Berwick USEPR Subsurface Investigation and Site Characterization

NRC Site Visit

October 16, 2007

Agenda

10/16/07

0800 – NRC (entire team) gathers at Information Center

0830 – Presentation on Berwick Site Characterization Project activities

0915 – Safety briefing by Mark Hunter

0930 – SUV tour of the site

1030 – Site Visit Review Activities

1145 – Lunch

1230 – Site Visit Review Activities

1700 – Site Visit Exit Meeting

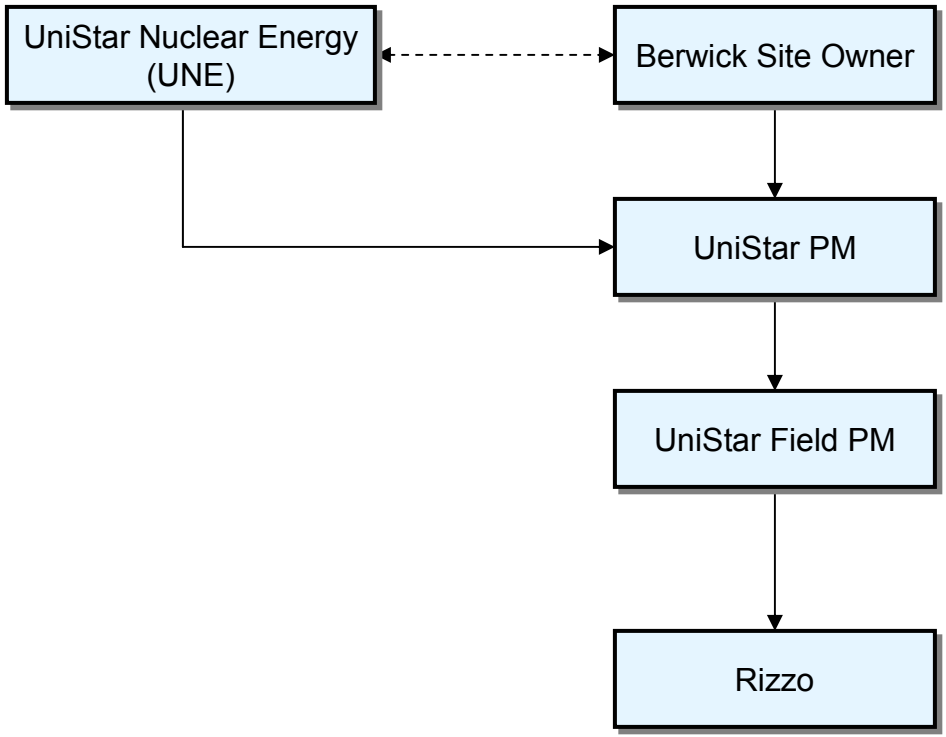
10/17/07

As needed

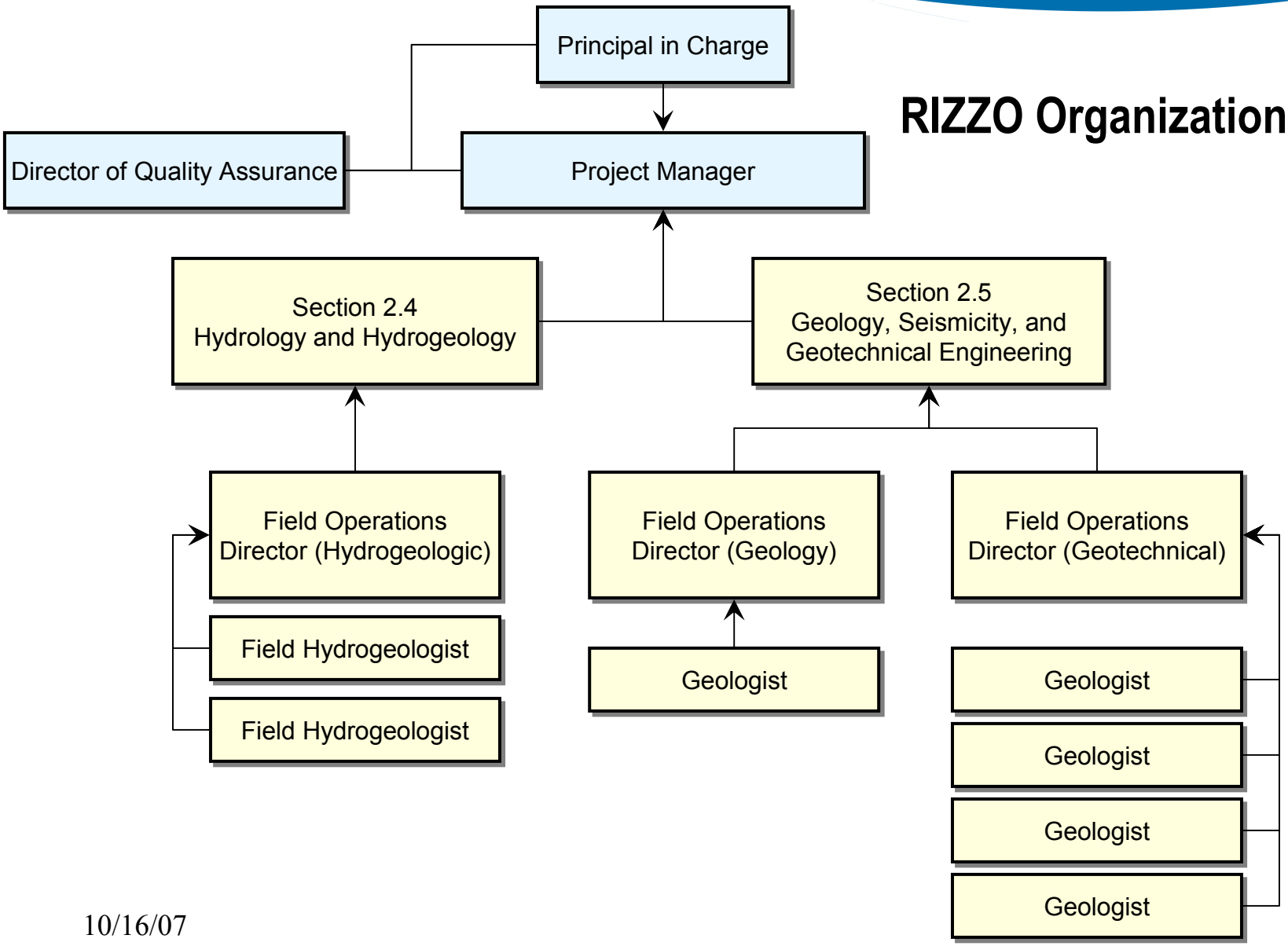
Berwick Project Overview

- Berwick Site Description
  - Primarily composed of woodlands, farmlands and recreational lands, 5 miles northwest of Berwick.
  - Elevations range from 500 feet to 1600 feet above mean sea level
  - Adjacent to the Susquehanna River
- Site Selection and Layout
  - Site Qualification and optimization Study has been performed
  - Evaluation of multiple criteria concluded property provides for a superior Site
  - Optimized location and orientation
    - Western portions of the property most favorable

UniStar Organization



RIZZO Organization



Geotechnical Investigation Program

- Boring Program (33 Borings, ~5000 ft)
- Geophysical exploration program
  - 4 Downhole geophysical surveys (Northwest Geophysical Associates)
  - 4 P-S Suspension geophysical surveys (GeoVision)
  - Seismic Refraction Lines
- Laboratory Testing Program
  - Index Testing
