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# Bedrock Characterization Mottolo Pig Farm Superfund Site

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## Acknowledgments

- GZA GeoEnvironmental (lead consultant)
- Hager-Richter (sub for geophysics)
- EPA, Region 1
- NH Geological Survey (regional bedrock)
- USGS (geochemistry / arsenic expertise)

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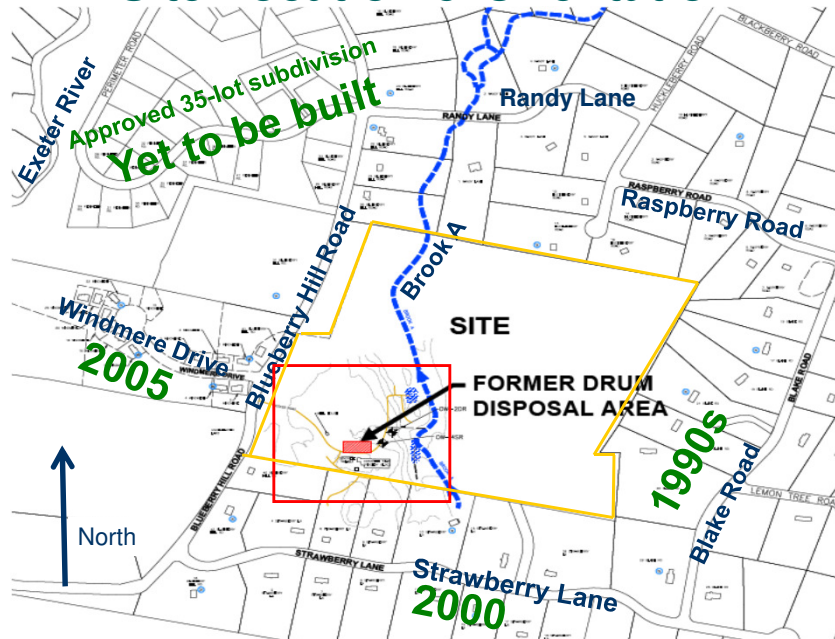
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# What's Ahead

- Site Orientation & Defining the Problem
- TCE Investigation
- Geophysical Surveys
- 3D Model (Representation)
- Groundwater Hydraulics & Geochemical Studies
- Results
- Questions & Discussion

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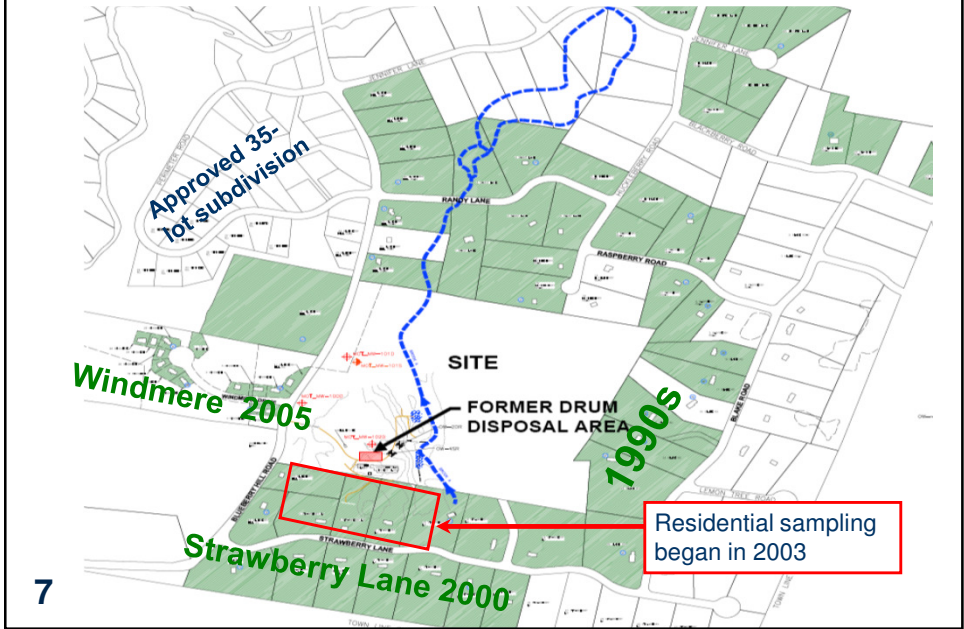
## Site Location & Orientation



