

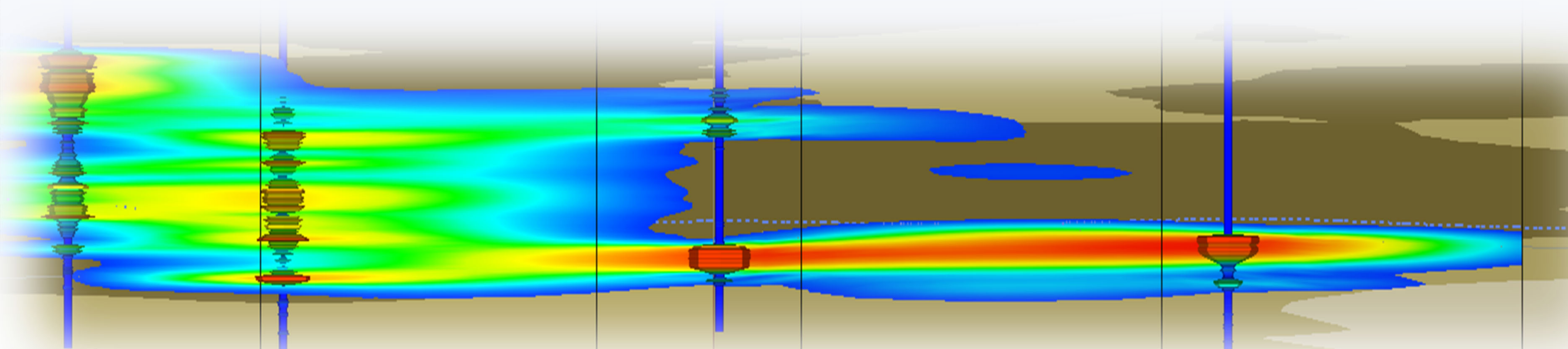
Site Characterization & Real-Time Data Collection: A Hands-On Workshop

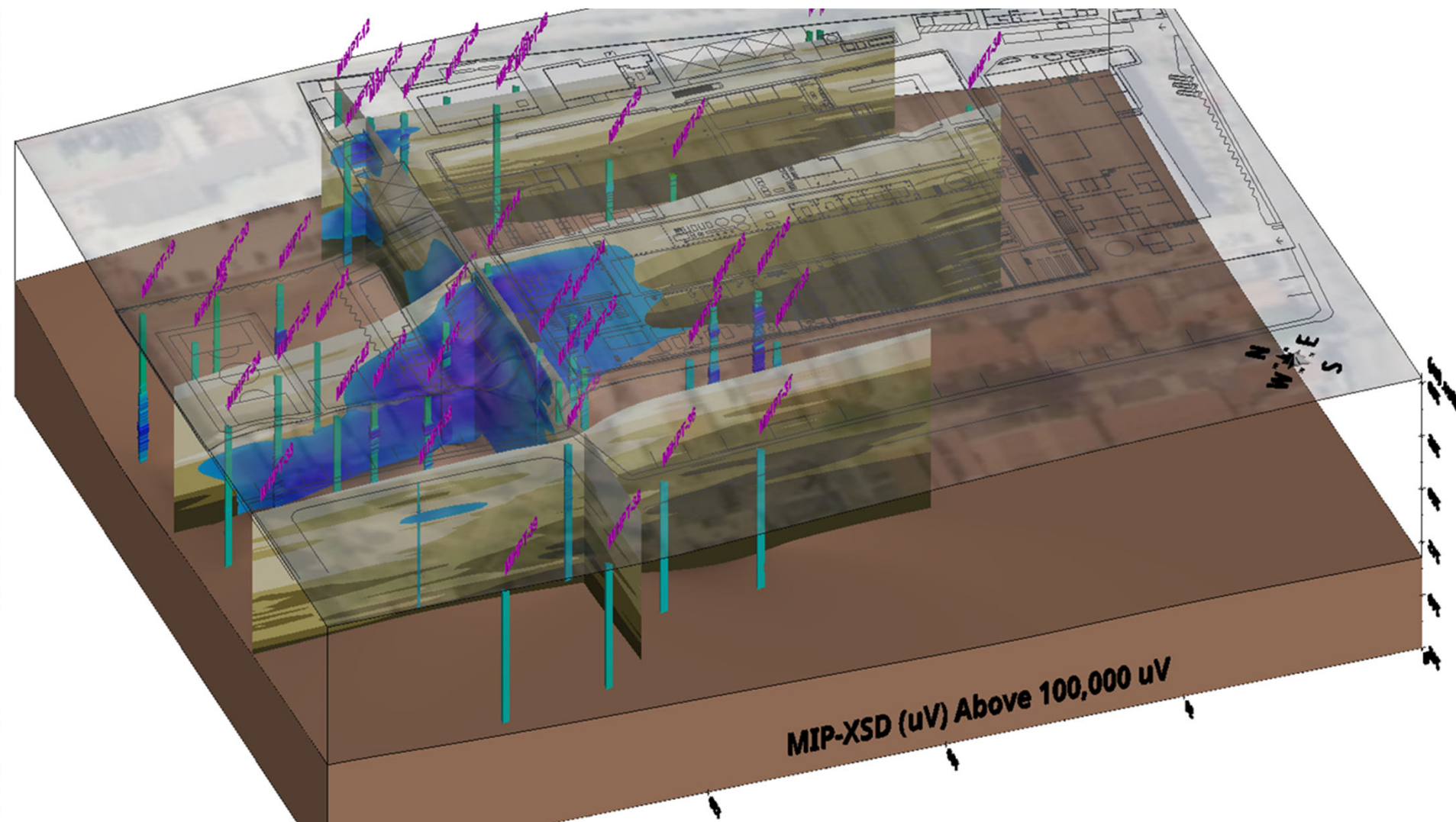
High Resolution Site Characterization (HRSC)
Direct-Sensing Tools, 3-Dimensional Data
Visualization and Confirmation Sampling Tools





Why HRSC?





High Resolution Site Characterization (HRSC)

HRSC uses direct-sensing technologies aimed at maximizing data density at the lowest cost per data point, to generate a high-resolution three-dimensional volumetric image of contaminant impacts in relationship to lithology, backed up with targeted discrete confirmation sampling.

