

Remediation Status Update Former Raytheon Facility Wayland, Massachusetts

Integrated Defense Systems
Jonathan Hone

December 3, 2015

Outline

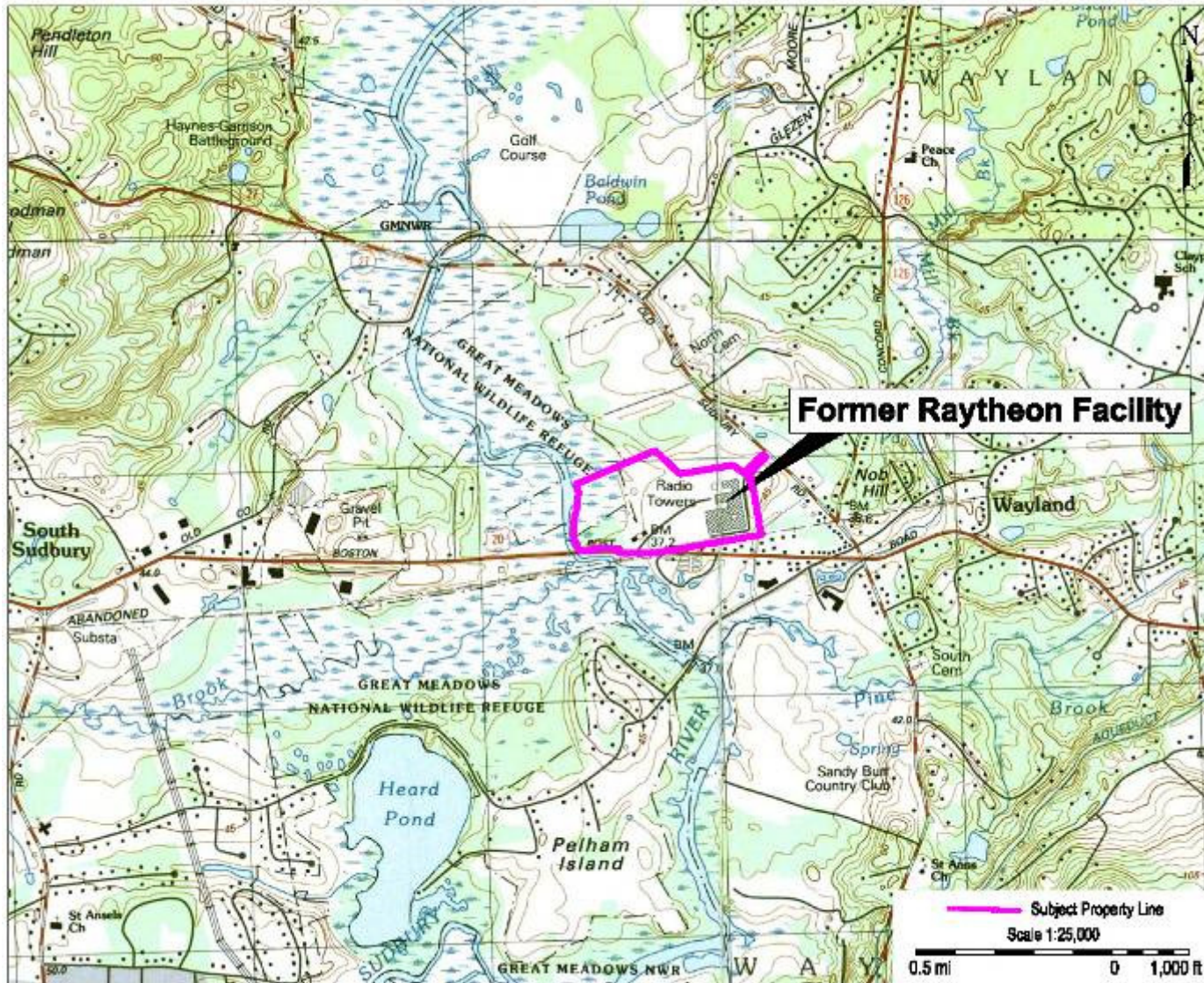
- Team Introductions
 - Chip Burkhardt, Raytheon
 - Lyndsey Colburn, PM, Environmental Resources Management
 - John Drobinski, LSP, Environmental Resources Management
 - Dr. Sami Fam, Innovative Engineering Solutions, Inc.

- Site Overview

- 2015 Site Activities
 - Site-Wide Activities
 - Southern Area
 - Northern Area Bioremediation

