



Historic Tie Plant
Approximate 2016 Water Line



Escanaba Tie Treating Plant Remediation

Construction of Remedy to Address NAPL Migration to Great Lakes

Railroad Environmental Conference
November 2016

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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Agenda



- Site Background
- NAPL Impacts
- Basis of Design
- Passive Remedy Description
- Early Performance Monitoring



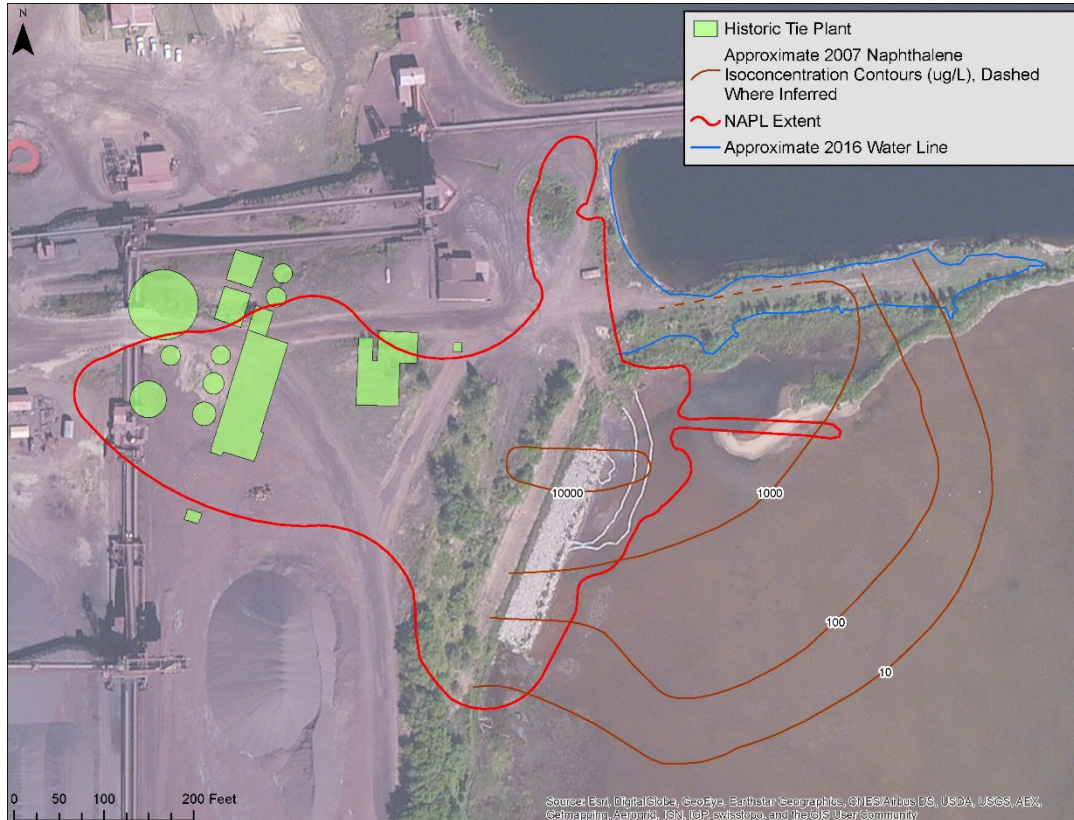
Site Background



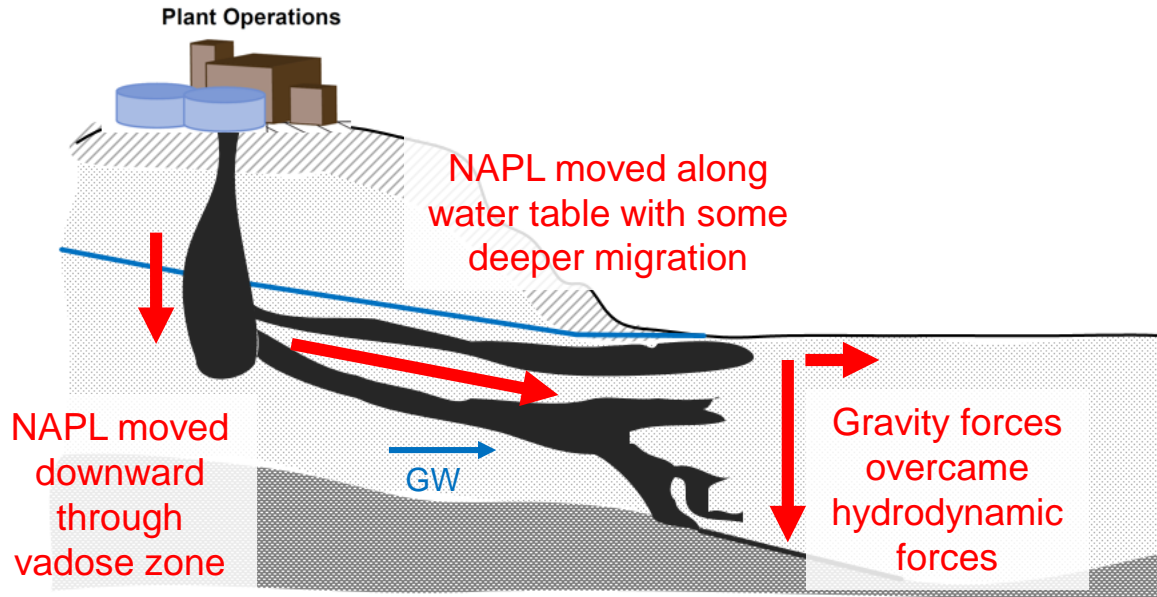
- Historic tie treating plant upland from Lake Michigan
- Operating ore dock owned by Canadian National
- Creosote Seep on shoreline observed in 2005
 - Both onshore and offshore NAPL impacts
- Interim measures taken to reduce surface impacts
- Final remedy design accounted for NAPL migration and groundwater discharge to surface water interface
 - Naphthalene <11 µg/L at GSI interface
- Michigan Department of Environmental Quality approved remedy construction in March 2015 as a voluntary action by UPRR



