

Raytheon

Customer Success Is Our Mission



Remediation Status Update

Former Raytheon Facility Wayland, Massachusetts

Jonathan Hone
December 4, 2013

Outline

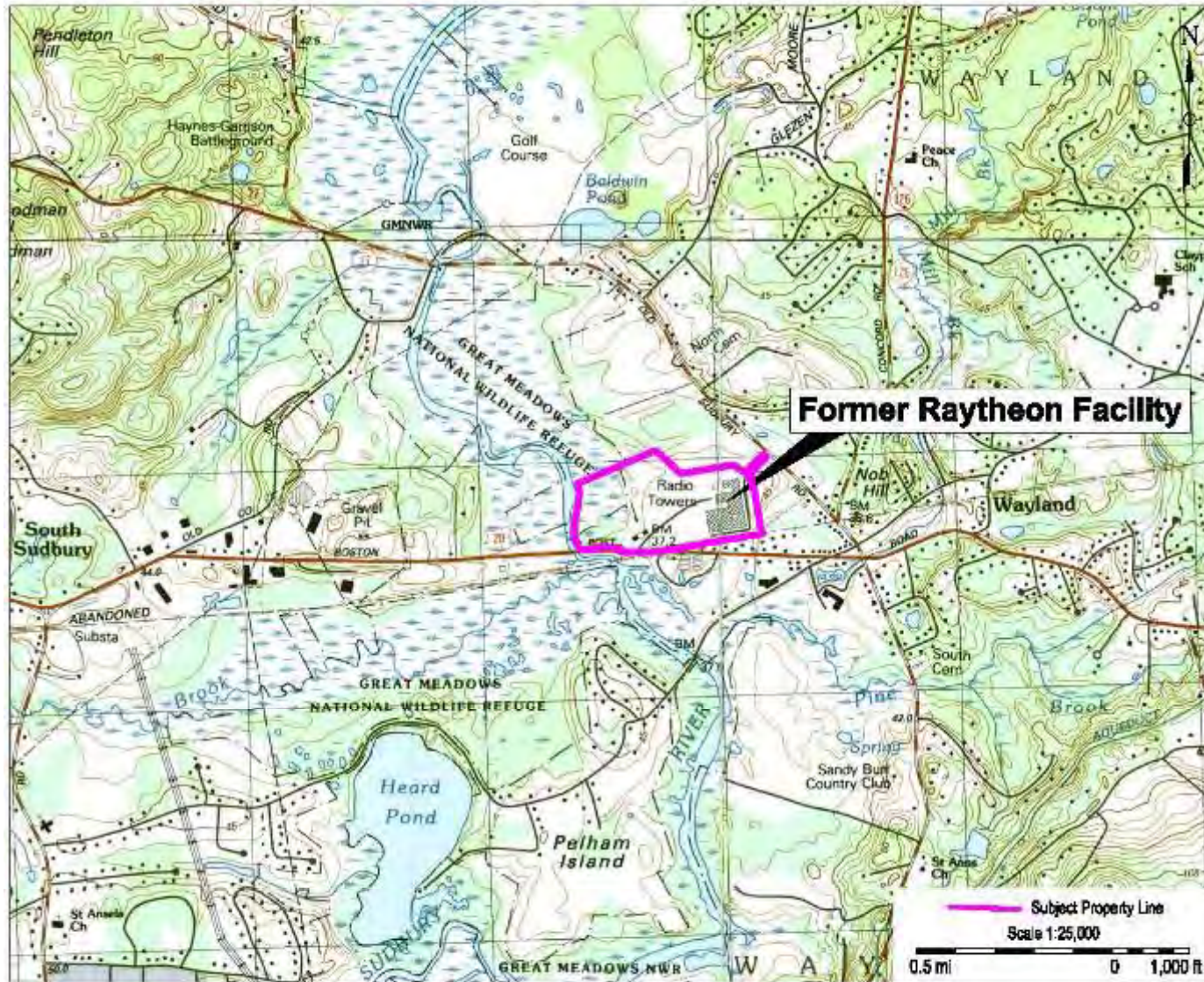
- Team Introductions
 - John Drobinski, LSP, Environmental Resources Management
 - Dr. Sami Fam, Innovative Engineering Solutions
 - Lyndsey Colburn, PM, Environmental Resources Management

- Site Overview

- 2013 Site Activities
 - Site-Wide Activities
 - Southern Area
 - Northern Area Bioremediation

- Q&A

Locus Plan



Wayland Site Plan



2013 Activities

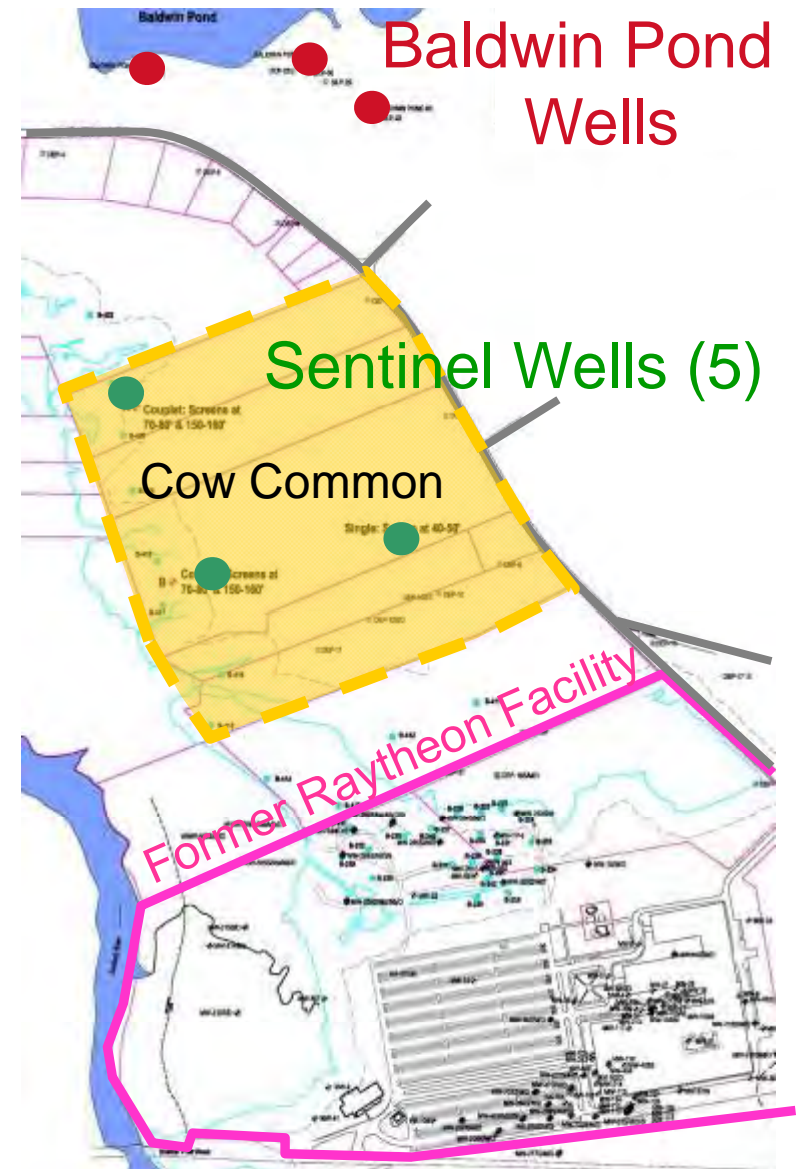
- Remedy Operation Status (ROS) Reports submitted in May & November
 - Available online and at the Town repository

