



Geotechnical Geophysics for Transportation Projects

*Presented by: Jorgen Bergstrom, GEL Solutions, LLC
jorgen.bergstrom@gel.com*





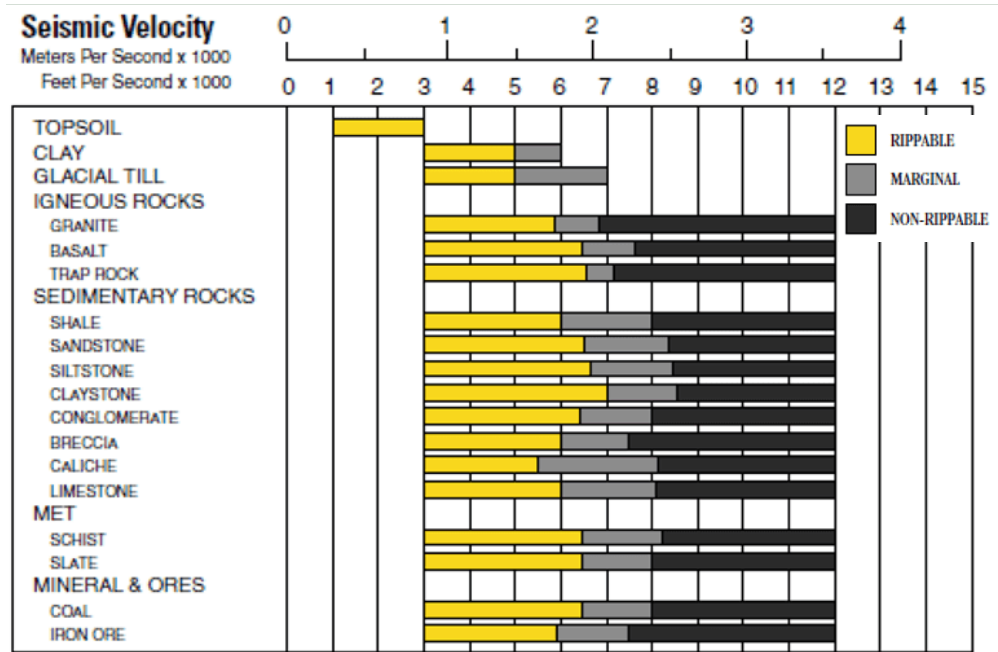
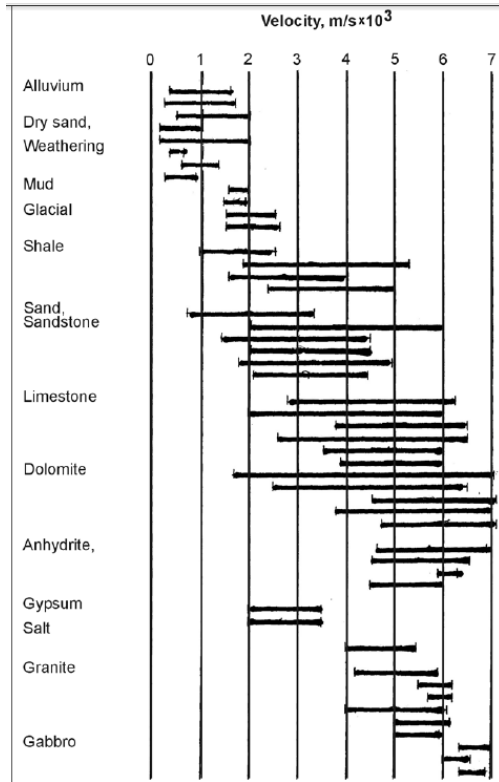
- Geotechnical geophysics is used to evaluate natural and artificial foundation conditions through applied geophysical techniques
- The most common methods used by transportation agencies are seismic and ground penetrating radar
- The most common applications are:
 - Bedrock mapping (depth, rippability)
 - Subsidence investigations (loose material, voids and sinkholes)
- Geophysical methods works best in tandem with a boring program and can fill the gap between borings, determine suitable boring locations, and determine where boring data may be inaccurate



Seismic Methods

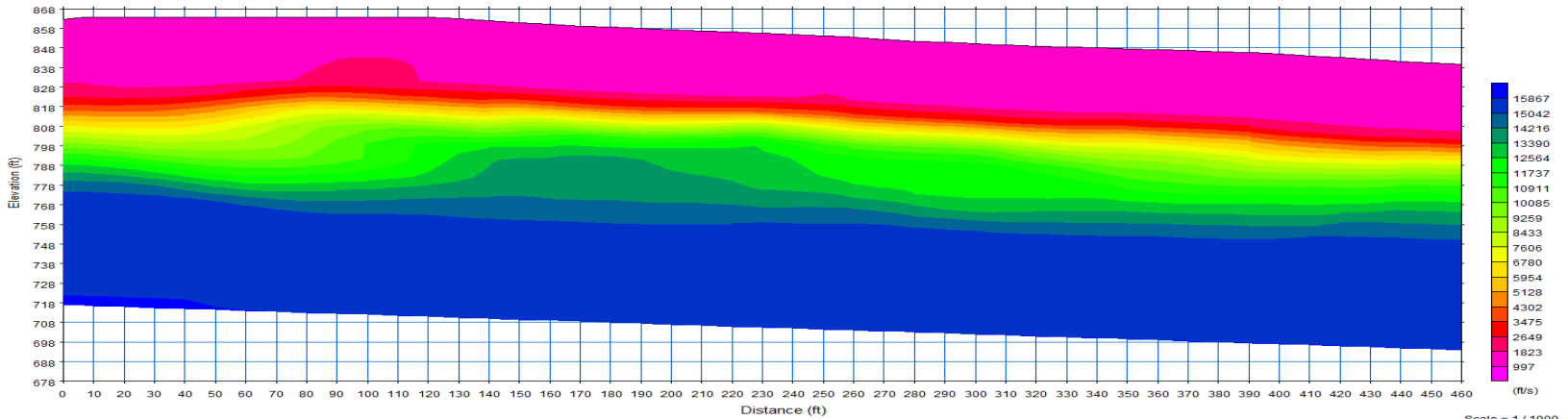
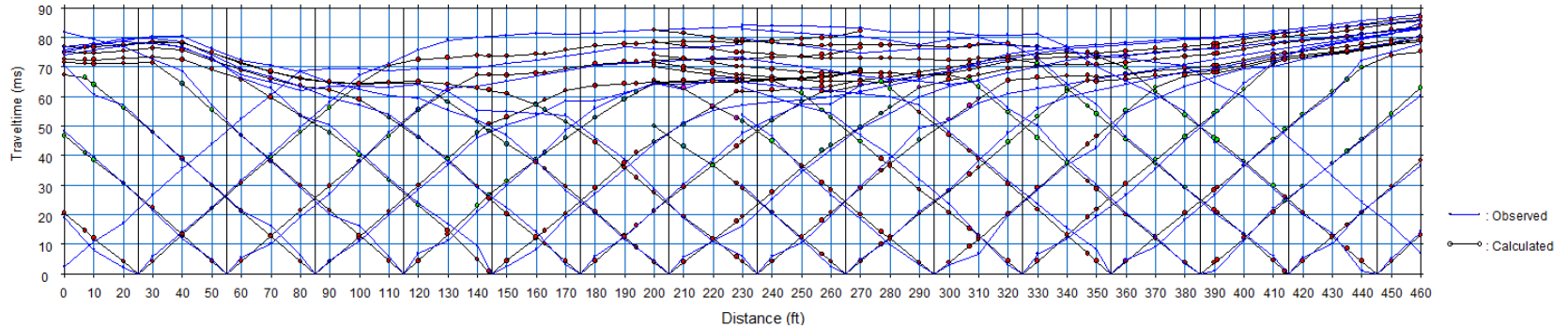