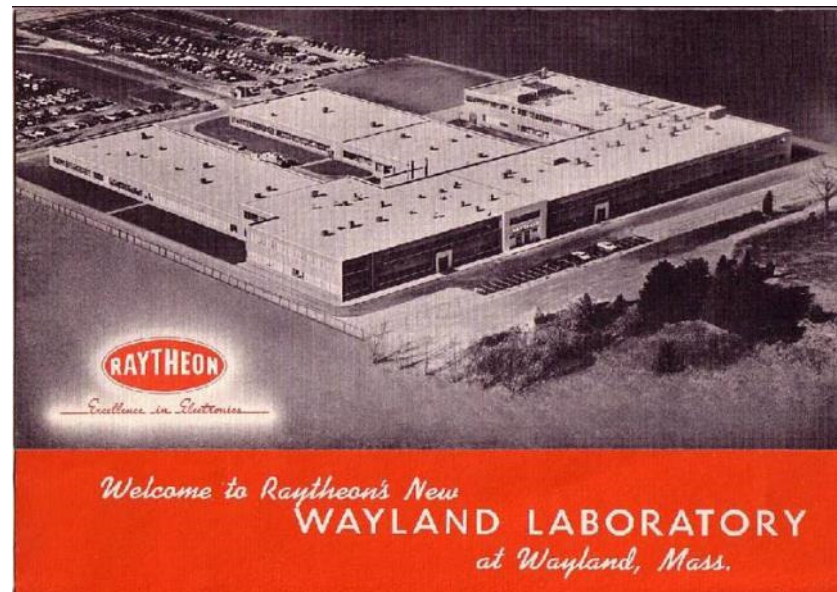
- Q&A

Locus Plan

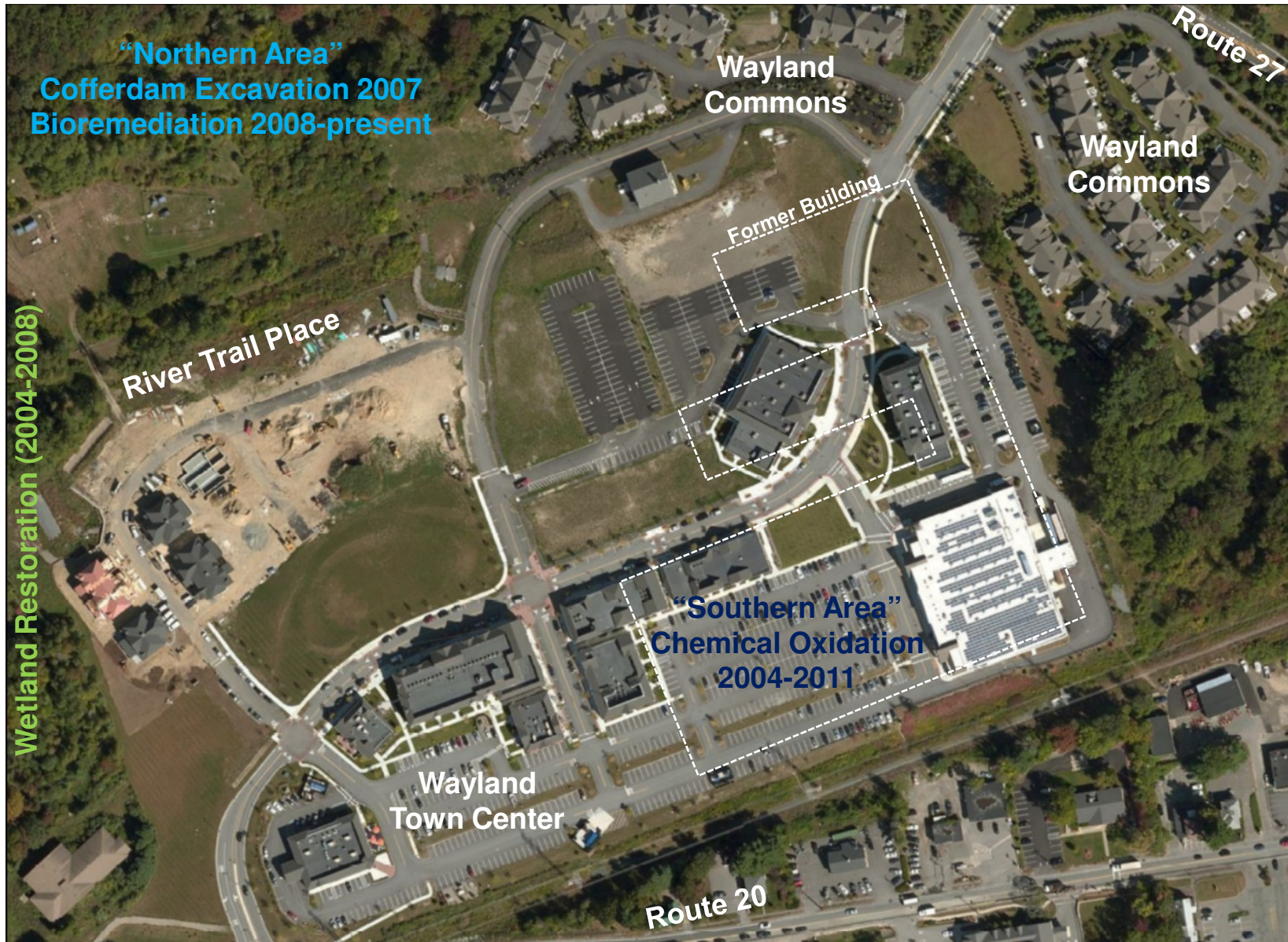


Site Overview

- Radar testing and development (1957-1995)
- Contamination discovered in 1996
- Regulated by the Massachusetts DEP
- Historic Site Contaminants
 - Chlorinated VOCs, PCBs
- Extensive Site Investigation (ongoing)
- 2 Primary Areas of Current Activity
 - Northern Area- Bioremediation
 - Southern Area – Chemical Oxidation
- 2 large soil removals & wetland restoration
- Deed restrictions have been implemented at the property/Site
- Groundwater flow is generally to the west
- Located within drinking water zone
 - Baldwin Pond Wells
- Ongoing site redevelopment since 2009
 - Wayland Commons
 - Wayland Town Center
 - River Trail Place



Wayland Site Plan



2015 Activities

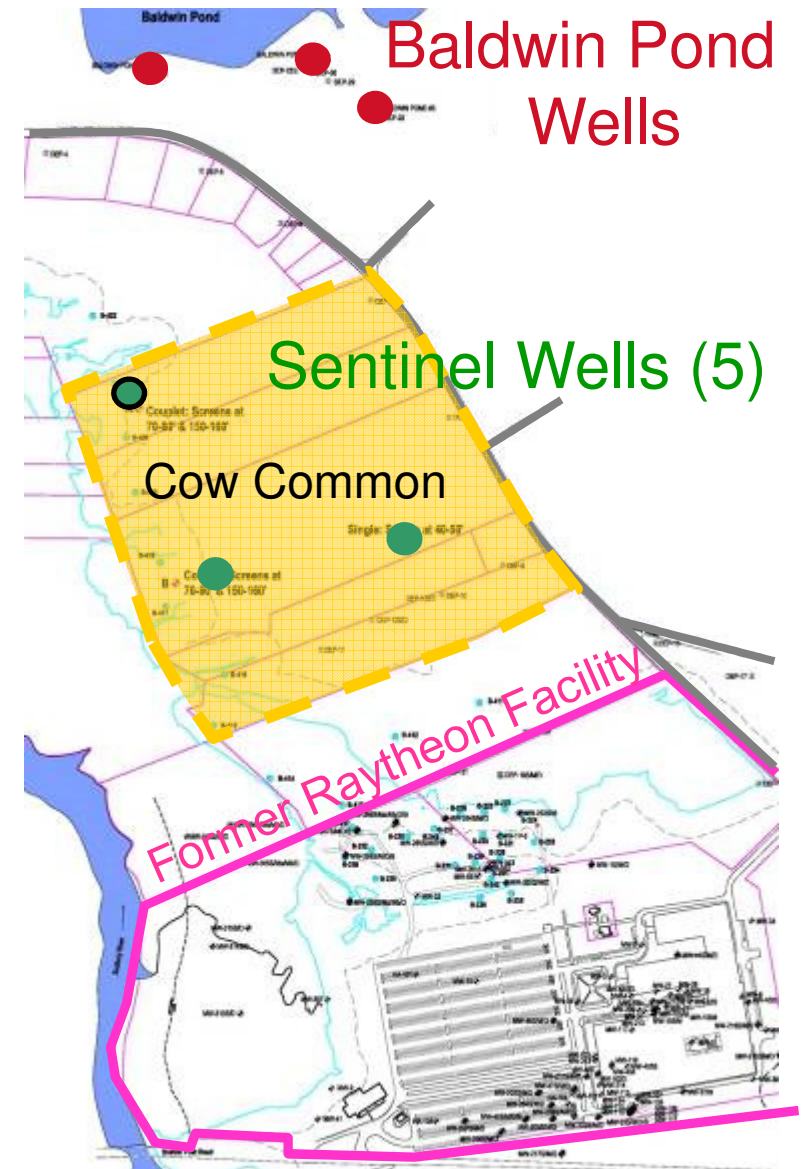
- Remedy Operation Status (ROS) Reports submitted in May & November
 - Available online and at the Town repository

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

- Northern Area Bioremediation System
 - Bioremediation System Operation, Maintenance & Monitoring
 - Groundwater monitoring
 - Injection and recirculation of amended groundwater

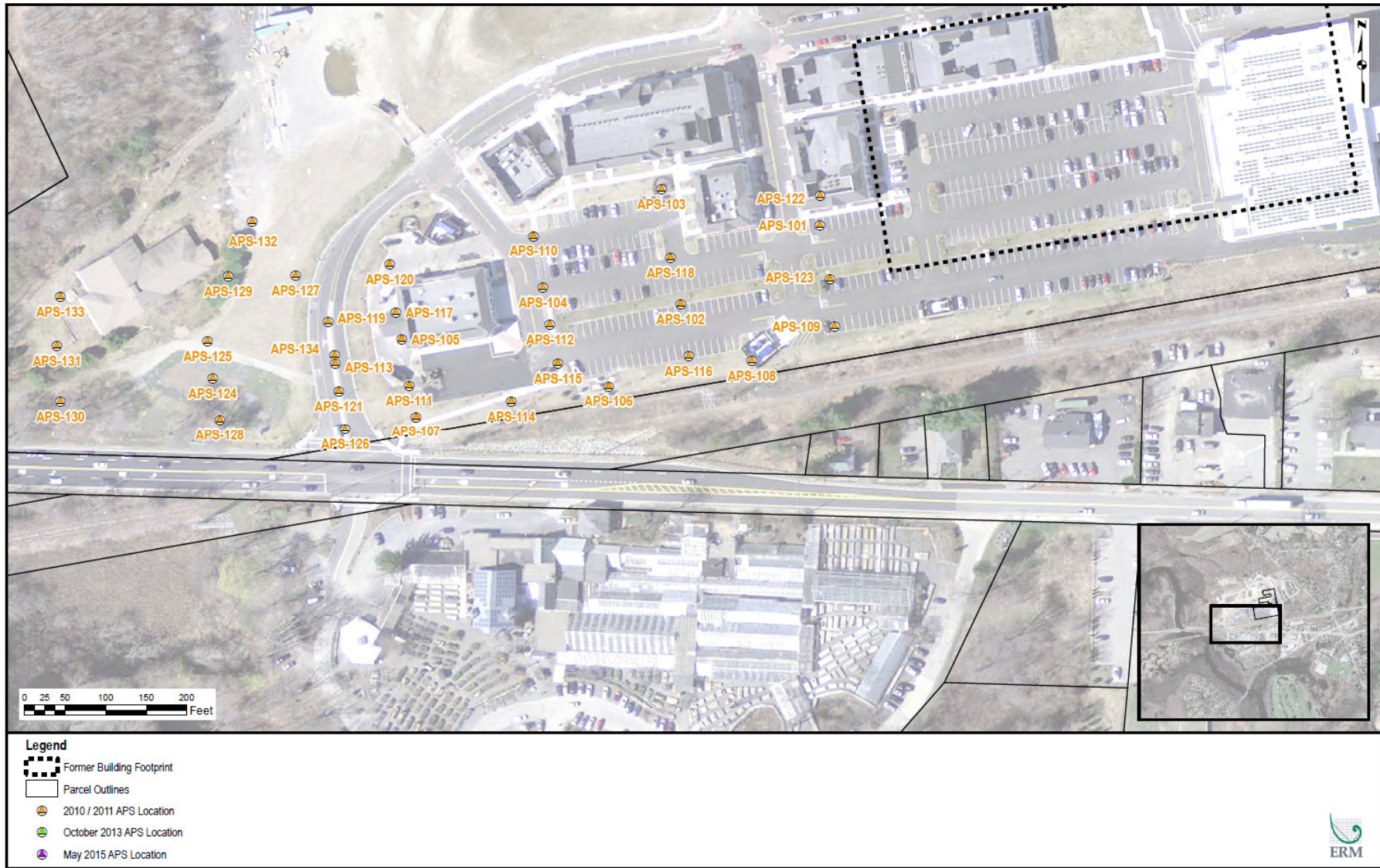
Cow Common/Sentinel Wells

- Groundwater samples collected from wells in September 2015
 - Analyzed for VOCs by Method 8260B
- All samples were Not Detected (ND) above the laboratory detection limit