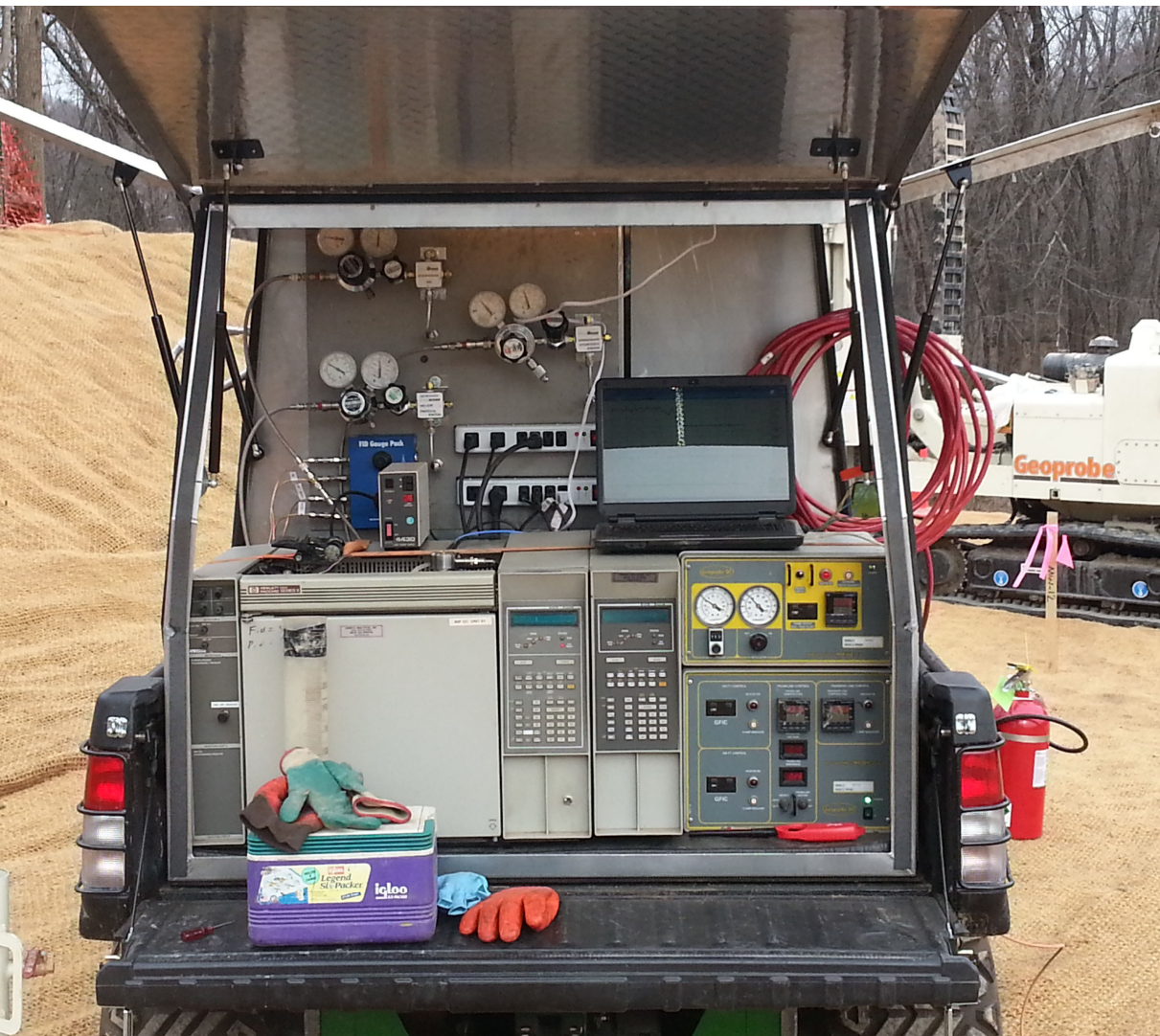
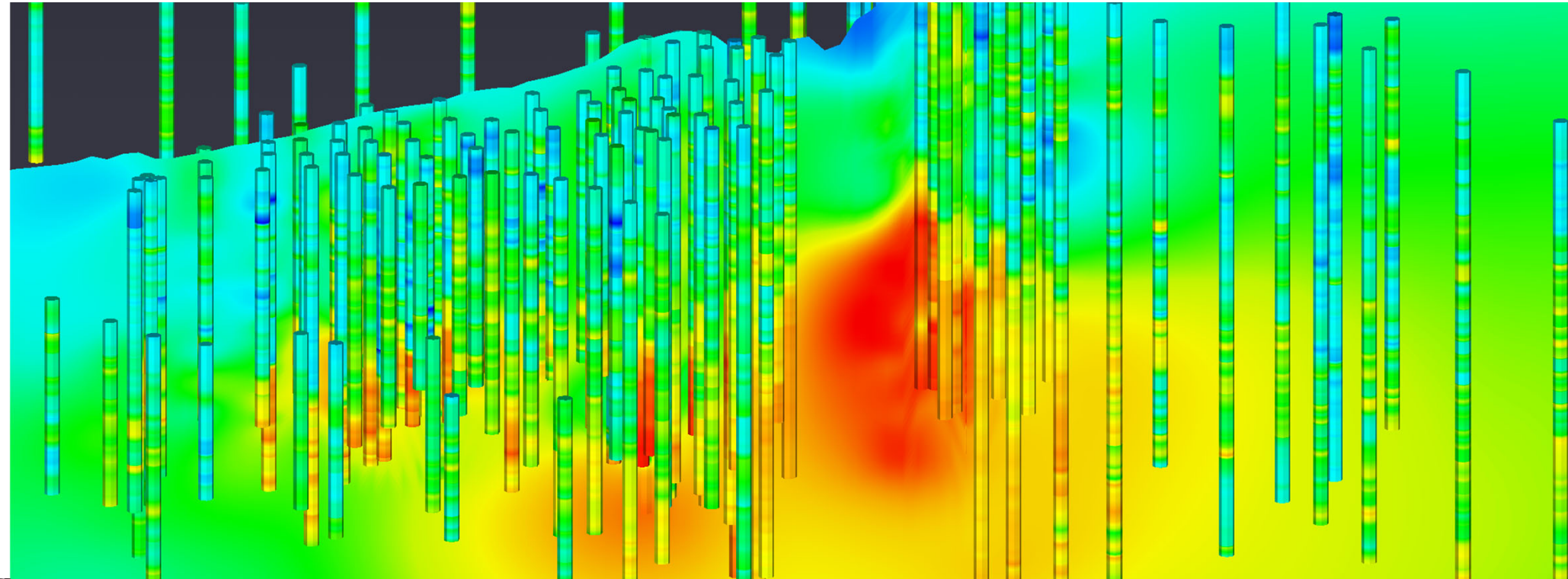
HRSC helps clients solve complex environmental problems

Key Takeaways!

- **HRSC can be used on any site:**
 - Dry Cleaner/Gas Station to Superfund Sites
- **Wells Can be Misleading!**
 - Wells are best for monitoring not delineation
- **Collecting representative confirmation soil samples can be challenging**
- **Failed Remediation??**
 - Often a result of under characterized heterogeneity
- **Direct-Sensing only slightly more expensive day rate - upside savings on life cycle costs!**



Direct-Sensing Tools



Lithology Mapping Sensors

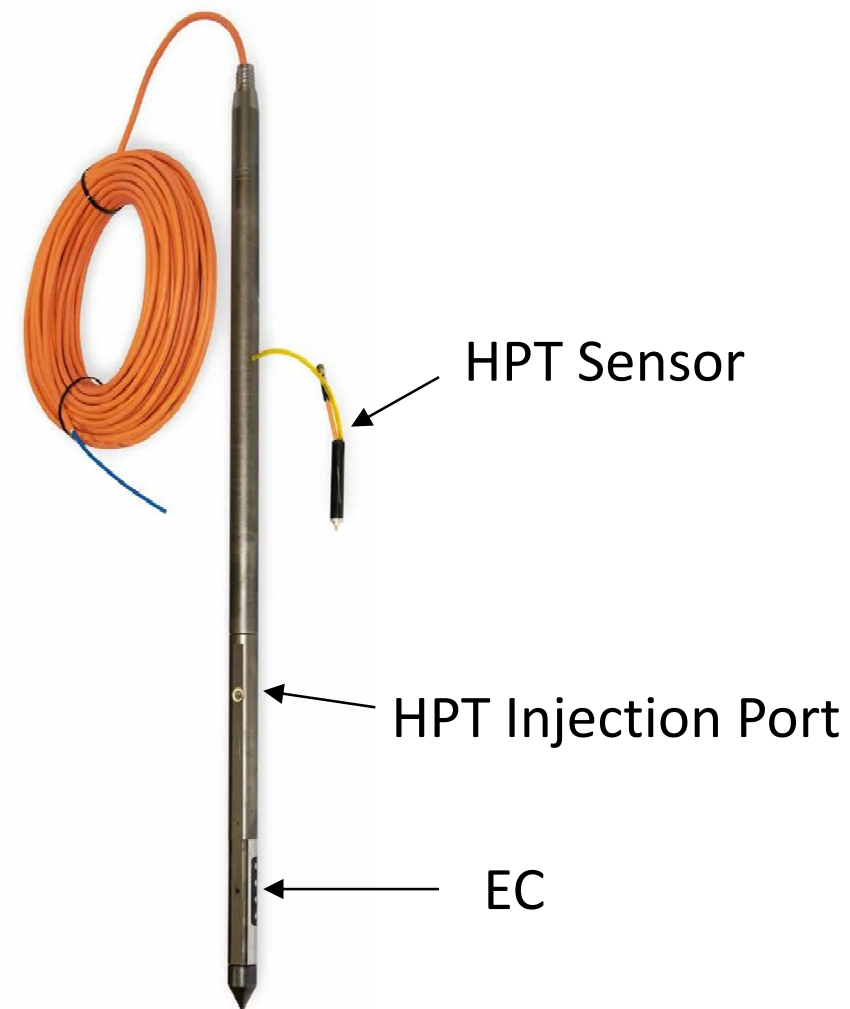
- Electrical Conductivity (EC)
- Hydraulic Profiling Tool (HPT)

