



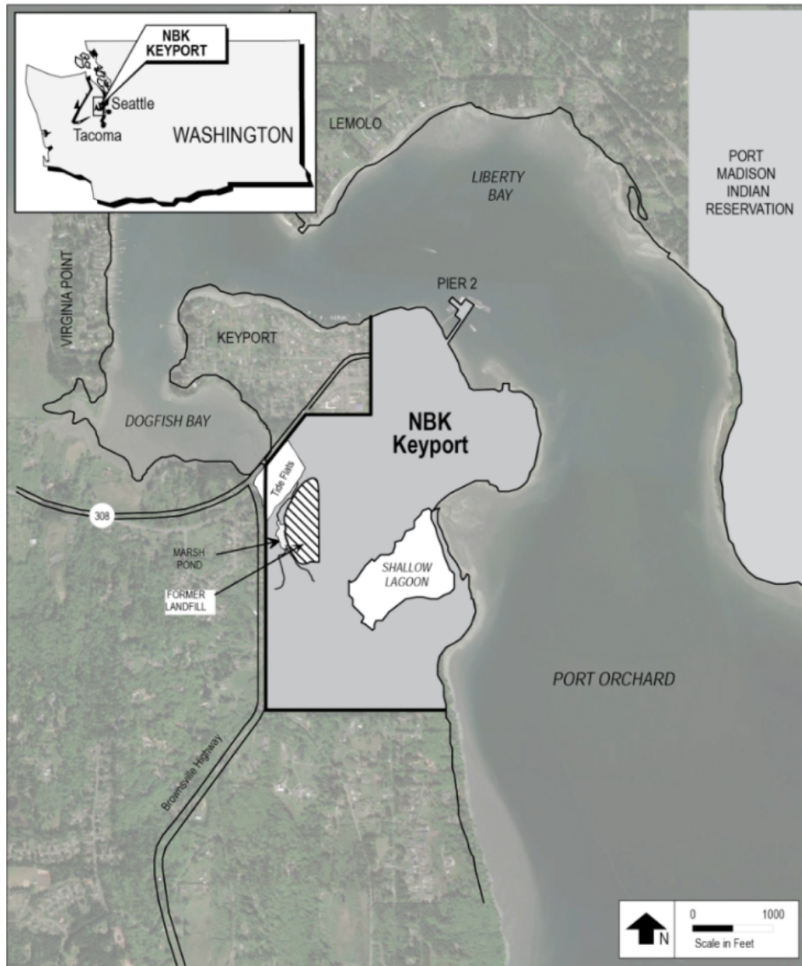
Presented by
Michael Meyer, Battelle Memorial Institute

Reevaluating the Conceptual Site Model of a Shoreline Chlorinated Solvent Plume in Groundwater

Path to a Revised CSM

- The Site, old CSM, and the driver for a revised CSM
- Recharacterization Approaches
 - Geophysical Survey and Tree Core Sampling
 - MIP Probe
 - Direct Push Soil and Groundwater Sampling
 - Well Installation and Sampling
 - Modeling and Environmental Sequence Stratigraphy
 - Intertidal Temporal Geophysical Survey
 - Deep Well Installation
 - Planned Barge Sampling with Added Geophysical Surveys
- Revised Conceptual Site Model

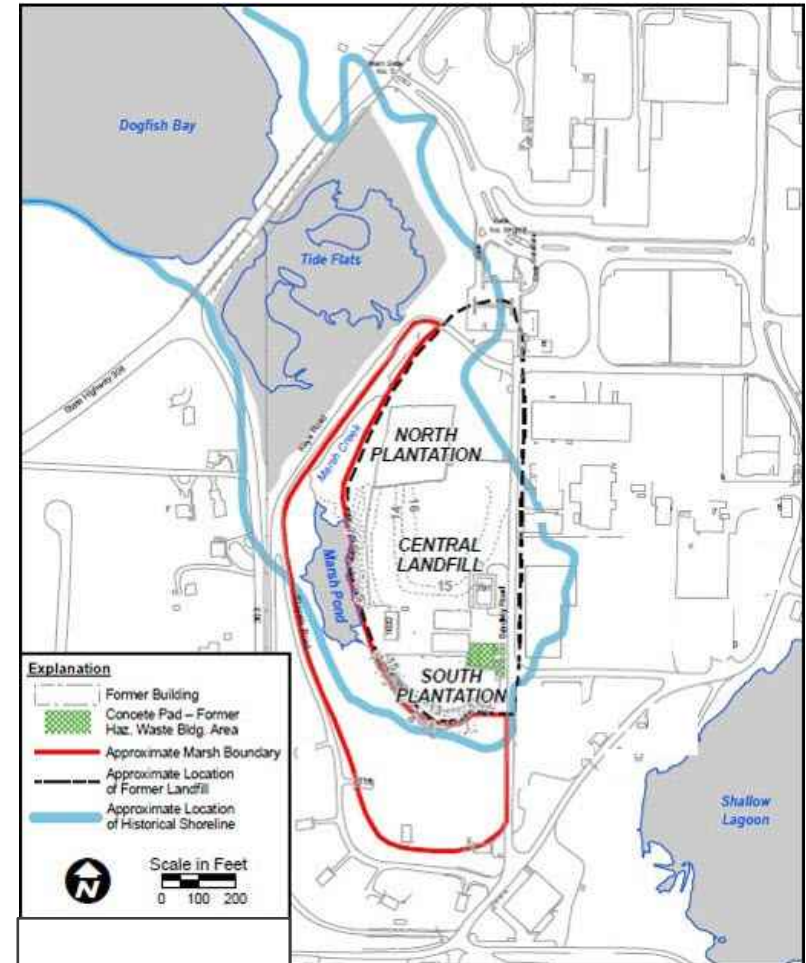
Site Background



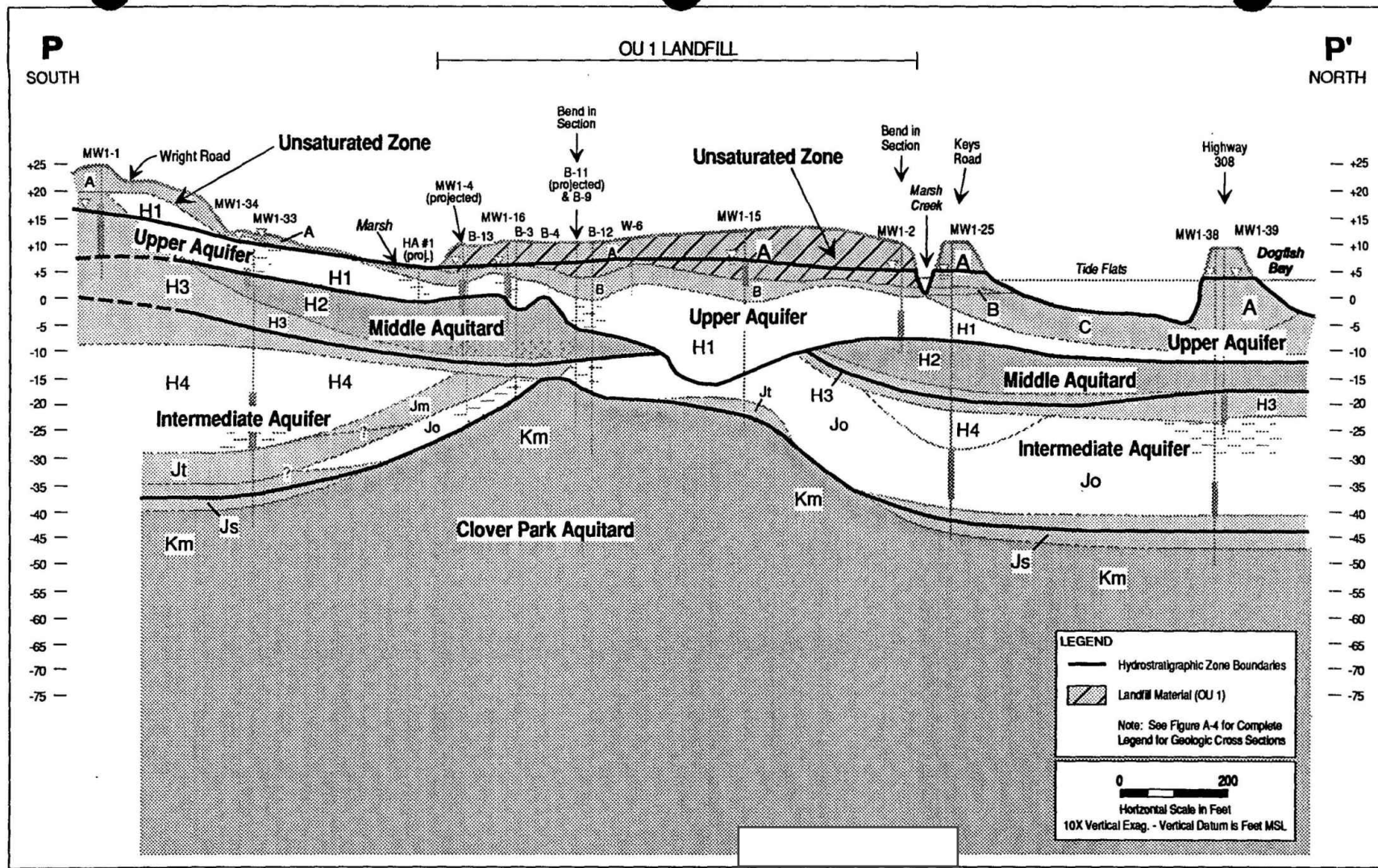
- Naval Undersea Warfare Center Division, Keyport is based at Naval Base Kitsap Keyport
- 1998 ROD designated the former Installation landfill Operable Unit 1
- Received domestic and industrial waste, 1930s to 1973
- Waste layer, between 5 and 15 feet thick, fills portion of tidal marsh
- Shallow groundwater between 2.5 and 4 feet below grade
- Contaminants of Concern are TCE/TCA and their daughter products

