EXHIBIT P

KNOWN SITE CONDITIONS BASELINE REPORT

[see attached]

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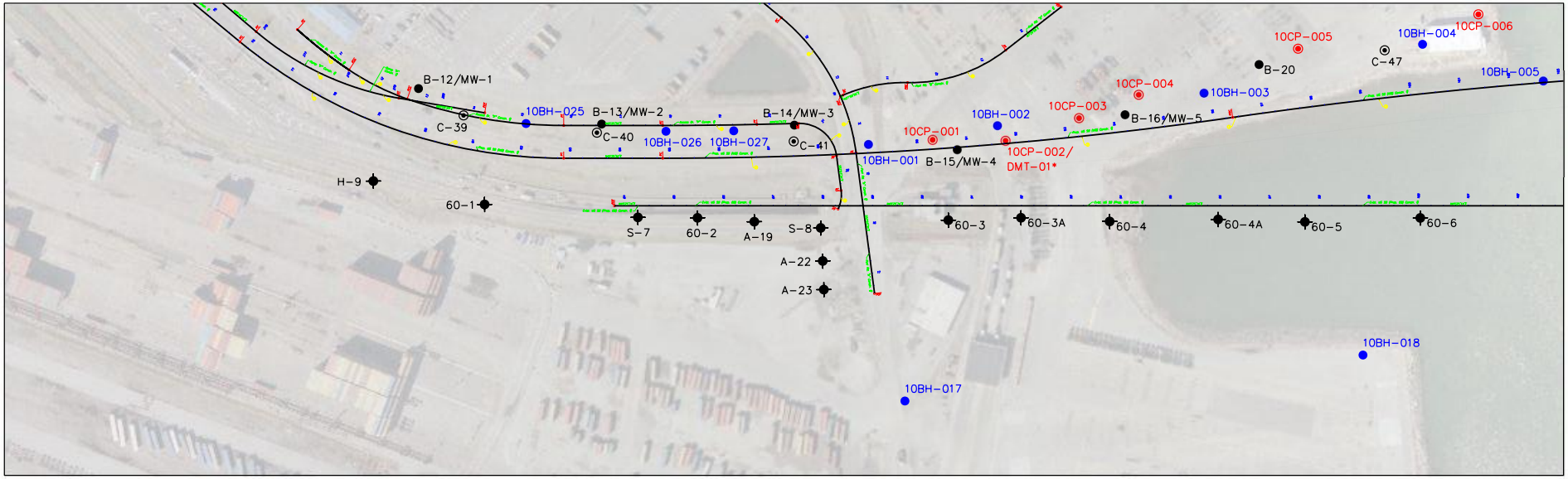
1. Geotechnical Conditions

The documents contained herewith, in PB's professional judgment, reasonably represent the state of ERC/SKW knowledge regarding "Known Geotechnical Conditions", as defined in the Comprehensive Agreement (Appendix A), and which may be included for that purpose and identified in Exhibit P. Unless otherwise designated, these documents were prepared by PB pursuant to its agreement with SKW ("the PB Work Product"). The documents designated as "-Non-PB" identified in the Table of Contents as Section 1.1.5 (Fugro) and 1.2.5 (Marshall Miller & Associates) were prepared by others not under contract to PB (Non-PB Work Product). PB disclaims and does not accept responsibility for the accuracy or completeness, or for any judgments, opinions or data reported or indicated in the Non-PB Work Product. PB has not reviewed the content of the Non-PB Work Product for any judgments or opinions reported.

1.1 Geotechnical Conditions - New Midtown Tunnel

1.1.1 Geotechnical Conditions - New Midtown Tunnel - Boring and CPT Location Diagrams

STATE	ROUTE	FEDERAL AID PROJECT	STATE ROUTE	STATE PROJECT	SHEET NO.
VA.	——				



N

SCALE: 1"=200'

LEGEND

- RECENT BORINGS (PB-2010)
- RECENT CPT SOUNDINGS (PB-2010)
- PREVIOUS BORINGS (FUGRO-2008)
- PREVIOUS CPT SOUNDINGS (FUGRO-2008)
- PREVIOUS BORINGS (SPRAGUE & HENWOOD-1960)
- * DENOTES PIEZOMETER LOCATION (PB-2010)

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No.	Description	Date
	Revisions	

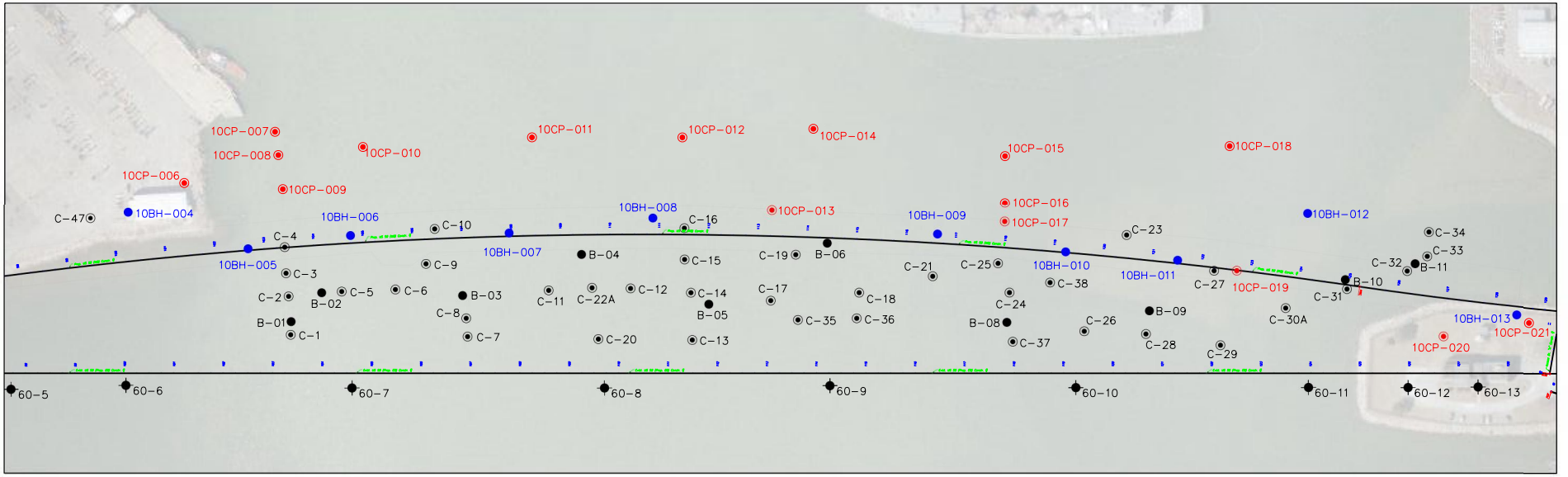
COMMONWEALTH OF VIRGINIA
DEPARTMENT OF TRANSPORTATION

STRUCTURE AND BRIDGE DIVISION

FIGURE
MIDTOWN TUNNEL - PORTSMOUTH
BORING / CPT LOCATION DIAGRAM

Designed: ..... Drawn: ..... Checked:	Date	Plan No.	Sheet No.
	1/21/11		1 OF 1

STATE	ROUTE	FEDERAL AID PROJECT	STATE ROUTE	STATE PROJECT	SHEET NO.
VA.	——				



N

SCALE: 1"=200'

LEGEND

- RECENT BORINGS (PB-2010)
- RECENT CPT SOUNDINGS (PB-2010)
- PREVIOUS BORINGS (FUGRO-2008)
- PREVIOUS CPT SOUNDINGS (FUGRO-2008)
- PREVIOUS BORINGS (SPRAGUE & HENWOOD-1960)

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Revisions		

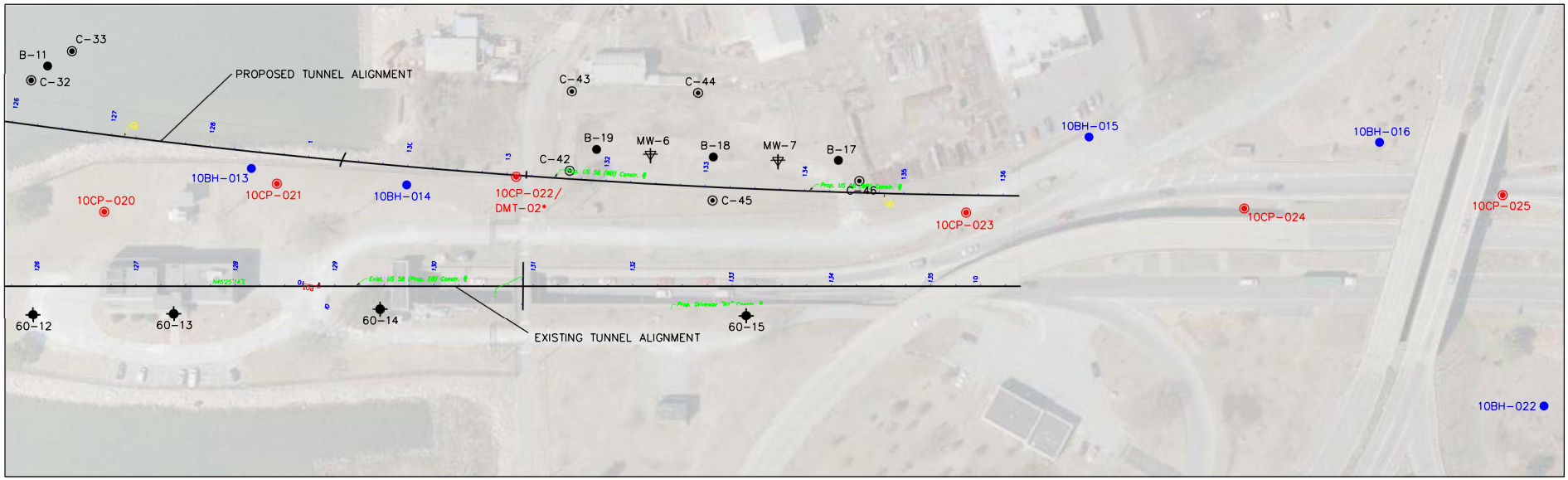
COMMONWEALTH OF VIRGINIA
DEPARTMENT OF TRANSPORTATION

STRUCTURE AND BRIDGE DIVISION

FIGURE
MIDTOWN TUNNEL - ELIZABETH RIVER
BORING / CPT LOCATION DIAGRAM

Designed: ..... Drawn: ..... Checked:	Date	Plan No.	Sheet No.
	1/21/11		1 OF 1

STATE	ROUTE	FEDERAL AID PROJECT	STATE ROUTE	STATE PROJECT	SHEET NO.
VA.	—				



N

SCALE: 1"=100'

LEGEND

- RECENT BORINGS (PB-2010)
- RECENT CPT SOUNDINGS (PB-2010)
- PREVIOUS BORINGS (FUGRO-2008)
- PREVIOUS CPT SOUNDINGS (FUGRO-2008)
- PREVIOUS BORINGS (SPRAGUE & HENWOOD-1960)
- MONITORING WELL LOCATION (MMA-2008)
- * DENOTES PIEZOMETER LOCATION (PB-2010)

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	Revisions	

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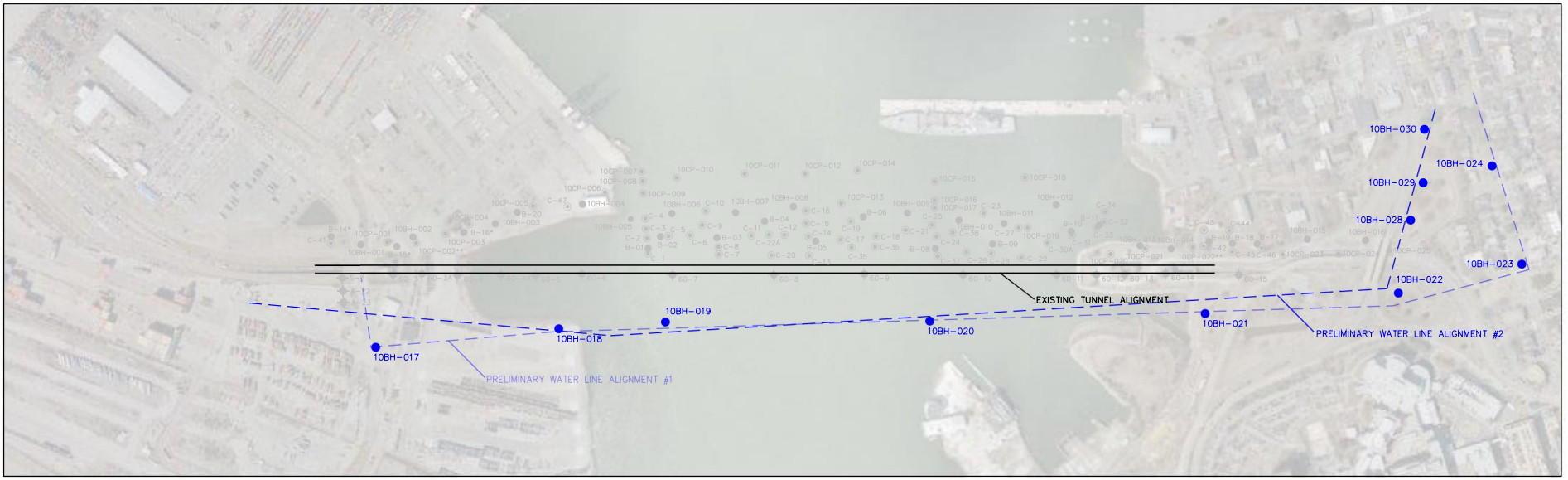
DEPARTMENT OF TRANSPORTATION

STRUCTURE AND BRIDGE DIVISION

FIGURE
MIDTOWN TUNNEL - NORFOLK
BORING / CPT LOCATION DIAGRAM

	Date	Plan No.	Sheet No.
Designed: ..... Drawn: ..... Checked:	1/21/11		1 OF 1

STATE	ROUTE	FEDERAL AID PROJECT	STATE ROUTE	STATE PROJECT	SHEET NO.
VA.	——				



N

SCALE: 1"=500'

LEGEND

● RECENT BORINGS (PB-2010)

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No.	Description	Date
	Revisions	

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF TRANSPORTATION

STRUCTURE AND BRIDGE DIVISION

FIGURE
MIDTOWN TUNNEL – WATER LINE RELOCATION
BORING LOCATION DIAGRAM

	Date	Plan No.	Sheet No.
Designed: ..... Drawn: ..... Checked:	12/20/10		1 OF 1

1.1.2 Geotechnical Conditions - New Midtown Tunnel - Boring Logs

SUMMARY OF BURMISTER SOIL CLASSIFICATION SYSTEM

Granular Soils

Principal Component:	GRAVEL, SAND, SILT		50% or more
Other Components:	Gravel, Sand, Silt	and	35-50%
	(+) nearer upper limit	some	20-35%
	(-) nearer lower limit	little	10-20%
	(no sign) middle of range	trace	1-10%

Particle Size Definitions

Soil	Fraction	Sieve Number and Size	
Gravel	coarse	3 to 1 in	(76 mm to 25 mm)
	medium	1 in to 3/8 in	(25 mm to 9.5 mm)
	fine	3/8 in to No. 10	(9.5 mm to 2.0 mm)
Sand	coarse	No. 10 to No. 30	(2.0 mm to 0.6 mm)
	medium	No. 30 to No. 60	(0.6 mm to 0.25 mm)
	fine	No. 60 to No. 200	(0.25 mm to 0.075 mm)
Silt		<No. 200	(<0.075 mm)

Density/Compactness

Description	SPT N-Value
Very loose	0-5
Loose	5-10
Medium Dense	10-30
Dense	30-50
Very Dense	>50

Gradation of Components

c-f/cmf	>10% all fractions
c-m/m-f/c/m/f	<10% unnamed fraction

Clay Soils And Organic Soils

Overall Plasticity	Plasticity Index	Thread Diameter	Written As
Slight PI	1-5	1/4" (6 mm)	Clayey SILT
Low PI	5-10	1/8" (3 mm)	SILT & CLAY
Medium PI	10-20	1/16" (1.5 mm)	CLAY & SILT
High PI	20-40	1/32" (0.75 mm)	Silty CLAY
Very High PI	40 or more	1/64" (0.4 mm)	CLAY

Notes:

1. Thread diameter indicates the size of thread attained at the ball moisture.
2. Ball moisture - Well worked ball, 1-1/2 in (40 mm) diameter which will exhibit a flat surface 3/4 to 1 (18 to 25 mm) in diameter when dropped 2 feet (0.6 m) at the proper moisture content.

Consistency	SPT N-value	Unconfined Strength tsf	Unconfined Strength (KPa)	Characteristics
Very Soft	<2	<0.25	(<25)	Extrudes between fingers when squeezed.
Soft	2-4	0.25-0.50	(25-50)	Can be pinched in two between thumb and forefinger.
Medium Stiff	4-8	0.50-1.0	(50-100)	Can be imprinted easily with fingers. Remolded by light finger pressure.
Stiff	8-15	1.0-2.0	(100-200)	Can be imprinted with considerable finger pressure, or indented with thumb nail.
Very Stiff	15-30	2.0-4.0	(200-400)	Can barely be imprinted by finger pressure, or indented by thumb nail.
Hard	>30	>4.0	(>400)	Cannot be imprinted by fingers, or difficult to indent by thumb nail.

EXAMPLES:

Full - brown, coarse+ medium to fine SAND, some medium to fine Gravel, trace+ Silt, very dense
Abbreviated - br c+mf SAND, s. mf Gravel, t+ Silt, v. dense

Full - gray, CLAY & SILT, little+ coarse - medium to fine+ Sand, Medium Plasticity, stiff, moist
Abbreviated - gray CLAY & SILT, l + c-mf+S, M.Pl, stiff, moist

DRAFT - NOT ISSUED FOR CONSTRUCTION

VDOT Virginia Department of Transportation

PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-001
PAGE 1 OF 2

STATION: OFFSET:
LATITUDE: 36.854530°N LONGITUDE: 76.318980°W
SURFACE ELEVATION: 5.3 ft COORD. DATUM: NAD 83

Date(s) Drilled: 7/29/2010 - 7/29/2010
Drilling Method(s): Rotary Wash
SPT Method: Safety Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Jeremy Raasio
Logger: Evan Garich, Carroll Stewart

GROUND WATER

FIELD DATA | **LAB DATA**

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
0	5	7 8 8	80		0.5						0.0 / 5.3 ARTIFICIAL FILL (af) Asphalt. **ASPH**			24.0
2		8 12 8	40		2 3						0.5 / 4.8 Dark brown, Clay and Silt, some coarse to fine Sand, little medium to fine Gravel, some partially decomposed plant material, strong hydrocarbon odor. **CL**			33.0 26.5
4	0	9 woh 2	25		4									73.9
6		1 6 2	100		6						2.0 / 3.3 Black, coarse to fine SAND, and medium to fine Gravel, some Clayey Silt, little partially decomposed plant material, strong hydrocarbon odor. **SM** -little Silt, little fine Gravel, 3'-4'			26.6
8		2 2 5	60		8									24.8
10	-5	4 4 3			10						4.0 / 1.3 Dark brown, medium to fine GRAVEL, some coarse to fine Sand, some Clayey Silt, hydrocarbon odor. **GM**			
12											6.0 / -0.7 ALLUVIUM (Qal) Gray, medium to fine SAND, some(-) Clayey Silt, abundant grass and root fibers, organic odor. **SM** -light gray, trace grass and root fibers, 8' -light gray and tan, little(+) Clayey Silt, slight odor, no grass or root fibers, 13'	NP	NP	26.4
14		5 3 4	50		13 15									
16	-10	4												
18		1 1 1	100		18						18.0 / -12.7 Brown-gray, organic CLAY, occasional brown fibrous Peat, slight organic odor. **OH**	92	66	64.1
20	-15	2	0		20									
22					22									
24		2 2 2	100		23 24.4							85	51	59.9
26	-20	2			25						24.4 / -19.1 TABB FORMATION (Qt) Brown-gray, Silty CLAY, some medium to fine Sand, trace brown fibrous Peat. **CL**			20.2
28		8 8 5	85		28						-brown-gray, Silt and Clay, and fine Sand, trace coarse to medium Sand, 28'	25	9	22.4
30	-25	6			30									
32														
34		1 2 8	60		33 35						33.0 / -27.7 Gray and tan, coarse to fine SAND, some Clayey Silt, little fine Gravel. **SM**			16.8
36	-30	10												
38		8 9 24	45		38						-brown and tan, some fine Gravel, little(+) Clayey Silt, 38'			11.8
40		11												

REMARKS: RIG TYPE: Truck Mounted CME-75HD.
Boring caved at 7.5 ft on 7-30-2010. Backfilled and capped with cold patch AC on 7-30-2010.

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10BH-001

SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-001
PAGE 2 OF 2

STATION: OFFSET:
LATITUDE: 36.854530°N LONGITUDE: 76.318980°W
SURFACE ELEVATION: 5.3 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 7/29/2010 - 7/29/2010
Drilling Method(s): Rotary Wash
SPT Method: Safety Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Jeremy Raasio
Logger: Evan Garich, Carroll Stewart

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
40	-35				40									
42														
43		10 10 13 13	100		43									31.1
44					44									30.9
45	-40				45						40.0 / -34.7 YORKTOWN FORMATION (Ty) Gray, coarse to fine SAND, little Silt and Clay, abundant shell fragments, interlayered with brown, calcareous coarse to fine SAND, some(-) Clayey Silt. **SM**			
46											43.5 / -38.2 Gray, coarse to fine SAND, trace Clayey Silt, numerous shell fragments. **SP**			
48		7 9 12 14	100		48						48.0 / -42.7 Grey, coarse to fine SAND, some(-) Clayey Silt, shell fragments scattered throughout. **SM**	NP	NP	35.6
50	-45				50									
52														
53		6 9 16 18	100		53						53.0 / -47.7 Green-gray, medium to fine SAND, some Clayey Silt, shell fragments scattered throughout, one layer of large-size shell fragments. **SM**			35.2
55					55									
56	-50													
58		4 6 10 14	100		58							28	3	34.9
60					60									
62	-55													
63		4 5 12 12	90		63									34.0
64														
65					65									
66	-60													
68		4 6 17 25	100		68						68.0 / -62.7 Gray, medium to fine SAND, some Clay and Silt, numerous shell fragments commonly in horizontal layers, some shell decomposed to Carbonate Clay. **SC**			23.9
70					70									

REMARKS: RIG TYPE: Truck Mounted CME-75HD.
Boring caved at 7.5 ft on 7-30-2010. Backfilled and capped with cold patch AC on 7-30-2010.

PAGE 2 OF 2
10BH-001

SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-002
PAGE 1 OF 3

STATION: OFFSET:
LATITUDE: 36.855090°N LONGITUDE: 76.318420°W
SURFACE ELEVATION: 5.9 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 7/30/2010 - 7/30/2010
Drilling Method(s): Rotary Wash
SPT Method: Safety Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Jeremy Raasio
Logger: Evan Garich, Carroll Stewart

GROUND WATER

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
		5	15 20 15	73		0.5						0.0 / 5.9 ARTIFICIAL FILL (af) Asphalt. **ASPH**			6.6
	2		12 10 8 6	50		2						0.5 / 5.4 Gray, coarse to fine SAND, some medium to fine Gravel, some Silt and Clay. **SC**			6.9
	4		5 6 8 7	50		4						-orange, brown, and tan, coarse(-) to fine SAND, little(-) Clayey Silt, 2'			15.0
	6	0	12 12 6 5	60		6 7						-brown, coarse to fine SAND, some Clay and Silt, 4'			20.8 17.4
	8		2 2 4 6	15		8						-orange-tan, some Silt and Clay, trace coarse Sand, 6'			
	10	-5				10						-black, medium to fine SAND, some Silt and Clay, trace coarse Sand, abundant wood chips, interlayered with gray medium to fine Sand, 7'			19.9
	12											Obstruction from approximately 6'-7', hard driving 4" casing			
	14		8 11 11 7	25		13 15						8.0 / -2.1 ALLUVIUM (Qal) Yellow-gray, medium to fine SAND, trace Silt and Clay, trace medium to fine Gravel. **SP**			20.0
	16	-10										13.0 / -7.1 Gray, coarse to fine SAND, trace fine Gravel, one piece coarse gravel on top of sample, may be from cobble or boulder broken during casing driving. **SP**			
	18		5 2 2 1	0		18									
	20					20						20.0 / -14.1 Gray, organic Silty CLAY, occasional brown organic plant material, organic odor. **OL**			
	22	-15													
	24		woh woh woh 1	100		23									60.2
	26	-20		100		25 27						-layer of shell fragments and one piece of medium Gravel at 2" from bottom of sample, 27'			58.4
	28		woh woh woh woh	100		28						28.0 / -22.1 Gray, CLAY, slight organic odor. **CH**	68	43	61.9
0	30					30									
	32	-25													
	34		woh woh woh 1	15		33 35									68.7
	36	-30													
	38		woh woh woh 2	100		38						-no organic odor, 38'			61.3
0.3	40														

REMARKS: RIG TYPE: Truck Mounted CME-75HD.
4" ID casing to 8 ft., backfilled and capped with cold patch AC on 7-30-2010.

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10BH-002

SPT_LOGA:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-002
PAGE 2 OF 3

STATION: OFFSET:
LATITUDE: 36.855090°N LONGITUDE: 76.318420°W
SURFACE ELEVATION: 5.9 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 7/30/2010 - 7/30/2010
Drilling Method(s): Rotary Wash
SPT Method: Safety Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Jeremy Raasio
Logger: Evan Garich, Carroll Stewart

GROUND WATER

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	40	-35		100		40									57.1
	42					42									
	44		woh woh woh 3	50		43 45						-trace brown organics throughout, 43'	69	42	53.6
	46	-40													
	48		woh woh 2 5	100		48 49.5						-occasional brown organics, trace shell fragments, 48'			52.0
	50					50						49.5 / -43.6			136.6
		-45		89								Brown, fibrous PEAT, organic odor. **PT**			101.2
	52					51.8						50.0 / -44.1			
			1 2 6 9	100		53 54 55						Gray, organic Silty CLAY, and brown fibrous Peat. **OL**			60.1
	54											53.0 / -47.1			242.9
	56	-50										Gray, organic Silty CLAY, some brown fibrous Peat, organic odor, interlayered with gray, coarse to fine Sand. **OL**			
												-wood, grains perpendicular to sampler, 8" thick, 54'			
	58		7 8 8 9	100		58 60						58.0 / -52.1			29.5
	60											YORKTOWN FORMATION			
		-55										Green-gray, medium to fine SAND, some Clay and Silt, trace fine Gravel, shell fragments scattered throughout. **SC**			
	62					63									
	64		7 6 8 9	100		64 65							35	14	28.1
	66	-60													
	68		8 7 11 13	100		68 70									27.3
	70														
		-65													
	72					73									
	74		8 10 13 19	100		75						73.0 / -67.1	22	1	27.9
	76	-70										Gray, medium to fine SAND, some(-) Clayey Silt, shell fragments scattered throughout. **SM**			
	78		7 9 15 17	100		78						78.0 / -72.1			27.6
	80											Green-gray, medium to fine SAND, some Clay and SIlt,			

REMARKS: RIG TYPE: Truck Mounted CME-75HD.
4" ID casing to 8 ft., backfilled and capped with cold patch AC on 7-30-2010.

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SPT_LOGA:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-002
PAGE 3 OF 3

STATION: OFFSET:
LATITUDE: 36.855090°N LONGITUDE: 76.318420°W
SURFACE ELEVATION: 5.9 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 7/30/2010 - 7/30/2010
Drilling Method(s): Rotary Wash
SPT Method: Safety Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Jeremy Raasio
Logger: Evan Garich, Carroll Stewart

GROUND WATER

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	82	-75				80						occasional whole shells and shell fragments scattered throughout. **SC**			
	84		9 11 18 19	85		83 85						83.0 / -77.1 Green-gray, medium to fine(+) SAND, some Silt and Clay, occasional whole shells and shell fragments throughout. **SM**			29.1

REMARKS: RIG TYPE: Truck Mounted CME-75HD.
4" ID casing to 8 ft., backfilled and capped with cold patch AC on 7-30-2010.

PAGE 3 OF 3
10BH-002

SPT_LOGA:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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VDOT Virginia Department of Transportation

PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-003
PAGE 1 OF 3

STATION: OFFSET:
LATITUDE: 36.856000°N LONGITUDE: 76.317540°W
SURFACE ELEVATION: 4.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 7/29/2010 - 7/29/2010
Drilling Method(s): Rotary Wash
SPT Method: Safety Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Jeremy Raasio
Logger: Carroll Stewart, Evan Garich

GROUND WATER

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
			33 33 28	64		0.5 0.6						0.0 / 4.6 ARTIFICIAL FILL (af) Asphalt. **ASPH**			6.0
	2		12 8 7 5	40		2						0.6 / 4.0 Gray, coarse to fine SAND, some coarse to fine Gravel, little Clayey Silt. **SP**			18.1
	4	0	4 7 10 16	40		4						2.0 / 2.6 Black, coarse to fine SAND, some medium to fine Gravel, little Clayey Silt, man-made waste materials (glass, wire). **SM**			17.2
	6		9 10 9 7	35		6						-dark gray, and medium to fine Gravel, trace(+) Clayey Silt, 4'			8.2
	8		4 7 9 9	25		8						6.0 / -1.4 Dark brown-gray, coarse to fine GRAVEL, and coarse to fine Sand, some Clay and Silt. **GC**			19.1
	10	-5				10						8.0 / -3.4 Gray, coarse to fine SAND, trace Silty Clay. **SC**	40	24	23.5
	12					13						-brown-gray, medium to fine SAND, some medium to fine Gravel, little Silty Clay, trace metal (slough?), 13'			
	14	-10	6 3 5 3	50		15									
	16														
	18		2 1 woh 1	100		18						18.0 / -13.4 ALLUVIUM (Qal) Gray, Silty CLAY, little medium to fine Sand, trace brown organics, grading to some medium to fine Sand at bottom of sample. **CH**	56	34	53.9
	20	-15		100		20									66.1
	22					22						-trace medium to fine Sand, 22'			
0	24	-20	woh woh woh woh	100		23 25									64.0
	26														
0.3	28		woh woh 1 1	100		28									54.6
0	30	-25		100		30						30.0 / -25.4 Gray, CLAY, trace fine Sand. **CH**	80	53	61.0
	32					32									
	34	-30	woh woh woh woh	85		33 35									79.9
	36														
	38		woh woh 2 1	100		38							83	58	63.1
	40	-35													

REMARKS: RIG TYPE: Truck Mounted CME-75HD.
4" ID casing to 4 ft., drilling with mud after 6', backfilled and capped with cold patch AC on 7-30-2010.

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10BH-003

SPT_LOGA:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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STATION: OFFSET:
LATITUDE: 36.856000°N LONGITUDE: 76.317540°W
SURFACE ELEVATION: 4.6 ft COORD. DATUM: NAD 83

Date(s) Drilled: 7/29/2010 - 7/29/2010
Drilling Method(s): Rotary Wash
SPT Method: Safety Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Jeremy Raasio
Logger: Carroll Stewart, Evan Garich

GROUND WATER

FIELD DATA | **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	40			25		40									67.2
	42					42									
	44	-40	woh woh 1 2	100		43 45							84	55	62.8
	46														
	48		1 1 1 1	100		48									63.6
	50	-45		95		50							95	65	63.6
	52					52									
	54	-50	woh 1 1 3	100		53 54.5						-trace shell fragments, 53'	88	60	68.8
	56					55						54.5 / -49.9 Brown, fibrous PEAT. **PT**			83.3
	58	-55	woh 2 1 2	100		58						58.0 / -53.4 Gray, organic CLAY, trace(+) brown Peat fibers scattered throughout, organic odor. **OH**	84	56	66.3
	60			90		60									102.4
	62					62									
	64	-60	1 1 2 4	100		63 65						-brown, trace fine Sand, 63'	130	75	85.5
	66														
	68		2 2 2 4	100		68						-1/4" Peat lamination, 68'			69.7
0.75	70	-65		90		70									70.0
	72					72									
	74	-70	2 4 3 6	0		73 75						73.0 / -68.4 TABB FORMATION (Qt) Gray, medium to fine SAND, little(-) Clayey Silt. **SM**			
	76														
	78		8 7 11 10	55		78									23.2
	80	-75													

REMARKS: RIG TYPE: Truck Mounted CME-75HD.
4" ID casing to 4 ft., drilling with mud after 6', backfilled and capped with cold patch AC on 7-30-2010.

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10BH-003

SPT_LOGA:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-003
PAGE 3 OF 3

STATION: OFFSET:
LATITUDE: 36.856000°N LONGITUDE: 76.317540°W
SURFACE ELEVATION: 4.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 7/29/2010 - 7/29/2010
Drilling Method(s): Rotary Wash
SPT Method: Safety Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Jeremy Raasio
Logger: Carroll Stewart, Evan Garich

GROUND WATER

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	80														
	82														
	83														15.5
	84	-80	7 2 3 5	75		84						83.0 / -78.4 Gray, coarse to fine SAND, some Silty Clay, trace fine Gravel. **SC**	33	9	38.5
	85					85						83.5 / -78.9 YORKTOWN FORMATION (Ty) Green-gray, medium to fine SAND, little(+) Silt and Clay. **SM** -shell fragments and whole shells scattered throughout, 88'			
	86														
	88		6 10 16 18	100		88							28	5	32.3
	90	-85				90									
	92														
	93		5 6 12 18	90		93						-shell fragments scattered throughout, 93'			31.8
	94	-90				95									

REMARKS: RIG TYPE: Truck Mounted CME-75HD.
4" ID casing to 4 ft., drilling with mud after 6', backfilled and capped with cold patch AC on 7-30-2010.

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10BH-003

SPT_LOGA:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-004
PAGE 1 OF 3

STATION: OFFSET:
LATITUDE: 36.857030°N LONGITUDE: 76.316680°W
SURFACE ELEVATION: 5.9 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 7/28/2010 - 7/28/2010
Drilling Method(s): Rotary Wash
SPT Method: Safety Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Jeremy Raasio
Logger: Jason Kotova, Carroll Stewart

GROUND WATER

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
		5	8 18 50	67		0.5						0.0 / 5.9 ARTIFICIAL FILL (af) Asphalt. **ASPH**			9.0
	2		38 48 38 14	70		2						0.5 / 5.4 Gray-brown, coarse to fine SAND, little(+) coarse to fine Gravel, little(+) Clayey Silt, Asphalt piece at bottom a sample. **SM**			8.5
	4		16 16 14 8	50		4 5									11.2 13.4
	6	0	2 1 2 2	65		6						-brown-gray, and coarse to fine Gravel, little Clayey Silt, trace Asphalt, 2'	40	23	28.7
	8		2 1 2 1	70		8						6.0 / -0.1 ALLUVIUM (Qal) Gray, Silty CLAY, and coarse(-) to fine Sand, trace brown organic fibers. **CL**			29.3
0.5	10	-5		73		10 11.5						8.0 / -2.1 Gray, coarse to fine SAND, and Silty Clay, trace brown organic fibers. **SC**			
	12		4 7 6 6	50		13						13.0 / -7.1 Gray, coarse to fine SAND, trace(-) Clayey Silt. **SP**			26.9
	14					15									
	16	-10													
	18		1 1 1 2	85		18						18.0 / -12.1 Gray, medium to fine SAND, little Silty Clay, trace shell fragments. **SC**	NP	NP	24.5
	20					20									
	22	-15													
	24		1 woh 1 woh	100		23 25						23.0 / -17.1 Gray, CLAY, and medium to fine Sand, trace shell fragments. **CH**			35.2
	26	-20		100		27									34.7
	28		woh woh woh woh	50		28						-and fine Sand, 28'			42.2
	30					30									
	32	-25		0		32									
	34		woh woh 1 1	20		33 35						-trace fine Sand, 33'	76	49	63.9
	36	-30				37						35.0 / -29.1 Gray, CLAY, trace(-) fine Sand. **CH**	97	65	70.7
	38		woh woh woh woh	100		38									75.3
0.3	40														

REMARKS: RIG TYPE: Truck Mounted CME-75HD.
4" ID casing to 4 ft., Boring caved at 12 ft. depth 7-29-2010, backfilled and capped with cold patch AC on 7-29-2010.

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10BH-004

SPT_LOGA:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-004
PAGE 2 OF 3

STATION: OFFSET:
LATITUDE: 36.857030°N LONGITUDE: 76.316680°W
SURFACE ELEVATION: 5.9 ft COORD. DATUM: NAD 83

Date(s) Drilled: 7/28/2010 - 7/28/2010
Drilling Method(s): Rotary Wash
SPT Method: Safety Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Jeremy Raasio
Logger: Jason Kotova, Carroll Stewart

GROUND WATER

FIELD DATA | **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
	40	-35											99	66	79.7
	42					42									
	43											43.0 / -37.1 Gray, Silty CLAY, little(-) fine Sand. **CH**	62	39	62.2
	44		woh woh woh woh												
	45					45						-some(-) fine Sand, scattered shell fragments, 47'			
	46	-40											52	28	61.2
	47					47									
	48		woh woh woh woh	100		48						-occasional Sand lenses, 48'-50'	58	38	42.6
	50					50						-little fine Sand, scattered shell fragments, 52'			47.5
	52	-45				52									
	53		woh 1			53						53.0 / -47.1 Gray, Silty CLAY. **CH**			
	54		1 2	15											
	55					55									
	56	-50													
	58		woh 1			58									68.7
	60		3 3			60						60.0 / -54.1 Brown, organic Clayey SILT, and fibrous Peat. **OL**			91.4
	62	-55		100		62									
	63					63									187.9
	64		1 2 2 3	100		64						63.0 / -57.1 Brown, fibrous PEAT, and organic Clay. **PT**			60.0
	65					65						63.2 / -57.3 Gray, CLAY, trace fine Sand. **CH**			
	66	-60													
	68		1 2 1 3	100		68						-slight organic odor, 68'	84	57	57.8
	70					70									
	72	-65													
	73					73						-gray-brown, scattered brown organic fibers, 73'			64.9
	74		1 2 3 4	100											
	75					75									
	76	-70													
	78		5 10 21 22	60		78						78.0 / -72.1 TABB FORMATION (Qt)			24.2
	80														

REMARKS: RIG TYPE: Truck Mounted CME-75HD.
4" ID casing to 4 ft., Boring caved at 12 ft. depth 7-29-2010, backfilled and capped with cold patch AC on 7-29-2010.

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10BH-004

SPT_LOGA:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-004
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STATION: OFFSET:
LATITUDE: 36.857030°N LONGITUDE: 76.316680°W
SURFACE ELEVATION: 5.9 ft COORD. DATUM: NAD 83

Date(s) Drilled: 7/28/2010 - 7/28/2010
Drilling Method(s): Rotary Wash
SPT Method: Safety Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Jeremy Raasio
Logger: Jason Kotova, Carroll Stewart

GROUND WATER

FIELD DATA | **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)
	80	-75										Brown-gray, medium to fine SAND, trace Clayey Silt. **SP**			
	82														
	83		21 20 11 11	60								-gray-tan, 83'			20.7
	84											-gray, coarse to fine SAND, 84'			21.8
	85														
	86	-80													
	88		15 21 21 17	40								-gray, coarse to fine SAND, 88'			19.2
	89											-gray-light gray, coarse to fine SAND, 89'			20.1
	90														
	92	-85													
	93		19 16 21 15	55								-gray-tan, coarse to fine SAND, trace fine Gravel, 93'			18.4
	94														
	95														
	96	-90													
	98		19 25 26 24	50								98.0 / -92.1 Gray, coarse to fine SAND, some(-) Clayey Silt, trace fine Gravel, shell layer near bottom of sample. **SM**			16.3
	100											100.0 / -94.1 YORKTOWN FORMATION (Ty) Green-gray, medium to fine SAND, some Clay and Silt, shell fragments scattered throughout. **SC**			
	102	-95													
	103		6 7 14 39	100											36.1
	104														
	105														
	106	-100													
	108		6 8 11 12	100								-and Clay and Silt, grading to medium to fine(+) SAND.	40	14	35.8
	110														

REMARKS: RIG TYPE: Truck Mounted CME-75HD.
4" ID casing to 4 ft., Boring caved at 12 ft. depth 7-29-2010, backfilled and capped with cold patch AC on 7-29-2010.

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10BH-004

SPT_LOGA:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-005
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STATION: OFFSET:
LATITUDE: 36.857335°N LONGITUDE: 76.315902°W
SURFACE ELEVATION: -16.0 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/11/2010 - 8/12/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Rodney Sedillo, Carroll Stewart

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
2		woh woh woh woh	5		2						0.0 / -16.0 ALLUVIUM (Qal) Gray, fine SAND, and Clay and Silt, trace shell fragments. **SC**			
4	-20				4									
6											Hard drilling from 5'-7' (bit chatter), large shell fragments in wash water.			
8		woh woh woh woh	15		7 9						7.0 / -23.0 Gray, Clay and Silt, trace fine Sand, trace shell fragments. **CL**			
10	-25													
12		woh woh	100		12						12.0 / -28.0 Gray, CLAY, little medium to fine Gravel, trace coarse to fine Sand, trace shell fragments. **CH**	84	56	77.8
14	-30	w woh	100		13 14						13.2 / -29.2 Gray, CLAY, little medium to fine Sand. **CH**			
16														
18		woh woh woh woh	100		17 19						-strong creosote odor, 17'	94	63	77.9
20	-35				20						-little shell fragments, 20'			82.9
22		woh woh woh woh	100		22						22.8 / -38.8 Gray, Silty CLAY, and medium to fine SAND, strong creosote odor. **CH**			
24	-40				24									
26														
28		wor wor wor wor	100		27						-occasional coarse to fine(-) Sand seams 1/8" to 1" thick, 27'			47.2
30	-45				29									
32		wor wor woh woh	100		32						-interbedded medium to fine SAND, seams are 1/8" to 1.5" thick, faint creosote odor, 32'			41.8
34	-50				34									
36														
38		woh woh woh woh	100		37 39						37.0 / -53.0 Gray, Organic CLAY, trace medium to fine Sand, trace brown organic fibers scattered throughout. **OH**	107	69	78.3
40	-55													

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 24 ft. below the mudline.

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10BH-005

SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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STATION: OFFSET:
LATITUDE: 36.857335°N LONGITUDE: 76.315902°W
SURFACE ELEVATION: -16.0 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/11/2010 - 8/12/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Rodney Sedillo, Carroll Stewart

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND / SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
42		woh woh	100	42–43						-trace fine Sand, 42'			83.2
44	-60	woh 1	100	44–45						43.7 / -59.7 Brown, fibrous PEAT interlayered with gray, organic Clay. **PT**	196	75	134.6
46			100	45–47									92.6
48	-65	woh woh woh woh	100	47–49							106	64	76.2
50													
52		5 5 6 6	90	52–54						52.0 / -68.0 TABB FORMATION (Qt) Gray, mottled dark gray, fine SAND, trace Clayey Silt, trace brown organic fibers. **SP**			23.3
54	-70												
56													
58	-75	2 3 3 8	65	57–59									
60													
62		3 7 7 9	40	62–64						62.0 / -78.0 Gray, interlayered fine SAND, little(-) Clayey Silt, trace shell fragments, trace brown organic lamination. **SM**	23	NP	23.3
64	-80												
66													
68	-85	6 8 9 10	55	67–69									19.7
70													
72		4 5 5 4	55	72–74						72.0 / -88.0 Gray, coarse to fine SAND, trace fine Gravel, trace Clayey Silt. **SP**			12.2
74	-90												
76													
78	-95	5 6 7 9	50	77–79						77.0 / -93.0 Gray, coarse to fine SAND, trace fine Gravel, little(+) Clayey Silt. **SM**	20	NP	19.8
80													

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 24 ft. below the mudline.

SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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VDOT Virginia Department of Transportation

PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-005
PAGE 3 OF 3

STATION: OFFSET:
LATITUDE: 36.857335°N LONGITUDE: 76.315902°W
SURFACE ELEVATION: -16.0 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/11/2010 - 8/12/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Rodney Sedillo, Carroll Stewart

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
82		2 3 5 10	100		82						82.0 / -98.0 YORKTOWN FORMATION (Ty) Green-gray, medium to fine SAND, some Silty Clay, trace shell fragments scattered throughout. **SC**			
84	-100				84									
86														
88	-105	2 3 4 6	100		87 89						-medium(-) to fine SAND, and Silty Clay, 87'	49	30	33.9
90														
92		2 3 5 7	100		92									
94	-110				94									
96														
98	-115	2 2 2 6	100		97 99						-occasional shell fragments in beds 1/2" to 3/4" thick, 97'	45	29	36.2
100														
102		1 2 2 6	100		102						-some Clay and Silt, numerous shell fragments scattered throughout, 102'	39	20	32.5
104	-120				104									
106														
108	-125	5 4 7 19	100		107 109						-green-gray, 107'			31.0
110														
112		4 5 5 10	100		112									
114	-130				114									

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 24 ft. below the mudline.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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PAGE 1 OF 3

STATION: OFFSET:
LATITUDE: 36.857780°N LONGITUDE: 76.315447°W
SURFACE ELEVATION: -35.8 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/19/2010 - 8/19/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Rodney Sedillo, Carroll Stewart

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
0											0.0 / -35.8 ALLUVIUM (Qal) Dark gray-black, Organic CLAY, trace fine Sand, organic odor. **OH**			
2		wor			2									
		wor												
4	-40	wor	100		3							87	61	90.0
		wor			4						-gray, trace(+) medium to fine Sand, 3.4'			
6														
					7						7.0 / -42.8 Gray, Silty CLAY, trace fine Sand. **CH**			
8		woh												66.8
		woh												
	-45	woh	100		9									
		woh												
10														
12		woh			12						-occasional shell fragments, 12'			
		woh												
		woh	100											
14	-50	woh			14									
16														
		woh			17						-little(+) medium to fine Sand, 17'	57	40	55.2
18		1 1	100		18						17.9 / -53.7	292	184	145.1
			100		19						Brown-gray, Organic CLAY, organic odor. **OH**			
	-55										-interlayered with brown, fibrous Peat, 17.9-19'			
20					20									
			100											86.8
22		woh			22						-trace(-) fine Sand, 22'			
		woh												
		woh	100									104	73	78.1
24	-60	woh			24									
26														
		wor			27						27.0 / -62.8 Gray, Silty CLAY. **CH**			
28		wor												
		wor	100											
	-65	wor			29									
30														
32		wor			32						-brownish-gray, little fine Sand, brown organic fibers throughout, slight organic odor, 32'			
		wor												76.2
		wor	100											
34	-70	wor			34									
36														
		2 2			37						37.0 / -72.8 Gray, Organic CLAY, trace fine Sand, organic odor. **OH**			
38		5 5	100									116	85	91.4
	-75				39						38.2 / -74.0			
40														

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 19 ft. below the mudline.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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PAGE 2 OF 3

STATION: OFFSET:
LATITUDE: 36.857780°N LONGITUDE: 76.315447°W
SURFACE ELEVATION: -35.8 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/19/2010 - 8/19/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Rodney Sedillo, Carroll Stewart

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
42		4 5 7 8	60		42						TABB FORMATION (Qt) Gray, fine SAND, trace Clayey Silt, trace brown organic fibers. **SP**			
44	-80				44									21.3
46														
48		1 3 2 3	90		47 48 49						-coarse to fine SAND, trace Silt and Clay, trace fine Gravel, trace shell fragments, 47' -medium to fine SAND, 48.5'			41.6 19.5
50	-85													
52		3 5 6 6	40		52						52.0 / -87.8 Gray, coarse to fine SAND, little Clayey Silt, trace brown organic fibers. **SM**	16	4	25.6
54	-90				54									
56														
58		2 4 7 6	45		57 59									13.5
60	-95													
62		3 2 6 6	100		62						62.0 / -97.8 YORKTOWN FORMATION (Ty) Green-gray fine SAND, Some(+) Silty Clay, trace shell fragments. **SC**	48	25	35.6
64	-100				64									
66														
68		2 3 3 6	100		67 69									
70	-105													
72		3 3 4 5	100		72							47	29	33.8
74	-110				74									
76														
78		3 3 5 6	100		77 79						77.0 / -112.8 Green-gray fine SAND, some Clay and Silt, trace shell fragments. **SC**			
80	-115													

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 19 ft. below the mudline.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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PAGE 3 OF 3

STATION: OFFSET:
LATITUDE: 36.857780°N LONGITUDE: 76.315447°W
SURFACE ELEVATION: -35.8 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/19/2010 - 8/19/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Rodney Sedillo, Carroll Stewart

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
82		2 2 4	100		82							37	15	33.8
84	-120	5			84									
86					87									
88		2 3 4	100		89									
90	-125	6												
92		3 4 6	100		92									32.9
94	-130	7			94									
96														
98		5 4 5	40		97						-medium to fine SAND, numerous shell fragments throughout, 97'			
100	-135	7			99									
102		1 2 4	100		102						102.0 / -137.8 Green-gray Silty CLAY **CH**			
104		5			104									

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 19 ft. below the mudline.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-007
PAGE 1 OF 3

STATION: OFFSET:
LATITUDE: 36.858395°N LONGITUDE: 76.314660°W
SURFACE ELEVATION: -48.2 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/17/2010 - 8/17/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Rodney Sedillo, Carroll Stewart

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND / SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
2	-50	wor wor wor wor	60	1 3						0.0 / -48.2 ALLUVIUM (Qal) Dark gray, Organic CLAY, trace medium to fine Sand, organic odor, spongy texture. **OH**			
6	-55	woh woh woh woh	100	6 8						-gray, trace fine Sand, 6'	107	76	94.0
12	-60	wor wor wor wor	100	11 13						-trace brown organic material in 1/16" thick layers, trace shell fragments, 11'			84.3
14			100	14						-gray, trace fine Sand, organic odor, 14'	98	40	70.8
16	-65	woh 2 3 5	100	16									74.9
18			100	17 18						17.5 / -65.7 TABB FORMATION (Qt) Gray, fine SAND, little Clay and Silt. **SC**			
22	-70	5 6 3 3	65	21 23						21.0 / -69.2 Gray, fine SAND, trace Clayey Silt. **SP**			27.2
26	-75	4 3 5 7	90	26 27						26.0 / -74.2 Gray, fine SAND, some(-) Clayey Silt. **SM**	32	NP	32.6
28			100	28						27.1 / -75.3 Light gray, fine SAND, trace Clayey Silt. **SP**			
32	-80	3 5 4 4	80	31 33						31.0 / -79.2 -gray, fine SAND, little(-) Clayey Silt. **SM**	24	NP	23.0
36	-85	4 4 5 9	100	36 37						36.0 / -84.2 Brown-gray, coarse to fine SAND, trace fine Gravel, trace Clayey Silt. **SP**	38	14	12.8 29.5
38			100	38						36.3 / -84.5 YORKTOWN FORMATION (Ty)			
40													

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 18 ft. below the mudline.
Driller noted loss of some drilling fluid beginning at 33'

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10BH-007

SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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PAGE 2 OF 3

STATION: OFFSET:
LATITUDE: 36.858395°N LONGITUDE: 76.314660°W
SURFACE ELEVATION: -48.2 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/17/2010 - 8/17/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Rodney Sedillo, Carroll Stewart

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
42	-90	2 2 4 7	100		41 43						Green-gray, medium to fine SAND, some(-) Clay and Silt, trace shell fragments. **SC** -interlayered with Brown-gray, coarse to fine SAND, little(-) Clayey Silt, trace fine Gravel, trace brown organic fibers, 36.3'-38'	43	19	33.8
44											-1/4" layer of brown organic fibers, 36.3'			
46	-95	2 2 3 7	100		46 48						-green-gray, medium to fine SAND, some Silt and Clay, trace sand-sized shell fragments throughout, 38' -trace sand-sized and occasional medium to fine gravel-sized shell fragments throughout, 41' -trace sand-sized and trace medium to fine gravel-sized shell fragments throughout, 46'			
48														
50														
52	-100	1 2 2 5	100		51 53						51.0 / -99.2 Green-gray, fine SAND, and Silty Clay, occasional whole shells throughout, trace sand-sized and trace gravel-sized shell fragments throughout. **SC**	49	27	33.6
54														
56	-105	2 3 5 7	100		56 58						56.0 / -104.2 Green-gray, medium(-) to fine SAND, and Clay and Silt, trace sand-sized and trace fine gravel-sized shell fragments throughout. **SC**			
58														
60														
62	-110	1 2 4 7	100		61 63						-occasional whole shells, 61'			33.4
64														
66	-115	1 1 2 3	100		66 68						66.0 / -114.2 Green-gray, medium to fine SAND, some Silty Clay. **SC**	46	25	34.4
68														
70														
72	-120	2 1 2 5	100		71 73						-two 1" thick coarse to fine gravel-sized shell beds, 71'-73'			29.6
74														
76	-125	2 4 5 9	85		76 78						76.0 / -124.2 Gray, fine SAND, some Clay and Silt, trace shell fragments. **SM**			30.8
78														
80														

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 18 ft. below the mudline.
Driller noted loss of some drilling fluid beginning at 33'

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10BH-007

SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-007
PAGE 3 OF 3

STATION: OFFSET:
LATITUDE: 36.858395°N LONGITUDE: 76.314660°W
SURFACE ELEVATION: -48.2 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/17/2010 - 8/17/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Rodney Sedillo, Carroll Stewart

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
82	-130	3 5 7 10	100		81 83									31.8
84														
86	-135	3 3 4 7	100		86 88						-blue-gray, 86'	40	18	28.4
88														
90														
92	-140	2 2 3 5	100		91 93									

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 18 ft. below the mudline.
Driller noted loss of some drilling fluid beginning at 33'

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10BH-007

SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-008
PAGE 1 OF 3

STATION: OFFSET:
LATITUDE: 36.859001°N LONGITUDE: 76.314007°W
SURFACE ELEVATION: -47.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/16/2010 - 8/16/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Rodney Sedillo, Carroll Stewart

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND / SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
2	-50	wor wor wor wor	100	1.5–3.5						0.0 / -47.5 ALLUVIUM (Qal) Gray, Organic CLAY, little coarse to fine Sand, trace brown organic material, slight organic odor. **OH**			
6	-55	woh woh woh woh	100	6.5–8.5						-occasional layers of coarse to fine Sand, trace wood fragments, trace shell fragments, occasional 1/8" thick brown organic layers, 6.5'	111	78	92.2
12	-60	wor wor wor woh	100	11.5–13.5						-dark gray, trace medium to fine Sand, 11.5'	138	103	91.5
14			95	14.5									31.1
16										15.5 / -63.0 TABB FORMATION (Qt) Gray, medium to fine SAND, trace Silt and Clay, brown organic fibers scattered throughout. **SP** -trace Clayey Silt, trace organic material, 16.5' -1/8" thick layer of brown organic material, ~17'			
18	-65	woh 1 1	65	16.5–18.5							21	NP	29.9
22	-70	woh woh 1 1	45	21.5–23.5						21.5 / -69.0 Gray, coarse to fine SAND, little Clayey Silt. **SM**	25	NP	35.4
26	-75	4 4 5 6	75	26.5–28.5						-strong organic odor during sample retrieval, 26.5'-28.5'	15	NP	25.4
32	-80	6 7 9 10	50	31.5–32.5						-medium gray, medium to fine SAND, 31.5'			23.9
			100	32.5–33.5						32.1 / -79.6 Light gray, coarse(-) to fine SAND, trace(+) Clay and Silt. **SP**	44	13	33.7
38	-85	2 3 6 8	100	36.5–38.5						36.5 / -84.0 YORKTOWN FORMATION (Ty) Green-gray medium to fine SAND, some Clay and Silt, trace shell fragments scattered throughout. **SC**	41	13	33.1
40				39.5									

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 23.5 ft. below the mudline.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-008
PAGE 2 OF 3

STATION: OFFSET:
LATITUDE: 36.859001°N LONGITUDE: 76.314007°W
SURFACE ELEVATION: -47.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/16/2010 - 8/16/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Rodney Sedillo, Carroll Stewart

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND / SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
42	-90	3 4 6	95 / 100	41.5 – 43.5						39.5 / -87.0 Gray-green medium to fine SAND, some Silt and Clay, trace whole shell fragments scattered throughout. **SM**			33.4
46	-95	3 3 5	100	46.5 – 48.5						46.5 / -94.0 Gray, fine SAND, some Silty Clay, trace whole shells and shell fragments scattered throughout. **SC**	47	22	34.3
52	-100	2 2 4	100	51.5 – 53.5						-trace shell fragments scattered throughout, 51.5'			
56	-105	2 3 4	100	56.5 – 58.5						56.5 / -104.0 Gray, medium to fine SAND, and Silty Clay, shell fragments scattered throughout. **SC**	55	37	35.2
62	-110	2 2 4	100	61.5 – 63.5						-fine SAND, 61.5'	52	32	36.7
66	-115	1 2 3	100	66.5 – 68.5						66.5 / -114.0 Gray, medium(-) to fine SAND, some Clay and Silt, trace shell fragments scattered throughout. **SC**			31.6
72	-120	1 2 7	100	71.5 – 73.5						-interlayered with gray coarse to fine Sand, some Clay and Silt, numerous whole and shell fragments scattered throughout, 71.5'			
76	-125	8 9 23 30	100	76.5 – 78.5						76.5 / -124.0 Blue-gray, fine SAND, some Clay and Silt. **SC**	39	16	27.6

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 23.5 ft. below the mudline.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-008
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STATION: OFFSET:
LATITUDE: 36.859001°N LONGITUDE: 76.314007°W
SURFACE ELEVATION: -47.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/16/2010 - 8/16/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Rodney Sedillo, Carroll Stewart

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
82	-130	7 7 12 22	100		81.5 – 83.5						-gray, 86.5'			
84														
86		woh 2			86.5 – 88.5									28.5
88	-135	7 9	100											
90														
92	-140	2 3 3 4	100		91.5 – 93.5									

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 23.5 ft. below the mudline.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-009
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STATION: OFFSET:
LATITUDE: 36.860022°N LONGITUDE: 76.312498°W
SURFACE ELEVATION: -13.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/10/2010 - 8/10/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Rodney Sedillo

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
0											0.0 / -13.5 ALLUVIUM (Qal) Gray, medium to fine SAND, and Silt and Clay, few shell fragments. **SM**			
2	-15	woh			3									
4		woh	5											
6		woh 1			5									
8	-20	1			8						-trace shell fragments, 8'			
10		woh	90		10						8.7 / -22.2 Gray, CLAY, trace fine Sand. **CH**	89	63	80.5
12	-25	woh	100		11									89.6
14		woh	90		13							97	71	87.6
16	-30	woh 1	85		15 17							100	74	89.1
18														
20		wor			20						-trace shell fragments, 20'			
22	-35	woh	80		22									79.1
24		woh	100		23							113	82	89.2
26	-40	wor	100		25 27									
28		wor												
30		wor	95		30									
32	-45	wor			32							103	76	79.3
34														
36	-50	wor	90		35 37									88.4
38		wor												
40														

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 15 ft. below the mudline.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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STATION: OFFSET:
LATITUDE: 36.860022°N LONGITUDE: 76.312498°W
SURFACE ELEVATION: -13.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/10/2010 - 8/10/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Rodney Sedillo

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
40		wor wor wor woh	95		40						-occasional organic partings, 40'	112	83	86.1
42	-55				42						-1/2" brown organic seam, 41.2'			
44			90		43							115	82	81.2
46	-60	1 1 1 1	90		45 47									
48														
50		3 3 4 3	90		50						50.0 / -63.5 TABB FORMATION (Qt) Gray and blue-gray, medium to fine SAND, trace Clayey Silt. **SP**			16.6
52	-65				52									
54														
56	-70	3 5 6 10	0		55 57						-loss of drilling fluid at 57', driller believes "gravelly"			
58											57.0 / -70.5 YORKTOWN FORMATION (Ty) Gray, fine SAND, little Clay and Silt, trace shell fragments and whole shells. **SM**			
60		4 5 7 10	100		60									
62	-75				62							38	15	32.5
64														
66	-80	2 4 7 11	100		65 67						-medium to fine SAND, 65'			
68														
70		4 4 4 7	95		70						70.0 / -83.5 Gray, fine SAND, and(-) Silty Clay, trace shell fragments. **SC**	45	26	37.7
72	-85				72									
74														
76	-90	2 3 4 7	100		75 77									35.2
78														
80														

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 15 ft. below the mudline.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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STATION: OFFSET:
LATITUDE: 36.860022°N LONGITUDE: 76.312498°W
SURFACE ELEVATION: -13.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/10/2010 - 8/10/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Rodney Sedillo

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB DATA: LIQUID LIMIT (LL)	LAB DATA: PLASTICITY INDEX (PI)	LAB DATA: MOISTURE CONTENT (%)
80														
82	-95	4 4 5 9	100		82									
84														
85					85									
86	-100	2 3 3 6	100		87							55	38	34.5
88														
90					90									
92	-105	3 3 5 8	100		92									

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 15 ft. below the mudline.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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STATION: OFFSET:
LATITUDE: 36.860439°N LONGITUDE: 76.311769°W
SURFACE ELEVATION: -6.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/11/2010 - 8/11/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Rodney Sedillo

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
0		1 wor			0						0.0 / -6.6 ALLUVIUM (Qal) Gray, medium to fine(+) SAND, little(+) Clayey Silt, trace shell fragments. **SM**			
2		wor			2									
4	-10													
6		wor wor wor	40		5						5.0 / -11.6 Gray, CLAY, trace fine Sand. **CH**	77	58	73.1
8	-15				7									
10		wor wor wor	95		10							101	78	90.7
12					12									
14	-20		100		13									90.6
16		wor wor wor wor	100		15							110	86	97.7
18	-25				17						-trace shell fragments, 16.5'-25'			
20		wor wor woh woh	75		20									
22					22									
24	-30													
26		wor woh woh woh	60		25							102	77	80.8
28					27									
30	-35													
32		woh woh woh woh	100		30									79.8
34	-40		105		32									78.7
36		woh woh woh woh	90		35							103	77	74.7
38	-45				37									
40														

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 47 ft. below the mudline.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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STATION: OFFSET:
LATITUDE: 36.860439°N LONGITUDE: 76.311769°W
SURFACE ELEVATION: -6.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/11/2010 - 8/11/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Rodney Sedillo

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
40		woh woh woh woh	100		40						-trace shell fragments, 40'	104	77	83.6
42					42									
44	-50													
45		wor wor woh 1	100		45						-trace brown fibrous organics, 45'			80.1
46			100		46									31.6
47					47						46.8 / -53.4			
48	-55										TABB FORMATION (Qt)			
											Gray, fine SAND, some(-) Silt and Clay, trace brown organics. **SM**			
50		woh woh woh 2	60		50						-blue-gray, 50'	31	7	26.7
52					52									
54	-60													
55		2 1 1 2	90		55						-blue-gray, 55'			
56											-gray, 56.6'			
57					57									
58	-65													
60		3 4 7 11	100		60						60.0 / -66.6			
62					62						YORKTOWN FORMATION (Ty)	38	9	33.9
											Gray, fine SAND, some(-) Silt and Clay, trace shell fragments scattered throughout. **SM**			
64	-70													
65		3 4 6 10	100		65						65.0 / -71.6			
66											Gray, fine SAND, some(-) Clay and Silt, trace shell fragments scattered throughout. **SC**			31.7
67					67									
68	-75													
70		5 6 8 12	100		70						-little(+) Clay and Silt, 70'	39	11	30.8
72					72									
74	-80													
75		5 6 6 8	30		75						-and(-) Clay and Silt			
76														39.5
77					77									
78	-85													
80														

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 47 ft. below the mudline.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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STATION: OFFSET:
LATITUDE: 36.860439°N LONGITUDE: 76.311769°W
SURFACE ELEVATION: -6.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/11/2010 - 8/11/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Rodney Sedillo

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
80														
82		2 3 3 7	100		80 82							48	19	38.7
84	-90													
85					85									
86		2 3 4 7	100											33.0
87					87									
88	-95													
90		2 3 4 7	100		90									
92					92									

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 47 ft. below the mudline.

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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STATION: OFFSET:
LATITUDE: 36.860832°N LONGITUDE: 76.311166°W
SURFACE ELEVATION: -4.3 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/13/2010 - 8/13/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Rodney Sedillo, Carroll Stewart, Todd Grifka

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
2	-5	2 3 3 1	0		2 4						0.0 / -4.3 ARTIFICIAL FILL (af) Probable sandy fill based on recovery and penetration resistance. **FL**			
6	-10	wor wor wor wor	100		7 9						7.0 / -11.3 ALLUVIUM (Qal) Gray, CLAY, trace(+) fine Sand. **CH**			56.5
10	-15		100		10							101	78	90.8
12		wor wor wor wor	100		12 14									
16	-20				17									
18		wor wor wor wor	100		19							108	81	90.5
20	-25													
22		wor wor wor wor	100		22 24									
24					25						25.0 / -29.3 Gray, CLAY, trace medium to fine Sand. **CH**			
26	-30		100		27							100	74	78.6
28		woh woh woh woh	100		29									
30	-35													
32		woh woh w woh	100 100		32 33 34							63	45	54.2 75.9
36	-40										32.7 / -37.0 Gray, CLAY, little medium to fine Sand, trace shell fragments. **CH**			
38		2 3 1 1	70 100		37 38 39						37.0 / -41.3 Gray, Silty CLAY, trace medium to fine Sand, trace shell fragments. **CH**			29.8
40														

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 28 ft. below the mudline.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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STATION: OFFSET:
LATITUDE: 36.860832°N LONGITUDE: 76.311166°W
SURFACE ELEVATION: -4.3 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/13/2010 - 8/13/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Rodney Sedillo, Carroll Stewart, Todd Grifka

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
42	-45	1 1 1 1	95		42 44						37.9 / -42.2 TABB FORMATION (Qt) Gray, mottled yellow-brown, fine SAND, little Clay and Silt. **SC** -yellow-brown to rust brown, 42'			34.1
46	-50	4 3 2 2	100		47 49						47.0 / -51.3 YORKTOWN FORMATION (Ty) Green-gray, fine SAND, some(-) Clay and Silt. **SC**			33.9
52	-55	3 5 8 12	100		52 54						-trace shell fragments scattered throughout, 52'			31.3
58	-60	3 7 11 12	100		57 59						-some Clay and Silt, 57'	40	14	33.5
62	-65	4 6 10 11	100		62 64						62.0 / -66.3 Gray, medium to fine SAND, some Clay and Silt, trace shell fragments scattered throughout. **SC**			36.1
68	-70	3 6 8 13	100		67 69									
72	-75	2 5 6 12	100		72 74						-fine SAND, 72'	41	10	32.9
78	-80	3 6 7 12	100		77 79									
80														

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 28 ft. below the mudline.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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STATION: OFFSET:
LATITUDE: 36.860832°N LONGITUDE: 76.311166°W
SURFACE ELEVATION: -4.3 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/13/2010 - 8/13/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Rodney Sedillo, Carroll Stewart, Todd Grifka

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
82	-85	2 3 3 10	100		82 84									35.4
84														
86	-90	1 2 3 6	100		87 89									
88														
90	-95	2 3 4 7	100		92 94						-fine SAND, 92'			39.2
92														
94														

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 28 ft. below the mudline.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-012
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STATION: OFFSET:
LATITUDE: 36.860824°N LONGITUDE: 76.310752°W
SURFACE ELEVATION: -6.0 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/20/2010 - 8/20/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Todd Grifka

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
2											0.0 / -6.0 ALLUVIUM (Qal) Gray, CLAY, little fine Sand. **CH**			
4	-10													
6														
8	-15													
10														
12		wor wor wor wor	100		11 13							83	61	70.0
14	-20													
16			100		16 18						-and medium(-) to fine Sand, 16'			46.0
18	-25													
20														
22		woh woh woh woh	100		21 23						21.0 / -27.0 Gray, medium(-) to fine SAND, some Clay and Silt. **SC**	35	16	34.9
24	-30													
26		4 11 12 13	25		26 28						26.0 / -32.0 TABB FORMATION (Qt) Brown-tan, coarse to fine SAND, trace Clayey Silt. **SP**			10.9
28														
30	-35													
32		1 2 3 4	65		31 33						31.0 / -37.0 Light gray, mottled orange, medium(-) to fine SAND, little Clayey Silt. **SM**	31	2	30.4
34	-40													
36		1 2 2 3	100		36 38						-brown, 36'			
38														
40	-45													

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 20 ft. below the mudline

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
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STATION: OFFSET:
LATITUDE: 36.860824°N LONGITUDE: 76.310752°W
SURFACE ELEVATION: -6.0 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/20/2010 - 8/20/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Todd Grifka

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
42		1 2 2 2	75		41 43						41.0 / -47.0 Gray, fine SAND, some Silt and Clay. **SM**	33	8	36.0
44	-50													
46		5 7 10 11	90		46 48						46.0 / -52.0 YORKTOWN FORMATION (Ty) Green-gray, fine SAND, little Clay and Silt, trace shell fragments scattered throughout. **SC**			30.4
48	-55													
50					51									
52			90		53									
54	-60													
56		3 5 7 10	100		56 58									
58														
60	-65													
62		2 5 6 10	100		61 63							41	12	35.6
64	-70													
66					66									
68			75		68									
70	-75													
72		2 4 8 10	100		71 73						-some Clay and Silt, 71'	43	13	35.1
74	-80													
76					76									
78			90		78									
80	-85													

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 20 ft. below the mudline

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-012
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STATION: OFFSET:
LATITUDE: 36.860824°N LONGITUDE: 76.310752°W
SURFACE ELEVATION: -6.0 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/20/2010 - 8/20/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Todd Grifka

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
82		3 4 5 9	100		81 83						-some Clay and Silt, 81'			

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 20 ft. below the mudline

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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STATION: OFFSET:
LATITUDE: 36.861900°N LONGITUDE: 76.309200°W
SURFACE ELEVATION: 3.8 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 7/26/2010 - 7/26/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Jeremy Raasio
Logger: Todd Grifka

GROUND WATER

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	0		5 6 10 11	75		0						0.0 / 3.8 ARTIFICIAL FILL (af) Topsoil. **FL**			8.9
	2		11 11 12 14	50		2						0.3 / 3.5 Light brown, medium to fine SAND, little Clayey Silt. **SM**			15.7
	4	0	7 8 10 9	75		4						4.0 / -0.2 Light brown, coarse to fine SAND, trace fine Gravel, trace Clayey Silt. **SP**			16.3
	6		3 3 3 3	75		6									17.4
	8	-5	2 3 3 3	75		8									19.3
	10					10									
	12														
	14	-10	1 2 1 1	40		13						13.0 / -9.2 ALLUVIUM (Qal) Gray, coarse to fine SAND, and Silty Clay. **SC**			18.7
	16			95		15						15.0 / -11.2 Brown-gray, medium to fine SAND, trace Clayey Silt. **SP**			
	18	-15	1 1 2 1	85		17									28.8
	20					19									
	22														
0.5	24	-20	1 woh 1 woh	85		23						23.0 / -19.2 Gray, CLAY, trace fine Sand. **CH**			66.7
	26			45		25							83	54	63.4
0.25	28	-25	woh woh woh woh	100		27									57.1
	30					29									
	32														
0	34	-30	woh woh 1 1	100		33						-Silty CLAY 33'	64	39	51.8
	36			100		35							68	42	52.1
	38	-35	woh woh woh woh	85		37									60.5
0.25	40					38						38.0 / -34.2 Gray, fine SAND, and Clay, trace organics. **SC**			

REMARKS: RIG TYPE: Track Mounted CME-45.
4" ID casing to 5 ft., boring caved at 3.8 ft. depth on 7-27-2010.

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SPT_LOGA:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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PAGE 2 OF 3

STATION: OFFSET:
LATITUDE: 36.861900°N LONGITUDE: 76.309200°W
SURFACE ELEVATION: 3.8 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 7/26/2010 - 7/26/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Jeremy Raasio
Logger: Todd Grifka

GROUND WATER

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	40			90		40									
	42					42									
0.25	44	-40	woh woh woh 1	85		43									77.2
	46			100		45						-little Clay, 46'	112	60	77.9
	48					47									
	50	-45	2 2 5 7	65		48						48.0 / -44.2 TABB FORMATION (Qt) Green-brown, medium to fine SAND, little Clayey Silt. **SP**			24.3
	52					50									
	54	-50	woh woh 1 1	100		53						53.0 / -49.2 Green-brown, medium to fine SAND, and Clayey Silt. **SM**	24	3	31.8
	56					55									
	58	-55	2 2 5 10	40		58						58.0 / -54.2 YORKTOWN FORMATION (Ty) Green-brown, medium to fine SAND, and Clayey Silt. **SM**			53.9
	60					60									
	62					63									
	64	-60	5 7 7 11	100		65						63.0 / -59.2 Gray, coarse to fine SAND, little Clayey Silt, trace shell fragments. **SM**	27	2	31.6
	66														
	68	-65	3 5 7 10	100		68						-medium to fine SAND, 68'			32.6
	70					70									
	72					73							32	6	32.5
	74	-70	4 5 7 11	100		75									
	76														
	78	-75	5 7 9 12	100		78									34.9
	80														

REMARKS: RIG TYPE: Track Mounted CME-45.
4" ID casing to 5 ft., boring caved at 3.8 ft. depth on 7-27-2010.

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10BH-013

SPT_LOGA:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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PAGE 3 OF 3

STATION: OFFSET:
LATITUDE: 36.861900°N LONGITUDE: 76.309200°W
SURFACE ELEVATION: 3.8 ft COORD. DATUM: NAD 83

Date(s) Drilled: 7/26/2010 - 7/26/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Jeremy Raasio
Logger: Todd Grifka

GROUND WATER

FIELD DATA													LAB DATA		
			SOIL				ROCK								
PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	STANDARD PENETRATION TEST HAMMER BLOWS	SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	CORE RECOVERY (%)	ROCK QUALITY DESIGNATION	DIP ° STRATA	DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
						80									

REMARKS: RIG TYPE: Track Mounted CME-45.
4" ID casing to 5 ft., boring caved at 3.8 ft. depth on 7-27-2010.

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SPT_LOGA:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-014

STATION: OFFSET:
LATITUDE: 36.862160°N LONGITUDE: 76.308770°W
SURFACE ELEVATION: 3.8 ft COORD. DATUM: NAD 83

Date(s) Drilled: 7/26/2010 - 7/26/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Jeremy Raasio
Logger: Todd Grifka, Carroll Stewart, Jason Kotova

GROUND WATER

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)
	0	0	11 6 10	100		0						0.0 / 3.8 ARTIFICIAL FILL (af) Yellow-brown, coarse to fine(+) SAND, little Clayey Silt, trace fine Gravel. **SM** -rods bouncing on obstruction (50/0.5"); Moved rig north-east approximately 2 ft and resampled 2'-4' depth.	NP	NP	5.6 15.1
	2		5 5 4 5	75		2									
	4		4 3 3 2	100		4									17.9
	6		2 2 2 3	45		6						2.0 / 1.8 ALLUVIUM (Qal) Tan, coarse to fine SAND, trace Clayey Silt, trace(-) fine Gravel. **SP** -little medium to fine Gravel, 4' -trace medium to fine subrounded Gravel, 6' -some medium to fine subrounded Gravel, 8'			23.0
	8	-5	2 3 1 2	65		8									19.5
	10					10									
	12					13									
	14	-10	2 2 4 4	50		15						13.0 / -9.2 Gray, coarse to fine SAND, little(+) Clayey Silt. **SM**			27.9
	16														
	18					18									
	20	-15	2 1 1 2	40		19 20						18.0 / -14.2 Gray, coarse(-) to fine SAND, some(-) Clayey Silt, scattered wood fragments. **SM**			40.2
	22			100		22						18.6 / -14.8 Gray, Clay and Silt, some coarse to fine Sand. **CH**	91	59	58.4
	24	-20	woh woh woh woh	100		23 25						20.0 / -16.2 Gray, organic CLAY, abundant shell fragments, strong organic odor. **OH** -trace shell fragments, 23'			69.5
	26			65		27									
	28	-25	woh woh woh woh	100		28						28.0 / -24.2 Gray, Silty CLAY. **CH**			49.7
	30			75		30						30.0 / -26.2 Gray, Clay and Silt, some(-) fine Sand. **CL**			48.3
	32					32									
	34	-30	woh woh woh woh	100		33 35						33.0 / -29.2 Gray, Silty CLAY, some(-) fine SAND, trace organic fibers less than 2mm in length scattered throughout. **CH**			53.6
	36			65		37									45.0
	38					38									
0.3	40	-35	woh woh woh woh	100											65.7

REMARKS: RIG TYPE: Track Mounted CME-45.
4" ID casing to 4 ft., boring caved at 3.3 ft. depth on 7-27-2010.

SPT_LOGA:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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STATION: OFFSET:
LATITUDE: 36.862160°N LONGITUDE: 76.308770°W
SURFACE ELEVATION: 3.8 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 7/26/2010 - 7/26/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Jeremy Raasio
Logger: Todd Grifka, Carroll Stewart, Jason Kotova

GROUND WATER

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	40					40						40.0 / -36.2 Dark brown, organic Clayey Silt, trace Peat fibers. **OL**			184.5
	42			90		42									
			woh 2			43									34.8
	44	-40	3 4	100		45						43.0 / -39.2 Dark brown, medium to fine SAND, and organic Clayey Silt, trace Peat fibers. **SM**			
	46														
	48		1 2			48						48.0 / -44.2 TABB FORMATION (Qt) Green-gray, medium to fine SAND, some(-) Clayey Silt. **SM**	28	5	30.5
		-45	1 2	100											
	50					50									
	52														
			2 3			53						-gray, coarse(-) to fine SAND, 53'			36.0
	54	-50	3 5	10		55									
	56														
	58		5 5			58						58.0 / -54.2 YORKTOWN FORMATION (Ty) Gray, medium to fine SAND, little Clayey Silt, little shell fragments scattered throughout. **SM**	27	3	33.0
		-55	7 6	100		60									
	60														
	62														
			4 4			63						-numerous whole shells, 63'			33.0
	64	-60	8 11	85		65									

REMARKS: RIG TYPE: Track Mounted CME-45.
4" ID casing to 4 ft., boring caved at 3.3 ft. depth on 7-27-2010.

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SPT_LOGA:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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PAGE 1 OF 2

STATION: OFFSET:
LATITUDE: 36.863550°N LONGITUDE: 76.307170°W
SURFACE ELEVATION: 6.0 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 7/27/2010 - 7/27/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Jeremy Raasio
Logger: Jason Kotova, Carroll Stewart

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
0	5	2 1 3 5	53		0.5						0.0 / 6.0 ARTIFICIAL FILL (af) Asphalt. **ASPH**			36.3
2		2 3 2 2	25		2						0.5 / 5.5 Dark brown, coarse to fine SAND, some medium to fine Gravel, little Clayey Silt, strong odor. **SM**			35.9
4		1 1 0 1	0		4						-and medium to fine Gravel, 2'			
6	0	1 0 2 1	25		6									31.7
8		1 0 1 0	30		8									38.2
10					10						8.0 / -2.0 ALLUVIUM (Qal) Brown-gray, medium to fine SAND, and Clay and Silt. **SC**			
12	-5				12									
14		woh woh woh woh	100		13						13.0 / -7.0 Gray, CLAY, trace medium to fine Sand, trace organics, laminated. **CH**			62.5
16	-10		100		15						16.0 / -10.0 Gray, coarse(-) to fine SAND, little Clay and Silt. **SC**	79	52	62.8
18		woh woh woh woh	100		17						18.0 / -12.0 Gray, Silty CLAY, trace fine Sand, trace organics, numerous shells at top, laminated. **CH**			92.6
20					18									
22	-15				20									
24		woh woh woh woh	100		23						23.0 / -17.0 Gray, medium to fine SAND, and Clay and Silt, trace coarse Sand, trace organics. **SC**	30	15	34.4
26	-20				25									
28		6 5 10 9	70		28						28.0 / -22.0 TABB FORMATION (Qt) Brown-green-gray, coarse to fine SAND, some(-) Clayey Silt. **SM**			20.9
30					30									
32	-25				33						-yellow-gray, little(-) Clayey Silt, 33'			17.0
34		8 10 16 17	65		35									
36	-30													
38		11 12 18 21	75		38						38.0 / -32.0 Gray, coarse to fine SAND, trace Clayey Silt, trace brown			21.4
40														

REMARKS: RIG TYPE: Track Mounted CME-45.
4" ID casing to 14 ft., boring caved at 34 ft. depth on 7-27-2010.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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PAGE 2 OF 2

STATION: OFFSET:
LATITUDE: 36.863550°N LONGITUDE: 76.307170°W
SURFACE ELEVATION: 6.0 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 7/27/2010 - 7/27/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Jeremy Raasio
Logger: Jason Kotova, Carroll Stewart

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
40											organics. **SP**			
42	-35													
43		2 1 1 1	100								43.0 / -37.0 Gray, medium to fine SAND, and Clay and Silt. **SC**			31.4
44														
45											-some(+) Clay and Silt, 47'			
46	-40		100											30.2
47														
48		4 6 12 11	100								48.0 / -42.0 YORKTOWN FORMATION (Ty) Gray, medium to fine SAND, little Clayey Silt, trace shell fragments. **SM**			28.5
50														
52	-45													
53		5 6 8 11	100								-pockets of numerous shell fragments, 53'	28	4	31.6
54														
55														
56	-50													
58		4 5 5 7	100								-shell fragments scattered throughout, 58'			32.2
60														

REMARKS: RIG TYPE: Track Mounted CME-45.
4" ID casing to 14 ft., boring caved at 34 ft. depth on 7-27-2010.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-016
PAGE 1 OF 2

STATION: OFFSET:
LATITUDE: 36.864090°N LONGITUDE: 76.306430°W
SURFACE ELEVATION: 10.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 7/27/2010 - 7/27/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Jeremy Raasio
Logger: Jason Kotova, Carroll Stewart

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
0	10	4 4 5	75		0						0.0 / 10.5 ARTIFICIAL FILL (af) Topsoil. **FL**			11.0
2		14 9 8	100		2						0.4 / 10.1 Tan-gray, coarse to fine SAND, and Clayey Silt, trace Gravel. **SM**			24.3
4		8 5 4	75		4						-dark gray-brown, some Clayey Silt, trace glass fragments, 2'			38.4
6	5	2 3 3	0		6						-dark brown, tan, red, and orange, some Clayey Silt, some medium to fine Gravel, 4'			
8		1 2 1	40		8						8.0 / 2.5 ALLUVIUM (Qal) Dark gray-brown, Clay and Silt, and medium to fine Sand, trace organics. **CL**	26	10	18.5
10	0				10									
12					13						13.0 / -2.5 Dark brown, medium to fine SAND, some(+) Silt and Clay, organic roots and fibers throughout. **SM**			42.0
14		woh woh woh	85		15									
16	-5													
18		3 1 2	85		18						18.0 / -7.5 Mottled yellow-red, medium(-) to fine SAND, and Clay and Silt. **SC**			32.1
20	-10		100		20						-gray, 18.5'			38.6
22					22						20.0 / -9.5 Gray, Silty CLAY, some(+) medium to fine Sand, trace coarse Sand, trace shell fragments. **CH**			69.5
24		woh 1 2	100		23						-little fine Sand, 23'			
26	-15				25									
28		1 1 1	100		28						-little medium to fine Sand, 28'			49.3
30	-20				29						29.0 / -18.5 Brown-gray, coarse to fine SAND, some Silt and Clay, occasional shell fragments. **SM**			34.6
32					30									
34		5 6 7	100		33						33.0 / -22.5 TABB FORMATION (Qt) Yellow-brown, coarse(-) to fine SAND, some(-) Clayey Silt. **SM**	NP	NP	23.7
36	-25				35									
38		6 8 11 18	65		38						38.0 / -27.5 Tan-gray, medium to fine SAND, trace Clayey Silt. **SP**			20.9
40														

REMARKS: RIG TYPE: Track Mounted CME-45.
4" ID casing to 9 ft. depth, boring caved at 28 ft. depth on 7-27-2010.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-016
PAGE 2 OF 2

STATION: OFFSET:
LATITUDE: 36.864090°N LONGITUDE: 76.306430°W
SURFACE ELEVATION: 10.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 7/27/2010 - 7/27/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Jeremy Raasio
Logger: Jason Kotova, Carroll Stewart

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
40	-30				40									
42		10 11 14 18	75		43									17.8
44					45									
46	-35													
48		8 10 8 11	100		48						48.0 / -37.5 YORKTOWN FORMATION (Ty) Green-gray, medium to fine SAND, little Clayey Silt, trace shell fragments. **SM**	26	4	29.0
50	-40				50									
52		4 6 8 11	100		53									28.7
54					55									
56	-45													
58		5 8 10 14	100		58									31.2
60					60									

REMARKS: RIG TYPE: Track Mounted CME-45.
4" ID casing to 9 ft. depth, boring caved at 28 ft. depth on 7-27-2010.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-017
PAGE 1 OF 1

STATION: OFFSET:
LATITUDE: 36.853630°N LONGITUDE: 76.317590°W
SURFACE ELEVATION: 6.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/24/2010 - 8/24/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s):
Driller: Fishburne, Rollen Ross
Logger: Todd Grifka

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
2	5	12 9 4 5	75		0 2						0.0 / 6.5 ARTIFICIAL FILL (af) Brown and gray, coarse(-) to fine SAND, some Silt and Clay. **SM**			12.3
4		11 6 3 2	20		4						2.0 / 4.5 Brown and gray, coarse to fine SAND, trace fine Gravel, trace Clayey Silt. **SP**			17.0
6	0	5 1 1 1	50		6							NP	NP	33.4
8		2 1 3 3	10		8						4.0 / 2.5 Light brown and red, coarse to fine SAND, little Clayey Silt, brick fragments. **SM** -angular gravel fragments up to 2" in length, 6' -wood, grain perpendicular to sampler, 8'			4.3
10		27 8 8 4	10		10									102.5
12	-5				13									
14		4 5 5 7	50		15						13.0 / -6.5 ALLUVIUM (Qal) Light gray, coarse to fine SAND, trace Clayey Silt. **SP**			19.1
16	-10													
18		1 2 woh 1	100		18						18.0 / -11.5 Gray, CLAY. **CH**	94	63	65.9
20					20									

REMARKS: RIG TYPE: Track Mounted CME-45.
4" ID casing to 9 ft. depth, boring caved at 28 ft. depth on 7-27-2010.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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STATION: OFFSET:
LATITUDE: 36.855550°N LONGITUDE: 76.315510°W
SURFACE ELEVATION: 3.7 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/24/2010 - 8/24/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Todd Grifka

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
0					0									
2		10 8 6 5	0		2						0.0 / 3.7 ARTIFICIAL FILL (af) Light brown, coarse(-) to fine SAND, some crushed shell fragments, little(-) Clayey Silt. **SM**			
4	0	3 4 4 5	65		4									21.3
6		3 4 4 6	50		6									22.8
8	-5	7 8 12 10	70		8							25	2	28.3
10			100		10									21.1
12					13									
14	-10	3 3 3 3	15		15						-and crushed shell fragments, 10'			27.2
16														
18	-15	3 3 3 2	35		18						18.0 / -14.3 ALLUVIUM (Qal) Brown-gray, coarse to fine SAND, and fine Gravel, little shell fragments, trace Clayey Silt. **SP**			6.4
20					20									
22														
24	-20	2 4 3 3	35		23									13.3
26					25									
28	-25	3 3 3 3	15		28									15.7
30					30									
32					33									
34	-30	2 2 2 2	15		35						-brown, 33'			13.4
36														
38	-35	2 1 1 1	100		38						38.0 / -34.3 Gray, Silty CLAY, some(-) medium to fine Sand. **CH**	47	26	37.7
40														

REMARKS: RIG TYPE: Track Mounted CME-45.
4" ID casing to 19 ft.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-018
PAGE 2 OF 3

STATION: OFFSET:
LATITUDE: 36.855550°N LONGITUDE: 76.315510°W
SURFACE ELEVATION: 3.7 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/24/2010 - 8/24/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Todd Grifka

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND / SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
40													
42													
44	-40		90										64.0
46													
48	-45	1 2 2	100							-CLAY, trace fine Sand, 48'	100	67	63.6
50			2										
52													
54	-50	1 1 2	90							-CLAY, trace fine Sand, 53' -1/2" thick Peat lens, 54.4'			130.1
56			2										
58	-55	1 1 2	100							58.0 / -54.3 Gray, Organic CLAY, and medium to fine Sand. **OH**	106	50	91.5
60			2										
62													
64	-60		0										
66													
68	-65	1 1 2	100										70.8
70			5										
72													
74	-70	6 2 3	100							73.0 / -69.3 Gray, Silty CLAY, trace fine Sand, little organics. **CH**			69.9
76			3										
78	-75	8 7 7	65							78.0 / -74.3 TABB FORMATION (Qt)			24.3
80			6										

REMARKS: RIG TYPE: Track Mounted CME-45.
4" ID casing to 19 ft.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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STATION: OFFSET:
LATITUDE: 36.855550°N LONGITUDE: 76.315510°W
SURFACE ELEVATION: 3.7 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/24/2010 - 8/24/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Todd Grifka

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
					80						Gray, medium to fine SAND, some Silt and Clay. **SM**			

REMARKS: RIG TYPE: Track Mounted CME-45.
4" ID casing to 19 ft.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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PAGE 1 OF 2

STATION: OFFSET:
LATITUDE: 36.856629°N LONGITUDE: 76.314250°W
SURFACE ELEVATION: -21.6 ft COORD. DATUM: NAD 83

Date(s) Drilled: 8/17/2010 - 8/18/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Rodney Sedillo, Carroll Stewart

GROUND WATER

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	0		wor			0						0.0 / -21.6 ALLUVIUM (Qal) Dark gray-black, Organic CLAY, some(-) medium to fine Sand, organic odor. **OH**			
	2		wor	10		2									
	4	-25													
	6		wor	100		5						-little coarse(-) to fine Sand, trace medium gravel-sized coal ash, 5'	145	114	143.7
	8	-30	wor			7									
	10		wor	100		10						-trace fine Sand, trace coarse to medium gravel-sized coal ash, 10'			
	12		wor			12									
	14	-35													
	16		wor	100		15						-trace fine Sand, 15'	138	104	129.6
	18	-40	wor	100		16 17						15.1 / -36.7 Gray, Organic CLAY, organic odor. **OH**	105	78	83.2
	20		wor	100		20						-little medium to fine Sand, occasional brown organic fibers, 20'			59.0
	22		woh			22									
	24	-45													
	26		woh	100		25						25.0 / -46.6 Gray, CLAY, trace fine Sand, occasional brown organic fibers. **CH**	101	75	75.5
	28	-50	woh			27									
	30		woh	90		30						-trace medium to fine Sand, 30'			82.7
	32		woh			32									
0.5	34	-55		100		33									78.9
	36		woh	100		35 37						-trace brown fibrous and woody organics, 35'	115	81	78.5
	38	-60													
	40														

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 27 ft. below the mudline.

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SPT_LOGA:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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PAGE 2 OF 2

STATION: OFFSET:
LATITUDE: 36.856629°N LONGITUDE: 76.314250°W
SURFACE ELEVATION: -21.6 ft COORD. DATUM: NAD 83

Date(s) Drilled: 8/17/2010 - 8/18/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Rodney Sedillo, Carroll Stewart

GROUND WATER

FIELD DATA | **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	40		woh woh woh woh	100		40						40.0 / -61.6 Gray, Organic CLAY, little coarse to fine Sand, numerous brown fibrous organics throughout. **OH**	156	112	104.6
	42					42									
	43	-65				43									71.0
	44			100		44									
	45		5 6 10 17	100		45						-trace coarse to fine Sand, 45'	124	89	88.7
	46			100		46									
	47					47						45.8 / -67.4 TABB FORMATION (Qt) Gray, medium(-) to fine SAND, little(+) Silt and Clay, occasional brown organics in 1/16" thick layers. **SM**			23.6
	48	-70				48									
	50		7 10 11 10	40		50						50.0 / -71.6 Gray to light gray, medium to fine SAND, trace Clayey Silt. **SP**			19.8
	52					52									
	54	-75				54									
	55					55									
	56		7 9 10 11	40		56						55.0 / -76.6 Gray, coarse to fine SAND, little Clayey Silt. **SM**	13	NP	17.2
	57					57						-brown, organic fibers in drill wash, loss of some drilling fluid and hard drilling from 57'-60'			
	58	-80				58									
	60		2 3 4 5	55		60						-brown-gray, layer of brown organic fibers, 60' -little fine(+) Gravel, 60.7'			35.6
	62					62									
	64	-85				64									
	65					65									
	66		3 5 5 10	100		66						65.0 / -86.6 YORKTOWN FORMATION (Ty) Green-gray, medium(-) to fine SAND, some Clay and Silt, trace shell fragments throughout. **SC** -two 1" thick shell beds, approximately 65.5'			
	67					67									
	68	-90				68									
	70		2 3 4 8	100		70						-some Silty Clay, 70'	49	23	33.8
	72					72									
	74	-95				74									
	75					75									
	76		2 3 4 7	100		76						-fine SAND, trace sand-sized and medium to fine gravel-sized shell fragments throughout, 75'			
	77					77									

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 27 ft. below the mudline.

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SPT_LOGA:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-020
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STATION: OFFSET:
LATITUDE: 36.859143°N LONGITUDE: 76.310943°W
SURFACE ELEVATION: -15.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/18/2010 - 8/18/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Rodney Sedillo, Carroll Stewart

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND / SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
2										0.0 / -15.5 ALLUVIUM (Qal) Gray, medium(-) to fine SAND, and Silt and Clay, trace shell fragments. **SM**			
4	-20	woh, woh	30	3.5 / 4.5						3.9 / -19.4 Gray, CLAY, trace fine Sand, trace organic material. **CH**	78	58	60.7
6		w, woh	100	5.5									
8		woh		8.5									
10	-25	woh woh	100	10.5									
12													
14	-30	woh woh woh	100	13.5 / 15.5						-little fine Sand, 13.5'	94	68	79.8
16													
18													
20	-35	wor wor wor	100	18.5 / 20.5						18.5 / -34.0 Gray, organic CLAY, trace fine Sand, organic odor. **OH**			108.1
22													
24	-40	wor wor wor	100	23.5 / 25.5							96	68	80.2
26													
28													
30	-45	woh woh woh	100	28.5 / 30.5						-trace brown organic fibers, 28.5'			
32													
34	-50	woh woh woh	100	33.5 / 35.5							122	94	81.8
36													
38													
40	-55	woh woh woh	0	38.5						38.5 / -54.0 Gray, CLAY. **CH**			

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 3.5 ft. below the mudline.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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STATION: OFFSET:
LATITUDE: 36.859143°N LONGITUDE: 76.310943°W
SURFACE ELEVATION: -15.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/18/2010 - 8/18/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Rodney Sedillo, Carroll Stewart

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
40		woh			40.5									
42														
44	-60	woh woh	100		43.5						43.5 / -59.0 Dark brown, fibrous PEAT. **PT**	332	34	240.5
		woh 1	100		44.5 45.5							178	117	113.9
46					46.5						44.4 / -59.9 Brown-gray, organic CLAY, some brown fibrous Peat throughout, little medium to fine Sand. **OH**			
48			80											119.8
	-65	2 3 3 4	100		48.5 50.5						48.5 / -64.0 Brown-gray, medium to fine SAND, some Clayey Silt, organic odor. **SM**	20	NP	27.6
52														
54	-70	1 4 6 10	65		53.5 55.5						53.5 / -69.0 TABB FORMATION (Qt) Gray, coarse(-) to fine SAND, some(-) Clayey Silt. **SM**			19.2
56														
58					58.5									
	-75	1 1 1 7	80		59.5						58.5 / -74.0 Gray, medium to fine SAND, trace Clay and Silt, trace shell fragments. **SP**			33.7
60			100		60.5							37	20	29.4
62											59.1 / -74.6 Brown, Organic Silty CLAY, and coarse(-) to fine Sand, organic odor. **OL**			
64	-80	7 7 5 7	100		63.5						63.5 / -79.0 Gray, medium to fine SAND, trace Clay and Silt, trace shell fragments. **SP**			22.5
			100		64.5 65.5									23.5
66											64.4 / -79.9 Gray, coarse(-) to fine SAND, trace Clayey Silt, trace brown organic fibers. **SP**			
68														
	-85	3 3 4 5	30		68.5									19.4
70			100		69.5 70.5						69.5 / -85.0 YORKTOWN FORMATION (Ty) Green-gray, medium to fine SAND, some(-) Clay and Silt. **SC**	44	19	31.5
72														
74	-90	2 2 4 7	100		73.5 75.5						-trace shell fragments throughout, 73.5'			36.3
76														
78					78.5									
	-95	2 3 5	100								78.5 / -94.0 Green-gray, medium to fine SAND, some Silty Clay, trace shell	55	33	35.6
80														

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 3.5 ft. below the mudline.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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STATION: OFFSET:
LATITUDE: 36.859143°N LONGITUDE: 76.310943°W
SURFACE ELEVATION: -15.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/18/2010 - 8/18/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Rodney Sedillo, Carroll Stewart

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB DATA: LIQUID LIMIT (LL)	LAB DATA: PLASTICITY INDEX (PI)	LAB DATA: MOISTURE CONTENT (%)
82														
84	-100	2 3 4 9 7	100		80.5 83.5 85.5						fragments throughout. **SC**			

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 3.5 ft. below the mudline.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-021
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STATION: OFFSET:
LATITUDE: 36.861830°N LONGITUDE: 76.307580°W
SURFACE ELEVATION: 4.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/26/2010 - 8/26/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Jeremy Raasio
Logger: Todd Grifka

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
0		2 4 4	60		0 2						0.0 / 4.5 ARTIFICIAL FILL (af) Brown, coarse to fine SAND, trace Silt and Clay. **SP** -brick fragments at 1.7' -trace Clayey Silt, 2'			8.3
2		3 3 5	75		2 4									15.4
4	0	6 9 3	60		4 6									21.5
6		6 9 10	100		6 8						-hydrocarbon odor, 6'			22.1
8		1 1 2	60		8 10						8.0 / -3.5 ALLUVIUM (Qal) Dark brown, coarse to fine SAND, some(+) Silt and Clay, some organic fibers. **SM**			150.8
10	-5													
12					13									
14	-10	woh woh woh woh	100		15						13.0 / -8.5 Gray, SILT and CLAY, some(+) medium to fine Sand, trace(-) shell fragments. **ML**			54.9
16														
18		1 1 1	100		18 20						18.0 / -13.5 Gray, CLAY, and coarse to fine Sand, trace(-) shell fragments. **CH**	72	47	63.4
20	-15	1												
22					23									
24	-20	woh woh 1 1	100		25									58.3
26														
28		woh 1 1 1	100		28 30						-little(+) organics, 28'	180	91	153.1
30	-25													
32					33									
34	-30	1 1 1 1	100		35						33.0 / -28.5 Gray, SILT and CLAY, some(-) medium to fine SAND, trace organics. **ML**			41.8
36														
38		15 14 10	100		38						38.0 / -33.5 TABB FORMATION (Qt)			18.1
40	-35	8												

REMARKS: RIG TYPE: Track Mounted CME-45.
4" ID casing to 5 ft.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-021
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STATION: OFFSET:
LATITUDE: 36.861830°N LONGITUDE: 76.307580°W
SURFACE ELEVATION: 4.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/26/2010 - 8/26/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Jeremy Raasio
Logger: Todd Grifka

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
40					40						Green, coarse to fine SAND, little(+) fine Gravel, trace(+) Clayey Silt. **SP**			
42														
44	-40	4 7 8 12	75		43 45						43.0 / -38.5 YORKTOWN FORMATION (Ty) Green-gray, fine SAND, little(+) Clayey Silt, little shell fragments. **SM**	27	3	27.8
46														
48	-45	5 8 12 14	100		48 50									31.0
50														
52					53						-lost piston push sampler in hole, offset 5 ft. north and drilled to 53 ft. depth then resumed sampling			
54	-50		0		55									
56														
58	-55	4 7 11 14	90		58 60									30.9
60														
62					63									
64	-60		0		65									
66														
68	-65	4 7 11 16	100		68 70						-some Silt and Clay, 68'	34	6	35.7
70														
72					73									
74	-70	3 7 12 15	100		75									27.9
76														
78					78									
80	-75		0											

REMARKS: RIG TYPE: Track Mounted CME-45.
4" ID casing to 5 ft.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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STATION: OFFSET:
LATITUDE: 36.861830°N LONGITUDE: 76.307580°W
SURFACE ELEVATION: 4.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/26/2010 - 8/26/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Jeremy Raasio
Logger: Todd Grifka

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
80					80									
82														
84	-80	3 4 9 10	100		83 85									34.4
86														
88		4 6 8 13	100		88 90						-some Clay and Silt, 88'	44	15	34.2
90	-85													
92					93									
94	-90	3 5 7 9	100		95									38.5
96														
98		4 9 11 13	100		98									32.8
100	-95				100									

REMARKS: RIG TYPE: Track Mounted CME-45.
4" ID casing to 5 ft.

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SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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STATION: OFFSET:
LATITUDE: 36.863870°N LONGITUDE: 76.305400°W
SURFACE ELEVATION: 2.8 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/25/2010 - 8/25/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Todd Grifka

GROUND WATER

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
	0	0	1 5 4 7	60		0						0.0 / 2.8 ARTIFICIAL FILL (af) Dark gray, coarse to fine SAND, some Silt and Clay, little fine Gravel. **SM**			12.1
	2		4 4 4 5	75		2							33	7	20.5
	4		3 2 2 1	5		4						-some brick fragments, 3.7'			28.5
	6		1 1 1 1	10		6						6.0 / -3.2 Dark gray, coarse to fine SAND, some medium to fine Gravel, little Silt and Clay, trace brick fragments. **SM**			35.2
	8	-5	1 1 1 1	40		8						8.0 / -5.2 ALLUVIUM (Qal) Dark gray, CLAY and SILT, little(+) medium(-) to fine Sand. **CH**			77.5
	10					10									
	12														
	14	-10	woh woh woh woh	100		13 15							91	61	73.8
	16														
	18	-15	woh woh 1 woh	100		18 20						18.0 / -15.2 Dark Gray, SILT and CLAY. **ML**			27.6
	20														
	22														
	24	-20	woh woh woh woh	100		23 25						23.0 / -20.2 Gray, CLAY, some medium to fine Sand, little(-) organic fibers. **CH**			75.6
	26														
	28	-25				28						-wood fibers present, 28'			
0	30			90		30									83.1
	32														
	34	-30	woh woh woh woh	65		33 35						-some organics, 33'	124	79	109.7
	36														
	38	-35	2 2 1 2	65		38						38.0 / -35.2 TABB FORMATION (Qt)			26.3
	40														

REMARKS: RIG TYPE: Track Mounted CME-45.
4" ID casing to 5 ft.

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SPT_LOGA:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-022
PAGE 2 OF 3

STATION: OFFSET:
LATITUDE: 36.863870°N LONGITUDE: 76.305400°W
SURFACE ELEVATION: 2.8 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/25/2010 - 8/25/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Todd Grifka

GROUND WATER

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	40					40						Gray, medium to fine SAND, some(-) Clayey Silt. **SC**			
	42	-40	1 1 1 2	80		43									31.7
	44					45									
	46														
	48	-45	4 5 6 13	100		48						48.0 / -45.2 YORKTOWN FORMATION (Ty) Green-gray medium(-) to fine SAND,some(-) Silt and Clay, trace shell fragments. **SM**	31	6	34.4
	50					50									
	52	-50	4 5 7 11	100		53									31.8
	54					55									
	56														
	58	-55	3 4 9 11	100		58									32.3
	60					60									
	62														
	64	-60		50		63									
	66					65									
	68	-65	11 7 9 13	85		68									32.6
	70					70									
	72														
	74	-70		0		73									
	76					75									
	78	-75	4 5 7 11	100		78									35.0
	80														

REMARKS: RIG TYPE: Track Mounted CME-45.
4" ID casing to 5 ft.