Seismic Compressional Wave Velocity of Geological Materials

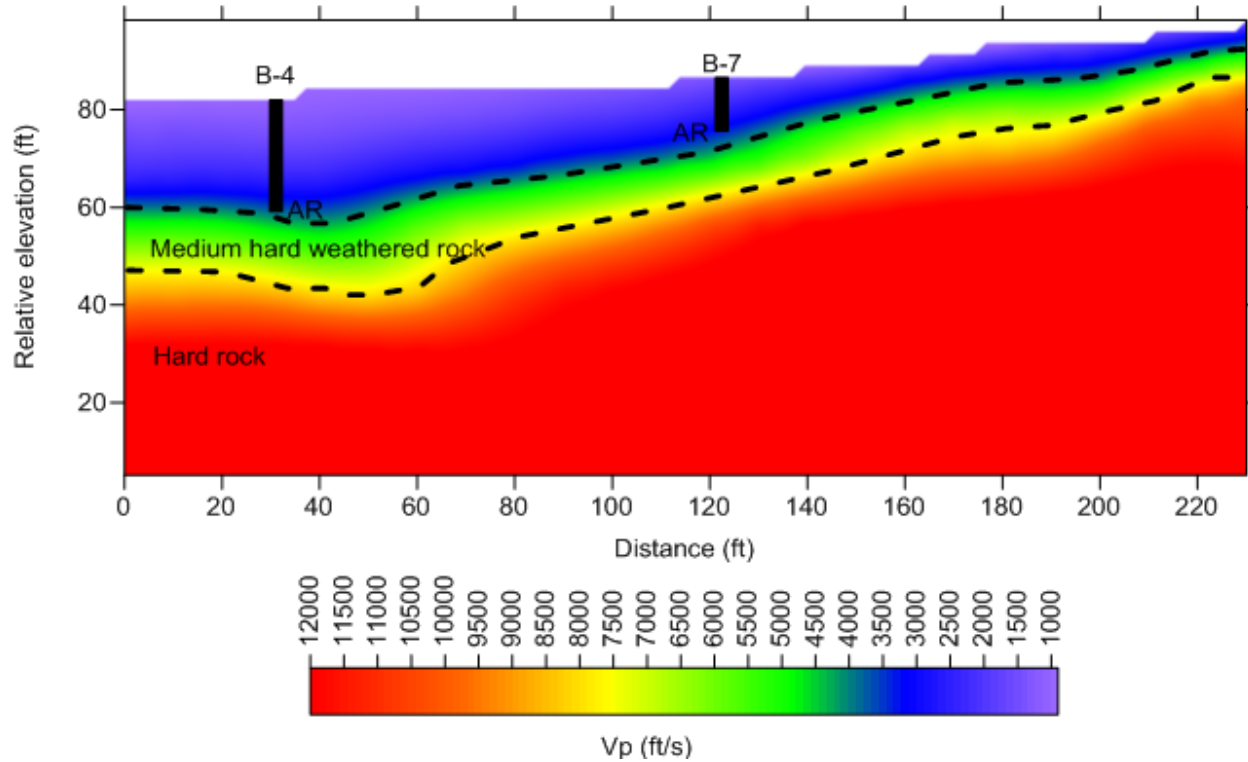




Seismic refraction data inversion

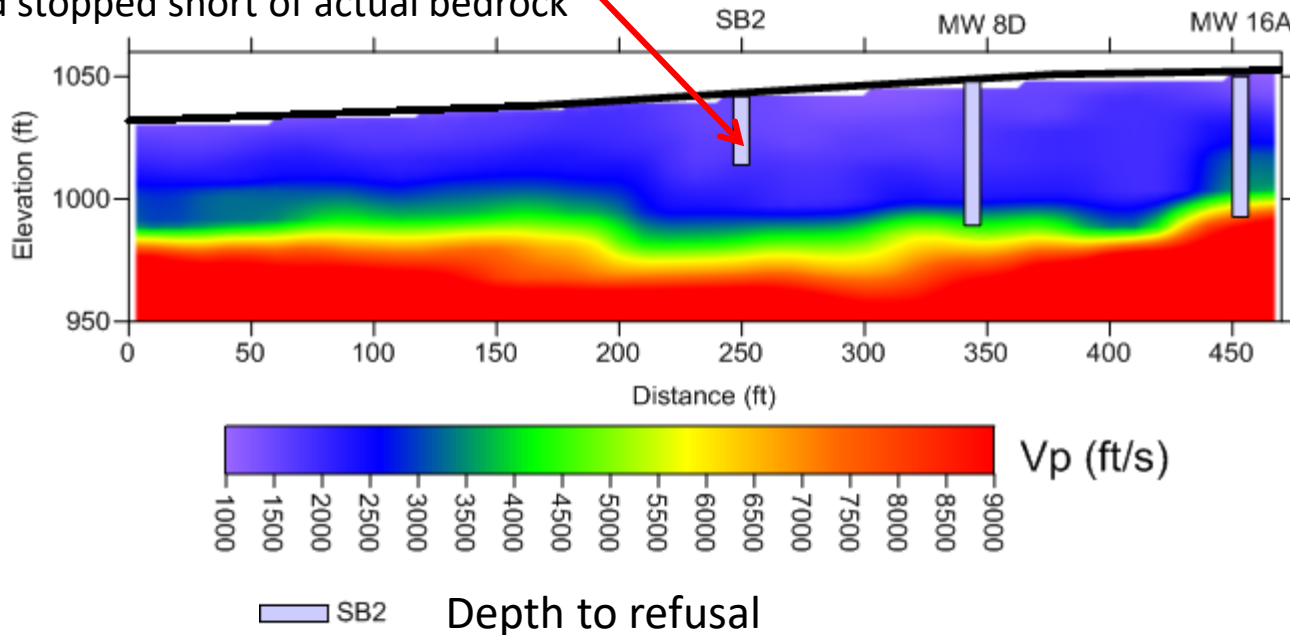


Refraction Seismic - correlation with borings



Refraction Seismic - correlation with borings

SB2 possibly hit large boulder and stopped short of actual bedrock



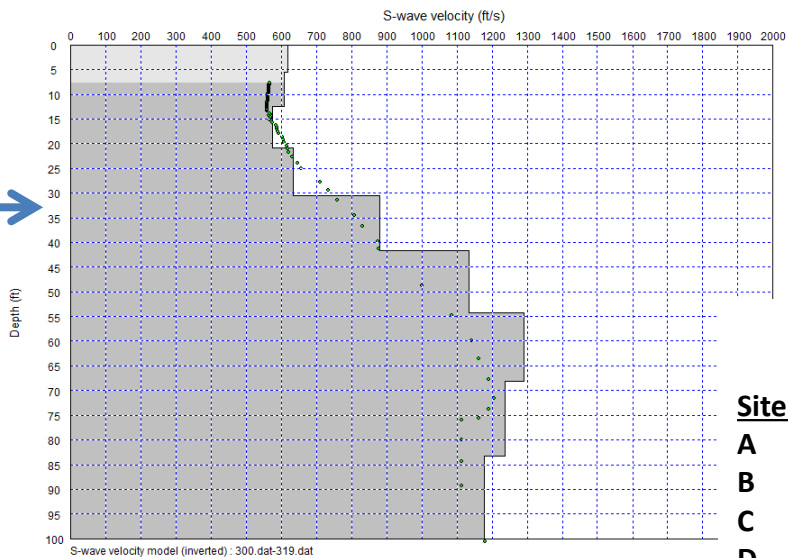
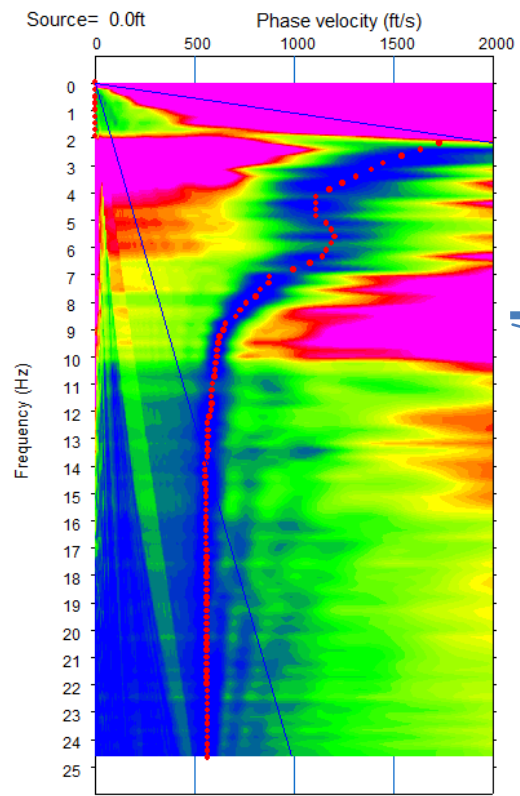


