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January 7, 2014 2013-3022-00

S&B Christ Consulting, LLC
5580 S. Fort Apache Road #130
Las Vegas, NV 89148

Attention: Jonathan Tull, PE, CEM, LEED-AP
Senior Project Manager

GEOTECHNICAL INVESTIGATION
ASSESSMENT AND DESIGN ACTIVITIES FOR EXISTING SANITARY SEWER
COATESVILLE VETERANS AFFAIRS MEDICAL CENTER
COATESVILLE, PENNSYLVANIA

Dear Mr. Tull:

Advanced GeoServices is pleased to present this report of a geotechnical investigation performed to assist in the assessment and design activities associated with the existing sanitary sewer system at the Veterans Affairs Medical Center (VAMC) in Coatesville, Pennsylvania. A Site Location Map is provided as Figure 1. This geotechnical investigation was performed in general accordance with our proposal no. 2013-P-0178-G dated June 20, 2013.

The scope of work for this investigation consisted of a geotechnical site reconnaissance; drilling four (4) test borings; moisture content testing of selected representative soil samples; appropriate engineering analyses; and the issue of this report.

PROJECT DESCRIPTION

S&B Christ Consulting, LLC (SBCC) has been requested by VAMC to evaluate the existing sanitary sewer conditions at four (4) specific site locations (Areas “A” through “D”) and to provide an engineered design approach for mitigating noted sanitary sewer conveyance issues at these locations. We understand that portions of the existing facility infrastructure at these locations have been reported to be experiencing clogs or constrictions to sewer flows.

A total of approximately 2,000 linear feet (LF) of existing gravity sewer line ranging in size from 5” to 8” nominal diameter, approximately 15 manhole structures (MH), and approximately 10 floor drain (FD) outlet structures are identified for possible improvements. A summary of the sanitary sewer elements associated with Areas “A” through “D” is provided below.

Area "A"

Area "A" contains a sanitary sewer outlet (approximately 470 LF of 6" diameter and 205 LF of 8" diameter gravity pipe) from Buildings 6 and 7. The sanitary sewer runs along the west side of Building 16 and flows into MH 14. In addition, three FD outlets (one each from Buildings 6, 7 and 16) are also subject to possible modifications.

Area "B"

Area "B" contains a sanitary sewer outlet (approximately 435 LF of 5" diameter and 360 LF of 6" diameter gravity pipe) from Buildings 3, 4 and 5 which flows into MH 34. This area also contains three FD outlets (one each from Buildings 3, 4 and 5) that are to be assessed. In addition, a single exterior FD at the basement entry to Building 4 (believed to be connected to the sanitary sewer and not the storm drain) may also be modified.

Area "C"

Area "C" contains a sanitary sewer outlet (approximately 270 LF of 6" diameter gravity pipe) from Buildings 38 and 39 which flows south to MH P. In addition, two FD (one each from Buildings 38 and 39) are subject to possible modifications.

Area "D"

Area "D" contains a sanitary sewer outlet (approximately 30 LF of 6" diameter and 230 LF of 8" diameter gravity pipe) from Building 59 which runs northeast (to the east of Building 12) and flows into MH 76. In addition, one FD from Building 59 is subject to possible modifications.

SUBSURFACE CONDITIONS

Subsurface conditions at the Coatesville VAMC were evaluated by drilling four (4) test borings (one each in Areas "A", "B", "C", and "D"). The locations of the test borings are shown on Figure 2. The logs of the test borings are included in the Appendix.

Moisture content testing was conducted on representative soil samples collected from the test borings. The results of this testing are shown on the boring logs adjacent to the samples tested.

The bedrock formation beneath the VAMC is the Chickies Formation. This formation consists of light-gray to white hard quartzite and quartz schist. A summary of the various materials encountered in the test borings is provided below.

Surface Cover

An asphalt pavement section was encountered in test borings B-2 and B-4. The pavement section in B-2 consists of 4.5 inches of asphalt underlain by about 4 inches of aggregate base course. The pavement section in B-4 consists of 2 inches of asphalt underlain by about 2 inches of aggregate base course.

Topsoil was encountered in test borings B-1 and B-3 to a depth of about 6 inches. The topsoil generally consists of brown clayey silt (B-1) to dark brown sandy silt (B-3).