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SPT_LOGA:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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PAGE 3 OF 3

STATION: OFFSET:
LATITUDE: 36.863870°N LONGITUDE: 76.305400°W
SURFACE ELEVATION: 2.8 ft COORD. DATUM: NAD 83

Date(s) Drilled: 8/25/2010 - 8/25/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed samples obtained with piston
Driller: Fishburne, Rollen Ross
Logger: Todd Grifka

GROUND WATER

FIELD DATA														LAB DATA		
			SOIL				ROCK									
PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	STANDARD PENETRATION TEST HAMMER BLOWS	SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	CORE RECOVERY (%)	ROCK QUALITY DESIGNATION	DIP ° STRATA	DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA		LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT (%)
						80								LL	PI	

REMARKS: RIG TYPE: Track Mounted CME-45.
4" ID casing to 5 ft.

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SPT_LOGA:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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PAGE 1 OF 1

STATION: OFFSET:
LATITUDE: 36.865330°N LONGITUDE: 76.304190°W
SURFACE ELEVATION: 5.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 8/25/2010 - 8/25/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s):
Driller: Fishburne, Rollen Ross
Logger: Todd Grifka

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
0	5	3			0						0.0 / 5.5 ARTIFICIAL FILL (af) Dark Brown, coarse to fine SAND, little Clayey Silt, some organics. **SM**			11.3
2		3 4 3	50		2									
4		2 2 3 4	60		4									5.6
6	0	2 2 2 2	45		6						2.0 / 3.5 ALLUVIUM (Qal) Light brown, medium to fine SAND, trace Clayey Silt. **SP**			19.1
8		2 1 2 1	60		8						4.0 / 1.5 Brown and gray, medium to fine SAND, and(+) Clayey Silt. **SM**	15	3	19.6
10	-5	1 1 1 1	75		10									18.7
12														
14		1 1 1 1	100		13 15						13.0 / -7.5 Gray, CLAY, little medium to fine Sand. **CH**	108	73	81.2
16	-10													
18		1 1 1 7	75		18 19.5						18.0 / -12.5 Gray, medium to fine SAND, and(+) Silt and Clay. **SM**			29.6
20					20						19.5 / -14.0 Dark brown, medium to fine SAND, some organics and wood fibers. **SP**			44.6

REMARKS: RIG TYPE: Track Mounted CME-45.
Boring uncased

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-024

STATION:
LATITUDE: 36.866040°N
SURFACE ELEVATION: 7.7 ft

OFFSET:
LONGITUDE: 76.305720°W
COORD. DATUM: NAD 83

Date(s) Drilled: 8/25/2010 - 8/25/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s):
Driller: Fishburne, Rollen Ross
Logger: Todd Grifka

GROUND WATER

FIELD DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP °: STRATA	ROCK: DIP °: JOINTS	STRATA LEGEND
		2 7 6 1	40		0					
2	5	2 1 1 1	15		2					
4		2 3 3 2	65		4					
6		2 3 3 3	70		6					
8	0	5 7 6 6	100		8					
10					10					
12	-5	2 3 3 3	65		13					
14					15					
16										
18	-10	2 1 1 1	100		18					
20					20					

FIELD DESCRIPTION OF STRATA

FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
0.0 / 7.7 ARTIFICIAL FILL (af) Brown, coarse to fine SAND, little Clayey Silt. **SM** -3" asphalt at 1'	NP	NP	10.0
2.0 / 5.7 ALLUVIUM (Qal) Light brown to brown, coarse to fine SAND, little(-) Clayey Silt. **SM**	NP	NP	17.4
4.0 / 3.7 Light brown, fine SAND, trace Clayey Silt. **SP** -light whitish-brown, 8'			24.0
-gray and light brown, varved medium to fine SAND, 13'			27.3
18.0 / -10.3 Gray, CLAY, little(+) fine Sand. **CH**	77	51	54.9

REMARKS: RIG TYPE: Track Mounted CME-45.
Boring uncased

SPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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STATION: OFFSET:
LATITUDE: 36.853310°N LONGITUDE: 76.320800°W
SURFACE ELEVATION: 7.7 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 12/2/10 - 12/2/10
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed
Driller: Fishburne, Rollen Ross
Logger: C Stewart, J Kotova

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
2	5	7 10 17 15	80		0 2						0.0 / 7.7 ARTIFICIAL FILL (af) Dark brown to light yellow gray, coarse (-) to fine SAND, some (-) Silt and Clay, little medium to fine Gravel. **SM**			
4		10 10 7 4	75		4						4.0 / 3.7 No Recovery.			
6		5 4 2 2	0		6						6.0 / 1.7 Dark brown to black to yellow, medium to fine SAND, some Clay and Silt, trace medium to fine Gravel, brick fragments, strong hydrocarbon odor. **SC**			
8	0	3 2 2 2	80		8						6.5 / 1.2 ALLUVIUM (Qal) Gray to tan, coarse (-) to fine SAND, some Silty Clay. **SC**			
10		3 3 3 3	100		10						8.0 / -0.3 Light gray mottled orange, medium to fine SAND, some (-) Clayey Silt, trace mica. **SM**			
12	-5	1 1 1 2	65		13									
14					15									
16														
18	-10	1 1 1 1	50		18						19.0 / -11.3 Medium gray, CLAY, little coarse to fine Sand. **CH**			
20					20									
22			90		21 23									
24	-15	woh woh woh woh	50		25									
26														
28	-20	2 1 1 4	80		28 30						28.0 / -20.3 Gray mottled orange, medium to fine SAND, and Silty Clay. **SC** 29.0 / -21.3 Gray, CLAY, and medium to fine Sand. **CH**			
32	-25	1 1 4 6	75		33 35						33.0 / -25.3 TABB FORMATION (Qt) Light tan mottled orange, coarse to fine (-) SAND, trace Clayey Silt grading to little Clayey Silt. **SP-SM**			
36														
38	-30	4 8 11 9	60		38						38.0 / -30.3 Tan mottled orange, coarse to fine SAND, little Clayey Silt. **SM**			
40														

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 7 ft.

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SPT_LOG:UPDATE_6_20_2011.GPJ:8.30.002:061109:6/21/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-025
PAGE 2 OF 3

STATION: OFFSET:
LATITUDE: 36.853310°N LONGITUDE: 76.320800°W
SURFACE ELEVATION: 7.7 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 12/2/10 - 12/2/10
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed
Driller: Fishburne, Rollen Ross
Logger: C Stewart, J Kotova

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
40														
42	-35	1 2 4 7	80		43						41.5 / -33.8 YORKTOWN FORMATION (Ty) Greenish gray, coarse (-) to fine SAND, some Clay and Silt, numerous gravel to sand sized shell fragments. **SC**			
44					45									
46														
48	-40	5 7 9 10	100		48						48.0 / -40.3 Greeninsh gray, coarse to fine SAND, some Silt and Clay, abundant fine gravel to sand sized shell fragments throughout. **SM**			
50					50									
52														
54	-45	3 3 4 7	100		53						53.0 / -45.3 Greeninsh gray, coarse (-) to fine SAND, and Clay and Silt, some fine gravel to sand sized shell fragments throughout. **SC**			
56			90		55 56									
58	-50	12 9 9 7	0		57 59						57.0 / -49.3 No Recovery.			
60														
62														
64	-55	7 2 3 4	90		63 65						63.0 / -55.3 Greenish gray, coarse (-) to fine SAND, some Silt and Clay, abundant fine gravel to sand sized shell fragments. **SM**			
66														
68	-60	2 2 4 7	100		68									
70					70									
72	-65	2 2 4 11	80 100		71 73 75									
74														
76														
78	-70	3 2 3 8	100		78									
80														

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 7 ft.

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SPT_LOG:UPDATE_6_20_2011.GPJ:8.30.002:061109:6/21/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

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PAGE 3 OF 3

STATION: OFFSET:
LATITUDE: 36.853310°N LONGITUDE: 76.320800°W
SURFACE ELEVATION: 7.7 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 12/2/10 - 12/2/10
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed
Driller: Fishburne, Rollen Ross
Logger: C Stewart, J Kotova

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
					80									

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 7 ft.

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SPT_LOG:UPDATE_6_20_2011.GPJ:8.30.002:061109:6/21/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-026
PAGE 1 OF 3

STATION: OFFSET:
LATITUDE: 36.853810°N LONGITUDE: 76.320060°W
SURFACE ELEVATION: 9.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 12/2/10 - 12/2/10
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed
Driller: Fishburne, Rollen Ross
Logger: C Stewart, J Kotova

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
0	9.4	5 9 7	70		0						0.0 / 9.4 ARTIFICIAL FILL (af) Orange brown, medium to fine SAND, some (-) Silt and Clay, trace coarse Sand. **SM**			
2		8 9 11	65		2									
4	5	6 5 10	65		4						2.0 / 7.4 Dark brown, coarse to fine SAND, some Clay and Silt, trace fine Gravel, strong hydrocarbon odor, nodules of black Silt. **SC**			
6		6 9 5	70		6						6.0 / 3.4 ALLUVIUM (Qal) Black, organic Clayey SILT, and coarse to fine Sand, numerous organic fibers. **OL**			
8		4 4 5	75		8									
10	0				10						8.0 / 1.4 Black, organic coarse to fine SAND, and (-) Clayey Silt, interlayered with black organic Clay. **SM**			
12					13									
14	-5	4 2 1	85		15									
16														
18		1 0 1	100		18						18.0 / -8.6 Dark gray, organic CLAY, trace medium to fine Sand, trace shell fragments, organic odor, some brown peat fibers scattered throughout. **OH**			
20	-10				20									
22			88		21									
24	-15	1 0 1	100		23									
26					25									
28		1 0 1	100		28						28.0 / -18.6 Dark gray to medium gray, coarse to fine SAND, Some Silty Clay, brown peat fibers scattered throughout. **SC**			
30	-20				30									
32														
34	-25	woh 1 1	100		33						33.0 / -23.6 Orange gray, Silty CLAY, some coarse to fine Sand. **CH**			
36					35									
38		1 1 2	25		38						38.0 / -28.6 TABB FORMATION (Qt)			
40	-30													

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 7 ft.

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SPT_LOG:UPDATE_6_20_2011.GPJ:8.30.002:061109:6/21/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-026
PAGE 2 OF 3

STATION: OFFSET:
LATITUDE: 36.853810°N LONGITUDE: 76.320060°W
SURFACE ELEVATION: 9.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 12/2/10 - 12/2/10
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed
Driller: Fishburne, Rollen Ross
Logger: C Stewart, J Kotova

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
40					40						Yellow gray mottled orange, coarse to fine SAND, little Clayey Silt, trace fine Gravel. **SM**			
42														
44	-35	5 11 2 3	75		43									
46					45									
48		4 4 8 9	100		48						46.5 / -37.1 YORKTOWN FORMATION (Ty) Greenish gray, coarse to fine SAND, some Clay and Silt, sand sized shell fragments scattered throughout. **SC**			
50	-40				50									
52											47.7 / -38.3 Greenish gray, coarse (+) to fine SAND, Some Silt and Clay, abundant gravel to sand sized shell fragments throughout. **SM**			
54	-45	6 6 7 9	95		53									
56			90		55									
58		6 7 7 5	90		56						58.0 / -48.6 Greenish gray, fine GRAVEL, and coarse to fine Sand, some Silt and Clay, abundant gravel to sand sized shell fragments throughout, interlayered greenish gray, coarse to fine Sand, some (+) Silty Clay. **GP**			
60	-50				58									
62					60									
64	-55	2 2 3 4	90		63						63.0 / -53.6 Greenish gray, coarse to fine SAND, some Clay and Silt, abundant gravel to sand sized shell fragments throughout. **SC**			
66					65									
68		1 1 2 3	100		68									
70	-60				70									
72			75		71									
74	-65	4 7 9 15	100		73									
76					75									
78		7 9 7 8	100		78									
80	-70													

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 7 ft.

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10BH-026

SPT_LOG:UPDATE_6_20_2011.GPJ:8.30.002:061109:6/21/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-026
PAGE 3 OF 3

STATION: OFFSET:
LATITUDE: 36.853810°N LONGITUDE: 76.320060°W
SURFACE ELEVATION: 9.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 12/2/10 - 12/2/10
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed
Driller: Fishburne, Rollen Ross
Logger: C Stewart, J Kotova

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
					80						-and Clay and Silt 78'			

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 7 ft.

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10BH-026

SPT_LOG:UPDATE_6_20_2011.GPJ:8.30.002:061109:6/21/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-027

STATION: OFFSET:
LATITUDE: 36.854070°N LONGITUDE: 76.319720°W
SURFACE ELEVATION: 9.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 12/1/10 - 12/1/10
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed
Driller: Fishburne, Rollen Ross
Logger: C Stewart, J Kotova

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
0		10 10 11 9	55		0						0.0 / 9.5 ARTIFICIAL FILL (af) Brown, Clay and Silt, and medium to fine Sand, trace roots. (Topsoil, No sample retained) **TOPS**			
2		11 5 5 13	90		2						0.7 / 8.8 Gray, coarse to fine GRAVEL, and coarse to fine Sand, some Clay and Silt. **GC**			
4	5	7 7 9 10	80		4						1.4 / 8.1 Brown to dark gray, coarse to fine SAND, some Silt and Clay. **SM**			
6		10 11 9 7	90		6									
8		8 9 9 6	50		8						4.0 / 5.5 ALLUVIUM (Qal) Dark gray to black, coarse to fine SAND, and organic Clay and Silt, trace organic fibers, strong hydrocarbon odor. -and medium to fine gravel, some Clay and Silt, 7' **SC**			
10	0				10									
12					12						8.0 / 1.5 Dark gray, Silty CLAY interlayered with black organic Clayey Silt, some coarse to fine Sand, trace fine Gravel. -trace medium to fine Sand, 13' **CH**			
14	-5	1 0 1 0	100		13 15									
16			70		16						16.0 / -6.5 Gray coarse to fine SAND, some Clay and Silt. **SC**			
18		1 1 1 2	100		18									
20	-10				20						19.4 / -9.9 Dark gray, CLAY, some coarse to fine Sand, numerous organic fibers and fragments. **CH**			
22														
24	-15	1 0 1 0	100		23 25						24.5 / -15.0 Dark gray, coarse to fine SAND, and organic CLAY, trace fine Gravel, numerous organic fibers. **SC**			
26														
28		woh woh 1 0	100		28						28.0 / -18.5 Dark gray, organic CLAY, little coarse to fine Sand, numerous organic fibers. **OH**			
30	-20				30									
32														
34	-25	1 0 1 0	100		33 35						-trace medium to fine Sand, 33'			
36														
38		woh woh 1 1	25		38						-some coarse to fine Sand, 38'			
40	-30													

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 7 ft.

SPT_LOG:UPDATE_6_20_2011.GPJ:8.30.002:061109:6/21/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-027
PAGE 2 OF 3

STATION: OFFSET:
LATITUDE: 36.854070°N LONGITUDE: 76.319720°W
SURFACE ELEVATION: 9.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 12/1/10 - 12/1/10
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed
Driller: Fishburne, Rollen Ross
Logger: C Stewart, J Kotova

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
40					40									
42														
43					43						43.0 / -33.5 Brown, organic Clayey SILT, some coarse to fine Sand, some fiberous Peat. **OL** -wood chips, 44.5'			
44	-35	1 0 1 1	80											
45					45									
46														
48		3 3 3 6	75		48						44.5 / -35.0 TABB FORMATION (Qt) Medium gray, coarse to fine (-) SAND, some (-) Clayey Silt. **SM**			
50	-40				50									
52														
53					53						53.0 / -43.5 YORKTOWN FORMATION (Ty) Gray, coarse to fine SAND, some Clay and Silt, abundant shell fragments. **SC**			
54		3 5 8 7	100											
55	-45				55									
56														
58		4 4 5 7	100		58						-greenish gray, 58'			
60	-50				60									
62														
63					63									
64		2 3 4 6												
65	-55				65									
66			75		66									
68		6 9 15 16	100		68						-greenish gray, medium to fine SAND, 68'			
70	-60				70									
72														
73					73									
74		3 5 6 8	100								-greenish gray, 2" thick shell layer, 74'			
75	-65				75									
76														
78		3 3 3 5			78						-greenish gray, 78'			
80	-70													

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 7 ft.

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10BH-027

SPT_LOG:UPDATE_6_20_2011.GPJ:8.30.002:061109:6/21/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-027
PAGE 3 OF 3

STATION: OFFSET:
LATITUDE: 36.854070°N LONGITUDE: 76.319720°W
SURFACE ELEVATION: 9.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 12/1/10 - 12/1/10
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s): undisturbed
Driller: Fishburne, Rollen Ross
Logger: C Stewart, J Kotova

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
					80									

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 7 ft.

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10BH-027

SPT_LOG:UPDATE_6_20_2011.GPJ:8.30.002:061109:6/21/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-028
PAGE 1 OF 1

STATION: OFFSET:
LATITUDE: 36.864725°N LONGITUDE: 76.306100°W
SURFACE ELEVATION: 10.0 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 11/29/2010 - 11/29/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s):
Driller: Fishburne, Rollen Ross
Logger: C Stewart, T Grifka

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
0		2 5 7 9	75		0						0.0 / 10.0 ARTIFICIAL FILL (af) Orange-brown, mixed coarse to fine SAND, and Clay, trace fine Gravel. **SC**			
2		10 11 9 9	65		2									
4		6 9 10 9	65		4						2.0 / 8.0 ALLUVIUM (Qal) Orange-brown, coarse to fine SAND, trace to little Clayey Silt. **SP-SM**			
6	5	10 13 15 8	60		6									
8		6 5 6 5	60		8									
10	0				10						10.0 / 0.0 Yellow-tan, coarse to fine(-) SAND, little Clayey Silt, trace fine Gravel. **SM**			
12					13									
14		6 9 8 8	50		15									
16	-5													
18		3 3 1 1	100		18						18.7 / -8.7 Gray, fine SAND, some Silt and Clay. **SM**			
20	-10				20									
22											21.5 / -11.5 Gray, CLAY, trace fine Sand. **CH**			
24		woh woh woh woh	100		23 25									
26	-15													
28		1 1 1 1	100		28									
30	-20				30									

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 7 ft.

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10BH-028

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-029

STATION: OFFSET:
LATITUDE: 36.865220°N LONGITUDE: 76.306380°W
SURFACE ELEVATION: 4.6 ft COORD. DATUM: NAD 83

Date(s) Drilled: 11/29/2010 - 11/29/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s):
Driller: Fishburne, Rollen Ross
Logger: C Stewart, T Grifka

GROUND WATER

FIELD DATA | **LAB DATA**

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
0	0	2 3 4 5	55		0						0.0 / 4.6 ARTIFICIAL FILL (af) Tan mottled orange, mixed coarse to fine SAND, some Silt and Clay. **SM**			
2		8 9 8 7	90		2									
4		8 6 6 7	100		4						2.0 / 2.6 ALLUVIUM (Qal) Orange-brown, medium to fine SAND, little(+) Clayey Silt. **SM**			
6		8 4 5 4	100		6						4.0 / 0.6 Tan, coarse(-) to fine SAND, little Clayey Silt. **SM**			
8	-5	3 3 3 3	100		8						6.0 / -1.4 Orange-brown, medium to fine SAND, little(+) Clayey Silt. **SM**			
10					10						8.0 / -3.4 Yellow-brown to orange-brown, coarse(-) to fine SAND, little Clayey Silt, trace fine Gravel. **SM**			
12														
14	-10	woh woh woh woh	100		13 15						12.0 / -7.4 Dark gray, Silty CLAY, little medium to fine Sand. **CH**			
16														
18	-15	1 1 1 1	100		18 20						16.5 / -11.9 Gray Silty CLAY. **CH**			
20														
22											21.5 / -16.9 Gray CLAY. **CH**			
24	-20	woh woh woh 1	100		23 25									
26														
28		1 1 1 1	100		28									
30	-25				30									

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 7 ft.

SPT_LOG:UPDATE_6_20_2011.GPJ:8.30.002:061109:6/21/11

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PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA
STRUCTURE:

10BH-030
PAGE 1 OF 1

STATION: OFFSET:
LATITUDE: 36.865770°N LONGITUDE: 76.307000°W
SURFACE ELEVATION: 6.1 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 11/29/2010 - 11/29/2010
Drilling Method(s): Rotary Wash
SPT Method: Automatic Hammer
Other Test(s):
Driller: Fishburne, Rollen Ross
Logger: C Stewart, T Grifka

GROUND WATER

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
0	6.1	1 2 3 4	35		0						0.0 / 6.1 ARTIFICIAL FILL (af) Brown SILT and CLAY, little medium to fine Sand, trace roots. **ML**			
2	5	3 2 2 3	35		2						2.0 / 4.1 Brown, coarse to fine SAND, some Silt and Clay, trace fine Gravel, trace brick. **SM**			
4		8 7 4 4	35		4						4.0 / 2.1 Brown, medium to fine GRAVEL, and coarse to fine Sand, some(-) Clayey Silt, trace metal fragments. **GM**			
6	0	1 1 0 1	40		6						6.0 / 0.1 ALLUVIUM (Qal) Brown, coarse(-) to fine SAND, little(+) Clayey Silt. **SM**			
8		3 3 3 4	85		8						-medium to fine SAND, 8'			
10	-5				10									
12					12						11.8 / -5.7 Light gray mottled orange-brown, interlayered coarse to medium SAND, little Clayey Silt, interlayered with fine SAND, some Clayey Silt. **SM**			
14		32 1 1 1	90		13									
16	-10				15						13.7 / -7.6 Gray, Silty CLAY, little(+) coarse to fine Sand. **CH**			
18		woh woh 18 1	100		18						16.5 / -10.4 Gray, CLAY, trace fine Sand. **CH**			
20					20									
22	-15				23						- trace shell fragments, 23'			
24		1 1 1 1	100		25									
26	-20				28						- trace shell fragments, 28'			
28		1 1 1 1	100		30									
30														

REMARKS: RIG TYPE: Track Mounted CME-55.
4" ID casing to 7 ft.

PAGE 1 OF 1
10BH-030

SPT_LOG:UPDATE_6_20_2011.GPJ:8.30.002:061109:6/21/11

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1.1.3 Geotechnical Conditions - New Midtown Tunnel - CPT and DMT Soundings

CONE PENETROMETER TEST LOG

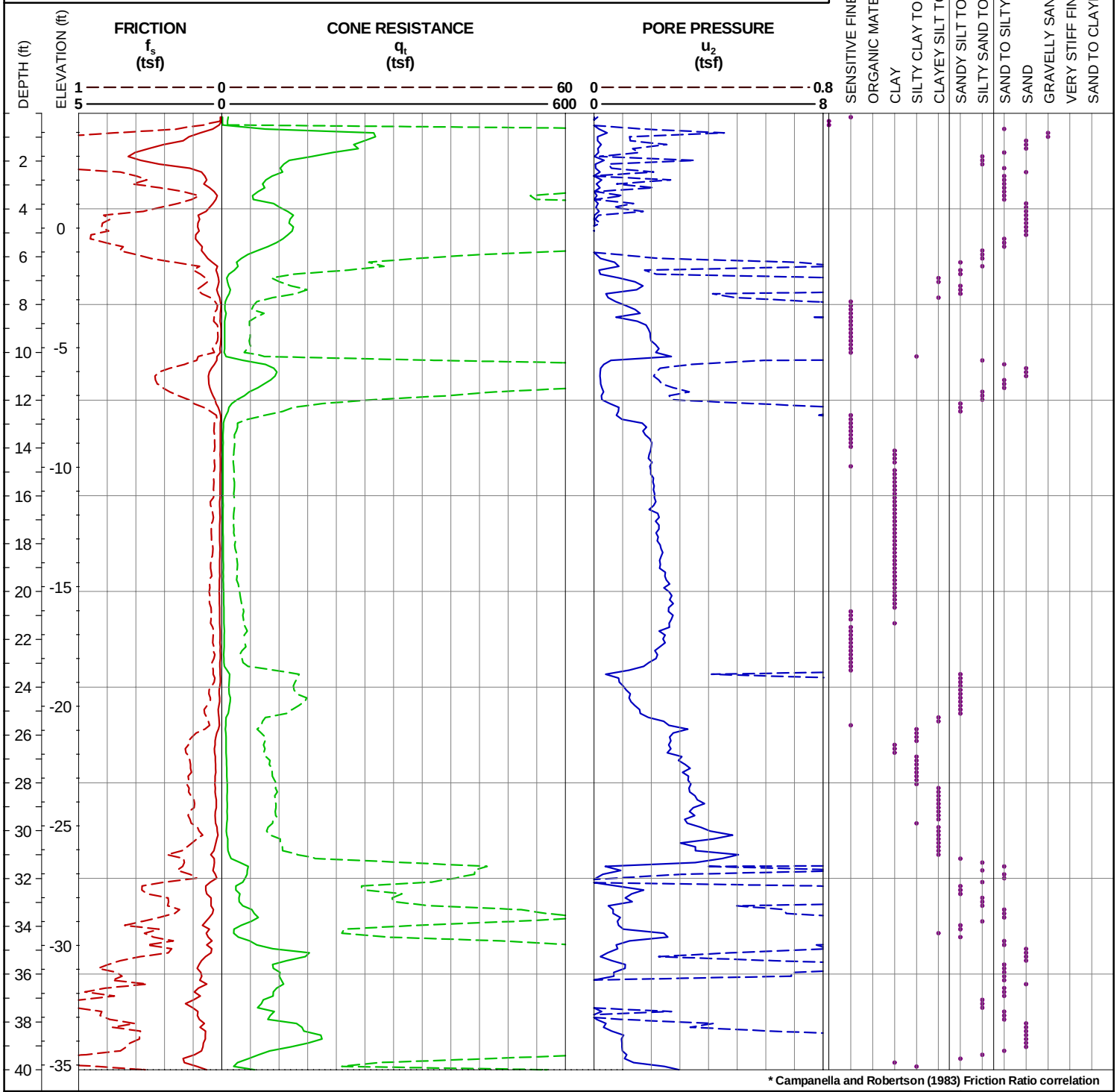
Virginia Department of Transportation

PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA

10CP-001
PAGE 1 OF 2

STATION:
OFFSET:
LATITUDE: °N
LONGITUDE: °W
SURFACE ELEVATION: 4.8
COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec
DATE(S) DRILLED:
CONE TYPE:
7/20/2010 - 7/20/2010
CONE SIZE:
CONE ID No.: 215:T1500F15U500
LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 1 OF 2
10CP-001

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

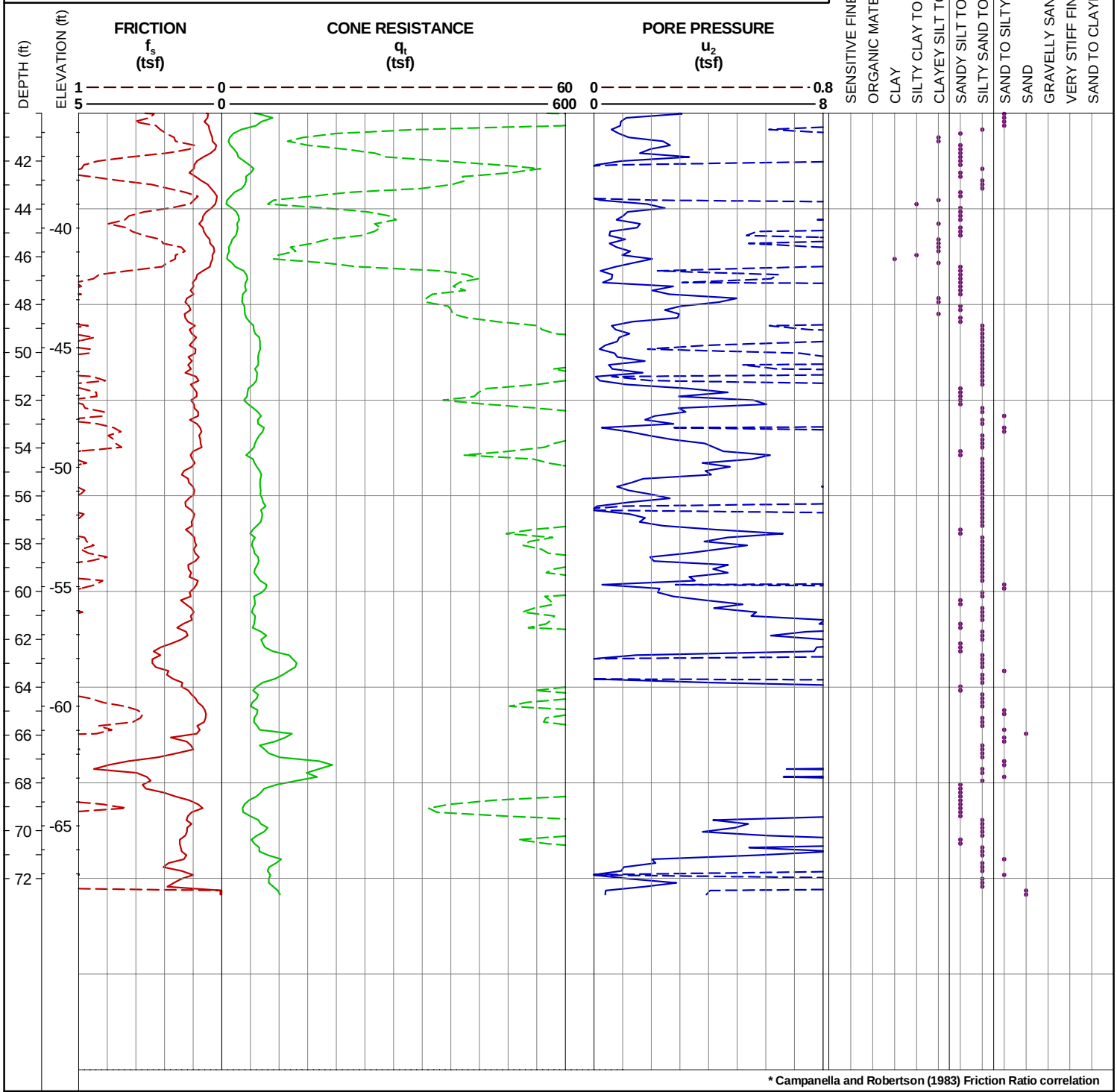
Virginia Department of Transportation

PROJECT #: 173189A | **10CP-001**

LOCATION: Norfolk and Portmouth, VA | **PAGE 2 OF 2**

STATION: OFFSET:
LATITUDE: °N LONGITUDE: °W
SURFACE ELEVATION: 4.8 COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:
CONE TYPE: 7/20/2010 - 7/20/2010
CONE SIZE:
CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 2 OF 2 | **10CP-001**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

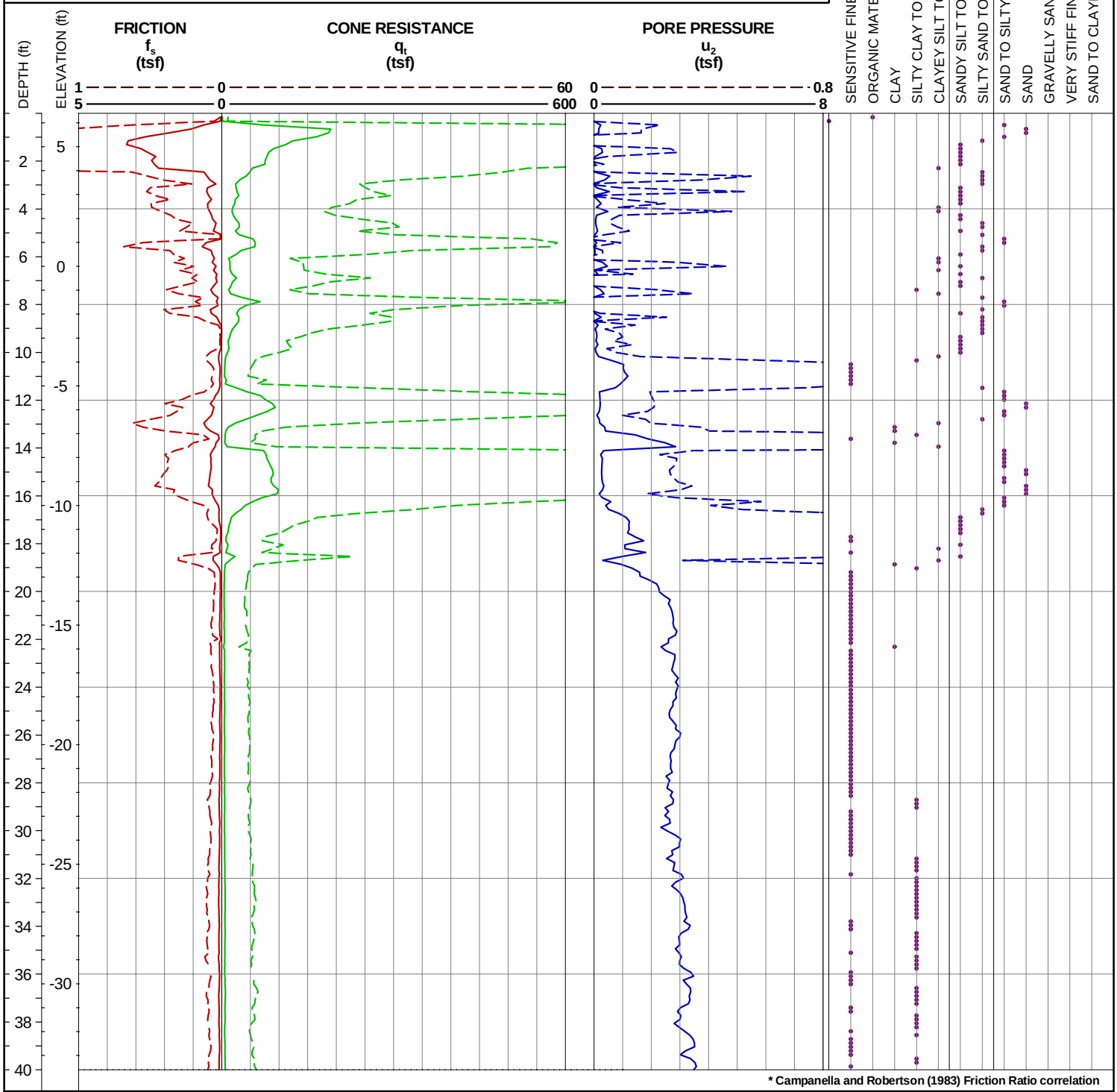
Virginia Department of Transportation

PROJECT #: 173189A | **10CP-002**

LOCATION: Norfolk and Portmouth, VA | **PAGE 1 OF 3**

STATION: OFFSET:
LATITUDE: °N LONGITUDE: °W
SURFACE ELEVATION: 6.4 COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:
CONE TYPE: 7/20/2010 - 7/20/2010
CONE SIZE:
CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 1 OF 3

10CP-002

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A | **10CP-002**

LOCATION: Norfolk and Portmouth, VA | **PAGE 2 OF 3**

STATION: OFFSET:

LATITUDE: °N LONGITUDE: °W

SURFACE ELEVATION: 6.4 COORD. DATUM: NAD 83

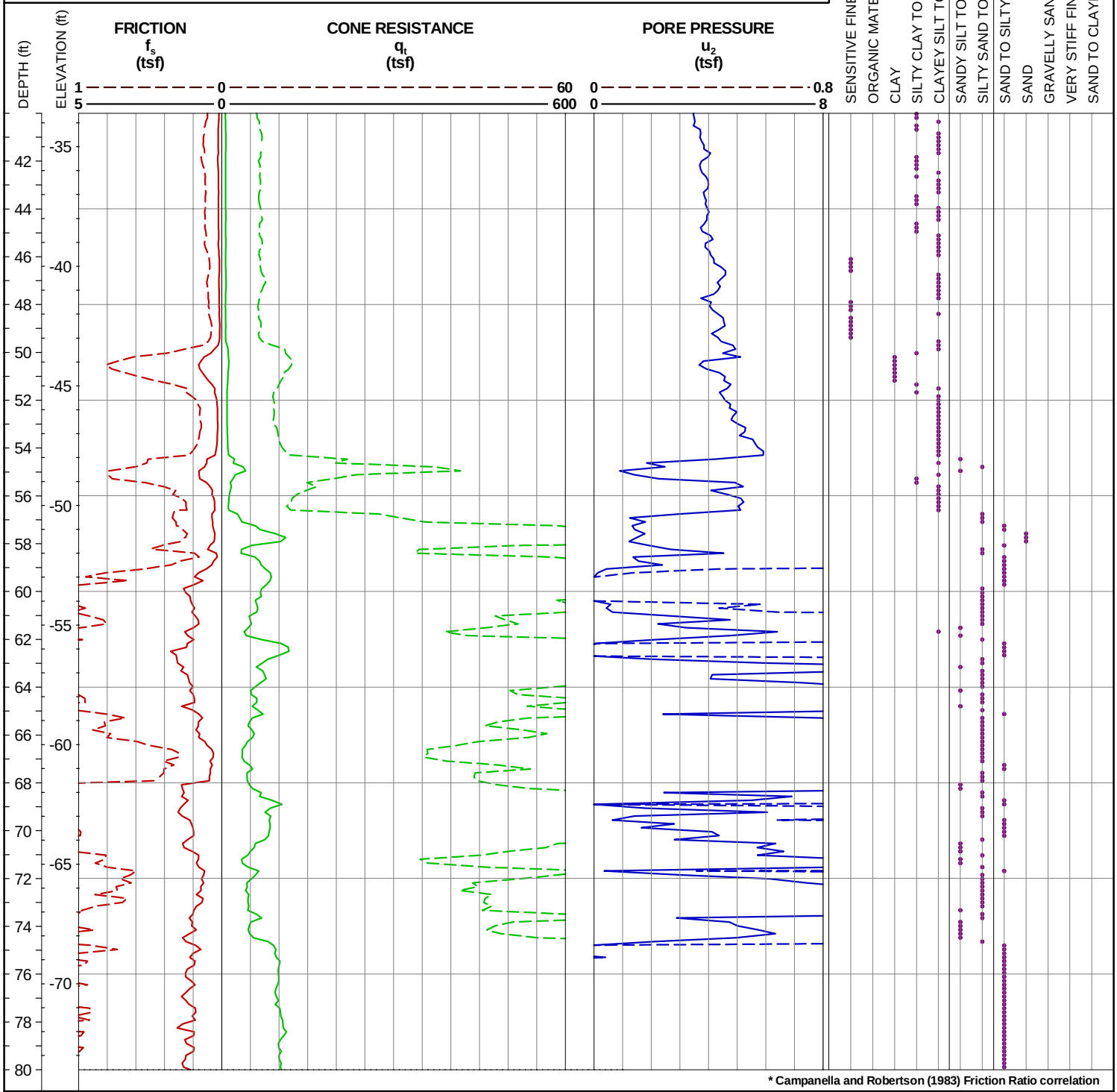
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:

CONE TYPE: 7/20/2010 - 7/20/2010

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 2 OF 3

10CP-002

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

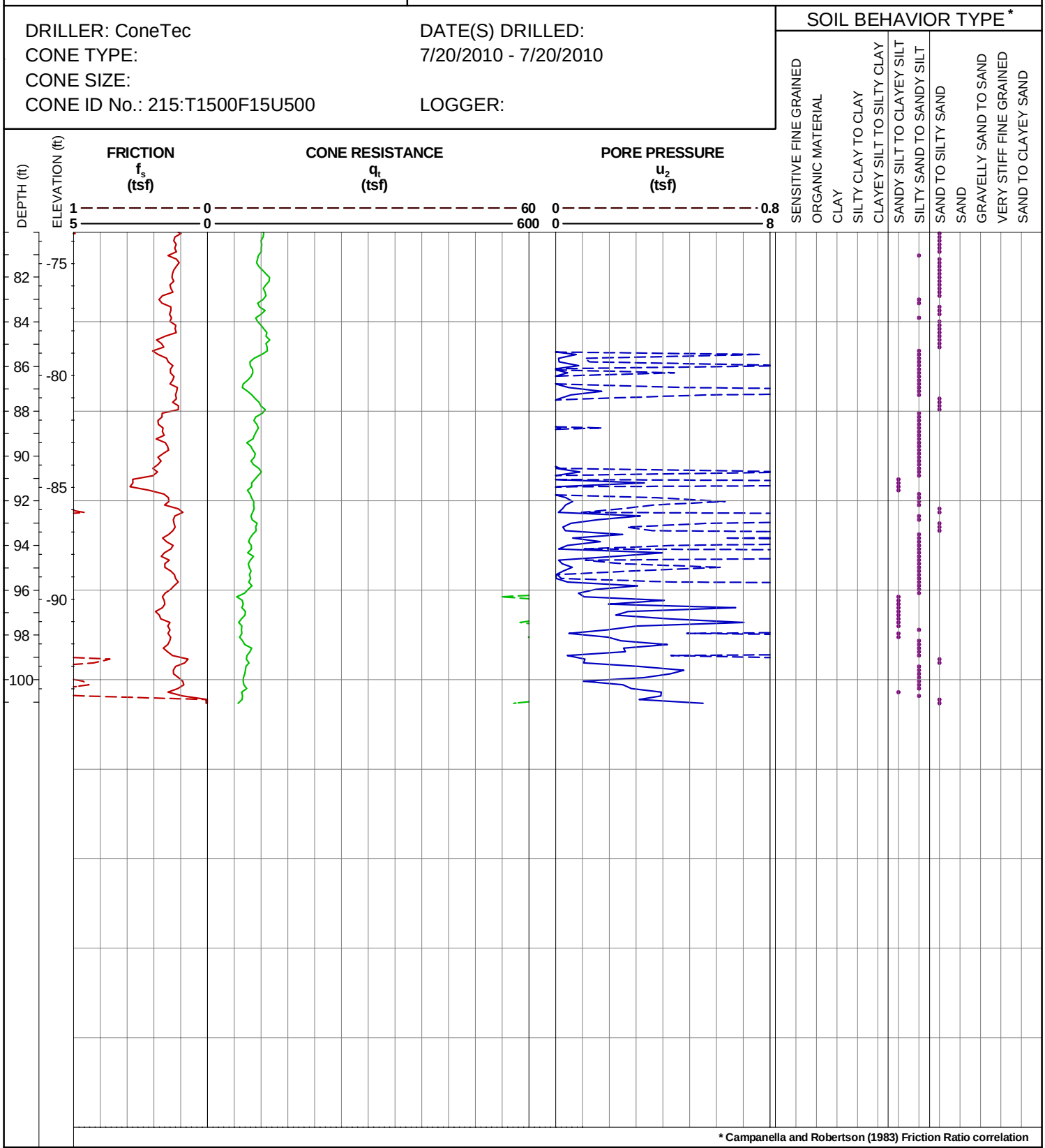
Virginia Department of Transportation

PROJECT #: 173189A | **10CP-002**

LOCATION: Norfolk and Portmouth, VA | **PAGE 3 OF 3**

STATION: OFFSET:
LATITUDE: °N LONGITUDE: °W
SURFACE ELEVATION: 6.4 COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:
CONE TYPE: 7/20/2010 - 7/20/2010
CONE SIZE:
CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 3 OF 3 | **10CP-002**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A | **10CP-003**

LOCATION: Norfolk and Portmouth, VA | **PAGE 1 OF 3**

STATION: OFFSET:

LATITUDE: °N LONGITUDE: °W

SURFACE ELEVATION: 4.9 COORD. DATUM: NAD 83

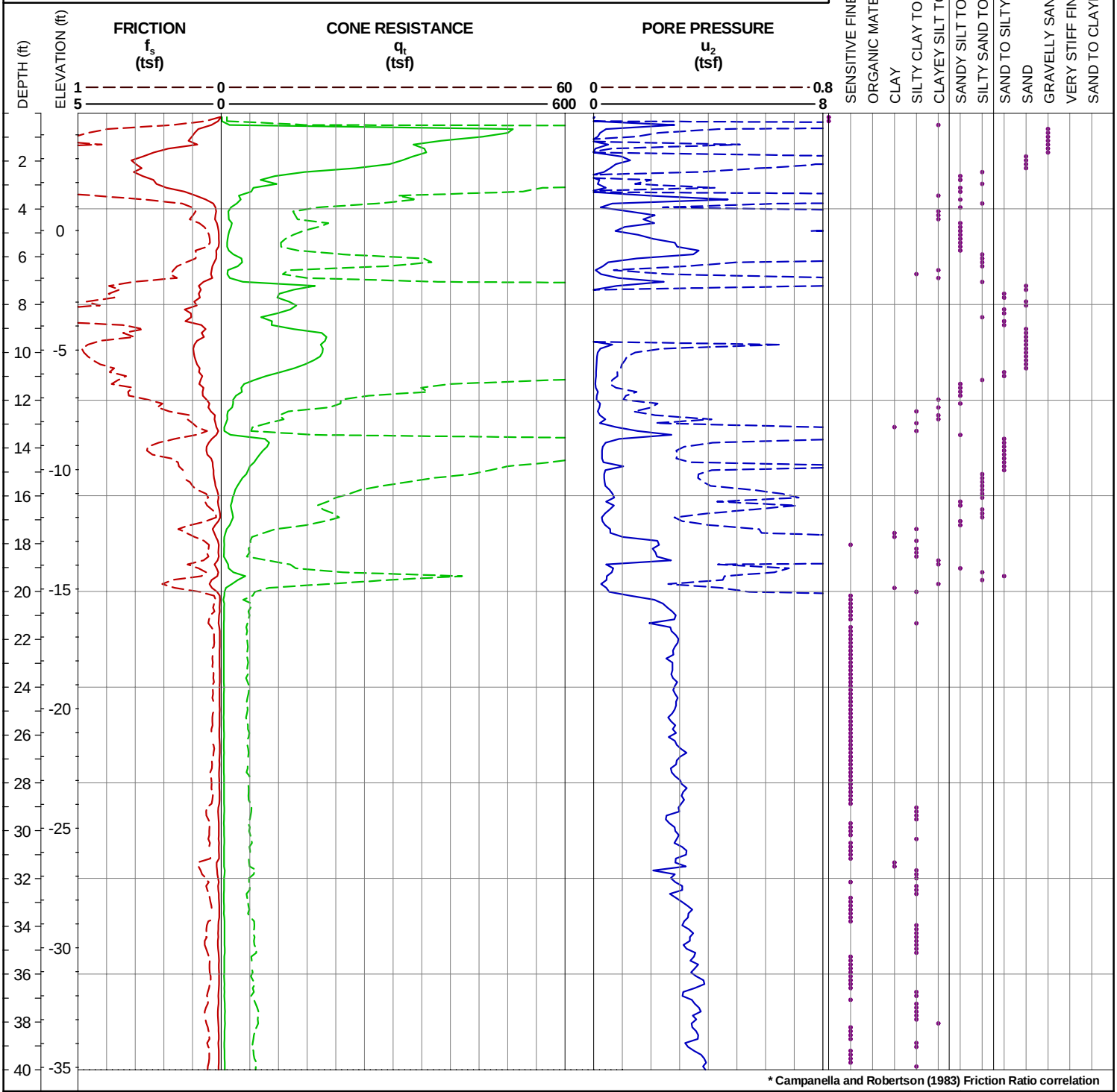
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:

CONE TYPE: 7/21/2010 - 7/21/2010

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 1 OF 3 | **10CP-003**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A | **10CP-003**

LOCATION: Norfolk and Portmouth, VA | **PAGE 2 OF 3**

STATION: OFFSET:

LATITUDE: °N LONGITUDE: °W

SURFACE ELEVATION: 4.9 COORD. DATUM: NAD 83

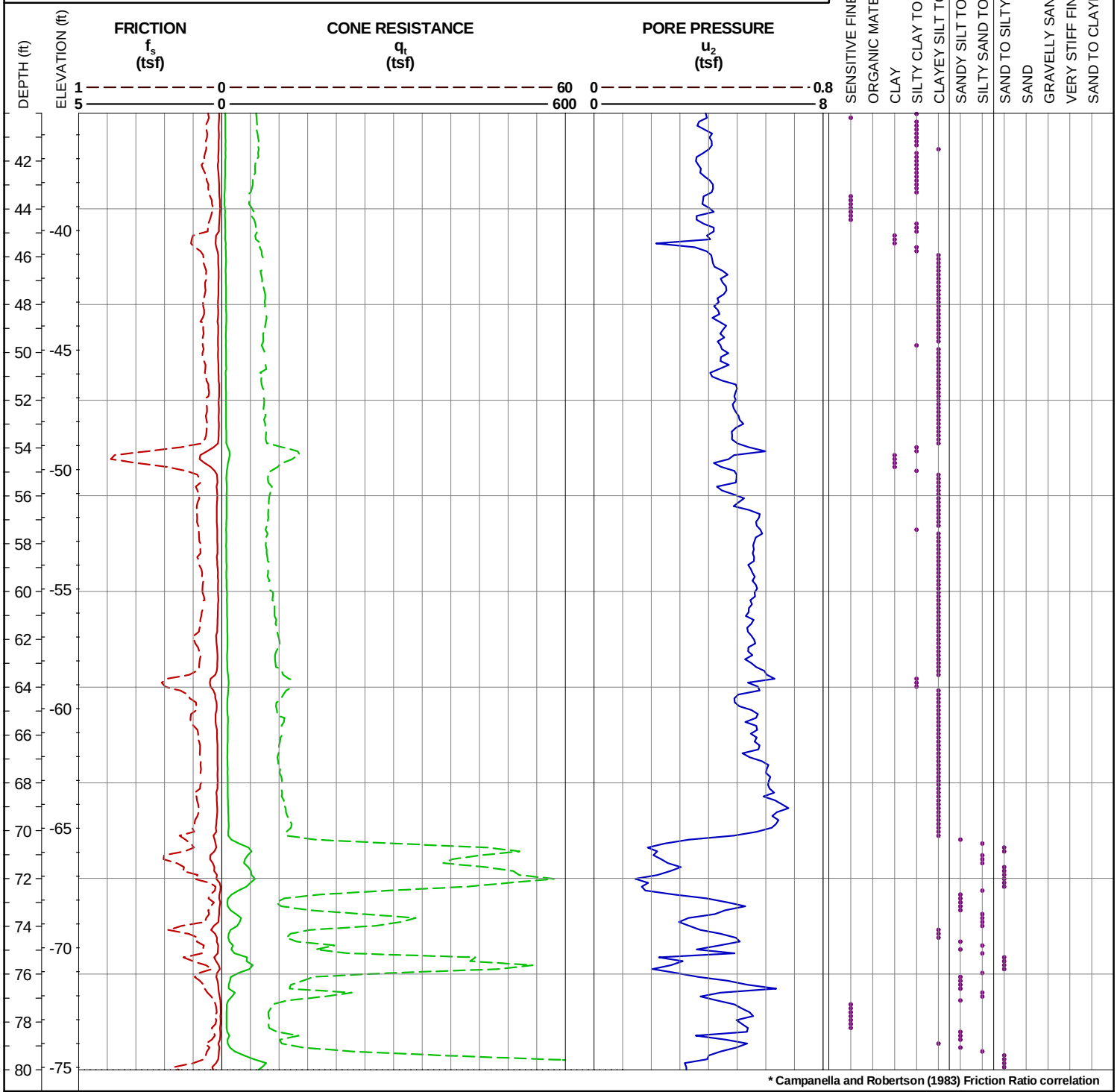
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:

CONE TYPE: 7/21/2010 - 7/21/2010

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 2 OF 3 | **10CP-003**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

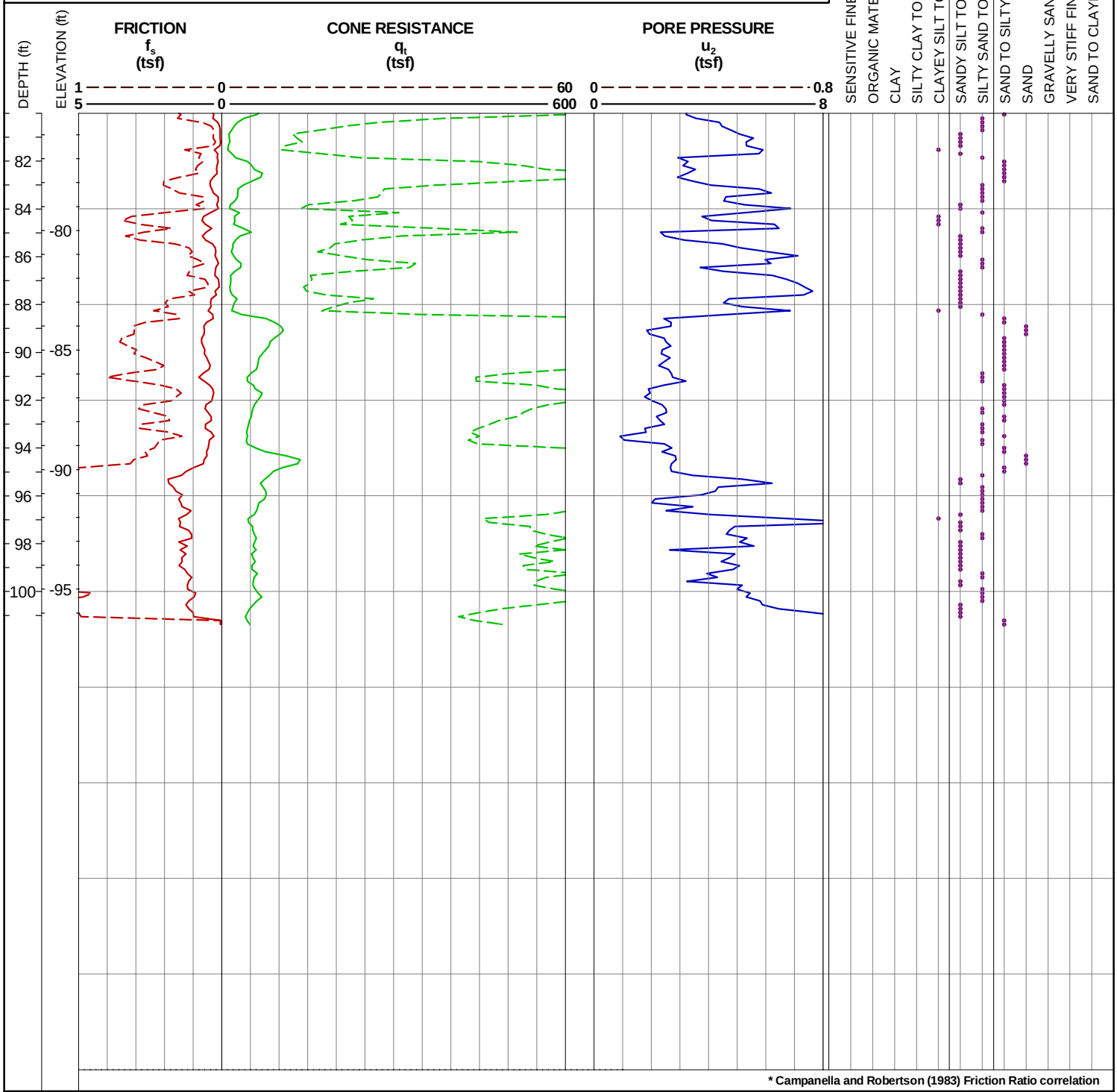
Virginia Department of Transportation

PROJECT #: 173189A | **10CP-003**

LOCATION: Norfolk and Portmouth, VA | **PAGE 3 OF 3**

STATION: OFFSET:
LATITUDE: °N LONGITUDE: °W
SURFACE ELEVATION: 4.9 COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:
CONE TYPE: 7/21/2010 - 7/21/2010
CONE SIZE:
CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 3 OF 3 | **10CP-003**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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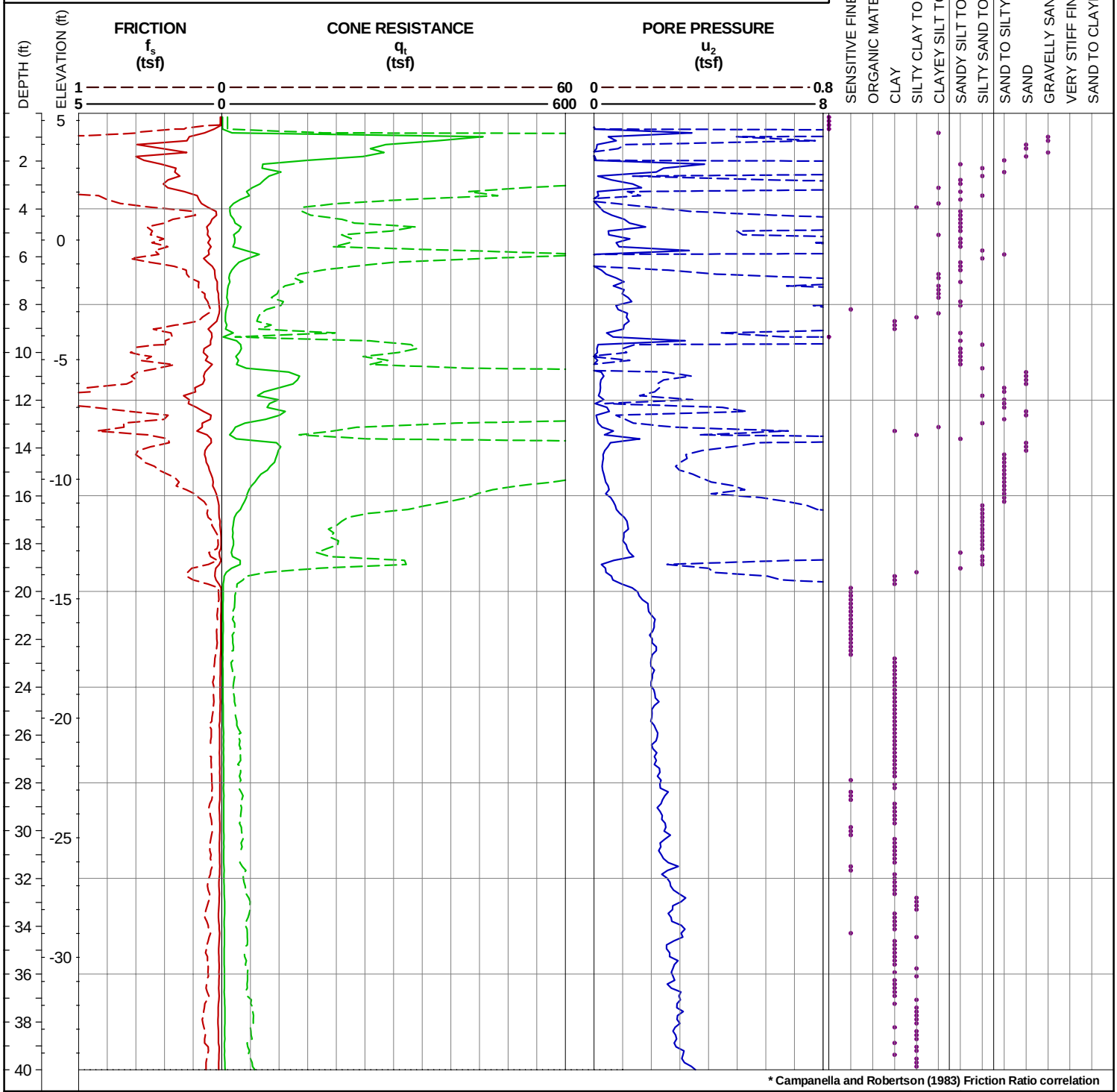
Virginia Department of Transportation

PROJECT #: 173189A | **10CP-004**

LOCATION: Norfolk and Portmouth, VA | **PAGE 1 OF 3**

STATION: OFFSET:
LATITUDE: °N LONGITUDE: °W
SURFACE ELEVATION: 5.3 COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:
CONE TYPE: 7/20/2010 - 7/20/2010
CONE SIZE:
CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 1 OF 3 | **10CP-004**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

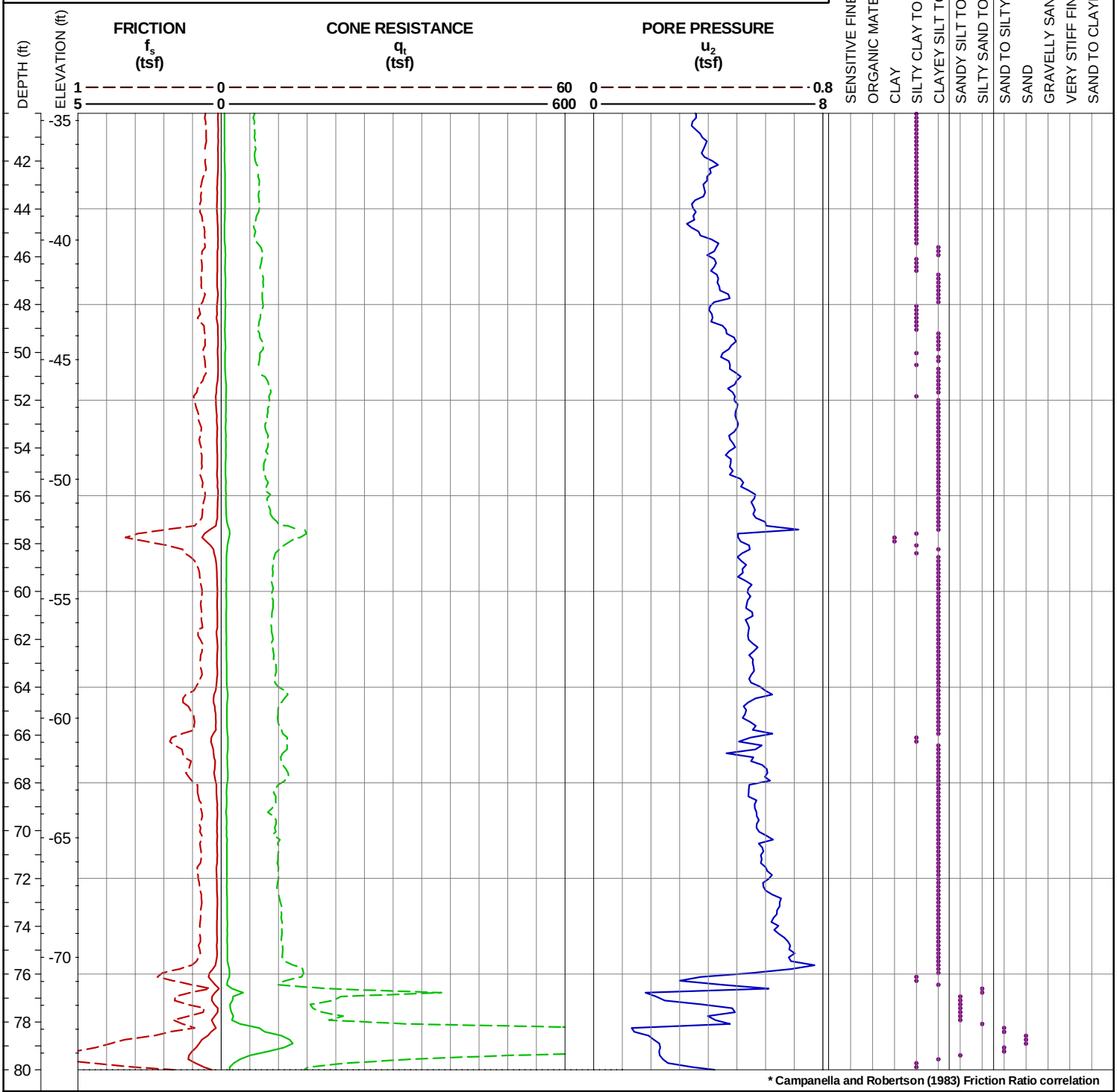
Virginia Department of Transportation

PROJECT #: 173189A | **10CP-004**

LOCATION: Norfolk and Portmouth, VA | **PAGE 2 OF 3**

STATION: OFFSET:
LATITUDE: °N LONGITUDE: °W
SURFACE ELEVATION: 5.3 COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:
CONE TYPE: 7/20/2010 - 7/20/2010
CONE SIZE:
CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 2 OF 3

10CP-004

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Virginia Department of Transportation

PROJECT #: 173189A | **10CP-004**

LOCATION: Norfolk and Portmouth, VA | **PAGE 3 OF 3**

STATION: OFFSET:
LATITUDE: °N LONGITUDE: °W
SURFACE ELEVATION: 5.3 COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:
CONE TYPE: 7/20/2010 - 7/20/2010
CONE SIZE:
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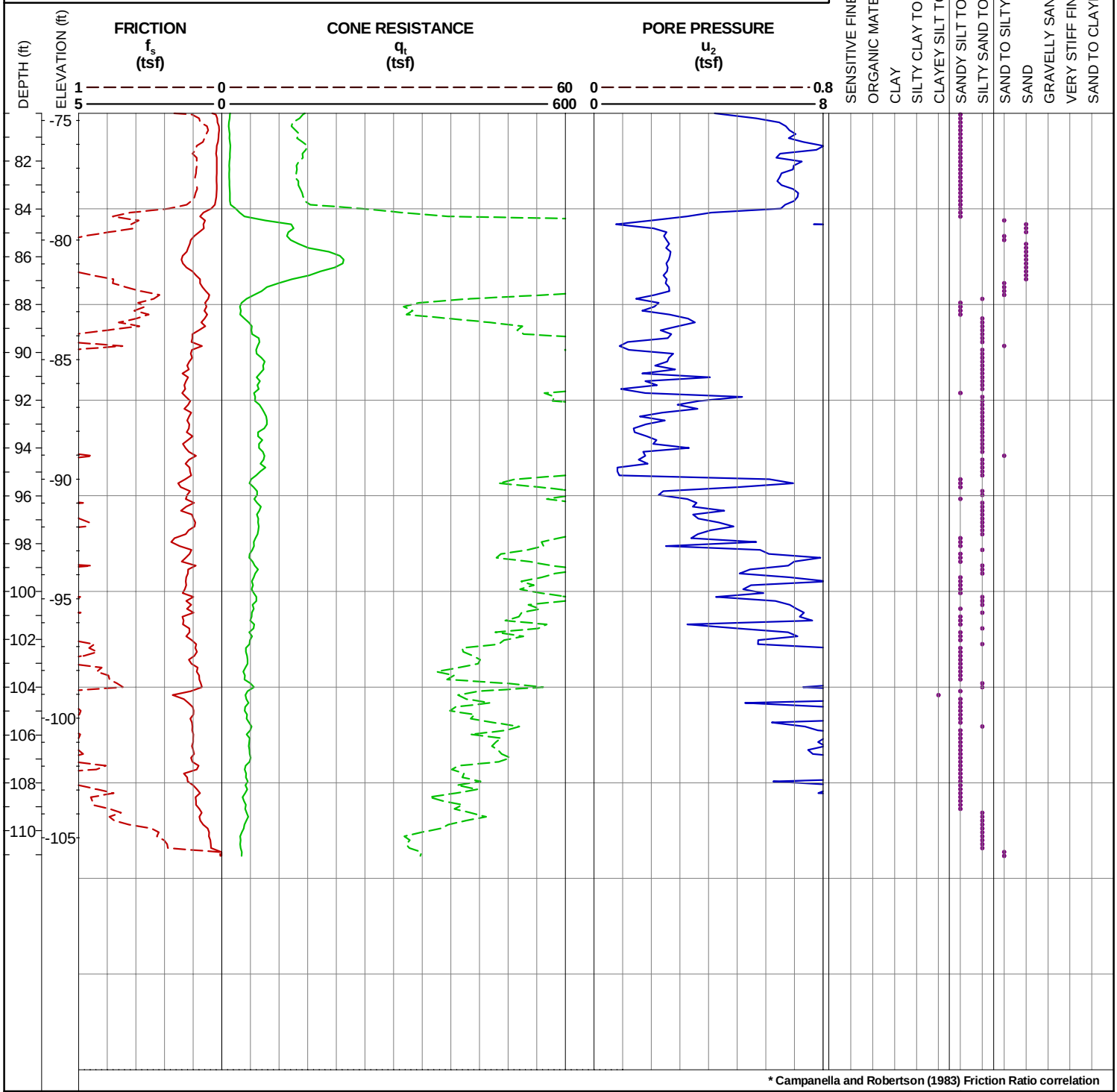

* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 3 OF 3 | **10CP-004**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A | **10CP-005**

LOCATION: Norfolk and Portmouth, VA | **PAGE 1 OF 4**

STATION: OFFSET:

LATITUDE: °N LONGITUDE: °W

SURFACE ELEVATION: 4.5 COORD. DATUM: NAD 83

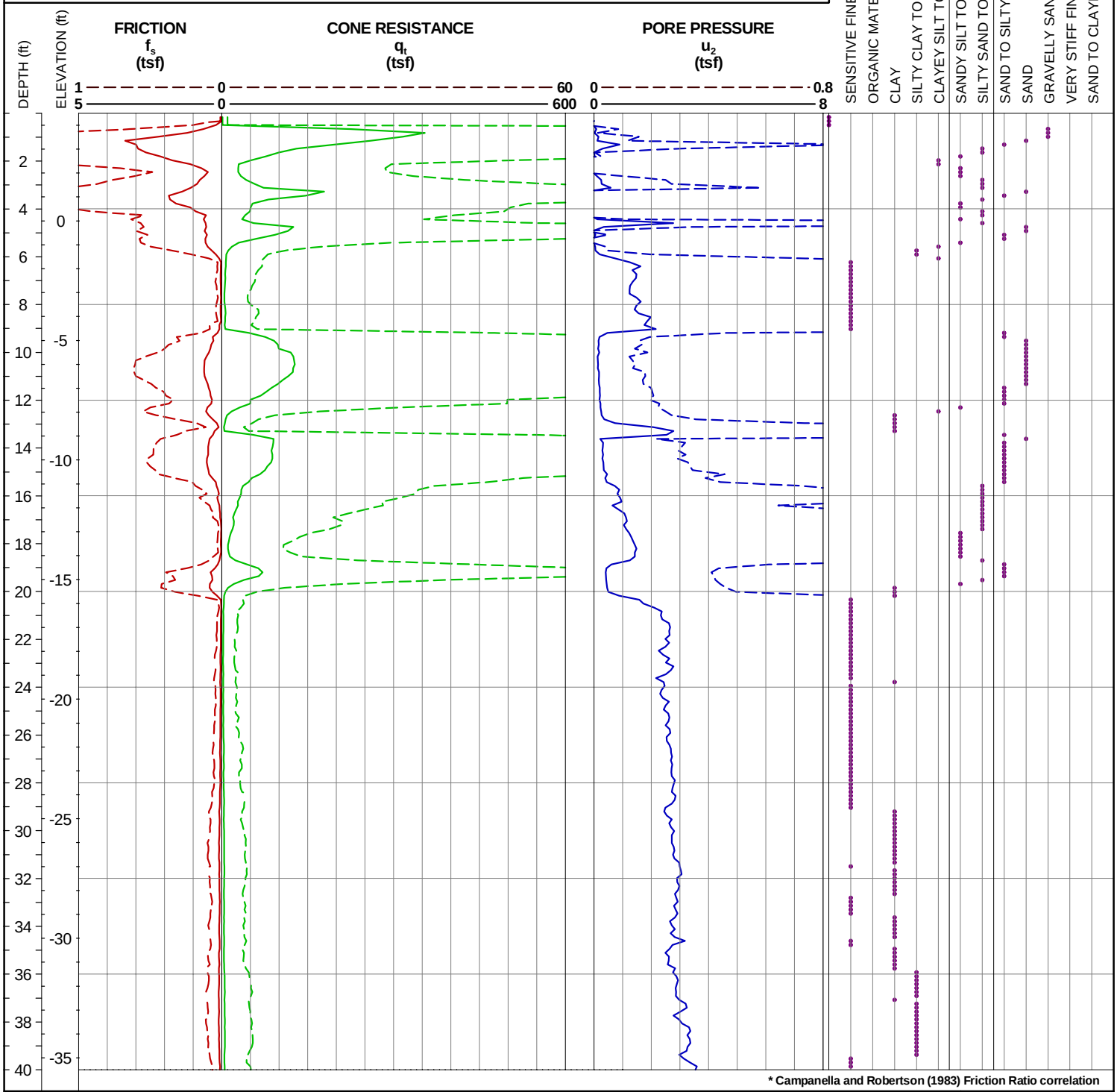
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:

CONE TYPE: 7/19/2010 - 7/19/2010

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 1 OF 4 | **10CP-005**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

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PROJECT #: 173189A | **10CP-005**

LOCATION: Norfolk and Portmouth, VA | **PAGE 2 OF 4**

STATION: OFFSET:

LATITUDE: °N LONGITUDE: °W

SURFACE ELEVATION: 4.5 COORD. DATUM: NAD 83

BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:

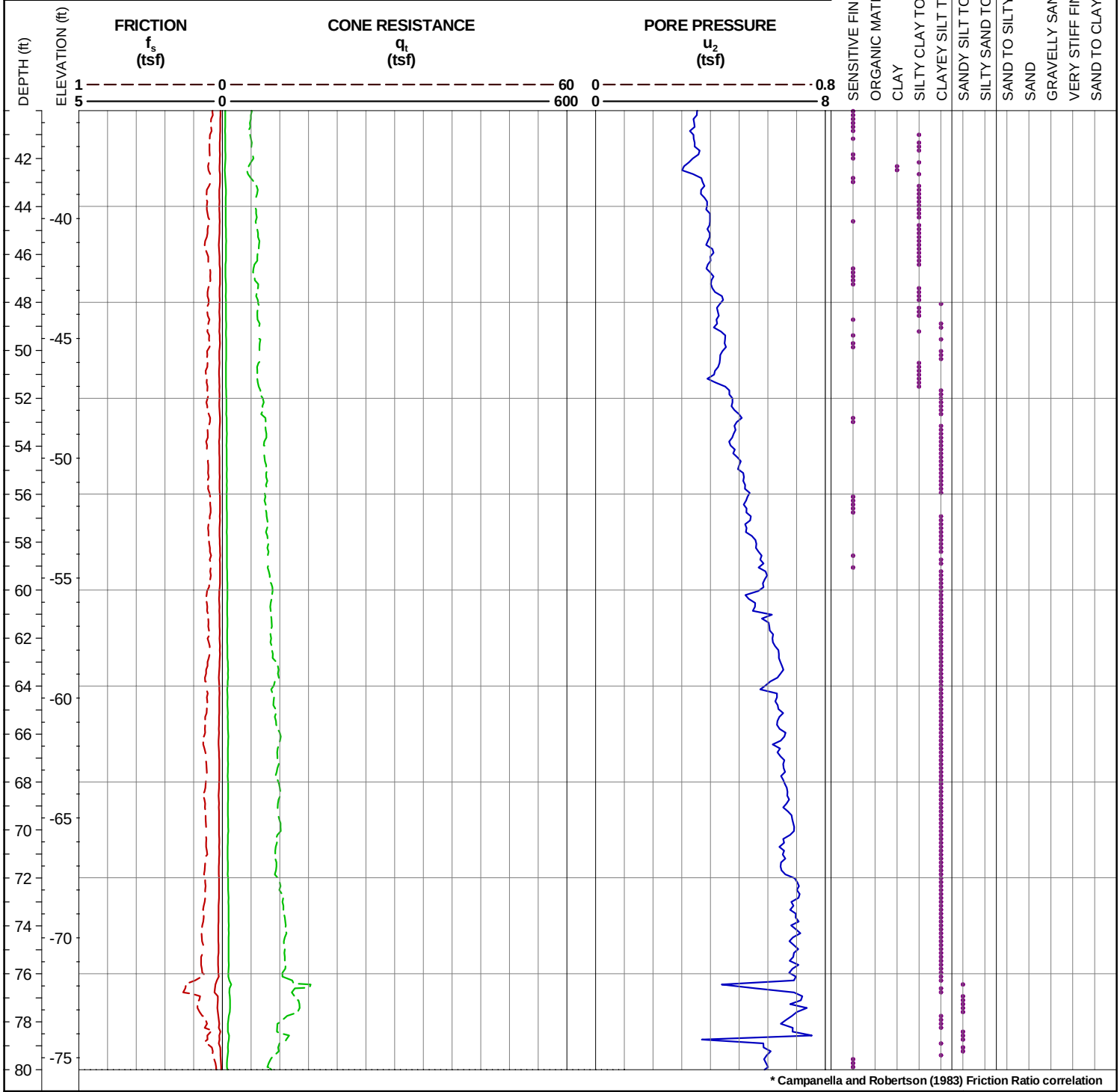
CONE TYPE: 7/19/2010 - 7/19/2010

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:

SOIL BEHAVIOR TYPE*

SENSITIVE FINE GRAINED
ORGANIC MATERIAL
CLAY
SILTY CLAY TO CLAY
CLAYEY SILT TO SILTY CLAY
SANDY SILT TO CLAYEY SILT
SILTY SAND TO SANDY SILT
SAND TO SILTY SAND
SAND
GRAVELLY SAND TO SAND
VERY STIFF FINE GRAINED
SAND TO CLAYEY SAND



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 2 OF 4

10CP-005

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A | **10CP-005**

LOCATION: Norfolk and Portmouth, VA | **PAGE 3 OF 4**

STATION: OFFSET:

LATITUDE: °N LONGITUDE: °W

SURFACE ELEVATION: 4.5 COORD. DATUM: NAD 83

BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:

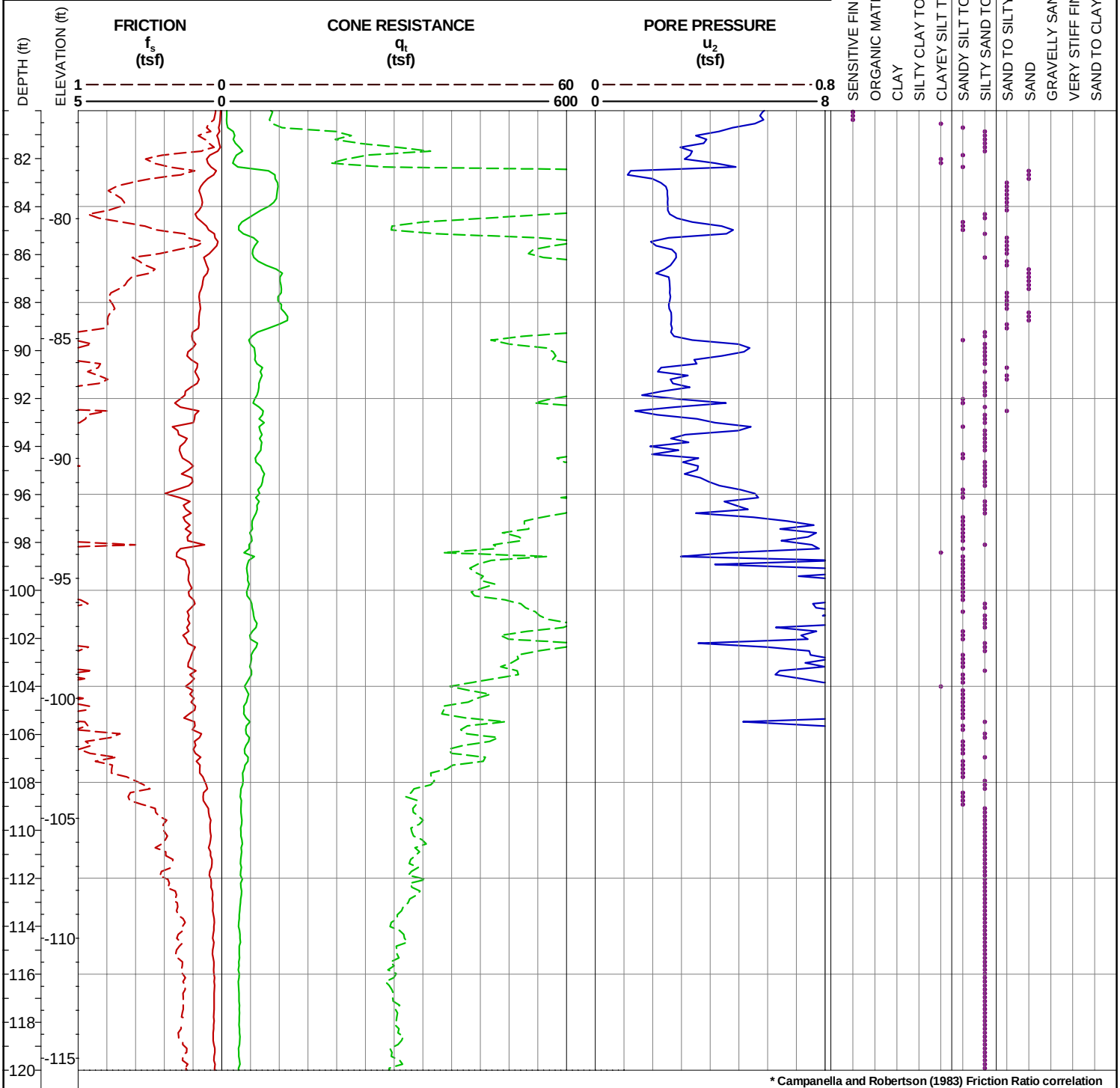
CONE TYPE: 7/19/2010 - 7/19/2010

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:

SOIL BEHAVIOR TYPE*

SENSITIVE FINE GRAINED
ORGANIC MATERIAL
CLAY
SILTY CLAY TO CLAY
CLAYEY SILT TO SILTY CLAY
SANDY SILT TO CLAYEY SILT
SILTY SAND TO SANDY SILT
SAND TO SILTY SAND
SAND
GRAVELLY SAND TO SAND
VERY STIFF FINE GRAINED
SAND TO CLAYEY SAND



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 3 OF 4 | **10CP-005**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

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PROJECT #: 173189A | **10CP-005**

LOCATION: Norfolk and Portmouth, VA | **PAGE 4 OF 4**

STATION: OFFSET:

LATITUDE: °N LONGITUDE: °W

SURFACE ELEVATION: 4.5 COORD. DATUM: NAD 83

BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED: 7/19/2010 - 7/19/2010

CONE TYPE:

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:

SOIL BEHAVIOR TYPE*

DEPTH (ft)

ELEVATION (ft)

FRICTION f_s (tsf): 1 – 0

CONE RESISTANCE q_t (tsf): 0 – 60

PORE PRESSURE u_2 (tsf): 0 – 0.8

5 – 0 – 600 – 0 – 8

SENSITIVE FINE GRAINED

ORGANIC MATERIAL

CLAY

SILTY CLAY TO CLAY

CLAYEY SILT TO SILTY CLAY

SANDY SILT TO CLAYEY SILT

SILTY SAND TO SANDY SILT

SAND TO SILTY SAND

SAND

GRAVELLY SAND TO SAND

VERY STIFF FINE GRAINED

SAND TO CLAYEY SAND



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

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10CP-005

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CONE PENETROMETER TEST LOG

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PROJECT #: 173189A | **10CP-006**

LOCATION: Norfolk and Portmouth, VA | **PAGE 1 OF 2**

STATION: OFFSET:

LATITUDE: °N LONGITUDE: °W

SURFACE ELEVATION: 5.5 COORD. DATUM: NAD 83

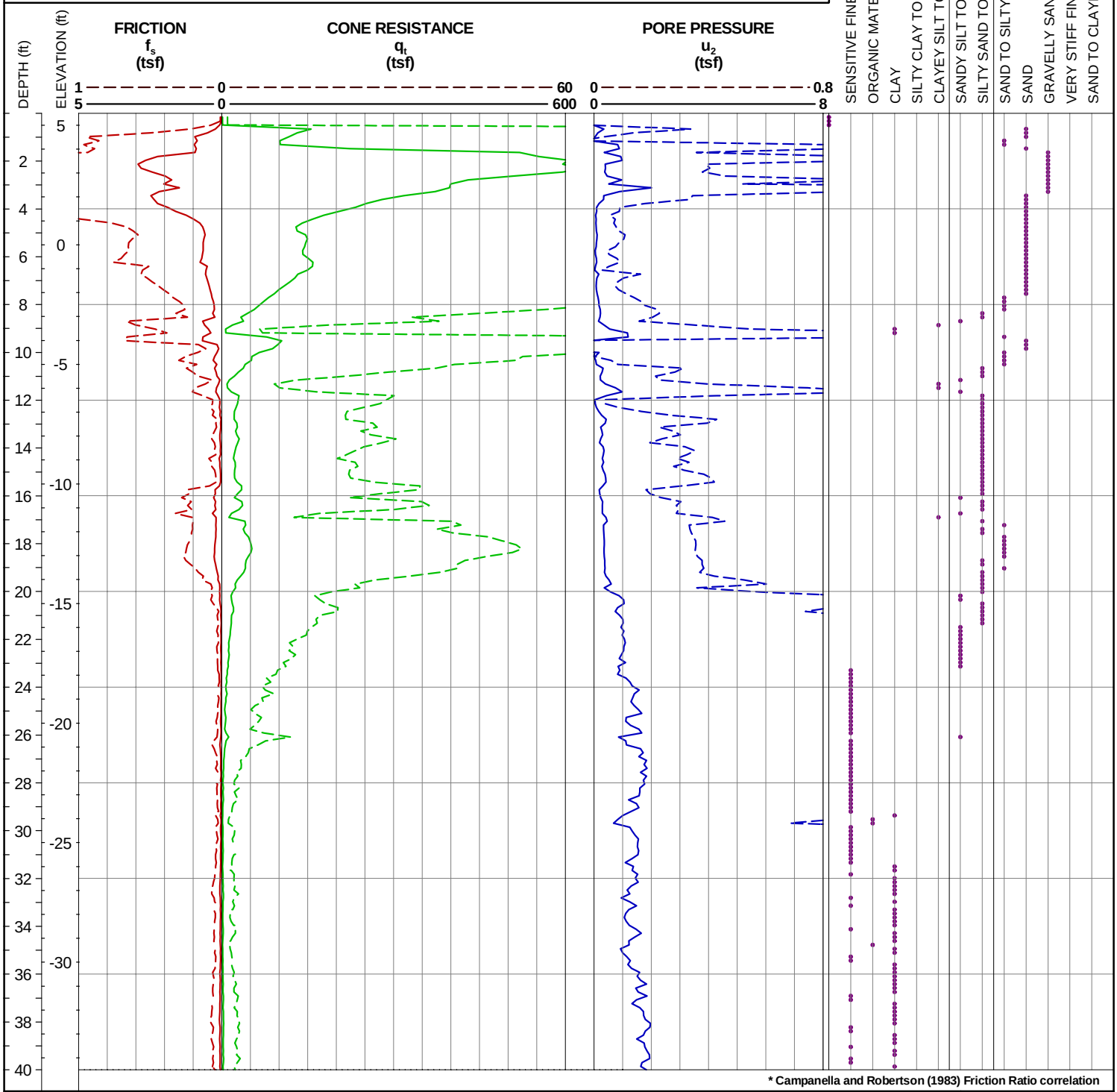
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:

CONE TYPE: 7/19/2010 - 7/19/2010

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 1 OF 2 | **10CP-006**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

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PROJECT #: 173189A | **10CP-006**

LOCATION: Norfolk and Portmouth, VA | **PAGE 2 OF 2**

STATION: OFFSET:
LATITUDE: °N LONGITUDE: °W
SURFACE ELEVATION: 5.5 COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED: 7/19/2010 - 7/19/2010
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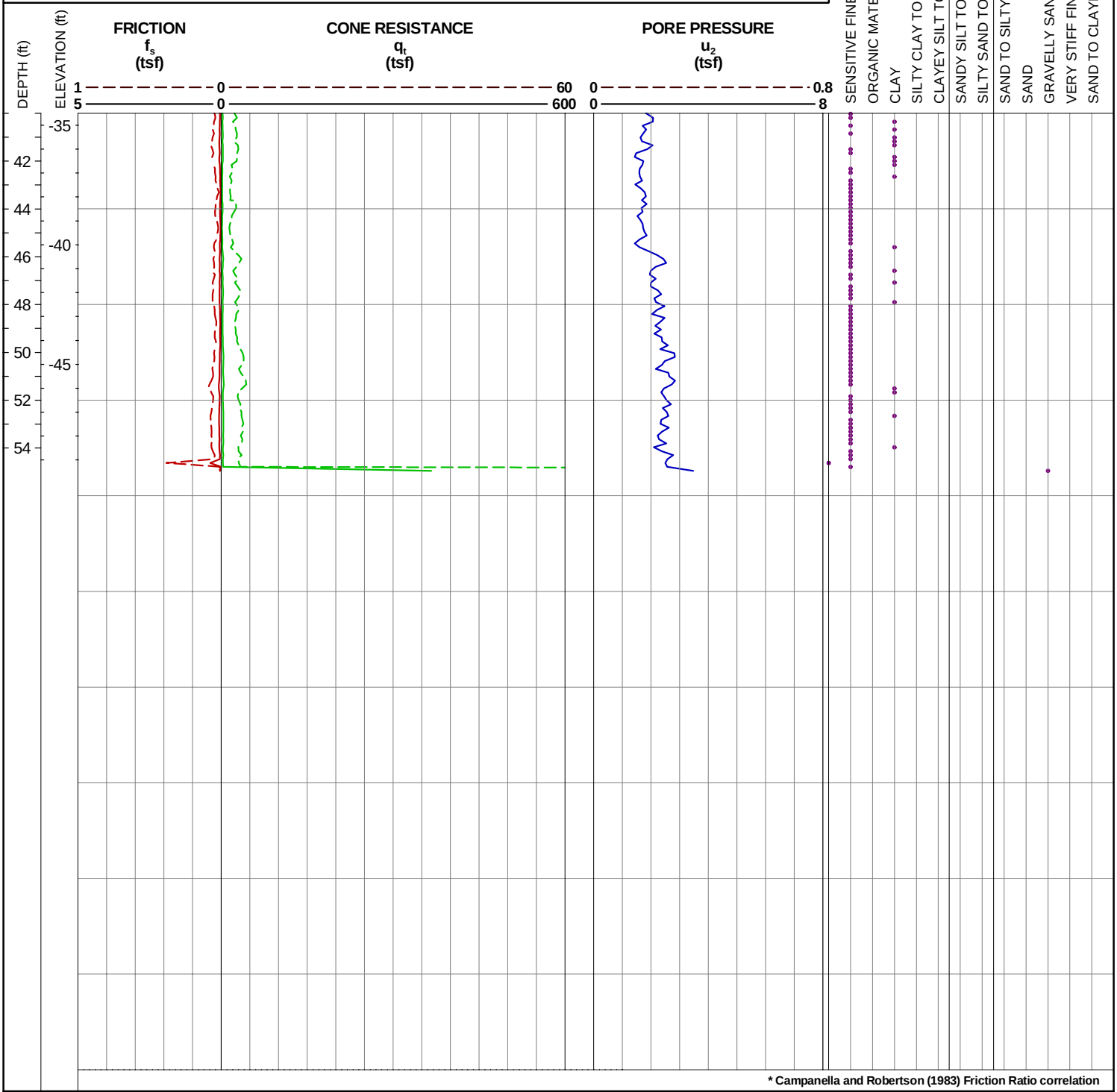
CONE SIZE:
CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 2 OF 2

10CP-006

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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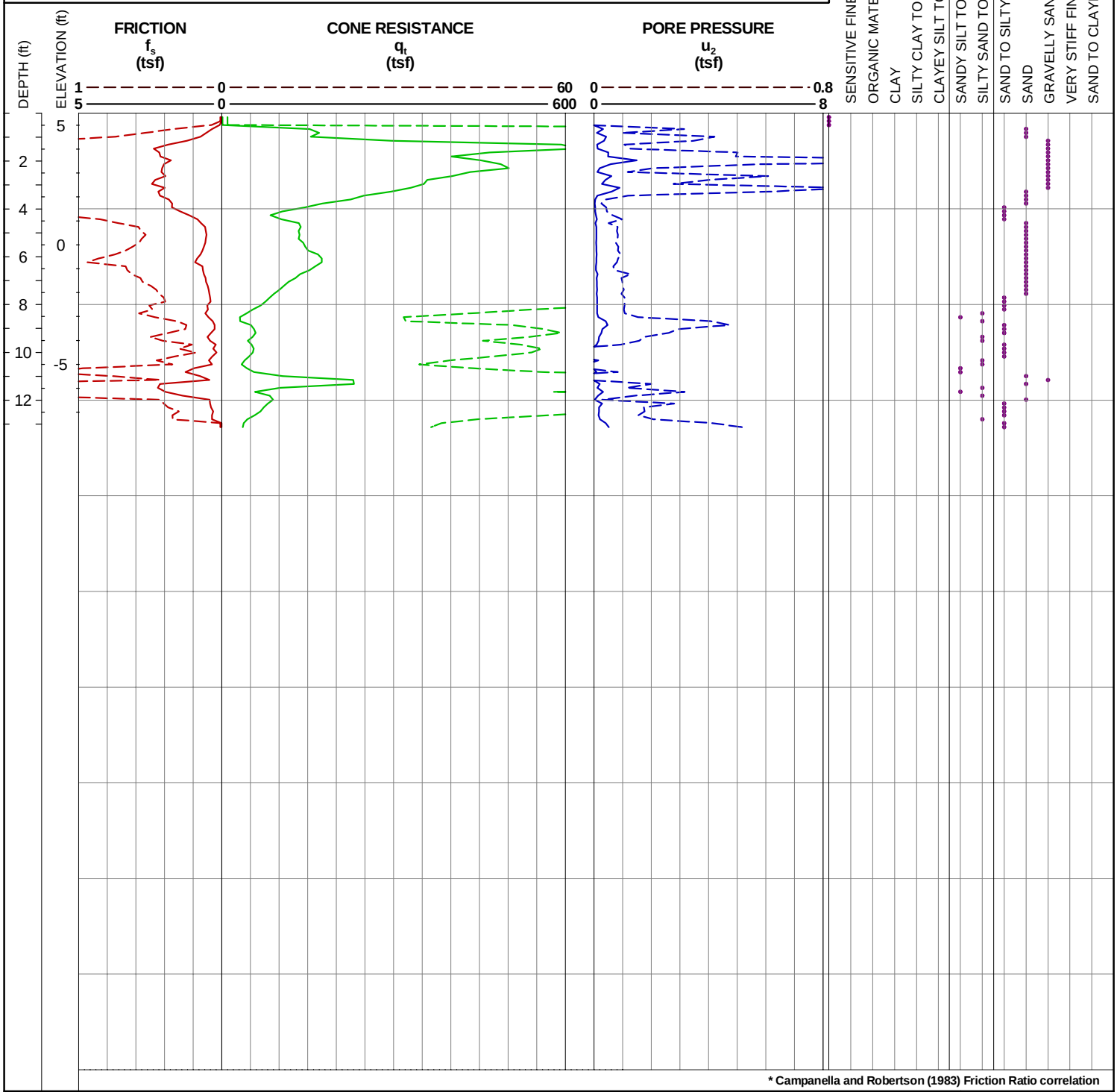
Virginia Department of Transportation

PROJECT #: 173189A | **10CP-006A**

LOCATION: Norfolk and Portmouth, VA | **PAGE 1 OF 1**

STATION: OFFSET:
LATITUDE: °N LONGITUDE: °W
SURFACE ELEVATION: 5.5 COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:
CONE TYPE: 7/19/2010 - 7/19/2010
CONE SIZE:
CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 1 OF 1 | **10CP-006A**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

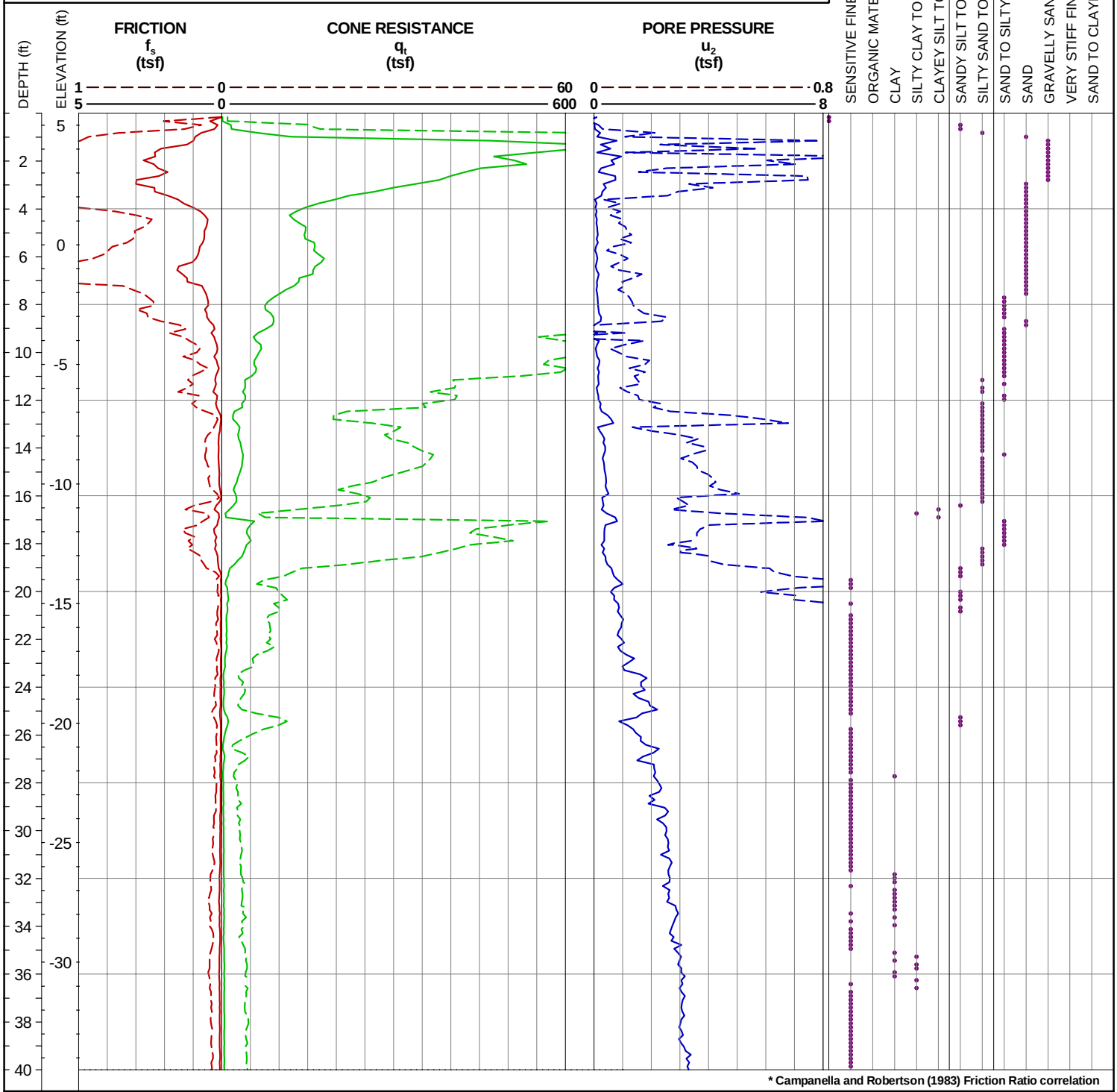
PROJECT #: 173189A | **10CP-006B**

LOCATION: Norfolk and Portmouth, VA | **PAGE 1 OF 4**

STATION: OFFSET:
LATITUDE: °N LONGITUDE: °W
SURFACE ELEVATION: 5.5 COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:
CONE TYPE: 7/19/2010 - 7/19/2010
CONE SIZE:
CONE ID No.: 215:T1500F15U500 LOGGER:

SOIL BEHAVIOR TYPE*



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 1 OF 4 | **10CP-006B**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A | **10CP-006B**

LOCATION: Norfolk and Portmouth, VA | **PAGE 2 OF 4**

STATION: OFFSET:

LATITUDE: °N LONGITUDE: °W

SURFACE ELEVATION: 5.5 COORD. DATUM: NAD 83

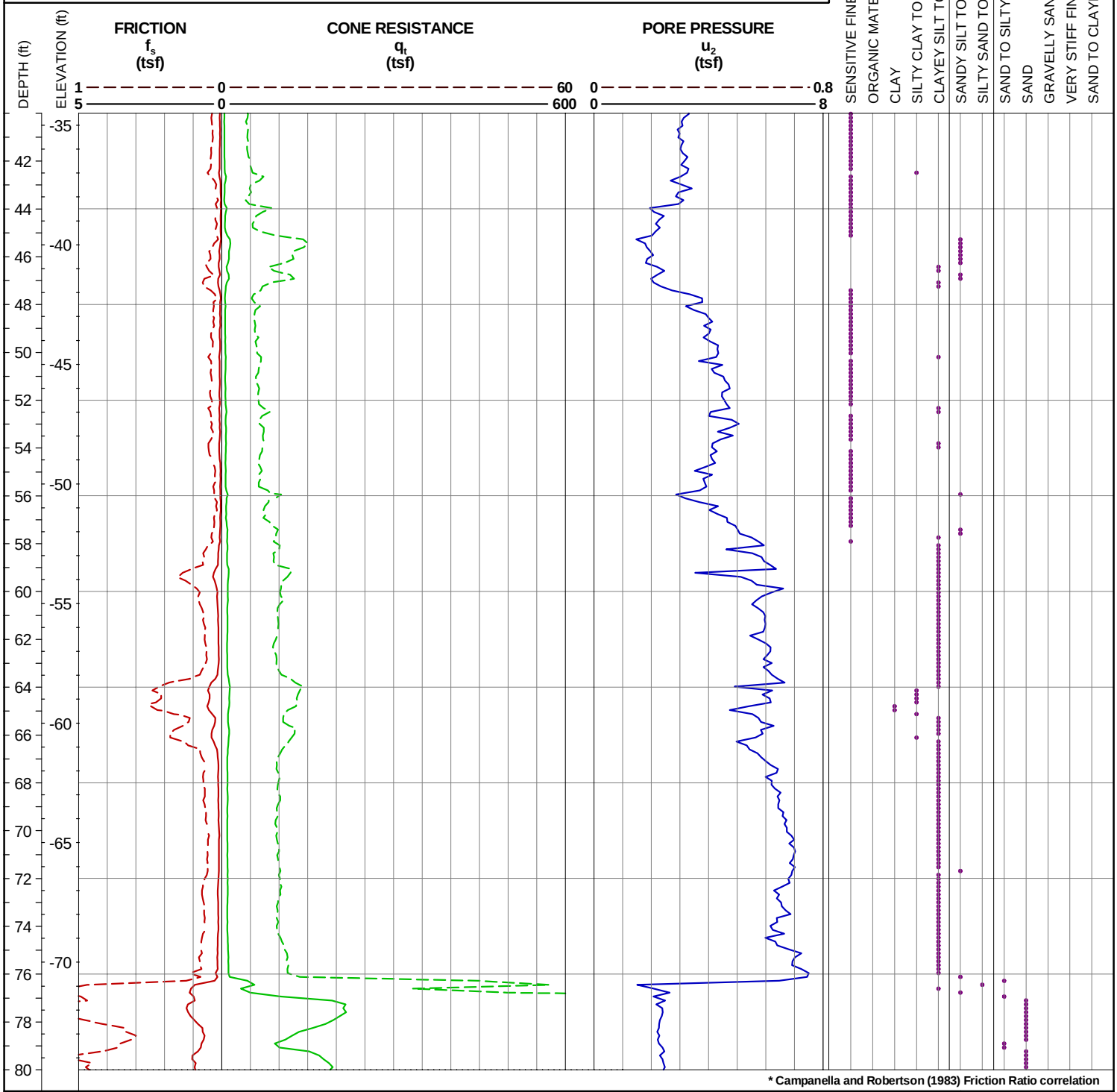
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:

CONE TYPE: 7/19/2010 - 7/19/2010

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 2 OF 4 | **10CP-006B**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

