Philadelphia Refinery Legacy Remediation

Act 2 Program Public Meeting

November 7, 2019

This presentation is for informational purposes only and does not constitute an official remedial investigation nor serve to replace the information contained in the Act 2 Reports

Philadelphia Refinery
LEGACY REMEDIATION
phillyrefinerycleanup.info

Agenda

Presentations (6:00 – 7:30 pm)

Welcome
Katrina McCullough, GHD

Introductions and Overview
Scott Cullinan, Evergreen

Regulatory Overview
Colleen Costello, GHD

Summary of Completed Remedial Investigations
Tiffani Doerr, Evergreen
Andrew Klingbeil, Stantec

Remedial Systems
Jim Oppenheim, Evergreen

Q&A (7:30 - 8:00 pm)

Facilitated by Katrina McCullough, GHD

Our Commitment as Participants

- Keep meeting purpose in mind
- Recognize diversity of perspectives
- Maintain respectful space
- Recognize future opportunities for dialogue

Introduction and Overview

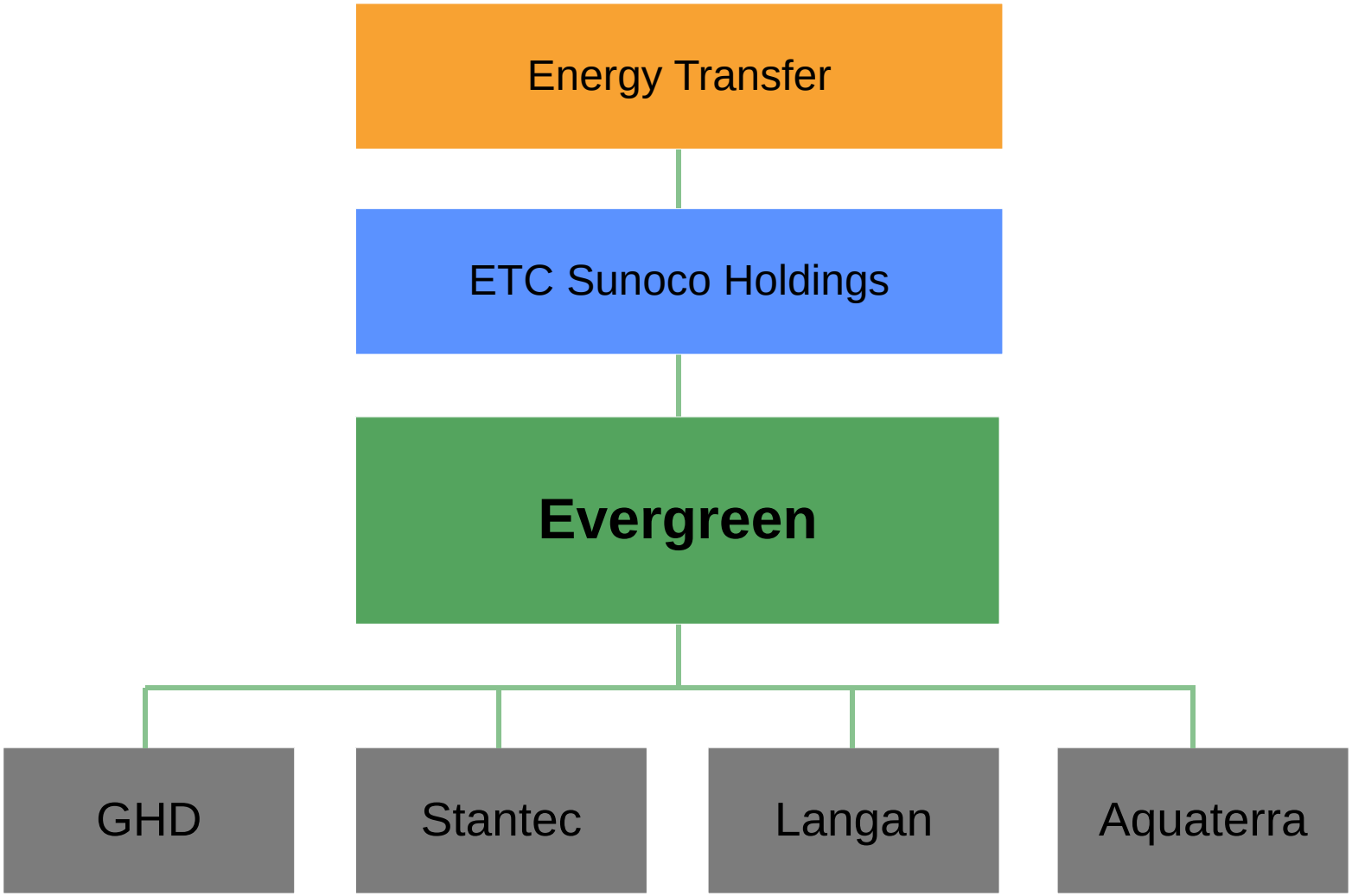
Meeting Purpose

- Present a summary of remedial activities performed at the Philadelphia Refinery
- Facilitate the public's review of the Act 2 Remedial Investigation Reports

Meeting Focus

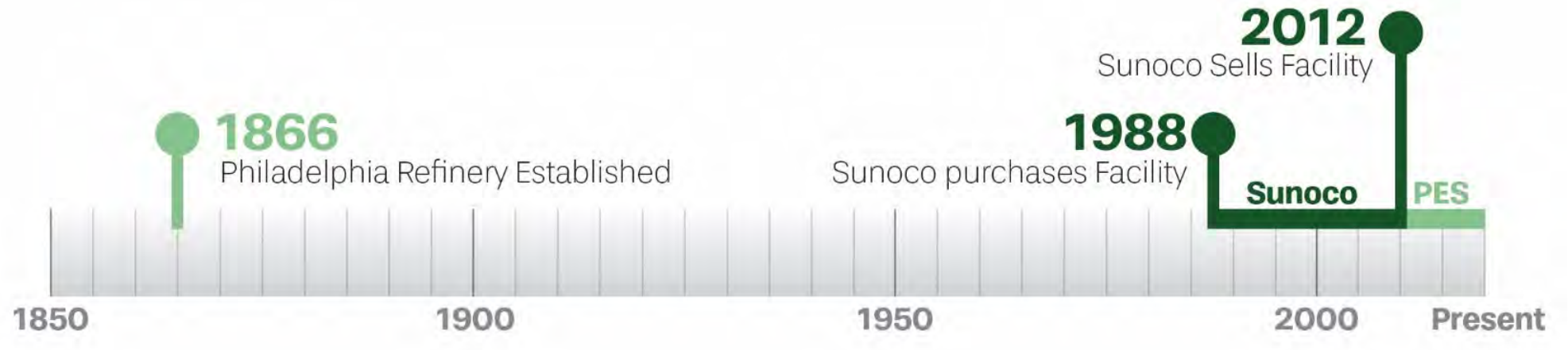
- Many unresolved issues currently swirling around the Philadelphia Refinery
- Tonight's meeting is focused on subsurface contamination related to Sunoco's operation of the facility
- Evergreen not involved in:
  - PES ownership/operation/future
  - June explosion/fire
  - Mayor's environmental task force
  - On-going bankruptcy proceedings
  - Speculation on property re-use

Corporate Structure/Remediation Team



Evergreen's Responsibilities

Shepherd the facility through the Act 2 process to address environmental impacts from Sunoco prior to the sale in 2012



Facility Remediation Stakeholders

Act 2 Reports

- 21 Act 2 Reports submitted to date to characterize environmental impacts (pre 2013)
- All Act 2 Reports available:
  - On the project website www.phillyrefinerycleanup.info
  - At the Thomas F. Donatucci, Sr. Library (1935 Shunk St.)
  - At Eastwick Library (2851 Island Avenue)
- Informal file review at PADEP https://www.dep.pa.gov/Citizens/PublicRecords/Pages/Informal-File-Review.aspx

Additional Opportunities for the Public to Comment

- Act 2 Reports are available on the project website
- Comments can be submitted:
  - ✓ Today in writing on comment forms
  - ✓ Through the online submission form on the website at www.phillyrefinerycleanup.info
  - ✓ Via email at phillyrefinerycleanup@ghd.com.
- Comment period begins today and will last for 120 days ending when the second meeting is held on or around March 9, 2020.
- Most recent report for each AOI supersedes all previous reports for that AOI for Act 2 Reports on website.

Regulatory Overview

Key Concepts in Regulatory Section

- What is Act 2?
- Where is the Facility in the Act 2 Process?
- What is an Act 2 Standard?
- When are there Opportunities for Public Comment?

Regulations Applicable to Facility

Act 2 Program

- Allows the voluntary cleanup and reuse of properties
- PADEP is regulating agency

RCRA (Resource Conservation and Recovery Act)

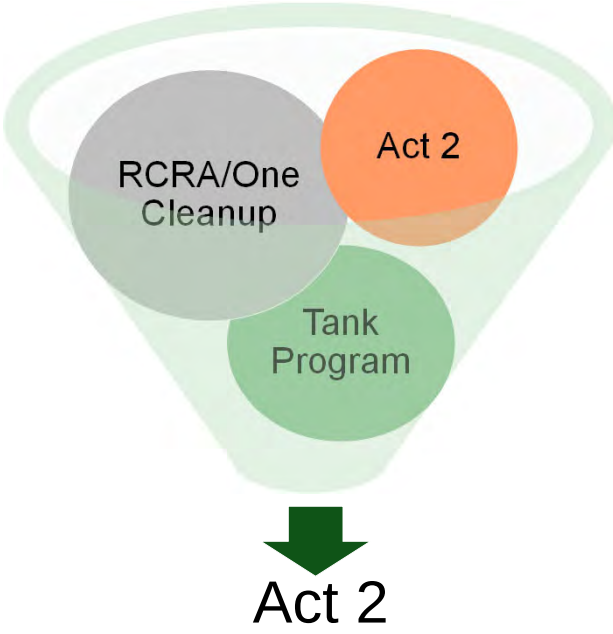
- Regulates facilities that handled waste
- EPA is the regulating agency

One Cleanup Program

- Allows Act 2 to satisfy RCRA requirements
- PADEP and EPA, with PADEP as lead regulating agency

Storage Tank Corrective Action Program

- Applies to releases from regulated tanks, uses Act 2 standards & reporting
- PADEP is regulating authority



Act 2 Standards

- Act 2 Standards are the concentrations of chemical compounds in soil or groundwater that are used to develop cleanup approach
- Three types of Act 2 Standards
  - **Background** - based on background conditions
  - **Statewide** – PADEP established values
  - **Site Specific**
    - Calculated values based on risk assessment
    - Pathway Elimination (demonstrated lack of pathway)
- Can be Residential or Non-Residential
- Act 2 Soil Standards
  - Non-Residential is applied at 2 depths (0-2 ft. and 2-15 ft.)
  - Evaluate Direct Contact and Soil to GW Pathways

Act 2 Process & Public Involvement

Municipality can request Public Involvement Plan at any point in Act 2 process

Facility's Public Involvement Process

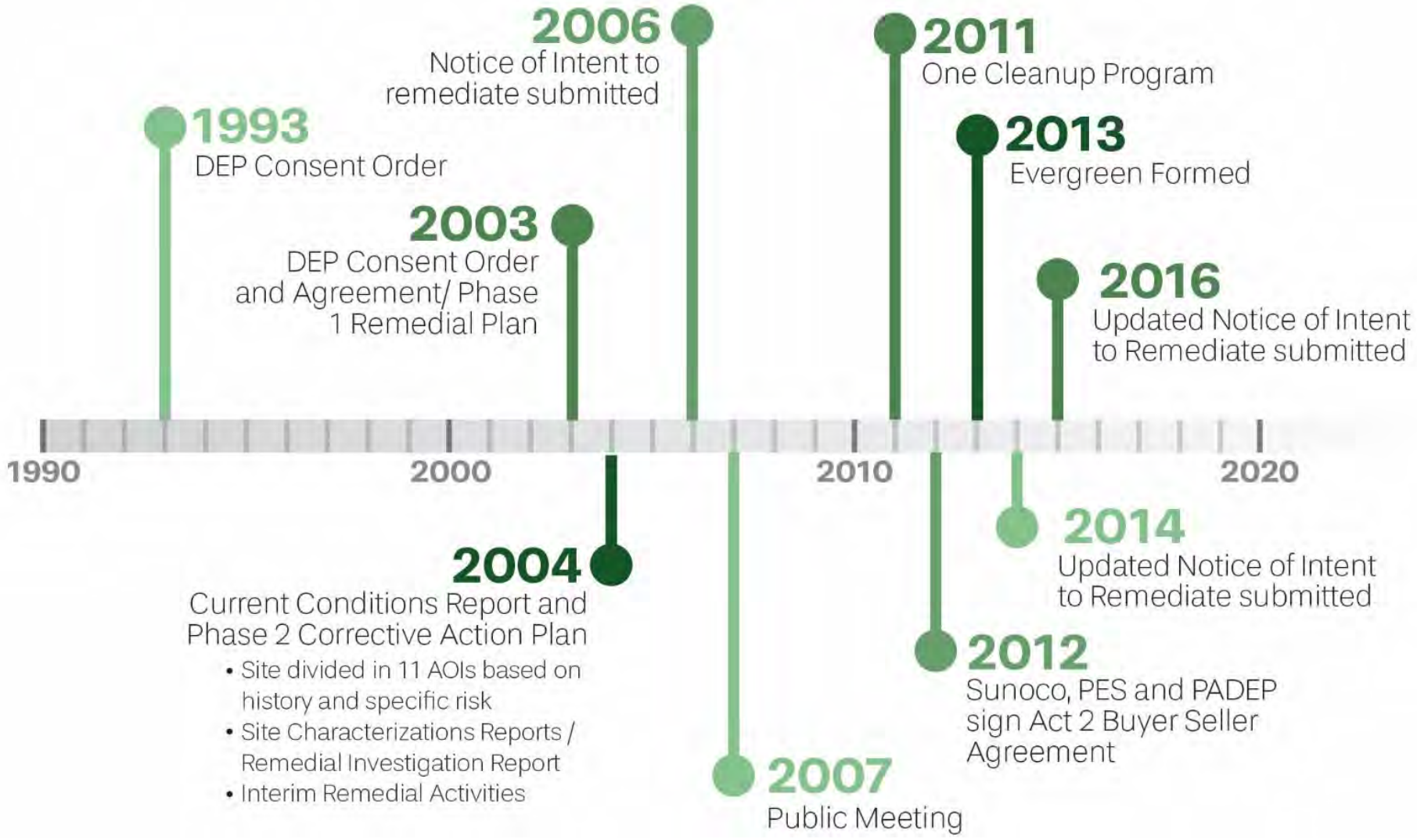
Facility Specific Public Involvement

- All Act 2 reports provided public notice (correspondence to City and newspaper publication) and 30 day comment period
- City of Philadelphia requested Public Involvement Plan in 2006
  - Public Meeting in 2007
  - Notice to City of Philadelphia for every Act 2 Report submitted, with 30 day comment period
  - Reports were available at PADEP for review

Additional Facility-Specific Public Involvement

- Evergreen began preparing a new Public Involvement Plan in August 2018 at the request of the City which includes public information sessions and the opportunity to comment on previously submitted Act 2 reports.
- Comments on the reports will be compiled along with Evergreen's responses and will be submitted to PADEP, USEPA, and City of Philadelphia and a copy of the comment/response document will be posted on the project website

Regulatory History



Key Take-Aways

- What is Act 2?
  - *A program to regulate Cleanup under PADEP.*
- Where is the Facility in the Act 2 Process?
  - *Remedial Investigation and Risk Assessment Phase.*
- What Act 2 Standards are used at the Facility ?
  - *Non-Residential Statewide Health Standard & Site Specific Standard.*
- When are there Opportunities for Public Comment?
  - *Begins today and ending on or around March 9, 2020, as well as each time a new Report is submitted.*

Remedial Investigation Process

Key Concepts in Remedial Investigation Section

- What is a Remedial Investigation (RI)?
- What are the Results of the Remedial Investigations?
- Are the Remedial Investigations Completed?

