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Customer Success Is Our Mission

Remediation Status Update Former Raytheon Facility Wayland, Massachusetts

Integrated Defense Systems

December 5, 2017

Outline

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- Team Introductions
  - Jonathan Hone, Project Manager, Raytheon
  - Lyndsey Colburn, Partner, Environmental Resources Management
  - John Drobinski, LSP, Environmental Resources Management
  - Dr. Sami Fam, Innovative Engineering Solutions, Inc.
- Site Overview
- 2017 Site Activities
  - Site-Wide Activities
  - Southern Area
  - Northern Area Bioremediation
- Q&A

Locus Plan

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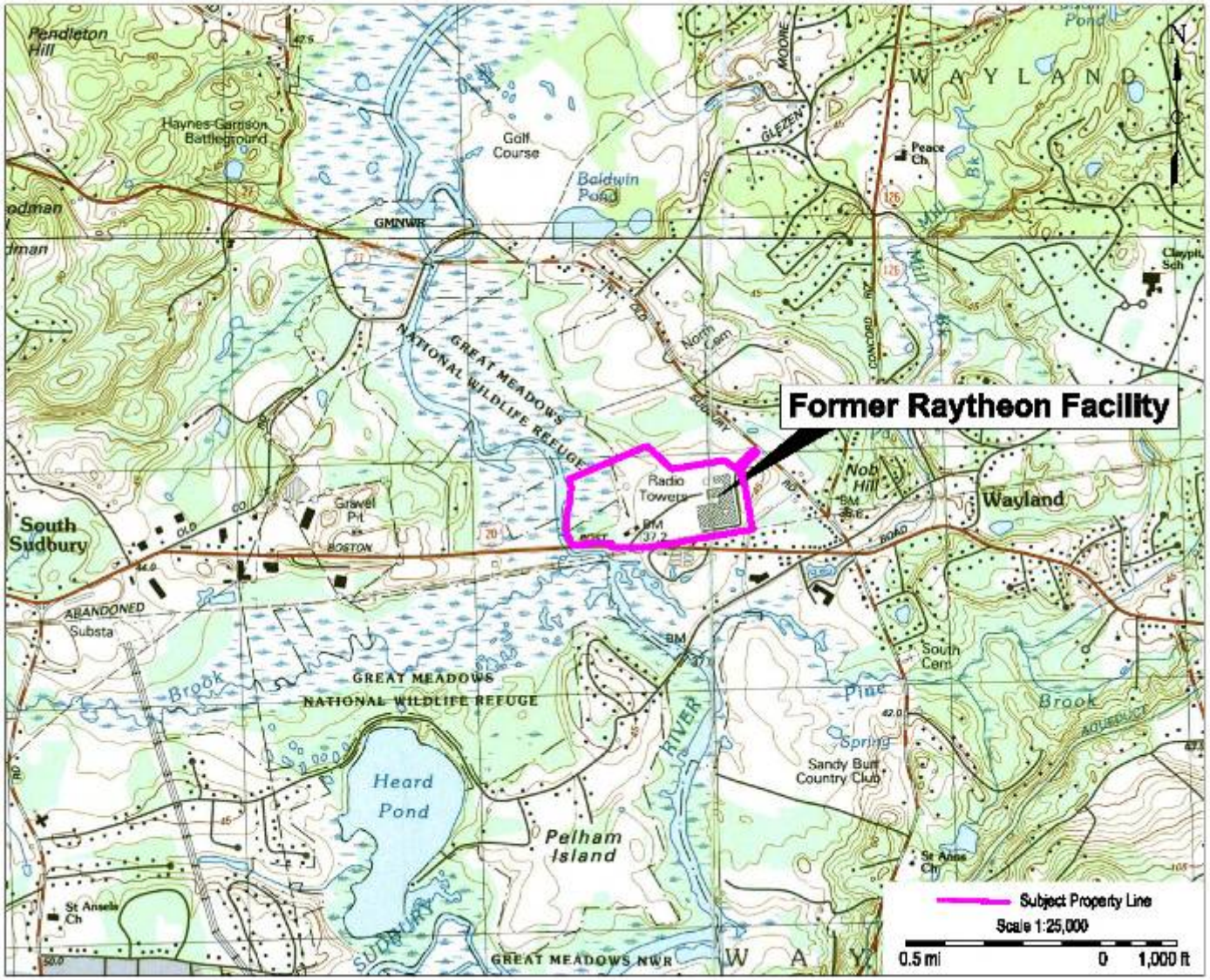

Site Overview

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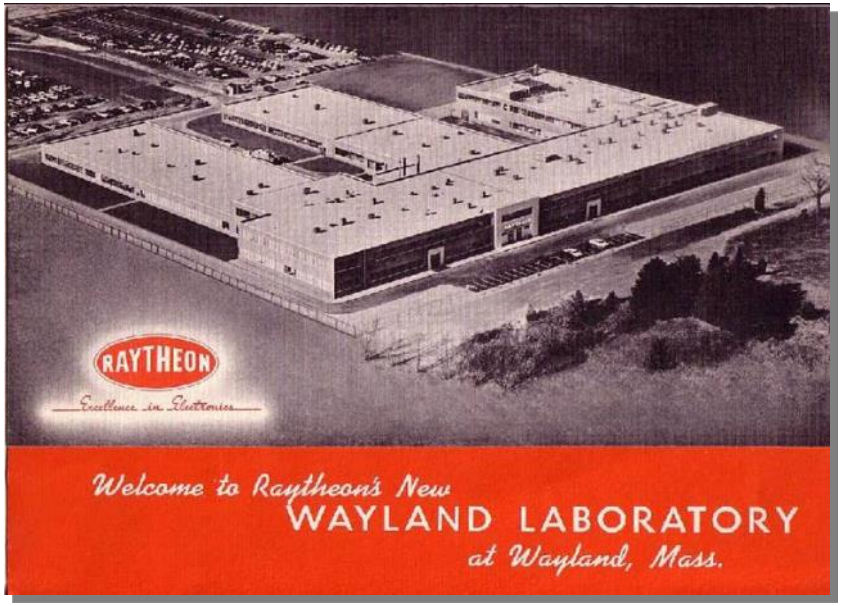
- Radar testing and development (1957-1995)
- Contamination discovered in 1996
- Regulated by the Massachusetts DEP
- Historic Site Contaminants
  - Chlorinated VOCs, PCBs
- Extensive Site Characterization
- 2 Primary Areas of Current Activity
  - Northern Area- Bioremediation
  - Southern Area – Chemical 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
- Site's current use includes:
  - Wayland Commons
  - Wayland Town Center
  - River Trail Place
  - "Hamlen" donated to USFW (closed)



