



ARM Group Inc.

Earth Resource Engineers and Consultants

April 11, 2013

Mr. Nicholas C. Mannix, P.E.
Miller-Remick LLC
1010 Kings Highway South
Cherry Hill, NJ 08034

Re: Evaluation of Subsurface Conditions
Proposed Entrance Structure
Disabled Veterans Administration Facility
Woodland Avenue, Philadelphia, PA
ARM Project 12510

Dear Mr. Mannix:

ARM Group Inc. (ARM) is pleased to present this evaluation of subsurface conditions at the location of a proposed entrance structure at the Veterans Administration facility on Woodland Avenue in Philadelphia, PA. The site is located at 3900 Woodland Avenue, approximately 1,000 feet to the west of the Schuylkill River. It is ARM's understanding that the entrance structure will have a footprint of approximately 5,000 square feet. ARM also understands that the structure will be single story, approximately 25 feet in height, and will include a mechanical mezzanine in one area. The structure does not currently include a basement; although it is possible one will be added as the design is finalized.

The proposed entrance structure will abut the existing facility entrance on the north side of the building. The area within which the structure will be located is shown in Figure 1. The footprint of the structure has not been finalized and is not shown on Figure 1; however the structure will generally extend from the existing entrance northward across the footprint of the existing canopy, and into an area currently occupied by the circular walkway shown in Figure 1.

SITE GEOLOGY

According to mapping compiled by the Pennsylvania Geological Society the site is underlain by bedrock of the Wissahickon Schist Formation. The Wissahickon Schist is composed of metamorphosed shale and sandstone. Several types of schist, including phyllite, mica schist, and quartzite schist; are present within the Wissahickon Schist Formation. Regardless of the type of schist present at any given site, the uppermost schist is typically very weathered and fractured. The degree of weathering and decomposition decreases with increasing depth. Based upon examination of the core recovered from the project site, it is believed that bedrock beneath the Veterans Administration facility is micaschist containing significant amounts of feldspar.

SUBSURFACE CONDITIONS

Exploration Program

Two exploratory borings (designated B1 and B2 on Figure 1) were performed at the site on February 4, 2012. Logs of the borings are attached. Earthcore Services of Birdsboro, PA, an ARM subcontractor, provided drilling services for this project using a truck-mounted Mobile B-57 drill rig. Boring locations were largely dictated by accessibility and by concerns over underground utilities. The upper 8 feet of material at each boring location had been vacuum excavated prior to drilling, as part of utility location and clearance precautions. Consequently, soil sampling during drilling began 8 feet below existing grade.

Drilling and sampling were conducted in general accordance with American Society for Testing and Materials (ASTM) standards ASTM D-1586 for Split-Spoon Sampling and Standard Penetration Testing. Split spoon sampling was performed at approximately 3-foot intervals while in spoil. Rock was cored in accordance with ASTM D-2113. An ARM representative supervised the drilling, field-classified soil and rock samples, and completed the boring logs. Field descriptions of the subsurface conditions encountered at each of the boring locations are presented on the attached boring logs. Soil descriptions presented on the boring logs are in general accordance with the Unified Soil Classification System.

Overburden

Both borings (and the vacuum excavation that preceded the drilling) encountered a layer of fill extending from existing grade to a depth of 10 to 12 feet. The fill consisted primarily of sandy silt with gravel, and containing varying proportions of manmade debris such as brick, pottery, and metal fragments. Only two Standard Penetration Test N-values (9 blows per foot in Boring B1 and 3 blows per foot in Boring B2) were obtained in the fill, but it is likely that the fill was placed with minimal compaction and is unconsolidated. These conditions are consistent with those encountered in borings performed previously at the facility, which encountered a surface layer of unconsolidated fill extending to varying depths below grade.

The surface fill is underlain by a thin layer of presumably native soils, underlain by weathered micaschist. At a depth of 14 to 15 feet below grade the soil had graded to highly weathered bedrock that could be spoon sampled to a depth of 25 to 30 feet below grade. The N-values obtained from spoon sampling increased rapidly with increasing depth, and were generally above 50 blows per foot within 5 to 10 feet of entering the highly weathered schist. The top of more competent rock, as evidenced by auger refusal (the inability of the drilling rig to further advance the augers), was reached at 29 feet in Boring B1 and at 40 feet in Boring B2.

