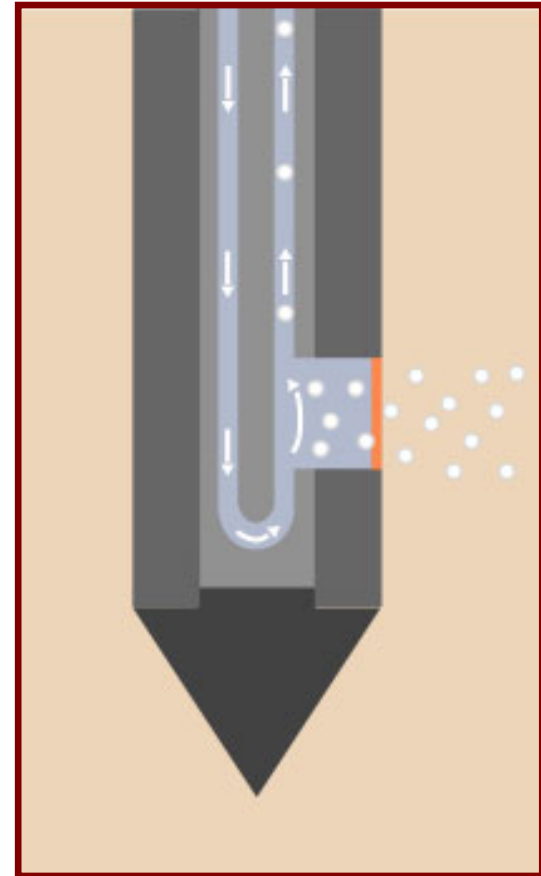


*“Using MIP Technology to
Detect VOCs in Real-Time
and HPT Data for Remedial
Action”*

**Sven Dean, V.P.
GroundTech Solutions®**



OUTLINE

- Introduction to Direct Push & Direct Image ®
- Cone Penetration Test (CPT)
- Electrical Conductivity Probe (EC)
- Membrane Interface Probe (MIP)
- New Hydraulic Profiling Tool (HPT)
- Case Study: Introduces HPT Data
- Soil Sampling Confirmation of Real-Time Data
- Summary & Conclusions



DIRECT PUSH

- Push or hammer specified probes for real-time data recovery in the field
- Push or hammer samplers to collect undisturbed soil samples and groundwater
- No cross-contamination and minimal disturbance to the site & subsurface



Data Acquisition Probes

Data Acquisition Probes:

Push-only

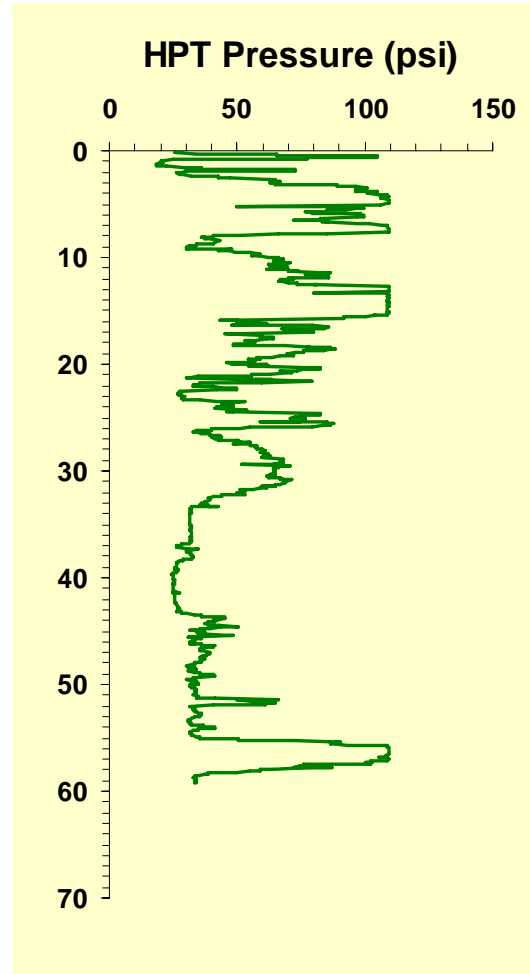
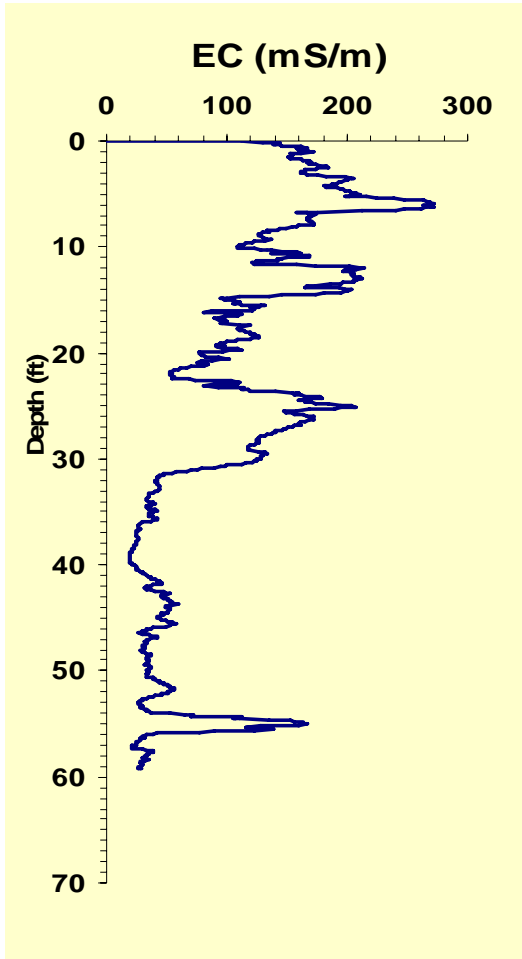
- Cone Penetration Test (CPT)



Percussion driven

- Electrical Conductivity (EC)
- Membrane Interface Probe (MIP)
- Hydraulic Profiling Tool (HPT)





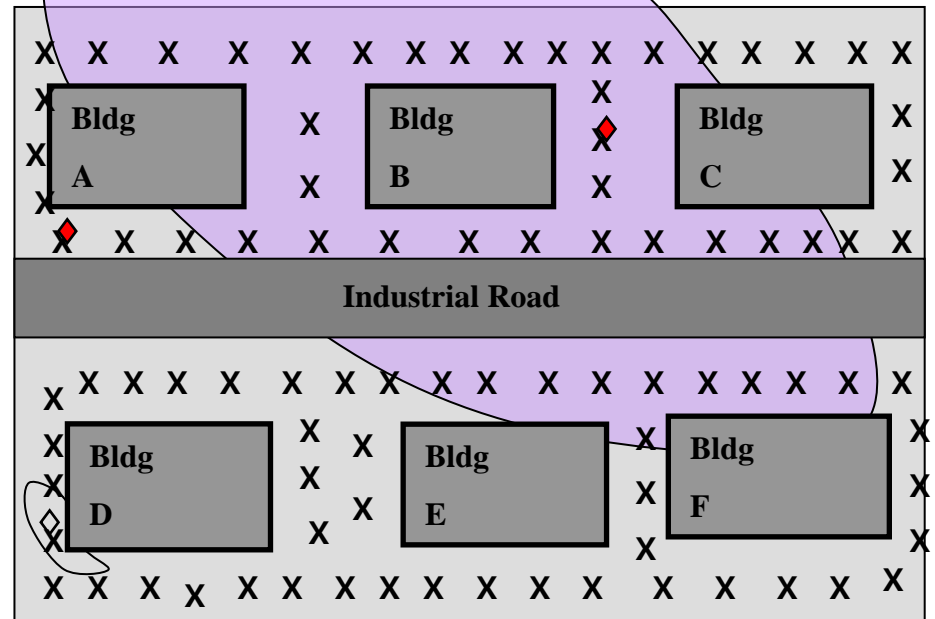
What is it?
Real-time data.

Why is it important?
Reduces Risk.

How is it done?
On site using
different probes with
a Field Computer.



Real-Time Data Collection from the Site



- **Provides better control on site conditions**
 - Increases confidence in decision-making process
 - Reduces impact of false positive/negative results
 - Reduces overall costs by minimizing the number of boreholes, remobilization to site and changes in remedial actions



Real-time data from the subsurface using Probes & Field Computers:

1. **CPT Probe: Cone Penetration Test**

- Data derived from the Tip, Sleeve & Pore Pressure
- Provides Geotechnical data in real-time
- Physical Properties of the soil are recorded

2. **EC Probe : Electrical Conductivity Probe**

- Provides lithology and physical properties of soils.

3. **MIP: Membrane Interface Probe**

- Detects & Measures Volatiles in the Subsurface
- Both chlorinated & non-chlorinated Volatiles in the subsurface.

4. **EC & HPT Probe: Permeability, Pathways & Lithology in one probe.**

- Hydraulic Profiling Tool (HPT) combines EC with hydraulic properties of the subsurface.
- HPT is utilized to confirm pathways and used in remedial injections.



CPT System

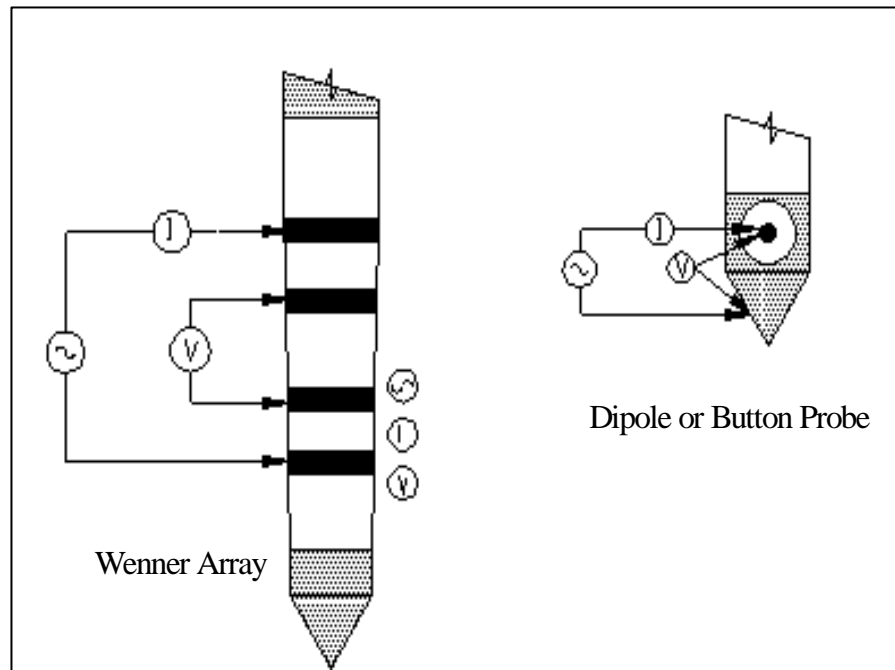
Cone Penetration Test (CPT):

- Acoustic Real-Time Data System (Laptop in the Field)
- Cordless CPT Probe with Digital Memory of all data
- Highly Accurate, Repeatable Geotechnical Data
- Sleeve Friction, Tip Resistance & Pore Pressure



What is EC?

The measure of a material's ability to conduct an electric current.