Fill

Fill material was encountered beneath the surface cover in test borings B-1, B-3, and B-4 as discussed below.

- Light brown to brown silty medium to fine sand was encountered to the depth of 2 feet in test boring B-1. The Standard Penetration Test result (ASTM D 1586 'N' value) of this material was 6 blows per foot (bpf), indicating a medium dense consistency. One (1) sample of this material was tested for moisture content, with a result of 19.4 percent.

- In test boring B-3, six inches of white sandy gravel was encountered beneath the topsoil.

- Beneath the asphalt pavement section, brown to dark brown slightly micaceous sandy silt with trace clay was encountered to the depth of 4.5 feet in test boring B-4. The 'N' values of this material range from 3 to 4 bpf, indicating a medium dense consistency. Two (2) samples of this material were tested for moisture content, with results ranging from 17.6 to 18.6 percent.

Residual Soil

Beneath the fill and/or surface cover, residual soil was encountered in all the test borings to depths ranging from 6 to 13 feet. Residual soil is a natural material that results from the complete weathering of the underlying bedrock. At the site, this material generally consists of light brown, brown, orange-brown, and whitish brown slightly micaceous silty coarse to fine sand. The 'N' values of this material range from 6 bpf to 24 bpf, indicating that this material is medium dense to very dense in consistency. Fourteen (14) samples of this material were tested for moisture content, with results ranging from 1.0 to 12.5 percent.

Decomposed Rock

Decomposed rock, characterized by a relic rock structure, was encountered in all test borings beneath the residual soil. This material generally consists of light brown to brown, grayish brown, light reddish brown, whitish brown, and white silty coarse to fine sand. The 'N' values of the decomposed rock material range from 25 bpf to well over 100 bpf, indicating that this material is very dense in consistency. Five (5) samples of this material were tested for moisture content, with results ranging from 3.9 to 10.9 percent.

Groundwater

During this investigation, groundwater was not encountered in any of the test borings.

DEVELOPMENT CONDITIONS

Based on our evaluation of the collected data, we offer the following conclusions.

Excavations

Excavations will be required to perform the repairs to the existing sanitary sewer elements. The existing fill, residual soil, and the majority of the decomposed rock materials can be excavated with conventional earth moving equipment. Some of the very dense decomposed rock seams (with 'N' values of well over 100 bpf) may be difficult to excavate and may require larger excavation equipment and/or breaking.

Based upon the test boring data, the regional groundwater table will not be encountered during the excavations for the sanitary sewer. Therefore, groundwater control measures (other than stormwater drainage control) will not be required during construction.

Backfill Materials

In general, the site soils are suitable for re-use as fill in their present state. The existing fill material encountered in test boring B-4 may require drying prior to reuse. We note that portions of the site soils are moisture-sensitive and will become unsuitable if exposed to additional moisture via precipitation or poor drainage.

RECOMMENDATIONS

Recommendations pertaining to the assessment and design activities as well as the repair of the existing sanitary sewer elements are presented in the following sections.

Site Preparation

All trees and associated roots, vegetation, surface topsoil/root mat, asphalt pavement and concrete sidewalks, slabs, and curbs within the proposed repair areas should be removed. The existing aggregate base course materials may remain. The vegetative, asphalt, and concrete debris should be disposed of in accordance with prevailing regulations.

Excavations

The excavation and trenching activities must comply with 29 CFR 1926.651 and 1926.652 or comparable OSHA-approved state plan requirements. If sheeting/shoring protection is required, the following parameters should be assumed for design.

- Sheeting/shoring that is restrained from rotation should be designed for the condition of at-rest lateral earth pressure; we recommend using a coefficient of at-rest earth pressure of 0.53.

- Sheeting/shoring that is free to rotate should be designed for the condition of active lateral earth pressure; we recommend using a coefficient of active earth pressure of 0.36.

- A moist soil unit weight of 125 pounds per cubic foot (pcf) should be assumed for both the at-rest and active lateral earth pressure cases.

- Additional lateral earth pressures exerted by adjacent surface surcharge loads (e.g., construction equipment, buildings, soil stockpiles, etc.) should be calculated as an added uniform pressure equivalent to one-half the average unit load of the surcharge.

