



DNAPL Containment Remedy at Large Site with Complex CSM

Former Nuodex Site, Fords, Woodbridge Township, New Jersey



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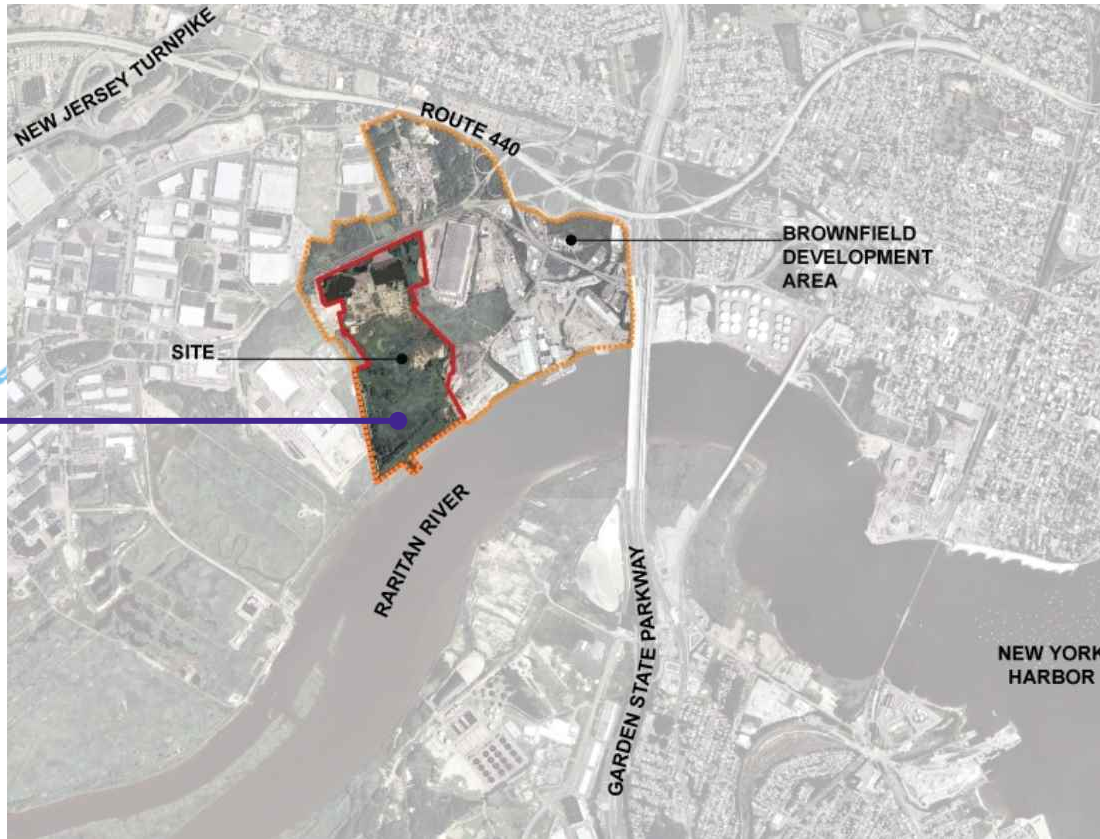
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Overview

- Site Overview
- Site-wide Remedial and Restoration Approach
- Specific Area of Concern (AOC) Overview
- Initial Remedial Approach
- Evolving CSM and Supplemental Investigation
- Updated Remedial Approach
- Remedial Implementation
- Lessons Learned and Challenges



Former Nuodex Site

Site Description

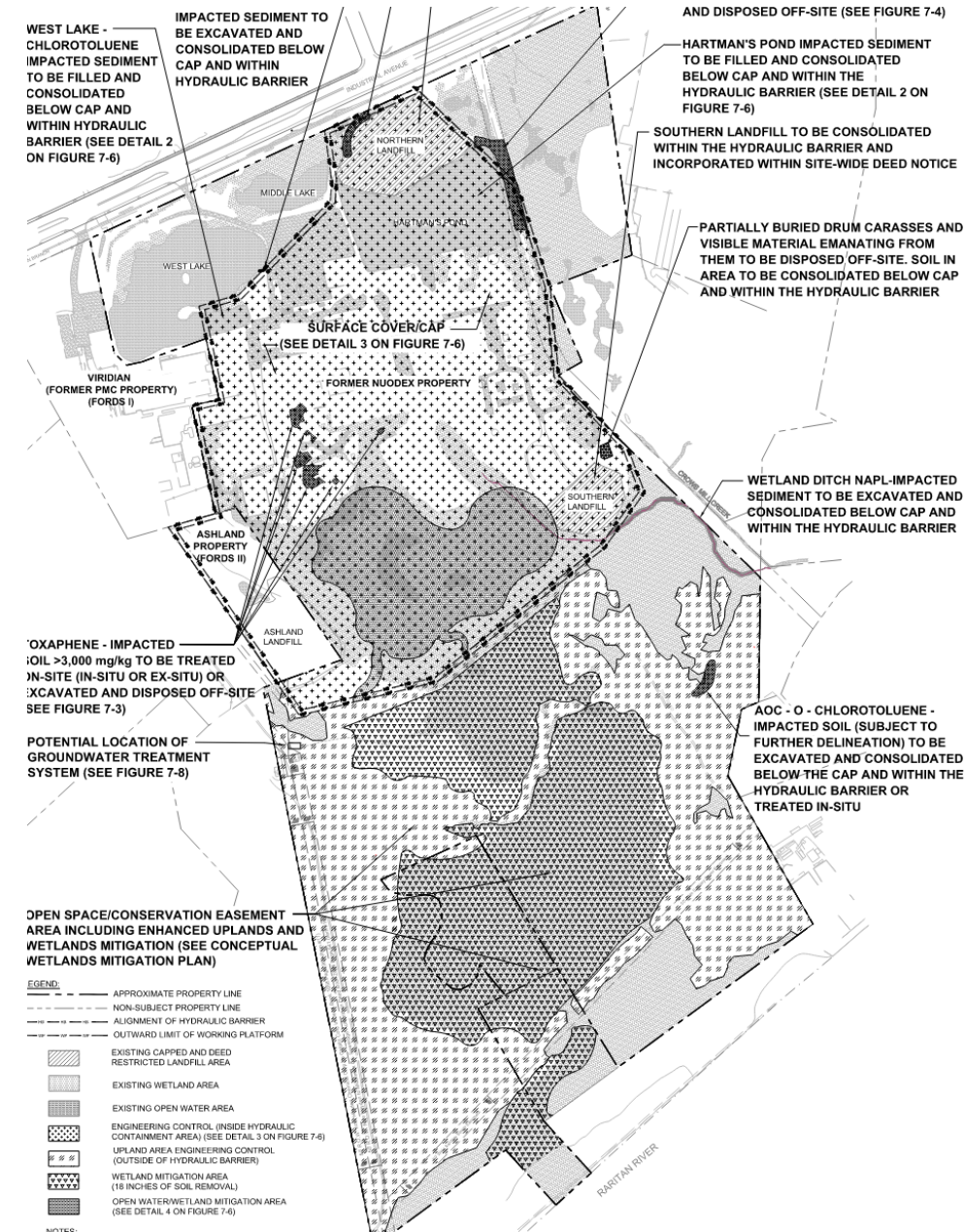
- 185-acre Site
- Central, New Jersey
- 42 Areas of Concern (AOCs)
- 95 acres of Wetlands/Open Water
 - Raritan River Watershed
- Former Clay Mining and Chemical Manufacturing
- Area Historically Heavily Industrialized
- Brownfield Development Area