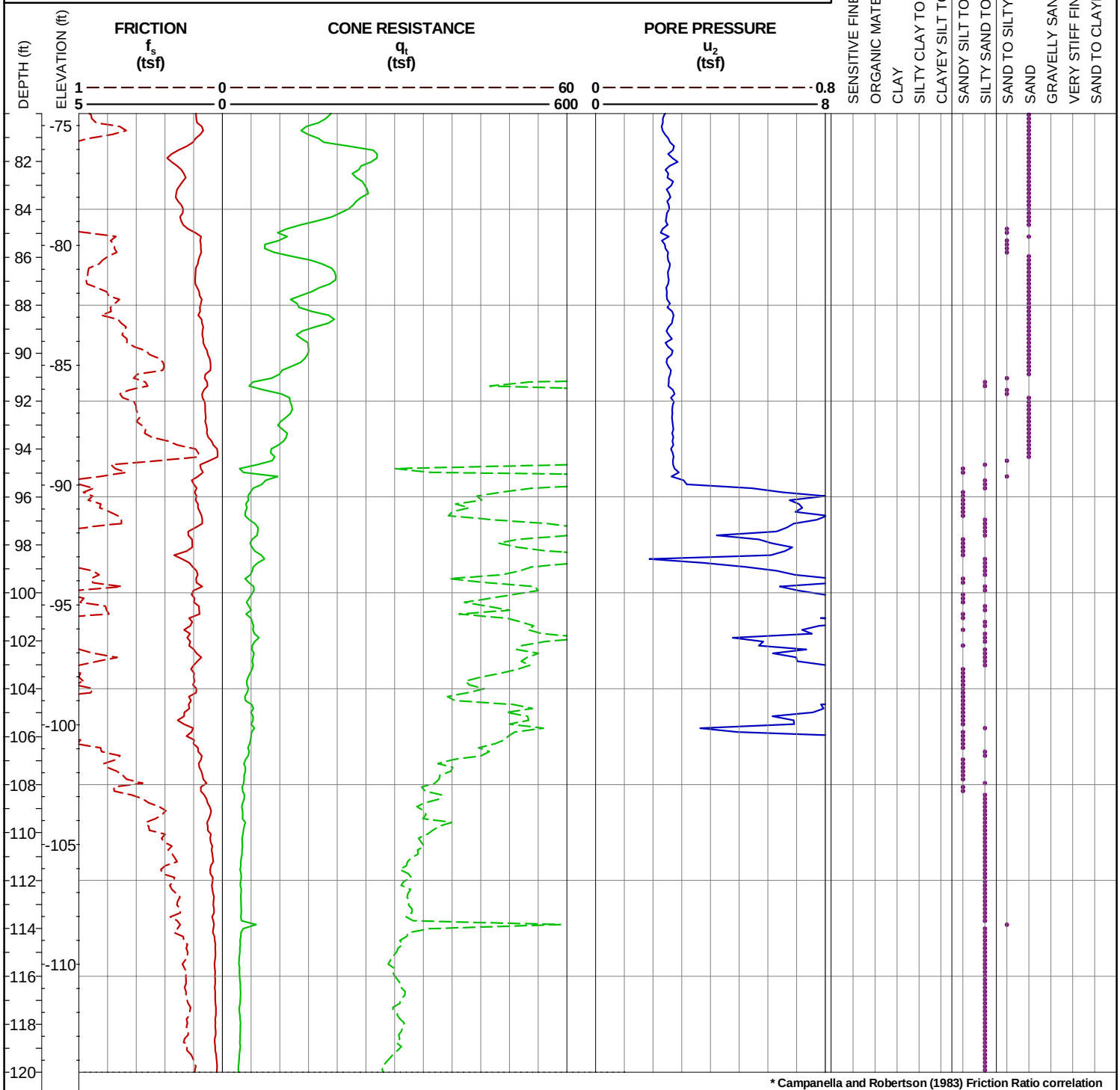
PROJECT #: 173189A | **10CP-006B**

LOCATION: Norfolk and Portmouth, VA | **PAGE 3 OF 4**

STATION: OFFSET:
LATITUDE: °N LONGITUDE: °W
SURFACE ELEVATION: 5.5 COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:
CONE TYPE: 7/19/2010 - 7/19/2010
CONE SIZE:
CONE ID No.: 215:T1500F15U500 LOGGER:

SOIL BEHAVIOR TYPE*



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 3 OF 4

10CP-006B

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

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PROJECT #: 173189A | **10CP-006B**

LOCATION: Norfolk and Portmouth, VA | **PAGE 4 OF 4**

STATION: OFFSET:
LATITUDE: °N LONGITUDE: °W
SURFACE ELEVATION: 5.5 COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:
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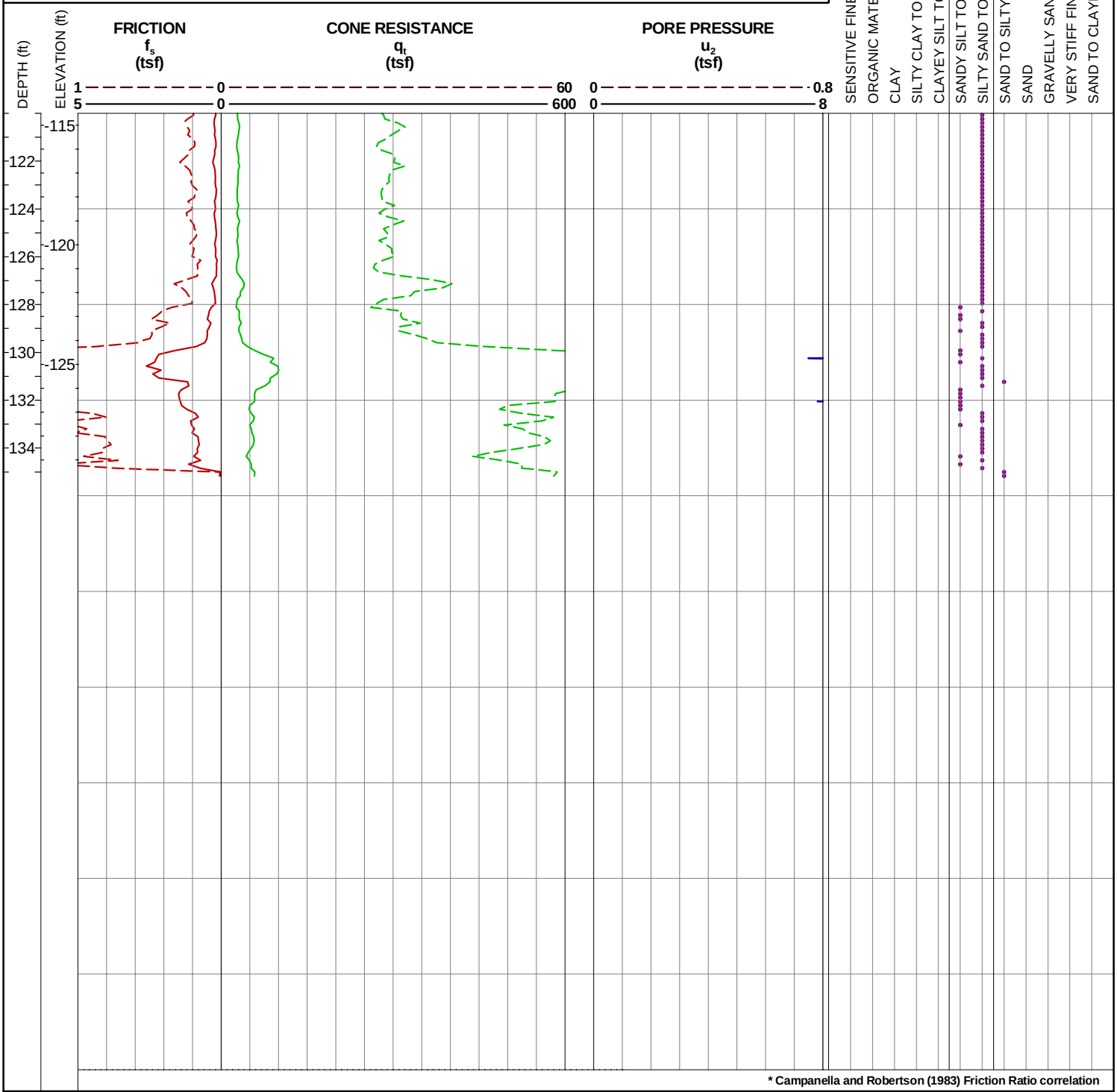
CONE SIZE:
CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 4 OF 4

10CP-006B

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A | **10CP-007**

LOCATION: Norfolk and Portmouth, VA | **PAGE 1 OF 2**

STATION: OFFSET:

LATITUDE: 36.857914°N LONGITUDE: 76.316324°W

SURFACE ELEVATION: -44.6 COORD. DATUM: NAD 83

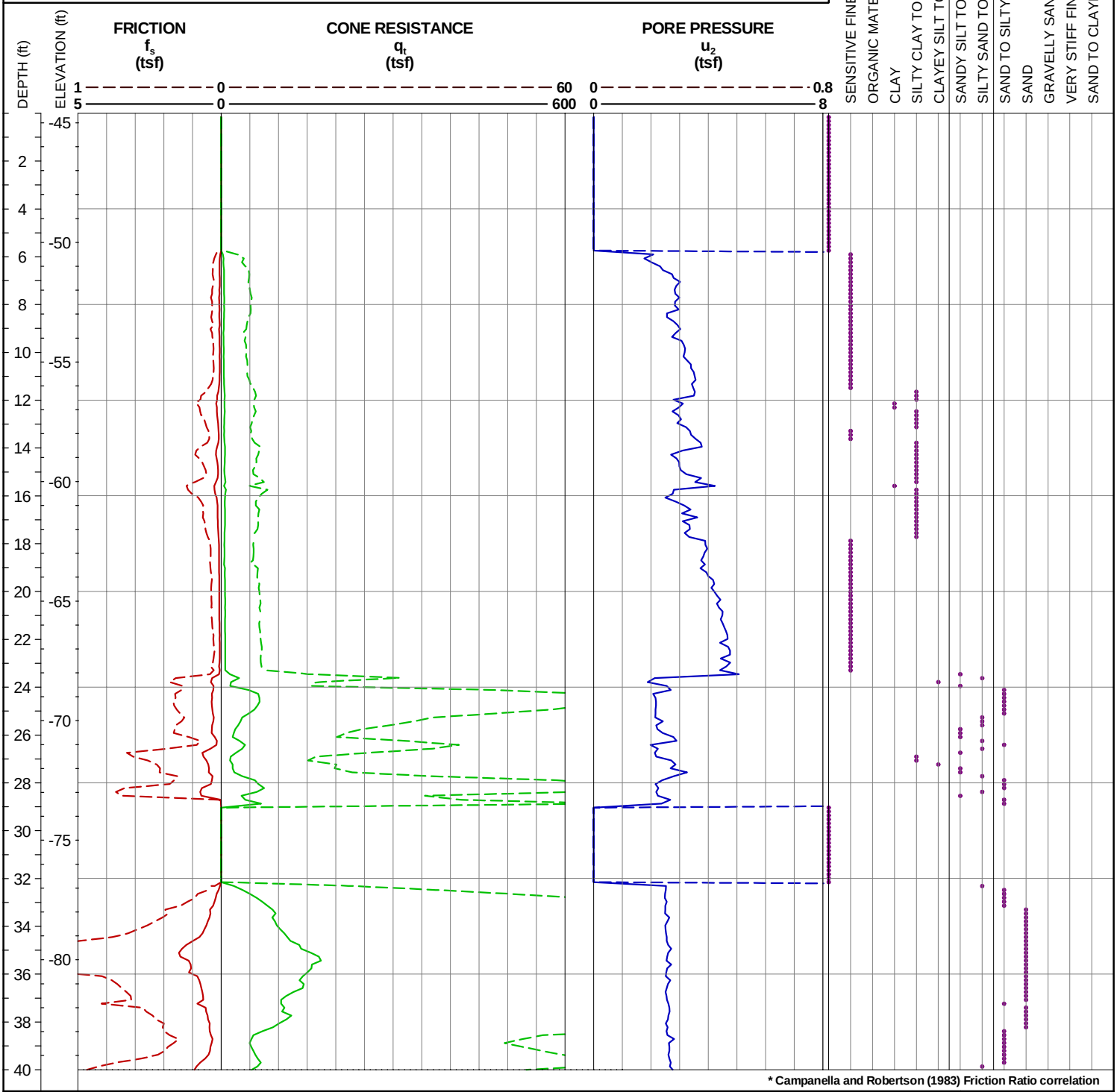
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:

CONE TYPE: 8/5/2010 - 8/5/2010

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 1 OF 2 | **10CP-007**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A | **10CP-007**

LOCATION: Norfolk and Portmouth, VA | **PAGE 2 OF 2**

STATION: OFFSET:

LATITUDE: 36.857914°N LONGITUDE: 76.316324°W

SURFACE ELEVATION: -44.6 COORD. DATUM: NAD 83

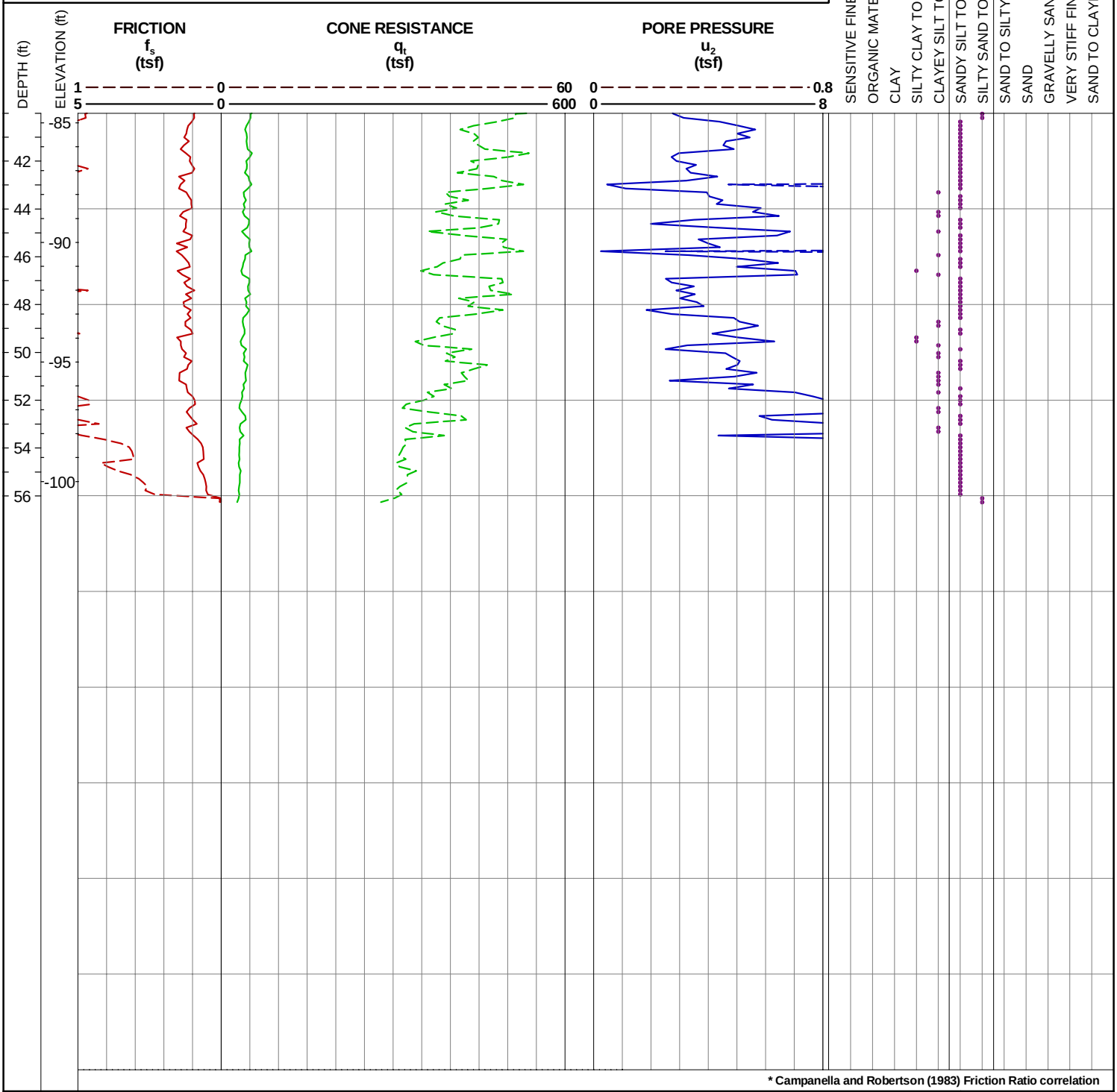
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:

CONE TYPE: 8/5/2010 - 8/5/2010

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 2 OF 2

10CP-007

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

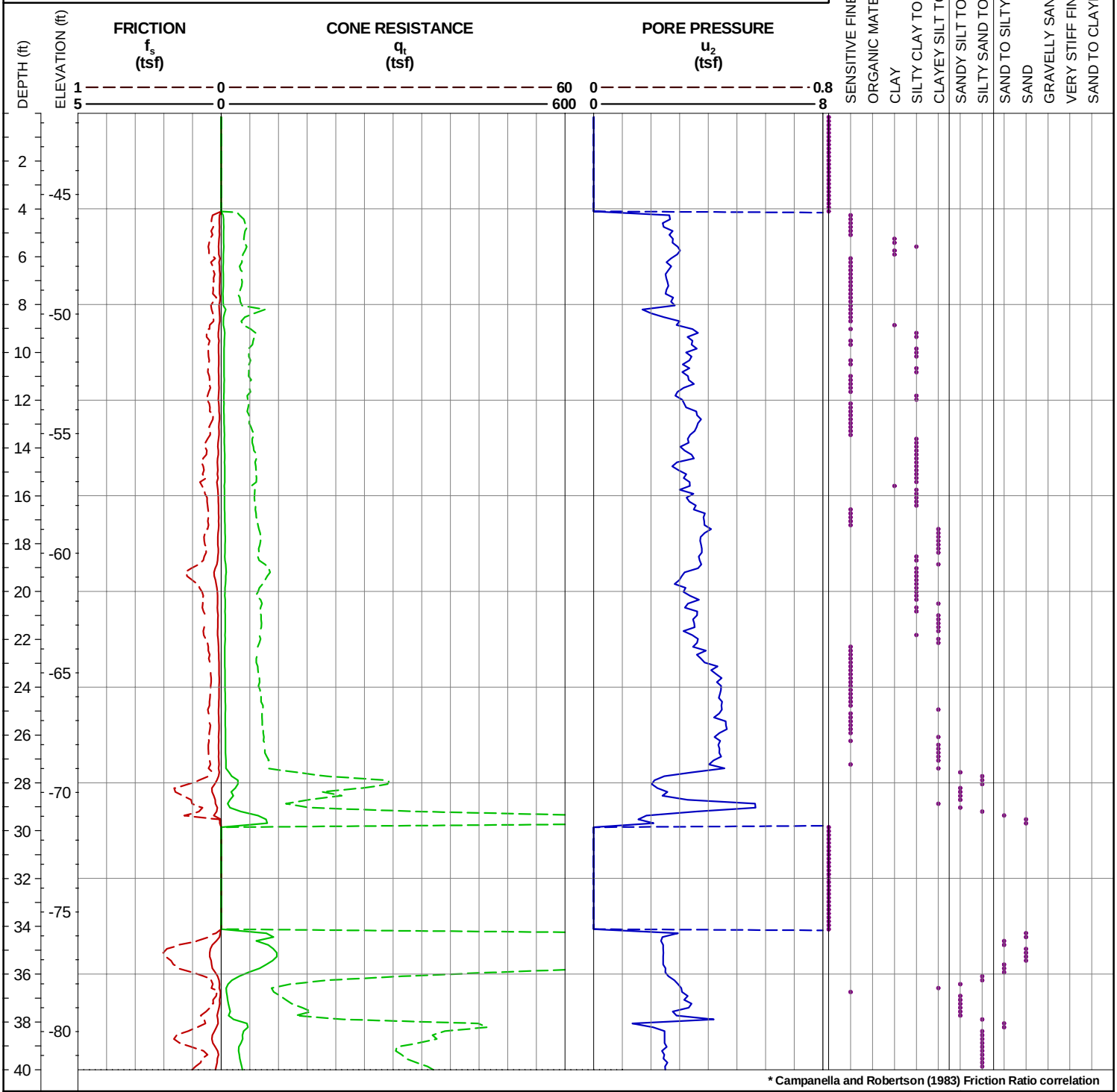
Virginia Department of Transportation

PROJECT #: 173189A | **10CP-008**

LOCATION: Norfolk and Portmouth, VA | **PAGE 1 OF 2**

STATION:
OFFSET:
LATITUDE: 36.857833°N
LONGITUDE: 76.316197°W
SURFACE ELEVATION: -41.6
COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec
DATE(S) DRILLED: 7/29/2010 - 7/29/2010
CONE TYPE:
CONE SIZE:
CONE ID No.: 215:T1500F15U500
LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 1 OF 2 | **10CP-008**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A | **10CP-008**

LOCATION: Norfolk and Portmouth, VA | **PAGE 2 OF 2**

STATION: OFFSET:

LATITUDE: 36.857833°N LONGITUDE: 76.316197°W

SURFACE ELEVATION: -41.6 COORD. DATUM: NAD 83

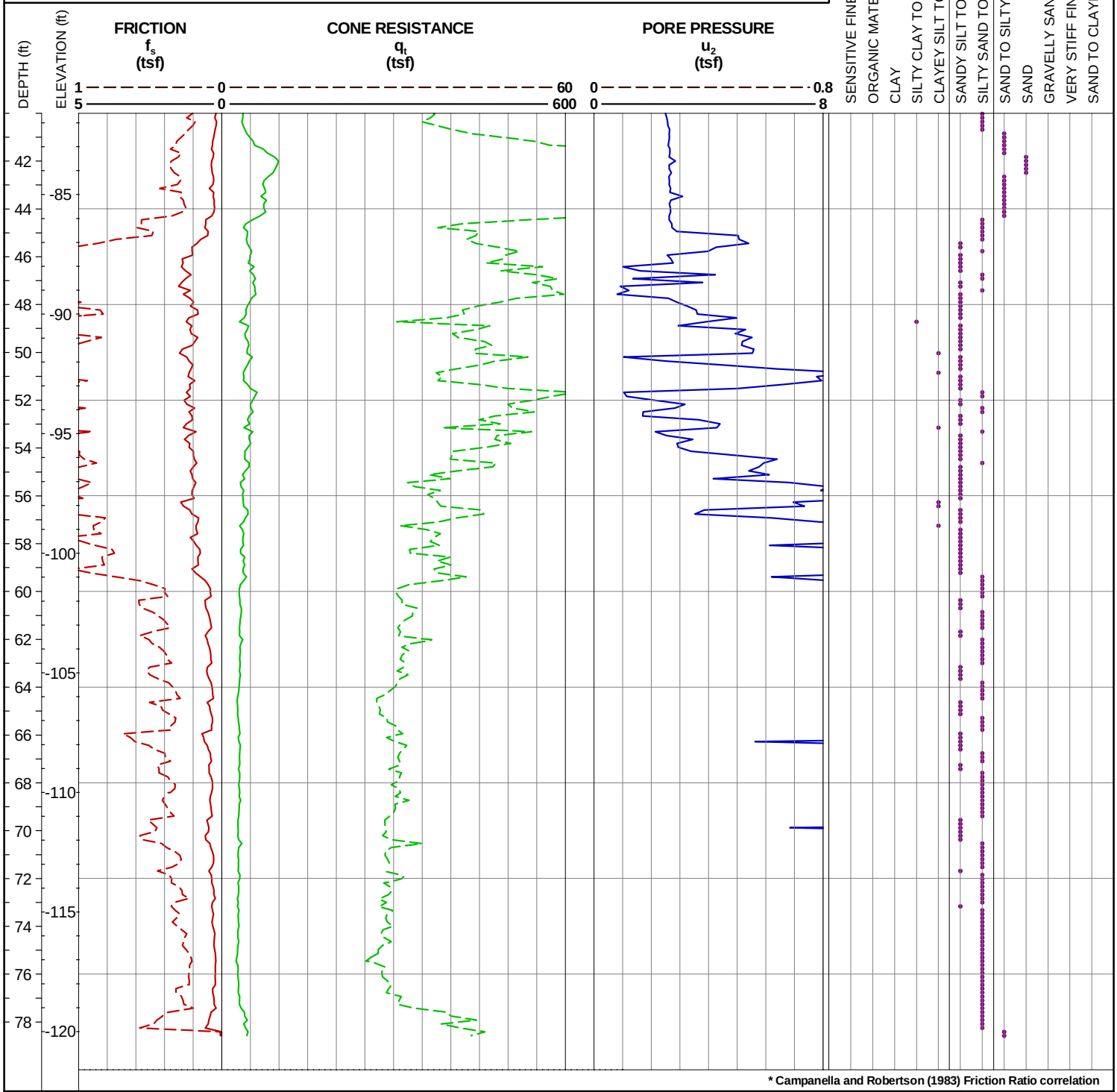
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:

CONE TYPE: 7/29/2010 - 7/29/2010

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 2 OF 2 | **10CP-008**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A | **10CP-009**

LOCATION: Norfolk and Portmouth, VA | **PAGE 1 OF 3**

STATION: OFFSET:

LATITUDE: 36.857713°N LONGITUDE: 76.316047°W

SURFACE ELEVATION: -33.6 COORD. DATUM: NAD 83

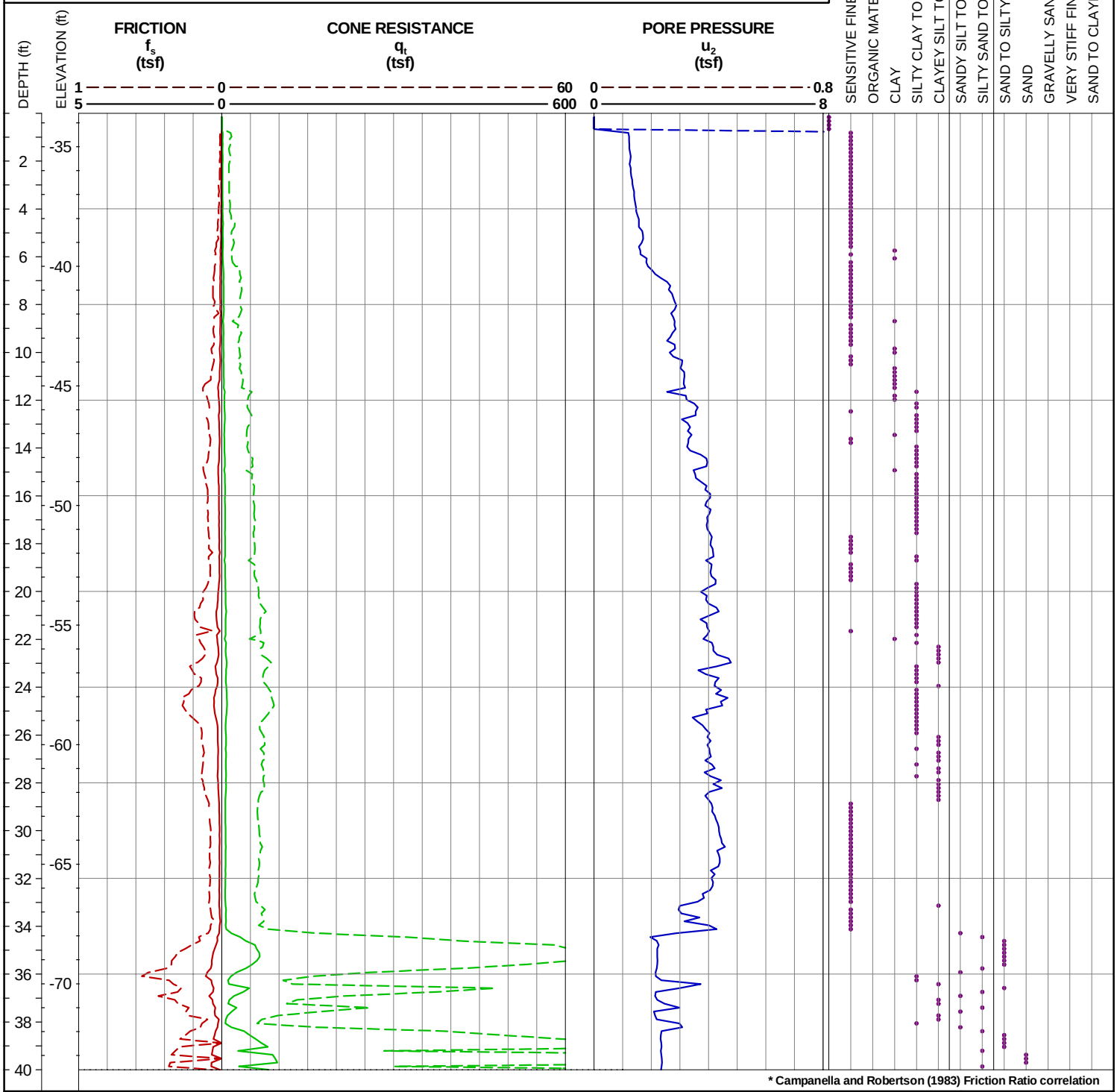
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:

CONE TYPE: 8/4/2010 - 8/4/2010

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 1 OF 3 | **10CP-009**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A | **10CP-009**

LOCATION: Norfolk and Portmouth, VA | **PAGE 2 OF 3**

STATION: OFFSET:

LATITUDE: 36.857713°N LONGITUDE: 76.316047°W

SURFACE ELEVATION: -33.6 COORD. DATUM: NAD 83

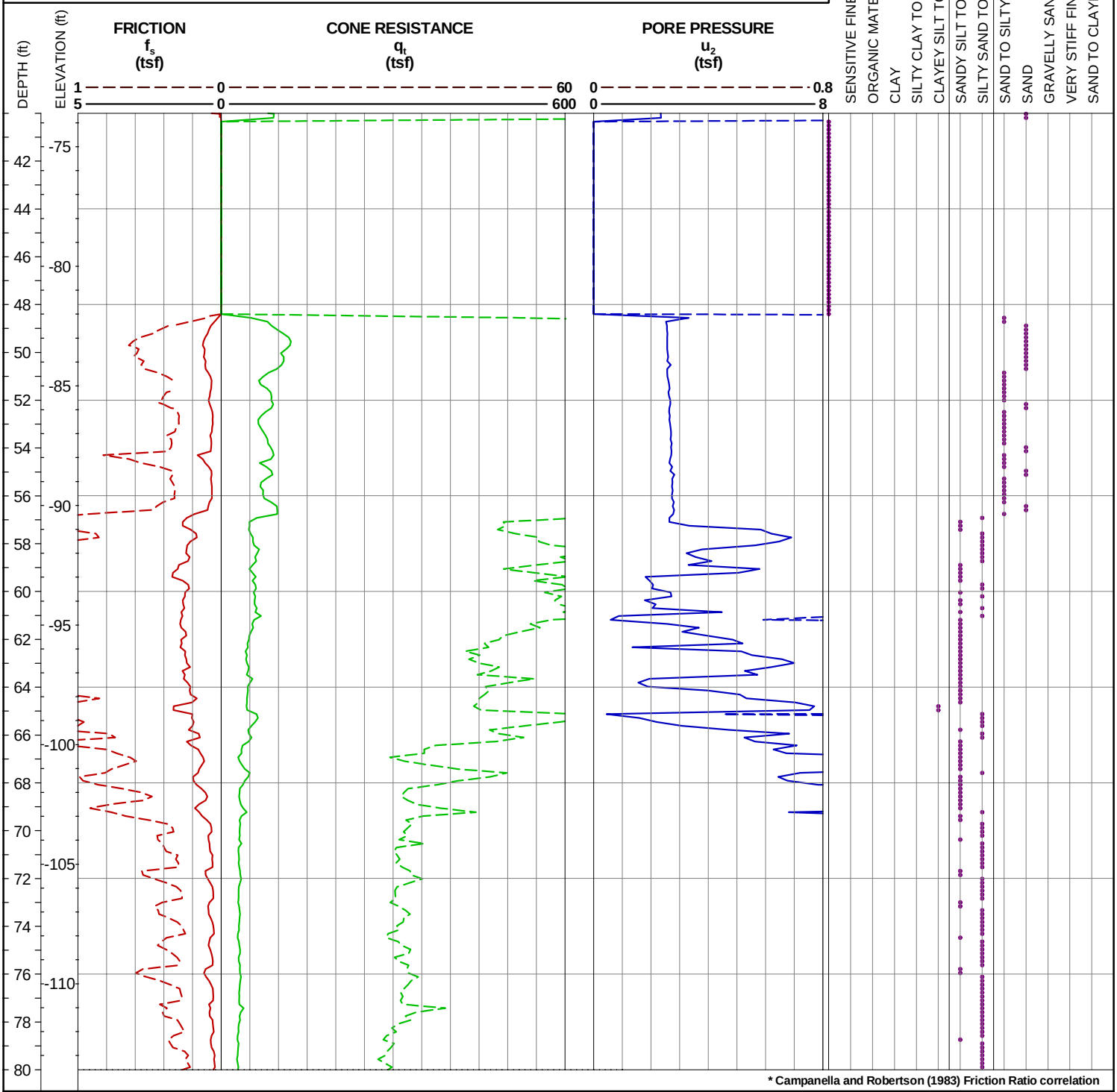
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:

CONE TYPE: 8/4/2010 - 8/4/2010

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 2 OF 3

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CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A | **10CP-009**

LOCATION: Norfolk and Portmouth, VA | **PAGE 3 OF 3**

STATION: OFFSET:

LATITUDE: 36.857713°N LONGITUDE: 76.316047°W

SURFACE ELEVATION: -33.6 COORD. DATUM: NAD 83

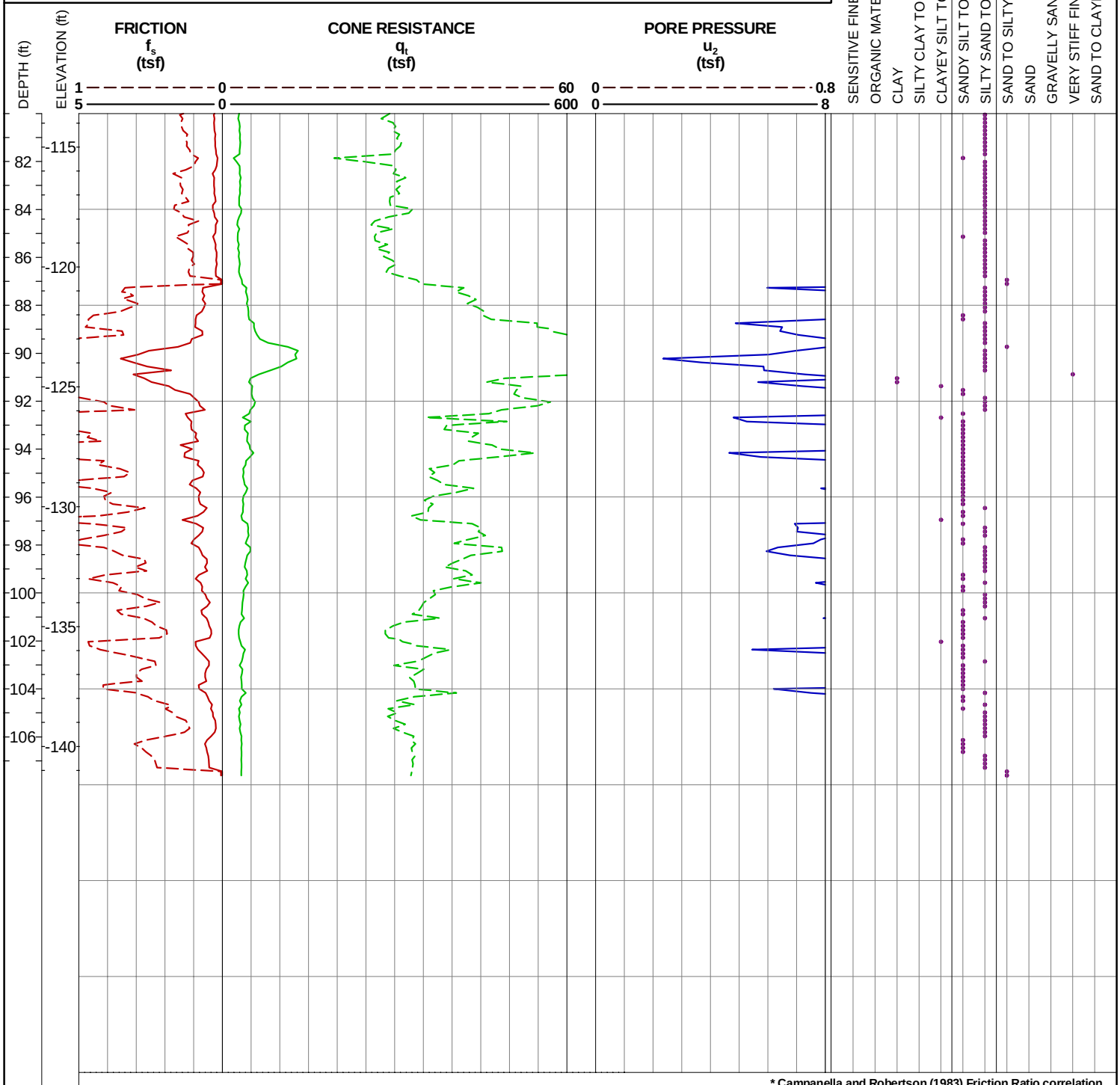
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:

CONE TYPE: 8/4/2010 - 8/4/2010

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 3 OF 3 | **10CP-009**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A | **10CP-010**

LOCATION: Norfolk and Portmouth, VA | **PAGE 1 OF 2**

STATION: OFFSET:

LATITUDE: 36.858188°N LONGITUDE: 76.315809°W

SURFACE ELEVATION: -43.6 COORD. DATUM: NAD 83

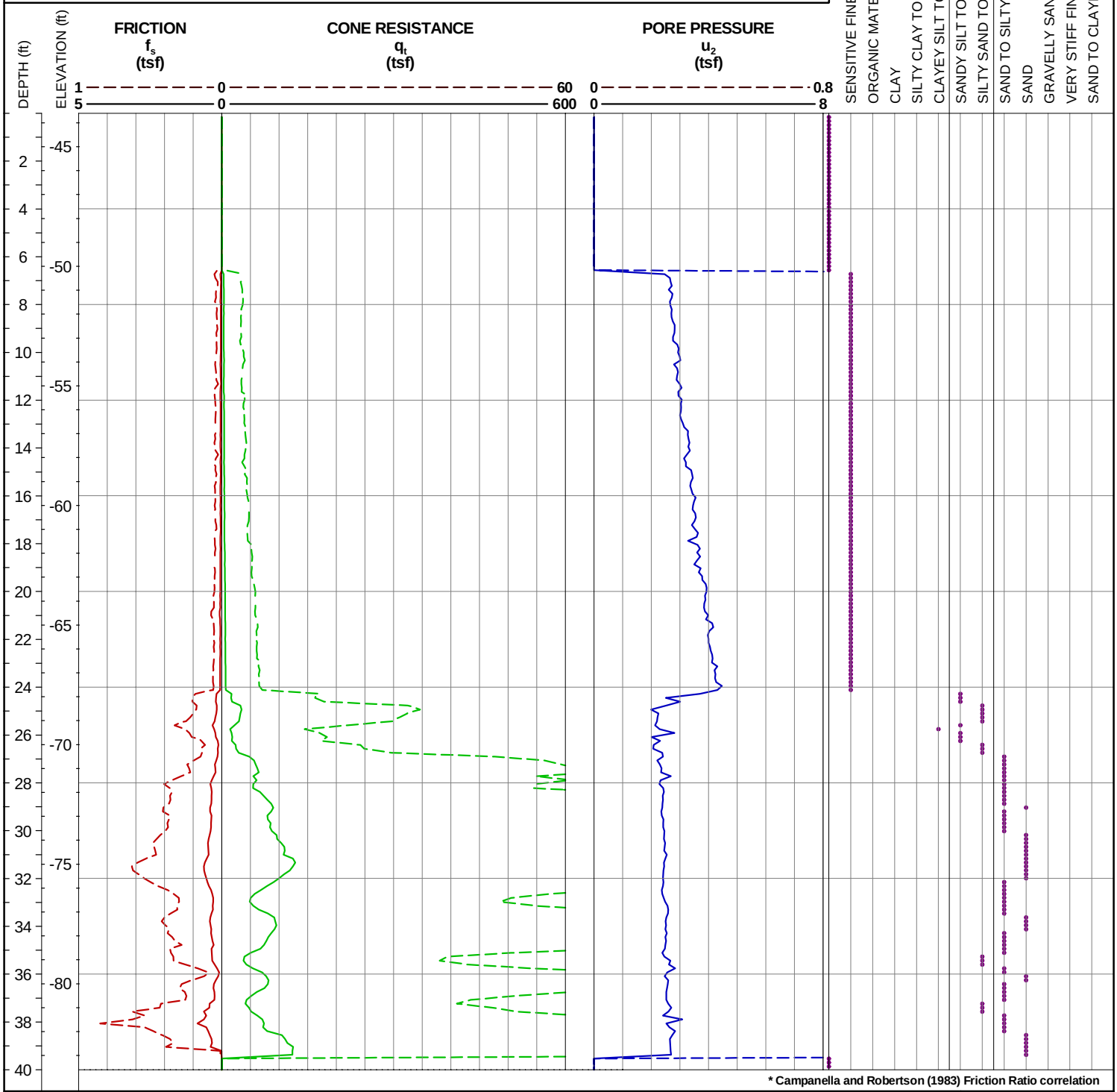
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:

CONE TYPE: 8/6/2010 - 8/6/2010

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 1 OF 2 | **10CP-010**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A | **10CP-010**

LOCATION: Norfolk and Portmouth, VA | **PAGE 2 OF 2**

STATION: OFFSET:

LATITUDE: 36.858188°N LONGITUDE: 76.315809°W

SURFACE ELEVATION: -43.6 COORD. DATUM: NAD 83

BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:

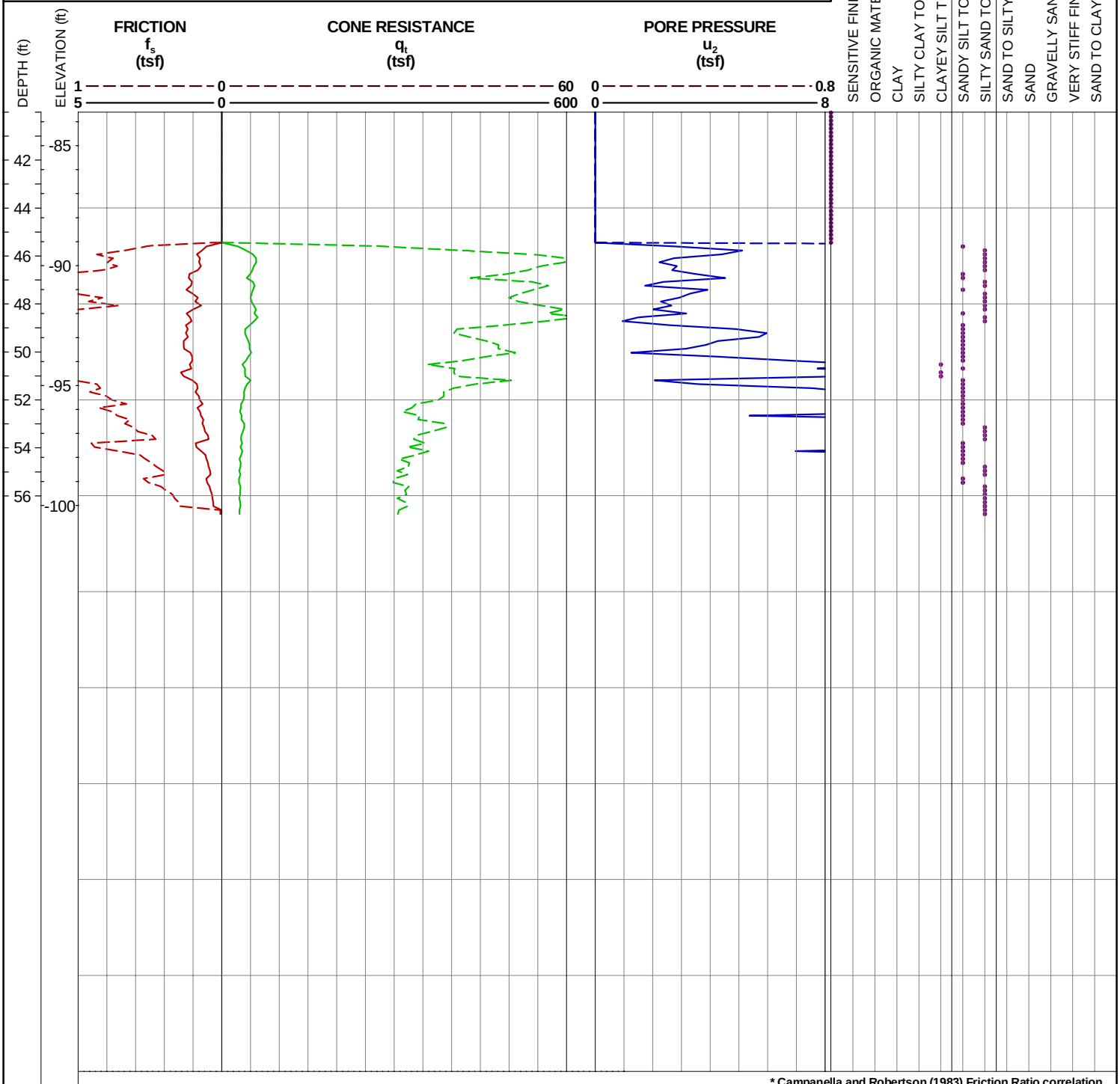
CONE TYPE: 8/6/2010 - 8/6/2010

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:

SOIL BEHAVIOR TYPE*

SENSITIVE FINE GRAINED
ORGANIC MATERIAL
CLAY
SILTY CLAY TO CLAY
CLAYEY SILT TO SILTY CLAY
SANDY SILT TO CLAYEY SILT
SILTY SAND TO SANDY SILT
SAND TO SILTY SAND
SAND
GRAVELLY SAND TO SAND
VERY STIFF FINE GRAINED
SAND TO CLAYEY SAND



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

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CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

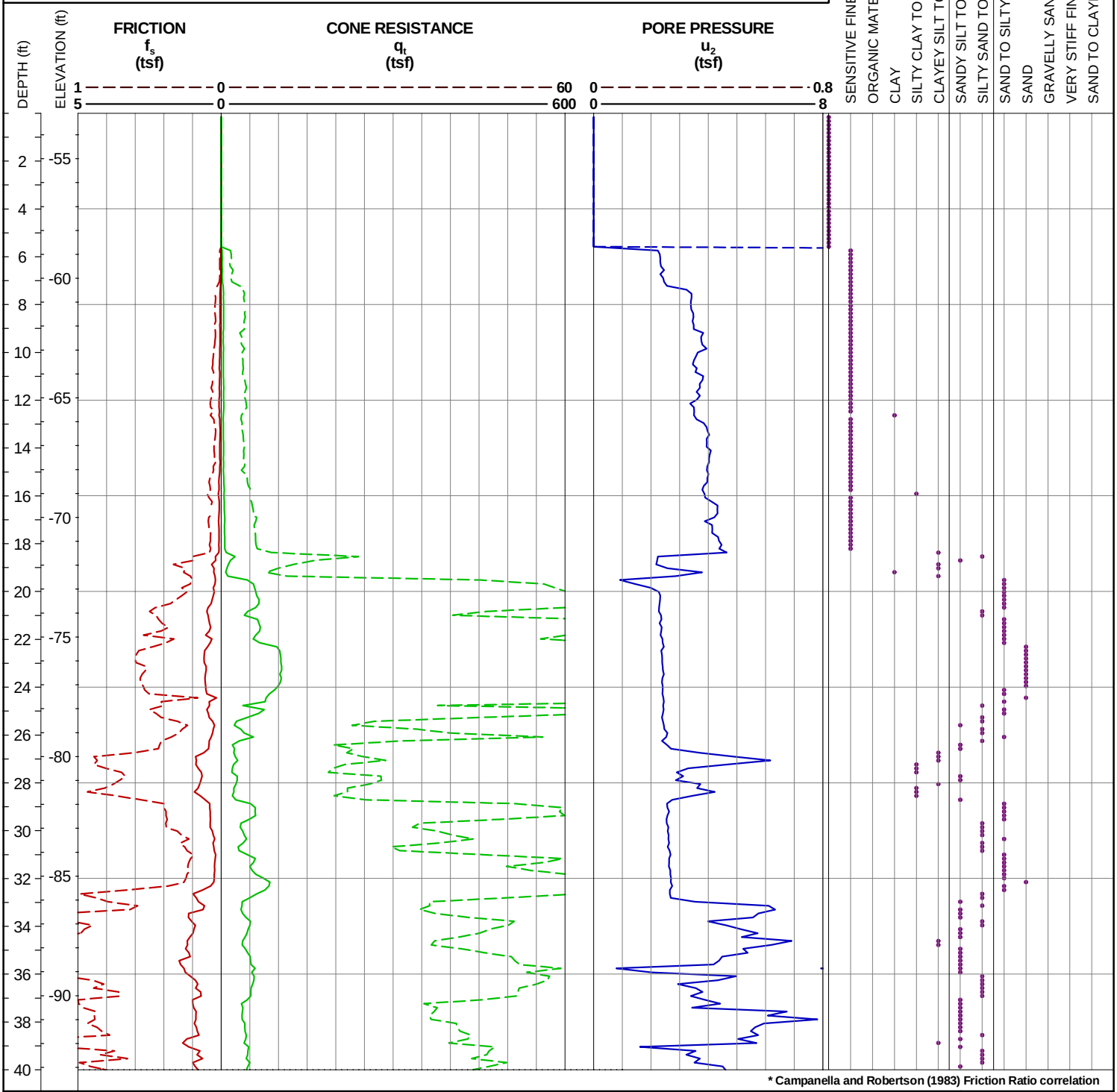
VDOT Virginia Department of Transportation

PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA

10CP-011
PAGE 1 OF 2

STATION:
OFFSET:
LATITUDE: 36.858871°N
LONGITUDE: 76.315003°W
SURFACE ELEVATION: -53.1
COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec
DATE(S) DRILLED: 8/9/2010 - 8/9/2010
CONE TYPE:
CONE SIZE:
CONE ID No.: 215:T1500F15U500
LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

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CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A | **10CP-011**

LOCATION: Norfolk and Portmouth, VA | **PAGE 2 OF 2**

STATION: OFFSET:

LATITUDE: 36.858871°N LONGITUDE: 76.315003°W

SURFACE ELEVATION: -53.1 COORD. DATUM: NAD 83

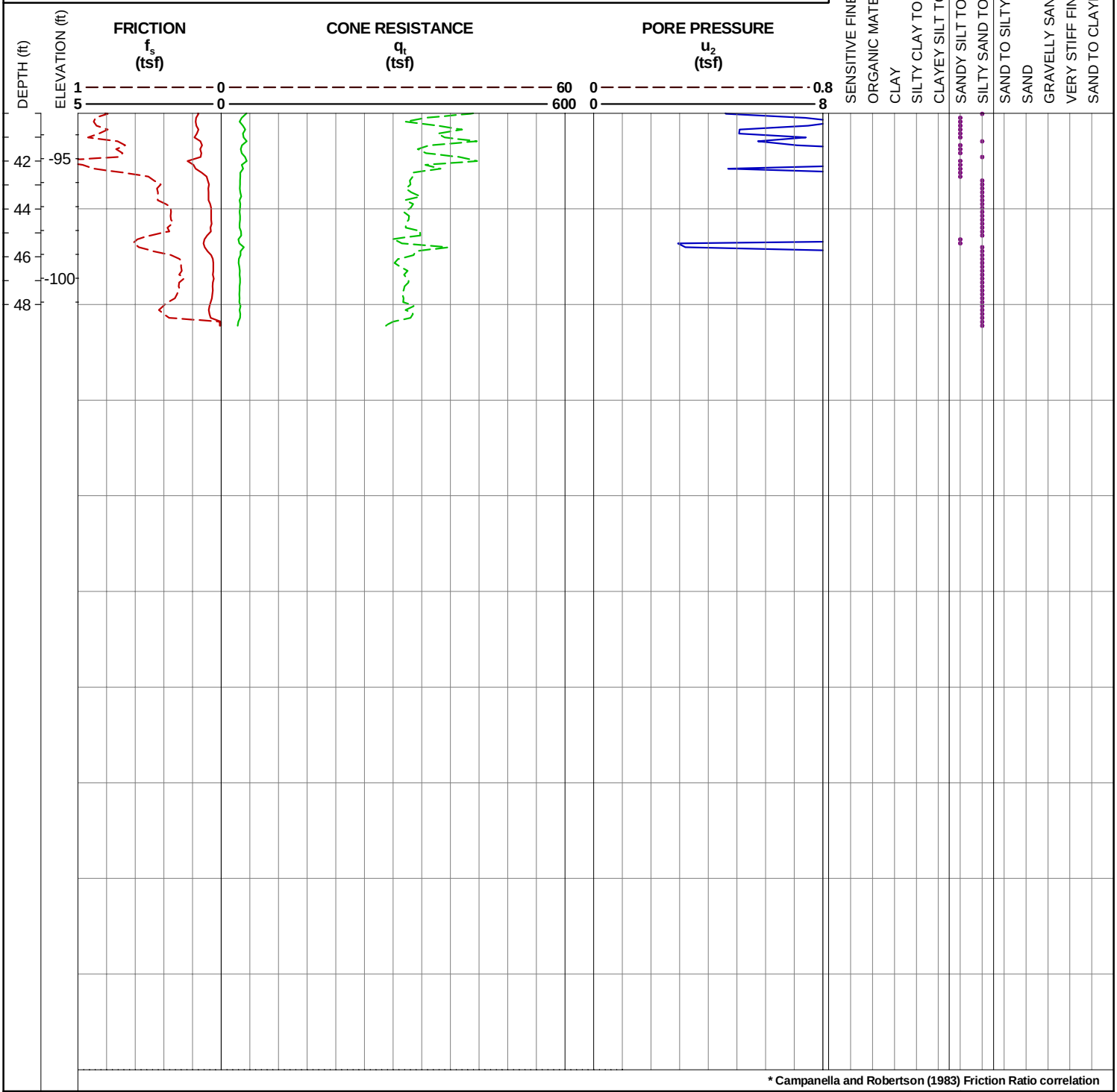
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:

CONE TYPE: 8/9/2010 - 8/9/2010

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

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CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A | **10CP-012**

LOCATION: Norfolk and Portmouth, VA | **PAGE 1 OF 2**

STATION: OFFSET:

LATITUDE: 36.859444°N LONGITUDE: 76.314348°W

SURFACE ELEVATION: -46.6 COORD. DATUM: NAD 83

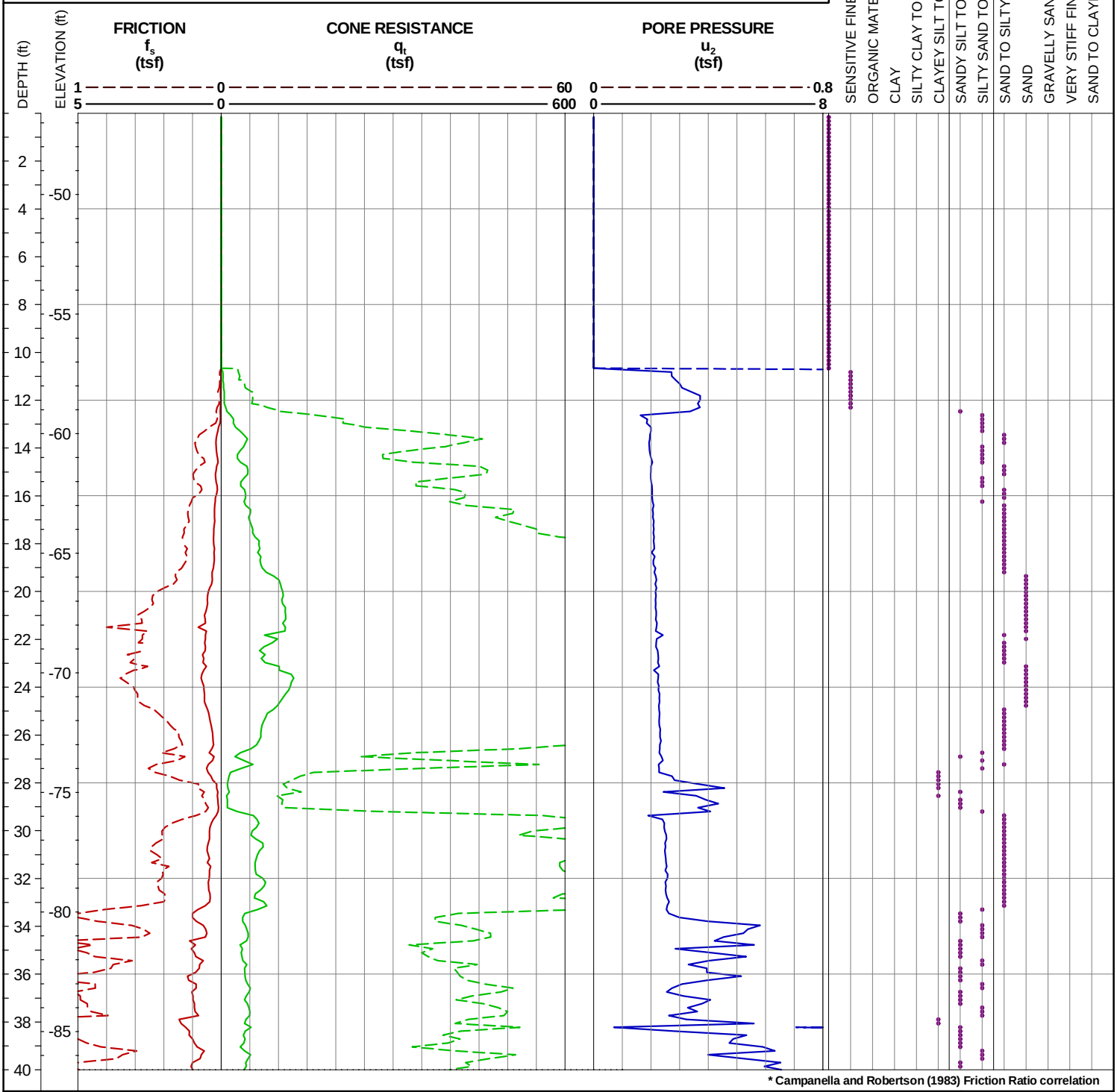
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:

CONE TYPE: 8/9/2010 - 8/9/2010

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 1 OF 2 | **10CP-012**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA

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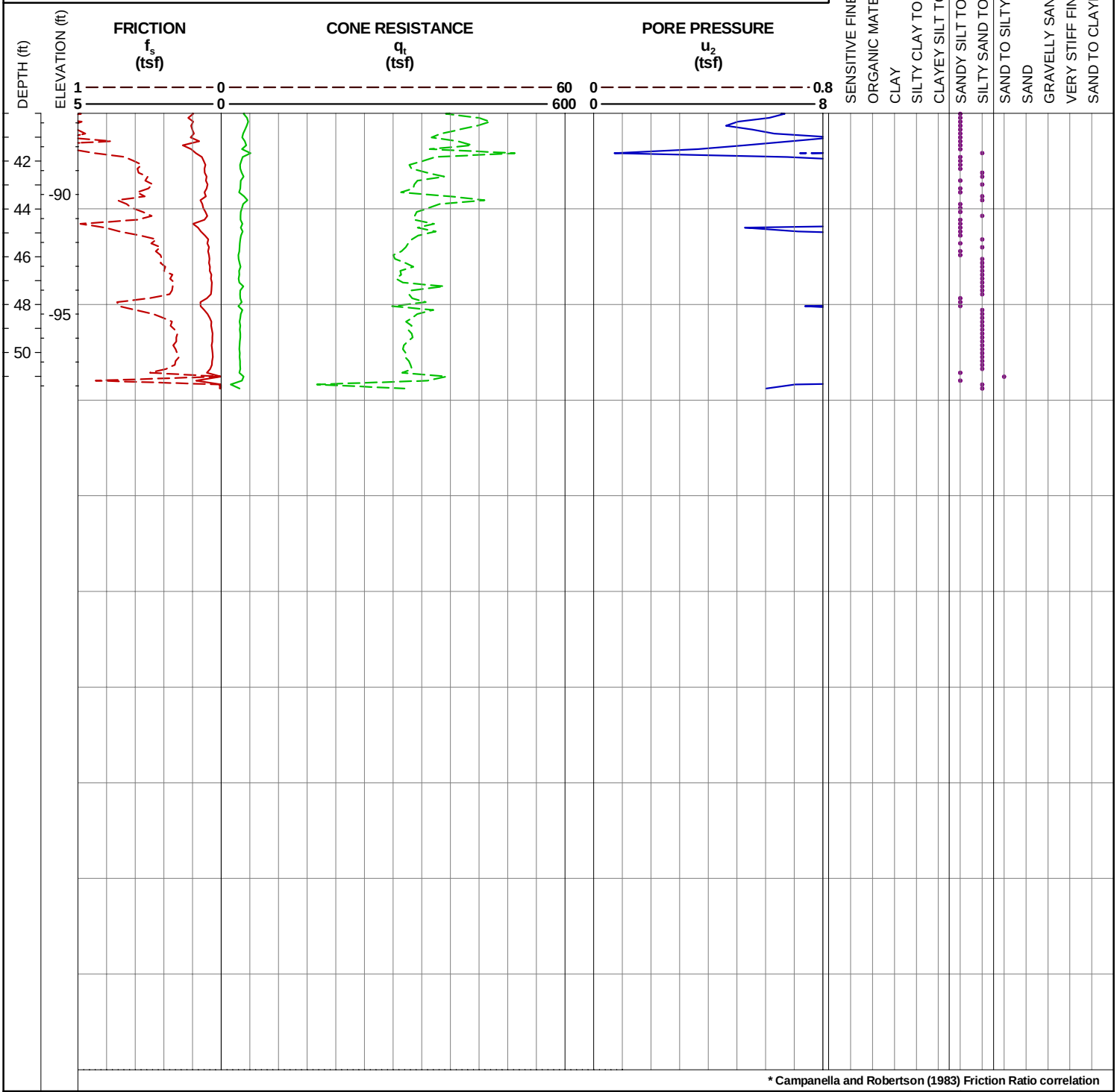
PAGE 2 OF 2

STATION:
OFFSET:
LATITUDE: 36.859444°N
LONGITUDE: 76.314348°W
SURFACE ELEVATION: -46.6
COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec
DATE(S) DRILLED:
CONE TYPE:
8/9/2010 - 8/9/2010
CONE SIZE:
CONE ID No.: 215:T1500F15U500
LOGGER:

SOIL BEHAVIOR TYPE*



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

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CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA

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PAGE 1 OF 3

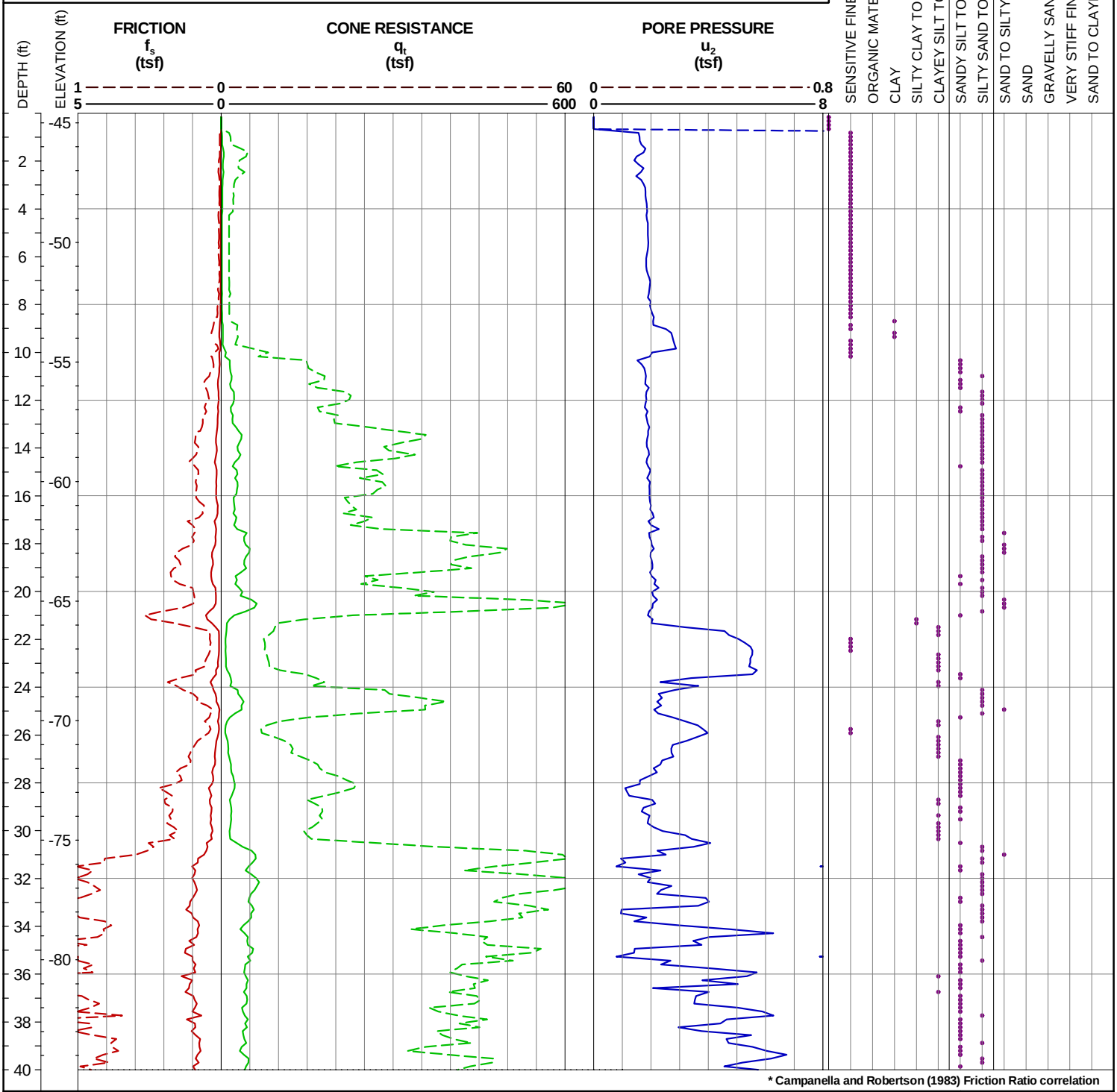
STATION:
OFFSET:
LATITUDE: 36.859488°N
LONGITUDE: 76.313446°W
SURFACE ELEVATION: -44.6
COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec
CONE TYPE:
CONE SIZE:
CONE ID No.: 215:T1500F15U500

DATE(S) DRILLED:
8/3/2010 - 8/3/2010

LOGGER:

SOIL BEHAVIOR TYPE*



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

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CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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Virginia Department of Transportation

PROJECT #: 173189A | **10CP-013**

LOCATION: Norfolk and Portmouth, VA | **PAGE 2 OF 3**

STATION: OFFSET:

LATITUDE: 36.859488°N LONGITUDE: 76.313446°W

SURFACE ELEVATION: -44.6 COORD. DATUM: NAD 83

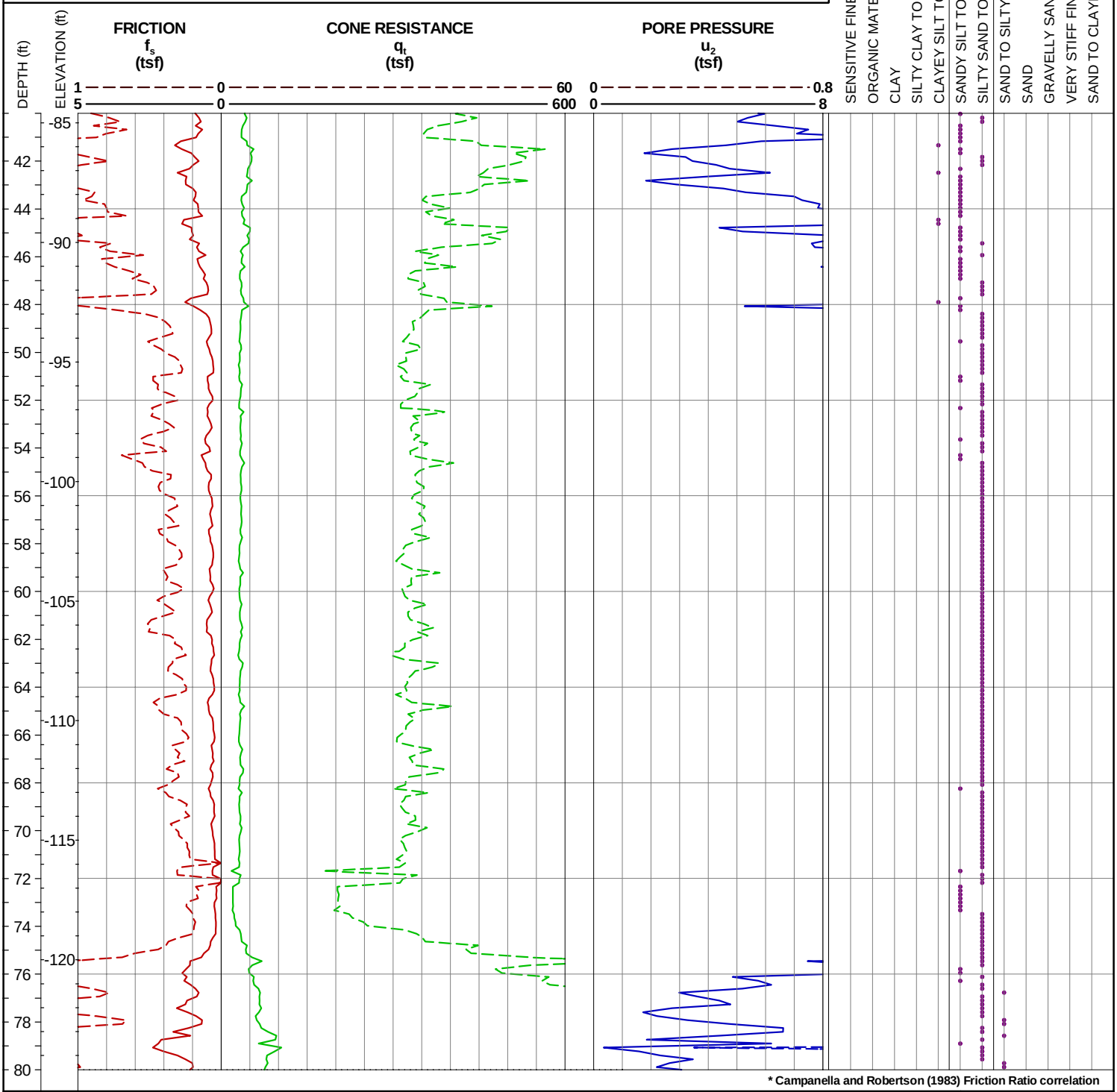
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:

CONE TYPE: 8/3/2010 - 8/3/2010

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

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CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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Virginia Department of Transportation

PROJECT #: 173189A | **10CP-013**

LOCATION: Norfolk and Portmouth, VA | **PAGE 3 OF 3**

STATION: OFFSET:

LATITUDE: 36.859488°N LONGITUDE: 76.313446°W

SURFACE ELEVATION: -44.6 COORD. DATUM: NAD 83

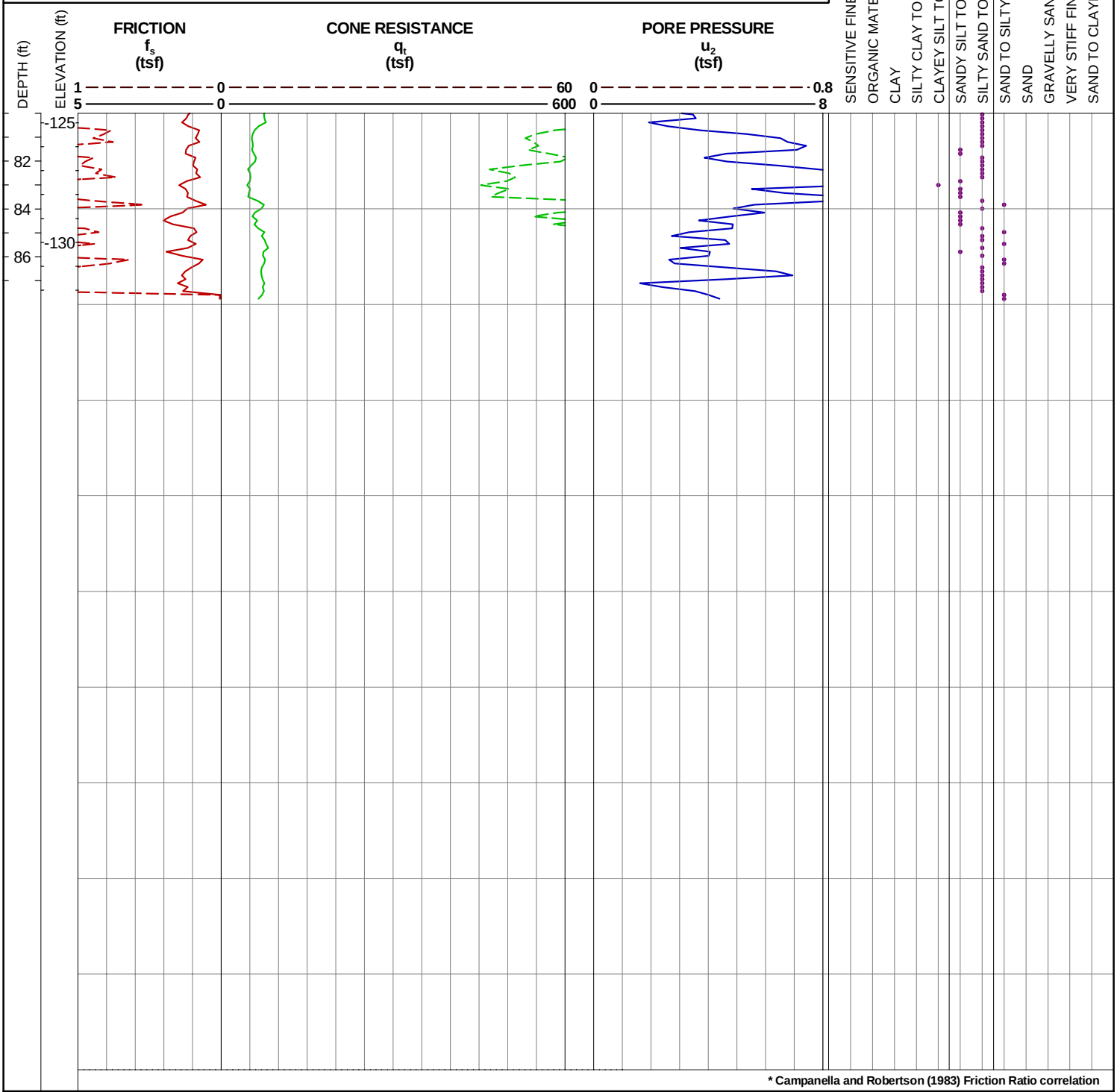
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:

CONE TYPE: 8/3/2010 - 8/3/2010

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

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CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA

10CP-014
PAGE 1 OF 2

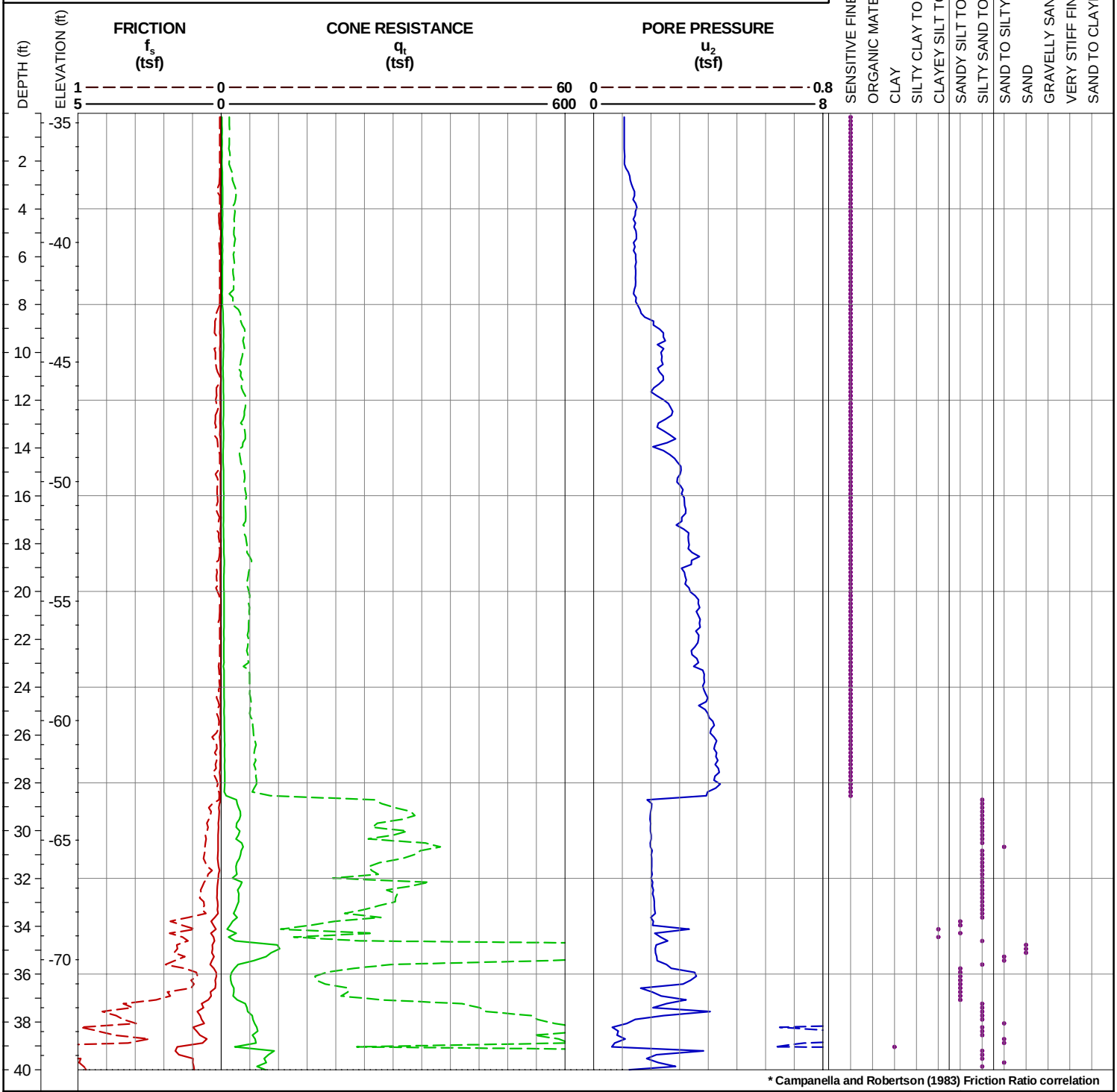
STATION:
OFFSET:
LATITUDE: 36.860671°N
LONGITUDE: 76.351215°W
SURFACE ELEVATION: -34.6
COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec
CONE TYPE:
CONE SIZE:
CONE ID No.: 205:T500F10U500

DATE(S) DRILLED:
7/26/2010 - 7/26/2010

LOGGER:

SOIL BEHAVIOR TYPE*



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

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10CP-014

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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Virginia Department of Transportation

PROJECT #: 173189A | **10CP-014**

LOCATION: Norfolk and Portmouth, VA | **PAGE 2 OF 2**

STATION: OFFSET:

LATITUDE: 36.860671°N LONGITUDE: 76.351215°W

SURFACE ELEVATION: -34.6 COORD. DATUM: NAD 83

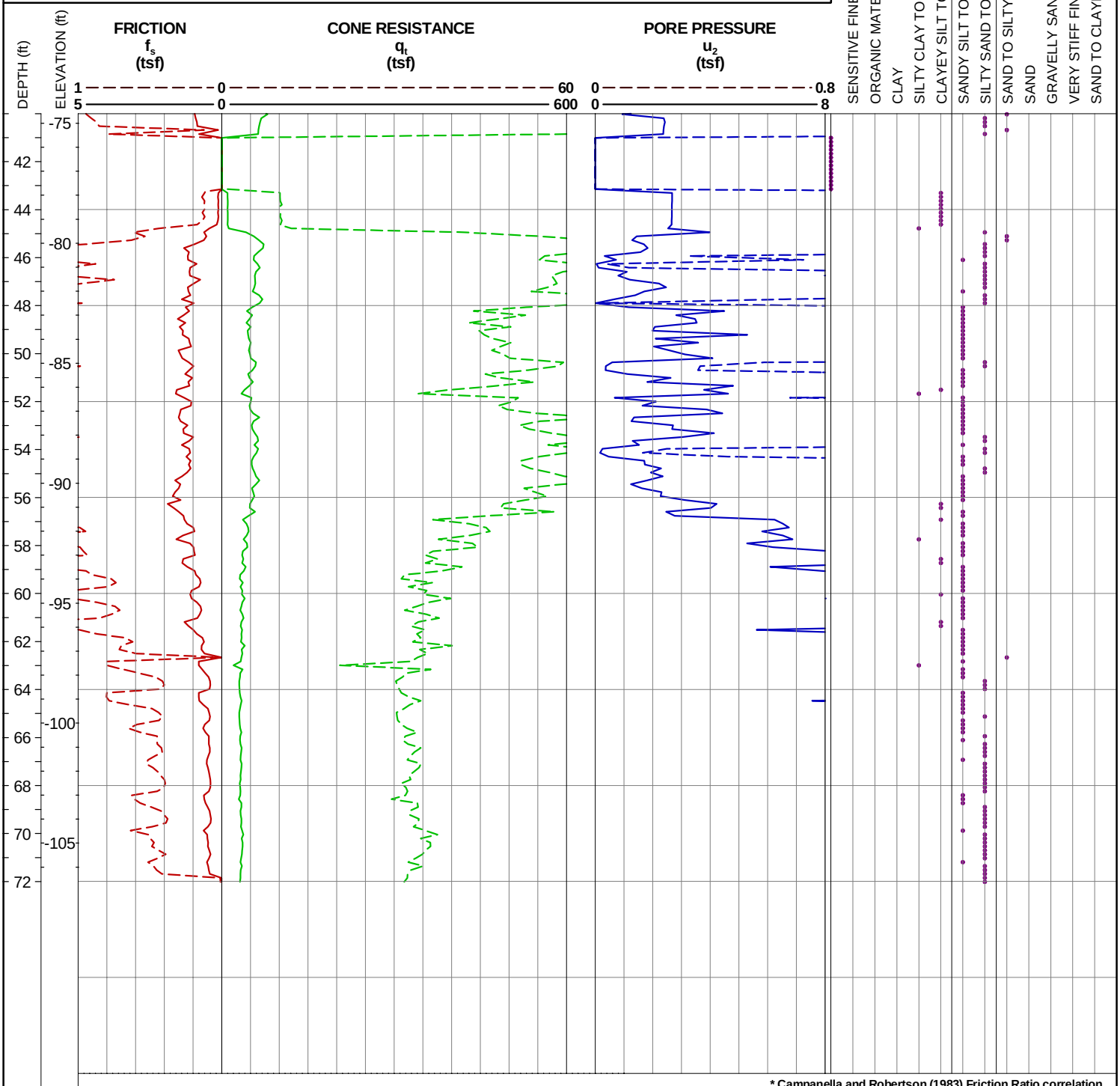
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED: 7/26/2010 - 7/26/2010

CONE TYPE:

CONE SIZE:

CONE ID No.: 205:T500F10U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 2 OF 2 | **10CP-014**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A | **10CP-015**

LOCATION: Norfolk and Portmouth, VA | **PAGE 1 OF 2**

STATION: OFFSET:

LATITUDE: 36.860597°N LONGITUDE: 76.312531°W

SURFACE ELEVATION: -10.6 COORD. DATUM: NAD 83

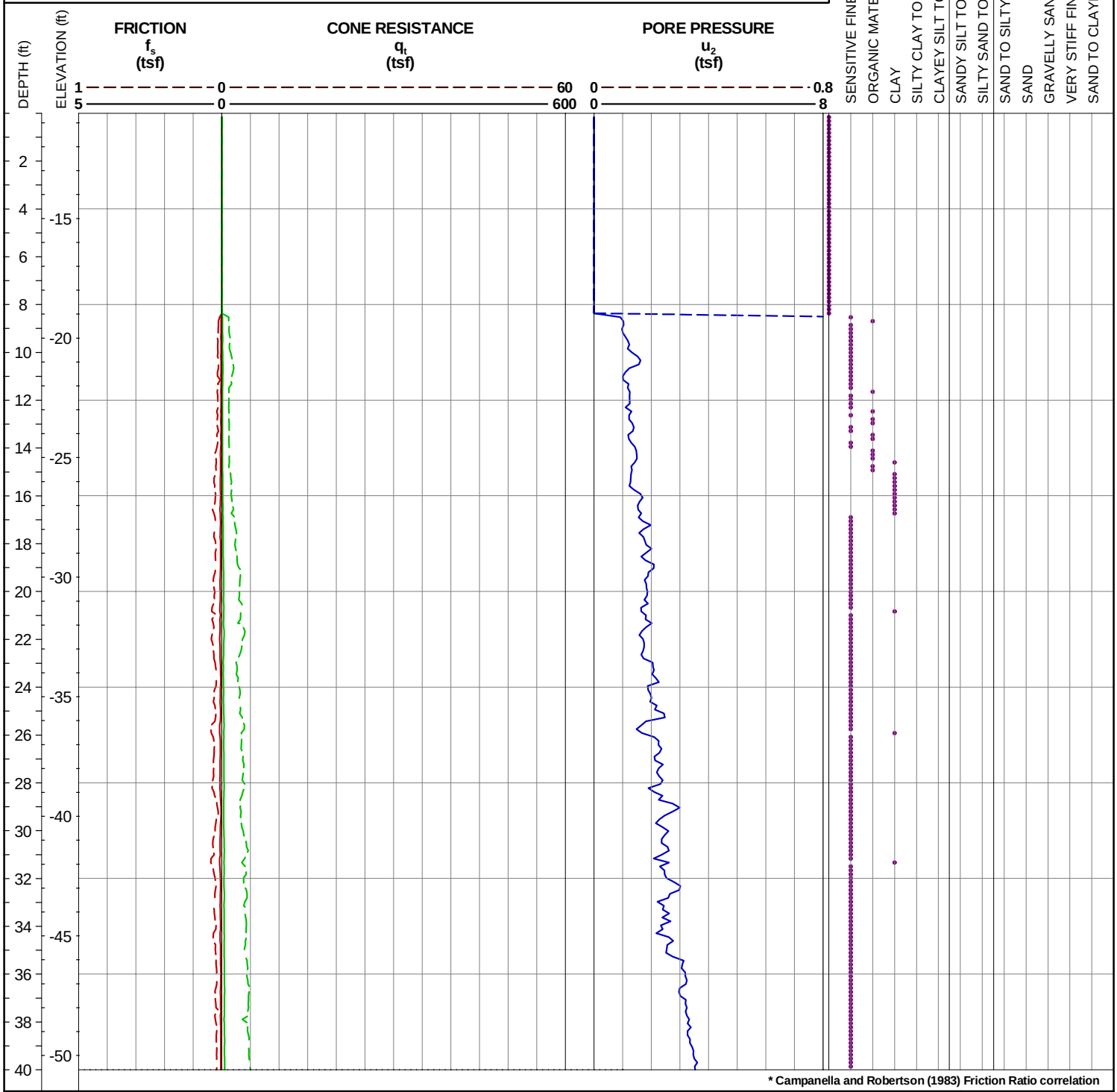
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:

CONE TYPE: 7/27/2010 - 7/27/2010

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 1 OF 2 | **10CP-015**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A | **10CP-015**

LOCATION: Norfolk and Portmouth, VA | **PAGE 2 OF 2**

STATION: OFFSET:

LATITUDE: 36.860597°N LONGITUDE: 76.312531°W

SURFACE ELEVATION: -10.6 COORD. DATUM: NAD 83

BENCHMARK LOCATION:

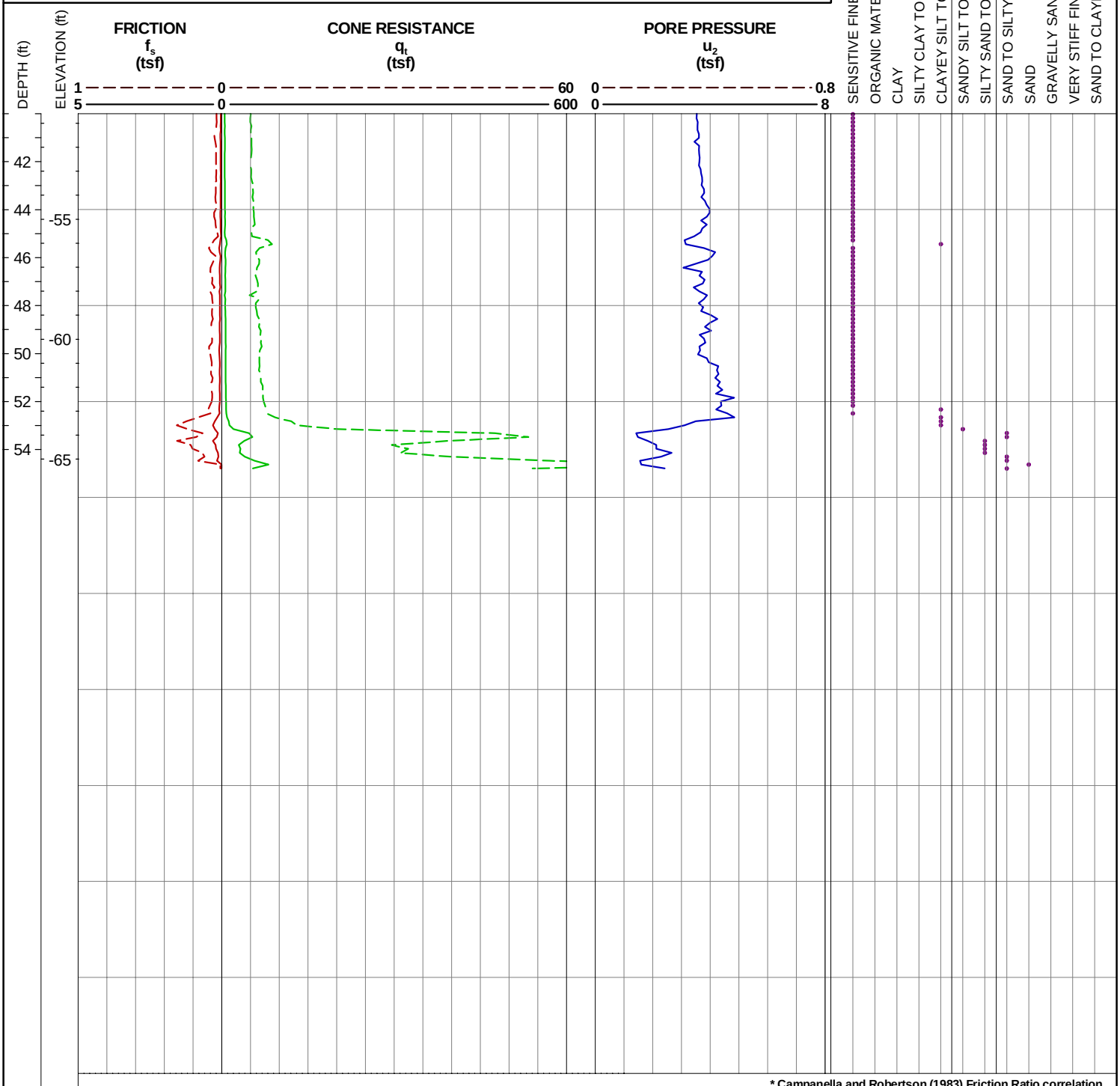
DRILLER: ConeTec DATE(S) DRILLED: 7/27/2010 - 7/27/2010

CONE TYPE:

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:

SOIL BEHAVIOR TYPE*



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 2 OF 2

10CP-015

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A | **10CP-016**

LOCATION: Norfolk and Portmouth, VA | **PAGE 1 OF 2**

STATION: OFFSET:

LATITUDE: 36.860405°N LONGITUDE: 76.312308°W

SURFACE ELEVATION: -12.6 COORD. DATUM: NAD 83

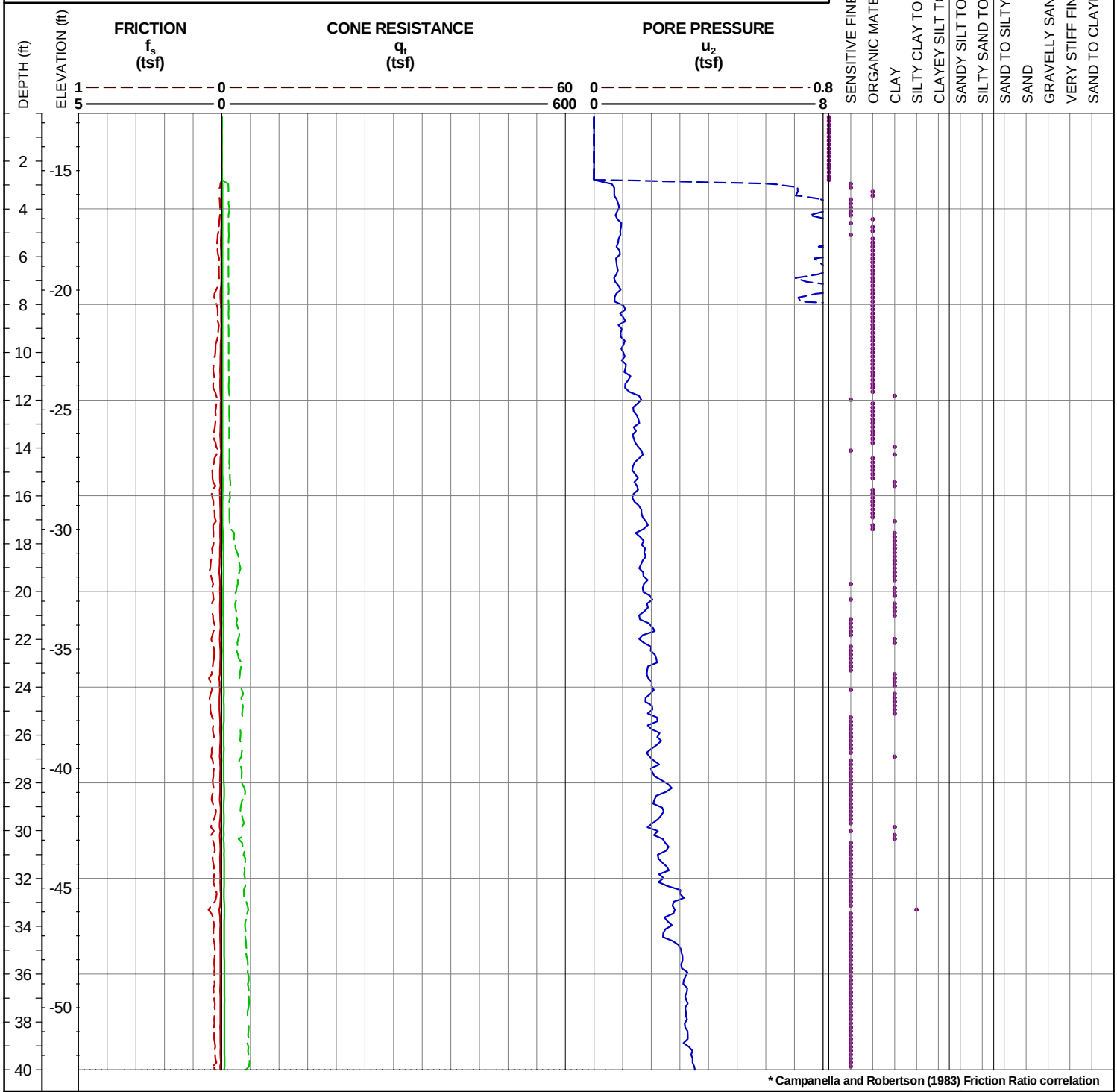
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:

CONE TYPE: 8/2/2010 - 8/2/2010

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

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CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A | **10CP-016**

LOCATION: Norfolk and Portmouth, VA | **PAGE 2 OF 2**

STATION: OFFSET:

LATITUDE: 36.860405°N LONGITUDE: 76.312308°W

SURFACE ELEVATION: -12.6 COORD. DATUM: NAD 83

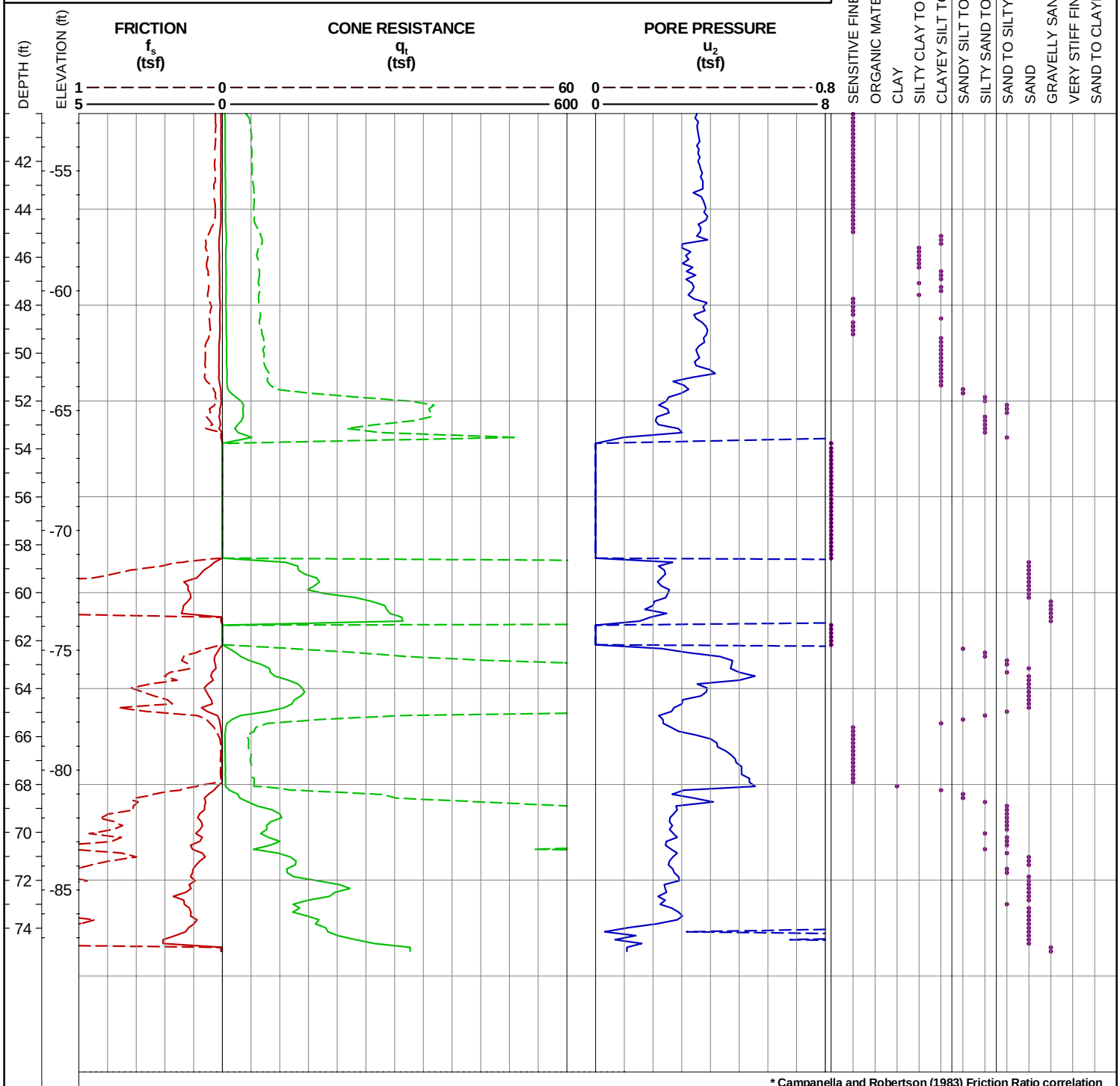
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:

CONE TYPE: 8/2/2010 - 8/2/2010

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

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CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A | **10CP-017**

LOCATION: Norfolk and Portmouth, VA | **PAGE 1 OF 3**

STATION: OFFSET:

LATITUDE: 36.860328°N LONGITUDE: 76.312220°W

SURFACE ELEVATION: -10.6 COORD. DATUM: NAD 83

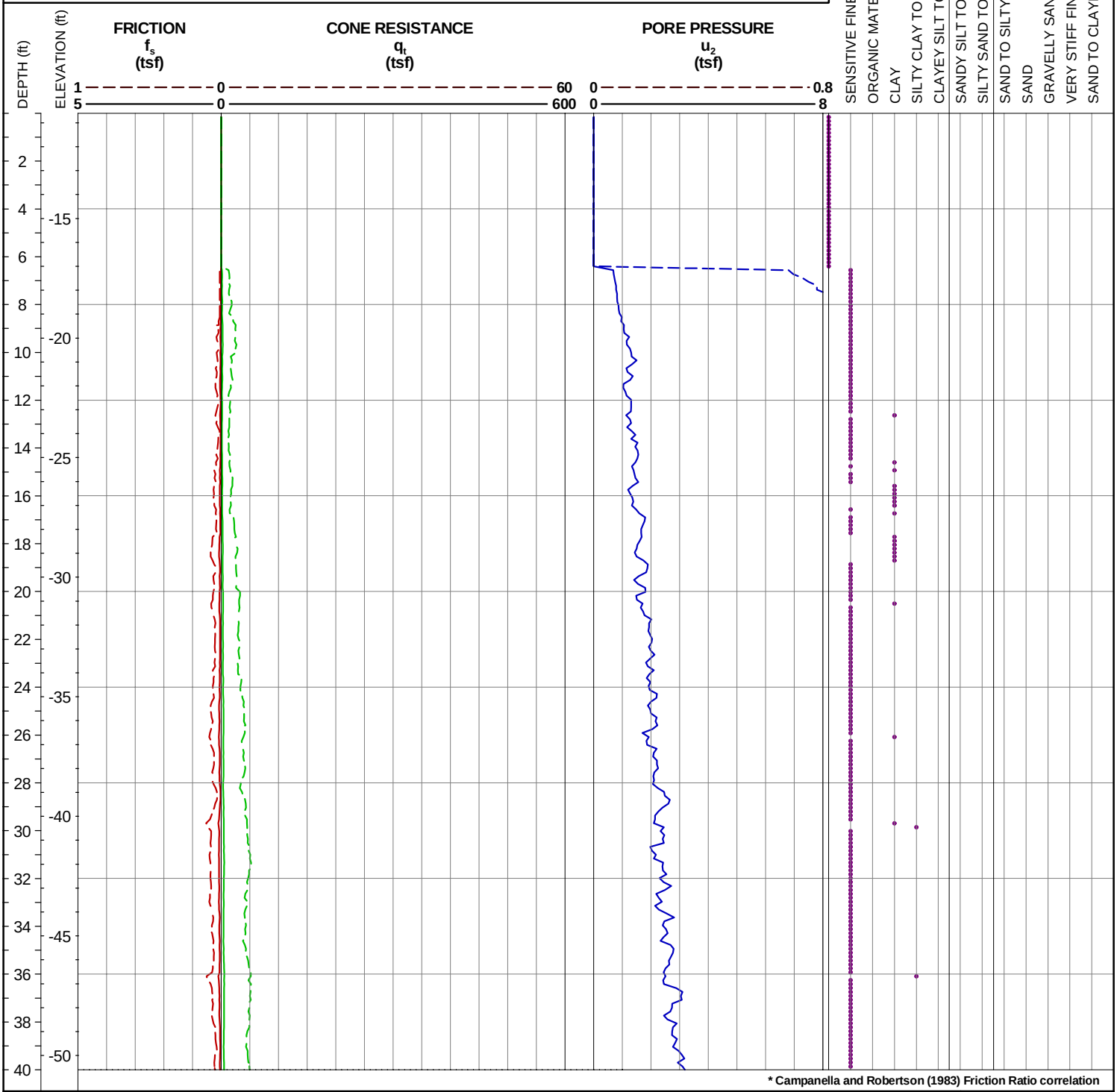
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:

CONE TYPE: 7/30/2010 - 7/30/2010

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 1 OF 3 | **10CP-017**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A | **10CP-017**

LOCATION: Norfolk and Portmouth, VA | **PAGE 2 OF 3**

STATION: OFFSET:

