

# MDEQ UPDATE MEETING

RACER Trust Plants 2, 3 & 6, Lansing, Michigan

October 21, 2015

# Agenda

- Redevelopment Update
- Technical Update
  - ISCO/Injections Update
  - CSIA Results
  - 3<sup>rd</sup> Quarter Groundwater Sampling Update
  - Lower 1,4-Dioxane Toe Investigation
- Remaining Schedule/Scope 2015
  - Excavations
  - Clarifier Demolition
- Schedule/Scope 2016
- 2016 Budget Request Summary

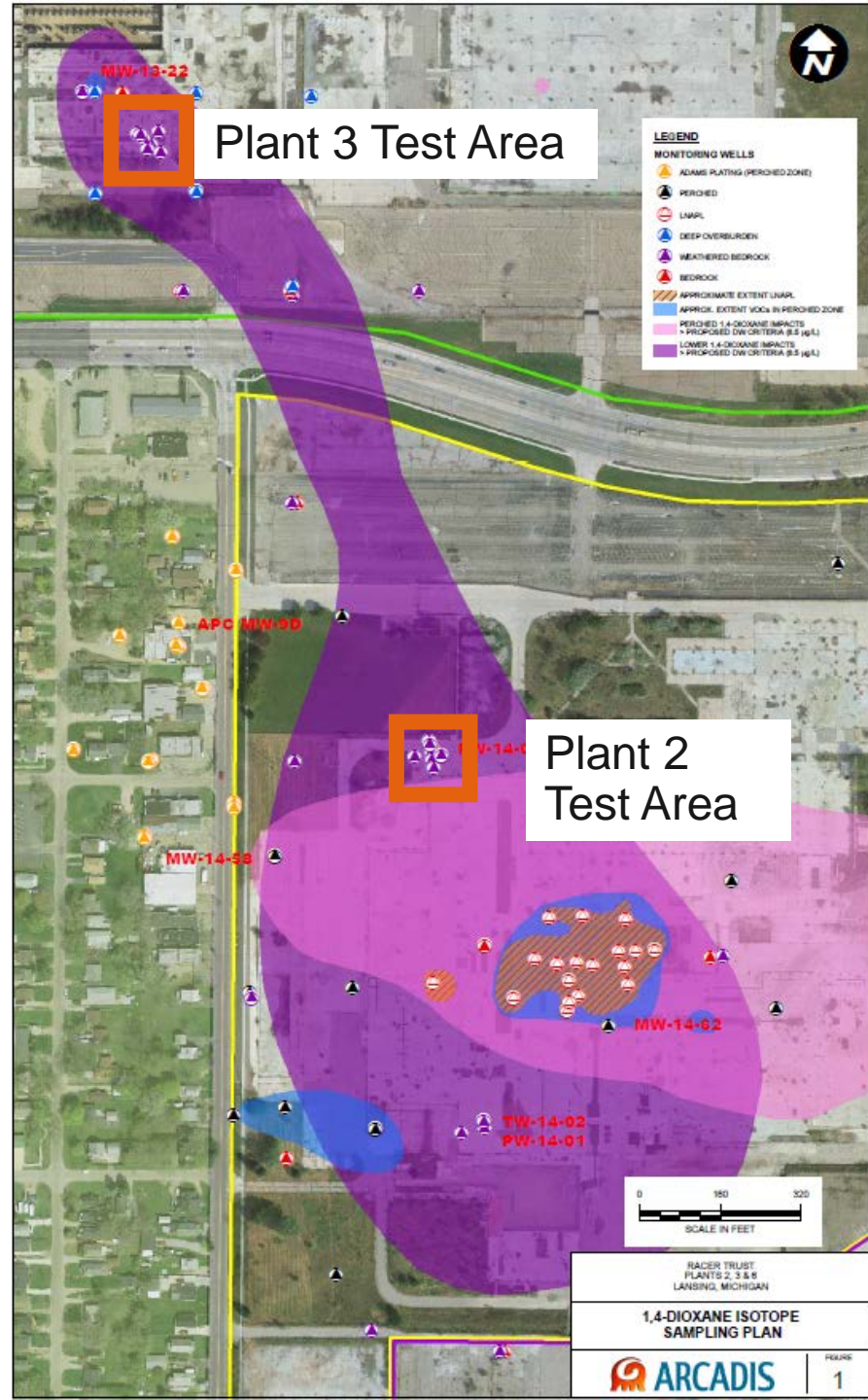
# ISCO Pilot Test Update

# Objectives

- Hydraulics
  - Evaluate reagent distribution
  - Determine mobile porosity
  - Determine localized groundwater flow direction
- Oxidation
  - Evaluate reduction of groundwater concentrations
  - Evaluate the potential of the temporary generation of oxidation by products and/or metals mobilization
  - Assess rebound of groundwater concentrations



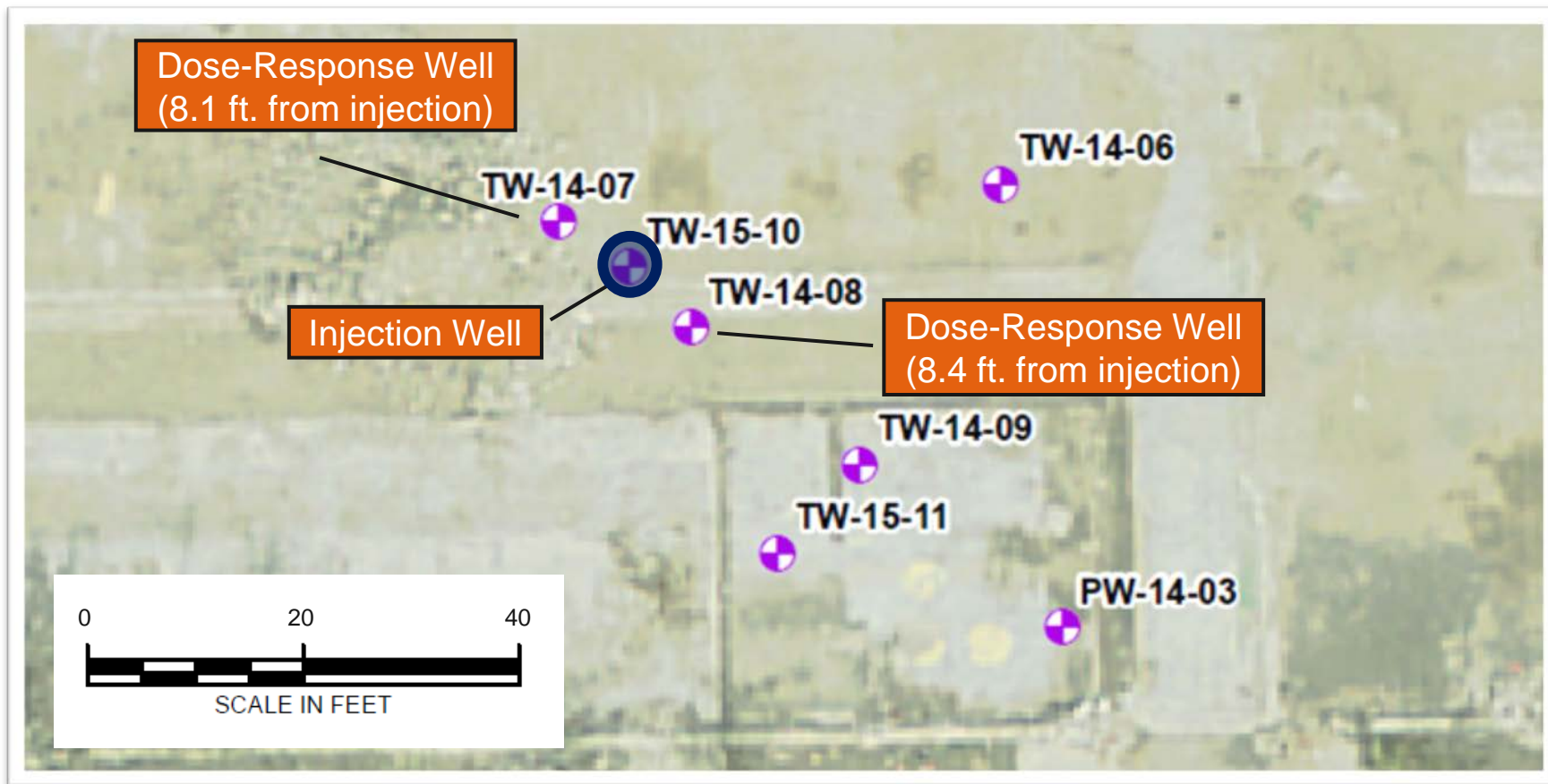
# Injection Areas



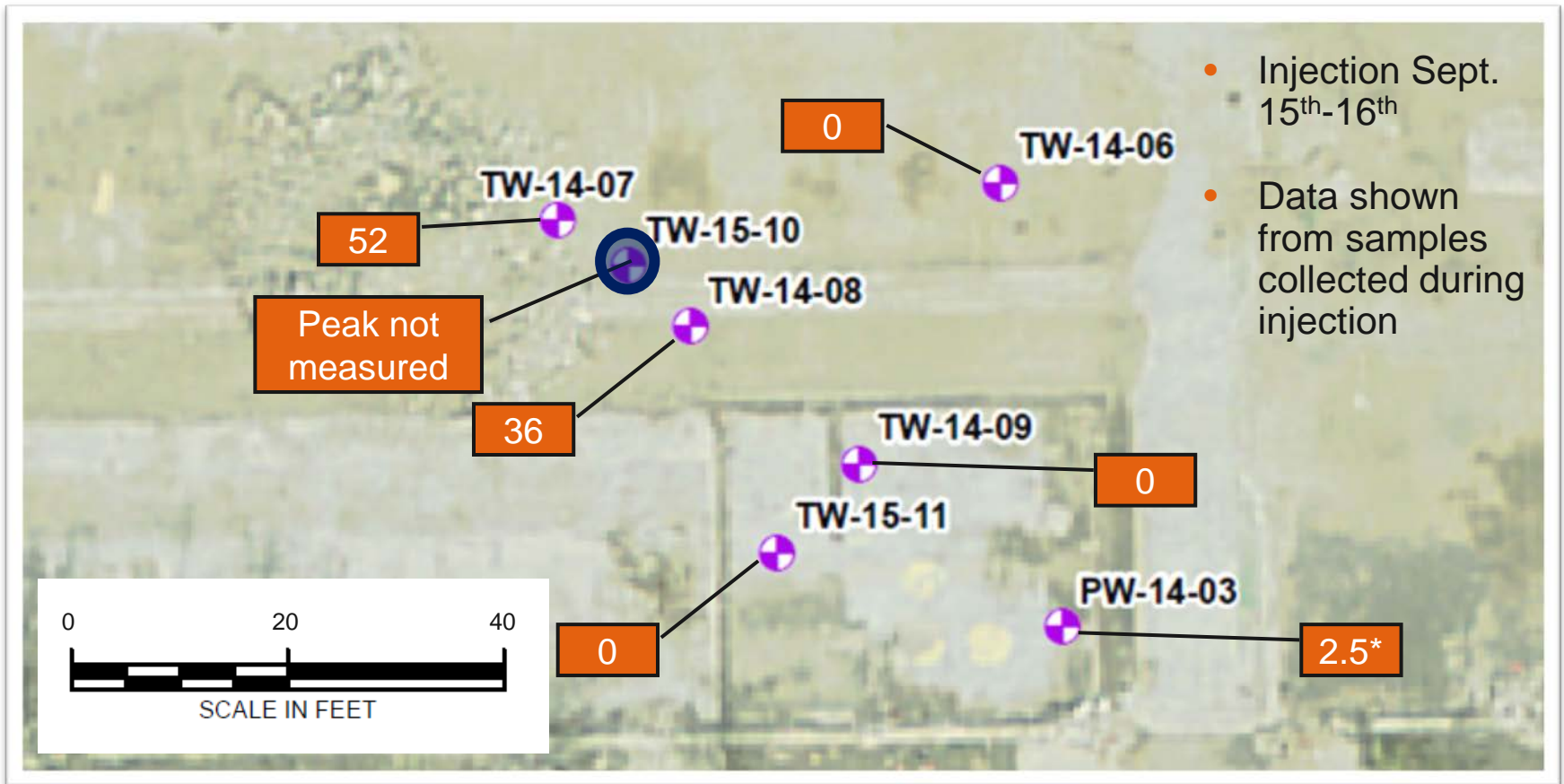
# Field Injection Summary

	Plant 3	Plant 2
Days of injection (Sept. 2015)	15 <sup>th</sup> – 16 <sup>th</sup>	17 <sup>th</sup> – 18 <sup>th</sup>
Volume injected (gallons)	3900	2970
Concentration of sodium persulfate (g/L)	60/45	60/70
Total mass of sodium persulfate injected (pounds)	1929	1653
Concentration of D2O (g/L)	2.5	2.5
Average injection rate	5.8-6.1 gpm	3.9-4.1 gpm

