

Geotechnical  
Environmental and  
Water Resources  
Engineering

**Geotechnical Report**

**National Synchrotron Light Source II**

Conceptual Design Phase  
Brookhaven National Laboratory  
Upton, New York

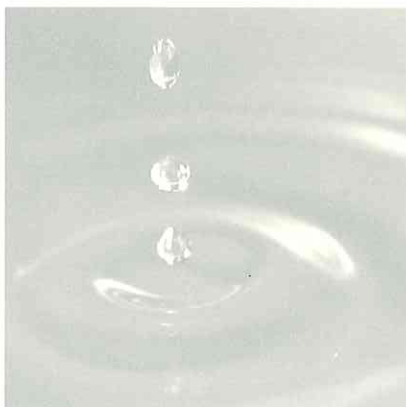
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Project 062150-\*-1000



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Nathan L. Whetten, P.E., C.G.  
Senior Project Manager

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# 1. Introduction

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## 1.1 Summary

This report presents the results of our subsurface explorations and geotechnical design and construction recommendations for conceptual design of the proposed National Synchrotron Light Source II (NSLS II), located within Brookhaven National Laboratory, in Upton, New York.

The subsurface explorations encountered up to 6 feet of fill overlying a sand deposit that extends to more than 100 feet deep. We recommend that foundations be designed as spread footing foundations with slab-on-grade floors. The existing fill should be removed within the building limits.

## 1.2 Scope of Work

GEI performed the following tasks:

1. Engaged subsurface exploration contractors to conduct the test borings and cone penetrometer tests.
2. Provided a full-time field representative to observe the explorations, and classify the soil samples in the borings.
3. Engaged a materials testing laboratory to perform mechanical gradation analyses on representative soil samples from the borings.
4. Evaluated the subsurface conditions and prepared this report containing our geotechnical recommendations for conceptual design.

## 1.3 Project Personnel

The following personnel performed services for this project.

Steven Hawkins	Field Engineer
Nathan Whetten, P.E.	Senior Project Manager
Michael Paster, P.E.	Technical Review



## **1.4 Authorization**

The work was completed in accordance with our agreement dated June 26, 2006.

## **1.5 Project Vertical Datum**

Elevations in this report are in feet. The vertical coordinate system is BNL '94. We understand that BNL '94 is substantially equivalent to National Geodetic Vertical Datum of 1929 (NGVD-29).

## 2. Site and Project Description

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### 2.1 Site Description

The approximately 50-acre site is bounded by Brookhaven Avenue to the north, Grove Street to the west, Fifth Street to the east, and a former landfill to the southeast. Seventh Street runs through the middle of the site in a north-south direction, and divides the site roughly in half.

The eastern portion of the site is generally a lawn area or is wooded. The western portion is occupied by several buildings, adjacent parking areas, access roads with asphalt, concrete, or gravel pavement, concrete loading docks, at-grade concrete pads, two railroad tracks, and chain link fences. Existing site features are shown on Figure 2.

The ground surface slopes gently downward from east to west. Ground surface elevations range from about El. 83 along Fifth Street to about El. 63 along Grove Street.

### 2.2 Project Description

Brookhaven Science Associates is planning to replace the existing National Synchrotron Light Source with a new facility, referred to as NSLS II. The new facility will be located within the Brookhaven National Laboratory, south and east of the existing NSLS building (Figure 1). NSLS II will be located south of Brookhaven Avenue and east of Grove Street. The proposed facility layout is shown in plan on Figure 2. The NSLS II will include a Ring Building, an Injector Building, an IR Source Building, and a Joint Photon Science Institute Building, with a total footprint area of approximately 400,000 square feet.

We understand that the lowest level floors will generally be at existing site grades, and no basement levels are planned. Proposed floor elevations for the various facility components, provided by HDR, are indicated in the table below.

<b>Structure</b>	<b>Proposed Floor El.</b>	<b>Ground Surface Elevation</b>
<u>Experimental Hall:</u> Experimental Floor and Access Corridor Ring Tunnel Tunnel Mezzanine	El. 73 El. 74.33 El. 86.58	El. 69 (SW) to El. 82 (East)
Lab/Office Building (LOB)	El. 73	El. 73 (N LOB) El. 76 to 79 (E LOB) El. 80 to 82 (SE LOB) El. 72 to 75 (S LOB) El. 68 to 72 (SW LOB)
Central Lab/Office Building	El. 73	El. 73 to 75
<u>Service Buildings:</u> Lower Level Ring Tunnel Access Upper Level	El. 71.33 El. 74 El. 86.58	El. 73 (N Svc Bldg) El. 77 to 78 (E Svc Bldg) El. 81 (SE Svc Bldg) El. 75 to 76 (S Svc Bldg) El. 71 to 72 (SW Svc Bldg)
Linac/RF Building	El. 78	El. 75

Comparing the proposed floor grades with the existing site grades, up to 9 feet of excavation and up to 5 feet of fill will be required below floors.

We understand that the floor slab for the experimental hall will be 18 inches thick, and the adjacent tunnel ring slab will be 36 inches thick. These elements will be constructed as a monolithic slab. The design live load for the floor in these areas is 250 pounds per square foot (psf).

## 3. Subsurface Conditions

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### 3.1 Previous Subsurface Explorations

**1977 Explorations** – In 1977, Stone & Webster conducted subsurface explorations for the existing NSLS facility. The explorations included six soil borings and four test pits. The borings were drilled to depths of 100 to 102 feet and the test pits were excavated to a depth of about 12 feet. Approximate exploration locations are shown on Figure 2, and logs of the test pits and borings are presented in Appendix A.

**2003 Explorations** – In 2003, we conducted eleven test borings for the nearby Center for Functional Nanomaterials (CFN) building, advanced to depths of up to 62 feet below ground surface. Drilling activities were monitored by a GEI field technician. Test boring locations are shown on Figure 2, and boring logs prepared by the driller are provided in Appendix B.

### 3.2 Subsurface Explorations for Conceptual Design

During the period July 19 to 21, and August 16, 2006, we conducted four test borings, (B101 through B104) and twelve cone penetrometer soundings (CPT-1 to -6, CPT-8, and CPT-10 to -14). Shear wave velocity measurements were made in CPT-3, -5A, -6, and -12 at 10 foot intervals within the sand. Explorations were monitored by a GEI engineer.

Test borings B101 and B102 were drilled 52 and 62 feet below ground surface, respectively. These borings were drilled using 3-inch diameter driven casing, and Standard Penetration Tests were conducted at 5-foot intervals. Borings B101A and B102A were drilled a few feet away from borings B101 and B102, respectively, with continuous samples taken to a depth of 10 feet. Borings B103 and B104B were drilled to a depth of 32 feet using hollow-stem augers, with semi-continuous samples taken within the top 14 feet. B104 and B104A were terminated after encountering shallow refusals. Logs are presented in Appendix C.

The CPT soundings penetrated to depths typically ranging from 53 to 100 feet, and were terminated at refusal or at a maximum depth of 100 feet. Shallow refusals at depths less than 10 feet were encountered in CPT-5, -7, -13, and -13A. A second sounding was completed a few feet away from CPT-5 (CPT-5A) to a depth of 83 feet, and we plan to conduct a second sounding at CPT-7. CPT-13 encountered two shallow refusals. CPT-7A and CPT-9 were originally proposed, but later deleted from the conceptual design exploration program. Logs of CPT soundings are presented in Appendix D.

### 3.3 Laboratory Testing

GeoTesting Express, of Boxborough, Massachusetts, performed sixteen mechanical gradation analyses on soil samples recovered from borings B101 and B102. Results are presented in Appendix E.

### 3.4 Subsurface Soil Conditions

**Topsoil** – Topsoil ranging in thickness from 2 to 12 inches was encountered in B101, B01A, B102 and B102A, which were drilled in landscaped areas. Topsoil was not encountered in B103 and B104, which were drilled in developed areas.

**Fill** – Each of the borings encountered fill typically described as silty sand (SM), and the thickness ranged from 3.3 to 7 feet. SPT N-Values ranged from 8 to 15 blows per foot (bpf), indicating the fill is loose to medium dense. Fill was also detected within the upper 1 to 5 feet in CPT soundings made near existing buildings and roadways. Explorations B104, B104A, CPT-13, and CPT-13A, located within the southern portion of the ring building, encountered refusals on buried objects within the fill.

**Sand** – A thick layer of stratified sand, sand with silt, and sand with gravel was encountered below the fill in all of the explorations. Subsurface explorations were terminated within the sand at maximum depths of about 100 feet. The sand is light brown to brown. SPT N-values ranged from about 15 bpf (medium dense) to greater than 50 bpf (very dense). The average corrected SPT N-value calculated from the CPTs within the upper 50 feet was about 30 bpf. The CPTs detected some localized zones with equivalent N-values between 10 and 20 bpf.

Shear wave velocity measurements made in CPT-3, -5A, -6, and -12 indicate a uniform to slightly increasing shear wave velocity with depth. Velocities varied from 860 feet per second (fps) to 1,180 fps. The average of 34 shear wave velocity tests in the four CPTs was 975 fps.

A 1999 report on the stratigraphy and hydrogeologic conditions at the lab prepared by the United States Geologic Survey<sup>1</sup> refers to the sand as the "Upper Glacial Aquifer," and the thickness at BNL appears to be about 185 feet. Confining clay units and additional sand and gravel aquifers overlie bedrock, which reportedly occurs at a depth of about 1,500 feet.

### 3.5 Groundwater Conditions

Depths to groundwater range from about 28 to 37 feet below ground surface, depending on the location at the site. This is based on the following observations:

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<sup>1</sup> "Stratigraphy and Hydrogeologic Conditions at the Brookhaven National Laboratory and Vicinity, Suffolk County, New York 1994-1997," prepared by the United States Geologic Survey, dated 1999.

- We measured water in boring B102 at a depth of 36.5 feet below ground surface. This measurement was made in a temporary PVC well installed in the boring, after groundwater was allowed to stabilize overnight. This level may not represent fully stabilized groundwater due to the short stabilization time.
- We measured water in borings B103 and B104 at depths of 28 and 31 feet below ground surface, respectively. These borings were drilled using hollow-stem augers, and water levels were measured during drilling.
- CPT soundings detected water at depths ranging from about 28 to 30 feet below ground surface. These measurements were made using an electronic pore pressure transducer mounted on the cone.

Groundwater level measurements represent conditions at the times and locations the measurements were made. Significantly different groundwater levels may occur at other times and locations.

## **4. Preliminary Foundation Recommendations**

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### **4.1 Foundation Design**

We recommend that the proposed buildings be supported on spread footings bearing directly on the sand deposit, or on compacted structural fill placed after removal of existing fill. We recommend that footings be designed for a maximum allowable bearing pressure of 2.5 tons per square foot, and that footings be at least 3 feet wide.

Exterior footings should bear at least 4 feet below the adjacent finished grade for frost protection. Interior footings should be founded at least 18 inches below the bottom of the floor slab. The top of all footings should be at least 6 inches below the bottom of the overlying floor slab.

### **4.2 Floor Slab Design**

Based on a comparison of proposed floor levels with existing site grades, the lowest level floors will range from 9 feet below to 6 feet above existing site grades. The lowest level floor may be designed as a slab-on-grade.

The existing fill is not considered suitable for support of floor slabs due to the low tolerance for settlement of the floor slabs. Therefore, we recommend that all existing fill be removed from within the building limits, and replaced as necessary with compacted structural fill. A minimum of 6 inches of compacted structural fill should be placed below all floors.

Floors are above groundwater levels encountered in the explorations. Underslab drainage will not be required.

### **4.3 Settlement**

#### **Column and Wall Settlement**

We estimate that total settlement of spread footings will be less than 1 inch, and differential settlements will be less than 0.75 inch. Settlement will occur as loads are applied. We understand that this settlement is acceptable for column and wall footings

## **Floor Settlement**

We understand that the floor slab within the experimental hall will support highly sensitive scientific equipment, and that settlement of the floor slab after the equipment has been installed and calibrated must be small. Based on discussions with HDR, we understand that post-construction total and differential settlement may need to be less than about 0.25 inch.

Soils beneath the floor slab will settle in response to dead and live loads. Based on our experience with granular soils similar to those at the site, we anticipate that settlement will be complete within about one to two weeks after load application.

Settlement resulting from floor slab dead loads and fill required beneath the floor slab is expected to occur during construction, and therefore will not contribute to post-construction settlement. However, the 250 psf live load could cause minor post-construction settlement. We calculate the total and differential post-construction settlement from the live load to be less than 0.25 inch. Differential settlement will be less than the total settlement. For particularly sensitive equipment, it may be desirable to allow a two to three week waiting period between installation and final calibration.

## **4.4 Seismic Design**

The soil beneath the proposed building is classified as a stiff soil profile for earthquake design purposes as defined by the New York State Building Code. The corresponding site class is D. The soil is not considered to be susceptible to liquefaction.

## **4.5 Reuse of Existing Fill**

Based on the results of sieve analyses conducted on soil samples recovered from borings B101 and B102, we anticipate that the natural sand deposit will be suitable for reuse as compacted structural fill below building foundations. The existing fill encountered in the borings is suitable for reuse as common fill outside building limits.

## **4.6 Subsurface Explorations for Final Design**

Subsurface explorations conducted for this conceptual design study included a relatively small number of widely-spaced test borings and cone penetrometer tests. Most of these explorations penetrated to depths of 50 to 100 feet, to evaluate general subsurface conditions in the area of the facility.

We recommend that subsurface explorations for final design include additional test borings with continuous SPT sampling, to further evaluate the nature and thickness of fill materials. Hollow-stem auger boring techniques are acceptable because of the low groundwater level.



Shallow refusals were encountered in B104, B104A, CPT-13 and -13A, within the southern portion of the ring building, and may indicate buried foundations or other objects within the fill. We recommend that test pits be excavated in this area to evaluate the nature of these materials.

## 5. Final Design Services and Limitations

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### 5.1 Final Design Engineering Services

We recommend that GEI be engaged during final design to:

- Conduct subsurface explorations, prepare a final geotechnical engineering report, and provide geotechnical consultation to the design team.
- Review plans and specifications to confirm that our recommendations have been interpreted and implemented as intended.

### 5.2 Limitations

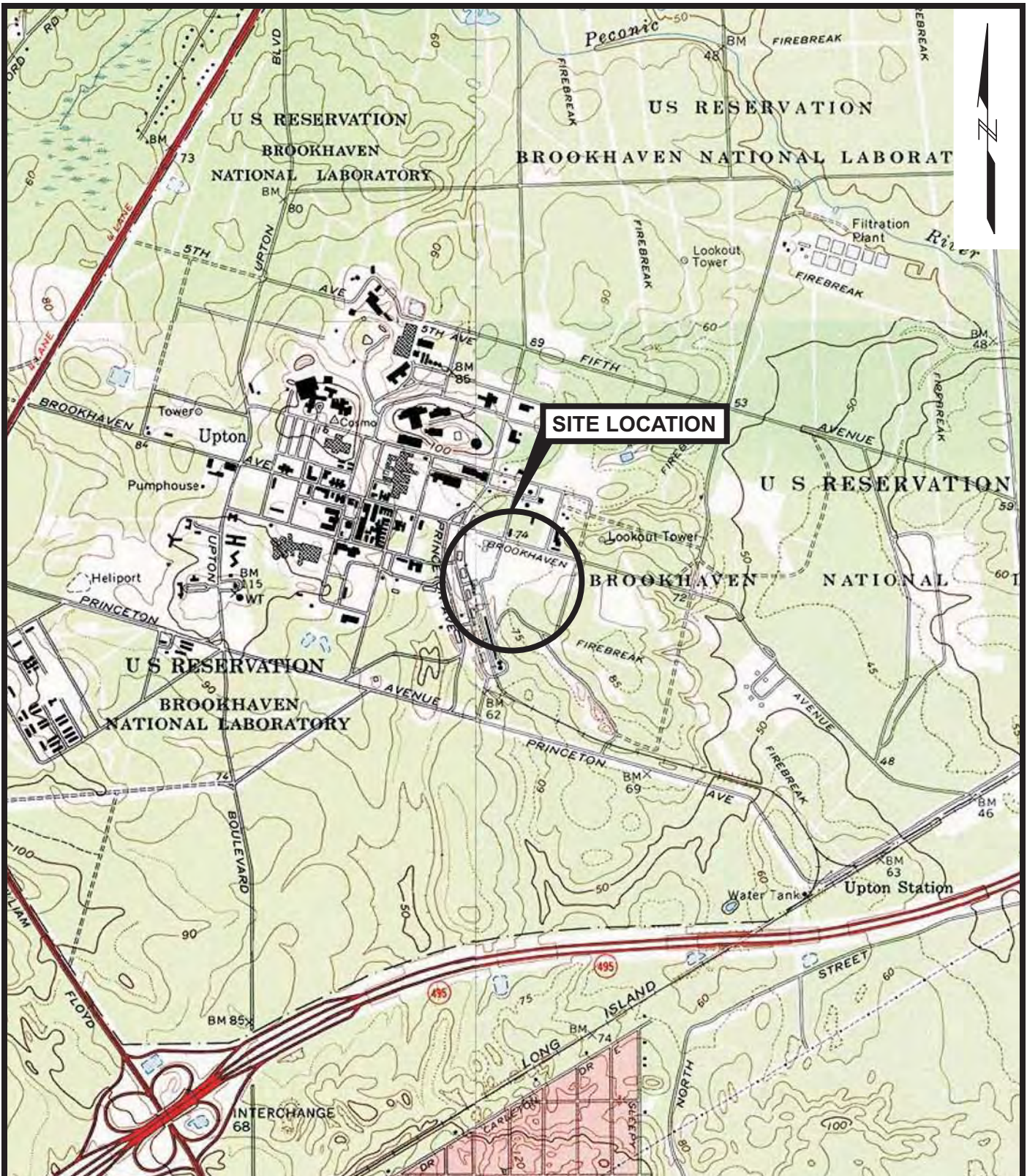
This report was prepared for the exclusive use of HDR Architecture, Inc., Brookhaven Science Associates, and the NSLS II design team. Our recommendations are based on the project information provided to us at the time of this report and may require modification if there are any changes in the nature, design, or location of the proposed structure. We cannot accept responsibility for designs based on our recommendations unless we are engaged to review the final plans and specifications to determine whether any changes in the project affect the validity of our recommendations and whether our recommendations have been properly implemented in the design.

The recommendations in this report are based in part on the data obtained from the subsurface explorations. The nature and extent of variations between explorations may not become evident until construction. If variations from the anticipated conditions are encountered, it may be necessary to revise the recommendations in this report.

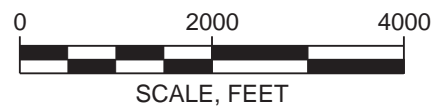
Our professional services for this project have been performed in accordance with generally accepted engineering practices. No warranty, express or implied, is made.

## Figures

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SOURCE: Map created with TOPO! © 2003 National Geographic  
 (www.nationalgeographic.com/topo)



**PROPOSED NSLS II  
 BROOKHAVEN NATIONAL LABORATORY  
 UPTON, NEW YORK**

**HDR ARCHITECTURE, INC.**



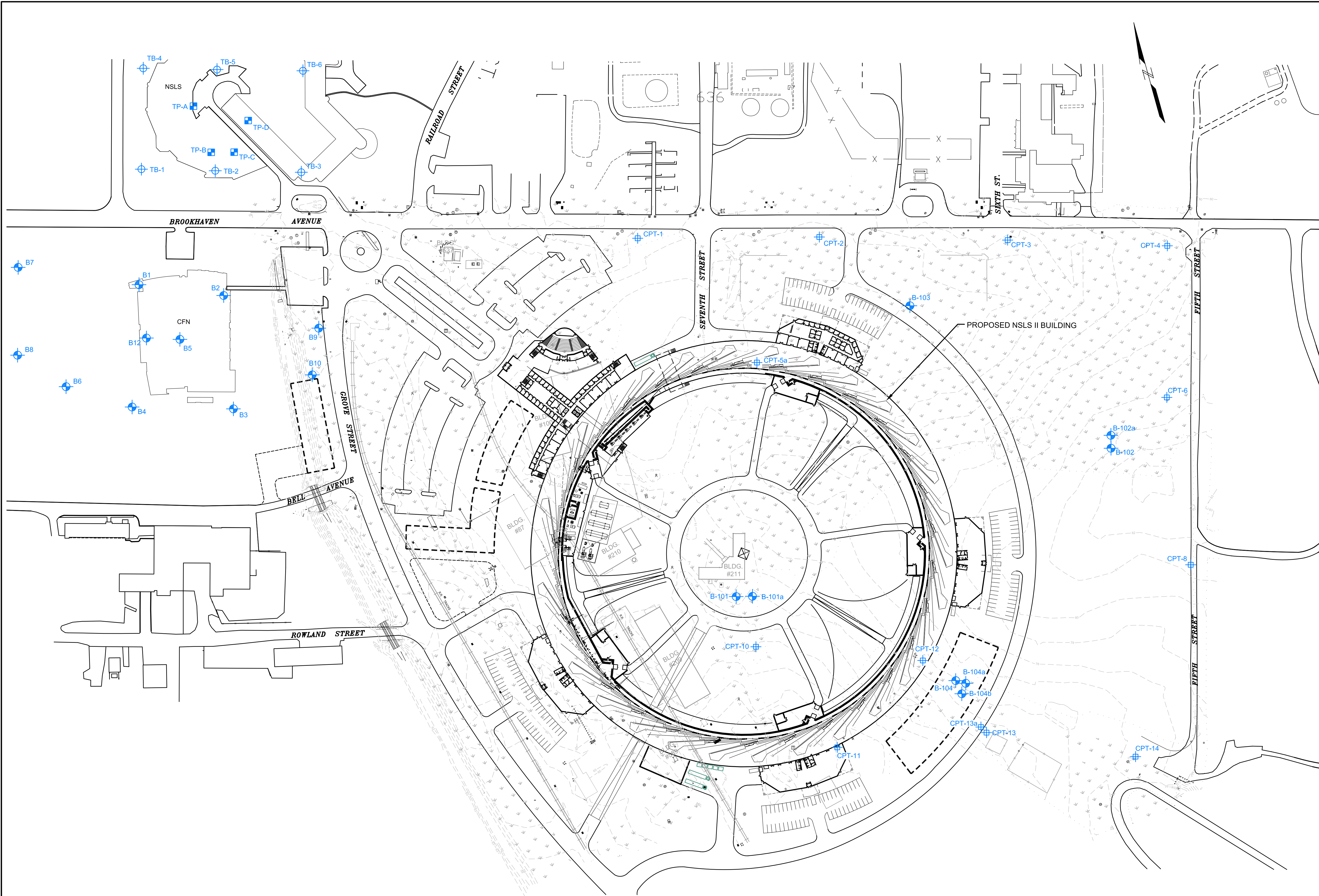
**PROJECT 062150**

**SITE LOCATION MAP**

**August 2006**

**Figure 1**



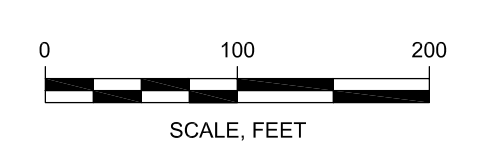


**LEGEND:**

- TB-1 ⊕ APPROXIMATE LOCATION OF TEST BORING INSTALLED IN 1977
- TP-A ⊕ APPROXIMATE LOCATION OF TEST PIT INSTALLED IN 1977
- B1 ⊕ APPROXIMATE LOCATION OF TEST BORING INSTALLED IN 2003
- B-101 ⊕ APPROXIMATE LOCATION OF TEST BORING INSTALLED IN JULY AND AUGUST 2006
- CPT-1 ⊕ APPROXIMATE LOCATION OF CONE PENETROMETER TEST MADE IN JULY 2006

**NOTES:**

1. PLAN BASED ON MAP TITLED *TOPOGRAPHIC SURVEY, PROPOSED NSLS II SITE, SITUATED AT BNL*, UPTON, NEW YORK, PREPARED BY MUNICIPAL LAND SURVEY P.C., 10 SYLVIA LANE, MIDDLE ISLAND, NEW YORK, 11953.
2. CONCEPTUAL STRUCTURE LAYOUT WAS PROVIDED BY HDR ARCHITECTURE, INC.
3. APPROXIMATE LOCATIONS OF 2006 EXPLORATIONS WERE PROVIDED BY BNL, AND WERE DETERMINED BY PACING FROM SITE FEATURES. LOCATIONS OF PREVIOUS EXPLORATIONS WERE ESTIMATED BASED ON RECORD DRAWINGS.
4. THE HORIZONTAL COORDINATE SYSTEM IS IN THE STATE PLANE COORDINATE SYSTEM, NEW YORK LONG ISLAND ZONE 3104, NAD '83, EXPRESSED IN US SURVEY FEET AS DEFINED BY BNL POINT COSMO RM3.
5. THE VERTICAL COORDINATE SYSTEM IS BNL '94 WHICH IS SUBSTANTIALLY EQUIVALENT TO THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD 1929), EXPRESSED IN US SURVEY FEET AS DEFINED BY BNL POINT COSMO RM3.
6. PROPOSED BUILDING LAYOUT REVISED BASED ON MAP TITLED *OVERALL SITE PLAN, 100% CONVENTIONAL FACILITIES CONCEPTUAL DESIGN REPORT*, PREPARED FOR BROOKHAVEN NATIONAL LABORATORY, NSLS-2, UPTON, NEW YORK, PREPARED BY HDR ARCHITECTURE, INC., SCALE: 1" = 200', DATED: SEPTEMBER 29, 2006.



PROPOSED NSLS II  
BROOKHAVEN NATIONAL LABORATORY  
UPTON, NEW YORK

HDR ARCHITECTURE, INC.

PROJECT 062150



**EXPLORATION LOCATION PLAN**

Revised: November 2006 Figure 2



# Appendix A

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## 1977 Test Boring and Test Pit Logs

04.2 of 2

SITE NATIONAL SYNCHROTRON LIGHT SOURCE J.O. No. 13011.01 BORING No. 1  
 TYPE OF BORING SS LOCATION BROOKHAVEN NATIONAL LABORATORY GROUND ELEV. 73.0  
 DATE DRILLED August 27, 1977 DRILLED BY V. ADAM LOGGED BY RST  
 SUMMARY OF BORING

ELEV. FEET	DEPTH FEET	OVERALL WEATHERING AND RQD	SAMPLE BLOW RECORD	GRAPHIC LOG	SOIL OR ROCK DESCRIPTION	
					FIELD AND LABORATORY TEST RESULTS	SOIL STRATA DESCRIPTION, LITHOLOGY AND TEXTURE

0	28				SM	TOP SOIL - SILTY SAND, WIDELY GRADED, COARSE TO FINE, MOSTLY MEDIUM AND FINE, 1-2% NONPLASTIC FINES, LIGHT BROWN.
5	36				SS-2	SAND, UNIFORM, MEDIUM TO FINE, MOSTLY MEDIUM, 8-10% NONPLASTIC FINES, LIGHT-BROWNISH BROWN.
10	18				SM	SILTY SAND, WIDELY GRADED, FINE TO VERY FINE, 20-3% NONPLASTIC FINES, GRAYISH BROWN.
15	43				SP	GRAVELLY SAND, POORLY GRADED, 10-15% ROUNDED GRAVEL TO 1.0 INCH MAXIMUM, COARSE TO FINE SAND, MOSTLY COARSE AND MEDIUM 3-5% NONPLASTIC FINES, GRAYISH BROWN.
20	18				SP-SH	GRAVELLY SAND, 10-15% ROUNDED GRAVEL TO 0.15 INCH MAXIMUM, COARSE TO FINE SAND, MOSTLY COARSE AND MEDIUM, 8-10% NONPLASTIC FINES, BROWNISH GRAY.
25	39				SP	SAND, SIMILAR TO SS #6, EXCEPT GRAVEL TO 0.5 INCH MAXIMUM
30	77				SP	GRAVELLY SAND, POORLY GRADED, 18-20% ROUNDED GRAVEL TO 1.0 INCH MAXIMUM, COARSE TO FINE SAND, MOSTLY MEDIUM, 3-5% NONPLASTIC FINES, BROWNISH GRAY.
35	65				SP	SAND, POORLY GRADED, COARSE TO FINE, MOSTLY MEDIUM, 3-5% NONPLASTIC FINES, BROWNISH GRAY.
40	35				SP	SAND, POORLY GRADED, COARSE TO FINE, MOSTLY MEDIUM AND FINE, 2-3% NONPLASTIC FINES, BROWNISH GRAY.
45	58				SP	GRAVELLY SAND, POORLY GRADED, 20-25% GRAVEL TO 0.75 INCH MAXIMUM, COARSE TO FINE SAND, MOSTLY COARSE AND MEDIUM 0-3% NONPLASTIC FINES, BROWNISH GRAY.
50	63				SP	SAND, SAME AS SS #10.
55	51				SP	SAND, UNIFORM MEDIUM TO FINE, SOME COARSE PIECES, LESS THAN 3% NONPLASTIC FINES, GRAY.
60	51				SP	GRAVELLY SAND, POORLY GRADED, 12-15% ROUNDED GRAVEL TO 0.5 INCH MAXIMUM, COARSE TO FINE, MOSTLY COARSE AND MEDIUM, LESS THAN 3% FINES, GRAY.
65	33				SP	GRAVELLY SAND, SIMILAR TO SS #13, EXCEPT ROUNDED GRAVEL TO 0.3 INCH MAXIMUM.
					SP	SAND, POORLY GRADED, 3-5% GRAVEL TO 0.5 INCH MAXIMUM, COARSE TO FINE, MOSTLY MEDIUM 1-5% NONPLASTIC FINES, BROWNISH GRAY.

1. FIGURES IN BLOW OR RECOVERY COLUMN OPPOSITE SOIL SAMPLE DENOTE THE NUMBER OF BLOWS OF A 140 LB HAMMER FALLING 30" REQUIRED TO DRIVE A 2" OD SAMPLE SPOON 12" OR THE DISTANCE SHOWN. FIGURES SHOWN OPPOSITE ROCK CORES DENOTE THE PERCENT OF CORE RECOVERED.

2. #2 INDICATES LOCATION OF UNDISTURBED SAMPLE. #6 INDICATES LOCATION OF SPLIT-SPOON SAMPLE. □ INDICATES LOCATION OF SAMPLING ATTEMPT WITH NO RECOVERY. SUBSCRIPT NEXT TO SYMBOL INDICATES SAMPLE NUMBER.

3. ↓ INDICATES LOCATION OF NATURAL GROUND WATER TABLE.

4. RQD - ROCK QUALITY DESIGNATION.

5. | | INDICATES DEPTH & LENGTH OF NX COILING RUN.

6. DAYM IS

NATIONAL SYNCHROTRON LIGHT SOURCE  
 BROOKHAVEN NATIONAL LABORATORY  
 STONE & WEBSTER ENGINEERING CORPORATION

04.2 of 2

SITE NATIONAL SYNCHROTRON LIGHT SOURCE J.O. No. 13011.1D BORING No. 1  
 TYPE OF BORING SS LOCATION BROOKHAVEN NATIONAL LABORATORY GROUND ELEV. 73.0  
 DATE DRILLED August 27, 1977 DRILLED BY V. ADAM LOGGED BY RST  
 SUMMARY OF BORING

ELEV. FEET	DEPTH FEET	OVERALL WEATHERING AND RQD	SAMPLE BLOW RECORD	GRAPHIC LOG	SOIL OR ROCK DESCRIPTION	
					FIELD AND LABORATORY TEST RESULTS	SOIL STRATA DESCRIPTION, LITHOLOGY AND TEXTURE

	79		56		SS	SAND, SAME AS SS #15.
	80		140		SS	SAND, UNIFORM FINE, SOME COARSE PIECES, LESS THAN 3% NONPLASTIC FINES, LIGHT BROWNISH GRAY.
	85		58		SS	GRAVELLY SAND, POORLY GRADED, 10-12% ROUNDED GRAVEL TO 0.5 INCH MAXIMUM, COARSE TO FINE SAND, MOSTLY MEDIUM 3-5% NONPLASTIC FINES, BROWNISH GRAY.
	90		58		SS	SAND, UNIFORM MEDIUM, SOME COARSE PIECES, LESS THAN 5% NONPLASTIC FINES, LIGHT BROWNISH GRAY.
	95		58		SS	SAND, SAME AS SS #19.
	100		59		SS	SAND, SAME AS SS #19, ABSENCE OF ROUNDED GRAVEL TO 0.3 INCH MAXIMUM.
		TERMINATED				END OF BORING AT 101.3 FT.

1. FIGURES IN BLOW OR RECOVERY COLUMN OPPOSITE SOIL SAMPLE DENOTE THE NUMBER OF BLOWS OF A 140 LB HAMMER FALLING 30" REQUIRED TO DRIVE A 2" OD SAMPLE SPOON 12" OR THE DISTANCE SHOWN. FIGURES SHOWN OPPOSITE ROCK CORES DENOTE THE PERCENT OF CORE RECOVERED.

2. #2 INDICATES LOCATION OF UNDISTURBED SAMPLE. #6 INDICATES LOCATION OF SPLIT-SPOON SAMPLE. □ INDICATES LOCATION OF SAMPLING ATTEMPT WITH NO RECOVERY. SUBSCRIPT NEXT TO SYMBOL INDICATES SAMPLE NUMBER.

3. ↓ INDICATES LOCATION OF NATURAL GROUND WATER TABLE.

4. RQD - ROCK QUALITY DESIGNATION.

5. | | INDICATES DEPTH & LENGTH OF NX COILING RUN.

6. DAYM IS

NATIONAL SYNCHROTRON LIGHT SOURCE  
 BROOKHAVEN NATIONAL LABORATORY  
 STONE & WEBSTER ENGINEERING CORPORATION

SITE NATIONAL SYNCHROTRON LIGHT SOURCE J.O. NO. 13011.00 BORING NO. 2  
 TYPE OF BORING SS LOCATION BROOKHAVEN NATIONAL LABORATORY GROUND ELEV. 71.4  
 DATE DRILLED AUGUST 23, 1977 DRILLED BY Y. AJAR LOGGED BY RBT  
 SUMMARY OF BORING

ELEV. FEET	DEPTH FEET	OVERALL WEATHERING AND ROD	SAMPLE BLOW COUNT	SAMPLE TYPE	GRAPHIC LOG	SOIL OR ROCK DESCRIPTION	
						FIELD AND LABORATORY TEST RESULTS: MOISTURE, PLASTICITY AND FAULTING	SOIL STATE DESCRIPTION, LITHOLOGY AND TEXTURE

0	13-55	1	SM	SILT SAND, WIDELY GRADED, COARSE TO FINE, MOSTLY FINE, 35-40% NONPLASTIC FINES, MOTTLED GRAY AND BROWN.
15	55	2	SP	SAND, UNIFORM; FINE, LESS THAN 5% NONPLASTIC FINES, LIGHT YELLOWISH GRAY.
25	55	3	SP	SAND, UNIFORM, MEDIUM TO FINE, MOSTLY FINE, LESS THAN 5% NONPLASTIC FINES, LIGHT YELLOWISH GRAY.
23	55	4	SP-SM	SAND, UNIFORM, MEDIUM TO FINE, MOSTLY FINE, 5-8% NONPLASTIC FINES, BROWNISH ORANGE.
30	55	5	SP	SAND, UNIFORM, MEDIUM TO FINE, MOSTLY FINE, LESS THAN 5% NONPLASTIC FINES, LIGHT YELLOWISH GRAY, SMALL BROWNISH ORANGE POCKETS OF SILT SAND.
39	55	6	SP	GRAVELLY SAND, POORLY GRADED, 12-15% SUBROUNDED GRAVEL TO 0.25 INCH MAXIMUM, COARSE TO FINE, MOSTLY MEDIUM AND FINE, 3-5% NONPLASTIC FINES, YELLOWISH GRAY, SMALL LAYER OF BROWNISH GRAY VERY FINE SILT SAND.
34	55	7	SP	GRAVELLY SAND, POORLY GRADED, 20-25% SUBROUNDED TO ROUNDED GRAVEL TO 1.0 INCH MAXIMUM, COARSE TO FINE, MOSTLY MEDIUM AND FINE, LESS THAN 5% NONPLASTIC FINES, YELLOWISH GRAY.
104	55	8	SM	SILT SAND, UNIFORM, MEDIUM TO FINE, MOSTLY FINE, 35-40% NONPLASTIC FINES, BROWN.
52	55	9	SP-SM	SAND, POORLY GRADED, 1 PIECE OF SUBROUNDED GRAVEL 1.0 INCH MAXIMUM, COARSE TO FINE, MOSTLY MEDIUM AND FINE, 5-8% NONPLASTIC FINES, YELLOWISH GRAY.
57	55	10	SP	GRAVELLY SAND, POORLY GRADED, 10-15% ROUNDED GRAVEL TO 0.25 INCH MAXIMUM, COARSE TO FINE, MOSTLY MEDIUM AND FINE, LESS THAN 5% NONPLASTIC FINES, YELLOWISH GRAY.
33	55	11	SP	SAND, POORLY GRADED, LESS THAN 5% SUBROUNDED GRAVEL TO 0.25 INCH MAXIMUM, COARSE TO FINE SAND, MOSTLY MEDIUM, LESS THAN 5% NONPLASTIC FINES, YELLOWISH GRAY.
64	55	12	SP	SAND, POORLY GRADED, 3-5% SUBANGULAR GRAVEL TO 0.5 INCH MAXIMUM, COARSE TO FINE, MOSTLY MEDIUM, LESS THAN 5% NONPLASTIC FINES, YELLOWISH GRAY.
44	55	13	SP	SAND, SIMILAR TO 55 #12 EXCEPT MOSTLY MEDIUM AND FINE SAND.
50	55	14	SP	SAND, POORLY GRADED, LESS THAN 3% SUBANGULAR GRAVEL TO 0.25 INCH MAXIMUM, COARSE TO FINE, MOSTLY MEDIUM, LESS THAN 3% NONPLASTIC FINES, YELLOWISH GRAY.
70	114	15	SP	GRAVELLY SAND, POORLY GRADED, 12-15% SUBROUNDED TO ROUNDED GRAVEL TO 0.75 INCH MAXIMUM, COARSE TO FINE SAND, MOSTLY MEDIUM AND FINE.