Site Background (Cont.)

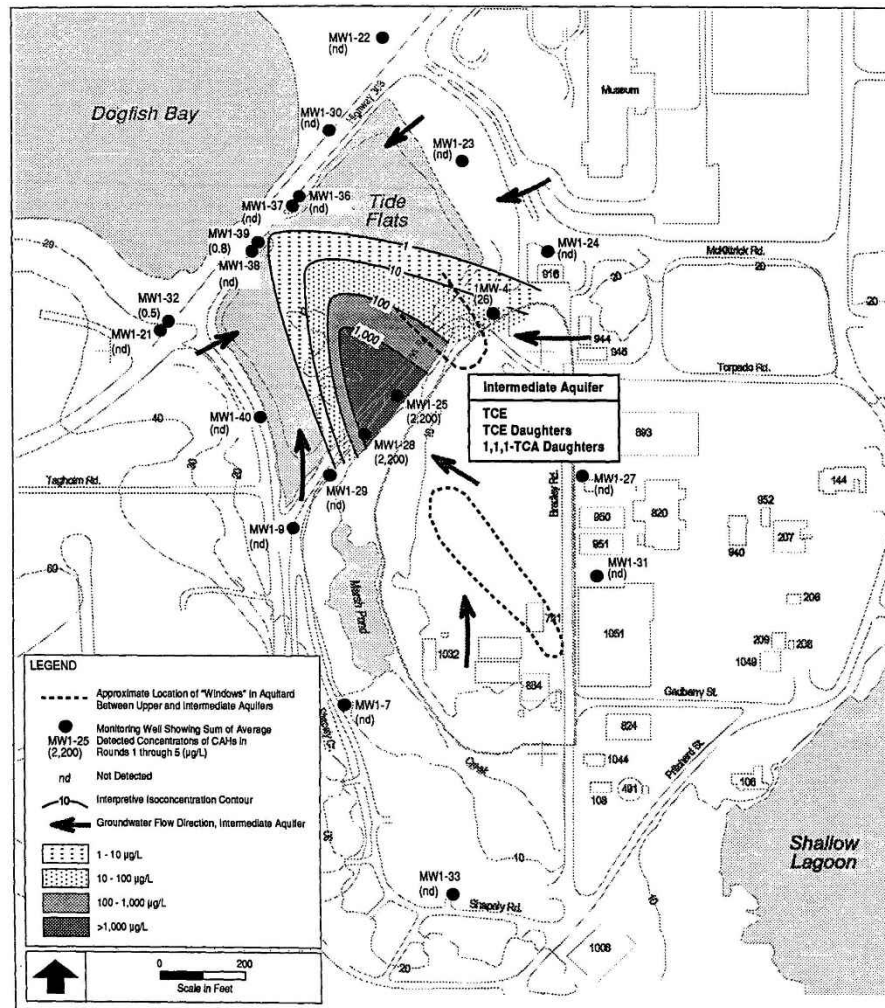
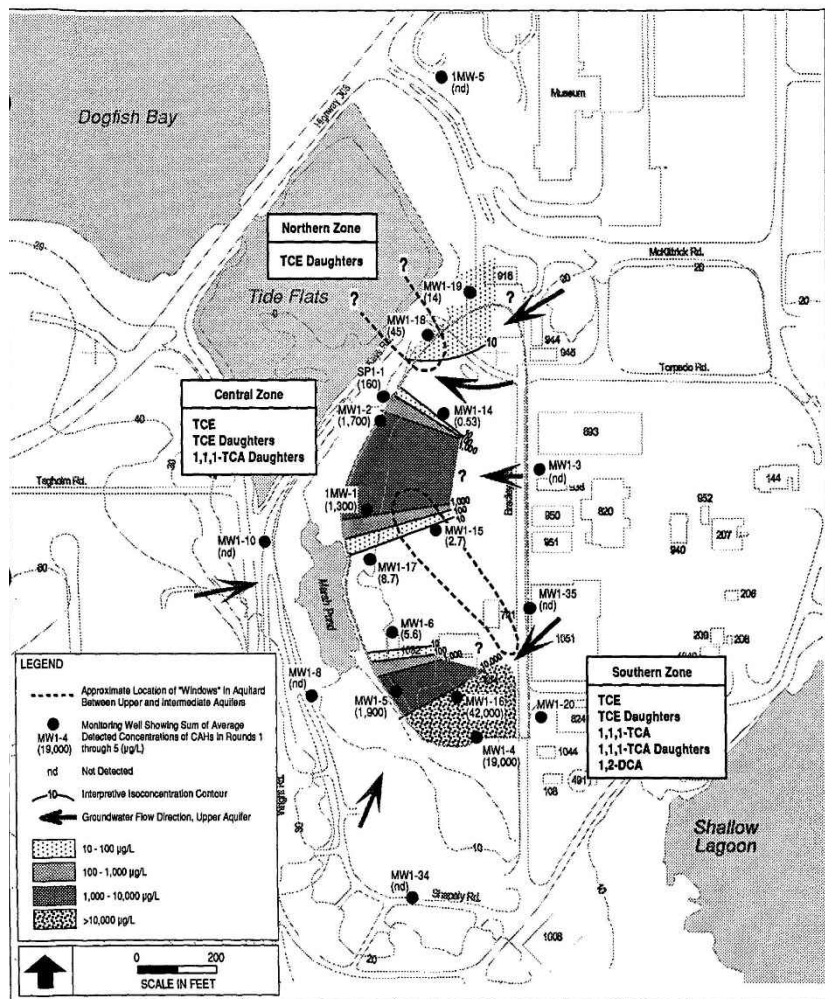
- Selected remedy includes:
 - Phytoremediation by hybrid Poplar trees to treat hot spots, including a “north plantation” and “south plantation”
 - Monitored Natural Attenuation
 - Capping and Institutional Controls
- Remedy in place for over 20 years
- Plume size appeared reduced, but cVOC concentrations remained very high beneath south plantation and in adjacent surface water
- **Driver - concerns regarding the expected restoration timeframe.**



