Shaft Sampling & Profiling at the Section 27 Mine

Presented By:
Amy Andrews

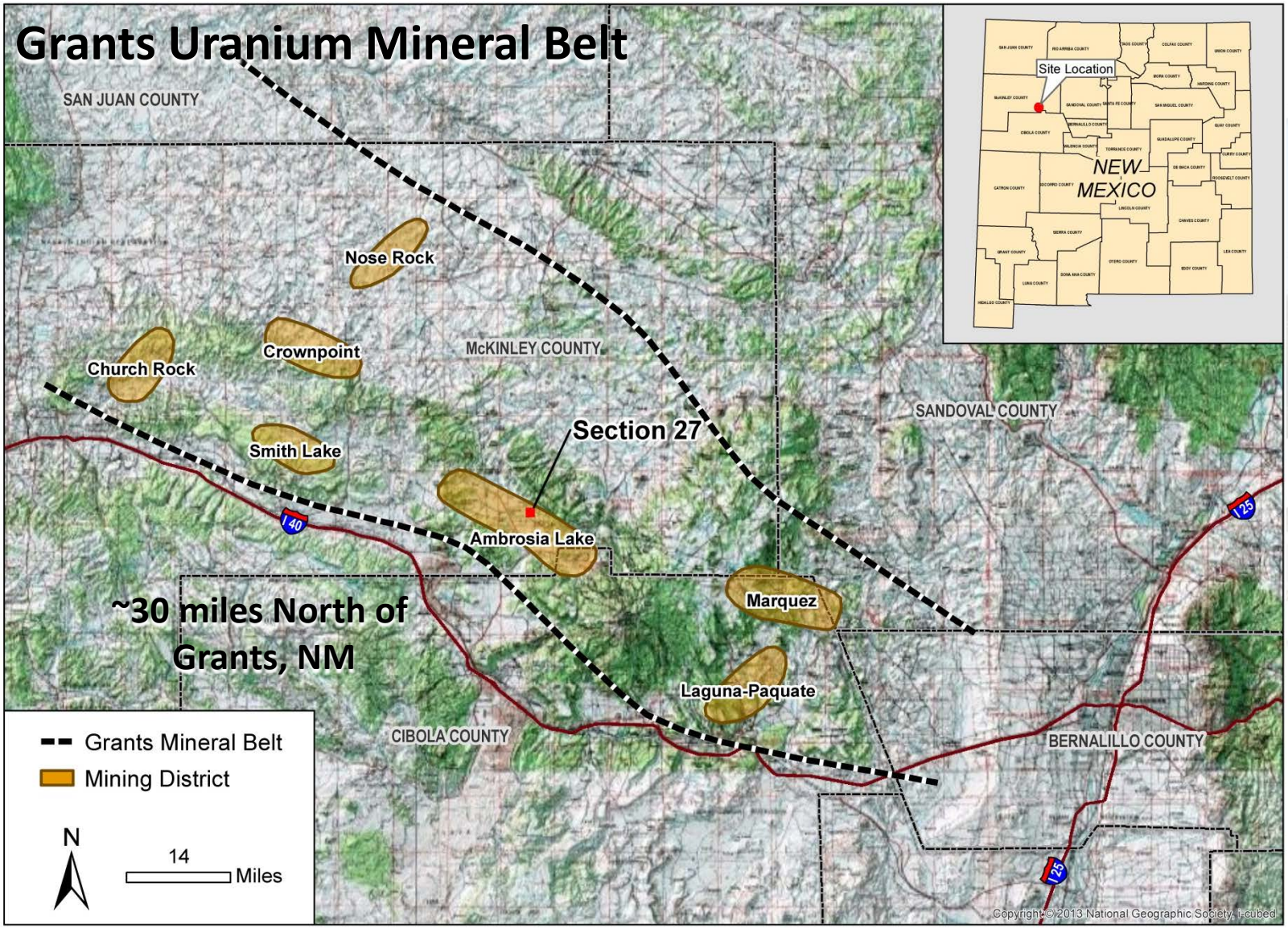
INTERA
GEOSCIENCE & ENGINEERING SOLUTIONS

2014

Outline

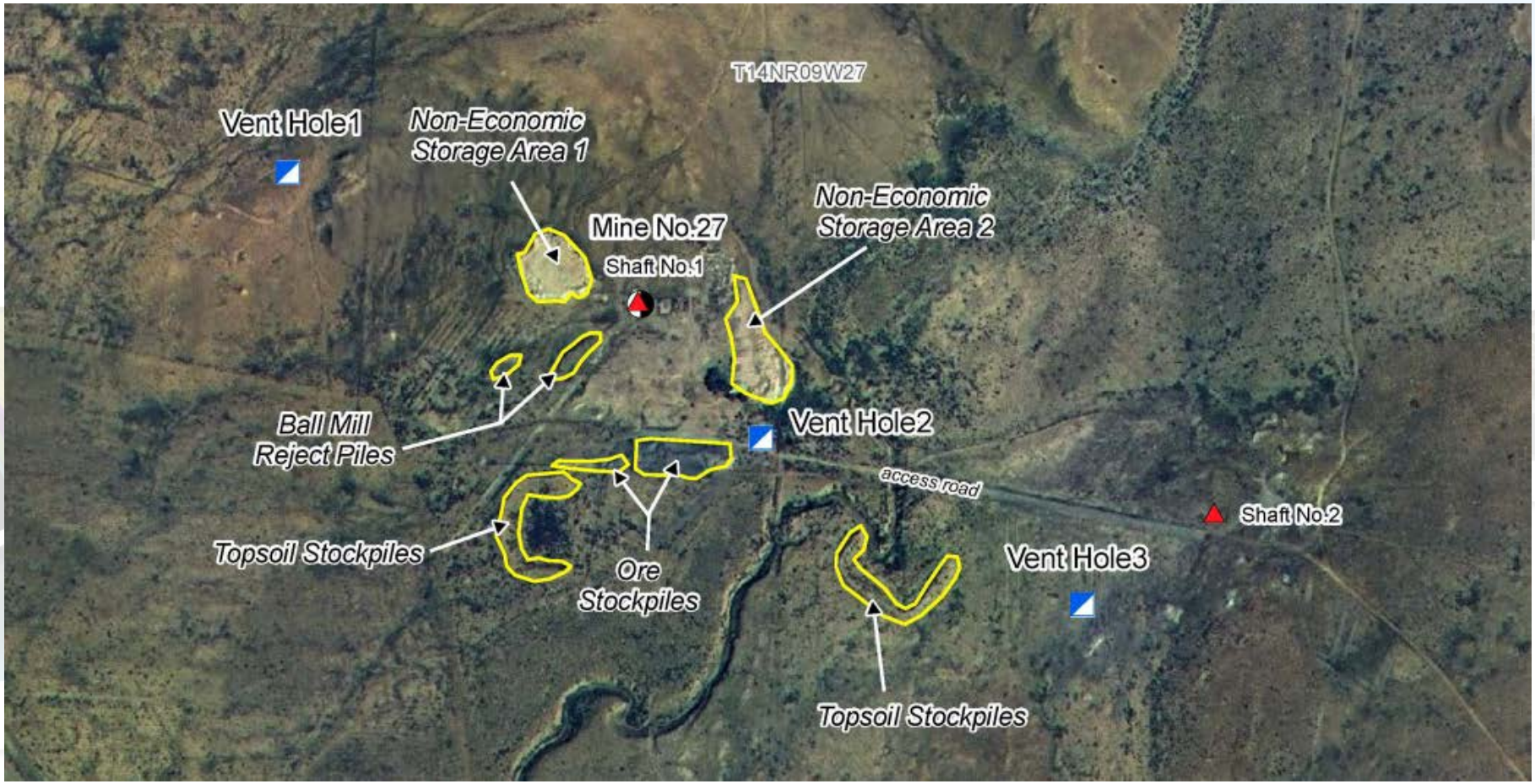
- Site Location
- History
- INTERA's Profiling and Sampling Plan
- Profiling and Sampling Procedure
- Results
- Conclusions

