

GEOTECHNICAL DATA REPORT

**US 264 HDD Crossings
Greenville, North Carolina
S&ME Project No. 1358-14-033**

Prepared For:

RK&K
2100 East Cary Street, Suite 209
Richmond, Virginia 23223

Prepared By:



3718 Old Battleground Road
Greensboro, North Carolina 27410
NC PE Firm License No. F-0176

July 28, 2014



July 28, 2014

RK&K
2100 East Cary Street, Suite 209
Richmond, Virginia 23223

Attention: Mr. Martin Rodgers, P.E.

Reference: GEOTECHNICAL DATA REPORT

US 264 HDD Crossings
Greenville, North Carolina
S&ME Project No. 1358-14-033

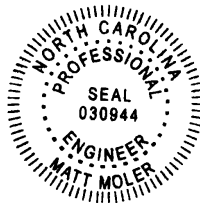
Dear Mr. Rodgers:

S&ME, Inc. (S&ME) has completed field exploration and laboratory testing for the above referenced project. The purpose was to explore and characterize subsurface conditions for use in design and construction of four sections of a directionally drilled pipeline along US 264 between Old River Road and MacGregor Downs Road in Greenville, North Carolina. Our work was performed in general accordance with S&ME Proposal No. 1581-13-P233 dated November 21, 2013 and the terms and conditions of the General Services Agreement between RK&K and S&ME dated June 4, 2010. The project scope was amended during a telephone call on June 27, 2014 between Wayne Noonoo with RK&K and Matt Moler with S&ME to include a total of eight soil test borings to depths of 40 or 50 feet below existing grade.

S&ME appreciates the opportunity to provide geotechnical exploration and testing services for this project. If you have any questions or need additional information in regard to this report, please call us at (336) 288-7180.

Respectfully,
S&ME, Inc.

Matt Moler, P.E.
Senior Engineer/Project Manager



Scott Hancock, P.E.
Technical Principal/Vice President

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- A Legend to Soil Classification and Symbols
Boring Logs (B-1 through B-8)
- B Summary of Laboratory Test Data
Laboratory Test Results (34 pages)

1.0 PROJECT INFORMATION

Project information was obtained from e-mail correspondence between Martin Rodgers with RK&K and Scott Hancock with S&ME dated November 19, 2013. In the e-mail correspondence, Mr. Rodgers provided a project schedule and requested five boring to depths of 60 feet below existing grade. The project scope was amended during a telephone call on June 27, 2014 between Wayne Noonoo with RK&K and Matt Moler with S&ME to include a total of eight soil test borings to depths of 40 or 50 feet below existing grade.

The proposed construction consists of four sections of horizontal directionally drilled (HDD) pipeline along US 264 between Old River Road and MacGregor Downs Road in Greenville, North Carolina, as shown on Figure 1 (Site Vicinity Plan) in the Appendix. S&ME was requested to perform two borings at each HDD crossing for use in the HDD design by RK&K.

2.0 GEOLOGY

The site is located within the Coastal Plain Physiographic Province of North Carolina. The Coastal Plain Province is typically characterized by marine, alluvial, and eolian sediments that were deposited during periods of fluctuating sea levels and moving shorelines. The soils in this province are typical of those laid down in a shallow sloping near-shore marine environment. Alluvial sands, silts, and clays are typically present near rivers and creeks.

According to the *1985 Geologic Map of North Carolina*, the site is underlain by the Black Creek Formation of the Cretaceous Period. The Black Creek Formation is described as clay, gray to black, lignitic, and contains thin beds and laminae of fine-grained micaceous sand and thick lenses of cross-bedded sand. Glauconitic, fossiliferous clayey sand lenses are located in the upper part of the formation. Borings performed for this exploration did not extend deep enough to encounter the Black Creek Formation.

Based on our experience with HDD and the area geology, we have the following comments relative to HDD natural geologic hazards associated with the subject site:

HDD GEOLOGIC HAZARD	COMMENTS
Cohesionless sand, gravel, cobbles, or boulders with little to no fines.	Zone of clean sands (5% or less passing the No. 200 sieve) encountered sporadically.
Horizontal zones of gravel, cobbles, or boulders in soil matrix.	Inconsistent with site geology.
Near vertical zones of gravel, cobbles, or boulders in soil matrix.	Inconsistent with site geology.
Voids or preferential seepage paths potentially resulting in loss of drilling fluid return.	Inconsistent with site geology.
Very loose sand or very soft silt/clay.	Encountered in several borings at various depths.

Peat, organic soil.	Inconsistent with site geology.
Material with sufficient potential swell upon exposure to water to reduce borehole diameter.	Inconsistent with site geology.
Continuous strata of hard material requiring rock drilling techniques to penetrate.	Inconsistent with site geology.
Artesian groundwater conditions.	Inconsistent with site geology.

3.0 EXPLORATION PROCEDURES

3.1 Field

Eight soil test borings (labeled B-1 through B-8) were conducted at the locations indicated on Figures 2, 4, 6, and 8 (Boring Location Plans). The borings were located roughly parallel to, and offset from, the planned pipeline alignment. Borings B-1 through B-6 were located along US 264, boring B-7 was located within the Greenville Utility right-of-way near the Greenville West 230 Substation, and boring B-8 was located off of MacGregor Downs Road.

The borings were located by S&ME using GPS equipment within the areas requested by RK&K. S&ME provided as-drilled boring coordinates to RK&K, and RK&K provided interpolated ground surface elevations. Subsurface conditions encountered at the boring locations are presented on the Boring Logs in Appendix A. Boring coordinates and ground surface elevations are provided on the Boring Logs and should be considered approximate.

The borings were conducted using a CME 550 drill rig mounted on a rubber-tired all-terrain vehicle. Mud rotary (wash boring) drilling procedures were used to advance the borings to termination depths of 40 or 50 feet. Standard Penetration Tests (SPT) were performed in the borings at 2.5-foot intervals in the top 10 feet, then at 5-foot intervals thereafter, in general accordance with ASTM D 1586 to provide an index for estimating strength parameters and relative consistency of subsurface soils.

3.2 Laboratory

Samples were returned to our laboratory where a geotechnical staff professional visually examined each soil sample to assess the distribution of grain sizes, plasticity, organic content, moisture condition, color, presence of lenses and seams, and apparent geological origin. The results of the classifications are presented on the individual Boring Logs included in Appendix A. The contact lines represent approximate boundaries between the soil types. The actual boundaries between the soil types in the field may vary in both the horizontal and vertical directions.

Classification tests were performed on selected soil samples obtained during the field exploration. Laboratory testing included:

- Atterberg Limits (ASTM D 4318)
- Grain Size Distribution (#200 wash) (ASTM D 422)
- Moisture Content (ASTM D 2216)

Results of the laboratory testing are presented in Appendix B. A Summary of Laboratory Test Data table is also included in Appendix B.

4.0 HDD SUBSURFACE CONDITIONS

Subsurface conditions at the four HDD crossings were characterized based on subsurface conditions encountered and geologic setting. Soils with similar HDD drilling characteristics were grouped into strata (as shown in the table below) based on visual soil classification, laboratory classification tests, consistencies inferred from standard penetration resistance values, and geologic origin. Material properties were estimated from correlations to material types, laboratory tests, and field tests. The Strata contacts shown on the Generalized Subsurface Profiles in the Appendix may vary between borings and should be considered approximate. Material properties are provided in tables based on correlations with subsurface conditions encountered. More detailed information is presented in the Appendix.

STRATA	DESCRIPTION	PERCENT OF MATERIAL			USCS	SPT (blows/ft)
		GRAVEL	SAND	SILT/CLAY		
I	COASTAL PLAIN SOILS: Very loose to medium dense SANDS and soft to stiff SILTS	< 1%	35% to 95%	5% to 65%	SP-SM, SP, SC, SM, SC-SM, ML, MH	WOH to 24
II	COASTAL PLAIN SOILS: Medium dense to dense SANDS	< 1%	80% to 95%	5% to 20%	SP-SM, SM	25 to 40
III	COASTAL PLAIN SOILS: High Plasticity CLAY with intermittent silty sand layers, sporadic shells	< 1%	20% to 50%	50% to 80%	CH, SM	2 to 15

Notes:

1. USCS – Unified Soil Classification System, visual classification.
2. SPT – Standard Penetration Test "N" value. Tests performed with an autohammer.
WOH – Weight of Hammer.
3. The range of Percentage of Materials was estimated based on lab data.
4. The information presented above is a generalization of predominant subsurface conditions encountered. The material descriptions, percentages of materials, USCS, and SPT values presented are estimated based on visual classification, laboratory testing, field testing, and experience.

Groundwater was encountered in the borings at depths of 2.5 to 16.5 feet below the existing ground surface. These depths correspond to approximate elevations of 11.5 to 77.3 feet. The groundwater level typically fluctuates during the year due to seasonal and climatic changes.

Based on the data obtained during our field and laboratory exploration, we recommend the following parameters for use in design of the HDD program.

Strata	Friction Angle (degrees)	Cohesion (psf)	Unit Weight (pcf)		Shear Modulus (ksf)
			Total	Submerged	
I	28	0	120	58	200
II	32	0	120	58	600
III	10	500	110	48	200

5.0 QUALIFICATIONS

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions contained in this report were based on the applicable standards of the engineering profession at the time this report was prepared. No other warranty, express or implied, is made.

The nature and extent of variations between borings may not become evident until construction. If variations appear evident, then it will be necessary to reevaluate the applicability of the information obtained with this exploration and laboratory testing program. Environmental services were beyond the scope of this report.

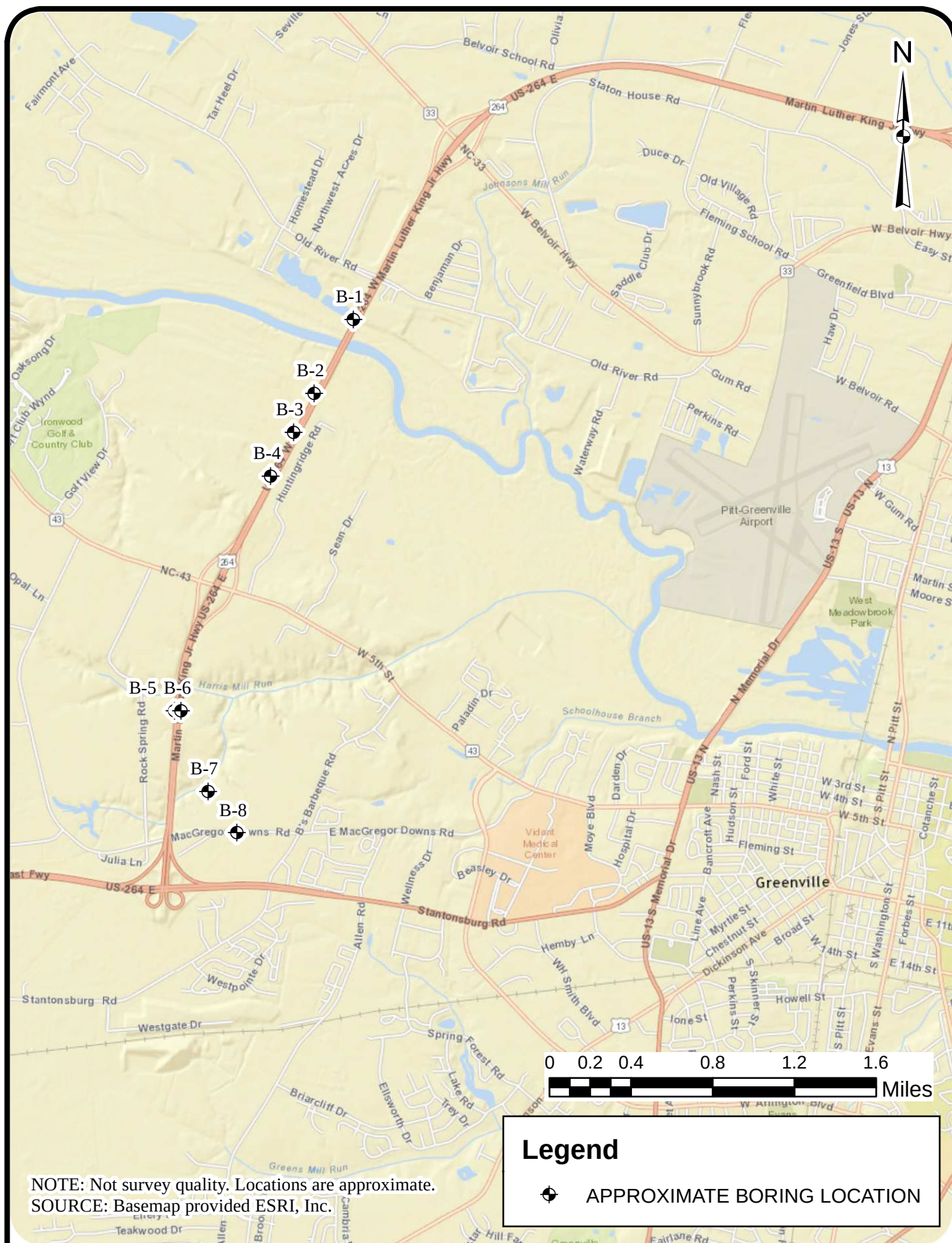
FIGURES

FIGURES

Site Vicinity Plan – Figure 1

Boring Location Plans – Figures 2, 4, 6, and 8

Generalized Subsurface Profiles – Figures 3, 5, 7, and 9



SCALE: As Shown
DATE: JUNE 2014
DRAWN BY: MWL
PROJECT NO: 1358-14-033



SITE VICINITY PLAN
US 264 HDD CROSSINGS
GREENVILLE, NORTH CAROLINA

FIGURE NO.

1



SCALE: As Shown
 DATE: JUNE 2014
 DRAWN BY: MWL
 PROJECT NO: 1358-14-033



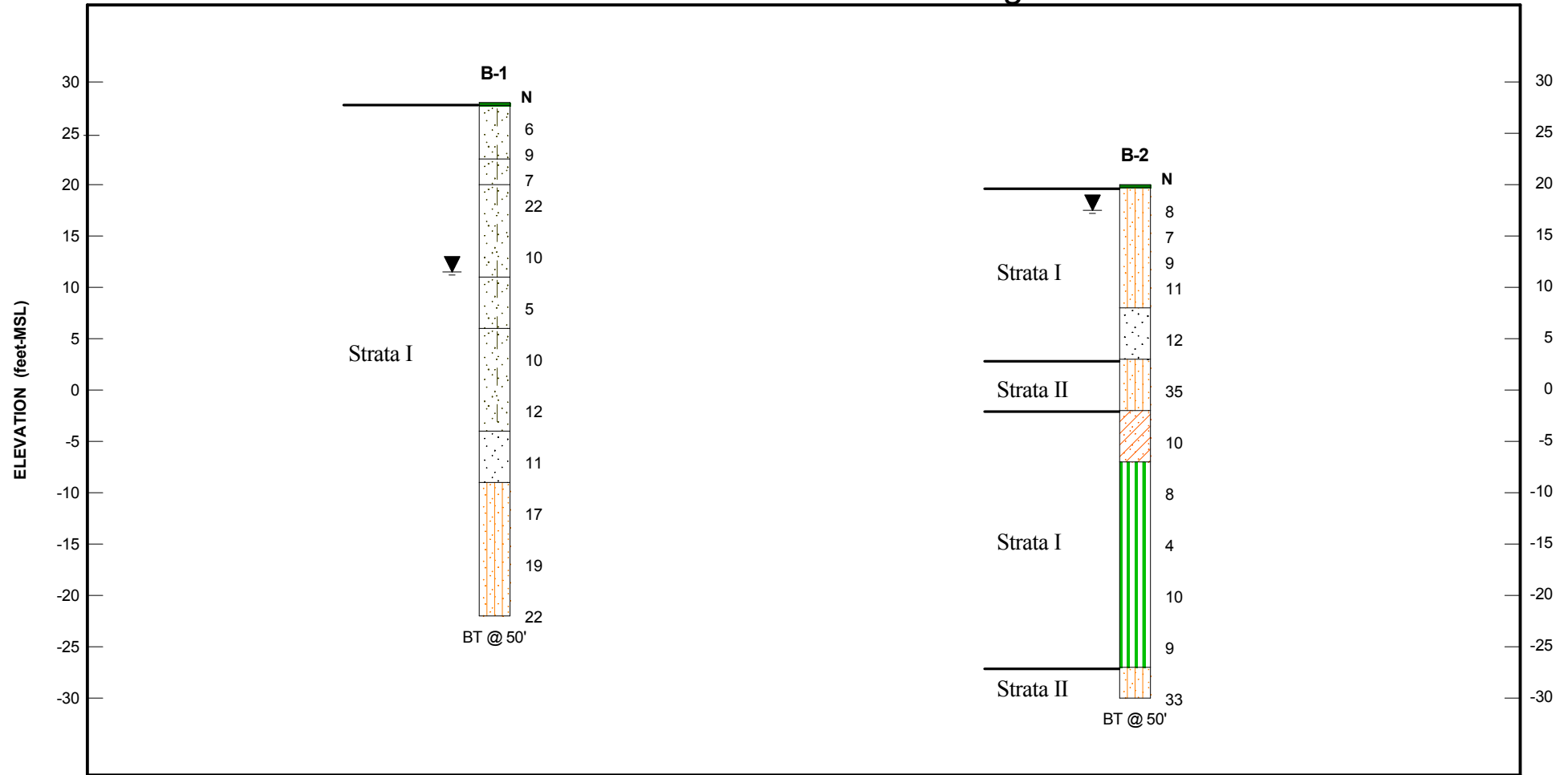
BORING LOCATION PLAN

US 264 HDD CROSSINGS
 GREENVILLE, NORTH CAROLINA

FIGURE NO.

2

Generalized Subsurface Profile - Borings B-1 and B-2



Topsoil



SC, Clayey Sand



SP/SM, Poorly-graded Sand with Silt



ML, Low Plasticity Silt



- Groundwater after 24 Hours



SP, Poorly-graded Sand



SM, Silty Sand

N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.

JOB NO: 1358-14-033

DATE: 7/24/14



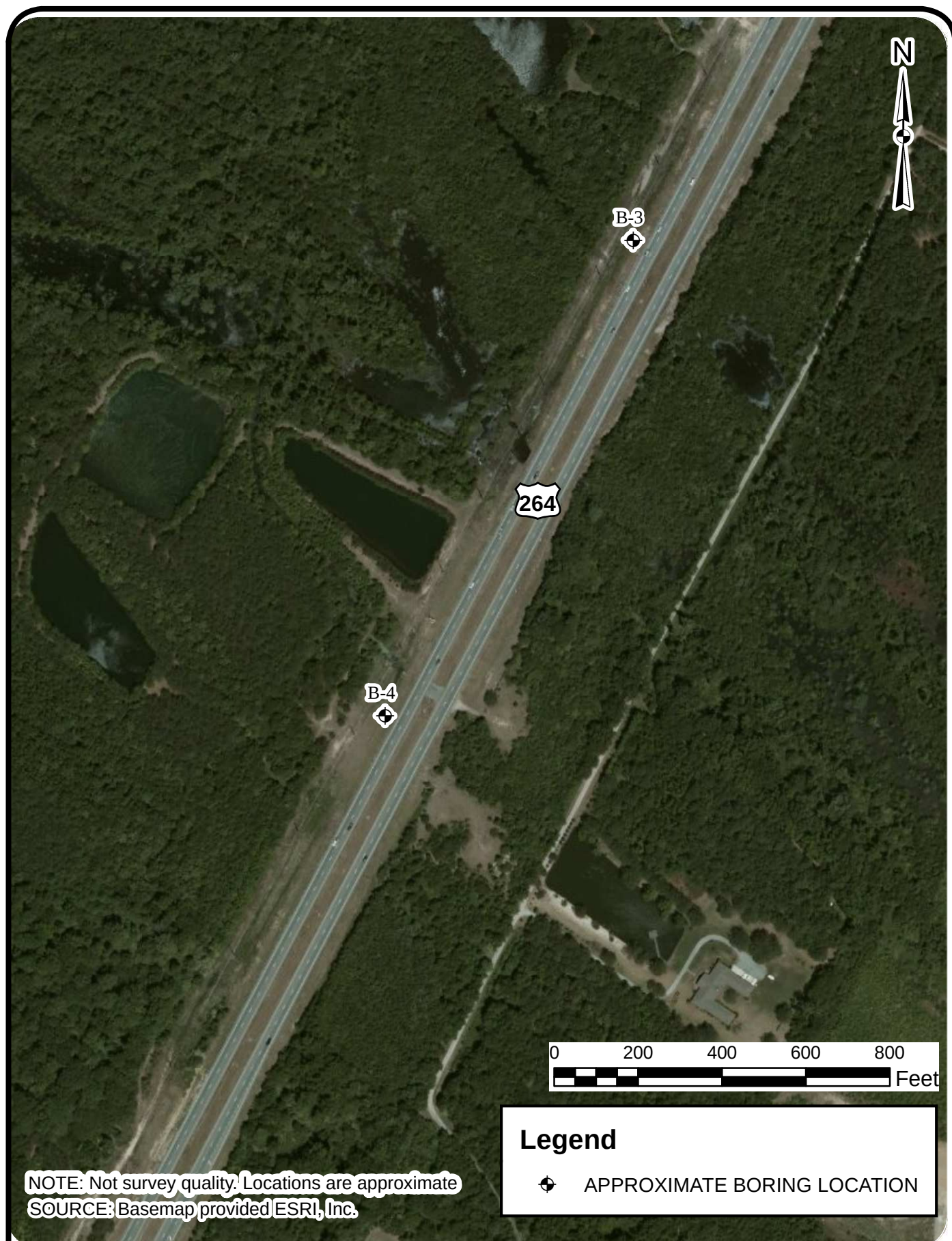
3718 Old Battleground Road
Greensboro, North Carolina

Diagram: Generalized Subsurface Profile

Project: US 264 HDD Crossings

Location: Greenville, North Carolina

Figure
3



SCALE: As Shown
 DATE: JUNE 2014
 DRAWN BY: SDK
 PROJECT NO: 1358-14-033



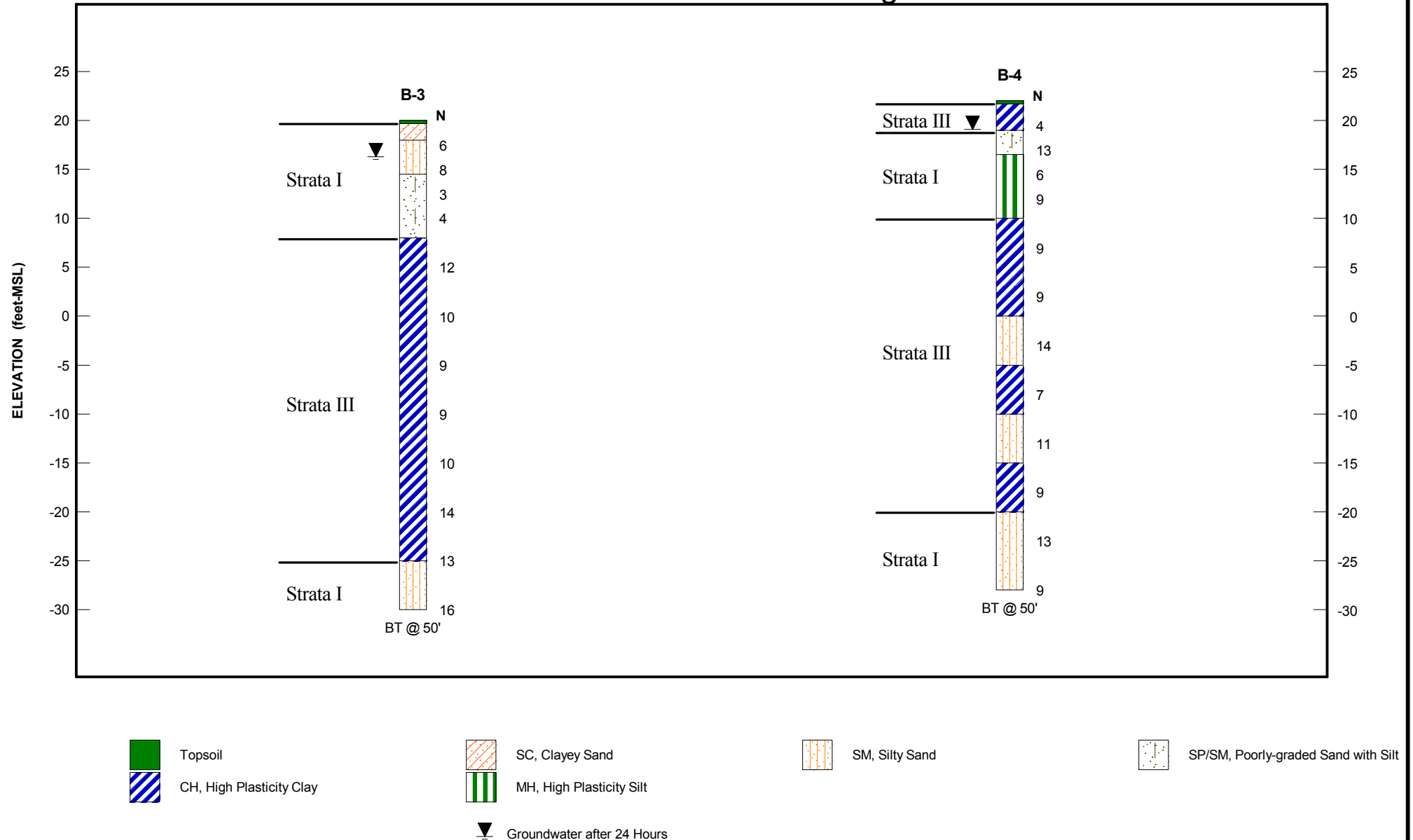
BORING LOCATION PLAN

US 264 HDD CROSSINGS
 GREENVILLE, NORTH CAROLINA

FIGURE NO.