Hamlen Parcel

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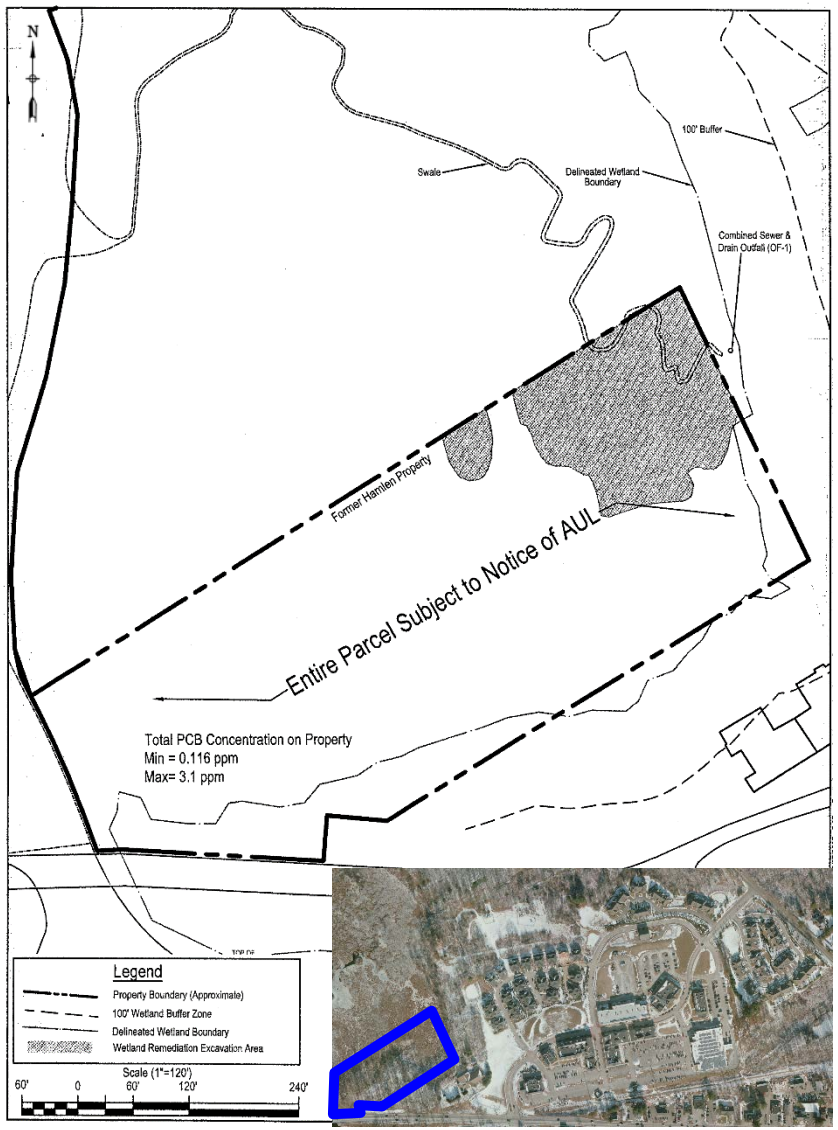
- Historic Site Contaminants (PAHs, PCBs, metals) in top 18” of sediment
- 2-acres of soil excavation & wetland restoration completed in 2003 & 2004
- Remedial activities overseen by USEPA & MassDEP
- Activity & Use Limitations (AUL) implemented at the site
- Site was restored to wetland habitat (71,000 plants & 5 years of monitoring) abutting the Sudbury River
- A “Condition of No Significant Risk” exists for the Former Hamlen Parcel; Partial Permanent Solution filed for the portion of Site (RTN 3-13302)
- Property (5.5-acres) was donated to USFW to become part of the Great Meadows National Wildlife Refuge in late 2016



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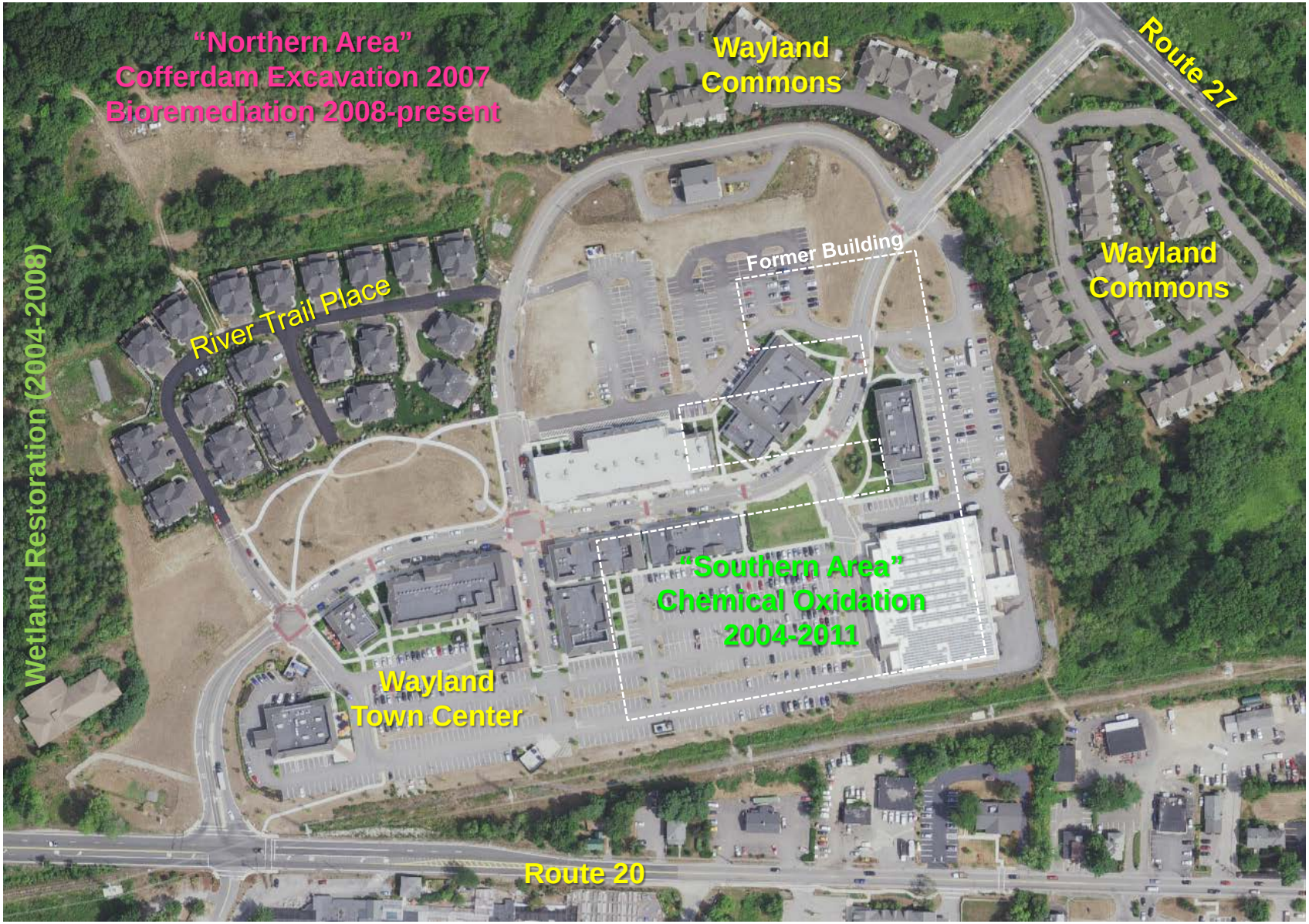
Wayland Site Plan