LATITUDE: 36.860328°N LONGITUDE: 76.312220°W

SURFACE ELEVATION: -10.6 COORD. DATUM: NAD 83

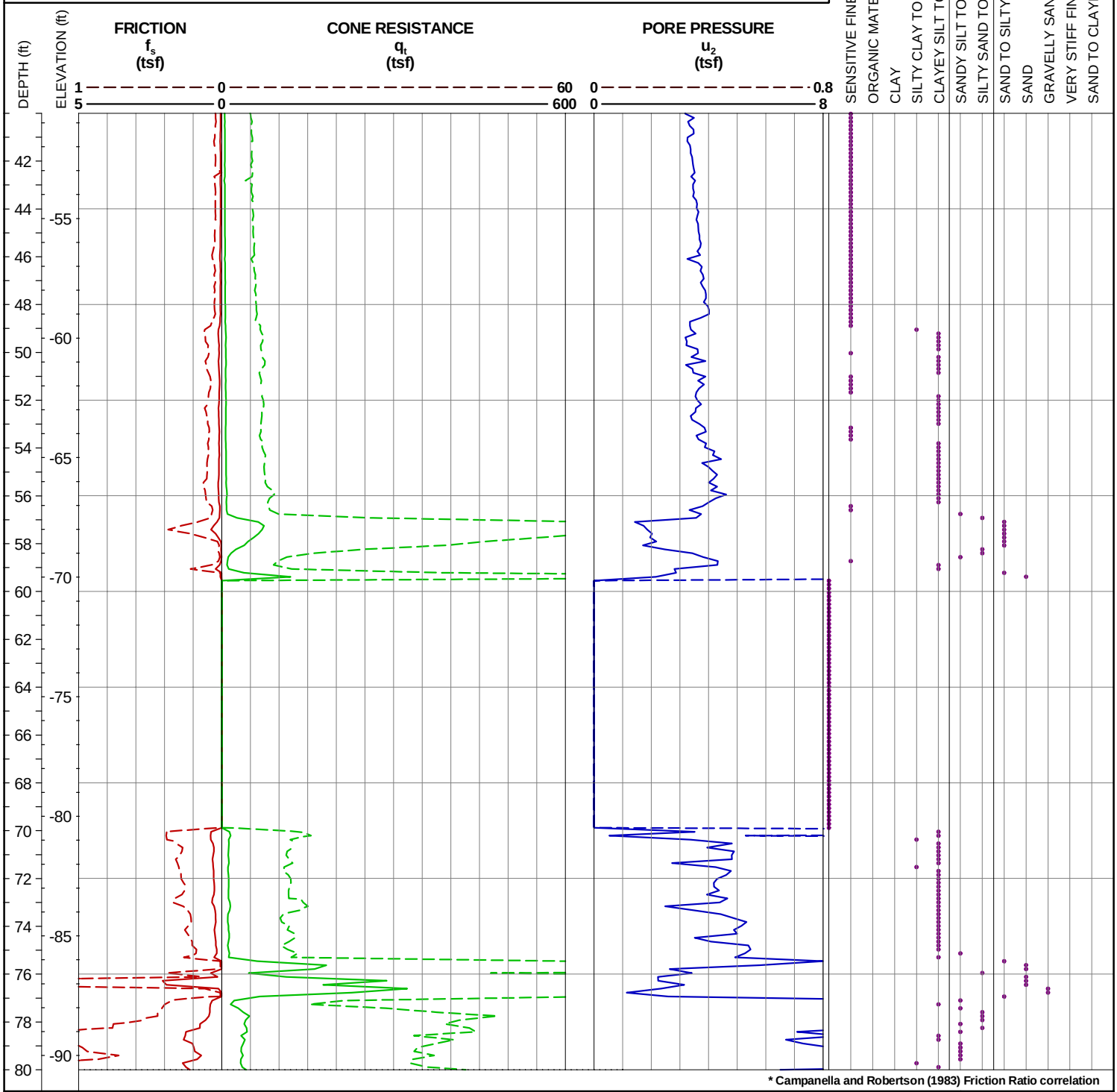
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED: 7/30/2010 - 7/30/2010

CONE TYPE:

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 2 OF 3 | **10CP-017**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A | **10CP-017**

LOCATION: Norfolk and Portmouth, VA | **PAGE 3 OF 3**

STATION: OFFSET:

LATITUDE: 36.860328°N LONGITUDE: 76.312220°W

SURFACE ELEVATION: -10.6 COORD. DATUM: NAD 83

BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:

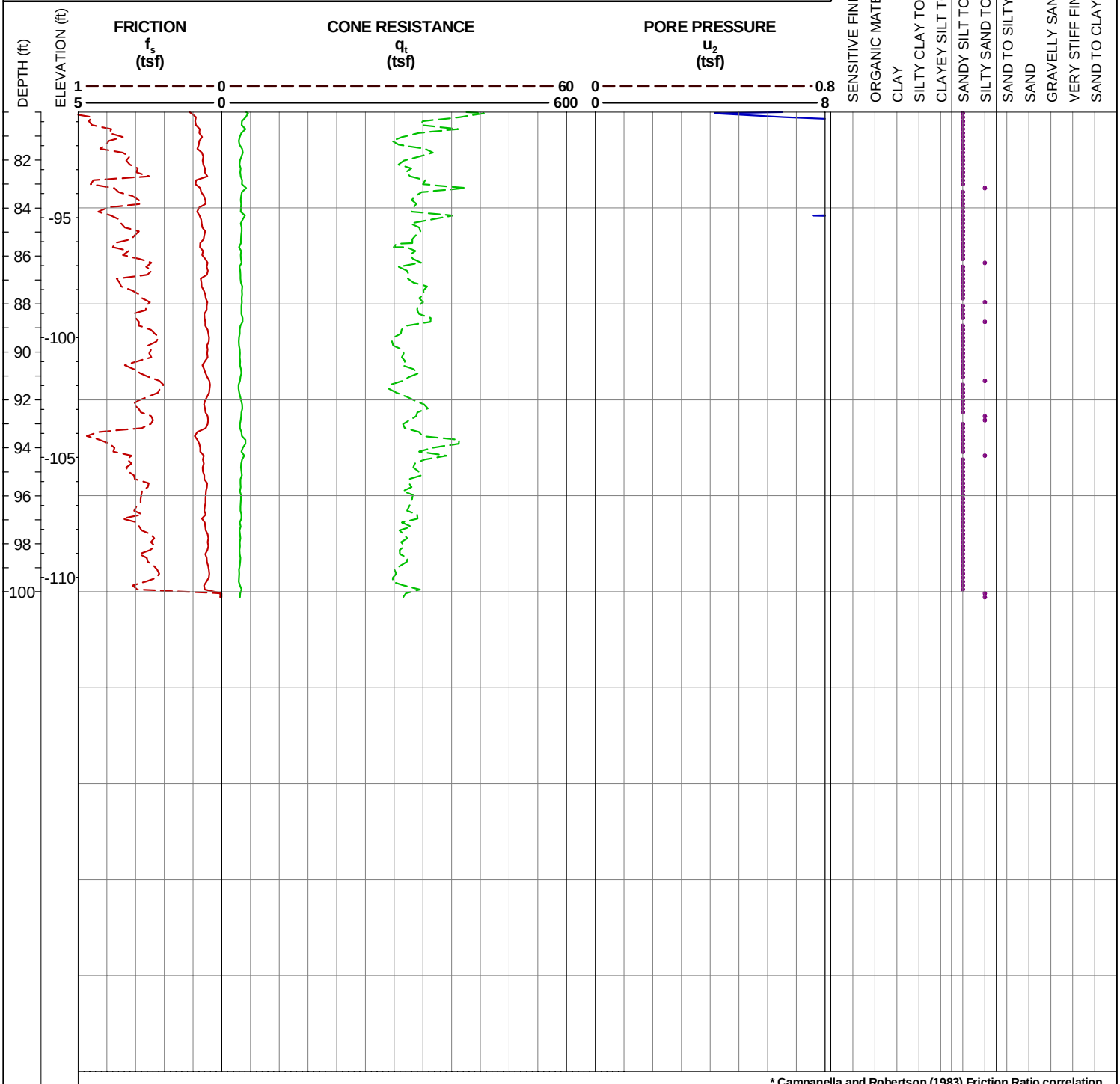
CONE TYPE: 7/30/2010 - 7/30/2010

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:

SOIL BEHAVIOR TYPE*

SENSITIVE FINE GRAINED
ORGANIC MATERIAL
CLAY
SILTY CLAY TO CLAY
CLAYEY SILT TO SILTY CLAY
SANDY SILT TO CLAYEY SILT
SILTY SAND TO SANDY SILT
SAND TO SILTY SAND
SAND
GRAVELLY SAND TO SAND
VERY STIFF FINE GRAINED
SAND TO CLAYEY SAND



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

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10CP-017

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

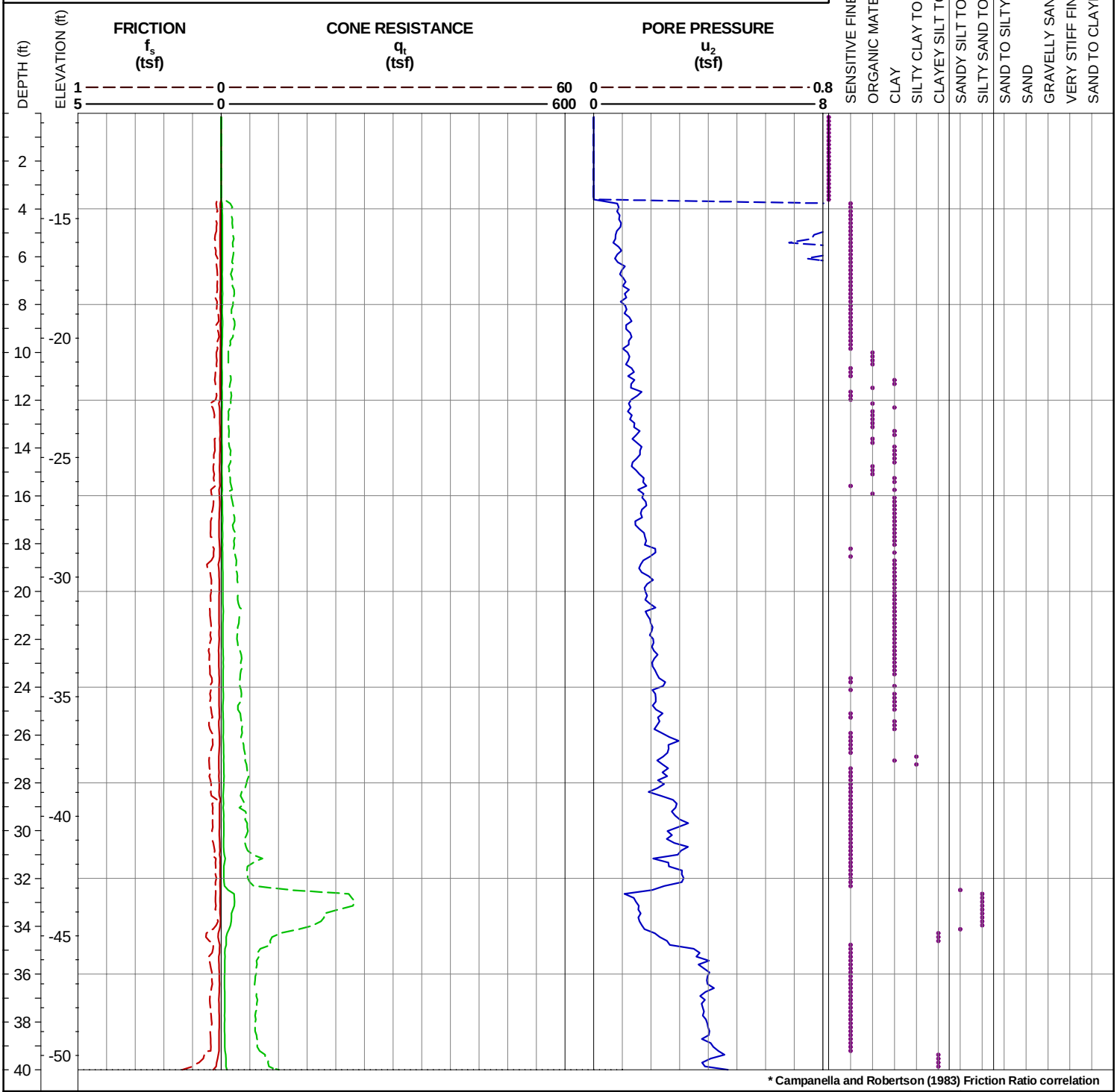
PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA

10CP-018
PAGE 1 OF 2

STATION:
OFFSET:
LATITUDE: 36.861493°N
LONGITUDE: 76.311447°W
SURFACE ELEVATION: -10.6
COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec
DATE(S) DRILLED:
CONE TYPE:
8/2/2010 - 8/2/2010
CONE SIZE:
CONE ID No.: 215:T1500F15U500
LOGGER:

SOIL BEHAVIOR TYPE*



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 1 OF 2
10CP-018

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

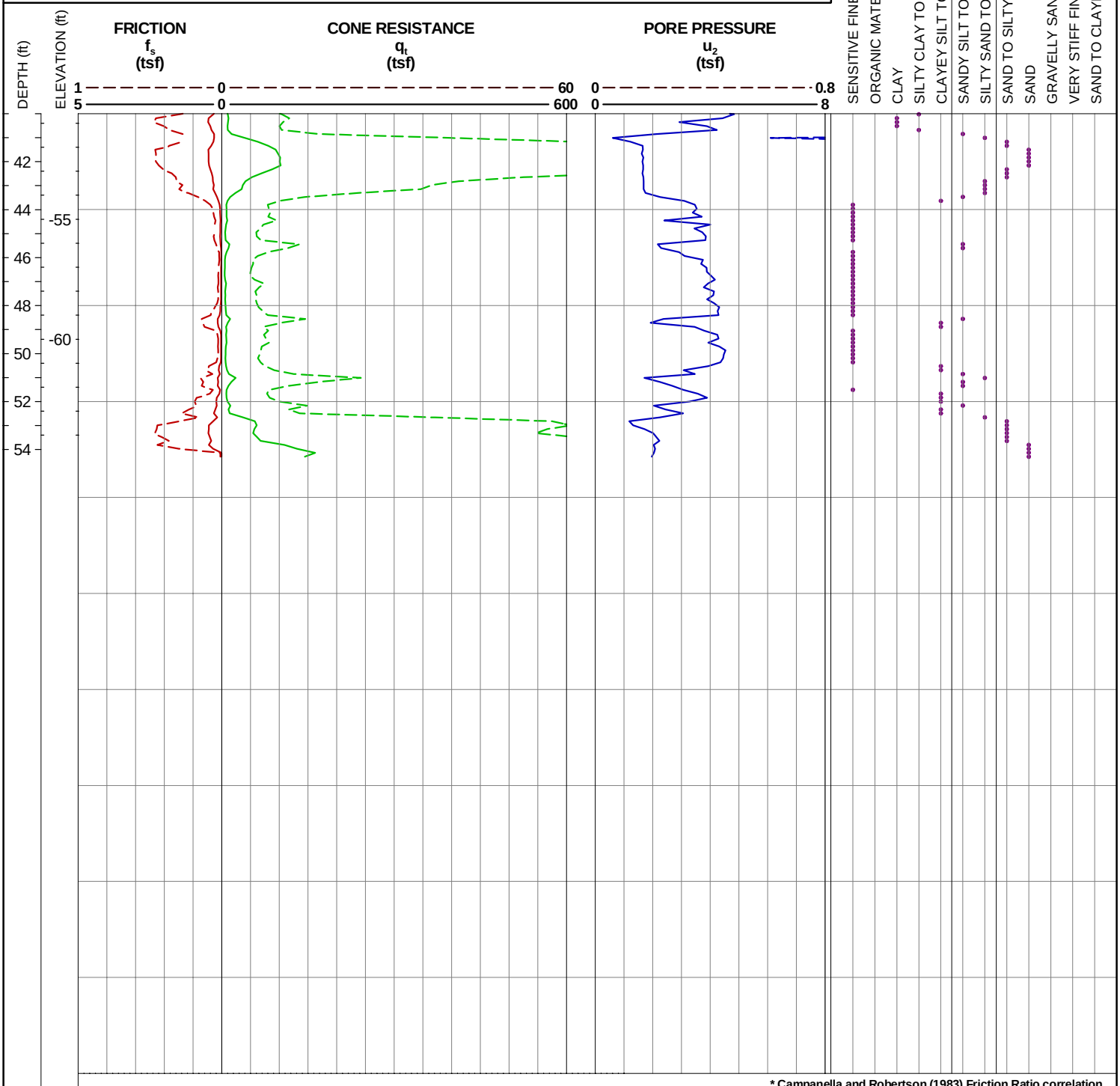
PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA

10CP-018
PAGE 2 OF 2

STATION:
OFFSET:
LATITUDE: 36.861493°N
LONGITUDE: 76.311447°W
SURFACE ELEVATION: -10.6
COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec
DATE(S) DRILLED:
CONE TYPE:
8/2/2010 - 8/2/2010
CONE SIZE:
CONE ID No.: 215:T1500F15U500
LOGGER:

SOIL BEHAVIOR TYPE*



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 2 OF 2
10CP-018

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

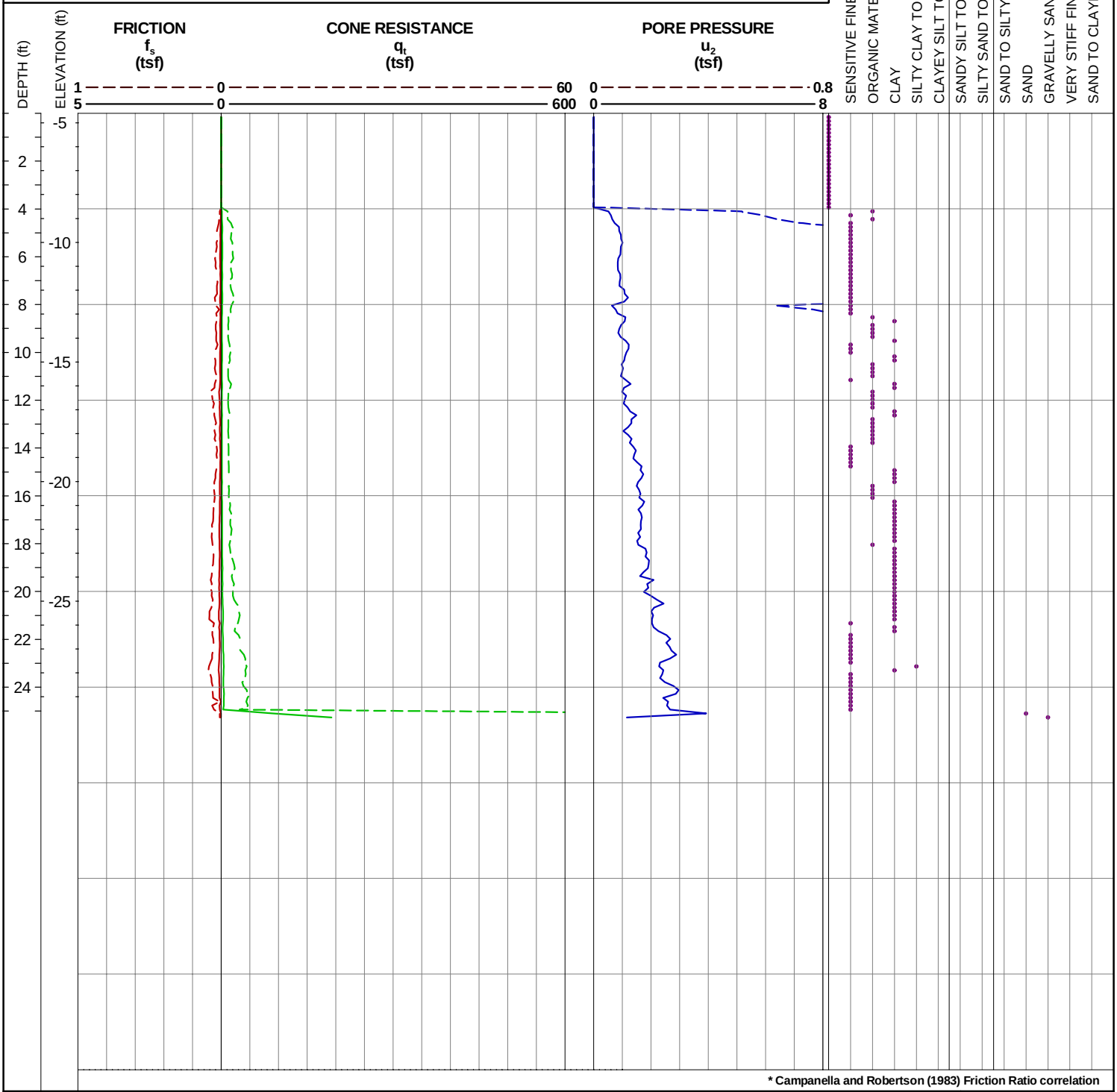
VDOT Virginia Department of Transportation

PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA

10CP-019
PAGE 1 OF 1

STATION:
OFFSET:
LATITUDE: 36.861012°N
LONGITUDE: 76.310818°W
SURFACE ELEVATION: -4.6
COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec
DATE(S) DRILLED: 8/5/2010 - 8/5/2010
CONE TYPE:
CONE SIZE:
CONE ID No.: 215:T1500F15U500
LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 1 OF 1
10CP-019

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

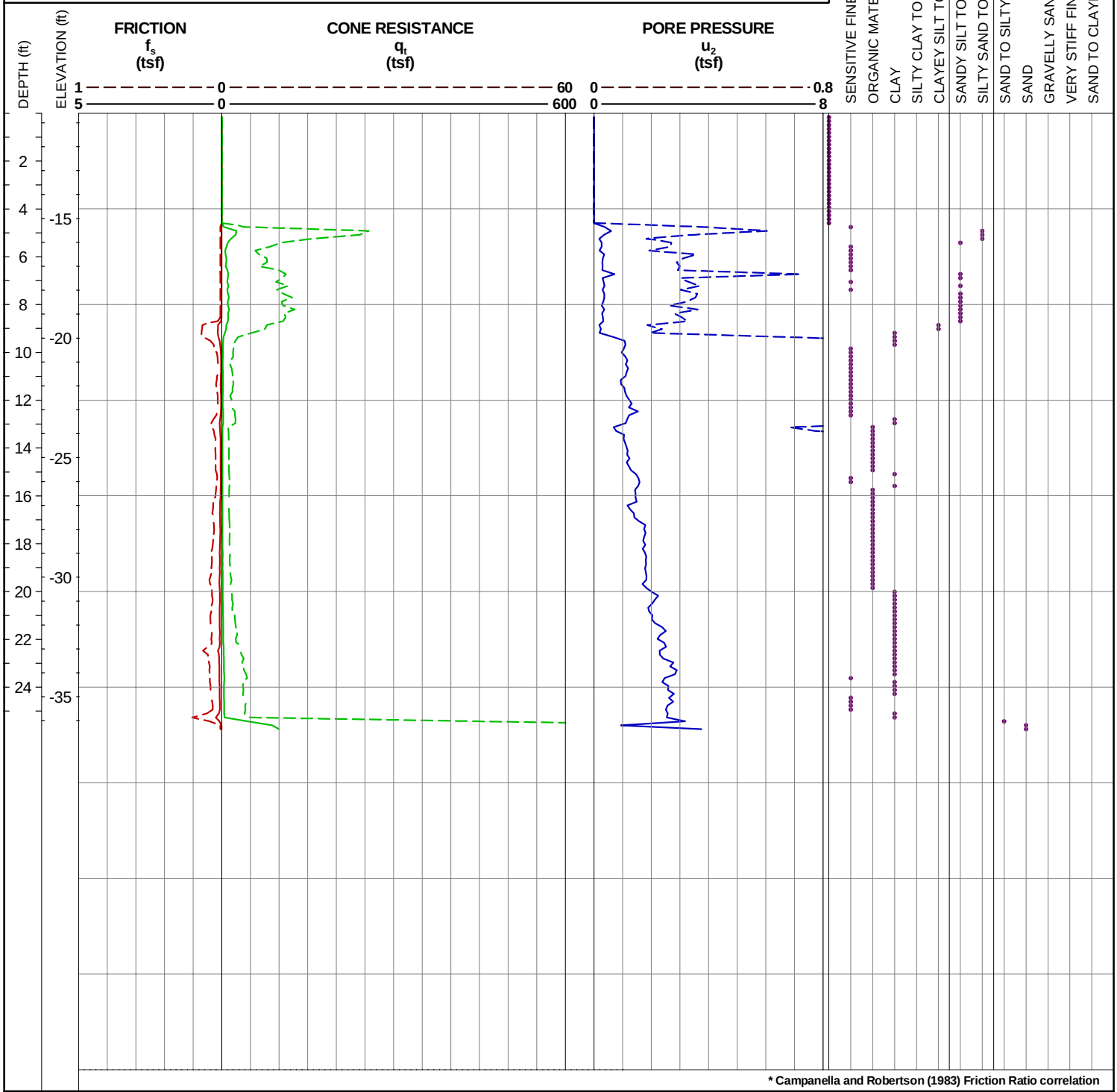
Virginia Department of Transportation

PROJECT #: 173189A | **10CP-019A**

LOCATION: Norfolk and Portmouth, VA | **PAGE 1 OF 1**

STATION: OFFSET:
LATITUDE: °N LONGITUDE: °W
SURFACE ELEVATION: -10.6 COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:
CONE TYPE: 8/5/2010 - 8/5/2010
CONE SIZE:
CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 1 OF 1 | **10CP-019A**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A | **10CP-019B**

LOCATION: Norfolk and Portmouth, VA | **PAGE 1 OF 1**

STATION: OFFSET:

LATITUDE: 36.860995°N LONGITUDE: 76.310774°W

SURFACE ELEVATION: -6.6 COORD. DATUM: NAD 83

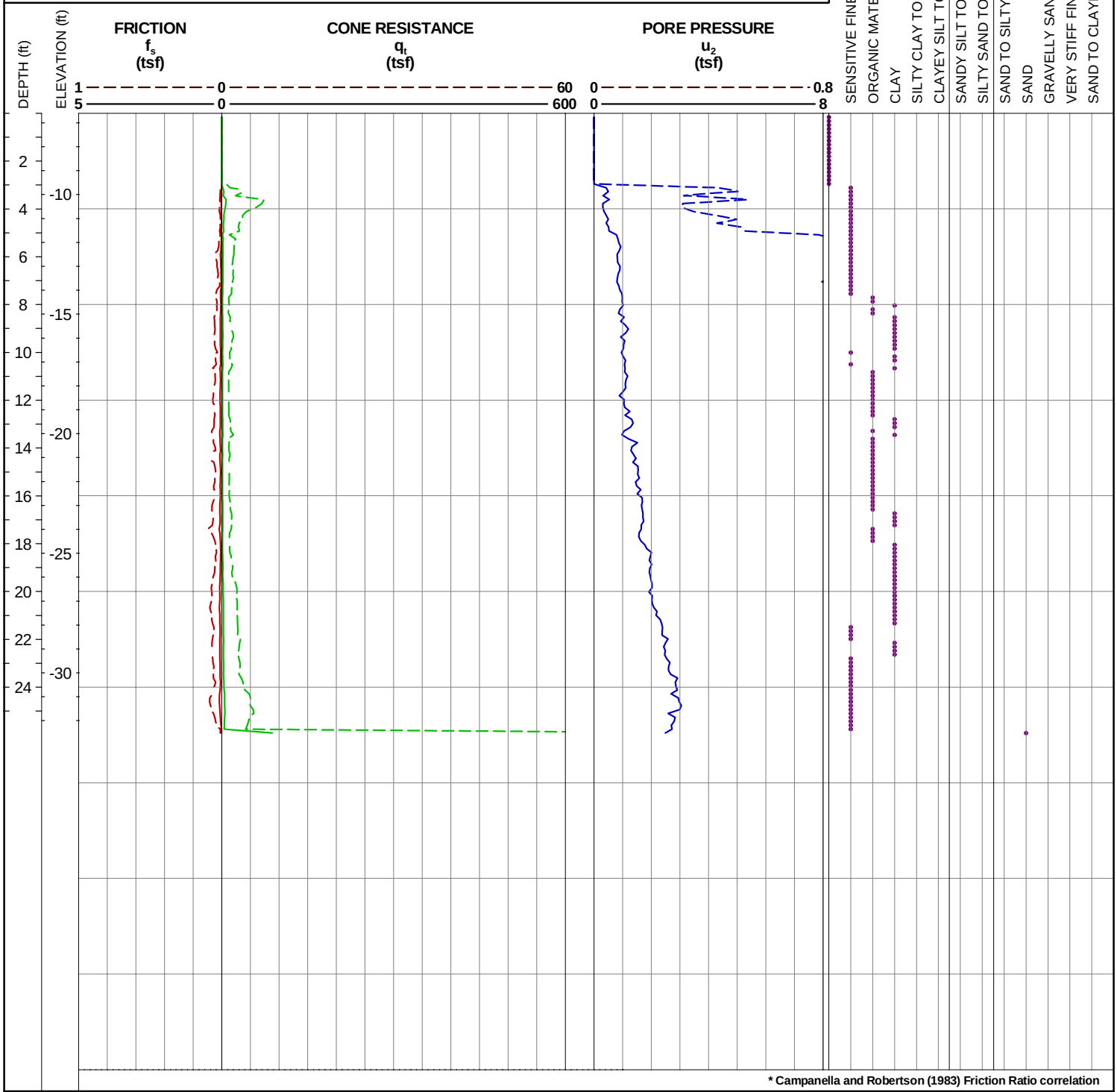
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:

CONE TYPE: 8/5/2010 - 8/5/2010

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 1 OF 1

10CP-019B

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A | **10CP-020**

LOCATION: Norfolk and Portmouth, VA | **PAGE 1 OF 2**

STATION: OFFSET:

LATITUDE: °N LONGITUDE: °W

SURFACE ELEVATION: 6.7 COORD. DATUM: NAD 83

BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:

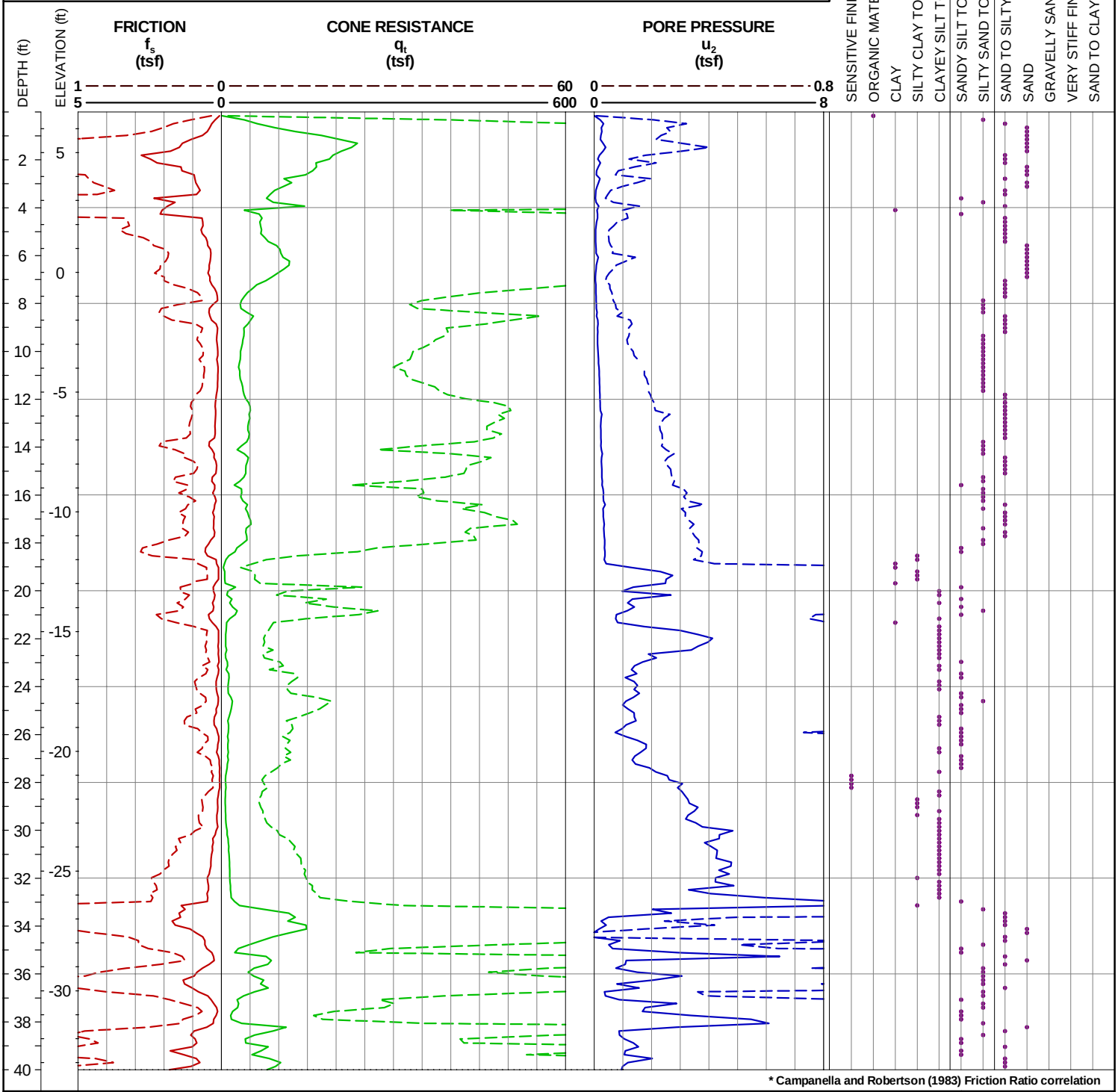
CONE TYPE: 7/22/2010 - 7/22/2010

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:

SOIL BEHAVIOR TYPE*

SENSITIVE FINE GRAINED
ORGANIC MATERIAL
CLAY
SILTY CLAY TO CLAY
CLAYEY SILT TO SILTY CLAY
SANDY SILT TO CLAYEY SILT
SILTY SAND TO SANDY SILT
SAND TO SILTY SAND
SAND
GRAVELLY SAND TO SAND
VERY STIFF FINE GRAINED
SAND TO CLAYEY SAND



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 1 OF 2 | **10CP-020**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

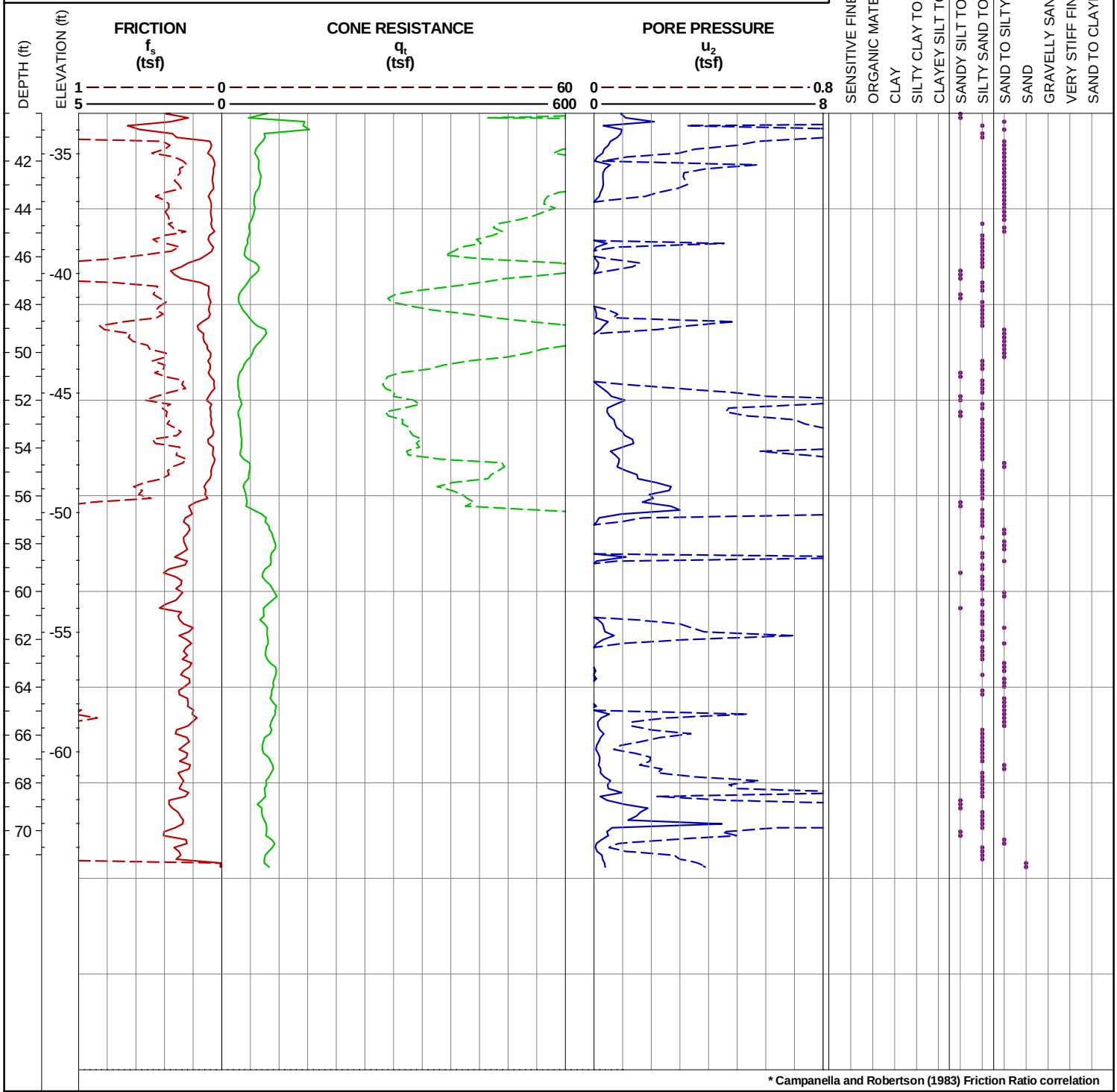
Virginia Department of Transportation

PROJECT #: 173189A | **10CP-020**

LOCATION: Norfolk and Portmouth, VA | **PAGE 2 OF 2**

STATION: OFFSET:
LATITUDE: °N LONGITUDE: °W
SURFACE ELEVATION: 6.7 COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:
CONE TYPE: 7/22/2010 - 7/22/2010
CONE SIZE:
CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 2 OF 2 | **10CP-020**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

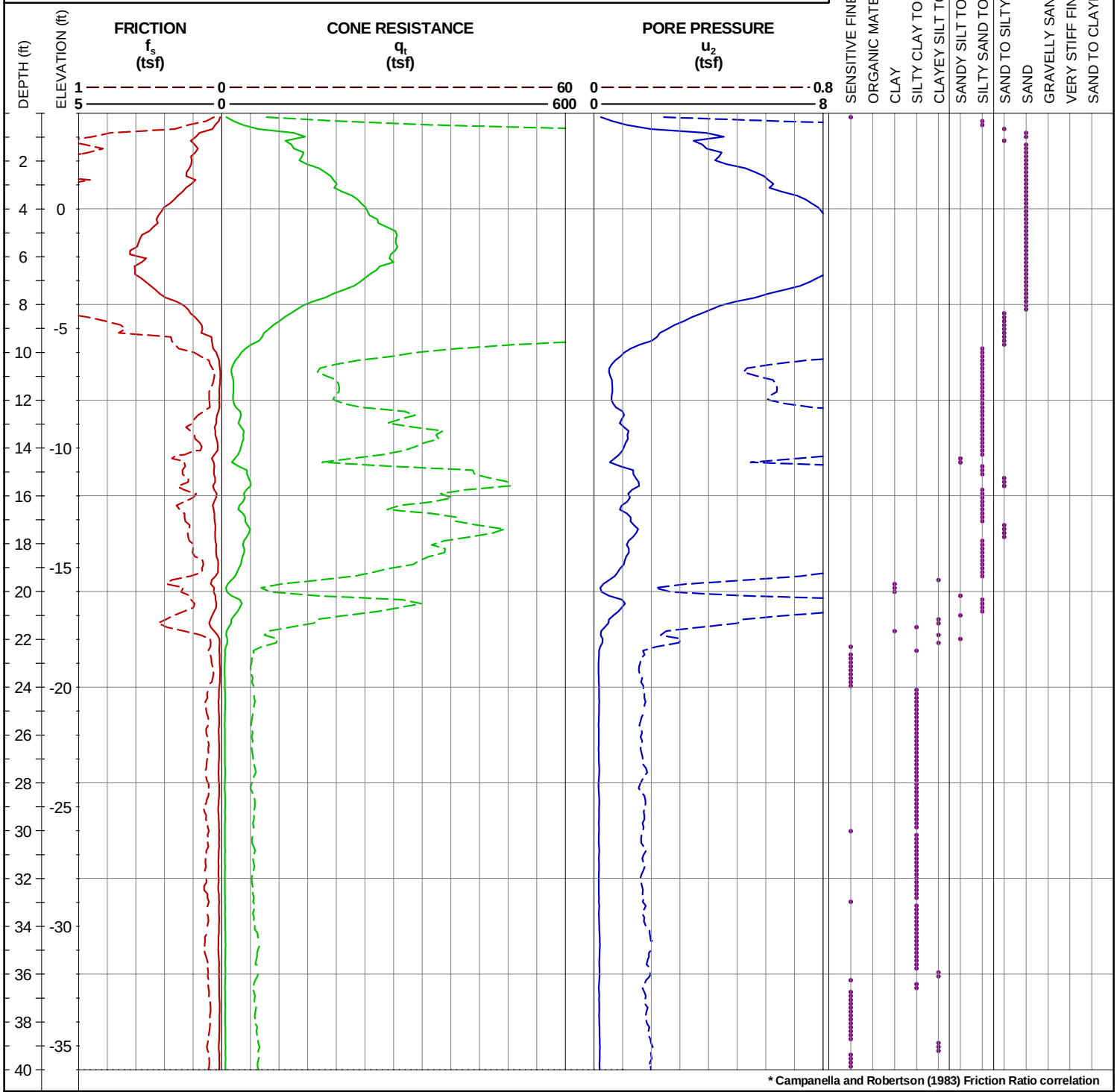
Virginia Department of Transportation

PROJECT #: 173189A | **10CP-021**

LOCATION: Norfolk and Portmouth, VA | **PAGE 1 OF 2**

STATION: OFFSET:
LATITUDE: °N LONGITUDE: °W
SURFACE ELEVATION: 4.0 COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:
CONE TYPE: 7/22/2010 - 7/22/2010
CONE SIZE:
CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 1 OF 2 | **10CP-021**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

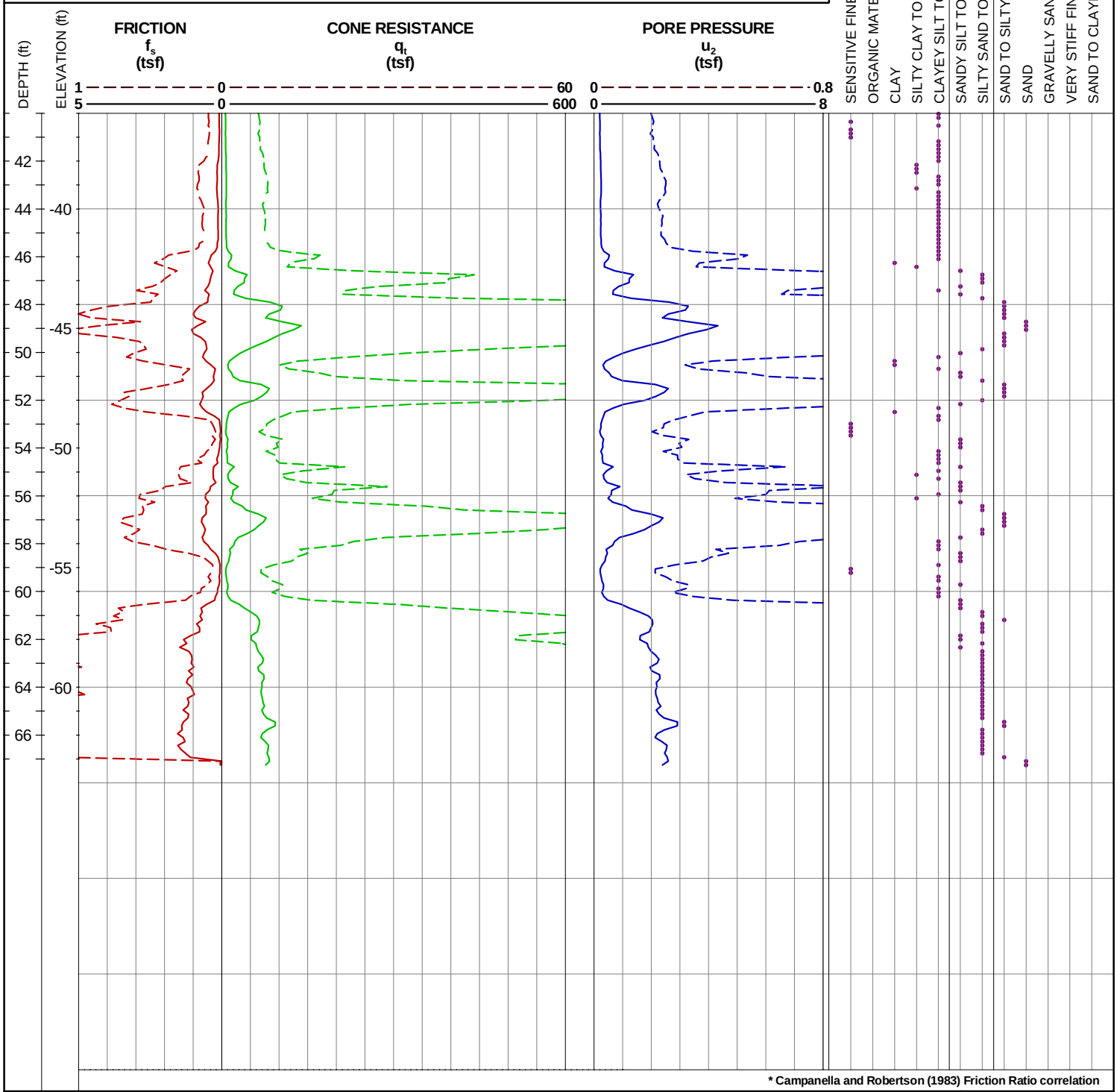
Virginia Department of Transportation

PROJECT #: 173189A | **10CP-021**

LOCATION: Norfolk and Portmouth, VA | **PAGE 2 OF 2**

STATION: OFFSET:
LATITUDE: °N LONGITUDE: °W
SURFACE ELEVATION: 4.0 COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED: 7/22/2010 - 7/22/2010
CONE TYPE:
CONE SIZE:
CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 2 OF 2 | **10CP-021**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

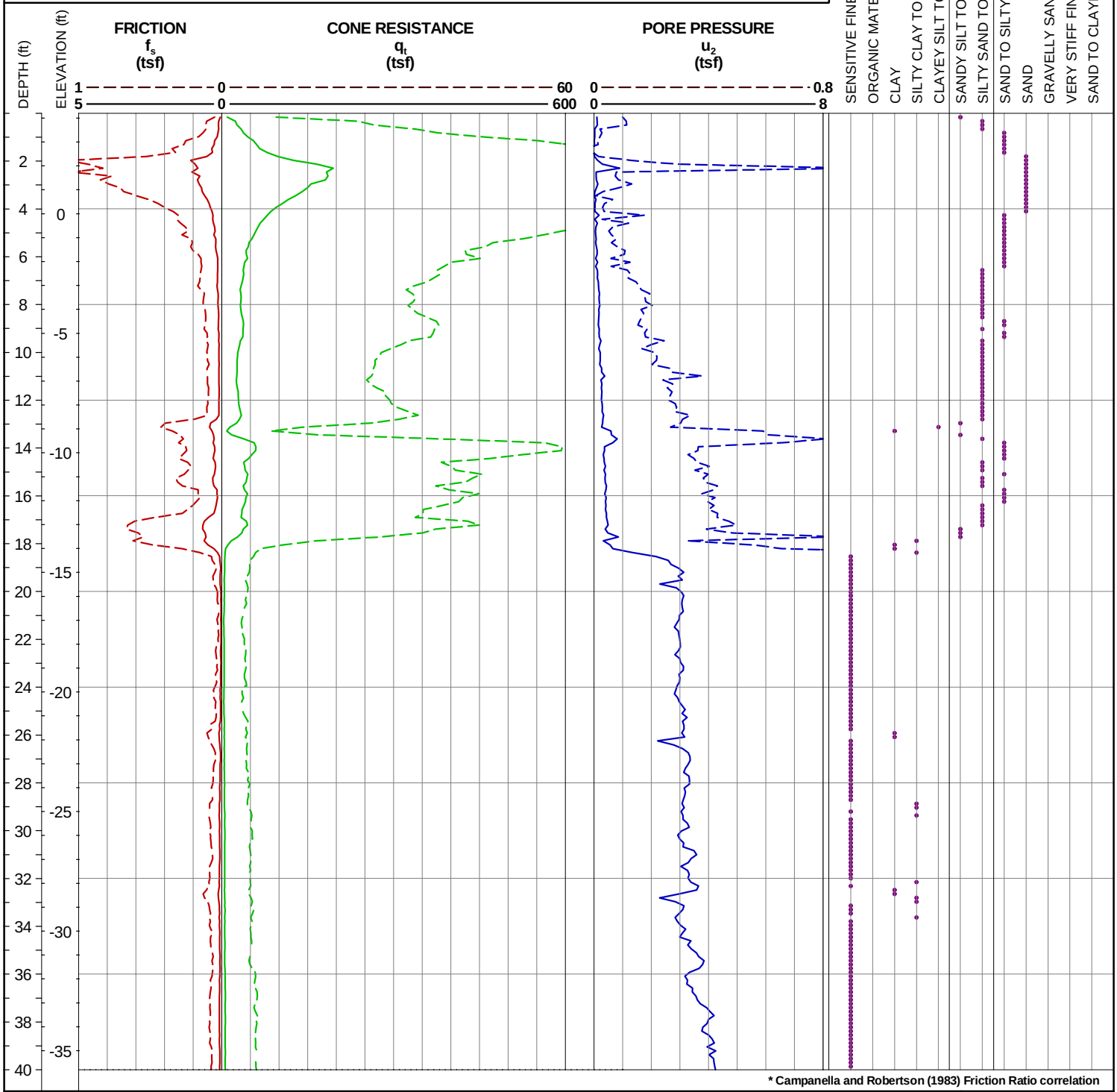
Virginia Department of Transportation

PROJECT #: 173189A | **10CP-022**

LOCATION: Norfolk and Portmouth, VA | **PAGE 1 OF 3**

STATION: OFFSET:
LATITUDE: °N LONGITUDE: °W
SURFACE ELEVATION: 4.2 COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:
CONE TYPE: 7/23/2010 - 7/23/2010
CONE SIZE:
CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 1 OF 3 | **10CP-022**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

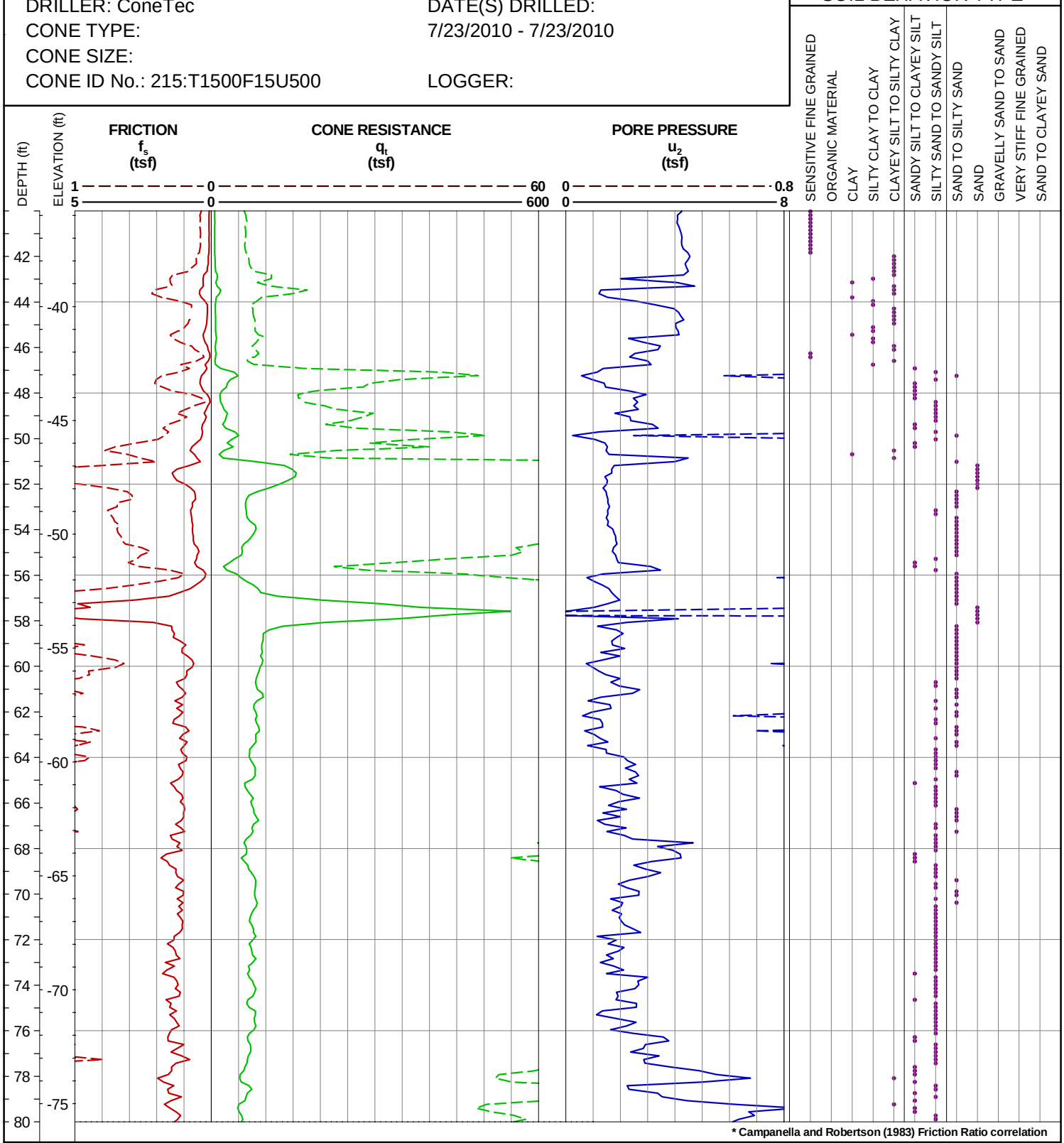
Virginia Department of Transportation

PROJECT #: 173189A | **10CP-022**

LOCATION: Norfolk and Portmouth, VA | **PAGE 2 OF 3**

STATION: OFFSET:
LATITUDE: °N LONGITUDE: °W
SURFACE ELEVATION: 4.2 COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:
CONE TYPE: 7/23/2010 - 7/23/2010
CONE SIZE:
CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 2 OF 3

10CP-022

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A | **10CP-022**

LOCATION: Norfolk and Portmouth, VA | **PAGE 3 OF 3**

STATION: OFFSET:

LATITUDE: °N LONGITUDE: °W

SURFACE ELEVATION: 4.2 COORD. DATUM: NAD 83

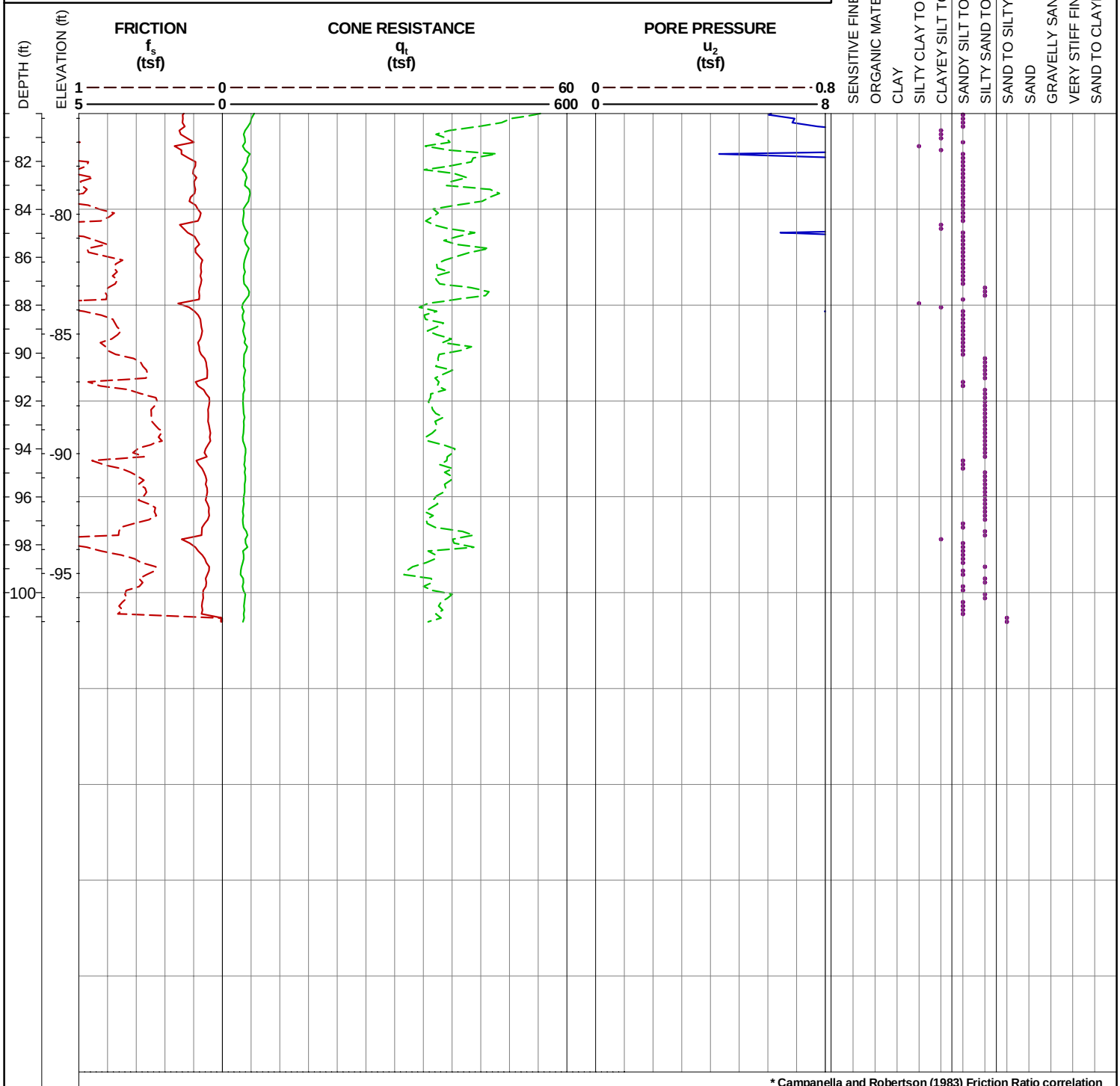
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:

CONE TYPE: 7/23/2010 - 7/23/2010

CONE SIZE:

CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 3 OF 3

10CP-022

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

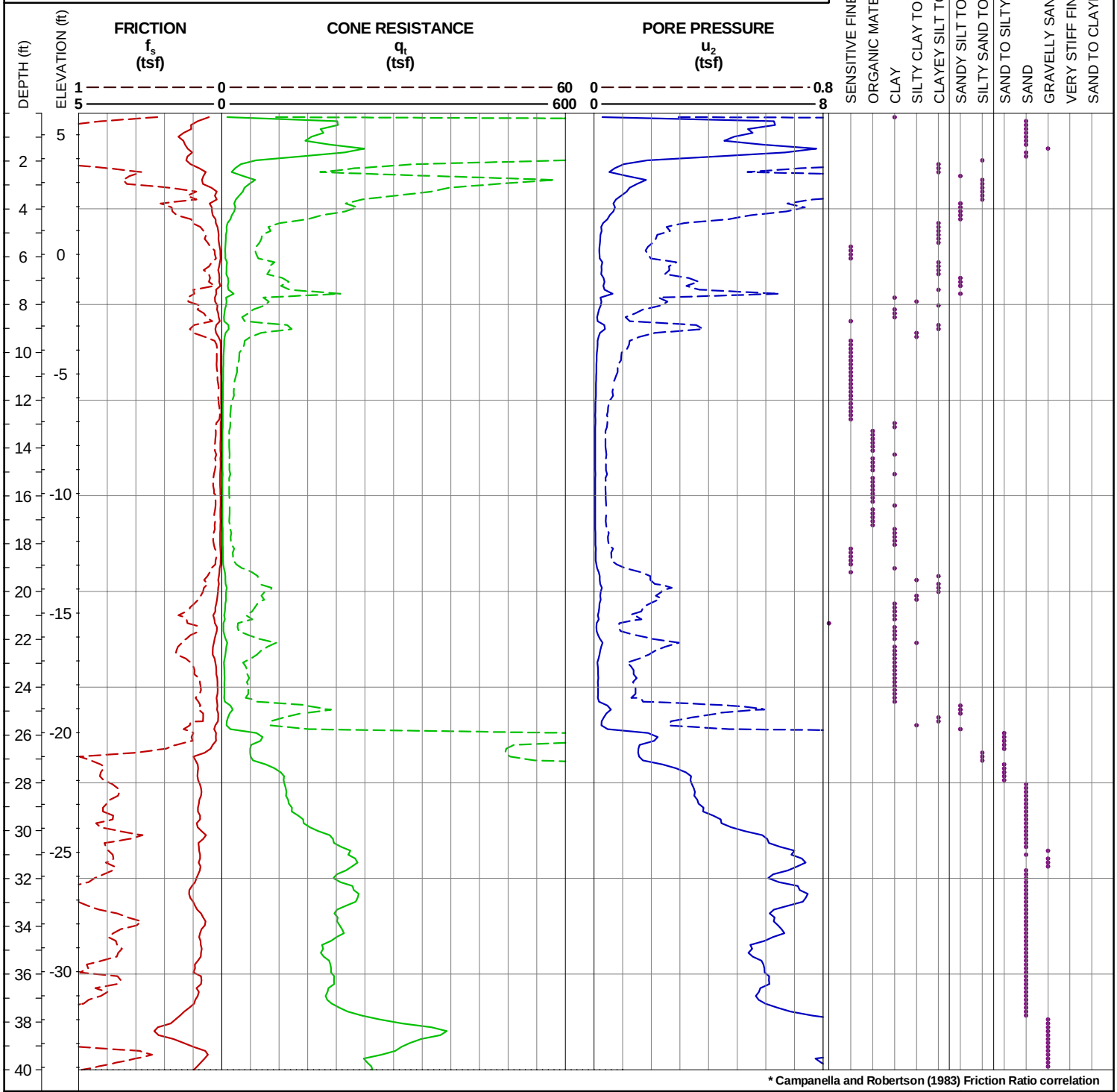
Virginia Department of Transportation

PROJECT #: 173189A | **10CP-023**

LOCATION: Norfolk and Portmouth, VA | **PAGE 1 OF 2**

STATION: OFFSET:
LATITUDE: °N LONGITUDE: °W
SURFACE ELEVATION: 5.9 COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:
CONE TYPE: 7/23/2010 - 7/23/2010
CONE SIZE:
CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 1 OF 2 | **10CP-023**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

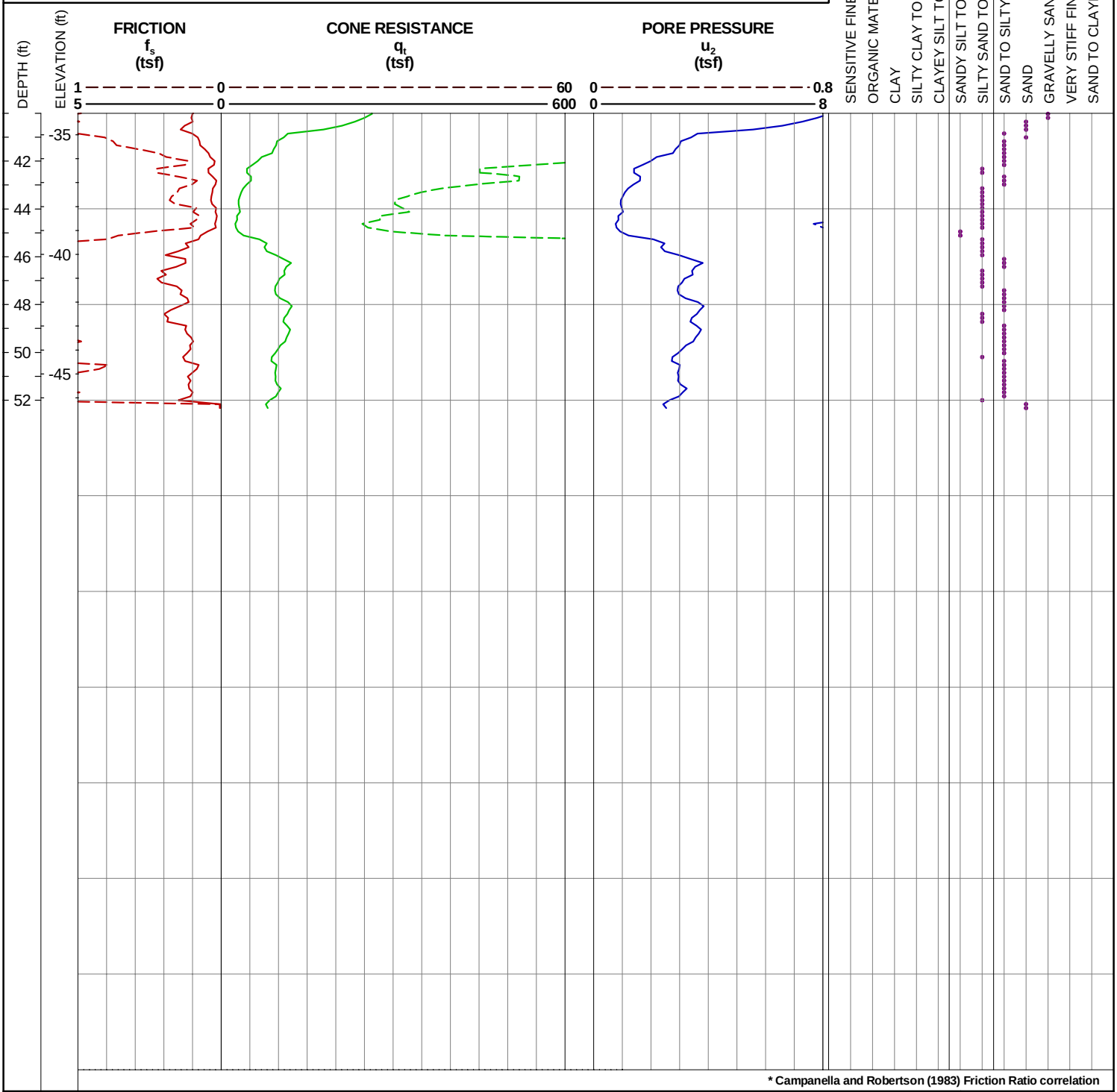
Virginia Department of Transportation

PROJECT #: 173189A | **10CP-023**

LOCATION: Norfolk and Portmouth, VA | **PAGE 2 OF 2**

STATION: OFFSET:
LATITUDE: °N LONGITUDE: °W
SURFACE ELEVATION: 5.9 COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:
CONE TYPE: 7/23/2010 - 7/23/2010
CONE SIZE:
CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 2 OF 2

10CP-023

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA

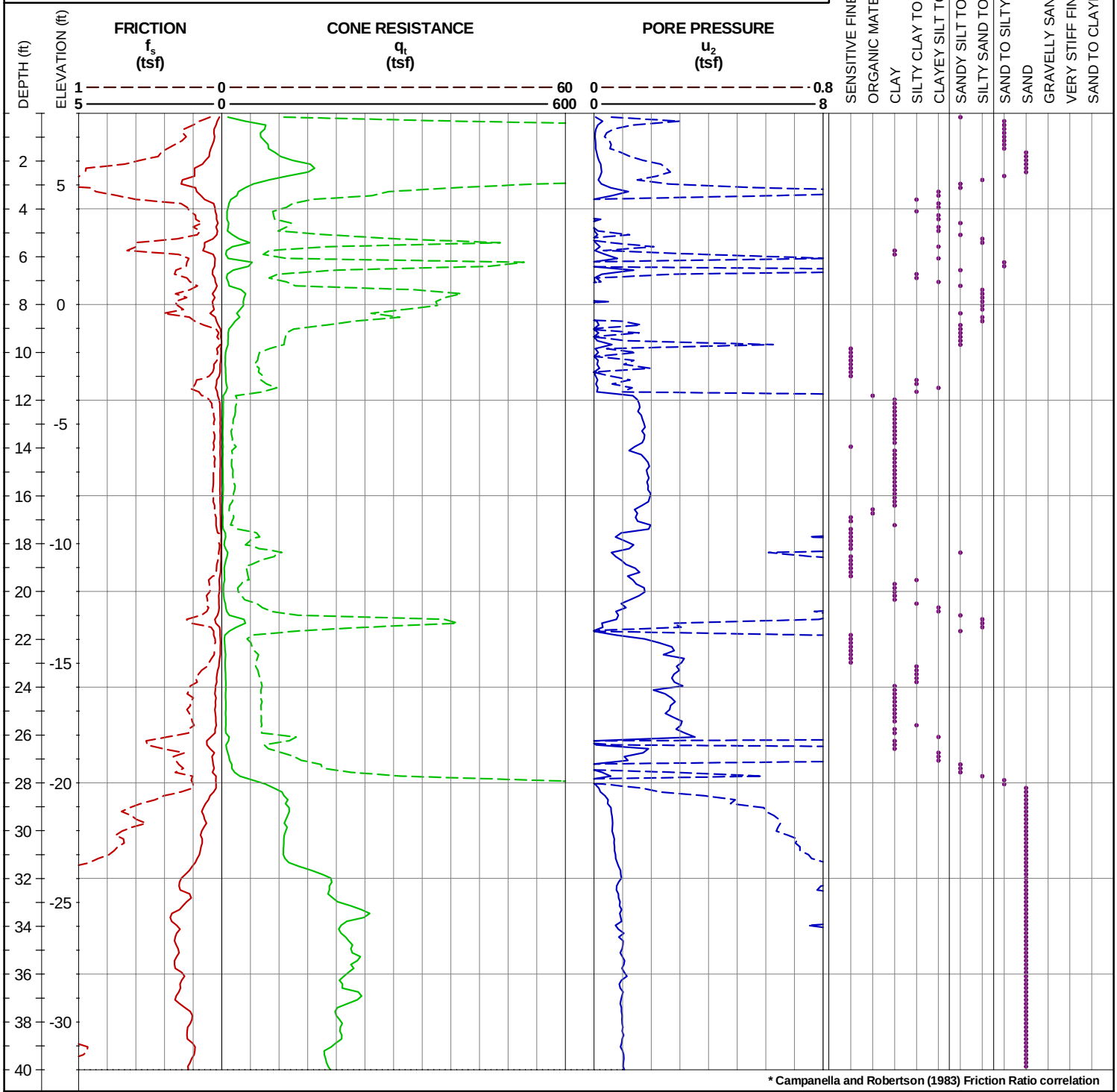
10CP-024
PAGE 1 OF 2

STATION:
OFFSET:
LATITUDE: °N
LONGITUDE: °W
SURFACE ELEVATION: 8.0
COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec
CONE TYPE:
CONE SIZE:
CONE ID No.: 215:T1500F15U500

DATE(S) DRILLED:
7/22/2010 - 7/22/2010

LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 1 OF 2
10CP-024

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

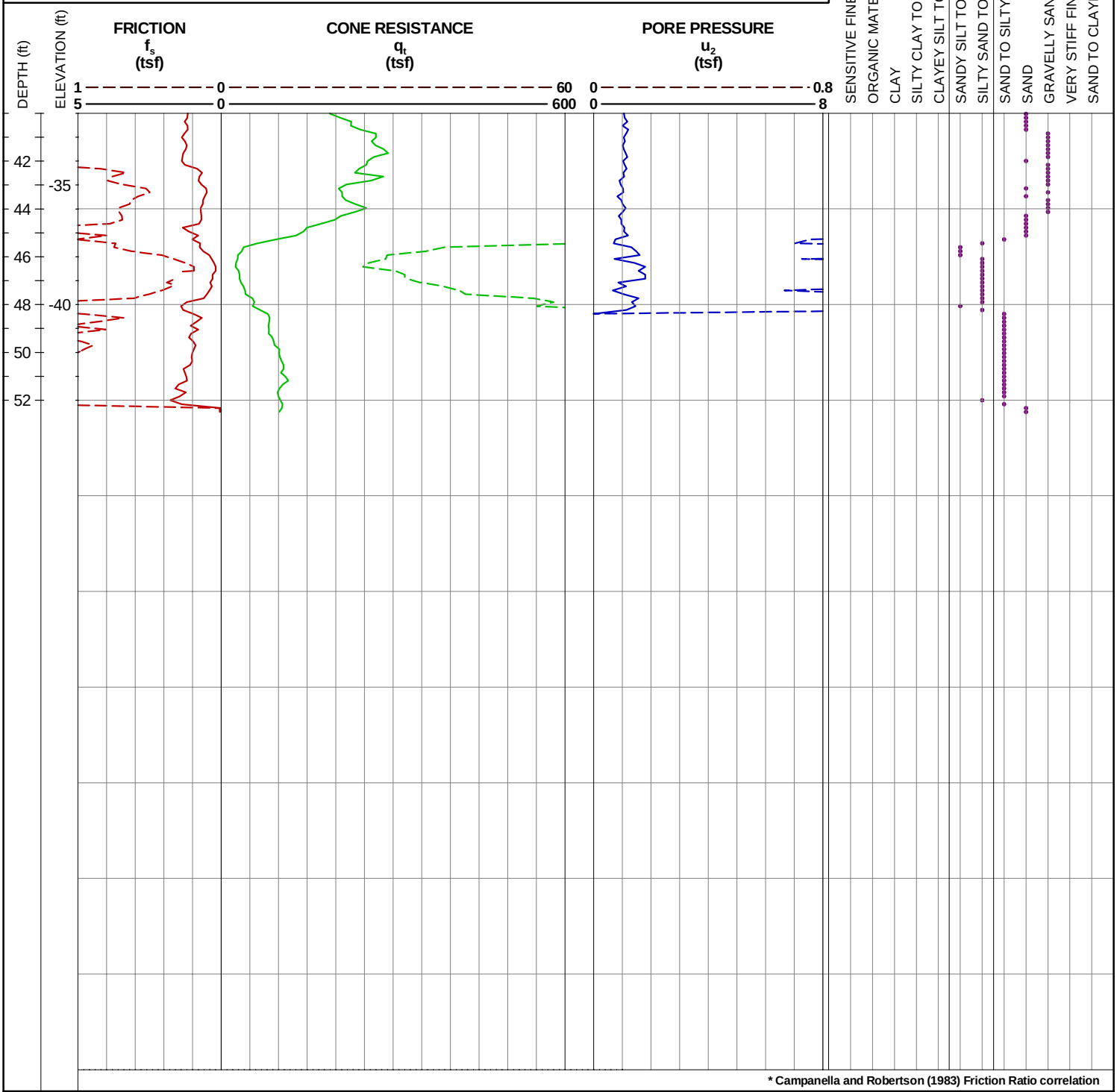
Virginia Department of Transportation

PROJECT #: 173189A | **10CP-024**

LOCATION: Norfolk and Portmouth, VA | **PAGE 2 OF 2**

STATION: OFFSET:
LATITUDE: °N LONGITUDE: °W
SURFACE ELEVATION: 8.0 COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec DATE(S) DRILLED:
CONE TYPE: 7/22/2010 - 7/22/2010
CONE SIZE:
CONE ID No.: 215:T1500F15U500 LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 2 OF 2 | **10CP-024**

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

Virginia Department of Transportation

PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA

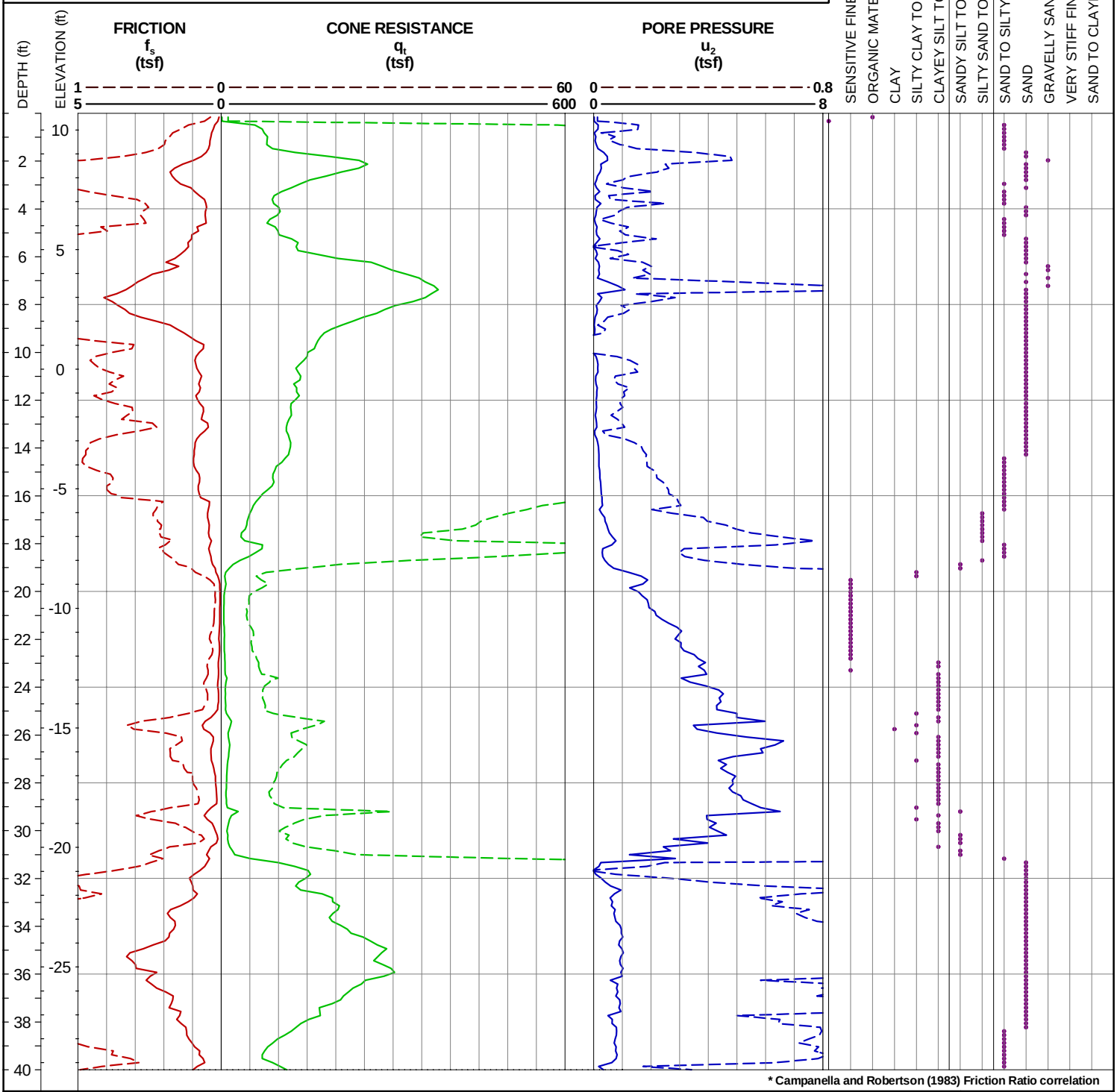
10CP-025
PAGE 1 OF 2

STATION:
OFFSET:
LATITUDE: °N
LONGITUDE: °W
SURFACE ELEVATION: 10.7
COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec
CONE TYPE:
CONE SIZE:
CONE ID No.: 215:T1500F15U500

DATE(S) DRILLED:
7/22/2010 - 7/22/2010

LOGGER:



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 1 OF 2
10CP-025

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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CONE PENETROMETER TEST LOG

VDOT Virginia Department of Transportation

PROJECT #: 173189A
LOCATION: Norfolk and Portmouth, VA

10CP-025
PAGE 2 OF 2

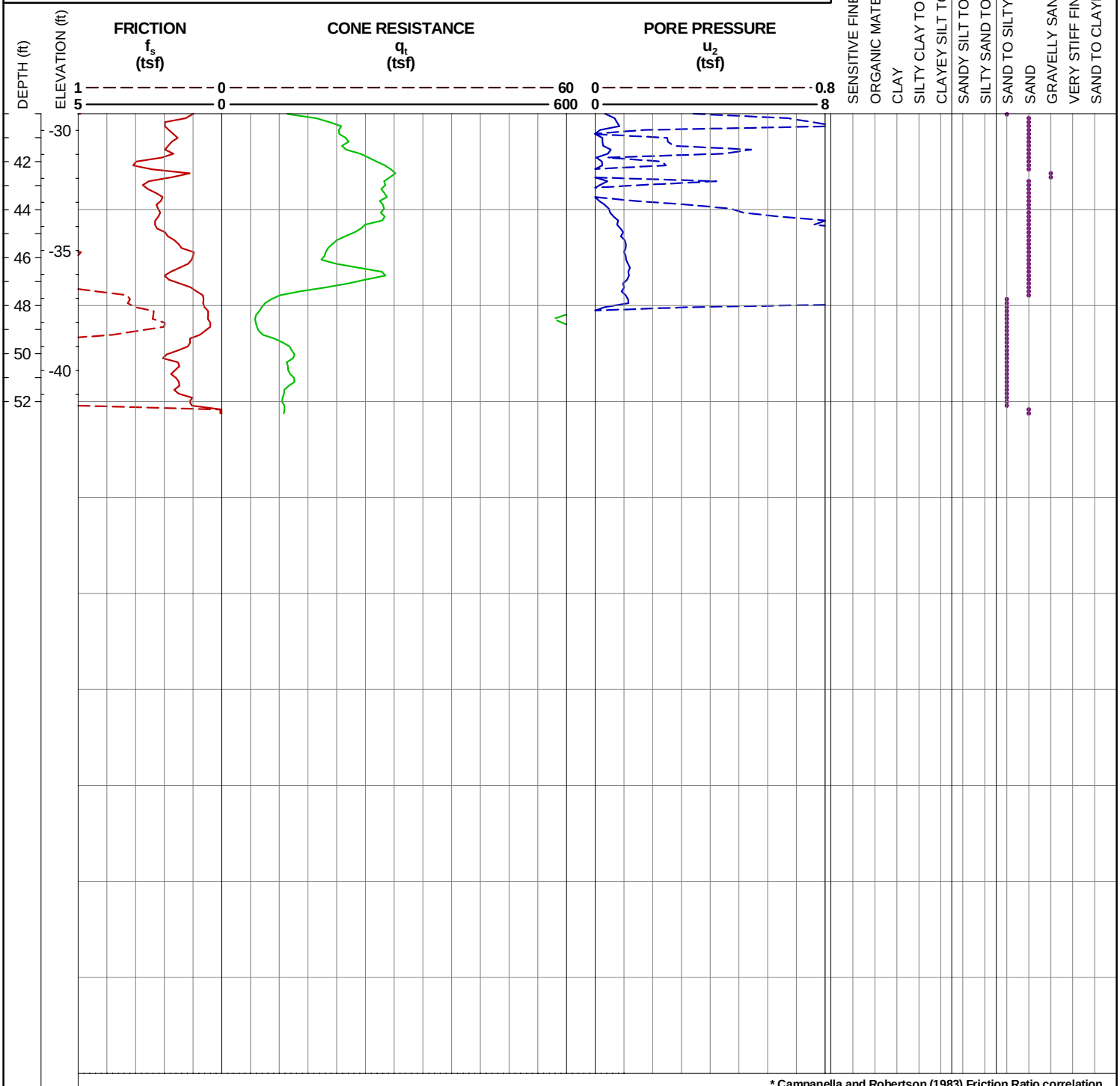
STATION:
OFFSET:
LATITUDE: °N
LONGITUDE: °W
SURFACE ELEVATION: 10.7
COORD. DATUM: NAD 83
BENCHMARK LOCATION:

DRILLER: ConeTec
CONE TYPE:
CONE SIZE:
CONE ID No.: 215:T1500F15U500

DATE(S) DRILLED:
7/22/2010 - 7/22/2010

LOGGER:

SOIL BEHAVIOR TYPE*



* Campanella and Robertson (1983) Friction Ratio correlation

REMARKS:

PAGE 2 OF 2
10CP-025

CPT_LOG:MIDTOWNTUNNELDRAFTLOGS_LABIMPORT1.GPJ:8.30.002:061109:6/17/11

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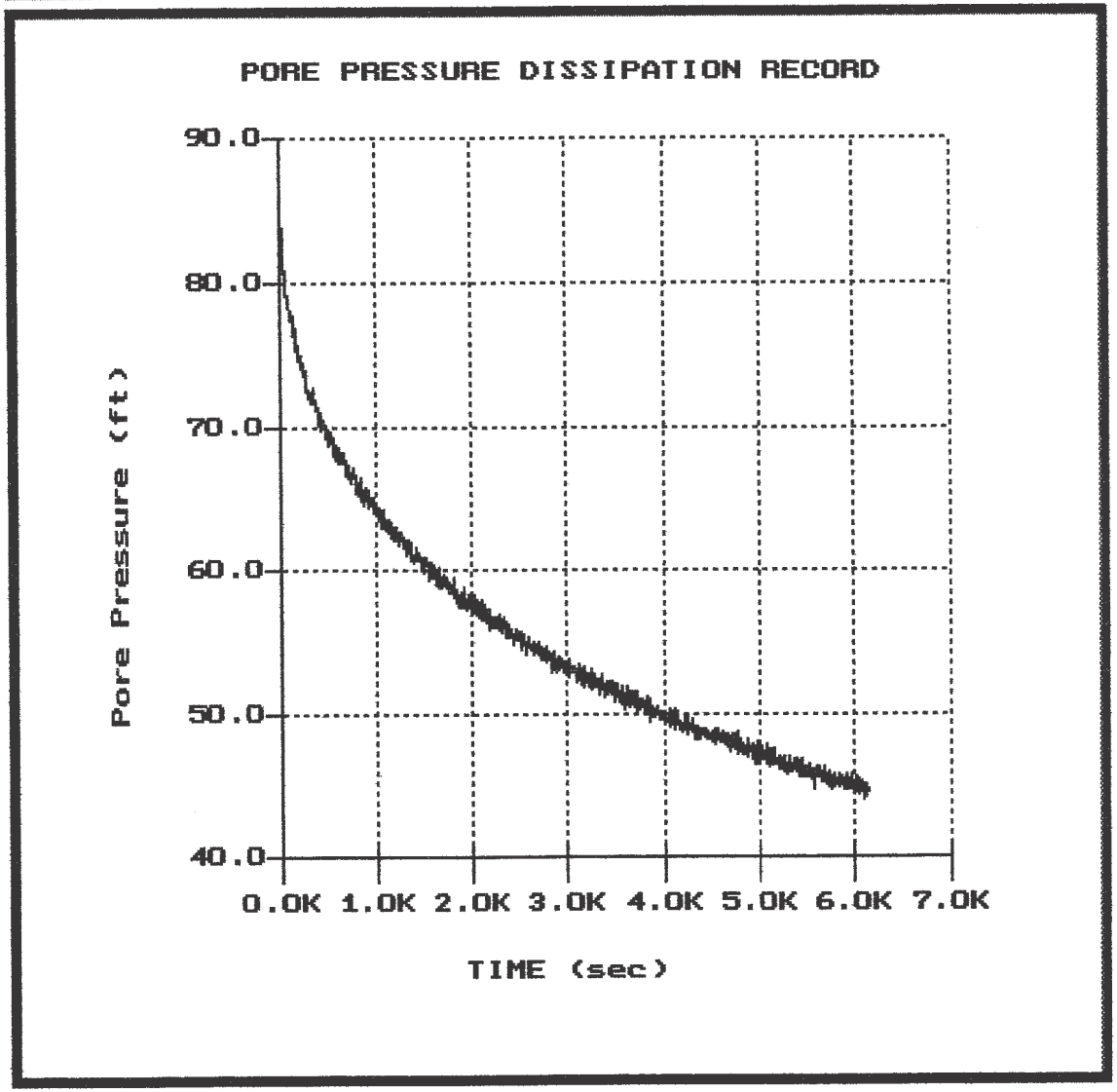
PB

Hole:10CP-03
Location:Midtown Tunnel

Cone:215:T1500F15U500
Date:07:21:10 08:50

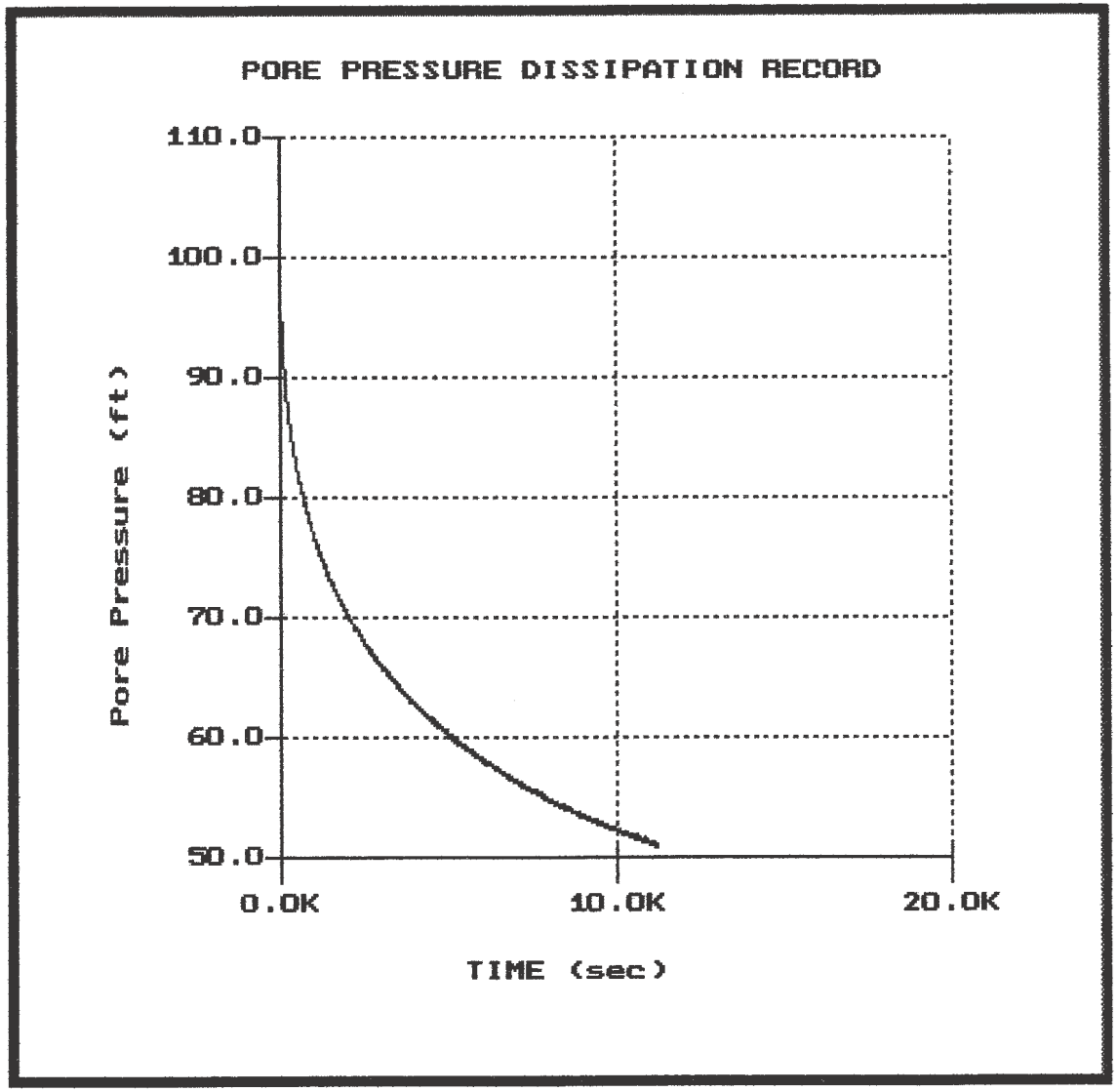


File: 952CP03.PPD
Depth (m): 6.45
(ft): 21.16
Duration : 6140.0s
U-min: 43.99 6090.0s
U-max: 89.31 0.0s

PB

Hole:10CP-03
Location:Midtown Tunnel

Cone:215:T150OF15U500
Date:07:21:10 08:50



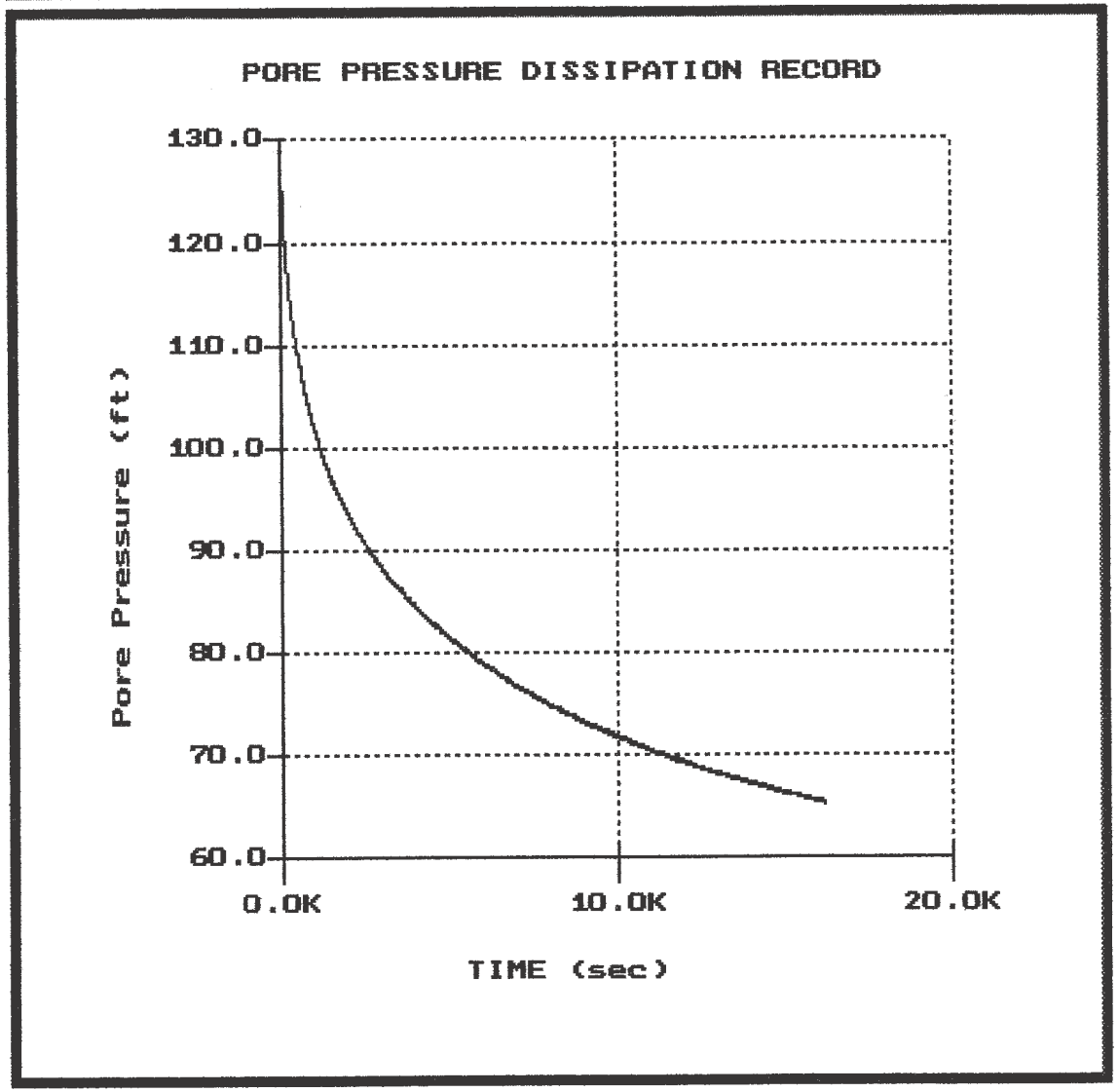
File: 952CP03.PPD
Depth (m): 9.60
(ft): 31.50
Duration : 11195.0s
U-min: 50.91 11165.0s
U-max: 101.78 0.0s

PB

Hole:10CP-03
Location:Midtown Tunnel

Cone:215:T1500F15U500
Date:07:21:10 08:50

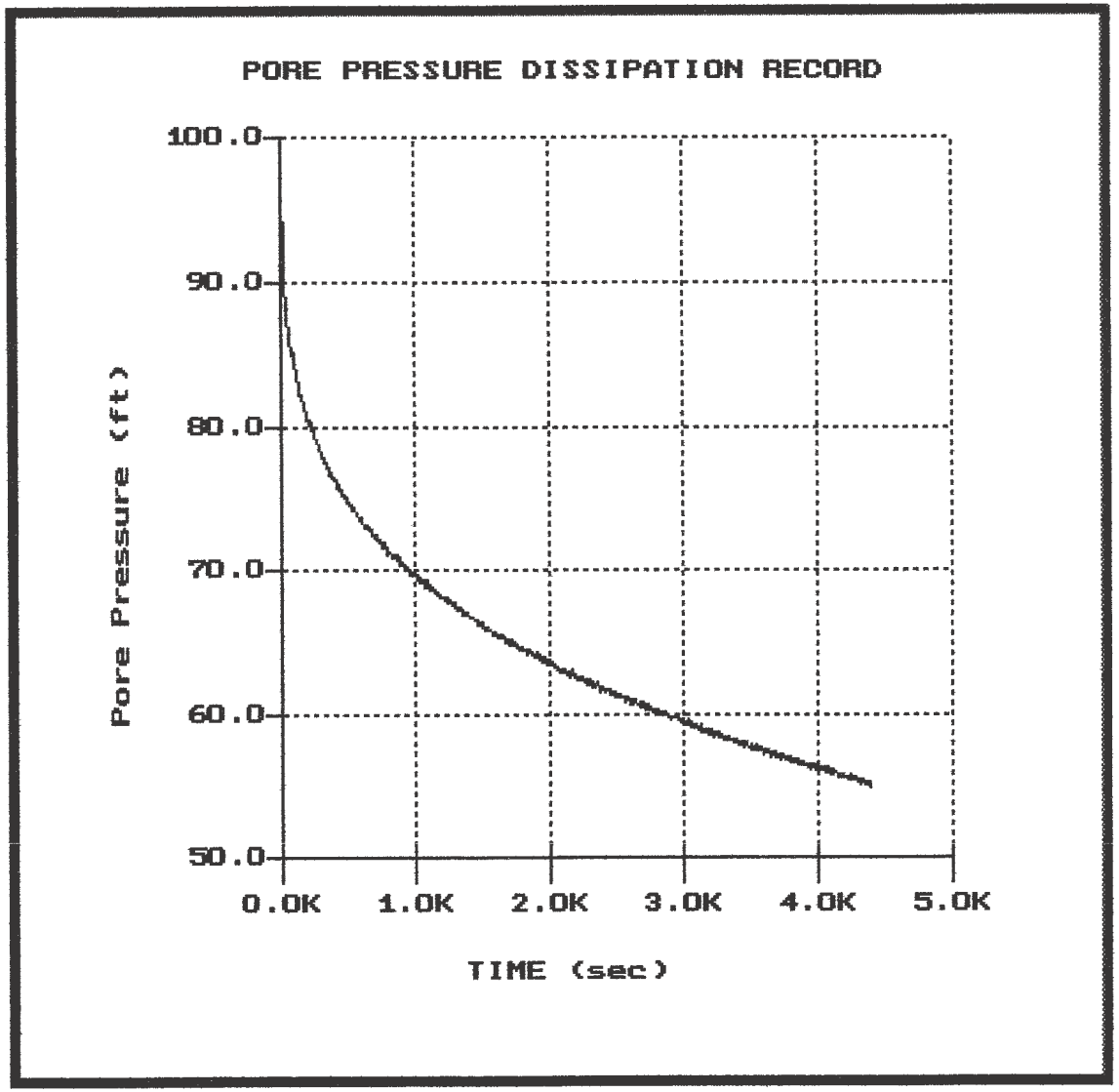
File: 952CP03.PPD
Depth (m): 13.80
(ft): 45.28
Duration : 16195.0s
U-min: 65.18 16195.0s
U-max: 126.77 10.0s



PB

Hole:10CP-22
Location:Midtown Tunnel

Cone:215:T1500F15U500
Date:07:23:10 08:46

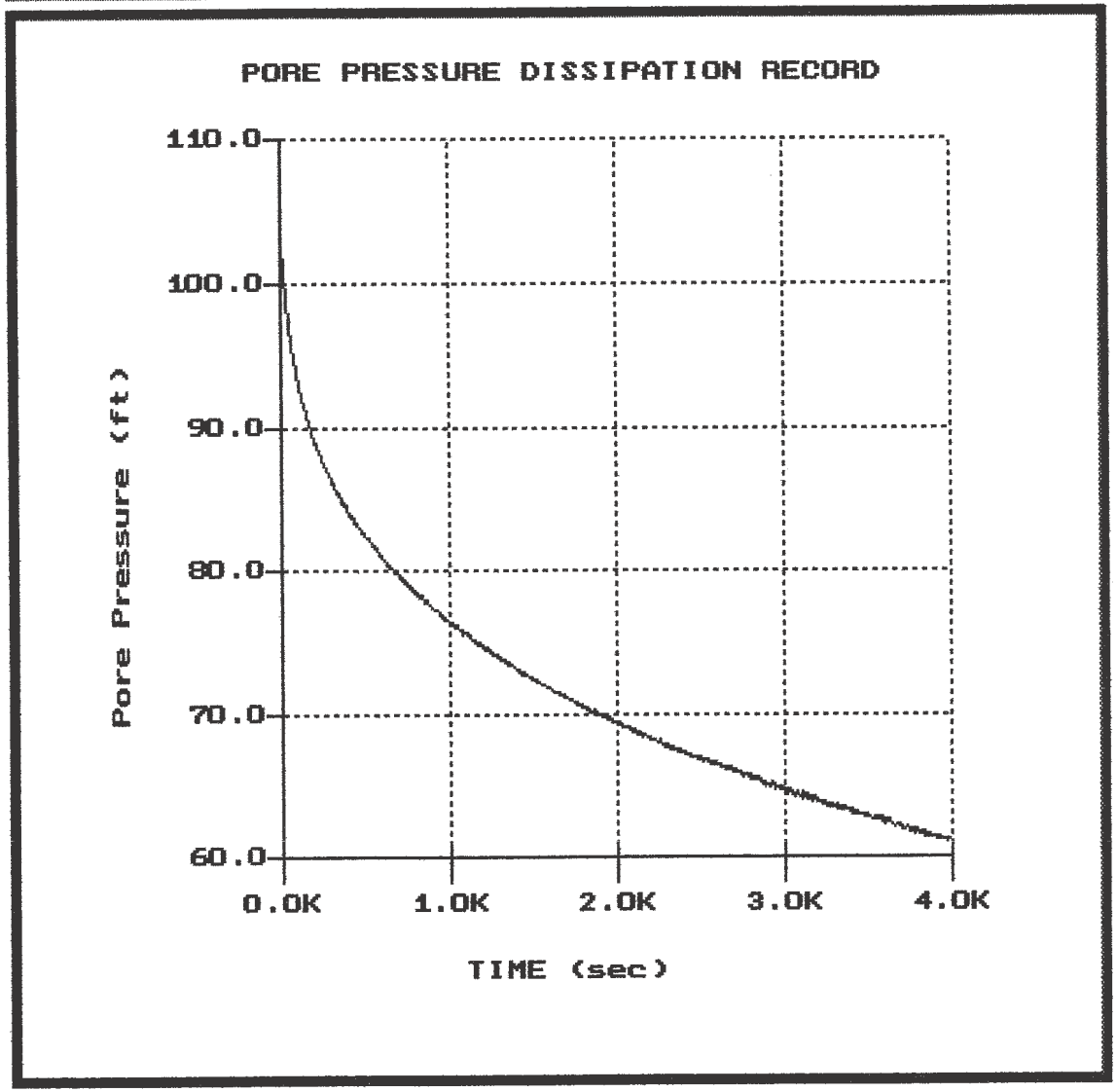


File: 952CP22.PPD
Depth (m): 5.95
(ft): 19.52
Duration : 4390.0s
U-min: 54.94 4390.0s
U-max: 99.00 0.0s

