Welcome

Environmental Advisory Board Meeting

Robins Air Force Base

February 13, 2020

Welcome and Program Introduction

Laurel Cordell
EAB Manager

Acronyms and Abbreviations

- 3-D – 3-Dimensional
- AS – Air Sparging
- AST – Aboveground Storage Tank
- BDL – Below Detection Limit
- CAO – Corrective Action Objectives
- CAP – Corrective Action Plan
- CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
- COC – Contaminant of Concern
- CSM – Conceptual Site Model

Acronyms and Abbreviations

- CT – Carbon Tetrachloride
- DPT – Direct Push Technology
- ERD – Enhanced Reductive Dechlorination
- ERP – Environmental Restoration Program
- EVS – Earth Volumetric Studio
- GBIA – Greater Base Industrial Area
- HVE – High Vacuum Extraction
- iSOC – In Situ Submerged Oxygen Curtain
- ISCO – In Situ Chemical Oxidation
- ISTT – In Situ Thermal Treatment

Acronyms and Abbreviations

- ITRC – Interstate Technology & Regulatory Council
- $KMnO_4$ – Potassium Permanganate
- LNAPL – Light Non-Aqueous Phase Liquid
- MNA – Monitored Natural Attenuation
- MPE – Multi-Phase Extraction
- µg/L – microgram per liter
- OES – Optimized Exit Strategy
- O&M – Operation and Maintenance
- OM&M – Operation, Maintenance, and Monitoring
- PCE – Tetrachloroethene

Acronyms and Abbreviations

- RC – Response Complete
- RCRA – Resource Conservation and Recovery Act
- RFI – RCRA Facility Investigation
- RL – Remediation Level
- SSI – Supplemental Site Investigation
- SVE – Soil Vapor Extraction
- SWMU – Solid Waste Management Unit
- TCE – Trichloroethene
- VOC – Volatile Organic Compound

Environmental Advisory Board

Update on Progress at Select Restoration Sites

Mike Perlmutter, P.E.,
Technical Lead
Jacobs

Adam Forsberg
Hydrogeologist
Jacobs

February 13, 2020

Site Updates

- **Solid Waste Management Unit (SWMU) 62 (OT037)**
- **SWMU 47 (CG504)**
- **SWMU 36 (DC034)**

Environmental Advisory Board

SWMU 62
(OT037)
Update on Progress

Mike Perlmutter, P.E.
Technical Lead
Jacobs

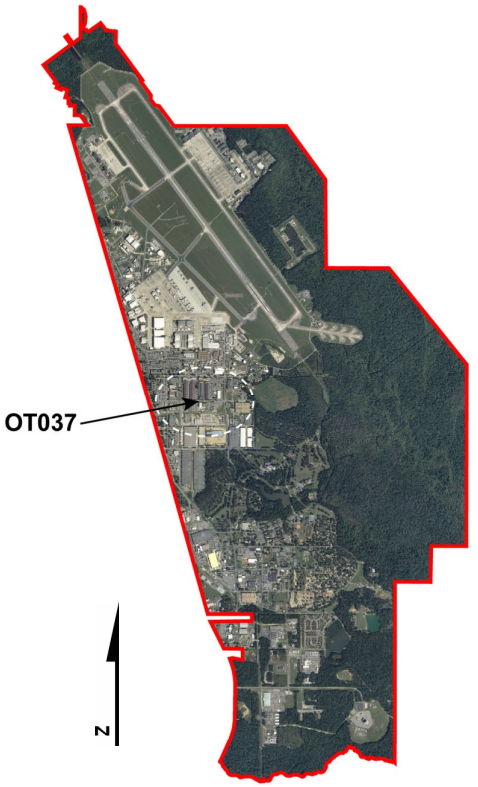
February 13, 2020

Overview

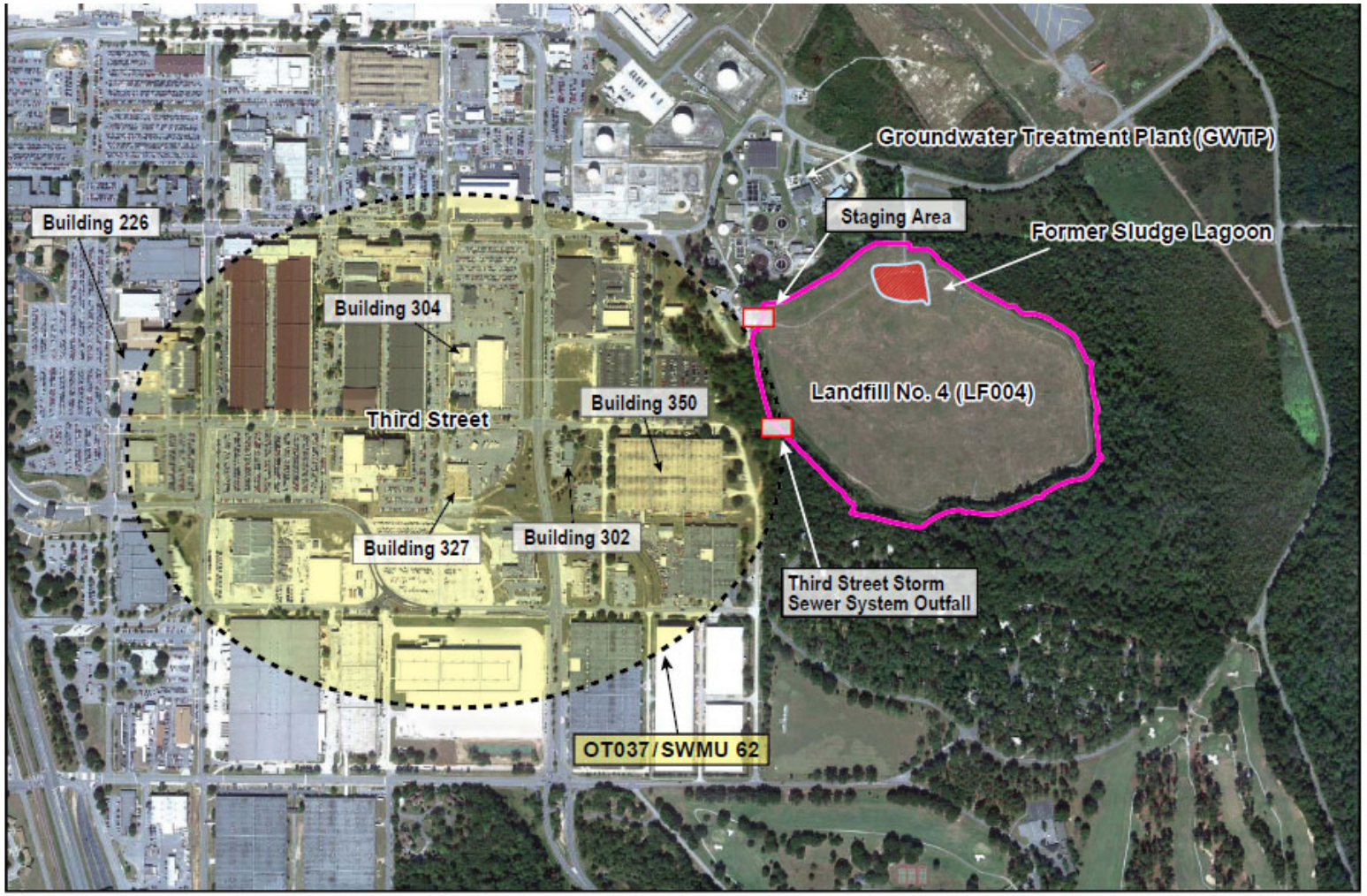
- Background
- Site location
- Remediation progress
- Path forward

Background

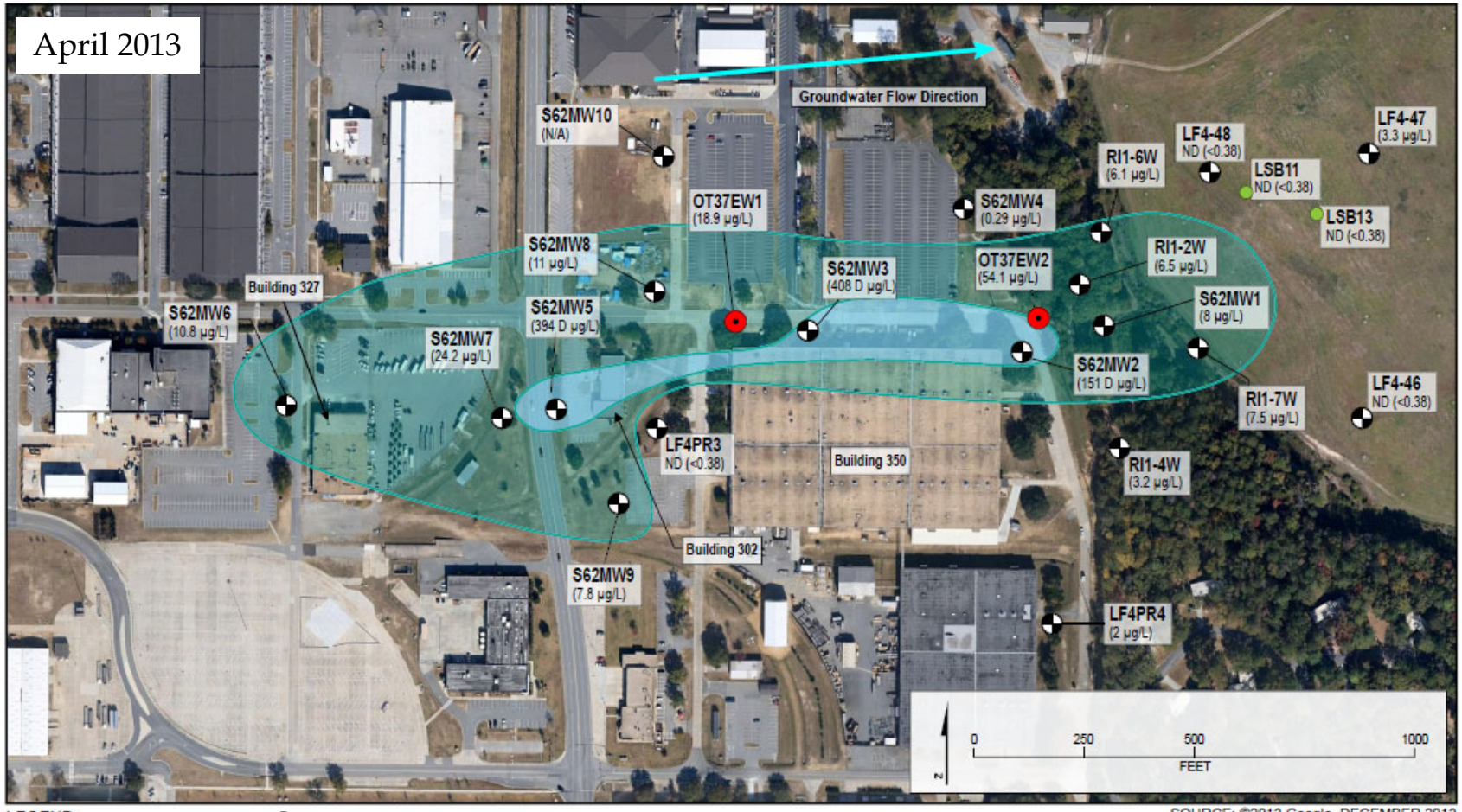
- Primary contaminants of concern in groundwater are tetrachloroethene (PCE), trichloethene (TCE), and carbon tetrachloride (CT)
- Originally identified in 1990, the groundwater plume is associated with a 48-inch storm sewer outfall (Third Street outfall) and other potential sources in the area
- Original remedy implemented in 2001
  - Groundwater extraction using two recovery wells
- Contract objective: Response Complete (RC) → Remediation Levels (RLs) at every site monitoring well



Site Location



Remediation Progress



SOURCE: ©2013 Google, DECEMBER 2013

LEGEND

- MONITORING WELL
- EXTRACTION WELL
- SURFICIAL WELL
- APPROXIMATE DIRECTION OF GROUNDWATER FLOW

TCE

- 5 µg/L
- 100 µg/L

NOTES:

1. µg/L = CONCENTRATIONS IN MICROGRAM(S) PER LITER
2. NO. = NUMBER
3. SWMU = SOLID WASTE MANAGEMENT UNIT
4. THE PLUME SHOWN ON THIS FIGURE DEPICTS THE TRICHLOROETHENE CONCENTRATIONS DURING APRIL 2013.

