

RETAINING WALL FOUNDATION INVESTIGATION REPORT
SR 316 Over Colonial Pipeline
(Revised December 10, 2012)
GDOT Project No. MSL00-0004-00(086)
PI No. 0004086
Gwinnett County, Georgia

WILLMER ENGINEERING INC.
Project No. 71.3852

Prepared for

Atkins North America, Inc.
Atlanta, Georgia

Prepared By

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3772 Pleasantdale Road
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Original Issue Date: October 26, 2012
(Revised December 10, 2012)

VIA E-MAIL/HAND DELIVERY

Michael R. Moseley Jr., PE
Project Manager, Transportation Design
Atkins North America, Inc.
1600 RiverEdge Parkway, NW Suite 600
Atlanta, Georgia 30328-4612

**SUBJECT: Retaining Wall Foundation Investigation Report
SR 316 Over Colonial Pipeline**
GDOT Project No. MSL00-0004-00(086); PI No. 0004086
Gwinnett County, Georgia
Willmer Project No. 71.3852

Dear Mr. Moseley:

Willmer Engineering Inc. (Willmer) is pleased to provide this Retaining Wall Foundation Investigation (WFI) report for the proposed widening of SR 316 over Colonial Pipeline bridge in Gwinnett County, Georgia. The WFI was performed in general accordance with our Subcontract for Professional Services dated September 17, 2012 and Georgia Department of Transportation (GDOT) guidance documents for bridge foundation investigation. This report was revised to address GDOT review comments dated November 20, 2012.

The attached summary presents the site and subsurface conditions along the proposed alignments and our geotechnical recommendations related to retaining wall foundation design and construction.

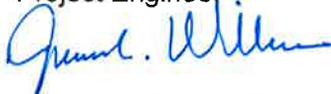
We appreciate the opportunity to be of service to you on this project and look forward to a continuing relationship. Please contact us if you have any questions concerning this report or require further assistance.

Sincerely,

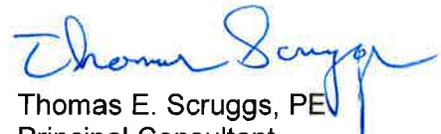
WILLMER ENGINEERING INC.



Paul Li, PhD, EIT
Project Engineer



James L. Willmer, PE
Executive Vice President/Principal Consultant



Thomas E. Scruggs, PE
Principal Consultant

The original of this document was signed and sealed by James L. Willmer, PE, Registration No. 10780 on December 10, 2012

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A CERTIFIED DOCUMENT**

PL/TES/JLW: bw

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Geotechnical Engineering ♦ Environmental Services and Engineering ♦ Construction Services

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Attachments: **Retaining Wall Foundation Investigation**

Figures

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Figure 3B	Boring Location Plan – Wall 2
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Figure 4B	Generalized Subsurface Profile – Wall 2
Figure 4C	Generalized Subsurface Profile – Wall 3
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Appendix I

Boring Record Legend
Unified Soil Classification System Reference Sheet
Boring Records

Appendix II

Laboratory Test Results

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Site Photographs

Retaining Wall Foundation Investigation	
Willmer Project Number	71.3852
GDOT Project Number	MSL00-0004-00(086)
Project P.I. Number	0004086
Location	State Route 316 (SR 316) over Colonial Pipeline in Gwinnett County, Georgia (see Figure 1)
Project Description	<p>Four retaining walls (Wall Nos. 1 through 4) are planned for the proposed SR 316 improvement in Gwinnett County, Georgia. Locations of the proposed retaining walls are shown in Figure 2. A brief description of each of the walls is provided in the following paragraphs.</p> <p><u>Wall No. 1:</u> Wall No. 1 is an MSE wall that extends from Station 1243+00 to 1249+46.12 (Wall Station 10+00 to 16+80.19) along the north side of the proposed SR 316 (see Figure 2 and Figure 3A). The total length of the wall is about 680 feet, the maximum height of the wall is about 50 feet, and the bottom elevation of the wall ranges from about 990 to 1,010 feet. This wall will retain the roadway embankment fill along the north side of the proposed SR 316 and northwest abutment of SR 316 bridge over Colonial Pipeline.</p> <p><u>Wall No. 2:</u> Wall No. 2 extends from Station 1243+25.00 to 1250+35.86 (Wall Station 20+00.00 to 28+71.71) along the median of the proposed SR 316 (see Figure 2 and Figure 3B). The total length of the wall is about 872 feet, the maximum height of the wall is about 30 feet, and the bottom elevation of the wall ranges from about 1,012 to 1,030 feet. This wall will retain the roadway embankment fill along the median of the proposed SR 316 and southwest abutment of SR 316 bridge over Colonial Pipeline. This wall will be constructed as a combination of cantilever wall and MSE wall.</p> <p><u>Wall No. 3:</u> Wall No. 3 is an MSE wall that extends from Station 1251+50.00 to 1251+30.68 (Wall Station 30+00 to 31+74.53) along the northeast abutment of SR 316 (see Figure 2 and Figure 3C). The total length of the wall is about 175 feet, the maximum height of the wall is about 30 feet, and the bottom elevation of the wall ranges from about 1,012.5 to 1,025 feet. This wall will be in partially cut and partially fill and retain the northeast abutment of SR 316 bridge over Colonial Pipeline.</p>
(continued)	

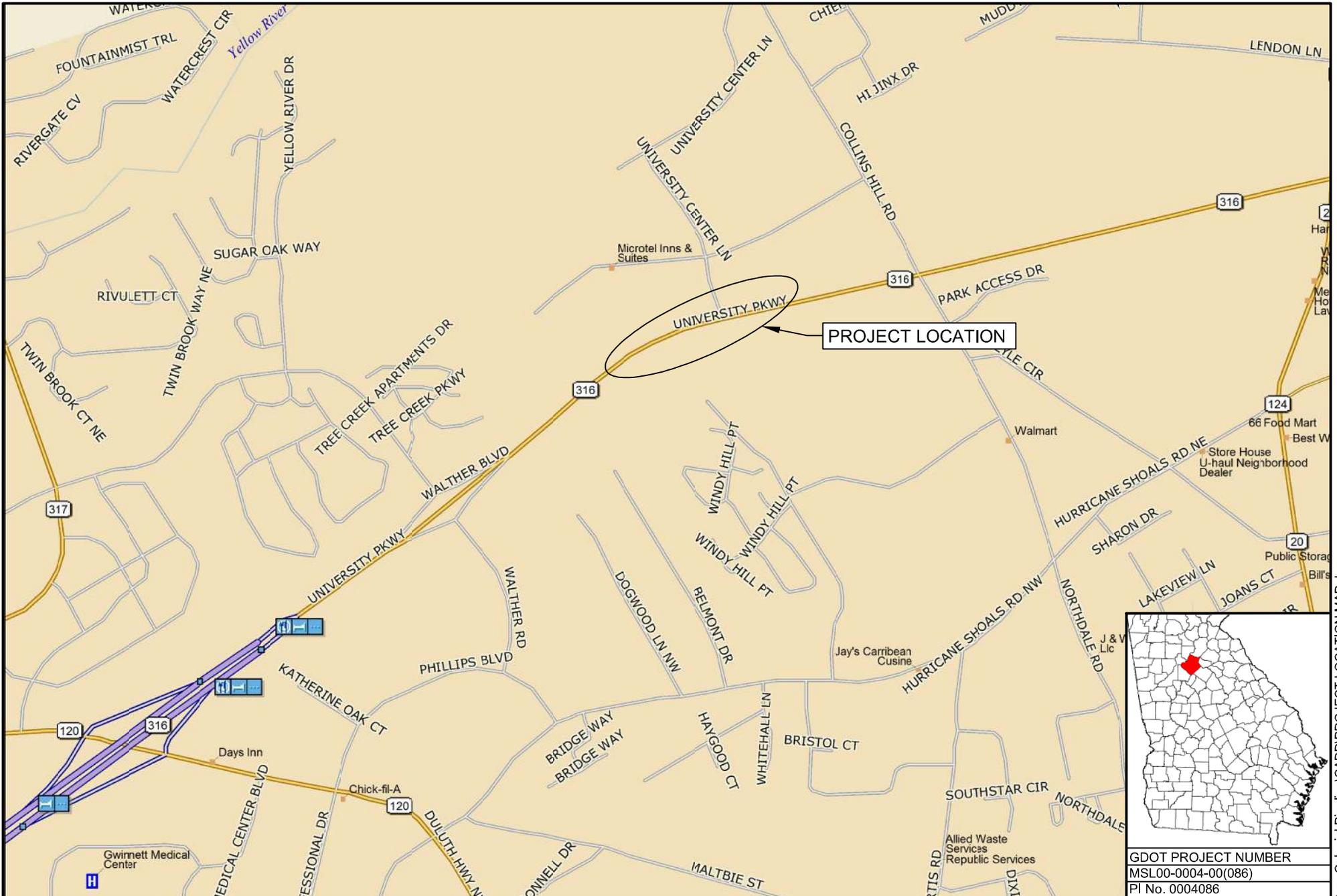
<p>Project Description (continued)</p>	<p><u>Wall No. 4:</u> Wall No. 4 extends from Station 1261+50.00 to 1252+50.00 (Wall Station 40+00.00 to 52+05.43) along the median of the proposed SR 316 (see Figure 2 and Figure 3D). The total length of the wall is about 1,205 feet, the maximum height of the wall is about 34 feet, and the bottom elevation of the wall ranges from about 1,012.3 to 1,052.0 feet. This wall will retain the roadway embankment fill along the median of the proposed SR 316 and southeast abutment of SR 316 bridge over Colonial Pipeline. This wall will be constructed as a combination of cantilever wall and MSE wall.</p>
<p>Geologic Formation</p>	<p>The project alignment is geologically sited within the Mica Schist and Amphibolite Formations of the Piedmont Physiographic Province of Georgia.</p>
<p>Subsurface Features</p>	<p><u>Wall No. 1:</u> The subsurface profile along Wall No. 1 (see boring logs W-1, W-3, W-5, B-1, and Figure 4A) is primarily comprised of fill and residual soils (where encountered). The fill soils consist of loose to dense silty sand and/or firm to stiff sandy elastic silt. The residual soils consist of very dense silty sand or stiff sandy elastic silt. Partially Weathered Rock (PWR) was encountered at elevation of 980 feet at boring W-5. Auger refusal was encountered at elevations ranging from 999 to 1,005 feet at borings W-1, W-3, and B-1. Groundwater was encountered at the elevation of 990 feet at boring W-5 at the time of our field investigation.</p> <p><u>Wall No. 2:</u> The subsurface profile along Wall No. 2 (see boring logs W-2, W-4, W-6, B-3, B-4, B-6, and Figure 4B) is comprised of fill, alluvial and residual soils (where encountered). The fill consists of loose to very dense silty/clayey sand. The alluvial soils consist of firm to stiff sandy elastic silt. The residual soils consist of medium dense silty sand. PWR was encountered at elevations ranging from 997 to 1,005 feet at borings W-6, B-3, and B-6. Auger refusal was encountered at elevations ranging from 996 to 1,004 feet. Groundwater was encountered at elevations of 999 and 1,003 feet at borings B-3 and B-4 at 24 hours after boring completion.</p>
<p>(continued)</p>	

<p>Subsurface Features (continued)</p>	<p><u>Wall No. 3:</u> The subsurface profile along Wall No. 3 (see boring logs B-2, B-5, and Figure 4C) is comprised of fill and residual soils (where encountered) underlain by PWR and parent bedrock. The fill consists of loose to medium dense silty/clayey sand and/or stiff sandy elastic silt. The residual soils consist of medium dense silty sand. PWR was encountered at elevations ranging from 998 to 1010 feet. Auger refusal was encountered at elevations ranging from 994 to 1005 feet. Groundwater was encountered at elevation of 1005 feet at boring B-5 at 24 hours after boring completion.</p> <p><u>Wall No. 4:</u> The subsurface profile along Wall No. 4 (see boring logs W-7 through W-11, B-7, B-5 and Figure 4D) is comprised primarily of fill and residual soils underlain by PWR and parent bedrock. The fill soils consist of loose to medium dense silty sand and/or soft to stiff sandy elastic silt. The residual soils consist of very loose to dense silty sand. PWR was encountered at elevations ranging from 992 to 1,041 feet. Auger refusal was encountered at elevations ranging from 990 to 1,040 feet at borings B-5, B-7, and W-10. Groundwater was encountered at elevation of 1,005 feet at boring B-5 at 24 hours after boring completion.</p>
<p>Retaining Wall Soil Parameters</p>	<p>The following soil parameters are recommended for use in design of the proposed MSE and cantilever retaining walls:</p> <p style="text-align: center;"> Soil Unit Weight γ = 125 pcf Cohesion c = 0 psf Angle of Internal Friction ϕ = 30 degrees Coefficient of Sliding Friction μ = 0.45 </p>

Retaining Wall Recommendations	<p>We recommend the following maximum allowable bearing pressures for use in design of the walls:</p> <p><u>Wall 1:</u></p> <p>Station 1243+00 to 1246+00± (Wall Station 10+00 to 13+00±): 3,000 psf</p> <p>Station 1246+00± to 1248+50± (Wall Station 13+00± to 15+50±): 2,000 psf. A 5-foot undercut and replacement with MSE wall backfill material should be set up from Wall Station 13+00± to 15+50± due to the soft/loose soils near the footing elevation. In addition to the waiting period noted below, we recommend that the coping from Wall Station 13+00± to 15+50± not be placed until an additional 30-day waiting period has passed to allow for settlement of underlying loose soil layers.</p> <p>Station 1248+50± to 1249+46.12 (Wall Station 15+50± to 16+80.19): 6,000 psf. Hard rock will likely be encountered at elevation 999± feet, and this should be confirmed on construction. If hard rock is encountered at elevation 999± feet, we recommend that the bottom of wall be founded on the top of rock.</p> <p><u>Wall 2:</u> 2,000 psf</p> <p><u>Wall 3:</u> 3,000 psf</p> <p><u>Wall 4:</u></p> <p>Station 1261+50 to 1251+50± (Wall Station 40+00 to 51+00±): 2,000 psf</p> <p>Station 1251+50± to 1252+50 (Wall Station 51+00± to 52+05): 1,500 psf. A 3-foot undercut and replacement with MSE wall backfill material should be set up from Wall Station 51+00± to 52+05 due to a soft sandy silt layer and high groundwater near the footing elevation.</p> <p>For all MSE walls, if the design bearing pressure exceeds the corresponding recommended maximum allowable bearing pressure, the walls should be constructed in two stages to minimize differential settlement of the walls. In the first stage, the wall should be constructed to half of its final height. A minimum 30-day waiting period should be allowed after the first stage before beginning of the second stage of construction. After the waiting period, the MSE wall should be constructed to the final height.</p>
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Prepared By	Paul Li, PhD, EIT/ Thomas E. Scruggs, PE
Senior Review By	James L. Willmer, PE

FIGURES



SCALE: 1" = 1000'

DATE: 10/24/2012

DRAWN BY: ZMH

REVIEWED BY: BD

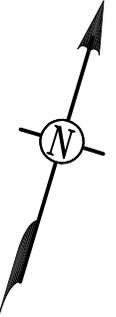
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FIGURE 1
 PROJECT LOCATION MAP
 RETAINING WALL FOUNDATION INVESTIGATION
 SR 316 OVER COLONIAL PIPELINE
 GWINNETT COUNTY, GEORGIA
 WILLMER PROJECT No.71.3852

GDOT PROJECT NUMBER MSL00-0004-00(086) PI No. 0004086

P:\13852 SR 316 Over Colonial Pipeline\CADD\PROJECT LOCATION MAP.dwg



COLLINS
IND. LANE

BEGIN WALL NO.1
STA. 1243+00.00, 73.46' LT
WALL STA. 10+00.00

END WALL NO.1
STA. 1249+46.12, 35.85' LT
WALL STA. 16+80.19

BEGIN WALL NO.3
STA. 1251+50.00, 105.59' LT
WALL STA. 30+00.00

END WALL NO.3
STA. 1251+30.68
WALL STA. 31+74.53

BEGIN WALL NO.2
STA. 1243+25.00
WALL STA. 20+00.00

END WALL NO.2
STA. 1250+35.86, 115.50' RT
WALL STA. 28+71.71

END WALL NO.4
STA. 1252+50.00, 115.50' RT
WALL STA. 52+05.43

BEGIN WALL NO.4
STA. 1261+50.00,
WALL STA. 40+00.00

1245+00

SR 316 WESTBOUND

1250+00

SR 316 EASTBOUND

1255+00

SR 316 WESTBOUND

1260+00

SR 316 EASTBOUND

GDOT PROJECT NUMBER
MSL00-0004-00(086)
PI No. 0004086

SCALE: 1" =200'