1. FIGURES IN BLOW OR RECOVERY COLUMN OPPOSITE SOIL SAMPLE DENOTE THE NUMBER OF BLOWS OF A 140 LB HAMMER FALLING 30" REQUIRED TO DRIVE A 2" OD SAMPLE SPOON 12" OR THE DISTANCE SHOWN. FIGURES SHOWN OPPOSITE ROCK CORES DENOTE THE PERCENT OF CORE RECOVERED.  
 2. #2 INDICATES LOCATION OF UNDISTURBED SAMPLE. #5 INDICATES LOCATION OF SPLIT-SPOON SAMPLE. #7 INDICATES LOCATION OF SAMPLING ATTEMPT WITH NO RECOVERY. SUBSCRIPT NEXT TO SYMBOL INDICATES SAMPLE NUMBER.  
 3. ↓ INDICATES LOCATION OF NATURAL GROUND WATER TABLE.  
 4. RD - ROCK QUALITY DESIGNATION.  
 5. L INDICATES DEPTH & LENGTH OF RE CORING RUN.  
 6. DATUM IS

NATIONAL SYNCHROTRON LIGHT SOURCE  
 BROOKHAVEN NATIONAL LABORATORY  
 STONE & WEBSTER ENGINEERING CORPORATION

SITE NATIONAL SYNCHROTRON LIGHT SOURCE J.O. NO. 13011.00 BORING NO. 2  
 TYPE OF BORING SS LOCATION BROOKHAVEN NATIONAL LABORATORY GROUND ELEV. 71.4  
 DATE DRILLED AUGUST 23, 1977 DRILLED BY Y. AJAR LOGGED BY RBT  
 SUMMARY OF BORING

ELEV. FEET	DEPTH FEET	OVERALL WEATHERING AND ROD	SAMPLE BLOW COUNT	SAMPLE TYPE	GRAPHIC LOG	SOIL OR ROCK DESCRIPTION	
						FIELD AND LABORATORY TEST RESULTS: MOISTURE, PLASTICITY AND FAULTING	SOIL STATE DESCRIPTION, LITHOLOGY AND TEXTURE

				LESS THAN 5% NONPLASTIC FINES, YELLOWISH GRAY.
75	55	16	SP-SM	SAND, POORLY GRADED, LESS THAN 5% ROUNDED GRAVEL TO 0.75 INCH MAXIMUM, COARSE TO FINE SAND, MOSTLY MEDIUM, 5-8% NONPLASTIC FINES, YELLOWISH GRAY.
80	55	17	SP	SAND, POORLY GRADED, LESS THAN 3% SUBANGULAR GRAVEL TO 0.5 INCH MAXIMUM, COARSE TO FINE SAND, MOSTLY MEDIUM TO FINE, LESS THAN 5% NONPLASTIC FINES, YELLOWISH GRAY.
85	55	18	SP	GRAVELLY SAND, POORLY GRADED, 15-20% ROUNDED GRAVEL TO 0.5 INCH MAXIMUM, COARSE TO FINE SAND, MOSTLY MEDIUM AND FINE, LESS THAN 5% NONPLASTIC FINES, YELLOWISH GRAY.
90	55	19	SP-SM	SAND, POORLY GRADED, COARSE TO FINE, MOSTLY MEDIUM AND FINE, 5-8% NONPLASTIC FINES, YELLOWISH GRAY, SOME REDDISH BROWN STAINING AND A FEW PIECES OF GRAVEL TO 0.25 INCH MAXIMUM.
95	55	20	SP	SAND, POORLY GRADED, LESS THAN 5% ROUNDED GRAVEL TO 0.5 INCH MAXIMUM, COARSE TO FINE SAND, MOSTLY MEDIUM AND FINE, LESS THAN 5% NONPLASTIC FINES, YELLOWISH GRAY.
100	55	21	SP-SM	SAND, POORLY GRADED, 3-5% SUBROUNDED GRAVEL TO 0.75 INCH MAXIMUM, COARSE TO FINE SAND, MOSTLY FINE, 5-8% NONPLASTIC FINES, LIGHT GRAY. END OF BORING AT 101.5 FT.

1. FIGURES IN BLOW OR RECOVERY COLUMN OPPOSITE SOIL SAMPLE DENOTE THE NUMBER OF BLOWS OF A 140 LB HAMMER FALLING 30" REQUIRED TO DRIVE A 2" OD SAMPLE SPOON 12" OR THE DISTANCE SHOWN. FIGURES SHOWN OPPOSITE ROCK CORES DENOTE THE PERCENT OF CORE RECOVERED.  
 2. #2 INDICATES LOCATION OF UNDISTURBED SAMPLE. #5 INDICATES LOCATION OF SPLIT-SPOON SAMPLE. #7 INDICATES LOCATION OF SAMPLING ATTEMPT WITH NO RECOVERY. SUBSCRIPT NEXT TO SYMBOL INDICATES SAMPLE NUMBER.  
 3. ↓ INDICATES LOCATION OF NATURAL GROUND WATER TABLE.  
 4. RD - ROCK QUALITY DESIGNATION.  
 5. L INDICATES DEPTH & LENGTH OF RE CORING RUN.  
 6. DATUM IS

NATIONAL SYNCHROTRON LIGHT SOURCE  
 BROOKHAVEN NATIONAL LABORATORY  
 STONE & WEBSTER ENGINEERING CORPORATION



SITE NATIONAL SYNCHROTRON LIGHT SOURCE J.O. No. 13011.10 BORING No. 1  
 TYPE OF BORING SS LOCATION BROOKHAVEN NATIONAL LABORATORY GROUND ELEV. 72.3  
 DATE DRILLED AUGUST 24, 1977 DRILLED BY Y. ADAM LOGGED BY JRM/11  
 SUMMARY OF BORING

ELEV. FEET	DEPTH FEET	OVERALL WEATHERING AND RQD	SAMPLE BLOW RECORD	GRAPHIC LOG	SOIL OR ROCK DESCRIPTION	
					FIELD AND LABORATORY TEST RESULTS: SOIL STRATA DESCRIPTION; LITHOLOGY AND TEXTURE	FIELD AND LABORATORY TEST RESULTS: SOIL STRATA DESCRIPTION; LITHOLOGY AND TEXTURE

0	18	SS	58	SP	TOP SOIL: SILTY SAND, VIELY GRADED, 15-20% ANGULAR GRAVEL TO 0.7 INCH MAX. COARSE TO FINE, MOSTLY MEDIUM TO FINE SAND, 15-20% SLIGHTLY PLASTIC FINES, DARK BROWN MOTTLED WITH LIGHT BROWN, SOME ORGANIC MATERIAL
5	36	SS	58	SP	SAND, POORLY GRADED, TRACE OF 0.4 INCH GRAVEL, COARSE TO FINE, MOSTLY MEDIUM SAND, <5% FINES, LIGHT BROWN
10	50	SS	3	SP	GRAVELLY SAND, POORLY GRADED, 40-45% SUBANGULAR TO SUBROUNDED GRAVEL TO 0.8 INCH MAX. COARSE TO FINE, MOSTLY MEDIUM SAND, <5% FINES, LIGHT BROWN
15	74	SS	4	SP-NH	SAND, POORLY GRADED, 3-25% GRAVEL TO 0.5 INCH MAX. COARSE TO FINE, MOSTLY MEDIUM SAND, 5-25% NONPLASTIC FINES, GRAYISH BROWN
20	39	SS	5	SP-NH	GRAVELLY SAND, POORLY GRADED, 35-40% SUBROUNDED TO SUBANGULAR GRAVEL TO 0.7 INCH MAXIMUM COARSE TO FINE, MOSTLY MEDIUM SAND, 5-25% NONPLASTIC FINES, GRAYISH BROWN
25	41	SS	6	SP-NH	GRAVELLY SAND, POORLY GRADED, 40-45% SUBANGULAR GRAVEL TO 0.9 INCH MAX. COARSE TO FINE, MOSTLY FINE SAND, 5-25% NONPLASTIC FINES, GRAYISH BROWN
30	73	SS	7	SP	GRAVELLY SAND, POORLY GRADED, 15-20% SUBANGULAR GRAVEL TO 0.7 INCH MAX. COARSE TO FINE, MOSTLY MEDIUM SAND, <5% FINES, GRAYISH BROWN
35	74	SS	8	SP	GRAVELLY SAND, SIMILAR TO ABOVE, EXCEPT 30-35% GRAVEL
40	96	SS	9	SP	SAND, POORLY GRADED, 3-5% GRAVEL TO 0.4 INCH MAX., COARSE TO FINE, MOSTLY FINE (VERY LITTLE COARSE) SAND, <5% FINES, GRAYISH BROWN
45	39	SS	10	SP	GRAVELLY SAND, POORLY GRADED, 30-35% SUBROUNDED GRAVEL TO 0.7 INCH MAX. COARSE TO FINE, MOSTLY MEDIUM SAND, <5% FINES, GRAYISH BROWN
50	43	SS	11	SP	GRAVELLY SAND, SIMILAR TO ABOVE
55	44	SS	12	SP	GRAVELLY SAND, SIMILAR TO ABOVE, EXCEPT 25-30% GRAVEL
60	51	SS	13	SP	GRAVELLY SAND, POORLY GRADED, 40-45% SUBANGULAR TO SUBROUNDED GRAVEL TO 0.8 INCH MAX. COARSE TO FINE, MOSTLY MEDIUM SAND, <5% FINES, GRAYISH BROWN
65	69	SS	14	SP	GRAVELLY SAND, POORLY GRADED, 25-30% SUBANGULAR TO SUBROUNDED TO 0.7 INCH MAX. COARSE TO FINE, MOSTLY MEDIUM SAND, <5% FINES, GRAYISH BROWN
70	45	SS	15	SP-NH	

- FIGURES IN BLOW OR RECOVERY COLUMN OPPOSITE SOIL SAMPLE DENOTE THE NUMBER OF BLOWS OF A 140 LB HAMMER FALLING 30" REQUIRED TO DRIVE A 2" OD SAMPLE SPOON 12" OR THE DISTANCE SHOWN. FIGURES SHOW OPPOSITE ROCK CORES DENOTE THE PERCENT OF CORE RECOVERED.
- #2 INDICATES LOCATION OF UNDISTURBED SAMPLE. #6 INDICATES LOCATION OF SPLIT-SPOON SAMPLE. [ ] INDICATES LOCATION OF SAMPLING ATTEMPT WITH NO RECOVERY. SUBSCRIPT NEXT TO SYMBOL INDICATES SAMPLE NUMBER.
- # indicates location of NATURAL GROUND WATER TABLE.
- RQD - ROCK QUALITY DESIGNATION.
- INDICATES DEPTH & LENGTH OF RC CORING RUN.
- DATE IS

NATIONAL SYNCHROTRON LIGHT SOURCE  
 BROOKHAVEN NATIONAL LABORATORY  
 STONE & WEBSTER ENGINEERING CORPORATION

SITE NATIONAL SYNCHROTRON LIGHT SOURCE J.O. No. 13011.10 BORING No. 3  
 TYPE OF BORING SS LOCATION BROOKHAVEN NATIONAL LABORATORY GROUND ELEV. 72.1  
 DATE DRILLED AUGUST 24, 1977 DRILLED BY Y. ADAM LOGGED BY JRM/11  
 SUMMARY OF BORING

ELEV. FEET	DEPTH FEET	OVERALL WEATHERING AND RQD	SAMPLE BLOW RECORD	GRAPHIC LOG	SOIL OR ROCK DESCRIPTION	
					FIELD AND LABORATORY TEST RESULTS: SOIL STRATA DESCRIPTION; LITHOLOGY AND TEXTURE	FIELD AND LABORATORY TEST RESULTS: SOIL STRATA DESCRIPTION; LITHOLOGY AND TEXTURE

75	33	SS	16	SP-NH	SAND, POORLY GRADED, 3-5% GRAVEL, 25 0.5 INCH MAX. COARSE TO FINE, MOSTLY MEDIUM TO FINE SAND, 5-25% NONPLASTIC FINES, GRAYISH BROWN
80	63	SS	17	SP	GRAVELLY SAND, POORLY GRADED, 40-45% SUBANGULAR TO SUBROUNDED GRAVEL TO 0.7 INCH MAX. COARSE TO FINE, MOSTLY MEDIUM TO FINE SAND, <5% FINES, GRAYISH BROWN
85	84	SS	14	SP	GRAVELLY SAND, SIMILAR TO ABOVE, EXCEPT 30-35% GRAVEL
90	65	SS	19	SP	GRAVELLY SAND, SIMILAR TO #18
95	73	SS	20	SP	GRAVELLY SAND, POORLY GRADED, 10-15% SUBROUNDED GRAVEL TO 0.4 INCH MAX. COARSE TO FINE, MOSTLY MEDIUM SAND, <5% FINES, GRAYISH BROWN
100	74	SS	21	SP	SAND, UNIFORM, MEDIUM TO FINE, TRACE OF COARSE SAND, <5% FINES, MEDIUM BROWN
					END OF BORING AT 101.5 FT

- FIGURES IN BLOW OR RECOVERY COLUMN OPPOSITE SOIL SAMPLE DENOTE THE NUMBER OF BLOWS OF A 140 LB HAMMER FALLING 30" REQUIRED TO DRIVE A 2" OD SAMPLE SPOON 12" OR THE DISTANCE SHOWN. FIGURES SHOW OPPOSITE ROCK CORES DENOTE THE PERCENT OF CORE RECOVERED.
- #2 INDICATES LOCATION OF UNDISTURBED SAMPLE. #6 INDICATES LOCATION OF SPLIT-SPOON SAMPLE. [ ] INDICATES LOCATION OF SAMPLING ATTEMPT WITH NO RECOVERY. SUBSCRIPT NEXT TO SYMBOL INDICATES SAMPLE NUMBER.
- # indicates location of NATURAL GROUND WATER TABLE.
- RQD - ROCK QUALITY DESIGNATION.
- INDICATES DEPTH & LENGTH OF RC CORING RUN.
- DATE IS

NATIONAL SYNCHROTRON LIGHT SOURCE  
 BROOKHAVEN NATIONAL LABORATORY  
 STONE & WEBSTER ENGINEERING CORPORATION

SITE NATIONAL SYNCHROTRON LIGHT SOURCE J.O. NO. BORING NO. 2-7  
TYPE OF BORING LOCATION BROOKHAVEN NATIONAL LABORATORY GROUND ELEV. 73.1  
DATE DRILLED AUGUST 25, 1977 DRILLED BY V. ATLAS LOGGED BY

Table with columns: ELEV. FEET, DEPTH FEET, OVERALL WEATHERING AND RQD, SAMPLE BLOW RECOV TYPE GRAPHIC LOG, SOIL OR ROCK DESCRIPTION. Contains detailed soil log data from 0 to 71 feet depth.

- 1. FIGURES IN BLOW OR RECOVERY COLUMN OPPOSITE SOIL SAMPLE DENOTE THE NUMBER OF BLOWS OF A 140 LB HAMMER FALLING 30" REQUIRED TO DRIVE A 2" OD SAMPLE SPOON 12" OR THE DISTANCE SHOWN. FIGURES SHOWN OPPOSITE ROCK CORES DENOTE THE PERCENT OF CORE RECOVERED.
- 2. #2 INDICATES LOCATION OF UNDISTURBED SAMPLE. #6 INDICATES LOCATION OF SPLIT-SPOON SAMPLE. [ ] INDICATES LOCATION OF SAMPLING ATTEMPT WITH NO RECOVERY.
- 3. \* INDICATES LOCATION OF NATURAL GROUND WATER TABLE.
- 4. RQD - ROCK QUALITY DESIGNATION.
- 5. [ ] INDICATES DEPTH & LENGTH OF NX CORING RUN.
- 6. DATUM IS

NATIONAL SYNCHROTRON LIGHT SOURCE  
BROOKHAVEN NATIONAL LABORATORY  
STONE & WEBSTER ENGINEERING CORPORATION

SITE NATIONAL SYNCHROTRON LIGHT SOURCE J.O. NO. 1-2-12 BORING NO. 2-7  
TYPE OF BORING LOCATION BROOKHAVEN NATIONAL LABORATORY GROUND ELEV. 73.1  
DATE DRILLED AUGUST 25, 1977 DRILLED BY V. ATLAS LOGGED BY

Table with columns: ELEV. FEET, DEPTH FEET, OVERALL WEATHERING AND RQD, SAMPLE BLOW RECOV TYPE GRAPHIC LOG, SOIL OR ROCK DESCRIPTION. Contains detailed soil log data from 71 to 101.5 feet depth, ending with 'TERMINATED' and 'END OF BORING AT 101.5 FT'.

- 1. FIGURES IN BLOW OR RECOVERY COLUMN OPPOSITE SOIL SAMPLE DENOTE THE NUMBER OF BLOWS OF A 140 LB HAMMER FALLING 30" REQUIRED TO DRIVE A 2" OD SAMPLE SPOON 12" OR THE DISTANCE SHOWN. FIGURES SHOWN OPPOSITE ROCK CORES DENOTE THE PERCENT OF CORE RECOVERED.
- 2. #2 INDICATES LOCATION OF UNDISTURBED SAMPLE. #6 INDICATES LOCATION OF SPLIT-SPOON SAMPLE. [ ] INDICATES LOCATION OF SAMPLING ATTEMPT WITH NO RECOVERY.
- 3. \* INDICATES LOCATION OF NATURAL GROUND WATER TABLE.
- 4. RQD - ROCK QUALITY DESIGNATION.
- 5. [ ] INDICATES DEPTH & LENGTH OF NX CORING RUN.
- 6. DATUM IS

NATIONAL SYNCHROTRON LIGHT SOURCE  
BROOKHAVEN NATIONAL LABORATORY  
STONE & WEBSTER ENGINEERING CORPORATION

SH. 1. 49. 2

SITE: NATIONAL SYNCHROTRON LIGHT SOURCE  
 TYPE OF BORING: SS LOCATION: BROOKHAVEN NATIONAL LABORATORY JO NO.: 12011.01 BORING NO.: 1  
 DATE DRILLED: AUGUST 24, 1977 DRILLED BY: TORPINS GROUND ELEV.: 72.6  
 SUMMARY OF BORING: LOGGED BY: [Signature]

ELEV. FEET	DEPTH FEET	OVERALL WEATHERING AND ROD	SAMPLE		GRAPHIC LOG	SOIL OR ROCK DESCRIPTION
			BLOWS RECORDED	TYPE		
0						
5			55	1	SP	SAND, UNIFORM, FINE TO VERY FINE, MOSTLY FINE, < 5% NONPLASTIC FINES, GRAYISH YELLOW.
10			22	3	SP	SAND, UNIFORM, MEDIUM TO FINE, MOSTLY FINE, < 5% NONPLASTIC FINES, GRAYISH YELLOW.
15			26	3	SP	SAND, SIMILAR TO SS #2, MOSTLY FINE, GRAY.
20			42	4	SP	SAND, UNIFORM, MEDIUM TO FINE, MOSTLY FINE, < 5% NONPLASTIC FINES, GRAYISH YELLOW.
25			67	5	SP	GRAVELLY SAND, POORLY GRADED, 15-20% SUBROUNDED TO ROUNDED GRAVEL TO 1.0 INCH MAXIMUM, COARSE TO FINE SAND, MOSTLY MEDIUM AND FINE, < 5% NONPLASTIC FINES, YELLOWISH GRAY.
30			39	6	SP-SH	GRAVELLY SAND, POORLY GRADED, 15-20% SUBROUNDED GRAVEL TO 0.5 INCH MAXIMUM, COARSE TO FINE SAND, MOSTLY MEDIUM AND FINE, 5-8% NONPLASTIC FINES, YELLOWISH GRAY.
35			35		SP-SH	SAND, SAME AS SS #3.
40			55	4	SP-SH	GRAVELLY SAND, POORLY GRADED, 15-20% BOUNDED GRAVEL TO 0.5 INCH MAXIMUM, COARSE TO FINE SAND, MOSTLY FINE, < 5% NONPLASTIC FINES, MOTTLED YELLOWISH GRAY AND LIGHT YELLOWISH GRAY.
45			79	4	SP	SAND, POORLY GRADED, COARSE TO FINE, MOSTLY MEDIUM AND FINE, < 5% NONPLASTIC FINES, YELLOWISH GRAY.
50			54	10	SP	SAND, UNIFORM, MEDIUM TO FINE, MOSTLY FINE (ONE PIECE OF GRAVEL TO 0.5 INCH) < 5% NONPLASTIC FINES, YELLOWISH GRAY.
55			2	11	SP	SAND, SAME AS SS #3 (W/ GRAVEL).
60			17	12	SP	SAND, UNIFORM, MEDIUM TO FINE, MOSTLY FINE (TRACE OF COARSE AND ONE PIECE OF GRAVEL TO 0.25 INCH) < 5% NONPLASTIC FINES.
65			20	13	SP	GRAVELLY SAND, POORLY GRADED, 20-25% SUBROUNDED GRAVEL TO 1.0 INCH MAXIMUM, MOSTLY MEDIUM AND FINE, < 5% NONPLASTIC FINES, GRAYISH YELLOW.
70			35	14	SP	SAND, UNIFORM, FINE TO MEDIUM (ONE PIECE OF GRAVEL TO 0.5 INCH) TRACE OF COARSE SAND, < 5% NONPLASTIC FINES, YELLOWISH GRAY.

- FIGURES IN BLOW OR RECOVERY COLUMN OPPOSITE SOIL SAMPLE DENOTE THE NUMBER OF BLOWS OF A 140 LB HAMMER FALLING 30" REQUIRED TO DRIVE A 2" OD SAMPLE SPOON 12" OR THE DISTANCE SHOWN. FIGURES SHOWN OPPOSITE ROCK CORES DENOTE THE PERCENT OF CORE RECOVERED.
- SP INDICATES LOCATION OF UNDISTURBED SAMPLE. FS INDICATES LOCATION OF SPLIT-SPOON SAMPLE. [ ] INDICATES LOCATION OF SAMPLING ATTEMPT WITH NO RECOVERY. SUBSCRIPT NEXT TO SYMBOL INDICATES SAMPLE NUMBER.
- W INDICATES LOCATION OF NATURAL GROUND WATER TABLE.
- RSD - ROCK QUALITY DESIGNATION.
- [ ] INDICATES DEPTH & LENGTH OF BK COATING RUN.
- DATE IS

NATIONAL SYNCHROTRON LIGHT SOURCE  
 BROOKHAVEN NATIONAL LABORATORY

STONE & WEBSTER ENGINEERING CORPORATION

SH. 2. 49. 2

SITE: NATIONAL SYNCHROTRON LIGHT SOURCE  
 TYPE OF BORING: SS LOCATION: BROOKHAVEN NATIONAL LABORATORY JO NO.: 12011.01 BORING NO.: 1  
 DATE DRILLED: AUGUST 24, 1977 DRILLED BY: TORPINS GROUND ELEV.: 72.6  
 SUMMARY OF BORING: LOGGED BY: [Signature]

ELEV. FEET	DEPTH FEET	OVERALL WEATHERING AND ROD	SAMPLE		GRAPHIC LOG	SOIL OR ROCK DESCRIPTION
			BLOWS RECORDED	TYPE		
75			33	15	SP	GRAVELLY SAND, POORLY GRADED, 12-15% SUBROUNDED GRAVEL TO 1.0 INCH MAXIMUM, MEDIUM TO FINE SAND, MOSTLY FINE, < 5% NONPLASTIC FINES, GRAYISH YELLOW - BROKEN JAR.
80			109	16	SP	SAND, POORLY GRADED, 5-8% SUBANGULAR GRAVEL TO 0.25 INCH MAXIMUM, COARSE TO FINE SAND, MOSTLY MEDIUM TO FINE, < 5% NONPLASTIC FINES, YELLOWISH GRAY.
85			121	17	SP	GRAVELLY SAND, POORLY GRADED, 15-20% GRAVEL TO 0.75 INCH MAXIMUM, COARSE TO FINE SAND, MOSTLY MEDIUM AND FINE, < 5% NONPLASTIC FINES, YELLOWISH GRAY, LAYER OF GRAY FINE TO VERY FINE SAND.
90			133	18	SP	SAND, UNIFORM, MEDIUM TO FINE, MOSTLY FINE (TRACE OF COARSE) < 5% NONPLASTIC FINES, GRAYISH YELLOW.
95			194	19	SP	SAND, POORLY GRADED, COARSE TO FINE, MOSTLY MEDIUM AND FINE, < 5% NONPLASTIC FINES, YELLOWISH GRAY WITH SOME REDDISH BROWN STAINING.
100			243	20	SP	SAND, UNIFORM, FINE TO VERY FINE (TRACE OF COARSE) < 5% NONPLASTIC FINES, YELLOWISH GRAY.
105						Terminated
109						END OF BORING AT 102.0 FT

- FIGURES IN BLOW OR RECOVERY COLUMN OPPOSITE SOIL SAMPLE DENOTE THE NUMBER OF BLOWS OF A 140 LB HAMMER FALLING 30" REQUIRED TO DRIVE A 2" OD SAMPLE SPOON 12" OR THE DISTANCE SHOWN. FIGURES SHOWN OPPOSITE ROCK CORES DENOTE THE PERCENT OF CORE RECOVERED.
- SP INDICATES LOCATION OF UNDISTURBED SAMPLE. FS INDICATES LOCATION OF SPLIT-SPOON SAMPLE. [ ] INDICATES LOCATION OF SAMPLING ATTEMPT WITH NO RECOVERY. SUBSCRIPT NEXT TO SYMBOL INDICATES SAMPLE NUMBER.
- W INDICATES LOCATION OF NATURAL GROUND WATER TABLE.
- RSD - ROCK QUALITY DESIGNATION.
- [ ] INDICATES DEPTH & LENGTH OF BK COATING RUN.
- DATE IS

NATIONAL SYNCHROTRON LIGHT SOURCE  
 BROOKHAVEN NATIONAL LABORATORY

STONE & WEBSTER ENGINEERING CORPORATION

SITE NATIONAL SYNCHROTRON LIGHT SOURCE J.O. No. 13011.01 BORING No. 6  
 TYPE OF BORING SS LOCATION BROOKHAVEN NATIONAL LABORATORY GROUND ELEV. 74.4  
 DATE DRILLED AUGUST 25, 1977 DRILLED BY TOOKENS LOGGED BY DMH  
 SUMMARY OF BORING

ELEV. FEET	DEPTH FEET	OVERALL WEATHERING AND RQD 0 TO 100 TO 100	SAMPLE BLOWS RECOVERED TYPE	GRAPHIC LOG	SOIL OR ROCK DESCRIPTION
0					
5			SS		SILTY SAND, UNIFORM MEDIUM TO FINE, MOSTLY FINE, 12-15% NONPLASTIC FINES, YELLOWISH BROWN.
10			SS 98 2		SILTY SAND, WIDELY GRADED, 18-23% SUBANGULAR GRAVEL TO 0.7 INCH MAX. COARSE TO FINE, MOSTLY MEDIUM TO FINE SAND, 18-23% NONPLASTIC FINES, BROWN
15			SS 50 3		SAND, POORLY GRADED, 10-15% SUBANGULAR GRAVEL TO 0.6 INCH MAX. COARSE TO FINE, MOSTLY MEDIUM TO FINE SAND, 3-5% FINES, BROWN
20			SS 147 4		SANDY GRAVEL, POORLY GRADED, SUBANGULAR TO 0.8 INCH MAX. 43-47% COARSE TO FINE, MOSTLY MEDIUM TO FINE SAND, 3-5% FINES, GRAYISH BROWN
25			SS 126 5		GRAVELLY SAND, POORLY GRADED, 40-45% SUBANGULAR TO SUBROUNDED TO 0.7 INCH MAX. COARSE TO FINE, MOSTLY MEDIUM SAND, 4-5% FINES, GRAYISH BROWN
30			SS 149 6		GRAVELLY SAND, POORLY GRADED, 20-25% SUBANGULAR GRAVEL TO 0.8 INCH MAX. COARSE TO FINE, MOSTLY MEDIUM TO FINE SAND, 4-5% FINES, GRAYISH BROWN
35			SS 123 7		GRAVELLY SAND, POORLY GRADED, 40-45% SUBANGULAR GRAVEL TO 0.7 INCH MAX. COARSE TO FINE, MOSTLY MEDIUM TO FINE SAND, 4-5% FINES, GRAYISH BROWN
40			SS 83 8		GRAVELLY SAND, POORLY GRADED, 12-14% SUBROUNDED GRAVEL TO 0.5 INCH MAX. COARSE TO FINE, MOSTLY MEDIUM TO FINE SAND, 4-5% FINES, GRAYISH BROWN
45			SS 99 9		GRAVELLY SAND, SIMILAR TO ABOVE, EXCEPT 10-15% GRAVEL
50			SS 126 10		GRAVELLY SAND, SIMILAR TO ABOVE, EXCEPT 15-25% GRAVEL TO 0.6 INCH MAX.
55			SS 112 11		SAND, POORLY GRADED, 4-8% GRAVEL TO 0.4 INCH MAX. COARSE TO FINE, MOSTLY MEDIUM TO FINE SAND, 5-8% NONPLASTIC FINES, GRAYISH BROWN
60			SS 40 12		SAND, SIMILAR TO ABOVE
65			SS 72 13		SAND, SIMILAR TO ABOVE
70			SS 57 14		SAND, UNIFORM, MEDIUM TO FINE, TRACE OF 0.6 INCH GRAVEL, 3-8% NONPLASTIC FINES, GRAY

1. FIGURES IN BLOW OR RECOVERY COLUMN OPPOSITE SOIL SAMPLE DENOTE THE NUMBER OF BLOWS OF A 140 LB HAMMER FALLING 30" REQUIRED TO DRIVE A 2" OD SAMPLE SPOON 12" OR THE DISTANCE SHOWN. FIGURES SHOWN OPPOSITE ROCK CORES DENOTE THE PERCENT OF CORE RECOVERED.  
 2. B2 INDICATES LOCATION OF UNDISTURBED SAMPLE. F6 INDICATES LOCATION OF SPLIT-SPOON SAMPLE.  INDICATES LOCATION OF SAMPLING ATTEMPT WITH NO RECOVERY.  
 SUBSCRIPT NEXT TO SYMBOL INDICATES SAMPLE NUMBER.  
 3.  INDICATES LOCATION OF NATURAL GROUND WATER TABLE.  
 4. RQD - ROCK QUALITY DESIGNATION.  
 5.  INDICATES DEPTH & LENGTH OF BK COATING RUN.  
 6. DATUM IS

NATIONAL SYNCHROTRON LIGHT SOURCE  
 BROOKHAVEN NATIONAL LABORATORY  
 STONE & WEBSTER ENGINEERING CORPORATION

SITE NATIONAL SYNCHROTRON LIGHT SOURCE J.O. No. 13011.01 BORING No. 6  
 TYPE OF BORING SS LOCATION BROOKHAVEN NATIONAL LABORATORY GROUND ELEV. 74.4  
 DATE DRILLED AUGUST 25, 1977 DRILLED BY TOOKENS LOGGED BY DMH  
 SUMMARY OF BORING

ELEV. FEET	DEPTH FEET	OVERALL WEATHERING AND RQD 0 TO 100 TO 100	SAMPLE BLOWS RECOVERED TYPE	GRAPHIC LOG	SOIL OR ROCK DESCRIPTION
75			SS 132 15		SAND, POORLY GRADED, 8-12% GRAVEL TO 0.5 INCH MAX., COARSE TO FINE, MOSTLY MEDIUM TO FINE SAND, 5-8% NONPLASTIC FINES, GRAYISH BROWN
80			SS 99/ 9 16		SAND, SIMILAR TO ABOVE
85			SS 206 17		GRAVELLY SAND, POORLY GRADED, 10-15% SUBANGULAR GRAVEL TO 0.5 INCH MAX. COARSE TO FINE, MOSTLY MEDIUM TO FINE SAND, 5-8% NONPLASTIC FINES, GRAYISH BROWN
90			SS 90 18		SAND, UNIFORM, MEDIUM TO FINE, TRACE OF 0.4 INCH GRAVEL, 5-8% NONPLASTIC FINES, GRAYISH BROWN
95			SS 116 19		GRAVELLY SAND, POORLY GRADED, 15-20% SUBANGULAR GRAVEL TO 0.6 INCH MAX. COARSE TO FINE, MOSTLY MEDIUM TO FINE SAND, 4-5% FINES, GRAYISH BROWN
100			SS 137 20		SAND, POORLY GRADED, 8-12% GRAVEL TO 0.5 INCH MAX. COARSE TO FINE, MOSTLY MEDIUM SAND, 4-5% FINES, GRAYISH BROWN
					END OF BORING AT 102 FT

1. FIGURES IN BLOW OR RECOVERY COLUMN OPPOSITE SOIL SAMPLE DENOTE THE NUMBER OF BLOWS OF A 140 LB HAMMER FALLING 30" REQUIRED TO DRIVE A 2" OD SAMPLE SPOON 12" OR THE DISTANCE SHOWN. FIGURES SHOWN OPPOSITE ROCK CORES DENOTE THE PERCENT OF CORE RECOVERED.  
 2. B2 INDICATES LOCATION OF UNDISTURBED SAMPLE. F6 INDICATES LOCATION OF SPLIT-SPOON SAMPLE.  INDICATES LOCATION OF SAMPLING ATTEMPT WITH NO RECOVERY.  
 SUBSCRIPT NEXT TO SYMBOL INDICATES SAMPLE NUMBER.  
 3.  INDICATES LOCATION OF NATURAL GROUND WATER TABLE.  
 4. RQD - ROCK QUALITY DESIGNATION.  
 5.  INDICATES DEPTH & LENGTH OF BK COATING RUN.  
 6. DATUM IS

NATIONAL SYNCHROTRON LIGHT SOURCE  
 BROOKHAVEN NATIONAL LABORATORY  
 STONE & WEBSTER ENGINEERING CORPORATION





## Appendix B

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### 2003 Test Boring Logs

CLIENT: **GEI**  
 PROJECT NAME: **Brookhaven**  
 LOCATION: **Long Island, NY**  
 DRILLER: **T. Roe**  
 INSPECTOR: **A. Smart**  
 DATE START: **10/28/03**  
 DATE FINISH: **10/28/03**

**NEW ENGLAND BORING CONTRACTORS OF CT., INC.**  
  
 129 KRIEGER LANE  
 GLASTONBURY, CT 06033  
 (860) 633-4649 - (413) 733-1232  
 FAX (860) 657-8046

**BORING No. B-1**  
 SHEET 1 OF 1  
 ARCHITECT/  
 ENGINEER  
 FILE NO. **GEI-LongIsland,**  
**NY**  
 SURFACE ELEV.  
 LINE & STATION  
 OFFSET

TYPE	Casing	Sampler	Core Barrel
SIZE I.D.	HSA 3-1/4"	SS 1-3/8"	
HAMMER WT.		140	
HAMMER FALL		30"	

No.	DEPTH RANGE IN FEET	SAMPLE BLOWS PER 6" ON SAMPLER				REC.	CASING BLOWS/CORING TIMES PER FT.	FIELD CLASSIFICATION AND REMARKS	Well Cons.	Installation Details
		0-6	6-12	12-18	18-24					
S1	0'-2'	1	1	2	1	8"		8" Dark Brown Topsoil		
S2	5'-7'	5	6	8	9	14"		Gray Brown Fine Sand, Some Silt, Trace of Roots - Fill		
S3	10'-12'	7	7	9	12	24"		Light Brown Fine Sand, Stratified		
S4	15'-17'	5	12	14	13	20"		Light Brown Fine Sand, Little Gravel, Stratified		
S5	20'-22'	5	7	7	9	24"		Cobble @ 19'-19'6"		
S6	25'-27'	5	6	10	11	24"		Brown Fine-Med. Sand, Trace of Gravel, Stratified		
S7	30'-32'	9	11	13	17	20"		Brown Med.-Crs. Sand, Little Fine Sand		
								End of Boring @ 32' Water @ 31'		

NOTES: 1) The stratification lines represent the approximate boundary between soil types. Transitions may be gradual.  
 2) Water level readings have been made in the drill holes at times and under conditions stated on the boring logs. Fluctuations in the level of ground-water may occur due to factors other than those present at the time measurements were made.

REMARKS:

CLIENT: GEI

PROJECT NAME: **Brookhaven**  
 National Labs  
 LOCATION: Long Island, NY

DRILLER: T. Roe

INSPECTOR: A. Smart

DATE START: 10/28/03

DATE FINISH: 10/28/03

**NEW ENGLAND BORING CONTRACTORS OF CT., INC.**



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 (860) 633-4649 - (413) 733-1232  
 FAX (860) 657-8046

**BORING No. B-2**

SHEET 1 OF 1

ARCHITECT/  
 ENGINEER

FILE NO. **GEI-LongIsland,**  
 NY

SURFACE ELEV.  
 LINE & STATION

OFFSET

TYPE	Casing	Sampler	Core Barrel
SIZE I.D.	HSA 3-1/4"	SS 1-3/8"	
HAMMER WT.		140	
HAMMER FALL		30"	

No.	DEPTH RANGE IN FEET	SAMPLE				REC.	CASING BLOWS/ CORING TIMES PER FT.	FIELD CLASSIFICATION AND REMARKS	Well Cons.	Installation Details
		BLOWS PER 6" ON SAMPLER								
		0-6	6-12	12-18	18-24					
S1	0'-2'	2	2	2	2	20"	5" Dark brown Sandy Topsoil Brown Fine Sand, Little Silt, Trace of Roots - Fill			
S2	5'-7'	4	7	10	13	18"	Light Brown Fine Sand Trace of Silt @ S6, Stratified Little Silt @ S7			
S3	10'-12'	3	5	5	7	18"				
S4	15'-17'	3	4	5	5	16"				
S5	20'-22'	5	5	6	8	18"				
S6	25'-27'	6	8	10	10	20"				
S7	30'-32'	7	9	10	9	18"	End of Boring @ 32' Water @ 29' Water @ 28' Overnight			

NOTES: 1) The stratification lines represent the approximate boundary between soil types. Transitions may be gradual.  
 2) Water level readings have been made in the drill holes at times and under conditions stated on the boring logs. Fluctuations in the level of groundwater may occur due to factors other than those present at the time measurements were made.

REMARKS: *Note: Moved Hole 10' West Due to Overhead Branches*



CLIENT: **GEI**  
 PROJECT NAME: **Brookhaven**  
 LOCATION: **Long Island, NY**  
 DRILLER: **T. Roe**  
 INSPECTOR: **A. Smart**  
 DATE START: **10/28/03**  
 DATE FINISH: **10/28/03**

**NEW ENGLAND BORING CONTRACTORS OF CT., INC.**



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 GLASTONBURY, CT 06033  
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 FAX (860) 657-8046

**BORING No. B-3**

SHEET 1 OF 1

ARCHITECT/  
 ENGINEER

FILE NO. **GEI-LongIsland,**

**NY**  
 SURFACE ELEV.

LINE & STATION

OFFSET

	Casing	Sampler	Core Barrel
TYPE	HSA	SS	
SIZE I.D.	3-1/4"	1-3/8"	
HAMMER WT.		140	
HAMMER FALL		30"	

No.	DEPTH RANGE IN FEET	SAMPLE				REC.	CASING BLOWS/ CORING TIMES PER FT.	FIELD CLASSIFICATION AND REMARKS	Well Cons.	Installation Details
		BLOWS PER 6" ON SAMPLER								
		0-6	6-12	12-18	18-24					
S1	0'-2'	3	3	1	1	14"	1" Asphalt - 2" Dark Brown Topsoil. Brown Fine Sand, Trace of Silt, Possible Fill Light Brown Fine Sand, Stratified			
S2	5'-7'	3	6	8	10	20"				
S3	10'-12'	3	5	5	5	16"				
S4	15'-17'	3	2	3	4	24"				
S5	20'-22'	3	4	5	8	20"				
S6	25'-27'	4	6	6	9	24"				
S7	30'-32'	2	5	6	10	24"	End of Boring @ 32' Water @ 31' Water @ 28' Overnight			

NOTES: 1) The stratification lines represent the approximate boundary between soil types. Transitions may be gradual.  
 2) Water level readings have been made in the drill holes at times and under conditions stated on the boring logs. Fluctuations in the level of groundwater may occur due to factors other than those present at the time measurements were made.