Geology in the ROD



CSM in the ROD

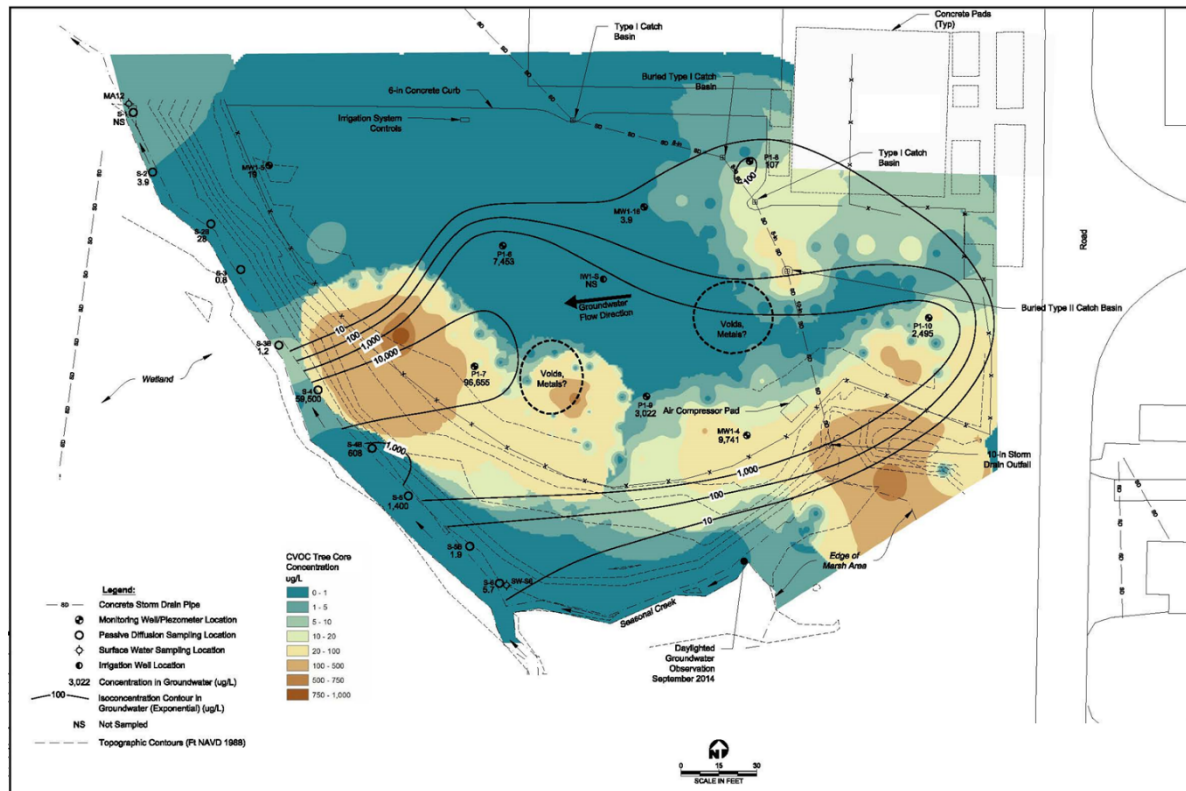


To a Revised CSM - From Many, One

- Rely on multiple (quite a lot) lines of evidence
- Follow the data
- Integrate the data into a holistic understanding

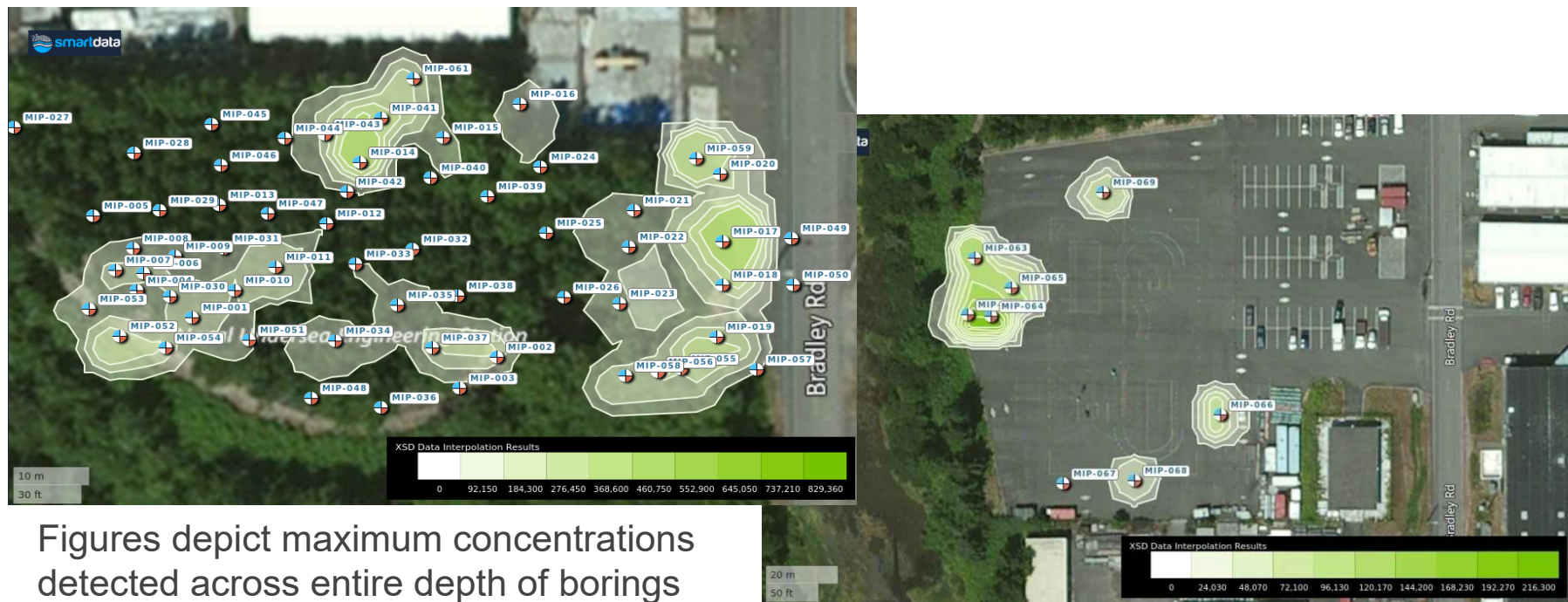
Geophysical Survey / Tree Core Sampling

Collected qualitative tree core data and perform a geophysical survey of the landfill to guide future intrusive investigations.



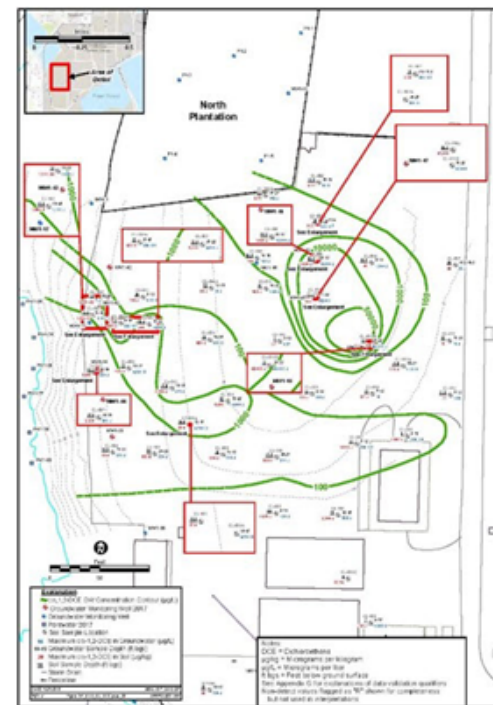
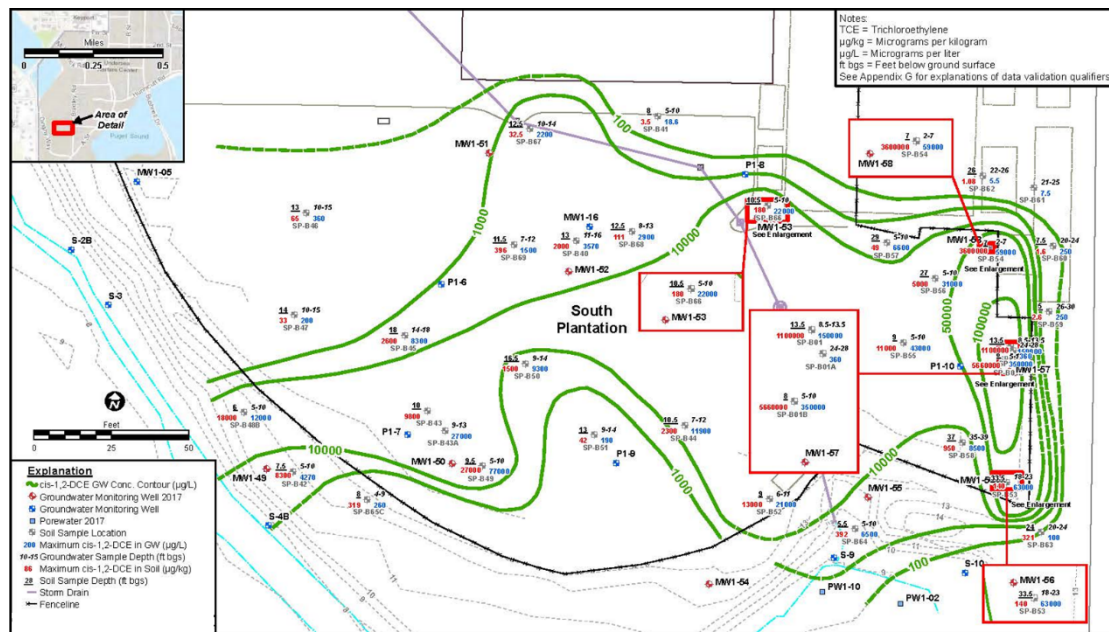
Initial Intrusive Data Collection