PB

Hole:10CP-22
Location:Midtown Tunnel

Cone:215:T1500F15U500
Date:07:23:10 08:46

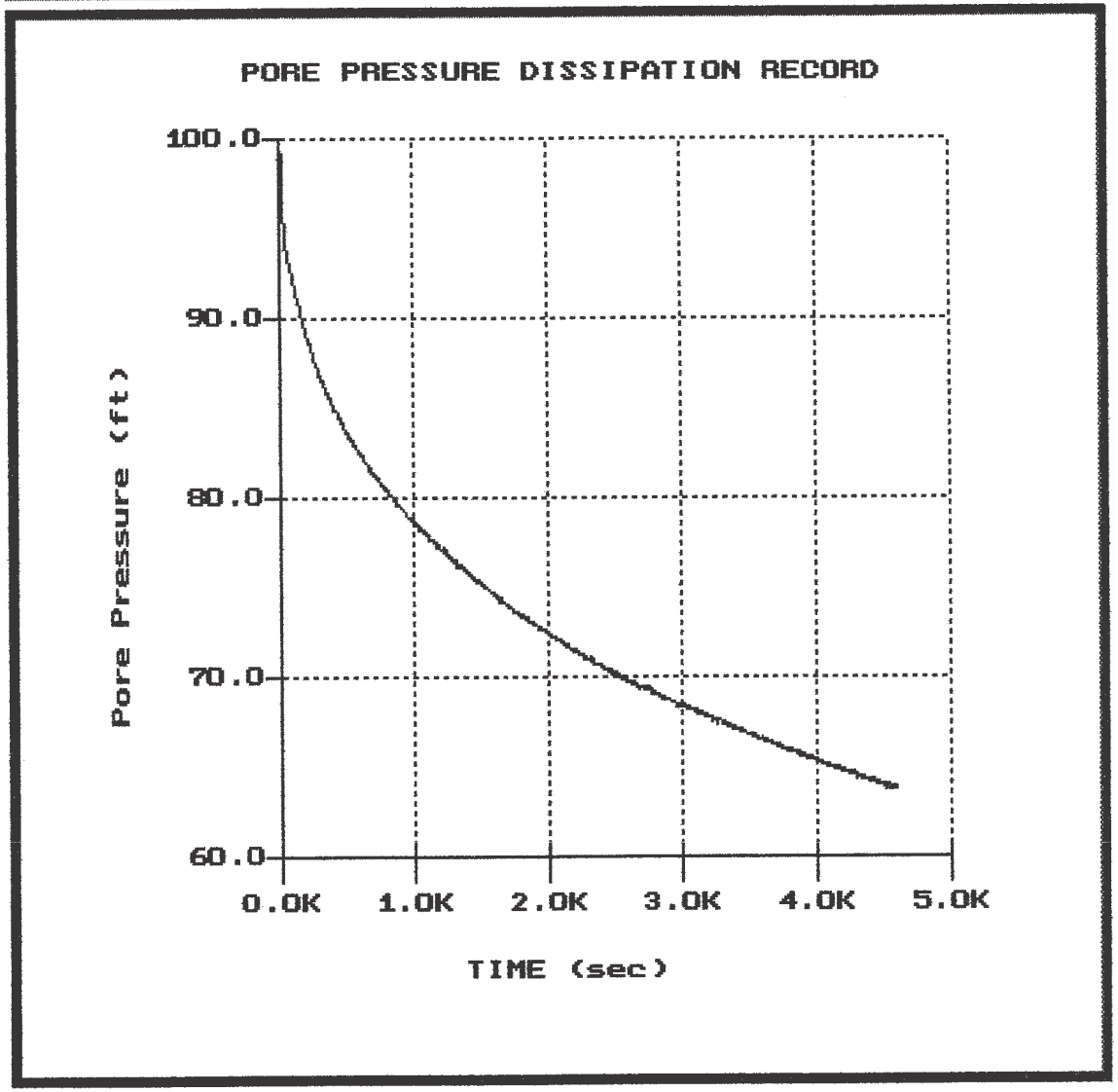


File: 952CP22.PPD
Depth (m): 7.95
(ft): 26.08
Duration : 3990.0s
U-min: 60.99 3975.0s
U-max: 101.79 5.0s

PB

Hole:10CP-22
Location:Midtown Tunnel

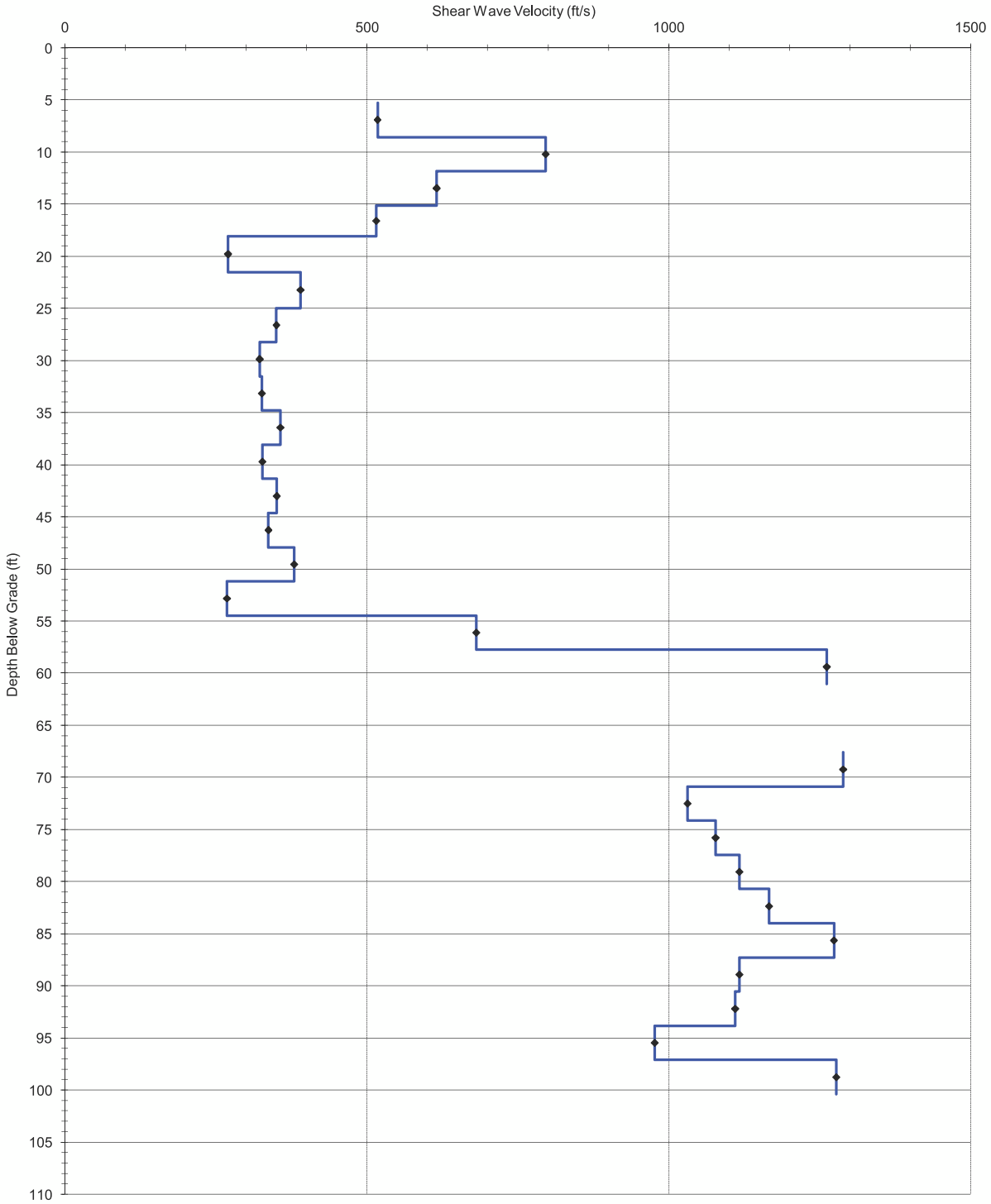
Cone:215:T150DF15U500
Date:07:23:10 08:46



File: 952CP22.PPD
Depth (m): 9.95
(ft): 32.64
Duration : 4590.0s
U-min: 63.71 4560.0s
U-max: 99.16 10.0s

CONETEC

Shear Wave Velocity- 10CP-02
Midtown Tunnel
10-952
July 20, 2010

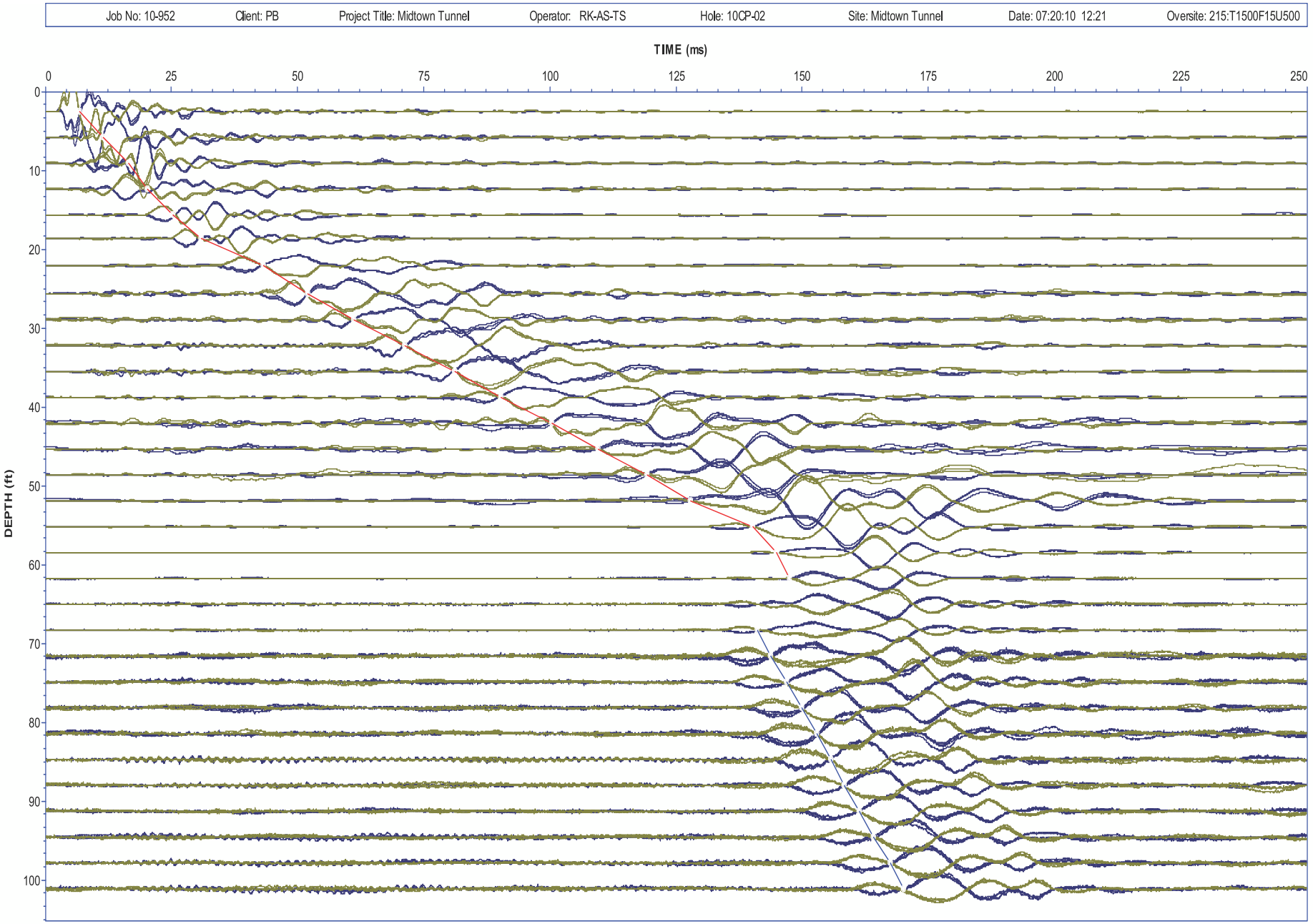


ConeTec Shear Wave Velocity Data Reduction Sheet

Hole: 10CP-02
Location: Midtown Tunnel
Cone: AD215
Date: 20-Jul-10
Source: Beam

Source Depth	0.00 m
Source Offset	1.45 m

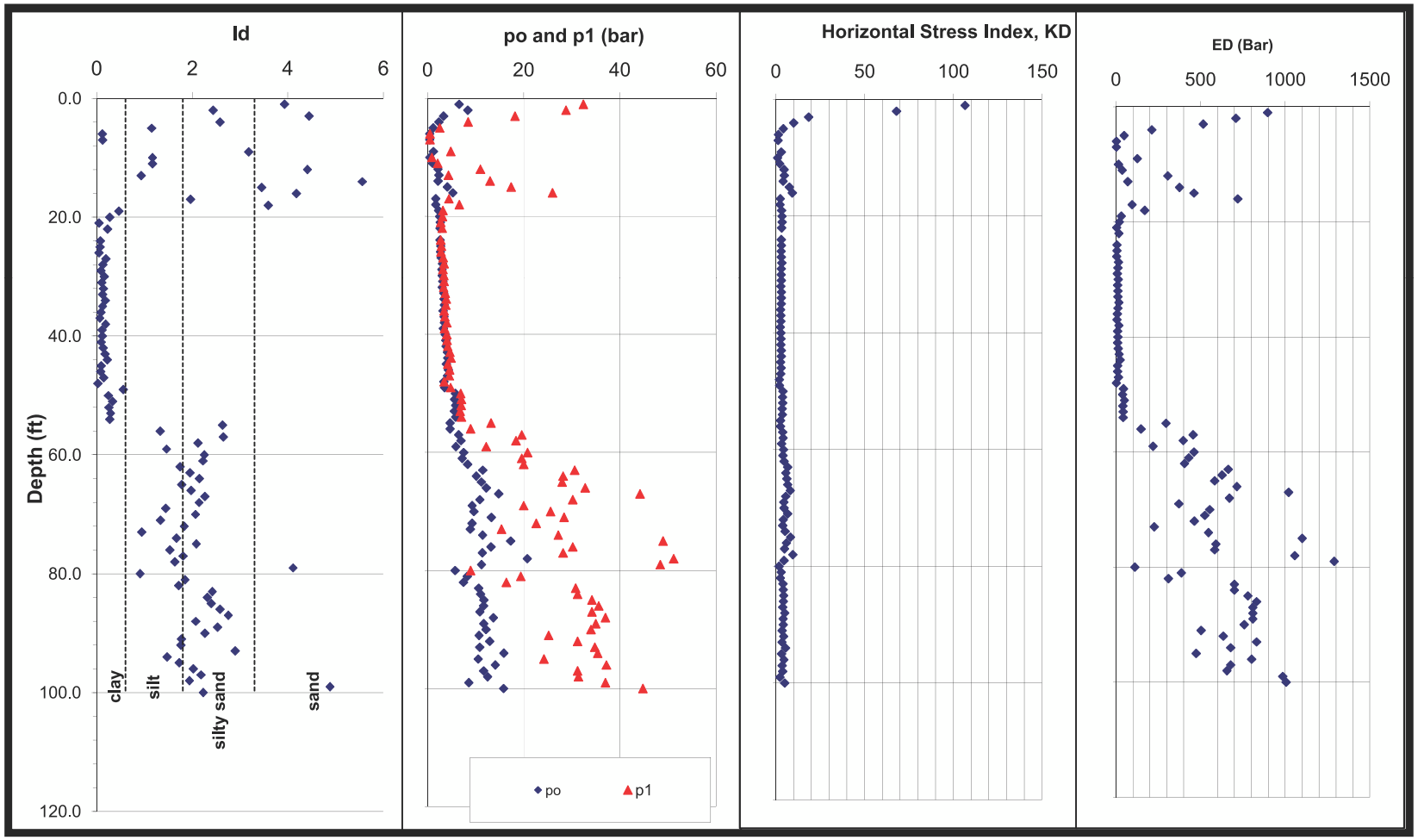
Tip Depth (m)	Geophone Depth(m)	Travel Path (m)	Interval time (ms)	Velocity (m/s)	Velocity (ft/s)	Interval Depth (m)	Interval Depth (ft)
0.00							
1.80	1.60	2.16					
2.80	2.60	2.98	5.19	157.7	517.3	2.10	6.89
3.80	3.60	3.88	3.73	242.6	795.8	3.10	10.17
4.80	4.60	4.82	5.02	187.5	615.3	4.10	13.45
5.70	5.50	5.69	5.51	156.9	514.9	5.05	16.57
6.75	6.55	6.71	12.42	82.2	269.7	6.03	19.77
7.80	7.60	7.74	8.66	118.8	389.6	7.08	23.21
8.80	8.60	8.72	9.23	106.6	349.8	8.10	26.57
9.80	9.60	9.71	10.07	98.1	321.8	9.10	29.86
10.80	10.60	10.70	9.97	99.2	325.6	10.10	33.14
11.80	11.60	11.69	9.13	108.6	356.3	11.10	36.42
12.80	12.60	12.68	9.99	99.4	326.2	12.10	39.70
13.80	13.60	13.68	9.31	106.8	350.4	13.10	42.98
14.80	14.60	14.67	9.70	102.6	336.5	14.10	46.26
15.80	15.60	15.67	8.61	115.6	379.2	15.10	49.54
16.80	16.60	16.66	12.20	81.6	267.8	16.10	52.82
17.80	17.60	17.66	4.80	207.6	681.0	17.10	56.10
18.80	18.60	18.66	2.59	384.4	1261.3	18.10	59.38
20.80	20.60	20.65					
21.80	21.60	21.65	2.54	392.8	1288.6	21.10	69.23
22.80	22.60	22.65	3.18	314.2	1030.7	22.10	72.51
23.80	23.60	23.64	3.04	328.4	1077.3	23.10	75.79
24.80	24.60	24.64	2.93	340.3	1116.6	24.10	79.07
25.80	25.60	25.64	2.81	355.4	1165.9	25.10	82.35
26.80	26.60	26.64	2.57	388.1	1273.4	26.10	85.63
27.80	27.60	27.64	2.93	340.5	1117.0	27.10	88.91
28.80	28.60	28.64	2.95	338.2	1109.7	28.10	92.19
29.80	29.60	29.64	3.36	297.6	976.2	29.10	95.47
30.80	30.60	30.63	2.57	389.3	1277.2	30.10	98.75


Job No: 10-952
Client: PB
Project Title: Midtown Tunnel
Operator: RK-AS-TS
Hole: 10CP-02
Site: Midtown Tunnel
Date: 07:20:10 12:21
Oversite: 215:T1500F15U500
TIME (ms)
0
25
50
75
100
125
150
175
200
225
250
DEPTH (ft)
0
10
20
30
40
50
60
70
80
90
100

CONETEC

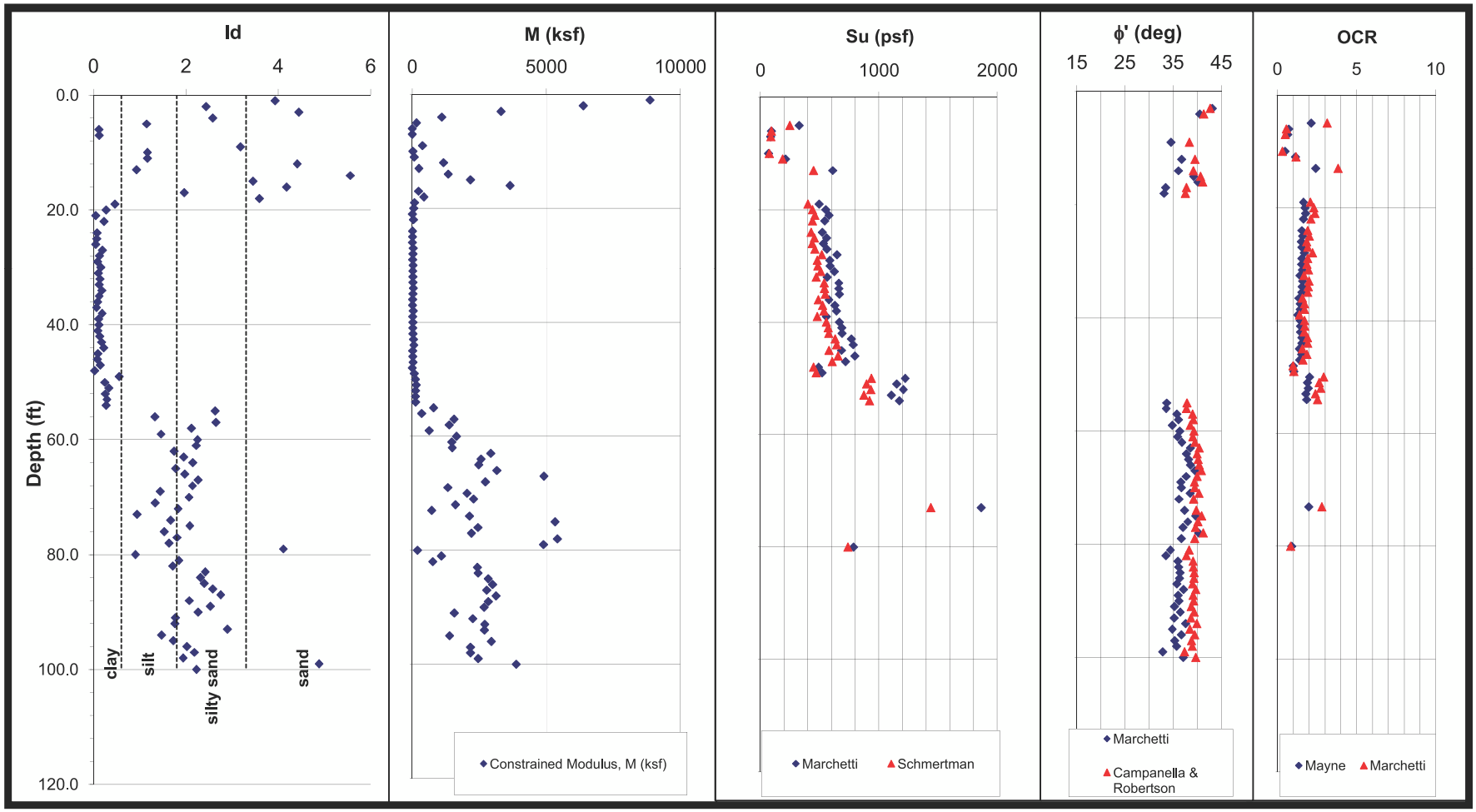
DILATOMETER TEST RESULTS

Test ID: DMT-01
Site: Midtown Tunnel
Location: Portsmouth, VA.
Project No.: 10-952



DILATOMETER TEST RESULTS

Test ID: DMT-01
Site: Midtown Tunnel
Location: Portsmouth, VA.
Project No.: 10-952



Job No: 10-952
Job Name: Midtown Tunnel
Job Location: Portsmouth, VA.
Date: 7/26/10
Sounding No: DMT-01
Ground Water Depth (ft): 6

ΔA = 0.2 bar
ΔB = 1 bar
Zm= 0 bar

[1] Depth Below Existing Ground Surface
[2] Mayne, 1995
[3] Marchetti,1980
[4] Marchetti, 1997
[5] Campanella and Robertson, 1991
[6] Marchetti,1980
[7] Schmertman, 1981

CONETEC

Depth[1]	A	B	C	po	p1	p2	u_o	σ_{vo}	σ_{vo}'			E_D				ϕ'[4]	ϕ'[5]		E_D	s_u[6]	s_u[7]	M
(ft)	(bar)	(bar)	(bar)	(bar)	(bar)	(bar)	(psf)	(psf)	(psf)	Id	K_D	(bar)	K_o	OCR[2]	OCR[3]	(deg)	(deg)	R_M	(ksf)	(psf)	(psf)	(ksf)
1.0	7.6	33.4	0	6.6	32.4		0	129	129	3.93	106.7	896	6.8			49.0	46.3	4.74	1872			8875
2.0	9.15	29.8	0	8.4	28.8		0	257	257	2.44	68.0	709	5.4			47.7	45.3	4.31	1480			6386
3.0	3.85	19.2	0	3.3	18.2		0	378	378	4.45	18.5	516	2.7			43.1	42.6	3.08	1077			3316
4.0	2.45	9.45	0	2.4	8.45		0	492	492	2.58	10.0	211	1.8			40.5	41.3	2.50	441			1104
5.0	1.05	3.55	0	1.2	2.55		0	594	594	1.15	4.2	47	1.0	2.1	3.1			1.63	99	327	247	162
6.0	0.25	1.5	0	0.4	0.5		0	676	676	0.12	1.4	2	0.4	0.7	0.6			0.85	4	94	93	3
7.0	0.25	1.5	0	0.4	0.5		62	759	696	0.13	1.3	2	0.3	0.6	0.5			0.85	4	85	87	3
9.0	1.2	5.85	0	1.2	4.85		187	972	785	3.18	3.0	126	0.8			34.5	38.3	1.46	263			384
10.0	0.3	1.9	0	0.5	0.9		250	1063	813	1.17	0.9	15	0.2	0.5	0.3			0.85	30	68	75	26
11.0	0.9	3.1	0	1.1	2.1		312	1162	850	1.17	2.2	36	0.6	1.1	1.2			1.01	76	212	188	77
12.0	2.4	12	0	2.2	11		374	1277	903	4.41	4.6	306	1.1			36.8	39.5	1.83	639			1170
13.0	2.25	5.35	0	2.4	4.35		437	1384	947	0.93	4.7	69	1.1	2.4	3.8			1.75	145	611	448	253
14.0	2.5	14	0	2.2	13		499	1500	1001	5.56	4.1	375	1.0			36.1	39.2	1.72	784			1346
15.0	4.55	18.4	0	4.1	17.4		562	1621	1059	3.45	7.6	461	1.5			39.2	40.7	2.26	963			2176
16.0	6.05	27	0	5.3	26		624	1746	1122	4.18	9.2	720	1.7			40.1	41.1	2.43	1503			3654
17.0	1.65	5.45	0	1.7	4.45		686	1853	1166	1.96	2.5	95	0.7			33.5	37.7	1.20	198			237
18.0	1.75	7.6	0	1.7	6.6		749	1962	1213	3.59	2.3	169	0.6			33.1	37.5	1.24	354			438
19.0	2.15	4.2	0.2	2.3	3.2	0.40	811	2064	1253	0.47	3.2	31	0.8	1.6	2.1			1.33	65	496	401	86
20.0	2.35	4.1	1.2	2.5	3.1	1.40	874	2165	1291	0.27	3.4	20	0.9	1.7	2.3			1.40	42	552	439	58
21.0	2.45	3.75	1.2	2.6	2.75	1.40	936	2257	1321	0.05	3.5	4	0.9	1.8	2.4			1.42	8	579	459	11
22.0	2.4	4.05	1.2	2.6	3.05	1.40	998	2357	1358	0.23	3.2	16	0.8	1.6	2.1			1.34	34	544	438	46
24.0	2.4	3.75	1.35	2.6	2.75	1.55	1123	2545	1422	0.08	3.0	5	0.8	1.5	1.9			1.27	11	523	429	15
25.0	2.55	3.9	1.4	2.7	2.9	1.60	1186	2639	1454	0.07	3.1	5	0.8	1.6	2.0			1.31	11	559	454	15
26.0	2.5	3.8	1.4	2.7	2.8	1.60	1248	2732	1484	0.05	3.0	4	0.8	1.5	1.8			1.25	8	531	438	10
27.0	2.65	4.25	1.35	2.8	3.25	1.55	1310	2831	1520	0.19	3.0	15	0.8	1.5	1.9			1.27	30	561	460	39
28.0	2.95	4.45	1.45	3.1	3.45	1.65	1373	2929	1556	0.13	3.3	11	0.9	1.7	2.2			1.37	23	646	517	31
29.0	2.8	4.2	1.45	3.0	3.2	1.65	1435	3025	1590	0.09	3.0	7	0.8	1.5	1.9			1.27	15	587	481	19
30.0	2.85	4.4	1.35	3.0	3.4	1.55	1498	3124	1626	0.16	3.0	13	0.8	1.5	1.9			1.26	27	587	484	33
31.0	3	4.45	1.45	3.2	3.45	1.65	1560	3221	1661	0.11	3.1	9	0.8	1.6	2.0			1.29	19	624	510	25
32.0	2.85	4.35		3.0	3.35		1622	3319	1696	0.14	2.8	11	0.7	1.4	1.7			1.19	23	563	472	27
33.0	3.2	4.7	1.7	3.4	3.7	1.90	1685	3417	1732	0.12	3.1	11	0.8	1.6	2.0			1.30	23	661	538	30
34.0	3.25	4.9	1.7	3.4	3.9	1.90	1747	3518	1771	0.18	3.1	16	0.8	1.6	1.9			1.29	34	662	541	44
35.0	3.3	4.8	1.9	3.5	3.8	2.10	1810	3616	1807	0.12	3.0	11	0.8	1.5	1.9			1.28	23	667	547	29
36.0	3.05	4.45	1.85	3.2	3.45	2.05	1872	3712	1840	0.09	2.7	7	0.7	1.4	1.6			1.14	15	578	489	17
37.0	3.25	4.6	1.85	3.4	3.6	2.05	1934	3807	1873	0.06	2.8	5	0.7	1.4	1.7			1.20	11	629	526	14
38.0	3.35	5	1.8	3.5	4	2.00	1997	3908	1911	0.18	2.8	16	0.7	1.4	1.7			1.20	34	643	537	41
39.0	3.1	4.55	1.55	3.3	3.55	1.75	2059	4005	1946	0.11	2.5	9	0.7	1.3	1.4			1.07	19	557	481	20
40.0	3.5	5	2.05	3.7	4	2.25	2122	4104	1982	0.12	2.8	11	0.7	1.4	1.7			1.20	23	668	557	27
41.0	3.6	5.05	2.2	3.8	4.05	2.40	2184	4201	2017	0.10	2.8	9	0.7	1.4	1.7			1.21	19	688	573	23
42.0	3.65	5.2	2.25	3.8	4.2	2.45	2246	4301	2055	0.13	2.8	13	0.7	1.4	1.7			1.20	27	689	576	32
43.0	3.95	5.65	2.3	4.1	4.65	2.50	2309	4403	2094	0.17	3.0	18	0.8	1.5	1.9			1.27	38	768	631	48
44.0	4.05	5.9	2.3	4.2	4.9	2.50	2371	4506	2135	0.22	3.0	24	0.8	1.5	1.9			1.27	49	785	644	63
45.0	3.75	5.2	2.2	3.9	4.2	2.40	2434	4604	2170	0.09	2.7	9	0.7	1.4	1.6			1.15	19	684	579	22
46.0	4.15	5.6	2.3	4.3	4.6	2.50	2496	4703	2207	0.08	3.0	9	0.8	1.5	1.9			1.26	19	797	656	24
47.0	3.95	5.55	2.2	4.1	4.55	2.40	2558	4803	2245	0.14	2.7	15	0.7	1.4	1.6			1.16	30	720	607	35
48.0	3.2	4.45	2.1	3.4	3.45	2.30	2621	4892	2272	0.02	2.0	2	0.5	1.0	1.0			0.85	4	490	448	3
49.0	3.4	5.8	1.75	3.5	4.8	1.95	2683	4997	2314	0.56	2.0	44	0.6	1.0	1.0			0.87	91	520	471	79
50.0	5.65	7.9	3.5	5.8	6.9	3.70	2746	5105	2359	0.25	4.0	38	1.0	2.0	2.9			1.55	80	1222	936	124
51.0	5.5	8.05	3.25	5.6	7.05	3.45	2808	5214	2406	0.33	3.7	49	0.9	1.9	2.6			1.49	103	1151	896	153
52.0	5.7	8	3.3	5.8	7	3.50	2870	5322	2452	0.26	3.8	40	0.9	1.9	2.7			1.51	84	1207	934	126
53.0	5.45	7.8	2.7	5.6	6.8	2.90	2933	5430	2497	0.29	3.5	42	0.9	1.8	2.4			1.42	88	1107	875	125
54.0	5.7	8.05	2.2	5.8	7.05	2.40	2995	5538	2543	0.27	3.6	42	0.9	1.8	2.5			1.46	88	1175	921	128
55.0	4.9	14.2	4.6	4.7	13.2	4.80	3058	5655	2598	2.63	2.6	295	0.7			33.7	37.9	1.30	616			799
56.0	4.7	9.95	3.7	4.7	8.95	3.90	3120	5769	2649	1.33	2.5	148	0.7			33.5	37.8	1.15	308			356
57.0	6.9	20.6	0	6.5	19.6		3182	5891	2709	2.65	3.8	455	1.0			35.8	39.0	1.64	951			1561

Job No: 10-952
Job Name: Midtown Tunnel
Job Location: Portsmouth, VA.
Date: 7/26/10
Sounding No: DMT-01
Ground Water Depth (ft): 6

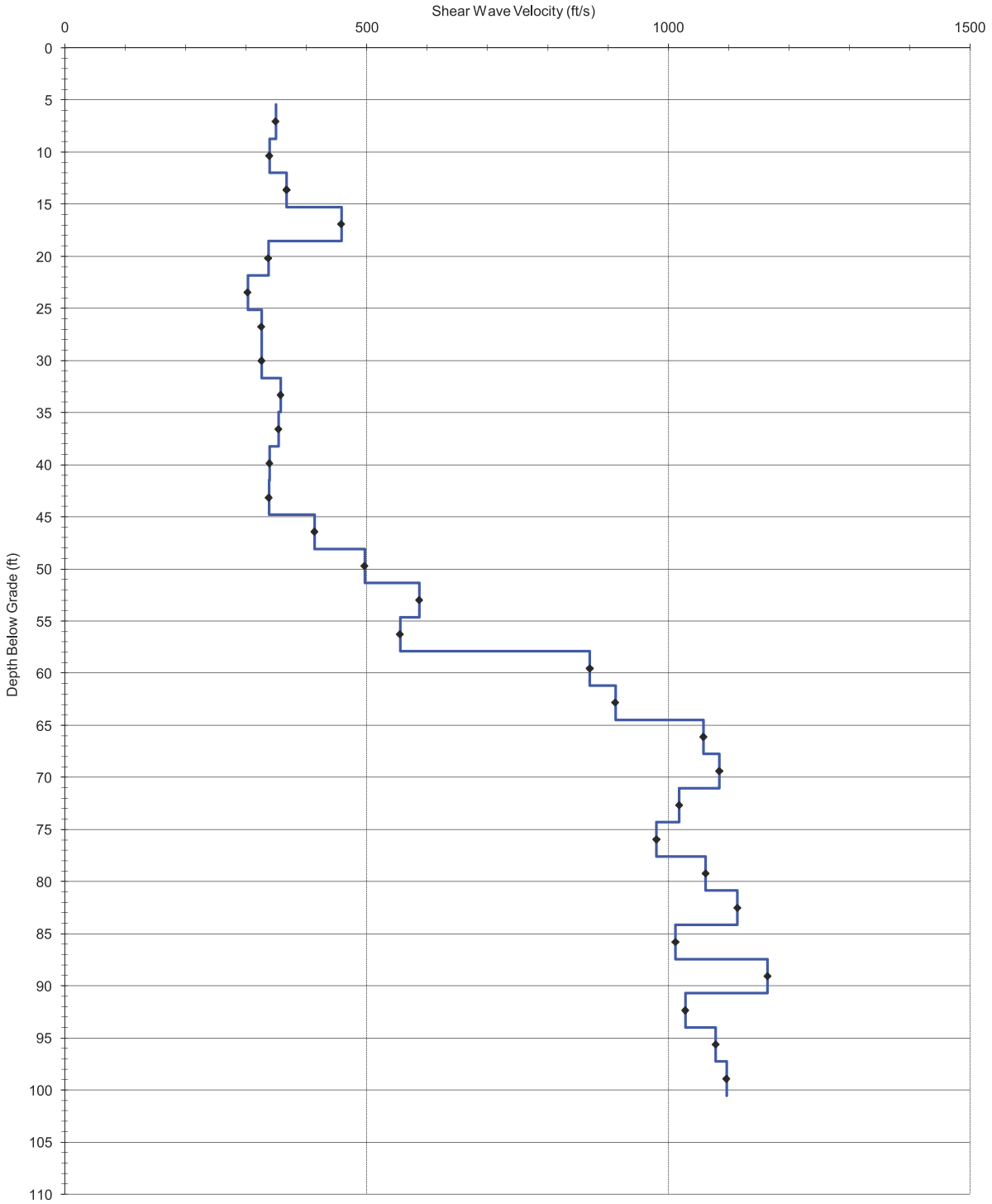
ΔA = 0.2 bar
ΔB = 1 bar
Zm= 0 bar

[1] Depth Below Existing Ground Surface
[2] Mayne, 1995
[3] Marchetti,1980
[4] Marchetti, 1997
[5] Campanella and Robertson, 1991
[6] Marchetti,1980
[7] Schmertman, 1981

Depth[1] (ft)	A (bar)	B (bar)	C (bar)	po (bar)	p1 (bar)	p2 (bar)	u_o (psf)	σ_{vo} (psf)	σ_{vo}' (psf)	Id	K_D	E_D (bar)	K_o	OCR[2]	OCR[3]	ϕ'[4] (deg)	ϕ'[5] (deg)	R_M	E_D (ksf)	s_u[6] (psf)	s_u[7] (psf)	M (ksf)
58.0	7.3	19.4	0.4	7.0	18.4	0.60	3245	6014	2769	2.12	4.1	397	1.0			36.1	39.2	1.67	829			1384
59.0	6	13.2	0.1	5.9	12.2	0.30	3307	6131	2824	1.46	3.2	219	0.8			34.8	38.5	1.39	457			636
60.0	7.95	21.8	0.55	7.5	20.8	0.75	3370	6255	2885	2.25	4.3	461	1.0			36.4	39.3	1.72	963			1656
61.0	7.6	20.6	0.6	7.2	19.6	0.80	3432	6378	2946	2.23	3.9	430	1.0			36.0	39.1	1.65	898			1478
62.0	8.7	21	0.8	8.3	20	1.00	3494	6502	3007	1.75	4.6	404	1.1			36.8	39.5	1.77	845			1494
63.0	12.2	31.6	1	11.5	30.6	1.20	3557	6631	3074	1.95	6.6	663	1.4			38.6	40.4	2.12	1385			2933
64.0	10.8	29.2	1	10.1	28.2	1.20	3619	6759	3140	2.15	5.6	627	1.3			37.7	40.0	1.96	1309			2569
65.0	11.8	29	0.6	11.2	28	0.80	3682	6887	3205	1.78	6.1	583	1.3			38.2	40.2	2.04	1218			2483
66.0	13	33.8	0.7	12.2	32.8	0.90	3744	7017	3273	1.97	6.7	714	1.4			38.6	40.4	2.12	1491			3160
67.0	16	45.2	1.15	14.8	44.2	1.35	3806	7151	3345	2.27	8.1	1020	1.6			39.5	40.9	2.31	2131			4916
68.0	11.6	31.2	0.7	10.9	30.2	0.90	3869	7280	3411	2.14	5.5	670	1.2			37.7	40.0	1.95	1400			2733
69.0	9.6	21	0.75	9.3	20	0.95	3931	7404	3473	1.45	4.5	372	1.1			36.6	39.4	1.72	776			1332
70.0	10.2	26.6	0.65	9.6	25.6	0.85	3994	7530	3537	2.07	4.6	554	1.1			36.7	39.5	1.77	1157			2048
71.0	13.8	29.4	0.8	13.3	28.4	1.00	4056	7659	3603	1.33	6.6	525	1.4			38.5	40.4	2.09	1096			2290
72.0	9.7	23.6	0.7	9.3	22.6	0.90	4118	7784	3666	1.83	4.2	463	1.0			36.2	39.2	1.67	966			1614
73.0	9	16.4	1	8.9	15.4	1.20	4181	7904	3724	0.95	3.9	226	1.0	2.0	2.8			1.55	472	1866	1439	730
74.0	12	28.2	1	11.5	27.2	1.20	4243	8032	3789	1.67	5.2	547	1.2			37.4	39.8	1.87	1141			2139
75.0	18.6	50		17.3	49		4306	8168	3862	2.08	8.2	1100	1.6			39.6	40.9	2.32	2298			5331
76.0	13.8	31.2	1	13.2	30.2	1.20	4368	8297	3929	1.53	5.9	590	1.3			38.0	40.1	1.99	1233			2455
77.0	12	29.2	0.5	11.4	28.2	0.70	4430	8425	3995	1.81	4.9	583	1.1			37.0	39.6	1.82	1218			2211
78.0	22	52.2	1.15	20.8	51.2	1.35	4493	8562	4069	1.64	9.5	1057	1.8			40.3	41.2	2.46	2207			5419
79.0	12.8	49.4	0.75	11.2	48.4	0.95	4555	8695	4140	4.11	4.6	1290	1.1			36.7	39.5	1.82	2694			4900
80.0	5.7	9.95	0.55	5.7	8.95	0.75	4618	8807	4190	0.91	1.8	111	0.5	0.9	0.8			0.85	232	787	739	197
81.0	8.6	20.4	0.6	8.3	19.4	0.80	4680	8930	4250	1.85	3.0	386	0.8			34.4	38.3	1.35	807			1091
82.0	7.7	17.4	0.25	7.5	16.4	0.45	4742	9051	4308	1.71	2.5	310	0.7			33.5	37.8	1.19	647			769
83.0	11.4	31.8	0.55	10.6	30.8	0.75	4805	9179	4374	2.42	4.0	700	1.0			36.0	39.1	1.67	1461			2433
84.0	11.8	32.2	0.95	11.0	31.2	1.15	4867	9308	4441	2.31	4.1	700	1.0			36.2	39.2	1.68	1461			2462
85.0	12.6	35.2	1.2	11.7	34.2	1.40	4930	9438	4509	2.40	4.3	780	1.0			36.5	39.3	1.74	1628			2837
86.0	12.6	36.6	0.95	11.7	35.6	1.15	4992	9569	4577	2.58	4.2	831	1.0			36.3	39.3	1.73	1735			3000
87.0	11.8	35.2	0.7	10.9	34.2	0.90	5054	9698	4644	2.75	3.8	809	0.9			35.8	39.0	1.65	1689			2781
88.0	14.6	38	0.8	13.7	37	1.00	5117	9830	4713	2.07	5.0	809	1.2			37.2	39.7	1.85	1689			3130
89.0	12.6	36	0.8	11.7	35	1.00	5179	9960	4781	2.53	4.0	809	1.0			36.1	39.1	1.68	1689			2841
90.0	13	35	0.65	12.2	34	0.85	5242	10090	4848	2.26	4.2	758	1.0			36.2	39.2	1.70	1583			2684
91.0	11.2	26.2	0.2	10.7	25.2	0.40	5304	10216	4912	1.77	3.5	503	0.9			35.3	38.7	1.50	1050			1572
92.0	13.6	32.2	0.65	12.9	31.2	0.85	5366	10345	4979	1.76	4.3	634	1.0			36.5	39.3	1.71	1324			2263
93.0	11.8	35.8	0.8	10.9	34.8	1.00	5429	10475	5046	2.90	3.4	831	0.9			35.2	38.7	1.56	1735			2708
94.0	16.6	36.4	0.85	15.9	35.4	1.05	5491	10606	5115	1.47	5.4	678	1.2			37.6	39.9	1.90	1415			2696
95.0	11	25.2	0.6	10.6	24.2	0.80	5554	10732	5179	1.73	3.2	474	0.8			34.8	38.5	1.41	989			1396
96.0	15	38.2	0.7	14.1	37.2	0.90	5616	10864	5248	2.02	4.5	802	1.1			36.7	39.5	1.76	1674			2954
97.0	12.4	32.2	0.35	11.7	31.2	0.55	5678	10993	5314	2.18	3.5	678	0.9			35.3	38.8	1.54	1415			2175
98.0	13.2	32.4	0.2	12.5	31.4	0.40	5741	11122	5381	1.94	3.8	656	0.9			35.7	39.0	1.59	1370			2176
99.0	9.75	38	0.45	8.6	37	0.65	5803	11250	5447	4.88	2.2	986	0.6			32.8	37.4	1.20	2058			2464
100.0	17	45.8	0.8	15.8	44.8	1.00	5866	11384	5518	2.23	4.9	1006	1.1			37.1	39.7	1.85	2100			3883

CONETEC

Shear Wave Velocity- 10CP-22
Midtown Tunnel
10-952
July 23 2010

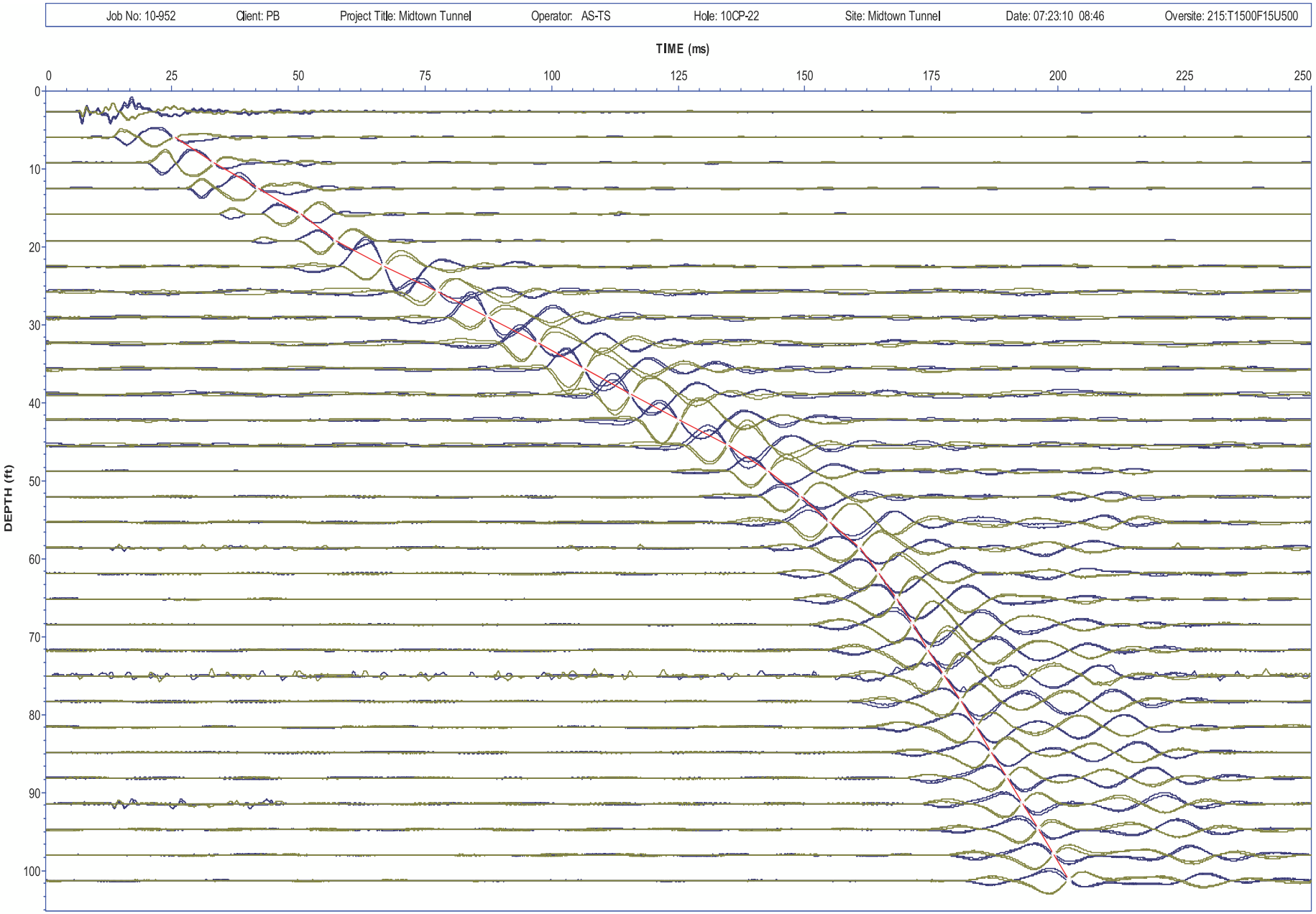


ConeTec Shear Wave Velocity Data Reduction Sheet

Hole: 10CP-22
Location: Midtown Tunnel
Cone: AD215
Date: 23-Jul-10
Source: Beam

Source Depth	0.00 m
Source Offset	1.45 m

Tip Depth (m)	Geophone Depth(m)	Travel Path (m)	Interval time (ms)	Velocity (m/s)	Velocity (ft/s)	Interval Depth (m)	Interval Depth (ft)
0.00							
1.85	1.65	2.20					
2.85	2.65	3.02	7.75	106.3	348.8	2.15	7.05
3.85	3.65	3.93	8.78	103.3	338.8	3.15	10.33
4.85	4.65	4.87	8.43	111.9	367.1	4.15	13.61
5.85	5.65	5.83	6.90	139.5	457.8	5.15	16.90
6.85	6.65	6.81	9.48	102.7	336.8	6.15	20.18
7.85	7.65	7.79	10.62	92.3	302.7	7.15	23.46
8.85	8.65	8.77	9.92	99.2	325.6	8.15	26.74
9.85	9.65	9.76	9.94	99.3	325.9	9.15	30.02
10.85	10.65	10.75	9.09	108.9	357.4	10.15	33.30
11.85	11.65	11.74	9.19	107.9	353.8	11.15	36.58
12.85	12.65	12.73	9.61	103.3	338.8	12.15	39.86
13.85	13.65	13.73	9.65	103.0	337.9	13.15	43.14
14.85	14.65	14.72	7.89	126.0	413.5	14.15	46.42
15.85	15.65	15.72	6.58	151.2	496.1	15.15	49.70
16.85	16.65	16.71	5.57	178.9	587.0	16.15	52.98
17.85	17.65	17.71	5.89	169.2	555.0	17.15	56.27
18.85	18.65	18.71	3.76	265.0	869.3	18.15	59.55
19.85	19.65	19.70	3.59	277.9	911.8	19.15	62.83
20.85	20.65	20.70	3.09	322.4	1057.7	20.15	66.11
21.85	21.65	21.70	3.02	330.4	1084.0	21.15	69.39
22.85	22.65	22.70	3.22	310.2	1017.8	22.15	72.67
23.85	23.65	23.69	3.34	298.7	980.1	23.15	75.95
24.85	24.65	24.69	3.08	323.6	1061.6	24.15	79.23
25.85	25.65	25.69	2.94	339.6	1114.0	25.15	82.51
26.85	26.65	26.69	3.24	308.3	1011.3	26.15	85.79
27.85	27.65	27.69	2.81	354.8	1163.9	27.15	89.07
28.85	28.65	28.69	3.19	313.3	1027.8	28.15	92.35
29.85	29.65	29.69	3.04	328.6	1078.0	29.15	95.64
30.85	30.65	30.68	2.99	334.1	1096.0	30.15	98.92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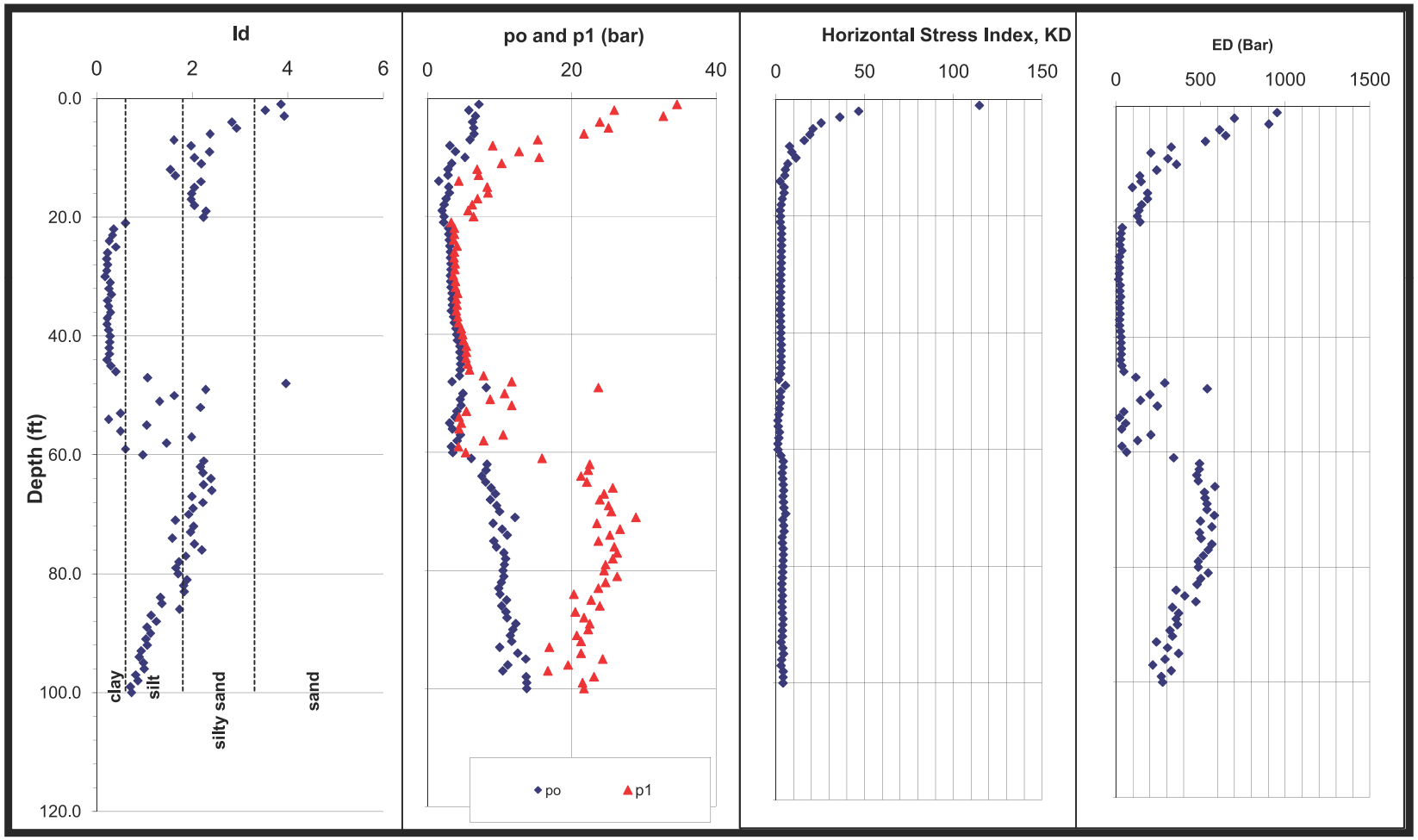
Client: PB
Project Title: Midtown Tunnel
Operator: AS-TS
Hole: 10CP-22
Site: Midtown Tunnel
Date: 07:23:10 08:46
Oversite: 215:T1500F15U500
TIME (ms)
0
25
50
75
100
125
150
175
200
225
250
DEPTH (ft)
0
10
20
30
40
50
60
70
80
90
100

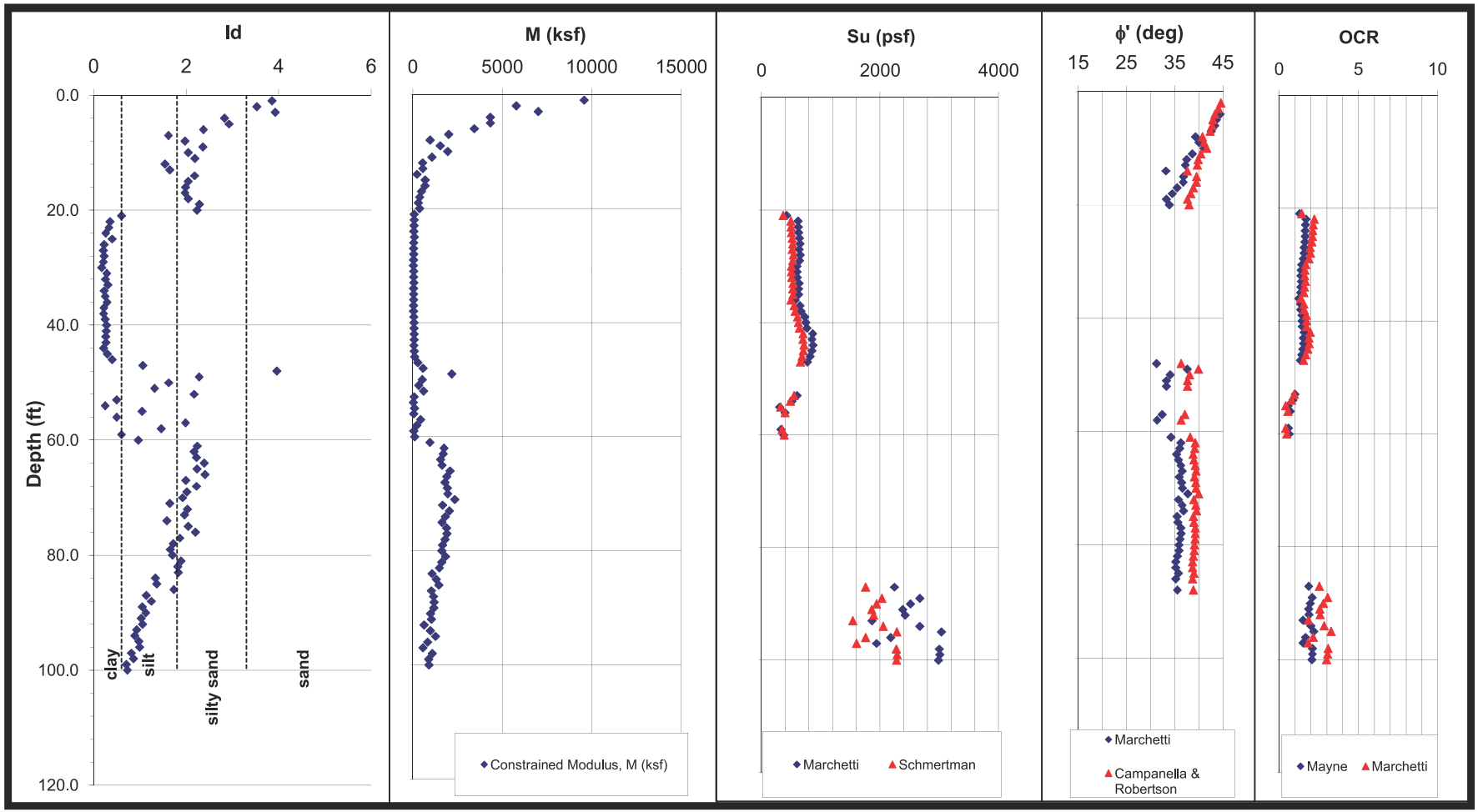
DILATOMETER TEST RESULTS

Test ID: DMT-02
Site: Midtown Tunnel
Location: Portsmouth, VA.
Project No.: 10-952



DILATOMETER TEST RESULTS

Test ID: DMT-02
Site: Midtown Tunnel
Location: Portsmouth, VA.
Project No.: 10-952



Job No: 10-952
Job Name: Midtown Tunnel
Job Location: Portsmouth, VA.
Date: 7/27/10
Sounding No: DMT-02
Ground Water Depth (ft): 5

ΔA = 0.125 bar
ΔB = 0.525 bar
Zm= 0 bar

[1] Depth Below Existing Ground Surface
[2] Mayne, 1995
[3] Marchetti,1980
[4] Marchetti, 1997
[5] Campanella and Robertson, 1991
[6] Marchetti,1980
[7] Schmertman, 1981

CONETEC

Depth[1]	A	B	C	po	p1	p2	u_o	σ_{vo}	σ_{vo}'			E_D				ϕ'[4]	ϕ'[5]		E_D	s_u[6]	s_u[7]	M
(ft)	(bar)	(bar)	(bar)	(bar)	(bar)	(bar)	(psf)	(psf)	(psf)	Id	K_D	(bar)	K_o	OCR[2]	OCR[3]	(deg)	(deg)	R_M	(ksf)	(psf)	(psf)	(ksf)
1.0	8.3	35.1	0	7.1	34.575		0	130	130	3.86	114.7	953	7.1			49.2	46.4	4.81	1990			9572
2.0	6.55	26.4	0	5.7	25.875		0	256	256	3.53	46.7	700	4.4			46.5	44.6	3.96	1461			5784
3.0	7.75	33.2	0	6.6	32.675		0	384	384	3.92	36.0	904	3.9			45.6	44.0	3.71	1887			7009
4.0	6.95	24.4	0	6.2	23.875		0	510	510	2.83	25.5	612	3.2			44.4	43.3	3.39	1278			4330
5.0	7.15	25.6	0	6.4	25.075		0	637	637	2.93	20.9	649	2.9			43.6	42.9	3.20	1355			4334
6.0	7.05	22.2	0	6.5	21.675		62	762	699	2.37	19.2	528	2.7			43.3	42.7	3.12	1103			3438
7.0	6.2	15.8	0	5.9	15.275		125	883	759	1.62	16.0	326	2.4			42.5	42.3	2.95	681			2006
8.0	3.25	9.55	0	3.1	9.025		187	998	811	1.98	7.7	206	1.6			39.3	40.7	2.26	430			971
9.0	4.15	13.2	0	3.9	12.675		250	1117	867	2.36	9.0	306	1.7			40.0	41.1	2.40	639			1536
10.0	5.55	16	0	5.2	15.475		312	1238	926	2.04	11.4	357	2.0			41.1	41.6	2.62	746			1954
11.0	3.55	10.8	0	3.3	10.275		374	1354	980	2.19	6.7	240	1.4			38.7	40.4	2.14	502			1074
12.0	2.9	7.4	0	2.8	6.875		437	1466	1029	1.54	5.3	140	1.2			37.5	39.9	1.89	293			554
13.0	2.9	7.6	0	2.8	7.075		499	1578	1079	1.65	5.0	148	1.2			37.2	39.7	1.84	308			566
14.0	1.55	4.85	0	1.5	4.325		562	1684	1123	2.18	2.4	97	0.6			33.2	37.6	1.17	202			236
15.0	3.05	8.8	0	2.9	8.275		624	1798	1174	2.04	4.7	186	1.1			36.8	39.5	1.79	388			695
16.0	3.15	8.9	0	3.0	8.375		686	1912	1225	1.99	4.6	186	1.1			36.7	39.5	1.77	388			688
17.0	2.65	7.45	0	2.6	6.925		749	2023	1274	1.97	3.6	151	0.9			35.5	38.9	1.55	316			489
18.0	2.35	6.7	0	2.3	6.175		811	2133	1322	2.04	3.0	135	0.8			34.5	38.3	1.38	282			389
19.0	2.05	6.15	0	2.0	5.625		874	2242	1368	2.29	2.4	126	0.7			33.3	37.6	1.20	263			315
20.0	2.35	6.9	0	2.3	6.375		936	2352	1416	2.24	2.7	142	0.7			33.9	38.0	1.30	297			385
21.0	2.15	3.8	0.2	2.2	3.275	0.33	998	2454	1456	0.60	2.5	36	0.7	1.3	1.4			1.08	76	425	365	82
22.0	2.8	4.25	1.1	2.9	3.725	1.23	1061	2557	1497	0.35	3.3	29	0.9	1.7	2.2			1.37	61	620	496	83
23.0	2.85	4.25	1.2	2.9	3.725	1.33	1123	2660	1537	0.33	3.3	27	0.8	1.7	2.1			1.35	57	623	501	77
24.0	2.9	4.15	1.3	3.0	3.625	1.43	1186	2762	1576	0.26	3.2	22	0.8	1.6	2.1			1.34	46	628	507	61
25.0	3	4.6	1.55	3.1	4.075	1.68	1248	2866	1618	0.40	3.2	35	0.8	1.6	2.1			1.33	72	641	518	96
26.0	3.05	4.25	1.4	3.1	3.725	1.53	1310	2967	1657	0.23	3.2	20	0.8	1.6	2.1			1.32	42	650	526	55
27.0	3.05	4.2	1.5	3.2	3.675	1.63	1373	3068	1695	0.21	3.1	18	0.8	1.6	2.0			1.29	38	637	521	49
28.0	3.15	4.35	1.15	3.2	3.825	1.28	1435	3170	1734	0.23	3.1	20	0.8	1.6	2.0			1.29	42	655	535	54
29.0	3.15	4.3	1.4	3.3	3.775	1.53	1498	3270	1773	0.21	3.0	18	0.8	1.5	1.9			1.26	38	643	529	48
30.0	3.05	4.1	1.5	3.2	3.575	1.63	1560	3370	1810	0.17	2.8	15	0.7	1.4	1.7			1.19	30	601	503	36
31.0	3.1	4.4	1.5	3.2	3.875	1.63	1622	3472	1850	0.28	2.7	24	0.7	1.4	1.6			1.17	49	600	505	58
32.0	3.15	4.4	0.8	3.2	3.875	0.93	1685	3574	1889	0.26	2.7	22	0.7	1.4	1.6			1.16	46	604	509	53
33.0	3.3	4.7	1.5	3.4	4.175	1.63	1747	3677	1930	0.31	2.8	27	0.7	1.4	1.7			1.18	57	635	533	67
34.0	3.3	4.5	1.5	3.4	3.975	1.63	1810	3778	1969	0.23	2.7	20	0.7	1.4	1.6			1.15	42	626	529	48
35.0	3.35	4.6	1.6	3.4	4.075	1.73	1872	3880	2008	0.25	2.7	22	0.7	1.3	1.6			1.14	46	628	532	52
36.0	3.2	4.5	1.9	3.3	3.975	2.03	1934	3982	2048	0.29	2.4	24	0.7	1.2	1.3			1.04	49	570	494	52
37.0	3.5	4.7	2.2	3.6	4.175	2.33	1997	4084	2087	0.22	2.6	20	0.7	1.3	1.5			1.14	42	651	552	48
38.0	3.6	4.8	2	3.7	4.275	2.13	2059	4185	2126	0.21	2.7	20	0.7	1.4	1.6			1.14	42	669	566	48
39.0	3.85	5.2	2.1	3.9	4.675	2.23	2122	4289	2167	0.25	2.8	26	0.7	1.4	1.7			1.20	53	732	611	64
40.0	3.95	5.4	2.15	4.0	4.875	2.28	2184	4393	2209	0.28	2.8	29	0.7	1.4	1.7			1.20	61	749	624	73
41.0	4.05	5.5	2.5	4.1	4.975	2.63	2246	4497	2251	0.27	2.8	29	0.7	1.4	1.7			1.21	61	767	639	74
42.0	4.4	5.9	2.9	4.5	5.375	3.03	2309	4603	2294	0.26	3.1	31	0.8	1.6	2.0			1.29	65	864	705	84
43.0	4.4	5.9	2.9	4.5	5.375	3.03	2371	4708	2336	0.27	3.0	31	0.8	1.5	1.9			1.26	65	850	699	82
44.0	4.5	5.85	2.6	4.6	5.325	2.73	2434	4812	2378	0.21	3.0	26	0.8	1.5	1.9			1.27	53	871	715	68
45.0	4.5	6.1	2.95	4.6	5.575	3.08	2496	4918	2422	0.29	2.9	35	0.8	1.5	1.8			1.24	72	854	706	89
46.0	4.45	6.35	1.9	4.5	5.825	2.03	2558	5025	2466	0.40	2.8	46	0.7	1.4	1.7			1.19	95	820	687	113
47.0	4.45	8.3	0.7	4.4	7.775	0.83	2621	5137	2516	1.06	2.6	117	0.7	1.3	1.5			1.17	244	777	660	285
48.0	3.65	12.2	0.5	3.4	11.675	0.63	2683	5251	2568	3.96	1.7	288	0.5			31.3	36.3	0.96	601			579
49.0	8.75	24.2	0.5	8.1	23.675	0.63	2746	5377	2631	2.28	5.4	539	1.2			37.6	39.9	1.94	1126			2183
50.0	5.05	11.2	0.15	4.9	10.675	0.28	2808	5493	2685	1.62	2.8	200	0.7			34.0	38.1	1.27	419			531
51.0	4.6	9.2	0.5	4.5	8.675	0.63	2870	5606	2736	1.32	2.4	144	0.6			33.3	37.6	1.11	301			333
52.0	4.85	12.2	0.4	4.6	11.675	0.53	2933	5722	2790	2.17	2.4	244	0.7			33.3	37.6	1.19	510			608
53.0	4	5.9	1.3	4.1	5.375	1.43	2995	5828	2833	0.50	1.9	46	0.5	1.0	1.0			0.85	95	599	549	81
54.0	3.7	4.9	1.55	3.8	4.375	1.68	3058	5929	2872	0.25	1.7	20	0.5	0.9	0.8			0.85	42	515	487	36
55.0	3	5.2	0.7	3.0	4.675	0.83	3120	6033	2913	1.05	1.1	56	0.3	0.6	0.4			0.85	118	308	324	100
56.0	3.35	4.9	1.15	3.4	4.375	1.28	3182	6136	2954	0.50	1.3	33	0.4	0.7	0.5			0.85	68	397	398	58

Job No: 10-952
Job Name: Midtown Tunnel
Job Location: Portsmouth, VA.
Date: 7/27/10
Sounding No: DMT-02
Ground Water Depth (ft): 5

ΔA = 0.125 bar
ΔB = 0.525 bar
Zm= 0 bar

[1] Depth Below Existing Ground Surface
[2] Mayne, 1995
[3] Marchetti,1980
[4] Marchetti, 1997
[5] Campanella and Robertson, 1991
[6] Marchetti,1980
[7] Schmertman, 1981

CONETEC

Depth[1] (ft)	A (bar)	B (bar)	C (bar)	po (bar)	p1 (bar)	p2 (bar)	u_o (psf)	σ_{vo} (psf)	σ_{vo}' (psf)	Id	K_D	E_D (bar)	K_o	OCR[2]	OCR[3]	ϕ'[4] (deg)	ϕ'[5] (deg)	R_M	E_D (ksf)	s_u[6] (psf)	s_u[7] (psf)	M (ksf)
57.0	4.7	11	1	4.5	10.475	1.13	3245	6251	3006	1.98	2.1	206	0.6			32.4	37.1	1.03	430			443
58.0	4.15	8.3	0.85	4.1	7.775	0.98	3307	6362	3055	1.46	1.7	128	0.5			31.3	36.3	0.85	266			226
59.0	3.2	4.8	0.8	3.3	4.275	0.93	3370	6464	3094	0.60	1.1	35	0.3	0.6	0.4			0.85	72	331	348	61
60.0	3.45	5.8	0.8	3.5	5.275	0.93	3432	6570	3138	0.97	1.2	62	0.3	0.6	0.5			0.85	129	376	386	110
61.0	6.4	16.4	0.5	6.1	15.875	0.63	3494	6690	3195	2.24	2.9	341	0.8			34.2	38.2	1.35	711			962
62.0	8.8	23	0.5	8.2	22.475	0.63	3557	6815	3258	2.17	4.2	494	1.0			36.3	39.3	1.70	1031			1752
63.0	8.65	22.8	0.2	8.1	22.275	0.33	3619	6939	3320	2.23	4.0	492	1.0			36.0	39.1	1.66	1027			1704
64.0	8.05	21.8	0.25	7.5	21.275	0.38	3682	7063	3382	2.39	3.6	477	0.9			35.4	38.8	1.56	997			1556
65.0	8.6	22.6	0.2	8.1	22.075	0.33	3744	7188	3444	2.24	3.8	486	0.9			35.8	39.0	1.61	1016			1637
66.0	9.5	26.2	1.1	8.8	25.675	1.23	3806	7314	3508	2.41	4.2	585	1.0			36.2	39.2	1.71	1221			2084
67.0	10	25	0.5	9.4	24.475	0.63	3869	7440	3571	1.99	4.4	523	1.1			36.5	39.4	1.74	1092			1897
68.0	9.3	24.4	0.6	8.7	23.875	0.73	3931	7565	3634	2.22	3.9	526	1.0			35.9	39.1	1.64	1100			1802
69.0	10.2	25.6	0.7	9.6	25.075	0.83	3994	7692	3698	2.02	4.3	537	1.0			36.4	39.3	1.72	1122			1931
70.0	10.6	26	0.5	10.0	25.475	0.63	4056	7819	3763	1.92	4.5	537	1.1			36.6	39.4	1.74	1122			1957
71.0	12.8	29.4	0.55	12.1	28.875	0.68	4118	7947	3829	1.65	5.5	581	1.2			37.7	40.0	1.93	1214			2349
72.0	9.65	24	0.85	9.1	23.475	0.98	4181	8073	3892	2.03	3.8	499	0.9			35.8	39.0	1.60	1043			1667
73.0	11	27.2	0.65	10.3	26.675	0.78	4243	8200	3957	1.96	4.4	567	1.1			36.5	39.4	1.73	1183			2046
74.0	11.6	25.8	0.7	11.0	25.275	0.83	4306	8327	4021	1.58	4.7	494	1.1			36.8	39.5	1.77	1031			1823
75.0	9.75	24.2	1.1	9.2	23.675	1.23	4368	8452	4084	2.04	3.6	503	0.9			35.5	38.9	1.56	1050			1634
76.0	10.2	26.4	1.05	9.5	25.875	1.18	4430	8579	4148	2.20	3.7	567	0.9			35.7	38.9	1.59	1183			1886
77.0	11.2	26.8	1.3	10.6	26.275	1.43	4493	8706	4213	1.86	4.2	545	1.0			36.3	39.2	1.68	1138			1908
78.0	11.4	26.2	1.4	10.8	25.675	1.53	4555	8832	4277	1.72	4.2	516	1.0			36.3	39.3	1.68	1077			1807
79.0	11.2	25.2	1.3	10.7	24.675	1.43	4618	8959	4341	1.66	4.1	486	1.0			36.1	39.2	1.64	1016			1665
80.0	11	25	0.8	10.5	24.475	0.93	4680	9085	4405	1.71	3.9	486	1.0			35.9	39.1	1.60	1016			1627
81.0	11.2	26.8	1.3	10.6	26.275	1.43	4742	9212	4469	1.89	3.9	545	1.0			35.9	39.0	1.61	1138			1831
82.0	10.8	25.2	1.2	10.2	24.675	1.33	4805	9338	4533	1.82	3.7	501	0.9			35.6	38.9	1.55	1046			1621
83.0	10.4	24.2	1.3	9.9	23.675	1.43	4867	9464	4596	1.83	3.4	479	0.9			35.2	38.7	1.49	1001			1489
84.0	10.4	20.8	1	10.0	20.275	1.13	4930	9587	4658	1.33	3.4	355	0.9			35.2	38.7	1.46	742			1082
85.0	11.4	23.2	1.4	11.0	22.675	1.53	4992	9713	4721	1.36	3.8	406	0.9			35.8	39.0	1.56	848			1320
86.0	10.8	24.4	1.3	10.3	23.875	1.43	5054	9838	4784	1.73	3.4	472	0.9			35.2	38.7	1.48	985			1461
87.0	11.2	21	1.1	10.9	20.475	1.23	5117	9962	4845	1.14	3.6	333	0.9	1.8	2.5			1.50	696	2244	1758	1042
88.0	11.4	22.2	1.45	11.0	21.675	1.58	5179	10087	4908	1.25	3.6	370	0.9			35.5	38.9	1.51	772			1162
89.0	12.6	23	1.6	12.2	22.475	1.73	5242	10212	4971	1.05	4.1	355	1.0	2.1	3.0			1.61	742	2672	2032	1194
90.0	12.2	22.8	1.1	11.8	22.275	1.23	5304	10337	5033	1.12	3.9	363	1.0	2.0	2.8			1.56	757	2514	1940	1178
91.0	11.8	21.2	1.25	11.5	20.675	1.38	5366	10461	5095	1.03	3.7	319	0.9	1.9	2.6			1.50	666	2382	1863	997
92.0	12	21.8	1.7	11.7	21.275	1.83	5429	10586	5157	1.06	3.7	333	0.9	1.9	2.6			1.50	696	2425	1894	1047
93.0	10.2	17.4	1.2	10.0	16.875	1.33	5491	10707	5216	0.93	3.0	239	0.8	1.5	1.8			1.28	498	1866	1539	636
94.0	12.8	21.8	1.7	12.5	21.275	1.83	5554	10831	5278	0.89	3.9	304	1.0	2.0	2.8			1.55	635	2673	2057	986
95.0	14	24.8	1.5	13.6	24.275	1.63	5616	10957	5341	0.98	4.3	370	1.0	2.2	3.3			1.65	772	3035	2282	1274
96.0	11.4	20	1.6	11.1	19.475	1.73	5678	11081	5402	0.99	3.3	290	0.8	1.7	2.1			1.38	605	2181	1756	833
97.0	10.6	17.2	2.2	10.4	16.675	2.33	5741	11201	5461	0.81	2.9	217	0.8	1.5	1.8			1.26	453	1942	1604	571
98.0	14	23.6	1.8	13.7	23.075	1.93	5803	11327	5524	0.86	4.1	326	1.0	2.1	3.1			1.61	681	3000	2276	1094
99.0	14	22	2.95	13.8	21.475	3.08	5866	11451	5585	0.70	4.1	268	1.0	2.1	3.1			1.59	559	3009	2287	890
100.0	14	22.2	2.1	13.7	21.675	2.23	5928	11575	5647	0.73	4.0	275	1.0	2.1	3.0			1.58	575	2987	2278	906

1.1.4 Geotechnical Conditions - New Midtown Tunnel - Laboratory Testing

Boring	Sample	Depth (ft)	Depth Interval (ft from Deck)		Depth Interval (ft)		Elevation (ft MLLW)	Geologic Unit	Material Description	Unit Weight (pcf)	MC %	Fines %	Atterberg Limits		Organic Content %	Specific Gravity
													LL	PI		
10BH-001	S-1	0.5			0.5	2	4.8	Fill	CL		24					
10BH-001	S-2A	2			2	3	3.3	Fill	SM		33					
10BH-001	S-2B	3			3	4	2.3	Fill	SM		26.5					
10BH-001	S-3	4			4	6	1.3	Fill	GM		73.9	33.3				
10BH-001	S-4	6			6	8	-0.7	Coarse Alluvium	SM		26.6					
10BH-001	S-5	8			8	10	-2.7	Coarse Alluvium	SM		24.8	11				
10BH-001	S-6	13			13	15	-7.7	Coarse Alluvium	SM		26.4		0	0		
10BH-001	S-7	18			18	20	-12.7	Fine Alluvium	OH		64.1		92	66	2.6	
10BH-001	P-1	20			20	22	-14.7	Fine Alluvium	OH							
10BH-001	S-8A	23			23	24	-17.7	Fine Alluvium	OH		59.9		85	51		
10BH-001	S-8B	24			24	25	-18.7	Tabb Formation	CL		20.2					
10BH-001	S-9	28			28	30	-22.7	Tabb Formation	CL		22.4	58.6	25	9		
10BH-001	S-10	33			33	35	-27.7	Tabb Formation	SM		16.8					
10BH-001	S-11	38			38	40	-32.7	Tabb Formation	SM		11.8					
10BH-001	S-12A	43			43	44	-37.7	Yorktown Formation	SM		31.1					
10BH-001	S-12B	44			44	45	-38.7	Yorktown Formation	SP		30.9					
10BH-001	S-13	48			48	50	-42.7	Yorktown Formation	SM		35.6	26.8	0	0		2.743
10BH-001	S-14	53			53	55	-47.7	Yorktown Formation	SM		35.2					
10BH-001	S-15	58			58	60	-52.7	Yorktown Formation	SM		34.9	29.4	28	3		
10BH-001	S-16	63			63	65	-57.7	Yorktown Formation	SM		34					
10BH-001	S-17	68			68	70	-62.7	Yorktown Formation	SC		23.9					
10BH-002	S-1	0.5			0.5	2	5.4	Fill	SC		6.6					
10BH-002	S-2	2			2	4	3.9	Fill	SC		6.9					
10BH-002	S-3	4			4	6	1.9	Fill	SC		15	28				
10BH-002	S-4A	6			6	7	-0.1	Fill	SC		20.8					
10BH-002	S-4B	7			7	8	-1.1	Fill	SC		17.4					
10BH-002	S-5	8			8	10	-2.1	Coarse Alluvium	SP		19.9					
10BH-002	S-6	13			13	15	-7.1	Coarse Alluvium	SP		20	8				
10BH-002	S-7	18			18	20	-12.1	Coarse Alluvium	SP							
10BH-002	S-8	23			23	25	-17.1	Fine Alluvium	OL		60.2				2.1	
10BH-002	P-1	25			25	27	-19.1	Fine Alluvium	OL		58.4					
10BH-002	S-9	28			28	30	-22.1	Fine Alluvium	CH		61.9		68	43		
10BH-002	S-10	33			33	35	-27.1	Fine Alluvium	CH		68.7				2.2	
10BH-002	S-11	38			38	40	-32.1	Fine Alluvium	CH		61.3					
10BH-002	P-2	40			40	42	-34.1	Fine Alluvium	CH		57.1					
10BH-002	S-12	43			43	45	-37.1	Fine Alluvium	CH		53.6		69	42		
10BH-002	S-13A	48			48	49	-42.1	Fine Alluvium	CH		52					
10BH-002	S-13B	49			49	50	-43.1	Fine Alluvium	PT		136.6					
10BH-002	P-3	50			50	52	-44.1	Fine Alluvium	OL	75.3	188.3	54.1	0	0	46.7	2.26
10BH-002	S-14A	53			53	54	-47.1	Fine Alluvium	OL		60.1					
10BH-002	S-14B	54			54	55	-48.1	Fine Alluvium	OL		242.9					
10BH-002	S-15	58			58	60	-52.1	Yorktown Formation	SC		29.8	24.5				
10BH-002	S-16A	63			63	64	-57.1	Yorktown Formation	SC		184.4					
10BH-002	S-16B	64			64	65	-58.1	Yorktown Formation	SC		28.1	31.9	35	14		
10BH-002	S-17	68			68	70	-62.1	Yorktown Formation	SC		27.3					
10BH-002	S-18	73			73	75	-67.1	Yorktown Formation	SM		27.9	21.3	22	1		
10BH-002	S-19	78			78	80	-72.1	Yorktown Formation	SC		27.6					
10BH-002	S-20	83			83	85	-77.1	Yorktown Formation	SM		29.1					
10BH-003	S-1	0.6			0.6	2	4	Fill	SP		6	16				
10BH-003	S-2	2			2	4	2.6	Fill	SM		18.1					
10BH-003	S-3	4			4	6	0.6	Fill	SM		17.2					
10BH-003	S-4	6			6	8	-1.4	Fill	GC		8.2					
10BH-003	S-5	8			8	10	-3.4	Fill	SC		19.1	8.5				
10BH-003	S-6	13			13	15	-8.4	Fill	SC		23.5	14.9	40	24		2.685
10BH-003	S-7	18			18	20	-13.4	Fine Alluvium	CH		53.9		56	34		
10BH-003	P-1	20			20	22	-15.4	Fine Alluvium	CH		66.1					
10BH-003	S-8	23			23	25	-18.4	Fine Alluvium	CH		64					
10BH-003	S-9	28			28	30	-23.4	Fine Alluvium	CH		54.6					
10BH-003	P-2	30			30	32	-25.4	Fine Alluvium	CH	101.2	61	98.6	80	53		2.71
10BH-003	S-10	33			33	35	-28.4	Fine Alluvium	CH		79.9					
10BH-003	S-11	38			38	40	-33.4	Fine Alluvium	CH		63.1		83	58		
10BH-003	P-3	40			40	42	-35.4	Fine Alluvium	CH		67.2					
10BH-003	S-12	43			43	45	-38.4	Fine Alluvium	CH		62.8		84	55		
10BH-003	S-13	48			48	50	-43.4	Fine Alluvium	CH		63.6					
10BH-003	P-4	50			50	52	-45.4	Fine Alluvium	CH	100.8	63.6	97.9	95	65	2.2	2.72
10BH-003	S-14A	53			53	54	-48.4	Fine Alluvium	CH		68.8		88	60		
10BH-003	S-14B	54			54	55	-49.4	Fine Alluvium	PT		83.3					
10BH-003	S-15	58			58	60	-53.4	Fine Alluvium	OH		66.3		84	56	3.6	
10BH-003	P-5	60			60	62	-55.4	Fine Alluvium	OH		102.4					
10BH-003	S-16	63			63	65	-58.4	Fine Alluvium	OH		85.5		130	75		
10BH-003	S-17	68			68	70	-63.4	Fine Alluvium	OH		69.7					
10BH-003	P-6	70			70	72	-65.4	Fine Alluvium	OH	96.1	69.5	97.5	103	64	5.5	2.65
10BH-003	S-18	73			73	75	-68.4	Tabb Formation	SM							
10BH-003	S-19	78			78	80	-73.4	Tabb Formation	SM		23.2	11.1				
10BH-003	S-20A	83			83	84	-78.4	Tabb Formation	SC		15.5					
10BH-003	S-20B	84			84	85	-79.4	Yorktown Formation	SM		38.5		33	9		
10BH-003	S-21	88			88	90	-83.4	Yorktown Formation	SM		32.3		28	5		
10BH-003	S-22	93			93	95	-88.4	Yorktown Formation	SM		31.8	17.9				
10BH-004	S-1	0.5			0.5	2	5.4	Fill	SM		9					
10BH-004	S-2	2			2	4	3.9	Fill	SM		8.5	19.7				
10BH-004	S-3A	4			4	5	1.9	Fill	SM		11.2					
10BH-004	S-3B	5			5	6	0.9	Fill	SM		13.4					
10BH-004	S-4	6			6	8	-0.1	Fine Alluvium	CL		28.7		40	23	1.5	
10BH-004	S-5	8			8	10	-2.1	Coarse Alluvium	SC		29.3					
10BH-004	P-1	10			10	11.5	-4.1	Coarse Alluvium	SC							
10BH-004	S-6	13			13	15	-7.1	Coarse Alluvium	SP		26.9	1.6				
10BH-004	S-7	18			18	20	-12.1	Coarse Alluvium	SC		24.5	11.3	0	0		2.67
10BH-004	S-8	23			23	25	-17.1	Fine Alluvium	CH		35.2					
10BH-004	P-2	25			25	27	-19.1	Fine Alluvium	CH		34.7					
10BH-004	S-9	28			28	30	-22.1	Fine Alluvium	CH		42.2					
10BH-004	P-3	30			30	32	-24.1	Fine Alluvium	CH							

Boring	Sample	Depth (ft)	Depth Interval (ft from Deck)		Depth Interval (ft)		Elevation (ft MLLW)	Geologic Unit	Material Description	Unit Weight (pcf)	MC %	Fines %	LL	PI	Organic Content %	Specific Gravity
10BH-004	S-10	33			33	35	-27.1	Fine Alluvium	CH		63.9		76	49		
10BH-004	P-4	35			35	37	-29.1	Fine Alluvium	CH	93.6	70.7	98.8	97	65		2.72
10BH-004	S-11	38			38	40	-32.1	Fine Alluvium	CH		75.3					
10BH-004	P-5	40			40	42	-34.1	Fine Alluvium	CH	92.5	79.7	98.4	99	66		2.73
10BH-004	S-12	43			43	45	-37.1	Fine Alluvium	CH		62.2		62	39		
10BH-004	P-6	45			45	47	-39.1	Fine Alluvium	CH	98.4	61.2	70.3	52	28		2.7
10BH-004	S-13	48			48	50	-42.1	Fine Alluvium	CH		42.6		58	38		
10BH-004	P-7	50			50	52	-44.1	Fine Alluvium	CH	108.2	47.5	60.3	67	45		2.69
10BH-004	S-14	53			53	55	-47.1	Fine Alluvium	CH							
10BH-004	S-15	58			58	60	-52.1	Fine Alluvium	CH		68.7					
10BH-004	P-8	60			60	62	-54.1	Fine Alluvium	OL		91.4					
10BH-004	S-16A	63			63	64	-57.1	Fine Alluvium	PT		187.9					
10BH-004	S-16B	64			64	65	-58.1	Fine Alluvium	CH		60					
10BH-004	S-17	68			68	70	-62.1	Fine Alluvium	CH		57.8		84	57		
10BH-004	S-18	73			73	75	-67.1	Fine Alluvium	CH		64.9				7.2	
10BH-004	S-19	78			78	80	-72.1	Tabb Formation	SP		24.2					
10BH-004	S-20A	83			83	84	-77.1	Tabb Formation	SP		20.7	5.6				
10BH-004	S-20B	84			84	85	-78.1	Tabb Formation	SP		21.8					
10BH-004	S-21A	88			88	89	-82.1	Tabb Formation	SP		19.2					
10BH-004	S-21B	89			89	90	-83.1	Tabb Formation	SP		20.1					
10BH-004	S-22	93			93	95	-87.1	Tabb Formation	SP		18.4	7				
10BH-004	S-23	98			98	100	-92.1	Tabb Formation	SM		16.3					
10BH-004	S-24	103			103	105	-97.1	Yorktown Formation	SC		36.1	23.6				
10BH-004	S-25	108			108	110	-102.1	Yorktown Formation	SC		35.8	41.1	40	14		2.743
10BH-005	S1	2	23	25	2	4	-18	Coarse Alluvium	SC							
10BH-005	S2	7	28	30	7	9	-23	Fine Alluvium	CL							
10BH-005	S3A	12	33	34	12	13	-28	Fine Alluvium	CH		77.8		84	56		
10BH-005	S4B	13	34	35	13	14	-29	Fine Alluvium	CH							
10BH-005	S4	17	38	40	17	19	-33	Fine Alluvium	CH		77.9	87.7	94	63		
10BH-005	P1	20	41	43	20	22	-36	Fine Alluvium	CH		82.9					
10BH-005	S5A	22	43	44	22	23	-38	Fine Alluvium	CH							
10BH-005	S5B	23	44	45	23	24	-39	Fine Alluvium	CH							
10BH-005	S6	27	48	50	27	29	-43	Fine Alluvium	CH		47.2	55.5			3.1	
10BH-005	S7	32	53	55	32	34	-48	Fine Alluvium	CH		41.8					
10BH-005	S8	37	58	60	37	39	-53	Fine Alluvium	OH		78.3		107	69	6.3	
10BH-005	S9A	42	63	64	42	43	-58	Fine Alluvium	OH		83.2					
10BH-005	S9B	43	64	65	43	44	-59	Fine Alluvium	PT		134.6		196	75		
10BH-005	P2	45	66	68	45	47	-61	Fine Alluvium	PT	86.3	90.5	87.2	169	122	15.5	2.544
10BH-005	S10	47	68	70	47	49	-63	Fine Alluvium	PT		76.2		106	64		
10BH-005	S11	52	73	75	52	54	-68	Tabb Formation	SP		23.3	7.2				
10BH-005	S12	57	78	80	57	59	-73	Tabb Formation	SP							
10BH-005	S13	62	83	85	62	64	-78	Tabb Formation	SM		23.3	11.6	23	0		
10BH-005	S14	67	88	90	67	69	-83	Tabb Formation	SM		19.7					
10BH-005	S15	72	93	95	72	74	-88	Tabb Formation	SP		12.2	6.2				
10BH-005	S16	77	98	100	77	79	-93	Tabb Formation	SM		19.8		20	0		
10BH-005	S17	82	103	105	82	84	-98	Yorktown Formation	SC							
10BH-005	S18	87	108	110	87	89	-103	Yorktown Formation	SC		33.9	41	49	30		
10BH-005	S19	92	113	115	92	94	-108	Yorktown Formation	SC							
10BH-005	S20	97	118	120	97	99	-113	Yorktown Formation	SC		36.2	31.6	45	29		
10BH-005	S21	102	123	125	102	104	-118	Yorktown Formation	SC		32.5		39	20		
10BH-005	S22	107	128	130	107	109	-123	Yorktown Formation	SC		31					
10BH-005	S23	112	133	135	112	114	-128	Yorktown Formation	SC							
10BH-006	S1A	2	43	44	2	3	-40.5	Fine Alluvium	OH							
10BH-006	S1B	3	44	45	3	4	-41.5	Fine Alluvium	CH		90		87	61		
10BH-006	S2	7	48	50	7	9	-45.5	Fine Alluvium	CH		66.8					
10BH-006	S3	12	53	55	12	14	-50.5	Fine Alluvium	CH							
10BH-006	S4A	17	58	58.5	17	17.5	-55.5	Fine Alluvium	CH		55.2		57	40	3.1	
10BH-006	S4B	17.5	58.5	59.5	17.5	18.5	-56	Fine Alluvium	CH		74					
10BH-006	S4C	18.5	59.5	60	18.5	19	-57	Fine Alluvium	OH		145.1		292	184	20.1	
10BH-006	P1	20	61	63	20	22	-58.5	Fine Alluvium	OH		86.8					
10BH-006	S5	22	63	65	22	24	-60.5	Fine Alluvium	OH		78.1	97.7	104	73	7	
10BH-006	S6	27	68	70	27	29	-65.5	Fine Alluvium	CH							
10BH-006	S7	32	73	75	32	34	-70.5	Fine Alluvium	CH		76.2					
10BH-006	S8A	37	78	79	37	38	-75.5	Fine Alluvium	OH		91.4		116	85	7.8	
10BH-006	S8B	38	79	80	38	39	-76.5	Tabb Formation	SP							
10BH-006	S9	42	83	85	42	44	-80.5	Tabb Formation	SP		21.3	5.3				
10BH-006	S10A	47	88	89	47	48	-85.5	Tabb Formation	SP		41.6					
10BH-006	S10B	48	89	90	48	49	-86.5	Tabb Formation	SP		19.5	6.6				
10BH-006	S11	52	93	95	52	54	-90.5	Tabb Formation	SM		25.6	14.1	16	4		
10BH-006	S12	57	98	100	57	59	-95.5	Tabb Formation	SM		13.5					
10BH-006	S13	62	103	105	62	64	-100.5	Yorktown Formation	SC		35.6	34.6	48	25		
10BH-006	S14	67	108	110	67	69	-105.5	Yorktown Formation	SC							
10BH-006	S15	72	113	115	72	74	-110.5	Yorktown Formation	SC		33.8		47	29		
10BH-006	S16	77	118	120	77	79	-115.5	Yorktown Formation	SC							
10BH-006	S17	82	123	125	82	84	-120.5	Yorktown Formation	SC		33.8	27.1	37	15		
10BH-006	S18	87	128	130	87	89	-125.5	Yorktown Formation	SC							
10BH-006	S19	92	133	135	92	94	-130.5	Yorktown Formation	SC		32.9					
10BH-006	S20	97	138	140	97	99	-135.5	Yorktown Formation	SC							
10BH-006	S21	102	143	145	102	104	-140.5	Yorktown Formation	CH							
10BH-007	S1	1	53	55	1	3	-49.2	Fine Alluvium	OH							
10BH-007	S2	6	58	60	6	8	-54.2	Fine Alluvium	OH		94		107	76		
10BH-007	S3	11	63	65	11	13	-59.2	Fine Alluvium	OH		84.3					
10BH-007	P1	14	66	68	14	16	-62.2	Fine Alluvium	OH	96.4	75	67.2	98	40	4.4	2.54
10BH-007	S4A	16	68	69	16	17	-64.2	Fine Alluvium	OH		74.9					
10BH-007	S4B	17	69	70	17	18	-65.2	Tabb Formation	SC							
10BH-007	S5	21	73	75	21	23	-69.2	Tabb Formation	SP		27.2	7.8				
10BH-007	S6A	26	78	79	26	27	-74.2	Tabb Formation	SM		32.6		32	0		
10BH-007	S6B	27	79	80	27	28	-75.2	Tabb Formation	SP							
10BH-007	S7	31	83	85	31	33	-79.2	Tabb Formation	SM		23		24	0		
10BH-007	S8A	36	88	88.5	36	36.5	-84.2	Tabb Formation	SP		12.8	5.8				
10BH-007	S8B	36.5	88.5	89	36.5	37	-84.7	Yorktown Formation	SC		29.5	20.7	38	14		
10BH-007	S8C	37	89	89.5	37	37.5	-85.2	Yorktown Formation	SC							

Boring	Sample	Depth (ft)	Depth Interval (ft from Deck)		Depth Interval (ft)		Elevation (ft MLLW)	Geologic Unit	Material Description	Unit Weight (pcf)	MC %	Fines %	LL	PI	Organic Content %	Specific Gravity
10BH-007	S8D	37.5	89.5	90	37.5	38	-85.7	Yorktown Formation	SC							
10BH-007	S9	41	93	95	41	43	-89.2	Yorktown Formation	SC		33.8		43	19		
10BH-007	S10	46	98	100	46	48	-94.2	Yorktown Formation	SC							
10BH-007	S11	51	103	105	51	53	-99.2	Yorktown Formation	SC		33.6	39	49	27		
10BH-007	S12	56	108	110	56	58	-104.2	Yorktown Formation	SC							
10BH-007	S13	61	113	115	61	63	-109.2	Yorktown Formation	SC		33.4					
10BH-007	S14	66	118	120	66	68	-114.2	Yorktown Formation	SC		34.4		46	25		
10BH-007	S15	71	123	125	71	73	-119.2	Yorktown Formation	SC		29.6	29.3				
10BH-007	S16	76	128	130	76	78	-124.2	Yorktown Formation	SM		30.8					
10BH-007	S17	81	133	135	81	83	-129.2	Yorktown Formation	SM		31.8	27.6				
10BH-007	S18	86	138	140	86	88	-134.2	Yorktown Formation	SM		28.4		40	18		
10BH-007	S19	91	143	145	91	93	-139.2	Yorktown Formation	SM							
10BH-008	S1	1.5	53	55	1.5	3.5	-49	Fine Alluvium	OH		92.2		111	78		
10BH-008	S2	6.5	58	60	6.5	8.5	-54	Fine Alluvium	OH		91.5		138	103	6.5	
10BH-008	S3	11.5	63	65	11.5	13.5	-59	Fine Alluvium	OH							
10BH-008	P1	14.5	66	68	14.5	16.5	-62	Tabb Formation	SP		31.1					
10BH-008	S4	16.5	68	70	16.5	18.5	-64	Tabb Formation	SP		29.9	7.1	21	0		
10BH-008	S5	21.5	73	75	21.5	23.5	-69	Tabb Formation	SM		34.5		25	0		
10BH-008	S6	26.5	78	80	26.5	28.5	-74	Tabb Formation	SM		25.4	12.1	15	0		
10BH-008	S7A	31.5	83	84	31.5	32.5	-79	Tabb Formation	SM		23.9	6				
10BH-008	S7B	32.5	84	85	32.5	33.5	-80	Tabb Formation	SP		33.7		44	13		
10BH-008	S8	36.5	88	90	36.5	38.5	-84	Yorktown Formation	SC		33.1		41	13		
10BH-008	P2	39.5	91	93	39.5	41.5	-87	Yorktown Formation	SM		33.4					
10BH-008	S9	41.5	93	95	41.5	43.5	-89	Yorktown Formation	SM							
10BH-008	S10	46.5	98	100	46.5	48.5	-94	Yorktown Formation	SC		34.3	31.1	47	22		
10BH-008	S11	51.5	103	105	51.5	53.5	-99	Yorktown Formation	SC							
10BH-008	S12	56.5	108	110	56.5	58.5	-104	Yorktown Formation	SC		35.2	40.7	55	37		
10BH-008	S13	61.5	113	115	61.5	63.5	-109	Yorktown Formation	SC		36.7		52	32		
10BH-008	S14	66.5	118	120	66.5	68.5	-114	Yorktown Formation	SC		31.6					
10BH-008	S15	71.5	123	125	71.5	73.5	-119	Yorktown Formation	SC							
10BH-008	S16	76.5	128	130	76.5	78.5	-124	Yorktown Formation	SC		27.6	26.9	39	16		
10BH-008	S17	81.5	133	135	81.5	83.5	-129	Yorktown Formation	SC							
10BH-008	S18	86.5	138	140	86.5	88.5	-134	Yorktown Formation	SC		28.5	29.1				
10BH-008	S19	91.5	143	145	91.5	93.5	-139	Yorktown Formation	SC							
10BH-009	S1	3			3	5	-16.5	Coarse Alluvium	SM							
10BH-009	S2	8			8	10	-21.5	Fine Alluvium	CH		80.5		89	63		
10BH-009	P1	11			11	13	-24.5	Fine Alluvium	CH		89.6					
10BH-009	S3	13			13	15	-26.5	Fine Alluvium	CH		87.6	98.8	97	71	3.1	
10BH-009	S4	15			15	17	-28.5	Fine Alluvium	CH		89.1		100	74		
10BH-009	S5	20			20	22	-33.5	Fine Alluvium	CH		79.1					
10BH-009	P2	23			23	25	-36.5	Fine Alluvium	CH	93.7	89.2	98.6	113	82	5.8	2.525
10BH-009	S6	25			25	27	-38.5	Fine Alluvium	CH							
10BH-009	S7	30			30	32	-43.5	Fine Alluvium	CH		79.3		103	76		
10BH-009	S8	35			35	37	-48.5	Fine Alluvium	CH		88.4					
10BH-009	S9	40			40	42	-53.5	Fine Alluvium	CH		86.1		112	83		
10BH-009	P3	43			43	45	-56.5	Fine Alluvium	CH	96.8	79.2	97.3	115	82	8.7	2.629
10BH-009	S10	45			45	47	-58.5	Fine Alluvium	CH							
10BH-009	S11	50			50	52	-63.5	Tabb Formation	SP		16.6	4.6				
10BH-009	S12	55			55	57	-68.5	Tabb Formation	SP							
10BH-009	S13	60			60	62	-73.5	Yorktown Formation	SM		32.5	18.7	38	15		
10BH-009	S14	65			65	67	-78.5	Yorktown Formation	SM							
10BH-009	S15	70			70	72	-83.5	Yorktown Formation	SC		37.7		45	26		
10BH-009	S16	75			75	77	-88.5	Yorktown Formation	SC		35.2					
10BH-009	S17	80			80	82	-93.5	Yorktown Formation	SC							
10BH-009	S18	85			85	87	-98.5	Yorktown Formation	SC		34.5	39.7	55	38		
10BH-009	S19	90			90	92	-103.5	Yorktown Formation	SC							
10BH-010	S1	0	13	15	0	2	-6.6	Coarse Alluvium	SM							
10BH-010	S2	5	18	20	5	7	-11.6	Fine Alluvium	CH		73.1		77	58		
10BH-010	S3	10	23	25	10	12	-16.6	Fine Alluvium	CH		90.7		101	78		
10BH-010	P1	13	26	28	13	15	-19.6	Fine Alluvium	CH		90.6					
10BH-010	S4	15	28	30	15	17	-21.6	Fine Alluvium	CH		97.7	98.8	110	86	6.6	
10BH-010	S5	20	33	35	20	22	-26.6	Fine Alluvium	CH							
10BH-010	S6	25	38	40	25	27	-31.6	Fine Alluvium	CH		80.8		102	77		
10BH-010	S7	30	43	45	30	32	-36.6	Fine Alluvium	CH		79.8					
10BH-010	P2	33	46	48	33	35	-39.6	Fine Alluvium	CH		78.7					
10BH-010	S8	35	48	50	35	37	-41.6	Fine Alluvium	CH		74.7	98.3	103	77		
10BH-010	S9	40	53	55	40	42	-46.6	Fine Alluvium	CH		83.6		104	77		
10BH-010	S10A	45	58	59	45	46	-51.6	Fine Alluvium	CH		80.1				4.7	
10BH-010	S10B	46	59	60	46	47	-52.6	Tabb Formation	SM		31.6					
10BH-010	S11	50	63	65	50	52	-56.6	Tabb Formation	SM		26.7	21.8	31	7		
10BH-010	S12	55	68	70	55	57	-61.6	Tabb Formation	SM							
10BH-010	S13	60	73	75	60	62	-66.6	Yorktown Formation	SM		33.9		38	9		
10BH-010	S14	65	78	80	65	67	-71.6	Yorktown Formation	SC		31.7	21.7				
10BH-010	S15	70	83	85	70	72	-76.6	Yorktown Formation	SC		30.8	19.4	39	11		
10BH-010	S16	75	88	90	75	77	-81.6	Yorktown Formation	SC		39.5					
10BH-010	S17	80	93	95	80	82	-86.6	Yorktown Formation	SC		38.7		48	19		
10BH-010	S18	85	98	100	85	87	-91.6	Yorktown Formation	SC		33	36.3				
10BH-010	S19	90	103	105	90	92	-96.6	Yorktown Formation	SC							
10BH-011	S1	2	13	15	2	4	-6.3	Fill	FL							
10BH-011	S2	7	18	20	7	9	-11.3	Fine Alluvium	CH		56.5					
10BH-011	P1	10	21	23	10	12	-14.3	Fine Alluvium	CH	94.3	90.8	91.3	101	78		2.585
10BH-011	S3	12	23	25	12	14	-16.3	Fine Alluvium	CH							
10BH-011	S4	17	28	30	17	19	-21.3	Fine Alluvium	CH		90.5		108	81		
10BH-011	S5	22	33	35	22	24	-26.3	Fine Alluvium	CH							
10BH-011	P2	25	36	38	25	27	-29.3	Fine Alluvium	CH	97.6	78.6	92.5	100	74		2.655
10BH-011	S6	27	38	40	27	29	-31.3	Fine Alluvium	CH							
10BH-011	S7A	32	43	44	32	33	-36.3	Fine Alluvium	CH		54.2					
10BH-011	S7B	33	44	45	33	34	-37.3	Fine Alluvium	CH		75.9		63	45		
10BH-011	S8A	37	48	49	37	38	-41.3	Fine Alluvium	CH							
10BH-011	S8B	38	49	50	38	39	-42.3	Tabb Formation	SC		29.8	15.7				
10BH-011	S9	42	53	55	42	44	-46.3	Tabb Formation	SC		34.1					
10BH-011	S10	47	58	60	47	49	-51.3	Yorktown Formation	SC		33.9					

