



# Integration of High Resolution Site Characterization Direct Sensing Tools

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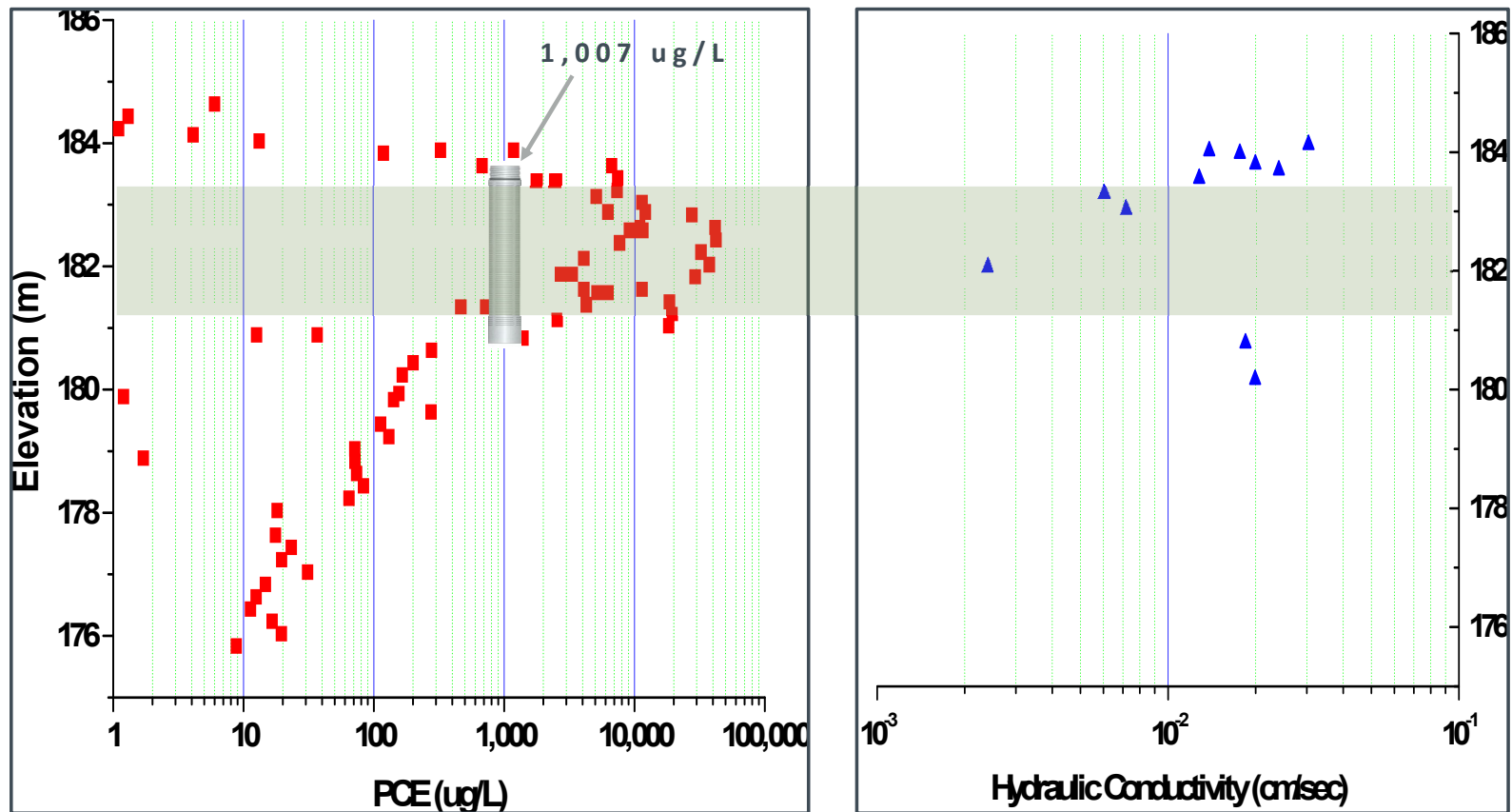


# Agenda

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- Background
- Applications
- Equipment
- Safety Considerations
- Q&A

# Depth-Integrated, Flow Weighted Averaging



Pitkin, 1996.



# The Problem

**"Most people spend more time and energy going around problems than in trying to solve them." -**

Henry Ford (1863 - 1947),

- Remedial Investigations often continue for years or even decades
- Many remedies underperform or fail due to a lack of understanding of site conditions and processes (heterogeneity)
- The cost of failed/ underperforming remedies is large
- The costs of excessive long term monitoring programs related to investigating sites with monitoring wells is large
- The costs of High Resolution Site Characterization, which allows for the development of more accurate CSMs, is small in comparison, but requires an up front investment to result in lower life cycle costs.