What To Expect In RI Reports

- Summary/Introduction
- Site Description/Environmental Setting
- Site Characterization
  - Source and Identification of Constituents of Concern
  - Nature and Extent of Contamination
  - Pathway Identification
- Fate and Transport/Conceptual Site Model
- Conclusions and Recommendations

Act 2 Reports Completed to Date

- AOI-1 RIR (Aug 2016)
- AOI-2 RIR (Jul 2017)
- AOI-3 RIR (Mar 2017)
- AOI-4 RIR (Mar 2017, Oct 2013)
- AOI-5 RIR (Jan 2017, Dec 2011)
- AOI-6 RIR (Dec 2017, Sept 2013)
- AOI-7 RIR (Jun 2017, Feb 2012, Sept 2013)
- AOI-8 RIR (Dec 2017, Jan 2012)
- AOI-9 RIR (Feb 2017, Dec 2015)
- AOI-10 RIR (Jun 2011)
- AOI-10 Ecological Risk Assessment for Sediment in Lands Creek (Jun 2016)
- AOI-11 RIR (Sep 2011) and Final Report (Jun 2013)
- Site Wide Lead Human Health Risk Assessment (Feb 2015)

Reports in grey are not approved

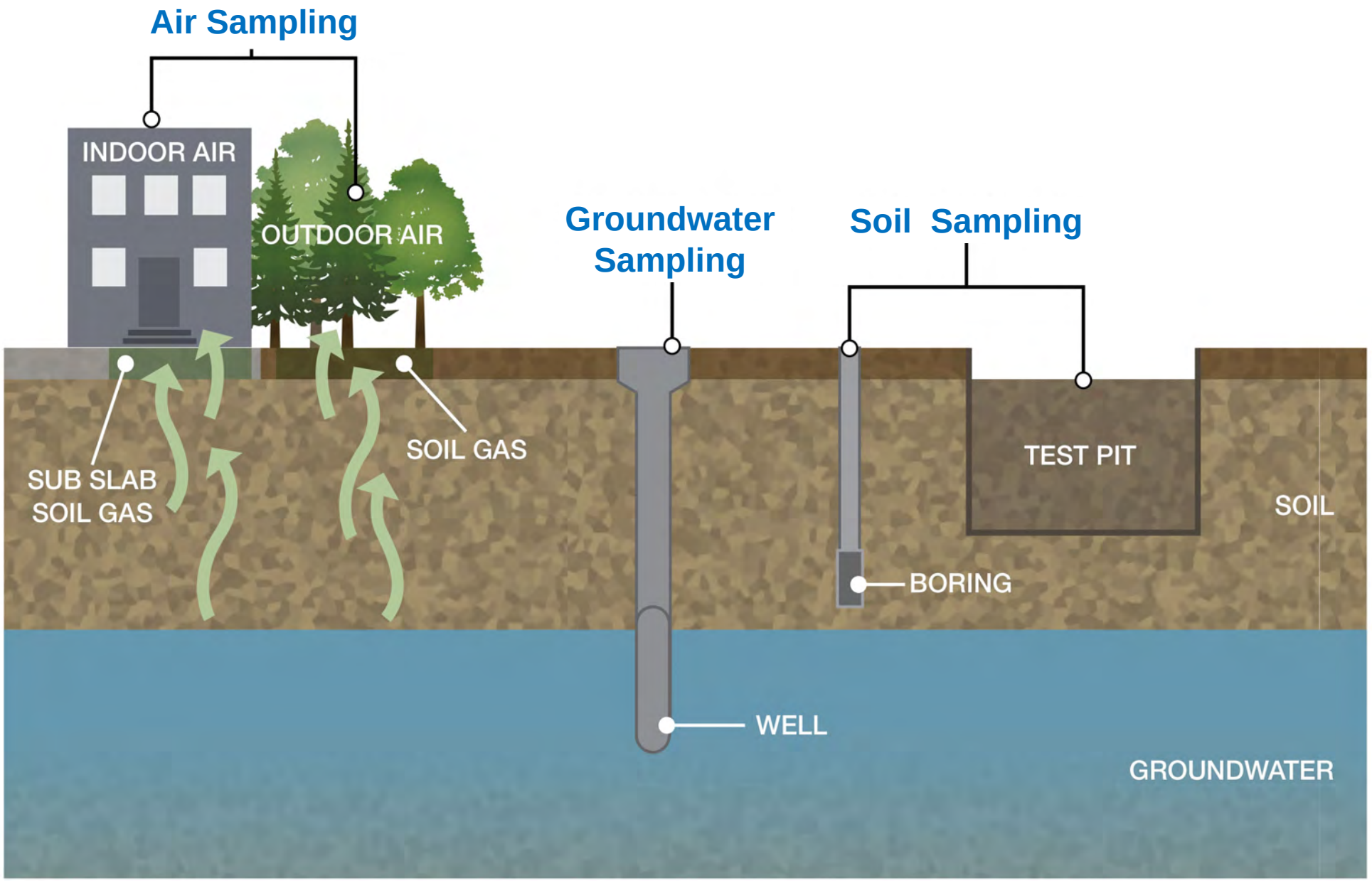
The Comprehensive Dataset

(The Library Company of Philadelphia)
www.librarycompany.org

- Historic documents (mid-1900s through Act 2)
- Historic imagery
- Published reports
- Geologic maps
- PA well database
- Well and boring logs
- Digital Data

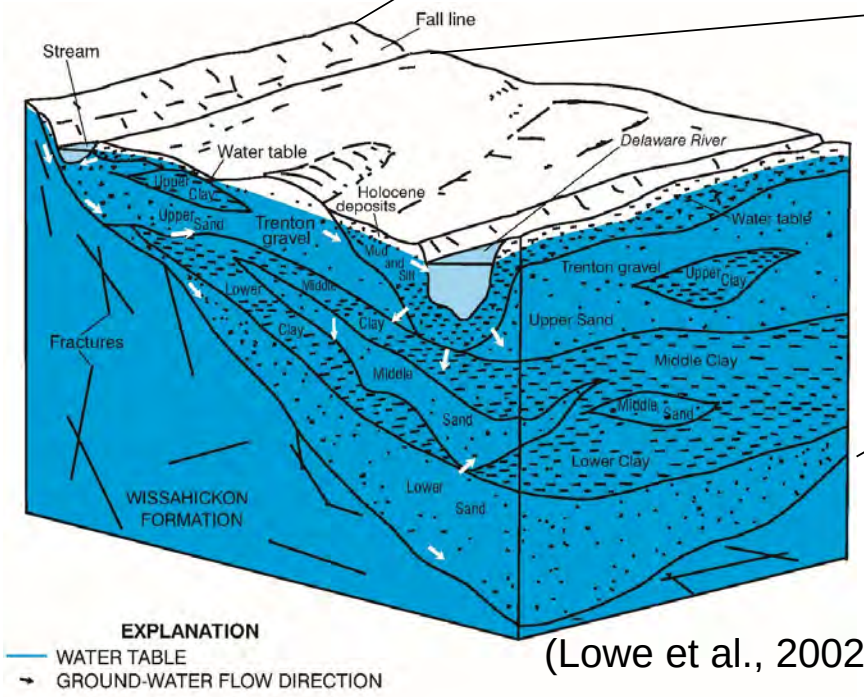
- Evergreen's Act 2 RI Goals:
  - Analyze existing data
  - Collect new data
  - Develop a conceptual model

Media and Methods of Investigation

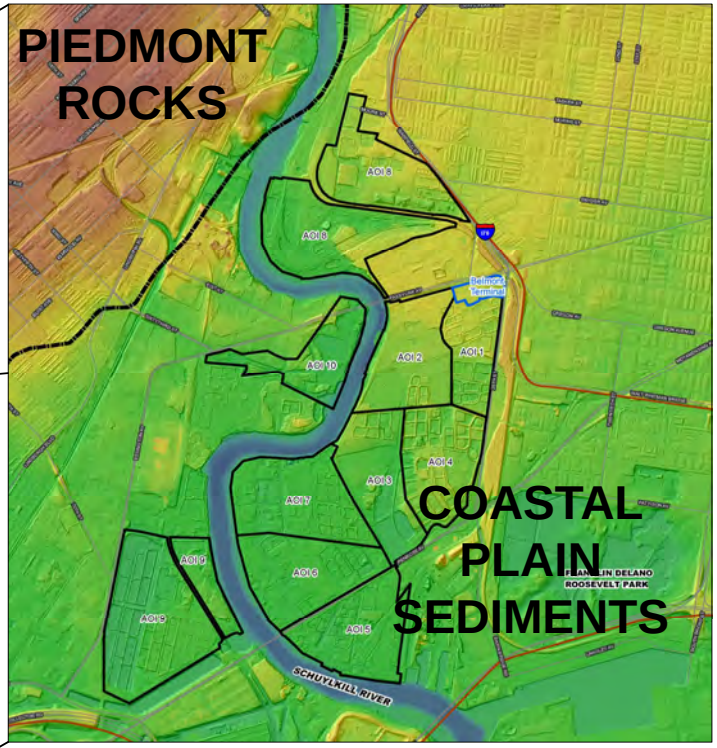


South Philadelphia Setting

- An environment in transition
- From mountains to plains



(Lowe et al., 2002)



- A “wedge” of sediments eroded from mountains
- Deposited by water
- Over millions of years
- Complex layering

Deposits and Their Permeability

Fine-Grained → Coarse-Grained

Muds | Muddy Sands | Sands | Gravelly Sands | Sandy Gravel | Gravel/Cobbles

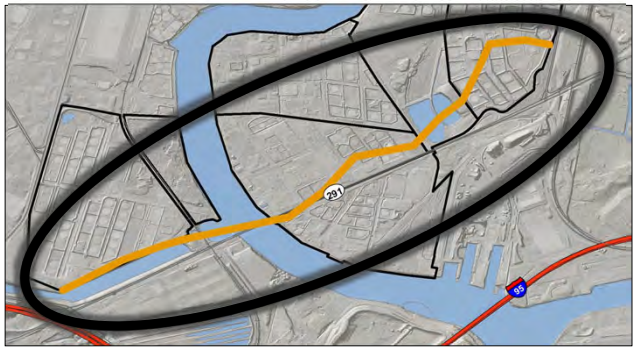
Slower Water Flow → Faster Water Flow

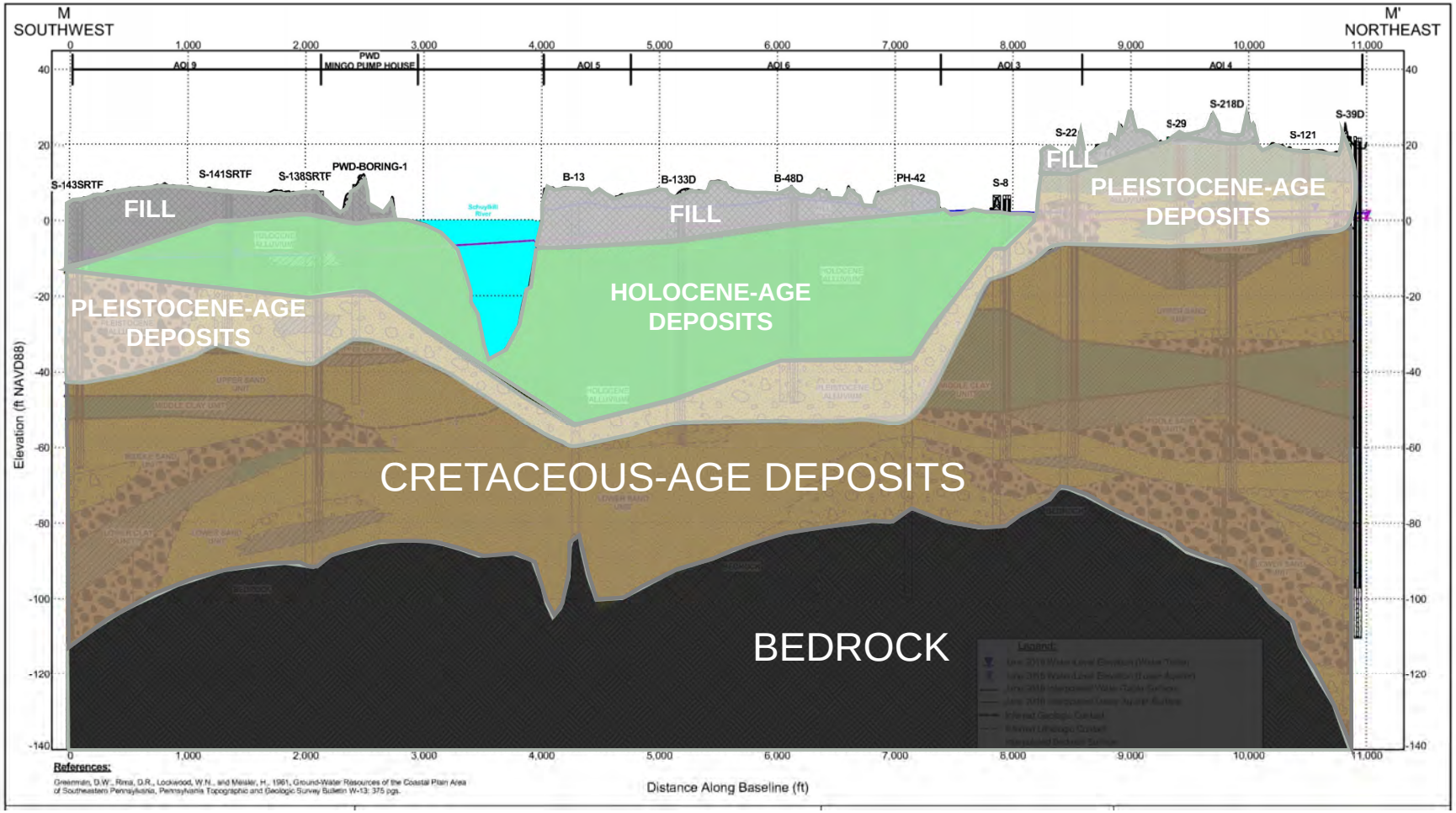
- Flow rates of a few inches to several tens of feet per day
- Permeability is not the only variable controlling groundwater flow
- Understanding the geology is key to characterizing the facility

Environmental Setting | Geology

Example RIR Cross Section M – M’

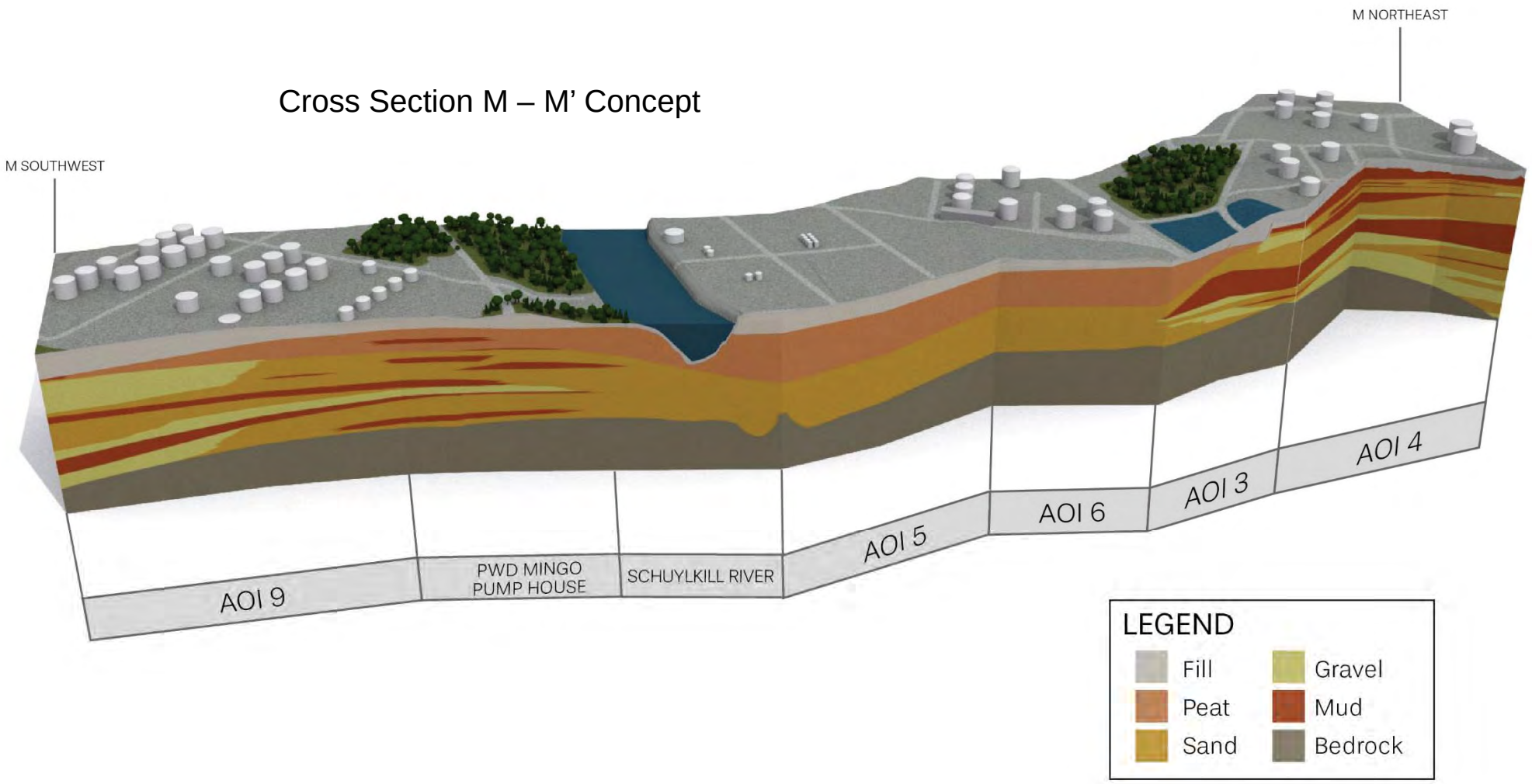
- A cross section is a slice through the earth
- Correlation between borings fills the gaps
- Regional context is important
- Must understand depositional relationships



