US

Characterization of Vertical Migration of PCE in a Granitic Aquifer Using Specialty Surface Geophysics

Todd Halihan^{1,2}, Stuart McDonald² (Oklahoma State University, Stillwater, Oklahoma, USA¹, Aestus, LLC, Loveland, Colorado, USA²)



Deformation Band

(sand & gravel seam within granite)

Legend

Source Area

Building Outline

Survey™ Data

No competent bedrock

observed in this zone

Competent Bedrock Surface

Modeled from GeoTrax Survey™ Data

PCE (µg/L)

www.aestusllc.com, info@aestusllc.com

Site Challenges and Ultra HRSC Approach

A significant number of industrial facilities have had releases of perchloroethylene (PCE) in hard rock aquifers. These locations are difficult to investigate as porous media concepts for site characterization are often inappropriate.

A specialty surface electrical resistivity method (Aestus GeoTrax Survey™) has been shown to detect PCE in sand aquifers, but it was unclear if the method could detect changes induced by PCE in electrically resistive granitic aquifers. The selected study site is an industrial facility in New England (USA) with a very thin soil zone underlain by a granitic fracture aquifer.

It was impacted by PCE at concentrations up to 100 parts per million (ppm) at depths up to 30 feet below ground surface (BGS). This study evaluated the use of this subsurface mapping technique to assess fracture mapping and direct detection of PCE distribution in the subsurface. Aestus GeoTrax CSM+™ conceptual site model development process with integrated ultra-high resolution site characterization (HRSC) specialty subsurface scanning (Aestus GeoTrax Survey™) was selected to help answer these questions.