# HRSC Approach

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**Subsurface investigation appropriate to the scale of heterogeneities in the subsurface which control contaminant distribution, transport, and fate, at the required degree of detail.**

**HRSC is not solely the use of Direct sensing tools. It is the use of multiple tools in series to maximize efficiency and data value, this includes:**

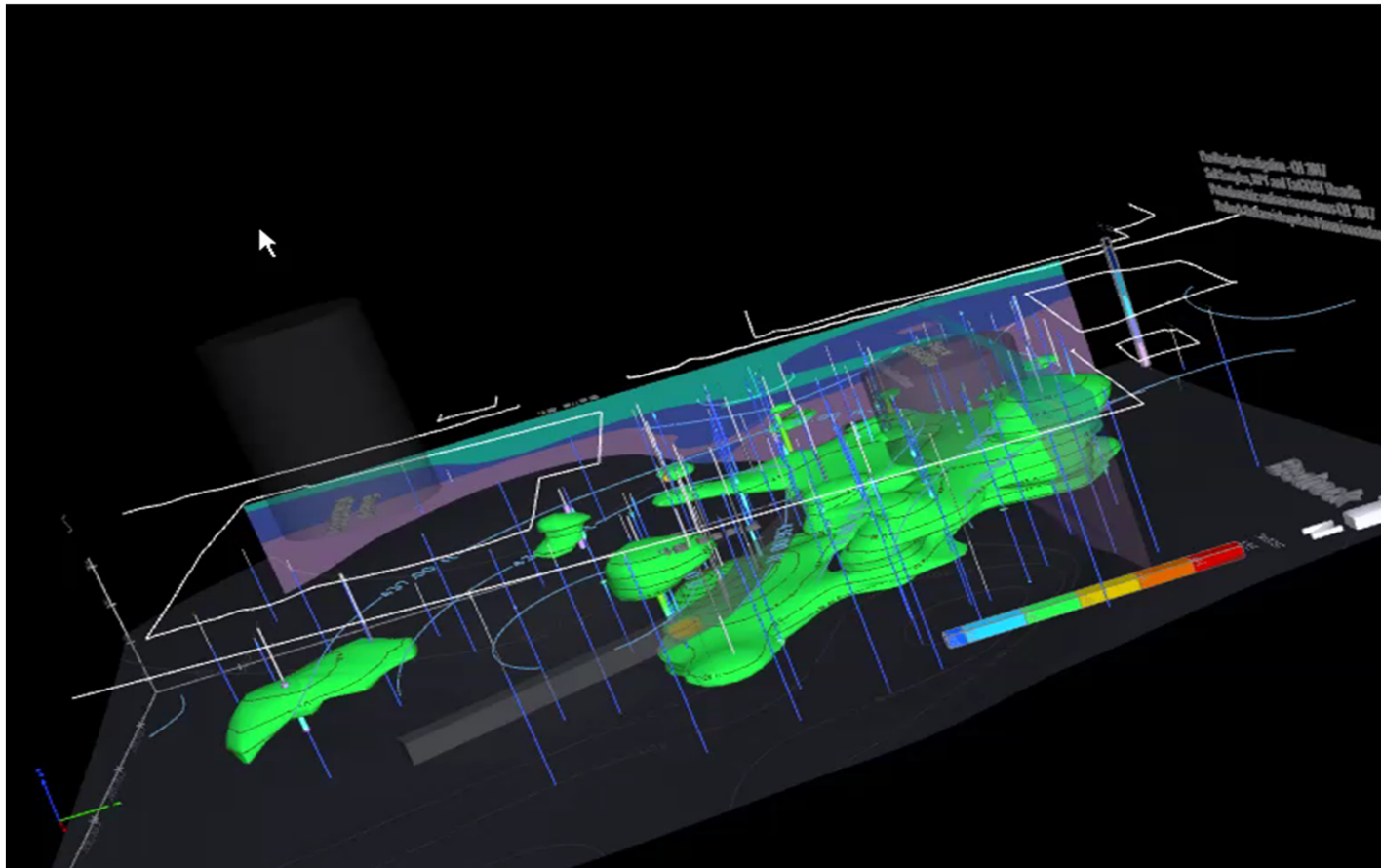
- Start at locations of known contamination and work outward (laterally),
- Implementing simple grid and transect approaches,
- Use rapid screening tools (e.g., MIHPT, OIP) in transects to ID plume cores and source zones as well as hydrostratigraphy.
- Use definitive techniques (e.g., soil core sampling, Waterloo<sup>APS</sup>, etc.) to define chemistry, concentrations, mass, and refine hydrostratigraphy.