4

Generalized Subsurface Profile - Borings B-3 and B-4



N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.

JOB NO: 1358-14-033

DATE: 7/24/14



3718 Old Battleground Road
Greensboro, North Carolina

Diagram: Generalized Subsurface Profile

Project: US 264 HDD Crossings

Location: Greenville, North Carolina

Figure
5



SCALE: As Shown
DATE: JUNE 2014
DRAWN BY: SDK
PROJECT NO: 1358-14-033



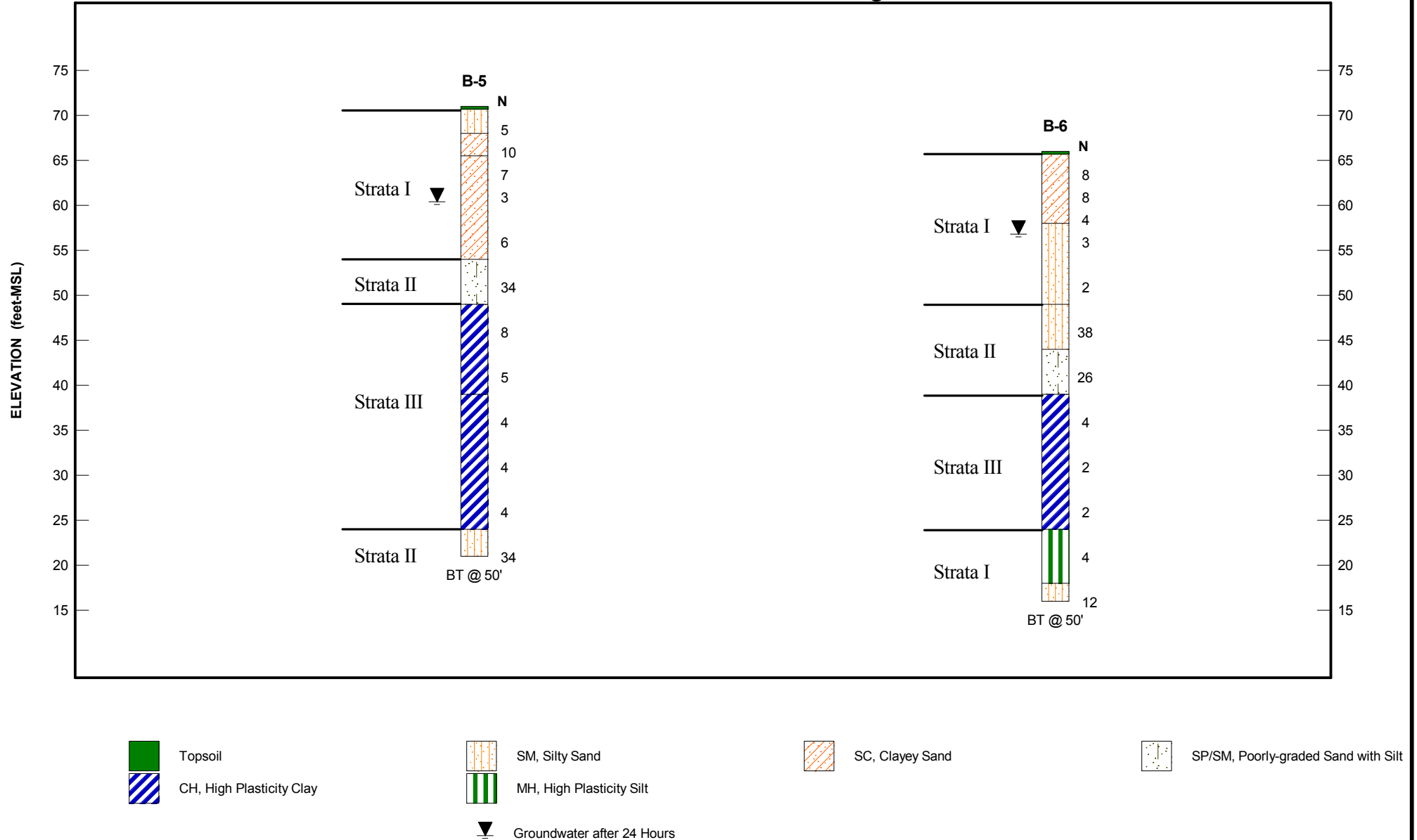
BORING LOCATION PLAN

US 264 HDD CROSSIGNS
GREENVILLE, NORTH CAROLINA

FIGURE NO.

6

Generalized Subsurface Profile - Borings B-5 and B-6



N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.

JOB NO: 1358-14-033

DATE: 7/24/14



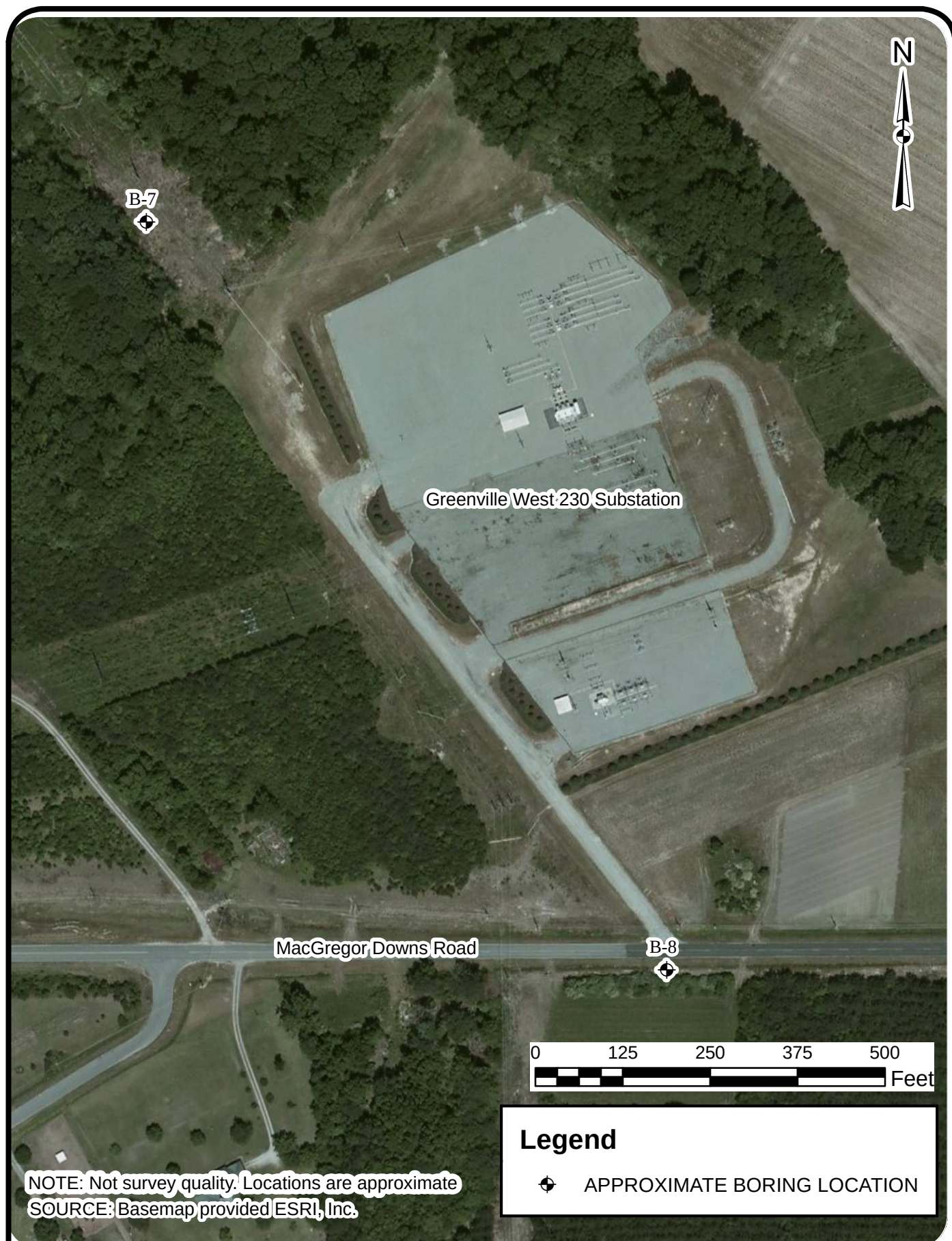
3718 Old Battleground Road
Greensboro, North Carolina

Diagram: Generalized Subsurface Profile

Project: US 264 HDD Crossings

Location: Greenville, North Carolina

Figure
7



SCALE: As Shown
 DATE: JUNE 2014
 DRAWN BY: SDK
 PROJECT NO: 1358-14-033



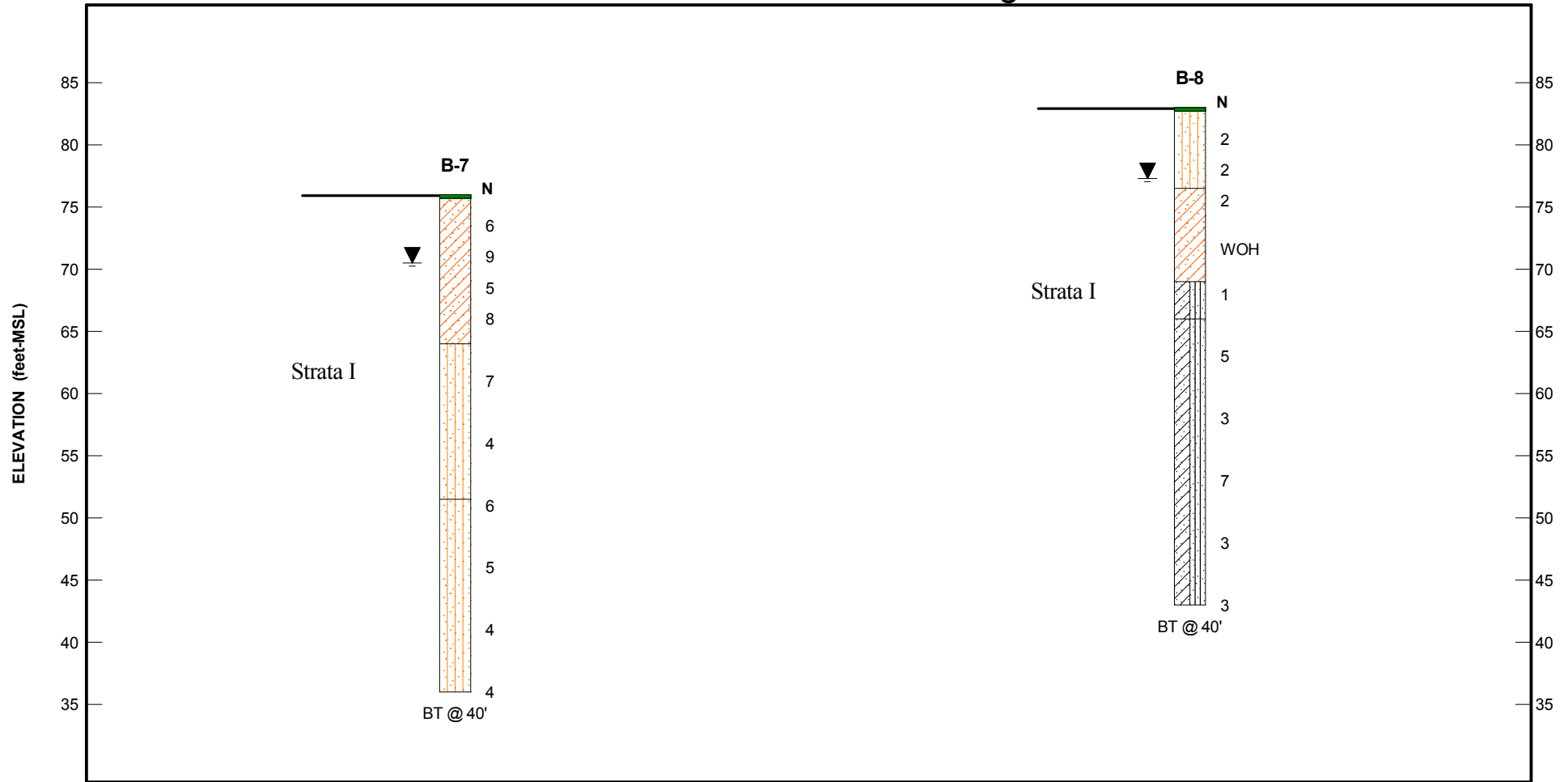
BORING LOCATION PLAN

US 264 HDD CROSSINGS
 GREENVILLE, NORTH CAROLINA

FIGURE NO.

8

Generalized Subsurface Profile - Borings B-7 and B-8



Topsoil

SC, Clayey Sand

SM, Silty Sand

SC/SM, Clayey Sand

Groundwater after 24 Hours

N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.

JOB NO: 1358-14-033

DATE: 7/24/14



3718 Old Battleground Road
Greensboro, North Carolina

Diagram: Generalized Subsurface Profile

Project: US 264 HDD Crossings

Location: Greenville, North Carolina

Figure
9

APPENDIX

APPENDIX A

Legend to Soil Classification and Symbols
Boring Logs (B-1 through B-8)

LEGEND TO SOIL CLASSIFICATION AND SYMBOLS

SOIL TYPES

(Shown in Graphic Log)



Fill



Asphalt



Concrete



Topsoil



Gravel



SP, Poorly Graded Sand



Silt



CH, High Plasticity Clay



MH, High Plasticity Silt



SM, Silty Sand



SC, Clayey Sand



SP/SM, Poorly-Graded Sand with Silt



SP/SC, Poorly-Graded Sand with Clay



ML, Low Plasticity Silt



CL, Low Plasticity Clay



Partially Weathered Rock



Cored Rock

WATER LEVELS

(Shown in Water Level Column)

▽ = Water Level At Termination of Boring

▼ = Water Level Taken After 24 Hours

◄ = Loss of Drilling Water

HC = Hole Cave

CONSISTENCY OF COHESIVE SOILS

CONSISTENCY

Very Soft

Soft

Firm

Stiff

Very Stiff

Hard

Very Hard

STD. PENETRATION RESISTANCE BLOWS/FOOT

0 to 2

3 to 4

5 to 8

9 to 15

16 to 30

31 to 50

Over 50

RELATIVE DENSITY OF COHESIONLESS SOILS

RELATIVE DENSITY

Very Loose

Loose

Medium Dense

Dense

Very Dense

STD. PENETRATION RESISTANCE BLOWS/FOOT

0 to 4

5 to 10

11 to 30

31 to 50

Over 50

SAMPLER TYPES

(Shown in Samples Column)

Shelby Tube



Split Spoon



Rock Core



No Recovery

TERMS

Standard Penetration Resistance - The Number of Blows of 140 lb. Hammer Falling 30 in. Required to Drive 1.4 in. I.D. Split Spoon Sampler 1 Foot. As Specified in ASTM D-1586.

REC - Total Length of Rock Recovered in the Core Barrel Divided by the Total Length of the Core Run Times 100%.

RQD - Total Length of Sound Rock Segments Recovered that are Longer Than or Equal to 4" (mechanical breaks excluded) Divided by the Total Length of the Core Run Times 100%.



S&ME

ENGINEERING • TESTING
ENVIRONMENTAL SERVICES

PROJECT: US 264 HDD Crossings Greenville, North Carolina S&ME Project No. 1358-14-033				BORING LOG B-1															
DATE DRILLED: 7/8/14				ELEVATION: 28.0 ft				NOTES: Temporary PVC standpipe installed to 50.0 ft. Boring tremie grouted to the ground surface with cement-bentonite grout.											
DRILL RIG: CME 550				BORING DEPTH: 50.0 ft															
DRILLER: J. White				WATER LEVEL: 16.5 ft @ 24 hrs															
HAMMER TYPE: Autohammer				LOGGED BY: F. Wright															
SAMPLING METHOD: Split Spoon								NORTHING: 694465				EASTING: 2469110							
DRILLING METHOD: Wash Boring																			
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS					N VALUE				
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60	80					
		TOPSOIL - 3 Inches			SS-1	▲▼	3	3	3						6				
5		COASTAL PLAIN: SAND (SP-SM) loose, tan, fine to medium, moist, poorly graded, with silt		23.0	SS-2	▲▼	3	4	5						9				
		SAND (SP-SM) loose, tan, fine to medium, moist, poorly graded, with silt			SS-3	▲▼	5	3	4						7				
10		SAND (SP-SM) medium dense, gray tan, fine to medium, moist, poorly graded, with silt		18.0	SS-4	▲▼	5	9	13						22				
15				13.0	SS-5	▲▼	4	5	5						10				
		SAND (SP-SM) loose, tan, fine to medium, wet, poorly gaded, with silt		8.0	SS-6	▲▼	2	2	3						5				
20					SS-7	▲▼	5	5	5						10				
25		SAND (SP-SM) medium dense, gray tan, fine to medium, wet, poorly graded, with silt		3.0	SS-8	▲▼	5	7	5						12				
30				-2.0															
		SAND (SP) medium dense, orange brown, fine to medium, wet, poorly graded			SS-9	▲▼	4	4	7						11				

NOTES:

- THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.
- BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.
- STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
- WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.



PROJECT: US 264 HDD Crossings Greenville, North Carolina S&ME Project No. 1358-14-033				BORING LOG B-1					
DATE DRILLED: 7/8/14		ELEVATION: 28.0 ft		NOTES: Temporary PVC standpipe installed to 50.0 ft. Boring tremie grouted to the ground surface with cement-bentonite grout.					
DRILL RIG: CME 550		BORING DEPTH: 50.0 ft							
DRILLER: J. White		WATER LEVEL: 16.5 ft @ 24 hrs							
HAMMER TYPE: Autohammer		LOGGED BY: F. Wright							
SAMPLING METHOD: Split Spoon				NORTHING: 694465		EASTING: 2469110			
DRILLING METHOD: Wash Boring									
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA	STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS	N VALUE
							1st 6in / RUN # 2nd 6in / REC 3rd 6in / RQD	10 20 30 60 80	
40	[Symbol]	SILTY SAND (SM) medium dense, gray, fine to coarse, wet		-12.0	SS-10	[Symbol]	6 7 10	[Symbol]	17
45	[Symbol]			-17.0	SS-11	[Symbol]	9 9 10	[Symbol]	19
50	[Symbol]	Boring terminated at 50 ft		-22.0	SS-12	[Symbol]	11 9 13	[Symbol]	22

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PROJECT: US 264 HDD Crossings Greenville, North Carolina S&ME Project No. 1358-14-033				BORING LOG B-2								
DATE DRILLED: 7/2/14		ELEVATION: 20.0 ft		NOTES: Temporary PVC standpipe installed to 50.0 ft. Boring tremie grouted to the ground surface with cement-bentonite grout.								
DRILL RIG: CME 550		BORING DEPTH: 50.0 ft										
DRILLER: J. White		WATER LEVEL: 2.5 ft @ 24 hrs										
HAMMER TYPE: Autohammer		LOGGED BY: F. Wright										
SAMPLING METHOD: Split Spoon				NORTHING: 692568		EASTING: 2468099						
DRILLING METHOD: Wash Boring												
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN # 2nd 6in / REC 3rd 6in / RQD	STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS 10 20 30 60 80				N VALUE
		TOPSOIL - 4 Inches			SS-1		4 4 4					8
5		COASTAL PLAIN: SILTY SAND (SM) loose, tan, fine to coarse, moist to wet			SS-2		3 3 4					7
					SS-3		3 4 5					9
10					SS-4		5 5 6					11
		SAND (SP) loose, tan gray, medium to coarse, wet, poorly graded			SS-5		4 3 9					12
15					SS-6		13 14 21					35
20		SILTY SAND (SM) dense, gray tan, fine to medium, wet			SS-7		4 4 6					10
25		CLAYEY SAND (SC) medium dense, gray, fine, wet, with silt and mica			SS-8		3 3 5					8
					SS-9		4 3 1					4
30		SANDY SILT (ML) firm to stiff, gray, wet, with mica										

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PROJECT: US 264 HDD Crossings Greenville, North Carolina S&ME Project No. 1358-14-033				BORING LOG B-2					
DATE DRILLED: 7/2/14		ELEVATION: 20.0 ft		NOTES: Temporary PVC standpipe installed to 50.0 ft. Boring tremie grouted to the ground surface with cement-bentonite grout.					
DRILL RIG: CME 550		BORING DEPTH: 50.0 ft							
DRILLER: J. White		WATER LEVEL: 2.5 ft @ 24 hrs							
HAMMER TYPE: Autohammer		LOGGED BY: F. Wright							
SAMPLING METHOD: Split Spoon				NORTHING: 692568		EASTING: 2468099			
DRILLING METHOD: Wash Boring									
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA	STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS	N VALUE
							1st 6in / RUN # 2nd 6in / REC 3rd 6in / RQD	10 20 30 60 80	
40		SANDY SILT (ML) firm to stiff, gray, wet, with mica (<i>continued</i>)		-20.0	SS-10	▲	4 4 6		10
45				-25.0	SS-11	▲	4 3 6		9
50		SILTY SAND (SM) dense, gray, fine, with clay		-30.0	SS-12	▲	11 14 19		33
		Boring terminated at 50 ft							

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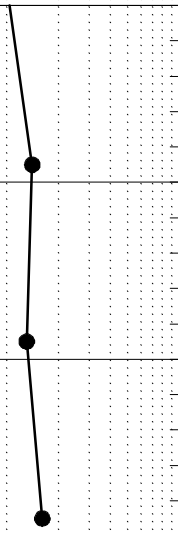


PROJECT: US 264 HDD Crossings Greenville, North Carolina S&ME Project No. 1358-14-033				BORING LOG B-3								
DATE DRILLED: 7/2/14		ELEVATION: 20.0 ft		NOTES: Temporary PVC standpipe installed to 50.0 ft. Boring tremie grouted to the ground surface with cement-bentonite grout.								
DRILL RIG: CME 550		BORING DEPTH: 50.0 ft										
DRILLER: J. White		WATER LEVEL: 3.7 ft @ 24 hrs										
HAMMER TYPE: Autohammer		LOGGED BY: F. Wright										
SAMPLING METHOD: Split Spoon				NORTHING: 691562		EASTING: 2467566						
DRILLING METHOD: Wash Boring												
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN # 2nd 6in / REC 3rd 6in / RQD	STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS 10 20 30 60 80				N VALUE
		TOPSOIL - 4 Inches			SS-1		2 2 4					6
		COASTAL PLAIN: CLAYEY SAND (SC) very loose, orange tan, fine, moist, with silt			SS-2		4 4 4					8
5		SILTY SAND (SM) loose, orange tan, fine to medium, moist to wet		15.0	SS-3		1 1 2					3
		SAND (SP-SM) very loose, gray black, fine to medium, wet, poorly graded, with silt			SS-4		2 1 3					4
10				10.0								
		SANDY CLAY (CH) stiff to firm, gray black, wet, fat, with shells			SS-5		4 5 7					12
15				5.0								
					SS-6		3 5 5					10
20				0.0								
					SS-7		3 4 5					9
25				-5.0								
					SS-8		3 4 5					9
30				-10.0								
					SS-9		3 5 5					10

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PROJECT: US 264 HDD Crossings Greenville, North Carolina S&ME Project No. 1358-14-033				BORING LOG B-3					
DATE DRILLED: 7/2/14		ELEVATION: 20.0 ft		NOTES: Temporary PVC standpipe installed to 50.0 ft. Boring tremie grouted to the ground surface with cement-bentonite grout.					
DRILL RIG: CME 550		BORING DEPTH: 50.0 ft							
DRILLER: J. White		WATER LEVEL: 3.7 ft @ 24 hrs							
HAMMER TYPE: Autohammer		LOGGED BY: F. Wright							
SAMPLING METHOD: Split Spoon				NORTHING: 691562		EASTING: 2467566			
DRILLING METHOD: Wash Boring									
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN # 2nd 6in / REC 3rd 6in / RQD	STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS 10 20 30 6080	N VALUE
40		SANDY CLAY (CH) stiff to firm, gray black, wet, fat, with shells (continued)		-20.0	SS-10		3 9 5		14
45		SILTY SAND (SM) medium dense, gray black, fine, wet, with clay		-25.0	SS-11		4 5 8		13
50		Boring terminated at 50 ft		-30.0	SS-12		6 7 9		16

