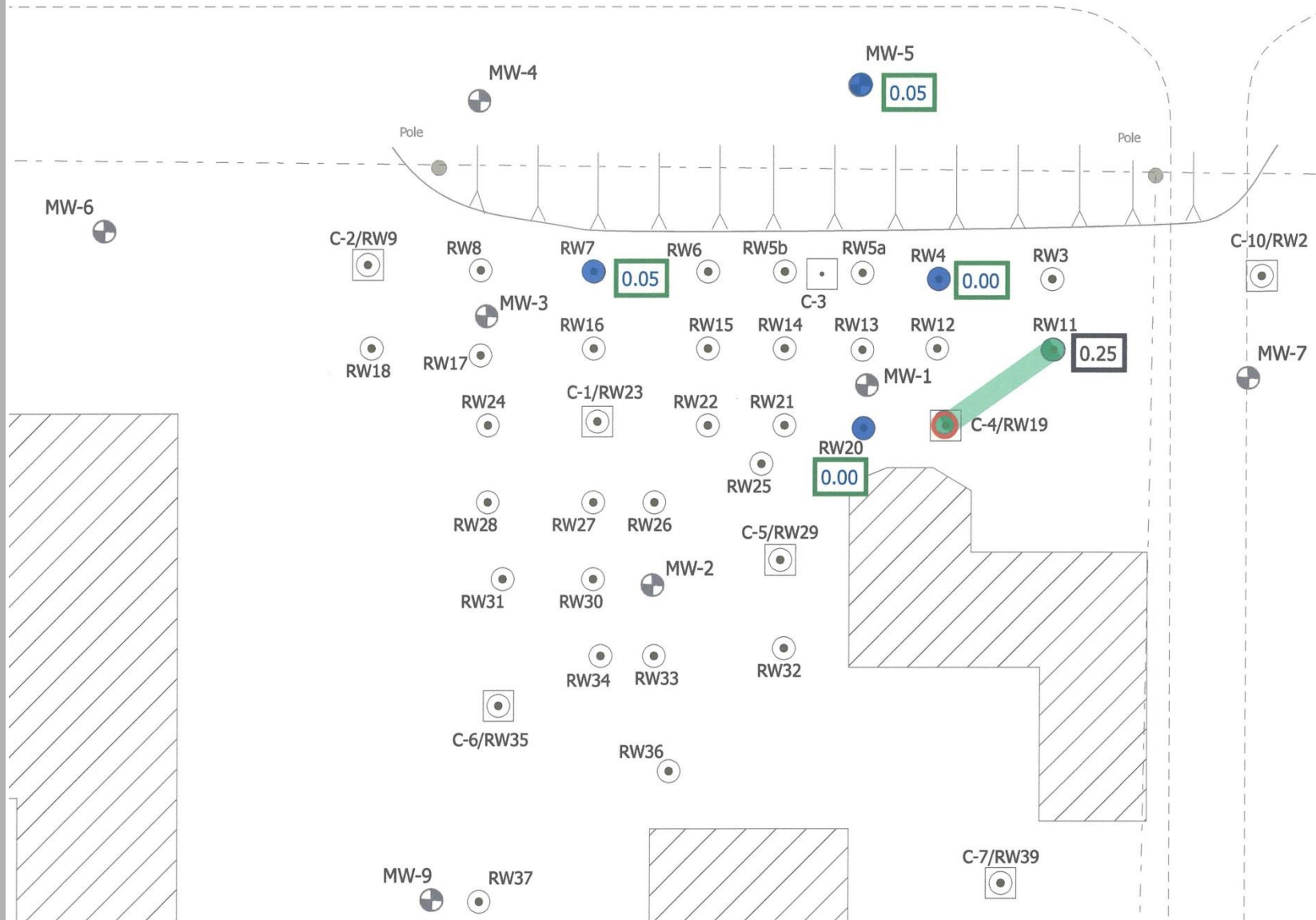
HVDPE Pilot Test



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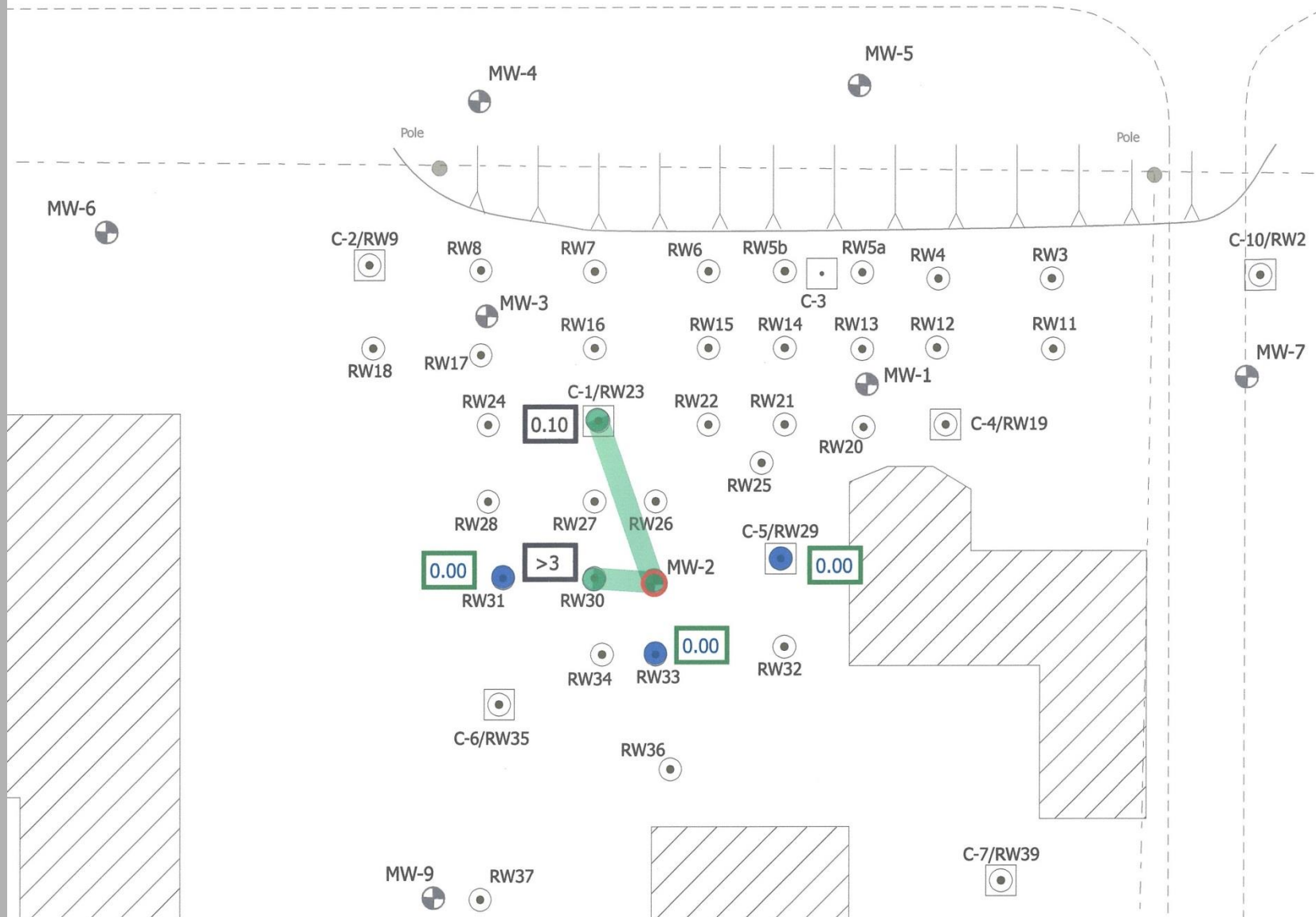