# Commonly Used Tools

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- MIP, MiHPT, Low Level MIP (Screening)
- Waterloo<sup>APS</sup> /HPT-GW (Definitive)
- OIP-UV/LIF/UVOST (LNAPL Detection) with hydrostratigraphic logging
- OIP-G/TarGOST (Coal Tar/ Creosote NAPL Detection) with hydrostratigraphic logging
- Other Combined Tools
  - Waterloo<sup>APS</sup>/UVOST
  - Waterloo<sup>APS</sup>/EC

# Applications



- When and why is it necessary?
- Contaminants (VOC, SVOC, Metals, etc.)
- Phase (NAPL vs Dissolved Phase)
- Site Conditions (Depth, geology)

# MiHPT – Combined MIP and HPT

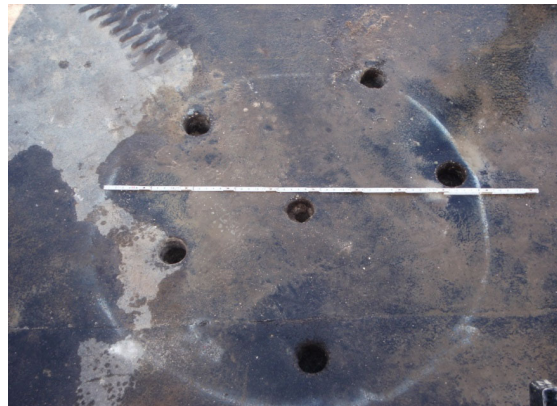


Provides three data streams;

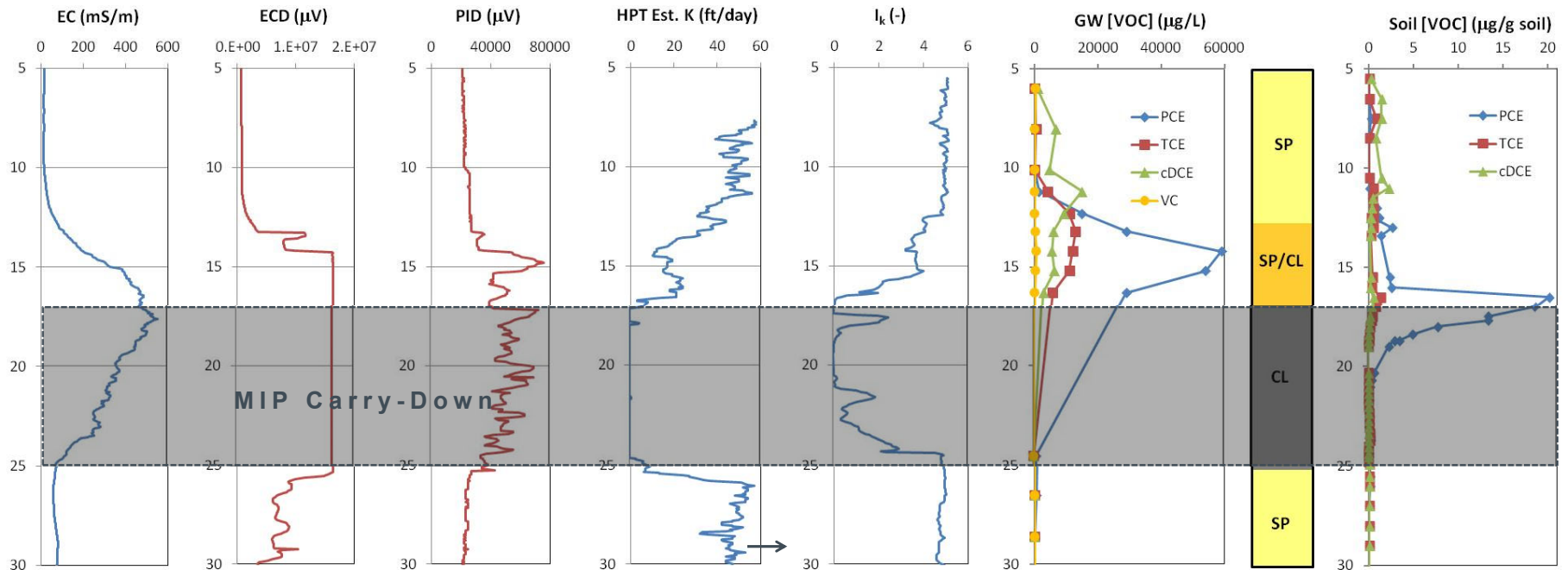
- Millivolt response indicating contaminant presence
- Electrical Conductivity response to soil type
- Hydraulic profile of index conductivity values