Contaminant Mapping Sensors

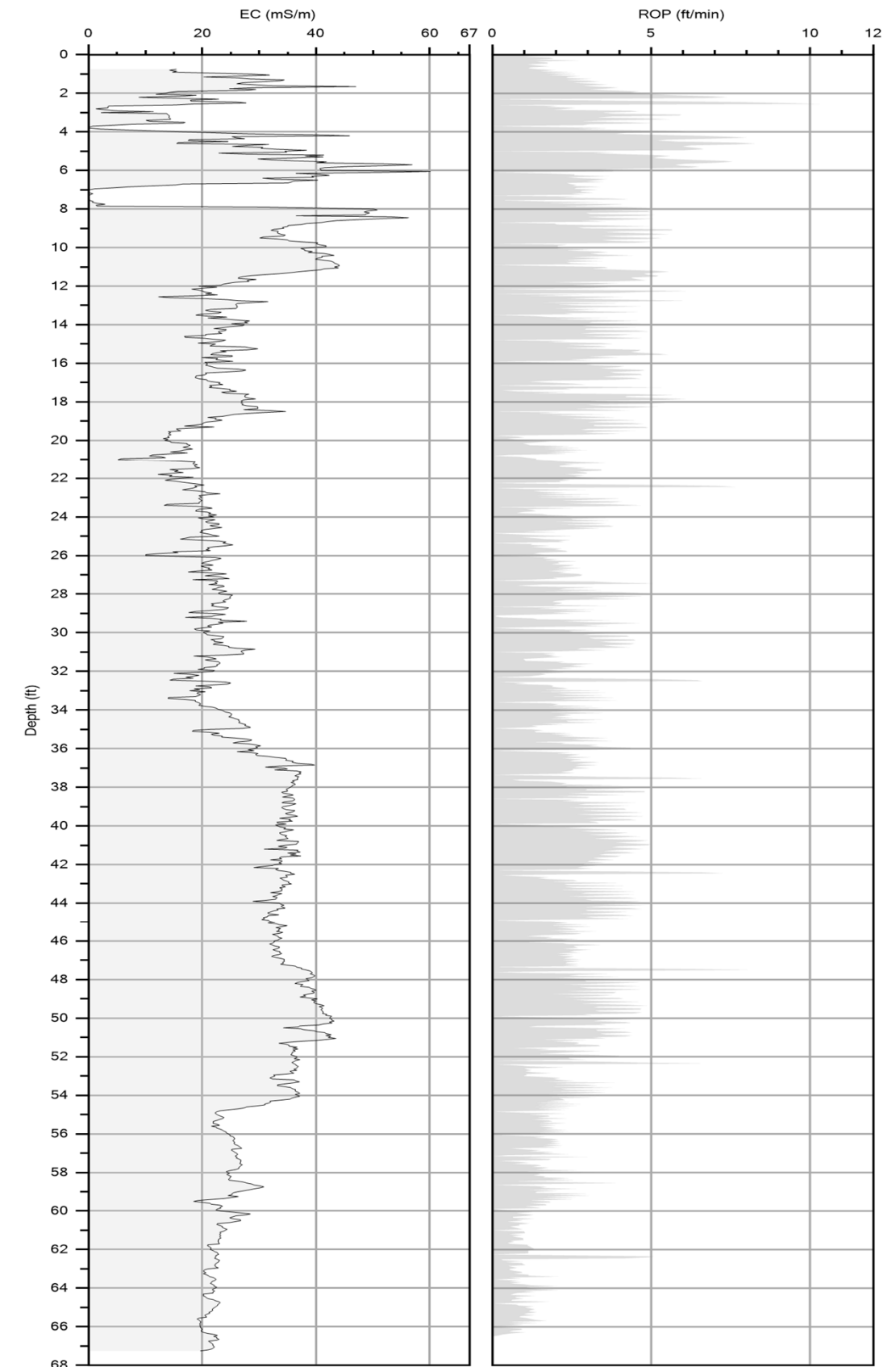
- Optical Image Profiler (OIP)
 - OiHPT-UV
 - OiHPT-G
 - OiHPT-UVR
- Membrane Interface Probe (MIP)
 - MiHPT
 - Heated Trunkline (HTL) MIP
 - Low Level MIP (LL MIP)

Electrical Conductivity and Hydraulic Profiling Tool (HPT)

- EC logs are used to define lithology based on bulk grain size measurements.
- The EC probe works by sending a current through the formation between two probe contacts. This current is measured along with the voltage and the conductivity is a ratio of current to voltage times a constant.
- EC can be affected by soil mineral content and pore water chemistry (brines, pH etc.)