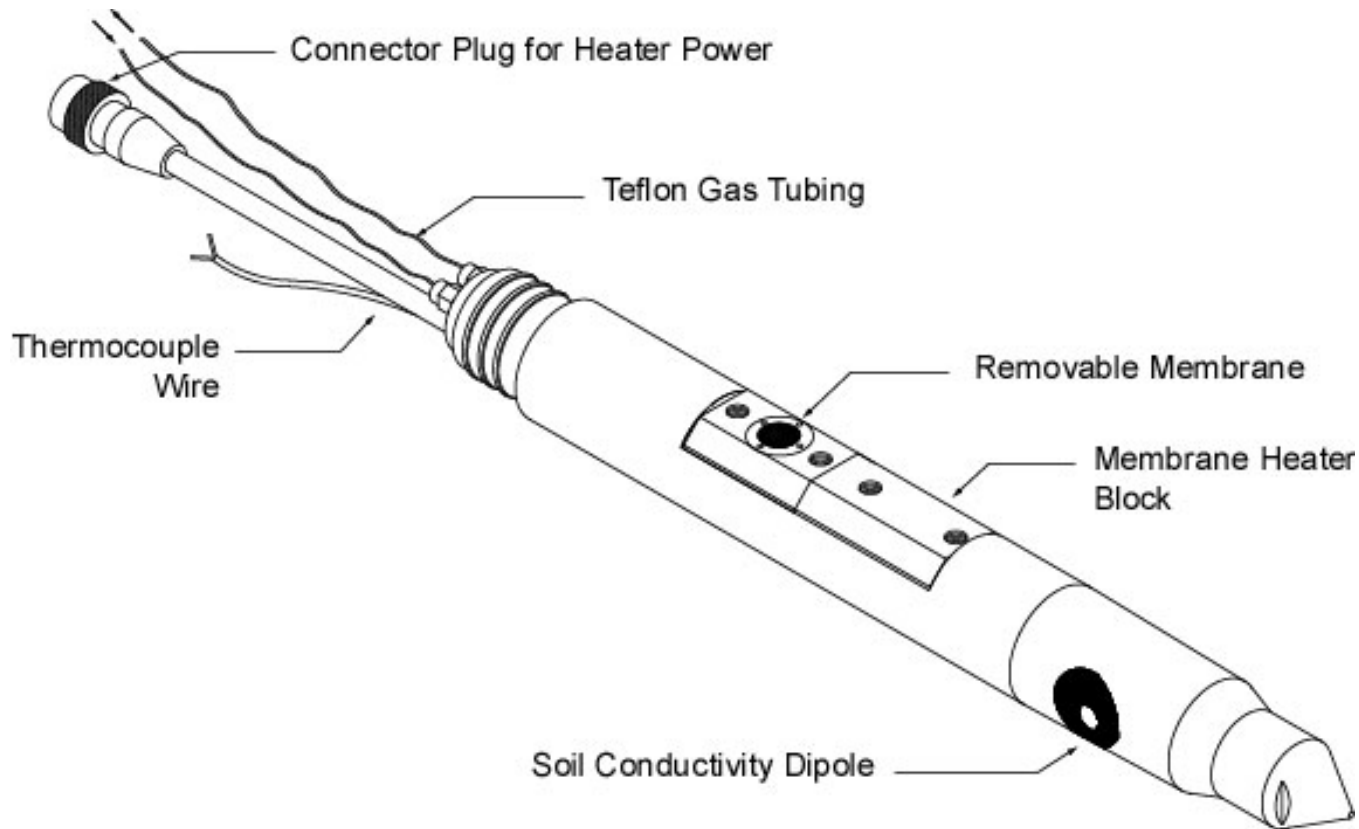


Low Conductivity = Large Grain Material
High Conductivity = Small Grain Materials



What is MIP?

An Interface between the VOCs and Detector System

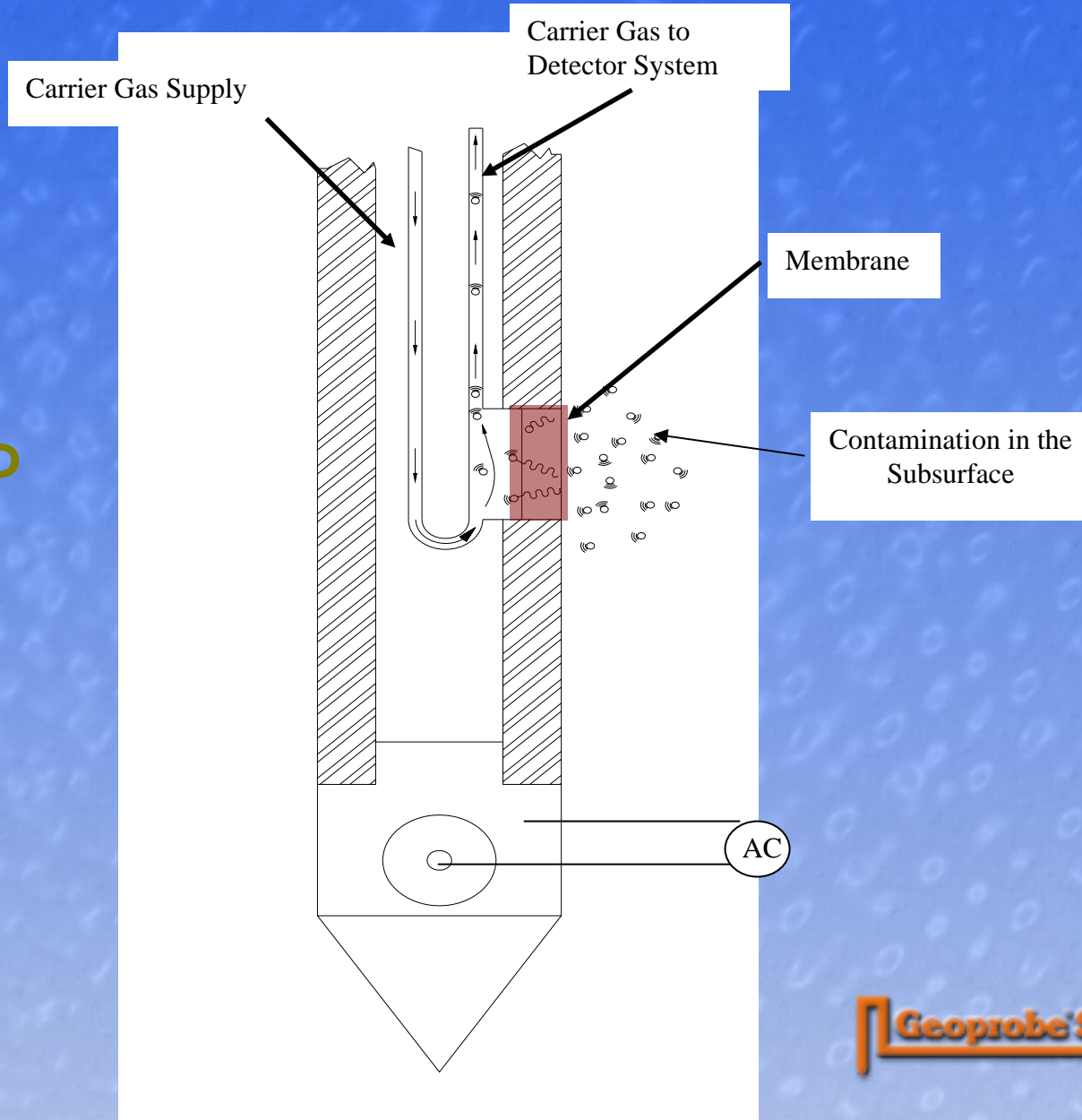


MIP Field Lab:

MIP Probe advanced with Direct Push Hammer while VOC's are recorded.



How MIP Works...



