ADVANCED GEOLOGICAL SERVICES

3 Mystic Lane
Malvern, PA19355
(610) 722-5500 (ph.)
(610) 722-0250 (fax)

December 30, 2005
Ref. No.: 05-426-1

Mr. David Winslow
GZA GeoEnvironmental of New York, Inc
Two Pennsylvania Plaza, 18th Floor
New York, New York 10121

**Subject:** Geophysical Investigation Results
Indian Point Nuclear Power Plant Site
Buchanan, New York

Dear Mr. Winslow:

Advanced Geological Services (AGS) presents this letter report to GZA GeoEnvironmental (GZA) of New York, New York detailing the methods and results of a geophysical investigation conducted at the Indian Point Nuclear Power Plant Site in Buchanan, New York. The area of investigation centered around four monitoring wells, located in the transformer yard. The objective of the survey was to map the depth to bedrock for the transformer yard. The field activities for this investigation were completed by AGS from December 5 through December 8, 2005.

**Methods**

To meet the objectives of the investigation, AGS utilized the ground penetrating radar (GPR) method. GPR profiles were collected in a grid pattern with a spacing of five feet throughout the survey area, except for areas with significant surficial obstructions. Special attention was given to the areas around the four monitoring wells so correlations between them could be made and interpolated throughout the survey area.

The depth to bedrock, as defined by the onsite GZA representative, at MW35, MW34, MW33 and MW111 was 7, 3.5, 6.5 and 18 feet, respectively. The GPR profiles near the monitoring wells were closely analyzed to correlate the known depth to bedrock with a specific reflector or group of reflectors. Then the reflector was extrapolated on every GPR profile throughout the entire survey area. Using a standard velocity function the approximate depths to bedrock, measured from the ground surface, were transferred and contoured (Figure 1).

**Ground Penetrating Radar (GPR) Method**

The GPR method is based upon the transmission of repetitive, radio-frequency electromagnetic (EM) pulses into the subsurface. When the transmitted energy of down-going wave contacts an interface of dissimilar electrical character, part of the energy is returned to the surface in the form of a reflected signal. This reflected signal is detected by a receiving transducer and is displayed on the screen of the GPR unit as well as being recorded on the internal hard-drive. The received GPR response remains constant as long as the electrical contrast between media is present and constant. Lateral or vertical changes in the electrical properties of the subsurface result in equivalent changes in the GPR responses. The system records a continuous image of the subsurface by plotting two-way travel time of the reflected EM pulse versus distance traveled along the ground surface. Two-way travel time values are then converted to depth using soil velocity functions.

The GPR field procedures involved (1) instrument calibration, (2) test run completion, (3) production profile collection and recording, and (4) data storage for subsequent processing and analysis in the office. Each radar profile was examined for characteristic GPR signatures that may indicate the presence of buried targets. A Geophysical Survey System SIR System 2 and a 200 megahertz (MHz) antenna were used with a recording window of 185 nanoseconds (ns) to provide the required depth penetration and subsurface detail.

**Results**

A site map, containing the approximate depth to bedrock and the locations of representative GPR profiles, is shown on Figure 1 and representative GPR profiles are shown on Figure 2.

The approximate depth to bedrock ranged between 3.5 and 16 feet (Figure 1). Generally the northern and southern ends of the survey area had the shallowest depths to bedrock with the deepest depths in the center. The greatest depth to bedrock is centered in the immediate vicinity of MW111. The depth to bedrock slightly shallows toward the (grid) eastern end of the survey area.

Based on the GPR profiles close to MW111 and MW33, the depth to bedrock at MW111 only appears to be approximately 16 feet deep. The reflectors associated with a depth of seven feet near MW33 could not be traced to a depth greater than 16 feet at MW111, although those same reflectors could be correlated with MW34 and MW35 and the

depth of penetration was up to 30 feet for the survey. It is possible that the substrate above bedrock contains an unusually high soil velocity function. In this scenario the interpreted depth would be shallower than the actual depth, possibly accounting for the discrepancy.

