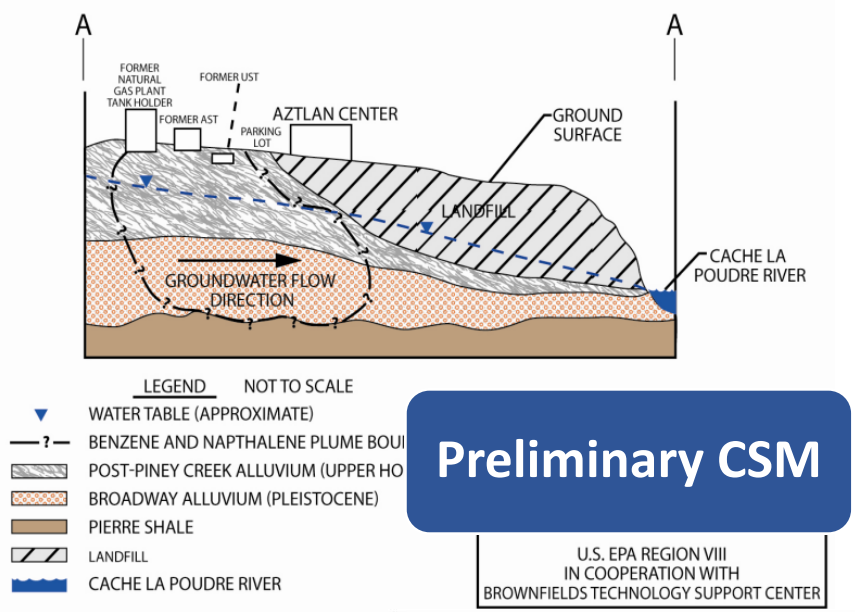
The Evolving Conceptual Site Model and Remedial Technology Selection

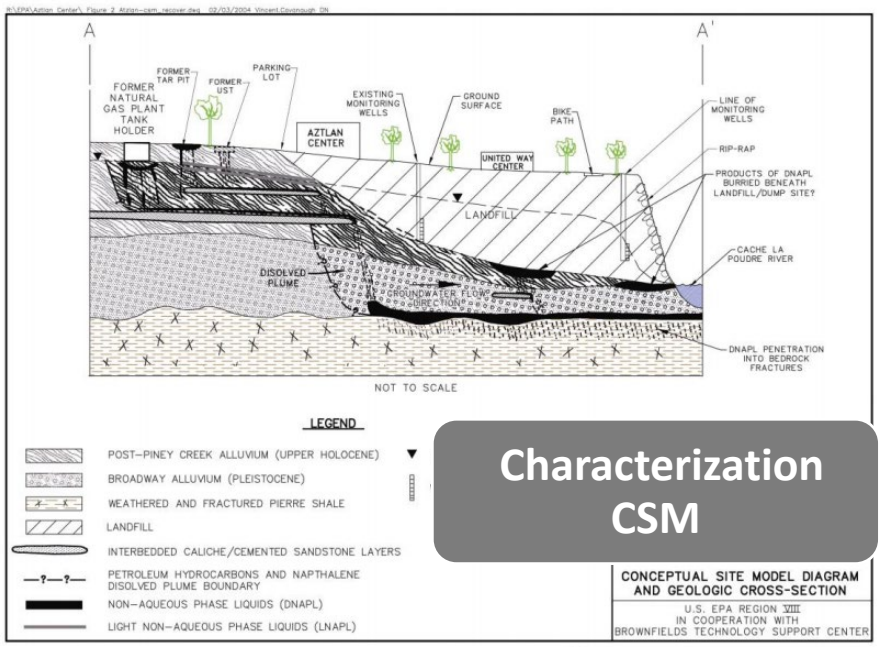
Examples from EPA Region 2 Superfund Sites

Kathryn Flynn
U.S. Environmental Protection Agency
Region 2 Technical Support Section

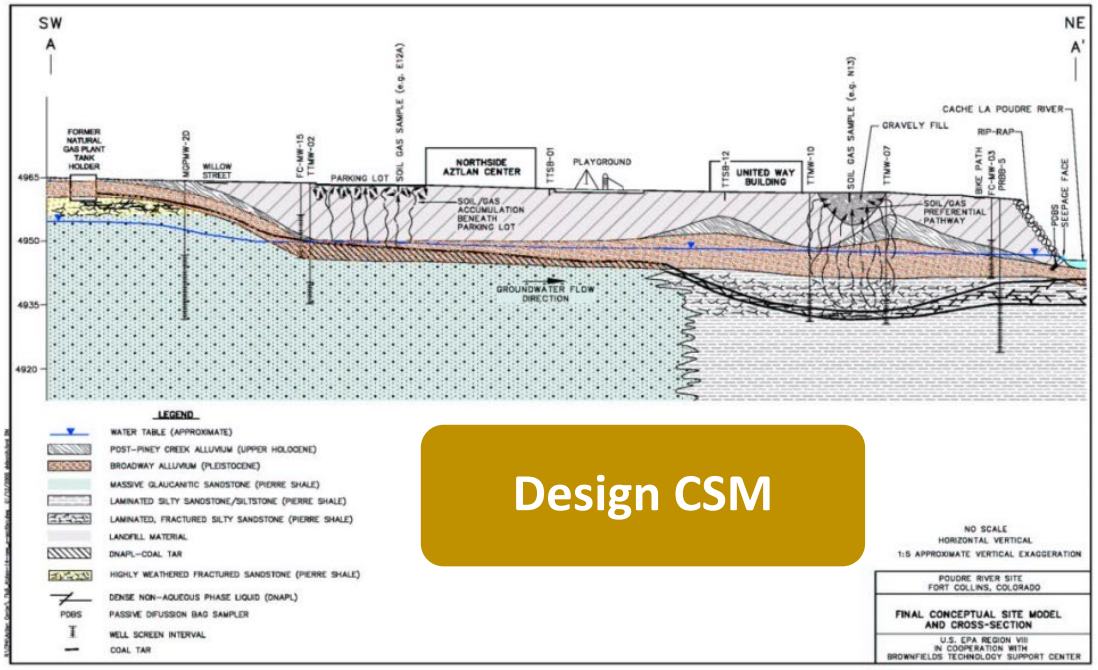


Preliminary CSM

U.S. EPA REGION VIII
IN COOPERATION WITH
BROWNFIELDS TECHNOLOGY SUPPORT CENTER



Characterization CSM

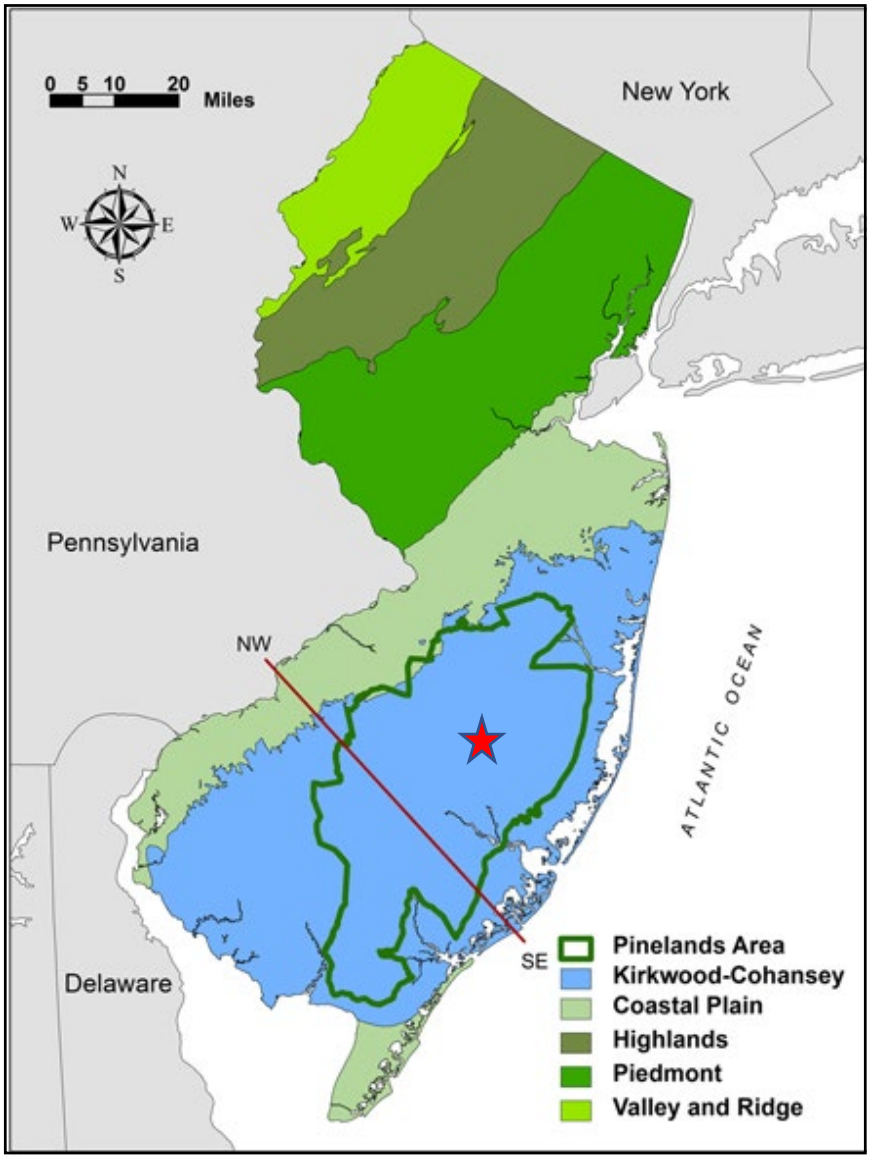


Design CSM

Effective Use of the Project Life Cycle Conceptual Site Model (EPA 2011)

Woodland Rt 72 Site

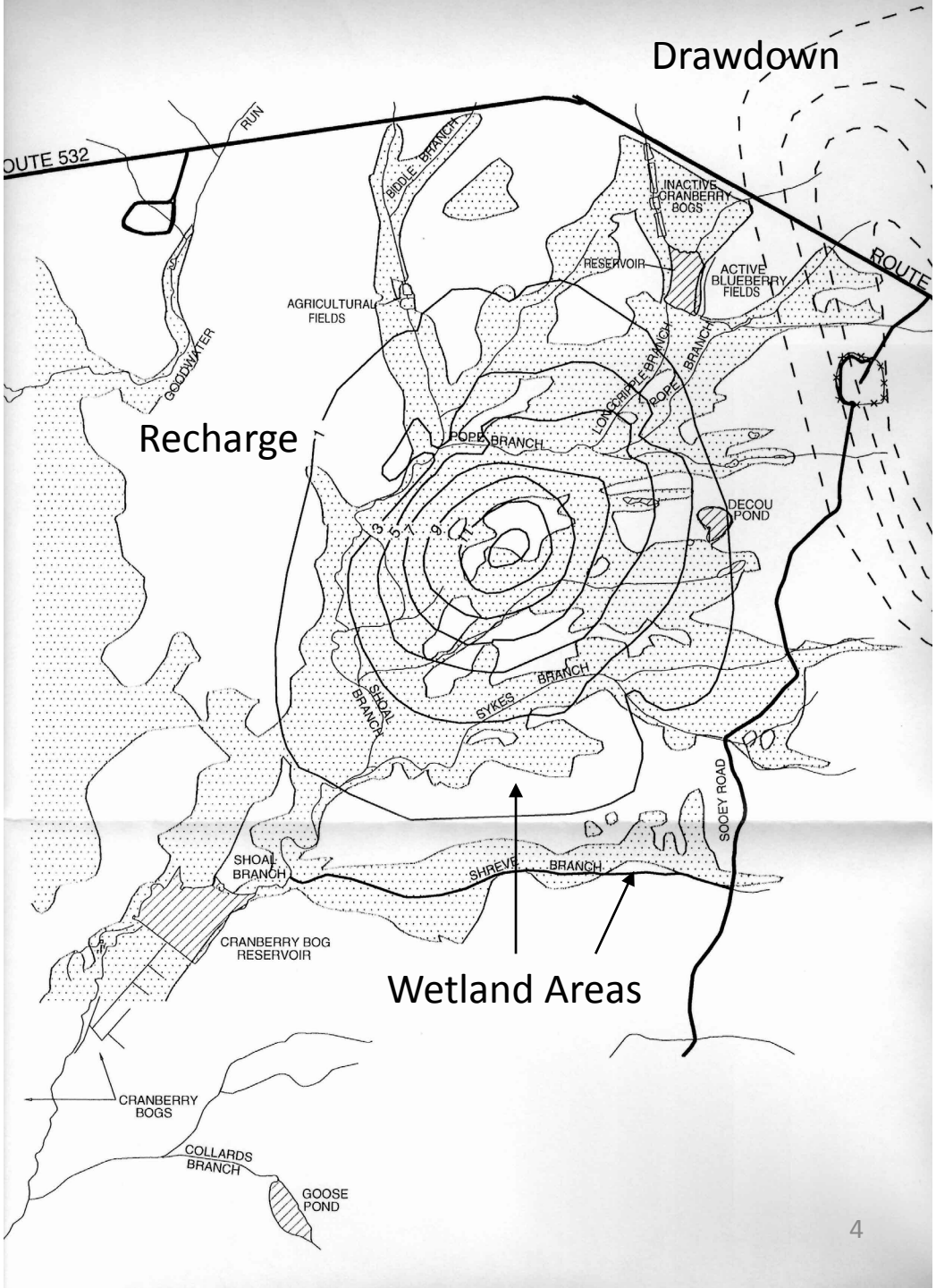
- NPL 1984
- Contaminants 1,2-DCA and BTEX
- Pinelands Preservation Area
- Kirkwood-Cohansey Aquifer



