Tesoro – Livermore Project Update

1619 First Street, Livermore, CA

Tesoro #67076

ACEH Case RO0000434

7 September 2017

Agenda

- Introduction
  - Review recent regulatory meetings and site information
- Path to closure
  - Discuss in terms of LTCP criteria
- 2017 investigation results
  - Well network analysis, downgradient plume investigation, and residual NAPL saturation and mobility testing
- Plume stability evaluation
  - Joe Ricker with EarthCon Consultants Inc.
- Discussion of path forward, agency requests, and upcoming actions

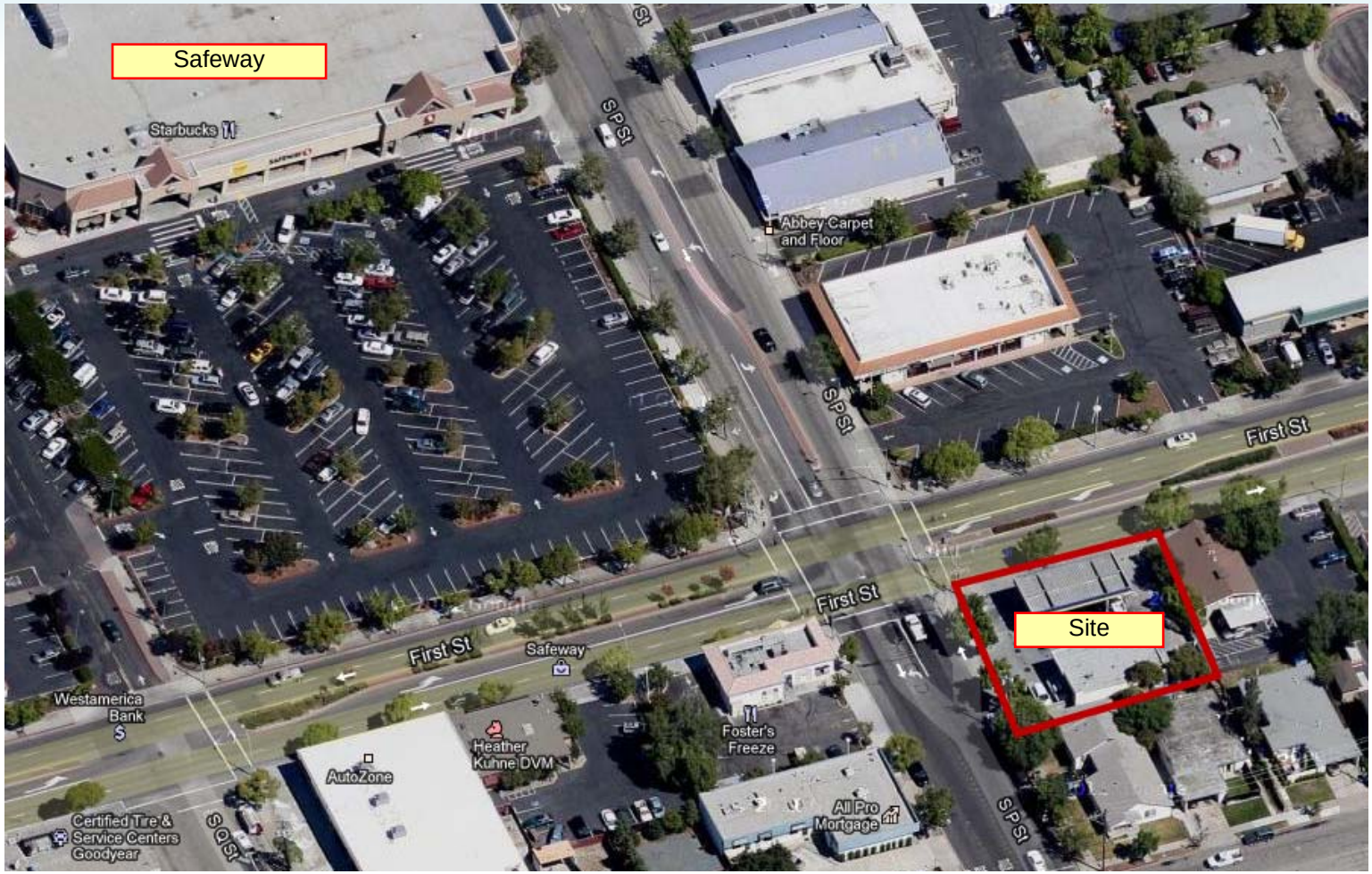
Introduction

Recent Regulatory Correspondence and Reporting

- August 2016 meeting
  - ACEH requested Remedial Action Plan (RAP)
  - Arctos submitted draft RAP in December 2016
- February 2017 meeting
  - ACEH requested monitoring well network analysis
  - Data gaps were identified and ACEH requested work plan
    - Downgradient plume delineation
    - Residual LNAPL in the vicinity of former USTs
  - Arctos submitted monitoring well analysis and work plan for data gap investigation in May 2017
- September 2017 meeting
  - Objective – review recent investigation activities, review current and historical plume conditions, discuss path to closure

Introduction

Site Location - 1619 First Street, Livermore, CA

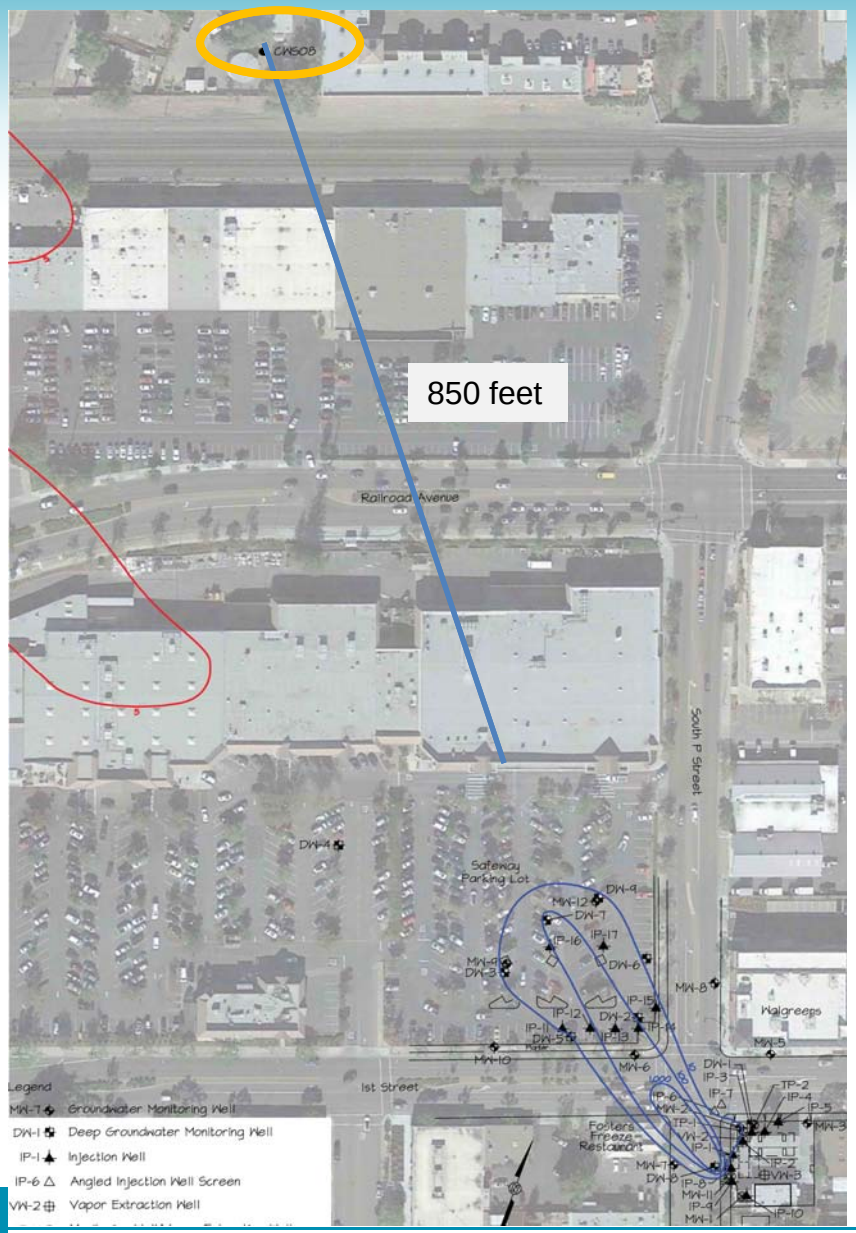


Introduction
Remediation History

- USTs replaced in November 1992
  - Tank pit excavated to 27 feet bgs
- On- and offsite SVE/AS operated May 1996 to February 1997
- Onsite SVE
  - June 2010 to November 2012
  - July 2014 to February 2015
  - June 2015 to December 2015
- On- and offsite ISCO
  - Onsite – 4Q11, 2Q-3Q 2013
  - Offsite – 2Q-3Q 2013
- Onsite oxygen injection
  - October 2010 to March 2013
  - June 2015 to present (currently operating)