**Closing**

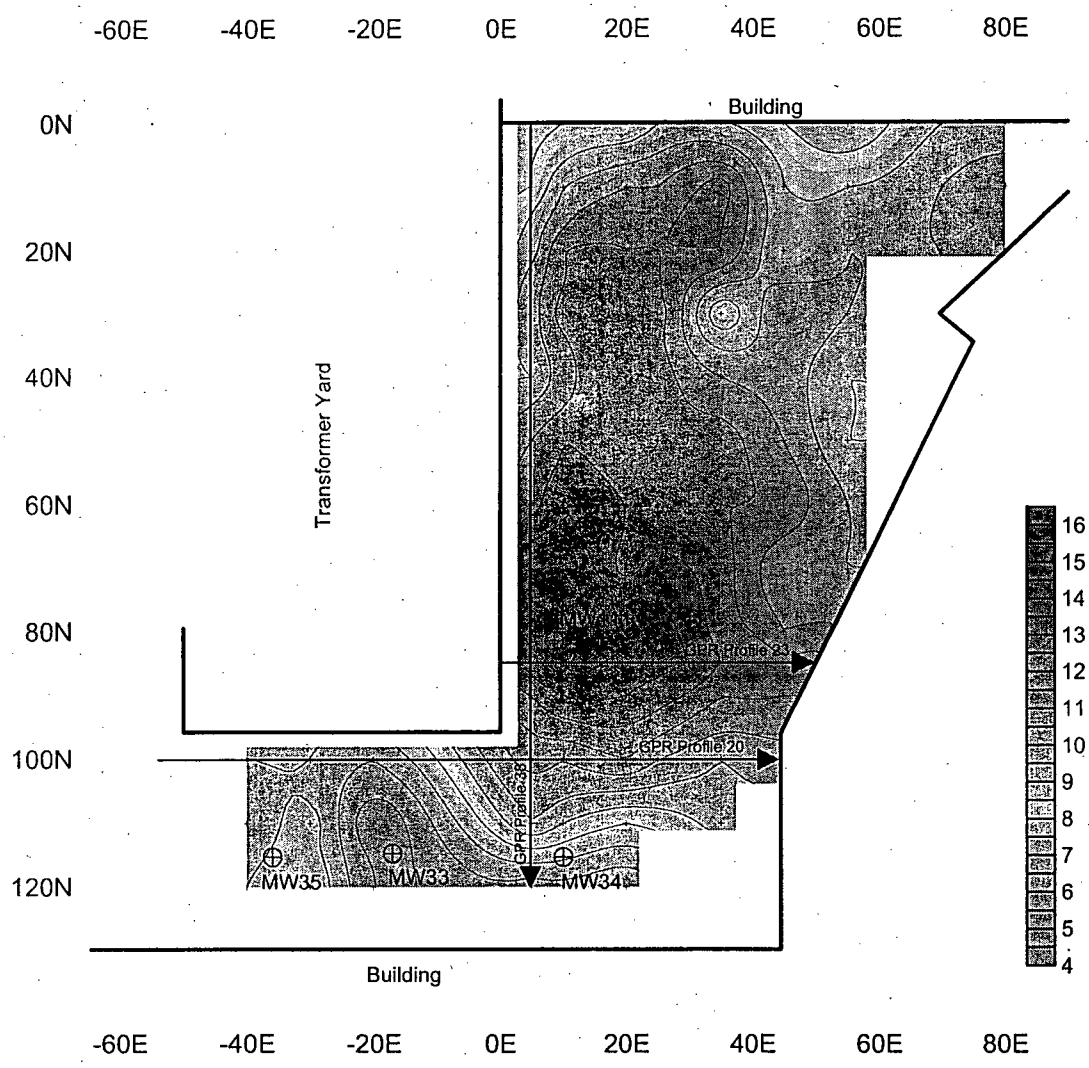
All geophysical data and field notes collected as a part of this investigation will be archived at the AGS office. The data collection and interpretation methods used in this investigation are consistent with standard practices applied to similar geophysical investigations. The correlation of geophysical responses with probable subsurface features is based on the past results of similar surveys although it is possible that some variation could exist at this site. Due to the nature of geophysical data, no guarantees can be made or implied regarding the presence or absence of additional objects or targets beyond those identified.

If you have any questions regarding the results of this field investigation, please contact me at 610-722-5500. It was a pleasure working with you on this project and we look forward to being able to provide you with sub-surface imaging services in the future.

Sincerely,

Christopher Call M.S.
Staff Geophysicist, AGS

Encl.: Figure 1 – Depth to Bedrock Contour Map
Figure 2 – Representative GPR Profiles




Grid North

0 10 20 30 40 50

**Notes**

(1) A SIR2 GPR System by GSSI was used for this survey. Four monitoring wells were located in the survey area. MW33,MW34, MW35 and MW111have recorded depths to bed rock of 6.5, 3.5, 7 and 18 feet respectively. GPR data was synthesized and correlated with the depths associated with the four monitoring wells to identify the depth and location to bedrock.

(2) GPR profiles were collected in a grid pattern with a five foot spacing. Depths taken from these GPR profiles are shown on this figure. Three representative GPR profiles are shown in figure 2.

(3) The depth of investigation for the GPR unit was approximately 30 feet. The depths included in this document should be considered approximate.