Raritan River

Overall Site Remedial Action Description

- 7,250 Lf Hydraulic Barrier Wall
 - Groundwater Extraction/Treatment System
 - Excavations
 - Lake Dredging and Filling
 - Wetland/Stream Sediment Removal
 - Surface Capping
 - Extensive Wetland/Open Water Mitigation
- *Remedy allowed for Site Redevelopment

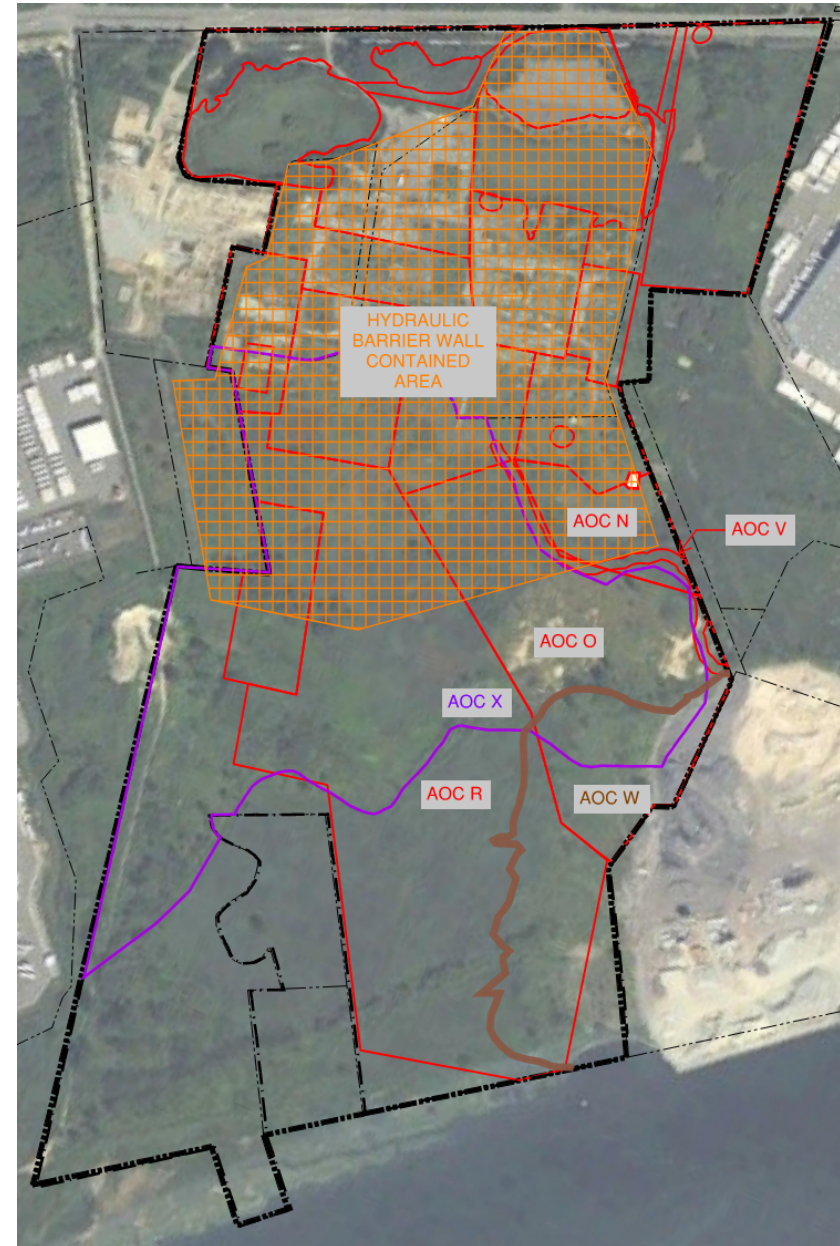


Overall Site Restoration Plan



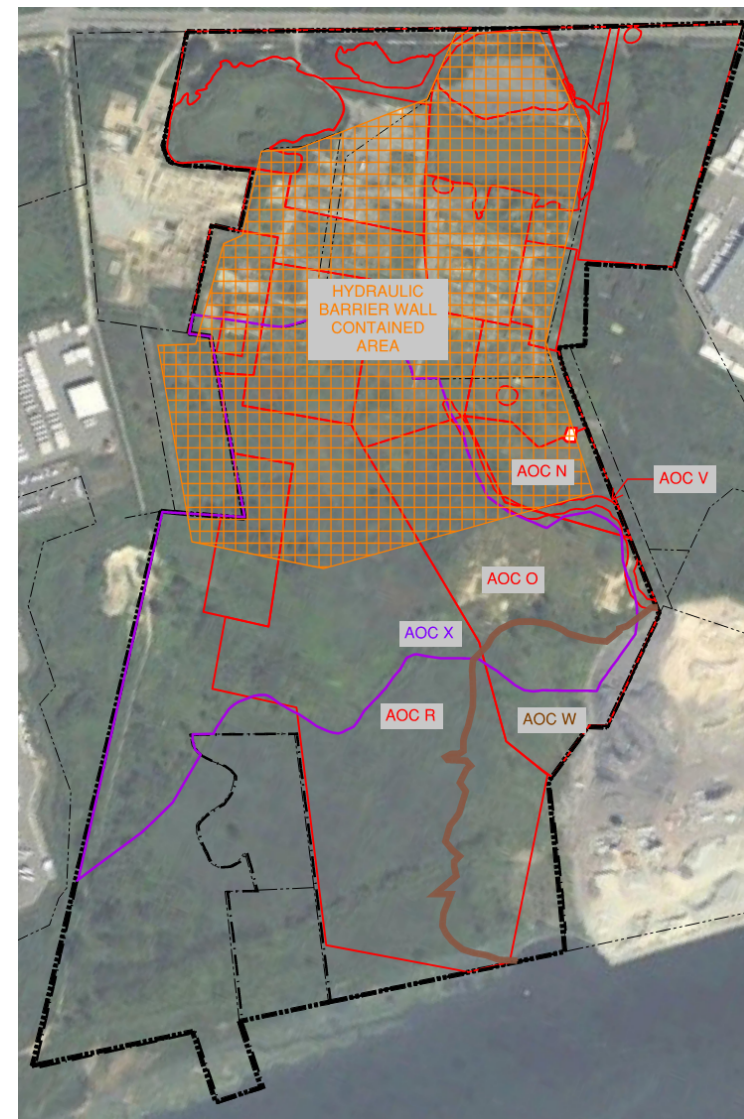
Buried Wetland Ditch and Related AOCs

- AOC N Southern Landfill
- AOC O Sludge Disposal Lagoons
- AOC R Salt Marsh Area
- AOC V Wetlands Ditch
- AOC W Encroachment Fill Area
- AOC X Radiological Licensed Area