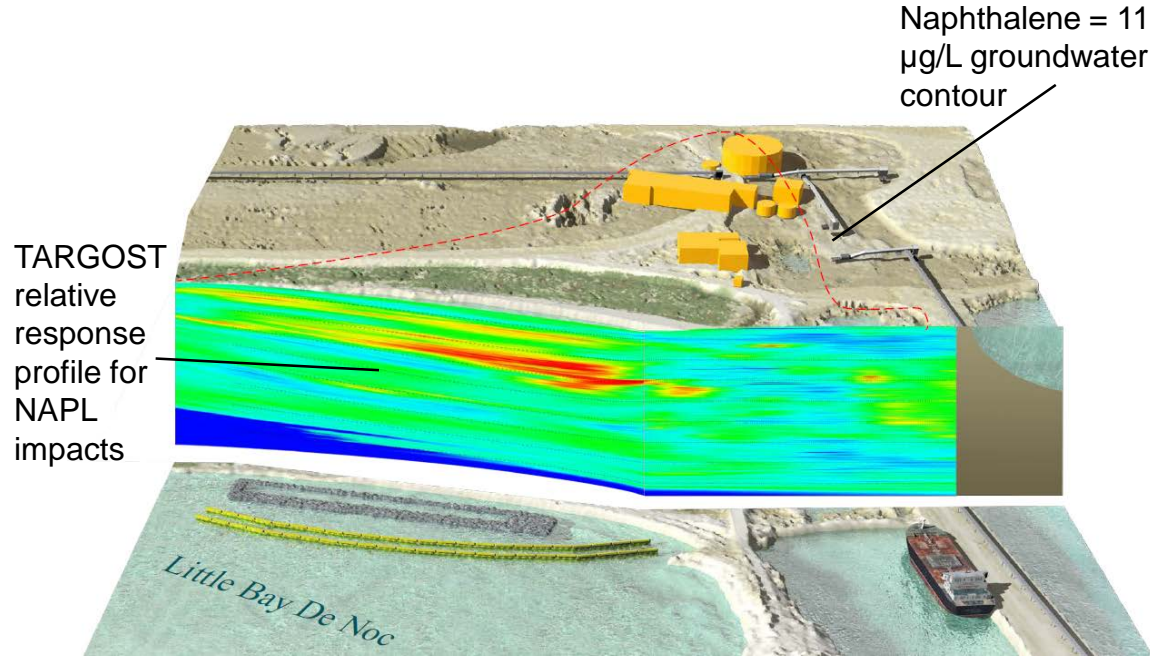
Site Overview



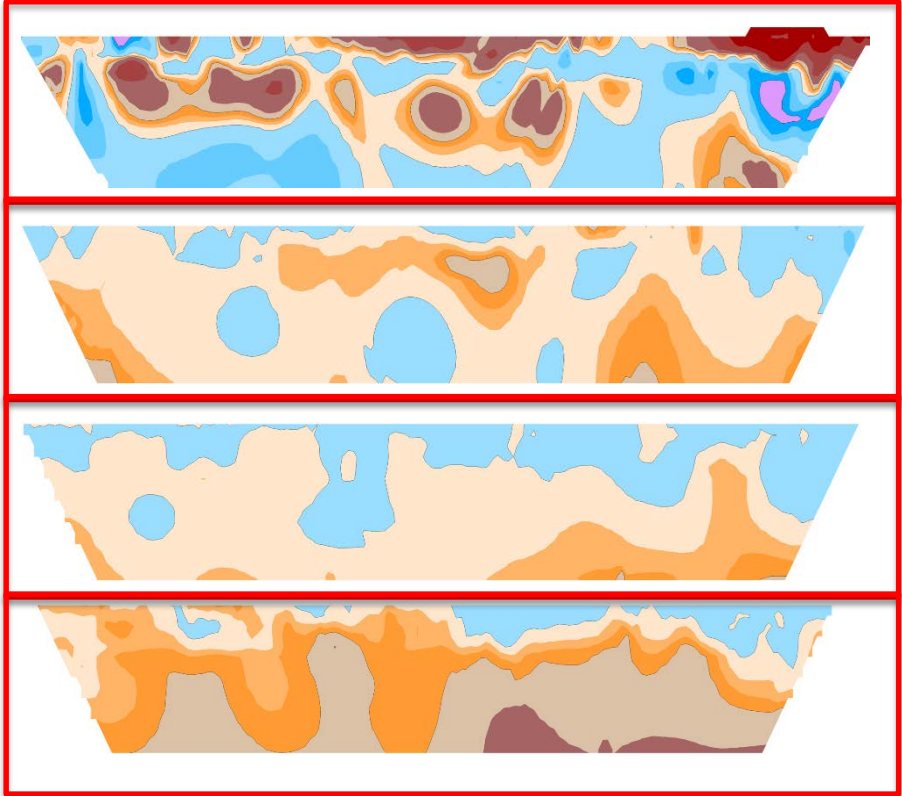