Section 27 Site Location



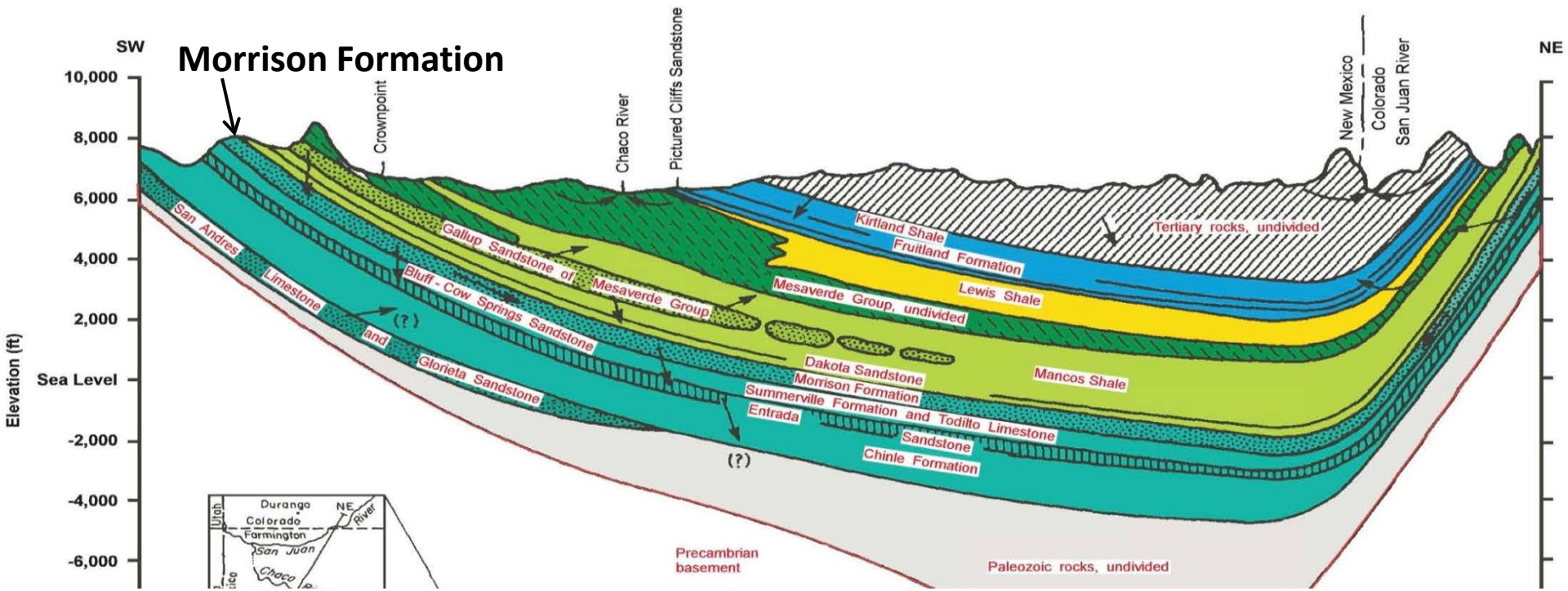
Section 27 Site History

- Uranium ore in Westwater Sandstone groundwater
- Operational in 1970's



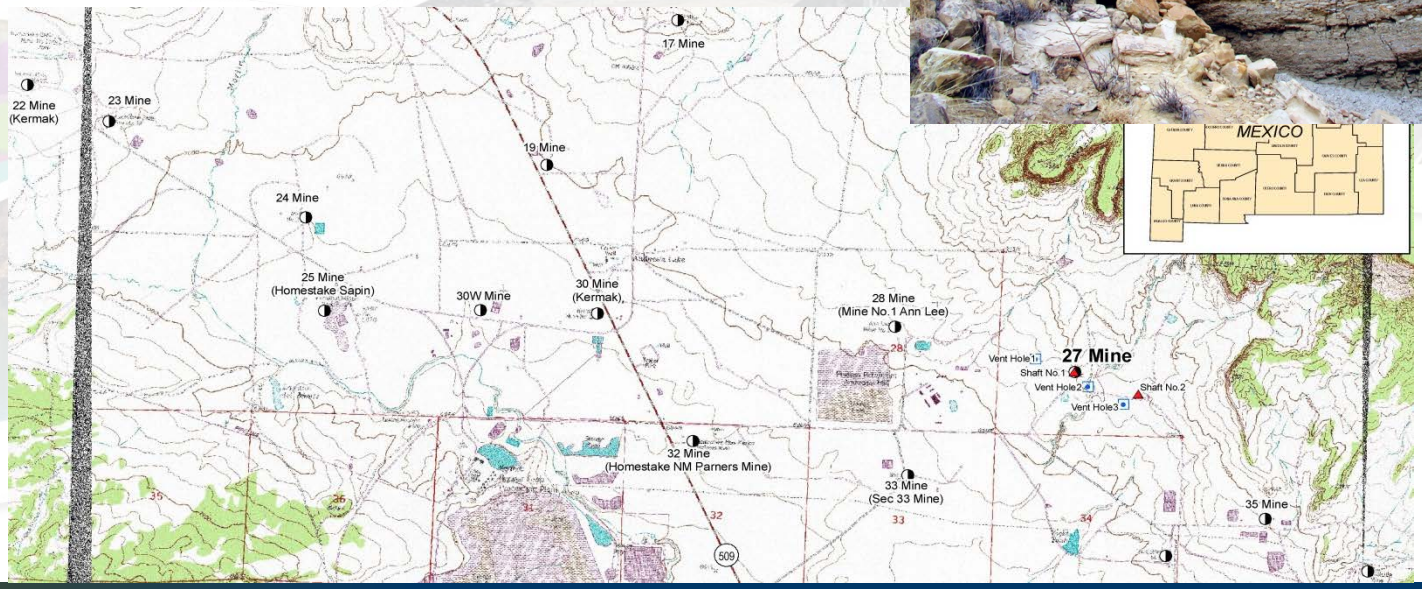
Hydrogeology

- Ore-bearing aquifer –
  - Westwater Canyon Member of the Morrison Formation
- Multiple aquifers
  - Westwater Canyon, Dakota Sandstone, Tres Hermanos in the Mancos Shale