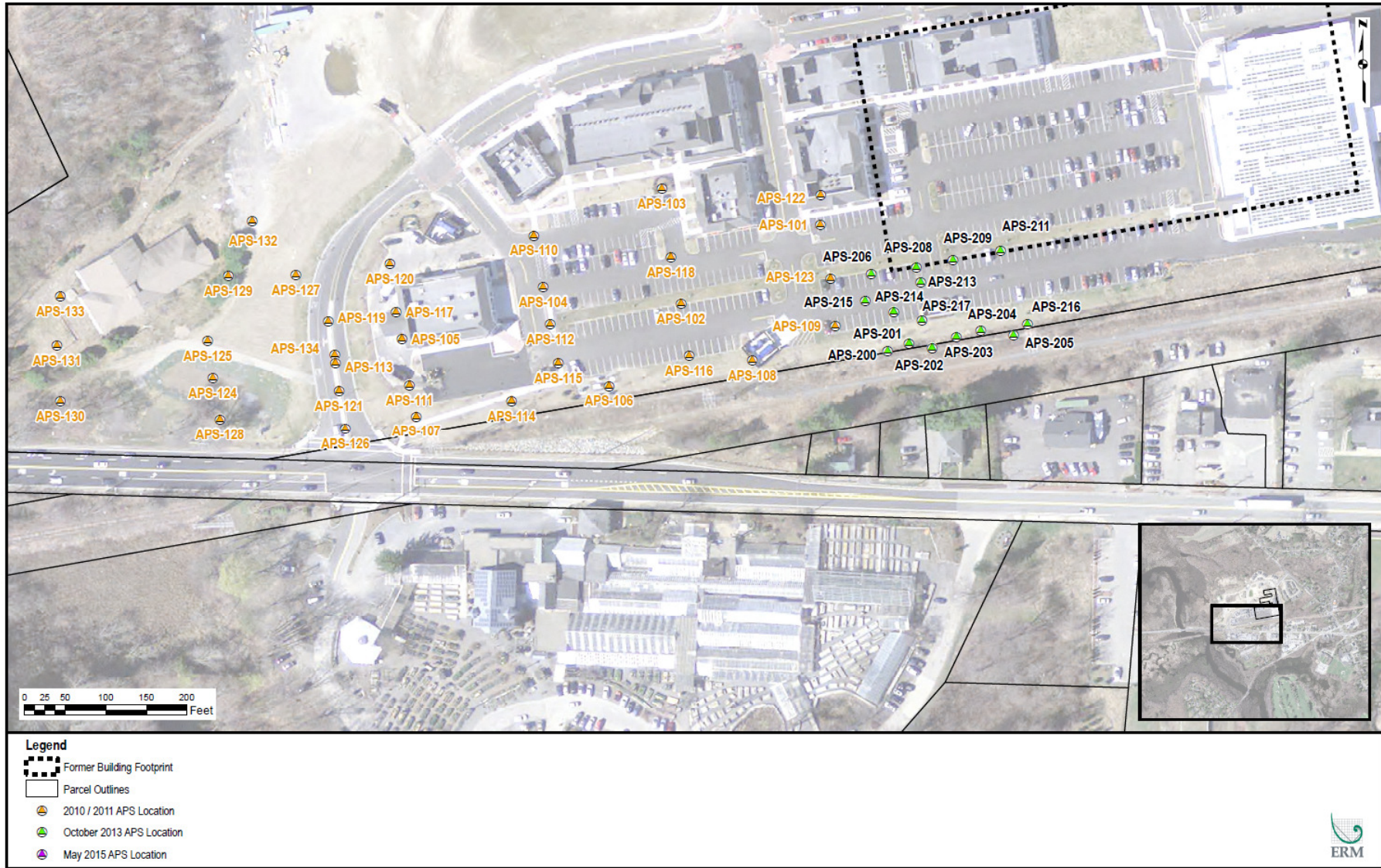


Southern Area

Post-Remediation Site Investigation Timeline

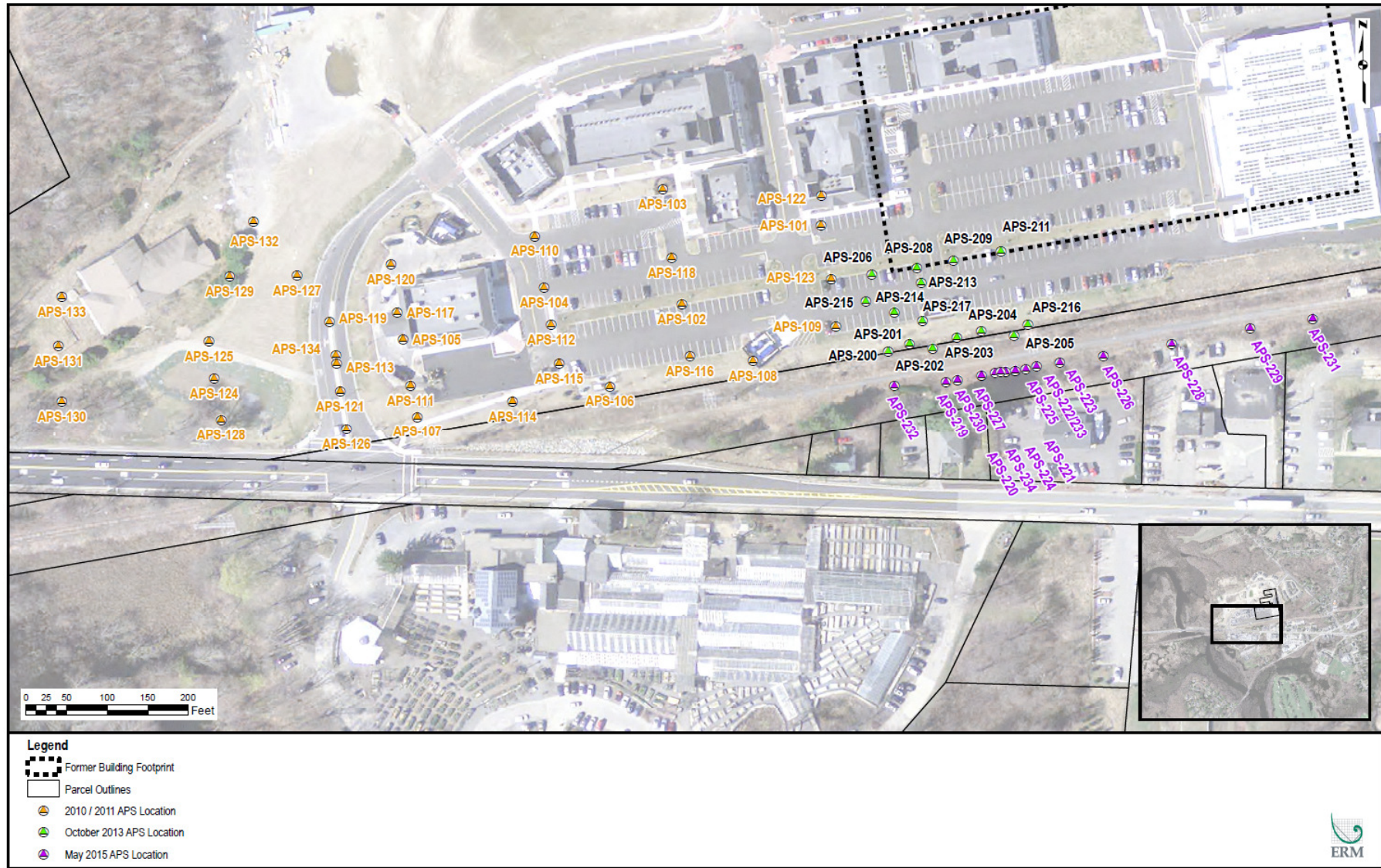


Post-Remediation Site Investigation Timeline

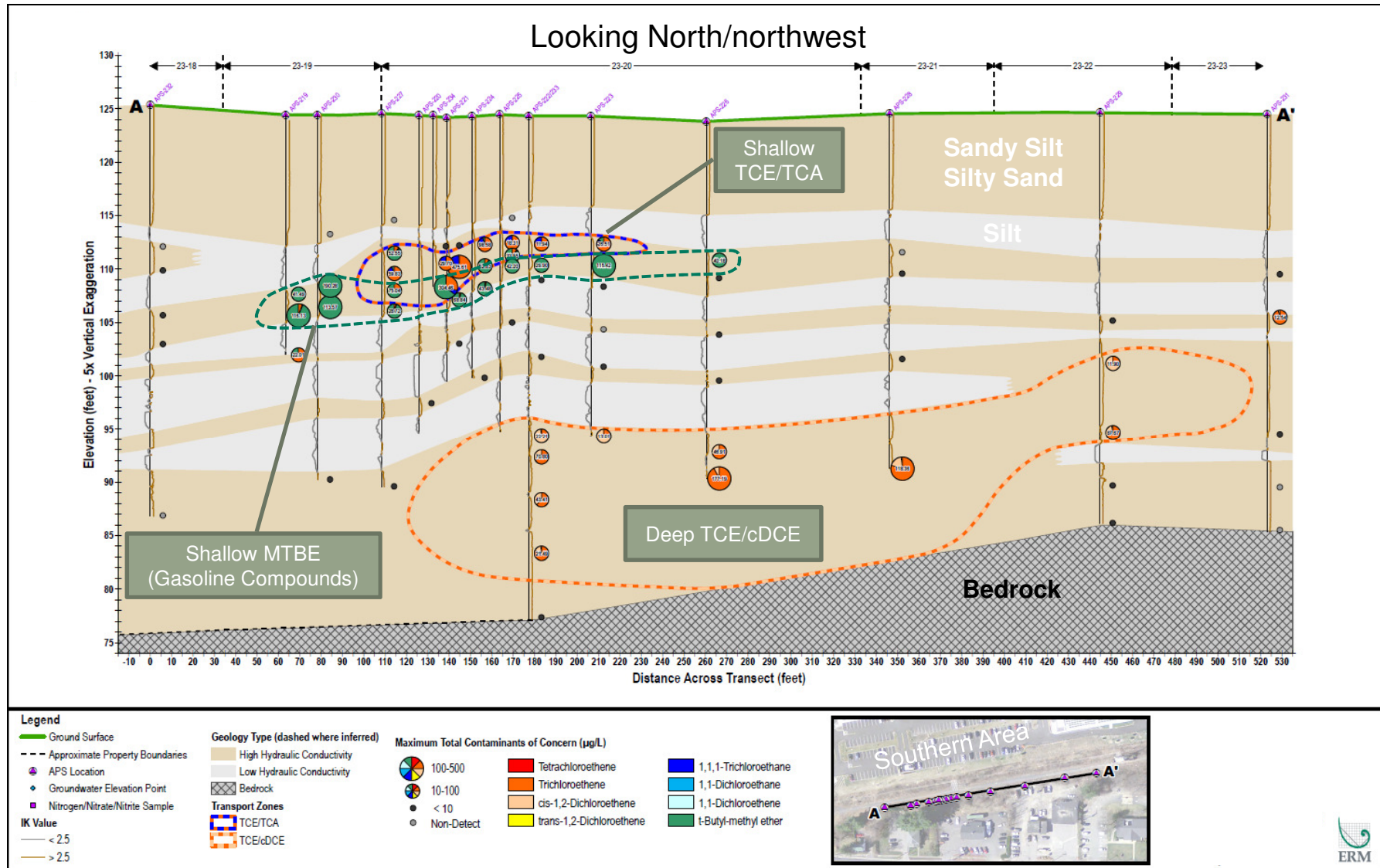


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Post-Remediation Site Investigation Timeline



2015 Investigation Data



Northern Area

Northern Area (Bioremediation)



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 and extraction 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 ~3 gallons per minute (gpm)

Recirculation System Photos