  - Strength Testing
  - Resonant Column Torsional Shear and Unconfined Resonant Column

Regulatory Framework

- R.G. 1.132, Site Investigation for Foundation
- R.G. 1.138, Lab Investigation of Soils
- R.G. 1.198, Soil Liquefaction (likely NA)
- R.G. 1.206, Combined License Applications
- R.G. 1.208, A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion
- NQA-1, 1994, Subpart 2.20

LOGISTICS

- Programmatic Approach: NQA-1
- Work done under the RIZZO QA Program
- QA in-process surveillances
- ASTM Procedures for sample classification, handling, and storage
- Qualification and training
- Records: all technical field documentation captured

Quality Assurance

- RIZZO is delegated responsibility by UniStar Nuclear to perform site characterization work under their QA program
- RIZZO has been audited and approved by UniStar Nuclear
- UniStar Nuclear observes site characterization activities to ensure quality meets expectations
- RIZZO is responsible for corrective action program implementation
- Issues have been identified and corrective actions taken

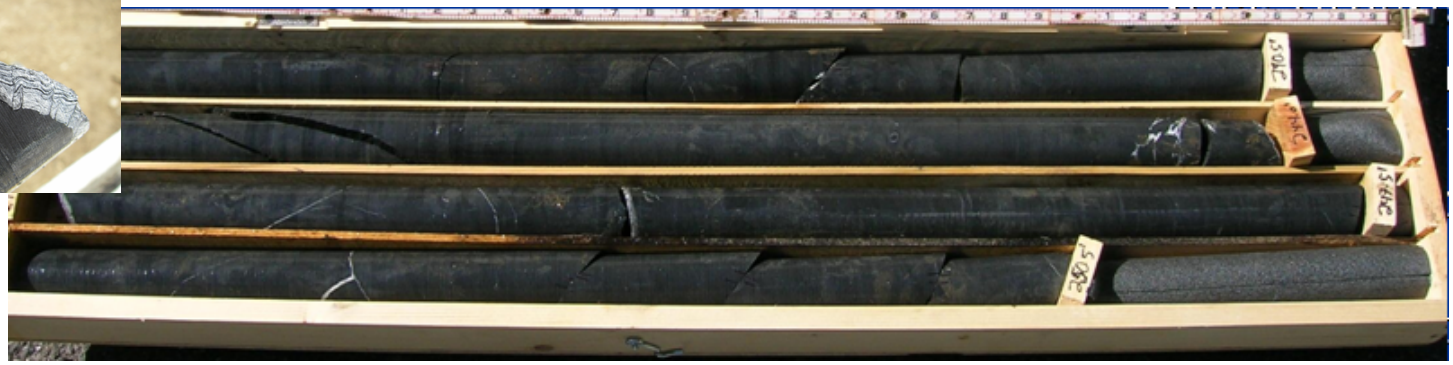
Regional Geology

- Located in Ridge and Valley Province adjacent to the Susquehanna River
  - Tightly folded Anticlines and Synclines
  - Site is near Centerline of Berwick Anticline
- Previously glaciated area- evidence of end moraine (glacial till overburden and uneven bedrock)
- Bedrock outcrops with strike N20^{o}W and dip 70°SE