# Layout of Points at NAS JAX



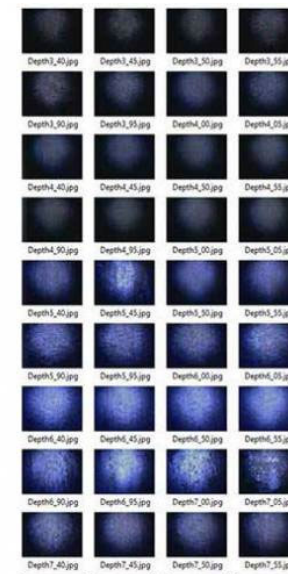
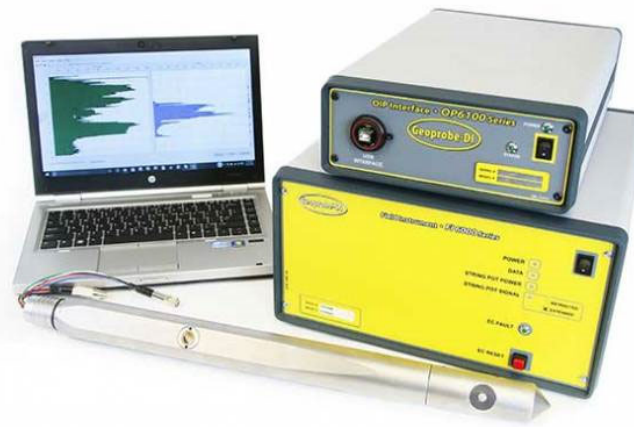
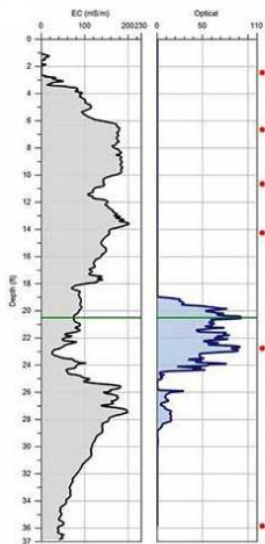
# NAS Jacksonville Composite Dataset (OU3-3, Near Source)