Introduction

Sensitive Receptors



- CA Water Service well CWS08
  - Screened approximately 122 to 263 feet bgs
  - Pumped at 260 gpm
- Downgradient toe of plume not defined to MCL (1 µg/l benzene)
  - CWS08 within 1,000 feet of plume boundary

Path to Closure

LTCP Analysis

- Based on data presented in RAP Section 4.3, the site meets the following LTCP criteria:
  - General criteria
  - Vapor intrusion to indoor air
  - Direct contact and outdoor air
- The site does not meet the following LTCP criteria:
  - Groundwater-specific criteria
    - Benzene concentrations are greater than 1,000 µg/l at well DW-8
    - Well CWS08 is less than 1,000 feet from the plume boundary

Path to Closure

Data Gaps

- Distance of CWS08 to lateral extent of plume disqualifies site from meeting LTCP groundwater-specific scenarios 1 to 4
  - Delineation of downgradient toe of plume was identified as a data gap
  - During August 2016 meeting, ACEH agreed to consider managing closure of the site under scenario 5 if site conditions are met except distance to CWS08
- During February 2017 meeting, the potential presence of submerged LNAPL in the vicinity of well DW-8 / former USTs was identified as a data gap

Investigation activities were conducted to address the data gaps identified in previous meetings with ACEH.

2017 Investigation

Scope of Work

- Conduct analysis of monitoring well network
  - Submitted in May 2017 work plan
- Investigate downgradient toe of plume
- Investigate the potential presence and mobility of submerged LNAPL in the vicinity of well DW-8, downgradient of former USTs

2017 Investigation

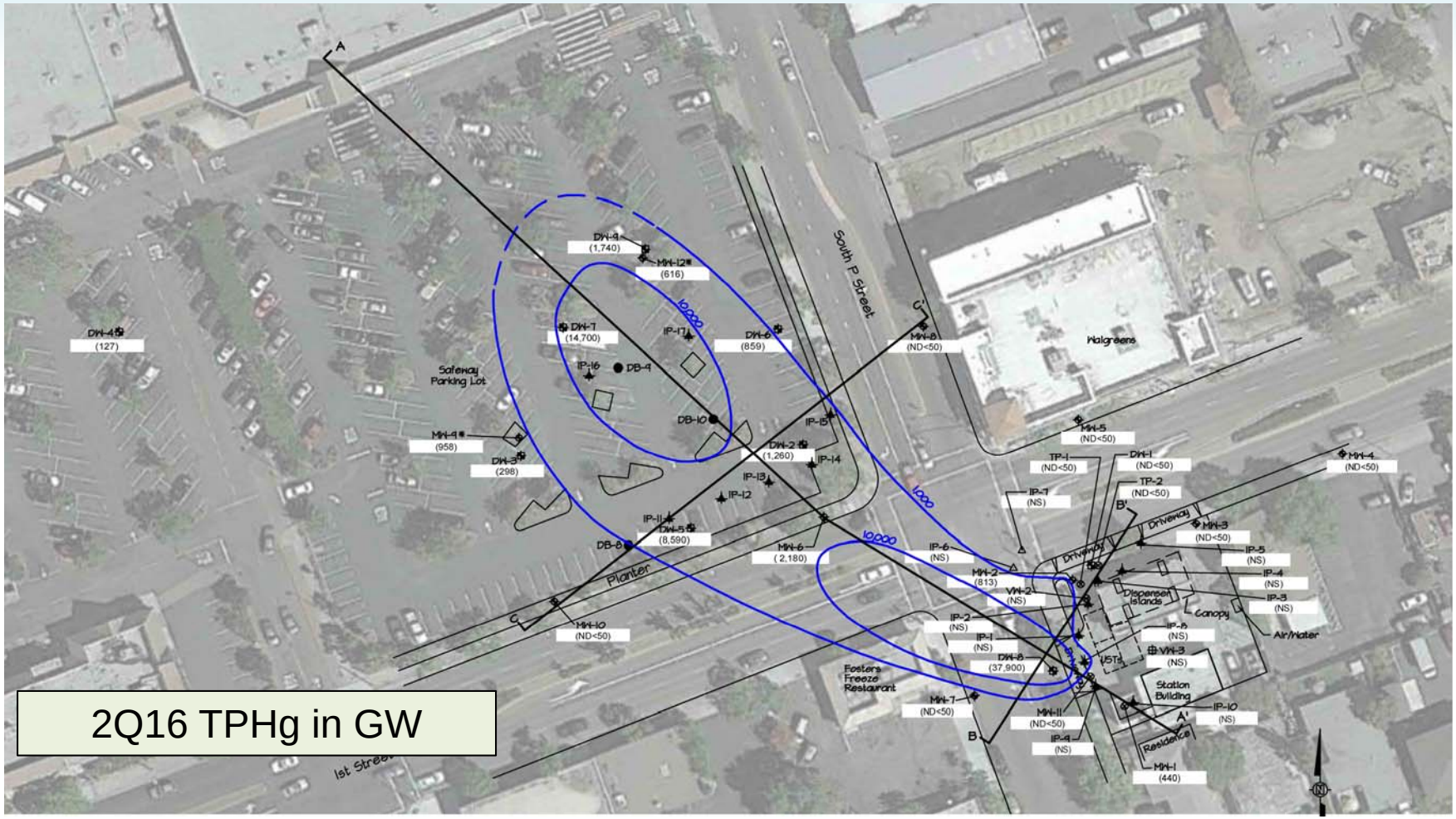
Monitoring Well Network Analysis

- Two historical release sources at the site
  - Former dispensers and product piping located in northern area of site
    - Replaced in 1992
    - Characterized by higher oxygenate concentrations
    - Occurred during period of generally high water levels and impacted shallow intervals (approximately 30 to 50 feet bgs)
  - Former USTs located in southwest area of site
    - Replaced in 1992
    - Characterized by higher TPHg and benzene concentrations
    - Occurred during period of generally low water levels and impacted deeper intervals (approximately 50 to 70 feet bgs)

- Shallow and deep groundwater wells effectively monitor shallow and deep historical releases
  - Reports now include wells grouped by shallow / deep intervals and percentage of screen interval submerged

2017 Investigation

Monitoring Well Network Analysis



Cross section A-A' shows historical soil impacts based on TPHg in soil or PID readings during drilling. Shallow and deep impacts are consistent with historical high and low groundwater levels. Well screens effectively monitor the shallow and deep impacted zones.