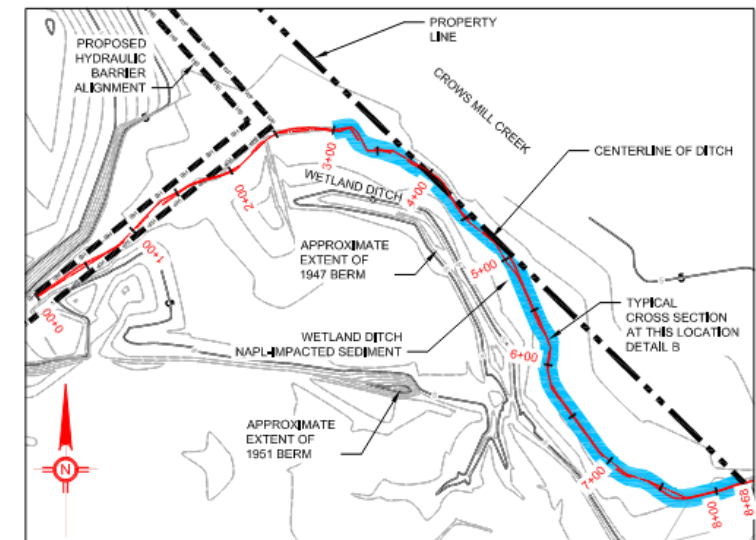
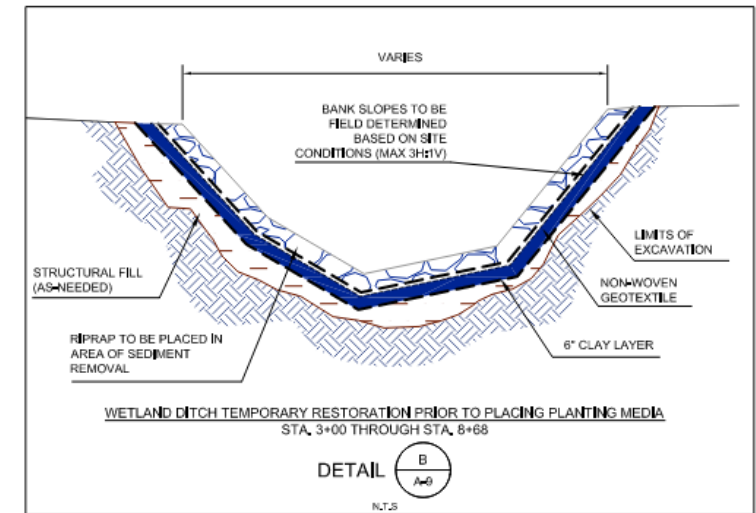
Initial Site Conceptual Model and Remedial Approach

Area of Concern	Site Conceptual Model	Remedial Approach
AOC O Sludge Disposal Lagoons	Area received sludges from former industrial wastewater lagoons	Excavate 2-CT NAPL/source material and consolidate within HWB
AOC R Salt Marshes	Wetlands area adjacent to industrial activities. Minor impacts.	Excavate surficial soils and cap. Phragmites removal and wetlands restoration primary driver.
AOC V Wetlands Ditch	Tidal ditch received industrial wastewater discharges.	Excavate ditch sediments – 2-CT NAPL impacts
AOC W Encroachment Fill Area	Impacted fill material/debris placed by adjacent property.	Surface cap
AOC X Radiological Licensed Area	Dredge spoils from Raritan River placed by USACE with radiological impacts.	Surface Cap and AOC-specific institutional controls



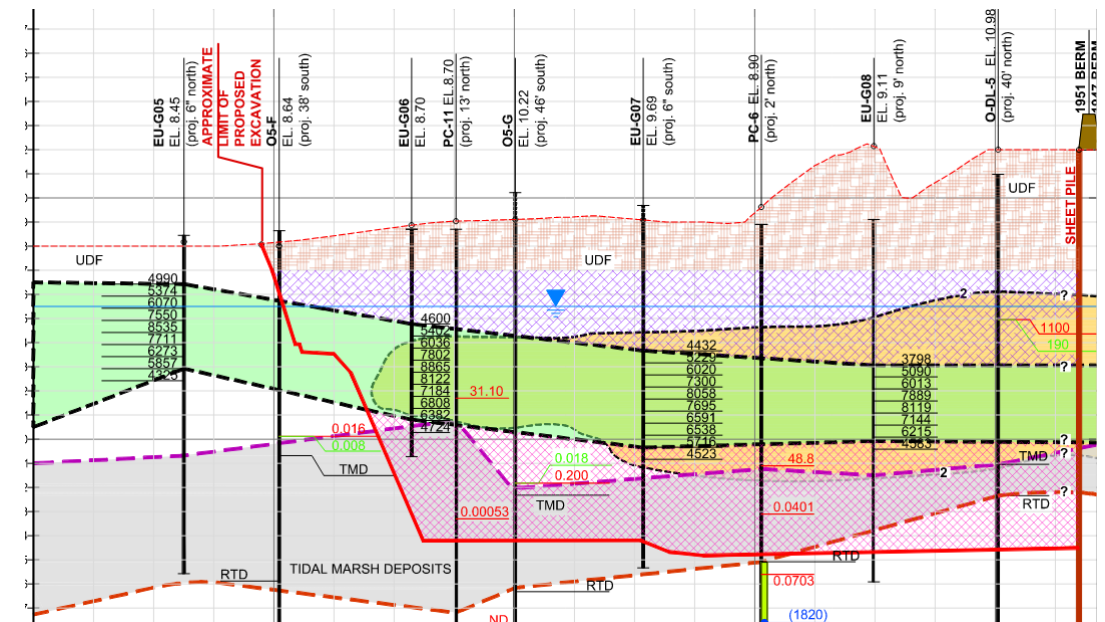
AOC-V Wetlands Ditch Excavation

- Implemented 2011-2012
- 3,500 CY of sediments excavated
 - 825 linear feet
 - 17-35 ft wide
 - depths of 1-6 ft
- Post-excavation porewater confirmatory sampling
- Temporarily restored



