



GEOTECHNICAL ENGINEERING REPORT

COATESVILLE VA HOSPITAL SUBTERRANEAN TUNNEL REPAIR

CALN TOWNSHIP, CHESTER COUNTY, PENNSYLVANIA

PREPARED FOR:

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A handwritten signature in black ink, appearing to read "D. Kreischer", written over a horizontal line.

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SENIOR PROJECT MANAGER

A handwritten signature in black ink, appearing to read "Edward L. Balsavage", written over a horizontal line.

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MANAGING PRINCIPAL
PA License No.: PE-042373-E

PROJECT NUMBER - 1300121

APRIL 2013

telecommunications / environmental / geotechnical

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1.0 INTRODUCTION

This report was prepared by Advantage Engineers, LLC (Advantage), on behalf of Barry Isett & Associates, Inc. (BIA), of Allentown, Pennsylvania, and contains the results of a geotechnical engineering investigation conducted adjacent to the existing subterranean tunnels on the grounds of the Coatesville VA Hospital in Caln Township, Chester County, Pennsylvania. The objective of our work was to evaluate the engineering characteristics of the underlying soils and bedrock, in order to provide criteria associated with design of any required temporary excavation support systems.

The scope of work for this project included completion of a subsurface field investigation, laboratory testing program, and geotechnical engineering analysis. This report summarizes the results of the work performed and provides soil strength criteria and general construction guidelines.

2.0 SITE AND PROJECT DESCRIPTION

The project site currently consists of two tunnels, used primarily for patient access, that have experienced water infiltration at expansion joints, and at interfaces with the adjacent buildings. The western tunnel, situated between buildings #9 and #38, is approximately 180 feet in length, and is founded approximately 16 feet beneath existing surface elevations. The eastern tunnel, situated between buildings #38 and #59, is approximately 30 feet in length, and is founded approximately 12 feet beneath existing site grades. The project site is located east and west of Pennsylvania Avenue, north of its intersection with South Delaware Avenue, on the grounds of the Coatesville VA Hospital in Caln Township, Chester County, Pennsylvania. Existing topography is relatively flat. The surface of the site currently consists of grass-covered areas, paved roads and parking areas, subsurface utilities, concrete sidewalks, and VA Hospital structures. The location of the site in relation to the surrounding area is presented on the *Topographic Map*, presented within the Appendix.

The project will consist of repairing the existing tunnels to address the water infiltration issues. It is understood that temporary excavation support will be required to complete the planned repairs to the tunnels.

3.0 SUBSURFACE INVESTIGATION PROGRAM

In an effort to evaluate subsurface conditions, six test borings were completed on March 25th and 26th, 2013. The test boring locations were staked in the field prior to mobilization by a representative of BIA. Supervision and monitoring of the field investigation were provided by a representative of Advantage. The approximate locations of the test borings, designated as B-1 through B-6, are shown on the *Test Boring Location Plan*, presented in the Appendix (Dwg. No.: 1300121-A-102).

The test borings were advanced using a truck-mounted drill rig equipped with hollow-stem augers. Split-spoon samples, conducted in accordance with ASTM standard D1586, were taken throughout the entire depth of the borings and the Standard Penetration Test (SPT) values were recorded for each sample obtained. The SPT values, which are a measure of relative density or consistency, are the number of blows required to drive a 2-inch (outer-diameter), split-barrel sampler 2 feet using a

140-pound weight dropped 30 inches. The number of blows required to advance the sampler over the 12-inch interval from 6 to 18 inches is considered the "N" value.

Data pertaining to the subsurface investigation were documented in the field and are presented in detail on the *Test Boring Profiles* and *Test Boring Logs*, presented within the Appendix. The *Test Boring Profiles* (Dwg. No.: 1300121-A-01) depict cross-sections of the subsurface conditions encountered within each test boring, including: soil types, depths of individual strata, and recorded "N" values. The *Test Boring Logs* contain general information about the subsurface program and specific data regarding each test boring, including: sample depths, blow counts per 6 inches of penetration, groundwater data, and detailed characterizations of the subsurface materials encountered.

4.0 LABORATORY TESTING

All soils encountered at the site were visually reviewed and classified by Advantage personnel. Two (2) representative soil samples were subjected to laboratory analyses, in an effort to verify visual classification and to establish the engineering parameters required for geotechnical analysis. The laboratory testing conducted on the soil samples consisted of standard classification testing, completed in accordance with ASTM standard D2487. The tests performed included Natural Moisture Content (ASTM D2216), Sieve Analysis (ASTM D422), and Atterberg Limits Determination (ASTM D4318).

Unified Soil Classification System (USCS) Group Symbols and ASTM Group Names have been assigned to the soils analyzed. Graphical depictions of the particle size analyses are presented in the Appendix. The results of the testing conducted are presented below in Table I.

TABLE I

LABORATORY RESULTS		
Boring Number	B-2	B-3
Sample Number	S2/S3	S5/S6
Sample Depths (ft.)	2.0'-4.0'/4.0'-6.0'	8.0'-10.0'/13.0'-15.0'
Soil Type	Fill	Stratum I
Particle Size Distribution (Percent)		
Gravel	18.6	0.2
Sand	45.9	35.9
Silt/Clay	35.5	63.9
Atterberg Limits		
Liquid Limit	NP	NP
Plastic Limit	NP	NP
Plasticity Index	NP	NP
Natural Moisture Content	9.9%	10.5%
USCS Group Symbol	SM	ML
ASTM Group Name	Silty Sand with Gravel	Sandy Silt

5.0 DESCRIPTION OF SUBSURFACE CONDITIONS

5.1 GEOLOGY

According to the Pennsylvania Geologic Survey's Geologic Map of the State of Pennsylvania, Fourth Series, 1981, the project site is situated within an area underlain by the Cambrian Chickies Formation (Geologic symbol Cch). The Pennsylvania Geologic Survey's publication, *The Engineering Characteristics of the Rocks of Pennsylvania*, Second Edition, 1982, describes this formation as consisting of light-gray to white quartzite and quartz schist.

This formation is moderately well to well bedded, consisting of thick layers. Joints of this formation form a blocky pattern, are moderately well developed, moderately abundant, widely spaced, steeply dipping, and open. This formation is highly resistant to weathering and is slightly to moderately weathered to a shallow depth. The overlying soil mantle is thin. This formation is considered to be difficult to excavate which results in a slow drilling rate.