2017 Investigation

Monitoring Well Network Analysis

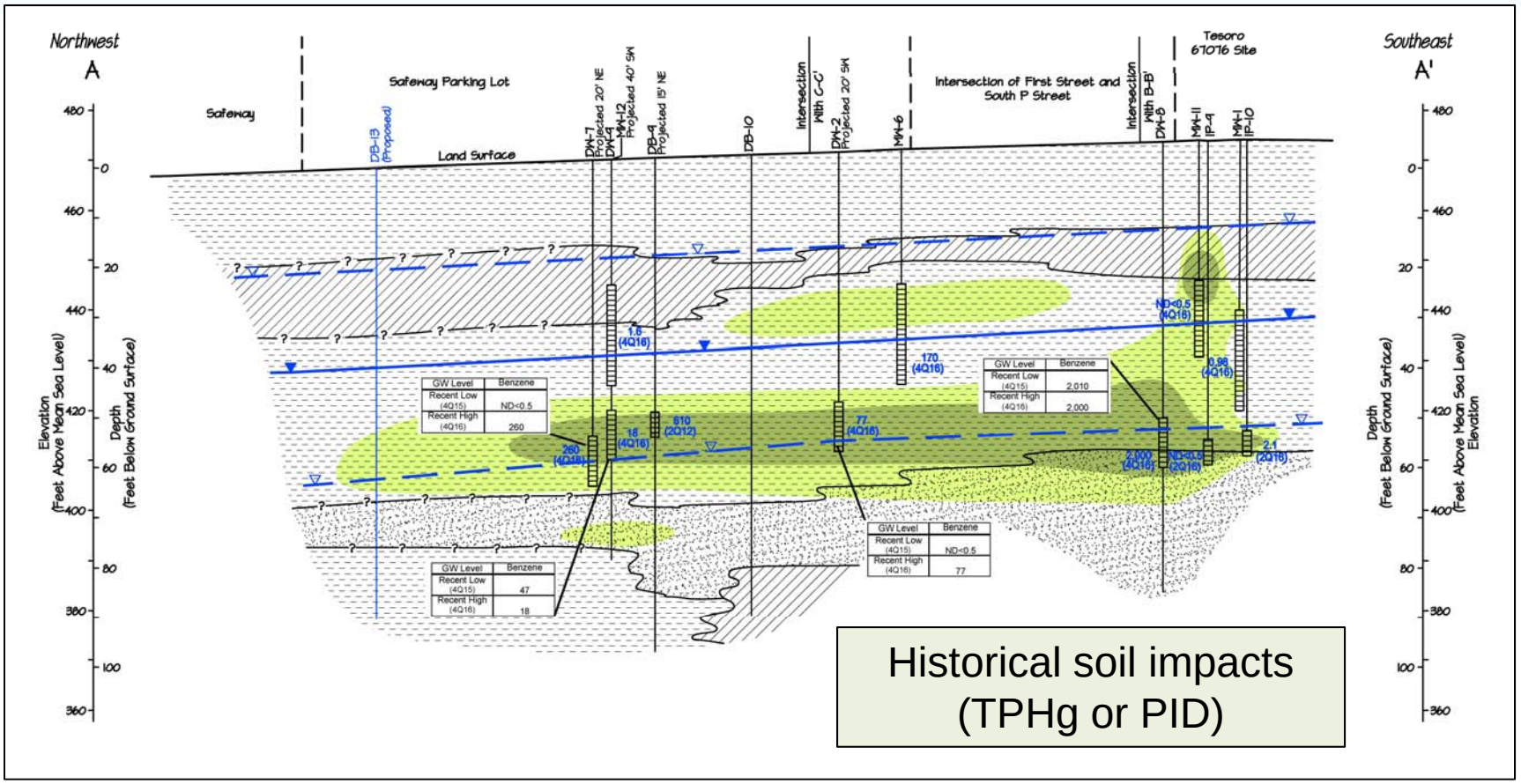
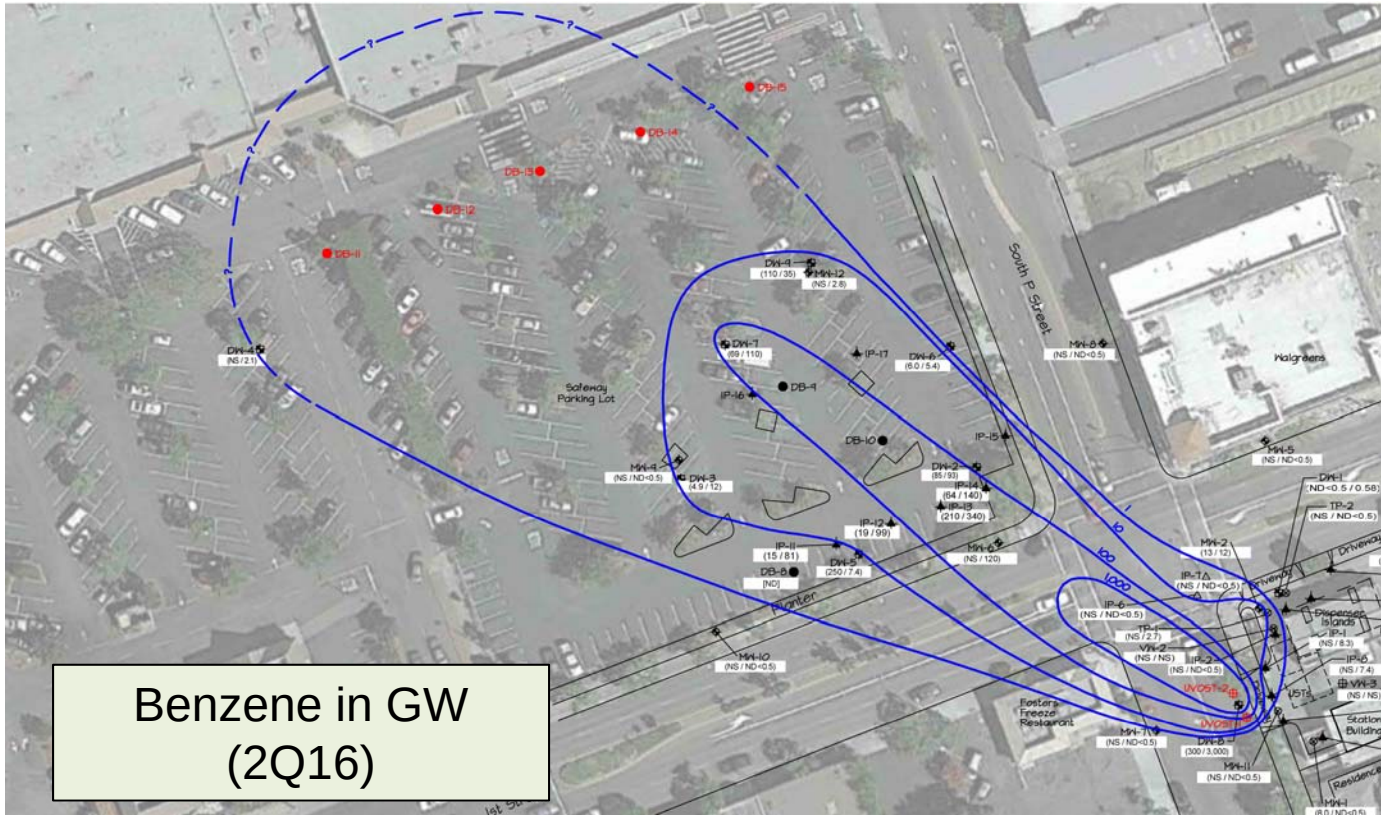


Figure shows the boring locations proposed in the May 2017 work plan.

2017 Investigation

Downgradient GW Sampling

- Downgradient toe of plume was not delineated to MCLs
- 5 CPT / grab GW sampling boring pairs proposed to investigate shallow and deep intervals near Safeway