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PROJECT: US 264 HDD Crossings Greenville, North Carolina S&ME Project No. 1358-14-033				BORING LOG B-4										
DATE DRILLED: 7/3/14		ELEVATION: 22.0 ft		NOTES: Temporary PVC standpipe installed to 50.0 ft. Boring tremie grouted to the ground surface with cement-bentonite grout.										
DRILL RIG: CME 550		BORING DEPTH: 50.0 ft												
DRILLER: J. White		WATER LEVEL: 2.9 ft @ 24 hrs												
HAMMER TYPE: Autohammer		LOGGED BY: F. Wright												
SAMPLING METHOD: Split Spoon				NORTHING: 690431		EASTING: 2466974								
DRILLING METHOD: Wash Boring														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA	STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE		
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080	
		TOPSOIL - 3 Inches			SS-1		3	2	2					4
		COASTAL PLAIN: SANDY CLAY (CH) stiff, gray tan, moist			SS-2		7	6	7					13
5		SAND (SP-SM) medium dense, gray tan, fine to medium, wet, poorly graded, with silt		17.0	SS-3		2	2	4					6
		SILT (MH) firm to stiff, gray black, wet, elastic, with fine sand veins		12.0	SS-4		3	4	5					9
10					SS-5		3	4	5					9
		CLAY (CH) stiff, gray, wet, with sand and shells; with mica		7.0	SS-6		3	4	5					9
15					SS-7		3	4	5					9
		SILTY SAND (SM) loose, gray olive, fine, wet, with clay		2.0	SS-8		3	4	5					9
20					SS-9		3	9	5					14
		SANDY CLAY (CH) firm, gray, wet, fat		-3.0	SS-10		3	3	4					7
25					SS-11		4	4	7					11
		SILTY SAND (SM) medium dense, gray olive, fine, wet, with clay		-8.0										
30														

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PROJECT: US 264 HDD Crossings Greenville, North Carolina S&ME Project No. 1358-14-033				BORING LOG B-4					
DATE DRILLED: 7/3/14		ELEVATION: 22.0 ft		NOTES: Temporary PVC standpipe installed to 50.0 ft. Boring tremie grouted to the ground surface with cement-bentonite grout.					
DRILL RIG: CME 550		BORING DEPTH: 50.0 ft							
DRILLER: J. White		WATER LEVEL: 2.9 ft @ 24 hrs							
HAMMER TYPE: Autohammer		LOGGED BY: F. Wright							
SAMPLING METHOD: Split Spoon				NORTHING: 690431		EASTING: 2466974			
DRILLING METHOD: Wash Boring									
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA	STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS	N VALUE
							1st 6in / RUN # 2nd 6in / REC 3rd 6in / RQD	10 20 30 60 80	
40		SILTY SAND (SM) medium dense, gray olive, fine, wet, with clay <i>(continued)</i>		-18.0	SS-10	▲	4 4 5	●	9
45		SANDY CLAY (CH) stiff, gray black, wet, fat, with mica		-23.0	SS-11	▲	3 5 8	●	13
50		SILTY SAND (SM) medium dense to loose, gray, fine to medium, wet, with clay		-28.0	SS-12	▲	3 4 5	●	9
		Boring terminated at 50 ft							

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PROJECT: US 264 HDD Crossings Greenville, North Carolina S&ME Project No. 1358-14-033				BORING LOG B-5													
DATE DRILLED: 7/3/14			ELEVATION: 71.0 ft						NOTES: Temporary PVC standpipe installed to 50.0 ft. Boring tremie grouted to the ground surface with cement-bentonite grout.								
DRILL RIG: CME 550			BORING DEPTH: 50.0 ft														
DRILLER: J. White			WATER LEVEL: 10.6 ft @ 24 hrs														
HAMMER TYPE: Autohammer			LOGGED BY: F. Wright														
SAMPLING METHOD: Split Spoon									NORTHING: 684340				EASTING: 2464484				
DRILLING METHOD: Wash Boring																	
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION			WATER LEVEL	ELEVATION (feet)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS					N VALUE
								1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60	80		
		TOPSOIL - 4 Inches					SS-1	▲▼	2	2	3						5
		COASTAL PLAIN: SILTY SAND (SM) loose, gray tan red, fine					SS-2	▲▼	3	4	6						10
5		CLAYEY SAND (SC) medium dense, orange tan, fine to medium, moist, with silt				66.0	SS-3	▲▼	2	3	4						7
		CLAYEY SAND (SC) loose, orange tan, fine, moist to wet, with clay					SS-4	▲▼	2	1	2						3
10					▼	61.0											
							SS-5	▲▼	6	3	3						6
15						56.0											
		SAND (SP-SM) dense, gray tan, medium to fine, wet, poorly graded, with silt					SS-6	▲▼	13	16	18						34
20						51.0											
		CLAY (CH) firm, gray olive, wet, fat					SS-7	▲▼	6	4	4						8
25						46.0											
							SS-8	▲▼	2	1	4						5
30						41.0											
		SANDY CLAY (CH) soft, gray, wet, with fine sandy seams					SS-9	▲▼	1	2	2						4

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PROJECT: US 264 HDD Crossings Greenville, North Carolina S&ME Project No. 1358-14-033				BORING LOG B-5													
DATE DRILLED: 7/3/14			ELEVATION: 71.0 ft						NOTES: Temporary PVC standpipe installed to 50.0 ft. Boring tremie grouted to the ground surface with cement-bentonite grout.								
DRILL RIG: CME 550			BORING DEPTH: 50.0 ft														
DRILLER: J. White			WATER LEVEL: 10.6 ft @ 24 hrs														
HAMMER TYPE: Autohammer			LOGGED BY: F. Wright														
SAMPLING METHOD: Split Spoon									NORTHING: 684340				EASTING: 2464484				
DRILLING METHOD: Wash Boring																	
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION			WATER LEVEL	ELEVATION (feet)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE	
								1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD		10	20	30	6080		
40		SANDY CLAY (CH) soft, gray, wet, with fine sandy seams (continued)			31.0	SS-10		1	1	3						4	
45					26.0	SS-11		2	1	3							4
50		SILTY SAND (SM) dense, medium to fine, wet, with shells			21.0	SS-12		16	16	18						34	
		Boring terminated at 50 ft															

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PROJECT: US 264 HDD Crossings Greenville, North Carolina S&ME Project No. 1358-14-033				BORING LOG B-6											
DATE DRILLED: 7/8/14			ELEVATION: 66.0 ft			NOTES: Temporary PVC standpipe installed to 50.0 ft. Boring tremie grouted to the ground surface with cement-bentonite grout.									
DRILL RIG: CME 550			BORING DEPTH: 50.0 ft												
DRILLER: J. White			WATER LEVEL: 9.2 ft @ 24 hrs												
HAMMER TYPE: Autohammer			LOGGED BY: F. Wright												
SAMPLING METHOD: Split Spoon						NORTHING: 684371				EASTING: 2464654					
DRILLING METHOD: Wash Boring															
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft)				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	/REMARKS 10 20 30 6080					
		<u>TOPSOIL</u> - 4 Inches			SS-1	▲▼	4	4	4					8	
5		<u>COASTAL PLAIN: CLAYEY SAND (SC)</u> loose to very loose, orange tan red, fine, moist, with silt		61.0	SS-2	▲▼	3	4	4					8	
					SS-3	▲▼	2	2	2					4	
10		<u>SILTY SAND (SM)</u> very loose, gray tan, fine, moist to wet, with clay	▼	56.0	SS-4	▲▼	2	2	1					3	
15				51.0	SS-5	▲▼	1	1	1					2	
20		<u>SILTY SAND (SM)</u> dense, gray, medium to fine, wet		46.0	SS-6	▲▼	13	15	23					38	
25		<u>SAND (SP-SM)</u> medium dense, gray, medium to fine, wet, poorly graded, with silt		41.0	SS-7	▲▼	8	10	16					26	
30		<u>SANDY CLAY (CH)</u> soft to very soft, gray olive, wet, fat		36.0	SS-8	▲▼	2	1	3					4	
					SS-9	▲▼	1	1	1					2	

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PROJECT: US 264 HDD Crossings Greenville, North Carolina S&ME Project No. 1358-14-033				BORING LOG				B-6						
DATE DRILLED: 7/8/14			ELEVATION: 66.0 ft			NOTES: Temporary PVC standpipe installed to 50.0 ft. Boring tremie grouted to the ground surface with cement-bentonite grout.								
DRILL RIG: CME 550			BORING DEPTH: 50.0 ft											
DRILLER: J. White			WATER LEVEL: 9.2 ft @ 24 hrs											
HAMMER TYPE: Autohammer			LOGGED BY: F. Wright											
SAMPLING METHOD: Split Spoon						NORTHING: 684371		EASTING: 2464654						
DRILLING METHOD: Wash Boring														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080	
40		SANDY CLAY (CH) soft to very soft, gray olive, wet, fat (continued)		26.0	SS-10		1	1	1					2
45		SILT (MH) soft, gray black, wet, elastic, with sand		21.0	SS-11		1	1	3					4
50		SILTY SAND (SM) medium dense, gray black, medium to fine, wet, with clay Boring terminated at 50 ft		16.0	SS-12		3	3	9					12

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PROJECT: US 264 HDD Crossings Greenville, North Carolina S&ME Project No. 1358-14-033				BORING LOG B-7										
DATE DRILLED: 7/8/14		ELEVATION: 76.0 ft		NOTES: Temporary PVC standpipe installed to 40.0 ft. Boring tremie grouted to the ground surface with cement-bentonite grout.										
DRILL RIG: CME 550		BORING DEPTH: 40.0 ft												
DRILLER: J. White		WATER LEVEL: 5.5 ft @ 24 hrs												
HAMMER TYPE: Autohammer		LOGGED BY: F. Wright												
SAMPLING METHOD: Split Spoon				NORTHING: 682282		EASTING: 2465353								
DRILLING METHOD: Wash Boring														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080	
40		SILTY SAND (SM) loose, gray, fine to medium, wet <i>(continued)</i>		36.0	SS-10		2	2	2					4
		Boring terminated at 40 ft												

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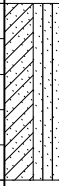
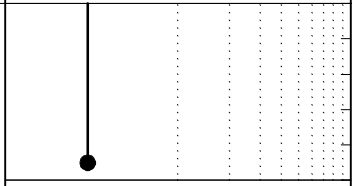


PROJECT: US 264 HDD Crossings Greenville, North Carolina S&ME Project No. 1358-14-033				BORING LOG B-8									
DATE DRILLED: 7/8/14		ELEVATION: 83.0 ft		NOTES: Temporary PVC standpipe installed to 40.0 ft. Boring tremie grouted to the ground surface with cement-bentonite grout.									
DRILL RIG: CME 550		BORING DEPTH: 40.0 ft											
DRILLER: J. White		WATER LEVEL: 5.7 ft @ 24 hrs											
HAMMER TYPE: Autohammer		LOGGED BY: F. Wright											
SAMPLING METHOD: Split Spoon				NORTHING: 681213		EASTING: 2466098							
DRILLING METHOD: Wash Boring													
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN # 2nd 6in / REC 3rd 6in / RQD	STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS 10 20 30 6080				N VALUE	
		TOPSOIL - 3 Inches			SS-1		3 1 1						2
5		COASTAL PLAIN: SILTY SAND (SM) very loose, gray, fine, moist to wet		78.0	SS-2		1 1 1						2
		CLAYEY SAND (SC) very loose, white tan, fine			SS-3		1 1 1						2
10				73.0	SS-4		WOHWOHWOH						WOH
		SILTY SAND (SC-SM) very loose, gray, fine, wet, with clay		68.0	SS-5		WOHWOH		1				1
15													
20		SILTY SAND (SC-SM) loose to very loose, gray, fine, wet, with clay		63.0	SS-6		2 2 3						5
25				58.0	SS-7		2 1 2						3
30				53.0	SS-8		2 3 4						7
					SS-9		2 1 2						3

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PROJECT: US 264 HDD Crossings Greenville, North Carolina S&ME Project No. 1358-14-033				BORING LOG B-8										
DATE DRILLED: 7/8/14		ELEVATION: 83.0 ft		NOTES: Temporary PVC standpipe installed to 40.0 ft. Boring tremie grouted to the ground surface with cement-bentonite grout.										
DRILL RIG: CME 550		BORING DEPTH: 40.0 ft												
DRILLER: J. White		WATER LEVEL: 5.7 ft @ 24 hrs												
HAMMER TYPE: Autohammer		LOGGED BY: F. Wright												
SAMPLING METHOD: Split Spoon				NORTHING: 681213		EASTING: 2466098								
DRILLING METHOD: Wash Boring														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA	STANDARD PENETRATION TEST DATA (blows/ft)				N VALUE		
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	/REMARKS				
40		SILTY SAND (SC-SM) loose to very loose, gray, fine, wet, with clay (continued)		43.0	SS-10		1	1	2	1020306080 				3
		Boring terminated at 40 ft												

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APPENDIX B

Summary of Laboratory Test Data
Laboratory Test Results (34 pages)



SUMMARY OF LABORATORY TEST DATA
US 264 HDD Crossings
Greenville, North Carolina
S&ME Project No. 1358-14-033

SAMPLE LOCATION				Sample Type	USCS Classification	Atterberg Limits			Natural Moisture Content	Diameter (millimeters)				% Silt and Clay	% Sand			% Gravel
Boring	Sample #	Depth	Strata			LL	PL	PI		D ₁₀₀	D ₆₀	D ₃₀	D ₁₀		Fine	Medium	Coarse	
B-1	5	13.5' - 15'	I	SS	SP-SM	--	--	--	20.7	2.3	0.53	0.31	0.17	5.0	39.3	52.8	2.8	0.1
	9	33.5' - 35'	I	SS	SP	--	--	--	22.8	1.0	0.51	0.33	0.17	3.8	38.9	56.8	0.5	0.0
B-2	5	13.5' - 15'	I	SS	SP	--	--	--	21.1	10.1	1.70	0.63	0.40	2.2	9.7	54.3	18.9	14.9
	9	33.5' - 35'	I	SS	ML	32	30	2	32.9	0.2	--	--	--	64.9	34.9	0.2	0.0	0.0
	11	43.5' - 45'	I	SS	ML	28	23	5	26.9	--	--	--	--	--	--	--	--	--
B-3	4	8.5' - 10'	I	SS	SP-SM	--	--	--	23.5	2.7	0.41	0.20	0.11	5.4	53.9	38.6	2.1	0.0
	5	13.5' - 15'	III	SS	CH	56	25	31	35.3	--	--	--	--	--	--	--	--	--
	10	38.5' - 40'	III	SS	CH	57	23	34	30.2	2.0	--	--	--	75.9	23.2	0.9	0.0	0.0
B-4	2	3.5' - 5'	I	SS	SP-SM	--	--	--	17.4	4.8	0.68	0.32	0.14	5.2	35.8	53.1	5.7	0.2
	3	6.0' - 7.5'	I	SS	MH	84	38	46	48.8	--	--	--	--	--	--	--	--	--
	8	28.5' - 30'	III	SS	CH	61	22	39	29.3	4.6	--	--	--	71.3	26.5	1.5	0.7	0.0
	10	38.5' - 40'	III	SS	CH	55	24	31	32.0	--	--	--	--	--	--	--	--	--
B-5	4	8.5' - 10'	I	SS	SC	--	--	--	40.2	2.0	0.10	--	--	46.2	52.9	0.8	0.1	0.0
	6	18.5' - 20'	II	SS	SP-SM	--	--	--	16.8	2.0	0.59	0.34	0.11	7.7	31.9	60.0	0.4	0.0
	7	23.5' - 25'	III	SS	CH	53	27	26	35.9	--	--	--	--	--	--	--	--	--
	9	33.5' - 35'	III	SS	CH	55	26	29	44.3	0.4	0.08	--	--	51.4	48.2	0.4	0.0	0.0
B-6	5	13.5' - 15'	I	SS	SM	--	--	--	29.3	2.0	0.53	0.27	--	14.1	35.3	50.1	0.5	0.0
	7	23.5' - 25'	II	SS	SP-SM	--	--	--	18.4	2.0	0.64	0.40	0.16	6.0	27.4	66.0	0.6	0.0
	8	28.5' - 30'	III	SS	CH	79	35	44	77.1	--	--	--	--	--	--	--	--	--
	10	38.5' - 40'	III	SS	CH	70	29	41	67.6	--	--	--	--	--	--	--	--	--
	11	43.5' - 45'	I	SS	MH	64	39	25	59.5	4.8	0.09	--	--	52.0	41.1	5.5	1.4	0.0
B-7	4	8.5' - 10'	I	SS	SC	--	--	--	17.9	2.0	0.13	--	--	31.1	65.6	3.3	0.0	0.0
	6	18.5' - 20'	I	SS	SM	--	--	--	36.5	0.2	0.11	0.08	--	22.4	77.1	0.5	0.0	0.0
	8	28.5' - 30'	I	SS	SM	--	--	--	33.4	0.4	0.11	0.08	--	18.4	81.1	0.5	0.0	0.0
B-8	4	8.5' - 10'	I	SS	SC	--	--	--	32.9	0.8	0.11	--	--	35.1	63.6	1.3	0.0	0.0
	7	23.5' - 25'	I	SS	SC-SM	--	--	--	37.5	0.4	0.11	0.08	--	30.6	69.3	0.1	0.0	0.0
	9	33.5' - 35'	I	SS	SC-SM	--	--	--	32.1	0.4	0.12	0.09	--	16.1	83.7	0.2	0.0	0.0

SS - Split Spoon Soil Sample

LL - Liquid Limit

PL - Plastic Limit

PI - Plasticity Index

Laboratory Determination of Water Content



ASTM D 2216



AASHTO T 265



Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #:	1358-14-033	Report Date:	07/17/2014
Project Name:	US 264 HDD Crossings	Test Date(s):	07/14 - 07/15/2014
Client Name:	RK&K		
Client Address:	2100 East Cary Street, Suite 209, Richmond, VA 23223		
Sample by:	S&ME, Inc.	Sample Date(s):	Varies
Sampling Method:	Site Borehole	Drill Rig :	N/A

Method:		A (1%)		B (0.1%)		Balance ID.	1024	Calibration Date:	11/14/13
Boring No.	Sample No.	Sample Depth	Tare #	Tare Weight	Tare Wt. + Wet Wt	Tare Wt. + Dry Wt	Water Weight	Percent Moisture	
		ft. or m.		grams	grams	grams	grams	%	
B-1	S-5	13.5' - 15.0'	137	111.73	389.82	342.08	47.74	20.7%	
B-1	S-9	33.5' - 35.0'	121	111.62	409.24	354.04	55.20	22.8%	
B-2	S-5	13.5' - 15.0'	130	109.97	442.72	384.74	57.98	21.1%	
B-2	S-9	33.5' - 35.0'	116	118.07	249.68	217.13	32.55	32.9%	
B-2	S-11	43.5' - 45.0'	119	116.09	200.27	182.43	17.84	26.9%	
B-3	S-4	8.5' - 10.0'	135	99.68	323.00	280.50	42.50	23.5%	
B-3	S-5	38.5' - 40.0'	108	91.53	200.82	172.30	28.52	35.3%	
B-3	S-10	38.5' - 40.0'	139	106.89	198.43	177.19	21.24	30.2%	
B-4	S-2	3.5' - 5.0'	147	115.73	406.19	363.04	43.15	17.4%	
B-4	S-3	6.0' - 7.5'	102	117.27	205.74	176.71	29.03	48.8%	
B-4	S-8	28.5' - 30.0'	144	133.62	208.64	191.64	17.00	29.3%	
B-4	S-10	38.5' - 40.0'	106	115.69	225.58	198.95	26.63	32.0%	
B-5	S-4	8.5' - 10.0'	146	93.91	262.91	214.43	48.48	40.2%	
B-5	S-6	18.5' - 20.0'	107	123.04	375.35	339.09	36.26	16.8%	
B-5	S-7	23.5' - 25.0'	129	113.25	203.60	179.73	23.87	35.9%	
B-5	S-9	33.5' - 35.0'	105	108.77	200.33	172.22	28.11	44.3%	

Notes / Deviations / References

AASHTO T 265: Laboratory Determination of Moisture Content of Soils

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Mal Krajan, ET

Technician Name

Signature

N/A

Certification Type / No.

Date

Mal Krajan, ET

Technical Responsibility

Signature

Laboratory Manager

Position

Date

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Laboratory Determination of Water Content



ASTM D 2216



AASHTO T 265



Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #: 1358-14-033

Report Date: 07/17/2014

Project Name: US 264 HDD Crossings

Test Date(s): 07/14 - 07/15/2014

Client Name: RK&K

Client Address: 2100 East Cary Street, Suite 209, Richmond, VA 23223

Sample by: S&ME, Inc.

Sample Date(s): Varies

Sampling Method: Site Borehole

Drill Rig : N/A

Method: A (1%) ☐ B (0.1%) ☒ Balance ID. 1024 Calibration Date: 11/14/13

Boring No.	Sample No.	Sample Depth	Tare #	Tare Weight	Tare Wt.+ Wet Wt	Tare Wt. + Dry Wt	Water Weight	Percent Moisture
		ft. or m.		grams	grams	grams	grams	%
B-6	S-5	13.5' - 15.0'	110	106.51	325.79	276.15	49.64	29.3%
B-6	S-7	23.5' - 25.0'	132	126.16	495.14	437.82	57.32	18.4%
B-6	S-8	28.5' - 30.0'	101	125.01	224.79	181.35	43.44	77.1%
B-6	S-10	38.5' - 40.0'	136	113.04	229.84	182.72	47.12	67.6%
B-6	S-11	43.5' - 45.0'	112	97.72	220.39	174.61	45.78	59.5%
B-7	S-4	8.5' - 10.0'	127	107.64	369.24	329.60	39.64	17.9%
B-7	S-6	18.5' - 20.0'	117	118.31	380.83	310.61	70.22	36.5%
B-7	S-8	28.5' - 30.0'	5X1	73.20	363.66	290.98	72.68	33.4%
B-8	S-4	8.5' - 10.0'	203	69.22	260.32	213.03	47.29	32.9%
B-8	S-7	23.5' - 25.0'	2X	74.19	322.63	254.88	67.75	37.5%
B-8	S-9	33.5' - 35.0'	53	120.06	453.23	372.30	80.93	32.1%

Notes / Deviations / References

AASHTO T 265: Laboratory Determination of Moisture Content of Soils

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Mal Krajan, ET

Technician Name

Signature

N/A

Certification Type / No.

Date

Mal Krajan, ET

Technical Responsibility

Signature

Laboratory Manager

Position

Date

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Sieve Analysis of Soils

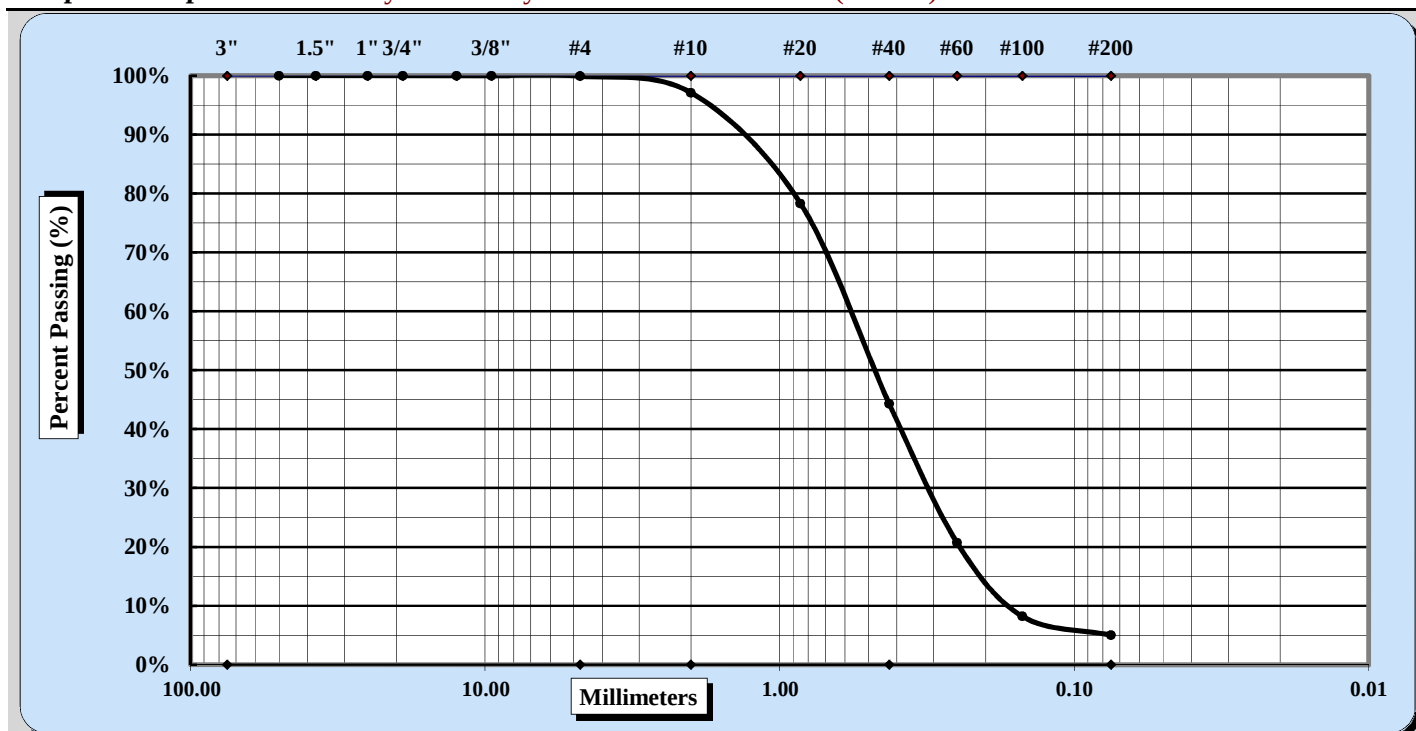


ASTM D 6913

Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #: 1358-14-033 **Report Date:** 07/17/2014
Project Name: US 264 HDD Crossings **Test Date(s):** 07/14 - 07/16/2014
Client Name: RK&K
Client Address: 2100 East Cary Street, Suite 209, Richmond, VA 23223
Boring No.: B-1 **Sample #:** S-5 **Sample Date:** 07/08/2014
Location: Site-Borehole **Offset:** N/A **Depth (ft):** 13.5' - 15.0'
Sample Description: Gray Tan Poorly Graded SAND with Silt (SP-SM)



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/8"	Coarse Sand	2.8%	Fine Sand	39.3%
Gravel	0.1%	Medium Sand	52.8%	Silt & Clay	5.0%
Liquid Limit	ND	Plastic Limit	ND	Plastic Index	ND
Specific Gravity	ND			Moisture Content	20.7%

Coarse Sand	2.8%	Medium Sand	52.8%	Fine Sand	39.3%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ND=Not Determined.