Conducted membrane interface probe (MIP) investigation to evaluate site lithology while ground truth the tree core results and confirming the presence of hot spots in the South Plantation and Central landfill area.



Direct Push Soil and Groundwater Sampling

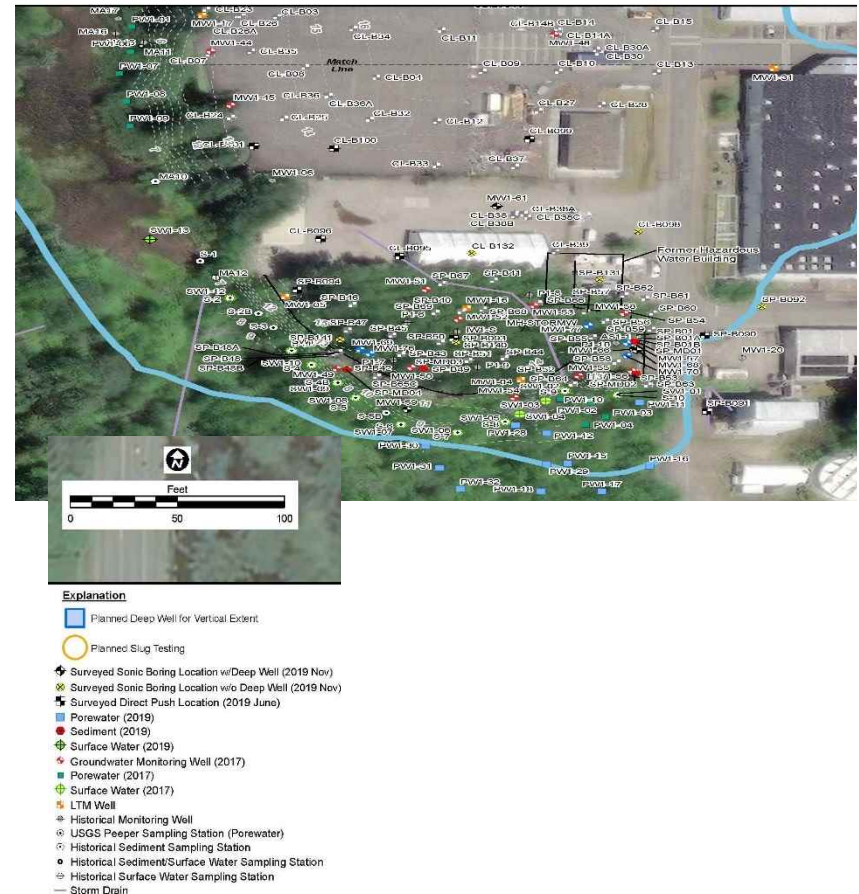
Conducted direct push drilling to collect soil and groundwater samples to ground-truth the MIP data, define the extent of hot spots, guide installation of new wells and evaluate impacts to the adjacent Marsh.



Well Installation and Sampling

- Installed numerous wells across the landfill
- Contamination found throughout footprint
- Pore water samples, show that cVOCs in the adjacent wetland appears to be constrained by the historical shoreline

