



# Picatinny Arsenal Installation Restoration Program

## *600 Area Data Report and Feasibility Study*

### *Presentation to the PAERAB*

April 15, 2010



Tracking Number

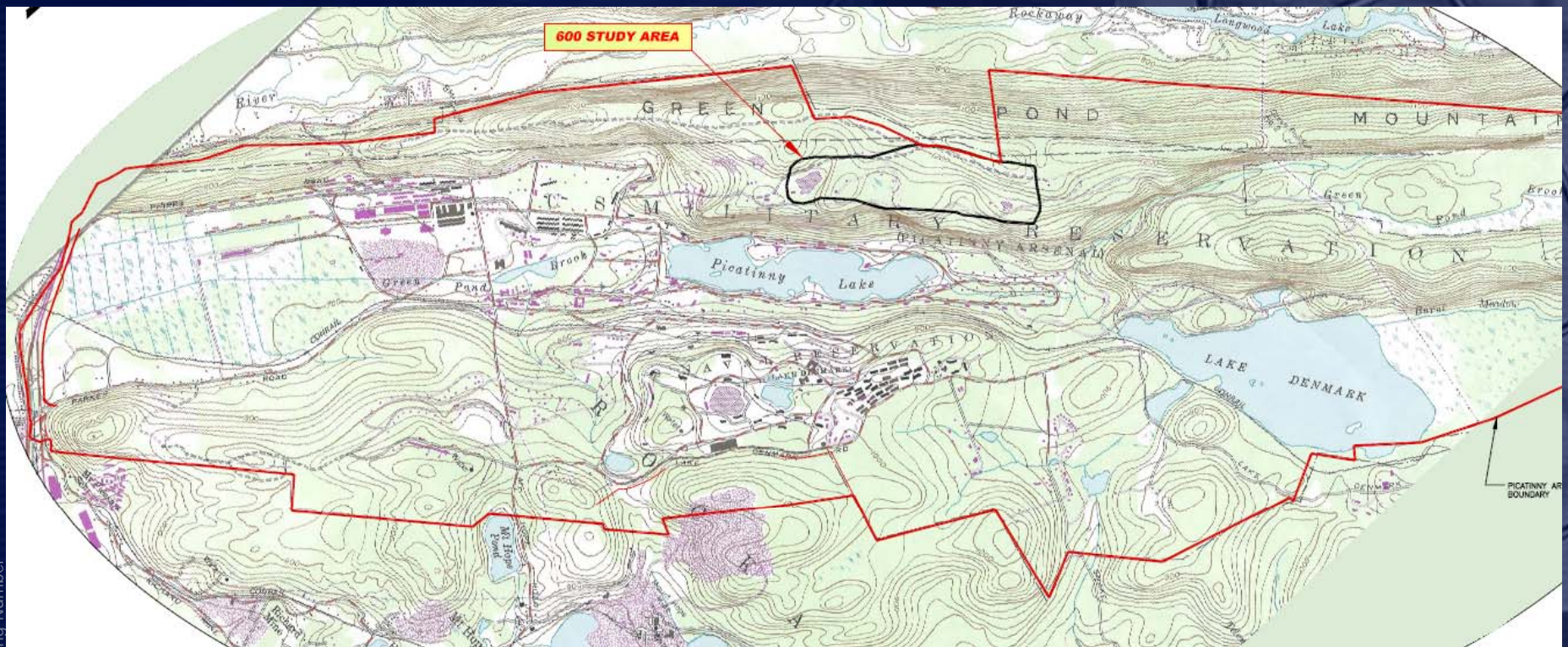


# Description of 600 STUDY AREA

- Located along the Northwest boundary of PTA, the 600 Study Area comprises an area of approximately 450 acres.
- The Study Area lies on the southeast slope of Green Pond Mountain, and is characterized by long northeast trending bedrock escarpments and intervening terraces.
- Current Site Use – Active Test Ranges and Range Buffer Areas.
- Secure area with limited accessibility.



# 600 Area Location Map



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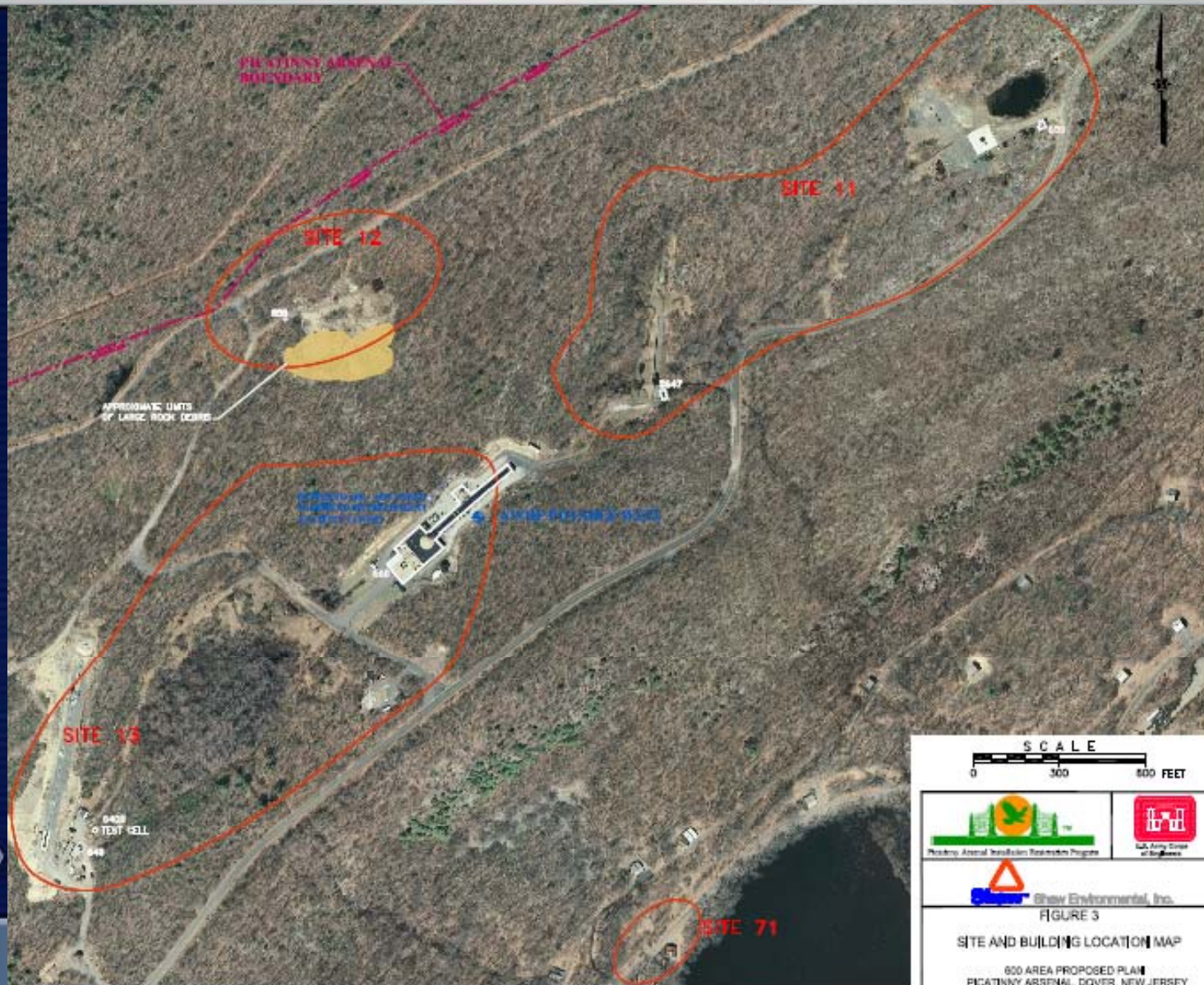