# Injection Area – Plant 3



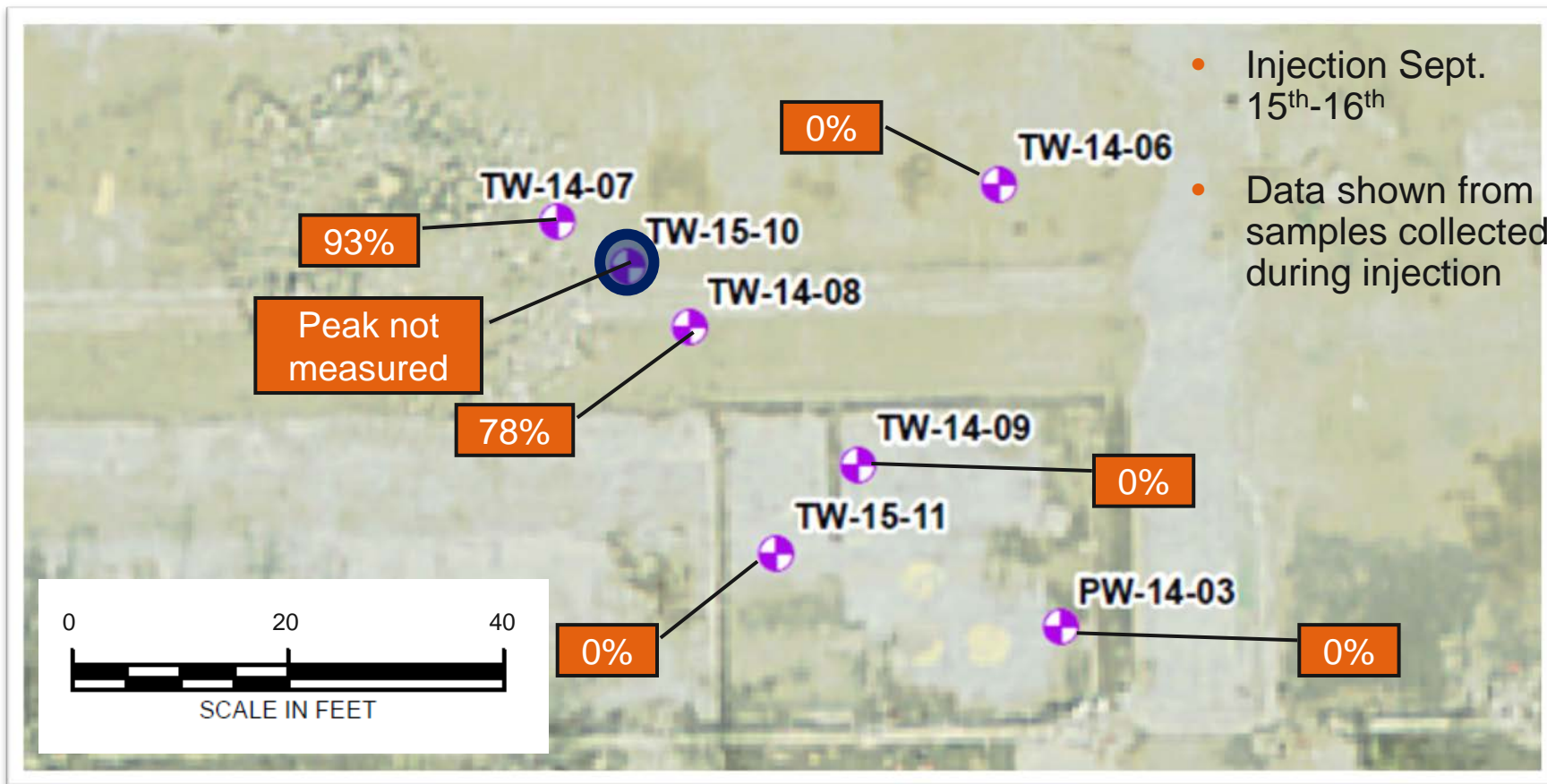
# Peak Oxidant Concentration – Plant 3



All concentrations in g/L

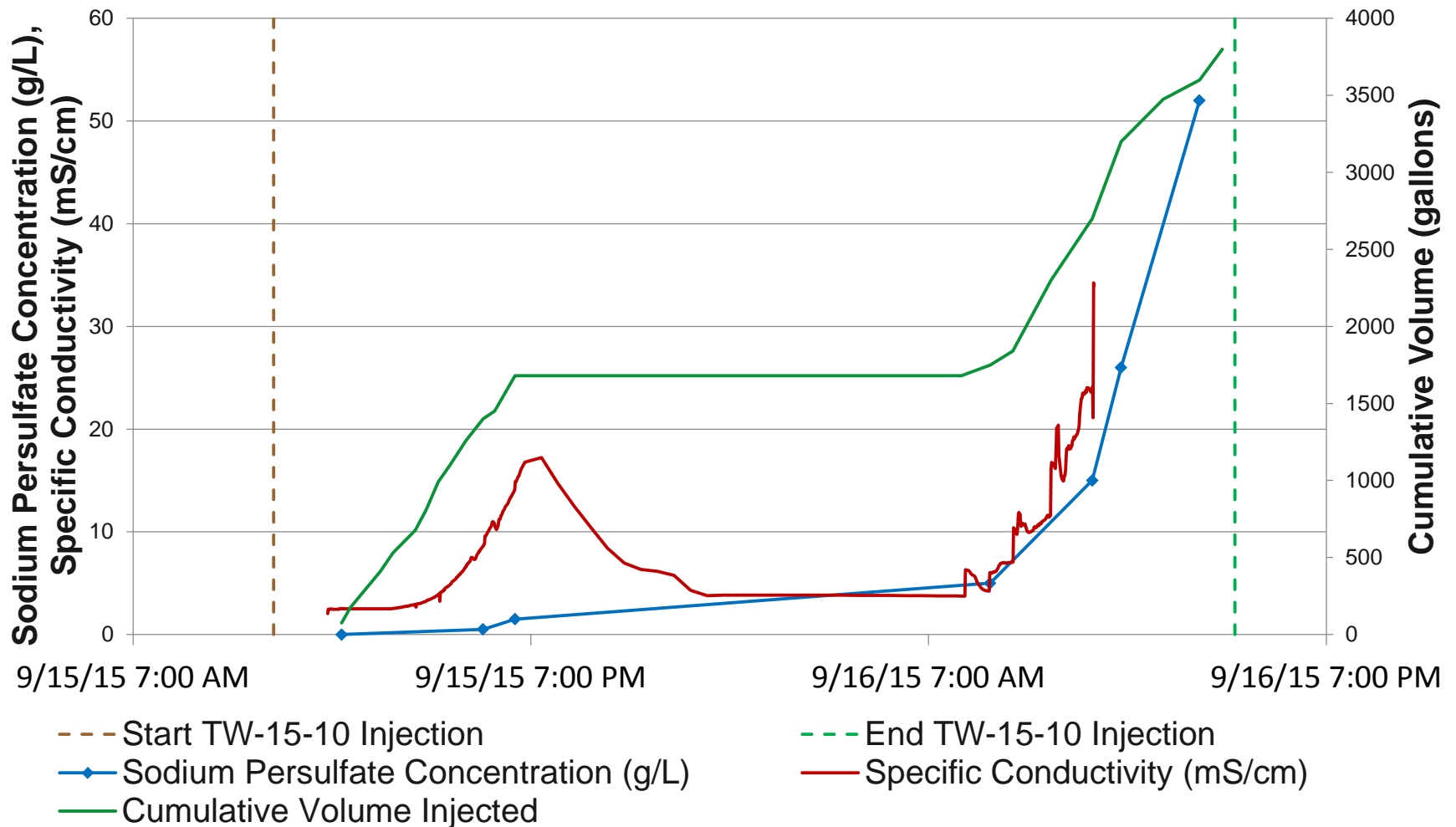
\*oxidant arrival not confirmed by tracer arrival