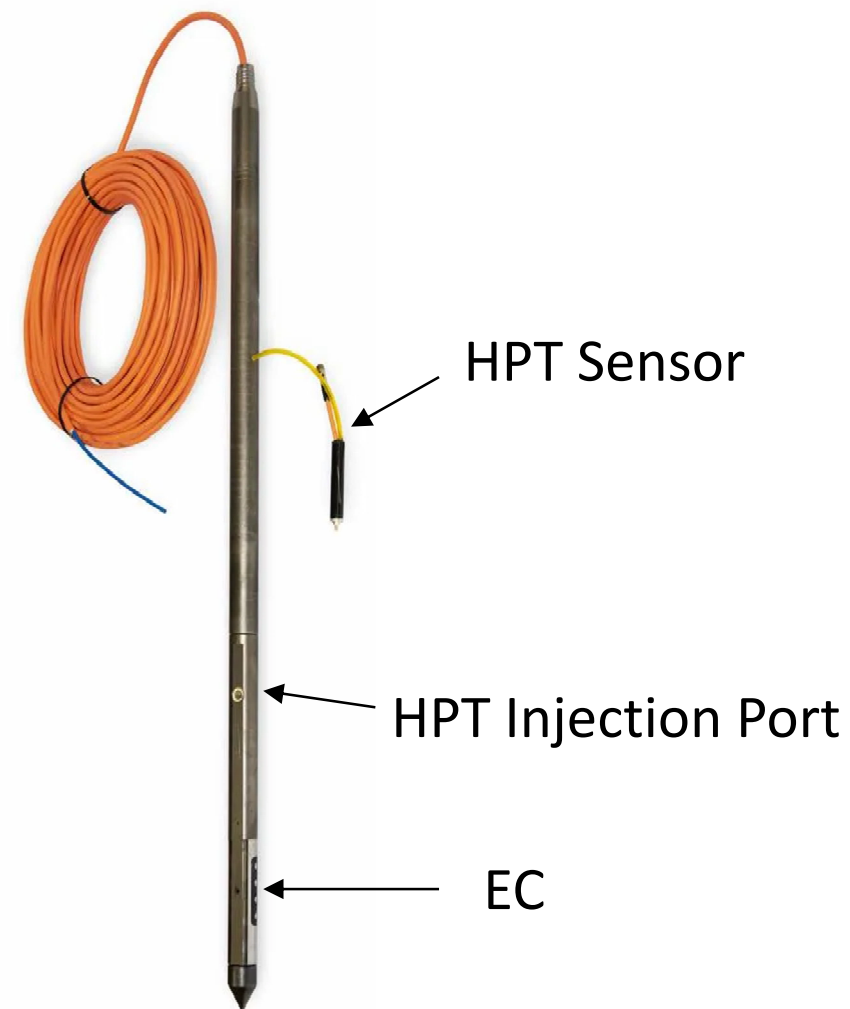


www.s2c2.us

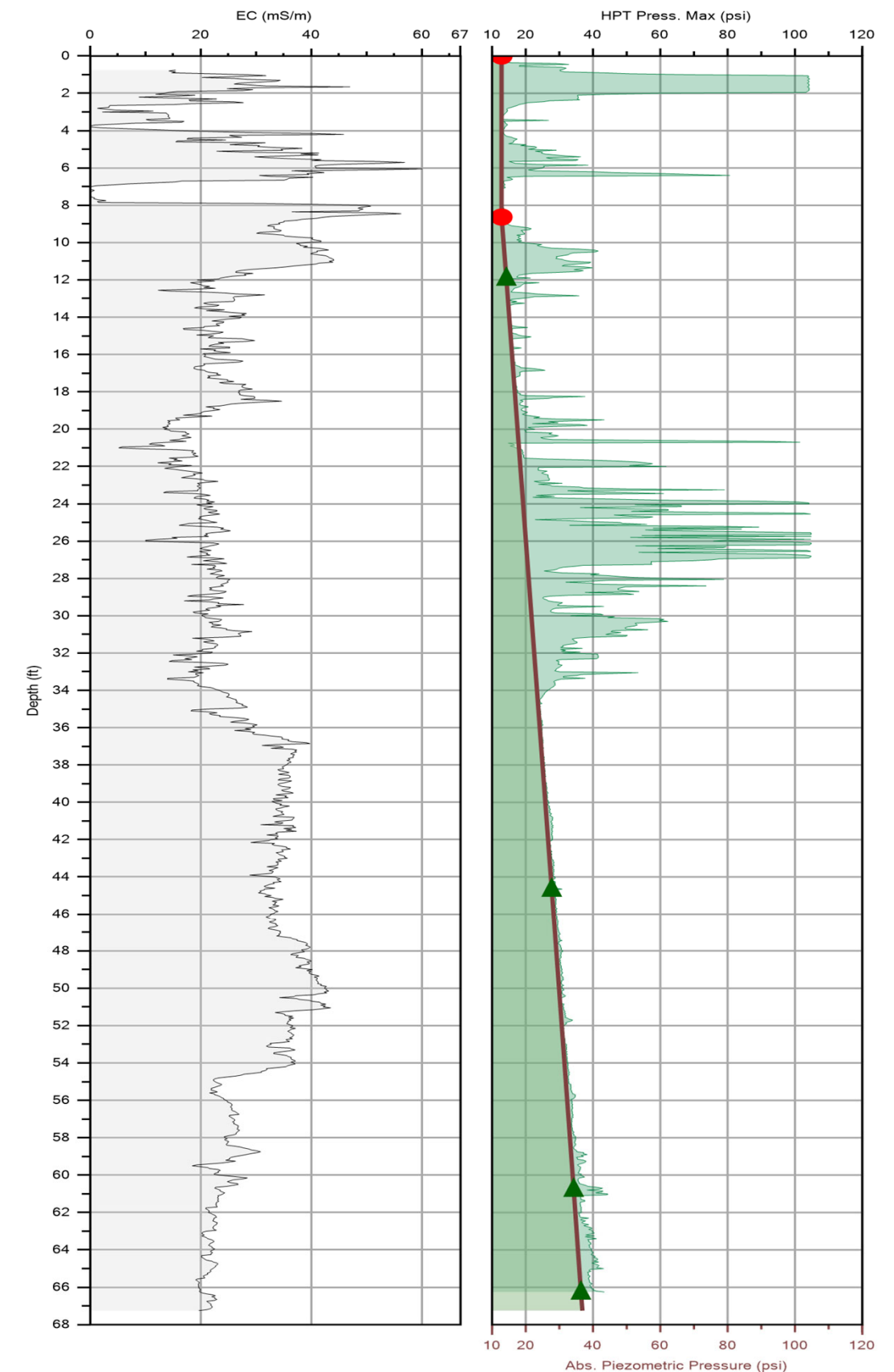


Electrical Conductivity and Hydraulic Profiling Tool (HPT)

- HPT is a downhole direct sensing tool that provides real-time profiles of soil permeability.
- HPT uses a sensitive downhole transducer to measure the pressure response of soil to the injection of water.
- Estimated Depth to Water and Est. K values

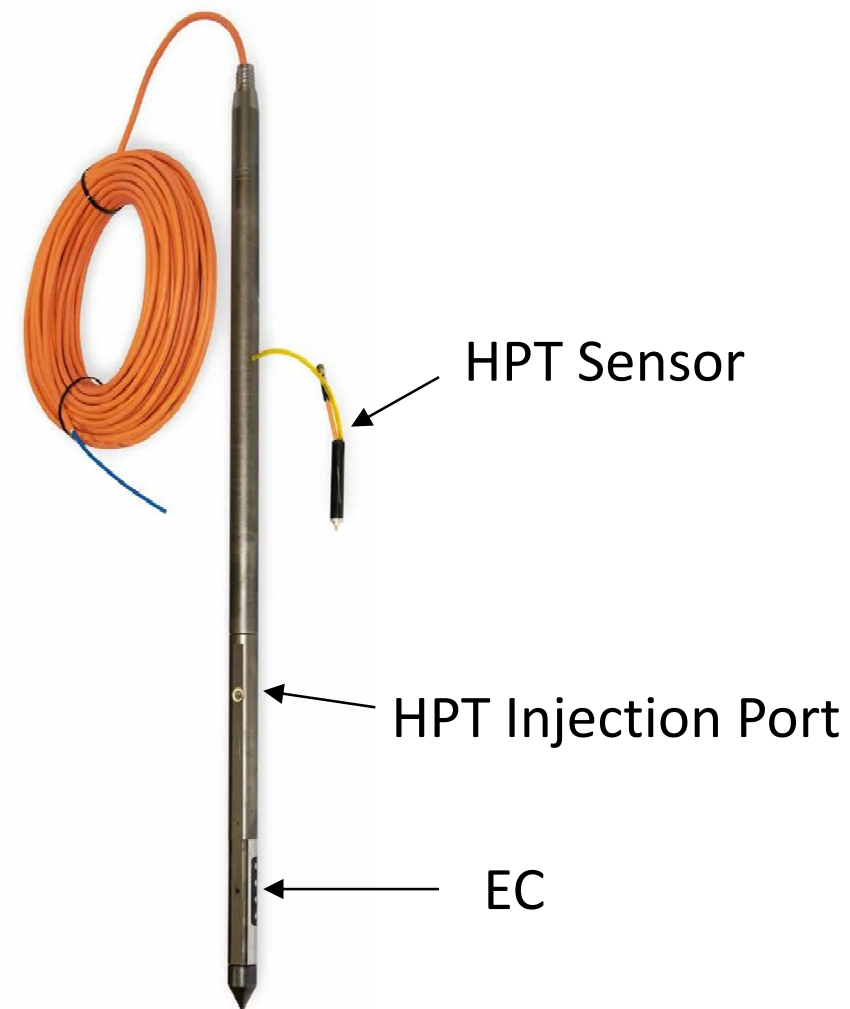


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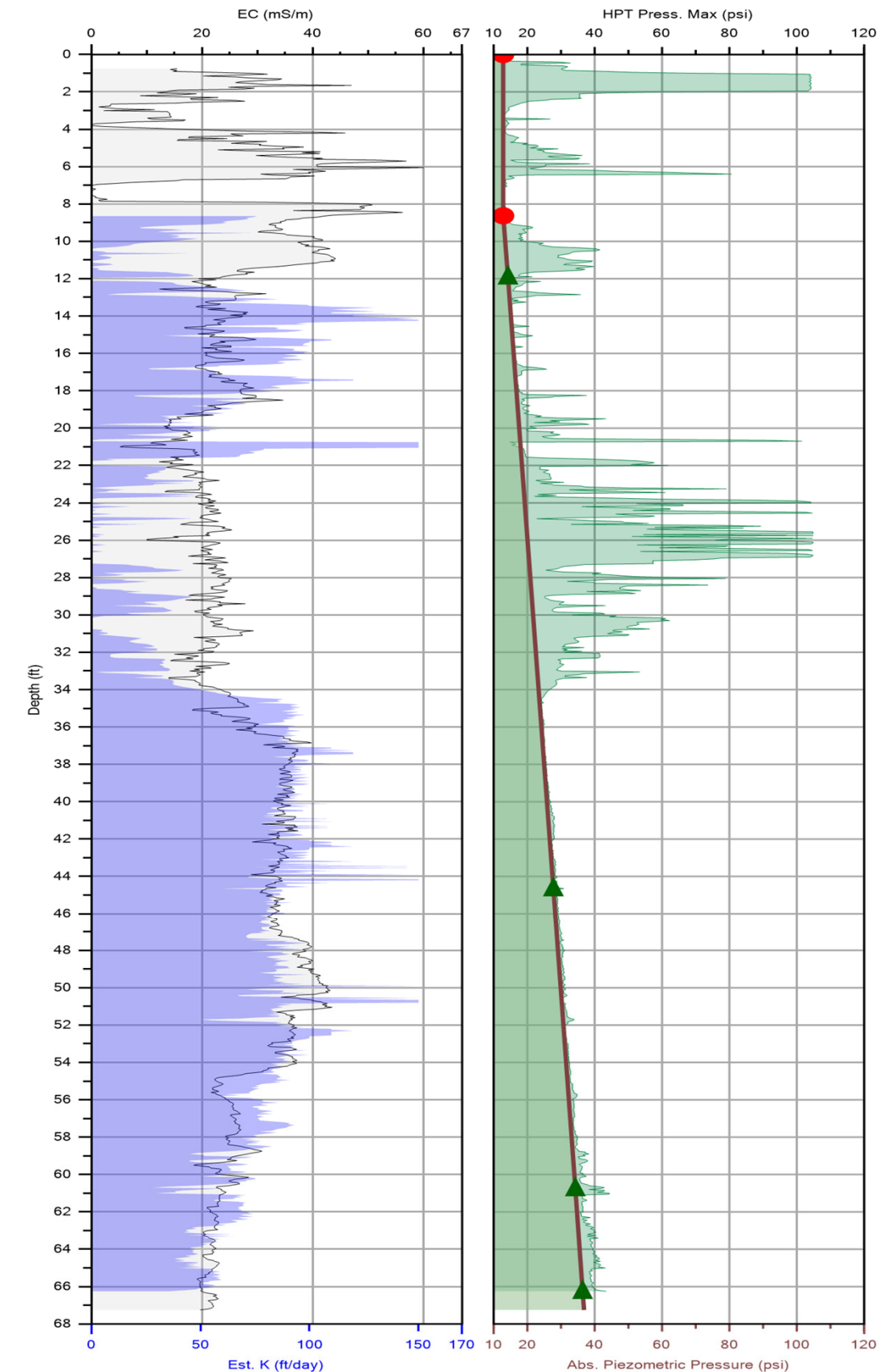