Sanitary Pipe Subgrades

The new sanitary pipe should be placed on a stable subgrade. Any unstable areas observed during pipe installation should be undercut and replaced with suitable backfill compacted to at least 92 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D 1557). An Elastic Modules of soil (Young's soil modulus (E_s)) of 350,000 pounds per square foot (psf) may be assumed for the design of the new piping.

Backfill

Soils used to backfill excavations should be free of organics, degradable inclusions, excess moisture, frozen materials, and particles larger than 4 inches. In general, the site soils will be suitable for re-use as fill in their present state. The existing fill material encountered in test boring B-4 may require drying prior to reuse.

The backfill should be placed in horizontal lifts with a maximum loose thickness of 8 inches. Each lift of backfill should be compacted by repeated passes of hand-manipulated compaction equipment (i.e., jumping jack-type tampers, trench rollers, etc.) to at least 92 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D 1557). In addition, all compacted fills should be stable, with no appreciable movement beneath the compaction equipment.

Pavement, Slab, and Sidewalk Subgrades

Immediately prior to reconstruction of the asphalt pavements and concrete sidewalks/slabs, the subgrades should be proof-rolled with a smooth-drum vibratory roller to densify any areas disturbed by adverse weather or previous construction activities. Any unstable areas observed during the proof-rolling should be undercut and replaced with suitable backfill compacted to at least 92 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D 1557).

A Resistance Value (R-value) of 40 may be assumed for pavement design.

Seismic Design Criteria

Based on the IBC (2012) criteria, seismic site classification D can be used for design. This classification is based upon the results of the test borings and our understanding of regional geologic conditions.

LIMITATIONS

All provisions and recommendations presented in this report are predicated on the assumption that subsurface conditions do not deviate appreciably from those disclosed by the test borings. These conclusions and recommendations are subject to confirmation or revision upon our review of the final plans and specifications for the proposed repairs to the existing sanitary sewer system. Conclusions and recommendations are also based on the premise that competent geotechnical field decisions will be provided during construction.

The scope of this geotechnical investigation was limited to an evaluation of the load-carrying capabilities and stability of the subsurface materials. Oil, hazardous waste, radon, radioactivity, irritants, pollutants, or other dangerous substances and conditions were not the subject of this report or this geotechnical investigation.

Statements and conclusions regarding the impact of geotechnical conditions on the design and construction of the proposed repairs to the existing sanitary sewer system as stated in this report are unique. Findings, conclusions, and recommendations are not transferable to other development schemes or site arrangements.

We appreciate this opportunity to be of service to you. If you have any questions concerning the contents of this report, or if we may be of further service, please contact us.

