Integration of a Technical Impracticability Waiver and Groundwater Hydraulic Containment to Mitigate Risk at a Fractured Rock DNAPL Site

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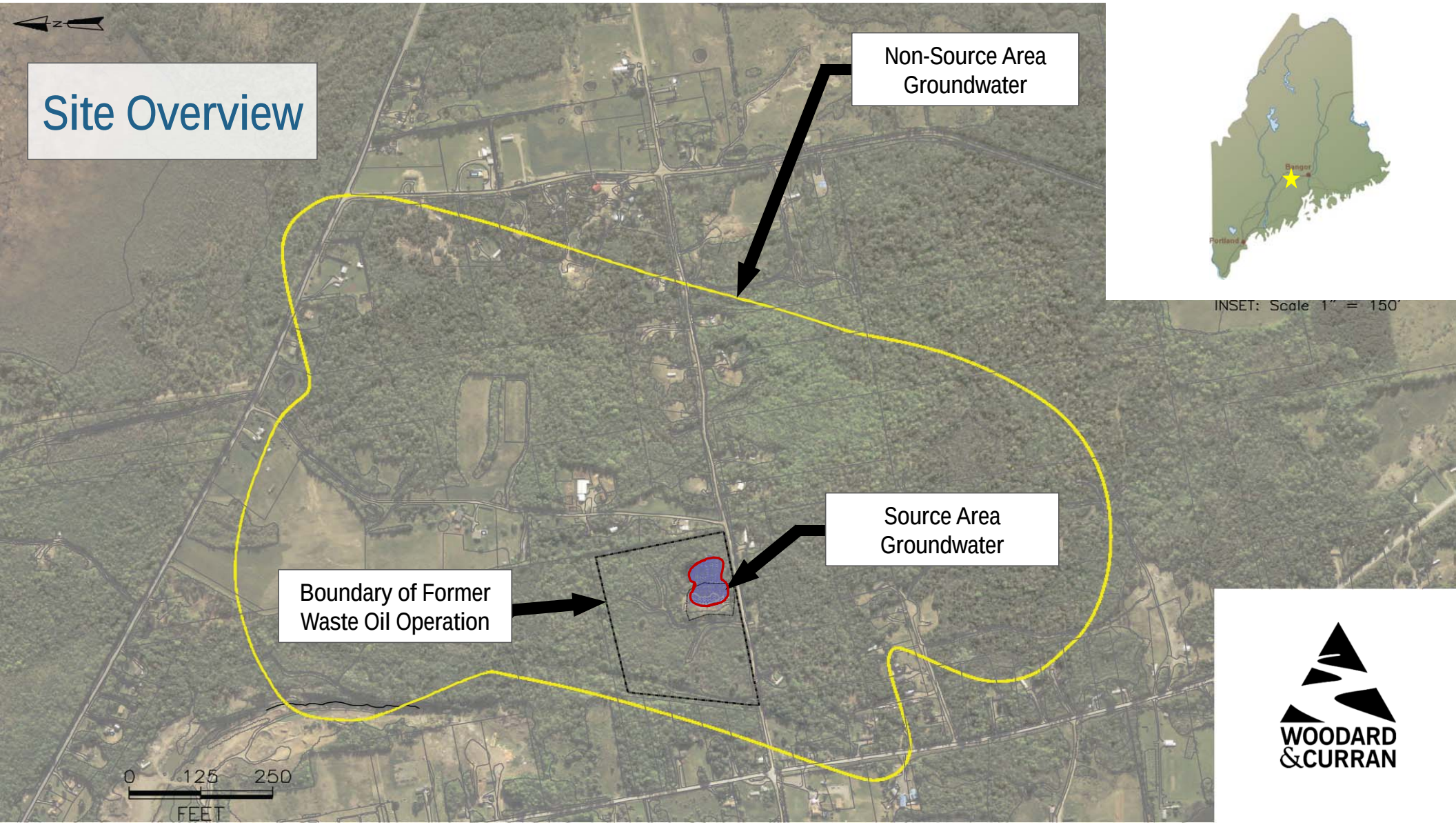
Presentation Outline

- Site Background
- Regulatory Process
- Technical Impracticability Waiver Determination
- Overview of Groundwater Modeling
- Remedy Effectiveness

Site Overview



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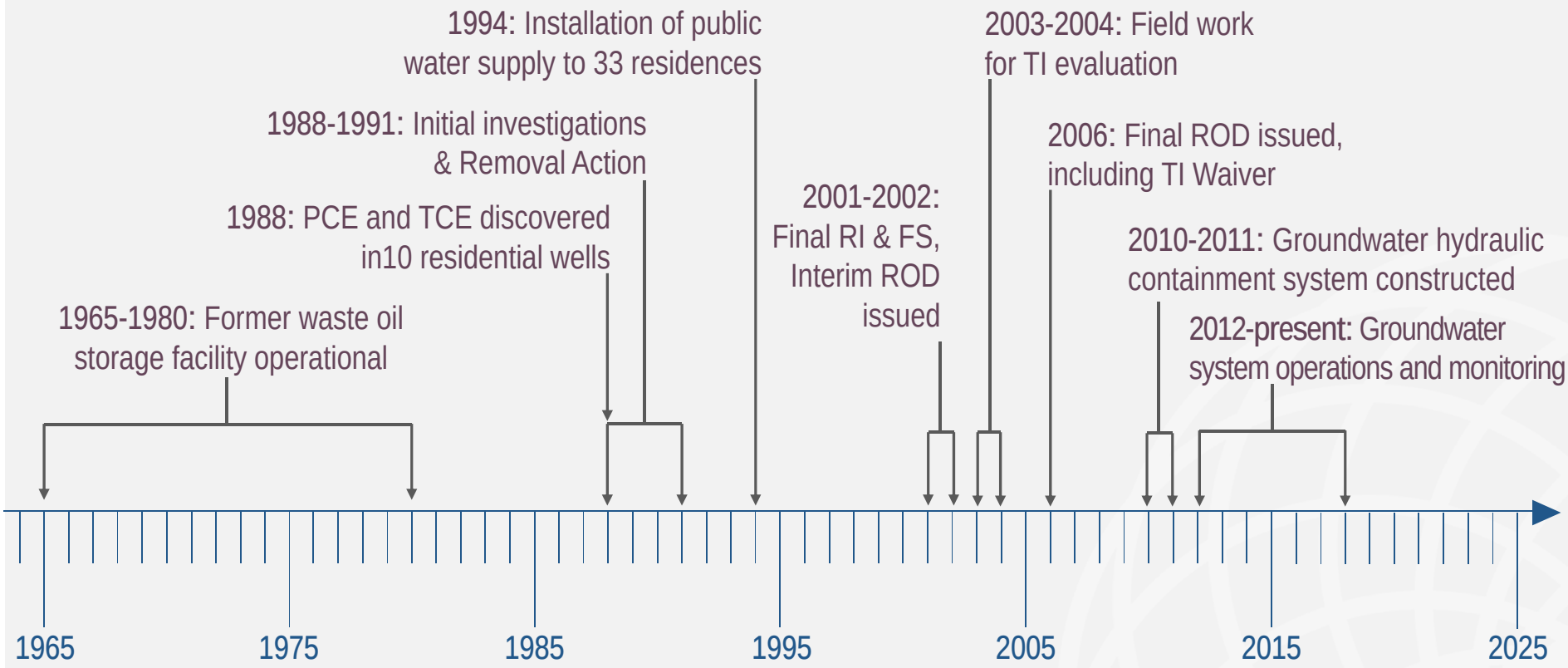
Site History