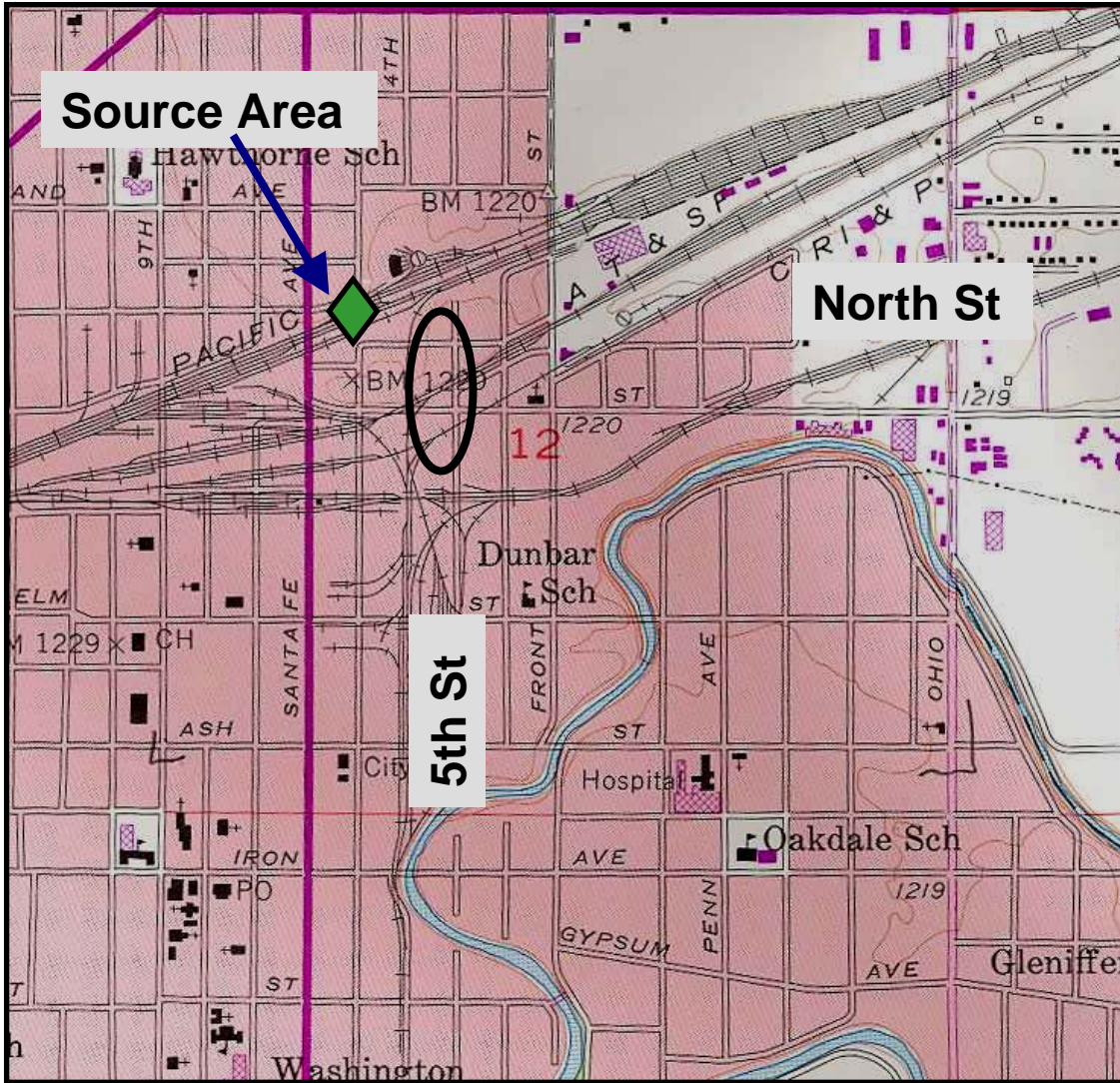
Case Study

5th St Study Area



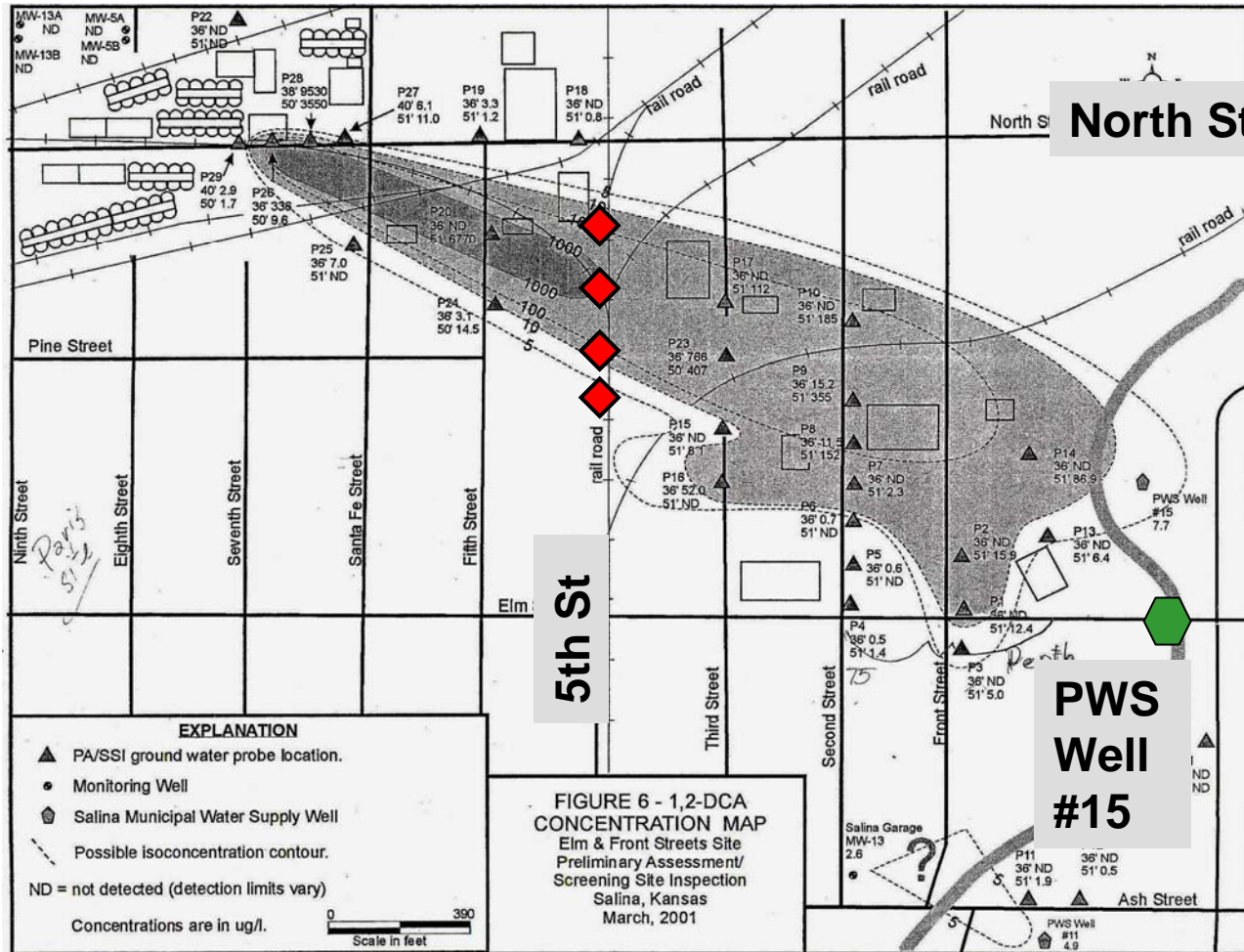
Salina, KS

Direct Image
and Sampling



Case Study Area

◆
New Direct
Image Log
Locations

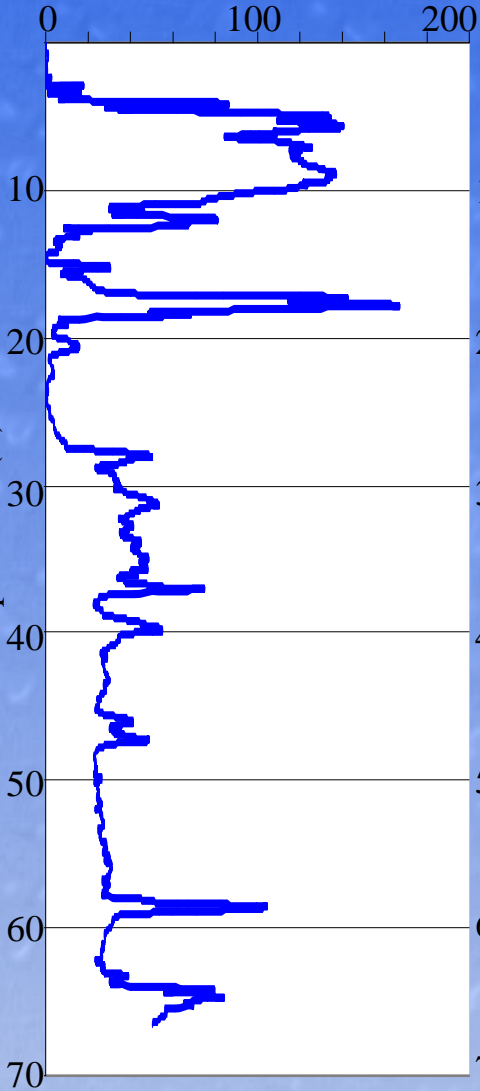


Plume & Previous BH's/Monitors

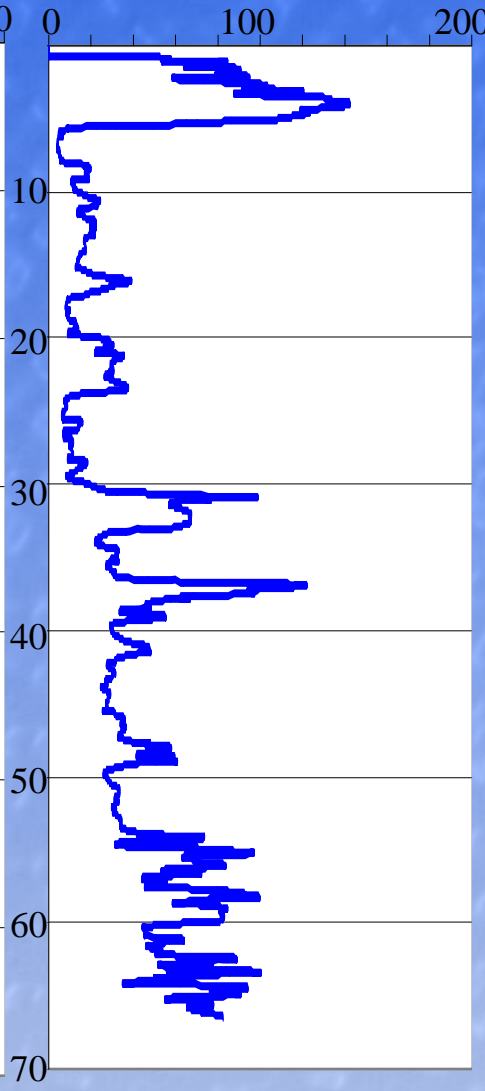


Case Study: Electrical Conductivity in mS/m

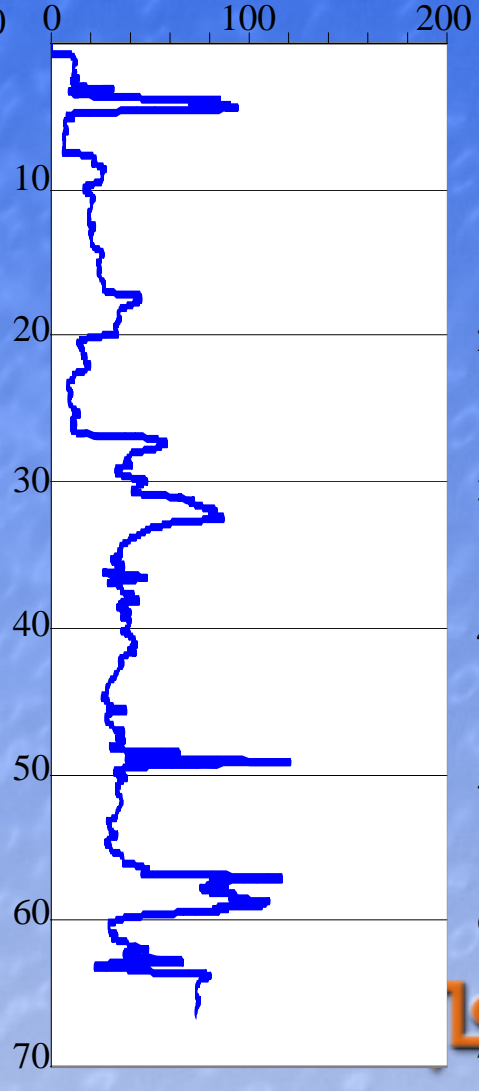
MIP 01



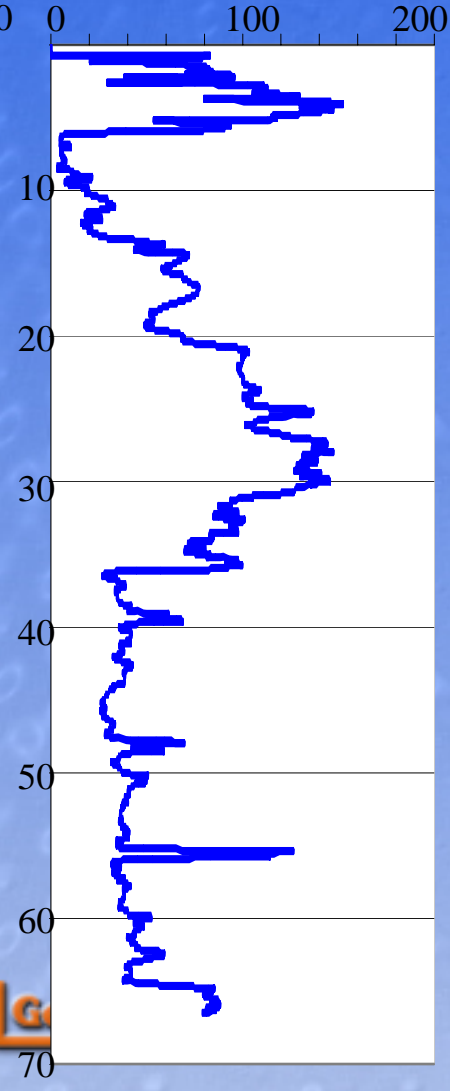
MIP 02



MIP 03



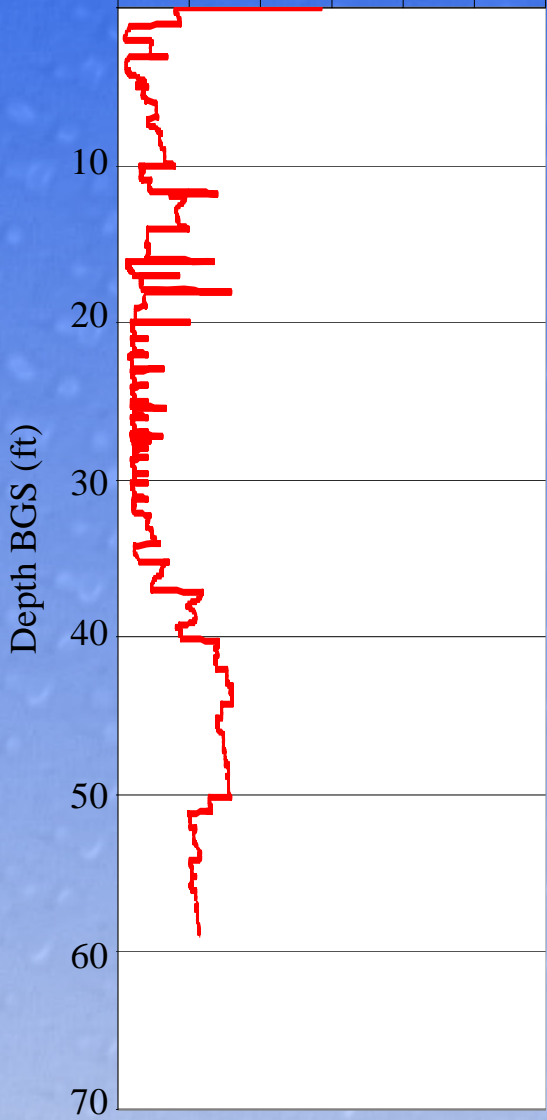
MIP 04



Case Study: MIP ECD Responses (uV)