Bedrock

Ten feet of rock was cored in Boring B1, and 5 feet was cored in Boring B2. Core recovery (the total length of rock core retrieved divided by the total length of the core run) ranged from 10 to 100 percent, averaging about 63 percent. Rock Quality Designator (RQD; the cumulative length of all intact core pieces 4 inches or more in length divided by the total length of the core run)



varied from 0 to 45 percent, averaging 25 percent. The recovered bedrock was soft to hard, highly fractured, and where bedding was apparent the relative dip of the beds varied from near horizontal to 45 degrees.

Groundwater

No groundwater was observed in the borings prior to the start of rock coring (when water is circulated within the borehole to cool the bit and flush cutting). It should be noted that the borings were backfilled at the end of the day they were drilled, and therefore no long term water level observations were obtained. Groundwater levels fluctuate with time due to a variety of influences, and could therefore be higher or lower at any given time.

DISCUSSION AND RECOMMENDATIONS

Foundations

The presence of unconsolidated fill materials across the location of the proposed entrance structure is problematic with respect to supporting the entrance structure on conventional spread footings. Even lightly loaded spread footings could experience noticeable settlement, the effects of which would be more pronounced at the juncture between the new entrance and the existing building. The existing building is supported on concrete caissons extending into bedrock, and therefore any settlement of the new entrance at its juncture with the existing building would be expressed as an abrupt differential.

Removal and replacement of the unconsolidated fill with properly compacted, stable backfill would be one remedial option that would allow placement of the entrance structure on conventional shallow foundations. The unconsolidated fill material extended to depths of 10 to 12 feet at the boring locations, and therefore it is likely that the depth of remedial overexcavation and replacement would be at least as great. The feasibility of this option would depend in large part upon the proximity of the excavation to adjacent buildings, streets, utility lines, and similar infrastructure that could be undermined by the excavation. At a minimum, it is expected that the excavation would require the installation of sheeting or shoring to allow the excavation to occur within the space available. Based on discussion with Miller-Remick, it is ARM's understanding that an overexcavation and replacement option would probably not be cost-effective.

In light of these considerations it is recommended that the proposed entrance structure be supported on deep foundations bearing on bedrock. The performance of deep foundations should not be adversely affected by the surface fill materials.

A variety of deep foundation types could be utilized, but given the relatively low foundation loads it is expected that drilled-in-place pipe piles (commonly referred to as "micropiles") would prove most cost-effective. Micropiles consist of relatively small diameter, heavy wall pipe drilled into bedrock. A bond zone within bedrock extends past the bottom of the casing pipe, and a threaded bar is typically grouted into place within the bond zone. The threaded bar typically extends 5 to 10 feet up into the casing pipe. The dimensions of the micropiles, and the



required bond length, should be established once the entrance structure design has progressed to the point where foundation loads have been established. For a lightly loaded structure such as the proposed entrance, it is expected that supporting the structure on reinforced concrete grade beams designed to span between adjacent piles will prove economical. Normal practice would be to space the piles at 4- to 8-foot intervals along the grade beams, and to size the piles for the loads associated with the selected spacing. If requested, ARM can provide a micropile detail and installation specification once foundation loads are available.

If any uplift resistance beyond the weight of the entrance structure is needed, the allowable uplift (i.e. tension) loads micropiles can accommodate should be more than sufficient to provide the required resistance.

Interior Floor Slabs

Interior floor slabs may be either be structural slabs designed to span between pile-supported grade beams, or conventional slabs-on-grade bearing on prepared subgrade. Assuming that interior floor slab loads are within a typical range for such structures (say no more than 200 pounds per square feet), and considering the significant cost of structural slabs; in ARM's opinion it would not be unreasonable to utilize slabs-on-grade between the pile supported grade beams. If slabs-on-grade are utilized, the underlying subgrade should be prepared as recommended below.