- Groundwater quality monitoring
 - Cow Commons sampling
 - Southern Area Groundwater Sampling
 - Southern Area Groundwater Profiling Investigation

- Northern Area Bioremediation System
 - BioSystem Operation and Maintenance
 - Groundwater monitoring
 - Injection and recirculation of Amended Groundwater

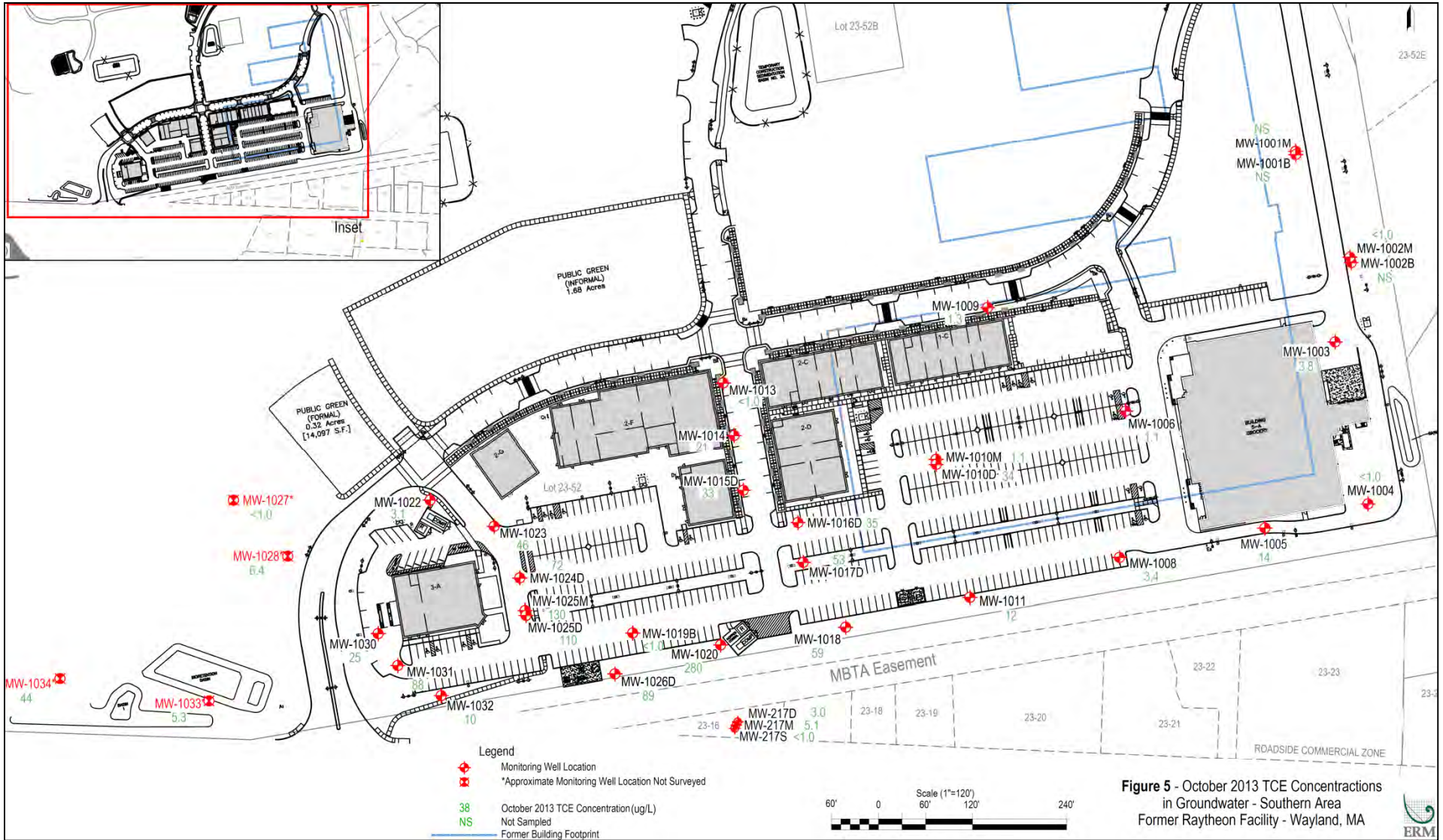
Cow Common/Sentinel Wells

- Groundwater samples collected from wells in October 2013
 - Analyzed for VOCs by Method 8260B
- 2 Detections (parts per billion)
 - Ethyl Ether -1.2 $\mu\text{g/L}$
 - *Drinking Water Standard* –1,000 $\mu\text{g/L}$
 - *Laboratory Detection Limit* – 1.0 $\mu\text{g/L}$
 - Cis-1,2-dichloroethene -1.0 $\mu\text{g/L}$
 - *Drinking Water Standard* –70 $\mu\text{g/L}$
 - *Laboratory Detection Limit* – 1.0 $\mu\text{g/L}$
- No detections of other previously identified compounds: carbon disulfide, chloroform, ethyl-tert-butyl ether, toluene