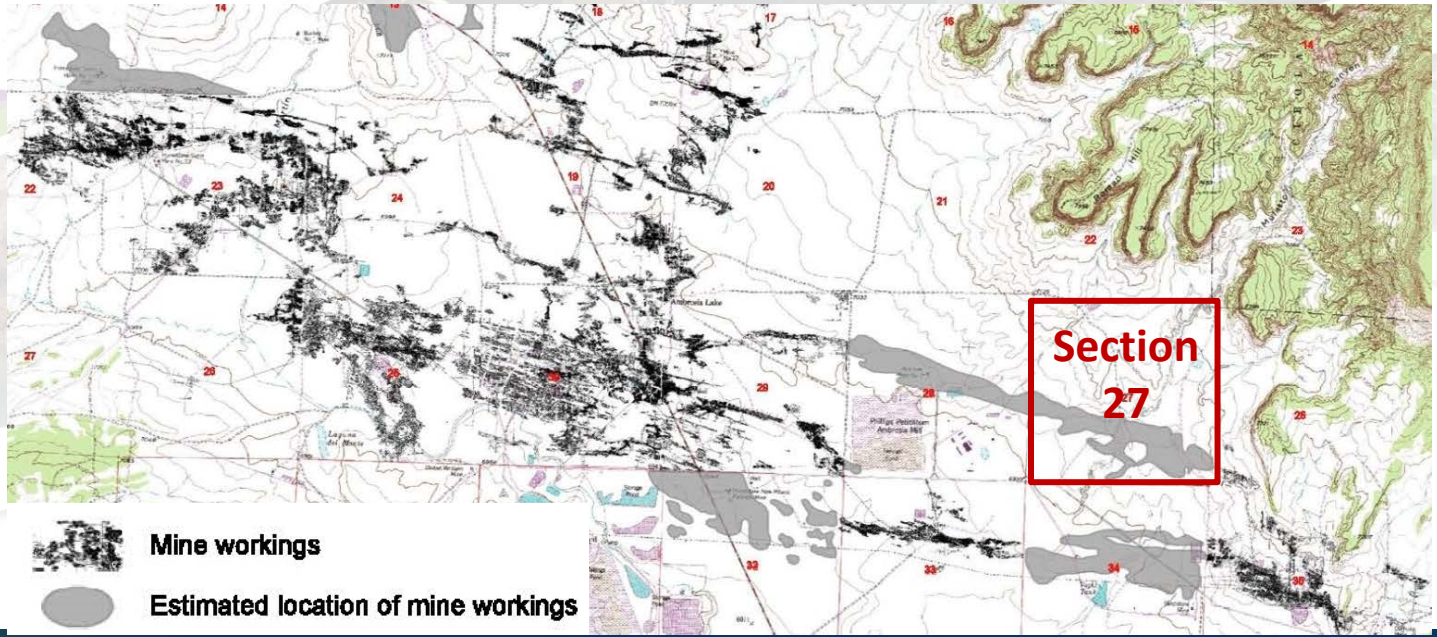
Regional Site History

- Uranium ore in Westwater Sandstone groundwater
- Dewatering 1950's - ~1986
  - Regional cone of depression
  - Groundwater recovery
- NMWQCC Standards exceeded
  - U, Ra, SO4, TDS
- Geochemical stabilization with time



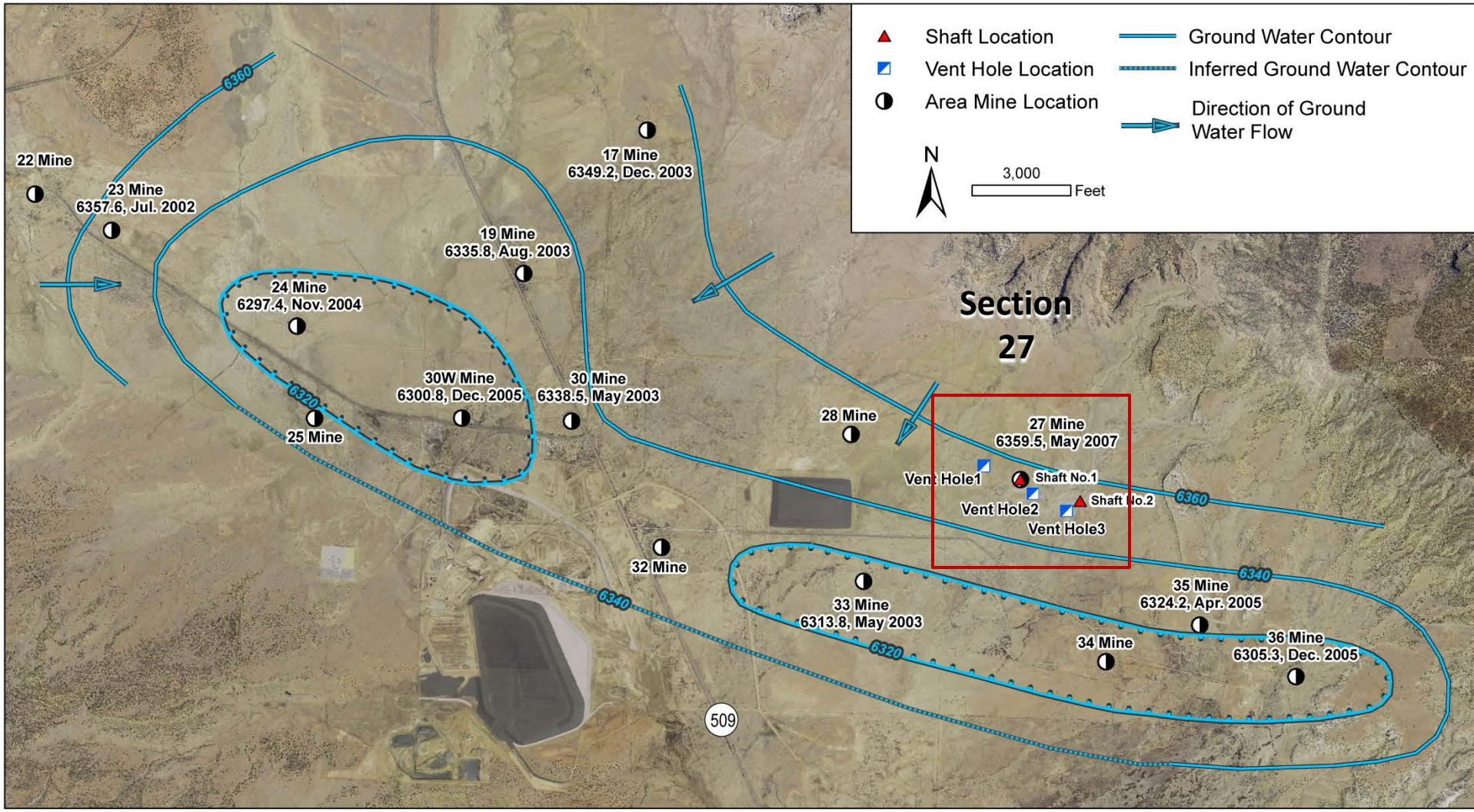
Dewatering and Area Groundwater

- Interconnected workings
  - 10 miles long, 3 miles wide
- Mine dewatering prior to implementation of surface water and groundwater regulations
  - 150 billion gallons from numerous mines
  - Surface discharge to several major arroyos
  - Saturated the alluvium and recharged deeper aquifers in some areas