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

- “Parent” compound degrade into “Daughter” products

Tetrachloroethene (PCE)



Trichloroethene (TCE)



cis-1,2-Dichloroethene (cDCE)



Vinyl Chloride (VC)



Ethene

Recirculation System Timeline

- 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

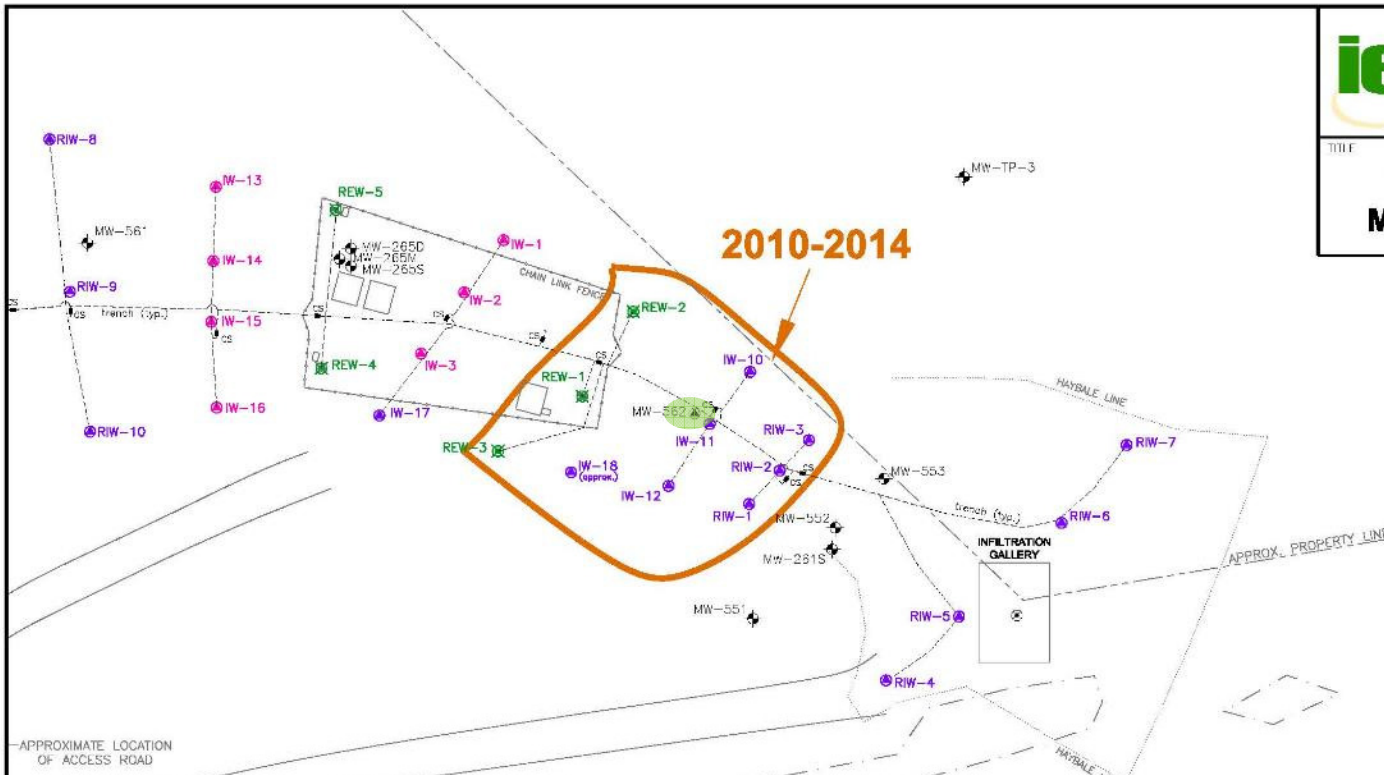
- 2015 Activities
 - System running at full capacity
 - Added another 4 solar panels and additional injection/extraction well
 - Recirculated approximately ~1.5 million gallons of groundwater in 2015 (10+ million gallons since the program began)