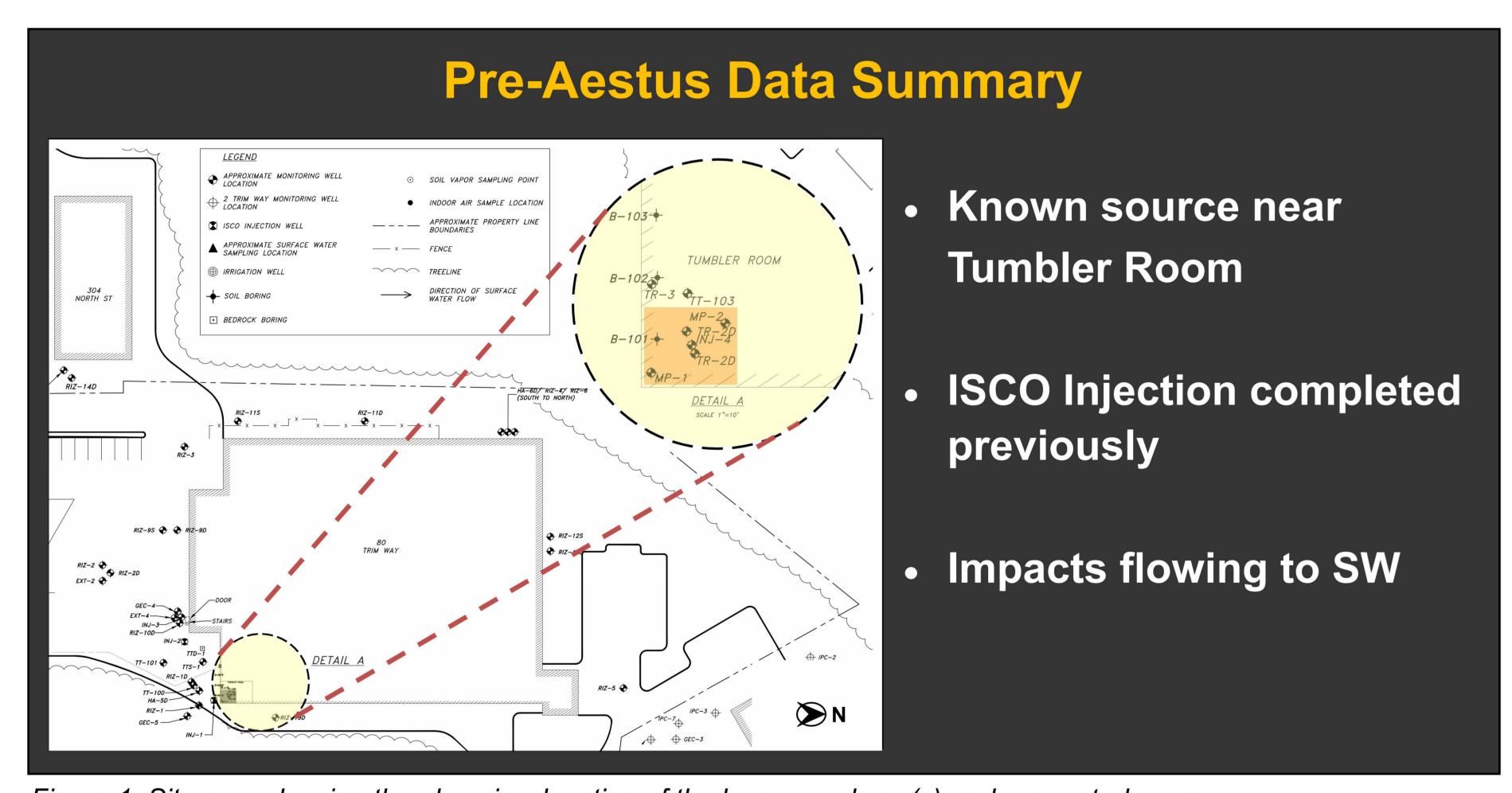
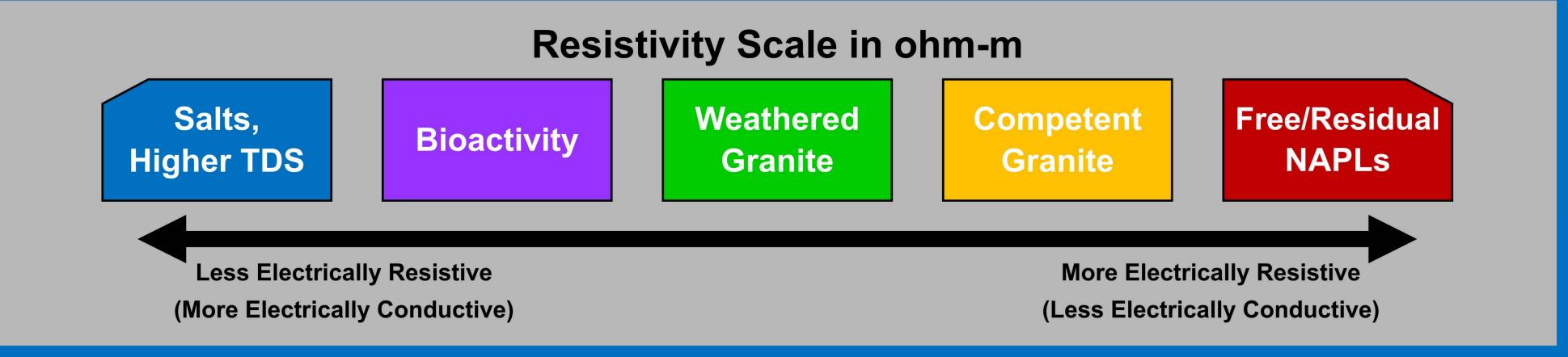


Figure 1. Site map showing the plan view location of the benzene plume(s) and suspected source.



Figure 2. Site photos showing the collection of GeoTrax Survey™ data

Electrical Imaging Data Interpretation



3-STEP BUILD PROCESS: Ultra High Data Density Conceptual Site Model (GeoTrax CSM+™)