TI Waiver Evaluation Components

- Specific ARARs or media standard for which TI determinations are sought
- Spatial area over which the TI decision will apply
- Detailed conceptual site model
- An evaluation of the restoration potential, including time to attain required cleanup levels and a demonstration that other remedial technologies are infeasible
- Cost estimates of the proposed remedy options
- Where GW ARARs are waived the remedy must:
  - prevent further migration of GW plume
  - prevent exposure to contaminated GW
  - evaluate further risk reduction measures as appropriate

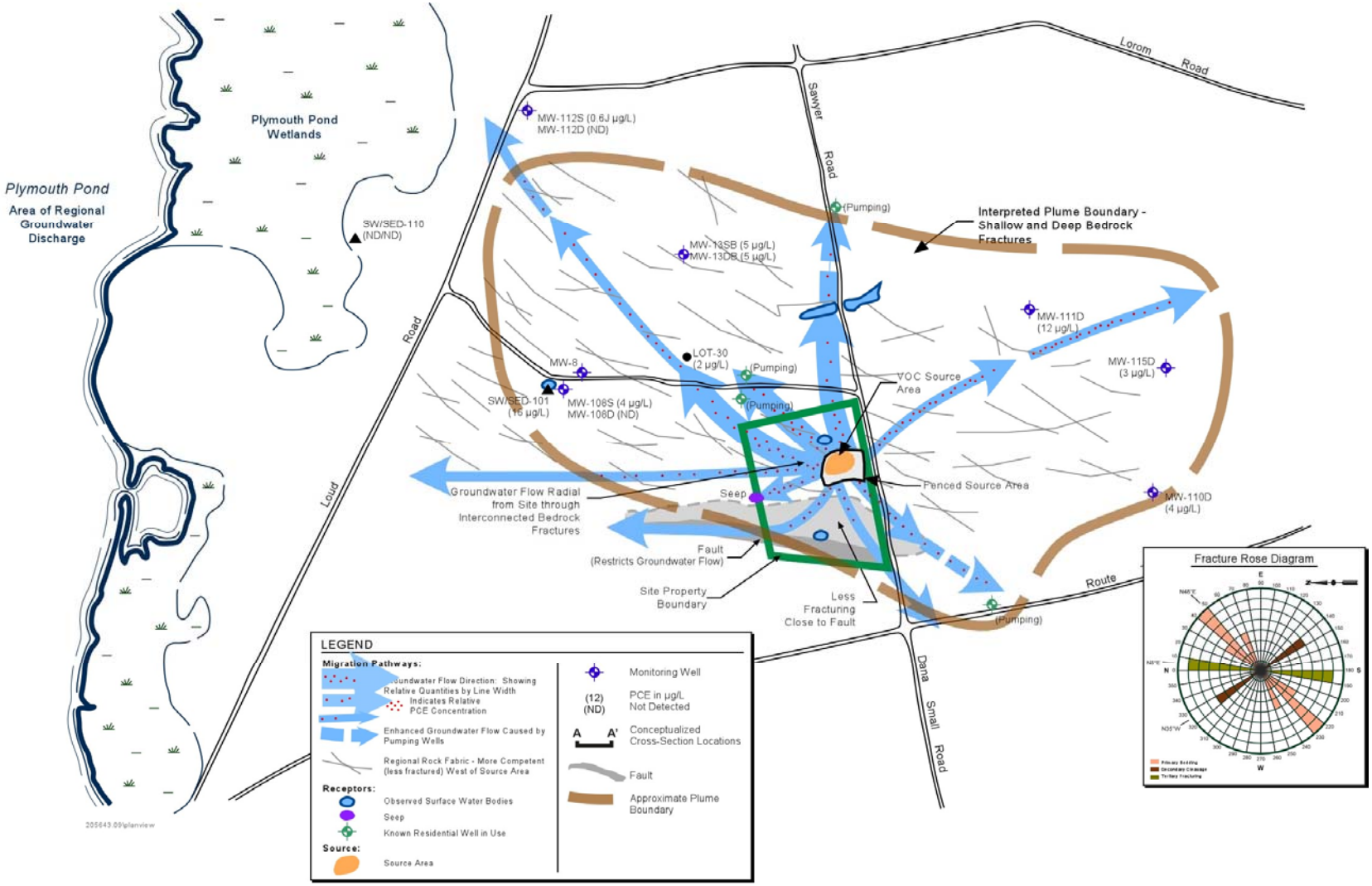
2002 ROD

- Four major components
  - Source area groundwater containment system
  - Institutional controls
  - Access to public water
  - Long-term monitoring
- Acknowledged TI potential but identified two questions
  1. Is it technically practicable to restore the source area GW to drinking water quality within a reasonable timeframe?
  2. Can the non-source area GW attain ARARs through MNA within a reasonable timeframe?

