Why Can't We Get Those Injection Wells Installed?

A Guide for Using Geophysics to Solve Your Problems

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Region 4 Scientific Support Section

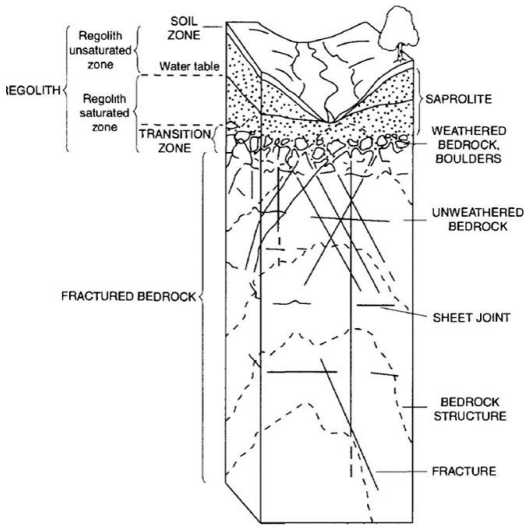
GMH Electronics in Roxboro, NC

- Small electronics manufacturer that was the back end of a building that was a gas station and convenience store at a country cross roads.
- Plumes: Solvent VOCs w/ 1,4-Dioxane in the back associated with septic disposal and petroleum in the front where the gas pumps were.
- First complaint - 1987 - gasoline in private well water
- 2009 IROD for water line to replace the private wells
- 2014 ROD selected Soil Vapor Extraction and In Situ Chemical reduction for the solvent source area.
  - "ISCR can be applied as an injectable element into the overlying regolith and into the bedrock aquifer through DPT injections and injection wells."

Putting waste solvents into the septic system created a plume downgradient from the leach field.

Priority Panel Slide

Site Geology



Principal components of a crystalline rock mantled by a thick regolith (from Harned and Daniel, 1992)

Saprolite - 42’ max, clay to sandy clay, 25’-35’ deep monitoring wells

Transition zone - thin w/ rock fragments

Bedrock - fractured bedrock, Roxboro metagranite
300+’ in private wells

Site Hydrogeology

- Topographic dome
- Radial groundwater flow
- Contaminant migration parallel to regional fracture pattern NE/SW
- 2-3 fracture zones per BR well, 150’ deep

Priority Panel Slide

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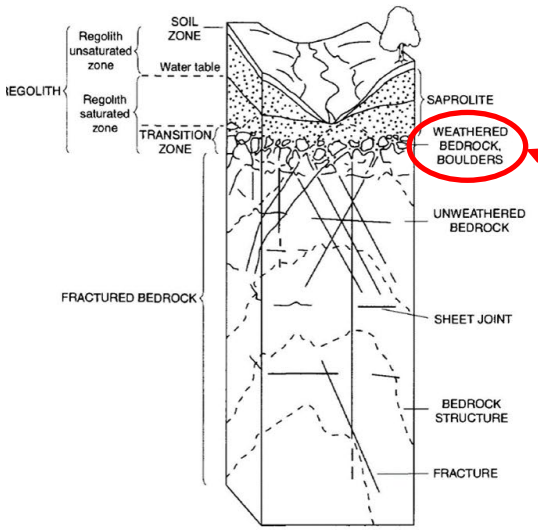