Southern Landfill



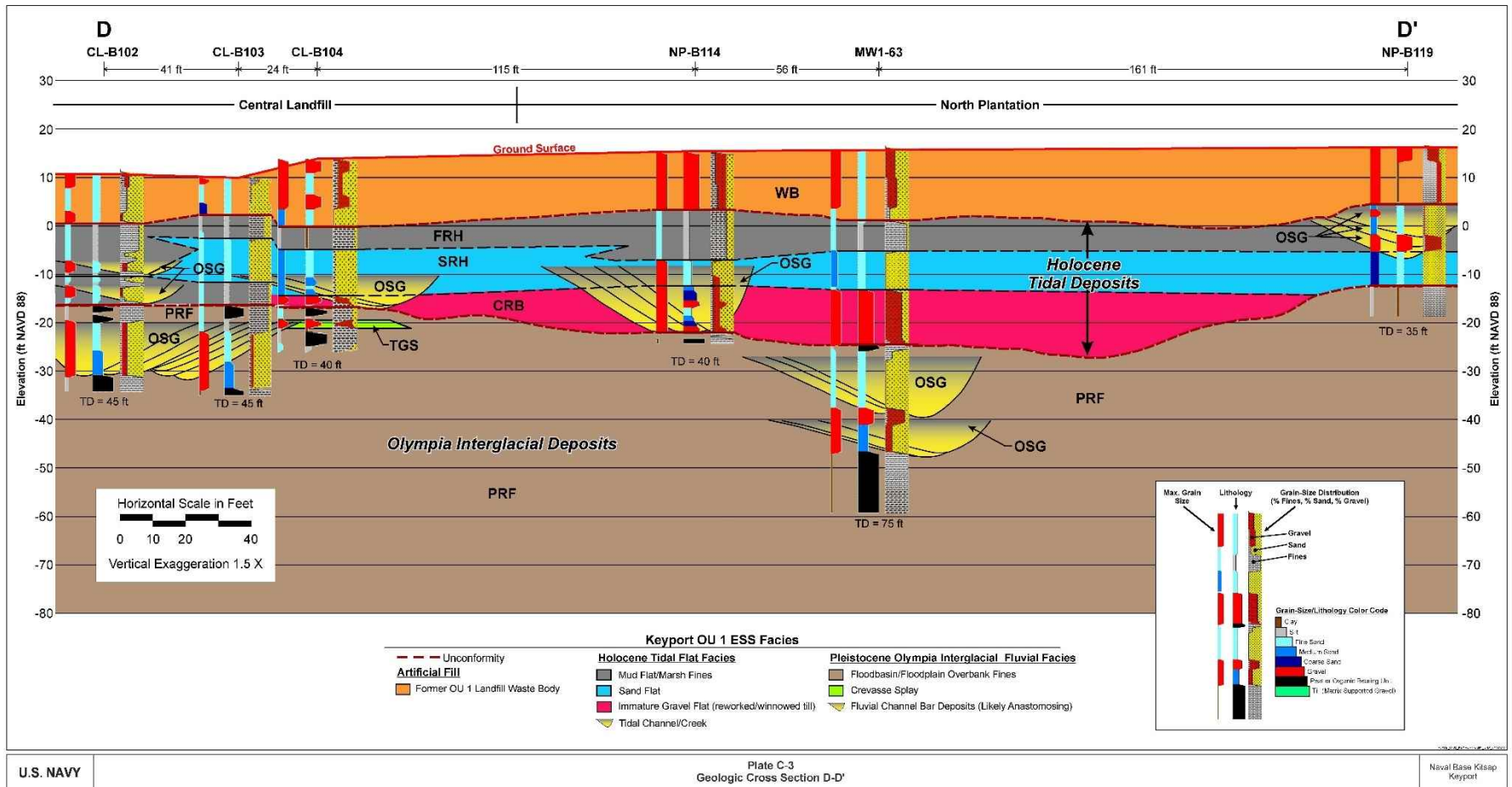
Well Installation and Sampling



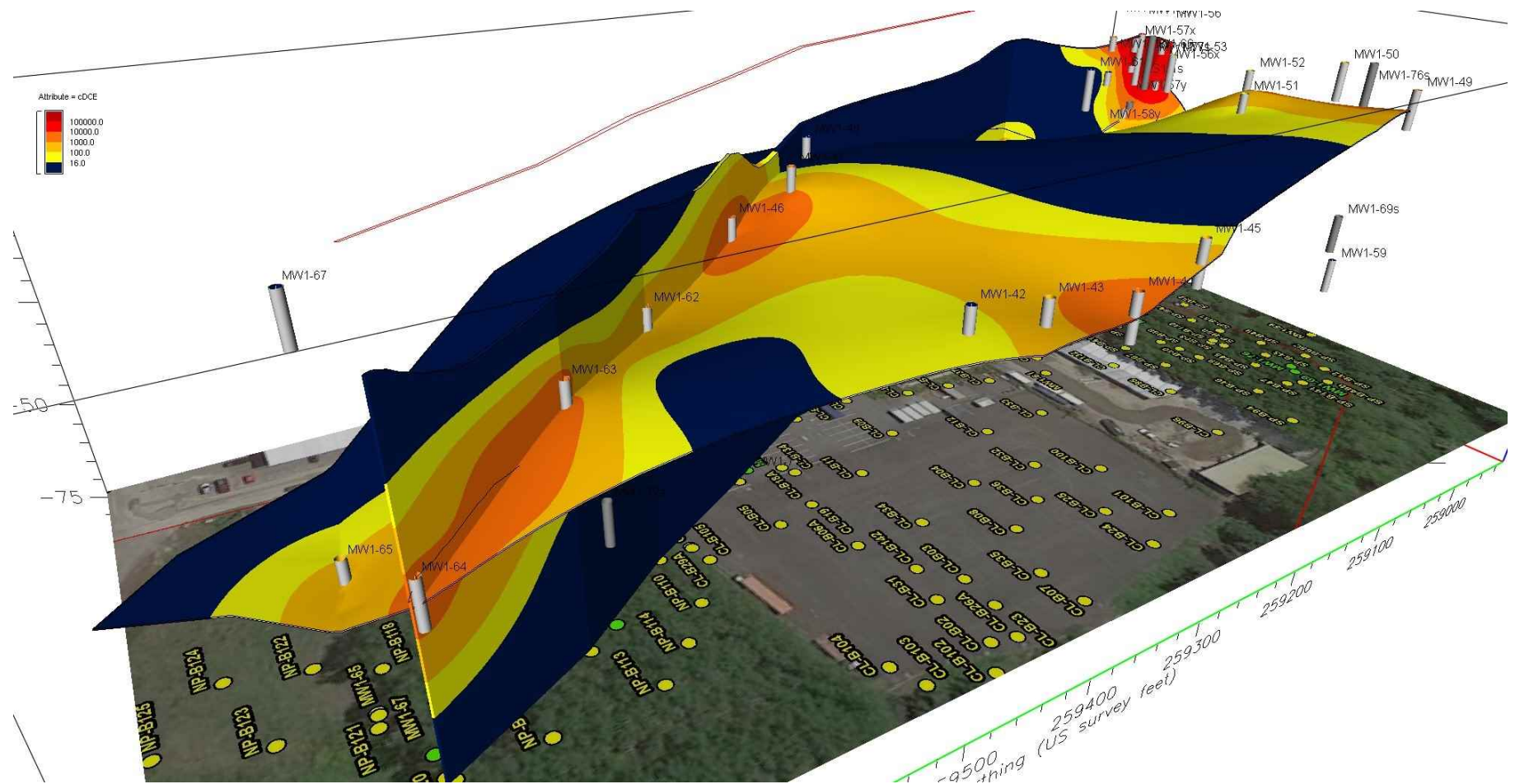
Northern Landfill

- ESS identified paleo-channels that appear to be controlling contaminant migration

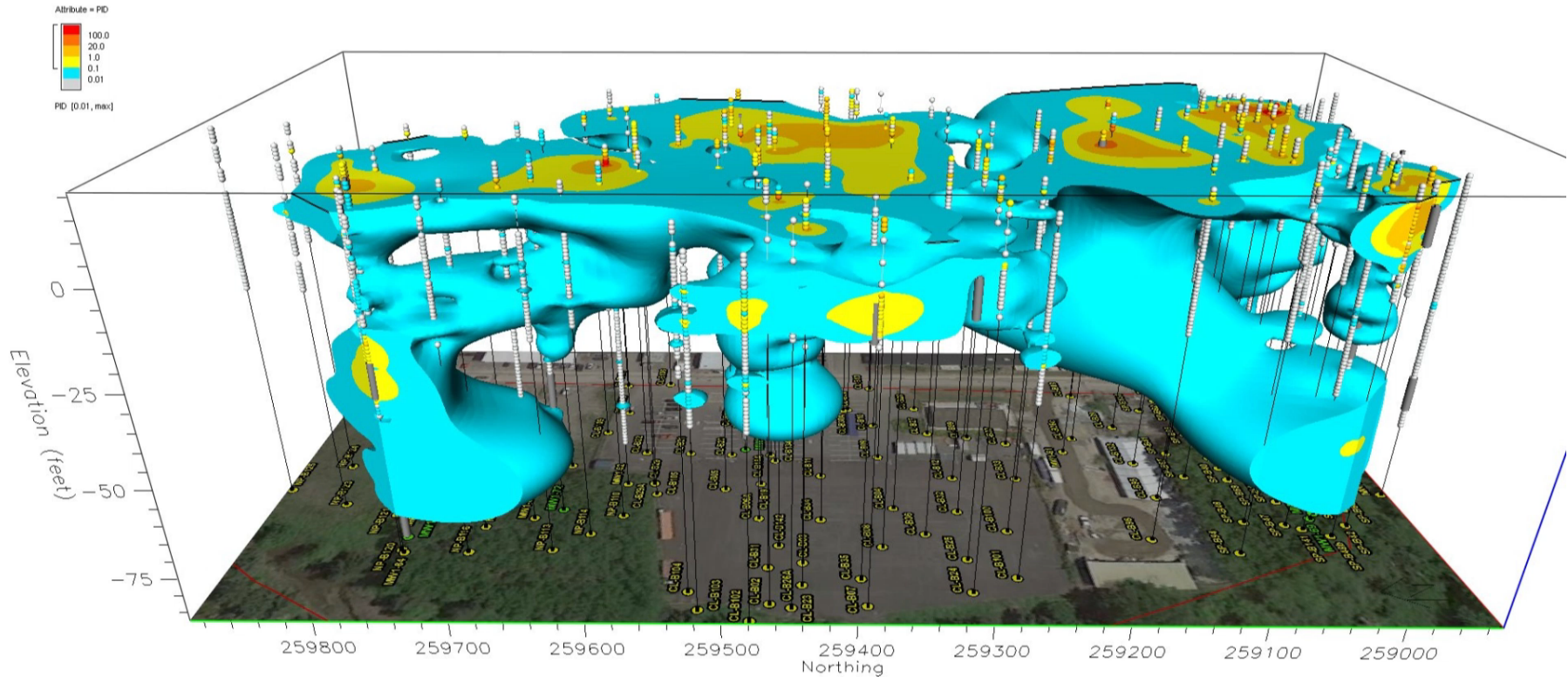
Environmental Sequence Strat.