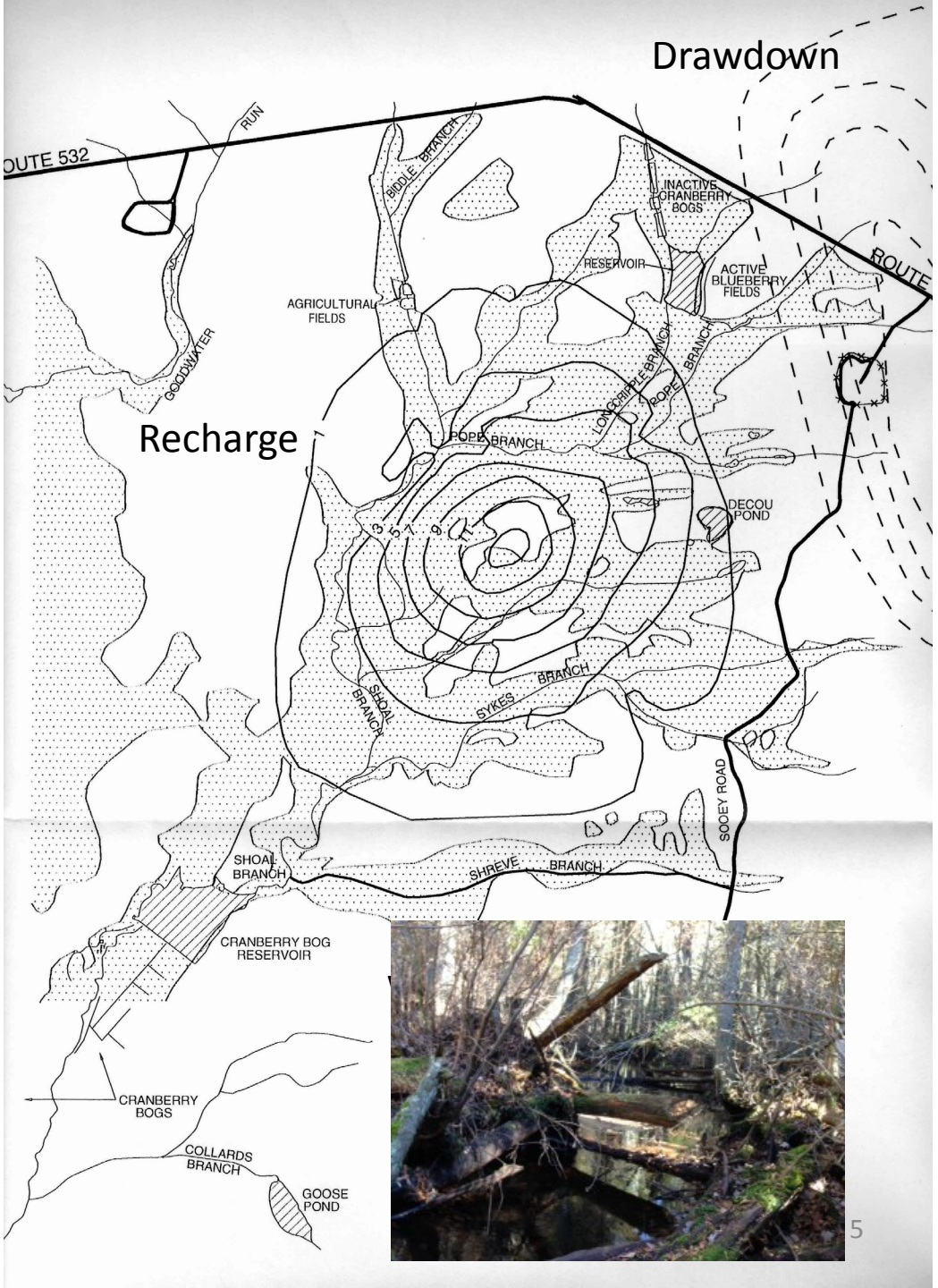
Woodland Rt 72 Site

1990 Remedy Pump and Treat

- ROD estimate was 1.2 Mgd for plume capture
- Groundwater model showed 10 Mgd required
- 1 – 12 feet of drawdown in plume
- 5 feet of recharge over 2 square miles
- Drastic consequences for ecology of Pinelands