2017 Activities

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- 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

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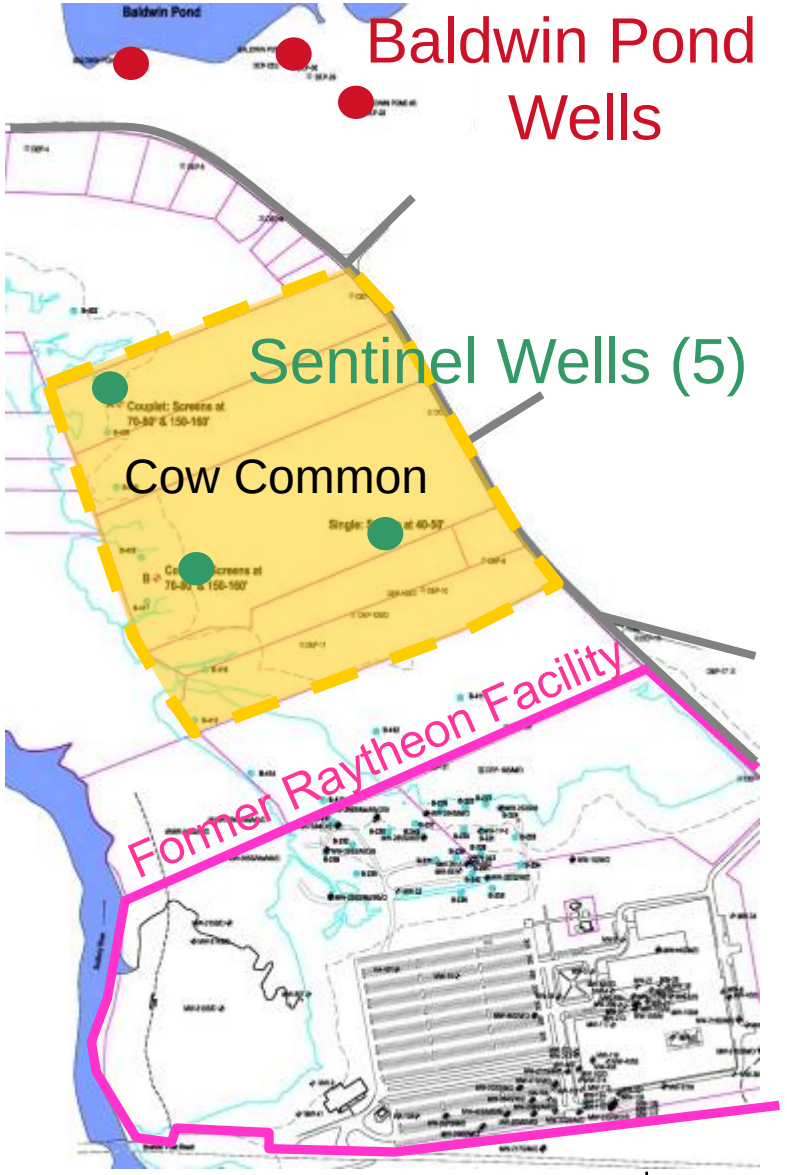
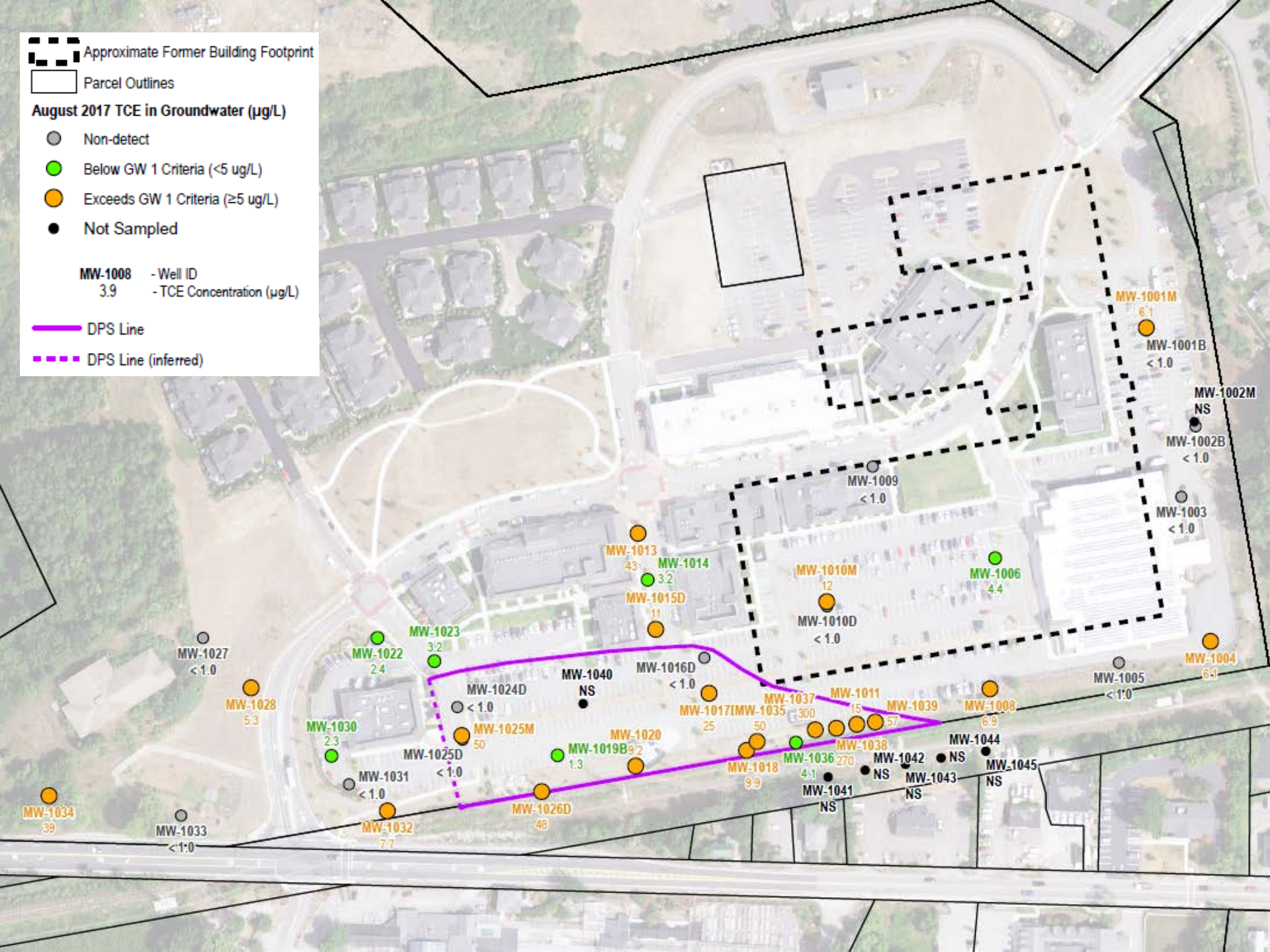
- Groundwater samples collected from wells in April 2017 analyzed for VOCs by Method 8260C.
- Low-level detections of 1,1-dichloroethane, cis-1,2-dichloroethene, and ethyl ether in SEN-1D. All detections below the GW-1 standards and consistent with low historical detections.
- Low-level detections of Acetone in SEN-1M/D, SEN-2M/D, and SEN-3; associated with laboratory contamination. All detections are well below the GW-1 standard.
- No other VOC detections above the laboratory reporting limit.