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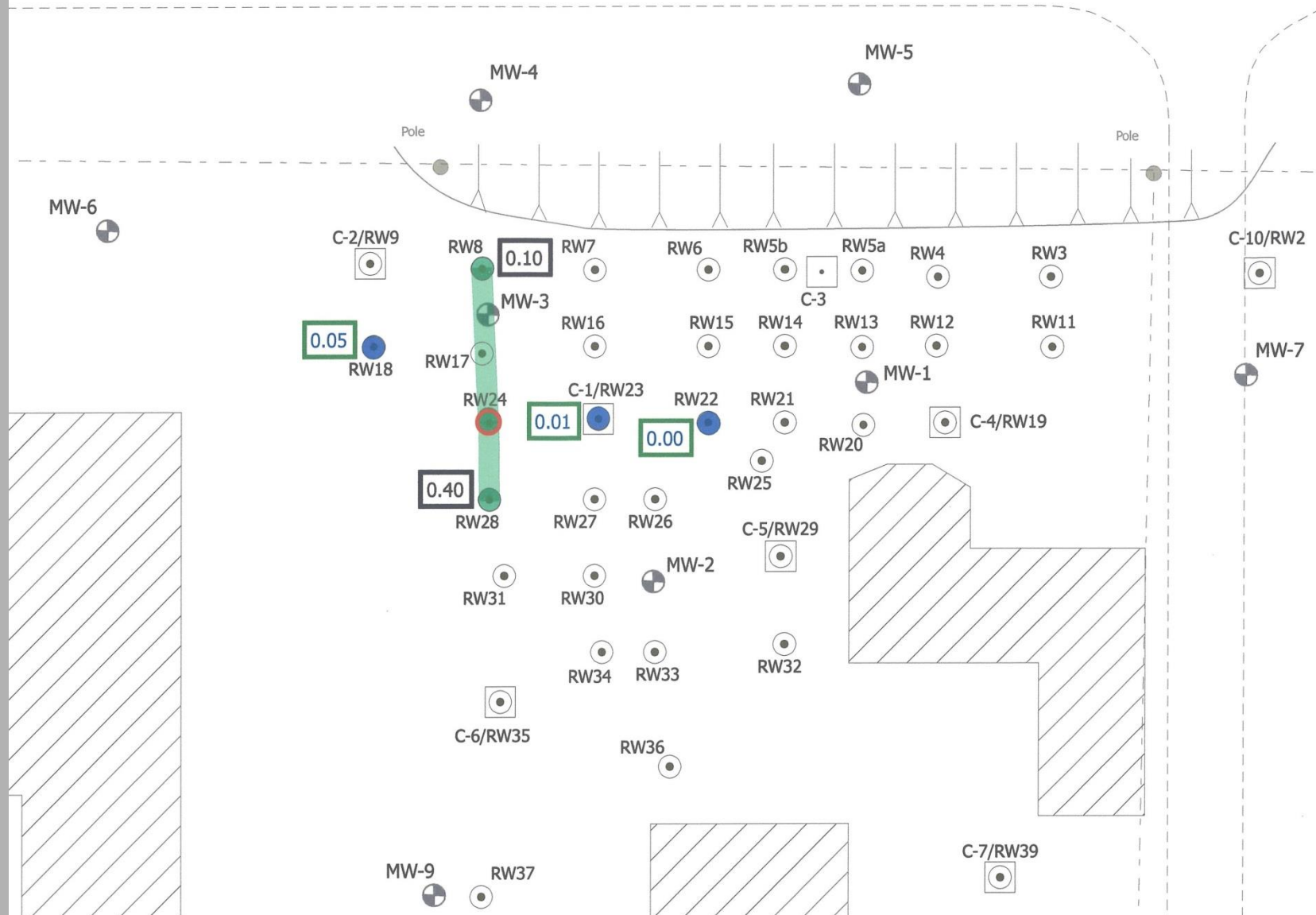
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