A depiction of the project site within its geologic setting is presented on the Geologic Map (Dwg. No.: 1300121-A-101), presented within the Appendix.

5.2 SOIL

The surfaces of the test borings were covered by either topsoil, ranging from 0.4 to 0.6 feet in approximate thickness; or concrete with associated gravel subbase, totaling approximately 1.3 feet in thickness. Beneath the surficial elements, subsurface conditions were found to be generally uniform, consisting of layer of Fill, followed by, a single, residual soil stratum, referenced herein as Stratum I. A general description of the soil encountered at the site is as follows.

Fill – Silty Sand, with varying amounts of Gravel

Fill was identified immediately below the surficial elements in each test boring, and extended to depths ranging from approximately 2 to 8 feet below existing site grades. The recorded N-values within the Fill indicate loose to very-dense soil conditions. No deleterious materials (i.e. cinder, slag, trash, wood, topsoil, etc.) were present in the samples of the Fill recovered from the site. However, these samples were taken from discrete locations and the possibility exists for deleterious materials to be encountered in uninvestigated portions of the site. Laboratory testing was conducted on representative samples of the Fill. The samples obtained from B-2 show this soil to be moderately well graded and non-plastic, with a natural moisture content of approximately 9.9%. The representative samples from test boring B-2 are described under the Unified Soil Classification System (USCS) as Silty Sand with Gravel, with the accompanying group symbol of SM.

The Fill encountered is expected to be associated with backfill placed during original construction. The Fill is expected to extend to the base of the tunnels immediately adjacent to the tunnel walls and decrease in thickness with distance from the tunnels.

Stratum I – Sandy Silt, with varying amounts of Gravel

Stratum I was encountered immediately beneath the Fill in each of the test borings completed, and extended to depths ranging from approximately 11 to 22 feet below existing site grades. The “N” values, recorded within Stratum I show this soil to be stiff to hard in consistency. In general, the SPT values increased markedly with depth. Laboratory testing was conducted on representative samples of Stratum I. The samples obtained from B-3 show this soil to be poorly-graded and non-plastic, with a natural moisture content of approximately 10.5%. The representative samples from test boring B-3 are described under the Unified Soil Classification System (USCS) as Sandy Silt, with the accompanying group symbol of ML.

5.3 BEDROCK

The bedrock surface was encountered in each of the test borings at depths ranging from approximately 11 to 22 feet beneath current site grades. These depths correspond to approximate bedrock surface elevations ranging from 620 to 630 feet. The bedrock surface was defined as the depth at which auger refusal was encountered.

In order to determine the composition and integrity of the bedrock present beneath this site, one bedrock sample was retrieved through rock coring. The percent recovery and rock quality designation (RQD) were determined for the core sample retrieved. Percent recovery is calculated by dividing the length of the rock core retained from the core barrel by the total length of the core run, and multiplying by 100. RQD is calculated by summing the total of all of the rock fragments in the core run greater than or equal to 4 inches in length, dividing by the total length of the core run, and multiplying by 100. The percent recovery and rock quality designation of the bedrock core sample are provided below in Table II.

TABLE II

BEDROCK CORING DATA SUMMARY				
Core Sample	Bedrock Core Sample (depth)	Length of Core	Percent Recovery (%)	RQD Value (%)
B-5/R-1	22.0' – 27.0'	5.0'	56	0

The bedrock recovered during the test boring operation consisted of highly fractured and moderately weathered brown, light-gray, and white quartzite and quartz schist.

5.4 GROUNDWATER

Groundwater was not encountered in any of the test borings completed. This observation was made at the time of the field operations and the groundwater table elevation will vary with daily, seasonal, and climatological variations, as well as anthropogenic activity.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 EXCAVATION CONSIDERATIONS

Excavation during repair of the tunnels will take place primarily within the Fill and residual soils of Stratum I. Fill and Stratum I may be removed using conventional earth moving equipment and techniques. Portions of Stratum I were found to exist in a very dense state, and may require the use of pneumatic equipment for removal. Excavation of competent bedrock is not expected to be required, based on the data obtained at the site.

6.1.1 TEMPORARY EXCAVATION SUPPORT

It is understood that the project may require temporary excavation support to allow safe access to the work area and to protect surrounding infrastructure. Where space allows, excavations may be sloped or benched at a maximum interval of 2H:1V in accordance with OSHA requirements. Where shoring or bracing is required, the system should be designed by the Contractor with shop drawings and calculations provided to the Owner for review and approval prior to construction.

6.2 BACKFILLING

6.2.1 IMPORTED FILL

Imported fill should meet the following criteria:

- free of organic matter, slag, ash, cinders, and demolition debris
- particle size distribution that is well-graded
- plasticity index less than 10; liquid limit less than 30
- less than 15 percent by weight rock fragments larger than 3", less than 30 percent by weight larger than the 3/4" and less than 30 percent smaller than the no. 200 sieve

Alternate soils proposed for use which differ from those specified above should be evaluated by the Geotechnical Engineer of Record regarding their suitability prior to placement at the site.

6.2.2 REUSE OF ON-SITE SOILS

Comments regarding the suitability of the on-site soil for use as backfill are provided below.

Fill – This soil was found to be moderately well graded and non-plastic, and to consist primarily of silty sand with varying constituent amounts of gravel. No deleterious materials were identified within the Fill. Based on this information, the Fill is considered suitable for use.

Stratum I – This soil was found to be poorly graded, non-plastic, and to consist of Sandy Silt (ML). Based on this information, this soil is considered to be suitable for use. **Due to the high silt content of Stratum I, this material will be moisture sensitive and difficult to place during periods of adverse weather.**

Our analysis of the suitability of the on-site soil for use as structural fill is based on data collected from the test borings completed at the site. Soil suitability should be confirmed in the field by the Geotechnical Engineer of Record during construction.

It is anticipated that backfilling upon completion will be accomplished predominantly through reuse of excavated on-site soils. The contractor should exercise care when stockpiling excavated soils to permit positive drainage and minimize moisture penetration which would impact the suitability of the stockpiled materials for use as backfill.

6.3 PLACEMENT & COMPACTION REQUIREMENTS

Backfill should be placed in lifts not exceeding 8 inches in loose thickness and compacted with suitable compaction equipment. The optimum lift thickness and number of repetitive passes with compaction equipment necessary to achieve the required percentage compaction values should be determined in the field with test passes of the chosen compaction equipment. All fill should be placed at, or deviate nominally from ($\pm 2\%$) the optimum moisture content as determined in accordance with ASTM D698 and compacted to 100% of the soil's maximum standard dry density.