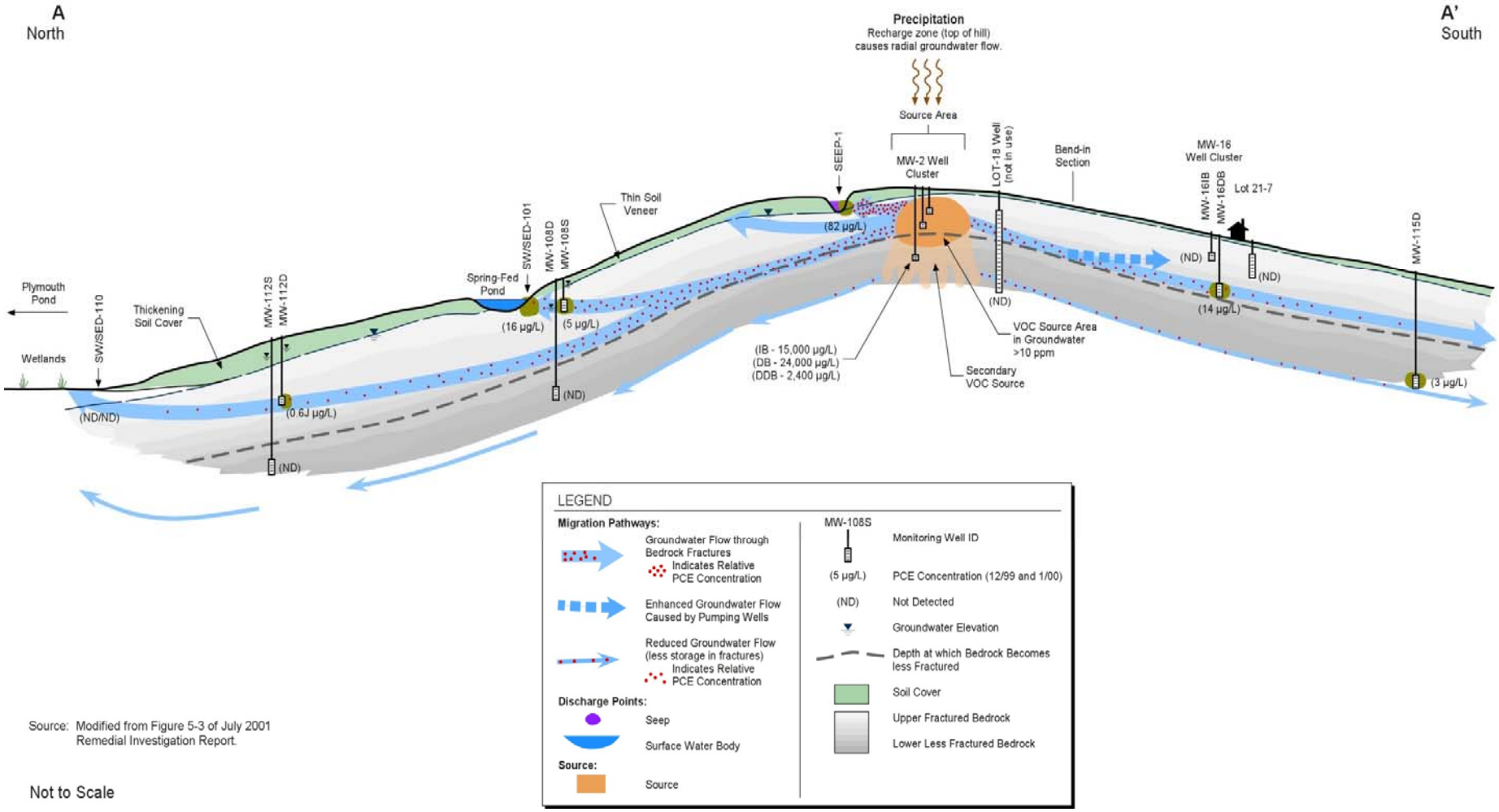
Technical Impracticability Field Program

- RI/FS data suggests restoration of source area GW may not be feasible
- Robust GW monitoring network
  - define TI Zone >10,000 ug/L
  - define extent of plume
- Analysis of bedrock cores, geophysical data evaluation
- Pumping tests
- Groundwater flow and fate and transport modeling
- ISCO pilot testing

Site Conceptual Model – Plan View



Site Conceptual Model – Section View



Source: Modified from Figure 5-3 of July 2001 Remedial Investigation Report.

Not to Scale

2006 ROD

- Technical impracticability waiver for the source area groundwater
- Determination that federal and state drinking water quality standards will be met in the non-source area groundwater through MNA
- Investigation of and appropriate response to the potential vapor intrusion pathway from contaminated groundwater to indoor air
- Five-year reviews.