AOC-0 Sludge Disposal Lagoon Excavation

- Implemented 2013-2014
- Pre-design investigation program
- Site-specific Soil, GW, and Migration-to-GW Remediation Standards established for 2-CT and 4-CT
- 50,000 CY of soil and debris Excavated from 2.5 acre area
- Soils consolidated on-site within hydraulic barrier wall

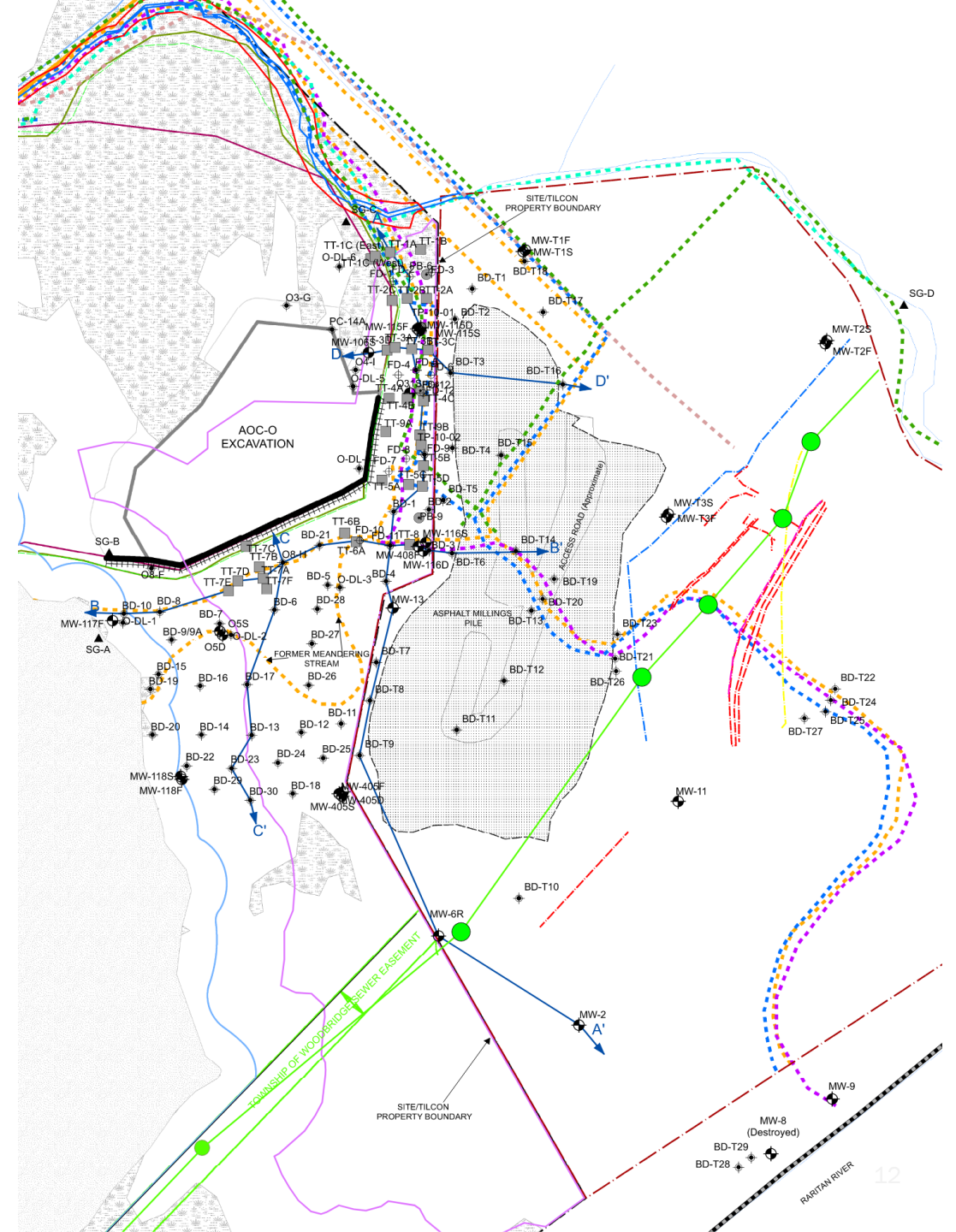


Evolving Conceptual Site Model



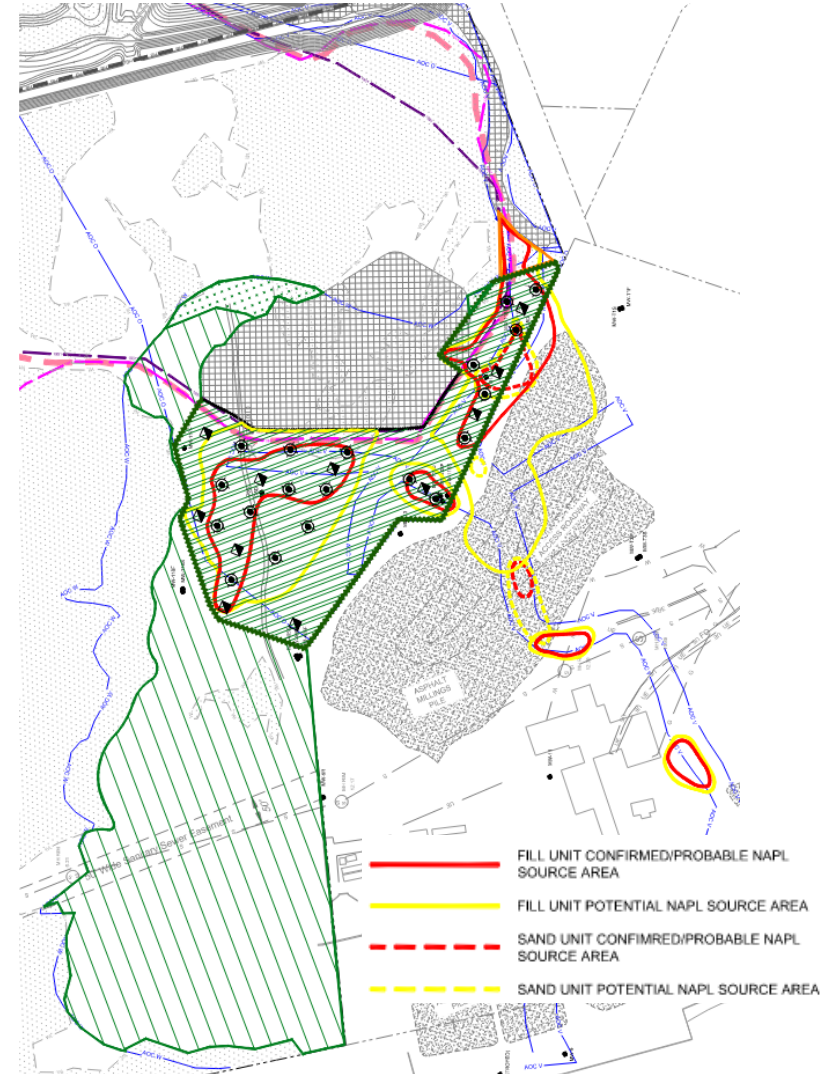
Supplemental Remedial Investigation

- Performed 2015-2018
- Industrial debris encountered
- Variety of drilling methods
- Investigating off-site asphalt plant
- Multiple lines of evidence to determine NAPL source areas