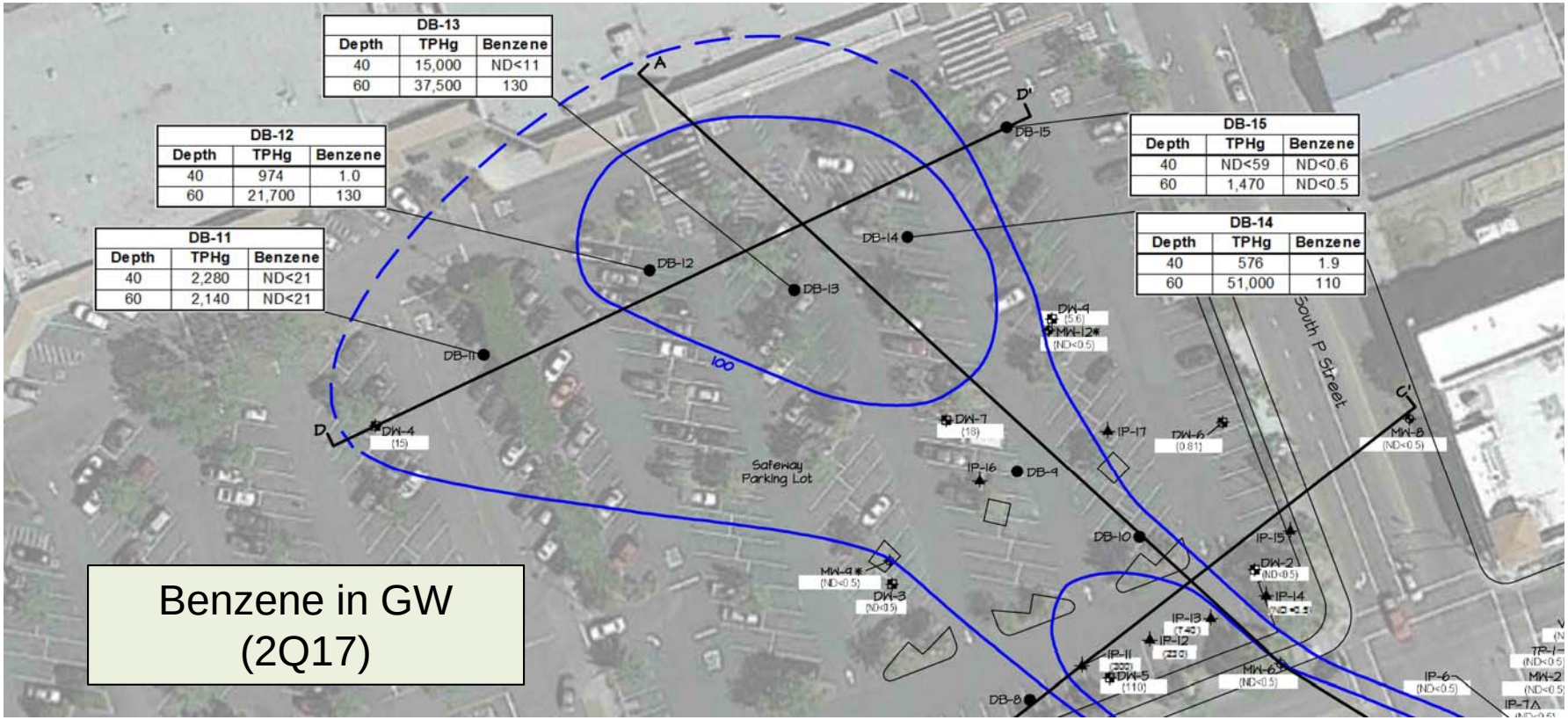


Actual boring locations were adjusted based on field conditions and access. Grab groundwater sample concentrations below are in micrograms per liter.

2017 Investigation

Downgradient GW Sampling

- CPT / grab GW sampling performed in June 2017
- GW samples collected at each boring pair from 35 to 40 feet bgs and 55 to 60 feet bgs

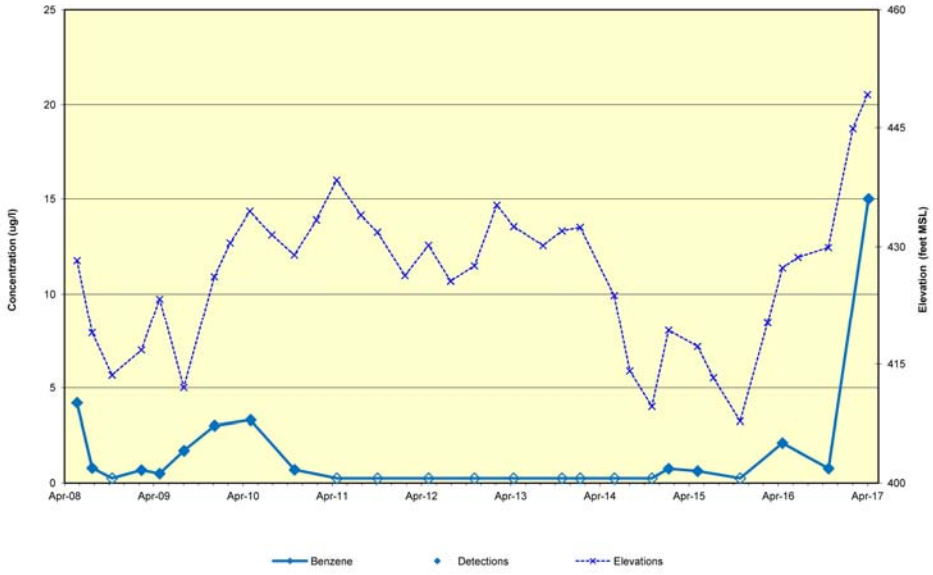


2017 Investigation

Downgradient GW Sampling

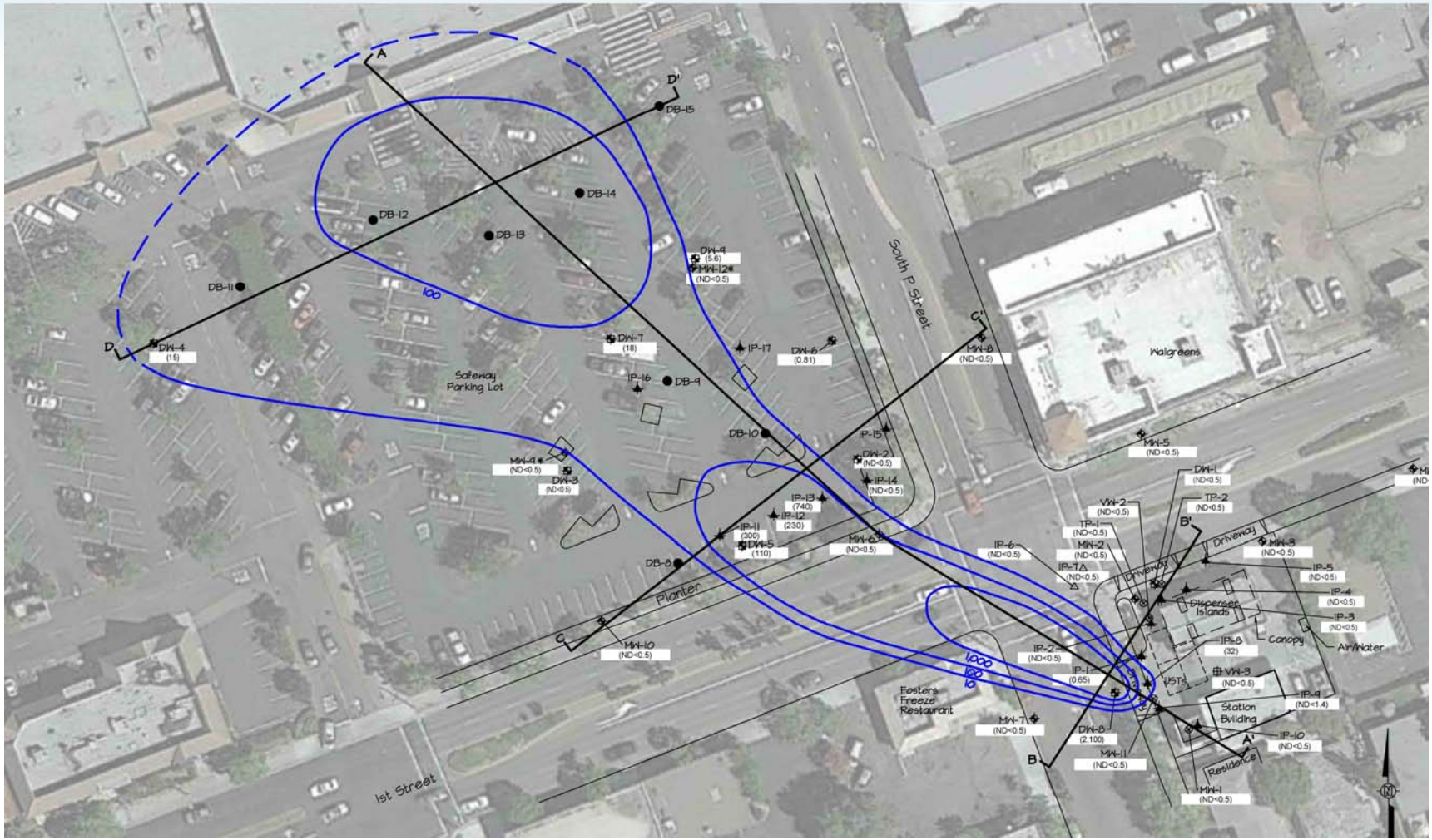
- Highest concentrations detected at borings DB-12, DB-13, and DB-14 (TPHg > 10,000 µg/l and benzene > 100 µg/l)
- TCE and PCE were analyzed in grab GW samples and not detected
- Grab sampling conducted during historically high GW elevation period
  - GW concentrations increased at well DW-4, generally consistent with historical responses to changing GW elevations

Historically, dissolved-phase concentrations at DW-4 have increased with increases in GW elevation, then stabilized and decreased. This may be due to matrix back diffusion. It is likely that benzene at DW-4 will equilibrate and decrease in future sampling events. The trend is not observed at all wells.