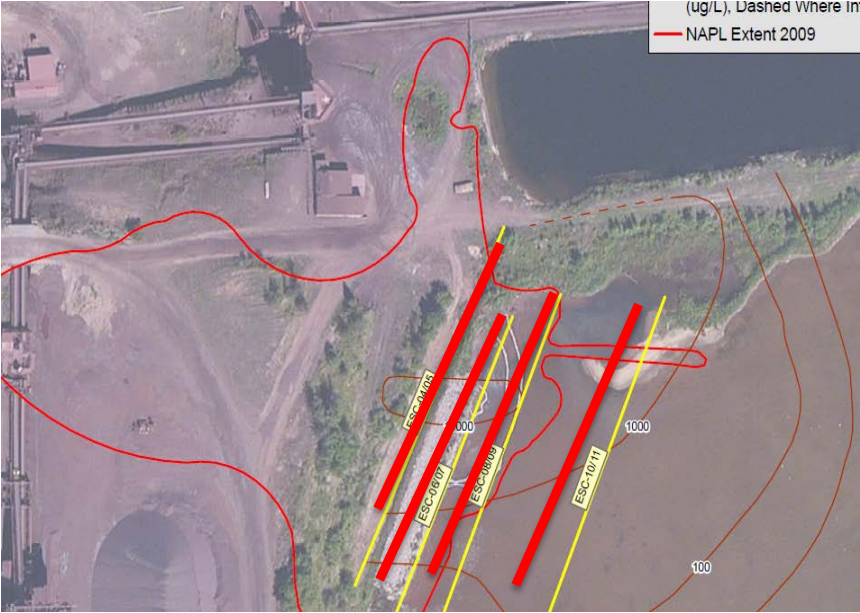
Cross Section of NAPL Impacts