# Tracer Peak Concentrations – Plant 3

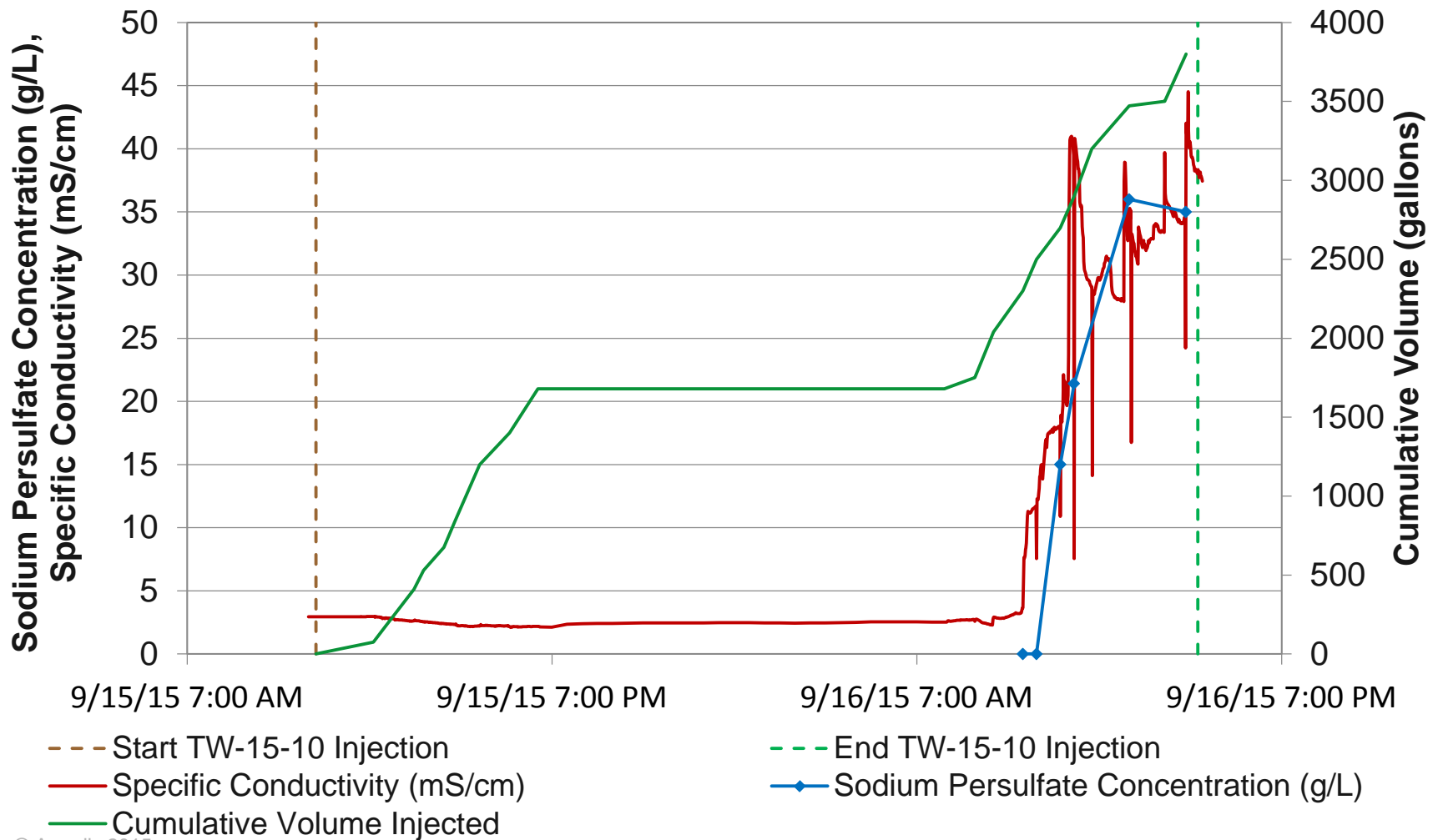


All concentrations % strength of injected solution

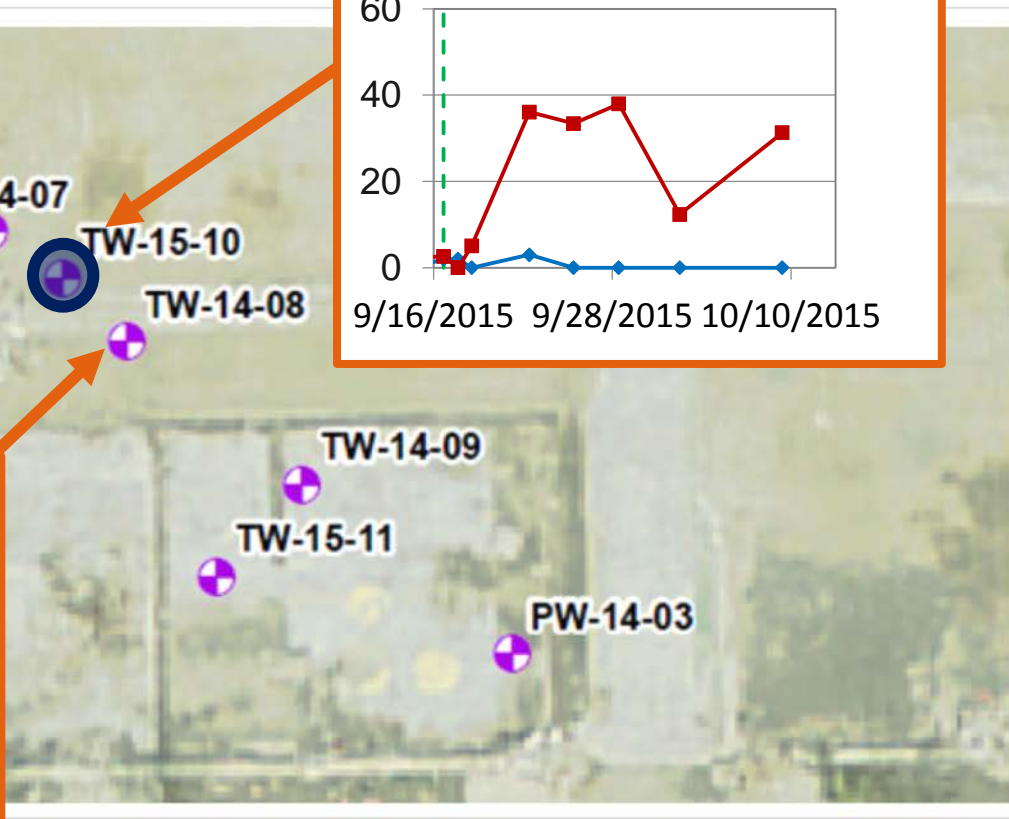
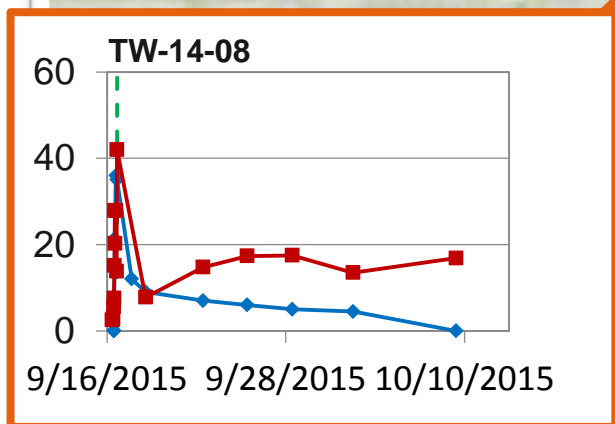
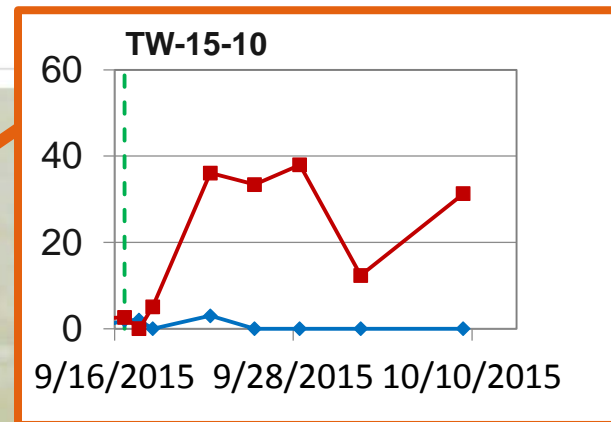
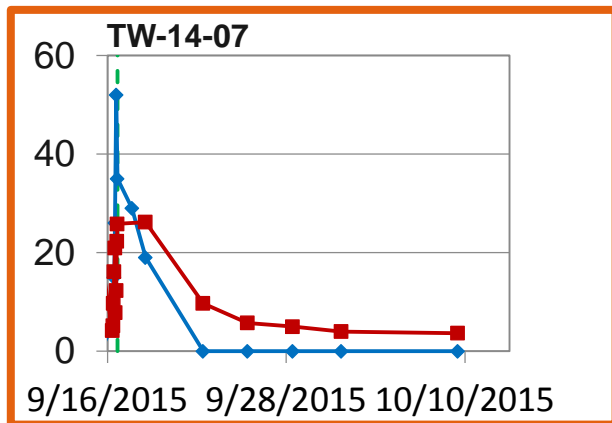
# TW-14-07 Dose Response Curve – Plant 3



# TW-14-08 Dose Response Curve – Plant 3

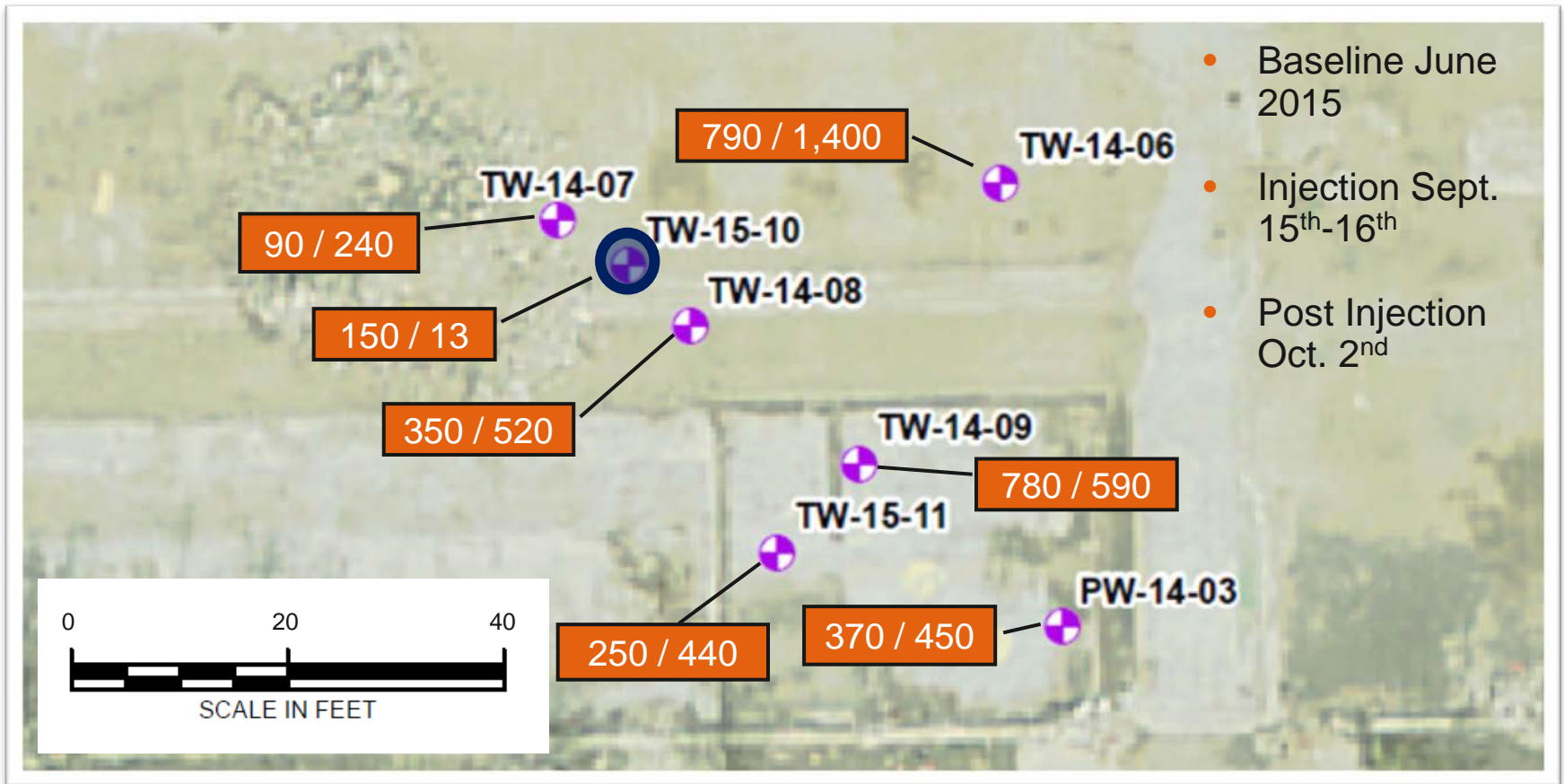


# Post Injection Monitoring– Plant 3



- End TW-15-10 Injection
- ◆— Sodium Persulfate Concentration (g/L)
- Specific Conductivity (mS/cm)

# Baseline / Post Injection 1,4-D – Plant 3



All concentrations in µg/L

# Plant 3 Results - Hydraulic

- Results thus far support hydraulic expectations of the pilot test
- Estimated radius of influence of 9.3 feet from 3900 gallons
- Mobile porosity = 19% based on an 11 foot vertical treatment interval
- Oxidant washout at upgradient DR well and persistence at downgradient DR well supports southerly flow direction
  - Awaiting subsequent tracer results for further evaluation