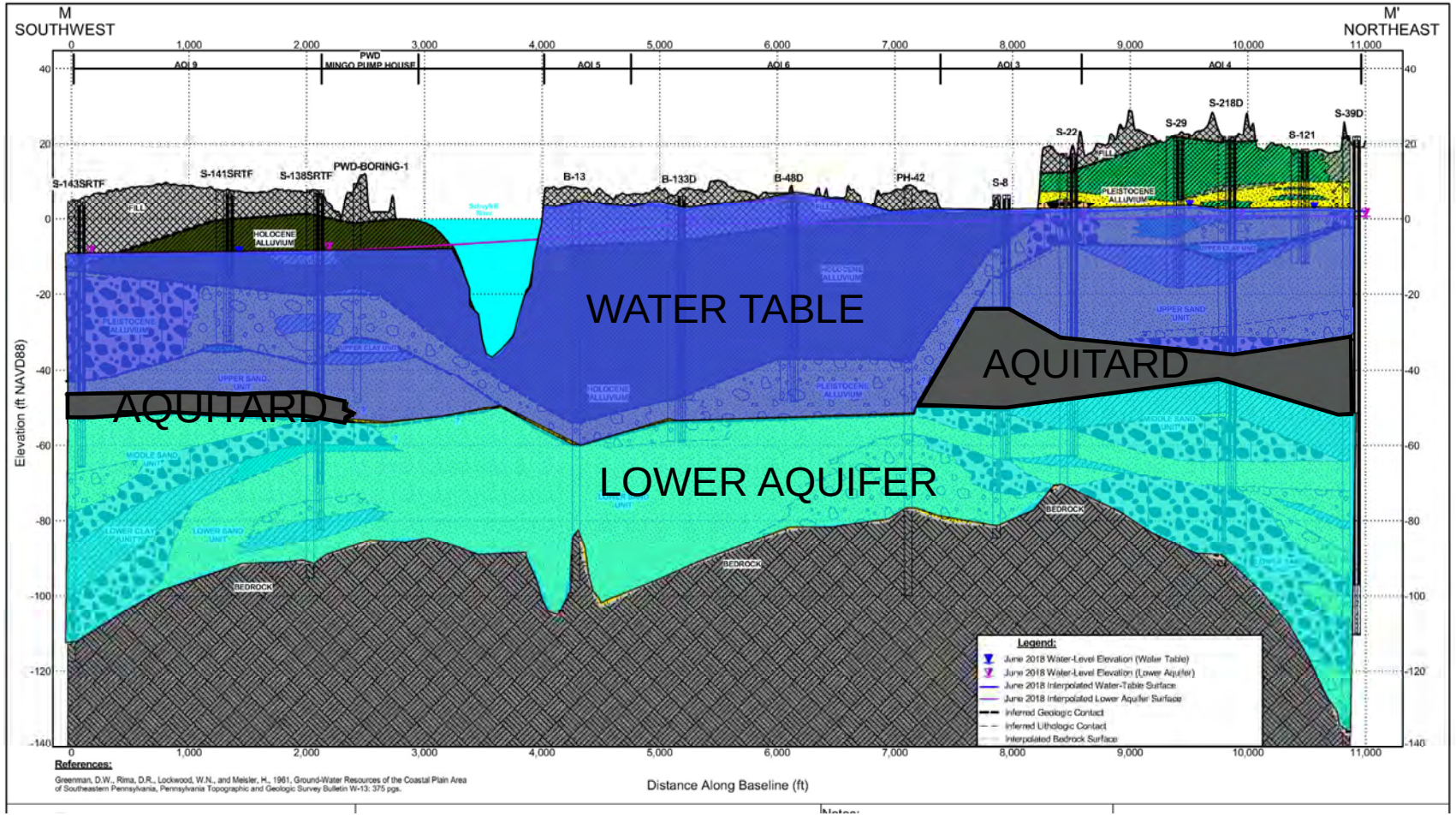


Environmental Setting | Geology

Cross Section M – M' Concept



Environmental Setting | Groundwater



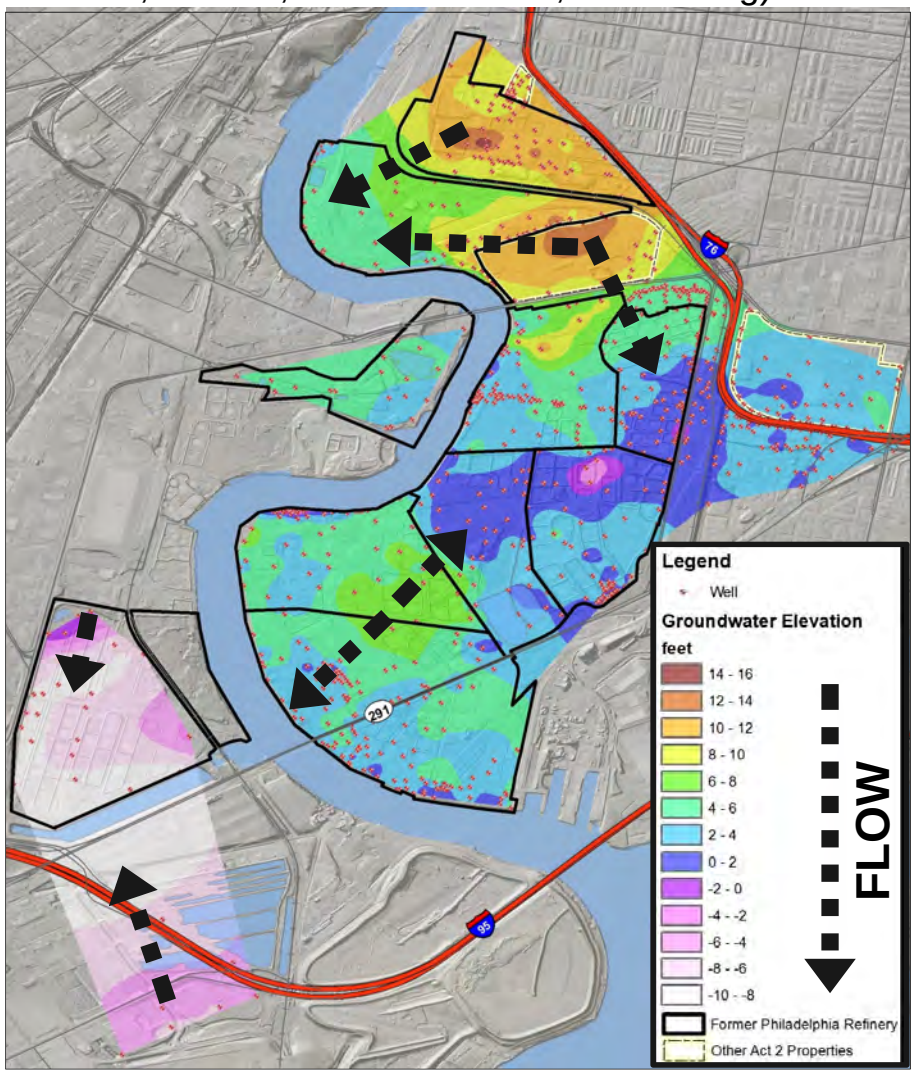
The facility geology supports two mappable water-bearing units (called aquifers):

- Water-Table Aquifer (shallow; younger sandy deposits)
- Lower Aquifer (deeper; older sandy deposits beneath a mappable aquitard)
- In places they are hydraulically connected

Environmental Setting | Groundwater Flow

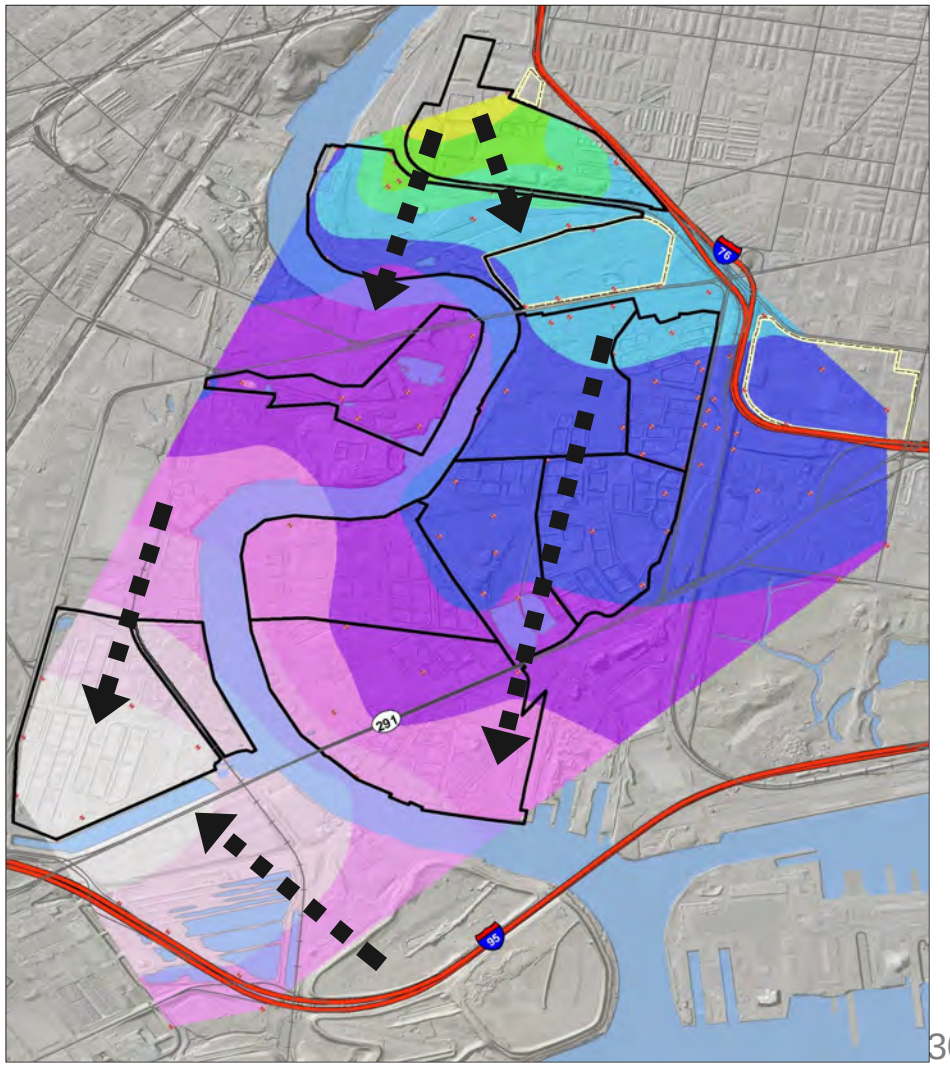
Water-Table Aquifer

- Mimics land surface shape, local flow patterns
- Recharged by rainfall, drains to surface water
- Influenced by human-made features (remediation wells, sewers, river bulkheads, dewatering)



Lower Aquifer

- More uniform shape, regional flow pattern
- Recharged by water table, interacts with river
- Influenced by human-made features (water supply wells, sewers, river bulkheads, dewatering)

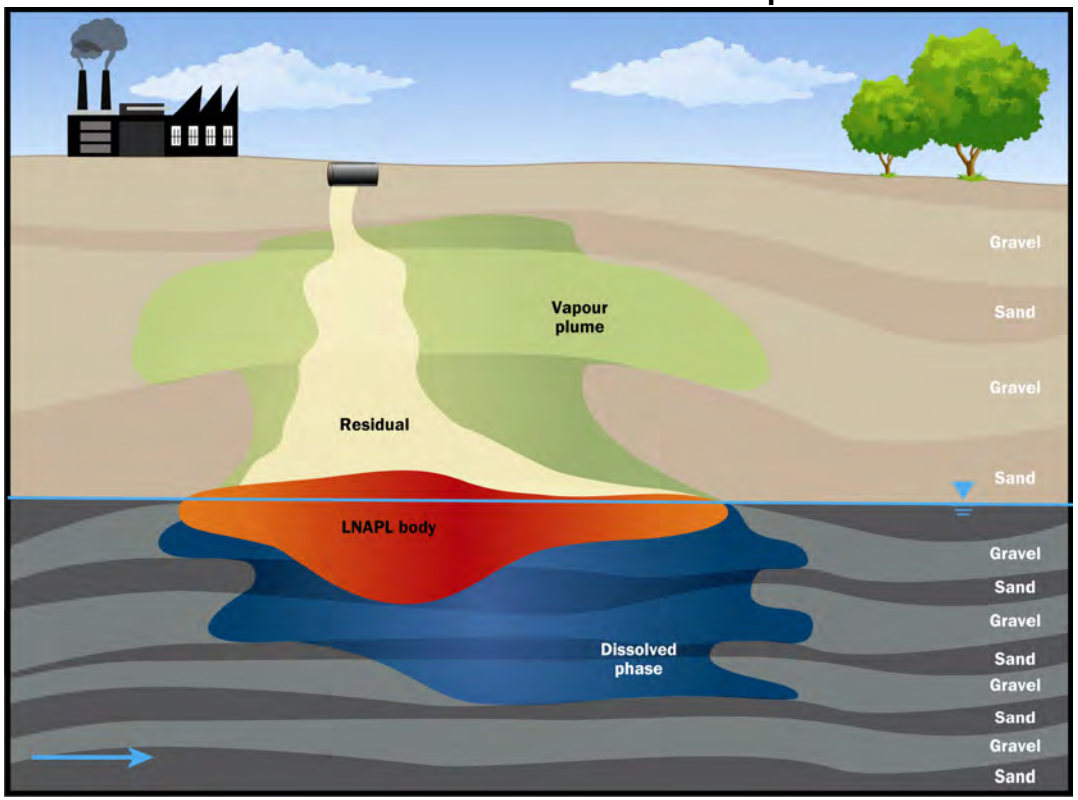


What is LNAPL?