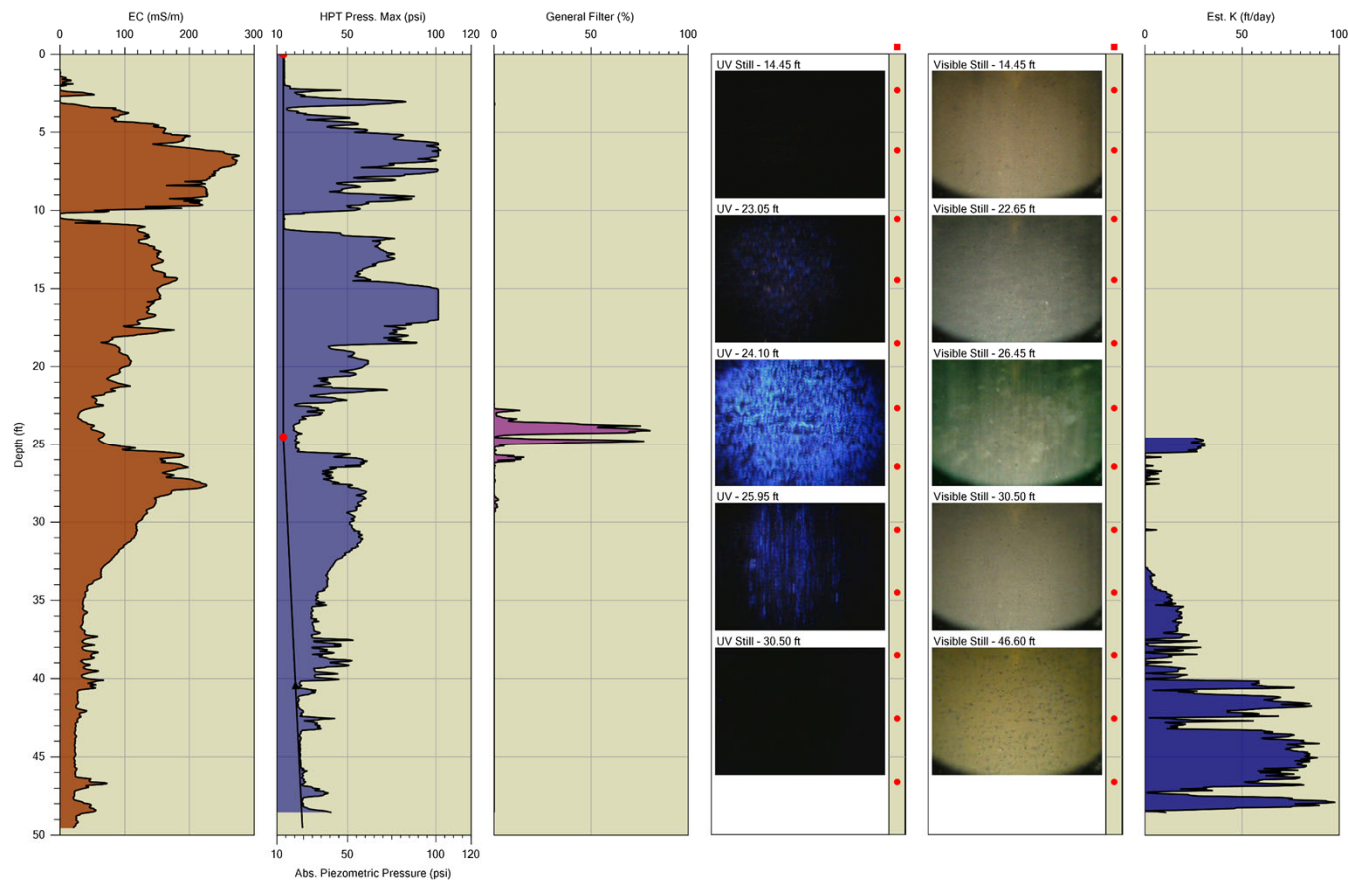
MIP → Geoprobe<sup>®</sup> HPT → Waterloo<sup>APS™</sup> → Soil Cores →

# Optical Image Profiler (OIP)

- OIP produces a detailed log of UV induced fuel fluorescence.
- The acquisition software analyzes each image for typical fuel fluorescence color.
- The results are the percent of the image area (up to 100%) that displays fuel fluorescence.
- Can be combined with Hydraulic Profiling Tool (HPT).



# OIHPT Log



The combination of optical response and hydrostatigraphy

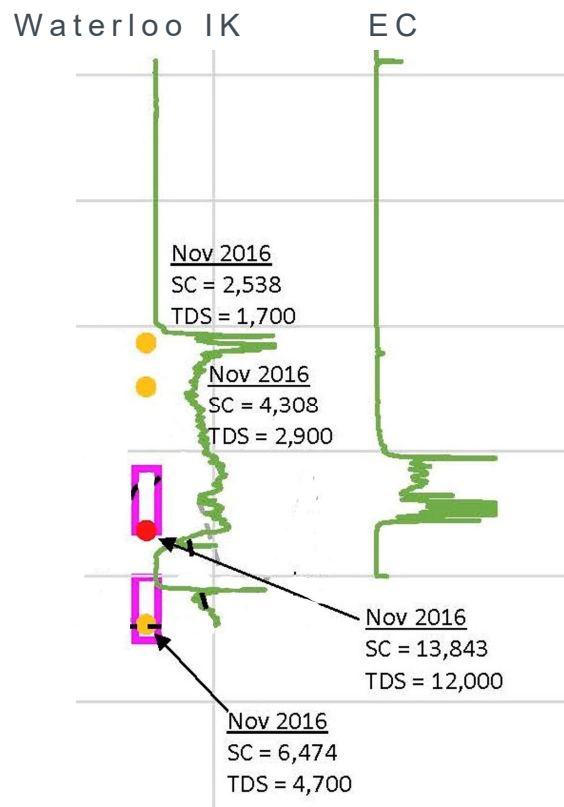
# WaterlooAPS/EC

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- Continuous Log of Index of hydraulic conductivity (Ik) and electrical conductivity (EC);
- Capable of Discrete groundwater sampling (peristaltic mode only);
- Uses; Currently significant market for dissolved metals or salt intrusion sites,