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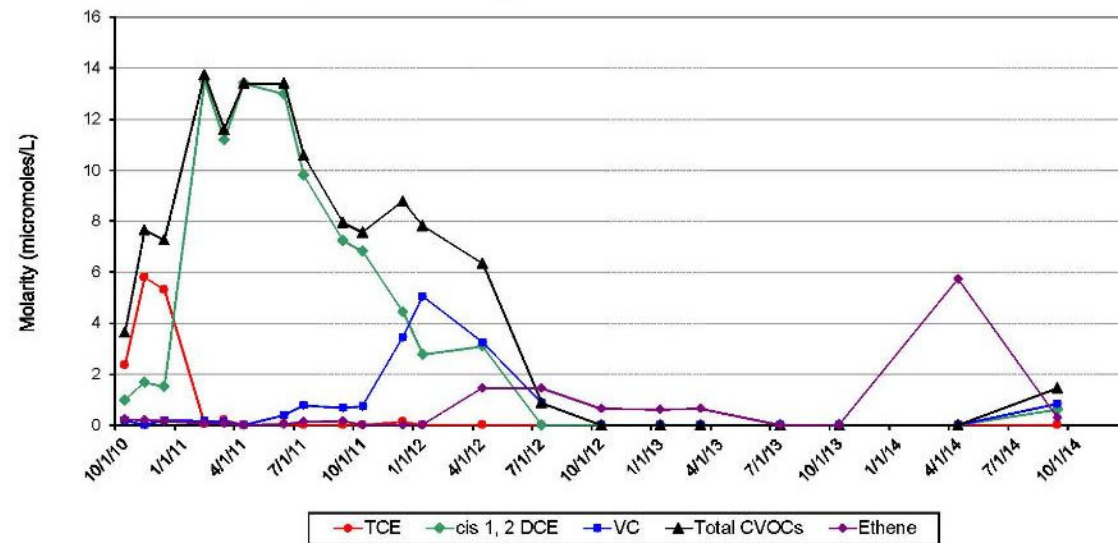
11/11

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

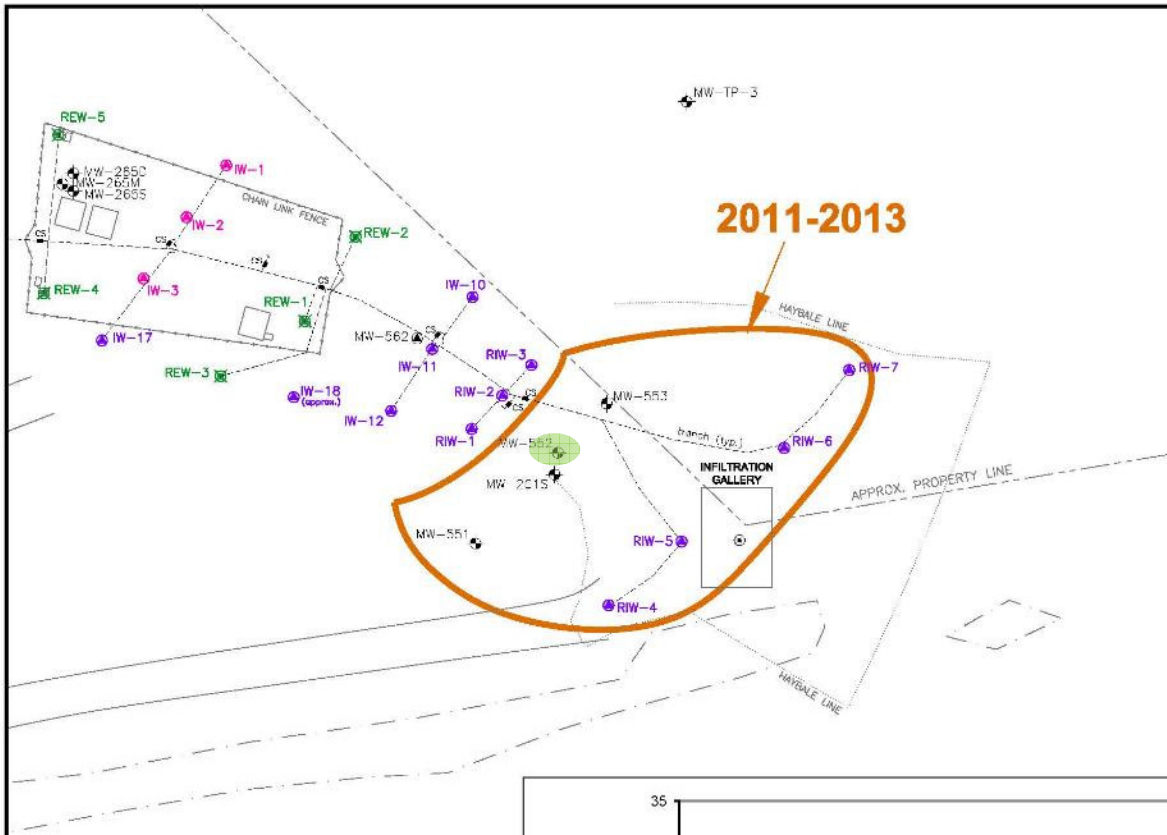




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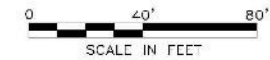
10/11