Site Geology

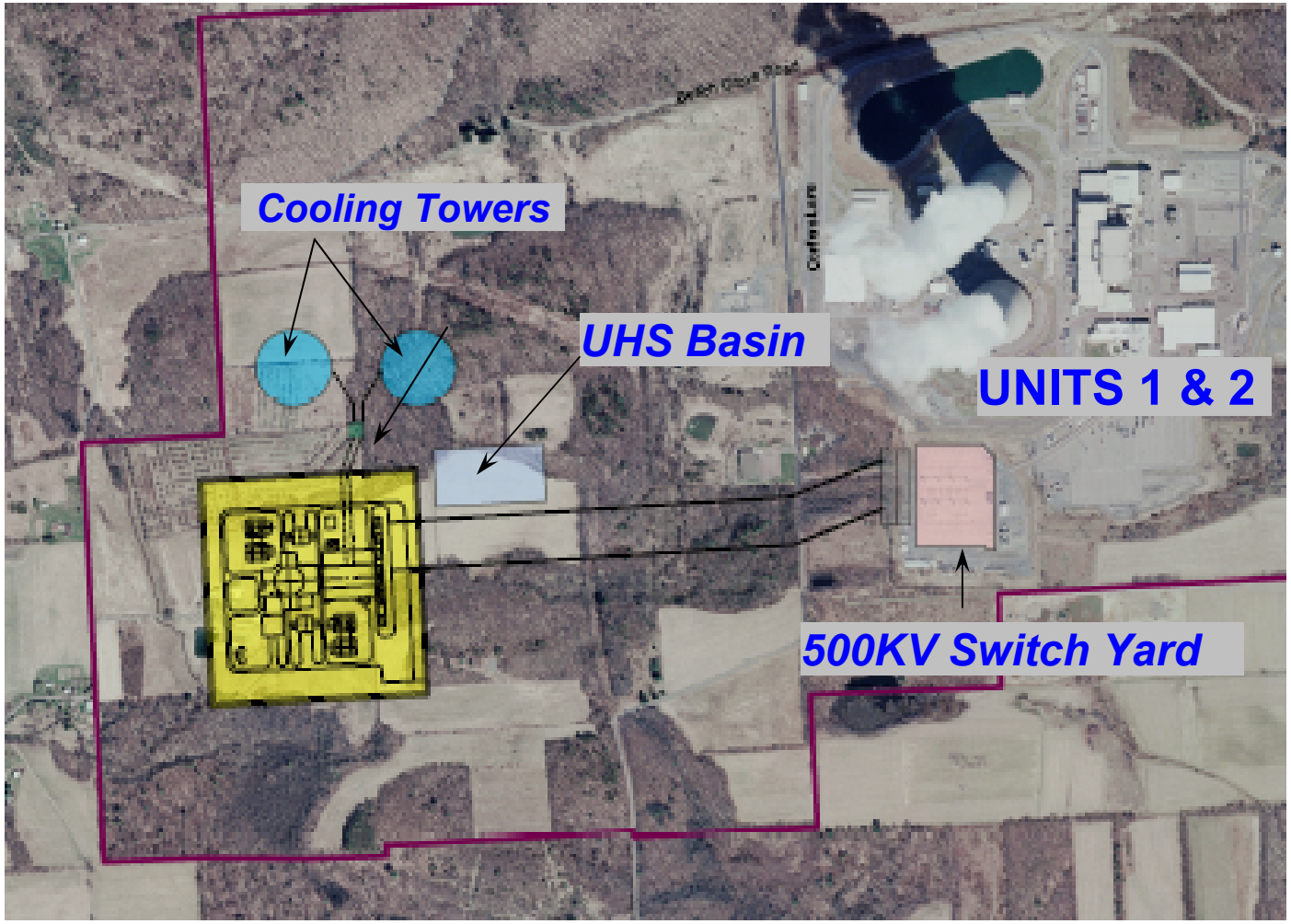
- Overburden consists of glacial till and outwash from the terminal end moraine
- Thin layer of highly weathered Shale
- Bedrock is Mahantango Formation