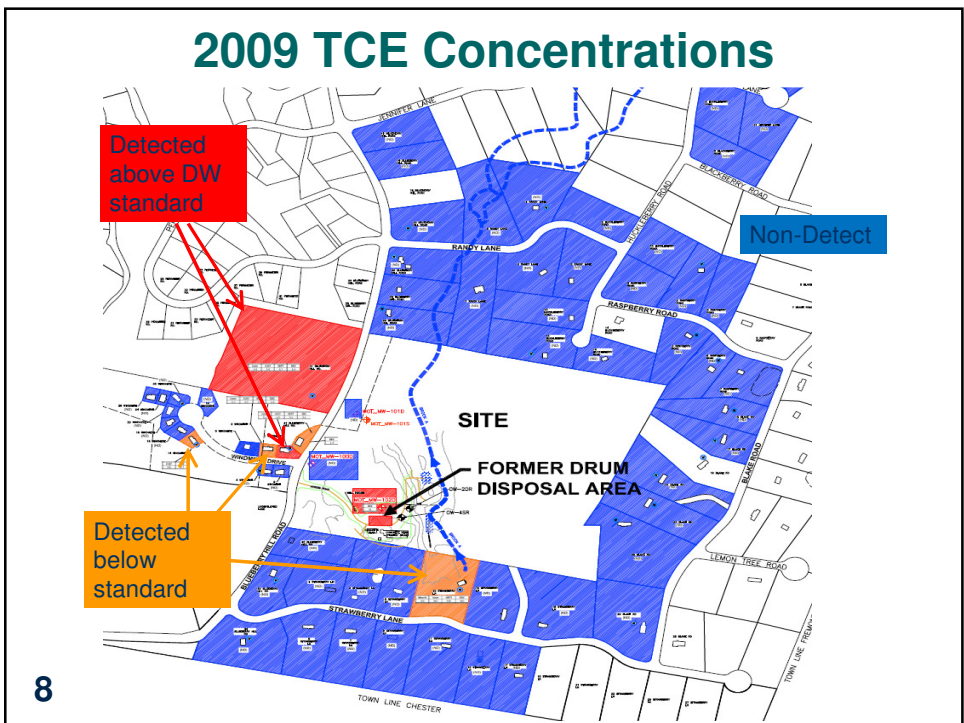
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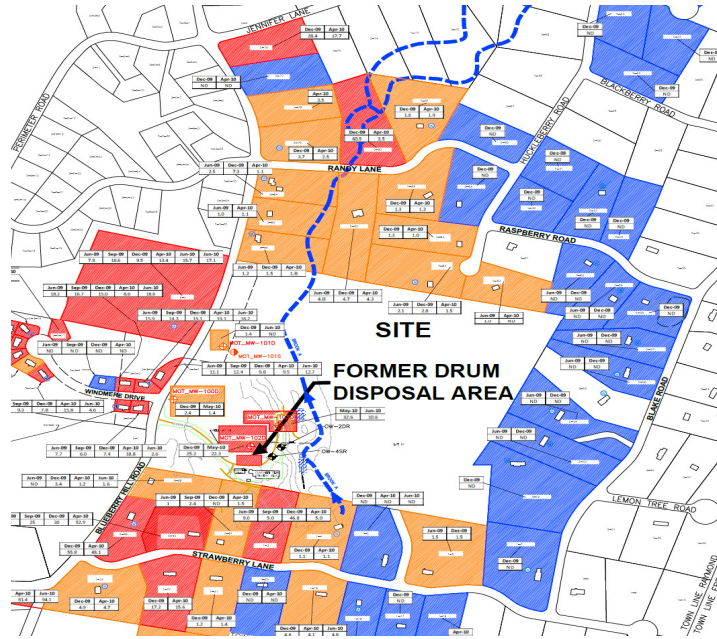
## 2009 Expanded Residential Well Sampling



## 2009 TCE Concentrations



## Arsenic Concentrations



## Unanswered Questions

1. Does the TCE found in residential wells originate from the Mottolo Site?
2. Any of the arsenic Site-related?
3. Extent of remedy?