DATA QUALIFIERS:

1. D = THE RESULT IS FROM A DILUTED ANALYSIS.
2. N/A = NOT AVAILABLE; WELL INSTALLED IN JUNE 2013; THEREFORE, NO DATA ARE AVAILABLE.
3. ND = NOT DETECTED, VALUE SHOWN IS METHOD DETECTION LIMIT

Remediation Progress

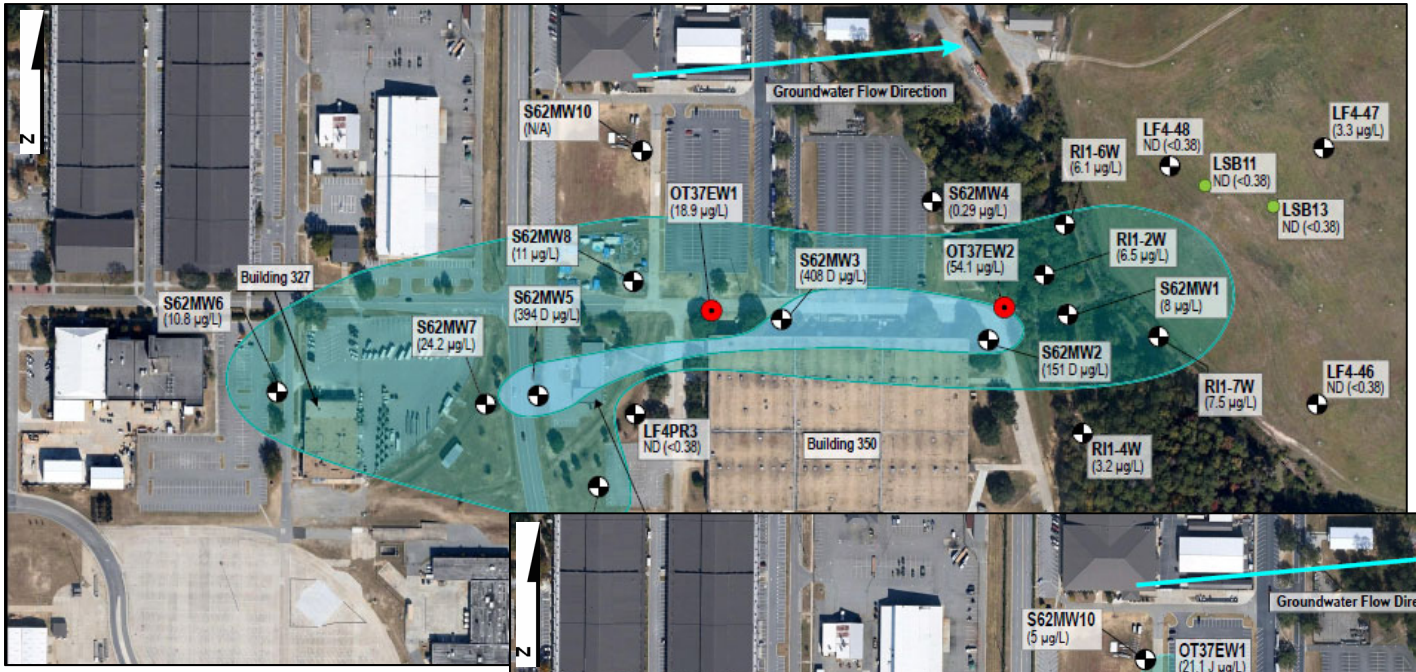
- New remedy implemented in 2013
  - Groundwater extraction wells shut down
  - In situ chemical oxidation (ISCO) using potassium permanganate ($KMnO_4$)
  - Injected 240,000 gallons of 3 percent $KMnO_4$ in 22 injection wells in May and June

Oxidant Injection

Oxidant Injection

Remediation Progress

Remediation Progress



Pre-ISCO
(April 2013)

LEGEND

TCE

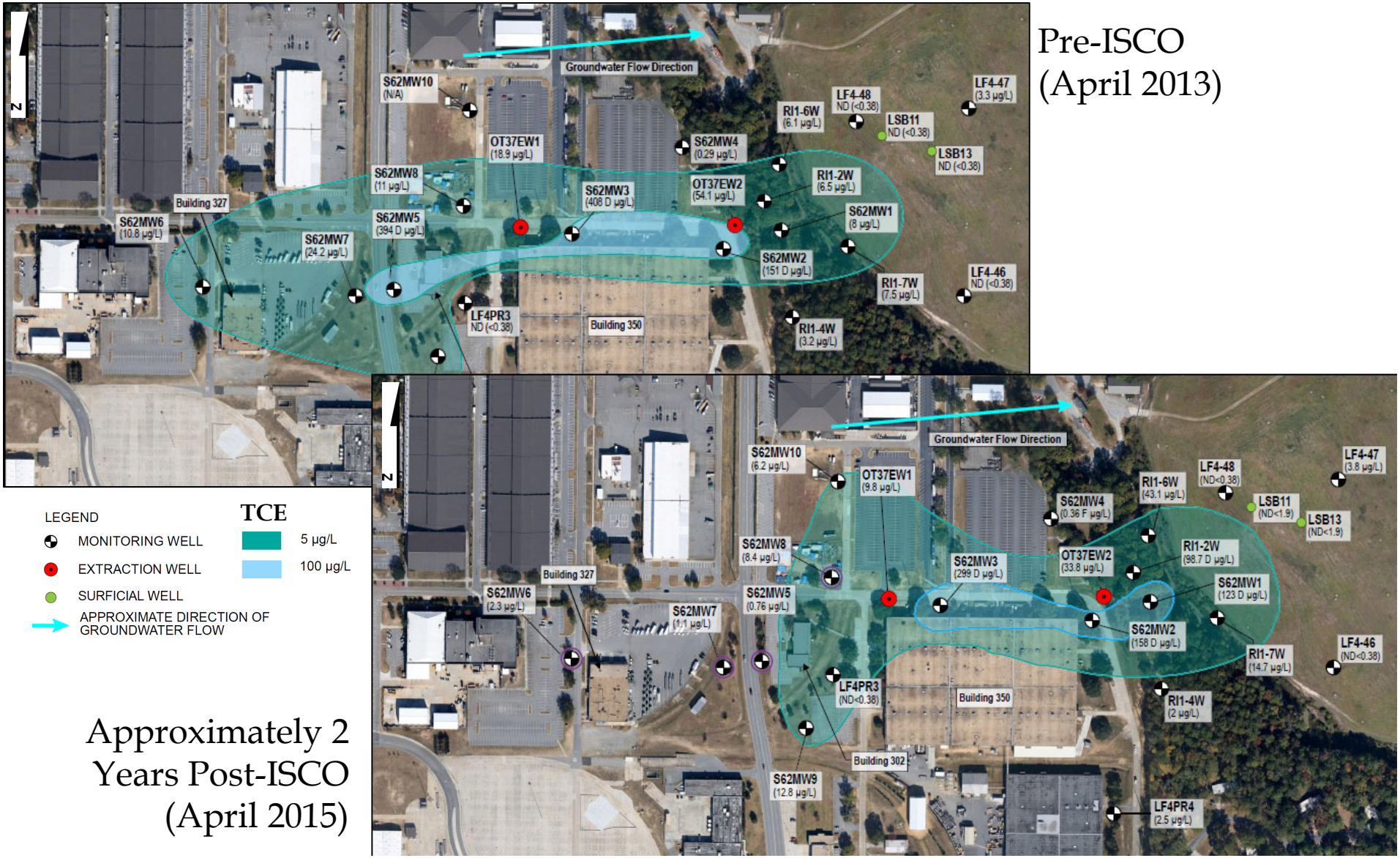
- MONITORING WELL
- EXTRACTION WELL
- SURFICIAL WELL
- APPROXIMATE DIRECTION OF GROUNDWATER FLOW

5 µg/L

100 µg/L

Approximately 1
Year Post-ISCO
(April 2014)

Remediation Progress

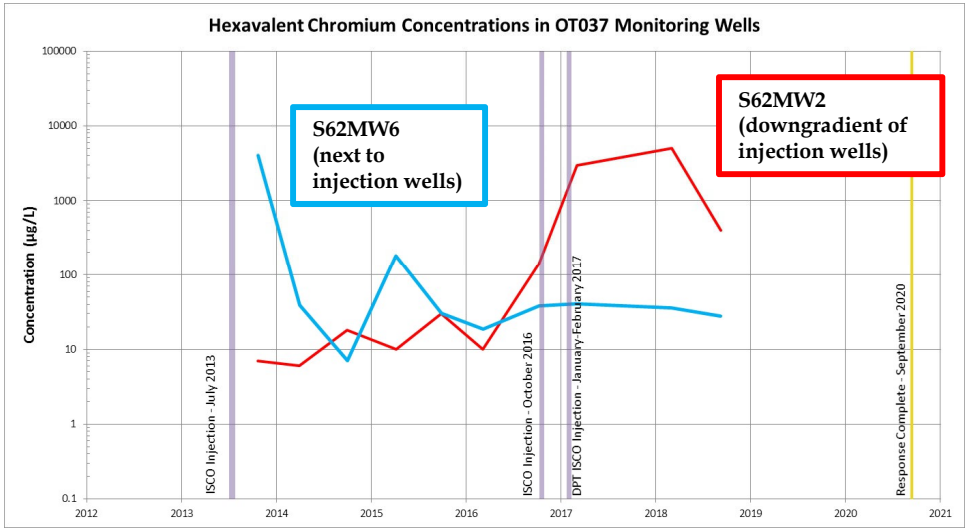


Pre-ISCO
(April 2013)

Approximately 2
Years Post-ISCO
(April 2015)

Remediation Progress

- ISCO can mobilize naturally present metals due to redox changes
- Metals concentrations increased after the first injection and then gradually decreased

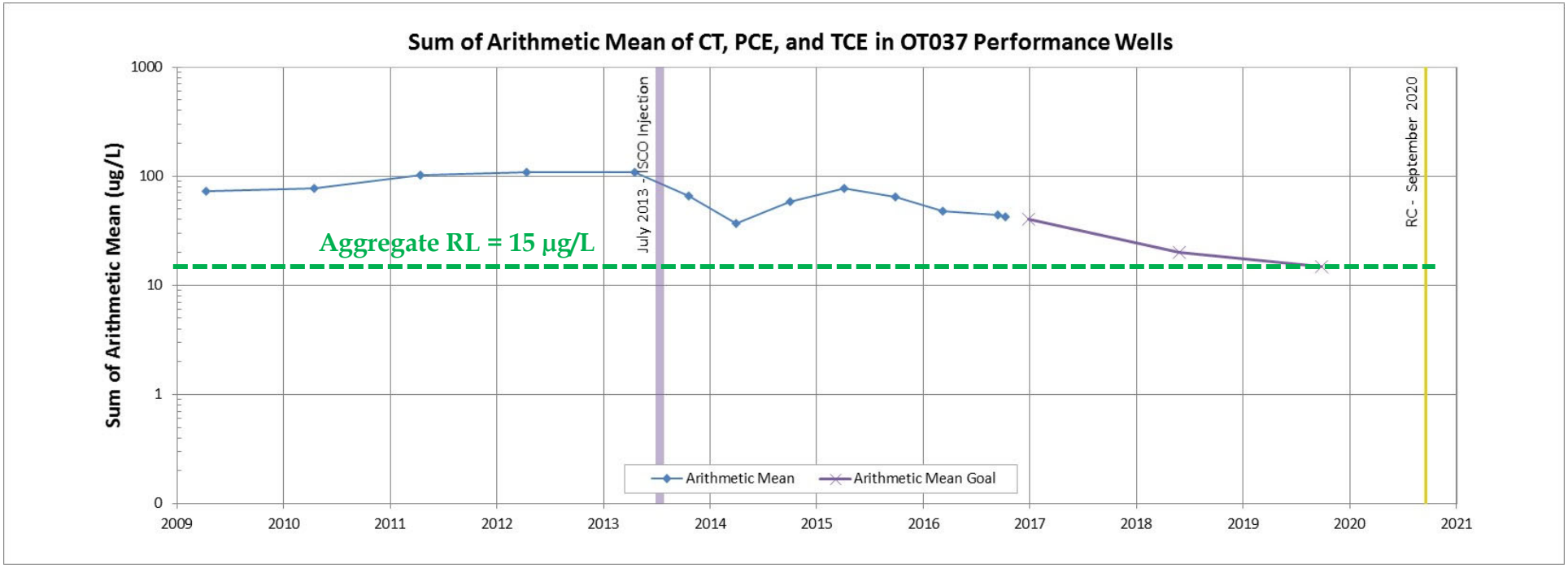


Remediation Progress

- **Initial performance metrics**
  - **Gradual reduction in TCE concentrations at S62MW1, S62MW2, S62MW3, S62MW5, and S62MW6**
  - **Achieve RLs by 2020**
- **Performance metrics revised in 2015**
  - **Reduce the sum of CT, PCE, and TCE concentrations at each of 17 performance monitoring wells by 50 percent as compared to April 2015**
  - **Reduce the sum of CT, PCE, and TCE concentrations at each of 17 performance monitoring wells by 75 percent as compared to April 2015**
  - **Achieve CT, PCE, and TCE RLs at each of 17 performance monitoring wells**