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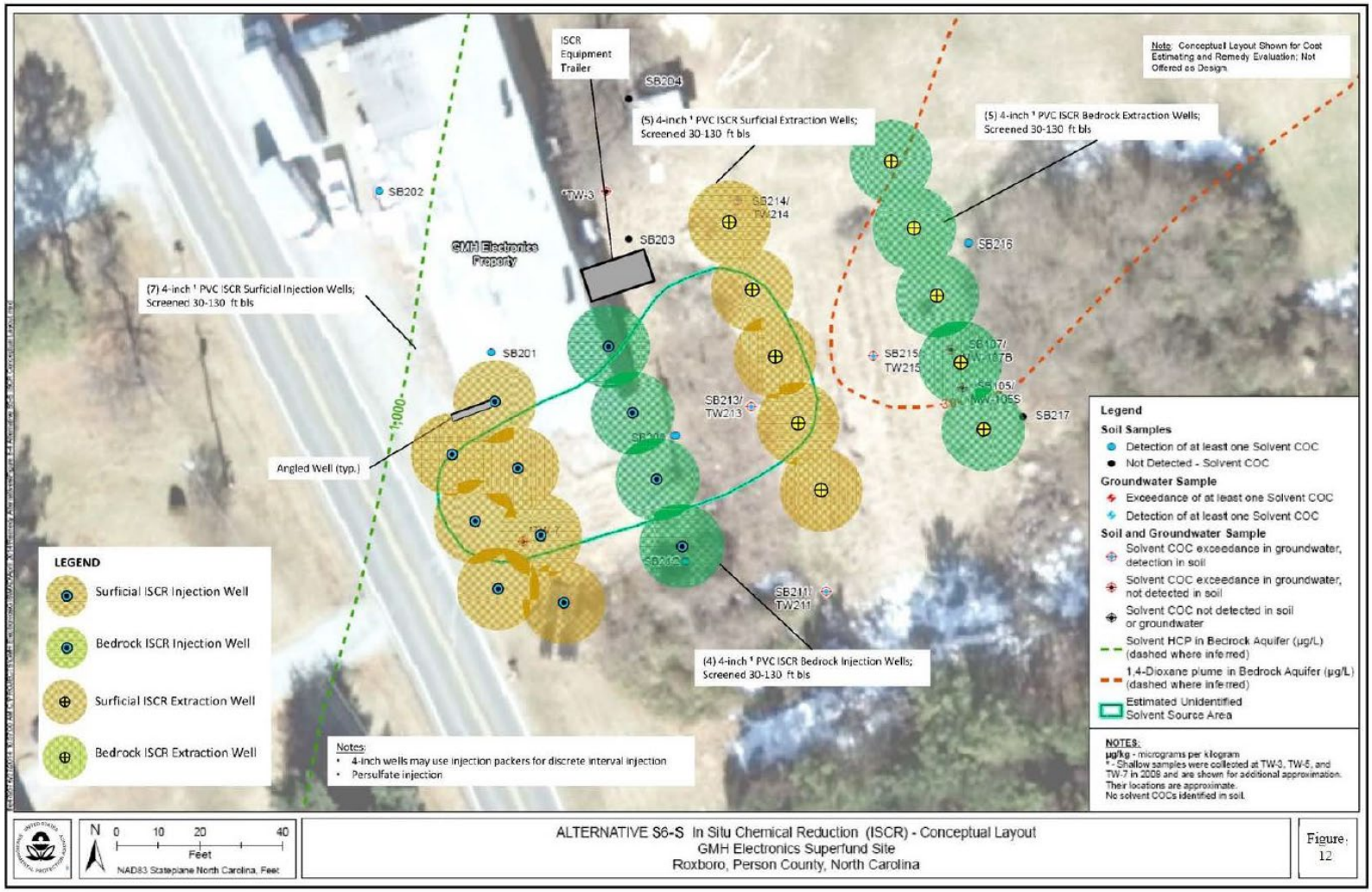
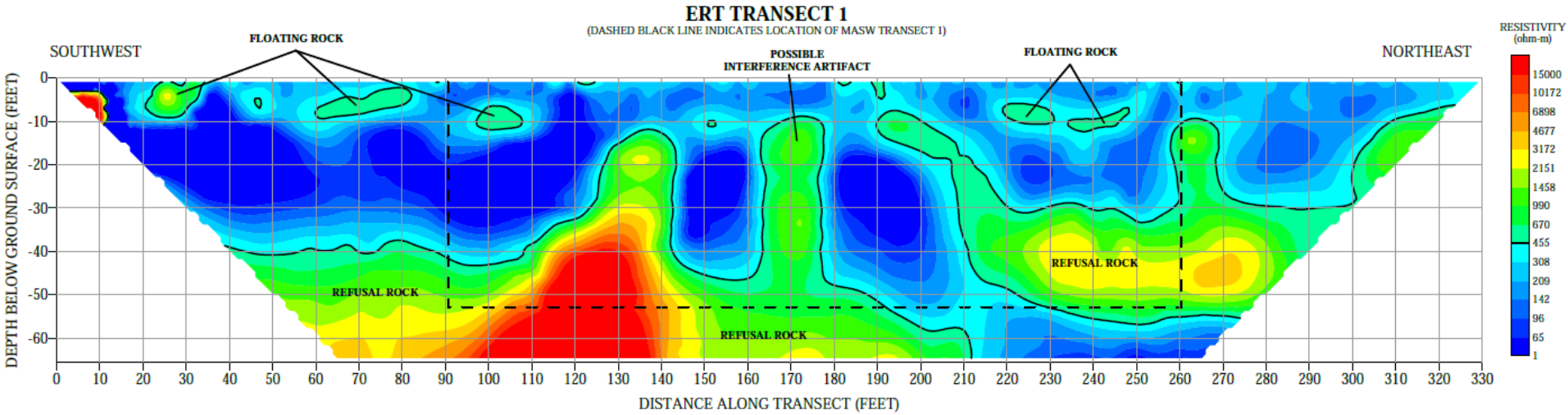
The Suggested Remedial Layout