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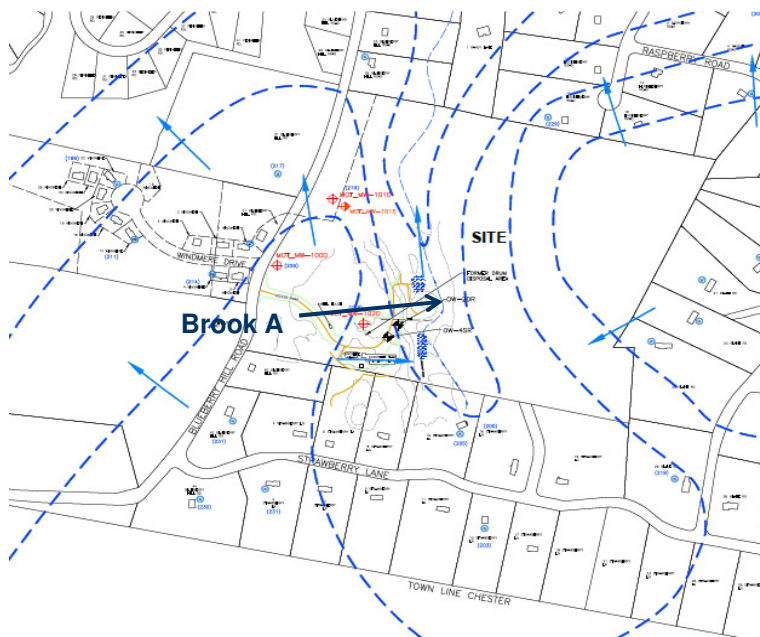
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## Bedrock Groundwater Contours



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- **Geophysical Surveys**
  - Surface geophysical methods
  - Borehole geophysical methods
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## Geophysical Surveys

### Surface Geophysical Methods:

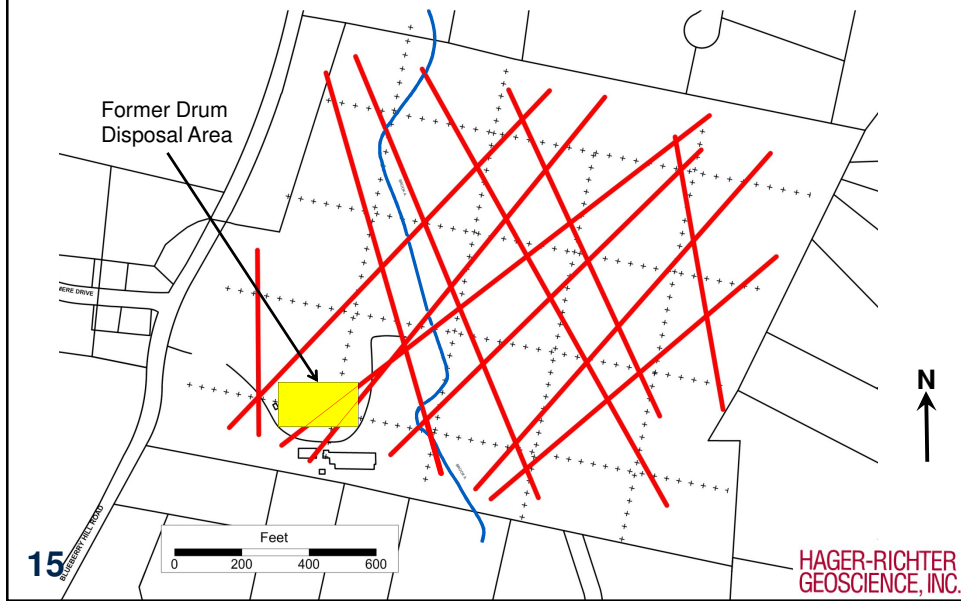
- Very Low Frequency Electromagnetics (VLF)
- Electromagnetic Induction - EM34
- Earth Resistivity Imaging (ERI)