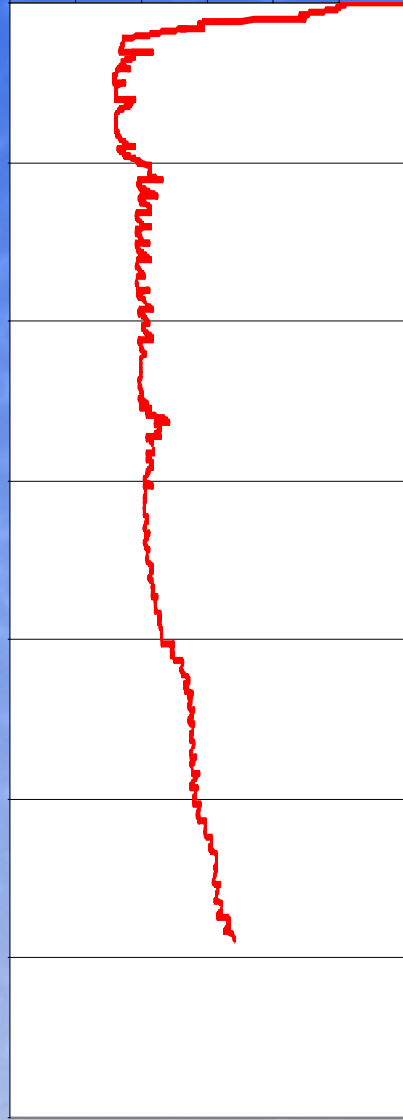
MIP 01

0.0E+05 1.5E+05 3.0E+05



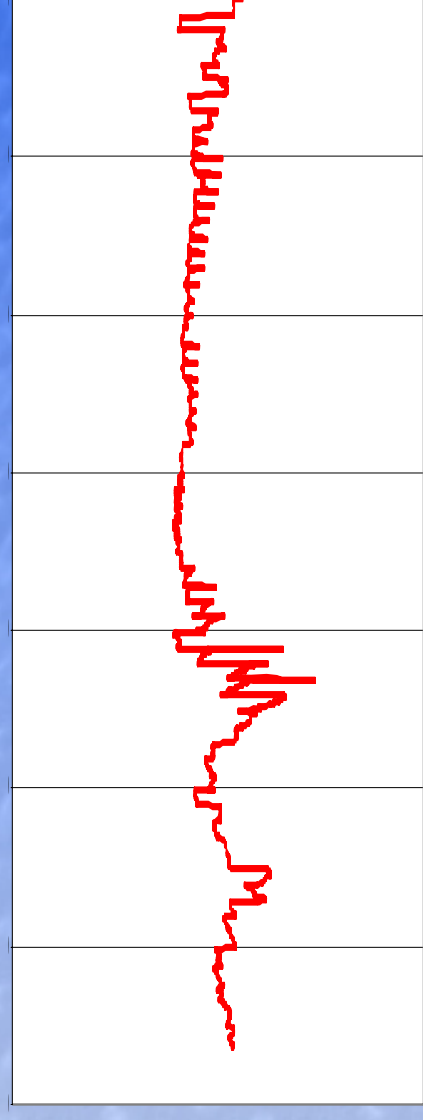
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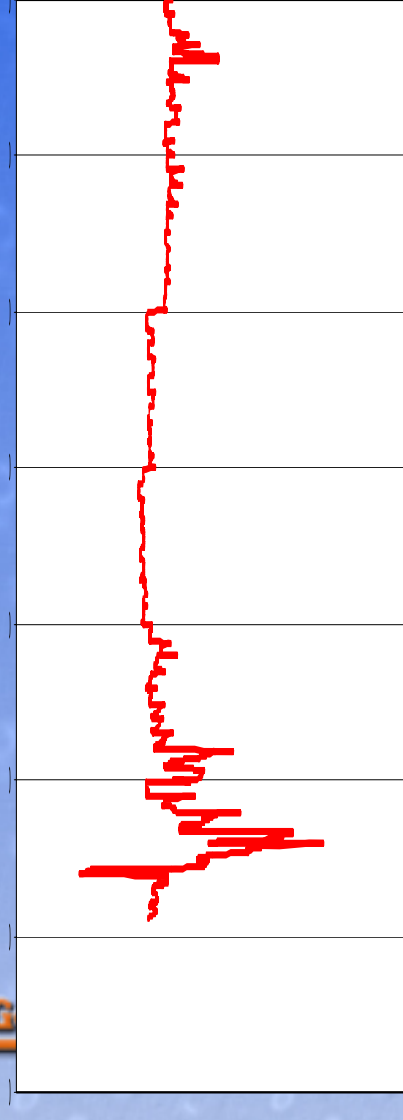
MIP 03

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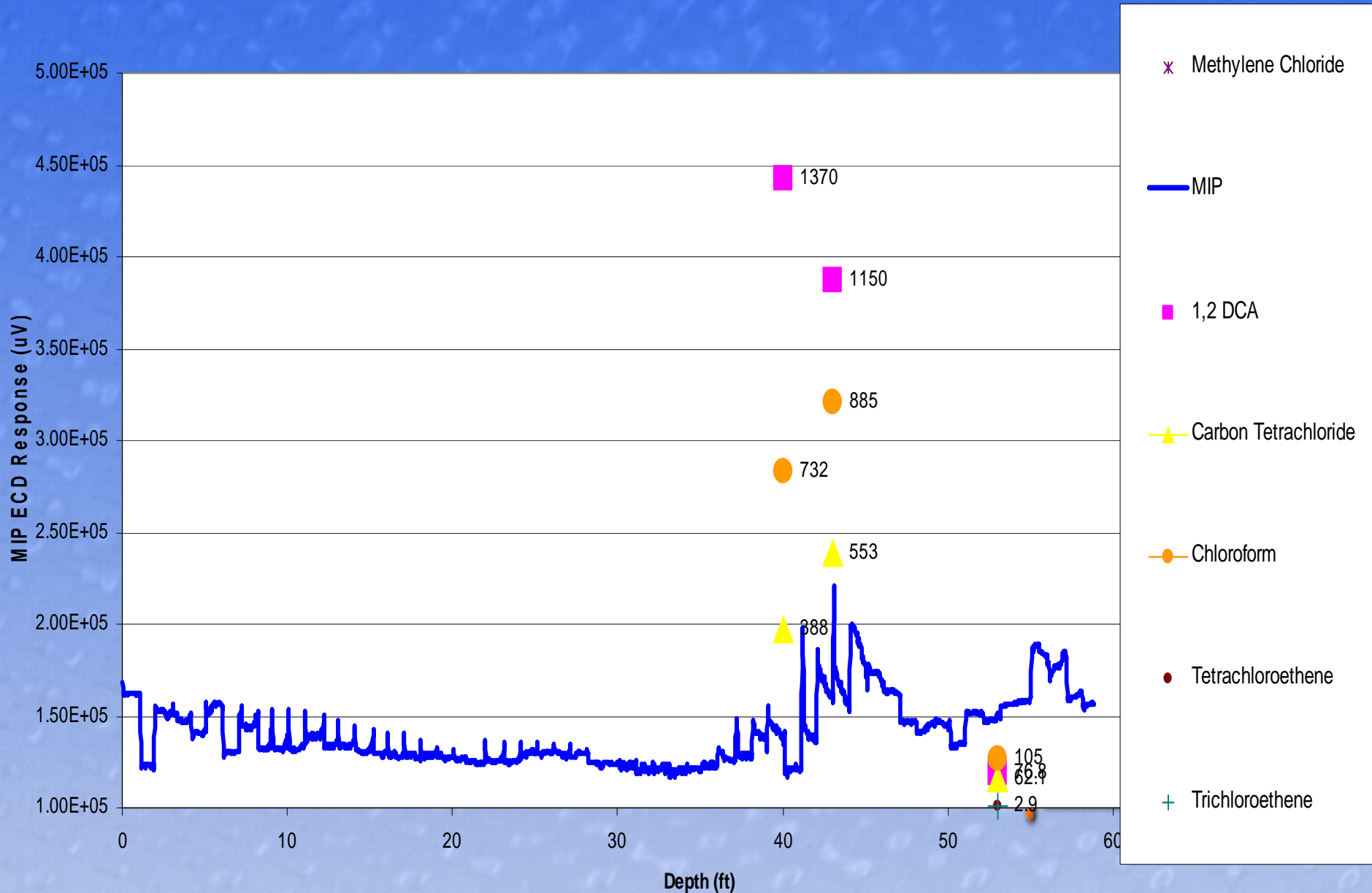


MIP 04

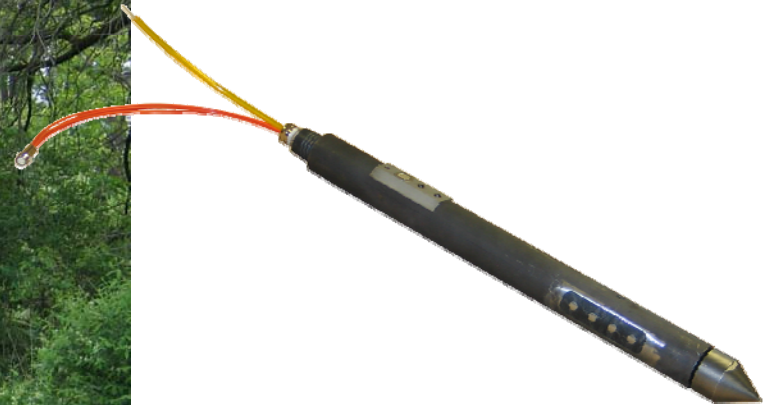
0.0E+05 1.5E+05 3.0E+05



Laboratory Results at MIP 03



A New Probe: Hydraulic Profiling Tool (HPT)

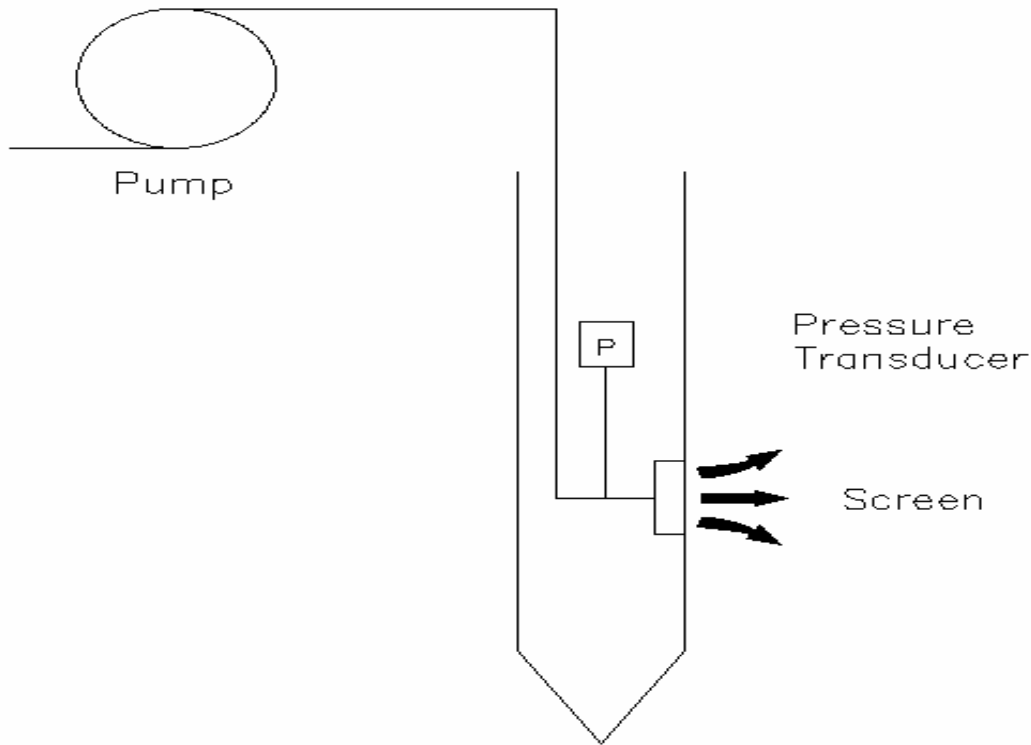


Hydraulic Profiling Tool (HPT)

- Continuous Hydraulic Profile
- Used to direct additional sampling
- Define locations for slug tests
- Used to direct the injection of remedial materials
- Used to locate potential contaminant migration pathways
- Push or hammer probe
- Integrated Electrical Conductivity
- Real-time data output using a Field Computer
 - Dynamic sampling and probing decisions
- HPT uses a downhole pressure transducer
 - Quickly measure formation response
 - Accurately measure static water level