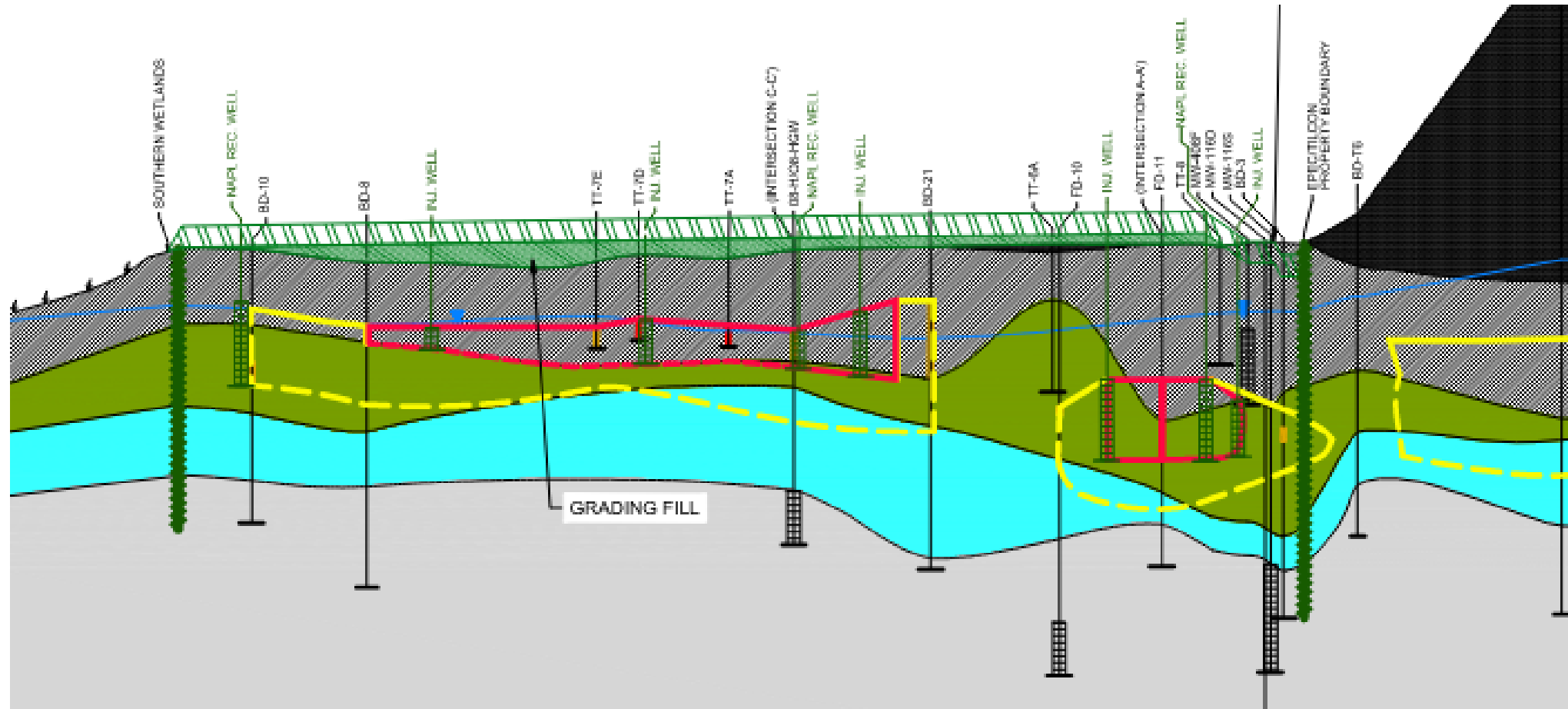


Updated CSM and Remedial Approach

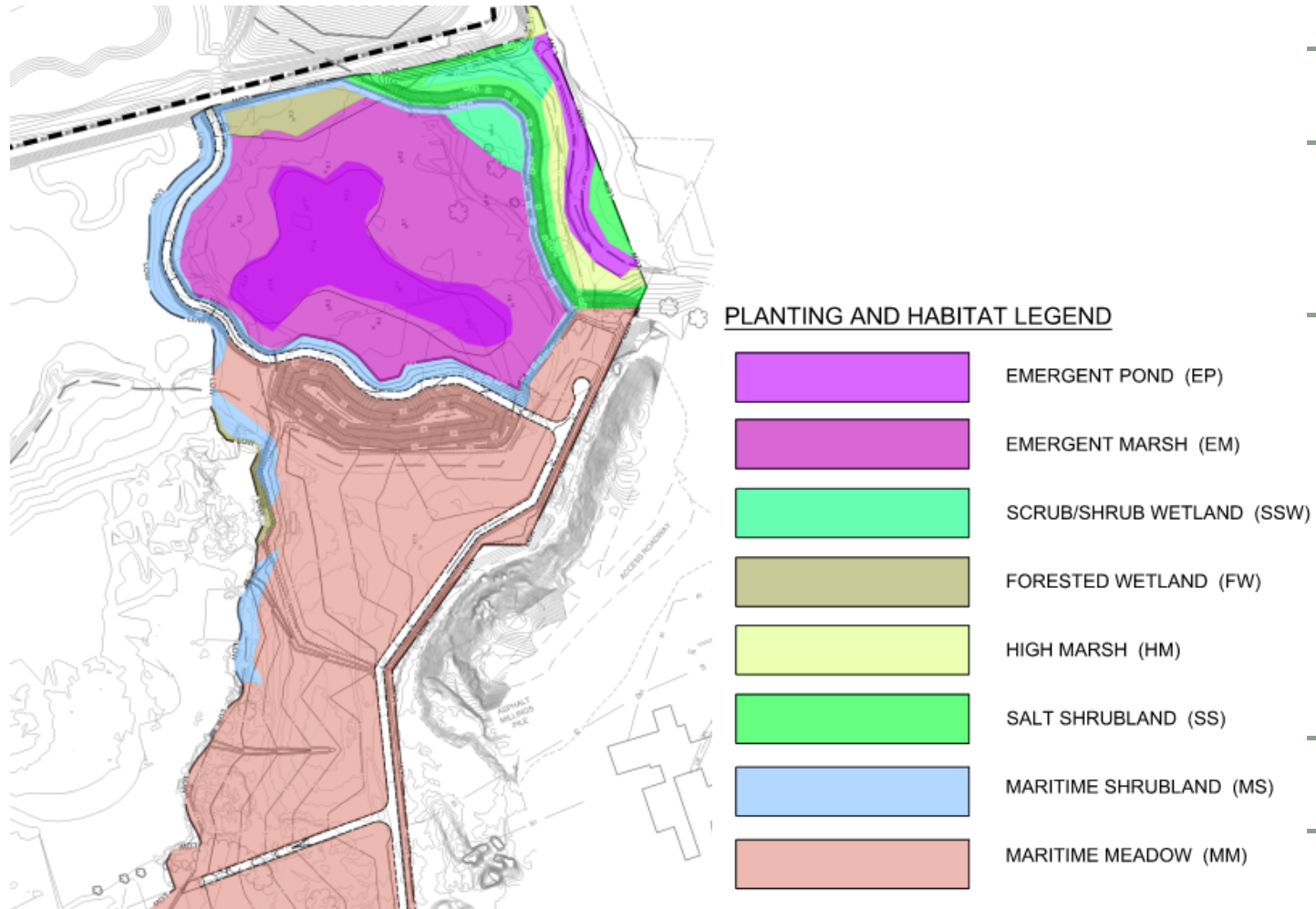
- NAPL/source material present in former ditch alignments
- Updated Remedial Approach:
 - Barrier Wall
 - Low-Permeability Surface Cap
 - Excavation of Accessible Area
 - NAPL Recovery Wells
 - In-Situ Treatment Program
 - Surface Capping of Adjacent AOCs