Shoreline NAPL Profile



Sediment Resistivity Profiles



Basis of Design



Isoconcentration contours suggest naphthalene degradation during GW transport

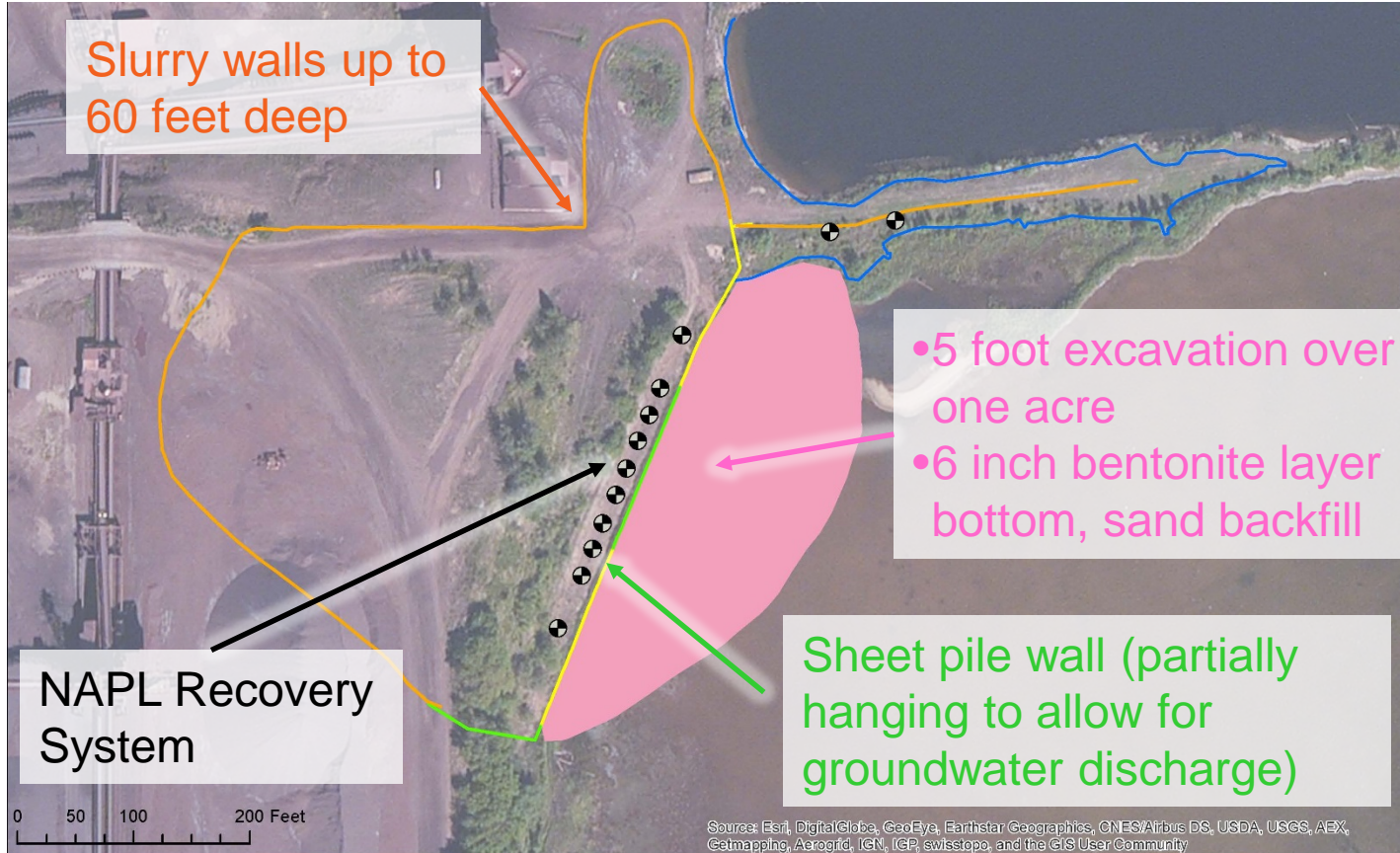
Naphthalene plume extends approximately 400 feet from leading edge of NAPL beneath sand flat

Model forecasts 400-day GW travel time till Naphthalene degradation below 11 ug/L

- Approximate 2007 Naphthalene Isoconcentration Contours (ug/L), Dashed Where Inferred
- NAPL Extent
- Approximate 2016 Water Line

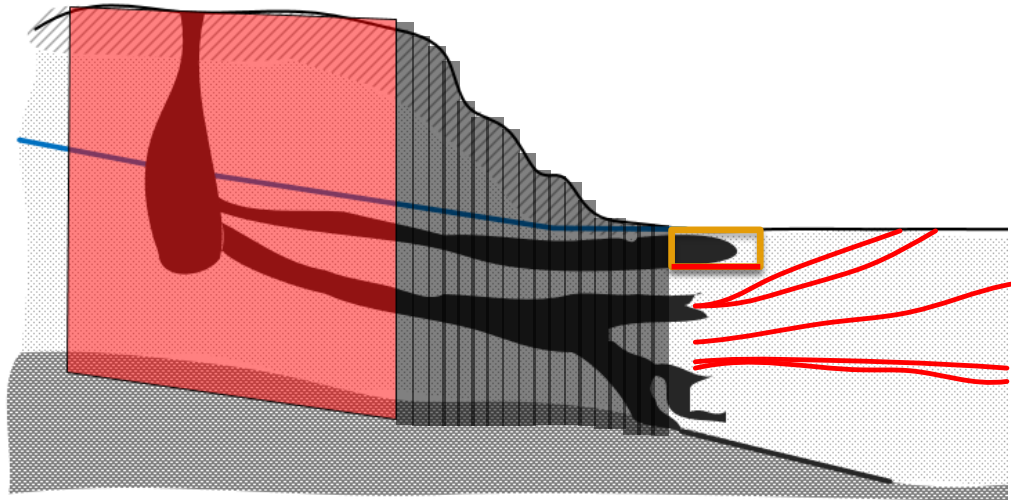
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Remedy Overview