Approximate Former Building Footprint
Parcel Outlines
August 2017 TCE in Groundwater (µg/L)
Non-detect
Below GW 1 Criteria (<5 ug/L)
Exceeds GW 1 Criteria (≥5 ug/L)
Not Sampled
MW-1008 - Well ID
3.9 - TCE Concentration (µg/L)
DPS Line
DPS Line (inferred)
MW-1001M 6.1
MW-1001B < 1.0
MW-1002M NS
MW-1002B < 1.0
MW-1009 < 1.0
MW-1003 < 1.0
MW-1013 43
MW-1014 3.2
MW-1015D 11
MW-1010M 12
MW-1010D < 1.0
MW-1006 4.4
MW-1027 < 1.0
MW-1028 5.3
MW-1022 2.4
MW-1023 3.2
MW-1040 NS
MW-1016D < 1.0
MW-1024D < 1.0
MW-1017 25
MW-1035 50
MW-1037 300
MW-1011 15
MW-1039 57
MW-1008 6.9
MW-1004 6.1
MW-1005 < 1.0
MW-1030 2.3
MW-1025M 50
MW-1025D < 1.0
MW-1019B 1.3
MW-1020 9.2
MW-1018 9.9
MW-1036 270
MW-1038 4.1
MW-1042 NS
MW-1044 NS
MW-1043 NS
MW-1045 NS
MW-1041 NS
MW-1031 < 1.0
MW-1034 39
MW-1033 < 1.0
MW-1032 7.7
MW-1026D 48

Northern Area (Bioremediation)

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Recirculation System Overview

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- 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 (up-gradient) and extraction (down-gradient) 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

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Enhanced Anaerobic Dechlorination

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- 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

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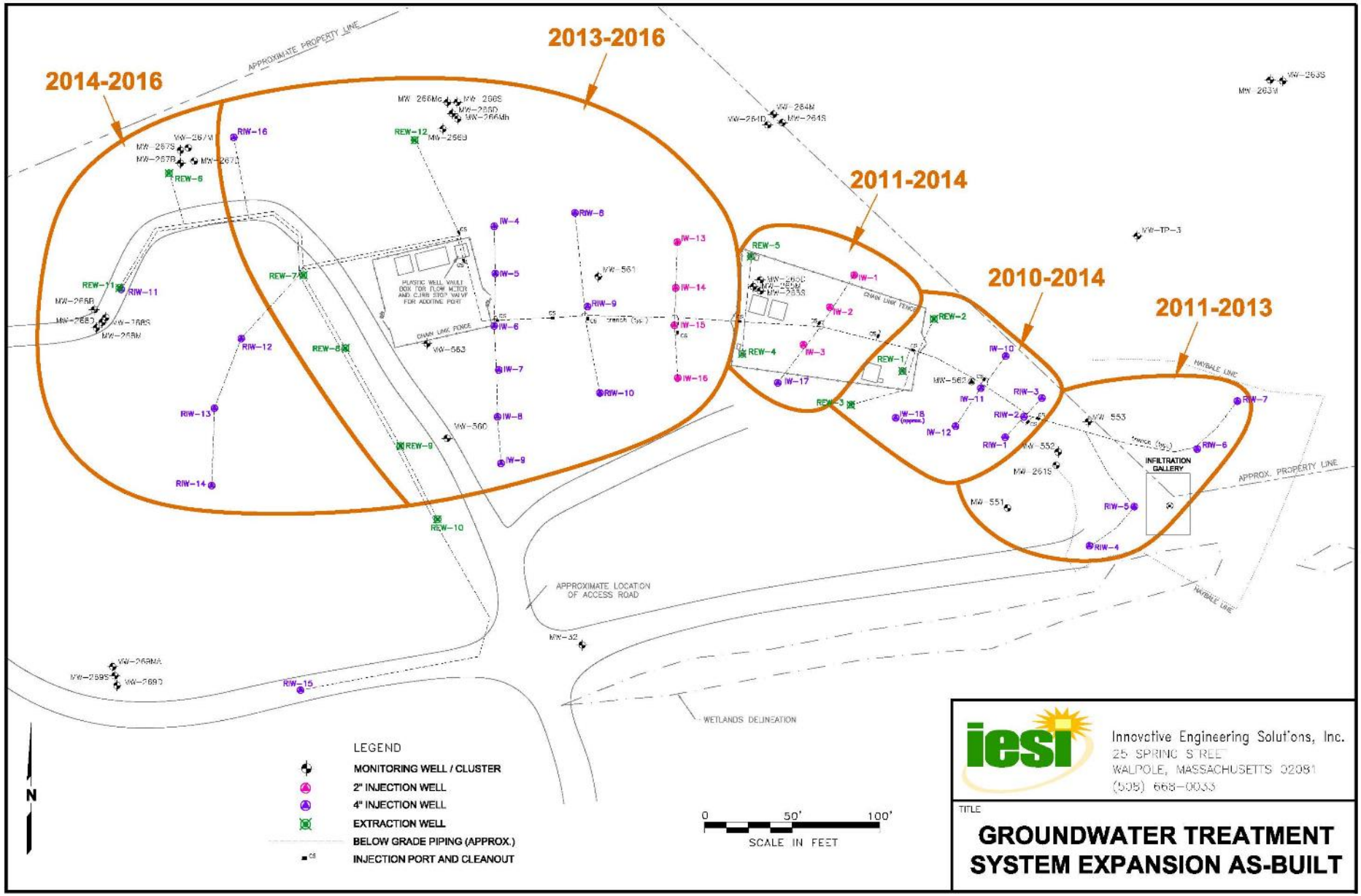
- October 2010: System initial start up
- 2011: Expansion included the installation of 3 extraction wells near 2007 Cofferdam excavation & 3rd Solar array
- 2012: Expansion included the installation of 6 injection wells, 9 extraction wells, 1 monitoring well, 12 solar panels, & incorporation of the “IW” series wells
- 2015-2016: System running at full capacity, added another 4 solar panels and additional injection/extraction well in 2015
- 2017: Deactivated recirculation system in late December 2016; groundwater monitoring ongoing in order to evaluate the progress of the system