2003-2007 Cone of Depression

- Cone of depression – contains affected groundwater



Site Characterization Strategy

- Groundwater monitoring program designed
- Support common goal to understand regional groundwater quality
  - Current groundwater quality
  - Vertical groundwater variability

Shaft Profiling Equipment

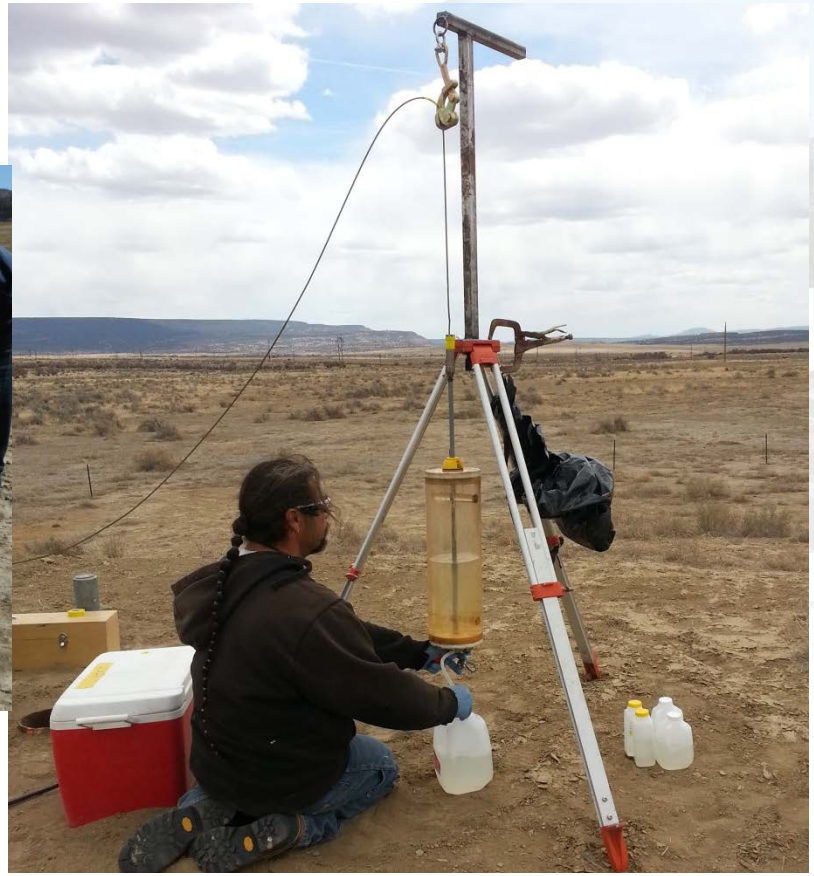
- In-Situ Troll 9500
  - Probes include temperature, pH, conductivity, oxidation reduction potential (ORP), rugged dissolved oxygen (RDO), and depth of water (via barometric pressure)
  - Parameters are logged every 10 seconds and can be seen on the Rugged Reader as they are collected