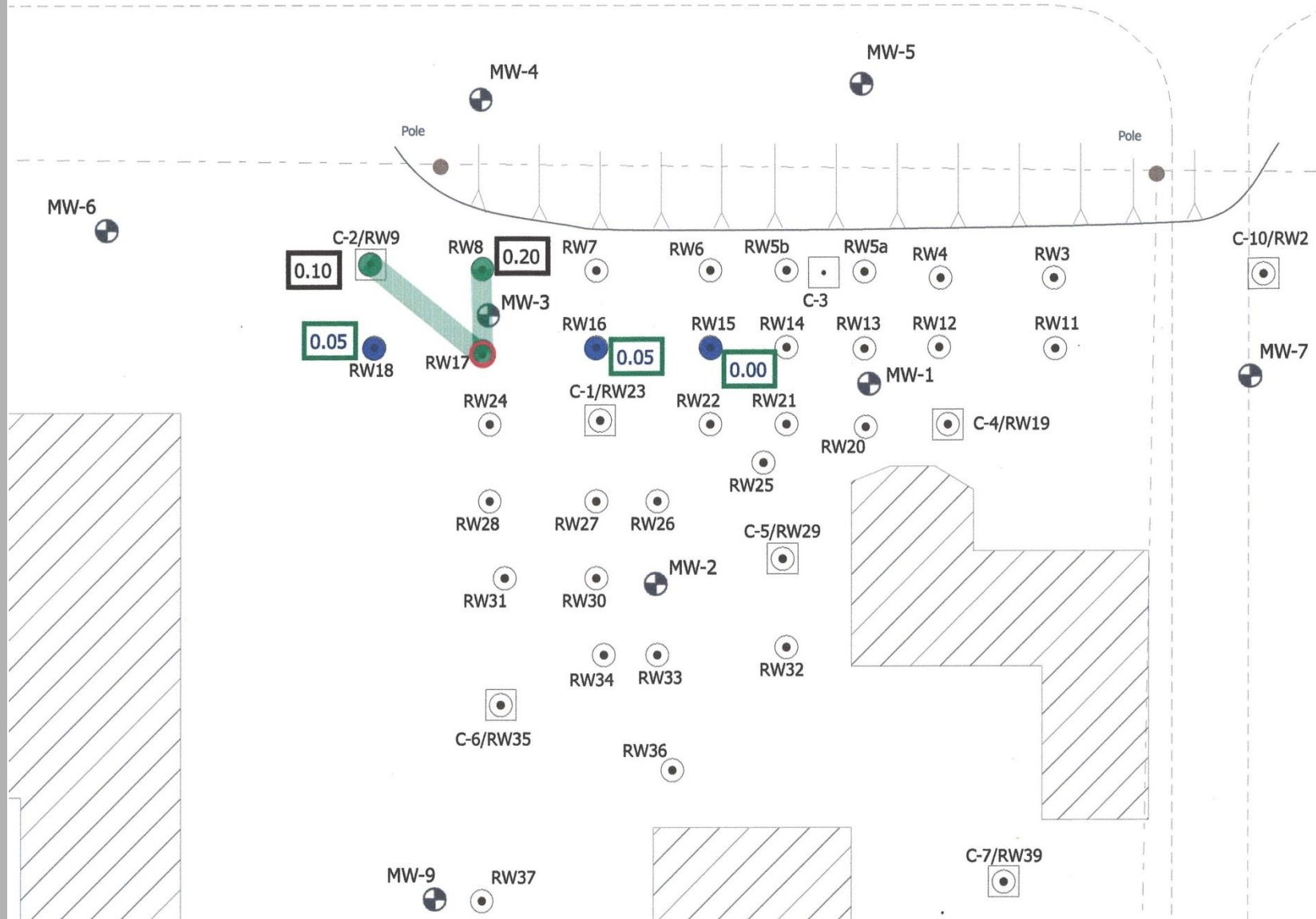
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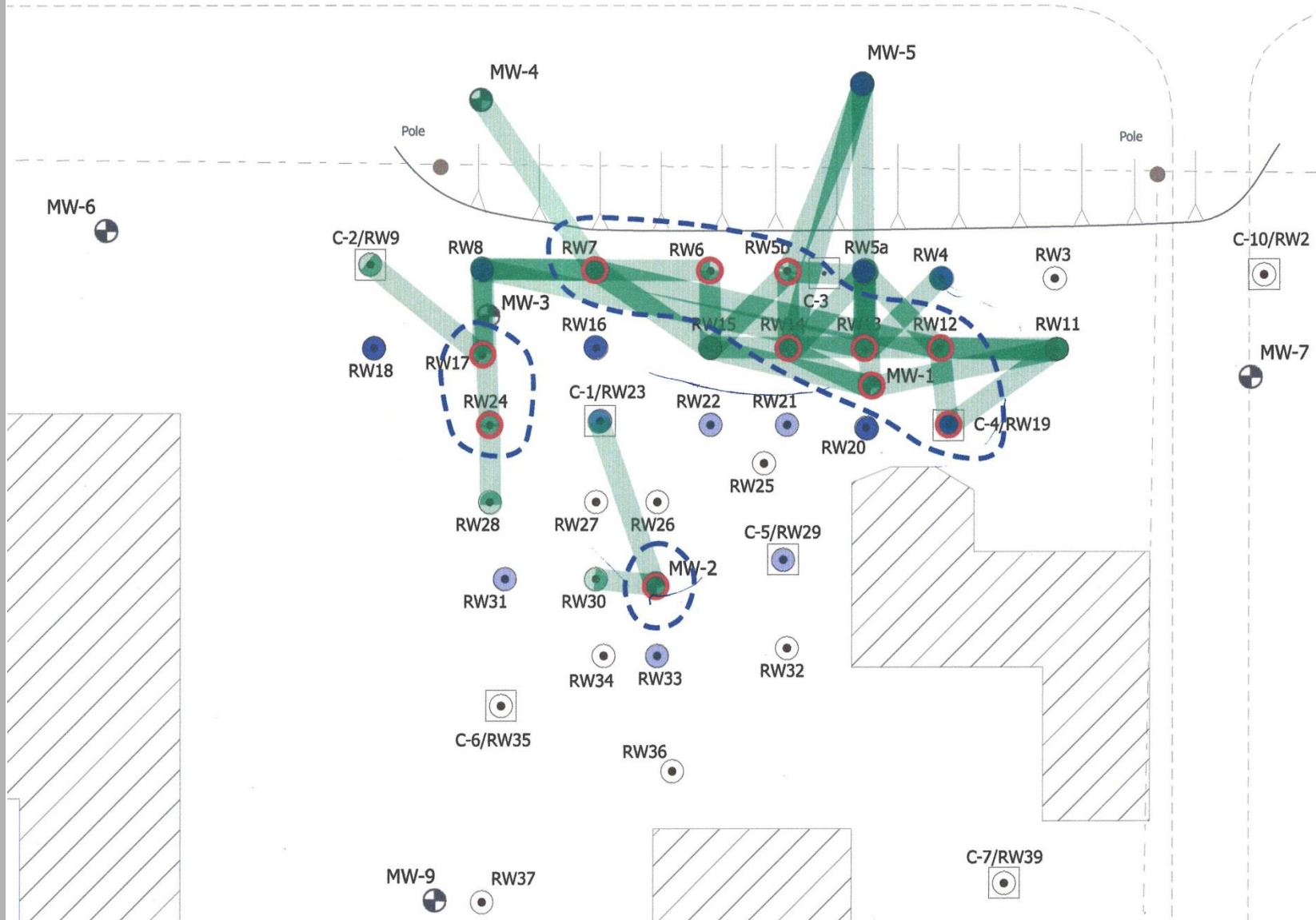
HVDPE Pilot Test