2014-2016
2013-2016
2011-2014
2010-2014
2011-2013
APPROXIMATE PROPERTY LINE
APPROX. PROPERTY LINE
APPROXIMATE LOCATION OF ACCESS ROAD
WETLANDS DELINEATION
NAVIGABLE LINE
INFILTRATION GALLERY
PLASTIC WELL VAULT DOR FOR FLOW METER AND CURB STOP VALVE FOR ADDITIVE PORT
CHAIN LINK FENCE
LEGEND
MONITORING WELL / CLUSTER
2" INJECTION WELL
4" INJECTION WELL
EXTRACTION WELL
BELOW GRADE PIPING (APPROX.)
INJECTION PORT AND CLEANOUT
N
0
50'
100'
SCALE IN FEET
iesi
Innovative Engineering Solutions, Inc.
25 SPRING STREET
WALPOLE, MASSACHUSETTS 02081
(508) 668-0033
TITLE
GROUNDWATER TREATMENT SYSTEM EXPANSION AS-BUILT

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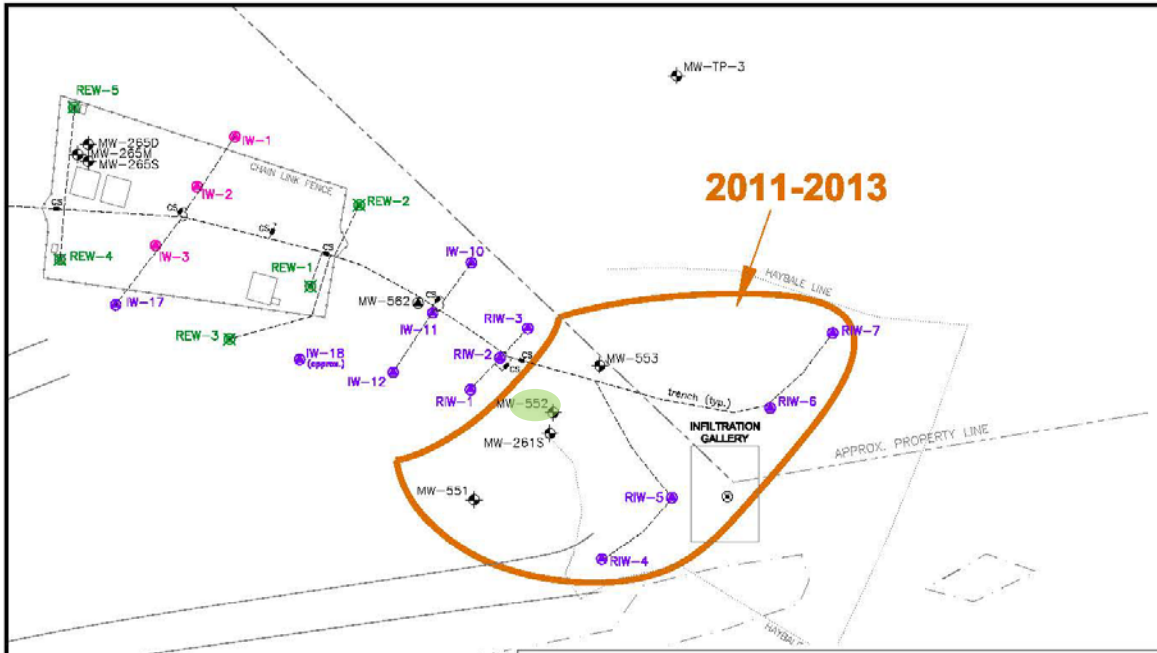
TITLE