RPM Troubles

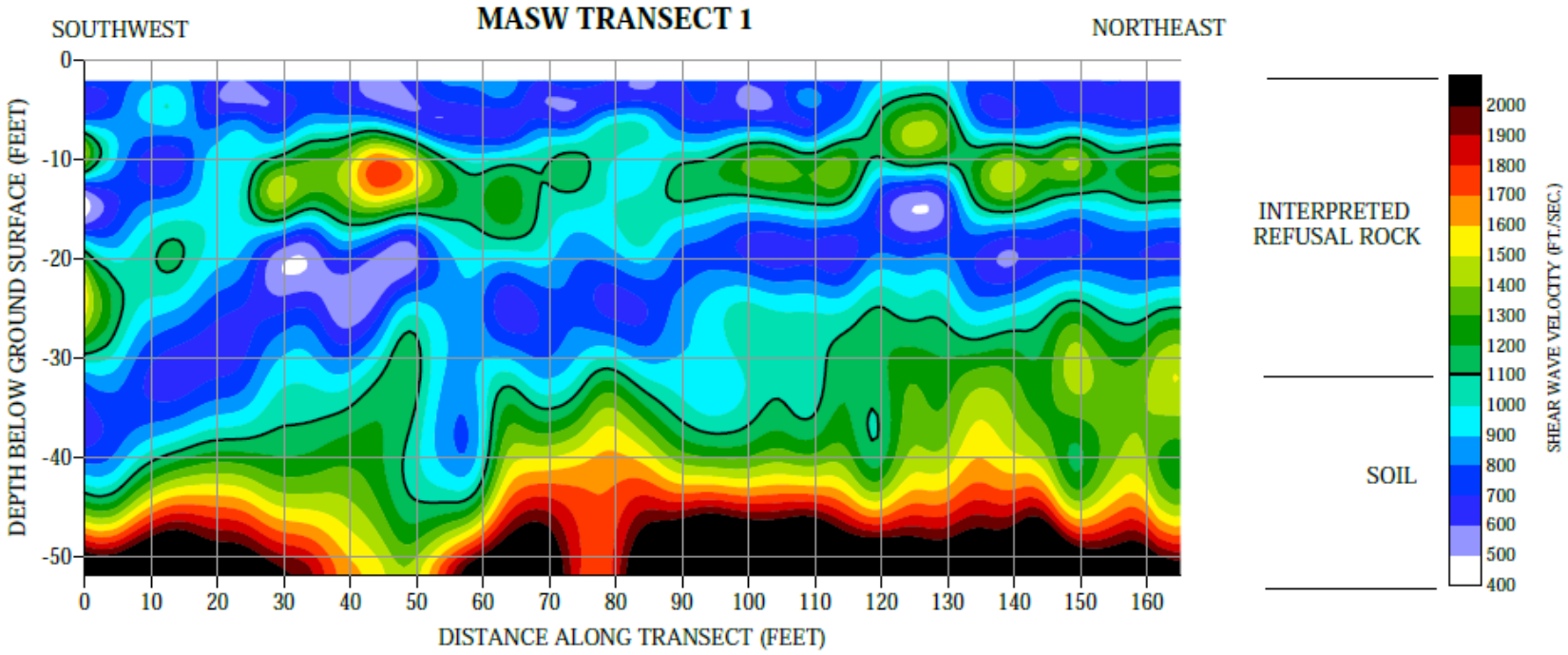
- Planned to put in the injection wells and reached refusal at several locations much shallower than expected
- Tried another drilling method
- Suggested Geophysical Survey
- Overall time from the first failed injection well installation and successful installation 2.5 years
- Costs of additional drilling, geophysical survey and two different contractors B&V & Tt support for that.