# History of Sites 11, 12 & 13

- **Site 11 ranges at Buildings 647, 649 and 650 were first developed in 1962. Building 647 and 649 ranges ceased operation in the 1990's.**
- **The Site 12 range was constructed between 1957 and 1963. Munitions testing operations took place from 1963 until the late 1980's.**
  - Disposal of fill was first observed in 1970 aerial photographs, additional fill was noted in 1974 photograph. A site reconnaissance in 1996 observed construction debris, drum debris, and a buried truck.
  - Large amounts of blasted rock and other debris from Site 13 (Building 660 Site) were deposited in the late 1990's.
- **Munitions /Pyrotechnics testing was conducted at Site 13 from 1963 to early 1990's.**



# 600 Area Groundwater Investigation Site Location Map



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# Previous Investigations

- **RI Concept Plan for PTA (USATHAMA, 1991)**
  - Identified Sites 11, 12 and 13 for further investigation in the 600 Area
- **Site Investigation of PTA (Dames and Moore, 1989)**
  - Site 11 – Sampled soils, surface water and sediment for explosives and metals.
  - Site 12 – Sampled site soils and sediment for explosives and metals.
  - Site 13 – Installed three shallow bedrock wells. Sampled site soils, sediment, surface water and groundwater for explosives and metals.



# Investigations

- **Phase II Health and Ecological Risk Assessment**
  - Conducted groundwater sampling for VOCs at 17 and 650) Sites.
- **Northeastern Ohio WDFW Well (1994)**
  - Detected concentration of TCE (1.39 ug/l).



# 600 AREA Groundwater Investigation



Tracking Number





# 600 Area Groundwater Investigation

- **AWDF well was sampled for VOCs again by SHAW in 2001 and 2003. TCE groundwater exceedances were detected in 2001 (39 ug/l) and 2003 (83 ug/l).**
- **Groundwater RI Work Plan (Shaw 2004)**
  - Identified four Areas of Concern (AOCs)
  - Fracture trace evaluation and VLF geophysical survey
  - Installation of four bedrock wells
  - Borehole geophysics and packer testing of AWDF and new wells
  - Passive soil gas survey in AOCs
  - Groundwater sampling for explosives and VOCs in new/existing wells
  - Synoptic water level round



# 600 Area Groundwater Investigation (continued)

## ➤ 600 Area Work Plan Addendum (Shaw 2005)

- Installation of five bedrock monitoring wells, with borehole geophysics and packer testing
- Groundwater sampling for VOCs and explosives at new and existing wells
- Surface water and sediment sampling at nine locations
- Isotope analysis of selected surface water samples
- Additional passive soil gas sampling.
- Synoptic water level monitoring