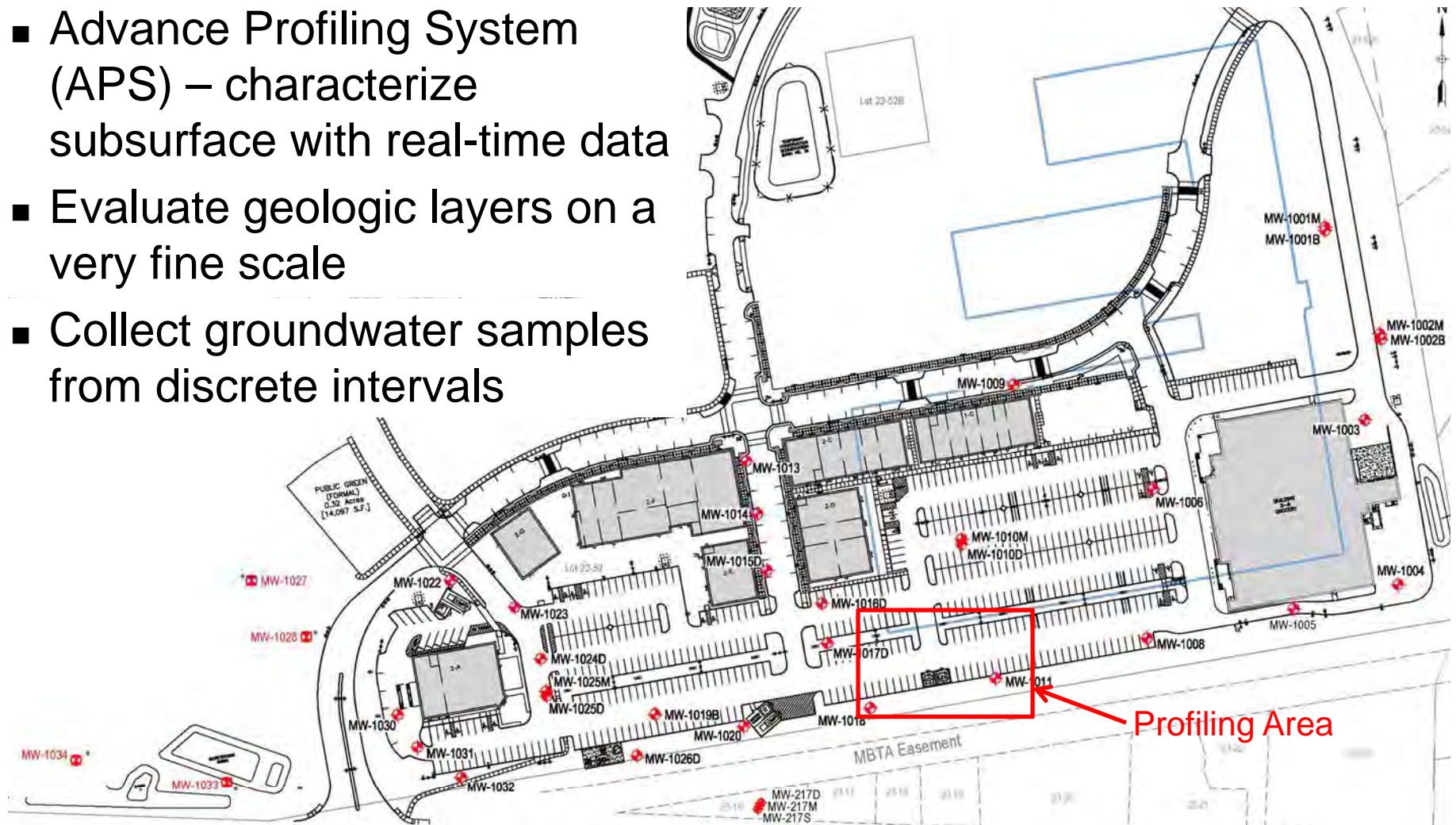
Southern Area

Southern Area Groundwater



Groundwater Profiling Investigation

- Advance Profiling System (APS) – characterize subsurface with real-time data
- Evaluate geologic layers on a very fine scale
- Collect groundwater samples from discrete intervals



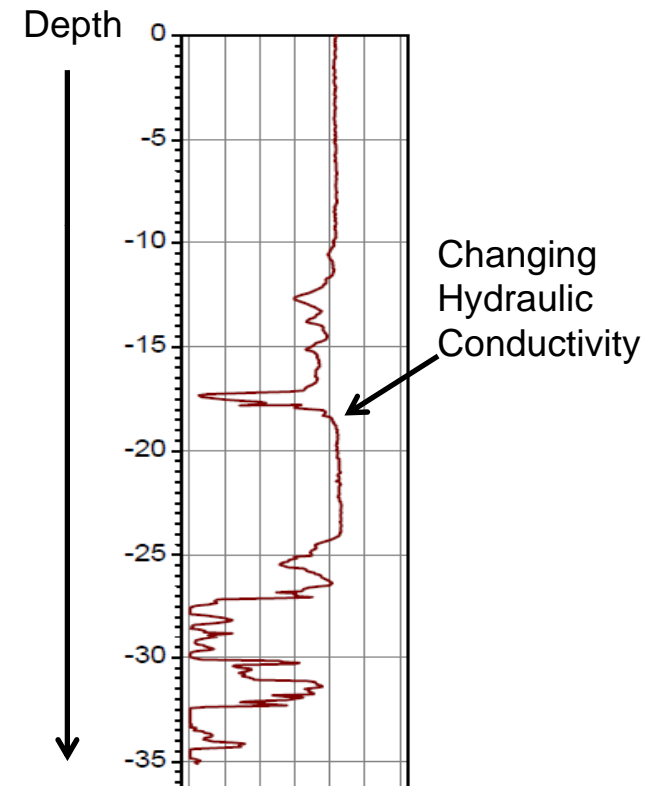
Advanced Profiling System (APS) Waterloo Profiler

Raytheon
Integrated Defense Systems

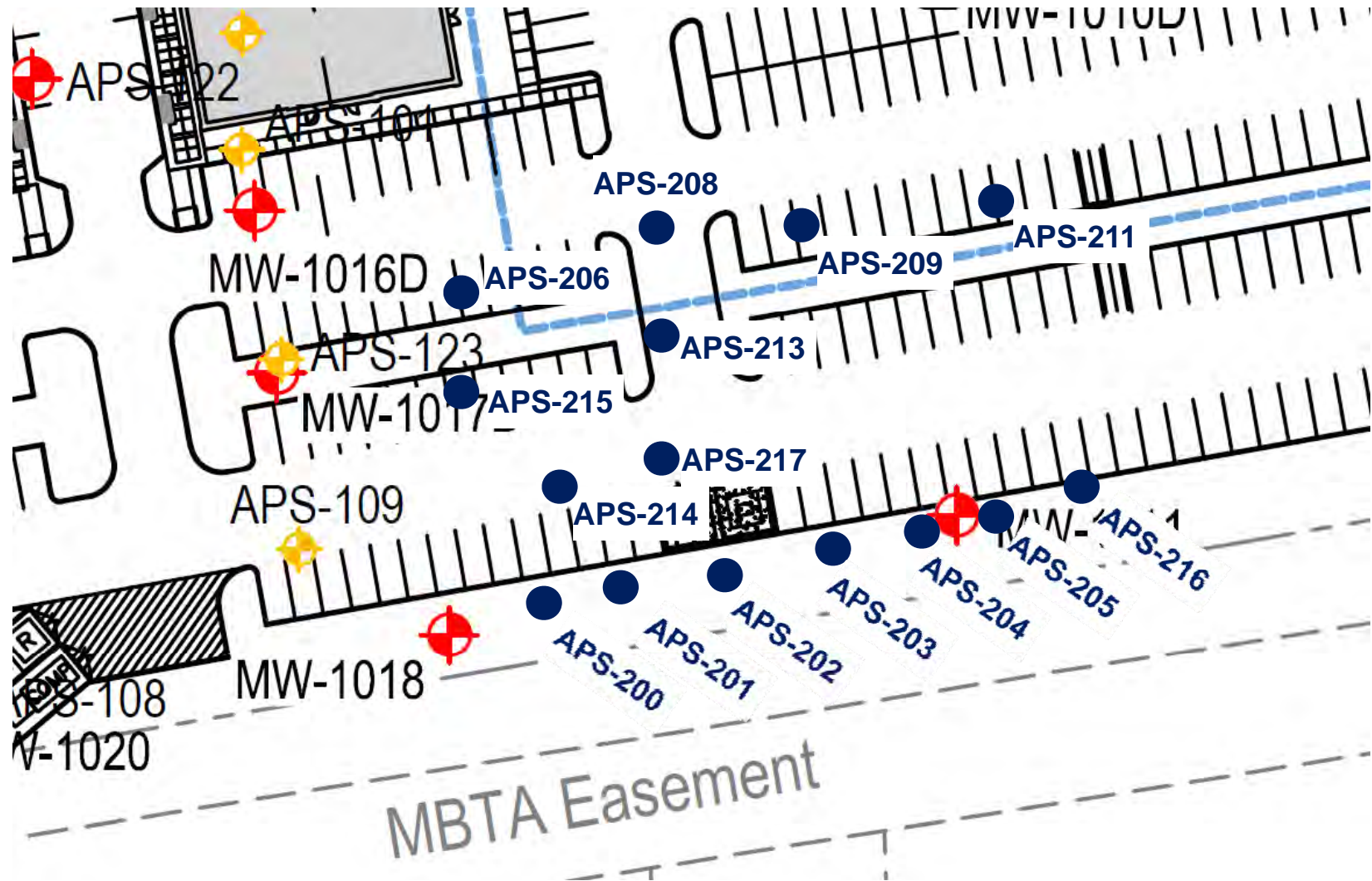
- Direct-push drilling rig advances instruments
- Geologists collect real-time data on subsurface conditions