LNAPL (Light, Non-Aqueous Phase Liquid) is:

- Crude oil and its refined products
- Lighter than water (floats)
- A mixture of petroleum compounds
- A source for soil and groundwater contamination
- A substance that naturally degrades underground

LNAPL Release Concept

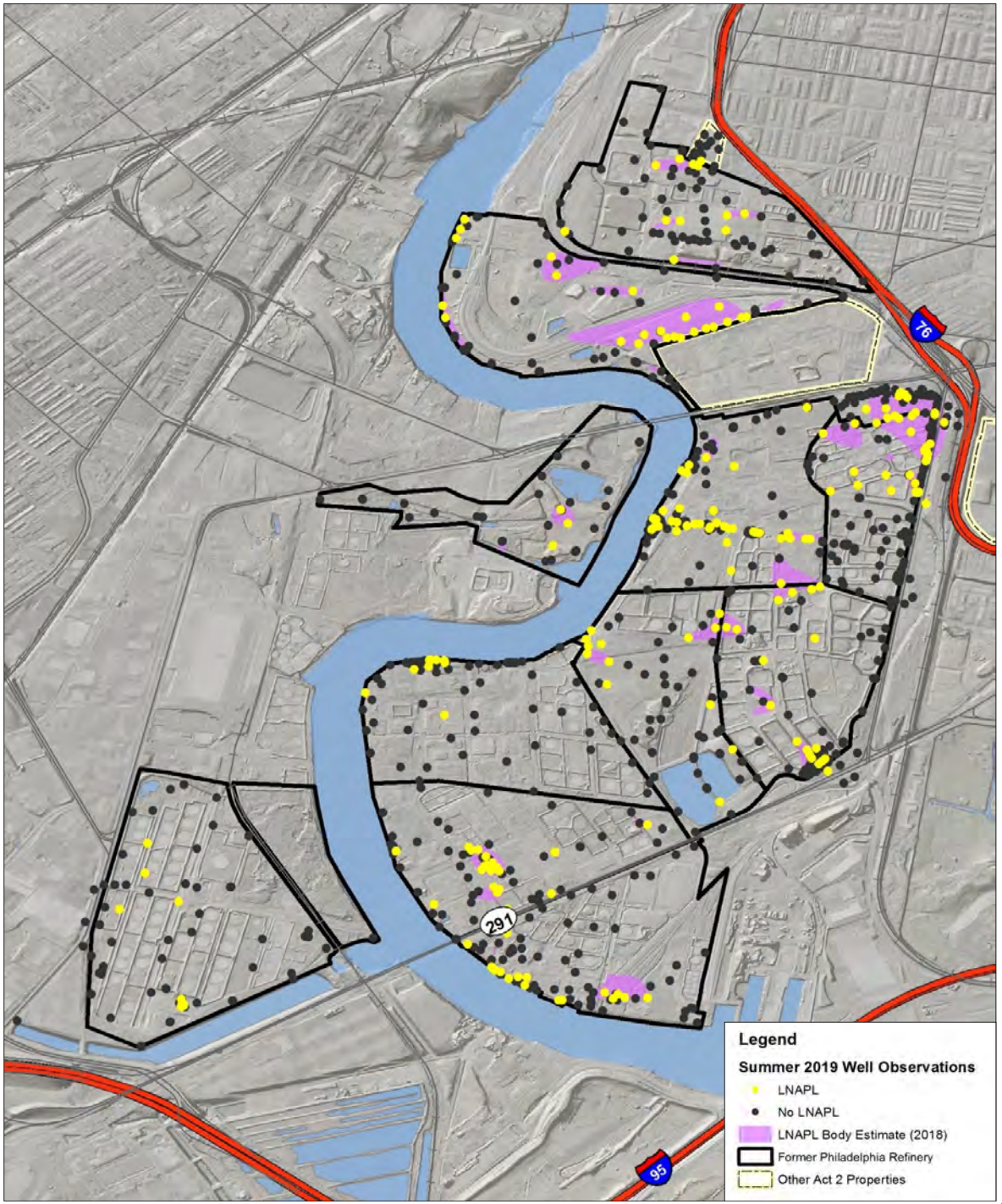


(CL:AIRE, 2014)

Investigation Results | LNAPL

LNAPL Bodies – Where/What/When

- Lines-of-evidence approach
- Observations from wells
- ~300 LNAPL samples collected since 1996
- LNAPL bodies have been characterized
- Most LNAPL bodies are stable
- Purple shading estimates LNAPL core areas



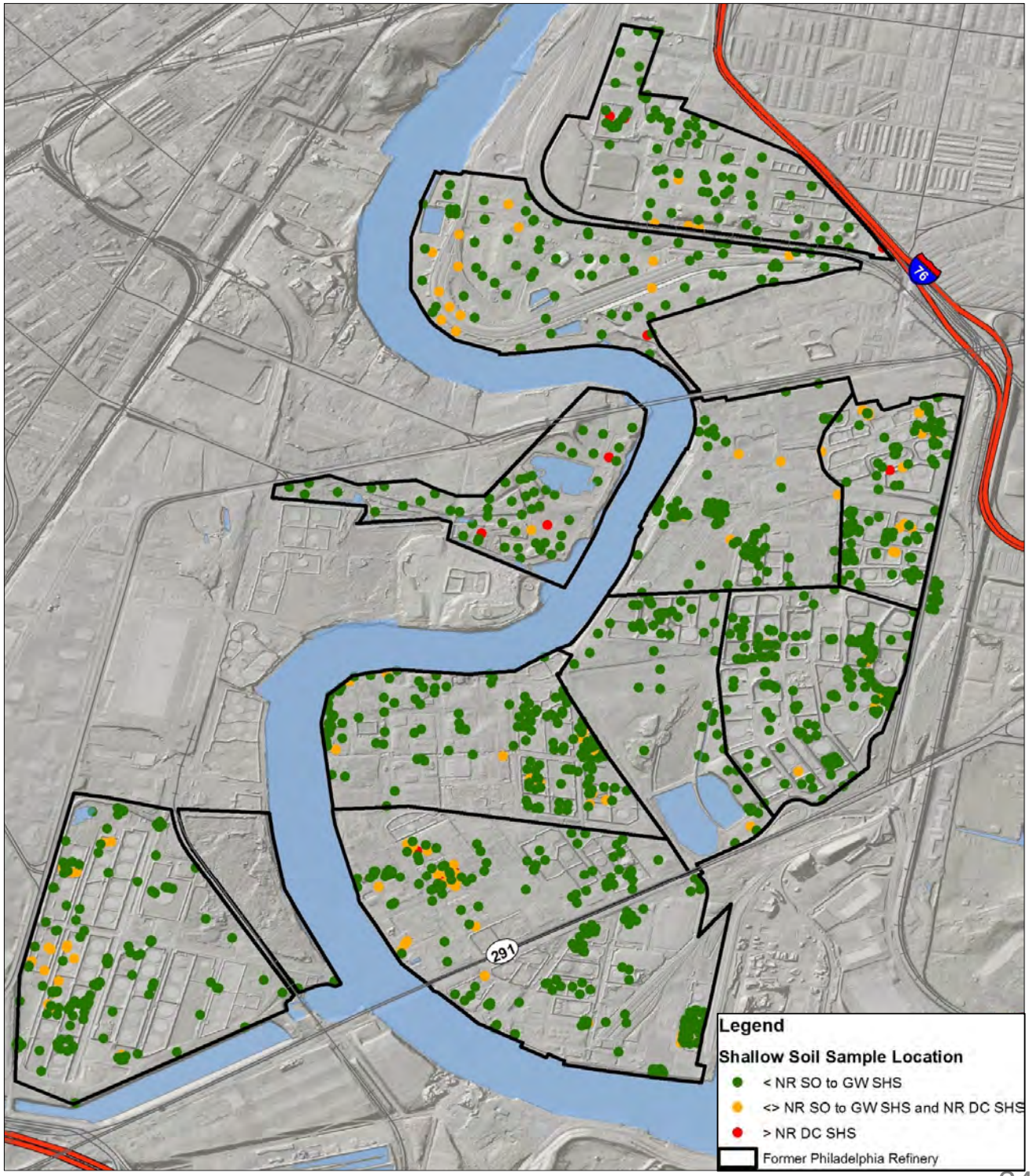
Contaminants of Concern

Volatile Organic Compounds	Semi Volatile Organic Compounds	Metals
Benzene	Anthracene	Lead
Cumene	Benzo(a)anthracene	
1,2-dibromoethane	Benzo(a)pyrene	
1,2-dichloroethane	Benzo(b)fluoranthene	
Ethylbenzene	Benzo(g,h,i)perylene	
Methyl tert-butyl ether (MTBE)	Benzo(k)fluoranthene	
	Chrysene	
Toluene	Dibenz(a,h)anthracene	
1,2,4-trimethylbenzene	Fluorene	
1,3,5-trimethylbenzene	Naphthalene	
Toluene	Phenanthrene	
Xylenes	Pyrene	

Soil Investigation Results

Surface (up to 2’ deep)

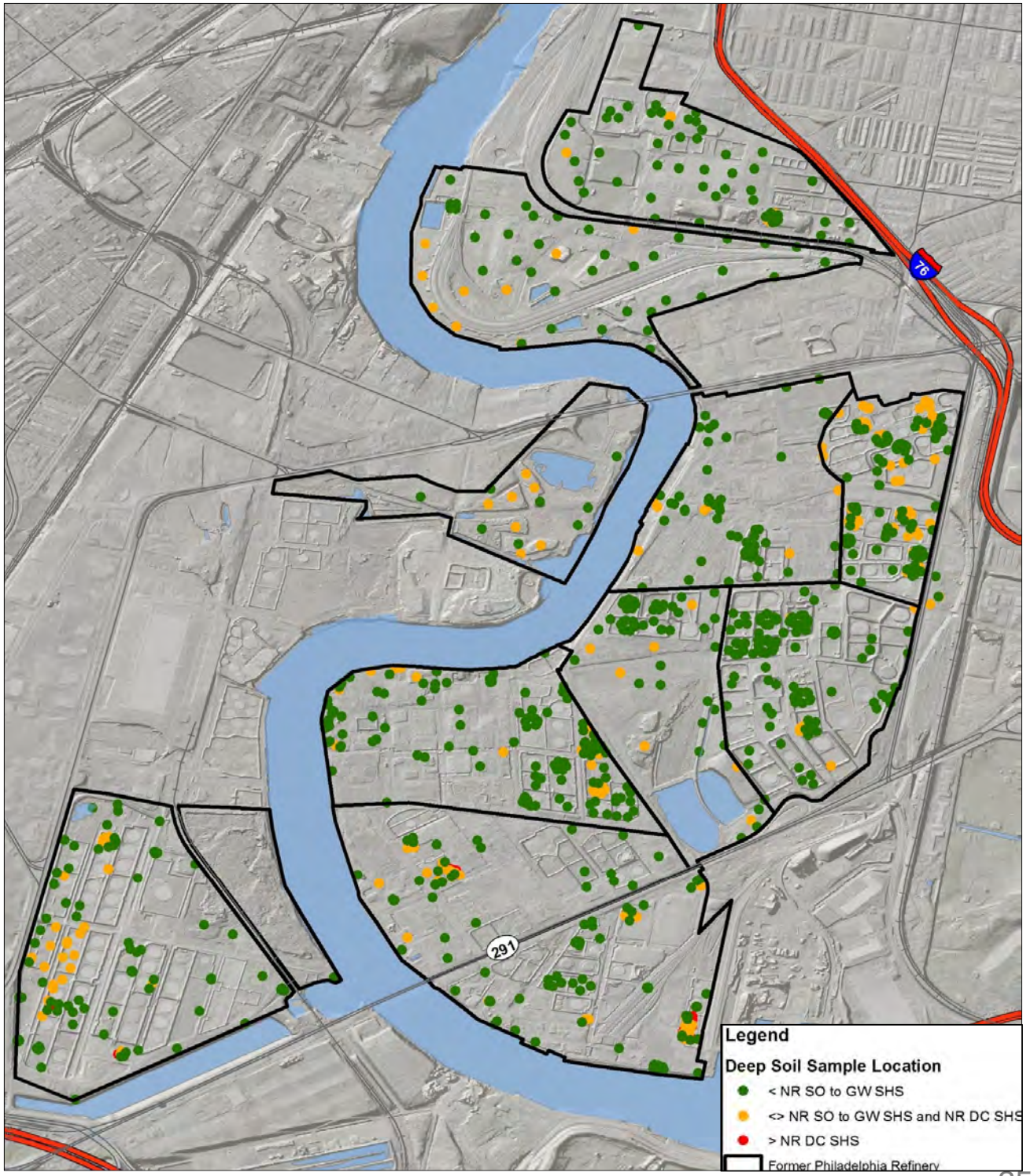
- Includes 1,294 soil samples (dots)
- Represents all available data
- Green dots meet the NR Soil to Groundwater SHS
- Yellow dots exceed the NR Soil to Groundwater SHS but meet the NR Direct Contact SHS
- Red dots exceed the NR Direct Contact SHS
- Red dots are delineated
- No Residential SHS exceedances in the Point Breeze North Yard Ball Field



Soil Investigation Results

Subsurface (2’-15’ deep)

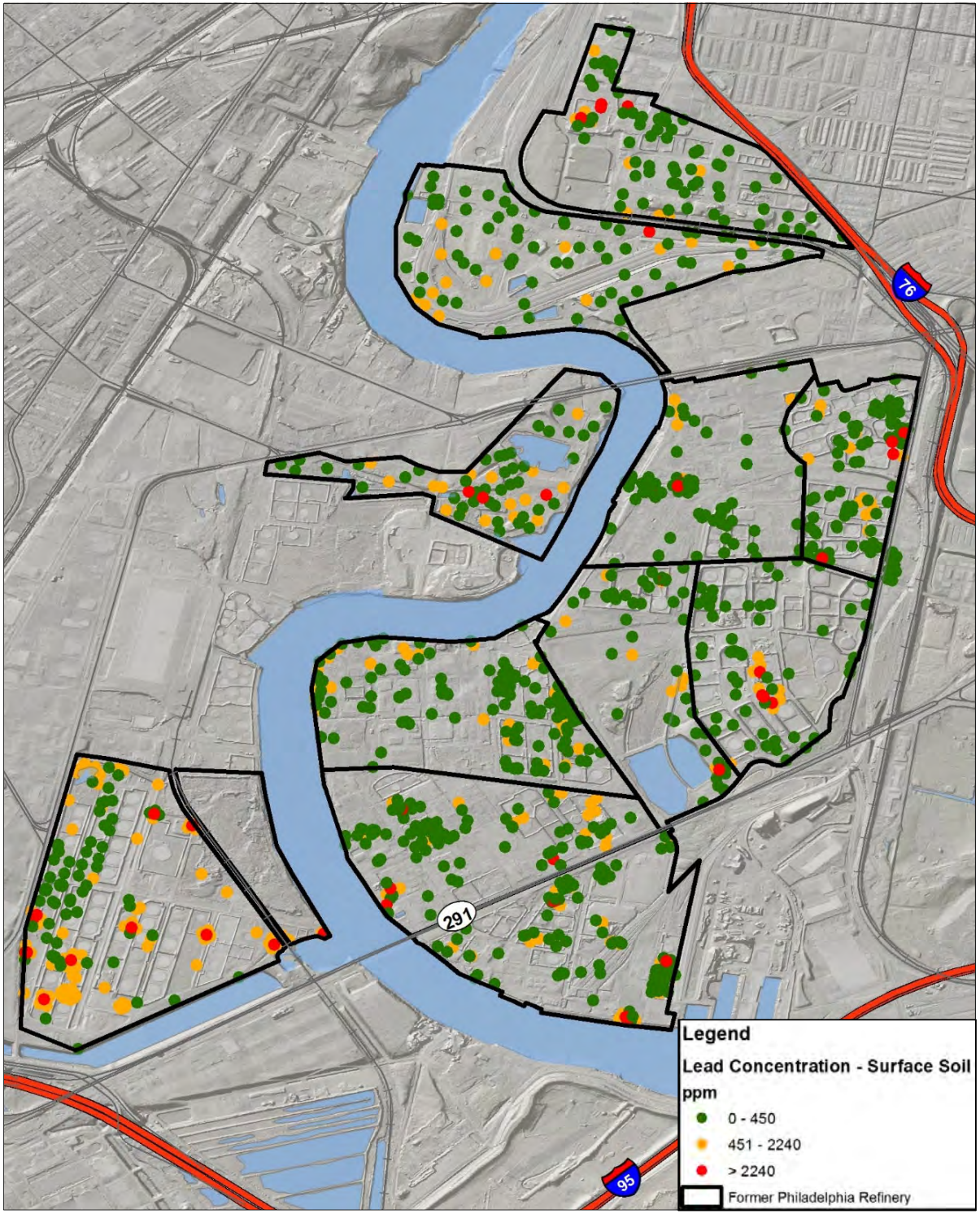
- Includes 1,008 soil samples (dots)
- Represents all available data
- Green dots meet the NR Soil to Groundwater SHS
- Yellow dots exceed the NR Soil to Groundwater SHS but meet the NR Direct Contact SHS
- Red dots exceed the NR Direct Contact SHS
- Red dots are delineated
- No Residential SHS exceedances in the Point Breeze North Yard Ball Field



Soil Investigation Results | Lead

Surface (up to 2’ deep)