Subgrade Preparation and Inspection

It is recommended that all load bearing subgrades (i.e., beneath footings, floor slabs, and pavement) be inspected by qualified personnel prior to placement of aggregate, concrete, and/or structural fill. Subgrades should be thoroughly compacted, and any problem areas excavated to stable material and backfilled with structural fill. Potential problem conditions include areas where the subgrade has been degraded due to contact with water and areas of existing fill of an unsuitable nature (i.e., material containing excessive amounts of debris or organics).

It should be noted that the soils encountered during excavation activities are expected to be moisture-sensitive, i.e., prone to loss of strength and stability if exposed to precipitation or groundwater. In order to help minimize the potential for moisture related problems; as well as to help compensate for what could be marginal subgrade in some areas; it is recommended that all slabs be placed on at least 8-inches of compacted Pennsylvania Department of Transportation (PennDOT) 2A coarse aggregate. The aggregate should be compacted to at least 95 percent of its maximum modified dry density established by ASTM D-1557 test procedures (modified Proctor).

Structural Fill and Backfill

Structural fill and backfill (i.e., load bearing, as beneath pavements, floor slabs, and footings) should be free of ice, snow, roots, sod, or other organic matter, rubbish, slag, or other deleterious materials. Any existing site soils that meet these criteria should be acceptable for re-use as



structural fill. Rock fragments mixed in structural fill should not have any one dimension greater than 6 inches, and the proportion of particles greater than 2 inches in maximum dimension should not exceed 25 percent.

Imported structural fill material should be approved prior to use. It should consist of clean, non-organic soil classifying as GW, GM, SW, SM, CL, or ML under the Unified Soil Classification System (USCS). The maximum dry density, as determined by the modified Proctor compaction test (ASTM D-1557), should be at least 100 pounds per cubic foot (pcf). Any rock contained in the fill should not have any one dimension greater than 6 inches, and the proportion of particles greater than 2 inches in maximum dimension should not exceed 25 percent. PennDOT No. 2A coarse aggregate may also be used as structural fill and backfill.

Structural fill and backfill should be placed in horizontal lifts, not exceeding 8 inches in loose thickness. Lifts should be compacted to at least 95 percent of the maximum dry density as determined by the modified Proctor test (ASTM D-1557). Where hand-operated equipment is used, a maximum loose lift thickness of 4 inches is recommended.

Field density testing of structural fill and backfill should be performed at a minimum frequency of one test per 5,000 square feet of lift surface; once every 25 lineal feet of foundation fill or backfill; and a minimum of 3 tests per lift. A greater frequency should be used if warranted by adverse field conditions or visual observations of potentially inadequate compaction. If field testing is performed using nuclear methods (ASTM D-2922), all tests should extend to the bottom of the lift being tested (i.e., backscatter testing methods should not be accepted).

Foundation Drainage

No groundwater was observed in the borings prior to rock coring, which commenced at depths of 29 to 40 feet below grade. Consequently; and assuming that any basement incorporated into the entrance structure will extend no more than say 12 feet below existing grade: there is no apparent need for permanent foundation drainage measures. If, however, the basement of the existing Veterans Administration facility has drainage measures, or has experienced moisture problems; it is recommended that permanent drainage measures be provided for the new entrance structure. At a minimum, it is recommended that any portions of the entrance extending below adjacent grade be waterproofed in accordance with normal practice.

Construction Dewatering

It is not expected that construction will extend below static groundwater levels, although lenses of perched groundwater may be encountered. As noted previously, site soils are moisture-sensitive, and for this reason, it is recommended that the construction documents require the contractor to maintain water levels at least 2 feet below working subgrades.