DATE: 10/23/2012

DRAWN BY: ZMH

REVIEWED BY: PL

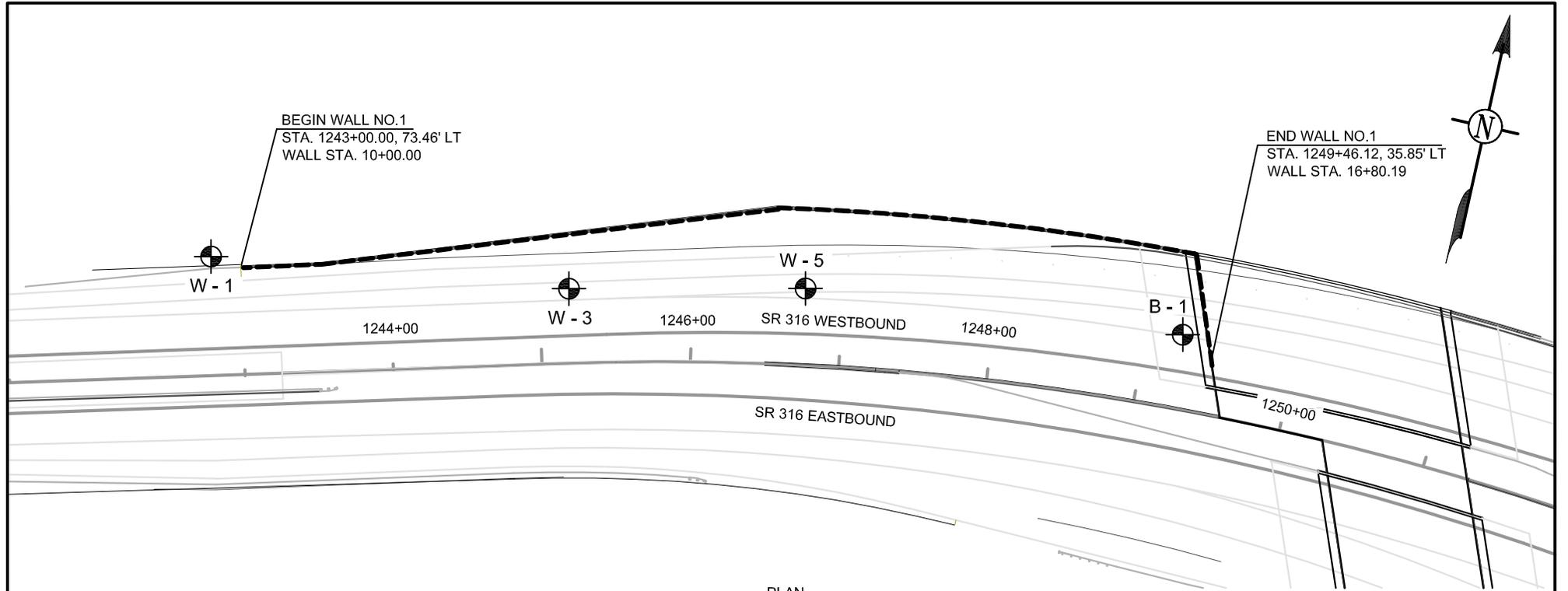
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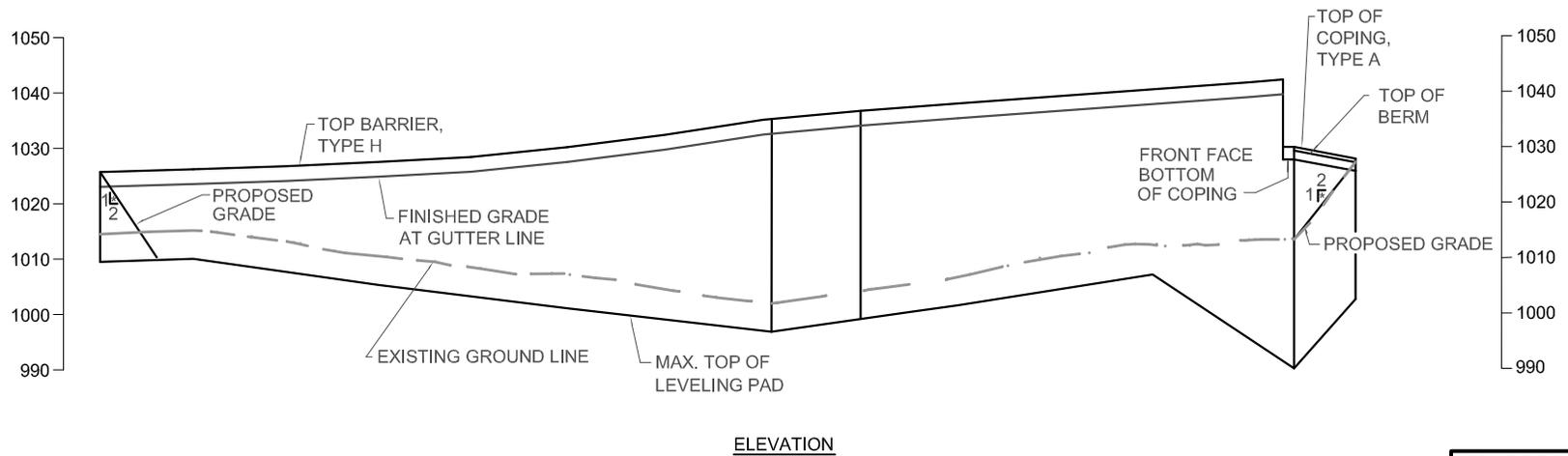
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FIGURE 2
 PROJECT ALIGNMENT PLAN
 WALL FOUNDATION INVESTIGATION
 SR 316 OVER COLONIAL PIPELINE
 GWINNETT COUNTY, GEORGIA
 WILLMER PROJECT No. 71.3852

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PLAN



GDOT PROJECT NUMBER
MSL00-0004-00(086)
PI No. 0004086

SCALE: 1" = 100'

DATE: 10/24/2012

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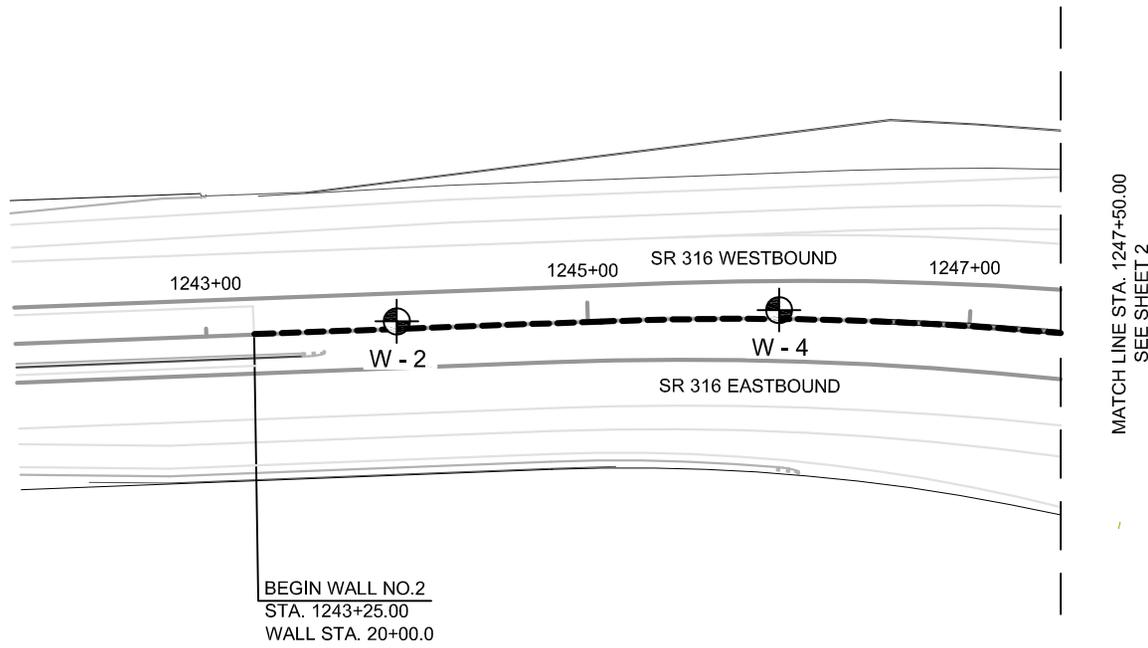
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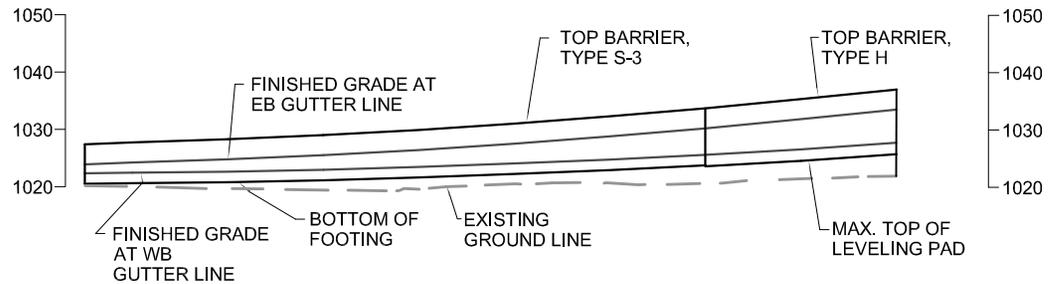
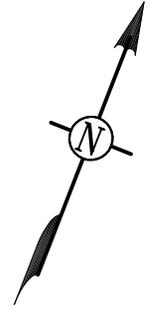


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FIGURE 3A
BORING LOCATION PLAN - WALL 1
WALL FOUNDATION INVESTIGATION
SR 316 OVER COLONIAL PIPELINE
GWINNETT COUNTY, GEORGIA
WILLMER PROJECT No. 71.3852



PLAN



ELEVATION

GDOT PROJECT NUMBER
MSL00-0004-00(086)
PI No. 0004086

SCALE: 1" = 100'

DATE: 10/23/2012

DRAWN BY: ZMH

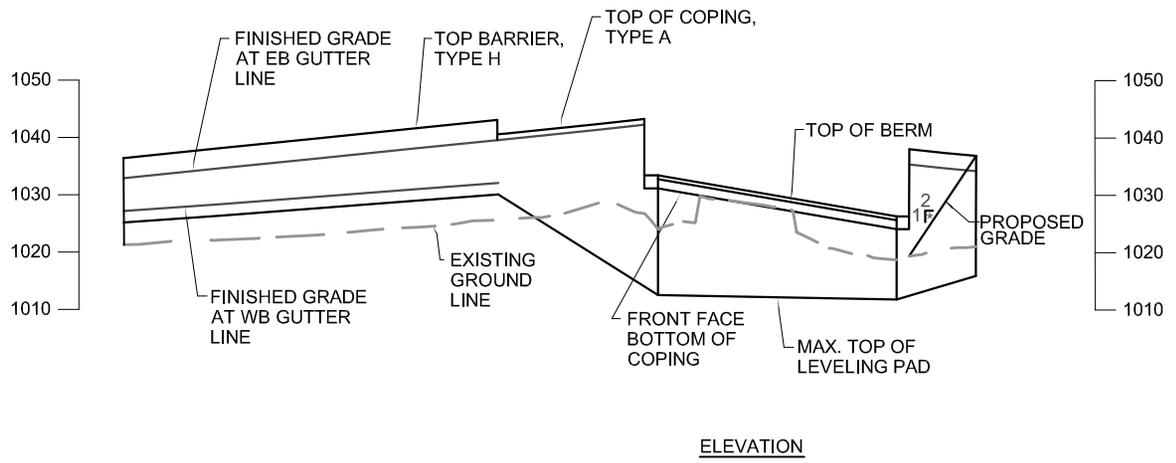
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FIGURE 3B (SHEET 1 OF 2)
BORING LOCATION PLAN - WALL 2
WALL FOUNDATION INVESTIGATION
SR 316 OVER COLONIAL PIPELINE
GWINNETT COUNTY, GEORGIA
WILLMER PROJECT No. 71.3852



GDOT PROJECT NUMBER
MSL00-0004-00(086)
PI No. 0004086

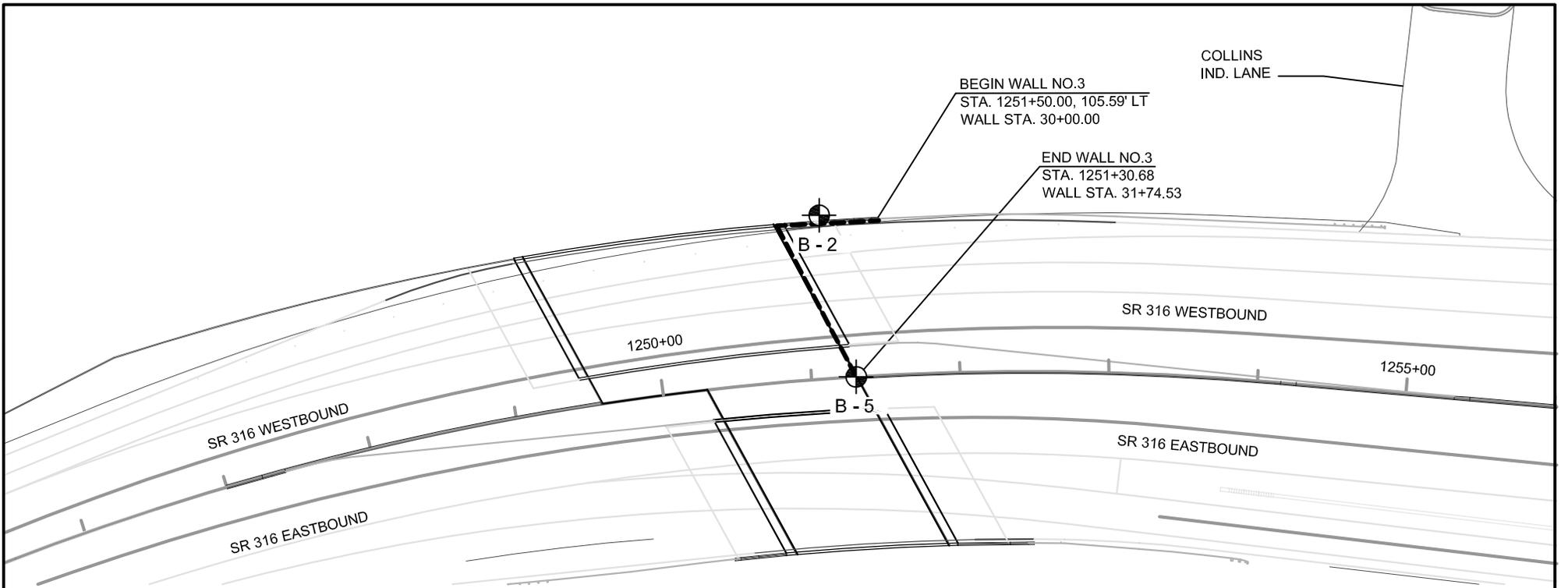
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WILLMER ENGINEERING INC.