Example APS Log



Groundwater Profiling Locations



Northern Area

Northern Area (Bioremediation)



Enhanced Anaerobic Dechlorination

- A carbon source or amendment has been introduced to the naturally occurring microbes to Enhance metabolic processes in an Anaerobic subsurface/environment
- Dechlorination is a process by which a consortia of microbes remove chlorine atoms from chlorinated solvents until all that is left is basic ethene

- Dechlorination Progression

Tetrachloroethene (PCE)

→ **Trichloroethene (TCE)**

→ **cis-1,2-Dichloroethene (cDCE)**

→ **Vinyl Chloride (VC)**

→ **Ethene**

Recirculation System Overview

- The program involves recirculation of groundwater within a area to distribute the added amendment (carbon source, “food”, electron donor)
 - Methanol (WFD permitted storage), nutrients, pH buffers, cultures
- Increases subsurface mixing by injection (upgradient) and extraction (downgradient) of amended groundwater
- Extraction wells are fitted with submersible pumps and control equipment to monitor flow, minimize possibility of leaks, and prevent damage to system
- Solar powered pumps and controls extract groundwater continuously at approximately 1-5 gallons per minute

Recirculation System Photos



System Activities

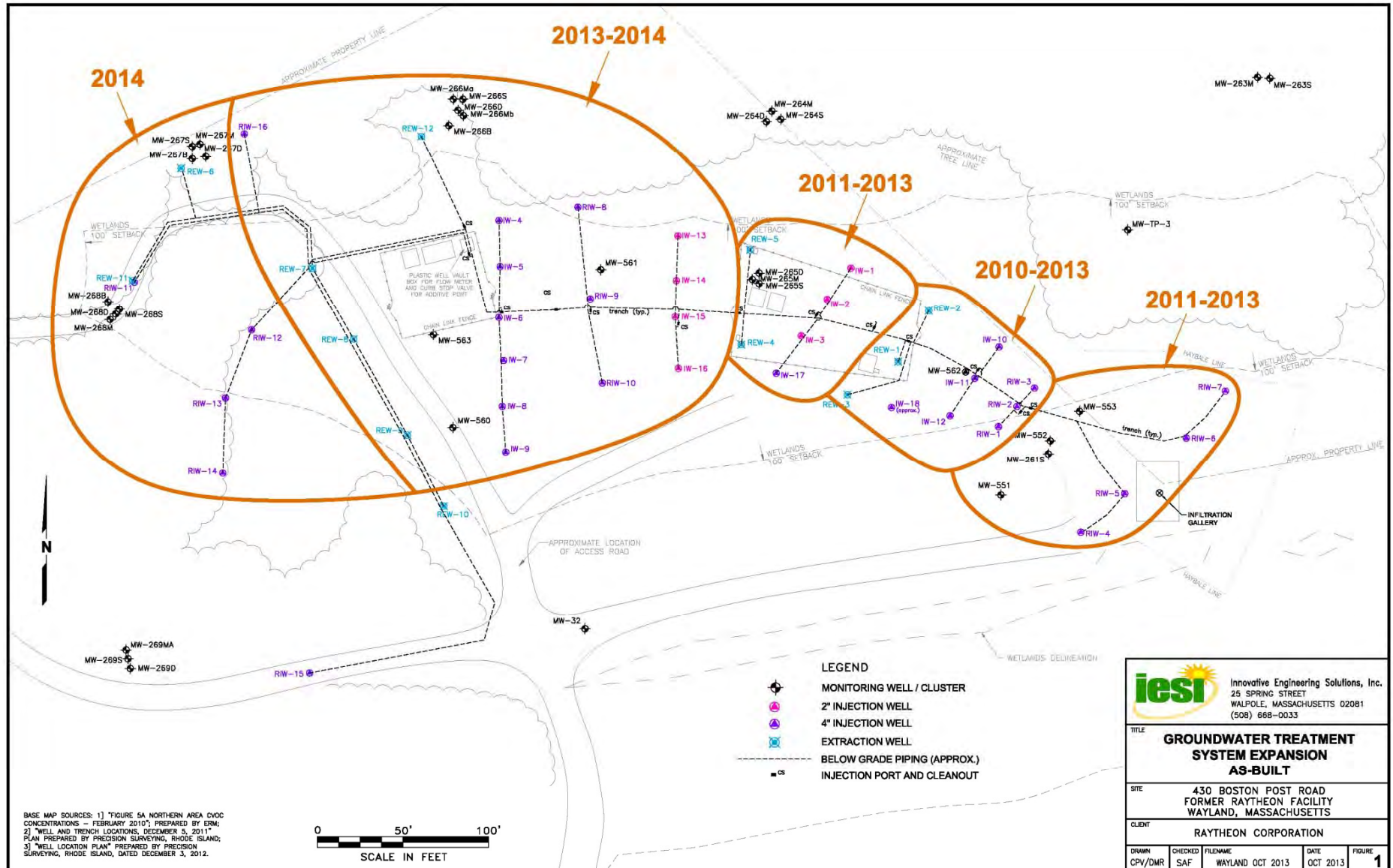
- October 2010: System initial start up

- 2011 expansion included the installation of 3 extraction wells near 2007 Cofferdam excavation & 3rd Solar array

- 2012 expansion included the installation of 6 injection wells, 9 extraction wells, 1 monitoring well, 12 solar panels, & incorporation of the IW series wells

- 2013 Activities
 - Recirculated approximately ~7 million gallons of groundwater since the program began (~3 million gallons in 2013)
 - Several “feeding” events (Methanol) in calendar year