Geotechnical Design Parameters

The following parameters were estimated based on the boring results and upon past experience at similar sites, and are recommended for design purposes:

Parameter	Value
Minimum Frost Depth (inches)	36
Moist Unit Weight of Soil, γ (pcf)	125
Cohesion (psf)	0
Angle of Internal Friction for Soil, ϕ (degrees)	30
Active Lateral Earth Pressure Coefficient, K_a	0.33
Passive Lateral Earth Pressure Coefficient, K_p	3.0
At-rest Lateral Earth Pressure Coefficient, K_o	0.5
Coefficient of Sliding Friction (concrete on site soils)	0.40
Soil Modulus of Vertical Subgrade Reaction, k_s (kcf)	75
Soil Modulus of Elasticity, E_s (ksf)	300
Seismic Site Class (per IBC Table 1613.5.2)	C

If local codes or other applicable design standards dictate more conservative values for any of the above properties, it is recommended that the more conservative value be utilized.

If you have any questions or require additional information, please do not hesitate to contact the undersigned at 717-508-0529. ARM appreciates the opportunity to provide our services to you.

Respectfully submitted,

ARM Group Inc.

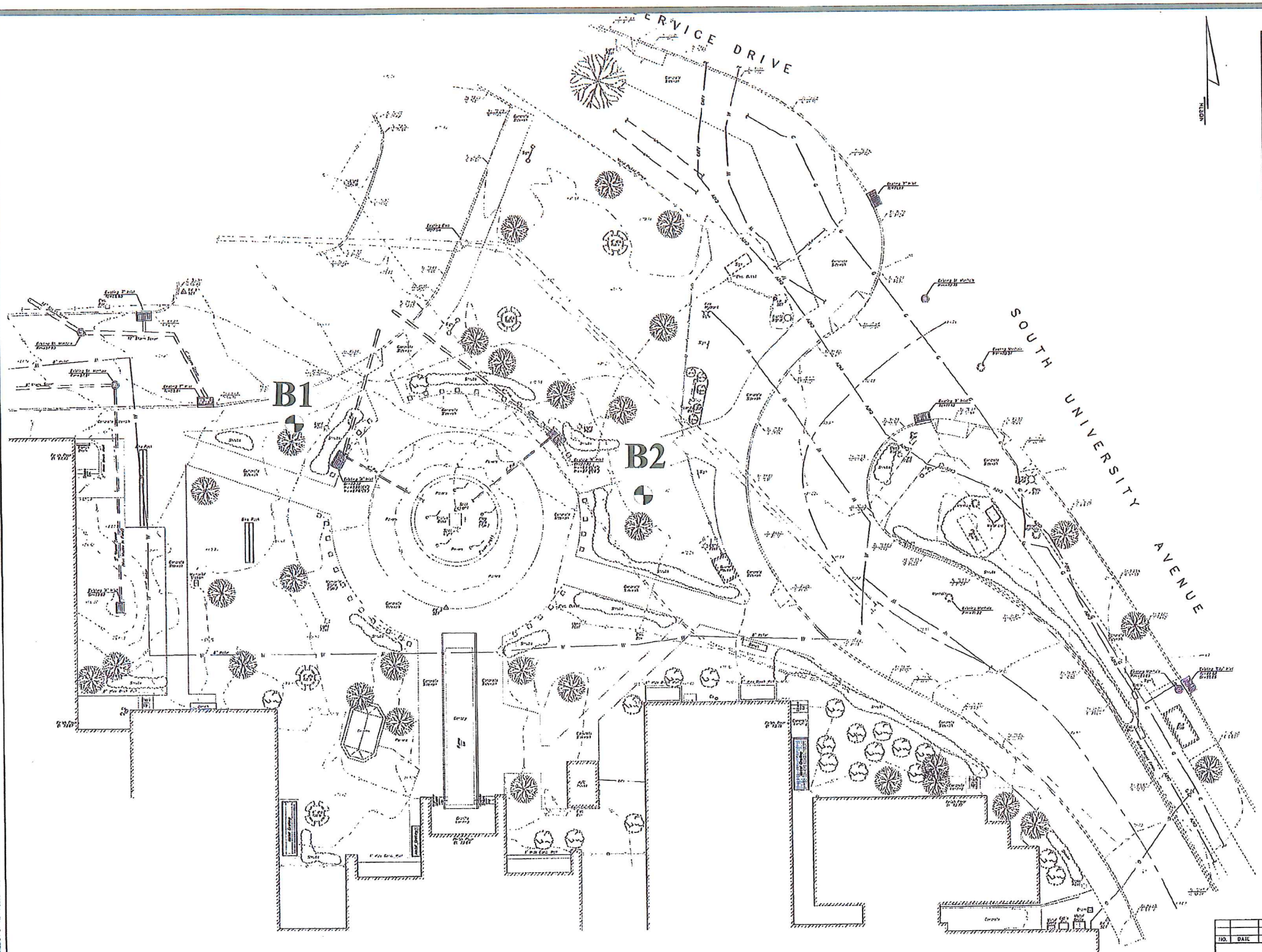


John C. Masland, P.E.
Vice President - Geotechnical Services

Attachments: Site Plan
Boring Logs



DATE: 02/01/2013
DRAWN: J. B. BROWN
CHECKED: J. B. BROWN
DATE: 02/01/2013
PROJECT: PHILADELPHIA VA MEDICAL CENTER
SHEET: 1 OF 1
SCALE: 1" = 10' 0"



Legend:

B1 Boring Location and Designation

BASE PLAN PROVIDED BY MILLER-REMYK LLC

LOCATION MAP

SCALE: 1" = 200'

PROJECT BENCHMARKS			
DESCRIPTION	NORTHING	EASTING	ELEVATION
PK 1	234,674.36	2,683,254.34	65.74
LP 2	234,671.38	2,683,402.84	72.01
PK 3	234,592.70	2,683,321.31	71.63
PK 4	234,510.50	2,683,491.65	70.23

LEGEND:

- EXISTING CONCRETE CURB
- EXISTING SIDEWALK RAMP
- EXISTING SPOT ELEVATION
- EXISTING CONTOUR LINE
- EXISTING DRIVE WAY
- EXISTING TREE/SHRUB
- EXISTING STORM DRAIN
- EXISTING MANHOLE
- EXISTING METAL PICKET FENCE
- EXISTING WATER LINE
- EXISTING GAS MAIN