REMARKS:

CLIENT: GEI

PROJECT NAME: Brookhaven  
 LOCATION: National Labs  
 Long Island, NY

DRILLER: T. Roe

INSPECTOR: A. Smart

DATE START: 10/27/03

DATE FINISH: 10/27/03

NEW ENGLAND BORING CONTRACTORS OF CT., INC.



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BORING No. B-4

SHEET 1 OF 2

ARCHITECT/  
 ENGINEER

FILE NO. GEI-LongIsland,  
 NY  
 SURFACE ELEV.

LINE & STATION

OFFSET

	Casing	Sampler	Core Barrel
TYPE	NW	SS	
SIZE I.D.	3"	1-3/8"	
HAMMER WT.	300	140	
HAMMER FALL	24"	30"	

No.	DEPTH RANGE IN FEET	SAMPLE BLOWS PER 6" ON SAMPLER				REC.	CASING BLOWS/ CORING TIMES PER FT.	FIELD CLASSIFICATION AND REMARKS	Well Cons.	Installation Details
		0-6	6-12	12-18	18-24					
S1	0'-2'	1	2	2	3	20"	Dark Brown Sandy Topsoil 1.0 Gray Fine Sand, Little Silt, Trace of Roots - Fill 3.0 Light Brown Fine-Med. Sand, Stratified			
S2	5'-7'	8	11	13	14	20"				
S3	10'-12'	9	10	9	8	18"				
S4	15'-17'	11	14	17	19	16"	Light Brown Fine-Crs. Sand, Trace of Fine Gravel, Stratified			
S5	20'-22'	3	4	6	9	12"	Light Brown Fine Sand, Some Med.-Crs. Sand, Trace of Fine-Crs. Gravel			
S6	25'-27'	14	16	26	28	12"				
S7	30'-32'	15	25	25	28	12"				
S8	35'-37'	9	12	15	22	14"				
S9	40'-42'	13	25	34	36	12"				
S10	45'-47'	9	22	22	25	14"				
S11	50'-52'	9	15	16	14	12"				
S12	55'-57'	10	14	10	9	12"				

NOTES: 1) The stratification lines represent the approximate boundary between soil types. Transitions may be gradual.  
 2) Water level readings have been made in the drill holes at times and under conditions stated on the boring logs. Fluctuations in the level of groundwater may occur due to factors other than those present at the time measurements were made.

REMARKS:

CLIENT: GEI

PROJECT NAME: Brookhaven

LOCATION: Long Island, NY  
National Labs

DRILLER: T. Roe

INSPECTOR: A. Smart

DATE START: 10/27/03

DATE FINISH: 10/27/03

NEW ENGLAND BORING CONTRACTORS OF CT., INC.



129 KRIEGER LANE  
GLASTONBURY, CT 06033  
(860) 633-4649 - (413) 733-1232  
FAX (860) 657-8046

BORING No. B-4

SHEET 2 OF 2

ARCHITECT/  
ENGINEER

FILE NO. GEI-LongIsland,

NY  
SURFACE ELEV.

LINE & STATION

OFFSET

	Casing	Sampler	Core Barrel
TYPE	NW	SS	
SIZE I.D.	3"	1-3/8"	
HAMMER WT.	300	140	
HAMMER FALL	24"	30"	

No.	DEPTH RANGE IN FEET	SAMPLE				REC.	CASING BLOWS/ CORING TIMES PER FT.	FIELD CLASSIFICATION AND REMARKS	Well Cons.	Installation Details
		BLOWS PER 6" ON SAMPLER								
		0-6	6-12	12-18	18-24					
S13	60'-62'	8	13	17	18	12"		62.0 End of Boring @ 62' Water @ 18' Overnight Water @ 23' After 60 Hours +/-		

CLIENT: GEI

PROJECT NAME: Brookhaven

LOCATION: National Labs  
Long Island, NY

DRILLER: T. Roe

INSPECTOR: A. Smart

DATE START: 10/30/03

DATE FINISH: 10/30/03

NEW ENGLAND BORING CONTRACTORS OF CT., INC.



129 KRIEGER LANE  
GLASTONBURY, CT 06033  
(860) 633-4649 -- (413) 733-1232  
FAX (860) 657-8046

BORING No. B-5

SHEET 1 OF 1

ARCHITECT/  
ENGINEER

FILE NO. GEI-LongIsland,  
NY

SURFACE ELEV.

LINE & STATION

OFFSET

TYPE	Casing	Sampler	Core Barrel
SIZE I.D.	HSA 3-1/4"	SS 1-3/8"	
HAMMER WT.		140	
HAMMER FALL		30"	

No.	DEPTH RANGE IN FEET	SAMPLE				REC.	CASING BLOWS/ CORING TIMES PER FT.	FIELD CLASSIFICATION AND REMARKS	Well Cons.	Installation Details
		BLOWS PER 6" ON SAMPLER								
		0-6	6-12	12-18	18-24					
S1	0'-2'	2	2	2	1	18"	6" Dark Brown Topsoil Brown Fine Sand, Little Silt - Fill Light Brown Fine Sand, Stratified			
S2	5'-7'	5	8	9	13	20"				
S3	10'-12'	4	5	6	7	24"				
S4	15'-17'	4	4	4	6	20"				
S5	20'-22'	4	7	9	11	24"	Brown Fine Sand, Little Silt, Stratified			
S6	25'-27'	6	10	12	16	18"	Light Brown Fine Sand, Little Fine Gravel, Stratified			
S7	30'-32'	5	4	9	8	15"	Light Brown Fine-Med. Sand, Some Gravel, Stratified End of Boring @ 32' Water @ 28' Overnight			

NOTES: 1) The stratification lines represent the approximate boundary between soil types. Transillions may be gradual.  
2) Water level readings have been made in the drill holes at times and under conditions stated on the boring logs. Fluctuations in the level of ground-water may occur due to factors other than those present at the time measurements were made.

REMARKS:

CLIENT: **GEI**

PROJECT NAME: **Brookhaven National Labs**  
 LOCATION: **Long Island, NY**

DRILLER: **T. Roe**

INSPECTOR: **A. Smart**

DATE START: **10/29/03**

DATE FINISH: **10/29/03**

**NEW ENGLAND BORING CONTRACTORS OF CT., INC.**



129 KRIEGER LANE  
 GLASTONBURY, CT 06033  
 (860) 633-4649 -- (413) 733-1232  
 FAX (860) 657-8046

**BORING No. B-6**

SHEET 1 OF 1

ARCHITECT/  
 ENGINEER

FILE NO. **GEI-Long Island, NY**  
 SURFACE ELEV.

LINE & STATION

OFFSET

TYPE	Casing	Sampler	Core Barrel
SIZE I.D.	HSA 3-1/4"	SS 1-3/8"	
HAMMER WT.		140	
HAMMER FALL		30"	

No.	DEPTH RANGE IN FEET	SAMPLE BLOWS PER 6" ON SAMPLER				REC.	CASING BLOWS/ CORING TIMES PER FT.	FIELD CLASSIFICATION AND REMARKS	Well Cons.	Installation Details
		0-6	6-12	12-18	18-24					
S1	0'-2'	2	7	4	2	24"	4" Dark Brown Topsoil - Fine Sand, Some Silt, Little Roots Brown Fine Sand, Some Silt, Stratified - Fill	.3		
S2	5'-7'	9	11	12	19	20"	Light Brown Fine Sand, Stratified	5.5		
S3	10'-12'	9	10	12	15	24"	Trace of Gravel @ S3			
S4	15'-17'	4	9	6	7	24"				
S5	20'-22'	8	18	18	21	24"	Light Brown Fine Sand, Trace of Med.-Crs. Sand, Stratified			
S6	25'-27'	10	21	25	30	24"				
S7	30'-32'	16	27	25	22	24"	End of Boring @ 32' Water @ 30' +/-	32.0		

NOTES: 1) The stratification lines represent the approximate boundary between soil types. Transitions may be gradual.  
 2) Water level readings have been made in the drill holes at times and under conditions stated on the boring logs. Fluctuations in the level of ground-water may occur due to factors other than those present at the time measurements were made.

REMARKS:

CLIENT: GEI

PROJECT NAME: Brookhaven

LOCATION: Long Island, NY  
National Labs

DRILLER: T. Roe

INSPECTOR: A. Smart

DATE START: 10/29/03

DATE FINISH: 10/29/03

NEW ENGLAND BORING CONTRACTORS OF CT., INC.



129 KRIEGER LANE  
GLASTONBURY, CT 06033  
(860) 633-4649 - (413) 733-1232  
FAX (860) 657-8046

BORING No. B-7

SHEET 1 OF 1

ARCHITECT/  
ENGINEER

FILE NO. GEI-LongIsland,  
NY

SURFACE ELEV.

LINE & STATION

OFFSET

TYPE	Casing	Sampler	Core Barrel
SIZE I.D.	SA 4"	SS 1-3/8"	
HAMMER WT.		140	
HAMMER FALL		30"	

No.	DEPTH RANGE IN FEET	SAMPLE				REC.	CASING BLOWS/ CORING TIMES PER FT.	FIELD CLASSIFICATION AND REMARKS	Well Cons.	Installation Details
		BLOWS PER 6" ON SAMPLER								
		0-6	6-12	12-18	18-24					
S1	0'-2'	1	2	1	1	24"		Dark Brown Topsoil		
								1.0		
								Brown Fine Sand, Some Silt - Fill		
								3.0		
S2	5'-7'	5	8	10	12	24"		Light Brown Fine Sand, Stratified		
								7.0		
								End of Boring @ 7'		
								No Water		

NOTES: 1) The stratification lines represent the approximate boundary between soil types. Transitions may be gradual.  
2) Water level readings have been made in the drill holes at times and under conditions stated on the boring logs. Fluctuations in the level of ground-water may occur due to factors other than those present at the time measurements were made.

REMARKS:

CLIENT: **GEI**  
 PROJECT NAME: **Brookhaven**  
 LOCATION: **Long Island, NY**  
 DRILLER: **T. Roe**  
 INSPECTOR: **A. Smart**  
 DATE START: **10/29/03**  
 DATE FINISH: **10/29/03**

**NEW ENGLAND BORING CONTRACTORS OF CT., INC.**



129 KRIEGER LANE  
 GLASTONBURY, CT 06033  
 (860) 633-4649 - (413) 733-1232  
 FAX (860) 657-8046

**BORING No. B-8**

SHEET 1 OF 1

ARCHITECT/  
 ENGINEER

FILE NO. **GEI-LongIsland,**  
**NY**  
 SURFACE ELEV.  
 LINE & STATION  
 OFFSET

	Casing	Sampler	Core Barrel
TYPE	SA	SS	
SIZE I.D.	4"	1-3/8"	
HAMMER WT.		140	
HAMMER FALL		30"	

No.	DEPTH RANGE IN FEET	SAMPLE				REC.	CASING BLOWS/ CORING TIMES PER FT.	FIELD CLASSIFICATION AND REMARKS	Well Cons.	Installation Details
		BLOWS PER 6" ON SAMPLER								
		0-6	6-12	12-18	18-24					
S1	0'-2'	3	2	3	2	18"		Brown Fine Sand, Little Silt - Fill		
								4.0		
S2	5'-7'	3	3	4	4	24"		Light Brown Fine Sand, Trace of Gravel, Stratified		
								7.0		
								End of Boring @ 7' No Water		

NOTES: 1) The stratification lines represent the approximate boundary between soil types. Transitions may be gradual.  
 2) Water level readings have been made in the drill holes at times and under conditions stated on the boring logs. Fluctuations in the level of ground-water may occur due to factors other than those present at the time measurements were made.

REMARKS:

CLIENT: GEI

PROJECT NAME: Brookhaven

LOCATION: Long Island, NY  
National Labs

DRILLER: T. Roe

INSPECTOR: A. Smart

DATE START: 10/29/03

DATE FINISH: 10/29/03

NEW ENGLAND BORING CONTRACTORS OF CT., INC.



129 KRIEGER LANE  
GLASTONBURY, CT 06033  
(860) 633-4649 -- (413) 733-1232  
FAX (860) 657-8046

BORING No. B-9

SHEET 1 OF 1

ARCHITECT/  
ENGINEER

FILE NO. GEI-LongIsland,  
NY  
SURFACE ELEV.

LINE & STATION

OFFSET

TYPE	Casing	Sampler	Core Barrel
SIZE I.D.	SA 4"	SS 1-3/8"	
HAMMER WT.		140	
HAMMER FALL		30"	

No.	DEPTH RANGE IN FEET	SAMPLE				REC.	CASING BLOWS/ CORING TIMES PER FT.	FIELD CLASSIFICATION AND REMARKS	Well Cons.	Installation Details
		BLOWS PER 6" ON SAMPLER								
		0-6	6-12	12-18	18-24					
S1	0'-2'	1	6	6	5	20"	8" Dark Brown Topsoil Black Fine Sand, Trace of Roots, Ash, Brick	.8		
S2	5'-7'	1	2	1	1	24"	Brown Fine Sand, Some Silt - Fill Light Brown Fine Sand	7.0		
S3	10'-12'	5	5	4	7	18"	End of Boring @ 12' No Water	12.0		

NOTES: 1) The stratification lines represent the approximate boundary between soil types. Transitions may be gradual.  
2) Water level readings have been made in the drill holes at times and under conditions stated on the boring logs. Fluctuations in the level of ground-water may occur due to factors other than those present at the time measurements were made.

REMARKS:



CLIENT: **GEI**  
 PROJECT NAME: **Brookhaven**  
 LOCATION: **Long Island, NY**  
 DRILLER: **T. Roe**  
 INSPECTOR: **A. Smart**  
 DATE START: **10/29/03**  
 DATE FINISH: **10/29/03**

**NEW ENGLAND BORING CONTRACTORS OF CT., INC.**



129 KRIEGER LANE  
 GLASTONBURY, CT 06033  
 (860) 633-4649 - (413) 733-1232  
 FAX (860) 657-8046

**BORING No. B-10**

SHEET 1 OF 1

ARCHITECT/  
 ENGINEER

FILE NO. **GEI-LongIsland,**

**NY**  
 SURFACE ELEV.

LINE & STATION

OFFSET

TYPE	Casing	Sampler	Core Barrel
SIZE I.D.	SA 4"	SS 1-3/8"	
HAMMER WT.		140	
HAMMER FALL		30"	

No.	DEPTH RANGE IN FEET	SAMPLE				REC.	CASING BLOWS/CORING TIMES PER FT.	FIELD CLASSIFICATION AND REMARKS	Well Cons.	Installation Details
		0-6	6-12	12-18	18-24					
S1	0'-2'	1	4	3	3	24"		Dark Brown Topsoil 1.0		
								Brown Fine Sand, Some Silt - Fill 5.0		
S2	5'-7'	2	4	6	5	24"		Light Brown Fine Sand, Trace of Gravel, Stratified 7.0		
								End of Boring @ 7' No Water		

NOTES: 1) The stratification lines represent the approximate boundary between soil types. Transitions may be gradual.  
 2) Water level readings have been made in the drill holes at times and under conditions stated on the boring logs. Fluctuations in the level of groundwater may occur due to factors other than those present at the time measurements were made.

REMARKS:

CLIENT: GEI

PROJECT NAME: Brookhaven  
 National Labs  
 LOCATION: Long Island, NY

DRILLER: T. Roe

INSPECTOR: A. Smart

DATE START: 10/29/03

DATE FINISH: 10/29/03

NEW ENGLAND BORING CONTRACTORS OF CT., INC.



129 KRIEGER LANE  
 GLASTONBURY, CT 06033  
 (860) 633-4649 - (413) 733-1232  
 FAX (860) 657-8046

BORING No. B-12

SHEET 1 OF 1

ARCHITECT/  
 ENGINEER

FILE NO. GEI-LongIsland,  
 NY

SURFACE ELEV.

LINE & STATION

OFFSET

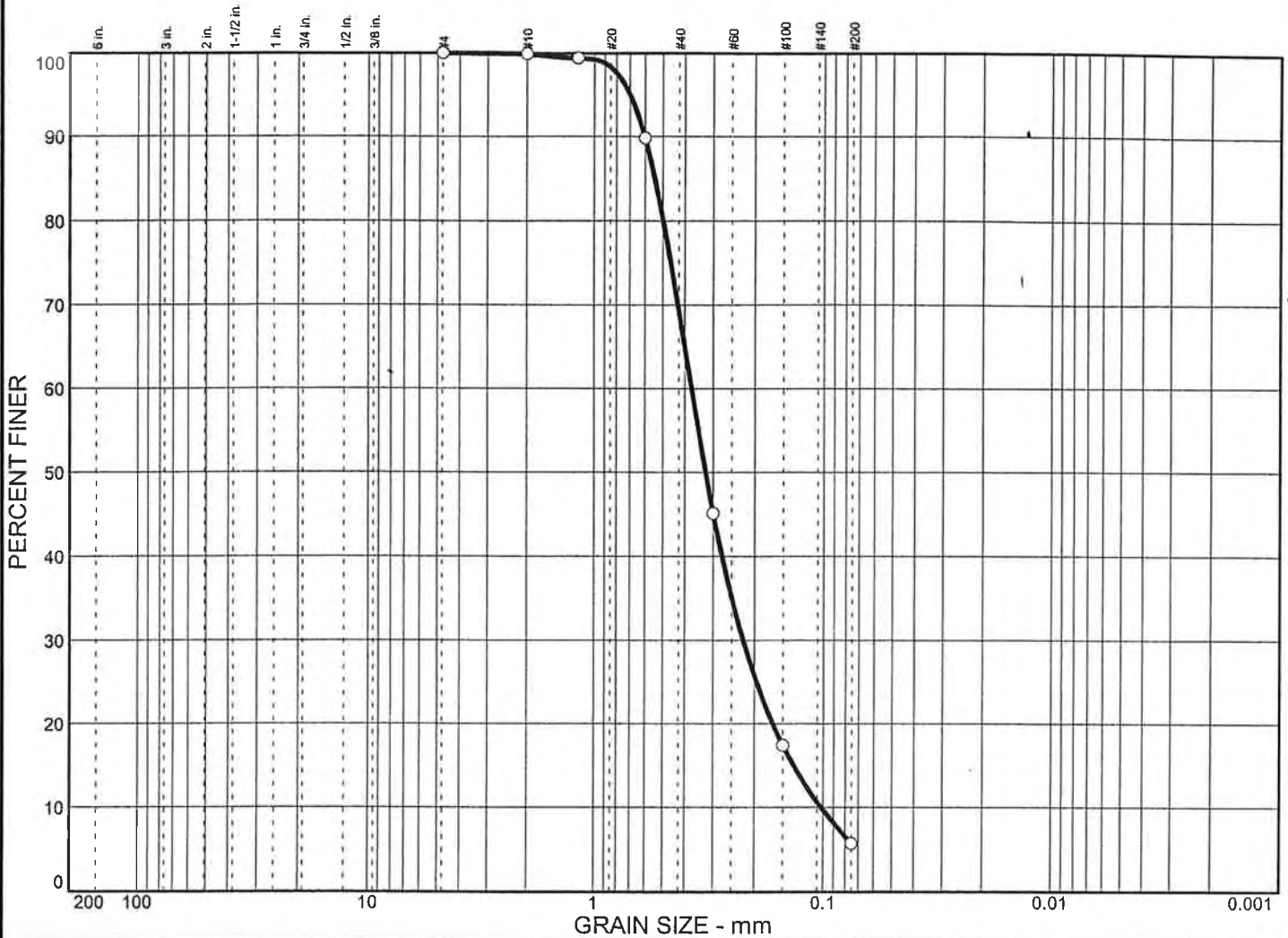
TYPE	Casing	Sampler	Core Barrel
SIZE I.D.	HSA 3-1/4"	SS 1-3/8"	
HAMMER WT.		140	
HAMMER FALL		30"	

No.	DEPTH RANGE IN FEET	SAMPLE BLOWS PER 6" ON SAMPLER				REC.	CASING BLOWS/CORING TIMES PER FT.	FIELD CLASSIFICATION AND REMARKS	Well Cons.	Installation Details
		0-6	6-12	12-18	18-24					
S1	0'-2'	1	2	3	2	24"	8" Dark Brown Topsoil Brown Fine Sand, Little Silt - Fill	.6 4.0		
S2	5'-7'	2	5	8	8	24"	Brown Fine Sand, Stratified			
S3	10'-12'	5	9	9	11	24"				
S4	15'-17'	4	5	5	5	24"	Alternating 4"-10" Layers of Brown Fine Sand and Brown Fine Sand, Little Silt			
S5	20'-22'	7	11	18	19	24"	Light Brown Fine-Med. Sand, Trace of Gravel, Stratified			
S6	25'-27'	4	5	8	8	16"	Cobbles @ 22' to 24' Depth Light Brown Med. Sand, Little Gravel, Stratified			
S7	30'-32'	9	12	14	18	20"	End of Boring @ 32' Water @ 30' +/-	32.0		

NOTES: 1) The stratification lines represent the approximate boundary between soil types. Transitions may be gradual.  
 2) Water level readings have been made in the drill holes at times and under conditions stated on the boring logs. Fluctuations in the level of groundwater may occur due to factors other than those present at the time measurements were made.

REMARKS: Note: B-11 was Omitted

# GRAIN SIZE DISTRIBUTION TEST REPORT



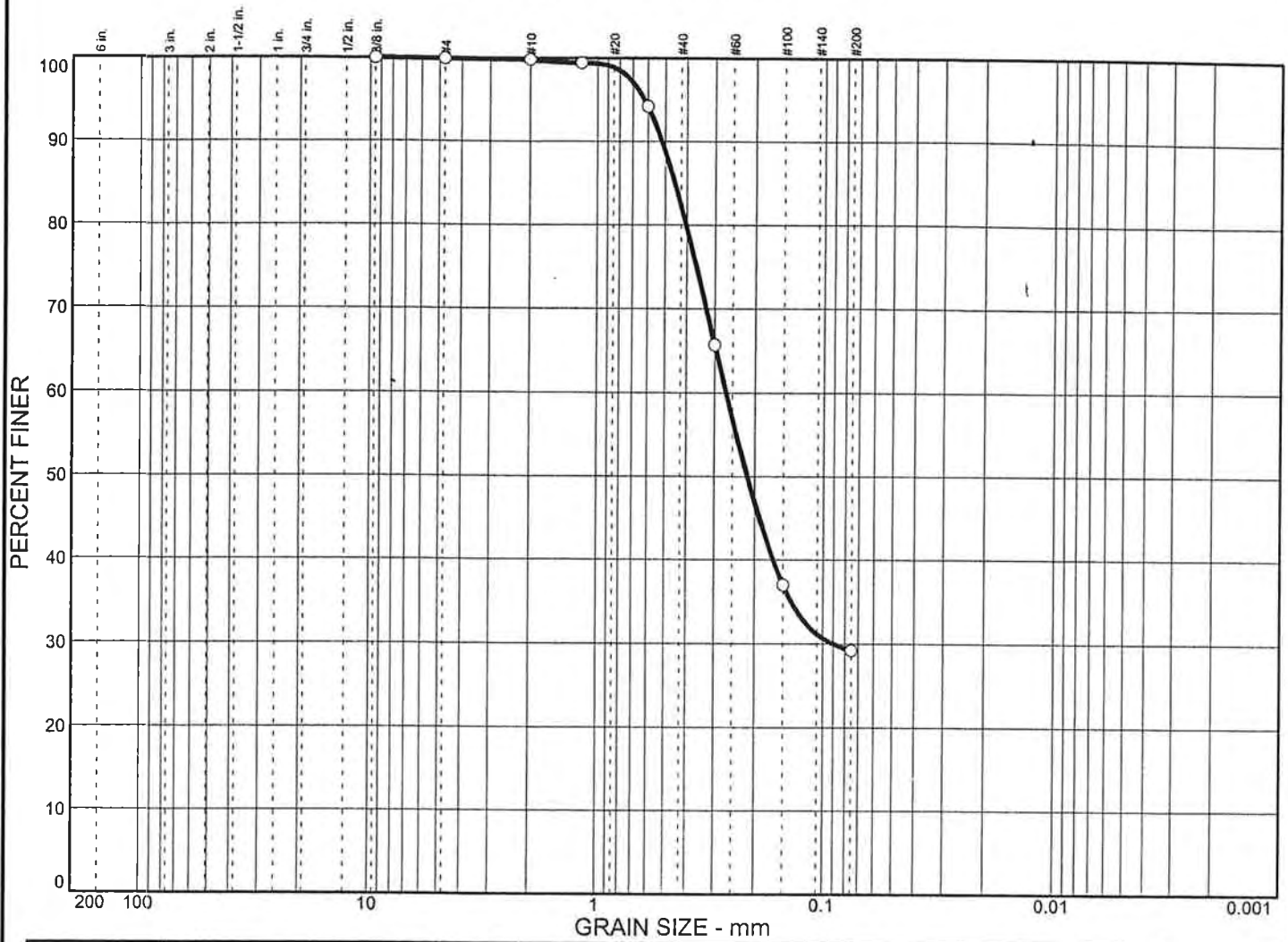
% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	94.3	5.7	

LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
X		0.544	0.374	0.324	0.223	0.135	0.102	1.31	3.67

MATERIAL DESCRIPTION	USCS	AASHTO
○ Narrowly graded SAND with Silt	SP-SM	

<b>Project No.</b> 03420 <b>Client:</b> HDR Architecture, Inc. <b>Project:</b> Center for Functional Nanomaterials, Brookhaven National Laboratory  ○ <b>Source:</b> B1 <b>Sample No.:</b> S2 <b>Elev./Depth:</b> 5 to 7 ft	<b>Remarks:</b> ○
--	----------------------

# GRAIN SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.1	70.7	29.2	

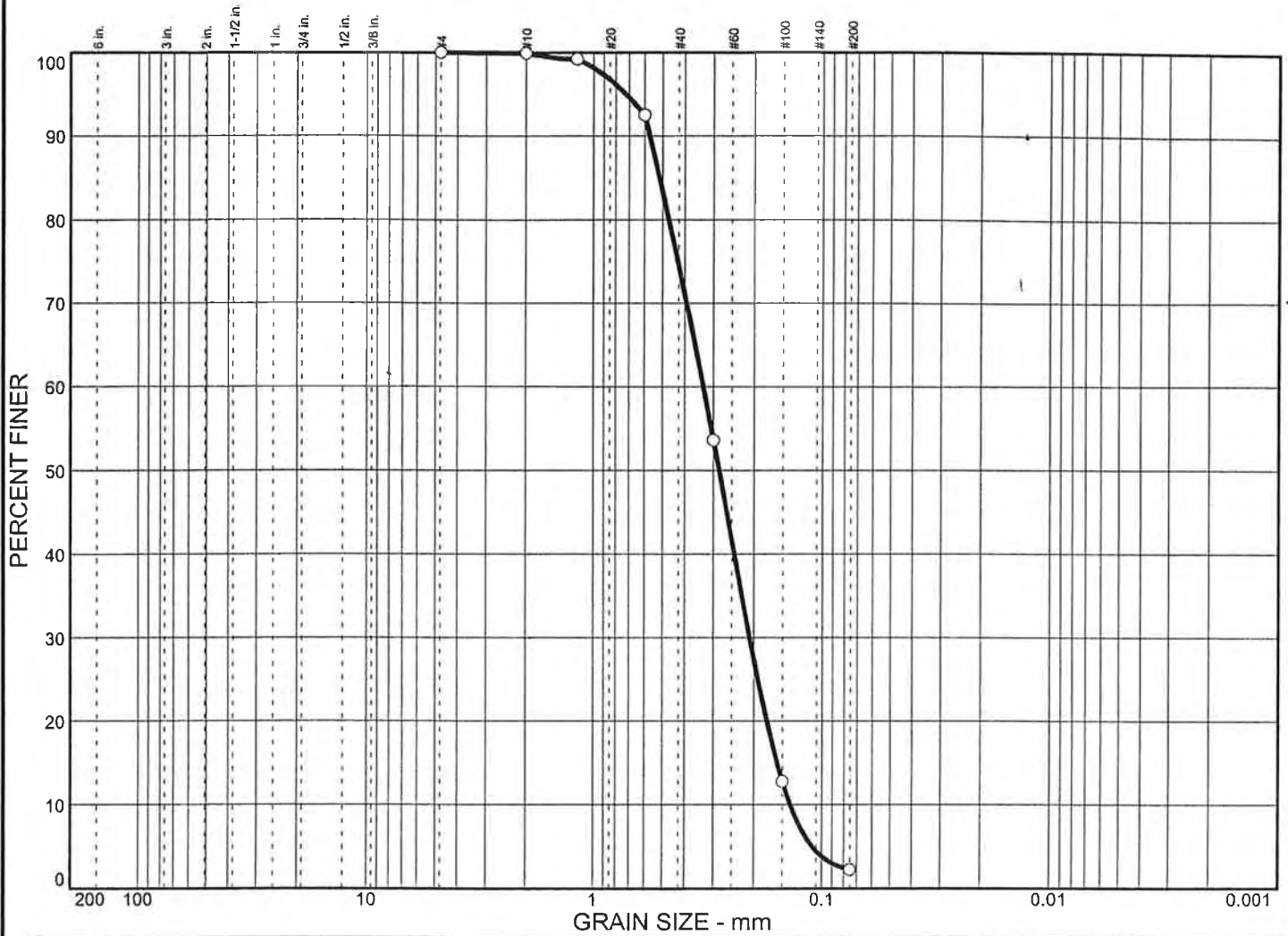
LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
		0.454	0.267	0.215	0.0903				

MATERIAL DESCRIPTION	USCS	AASHTO
○ Silty SAND	SM	

**Project No.** 03420      **Client:** HDR Architecture, Inc.  
**Project:** Center for Functional Nanomaterials, Brookhaven National Laboratory  
  
 ○ **Source:** B2                      **Sample No.:** S1                      **Elev./Depth:** 5 to 7 ft

**Remarks:**  
 ○

# GRAIN SIZE DISTRIBUTION TEST REPORT



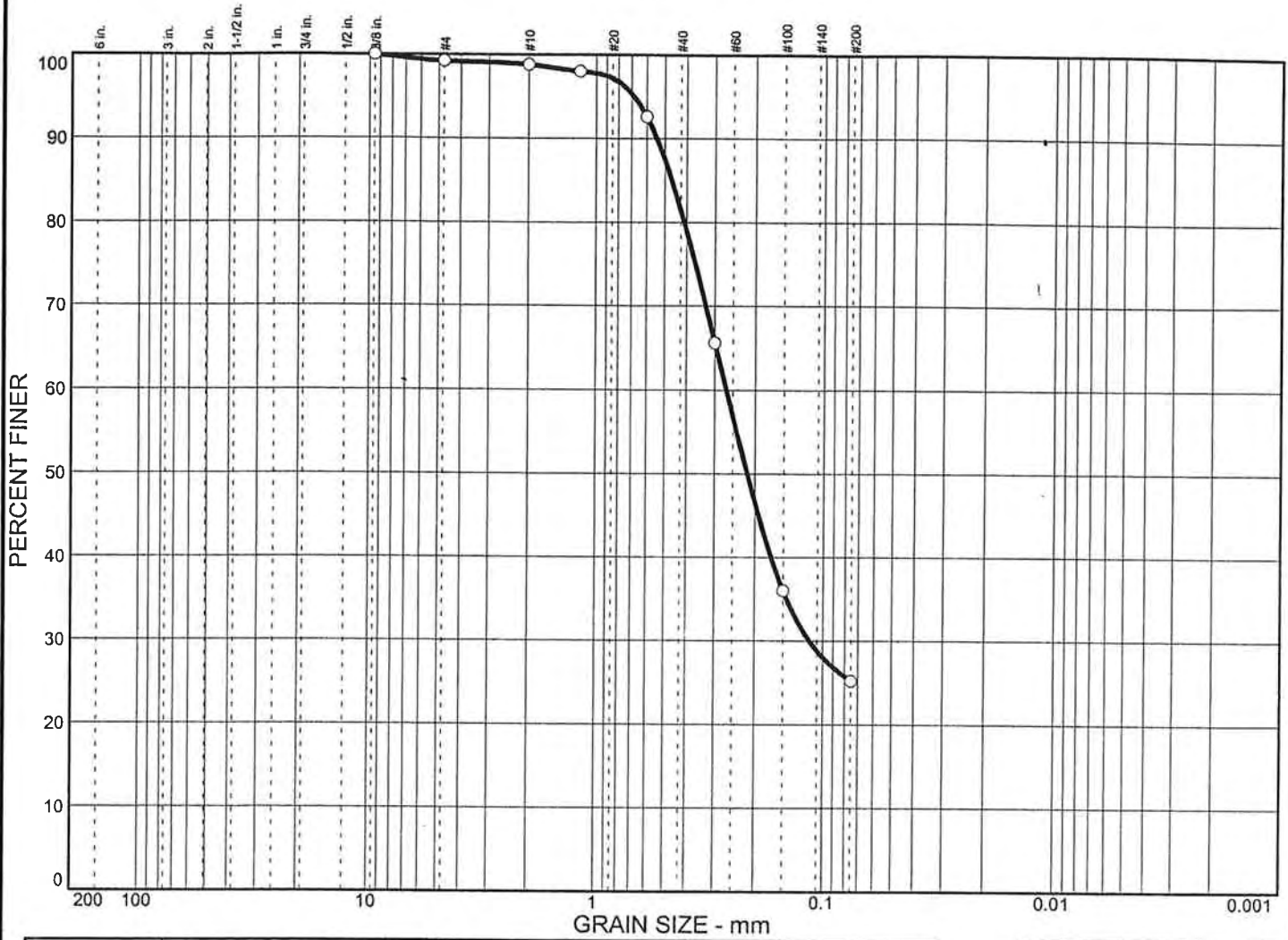
% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	97.8	2.2	

LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
0.95	0.24	0.518	0.332	0.284	0.209	0.158	0.138	0.95	2.40

MATERIAL DESCRIPTION	USCS	AASHTO
○ Narrowly graded SAND	SP	

<b>Project No.</b> 03420 <b>Client:</b> HDR Architecture, Inc. <b>Project:</b> Center for Functional Nanomaterials, Brookhaven National Laboratory  ○ <b>Source:</b> B3 <b>Sample No.:</b> S2 <b>Elev./Depth:</b> 5 to 7 ft	<b>Remarks:</b> ○
--	----------------------

# GRAIN SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
○ 0.0	0.8	74.0	25.2	

LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
X		0.467	0.267	0.216	0.115				

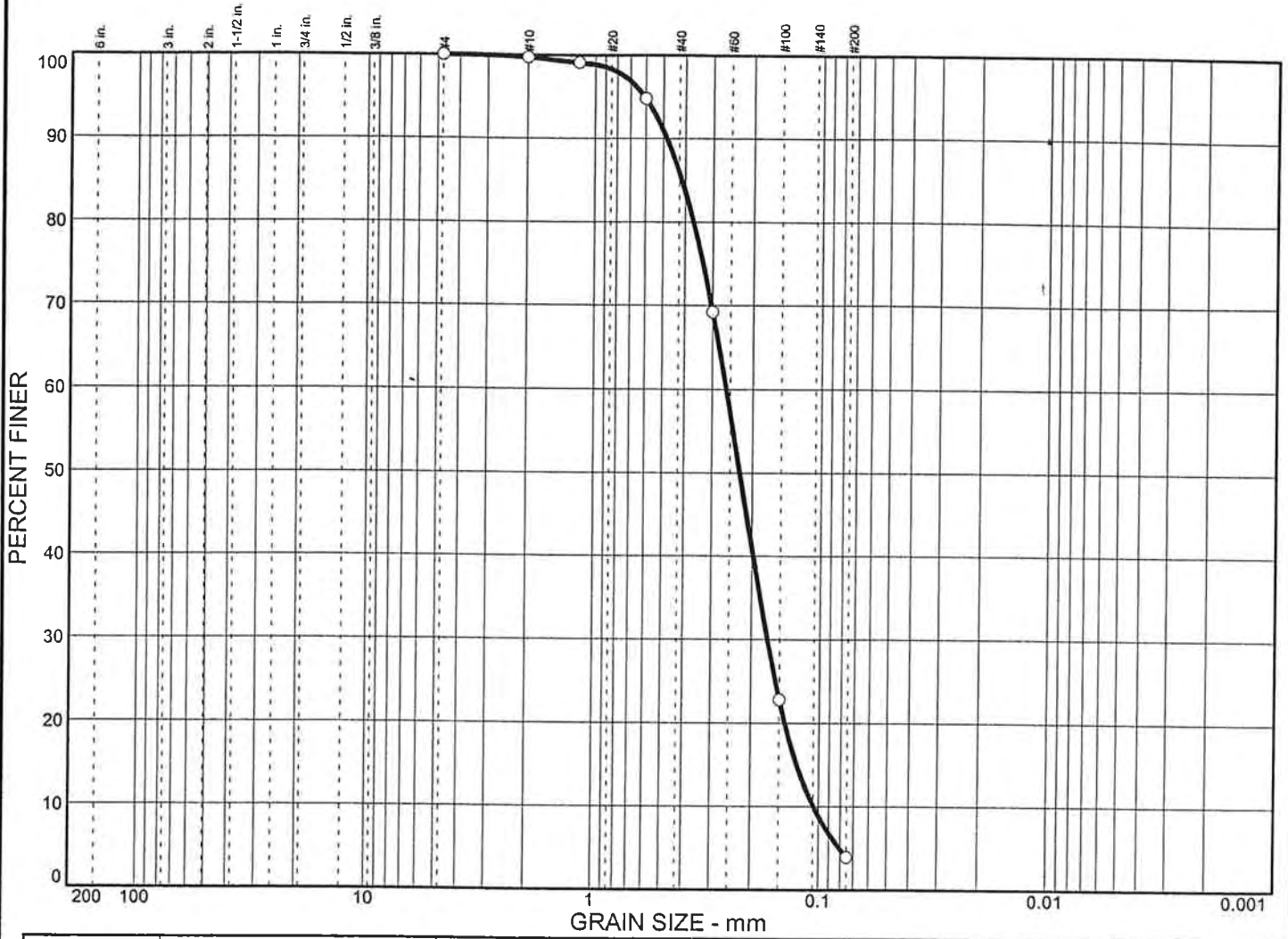
MATERIAL DESCRIPTION	USCS	AASHTO
○ Silty SAND	SM	

**Project No.** 03420      **Client:** HDR Architecture, Inc.  
**Project:** Center for Functional Nanomaterials, Brookhaven National Laboratory  
  
 ○ **Source:** B5                      **Sample No.:** S1                      **Elev./Depth:** 0 to 2 ft

**Remarks:**  
 ○



# GRAIN SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	96.1	3.9	

LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
		0.415	0.261	0.227	0.170	0.125	0.105	1.05	2.48

MATERIAL DESCRIPTION	USCS	AASHTO
○ Narrowly graded SAND	SP	

**Project No.** 03420      **Client:** HDR Architecture, Inc.  
**Project:** Center for Functional Nanomaterials, Brookhaven National Laboratory  
**Source:** B5                      **Sample No.:** S2                      **Elev./Depth:** 5 to 7 ft

**Remarks:**  
 ○

## Appendix C

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### 2006 Test Boring Logs



**Boring Location**

NORTHING: \_\_\_\_\_ EASTING: \_\_\_\_\_ STATION: \_\_\_\_\_ OFFSET: \_\_\_\_\_  
 HORIZONTAL DATUM: NAD 83 STATION CENTERLINE: \_\_\_\_\_  
 VERTICAL DATUM: BNL 94 GROUND SURFACE ELEVATION (FT): 74.0  
 LOCATION: See Figure 2

BORING

**B-101**

PAGE 1 of 2

**Drilling Information**

DATE START / END: 7/20/2006 - 7/20/2006 TOTAL DEPTH (FT): 52.0  
 CONTRACTOR: New England Boring DRILLER: Jeff Leavitt LOGGED BY: Steve Hawkins  
 EQUIPMENT: Mobile Drill B-53 Truck mounted Drill Rig BORING METHOD: Drive and Wash  
 AUGER ID/OD: N/A / N/A CASING ID/OD: N/A / 3 in CORE INFO: \_\_\_\_\_  
 HAMMER TYPE: Safety Hammer HAMMER WEIGHT (lbs): 140 HAMMER DROP (Inch): 30  
 WATER LEVEL DEPTHS (ft): \_\_\_\_\_

GENERAL NOTES: Samples collected using a 2-in diameter split spoon

ABBREVIATIONS: ID = Inside Diameter bpf = Blows per Foot U = Undisturbed Tube Sample WOR = Weight of Rods Q<sub>p</sub> = Pocket Penetrometer Strength  
 OD = Outside Diameter mpf = Minute per Foot C = Rock Core WOH = Weight of Hammer S<sub>v</sub> = Pocket Torvane Shear Strength  
 Pen. = Penetration Length S = Split Spoon V = Field Vane Shear RQD = Rock Quality Designation F<sub>v</sub> = Field Vane Shear Strength  
 Rec. = Recovery Length DP = Direct Push Sample SC = Sonic Core OVM = Organic Vapor Meter NA, NM = Not Applicable, Not Measured


Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION					GRAPHIC LOG	Sample Description & Classification	H <sub>2</sub> O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD				
			1	X	0 to 2	24/18	4-6-9-9		SILTY SAND (SM); fine to coarse sand, 32% silty fines, 6% fine gravel, moist, dark brown, roots (TOPSOIL). Probable Fill, Silty Sand on auger cuttings.		Strata change estimated at 3.5 feet
	5		2	X	5 to 7	24/12	21-25-27-30		WIDELY GRADED SAND WITH SILT (SW-SM); fine to coarse sand, 12% silty fines, 3% fine gravel, moist, light brown.		
	10		3	X	10 to 12	24/10	4-8-8-9		WIDELY GRADED SAND (SW); fine to coarse sand, 8% fine gravel, 1% silty fines, wet, light brown.		
	15		4	X	15 to 17	24/10	13-15-17-17		WIDELY GRADED SAND (SW); fine to coarse sand, 6% fine gravel, 3% silty fines, wet, light brown.		
	20		5	X	20 to 22	24/12	20-25-32-41		WIDELY GRADED SAND (SW); fine to coarse sand, 5% fine gravel, 4% silty fines, wet, light brown.		