As-built & Operational History





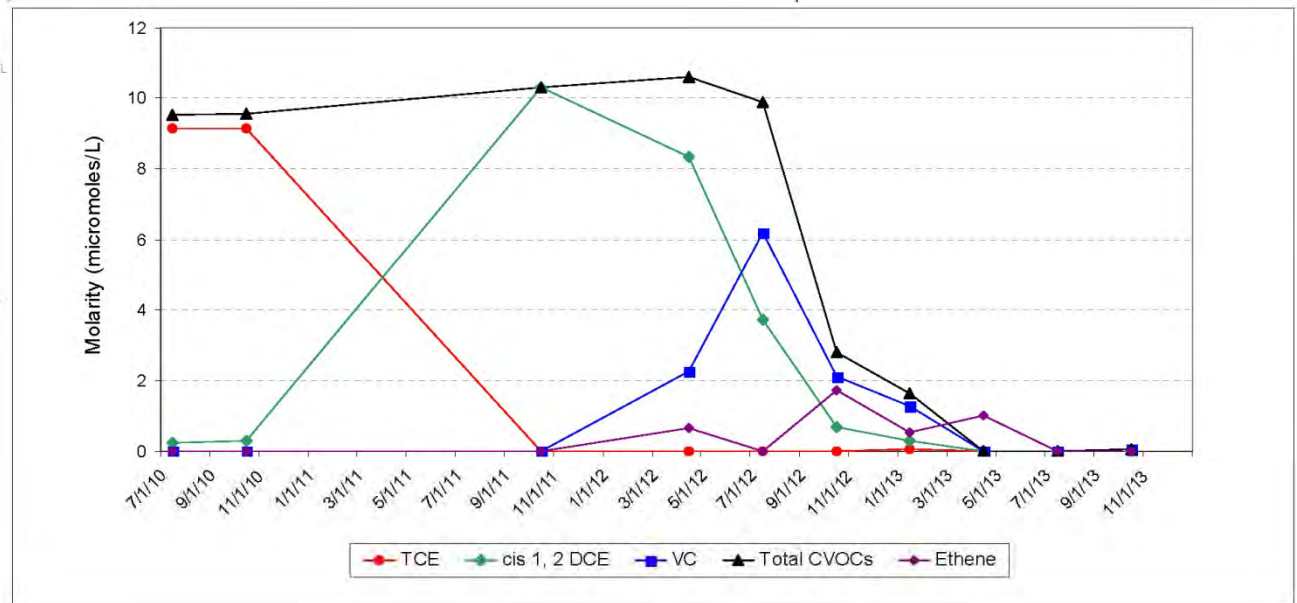
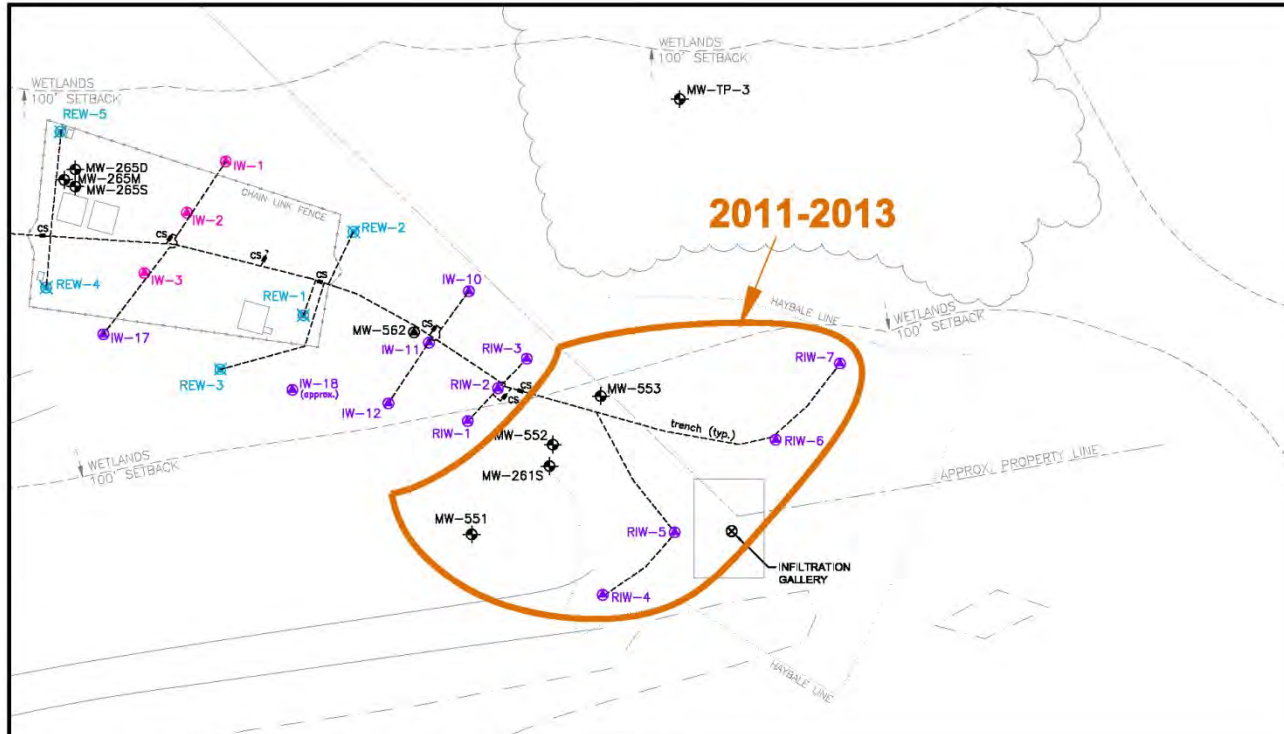
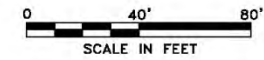
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 25 SPRING STREET
 WALPOLE, MASSACHUSETTS 02081
 (508) 668-0033

TITLE

TREATMENT AREA WITH MW-261S MONITORING DATA

LEGEND

- MONITORING WELL / CLUSTER
- 2" INJECTION WELL
- 4" INJECTION WELL
- EXTRACTION WELL
- BELOW GRADE PIPING (APPROX.)
- INJECTION PORT AND CLEANOUT





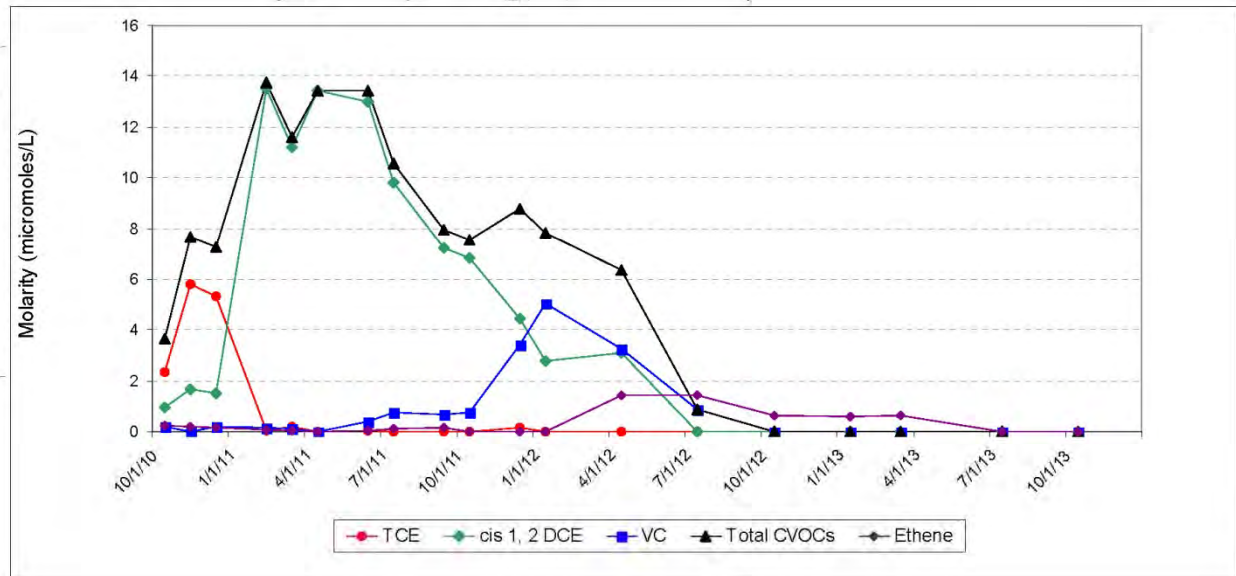
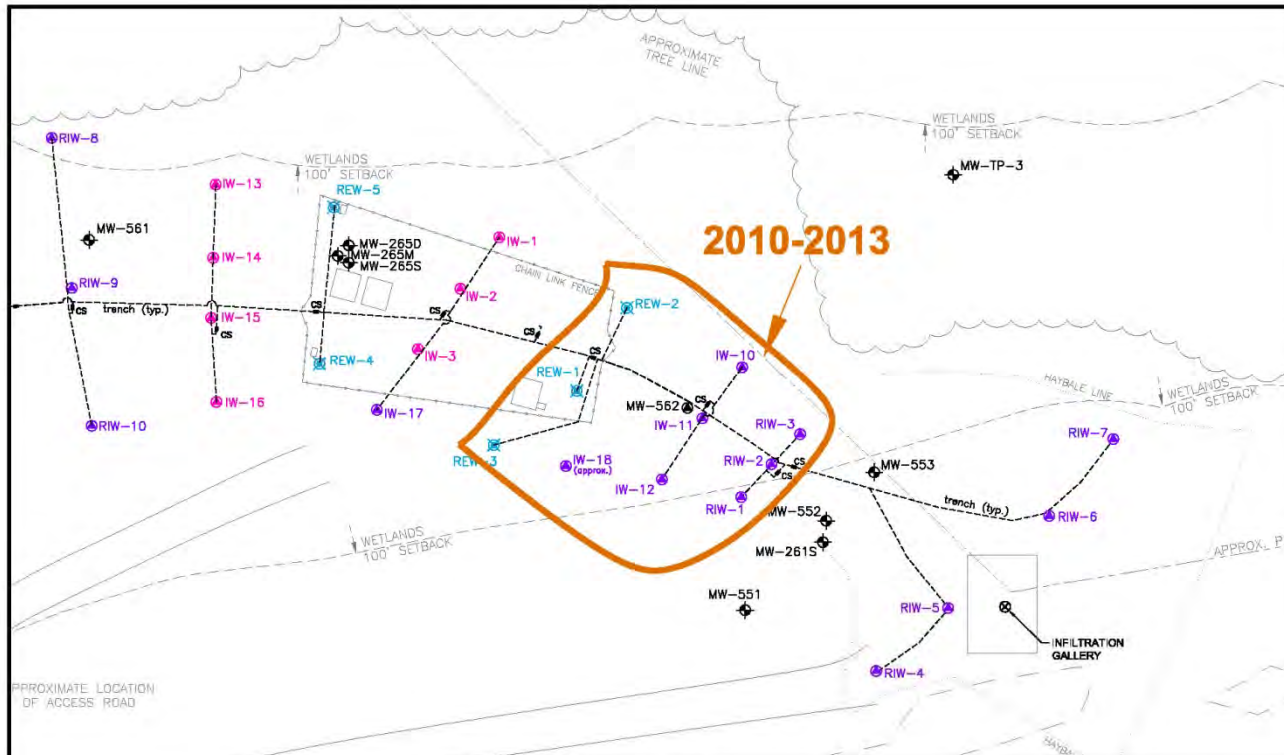
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TITLE