Electrical Conductivity and Hydraulic Profiling Tool (HPT)

- Determine soil lithology
- Identify injection intervals for remediation
- Identify zones that yield water for groundwater sample collection
 - VOCs
 - CVOCS
 - PFAs
- Identify metals/ash layers in historic fill



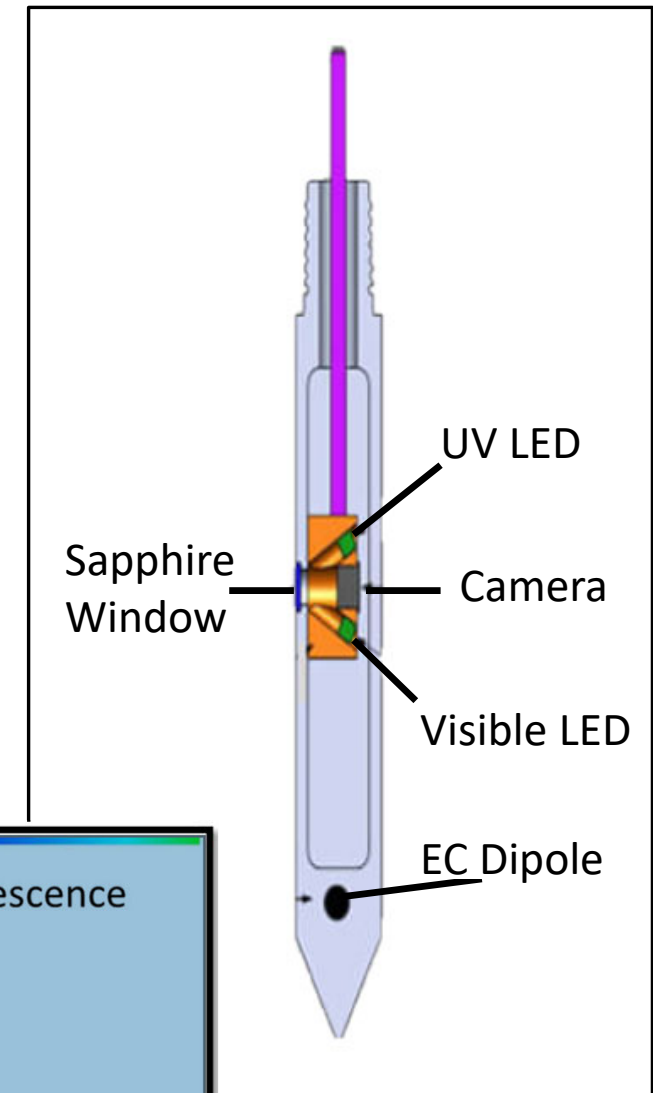
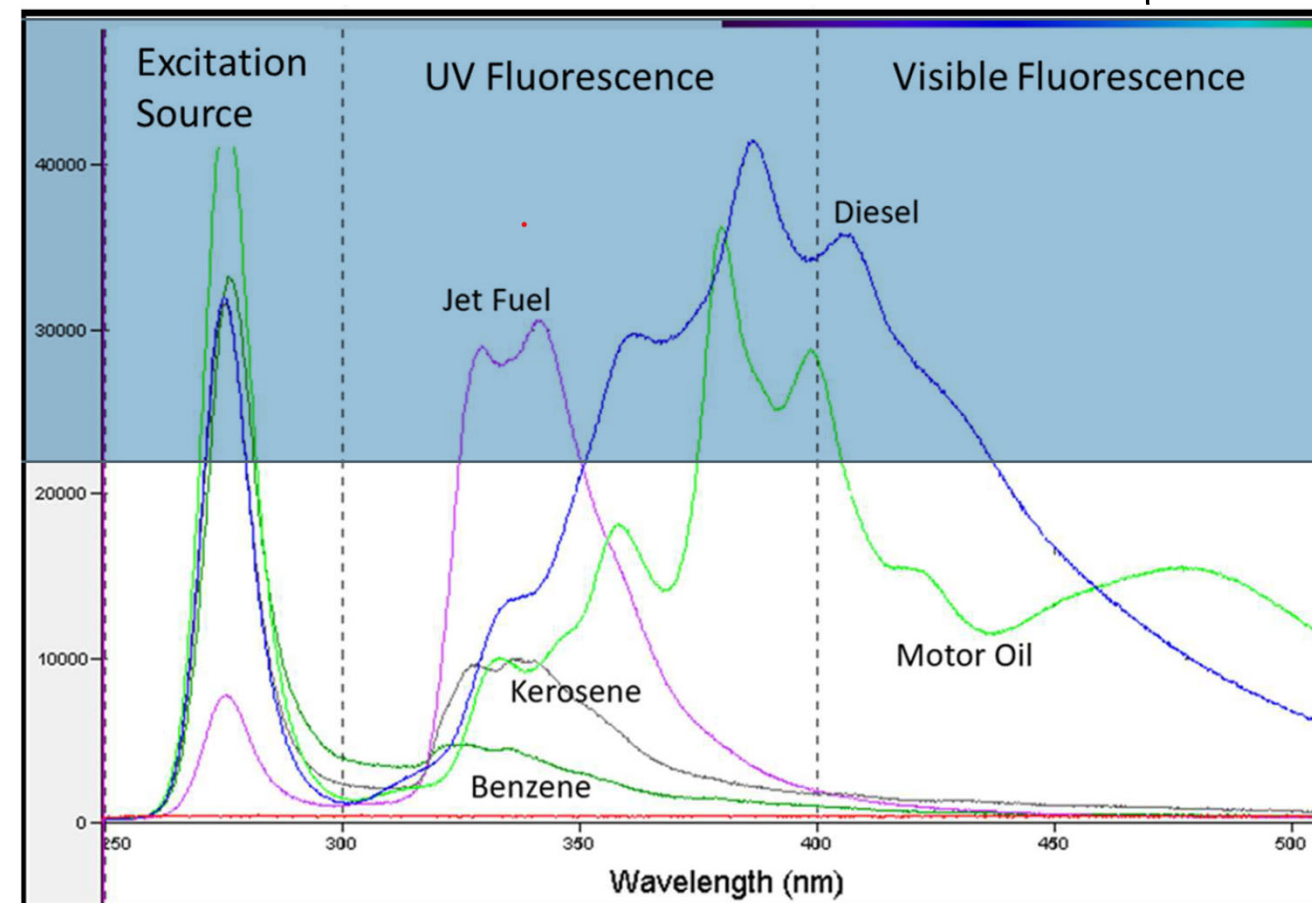
www.s2c2.us



OIP Technology

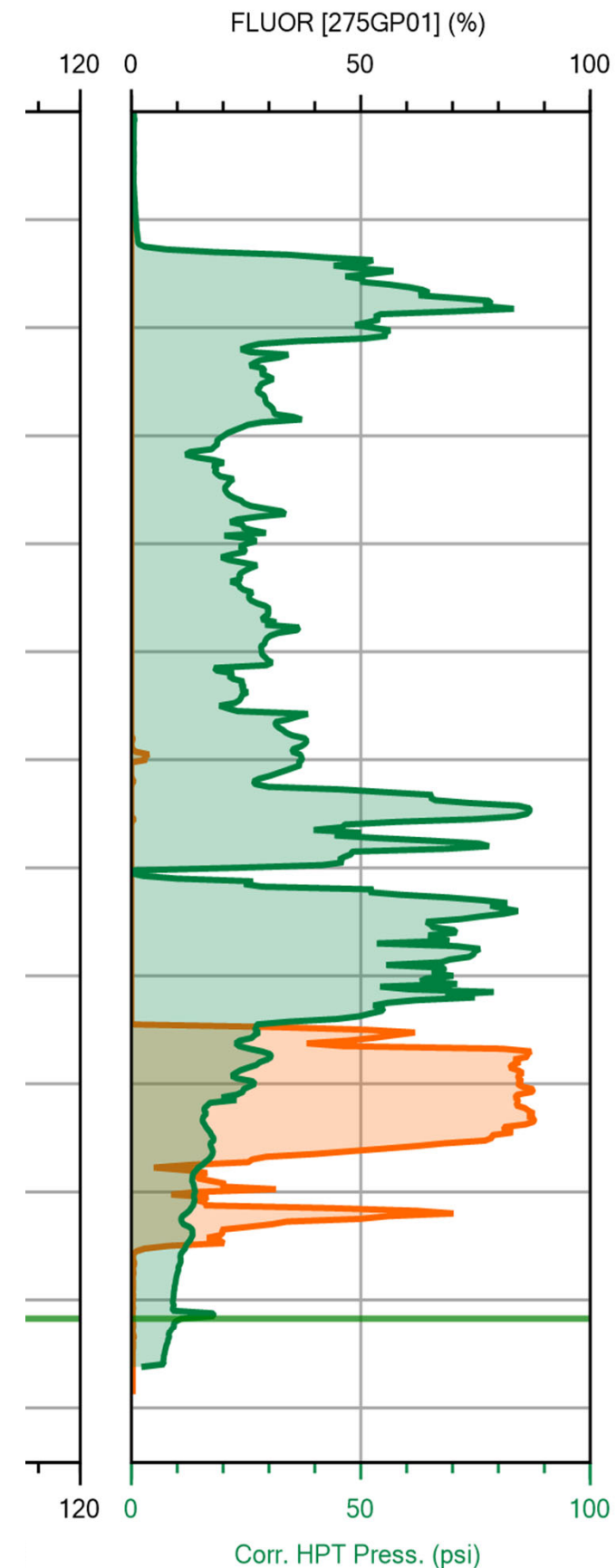
- Detects UV-induced fluorescence of PAHs
- 275nm UV (standard OIP) or 520 nm (OIP-G) directed at soil through sapphire window
- Camera takes image of soil and OIP interface analyzes for fluorescence