Mal Krajan, ET

Technical Responsibility

Signature

Laboratory Manager

Position

Date

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Sieve Analysis of Soils

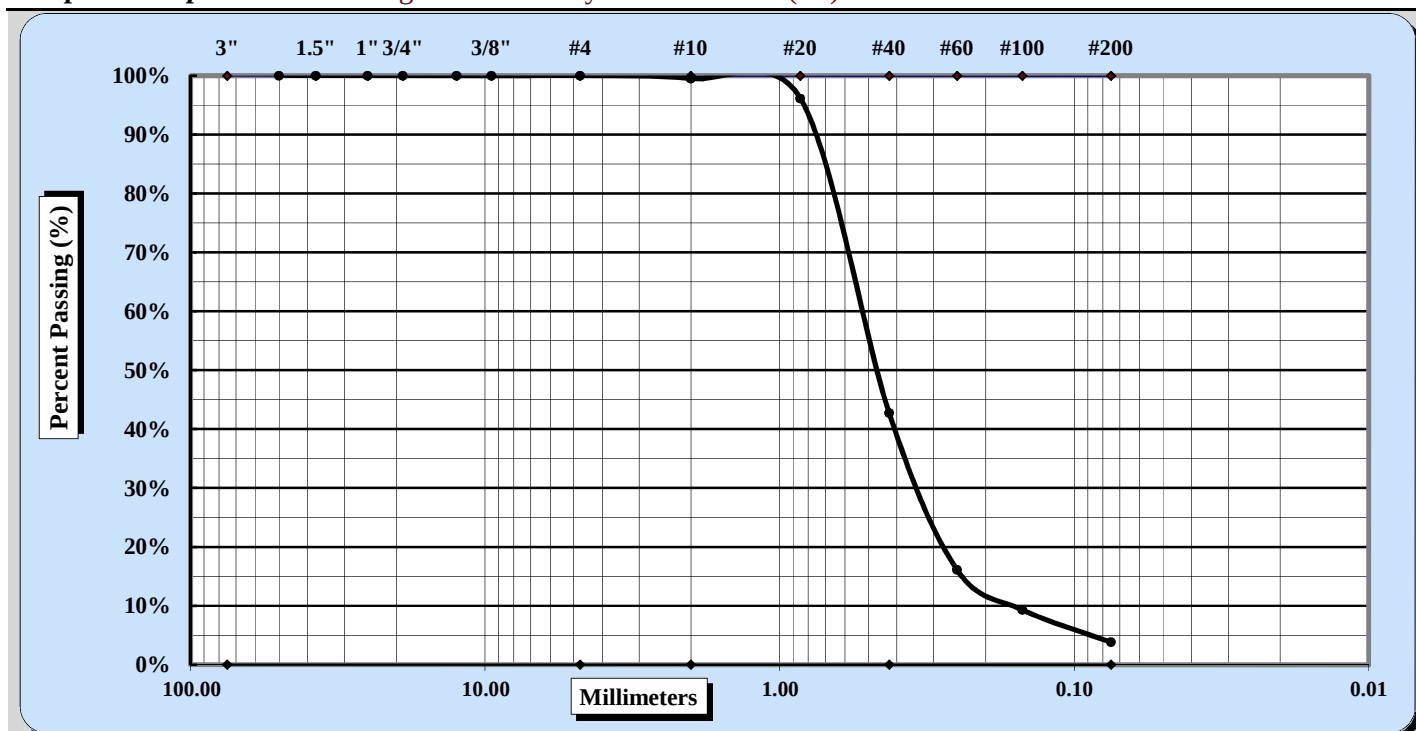


ASTM D 6913

Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #: 1358-14-033 **Report Date:** 07/17/2014
Project Name: US 264 HDD Crossings **Test Date(s):** 07/14 - 07/16/2014
Client Name: RK&K
Client Address: 2100 East Cary Street, Suite 209, Richmond, VA 23223
Boring No.: B-1 **Sample #:** S-9 **Sample Date:** 07/08/2014
Location: Site-Borehole **Offset:** N/A **Depth (ft):** 33.5' - 35.0'
Sample Description: Orange Brown Poorly Graded SAND (SP)



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.0 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.0 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#4	Coarse Sand	0.5%	Fine Sand	38.9%
Gravel	0.0%	Medium Sand	56.8%	Silt & Clay	3.8%
Liquid Limit	ND	Plastic Limit	ND	Plastic Index	ND
Specific Gravity	ND			Moisture Content	22.8%

Coarse Sand	0.5%	Medium Sand	56.8%	Fine Sand	38.9%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ND=Not Determined.

Mal Krajan, ET

Technical Responsibility

Signature

Laboratory Manager

Position

Date

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Sieve Analysis of Soils

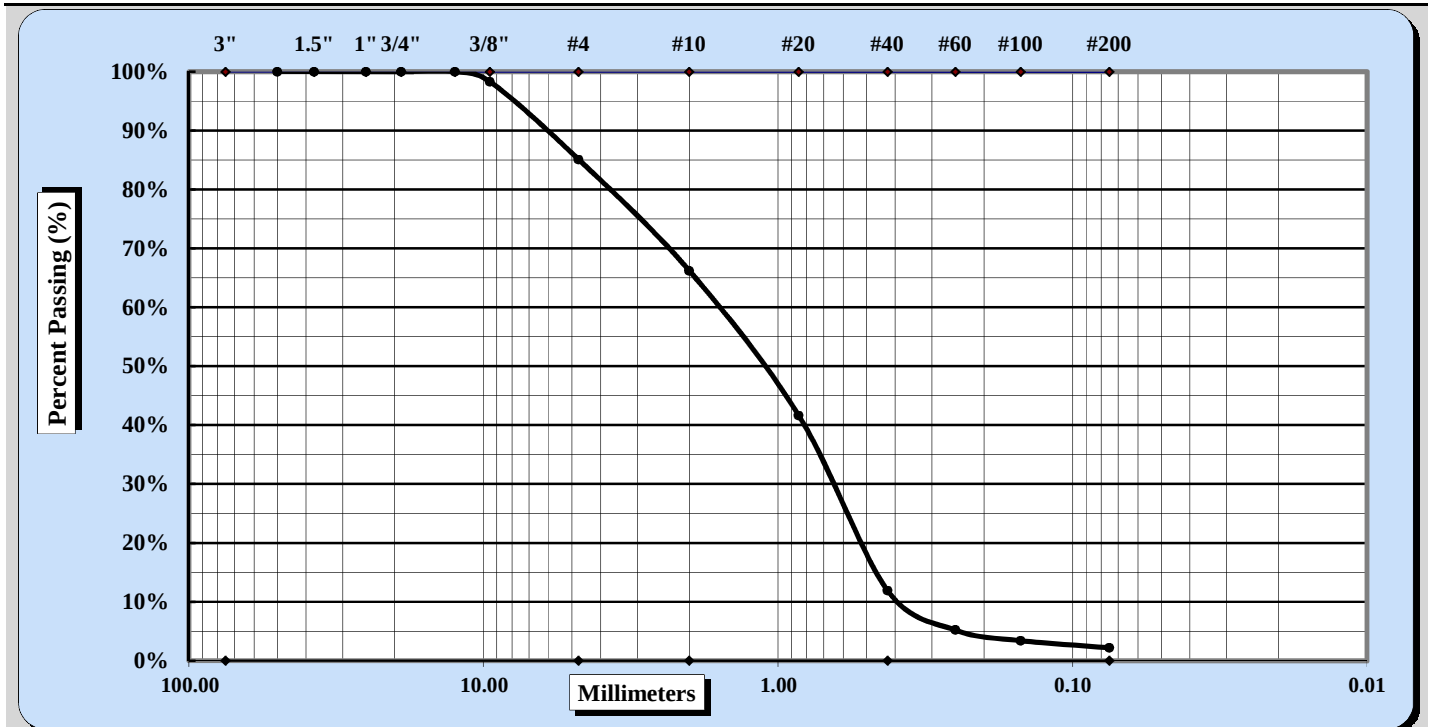


ASTM D 6913

Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #:	1358-14-033	Report Date:	07/17/2014
Project Name:	US 264 HDD Crossings	Test Date(s):	07/14 - 07/16/2014
Client Name:	RK&K		
Client Address:	2100 East Cary Street, Suite 209, Richmond, VA 23223		
Boring No.:	B-2	Sample #:	S-5
Location:	Site-Borehole	Offset:	N/A
		Sample Date:	07/02/2014
		Depth (ft):	13.5' - 15.0'
Sample Description: Tan Gray Poorly Graded SAND (SP)			



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	1/2"	Coarse Sand	18.9%	Fine Sand	9.7%
Gravel	14.9%	Medium Sand	54.3%	Silt & Clay	2.2%
Liquid Limit	ND	Plastic Limit	ND	Plastic Index	ND
Specific Gravity	ND			Moisture Content	21.1%

Coarse Sand	18.9%	Medium Sand	54.3%	Fine Sand	9.7%
Description of Sand & Gravel Particles:		Rounded	☒	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ND=Not Determined.

Mal Krajan, ET

Technical Responsibility

Signature

Laboratory Manager

Position

Date

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Sieve Analysis of Soils

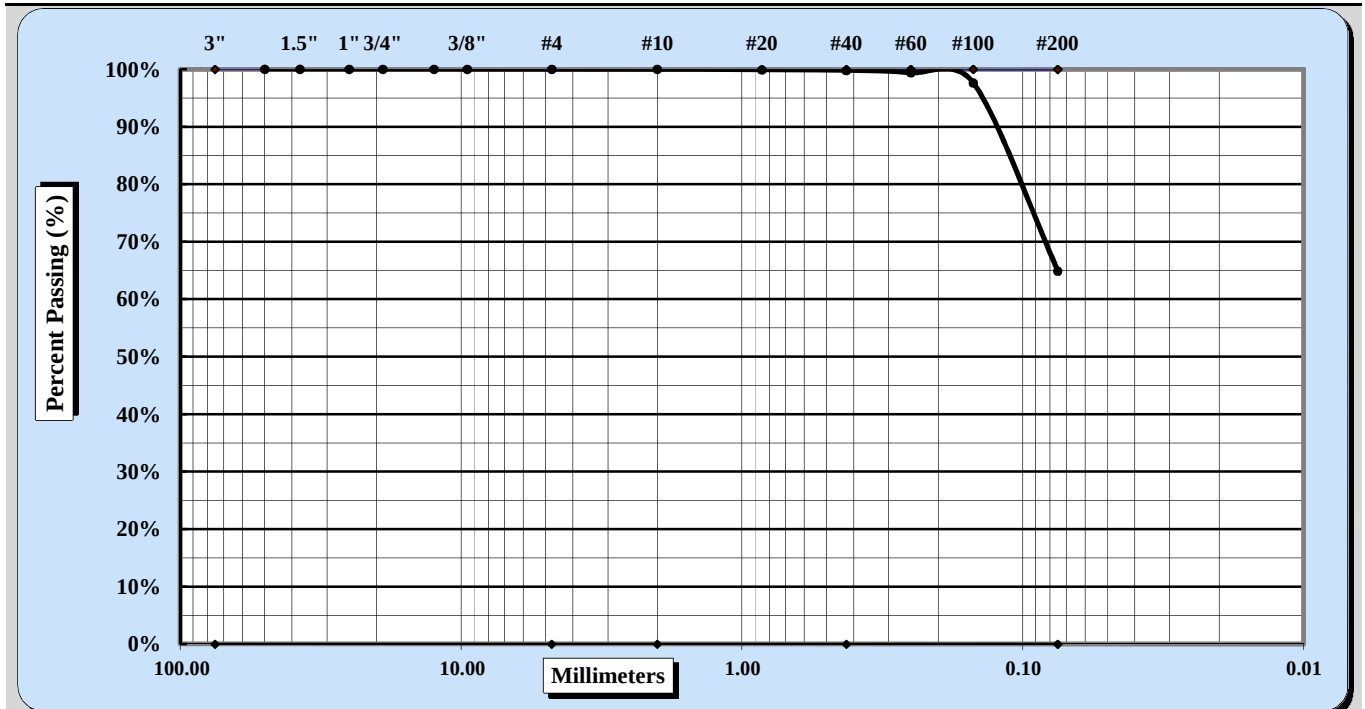


ASTM D 6913

Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #:	1358-14-033	Report Date:	07/17/2014
Project Name:	US 264 HDD Crossings	Test Date(s):	07/14 - 07/16/2014
Client Name:	RK&K		
Client Address:	2100 East Cary Street, Suite 209, Richmond, VA 23223		
Boring No.:	B-2	Sample:	S-9
		Sample Date:	07/02/2014
Location:	Site-Borehole	Offset:	N/A
		Depth (ft):	33.5' - 35.0'
Sample Description: Gray Sandy SILT (ML)			



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#10	Coarse Sand	0.0%	Fine Sand	34.9%
Gravel	0.0%	Medium Sand	0.2%	Silt & Clay	64.9%
Liquid Limit	32	Plastic Limit	30	Plastic Index	2
Specific Gravity	ND			Moisture Content	32.9%

Coarse Sand	0.0%	Medium Sand	0.2%	Fine Sand	34.9%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Mal Krajan, ET

Technical Responsibility

Laboratory Manager

Position

Date

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Liquid Limit, Plastic Limit, and Plastic Index



Test Methods.

ASTM D 4318



AASHTO T 89



AASHTO T 90



Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #: 1358-14-033

Report Date: 07/17/2014

Project Name: US 264 HDD Crossings

Test Date(s) 07/14 - 07/16/2014

Client Name: RK&K

Client Address: 2100 East Cary Street, Suite 209, Richmond, VA 23223

Boring #: B-2

Sample #: S-9

Sample Date: 07/02/2014

Location: Site-Borehole

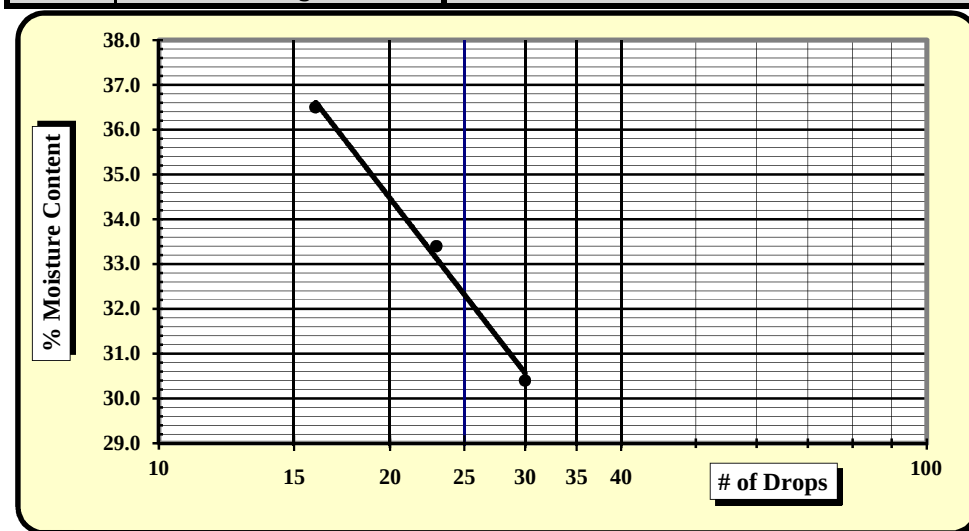
Offset: N/A

Depth (ft): 33.5' - 35.0'

Sample Description: Gray Sandy SILT (ML)

Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	1024	11/14/2013	Grooving tool	S-1	5/20/2014
LL Apparatus	1084	8/17/2013			
Oven	1454	10/1/2013			

Pan #	Tare #:	Liquid Limit					Plastic Limit		
		12	1	9			7	12	
A	Tare Weight	13.02	12.92	13.09			15.34	11.15	
B	Wet Soil Weight + A	26.06	25.50	25.00			26.29	24.27	
C	Dry Soil Weight + A	22.57	22.35	22.22			23.78	21.20	
D	Water Weight (B-C)	3.49	3.15	2.78			2.51	3.07	
E	Dry Soil Weight (C-A)	9.55	9.43	9.13			8.44	10.05	
F	% Moisture (D/E)*100	36.5%	33.4%	30.4%			29.7%	30.5%	
N	# OF DROPS	16	23	30			Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR								
Ave.	Average						30.1%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic ☐

Liquid Limit 32

Plastic Limit 30

Plastic Index 2

Group Symbol ML

Multipoint Method ☒One-point Method ☐Wet Preparation ☒Dry Preparation ☐Air Dried ☐

Estimate the % Retained on the #40 Sieve:

Notes / Deviations / References:

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Mal Krajan, ET

Technical Responsibility

Signature

Laboratory Manager

Position

Date

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Liquid Limit, Plastic Limit, and Plastic Index



Test Methods:

ASTM D 4318



AASHTO T 89



AASHTO T 90



Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #: 1358-14-033

Report Date: 7/19/14

Project Name: US 264 HDD Crossings

Test Date(s) 7/14 - 7/17/14

Client Name: RK&K

Client Address: 2100 East Cary Street, Suite 209, Richmond, VA 23223

Boring #: B-2

Sample #: S-11

Sample Date: 07/02/2014

Location: Site Borehole

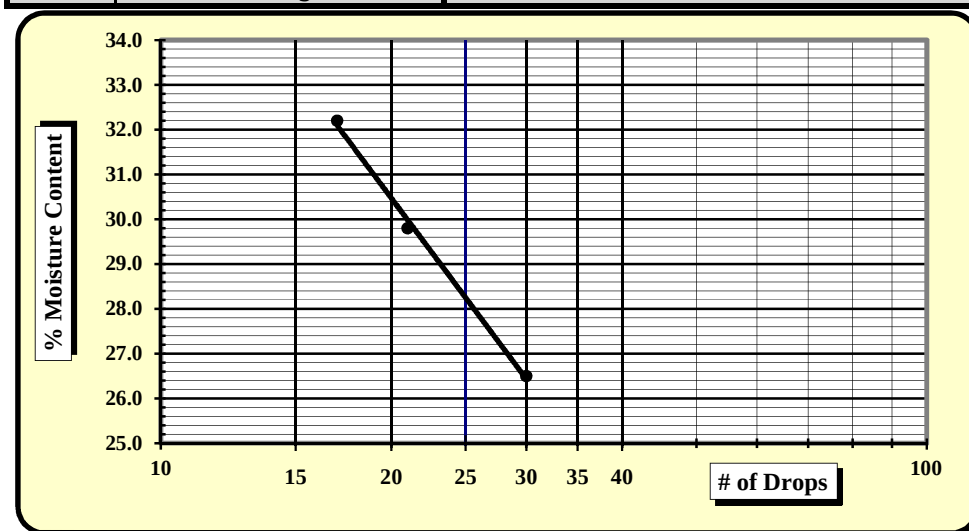
Offset: N/A

Depth (ft): 43.5 - 45 ft.

Sample Description: Gray Sandy SILT (ML)

Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	1024	11/4/2013	Grooving tool	S-1	5/20/2014
LL Apparatus	13288	8/10/2013			
Oven	1454	10/1/2013			

Pan #		Liquid Limit						Plastic Limit		
Tare #:		158	53	23				812	6	
A	Tare Weight	20.72	20.84	20.87				16.70	15.23	
B	Wet Soil Weight + A	36.05	36.30	39.80				28.19	26.20	
C	Dry Soil Weight + A	32.32	32.75	35.84				26.08	24.17	
D	Water Weight (B-C)	3.73	3.55	3.96				2.11	2.03	
E	Dry Soil Weight (C-A)	11.60	11.91	14.97				9.38	8.94	
F	% Moisture (D/E)*100	32.2%	29.8%	26.5%				22.5%	22.7%	
N	# OF DROPS	17	21	30				Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR									
Ave.	Average							22.6%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic ☐

Liquid Limit 28

Plastic Limit 23

Plastic Index 5

Group Symbol ML

Multipoint Method ☒One-point Method ☐Wet Preparation ☒Dry Preparation ☐Air Dried ☐

Estimate the % Retained on the #40 Sieve: 10%

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Mal Krajan, ET

Technical Responsibility

Signature

Laboratory Manager

Position

Date

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Sieve Analysis of Soils

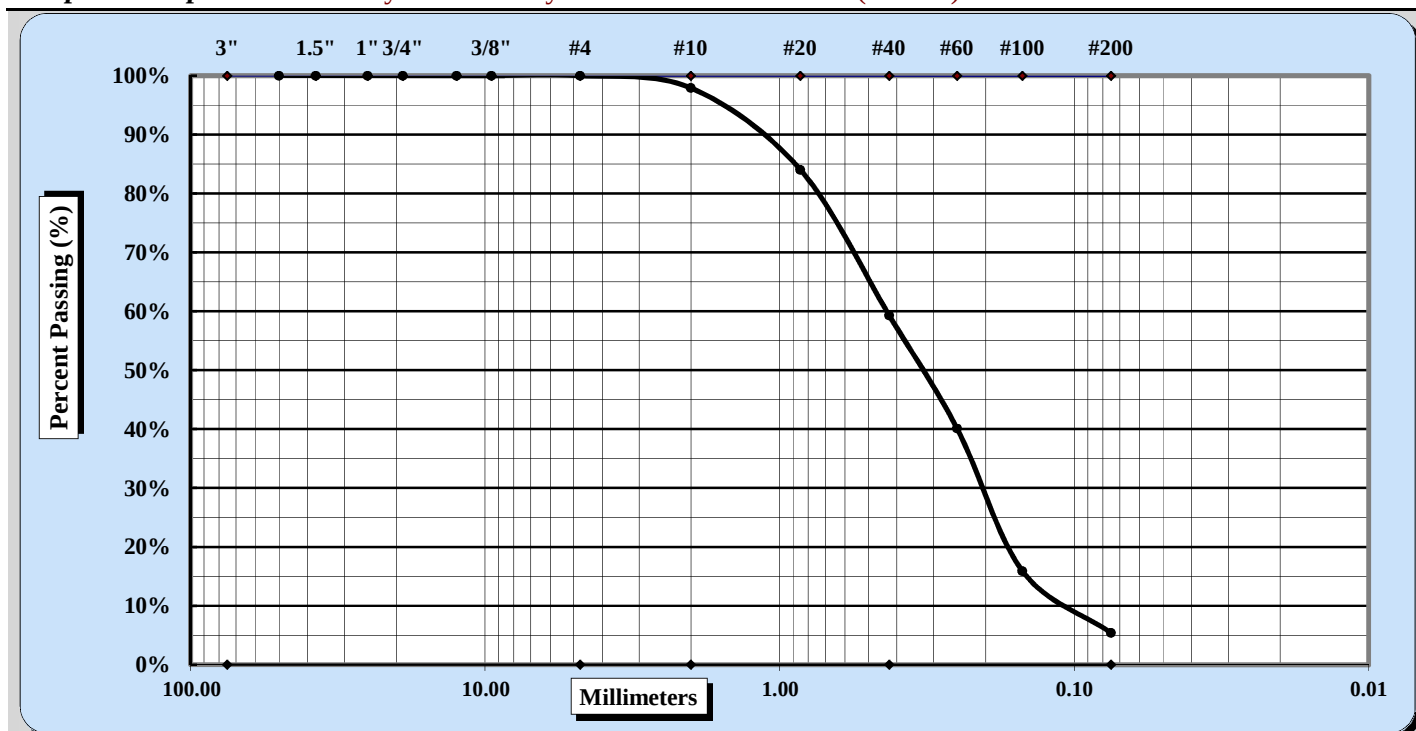


ASTM D 6913

Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #: 1358-14-033 **Report Date:** 07/17/2014
Project Name: US 264 HDD Crossings **Test Date(s):** 07/14 - 07/16/2014
Client Name: RK&K
Client Address: 2100 East Cary Street, Suite 209, Richmond, VA 23223
Boring No.: B-3 **Sample #:** S-4 **Sample Date:** 07/02/2014
Location: Site-Borehole **Offset:** N/A **Depth (ft):** 8.5' - 10.0'
Sample Description: Gray Black Poorly Graded SAND with Silt (SP-SM)



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#4	Coarse Sand	2.1%	Fine Sand	53.9%
Gravel	0.0%	Medium Sand	38.6%	Silt & Clay	5.4%
Liquid Limit	ND	Plastic Limit	ND	Plastic Index	ND
Specific Gravity	ND			Moisture Content	23.5%

Coarse Sand	2.1%	Medium Sand	38.6%	Fine Sand	53.9%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ND=Not Determined.