It is recommended that drainage aggregate be placed immediately adjacent to the existing tunnel walls during backfilling. The drainage aggregate should consist of clean, crushed stone, such as AASHTO No. 57, and extend a minimum of 12 inches beyond the walls and be connected to the existing foundation drains at the base of the walls. Consideration should be given to placing a non-woven geotextile filter fabric between the soil backfill and drainage aggregate to minimize clogging.

6.4 LATERAL EARTH PRESSURES

The following data is provided for design of temporary excavation support systems for the project. The data presented is based on conditions encountered in the test borings. Table III, presented below, provides the Earth Pressure Design Data for the use of the above referenced soils.

TABLE III

EARTH PRESSURE DESIGN DATA		
Parameter	Fill	Stratum I
Angle of Internal Friction	30°	25°
Unit Weight of Soil	135 pcf	130 pcf
Coefficient of Active Earth Pressure	0.33	0.41
Coefficient of Passive Earth Pressure	2.99	2.46
Coefficient of At-Rest Earth Pressure	0.50	0.58
Cohesion	0.0 psf	0.0 psf

7.0 CONSTRUCTION OBSERVATION AND TESTING

Regardless of the thoroughness of a geotechnical engineering exploration, there is always a possibility that conditions between the test borings and auger probes, and below the depths explored, may be different from those encountered, that conditions are not as anticipated by the designers, or that the construction process has altered the subsurface conditions. Therefore, geotechnical engineering construction observation should be performed under the supervision of the Geotechnical Engineer who is familiar with the intent of the recommendations presented herein. Construction observation is recommended to evaluate whether the conditions anticipated in the design actually exist or whether the recommendations presented herein should be modified where necessary.

8.0 LIMITATIONS

This report has been prepared in accordance with generally accepted geotechnical design practices for specific application to this project. This report has been based on assumed conditions and characteristics of the proposed development where specific information was not available.

The conclusions and recommendations contained in this report are based upon the subsurface data obtained during this investigation and on details stated in this report. The validity of the projections, conclusions and recommendations contained in this report is necessarily limited by the scope of field investigation and by the number of test borings and auger probes that were made. It is understood that the number of test borings and auger probes made are consistent with good engineering practice but, given the nature of subsurface conditions, there is a possibility that actual conditions encountered may differ significantly from those projected in this report. Should conditions arise which differ from those described in this report, Advantage should be notified immediately and provided with all available information regarding subsurface conditions.

Our recommendations are based upon the assumption that the services of a qualified Geotechnical Engineer will be retained for the observation of the proof-rolling procedures, structural fill placement, foundation subgrade review, and all critical earthwork operations. Advantage has the capability of providing these services and would be pleased to present a proposal to do the on-site quality control observation.



The scope of this investigation was limited to the evaluation of the load-carrying capabilities and load stability of the subsoils. Oil, hazardous waste, radioactivity, irritants, pollutants, radon or other dangerous substances and conditions were not the subject of this study. Their presence and/or absence are not implied, inferred or suggested by this report or results of this study.