Very truly yours,

ADVANCED GEOSERVICES

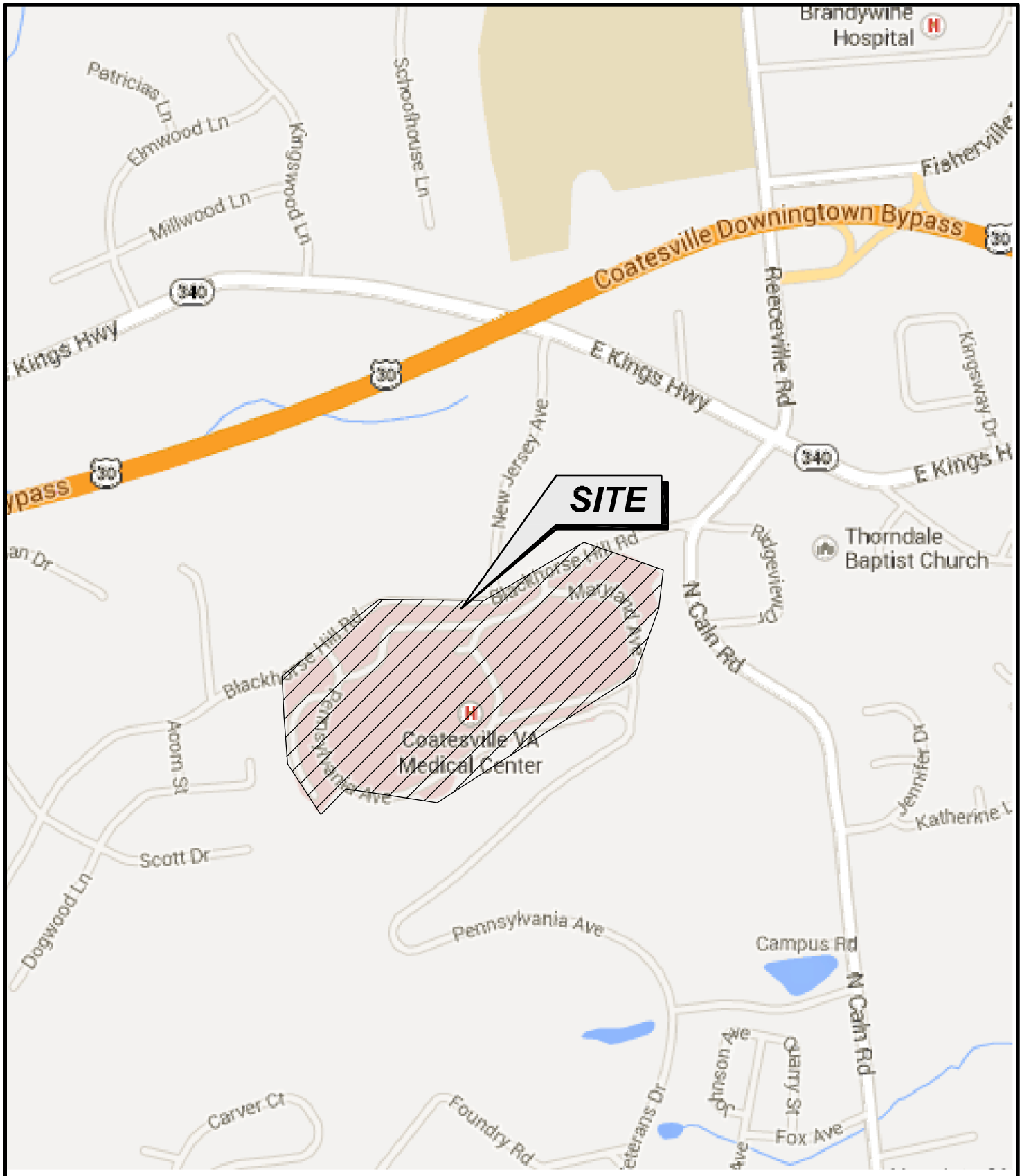
Paul F. Marano, P.E.
Project Consultant

Todd D. Trotman, P.E.
Project Consultant

TDT:PFM:kk

Enclosure(s)

FIGURES



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SITE LOCATION MAP

COATESVILLE VAMC
COATESVILLE, PENNSYLVANIA

PROJECT ENGINEER:	T.D.T.	SCALE:	N.T.S.
CHECKED BY:	T.D.T.	PROJECT NUMBER:	20133022
DRAWN BY:	JS	DATE: 8/30/2013	FIGURE: 1

FIG 2

COATESVILLE VAMC

COATESVILLE, PENNSYLVANIA

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BORING LOCATION PLAN

PROJECT MANAGER:	TDT	SCALE:	1" = 120'
CHECKED BY:	TDT	PROJECT NUMBER:	2013-3022
DRAWN BY:	JS	DATE:	8/30/2013

APPENDIX

APPENDIX

Subsurface conditions at the Coatesville VAMC were evaluated by drilling four (4) test borings (one each in Areas “A”, “B”, “C”, and “D”. The locations of the test borings are shown on Figure 2. The logs of the test borings are included in this appendix.

The test borings were drilled by F.M.&W. Drilling Company, Inc. under the technical supervision of Advanced GeoServices personnel. The field locations of the test borings were determined by Advanced GeoServices and VAMC personnel. The ground surface elevation at each test boring location was surveyed by Advanced GeoServices.

Soil samples were obtained from the test borings for identification and classification purposes by means of the Standard Penetration Test (ASTM D 1586). The sampling resistance of the soils is recorded on the boring log adjacent to the sample locations; this resistance is given in hammer blows per six inches of sampler penetration (or fraction of the 6-inch increment). The SPT (N) values are also shown on the log; these values are determined by totaling the blow counts required for the second and third 6-inch increment (or fraction of the 12-inch increment) of sampler penetration.