HVDPE Pilot Test

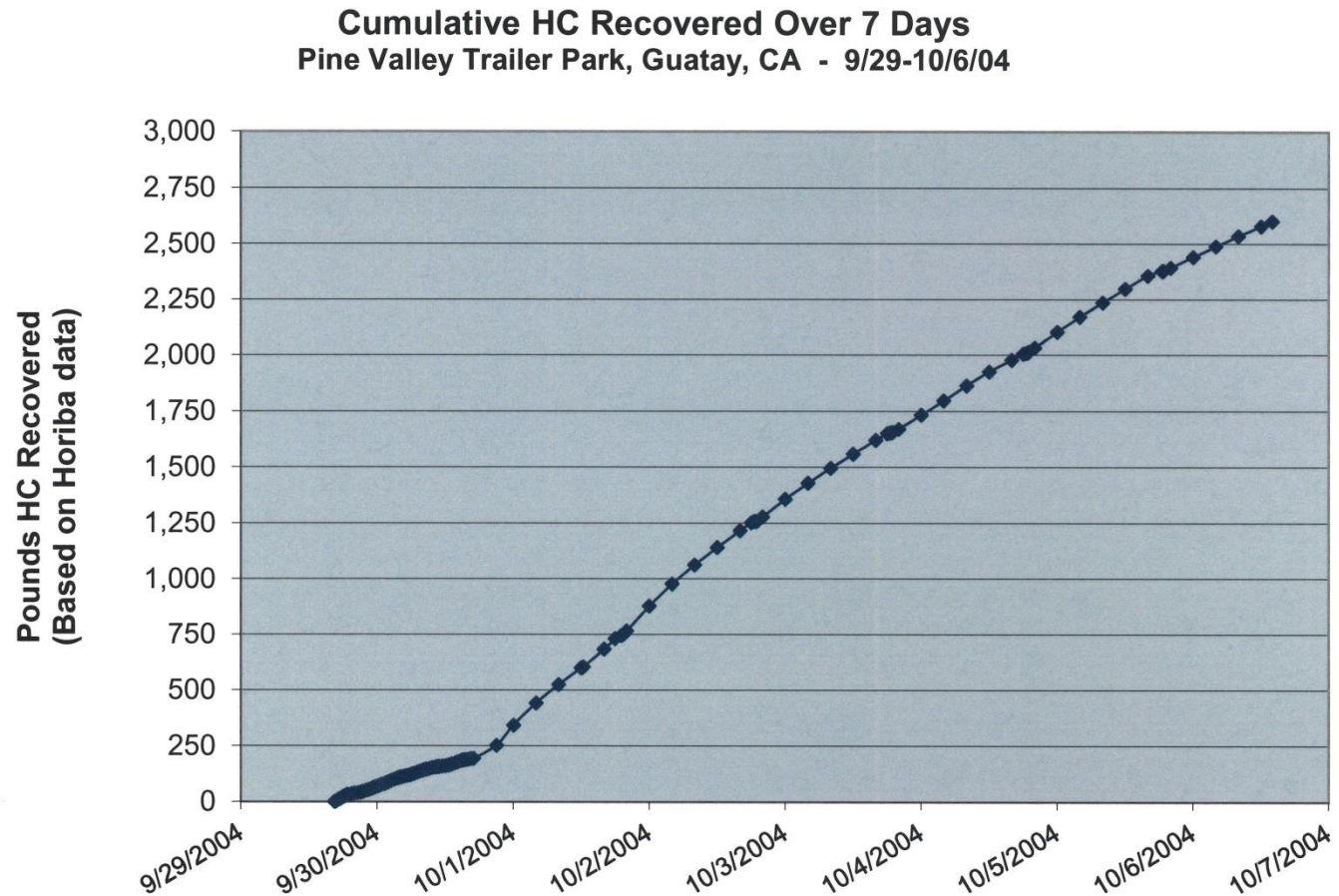


HVDPE Pilot Test



HVDPE Pilot Test

- Mass Removed:
 - 2,846 pounds in 7 days (407 pounds per day)

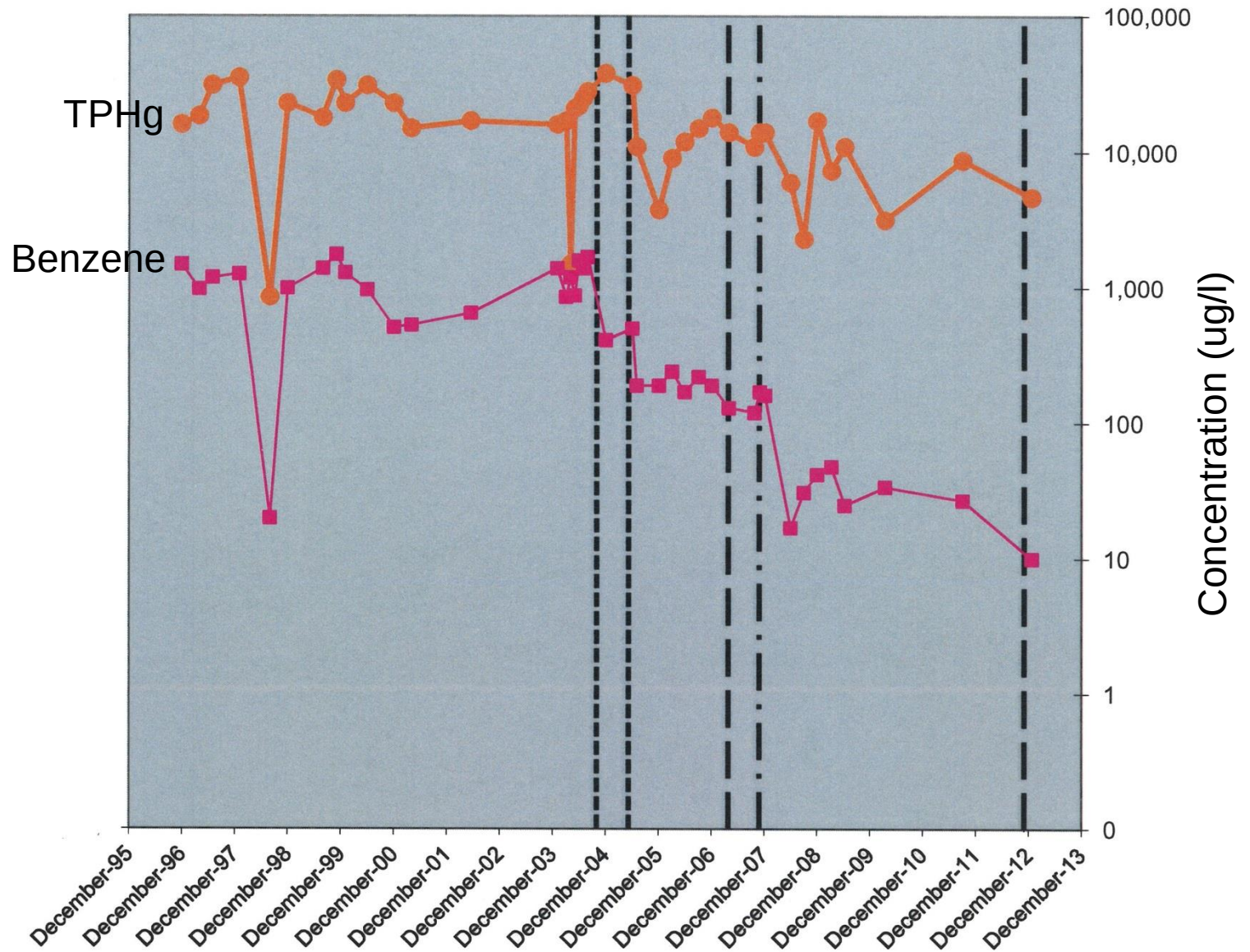


CAP

- HVDPE:
 - Pilot test demonstrated effectiveness
 - Submitted HVDPE pilot test report including workplan for Site remediation using HVDPE
 - Three 30-day and one 15-day remediation events
- Result:
 - Mobile HVDPE: 11,000 pounds
 - No FP remaining after the third event
 - Dissolved BTEX continued to decline