APPENDIX

TOPOGRAPHIC MAP

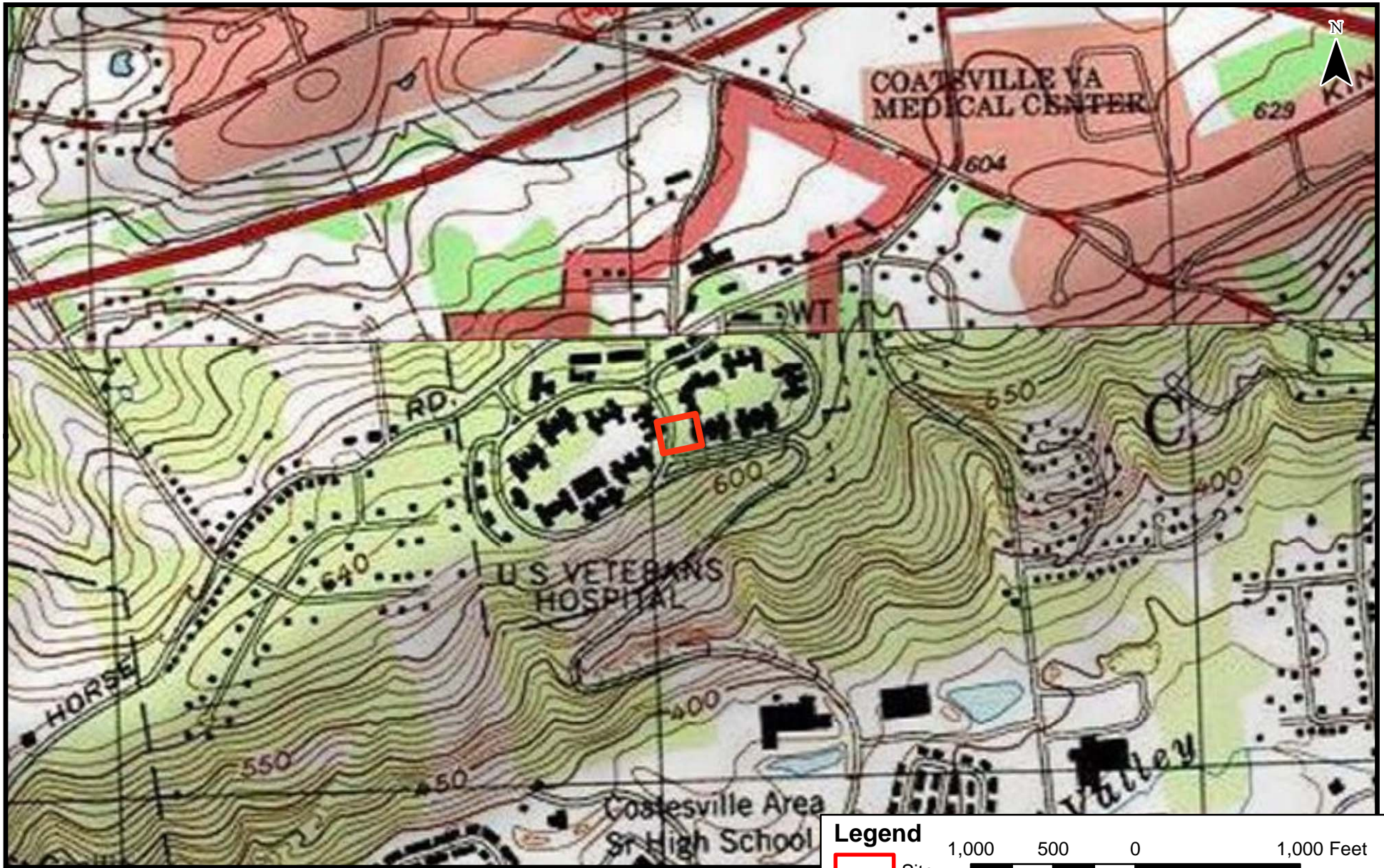
GEOLOGIC MAP

TEST BORING LOCATION PLAN

TEST BORING PROFILES

LABORATORY TEST RESULTS

TEST BORING LOGS



*Source - USGS 7.5 - Minute Topographic Quadrangle, Provided by ESRI

SCALE: AS SHOWN	DRAWING NUMBER: 1300121-A-100
DRAWN BY: T.C. SERFASS	CHECKED BY: D. KREISCHER
APPROVED BY: D. KREISCHER	DATE: 3-20-2013

TOPOGRAPHIC MAP

PREPARED FOR

COATESVILLE VA HOSPITAL

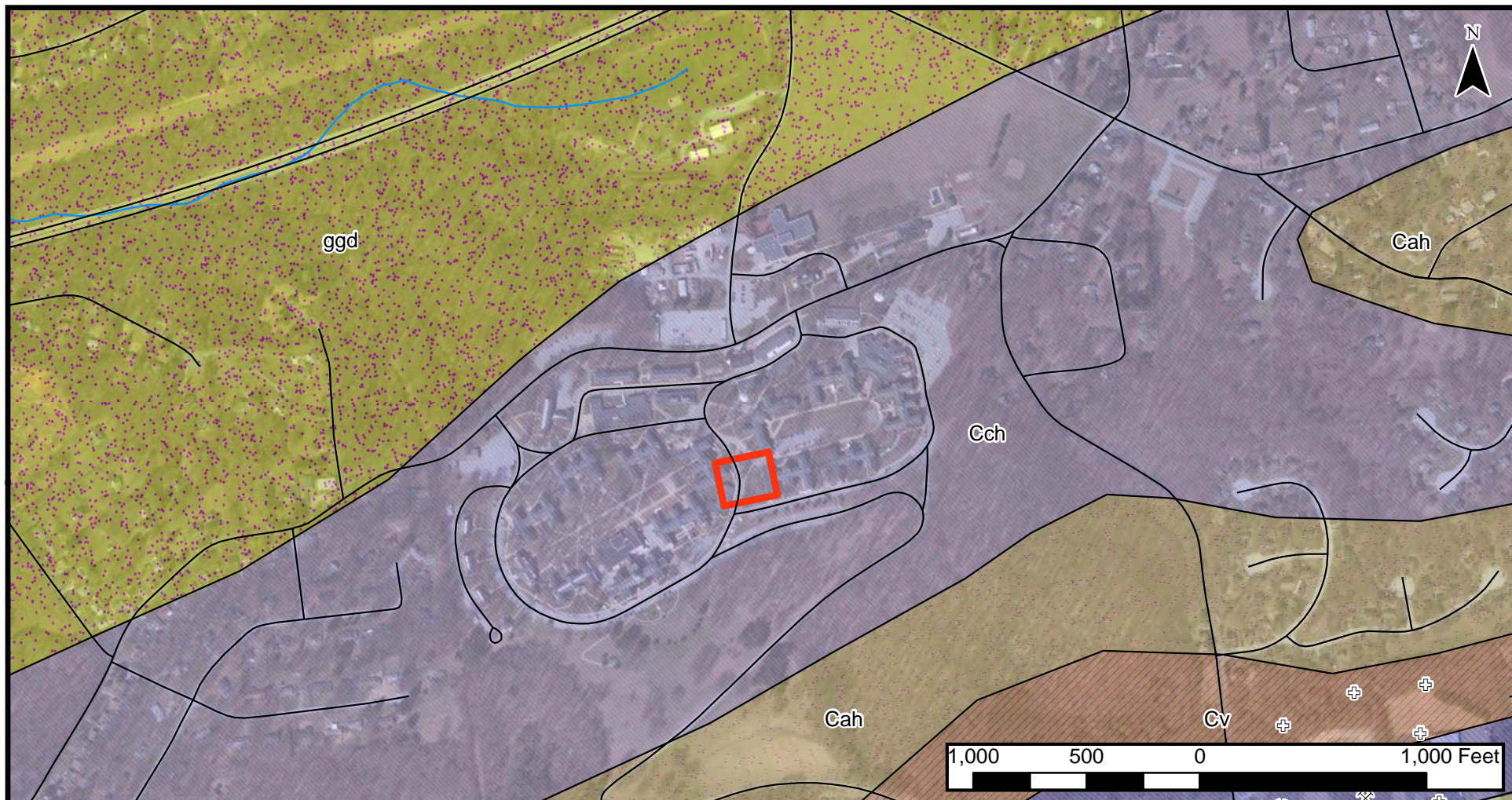
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Legend

- Roads
- Streams
- Site Outline

- Geology**
- Cah Cambrian Antietam and Harpers Formations
 - Cch Cambrian Chickies Formation
 - Ck Cambrian Kinzers Formation
 - Cv Cambrian Vintage Formation
 - ggd Granodiorite and granodiorite gneiss

Contact, Fault

- n, n
- n, y
- y, y
- y, n

Feature

- + surface depression
- × surface mine

SCALE: AS SHOWN	DRAWING NUMBER: 1300121-A-101
DRAWN BY: T.C. SERFASS	CHECKED BY: D. KREISCHER
APPROVED BY: D. KREISCHER	DATE: 3-20-2013

CALN TOWNSHIP

GEOLOGIC MAP

PREPARED FOR
COATESVILLE V.A. HOSPITAL

CHESTER COUNTY

PENNSYLVANIA

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Legend



Test Boring Location

50

25

0

50 Feet



SCALE: AS SHOWN	DRAWING NUMBER: 1300121-A-102
DRAWN BY: T.C. SERFASS	CHECKED BY: D. KREISCHER
APPROVED BY: D. KREISCHER	DATE: 3-3-2013