### Borehole Geophysical Methods:

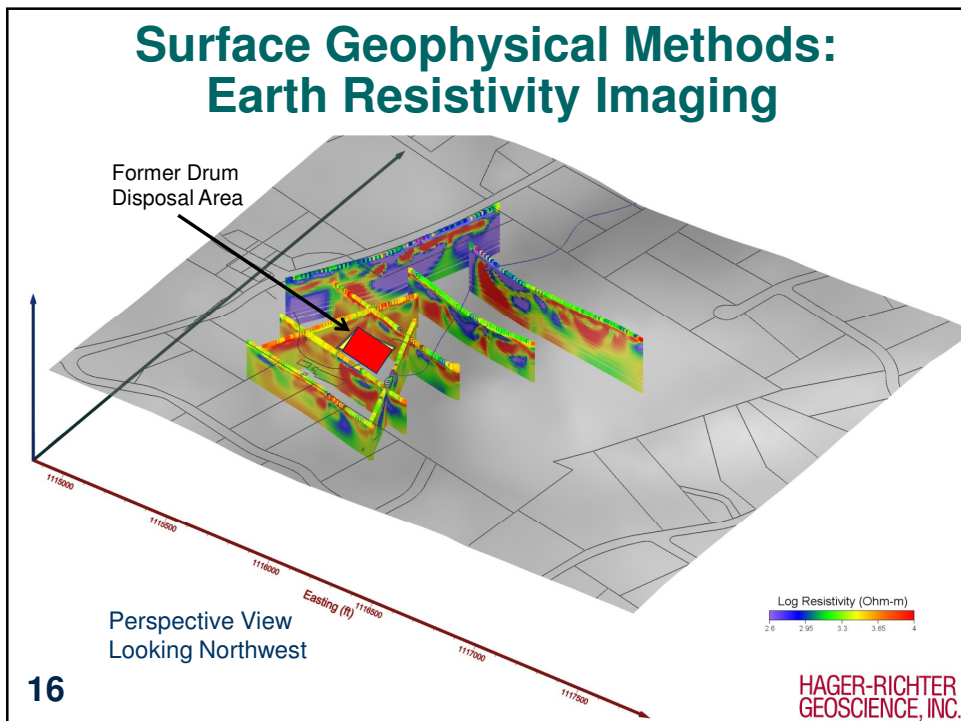
- Optical Televiwer (OTV)
- Acoustic Televiwer (ATV)
- Fluid Temperature & Fluid Resistivity
- Heat Pulse Flow Meter (HPFM) Ambient & Pumped Conditions

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## Surface Geophysical Methods: VLF & EM34 Fracture Interpretation