Electrical Resistivity Tomography



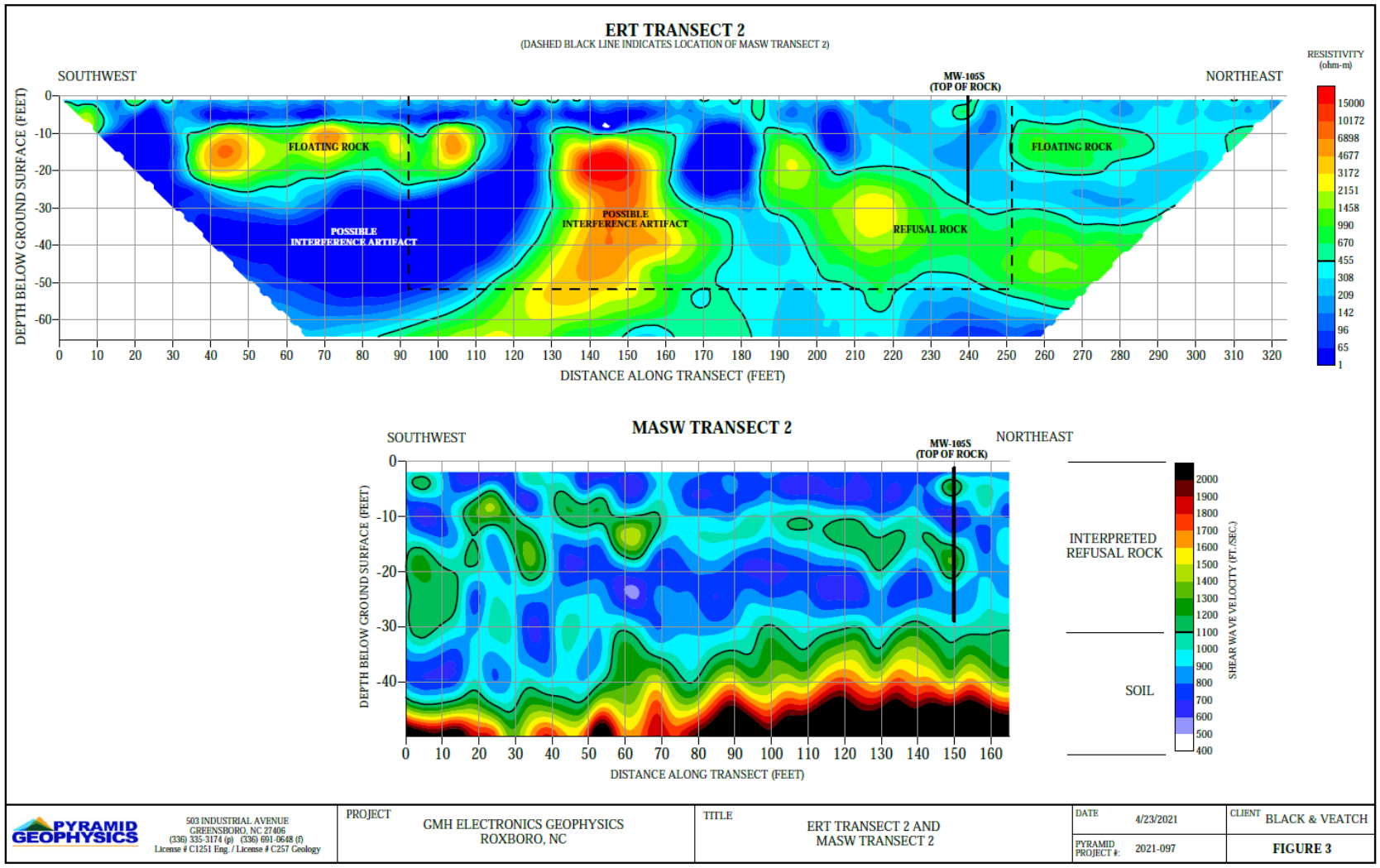
- Electrodes laid out in a line, calculates the resistivity between point N and all the others, then point N+1 and so on.
- Spacing of the electrodes controls the depth
- Between the blue and green identifies the soil/rock interface