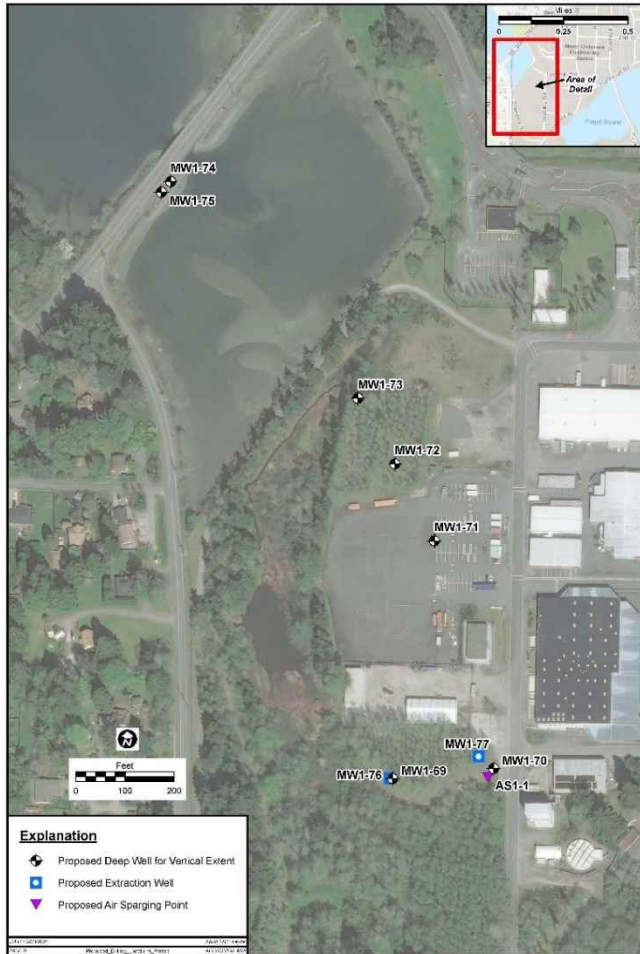
Modeling - EarthVision



COC Distribution – 3D Rotations

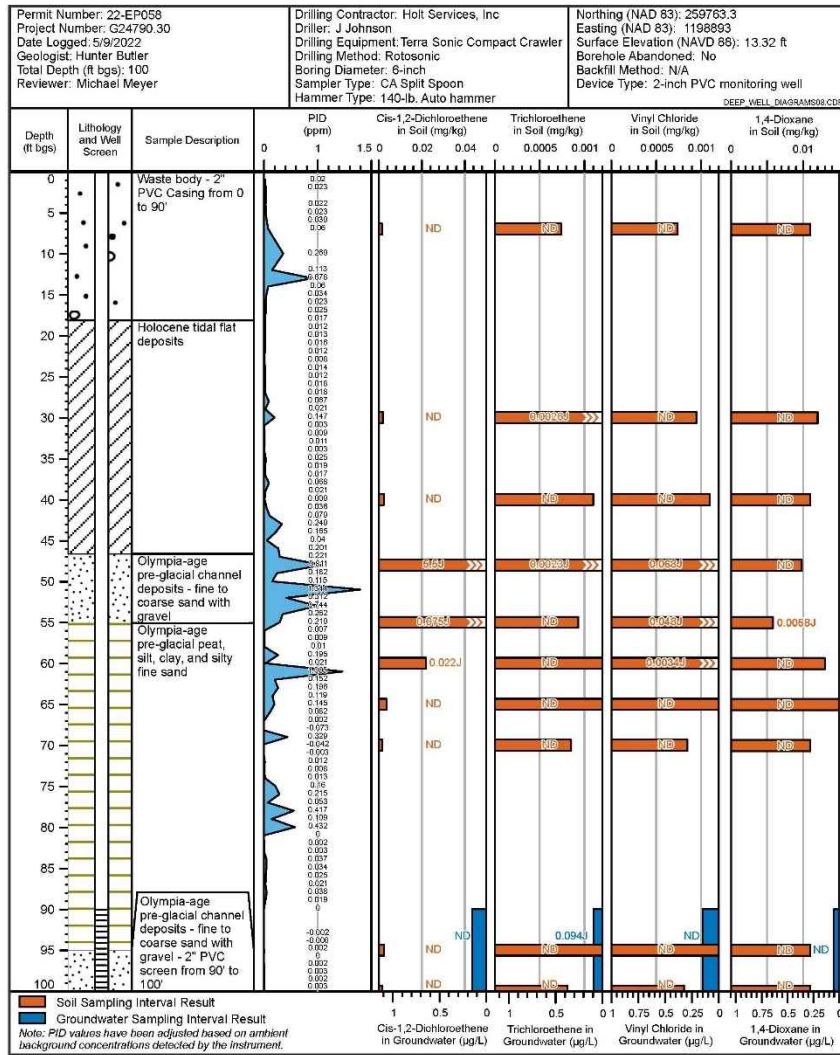


Deep Well Installation/Sampling



- Delimit vertical extent beneath hotspots and other key locations
- Leverage to also characterize upper portion of regional aquitard, age date a peat layer
- Slug tests and measurement of soil physical properties to refine hydraulic transport parameters

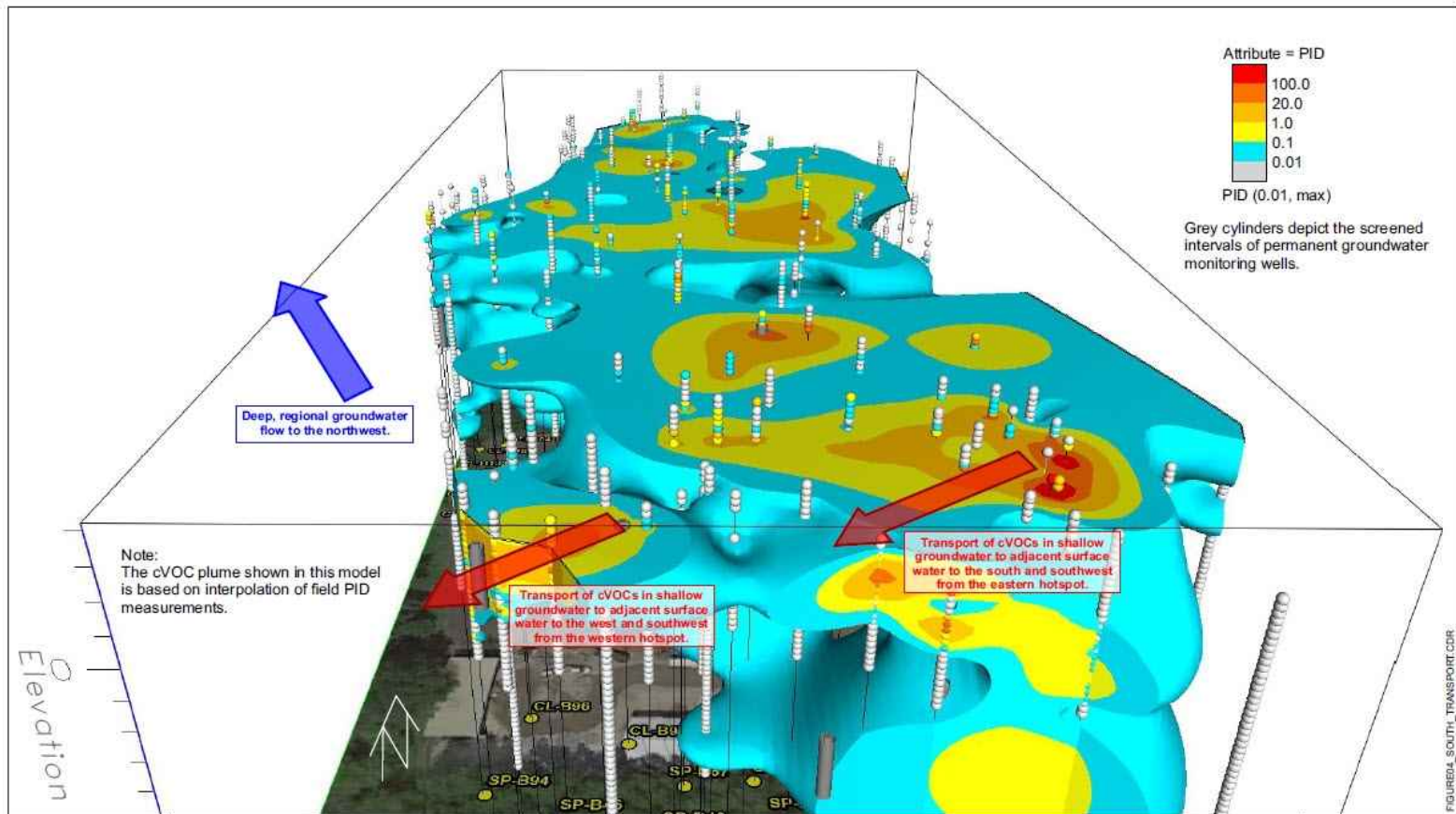
Deep Well Results



- PPB level PID for field decisions
- Grab soil samples
- Groundwater from completed deep well