GEO TECHNICAL BORING LOG 02 BNL NSLSII BORING LOGS.GPJ GEI DATA TEMPLATE.GDT 8/24/06

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: HDR Architecture, Inc.  
 PROJECT NAME: NSLS II Geotechnical Investigation  
 CITY/STATE: Upton, New York  
 GEI PROJECT NUMBER: 062150-\*1000

**GEI Consultants, Inc.**  
 455 Winding Brook Dr  
 Glastonbury, CT 06033  
 860.368.5408



**Boring Location**  
 NORTHING: \_\_\_\_\_ EASTING: \_\_\_\_\_ STATION: \_\_\_\_\_ OFFSET: \_\_\_\_\_  
 HORIZONTAL DATUM: NAD 83 STATION CENTERLINE: \_\_\_\_\_  
 VERTICAL DATUM: BNL 94 GROUND SURFACE ELEVATION (FT): 74.0  
 LOCATION: See Figure 2

**BORING**  
**B-101**  
 PAGE 2 of 2

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION					GRAPHIC LOG	Sample Description & Classification	H <sub>2</sub> O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD				
25			6		25 to 27	24/12	25-27-29-31		WIDELY GRADED SAND WITH GRAVEL (SW); fine to coarse sand, 25% fine gravel, 5% silty fines, wet, light brown.		
30			7		30 to 32	24/10	18-22-24-29		WIDELY GRADED SAND WITH GRAVEL (SW); fine to coarse sand, ~30% fine gravel, <5% silty fines, wet, light brown.		
35			8		35 to 37	24/6	14-16-20-22		WIDELY GRADED SAND WITH GRAVEL (SW); fine to coarse sand, 27% fine to coarse gravel, 5% silty fines, wet, light brown.		
40			9		40 to 42	24/8	15-16-20-22		WIDELY GRADED SAND WITH GRAVEL (SW); fine to coarse sand, ~30% fine gravel, <5% silty fines, wet, light brown.		
45			10		45 to 47	24/8	20-26-35-47		WIDELY GRADED SAND WITH SILT (SW-SM); fine to coarse sand, 8% silty fines, 1% fine gravel, wet, light brown.		
50			11		50 to 52	24/12	29-30-31-28		WIDELY GRADED SAND WITH SILT (SW-SM); fine to coarse sand, ~10% silty fines, ~10% fine gravel, wet, brown.		
									End of Boring at 52 feet		

GEO-TECHNICAL BORING LOG 02 BNL NSLS II BORING LOGS GPJ GEI DATA TEMPLATE GDT 8/24/06

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: HDR Architecture, Inc.  
 PROJECT NAME: NSLS II Geotechnical Investigation  
 CITY/STATE: Upton, New York  
 GEI PROJECT NUMBER: 062150-\*1000



**GEI Consultants, Inc.**  
 455 Winding Brook Dr  
 Glastonbury, CT 06033  
 860.368.5408

<b>Boring Location</b>	<b>BORING</b>
NORTHING: _____ EASTING: _____ STATION: _____ OFFSET: _____	<b>B-101a</b>
HORIZONTAL DATUM: NAD 83 STATION CENTERLINE: _____	
VERTICAL DATUM: BNL 94 GROUND SURFACE ELEVATION (FT): 74.0	
LOCATION: See Figure 2	
PAGE 1 of 1	

<b>Drilling Information</b>	
DATE START / END: 8/16/2006 - 8/16/2006	TOTAL DEPTH (FT): 10.0
CONTRACTOR: New England Borings DRILLER: Jeff Leavitt	LOGGED BY: Steven Hawkins
EQUIPMENT: Mobile Drill B-53 truck mounted drill rig.	BORING METHOD: Hollow Stem Auger
AUGER ID/OD: 4.25 in / N/A CASING ID/OD: N/A / N/A	CORE INFO: _____
HAMMER TYPE: Safety Hammer HAMMER WEIGHT (lbs): 140	HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft): _____	
GENERAL NOTES: Samples collected using a 2-inch diameter split spoon.	

**ABBREVIATIONS:** ID = Inside Diameter    bpf = Blows per Foot    U = Undisturbed Tube Sample    WOR = Weight of Rods    Q<sub>p</sub> = Pocket Penetrometer Strength  
 OD = Outside Diameter    mpf = Minute per Foot    C = Rock Core    WOH = Weight of Hammer    S<sub>v</sub> = Pocket Torvane Shear Strength  
 Pen. = Penetration Length    S = Split Spoon    V = Field Vane Shear    RQD = Rock Quality Designation    F<sub>v</sub> = Field Vane Shear Strength  
 Rec. = Recovery Length    DP = Direct Push Sample    SC = Sonic Core    OVM = Organic Vapor Meter    NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION					GRAPHIC LOG	Sample Description & Classification	H <sub>2</sub> O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD				
			S-1	0 to 2	24/14	3-3-4-4		SILTY SAND (SM); fine to coarse sand, ~25% silty fines, ~5% fine gravel, dry, brown, ~10% organics, 4 inches of topsoil.		Strata change estimated at 3.3 feet	
			S-2	2 to 4	24/20	4-9-9-10		SILTY SAND (SM); fine to coarse sand, ~25% silty fines, ~5% fine gravel, dry, brown, Bottom 5 inches consists of fine to coarse sand. FILL.			
70	5		S-3	4 to 6	24/12	9-10-10-12		WIDELY GRADED SAND WITH SILT (SW-SM); fine to coarse sand, ~10% silty fines, ~5% fine gravel, dry, brown.			
			S-4	6 to 8	24/12	13-16-16-15		WIDELY GRADED SAND (SW); fine to coarse sand, ~5% silty fines, ~5% fine to coarse gravel, dry, brown.			
			S-5	8 to 10	24/18	12-13-13-15		WIDELY GRADED SAND (SW); fine to coarse sand, ~5% silty fines, ~5% fine gravel, dry, brown.			
	10							End of Boring at 10 feet Fill with cuttings upon completion			
	60										
	15										
	55										
	20										

GEOTECHNICAL BORING LOG 02. BNL NSLSII ADDITIONAL BORING LOGS.GPJ GEI DATA TEMPLATE GDT 8/24/06

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: HDR Architecture, Inc.  
 PROJECT NAME: NSLS II Geotechnical Investigation  
 CITY/STATE: Upton, New York  
 GEI PROJECT NUMBER: 062150-\*1000

**GEI Consultants, Inc.**  
 455 Winding Brook Dr  
 Glastonbury, CT 06033  
 860.368.5408

**Boring Location**  
 NORTHING: \_\_\_\_\_ EASTING: \_\_\_\_\_ STATION: \_\_\_\_\_ OFFSET: \_\_\_\_\_  
 HORIZONTAL DATUM: NAD 83 STATION CENTERLINE: \_\_\_\_\_  
 VERTICAL DATUM: BNL 94 GROUND SURFACE ELEVATION (FT): 81.0  
 LOCATION: See Figure 2

**BORING**  
**B-102**  
 PAGE 1 of 3

**Drilling Information**  
 DATE START / END: 7/19/2006 - 7/20/2006 TOTAL DEPTH (FT): 62.0  
 CONTRACTOR: New England Boring DRILLER: Jeff Leavitt LOGGED BY: Steve Hawkins  
 EQUIPMENT: Mobile Drilli B-53 Truck mounted Drill Rig BORING METHOD: Drive and Wash  
 AUGER ID/OD: N/A / N/A CASING ID/OD: N/A / 3 in CORE INFO: \_\_\_\_\_  
 HAMMER TYPE: Safety Hammer HAMMER WEIGHT (lbs): 140 HAMMER DROP (inch): 30  
 WATER LEVEL DEPTHS (ft):  $\nabla$  36.50 7/20/2006 9:20 am  $\nabla$  36.50 7/20/2006 1:55 pm  
 GENERAL NOTES: Samples collected using a 2-in diameter split spoon

**ABBREVIATIONS:** ID = Inside Diameter    bpf = Blows per Foot    U = Undisturbed Tube Sample    WOR = Weight of Rods     $Q_u$  = Pocket Penetrometer Strength  
 OD = Outside Diameter    mpf = Minute per Foot    C = Rock Core    WOH = Weight of Hammer     $S_u$  = Pocket Torvane Shear Strength  
 Pen. = Penetration Length    S = Split Spoon    V = Field Vane Shear    RQD = Rock Quality Designation     $F_v$  = Field Vane Shear Strength  
 Rec. = Recovery Length    DP = Direct Push Sample    SC = Sonic Core    OVM = Organic Vapor Meter    NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION					GRAPHIC LOG	Sample Description & Classification	H <sub>2</sub> O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD				
80			1	X	0 to 2	24/8	3-13-5-4		SILTY SAND (SM); fine to coarse sand, 27% silty fines, 11% fine gravel, dry, brown, Contains roots. TOPSOIL. Probable Fill, Silty Sand on auger cuttings.		
75	5		2	X	5 to 7	24/12	8-14-15-16		WIDELY GRADED SAND (SW); fine to coarse sand, 13% fine gravel, 5% silty fines, moist, light brown.		Strata change estimated at 5.0 feet
70	10		3	X	10 to 12	24/10	8-10-13-13		WIDELY GRADED SAND (SW); fine to coarse sand, 9% fine gravel, 3% silty fines, moist, light brown.		
65	15		4	X	15 to 17	24/12	4-9-18-18		WIDELY GRADED SAND WITH SILT (SW-SM); fine to coarse sand, 7% fine gravel, 7% silty fines, moist, light brown.		
60	20		5	X	20 to 22	24/12	12-18-24-22		WIDELY GRADED SAND WITH SILT (SW-SM); fine to medium sand, 6% silty fines, 1% fine gravel, moist, light brown.		

GEO TECHNICAL BORING LOG 02 BNL NSLSII BORING LOGS.GPJ GEI DATA TEMPLATE.GDT 8/24/06

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

**CLIENT:** HDR Architecture, Inc.  
**PROJECT NAME:** NSLS II Geotechnical Investigation  
**CITY/STATE:** Upton, New York  
**GEI PROJECT NUMBER:** 062150-\*1000

**GEI Consultants, Inc.**  
 455 Winding Brook Dr  
 Glastonbury, CT 06033  
 860.368.5408





**Boring Location**

NORTHING: \_\_\_\_\_ EASTING: \_\_\_\_\_ STATION: \_\_\_\_\_ OFFSET: \_\_\_\_\_  
 HORIZONTAL DATUM: NAD 83 STATION CENTERLINE: \_\_\_\_\_  
 VERTICAL DATUM: BNL 94 GROUND SURFACE ELEVATION (FT): 81.0  
 LOCATION: See Figure 2

BORING

**B-102**

PAGE 2 of 3

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION					GRAPHIC LOG	Sample Description & Classification	H <sub>2</sub> O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD				
55	25		6	X	25 to 27	24/12	27-36-46-45		WIDELY GRADED SAND WITH SILT (SW-SM); fine to medium sand, 10% silty fines, 3% fine gravel, moist, light brown.		Begins washing out ahead of casing advancement. Material too dense to drive casing.
50	30		7	X	30 to 32	24/10	37-45-47-61		WIDELY GRADED SAND (SW); fine to coarse sand, ~10% fine gravel, ~5% silty fines, wet, light brown.		
45	35		8	X	35 to 37	24/10	31-47-61-73		WIDELY GRADED SAND WITH SILT (SW-SM); fine to coarse sand, 7% silty fines, 5% fine gravel, wet, light brown.	▼	
40	40		9	X	40 to 41.5	18/10	39-62-100		WIDELY GRADED SAND (SW); fine to coarse sand, ~5% fine gravel, ~5% silty fines, wet, brown.		
35	45		10	X	45 to 47	24/12	31-42-49-55		WIDELY GRADED SAND WITH SILT (SW-SM); fine to coarse sand, 9% fine gravel, 8% silty fines, wet, brown.		
30	50		11	X	50 to 52	24/14	29-37-40-46		WIDELY GRADED SAND WITH GRAVEL (SW); fine to coarse sand, ~20% fine gravel, ~5% silty fines, wet, light brown.		

GEOTECHNICAL BORING LOG 02. BNL NSLS II BORING LOGS.GPJ GEI DATA TEMPLATE.GDT 8/24/06

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: HDR Architecture, Inc.  
 PROJECT NAME: NSLS II Geotechnical Investigation  
 CITY/STATE: Upton, New York  
 GEI PROJECT NUMBER: 062150-\*1000



**GEI Consultants, Inc.**  
 455 Winding Brook Dr  
 Glastonbury, CT 06033  
 860.368.5408

**Boring Location**  
 NORTHING: \_\_\_\_\_ EASTING: \_\_\_\_\_ STATION: \_\_\_\_\_ OFFSET: \_\_\_\_\_  
 HORIZONTAL DATUM: NAD 83 STATION CENTERLINE: \_\_\_\_\_  
 VERTICAL DATUM: BNL 94 GROUND SURFACE ELEVATION (FT): 81.0  
 LOCATION: See Figure 2

**BORING**  
**B-102**  
 PAGE 3 of 3

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION				GRAPHIC LOG	Sample Description & Classification	H <sub>2</sub> O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)				
25			12		55 to 57	24/14	27-32-39-48			WIDELY GRADED SAND WITH GRAVEL (SW); fine to coarse sand, ~20% fine gravel, ~5% silty fines, wet, light brown.
60	20		13		60 to 62	24/10	30-36-39-45			WIDELY GRADED SAND WITH GRAVEL (SW); fine to coarse sand, ~20% fine gravel, ~5% silty fines, wet, light brown.
										End of Boring at 62 feet

GEOTECHNICAL BORING LOG 02 BNL NSLSII BORING LOGS GPJ GEI DATA TEMPLATE GDT 8/24/06

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: HDR Architecture, Inc.  
 PROJECT NAME: NSLS II Geotechnical Investigation  
 CITY/STATE: Upton, New York  
 GEI PROJECT NUMBER: 062150-\*1000



**GEI Consultants, Inc.**  
 455 Winding Brook Dr  
 Glastonbury, CT 06033  
 860.368.5408

<b>Boring Location</b>	<b>BORING</b>
NORTHING: _____ EASTING: _____ STATION: _____ OFFSET: _____	<b>B-102a</b>
HORIZONTAL DATUM: NAD 83 STATION CENTERLINE: _____	
VERTICAL DATUM: BNL 94 GROUND SURFACE ELEVATION (FT): 81.0	
LOCATION: See Figure 2	
PAGE 1 of 1	

<b>Drilling Information</b>	
DATE START / END: 8/16/2006 - 8/16/2006	TOTAL DEPTH (FT): 10.0
CONTRACTOR: New England Borings DRILLER: Jeff Leavitt	LOGGED BY: Steven Hawkins
EQUIPMENT: Mobile Drill B-53 truck mounted drill rig.	BORING METHOD: Hollow Stem Auger
AUGER ID/OD: 4.25 in / N/A CASING ID/OD: N/A / N/A	CORE INFO: _____
HAMMER TYPE: Safety Hammer HAMMER WEIGHT (lbs): 140	HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft): _____	
GENERAL NOTES: Samples collected using a 2-inch diameter split spoon.	

<b>ABBREVIATIONS:</b>	ID = Inside Diameter OD = Outside Diameter Pen. = Penetration Length Rec. = Recovery Length	bpf = Blows per Foot mpf = Minute per Foot S = Split Spoon DP = Direct Push Sample	U = Undisturbed Tube Sample C = Rock Core V = Field Vane Shear SC = Sonic Core	WOR = Weight of Rods WOH = Weight of Hammer RQD = Rock Quality Designation OVM = Organic Vapor Meter	Q <sub>v</sub> = Pocket Penetrometer Strength S <sub>v</sub> = Pocket Torvane Shear Strength F <sub>v</sub> = Field Vane Shear Strength NA, NM = Not Applicable, Not Measured
-----------------------	--	---	---	---	--

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION					GRAPHIC LOG	Sample Description & Classification	H <sub>2</sub> O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD				
80			S-1		0 to 2	24/24	4-3-2-2		SILTY SAND (SM); fine to coarse sand, ~20% silty fines, ~10% fine to coarse gravel, dry, brown, Organics, 4 inches of Topsoil.		Strata change estimated at 4 feet
			S-2		2 to 4	24/12	3-3-3-4		SILTY SAND (SM); fine to coarse sand, ~15% silty fines, ~5% fine to coarse gravel, dry, brown, FILL.		
	5		S-3		4 to 6	24/12	4-5-6-6		WIDELY GRADED SAND WITH SILT (SW-SM); fine to coarse sand, ~10% silty fines, ~5% fine gravel, dry, light brown.		
	75		S-4		6 to 8	24/13	8-10-11-6		WIDELY GRADED SAND WITH SILT (SW-SM); fine to coarse sand, ~10% silty fines, ~5% fine gravel, dry, light brown.		
	10		S-5		8 to 10	24/17	8-12-12-14		WIDELY GRADED SAND WITH SILT (SW-SM); fine to coarse sand, ~10% silty fines, ~5% fine gravel, dry, light brown.		
	70								End of Boring at 10 feet Fill with cuttings upon completion		
	15										
	65										
	20										
	60										

GEOTECHNICAL BORING LOG 02 BNL NSLSII ADDITIONAL BORING LOGS SPJ GEI DATA TEMPLATE GDT 8/24/06

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: HDR Architecture, Inc.
PROJECT NAME: NSLS II Geotechnical Investigation
CITY/STATE: Upton, New York
GEI PROJECT NUMBER: 062150-*/-1000

	<b>GEI Consultants, Inc.</b> 455 Winding Brook Dr Glastonbury, CT 06033 860.368.5408
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<b>Boring Location</b>	<b>BORING</b>
NORTHING: _____ EASTING: _____ STATION: _____ OFFSET: _____	<b>B-103</b>
HORIZONTAL DATUM: NAD 83 STATION CENTERLINE: _____	PAGE 1 of 2
VERTICAL DATUM: BNL 94 GROUND SURFACE ELEVATION (FT): 73.0	
LOCATION: See Figure 2	

<b>Drilling Information</b>	
DATE START / END: 8/16/2006 - 8/16/2006	TOTAL DEPTH (FT): 32.0
CONTRACTOR: New England Borings DRILLER: Jeff Leavitt	LOGGED BY: Steven Hawkins
EQUIPMENT: Mobile Drill B-53 truck mounted drill rig.	BORING METHOD: Hollow Stem Auger
AUGER ID/OD: 4.25 in / N/A CASING ID/OD: N/A / N/A	CORE INFO: _____
HAMMER TYPE: Safety Hammer HAMMER WEIGHT (lbs): 140	HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft): $\nabla$ 28.00 8/16/2006 10:19 am	
GENERAL NOTES: Samples collected using a 2-inch diameter split spoon.	

**ABBREVIATIONS:** ID = Inside Diameter    bpf = Blows per Foot    U = Undisturbed Tube Sample    WOR = Weight of Rods    Q<sub>v</sub> = Pocket Penetrometer Strength  
 OD = Outside Diameter    mpf = Minute per Foot    C = Rock Core    WOH = Weight of Hammer    S<sub>v</sub> = Pocket Torvane Shear Strength  
 Pen. = Penetration Length    S = Split Spoon    V = Field Vane Shear    RQD = Rock Quality Designation    F<sub>v</sub> = Field Vane Shear Strength  
 Rec. = Recovery Length    DP = Direct Push Sample    SC = Sonic Core    OVM = Organic Vapor Meter    NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION					GRAPHIC LOG	Sample Description & Classification	H <sub>2</sub> O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD				
			S-1		0 to 2	24/12	4-7-8-8		WIDELY GRADED SAND WITH SILT (SW-SM); fine to coarse sand, ~10% silty fines, ~5% fine gravel, dry, light brown, roots, topsoil, FILL.		Strata change estimated at 5 feet
70			S-2		2 to 4	24/12	7-4-5-9		SILTY SAND (SM); fine to coarse sand, ~20% silty fines, ~5% fine gravel, moist, brown, FILL.		
	5		S-3		5 to 7	24/24	5-9-25-46		4-5 ft: Soil cuttings similar to material observed in S-2, FILL. WIDELY GRADED SAND WITH SILT (SW-SM); fine to coarse sand, ~10% silty fines, ~10% fine gravel, moist, brown.		
			S-4		7 to 9	24/18	16-29-30-35		SILTY SAND (SM); fine to coarse sand, ~15% silty fines, ~5% fine gravel, moist, reddish brown.		
65			S-5		10 to 12	24/20	13-16-16-17		9-10 ft: Soil cuttings similar to material observed in S-4. WIDELY GRADED SAND WITH SILT (SW-SM); fine to coarse sand, ~10% silty fines, ~5% fine gravel, dry, brown.		
	10		S-6		12 to 14	24/14	17-19-19-20		WIDELY GRADED SAND WITH SILT (SW-SM); fine to coarse sand, ~15% fine to coarse gravel, ~10% silty fines, dry, brown.		
			S-7		15 to 17	24/15	4-5-6-9		WIDELY GRADED SAND (SW); fine to coarse sand, ~5% silty fines, ~5% fine gravel, dry, tan.		
60			S-8		20 to 22	24/15	7-9-13-13		WIDELY GRADED SAND (SW); fine to coarse sand, ~10% fine to coarse gravel, ~5% silty fines, moist, tan.		
55											
	15										
	20										
	50										

GEOTECHNICAL BORING LOG 02 BNL NSLSII ADDITIONAL BORING LOGS.GPJ GEI DATA TEMPLATE GDT 8/24/06

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.	<b>CLIENT:</b> HDR Architechture, Inc. <b>PROJECT NAME:</b> NSLS II Geotechnical Investigation <b>CITY/STATE:</b> Upton, New York <b>GEI PROJECT NUMBER:</b> 062150-1000	 <b>GEI Consultants, Inc.</b> 455 Winding Brook Dr Glastonbury, CT 06033 860.368.5408
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**Boring Location**  
 NORTHING: \_\_\_\_\_ EASTING: \_\_\_\_\_ STATION: \_\_\_\_\_ OFFSET: \_\_\_\_\_  
 HORIZONTAL DATUM: NAD 83 STATION CENTERLINE: \_\_\_\_\_  
 VERTICAL DATUM: BNL 94 GROUND SURFACE ELEVATION (FT): 73.0  
 LOCATION: See Figure 2

**BORING**  
**B-103**  
 PAGE 2 of 2

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION					GRAPHIC LOG	Sample Description & Classification	H <sub>2</sub> O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./Rec. (in)	Blows Count or RQD				
25			S-9	⊗	25 to 27	24/15	9-12-16-17	●●●●●	WIDELY GRADED SAND (SW); fine to coarse sand, ~5% silty fines, ~5% fine gravel, moist, tan.	▽	
45			S-10	⊗	30 to 32	24/18	13-16-19-39		WIDELY GRADED SAND (SW); fine to coarse sand, ~5% silty fines, wet, brown.		
30			End of Boring at 32 feet Fill with cuttings upon completion								
40											
35											
35											
40											
30											
45											
25											
50											
20											

GEOTECHNICAL BORING LOG 02 BNL NSLS II ADDITIONAL BORING LOGS.GPJ GEI DATA TEMPLATE GDT 8/24/06

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

**CLIENT:** HDR Architecture, Inc.  
**PROJECT NAME:** NSLS II Geotechnical Investigation  
**CITY/STATE:** Upton, New York  
**GEI PROJECT NUMBER:** 062150-\*1000



**GEI**  
Consultants

**GEI Consultants, Inc.**  
 455 Winding Brook Dr  
 Glastonbury, CT 06033  
 860.368.5408

**Boring Location**  
 NORTHING: \_\_\_\_\_ EASTING: \_\_\_\_\_ STATION: \_\_\_\_\_ OFFSET: \_\_\_\_\_  
 HORIZONTAL DATUM: NAD 83 STATION CENTERLINE: \_\_\_\_\_  
 VERTICAL DATUM: BNL 94 GROUND SURFACE ELEVATION (FT): 76.0  
 LOCATION: See Figure 2

**BORING**  
**B-104**  
 PAGE 1 of 1

**Drilling Information**

DATE START / END: 8/16/2006 - 8/16/2006 TOTAL DEPTH (FT): 7.0  
 CONTRACTOR: New England Boring DRILLER: Jeff Leavitt LOGGED BY: Steve Hawkins  
 EQUIPMENT: Mobile Drill B-53 truck mounted drill rig. BORING METHOD: Hollow Stem Auger  
 AUGER ID/OD: 4.25 in / N/A CASING ID/OD: N/A / N/A CORE INFO: \_\_\_\_\_  
 HAMMER TYPE: Safety Hammer HAMMER WEIGHT (lbs): 140 HAMMER DROP (inch): 30  
 WATER LEVEL DEPTHS (ft): \_\_\_\_\_  
 GENERAL NOTES: Samples collected using a 2-inch diameter split spoon.

**ABBREVIATIONS:** ID = Inside Diameter    bpf = Blows per Foot    U = Undistrubed Tube Sample    WOR = Weight of Rods    Q<sub>v</sub> = Pocket Penetrometer Strength  
 OD = Outside Diameter    mpf = Minute per Foot    C = Rock Core    WOH = Weight of Hammer    S<sub>v</sub> = Pocket Torvane Shear Strength  
 Pen. = Penetration Length    S = Split Spoon    V = Field Vane Shear    RQD = Rock Quality Designation    F<sub>v</sub> = Field Vane Shear Strength  
 Rec. = Recovery Length    DP = Direct Push Sample    SC = Sonic Core    OVM = Organic Vapor Meter    NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION					GRAPHIC LOG	Sample Description & Classification	H <sub>2</sub> O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD				
75			S-1		0 to 2	24/12	3-4-4-3		SILTY SAND (SM); fine to coarse sand, ~25% silty fines, slight petroleum-like odor, moist, dark brown, organics, FILL.		
			S-2		2 to 4	24/15	3-4-6-16		SILTY SAND (SM); fine to coarse sand, ~30% silty fines, ~10% fine gravel, moist, brown, FILL.		
5			S-3		5 to 7	24/10	16-19-30-30		4-5 ft: Soil cuttings similar to material observed in S-2, FILL. SILTY SAND (SM); fine to coarse sand, ~15% silty fines, ~5% fine gravel, dry, brown, Probable FILL.		
70									Auger refusal encountered ~7-feet bgs. Fill with cuttings upon completion		
10											
65											
15											
60											
20											
55											

GEO TECHNICAL BORING LOG 02 BNL NSLSII ADDITIONAL BORING LOGS GPJ GEI DATA TEMPLATE.GDT 8/24/06

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

**CLIENT:** HDR Architechture, Inc.  
**PROJECT NAME:** NSLS II Geotechnical Investigation  
**CITY/STATE:** Upton, New York  
**GEI PROJECT NUMBER:** 062150-\*-1000

**GEI Consultants, Inc.**  
 455 Winding Brook Dr  
 Glastonbury, CT 06033  
 860.368.5408

<b>Boring Location</b> NORTHING: _____ EASTING: _____ STATION: _____ OFFSET: _____ HORIZONTAL DATUM: NAD 83 STATION CENTERLINE: _____ VERTICAL DATUM: BNL 94 GROUND SURFACE ELEVATION (FT): 76.0 LOCATION: ~5 feet North of B-104; See Figure 2	<b>BORING</b>  <b>B-104a</b>  PAGE 1 of 1
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<b>Drilling Information</b>	
DATE START / END: 8/16/2006 - 8/16/2006 CONTRACTOR: New England Boring DRILLER: Jeff Leavitt EQUIPMENT: Mobile Drill B-53 truck mounted drill rig. AUGER ID/OD: 4.25 in / N/A CASING ID/OD: N/A / N/A HAMMER TYPE: Safety Hammer HAMMER WEIGHT (lbs): 140 WATER LEVEL DEPTHS (ft): _____	TOTAL DEPTH (FT): 3.0 LOGGED BY: Steve Hawkins BORING METHOD: Hollow Stem Auger CORE INFO: _____ HAMMER DROP (inch): 30
GENERAL NOTES: Samples collected using a 2-inch diameter split spoon.	

**ABBREVIATIONS:** ID = Inside Diameter    bpf = Blows per Foot    U = Undisturbed Tube Sample    WOR = Weight of Rods    Q<sub>v</sub> = Pocket Penetrometer Strength  
                   OD = Outside Diameter    mpf = Minute per Foot    C = Rock Core    WOH = Weight of Hammer    S<sub>v</sub> = Pocket Torvane Shear Strength  
                   Pen. = Penetration Length    S = Split Spoon    V = Field Vane Shear    RQD = Rock Quality Designation    F<sub>v</sub> = Field Vane Shear Strength  
                   Rec. = Recovery Length    DP = Direct Push Sample    SC = Sonic Core    OVM = Organic Vapor Meter    NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION					GRAPHIC LOG	Sample Description & Classification	H <sub>2</sub> O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./Rec. (in)	Blows Count or RQD				
75								[Hatched Box]			Soil cuttings similar to B-104a S-1, FILL.
5											Electrical wire encountered ~3-feet bgs. Auger refusal at ~3 feet bgs. Fill with cuttings upon completion
70											
10											
65											
15											
60											
20											
55											

GEOTECHNICAL BORING LOG 02\_BNL NSLSII/ADDITIONAL BORING LOGS.GPJ\_GEI DATA TEMPLATE.GDT\_8/24/06

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.	<b>CLIENT:</b> HDR Architecture, Inc. <b>PROJECT NAME:</b> NSLS II Geotechnical Investigation <b>CITY/STATE:</b> Upton, New York <b>GEI PROJECT NUMBER:</b> 062150-*--1000	 <b>GEI Consultants, Inc.</b> 455 Winding Brook Dr Glastonbury, CT 06033 860.368.5408
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**Boring Location**  
 NORTHING: \_\_\_\_\_ EASTING: \_\_\_\_\_ STATION: \_\_\_\_\_ OFFSET: \_\_\_\_\_  
 HORIZONTAL DATUM: NAD 83 STATION CENTERLINE: \_\_\_\_\_  
 VERTICAL DATUM: BNL 94 GROUND SURFACE ELEVATION (FT): 76.0  
 LOCATION: ~5 feet West of B-104a; See Figure 2

**BORING**  
**B-104b**  
 PAGE 1 of 2

**Drilling Information**

DATE START / END: 8/16/2006 - 8/16/2006 TOTAL DEPTH (FT): 32.0  
 CONTRACTOR: New England Borings DRILLER: Jeff Leavitt LOGGED BY: Steven Hawkins  
 EQUIPMENT: Mobile Drill B-53 truck mounted drill rig BORING METHOD: Hollow Stem Auger  
 AUGER ID/OD: 4.25 in / N/A CASING ID/OD: N/A / N/A CORE INFO: \_\_\_\_\_  
 HAMMER TYPE: Safety Hammer HAMMER WEIGHT (lbs): 140 HAMMER DROP (inch): 30  
 WATER LEVEL DEPTHS (ft):  $\nabla$  31.00 8/16/2006 12:57 pm

GENERAL NOTES: Samples collected using a 2-inch diameter split spoon.