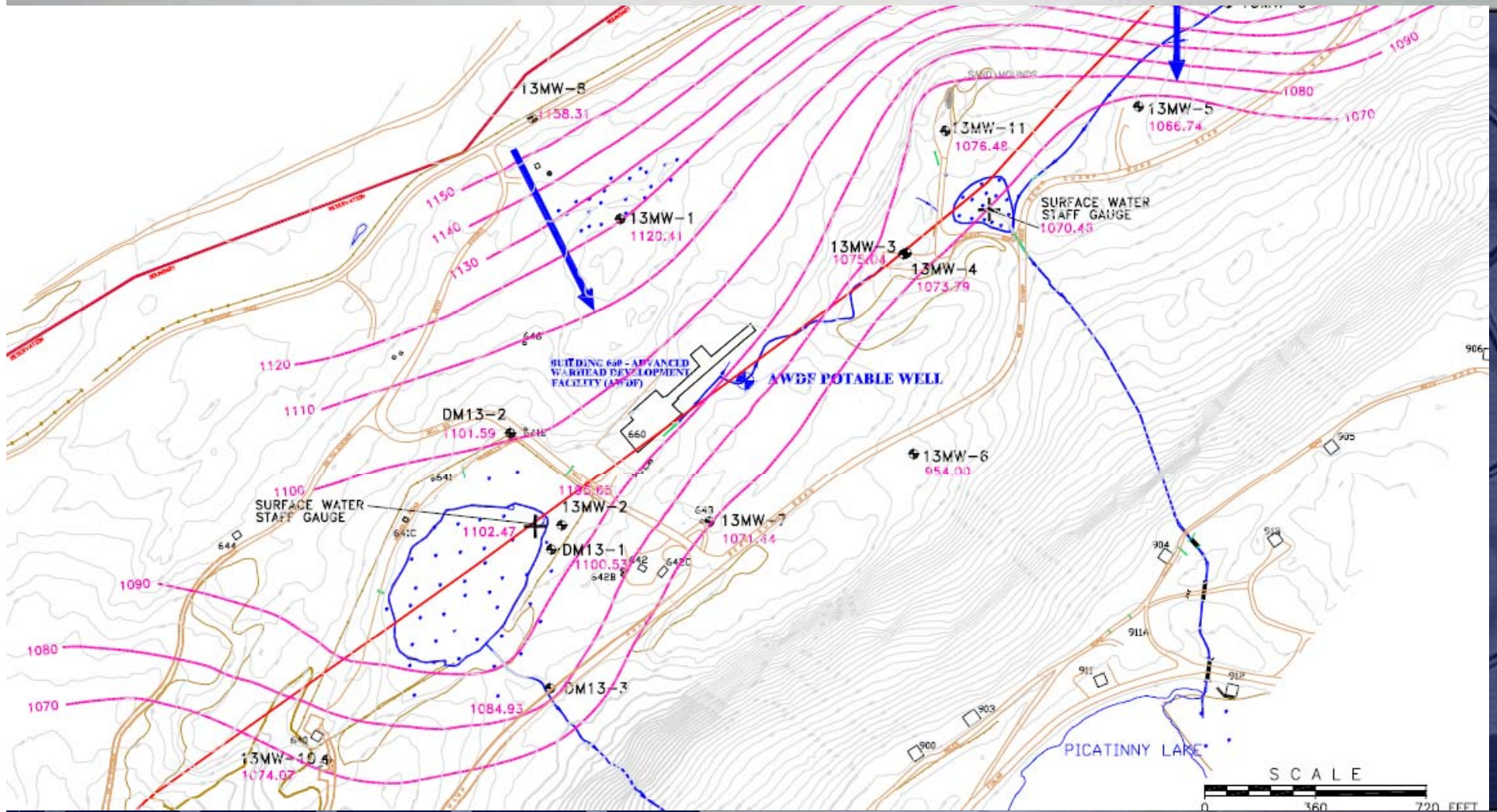


# 600 AREA Groundwater Investigation (continued)

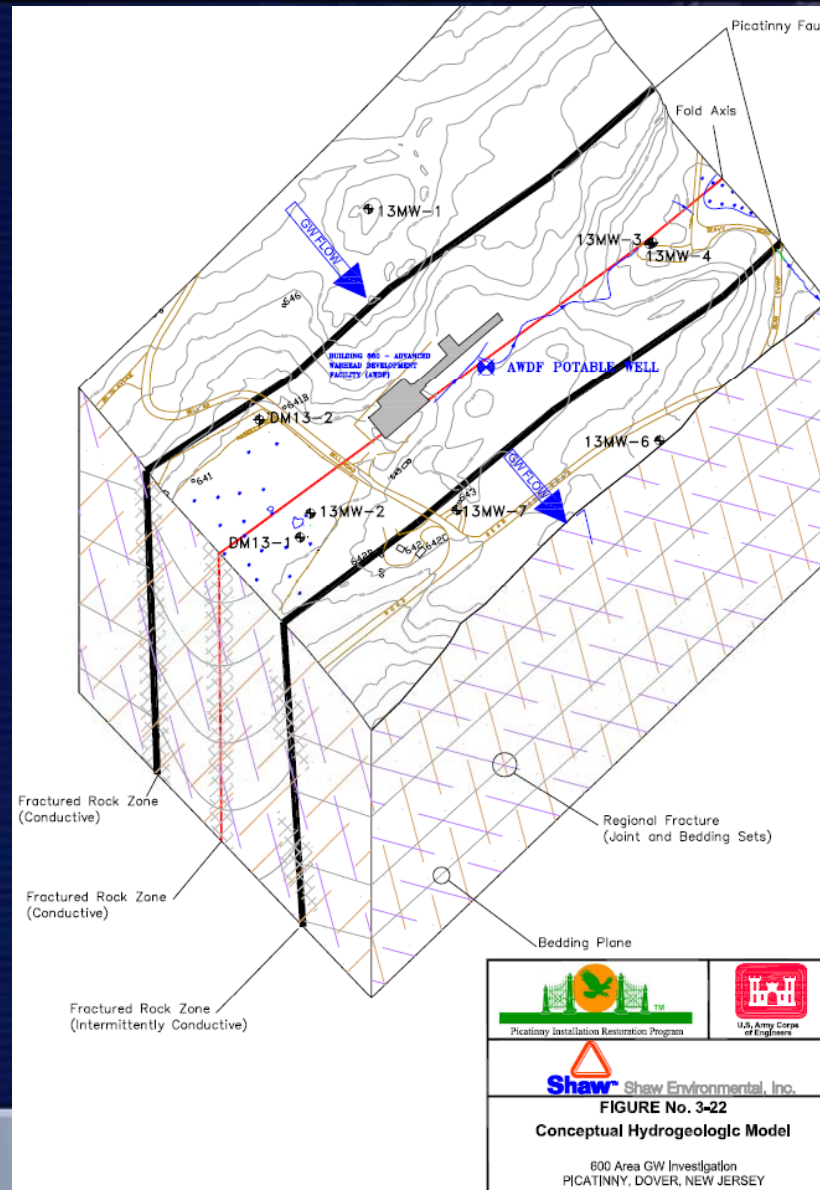
- **600 Area Supplemental Work Plan (Shaw 2007)**
  - Installation of two bedrock wells with borehole geophysics & packer testing.
  - Aquifer pumping test
  - Four rounds of quarterly groundwater, surface water and sediment sampling for VOCs and explosives
  - Analyze selected groundwater samples for bioremediation parameters .
  - Quarterly synoptic water level measurements
  - Additional soil sampling for VOCs
  - Prepared a Human Health Risk Assessment (HHRA)



# 600 Area Groundwater Investigation Groundwater Elevation Contour Map



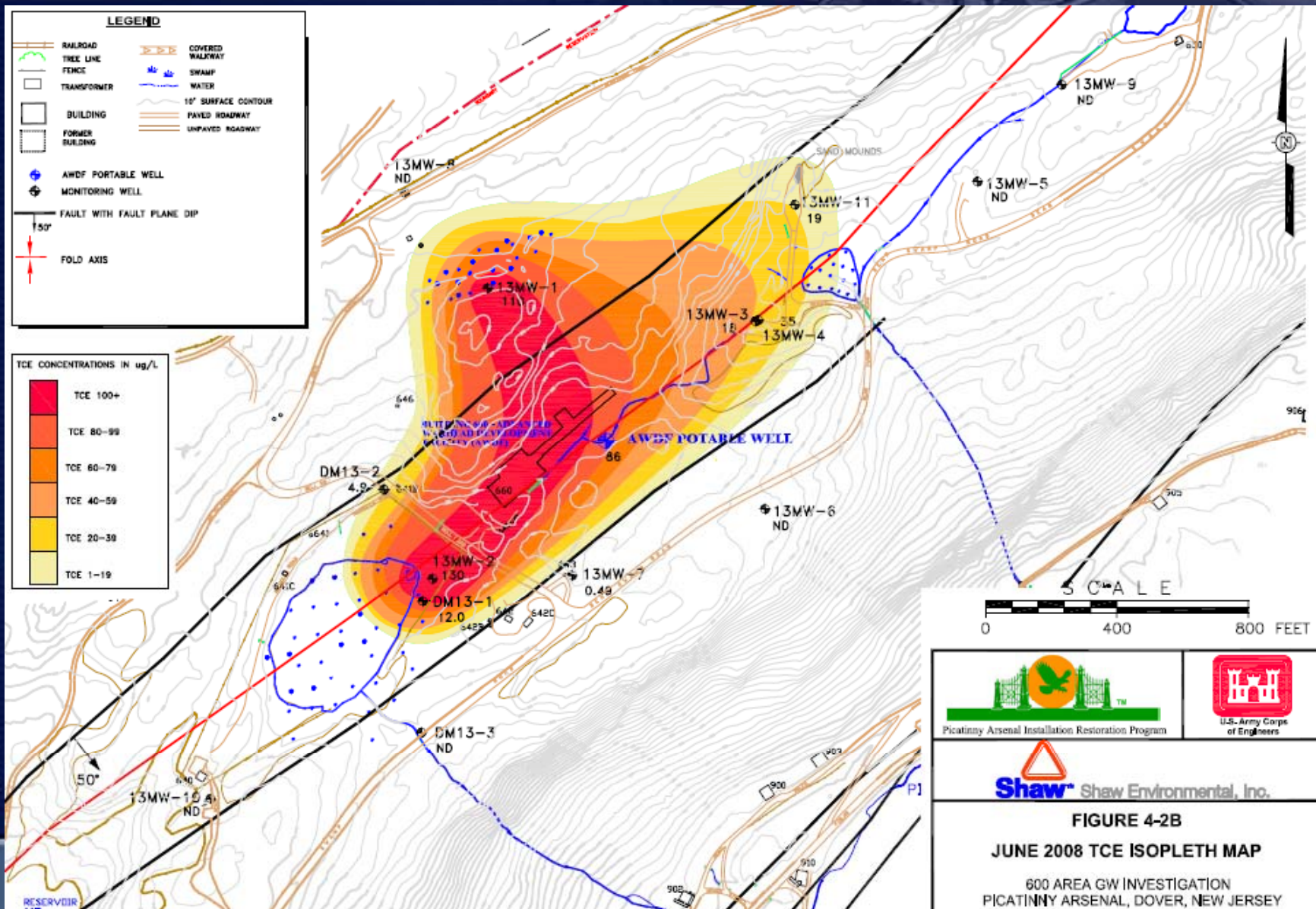
# 600 Area Groundwater Investigation Conceptual Hydrogeologic Model