Updated CSM and Remedial Approach



Remedial Approach Constraints



- Wetlands Mitigation
- AOC-specific co-located contamination
- NJDEP requirement to treat or remove NAPL
 - NAPL containment when treatment/removal is not practicable
- Radiological Impacts
- Encroachment Fill

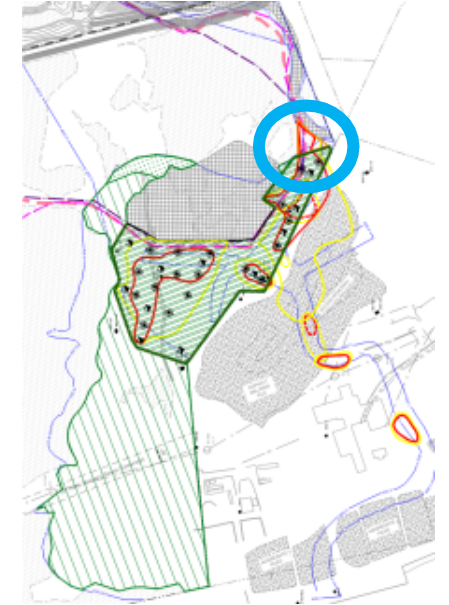
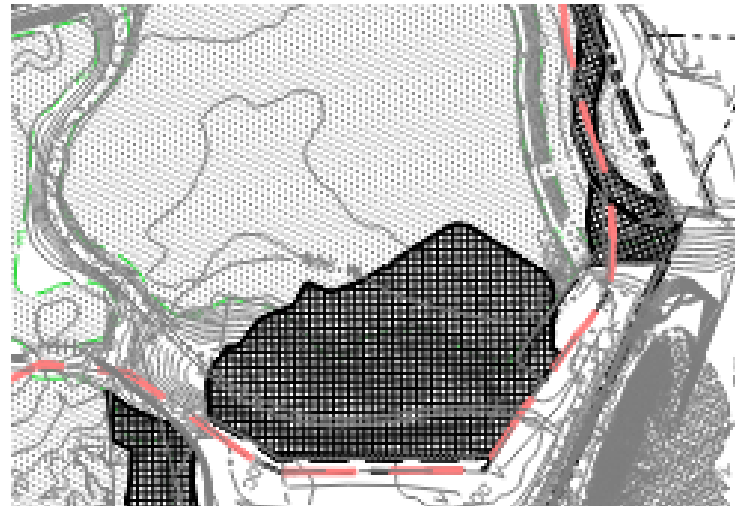
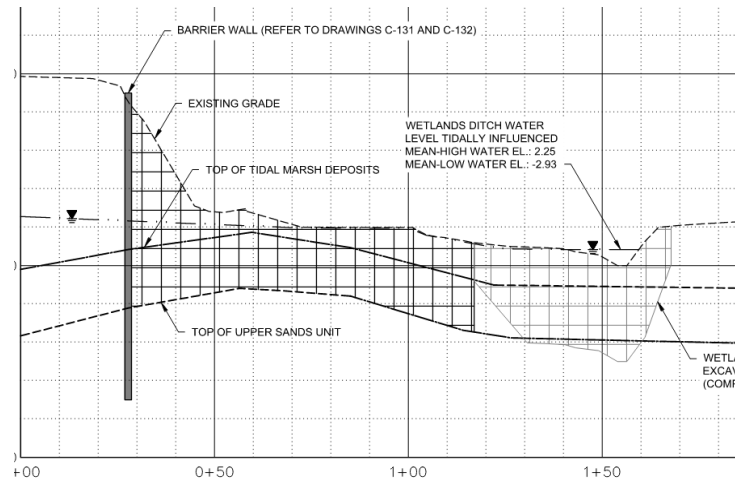


Alternative Remedial Approaches Evaluated

- Large-scale Excavation
- In-situ Treatments
- Alternative Containment Approaches
- Monitored Natural Attenuation

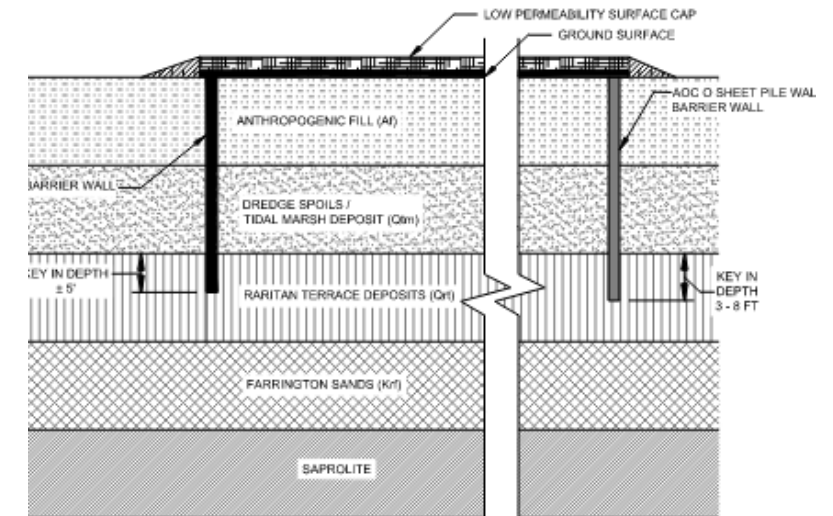
Remedial Construction – Excavation

- Performed July 2020
- 2,500 CY
 - 1,050 CY disposed off-site.
 - 1,450 CY consolidated within BWD barrier wall