ABBREVIATIONS: ID = Inside Diameter    bpf = Blows per Foot    U = Undistrubed Tube Sample    WOR = Weight of Rods    Q<sub>p</sub> = Pocket Penetrometer Strength  
 OD = Outside Diameter    mpf = Minute per Foot    C = Rock Core    WOH = Weight of Hammer    S<sub>v</sub> = Pocket Torvane Shear Strength  
 Pen. = Penetration Length    S = Split Spoon    V = Field Vane Shear    RQD = Rock Quality Designation    F<sub>v</sub> = Field Vane Shear Strength  
 Rec. = Recovery Length    DP = Direct Push Sample    SC = Sonic Core    OVM = Organic Vapor Meter    NA, NM = Not Applicable, Not Measured


Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION					GRAPHIC LOG	Sample Description & Classification	H <sub>2</sub> O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./Rec. (in)	Blows Count or RQD				
75										See boring log B-104a for sample information and description of material from 0 to 7-foot bgs.	
	5										
70			S-1	X	7 to 9	24/6	15-22-27-39			SILTY SAND (SM); fine to coarse sand, ~15% silty fines, ~5% fine gravel, dry, brown.	
	10		S-2	X	10 to 12	24/19	9-17-19-15			9-10: Soil cuttings similar to material observed in S-4. SILTY SAND (SM); fine to coarse sand, ~15% silty fines, ~5% fine gravel, moist, brown.	
65			S-3	X	12 to 14	24/20	13-14-16-16			WIDELY GRADED SAND (SW); fine to coarse sand, ~5% silty fines, ~5% fine gravel, moist, brown.	
	15		S-4	X	15 to 17	24/12	3-4-8-7			WIDELY GRADED SAND (SW); fine to coarse sand, ~10% fine to coarse gravel, ~5% silty fines, dry, tan.	
60											
	20		S-5	X	20 to 22	24/18	6-9-12-10			WIDELY GRADED SAND (SW); fine to coarse sand, ~10% fine to coarse gravel, ~5% silty fines, dry, tan.	
55											

GEOTECHNICAL BORING LOG 02 BNL NSLSII ADDITIONAL BORING LOGS.GPJ GEI DATA TEMPLATE GDT 8/24/06

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: HDR Architechture, Inc.  
 PROJECT NAME: NSLS II Geotechnical Investigation  
 CITY/STATE: Upton, New York  
 GEI PROJECT NUMBER: 062150-\*1000

**GEI Consultants, Inc.**  
 455 Winding Brook Dr  
 Glastonbury, CT 06033  
 860.368.5408



**Boring Location**  
 NORTHING: \_\_\_\_\_ EASTING: \_\_\_\_\_ STATION: \_\_\_\_\_ OFFSET: \_\_\_\_\_  
 HORIZONTAL DATUM: NAD 83 STATION CENTERLINE: \_\_\_\_\_  
 VERTICAL DATUM: BNL 94 GROUND SURFACE ELEVATION (FT): 76.0  
 LOCATION: ~5 feet West of B-104a; See Figure 2

**BORING**  
**B-104b**  
 PAGE 2 of 2

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION					GRAPHIC LOG	Sample Description & Classification	H <sub>2</sub> O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD				
25			S-6	⊗	25 to 27	24/12	10-15-19-17				WIDELY GRADED SAND WITH GRAVEL (SW); fine to coarse sand, ~15% fine to coarse gravel, ~5% silty fines, dry, tan.
30			S-7	⊗	30 to 32	24/16	7-11-11-10				WIDELY GRADED SAND (SW); fine to coarse sand, ~10% fine to coarse gravel, ~5% silty fines, moist, tan.
											End of Boring at 32 feet Fill with cuttings upon completion

GEOTECHNICAL BORING LOG 02 BNL NSLS/II ADDITIONAL BORING LOGS.GPJ\_GEI DATA TEMPLATE.GDT 8/24/06

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: HDR Architecture, Inc.  
 PROJECT NAME: NSLS II Geotechnical Investigation  
 CITY/STATE: Upton, New York  
 GEI PROJECT NUMBER: 062150-\*1000

**GEI**  **Consultants**  
**GEI Consultants, Inc.**  
 455 Winding Brook Dr  
 Glastonbury, CT 06033  
 860.368.5408

## Appendix D

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### 2006 Cone Penetrometer Test (CPT) Logs





**TABLE 1 - SUMMARY OF CPTU SOUNDINGS**

**Job No.:** 06-773  
**Location:** Brookhaven National Labs  
**Client:** GEI Consultants  
**Date:** July 19, 20, 21, 2006

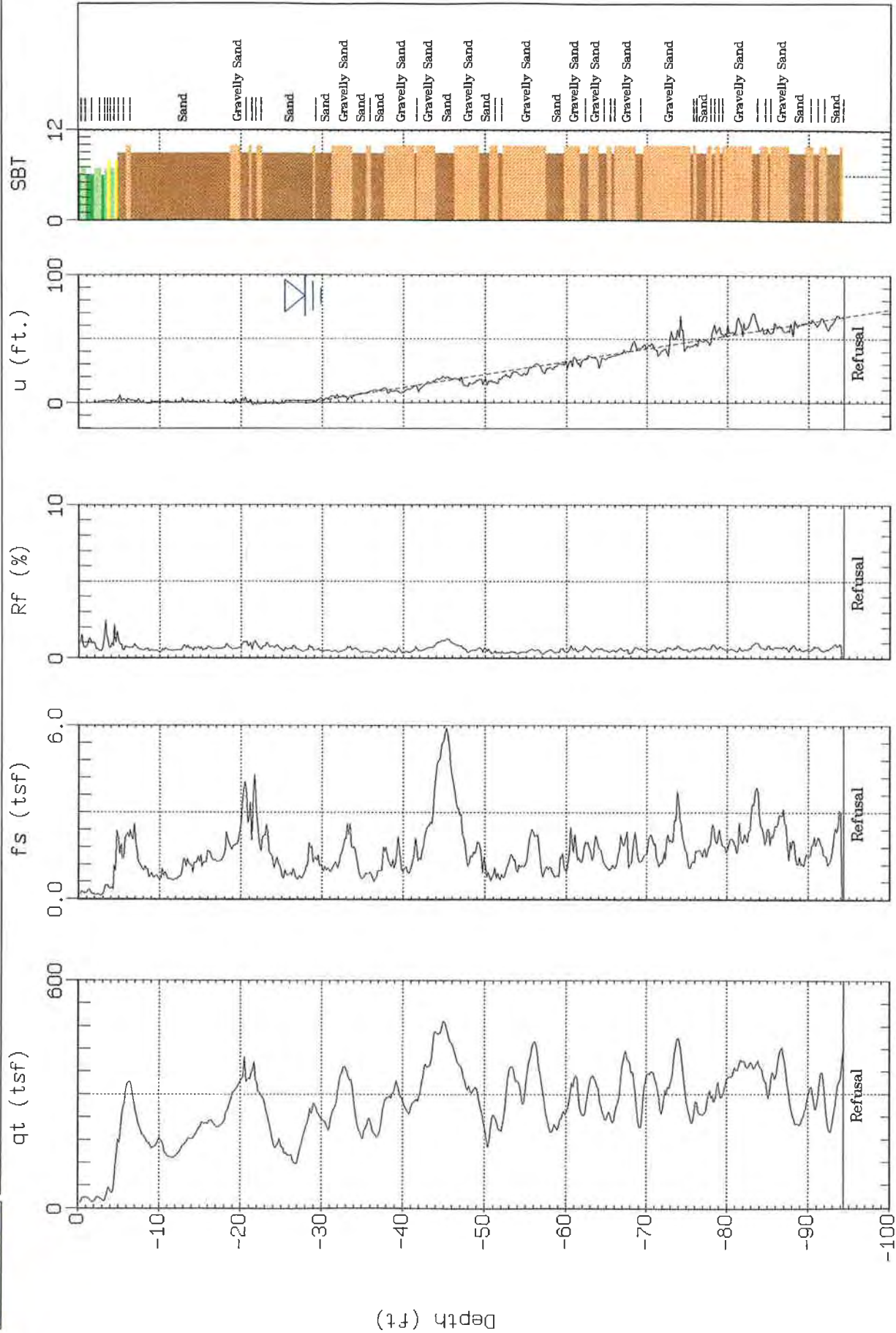
Date	CPTU Sounding	File Name	CPT Total Depth (ft)	Shear wave Velocity Tests	Comments	
19-Jul-06	CPT-1	773cp01.cor	94.32		refusal	
19-Jul-06	CPT-2	773cp02.cor	100.06			
20-Jul-06	CPT-3	773cp03.cor	86.12	9	refusal	
19-Jul-06	CPT-4	773cp04.cor	95.14		refusal	
20-Jul-06	CPT-5	773cp05.cor	7.87		refusal	
20-Jul-06	CPT-5A	773cp05a.cor	82.68	9	refusal	
20-Jul-06	CPT-6	773cp06.cor	100.06	10		
21-Jul-06	CPT-7	773cp07.cor	6.40		refusal	
20-Jul-06	CPT-8	773cp08.cor	52.98		refusal	
21-Jul-06	CPT-10	773cp10.cor	61.02			
21-Jul-06	CPT-11	773cp11.cor	73.49			
20-Jul-06	CPT-12	773cp12.cor	100.06	10		
20-Jul-06	CPT-13	773cp13.cor	6.73		refusal	
20-Jul-06	CPT-13A	773cp13a.cor	5.58		refusal	
21-Jul-06	CPT-14	773cp14.cor	95.80		refusal	
<b>Job Totals:</b>			<b>15</b>	<b>968.31</b>	<b>38</b>	



# GEI Consultants

Sounding: CPT-1  
Site: National Labs

Piezocone: 20 Ton AD164  
Date: 07:19:06 16:08



Max. Depth: 94.32 (ft)  
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)  
Estimated Phreatic Surface

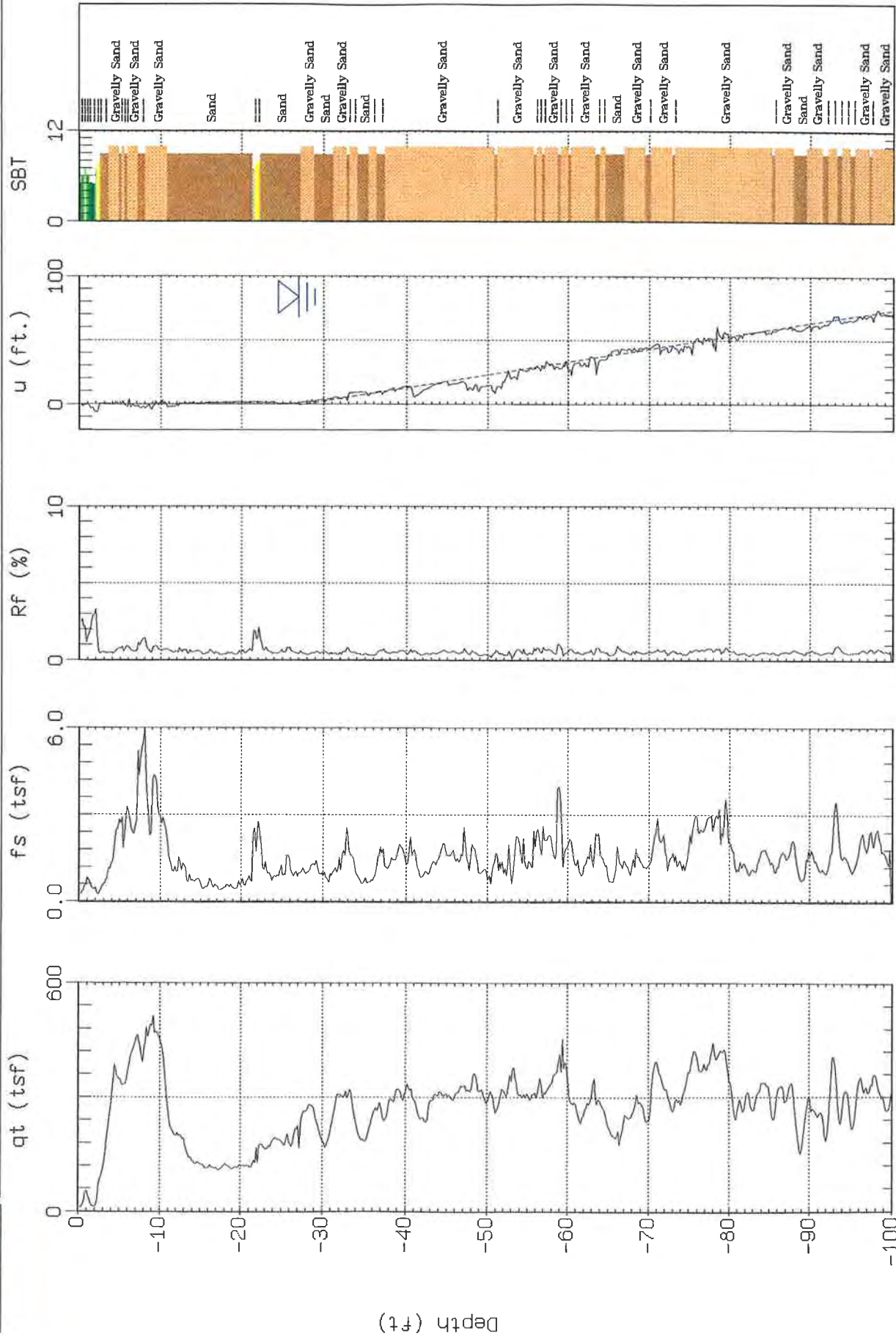




# GEI Consultants

Sounding: CPT-2  
Site: National Labs

Piezocene: 20 Ton AD164  
Date: 07:19:06 14:30



SBT: Soil Behavior Type (Robertson 1990)  
Estimated Phreatic Surface

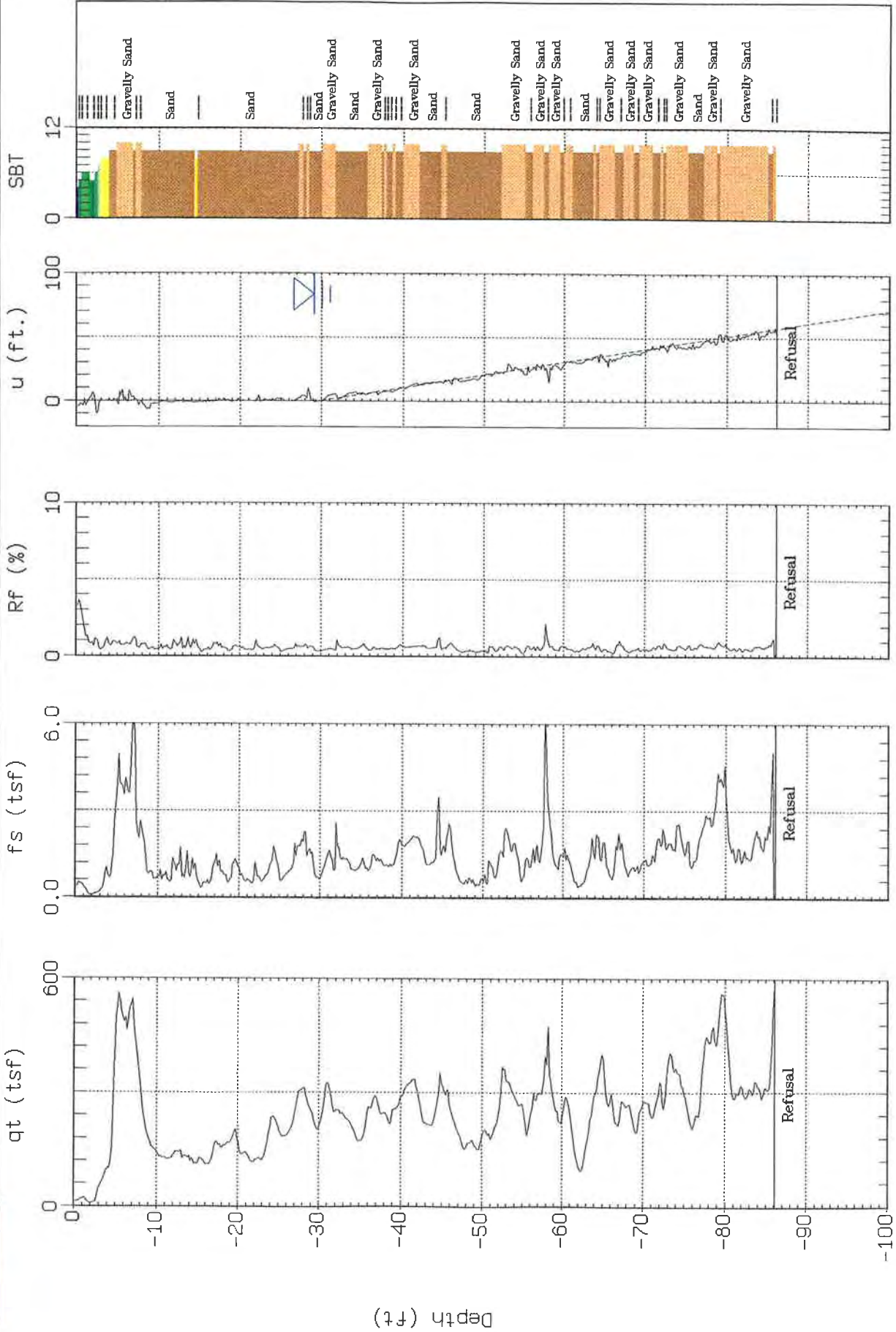
Max. Depth: 100.06 (ft)  
Depth Inc.: 0.164 (ft)



GEI Consultants

Sounding: CPT-3  
Site: National Labs

Piezocene: 20 Ton AD164  
Date: 07:20:06 07:32



Max. Depth: 86.12 (ft)  
Depth Inc.: 0.164 (ft)

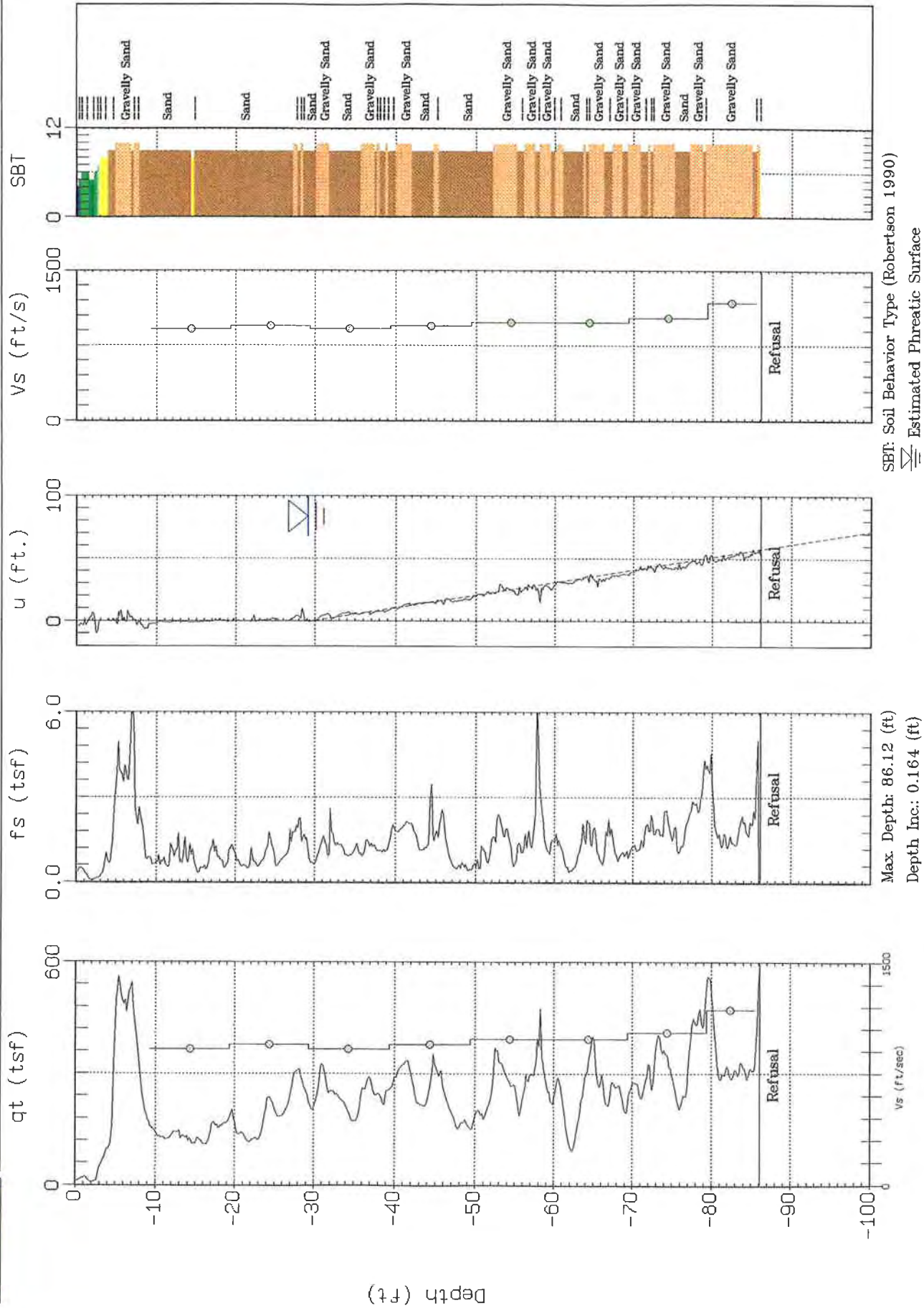
SBT: Soil Behavior Type (Robertson 1990)  
▽ Estimated Phreatic Surface



# GEI Consultants

Sounding: CPT-3  
Site: National Labs

Piezocone: 20 Ton AD164  
Date: 07:20:06 07:32



SBT: Soil Behavior Type (Robertson 1990)  
≡ Estimated Phreatic Surface

Max. Depth: 86.12 (ft)  
Depth Inc.: 0.164 (ft)

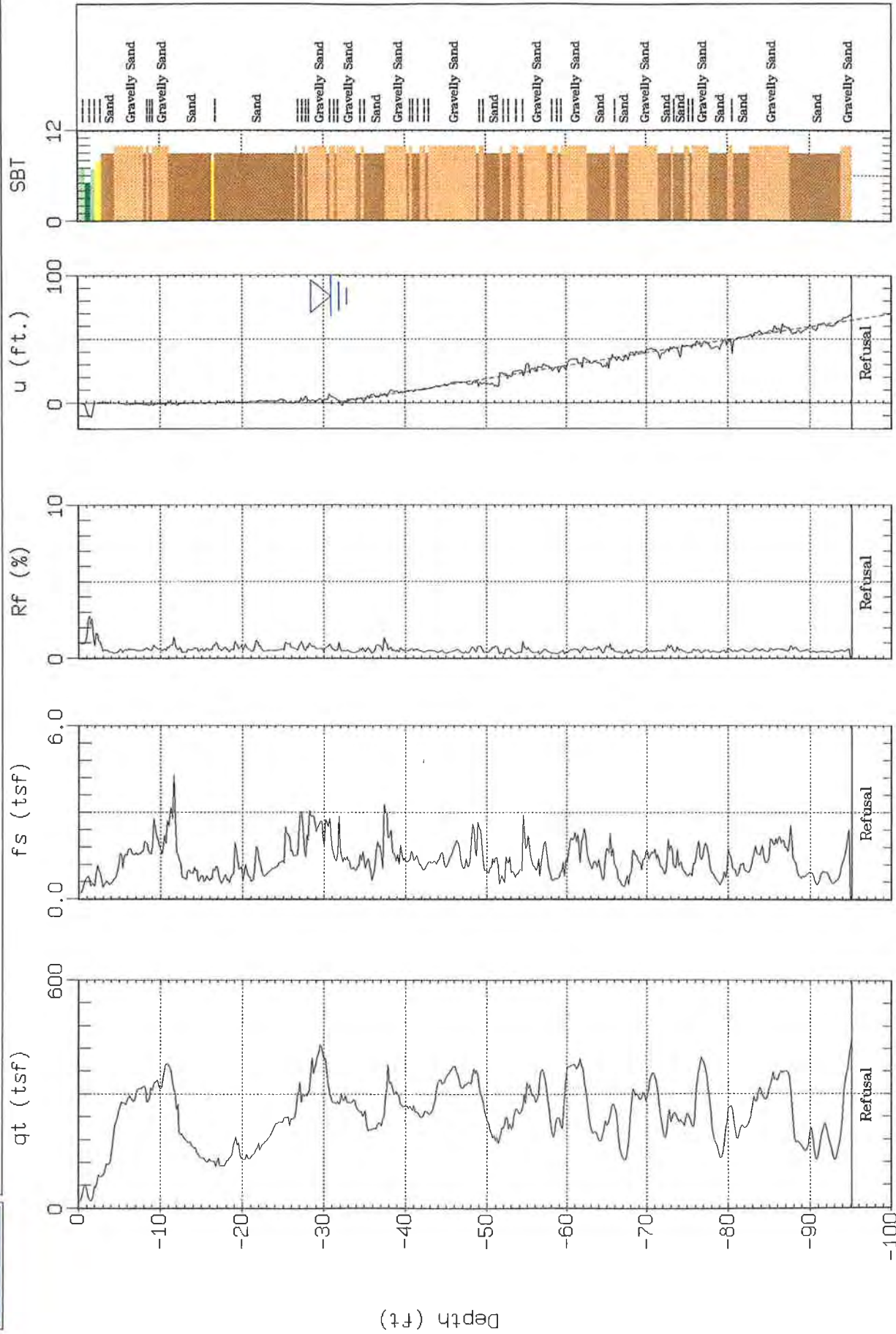




# GEI Consultants

Sounding: CPT-4  
Site: National Labs

Piezocene: 20 Ton AD164  
Date: 07:19:06 13:13



SBT: Soil Behavior Type (Robertson 1990)  
Estimated Phreatic Surface

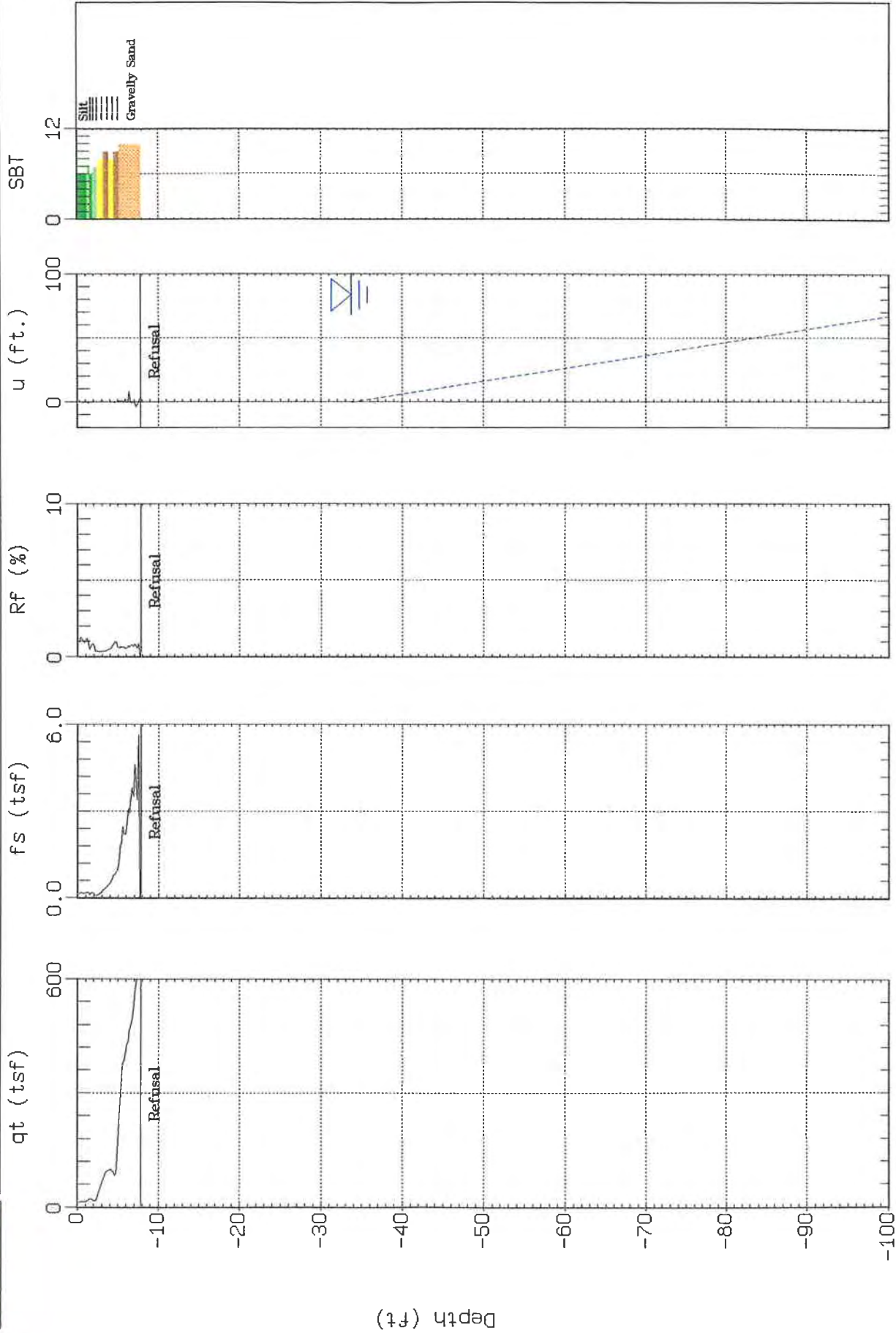
Max. Depth: 95.14 (ft)  
Depth Inc.: 0.164 (ft)



# GEI Consultants

Sounding: CPT-5  
Site: National Labs

Piezocone: 20 Ton AD164  
Date: 07:20:06 08:58



Max. Depth: 7.87 (ft)  
Depth Inc.: 0.164 (ft)

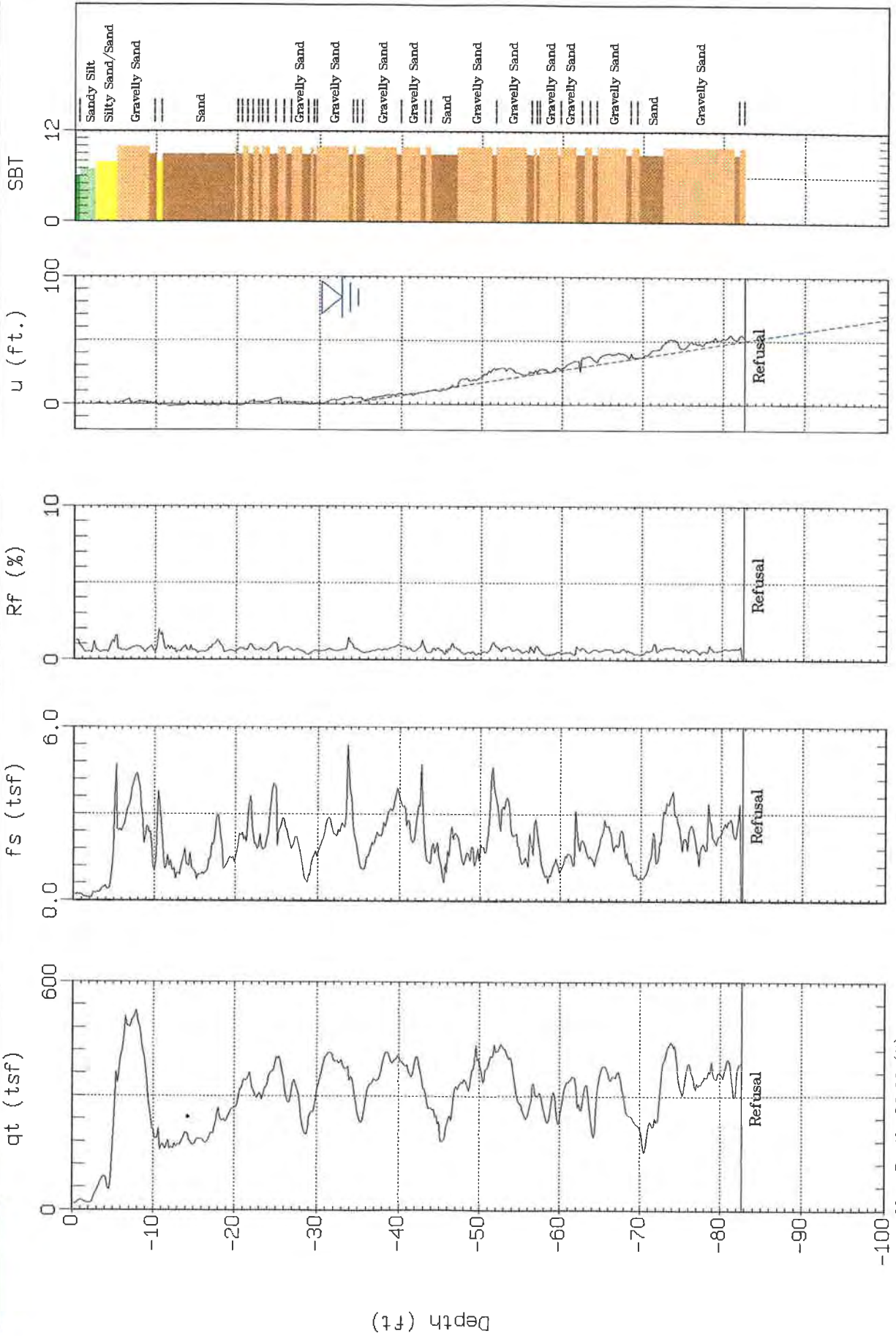
SBT: Soil Behavior Type (Robertson 1990)  
Estimated Phreatic Surface



GEI Consultants

Sounding: CPT-5A  
Site: National Labs

Piezocene: 20 Ton AD164  
Date: 07:20:06 09:27



SBT: Soil Behavior Type (Robertson 1990)  
∇ Estimated Phreatic Surface

Max Depth: 82.68 (ft)  
Depth Inc.: 0.164 (ft)

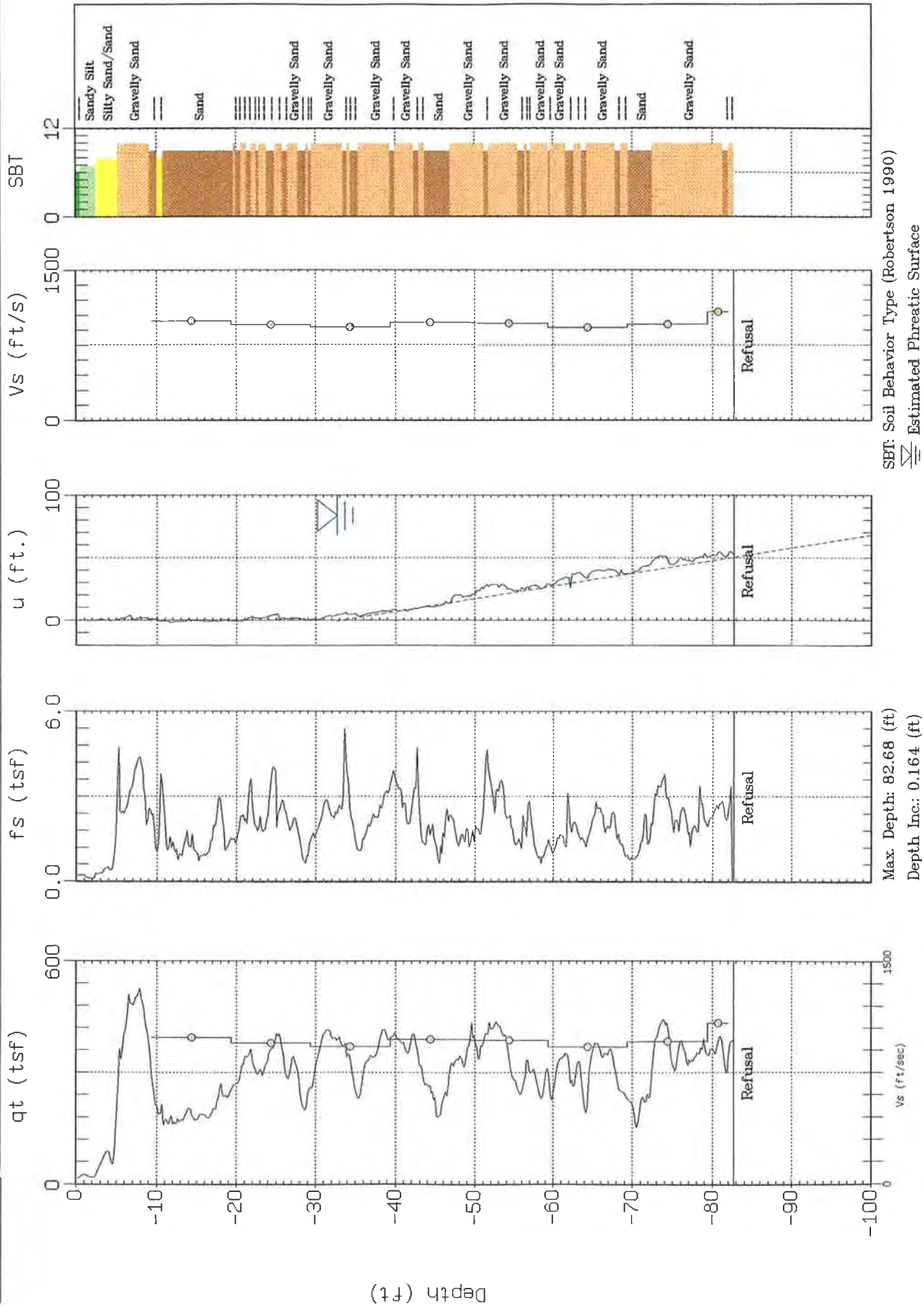




# GEI Consultants

Sounding: CPT-5A  
Site: National Labs

Piezocone: 20 Ton ADI64  
Date: 07:20:06 09:27



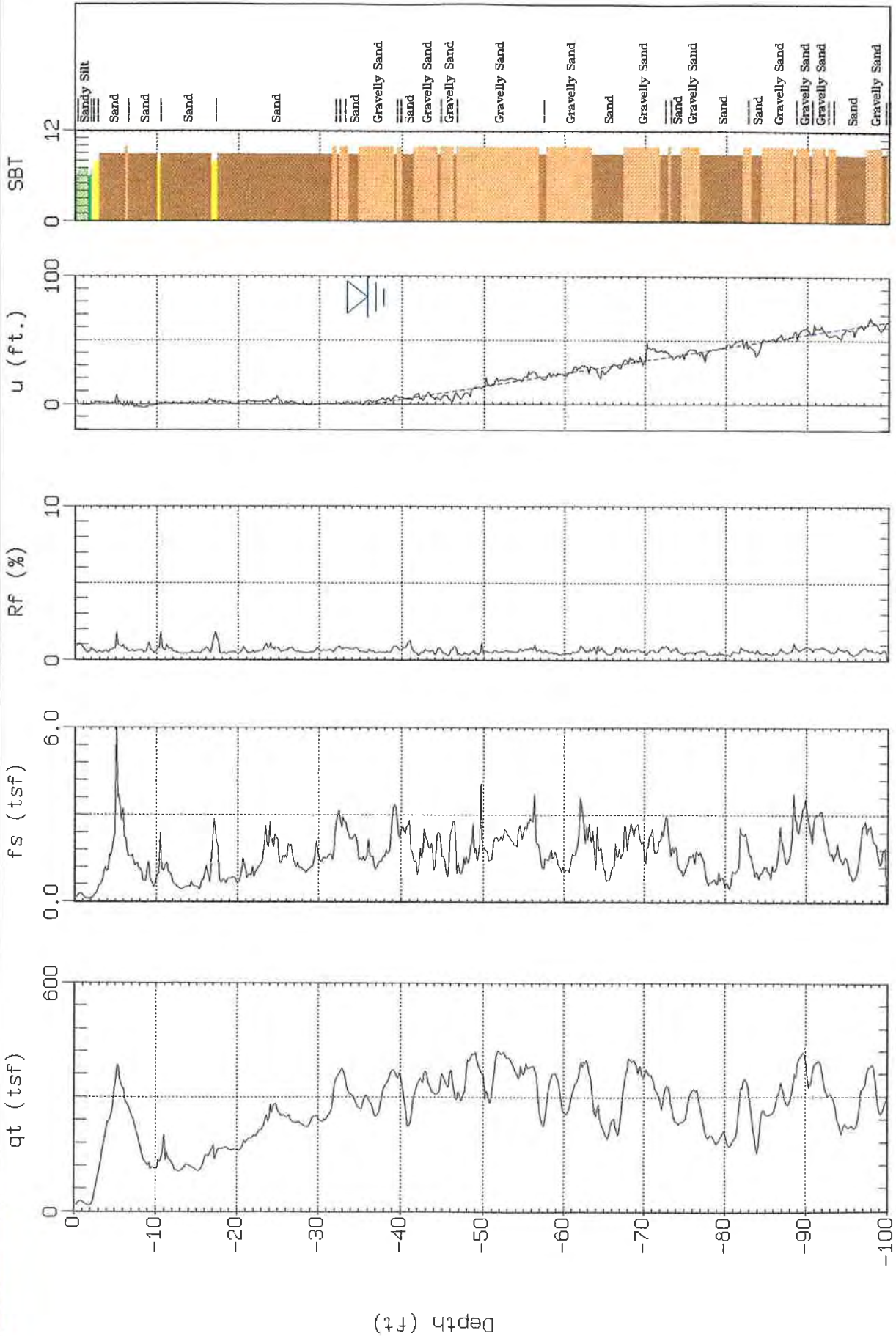
SBT: Soil Behavior Type (Robertson 1990)  
 Estimated Phreatic Surface



GEI Consultants

Sounding: CPT-6  
Site: National Labs

Piezocene: 20 Ton AD164  
Date: 07:20:06 10:46



SBT: Soil Behavior Type (Robertson 1990)  
 Estimated Phreatic Surface

Max. Depth: 100.06 (ft)  
 Depth Inc.: 0.164 (ft)