1D Multichannel Analysis of Surface Waves (MASW)



Solutions LLC

Vs 30m / Vs 100ft for IBC and ASCE Seismic Site Classification



Site Class D

Site Class	Vs 100 (ft/s)
A	> 5,000
B	2,500-5000
C	1,200-2,500
D	600-1,200
E	<600

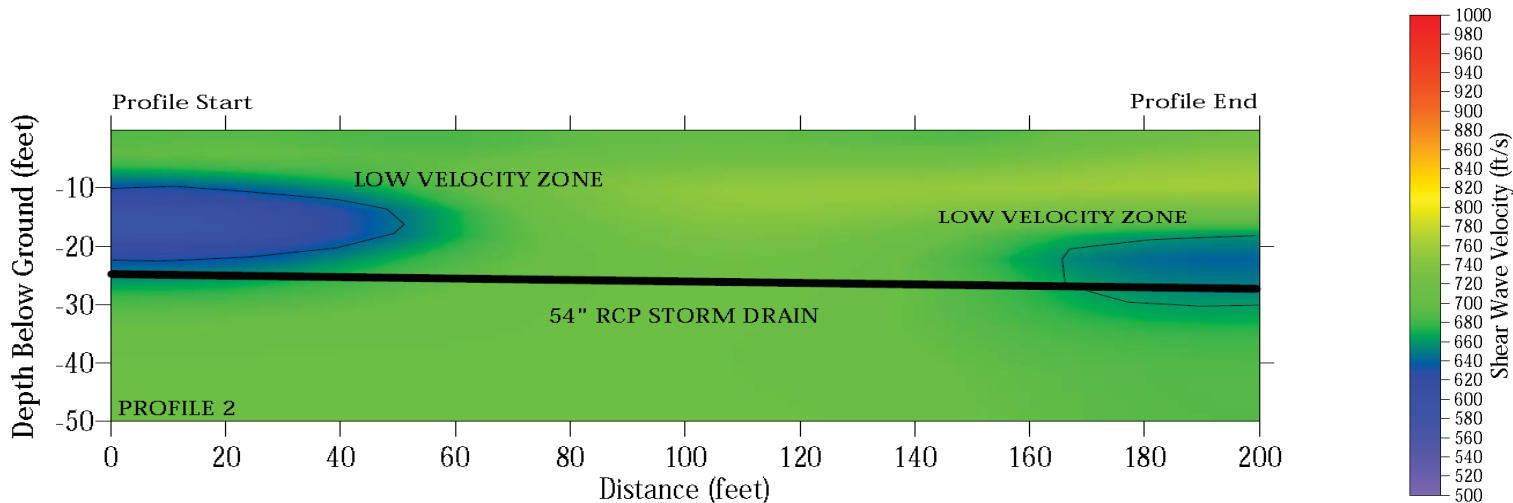


2D Multichannel Analysis of Surface Waves (MASW)