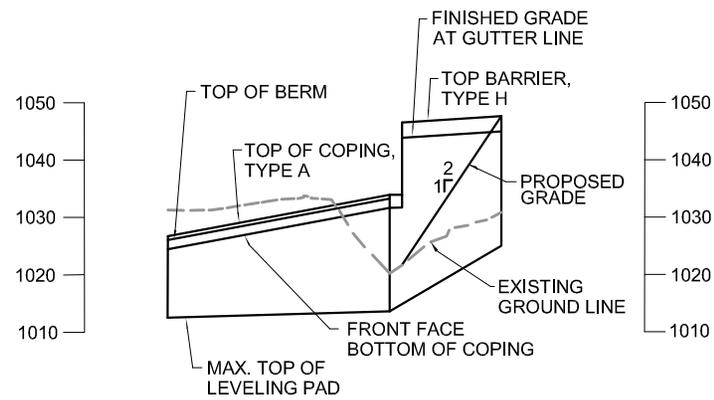


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FIGURE 3B (SHEET 2 OF 2)
BORING LOCATION PLAN - WALL 2
WALL FOUNDATION INVESTIGATION
SR 316 OVER COLONIAL PIPELINE
GWINNETT COUNTY, GEORGIA
WILLMER PROJECT No. 71.3852



PLAN



ELEVATION

GDOT PROJECT NUMBER
MSL00-0004-00(086)
PI No. 0004086

SCALE: 1" = 100'

DATE: 10/24/2012

DRAWN BY: ZMH

REVIEWED BY: PL

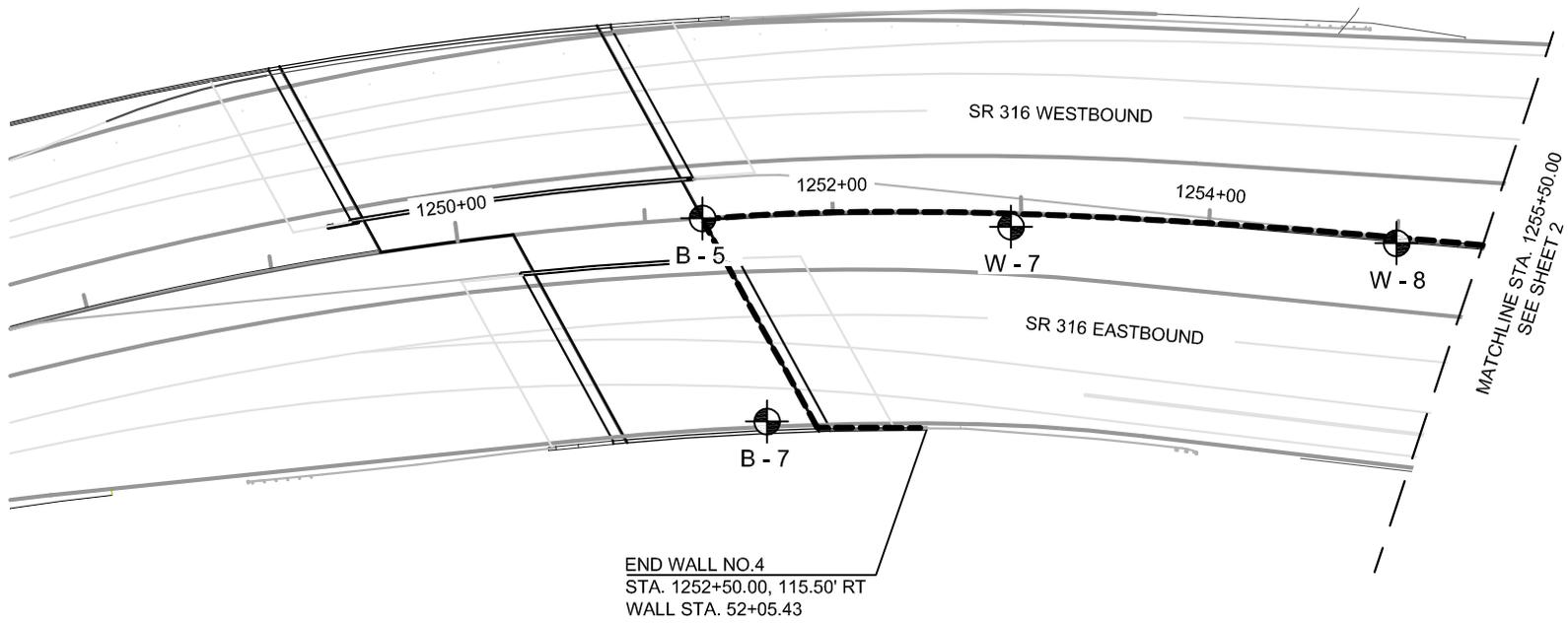
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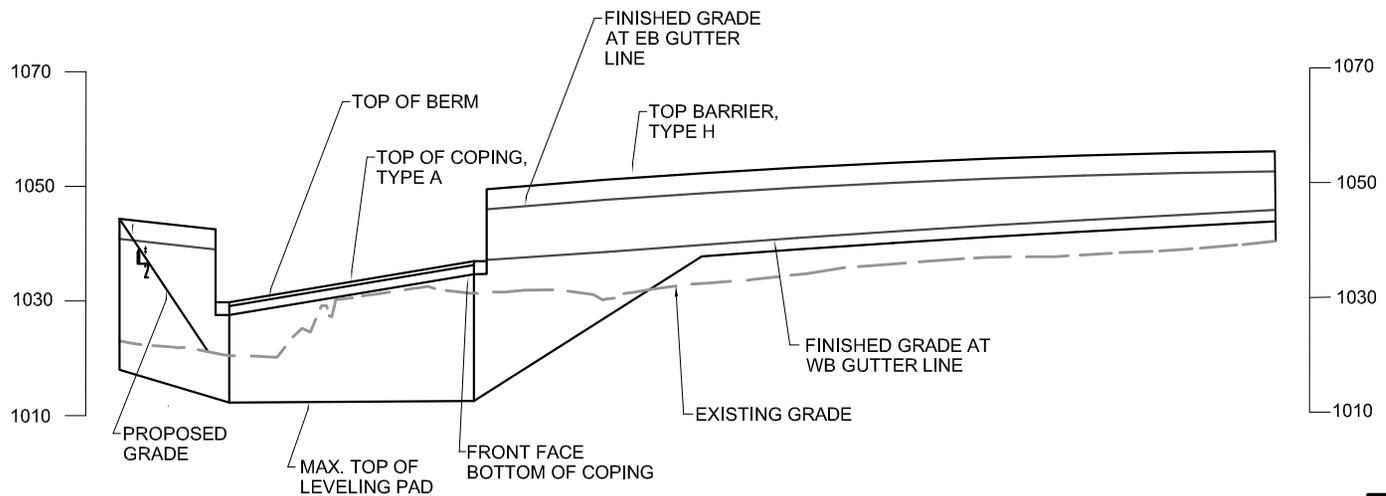
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FIGURE 3C
BORING LOCATION PLAN - WALL 3
WALL FOUNDATION INVESTIGATION
SR 316 OVER COLONIAL PIPELINE
GWINNETT COUNTY, GEORGIA
WILLMER PROJECT No. 71.3852

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PLAN



ELEVATION

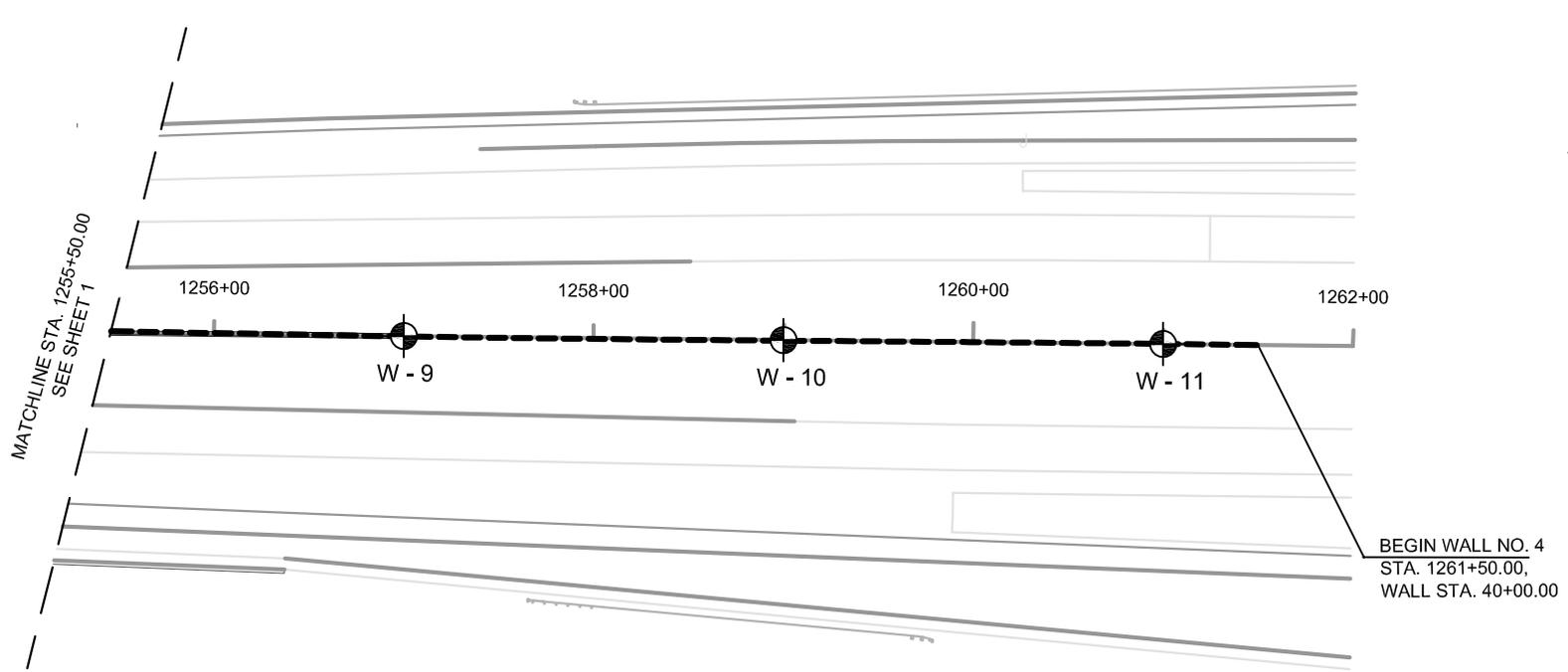
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SCALE: 1" = 100'
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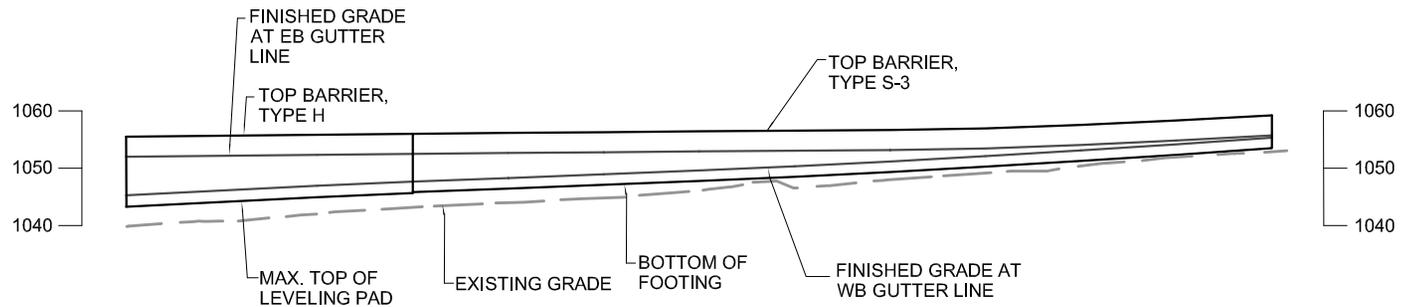
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FIGURE 3D (SHEET 1 OF 2)
 BORING LOCATION PLAN - WALL 4
 WALL FOUNDATION INVESTIGATION
 SR 316 OVER COLONIAL PIPELINE
 GWINNETT COUNTY, GEORGIA
 WILLMER PROJECT No. 71.3852



PLAN



ELEVATION

GDOT PROJECT NUMBER
MSL00-0004-00(086)
PI No. 0004086

SCALE: 1" = 100'

DATE: 10/23/2012

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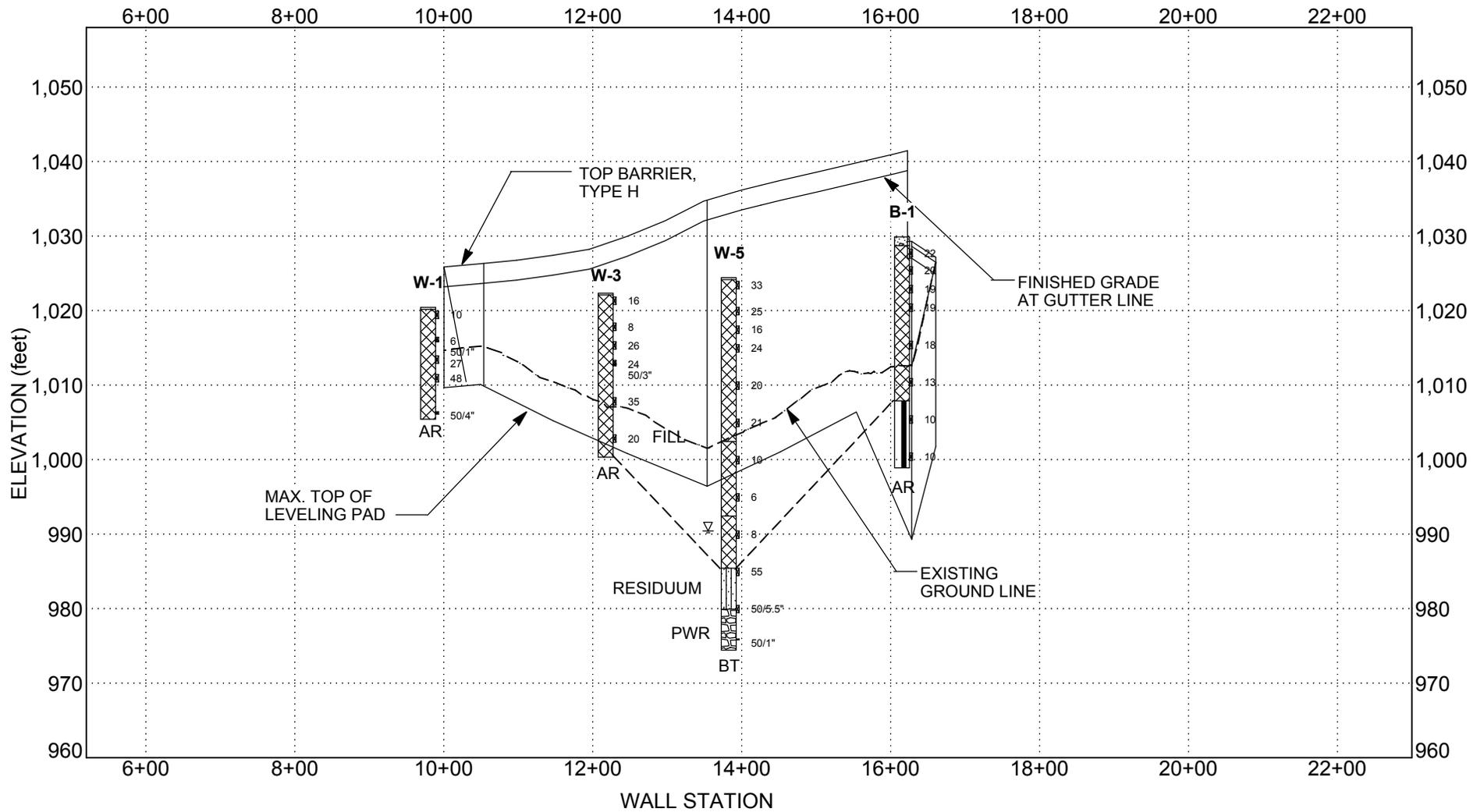
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FIGURE 3D (SHEET 2 OF 2)
 WALL FOUNDATION INVESTIGATION
 SR 316 OVER COLONIAL PIPELINE
 GWINNETT COUNTY, GEORGIA
 WILLMER PROJECT No. 71.3852



LEGEND:
 ∇ - Groundwater Table @ Time of Boring
 BT - Boring Terminated
 AR - Auger Refusal
 PWR - Partially Weathered Rock