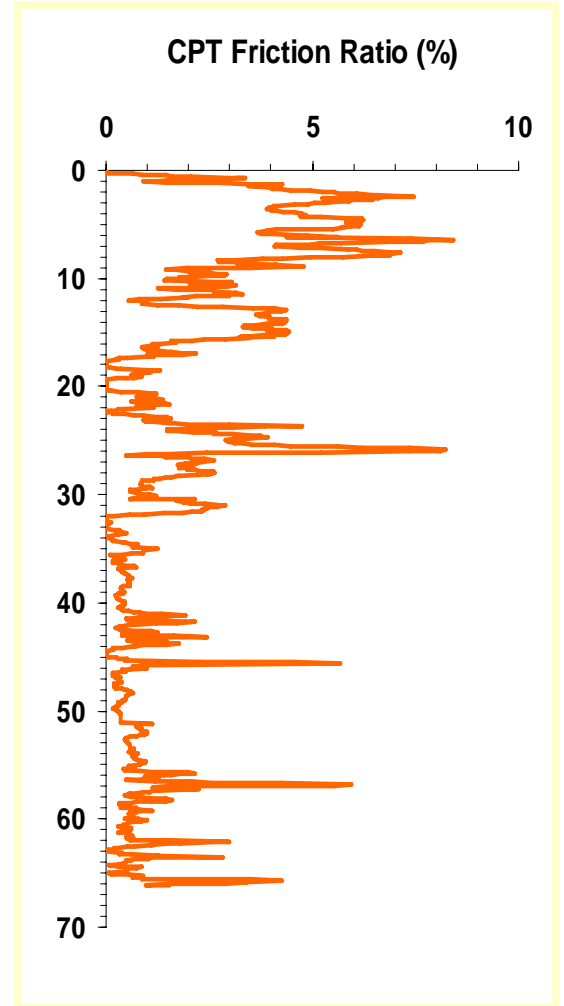
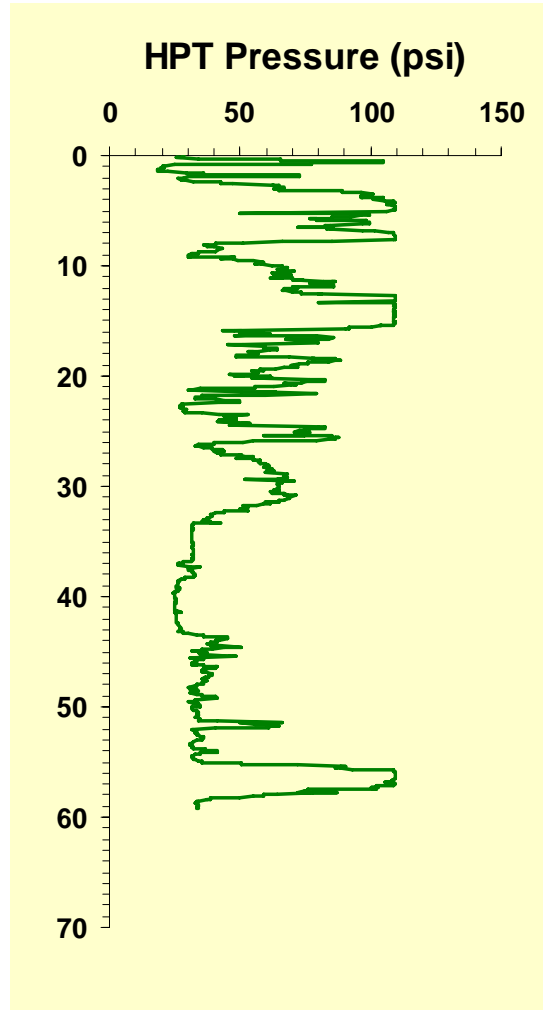
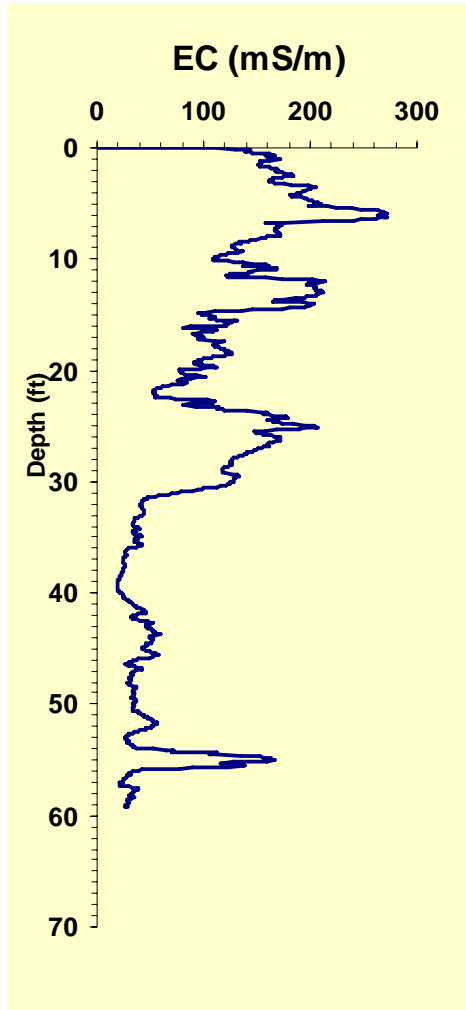
HPT Probe

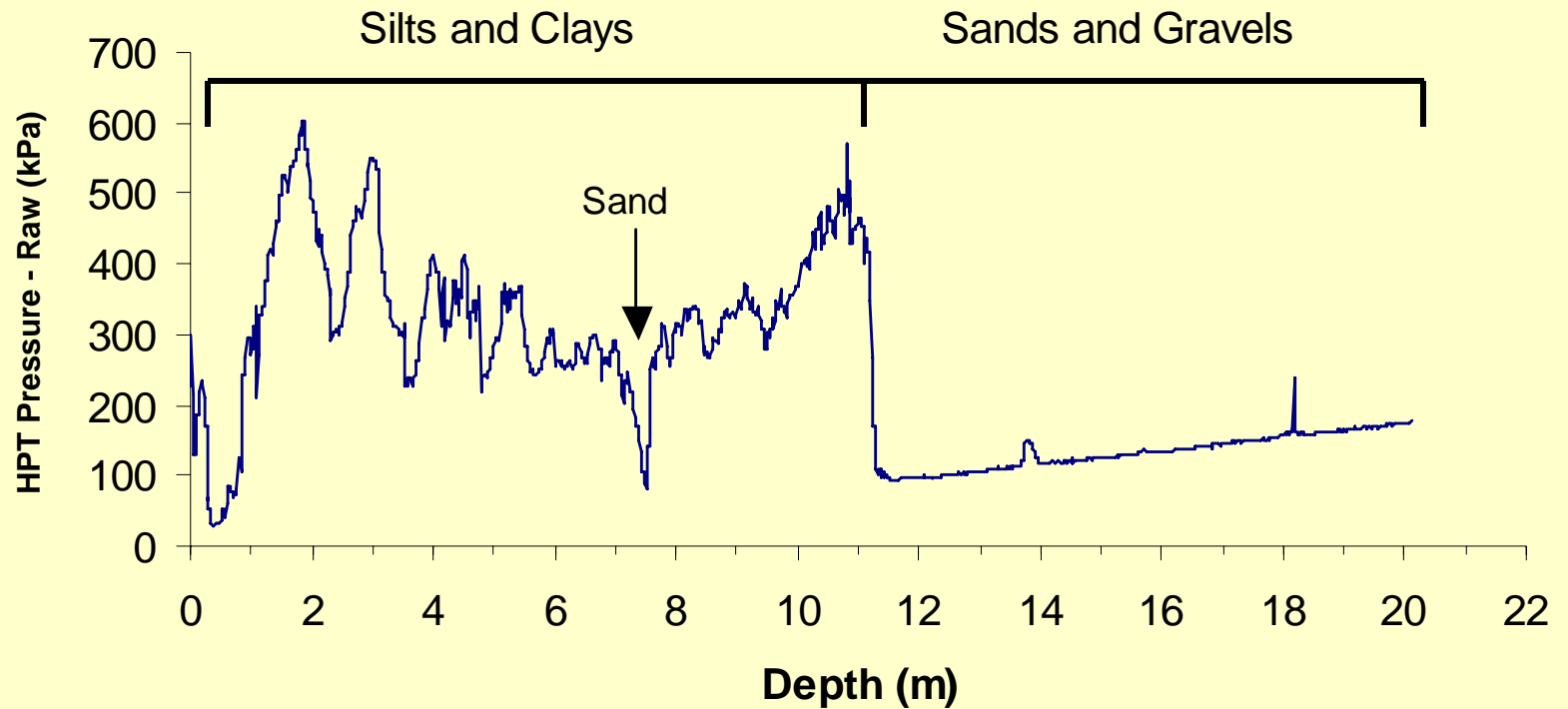


- Advance Probe at constant rate
- Inject water at low flow rate
- Measure formation pressure response



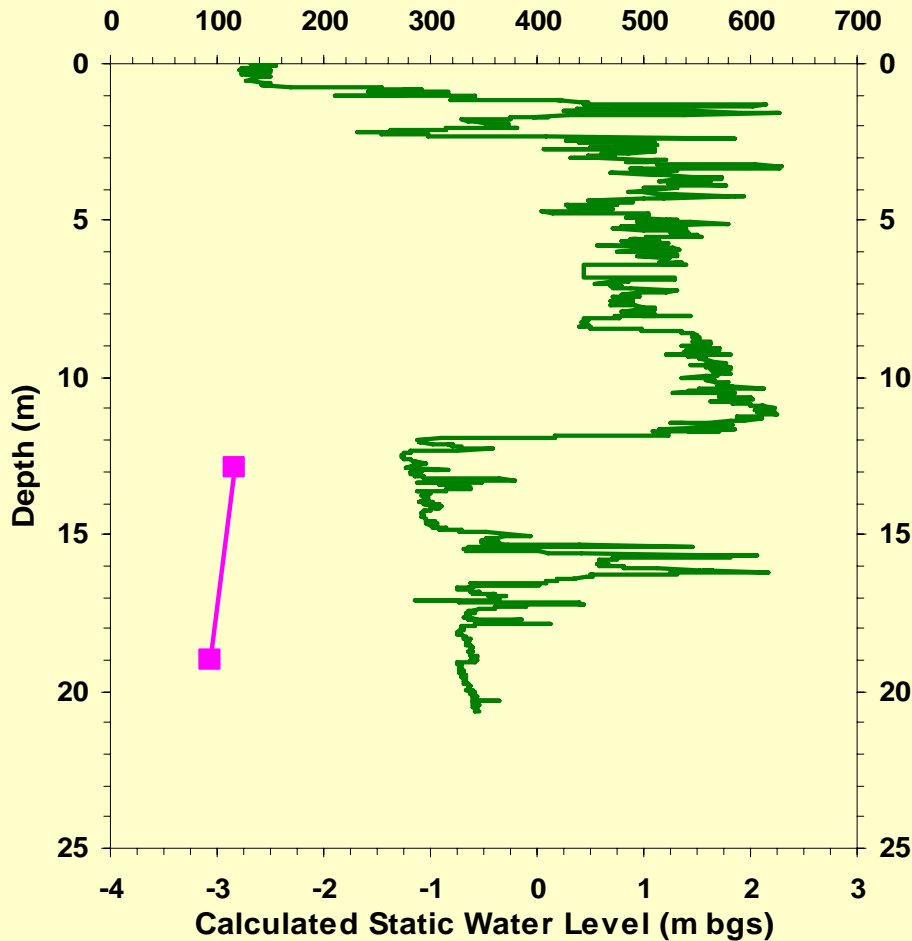
EC, HPT & CPT DATA:





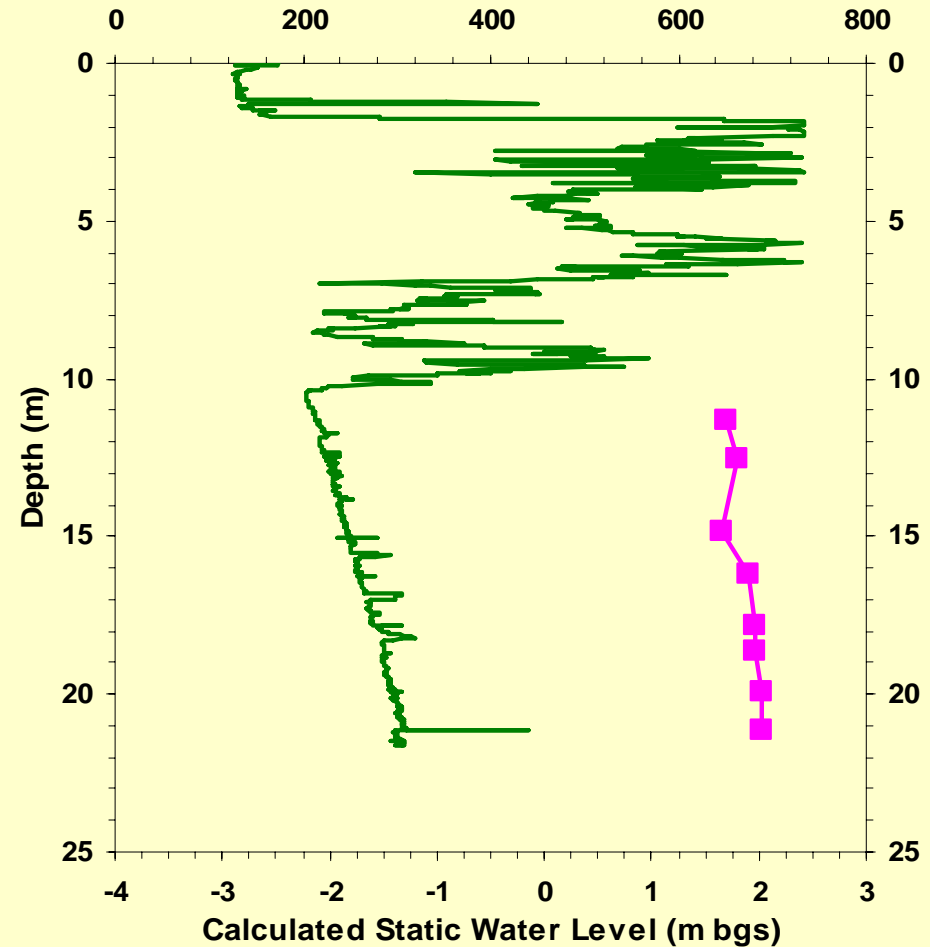
GP3 - Iron River, WI

HPT Pressure (kPa)



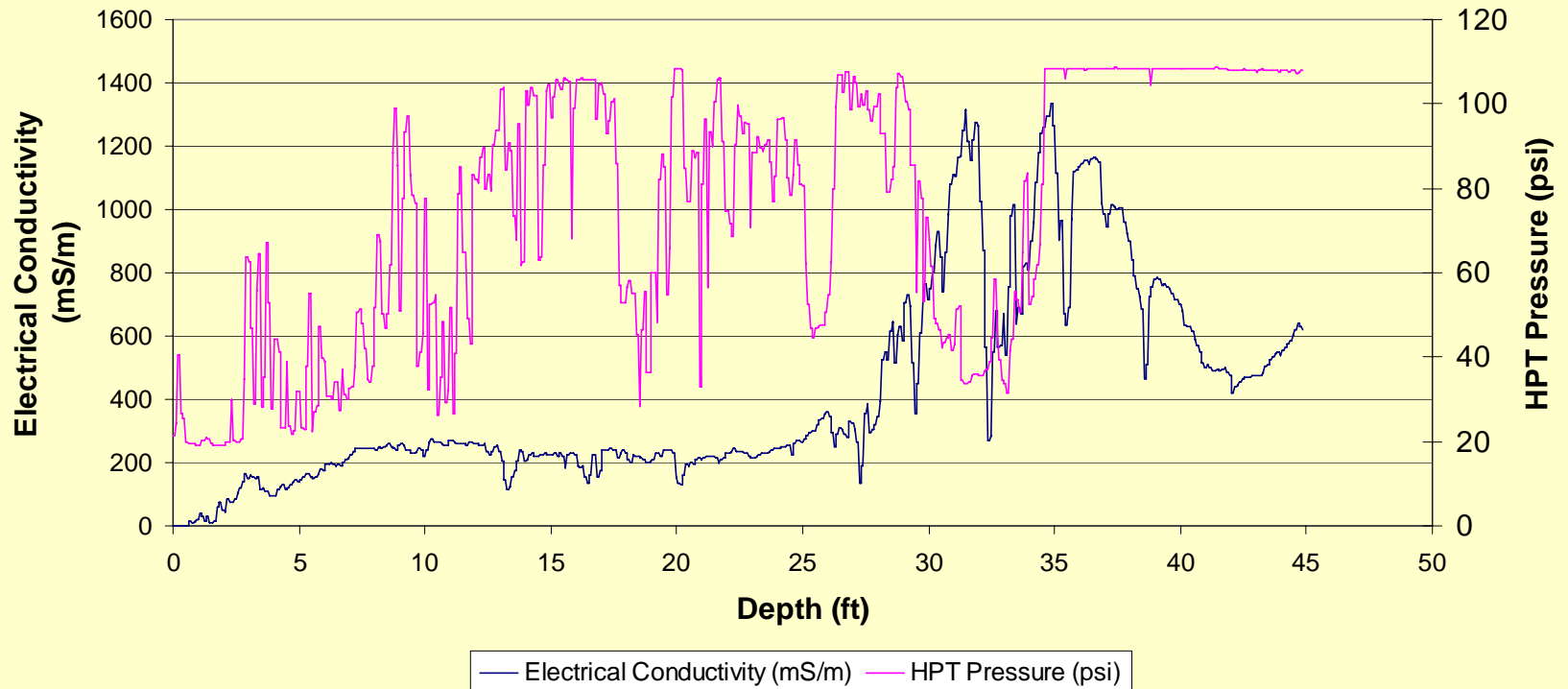
GP1 - Iron River, WI

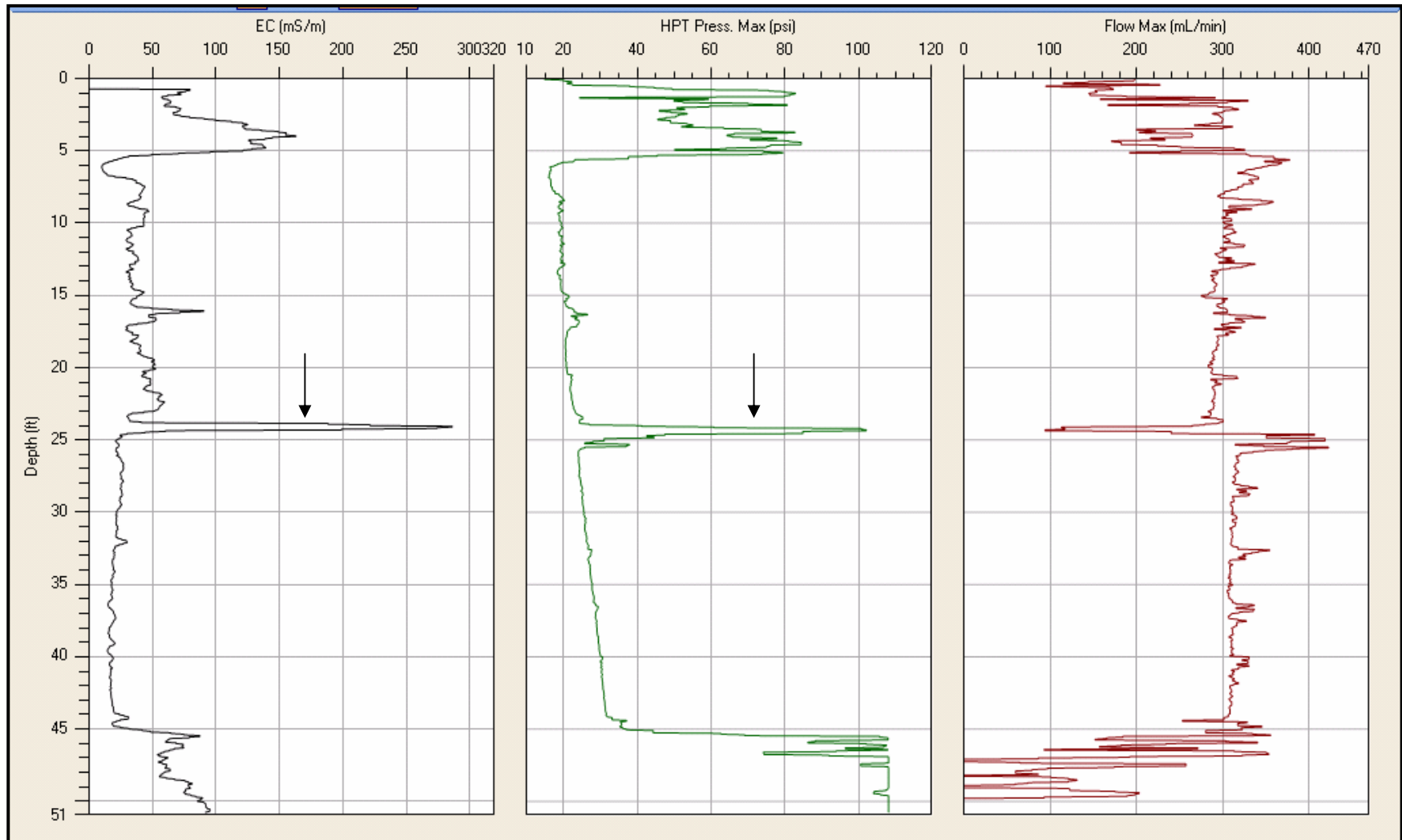
HPT Pressure (kPa)