Mal Krajan, ET

Technical Responsibility

Signature

Laboratory Manager

Position

Date

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Liquid Limit, Plastic Limit, and Plastic Index



Test Methods:

ASTM D 4318



AASHTO T 89



AASHTO T 90



Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #: 1358-14-033

Report Date: 7/19/14

Project Name: US 264 HDD Crossings

Test Date(s) 7/14 - 7/17/14

Client Name: RK&K

Client Address: 2100 East Cary Street, Suite 209, Richmond, VA 23223

Boring #: B-3

Sample #: S-5

Sample Date: 07/02/2014

Location: Site Borehole

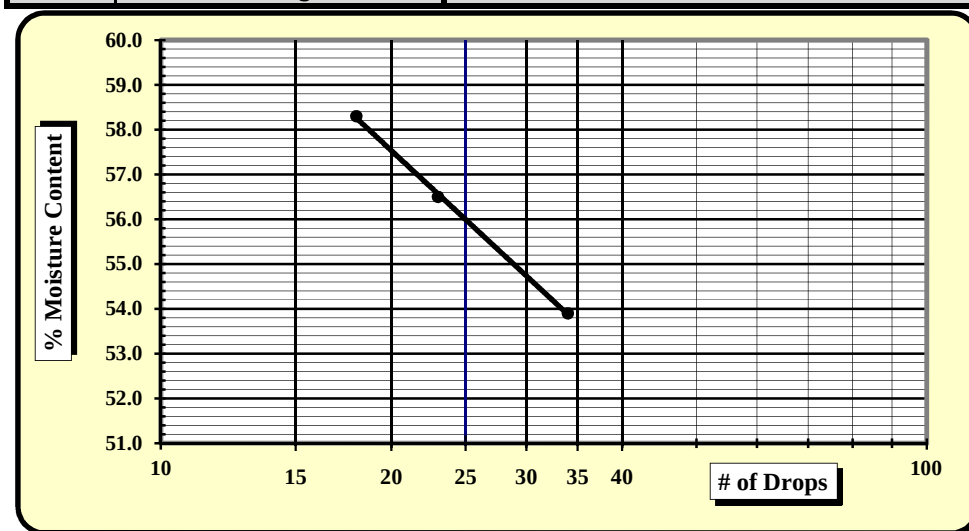
Offset: N/A

Depth (ft): 13.5 - 15 ft.

Sample Description: Gray Black Sandy Fat CLAY (CH)

Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	1024	11/4/2013	Grooving tool	S-1	5/20/2014
LL Apparatus	13288	8/10/2013			
Oven	1454	10/1/2013			

Pan #		Liquid Limit						Plastic Limit		
Tare #:		802	803	55				11	8	
A	Tare Weight	16.75	16.71	15.23				12.48	12.99	
B	Wet Soil Weight + A	30.65	29.17	29.10				23.42	21.98	
C	Dry Soil Weight + A	25.78	24.67	23.99				21.18	20.18	
D	Water Weight (B-C)	4.87	4.50	5.11				2.24	1.80	
E	Dry Soil Weight (C-A)	9.03	7.96	8.76				8.70	7.19	
F	% Moisture (D/E)*100	53.9%	56.5%	58.3%				25.7%	25.0%	
N	# OF DROPS	34	23	18				Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR									
Ave.	Average							25.4%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic ☐

Liquid Limit 56

Plastic Limit 25

Plastic Index 31

Group Symbol CH

Multipoint Method ☒One-point Method ☐Wet Preparation ☒Dry Preparation ☐Air Dried ☐

Estimate the % Retained on the #40 Sieve: 0%

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Mal Krajan, ET

Technical Responsibility

Signature

Laboratory Manager

Position

Date

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Sieve Analysis of Soils

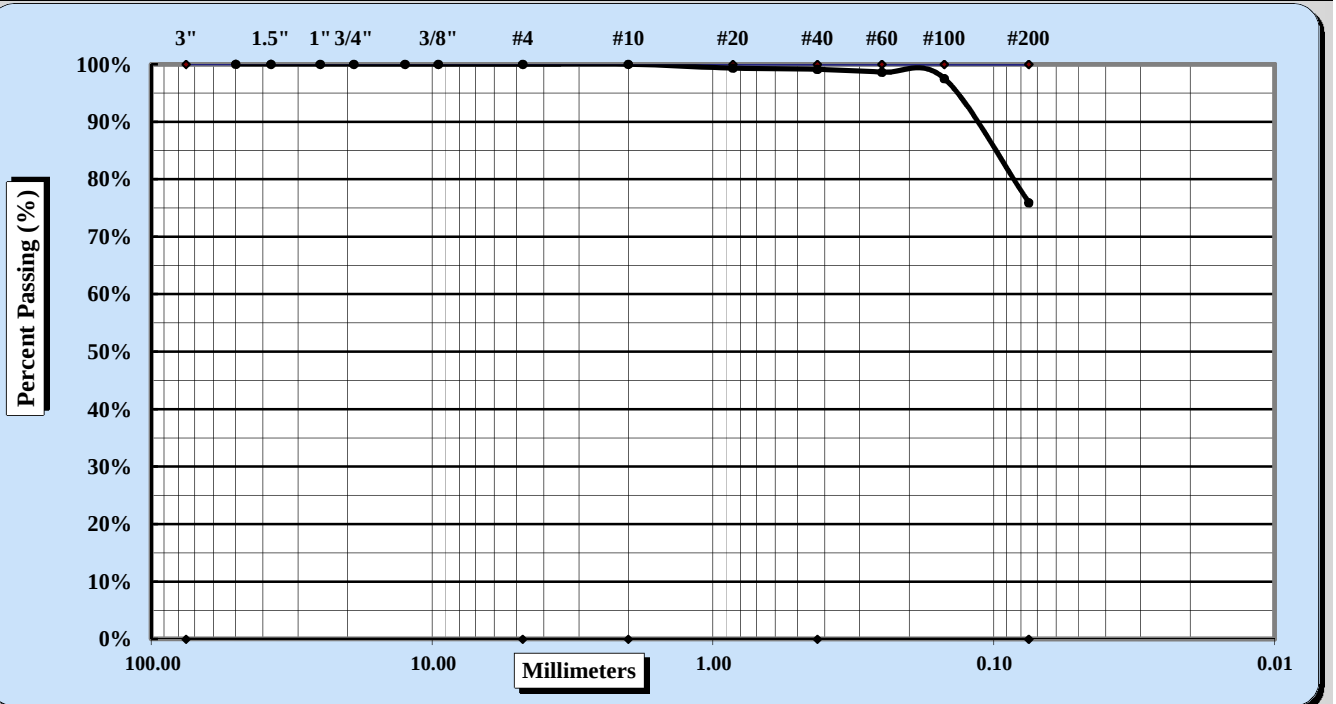


ASTM D 6913

Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #:	1358-14-033	Report Date:	07/17/2014
Project Name:	US 264 HDD Crossings	Test Date(s):	07/14 - 07/16/2014
Client Name:	RK&K		
Client Address:	2100 East Cary Street, Suite 209, Richmond, VA 23223		
Boring No.:	B-3	Sample:	S-10
		Sample Date:	07/03/2014
Location:	Site-Borehole	Offset:	N/A
		Depth (ft):	38.5' - 40.0'
Sample Description: Gray Black Sandy Fat CLAY (CH)			



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#10	Coarse Sand	0.0%	Fine Sand	23.2%
Gravel	0.0%	Medium Sand	0.9%	Silt & Clay	75.9%
Liquid Limit	57	Plastic Limit	23	Plastic Index	34
Specific Gravity	ND			Moisture Content	30.3%

Coarse Sand	0.0%	Medium Sand	0.9%	Fine Sand	23.2%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Mal Krajan, ET

Technical Responsibility

Laboratory Manager

Position

Date

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Liquid Limit, Plastic Limit, and Plastic Index



Test Methods.

ASTM D 4318



AASHTO T 89



AASHTO T 90



Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #: 1358-14-033

Report Date: 07/17/2014

Project Name: US 264 HDD Crossings

Test Date(s) 07/14 - 07/16/2014

Client Name: RK&K

Client Address: 2100 East Cary Street, Suite 209, Richmond, VA 23223

Boring #: B-3

Sample #: S-10

Sample Date: 07/03/2014

Location: Site-Borehole

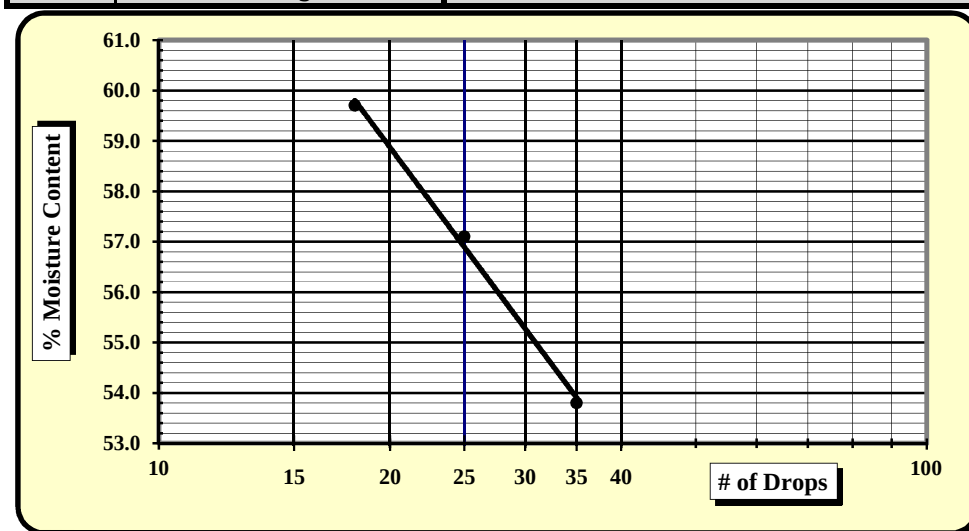
Offset: N/A

Depth (ft): 38.5' - 40.0'

Sample Description: Gray Black Sandy Fat CLAY (CH)

Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	1024	11/4/2013	Grooving tool	S-1	5/20/2014
LL Apparatus	13288	8/10/2013			
Oven	1454	10/1/2013			

Pan #		Liquid Limit						Plastic Limit		
Tare #:		9	806	10				809	807	
A	Tare Weight	15.30	16.58	11.01				16.70	16.73	
B	Wet Soil Weight + A	26.94	29.32	21.42				25.17	27.25	
C	Dry Soil Weight + A	22.87	24.69	17.53				23.63	25.25	
D	Water Weight (B-C)	4.07	4.63	3.89				1.54	2.00	
E	Dry Soil Weight (C-A)	7.57	8.11	6.52				6.93	8.52	
F	% Moisture (D/E)*100	53.8%	57.1%	59.7%				22.2%	23.5%	
N	# OF DROPS	35	25	18				Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR									
Ave.	Average							22.9%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic ☐

Liquid Limit 57

Plastic Limit 23

Plastic Index 34

Group Symbol CH

Multipoint Method ☒One-point Method ☐Wet Preparation ☒Dry Preparation ☐Air Dried ☐

Estimate the % Retained on the #40 Sieve:

Notes / Deviations / References:

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Mal Krajan, ET

Technical Responsibility

Signature

Laboratory Manager

Position

Date

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Sieve Analysis of Soils

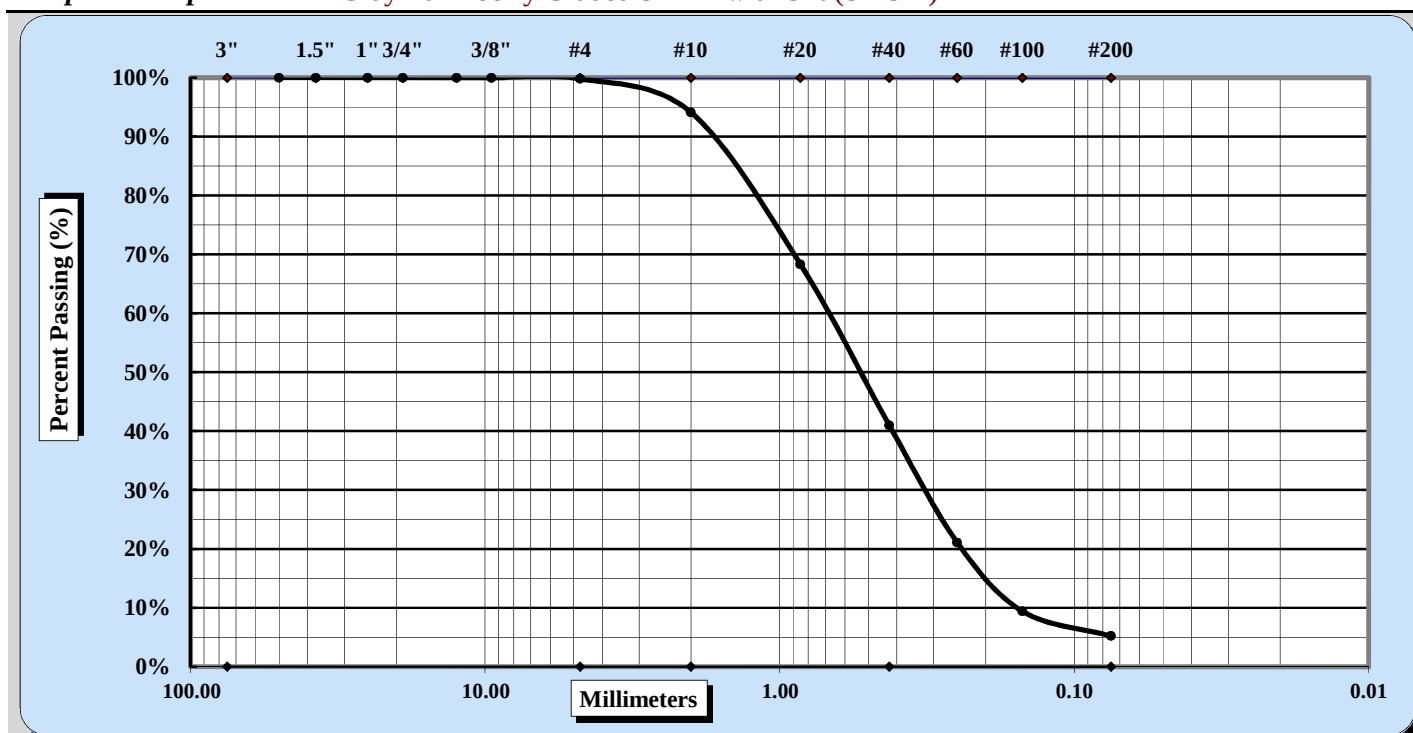


ASTM D 6913

Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #:	1358-14-033	Report Date:	07/17/2014
Project Name:	US 264 HDD Crossings	Test Date(s):	07/14 - 07/16/2014
Client Name:	RK&K		
Client Address:	2100 East Cary Street, Suite 209, Richmond, VA 23223		
Boring No.:	B-4	Sample #:	S-2
		Sample Date:	07/03/2014
Location:	Site-Borehole	Offset:	N/A
		Depth (ft):	3.5' - 5.0'

Sample Description: Gray Tan Poorly Graded SAND with Silt (SP-SM)

Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/8"	Coarse Sand	5.7%	Fine Sand	35.8%
Gravel	0.2%	Medium Sand	53.1%	Silt & Clay	5.2%
Liquid Limit	ND	Plastic Limit	ND	Plastic Index	ND
Specific Gravity	ND			Moisture Content	17.4%

Coarse Sand	5.7%	Medium Sand	53.1%	Fine Sand	35.8%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ND=Not Determined.Mal Krajan, ET

Technical Responsibility

Laboratory Manager

Position

Date

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Liquid Limit, Plastic Limit, and Plastic Index



Test Methods:

ASTM D 4318



AASHTO T 89



AASHTO T 90



Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #: 1358-14-033

Report Date: 7/19/14

Project Name: US 264 HDD Crossings

Test Date(s) 7/14 - 7/17/14

Client Name: RK&K

Client Address: 2100 East Cary Street, Suite 209, Richmond, VA 23223

Boring #: B-4

Sample #: S-3

Sample Date: 07/03/2014

Location: Site Borehole

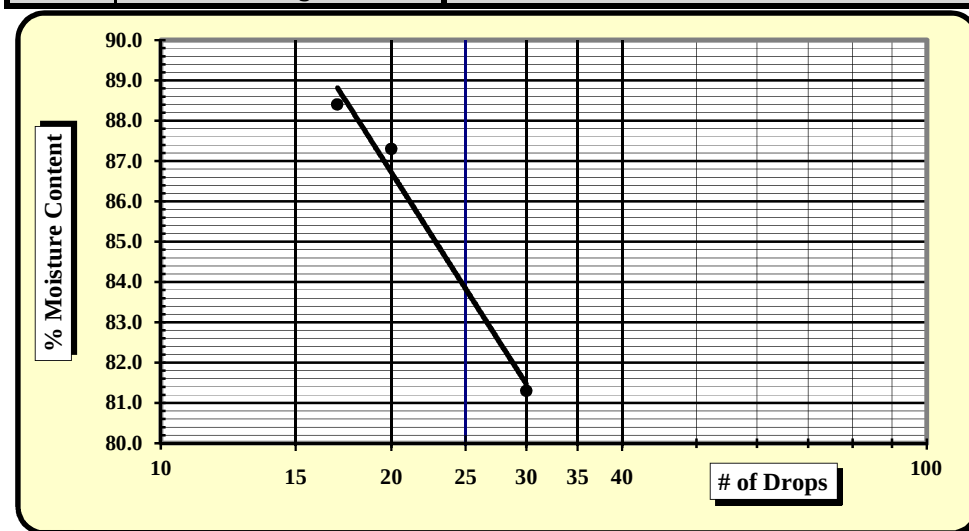
Offset: N/A

Depth (ft): 6 - 7.5 ft.

Sample Description: Gray Black Elastic SILT (MH)

Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	1024	11/4/2013	Grooving tool	S-1	5/20/2014
LL Apparatus	13288	8/10/2013			
Oven	1454	10/1/2013			

Pan #		Liquid Limit						Plastic Limit		
Tare #:		98	13	12				51	1	
A	Tare Weight	20.91	20.86	21.00				20.86	20.88	
B	Wet Soil Weight + A	32.43	32.90	33.09				28.63	29.82	
C	Dry Soil Weight + A	27.06	27.25	27.67				26.46	27.40	
D	Water Weight (B-C)	5.37	5.65	5.42				2.17	2.42	
E	Dry Soil Weight (C-A)	6.15	6.39	6.67				5.60	6.52	
F	% Moisture (D/E)*100	87.3%	88.4%	81.3%				38.8%	37.1%	
N	# OF DROPS	20	17	30				Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR									
Ave.	Average							38.0%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic ☐

Liquid Limit 84

Plastic Limit 38

Plastic Index 46

Group Symbol MH

Multipoint Method ☒One-point Method ☐Wet Preparation ☒Dry Preparation ☐Air Dried ☐

Estimate the % Retained on the #40 Sieve: 0%

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Mal Krajan, ET

Technical Responsibility

Laboratory Manager

Position

Date

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Sieve Analysis of Soils

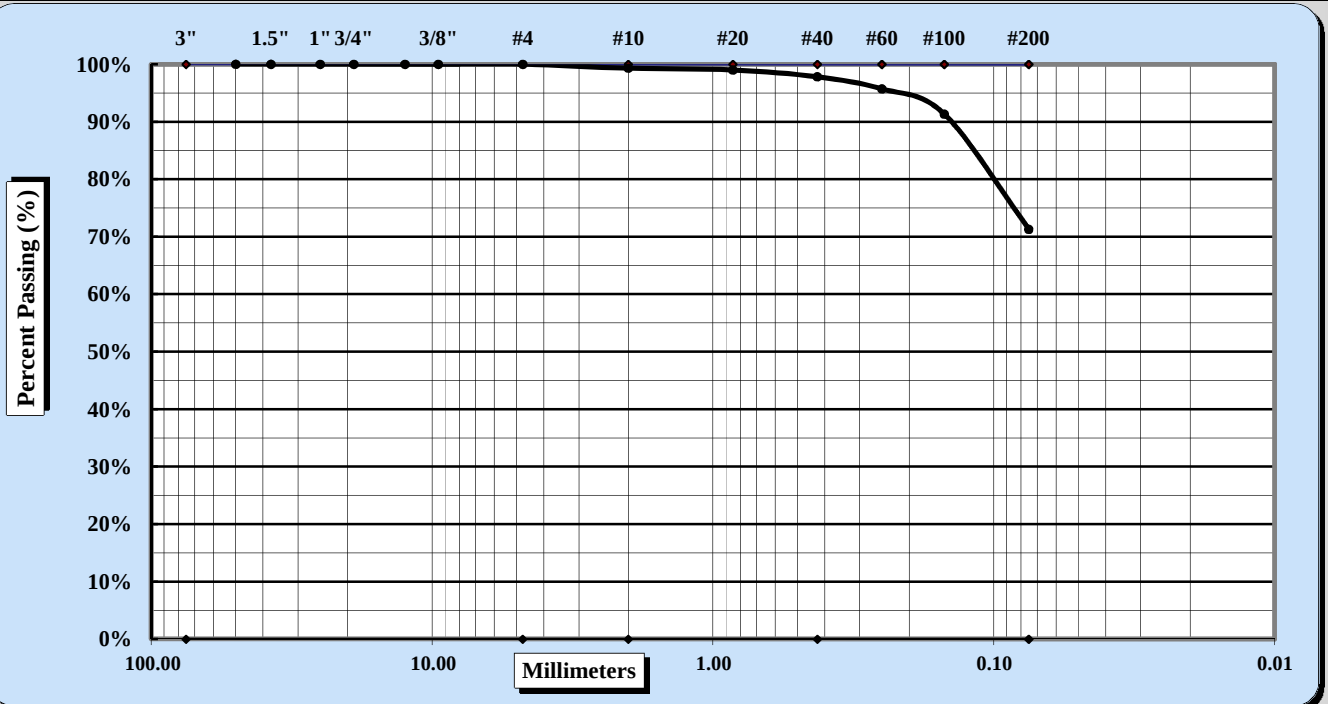


ASTM D 6913

Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #:	1358-14-033	Report Date:	07/17/2014
Project Name:	US 264 HDD Crossings	Test Date(s):	07/14 - 07/16/2014
Client Name:	RK&K		
Client Address:	2100 East Cary Street, Suite 209, Richmond, VA 23223		
Boring No.:	B-4	Sample:	S-8
Sample Date:	07/03/2014		
Location:	Site-Borehole	Offset:	N/A
Depth (ft):	28.5' - 30.0'		
Sample Description: Gray Fat Sandy CLAY (CH)			



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#4	Coarse Sand	0.7%	Fine Sand	26.5%
Gravel	0.0%	Medium Sand	1.5%	Silt & Clay	71.3%
Liquid Limit	61	Plastic Limit	22	Plastic Index	39
Specific Gravity	ND			Moisture Content	29.3%

Coarse Sand	0.7%	Medium Sand	1.5%	Fine Sand	26.5%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☐
Hard & Durable	☐	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Mal Krajan, ET

Technical Responsibility

Laboratory Manager

Position

Date

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Liquid Limit, Plastic Limit, and Plastic Index



Test Methods.