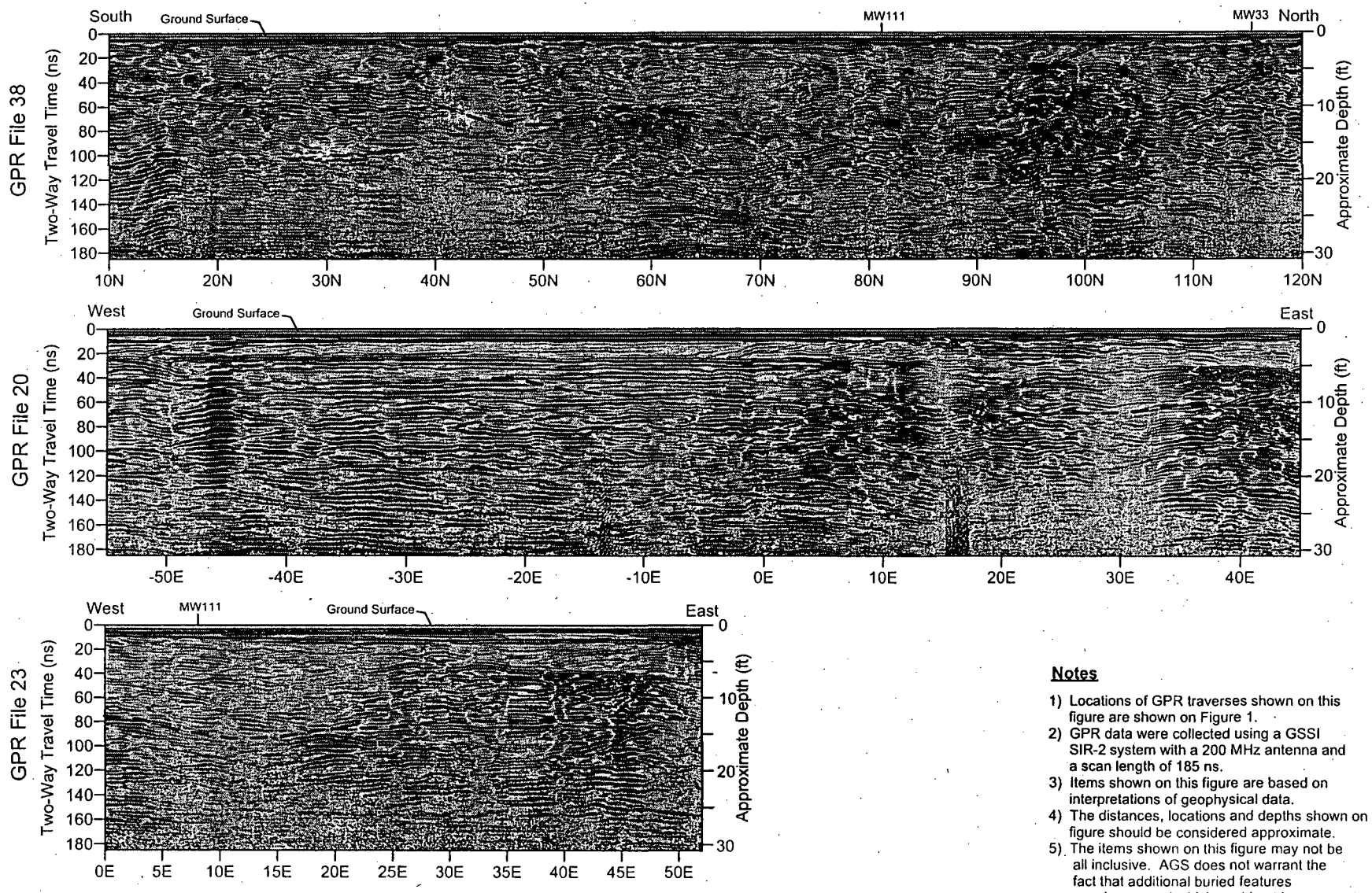
(4) The field positions were not surveyed by a licensed surveyor and should be considered approximate.

Date: December 30, 2005
AGS Reference: 05-426-1 cc

**Figure 1**
**Depth to Bedrock Contour Map**
**Site Features, and GPR Profiles**

GZA GeoEnvironmental of New York, Inc.
Indian Point Nuclear Power Plant
Transformer Yard
Buchanan, New York

ADVANCED GEOLOGICAL SERVICES




Date: December 30, 2005
AGS Reference: 05-426-1 cc

**Notes**

1) Locations of GPR traverses shown on this figure are shown on Figure 1.
2) GPR data were collected using a GSSI SIR-2 system with a 200 MHz antenna and a scan length of 185 ns.
3) Items shown on this figure are based on interpretations of geophysical data.
4) The distances, locations and depths shown on this figure should be considered approximate.
5) The items shown on this figure may not be all inclusive. AGS does not warrant the fact that additional buried features may be present which could not be identified by AGS personnel during this investigation.

**Figure 2**
**Select Representative GPR Traverses**

GZA GeoEnvironmental of New York, Inc.
Indian Point Nuclear Power Plant
Transformer Yard
Buchanan, New York

ADVANCED GEOLOGICAL SERVICES