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# 600 Area Groundwater Investigation TCE Groundwater Isopleth Map

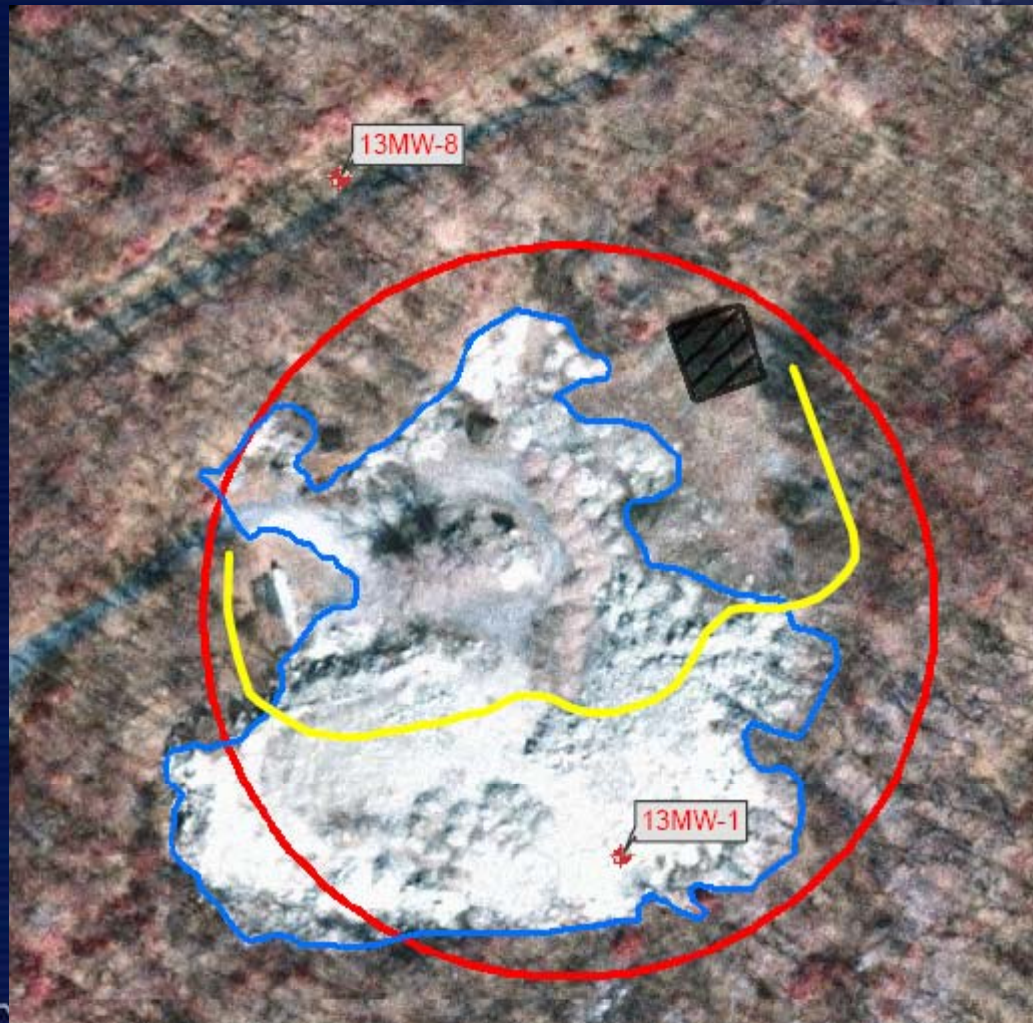


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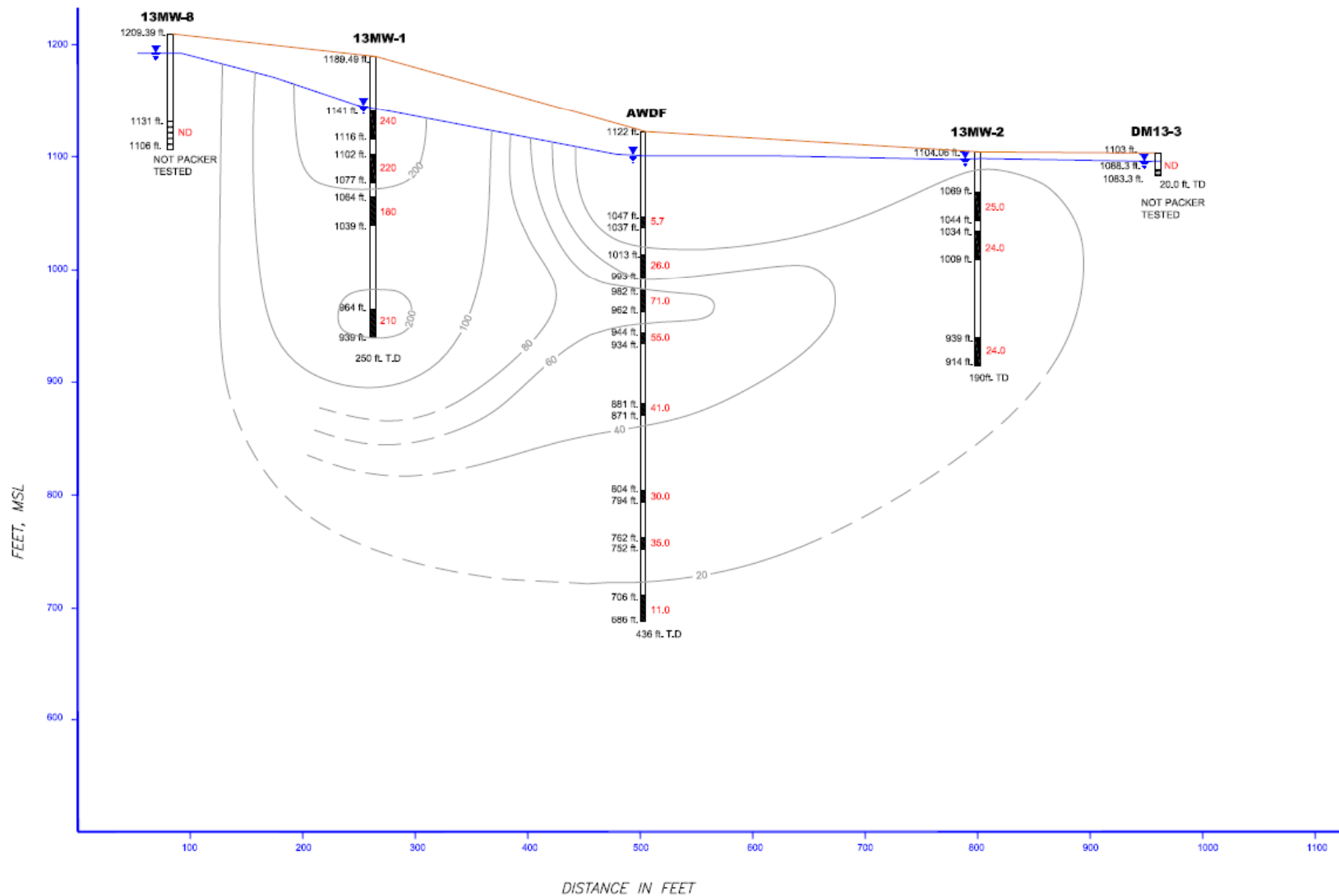
# 600 AREA Groundwater Investigation Interpreted Aerial Photo of Site 12 (AOC 1)