Mahantango Formation

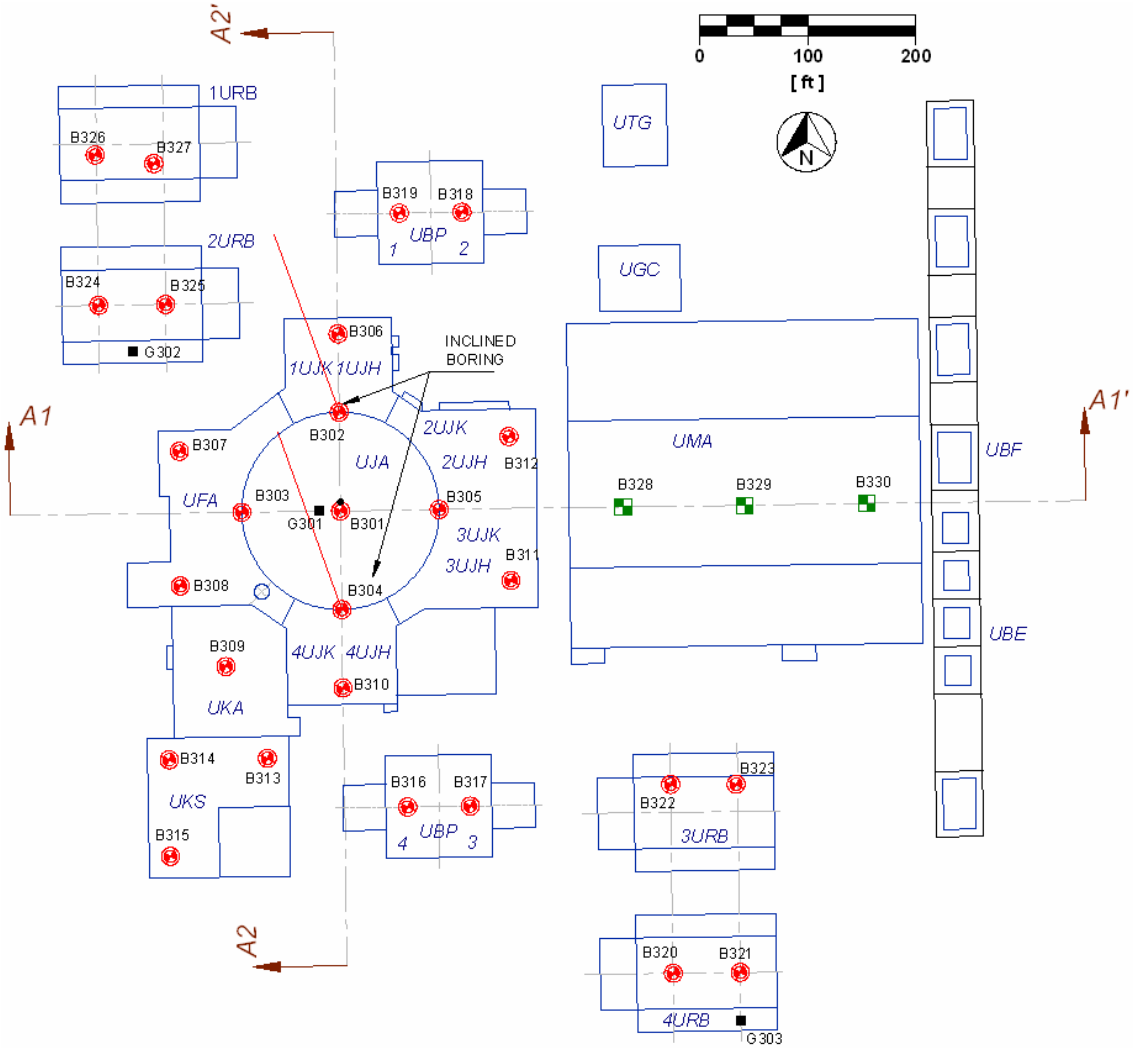


- Middle Devonian age (400) marine deposition
- Estimated depth:1800 ft
- Medium to dark gray
- Non-calcareous to calcareous
- Medium hard to hard; indurated
- Fractures healed with calcite or highly breccia zone
- Bedding plane only visible at breaks in rock, nearly vertical
- Bedding intermittent fossil zones- mainly brachiopod casts filled with calcite
- Thin pyrite pockets throughout
- Secondary mineral deposits of calcite and quartz

Site Map (Reference)