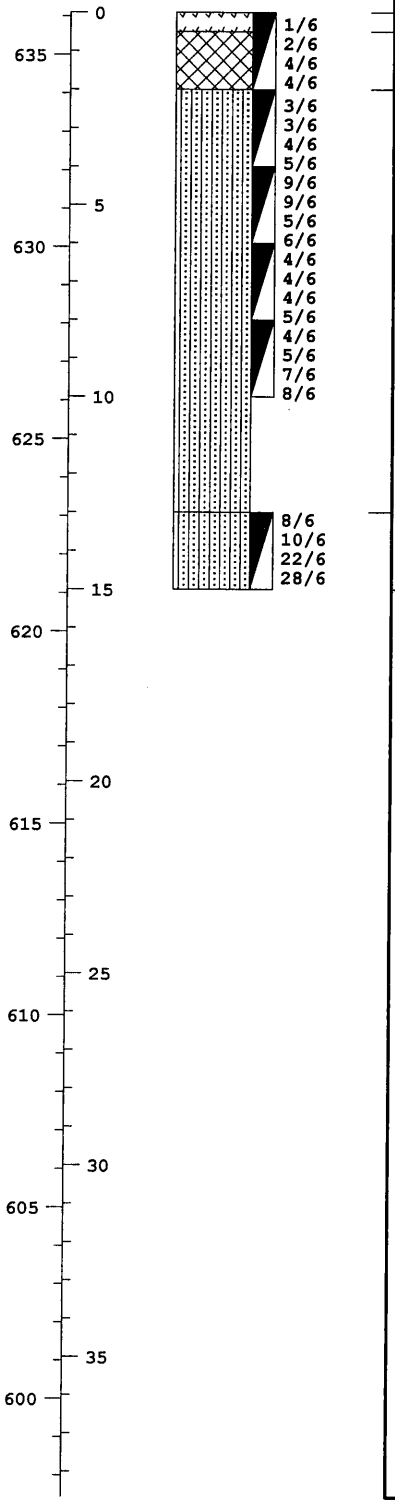
Upon completion, the borings were backfilled with the drilling spoils. Borings located in paved areas were capped with a cold patch asphalt mix.

Moisture content testing was conducted on representative soil samples collected from the test borings. The results of this testing are shown on the boring logs adjacent to the samples tested.

LOG OF TEST BORING
TEST BORING B-1

DATE: 8/24/2013
PROJECT: Coatesville VAMC
BORING LOCATION: See Figure 2
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: F. M. & W. Drilling Company, Inc.
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2013-3022-00
SURFACE ELEVATION: 636.1
CHECKED BY: TDT
DRILLER: Joe Brophy
INSPECTOR: T. Trotman