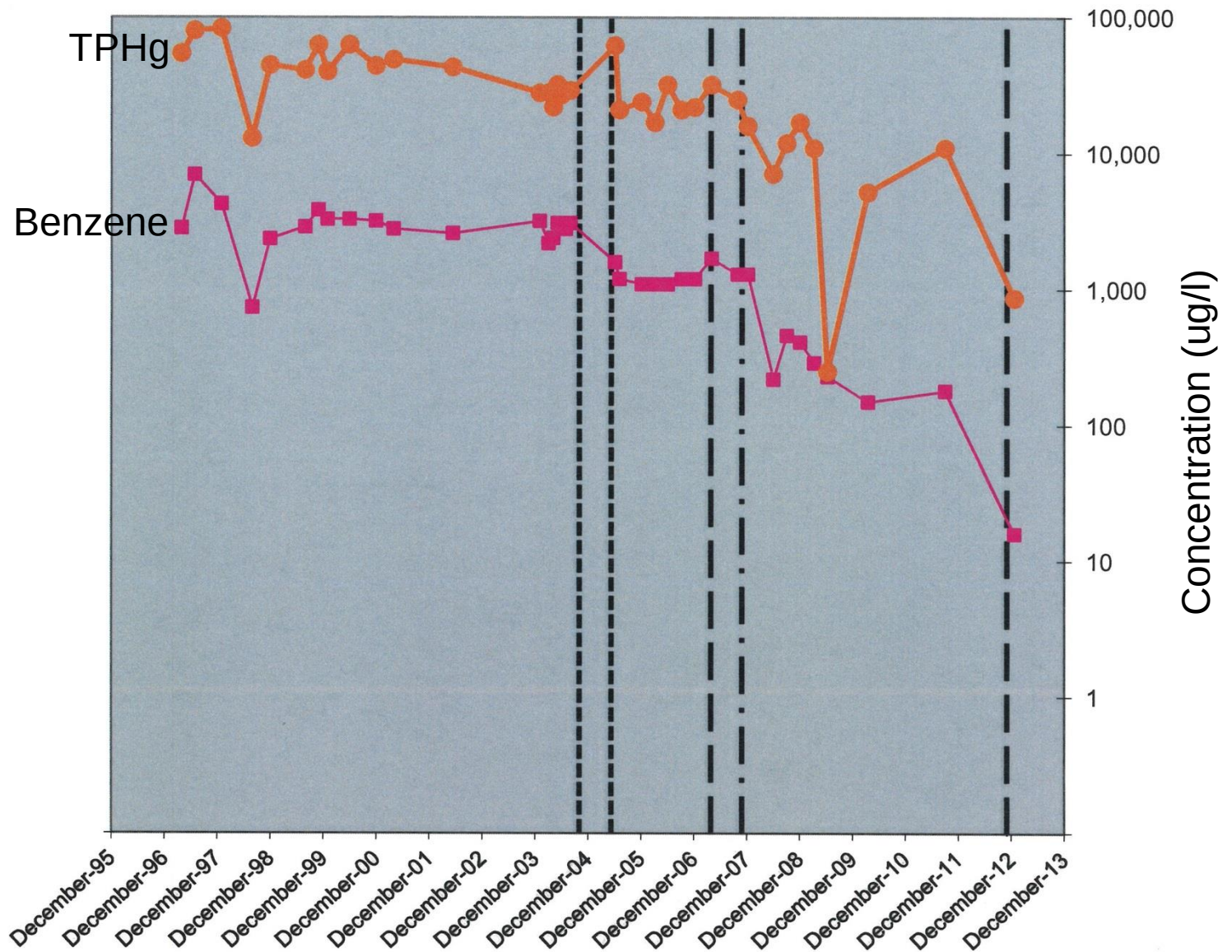
MW-3

CAP



MW-4

CAP



Closure Report

After addressing several issues raised by DEH, they indicated two impediments to closure:

- Possible connectivity between PVTP and Guatay Mutual Benefit Corporation (GMBC) Well #3
- High TPH and whether additional mass needed to be or could be removed