- EXISTING ELECTRIC LINE
- EXISTING COMMUNICATION CABLE
- EXISTING LANDSCAPE UTILITY
- EXISTING STORM DRAIN
- EXISTING LIGHT POST
- EXISTING TRAFFIC SIGNAL
- EXISTING CEMENT OUT
- EXISTING SIGN

NOTES:

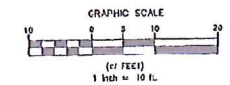
Boring Location Plan

**Philadelphia VA Medical Center
Main Entrance**

February 2013 | ARM Project 12510

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Figure 1



T&M ASSOCIATES
CONSULTING ENGINEERS
215 PENNSYLVANIA AVE
SUITE 200
PHILADELPHIA, PA 19102



ARM Group Inc.
Earth Resource Engineers
and Consultants

Site Description : Phila VA Medical Center
Site Location : Philadelphia, PA
ARM Project No. : 12510
Client : Miller-Remick
ARM Representative : C. Iozza
Checked By : J. Masland, P.E.
Drilling Company : Earthcore Services
Driller : John Swope

Drilling Equipment : Mobile B-57 Truck mounted
Casing Diameter : 4.25" ID / NQ-2.25"
Casing Type : HSA/NQ-2
Date Started : 2/4/2013
Date Completed : 2/4/2013
Weather : Sunny, cold, 20s
0 hr Depth to GW : Dry prior to coring

Boring ID: B1

(Page 1 of 2)

Depth (ft.)	Surface Elev.(ft.)	Sample Type	Sample No.	Blows per 0.5 ft.	N-Value	Pocket Penetrometer Reading (tsf)	Recovery (%)	RQD (%)	DESCRIPTION	REMARKS
0									0 - 14.0' Sandy Silt with Gravel (ML), gray, loose, moist, trace cobbles; trace debris	Material from 0 - 8.0' was backfill from preceeding vacuum excavation Brick fragments present 0-10'
1										
2										
3										
4										
5										
6										
7										
8										
9		SS	S-1	3186	9	C	55			
10									14.0' - 29.0' Silt with Sand (ML), gold to gray, loose to very dense	Hydrocarbon odor from borehole at approximately 12.0' Highly weathered schist 14'-20'; degree of weathering decreases with depth.
11										
12										
13										
14										
15		SS	S-2	6433	7	0.5	50			
16										
17										
18										
19										
20										
21		SS	S-3	8101011	20	3.0	90			
22										
23										
24		SS	S-4	91550/4		0.75	60			
25										