Remediation Progress

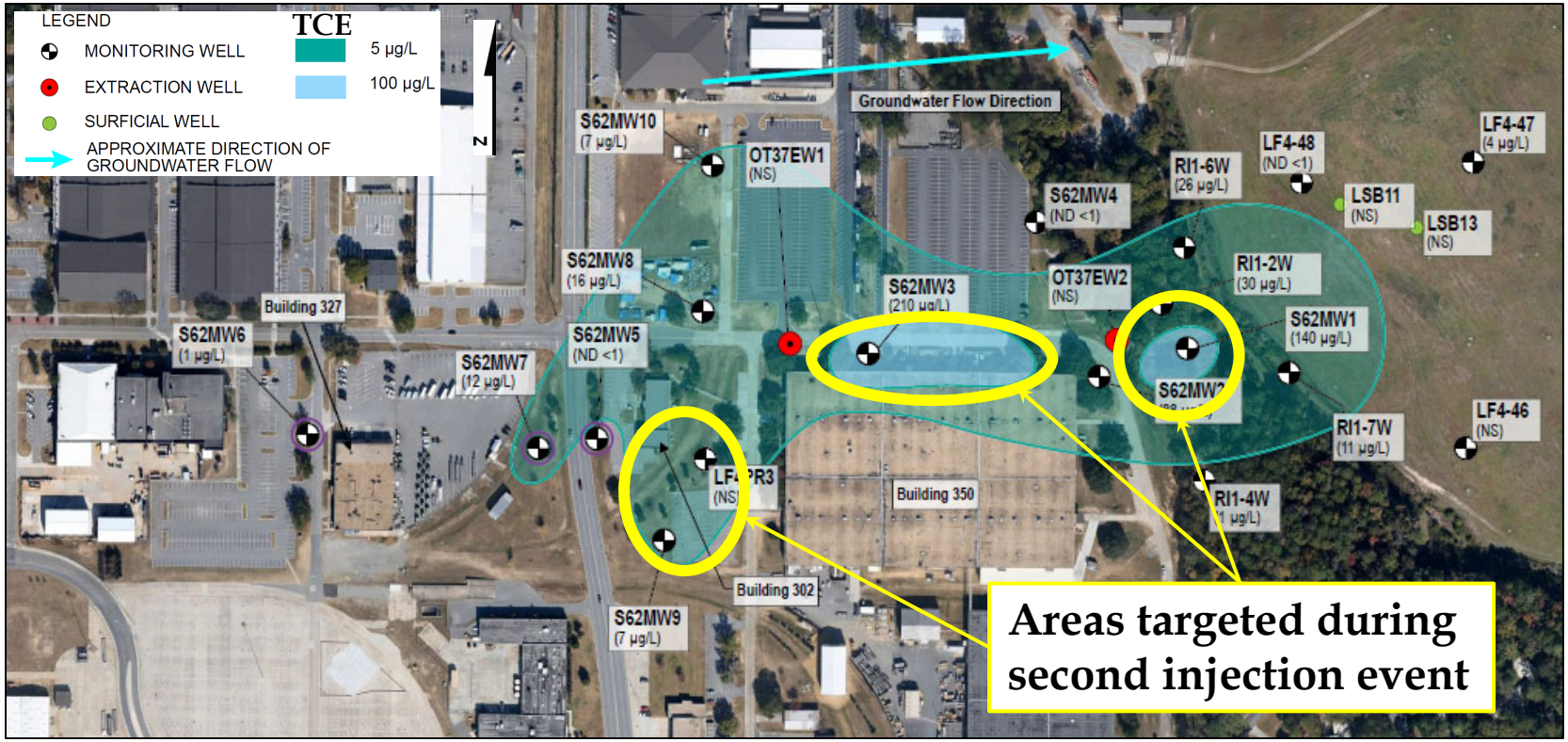
- **Aggregate trends**



*Data from 17 wells used to assess remediation progress

Remediation Progress

- **Implementation of second ISCO injection event to address recalcitrant areas**



Remediation Progress

- **Second injection event included two phases:**
  - **October 2016: Injection into four existing injection wells to target areas within the original injection well network**
    - 60,000 gallons of 1.5% $KMnO_4$ solution
  - **February 2017: Injection into nine direct push technology (DPT) locations to target areas outside the original injection well network**
    - 45,000 gallons of 2% $KMnO_4$ solution injected upgradient of RI1-2W and S62MW1

Location	Screen Interval (feet bgs)	Treatment Volume (gallons)	$KMnO_4$ (lbs)
T3IW1	48 – 58	15,000	2,000
T3IW2	48 – 58	15,000	2,000
T5IW1	46 – 56	15,000	2,000
T5IW2	40 – 50	15,000	2,000
IP-01	47 – 57	5,000	1,200
IP-02	47 – 57	5,000	1,200
IP-03	30 – 40	5,000	1,200
IP-04	30 – 40	5,000	1,200
IP-05	30 – 40	5,000	1,200
IP-06	30 – 40	5,000	1,200
IP-07	30 – 40	5,000	1,200
IP-08	30 – 40	5,000	1,200
IP-09	30 – 40	5,000	1,200
Total	—	105,000	18,800

Remediation Progress

Addition of dry $KMnO_4$ to prepare 1.5% oxidant solution

1.5% oxidant solution secondary containment during injection

Remediation Progress

Current Status

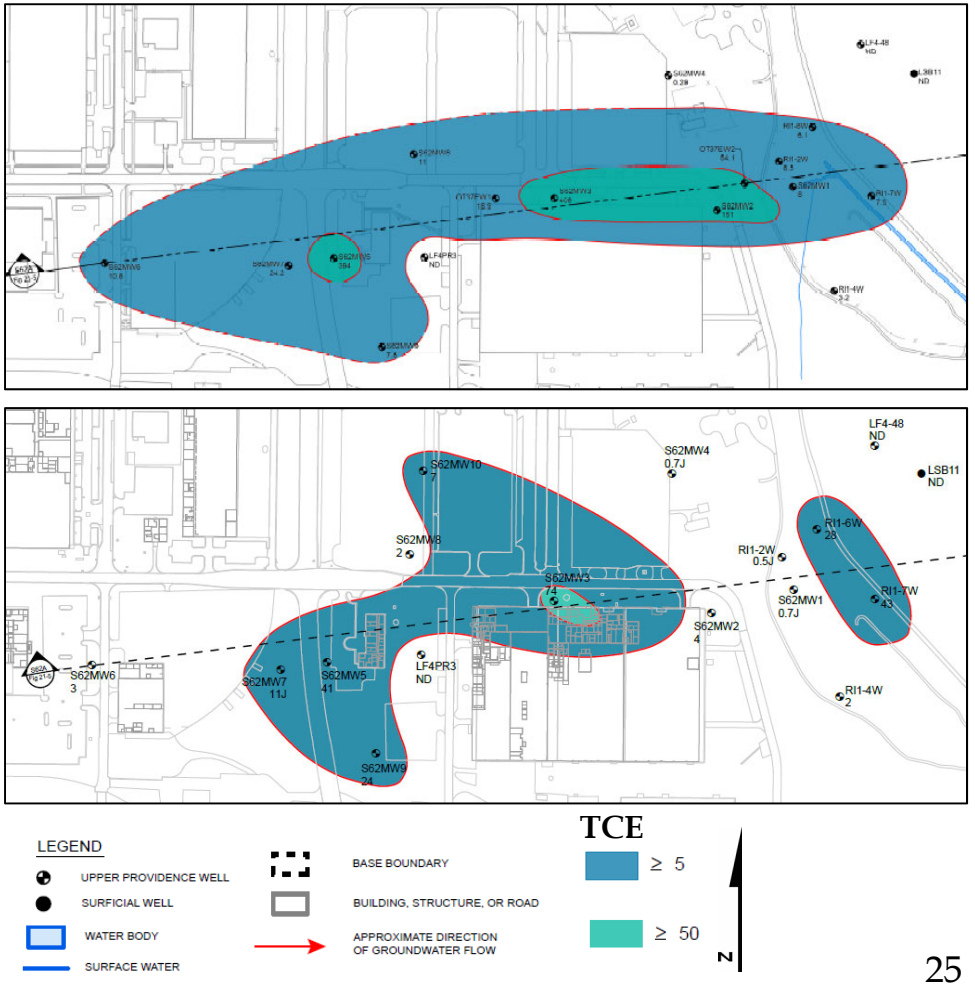
Performance Metrics

- Wells at 50% reduction (or RLs): 8 of 17
- Wells at 75% reduction (or RLs): 7 of 17
- Wells at RLs: 4 of 17

Overall Progress since 2013

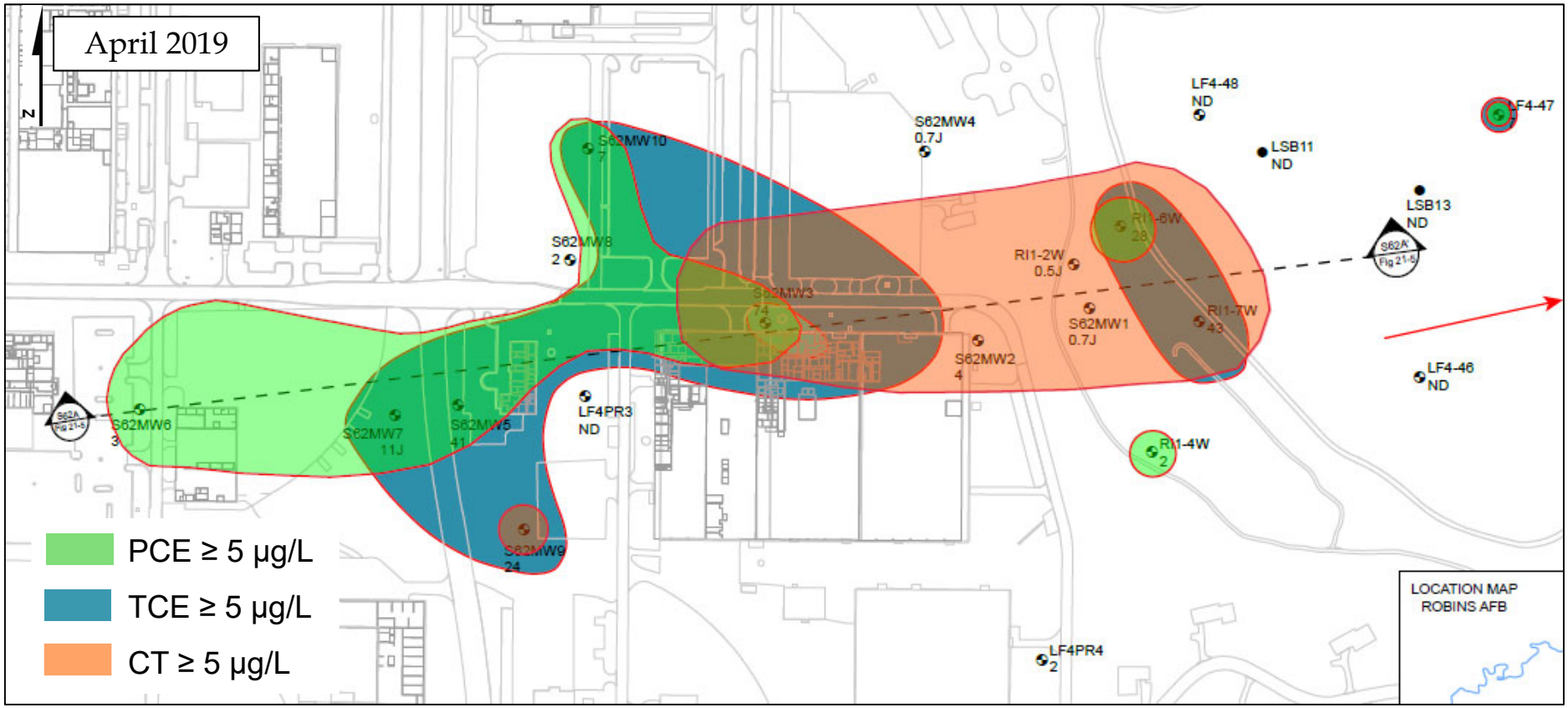
- Average PCE concentration reduced by 70 percent
- Average TCE concentration reduced by 85 percent
- Average CT concentration reduced by 70 percent

- TCE plume from 2013 to 2019



Current Status

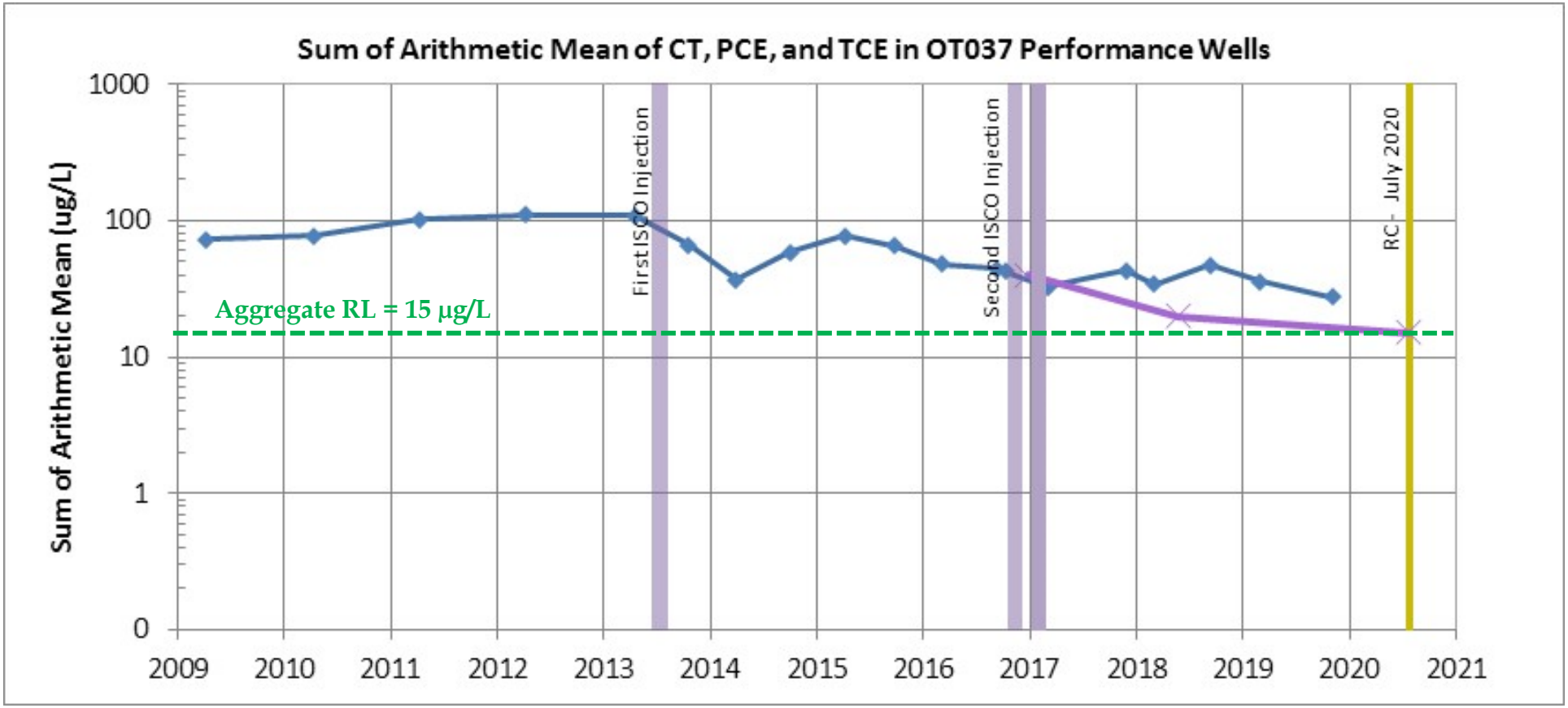
- **Current extent of PCE, TCE, and CT exceedances**