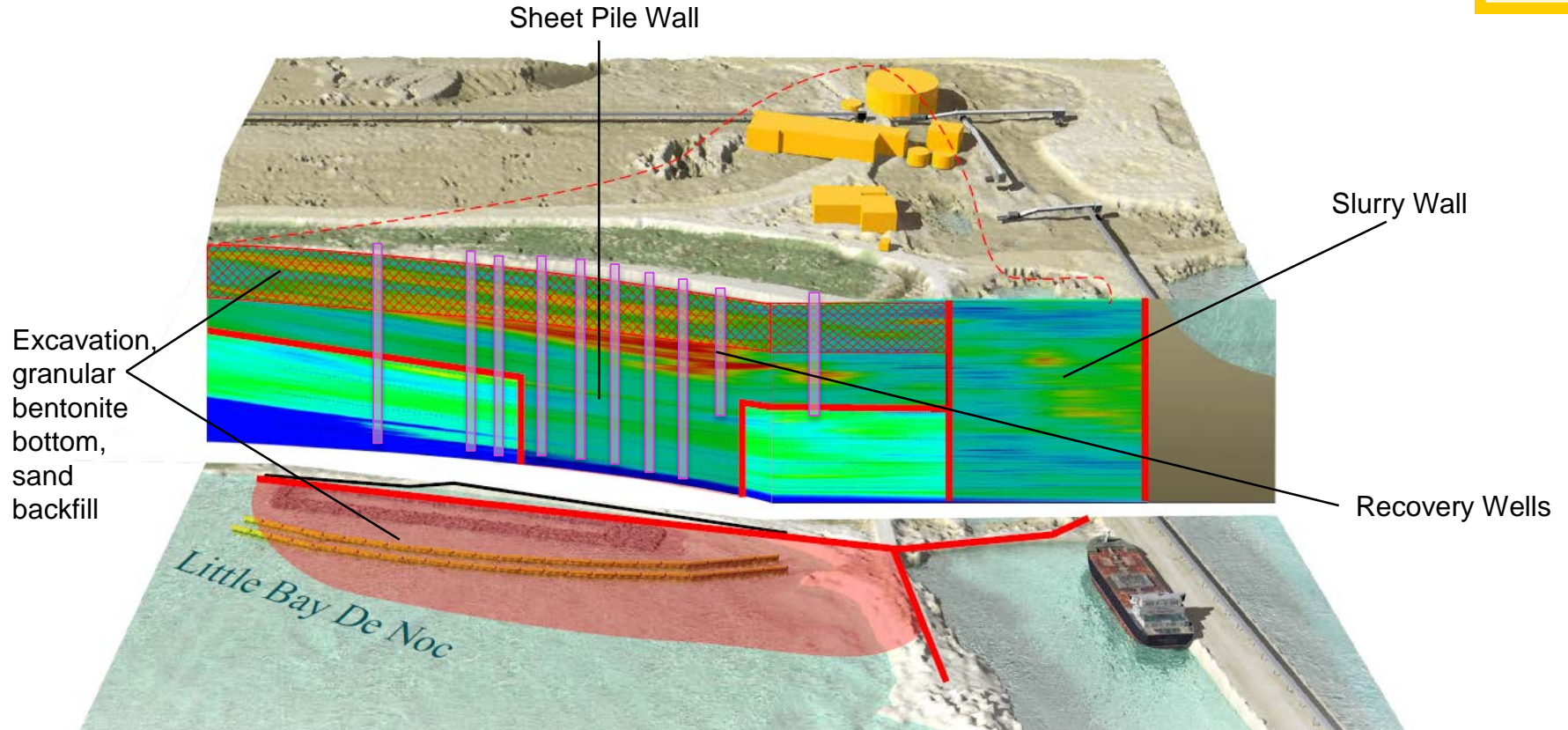
- Recovery Wells
- Approximate 2016 Water Line
- As-Built SSP - Partial Depth
- As-Built SSP - Full Depth
- As-Built SBCW
- Aggregate Coated Bentonite