# WaterlooAPS/EC

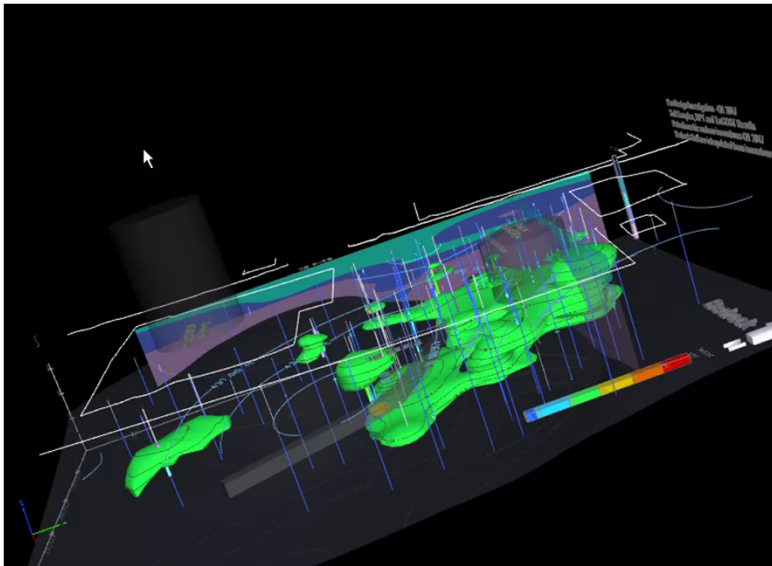


Multiple lines of data used to identify leachate plume

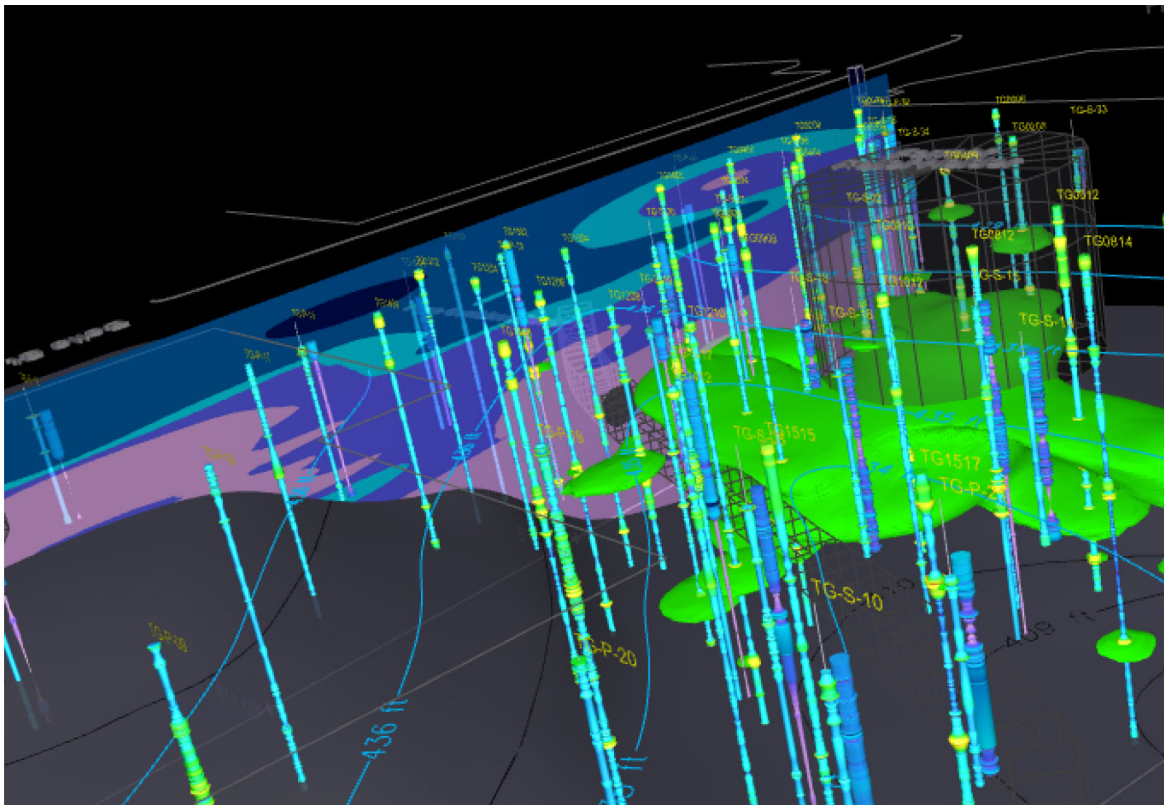
- WaterlooAPS Hydrostratigraphy
- Electrical Conductivity contaminate surrogate