TREATMENT AREA WITH MW-552 MONITORING DATA

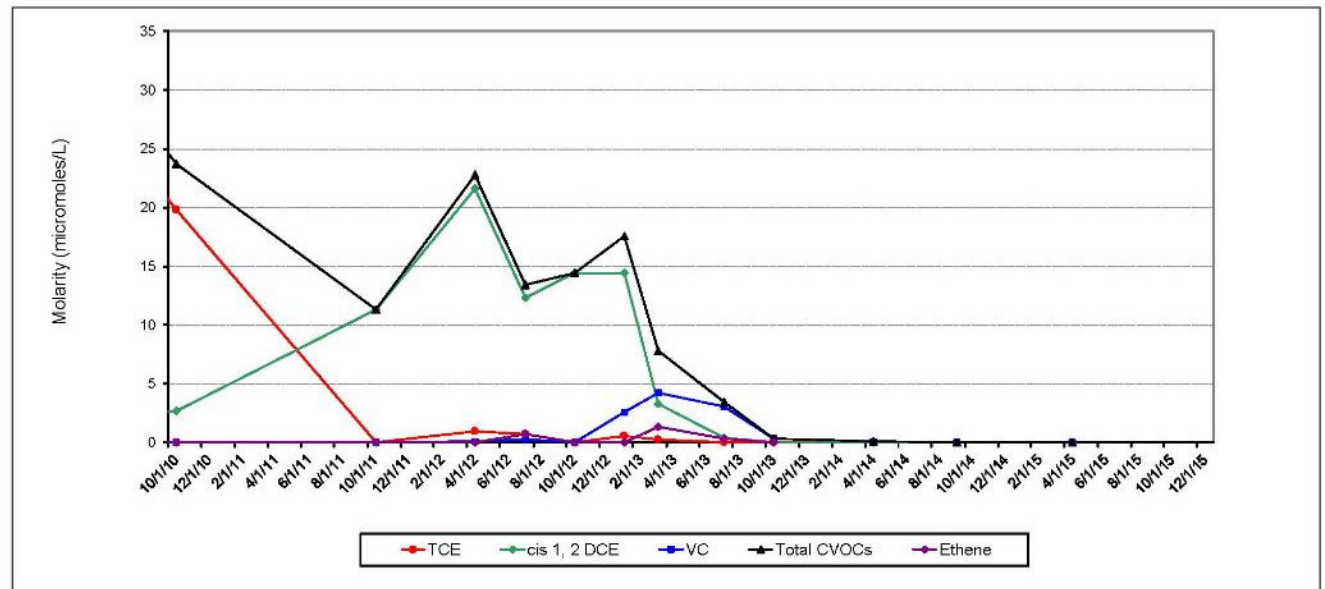


LEGEND

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



LANDS DELINEATION





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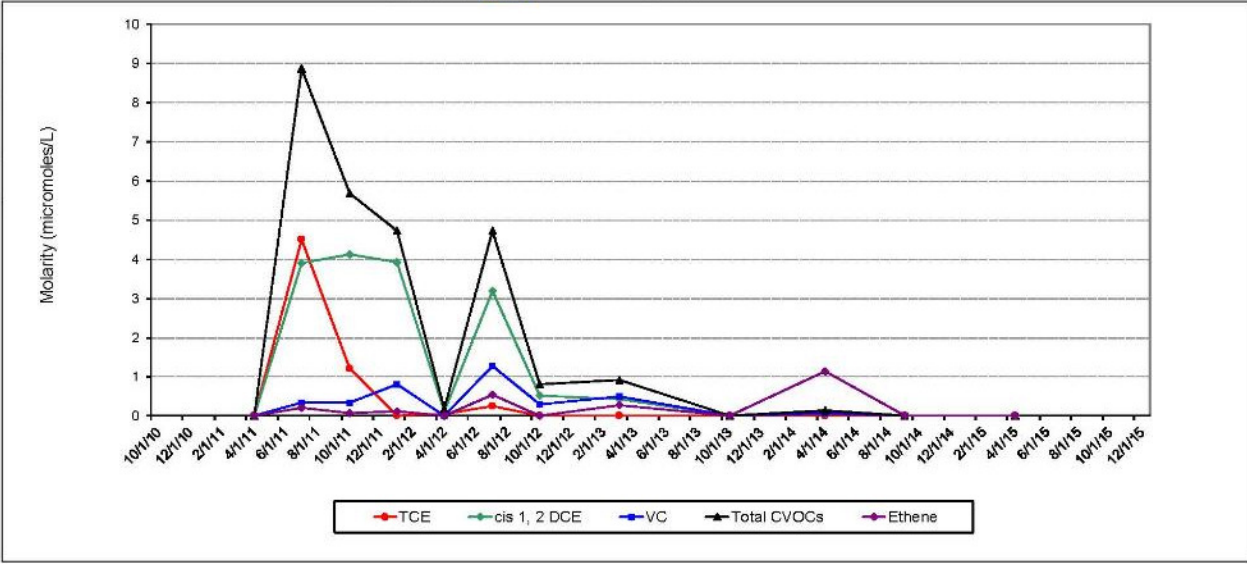
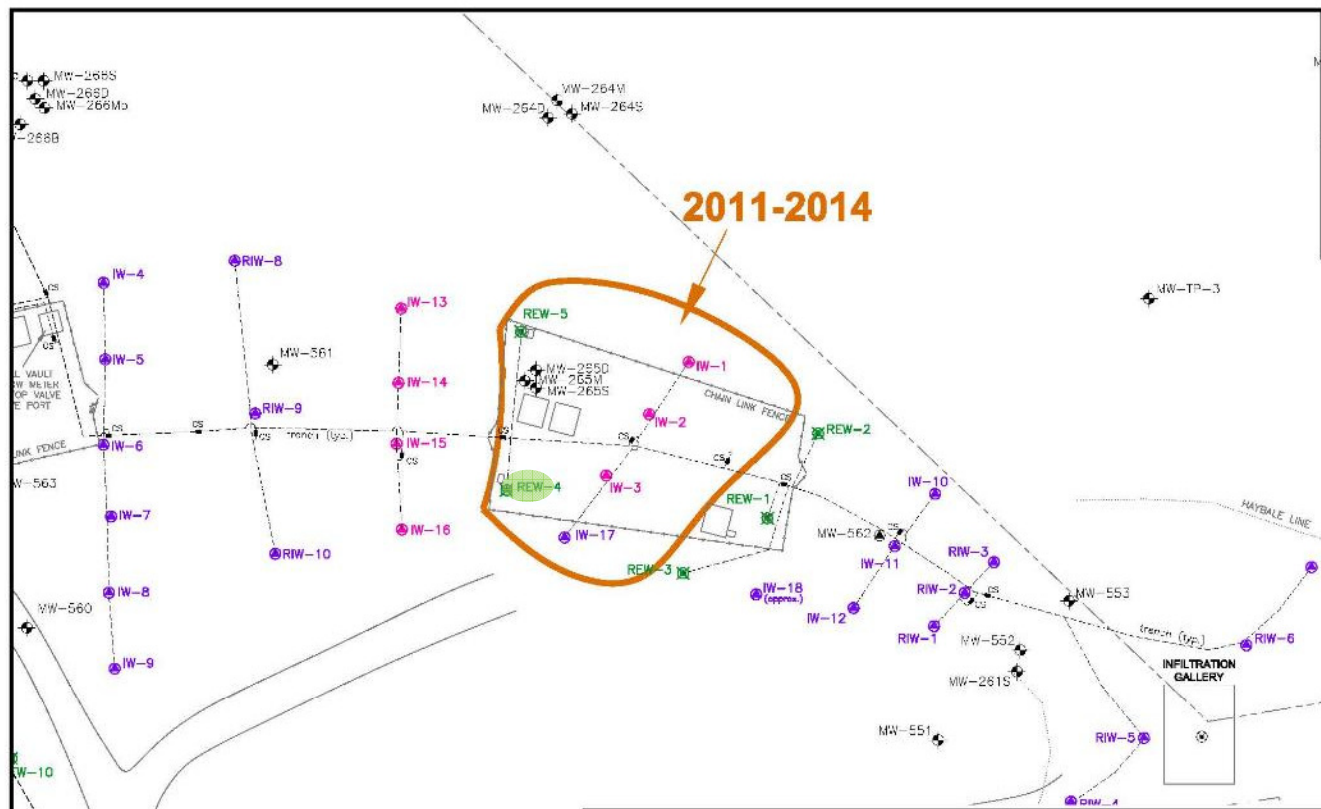
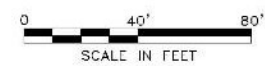
TITLE

TREATMENT AREA WITH REW-4 MONITORING DATA

2011-2014

LEGEND

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



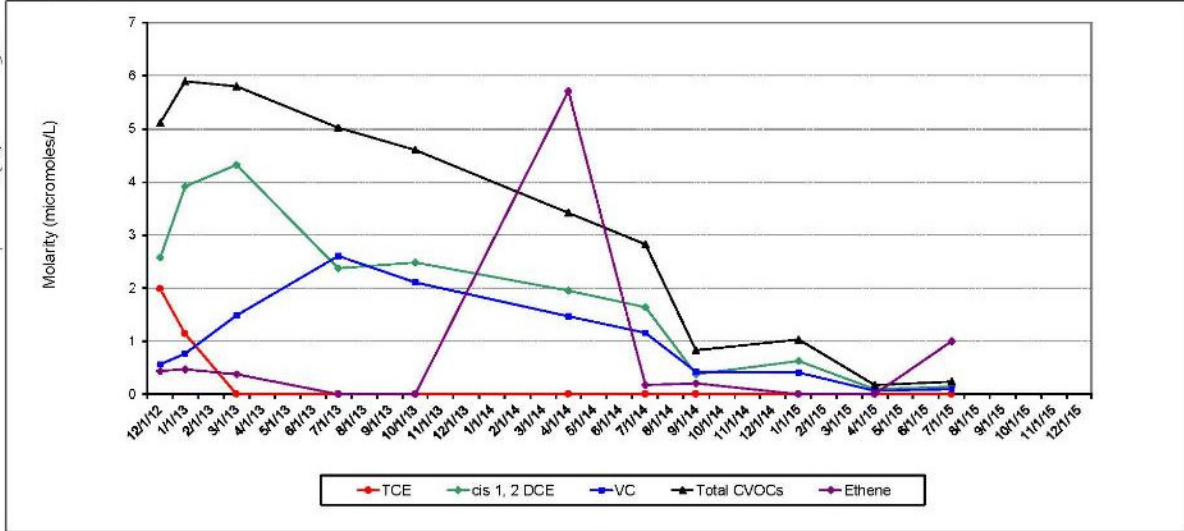
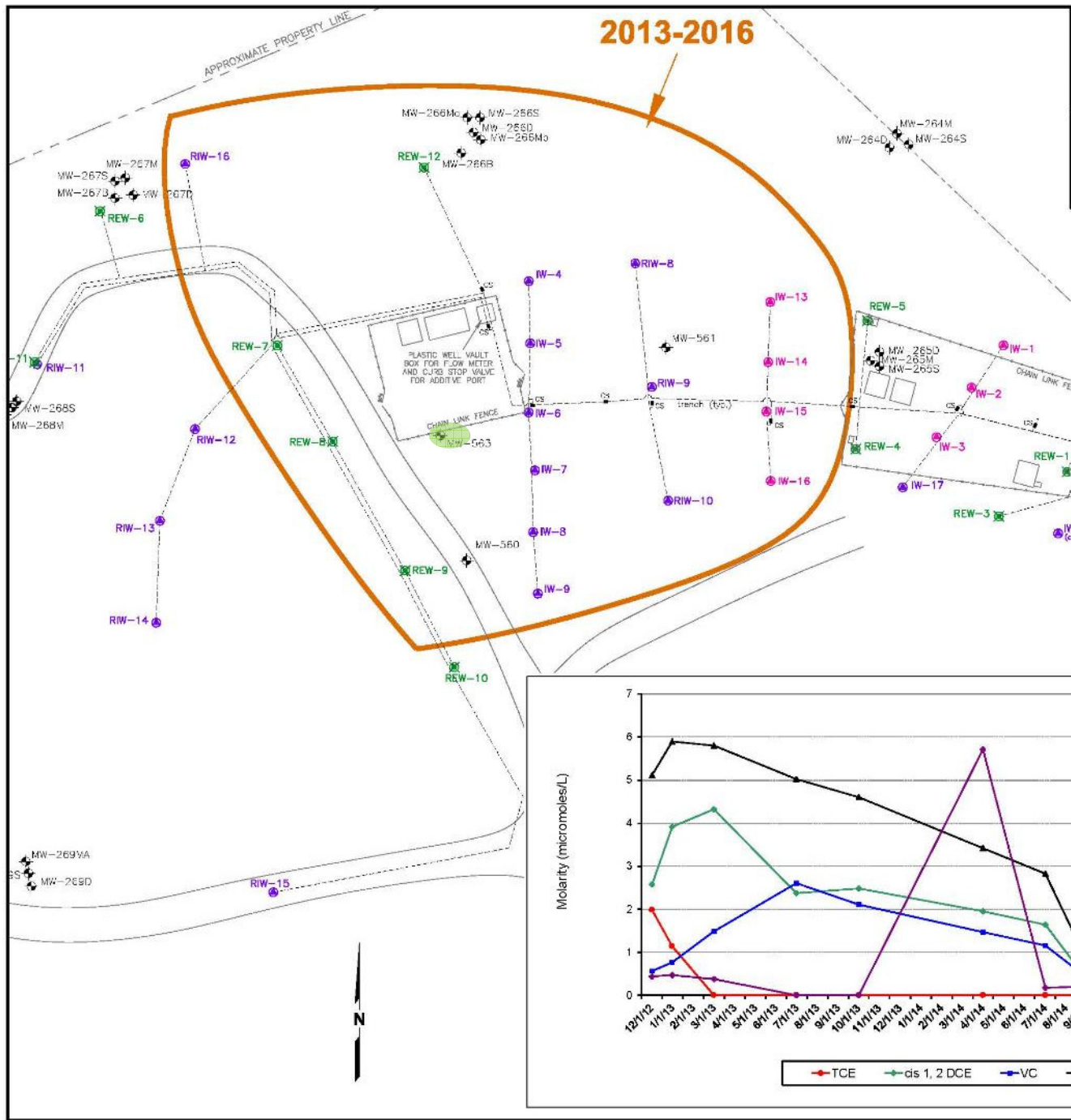
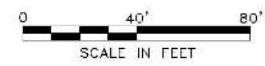