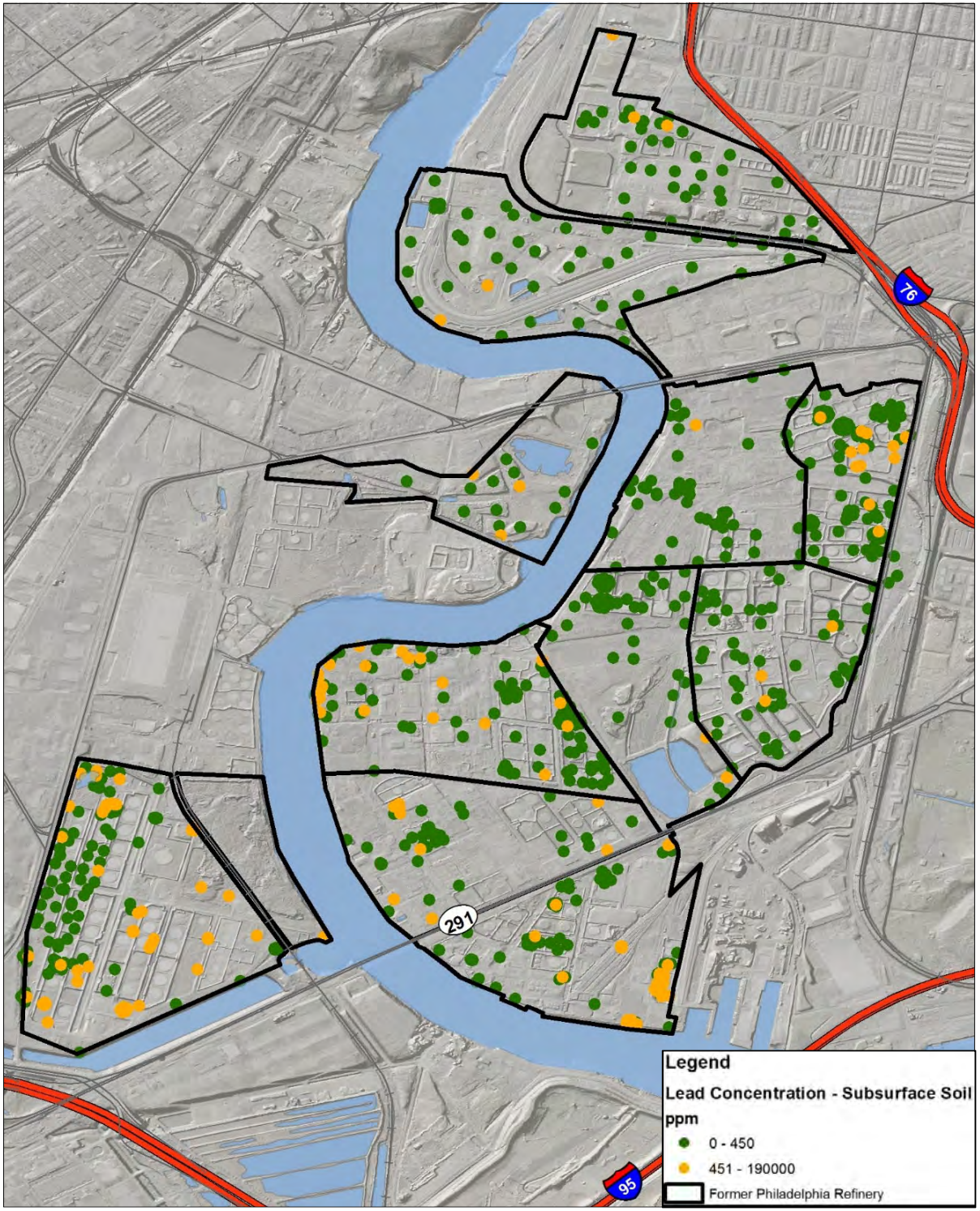
- Includes 1,173 soil samples (dots)
- Represents all available data
- Green dots meet the NR Soil to Groundwater SHS
- Yellow dots exceed the NR Soil to Groundwater SHS but meet the Site-Specific Standard
- Red dots exceed the Site-Specific Standard
- Red dots are delineated
- No Residential SHS exceedances in the Point Breeze North Yard Ball Field



Soil Investigation Results | Lead

Subsurface (2’-15’ deep)

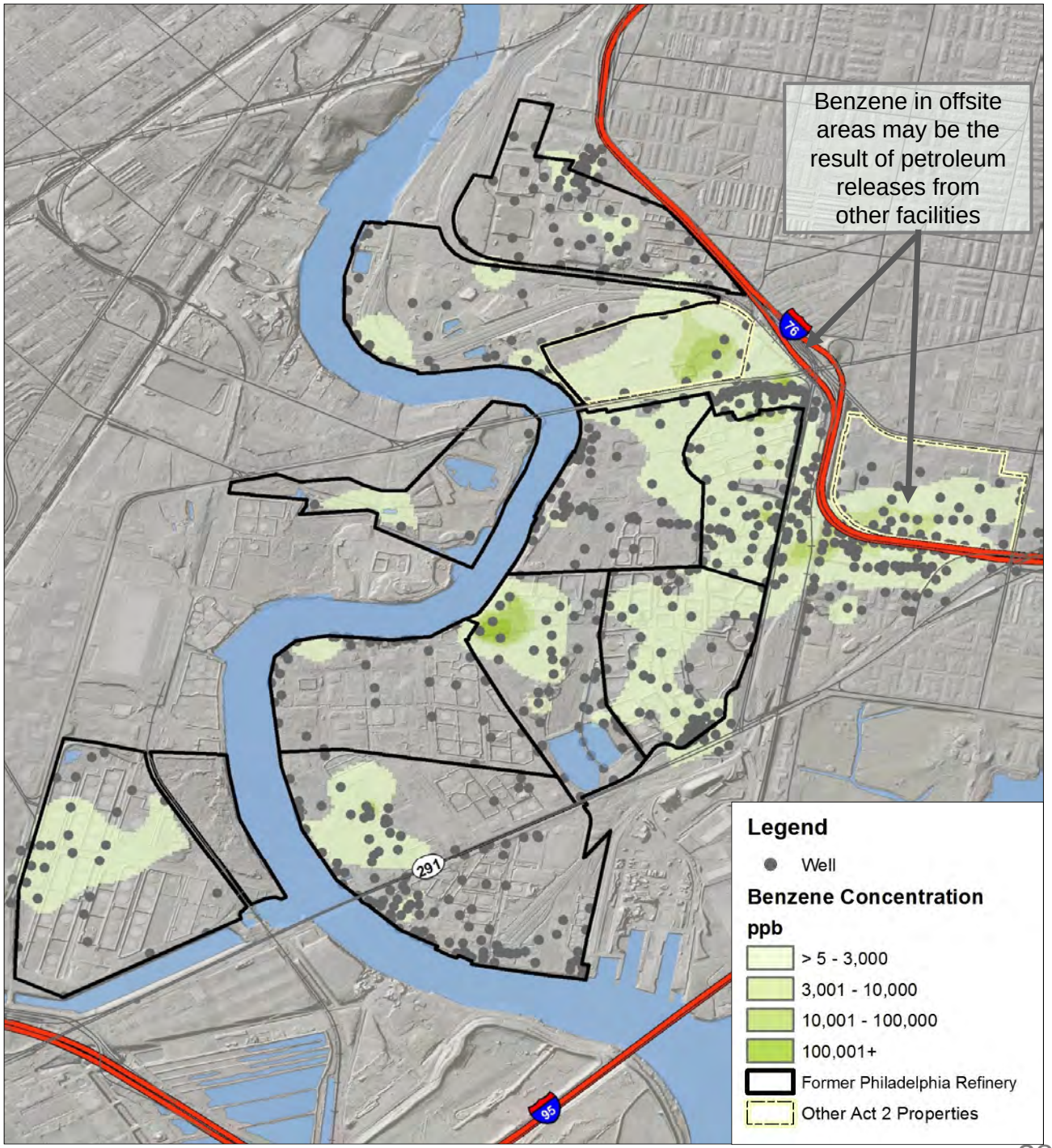
- Includes 802 soil samples (dots)
- Represents all available data
- Green dots meet the NR Soil to Groundwater SHS
- Yellow dots exceed the NR Soil to Groundwater SHS but meet the NR Direct Contact SHS
- No exceedances of the NR Direct Contact SHS



Groundwater Investigation Results | Benzene

Water-Table Aquifer

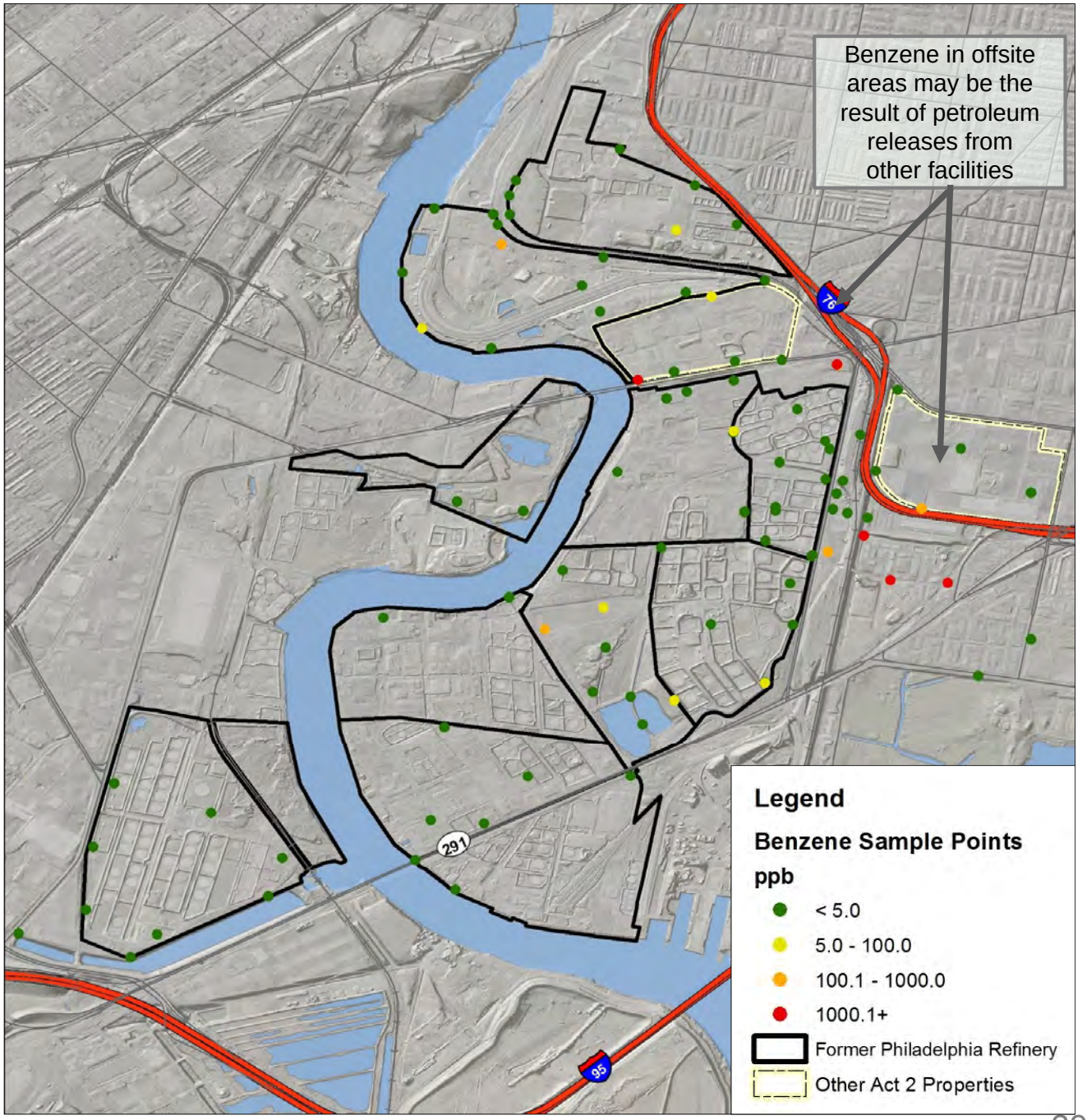
- Benzene considered a primary driver
- Includes 788 well samples (dots)
- Includes data from other offsite Act 2 facilities
- Represents data of current conditions (2014-2019)
- Green shading indicates concentrations above the SHS
- Darker green indicates higher concentrations
- Demonstrates delineation in most areas



Groundwater Investigation Results | Benzene

Lower Aquifer

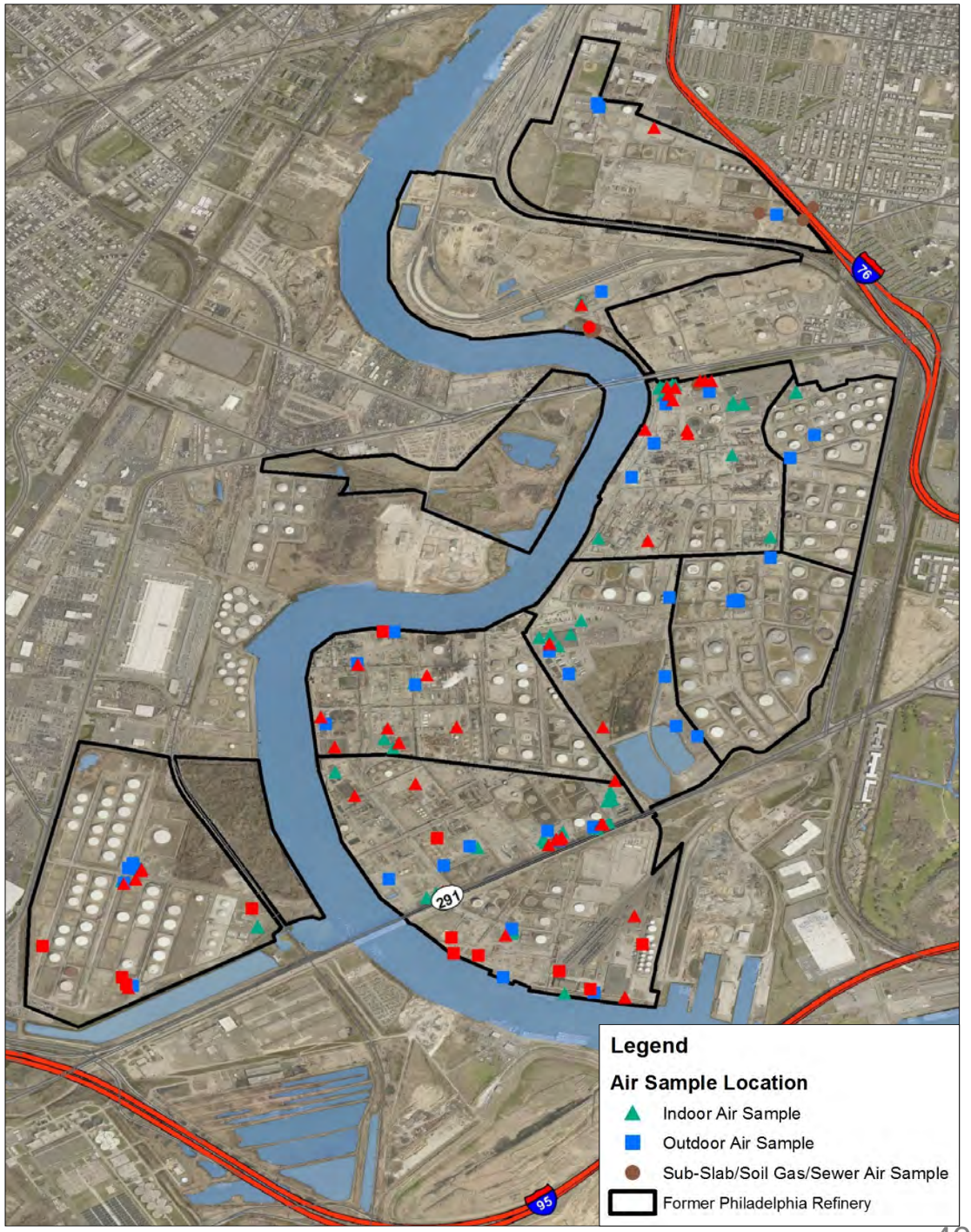
- Includes 97 well samples (dots)
- Includes data from other offsite Act 2 facilities
- Represents data for current conditions (2014 – 2019)
- Green dots indicate concentrations below the SHS
- Yellow, orange, and red dots indicate concentrations above the SHS
- Demonstrates delineation in most areas