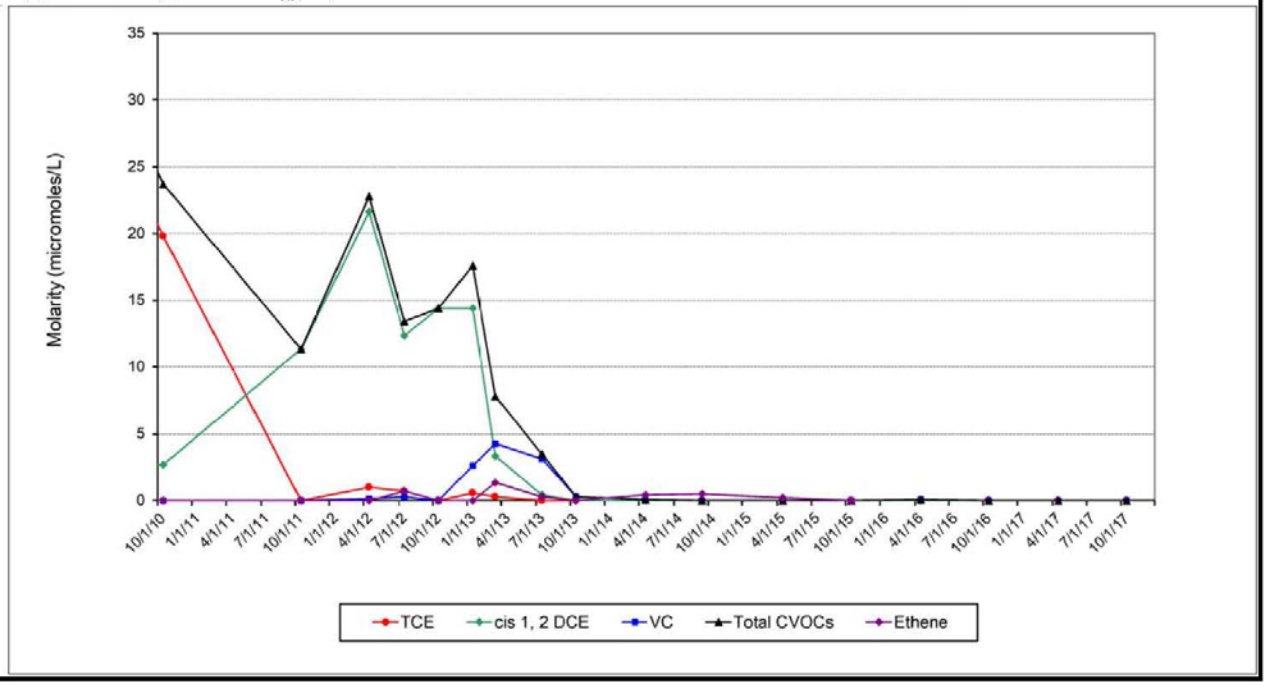
TREATMENT AREA WITH MW-552 MONITORING DATA



LEGEND

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

0 40' 80'
SCALE IN FEET



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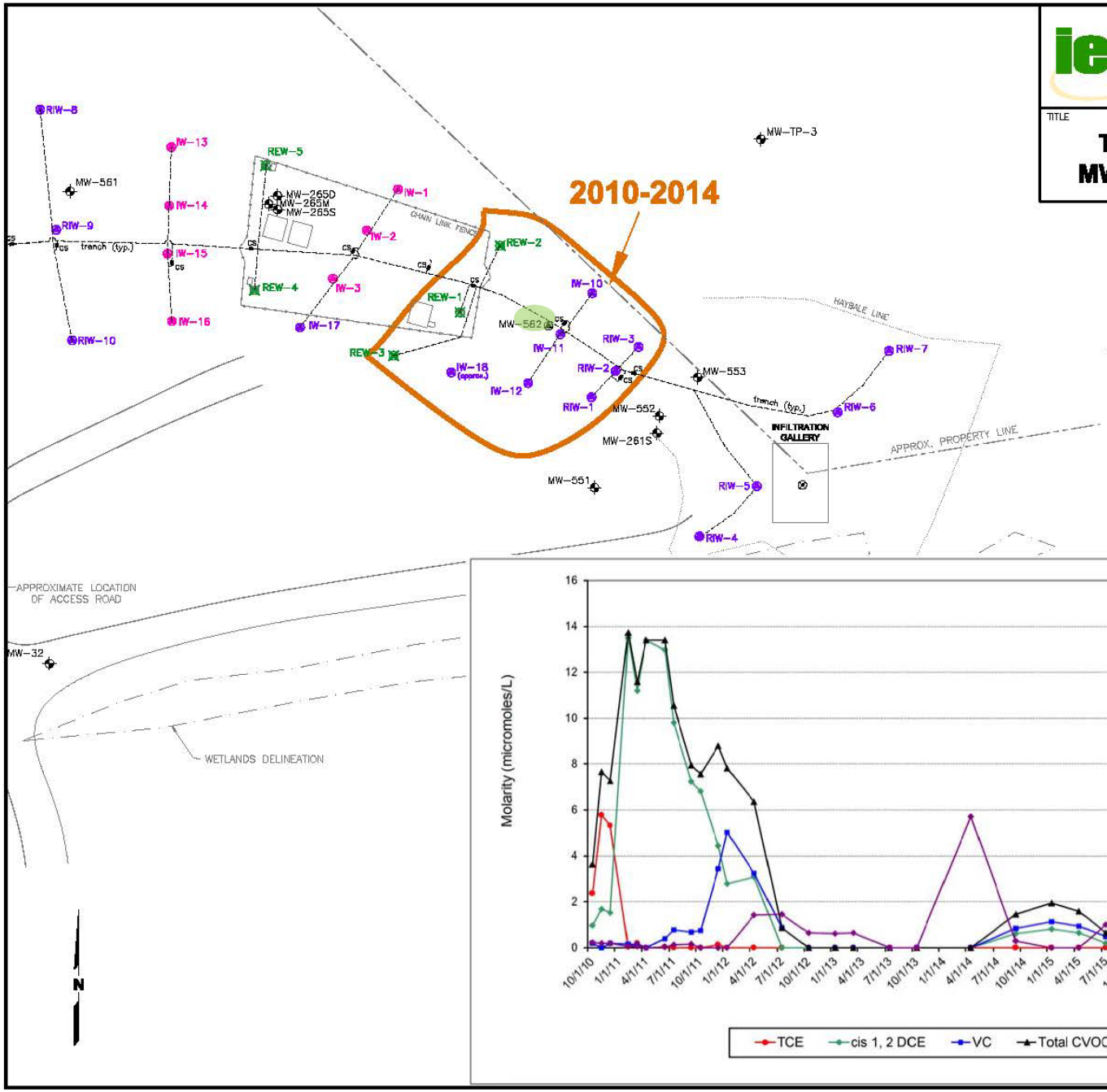