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# 600 Area Groundwater Investigation Vertical Extent of TCE in Packer Tested Wells

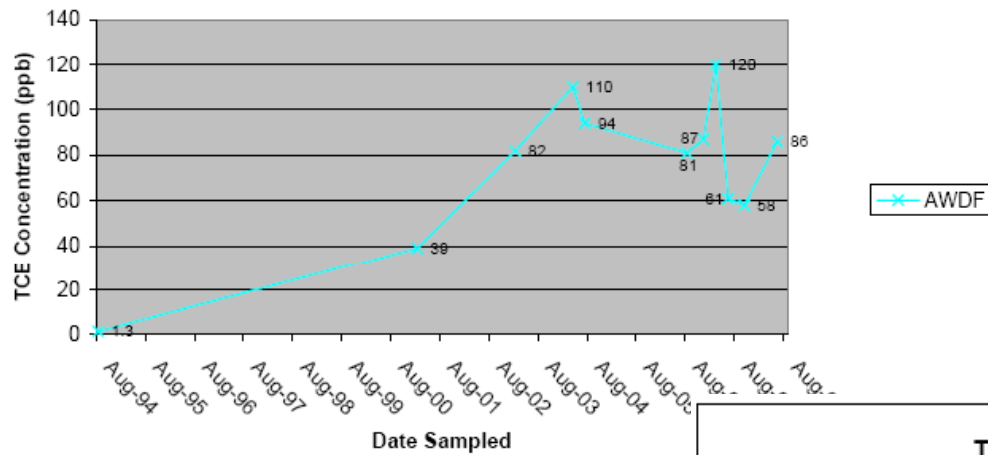




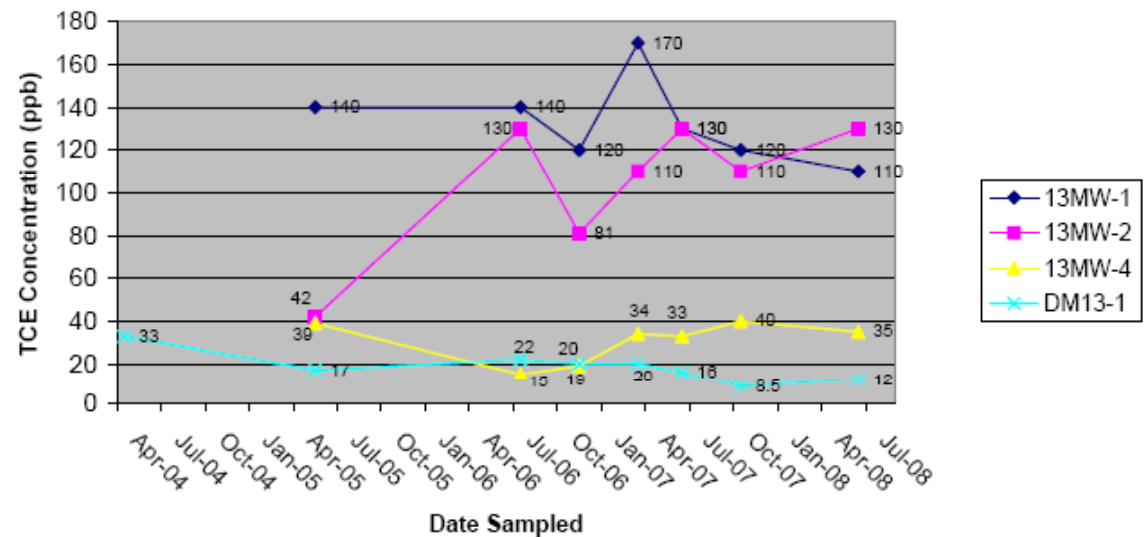
# 600 Area Groundwater Investigation

## Groundwater TCE Time-Concentration Data

TCE Concentration in AWDF Over Time  
(Spigot Sample Prior to Treatment)