GDOT PROJECT NUMBER MSL00-0004-00(086) PI No. 0004086

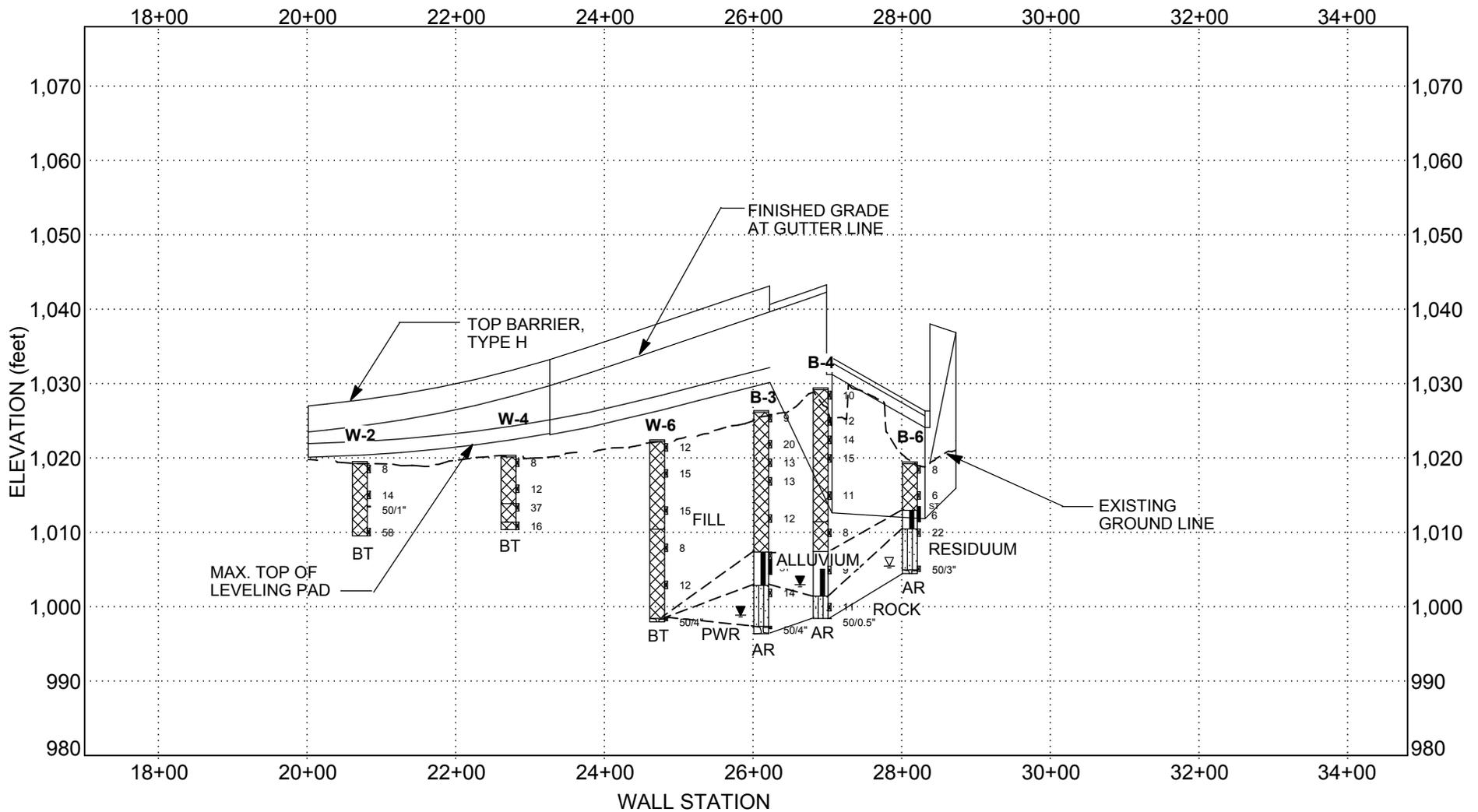
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 1" = 200' (H)
 DATE: 10/05/2012
 DRAWN BY: PL
 REVIEWED BY: TES

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FIGURE 4A
 GENERALIZED SUBSURFACE PROFILE - WALL 1
 WALL FOUNDATION INVESTIGATION
 SR 316 OVER COLONIAL PIPELINE
 GWINNETT COUNTY, GEORGIA
 WILLMER PROJECT No. 71.3852



LEGEND:

- ▽ - Groundwater Table @ Time of Boring
- ▼ - Groundwater Table @ 24 hours
- ST - Shelby Tube
- BT - Boring Terminated
- AR - Auger Refusal
- PWR - Partially Weathered Rock

GDOT PROJECT NUMBER MSL00-0004-00(086) PI No. 0004086

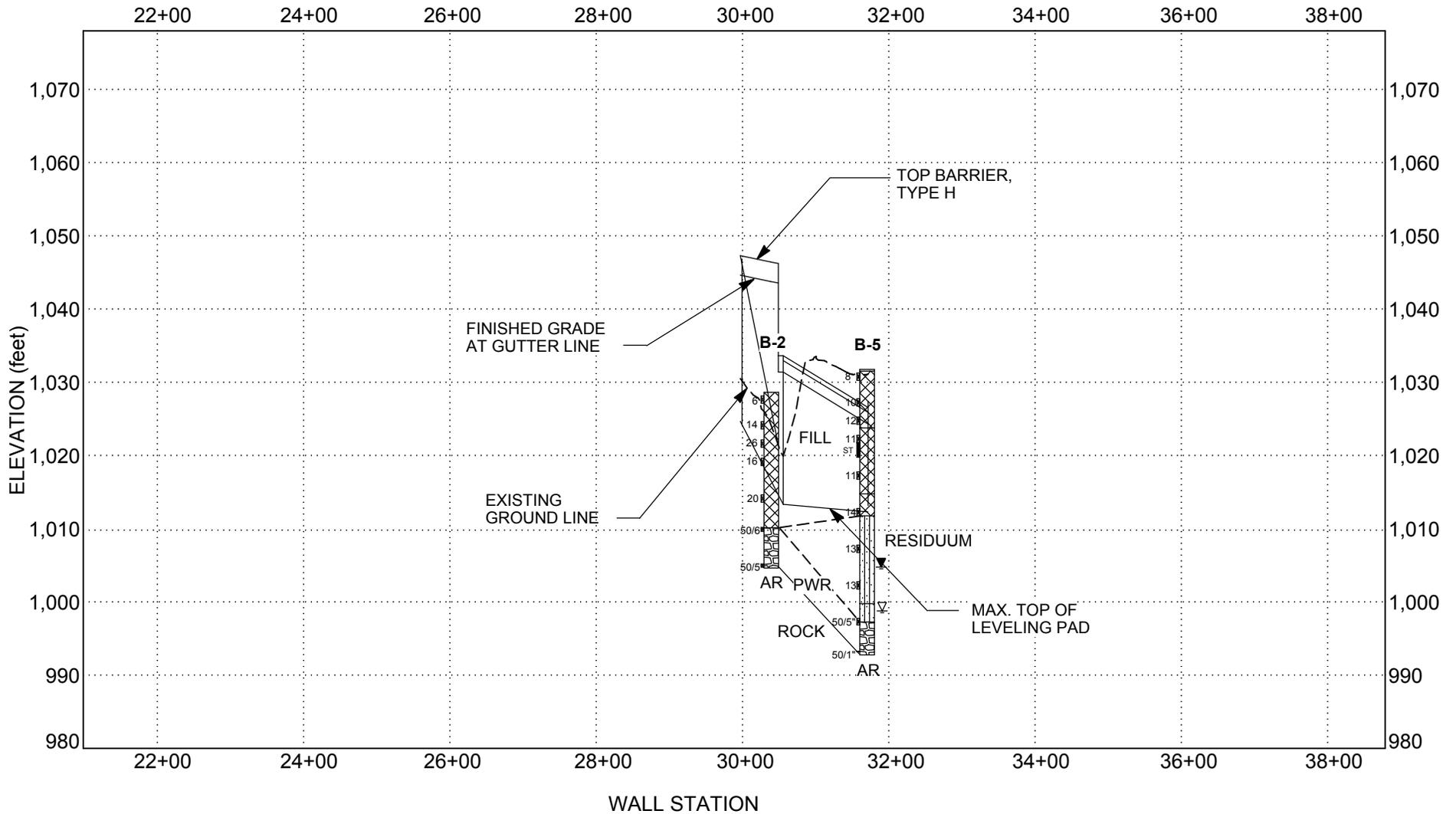
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 1" = 200' (H)
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FIGURE 4B
 GENERALIZED SUBSURFACE PROFILE - WALL 2
 WALL FOUNDATION INVESTIGATION
 SR 316 OVER COLONIAL PIPELINE
 GWINNETT COUNTY, GEORGIA
 WILLMER PROJECT No. 71.3852



LEGEND:

- ▽ - Groundwater Table @ Time of Boring
- ▼ - Groundwater Table @ 24 hours
- ST - Shelby Tube
- AR - Auger Refusal
- PWR - Partially Weathered Rock

GDOT PROJECT NUMBER
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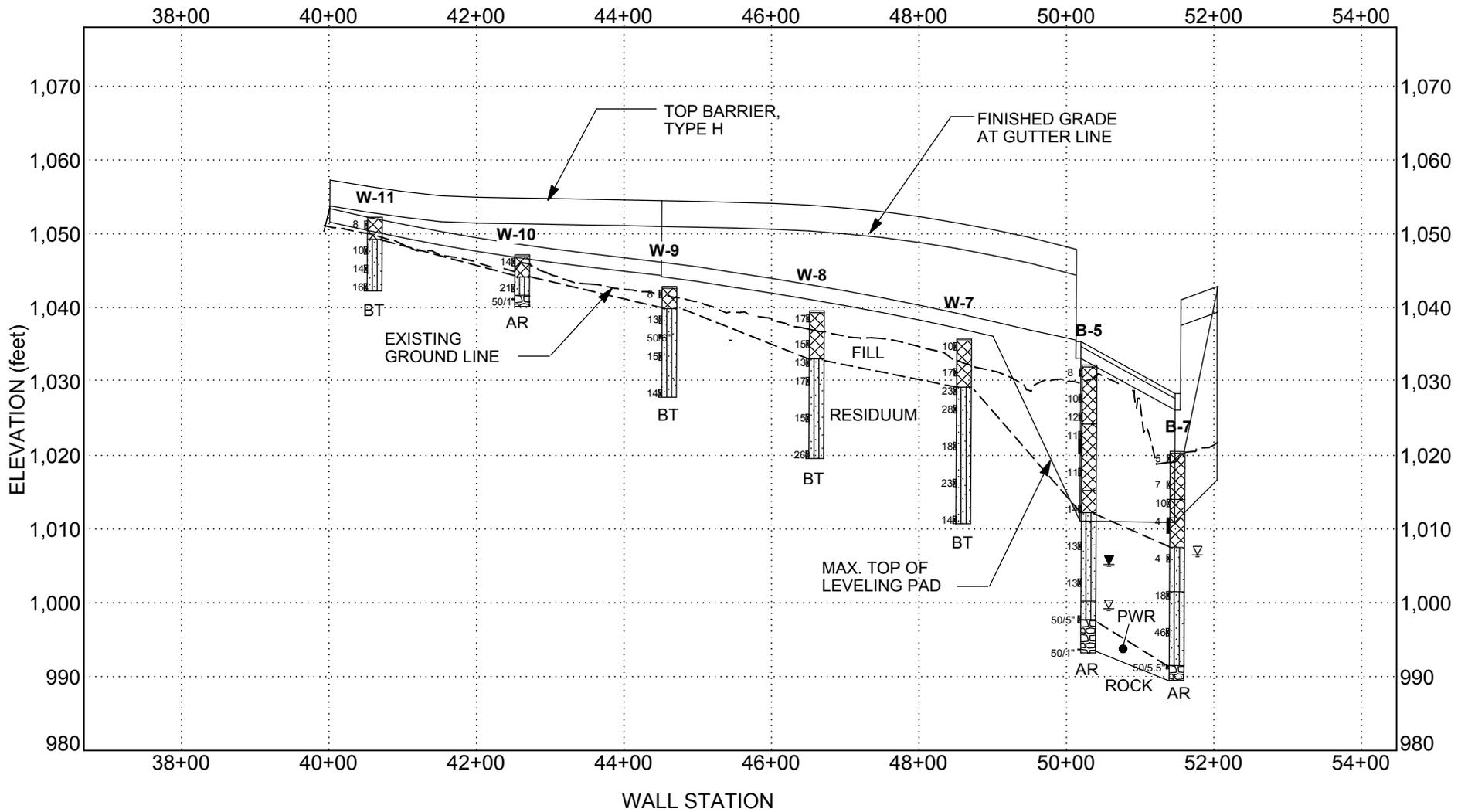
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FIGURE 4C
 GENERALIZED SUBSURFACE PROFILE - WALL 3
 WALL FOUNDATION INVESTIGATION
 SR 316 OVER COLONIAL PIPELINE
 GWINNETT COUNTY, GEORGIA
 WILLMER PROJECT No. 71.3852



LEGEND:

- ▽ - Groundwater Table @ Time of Boring
- ▼ - Groundwater Table @ 24 hours
- ST - Shelby Tube
- BT - Boring Terminated
- AR - Auger Refusal
- PWR - Partially Weathered Rock

GDOT PROJECT NUMBER MSL00-0004-00(086) PI No. 0004086

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FIGURE 4D
 GENERALIZED SUBSURFACE PROFILE - WALL 4
 WALL FOUNDATION INVESTIGATION
 SR 316 OVER COLONIAL PIPELINE
 GWINNETT COUNTY, GEORGIA
 WILLMER PROJECT No. 71.3852

APPENDIX I

BORING RECORD LEGEND

SM, CL, etc: - GROUP SYMBOL based on Unified Soil Classification System.
(Refer to ASTM D-2488 and Table 1 of D-2487)

N-VALUE: BLOWS PER FOOT- Standard Penetration Resistance (SPT) blow count ,
the sum of the second and third 6-inch increments of the SPT test.
(Refer to ASTM D-1586)

CONSISTENCY / RELATIVE DENSITY Correlated with SPT Blow Count, N:

<u>SILTS AND CLAYS</u>		<u>SANDS</u>	
<u>N</u> (blows per foot)	<u>Consistency</u>	<u>N</u> (blows per foot)	<u>Relative Density</u>
0 - 2	Very Soft	0 - 4	Very Loose
3 - 4	Soft	5 - 10	Loose
5 - 8	Firm	11 - 30	Medium Dense
9 - 15	Stiff	31 - 50	Dense
16 - 30	Very Stiff	> 50	Very Dense
31 - 50	Hard		
> 50	Very Hard		

NOTES:

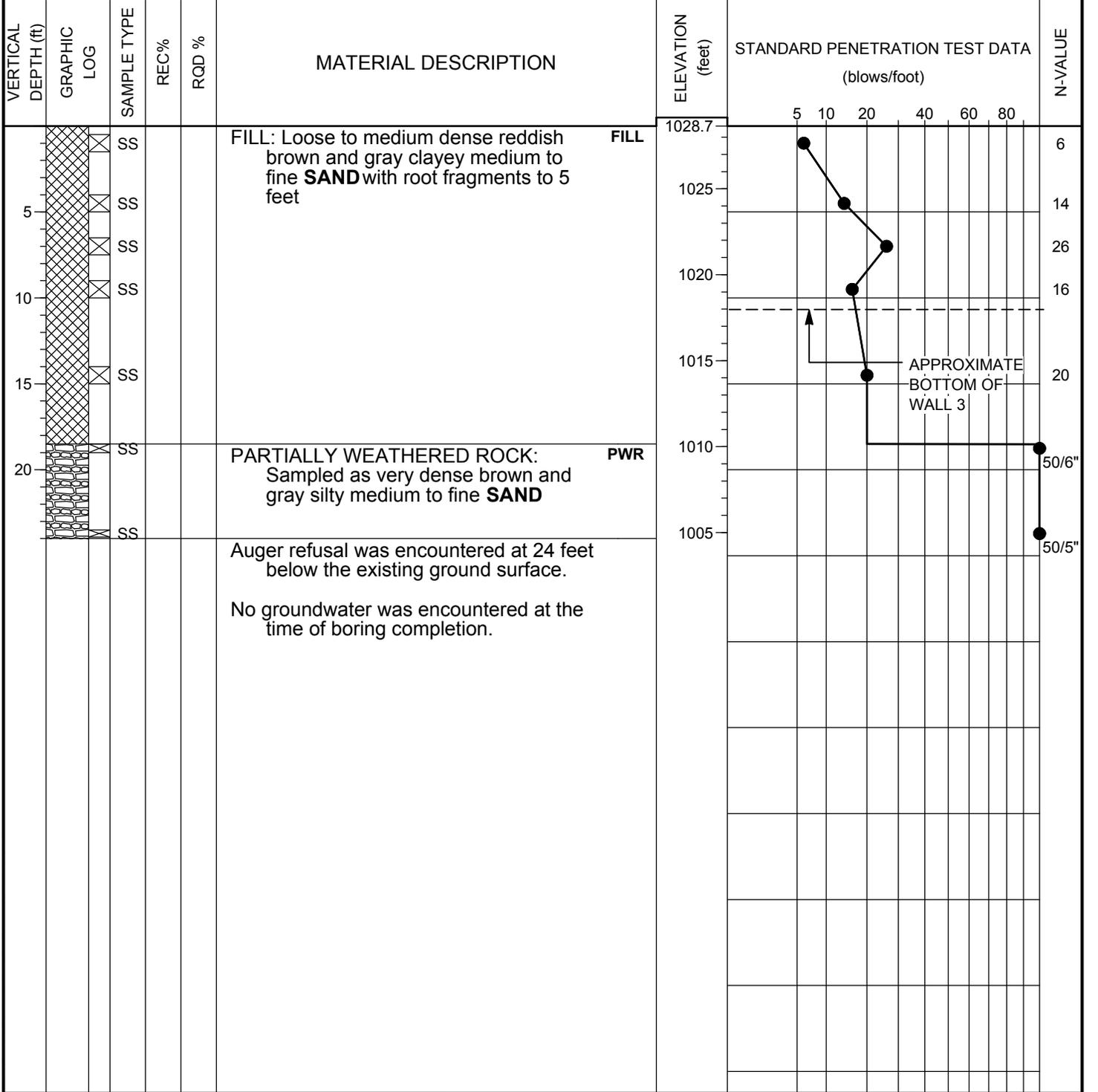
- Groundwater Measurements:
- Water level at 24 hours
 - Water level at time of boring
 - Caved level at 24 hours