GMBC Well #3

- Approximately 650 feet east-northeast of the Site



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 - Fracture Mapping

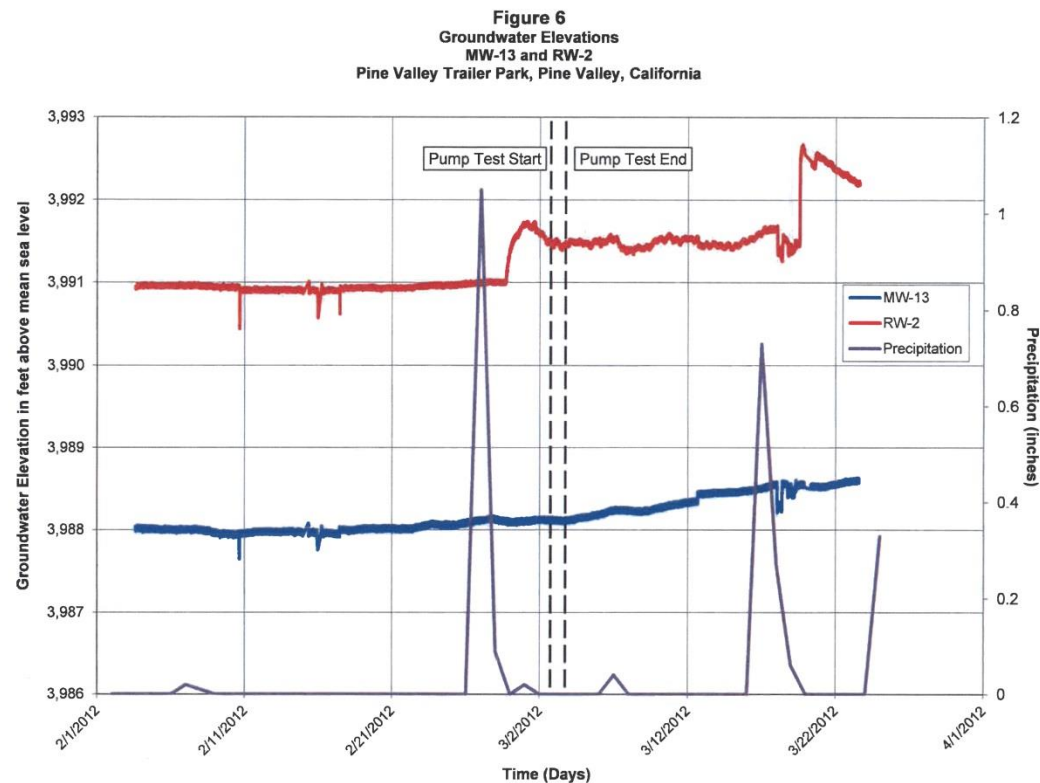


GMBC Well #3

- Approximately 650 feet east-northeast of the Site
- Low Toluene (about 15 ug/l)
- ***DEH requested evaluation of connectivity between PVTP and GMBC Well #3***
 - Fracture Trace Analysis
 - Fracture Mapping
 - Pump GMBC #3

GMBC Well #3

- Aquifer test – DEH agreed on a scope to provide a direct evaluation of potential connectivity