Boring	Sample	Depth (ft)	Depth Interval (ft from Deck)		Depth Interval (ft)		Elevation (ft MLLW)	Geologic Unit	Material Description	Unit Weight (pcf)	MC %	Fines %	LL	PI	Organic Content %	Specific Gravity
10BH-011	S11	52	63	65	52	54	-56.3	Yorktown Formation	SC		31.3	21.1				
10BH-011	S12	57	68	70	57	59	-61.3	Yorktown Formation	SC		33.5		40	14		
10BH-011	S13	62	73	75	62	64	-66.3	Yorktown Formation	SC		36.1					
10BH-011	S14	67	78	80	67	69	-71.3	Yorktown Formation	SC							
10BH-011	S15	72	83	85	72	74	-76.3	Yorktown Formation	SC		32.9	22.6	41	10		
10BH-011	S16	77	88	90	77	79	-81.3	Yorktown Formation	SC							
10BH-011	S17	82	93	95	82	84	-86.3	Yorktown Formation	SC		35.4	28.7				
10BH-011	S18	87	98	100	87	89	-91.3	Yorktown Formation	SC							
10BH-011	S19	92	103	105	92	94	-96.3	Yorktown Formation	SC		39.2					
10BH-012	S1	11	23	25	11	13	-17	Fine Alluvium	CH		70	84.1	83	61		
10BH-012	P1	16	28	30	16	18	-22	Fine Alluvium	CH		46					
10BH-012	S2	21	33	35	21	23	-27	Coarse Alluvium	SC		34.9	30	35	16		
10BH-012	S3	26	38	40	26	28	-32	Tabb Formation	SP		10.9	6.2				
10BH-012	S4	31	43	45	31	33	-37	Tabb Formation	SM		30.4	14.5	31	2		
10BH-012	S5	36	48	50	36	38	-42	Tabb Formation	SM							
10BH-012	S6	41	53	55	41	43	-47	Tabb Formation	SM		36	22.9	33	8		
10BH-012	S7	46	58	60	46	48	-52	Yorktown Formation	SC		30.4					
10BH-012	P2	51	63	65	51	53	-57	Yorktown Formation	SC							
10BH-012	S8	56	68	70	56	58	-62	Yorktown Formation	SC							
10BH-012	S9	61	73	75	61	63	-67	Yorktown Formation	SC		35.6	18.4	41	12		
10BH-012	P3	66	78	80	66	68	-72	Yorktown Formation	SC							
10BH-012	S10	71	83	85	71	73	-77	Yorktown Formation	SC		35.1	24.7	43	13		
10BH-012	P4	76	88	90	76	78	-82	Yorktown Formation	SC							
10BH-012	S11	81	93	95	81	83	-87	Yorktown Formation	SC							
10BH-013	S-1	0			0	2	3.8	Fill	SM		8.9					
10BH-013	S-2	2			2	4	1.8	Fill	SM		15.7					
10BH-013	S-3	4			4	6	-0.2	Fill	SP		16.3					
10BH-013	S-4	6			6	8	-2.2	Fill	SP		17.4	7.4				
10BH-013	S-5	8			8	10	-4.2	Fill	SP		19.3					
10BH-013	S-6	13			13	15	-9.2	Coarse Alluvium	SC		18.7					
10BH-013	P-1	15			15	17	-11.2	Coarse Alluvium	SP							
10BH-013	S-7	17			17	19	-13.2	Coarse Alluvium	SP		28.8	6				
10BH-013	S-8	23			23	25	-19.2	Fine Alluvium	CH		66.7					
10BH-013	P-2	25			25	27	-21.2	Fine Alluvium	CH	97.1	63.4	95.9	83	54		
10BH-013	S-9	27			27	29	-23.2	Fine Alluvium	CH		57.1					
10BH-013	S-10	33			33	35	-29.2	Fine Alluvium	CH		51.8		64	39		
10BH-013	P-3	35			35	37	-31.2	Fine Alluvium	CH	101.2	52.1	94.5	68	42		2.7
10BH-013	S-11	38			38	40	-34.2	Coarse Alluvium	SC		60.5					
10BH-013	P-4	40			40	42	-36.2	Coarse Alluvium	SC							
10BH-013	S-12	43			43	45	-39.2	Coarse Alluvium	SC		77.2				4.7	
10BH-013	P-5	45			45	47	-41.2	Coarse Alluvium	SC	94.5	77.9	39.5	112	60		2.58
10BH-013	S-13	48			48	50	-44.2	Tabb Formation	SP		24.3					
10BH-013	S-14	53			53	55	-49.2	Tabb Formation	SM		31.8	42.9	24	3		
10BH-013	S-15	58			58	60	-54.2	Yorktown Formation	SM		53.9					
10BH-013	S-16	63			63	65	-59.2	Yorktown Formation	SM		31.6	17.5	37	2		
10BH-013	S-17	68			68	70	-64.2	Yorktown Formation	SM		32.6					
10BH-013	S-18	73			73	75	-69.2	Yorktown Formation	SM		32.5		32	6		
10BH-013	S-19	78			78	80	-74.2	Yorktown Formation	SM		34.9					
10BH-014	S-1	0			0	2	3.8	Fill	SM		5.6					
10BH-014	S-2	2			2	4	1.8	Coarse Alluvium	SP		15.1	8.6	0	0		
10BH-014	S-3	4			4	6	-0.2	Coarse Alluvium	SP		17.9					
10BH-014	S-4	6			6	8	-2.2	Coarse Alluvium	SP		23	3.4				
10BH-014	S-5	8			8	10	-4.2	Coarse Alluvium	SP		19.5					
10BH-014	S-6a	13			13	14	-9.2	Coarse Alluvium	SM		27.9					
10BH-014	S-6b	14			14	15	-10.2	Coarse Alluvium	SM							
10BH-014	S-7a	18			18	19	-14.2	Coarse Alluvium	SM							
10BH-014	S-7b	19			19	20	-15.2	Fine Alluvium	CH		40.2					
10BH-014	P-1	20			20	22	-16.2	Fine Alluvium	OL	92.7	58.4	85.1	91	59		
10BH-014	S-8	23			23	25	-19.2	Fine Alluvium	OL		69.5					
10BH-014	P-2	25			25	27	-21.2	Fine Alluvium	OL							
10BH-014	S-9	28			28	30	-24.2	Fine Alluvium	CH		49.7					
10BH-014	P-3	30			30	32	-26.2	Fine Alluvium	CL	105.6	55.5	79.3	59	37		2.7
10BH-014	S-10	33			33	35	-29.2	Fine Alluvium	CH		53.6					
10BH-014	P-4	35			35	37	-31.2	Fine Alluvium	CH	102.9	57.3	66.6	69	45	2.7	2.66
10BH-014	S-11	38			38	40	-34.2	Fine Alluvium	CH		65.7					
10BH-014	P-5	40			40	42	-36.2	Fine Alluvium	OL		184.5					
10BH-014	S-12	43			43	45	-39.2	Coarse Alluvium	SM		34.8				1.5	
10BH-014	S-13	48			48	50	-44.2	Tabb Formation	SM		30.5		28	5		
10BH-014	S-14	53			53	55	-49.2	Tabb Formation	SM		36					
10BH-014	S-15	58			58	60	-54.2	Yorktown Formation	SM		33	16.6	27	3		
10BH-014	S-16	63			63	65	-59.2	Yorktown Formation	SM		33					
10BH-015	S-1	0.5			0.5	2	5.5	Fill	SM		36.3					
10BH-015	S-2	2			2	4	4	Fill	SM		35.9	12.1				
10BH-015	S-3	4			4	6	2	Fill	SM							
10BH-015	S-4	6			6	8	0	Fill	SM		31.7					
10BH-015	S-5	8			8	10	-2	Coarse Alluvium	SC		38.2					
10BH-015	S-6	13			13	15	-7	Fine Alluvium	CH		62.5				7.1	
10BH-015	P-1	15			15	17	-9	Coarse Alluvium	SC	93.7	62.8	96.6	79	52		
10BH-015	S-7	18			18	20	-12	Fine Alluvium	CH		92.6					
10BH-015	S-8	23			23	25	-17	Coarse Alluvium	SC		34.4		30	15	3.4	
10BH-015	S-9	28			28	30	-22	Tabb Formation	SM		20.9					
10BH-015	S-10	33			33	35	-27	Tabb Formation	SM		17					
10BH-015	S-11	38			38	40	-32	Tabb Formation	SP		21.4	4.7			0.1	
10BH-015	S-12	43			43	45	-37	Tabb Formation	SC		31.4					
10BH-015	P-2	45			45	47	-39	Tabb Formation	SC		30.2					
10BH-015	S-13	48			48	50	-42	Yorktown Formation	SM		28.5					
10BH-015	S-14	53			53	55	-47	Yorktown Formation	SM		31.6	16.6	28	4		
10BH-015	S-15	58			58	60	-52	Yorktown Formation	SM		32.2					
10BH-016	S-1	0			0	2	10.5	Fill	SM		11					
10BH-016	S-2	2			2	4	8.5	Fill	SM		24.3					
10BH-016	S-3	4			4	6	6.5	Fill	SM		38.4	28.6				
10BH-016	S-4	6			6	8	4.5	Fill	SM							

Boring	Sample	Depth (ft)	Depth Interval (ft from Deck)		Depth Interval (ft)		Elevation (ft MLLW)	Geologic Unit	Material Description	Unit Weight (pcf)	MC %	Fines %	LL	PI	Organic Content %	Specific Gravity
10BH-016	S-5	8			8	10	2.5	Fine Alluvium	CL		18.5		26	10	1.6	
10BH-016	S-6	13			13	15	-2.5	Coarse Alluvium	SM		42				1.6	
10BH-016	S-7	18			18	20	-7.5	Coarse Alluvium	SC		32.1					
10BH-016	P-1	20			20	22	-9.5	Fine Alluvium	CH		38.6					
10BH-016	S-8	23			23	25	-12.5	Fine Alluvium	Ch		69.5					
10BH-016	S-9A	28			28	29	-17.5	Fine Alluvium	CH		49.3					
10BH-016	S-9B	29			29	30	-18.5	Coarse Alluvium	SM		34.6					
10BH-016	S-10	33			33	35	-22.5	Tabb Formation	SM		23.7		0	0		
10BH-016	S-11	38			38	40	-27.5	Tabb Formation	SP		20.9					
10BH-016	S-12	43			43	45	-32.5	Tabb Formation	SP		17.8	6.2				
10BH-016	S-13	48			48	50	-37.5	Yorktown Formation	SM		29		26	4		
10BH-016	S-14	53			53	55	-42.5	Yorktown Formation	SM		28.7					
10BH-016	S-15	58			58	60	-47.5	Yorktown Formation	SM		31.2					
10BH-017	S-1	0			0	2	6.5	Fill	SM		12.3					
10BH-017	S-2	2			2	4	4.5	Fill	SM		17					
10BH-017	S-3	4			4	6	2.5	Fill	SM		33.4	15.8	0	0		
10BH-017	S-4	6			6	8	0.5	Fill	SM		4.3					
10BH-017	S-5	8			8	10	-1.5	Fill	SM		102.5					
10BH-017	S-6	13			13	15	-6.5	Coarse Alluvium	SP		19.1					
10BH-017	S-7	18			18	20	-11.5	Fine Alluvium	CH		65.9		94	63		
10BH-018	S-1	0			0	2	3.7	Fill	SM							
10BH-018	S-2	2			2	4	1.7	Fill	SM		21.3					
10BH-018	S-3	4			4	6	-0.3	Fill	SM		22.8					
10BH-018	S-4	6			6	8	-2.3	Fill	SM		28.3	15.7	25	2		
10BH-018	S-5	8			8	10	-4.3	Fill	SM		21.1					
10BH-018	S-6	13			13	15	-9.3	Fill	SM		27.2					
10BH-018	S-7	18			18	20	-14.3	Fill	SP		6.4					
10BH-018	S-8	23			23	25	-19.3	Fill	SP		13.3	3.2				
10BH-018	S-9	28			28	30	-24.3	Fill	SP		15.7					
10BH-018	S-10	33			33	35	-29.3	Fill	SP		13.4					
10BH-018	S-11	38			38	40	-34.3	Fine Alluvium	CH		37.7	64.3	47	26		
10BH-018	P-1	43			43	45	-39.3	Fine Alluvium	CH	100.2	65.3	96.4	96	64		2.72
10BH-018	S-12	48			48	50	-44.3	Fine Alluvium	CH		63.6	92.1	100	67		
10BH-018	S-13	53			53	55	-49.3	Fine Alluvium	CH		130.1					
10BH-018	S-14	58			58	60	-54.3	Fine Alluvium	OH		91.5	59.3	106	50		
10BH-018	P-2	63			63	65	-59.3	Fine Alluvium	OH							
10BH-018	S-15	68			68	70	-64.3	Fine Alluvium	OH		70.8					
10BH-018	S-16	73			73	75	-69.3	Fine Alluvium	CH		69.9					
10BH-018	S-17	78			78	80	-74.3	Tabb Formation	SM		24.3					
10BH-019	S-1	0	28	30	0	2	-21.6	Fine Alluvium	OH							
10BH-019	S-2	5	33	35	5	7	-26.6	Fine Alluvium	OH		143.7		145	114	4.4	
10BH-019	S-3	10	38	40	10	12	-31.6	Fine Alluvium	OH							
10BH-019	S-4A	15	43	44	15	16	-36.6	Fine Alluvium	OH		129.6		138	104		
10BH-019	S-4B	16	44	45	16	17	-37.6	Fine Alluvium	OH		83.2		105	78	3	
10BH-019	S-5	20	48	50	20	22	-41.6	Fine Alluvium	OH		59					
10BH-019	S-6	25	53	55	25	27	-46.6	Fine Alluvium	CH		75.5		101	75		
10BH-019	S-7	30	58	60	30	32	-51.6	Fine Alluvium	CH		82.7					
10BH-019	P-1	33	61	63	33	35	-54.6	Fine Alluvium	CH		78.9					
10BH-019	S-8	35	63	65	35	37	-56.6	Fine Alluvium	CH		78.5		115	81		
10BH-019	S-9	40	68	70	40	42	-61.6	Fine Alluvium	OH		104.6	88.3	156	112		
10BH-019	P-2	43	71	73	43	45	-64.6	Fine Alluvium	OH		71					
10BH-019	S-10A	45	73	74	45	46	-66.6	Fine Alluvium	OH		88.7	97.1	124	89		
10BH-019	S-10B	46	74	75	46	47	-67.6	Tabb Formation	SM		23.6					
10BH-019	S-11	50	78	80	50	52	-71.6	Tabb Formation	SP		19.8	4.9				
10BH-019	S-12	55	83	85	55	57	-76.6	Tabb Formation	SM		17.2		13	0		
10BH-019	S-13	60	88	90	60	62	-81.6	Tabb Formation	SM		35.6	17.2				
10BH-019	S-14	65	93	95	65	67	-86.6	Yorktown Formation	SC							
10BH-019	S-15	70	98	100	70	72	-91.6	Yorktown Formation	SC		33.8		49	23		
10BH-019	S-16	75	103	105	75	77	-96.6	Yorktown Formation	SC							
10BH-020	S-1A	3.5	23	24	3.5	4.5	-19	Coarse Alluvium	SM							
10BH-020	S-1B	4.5	24	25	4.5	5.5	-20	Fine Alluvium	CH		60.7		78	58		
10BH-020	S-2	8.5	28	30	8.5	10.5	-24	Fine Alluvium	CH							
10BH-020	S-3	13.5	33	35	13.5	15.5	-29	Fine Alluvium	CH		79.8		94	68		
10BH-020	S-4	18.5	38	40	18.5	20.5	-34	Fine Alluvium	OH		108.1				3.1	
10BH-020	S-5	23.5	43	45	23.5	25.5	-39	Fine Alluvium	OH		80.2		96	68		
10BH-020	S-6	28.5	48	50	28.5	30.5	-44	Fine Alluvium	OH							
10BH-020	S-7	33.5	53	55	33.5	35.5	-49	Fine Alluvium	OH		81.8		122	94	3.4	
10BH-020	S-8	38.5	58	60	38.5	40.5	-54	Fine Alluvium	CH							
10BH-020	S-9A	43.5	63	64	43.5	44.5	-59	Fine Alluvium	PT		240.5	54.4	332	34	41.3	
10BH-020	S-9B	44.5	64	65	44.5	45.5	-60	Fine Alluvium	OH		113.9	89.3	178	117		
10BH-020	P-1	46.5	66	68	46.5	48.5	-62	Fine Alluvium	OH		119.8					
10BH-020	S-10	48.5	68	70	48.5	50.5	-64	Coarse Alluvium	SM		27.6	26.1	20	0		
10BH-020	S-11	53.5	73	75	53.5	55.5	-69	Tabb Formation	SM		19.2					
10BH-020	S-12A	58.5	78	79	58.5	59.5	-74	Tabb Formation	SP		33.7	7.5				
10BH-020	S-12B	59.5	79	80	59.5	60.5	-75	Tabb Formation	OH		29.4		37	20	3.8	
10BH-020	S-13A	63.5	83	84	63.5	64.5	-79	Tabb Formation	OH		22.5	7.2				
10BH-020	S-13B	64.5	84	85	64.5	65.5	-80	Tabb Formation	SP		23.5				0.2	
10BH-020	S-14A	68.5	88	89	68.5	69.5	-84	Tabb Formation	SP		19.4	6.6				
10BH-020	S-14B	69.5	89	90	69.5	70.5	-85	Yorktown Formation	SC		31.5		44	19		
10BH-020	S-15	73.5	93	95	73.5	75.5	-89	Yorktown Formation	SC		36.3	20.6			0.6	
10BH-020	S-16	78.5	98	100	78.5	80.5	-94	Yorktown Formation	SC		35.6		55	33		
10BH-020	S-17	83.5	103	105	83.5	85.5	-99	Yorktown Formation	SC							
10BH-021	S-1	0			0	2	4.5	Fill	SP		8.3					
10BH-021	S-2	2			2	4	2.5	Fill	SP		15.4					
10BH-021	S-3	4			4	6	0.5	Fill	SP		21.5					
10BH-021	S-4	6			6	8	-1.5	Fill	SP		22.1	4.4				
10BH-021	S-5	8			8	10	-3.5	Coarse Alluvium	SM		150.8					
10BH-021	S-6	13			13	15	-8.5	Fine Alluvium	CL		54.9					
10BH-021	S-7	18			18	20	-13.5	Fine Alluvium	CH		63.4		72	47		
10BH-021	S-8	23			23	25	-18.5	Fine Alluvium	CH		58.3					
10BH-021	S-9	28			28	30	-23.5	Fine Alluvium	CH		153.1	64.2	180	91		
10BH-021	S-10	33			33	35	-28.5	Fine Alluvium	CL		41.8					

Boring	Sample	Depth (ft)	Depth Interval (ft from Deck)		Depth Interval (ft)		Elevation (ft MLLW)	Geologic Unit	Material Description	Unit Weight (pcf)	MC %	Fines %	LL	PI	Organic Content %	Specific Gravity
10BH-021	S-11	38			38	40	-33.5	Tabb Formation	SP		18.1					
10BH-021	S-12	43			43	45	-38.5	Yorktown Formation	SM		27.8	18.1	27	3		
10BH-021	S-13	48			48	50	-43.5	Yorktown Formation	SM		31					
10BH-021	P-1	53			53	55	-48.5	Yorktown Formation	SM							
10BH-021	S-14	58			58	60	-53.5	Yorktown Formation	SM		30.9					
10BH-021	P-2	63			63	65	-58.5	Yorktown Formation	SM							
10BH-021	S-15	68			68	70	-63.5	Yorktown Formation	SM		35.7	20.8	34	6		
10BH-021	S-16	73			73	75	-68.5	Yorktown Formation	SM		27.9					
10BH-021	P-3	78			78	80	-73.5	Yorktown Formation	SM							
10BH-021	S-17	83			83	85	-78.5	Yorktown Formation	SM		34.4					
10BH-021	S-18	88			88	90	-83.5	Yorktown Formation	SM		34.2	37.2	44	15		
10BH-021	S-19	93			93	95	-88.5	Yorktown Formation	SM		38.5					
10BH-021	S-20	98			98	100	-93.5	Yorktown Formation	SM		32.8					
10BH-022	S-1	0			0	2	2.8	Fill	SM		12.1					
10BH-022	S-2	2			2	4	0.8	Fill	SM		20.5	29.9	33	7		
10BH-022	S-3	4			4	6	-1.2	Fill	SM		28.5					
10BH-022	S-4	6			6	8	-3.2	Fill	SM		35.2					
10BH-022	S-5	8			8	10	-5.2	Fine Alluvium	CH		77.5					
10BH-022	S-6	13			13	15	-10.2	Fine Alluvium	CH		73.8	90.2	91	61		
10BH-022	S-7	18			18	20	-15.2	Fine Alluvium	CL		27.6					
10BH-022	S-8	23			23	25	-20.2	Fine Alluvium	CH		75.6					
10BH-022	P-1	28			28	30	-25.2	Fine Alluvium	CH	98.5	68.5	96.1	84	53		2.71
10BH-022	S-9	33			33	35	-30.2	Fine Alluvium	CH		109.7	68.9	124	79	9.5	
10BH-022	S-10	38			38	40	-35.2	Tabb Formation	SC		26.3					
10BH-022	S-11	43			43	45	-40.2	Tabb Formation	SC		31.7					
10BH-022	S-12	48			48	50	-45.2	Yorktown Formation	SC		34.4	20.8	31	6		
10BH-022	S-13	53			53	55	-50.2	Yorktown Formation	SC		31.8					
10BH-022	S-14	58			58	60	-55.2	Yorktown Formation	SC		32.3					
10BH-022	P-2	63			63	65	-60.2	Yorktown Formation	SC	115.7	35.3	19.8	0	0		2.65
10BH-022	S-15	68			68	70	-65.2	Yorktown Formation	SC		32.6					
10BH-022	P-3	73			73	75	-70.2	Yorktown Formation	SC							
10BH-022	S-16	78			78	80	-75.2	Yorktown Formation	SC		35					
10BH-023	S-1	0			0	2	5.5	Fill	SM		11.3					
10BH-023	S-2	2			2	4	3.5	Coarse Alluvium	SP		5.6					
10BH-023	S-3	4			4	6	1.5	Coarse Alluvium	SM		19.1					
10BH-023	S-4	6			6	8	-0.5	Coarse Alluvium	SM		19.6	49.4	15	3		
10BH-023	S-5	8			8	10	-2.5	Coarse Alluvium	SM		18.7					
10BH-023	S-6	13			13	15	-7.5	Fine Alluvium	CH		81.2		108	73		
10BH-023	S-7A	18			18	19	-12.5	Coarse Alluvium	SM		29.6					
10BH-023	S-7B	19			19	20	-13.5	Coarse Alluvium	SP		44.6					
10BH-024	S-1	0			0	2	7.5	Fill	SM		10		0	0		
10BH-024	S-2	2			2	4	5.5	Coarse Alluvium	SM		17.4		0	0		
10BH-024	S-3	4			4	6	3.5	Coarse Alluvium	SP		24					
10BH-024	S-4	6			6	8	1.5	Coarse Alluvium	SP		27.3					
10BH-024	S-5	8			8	10	-0.5	Coarse Alluvium	SP		24.2	6.1				
10BH-024	S-6	13			13	15	-5.5	Coarse Alluvium	SP		26.2					
10BH-024	S-7	18			18	20	-10.5	Fine Alluvium	CH		54.9		77	51		
10BH-025	S-1	0			0	2	7.7	Fill	SM							
10BH-025	S-2	2			2	4	5.7	Fill	SM							
10BH-025	S-3	4			4	6	3.7	No Recovery								
10BH-025	S-4A	6			6	6.5	1.7	Fill	SC							
10BH-025	S-4B	6.5			6.5	8	1.2	Coarse Alluvium	SC							
10BH-025	S-5	8			8	10	-0.3	Coarse Alluvium	SM							
10BH-025	S-6	13			13	15	-5.3	Coarse Alluvium	SM							
10BH-025	S-7A	18			18	18.5	-10.3	Coarse Alluvium	SM							
10BH-025	S-7B	18.5			18.5	20	-10.8	Fine Alluvium	CH							
10BH-025	P-1	21			21	23	-13.3	Fine Alluvium	CH							
10BH-025	S-8	23			23	25	-15.3	Fine Alluvium	CH							
10BH-025	S-9A	28			28	28.5	-20.3	Coarse Alluvium	SC							
10BH-025	S-9B	28.5			28.5	30	-20.8	Fine Alluvium	CH							
10BH-025	S-10	33			33	35	-25.3	Tabb Formation	SP-SM							
10BH-025	S-11	38			38	40	-30.3	Tabb Formation	SM							
10BH-025	S-12	43			43	45	-35.3	Yorktown Formation	SC							
10BH-025	S-13	48			48	50	-40.3	Yorktown Formation	SM							
10BH-025	S-14	53			53	55	-45.3	Yorktown Formation	SC							
10BH-025	P-2	56			56	57	-48.3	Yorktown Formation	SC							
10BH-025	S-15	57			57	59	-49.3	No Recovery								
10BH-025	S-16	63			63	65	-55.3	Yorktown Formation	SC							
10BH-025	S-17	68			68	70	-60.3	Yorktown Formation	SM							
10BH-025	P-3	71			71	73	-63.3	Yorktown Formation	SM							
10BH-025	S-18	73			73	75	-65.3	Yorktown Formation	SM							
10BH-025	S-19	78			78	80	-70.3	Yorktown Formation	SC							
10BH-026	S-1	0			0	2	9.4	Fill	SM							
10BH-026	S-2	2			2	4	7.4	Fill	SC							
10BH-026	S-3	4			4	6	5.4	Fill	SC							
10BH-026	S-4	6			6	8	3.4	Fine Alluvium	ML							
10BH-026	S-5	8			8	10	1.4	Coarse Alluvium	SM							
10BH-026	S-6A	13			13	14	-3.6	Fine Alluvium	OH							
10BH-026	S-6B	14			14	15	-4.6	Coarse Alluvium	SM							
10BH-026	S-7	18			18	20	-8.6	Fine Alluvium	OH							
10BH-026	P-1	21			21	23	-11.6	Fine Alluvium	OH							
10BH-026	S-8	23			23	25	-13.6	Fine Alluvium	OH							
10BH-026	S-9	28			28	30	-18.6	Coarse Alluvium	SC							
10BH-026	S-10A	33			33	34.5	-23.6	Fine Alluvium	CH							
10BH-026	S-10B	34.5			34.5	35	-25.1	Fine Alluvium	CH							
10BH-026	S-11	38			38	40	-28.6	Tabb Formation	SM							
10BH-026	S-12	43			43	45	-33.6	Tabb Formation	SM							
10BH-026	S-13A	48			48	49	-38.6	Yorktown Formation	SC							
10BH-026	S-13B	49			49	50	-39.6	Yorktown Formation	SM							
10BH-026	S-14	53			53	55	-43.6	Yorktown Formation	SM							
10BH-026	P-2	56			56	58	-46.6	Yorktown Formation	SM							
10BH-026	S-15	58			58	60	-48.6	Yorktown Formation	GP							

Boring	Sample	Depth (ft)	Depth Interval (ft from Deck)		Depth Interval (ft)		Elevation (ft MLLW)	Geologic Unit	Material Description	Unit Weight (pcf)	MC %	Fines %	LL	PI	Organic Content %	Specific Gravity
10BH-026	S-16A	63			63	64.5	-53.6	Yorktown Formation	SC							
10BH-026	S-16B	64.5			64.5	65	-55.1	Yorktown Formation	SC							
10BH-026	S-17	68			68	70	-58.6	Yorktown Formation	SC							
10BH-026	P-3	71			71	73	-61.6	Yorktown Formation	SC							
10BH-026	S-18	73			73	75	-63.6	Yorktown Formation	SC							
10BH-026	S-19	78			78	80	-68.6	Yorktown Formation	SC							
10BH-027	S-1A	0			0	0.7	9.5	Fill	CL							
10BH-027	S-1B	0.7			0.7	1.4	8.8	Fill	GP							
10BH-027	S-1C	1.4			1.4	2	8.1	Fill	SC							
10BH-027	S-2	2			2	4	7.5	Fill	SM							
10BH-027	S-3	4			4	6	5.5	Coarse Alluvium	SC							
10BH-027	S-4A	6			6	7	3.5	Fine Alluvium	OH							
10BH-027	S-4B	7			7	8	2.5	Coarse Alluvium	SC							
10BH-027	S-5	8			8	10	1.5	Fine Alluvium	CH							
10BH-027	S-6	13			13	15	-3.5	Fine Alluvium	CH							
10BH-027	P-1	16			16	18	-6.5	Coarse Alluvium	SC							
10BH-027	S-7A	18			18	18.7	-8.5	Fine Alluvium	CH							
10BH-027	S-7B	18.7			18.7	19.4	-9.2	Coarse Alluvium	SC							
10BH-027	S-7C	19.4			19.4	20	-9.9	Fine Alluvium	CH							
10BH-027	S-8A	23			23	24.5	-13.5	Fine Alluvium	CH							
10BH-027	S-8B	24.5			24.5	25	-15	Coarse Alluvium	SC							
10BH-027	S-9	28			28	30	-18.5	Fine Alluvium	OH							
10BH-027	S-10	33			33	35	-23.5	Fine Alluvium	OH							
10BH-027	S-11	38			38	40	-28.5	Fine Alluvium	OH							
10BH-027	S-12A	43			43	44	-33.5	Fine Alluvium	ML							
10BH-027	S-12B	44			44	45	-34.5	Tabb Formation	SM							
10BH-027	S-13	48			48	50	-38.5	Tabb Formation	SM							
10BH-027	S-14	53			53	55	-43.5	Yorktown Formation	SC							
10BH-027	S-15	58			58	60	-48.5	Yorktown Formation	SC							
10BH-027	S-16	63			63	65	-53.5	Yorktown Formation	SC							
10BH-027	P-2	66			66	68	-56.5	Yorktown Formation	SC							
10BH-027	S-17	68			68	70	-58.5	Yorktown Formation	SC							
10BH-027	S-18	73			73	75	-63.5	Yorktown Formation	SC							
10BH-027	S-19	78			78	80	-68.5	Yorktown Formation	SC							
10BH-028	S-1	0			0	2	10	FILL	SC							
10BH-028	S-2	2			2	4	8	Coarse Alluvium	SP-SM							
10BH-028	S-3	4			4	6	6	Coarse Alluvium	SP-SM							
10BH-028	S-4	6			6	8	4	Coarse Alluvium	SP-SM							
10BH-028	S-5	8			8	10	2	Coarse Alluvium	SP-SM							
10BH-028	S-6	13			13	15	-3	Coarse Alluvium	SM							
10BH-028	S-7A	18			18	19	-8	Coarse Alluvium	SM							
10BH-028	S-7B	19			19	20	-9	Coarse Alluvium	SM							
10BH-028	S-8	23			23	25	-13	Fine Alluvium	CH							
10BH-028	S-9	28			28	30	-18	Fine Alluvium	CH							
10BH-029	S-1	0			0	2	4.6	FILL	SM							
10BH-029	S-2	2			2	4	2.6	Coarse Alluvium	SM							
10BH-029	S-3	4			4	6	0.6	Coarse Alluvium	SM							
10BH-029	S-4	6			6	8	-1.4	Coarse Alluvium	SM							
10BH-029	S-5	8			8	10	-3.4	Coarse Alluvium	SM							
10BH-029	S-6	13			13	15	-8.4	Fine Alluvium	CH							
10BH-029	S-7	18			18	20	-13.4	Fine Alluvium	CH							
10BH-029	S-8	23			23	25	-18.4	Fine Alluvium	CH							
10BH-029	S-9	28			28	30	-23.4	Fine Alluvium	CH							
10BH-030	S-1	0			0	2	6.1	FILL	ML							
10BH-030	S-2	2			2	4	4.1	FILL	SM							
10BH-030	S-3	4			4	6	2.1	FILL	GM							
10BH-030	S-4	6			6	8	0.1	Coarse Alluvium	SM							
10BH-030	S-5	8			8	10	-1.9	Coarse Alluvium	SM							
10BH-030	S-6A	13			13	14	-6.9	Coarse Alluvium	SM							
10BH-030	S-6B	14			14	15	-7.9	Fine Alluvium	CH							
10BH-030	S-7	18			18	20	-11.9	Fine Alluvium	CH							
10BH-030	S-8	23			23	25	-16.9	Fine Alluvium	CH							
10BH-030	S-9	28			28	30	-21.9	Fine Alluvium	CH							

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Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Natural Moisture (%)	Liquid Limit	Plastic Limit	Plasticity Index	Oven Dry Liquid Limit	Organic Content (%)	% Passing No. 200 Sieve	% Passing No. 40 Sieve	% Retained No. 4 Sieve	Specific Gravity
10BH-001	4.0 - 6.0	Jar	Dark brown and black, fine to coarse silty SAND, contains brick fragments, crushed stone and organics, SM (Visual)	73.9	--	--	--	--	--	33.3	51.6	19.7	--
10BH-001	8.0 - 10.0	Jar	Light gray, fine to medium poorly graded SAND with silt, SP-SM (Visual)	24.8	--	--	--	--	--	11.0	99.7	--	--
10BH-001	18.0 - 20.0	Jar	Dark gray, fat CLAY, trace sand, CH (Visual)	64.1	92	26	66	--	2.6	--	--	--	--
10BH-001	23.0 - 24.0	Jar	Gray-brown, organic CLAY, OH (Visual)	59.9	85	34	51	62	--	--	--	--	--
10BH-001	28.0 - 30.0	Jar	Gray, sandy lean CLAY, CL	22.4	25	16	9	--	--	58.6	99.4	--	--
10BH-001	48.0 - 50.0	Jar	Gray, fine to coarse silty SAND, contains shell fragments, SM	35.6	NP	NP	NP	--	--	26.5	94.8	0.2	2.74
10BH-001	58.0 - 60.0	Jar	Gray, fine to medium silty SAND, contains shell fragments, SM	34.9	28	25	3	--	--	29.4	95.8	0.1	--

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Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Natural Moisture (%)	Liquid Limit	Plastic Limit	Plasticity Index	Oven Dry Liquid Limit	Organic Content (%)	% Passing No. 200 Sieve	% Passing No. 40 Sieve	% Retained No. 4 Sieve	Specific Gravity
10BH-002	4.0 - 6.0	Jar	Orange-brown, fine to coarse clayey SAND, SC (Visual)	15.0	--	--	--	--	--	28.0	91.9	0.0	--
10BH-002	6.0 - 7.0	Jar	Orange-brown, fine to medium silty SAND, SM (Visual)	20.8	NP	NP	NP	--	--	--	--	--	--
10BH-002	13.0 - 15.0	Jar	Light gray, poorly graded SAND with silt, contains large sizes of crushed stone and asphalt, SP-SM (Visual)	20.0	--	--	--	--	--	8.0	74.5	4.5	--
10BH-002	23.0 - 25.0	Jar	Dark gray, fat CLAY, trace sand, CH (Visual)	60.2	--	--	--	--	2.1	--	--	--	--
10BH-002	28.0 - 30.0	Jar	Gray, fat CLAY, trace sand, CH (Visual)	61.9	68	25	43	--	--	--	--	--	--
10BH-002	33.0 - 35.0	Jar	Dark gray, fat CLAY, trace sand, CH (Visual)	68.7	--	--	--	--	2.2	--	--	--	--
10BH-002	43.0 - 45.0	Jar	Gray, fat CLAY, trace sand, CH (Visual)	53.6	69	27	42	--	--	--	--	--	--

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Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Natural Moisture (%)	Liquid Limit	Plastic Limit	Plasticity Index	Oven Dry Liquid Limit	Organic Content (%)	% Passing No. 200 Sieve	% Passing No. 40 Sieve	% Retained No. 4 Sieve	Specific Gravity
10BH-002	58.0 - 60.0	Jar	Gray, fine silty SAND, contains shell fragments, SM (Visual)	29.5	--	--	--	--	--	24.5	86.7	4.1	--
10BH-002	64.0 - 65.0	Jar	Gray, fine to medium clayey SAND, contains shell fragments, SC	28.1	35	21	14	--	--	31.9	72.9	6.0	--
10BH-002	73.0 - 75.0	Jar	Gray, fine to medium silty SAND, contains shell fragments, SM	27.9	22	21	1	--	--	21.3	96.2	0.0	--
10BH-003	0.5 - 2.0	Jar	Gray-brown, silty SAND, contains glass, cement and crushed stone, SM (Visual)	6.0	--	--	--	--	--	16.0	34.3	21.9	--
10BH-003	8.0 - 10.0	Jar	Light gray-brown, fine to medium poorly graded SAND with silt, contains metal pieces, SP-SM (Visual)	19.1	--	--	--	--	--	8.5	85.2	0.7	--
10BH-003	13.0 - 15.0	Jar	Gray, fine to coarse clayey SAND, contains crushed stone, SC	23.5	40	16	24	--	--	14.9	59.2	22.4	2.69
10BH-003	18.0 - 20.0	Jar	Gray, sandy organic CLAY, contains pieces of metal, OH (Visual)	53.9	56	22	34	35	--	--	--	--	--

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Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Natural Moisture (%)	Liquid Limit	Plastic Limit	Plasticity Index	Oven Dry Liquid Limit	Organic Content (%)	% Passing No. 200 Sieve	% Passing No. 40 Sieve	% Retained No. 4 Sieve	Specific Gravity
10BH-003	38.0 - 40.0	Jar	Gray, fat CLAY, trace sand, CH (Visual)	63.1	83	25	58	--	--	--	--	--	--
10BH-003	43.0 - 45.0	Jar	Gray, fat CLAY, trace sand, contains mica, CH (Visual)	62.8	84	29	55	--	--	--	--	--	--
10BH-003	53.0 - 54.0	Jar	Gray, fat CLAY, trace sand, contains shell fragments, CH (Visual)	68.8	88	28	60	--	--	--	--	--	--
10BH-003	58.0 - 60.0	Jar	Dark gray, fat CLAY, trace sand, CH (Visual)	66.3	84	28	56	--	3.6	--	--	--	--
10BH-003	63.0 - 65.0	Jar	Dark gray, organic SILT, trace sand, OH (Visual)	85.5	130	55	75	75	--	--	--	--	--
10BH-003	68.0 - 70.0	Jar	Dark gray, fat CLAY, trace sand, CH (Visual)	69.7	--	--	--	--	5.6	--	--	--	--
10BH-003	78.0 - 80.0	Jar	Brown-gray, fine poorly graded SAND with silt, contains mica, SP-SM (Visual)	23.2	--	--	--	--	--	11.1	99.2	--	--

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Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Natural Moisture (%)	Liquid Limit	Plastic Limit	Plasticity Index	Oven Dry Liquid Limit	Organic Content (%)	% Passing No. 200 Sieve	% Passing No. 40 Sieve	% Retained No. 4 Sieve	Specific Gravity
10BH-003	84.0 - 85.0	Jar	Gray, fine silty SAND, SM (Visual)	38.5	33	24	9	--	--	--	--	--	--
10BH-003	88.0 - 90.0	Jar	Gray, fine to medium silty SAND, contains shell fragments, SM (Visual)	32.3	28	23	5	--	--	--	--	--	--
10BH-003	93.0 - 95.0	Jar	Dark gray, fine to medium clayey SAND, contains shell fragments and mica, SC (Visual)	31.8	--	--	--	--	--	17.9	96.4	1.4	--
10BH-004	2.0 - 4.0	Jar	Yellow-brown, fine to coarse clayey SAND, contains crushed stone, SC (Visual)	8.5	--	--	--	--	--	19.7	40.8	19.2	--
10BH-004	6.0 - 8.0	Jar	Dark gray, sandy lean CLAY, CL (Visual)	28.7	40	17	23	--	1.5	--	--	--	--
10BH-004	13.0 - 15.0	Jar	Gray-brown, fine to medium poorly graded SAND, trace silt, contains shell fragments, SP (Visual)	26.9	--	--	--	--	--	1.6	96.1	0.1	--
10BH-004	18.0 - 20.0	Jar	Gray, fine to coarse poorly graded SAND with silt, trace gravel, SP-SM	24.5	NP	NP	NP	--	--	11.3	86.7	0.2	2.67

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Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Natural Moisture (%)	Liquid Limit	Plastic Limit	Plasticity Index	Oven Dry Liquid Limit	Organic Content (%)	% Passing No. 200 Sieve	% Passing No. 40 Sieve	% Retained No. 4 Sieve	Specific Gravity
10BH-004	33.0 - 35.0	Jar	Dark gray, fat CLAY, trace sand, CH (Visual)	63.9	76	27	49	--	--	--	--	--	--
10BH-004	43.0 - 45.0	Jar	Dark gray, fat CLAY, trace sand, CH (Visual)	62.2	62	23	39	--	--	--	--	--	--
10BH-004	48.0 - 50.0	Jar	Dark gray, fat CLAY, trace sand, CH (Visual)	--	58	20	38	--	--	--	--	--	--
10BH-004	68.0 - 70.0	Jar	Dark gray, organic CLAY, trace sand, OH (Visual)	57.8	84	27	57	52	--	--	--	--	--
10BH-004	73.0 - 75.0	Jar	Dark gray, fat CLAY, trace sand, CH (Visual)	64.9	--	--	--	--	7.2	--	--	--	--
10BH-004	83.0 - 84.0	Jar	Dark brown-gray, fine to medium poorly graded SAND with silt, SP-SM (Visual)	20.7	--	--	--	--	--	5.6	86.1	0.0	--
10BH-004	93.0 - 95.0	Jar	Gray-brown, fine to coarse poorly graded SAND with silt, contains gravel, SP-SM (Visual)	18.4	--	--	--	--	--	7.0	74.1	3.7	--

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Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Natural Moisture (%)	Liquid Limit	Plastic Limit	Plasticity Index	Oven Dry Liquid Limit	Organic Content (%)	% Passing No. 200 Sieve	% Passing No. 40 Sieve	% Retained No. 4 Sieve	Specific Gravity
10BH-004	103.0 - 105.0	Jar	Green-gray, fine to medium clayey SAND, contains shell fragments and mica, SC (Visual)	36.1	--	--	--	--	--	23.6	97.3	0.0	--
10BH-004	108.0 - 110.0	Jar	Gray, fine to coarse silty SAND, contains shell fragments, SM	35.8	40	26	14	--	--	41.1	99.6	--	2.74
10BH-013	2.0 - 4.0	Jar	Orange-brown, fine to coarse silty SAND, SM (Visual)	15.7	--	--	--	--	--	18.2	81.4	0.0	--
10BH-013	6.0 - 8.0	Jar	Brown, fine to coarse poorly graded SAND with silt, SP-SM (Visual)	17.4	--	--	--	--	--	7.4	74.6	0.0	--
10BH-013	17.0 - 19.0	Jar	Gray-brown, fine to coarse poorly graded SAND with silt, contains gravel, wood and mica, SP-SM (Visual)	28.8	--	--	--	--	--	6.0	88.7	1.2	--
10BH-013	33.0 - 35.0	Jar	Dark gray, fat CLAY, trace sand, CH (Visual)	51.8	64	25	39	--	--	--	--	--	--
10BH-013	43.0 - 45.0	Jar	Gray, fat CLAY, trace sand, CH (Visual)	77.2	--	--	--	--	4.7	--	--	--	--

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Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Natural Moisture (%)	Liquid Limit	Plastic Limit	Plasticity Index	Oven Dry Liquid Limit	Organic Content (%)	% Passing No. 200 Sieve	% Passing No. 40 Sieve	% Retained No. 4 Sieve	Specific Gravity
10BH-013	53.0 - 55.0	Jar	Gray, fine to medium silty SAND, contains organics, SM	31.8	24	21	3	--	--	42.9	98.7	--	--
10BH-013	63.0 - 65.0	Jar	Gray, fine to medium silty SAND, contains shell fragments and mica, SM	31.6	27	25	2	--	--	17.5	96.7	1.8	--
10BH-013	73.0 - 75.0	Jar	Gray, fine to medium silty SAND, contains shell fragments, SM (Visual)	32.5	32	26	6	--	--	--	--	--	--
10BH-014	2.0 - 4.0	Jar	Brown, fine to coarse poorly graded SAND with silt, contains gravel, SP-SM	15.1	NP	NP	NP	--	--	8.6	70.9	1.5	--
10BH-014	6.0 - 8.0	Jar	Orange-brown, poorly graded SAND, trace silt, contains gravel, SP (Visual)	23.0	--	--	--	--	--	3.4	68.1	3.6	--
10BH-014	43.0 - 45.0	Jar	Dark gray, silty SAND, SM	34.8	--	--	--	--	1.5	14.2	50.1	0.0	--
10BH-014	48.0 - 50.0	Jar	Blue-gray, fine silty SAND, contains mica, SM	30.5	28	23	5	--	--	20.0	99.3	--	--

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Summary Of Laboratory Tests

Project Number: 10613051 Task 21

Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Natural Moisture (%)	Liquid Limit	Plastic Limit	Plasticity Index	Oven Dry Liquid Limit	Organic Content (%)	% Passing No. 200 Sieve	% Passing No. 40 Sieve	% Retained No. 4 Sieve	Specific Gravity
10BH-014	58.0 - 60.0	Jar	Gray, fine silty SAND, contains shell fragments, SM	33.0	27	24	3	--	--	16.6	98.6	0.3	--
10BH-015	2.0 - 4.0	Jar	Black, silty SAND, contains coal and gravel, SM (Visual) (Strong petroleum odor)	35.9	--	--	--	--	--	12.1	33.4	31.2	--
10BH-015	8.0 - 10.0	Jar	Dark gray, fat CLAY with sand, contains organics, CH (Visual)	38.2	--	--	--	--	--	71.9	--	--	--
10BH-015	13.0 - 15.0	Jar	Dark gray, fat CLAY, trace sand, CH (Visual)	62.5	--	--	--	--	7.1	--	--	--	--
10BH-015	23.0 - 25.0	Jar	Gray, sandy lean CLAY, CL	34.4	30	15	15	--	3.4	60.4	77.0	0.0	--
10BH-015	38.0 - 40.0	Jar	Brown, fine to medium poorly graded SAND, trace silt, SP	21.4	--	--	--	--	0.1	4.7	59.1	0.0	--
10BH-015	53.0 - 55.0	Jar	Gray, fine to medium silty SAND, contains shell fragments, SM	31.6	28	24	4	--	--	16.6	98.2	0.7	--

Notes:
1. Soil tests in general accordance with ASTM standards.
2. Soil classifications are in general accordance with ASTM D2487(as applicable), based on testing indicated and visual classification.
3. Key to abbreviations: NP=Non-Plastic; -- indicates no test performed

Schnabel ENGINEERING

Project: MTT, DTT & MLK Exp. Project

Norfolk & Portsmouth, VA

DYNAMIC LAB SUMMARY 10613051 TASK 21 -MASTER.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 9/15/10

Summary Of Laboratory Tests

Project Number: 10613051 Task 21

Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Natural Moisture (%)	Liquid Limit	Plastic Limit	Plasticity Index	Oven Dry Liquid Limit	Organic Content (%)	% Passing No. 200 Sieve	% Passing No. 40 Sieve	% Retained No. 4 Sieve	Specific Gravity
10BH-016	4.0 - 6.0	Jar	Dark brown, fine to medium silty SAND, contains coal, organics and wood, SM (Visual)	38.4	--	--	--	--	--	28.6	46.2	24.5	--
10BH-016	8.0 - 10.0	Jar	Dark brown, sandy lean CLAY, CL	18.5	26	16	10	--	1.6	52.4	72.3	0.0	--
10BH-016	13.0 - 15.0	Jar	Dark brown, silty SAND, SM (Visual)	42.0	--	--	--	--	1.6	--	--	--	--
10BH-016	29.0 - 30.0	Jar	Brown, fine to medium clayey SAND, contains shell fragments, SC (Visual)	34.6	--	--	--	--	--	30.1	--	--	--
10BH-016	33.0 - 35.0	Jar	Light brown and gray, fine to medium poorly graded SAND with silt, SP-SM (Visual)	23.7	NP	NP	NP	--	--	--	--	--	--
10BH-016	43.0 - 45.0	Jar	Orange-brown and gray, fine to medium poorly graded SAND with silt, SP-SM (Visual)	17.8	--	--	--	--	--	6.2	48.8	0.4	--
10BH-016	48.0 - 50.0	Jar	Gray, fine to medium silty SAND, contains shell fragments, SM	29.0	26	22	4	--	--	14.7	--	--	--

Notes:
1. Soil tests in general accordance with ASTM standards.
2. Soil classifications are in general accordance with ASTM D2487(as applicable), based on testing indicated and visual classification.
3. Key to abbreviations: NP=Non-Plastic; -- indicates no test performed

Schnabel ENGINEERING

Project: MTT, DTT & MLK Exp. Project

Norfolk & Portsmouth, VA

DYNAMIC LAB SUMMARY 10613051 TASK 21 -MASTER.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 9/15/10

LABORATORY DATA SUMMARY

Project: **Midtown Tunnel**
(Split Spoon Samples)
Boring Number: 10BH-005

Project Number: **4955-110**
Date: **09/30/10**

SAMPLE NUMBER	DEPTH (FEET)	CLASS.	MOISTURE CONTENT (%)	% FINES	LL	PL	PI	ORGANIC MATTER (%)	OTHER TESTS
S3A	12 to 13	CH	77.8	-	84	28	56	-	-
S4	17 to 19	CH	77.9	87.7	94	31	63	-	SIEVE
S6	27 to 29	CL	47.2	55.5	-	-	-	3.1	SIEVE
S7	32 to 34	CL	41.8	-	-	-	-	-	-
S8	37 to 39	OH	78.3	-	107	38	69	6.3	-
S9A	42 to 43	OH	83.2	-	-	-	-	-	-
S9B	43 to 44	OH	134.6	-	196	121	75	-	-
S10	47 to 49	OH	76.2	-	106	42	64	-	-
S11	52 to 54	SP-SM	23.3	7.2	-	-	-	-	SIEVE, CORROSIVES
S12	57 to 59	SP-SM	23.0	-	-	-	-	-	CORROSIVES
S13	62 to 64	SP-SM	23.3	11.6	23	23	0	-	SIEVE, CORROSIVES
S14	67 to 69	SP-SM	19.7	-	-	-	-	-	CORROSIVES
S15	72 to 74	SP-SM	12.2	6.2	-	-	-	-	SIEVE, CORROSIVES
S16	77 to 79	SM	19.8	-	20	20	0	-	CORROSIVES
S18	87 to 89	SC	33.9	41.0	49	19	30	-	HYDROMETER/SIEVE
S20	97 to 99	SC	36.2	31.6	45	16	29	-	SIEVE
S21	102 to 104	SC	32.5	-	39	19	20	-	-
S22	107 to 109	SM	31.0	-	-	-	-	-	-

Organic Matter % Furnace Temperature: 440° C

Tests performed in accordance with applicable ASTM Standards.

etc.

LABORATORY DATA SUMMARY

Project: **Midtown Tunnel**
(Split Spoon Samples)
Boring Number: 10BH-006

Project Number: **4955-110**
Date: **09/30/10**

SAMPLE NUMBER	DEPTH (FEET)	CLASS.	MOISTURE CONTENT (%)	% FINES	LL	PL	PI	ORGANIC MATTER (%)	OTHER TESTS
S1B	3 to 4	CH	90.0	-	87	26	61	-	-
S2	7 to 9	CH	66.8	-	-	-	-	-	-
S4A	17 to 17.5	CH	55.2	-	57	17	40	3.1	-
S4B	17.5 to 18.5	CH	74.0	-	-	-	-	-	-
S4C	18.5 to 19	PT	145.1	-	292	108	184	20.1	-
S5	22 to 24	OH	78.1	97.7	104	31	73	7.0	HYDROMETER/SIEVE
S7	32 to 34	CH	76.2	-	-	-	-	-	-
S8A	37 to 38	OH	91.4	-	116	31	85	7.8	-
S9	42 to 44	SP-SM	21.3	5.3	-	-	-	-	SIEVE
S10A	47 to 48	SM	41.6	-	-	-	-	-	-
S10B	48 to 49	SP-SM	19.5	6.6	-	-	-	-	SIEVE
S11	52 to 54	SC-SM	25.6	14.1	16	12	4	-	SIEVE
S12	57 to 59	SM	13.5	-	-	-	-	-	-
S13	62 to 64	SC	35.6	34.6	48	23	25	-	SIEVE
S15	72 to 74	SC	33.8	-	47	18	29	-	-
S17	82 to 84	SC	33.8	27.1	37	22	15	-	SIEVE
S19	92 to 94	SC	32.9	-	-	-	-	-	-

Organic Matter % Furnace Temperature: 440° C

Tests performed in accordance with applicable ASTM Standards.

etc.

LABORATORY DATA SUMMARY

Project: **Midtown Tunnel**
(Split Spoon Samples)
Boring Number: 10BH-007

Project Number: **4955-110**
Date: **09/30/10**

SAMPLE NUMBER	DEPTH (FEET)	CLASS.	MOISTURE CONTENT (%)	% FINES	LL	PL	PI	ORGANIC MATTER (%)	OTHER TESTS
S2	6 to 8	OH	94.0	-	107	31	76	3.7	-
S3	11 to 13	OH	84.3	-	-	-	-	-	-
S4A	16 to 17	OH	74.9	-	-	-	-	-	-
S5	21 to 23	SP-SM	27.2	7.8	-	-	-	-	SIEVE
S6A	26 to 27	SM	32.6	-	32	32	0	-	-
S7	31 to 33	SP-SM	23.0	-	24	24	0	-	-
S8A	36 to 36.5	SP-SM	12.8	5.8	-	-	-	-	SIEVE
S8B	36.5 to 37	SC	29.5	20.7	38	24	14	-	SIEVE
S9	41 to 43	SC	33.8	-	43	24	19	-	-
S11	51 to 53	SC	33.6	39.0	49	22	27	-	SIEVE
S13	61 to 63	SM	33.4	-	-	-	-	-	-
S14	66 to 68	SC	34.4	-	46	21	25	-	-
S15	71 to 73	SC	29.6	29.3	-	-	-	-	SIEVE
S16	76 to 78	SM	30.8	-	-	-	-	-	-
S17	81 to 83	SM	31.8	27.6	-	-	-	-	SIEVE
S18	86 to 88	SC	28.4	-	40	22	18	-	-

Organic Matter % Furnace Temperature: 440° C

Tests performed in accordance with applicable ASTM Standards.

etc.

LABORATORY DATA SUMMARY

Project: **Midtown Tunnel**
(Split Spoon Samples)
Boring Number: 10BH-008

Project Number: **4955-110**
Date: **09/30/10**

SAMPLE NUMBER	DEPTH (FEET)	CLASS.	MOISTURE CONTENT (%)	% FINES	LL	PL	PI	ORGANIC MATTER (%)	OTHER TESTS
S2	6.5 to 8.5	OH	92.2	-	111	33	78	-	-
S3	11.5 to 13.5	OH	91.5	-	138	35	103	6.5	-
S4	16.5 to 18.5	SP-SM	29.9	7.1	21	21	0	-	SIEVE
S5	21.5 to 23.5	SM	35.4	-	25	25	0	-	-
S7A	31.5 to 32.5	SM	25.4	12.1	15	15	0	-	SIEVE
S7B	32.5 to 33.5	SP-SM	23.9	6.0	-	-	-	-	SIEVE
S8	36.5 to 38.5	SM	33.7	-	44	31	13	-	CORROSIVES
S9	41.5 to 43.5	SM	33.1	-	41	28	13	-	CORROSIVES
S10	46.5 to 48.5	SC	34.3	31.1	47	25	22	-	SIEVE
S11	51.5 to 53.5	SC	36.1	-	-	-	-	-	CORROSIVES
S12	56.5 to 58.5	SC	35.2	40.7	55	18	37	-	SIEVE, CORROSIVES
S13	61.5 to 63.5	SC	36.7	-	52	20	32	-	-
S14	66.5 to 68.5	SC	31.6	-	-	-	-	-	-
S16	76.5 to 78.5	SC	27.6	26.9	39	23	16	-	HYDROMETER/SIEVE
S18	86.5 to 88.5	SM	28.5	29.1	-	-	-	-	SIEVE

Organic Matter % Furnace Temperature: 440° C

Tests performed in accordance with applicable ASTM Standards.

etc.

LABORATORY DATA SUMMARY

Project: **Midtown Tunnel**
(Split Spoon Samples)
Boring Number: 10BH-009

Project Number: **4955-110**
Date: **09/30/10**

SAMPLE NUMBER	DEPTH (FEET)	CLASS.	MOISTURE CONTENT (%)	% FINES	LL	PL	PI	ORGANIC MATTER (%)	OTHER TESTS
S2	8 to 10	CH	80.5	-	89	26	63	-	-
S3	13 to 15	CH	87.6	98.8	97	26	71	3.1	SIEVE
S4	15 to 17	CH	89.1	-	100	26	74	-	-
S5	20 to 22	CH	79.1	-	-	-	-	-	-
S7	30 to 32	CH	79.3	-	103	27	76	-	-
S8	35 to 37	CH	88.4	-	-	-	-	-	-
S9	40 to 42	CH	86.1	-	112	29	83	-	-
S11	50 to 52	SP	16.6	4.6	-	-	-	-	SIEVE
S13	60 to 62	SC	32.5	18.7	38	23	15	-	SIEVE
S15	70 to 72	SC	37.7	-	45	19	26	-	-
S16	75 to 77	SC	35.2	-	-	-	-	-	-
S18	85 to 87	SC	34.5	39.7	55	17	38	-	SIEVE

Organic Matter % Furnace Temperature: 440° C

Tests performed in accordance with applicable ASTM Standards.

LABORATORY DATA SUMMARY

Project: **Midtown Tunnel**
(Split Spoon Samples)
Boring Number: 10BH-010

Project Number: **4955-110**
Date: **09/30/10**

SAMPLE NUMBER	DEPTH (FEET)	CLASS.	MOISTURE CONTENT (%)	% FINES	LL	PL	PI	ORGANIC MATTER (%)	OTHER TESTS
S2	5 to 7	CH	73.1	-	77	19	58	-	-
S3	10 to 12	CH	90.7	-	101	23	78	-	-
S4	15 to 17	CH	97.7	98.8	110	24	86	6.6	SIEVE
S6	25 to 27	CH	80.8	-	102	25	77	-	-
S7	30 to 32	CH	79.8	-	-	-	-	-	-
S8	35 to 37	CH	74.7	98.3	103	26	77	-	SIEVE
S9	40 to 42	CH	83.6	-	104	27	77	-	-
S10A	45 to 46	CH	80.1	-	-	-	-	4.7	-
S10B	46 to 47	CH	31.6	-	-	-	-	-	-
S11	50 to 52	SC	26.7	21.8	31	24	7	-	SIEVE
S13	60 to 62	SM	33.9	-	38	29	9	-	-
S14	65 to 67	SC	31.7	21.7	-	-	-	-	SIEVE
S15	70 to 72	SM	30.8	19.4	39	28	11	-	SIEVE
S16	75 to 77	SC	39.5	-	-	-	-	-	-
S17	80 to 82	SM	38.7	-	48	29	19	-	-
S18	85 to 87	SC	33.0	36.3	-	-	-	-	SIEVE

Organic Matter % Furnace Temperature: 440° C

Tests performed in accordance with applicable ASTM Standards.

etc.

LABORATORY DATA SUMMARY

Project: **Midtown Tunnel**
(Split Spoon Samples)
Boring Number: 10BH-011

Project Number: **4955-110**
Date: **09/30/10**

SAMPLE NUMBER	DEPTH (FEET)	CLASS.	MOISTURE CONTENT (%)	% FINES	LL	PL	PI	ORGANIC MATTER (%)	OTHER TESTS
S2	7 to 9	CL	56.5	-	-	-	-	-	-
S4	17 to 19	CH	90.5	-	108	27	81	-	-
S7A	32 to 33	CL	54.2	-	-	-	-	-	-
S7B	33 to 34	CH	75.9	-	63	18	45	-	-
S8B	38 to 39	SM	29.8	15.7	-	-	-	-	SIEVE
S9	42 to 44	SM	34.1	-	-	-	-	-	-
S10	47 to 49	SC	33.9	-	-	-	-	-	CORROSIVES
S11	52 to 54	SM	31.3	21.1	-	-	-	-	SIEVE, CORROSIVES
S12	57 to 59	SM	33.5	-	40	26	14	-	CORROSIVES
S13	62 to 64	SM	36.1	-	-	-	-	-	CORROSIVES
S14	67 to 69	SM	31.2	-	-	-	-	-	CORROSIVES
S15	72 to 74	SM	32.9	22.6	41	31	10	-	SIEVE
S17	82 to 84	SM	35.4	28.7	-	-	-	-	SIEVE
S19	92 to 94	SC	39.2	-	-	-	-	-	-

Organic Matter % Furnace Temperature: 440° C

Tests performed in accordance with applicable ASTM Standards.

etc.

LABORATORY DATA SUMMARY

Project: **Midtown Tunnel**
(Split Spoon Samples)
Boring Number: 10BH-012

Project Number: **4955-110**
Date: **09/30/10**

SAMPLE NUMBER	DEPTH (FEET)	CLASS.	MOISTURE CONTENT (%)	% FINES	LL	PL	PI	ORGANIC MATTER (%)	OTHER TESTS
S1	11 to 13	CH	70.0	84.1	83	22	61	-	SIEVE
S2	21 to 23	SC	34.9	30.0	35	19	16	-	SIEVE
S3	26 to 28	SP-SM	10.9	6.2	-	-	-	-	SIEVE
S4	31 to 33	SM	30.4	14.5	31	29	2	-	SIEVE
S6	41 to 43	SM	36.0	22.9	33	25	8	-	SIEVE
S7	46 to 48	SC	30.4	-	-	-	-	-	-
S9	61 to 63	SM	35.6	18.4	41	29	12	-	SIEVE
S10	71 to 73	SM	35.1	24.7	43	30	13	-	SIEVE

Organic Matter % Furnace Temperature: 440° C

Tests performed in accordance with applicable ASTM Standards.

LABORATORY DATA SUMMARY

Project: **Midtown Tunnel**
(Split Spoon Samples)
Boring Number: 10BH-019

Project Number: **4955-110**
Date: **09/30/10**

SAMPLE NUMBER	DEPTH (FEET)	CLASS.	MOISTURE CONTENT (%)	% FINES	LL	PL	PI	ORGANIC MATTER (%)	OTHER TESTS
S2	5 to 7	OH	143.7	-	145	31	114	4.4	-
S4A	15 to 16	OH	129.6	-	138	34	104	-	-
S4B	16 to 17	CH	83.2	-	105	27	78	3.0	-
S5	20 to 22	CH	59.0	-	-	-	-	-	-
S6	25 to 27	CH	75.5	-	101	26	75	-	-
S7	30 to 32	OH	82.7	-	-	-	-	-	CORROSIVES
S8	35 to 37	CH	78.5	-	115	34	81	-	CORROSIVES
S9	40 to 42	OH	104.6	88.3	156	44	112	-	SIEVE, CORROSIVES
S10A	45 to 46	OH	88.7	97.1	124	35	89	-	SIEVE
S10B	46 to 47	SM	23.6	-	-	-	-	-	-
S11	50 to 52	SP	19.8	4.9	-	-	-	-	SIEVE
S12	55 to 57	SM	17.2	-	13	13	0	-	-
S13B	60 to 62	SM	35.6	17.2	-	-	-	-	SIEVE
S16	75 to 77	SC	33.8	-	49	26	23	-	-

Organic Matter % Furnace Temperature: 440° C

Tests performed in accordance with applicable ASTM Standards.

LABORATORY DATA SUMMARY

Project: **Midtown Tunnel**
(Split Spoon Samples)
Boring Number: 10BH-020

Project Number: **4955-110**
Date: **09/30/10**

SAMPLE NUMBER	DEPTH (FEET)	CLASS.	MOISTURE CONTENT (%)	% FINES	LL	PL	PI	ORGANIC MATTER (%)	OTHER TESTS
S1B	4.5 to 5.5	CH	60.7	-	78	20	58	-	-
S3	13.5 to 15.5	CH	79.8	-	94	26	68	-	-
S4	18.5 to 20.5	CH	108.1	-	-	-	-	3.1	-
S5	23.5 to 25.5	CH	80.2	-	96	28	68	-	-
S7	33.5 to 35.5	OH	81.8	-	122	28	94	3.4	-
S9A	43.5 to 44.5	PT	240.5	54.4	332	298	34	41.3	HYDROMETER/SIEVE
S9B	44.5 to 45.5	OH	113.9	89.3	178	61	117	-	SIEVE
S10	48.5 to 50.5	SM	27.6	26.1	20	20	0	-	SIEVE
S11	53.5 to 55.5	SM	19.2	-	-	-	-	-	CORROSIVES
S12A	58.5 to 59.5	SP-SM	33.7	7.5	-	-	-	-	SIEVE
S12B	59.5 to 60.5	OL	29.4	-	37	17	20	3.8	-
S13A	63.5 to 64.5	SP-SM	22.5	7.2	-	-	-	-	SIEVE
S13B	64.5 to 65.5	SM	23.5	-	-	-	-	0.2	-
S14A	68.5 to 69.5	SP-SM	19.4	6.6	-	-	-	-	SIEVE
S14B	69.5 to 70.5	SC	31.5	-	44	25	19	-	-
S15	73.5 to 75.5	SM	36.3	20.6	-	-	-	0.6	SIEVE
S16	78.5 to 80.5	SC	35.6	-	55	22	33	-	-

Organic Matter % Furnace Temperature: 440° C

Tests performed in accordance with applicable ASTM Standards.

etc.

Summary Of Laboratory Tests

Project Number: 10613051.00.21

Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Wet Natural Density (pcf)	Natural Moisture (%)	Liquid Limit	Plastic Limit	Plasticity Index	% Retained No. 4 Sieve	% Passing No. 200 Sieve	Percent Clay	Specific Gravity
10BH-003	30.0 - 32.0 -25.4 - -27.4	Tube	FAT CLAY (CH) - gray	101.2	61.0	80	27	53	0.0	98.6	41.3	2.71
10BH-004	40.0 - 42.0 -34.1 - -36.1	Tube	FAT CLAY (CH) - gray	92.5	79.7	99	33	66	0.0	98.4	46.7	2.73
10BH-013	35.0 - 37.0 -31.2 - -33.2	Tube	FAT CLAY (CH) - light gray	101.2	52.1	68	26	42	0.0	94.5	36.7	2.70
10BH-014	20.0 - 22.0 -16.2 - -18.2	Tube	FAT CLAY (CH), contains gravel - gray	92.7	58.4	91	32	59	0.8	85.1	--	--

Notes:
1. Soil tests in general accordance with ASTM standards.
2. Soil classifications are in general accordance with ASTM D2487(as applicable), based on testing indicated and visual classification.
3. Key to abbreviations: NP=Non-Plastic; -- indicates no test performed

Schnabel ENGINEERING

Project: MTT, DTT & MLK Exp. Project

Norfolk & Portsmouth, VA

DYNAMIC LAB SUMMARY 10613051 MTT LAB TESTING.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 9/27/10

Summary Of Laboratory Tests

Project Number: 10613051.00.21

Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Wet Natural Density (pcf)	Natural Moisture (%)	Liquid Limit	Oven Dry Liquid Limit	Plastic Limit	Plasticity Index	Organic Content (%)	% Retained No. 4 Sieve	% Passing No. 200 Sieve	Percent Clay	Specific Gravity	pH	Oxidation Reduction Potential (mV)	Resistivity (ohm-cm)	Sulfides
10BH-003	50.0 - 52.0 / -45.4 - -47.4	Tube	ORGANIC CLAY (OH) - gray	100.8	63.6	95	56	30	65	2.2	0.0	97.9	48.3	2.72	--	--	--	--
10BH-004	35.0 - 37.0 / -29.1 - -31.1	Tube	FAT CLAY (CH) - gray	93.6	70.7	97	--	32	65	--	0.0	98.8	46.4	2.72	--	--	--	--
10BH-004	45.0 - 47.0 / -39.1 - -41.1	Tube	FAT CLAY WITH SAND (CH) - gray	98.4	61.2	52	--	24	28	--	0.0	70.3	36.3	2.70	--	--	--	--
10BH-013	25.0 - 27.0 / -21.2 - -23.2	Tube	FAT CLAY (CH), contains shells - gray	97.1	63.4	83	--	29	54	--	0.0	95.9	--	--	--	--	--	--
10BH-013	45.0 - 46.0 / -41.2 - -42.2	Tube	SILTY SAND (SM), fine to medium, contains fibrous organics - gray	94.5	77.9	112	--	52	60	--	0.0	39.5	5.2	2.58	--	--	--	--
10BH-013	46.0 - 47.0 / -42.2 - -43.2	Tube	SILTY SAND (SM), fine to medium - gray	--	--	--	--	--	--	--	0.0	19.4	--	--	--	--	--	--
10BH-015	15.0 - 16.0 / -9.0 - -10.0	Tube	FAT CLAY (CH) - gray	93.7	62.8	79	--	27	52	--	0.0	96.6	--	--	--	--	--	--

Notes:
1. Soil tests in general accordance with ASTM standards.
2. Soil classifications are in general accordance with ASTM D2487(as applicable), based on testing indicated and visual classification.
3. Key to abbreviations: NP=Non-Plastic; -- indicates no test performed

Schnabel ENGINEERING

Project: MTT, DTT & MLK Exp. Project

Norfolk & Portsmouth, VA

DYNAMIC LAB SUMMARY 10613051 MTT LAB TESTING.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 10/8/10

Summary Of Laboratory Tests

Project Number: 10613051.00.21

Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Wet Natural Density (pcf)	Natural Moisture (%)	Liquid Limit	Oven Dry Liquid Limit	Plastic Limit	Plasticity Index	Organic Content (%)	% Retained No. 4 Sieve	% Passing No. 200 Sieve	Percent Clay	Specific Gravity	pH	Oxidation Reduction Potential (mV)	Resistivity (ohm-cm)	Sulfides
10BH-015	16.0 - 17.0 / -10.0 - -11.0	Tube	POORLY GRADED SAND WITH CLAY (SP-SC), fine to medium - gray	--	--	--	--	--	--	--	0.0	12.0	--	--	--	--	--	--

Notes:
1. Soil tests in general accordance with ASTM standards.
2. Soil classifications are in general accordance with ASTM D2487(as applicable), based on testing indicated and visual classification.
3. Key to abbreviations: NP=Non-Plastic; -- indicates no test performed

Schnabel ENGINEERING

Project: MTT, DTT & MLK Exp. Project

Norfolk & Portsmouth, VA

DYNAMIC LAB SUMMARY 10613051 MTT LAB TESTING.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 10/8/10

LABORATORY DATA SUMMARY

Project: **Midtown Tunnel (Tube Samples)**

Project Number: **4955-110**
Date: **10/18/10**

SAMPLE NUMBER	DEPTH (FEET)	CLASS.	SAMPLE LOCATION	MOISTURE CONTENT (%)	NATURAL DENSITY (pcf)	% FINES	LL	PL	PI	SPECIFIC GRAVITY	ORGANIC MATTER (%)	OTHER TESTS
10BH-005 (P1)	20 to 22	CH	BOTTOM	82.9	-	-	-	-	-	-	-	-
10BH-005 (P2)	45 to 47	OH	TOP	92.9	81.2	87.2	169	48	122	2.544	15.5	HYDROMETER, CU TRIAXIAL
			MIDDLE	92.2	90.2							
			BOTTOM	86.4	87.4							
10BH-006 (P1)	20 to 22	OH	BOTTOM	86.8	-	-	-	-	-	-	-	-
10BH-007 (P1)	14 to 16	OH	TOP	83.5	94.0	67.2	98	58	40	2.540	4.4	HYDROMETER, CU TRIAXIAL
			MIDDLE	66.4	96.0							
			BOTTOM	75.2	99.3							
10BH-008 (P1)	14.5 to 16.5	SM	BOTTOM	31.1	-	-	-	-	-	-	-	-
10BH-008 (P2)	39.5 to 41.5	SM	BOTTOM	33.4	-	-	-	-	-	-	-	-
10BH-009 (P1)	11 to 13	CH	BOTTOM	89.6	-	-	-	-	-	-	-	-
10BH-009 (P2)	23 to 25	CH	TOP	85.3	96.3	98.6	113	27	86	2.525	5.8	HYDROMETER, UU TRIAXIAL, CONSOLIDATION
			MIDDLE	97.8	93.9							
			BOTTOM	84.6	90.8							

Tests performed in accordance with applicable ASTM Standards.

etc.

LABORATORY DATA SUMMARY

Project: **Midtown Tunnel (Tube Samples)**

Project Number: **4955-110**
Date: **10/18/10**

SAMPLE NUMBER	DEPTH (FEET)	CLASS.	SAMPLE LOCATION	MOISTURE CONTENT (%)	NATURAL DENSITY (pcf)	% FINES	LL	PL	PI	SPECIFIC GRAVITY	ORGANIC MATTER (%)	OTHER TESTS
10BH-009 (P3)	43 to 45	CH	TOP	75.2	97.4	97.3	115	33	82	2.629	8.7	HYDROMETER, UU TRIAXIAL, UNCONFINED COMPRESSION
			MIDDLE	79.4	96.9							
			BOTTOM	82.9	96.1							
10BH-010 (P1)	13 to 15	CH	BOTTOM	90.6	-	-	-	-	-	-	-	-
10BH-010 (P2)	33 to 35	CH	BOTTOM	78.7	-	-	-	-	-	-	-	-
10BH-011 (P1)	10 to 12	CH	TOP	85.0	92.5	91.3	101	23	78	2.585	-	HYDROMETER, UU TRIAXIAL, CONSOLIDATION
			MIDDLE	96.6	93.8							
			BOTTOM	90.9	96.5							
10BH-011 (P2)	25 to 27	CH	TOP	84.6	93.3	92.5	100	26	74	2.655	-	HYDROMETER, UU TRIAXIAL, CONSOLIDATION
			MIDDLE	74.2	100.2							
			BOTTOM	77.1	99.2							
10BH-012 (P1)	16 to 18	CL	BOTTOM	46.0	-	-	-	-	-	-	-	-
10BH-019 (P1)	33 to 35	CH	BOTTOM	78.9	-	-	-	-	-	-	-	-
10BH-019 (P2)	43 to 45	CH	BOTTOM	71.0	-	-	-	-	-	-	-	-
10BH-020 (P1)	46.5 to 48.5	OH	BOTTOM	119.8	-	-	-	-	-	-	-	-

Organic Matter % Furnace Temperature: 440° C

Tests performed in accordance with applicable ASTM Standards.

etc.

Schnabel ENGINEERING

Project No: 10163051 Task 21
Project Name: MTT Tunnel

Moisture Content Analysis

Sample No.	10BH-001	10BH-001	10BH-001	10BH-001	10BH-001	10BH-001
Depth (ft)	0.5	2.0	3.0	6.0	13.0	23.0
Tare No.	A2	21A	52A	A18	57A1	A11
Wgt. Tare + Wet Wgt, gm.	101.0	65.9	60.9	79.3	100.3	70.8
Wgt. Tare + Dry Wgt, gm.	87.6	57.4	54.7	69.4	86.0	64.2
Wgt. Water, gm.	13.4	8.5	6.2	10.0	14.3	6.6
Wgt. Tare, gm.	31.6	31.7	31.4	32.0	31.7	31.7
Dry Wgt of Material, gm.	56.0	25.7	23.3	37.4	54.3	32.5
Water Content, %	24.0	33.0	26.5	26.6	26.4	20.2
		Top Low recovery	Bottom			Bottom

Sample No.	10BH-001	10BH-001	10BH-001	10BH-001	10BH-001	10BH-001
Depth (ft)	33.0	38.0	43.0	44.0	53.0	63.0
Tare No.	8A	S12	11A	9A	65A	53A
Wgt. Tare + Wet Wgt, gm.	106.3	96.2	66.6	62.7	82.6	89.6
Wgt. Tare + Dry Wgt, gm.	95.6	89.3	58.4	55.4	69.0	74.9
Wgt. Water, gm.	10.7	6.8	8.2	7.3	13.5	14.7
Wgt. Tare, gm.	31.9	31.6	31.9	31.9	30.6	31.6
Dry Wgt of Material, gm.	63.7	57.8	26.5	23.6	38.4	43.3
Water Content, %	16.8	11.8	31.1	30.9	35.2	34.0
			Top	Bottom		

Sample No.	10BH-001	10BH-002	10BH-002	10BH-002	10BH-002	10BH-002
Depth (ft)	68.0	0.5	2.0	7.0	18.0	38.0
Tare No.	78A	54A	10A	A20		77A
Wgt. Tare + Wet Wgt, gm.	70.2	119.6	75.8	64.4		63.9
Wgt. Tare + Dry Wgt, gm.	62.8	114.2	73.0	59.6		51.6
Wgt. Water, gm.	7.4	5.4	2.8	4.9	0.0	12.3
Wgt. Tare, gm.	31.8	31.6	32.0	31.6		31.6
Dry Wgt of Material, gm.	30.9	82.6	40.9	27.9	0.0	20.0
Water Content, %	23.9	6.6	6.9	17.4	#DIV/0!	61.3
				Bottom Low recovery	No Recovery	

Organic material was dried at 75ºC.

Equipment ID:

Tested by: KR Checked by: DS Date: 8-17-2010

Schnabel ENGINEERING

Project No: 10163051
Project Name: Task 21 MTT Tunnel

Moisture Content Analysis

Sample No.	10BH-002	10BH-002	10BH-002	10BH-002	10BH-002	10BH-002
Depth (ft)	48.0	49.0	53.0	54.0	63.0	68.0
Tare No.	29A	6A	S17	118A	73A	75A
Wgt. Tare + Wet Wgt, gm.	68.3	57.7	59.5	63.5	57.8	75.6
Wgt. Tare + Dry Wgt, gm.	55.8	42.8	49.1	41.0	41.1	66.2
Wgt. Water, gm.	12.4	14.9	10.4	22.5	16.7	9.4
Wgt. Tare, gm.	31.9	31.9	31.8	31.7	32.0	31.7
Dry Wgt of Material, gm.	23.9	10.9	17.3	9.3	9.1	34.5
Water Content, %	52.0	136.6	60.1	242.9	184.4	27.3
	Top	Bottom Organics	Top Organics	Bottom Wood	Top Low Recovery Organics	

Sample No.	10BH-002	10BH-002	10BH-003	10BH-003	10BH-003	10BH-003
Depth (ft)	78.0	83.0	2.0	4.0	6.0	23.0
Tare No.	A13	28A	13A	A9	69A	33A
Wgt. Tare + Wet Wgt, gm.	56.4	69.4	77.2	113.3	90.3	69.8
Wgt. Tare + Dry Wgt, gm.	51.0	60.9	70.2	101.3	85.9	54.5
Wgt. Water, gm.	5.4	8.5	7.0	12.0	4.5	15.3
Wgt. Tare, gm.	31.4	31.6	31.9	31.7	31.6	30.5
Dry Wgt of Material, gm.	19.6	29.3	38.4	69.6	54.2	24.0
Water Content, %	27.6	29.1	18.1	17.2	8.2	64.0
					Crushed Stone	

Sample No.	10BH-003	10BH-003	10BH-003	10BH-003	10BH-003	10BH-003
Depth (ft)	28.0	33.0	48.0	54.0	73.0	83.0
Tare No.	66A	27A	3A	S15		80A
Wgt. Tare + Wet Wgt, gm.	61.0	56.4	67.1	73.0		71.8
Wgt. Tare + Dry Wgt, gm.	50.6	45.4	53.3	54.3		66.5
Wgt. Water, gm.	10.4	11.0	13.7	18.7	0.0	5.4
Wgt. Tare, gm.	31.5	31.5	31.8	31.7		31.7
Dry Wgt of Material, gm.	19.1	13.8	21.6	22.5	0.0	34.8
Water Content, %	54.6	79.9	63.6	83.3	#DIV/0!	15.5
				Bottom Organics	No Recovery	

Organic material was dried at 75ºC.

Equipment ID:

Tested by: KR Checked by: DS Date: 8-17-2010

Schnabel ENGINEERING

Project No: 10163051
Task 21
Project Name: MTT Tunnel

Moisture Content Analysis

Sample No.	10BH-004	10BH-004	10BH-004	10BH-004	10BH-004	10BH-004
Depth (ft)	0.5	4.0	5.0	8.0	23.0	28.0
Tare No.	76A	A12	A22	43A	A4	41A
Wgt. Tare + Wet Wgt, gm.	89.5	97.0	102.5	65.0	81.5	68.8
Wgt. Tare + Dry Wgt, gm.	84.8	90.4	94.2	57.5	68.6	57.7
Wgt. Water, gm.	4.8	6.6	8.4	7.6	12.9	11.1
Wgt. Tare, gm.	31.3	31.5	31.7	31.7	31.9	31.5
Dry Wgt of Material, gm.	53.4	58.9	62.5	25.8	36.7	26.2
Water Content, %	9.0	11.2	13.4	29.3	35.2	42.2
		Top	Bottom Low Recovery			

Sample No.	10BH-004	10BH-004	10BH-004	10BH-004	10BH-004	10BH-004
Depth (ft)	38.0	48.0	58.0	63.0	64.0	78.0
Tare No.	S13	1A	42A	71A	A21	45A
Wgt. Tare + Wet Wgt, gm.	59.7	68.5	65.2	61.4	79.6	81.5
Wgt. Tare + Dry Wgt, gm.	47.8	57.4	51.6	42.1	61.4	71.7
Wgt. Water, gm.	11.9	11.1	13.6	19.3	18.3	9.8
Wgt. Tare, gm.	31.9	31.4	31.7	31.8	30.9	31.5
Dry Wgt of Material, gm.	15.9	26.0	19.9	10.3	30.5	40.2
Water Content, %	75.3	42.6	68.7	187.9	60.0	24.2
			Organics	Top Low Recovery Organics	Bottom Organics	

Sample No.	10BH-004	10BH-004	10BH-004	10BH-004	10BH-013	10BH-013
Depth (ft)	84.0	88.0	89.0	98.0	0.0	4.0
Tare No.	2A	50A	72A	37A	61A	31A
Wgt. Tare + Wet Wgt, gm.	86.3	84.4	74.9	91.5	90.5	81.7
Wgt. Tare + Dry Wgt, gm.	76.6	75.9	67.7	83.1	85.7	74.6
Wgt. Water, gm.	9.8	8.5	7.2	8.4	4.8	7.0
Wgt. Tare, gm.	31.6	31.6	32.0	31.5	31.7	31.5
Dry Wgt of Material, gm.	45.0	44.3	35.7	51.6	53.9	43.1
Water Content, %	21.8	19.2	20.1	16.3	8.9	16.3
	Bottom	Top	Bottom		Dry	

Organic material was dried at 75ºC.

Equipment ID:

Tested by: KR Checked by: DS Date: 8-17-2010

Schnabel ENGINEERING

Project No: 10163051 Task 21
Project Name: MTT Tunnel

Moisture Content Analysis

Sample No.	10BH-013	10BH-013	10BH-013	10BH-013	10BH-013	10BH-013
Depth (ft)	8.0	13.0	23.0	27.0	38.0	48.0
Tare No.	64A	58A	A14	A1	55A	62A
Wgt. Tare + Wet Wgt, gm.	103.1	86.5	70.1	65.4	68.6	91.5
Wgt. Tare + Dry Wgt, gm.	91.5	77.9	54.8	53.0	54.7	79.6
Wgt. Water, gm.	11.5	8.7	15.4	12.4	13.9	11.8
Wgt. Tare, gm.	31.9	31.7	31.8	31.4	31.7	30.9
Dry Wgt of Material, gm.	59.7	46.2	23.0	21.6	22.9	48.8
Water Content, %	19.3	18.7	66.7	57.1	60.5	24.3

Sample No.	10BH-013	10BH-013	10BH-013	10BH-014	10BH-014	10BH-014
Depth (ft)	58.0	68.0	78.0	0.0	4.0	8.0
Tare No.	68A	39A	A17	A19	23A	40A
Wgt. Tare + Wet Wgt, gm.	79.8	69.7	64.0	90.5	97.4	112.2
Wgt. Tare + Dry Wgt, gm.	63.0	60.0	55.7	87.4	87.2	99.1
Wgt. Water, gm.	16.8	9.6	8.3	3.1	10.1	13.2
Wgt. Tare, gm.	31.8	30.5	32.1	31.7	30.5	31.6
Dry Wgt of Material, gm.	31.1	29.5	23.7	55.7	56.7	67.5
Water Content, %	53.9	32.6	34.9	5.6	17.9	19.5
	Saturated			Dry	Gravel	Saturated Gravel

Sample No.	10BH-014	10BH-014	10BH-014	10BH-014	10BH-014	10BH-014
Depth (ft)	23.0	28.0	33.0	38.0	53.0	63.0
Tare No.	14A	A5	51A	70A	A6	S14
Wgt. Tare + Wet Wgt, gm.	59.3	72.1	69.7	77.2	85.9	75.0
Wgt. Tare + Dry Wgt, gm.	48.0	58.8	56.5	59.1	71.5	64.3
Wgt. Water, gm.	11.3	13.4	13.3	18.1	14.4	10.7
Wgt. Tare, gm.	31.8	31.9	31.7	31.6	31.5	31.9
Dry Wgt of Material, gm.	16.3	26.9	24.8	27.5	40.0	32.4
Water Content, %	69.5	49.7	53.6	65.7	36.0	33.0
		Organics	Organics	Organics	Low Recovery	

Organic material was dried at 75ºC.

Equipment ID:

Tested by: KR Checked by: DS Date: 8-18-2010

Schnabel ENGINEERING

Project No: 10163051
Task 21
Project Name: MTT Tunnel

Moisture Content Analysis

Sample No.	10BH-015	10BH-015	10BH-015	10BH-015	10BH-015	10BH-015
Depth (ft)	0.5	4.0	6.0	18.0	28.0	33.0
Tare No.	47A		38A	67A	A3	S16
Wgt. Tare + Wet Wgt, gm.	68.0		91.3	74.6	109.6	85.9
Wgt. Tare + Dry Wgt, gm.	58.3		76.9	53.9	96.1	78.1
Wgt. Water, gm.	9.7	0.0	14.4	20.7	13.6	7.9
Wgt. Tare, gm.	31.7		31.6	31.6	31.4	31.9
Dry Wgt of Material, gm.	26.7	0.0	45.4	22.3	64.7	46.2
Water Content, %	36.3	#DIV/0!	31.7	92.6	20.9	17.0
		No Recovery	Petroleum Odor Saturated	Organics	Sand	Sand

Sample No.	10BH-015	10BH-015	10BH-015	10BH-016	10BH-016	10BH-016
Depth (ft)	43.0	48.0	58.0	0.0	2.0	6.0
Tare No.	4A	30A	5A	34A	7	
Wgt. Tare + Wet Wgt, gm.	96.1	82.4	85.2	78.0	65.0	
Wgt. Tare + Dry Wgt, gm.	80.7	71.2	72.2	73.4	58.5	
Wgt. Water, gm.	15.4	11.2	13.0	4.6	6.5	0.0
Wgt. Tare, gm.	31.7	31.7	31.7	31.7	31.8	
Dry Wgt of Material, gm.	49.0	39.5	40.4	41.8	26.7	0.0
Water Content, %	31.4	28.5	32.2	11.0	24.3	#DIV/0!
				Dry		No Recovery

Sample No.	10BH-016	10BH-016	10BH-016	10BH-016	10BH-016	10BH-016
Depth (ft)	18.0	23.0	28.0	38.0	53.0	58.0
Tare No.	12	26A	1	8	15A	5
Wgt. Tare + Wet Wgt, gm.	74.5	64.8	68.2	92.0	71.1	92.9
Wgt. Tare + Dry Wgt, gm.	64.1	51.1	56.1	81.5	62.3	78.3
Wgt. Water, gm.	10.4	13.7	12.1	10.5	8.8	14.6
Wgt. Tare, gm.	31.8	31.5	31.6	31.5	31.7	31.7
Dry Wgt of Material, gm.	32.3	19.7	24.5	50.1	30.7	46.6
Water Content, %	32.1	69.5	49.3	20.9	28.7	31.2
			Top			

Organic material was dried at 75ºC.

Equipment ID:

Tested by: KR Checked by: DS Date: 8-18-2010

Schnabel ENGINEERING

Project No: 10163051
Task 21
Project Name: MTT Tunnel

Moisture Content Analysis

Sample No.	10BH-002	10BH-014	10BH-014			
Depth (ft)	8.0	13.0	19.0			
Tare No.	A10	Noah	3			
Wgt. Tare + Wet Wgt, gm.	120.1	253.4	252.6			
Wgt. Tare + Dry Wgt, gm.	105.4	237.5	237.7			
Wgt. Water, gm.	14.7	15.9	15.0	0.0	0.0	0.0
Wgt. Tare, gm.	31.5	180.8	200.5			
Dry Wgt of Material, gm.	74.0	56.7	37.2	0.0	0.0	0.0
Water Content, %	19.9	27.9	40.2	#DIV/0!	#DIV/0!	#DIV/0!

Top

Sample No.						
Depth (ft)						
Tare No.						
Wgt. Tare + Wet Wgt, gm.						
Wgt. Tare + Dry Wgt, gm.						
Wgt. Water, gm.	0.0	0.0	0.0	0.0	0.0	0.0
Wgt. Tare, gm.						
Dry Wgt of Material, gm.	0.0	0.0	0.0	0.0	0.0	0.0
Water Content, %	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Sample No.						
Depth (ft)						
Tare No.						
Wgt. Tare + Wet Wgt, gm.						
Wgt. Tare + Dry Wgt, gm.						
Wgt. Water, gm.	0.0	0.0	0.0	0.0	0.0	0.0
Wgt. Tare, gm.						
Dry Wgt of Material, gm.	0.0	0.0	0.0	0.0	0.0	0.0
Water Content, %	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Equipment ID:
Tested by: Checked by: DS Date:

Schnabel ENGINEERING

Project No: 10613051 task
Project Name: MTT Testing-T

Moisture Content Analysis

Sample No.	10BH-001	10BH-002	10BH-002	10BH-002	10BH-003	10BH-003
Depth (ft)	20.0	25.0	40.0	50.0	20.0	30.0
Tare No.		A2	55A	80A	4A	77A
Wgt. Tare + Wet Wgt, gm.		68.8	66.5	56.1	64.6	62.6
Wgt. Tare + Dry Wgt, gm.		55.1	54.0	43.8	51.5	51.4
Wgt. Water, gm.	0.0	13.7	12.5	12.3	13.1	11.1
Wgt. Tare, gm.		31.6	32.1	31.7	31.7	31.6
Dry Wgt of Material, gm.	0.0	23.5	21.9	12.2	19.9	19.9
Water Content, %	#DIV/0!	58.4	57.1	101.2	66.1	56.1
	No Jar			Organics		

Sample No.	10BH-003	10BH-003	10BH-003	10BH-003	10BH-004	10BH-014
Depth (ft)	40.0	50.0	60.0	70.0	10.0	25.0
Tare No.	A19	50A	29A	20A		2A
Wgt. Tare + Wet Wgt, gm.	103.9	71.8	58.2	61.5		62.4
Wgt. Tare + Dry Wgt, gm.	74.9	56.8	44.9	49.3		54.5
Wgt. Water, gm.	29.0	15.0	13.3	12.2	0.0	7.9
Wgt. Tare, gm.	31.7	31.6	31.9	31.9		31.7
Dry Wgt of Material, gm.	43.2	25.2	13.0	17.4	0.0	22.8
Water Content, %	67.2	59.8	102.4	70.0	#DIV/0!	34.7
			Organics		No Jar	Sandy

Sample No.	10BH-004	10BH-004	10BH-004	10BH-004	10BH-004	10BH-004
Depth (ft)	30.0	35.0	40.0	45.0	50.0	60.0
Tare No.		58A	31A	22A	72A	118A
Wgt. Tare + Wet Wgt, gm.		63.4	61.6	90.3	85.4	67.0
Wgt. Tare + Dry Wgt, gm.		50.7	50.7	73.9	68.2	50.3
Wgt. Water, gm.	0.0	12.7	10.9	16.5	17.2	16.8
Wgt. Tare, gm.		31.7	31.6	31.8	31.9	31.9
Dry Wgt of Material, gm.	0.0	19.0	19.0	42.1	36.3	18.4
Water Content, %	#DIV/0!	66.9	57.5	39.1	47.5	91.4
	No Jar					Organics

Equipment ID:
Tested by: KR Checked by: ND Date: 9/17/2010

Schnabel ENGINEERING

Project No: 10613051 task
Project Name: MTT Testing-T

Moisture Content Analysis

Sample No.	10BH-013	10BH-013	10BH-013	10BH-013	10BH-013	10BH-015
Depth (ft)	15.0	25.0	35.0	40.0	45.0	15.0
Tare No.						30A
Wgt. Tare + Wet Wgt, gm.						87.5
Wgt. Tare + Dry Wgt, gm.						76.0
Wgt. Water, gm.	0.0	0.0	0.0	0.0	0.0	11.5
Wgt. Tare, gm.						31.7
Dry Wgt of Material, gm.	0.0	0.0	0.0	0.0	0.0	44.3
Water Content, %	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	26.1
	No Jar	No Jar	No Jar	No Jar	No Jar	Sandy

Sample No.	10BH-015	10BH-014	10BH-014	10BH-014	10BH-014	10BH-014
Depth (ft)	45.0	20.0	25.0	30.0	35.0	40.0
Tare No.	34A	45A		A9	A21	41A
Wgt. Tare + Wet Wgt, gm.	80.1	70.7		52.6	66.3	51.8
Wgt. Tare + Dry Wgt, gm.	68.8	52.3		45.8	55.3	38.7
Wgt. Water, gm.	11.2	18.4	0.0	6.8	11.0	13.1
Wgt. Tare, gm.	31.7	31.5		31.7	30.9	31.6
Dry Wgt of Material, gm.	37.2	20.8	0.0	14.1	24.4	7.1
Water Content, %	30.2	88.4	#DIV/0!	48.3	45.0	184.5
	Sand		No sample			Organics

Sample No.	10BH-016	10BH-018	10BH-018	10BH-021	10BH-021	10BH-021
Depth (ft)	20.0	43.0	63.0	53.0	63.0	78.0
Tare No.	A11	S15				
Wgt. Tare + Wet Wgt, gm.	83.8	72.2				
Wgt. Tare + Dry Wgt, gm.	69.3	56.4				
Wgt. Water, gm.	14.5	15.8	0.0	0.0	0.0	0.0
Wgt. Tare, gm.	31.7	31.8				
Dry Wgt of Material, gm.	37.6	24.7	0.0	0.0	0.0	0.0
Water Content, %	38.6	64.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
			No sample	No sample	No sample	No sample

Equipment ID:
Tested by: KR Checked by: ND Date: 9/17/2010

Schnabel ENGINEERING

Project No: 10613051 task
Project Name: MTT Testing-T

Moisture Content Analysis

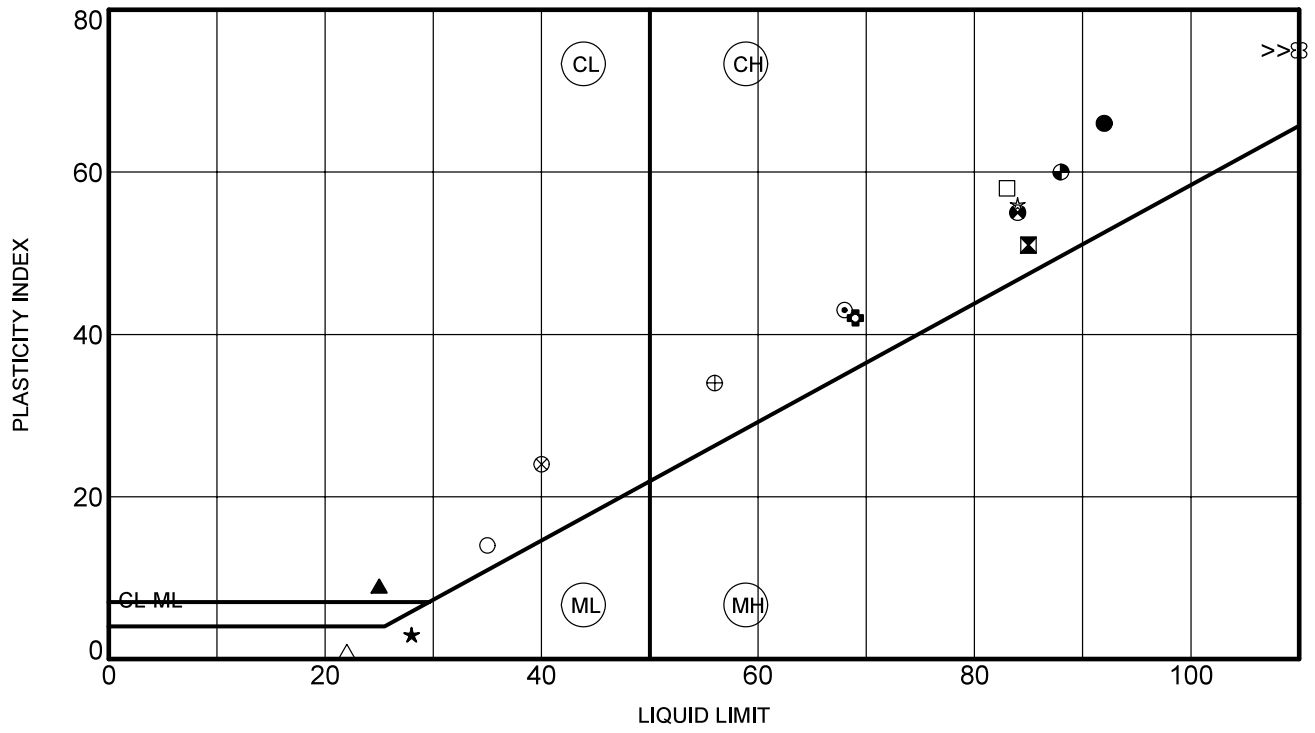
Sample No.	10BH-022	10BH-022	10BH-022			
Depth (ft)	28.0	63.0	73.0			
Tare No.	13A					
Wgt. Tare + Wet Wgt, gm.	62.0					
Wgt. Tare + Dry Wgt, gm.	48.4					
Wgt. Water, gm.	13.7	0.0	0.0	0.0	0.0	0.0
Wgt. Tare, gm.	32.0					
Dry Wgt of Material, gm.	16.4	0.0	0.0	0.0	0.0	0.0
Water Content, %	83.1	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

No sample No sample

Sample No.						
Depth (ft)						
Tare No.						
Wgt. Tare + Wet Wgt, gm.						
Wgt. Tare + Dry Wgt, gm.						
Wgt. Water, gm.	0.0	0.0	0.0	0.0	0.0	0.0
Wgt. Tare, gm.						
Dry Wgt of Material, gm.	0.0	0.0	0.0	0.0	0.0	0.0
Water Content, %	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Sample No.						
Depth (ft)						
Tare No.						
Wgt. Tare + Wet Wgt, gm.						
Wgt. Tare + Dry Wgt, gm.						
Wgt. Water, gm.	0.0	0.0	0.0	0.0	0.0	0.0
Wgt. Tare, gm.						
Dry Wgt of Material, gm.	0.0	0.0	0.0	0.0	0.0	0.0
Water Content, %	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Equipment ID:
Tested by: KR Checked by: ND Date: 9/17/2010



PLOTTED DATA REPRESENTS SOIL PASSING NO. 40 SIEVE

	Specimen		LL	PL	PI	Fines	Oven Dry Liquid Limit	Description
●	10BH-001	18.0 ft	92	26	66			Dark gray, fat CLAY, trace sand, CH (Visual)
⧓	10BH-001	23.0 ft	85	34	51		62.0	Gray-brown, organic CLAY, OH (Visual)
▲	10BH-001	28.0 ft	25	16	9	59		Gray, sandy lean CLAY, CL
★	10BH-001	58.0 ft	28	25	3	29		Gray, fine to medium silty SAND, contains shell fragments, SM
⊙	10BH-002	28.0 ft	68	25	43			Gray, fat CLAY, trace sand, CH (Visual)
✿	10BH-002	43.0 ft	69	27	42			Gray, fat CLAY, trace sand, CH (Visual)
○	10BH-002	64.0 ft	35	21	14	32		Gray, fine to medium clayey SAND, contains shell fragments, SC
△	10BH-002	73.0 ft	22	21	1	21		Gray, fine to medium silty SAND, contains shell fragments, SM
⊗	10BH-003	13.0 ft	40	16	24	15		Gray, fine to coarse clayey SAND, contains crushed stone, SC
⊕	10BH-003	18.0 ft	56	22	34		35.0	Gray, sandy organic CLAY, contains pieces of metal, OH (Visual)
□	10BH-003	38.0 ft	83	25	58			Gray, fat CLAY, trace sand, CH (Visual)
⊠	10BH-003	43.0 ft	84	29	55			Gray, fat CLAY, trace sand, contains mica, CH (Visual)
◕	10BH-003	53.0 ft	88	28	60			Gray, fat CLAY, trace sand, contains shell fragments, CH (Visual)
☆	10BH-003	58.0 ft	84	28	56			Dark gray, fat CLAY, trace sand, CH (Visual)
⧓	10BH-003	63.0 ft	130	55	75		75.0	Dark gray, organic SILT, trace sand, OH (Visual)

NOTE: An organic clay or silt is a soil that would be classified as a clay or silt, respectively, except that its oven dried liquid limit is less than 75% of its liquid limit value.