ASPHALT 	CONCRETE 	TOPSOIL 	FILL 	GW 	GP 	GM
GC 	SW 	SP 	SM 	SC 	SANDY SILT 	SANDY CLAY
ML 	MH 	CL-ML 	CL 	CH 	OL 	OH
PEAT 	PWR 	ROCK 	LIMESTONE 	SHALE 	SANDSTONE 	

UNIFIED SOIL CLASSIFICATION SYSTEM REFERENCE SHEET

MAJOR DIVISIONS		LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS <u>LARGER</u> THAN #200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION <u>RETAINED</u> #4 SIEVE	CLEAN GRAVELS LITTLE OR NO FINES	(GW) WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
			(GP) POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES APPRECIABLE AMOUNT OF FINES	(GM) SILTY GRAVELS and GRAVEL-SAND-SILT MIXTURES
			(GC) CLAYEY GRAVELS and GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION <u>PASSING</u> #4 SIEVE	CLEAN SAND LITTLE OR NO FINES	(SW) WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			(SP) POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES APPRECIABLE AMOUNT OF FINES	(SM) SILTY SANDS and SAND-SILT MIXTURES
			(SC) CLAYEY SANDS and SAND-CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS <u>SMALLER</u> THAN #200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT <u>LESS</u> THAN 50	(ML)	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR VERY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
		(CL)	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, □ SILTY CLAYS, LEAN CLAYS
		(OL)	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT <u>GREATER</u> THAN 50	(MH)	INORGANIC ELASTIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
		(CH)	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
		(OH)	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS		(PT)	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

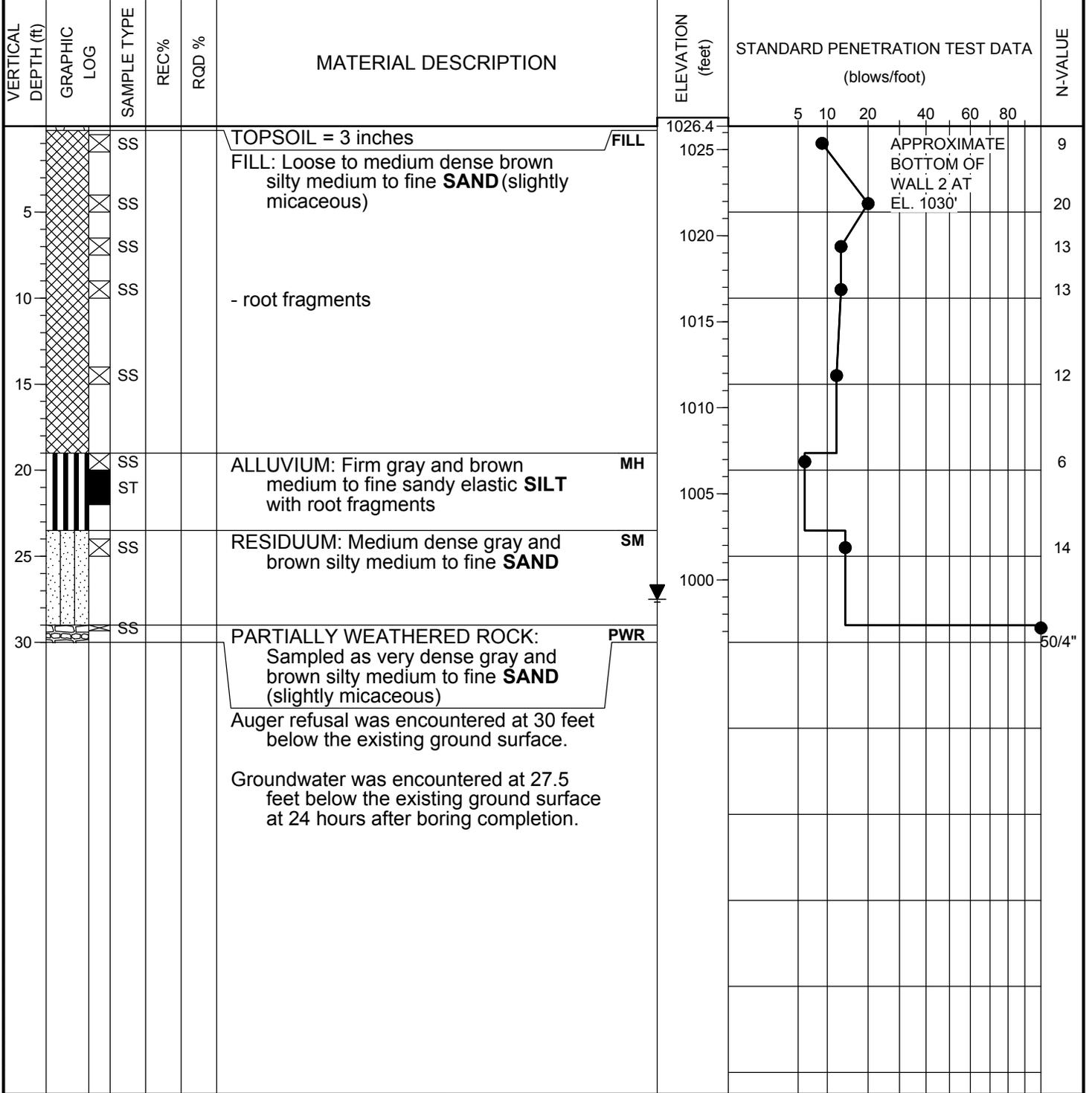
Project: SR 316 Over Colonial Pipeline BFI		HOLE No. B-2	
Location: Gwinnett County, Georgia		Sheet 1 of 1	
Project Number: 71.3852; GDOT Project # MSL00-0004-00(086), PI No. 0004086		Location: WB Bent 2 LT (See Figure 2)	
Azimuth: --	Angle from Horizontal: 90	Surface Elevation (ft): 1028.65	Station: 1251+12, 110' LT
Drilling Equipment: CME 55		Drilling Method: HSA Automatic Hammer	
Core Boxes: NA	Samples: 7	Overburden (ft): 24	Rock (ft): NA Total Depth (ft): 24.0
Logged By: PL		Date Drilled: 9/25/12	



SPTN SR 316 OVER COLONIAL PIPELINE WFI.GPJ 10/5/12

SAMPLER TYPE SS - Split Spoon NX - Rock Core, 2-1/8" ST - Shelby Tube CU - Cuttings NQ - Rock Core, 1-7/8" CT - Continuous Tube	DRILLING METHOD HSA - Hollow Stem Auger RW - Rotary Wash CFA - Continuous Flight Augers RC - Rock Core DC - Driving Casing	Hole No. <p style="text-align: center; font-size: 1.2em;">B-2</p>
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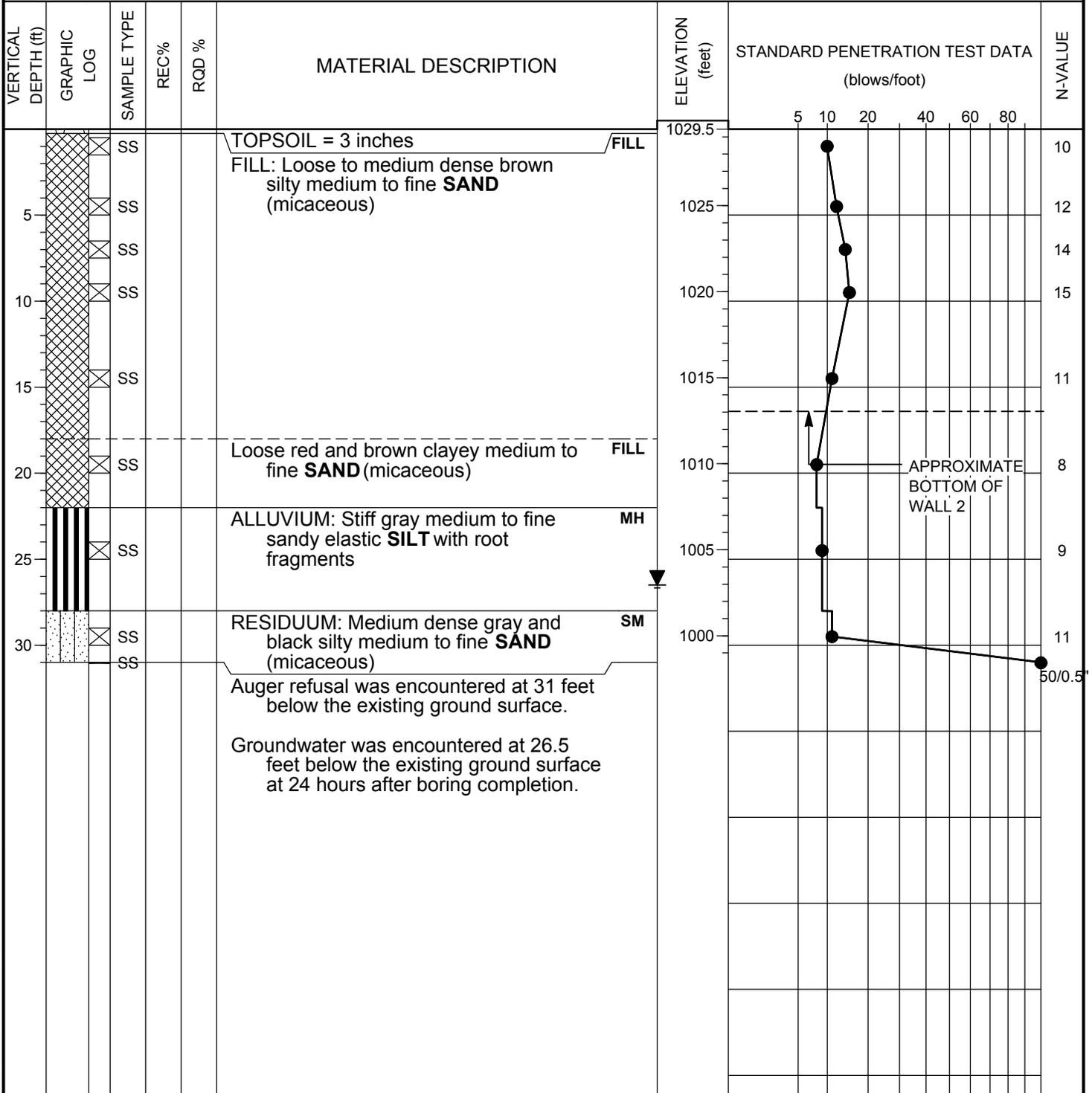
Project: SR 316 Over Colonial Pipeline BFI		HOLE No. B-3	
Location: Gwinnett County, Georgia		Sheet 1 of 1	
Project Number: 71.3852; GDOT Project # MSL00-0004-00(086), PI No. 0004086		Location WB Bent 1 RT (See Figure 2)	
Azimuth: --	Angle from Horizontal: 90	Surface Elevation (ft): 1026.37	Station: 1249+40, 3' LT
Drilling Equipment: CME 55		Drilling Method: HSA Automatic Hammer	
Core Boxes: NA	Samples: 9	Overburden (ft): 30	Rock (ft): NA Total Depth (ft): 30.0
Logged By: BD		Date Drilled: 9/24/12	



SPTN SR 316 OVER COLONIAL PIPELINE WFI.GPJ 10/5/12

SAMPLER TYPE SS - Split Spoon NX - Rock Core, 2-1/8" ST - Shelby Tube CU - Cuttings NQ - Rock Core, 1-7/8" CT - Continuous Tube	DRILLING METHOD HSA - Hollow Stem Auger RW - Rotary Wash CFA - Continuous Flight Augers RC - Rock Core DC - Driving Casing	Hole No. <p style="text-align: center; font-size: 1.2em;">B-3</p>
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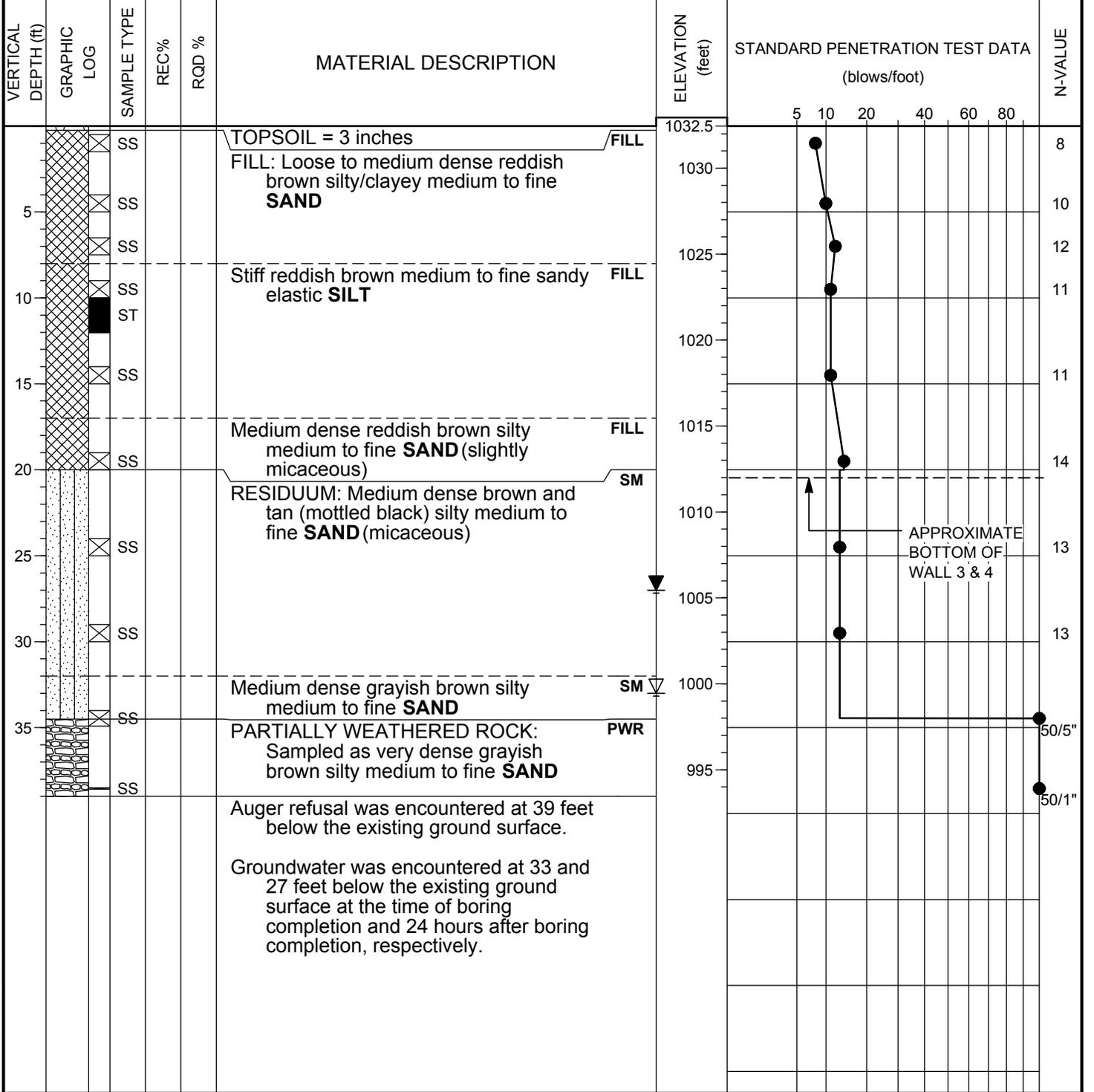
Project: SR 316 Over Colonial Pipeline BFI		HOLE No. B-4	
Location: Gwinnett County, Georgia		Sheet 1 of 1	
Project Number: 71.3852; GDOT Project # MSL00-0004-00(086), PI No. 0004086		Location: EB Bent 1 LT (See Figure 2)	
Azimuth: --	Angle from Horizontal: 90	Surface Elevation (ft): 1029.45	Station: 1250+19, 10' RT
Drilling Equipment: CME 55		Drilling Method: HSA Automatic Hammer	
Core Boxes: NA	Samples: 9	Overburden (ft): 31	Rock (ft): NA
Logged By: BD		Date Drilled: 9/24/12	
Total Depth (ft): 31.0			