TEST BORING LOCATION PLAN

PREPARED FOR
COATESVILLE VA HOSPITAL

CALN TOWNSHIP

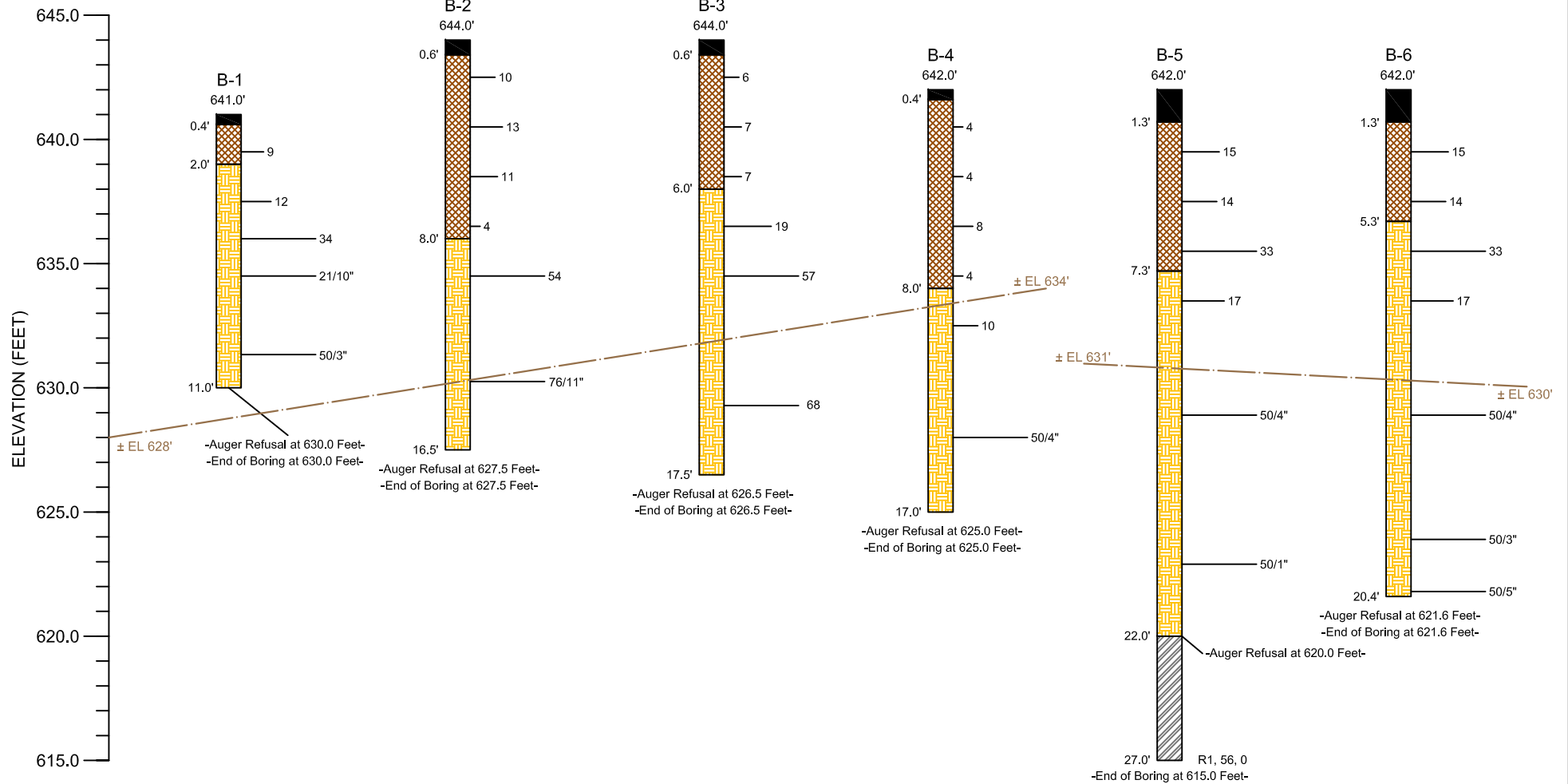
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WEST TUNNEL

EAST TUNNEL



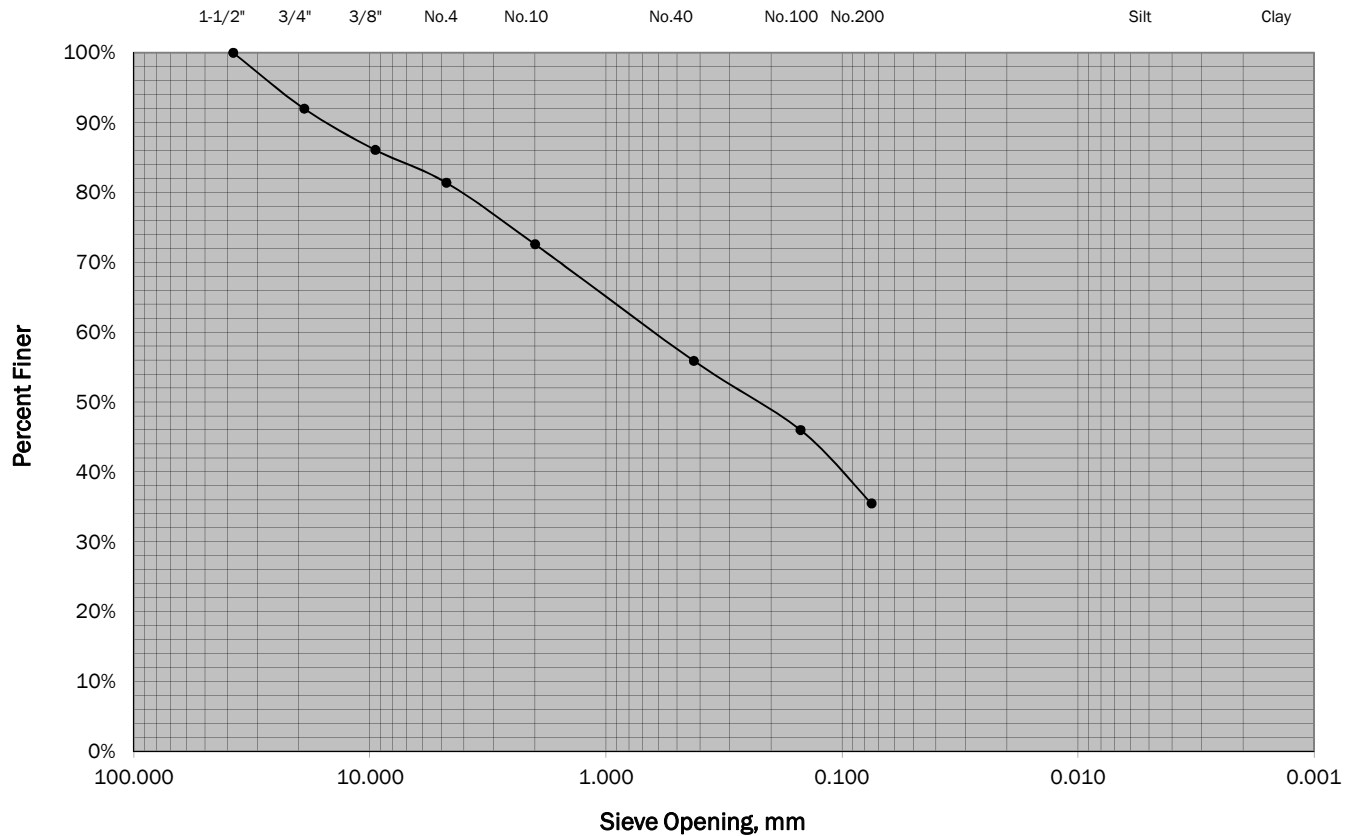
LEGEND	
	SURFICIAL MATERIAL
	FILL
	STRATUM I
	BEDROCK
	TOPSOIL OR BITUMINOUS CONCRETE WITH GRAVEL SUBBASE
	SILTY SAND WITH VARYING AMOUNTS OF GRAVEL
	SANDY SILT VARYING AMOUNTS OF GRAVEL
	QUARTZITE AND QUARTZ SCHIST
	APPROXIMATE FOUNDATION SUBGRADE ELEVATION