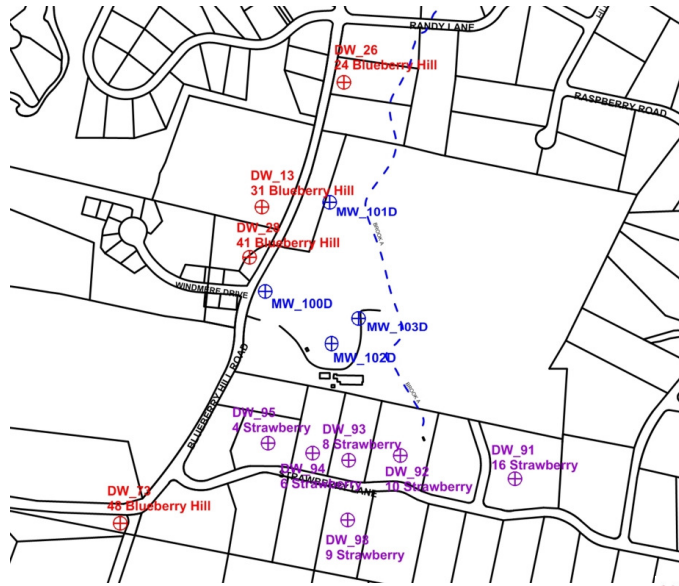


## Surface Geophysical Methods: Earth Resistivity Imaging





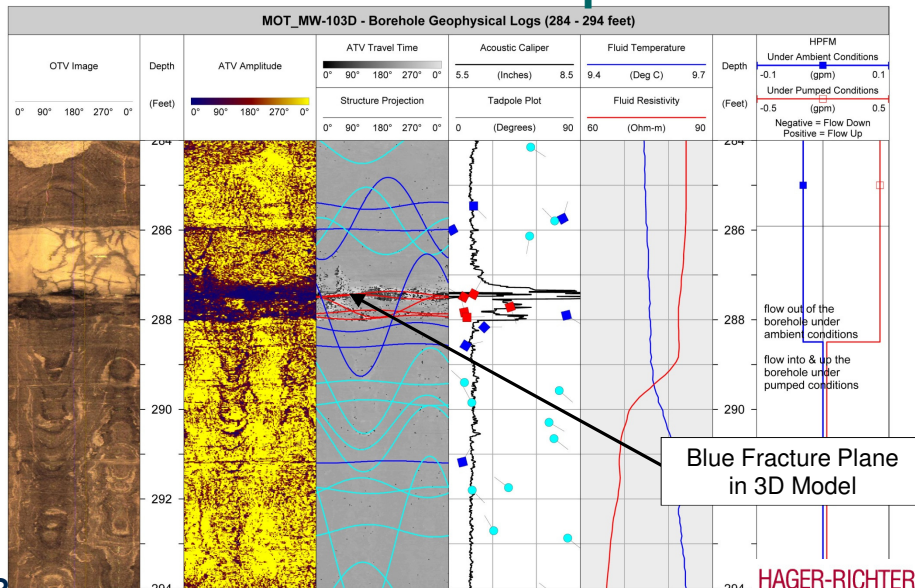
# Geophysically Logged Wells



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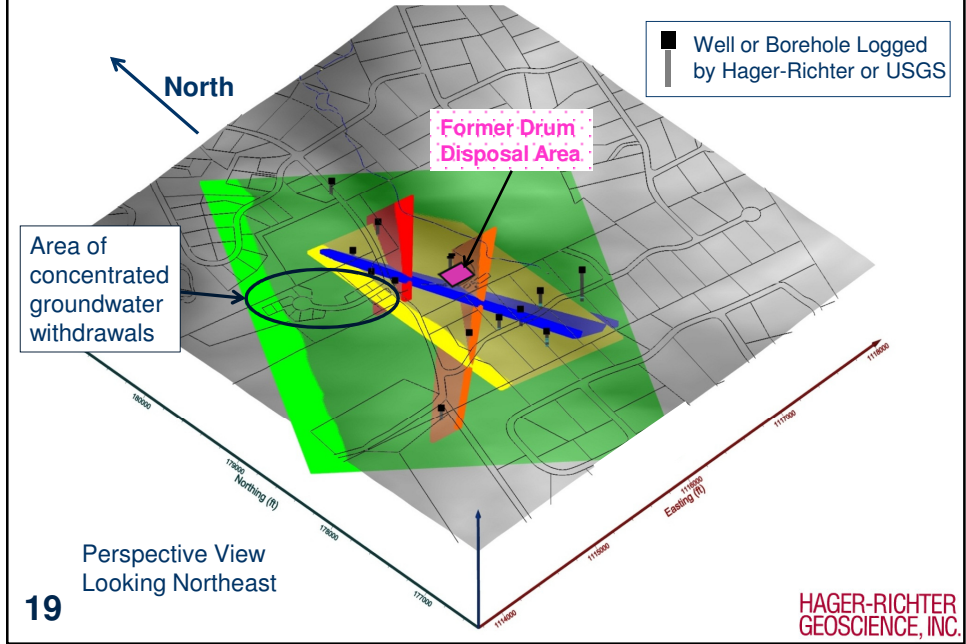
# Borehole Geophysical Logging Fracture & Flow Interpretation