Woodland Rt 72 Site

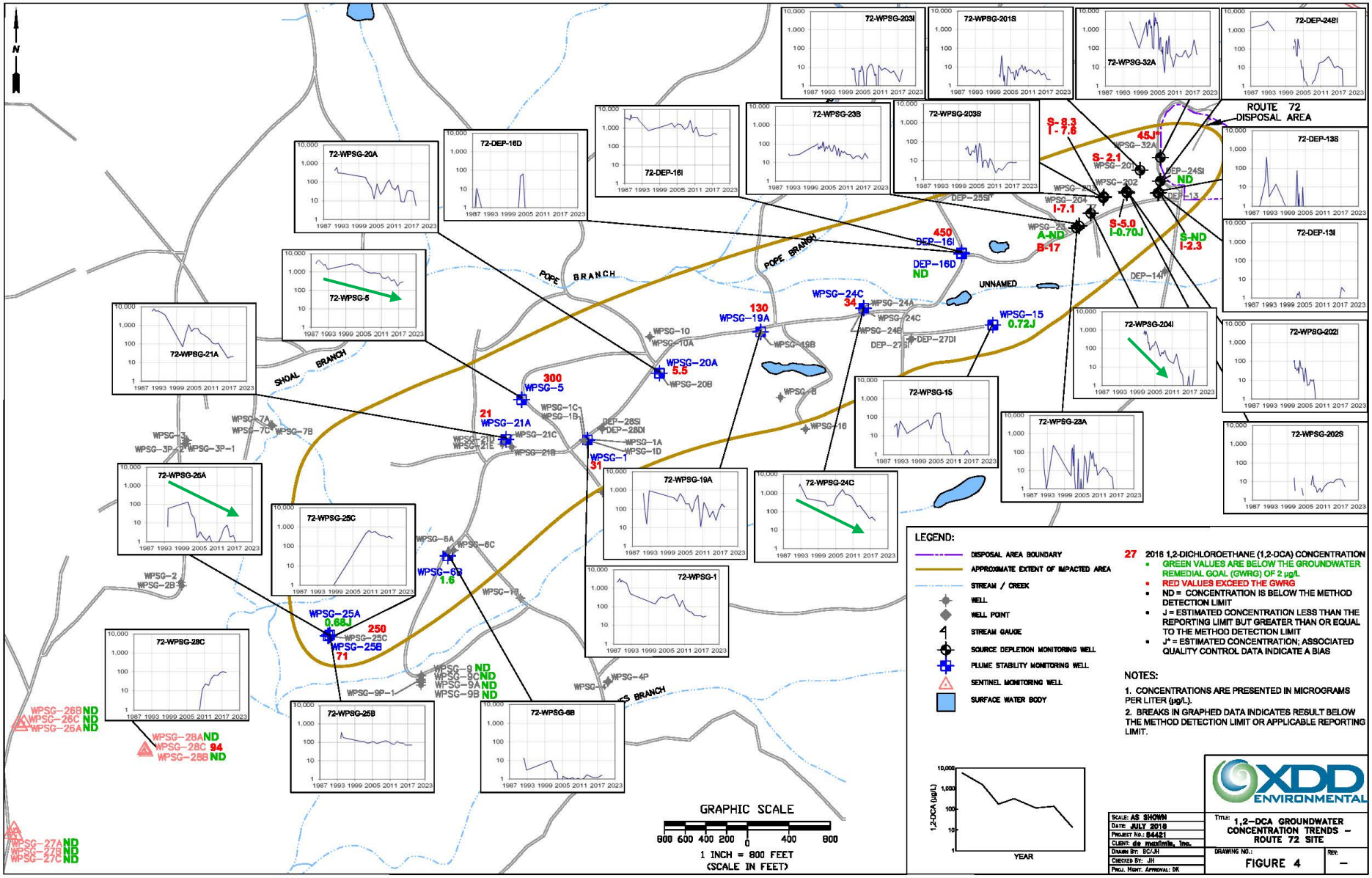


Woodland Rt 72 Site

1999 ROD Amendment
AS/SVE with Pump and Treat
Contingency

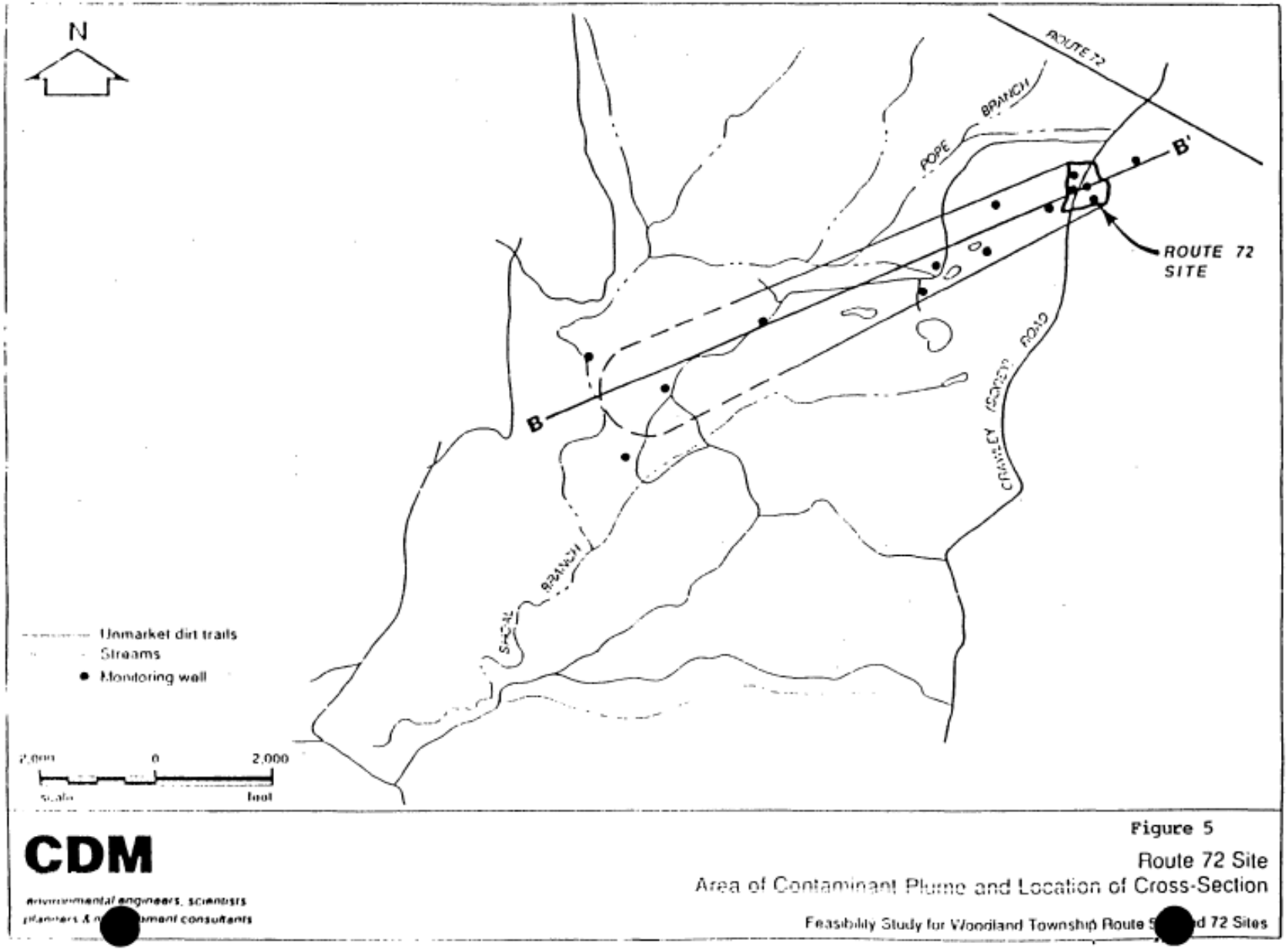
Woodland Rt 72 Site

Woodland Rt 72 Site



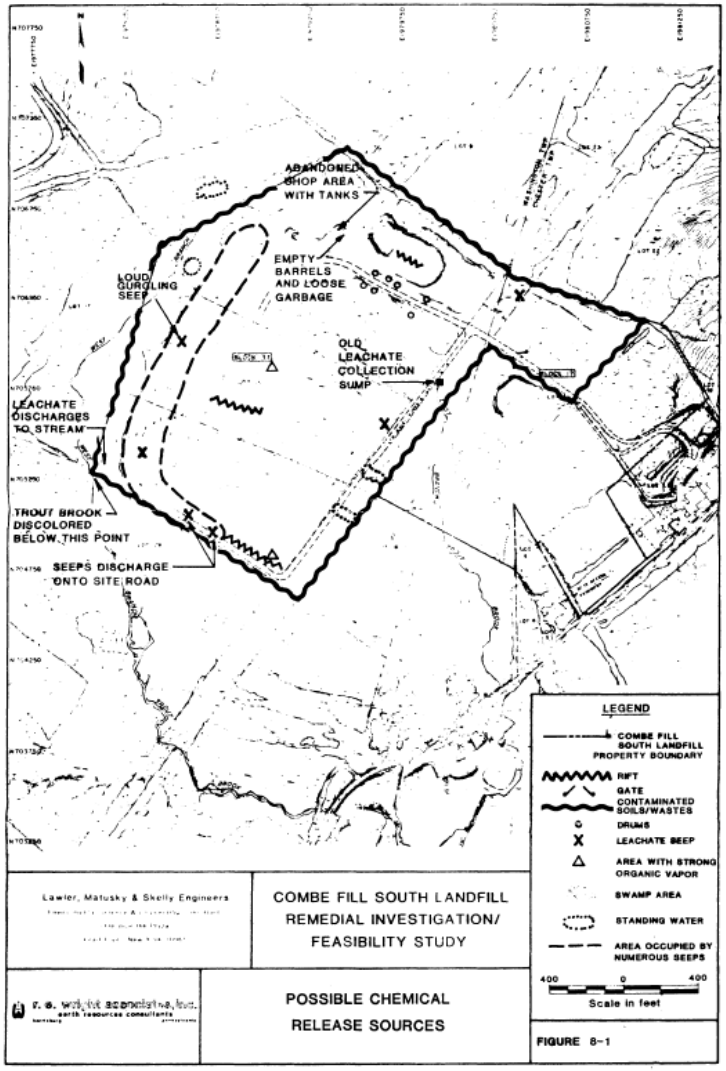
2018 Groundwater Monitoring Data

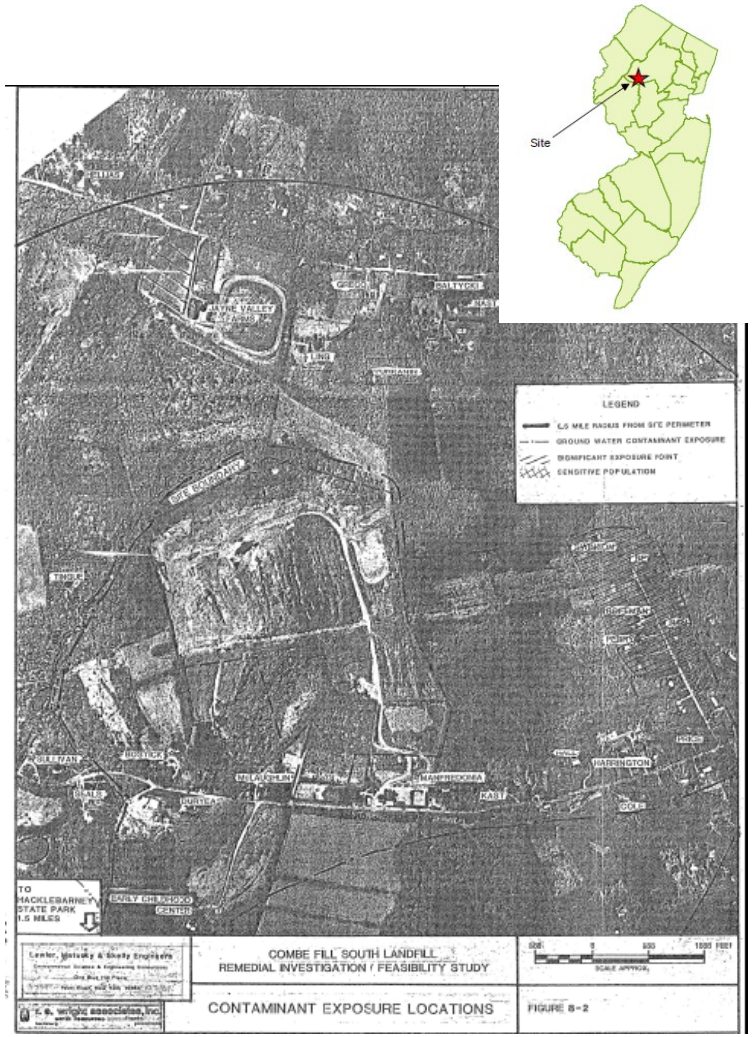
Woodland Rt 72 Site



1990 Record of Decision Plume Map

Combe Fill South Site



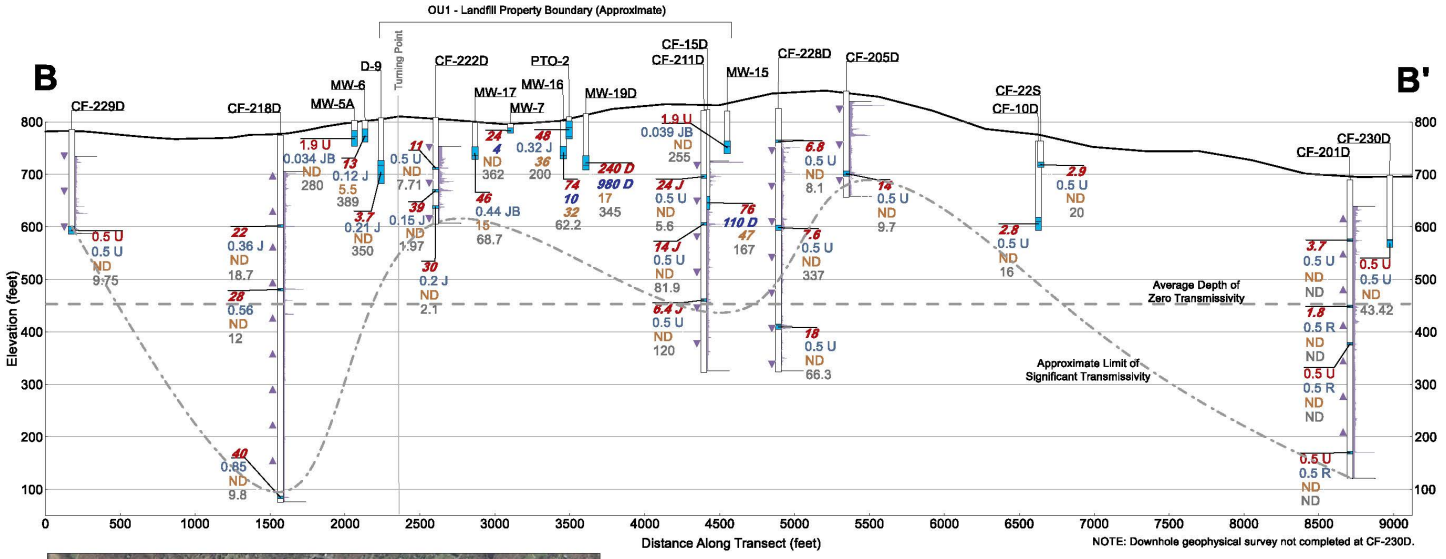


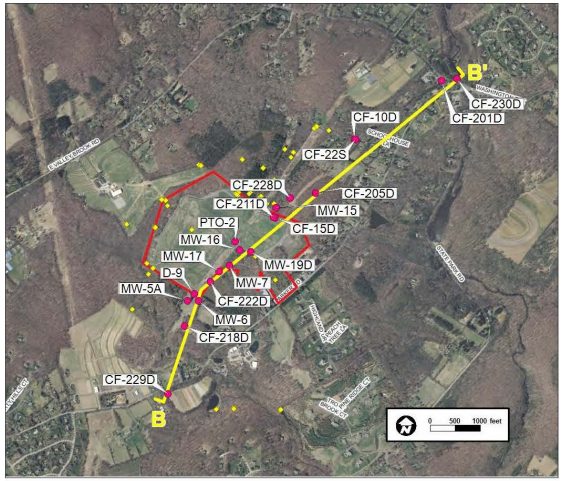
CSM Remedial Investigation 1986

NPL 1983

ROD 1986: Water supply + pump and treat

Combe Fill South Site





Analytical Data Sources:
HDR OU2 Remedial Investigation Groundwater Samples (2011 to 2015, 2017)
NJDEP Post-Construction Environmental Monitoring (PCEM) Program Samples (Q4 2011 to Q4 2015)

Average site-wide depth of zero transmissivity calculated using OU2 RI geophysical data.

Geophysical Data Source:
Downhole Geophysical Report (see RI Appendix K)
(NOTE: Downhole geophysical survey not completed at CF-230D.)

Transmissivity Data Source:
FLUTe Hydraulic Profiling Report (see RI Table 4-1 and RI Appendix T)

Well	Total Depth (ft bgs)	Depth to Competent Rock (ft bgs)	Maximum Depth of Liner Eversion (ft bgs)	Vertical Flow Direction
CF-201D	571	30	570	Upwards
CF-205D	198	6	173	Down or none
CF-211D	499	87	359	Down or none
CF-218D	700	67	698	Upwards
CF-222D	200	60	200	Down or none
CF-228D	499	35	428	Down or none
CF-229D	197	35	197	Down or none

Combe Fill South Landfill Superfund Site RI/FS

Legend (Inset Map)
- Well Location On Section
- Other Well Location
- OU1 - Landfill Property Boundary

Cross Section Legend
- 20 — 1,4-Dioxane
- 37 D — Benzene
- 8.4 — Total Carcinogenic TICs
- 493 — Total Non-Carcinogenic TICs

Generalized Vertical Flow Direction
Well Screen or Sample Port Zone
Well Casing
Borehole Caliper Reading (Relative Width of Hole) Spikes indicate potential fracture zones.

Notes:
Constituents are presented in the same order adjacent to the sample location.

Concentrations shown in ug/L.

Bold Italics indicates exceedance of applicable NJGWQS.

Constituent	GWQS
1,4-Dioxane	0.4
Benzene	1
Total Carcinogenic SOCs *	25
Total Non-Carcinogenic SOCs *	500

NJAC 7:9C Ground Water Quality Standards, Tables 1 & 2
** Interim Generic Criteria for Synthetic Organic Chemicals*

Synthetic Organic Chemicals (SOCs) are purposefully produced organic chemical compounds defined in NJAC 7:9C-1.4. SOCs do not have a specific groundwater quality criterion. Criteria for individual carcinogenic and non-carcinogenic are 5 ug/L and 100 ug/L respectively. The criteria for totals of each are 25 ug/L and 500 ug/L respectively.

Tentatively Identified Compounds (TICs) are non-target analytes for which there is presumptive evidence of their presence. Some TICs are unidentifiable and reported as unknowns. SOC TICs were grouped based on their carcinogenicity listed by the International Agency for Research on Cancer (IARC, March 2018).