SCALE: AS SHOWN	DRAWING NUMBER: 1300121-A-01	KEY: 	TEST BORING PROFILES PREPARED FOR COATESVILLE VA HOSPITAL CALN TOWNSHIP CHESTER COUNTY PENNSYLVANIA			 6520 STONEGATE DRIVE, SUITE 110 ALLENTOWN, PA 18106 PH (610) 366-7120 FAX (610) 366-7121
DRAWN BY: T.C.SERFASS	CHECKED BY: D. KREISCHER					
APPROVED BY: D.KREISCHER	DATE: 4/4/2013					

Soil Classification Report

Per ASTM Designations D 2487 - 06 and D 2488 - 06

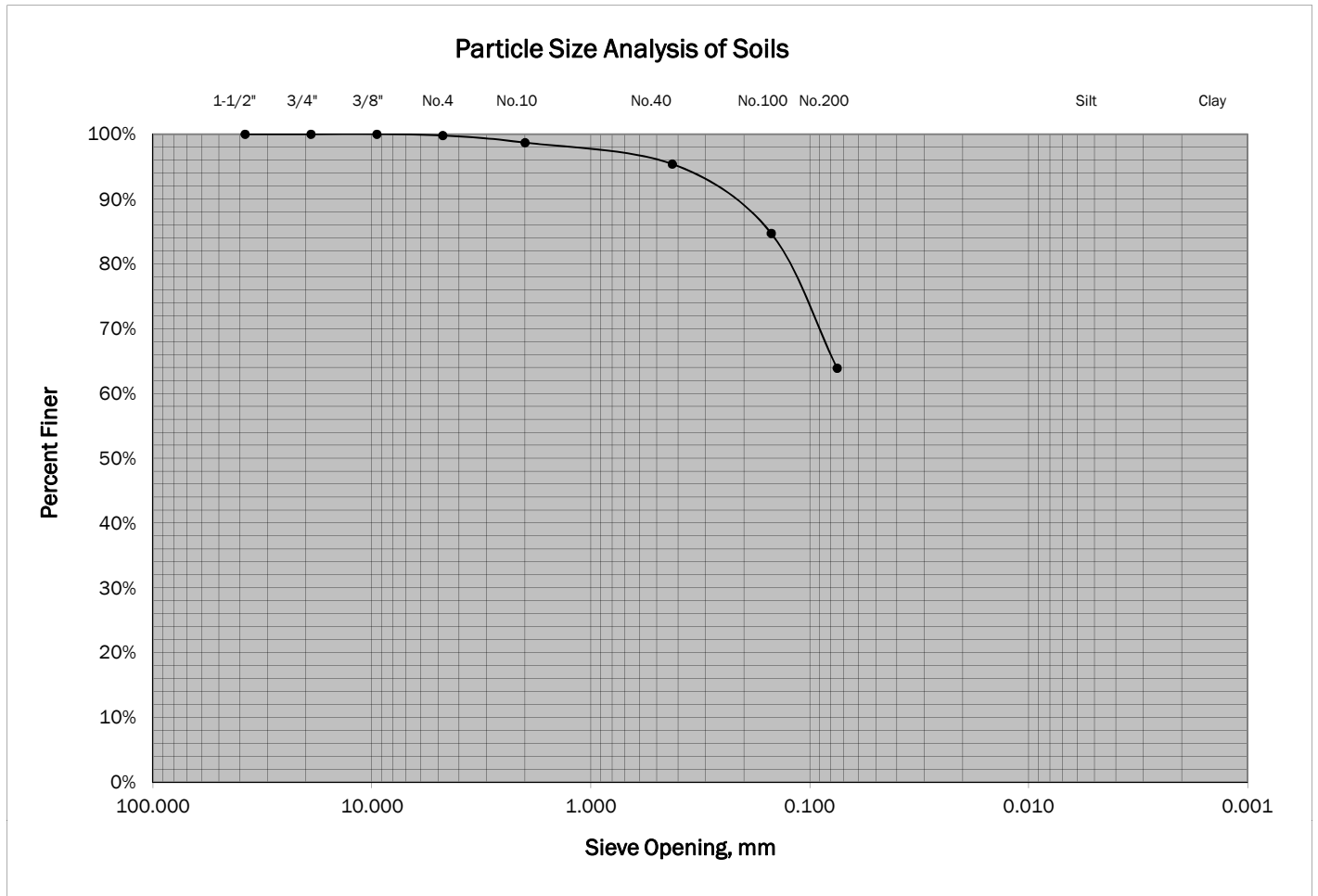
Particle Size Analysis of Soils



As-Received Moisture: 9.9%					Particle Size Distribution					
USCS Classification: SM - Silty Sand with Gravel					US Standard Sieve Size		Opening (mm)		%Finer	
Gravel:	18.6%	Coarse: 8.0%		Fine: 10.6%	GRAVEL	1-1/2"	38.0	100.0%		
Sand:	45.9%	Coarse: 8.8%	Medium: 16.7%	Fine: 20.4%		3/4"	19.0	92.0%		
Fines:	35.5%	Silt:	Clay:			3/8"	9.50	86.1%		
Gravel Description:		Angular/Sub-Angular/Sub-Rounded			SAND	No. 4	4.75	81.4%		
Sand Description: Sub-Angular/Sub-Rounded						No. 10	2.00	72.6%		
						No. 40	0.425	55.9%		
						No. 100	0.150	46.0%		
Consistency: N/A		Dry Strength: N/A		FINES	No. 200	0.075	35.5%			
Dilatancy: N/A		Toughness: N/A			Silt Size	0.005				
Structure: Stratified		Cementation: N/A			Clay Size	0.001				
					D ₆₀ :	D ₃₀ :	D ₁₀ :	Cu:	Cc:	
Boring: B-2					Atterberg Limits		LL: NP	PL: NP	PI: NP	
Sample: S-2 / S-3		Depth: 2-4' / 4-6'			Description: brown , gray, tan					
Project: Coatsville VA Hospital					Remarks: Fill					
Client: Barry Isset & Associates, Inc.										
Project Number: 1300121					Report Date: April 10, 2013					

Soil Classification Report

Per ASTM Designations D 2487 - 06 and D 2488 - 06



As-Received Moisture: 10.5%					Particle Size Distribution							
USCS Classification: ML - Sandy Silt					US Standard Sieve Size		Opening (mm)		%Finer			
Gravel:	0.2%	Coarse: 0.0%		Fine: 0.2%	GRAVEL	1-1/2"	38.0	100.0%				
Sand:	35.9%	Coarse: 1.1%	Medium: 3.3%	Fine: 31.5%		3/4"	19.0	100.0%				
Fines:	63.9%	Silt:	Clay:			3/8"	9.50	100.0%				
Gravel Description:		Angular			SAND	No. 4	4.75	99.8%				
						No. 10	2.00	98.7%				
Sand Description:		Angular				No. 40	0.425	95.4%				
						No. 100	0.150	84.7%				
Consistency:	Very Soft		Dry Strength:	N/A		FINES	No. 200	0.075	63.9%			
Dilatancy:	N/A		Toughness:	N/A			Silt Size	0.005				
Structure:	Homogeneous		Cementation:	N/A			Clay Size	0.001				
					D ₆₀ :	D ₃₀ :	D ₁₀ :	Cu:	Cc:			
Boring:	B-3				Atterberg Limits		LL:	NP	PL:	NP	PI:	NP
Sample:	S-5 / S-6		Depth: 8-10' / 13-15'			Description: Tan brown						
Project:	Coatsville VA Hospital					Remarks: Stratum I						
Client:	Barry Isset & Associates, Inc.											