SPTN SR 316 OVER COLONIAL PIPELINE WFI.GPJ 10/5/12

SAMPLER TYPE SS - Split Spoon ST - Shelby Tube NQ - Rock Core, 1-7/8"	NX - Rock Core, 2-1/8" CU - Cuttings CT - Continuous Tube	DRILLING METHOD HSA - Hollow Stem Auger CFA - Continuous Flight Augers DC - Driving Casing	RW - Rotary Wash RC - Rock Core Hole No. B-4
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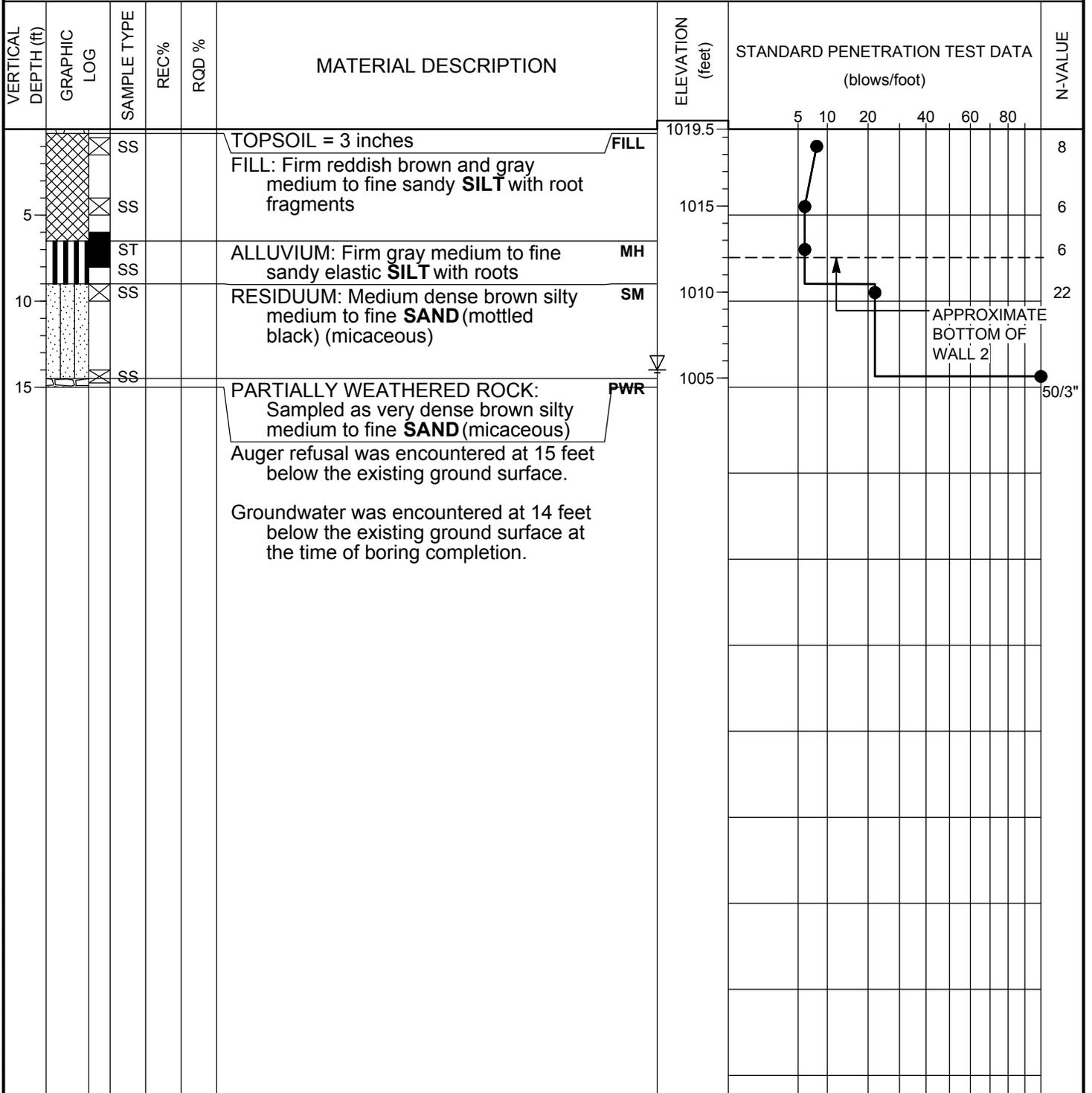
Project: SR 316 Over Colonial Pipeline BFI		HOLE No. B-5	
Location: Gwinnett County, Georgia		Sheet 1 of 1	
Project Number: 71.3852; GDOT Project # MSL00-0004-00(086), PI No. 0004086		Location: WB/EB Bent 2 (See Figure 2)	
Azimuth: --	Angle from Horizontal: 90	Surface Elevation (ft): 1032.45	Station: 1251+30, CL
Drilling Equipment: CME 55		Drilling Method: HSA Automatic Hammer	
Core Boxes: NA	Samples: 11	Overburden (ft): 39	Rock (ft): NA
Logged By: BD		Date Drilled: 9/24/12	



SPTN SR 316 OVER COLONIAL PIPELINE WFI.GPJ 10/5/12

SAMPLER TYPE SS - Split Spoon ST - Shelby Tube NX - Rock Core, 2-1/8" CU - Cuttings NQ - Rock Core, 1-7/8" CT - Continuous Tube	DRILLING METHOD HSA - Hollow Stem Auger CFA - Continuous Flight Augers DC - Driving Casing RW - Rotary Wash RC - Rock Core	Hole No. <p style="text-align: center; font-weight: bold; font-size: 1.2em;">B-5</p>
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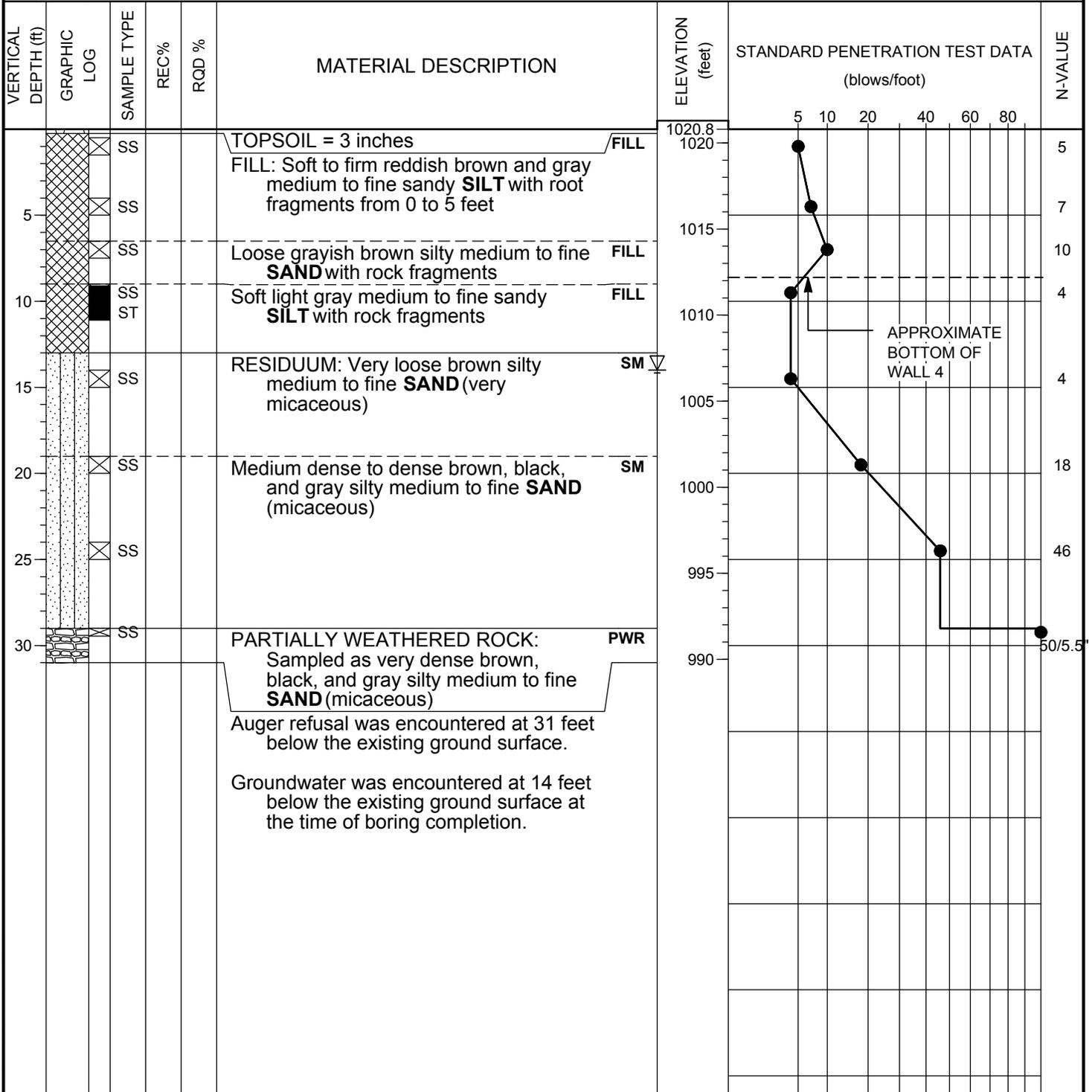
Project: SR 316 Over Colonial Pipeline BFI		HOLE No. B-6	
Location: Gwinnett County, Georgia		Sheet 1 of 1	
Project Number: 71.3852; GDOT Project # MSL00-0004-00(086), PI No. 0004086		Location: EB Bent 1 RT (See Figure 2)	
Azimuth: --	Angle from Horizontal: 90	Surface Elevation (ft): 1019.47	Station: 1250+60, 110' RT
Drilling Equipment: CME 45 ATV		Drilling Method: HSA Automatic Hammer	
Core Boxes: NA	Samples: 6	Overburden (ft): 15	Rock (ft): NA Total Depth (ft): 15.0
Logged By: BD		Date Drilled: 9/28/12	



SPTN SR 316 OVER COLONIAL PIPELINE WFI.GPJ 10/5/12

SAMPLER TYPE SS - Split Spoon NX - Rock Core, 2-1/8" ST - Shelby Tube CU - Cuttings NQ - Rock Core, 1-7/8" CT - Continuous Tube	DRILLING METHOD HSA - Hollow Stem Auger RW - Rotary Wash CFA - Continuous Flight Augers RC - Rock Core DC - Driving Casing	Hole No. B-6
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Project: SR 316 Over Colonial Pipeline BFI		HOLE No. B-7	
Location: Gwinnett County, Georgia		Sheet 1 of 1	
Project Number: 71.3852; GDOT Project # MSL00-0004-00(086), PI No. 0004086		Location EB Bent 2 RT (See Figure 2)	
Azimuth: --	Angle from Horizontal: 90	Surface Elevation (ft): 1020.80	Station: 1251+60, 110' RT
Drilling Equipment: CME 45 ATV		Drilling Method: HSA Automatic Hammer	
Core Boxes: NA	Samples: 9	Overburden (ft): 31	Rock (ft): NA Total Depth (ft): 31.0
Logged By: BD		Date Drilled: 9/28/12	



SPTN SR 316 OVER COLONIAL PIPELINE WFI.GPJ 10/5/12

SAMPLER TYPE SS - Split Spoon ST - Shelby Tube NQ - Rock Core, 1-7/8"	NX - Rock Core, 2-1/8" CU - Cuttings CT - Continuous Tube	DRILLING METHOD HSA - Hollow Stem Auger CFA - Continuous Flight Augers DC - Driving Casing	RW - Rotary Wash RC - Rock Core Hole No. <p style="text-align: center; font-weight: bold; font-size: 1.2em;">B-7</p>
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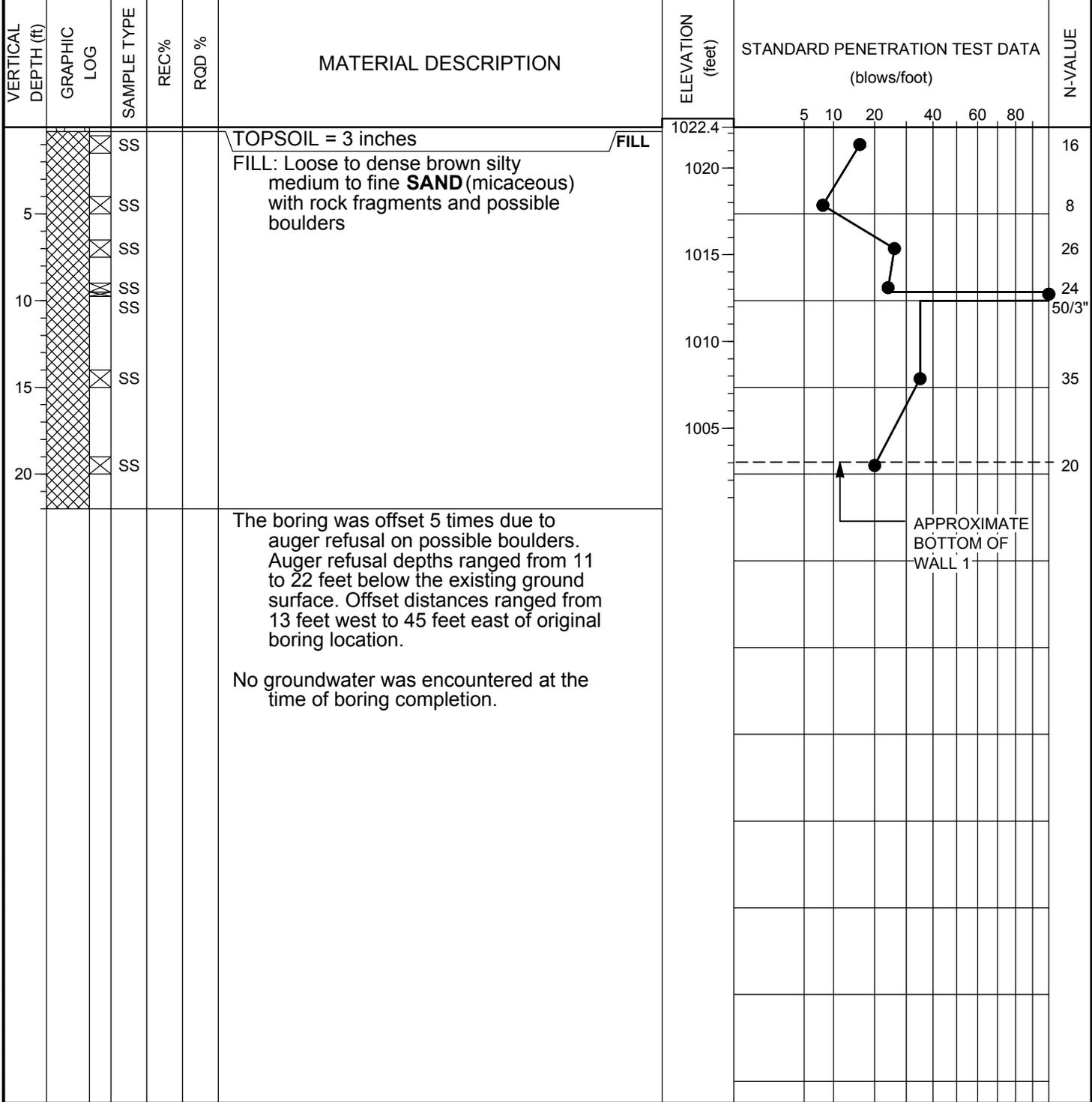
Project: SR 316 Over Colonial Pipeline BFI		HOLE No. W-2	
Location: Gwinnett County, Georgia		Sheet 1 of 1	
Project Number: 71.3852; GDOT Project # MSL00-0004-00(086), PI No. 0004086		Location: Wall 2	
Azimuth: --	Angle from Horizontal: 90	Surface Elevation (ft): 1019.52	Station: 1244+00, 3' LT
Drilling Equipment: CME 55		Drilling Method: HSA Automatic Hammer	
Core Boxes: NA	Samples: 4	Overburden (ft): NA	Rock (ft): NA
Logged By: BD		Date Drilled: 9/24/12	
Total Depth (ft): 10.0			

VERTICAL DEPTH (ft)	GRAPHIC LOG	SAMPLE TYPE	REC%	ROD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST DATA (blows/foot)	N-VALUE
	X	SS			TOPSOIL = 3 inches	1019.5	5	8
5	X	SS			FILL: Loose to very dense reddish brown silty medium to fine SAND (micaceous) with rock fragments and possible boulders.	1015	14	14
	X	SS				1010	50/1"	58
10	X	SS						
					Boring was terminated at 10 feet below the existing ground surface.			
					No groundwater was encountered at the time of boring completion.			