# WaterlooAPS/UVOST

- Combination of Hydro Stratigraphy and NAPL Distribution
- Rapid deployment and Data Collection
- Valuable Remediation Data Collection



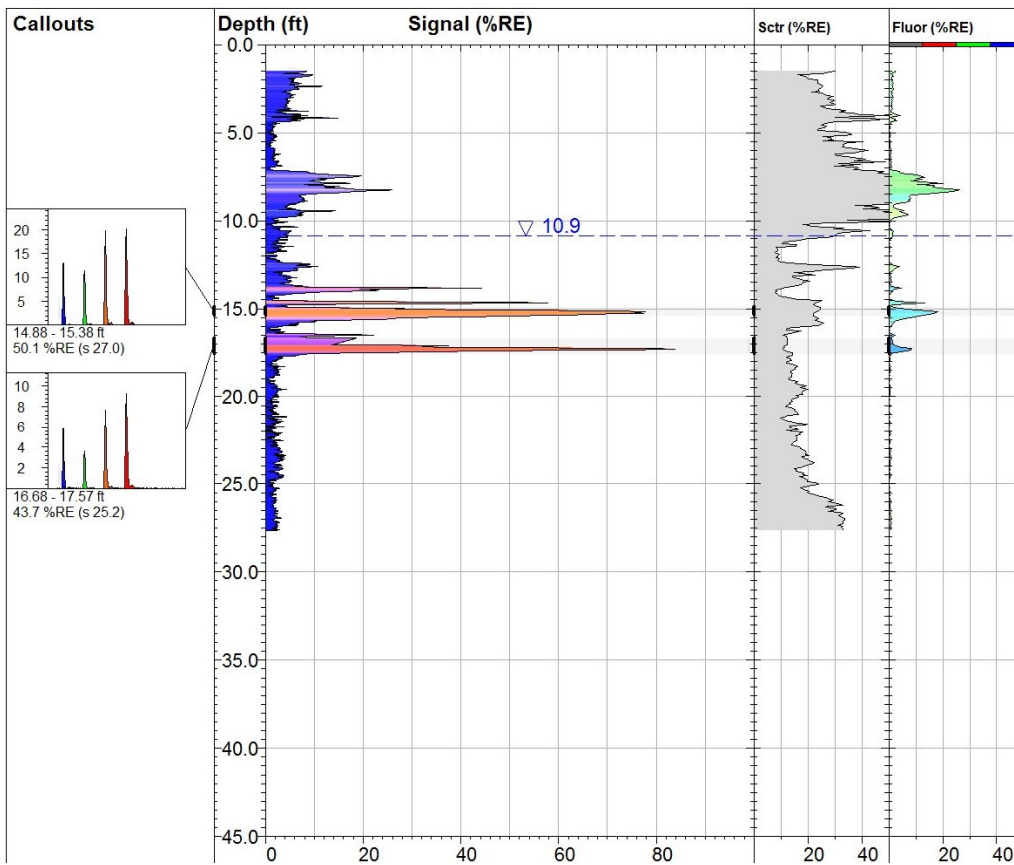
# WaterlooAPS/UVOST



- WaterlooAPS hydrostratigraphy and groundwater sampling
- UVOST contaminant surrogate