Air Investigation Results

Total of 234 Air Samples Collected

- Evaluate air quality related to subsurface conditions
- Indoor Air Samples (173 collected)
  - Air samples collected in occupied buildings
- Outdoor Air Samples (52 collected)
  - Air samples collected in outdoor areas
  - Includes background samples
- Sub-slab/Soil Gas/Sewer Air Samples (9 collected)
  - Vapor samples collected from beneath the surface to aid in interpretation of indoor and/or outdoor air results
- Red symbols denote exceedances of indoor/outdoor air screening criteria (EPA RSLs TR=1E-5 HQ=0.1) or soil vapor criteria (SVNS-NR SHS)
- Comparison of data to conservative screening values determines if further evaluation is warranted

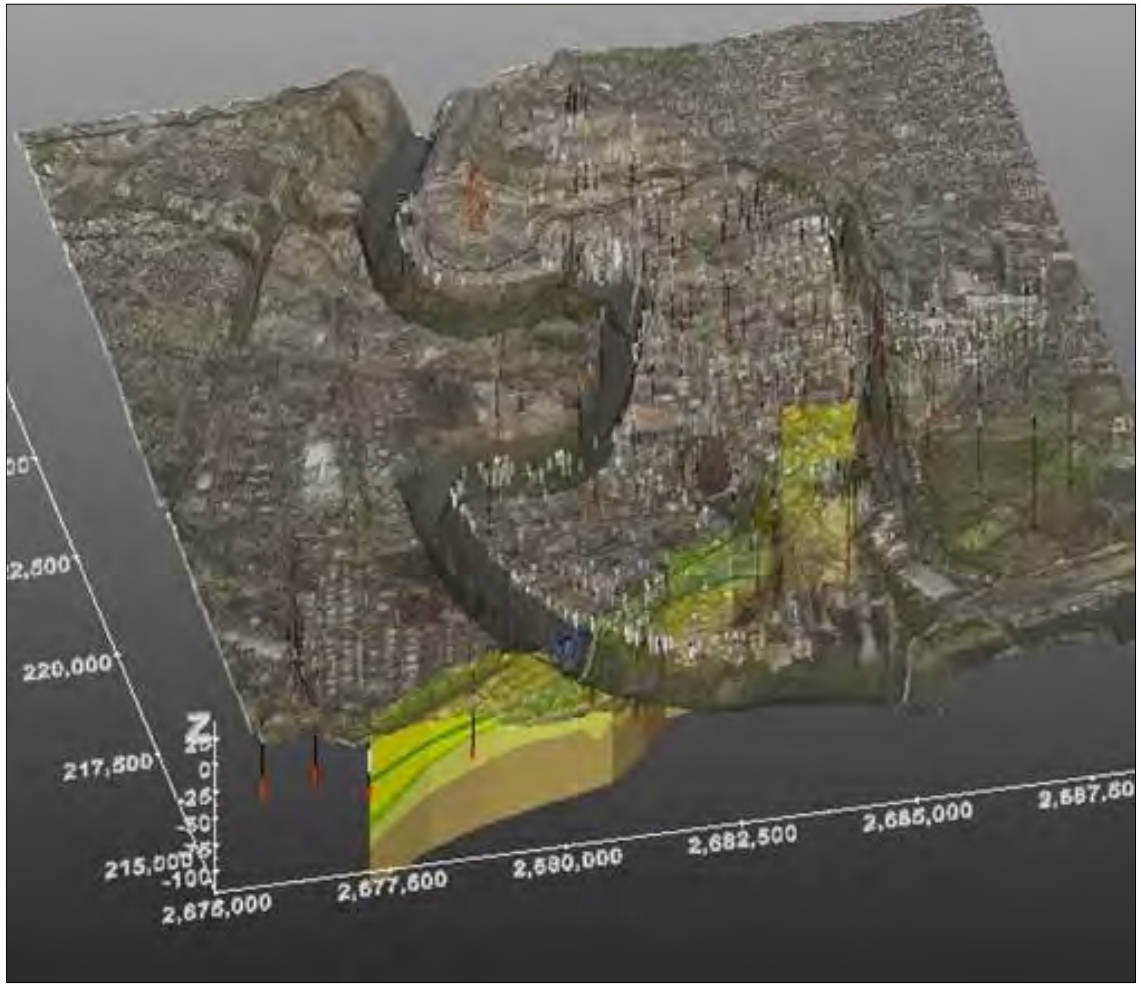


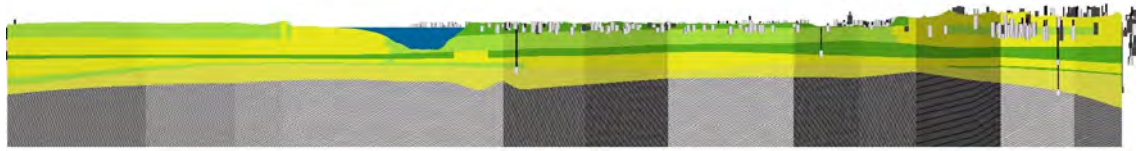
Conceptual Site Model (CSM)

An Organized Set of Ideas (4D) Summarizing:

- Site history and geology
- Groundwater occurrence and flow patterns
- Pathway evaluation
- Contaminant distribution
- Contaminant trends

- ➢ A CSM is the foundation for a groundwater flow model (completed draft RIR)
- ➢ A CSM supports fate and transport analysis to predict future contamination extent (in progress)
- ➢ Transport model results will be used in risk assessment and cleanup plan (in progress)





Key Take-Away

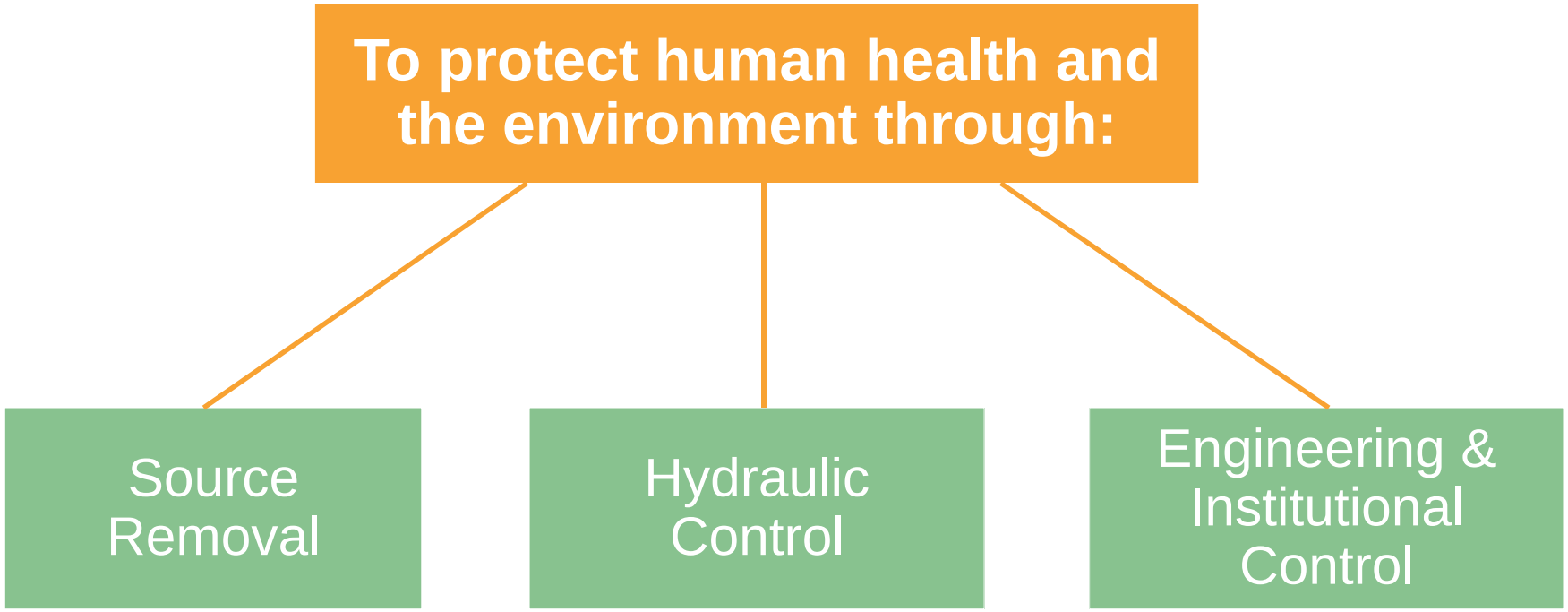
- What is a Remedial Investigation (RI)?
  - *Collection of available information on the facility*
  - *Characterization of the geologic and hydrogeologic framework*
  - *Characterization of the nature and extent of contamination and how it may change over time*
  - *Identification of exposure pathways*
- What are the Results of the Remedial Investigation?
  - *Geologic and hydrogeologic conditions have been characterized*
  - *Soil impacts have been delineated in each AOI*
  - *Groundwater has been delineated in most areas – additional characterization and routine sampling continue*
- Are the Remedial Investigations Complete?
  - *Public Comments on all past Act 2 Reports will be submitted as an RIR document*
  - *AOI's 4 & 9 require RIR Addendums which will include offsite groundwater information from recently installed wells*
  - *AOI-11 will have an updated RIR to include data collected since the Final Report*
  - *Fate and Transport numerical model RIR forthcoming*

Remediation Systems

Key Concepts in Remediation Section

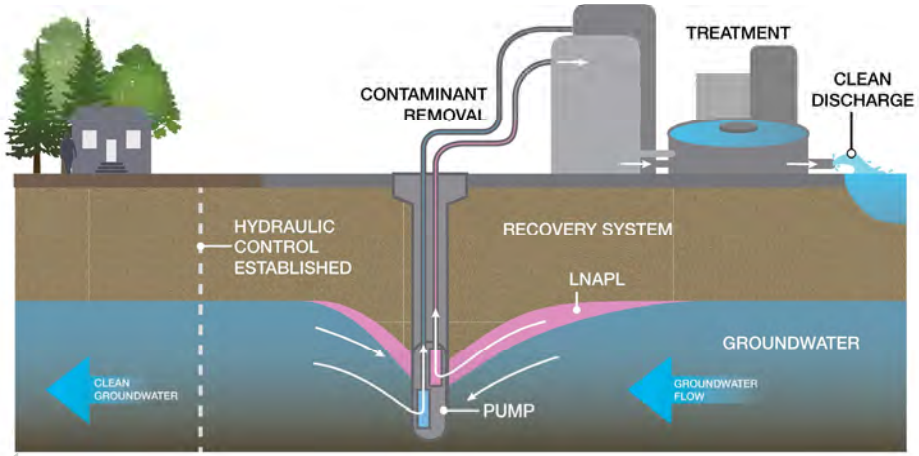
- Purpose of Remediation
- Types Remediation Systems
- How Much has been Remediated
- Systems at the Site
- Future Plans

Purpose of Remedial Systems

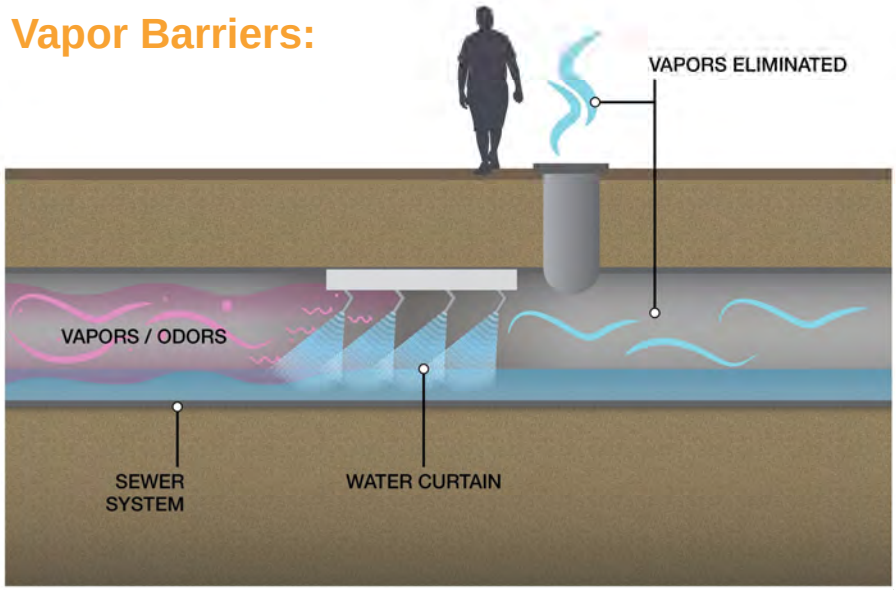


How Remediation Systems Work

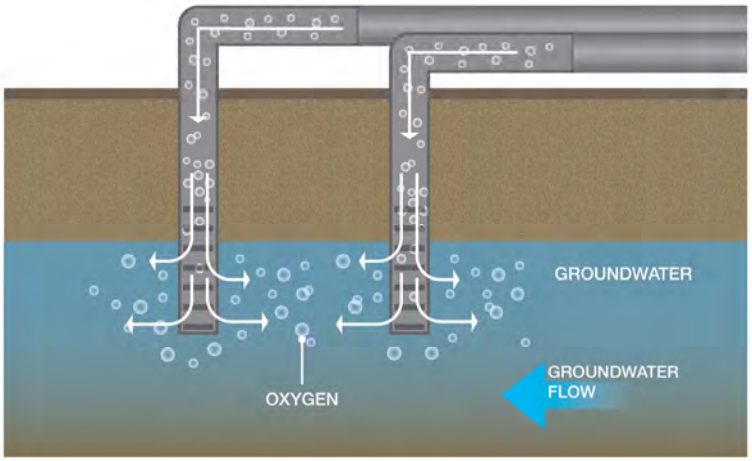
Recovery Systems



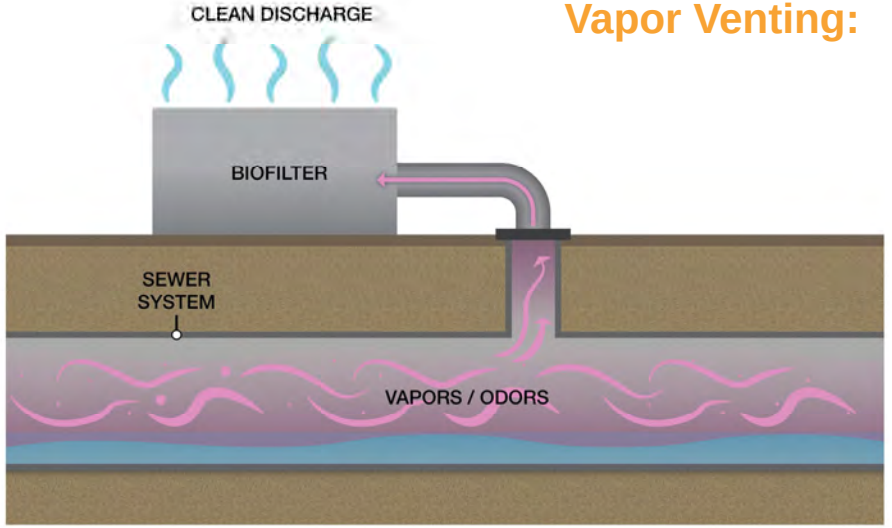
Vapor Barriers:



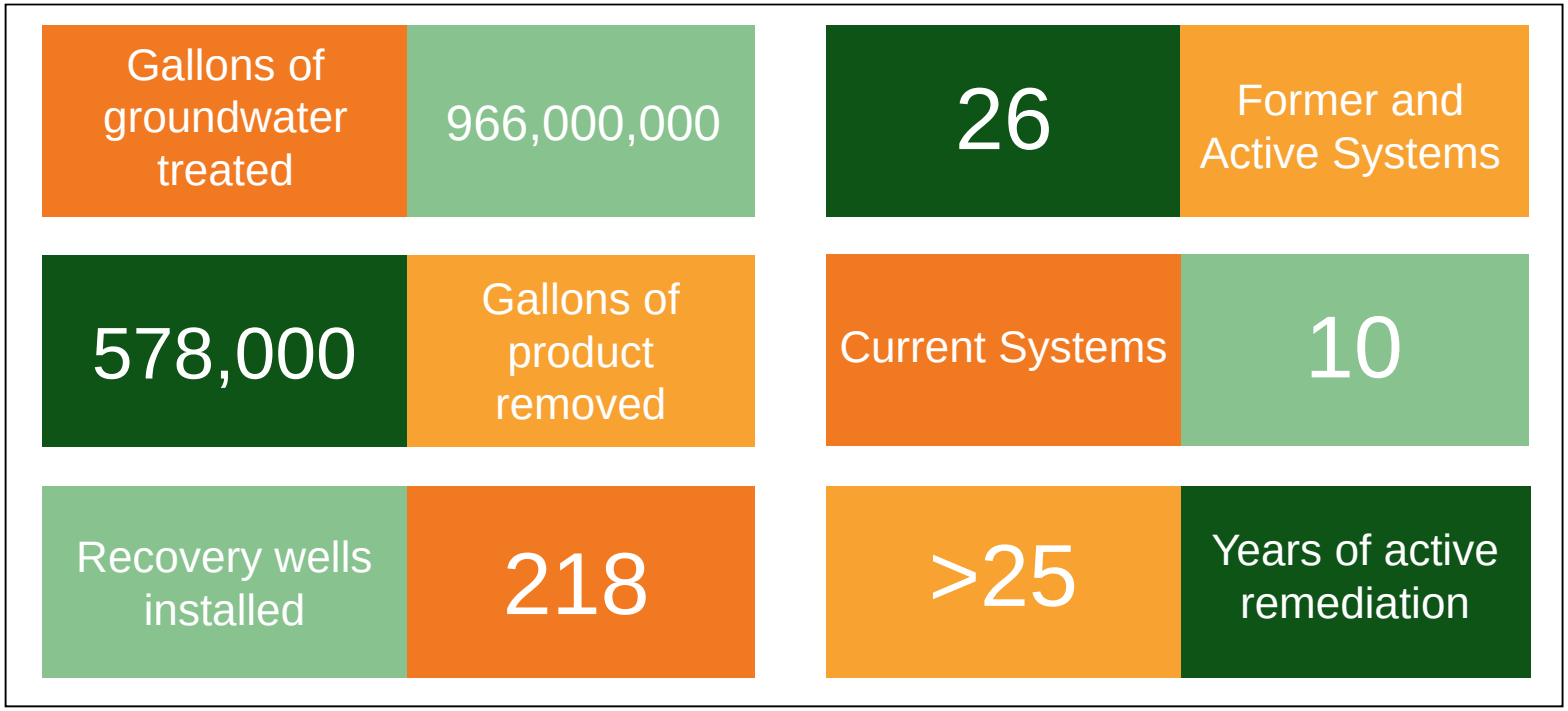
Injections (Biodegradation):



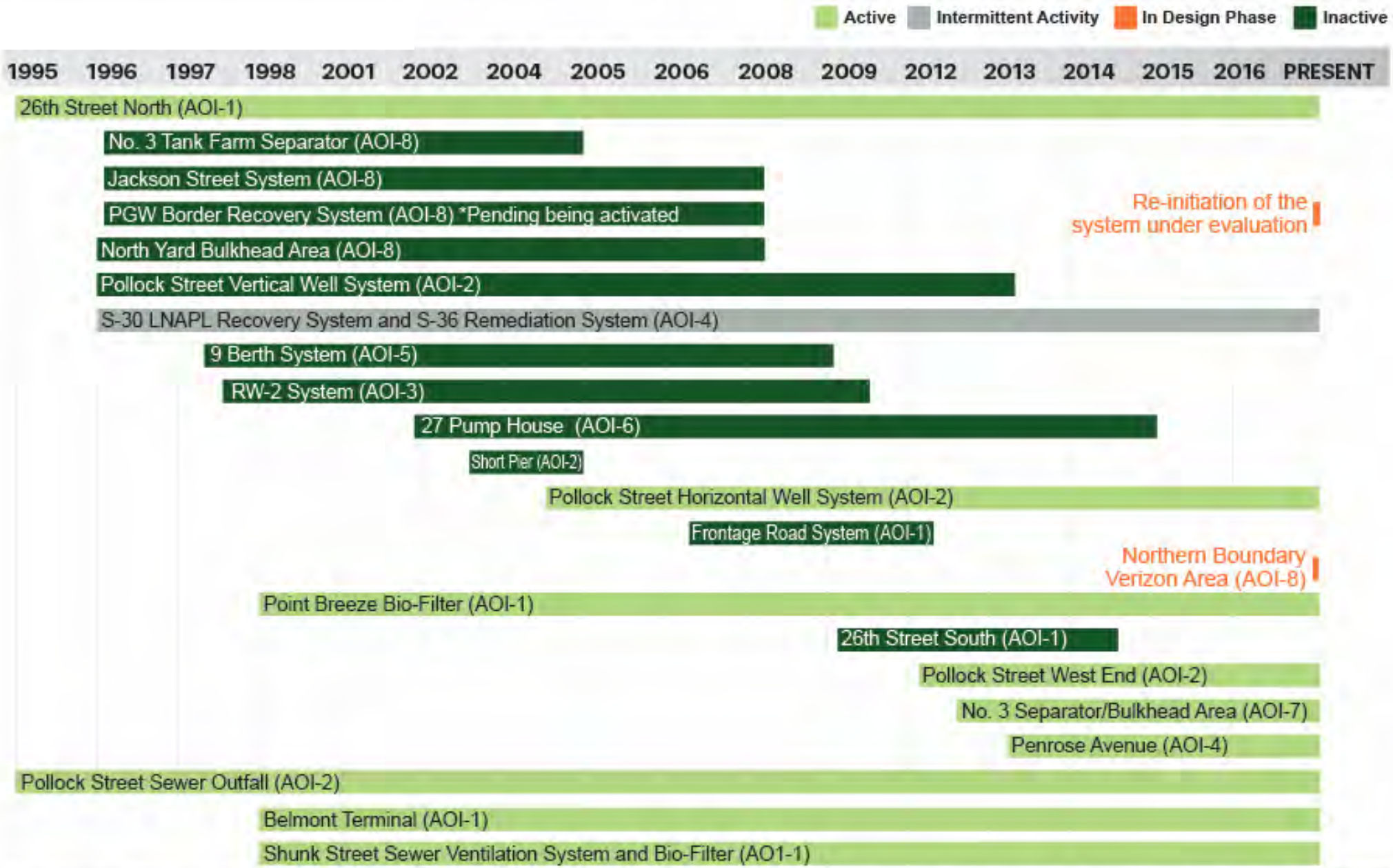
Vapor Venting:



Quick Facts about Remediation

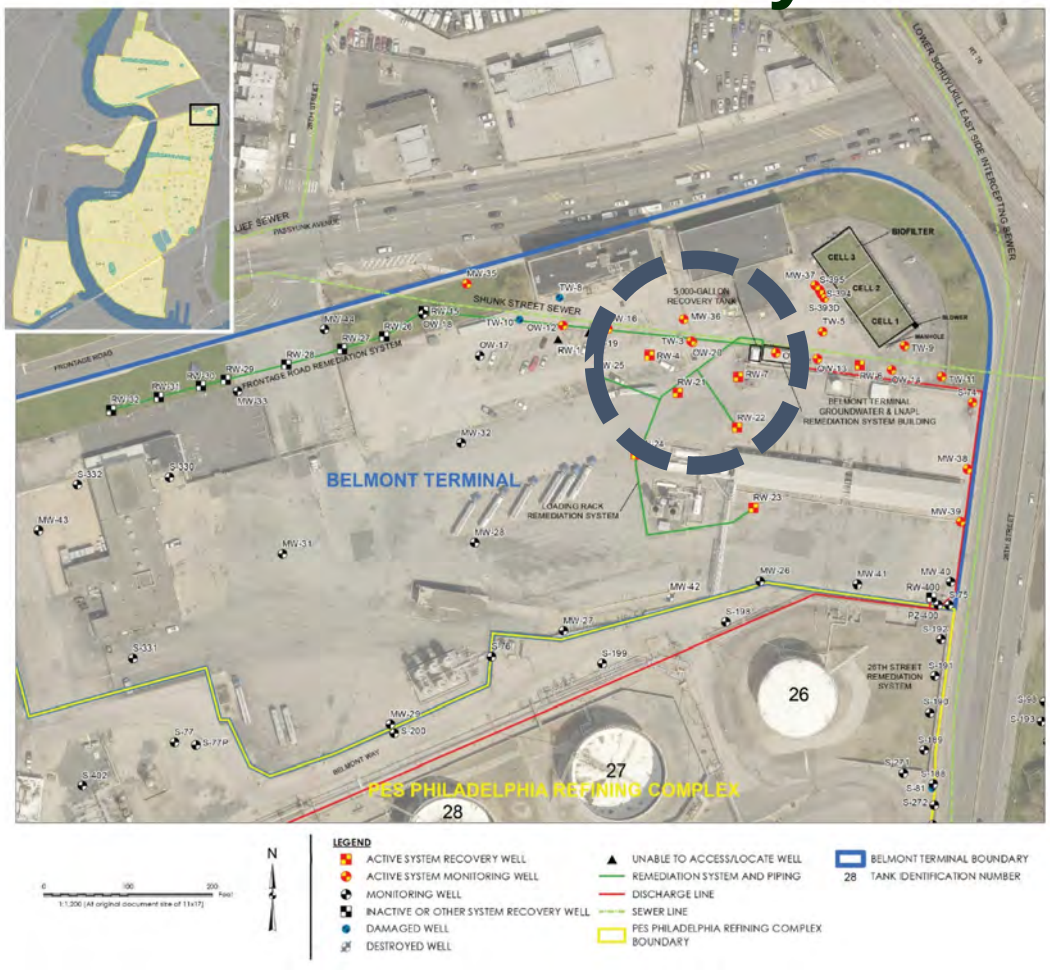


Remediation Timeline



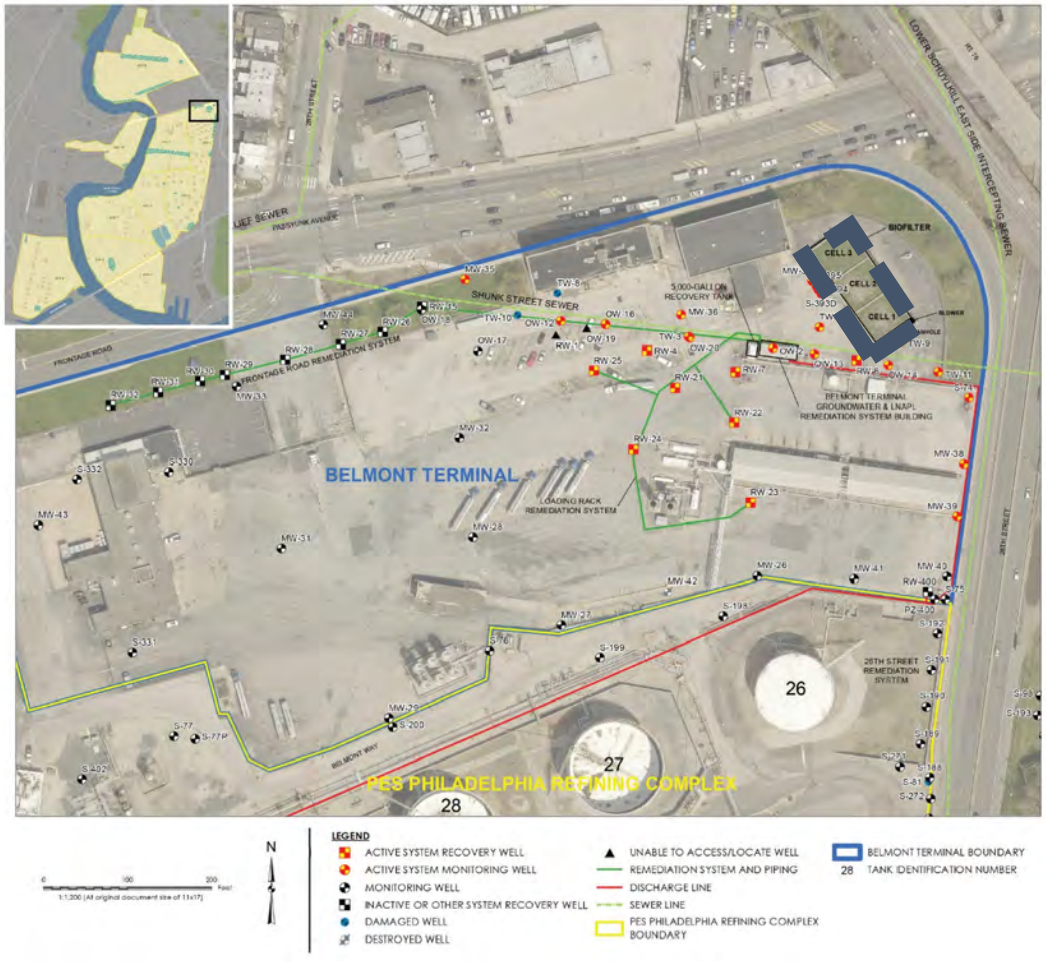
Remediation Systems

Belmont Terminal System – Remediation Summary



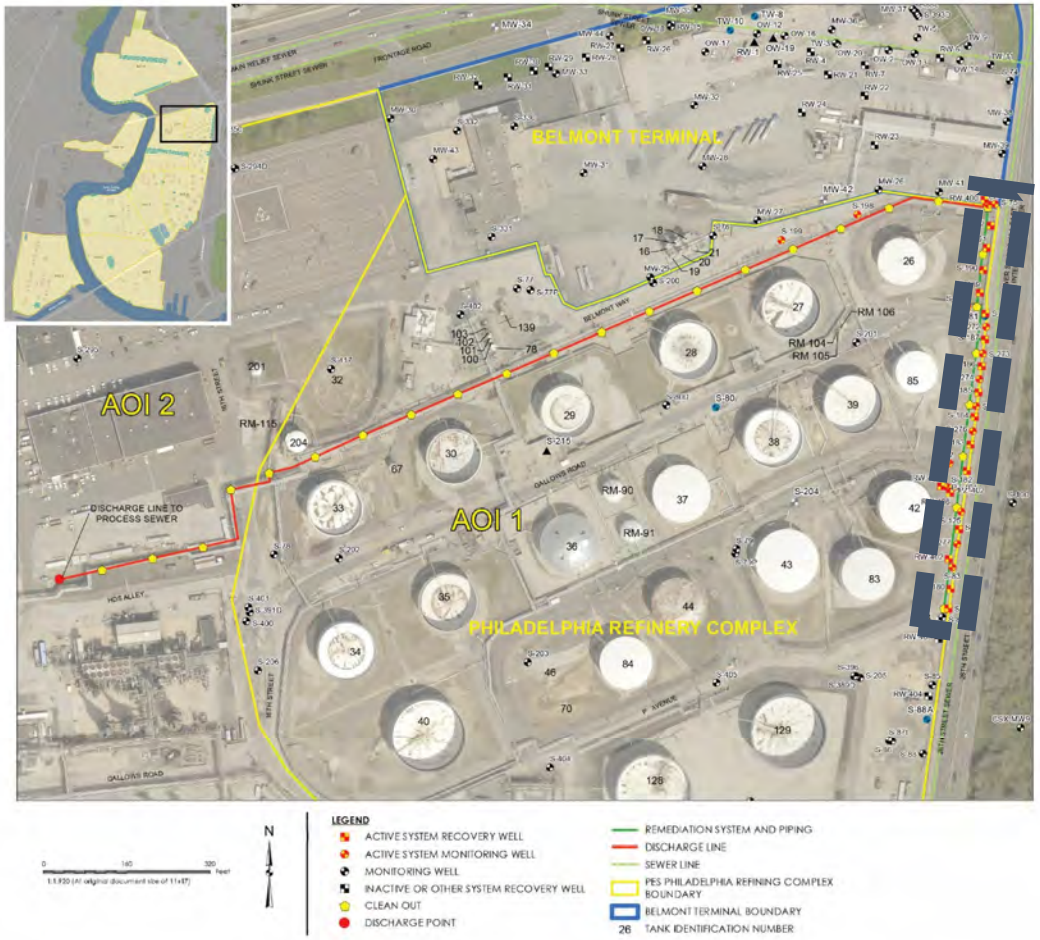
Purpose:	Containment Source Removal
Location:	AOI-1
Active Operation:	1995 - Present
Recovery Wells:	10
Recovery Volume:	• >100 million gallons groundwater • >250,000 gallons LNAPL
Other Elements:	• Well pumps controlled by density floats • Pumps turned on/off as needed