# Plant 3 Results - Oxidation

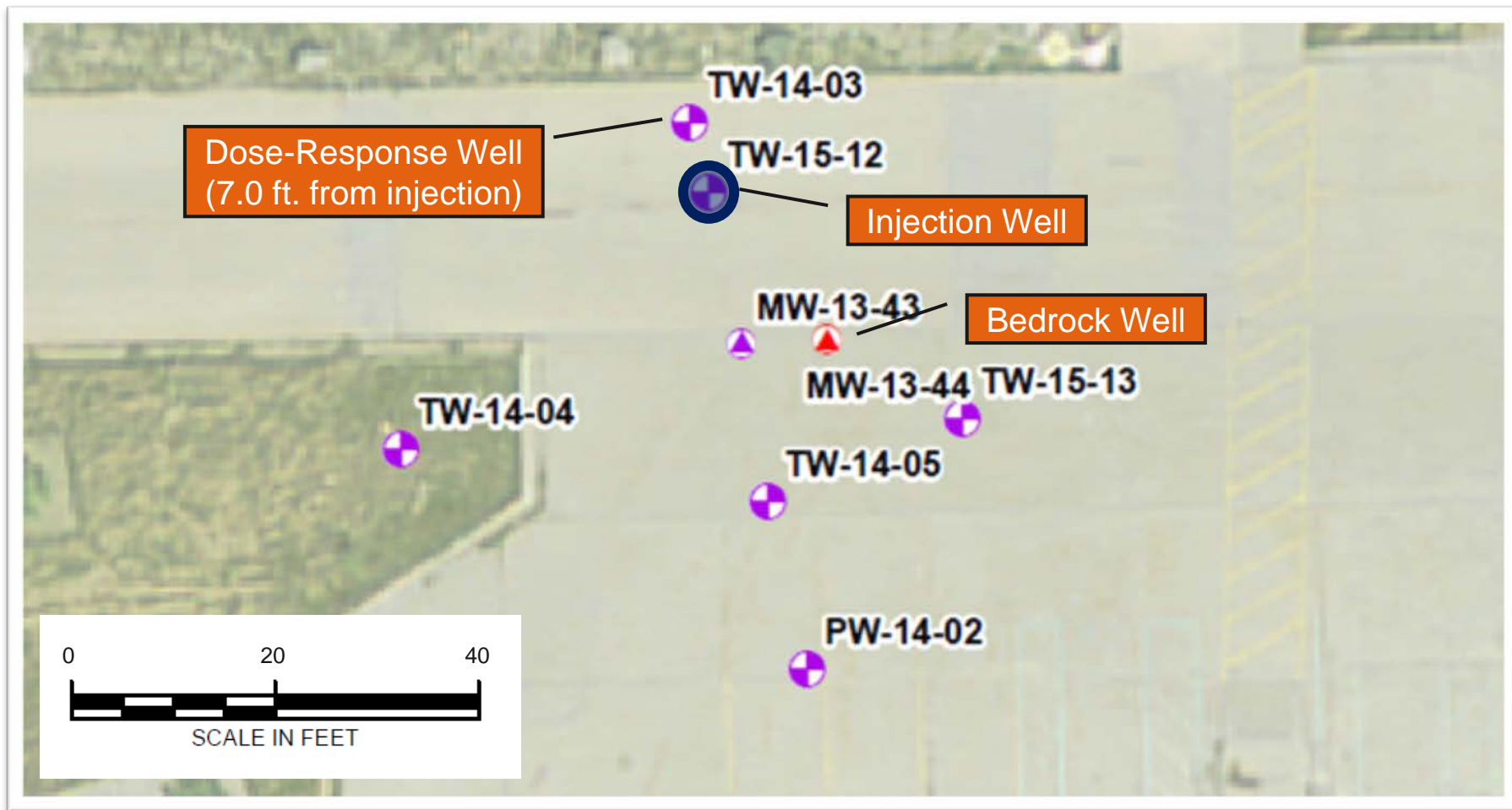
## ➤ Reduction of 1,4-Dioxane

- 90% reduction in the injection well indicates destruction of 1,4-D reduction via ambient activated sodium persulfate is achievable
- Additional 1,4-D sample pending for TW-14-08 collected after oxidant has washed out
- Presence of oxidation by-products indicates reactions occurred (or are still occurring)

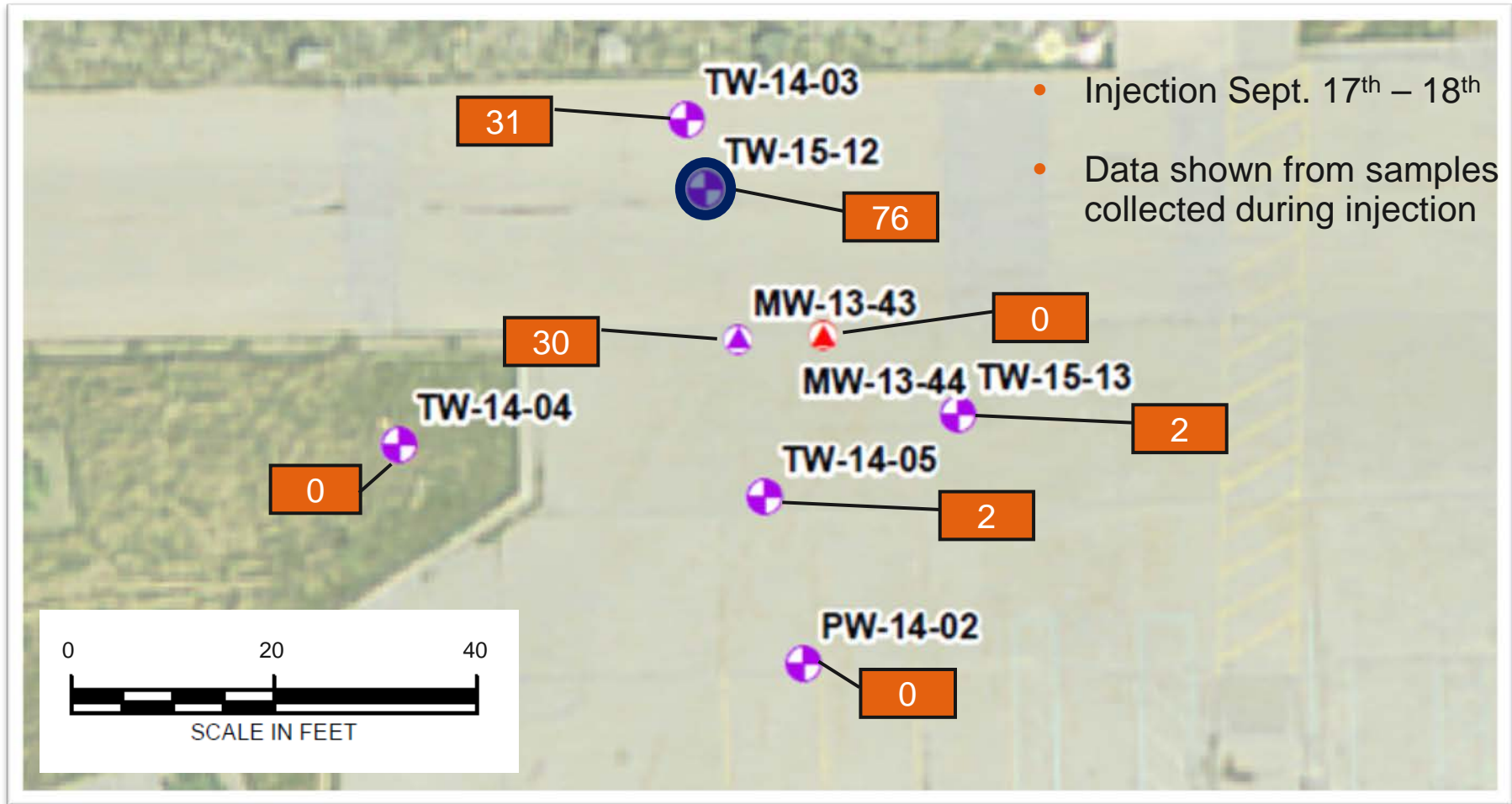
## ➤ Some oxidation byproducts observed in injection well and dose response wells

- All observed byproducts below DWC with the exception of Methylene Chloride observed at the injection well - 33 ug/L (DWC – 5 ug/L)
- Not observed in any drift wells – supports oxidant and tracer drift observations to date