Multichannel Analysis of Surface Waves

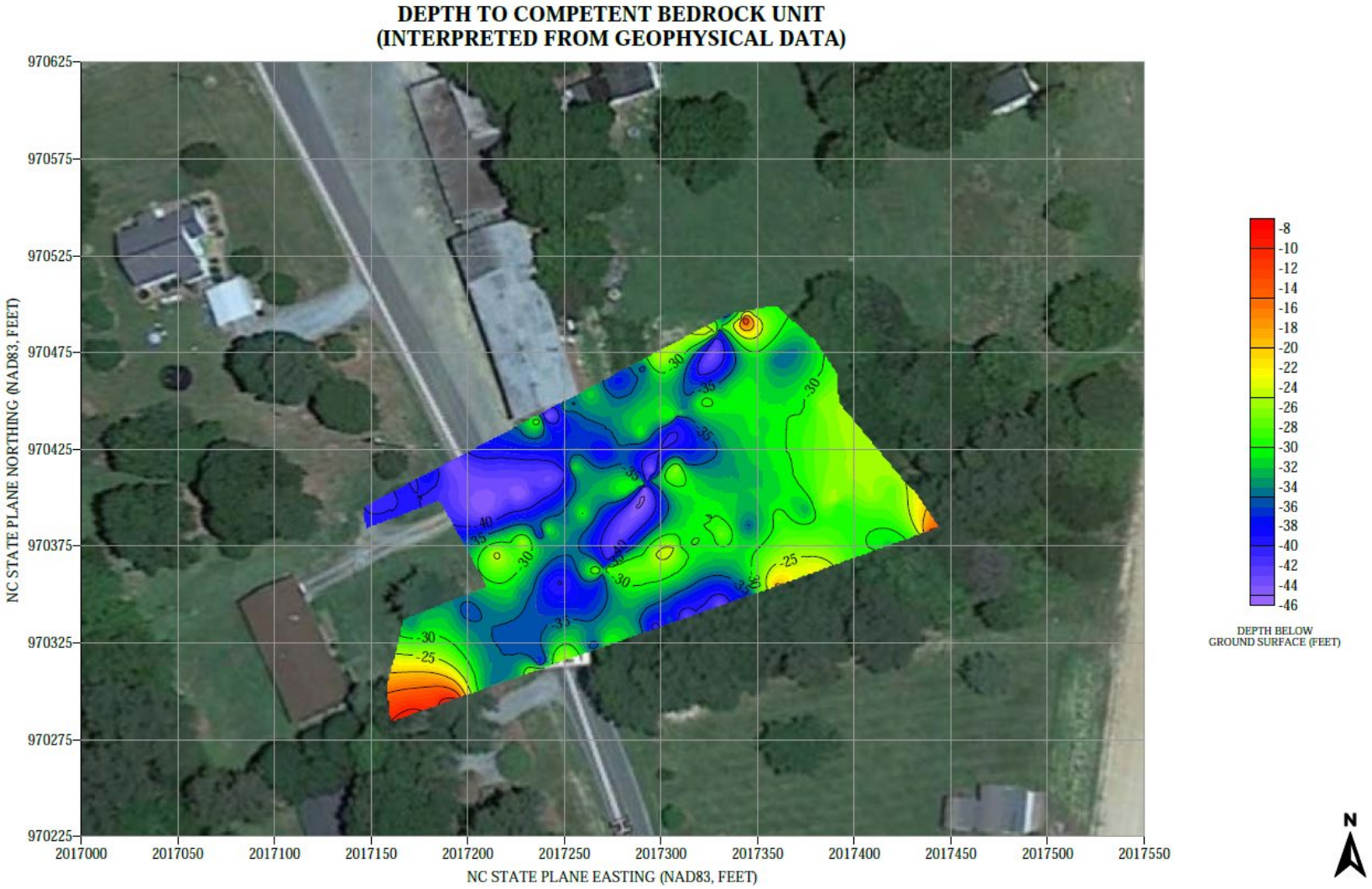


Seismic Survey - Input energy and the pressure waves are affected by the different density of the subsurface material