Technical Impracticability Determination

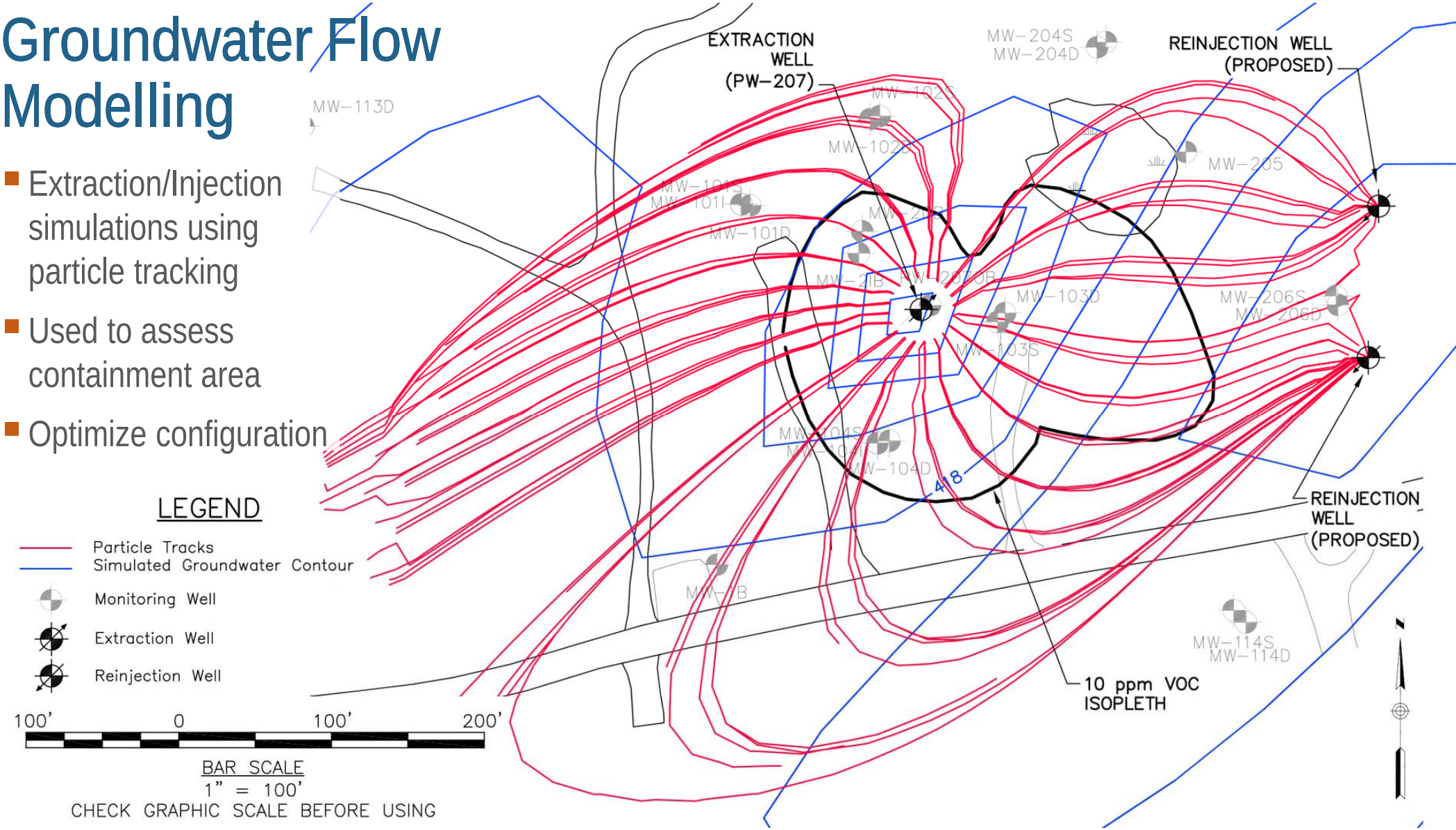
- Technically Impracticable to restore the source area GW to drinking water quality within a reasonable timeframe
- 3 lines of evidence
  - DNAPL in bedrock in source area
    - Source entirely in the bedrock
    - Bedrock has complex, heterogeneous structure
  - Results of GW modeling
    - >400 years to attain drinking water standards
  - No technology identified to restore GW quality in reasonable timeframe

Groundwater Modeling

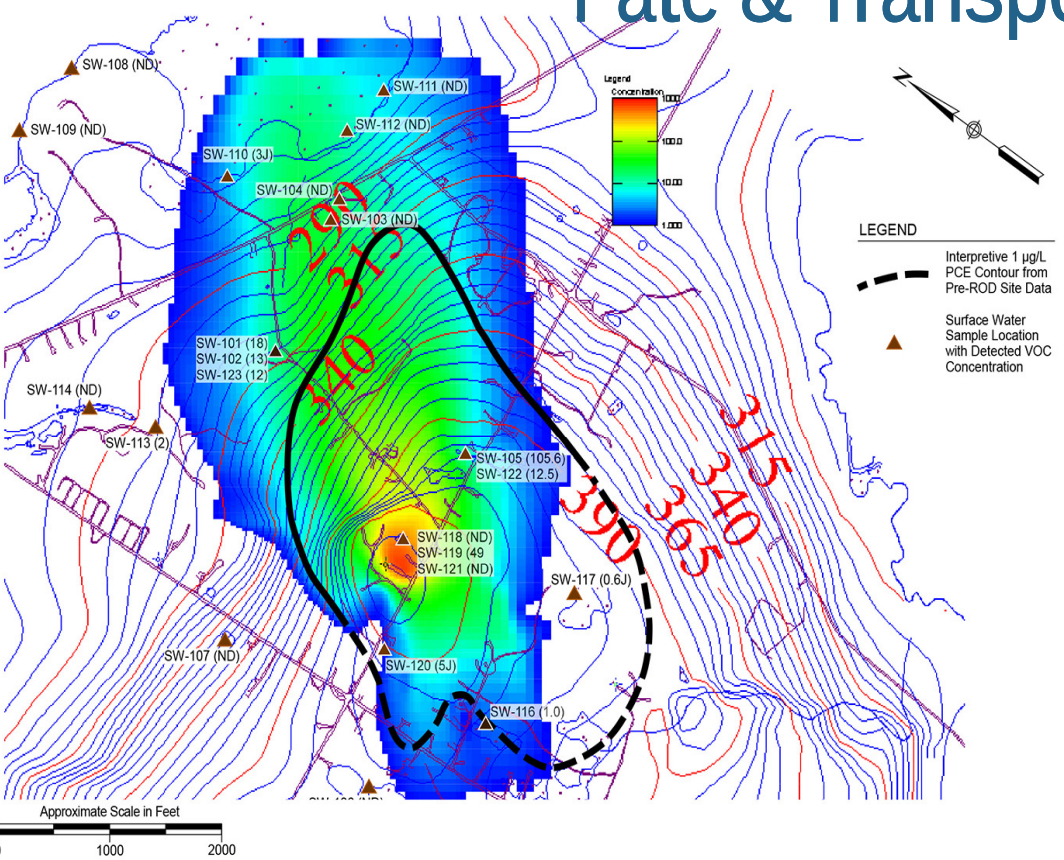
- Flow modeling
  - Pumping tests for model calibration
  - Assess near field containment
  - Evaluate extraction/re-injection configuration
- Determine Institutional Control bounds
  - Containment Zone
  - Institutional Control Zone
- Evaluate potential cleanup times