Project Number:	1300121					Report Date: March 26, 2013						

TEST BORING LOG

SHEET 1 OF 1

PROJECT NAME: Coatesville VA Hospital

BORING NO.: B-1

PROJECT NUMBER: 1300121

CLIENT: Barry Isett & Associates, Inc.

LOCATION: See Location Plan (Drawing: 1300121-A-102)

☐ FIELD SURVEYED

☒ TOPO ESTIMATE

E
L
E
V

TOP OF GROUND: ±641.0'

GROUNDWATER DATA: Dry

Depth: N/A

Time: Completion

DEPTH (feet)	SAMPLE NUMBER	SAMPLE DEPTH (ft)	BLOWS PER 6"		REMARKS
				0.0' - 0.4'	Gray to dark brown silty sand with organic material Topsoil
	S1	0' - 2'	3-4-5-12	0.4' - 2.0'	Medium dense gray to brown silty sand, with organic material and concrete fragments Rec=60% Fill
	S2	2' - 4'	1-5-7-4	2.0' - 11.0'	Stiff tan and gray sandy silt, trace gravel Rec=40%
5					
	S3	4' - 6'	13-15-19-25		Hard gray, tan and red sandy silt, some gravel Rec=60%
	S4	6' - 6.8'	21-50/4"		Hard orange and gray sandy silt (saprolitic) Rec=40%
	S5	8' - 8.3'	50/3"		Hard orange-brown sandy silt (saprolitic) Rec=20%
10					
					Stratum I
15					
20					
25					
30					

- Auger Refusal at 11.0' -
- End of Boring at 11.0' -



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www.advantageengineers.com

RIG TYPE: Truck-Mounted CME 55
DRILLING METHOD: Hollow Stem Auger
DRILLER: FM & W Drilling, Inc.
ADVANTAGE REPRESENTATIVE: T.C.Serfass
DATE DRILLED: March 25, 2013
DRAWN/COMPILED BY: T.C.Serfass
DATE COMPILED: April 3, 2013

TEST BORING LOG

SHEET 1 OF 1

PROJECT NAME: Coatesville VA Hospital

BORING NO.: B-2

PROJECT NUMBER: 1300121

CLIENT: Barry Isett & Associates, Inc.

LOCATION: See Location Plan (Drawing: 1300121-A-102)

☐ FIELD SURVEYED

☒ TOPO ESTIMATE

E
L
E
V

TOP OF GROUND: ±644'

GROUNDWATER DATA: Dry

Depth: N/A

Time: Completion

DEPTH (feet)	SAMPLE NUMBER	SAMPLE DEPTH (ft)	BLOWS PER 6"		REMARKS
				0.0' - 0.6'	Dark brown silty sand with organic material Topsoil
	S1	0' - 2'	1-4-6-4	0.6' - 8.0'	Medium dense orange-brown silty sand, trace gravel Rec=20%
	S2	2' - 4'	5-6-7-12		Dense brown and orange-brown silty sand, little gravel Rec=60%
5					
	S3	4' - 6'	9-5-6-3		Dense gray, white, and orange-brown silty sand, little gravel Rec=50%
	S4	6' - 8'	3-2-2-1		Rec=55%
				8.0' - 16.5'	Loose gray and orange-brown silty sand, little gravel Fill
10	S5	8' - 10'	21-28-26-21		Hard orange sandy silt, trace gravel Rec=55%
15	S6	14' - 14.9'	11-26-50/5"		Hard orange and white gravel, little sandy silt (saprolitic) Rec=40%
					Stratum I
					- Auger Refusal at 16.5' -
					-End of Boring at 16.5'-
20					
25					
30					



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RIG TYPE: Truck-Mounted CME 55

DRILLING METHOD: Hollow Stem Auger

DRILLER: FM & W Drilling, Inc.