Remedial Construction – Barrier Wall

- Performed July-Aug 2020
- 1,800 linear feet of sheeting to depth of 30-40 feet
- Connected to existing 550 linear feet of AOC-0 excavation sheeting
- Significant debris encounter in sheeting alignment



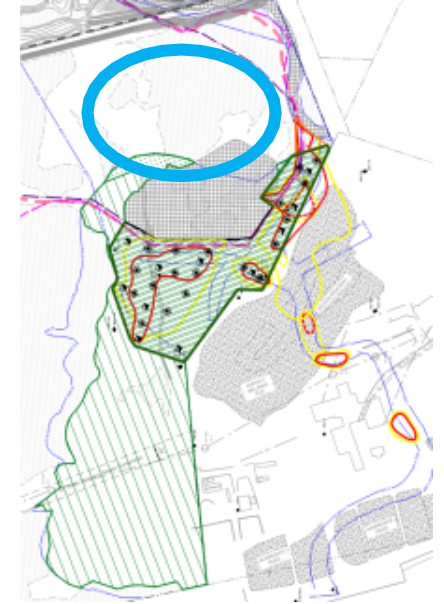
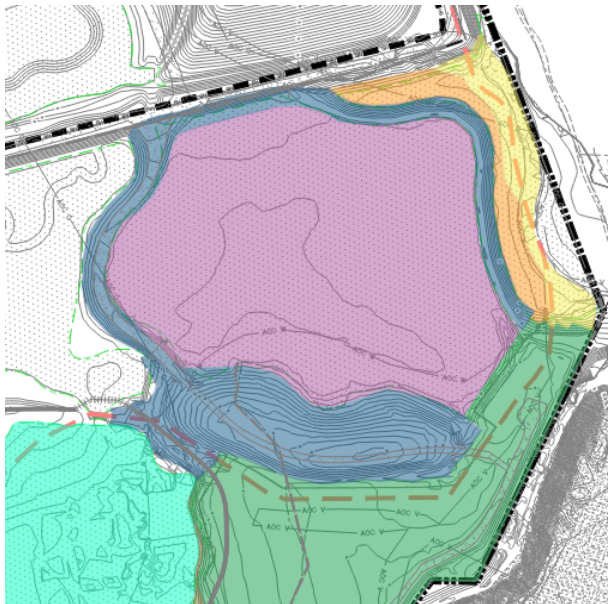
Remedial Construction – Low Permeability Surface Cap and Recovery/Injection Wells

- Performed Sept-Dec 2020
- 4.0 acre low-permeability surface cap
 - LLDPE geomembrane and drainage net
- 11 NAPL Recovery Wells
- 19 Injection Wells
- 13 Barrier Wall Piezometers



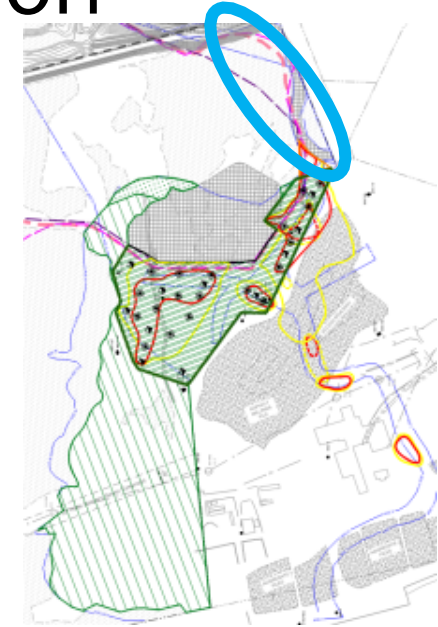
Remedial Construction East-Central Wetlands

- Performed June 2020-May 2021
- 6.2 acre Wetland Area
 - GCL Geotextile Incorporated
- 30,000 CY of Earthwork
- Alternate GTS Effluent Irrigation Outfall



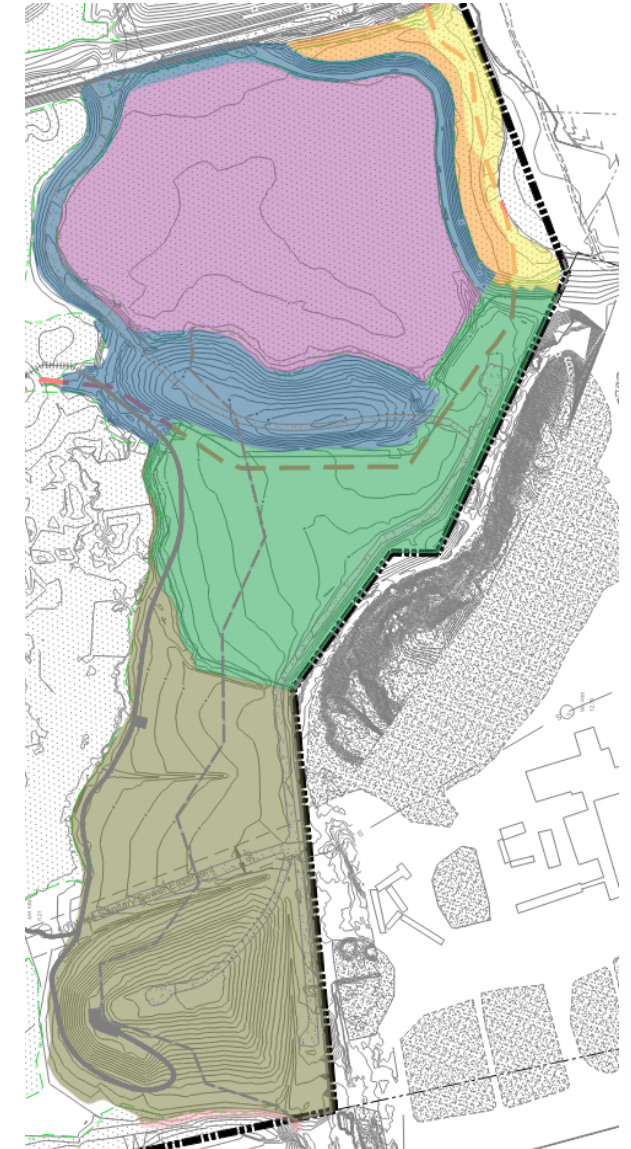
Remedial Construction – Wetlands Ditch Restoration

- Performed April - May 2021
- Sediments previously removed in 2012
- 1.2 acre tidal wetland mitigation
 - Increased area of tidal wetlands
- Primary GTS effluent outfall location



Remedial Construction – Upland Capping

- Performed June - Nov 2020 and Sept 2021 – March 2022
- 7.0 acre surface cap area
- Consolidation of 30,000 CY of sediments from on-Site lake
- Public access trails and overlook area