Average: 150-225' per day
Residual and Free Phase Only
Detection Limits well below
EPH/TPH criteria

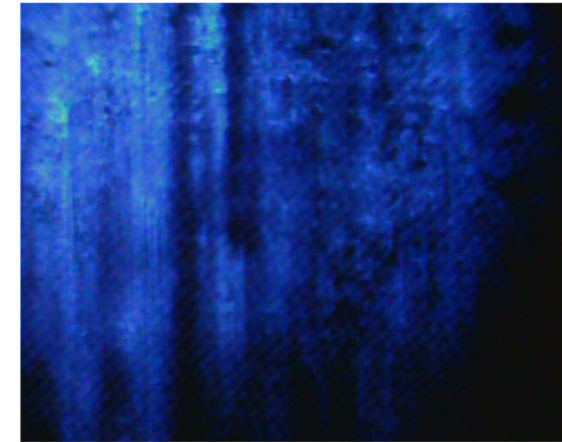


OIP Technology

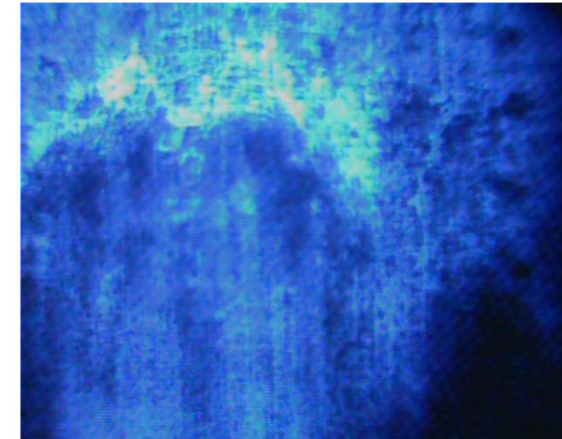
- **OiHPT-UV** detects gasoline, diesel, jet fuel, motor, hydraulic and cutting oil.
- **OiHPT-G** detects Creosote, Coal Tars, Heavy Crude Oils, and Bunker Fuels.
- **OiHPT-UV R (Beta)** Better Resolution for Kerosene, Jet Fuel and BTEX compounds



UV - 17.05 ft



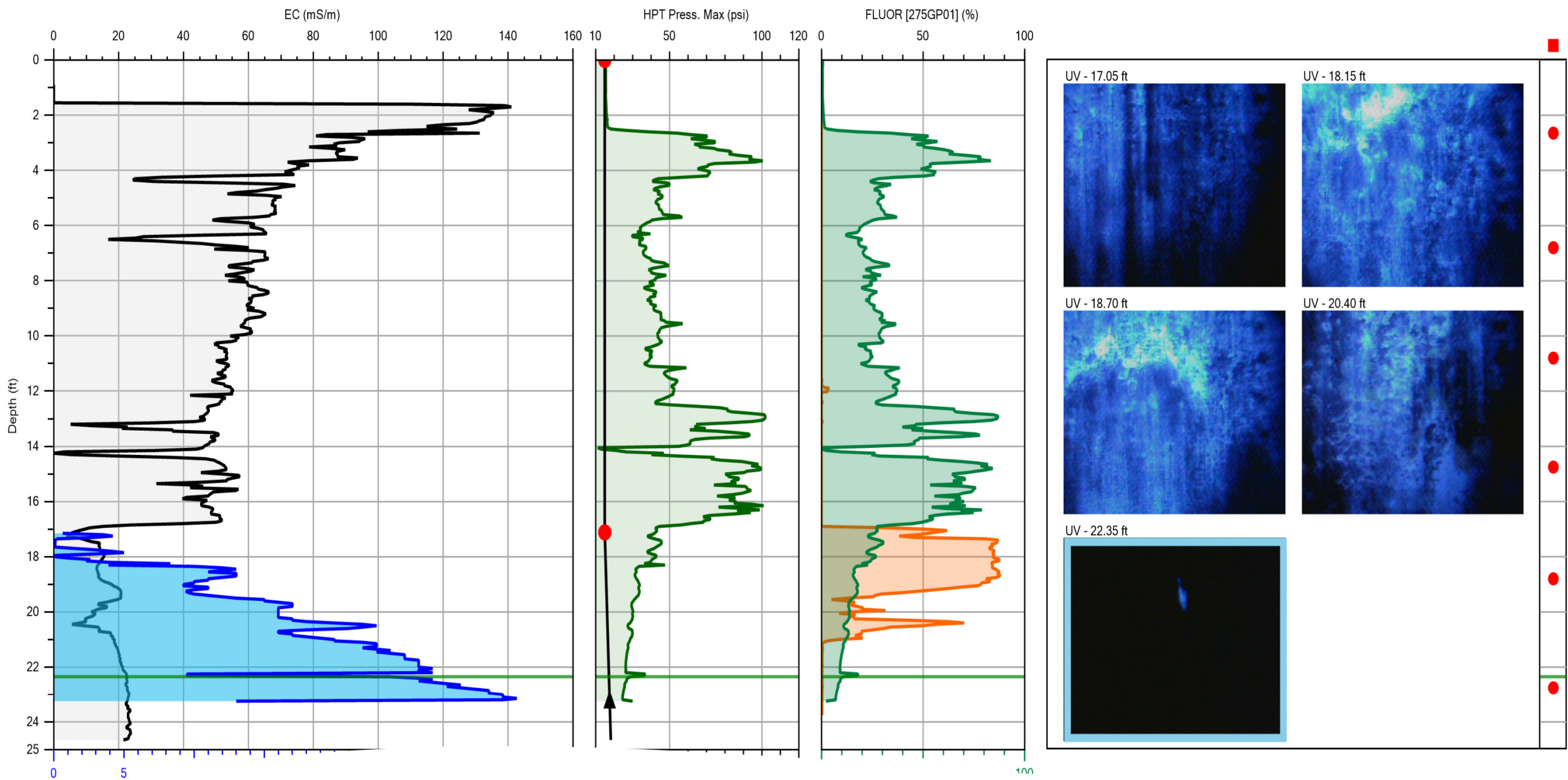
UV - 18.70 ft



UV - 22.35 ft



Optical Image Profiler with Hydraulic Profiling Tool (OiHPT) Log



Membrane Interface Probe with Hydraulic profiling Tool (MiHPT)

Probe Options:

- MiHPT
- Heated Trunkline (HTL) MIP
- Low Level MIP (LL MIP)