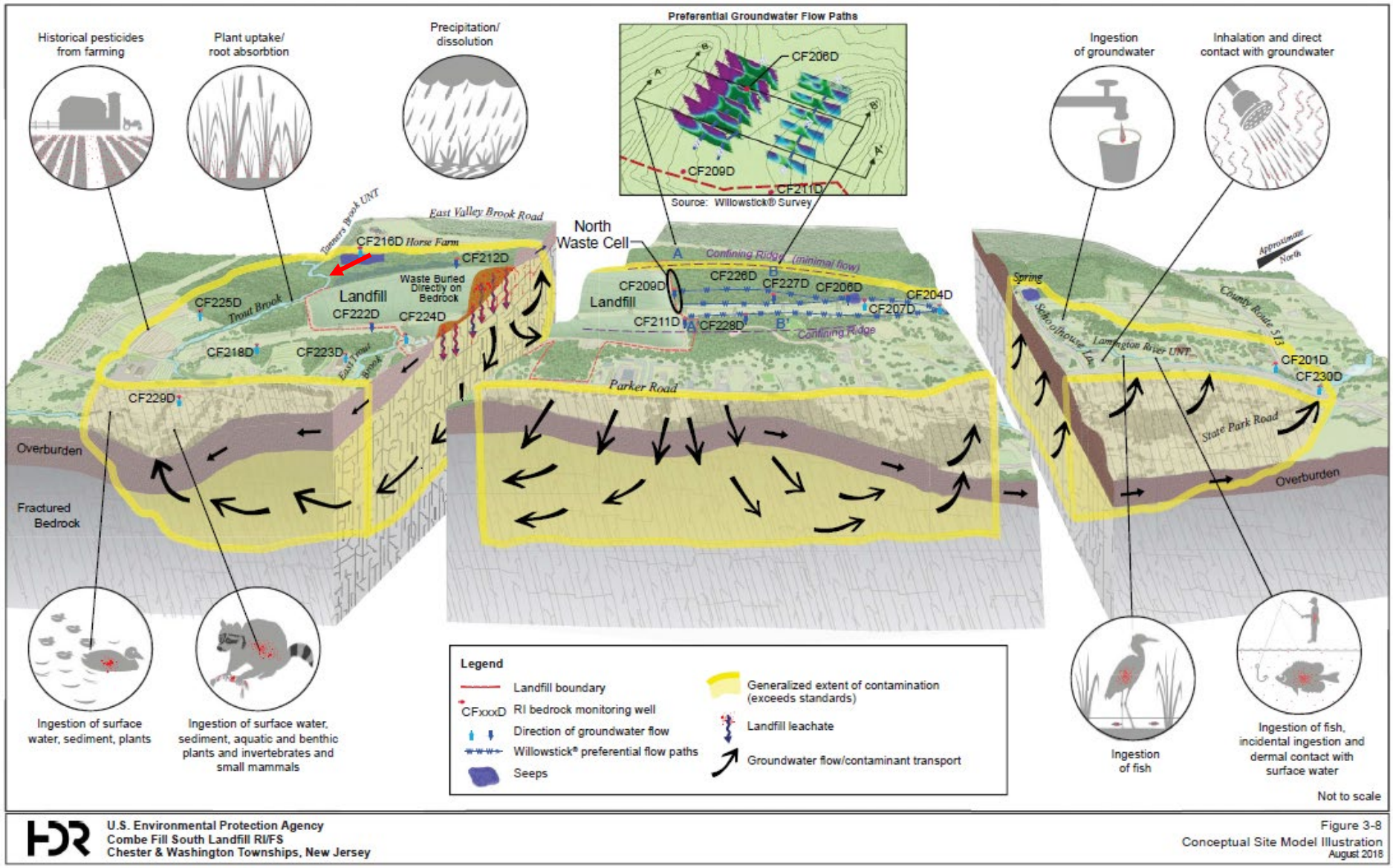
Unknown TICs, non-SOCs, and TICs for which there is a promulgated standard in Table 1 of NJAC 7:9C are excluded from summations.

Maximum detected concentration occurring within the study duration is shown. Sample dates range from 4th Quarter 2011 through 4th Quarter 2015; and 1st Quarter 2017 (CF-209D and CF-209D-R). Samples collected by NJDEP and HDR.

CROSS SECTION B - B' **Figure 3-5**
June, 2018

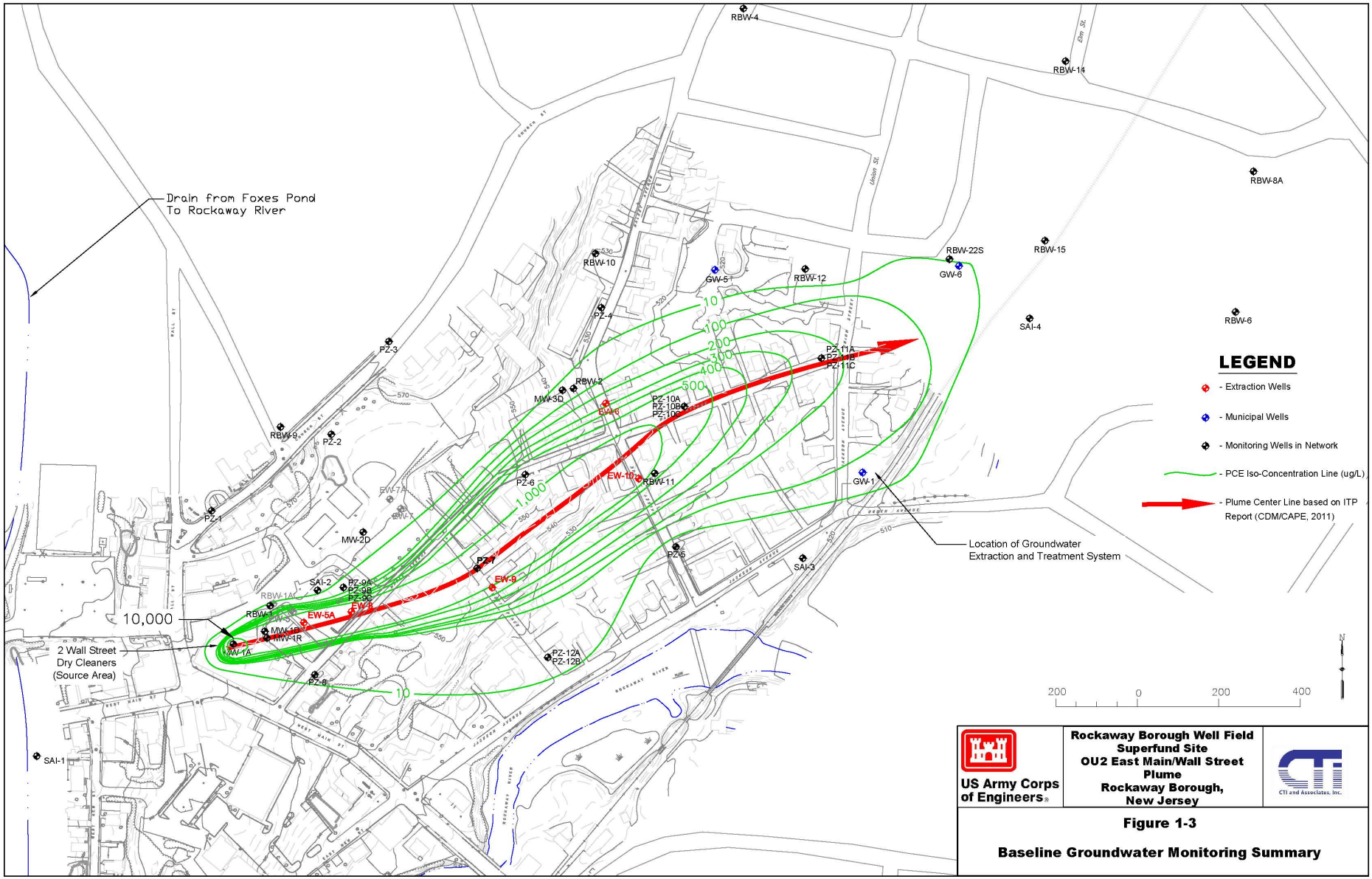
1,4-Dioxane Results from Remedial Investigation 2015