2017 Investigation

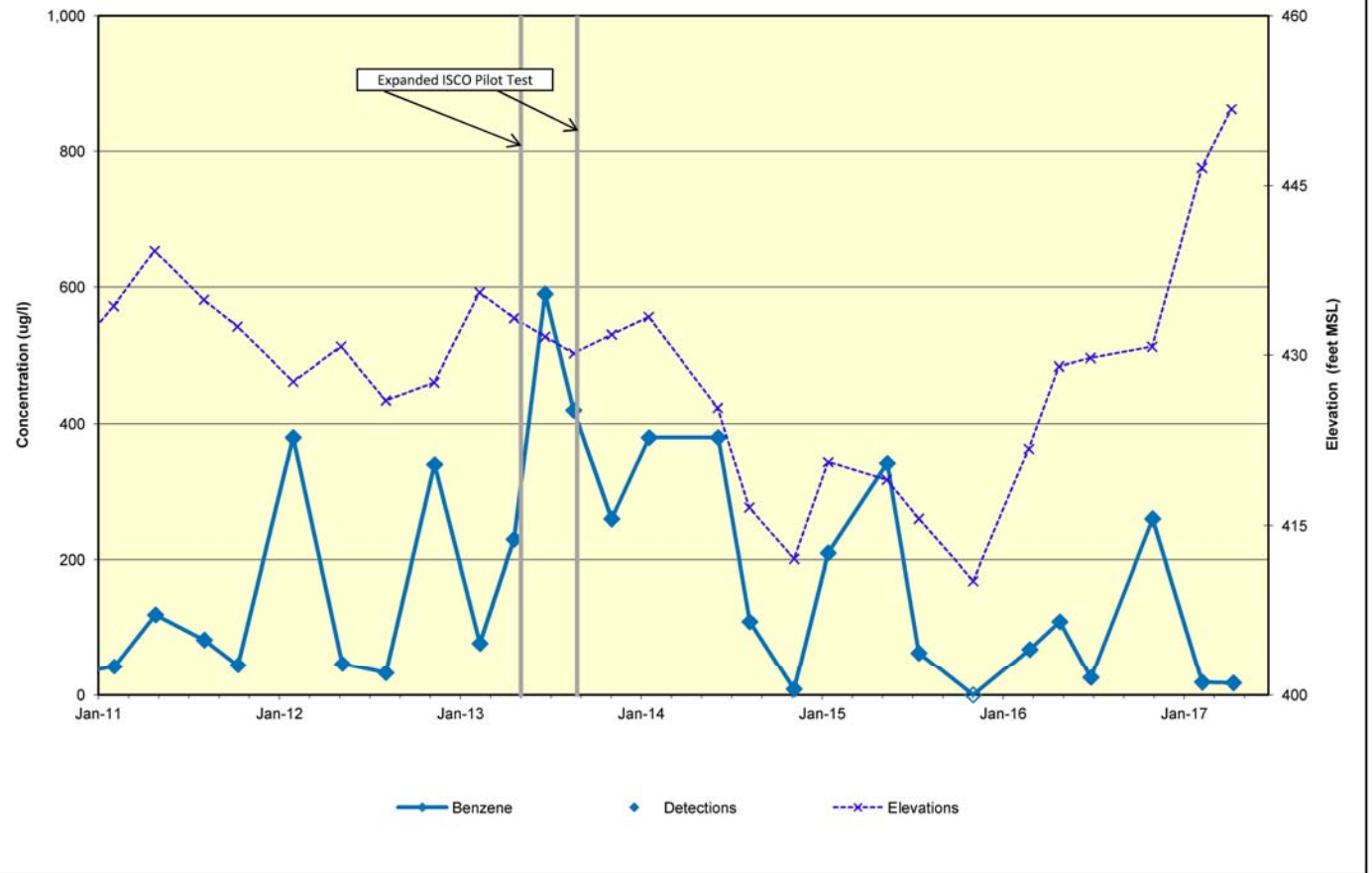
Downgradient GW Sampling



Well DW-7 is located upgradient of the grab groundwater sample borings advanced in 2Q17. During 2Q17, benzene at DW-7 was 18 ug/l, an order of magnitude lower than concentrations in grab samples. The grab groundwater sample results are likely biased high due to disturbance from drilling and sediment in samples. A decreasing trend is observed at DW-7 since the offsite ISCO pilot test in 2013.

2017 Investigation

Downgradient GW Sampling

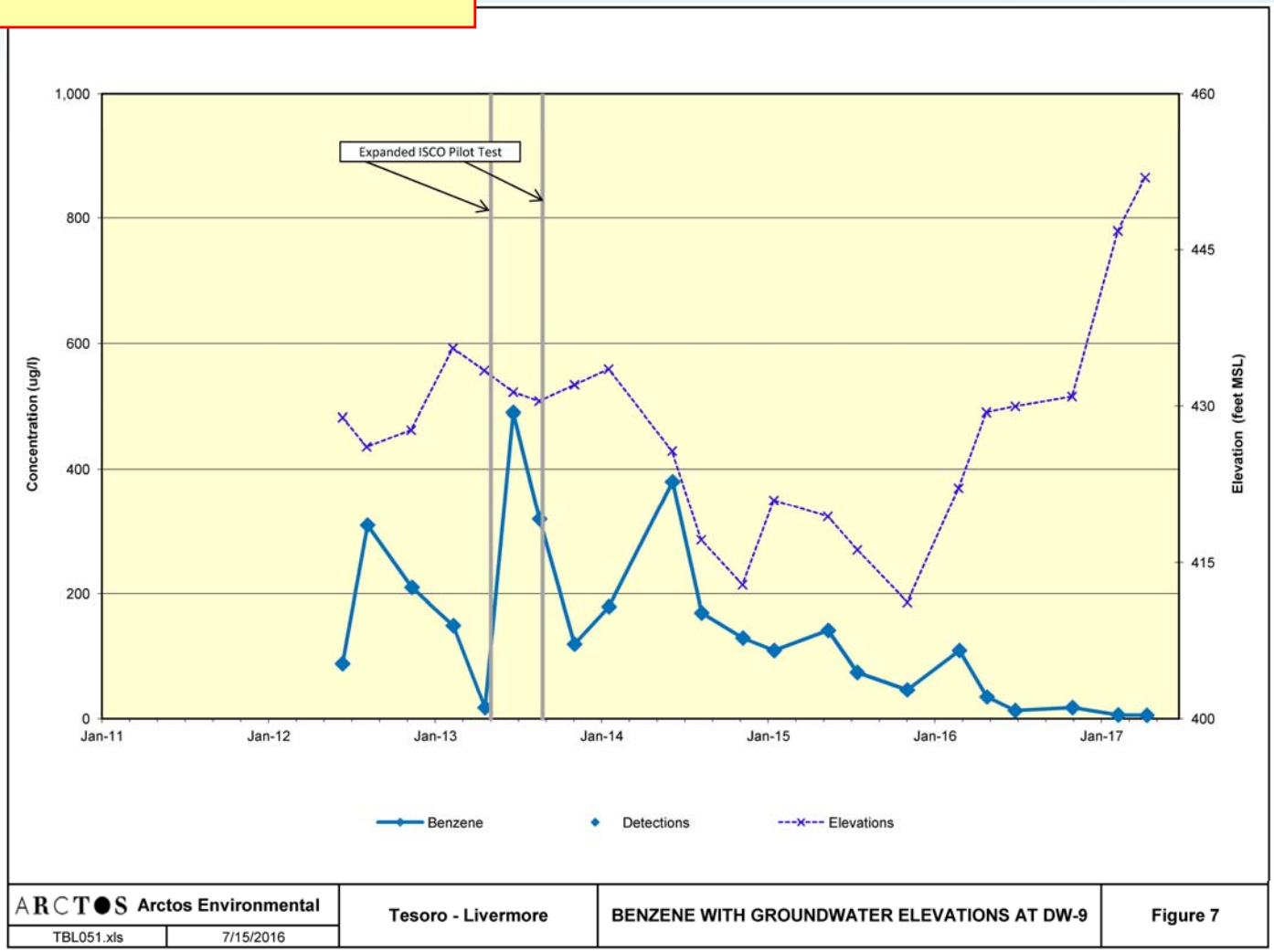


ARCTOS Arctos Environmental	Tesoro - Livermore	BENZENE WITH GROUNDWATER ELEVATIONS AT DW-7	Figure 7
TBL051.xls 7/15/2016			