Remediation Progress

- **Aggregate trends**

*Data from 17 wells used to assess remediation progress



Path Forward

- Continue semiannual groundwater sampling
- Continue to evaluate permanganate persistence following second injection event
- Not likely to achieve RLs by end of current contract
  - Remedy optimization during next contract

Environmental Advisory Board

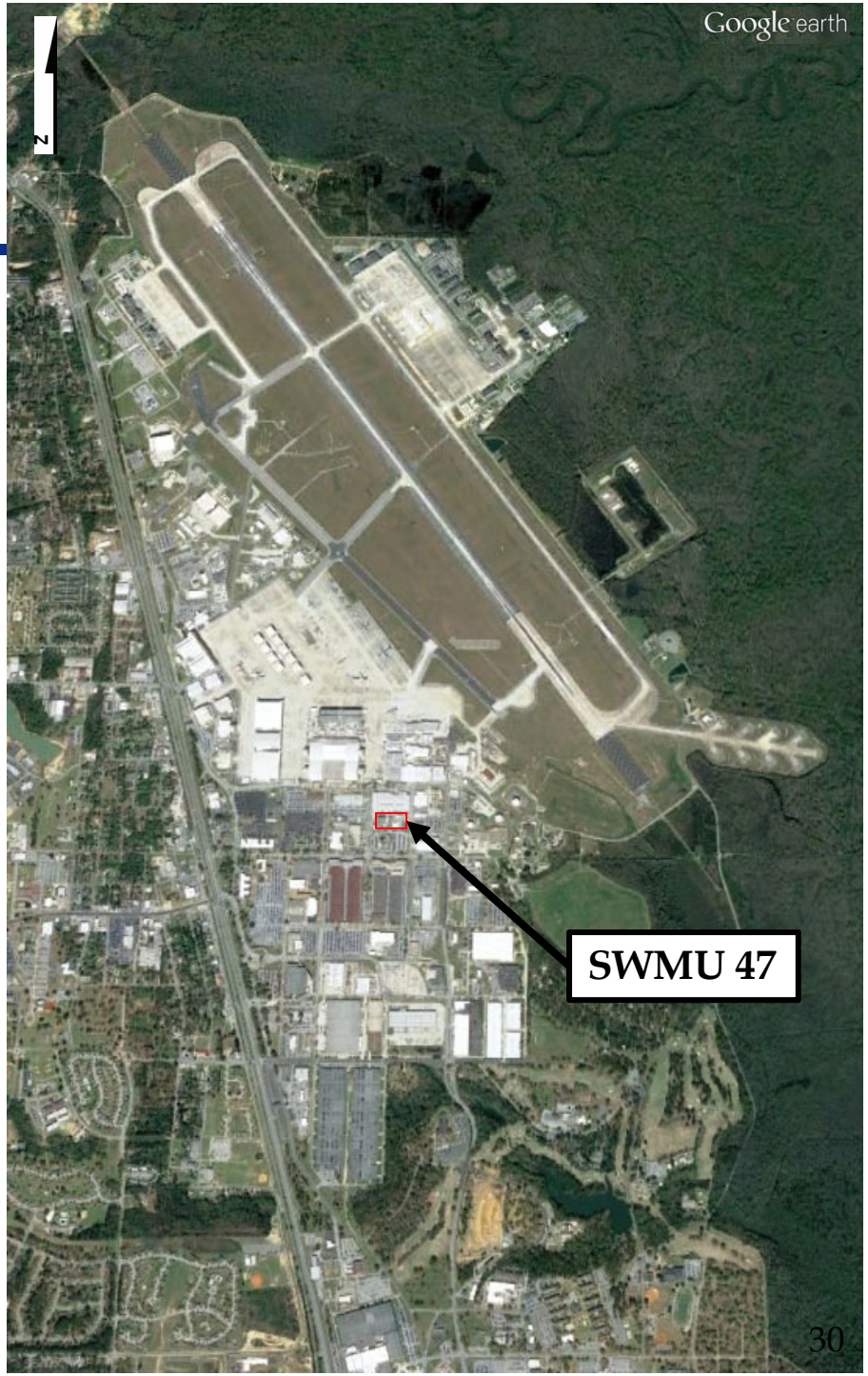
SWMU 47
(CG504)
Update on Progress

Mike Perlmutter, P.E.
Technical Lead
Jacobs

February 13, 2020

Overview

- Background
- Site layout
- Remediation progress
- Light non-aqueous phase liquid (LNAPL) assessment
- Current Optimized Exit Strategy (OES)
- Groundwater status
- Engineering evaluation
- Path forward



Background

- SWMU 47 is located east of Building 177 in vicinity of 250,000-gallon aboveground storage tank (AST) that contains No. 2 diesel fuel
- Building 177 is a steam plant that supports Greater Base Industrial Area (GBIA) and other areas

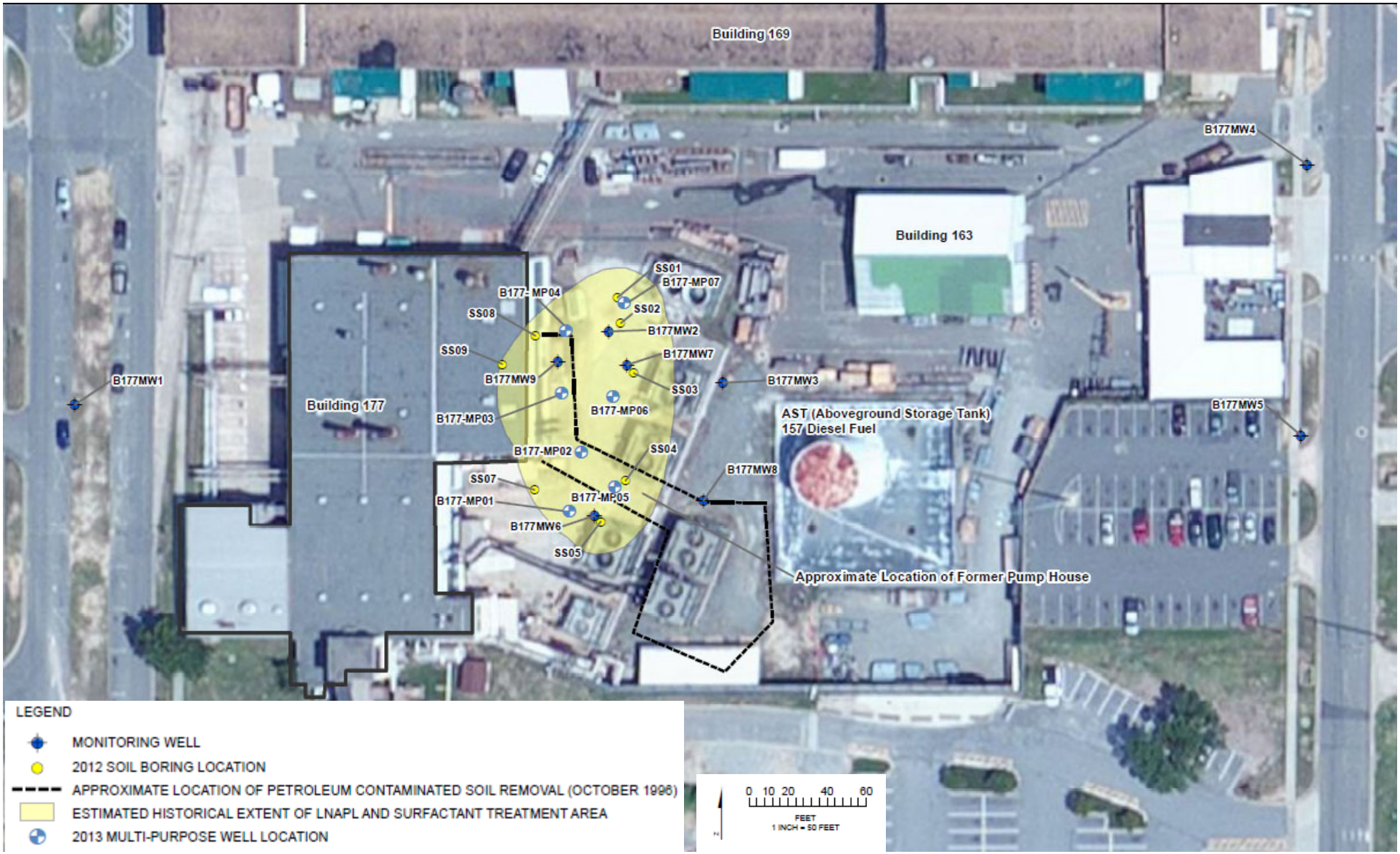
Background

- AST is connected to Base's tank farm, approximately 1,000 feet east, by an underground pipeline
- In 1996, petroleum-contaminated soil was encountered by contractors during upgrades made to AST containment dike and fuel lines
- Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) completed in 1997

Background

- 2003 Corrective Action Plan (CAP)
  - LNAPL recovery using dual-phase extraction
  - Biosparging
- 2012 CAP Addendum
  - Continued LNAPL recovery
  - Surfactant flushing using biodegradable surfactant that will promote mobilization, solubilization, and recovery of LNAPL
  - Excavation of arsenic-impacted soil
  - Sample soil to assess extent of hexavalent chromium
- Current contract objective: OES

Site Layout


Building 169
Building 163
Building 177
B177MW4
B177MW1
B177MW2
B177MW3
B177MW5
B177MW6
B177MW7
B177MW8
B177MW9
B177-MP01
B177-MP02
B177-MP03
B177-MP04
B177-MP05
B177-MP06
B177-MP07
SS01
SS02
SS03
SS04
SS05
SS07
SS08
SS09
AST (Aboveground Storage Tank)
157 Diesel Fuel
Approximate Location of Former Pump House
LEGEND
MONITORING WELL
2012 SOIL BORING LOCATION
APPROXIMATE LOCATION OF PETROLEUM CONTAMINATED SOIL REMOVAL (OCTOBER 1996)
ESTIMATED HISTORICAL EXTENT OF LNAPL AND SURFACTANT TREATMENT AREA
2013 MULTI-PURPOSE WELL LOCATION
0 10 20 40 60
FEET
1 INCH = 50 FEET

Remediation Progress

- Fall 2013: Surfactant flushing using biodegradable surfactant and recovery of LNAPL
- November 2013: Excavation of 45 cubic yards of arsenic-impacted soil
- Early 2014 to June 2017: Installed and operated groundwater extraction and treatment system to remove LNAPL and dissolved-phase contamination

Remediation Trailer (↑) and LNAPL Collection Tank (↓)

Soil excavation

Remediation Progress

- **Remediation quantities**
  - **More than 12 million gallons of groundwater extracted, treated, and discharged to Base wastewater treatment plant through June 2017**
    - Equal to approximately 30 to 40 pore volumes
  - **Nearly 625 gallons of LNAPL recovered**
    - 175 from the surfactant flushing event in Fall 2013
    - 450 from groundwater extraction and treatment or manual recovery