Restored Conditions



Restored Conditions

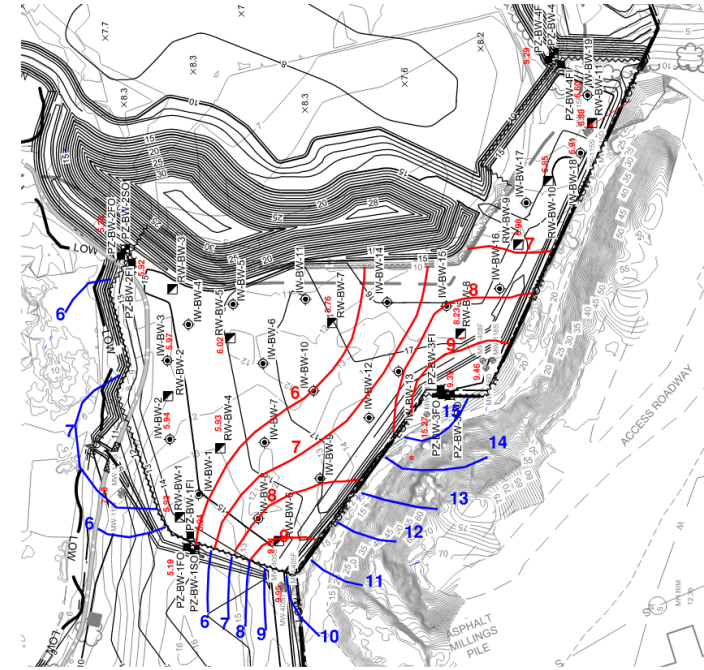


Restored Conditions

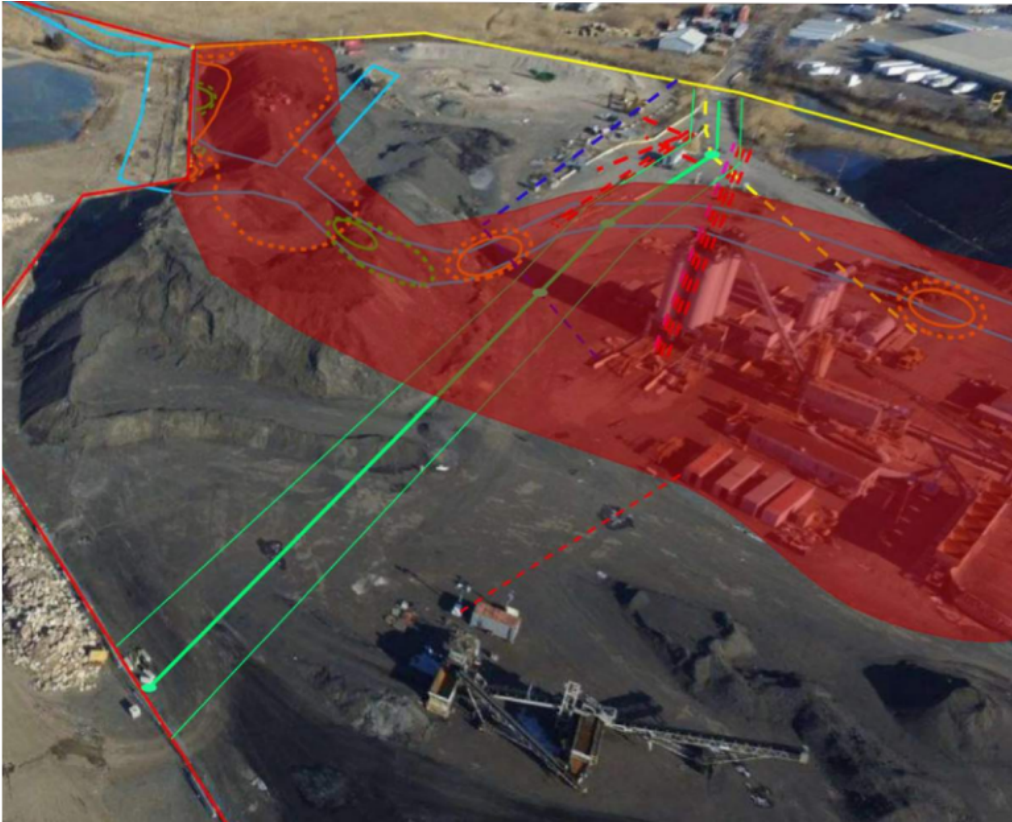


Remedial Outcomes

- Engineering Controls containing source material
- Small amounts of NAPL recovered
- In-situ bench scale study completed
 - Found that evaluated reagents did not improve natural degradation process
 - Injection program not implemented
- Thriving wetland system



Off-Site Remediation Approach



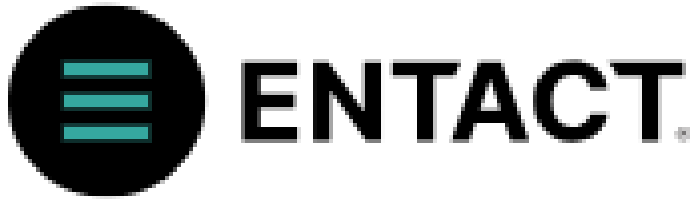
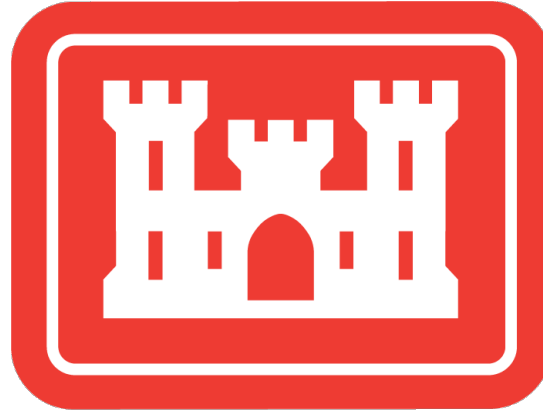
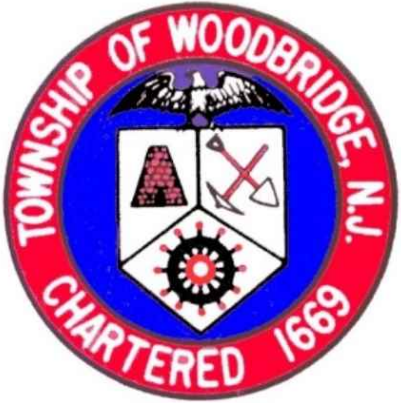
Lessons Learned

- Continually evaluating and updating CSM
- Site-wide Remedial Approach
- Comprehensive Soil Management Plan
- Unexpected Conditions
 - Management of Debris Encountered
- Stakeholder Involvement
 - Internal – Client, LSRP, Contractor, Ecologists
 - External – NJDEP, USACE, Township, Utilities

HIGH POINTS:

- Limited off-site disposal
- Passive NAPL containment
- Accommodated site-specific wetland constraints

Acknowledgements



Thank you.

Questions?

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