ADVANTAGE REPRESENTATIVE: T.C.Serfass

DATE DRILLED: March 25, 2013

DRAWN/COMPILED BY: T.C.Serfass

DATE COMPILED: April 3, 2013

TEST BORING LOG

SHEET 1 OF 1

PROJECT NAME: Coatesville VA Hospital

BORING NO.: B-3

PROJECT NUMBER: 1300121

CLIENT: Barry Isett & Associates, Inc.

LOCATION: See Location Plan (Drawing: 1300121-A-102)

☐ FIELD SURVEYED

☒ TOPO ESTIMATE

E
L
E
V

TOP OF GROUND: ±644'

GROUNDWATER DATA: Dry

Depth: N/A

Time: Completion

DEPTH (feet)	SAMPLE NUMBER	SAMPLE DEPTH (ft)	BLOWS PER 6"		REMARKS
				0.0' - 0.6'	Dark brown silty sand with organic material Topsoil
	S1	0' - 2'	3-3-3-3	0.6' - 6.0'	Medium dense orange-brown and redsilty sand, little gravel and organic material Rec=70%
	S2	2' - 4'	3-4-3-4		Medium dense light brown and orange-brown silty sand, trace gravel Rec=50%
5					
	S3	4' - 6'	4-3-4-3		Medium dense red-brown and light brown silty sand, trace gravel Rec=70%
					Fill
	S4	6' - 8'	5-6-13-12	6.0' - 17.5'	Very stiff tan and gray sandy silt (saprolitic) Rec=70%
10	S5	8' - 10'	16-24-33-42		Hard gray, tan, and red sandy silt (saprolitic) Rec=70%
15	S6	13' - 15'	30-36-32-26		Hard gray, tan, and red sandy silt (saprolitic) Rec=100%
					Stratum I
20					- Auger Refusal at 17.5' - -End of Boring at 17.5'-
25					
30					



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RIG TYPE: Truck-Mounted CME 55

DRILLING METHOD: Hollow Stem Auger

DRILLER: FM & W Drilling, Inc.

ADVANTAGE REPRESENTATIVE: T.C.Serfass

DATE DRILLED: March 25, 2013

DRAWN/COMPILED BY: T.C.Serfass

DATE COMPILED: April 3, 2013

TEST BORING LOG

SHEET 1 OF 1

PROJECT NAME: Coatesville VA Hospital

BORING NO.: B-4

PROJECT NUMBER: 1300121

CLIENT: Barry Isett & Associates, Inc.

E
L
E
V

TOP OF GROUND: ±642'

LOCATION: See Location Plan (Drawing: 1300121-A-102)

GROUNDWATER DATA: Dry

☐ FIELD SURVEYED

☒ TOPO ESTIMATE

Depth: N/A

Time: Completion

DEPTH (feet)	SAMPLE NUMBER	SAMPLE DEPTH (ft)	BLOWS PER 6"		REMARKS
				0.0' - 0.4'	Dark brown silty sand with organic material Topsoil
	S1	0' - 2'	1-2-2-1	0.4' - 8.0'	Medium dense light brown to orange-brown silty sand, trace gravel and organic material Rec=10%
	S2	2' - 4'	1-2-2-2		Medium dense brown to light brown silty sand, trace gravel Rec=50%
5					
	S3	4' - 6'	3-4-4-3		Medium dense light brown to brown, and gray silty sand, little gravel Rec=40%
	S4	6' - 8'	2-2-2-1		Loose orange-brown and light brown silty sand, little gravel Rec=30%
					Fill
10	S5	8' - 10'	1-2-8-14	8.0' - 17.0'	Stiff orange to gray sandy silt, little gravel Rec=40%
15	S6	14' - 14.3'	50/4"		Hard orange to gray sandy silt, some gravel (saprolitic) Rec=40%
					Stratum I
					- Auger Refusal at 17.0' -
					- End of Boring at 17.0'-
20					
25					
30					



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RIG TYPE: Truck-Mounted CME 55
DRILLING METHOD: Hollow Stem Auger
DRILLER: FM & W Drilling, Inc.
ADVANTAGE REPRESENTATIVE: T.C.Serfass
DATE DRILLED: March 25, 2013
DRAWN/COMPILED BY: T.C.Serfass
DATE COMPILED: April 3, 2013

SHEET 1 OF 1

BORING NO.: B-5

E	TOP OF GROUND:	±642'
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GROUNDWATER DATA: Dry

X TOPO ESTIMATE

Time: Completion

 <p>6520 Stonegate Drive, Suite 110, Allentown, PA 18106 (610) 366-7120 FAX: (610) 366-7121 www.advantageengineers.com</p>	<p>RIG TYPE: Truck-Mounted CME 55 DRILLING METHOD: Hollow Stem Auger DRILLER: FM & W Drilling, Inc. ADVANTAGE REPRESENTATIVE: T.C.Serfass DATE DRILLED: March 26, 2013 DRAWN/COMPILED BY: T.C.Serfass DATE COMPILED: April 3, 2013</p>
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SHEET 1 OF 1

BORING NO.: B-6

E	TOP OF GROUND:	±642'
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GROUNDWATER DATA: Dry

X TOPO ESTIMATE

Time: Completion

 <p>6520 Stonegate Drive, Suite 110, Allentown, PA 18106 (610) 366-7120 FAX: (610) 366-7121 www.advantageengineers.com</p>	<p>RIG TYPE: Truck-Mounted CME 55 DRILLING METHOD: Hollow Stem Auger DRILLER: FM & W Drilling, Inc. ADVANTAGE REPRESENTATIVE: T.C.Serfass DATE DRILLED: March 26, 2013 DRAWN/COMPILED BY: T.C.Serfass DATE COMPILED: April 3, 2013</p>
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