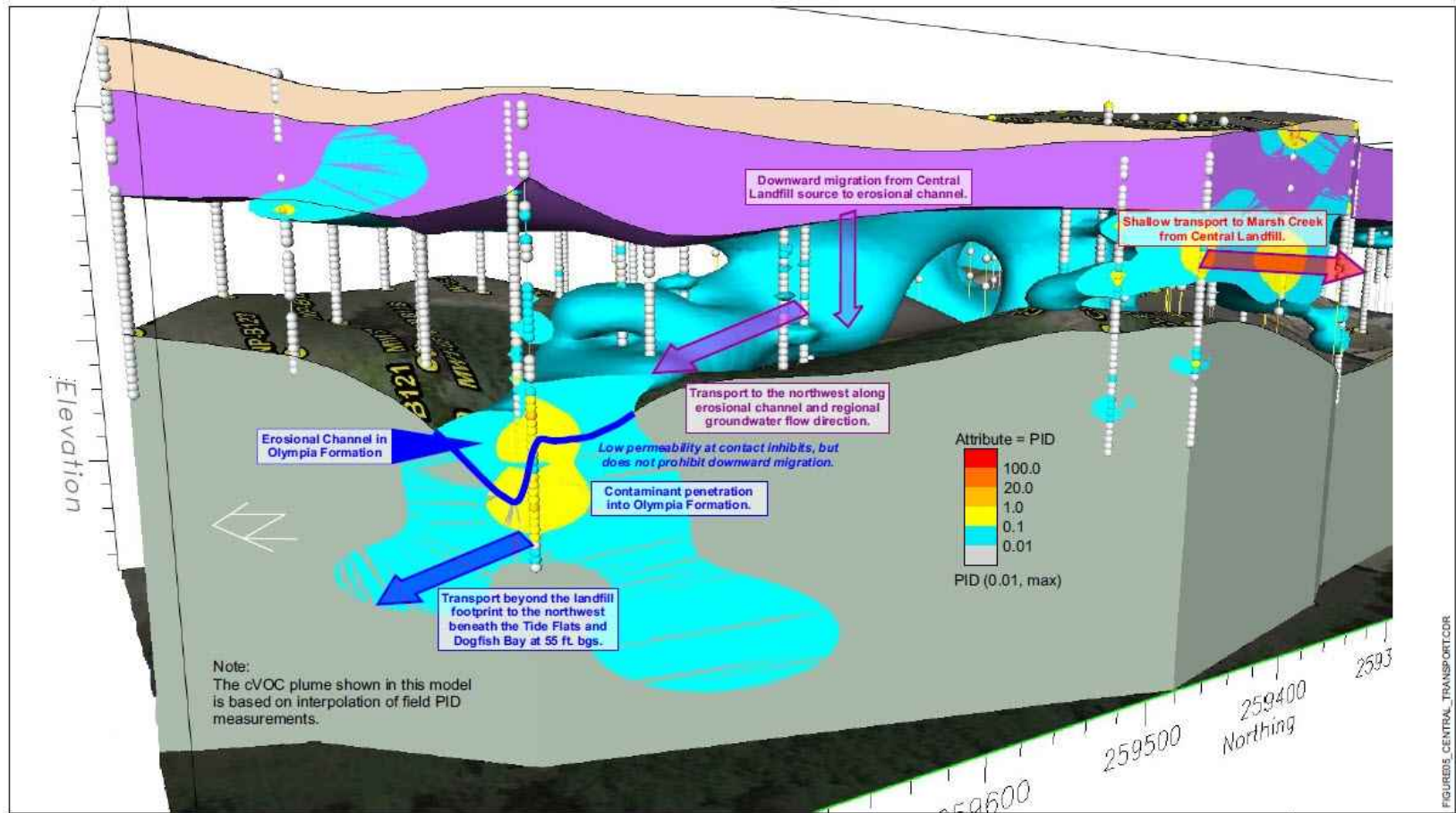
Revised CSM – South Plantation

Based on the work performed to-date, this depicts the current CSM of the South Plantation area

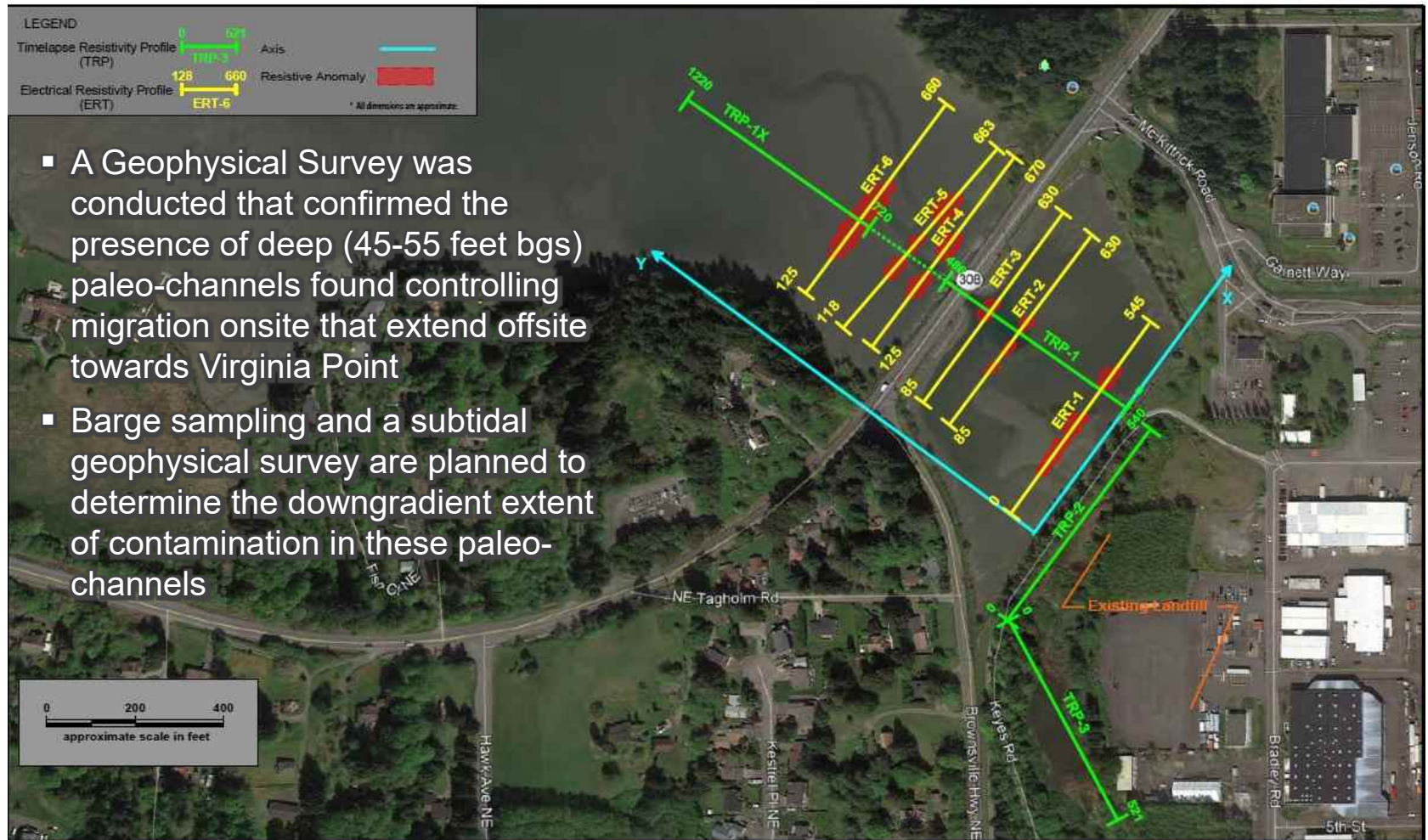


Revised CSM – Central Landfill

Based on the work performed to-date, this depicts the current CSM of the Central Landfill area