SPTN SR 316 OVER COLONIAL PIPELINE WFI.GPJ 10/5/12

SAMPLER TYPE SS - Split Spoon ST - Shelby Tube NQ - Rock Core, 1-7/8"	DRILLING METHOD NX - Rock Core, 2-1/8" CU - Cuttings CT - Continuous Tube	DRILLING METHOD HSA - Hollow Stem Auger CFA - Continuous Flight Augers DC - Driving Casing	RW - Rotary Wash RC - Rock Core Hole No. <div style="text-align: center; font-weight: bold; font-size: 1.2em;">W-2</div>
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Project: SR 316 Over Colonial Pipeline BFI		HOLE No. W-3	
Location: Gwinnett County, Georgia		Sheet 1 of 1	
Project Number: 71.3852; GDOT Project # MSL00-0004-00(086), PI No. 0004086		Location: Wall 1	
Azimuth: --	Angle from Horizontal: 90	Surface Elevation (ft): 1022.35	Station: 1245+20, 50' LT
Drilling Equipment: CME 45 ATV		Drilling Method: HSA Automatic Hammer	
Core Boxes: NA	Samples: 5	Overburden (ft): NA	Rock (ft): NA
Logged By: BD		Date Drilled: 9/26/12	
Total Depth (ft): 22.0			



SPTN SR 316 OVER COLONIAL PIPELINE WFI.GPJ 10/5/12

SAMPLER TYPE SS - Split Spoon ST - Shelby Tube NQ - Rock Core, 1-7/8"	NX - Rock Core, 2-1/8" CU - Cuttings CT - Continuous Tube	DRILLING METHOD HSA - Hollow Stem Auger CFA - Continuous Flight Augers DC - Driving Casing	RW - Rotary Wash RC - Rock Core Hole No. <div style="text-align: center; font-weight: bold; font-size: 1.2em;">W-3</div>
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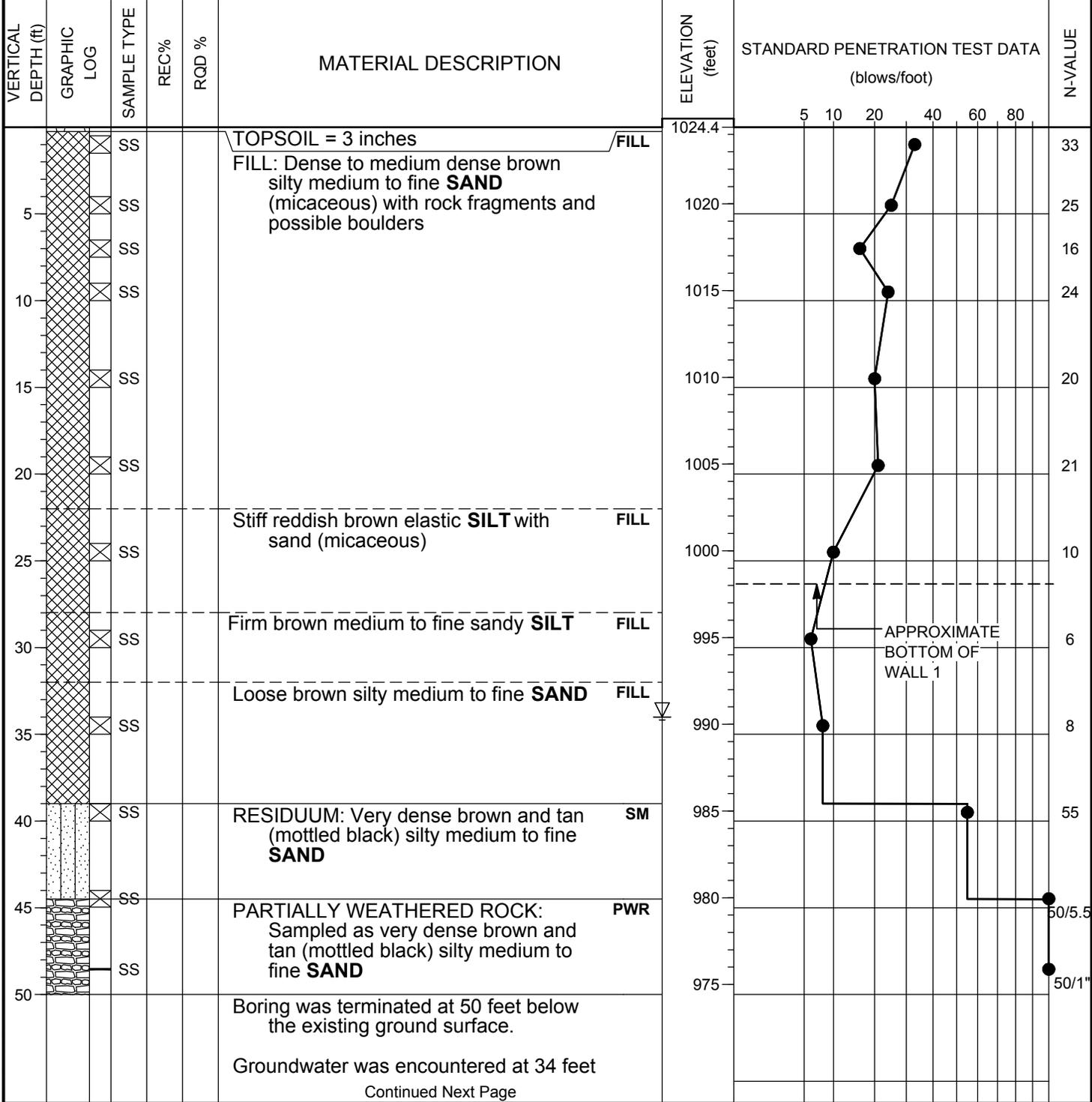
Project: SR 316 Over Colonial Pipeline BFI		HOLE No. W-4	
Location: Gwinnett County, Georgia		Sheet 1 of 1	
Project Number: 71.3852; GDOT Project # MSL00-0004-00(086), PI No. 0004086		Location: Wall 2	
Azimuth: --	Angle from Horizontal: 90	Surface Elevation (ft): 1020.37	Station: 1246+00, 3' LT
Drilling Equipment: CME 55		Drilling Method: HSA Automatic Hammer	
Core Boxes: NA	Samples: 4	Overburden (ft): NA	Rock (ft): NA
Logged By: BD		Date Drilled: 9/24/12	
Total Depth (ft): 10.0			

VERTICAL DEPTH (ft)	GRAPHIC LOG	SAMPLE TYPE	REC%	ROD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST DATA (blows/foot)	N-VALUE
					TOPSOIL = 3 inches	1020.4		
		SS			FILL: Loose to medium dense reddish brown silty/clayey medium to fine SAND	1020	10	8
5		SS				1015	15	12
		SS			Dense gray and brown silty medium to fine SAND (micaceous) with rock fragments		35	37
10		SS			Medium dense reddish brown silty medium to fine SAND		15	16
					Boring was terminated at 10 feet below the existing ground surface.			
					No groundwater was encountered at the time of boring completion.			

SAMPLER TYPE SS - Split Spoon ST - Shelby Tube NQ - Rock Core, 1-7/8"	DRILLING METHOD HSA - Hollow Stem Auger CFA - Continuous Flight Augers DC - Driving Casing	RW - Rotary Wash RC - Rock Core Hole No. W-4
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SPTN SR 316 OVER COLONIAL PIPELINE WFI.GPJ 10/5/12

Project: SR 316 Over Colonial Pipeline BFI		HOLE No. W-5	
Location: Gwinnett County, Georgia		Sheet 1 of 2	
Project Number: 71.3852; GDOT Project # MSL00-0004-00(086), PI No. 0004086		Location: Wall 1	
Azimuth: --	Angle from Horizontal: 90	Surface Elevation (ft): 1024.42	Station: 1246+75, 52' LT
Drilling Equipment: CME 45 ATV		Drilling Method: HSA Automatic Hammer	
Core Boxes: NA	Samples: 12	Overburden (ft): NA	Rock (ft): NA
Logged By: BD		Date Drilled: 9/26/12	
Total Depth (ft): 50.0			

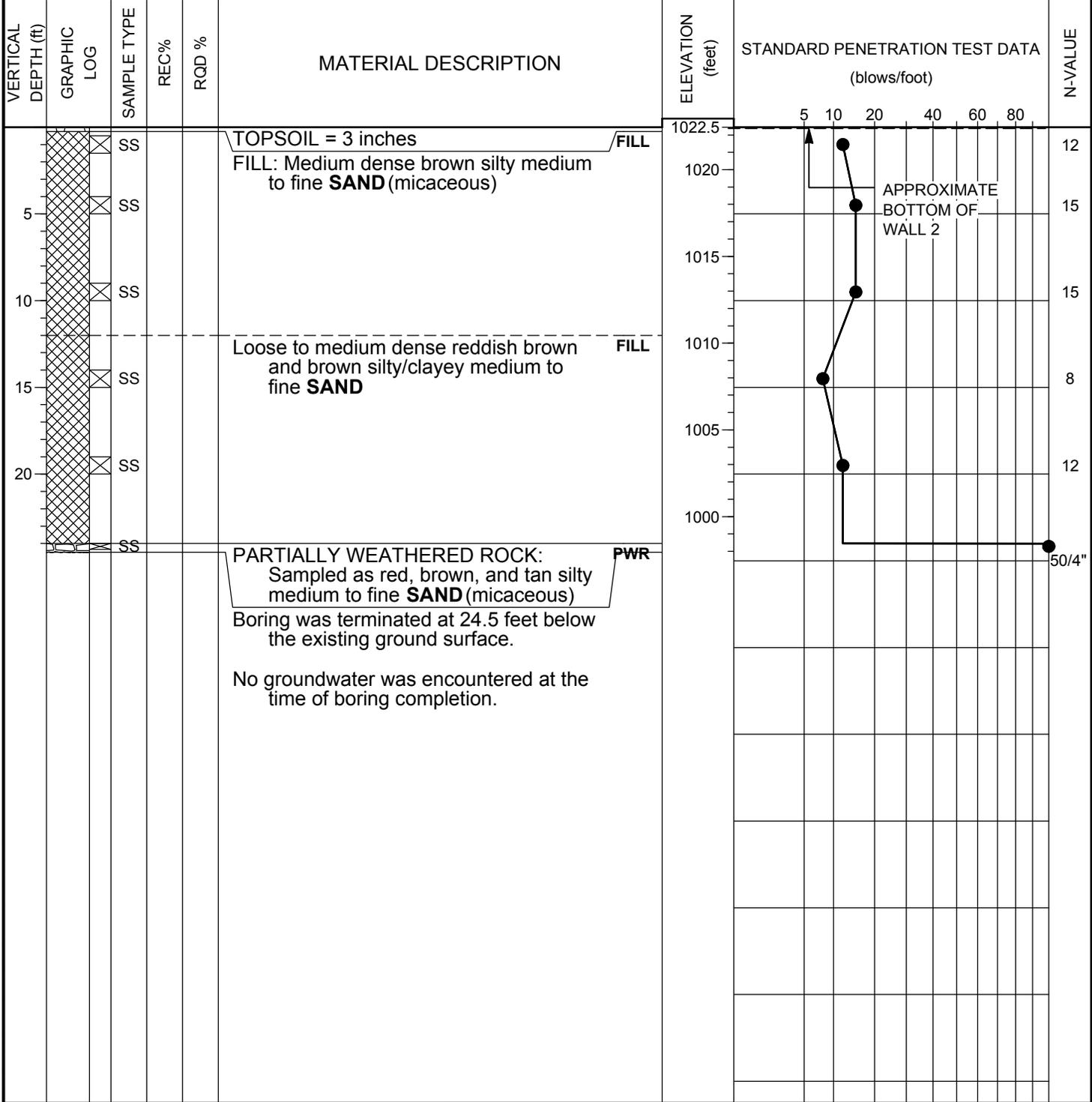


SPTN SR 316 OVER COLONIAL PIPELINE WFI.GPJ 10/5/12

Continued Next Page

SAMPLER TYPE SS - Split Spoon ST - Shelby Tube NQ - Rock Core, 1-7/8"	NX - Rock Core, 2-1/8" CU - Cuttings CT - Continuous Tube	DRILLING METHOD HSA - Hollow Stem Auger CFA - Continuous Flight Augers DC - Driving Casing
RW - Rotary Wash RC - Rock Core		Hole No. W-5

Project: SR 316 Over Colonial Pipeline BFI		HOLE No. W-6	
Location: Gwinnett County, Georgia		Sheet 1 of 1	
Project Number: 71.3852; GDOT Project # MSL00-0004-00(086), PI No. 0004086		Location: Wall 2	
Azimuth: --	Angle from Horizontal: 90	Surface Elevation (ft): 1022.45	Station: 1248+00, 5' LT
Drilling Equipment: CME 55		Drilling Method: HSA Automatic Hammer	
Core Boxes: NA	Samples: 6	Overburden (ft): NA	Rock (ft): NA
Logged By: BD		Date Drilled: 9/24/12	
Total Depth (ft): 24.5			