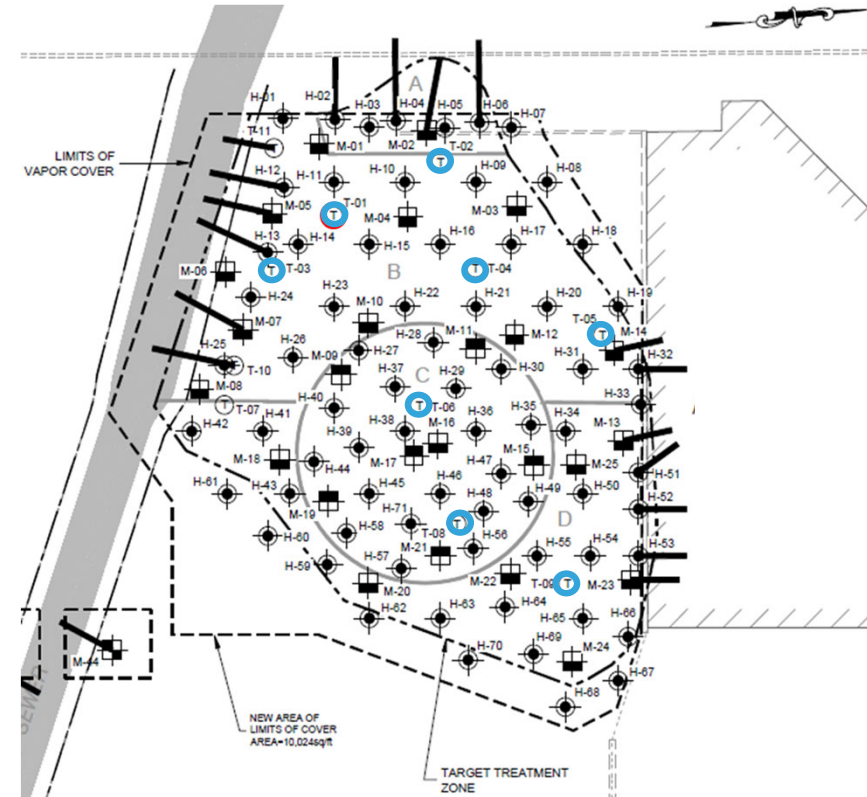
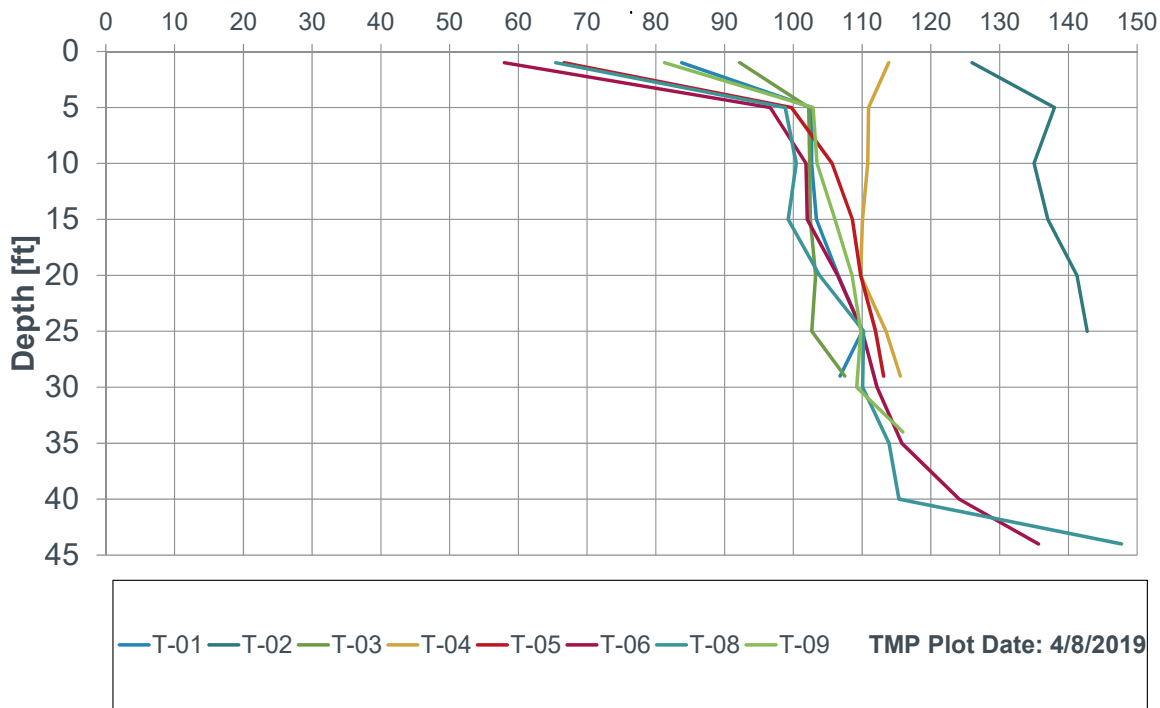


# NAPL RESPONSE CONFIRMATION



# Application

## TMP Vertical Temperature Profiles Temperature [°C]



# Tool Development

Based on experience we designed and constructed a beta testing tool.

- Heat treating
- Trunkline Development
- Redesign



# Considerations

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- Tool selection prior to mobilization
- Use of multiple tools and understanding of how they support each other
- Collection of potential remediation parameters while completing SI activities
- Flexibility and communication

# Questions

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# Engage with Cascade Environmental

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