Solutions LLC

Good seismic method for mapping potential loose materials and voids

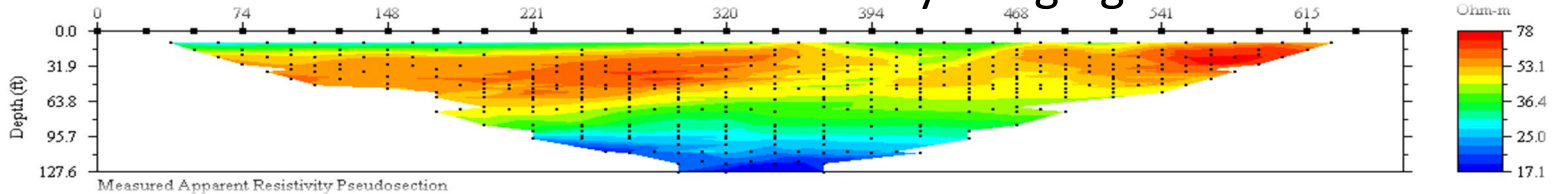


Electrical Resistivity Imaging

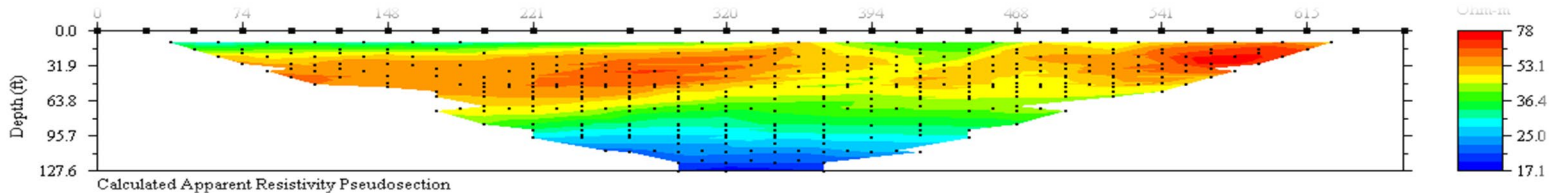




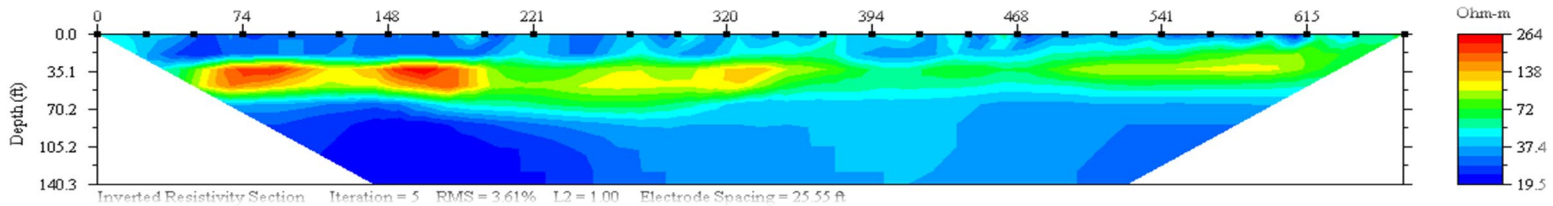
Electrical Resistivity Imaging



Observed Data

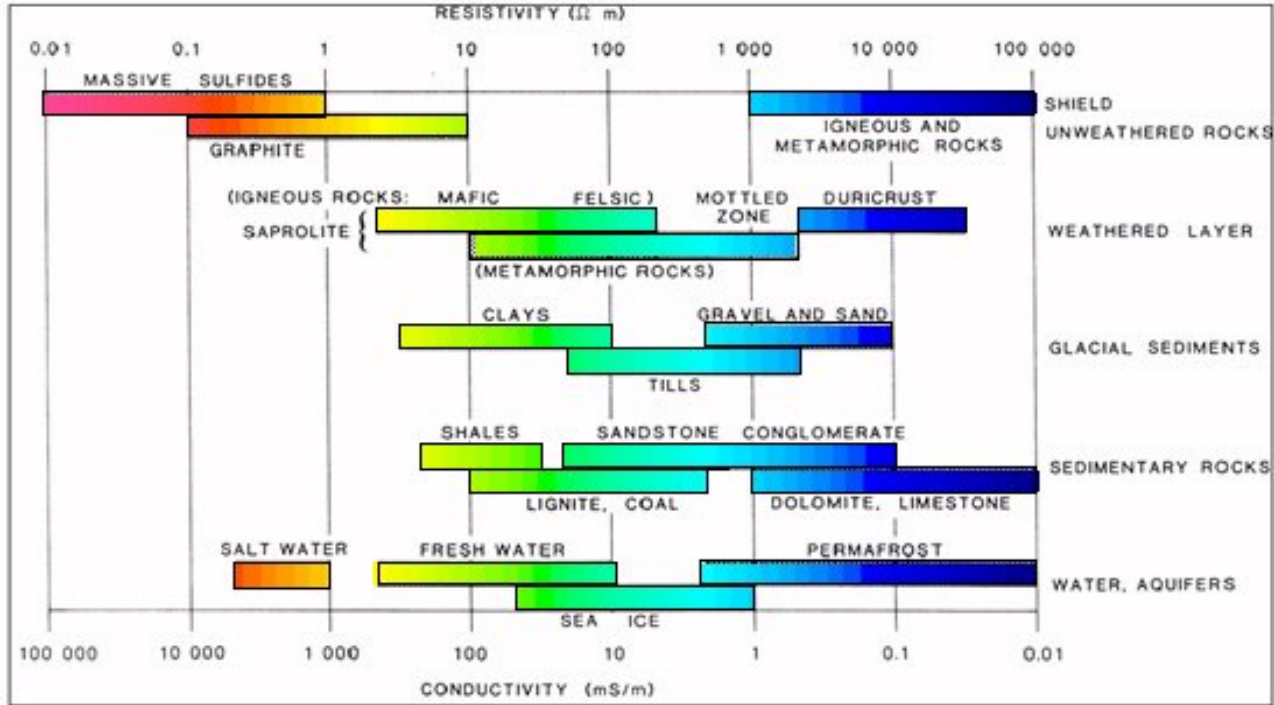


Back-calculated data from inverted model



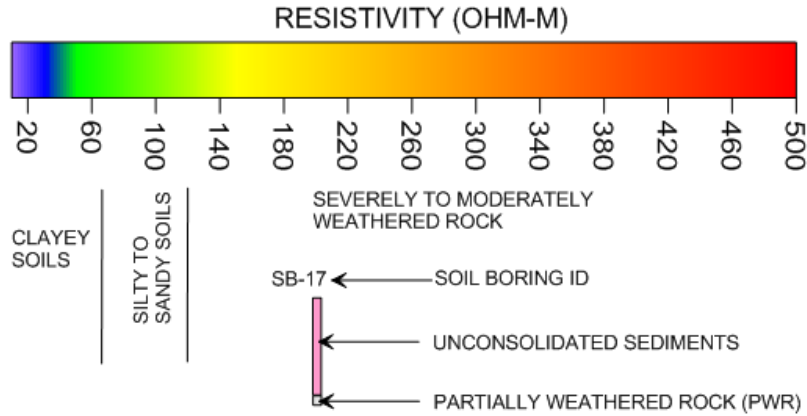
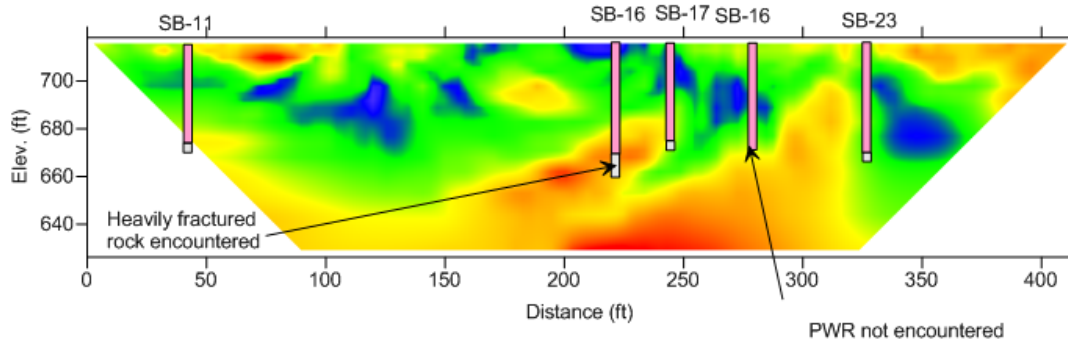
Inverted Model

Electrical Resistivity of Geological Materials





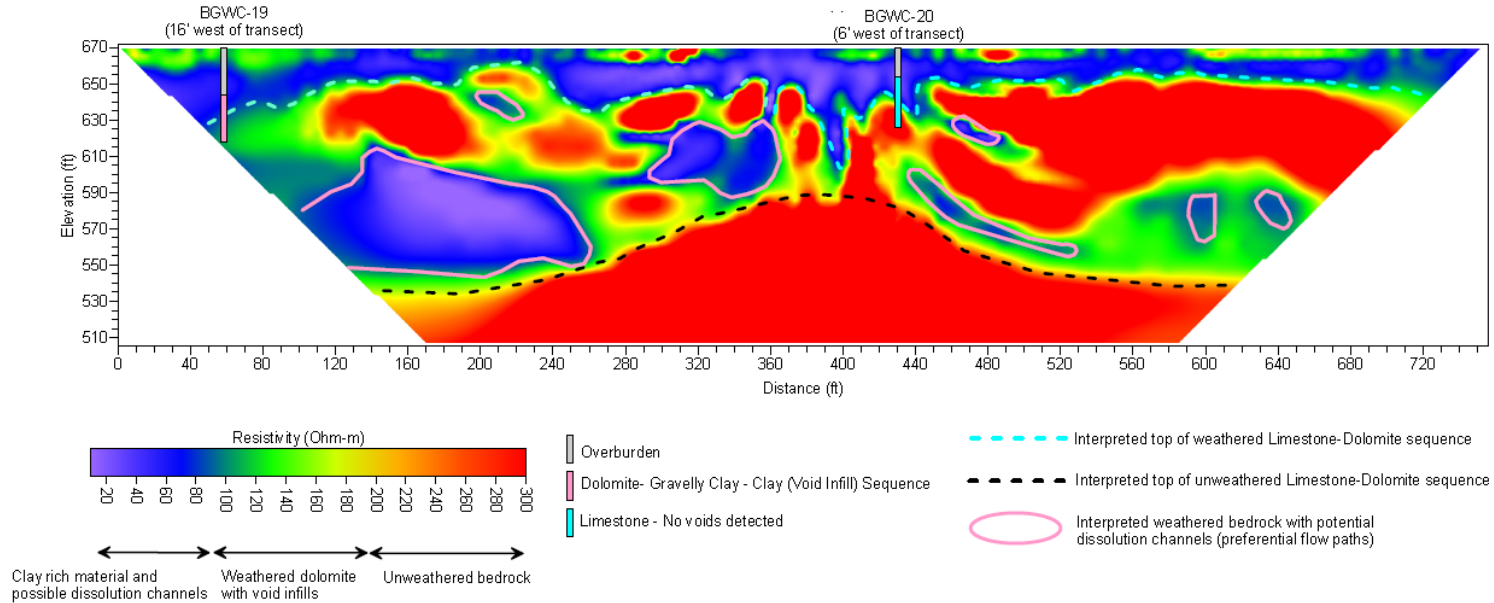
Bedrock mapping with Electrical Resistivity Imaging