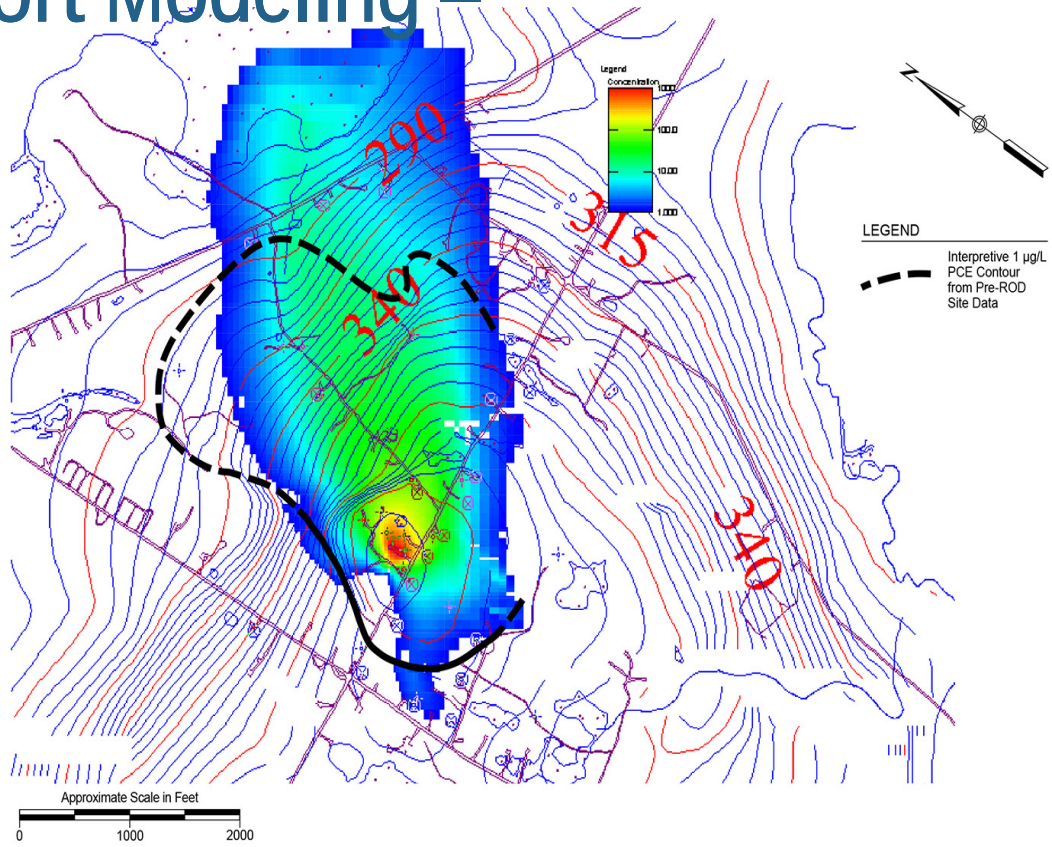
Groundwater Flow Modelling

- Extraction/Injection simulations using particle tracking
- Used to assess containment area
- Optimize configuration