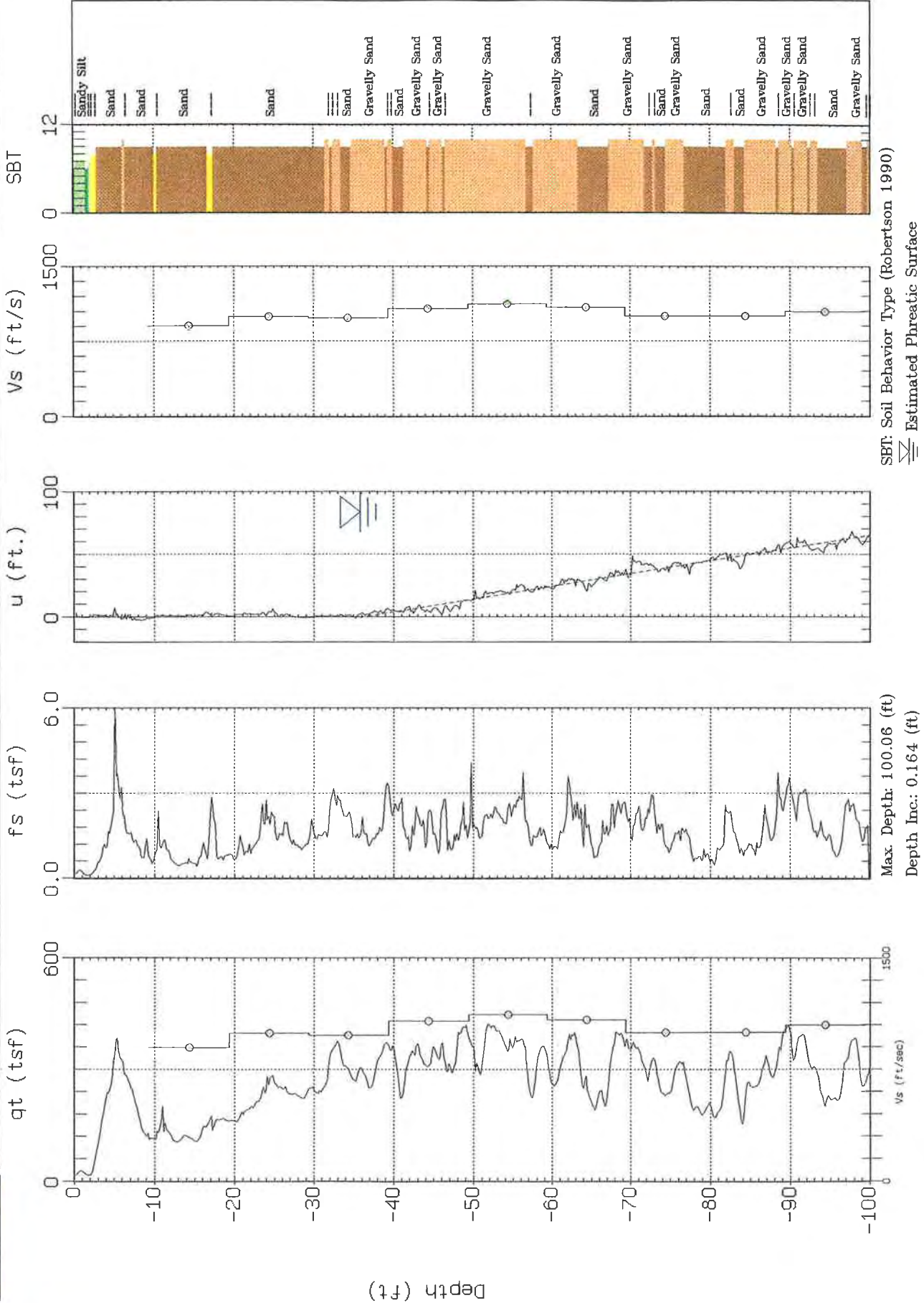




# GEI Consultants

Sounding: CPT-6  
Site: National Labs

Piezocene: 20 Ton AD164  
Date: 07:20:06 10:46

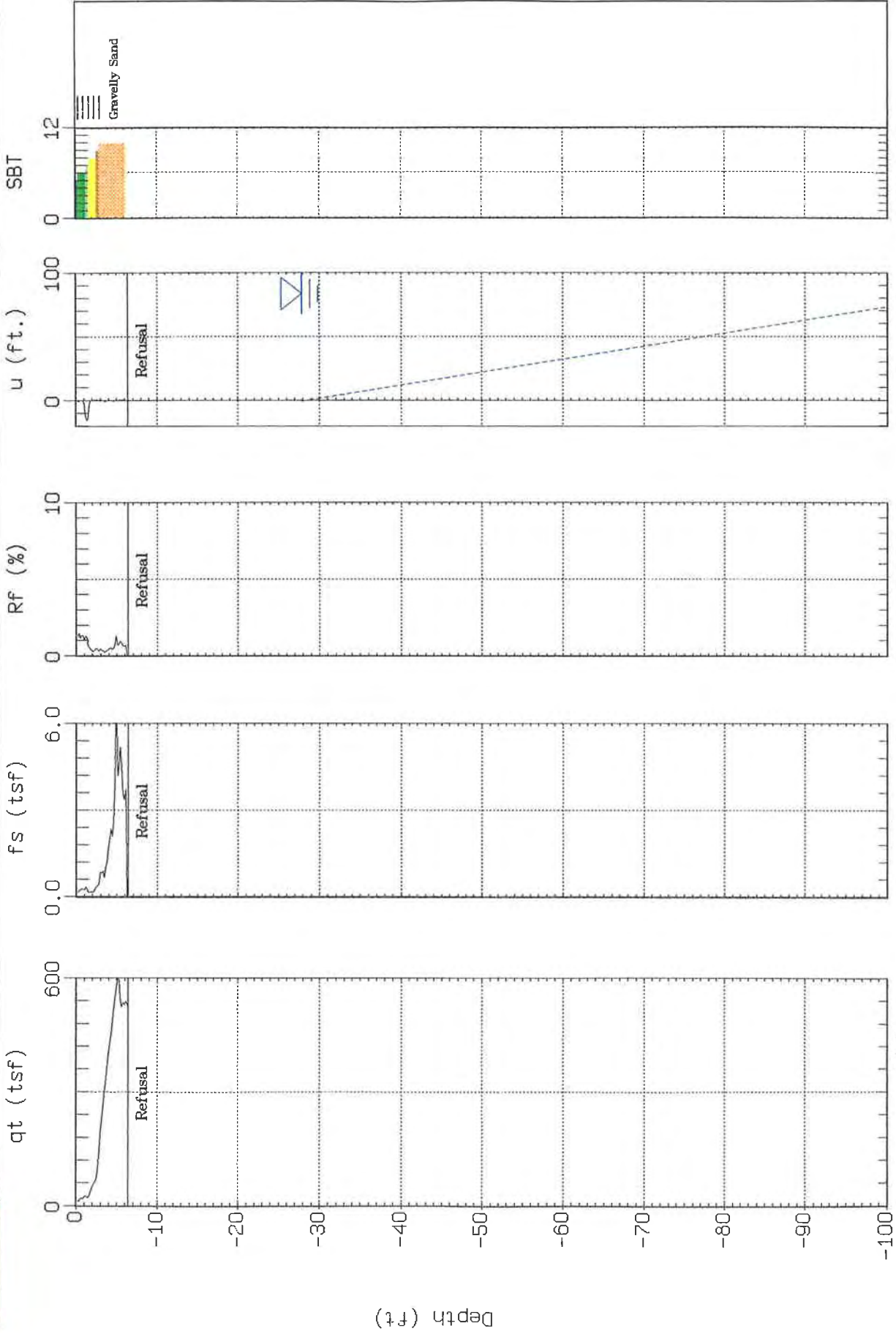




GEI Consultants

Sounding: CPT-7  
Site: National Labs

Piezocene: 20 Ton AD179  
Date: 07:21:06 12:03



Max. Depth: 6.40 (ft)  
Depth Inc.: 0.164 (ft)

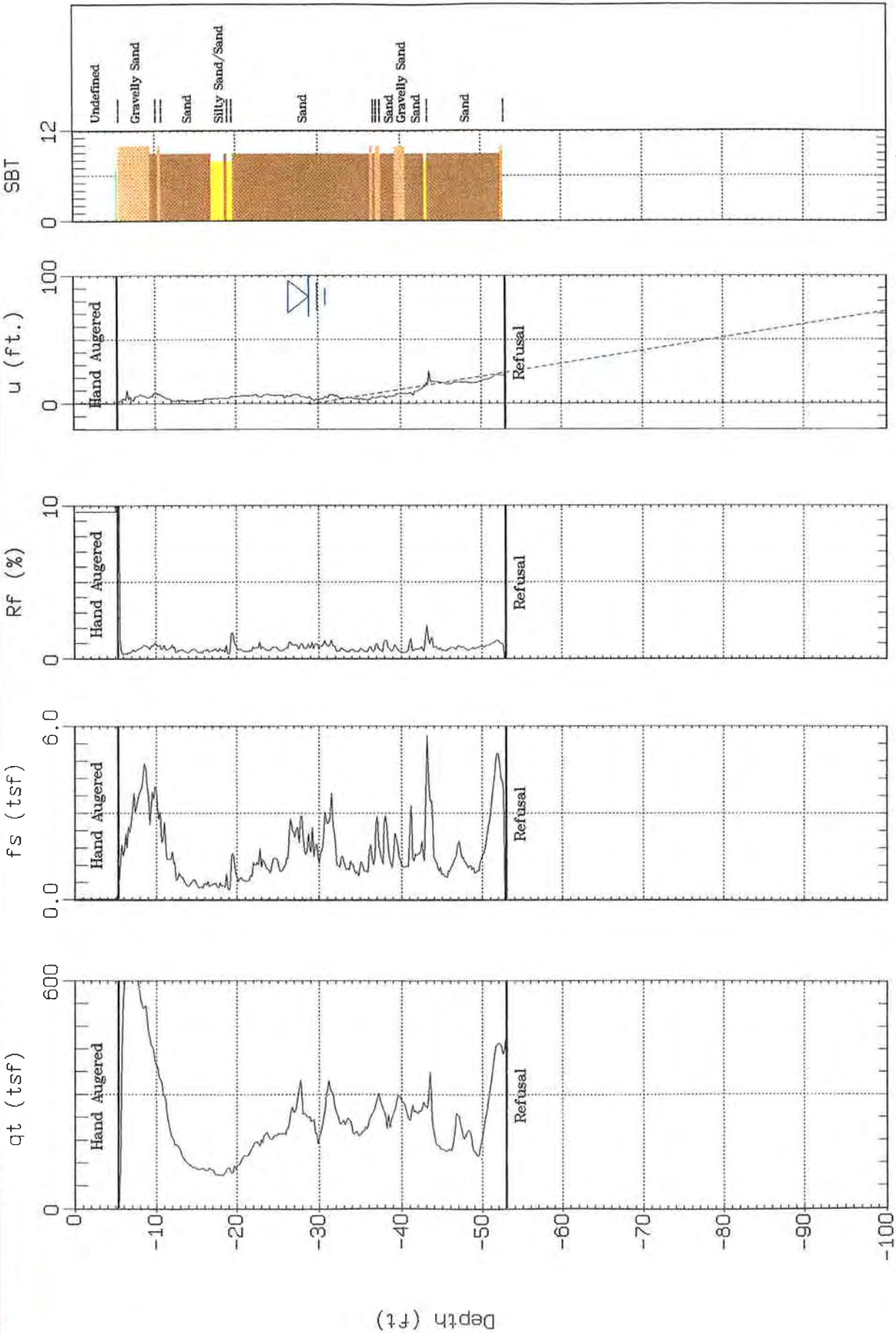
SBT: Soil Behavior Type (Robertson 1990)  
△ Estimated Phreatic Surface



# GEI Consultants

Sounding: CPT-8  
Site: National Labs

Piezocene: 20 Ton AD164  
Date: 07:20:06 15.23



Max. Depth: 52.98 (ft)  
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)  
△ Estimated Phreatic Surface

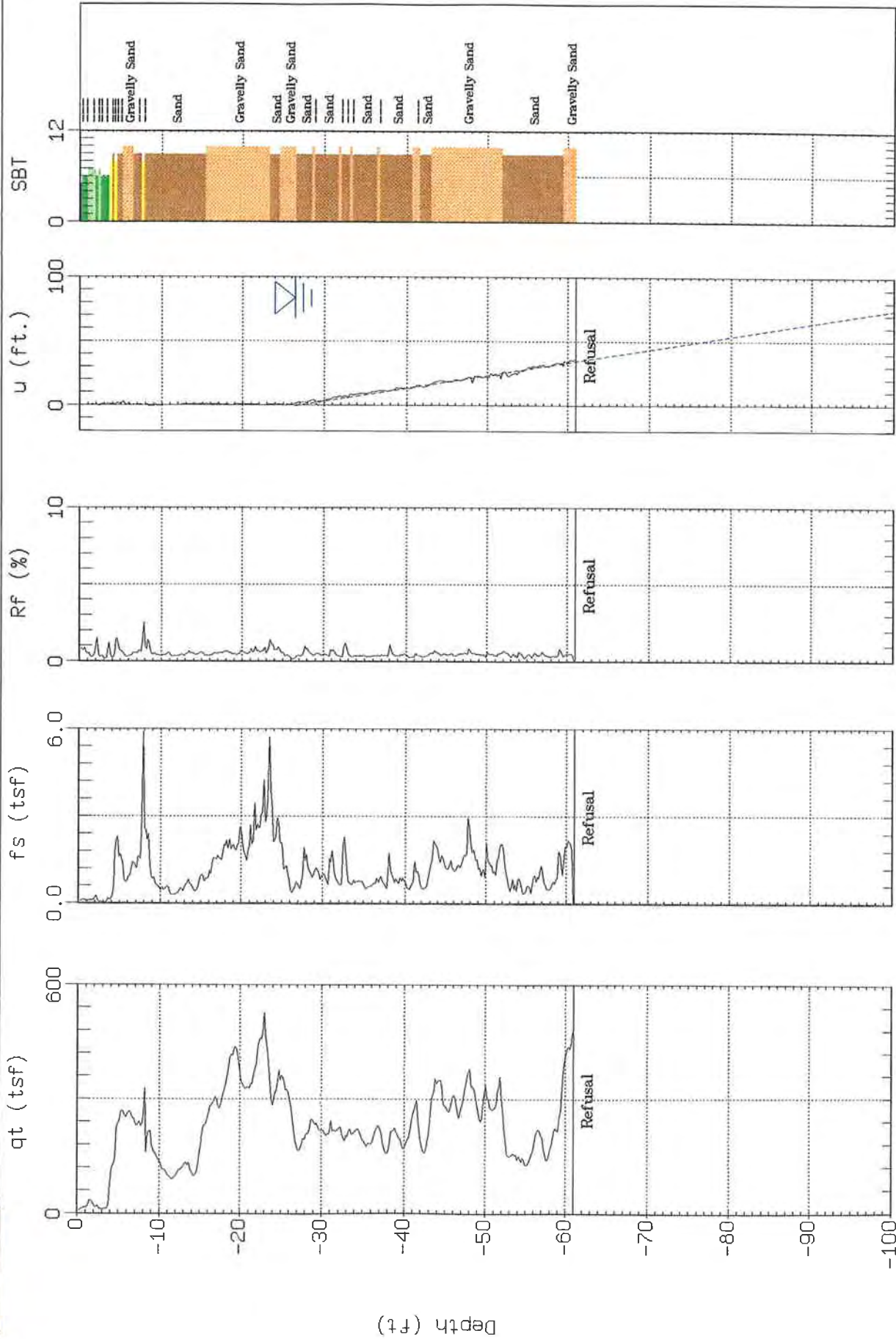




GEI Consultants

Sounding: CPT-10  
Site: National Labs

Piezocene: 20 Ton AD179  
Date: 07:21:06 09:56



SBT: Soil Behavior Type (Robertson 1990)  
Estimated Phreatic Surface

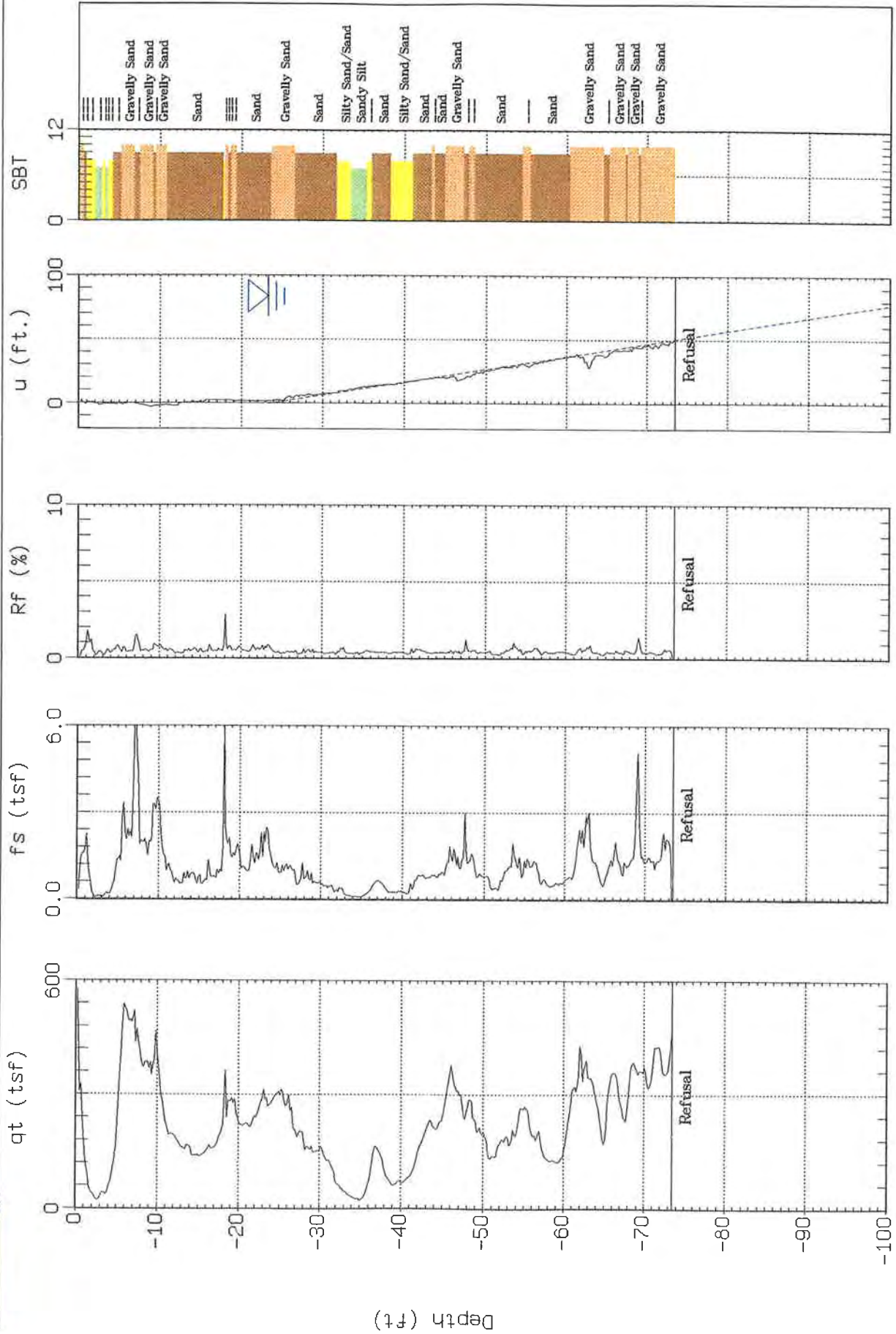
Max. Depth: 61.02 (ft)  
Depth Inc.: 0.164 (ft)



GEI Consultants

Sounding: CPT-11  
Site: National Labs

Piezocone: 20 Ton AD179  
Date: 07:21:06 08:42



SBT: Soil Behavior Type (Robertson 1990)  
△ Estimated Phreatic Surface

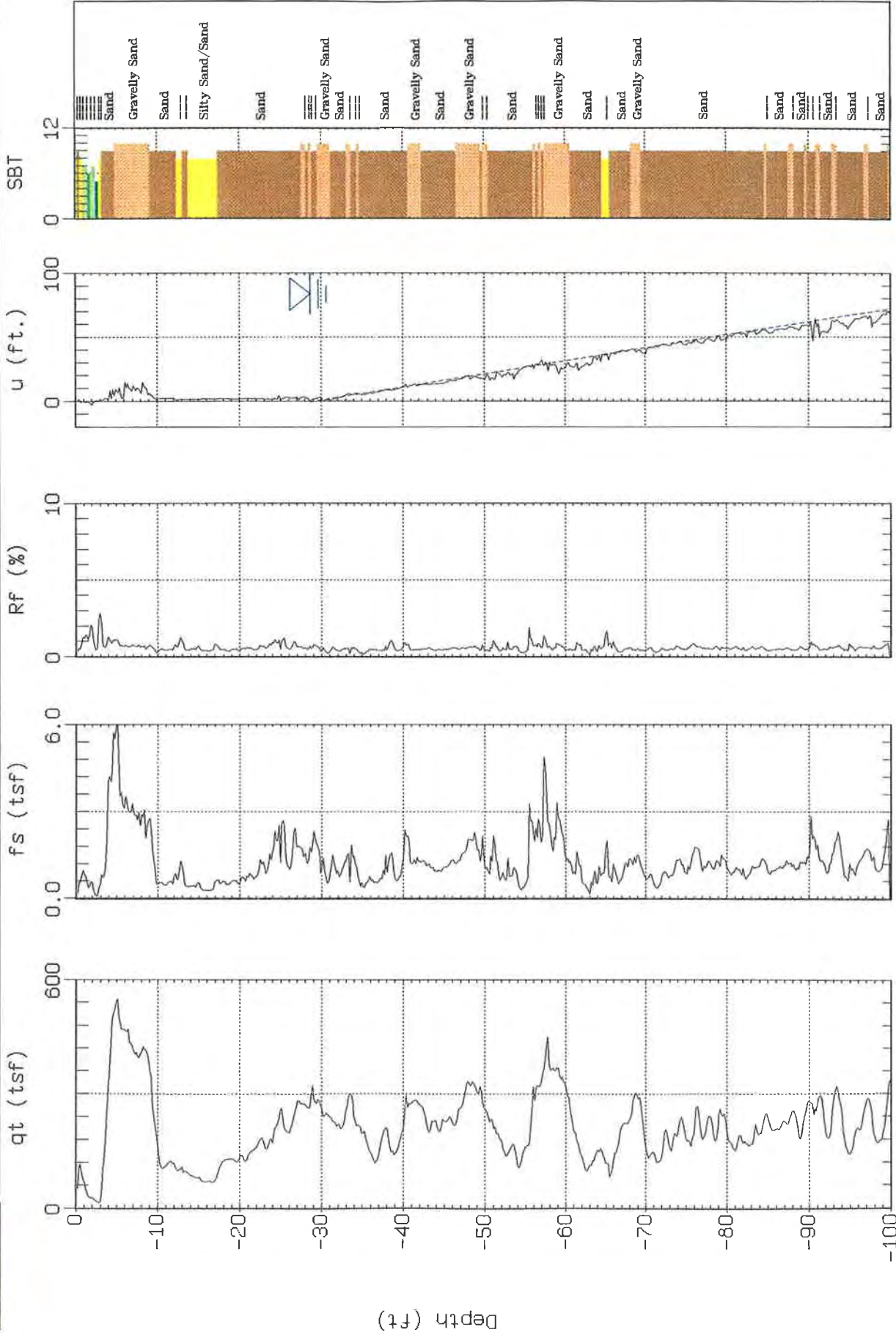
Max. Depth: 73.49 (ft)  
Depth Inc.: 0.164 (ft)



GEI Consultants

Sounding: CPT-12  
Site: National Labs

Piezocene: 20 Ton ADI64  
Date: 07:20:06 13:19



SBT: Soil Behavior Type (Robertson 1990)  
△ Estimated Phreatic Surface

Max Depth: 100.06 (ft)  
Depth Inc: 0.164 (ft)

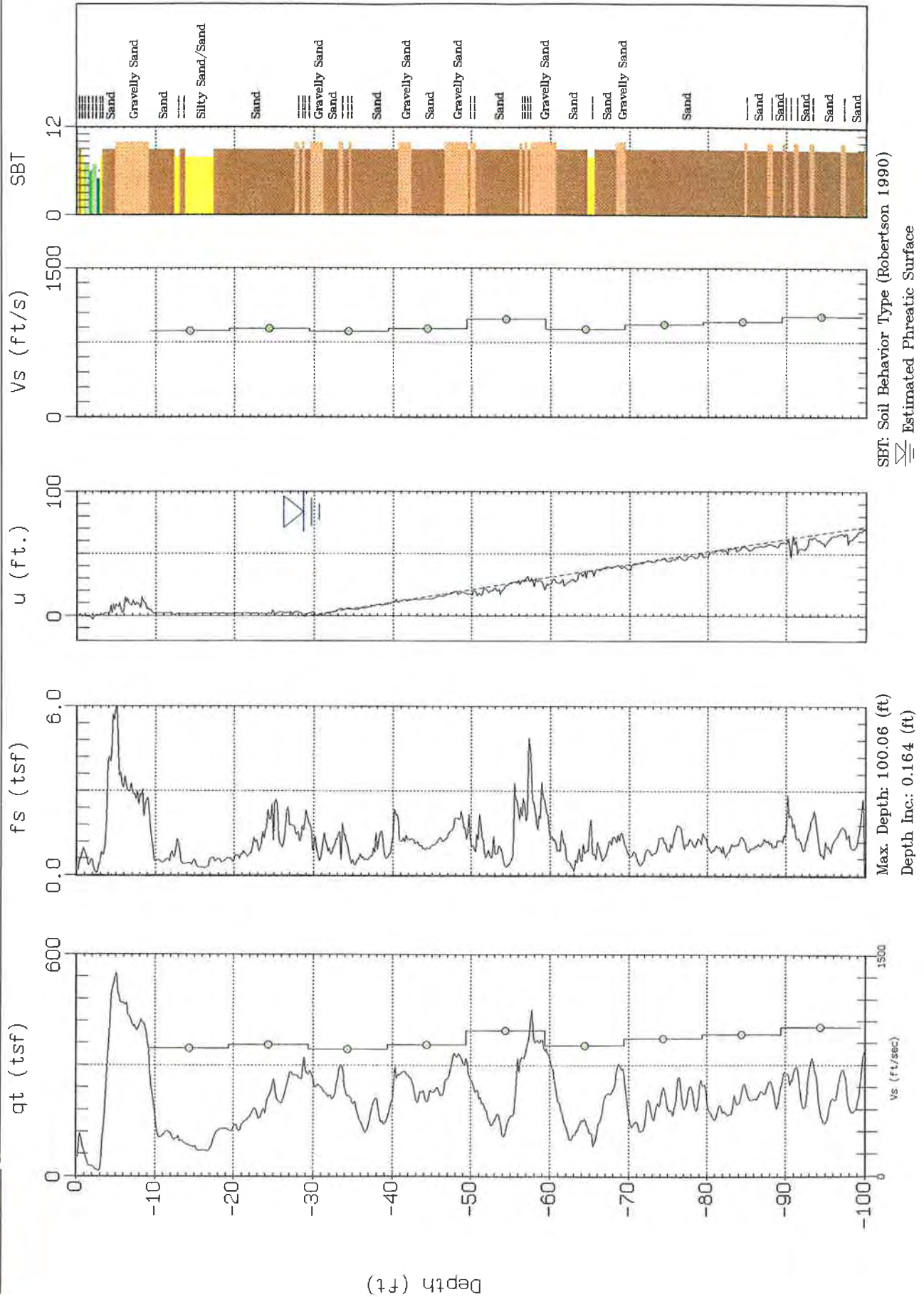




# GEI Consultants

Sounding: CPT-12  
Site: National Labs

Piezocone: 20 Ton AD164  
Date: 07:20:06 13:19



Max. Depth: 100.06 (ft)  
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)  
△ Estimated Phreatic Surface

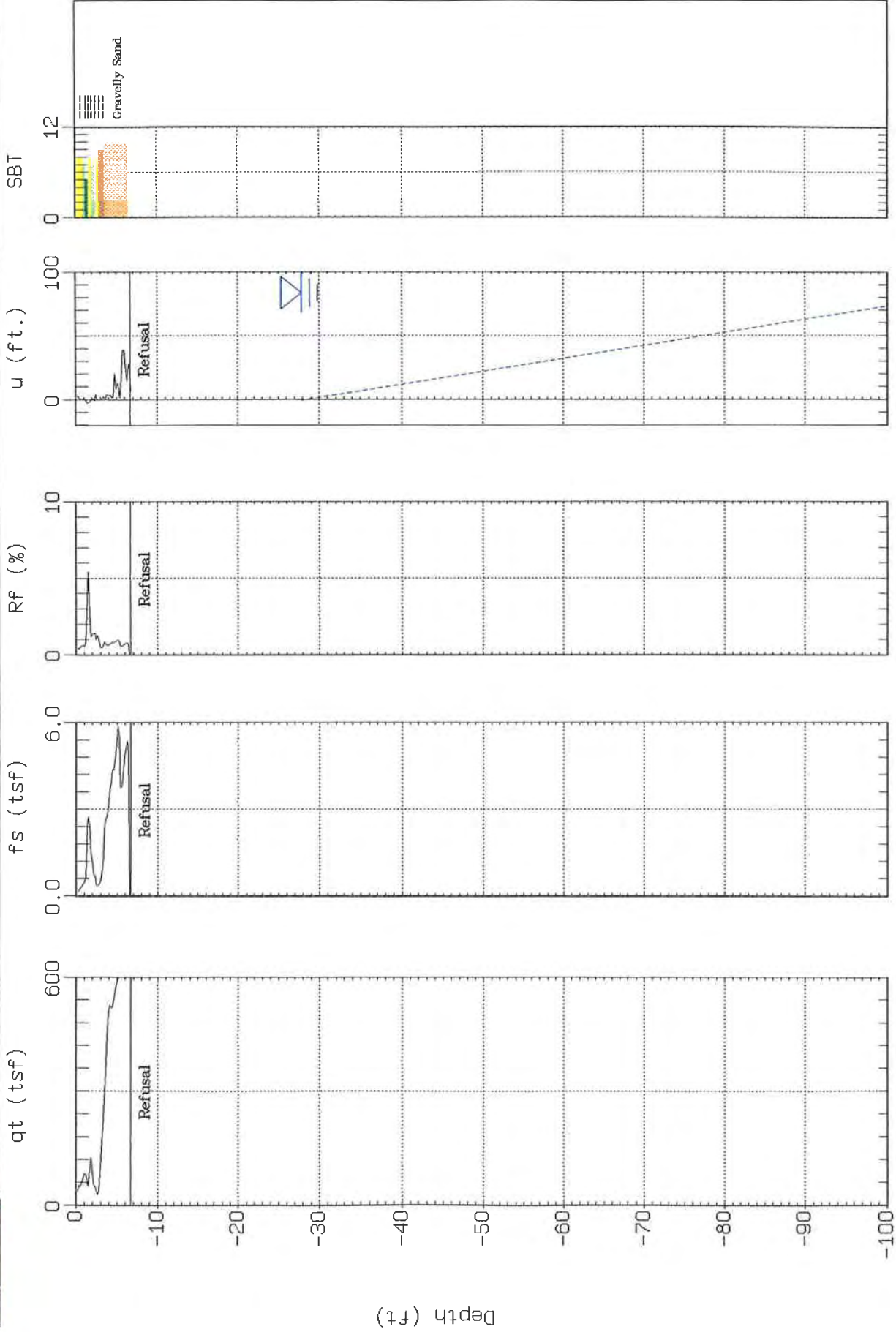




GEI Consultants

Sounding: CPT-13  
Site: National Labs

Piezocone: 20 Ton AD164  
Date: 07:20:06 12:23



Max. Depth: 6.73 (ft)  
Depth Inc.: 0.164 (ft)

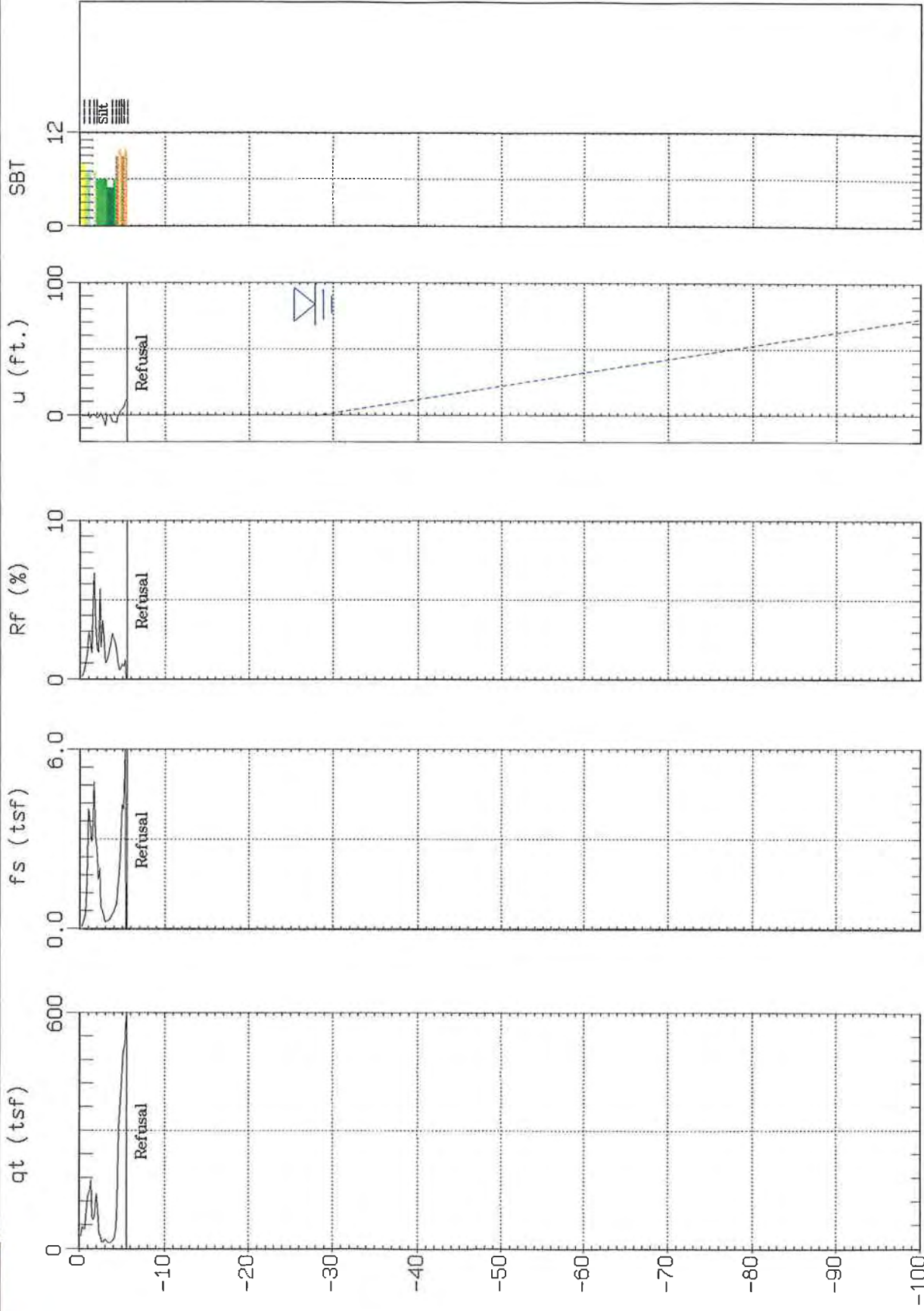
SBT: Soil Behavior Type (Robertson 1990)  
Estimated Phreatic Surface



GEI Consultants

Sounding: CPT-13A  
Site: National Labs

Piezocene: 20 Ton AD164  
Date: 07:20:06 12:50



Max. Depth: 5.58 (ft)  
Depth Inc.: 0.164 (ft)

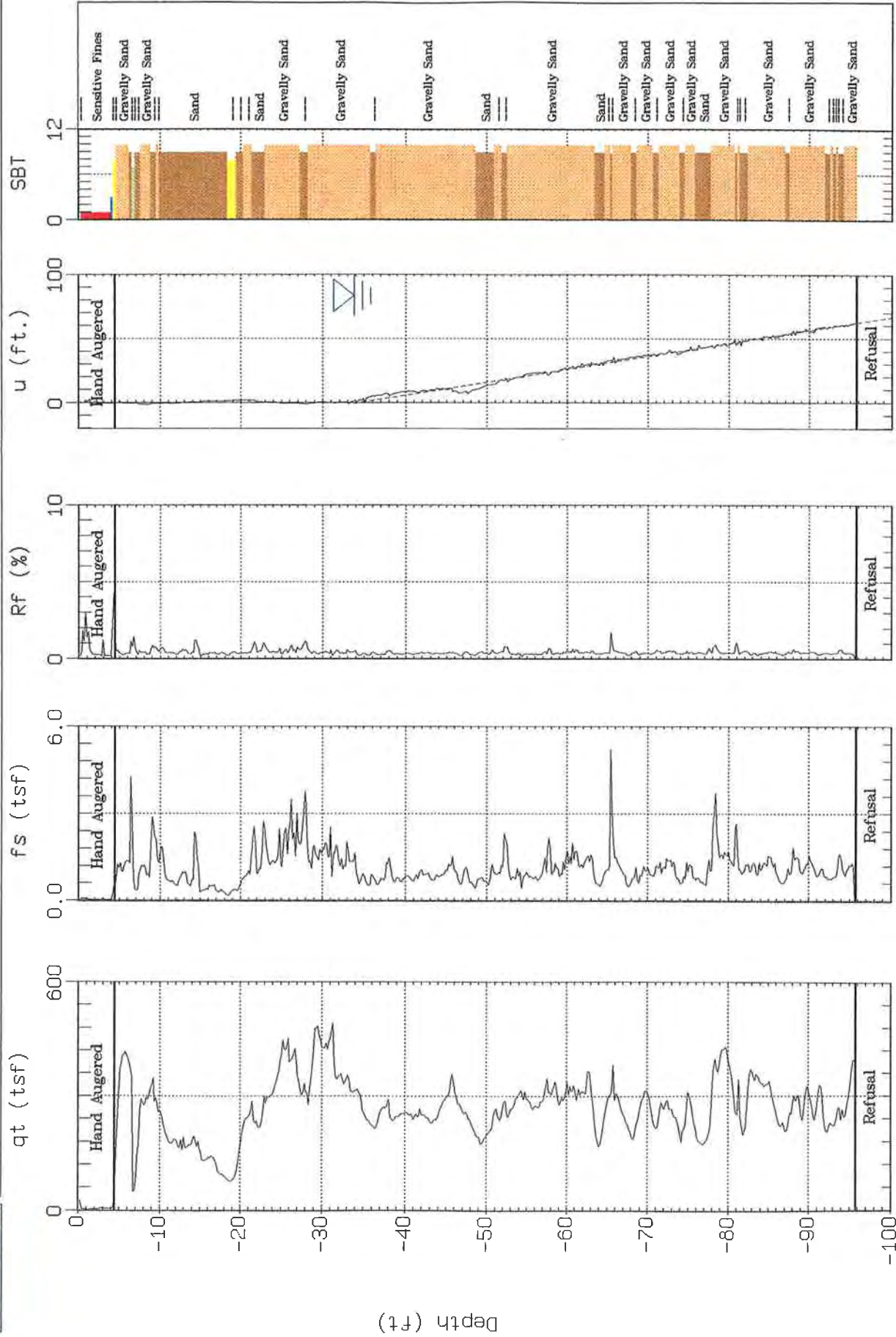
SBT: Soil Behavior Type (Robertson 1990)  
△ Estimated Phreatic Surface