Remedy in Profile

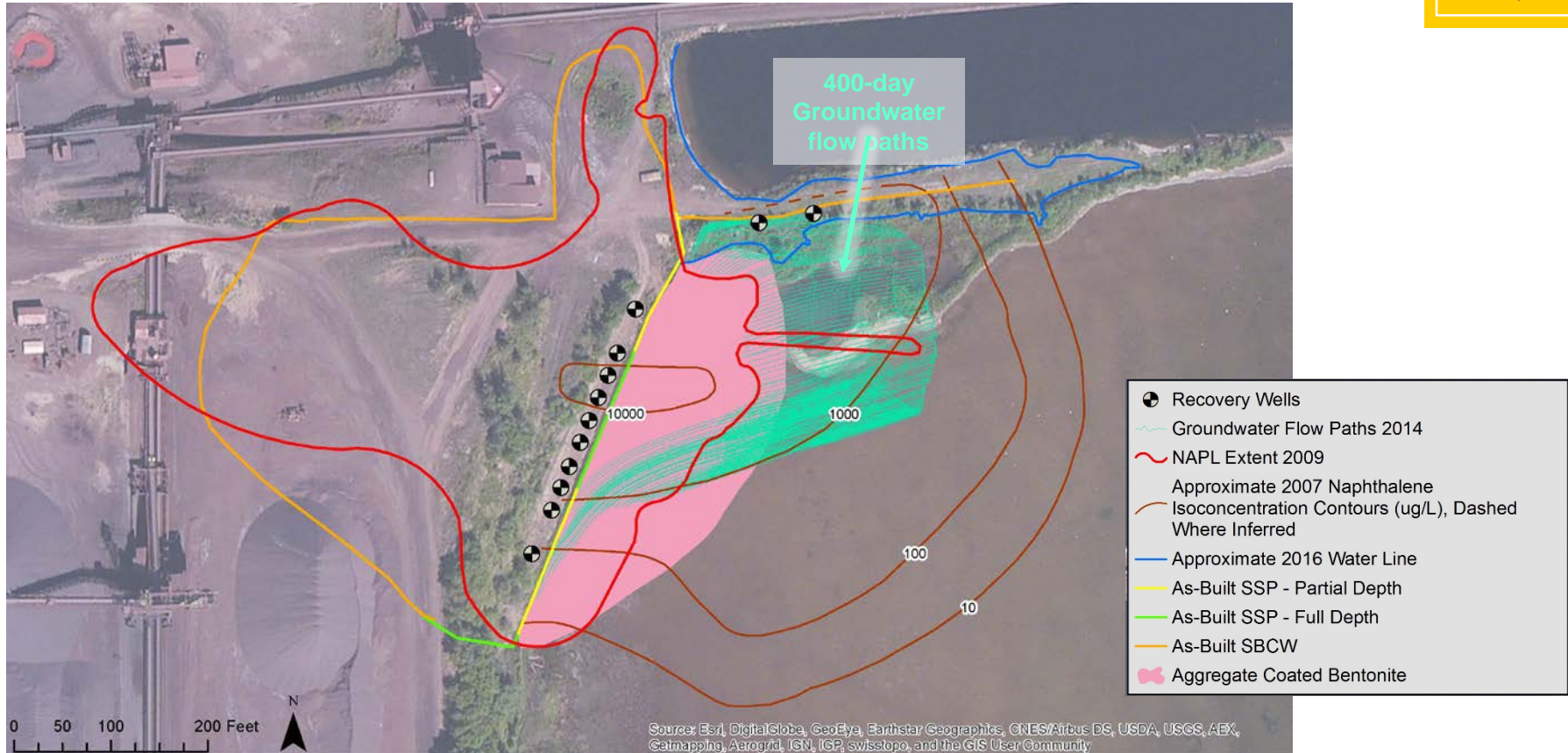


- Slurry wall constructed around upland impacts where constructible
- Sheet pile wall constructed in upland on slopes too steep for slurry wall
- Temporary shoring used to support five foot sediment excavation
- Aggregate coated bentonite placed in excavation bottom to elongate groundwater flow paths

Shoreline Remedy in Profile



Remedy Simulations



Overall

Lessons Learned



- Working on Canadian National property. Cooperation of CN staff
- Site transportation got complicated with upland and in water work performed at the same time
- Keep your land owner happy!

Slurry Wall Construction

Lessons Learned



60-Foot Continuous Trencher



Bulk Bentonite Added For Lubrication



Bulk Bentonite Metered into Trench



Excess slurry on spit

- “Swell” housekeeping
- Trencher boom stuck 40 feet in ground, extracted but chain left in ground
- Trencher as second tier subcontractor
- Slurry in water in take line for facility

Dredging in Lake Michigan

Lessons Learned



**Installing Temporary
Perimeter Sheet Pile Wall**



**Finger Piers
Constructed for Access**



Active Dredging



**Loading Spoils for Transport
To Dewatering Area**

- Both MDEQ and COE permit required
- No turbidity releases
- Contractor behind schedule.
- We were still placing backfill in December in the Upper Peninsula of Michigan!

Sheet Pile Wall

Lessons Learned



Sheet Pile Setup on Shoreline



Vibratory Hammer Used to Install Sheet Piles



Sheets Extend Above Historic High lake Level



Shoreline Picture

- Sheet pile designed as permanent structure. During construction also needed to support 5 foot cut for dredging
- Specification for a secondary seal on interlocks. Contractor offered as adder, not really cost effective option

Sediment Dewatering and Transport

Lessons Learned



Dewatering Pad Constructed



**Dredge Spoils Loaded in
Dewatering Area**



Dredge Spoils Dewatering



**After Dewatering, Sediment Loaded
for Offsite Disposal**

- Drying tests performed by CH2M and included in specification to show how easily sediment dewatered
- Both excess swell from slurry wall contraction and sediment disposed offsite