ASTM D 4318



AASHTO T 89



AASHTO T 90



Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #: 1358-14-033

Report Date: 07/17/2014

Project Name: US 264 HDD Crossings

Test Date(s) 07/14 - 07/16/2014

Client Name: RK&K

Client Address: 2100 East Cary Street, Suite 209, Richmond, VA 23223

Boring #: B-4

Sample #: S-8

Sample Date: 07/03/2014

Location: Site-Borehole

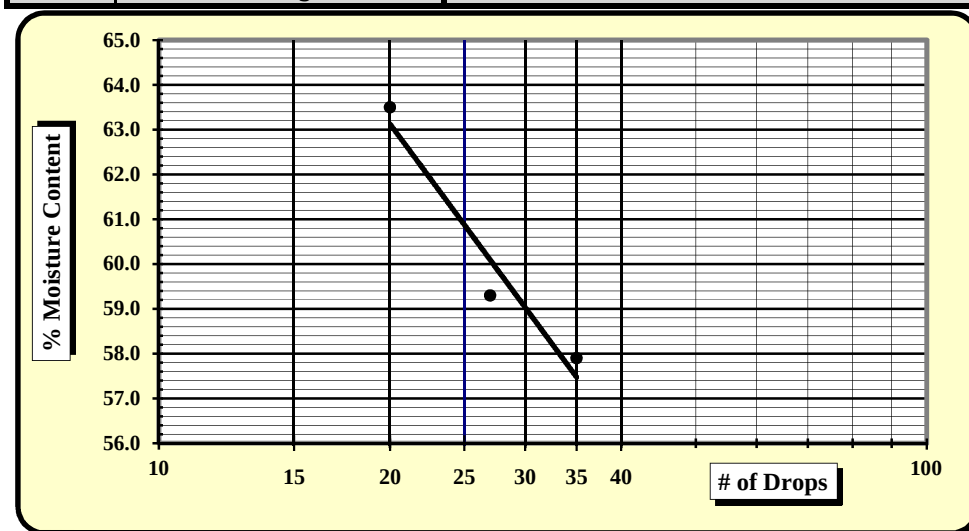
Offset: N/A

Depth (ft): 28.5' - 30.0'

Sample Description: Gray Fat Sandy CLAY (CH)

Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	1024	11/4/2013	Grooving tool	S-1	5/20/2014
LL Apparatus	13288	8/10/2013			
Oven	1454	10/1/2013			

Pan #	Tare #:	Liquid Limit					Plastic Limit		
		19	10	3			22	14	
A	Tare Weight	13.00	13.06	13.04			13.06	12.96	
B	Wet Soil Weight + A	25.41	26.60	24.81			22.25	20.94	
C	Dry Soil Weight + A	20.86	21.56	20.24			20.54	19.52	
D	Water Weight (B-C)	4.55	5.04	4.57			1.71	1.42	
E	Dry Soil Weight (C-A)	7.86	8.50	7.20			7.48	6.56	
F	% Moisture (D/E)*100	57.9%	59.3%	63.5%			22.9%	21.6%	
N	# OF DROPS	35	27	20			Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR								
Ave.	Average						22.3%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic ☐

Liquid Limit 61

Plastic Limit 22

Plastic Index 39

Group Symbol CH

Multipoint Method ☒One-point Method ☐Wet Preparation ☒Dry Preparation ☐Air Dried ☐

Estimate the % Retained on the #40 Sieve:

Notes / Deviations / References:

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Mal Krajan, ET

Technical Responsibility

Signature

Laboratory Manager

Position

Date

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Liquid Limit, Plastic Limit, and Plastic Index



Test Methods:

ASTM D 4318



AASHTO T 89



AASHTO T 90



Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #: 1358-14-033

Report Date: 7/19/14

Project Name: US 264 HDD Crossings

Test Date(s) 7/14 - 7/17/14

Client Name: RK&K

Client Address: 2100 East Cary Street, Suite 209, Richmond, VA 23223

Boring #: B-4

Sample #: S-10

Sample Date: 07/03/2014

Location: Site Borehole

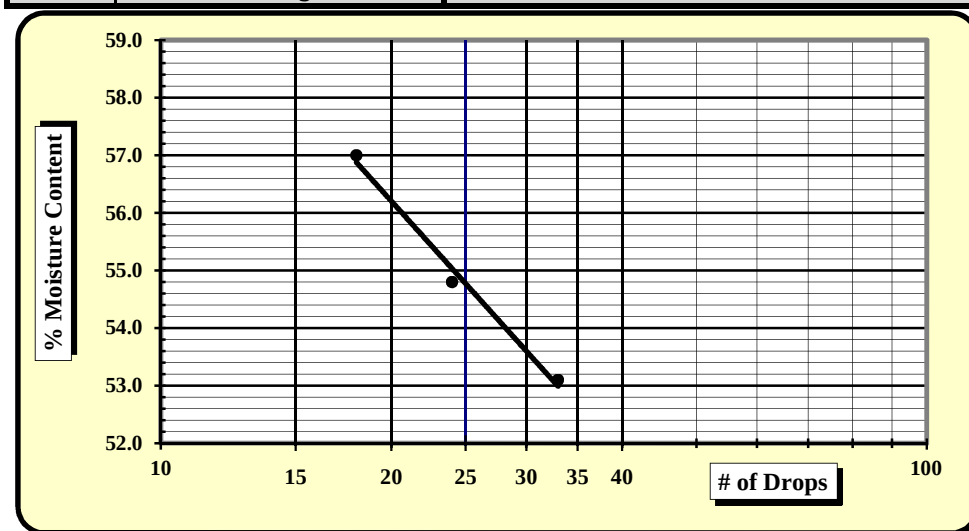
Offset: N/A

Depth (ft): 38.5 - 40 ft.

Sample Description: Gray Black Fat Sandy CLAY (CH)

Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	1024	11/4/2013	Grooving tool	S-1	5/20/2014
LL Apparatus	13288	8/10/2013			
Oven	1454	10/1/2013			

Pan #		Liquid Limit						Plastic Limit		
Tare #:		2	15	107				16	58	
A	Tare Weight	21.04	20.71	21.01				21.02	20.58	
B	Wet Soil Weight + A	35.03	34.81	34.94				32.58	31.97	
C	Dry Soil Weight + A	30.18	29.82	29.88				30.31	29.77	
D	Water Weight (B-C)	4.85	4.99	5.06				2.27	2.20	
E	Dry Soil Weight (C-A)	9.14	9.11	8.87				9.29	9.19	
F	% Moisture (D/E)*100	53.1%	54.8%	57.0%				24.4%	23.9%	
N	# OF DROPS	33	24	18				Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR									
Ave.	Average							24.2%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic ☐

Liquid Limit 55

Plastic Limit 24

Plastic Index 31

Group Symbol CH

Multipoint Method ☒One-point Method ☐Wet Preparation ☒Dry Preparation ☐Air Dried ☐

Estimate the % Retained on the #40 Sieve: 0%

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Mal Krajan, ET

Technical Responsibility

Signature

Laboratory Manager

Position

Date

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Sieve Analysis of Soils

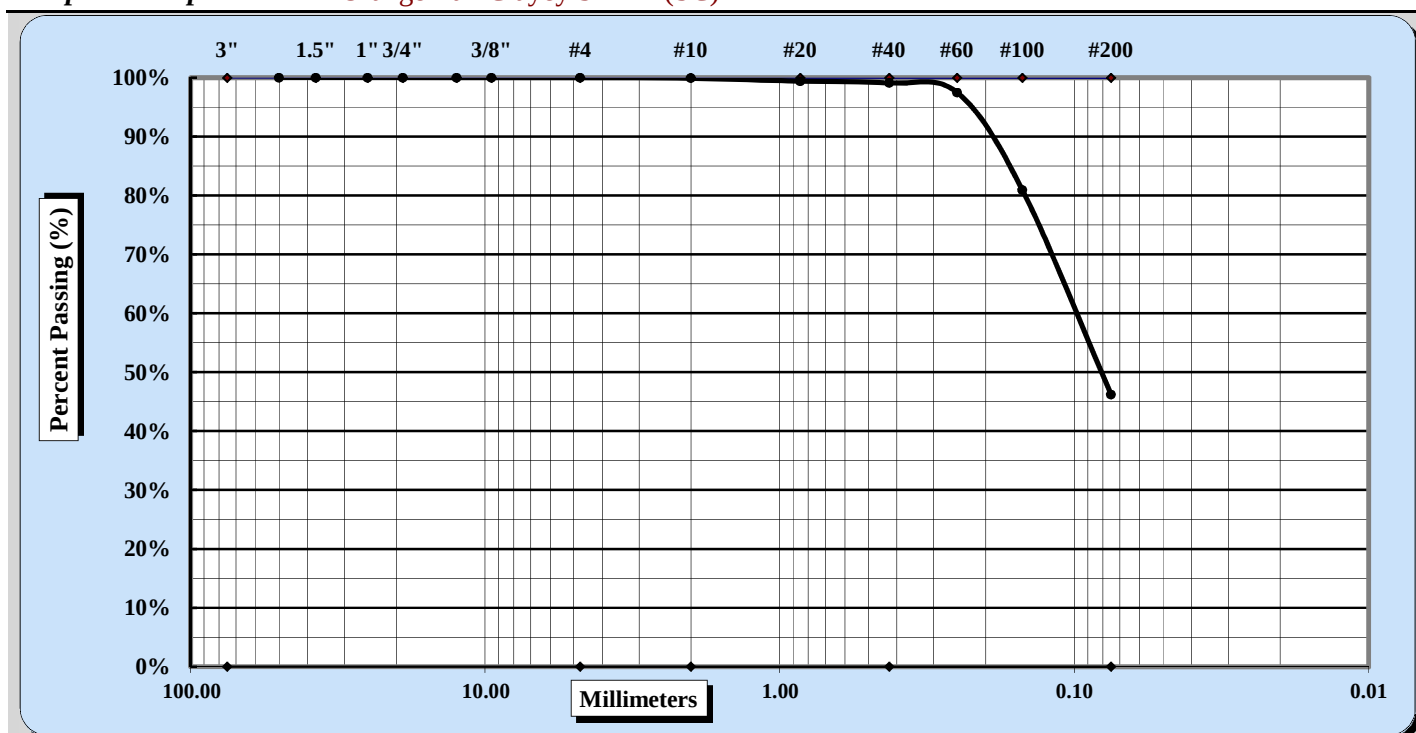


ASTM D 6913

Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #: 1358-14-033 **Report Date:** 07/17/2014
Project Name: US 264 HDD Crossing **Test Date(s):** 07/14 - 07/16/2014
Client Name: RK&K
Client Address: 2100 East Cary Street, Suite 209, Richmond, VA 23223
Boring No.: B-5 **Sample #:** S-4 **Sample Date:** 07/03/2014
Location: Site-Borehole **Offset:** N/A **Depth (ft):** 8.5' - 10.0'
Sample Description: Orange Tan Clayey SAND (SC)



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#4	Coarse Sand	0.1%	Fine Sand	52.9%
Gravel	0.0%	Medium Sand	0.8%	Silt & Clay	46.2%
Liquid Limit	ND	Plastic Limit	ND	Plastic Index	ND
Specific Gravity	ND			Moisture Content	40.2%

Coarse Sand	0.1%	Medium Sand	0.8%	Fine Sand	52.9%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ND=Not Determined.

Mal Krajan, ET

Technical Responsibility

Laboratory Manager

Position

Date

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Sieve Analysis of Soils

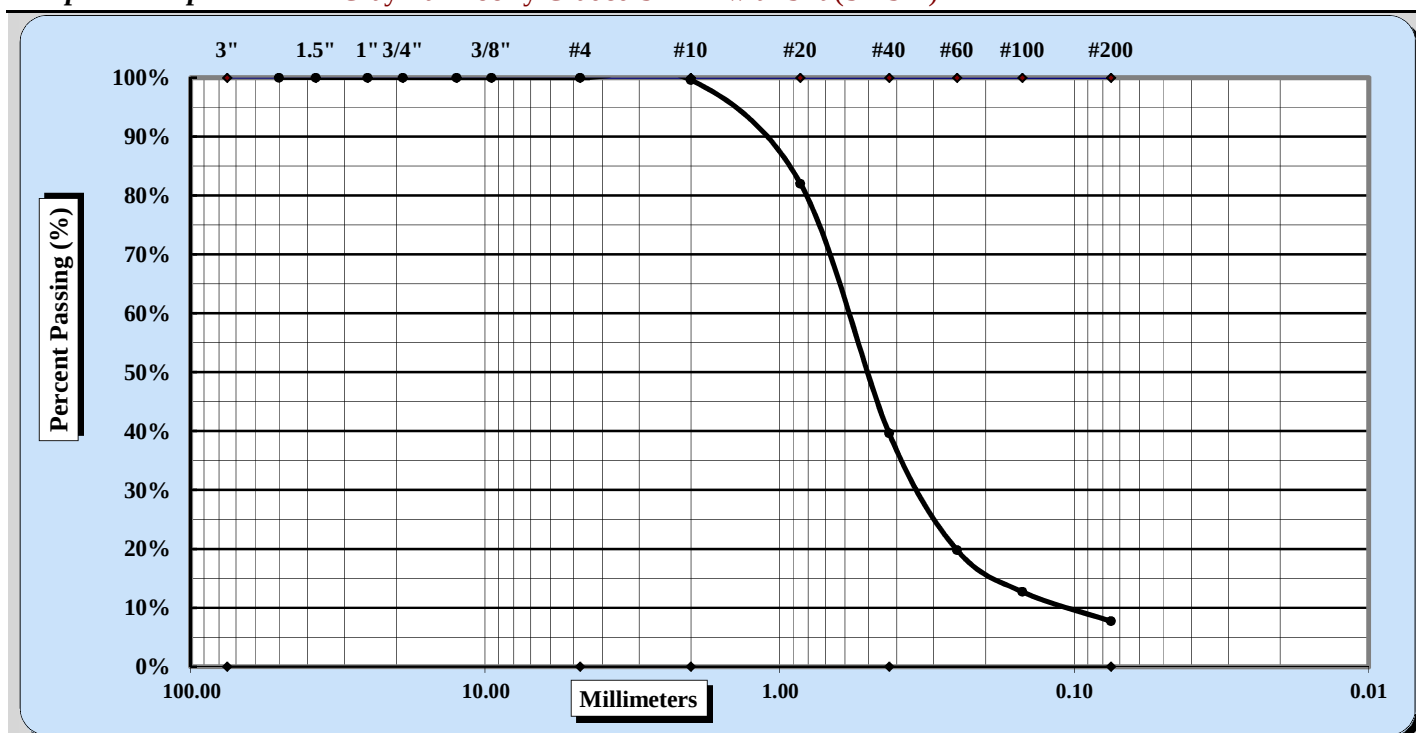


ASTM D 6913

Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #:	1358-14-033	Report Date:	07/17/2014
Project Name:	US 264 HDD Crossings	Test Date(s):	07/14 - 07/16/2014
Client Name:	RK&K		
Client Address:	2100 East Cary Street, Suite 209, Richmond, VA 23223		
Boring No.:	B-5	Sample #:	S-6
		Sample Date:	07/03/2014
Location:	Site-Borehole	Offset:	N/A
		Depth (ft):	18.5' - 20.0'

Sample Description: Gray Tan Poorly Graded SAND with Silt (SP-SM)

Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#4	Coarse Sand	0.4%	Fine Sand	31.9%
Gravel	0.0%	Medium Sand	60.0%	Silt & Clay	7.7%
Liquid Limit	ND	Plastic Limit	ND	Plastic Index	ND
Specific Gravity	ND			Moisture Content	16.8%

Coarse Sand	0.4%	Medium Sand	60.0%	Fine Sand	31.9%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ND=Not Determined.Mal Krajan, ET

Technical Responsibility

Laboratory Manager

Position

Date

Signature

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Liquid Limit, Plastic Limit, and Plastic Index



Test Methods:

ASTM D 4318



AASHTO T 89



AASHTO T 90



Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #: 1358-14-033

Report Date: 7/19/14

Project Name: US 264 HDD Crossings

Test Date(s) 7/14 - 7/17/14

Client Name: RK&K

Client Address: 2100 East Cary Street, Suite 209, Richmond, VA 23223

Boring #: B-5

Sample #: S-7

Sample Date: 07/03/2014

Location: Site Borehole

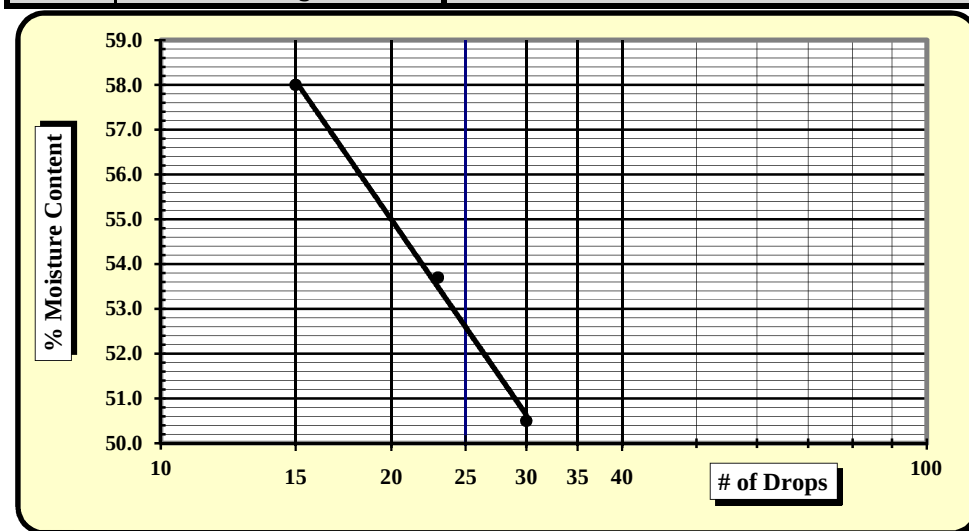
Offset: N/A

Depth (ft): 23.5 - 25 ft.

Sample Description: Gray Olive Fat CLAY (CH)

Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	1024	11/4/2013	Grooving tool	S-1	5/20/2014
LL Apparatus	13288	8/10/2013			
Oven	1454	10/1/2013			

Pan #		Liquid Limit						Plastic Limit		
Tare #:		13	21	25				5	2	
A	Tare Weight	13.09	12.94	12.94				12.50	11.10	
B	Wet Soil Weight + A	27.94	26.82	24.54				20.77	20.36	
C	Dry Soil Weight + A	22.49	21.97	20.65				18.99	18.41	
D	Water Weight (B-C)	5.45	4.85	3.89				1.78	1.95	
E	Dry Soil Weight (C-A)	9.40	9.03	7.71				6.49	7.31	
F	% Moisture (D/E)*100	58.0%	53.7%	50.5%				27.4%	26.7%	
N	# OF DROPS	15	23	30				Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR									
Ave.	Average							27.1%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic ☐

Liquid Limit 53

Plastic Limit 27

Plastic Index 26

Group Symbol CH

Multipoint Method ☒One-point Method ☐Wet Preparation ☒Dry Preparation ☐Air Dried ☐

Estimate the % Retained on the #40 Sieve: 1%

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Mal Krajan, ET

Technical Responsibility

Signature

Laboratory Manager

Position

Date

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Sieve Analysis of Soils

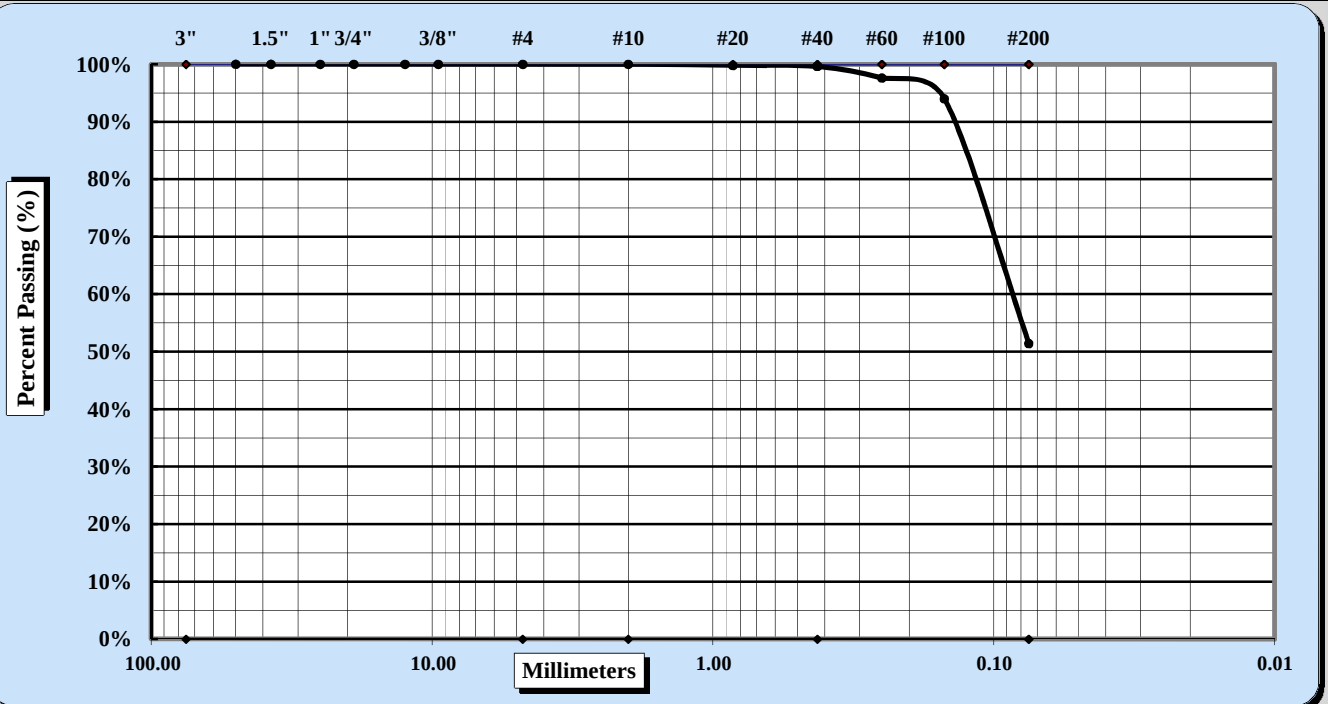


ASTM D 6913

Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #:	1358-14-033	Report Date:	07/17/2014
Project Name:	US 264 HDD Crossings	Test Date(s):	07/14 - 07/16/2014
Client Name:	RK&K		
Client Address:	2100 East Cary Street, Suite 209, Richmond, VA 23223		
Boring No.:	B-5	Sample:	S-9
Sample Date:	07/03/2014		
Location:	Site-Borehole	Offset:	N/A
Depth (ft):	33.5' - 35.0'		
Sample Description:	Gray Sandy CLAY (CH)		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#4	Coarse Sand	0.0%	Fine Sand	48.2%
Gravel	0.0%	Medium Sand	0.4%	Silt & Clay	51.4%
Liquid Limit	55	Plastic Limit	26	Plastic Index	29
Specific Gravity	ND			Moisture Content	44.3%

Coarse Sand	0.0%	Medium Sand	0.4%	Fine Sand	48.2%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Mal Krajan, ET

Technical Responsibility

Laboratory Manager

Position

Date

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Liquid Limit, Plastic Limit, and Plastic Index



Test Methods.