# Injection Area – Plant 2

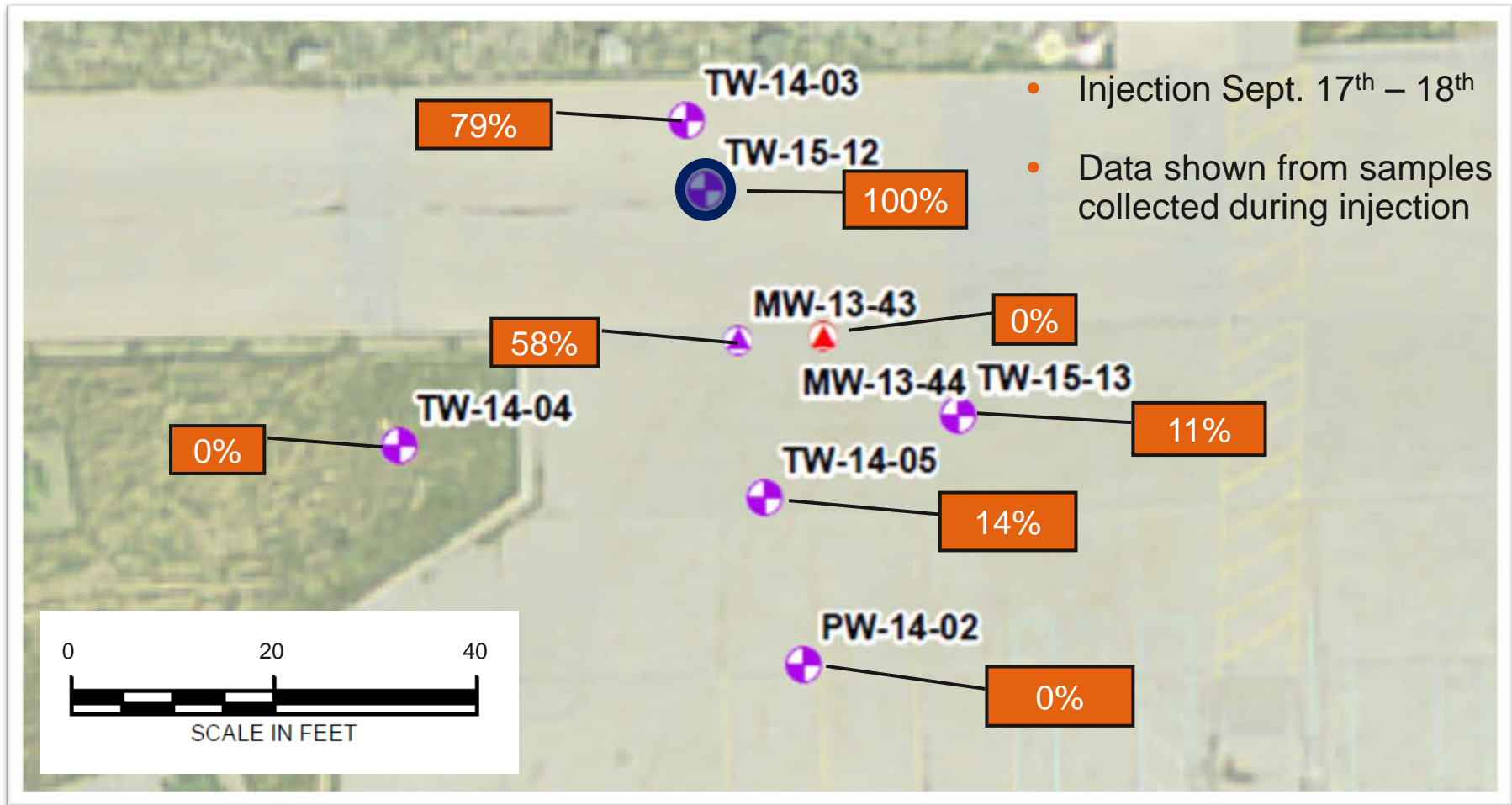


# Peak Oxidant Concentration – Plant 2



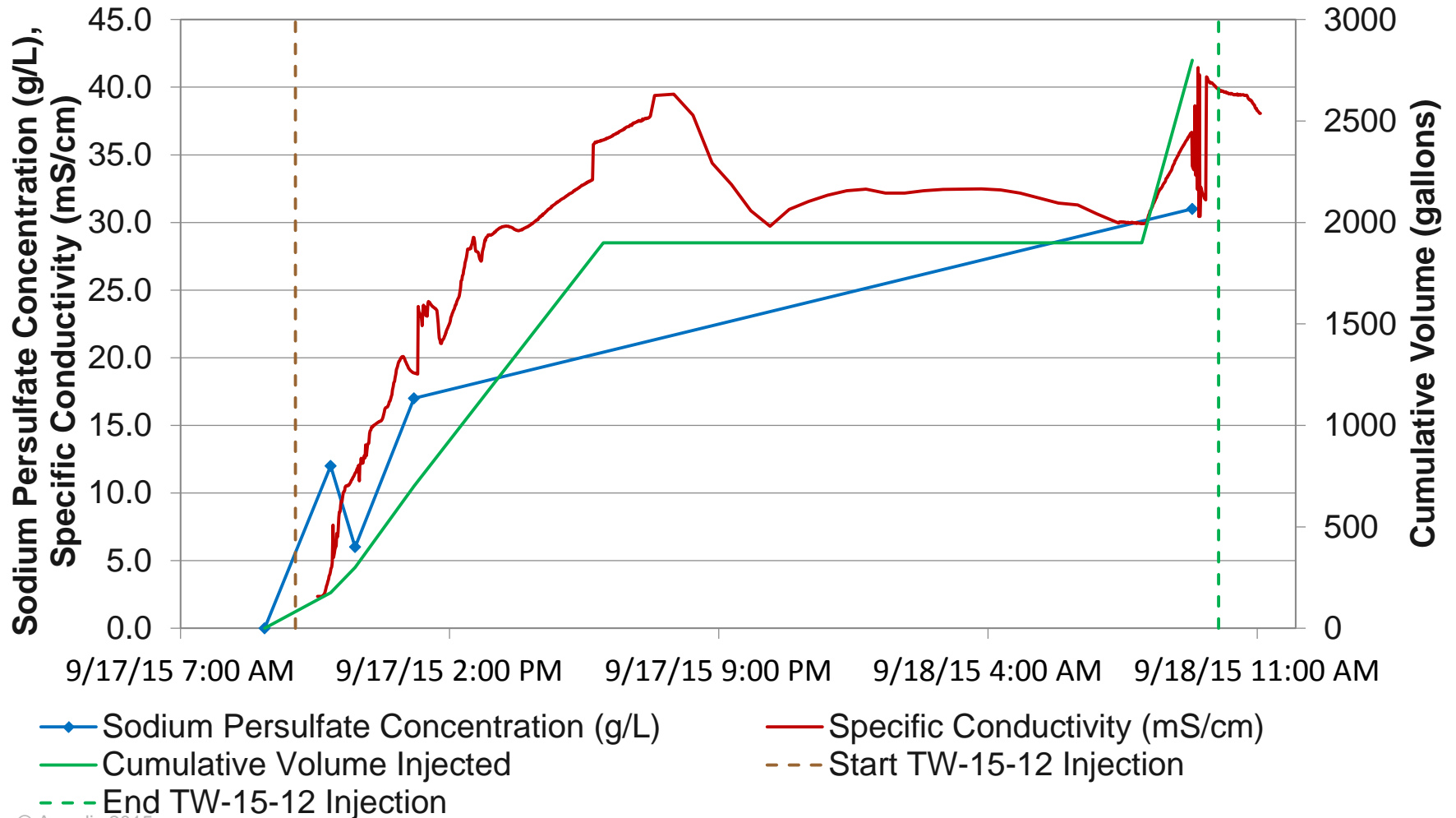
All concentrations in g/L

# Tracer Peak Concentrations– Plant 2

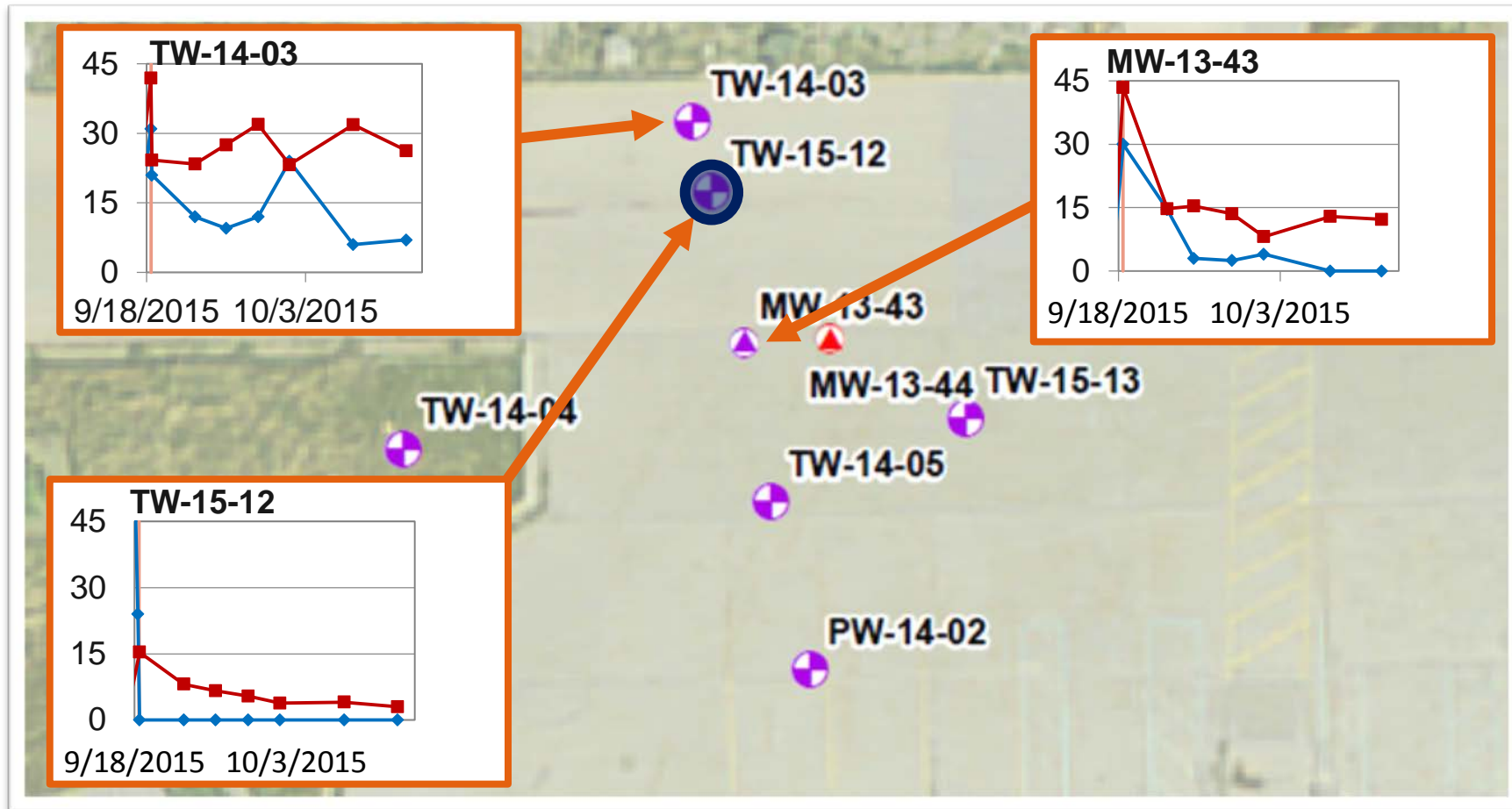


All concentrations are percentage of injected solution

# TW-14-03 Dose Response Curve – Plant 2



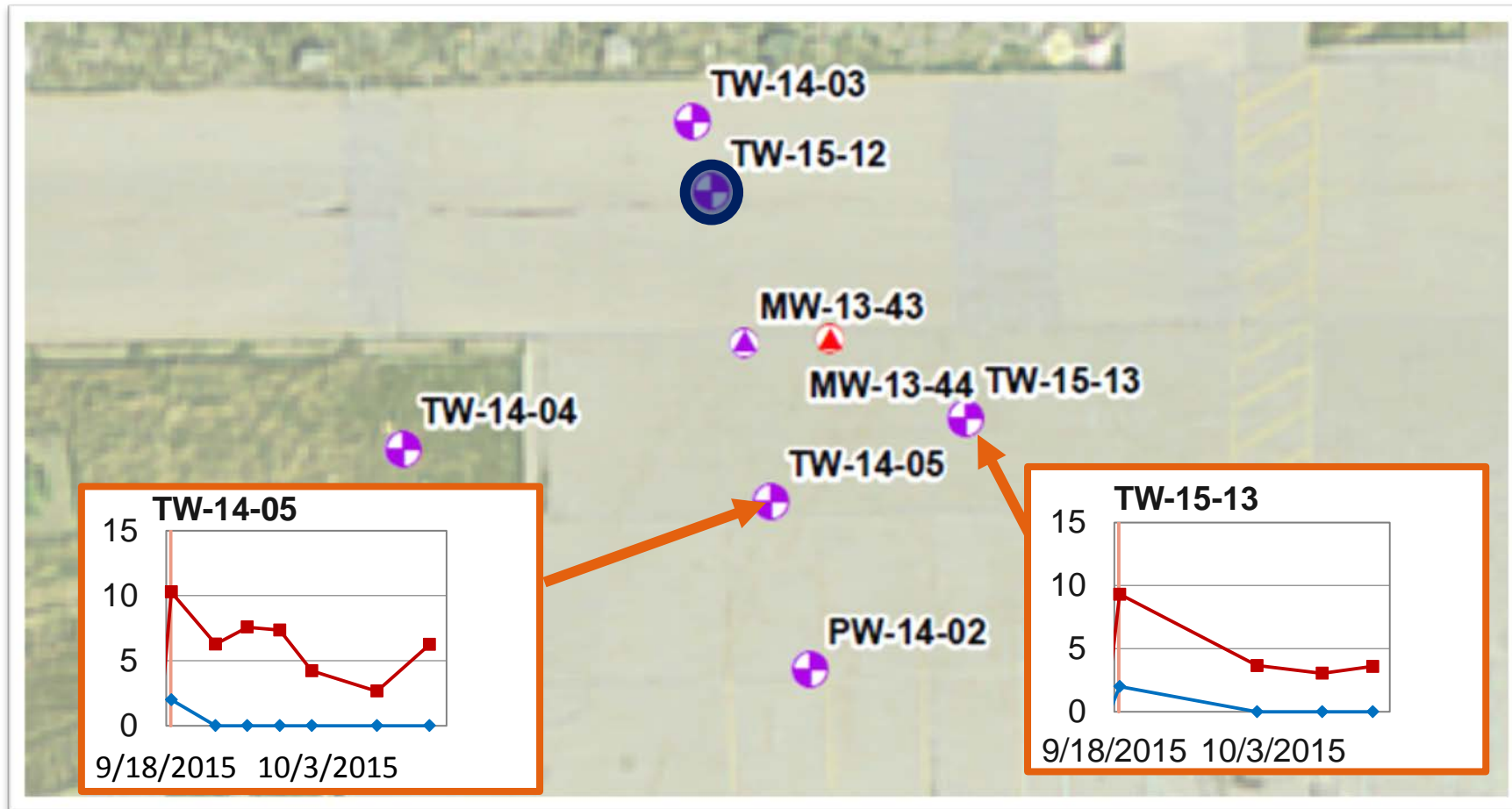
# Post Injection Monitoring – Plant 2



Persulfate also detected at trace levels up to 2 g/L in TW-14-04, TW-15-13, and PW-14-02

- End TW-15-12 Injection
- Sodium Persulfate Concentration (g/L)
- Specific Conductivity (mS/cm)