The bedrock surface in the Piedmont Geological Province can be quite erratic and often exhibits various degree of weathering

Limestone bedrock with dissolution channels

ERI data used to guide future drilling

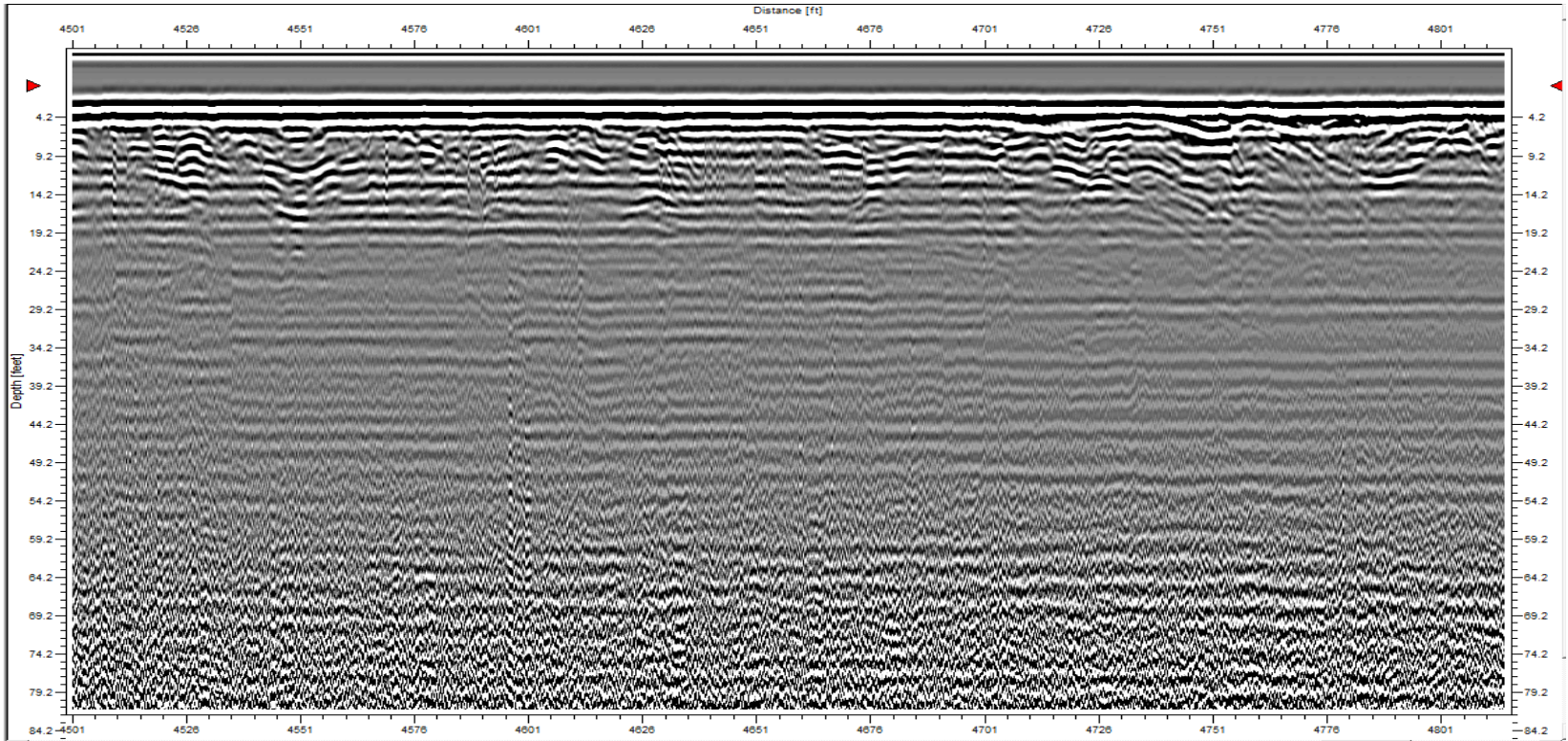




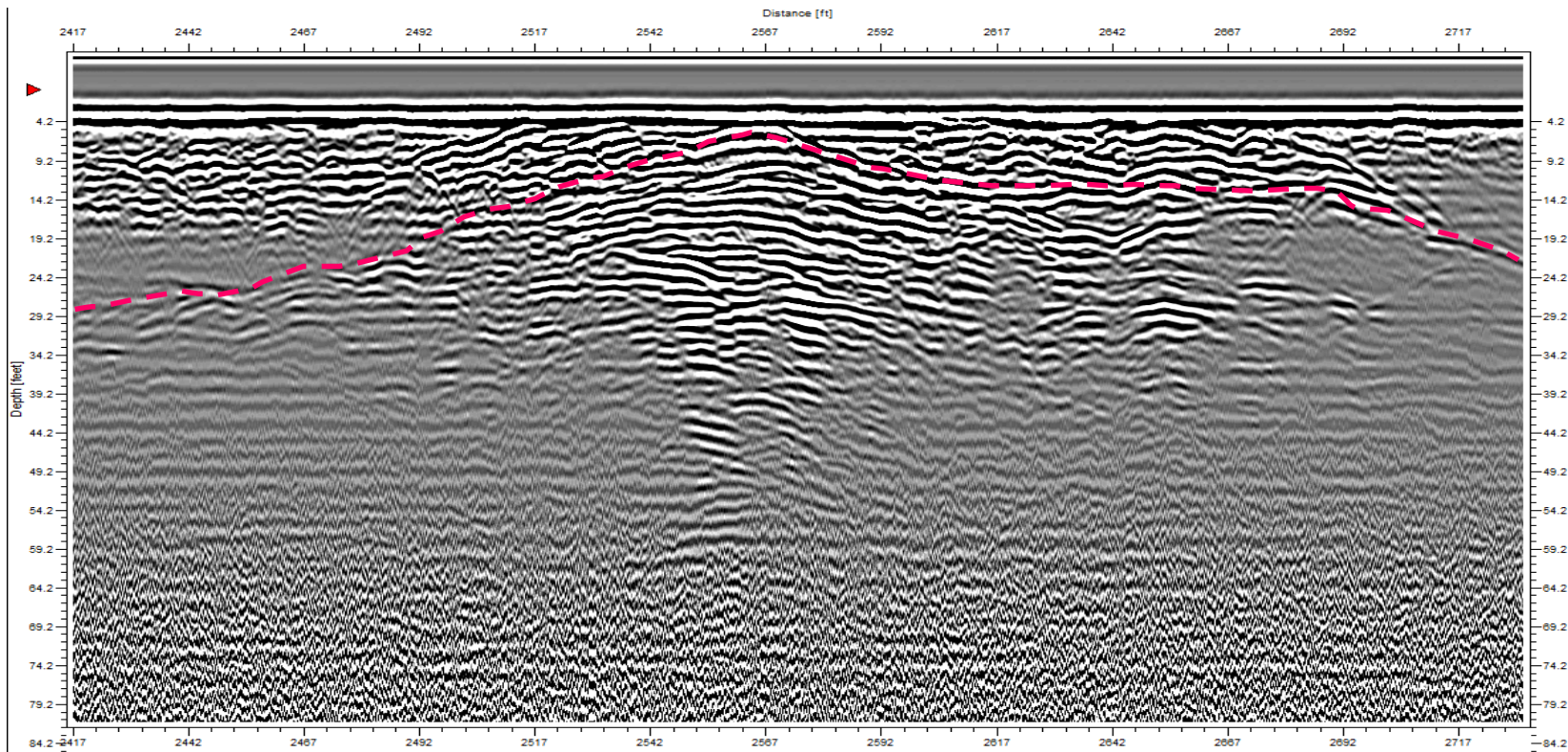
Bedrock mapping with low frequency Ground Penetrating Radar