Belmont Biofilter System – Remediation Summary



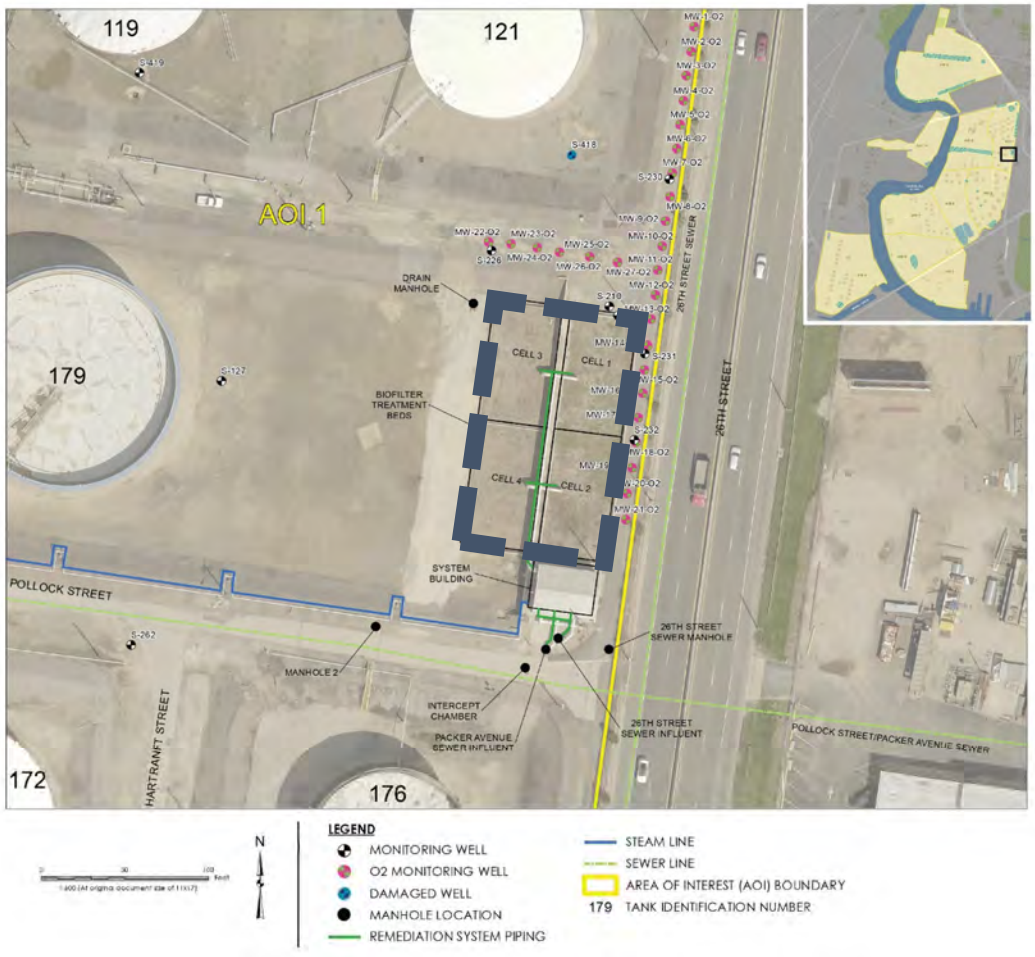
Purpose:	Vapor Control
Location:	AOI-1
Active Operation:	2002 - Present
Recovery Wells:	No wells; blowers extract vapors from the sewers
Remediation Type:	• Vapor extraction
Other Elements:	• Treatment via fixed bed biofilter

26th Street North System – Remediation Summary



Purpose:	Containment Source Removal
Location:	AOI-1
Active Operation:	1995 - Present
Recovery Wells:	16
Recovery Volume:	• >111 million gallons groundwater • >9,000 gallons LNAPL
Other Elements:	• Total fluids system • Recovery wells rehabilitated in 2015

Point Breeze Bio-Filter System – Remediation Summary

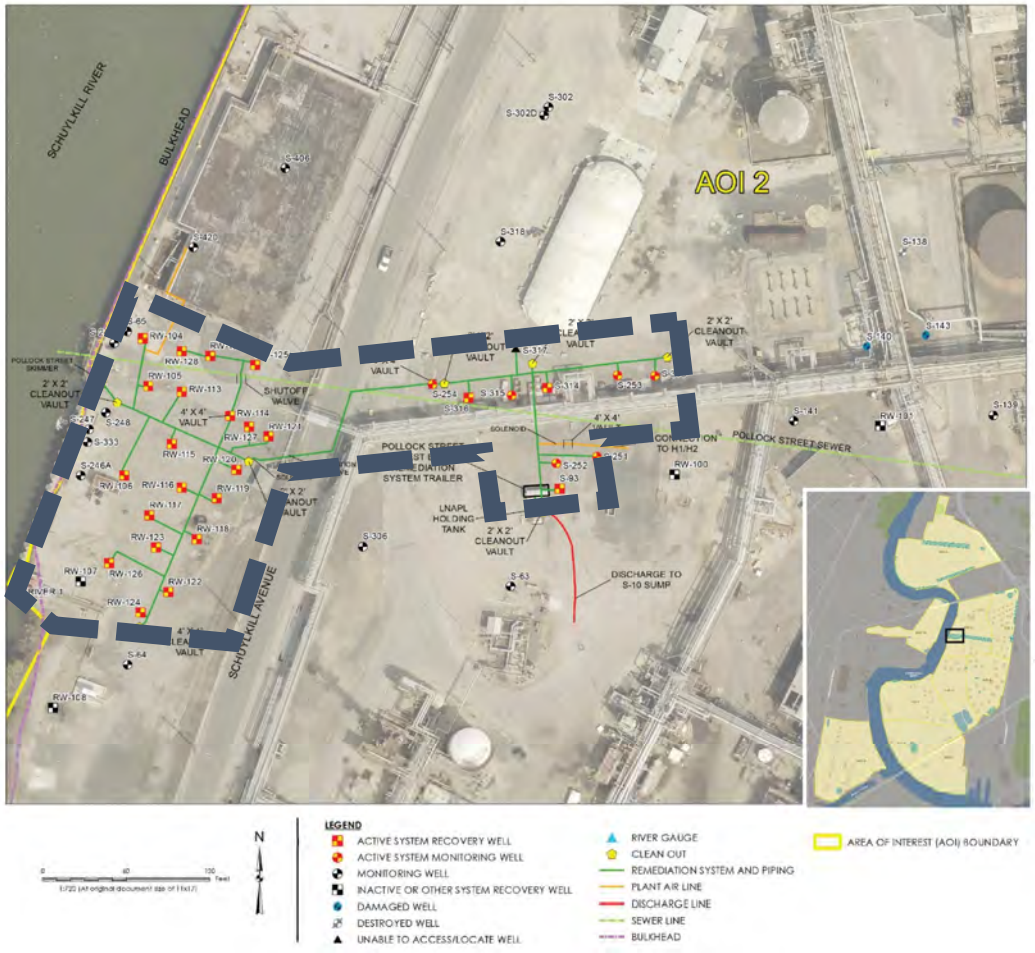


Purpose:	Vapor Control
Location:	AOI-1
Active Operation:	1998 - Present
Recovery Wells:	No wells; blowers extract vapors from the sewers
Remediation Type:	• Vapor extraction
Other Elements:	• Treatment via fixed bed biofilter • Rehabilitated in 2015/2016

Pollock Street Horizontal Well System Remediation Summary

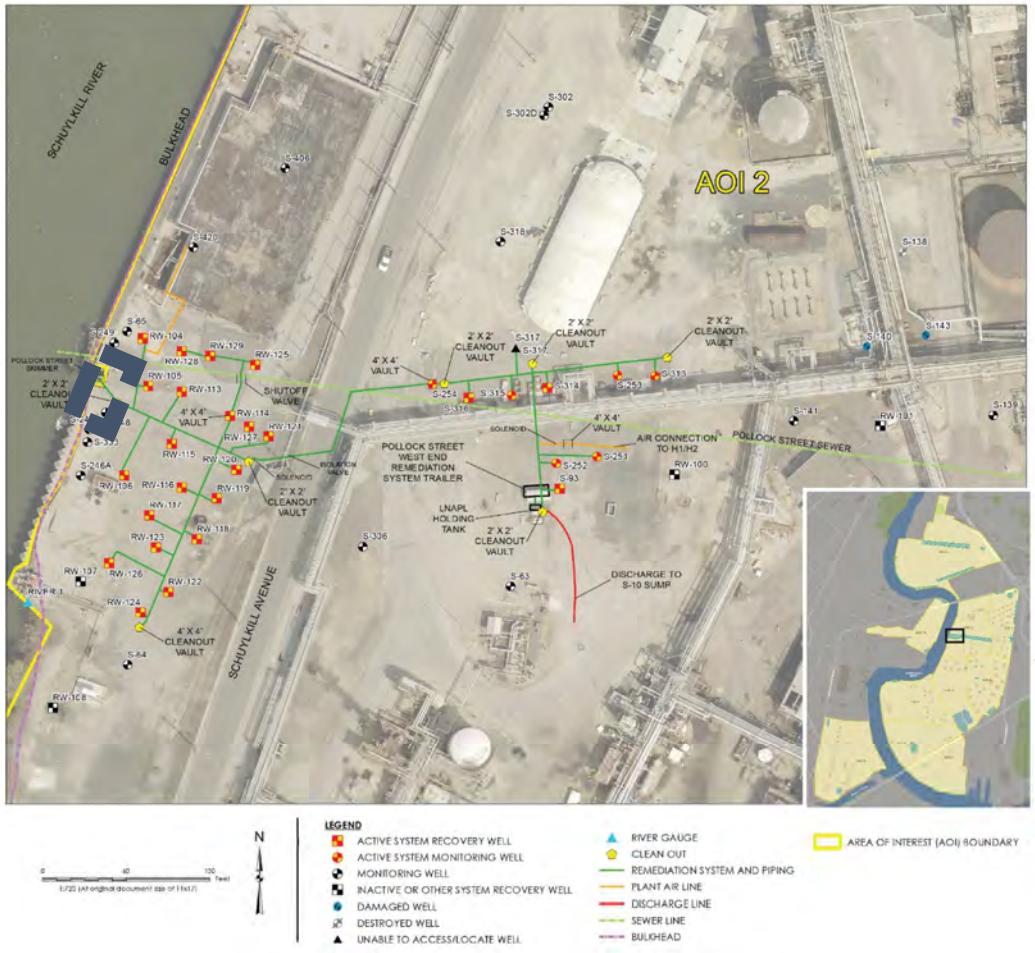
Purpose:	Containment Source Removal
Location:	AOI-2
Active Operation:	July 2004 - Present
Recovery Wells:	3 horizontal wells
Recovery Volume:	• >120 million gallons of groundwater and LNAPL

Pollock Street West End System – Remediation Summary



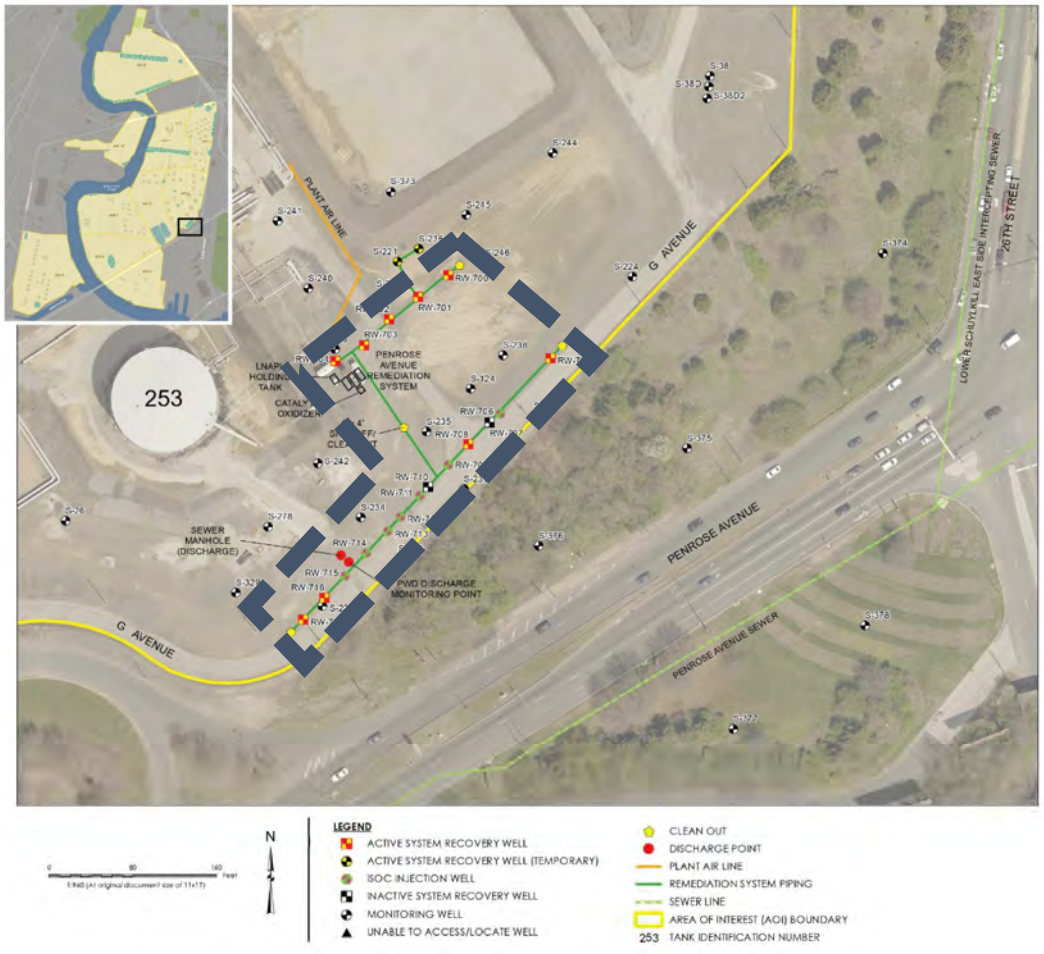
Purpose:	Containment Source Removal
Location:	AOI-2
Active Operation:	Feb. 2012 - 2017
Recovery Wells:	10
Recovery Volume:	• >30 million gallons groundwater • >60,500 gallons LNAPL
Other Elements:	• Carbon filters control vapor emissions from holding tank

Pollock Street Sewer System – Remediation Summary



Purpose:	Monitoring and Prevention of LNAPL to Schuylkill River
Location:	AOI-2
Active Operation:	1995 - Present
Remediation Type:	• Skimmer system located in outfall
Other Elements:	• Coffer dam with tie gates • River boom • Sorbent material

Penrose Avenue System – Remediation Summary



Purpose:	Containment Source Removal Vapor Control
Location:	AOI-4
Active Operation:	March 2013 - Present
Recovery Wells:	20
Recovery Volume:	• 22 million gallons groundwater • 6,000 gallons LNAPL
Other Elements:	• Oxygen injection • Catalytic oxidizer controls vapor emissions from holding tank

No. 3 Separator System – Remediation Summary

Purpose:	Containment Source Removal
Location:	AOI-7
Active Operation:	2012 - Present
Recovery Wells:	10
Recovery Volume:	• 25 million gallons groundwater • >113,800 gallons LNAPL
Other Elements:	• Carbon filters control vapor emissions from holding tank • Prevention of LNAPL in the Schuylkill River

Key Take-Away

- What is a Remedial System?
  - *A system that protects human health and the environment through source removal, hydraulic control or engineering or instrumental controls*
- What Systems are at the Site?
  - *Recovery systems, biodegradation, vapor barriers, and vent systems*
- How Much has been Remediated?
  - *Over 1 Billion gallons of water and oil has been removed and treated*
- What are the Future Plans?
  - *Evergreen will continue to remediate as necessary, adapting to the specific conditions of the site.*

Next Steps

- Act 2 Reports are available on the project website, at the Thomas F. Donatucci, Sr. Library (1935 Shunk St.) and at Eastwick Library (2851 Island Avenue) and at PADEP (https://www.dep.pa.gov/Citizens/PublicRecords/Pages/Informal-File-Review.aspx)
- Comments can be submitted today in writing on comment forms, through the online submission form on the website at www.phillyrefinerycleanup.info, via email to phillyrefinerycleanup@ghd.com, or through Q&A tonight.
- Comment period begins today and will last for 120 days ending when the second meeting is held on or around March 9, 2020.