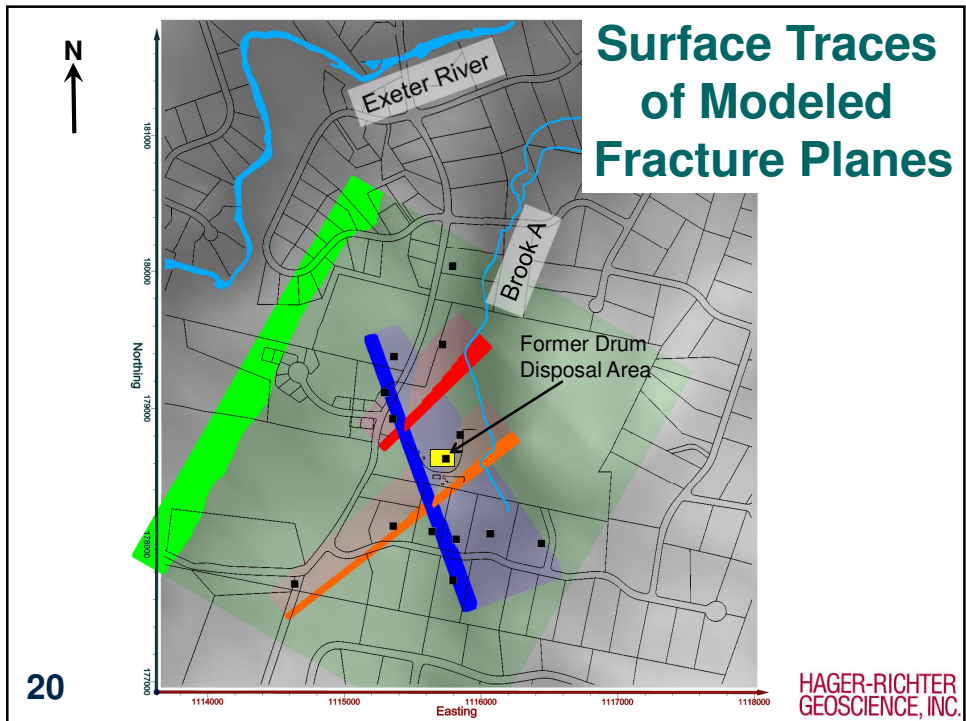
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# 3D Geophysical Conceptual Model



# Surface Traces of Modeled Fracture Planes





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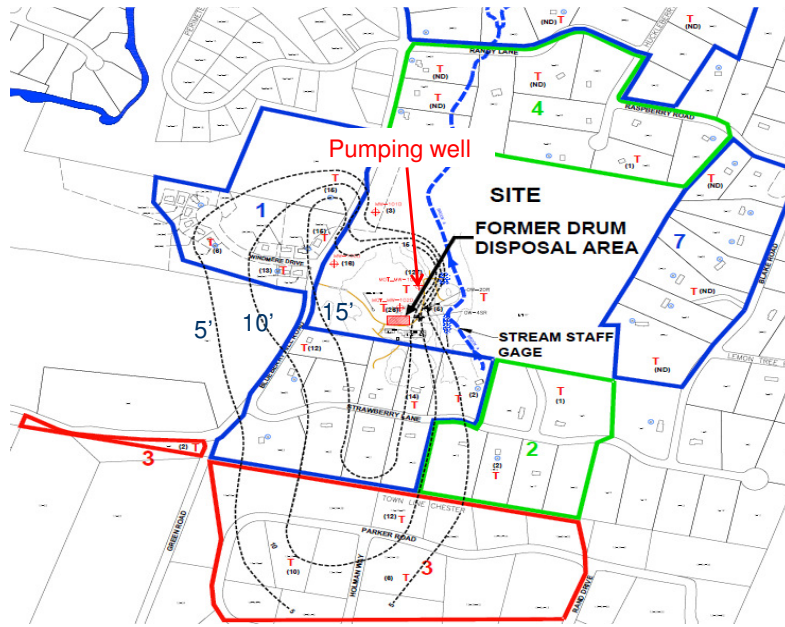
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## Pump Test

- Pumped from Site Well
- 30 gpm for First Two Days;  
50 gpm Remaining Five Days
- Treated Extracted Water for  
VOCs and Arsenic
- Measured Groundwater Level  
Response at 27 Locations