Clayey/silty overburden detected to 15 feet. No rock detected

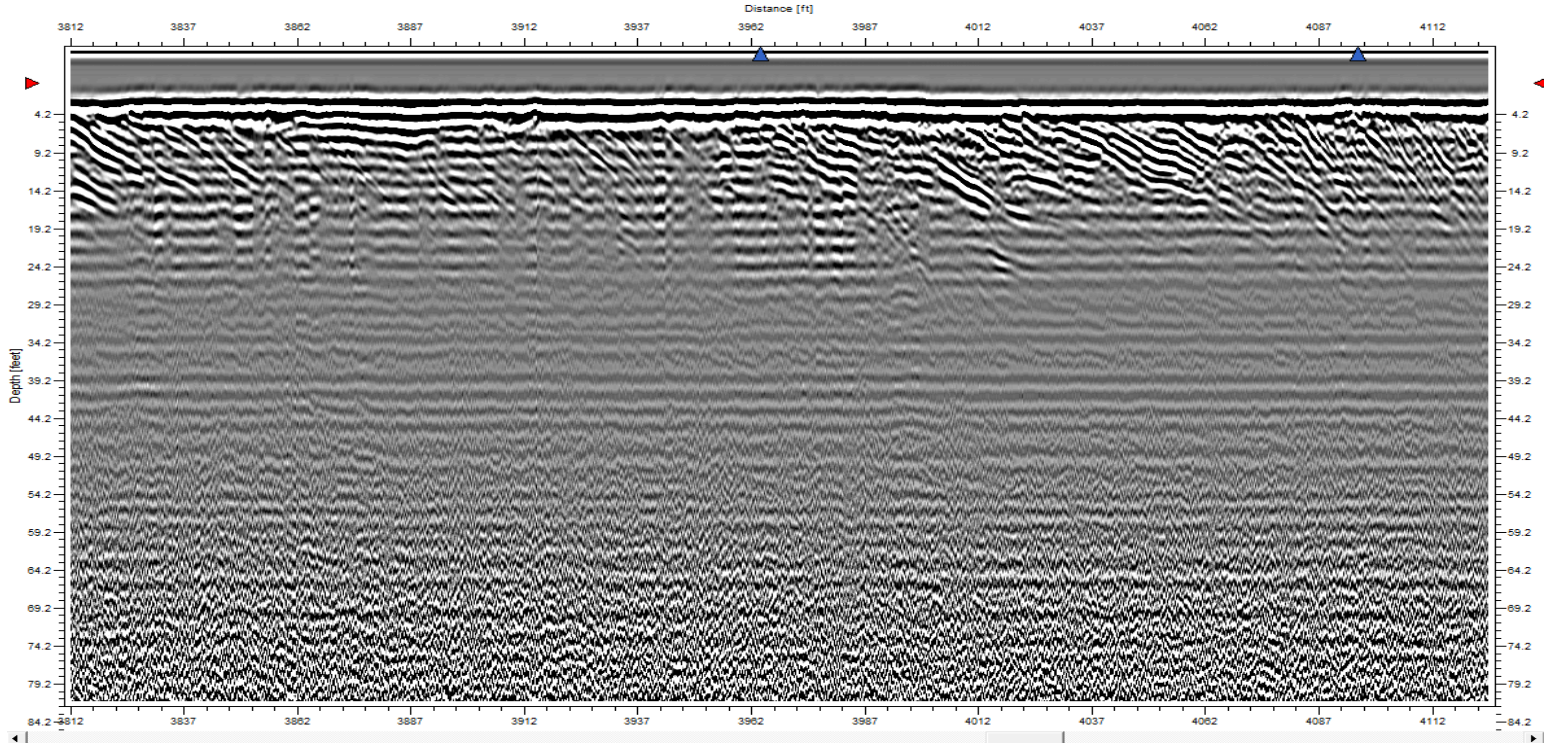


Hard (unweathered) rock detected 5-30 feet deep

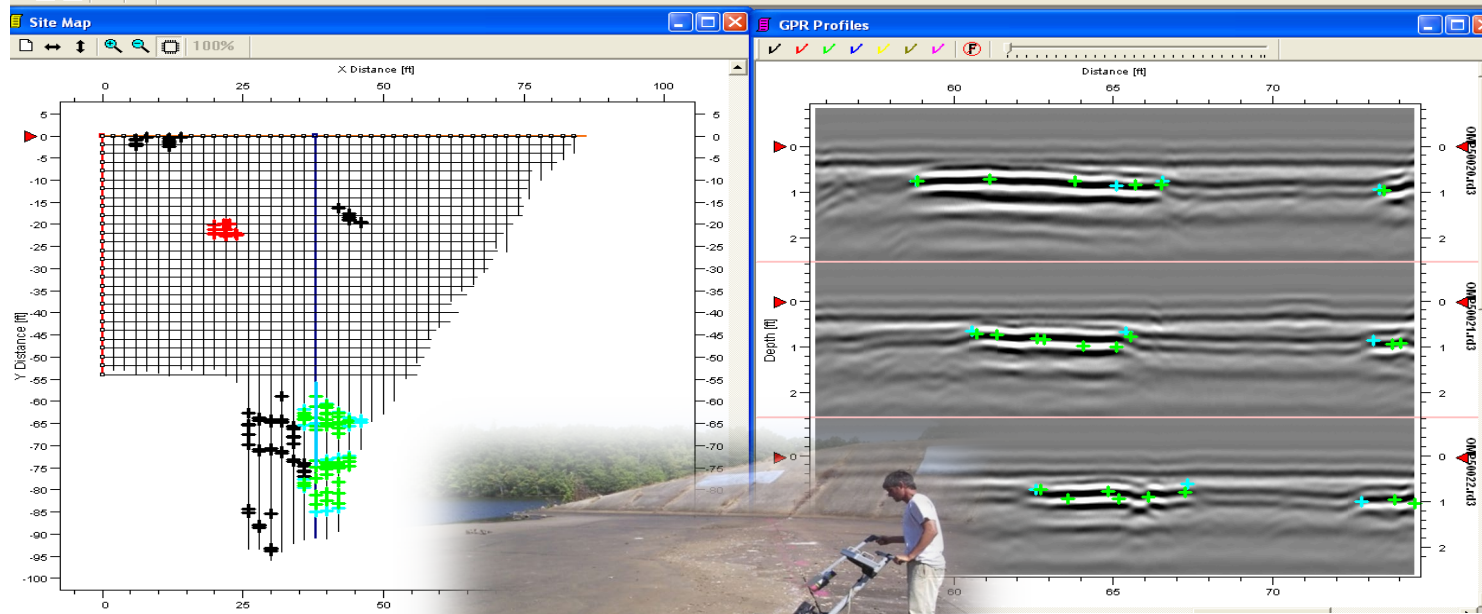




Shallow saprolite or partially weathered rock detected.