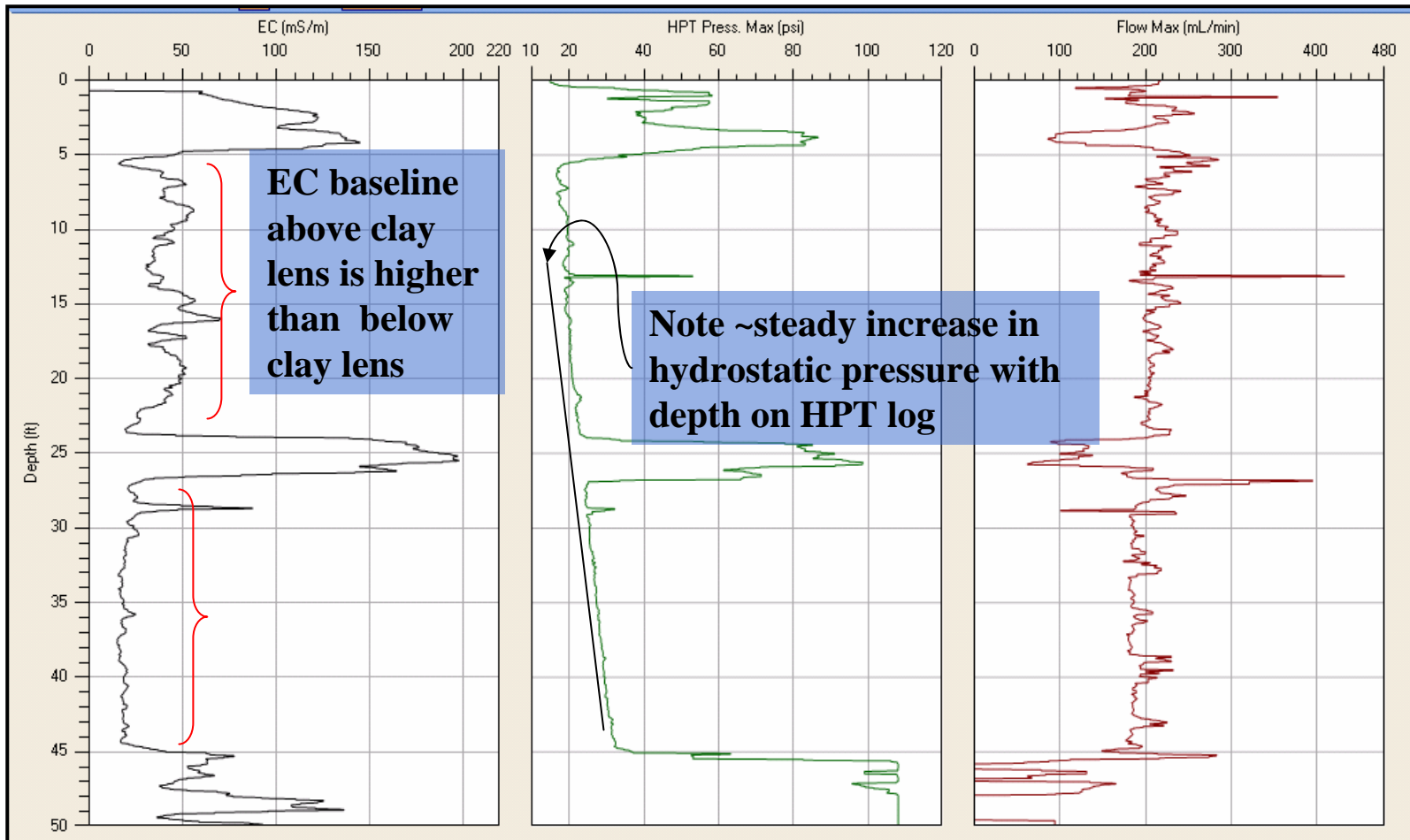
Mitchell, KS

HPT04 - EC and HPT Pressure - Mitchell, KS - 10.11.06

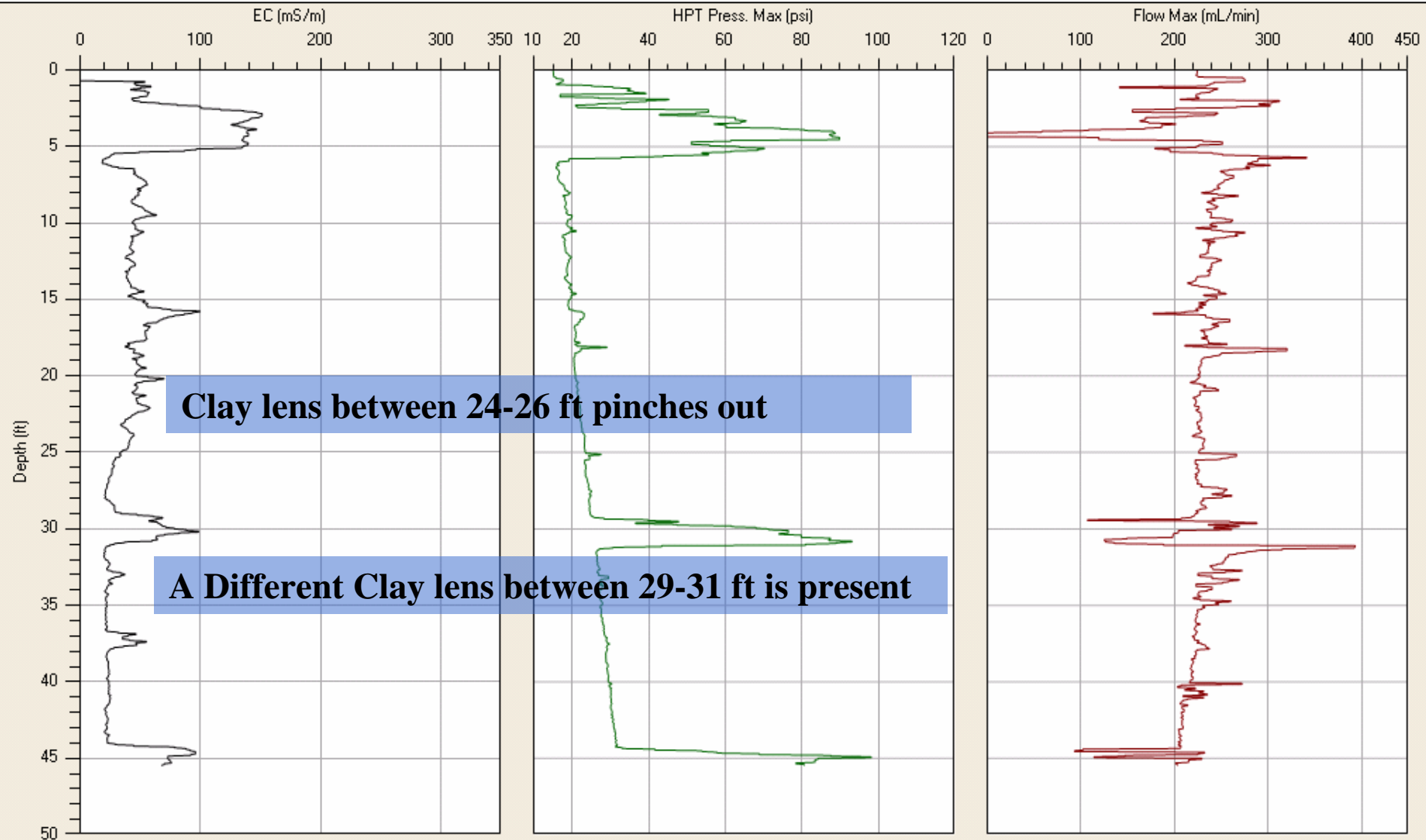




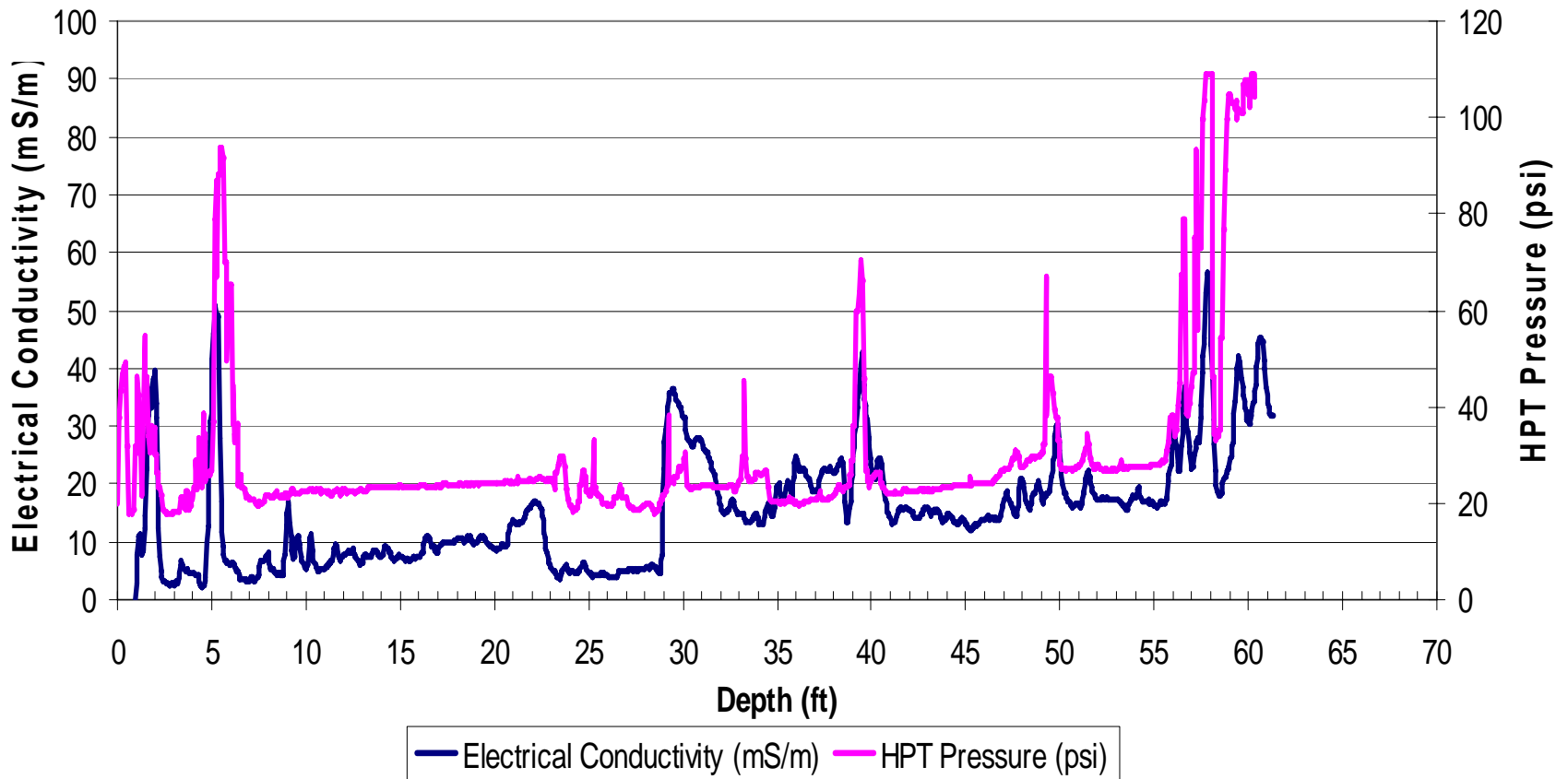
Location HPT1: Moderately high EC and pressure suggest fine grained soils to about 5 feet. Lower EC & Pressure indicate mostly coarse grained materials to about 45ft. Spike between 24-25ft indicates clay rich lens.



Location HPT2: Similar to first log but note clay lens near 25ft depth is thicker. Local bedrock was encountered at about 45ft in each log and evaluation of samples and local geology map indicate it may be weathered Niobrara chalk.