2017 Investigation

Downgradient GW Sampling

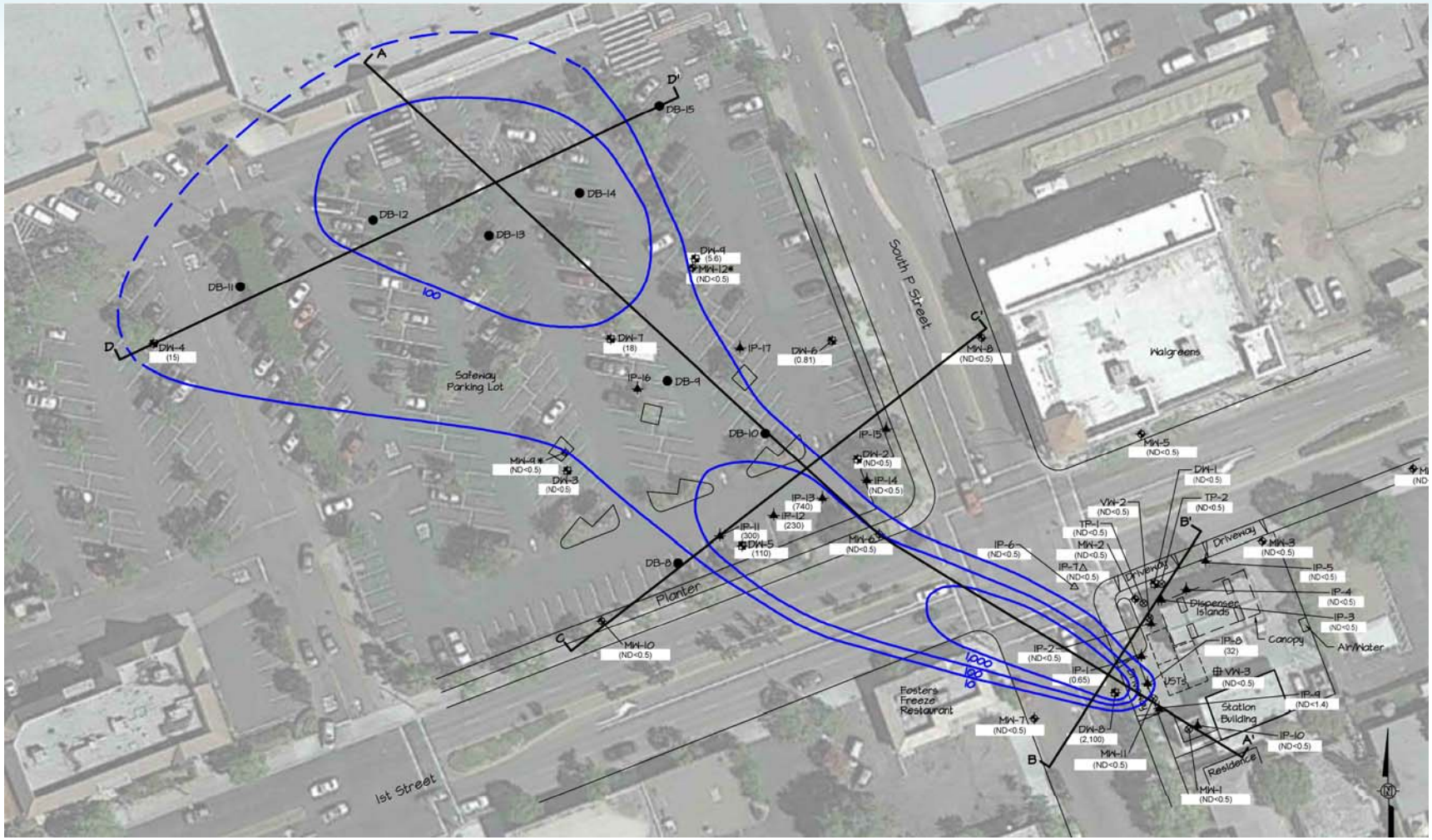
Well DW-9 is located upgradient of the grab groundwater sample borings advanced in 2Q17, though farther northeast of the centerline of the plume. During 2Q17, benzene at DW-9 was 6 ug/l, an order of magnitude lower than concentrations in grab samples. Similar to well DW-7, a decreasing trend is observed at DW-9 since the offsite ISCO pilot test in 2013.



ARCTOS Arctos Environmental		Tesoro - Livermore	BENZENE WITH GROUNDWATER ELEVATIONS AT DW-9	Figure 7
TBL051.xls	7/15/2016			

2017 Investigation

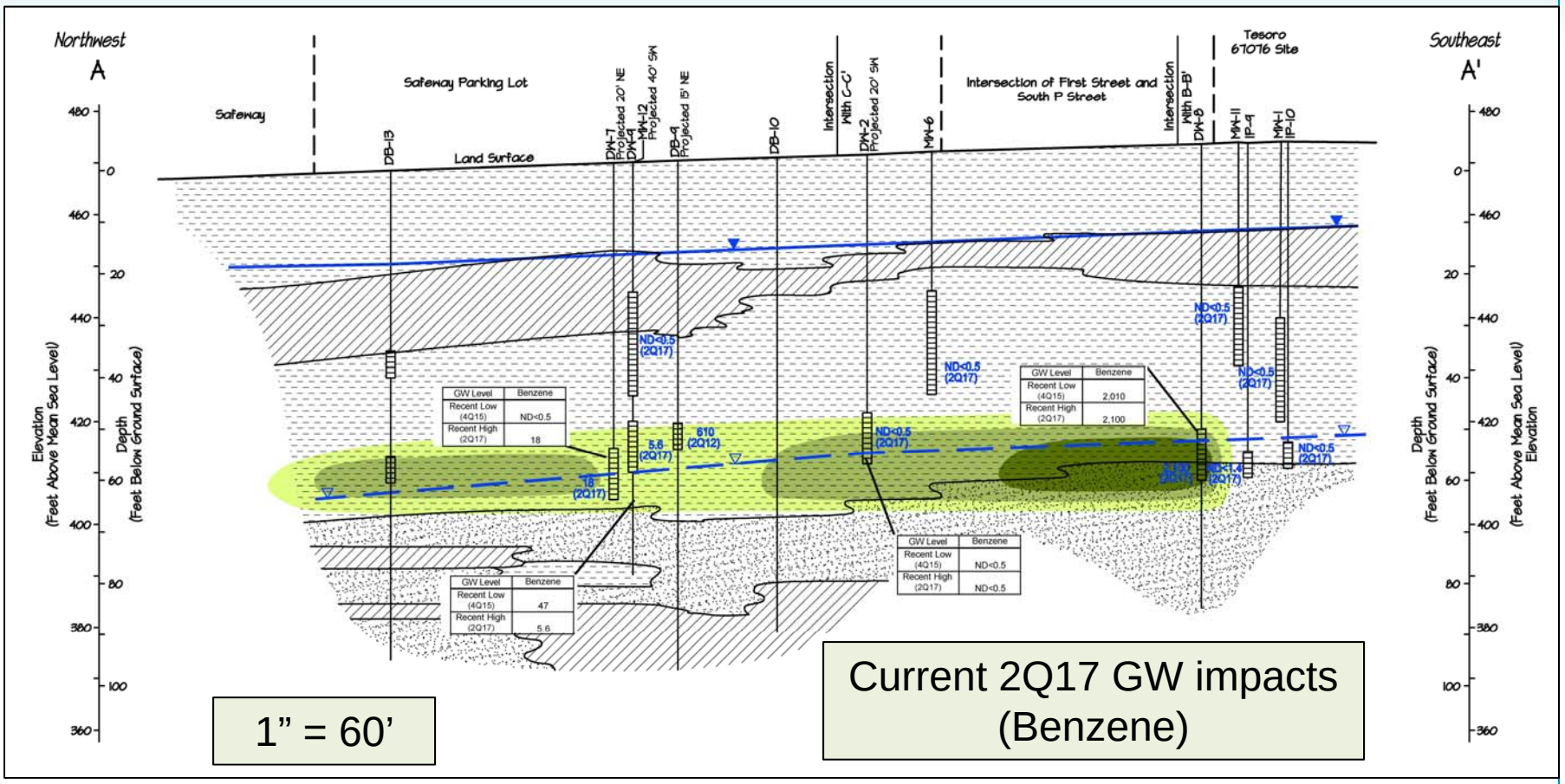
Downgradient GW Sampling



Cross section A-A' was revised to show current dissolved-phase impacts. Shallow impacts have attenuated. Remediation has decreased the magnitude and extent of on- and offsite impacts.