Granular Bentonite Layer Construction

Lessons Learned



Upland trial



Granular Bentonite Placement



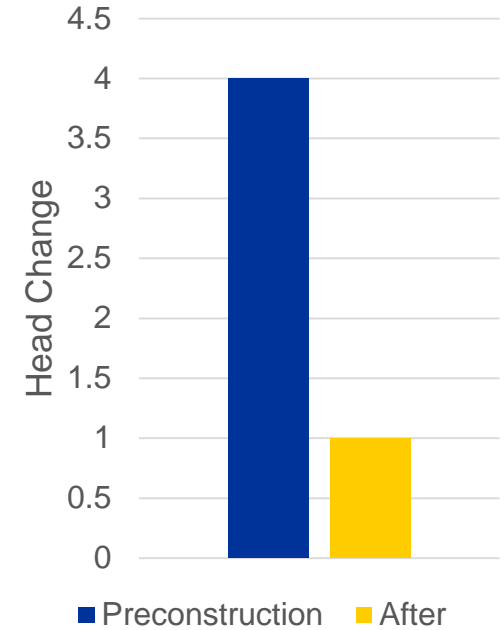
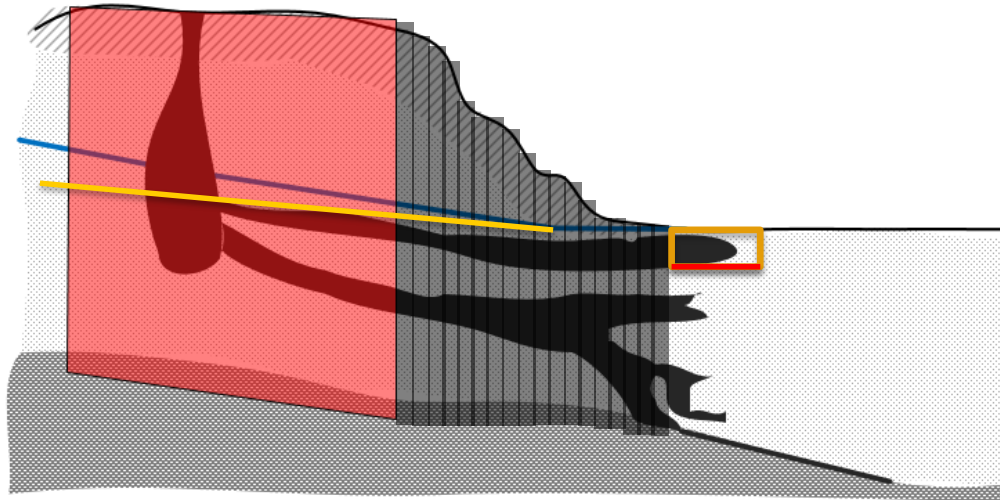
Granular Bentonite Placement



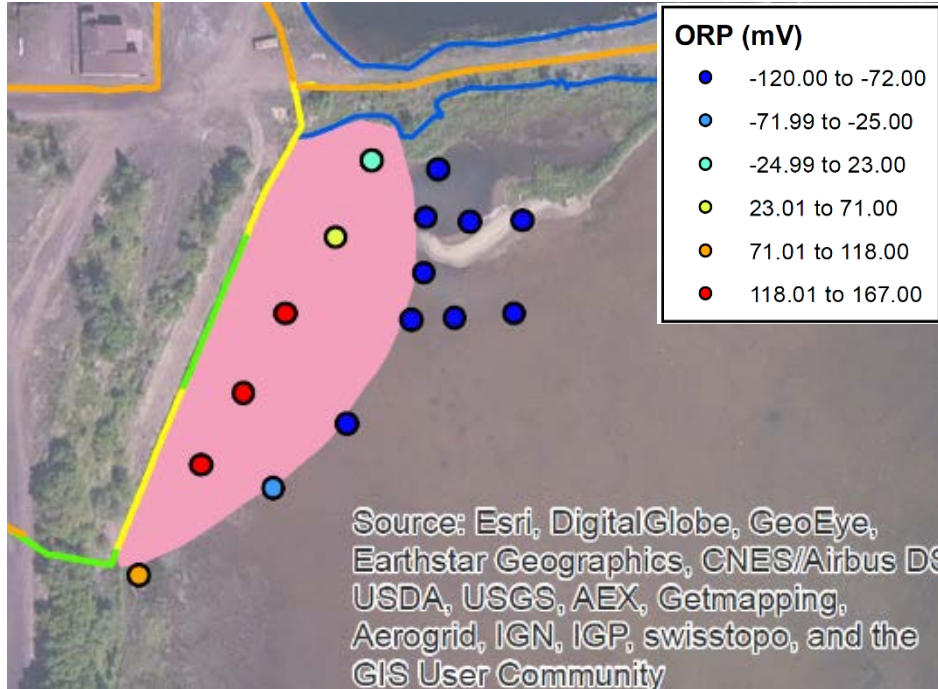
Confirmation Core

- Specifications require “low energy” placement of granular bentonite, but that can mean many things
- Confirming specification by survey difference was difficult
- Confirmation cores were collected to verify placement