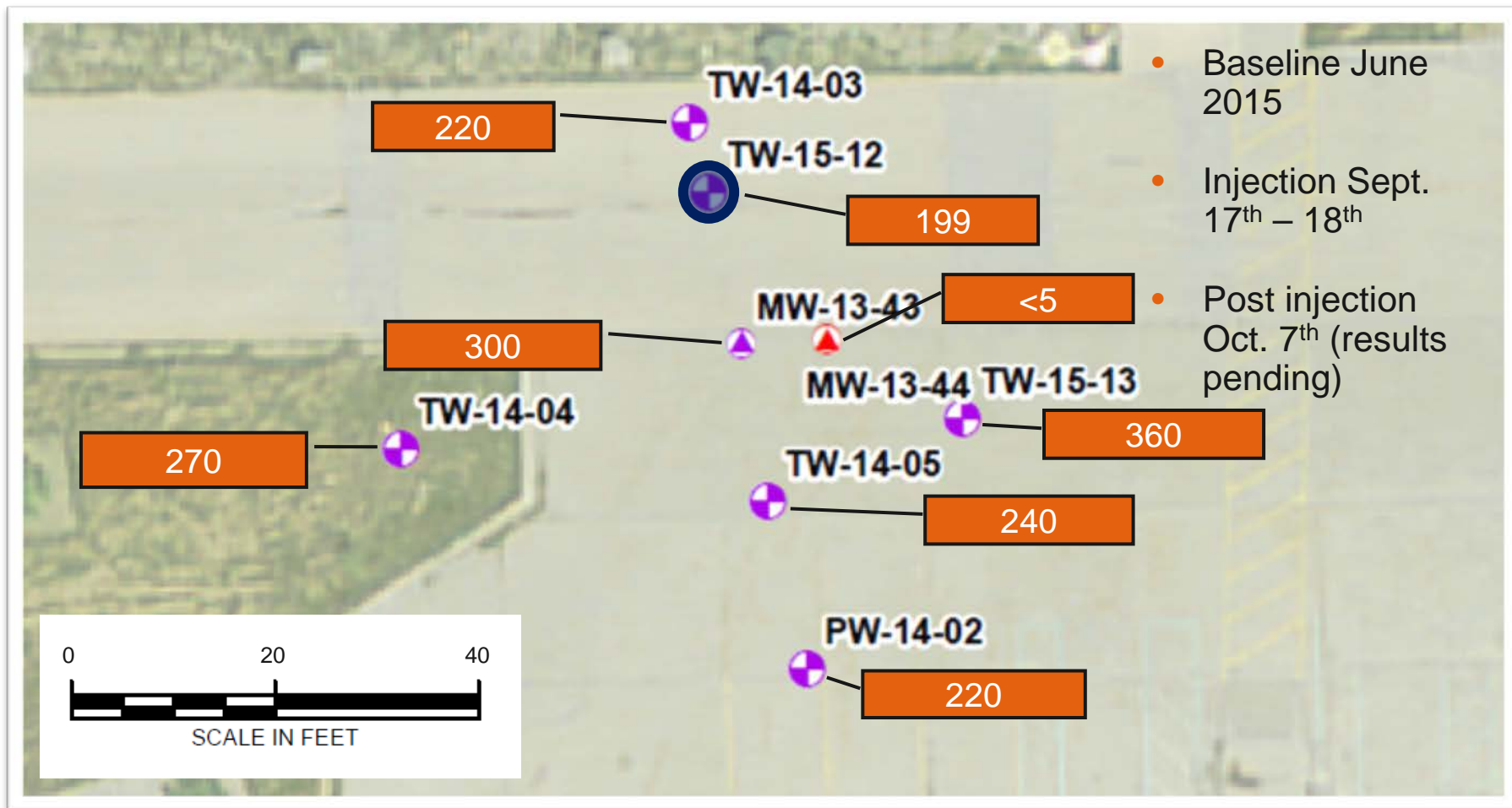
# Post Injection Monitoring – Plant 2



Persulfate also detected at trace levels in TW-14-04 and PW-14-02

- End TW-15-12 Injection
- Sodium Persulfate Concentration (g/L)
- Specific Conductivity (mS/cm)

# Baseline 1,4-D– Plant 2



All concentrations in µg/L

# Plant 2 Results -Hydraulic

- Results thus far support expectations of the pilot test
- 7.0 foot radius of influence treatment with 710 gallons of oxidant solution
- Arrival at DR well within first 2 hours of injection, 30 feet south within 3 hours
- Mobile porosity = 5.6% based on an 9 foot vertical treatment interval (TW-14-03)
- Estimated radius of influence of 9.3 feet from 3900 gallons
- Groundwater flow direction/velocity pending tracer results

# Next Steps

- Continue tracer/ISCO performance monitoring weekly for ~4 weeks, decreasing thereafter
- Assess tracer results to verify groundwater flow direction and velocity
- Assess VOC, 1,4-D, and oxidant distribution results to determine conceptual design parameters/cost implications of full scale ISCO remedy
  - Oxidant dosage, well spacing, transect spacing
- Assess full scale ISCO approach compared to other potential remedy options (enhanced bioremediation, source treatment with natural attenuation, etc.) and determine the appropriate path forward

# CSIA Sampling

# CSIA Sampling Methodology

- Analytical method that measures the ratios of naturally occurring stable isotopes
- Can provide useful information related to
  - contaminant source
  - extent of compound degradation
  - comingling of contaminant plumes
- Changes in isotopic ratios caused by breaking of bonds between atoms primarily related to chemical or biological processes
  - For COCs in groundwater, biodegradation is the major cause of significant changes in isotopic ratios

# Isotope Study Objectives

## Objective #1

- Determine if 1,4-dioxane from perched groundwater is migrating into deep zone

## Objective #2

- Identify if an off-site source is contributing to 1,4-dioxane in groundwater

## Objective #3

- Look for evidence of biodegradation of 1,4-dioxane in the perched zone

## Objective #4

- Look for evidence of biodegradation of 1,4-dioxane in the deep zone

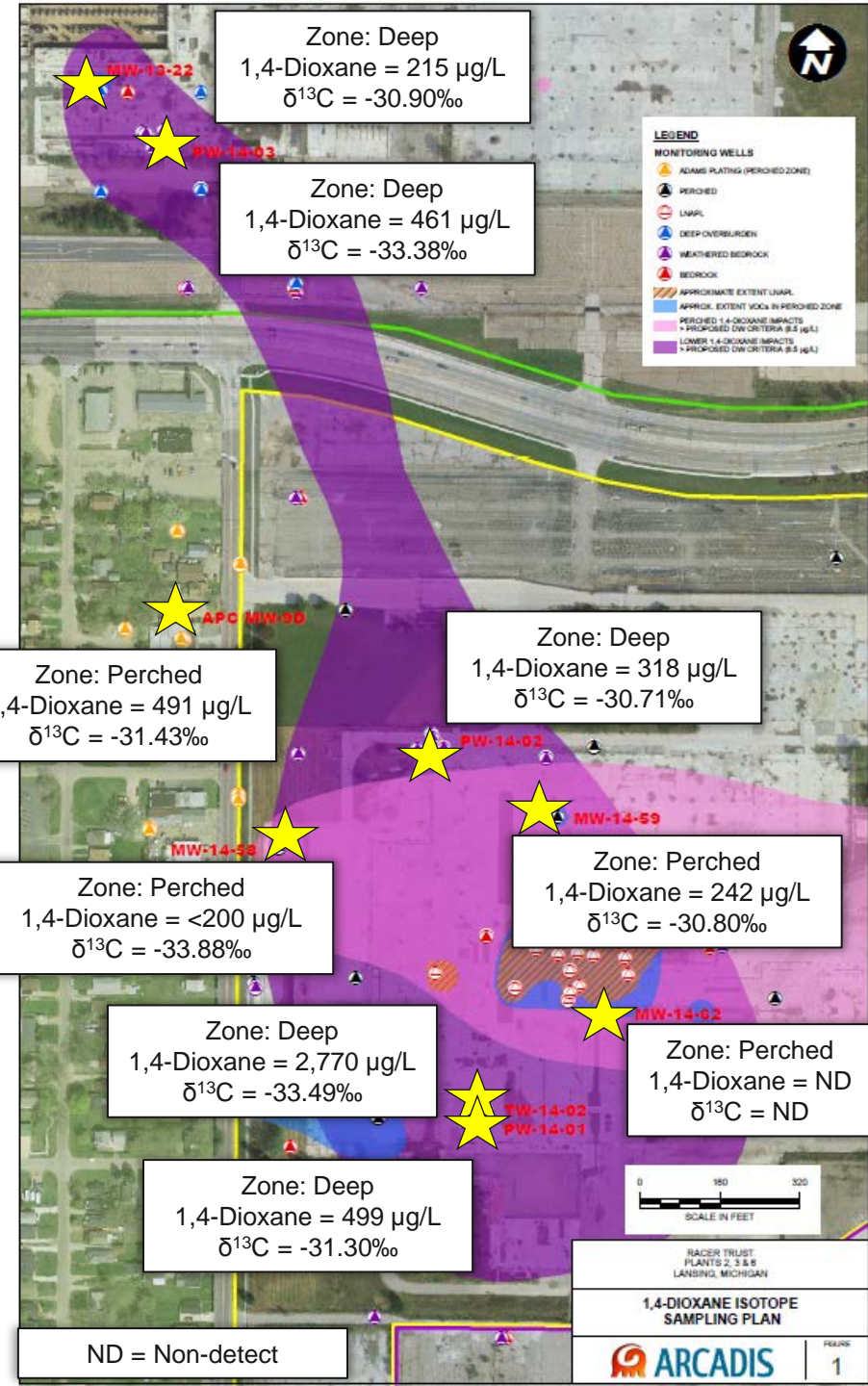
# Approach & Results

## Sample locations

- Perched zone and deep zone
- Off-site and plume edge
- Along deep zone plume centerline
- BioTrap<sup>®</sup> locations

## General results

- 1,4-Dioxane concentrations similar to prior sampling
- $\delta^{13}\text{C}$  fell into two groups
  - More negative values (e.g.,  $-33\text{‰}$ ) → closer to “stock”
  - Less negative values (e.g.,  $-30\text{‰}$ ) → potential biodegradation



# Isotope Study Conclusions

## Objective #1: Migration into Deep Zone

Compare perched zone MW-14-62 to deep zone TW-14-02

- The variability and distribution of carbon ratios, both within the lower unit and perched zone, do not provide evidence of a 1,4-dioxane migration from the perched zone to the lower unit

## Objective #2: Off-Site Source

Compare off-site APC MW-9D to on-site MW-14-58

- The  $\delta^{13}\text{C}$  value of the APC well MW-9D was similar to that collected at wells located on-site and does not provide a line of evidence supporting off-site contribution to the Site 1,4-dioxane impacts

## Objective #3: Biodegradation in Perched Zone

Review perched zone

- A less negative  $\delta^{13}\text{C}$  value at MW-14-59 suggests biodegradation occurs within the perched zone, consistent with BioTrap<sup>®</sup> results for the perched zone.