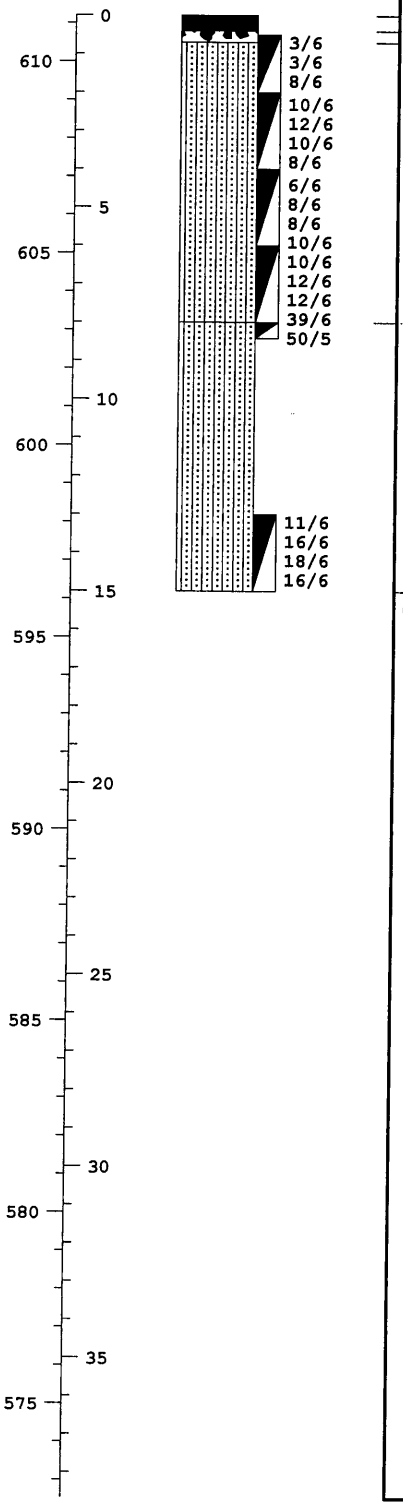
ELEVATION / DEPTH	Soil Description		SPT (N)	Moisture (%)	Other Tests
	Brown clayey SILT.	636.1	6	19.7	
	(TOPSOIL)	0.5 635.6			
	Medium dense light brown to brown silty medium to fine SAND.	2.0 634.1	7	9.4	
	(FILL)				
	Medium dense light brown to brown silty medium to fine SAND.		14	12.5	
	(RESIDUAL SOIL)		8	11.3	
			12	10.0	
	Very dense light brown to grayish brown silty medium to fine SAND.	13.0 623.1	32	10.9	
	(DECOMPOSED ROCK)	15.0 621.1			
	Completion Depth = 15 feet END OF TEST BORING @ 15 FT.				

LOG OF TEST BORING

TEST BORING B-2

DATE: 8/24/2013
PROJECT: Coatesville VAMC
BORING LOCATION: See Figure 2
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: F. M. & W. Drilling Company, Inc.
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2013-3022-00
SURFACE ELEVATION: 611.2
CHECKED BY: TDT
DRILLER: Joe Brophy
INSPECTOR: T. Trotman

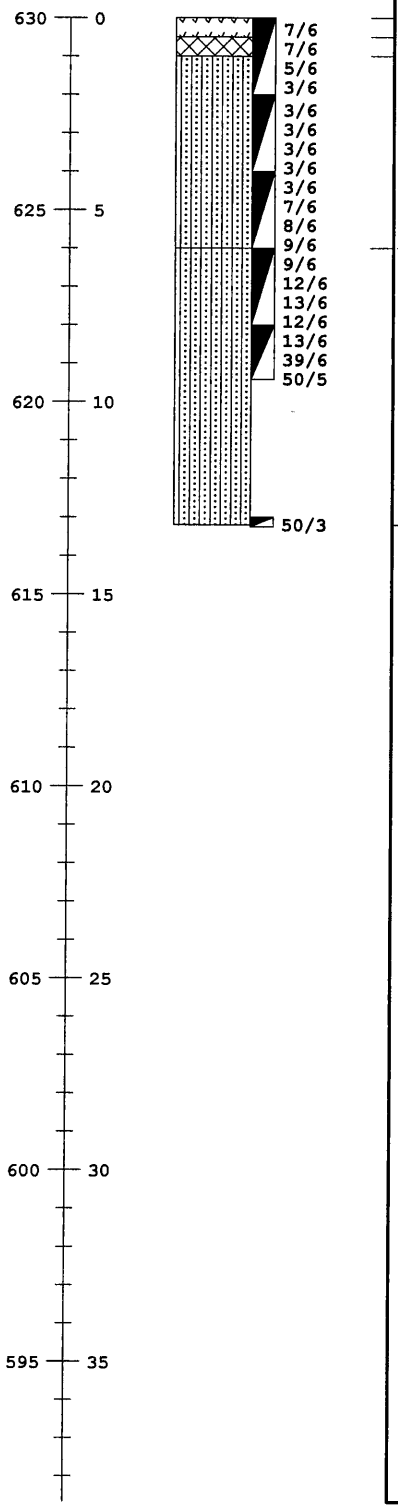


ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description		SPT (N)	Moisture (%)	Other Tests
		Asphalt pavement.	611.2			
		Aggregate base course.	0.4 610.8	11	11.2	
		Dense to very dense light brown to orange-brown silty coarse to fine SAND, trace clay and gravel. (RESIDUAL SOIL)	0.7 610.5	22	11.1	
				16	10.7	
				24	1.0	
			8.0	50/5"		
		Very dense white, light brown, and light reddish brown silty coarse to fine SAND, trace gravel. (DECOMPOSED ROCK)	603.2			
				34	4.1	
			15.0			
		Completion Depth = 15 feet END OF TEST BORING @ 15 FT.	596.2			