Fate & Transport Modeling –

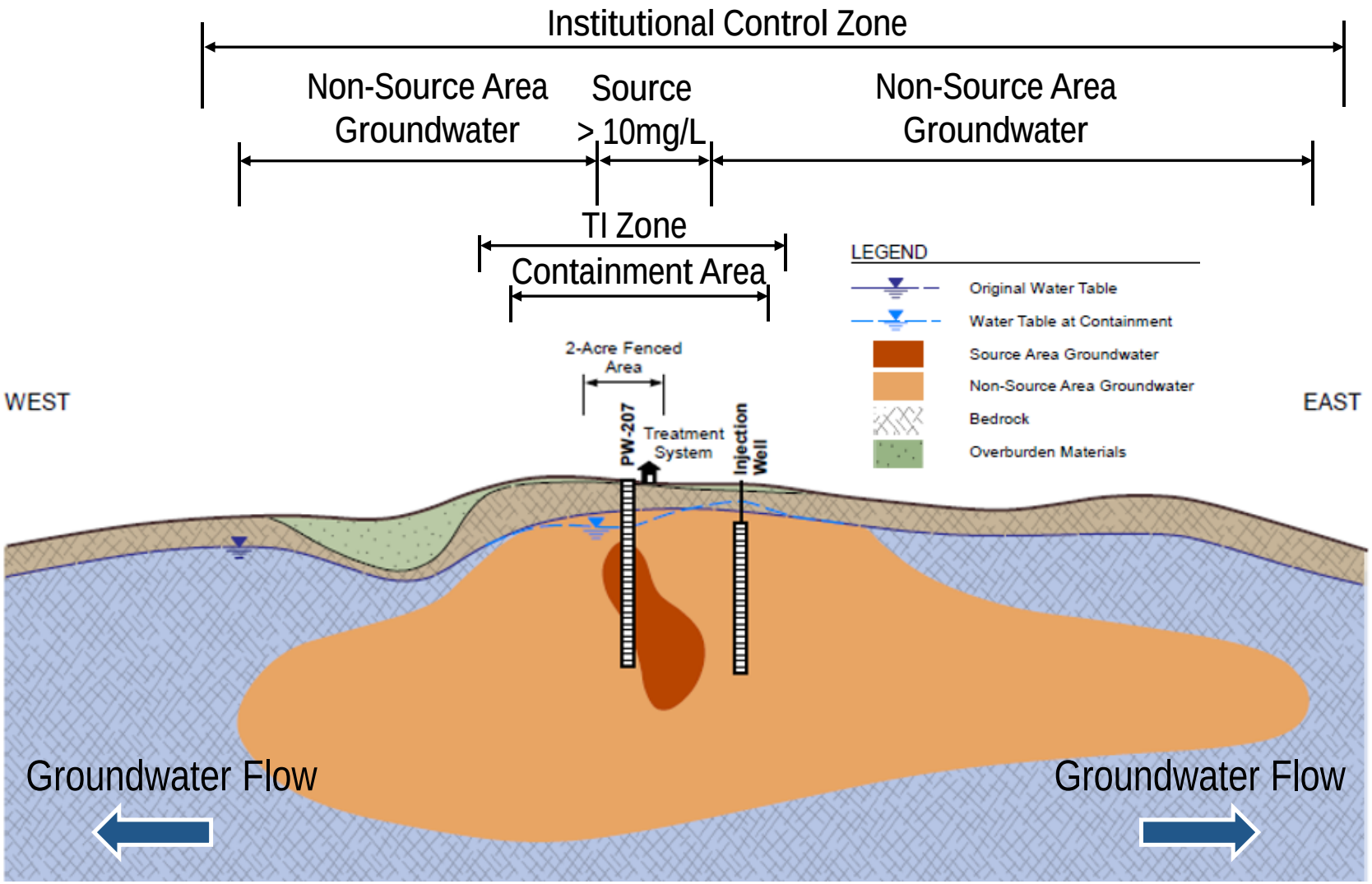




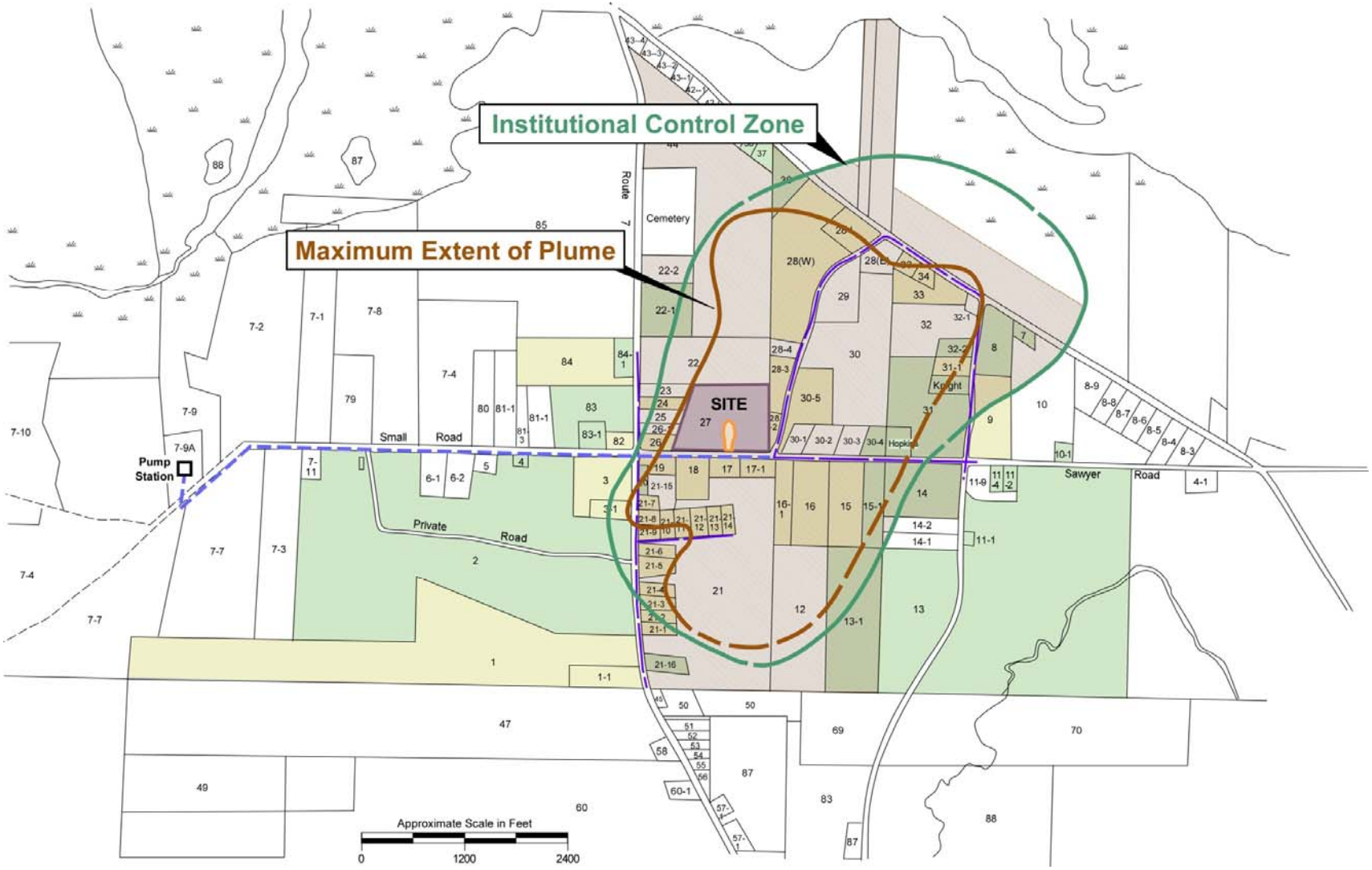
- Transport model
- Estimate probable plume extent

- Shallow and deep bedrock
- Used to establish bounds of Institutional Control Zone