Shaft Profiling

- Profile 2 Vent Shafts
- Parameters plotted
- Sample depth determined

Shaft Sampling

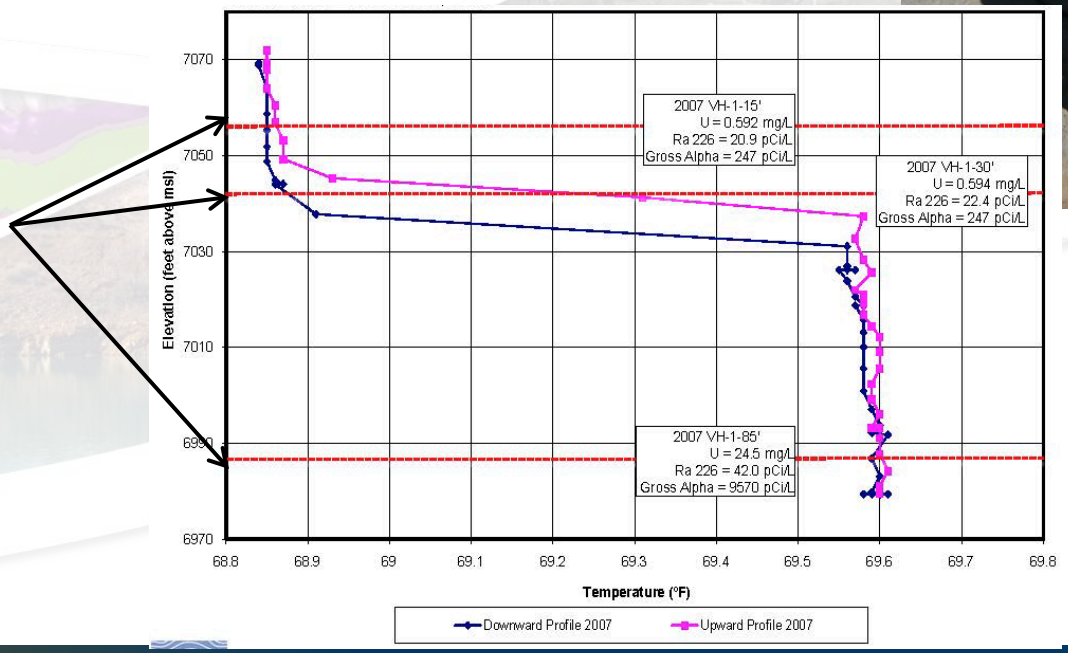
- Discrete depth grab sampler



Field Investigations

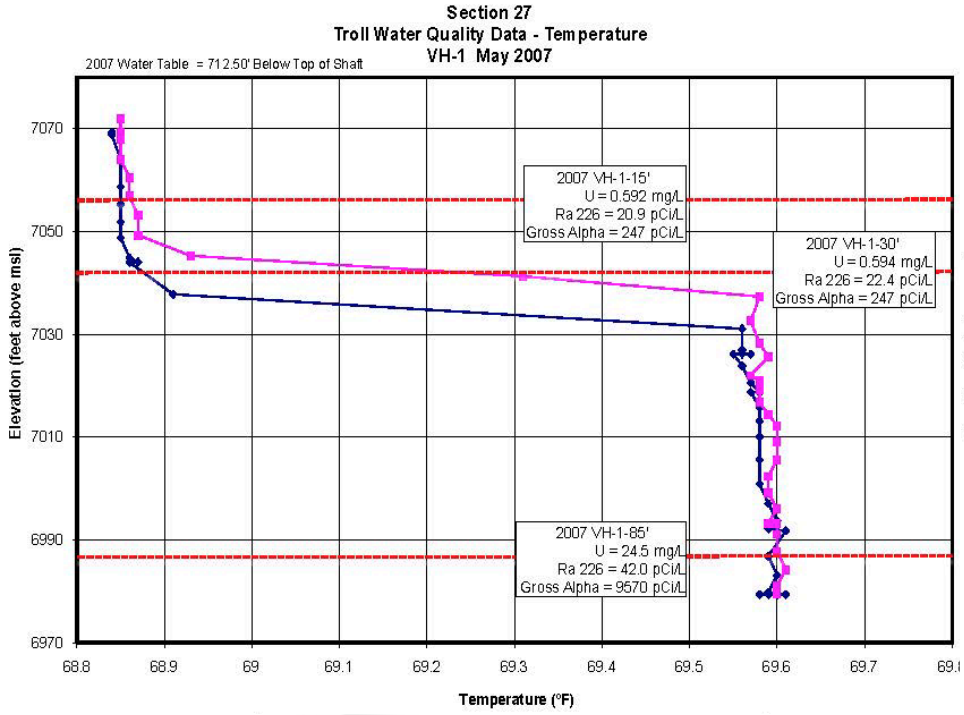
- Depth-to-water measurements
- Vertical profiling of vent holes
  - Continuous profiling
  - Profiling results influenced sample depth in each vent shaft
- Groundwater quality sampling

SAMPLE DEPTHS

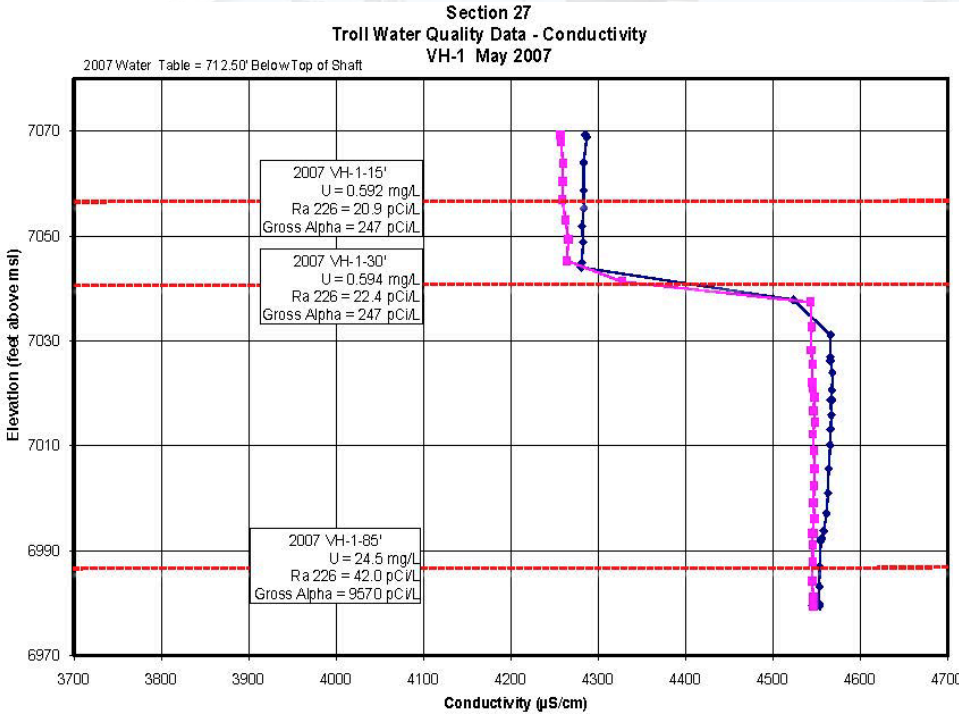


Shaft Profiling Results

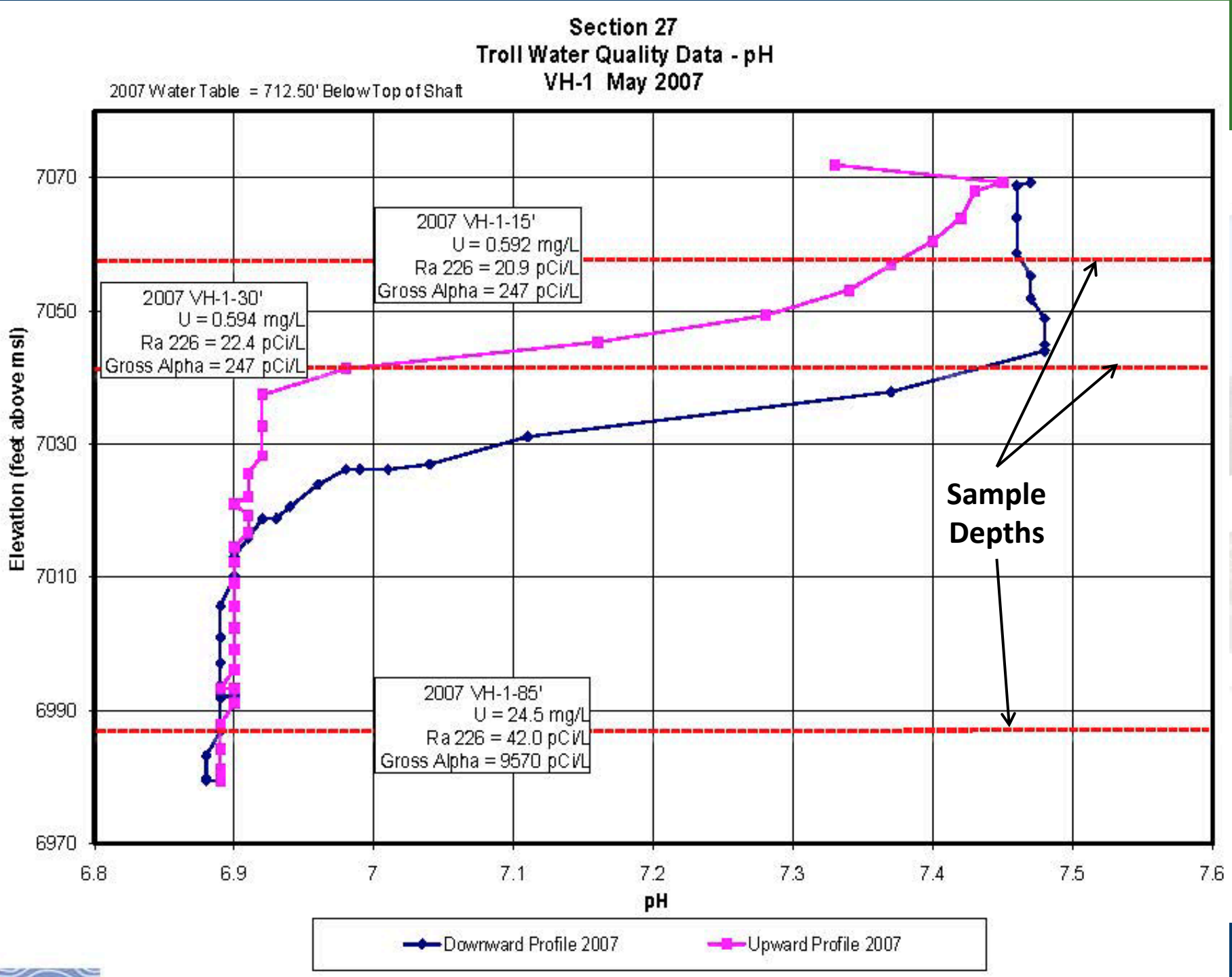
- Parameters
  - Temperature, pH, Conductivity, Dissolved Oxygen, Oxidation Reduction Potential