Geotechnical Investigation



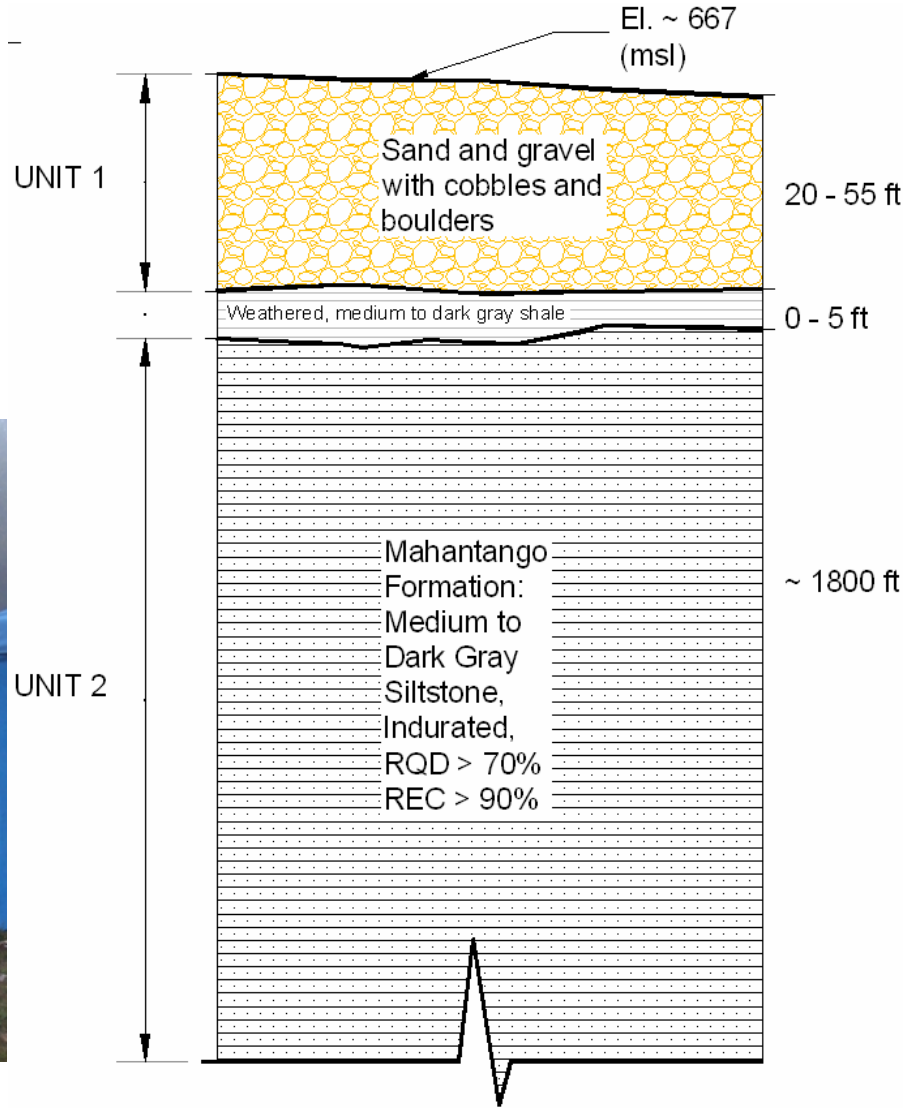
LEGEND

- SAFETY RELATED BORING
- TURBINE BUILDING BORINGS
- A1 and A2' REFLECTION/REFRACTION SURVEYS
- PS SUSPENSION TEST AT B301 - 400 FT (PERFORM TEST IF BOREHOLE MAY REMAIN UNCASED AT COMPETENT ROCK DEPTHS)
- G301 PS SUSPENSION AND DOWNHOLE TEST (400 FT, 3" OR 4" PVC CASING, GROUTED ANNULAR SPACE)
- G302, G303 PS SUSPENSION AND DOWNHOLE TEST (200 FT, 3" OR 4" PVC CASING, GROUTED ANNULAR SPACE)

UJA - REACTOR BUILDING
UFA - FUEL BUILDING
UKA - REACTOR AUXILIARY BUILDING
UJH - SAFEGUARD BUILDING (MECHANICAL)
UJK - SAFEGUARD BUILDING (ELECTRICAL)
UKS - RADIOACTIVE WASTE BUILDING
UBP - EMERGENCY DIESEL BUILDING
URB - ULTIMATE HEAT SINK
UMA - TURBINE BUILDING
UGC - DEMINERALIZED WATER TANKS
UTG - CENTRAL GAS SUPPLY
UBE - AUXILIARY POWER TRANSFORMERS
UBF - GENERATING POWER TRANSFORMERS

Geotechnical Site Features

- Uniform conditions across site area investigation
- 2 very distinguishable units
- Favorable foundation conditions