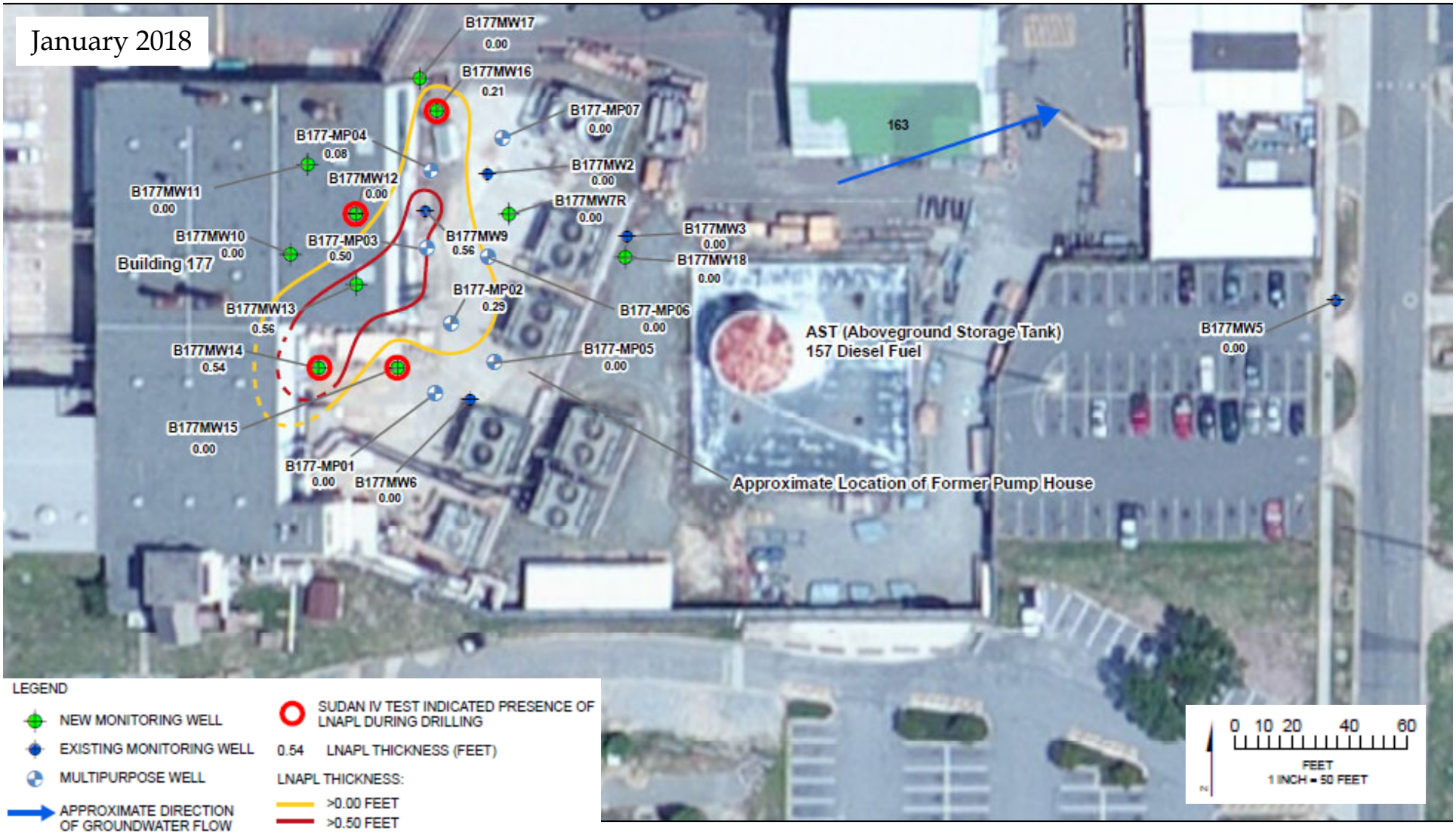
Remediation Progress

- **Supplemental Site Investigation (SSI)**
  - **Objectives were to: (1) fully delineate LNAPL; and (2) assess whether LNAPL is migrating from underneath Building 177**
- **Well installation activities conducted between September 14 and December 21, 2017**
  - **Soil screening with Sudan IV dye to assist with well placement**
- **Weekly LNAPL gauging through January 2018**

Positive result

Negative result

LNAPL Assessment



LNAPL Assessment

- During SSI, LNAPL was detected at:
  - One monitoring well inside Building 177 (B177MW13)
  - Three monitoring wells outside Building 177 (B177MW9, B177MW14, and B177MW16)
  - Three multipurpose wells outside Building 177 (B177-MP02, B177-MP03, and B177-MP04)
- The maximum LNAPL thickness:
  - Inside Building 177 – 0.63 foot (B177MW13)
  - Outside Building 177 – 0.94 foot (B177-MP02)
  - In 2013 – 7+ feet (B177-MP03)

LNAPL Assessment

- LNAPL samples were collected from B177-MP03, B177MW13, and B177MW14 on February 7, 2018
- Shipped to Eurofins Lancaster Laboratories Environmental, LLC in Lancaster, Pennsylvania for fuel typing
- Findings
  - All three samples were most similar to the reference standard for diesel fuel
  - LNAPL did not appear to be weathered

LNAPL Assessment

- **A second LNAPL sample was collected from B177-MP03 on March 26, 2018 to confirm that the LNAPL is not the result of an ongoing leak from the AST, which contains diesel fuel**
  - **A sample was also collected from the AST for comparison**
  - **Collected in unpreserved 40-milliliter glass vials and shipped to NewFields in Rockland, Massachusetts for chemical fingerprinting and sulfur analysis**

LNAPL Assessment

- **Findings**
  - Both samples were relatively unweathered diesel fuel (Figure 1)
  - However, sulfur content for LNAPL is consistent with high sulfur diesel fuel while sample from AST is consistent with an ultra-low sulfur diesel fuel (Figure 2)
  - Therefore, LNAPL in site monitoring wells at SWMU 47 is not resulting from an ongoing leak from AST

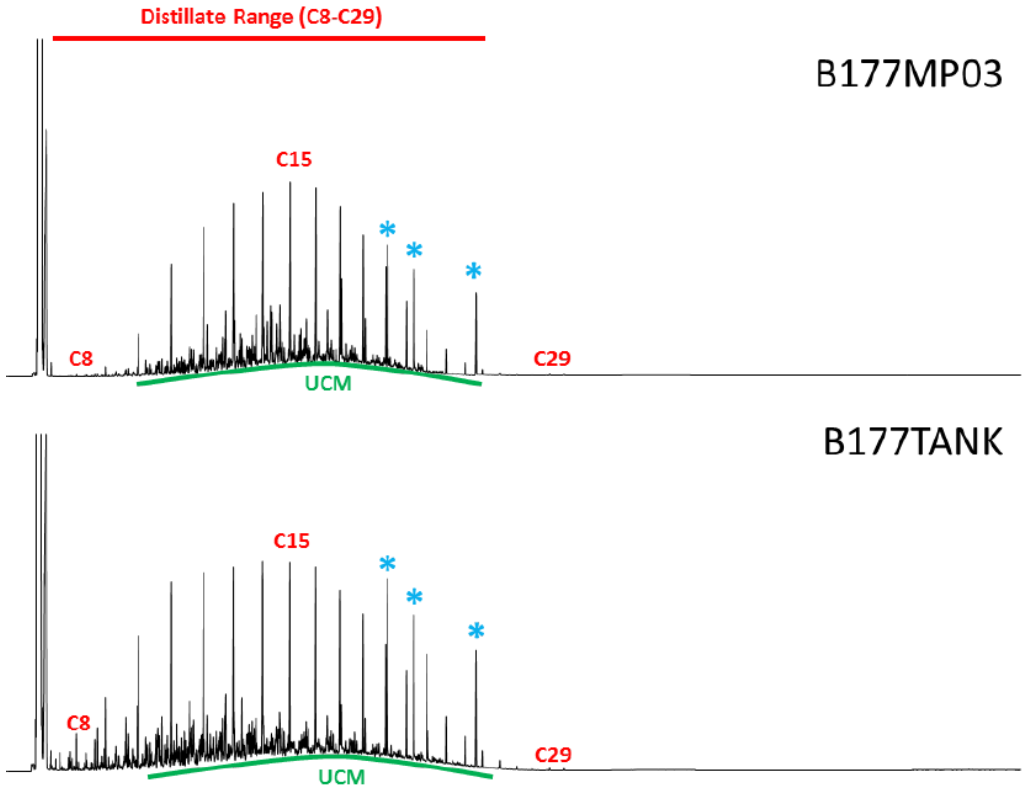


Figure 1. GC/FID fingerprints of the study samples:
a) B177MP03
b) B177TANK
'*': laboratory-added internal standard

LNAPL Assessment

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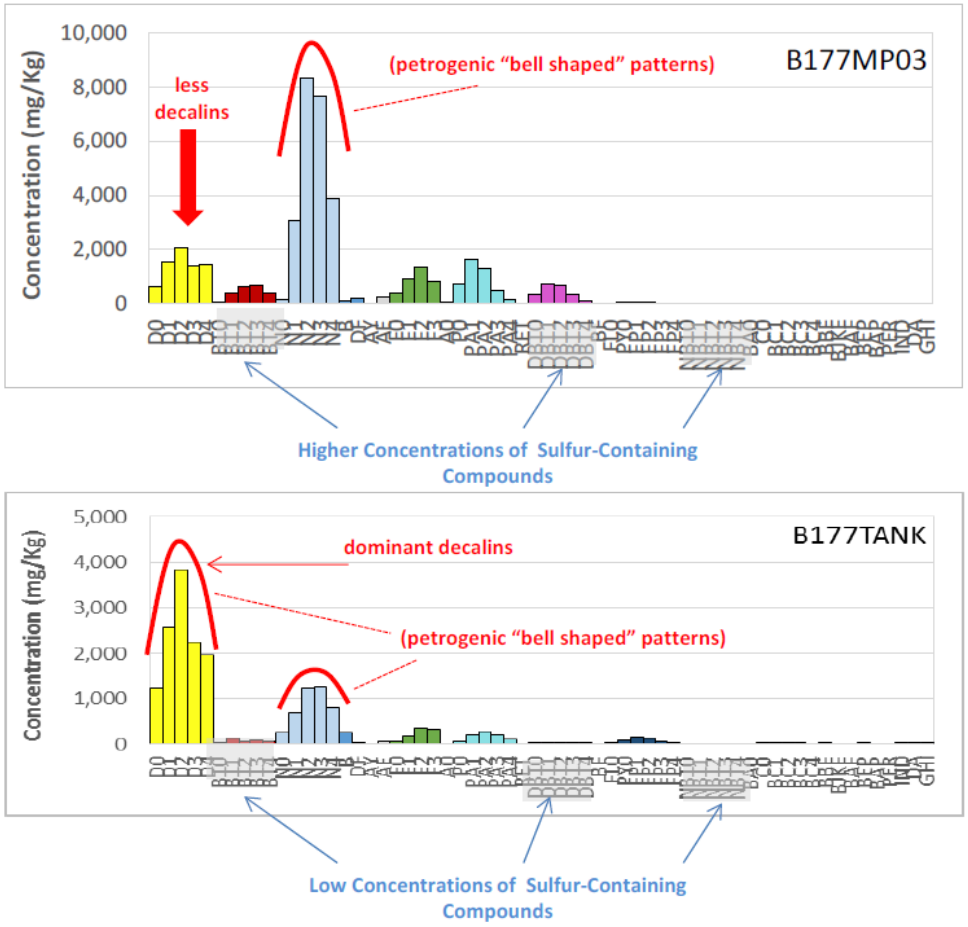


Figure 2. Compositional Analysis of Field Samples (PAH histograms)
a) B177MP03
b) B177TANK

Current OES

- **OES plan approved by the Air Force in August 2019**
- **Performance objectives**
  - **High vacuum extraction (HVE)**
    - Four quarterly HVE events (3Q19, 4Q19, 1Q20, and 2Q20) at the monitoring and multi-purpose wells with measurable LNAPL
    - Each HVE event will be tailored to site based on most recent gauging data; however, events are expected to consist of 8 hours of extraction at up to 5 wells
  - **LNAPL monitoring**
    - Site monitoring and multi-purpose wells gauged with an oil-water interface probe monthly between July 2019 and June 2020
    - If detected, LNAPL is removed with a peristaltic pump, bailer, or absorbent sock

Current OES

- **HVE results**
  - On August 30, removed 16 equivalent gallons of hydrocarbons from MW9, MW16, and MP-03
  - On November 12, removed 27 equivalent gallons of hydrocarbons from MW9, MW16, and MP-03
- **LNAPL thickness observations**
  - As of December 2019, LNAPL detected in 6 exterior wells (up to 0.68 feet) and one well inside Building 645 (0.61 feet)

Groundwater Status

COC	RL (µg/L)	Above RL?	Number of Wells with RL Exceedance	Maximum Value (µg/L) 1Q2019	Maximum Value (µg/L) 2013*
1,2,4-Trimethylbenzene	4.2	Yes	2 of 8	34	134
1,3,5-Trimethylbenzene	156	No	0 of 8	9	43
1-Methylnaphthalene	2.94	Yes	2 of 8	88	720
2-Methylnaphthalene	62.6	Yes	1 of 8	72	936
Arsenic	10	Yes	1 of 8	26.8	27.1
Benzene	5	No	0 of 8	2	3
Benzo(a)anthracene	1	No	0 of 8	0.05	0.08
Dibenzo(a,h)anthracene	1	No	0 of 8	BDL	0.047
Naphthalene	0.19	Yes	2 of 8	20	186

Notes:

COC = contaminant of concern

LNAPL = light non-aqueous phase liquid

µg/L = microgram(s) per liter

RL = remediation level

BDL = below detection limit

* Before implementation of the updated remedy

- **Highest dissolved-phase concentrations are co-located with residual LNAPL**

Engineering Evaluation

- Develop, screen, and evaluate remedial alternatives to accelerate removal of LNAPL and reduce concentrations of dissolved phase hydrocarbons to below RLs
- Prepared to support Air Force beyond current contract
- Submitted and approved by Air Force in December 2019

Engineering Evaluation

Considered Technologies

- Natural Attenuation
  - Monitored natural attenuation (MNA)
- Removal
  - Air sparging (AS)/Soil vapor extraction (SVE)
  - Excavation and disposal
  - Groundwater extraction and treatment
  - HVE
  - Multi-phase extraction (MPE)
- In Situ Treatment
  - Enhanced aerobic bioremediation
  - ISCO
  - In situ thermal treatment (ISTT)
  - Surfactant flushing

Retained Technologies

- Natural Attenuation
  - MNA
- Removal
  - AS/SVE
  - Groundwater extraction and treatment
  - HVE
  - MPE
- In Situ Treatment
  - Enhanced aerobic bioremediation
  - Surfactant flushing

Engineering Evaluation

- **The retained alternatives were assembled into three remedial alternatives:**
  - **Alternative 1: Groundwater extraction with surfactant flushing and MPE**
  - **Alternative 2: AS/SVE**
  - **Alternative 3: HVE and enhanced aerobic bioremediation**