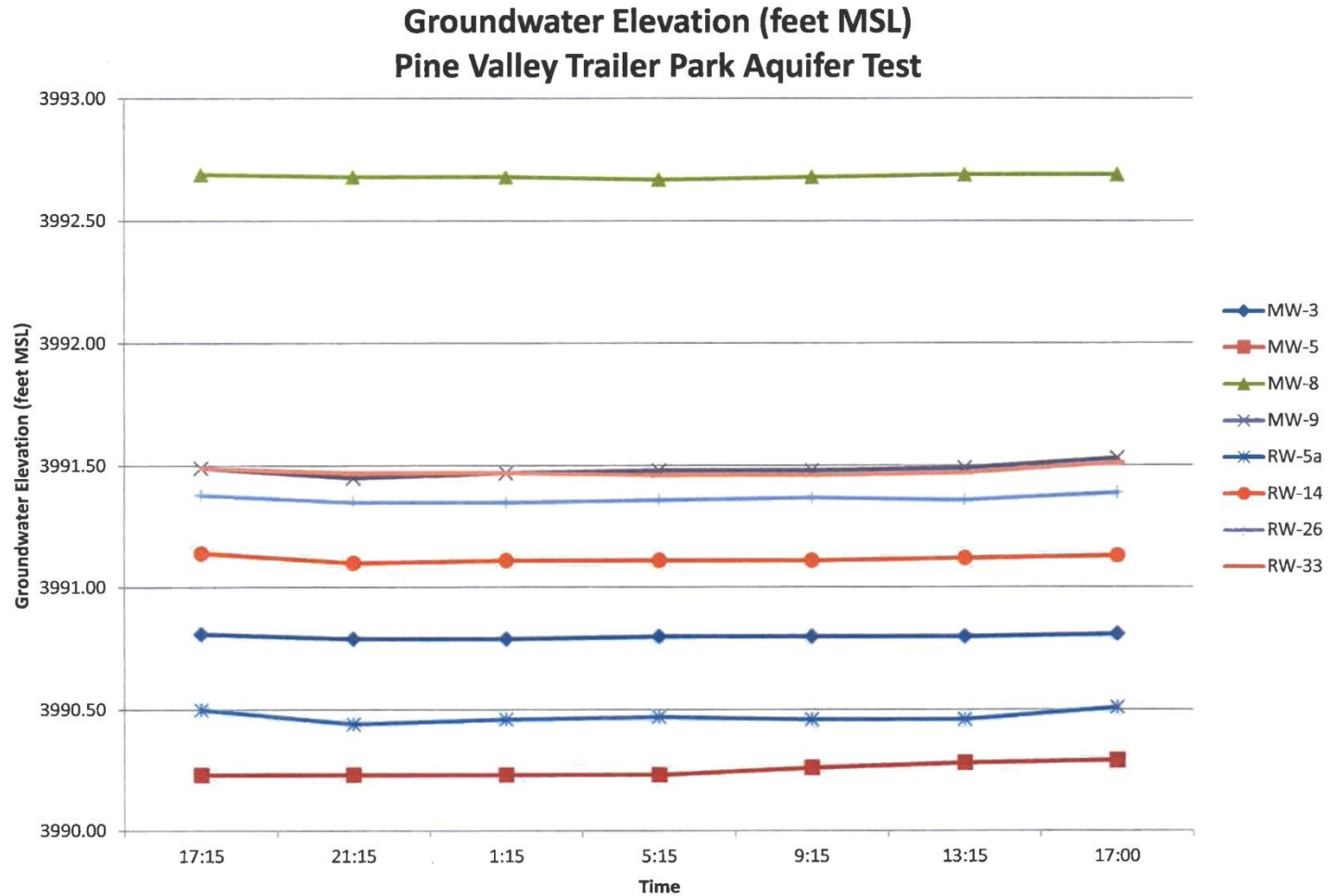


SCS ENGINEERS

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GMBC Well #3

- Aquifer test



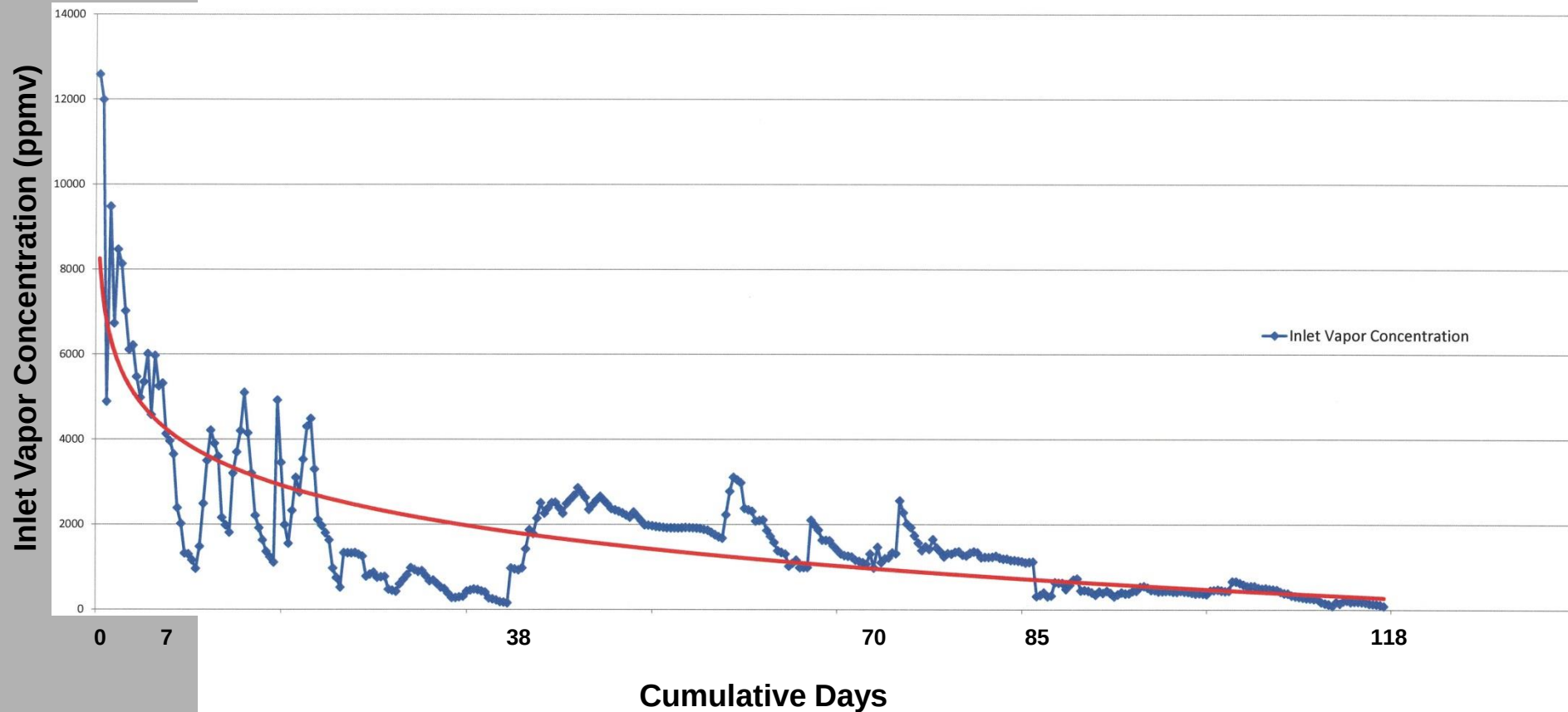
GMBC Well #3

- No connection between the shallow aquifer at PVTP and the deeper aquifer at GMBC Well #3
- Toluene ND in GMBC Well #3 after the test

Additional Mass Removal

- BTEX greatly reduced from thousands to a few hundred or less.
- High TPH (1,000 to 10,000 +/-) in several wells (MW-3, MW-4, MW-5)
- ***DEH offered two possible solutions***
 - Continue GWM and see if TPHg concentrations come down
 - Conduct one more HVDPE event and evaluate whether the mass has been removed to the extent practicable

Additional Mass Removal



Summary

- Assessment completed-GW in fractured rock
- Two aquifers
- ORC-free product changed the gameplan
- HVDPE effective at removing FP, not present after 3 events
- Impediments to closure:
 - PVTP and GMBC Well #3 not connected
 - Hydrocarbon mass removed to the extent practicable
- ***Case Transferred to RWQCB***

“Take Home”

- Fractured rock
 - Challenges
 - Data interpretation
 - Regional effects
- Keep options open in remediation plan
 - DEH requested provision in CAP for more active FP removal
- Path to Closure
 - DEH provided clear understanding of impediments to closure
 - Relatively easy to design scope and provide data addressing those impediments

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- **CLOSURE!**
 - ***Wells scheduled to be destroyed beginning October 20, 2014***