Combe Fill South Site



CSM Remedial Investigation 2017 -> 2018 ROD Amendment

Rockaway Borough Site

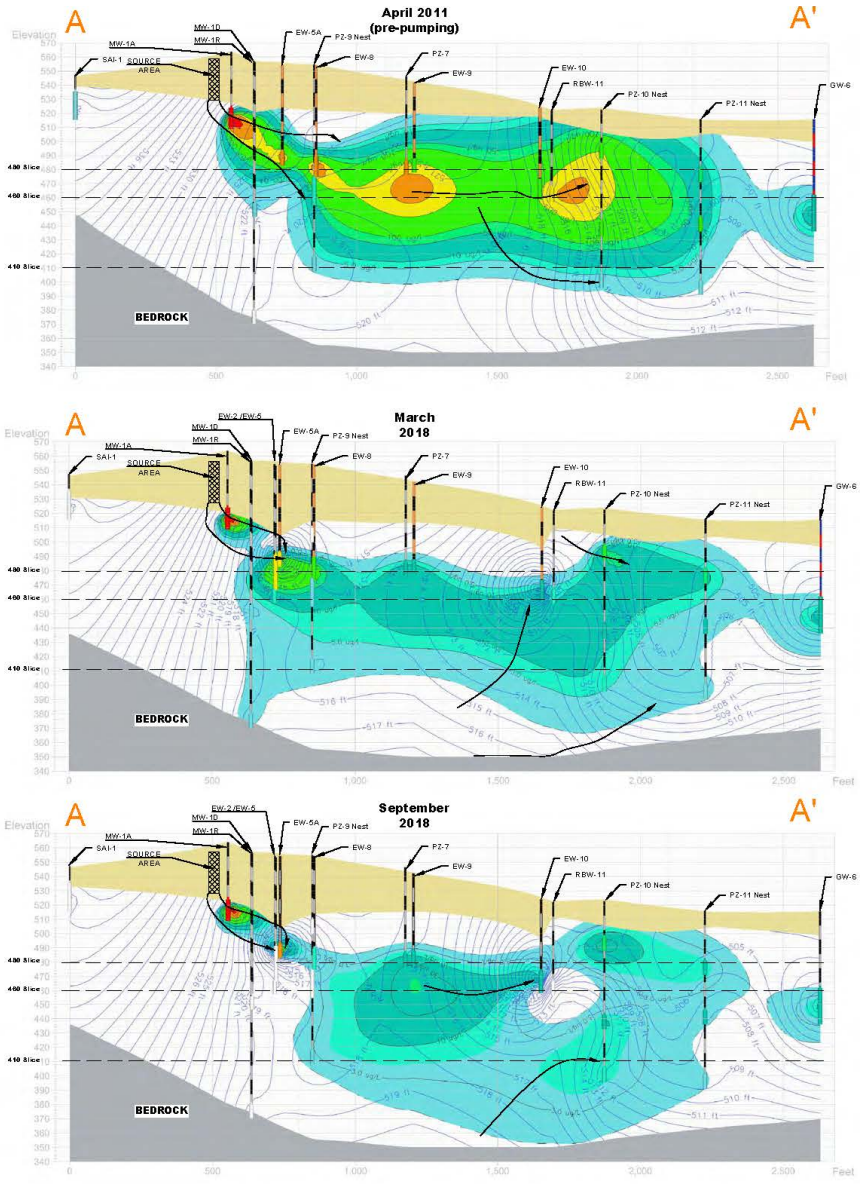


NPL 1983

Source removal and SVE system 2008

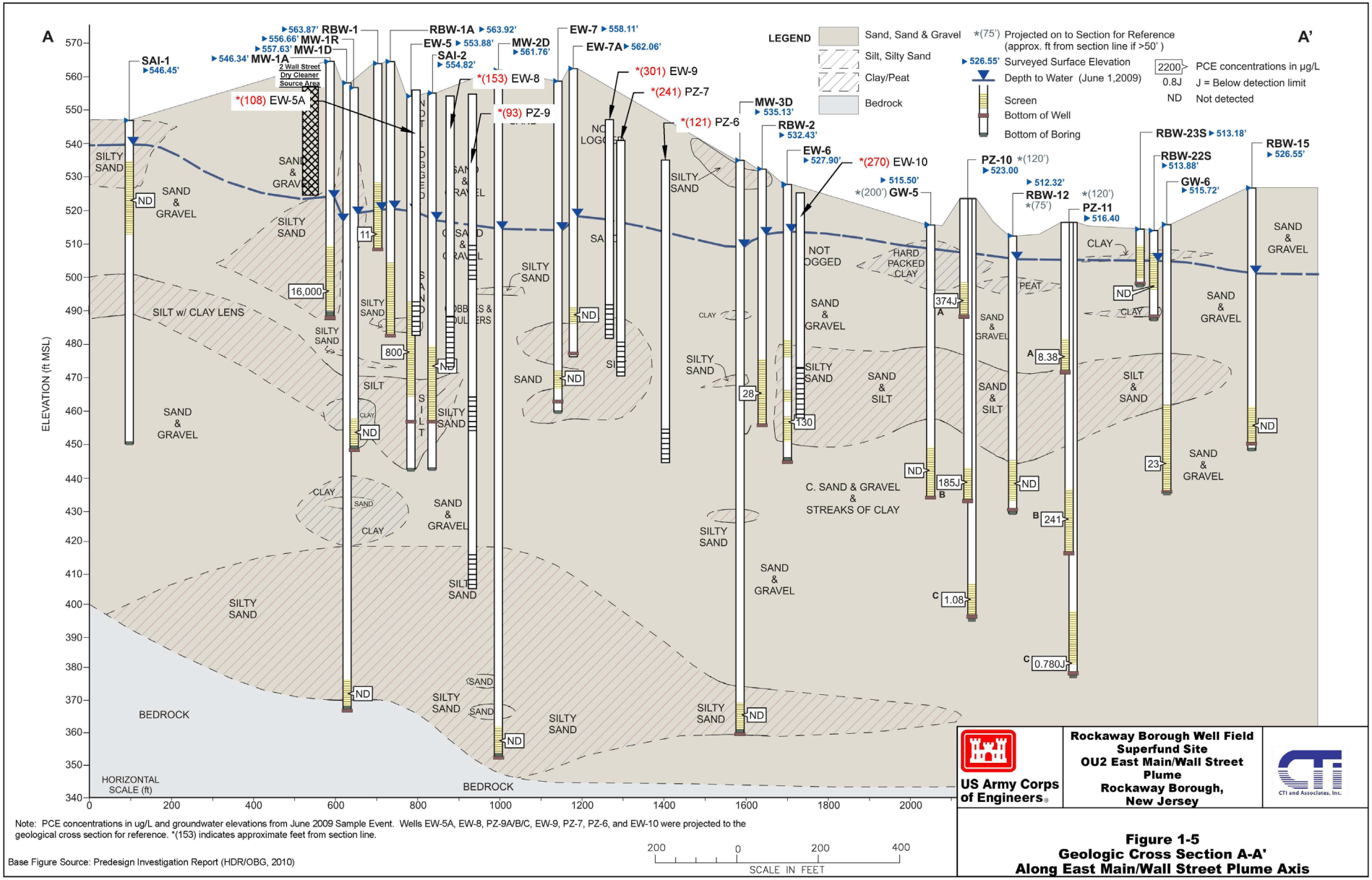
Pump and treat system start up November 2011

Rockaway Borough Site



April 2011 and 2017-2018 Flow Nets Showing PCE Plume

Rockaway Borough Site



Note: PCE concentrations in ug/L and groundwater elevations from June 2009 Sample Event. Wells EW-5A, EW-8, PZ-9A/B/C, EW-9, PZ-7, PZ-6, and EW-10 were projected to the geological cross section for reference. *(153) indicates approximate feet from section line.

Base Figure Source: Predesign Investigation Report (HDR/OBG, 2010)

US Army Corps of Engineers

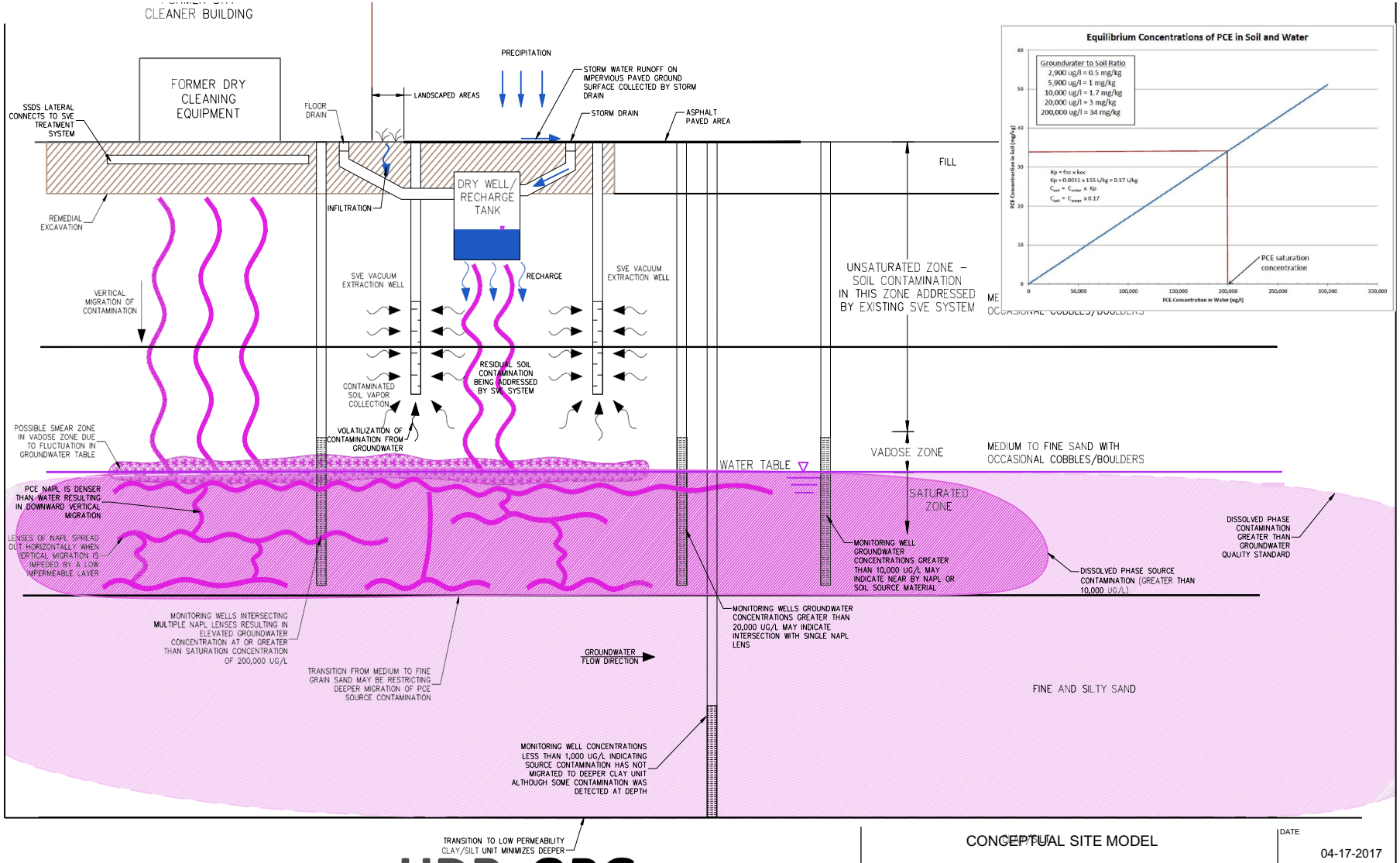
Rockaway Borough Well Field Superfund Site
OU2 East Main/Wall Street Plume
Rockaway Borough, New Jersey

CTI and Associates, Inc.

Figure 1-5
Geologic Cross Section A-A'
Along East Main/Wall Street Plume Axis

2012 Cross-Section from Source Area to Extraction Wells

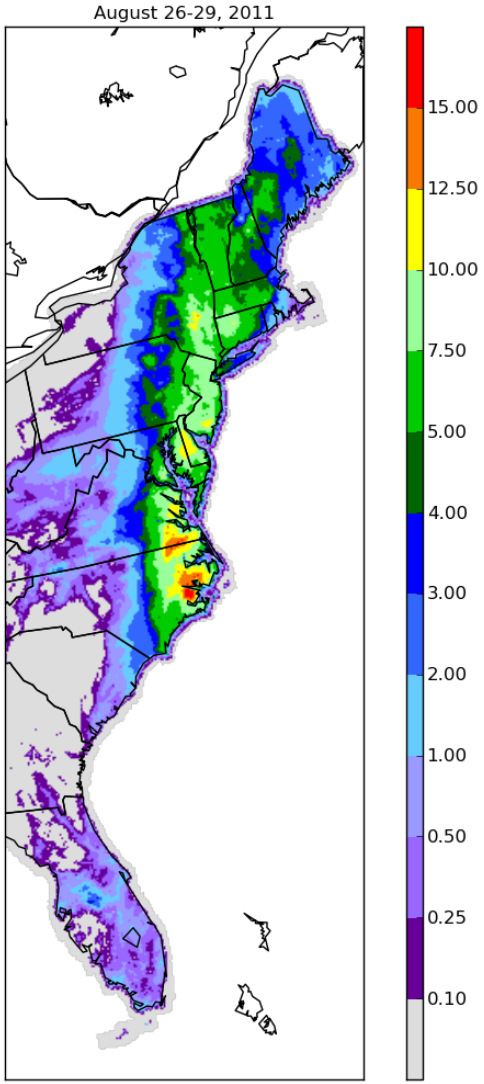
Rockaway Borough Site

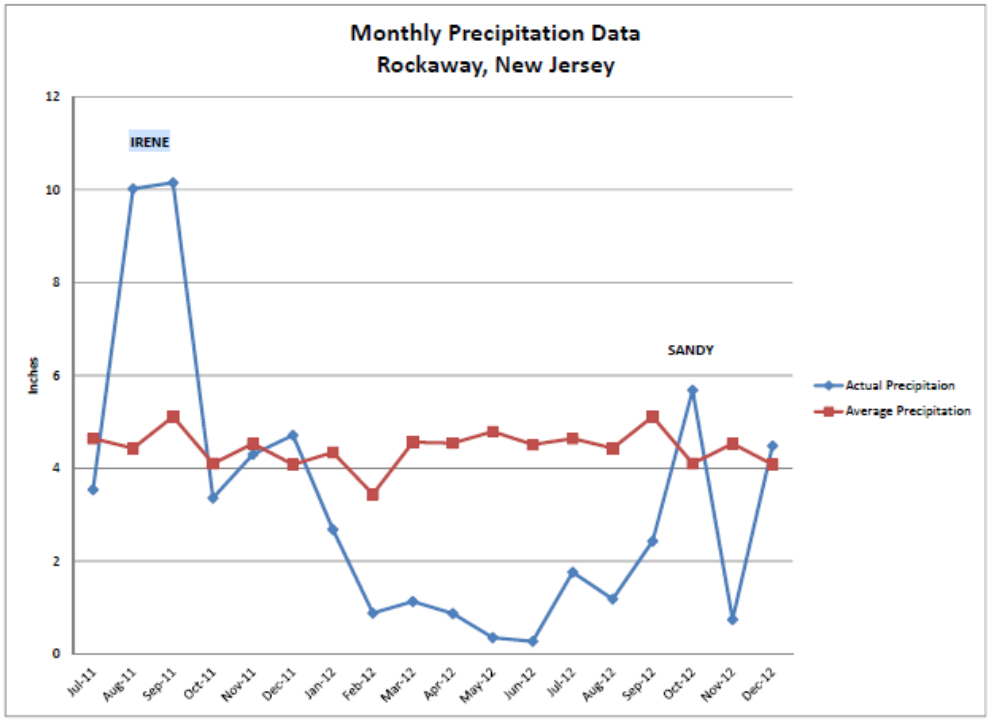


Source Area NAPL Investigation 2016 -> New Remedial Design for ISCO, SVE, Extraction Well

Rockaway Borough Site

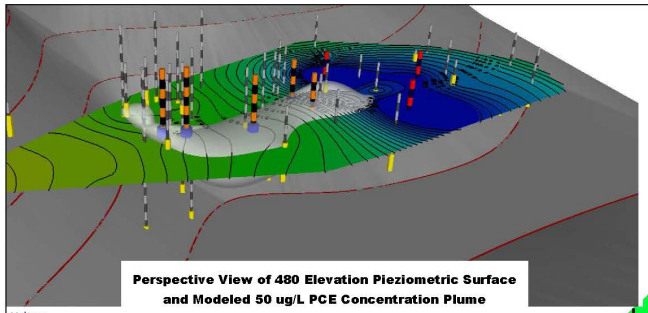
Total Radar Estimated Precipitation





Hurricane Irene August 2011

Rockaway Borough Site



Perspective View of 480 Elevation Piezometric Surface and Modeled 50 ug/L PCE Concentration Plume

Notes:

1) Piezometric contours were generated by EVS-Pro 3D Kriging algorithm of measured groundwater elevation. Each well was assigned a Northing, Easting and center well screen elevation to generate a 3D piezometric model. The model cut along the elevation plane, and contoured to produce contour map.

2) 50 ug/L PCE iso-concentration line was generated EVS-Pro 3D Kriging algorithm of PCE concentration at each well to generate a 3D PCE concentration model. Model cut is along the given elevation to produce the area in the map or the 3D shell of the plume is presented in the perspective view above.