2017 Investigation

Downgradient GW Sampling



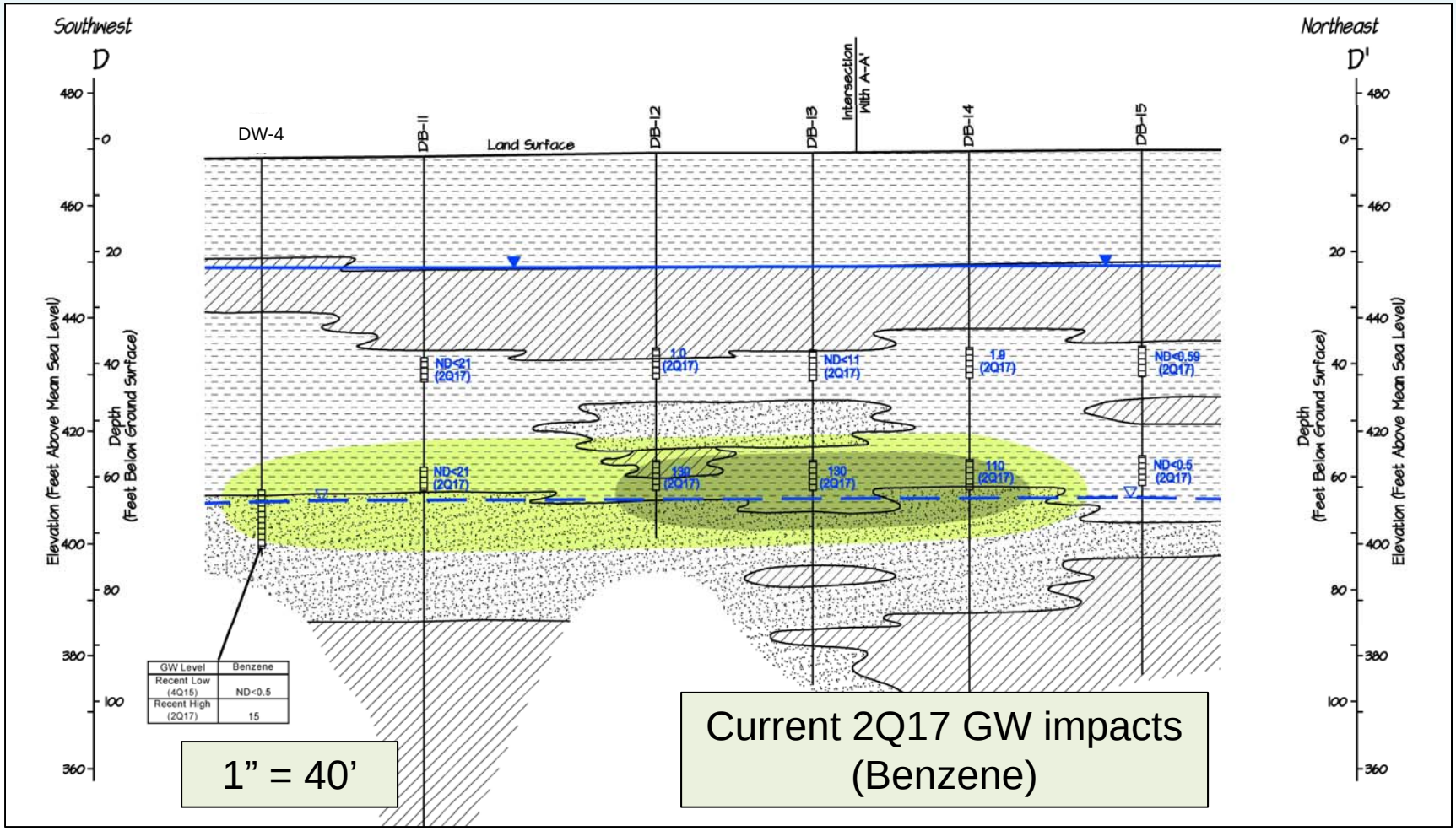
1" = 60'

Current 2Q17 GW impacts (Benzene)

Cross section D-D' is a transect perpendicular to groundwater flow. Well DW-4 delineates the southwest extent of this area of the offsite plume and boring DB-15 delineates the northeast extent. Shallow grab groundwater samples were non-detect or below 2 ug/l.

2017 Investigation

Downgradient GW Sampling



Residual LNAPL near the former USTs was investigated in 2017 based on measureable LNAPL previously detected in an oxygen injection well.

2017 Investigation

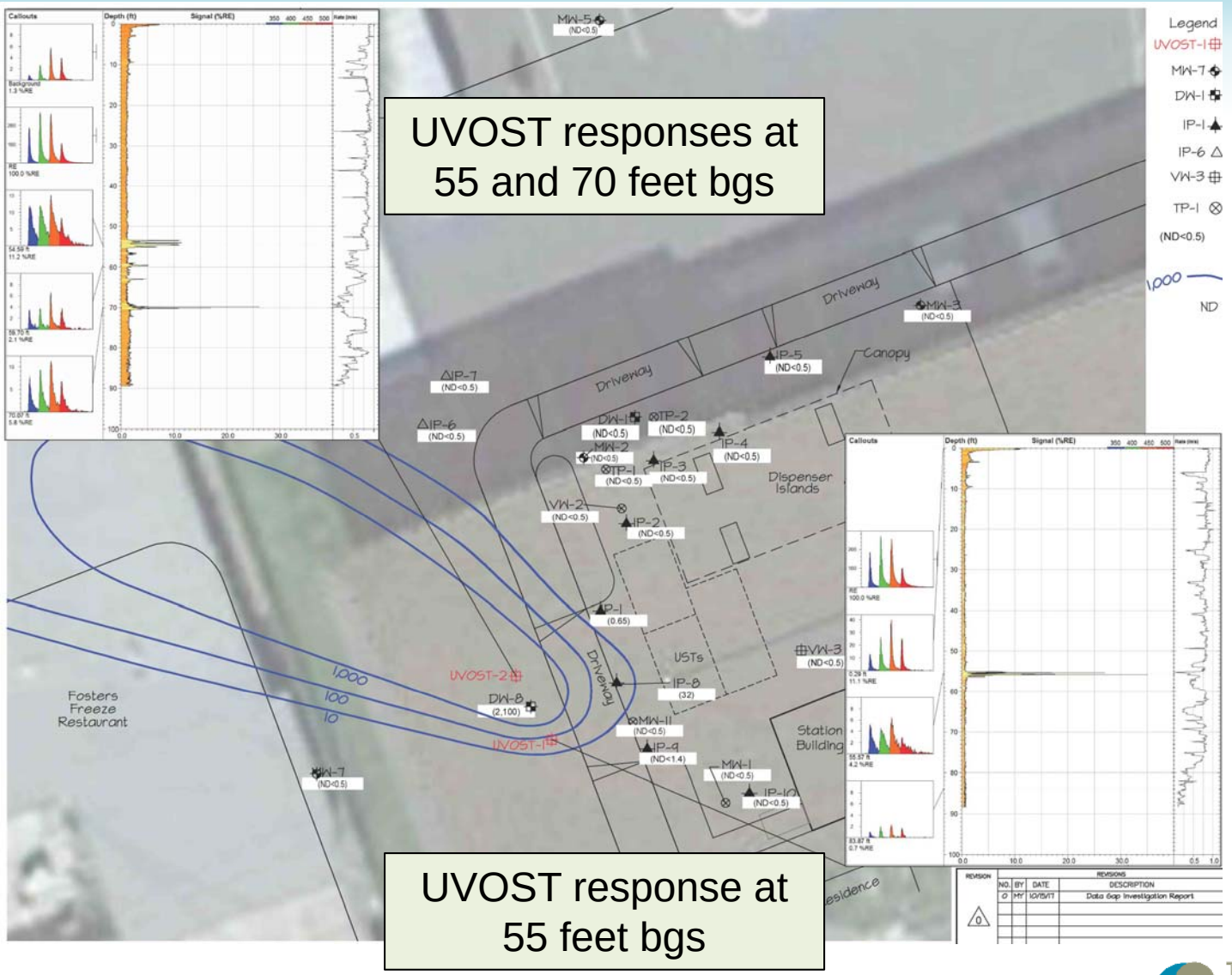
Residual LNAPL Summary

- Approximately 1 foot of LNAPL measured and bailed from injection well IP-8 in October 2010 after startup of oxygen injection system
  - IP-8 screened 60 to 65
  - DTW approximately 37 feet bgs
- In November 2015, GW elevation decreased about 2 feet below top of DW-8 well screen and no LNAPL measured in well
  - DW-8 screened 55 to 65 feet bgs
- Investigation conducted in June and July 2017
  - Advanced two borings to measure CPT and UVOST response
    - Ultra-Violet Optical Screening Tool creates vertical profile of residual NAPL
  - Advanced a third boring to collect soil samples for LNAPL saturation and mobility testing

Peaks in UVOST response indicate the presence of NAPL.