LOG OF TEST BORING
TEST BORING B-3

DATE: 8/24/2013
PROJECT: Coatesville VAMC
BORING LOCATION: See Figure 2
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: F. M. & W. Drilling Company, Inc.
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2013-3022-00
SURFACE ELEVATION: 630.0
CHECKED BY: TDT
DRILLER: Joe Brophy
INSPECTOR: T. Trotman

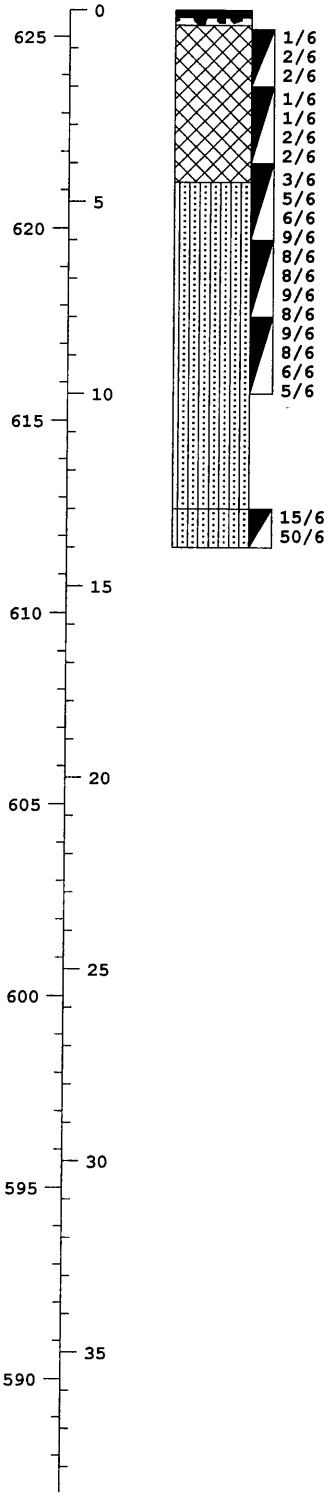


ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description		SPT (N)	Moisture (%)	Other Tests
		Dark brown sandy SILT.	630	12	9.2	
		(TOPSOIL)	0.5 629.5			
		White sandy GRAVEL.	1.0	6	10.9	
		(FILL)	629			
		Medium dense to dense light brown to whitish brown silty medium to fine SAND.		15	3.5	
		(RESIDUAL SOIL)	6.0			
		Very dense white to whitish brown medum to fine SAND, trace silt and gravel.	624	25	3.9	
		(DECOMPOSED ROCK)		89	5.0	
			13.2	50/3"		
		Completion Depth = 13.2 feet END OF TEST BORING @ 13.2 FT.	616.8			

LOG OF TEST BORING
TEST BORING B-4

DATE: 8/24/2013
PROJECT: Coatesville VAMC
BORING LOCATION: See Figure 2
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: F. M. & W. Drilling Company, Inc.
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2013-3022-00
SURFACE ELEVATION: 625.7
CHECKED BY: TDT
DRILLER: Joe Brophy
INSPECTOR: T. Trotman



ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description		SPT (N)	Moisture (%)	Other Tests
		Asphalt pavement.	625.7			
		Aggregate base course.	0.2 625.5	4	18.6	
		Medium dense brown to dark brown slightly micaceous sandy SILT, trace clay. (FILL)	0.4 625.3	3	17.6	
		Medium dense to dense light brown to brown slightly micaceous silty coarse to fine SAND. (RESIDUAL SOIL)	4.5 621.2	11	11.9	
				17	9.3	
				14	4.9	
		Very dense brown silty coarse to fine SAND. (DECOMPOSED ROCK)	13.0 612.7 14.0 611.7	50/6"	6.8	
		Completion Depth = 14 feet END OF TEST BORING @ 14 FT.				