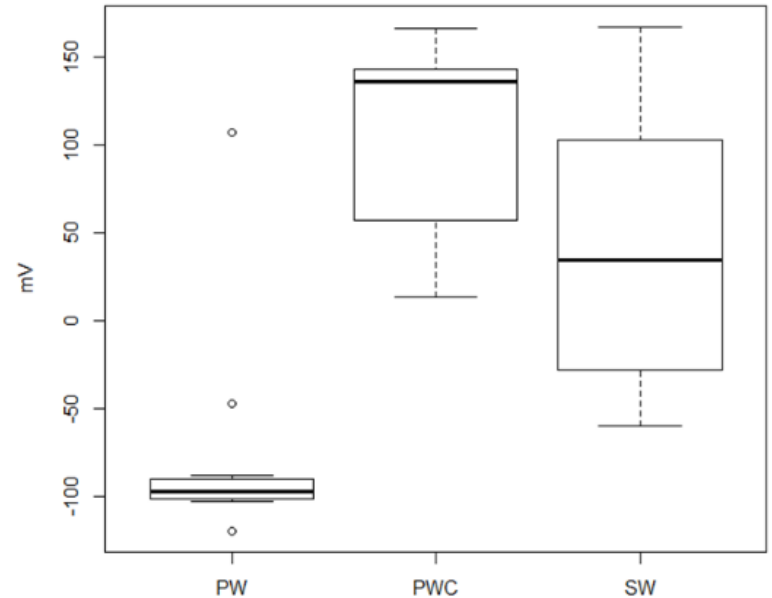
Hydraulic Response



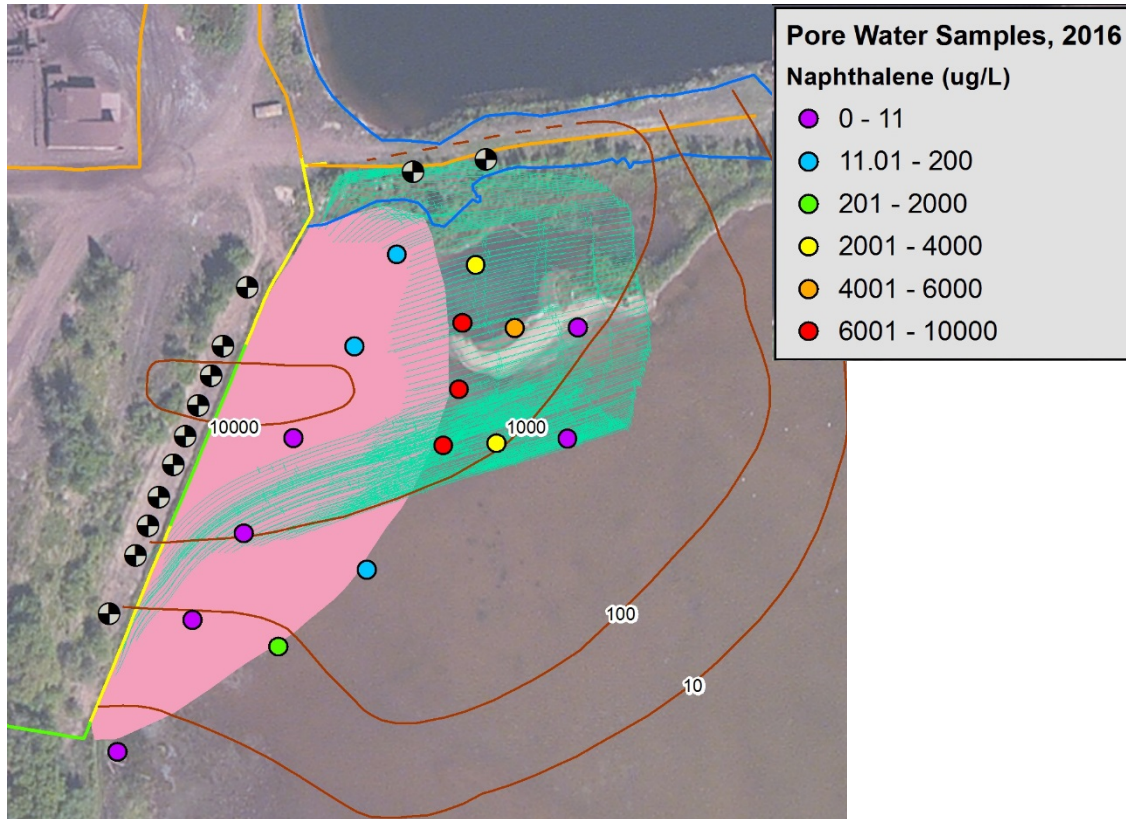
Defined Groundwater Venting Zone



GSI Monitoring, UPRR Escanaba - Surface and Pore Water ORP



Spring 2016 Naphthalene Results



- Sampled sediment pore water at GSI interface
- Naphthalene concentration results:
 - Low over cap
 - High at edge of cap
 - Decreasing along GW flow path after cap
- Naphthalene > GSI
 - 400 feet preconstruction
 - <100 feet 6 months after
 - Results already exceed groundwater model travel time predictions

Before and After

Lessons Learned



Discovery



Interim Action



Completed Project

- The Escanaba Tie Treating Plant remedy in summary is:
 - Sustainable – no groundwater pumping or discharge, no energy consumption
 - Cost effective – high capital cost, low annual O&M for monitoring
 - Provides treatment– the biodegradation that naturally occurs treats naphthalene discharge