TITLE

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

0 40' 80'
SCALE IN FEET

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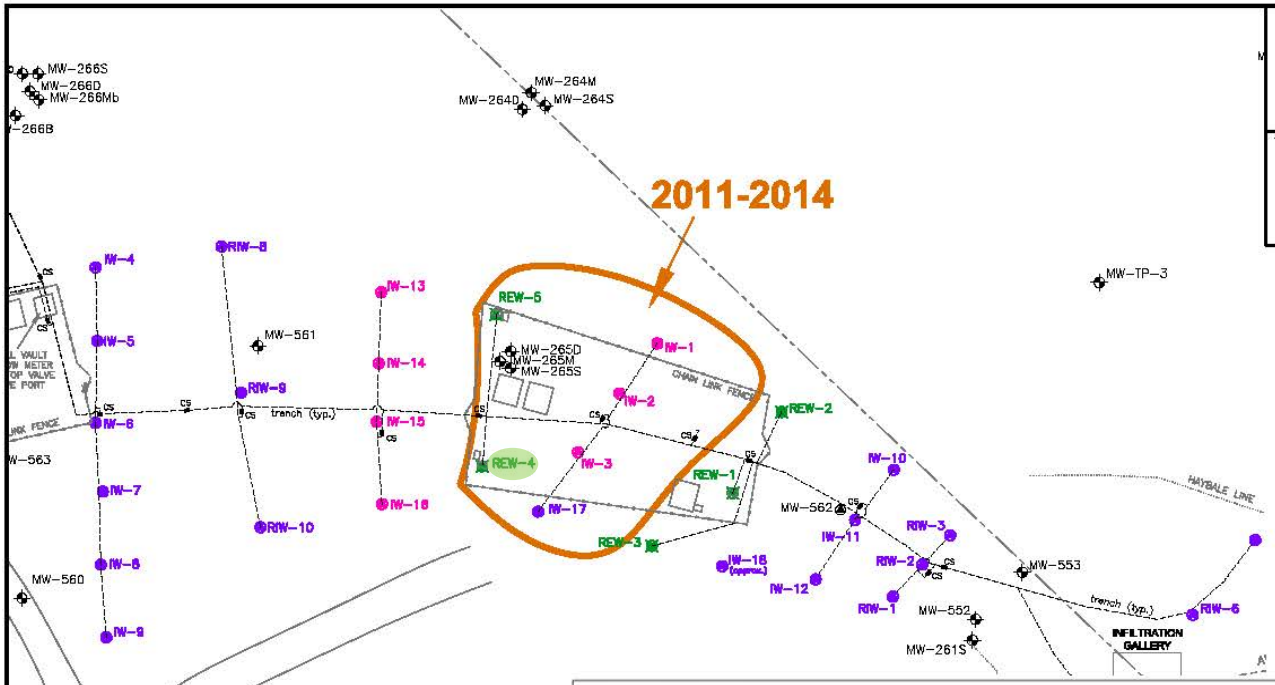
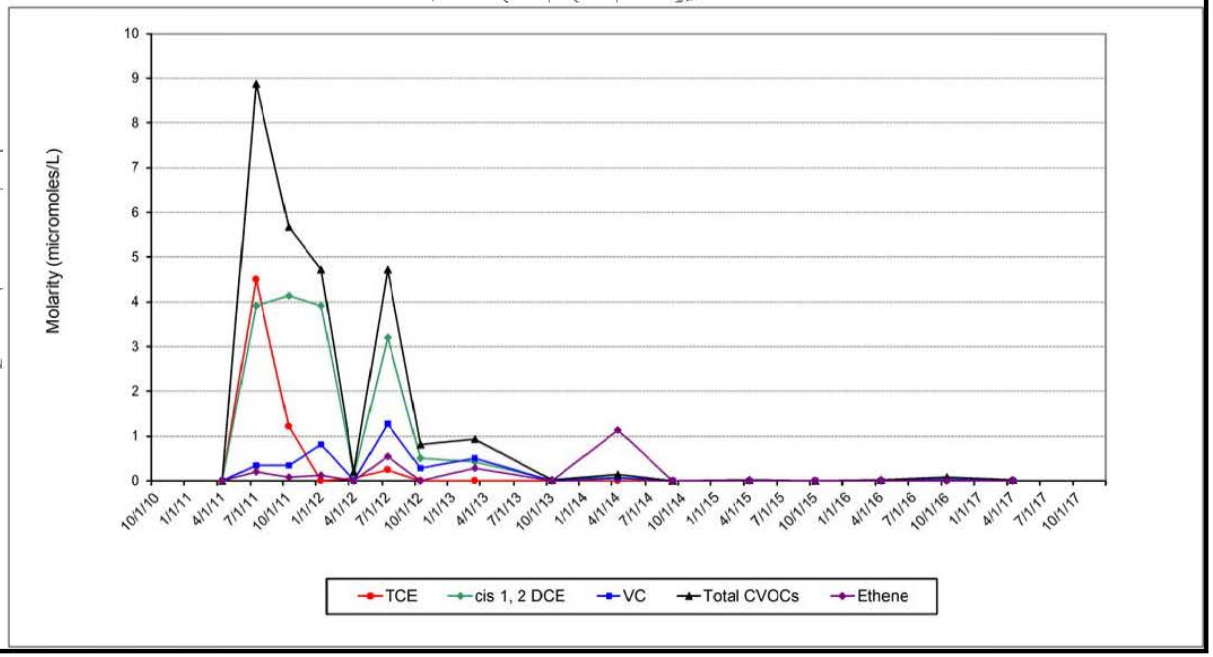
TREATMENT AREA WITH REW-4 MONITORING DATA