## Objective #4: Biodegradation in Deep Zone

Compare locations along the deep zone plume centerline

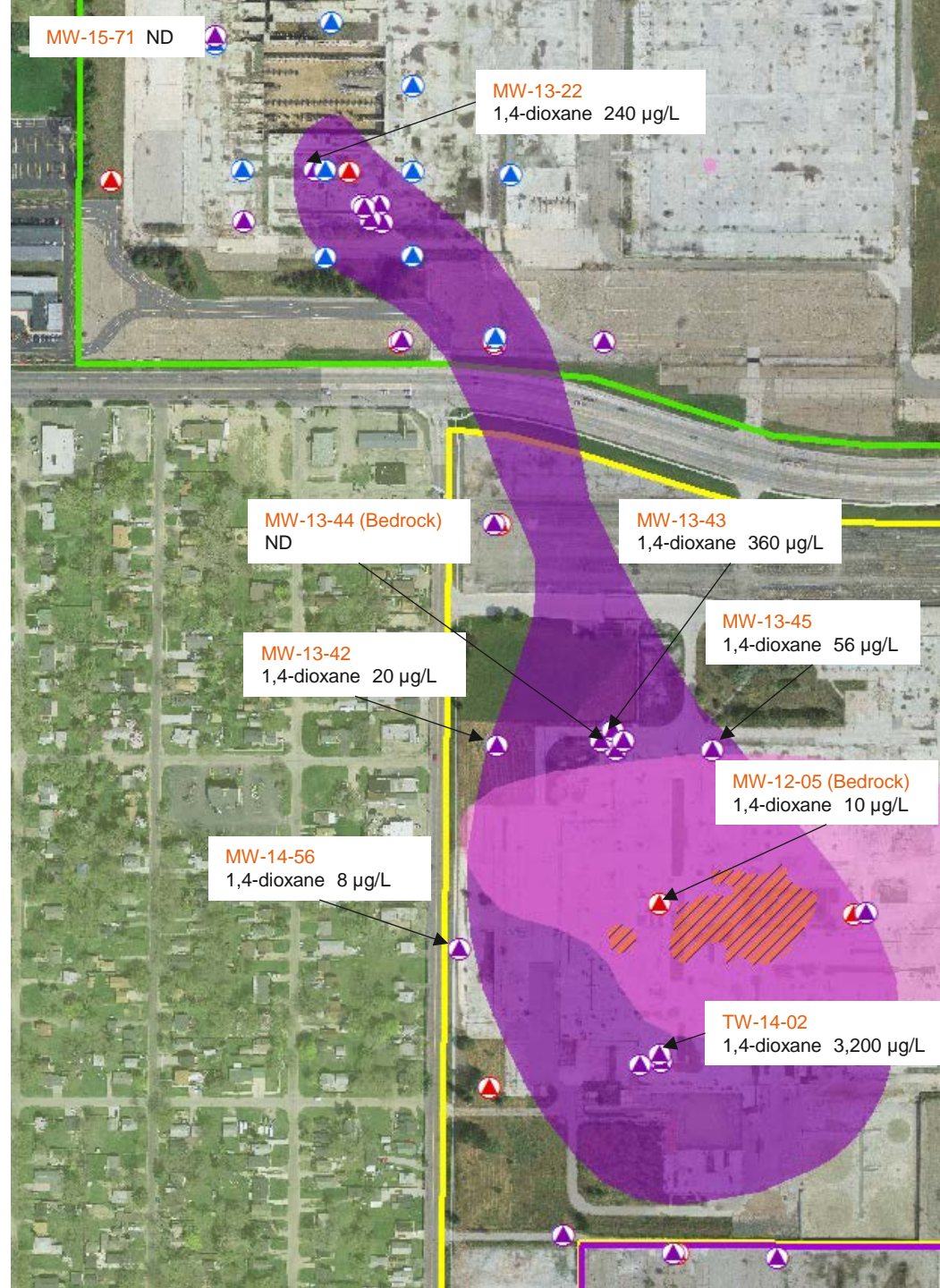
- The ideal image of increasing  $\delta^{13}\text{C}$  values (less negative values) along the plume centerline was not present
- Less negative  $\delta^{13}\text{C}$  values at some wells (i.e., MW-13-22, PW-14-02, and PW-14-01) suggest biodegradation may occur sporadically. Aligns with previous BioTrap<sup>®</sup> data.

# 3<sup>rd</sup> Quarter Groundwater Sampling

# Sampling Results

## Deep Monitoring Wells

- Slightly higher concentrations at the two perimeter wells (MW-13-42 & MW-14-56)
- Detection at MW-12-05 at 10 µg/L



# Sampling Results

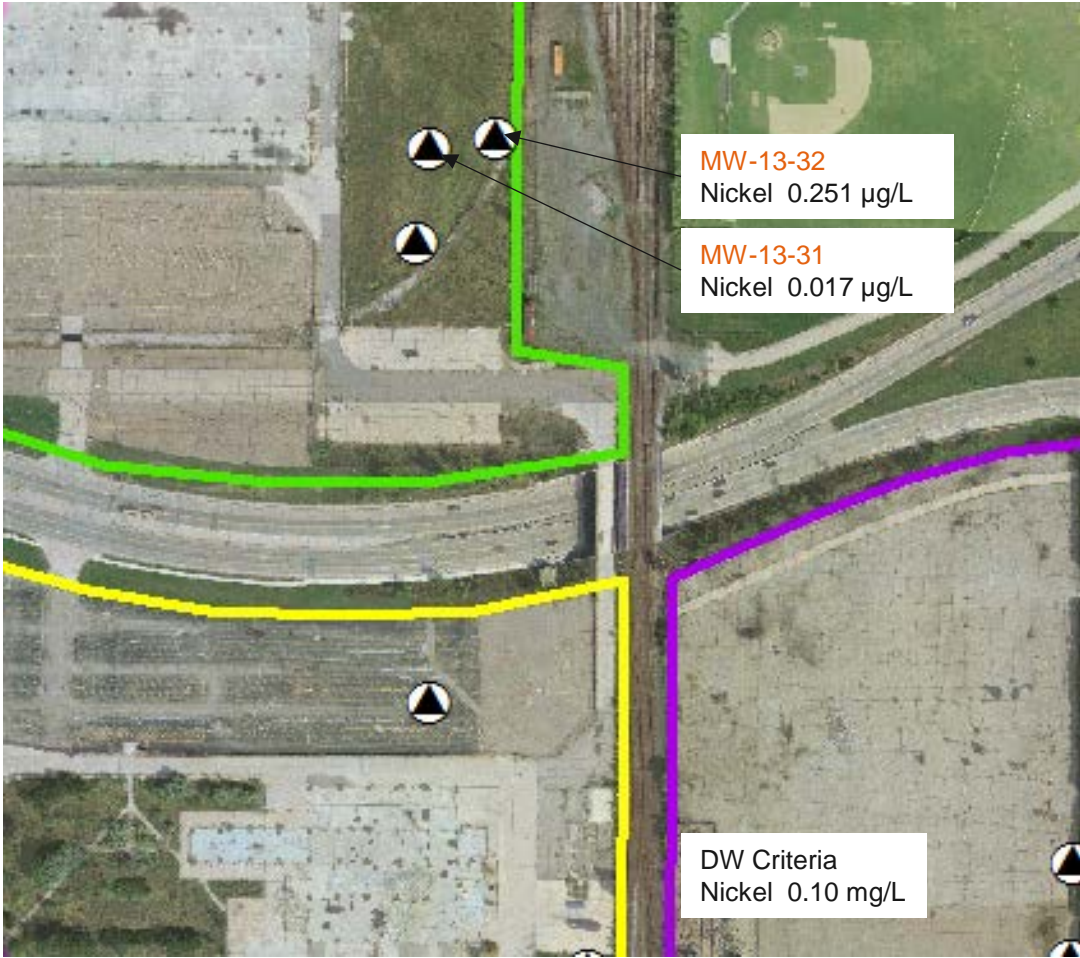
## Perched Monitoring Wells

### MW-13-31

- December - 0.049 mg/L
- March - 2.75
- June - 2.16
- September- 0.017

### MW-13-32

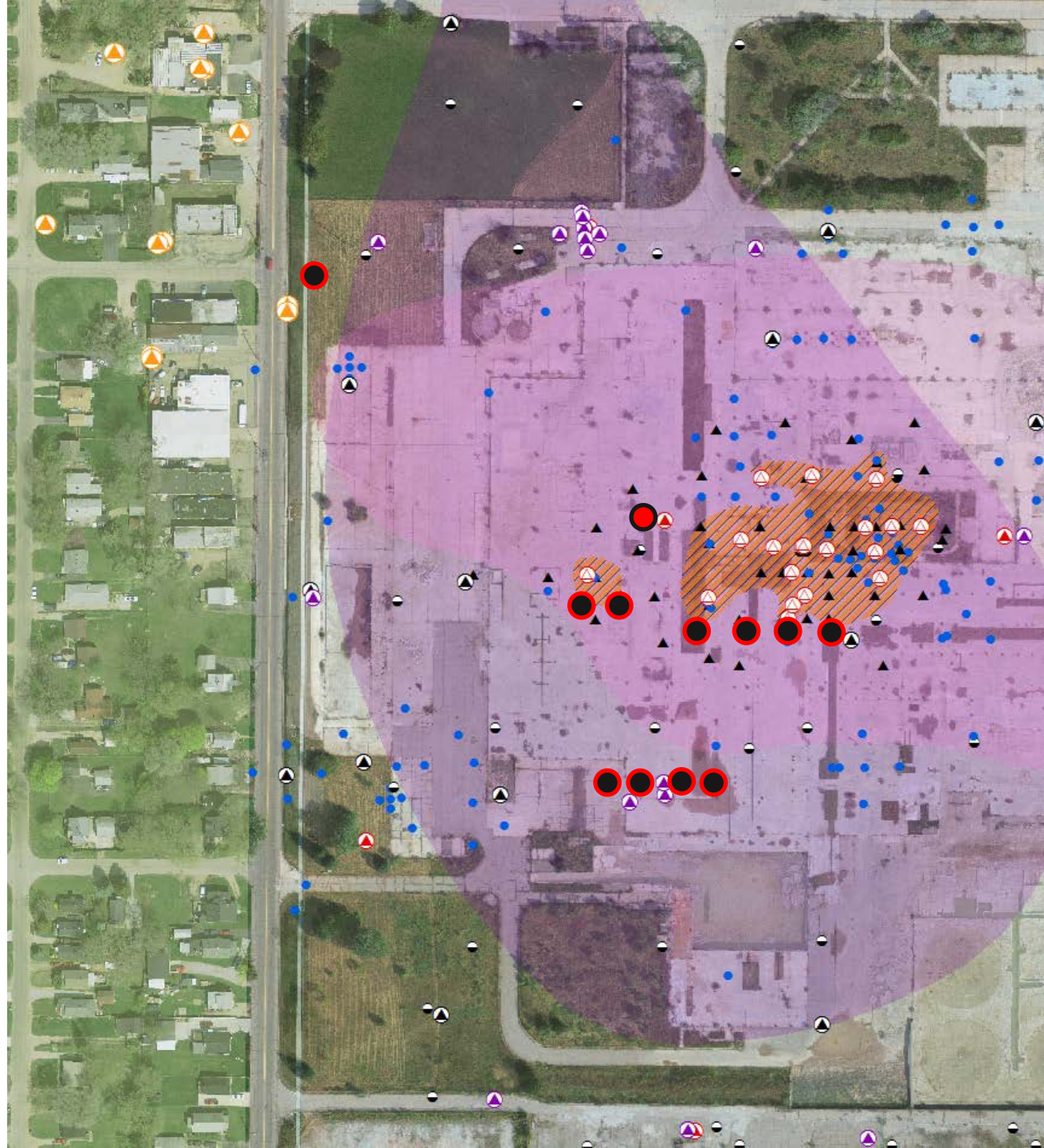
- December - 1.41 mg/L
- March - 4.66
- June - 1.77
- September- 0.251



# Lower 1,4-Dioxane Toe Investigation

# Scope of Work

- Further characterize the core of the plume near TW-14-02
- Identify if an off site source or the perched plume is contributing to the lower plume
- Delineate extent west of MW-12-42
- Establish continuity of plume from north to south