ASTM D 4318



AASHTO T 89



AASHTO T 90



Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #: 1358-14-033

Report Date: 07/17/2014

Project Name: US 264 HDD Crossings

Test Date(s) 07/14 - 07/16/2014

Client Name: RK&K

Client Address: 2100 East Cary Street, Suite 209, Richmond, VA 23223

Boring #: B-5

Sample #: S-9

Sample Date: 07/03/2014

Location: Site-Borehole

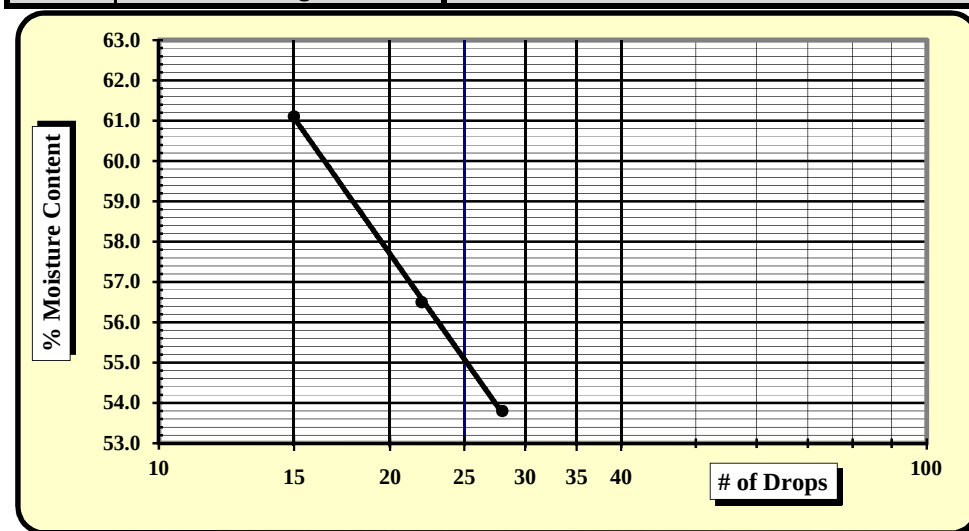
Offset: N/A

Depth (ft): 33.5' - 35.0'

Sample Description: Gray Sandy CLAY (CH)

Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	1024	11/4/2013	Grooving tool	S-1	5/20/2014
LL Apparatus	13288	8/10/2013			
Oven	1454	10/1/2013			

Pan #		Liquid Limit						Plastic Limit		
Tare #:		4	2	26				6	15	
A	Tare Weight	10.97	12.97	12.90				12.97	12.41	
B	Wet Soil Weight + A	23.49	25.82	24.74				20.87	23.95	
C	Dry Soil Weight + A	18.74	21.18	20.60				19.24	21.58	
D	Water Weight (B-C)	4.75	4.64	4.14				1.63	2.37	
E	Dry Soil Weight (C-A)	7.77	8.21	7.70				6.27	9.17	
F	% Moisture (D/E)*100	61.1%	56.5%	53.8%				26.0%	25.8%	
N	# OF DROPS	15	22	28				Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR									
Ave.	Average							25.9%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic ☐

Liquid Limit 55

Plastic Limit 26

Plastic Index 29

Group Symbol CH

Multipoint Method ☒One-point Method ☐Wet Preparation ☒Dry Preparation ☐Air Dried ☐

Estimate the % Retained on the #40 Sieve:

Notes / Deviations / References:

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Mal Krajan, ET

Technical Responsibility

Signature

Laboratory Manager

Position

Date

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Sieve Analysis of Soils

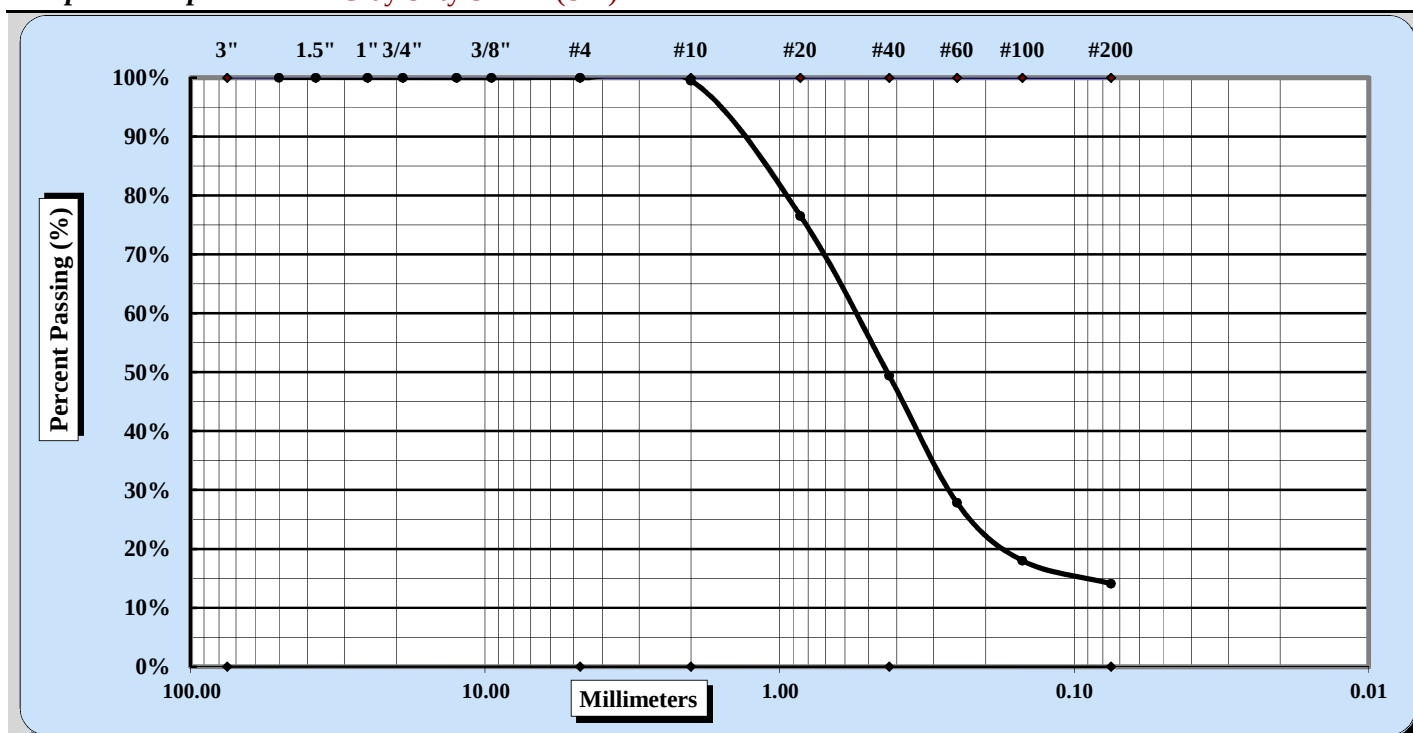


ASTM D 6913

Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #:	1358-14-033	Report Date:	07/17/2014
Project Name:	US 264 HDD Crossings	Test Date(s):	07/14 - 07/16/2014
Client Name:	RK&K		
Client Address:	2100 East Cary Street, Suite 209, Richmond, VA 23223		
Boring No.:	B-6	Sample #:	S-5
		Sample Date:	07/08/2014
Location:	Site-Borehole	Offset:	N/A
		Depth (ft):	13.5' - 15.0'

Sample Description: Gray Silty SAND (SM)

Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#4	Coarse Sand	0.5%	Fine Sand	35.3%
Gravel	0.0%	Medium Sand	50.1%	Silt & Clay	14.1%
Liquid Limit	ND	Plastic Limit	ND	Plastic Index	ND
Specific Gravity	ND			Moisture Content	29.3%

Coarse Sand	0.5%	Medium Sand	50.1%	Fine Sand	35.3%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ND=Not Determined.Mal Krajan, ET

Technical Responsibility

Laboratory Manager

Position

Date

Signature

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Sieve Analysis of Soils

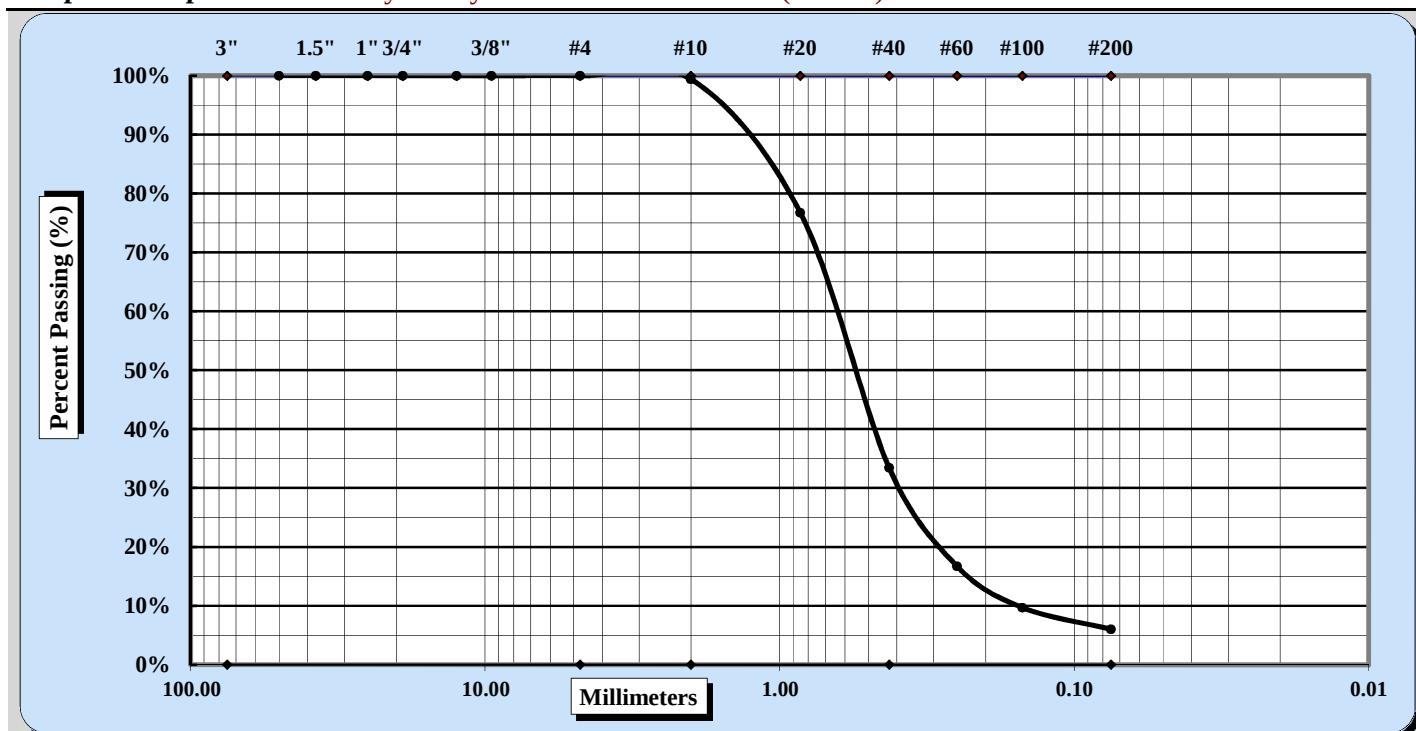


ASTM D 6913

Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #:	1358-14-033	Report Date:	07/17/2014
Project Name:	US 264 HDD Crossings	Test Date(s):	07/14 - 07/16/2014
Client Name:	RK&K		
Client Address:	2100 East Cary Street, Suite 209, Richmond, VA 23223		
Boring No.:	B-6	Sample #:	S-7
		Sample Date:	07/08/2014
Location:	Site-Borehole	Offset:	N/A
		Depth (ft):	23.5' - 25.0'
Sample Description: Gray Poorly Graded SAND with Silt (SP-SM)			



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#4	Coarse Sand	0.6%	Fine Sand	27.4%
Gravel	0.0%	Medium Sand	66.0%	Silt & Clay	6.0%
Liquid Limit	ND	Plastic Limit	ND	Plastic Index	ND
Specific Gravity	ND			Moisture Content	18.4%

Coarse Sand	0.6%	Medium Sand	66.0%	Fine Sand	27.4%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ND=Not Determined.

Mal Krajan, ET

Technical Responsibility

Signature

Laboratory Manager

Position

Date

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Liquid Limit, Plastic Limit, and Plastic Index



Test Methods:

ASTM D 4318



AASHTO T 89



AASHTO T 90



Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #: 1358-14-033

Report Date: 7/19/14

Project Name: US 264 HDD Crossings

Test Date(s) 7/14 - 7/17/14

Client Name: RK&K

Client Address: 2100 East Cary Street, Suite 209, Richmond, VA 23223

Boring #: B-6

Sample #: S-8

Sample Date: 07/08/2014

Location: Site Borehole

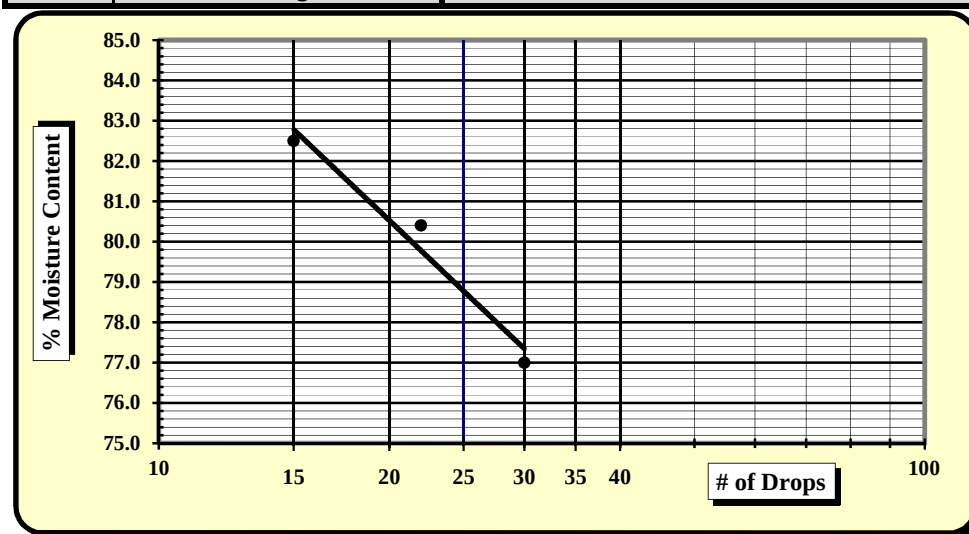
Offset: N/A

Depth (ft): 18.5 - 20 ft.

Sample Description: Gray Olive Sandy Fat CLAY (CH)

Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	1024	11/4/2013	Grooving tool	S-1	5/20/2014
LL Apparatus	13288	8/10/2013			
Oven	1454	10/1/2013			

Pan #		Liquid Limit						Plastic Limit		
Tare #:		17	23	7				29	27	
A	Tare Weight	12.88	13.06	12.92				13.07	13.01	
B	Wet Soil Weight + A	23.41	25.76	22.90				20.32	22.88	
C	Dry Soil Weight + A	18.65	20.10	18.56				18.44	20.32	
D	Water Weight (B-C)	4.76	5.66	4.34				1.88	2.56	
E	Dry Soil Weight (C-A)	5.77	7.04	5.64				5.37	7.31	
F	% Moisture (D/E)*100	82.5%	80.4%	77.0%				35.0%	35.0%	
N	# OF DROPS	15	22	30				Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR									
Ave.	Average							35.0%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic ☐

Liquid Limit 79

Plastic Limit 35

Plastic Index 44

Group Symbol CH

Multipoint Method ☒One-point Method ☐Wet Preparation ☒Dry Preparation ☐Air Dried ☐

Estimate the % Retained on the #40 Sieve: 0%

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Mal Krajan, ET

Technical Responsibility

Signature

Laboratory Manager

Position

Date

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Liquid Limit, Plastic Limit, and Plastic Index



Test Methods:

ASTM D 4318



AASHTO T 89



AASHTO T 90



Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #: 1358-14-033

Report Date: 7/19/14

Project Name: US 264 HDD Crossings

Test Date(s) 7/14 - 7/17/14

Client Name: RK&K

Client Address: 2100 East Cary Street, Suite 209, Richmond, VA 23223

Boring #: B-6

Sample #: S-10

Sample Date: 07/08/2014

Location: Site Borehole

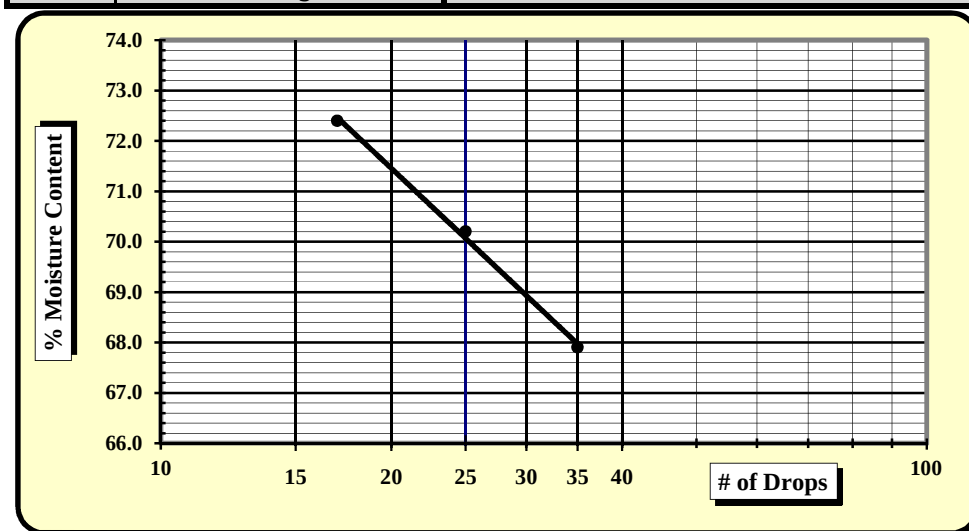
Offset: N/A

Depth (ft): 38.5 - 40 ft.

Sample Description: Gray Olive Sandy Fat CLAY (CH)

Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	1024	11/4/2013	Grooving tool	S-1	5/20/2014
LL Apparatus	13288	8/10/2013			
Oven	1454	10/1/2013			

Pan #		Liquid Limit						Plastic Limit		
Tare #:		810	3	5				24	4	
A	Tare Weight	16.63	15.30	10.99				13.06	13.04	
B	Wet Soil Weight + A	31.01	27.83	23.50				21.84	21.66	
C	Dry Soil Weight + A	24.97	22.66	18.44				19.87	19.73	
D	Water Weight (B-C)	6.04	5.17	5.06				1.97	1.93	
E	Dry Soil Weight (C-A)	8.34	7.36	7.45				6.81	6.69	
F	% Moisture (D/E)*100	72.4%	70.2%	67.9%				28.9%	28.8%	
N	# OF DROPS	17	25	35				Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR									
Ave.	Average							28.9%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic ☐

Liquid Limit 70

Plastic Limit 29

Plastic Index 41

Group Symbol CH

Multipoint Method ☒One-point Method ☐Wet Preparation ☒Dry Preparation ☐Air Dried ☐

Estimate the % Retained on the #40 Sieve: 0%

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Mal Krajan, ET

Technical Responsibility

Laboratory Manager

Position

Date

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Sieve Analysis of Soils

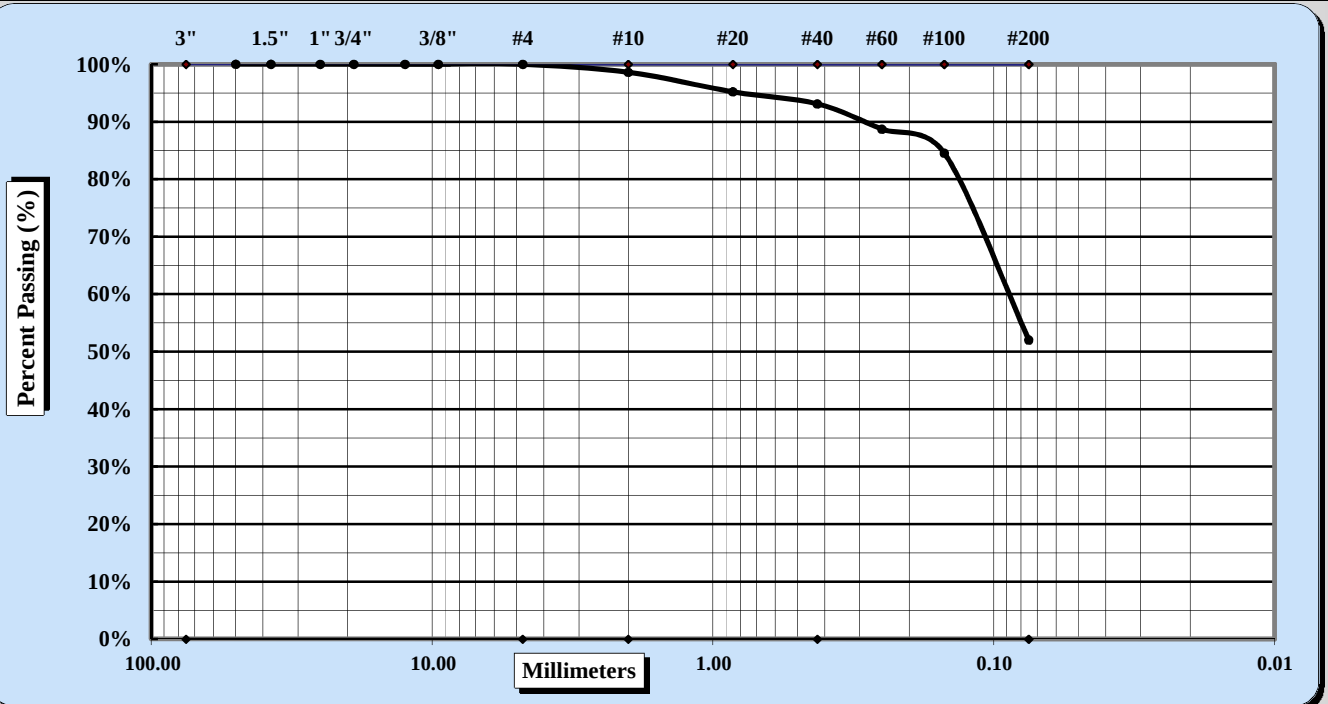


ASTM D 6913

Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #:	1358-14-033	Report Date:	07/19/2014
Project Name:	US 264 HDD Crossings	Test Date(s):	07/14 - 07/16/2014
Client Name:	RK&K		
Client Address:	2100 East Cary Street, Suite 209, Richmond, VA 23223		
Boring No.:	B-6	Sample:	S-11
		Sample Date:	07/08/2014
Location:	Site-Borehole	Offset:	N/A
		Depth (ft):	43.5' - 45.0'
Sample Description: Gray Black Elastic SILT with Sand (MH)			



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#4	Coarse Sand	1.4%	Fine Sand	41.1%
Gravel	0.0%	Medium Sand	5.5%	Silt & Clay	52.0%
Liquid Limit	64	Plastic Limit	39	Plastic Index	25
Specific Gravity	ND			Moisture Content	59.5%

Coarse Sand	1.4%	Medium Sand	5.5%	Fine Sand	41.1%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☐
Hard & Durable	☐	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Mal Krajan, ET

Technical Responsibility

Laboratory Manager

Position

Date

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Liquid Limit, Plastic Limit, and Plastic Index



Test Methods.

ASTM D 4318



AASHTO T 89



AASHTO T 90



Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #: 1358-14-033

Report Date: 07/19/2014

Project Name: US 264 HDD Crossings

Test Date(s) 07/14 - 07/16/2014

Client Name: RK&K

Client Address: 2100 East Cary Street, Suite 209, Richmond, VA 23223

Boring #: B-6

Sample #: S-11

Sample Date: 07/08/2014

Location: Site-Borehole

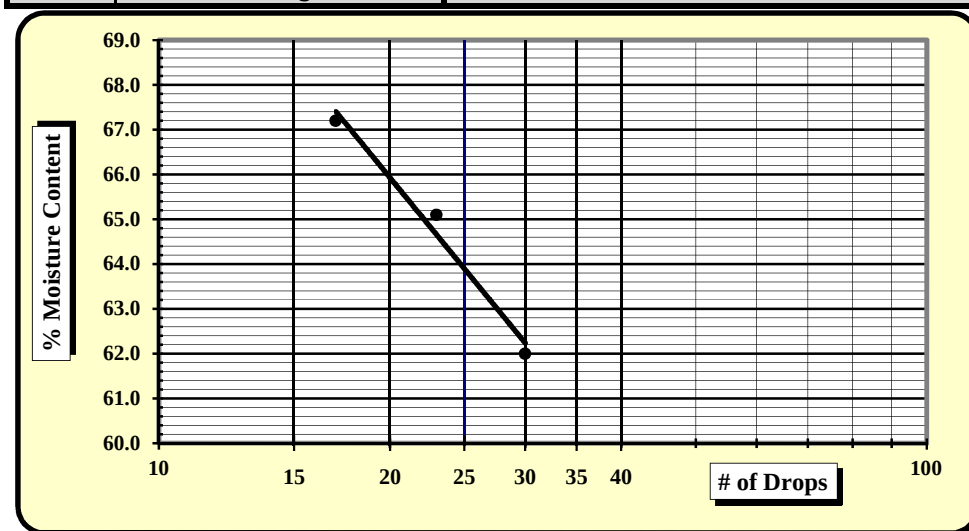
Offset: N/A

Depth (ft): 43.5' - 45.0'

Sample Description: Gray Black Elastic SILT with Sand (MH)

Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	1024	11/14/2013	Grooving tool	S-1	5/20/2014
LL Apparatus	1084	8/17/2013			
Oven	1454	10/1/2013			

Pan #	Tare #:	Liquid Limit					Plastic Limit		
		18	803	16			20	28	
A	Tare Weight	12.97	16.70	13.01			12.95	12.98	
B	Wet Soil Weight + A	25.36	29.08	24.90			22.27	21.06	
C	Dry Soil Weight + A	20.38	24.20	20.35			19.62	18.84	
D	Water Weight (B-C)	4.98	4.88	4.55			2.65	2.22	
E	Dry Soil Weight (C-A)	7.41	7.50	7.34			6.67	5.86	
F	% Moisture (D/E)*100	67.2%	65.1%	62.0%			39.7%	37.9%	
N	# OF DROPS	17	23	30			Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR								
Ave.	Average						38.8%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic ☐

Liquid Limit 64

Plastic Limit 39

Plastic Index 25

Group Symbol MH

Multipoint Method ☒One-point Method ☐Wet Preparation ☒Dry Preparation ☐Air Dried ☐

Estimate the % Retained on the #40 Sieve:

Notes / Deviations / References:

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Mal Krajan, ET

Technical Responsibility

Signature

Laboratory Manager

Position

Date

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Sieve Analysis of Soils

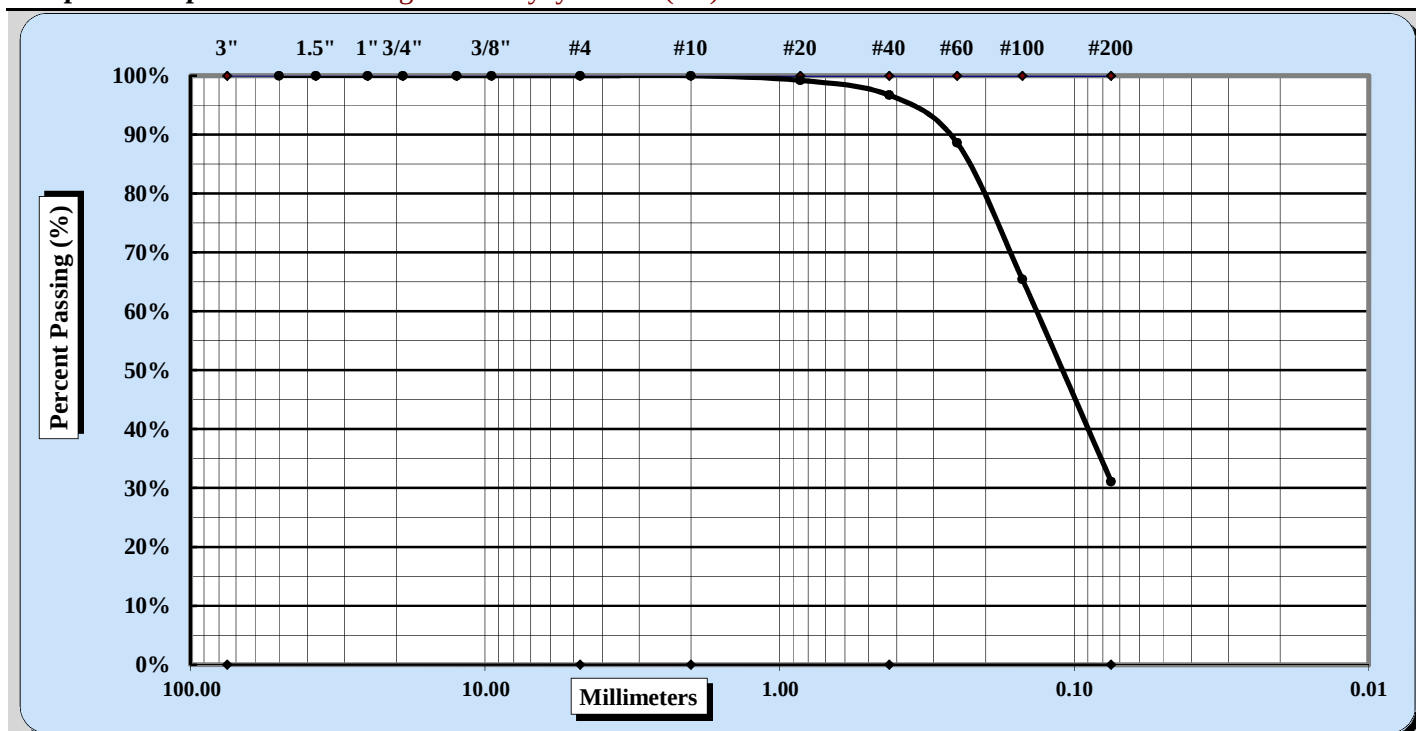


ASTM D 6913

Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #: 1358-14-033 **Report Date:** 07/17/2014
Project Name: US 264 HDD Crossings **Test Date(s):** 07/14 - 07/16/2014
Client Name: RK&K
Client Address: 2100 East Cary Street, Suite 209, Richmond, VA 23223
Boring No.: B-7 **Sample #:** S-4 **Sample Date:** 07/08/2014
Location: Site-Borehole **Offset:** N/A **Depth (ft):** 8.5' - 10.0'
Sample Description: Orange Tan Clayey SAND (SC)



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#4	Coarse Sand	0.0%	Fine Sand	65.6%
Gravel	0.0%	Medium Sand	3.3%	Silt & Clay	31.1%
Liquid Limit	ND	Plastic Limit	ND	Plastic Index	ND
Specific Gravity	ND			Moisture Content	17.9%

Coarse Sand	0.0%	Medium Sand	3.3%	Fine Sand	65.6%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ND=Not Determined.