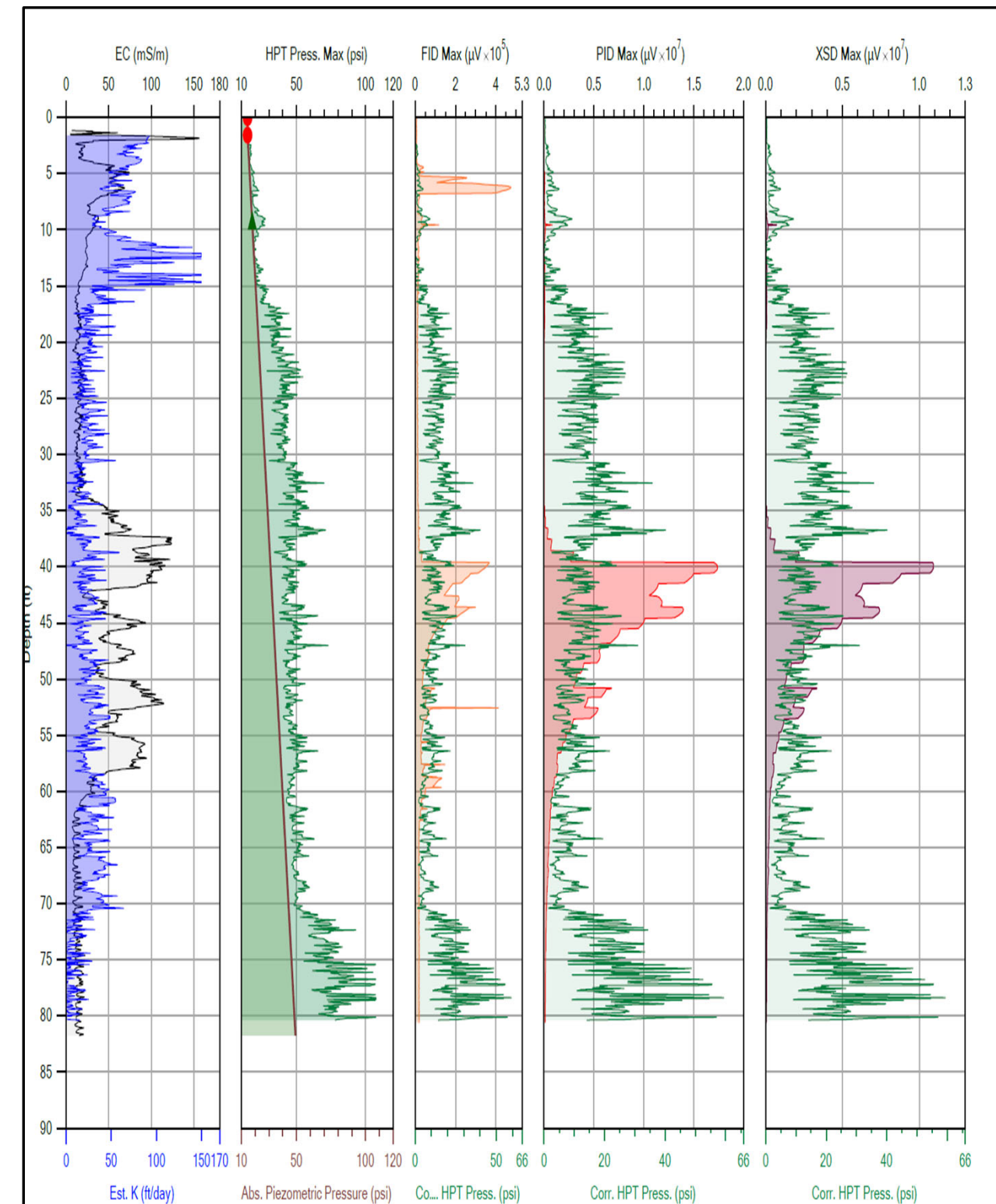
Data Generated:

- EC
- HPT
- FID
- PID
- XSD
- Est K.