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TITLE
**TREATMENT AREA WITH
 MW-563 MONITORING DATA**

LEGEND

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



2014-2016



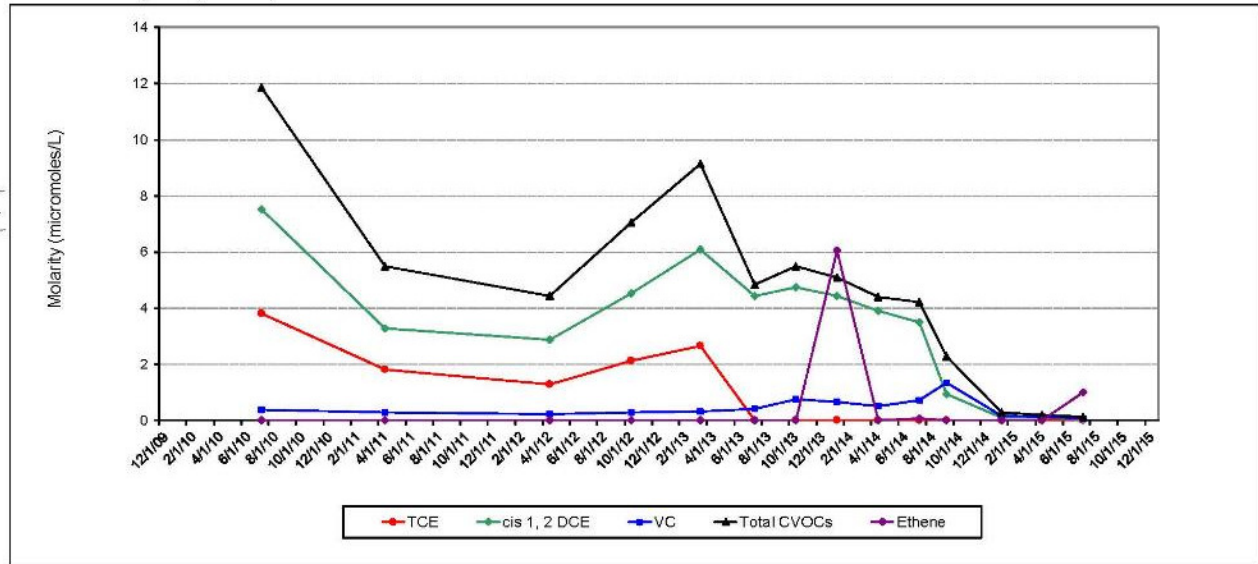
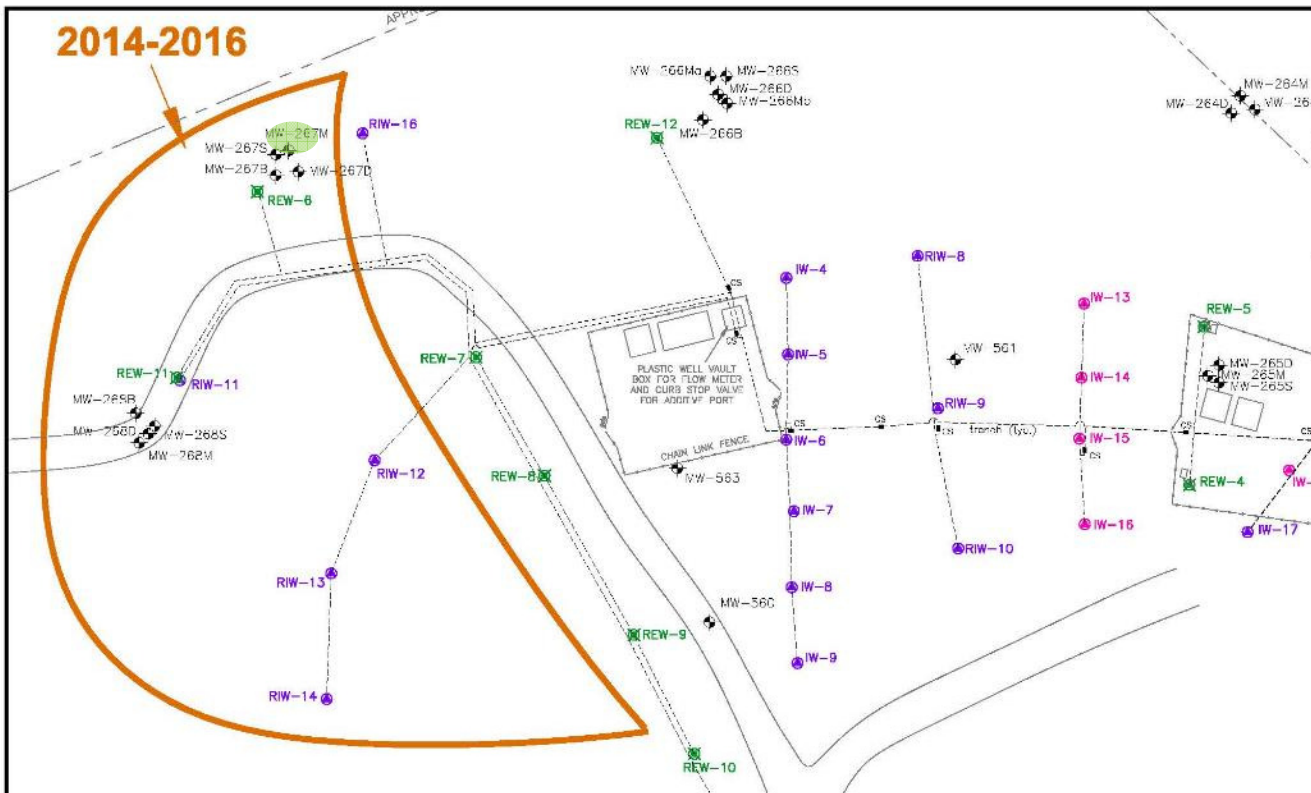
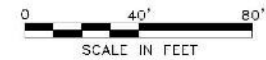
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TITLE