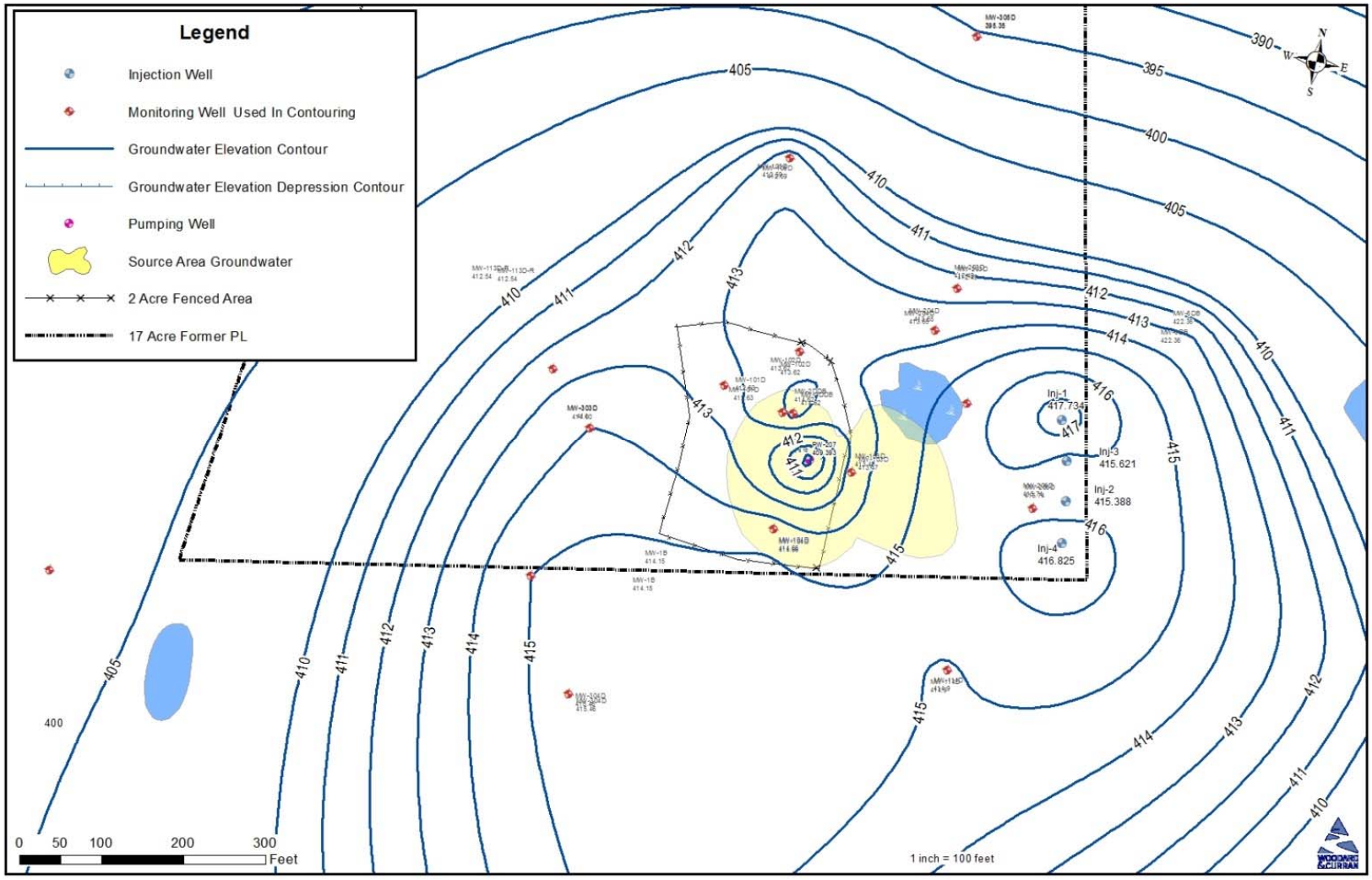
TI and Institutional Control Zones



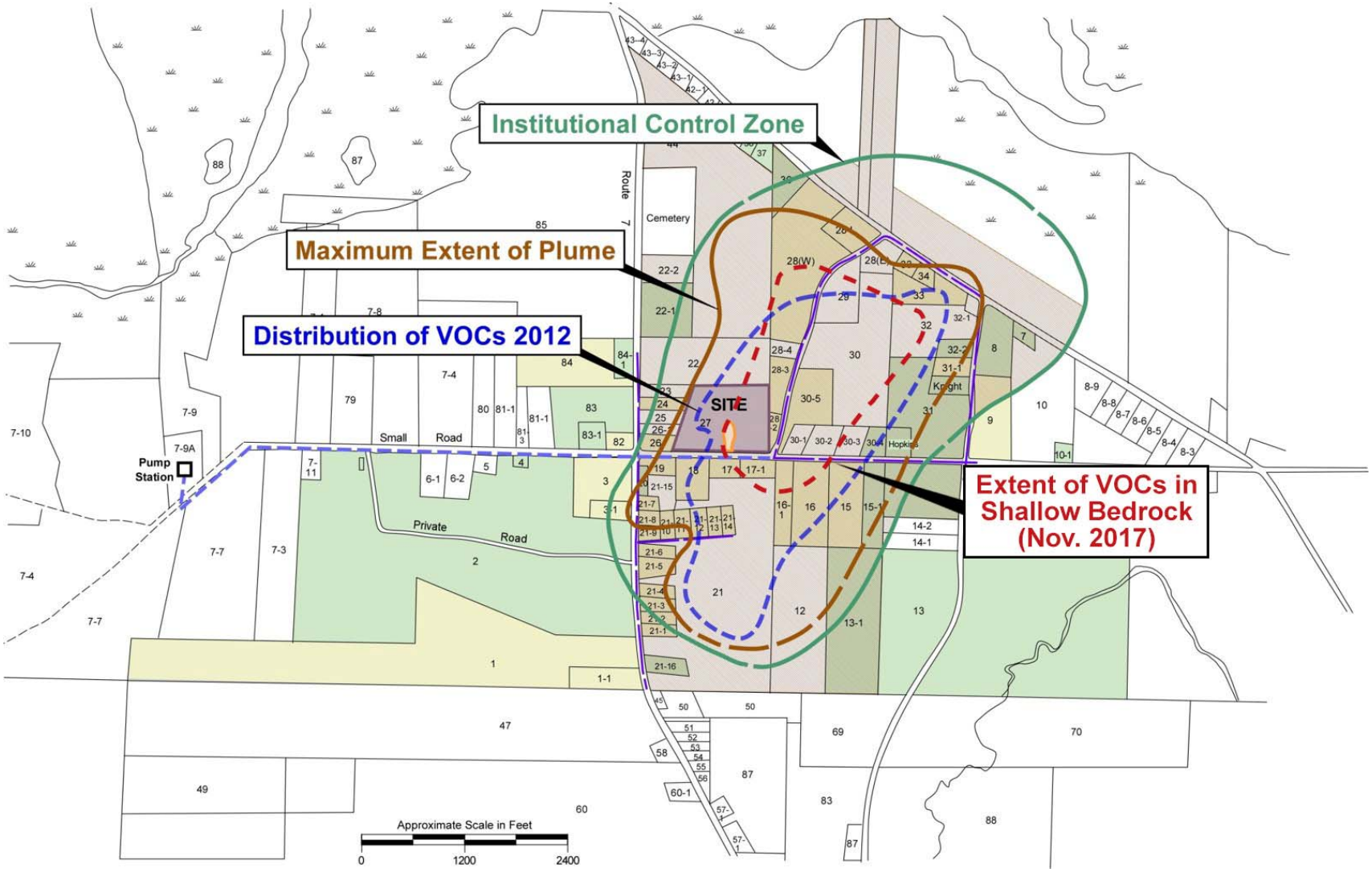
Establishing the Institutional Control Zone