Schnabel ENGINEERING

ATTERBERG LIMITS

Project: MTT, DTT & MLK Exp. Project

Norfolk & Portsmouth, VA

Contract: 10613051 Task 21

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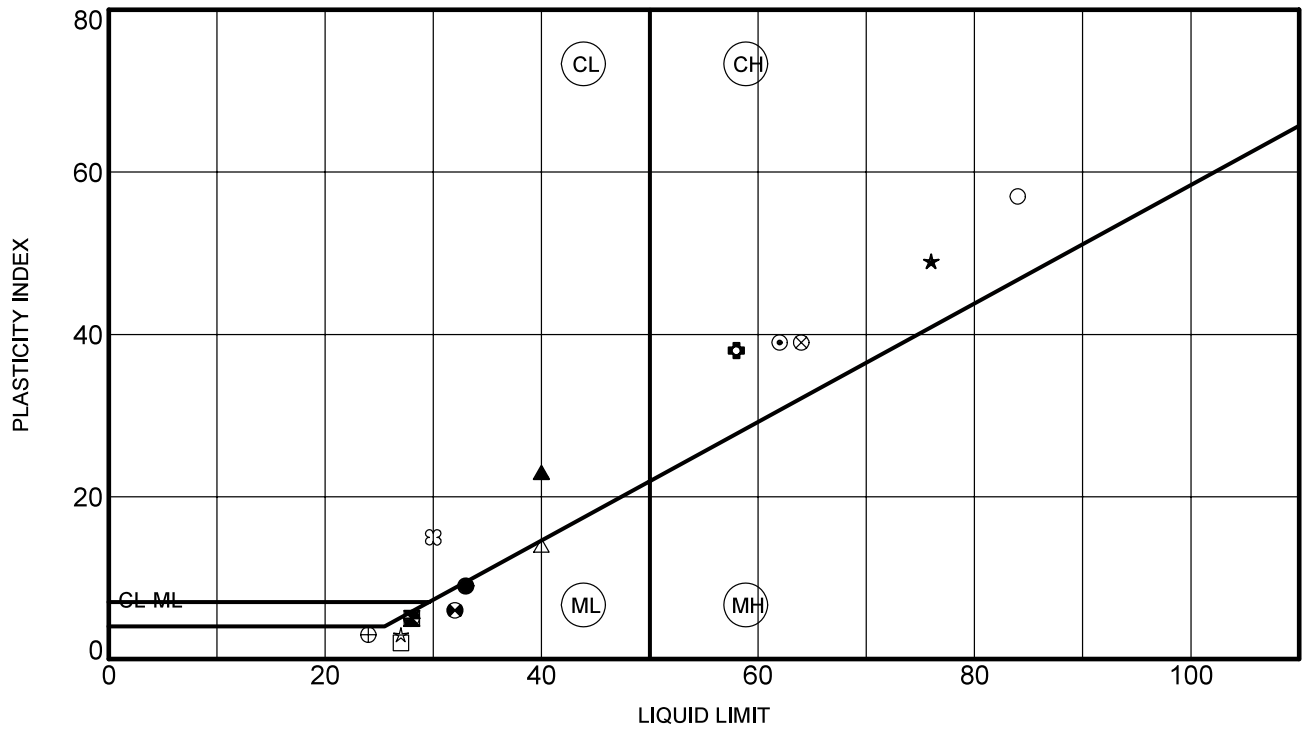

PLOTTED DATA REPRESENTS SOIL PASSING NO. 40 SIEVE

	Specimen		LL	PL	PI	Fines	Oven Dry Liquid Limit	Description
●	10BH-003	84.0 ft	33	24	9			Gray, fine silty SAND, SM (Visual)
⧓	10BH-003	88.0 ft	28	23	5			Gray, fine to medium silty SAND, contains shell fragments, SM (Visual)
▲	10BH-004	6.0 ft	40	17	23			Dark gray, sandy lean CLAY, CL (Visual)
★	10BH-004	33.0 ft	76	27	49			Dark gray, fat CLAY, trace sand, CH (Visual)
⊙	10BH-004	43.0 ft	62	23	39			Dark gray, fat CLAY, trace sand, CH (Visual)
✿	10BH-004	48.0 ft	58	20	38			Dark gray, fat CLAY, trace sand, CH (Visual)
○	10BH-004	68.0 ft	84	27	57		52.0	Dark gray, organic CLAY, trace sand, OH (Visual)
△	10BH-004	108.0 ft	40	26	14	41		Gray, fine to coarse silty SAND, contains shell fragments, SM
⊗	10BH-013	33.0 ft	64	25	39			Dark gray, fat CLAY, trace sand, CH (Visual)
⊕	10BH-013	53.0 ft	24	21	3	43		Gray, fine to medium silty SAND, contains organics, SM
□	10BH-013	63.0 ft	27	25	2	18		Gray, fine to medium silty SAND, contains shell fragments and mica, SM
◍	10BH-013	73.0 ft	32	26	6			Gray, fine to medium silty SAND, contains shell fragments, SM (Visual)
◕	10BH-014	48.0 ft	28	23	5	20		Blue-gray, fine silty SAND, contains mica, SM
☆	10BH-014	58.0 ft	27	24	3	17		Gray, fine silty SAND, contains shell fragments, SM
⊠	10BH-015	23.0 ft	30	15	15	60		Gray, sandy lean CLAY, CL

NOTE: An organic clay or silt is a soil that would be classified as a clay or silt, respectively, except that its oven dried liquid limit is less than 75% of its liquid limit value.

Schnabel ENGINEERING

ATTERBERG LIMITS

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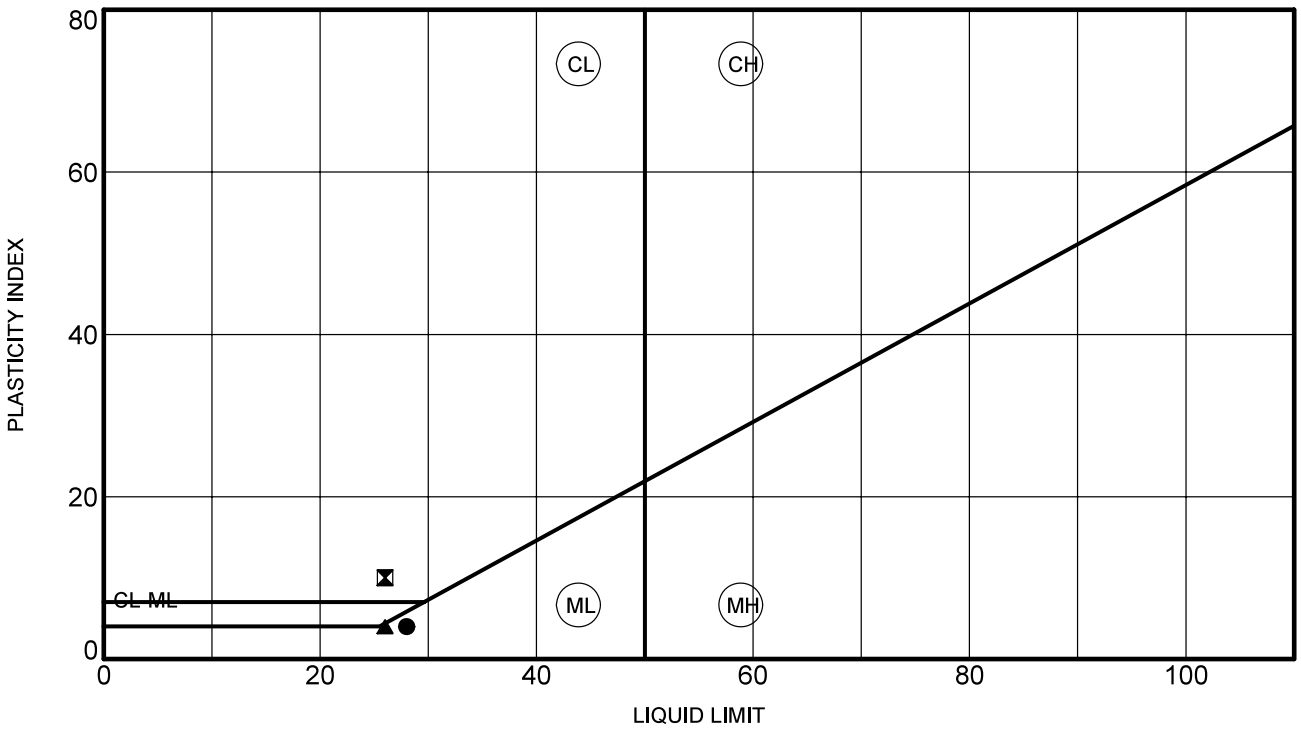

PLOTTED DATA REPRESENTS SOIL PASSING NO. 40 SIEVE

	Specimen		LL	PL	PI	Fines	Oven Dry Liquid Limit	Description
●	10BH-015	53.0 ft	28	24	4	17		Gray, fine to medium silty SAND, contains shell fragments, SM
⧓	10BH-016	8.0 ft	26	16	10	52		Dark brown, sandy lean CLAY, CL
▲	10BH-016	48.0 ft	26	22	4	15		Gray, fine to medium silty SAND, contains shell fragments, SM

NOTE: An organic clay or silt is a soil that would be classified as a clay or silt, respectively, except that its oven dried liquid limit is less than 75% of its liquid limit value.

Schnabel ENGINEERING

ATTERBERG LIMITS

Project: MTT, DTT & MLK Exp. Project

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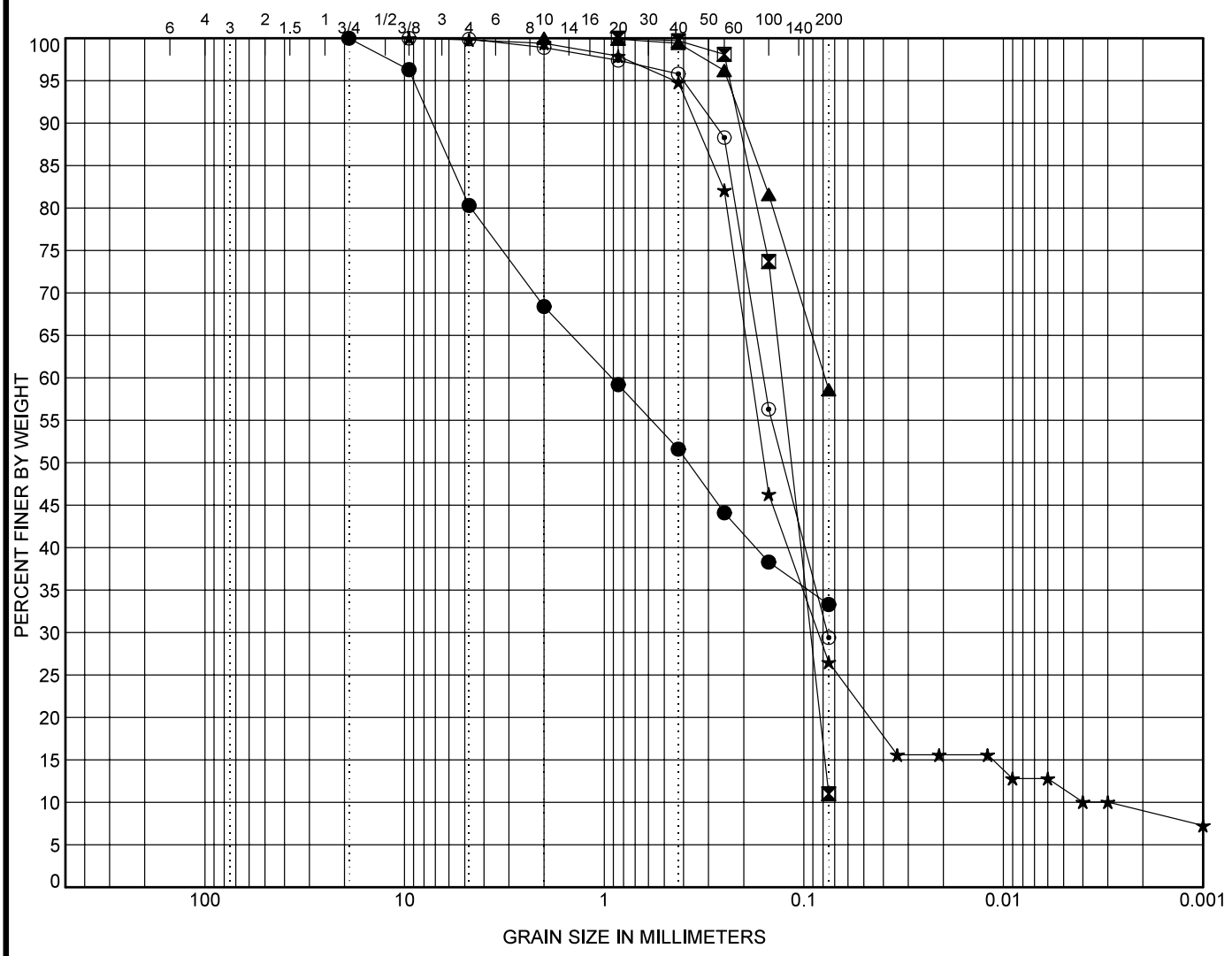

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen		Sample Description	LL	PL	PI
●	10BH-001 4.0 ft	Dark brown and black, fine to coarse silty SAND, contains brick fragments, crushed stone and organics, SM (Visual)	--	--	–
⊠	10BH-001 8.0 ft	Light gray, fine to medium poorly graded SAND with silt, SP-SM (Visual)	--	--	–
▲	10BH-001 28.0 ft	Gray, sandy lean CLAY, CL	25	16	9
★	10BH-001 48.0 ft	Gray, fine to coarse silty SAND, contains shell fragments, SM	NP	NP	NP
⊙	10BH-001 58.0 ft	Gray, fine to medium silty SAND, contains shell fragments, SM	28	25	3

Specimen		Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	10BH-001 4.0 ft	ASTM D422	19	0.916			19.7	47.0	33.3	
⊠	10BH-001 8.0 ft	ASTM D422	0.85	0.129	0.093				11.0	
▲	10BH-001 28.0 ft	ASTM D422	2	0.078					58.6	
★	10BH-001 48.0 ft	ASTM D422	9.5	0.182	0.085	0.003	0.2	73.3	17.5	9.0
⊙	10BH-001 58.0 ft	ASTM D422	9.5	0.159	0.076		0.1	70.5	29.4	

Schnabel ENGINEERING

GRADATION CURVES

Project: MTT, DTT & MLK Exp. Project

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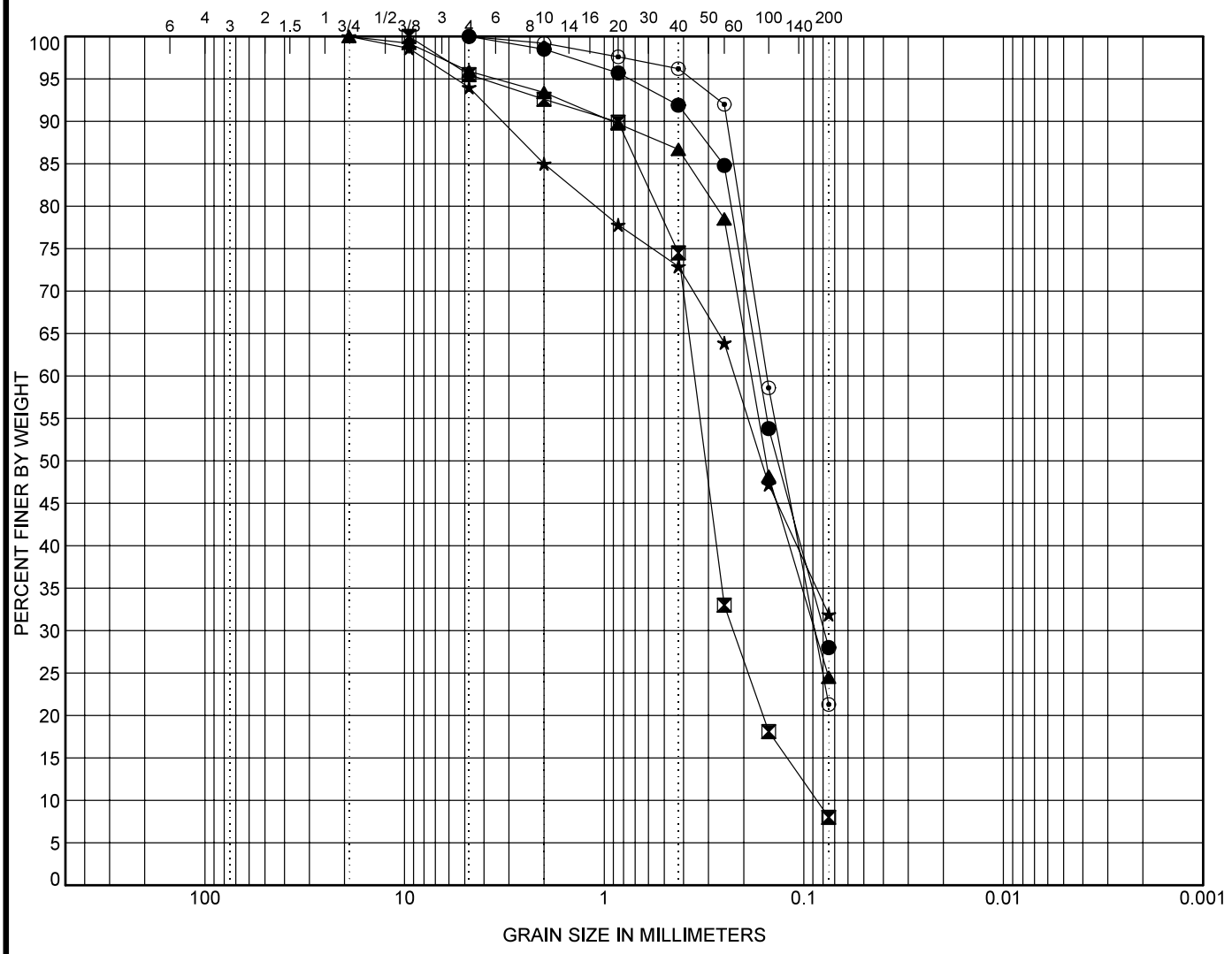

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen		Sample Description	LL	PL	PI
●	10BH-002	4.0 ft	Orange-brown, fine to coarse clayey SAND, SC (Visual)	--	--	--
⊠	10BH-002	13.0 ft	Light gray, poorly graded SAND with silt, contains large sizes of crushed stone and asphalt, SP-SM (Visual)	--	--	--
▲	10BH-002	58.0 ft	Gray, fine silty SAND, contains shell fragments, SM (Visual)	--	--	--
★	10BH-002	64.0 ft	Gray, fine to medium clayey SAND, contains shell fragments, SC	35	21	14
⊙	10BH-002	73.0 ft	Gray, fine to medium silty SAND, contains shell fragments, SM	22	21	1

	Specimen		Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	10BH-002	4.0 ft	ASTM D422	4.75	0.166	0.079		0.0	72.0	28.0	
⊠	10BH-002	13.0 ft	ASTM D422	9.5	0.353	0.226	0.086	4.5	87.5	8.0	
▲	10BH-002	58.0 ft	ASTM D422	19	0.183	0.088		4.1	71.4	24.5	
★	10BH-002	64.0 ft	ASTM D422	19	0.222			6.0	62.1	31.9	
⊙	10BH-002	73.0 ft	ASTM D422	4.75	0.153	0.088		0.0	78.7	21.3	

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GRADATION CURVES

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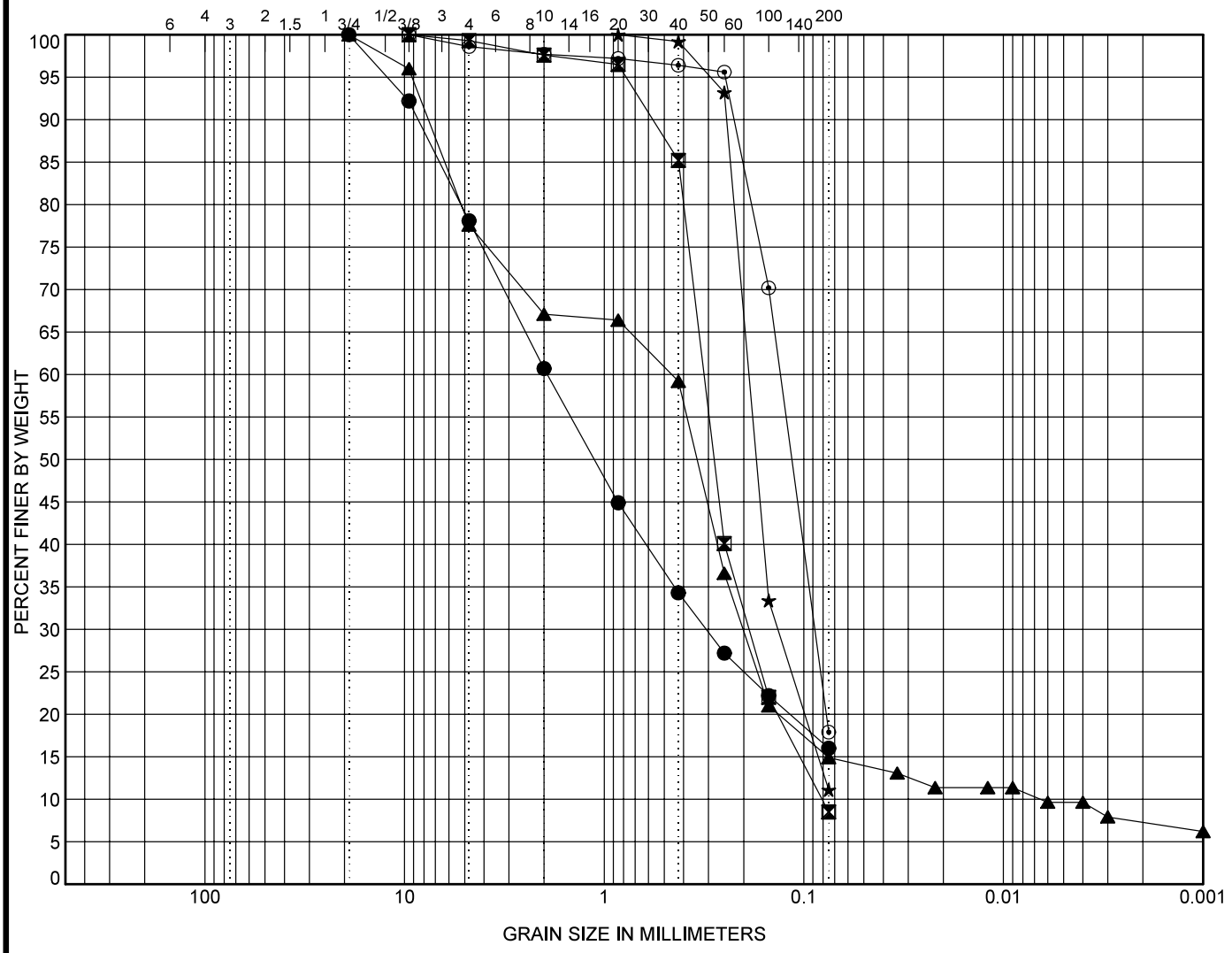

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen		Sample Description	LL	PL	PI
●	10BH-003 0.5 ft	Gray-brown, silty SAND, contains glass, cement and crushed stone, SM (Visual)	--	--	--
⊠	10BH-003 8.0 ft	Light gray-brown, fine to medium poorly graded SAND with silt, contains metal pieces, SP-SM (Visual)	--	--	--
▲	10BH-003 13.0 ft	Gray, fine to coarse clayey SAND, contains crushed stone, SC	40	16	24
★	10BH-003 78.0 ft	Brown-gray, fine poorly graded SAND with silt, contains mica, SP-SM (Visual)	--	--	--
⊙	10BH-003 93.0 ft	Dark gray, fine to medium clayey SAND, contains shell fragments and mica, SC (Visual)	--	--	--

Specimen		Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	10BH-003 0.5 ft	ASTM D422	19	1.926	0.308		21.9	62.1	16.0	
⊠	10BH-003 8.0 ft	ASTM D422	9.5	0.316	0.188	0.081	0.7	90.8	8.5	
▲	10BH-003 13.0 ft	ASTM D422	19	0.459	0.201	0.007	22.4	62.7	7.6	7.3
★	10BH-003 78.0 ft	ASTM D422	0.85	0.188	0.135				11.1	
⊙	10BH-003 93.0 ft	ASTM D422	9.5	0.131	0.088		1.4	80.7	17.9	

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GRADATION CURVES

Project: MTT, DTT & MLK Exp. Project

Norfolk & Portsmouth, VA

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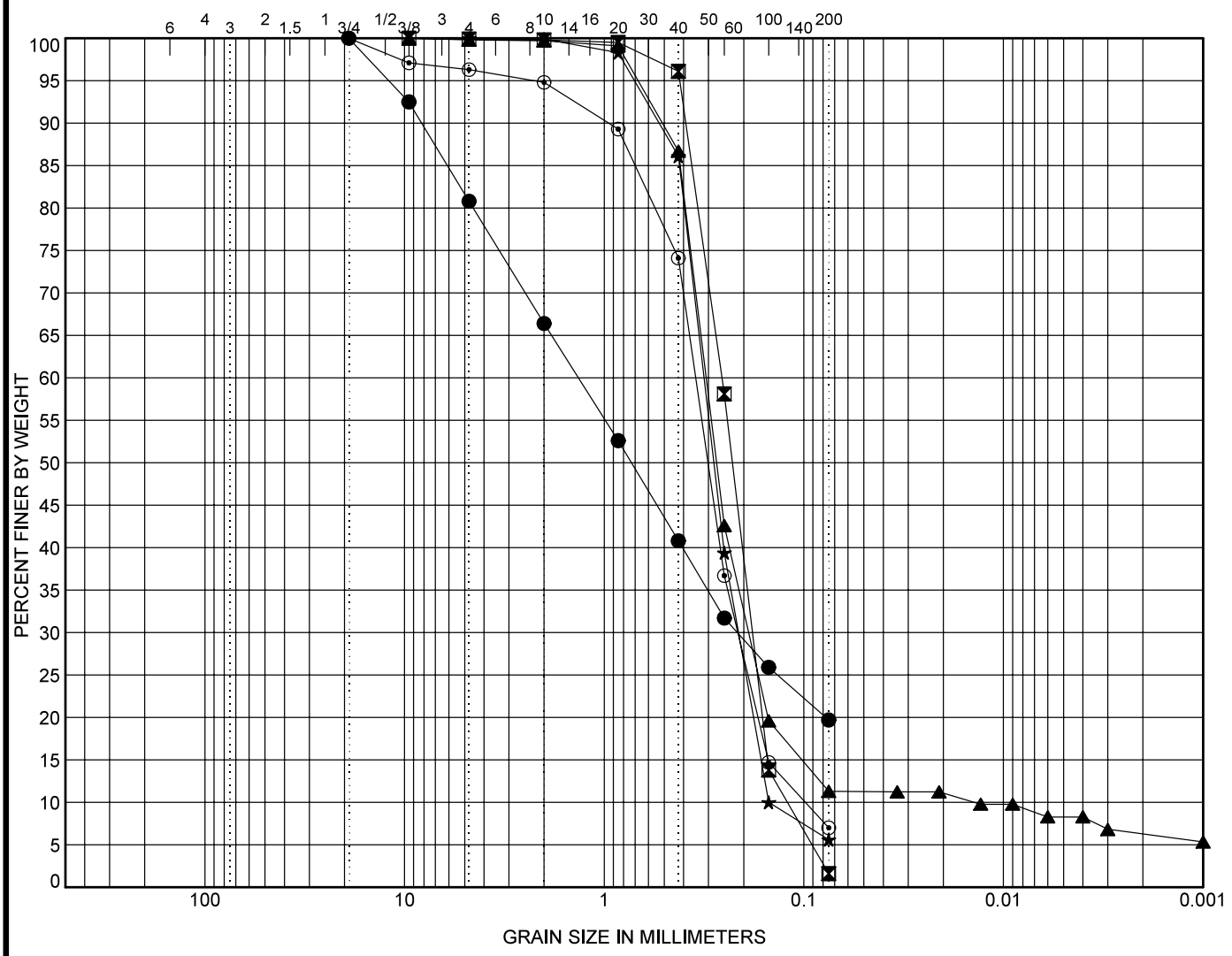

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen		Sample Description	LL	PL	PI	Cc	Cu
●	10BH-004	2.0 ft	Yellow-brown, fine to coarse clayey SAND, contains crushed stone, SC (Visual)	--	--	–		
⊠	10BH-004	13.0 ft	Gray-brown, fine to medium poorly graded SAND, trace silt, contains shell fragments, SP (Visual)	--	--	–	1.05	2.12
▲	10BH-004	18.0 ft	Gray, fine to coarse poorly graded SAND with silt, trace gravel, SP-SM	NP	NP	NP	8.27	21.99
★	10BH-004	83.0 ft	Dark brown-gray, fine to medium poorly graded SAND with silt, SP-SM (Visual)	--	--	–	0.95	2.11
⊙	10BH-004	93.0 ft	Gray-brown, fine to coarse poorly graded SAND with silt, contains gravel, SP-SM (Visual)	--	--	–	1.34	3.54

	Specimen		Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	10BH-004	2.0 ft	ASTM D422	19	1.345	0.215		19.2	61.1	19.7	
⊠	10BH-004	13.0 ft	ASTM D422	9.5	0.257	0.181	0.121	0.1	98.3	1.6	
▲	10BH-004	18.0 ft	ASTM D422	9.5	0.308	0.189	0.014	0.2	88.5	5.0	6.3
★	10BH-004	83.0 ft	ASTM D422	4.75	0.316	0.212	0.15	0.0	94.4	5.6	
⊙	10BH-004	93.0 ft	ASTM D422	19	0.348	0.214	0.098	3.7	89.3	7.0	

Schnabel ENGINEERING

GRADATION CURVES

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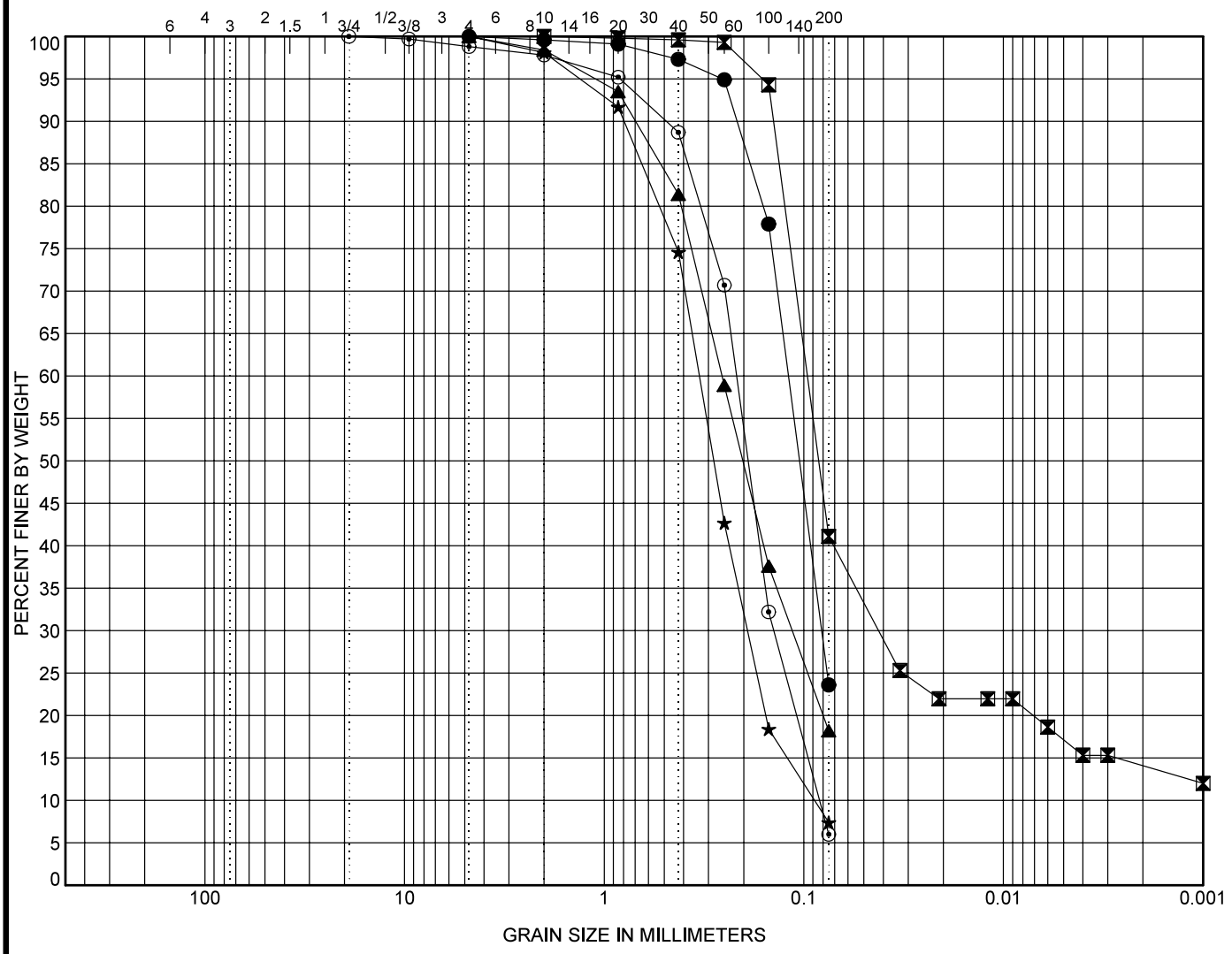

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen		Sample Description	LL	PL	PI	Cc	Cu
●	10BH-004 103.0 ft	Green-gray, fine to medium clayey SAND, contains shell fragments and mica, SC (Visual)	--	--	–		
⊠	10BH-004 108.0 ft	Gray, fine to coarse silty SAND, contains shell fragments, SM	40	26	14		
▲	10BH-013 2.0 ft	Orange-brown, fine to coarse silty SAND, SM (Visual)	--	--	–		
★	10BH-013 6.0 ft	Brown, fine to coarse poorly graded SAND with silt, SP-SM (Visual)	--	--	–	1.24	3.77
⊙	10BH-013 17.0 ft	Gray-brown, fine to coarse poorly graded SAND with silt, contains gravel, wood and mica, SP-SM (Visual)	--	--	–	1.11	2.60

Specimen		Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	10BH-004 103.0 ft	ASTM D422	4.75	0.119	0.081		0.0	76.4	23.6	
⊠	10BH-004 108.0 ft	ASTM D422	2	0.096	0.042				27.0	14.1
▲	10BH-013 2.0 ft	ASTM D422	4.75	0.257	0.114		0.0	81.8	18.2	
★	10BH-013 6.0 ft	ASTM D422	4.75	0.333	0.191	0.088	0.0	92.6	7.4	
⊙	10BH-013 17.0 ft	ASTM D422	19	0.217	0.142	0.083	1.2	92.8	6.0	

Schnabel ENGINEERING

GRADATION CURVES

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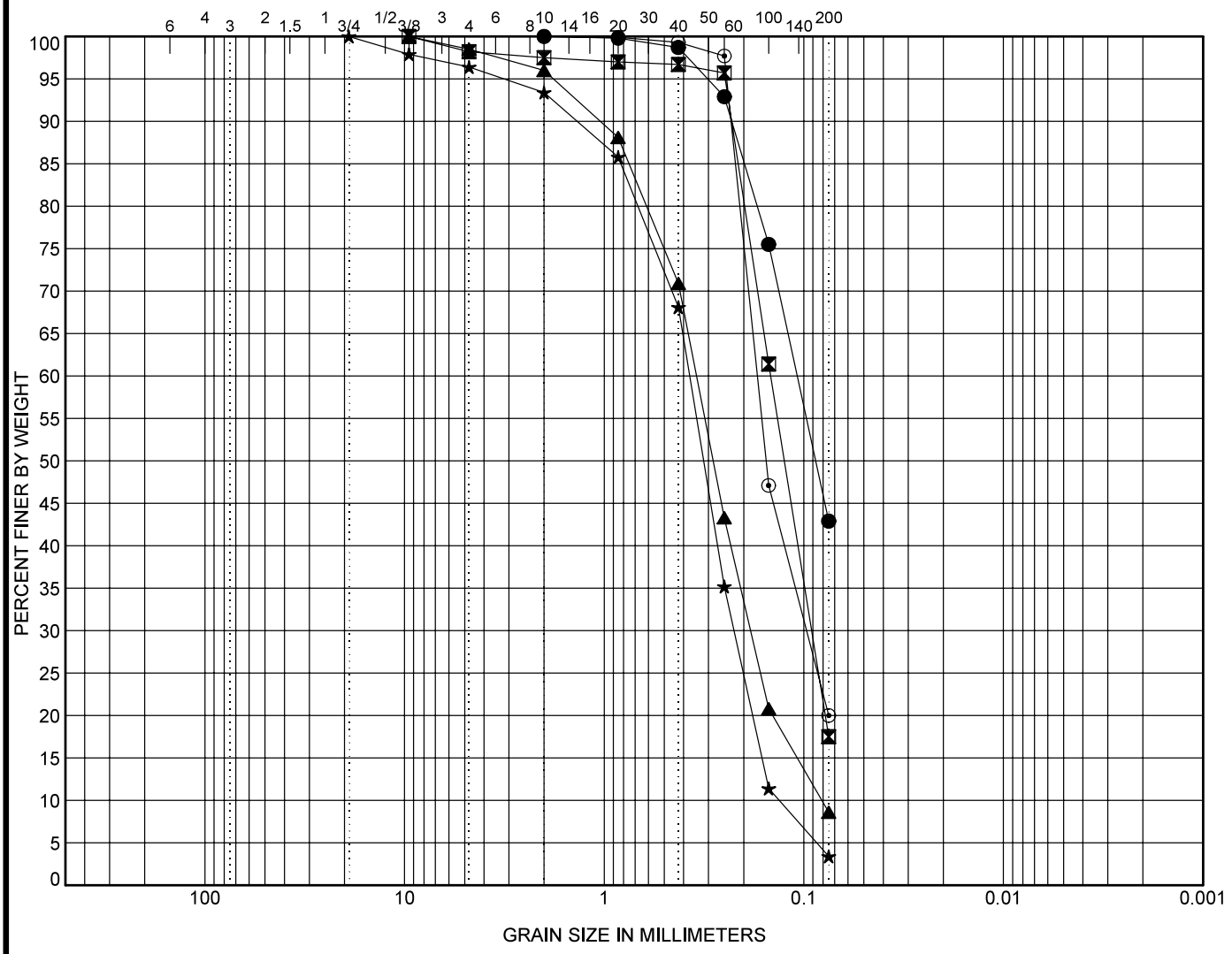


COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen		Sample Description	LL	PL	PI
● 10BH-013	53.0 ft	Gray, fine to medium silty SAND, contains organics, SM	24	21	3
⊠ 10BH-013	63.0 ft	Gray, fine to medium silty SAND, contains shell fragments and mica, SM	27	25	2
▲ 10BH-014	2.0 ft	Brown, fine to coarse poorly graded SAND with silt, contains gravel, SP-SM	NP	NP	NP
★ 10BH-014	6.0 ft	Orange-brown, poorly graded SAND, trace silt, contains gravel, SP (Visual)	--	--	–
⊙ 10BH-014	48.0 ft	Blue-gray, fine silty SAND, contains mica, SM	28	23	5

Specimen		Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● 10BH-013	53.0 ft	ASTM D422	2	0.108					42.9	
⊠ 10BH-013	63.0 ft	ASTM D422	9.5	0.147	0.091		1.8	80.7	17.5	
▲ 10BH-014	2.0 ft	ASTM D422	9.5	0.345	0.185	0.081	1.5	89.9	8.6	
★ 10BH-014	6.0 ft	ASTM D422	19	0.373	0.224	0.133	3.6	93.0	3.4	
⊙ 10BH-014	48.0 ft	ASTM D422	2	0.171	0.097				20.0	

Schnabel ENGINEERING

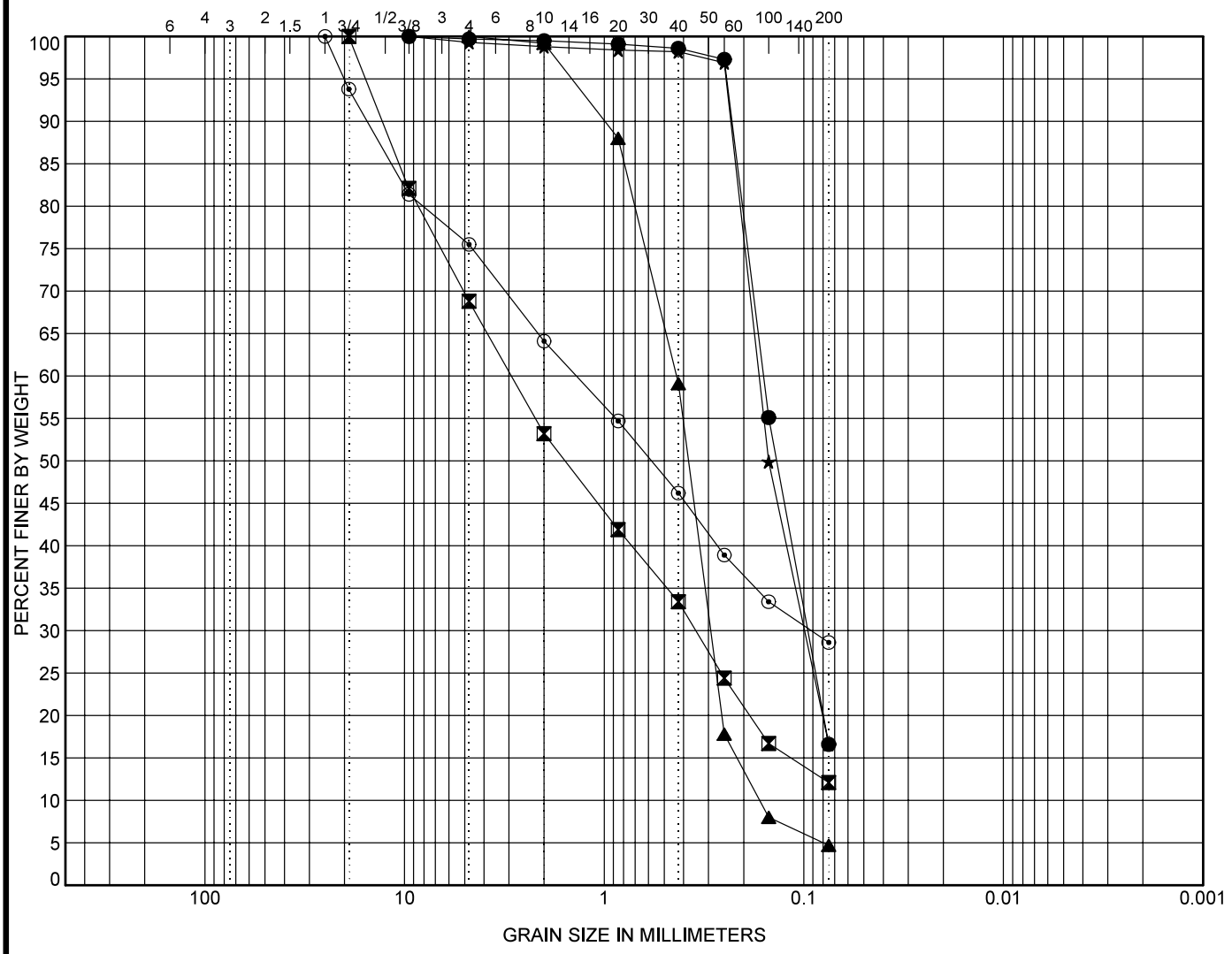
GRADATION CURVES

Project: MTT, DTT & MLK Exp. Project

Norfolk & Portsmouth, VA

Contract: 10613051 Task 21

SIEVE 5 SHEET 10613051 TASK 21 - MASTER.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 9/15/10



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen		Sample Description	LL	PL	PI
●	10BH-014	58.0 ft	Gray, fine silty SAND, contains shell fragments, SM	27	24	3
⊠	10BH-015	2.0 ft	Black, silty SAND, contains coal and gravel, SM (Visual) (Strong petroleum odor)	--	--	--
▲	10BH-015	38.0 ft	Brown, fine to medium poorly graded SAND, trace silt, SP	--	--	--
★	10BH-015	53.0 ft	Gray, fine to medium silty SAND, contains shell fragments, SM	28	24	4
⊙	10BH-016	4.0 ft	Dark brown, fine to medium silty SAND, contains coal, organics and wood, SM (Visual)	--	--	--

	Specimen		Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	10BH-014	58.0 ft	ASTM D422	9.5	0.159	0.095		0.3	83.1	16.6	
⊠	10BH-015	2.0 ft	ASTM D422	19	2.916	0.348		31.2	56.7	12.1	
▲	10BH-015	38.0 ft	ASTM D6913	4.75	0.434	0.292	0.166	0.0	95.3	4.7	
★	10BH-015	53.0 ft	ASTM D422	9.5	0.167	0.099		0.7	82.7	16.6	
⊙	10BH-016	4.0 ft	ASTM D422	25	1.377	0.092		24.5	46.9	28.6	

Schnabel ENGINEERING

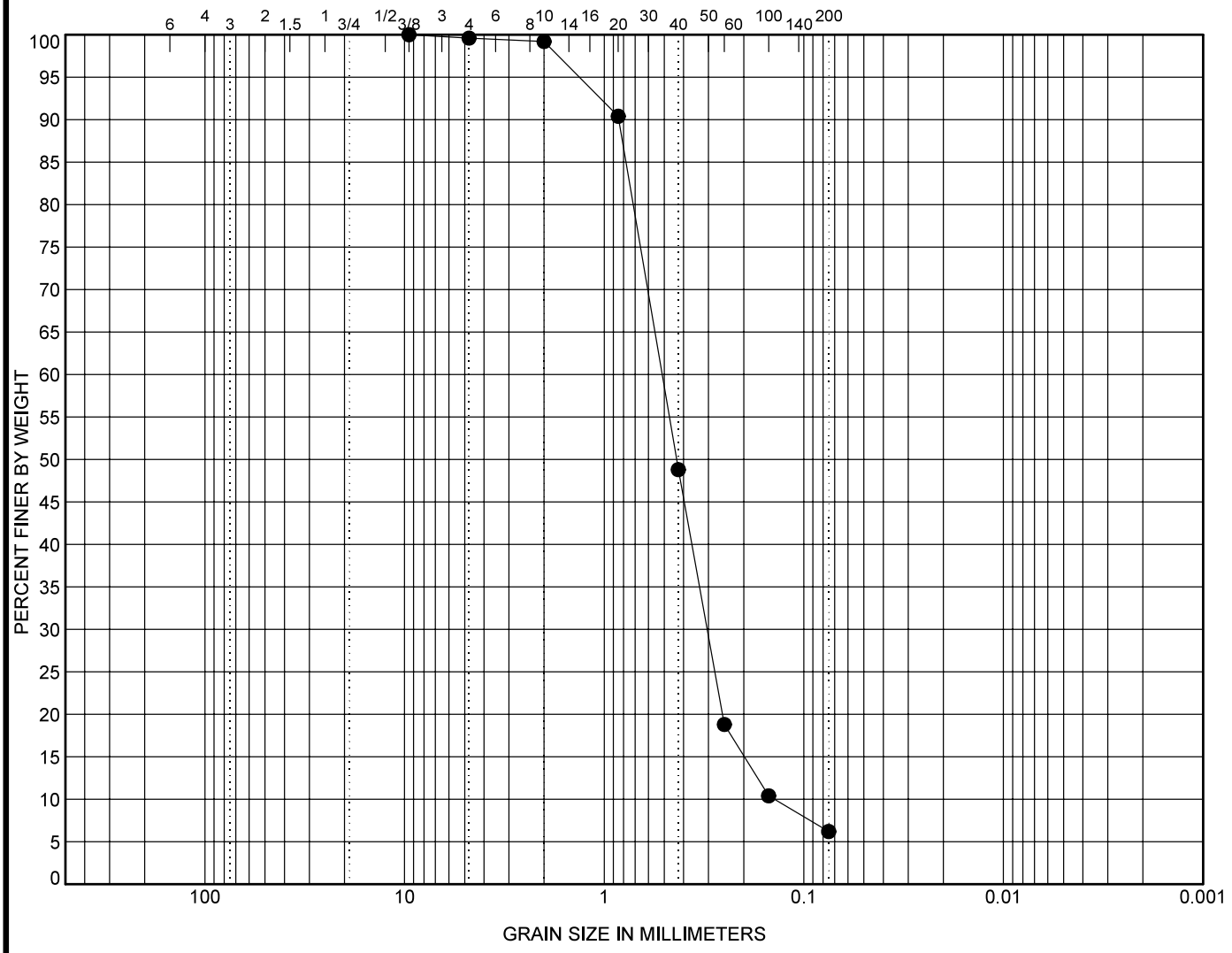
GRADATION CURVES

Project: MTT, DTT & MLK Exp. Project

Norfolk & Portsmouth, VA

Contract: 10613051 Task 21

SIEVE 5 SHEET 10613051 TASK 21 - MASTER.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 9/15/10



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen		Sample Description	LL	PL	PI	Cc	Cu
● 10BH-016	43.0 ft	**Orange-brown and gray, fine to medium poorly graded SAND with silt, SP-SM (Visual)**	--	--	--	1.29	3.65

Specimen		Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● 10BH-016	43.0 ft	ASTM D422	9.5	0.512	0.305	0.14	0.4	93.4	6.2	

Schnabel ENGINEERING

GRADATION CURVES

Project: MTT, DTT & MLK Exp. Project

Norfolk & Portsmouth, VA

Contract: 10613051 Task 21

SIEVE 5 SHEET 10613051 TASK 21 - MASTER.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 9/15/10

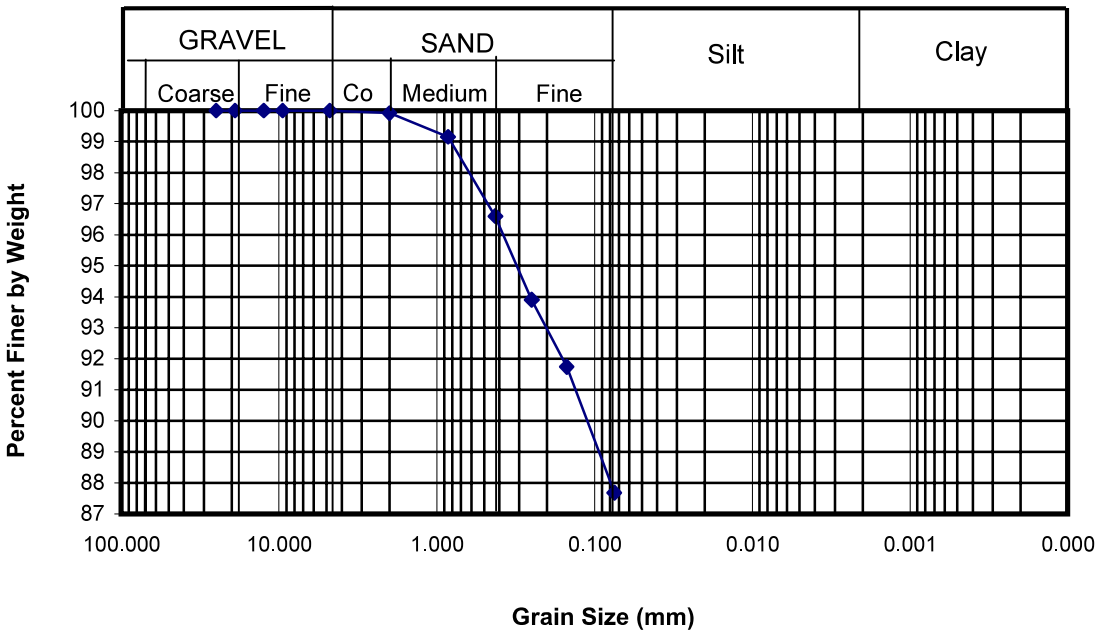
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-005 (S4)
Sample Depth:	17 to 19 feet
Sample Description:	CLAY (CH), Dark Gray, with Silt and Fine to Medium Sand
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	99.9
20	99.2
40	96.6
60	93.9
100	91.7
200	87.7



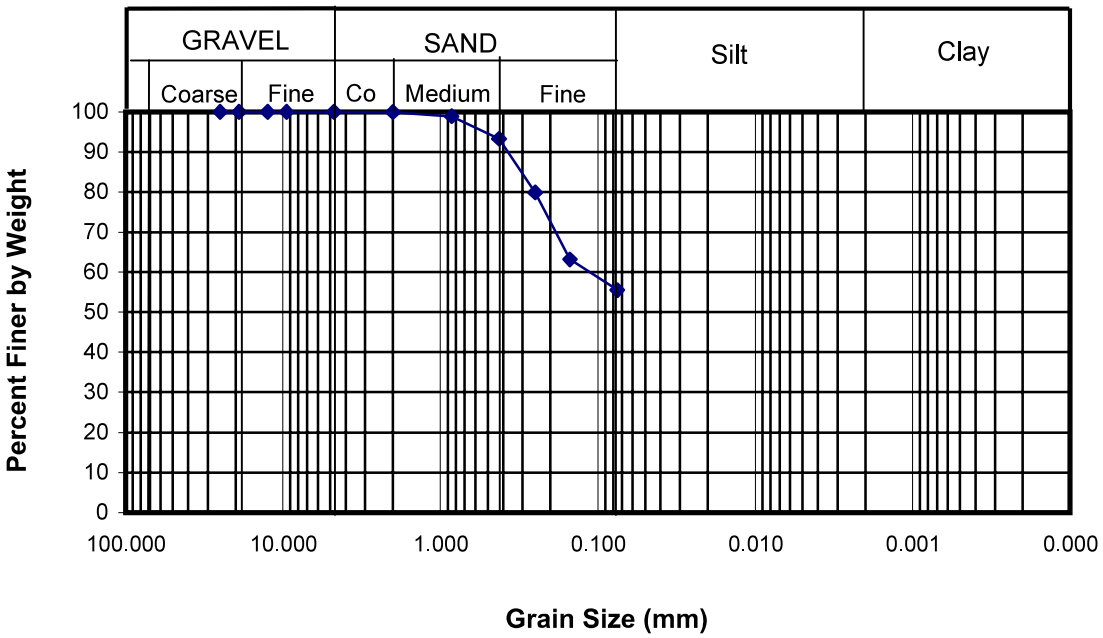
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name: **Midtown Tunnel**
Client: **PB Americas**
Project Number: 4955-110
Sample Number: 10BH-005 (S6)
Sample Depth: 27 to 29 feet
Sample Description: Sandy CLAY (CL), Dark Gray, with Silt
Test Method: ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	99.9
20	98.9
40	93.3
60	79.8
100	63.2
200	55.5



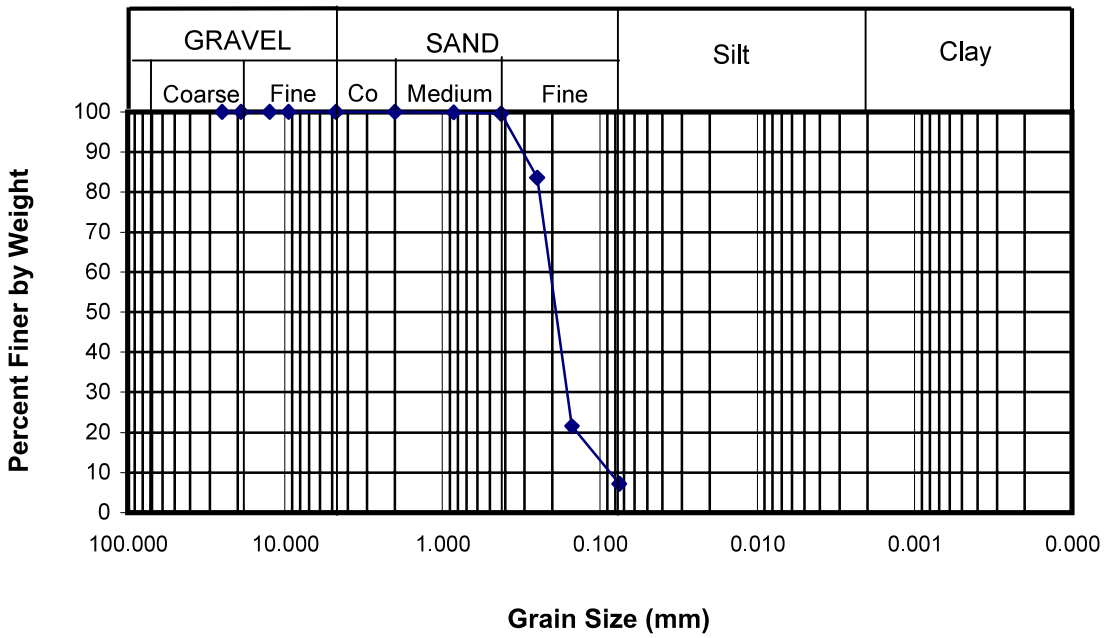
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-005 (S11)
Sample Depth:	52 to 54 feet
Sample Description:	SAND (SP-SM), Tan and Gray, Fine, Trace Silt
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	99.8
40	99.5
60	83.6
100	21.6
200	7.2



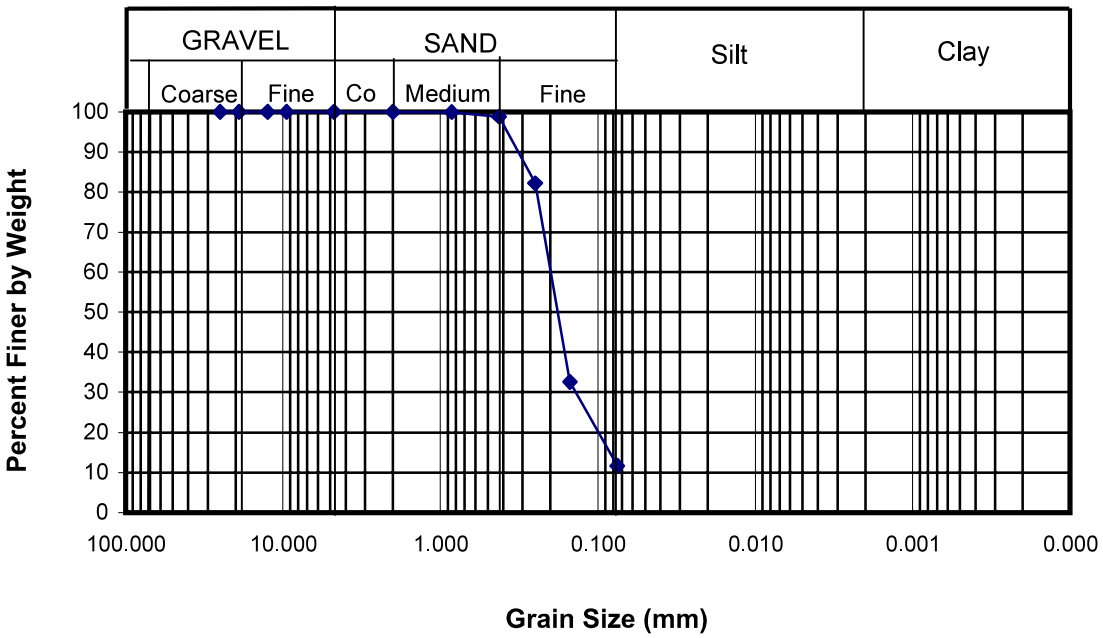
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-005 (S13)
Sample Depth:	62 to 64 feet
Sample Description:	SAND (SP-SM), Tan and Gray, Fine, with Silt
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	99.9
40	98.8
60	82.2
100	32.6
200	11.6



Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-005 (S15)
Sample Depth:	72 to 74 feet
Sample Description:	SAND (SP-SM), Tan and Gray, Fine to Coarse, Trace Silt, Trace Fine Gravel
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	98.3
10	91.2
20	68.7
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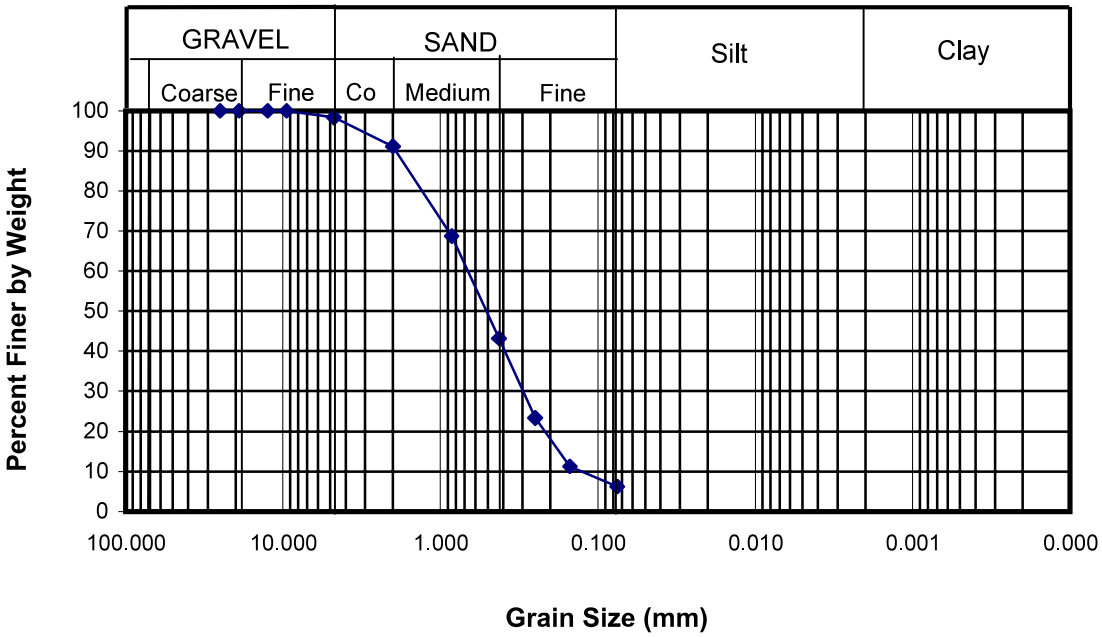
60	23.3
100	11.3
200	6.2



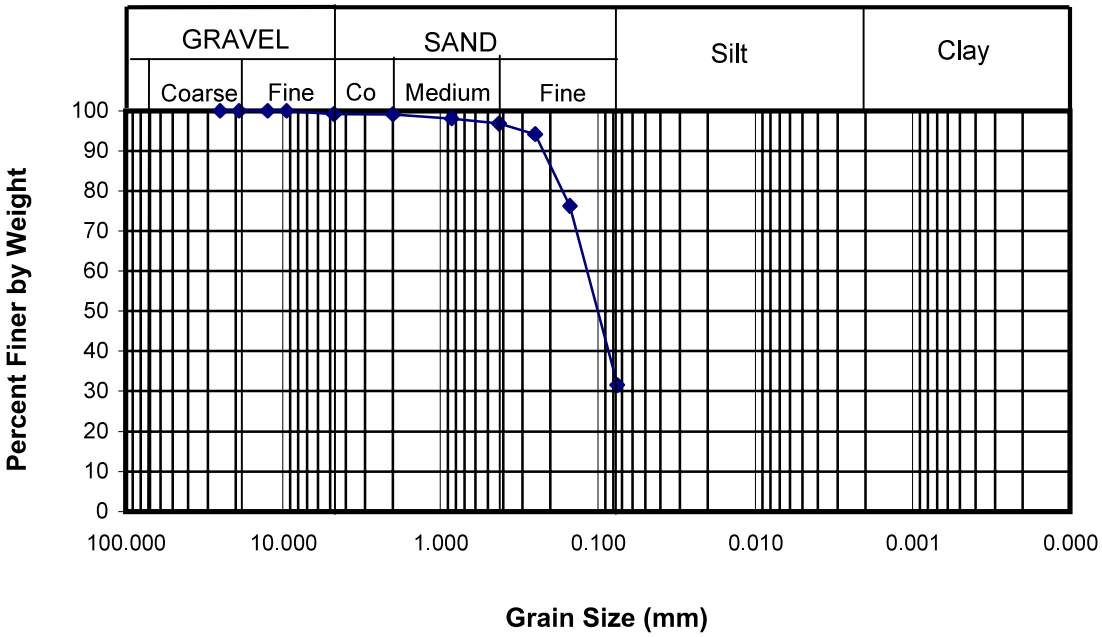
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-005 (S20)
Sample Depth:	97 to 99 feet
Sample Description:	Clayey SAND (SC), Dark Gray, Fine, with Silt, Trace Shell Fragments
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	99.2
10	99.1
20	98.1
40	96.8
60	94.2
100	76.3
200	31.6



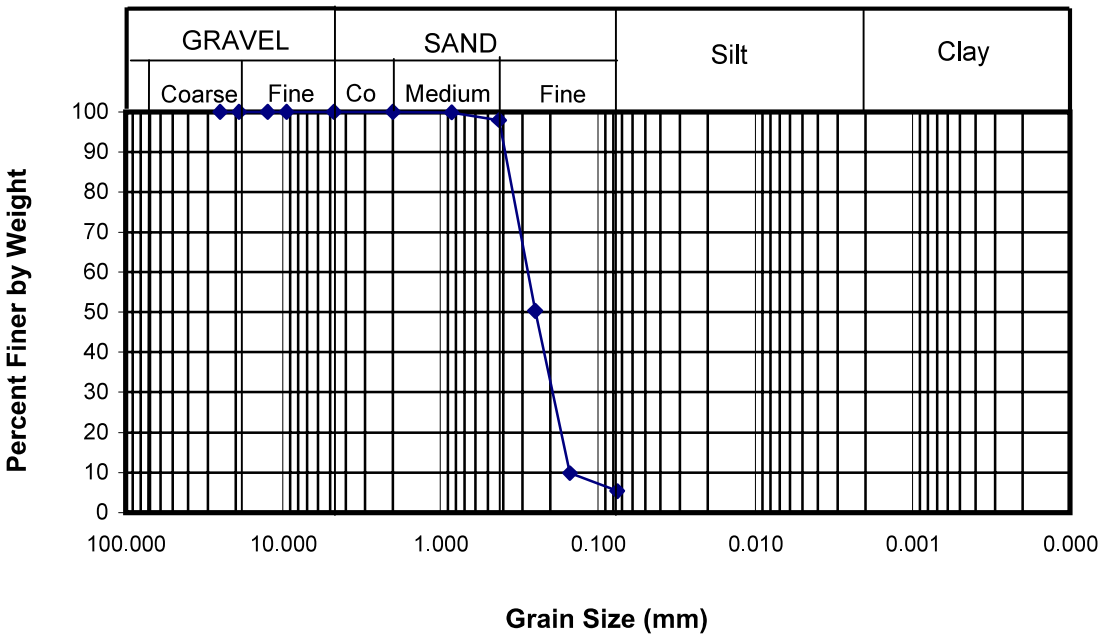
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-006 (S9)
Sample Depth:	42 to 44 feet
Sample Description:	SAND (SP-SM), Gray, Fine, Trace Silt
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	99.8
40	97.9
60	50.3
100	9.9
200	5.3



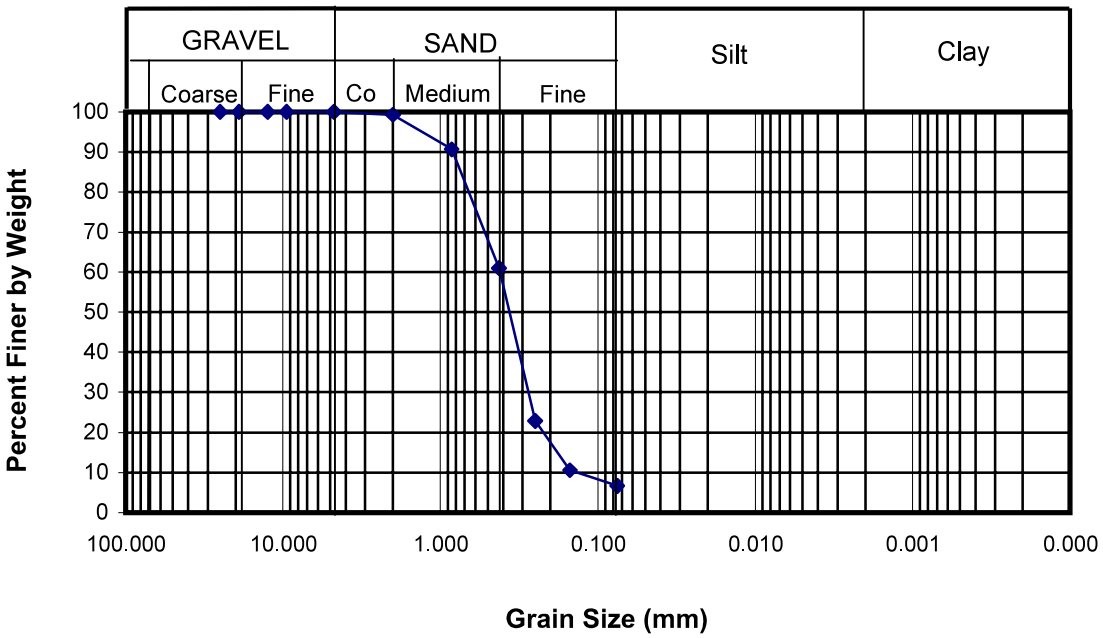
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name: **Midtown Tunnel**
Client: **PB Americas**
Project Number: 4955-110
Sample Number: 10BH-006 (S10B)
Sample Depth: 48 to 49 feet
Sample Description: SAND (SP-SM), Gray, Fine to Medium, Trace Silt
Test Method: ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	99.3
20	90.7
40	61.0
60	22.8
100	10.5
200	6.6



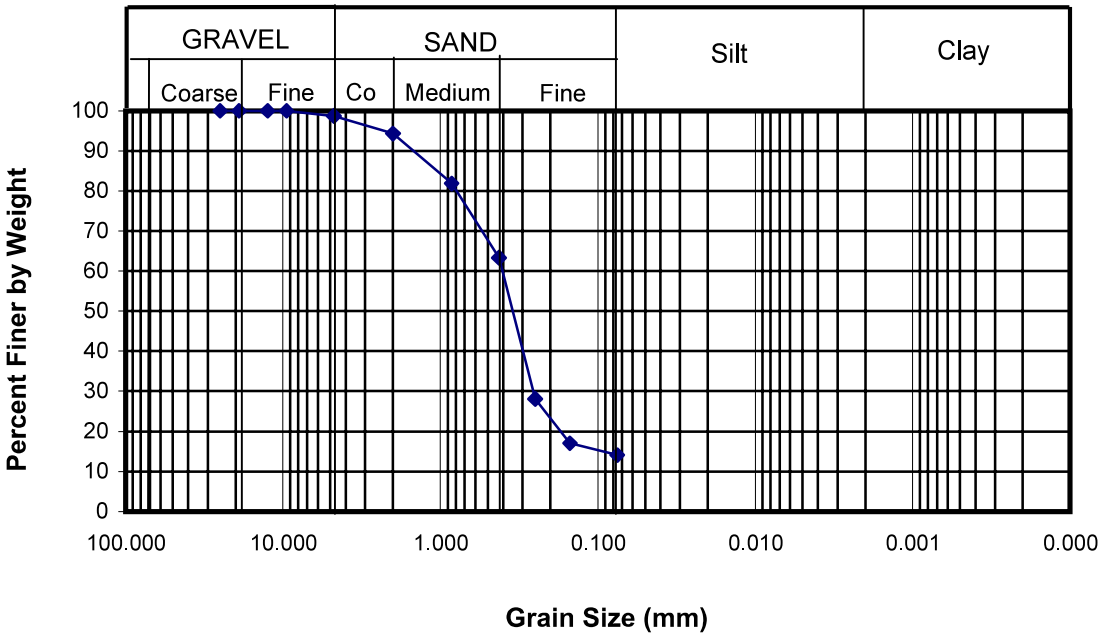
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-006 (S11)
Sample Depth:	52 to 54 feet
Sample Description:	Silty, Clayey SAND (SC-SM), Gray, Fine to Coarse, Trace Fine Gravel
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	98.7
10	94.3
20	81.8
40	63.3
60	28.1
100	17.0
200	14.1



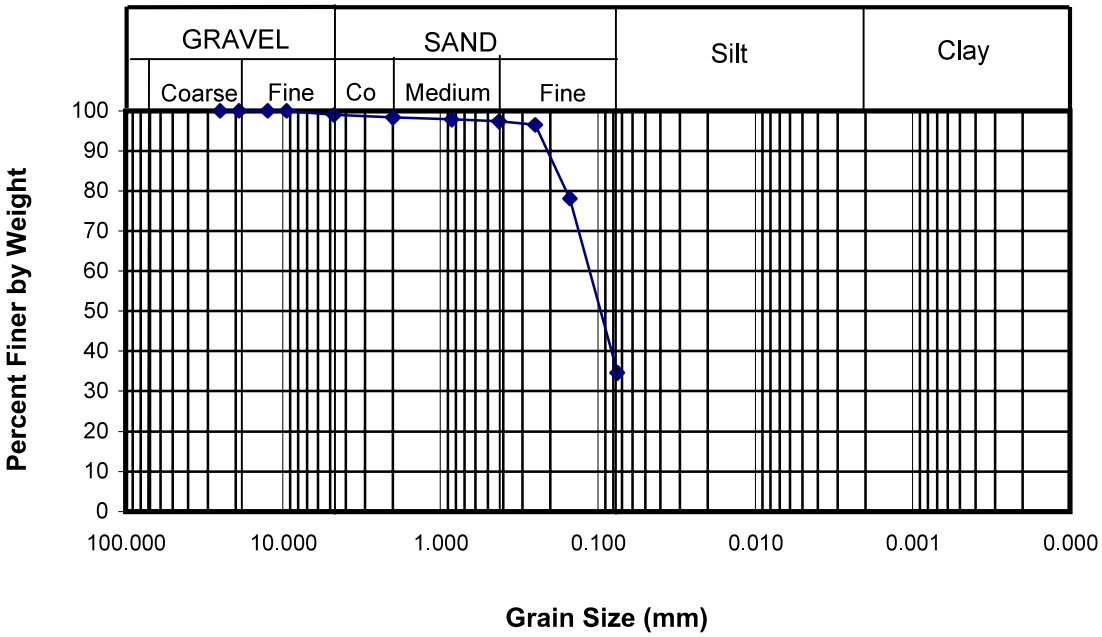
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-006 (S13)
Sample Depth:	62 to 64 feet
Sample Description:	Clayey SAND (SC), Gray, Fine, with Silt, Trace Fine Gravel
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	98.9
10	98.3
20	97.9
40	97.4
60	96.5
100	78.2
200	34.6



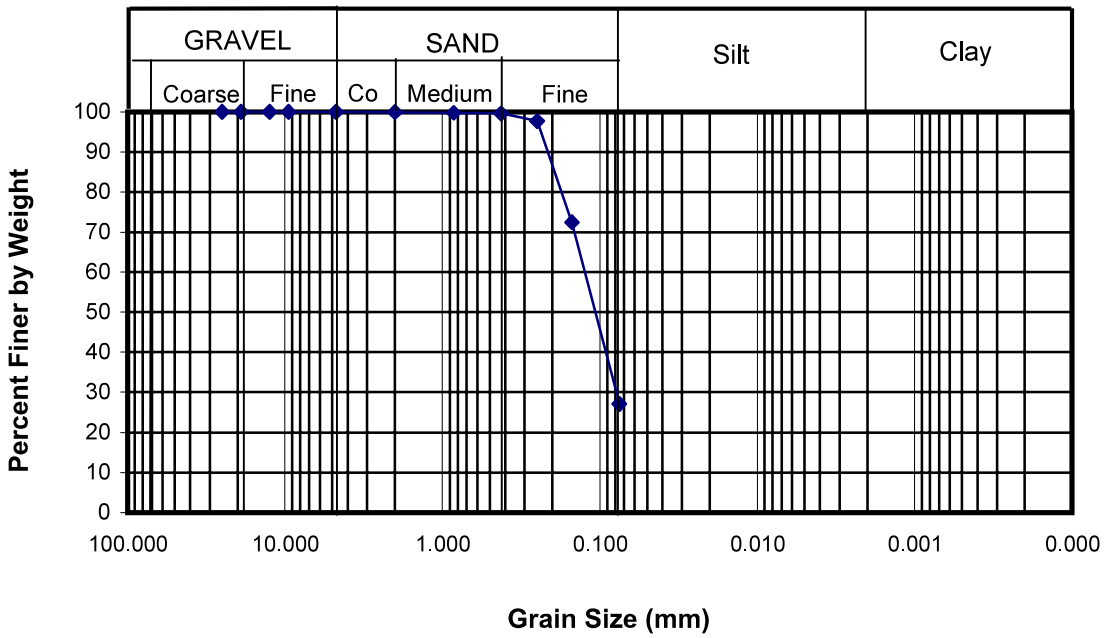
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-006 (S17)
Sample Depth:	82 to 84 feet
Sample Description:	Clayey SAND (SC), Gray, Fine, with Silt
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	99.9
20	99.8
40	99.6
60	97.7
100	72.4
200	27.1



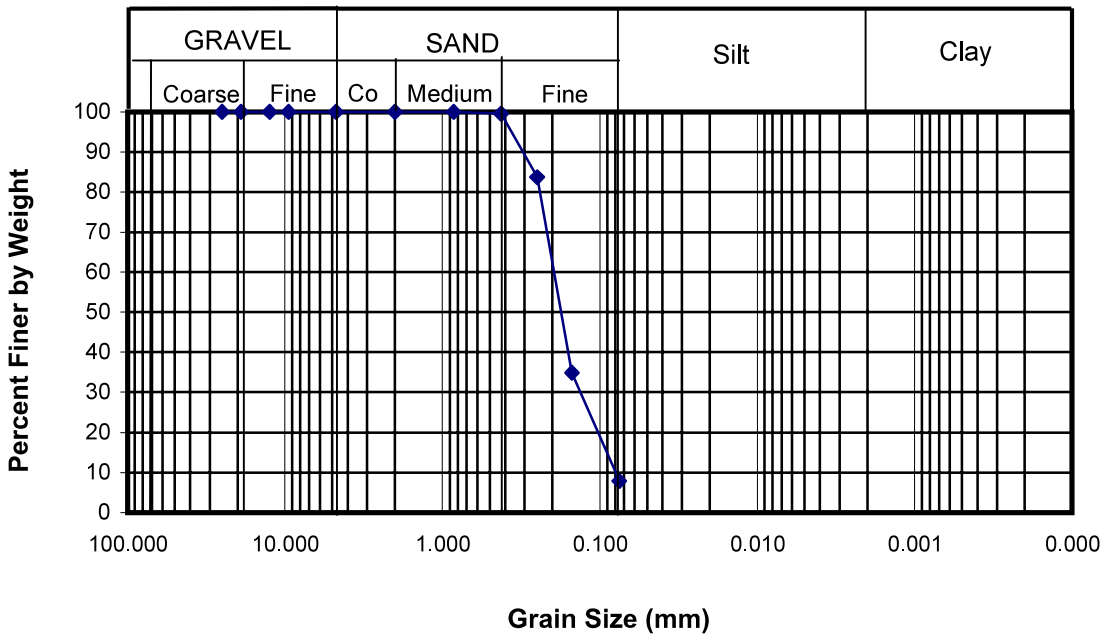
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name: **Midtown Tunnel**
Client: **PB Americas**
Project Number: 4955-110
Sample Number: 10BH-007 (S5)
Sample Depth: 21 to 23 feet
Sample Description: SAND (SP-SM), Gray, Fine, Trace Silt
Test Method: ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	100.0
40	99.5
60	83.7
100	34.9
200	7.8



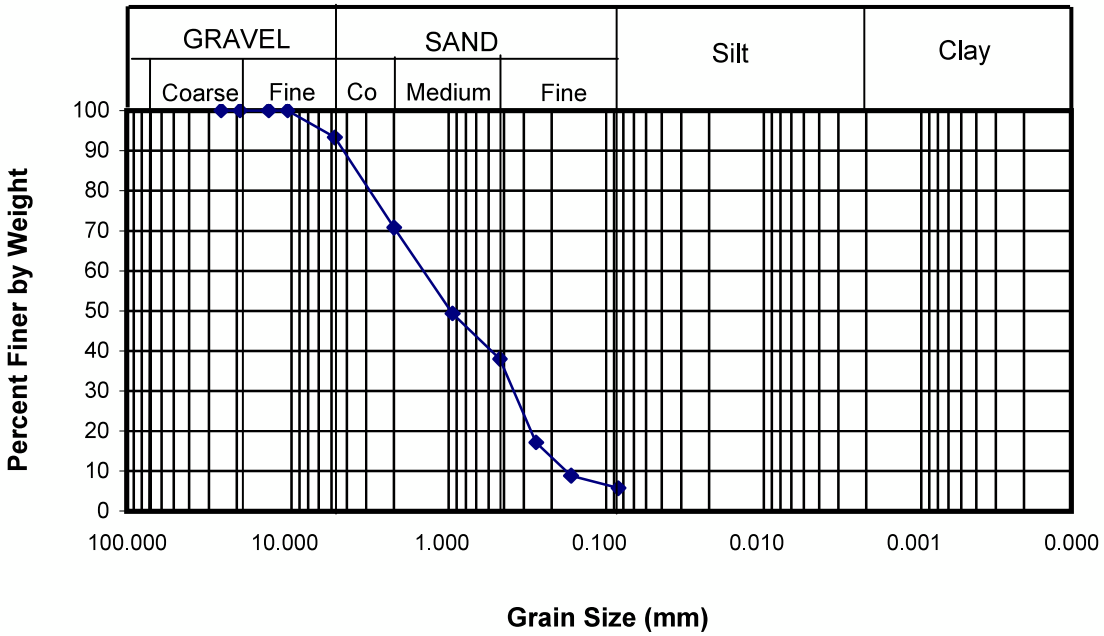
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-007 (S8A)
Sample Depth:	36 to 36.5 feet
Sample Description:	SAND (SP-SM), Gray, Fine to Coarse, Trace Silt, Trace Fine Gravel
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	93.3
10	70.8
20	49.3
40	38.0
60	17.2
100	8.9
200	5.8



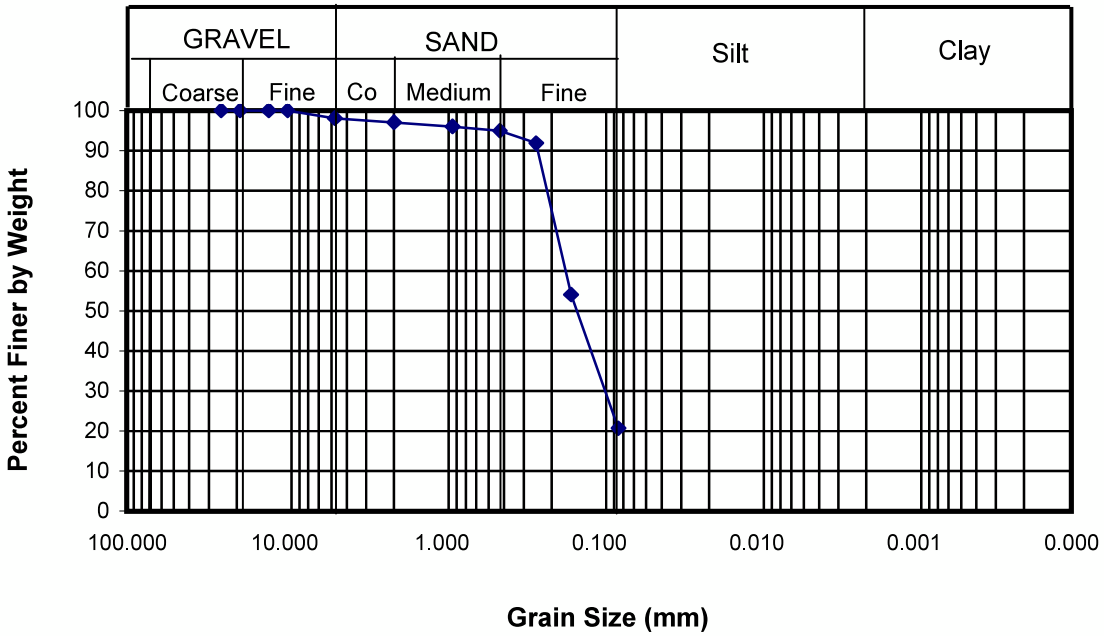
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-007 (S8B)
Sample Depth:	36 to 37 feet
Sample Description:	Clayey SAND (SC), Dark Gray, Fine, with Silt, Trace Fine Gravel
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	98.0
10	97.1
20	96.0
40	95.0
60	91.8
100	54.1
200	20.7



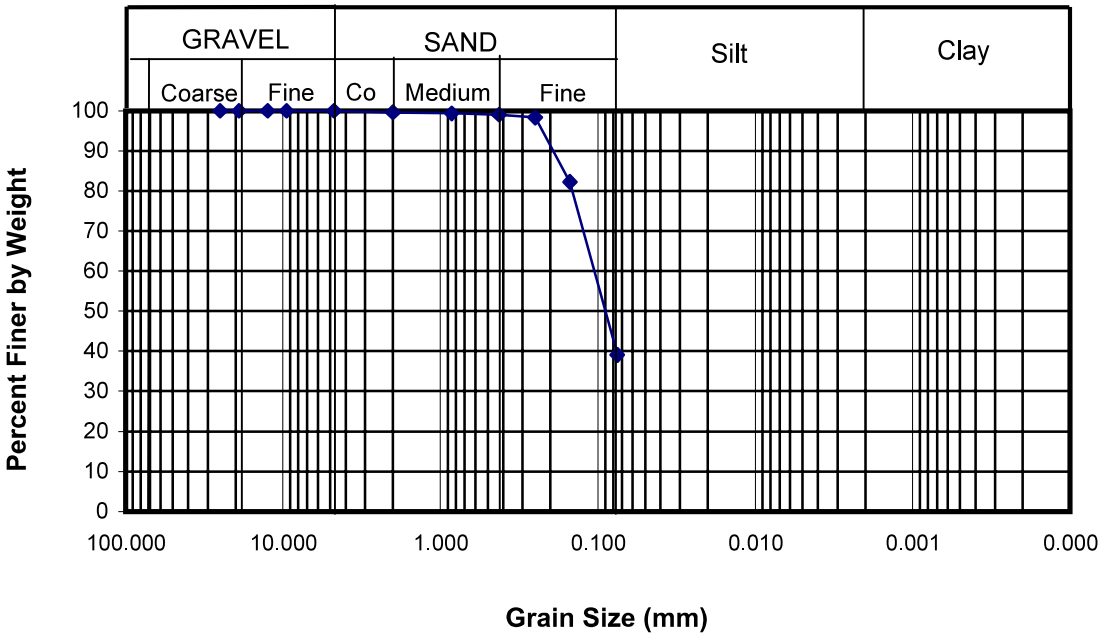
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-007 (S11)
Sample Depth:	51 to 53 feet
Sample Description:	Clayey SAND (SC), Dark Gray, Fine, with Silt, Trace Shell Fragments
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	99.6
20	99.4
40	99.1
60	98.3
100	82.3
200	39.0



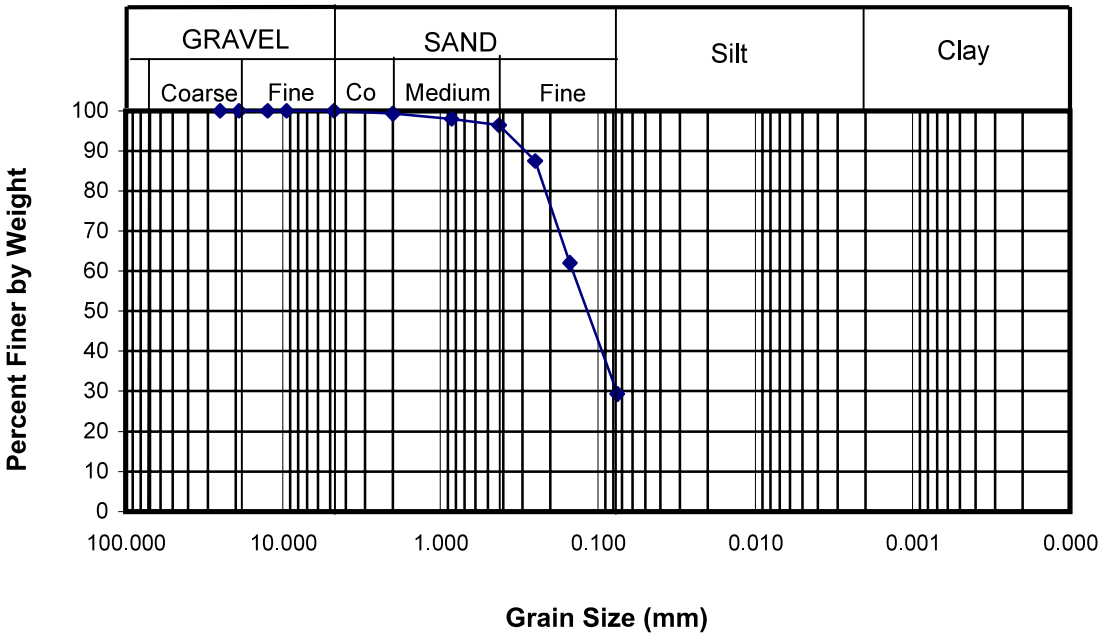
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-007 (S15)
Sample Depth:	71 to 73 feet
Sample Description:	Clayey SAND (SC), Dark Gray, Fine, with Silt, Trace Shell Fragments
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	99.3
20	98.0
40	96.4
60	87.4
100	62.1
200	29.3



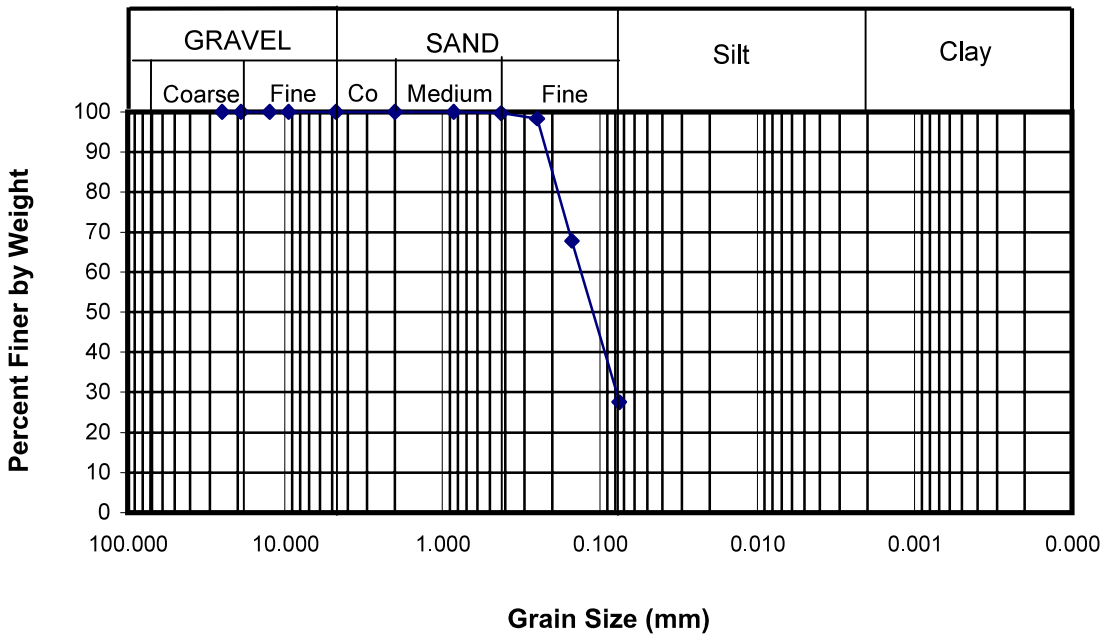
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-007 (S17)
Sample Depth:	81 to 83 feet
Sample Description:	Silty SAND (SM), Dark Gray, Fine, Trace Clay
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	100.0
40	99.7
60	98.3
100	67.8
200	27.6



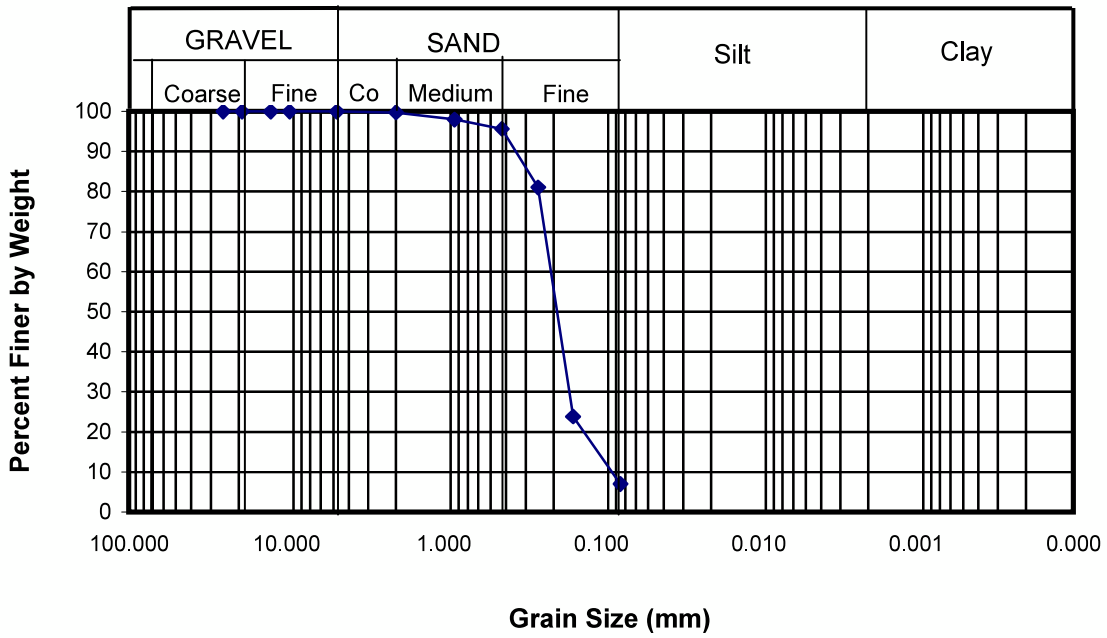
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-008 (S4)
Sample Depth:	16.5 to 18.5 feet
Sample Description:	SAND (SP-SM), Dark Gray, Fine, Trace Silt
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	99.8
20	98.0
40	95.7
60	81.1
100	23.9
200	7.1



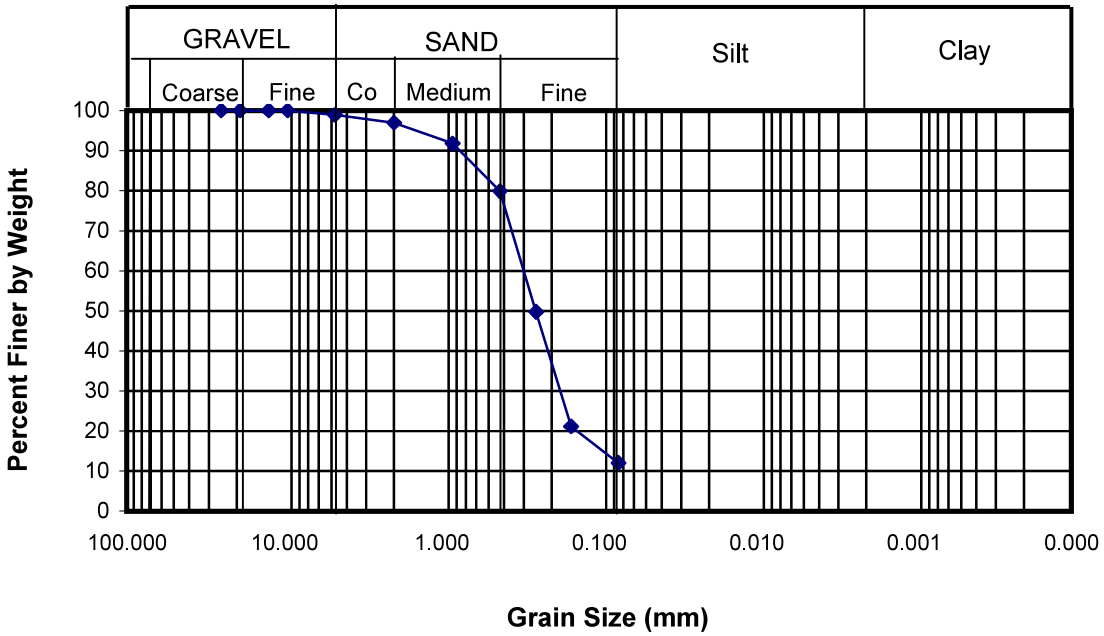
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-008 (S7A)
Sample Depth:	31.5 to 32.5 feet
Sample Description:	Silty SAND (SM), Dark Gray, Fine to Medium, Trace Clay, Trace Fine Gravel
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	98.9
10	97.0
20	91.8
40	79.9
60	49.8
100	21.2
200	12.1



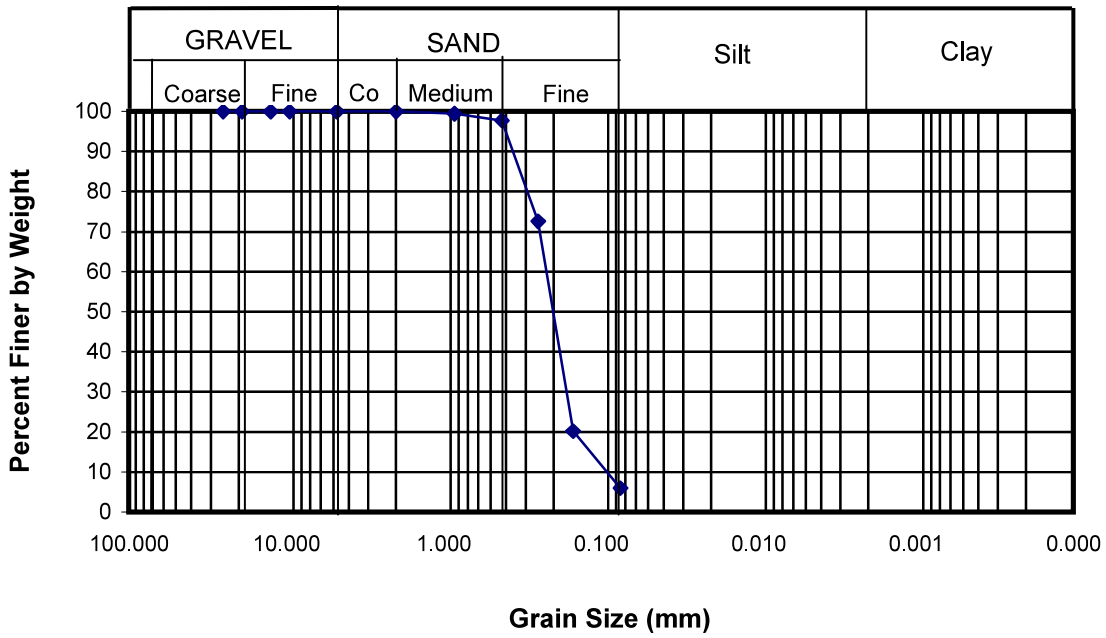
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-008 (S7B)
Sample Depth:	32.5 to 33.5 feet
Sample Description:	SAND (SP-SM), Gray, Fine, Trace Silt
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	99.4
40	97.8
60	72.6
100	20.2
200	6.0



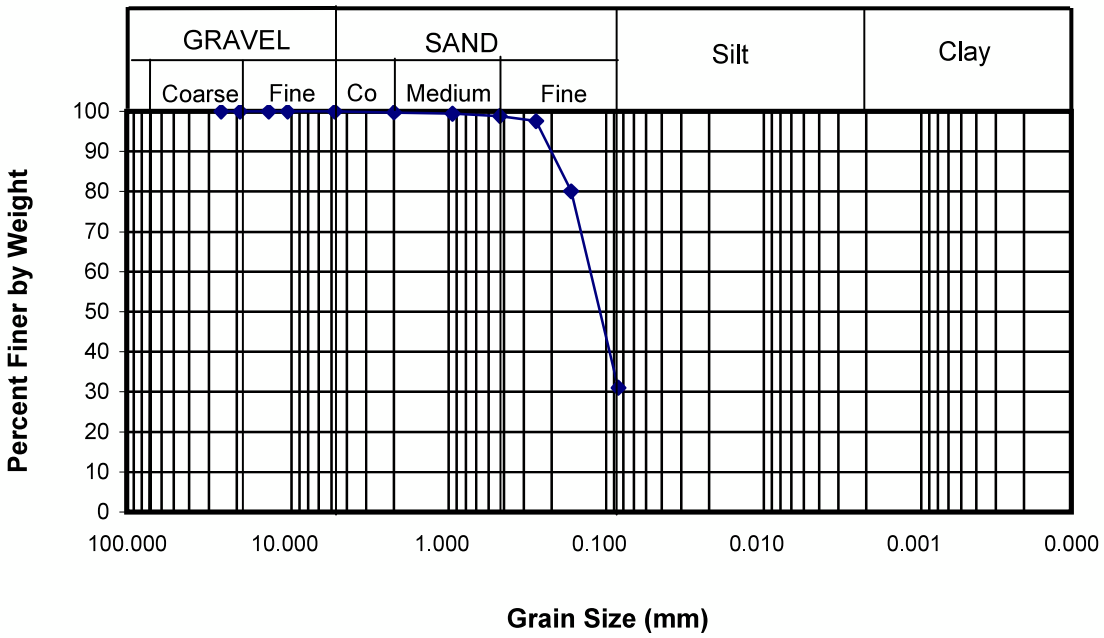
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-008 (S10)
Sample Depth:	46.5 to 48.5 feet
Sample Description:	Clayey SAND (SC), Dark Gray, Fine, with Silt
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	99.8
20	99.4
40	98.9
60	97.6
100	80.1
200	31.1



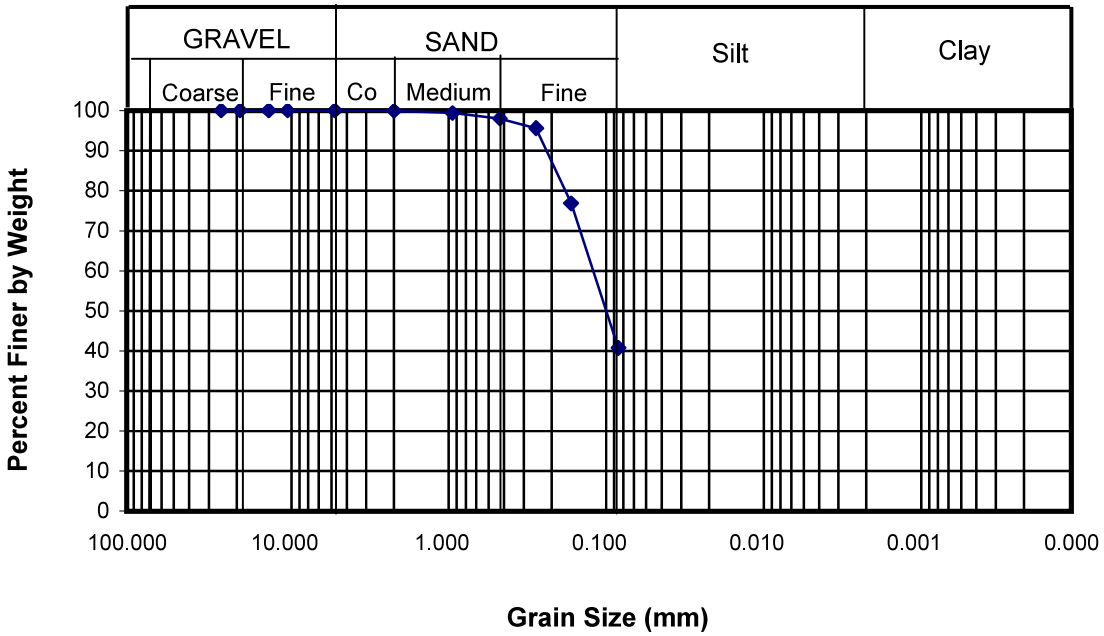
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-008 (S12)
Sample Depth:	56.5 to 58.5 feet
Sample Description:	Clayey SAND (SC), Dark Gray, Fine, with Silt, Trace Shell Fragments
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	99.9
20	99.4
40	98.0
60	95.6
100	76.8
200	40.7