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(Page 2 of 2)

Depth (ft.)	Surface Elev.(ft.)	Sample Type	Sample No.	Blows per 0.5 ft.	N-Value	Pocket Penetrometer Reading (tsf)	Recovery (%)	RQD (%)	DESCRIPTION	REMARKS
25		SS	S-4	19 50/4		0.75	60			
26										
27										
28										
29										
30										
31		NQ	R-1				10	0		
32										
33										
34										
35										
36		NQ	R-2				80	30		
37										
38										
39										
40										
41										
42										
43										
44										
45										
46										
47										
48										
49										
50										

End of Boring at 39.0'

Began coring at 29.0'

29.0' - 39.0' MICASCHIST, variegated, soft to hard, completely to moderately weathered, no apparent bedding pattern, medium to closely spaced fractures (RD= 45°)



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Boring ID: B2

(Page 1 of 2)

Site Description : Phila VA Medical Center
Site Location : Philadelphia, PA
ARM Project No. : 12510
Client : Miller-Remick
ARM Representative : C. Iozza
Checked By : J. Masland, P.E.
Drilling Company : Earthcore Services
Driller : John Swope

Drilling Equipment : Mobile B-57 Truck mounted
Casing Diameter : 4.25" ID / NQ-2.25" N
Casing Type : HSA/NQ-2
Date Started : 2/4/2013
Date Completed : 2/4/2013
Weather : Sunny, cold, 20s
0 hr Depth to GW : Dry prior to coring

Depth (ft.)	Surface Elev.(ft.)	Sample Type	Sample No.	Blows per 0.5 ft.	N-Value	Pocket Penetrometer Reading (tsf)	Recovery (%)	RQD (%)	DESCRIPTION	REMARKS
0									0 - 15.0' Sandy Silt with Gravel (ML), gray, loose, moist, trace cobbles (Fill material to at least 12 feet)	Material from 0 - 8' was backfill from preceeding vacuum excavation Brick, clay pipe and metal present in 0-12'
1										
2										
3										
4										
5										
6										
7										
8										
9										
10				1					15.0' - 40.0' Silt with Sand (ML), gold to gray, medium dense, moist	Highly decomposed schist 15.0' - 20.0'; degree of weathering decreases with depth.
11		SS	S-1	1	3	1.5	65			
12				2						
13				3						
14										
15				7						
16		SS	S-2	6	13	C	75			
17				7						
18				8						
19										
20										
21		SS	S-3	10	66	C	95			
22				22						
23				24						
24				33						
25										



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Casing Type : HSA/NQ-2
Date Started : 2/4/2013
Date Completed : 2/4/2013
Weather : Sunny, cold, 20s
0 hr Depth to GW : Dry prior to coring

Boring ID: B2

(Page 2 of 2)

Depth (ft.)	Surface Elev.(ft.)	Sample Type	Sample No.	Blows per 0.5 ft.	N-Value	Pocket Penetrometer Reading (tsf)	Recovery (%)	RQD (%)	DESCRIPTION	REMARKS
25				20						
26		SS	S-4	19	49	-	90			
27				30						
28				32						
29										
30										
31		SS	S-5	21		2.25	100			
32				32						
33				50/.4						
34										
35										
36		SS	S-6	23		C	87			
37				50/.4						
38										
39										
40										
41										
42										
43		NQ	R-1				100	45	40.0' - 45.0' MICASCHIST, varigated, soft to hard, completely to moderately weathered, no apparent bedding pattern, medium to closely spaced fractures (RD= 45°)	Began coring at 40.0'
44										
45										
46									End of Boring at 45.0'	
47										
48										
49										
50										