Engineering Evaluation

Alternative 1

- Use existing infrastructure and new monitoring wells to conduct surfactant flushing and MPE
- Six surfactant events over four years
- Remediation timeframe estimated at 5 years
- Total cost = $1,250,000

Engineering Evaluation

Alternative 2

- Install AS/SVE system to reduce LNAPL and volatile organic compound (VOC) concentrations
- Angled AS and SVE wells would be used to access underneath the building
- New remediation equipment
- Remediation timeframe estimated at 2 years
- Total cost = $1,000,000

LEGEND

- MONITORING WELL
- MULTIPURPOSE WELL
- APPROXIMATE EXTENT OF LNAPL PLUME
- APPROXIMATE DIRECTION OF GROUNDWATER FLOW
- AS/SVE SYSTEM COMPOUND
- VAPOR-PHASE CARBON FILTRATION VESSELS
- COMPRESSED AIR/SOIL VAPOR CONVEYANCE LINES
- AS WELL
- SVE WELL
- ELECTRICAL POLE AND OVERHEAD WIRES
- ABOVEGROUND CONVEYANCE PIPE
- BELOWGROUND CONVEYANCE PIPE
- MANHOLE CONNECTED TO INDUSTRIAL WASTEWATER SEWER SYSTEM
- ANGLED WELL CASING

NOTES:
1. AS = AIR SPARGE
2. LNAPL = LIGHT NON-AQUEOUS PHASE LIQUID
3. LNAPL = DATA PRESENTED ON THE FIGURE WAS COLLECTED ON JANUARY 29, 2018
4. SVE = SOIL VAPOR EXTRACTION
5. SWMU = SOLID WASTE MANAGEMENT UNIT

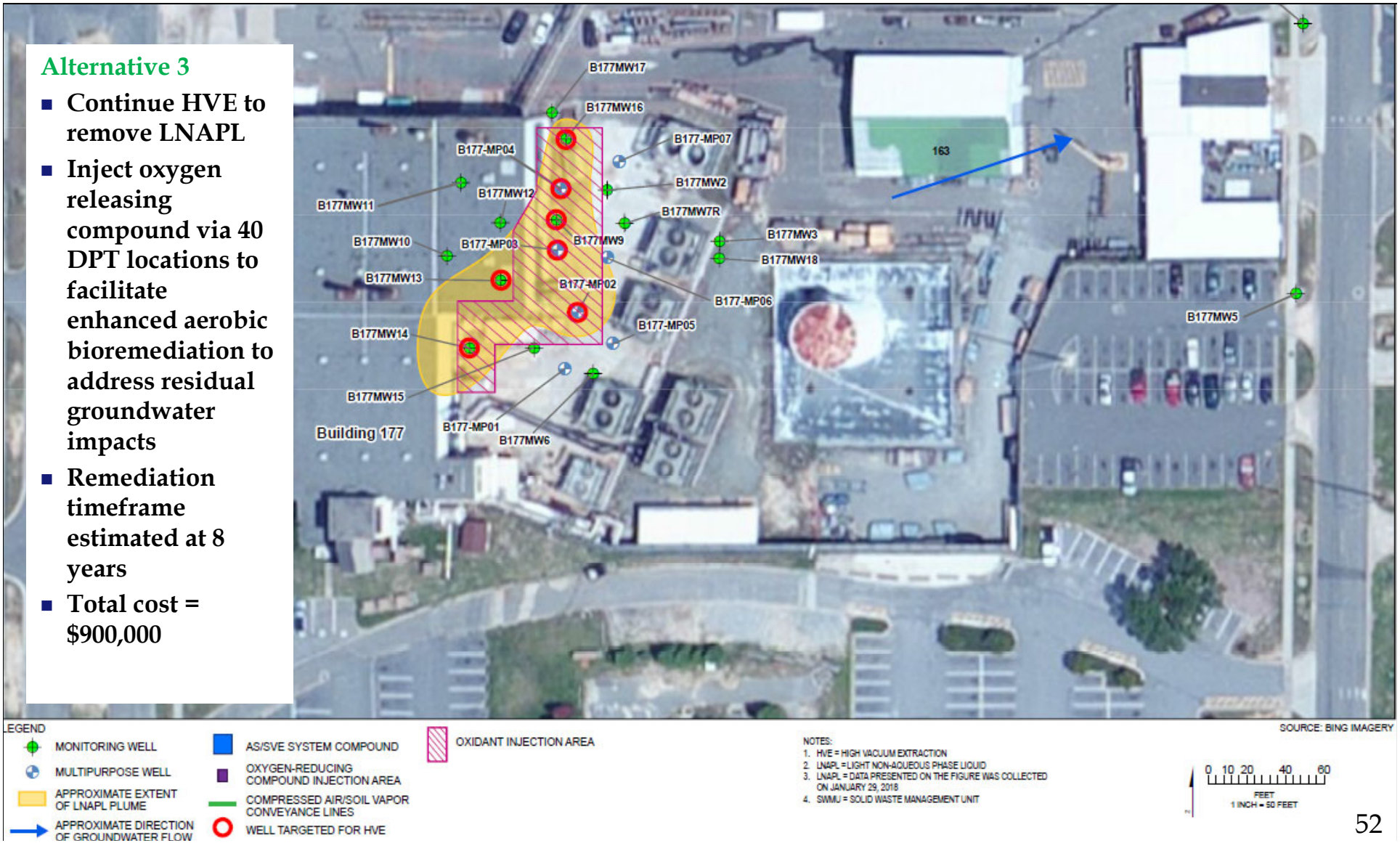
SOURCE: BING IMAGERY

0 10 20 40 60
FEET
1 INCH = 50 FEET

Engineering Evaluation

Alternative 3

- Continue HVE to remove LNAPL
- Inject oxygen releasing compound via 40 DPT locations to facilitate enhanced aerobic bioremediation to address residual groundwater impacts
- Remediation timeframe estimated at 8 years
- Total cost = $900,000



Engineering Evaluation

- **Alternative 1**
  - Expected to achieve corrective action objectives (CAOs) within 5 years
  - Easiest to implement because infrastructure is currently in place
  - Most expensive alternative because it would require regular operations and maintenance (O&M) for 5 years
- **Alternative 2**
  - Expected to be most effective option, achieving CAOs in approximately 2 years.
  - Only slightly more expensive than Alternative 3 because of limited O&M requirements
  - Most challenging to implement due to installation of new AS and SVE wells, conveyance lines, and other associated infrastructure
- **Alternative 3**
  - Most flexible and least expensive alternative
  - Expected to take approximately 8 years to achieve CAOs

Path Forward

- Complete third and fourth HVE events
  - Tentatively scheduled for February and May 2020
- Continue monthly LNAPL gauging and long-term groundwater monitoring
- Support transition to next contract

Environmental Advisory Board

SWMU 36
(DC034)
Update on Progress

Adam Forsberg
Hydrogeologist
Jacobs

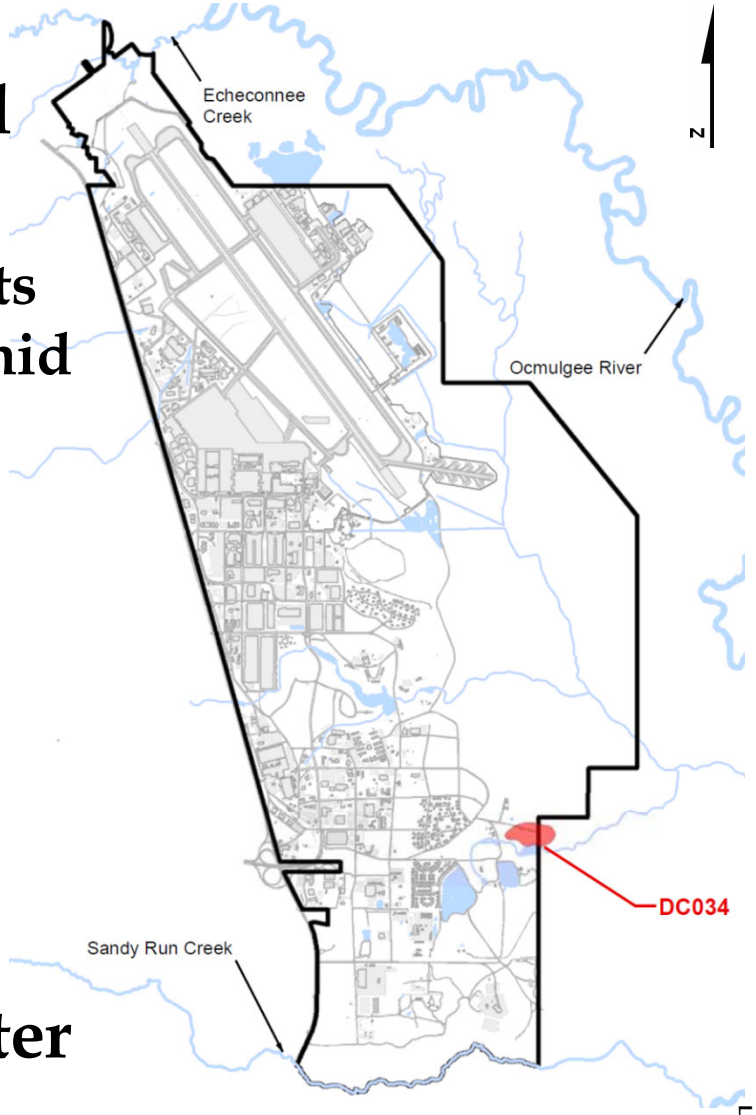
February 13, 2020

Overview

- Background
- Site layout
- Conceptual site model (CSM) overview
- DC034 CSM refinement
- DC034 3-dimensional (3-D) model development

Background

- **Horse Pasture Trench Disposal Site**
  - **Used for disposal of wastes in pits and trenches from mid 1950s to mid 1970s**
- **Nearly 64,000 tons of impacted soil excavated and disposed offsite in November 2004**
- **ISCO used to remediate chlorinated ethenes, chlorobenzene, and dichlorobenzene in groundwater**



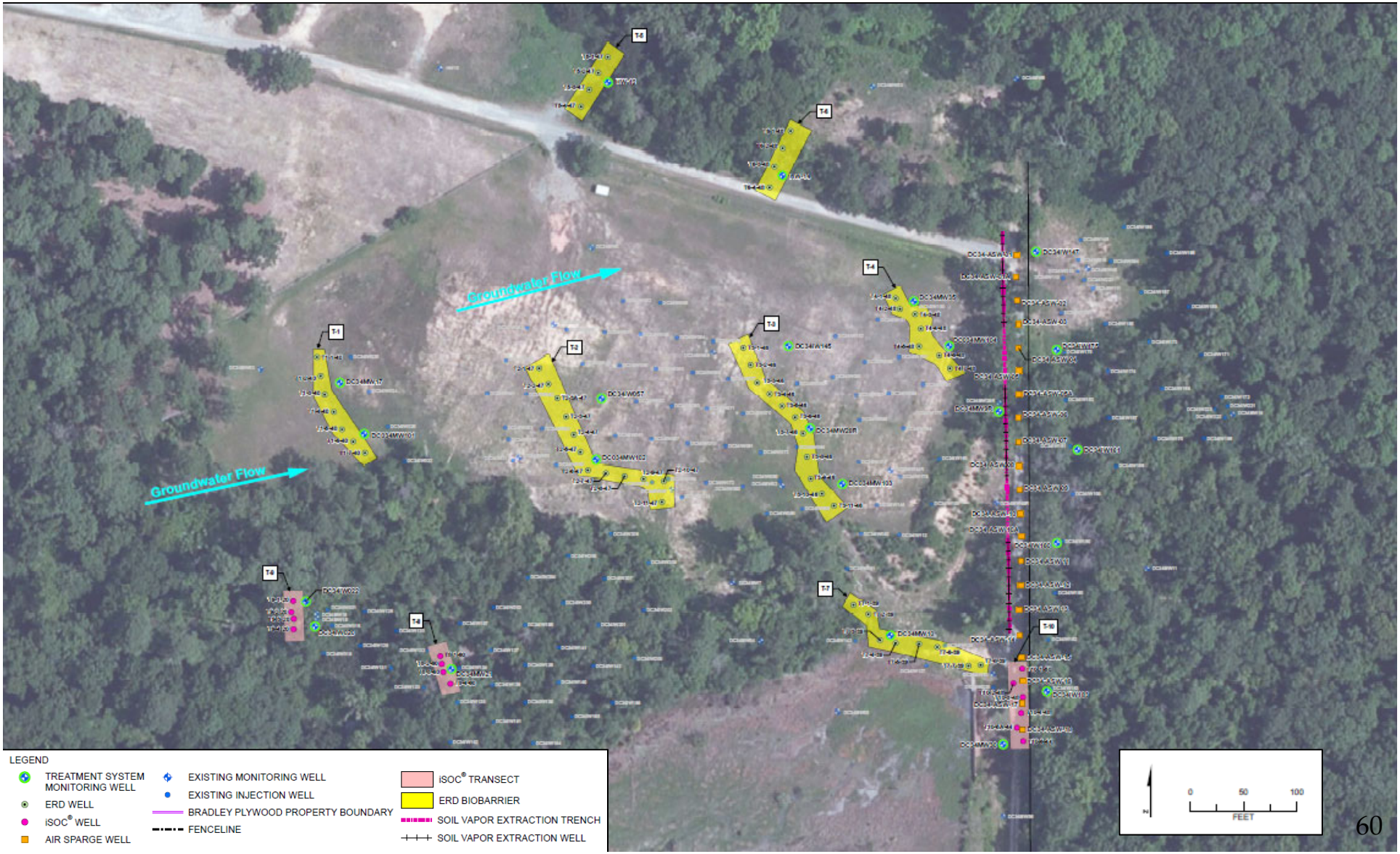
Background

- **Revised CAP prepared in 2013 to address remaining groundwater impacts**
  - **Enhanced Reductive Dechlorination (ERD)**
  - **Aerobic bioremediation using in situ submerged oxygen curtain (iSOC)**
  - **AS/SVE cut-off barrier**
- **Corrective Action Objectives:**
  - **Reduce COCs in groundwater to below RLs**
  - **Limit further off-site migration of groundwater COCs**