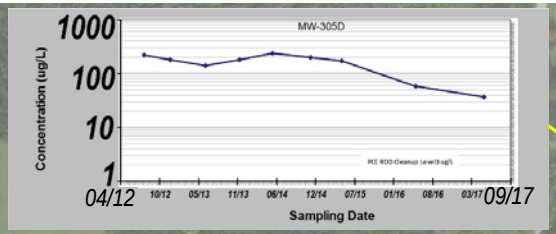
Groundwater Capture Map Deep Zone

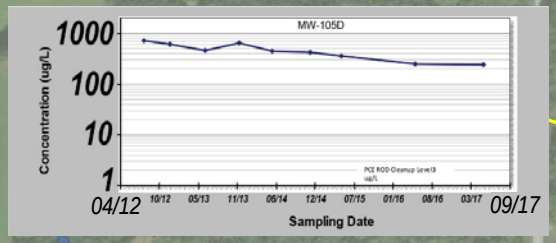


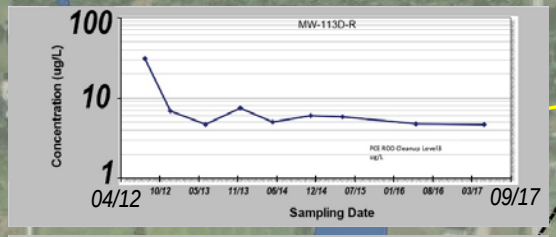
2017 Distribution of VOCs Indicates Plume Has Contracted

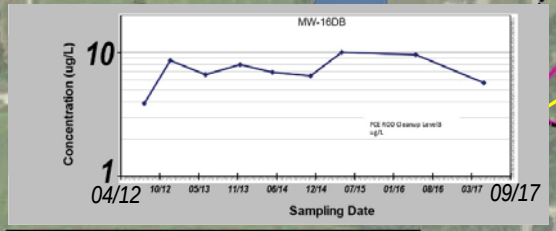


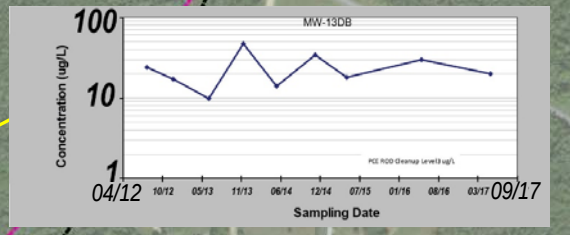
Groundwater Quality Improvements

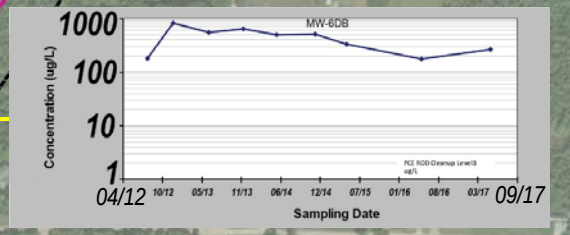


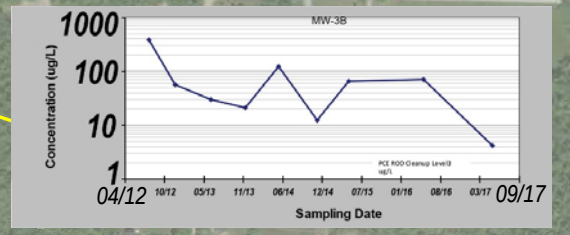


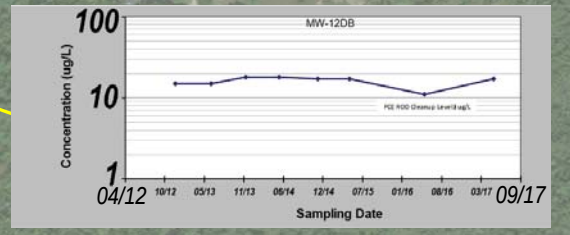


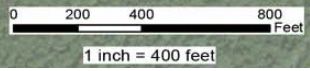












Summary and Conclusions

Technical Impracticability was a good choice for this site

Human health is protected through ICZ and remains protective as indicated by shrinking plume

Significant cost savings achieved by not pursuing ineffective source remedies

Wells inside and outside of the capture zone are showing improvement

THANK YOU!!

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