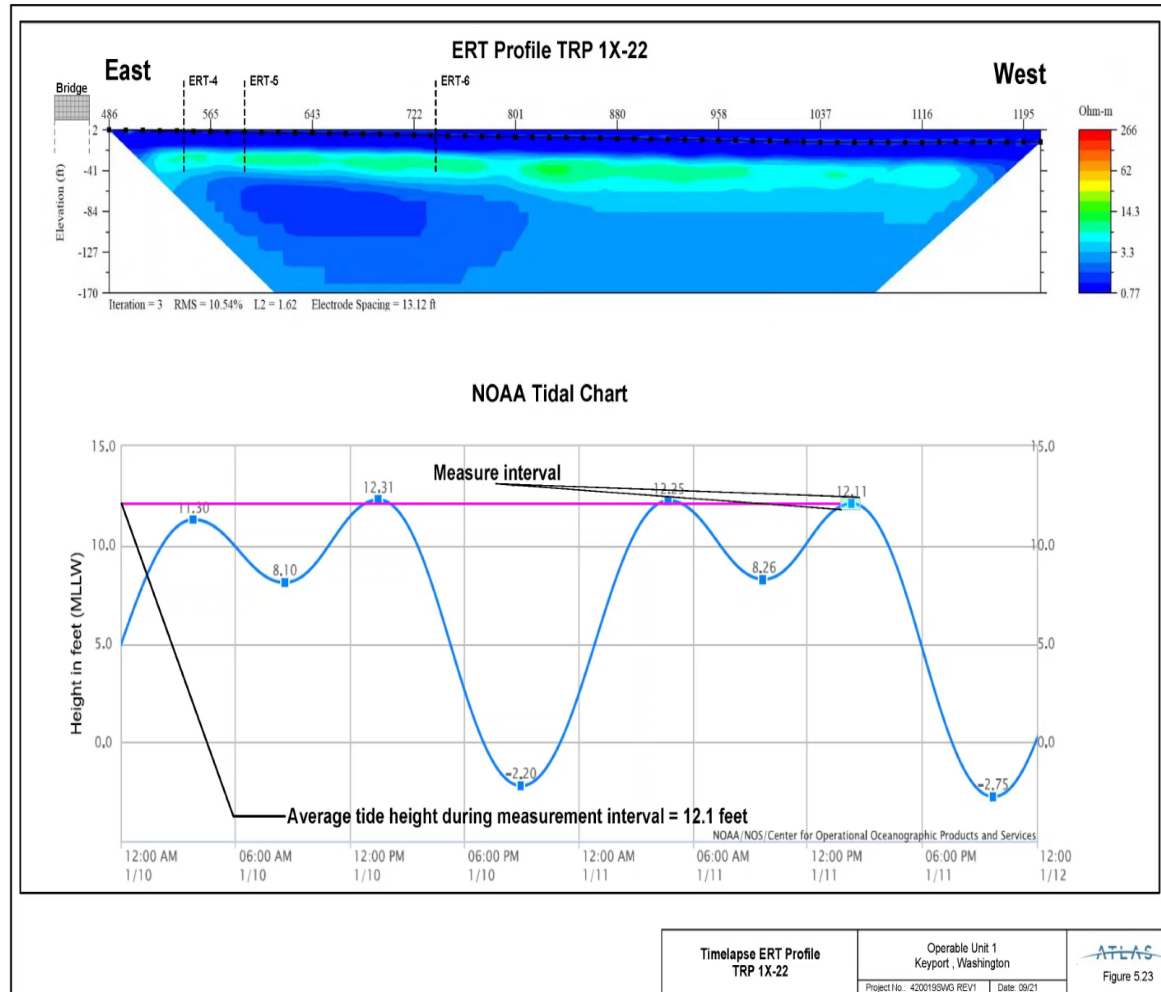


Intertidal Geophysical Survey



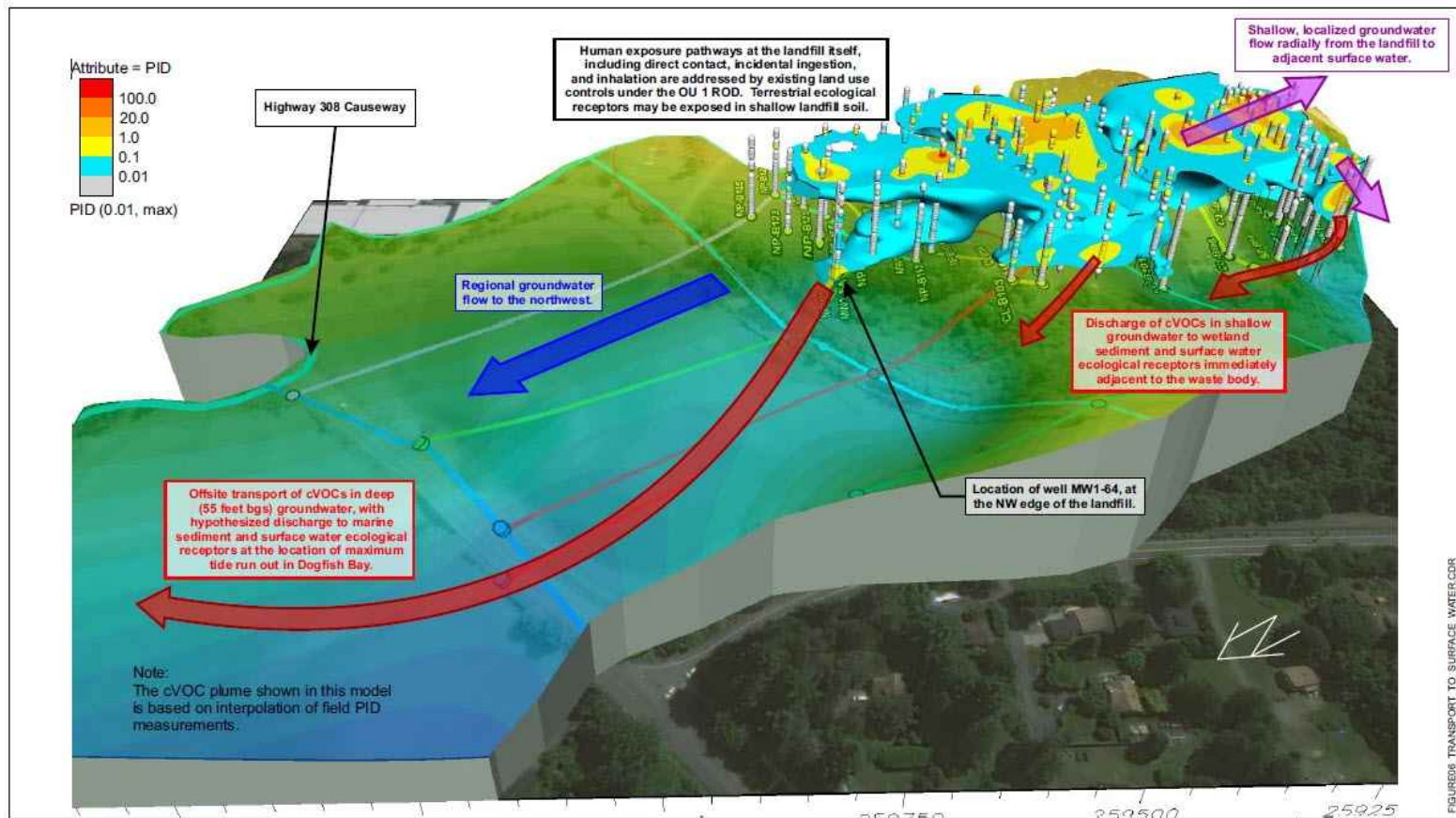
- A Geophysical Survey was conducted that confirmed the presence of deep (45-55 feet bgs) paleo-channels found controlling migration onsite that extend offsite towards Virginia Point
- Barge sampling and a subtidal geophysical survey are planned to determine the downgradient extent of contamination in these paleo-channels

Intertidal Geophysical Survey



Revised CSM – Groundwater to Surface Water

Based on the work performed to-date, this depicts the current understanding of groundwater to surface water migration



Questions?

Contact Information

Steve Verdibello, PG

Project Geologist

Battelle Memorial Institute

verdibello@battelle.org

Michael Meyer, PMP, RG, LHG,
LEG

Project Manager

Battelle Memorial Institute

meyerm@battelle.org

Amanda Rohrbaugh

Restoration Project Manager

Naval Facilities Engineering Systems
Command

amanda.l.rohrbaugh.civ@us.navy.mil



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800.201.2011 | solutions@battelle.org | www.battelle.org