Temperature – May 2007

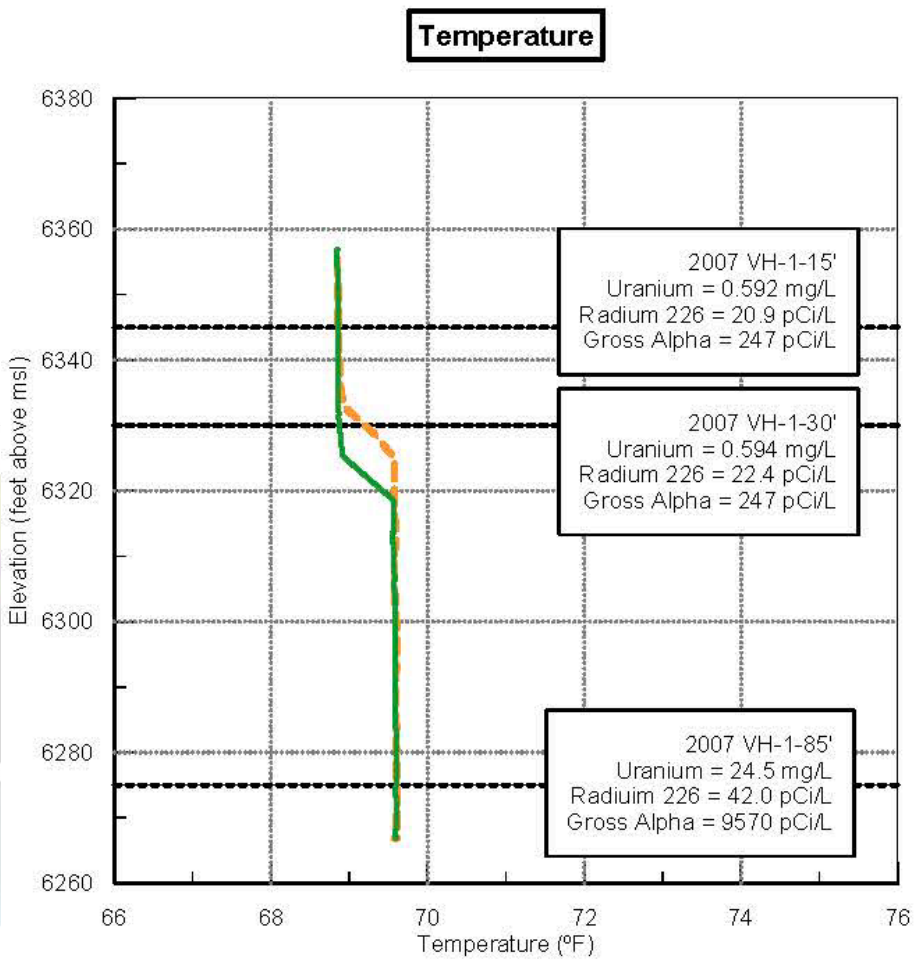


Conductivity – May 2007

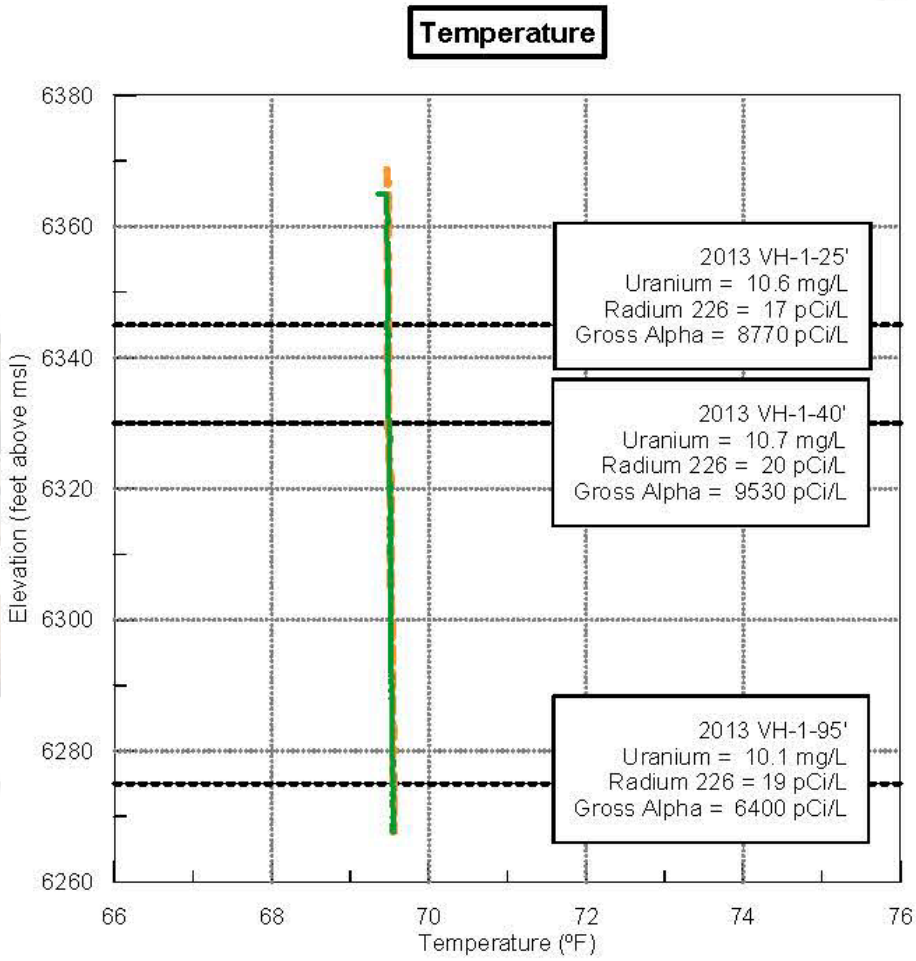

Section 27
Troll Water Quality Data - pH
VH-1 May 2007
2007 Water Table = 712.50' Below Top of Shaft
2007 VH-1-15'
U = 0.592 mg/L
Ra 226 = 20.9 pCi/L
Gross Alpha = 247 pCi/L
2007 VH-1-30'
U = 0.594 mg/L
Ra 226 = 22.4 pCi/L
Gross Alpha = 247 pCi/L
2007 VH-1-85'
U = 24.5 mg/L
Ra 226 = 42.0 pCi/L
Gross Alpha = 9570 pCi/L
Sample Depths
Elevation (feet above msl)
7070
7050
7030
7010
6990
6970
6.8
6.9
7
7.1
7.2
7.3
7.4
7.5
7.6
pH
Downward Profile 2007
Upward Profile 2007