Mal Krajan, ET

Technical Responsibility

Signature

Laboratory Manager

Position

Date

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Sieve Analysis of Soils

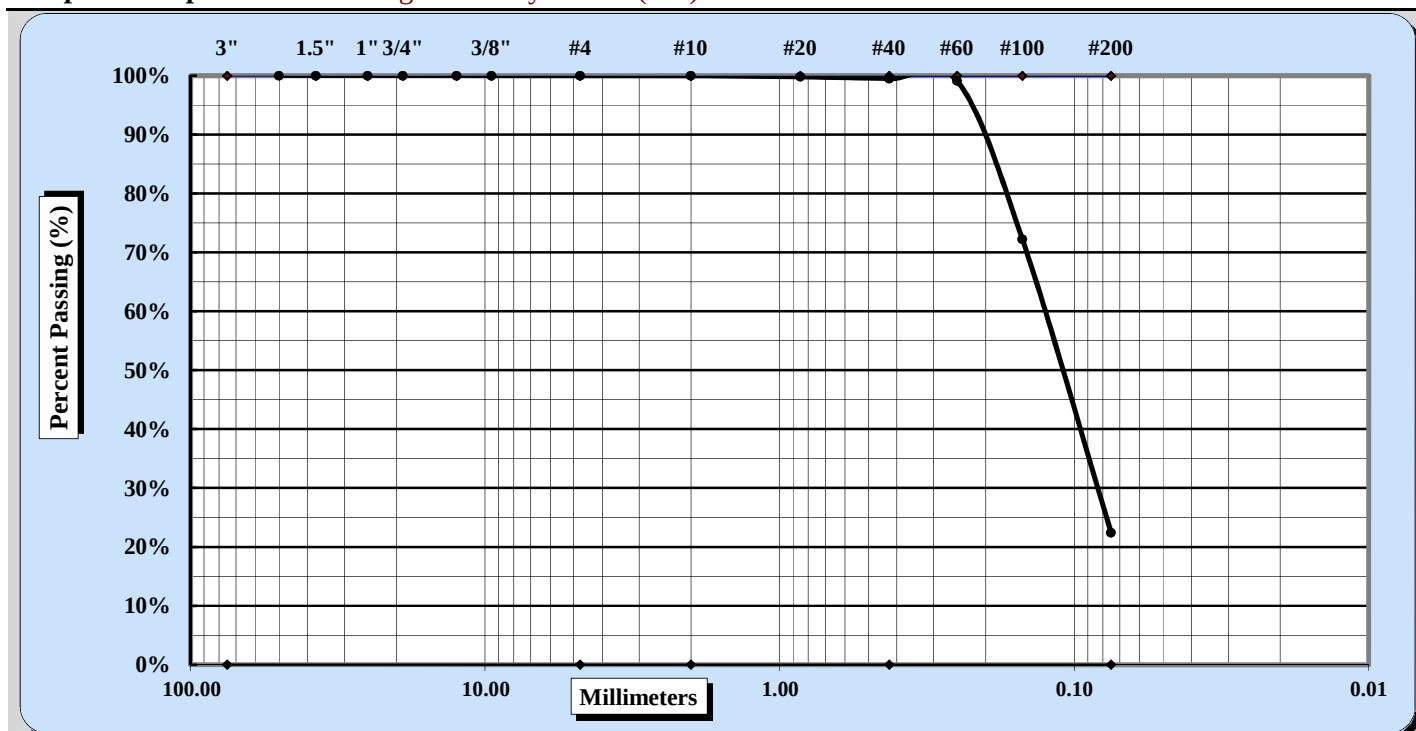


ASTM D 6913

Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #: 1358-14-033 **Report Date:** 07/17/2014
Project Name: US 264 HDD Crossings **Test Date(s):** 07/14 - 07/16/2014
Client Name: RK&K
Client Address: 2100 East Cary Street, Suite 209, Richmond, VA 23223
Boring No.: B-7 **Sample #:** S-6 **Sample Date:** 07/08/2014
Location: Site-Borehole **Offset:** N/A **Depth (ft):** 18.5' - 20.0'
Sample Description: Orange Tan Silty SAND (SM)



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#4	Coarse Sand	0.0%	Fine Sand	77.1%
Gravel	0.0%	Medium Sand	0.5%	Silt & Clay	22.4%
Liquid Limit	ND	Plastic Limit	ND	Plastic Index	ND
Specific Gravity	ND			Moisture Content	36.5%

Coarse Sand	0.0%	Medium Sand	0.5%	Fine Sand	77.1%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ND=Not Determined.

Mal Krajan, ET

Technical Responsibility

Signature

Laboratory Manager

Position

Date

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Sieve Analysis of Soils

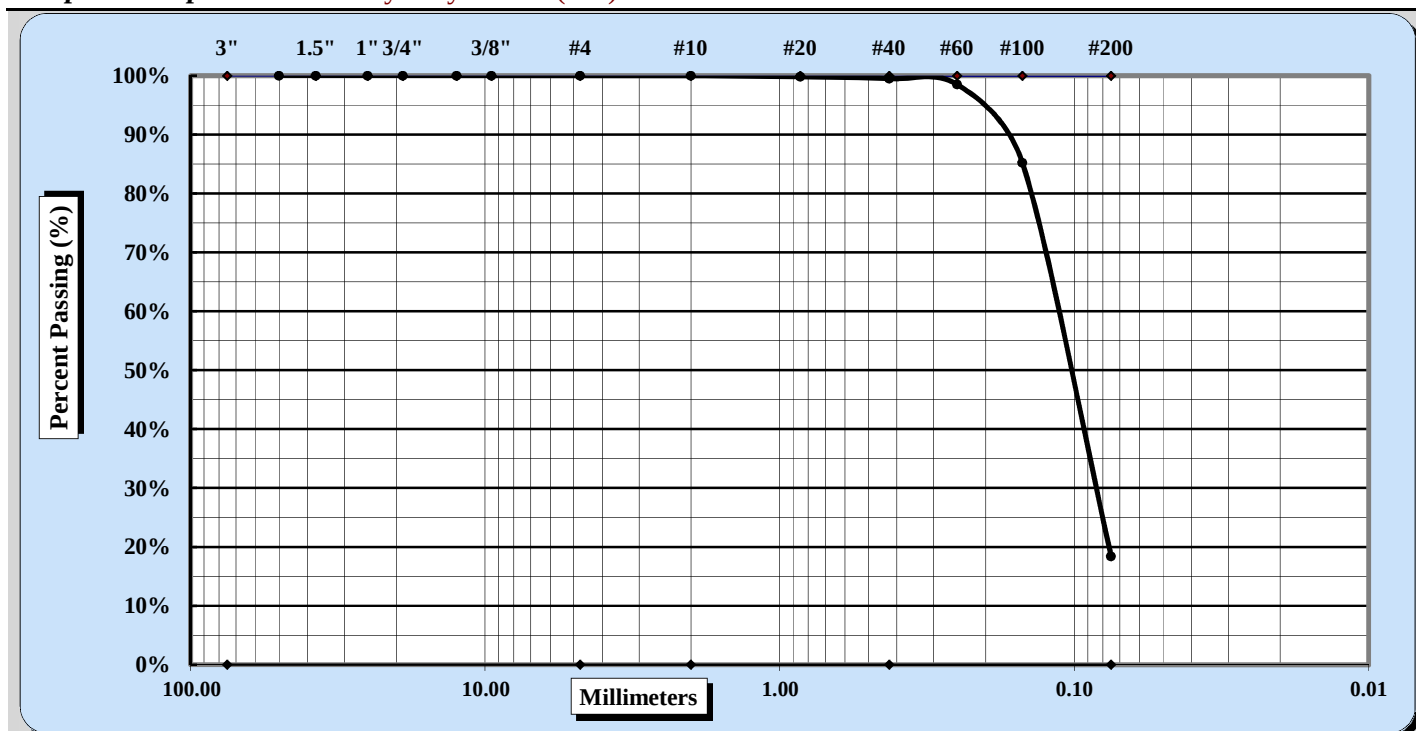


ASTM D 6913

Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #: 1358-14-033 **Report Date:** 07/17/2014
Project Name: US 264 HDD Crossings **Test Date(s):** 07/14 - 07/16/2014
Client Name: RK&K
Client Address: 2100 East Cary Street, Suite 209, Richmond, VA 23223
Boring No.: B-7 **Sample #:** S-8 **Sample Date:** 07/08/2014
Location: Site-Borehole **Offset:** N/A **Depth (ft):** 28.5' - 30.0'
Sample Description: Gray Silty SAND (SM)



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#4	Coarse Sand	0.0%	Fine Sand	81.1%
Gravel	0.0%	Medium Sand	0.5%	Silt & Clay	18.4%
Liquid Limit	ND	Plastic Limit	ND	Plastic Index	ND
Specific Gravity	ND			Moisture Content	33.4%

Coarse Sand	0.0%	Medium Sand	0.5%	Fine Sand	81.1%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ND=Not Determined.

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Laboratory Manager

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Sieve Analysis of Soils

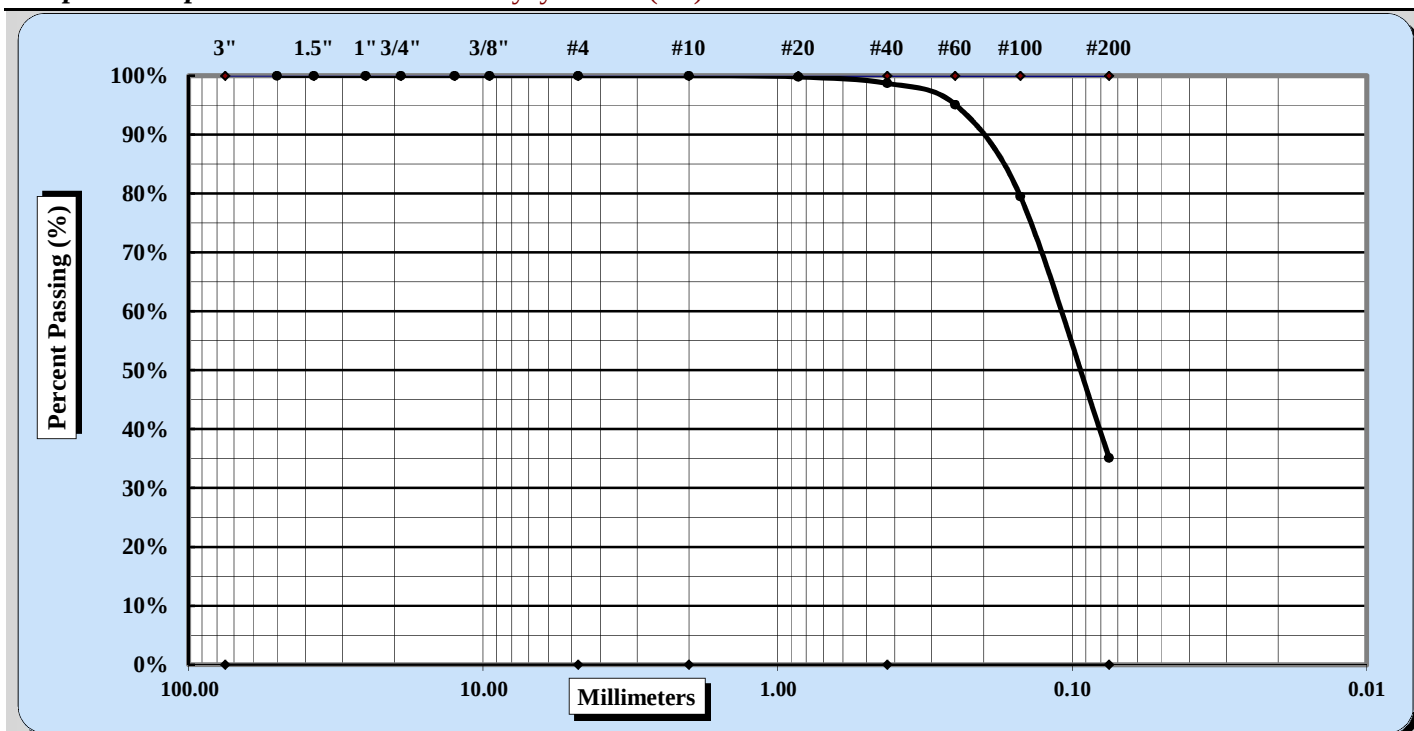


ASTM D 6913

Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #: 1358-14-033 **Report Date:** 07/17/2014
Project Name: US 264 HDD Crossings **Test Date(s):** 07/14 - 07/16/2014
Client Name: RK&K
Client Address: 2100 East Cary Street, Suite 209, Richmond, VA 23223
Boring No.: B-8 **Sample #:** S-4 **Sample Date:** 07/08/2014
Location: Site-Borehole **Offset:** N/A **Depth (ft):** 8.5' - 10.0'
Sample Description: White Tan Clayey SAND (SC)



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#10	Coarse Sand	0.0%	Fine Sand	63.6%
Gravel	0.0%	Medium Sand	1.3%	Silt & Clay	35.1%
Liquid Limit	ND	Plastic Limit	ND	Plastic Index	ND
Specific Gravity	ND			Moisture Content	32.9%

Coarse Sand	0.0%	Medium Sand	1.3%	Fine Sand	63.6%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ND=Not Determined.

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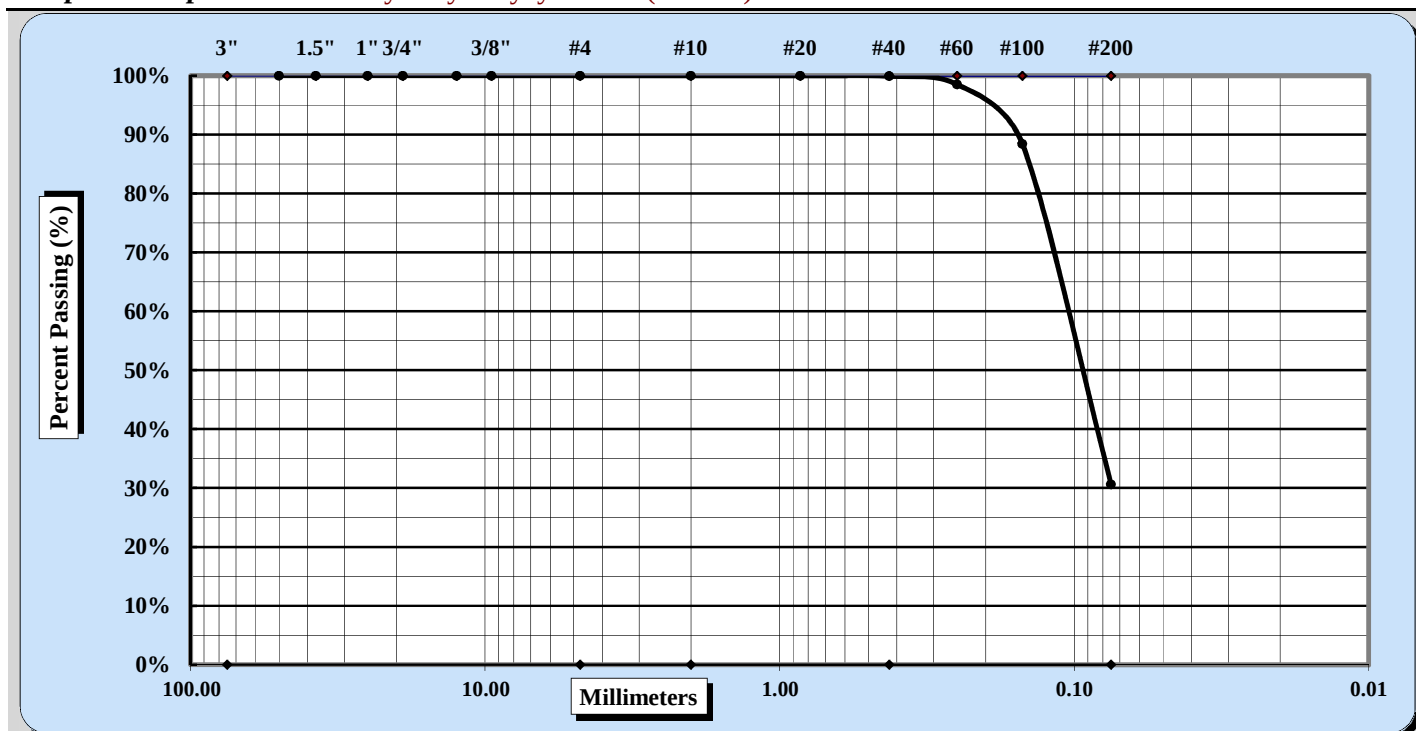


ASTM D 6913

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S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #: 1358-14-033 **Report Date:** 07/17/2014
Project Name: US 264 HDD Crossings **Test Date(s):** 07/14 - 07/16/2014
Client Name: RK&K
Client Address: 2100 East Cary Street, Suite 209, Richmond, VA 23223
Boring No.: B-8 **Sample #:** S-7 **Sample Date:** 07/08/2014
Location: Site-Borehole **Offset:** N/A **Depth (ft):** 23.5' - 25.0'
Sample Description: Gray Silty Clayey SAND (SC-SM)



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#10	Coarse Sand	0.0%	Fine Sand	69.3%
Gravel	0.0%	Medium Sand	0.1%	Silt & Clay	30.6%
Liquid Limit	ND	Plastic Limit	ND	Plastic Index	ND
Specific Gravity	ND			Moisture Content	37.5%

Coarse Sand	0.0%	Medium Sand	0.1%	Fine Sand	69.3%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ND=Not Determined.

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Sieve Analysis of Soils

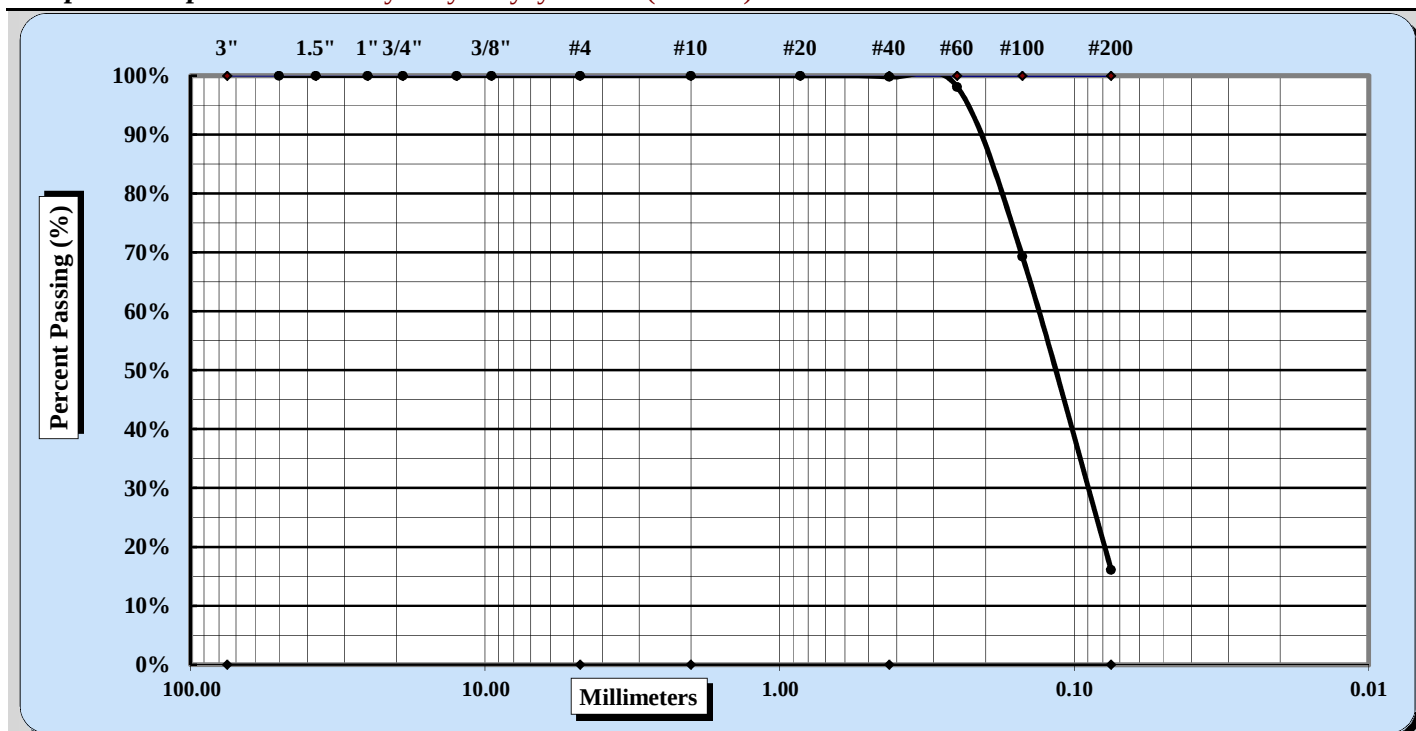


ASTM D 6913

Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #: 1358-14-033 **Report Date:** 07/17/2014
Project Name: US 264 HDD Crossings **Test Date(s):** 07/14 - 07/16/2014
Client Name: RK&K
Client Address: 2100 East Cary Street, Suite 209, Richmond, VA 23223
Boring No.: B-8 **Sample #:** S-9 **Sample Date:** 07/08/2014
Location: Site-Borehole **Offset:** N/A **Depth (ft):** 33.5' - 35.0
Sample Description: Gray Silty Clayey SAND (SC-SM)



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#10	Coarse Sand	0.0%	Fine Sand	83.7%
Gravel	0.0%	Medium Sand	0.2%	Silt & Clay	16.1%
Liquid Limit	ND	Plastic Limit	ND	Plastic Index	ND
Specific Gravity	ND			Moisture Content	32.1%

Coarse Sand	0.0%	Medium Sand	0.2%	Fine Sand	83.7%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

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