Background

- Contract objectives to be achieved by September 2020
- Implement an OES with performance metrics
  - ERD – Reduction of trichloroethene (TCE) concentrations in seven (7) performance monitoring wells as compared to April 2009 results
  - ERD – Reduction of total VOC concentrations in 13 ERD performance monitoring wells as compared to April 2015 results
  - iSOC – Reduction of chlorobenzene concentrations in three (3) performance monitoring wells as compared to April 2009 results
  - AS/SVE – Reduction of total VOC in three (3) performance monitoring wells as compared to December 2013 results

Site Layout

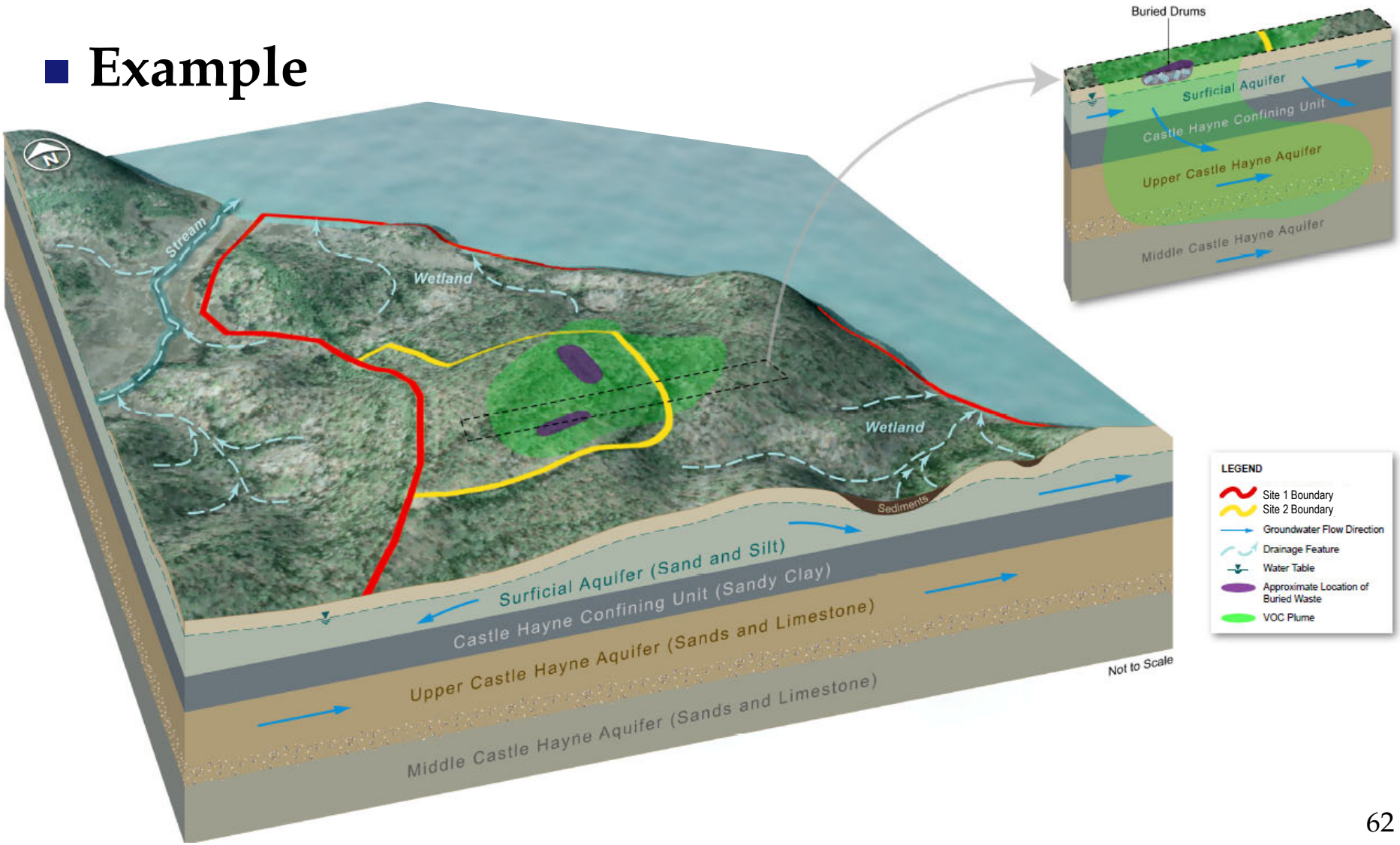

Groundwater Flow
Groundwater Flow
T1
T2
T3
T4
T5
T6
T7
T8
LEGEND
TREATMENT SYSTEM MONITORING WELL
ERD WELL
iSOC® WELL
AIR SPARGE WELL
EXISTING MONITORING WELL
EXISTING INJECTION WELL
BRADLEY PLYWOOD PROPERTY BOUNDARY
FENCELINE
iSOC® TRANSECT
ERD BIOBARRIER
SOIL VAPOR EXTRACTION TRENCH
SOIL VAPOR EXTRACTION WELL
0
50
100
FEET

CSM Overview

- **To support transition to next contract, we were tasked with revisiting DC034 CSM to provide a foundation for remediation optimization**
- **A CSM describes the processes that control transport of contaminants through physical media to environmental receptors (Interstate Technology & Regulatory Council [ITRC], 2017)**
  - ***When and how did contaminants enter the subsurface?***
    - Site history and operations
  - ***What are the contaminants?***
    - Contaminant class and behavior
  - ***Where are contaminants in the aquifer today and where will they travel?***
    - Geology and hydrogeology

CSM Overview

- **Example**



CSM Overview

- *How a CSM is used?*
  - Decision-making
  - Data interpretation
  - Communication
  - Data gaps
- A CSM is iterative and dynamic
  - Updated throughout a project lifecycle

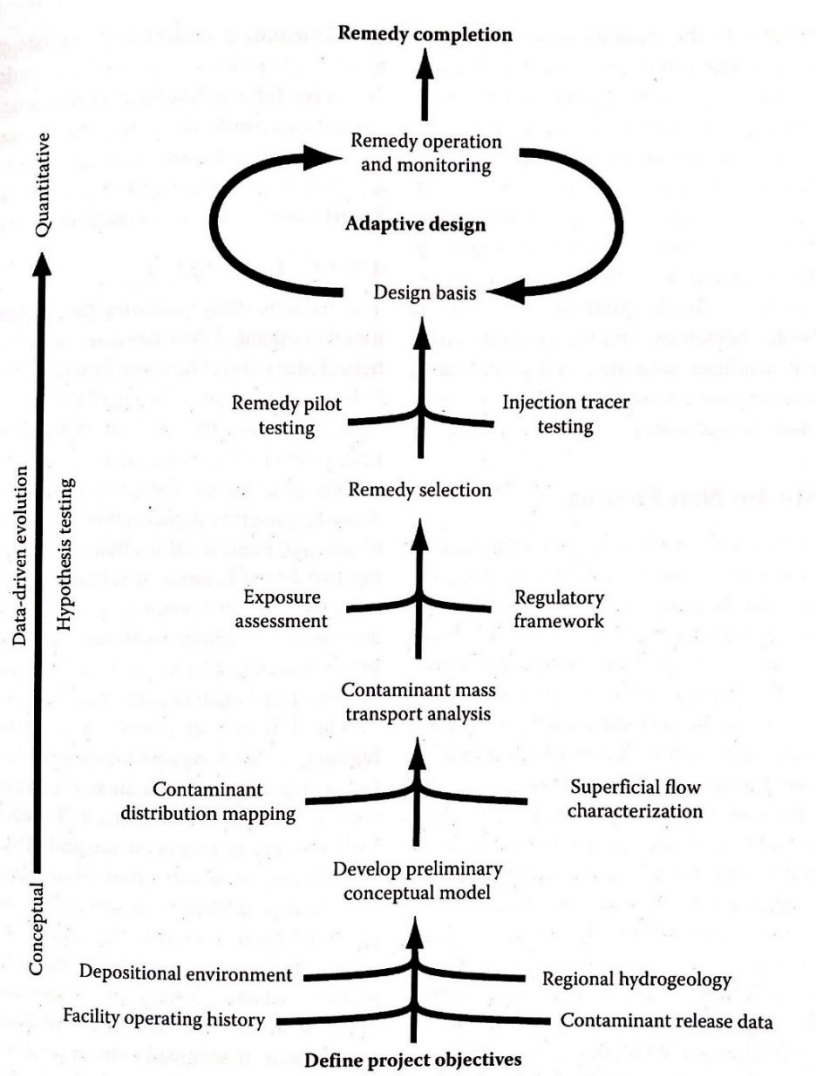


Figure source: Suthersan et. al (2016)