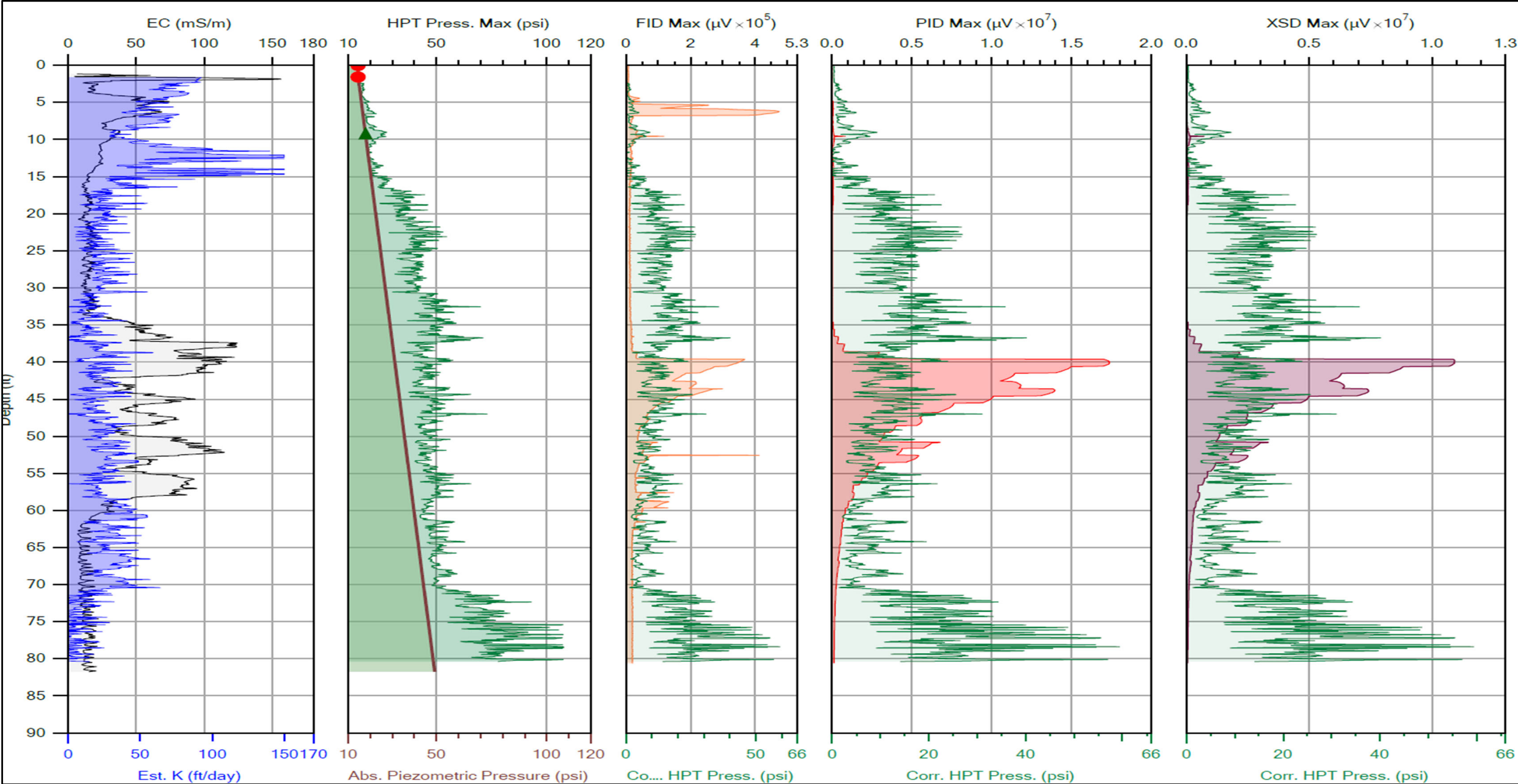
20 Readings per foot

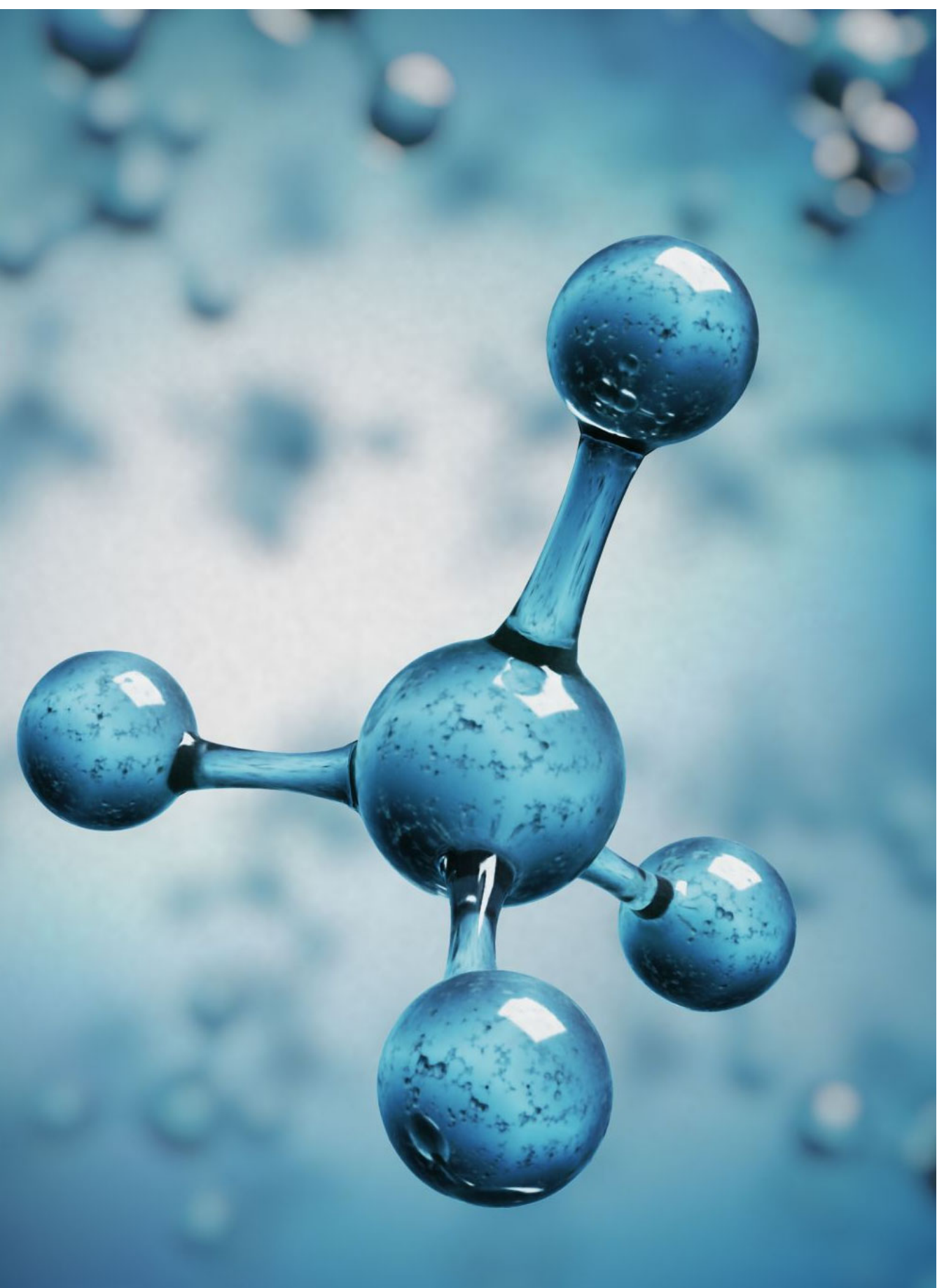
7200 Data Points per 60 foot boring!

Average 135-150' per day



Membrane Interface Probe with Hydraulic profiling Tool (MiHPT)





MIP Compounds of Concern

Logs relative concentration of VOCs with depth in soil

- CVOCs
 - MiHPT
- BTEX
 - MiHPT (Dissolved Phase only)
 - Heated Trunkline (No HPT)
- Chlorobenzene/Chlorotoluene
 - Heated Trunkline (No HPT)
- Others – Dependent on Boiling Point, Vapor Pressure and other chemical properties
 - [Detectable Compounds by MIP.xlsx \(geoprobe.com\)](#)
 - Ask Us

**Detection limits:
Product to <100ppb**

Direct-Push Confirmation Sampling

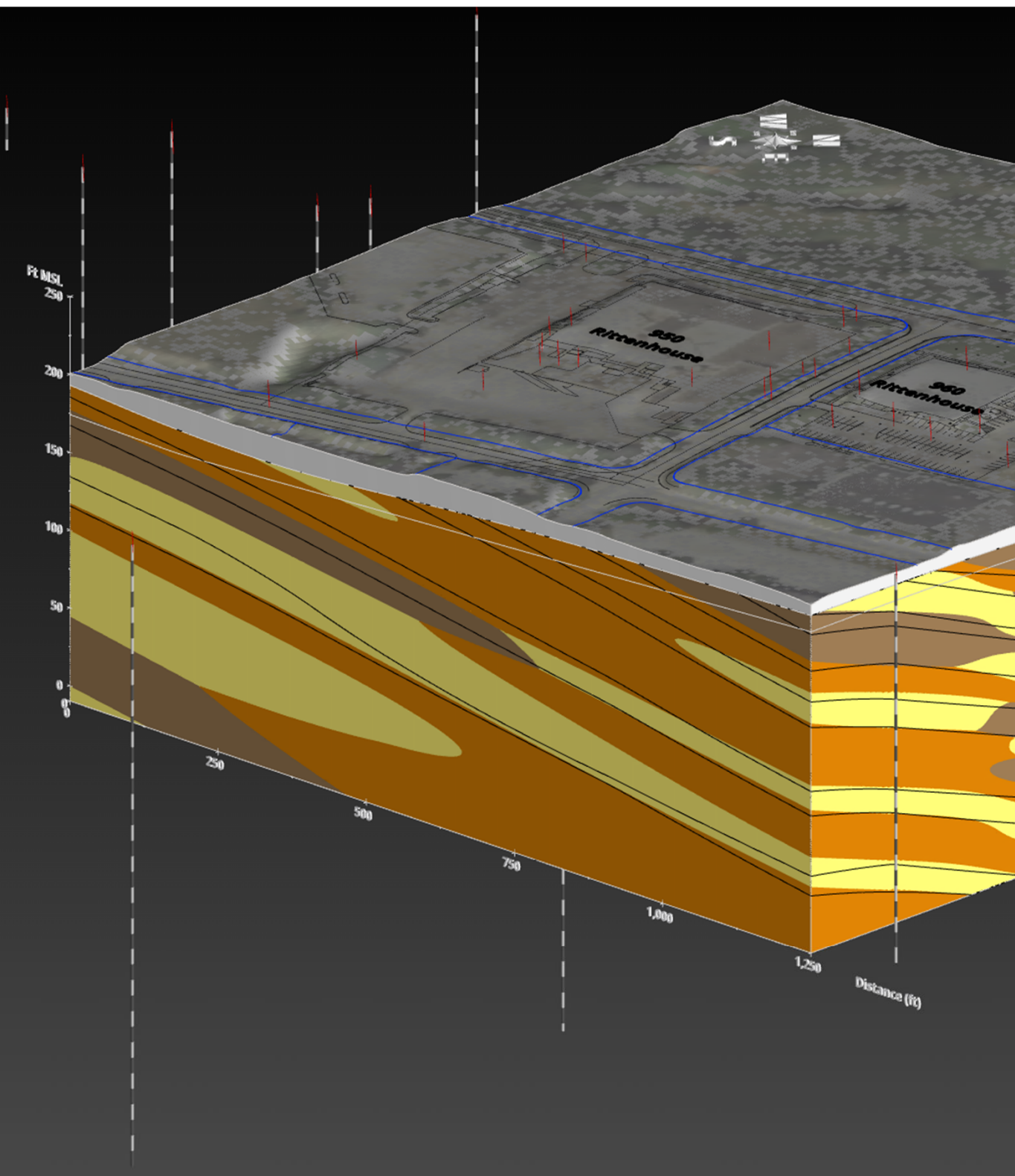


- Soil Sampling
 - MC5
 - 2.25" Dual Tube
 - 3.25" Dual Tube
- Groundwater Sampling
 - SP16/19/22
 - Temp Wells
 - Pre-Packed Monitoring Wells
 - PFAS

**Critical that any sample
collected represents
the interval sampled!**

3-Dimensional Data Visualization and Analysis (3DVA)

- Complex Geologic Modeling: Bedrock, overburden, environmental sequence stratigraphy (Depositional Based Modeling)
- HRSC Data Evaluation and CSM Development
- Groundwater and Soil Analytical Data Evaluation and 3D CSM Development
- Volumetric Analysis and Mass Calculations
- Groundwater Plume Trend Analysis
- Database Management - EnviroData



Conceptual Site Model Model Development

S2C2
HRSC Specialists

Leverage Existing Data Investments and
migrate them into a 3D CSM

ELEVATION SURFACE DEPTH	MEAN DEPTH	REMARKS	SOIL/ROCK TYPE	COLOR	PROB. FT. FILL PROB. FT.	COMMENTS
36	36		Silt and clay	RED-BROWN		Top 6" moist soil at top
85	85		Silt	BROWN-RED		Band sandstone ore at top 5 Spm in lower 16 inches
86	86		Heavy silt	BROWN-RED		
87	87		Silt	BROWN-RED		Basalt bedding, soil is fissile
88	88		Silt	BROWN-RED		Micaschist clay, high plasticity
89	89		Silt	BROWN-RED		Micaschist, highly fractured, all vertical
90	90		Silt	BROWN-RED		Layer, base at 16 ft. Open vert. fractures 14.5-16.1
91	91		Silt	BROWN-RED		Basalt 87.3-92. Apparently good intergr. permeability
92	92		Silt	BROWN-RED		
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Case Study – OiHPT, MiHPT, 3D CSM

HRSC Investigation
Former Industrial Site