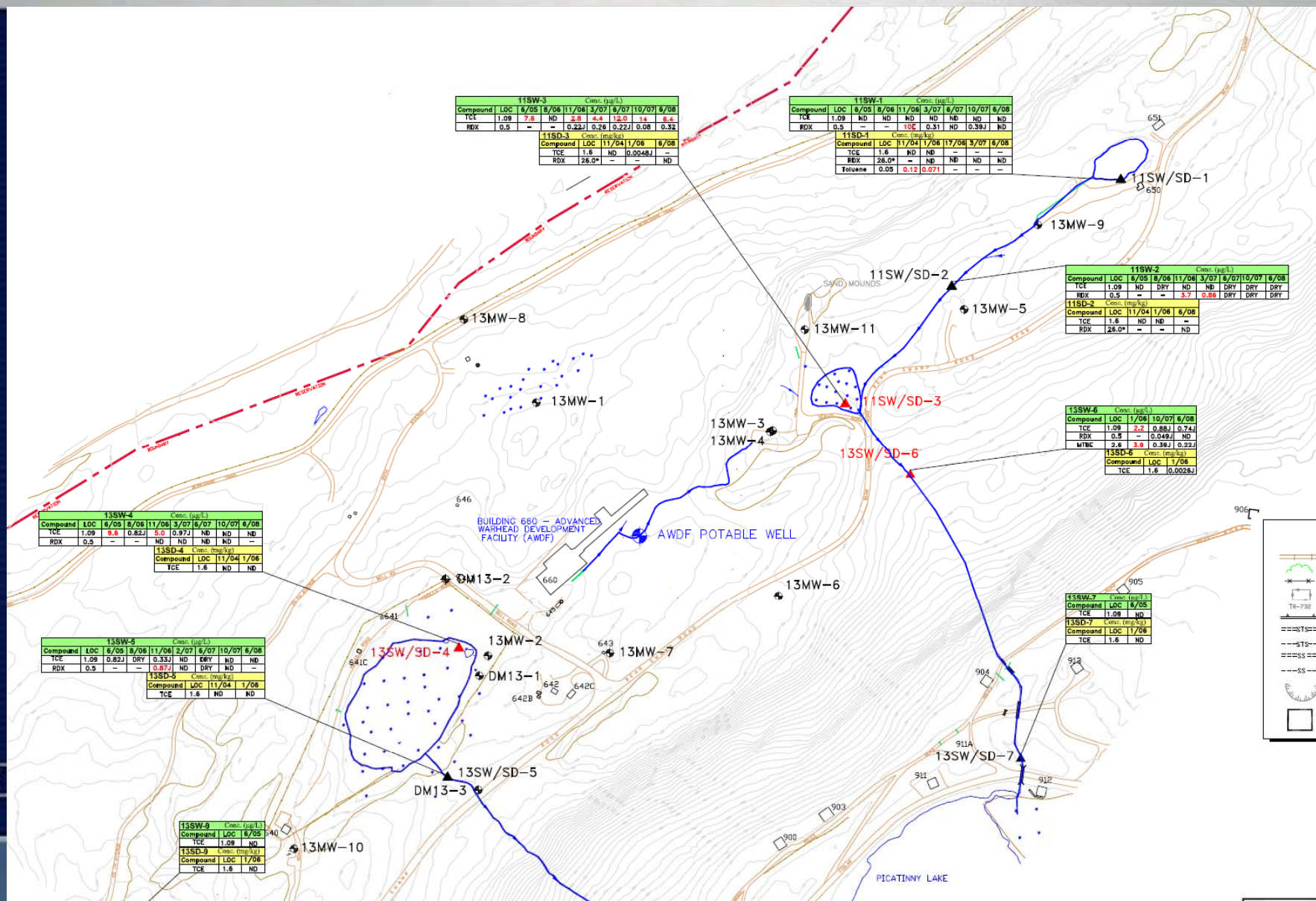
TCE Concentration in Monitoring Wells Over Time



Tracking Number



# 600 Area Groundwater Investigation Surface Water and Sediment Sampling Data



Tracking Number

# 600 AREA Feasibility Study

## ➤ Remedial Action Objectives (RAO's)

- To prevent human exposure to contaminated groundwater that would cause unacceptable risk over the duration of the response action; and
- To achieve the more stringent of the MCL's or NJGWQS to restore groundwater to meet state GWQS or risk based cleanup goals to its beneficial use as a drinking water source.

## ➤ Chemical Specific ARARs and TBCs

- Federal and State Groundwater ARARs
- Federal lifetime drinking water Health Advisory (HA) and USEPA RBCs.

## ➤ Contaminants of Concern (COCs)

- Screening of COPCs to derive the COC(s)



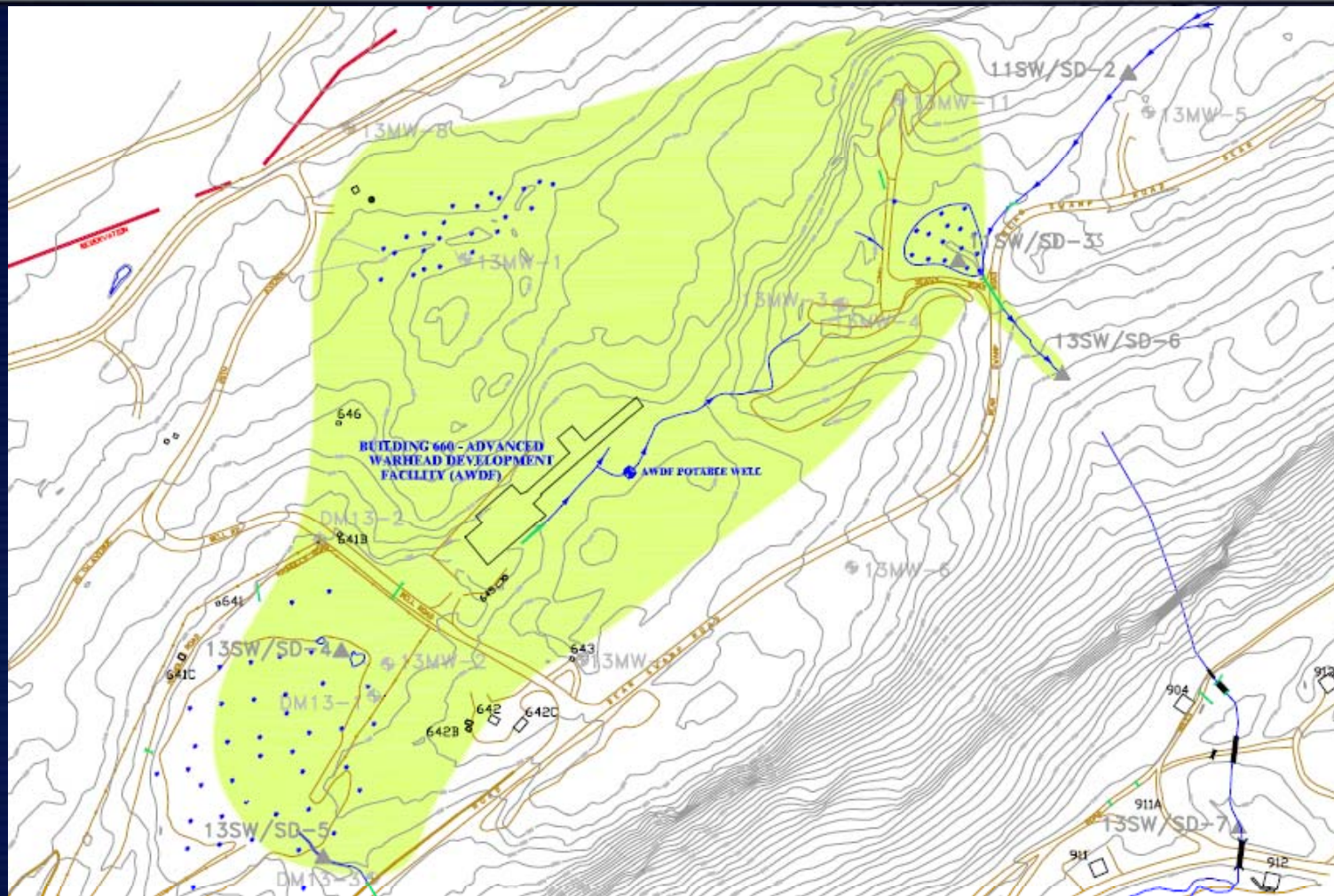
# 600 AREA Feasibility Study

- **Groundwater COC Screening Criteria**
  - Exceeds applicable ARARs
  - Plume distribution
  - HHRA Risk Driver
  
- **TCE is the 600 Area GW COC**
  
- **Groundwater Area of Attainment (AA)**
  - Defines the area in which RAO's are achieved
  - Cleanup levels must be achieved throughout AA

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# 600 AREA Feasibility Study Area of Attainment