GPR for Void Detection





3D GPR Array (Raptor) 18-channel GPR system





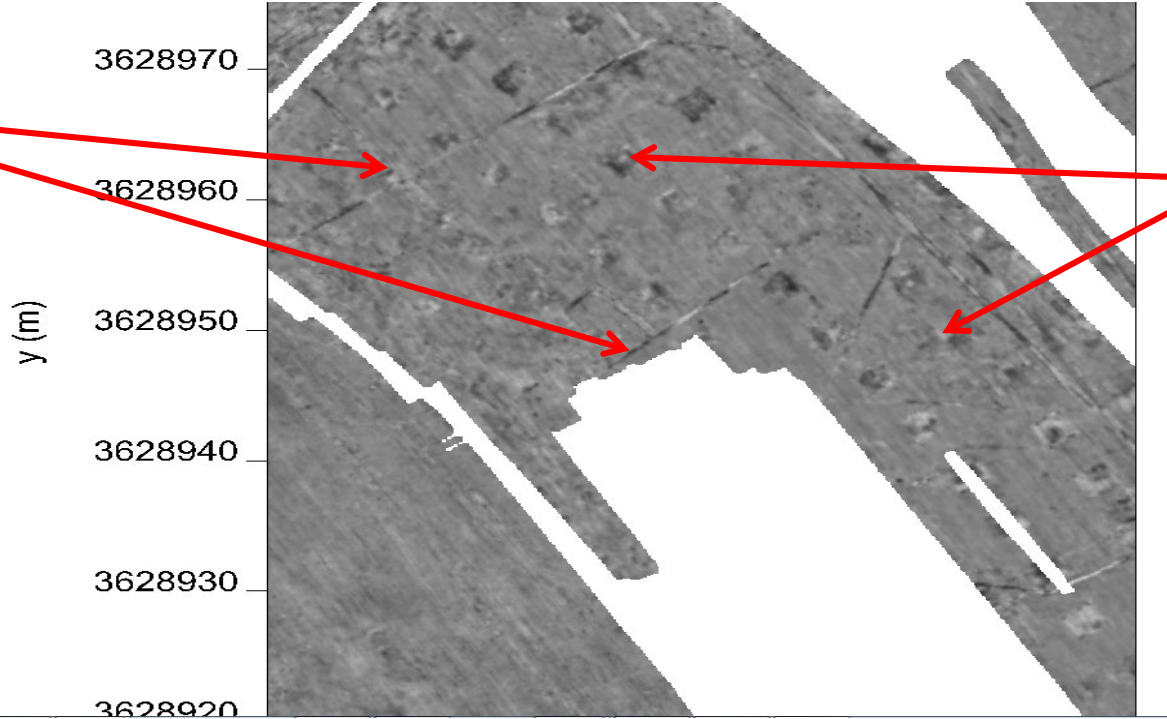
3D GPR Array (Raptor) Collecting Data





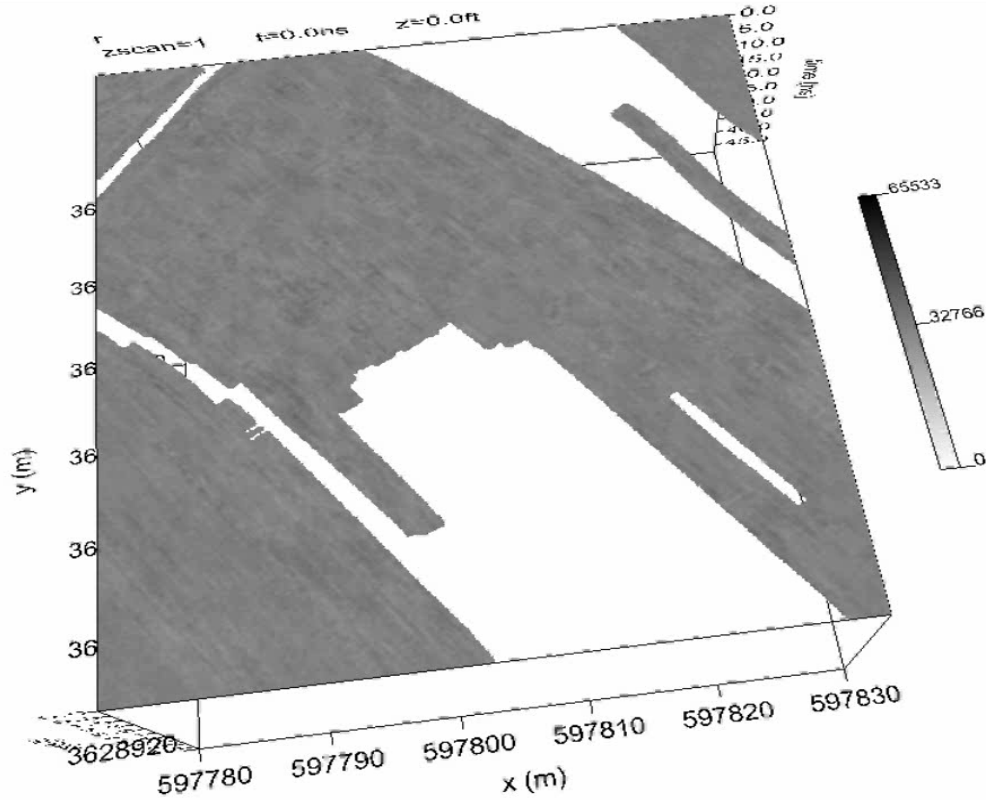
3D GPR Imaging

Buried
Utilities



Buried
Concrete
Structures

GPR Slice at 2.5 feet
below ground surface

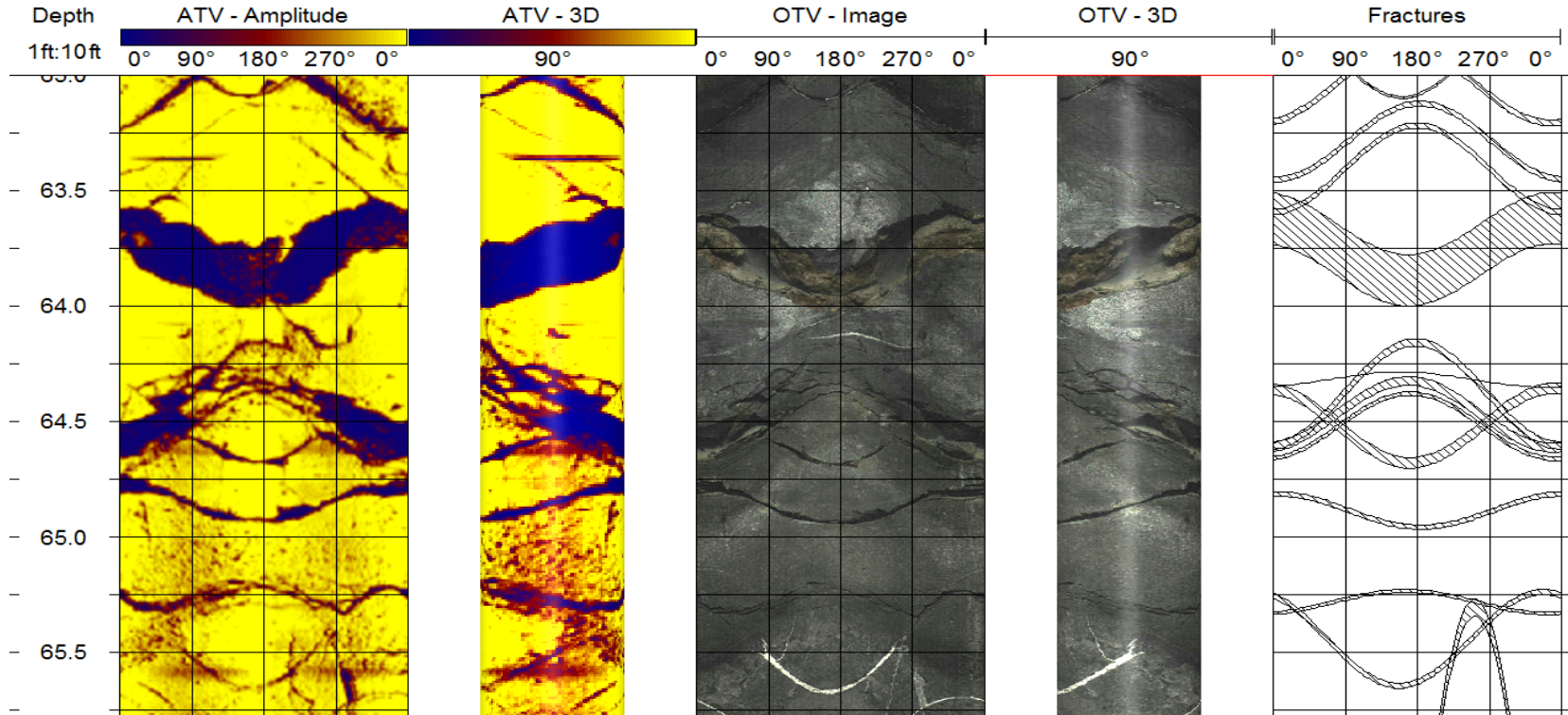




Geophysical Borehole Logging