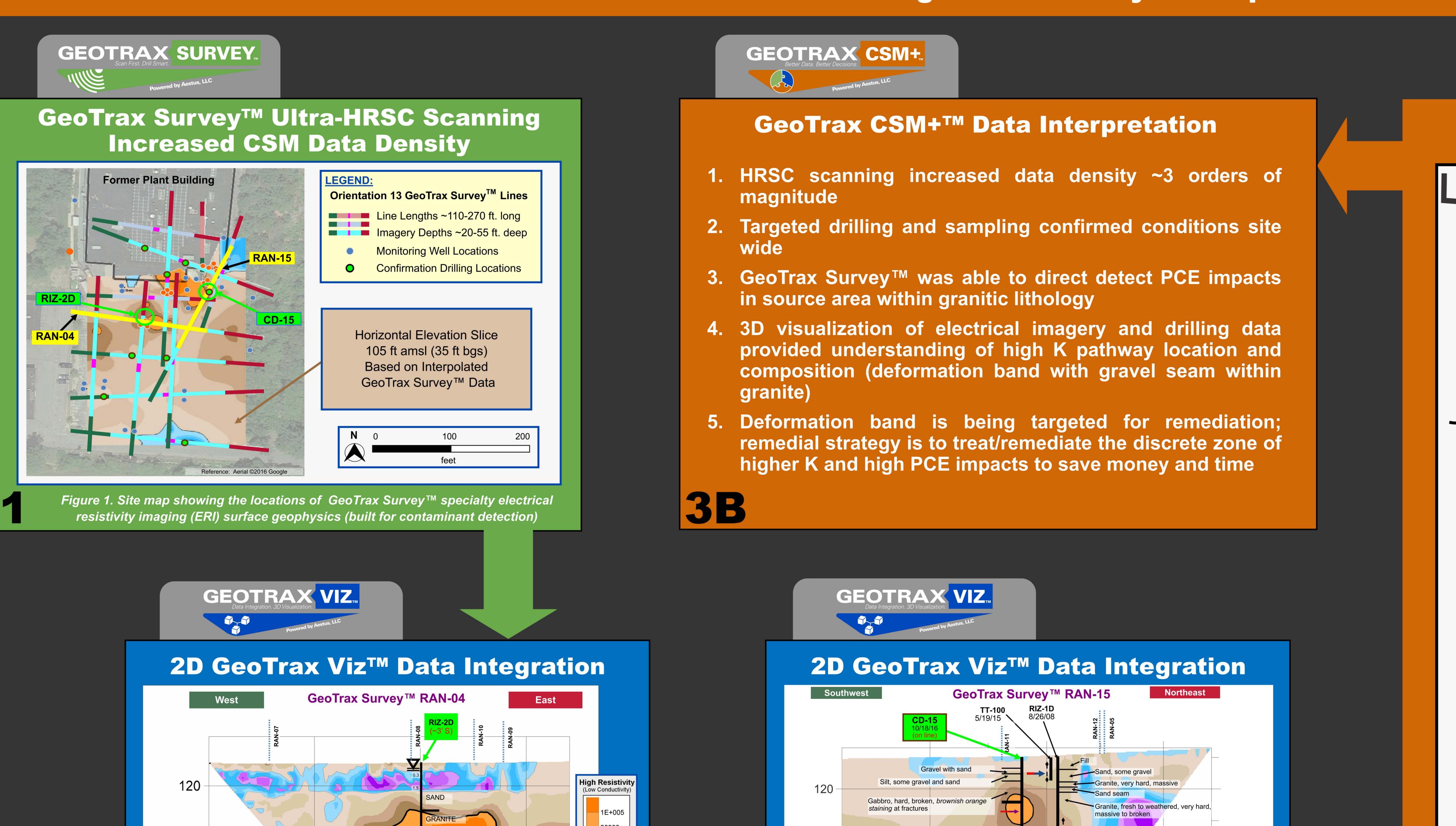
GEOTRAX CSM+

RIZ-9D

PCE > 1,000 ug/L

3D GeoTrax CSM+ Data Interpretation

Figure 4: Confirmation drilling of most anomalous GeoTrax zones yielded conclusion of discrete LNAPL targets



Acknowledgements

Distance (ft)

GeoTrax Survey™ Image RAN-04 Confirmed
Distinct Geology and Impacted Zone at RIZ-2D

Low Resistivity
(High Conductivity)

We would like to thank Tetra Tech for providing the opportunity to assist in this environmental investigation, and also for performing field operations support and confirmation drilling data collection. Dr. Todd Halihan has a managed conflict of interest relative to his positions at Oklahoma State University and Aestus, LLC (based in Loveland, CO and with an office in Stillwater, Oklahoma) Copyright 2018 by Aestus, LLC. Reproduction and distribution in whole or in part without the written consent of Aestus, LLC is prohibited.

GABBRO and pink GRANITE, very hard, slight weathering broken to massive

Confirmation Drilling CD-15 on Image RAN-15

Confirmed Distinct Geology and Impacted Zone