GEI Consultants

Sounding: CPT-14  
Site: National Labs

Piezocene: 20 Ton AD179  
Date: 07:21:06 07:28



SBT: Soil Behavior Type (Robertson 1990)  
Estimated Phreatic Surface

Max. Depth: 95.80 (ft)  
Depth Inc.: 0.164 (ft)

## Appendix E

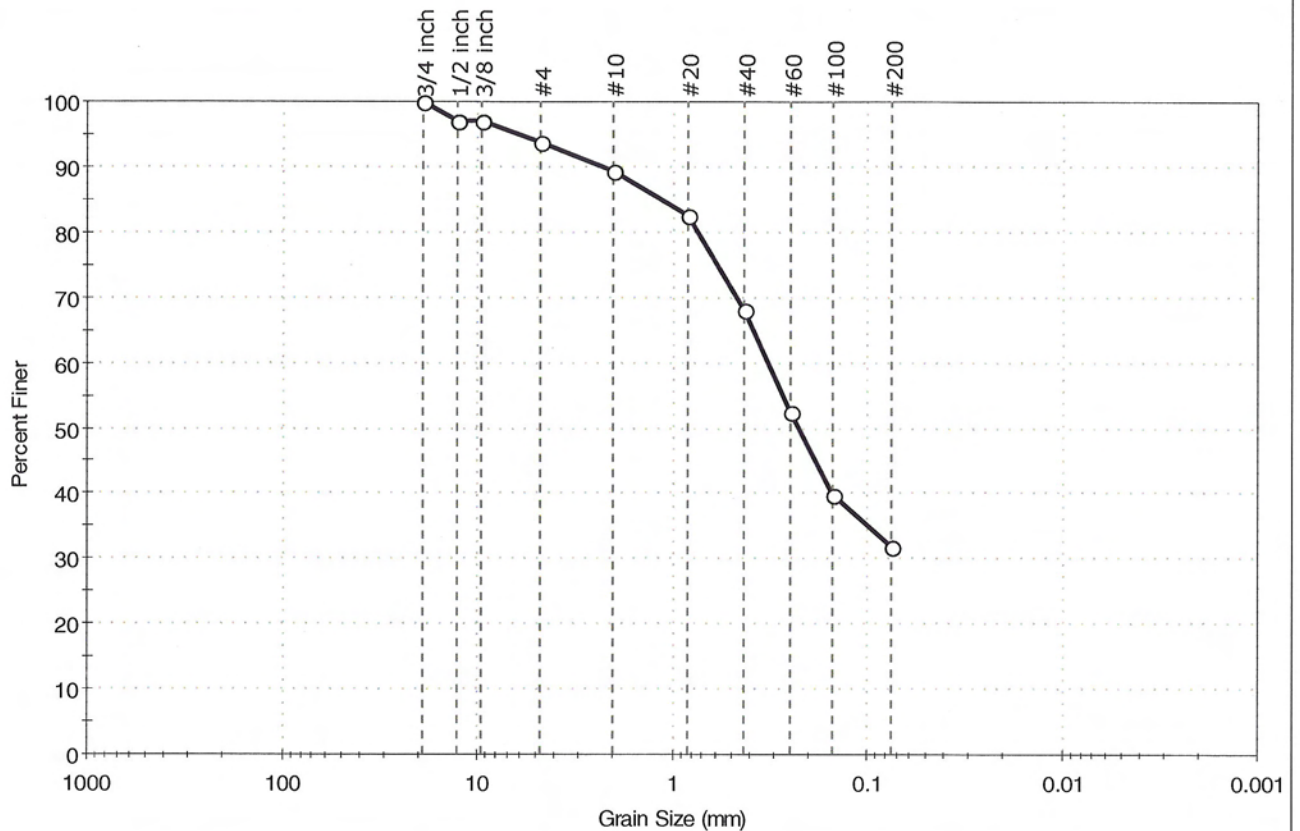
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### Laboratory Test Results



Client: GEI Consultants	Project: Brookhaven National Laboratory	Location: Upton, NY	Project No: GTX-6864
Boring ID: B-101	Sample Type: jar	Tested By: pcs	Checked By: jdt
Sample ID: S-1	Test Date: 08/04/06	Test Id: 94474	
Depth: 0-2 ft			
Test Comment: sieve stack 6			
Sample Description: Moist, yellowish brown silty sand			
Sample Comment: ---			

## Particle Size Analysis - ASTM D 422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	6.2	61.9	31.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3/4 inch	19.00	100		
1/2 inch	12.70	97		
3/8 inch	9.51	97		
#4	4.75	94		
#10	2.00	89		
#20	0.84	83		
#40	0.42	68		
#60	0.25	52		
#100	0.15	40		
#200	0.075	32		

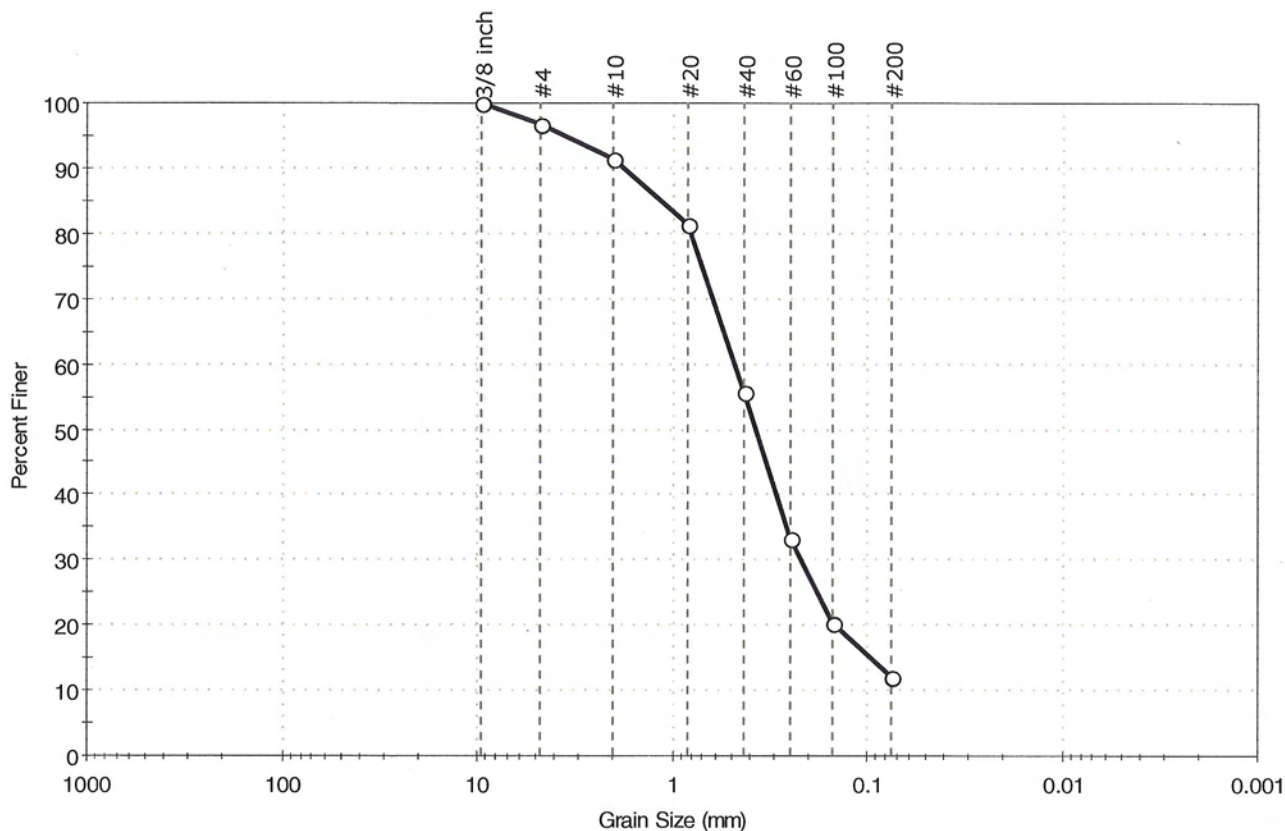
<u>Coefficients</u>	
D <sub>85</sub> = 1.1382 mm	D <sub>30</sub> = N/A
D <sub>60</sub> = 0.3233 mm	D <sub>15</sub> = N/A
D <sub>50</sub> = 0.2260 mm	D <sub>10</sub> = N/A
C <sub>u</sub> = N/A	C <sub>c</sub> = N/A

<u>Classification</u>	
ASTM	N/A
AASHTO	Silty Gravel and Sand (A-2-4 (0))

<u>Sample/Test Description</u>
Sand/Gravel Particle Shape : ROUNDED
Sand/Gravel Hardness : HARD

Client: GEI Consultants	Project: Brookhaven National Laboratory	Location: Upton, NY	Project No: GTX-6864
Boring ID: B-101	Sample Type: jar	Tested By: pcs	Checked By: jdt
Sample ID: S-2	Test Date: 08/04/06	Test Id: 94475	
Depth: 5-7 ft			
Test Comment: sieve stack 6			
Sample Description: Moist, light gray silty sand			
Sample Comment: ---			

## Particle Size Analysis - ASTM D 422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	3.2	84.6	12.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3/8 inch	9.51	100		
#4	4.75	97		
#10	2.00	91		
#20	0.84	81		
#40	0.42	56		
#60	0.25	33		
#100	0.15	20		
#200	0.075	12		

<u>Coefficients</u>	
D <sub>85</sub> = 1.1429 mm	D <sub>30</sub> = 0.2189 mm
D <sub>60</sub> = 0.4753 mm	D <sub>15</sub> = 0.0949 mm
D <sub>50</sub> = 0.3706 mm	D <sub>10</sub> = 0.0622 mm
C <sub>u</sub> = 7.641	C <sub>c</sub> = 1.621

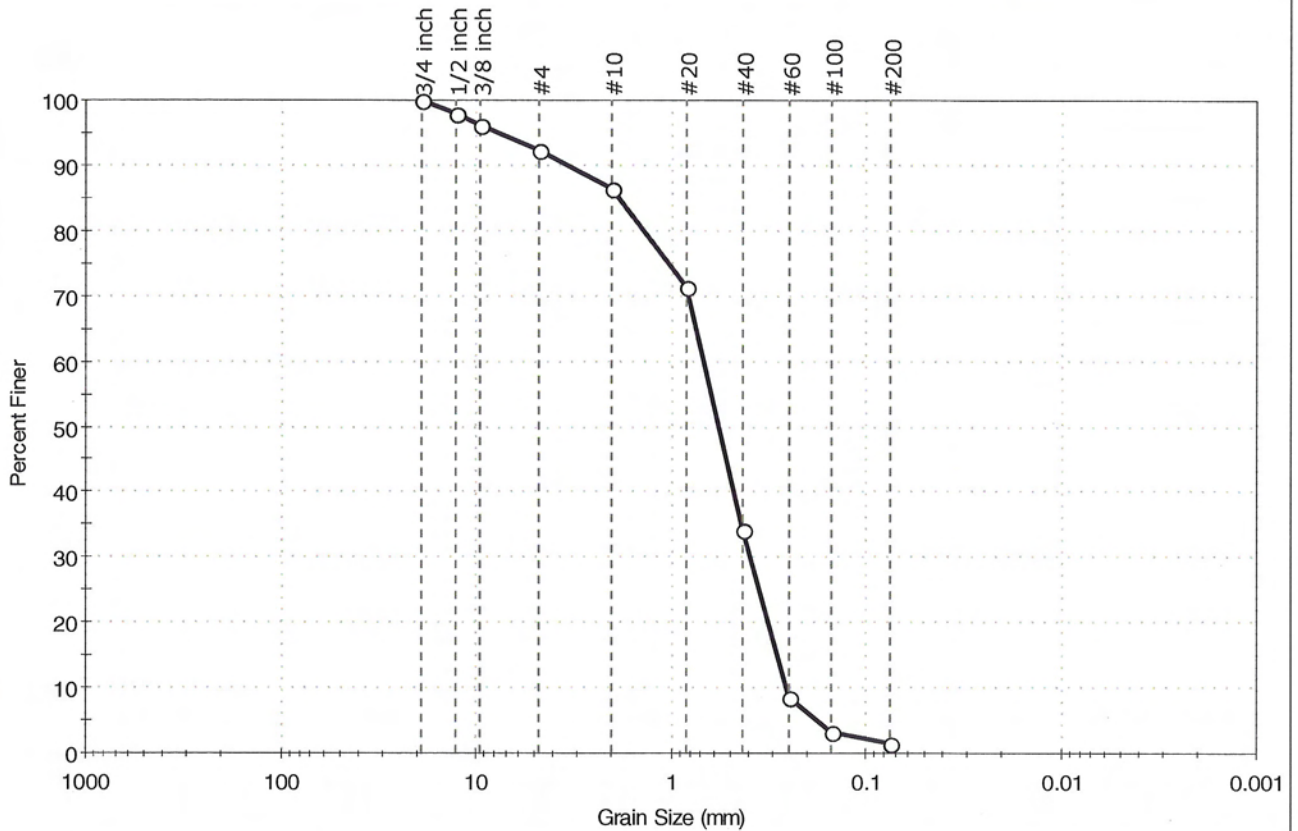
<u>Classification</u>	
ASTM	N/A
AASHTO	Silty Gravel and Sand (A-2-4 (0))

<u>Sample/Test Description</u>
Sand/Gravel Particle Shape : ANGULAR
Sand/Gravel Hardness : HARD



Client: GEI Consultants	Project: Brookhaven National Laboratory	Location: Upton, NY	Project No: GTX-6864
Boring ID: B-101	Sample Type: jar	Tested By: pcs	Checked By: jdt
Sample ID: S-3	Test Date: 08/04/06	Test Id: 94476	
Depth: 10-12 ft			
Test Comment: sieve stack 6			
Sample Description: Moist, light gray sand			
Sample Comment: ---			

## Particle Size Analysis - ASTM D 422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	7.8	90.8	1.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3/4 inch	19.00	100		
1/2 inch	12.70	98		
3/8 inch	9.51	96		
#4	4.75	92		
#10	2.00	86		
#20	0.84	71		
#40	0.42	34		
#60	0.25	9		
#100	0.15	3		
#200	0.075	1		

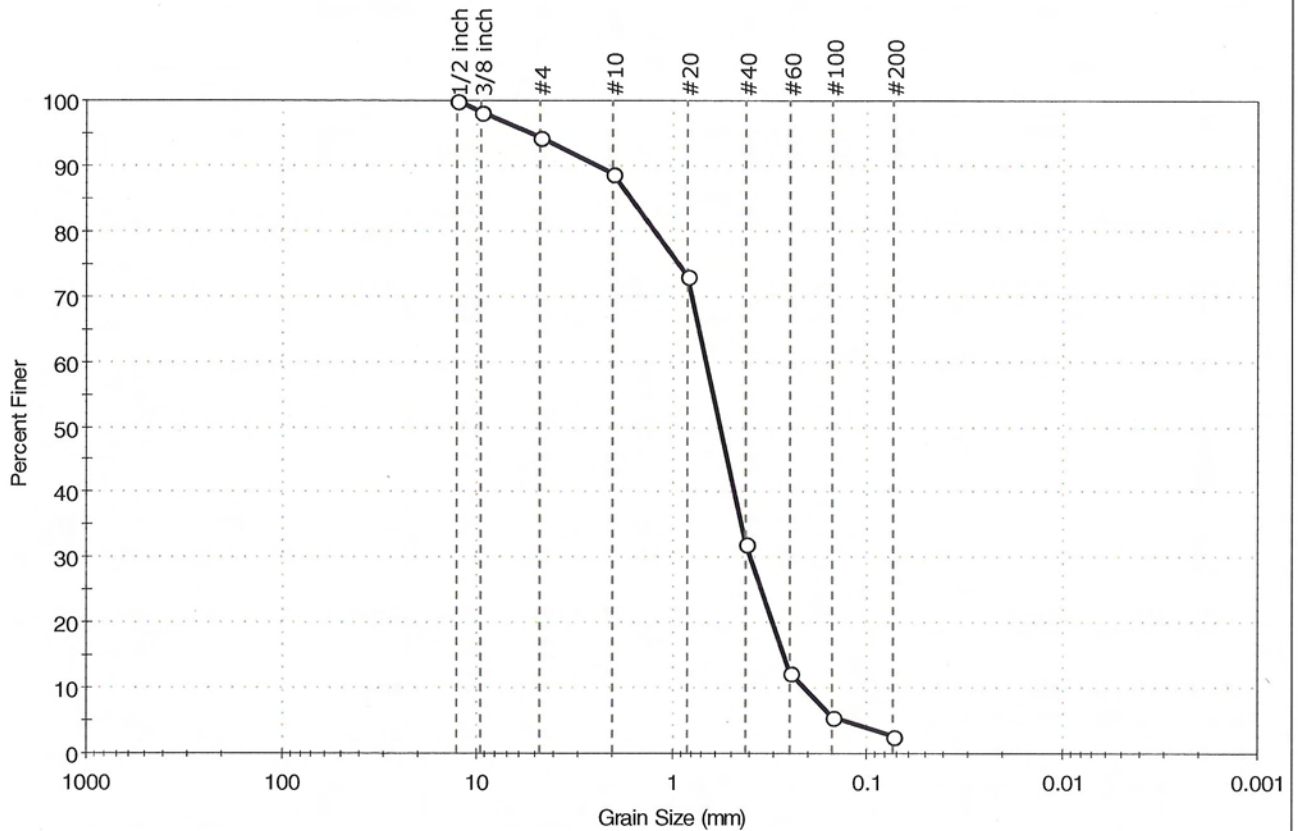
<b>Coefficients</b>	
D <sub>85</sub> = 1.8530 mm	D <sub>30</sub> = 0.3886 mm
D <sub>60</sub> = 0.6828 mm	D <sub>15</sub> = 0.2854 mm
D <sub>50</sub> = 0.5676 mm	D <sub>10</sub> = 0.2575 mm
C <sub>u</sub> = 2.652	C <sub>c</sub> = 0.859

<b>Classification</b>	
<b>ASTM</b>	Poorly graded sand (SP)
<b>AASHTO</b>	Stone Fragments, Gravel and Sand (A-1-b (0))

<b>Sample/Test Description</b>	
Sand/Gravel Particle Shape :	ANGULAR
Sand/Gravel Hardness :	HARD

Client: GEI Consultants	Project: Brookhaven National Laboratory	Location: Upton, NY	Project No: GTX-6864
Boring ID: B-101	Sample Type: jar	Tested By: pcs	Checked By: jdt
Sample ID: S-4	Test Date: 08/04/06	Test Id: 94477	
Depth: 15-17 ft			
Test Comment: sieve stack 1			
Sample Description: Moist, light gray sand			
Sample Comment: ---			

## Particle Size Analysis - ASTM D 422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	5.5	91.8	2.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1/2 Inch	12.70	100		
3/8 Inch	9.51	98		
#4	4.75	95		
#10	2.00	89		
#20	0.84	73		
#40	0.42	32		
#60	0.25	12		
#100	0.15	6		
#200	0.074	3		

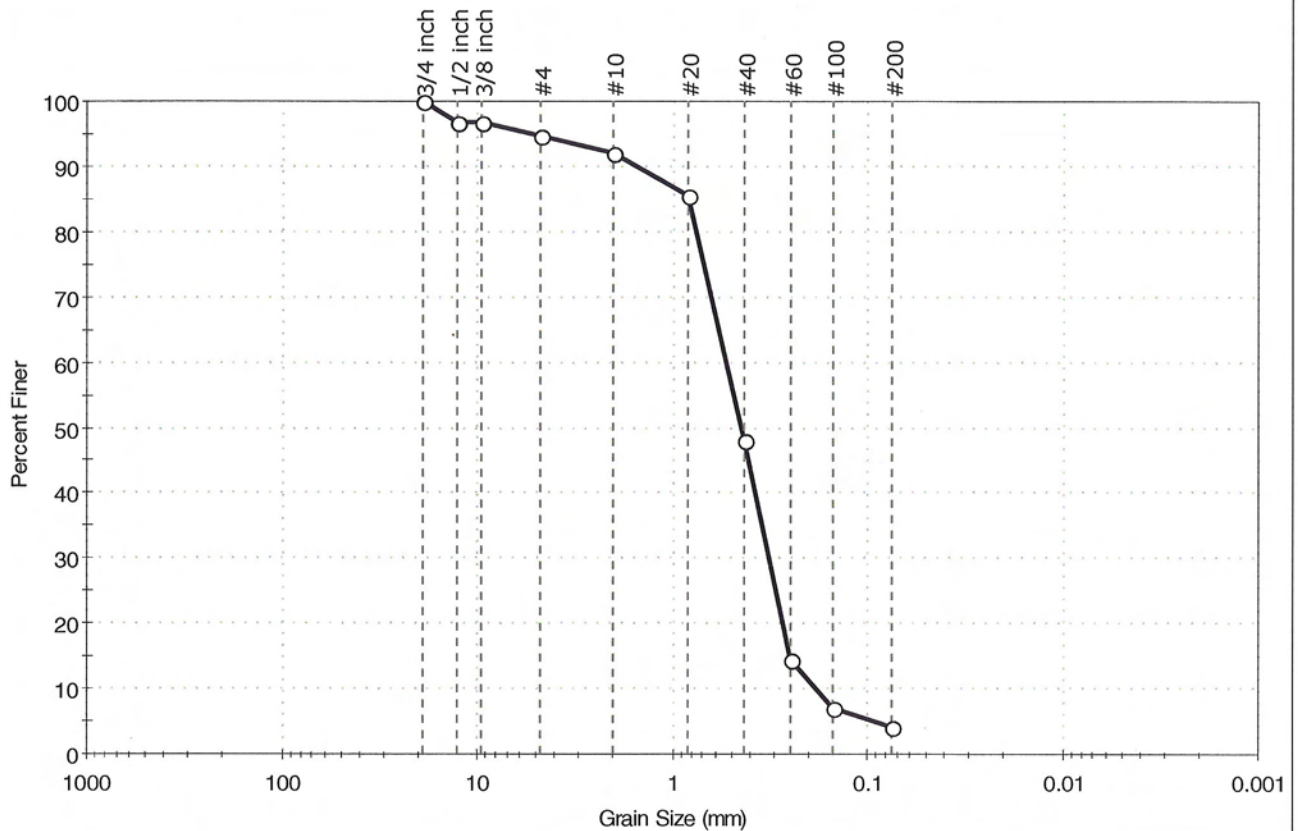
<b>Coefficients</b>	
D <sub>85</sub> = 1.6294 mm	D <sub>30</sub> = 0.3979 mm
D <sub>60</sub> = 0.6737 mm	D <sub>15</sub> = 0.2672 mm
D <sub>50</sub> = 0.5689 mm	D <sub>10</sub> = 0.2070 mm
C <sub>u</sub> = 3.255	C <sub>c</sub> = 1.135

<b>Classification</b>	
<b>ASTM</b>	Poorly graded sand (SP)
<b>AASHTO</b>	Stone Fragments, Gravel and Sand (A-1-b (0))

<b>Sample/Test Description</b>	
Sand/Gravel Particle Shape :	ANGULAR
Sand/Gravel Hardness :	HARD

Client: GEI Consultants	Project: Brookhaven National Laboratory	Location: Upton, NY	Project No: GTX-6864
Boring ID: B-101	Sample Type: jar	Tested By: pcs	Checked By: jdt
Sample ID: S-5	Test Date: 08/02/06	Test Id: 94478	
Depth: 20-22 ft			
Test Comment: sieve stack 6			
Sample Description: Moist, white sand			
Sample Comment: ---			

## Particle Size Analysis - ASTM D 422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	5.4	90.5	4.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3/4 inch	19.00	100		
1/2 inch	12.70	97		
3/8 inch	9.51	97		
#4	4.75	95		
#10	2.00	92		
#20	0.84	86		
#40	0.42	48		
#60	0.25	15		
#100	0.15	7		
#200	0.075	4		

<b>Coefficients</b>	
D <sub>85</sub> = 0.8317 mm	D <sub>30</sub> = 0.3192 mm
D <sub>60</sub> = 0.5280 mm	D <sub>15</sub> = 0.2516 mm
D <sub>50</sub> = 0.4402 mm	D <sub>10</sub> = 0.1818 mm
C <sub>u</sub> = 2.904	C <sub>c</sub> = 1.061

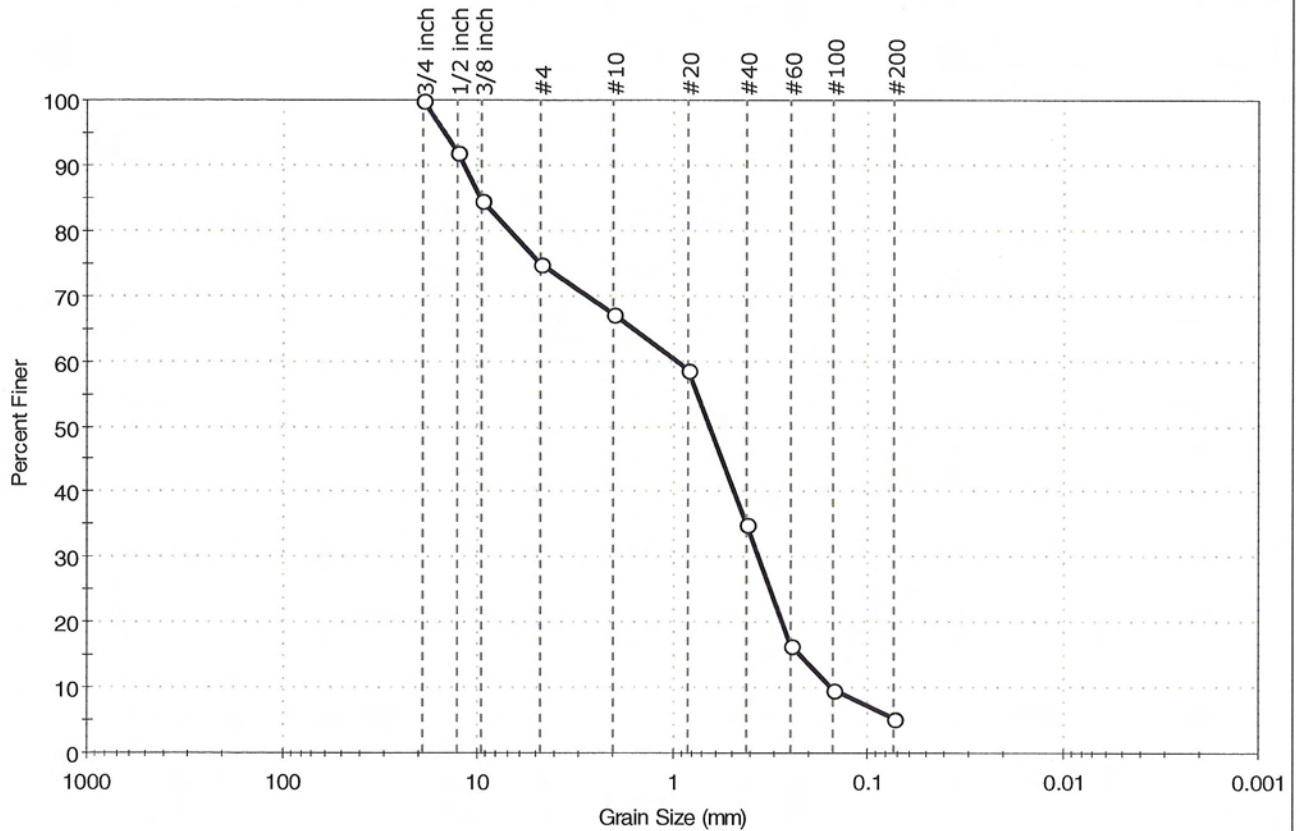
<b>Classification</b>	
<b>ASTM</b>	Poorly graded sand (SP)
<b>AASHTO</b>	Stone Fragments, Gravel and Sand (A-1-b (0))

<b>Sample/Test Description</b>	
Sand/Gravel Particle Shape :	ANGULAR
Sand/Gravel Hardness :	HARD



Client: GEI Consultants	Project: Brookhaven National Laboratory	Location: Upton, NY	Project No: GTX-6864
Boring ID: B-101	Sample Type: jar	Tested By: pcs	Checked By: jdt
Sample ID: S-6	Test Date: 08/02/06	Test Id: 94479	
Depth: 25-27 ft			
Test Comment: sieve stack 1			
Sample Description: Moist, very pale brown sand with silt and gravel			
Sample Comment: ---			

## Particle Size Analysis - ASTM D 422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	25.2	69.5	5.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3/4 inch	19.00	100		
1/2 inch	12.70	92		
3/8 inch	9.51	85		
#4	4.75	75		
#10	2.00	67		
#20	0.84	59		
#40	0.42	35		
#60	0.25	17		
#100	0.15	10		
#200	0.074	5		

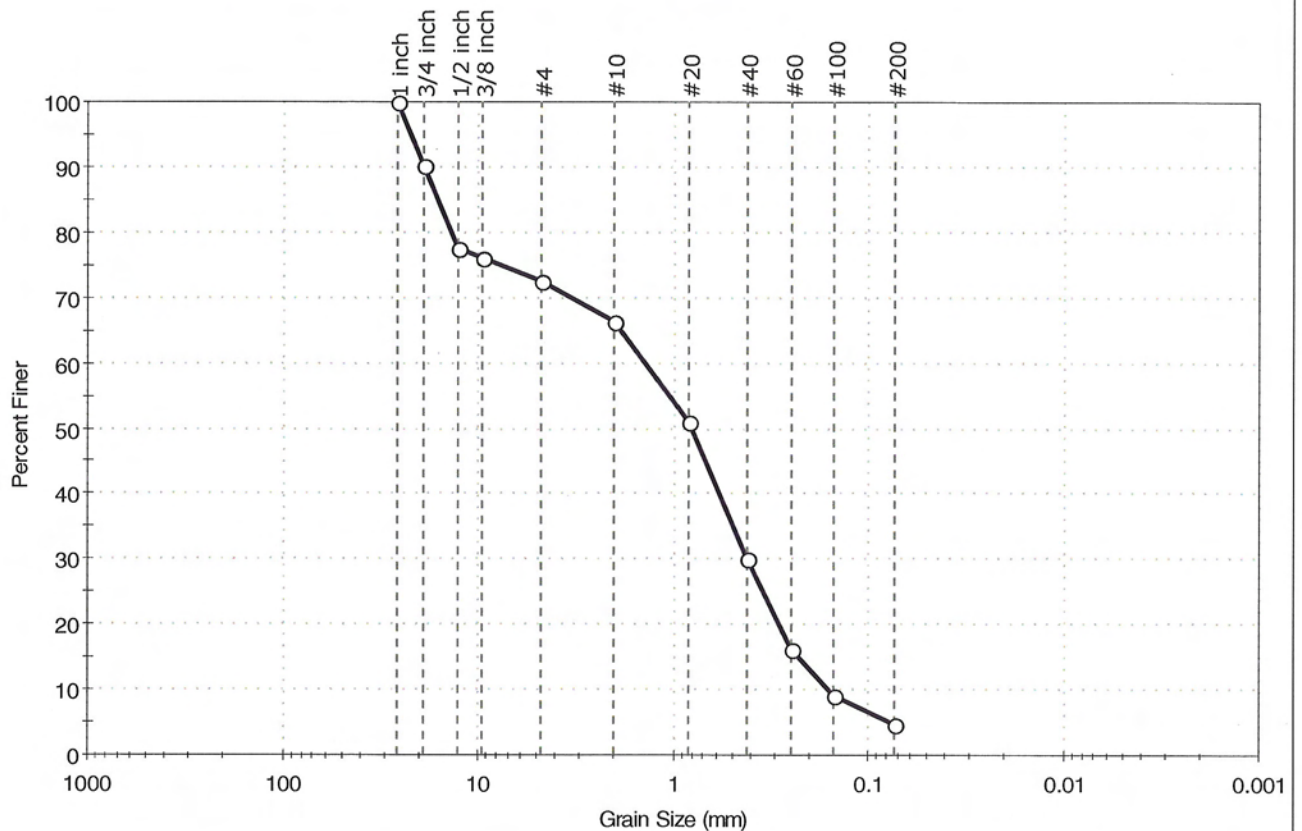
<u>Coefficients</u>	
D <sub>85</sub> = 9.6327 mm	D <sub>30</sub> = 0.3633 mm
D <sub>60</sub> = 0.9539 mm	D <sub>15</sub> = 0.2209 mm
D <sub>50</sub> = 0.6500 mm	D <sub>10</sub> = 0.1520 mm
C <sub>u</sub> = 6.276	C <sub>c</sub> = 0.910

<u>Classification</u>	
ASTM	N/A
AASHTO	Stone Fragments, Gravel and Sand (A-1-b (0))

<u>Sample/Test Description</u>
Sand/Gravel Particle Shape : ROUNDED
Sand/Gravel Hardness : HARD

Client: GEI Consultants	Project: Brookhaven National Laboratory	Location: Upton, NY	Project No: GTX-6864
Boring ID: B-101	Sample Type: jar	Tested By: pcs	Checked By: jdt
Sample ID: S-8	Test Date: 08/04/06	Test Id: 94480	
Depth: 35-37 ft			
Test Comment: sieve stack 1			
Sample Description: Moist, pale brown sand with gravel			
Sample Comment: ---			

## Particle Size Analysis - ASTM D 422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	27.3	68.1	4.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 inch	25.70	100		
3/4 inch	19.00	90		
1/2 inch	12.70	78		
3/8 inch	9.51	76		
#4	4.75	73		
#10	2.00	66		
#20	0.84	51		
#40	0.42	30		
#60	0.25	16		
#100	0.15	9		
#200	0.074	5		

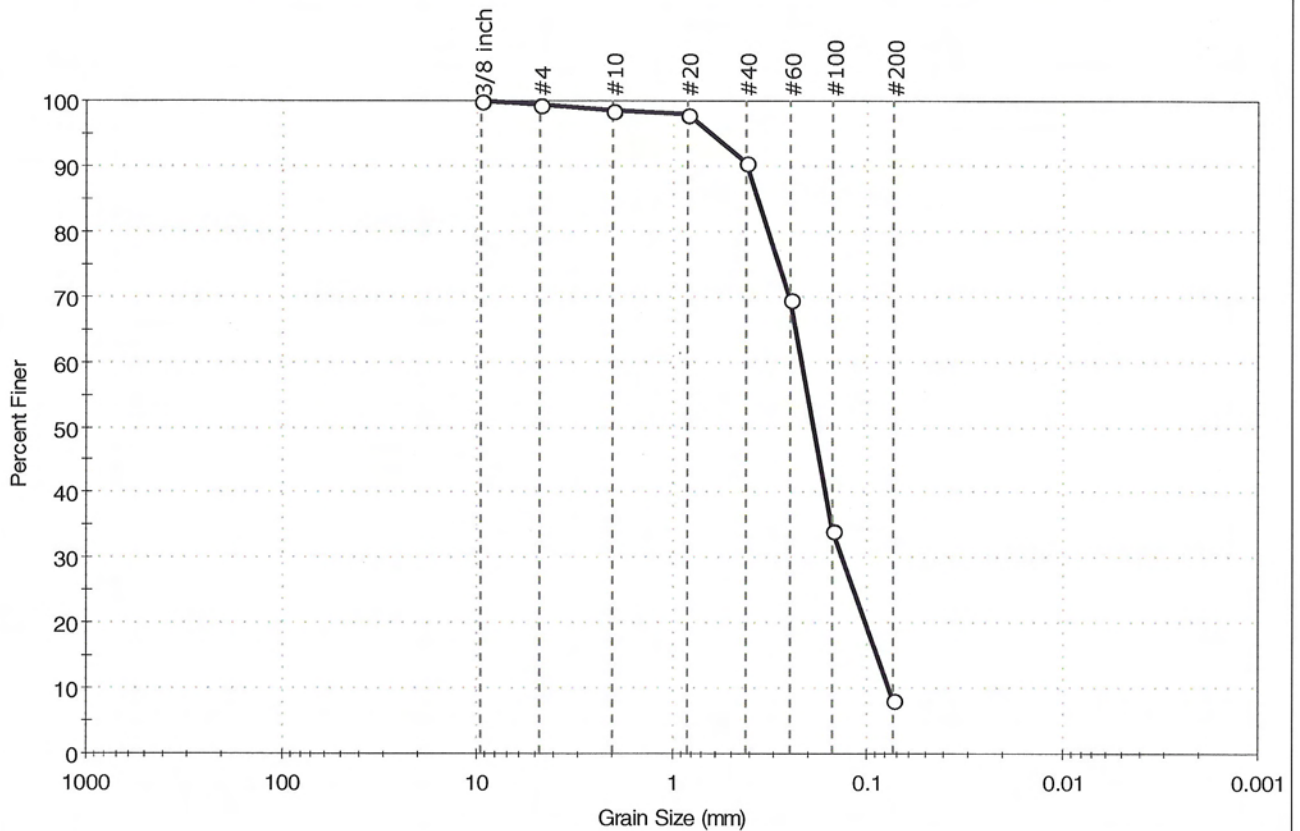
Coefficients	
D <sub>85</sub> = 16.0845 mm	D <sub>30</sub> = 0.4168 mm
D <sub>60</sub> = 1.3899 mm	D <sub>15</sub> = 0.2294 mm
D <sub>50</sub> = 0.8125 mm	D <sub>10</sub> = 0.1594 mm
C <sub>u</sub> = 8.720	C <sub>c</sub> = 0.784

Classification	
ASTM	Poorly graded sand with gravel (SP)
AASHTO	Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description	
Sand/Gravel Particle Shape	: ANGULAR
Sand/Gravel Hardness	: HARD

Client: GEI Consultants	Project: Brookhaven National Laboratory	Location: Upton, NY	Project No: GTX-6864
Boring ID: B-101	Sample Type: jar	Tested By: pcs	Checked By: jdt
Sample ID: S-10	Test Date: 08/04/06	Test Id: 94481	
Depth: 45-47 ft			
Test Comment: sieve stack 1	Sample Description: Moist, light yellowish brown sand with silt		
Sample Comment: ---			

## Particle Size Analysis - ASTM D 422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.5	91.2	8.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3/8 inch	9.51	100		
#4	4.75	99		
#10	2.00	99		
#20	0.84	98		
#40	0.42	90		
#60	0.25	70		
#100	0.15	34		
#200	0.074	8		