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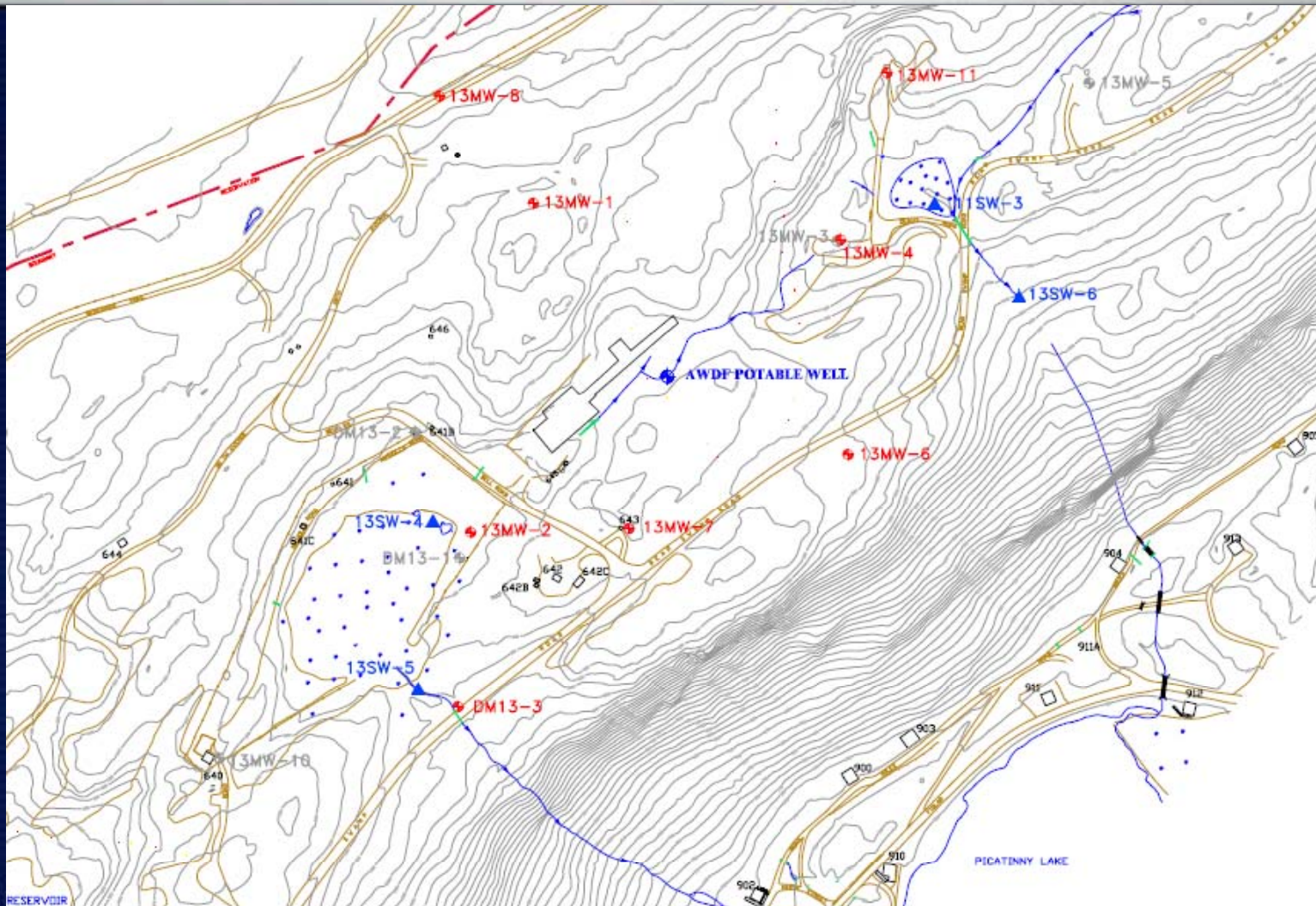
# 600 Area Feasibility Study Remedial Alternatives

- **Alternative GW-1: No Action**
- **Alternative GW-2: Long Term Monitoring with Institutional Controls (ICs)**
- **Alternative GW-3: Monitored Natural Attenuation (MNA) with ICs**
- **Alternative GW-4: *In situ* Chemical Oxidation and MNA with ICs**
- **Alternative GW-5: *In situ* Enhanced Anaerobic Bioremediation and MNA with ICs**
- **Alternative GW-6: Source Removal and MNA with ICs**

Tracking Number



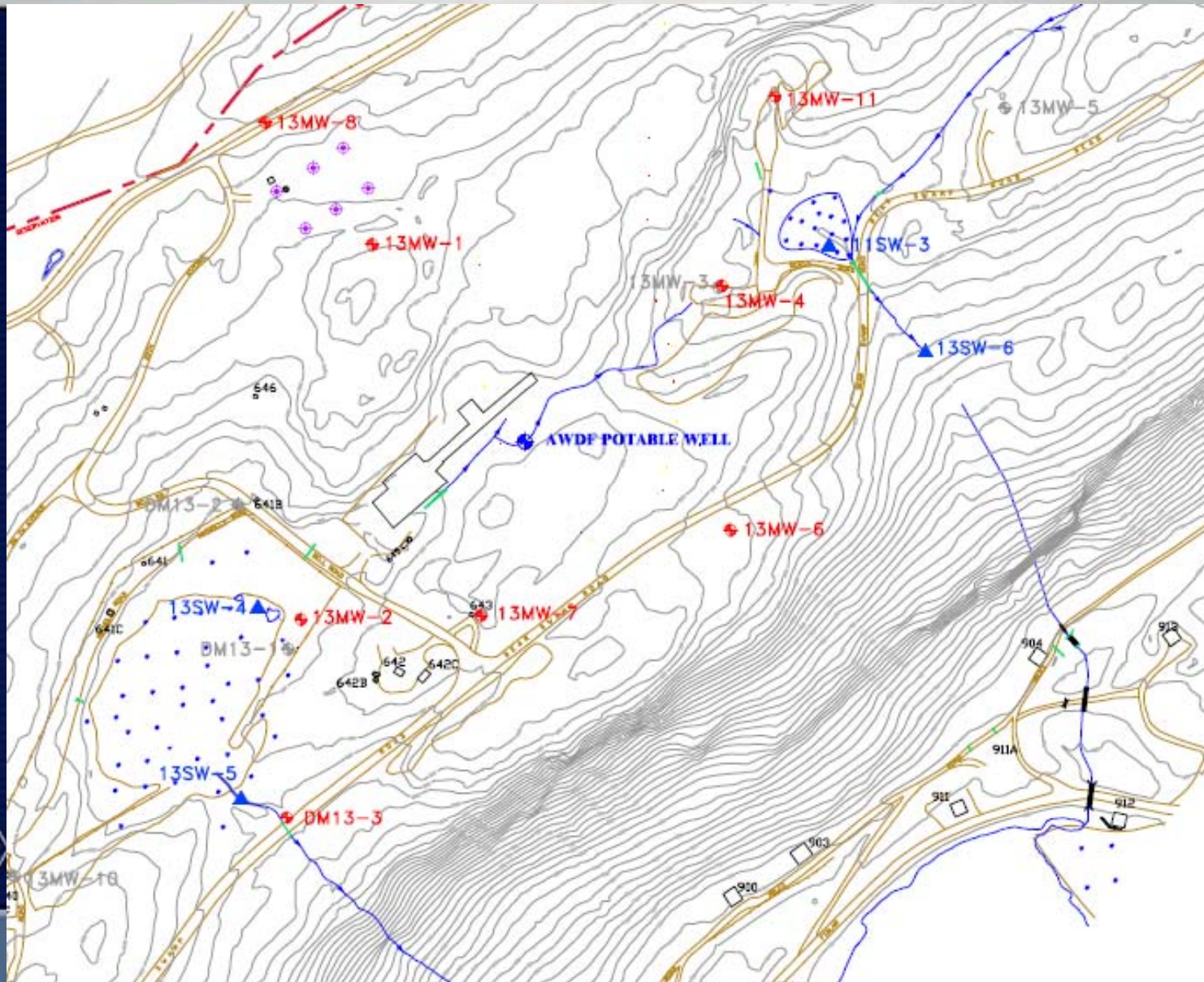
# 600 Area Feasibility Study Remedial Alternatives GW-2 & 3