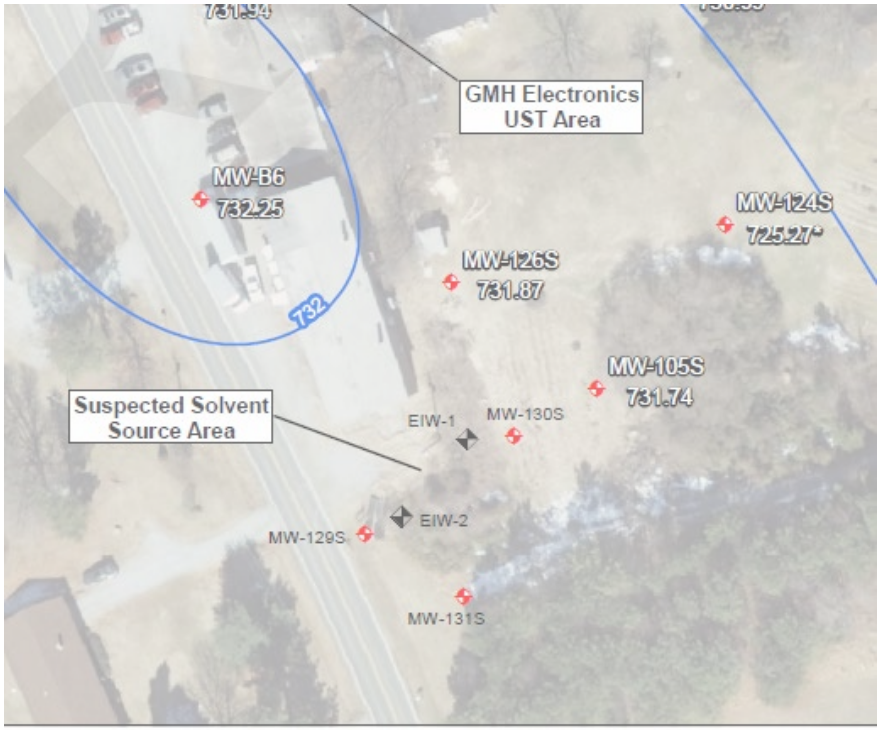
Paired Geophysical Surveys



There Are Places to Drill!