<u>Coefficients</u>	
D <sub>85</sub> = 0.3666 mm	D <sub>30</sub> = 0.1332 mm
D <sub>60</sub> = 0.2172 mm	D <sub>15</sub> = 0.0888 mm
D <sub>50</sub> = 0.1877 mm	D <sub>10</sub> = 0.0775 mm
C <sub>u</sub> = 2.803	C <sub>c</sub> = 1.054

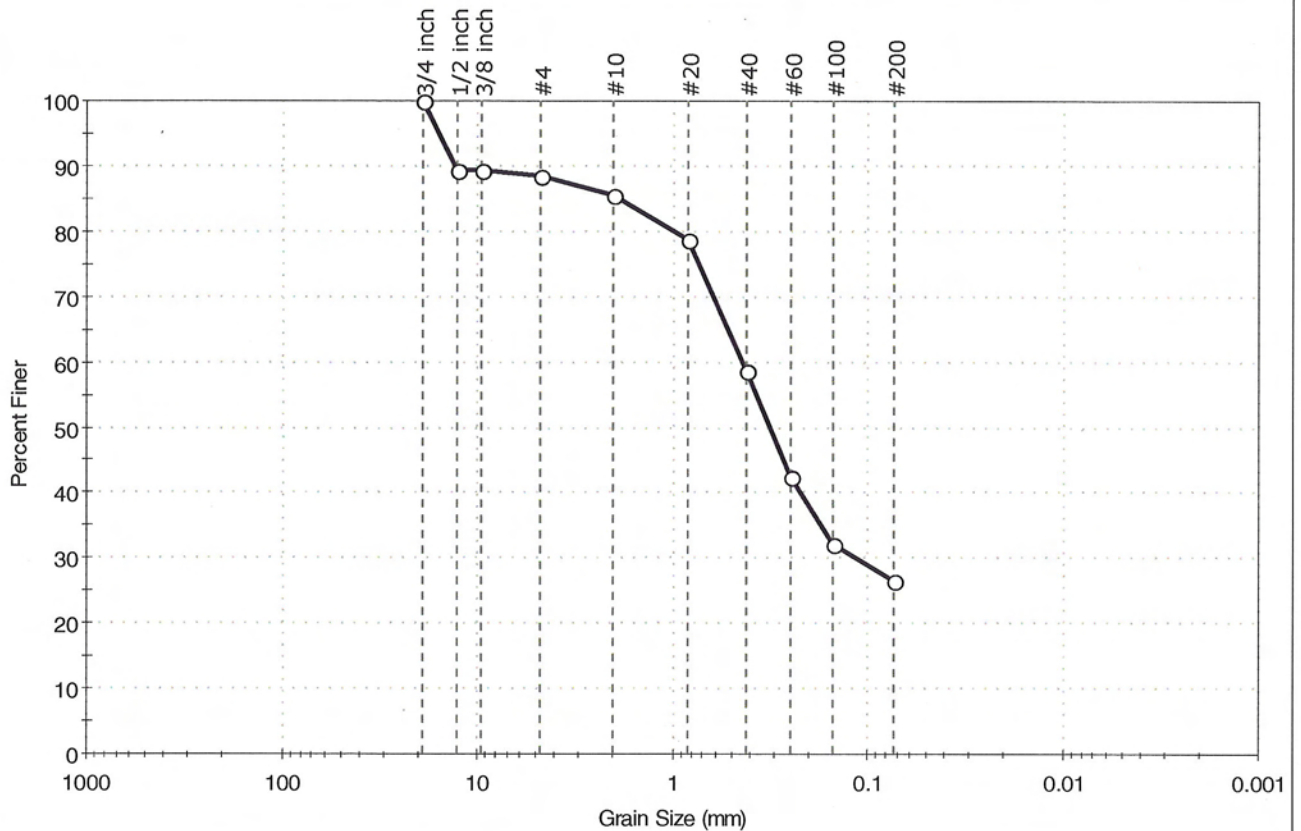
<u>Classification</u>	
ASTM	N/A
AASHTO	Fine Sand (A-3 (0))

<u>Sample/Test Description</u>
Sand/Gravel Particle Shape : ---
Sand/Gravel Hardness : ---



Client: GEI Consultants	Project: Brookhaven National Laboratory	Location: Upton, NY	Project No: GTX-6864
Boring ID: B-102	Sample Type: jar	Tested By: pcs	Checked By: jdt
Sample ID: S-1	Test Date: 08/04/06	Test Id: 94482	
Depth: 0-2 ft			
Test Comment: sieve stack 1			
Sample Description: Moist, Dark yellowish brown silty sand			
Sample Comment: ---			

## Particle Size Analysis - ASTM D 422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	11.4	61.9	26.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3/4 inch	19.00	100		
1/2 inch	12.70	89		
3/8 inch	9.51	89		
#4	4.75	89		
#10	2.00	86		
#20	0.84	79		
#40	0.42	59		
#60	0.25	42		
#100	0.15	32		
#200	0.074	27		

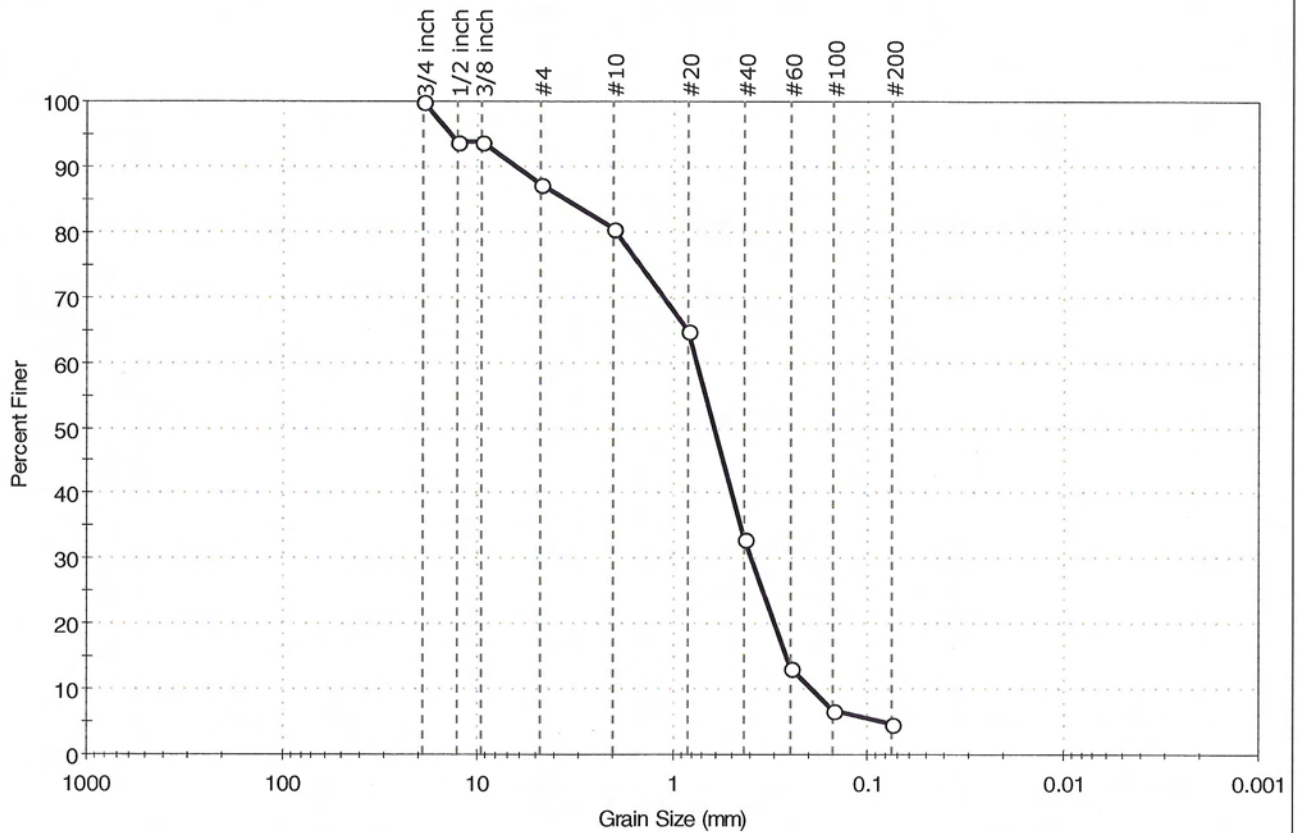
<u>Coefficients</u>	
D <sub>85</sub> = 1.8592 mm	D <sub>30</sub> = 0.1121 mm
D <sub>60</sub> = 0.4377 mm	D <sub>15</sub> = N/A
D <sub>50</sub> = 0.3177 mm	D <sub>10</sub> = N/A
C <sub>u</sub> = N/A	C <sub>c</sub> = N/A

<u>Classification</u>	
ASTM	N/A
AASHTO	Silty Gravel and Sand (A-2-4 (0))

<u>Sample/Test Description</u>
Sand/Gravel Particle Shape : ANGULAR
Sand/Gravel Hardness : HARD

Client: GEI Consultants	Project: Brookhaven National Laboratory	Location: Upton, NY	Project No: GTX-6864
Boring ID: B-102	Sample Type: jar	Tested By: pcs	Checked By: jdt
Sample ID: S-2	Test Date: 08/04/06	Test Id: 94483	
Depth: 5-7 ft			
Test Comment: sieve stack 6			
Sample Description: Moist, light olive brown sand			
Sample Comment: ---			

## Particle Size Analysis - ASTM D 422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	12.7	82.7	4.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3/4 inch	19.00	100		
1/2 inch	12.70	94		
3/8 inch	9.51	94		
#4	4.75	87		
#10	2.00	81		
#20	0.84	65		
#40	0.42	33		
#60	0.25	13		
#100	0.15	7		
#200	0.075	5		

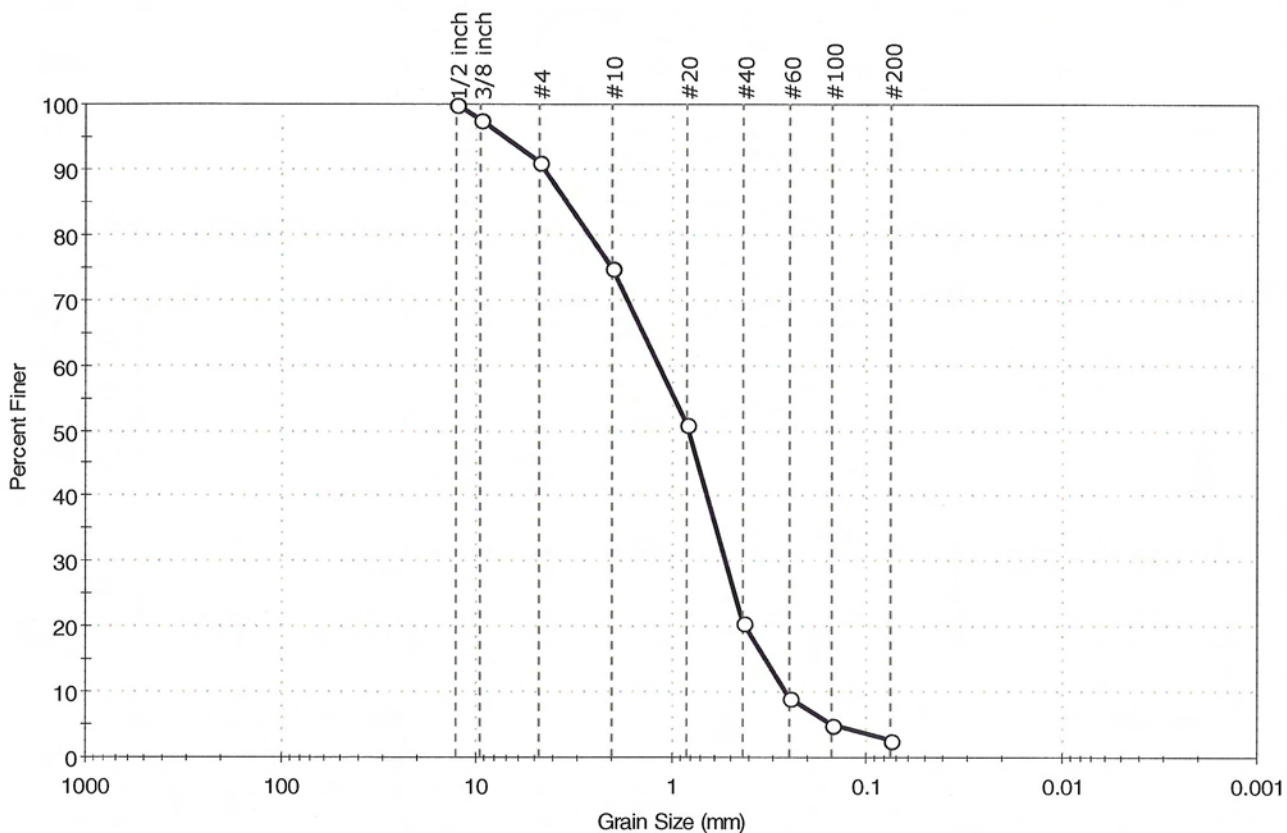
Coefficients	
D <sub>85</sub> = 3.5367 mm	D <sub>30</sub> = 0.3920 mm
D <sub>60</sub> = 0.7575 mm	D <sub>15</sub> = 0.2627 mm
D <sub>50</sub> = 0.6114 mm	D <sub>10</sub> = 0.1938 mm
C <sub>u</sub> = 3.909	C <sub>c</sub> = 1.047

Classification	
ASTM	Poorly graded sand (SP)
AASHTO	Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description	
Sand/Gravel Particle Shape	: ANGULAR
Sand/Gravel Hardness	: HARD

Client: GEI Consultants	Project: Brookhaven National Laboratory	Location: Upton, NY	Project No: GTX-6864
Boring ID: B-102	Sample Type: jar	Tested By: pcs	Checked By: jdt
Sample ID: S-3	Test Date: 08/04/06	Test ID: 94484	
Depth: 10-12 ft			
Test Comment: sieve stack 6			
Sample Description: Moist, light yellowish brown sand			
Sample Comment: ---			

## Particle Size Analysis - ASTM D 422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	9.0	88.2	2.8

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1/2 inch	12.70	100		
3/8 inch	9.51	98		
#4	4.75	91		
#10	2.00	75		
#20	0.84	51		
#40	0.42	21		
#60	0.25	9		
#100	0.15	5		
#200	0.075	3		

<b>Coefficients</b>	
D <sub>85</sub> = 3.4384 mm	D <sub>30</sub> = 0.5240 mm
D <sub>60</sub> = 1.1657 mm	D <sub>15</sub> = 0.3278 mm
D <sub>50</sub> = 0.8227 mm	D <sub>10</sub> = 0.2611 mm
C <sub>u</sub> = 4.465	C <sub>c</sub> = 0.902

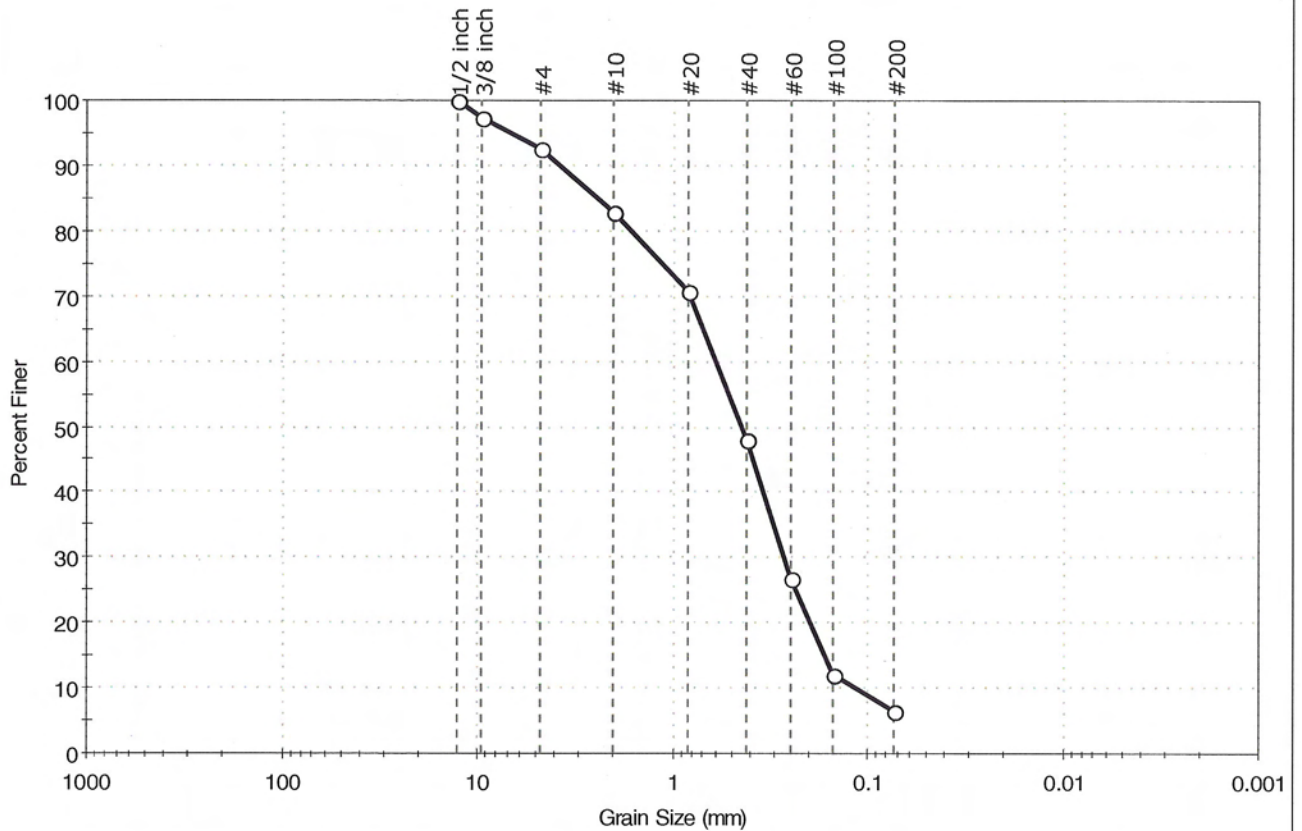
<b>Classification</b>	
<b>ASTM</b>	Poorly graded sand (SP)
<b>AASHTO</b>	Stone Fragments, Gravel and Sand (A-1-b (0))

<b>Sample/Test Description</b>	
Sand/Gravel Particle Shape :	
Sand/Gravel Hardness :	



Client: GEI Consultants	Project: Brookhaven National Laboratory	Location: Upton, NY	Project No: GTX-6864
Boring ID: B-102	Sample Type: jar	Tested By: pcs	Checked By: jdt
Sample ID: S-4	Test Date: 08/02/06	Test Id: 94485	
Depth: 15-17 ft			
Test Comment: sieve stack 1			
Sample Description: Moist, brown sand with silt			
Sample Comment: ---			

## Particle Size Analysis - ASTM D 422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	7.4	86.1	6.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1/2 inch	12.70	100		
3/8 inch	9.51	97		
#4	4.75	93		
#10	2.00	83		
#20	0.84	71		
#40	0.42	48		
#60	0.25	27		
#100	0.15	12		
#200	0.074	7		

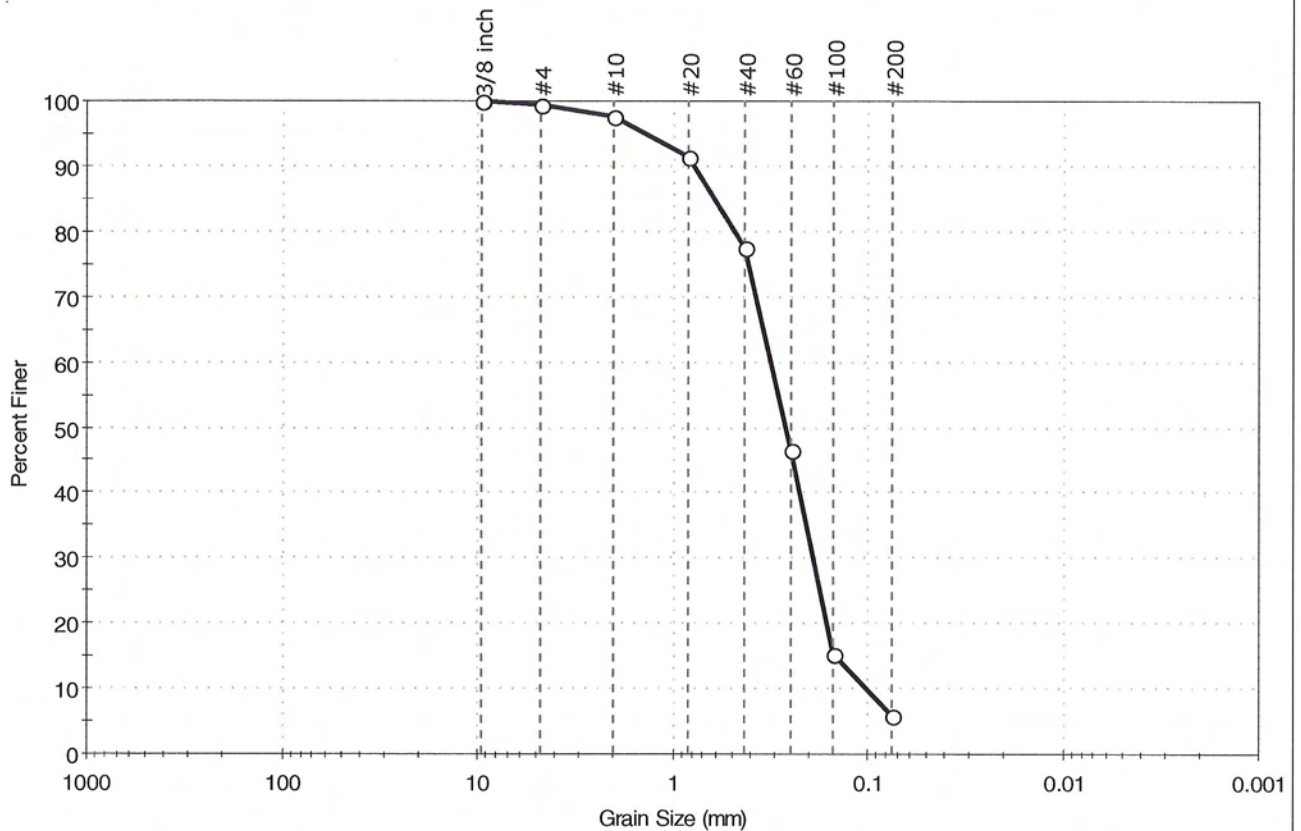
Coefficients	
D <sub>85</sub> = 2.4268 mm	D <sub>30</sub> = 0.2707 mm
D <sub>60</sub> = 0.6058 mm	D <sub>15</sub> = 0.1657 mm
D <sub>50</sub> = 0.4464 mm	D <sub>10</sub> = 0.1157 mm
C <sub>u</sub> = 5.236	C <sub>c</sub> = 1.045

Classification	
ASTM	N/A
AASHTO	Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description	
Sand/Gravel Particle Shape	: ANGULAR
Sand/Gravel Hardness	: HARD

Client: GEI Consultants	Project: Brookhaven National Laboratory	Location: Upton, NY	Project No: GTX-6864
Boring ID: B-102	Sample Type: jar	Tested By: pcs	Checked By: jdt
Sample ID: S-5	Test Date: 08/02/06	Test Id: 94486	
Depth: 20-22 ft			
Test Comment: sieve stack 6			
Sample Description: Moist, light brown sand with silt			
Sample Comment: ---			

## Particle Size Analysis - ASTM D 422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.8	93.2	6.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3/8 inch	9.51	100		
#4	4.75	99		
#10	2.00	98		
#20	0.84	92		
#40	0.42	78		
#60	0.25	47		
#100	0.15	15		
#200	0.075	6		

<u>Coefficients</u>	
D <sub>85</sub> = 0.6113 mm	D <sub>30</sub> = 0.1901 mm
D <sub>60</sub> = 0.3148 mm	D <sub>15</sub> = 0.1455 mm
D <sub>50</sub> = 0.2653 mm	D <sub>10</sub> = 0.1005 mm
C <sub>u</sub> = 3.132	C <sub>c</sub> = 1.142

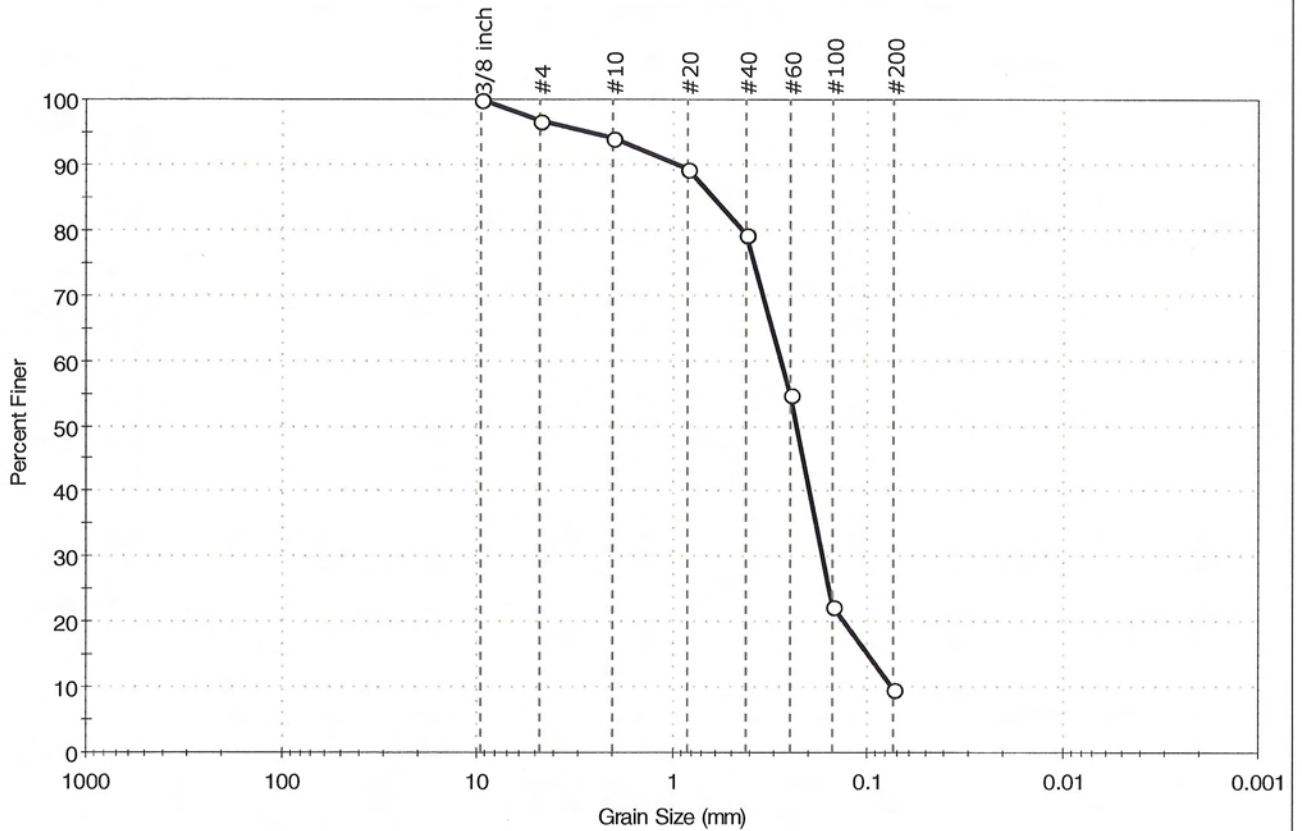
<u>Classification</u>	
ASTM	N/A
AASHTO	Fine Sand (A-3 (0))

<u>Sample/Test Description</u>	
Sand/Gravel Particle Shape	: ---
Sand/Gravel Hardness	: ---



Client: GEI Consultants	Project: Brookhaven National Laboratory	Location: Upton, NY	Project No: GTX-6864
Boring ID: B-102	Sample Type: jar	Tested By: pcs	Checked By: jdt
Sample ID: S-6	Test Date: 08/04/06	Test Id: 94487	
Depth: 25-27 ft			
Test Comment: sieve stack 1			
Sample Description: Moist, light yellowish brown sand with silt			
Sample Comment: ---			

## Particle Size Analysis - ASTM D 422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	3.4	87.0	9.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3/8 inch	9.51	100		
#4	4.75	97		
#10	2.00	94		
#20	0.84	89		
#40	0.42	79		
#60	0.25	55		
#100	0.15	22		
#200	0.074	10		

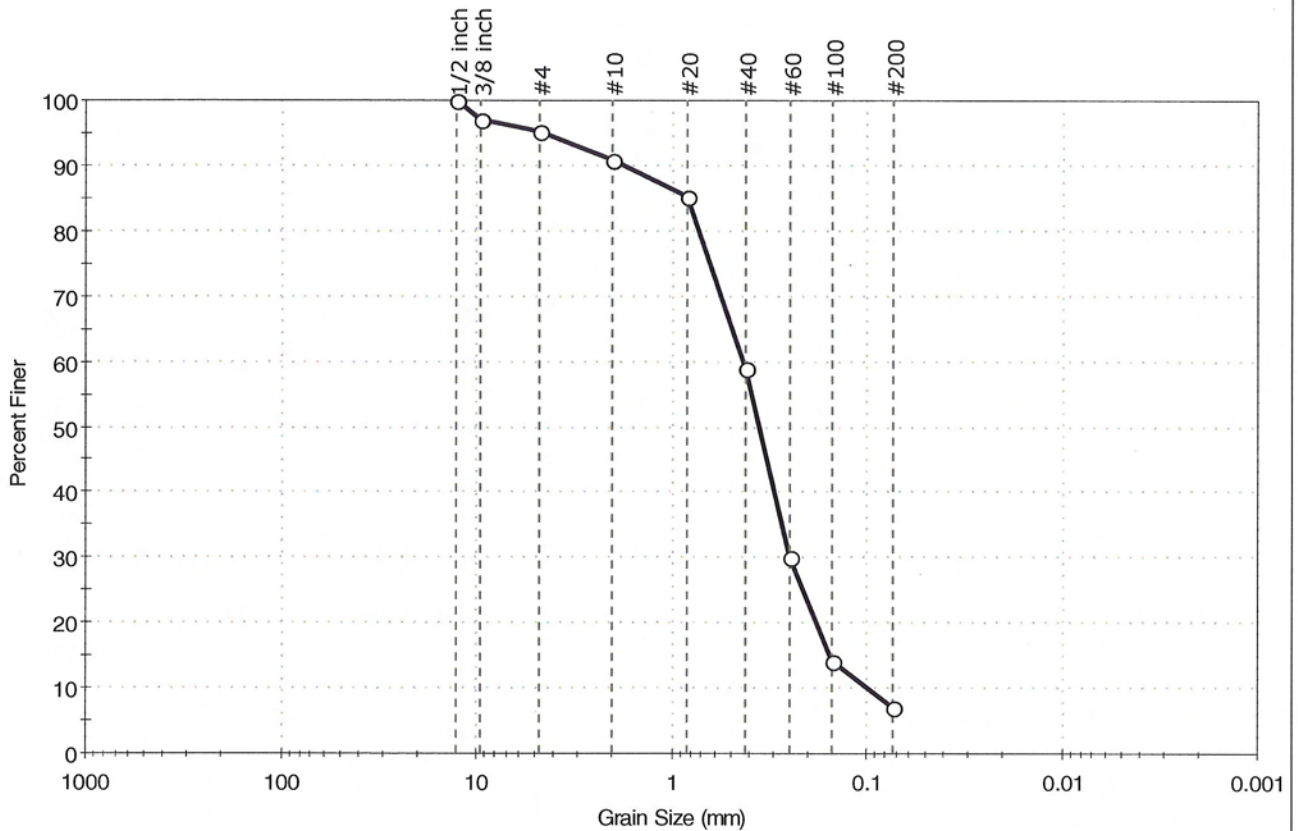
<b>Coefficients</b>	
D <sub>85</sub> = 0.6207 mm	D <sub>30</sub> = 0.1681 mm
D <sub>60</sub> = 0.2791 mm	D <sub>15</sub> = 0.0992 mm
D <sub>50</sub> = 0.2315 mm	D <sub>10</sub> = 0.0756 mm
C <sub>u</sub> = 3.692	C <sub>c</sub> = 1.339

<b>Classification</b>	
ASTM	N/A
AASHTO	Fine Sand (A-3 (0))

<b>Sample/Test Description</b>
Sand/Gravel Particle Shape : ---
Sand/Gravel Hardness : ---

Client: GEI Consultants	Project: Brookhaven National Laboratory	Location: Upton, NY	Project No: GTX-6864
Boring ID: B-102	Sample Type: jar	Tested By: pcs	Checked By: jdt
Sample ID: S-8	Test Date: 08/04/06	Test Id: 94488	
Depth: 35-37 ft			
Test Comment: sieve stack 1			
Sample Description: Moist, pale brown sand with silt			
Sample Comment: ---			

## Particle Size Analysis - ASTM D 422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	4.7	88.2	7.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1/2 inch	12.70	100		
3/8 inch	9.51	97		
#4	4.75	95		
#10	2.00	91		
#20	0.84	85		
#40	0.42	59		
#60	0.25	30		
#100	0.15	14		
#200	0.074	7		

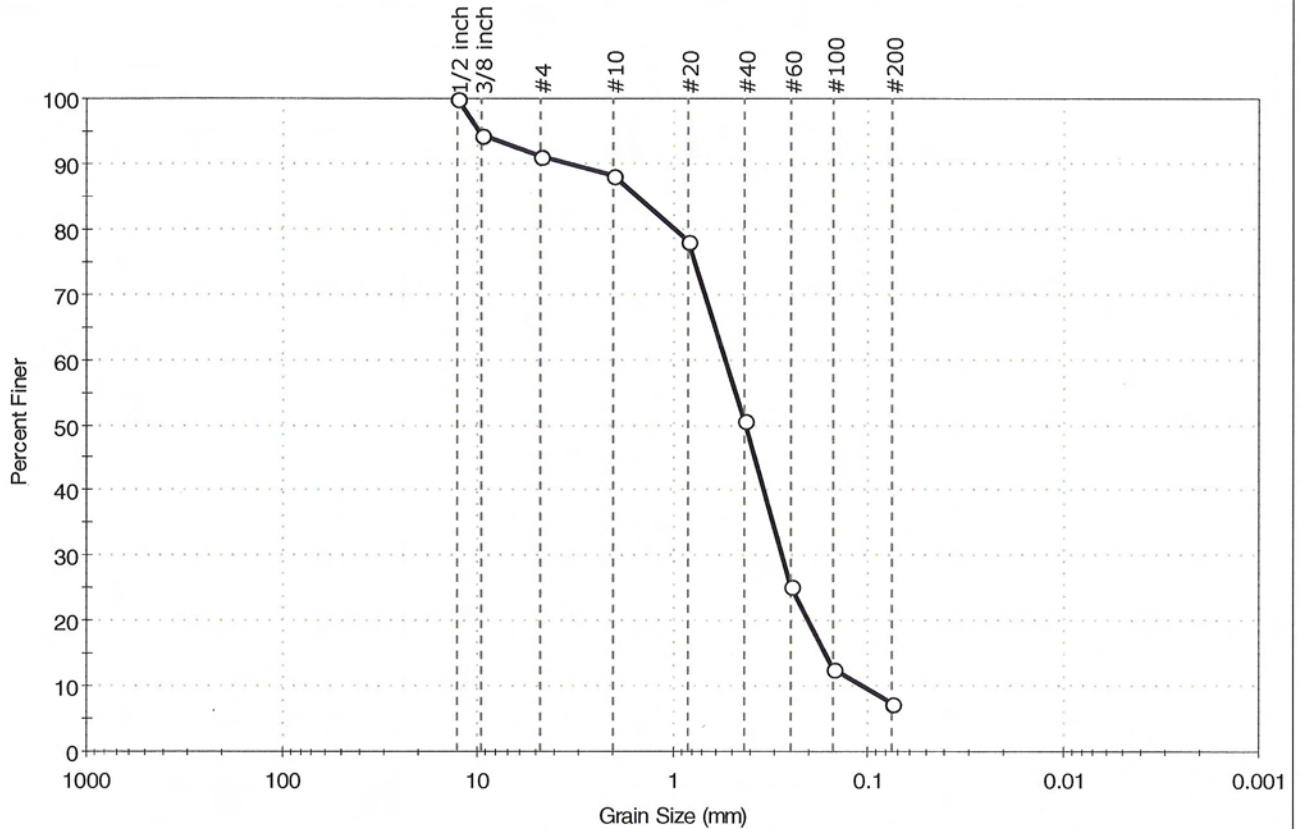
<u>Coefficients</u>	
D <sub>85</sub> = 0.8377 mm	D <sub>30</sub> = 0.2499 mm
D <sub>60</sub> = 0.4304 mm	D <sub>15</sub> = 0.1533 mm
D <sub>50</sub> = 0.3572 mm	D <sub>10</sub> = 0.0988 mm
C <sub>u</sub> = 4.356	C <sub>c</sub> = 1.469

<u>Classification</u>	
ASTM	N/A
AASHTO	Fine Sand (A-3 (0))

<u>Sample/Test Description</u>
Sand/Gravel Particle Shape : ANGULAR
Sand/Gravel Hardness : HARD

Client: GEI Consultants	Project: Brookhaven National Laboratory	Location: Upton, NY	Project No: GTX-6864
Boring ID: B-102	Sample Type: jar	Tested By: pcs	Checked By: jdt
Sample ID: S-10	Test Date: 08/04/06	Test Id: 94489	
Depth: 45-47 ft			
Test Comment: sieve stack 6			
Sample Description: Moist, light olive brown sand with silt			
Sample Comment: ---			

## Particle Size Analysis - ASTM D 422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	9.0	83.5	7.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1/2 inch	12.70	100		
3/8 inch	9.51	94		
#4	4.75	91		
#10	2.00	88		
#20	0.84	78		
#40	0.42	51		
#60	0.25	25		
#100	0.15	13		
#200	0.075	7		

**Coefficients**

D <sub>85</sub> = 1.5029 mm	D <sub>30</sub> = 0.2758 mm
D <sub>60</sub> = 0.5361 mm	D <sub>15</sub> = 0.1639 mm
D <sub>50</sub> = 0.4196 mm	D <sub>10</sub> = 0.1047 mm
C <sub>u</sub> = 5.120	C <sub>c</sub> = 1.355

**Classification**

ASTM	N/A
AASHTO	Fine Sand (A-3 (0))

**Sample/Test Description**

Sand/Gravel Particle Shape : ANGULAR  
Sand/Gravel Hardness : HARD