CSM Overview

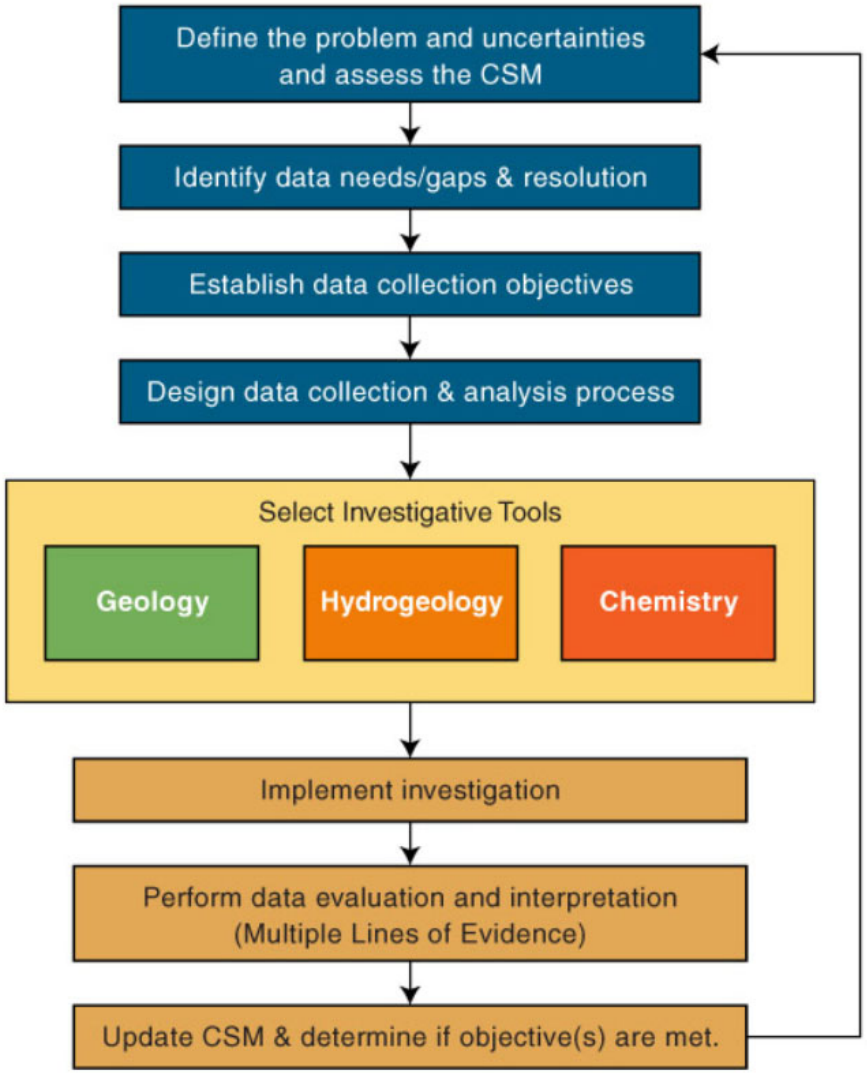


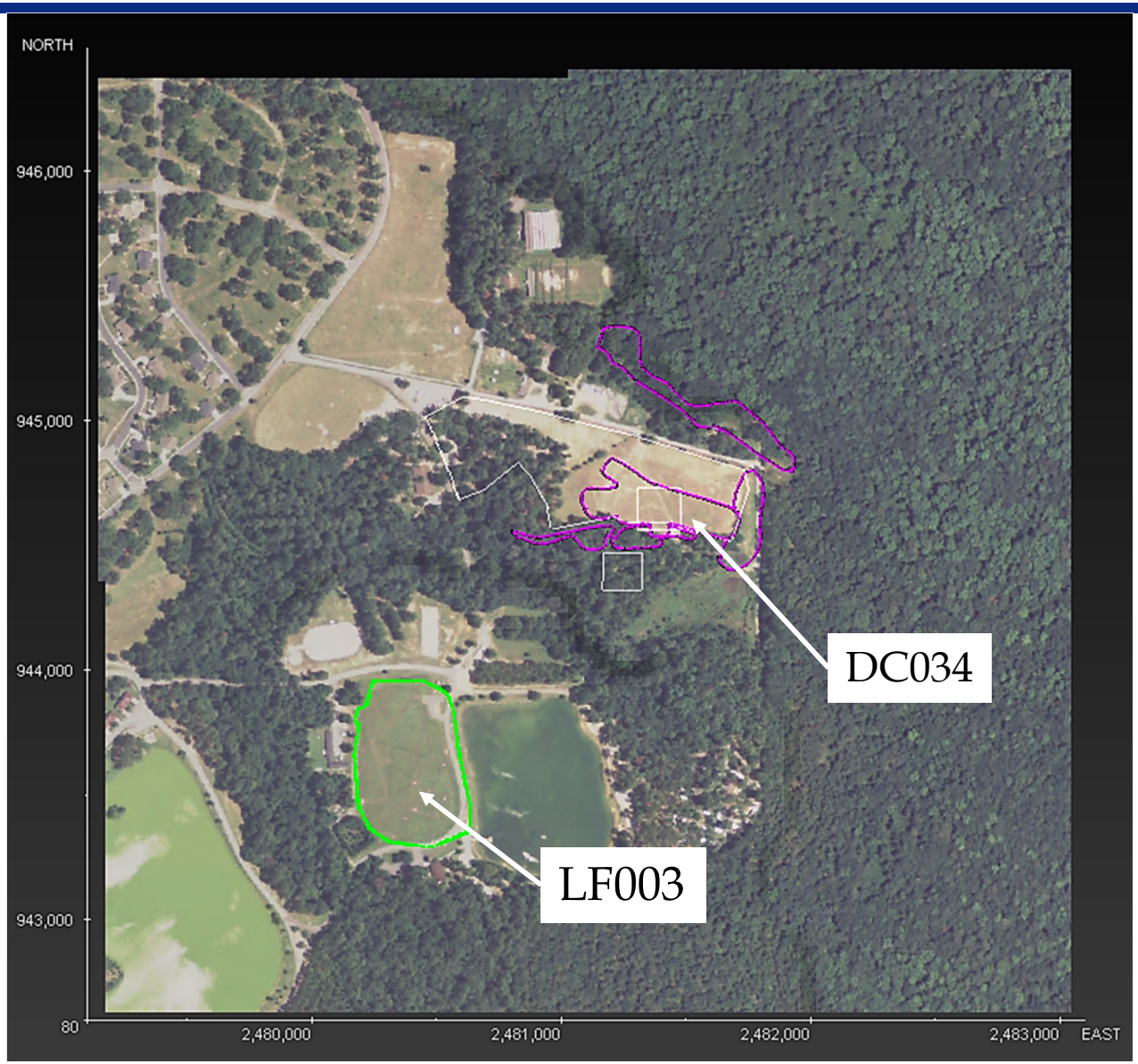
Figure source: ITRC (2015)

- **CSM Refinement**
  - **Long-term planning**
  - **Remedy implementation**
  - **Data evaluation**
    - Monitoring and Performance
  - **Optimization**
    - Data gaps

DC034 CSM Refinement

- **Objective**
  - **Identify data gaps and reduce uncertainty in the DC034 CSM**
    - Hydrogeologic unit extent
    - Contaminant sources and extents
    - Migration pathways
- **Methodology**
  - **Construct a digital CSM by compiling historical lithologic and analytical data from DC034 and LF003 into 3-D geostatistical visualization model**
    - Earth Volumetric Studio (EVS) by C Tech Corporation

DC034 3-D Model Development
Digital CSM Layout



DC034 3-D Model Development
Earth Volumetric Studio

- **EVS**
  - **Uses geostatistical methods to produce 2-dimensional and 3-D spatial models from measured geospatial input data**
  - **Complete EVS documentation can be found at C Tech Corporation help website (https://www.ctech.com/studio_help/Default.htm).**

DC034 3-D Model Development
Earth Volumetric Studio

- **EVS geostatistical methods**
  - **Variography**
    - Process of characterizing and modeling spatial continuity (variation) in a data set
  - **Gridding (interpolation)**
    - Process of generating a grid of predicted data from a measured data set using two-dimensional (spatial) interpolation methods

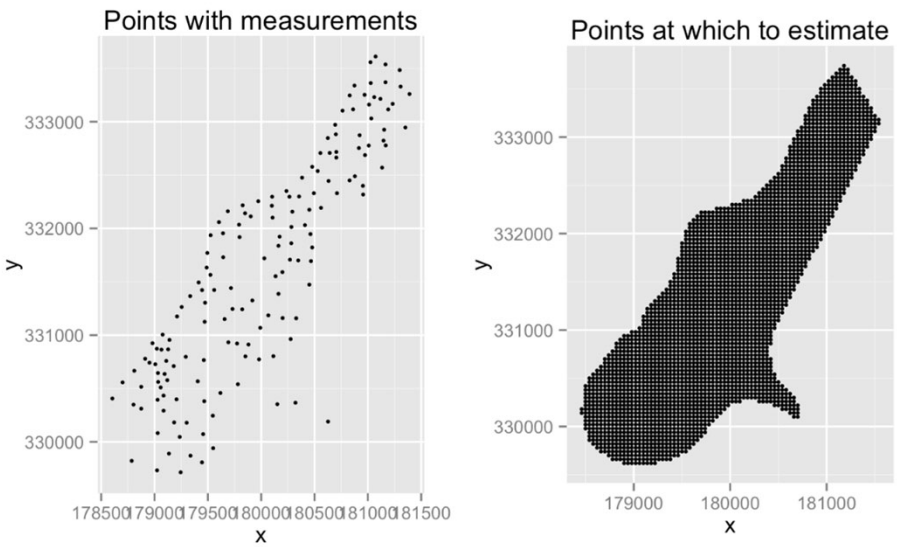


Photo credit: https://rpubs.com/nabilabd/118172

DC034 3-D Model Development
Data Sources

- **Robins Air Force Base Environmental Resources Program Info Management System (ERPIMS) database**
  - **Well/boring coordinates**
  - **Well construction details**
  - **Sample depths/intervals**
  - **Groundwater analytical data**
  - **Groundwater levels**
- **Historical Reports**
  - **Soil boring descriptions and Unified Soil Classification System group symbols**
  - **Boundary conditions (such as confining layers, faults, and remedial structures)**
- **Open-source spatial data**
  - **Topography**
    - United States Geological Survey National Elevation Dataset 1/3 arc-second ArcGrid 2018
  - **Aerial imagery**
    - United States Department of Agriculture National Agriculture Imagery Program Imagery 2016

DC034 3-D Model Development
Model Components

- **Lithology dataset**
  - **Digitized historical soil boring logs**
  - **Total of 208 well/boring locations**

Title	Author(s)	Date
RCRA Facility Investigation Report, Zone 3 USAF	CH2M HILL	May-91
Draft Final Corrective Action Plan Landfill No. 3	Geophex	Dec-95
[Phase I] RCRA Facility Investigation Report for the Horse Pasture Site (ERP Site DC034, Project No. UHHZ96-7039) at Robins Air Force Base	Geophex	Jun-00
Revised Draft Final Phase II Report Horse Pasture Site	GeoSyntec Consultants	Oct-03
Hydraulic Containment Evaluation Report for Landfill No. 3 (LF003)	GeoSyntec Consultants	Jan-06
Additional Site Investigations at LF003 and Luna Lake	GeoSyntec Consultants	Dec-06
Draft Final Corrective Action Plan Annual Progress Report for SWMU 36 Groundwater	BEM System and Tetra Tech	Apr-07
Construction Completion Report and OM&M Plan for DC034 – Horse Pasture Trench Disposal Site (SWMU 36)	CAPE Environmental and CH2M HILL	Mar-14

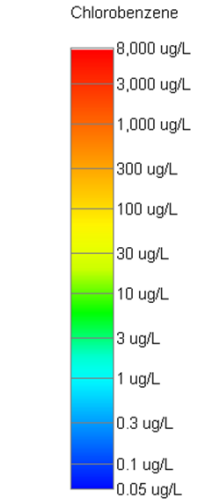
ERP – Environmental Restoration Program
OM&M – Operations, Maintenance, and Monitoring

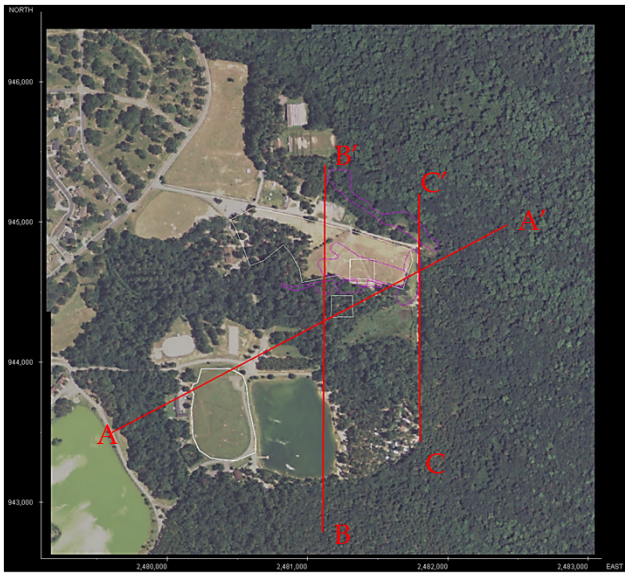
DC034 3-D Model Development
Model Components

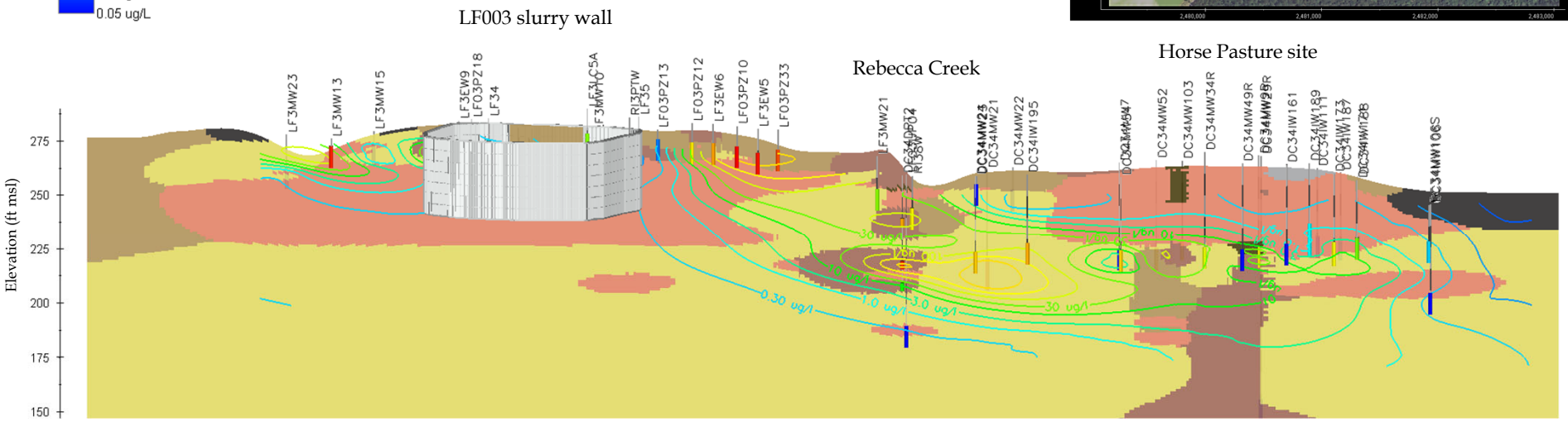
- **Analytical dataset**
  - **March 2019 monitoring data**
    - Supplemental Fall 2018 and 2017 DPT grab sample data
    - Select historical analytical data used as control points to reflect site knowledge
  - **Total of 171 well/boring sample locations**
  - **Plume limits set for RLs**

Analyte	Sample Size	Remedial Level µg/L
Chlorobenzene	159	100
Trichloroethene	168	5
Benzene	168	5
1,2-DCA	160	5
1,3-DCB	160	9.5
1,4-DCB	154	75
cis-1,2-DCE	162	70
VC	168	2

DC034 3-D Model Development
EVS Model







DC034 3-D Model Development
EVS Model

- **(interactive EVS model viewer)**

References

- ITRC. 2015. Integrated DNAPL Site Characterization and Tools Selection. Washington, D.C.: Interstate Technology & Regulatory Council, Remediation Management of Complex Sites Team.
- ITRC. 2017. Remediation Management of Complex Sites. RMCS-1. Washington, D.C.: Interstate Technology & Regulatory Council, Remediation Management of Complex Sites Team. https://rmcs-1.itrcweb.org.
- Suthersan S.S., J. Horst, M. Schnobrich, N. Welty, J. McDonough. 2016. Remediation Engineering: Design Concepts, Second Edition. CRC Press. ISBN 9781498773270 - CAT# K29550.

Administrative Record Overview

Laurel Cordell
Environmental Engineer/EAB Manager
AFCEC/CZOE

February 13, 2020

Overview

- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Requirement
- Previous Location
  - Nola Brantley
- Current Online Location
  - http://afcec.publicadmin-record.us.af.mil/
- Website Overview

New Business
and
Program Closing

Laurel Cordell

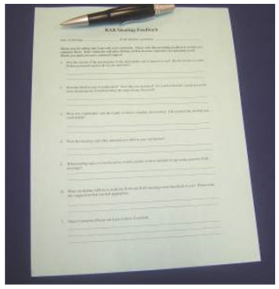
EAB Manager

Next EAB Meeting

Thursday, May 7, 2020

Please…

Complete the meeting evaluation and feedback form and leave at your seat



Leave your name tag at the sign-in table for the next meeting

Thank you!