KDHE3 - 5th and Pine - Salina, KS - 4/11/06

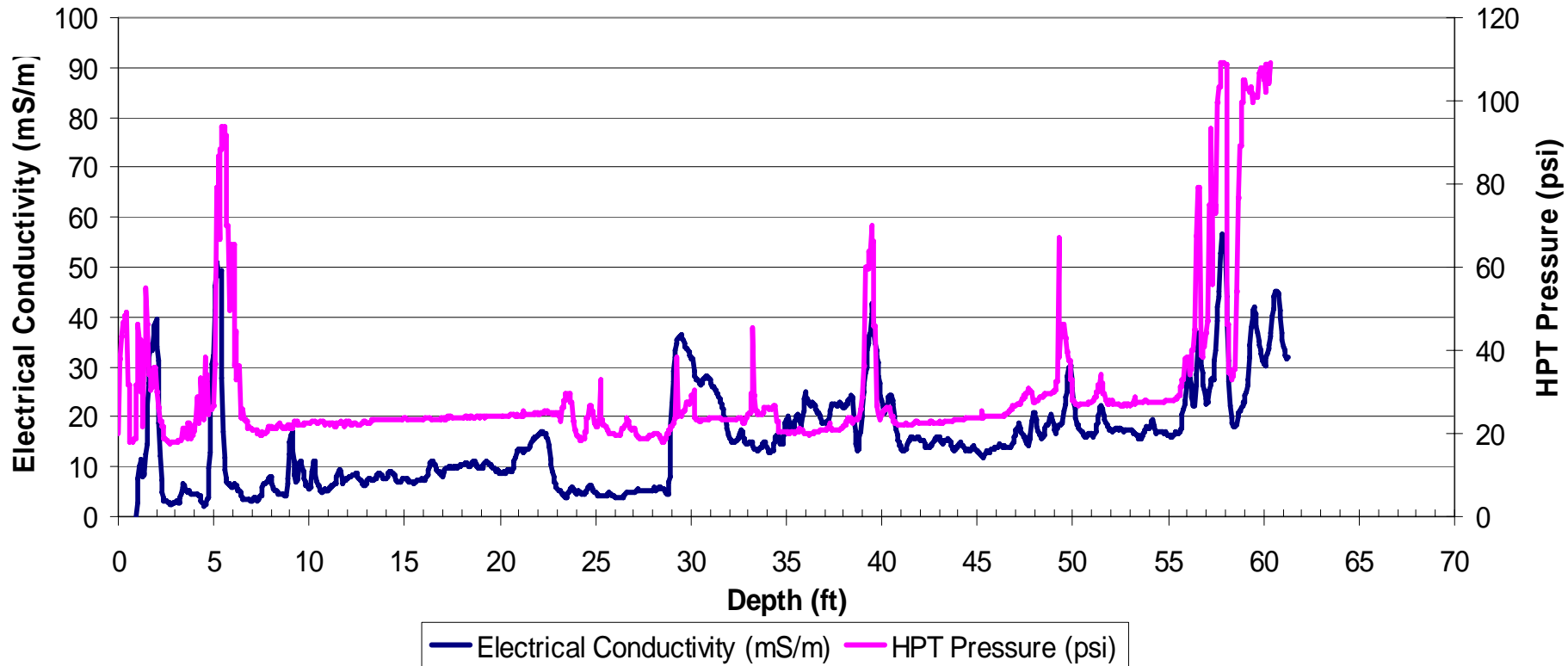


Direct Push (DT325 Dual Tube) Soil Sampling System used on this project



40' BGS

KDHE3 - 5th and Pine - Salina, KS - 4/11/06

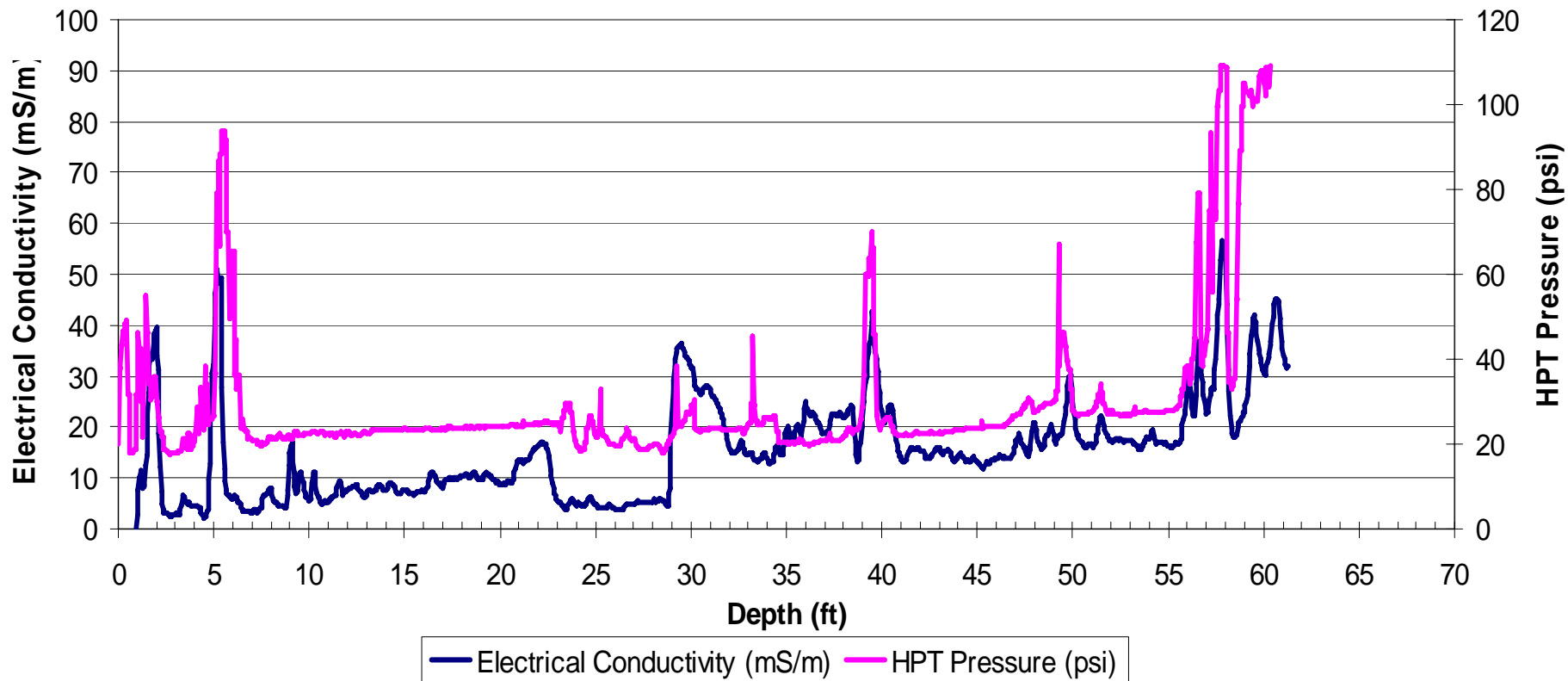


40' BGS (SS)



45' BGS

KDHE3 - 5th and Pine - Salina, KS - 4/11/06

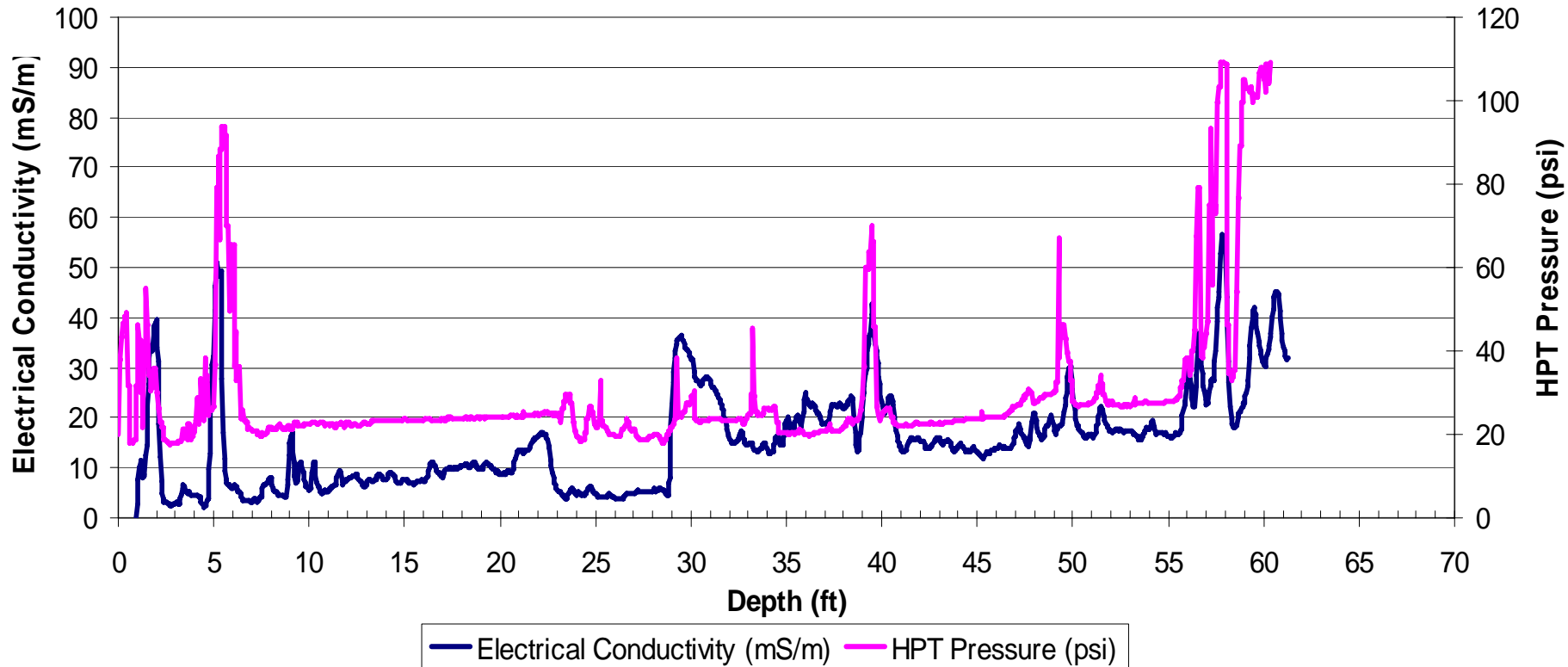


45' BGS (SS)



50' BGS

KDHE3 - 5th and Pine - Salina, KS - 4/11/06

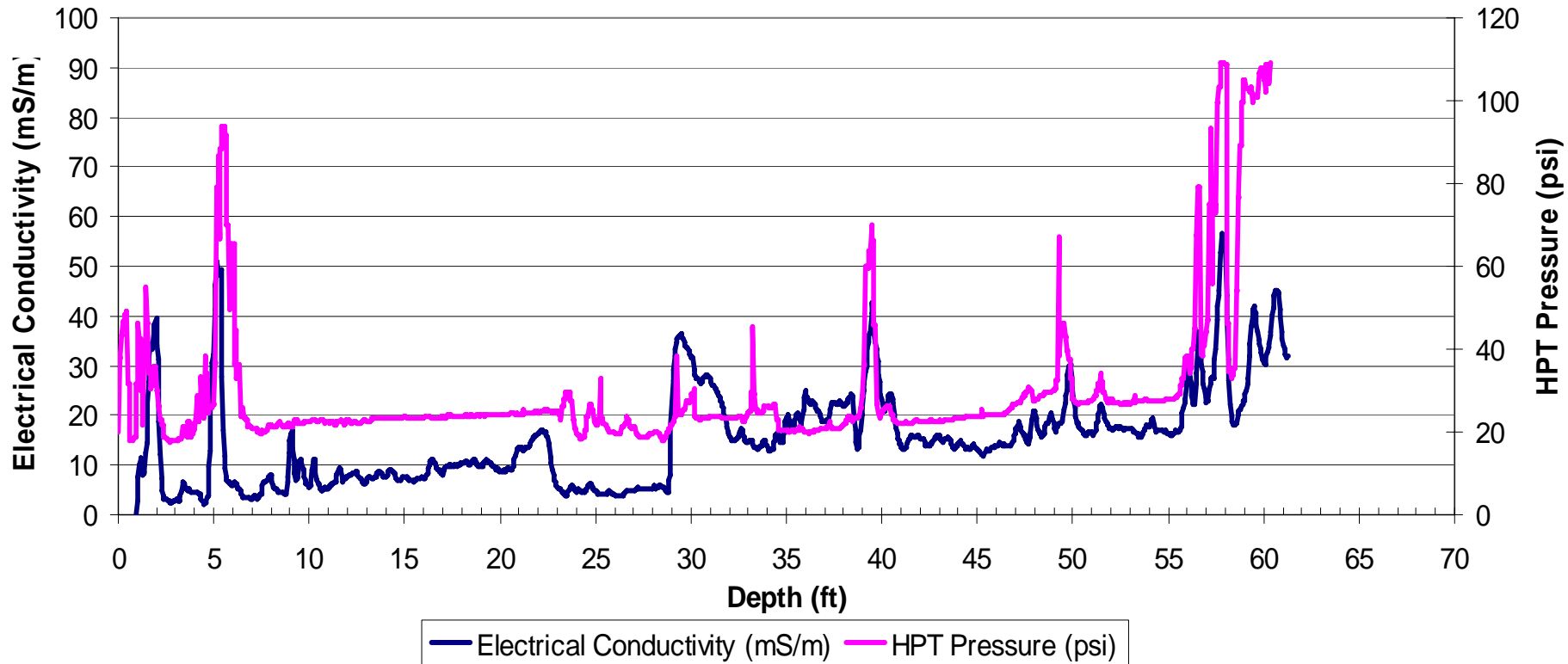


50' BGS (SS)



55' & 65' BGS

KDHE3 - 5th and Pine - Salina, KS - 4/11/06



55' BGS (SS)



65' BGS (SS)



General Summary and Conclusions

- HPT/EC Probe records the site lithology and shows subsurface pathways in real-time.
- The soil cores were used to confirm the lithology recorded by the EC and HPT data.
- MIP data shows the position of chlorinated contaminants
- MIP indicates chlorinated contamination zones from 35 to 60'.
- The MIP results were confirmed by the laboratory data.