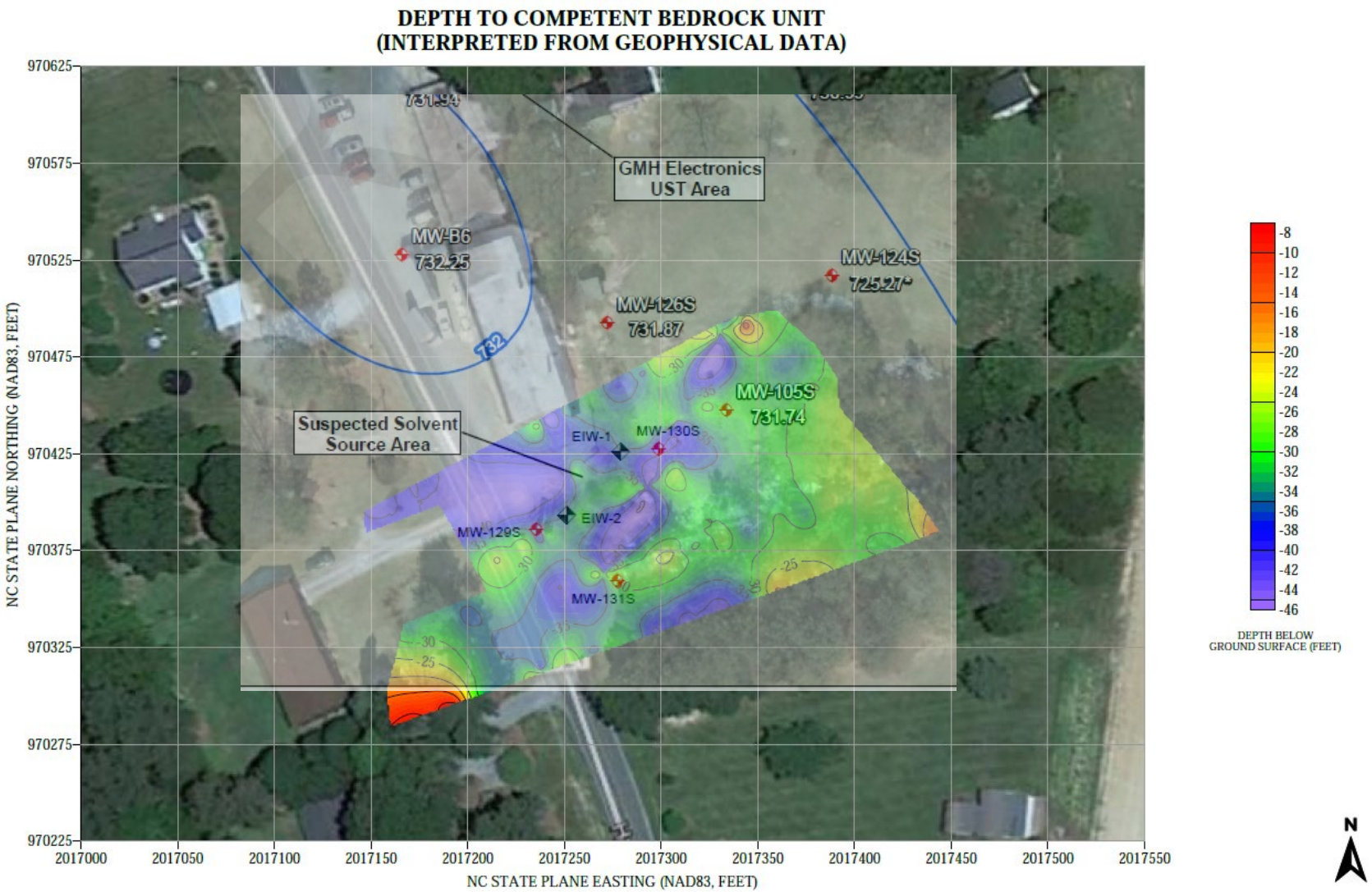


But, please use the geophysical information



Take a screen shot of the proposed injection wells and make it more transparent, so you can overlay it with the geophysical results

Overlap the images and see what you see



There Were Clues…

"Locally, boulders are so numerous that it is difficult to distinguish outcrops from float. Some rounded boulder outcrops exceed 4 meters (about 13 feet) in diameter."

Figure 3. A typical granite boulder field near the GMH Electronics Superfund site.

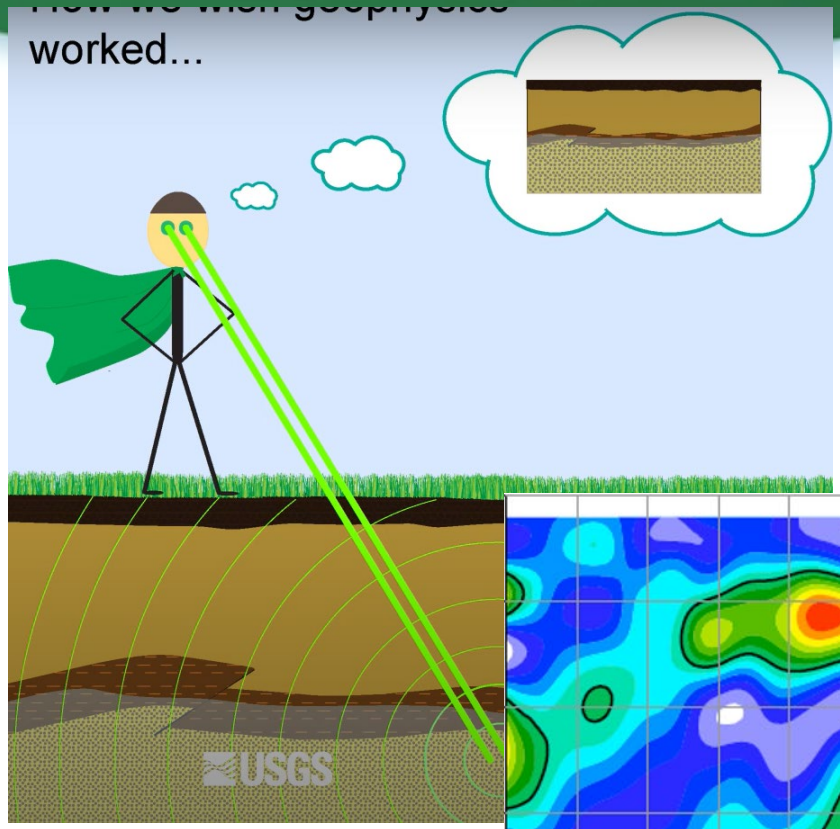
Chapman, M.J., Clark, T.W., and Williams, J.H., 2013, Geophysical logging and geologic mapping data in the vicinity of the GMH Electronics Superfund site near Roxboro, North Carolina: U.S. Geological Survey Data Series 762, 35 p., at http://pubs.usgs.gov/ds/762/.