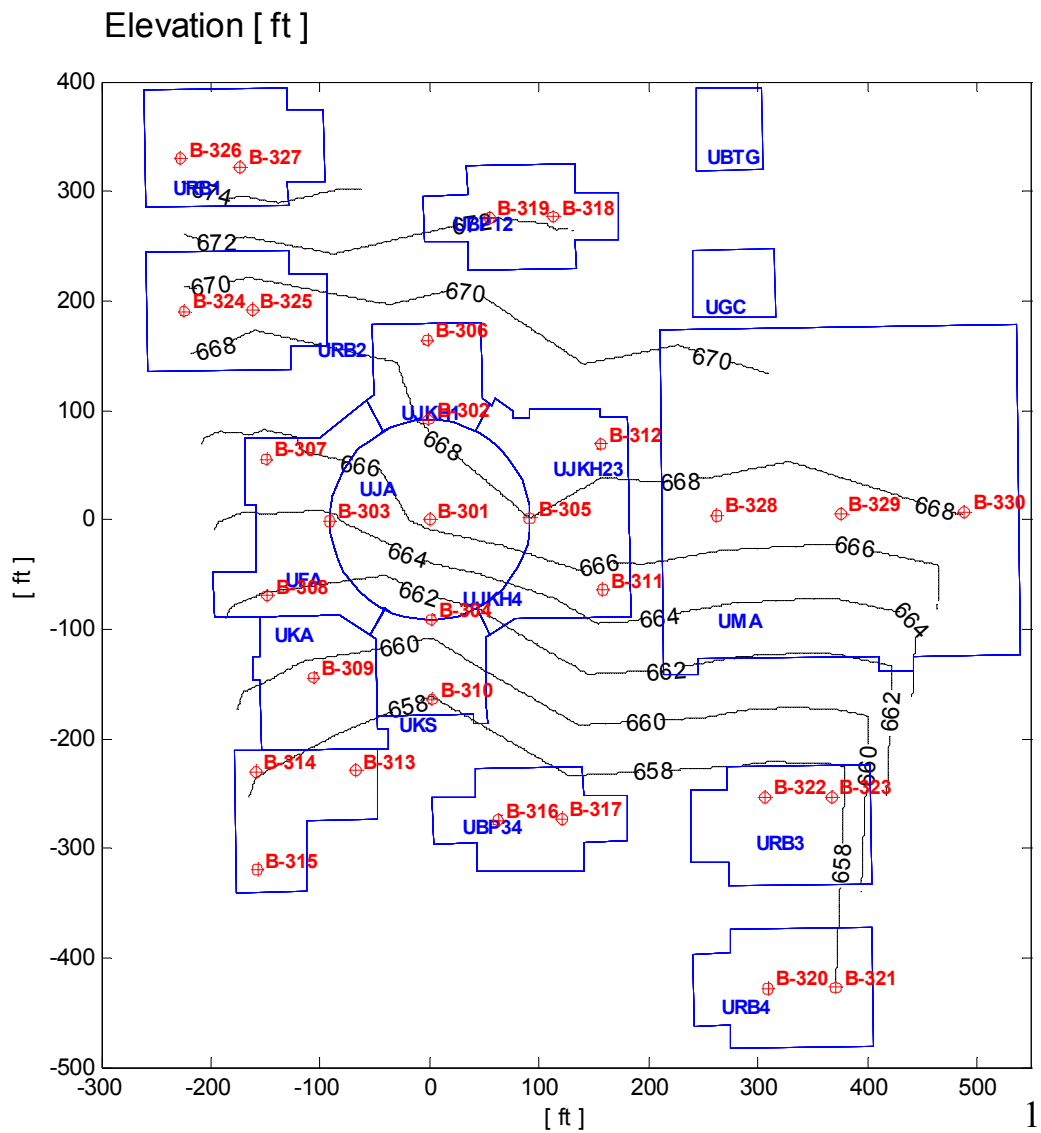


Sample Extraction, Handling, Storage, and Transportation

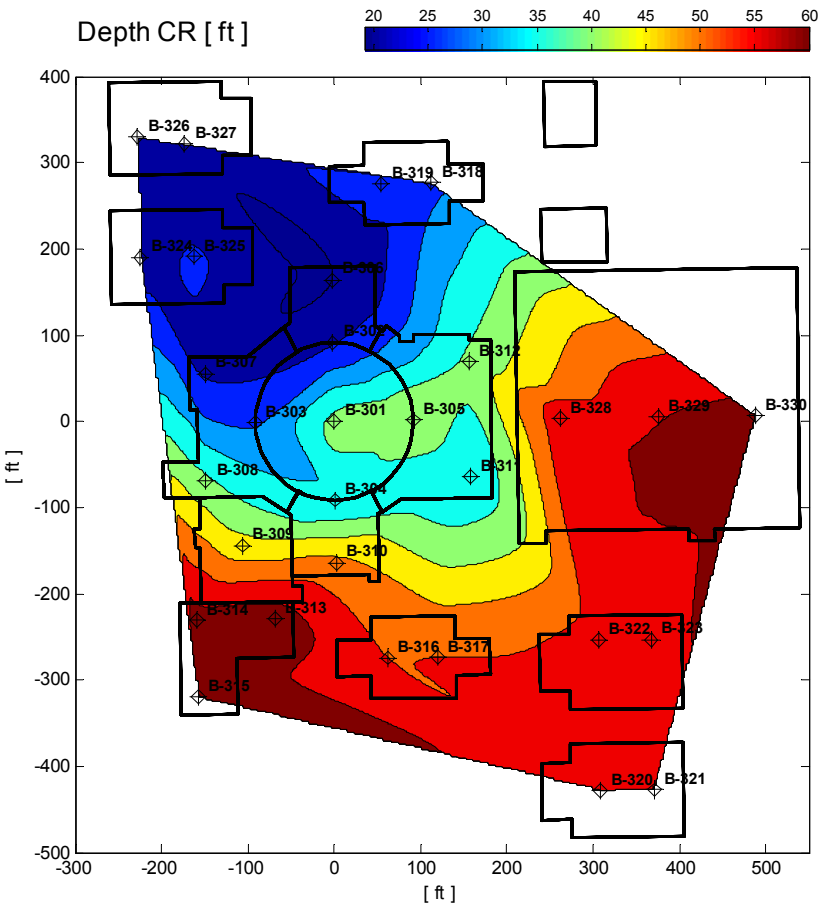
- Type of Sample
  - Disturbed sample (jar sample)
  - Undisturbed sample (thin wall sampler)
  - Rock core
  - Special care rock core sample
- Sample extraction
  - Description and documentation
  - Containment and labeling
- Sample site transportation
- Storage facility
- Transportation for laboratory testing
  - Chain of Custody
  - Handling