Acoustic and Optical Televiewer



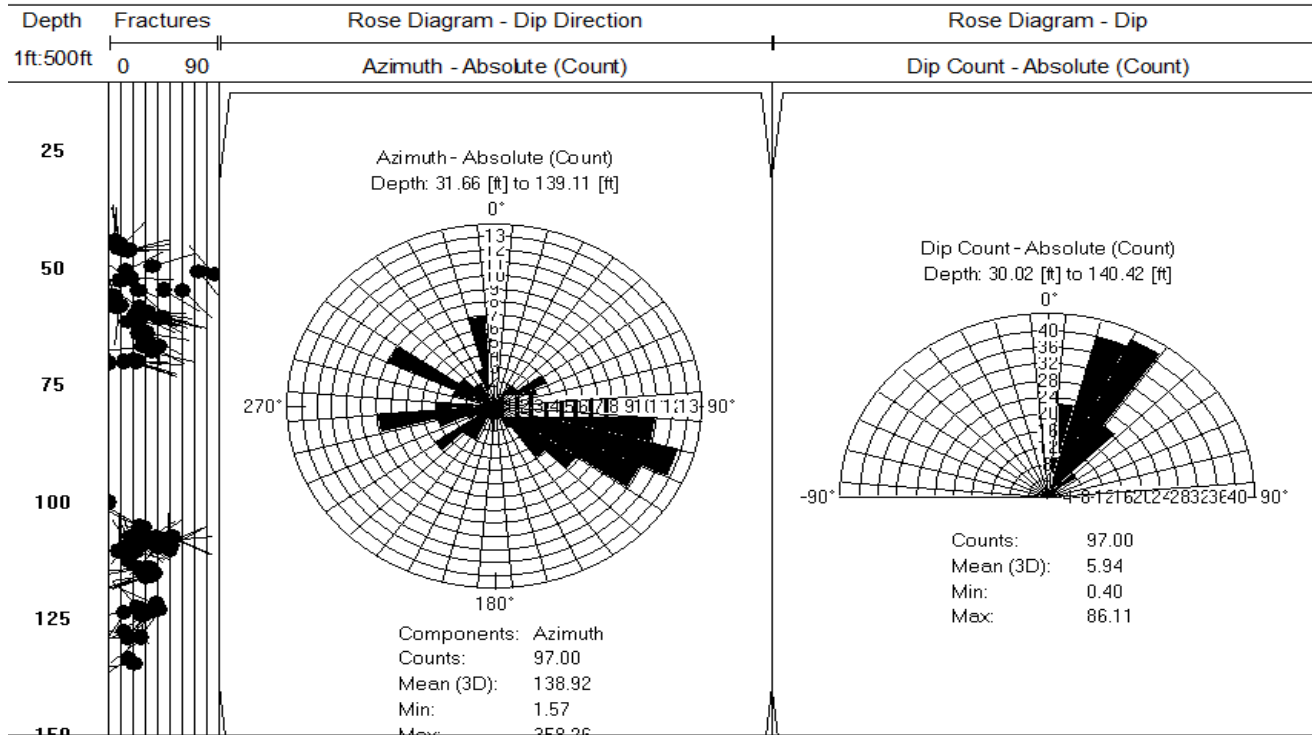


Borehole Logging



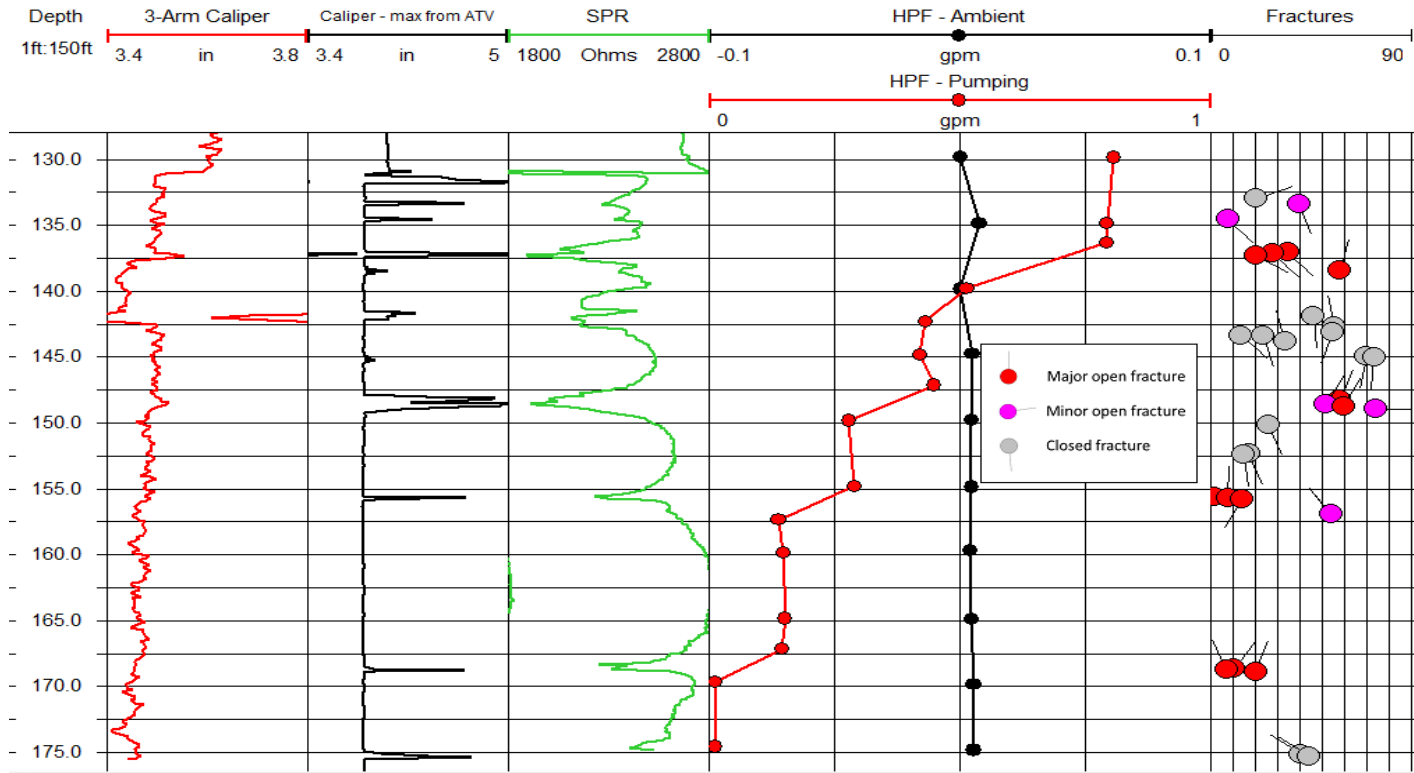
Solutions LLC

Fracture orientations (corrected for borehole deviation)





Geophysical Borehole Logging - Interpretations





Geotechnical Geophysics for Transportation Projects

*Presented by: Jorgen Bergstrom, GEL Solutions, LLC
jorgen.bergstrom@gel.com*

Thank You