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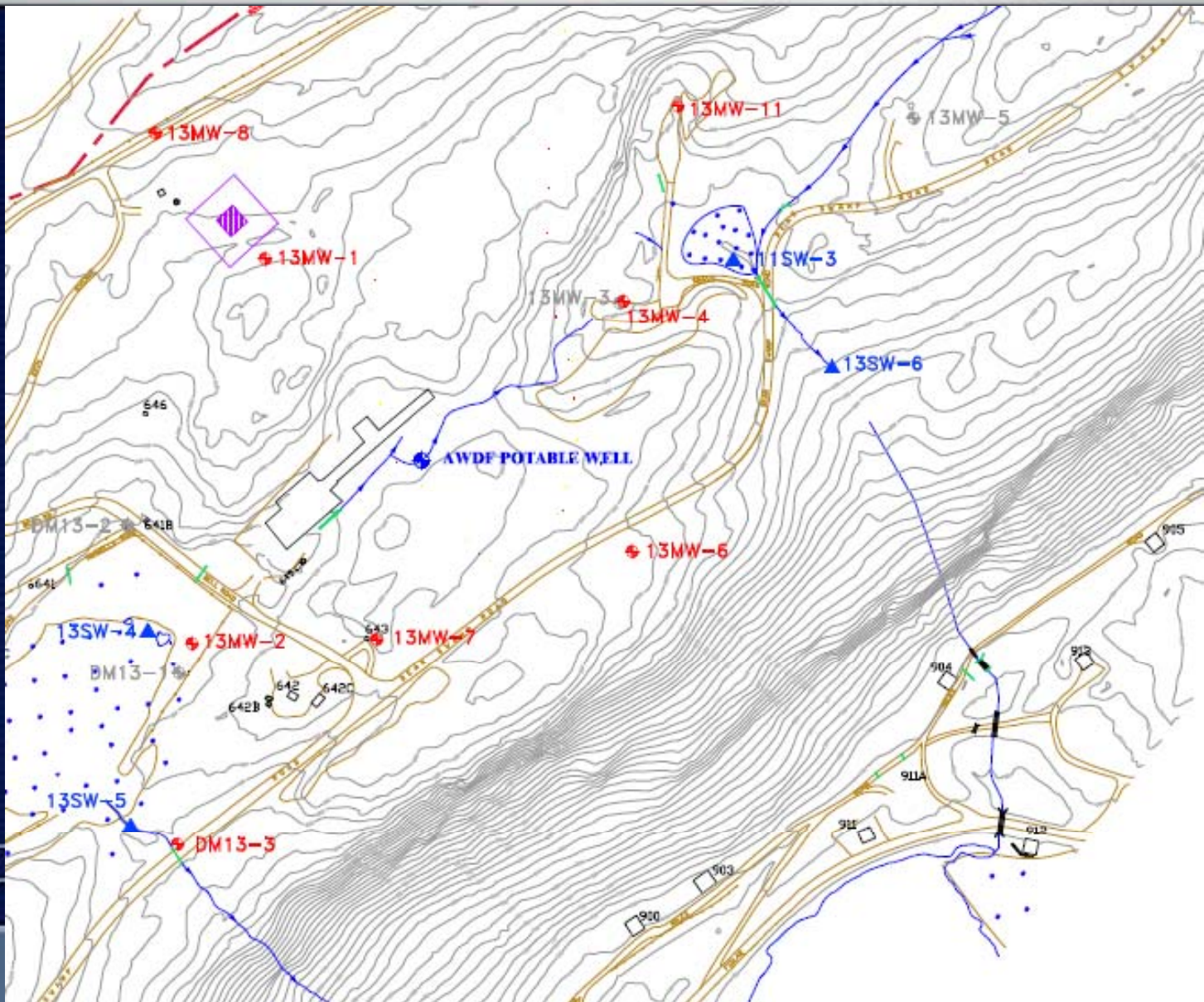


# 600 Area Feasibility Study Remedial Alternative GW-4 & 5





# 600 Area Feasibility Study Remedial Alternative GW-6



Tracking Number

# 600 Area Feasibility Study

## Comparison of Costs

| Remedial Alternative  | Capital Costs | Discounted O&M Cost | Total Present Value Worth | Timeframe                        |
|---|---------------|---------------------|---------------------------|----------------------------------|
| GW-1: No Action   | \$0           | \$0                 | \$0                       | NA                               |
| GW-2: Long Term Monitoring with Institutional Controls (ICs)            | \$60,000      | \$565,315           | \$625,315                 | 60 years                         |
| GW-3: Monitored Natural Attenuation (MNA) with ICs                      | \$60,000      | \$643,809           | \$703,809                 | 60 years                         |
| GW-4: <i>In Situ</i> Chemical Oxidation with MNA and ICs                | \$466,891     | \$675,902           | \$1,142,793               | 3 years active<br>60 years total |
| GW-5: <i>In Situ</i> Enhanced Anaerobic Bioremediation with MNA and ICs | \$505,644     | \$755,269           | \$1,260,913               | 4 years active<br>60 years total |
| GW-6: Source Material Excavation and MNA with ICs                       | \$999,212     | \$424,200           | \$1,424,200               | >1 year active<br>20 years total |

Tracking Number



# 600 Area Feasibility Study

## Preferred Alternative

- **Preferred Alternative is GW-2: Long Term Monitoring with Institutional Controls**
  - Lowest cost alternative
  - Can be readily implemented with no treatment or other risk
- **Objectives of Long Term Monitoring**
  - Ensure that the TCE groundwater plume does not spread
  - Assess the need to implement a contingent remedy
- **Groundwater plume TCE concentrations are expected to decrease over time**
- **The LTM program will be evaluated in a Five Year Review**
- **MNA may be reevaluated as a remedy if a TCE attenuation rate and time to cleanup can be determined.**