2017 Investigation

UVOST Results

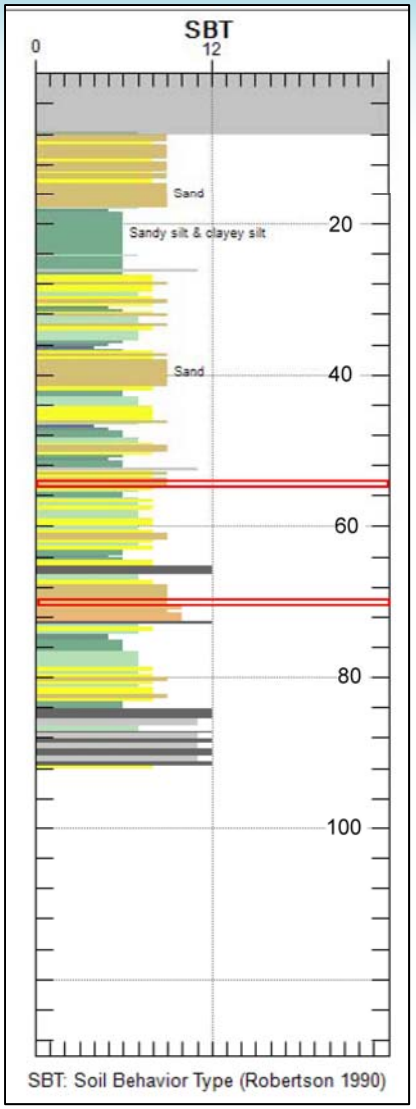


UVOST responses were consistent with previous investigation in the vicinity of the former USTs.

2017 Investigation

CPT Results

- Highest UVOST responses at depths of approximately 55 and 70 feet bgs
- At these depths, soil types were sands underlying finer-grained, silt layers
- These depths are consistent with MIP investigation performed in 2011 and historical soil sampling in the area of the former USTs



Based on UVOST responses, soil samples were collected. PTS Labs tested samples for NAPL saturation.

2017 Investigation

NAPL Mobility Testing

- In July 2017, a boring was advanced adjacent to UVOST-2 using hollow stem auger and soil samples were collected at depths of 55 and 70 feet bgs
- PTS Labs tested soil for initial water and NAPL saturations, centrifuged samples according to ASTM methods, and measured residual water and NAPL saturations

	API RP 40			ASTM D425M, Dean-Stark			
	Density			Initial Fluid Saturations		After Centrifuge at 1000xG	
Sample Depth	Dry Bulk (g/cc)	Grain (g/cc)	Total Porosity (%Vb)	Water Saturation (Swi)	NAPL Saturation (Soi)	Water Saturation (Srw)	NAPL Saturation (Sor)
54-55.5	1.87	2.72	31.0	62.3	3.1	54.2	3.1
69-70.5	1.92	2.74	29.7	66.6	2.1	55.6	2.1

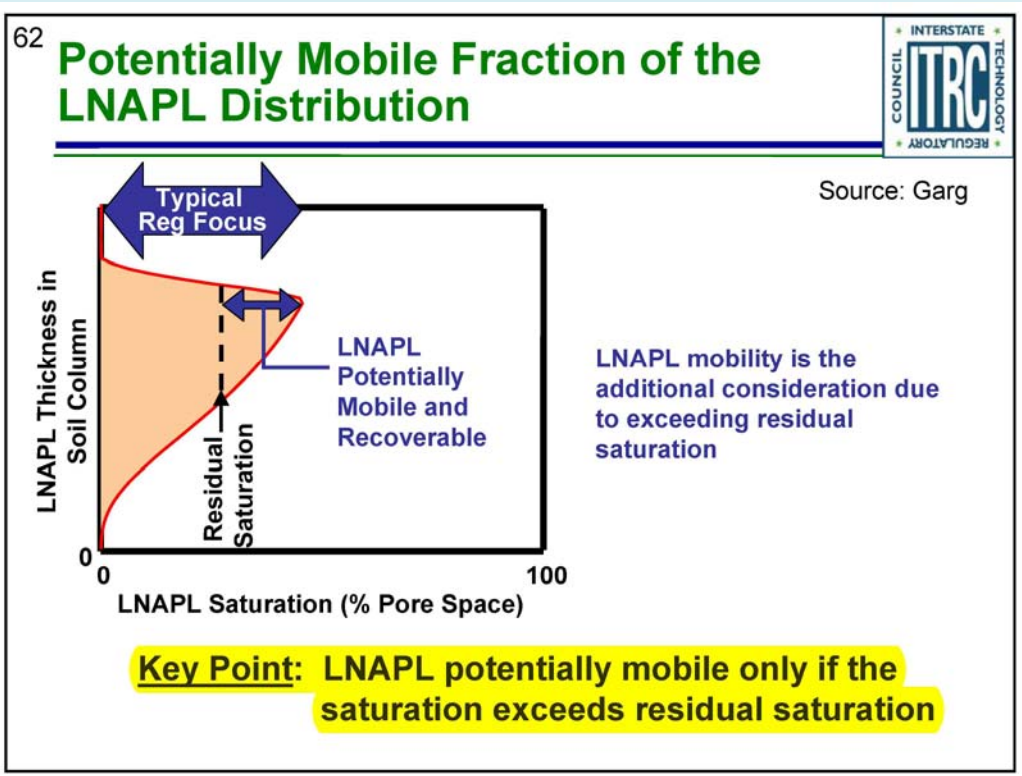
Typical residual saturation values are determined based on soil types. For sands, residual saturation is typically 5%.

Initial saturation in the samples collected at the depths of highest UVOST response were 2 to 3%. The saturations did not change after centrifuging, and were less than residual saturation, indicating the NAPL present in soil is non-mobile and non-recoverable.

2017 Investigation

NAPL Mobility Testing

- Initial NAPL saturation was low and less than residual saturation
  - Typically 5% for sands (Brady and Kunkel, 2005)
- NAPL is disconnected in pore spaces and immobile
- Supported by observation that NAPL was not measured in DW-8 when GW levels decreased below top of well screen



Current Conditions

Summary

- Benzene was detected at approximately 100 µg/l in deep grab samples at boundary with Safeway
  - Upgradient wells DW-7 and DW-9 show decreasing trends and 2Q17 benzene concentrations are 18 and 6 µg/l
- In vicinity of former USTs, NAPL saturation was below residual saturation indicating NAPL is not mobile nor recoverable
- Remediation on site near former source areas has decreased plume magnitude and lateral extent
  - Oxygen injection is no longer warranted
- Remediation off site has decreased plume mass
- Site meets LTCP category 5 criteria and does not pose risk to receptors

Plume Stability and Trends

Joe Ricker (EarthCon Consultants) evaluated plume stability using all historical data available for TPHg, BTEX, MTBE, and TBA. Results indicated that significant reductions in COC mass and plume extent have occurred. Fluctuations in the plume center of mass over time indicate that mass reductions are due to attenuation and not migration of impacts downgradient. COC reductions on site have reached asymptotic levels indicating the onsite remediation system is no longer warranted.

The complete plume stability analysis will be sent to ACEH.