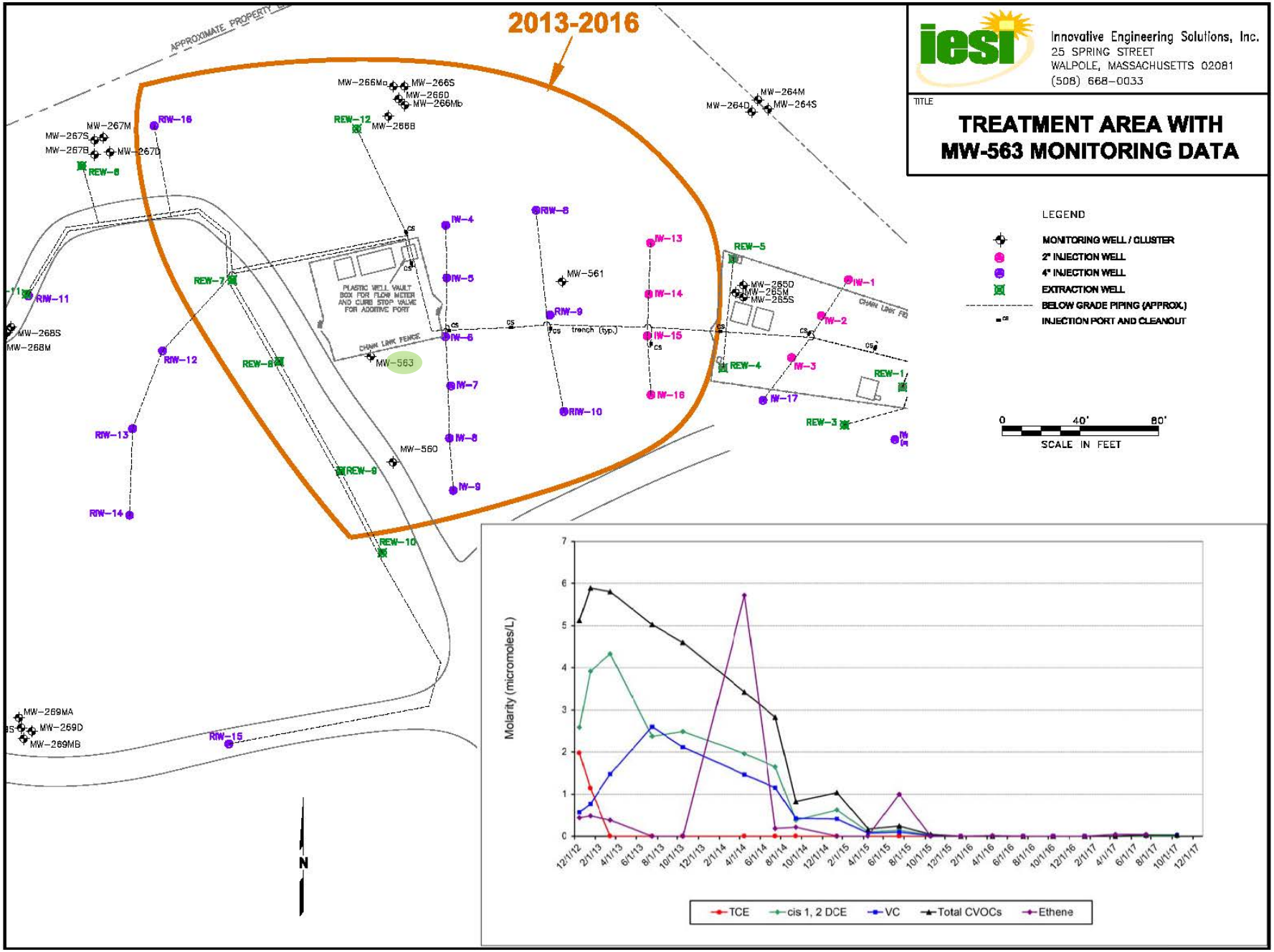


LEGEND

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

0 40' 80'
SCALE IN FEET





iesi
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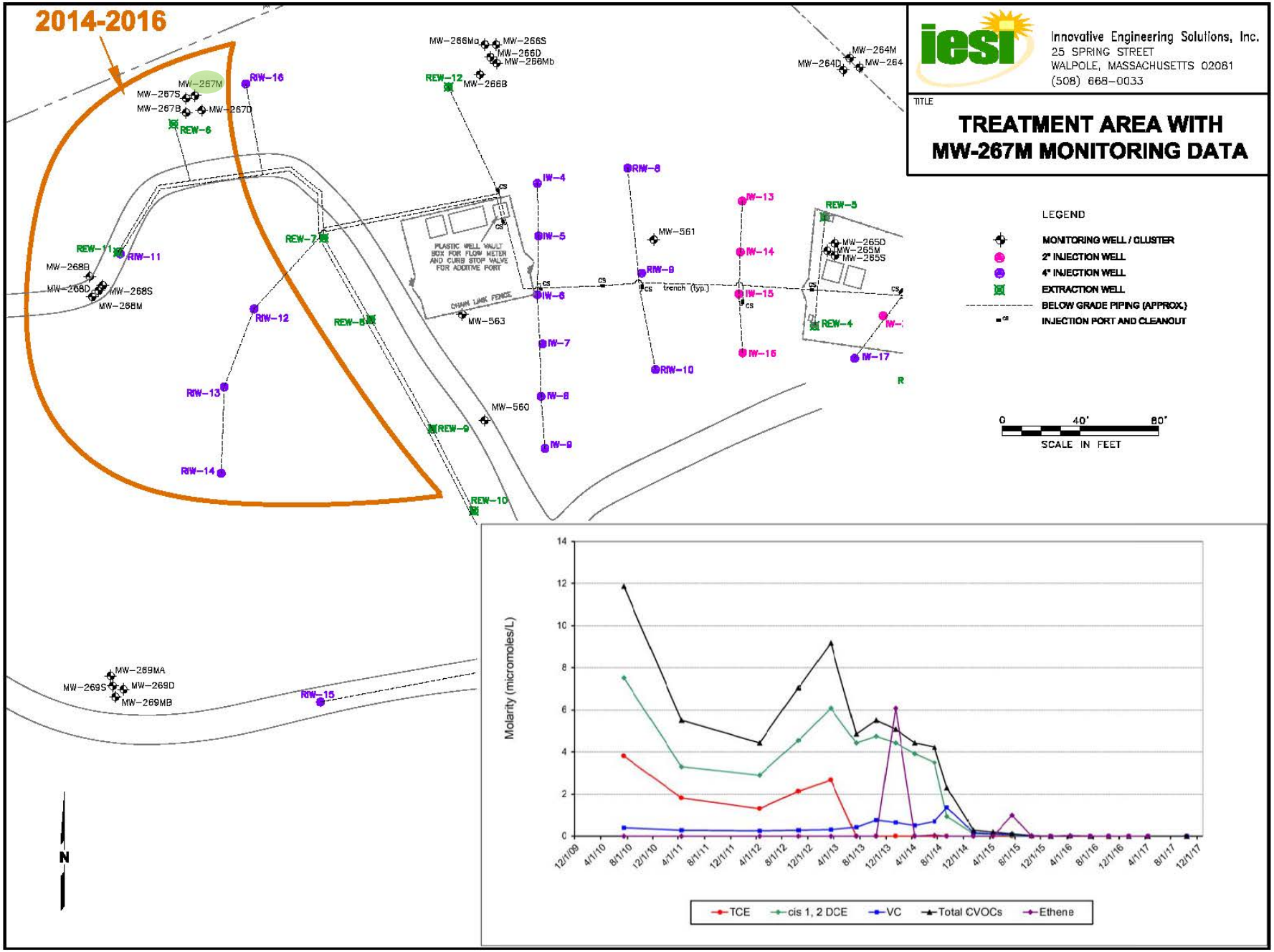
TITLE

TREATMENT AREA WITH MW-563 MONITORING DATA



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TITLE

TREATMENT AREA WITH MW-267M MONITORING DATA

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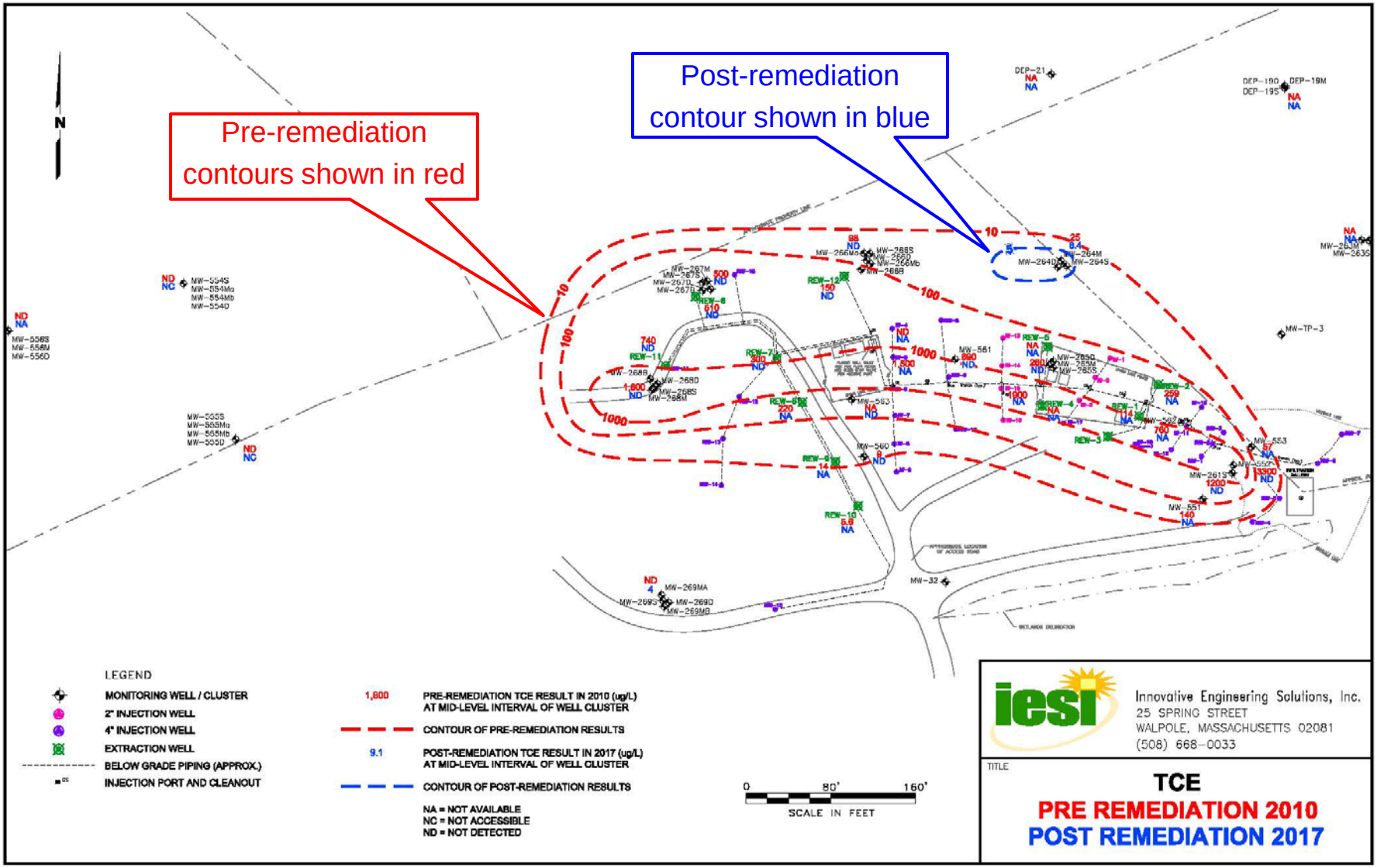
TCE Concentration Contours



Summary

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- VOC trends continue to decrease in wells monitoring the Northern and Southern area releases.
- Low-level detections of VOC concentrations in one Cow Commons well; samples from all other wells are non-detect for VOCs.
- Remedial system recirculation in Northern Area deactivated in December 2016; groundwater monitoring is ongoing.
- Groundwater sampling will continue on a quarterly (Northern Area) and semi-annual (Southern Area) basis in 2018. Reporting will continue on a semi-annual basis.

Questions?

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

http://raytheon.erm.com