Drain from Foxes Pond To Rockaway River

LEGEND

- Groundwater Contour
- Monitoring Well
- Extraction Well
- Municipal Well
- MW-29S 33.67 - Groundwater Elevation
- Baseline PCE Plume Centerline (April 2011)
- Horizontal Extent of PCE exceeding 50 ug/L

US Army Corps of Engineers

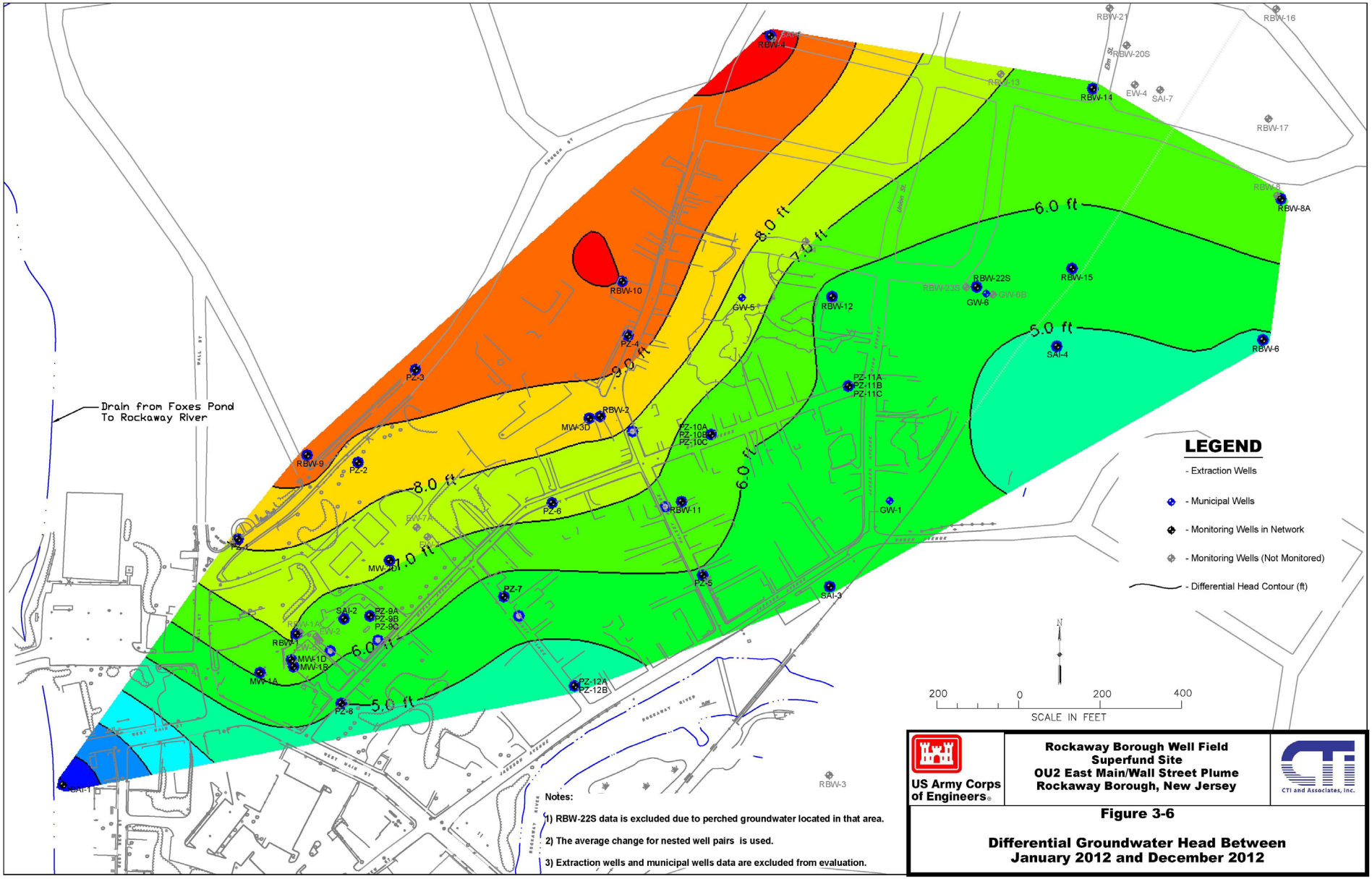
Rockaway Borough Well Field Superfund Site
OU2 East Main/Wall Street Plume
Rockaway Borough, New Jersey

CTI and Associates, Inc.

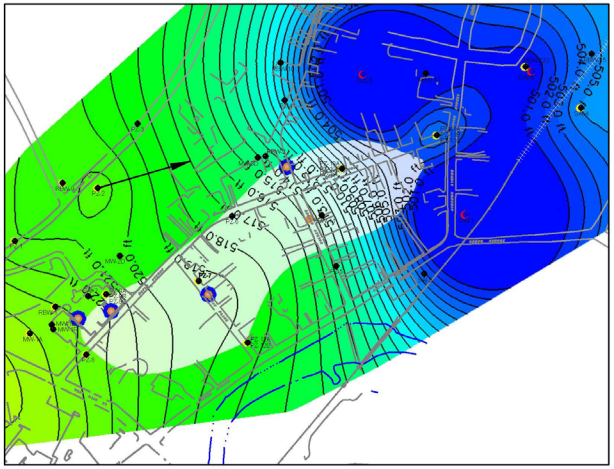
Figure 3-3

April 2011 Piezometric Surface at Elevation 480 ft MSL.

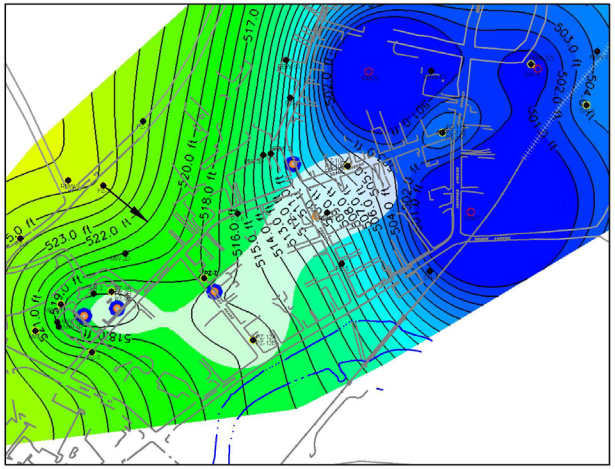
Rockaway Borough Site



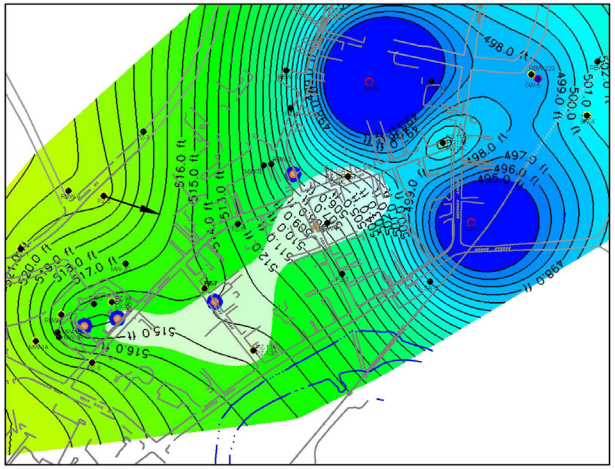
Rockaway Borough Site



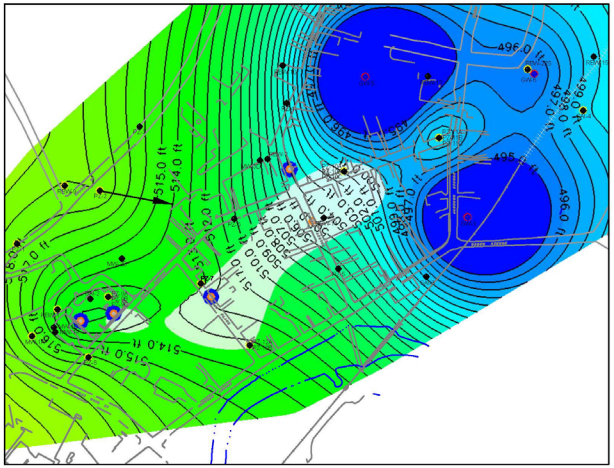
April 2011 Piezoimetric Surface



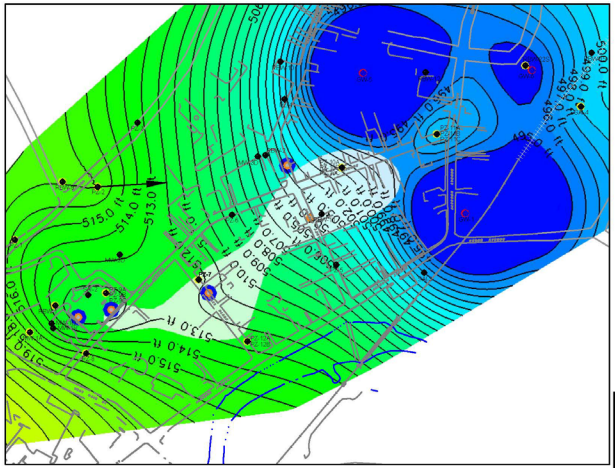
January 2012 Pieziometric Surface



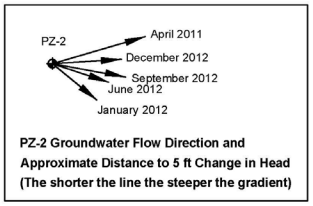
June 2012 Pieziometric Surface

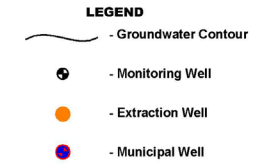


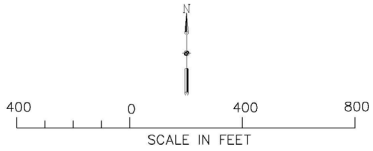
September 2012 Pieziometric Surface



December 2012 Pieziometric Surface







US Army Corps of Engineers

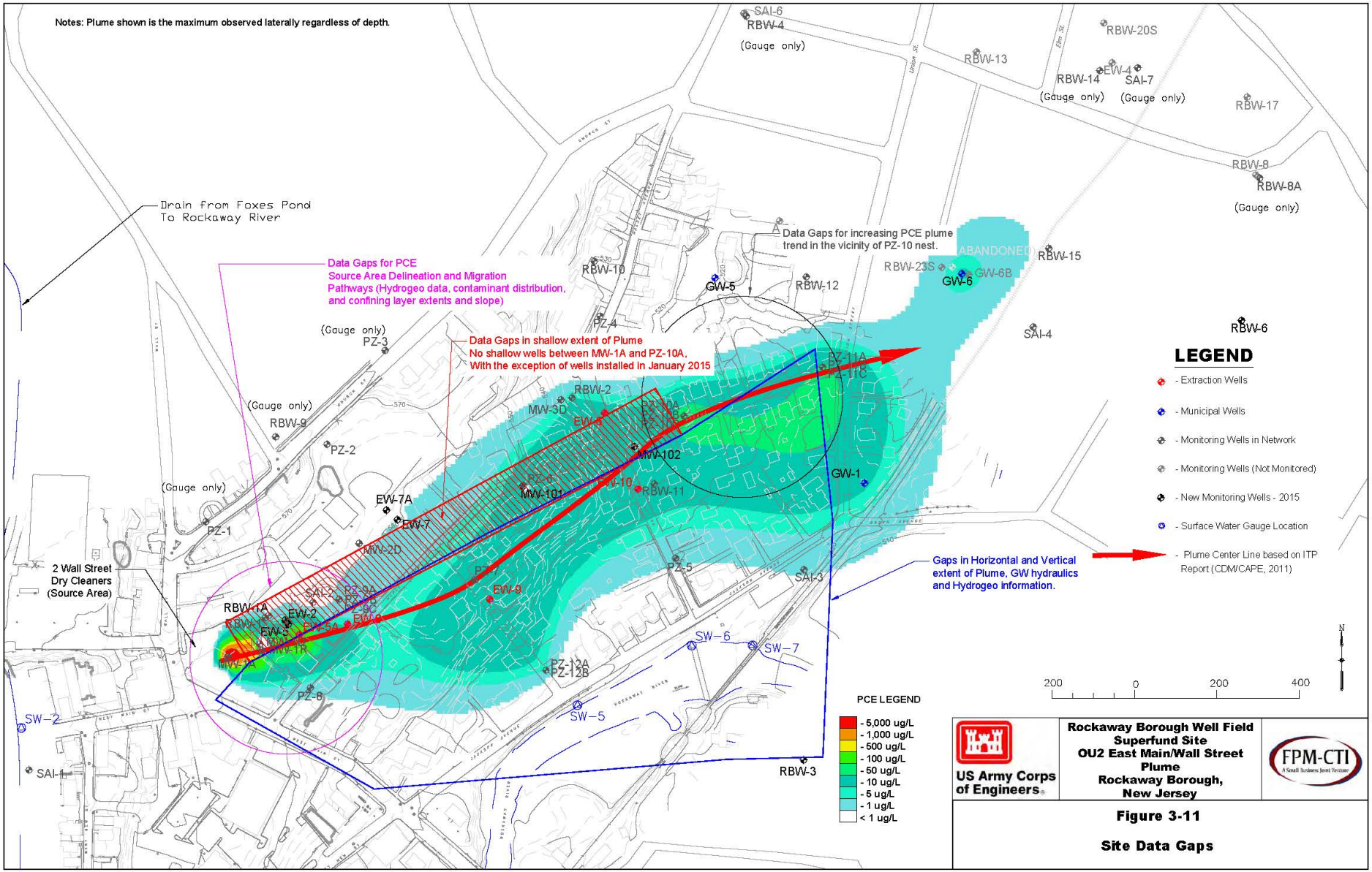
Rockaway Borough Well Field
Superfund Site
OU2 East Main/Wall Street Plume
Rockaway Borough, New Jersey

CTI and Associates, Inc.