**TREATMENT AREA WITH
 MW-267M MONITORING DATA**

LEGEND

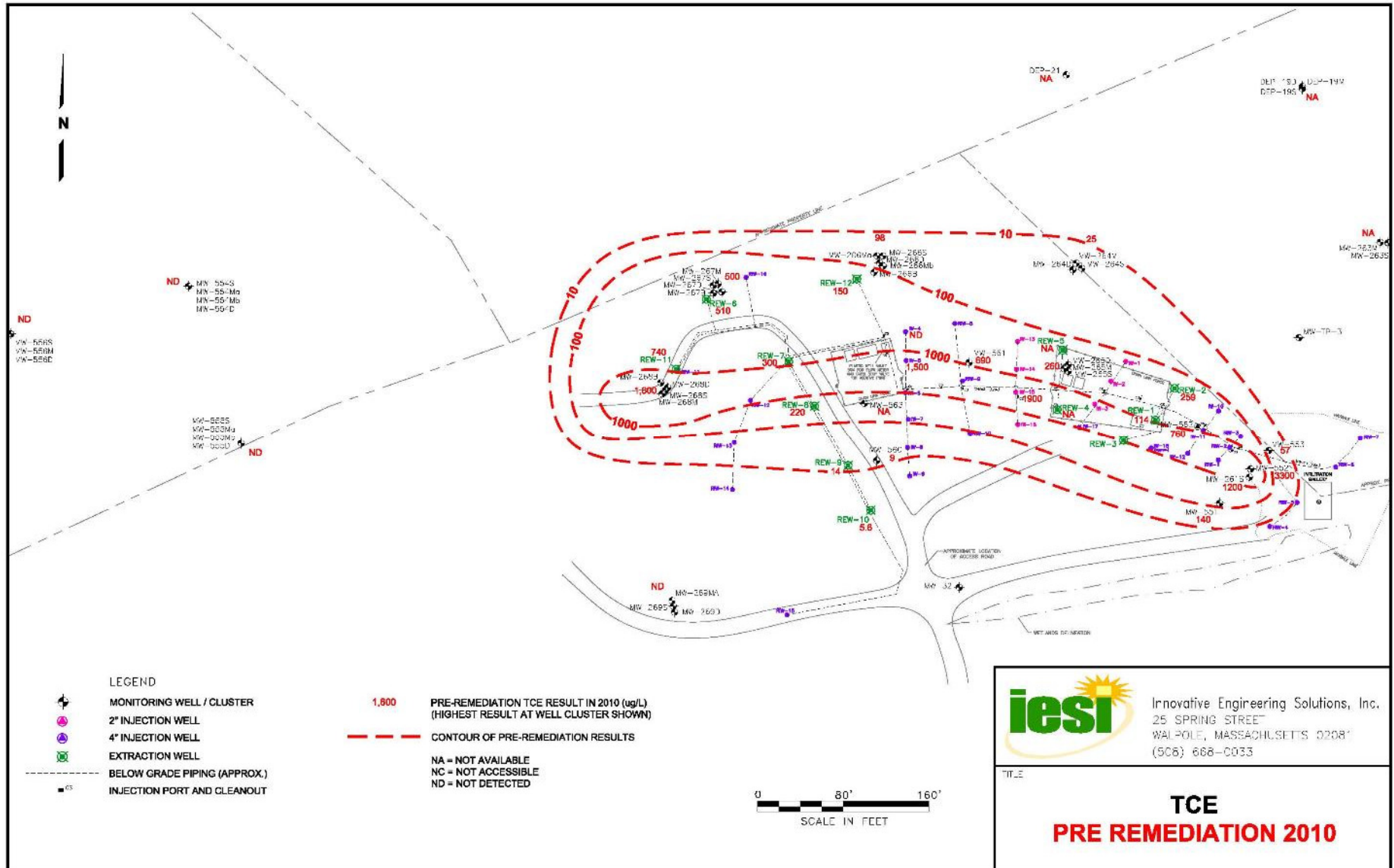
- MONITORING WELL / CLUSTER
- 2" INJECTION WELL
- 4" INJECTION WELL
- EXTRACTION WELL
- BELOW GRADE PIPING (APPROX.)
- INJECTION PORT AND CLEANOUT



TCE Concentration Contours

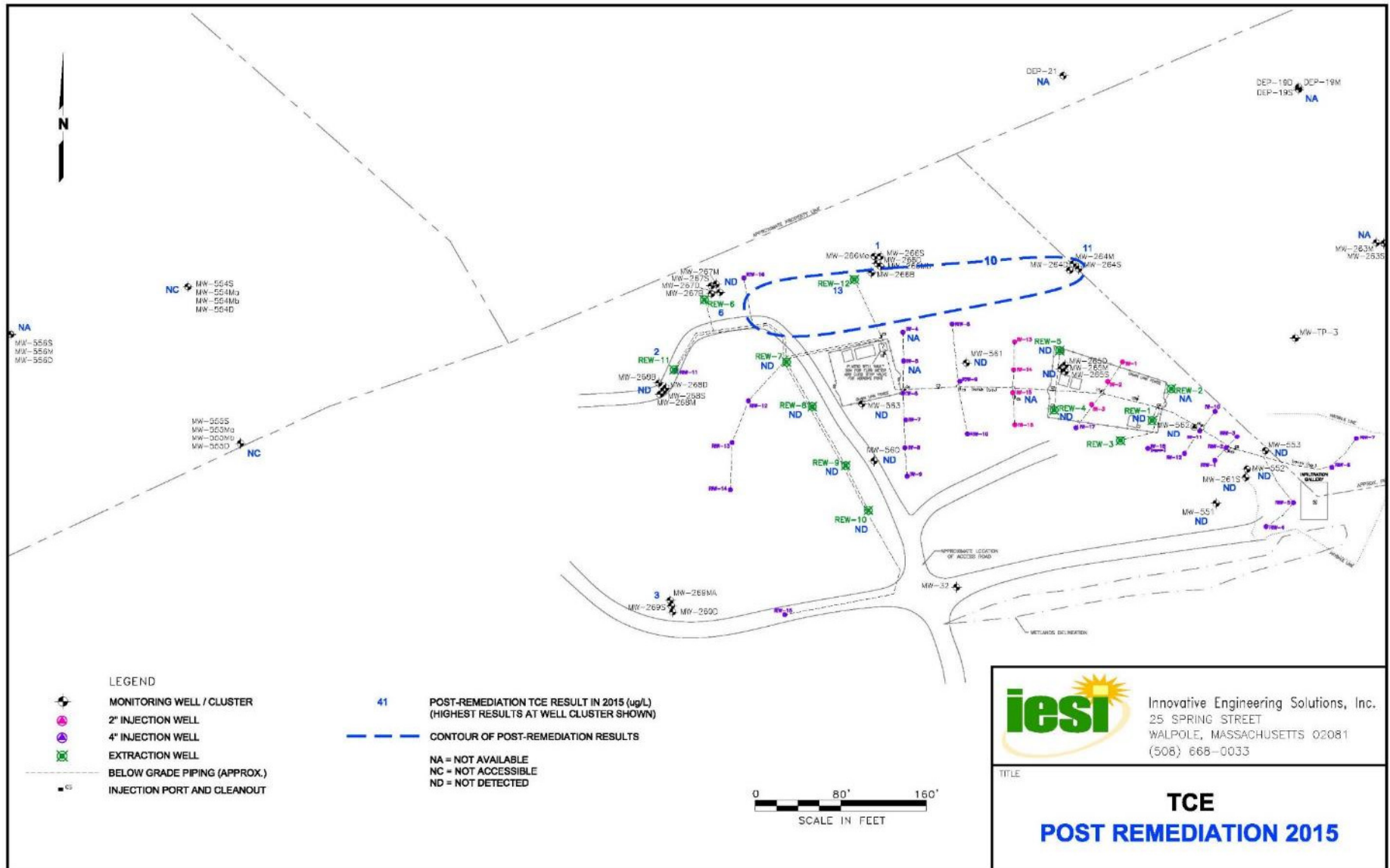
Pre-recirculation

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TCE Concentration Contours

Current Conditions



Summary

- No detections of VOC concentrations in Cow Commons wells.
- Extensive groundwater investigation on-property and within the MBTA right-of-way & Eversource easement
 - VOCs detected in 2 areas hydraulically up/cross gradient of the Southern Area.
- All portions of the Northern Area system are active and anticipated to continue in 2016.
- Northern Area groundwater monitoring data is positive and encouraging.
- Groundwater sampling and reporting will continue on a biannual basis in 2016.

Questions?

- Raytheon will continue to make documents available at the information repository Wayland Board of Health and extranet web site

<http://raytheon.erm.com>