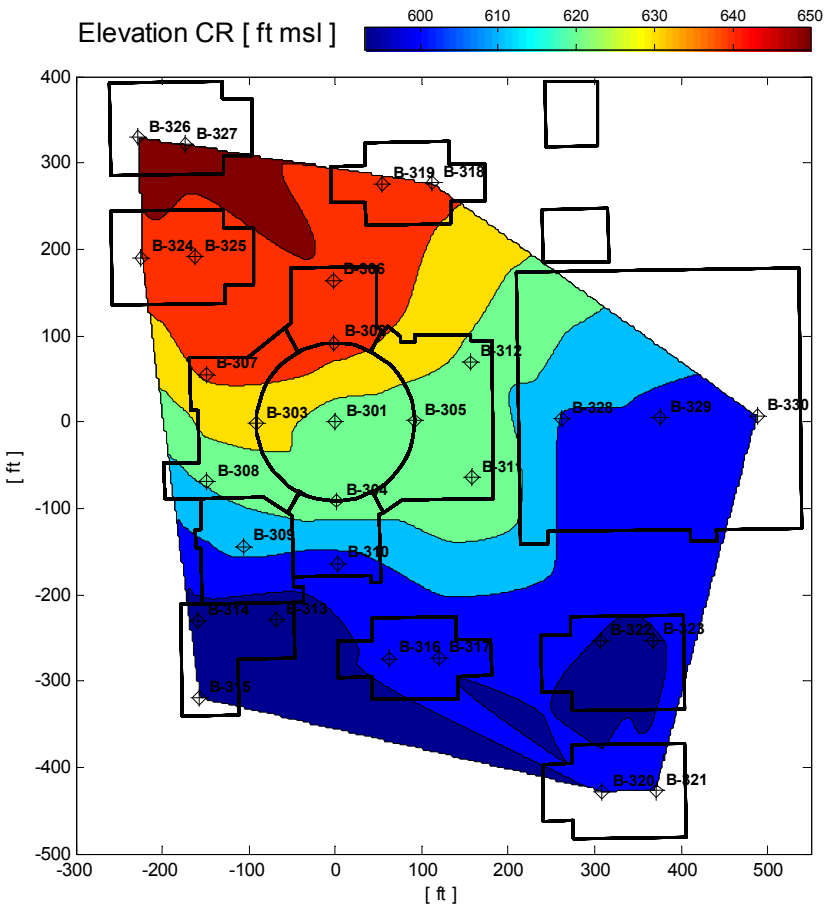
Topography

- South of the Anticline Feature
- Approximately 2.5% grade to the South
- Favorable construction conditions



Top of Rock Elevation (Preliminary)