TREATMENT AREA WITH MW-562 MONITORING DATA

LEGEND

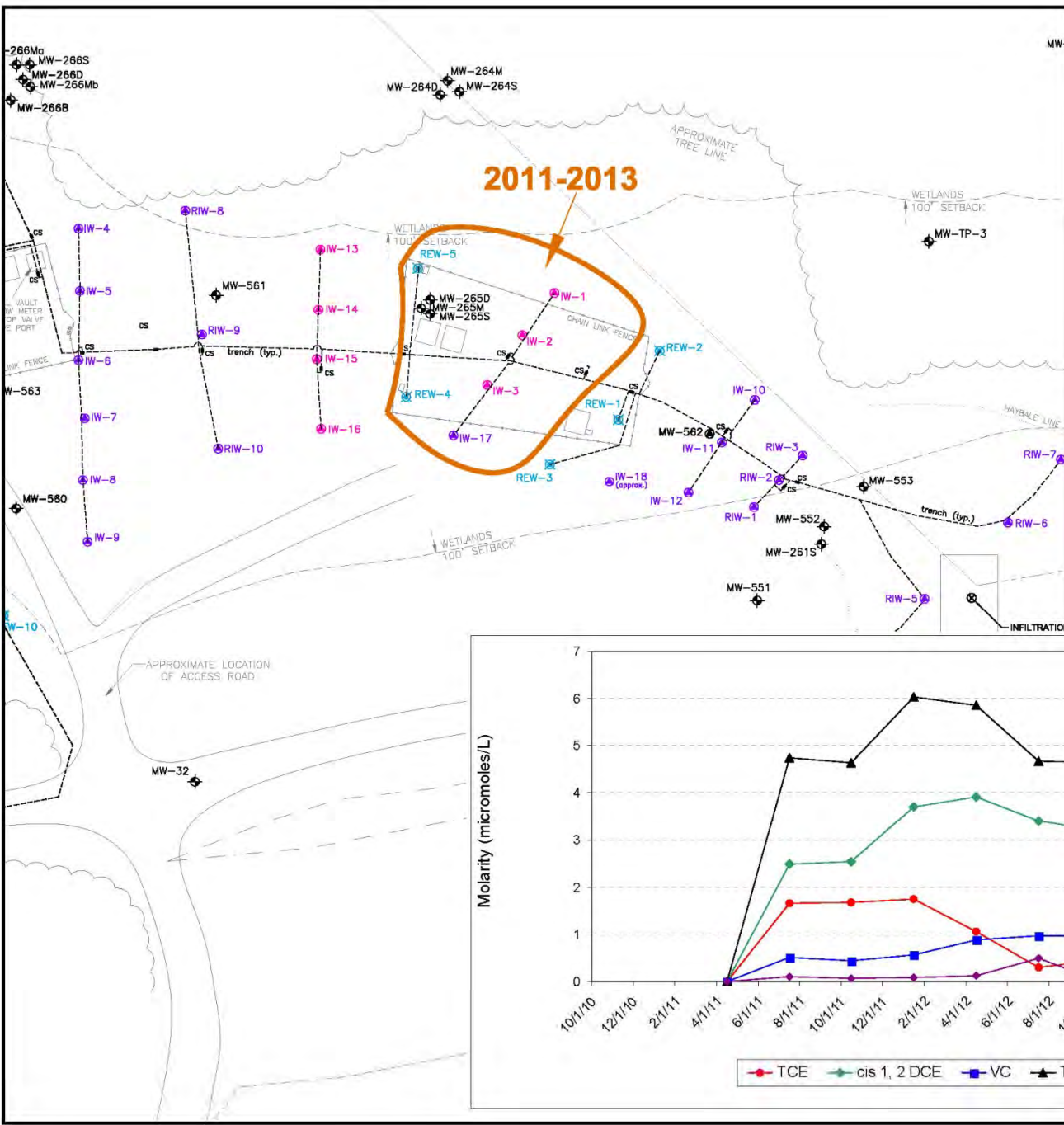
- MONITORING WELL / CLUSTER
- 2" INJECTION WELL
- 4" INJECTION WELL
- EXTRACTION WELL
- BELOW GRADE PIPING (APPROX.)
- INJECTION PORT AND CLEANOUT