Figure 3-10

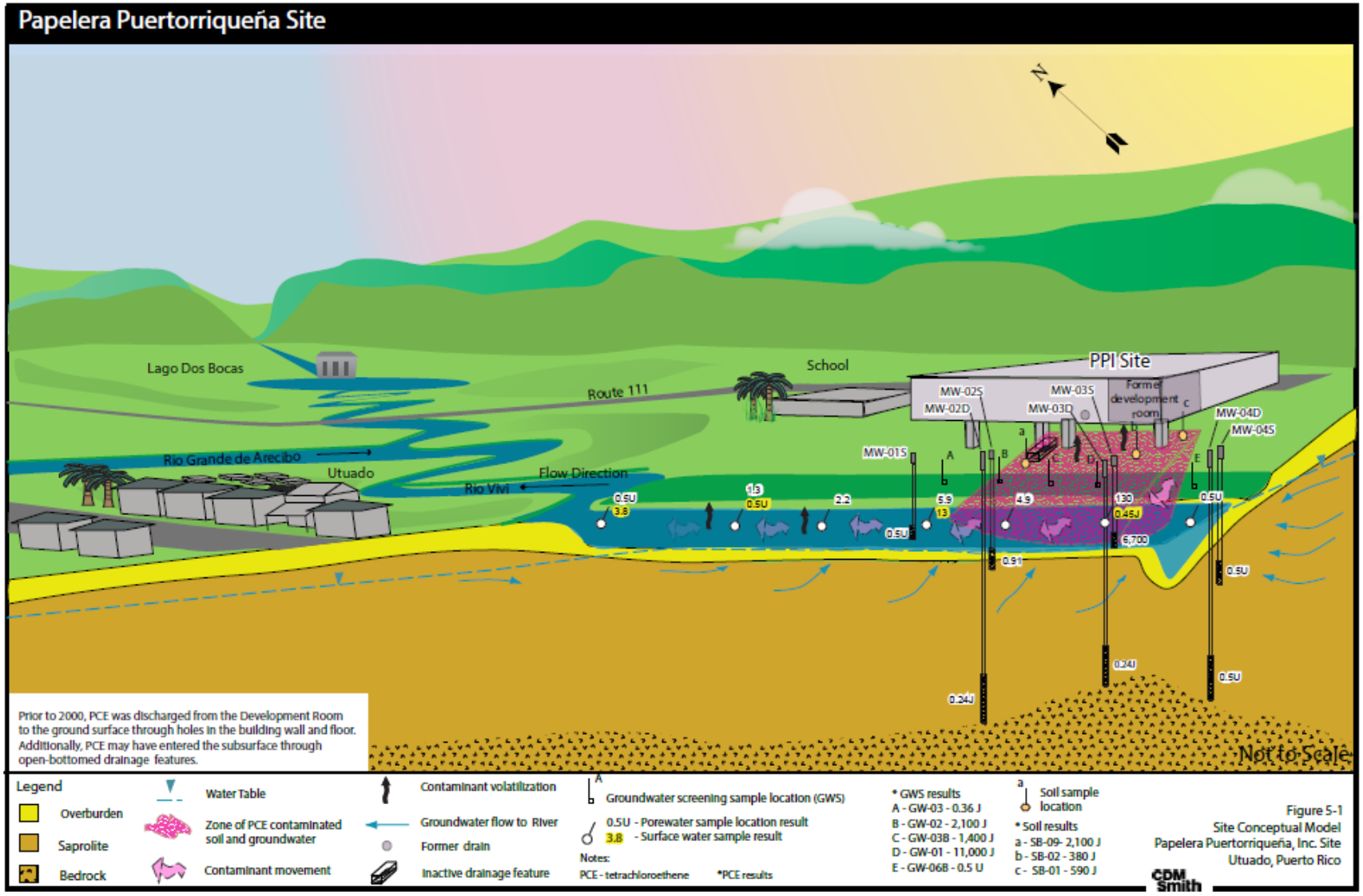
480 Cut Elevation Potentiometric Surface