SPTN SR 316 OVER COLONIAL PIPELINE WFI.GPJ 10/5/12

SAMPLER TYPE SS - Split Spoon ST - Shelby Tube NQ - Rock Core, 1-7/8"	NX - Rock Core, 2-1/8" CU - Cuttings CT - Continuous Tube	DRILLING METHOD HSA - Hollow Stem Auger CFA - Continuous Flight Augers DC - Driving Casing	RW - Rotary Wash RC - Rock Core Hole No. W-6
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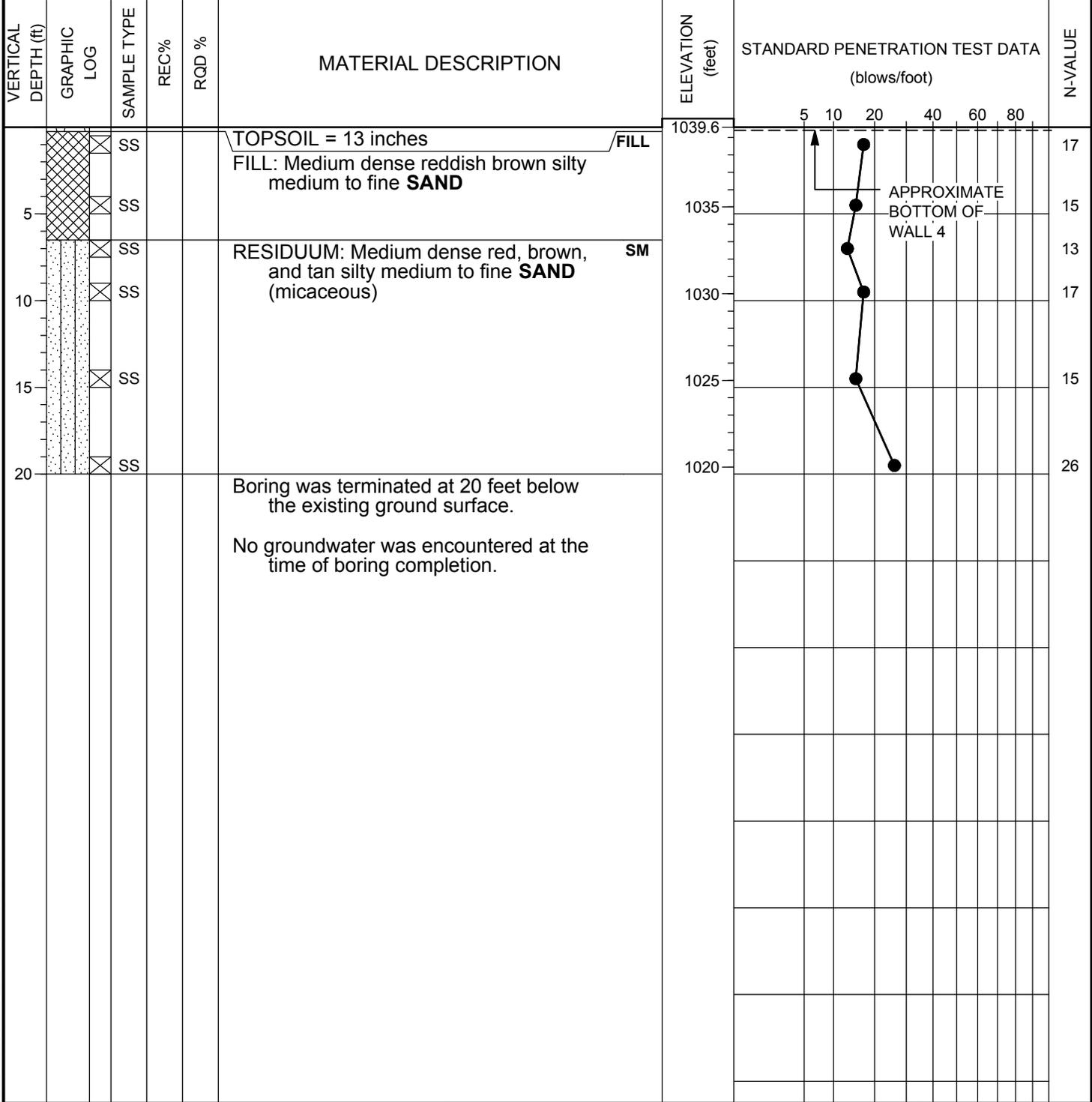
Project: SR 316 Over Colonial Pipeline BFI		HOLE No. W-7	
Location: Gwinnett County, Georgia		Sheet 1 of 1	
Project Number: 71.3852; GDOT Project # MSL00-0004-00(086), PI No. 0004086		Location: Wall 4	
Azimuth: --	Angle from Horizontal: 90	Surface Elevation (ft): 1035.88	Station: 1252+95, 7' RT
Drilling Equipment: CME 55		Drilling Method: HSA Automatic Hammer	
Core Boxes: NA	Samples: 7	Overburden (ft): NA	Rock (ft): NA
Logged By: PL		Date Drilled: 9/25/12	
Total Depth (ft): 25.0			

VERTICAL DEPTH (ft)	GRAPHIC LOG	SAMPLE TYPE	REC%	ROD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST DATA (blows/foot)	N-VALUE
					TOPSOIL = 3 inches / FILL	1035.9		
5		SS			FILL: Loose to medium dense reddish brown silty medium to fine SAND	1035	10	10
		SS				1030		17
		SS			RESIDUUM: Medium dense brown and gray silty medium to fine SAND (micaceous) / SM	1028		23
10		SS				1026		28
		SS				1022		18
15		SS				1020		18
		SS				1018		23
20		SS				1016		23
		SS				1014		14
25		SS				1012		
Boring was terminated at 25 feet below the existing ground surface.								
No groundwater was encountered at the time of boring completion.								

SAMPLER TYPE SS - Split Spoon ST - Shelby Tube NQ - Rock Core, 1-7/8"	DRILLING METHOD NX - Rock Core, 2-1/8" CU - Cuttings CT - Continuous Tube HSA - Hollow Stem Auger CFA - Continuous Flight Augers DC - Driving Casing RW - Rotary Wash RC - Rock Core	Hole No. <p style="text-align: center; font-size: 1.2em;">W-7</p>
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SPTN SR 316 OVER COLONIAL PIPELINE WFI.GPJ 10/5/12

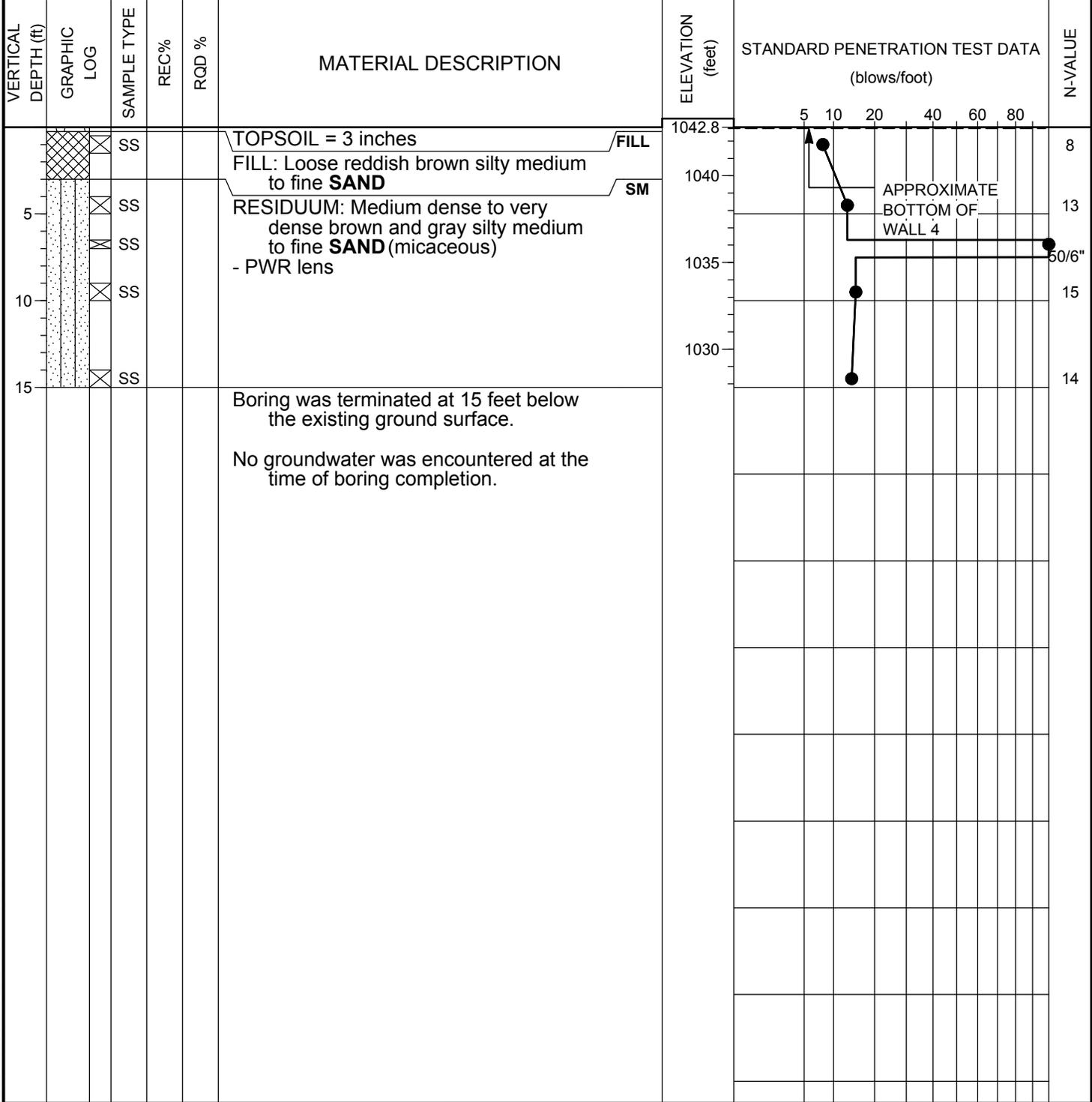
Project: SR 316 Over Colonial Pipeline BFI		HOLE No. W-8	
Location: Gwinnett County, Georgia		Sheet 1 of 1	
Project Number: 71.3852; GDOT Project # MSL00-0004-00(086), PI No. 0004086		Location: Wall 4	
Azimuth: --	Angle from Horizontal: 90	Surface Elevation (ft): 1039.60	Station: 1255+00, 3' RT
Drilling Equipment: CME 55		Drilling Method: HSA Automatic Hammer	
Core Boxes: NA	Samples: 6	Overburden (ft): NA	Rock (ft): NA
Logged By: PL		Date Drilled: 9/25/12	



SPTN SR 316 OVER COLONIAL PIPELINE WFI.GPJ 10/5/12

SAMPLER TYPE SS - Split Spoon ST - Shelby Tube NQ - Rock Core, 1-7/8"	DRILLING METHOD NX - Rock Core, 2-1/8" CU - Cuttings CT - Continuous Tube	HSA - Hollow Stem Auger CFA - Continuous Flight Augers DC - Driving Casing	RW - Rotary Wash RC - Rock Core Hole No. W-8
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Project: SR 316 Over Colonial Pipeline BFI		HOLE No. W-9	
Location: Gwinnett County, Georgia		Sheet 1 of 1	
Project Number: 71.3852; GDOT Project # MSL00-0004-00(086), PI No. 0004086		Location: Wall 4	
Azimuth: --	Angle from Horizontal: 90	Surface Elevation (ft): 1042.80	Station: 1257+00, CL
Drilling Equipment: CME 55		Drilling Method: HSA Automatic Hammer	
Core Boxes: NA	Samples: 5	Overburden (ft): NA	Rock (ft): NA
Logged By: PL		Date Drilled: 9/25/12	
Total Depth (ft): 15.0			



SPTN SR 316 OVER COLONIAL PIPELINE WFI.GPJ 10/5/12

SAMPLER TYPE SS - Split Spoon ST - Shelby Tube NQ - Rock Core, 1-7/8"	DRILLING METHOD NX - Rock Core, 2-1/8" CU - Cuttings CT - Continuous Tube	HSA - Hollow Stem Auger CFA - Continuous Flight Augers DC - Driving Casing	RW - Rotary Wash RC - Rock Core Hole No. W-9
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Project: SR 316 Over Colonial Pipeline BFI		HOLE No. W-10	
Location: Gwinnett County, Georgia		Sheet 1 of 1	
Project Number: 71.3852; GDOT Project # MSL00-0004-00(086), PI No. 0004086		Location: Wall 4	
Azimuth: --	Angle from Horizontal: 90	Surface Elevation (ft): 1047.00	Station: 1259+00, CL
Drilling Equipment: CME 55		Drilling Method: HSA Automatic Hammer	
Core Boxes: NA	Samples: 3	Overburden (ft): NA	Rock (ft): NA
Logged By: PL		Date Drilled: 9/25/12	

VERTICAL DEPTH (ft)	GRAPHIC LOG	SAMPLE TYPE	REC%	ROD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST DATA (blows/foot)	N-VALUE
	5	SS			TOPSOIL = 3 inches FILL: Medium dense reddish brown silty medium to fine SAND	1047.0	5 10 20 40 60 80	14
		SS			RESIDUUM: Medium dense brown and gray (mottled black) silty medium to fine SAND (micaceous)	1045		21
		SS			PARTIALLY WEATHERED ROCK: Sampled as very dense brown and gray (mottled black) silty medium to fine SAND (micaceous)	1040		50/1"
					Auger refusal was encountered at 7 feet below the existing ground surface.			
					No groundwater was encountered at the time of boring completion.			

SAMPLER TYPE SS - Split Spoon ST - Shelby Tube NQ - Rock Core, 1-7/8"	NX - Rock Core, 2-1/8" CU - Cuttings CT - Continuous Tube	DRILLING METHOD HSA - Hollow Stem Auger CFA - Continuous Flight Augers DC - Driving Casing	RW - Rotary Wash RC - Rock Core Hole No. <div style="text-align: center; font-weight: bold; font-size: 1.2em;">W-10</div>
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SPTN SR 316 OVER COLONIAL PIPELINE WFI.GPJ 10/5/12

Project: SR 316 Over Colonial Pipeline BFI		HOLE No. W-11	
Location: Gwinnett County, Georgia		Sheet 1 of 1	
Project Number: 71.3852; GDOT Project # MSL00-0004-00(086), PI No. 0004086		Location: Wall 4	
Azimuth: --	Angle from Horizontal: 90	Surface Elevation (ft): 1052.00	Station: 1261+00, CL
Drilling Equipment: CME 55		Drilling Method: HSA Automatic Hammer	
Core Boxes: NA	Samples: 4	Overburden (ft): NA	Rock (ft): NA
Logged By: PL		Date Drilled: 9/25/12	

VERTICAL DEPTH (ft)	GRAPHIC LOG	SAMPLE TYPE	REC%	ROD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST DATA (blows/foot)	N-VALUE
	[Cross-hatched pattern]	SS			TOPSOIL = 3 inches	1052.0	5 10 20 40 60 80	8
					FILL: Loose reddish brown silty medium to fine SAND	1050		
5	[Dotted pattern]	SS			RESIDUUM: Loose to medium dense red, brown, and gray (mottled black) silty medium to fine SAND	1045		10
		SS				1045		14
10		SS				1045		16
					Boring was terminated at 10 feet below the existing ground surface.			
					No groundwater was encountered at the time of boring completion.			

SAMPLER TYPE SS - Split Spoon ST - Shelby Tube NQ - Rock Core, 1-7/8"	DRILLING METHOD HSA - Hollow Stem Auger CFA - Continuous Flight Augers DC - Driving Casing	RW - Rotary Wash RC - Rock Core Hole No. W-11
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SPTN SR 316 OVER COLONIAL PIPELINE WFI.GPJ 10/5/12

APPENDIX II

Table All-1

**Summary of Laboratory Test Results
Retaining Wall Foundation Investigation – SR 316 Over Colonial Pipeline
GDOT Project No. MSL00-0004-00(086); PI No. 0004086
Gwinnett County, Georgia
Willmer Project No. 71.3852**

Sample Number	Sample Depth (feet)	Soil Description	Natural Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Fines Content (%)	Void Ratio	σ_p' (psf)	C_c	C_r	C_v (ft ² /day)
B-3	22	Gray and brown medium to fine sandy elastic SILT	24.0	56	24	65.6	0.73	5500	0.14	0.01	6
B-1	25	Gray and tan (mottled black) medium to fine sandy elastic SILT (micaceous)	31.3	60	24	62.5	--	--	--	--	--
B-5	12	Reddish brown medium to fine sandy elastic SILT	25.1	63	27	69.5	--	--	--	--	--
W-5-1	25	Reddish brown elastic SILT with sand (micaceous)	29.7	61	25	74.6	--	--	--	--	--
W-5-2	30	Brown sandy SILT	22.7	41	14	59.3	--	--	--	--	--

Abbreviations: σ_p' - Preconsolidation Pressure
 C_c - Compression Index
 C_r - Recompression Index
 C_v - Coefficient of Consolidation

APPENDIX III



Wall 1: From W-1 Facing East



Wall 1: From B-1 Facing West



Wall 2: From W-2 Facing East



Wall 2: From B-4 Facing East



Wall 3: From B-2 Facing West



Wall 4: From B-5 Facing West