# Remaining Scope and Schedule 2015

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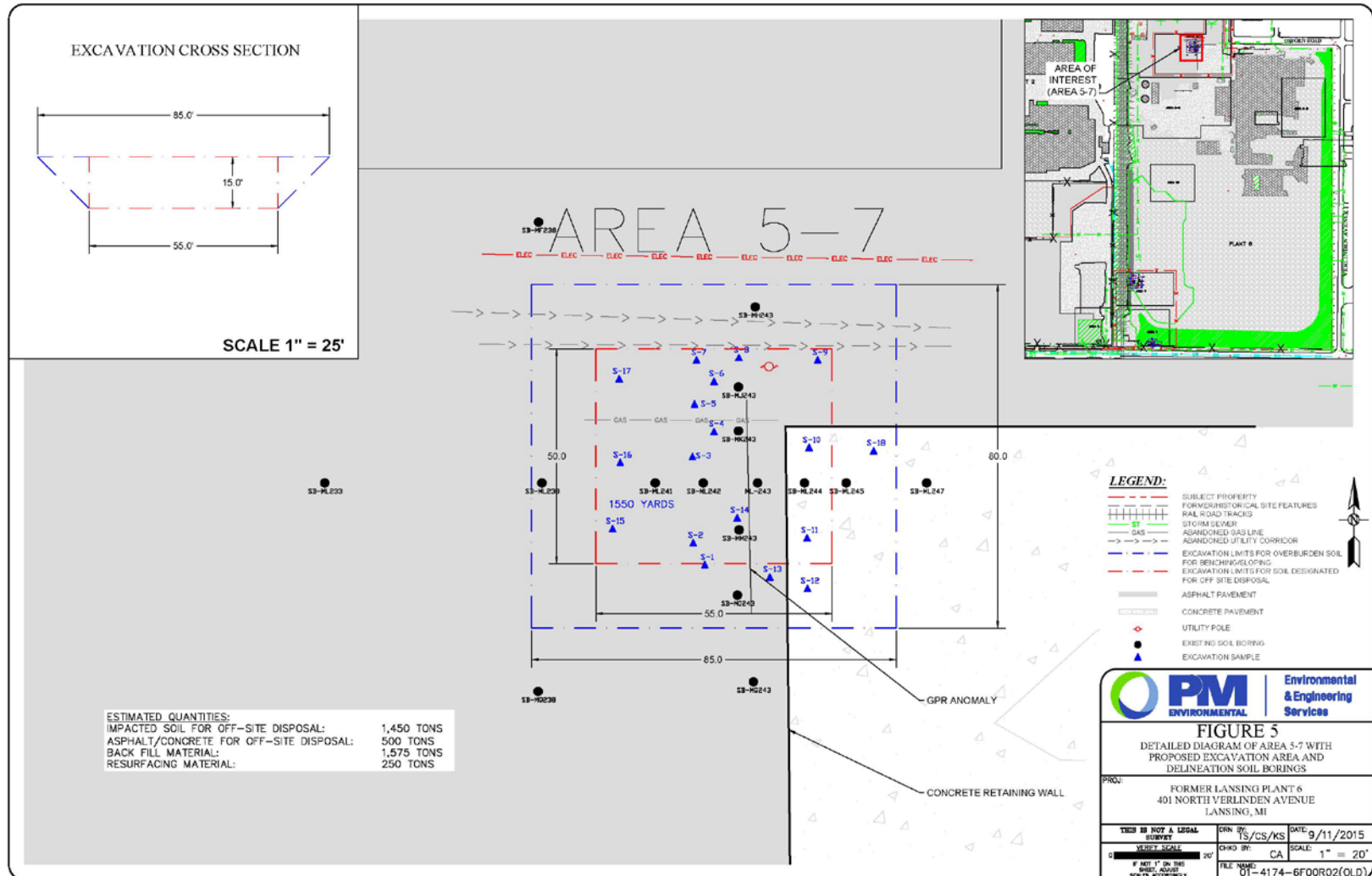
- October
  - Continue tracer/ISCO pilot test performance monitoring
  - Begin Clarifier Demolition
- November
  - Begin 1,4-Dioxane Toe Investigation
  - Begin Excavations
    - Initiation of Plant 2 excavation may be delayed due to need to complete 1,4-Dioxane Toe Investigation
- December →
  - 4<sup>th</sup> Quarter Groundwater Sampling
  - Tracer/ISCO pilot test data summary report (pending results)
  - Begin Remedial options evaluation

# Clarifier Demolition

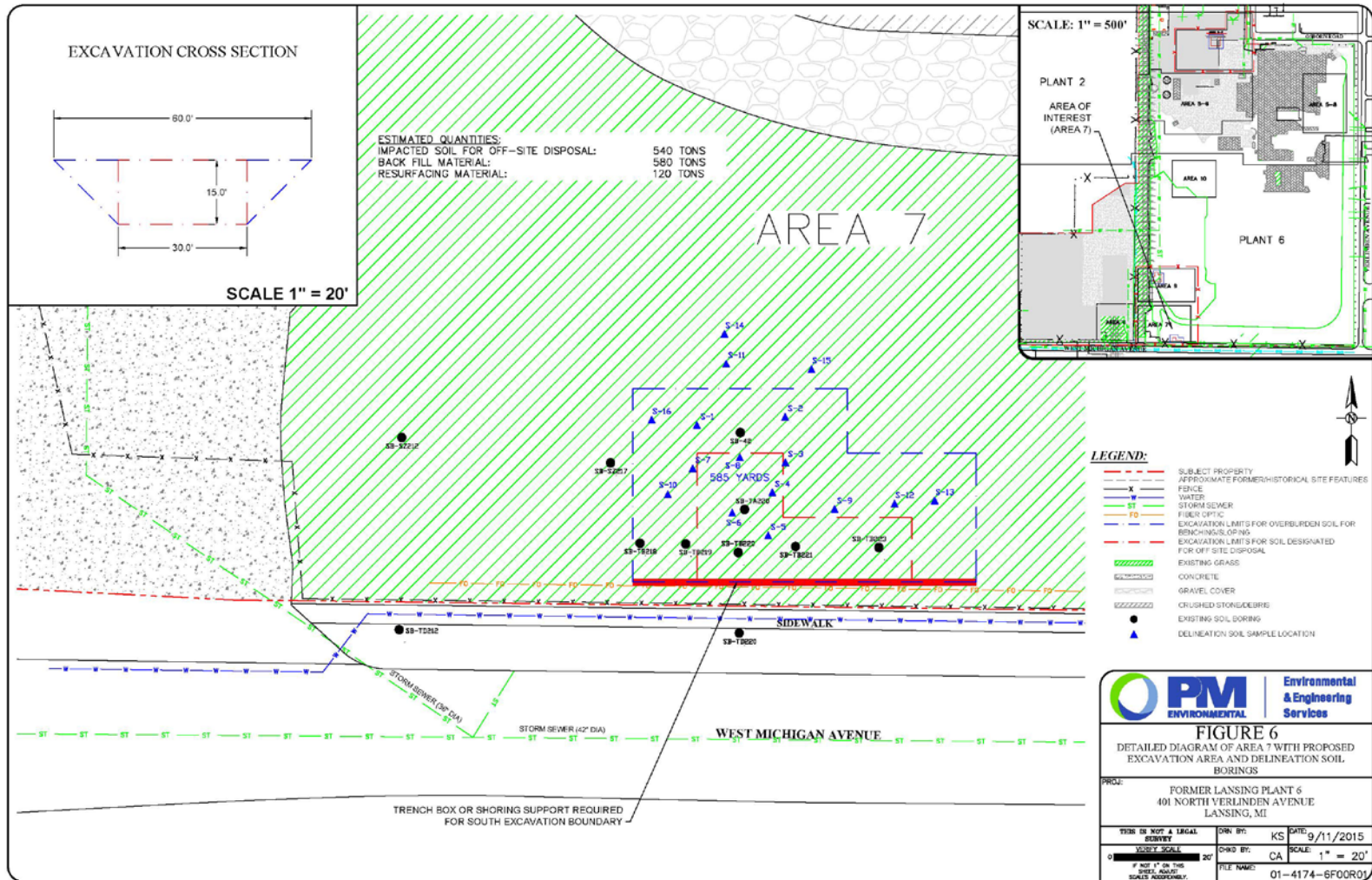


# Excavations

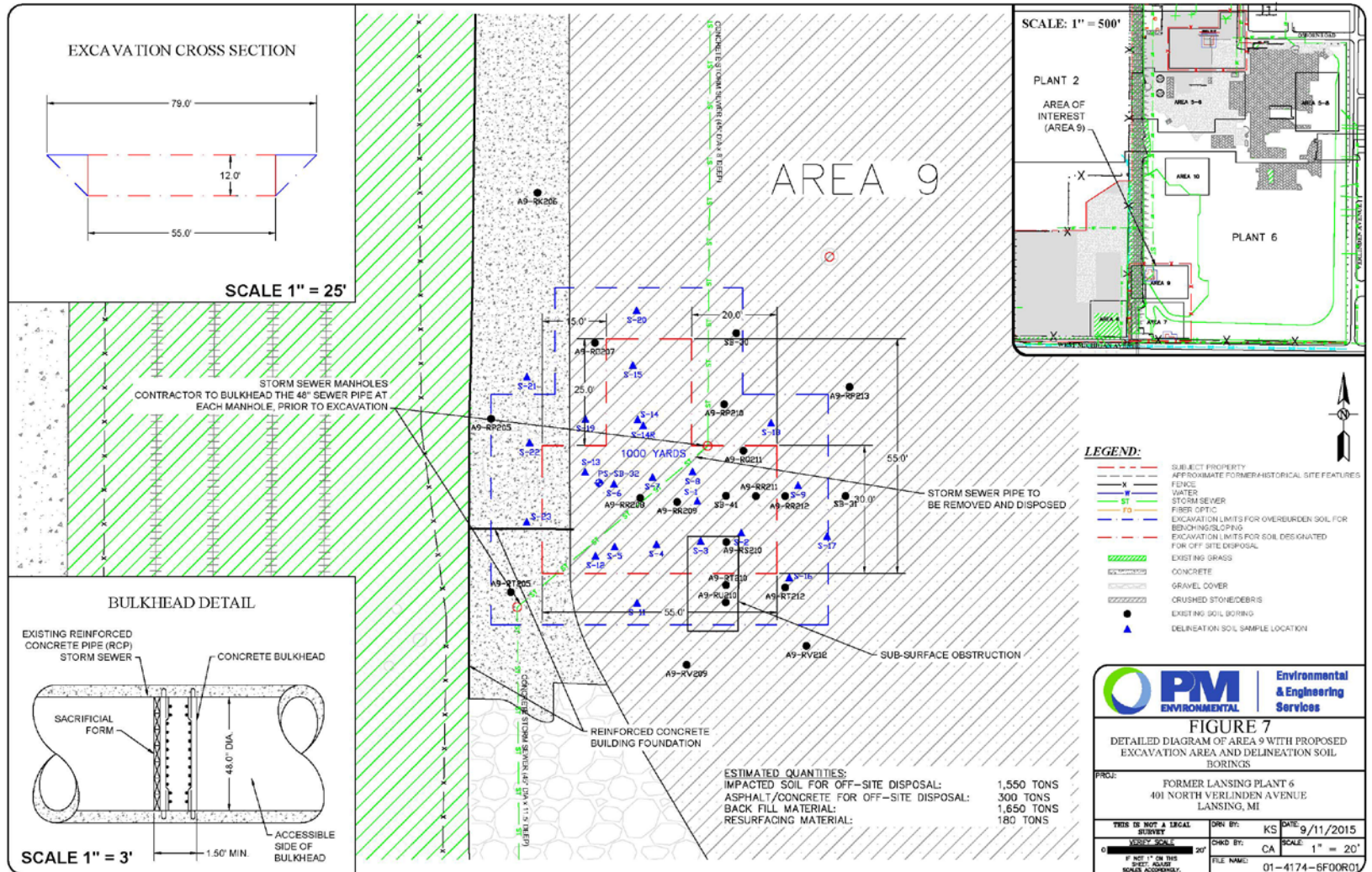
# Plant 6 Excavations Area 5-7



# Plant 6 Excavations Area 7



# Plant 6 Excavations Area 9



# Plant 2 Excavation