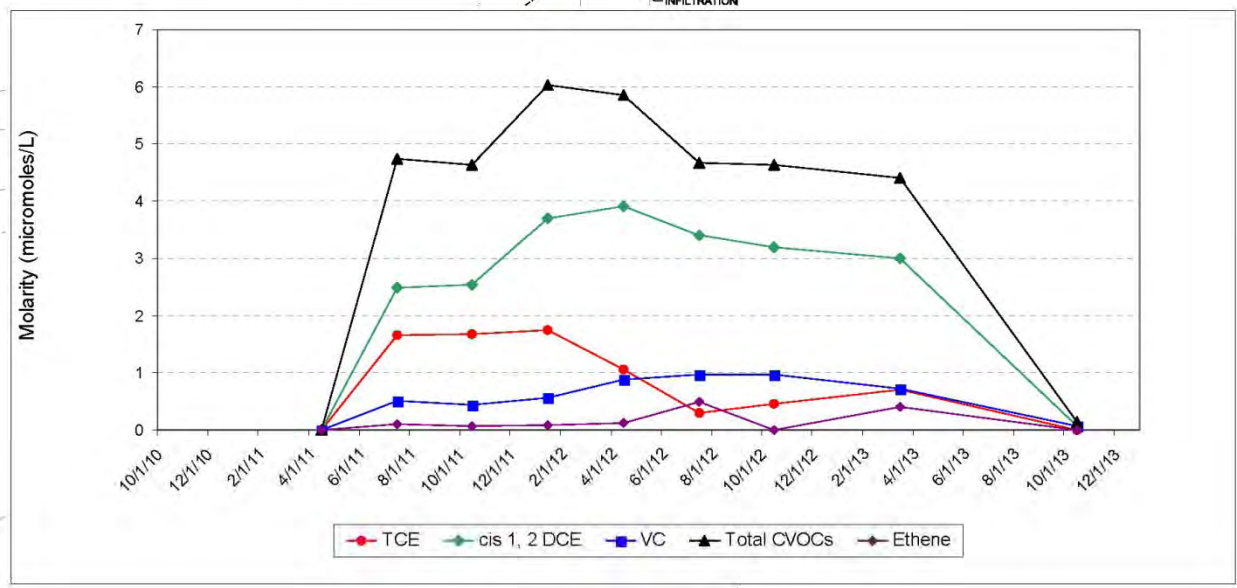
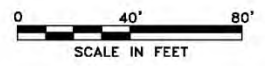


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TITLE
**TREATMENT AREA WITH
REW-5 MONITORING DATA**



- LEGEND
- Monitoring Well / Cluster
 - 2" Injection Well
 - 4" Injection Well
 - Extraction Well
 - Below Grade Piping (Approx.)
 - Injection Port and Cleanout





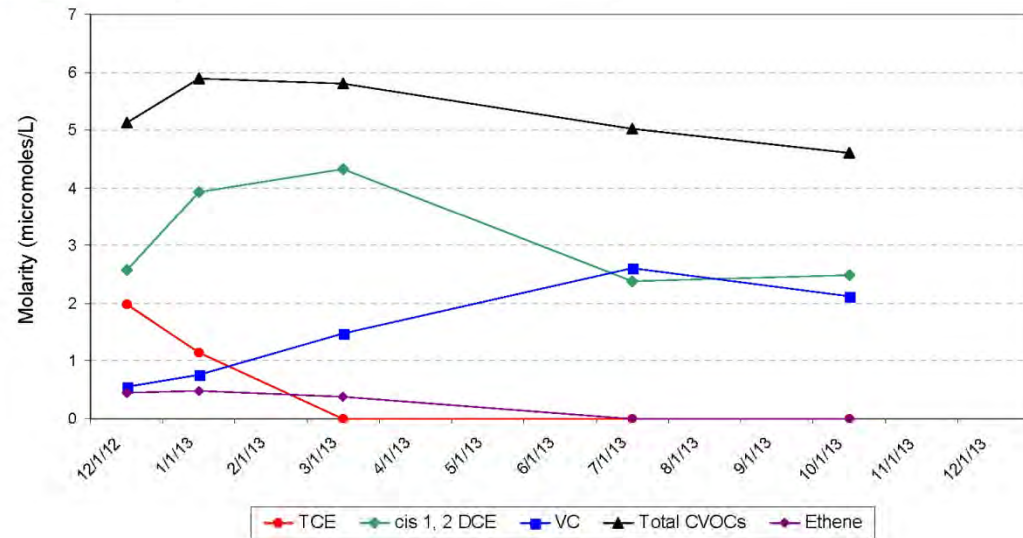
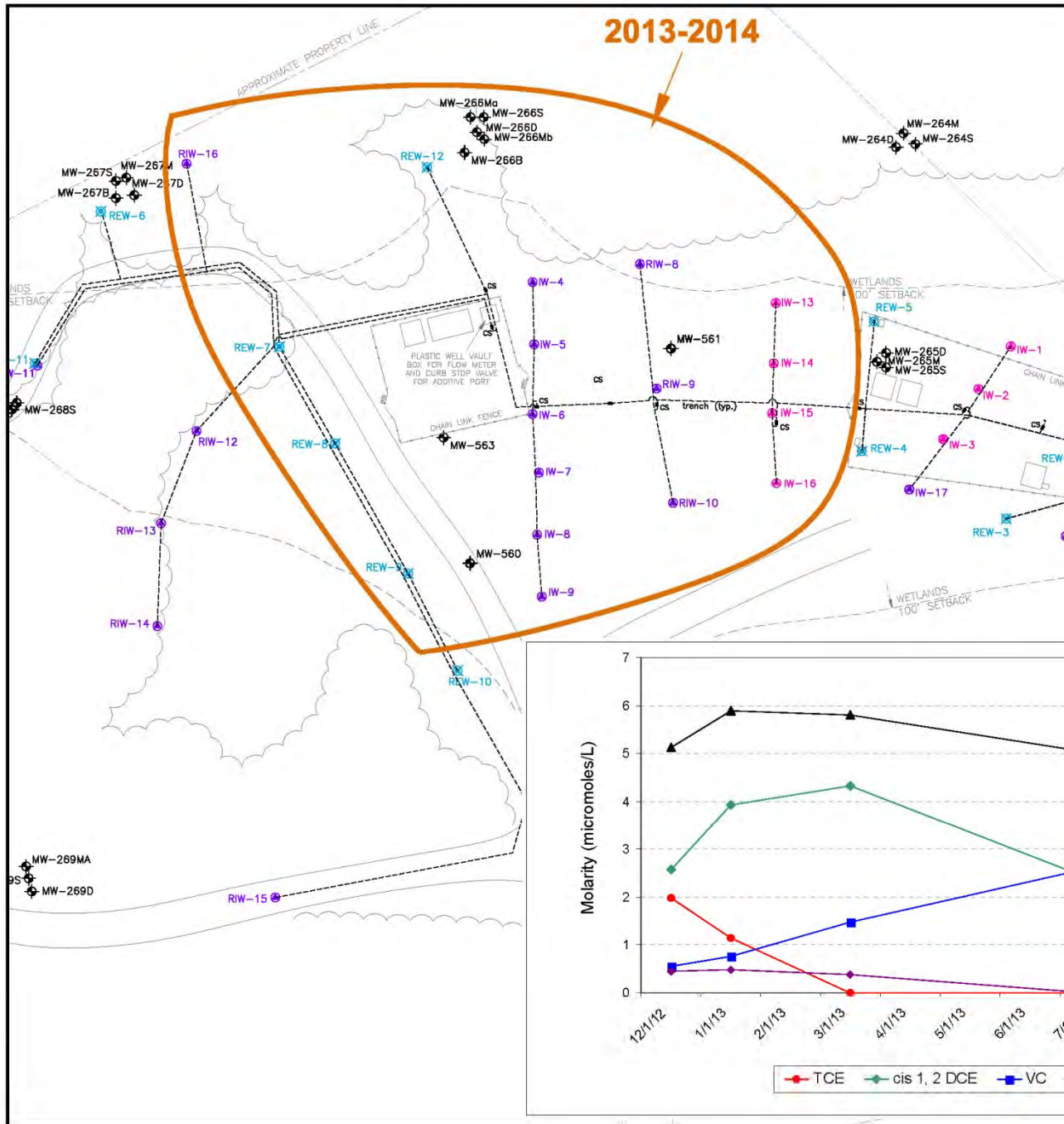
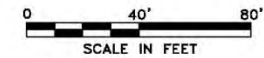
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TITLE