Shaft Profiling Results

2007 Profile Results

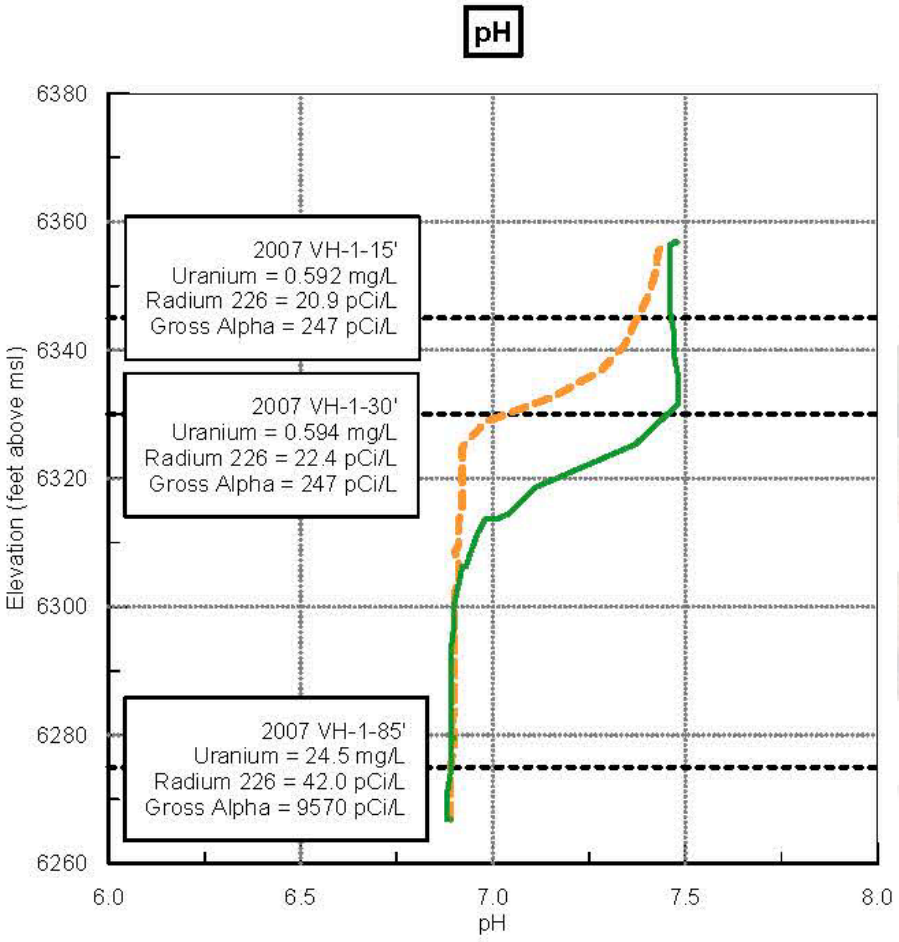


2013 Profile Results

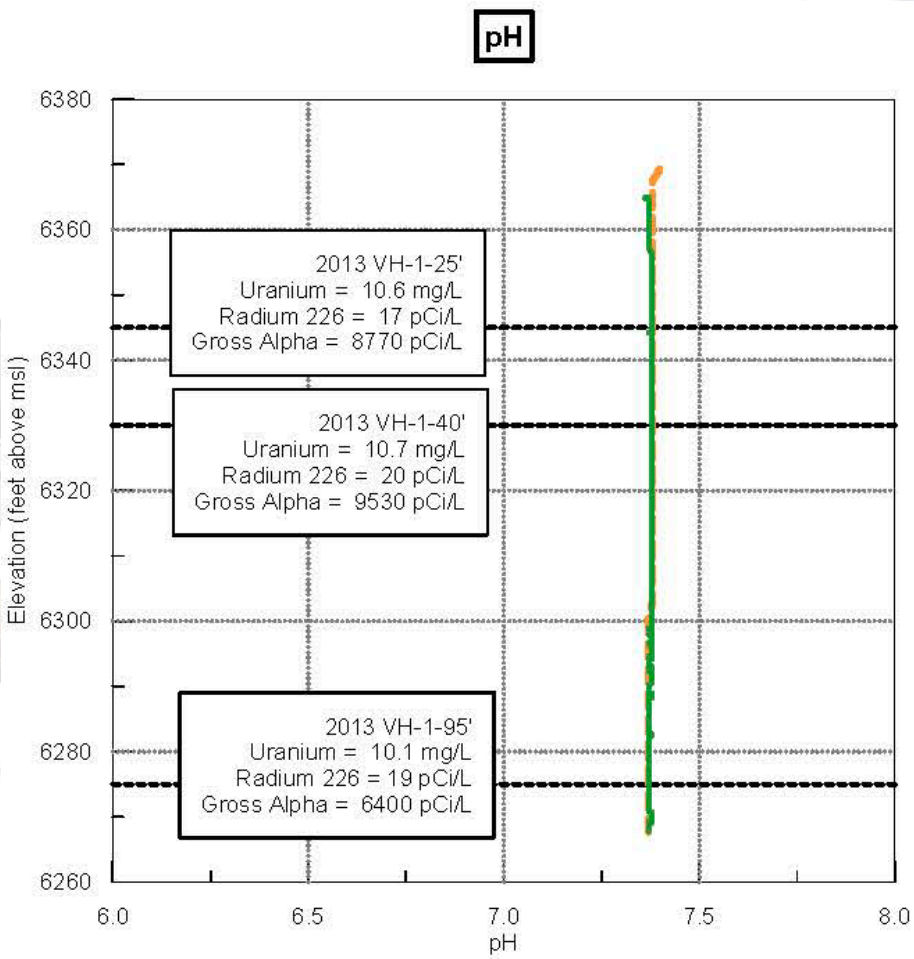


Shaft Profiling Results

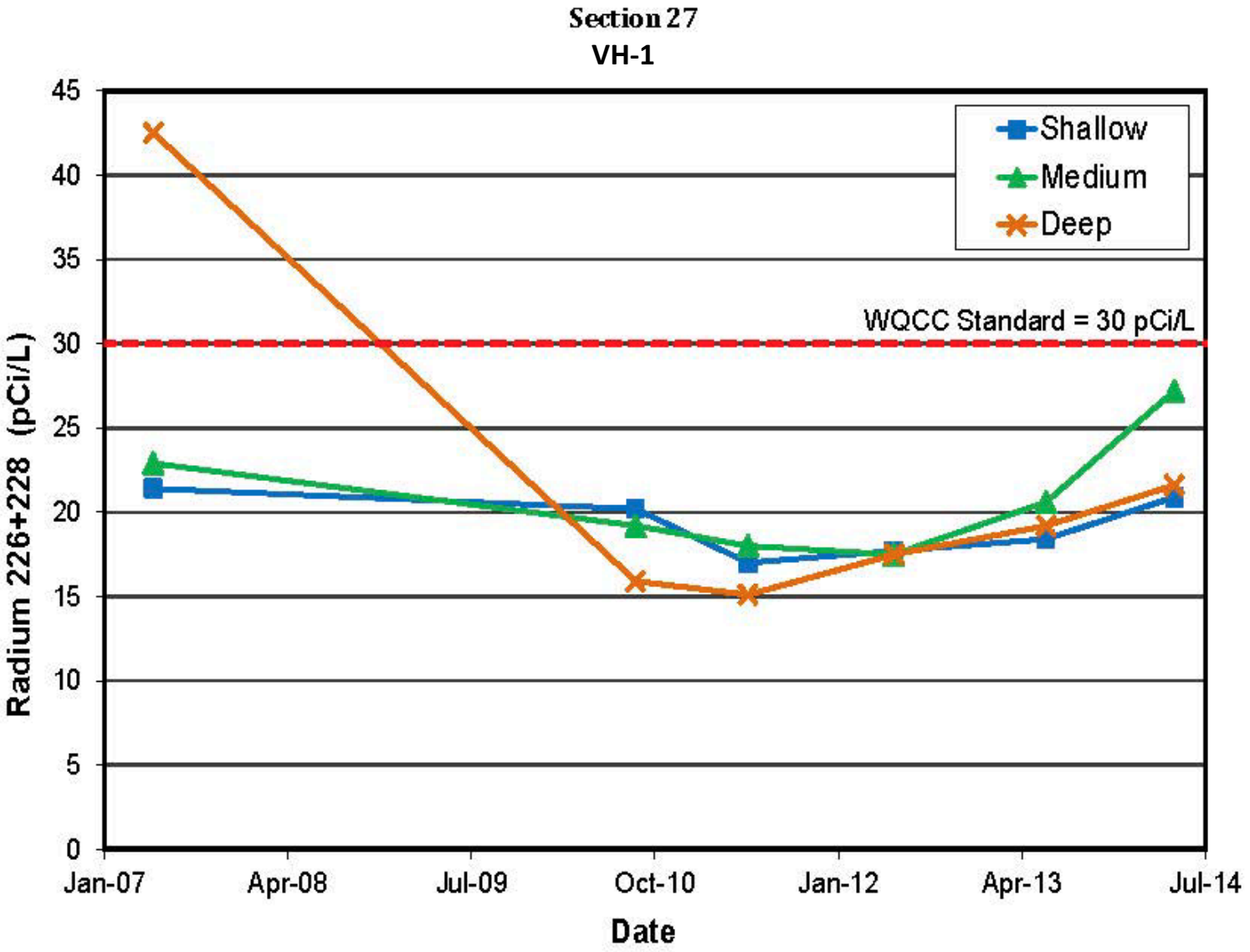
2007 Profile Results



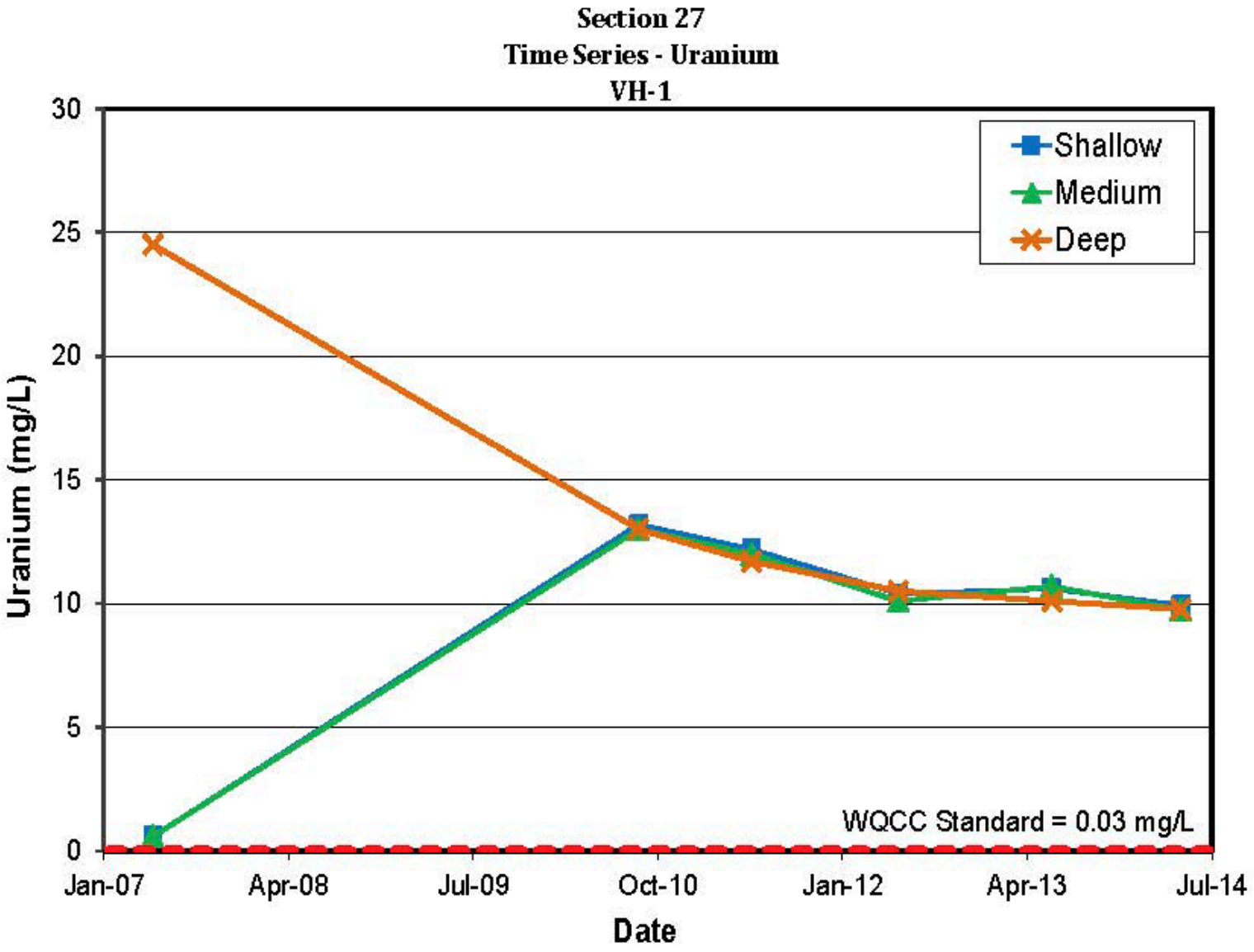
2013 Profile Results



Sampling Results



Sampling Results



Results

- Groundwater levels rising
  - average of 12.35 ft from 2007-2013
- Groundwater stratification no longer observed
- Groundwater quality results above the NM Water Quality Control Commission (NMWQCC):
  - Uranium
  - Radium 226 and 228
  - Iron
  - Manganese
  - Sulfate
  - Total dissolved solids (TDS)
  - Molybdenum

Regulatory Status

- 5-year renewal of sampling program for Section 27
- Provide information for understanding regional water quality conditions
- Final report and recommendations in January 2015
- Traditional approaches to groundwater remediation inappropriate

Conclusions

- Groundwater levels are rising due to cessation of mine dewatering
- Groundwater quality is spatially variable
- Uranium and radium concentrations have remained relatively stable or decreased over the 5-year monitoring period

Questions