Lessons to be Learned

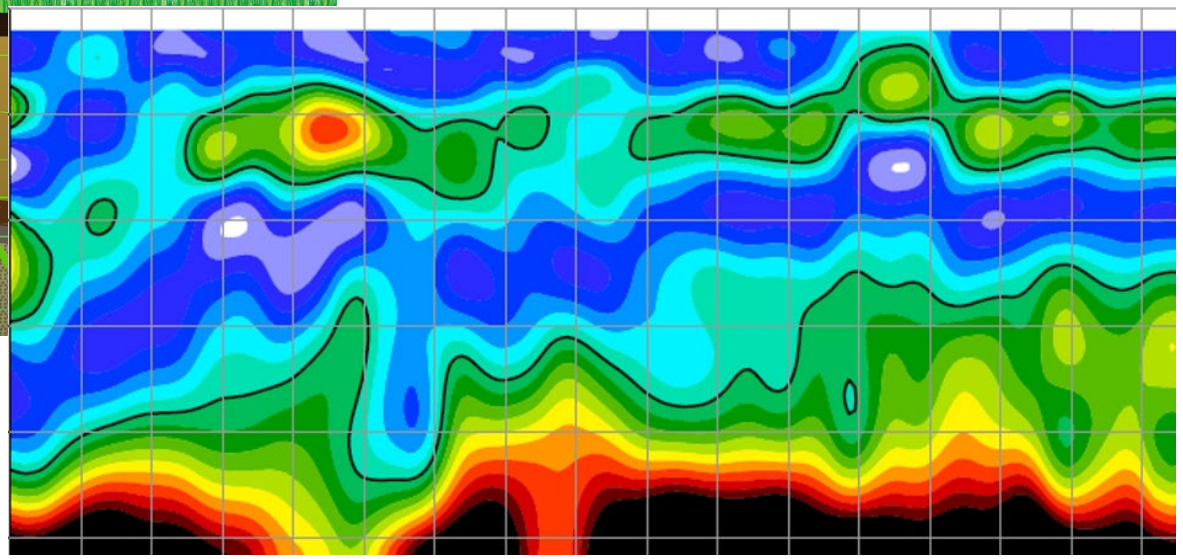
- When you are working on a site with bedrock or partially weathered rock possible and shallow enough to be a problem, you are advised take some extra steps, using non-invasive geophysical surveys like seismic and/or resistivity to get an understanding of the subsurface.
- Don’t rely upon a decades old hydrogeologic CSM without recent on-site characterization. What might I be missing?

Lessons to be Learned

- Other types of geophysics can also be useful
  - Ground penetrating radar for 10’-15’ deep - site clearing
  - EM and magnetometer surveys for shallower metal objects and shallow plumes
- There are technical resources available to you
  - ORD and ERT technical support, specialists within your existing contractor network, in-house hydrogeologists for initial guidance



…or you could put in a call for someone with X-Ray vision!



Contact Information

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