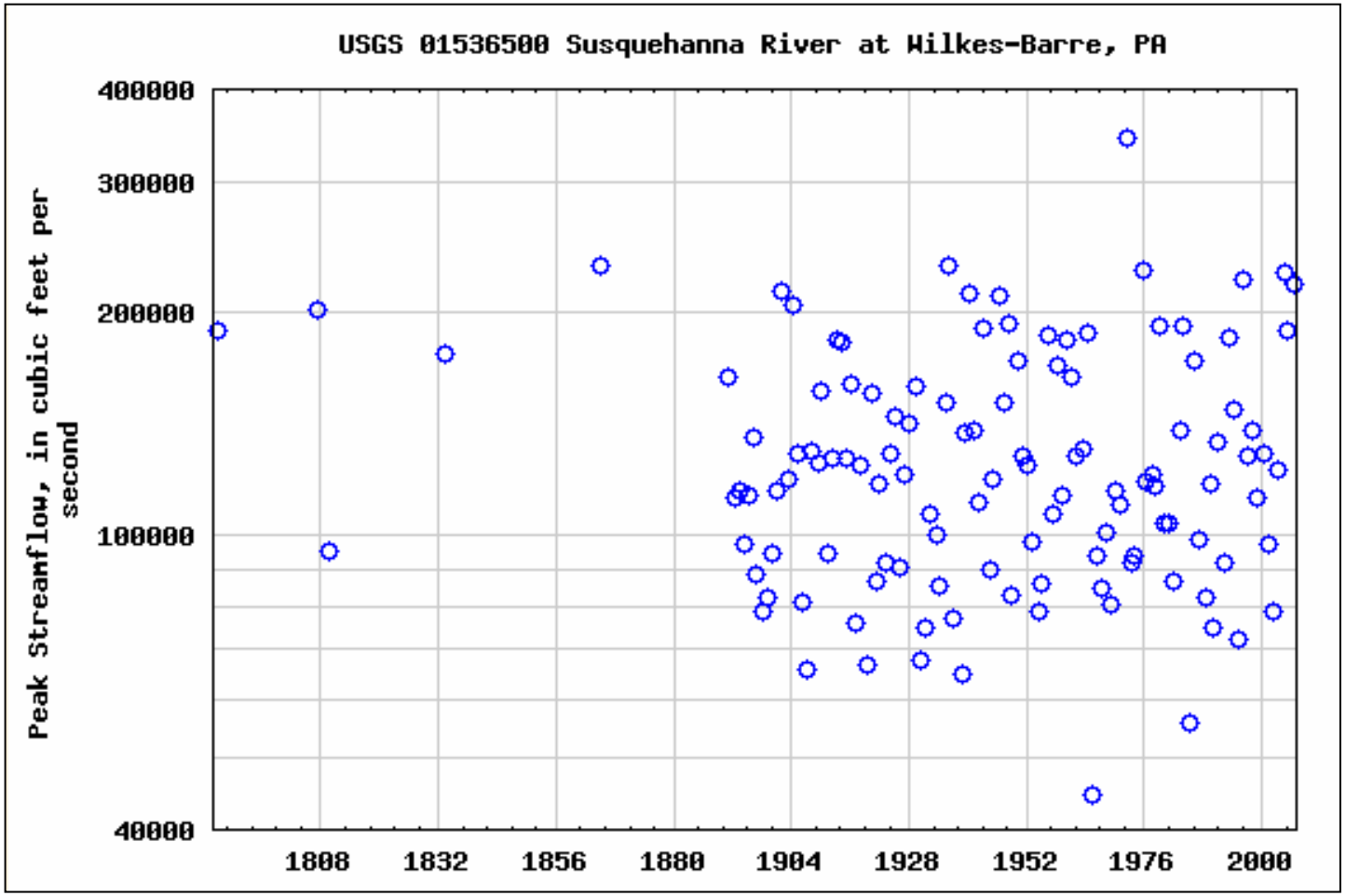




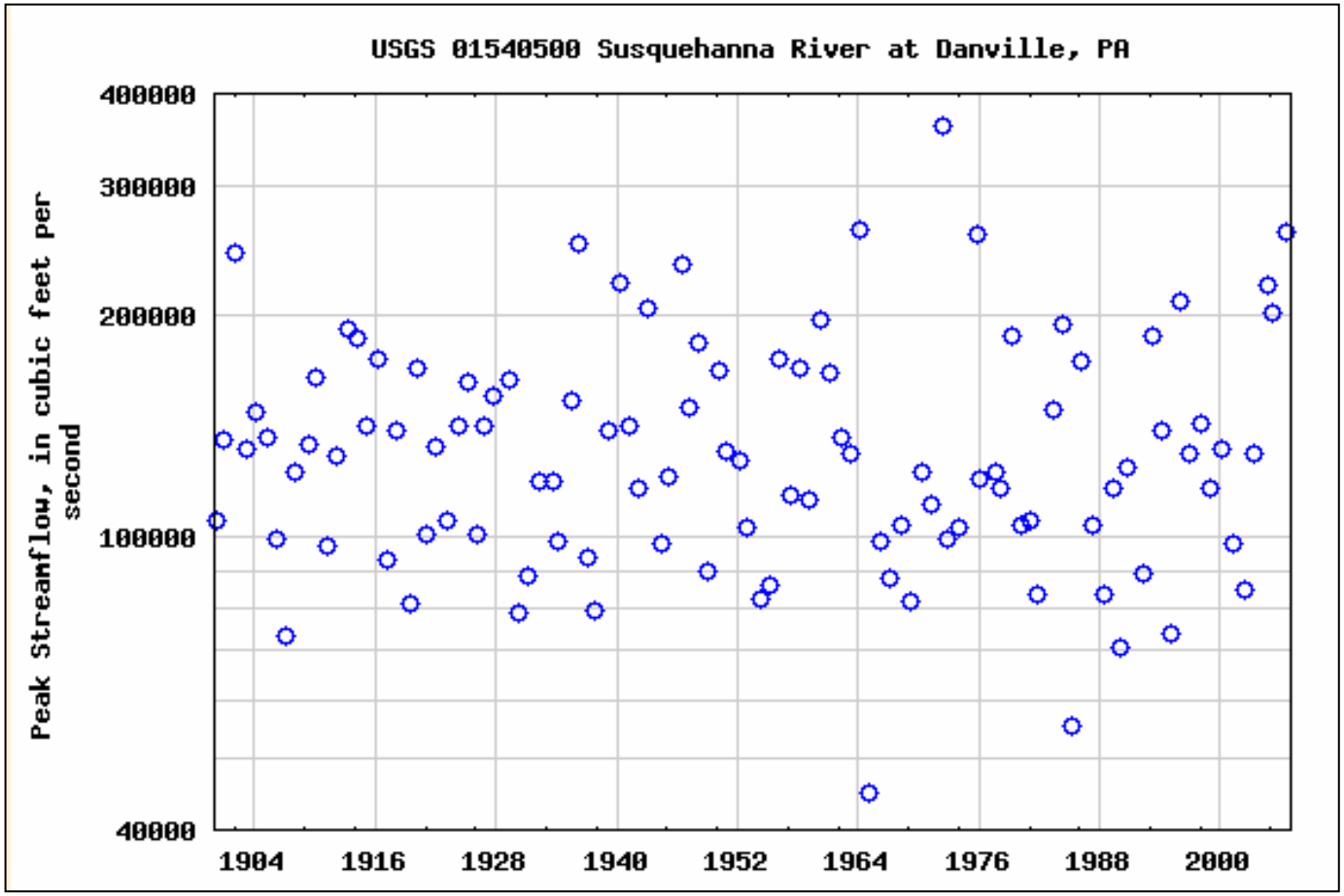
Surface Water Hydrology

- Site located along North Branch of the Susquehanna River
  - River lies 1.3 miles south and 1.7 miles east of Site
  - On relatively flat upland about 170 feet above river level
  - 22 miles downstream of Wilkes-Barre, PA
  - 5 miles upstream of Berwick, PA
- Small streams flow southward from ridge and drain into River
  - Walker Run flows along western side and drains most of site
  - Unnamed tributary drains southeast corner of the Site
- Small wetlands located on-site
- North Branch of the Susquehanna River is receiving stream for all surface water and groundwater drainage
  - Upstream USGS gauging station at Wilkes-Barre (1786-2006)
  - Downstream USGS gauging station at Danville (1865-2006)

Susquehanna River at Wilkes-Barre, PA



Susquehanna River at Danville, PA



Groundwater Hydrology

- Glacial sand and gravel covers most of the Site
  - Depth to groundwater generally 0 - 20 feet below ground surface
  - Lateral flow in gravel discharges to wetlands and small streams
- Shale discharges upward into gravel and southward toward West Branch of the Susquehanna River
  - Flow primarily through fractures
- 42 Monitoring Wells are being installed in 14 clusters
  - 14 wells to be installed in overburden
  - 28 wells to be installed in bedrock
  - Packer tests, slug tests, and pumping tests to be performed

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