Rockaway Borough Site



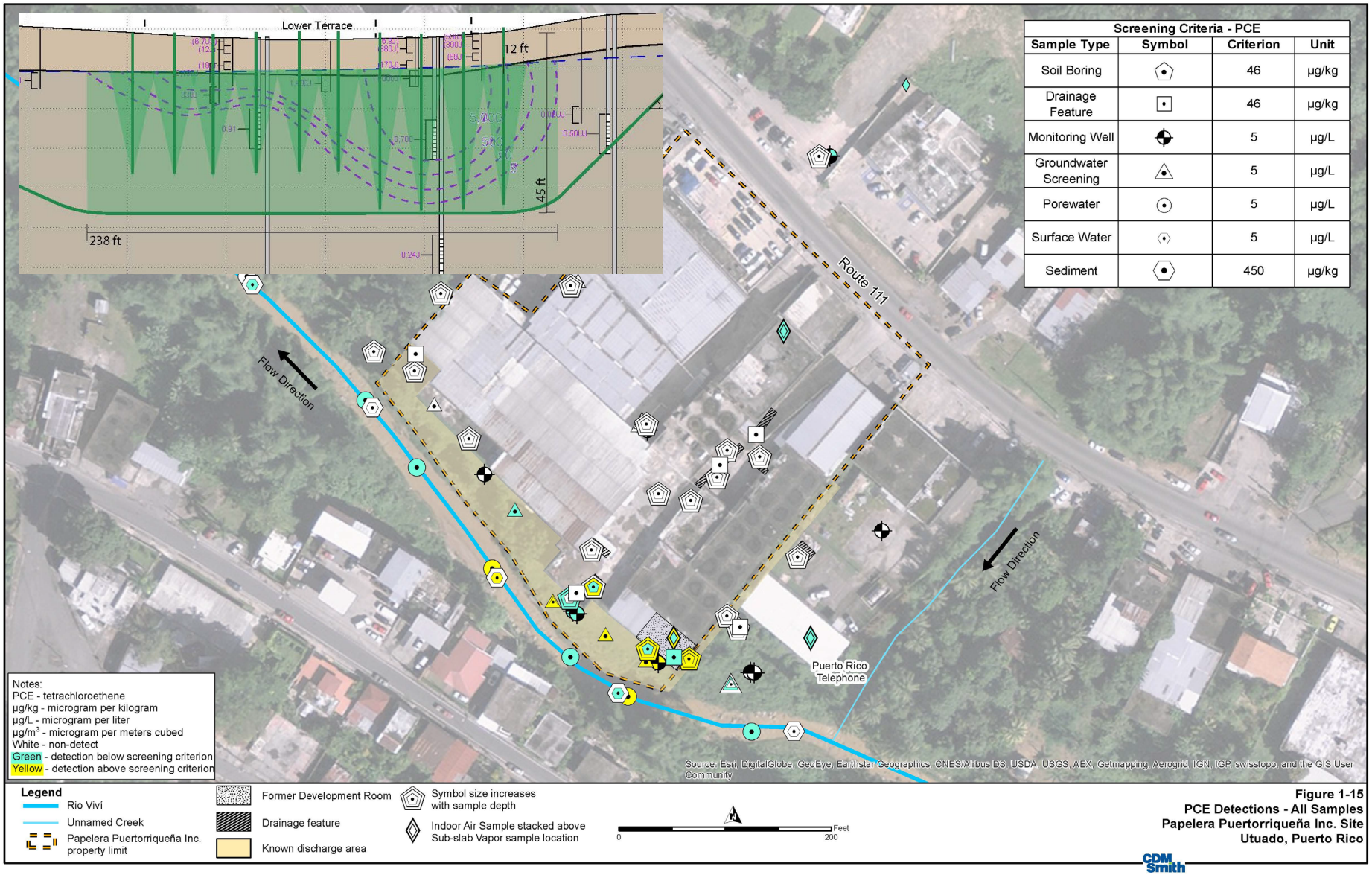
2018 Conceptual Site Model

Papelera Puertorriqueña Site



NPL 2009

Papelera Puertorriqueña Site



2017 ROD selected AS/SVE

Papelera Puertorriqueña Site

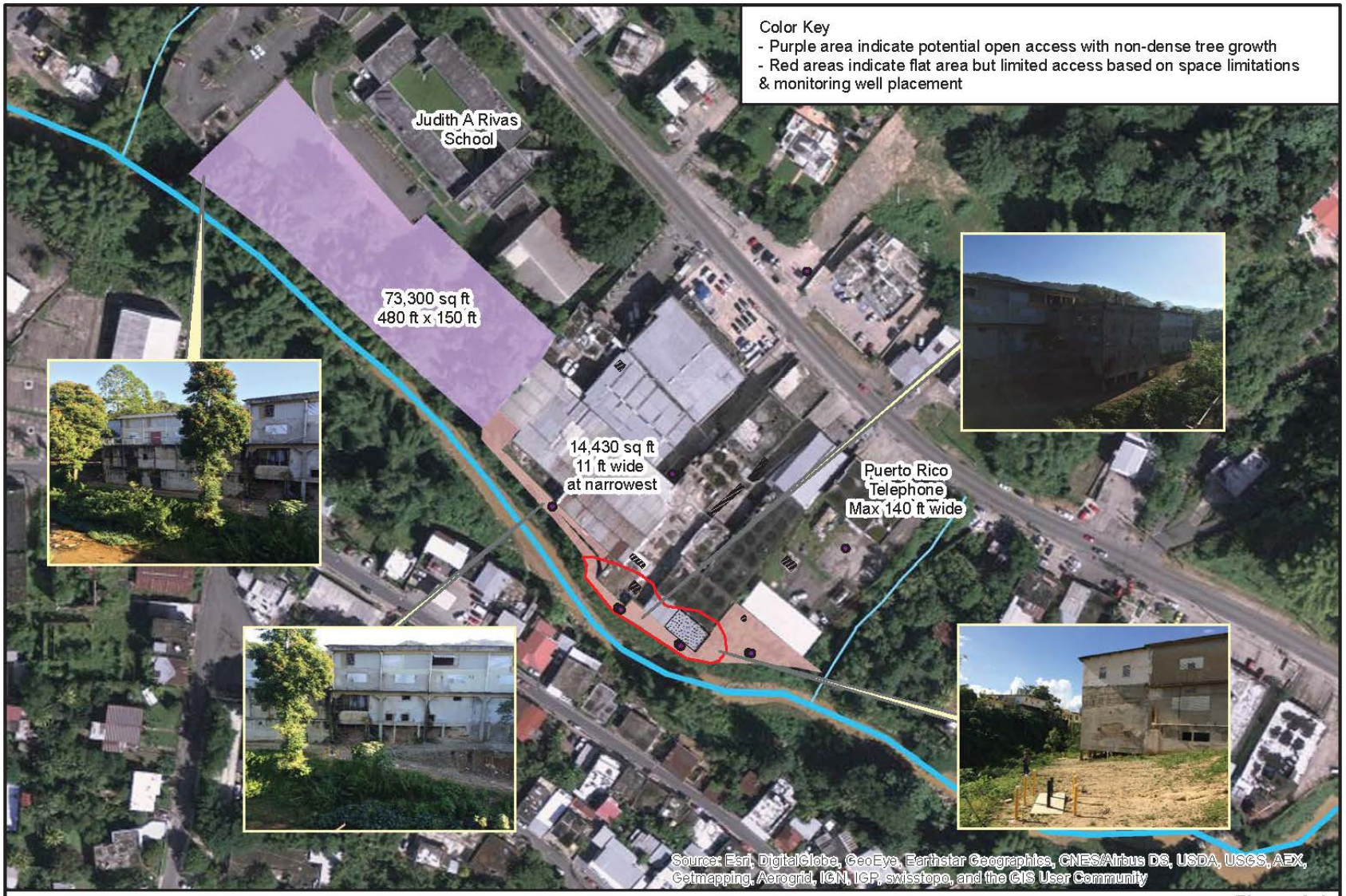
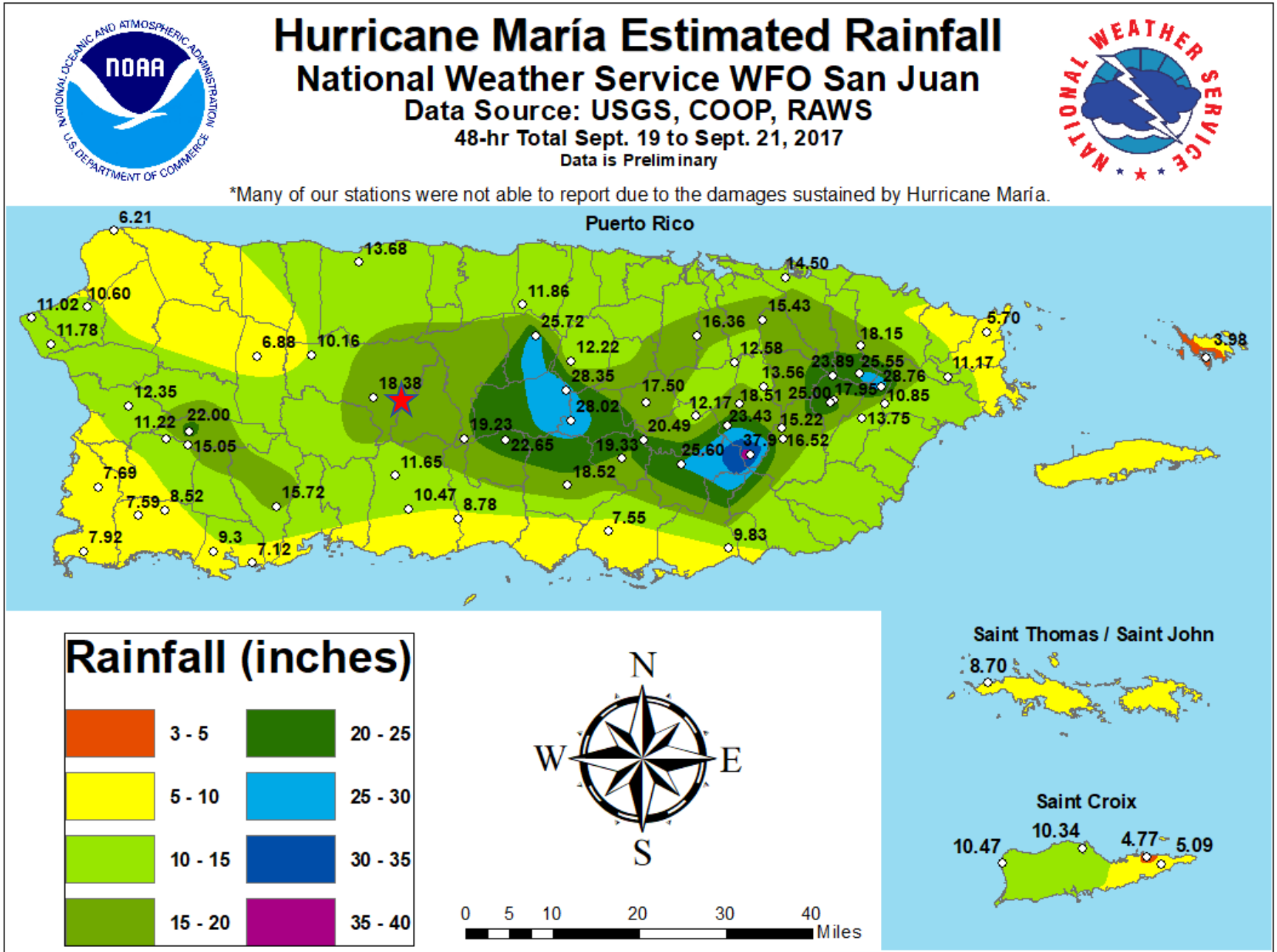


Figure 3-1
Site Accessibility
Papelera Puertorriqueña, Inc. Site
Utuado, Puerto Rico

CDM Smith

Papelera Puertorriqueña Site



Papelera Puertorriqueña Site

2006

2016

2018

Papelera Puertorriqueña Site

2006

- Significant deposition in riverbed
- Collapsed retaining wall on opposite side of the river

March 2018

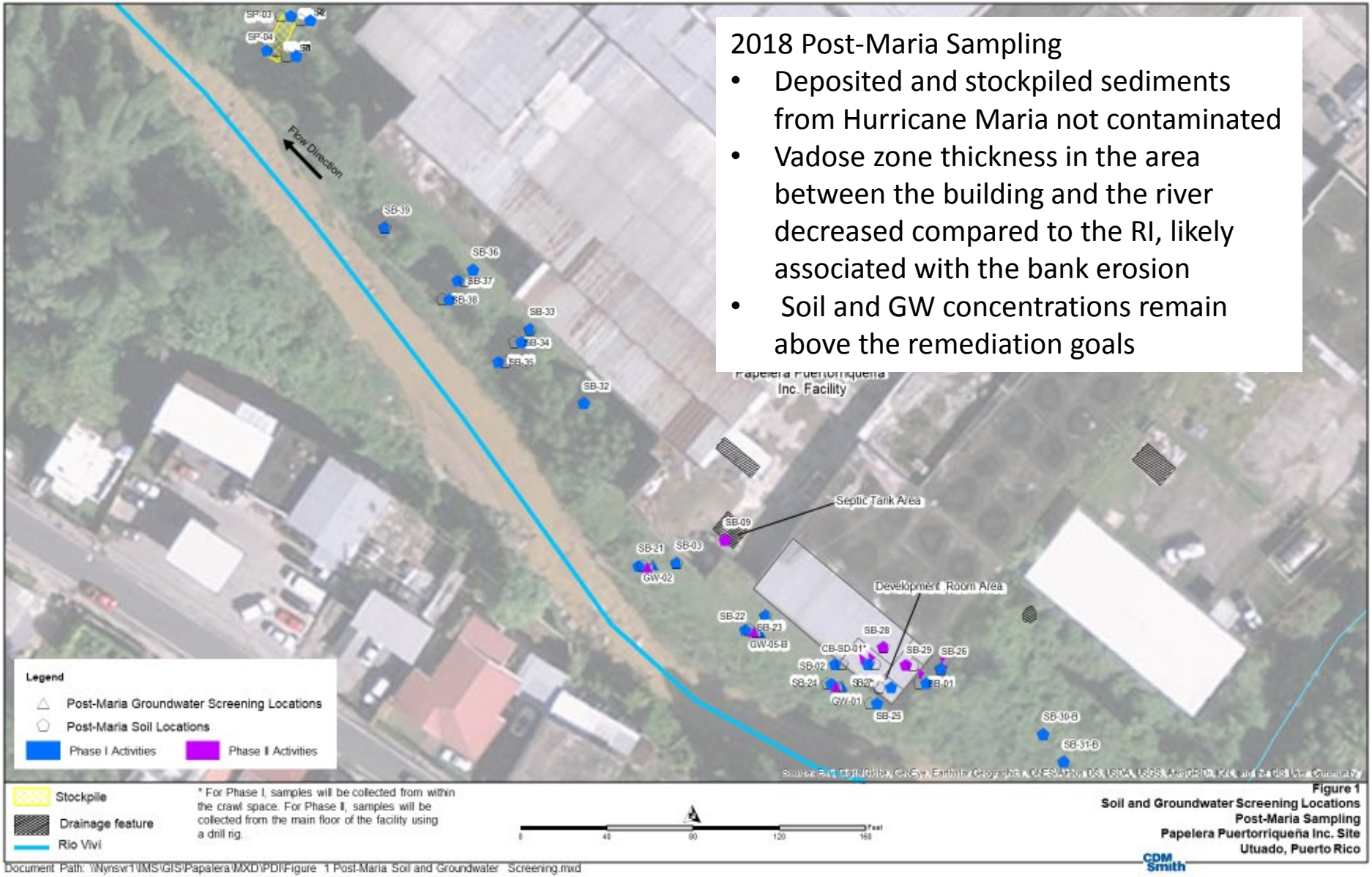
Papelera Puertorriqueña Site

2016

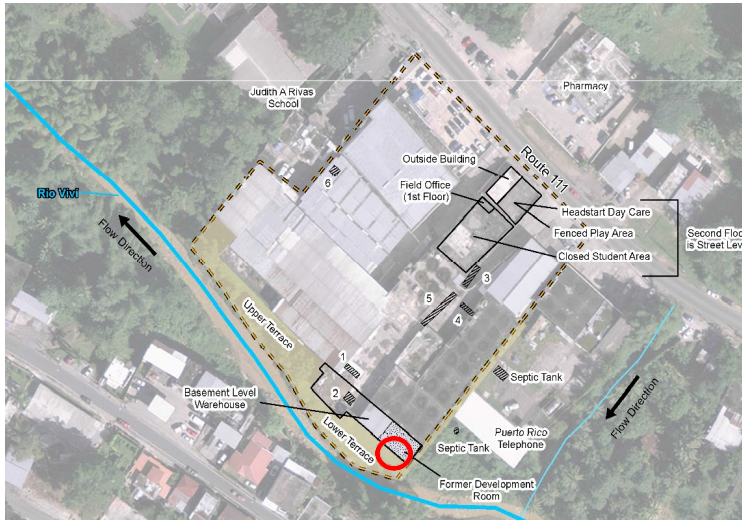
March 2018

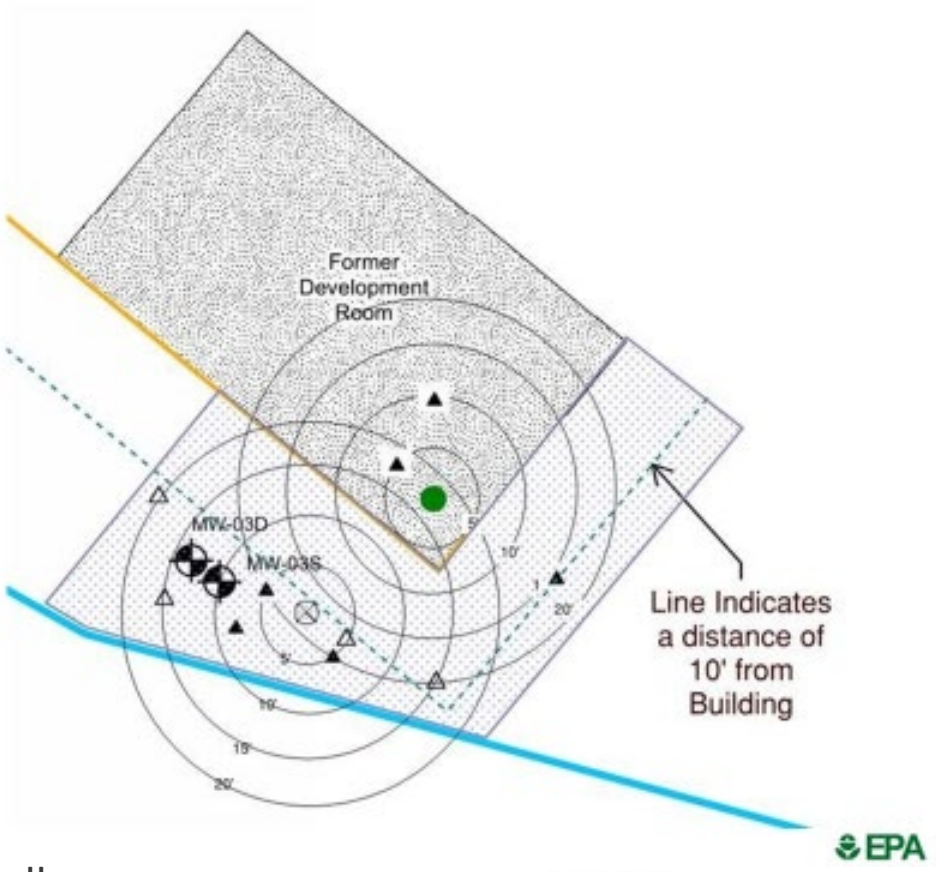
- Significant erosion along back of building
- Exposed foundation
- Damaged wells

Papelera Puertorriqueña Site



Papelera Puertorriqueña Site





2020 Pilot Study Issues

- Site improvement will be required to construct the remedy and protect equipment
- Design will need to account for the shallow vadose zone
- Protection against flooding and coordination with the retaining wall will need to be considered

Papelera Puertorriqueña Site