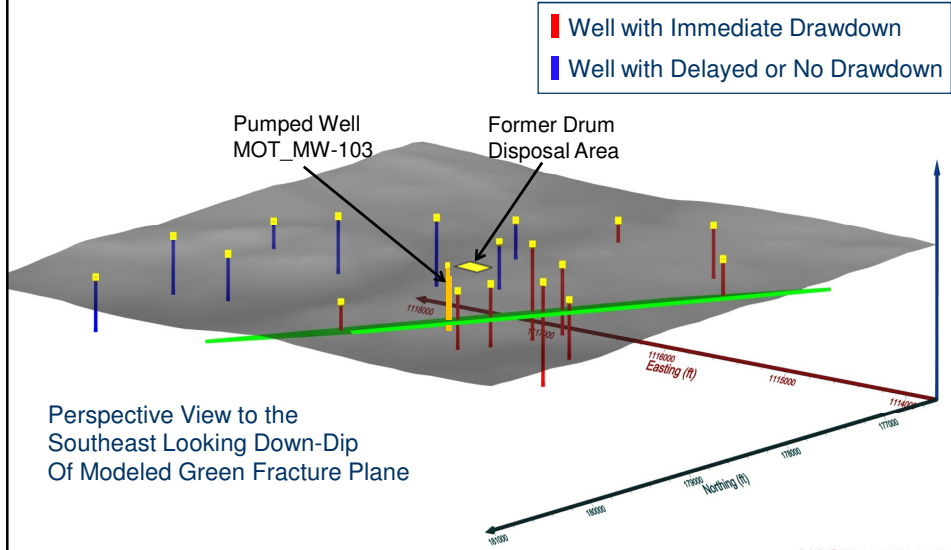
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## Pump Test Drawdown



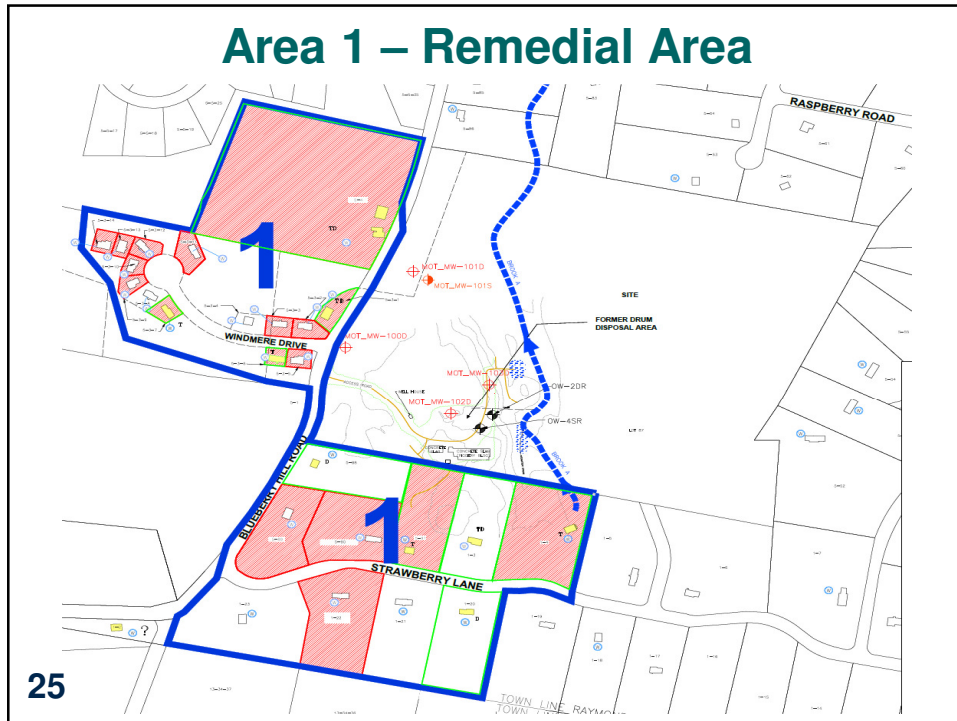
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## 3D Geophysical Conceptual Model With Pump Test Results



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## Results

- Bedrock groundwater flow and contaminant migration largely influenced by a dominant set of fractures and pumping of residential wells
- TCE generally detected in wells intersecting the dominant bedrock fractures
- Water line remedy addressed residences that were impacted or likely to be impacted

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## Results (continued)

- Predictions of plume contraction since 2012
- 9 of 25 former drinking water wells became additional site monitoring wells
- Have not detected site-related VOCs since pre-water line
- Continued sampling of residential wells and site wells support remedy decision

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## Lessons Learned

- Data from residential wells critical
- Multiple lines of evidence inform decisions
- 3D model can be kept simple to explain the primary bedrock fracture network
- Integration of multidiscipline team was key to decision making process

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## Questions and Discussion



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