TREATMENT AREA WITH MW-563 MONITORING DATA

LEGEND

- MONITORING WELL / CLUSTER
- 2" INJECTION WELL
- 4" INJECTION WELL
- EXTRACTION WELL
- BELOW GRADE PIPING (APPROX.)
- INJECTION PORT AND CLEANOUT



2014



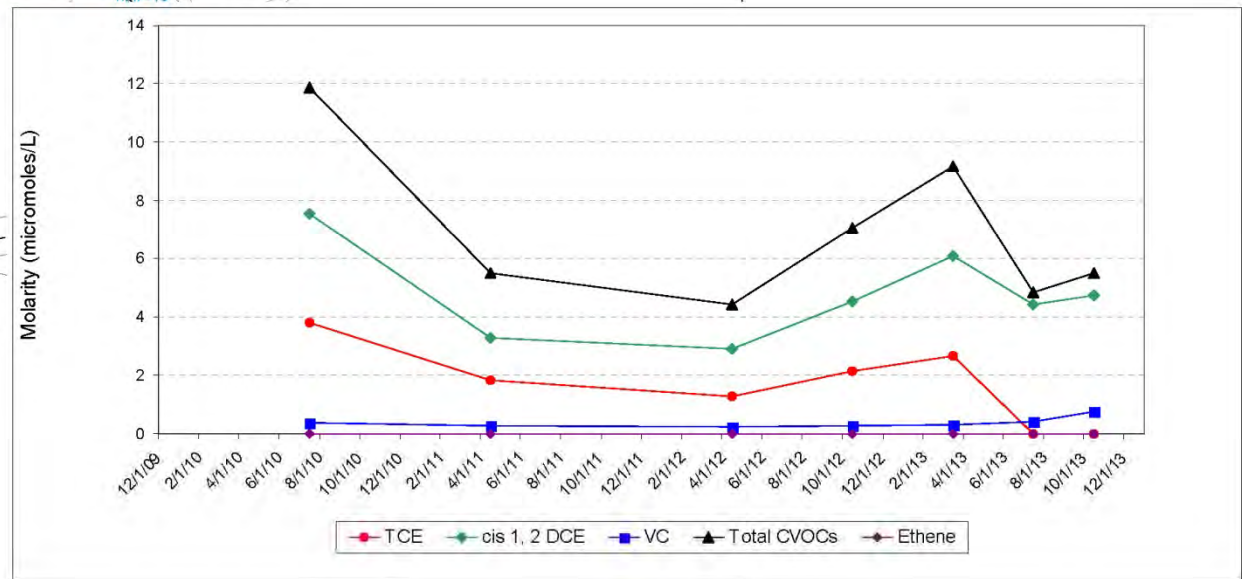
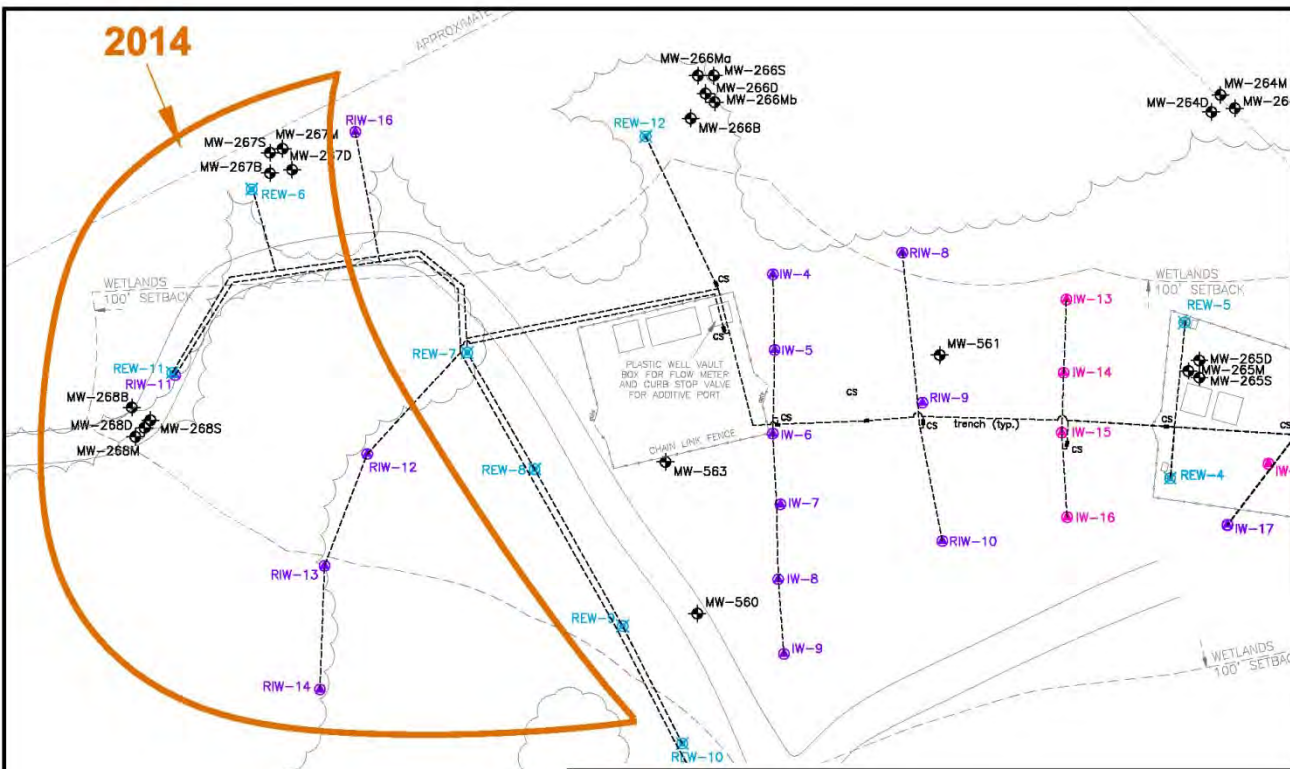
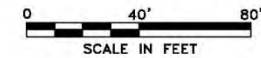
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TITLE

TREATMENT AREA WITH MW-267M MONITORING DATA

LEGEND

- MONITORING WELL / CLUSTER
- 2" INJECTION WELL
- 4" INJECTION WELL
- EXTRACTION WELL
- BELOW GRADE PIPING (APPROX.)
- INJECTION PORT AND CLEANOUT



Project Summary

- Detected concentrations in groundwater in the Cow Commons wells are similar to historic detections.
- First full year of sampling in the “replacement wells” in the Southern Area; generally consistent with post-treatment groundwater data.
- Groundwater profiling data is being evaluated in conjunction with the 2011 profiling program.
- All portions of the Northern Area system will be active in December 2013, and continue into 2014.
- Northern Area groundwater monitoring data is positive and encouraging.
- Groundwater sampling and reporting will continue on a biannual basis in 2014.

Questions?

- Raytheon will continue to make documents available at the information repository Wayland Board of Health and extranet web site
www.ermne.com; username – raytheon; password – wayland