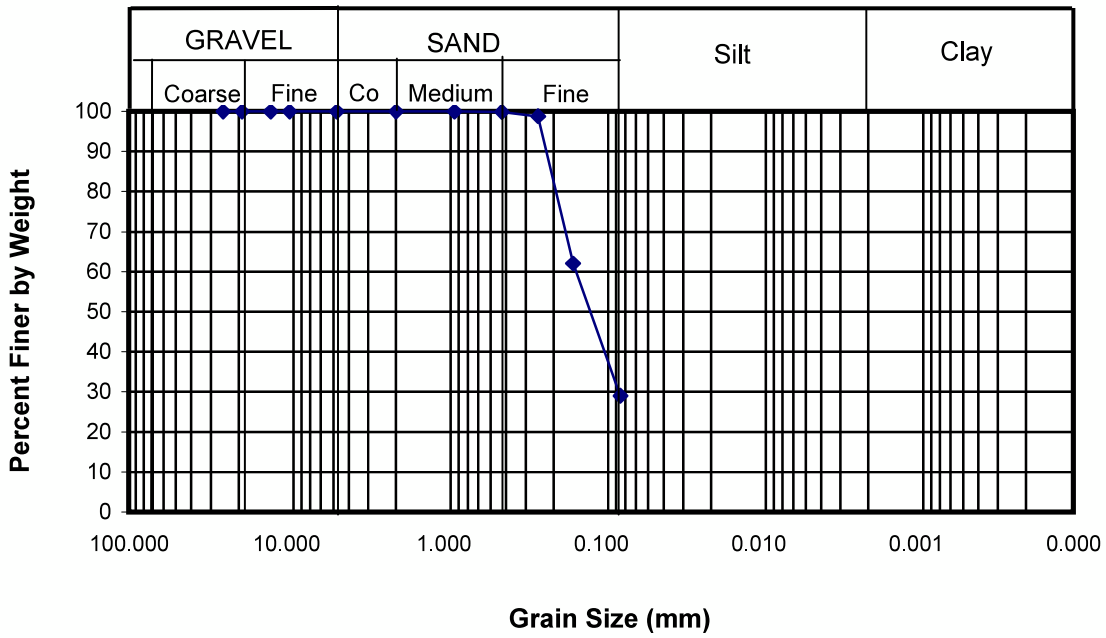
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-008 (S18)
Sample Depth:	86.5 to 88.5 feet
Sample Description:	Silty SAND (SM), Dark Gray, Fine, Trace Clay
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	100.0
40	99.9
60	98.8
100	62.0
200	29.1



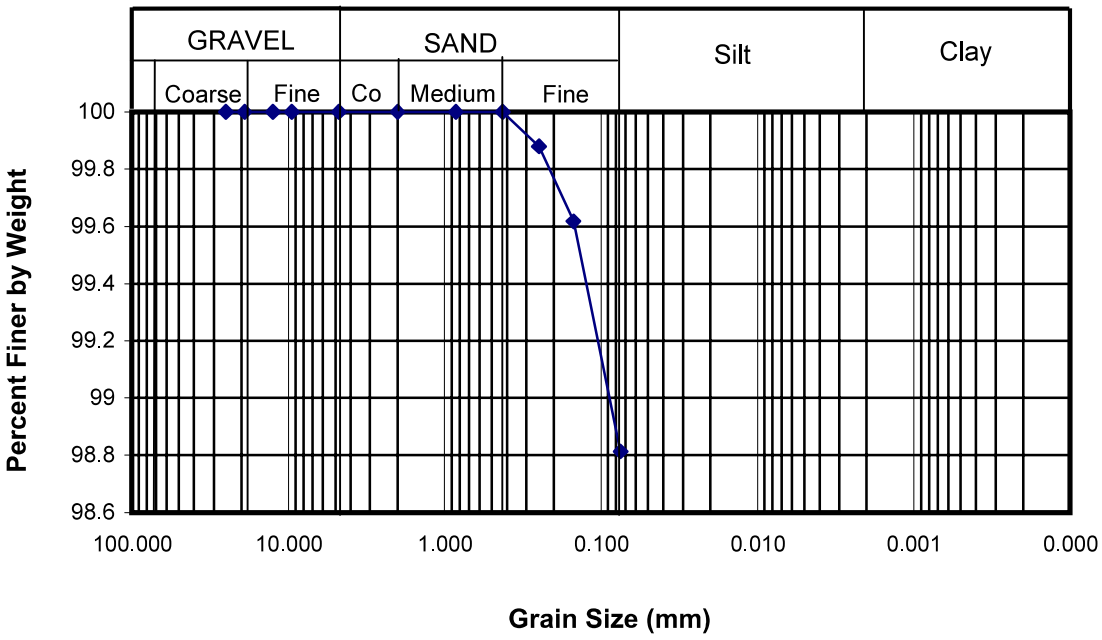
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-009 (S3)
Sample Depth:	13 to 15 Feet
Sample Description:	CLAY (CH), Dark Gray, with Silt, Trace Fine Sand
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	100.0
40	100.0
60	99.9
100	99.6
200	98.8



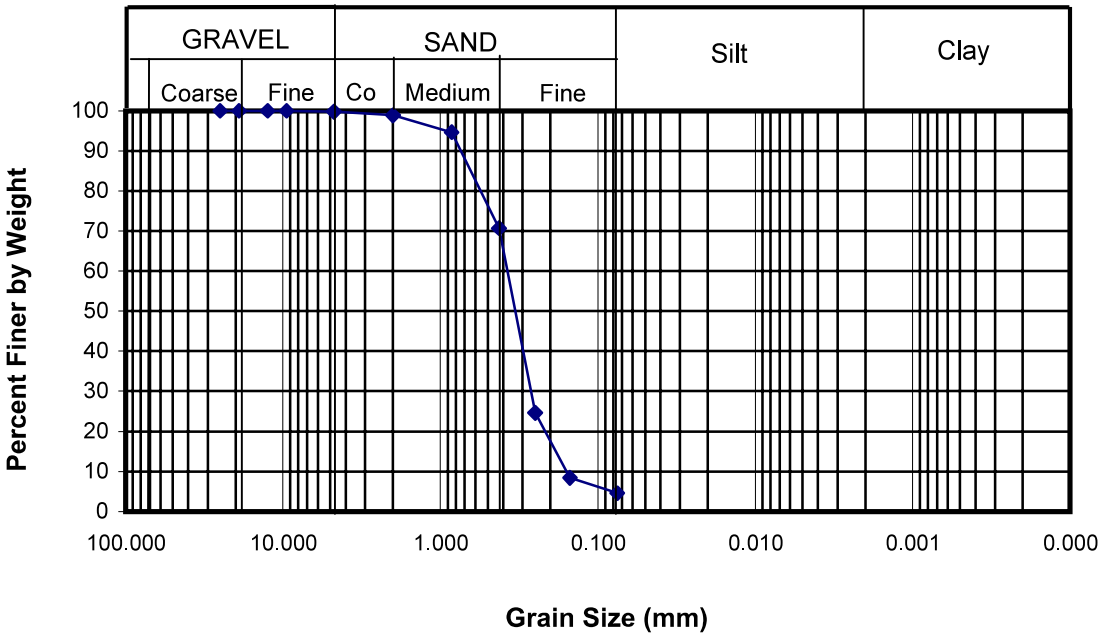
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-009 (S11)
Sample Depth:	50 to 52 Feet
Sample Description:	SAND (SP), Gray, Fine to Medium, Trace Silt, Trace Fine Gravel
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	99.8
10	98.8
20	94.7
40	70.7
60	24.6
100	8.4
200	4.6



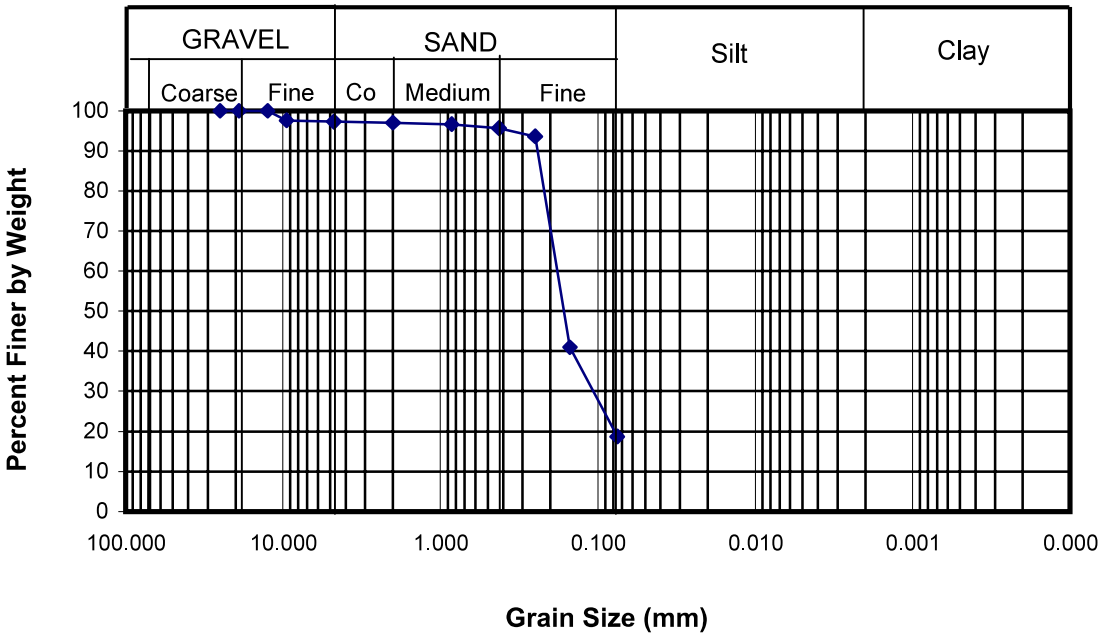
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-009 (S13)
Sample Depth:	60 to 62 Feet
Sample Description:	Clayey SAND (SC), Gray, Fine, with Silt, Trace Fine Gravel
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	97.6
4	97.3
10	97.0
20	96.6
40	95.7
60	93.6
100	40.9
200	18.7



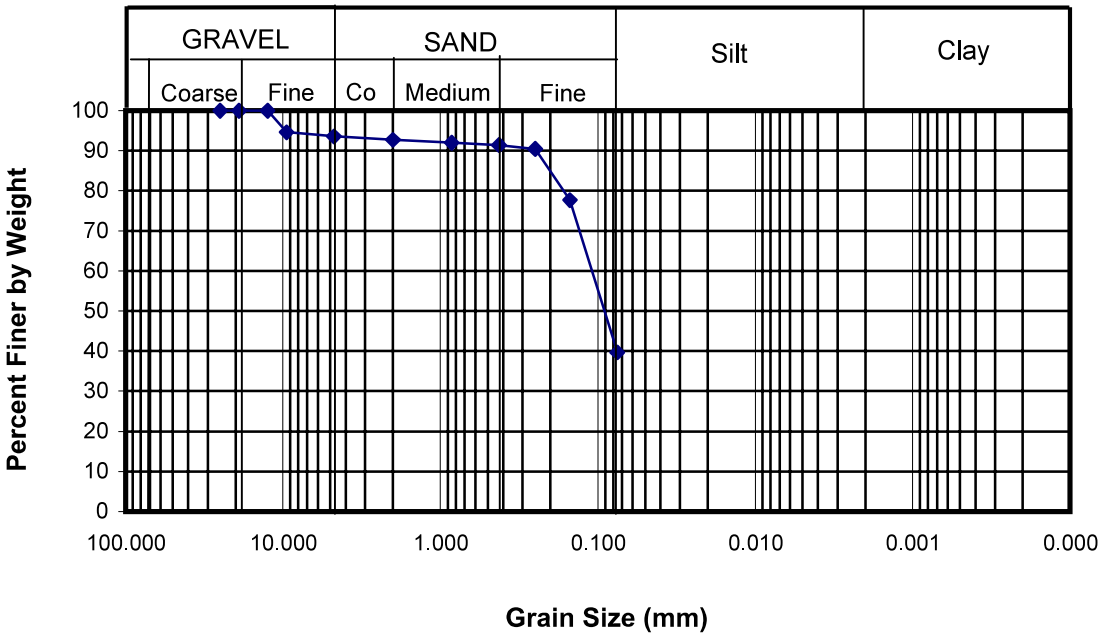
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-009 (S18)
Sample Depth:	85 to 87 Feet
Sample Description:	Clayey SAND (SC), Dark Gray, Fine, with Silt, Trace Medium to Coarse Sand-sized Shell Fragments, Trace Fine Gravel-sized Shell Fragments
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	94.7
4	93.6
10	92.7
20	92.0
40	91.5
60	90.5
100	77.7
200	39.7



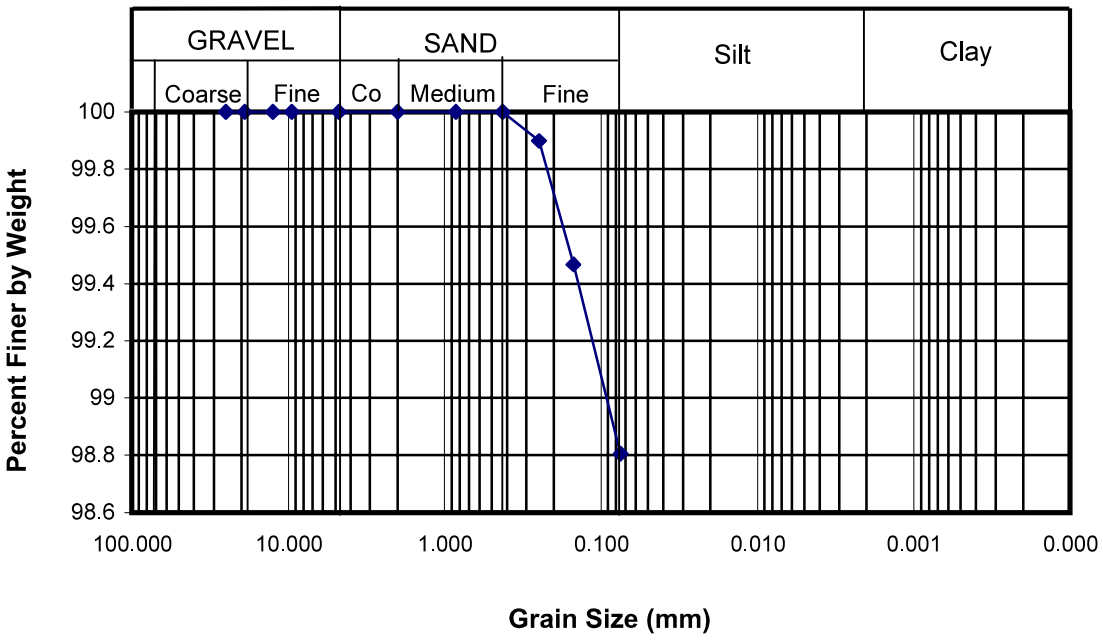
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-010 (S4)
Sample Depth:	15 to 17 feet
Sample Description:	CLAY (CH), Dark Gray, with Silt, Trace Fine Sand
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	100.0
40	100.0
60	99.9
100	99.5
200	98.8



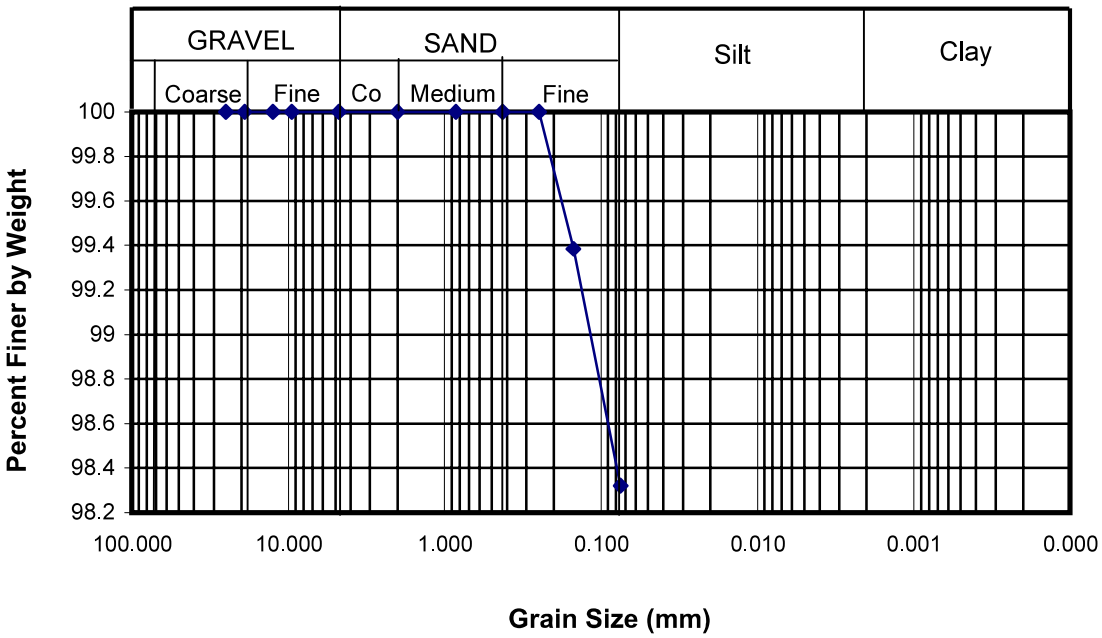
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-010 (S8)
Sample Depth:	35 to 37 feet
Sample Description:	CLAY (CH), Dark Gray, with Silt, Trace Fine Sand
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	100.0
40	100.0
60	100.0
100	99.4
200	98.3



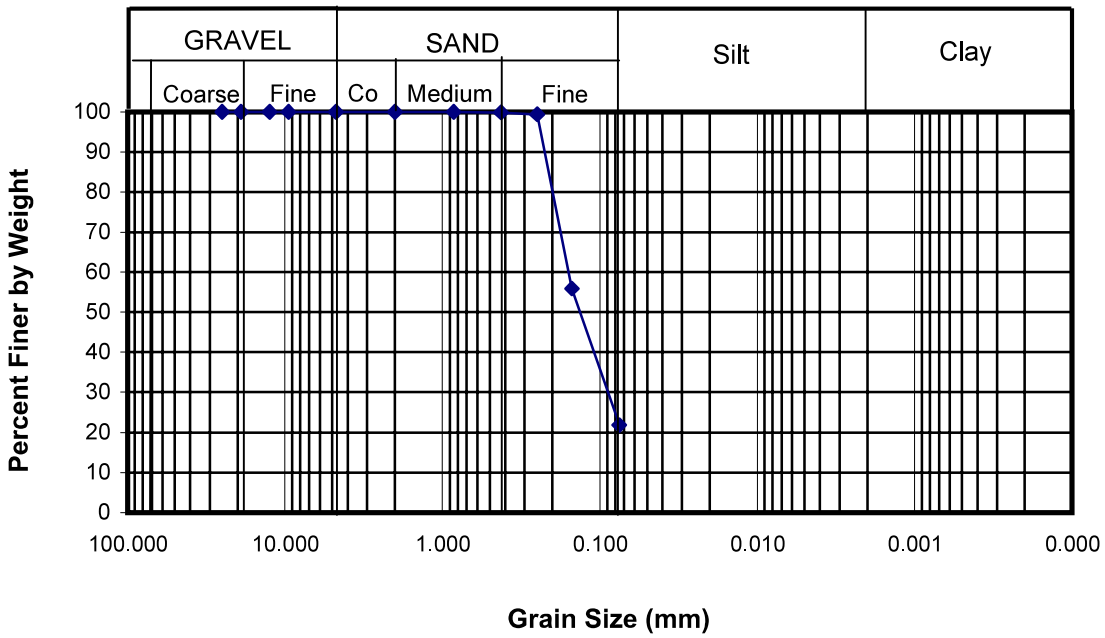
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-010 (S11)
Sample Depth:	50 to 52 feet
Sample Description:	Clayey SAND (SC), Gray, Fine, with Silt
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	100.0
40	99.8
60	99.4
100	55.9
200	21.8



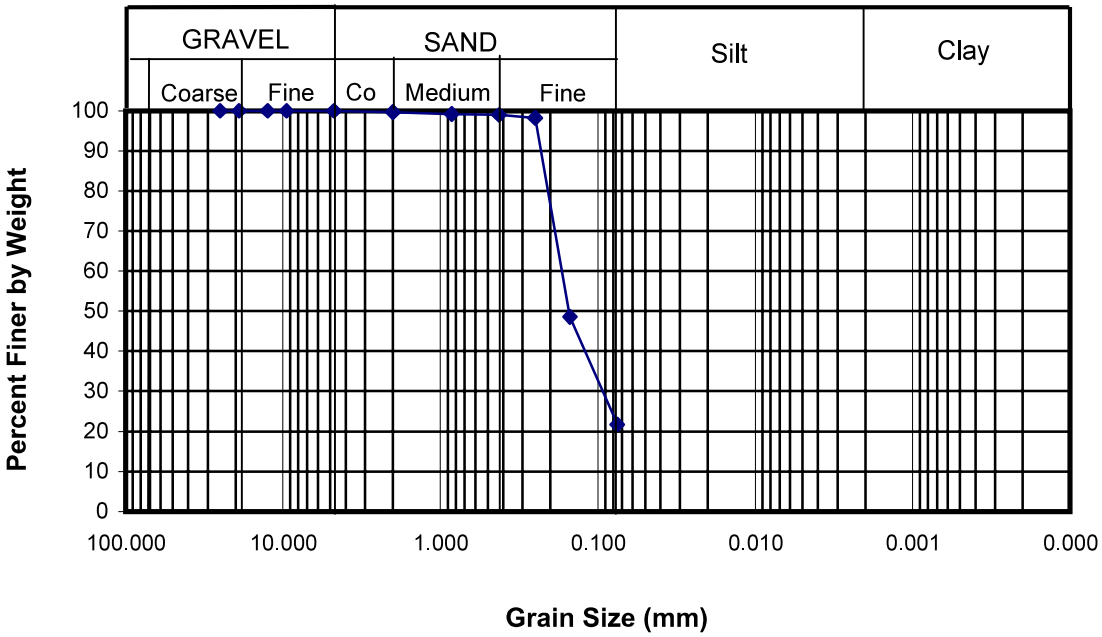
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-010 (S14)
Sample Depth:	65 to 67 feet
Sample Description:	Clayey SAND (SC), Dark Gray, Fine, with Silt, Trace Shell Fragments
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	99.7
20	99.2
40	98.9
60	98.2
100	48.5
200	21.7



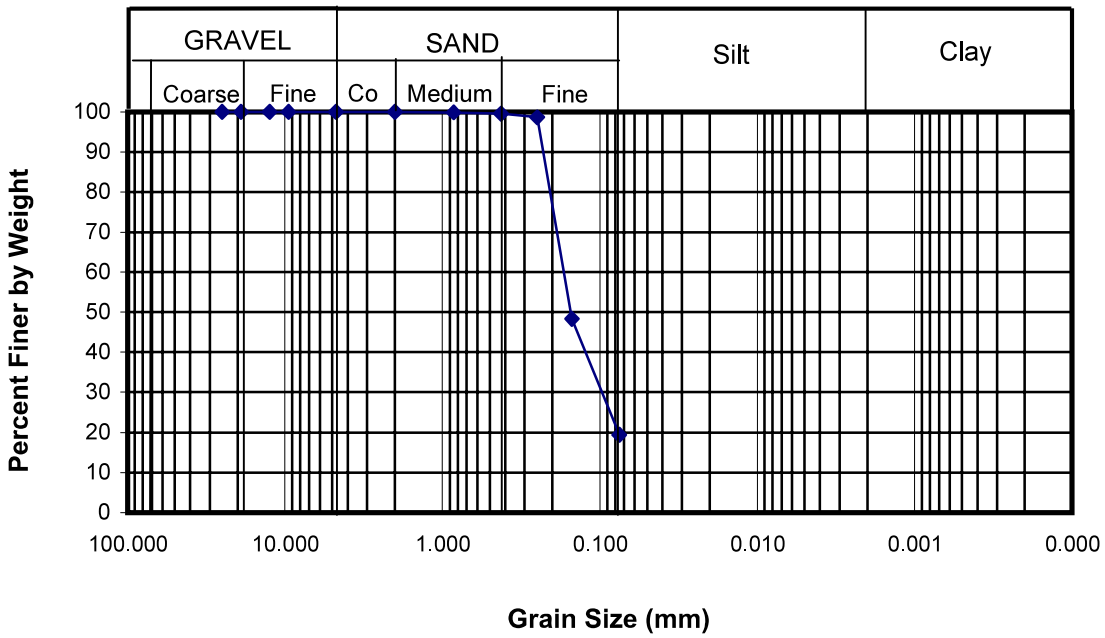
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-010 (S15)
Sample Depth:	70 to 72 feet
Sample Description:	Silty SAND (SM), Dark Gray, Fine, Trace Clay
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	99.8
40	99.5
60	98.7
100	48.4
200	19.4



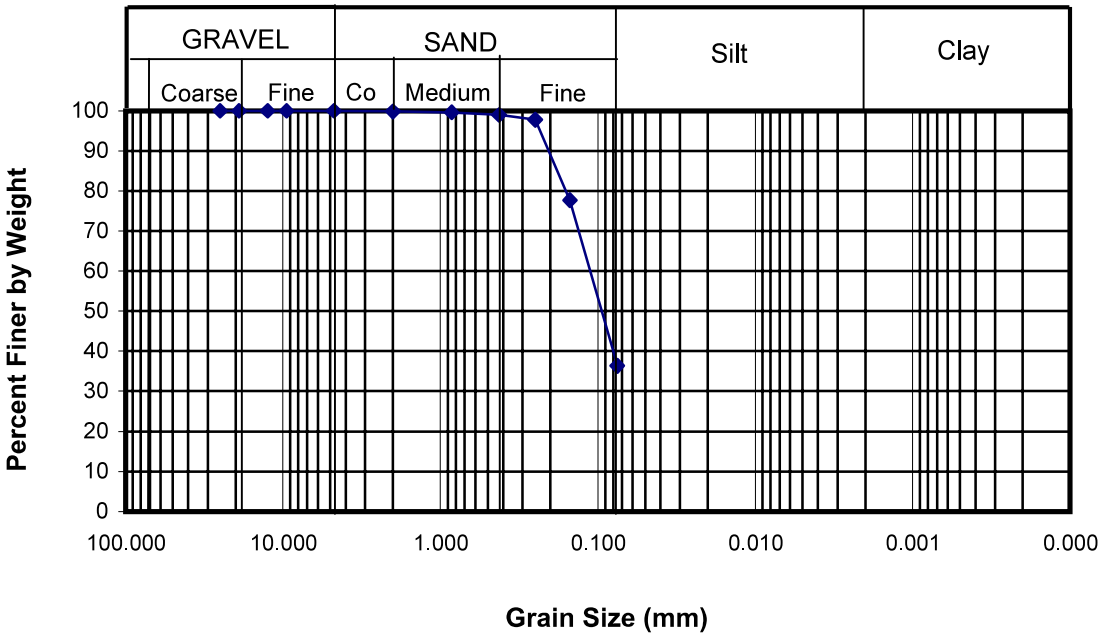
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-010 (S18)
Sample Depth:	85 to 87 feet
Sample Description:	Clayey SAND (SC), Dark Gray, Fine, with Silt, Trace Shell Fragments
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	99.8
20	99.6
40	99.0
60	97.8
100	77.7
200	36.3



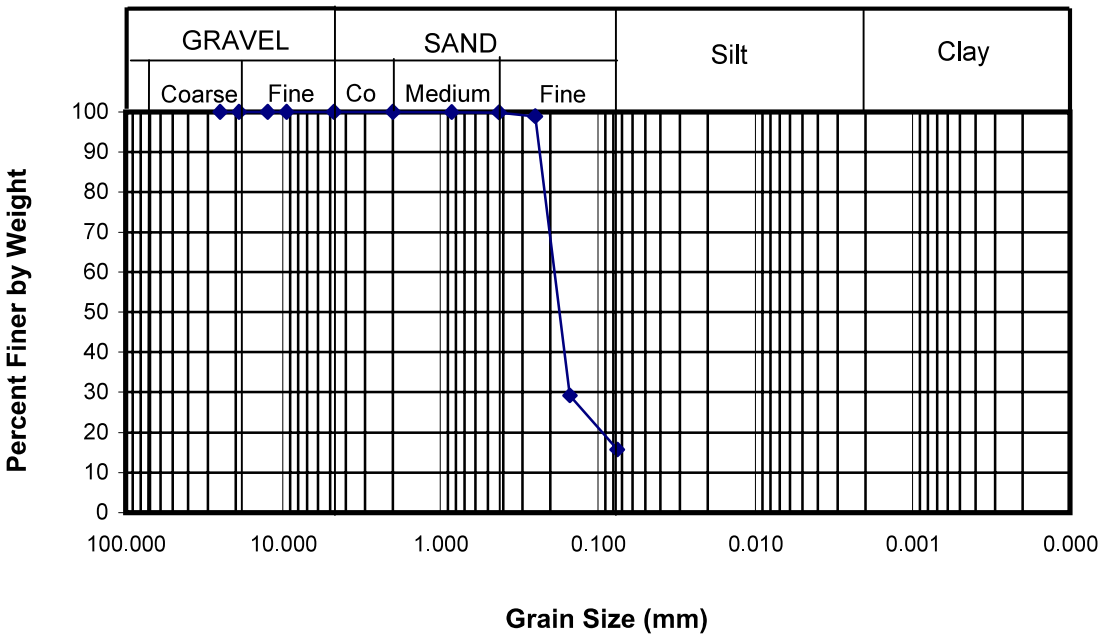
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-011 (S8B)
Sample Depth:	38 to 39 feet
Sample Description:	Silty SAND (SM), Gray and Tan, Fine
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	100.0
40	99.9
60	98.9
100	29.2
200	15.7



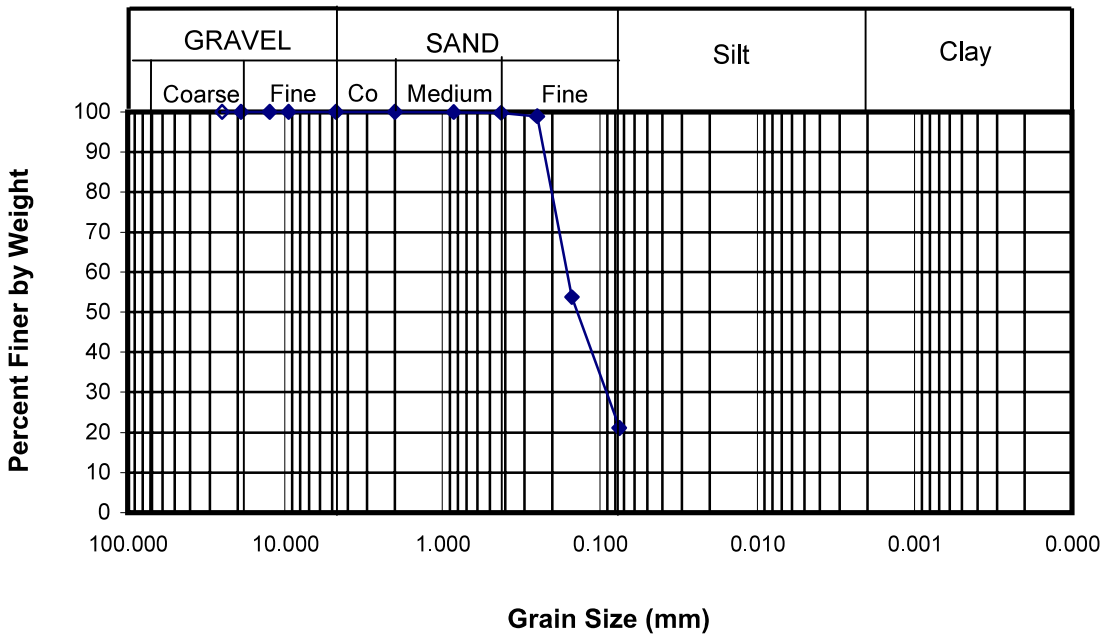
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name: **Midtown Tunnel**
Client: **PB Americas**
Project Number: 4955-110
Sample Number: 10BH-011 (S11)
Sample Depth: 52 to 54 feet
Sample Description: Silty SAND (SM), Gray, Fine
Test Method: ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	99.9
40	99.7
60	98.9
100	53.8
200	21.1



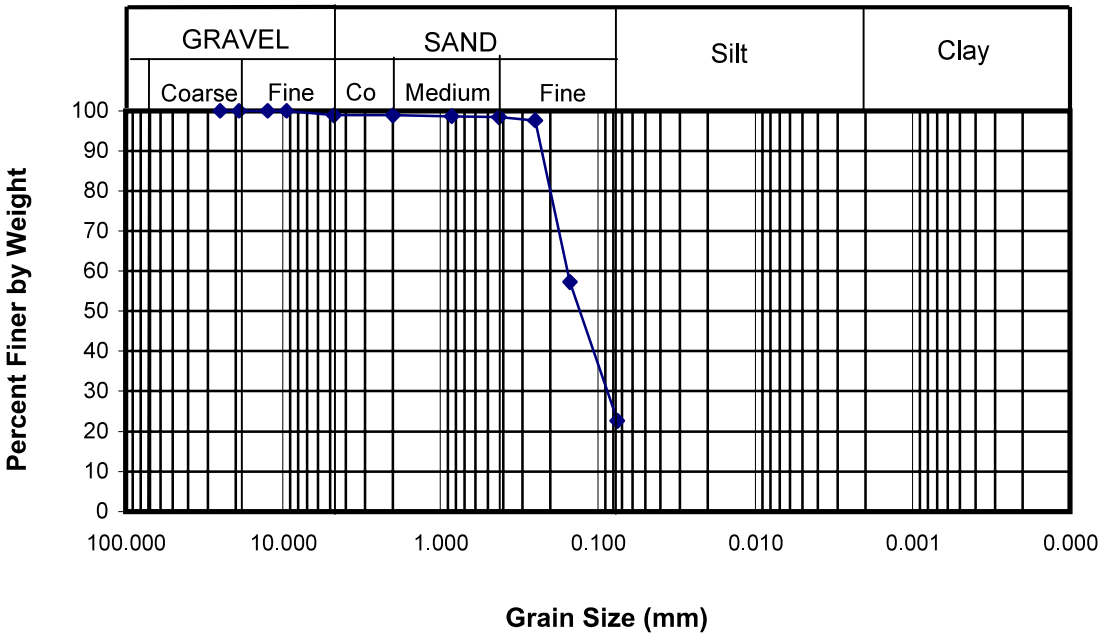
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-011 (S15)
Sample Depth:	72 to 74 feet
Sample Description:	Silty SAND (SM), Dark Gray, Fine, Trace Clay, Trace Shell Fragments
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	98.9
10	98.9
20	98.6
40	98.4
60	97.6
100	57.2
200	22.6



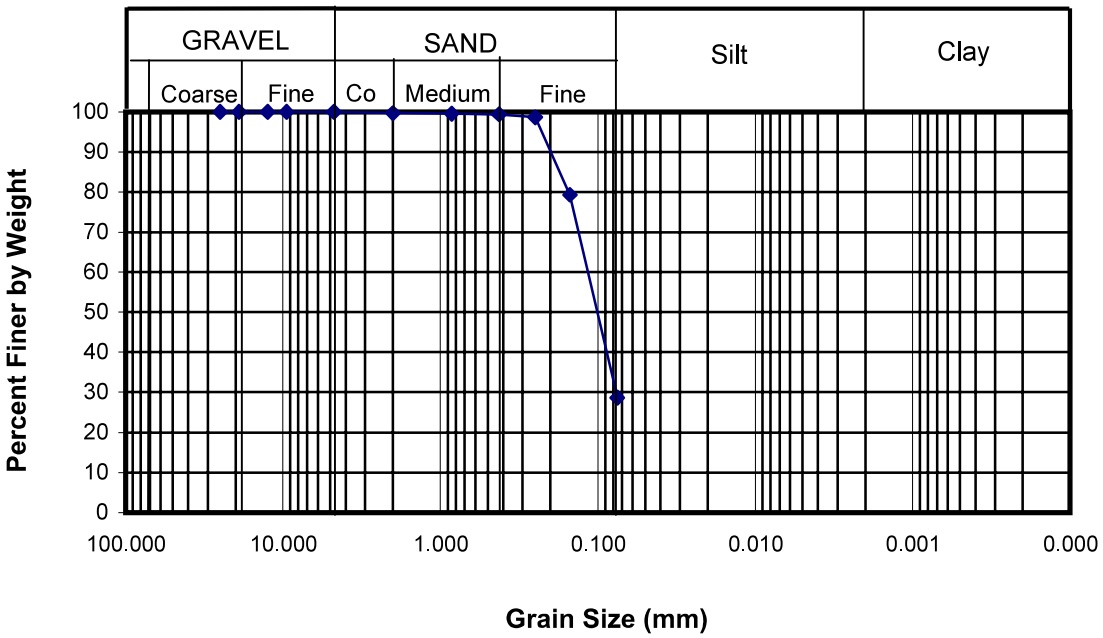
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-011 (S17)
Sample Depth:	82 to 84 feet
Sample Description:	Silty SAND (SM), Dark Gray, Fine, Trace Clay
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	99.7
20	99.6
40	99.4
60	98.7
100	79.3
200	28.7



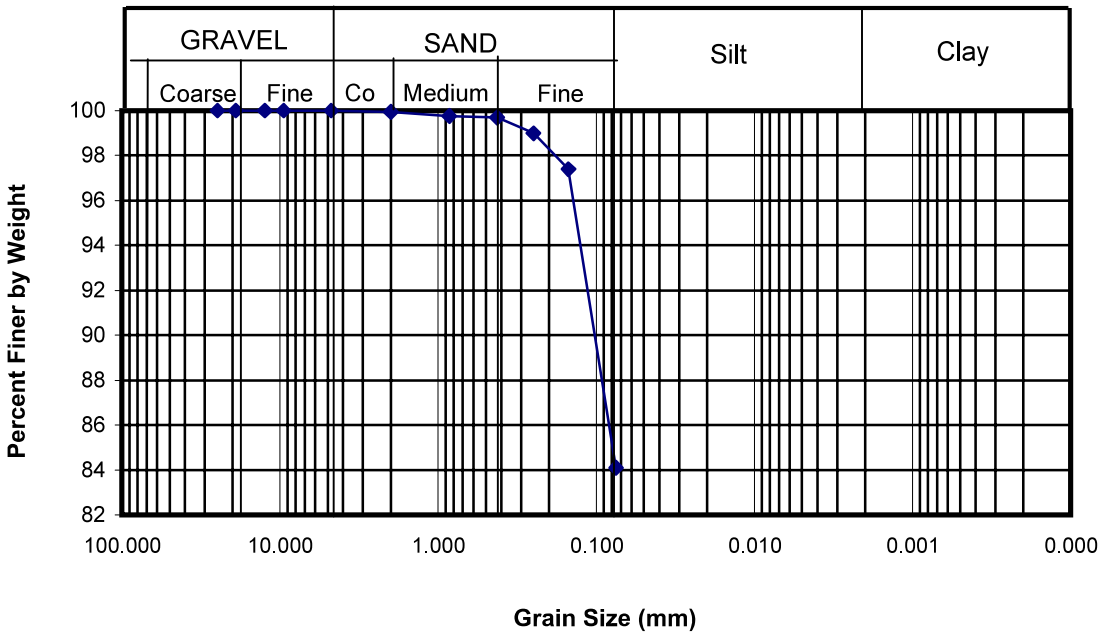
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name: **Midtown Tunnel**
Client: **PB Americas**
Project Number: 4955-110
Sample Number: 10BH-012 (S1)
Sample Depth: 11 to 13 feet
Sample Description: CLAY (CH), Dark Gray, with Silt and Fine Sand
Test Method: ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	99.9
20	99.8
40	99.7
60	99.0
100	97.4
200	84.1



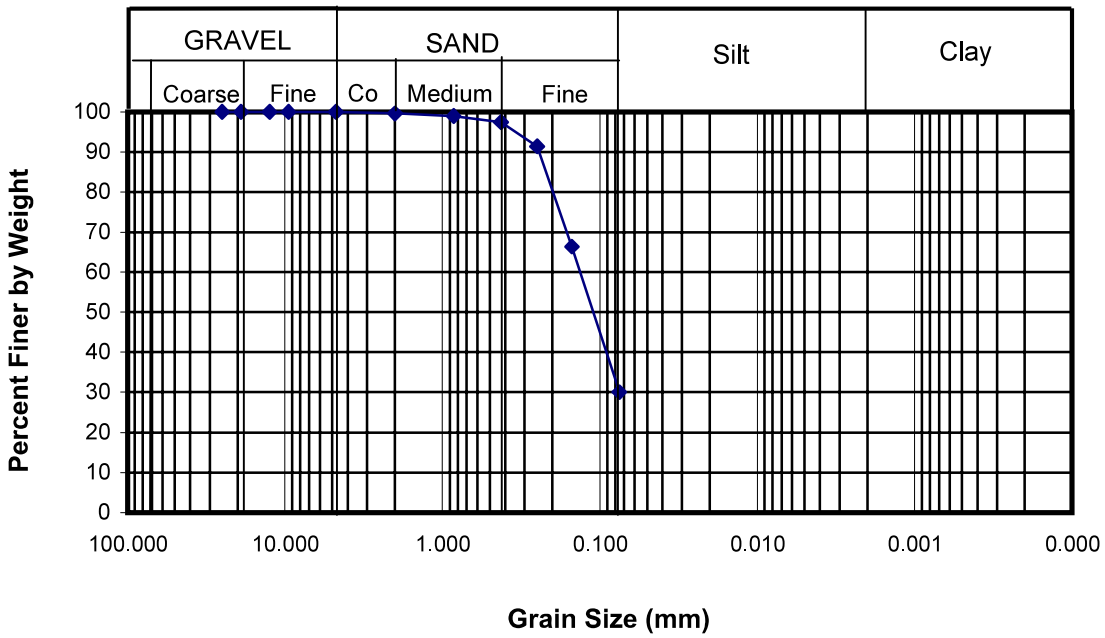
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-012 (S2)
Sample Depth:	21 to 23 feet
Sample Description:	Clayey SAND (SC), Dark Gray, Fine, with Silt
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	99.6
20	99.0
40	97.4
60	91.4
100	66.4
200	30.0



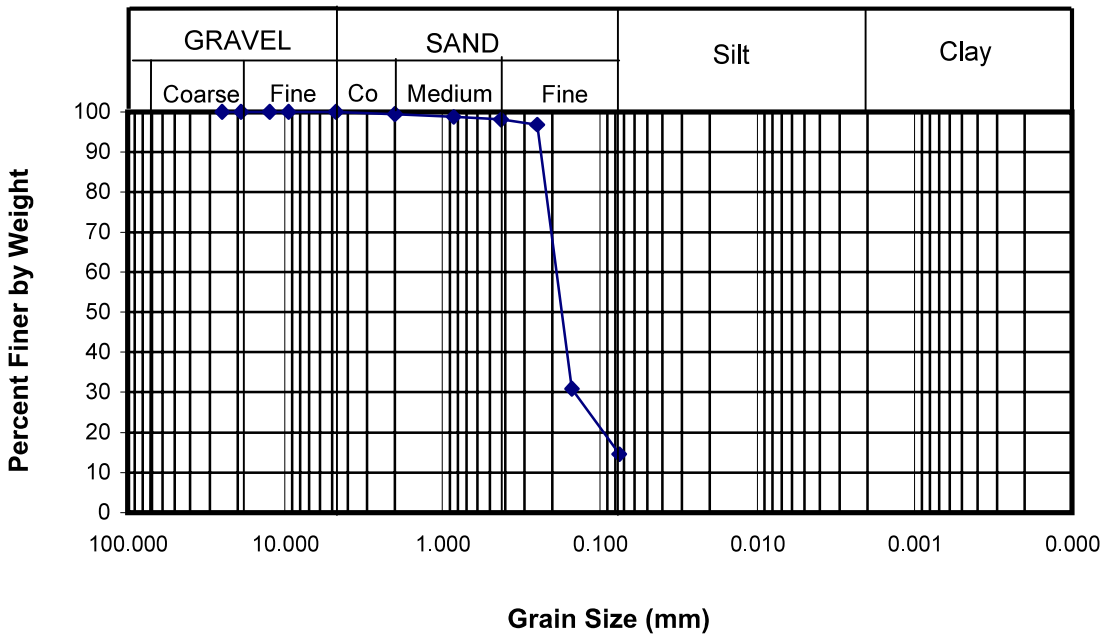
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-012 (S4)
Sample Depth:	31 to 33 feet
Sample Description:	Silty SAND (SM), Tan and Gray, Fine
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	99.4
20	98.7
40	98.1
60	96.8
100	30.9
200	14.5



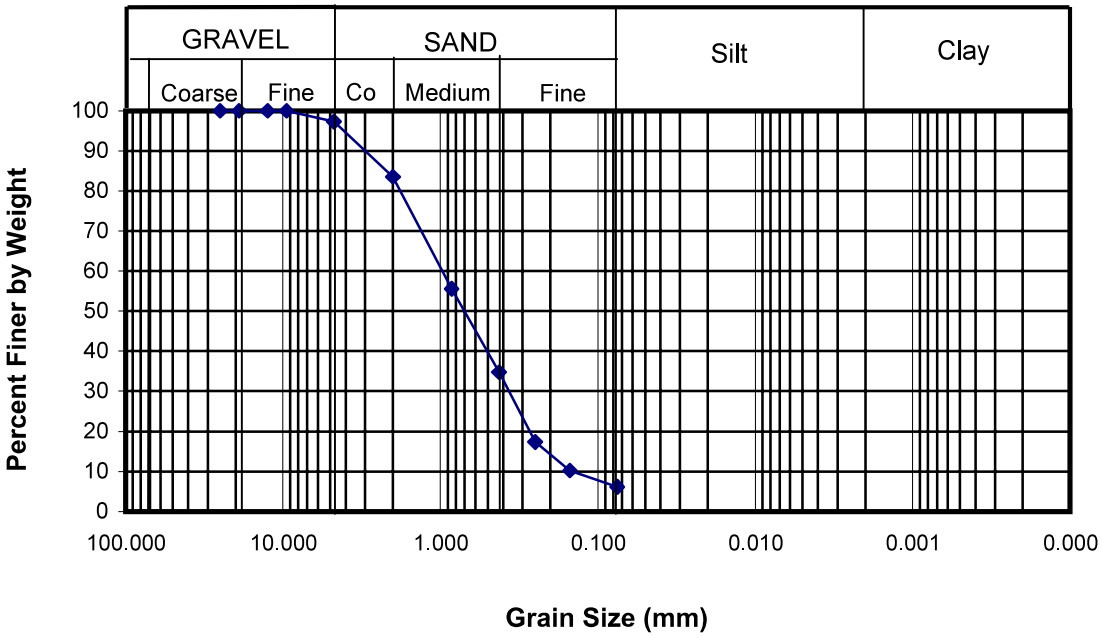
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-012 (S3)
Sample Depth:	26 to 28 feet
Sample Description:	SAND (SP-SM), Tan-Orange, Fine to Coarse, Trace Silt, Trace Fine Gravel
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	97.3
10	83.5
20	55.6
40	34.8
60	17.4
100	10.2
200	6.2



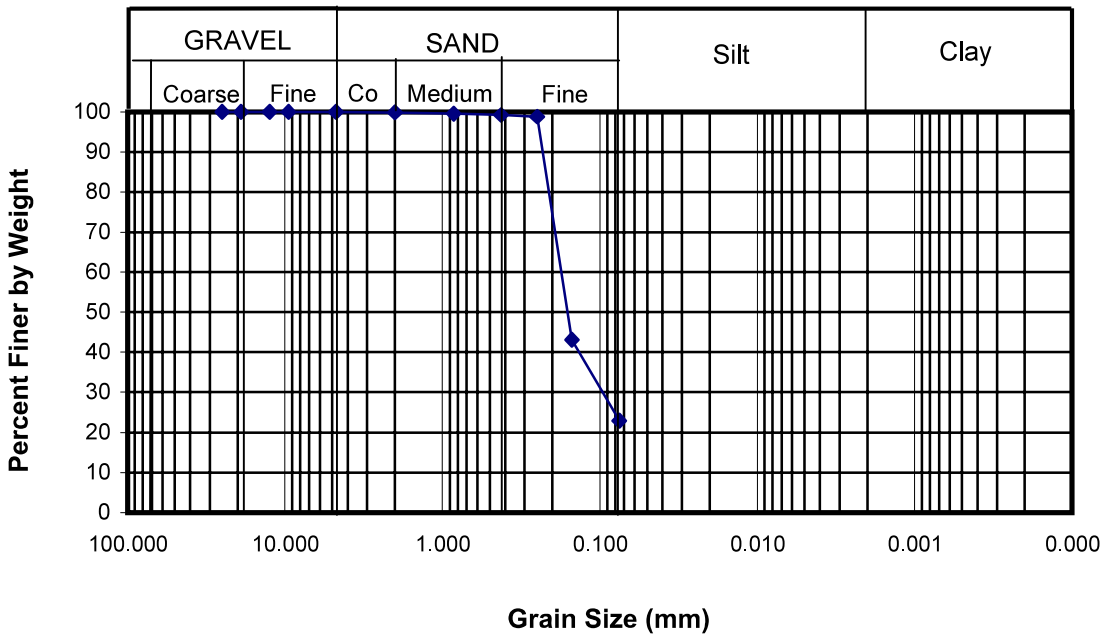
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name: **Midtown Tunnel**
Client: **PB Americas**
Project Number: 4955-110
Sample Number: 10BH-012 (S6)
Sample Depth: 41 to 43 feet
Sample Description: Silty SAND (SM), Gray, Fine, Trace Clay
Test Method: ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	99.8
20	99.5
40	99.2
60	98.8
100	43.1
200	22.9



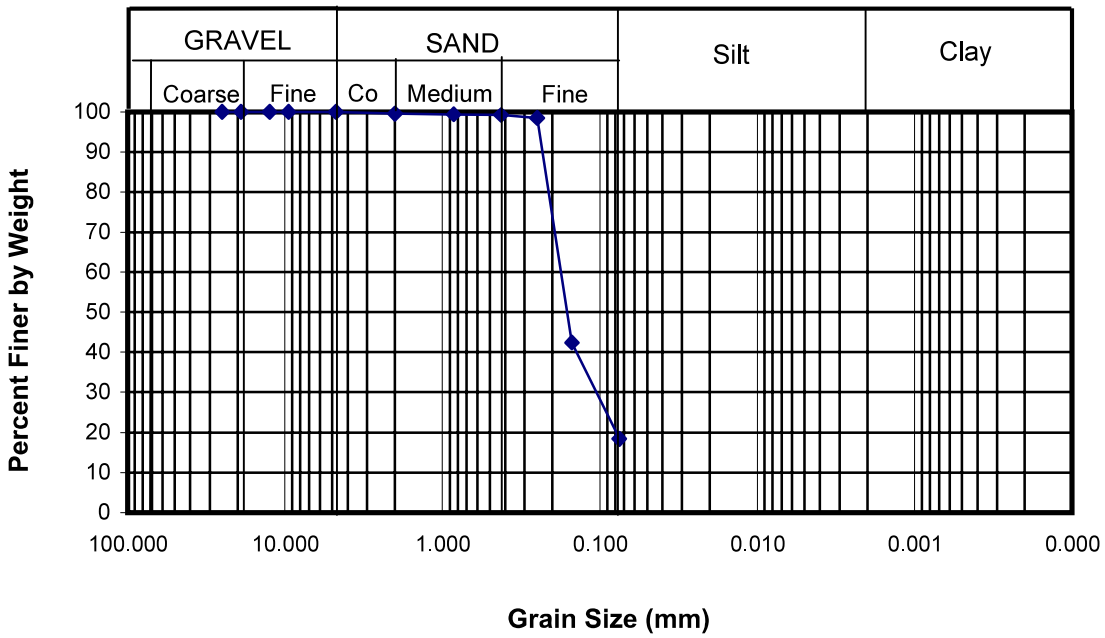
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-012 (S9)
Sample Depth:	61 to 63 feet
Sample Description:	Silty SAND (SM), Gray, Fine, Trace Clay
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	99.6
20	99.4
40	99.2
60	98.5
100	42.4
200	18.4



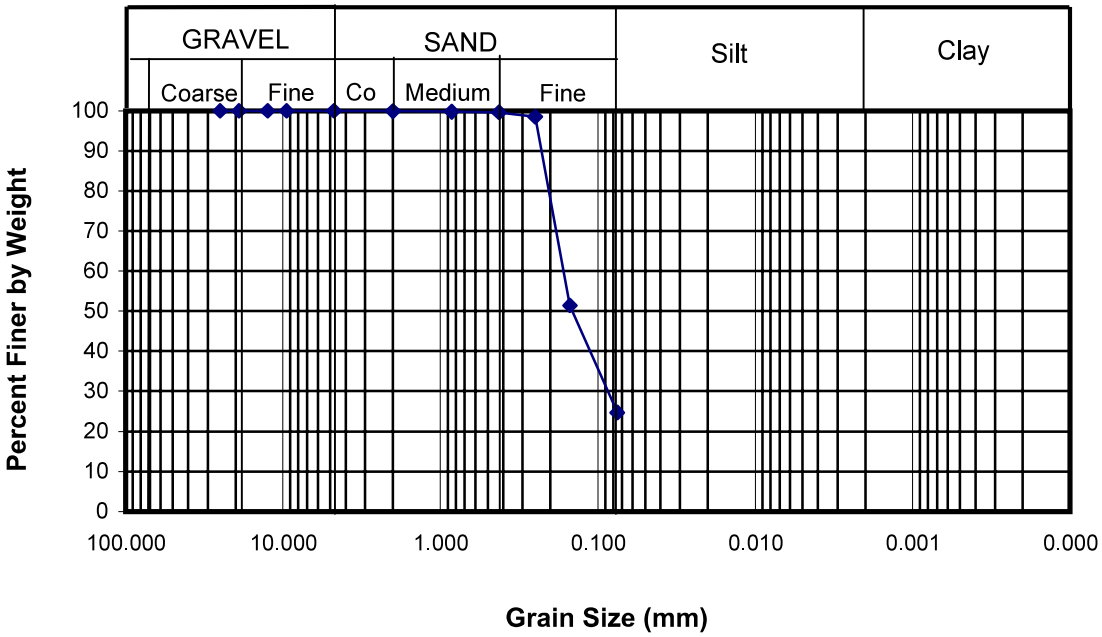
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-012 (S10)
Sample Depth:	71 to 73 feet
Sample Description:	Silty SAND (SM), Dark Gray, Fine, Trace Clay, Trace Shell Fragments
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	99.9
20	99.8
40	99.6
60	98.5
100	51.4
200	24.7



Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Project Number:	4955-110
Sample Number:	**10BH-005 (P2)**
Sample Depth:	**45 to 47 feet**
Sample Description:	Organic CLAY (OH), Dark Brown, with Silt, with Fine to Medium Sand
Test Method:	ASTM D 422
In Situ Moisture (%):	92.2
Specific Gravity:	2.544

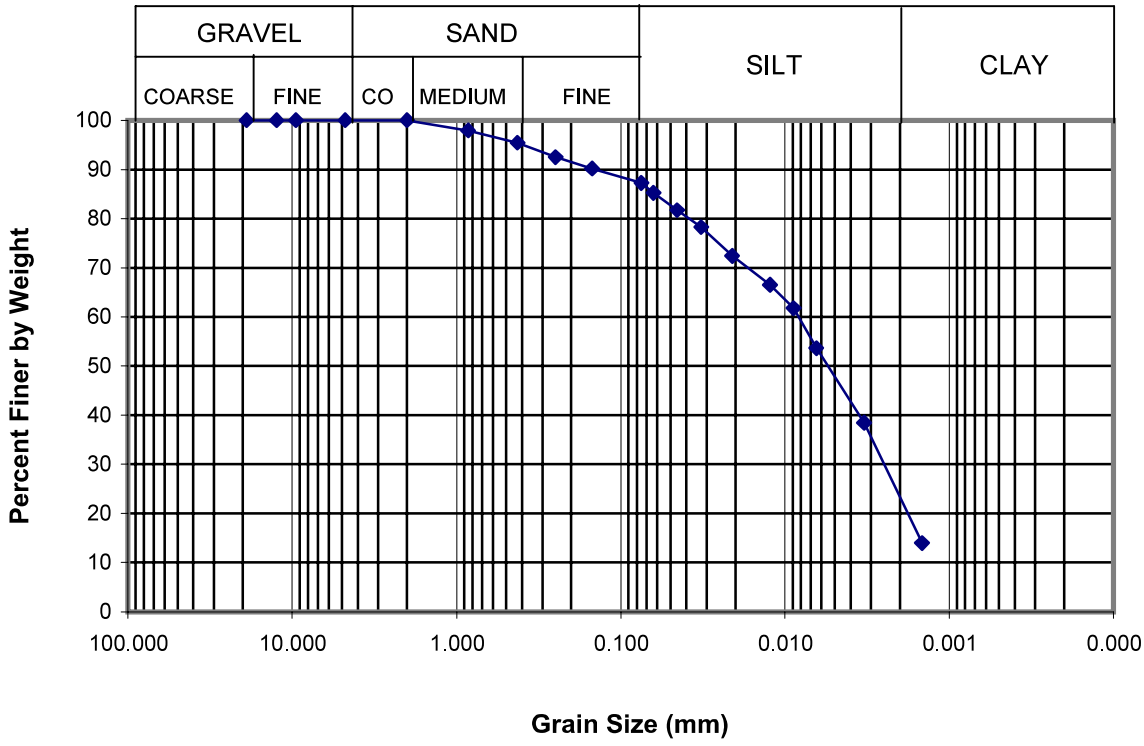
Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	97.9
40	95.4
60	92.5
100	90.2
200	87.2

Hydrometer Analysis Data

DIAMETER (mm)	PERCENT FINER
0.0633	85.2
0.0453	81.7
0.0325	78.2
0.0210	72.4
0.0124	66.5
0.0089	61.8
0.0065	53.6
0.0033	38.5
0.0015	14.0

GRAIN SIZE DISTRIBUTION



Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Project Number:	4955-110
Sample Number:	**10BH-005 (S18)**
Sample Depth:	**87 to 89 feet**
Sample Description:	Clayey SAND (SC), Gray, Fine, with Silt
Test Method:	ASTM D 422
In Situ Moisture (%):	33.9
Specific Gravity:	2.645

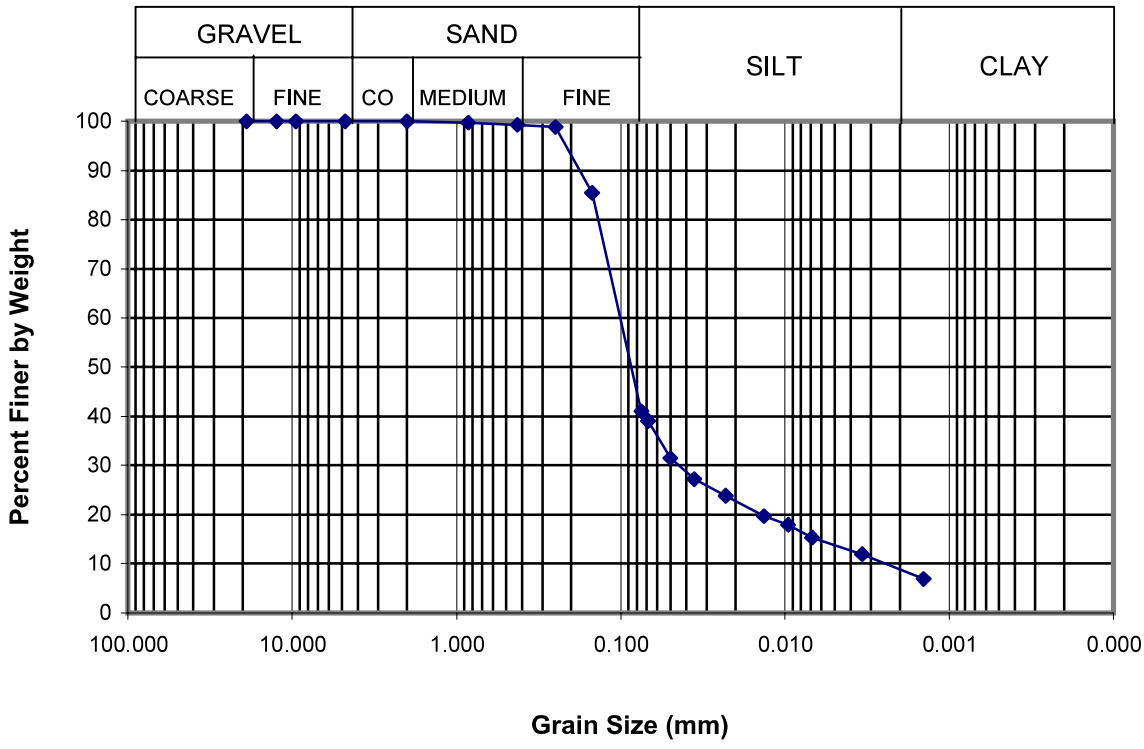
Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	99.7
40	99.3
60	98.8
100	85.5
200	41.0

Hydrometer Analysis Data

DIAMETER (mm)	PERCENT FINER
0.0683	39.1
0.0499	31.4
0.0359	27.2
0.0230	23.8
0.0135	19.6
0.0096	17.9
0.0068	15.3
0.0034	11.9
0.0014	6.9

GRAIN SIZE DISTRIBUTION



Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Project Number:	4955-110
Sample Number:	**10BH-006 (S5)**
Sample Depth:	**22 to 24 feet**
Sample Description:	Organic CLAY (OH), Dark Gray and Brown, with Silt, Trace Fine Sand
Test Method:	ASTM D 422
In Situ Moisture (%):	78.1
Specific Gravity:	2.535

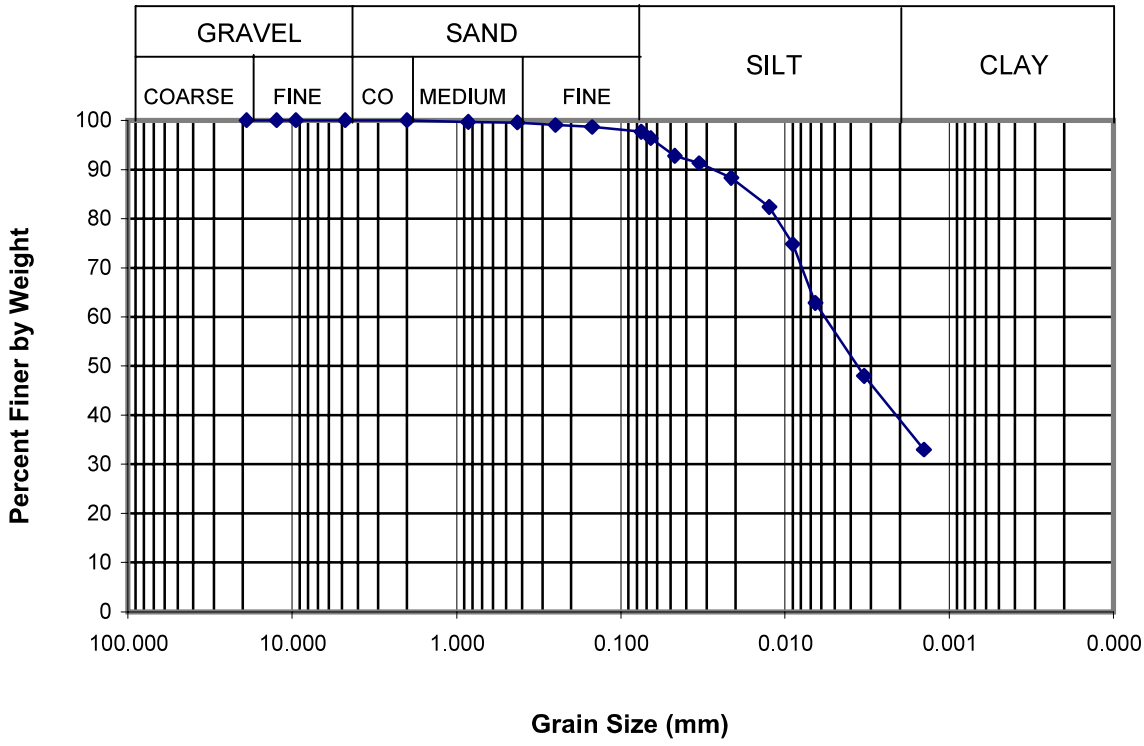
Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	99.7
40	99.6
60	99.0
100	98.6
200	97.7

Hydrometer Analysis Data

DIAMETER (mm)	PERCENT FINER
0.0657	96.4
0.0469	92.8
0.0333	91.3
0.0212	88.3
0.0125	82.4
0.0090	74.8
0.0065	62.8
0.0033	48.0
0.0014	33.0

GRAIN SIZE DISTRIBUTION



Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Project Number:	4955-110
Sample Number:	**10BH-007 (P1)**
Sample Depth:	**14 to 16 feet**
Sample Description:	Organic CLAY (OH), Dark Gray and Brown, with Silt, with Fine Sand
Test Method:	ASTM D 422
In Situ Moisture (%):	75.2
Specific Gravity:	2.540

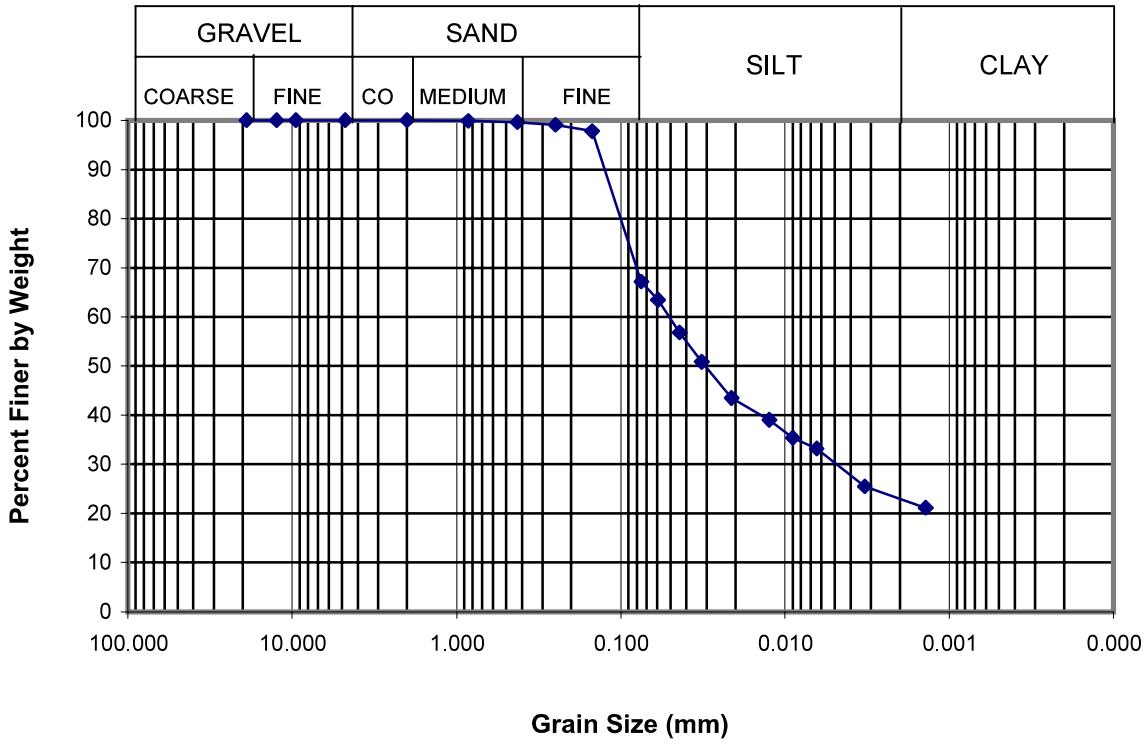
Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	99.8
40	99.6
60	99.1
100	97.8
200	67.2

Hydrometer Analysis Data

DIAMETER (mm)	PERCENT FINER
0.0594	63.5
0.0438	56.8
0.0321	50.9
0.0212	43.5
0.0125	39.1
0.0090	35.4
0.0064	33.2
0.0033	25.5
0.0014	21.1

GRAIN SIZE DISTRIBUTION



Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Project Number:	4955-110
Sample Number:	**10BH-008 (S16)**
Sample Depth:	**76.5 to 78.5 feet**
Sample Description:	Clayey SAND (SC), Gray, Fine, with Silt
Test Method:	ASTM D 422
In Situ Moisture (%):	27.6
Specific Gravity:	2.634

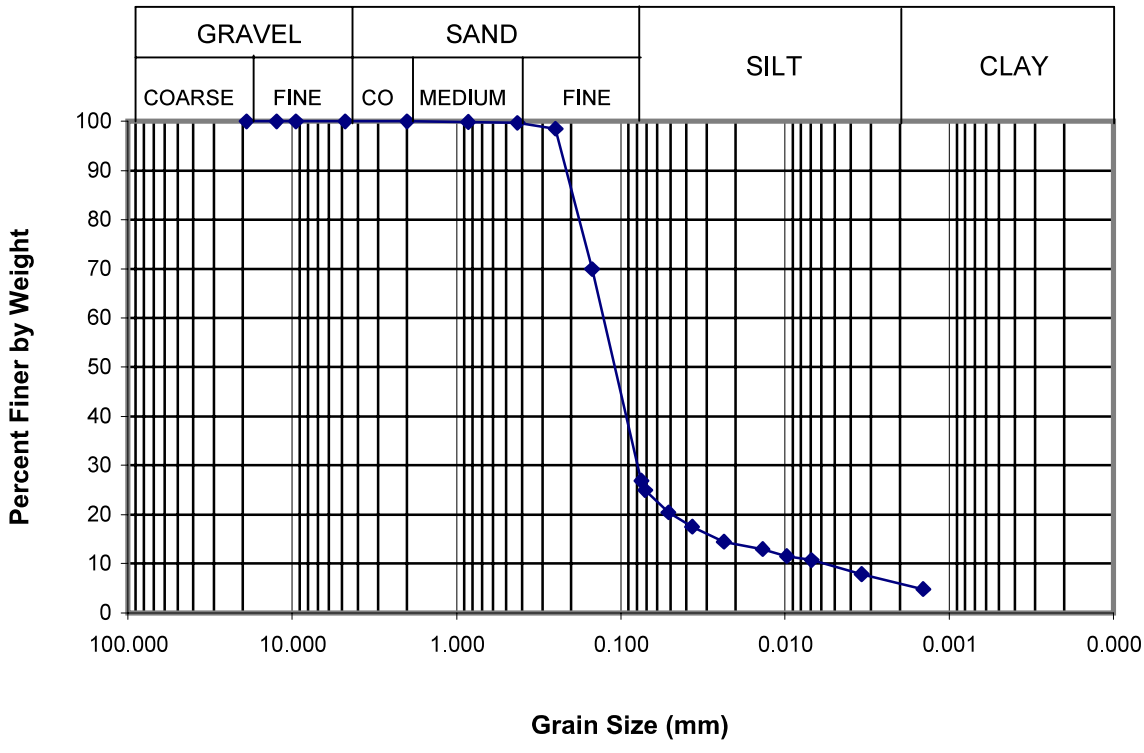
Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	99.8
40	99.7
60	98.5
100	69.9
200	26.9

Hydrometer Analysis Data

DIAMETER (mm)	PERCENT FINER
0.0711	24.9
0.0513	20.5
0.0367	17.5
0.0236	14.5
0.0137	13.0
0.0097	11.5
0.0069	10.8
0.0034	7.9
0.0014	4.8

GRAIN SIZE DISTRIBUTION



Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Project Number:	4955-110
Sample Number:	**10BH-009 (P2)**
Sample Depth:	**23 to 25 feet**
Sample Description:	CLAY (CH), Dark Gray, with Silt, Trace Fine Sand
Test Method:	ASTM D 422
In Situ Moisture (%):	97.8
Specific Gravity:	2.525

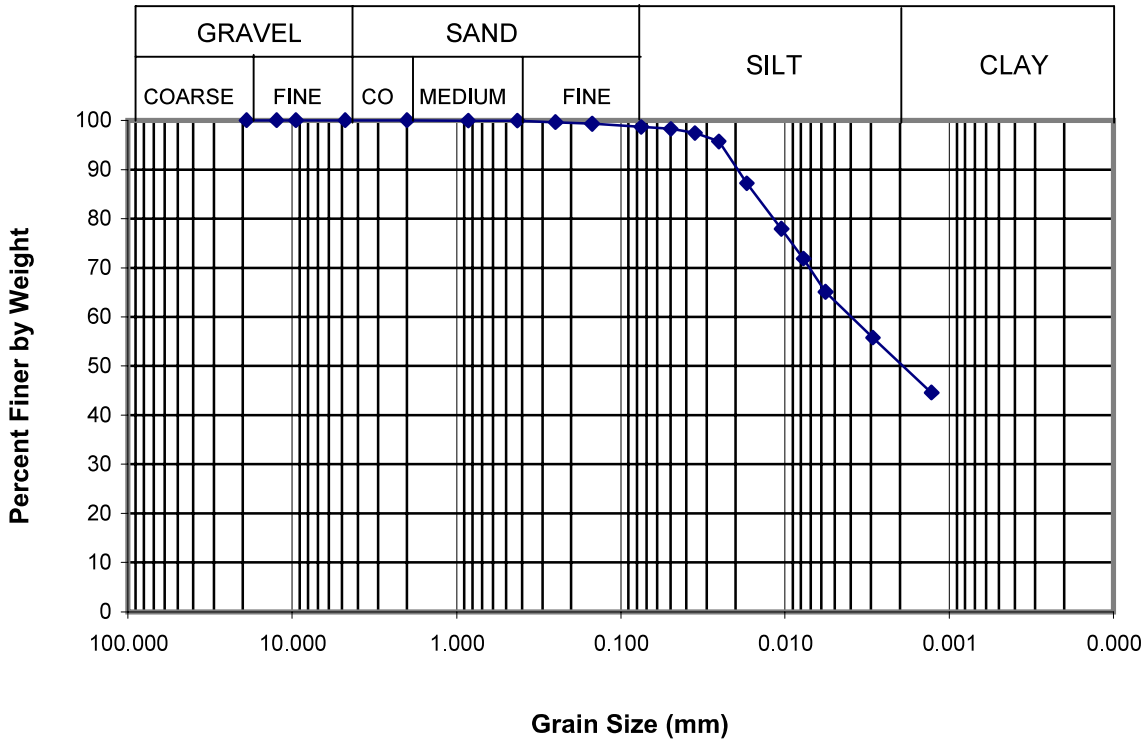
Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	100.0
40	99.9
60	99.6
100	99.3
200	98.6

Hydrometer Analysis Data

DIAMETER (mm)	PERCENT FINER
0.0496	98.2
0.0353	97.4
0.0253	95.7
0.0171	87.2
0.0105	77.9
0.0077	71.9
0.0057	65.1
0.0029	55.8
0.0013	44.6

GRAIN SIZE DISTRIBUTION



Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Project Number:	4955-110
Sample Number:	**10BH-009 (P3)**
Sample Depth:	**43 to 45 feet**
Sample Description:	CLAY (CH), Dark Gray, with Silt, Trace Fine Sand
Test Method:	ASTM D 422
In Situ Moisture (%):	79.4
Specific Gravity:	2.629

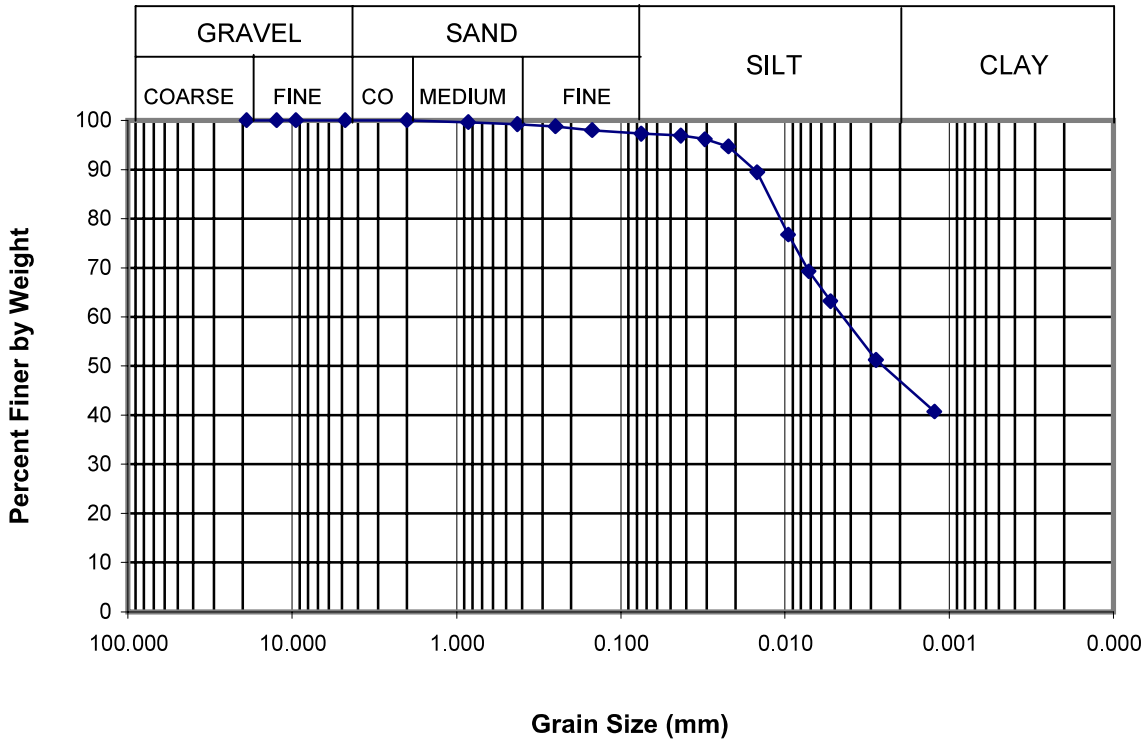
Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	99.6
40	99.2
60	98.7
100	98.0
200	97.3

Hydrometer Analysis Data

DIAMETER (mm)	PERCENT FINER
0.0432	96.9
0.0308	96.1
0.0221	94.7
0.0148	89.5
0.0096	76.8
0.0072	69.3
0.0053	63.2
0.0028	51.2
0.0012	40.8

GRAIN SIZE DISTRIBUTION



Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Project Number:	4955-110
Sample Number:	**10BH-011 (P1)**
Sample Depth:	**10 to 12 feet**
Sample Description:	CLAY (CH), Dark Gray, with Silt, Trace Fine Sand
Test Method:	ASTM D 422
In Situ Moisture (%):	96.6
Specific Gravity:	2.585

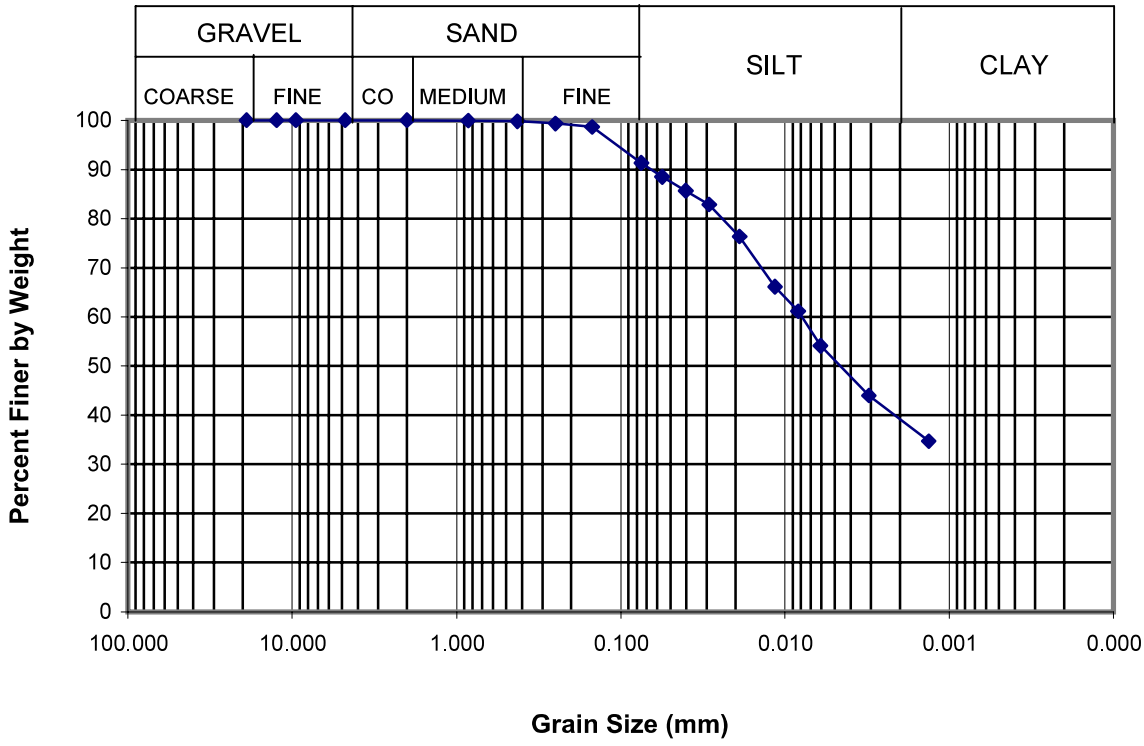
Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	100.0
40	99.8
60	99.3
100	98.6
200	91.3

Hydrometer Analysis Data

DIAMETER (mm)	PERCENT FINER
0.0560	88.5
0.0403	85.7
0.0289	82.9
0.0190	76.4
0.0115	66.1
0.0083	61.1
0.0061	54.1
0.0031	44.0
0.0013	34.7

GRAIN SIZE DISTRIBUTION



Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Project Number:	4955-110
Sample Number:	**10BH-011 (P2)**
Sample Depth:	**25 to 27 feet**
Sample Description:	CLAY (CH), Dark Gray, with Silt, Trace Fine Sand
Test Method:	ASTM D 422
In Situ Moisture (%):	74.2
Specific Gravity:	2.655

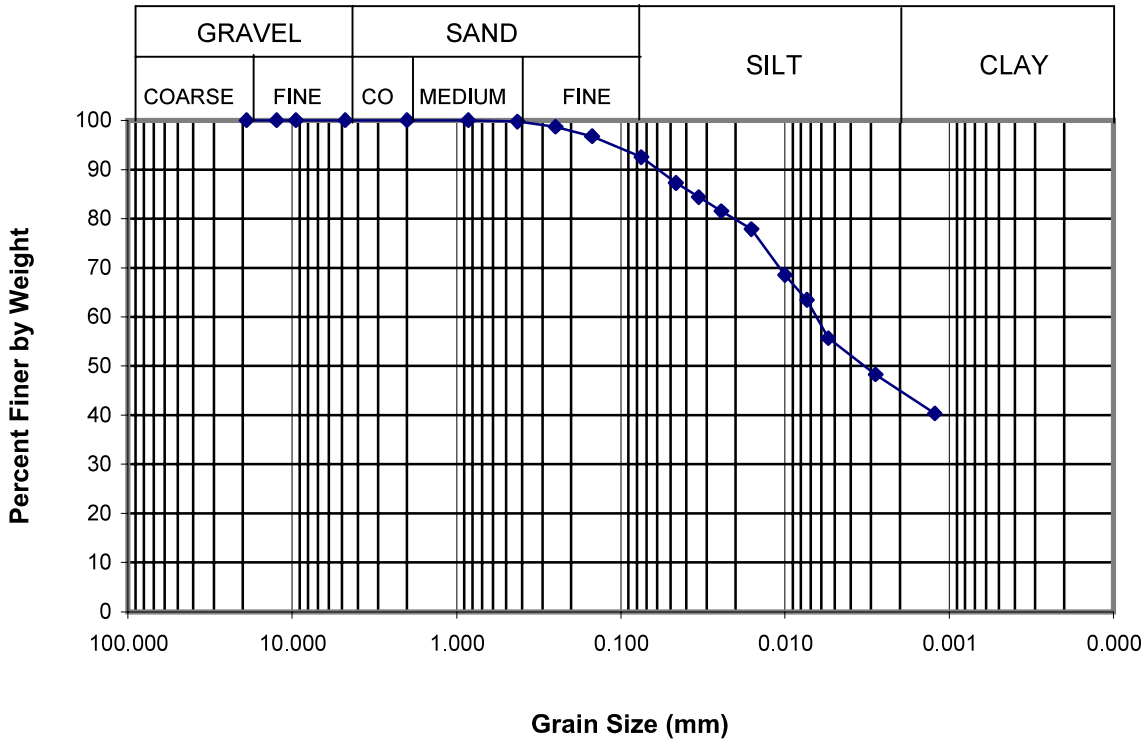
Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	100.0
40	99.8
60	98.7
100	96.7
200	92.5

Hydrometer Analysis Data

DIAMETER (mm)	PERCENT FINER
0.0461	87.3
0.0336	84.4
0.0245	81.5
0.0160	77.9
0.0100	68.6
0.0073	63.5
0.0055	55.7
0.0028	48.3
0.0012	40.4

GRAIN SIZE DISTRIBUTION



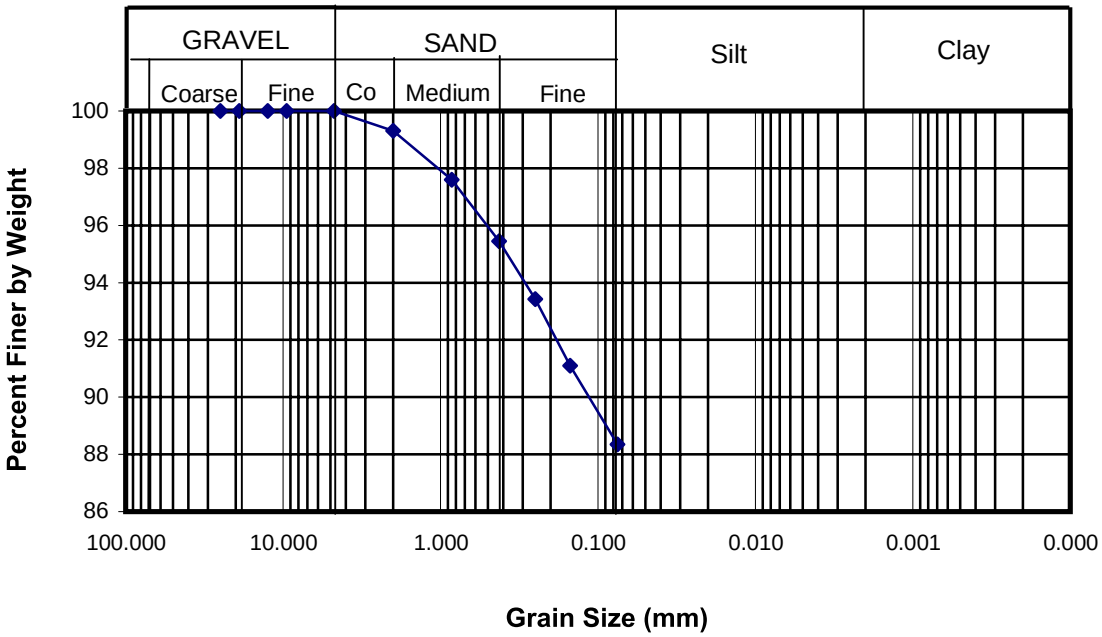
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-019 (S9)
Sample Depth:	40 to 42 feet
Sample Description:	Organic CLAY (OH), Dark Gray and Brown, with Silt, Trace Fine to Coarse Sand
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	99.3
20	97.6
40	95.4
60	93.4
100	91.1
200	88.3



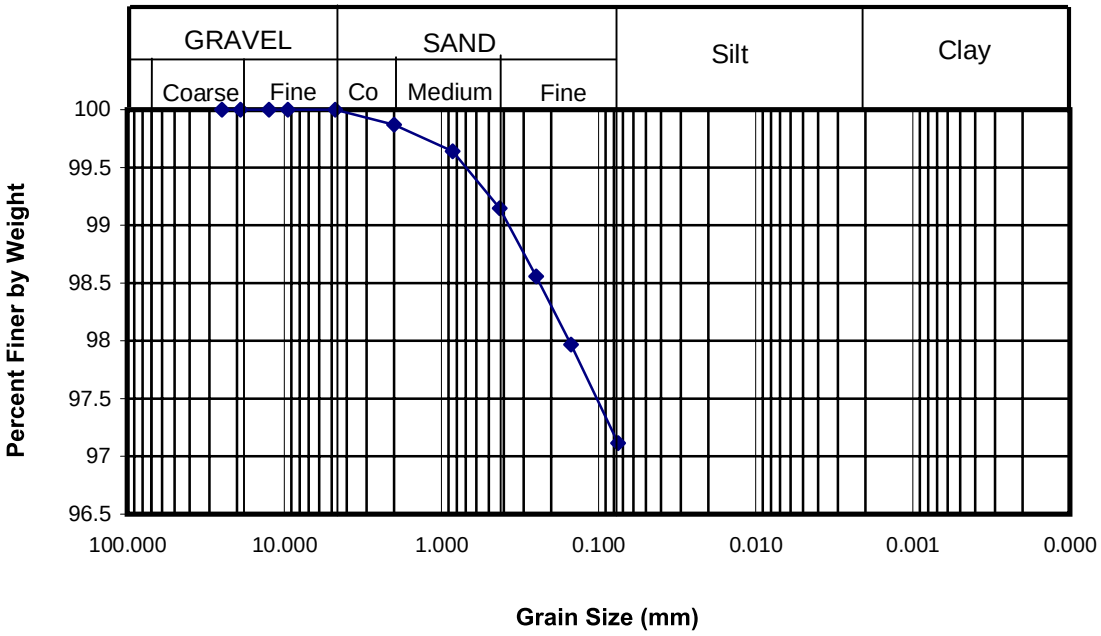
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-019 (S10A)
Sample Depth:	45 to 46 feet
Sample Description:	Organic CLAY (OH), Dark Gray and Brown, with Silt, Trace Fine to Coarse Sand
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	99.9
20	99.6
40	99.1
60	98.6
100	98.0
200	97.1



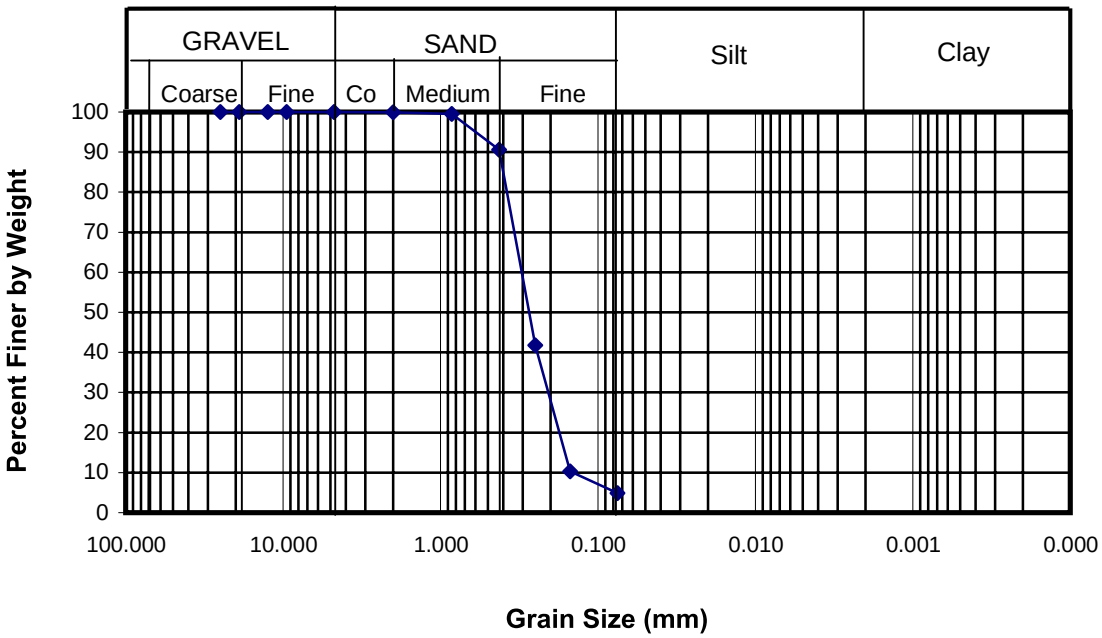
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-019 (S11)
Sample Depth:	50 to 52 feet
Sample Description:	SAND (SP), Light Gray, Fine to Medium, Trace Silt
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	99.9
20	99.5
40	90.5
60	41.7
100	10.3
200	4.9



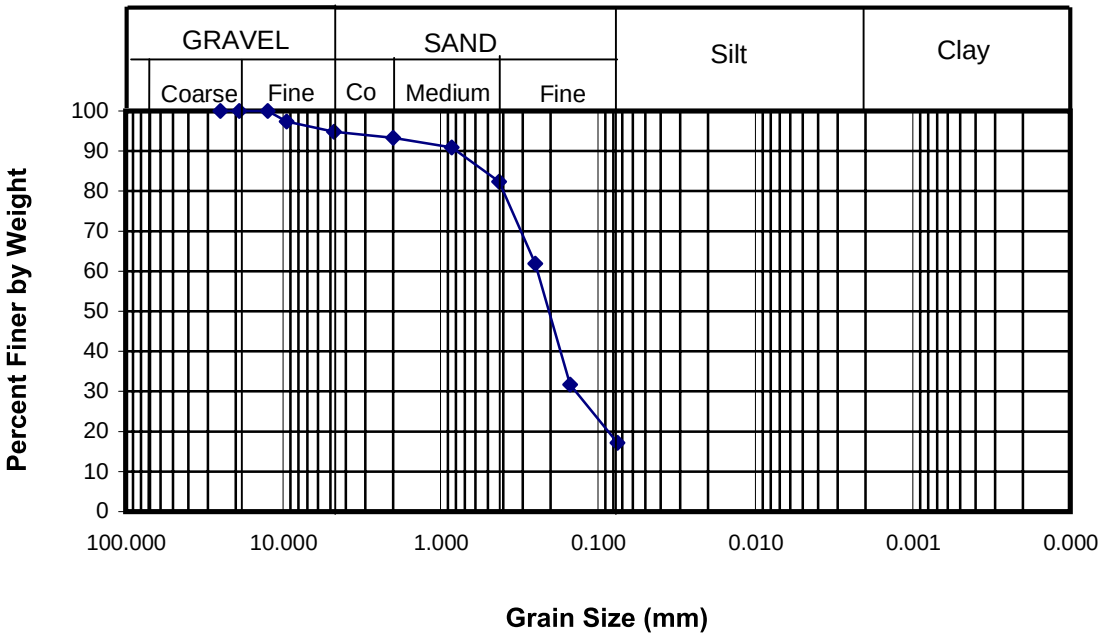
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-019 (S13B)
Sample Depth:	60 to 62 feet
Sample Description:	Silty SAND (SM), Gray, Fine to Coarse, Trace Fine Gravel
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	97.4
4	94.8
10	93.3
20	90.9
40	82.3
60	61.9
100	31.7
200	17.2



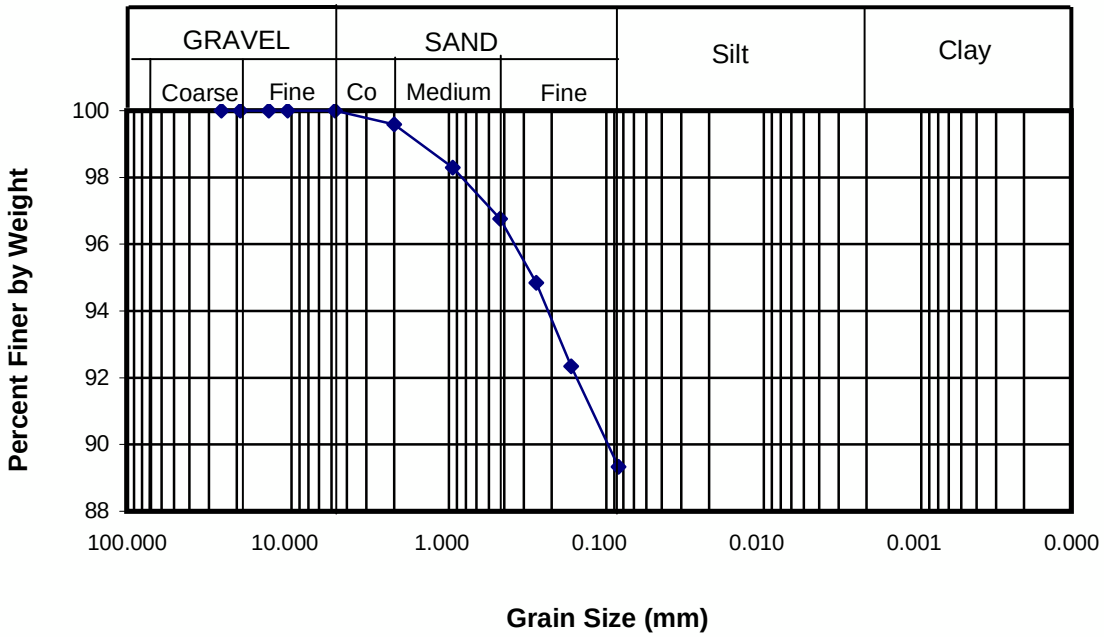
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-020 (S9B)
Sample Depth:	44.5 to 45.5 feet
Sample Description:	Organic CLAY (OH), Dark Brown and Gray, with Silt, Trace Fine to Medium Sand
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	99.6
20	98.3
40	96.8
60	94.8
100	92.3
200	89.3



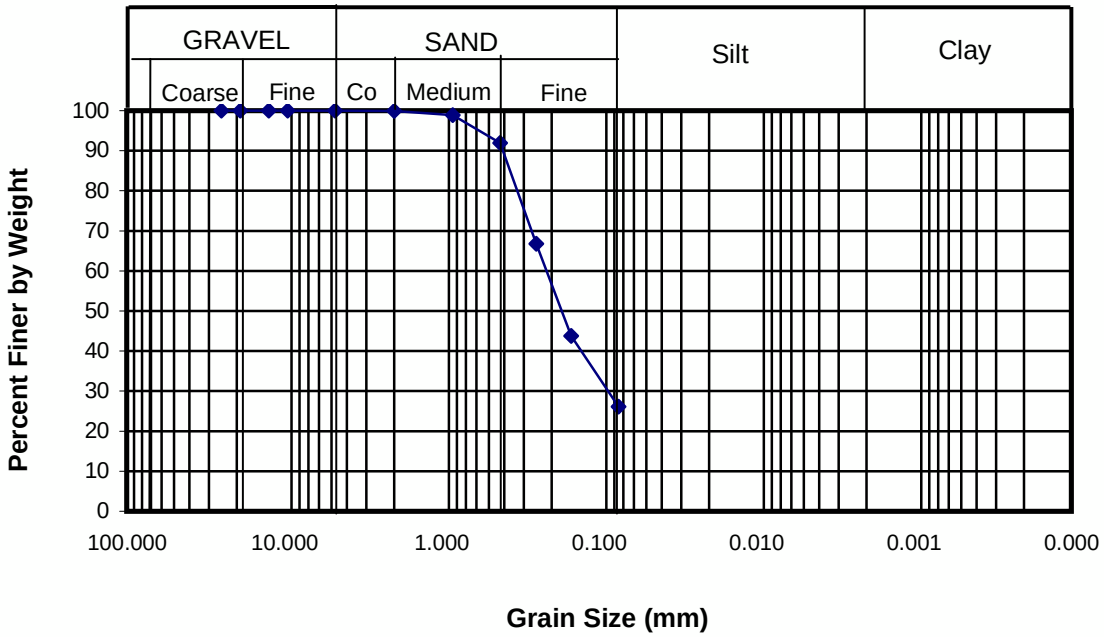
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-020 (S10)
Sample Depth:	48.5 to 50.5 feet
Sample Description:	Silty SAND (SM), Dark Brown and Gray, Fine to Medium, Trace Clay
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	99.9
20	98.8
40	92.0
60	66.7
100	43.8
200	26.1



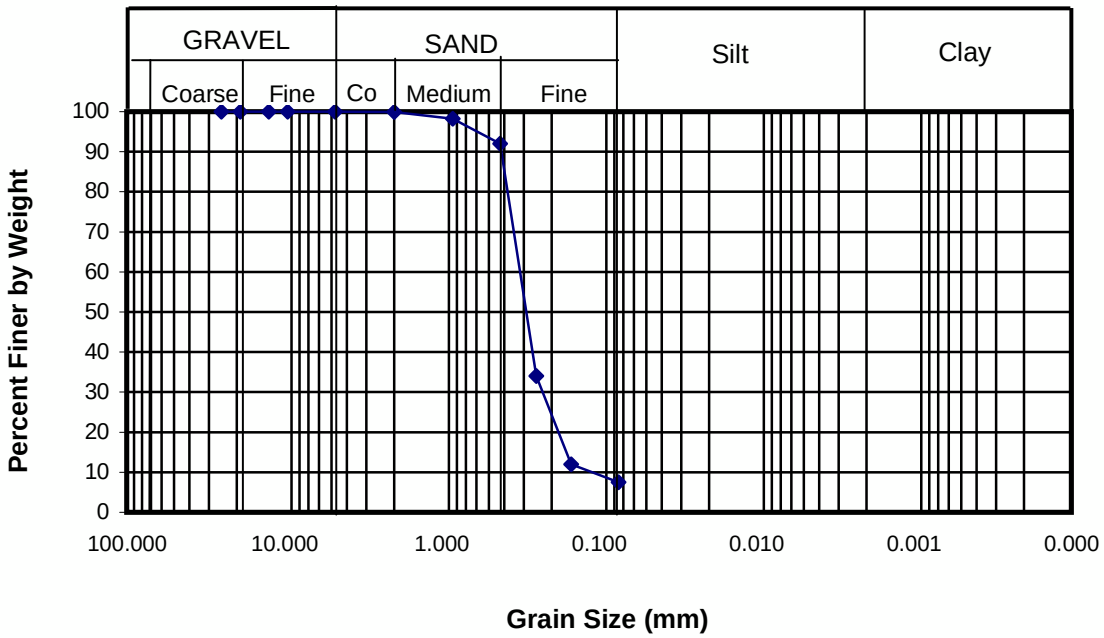
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name: **Midtown Tunnel**
Client: **PB Americas**
Project Number: 4955-110
Sample Number: 10BH-020 (S12A)
Sample Depth: 58.5 to 59.5 feet
Sample Description: SAND (SP-SM), Gray, Fine to Medium, Trace Silt
Test Method: ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	99.9
20	98.2
40	92.0
60	34.0
100	12.0
200	7.5



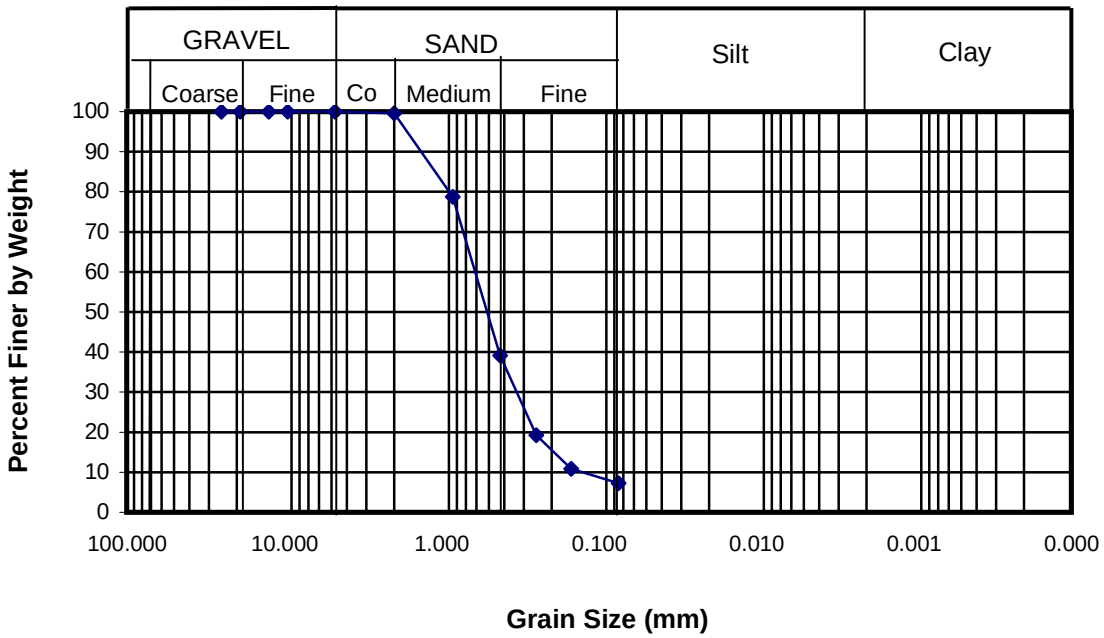
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-020 (S13A)
Sample Depth:	63.5 to 64.5 feet
Sample Description:	SAND (SP-SM), Gray, Fine to Medium, Trace Silt
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	99.6
20	78.7
40	39.2
60	19.2
100	10.9
200	7.2



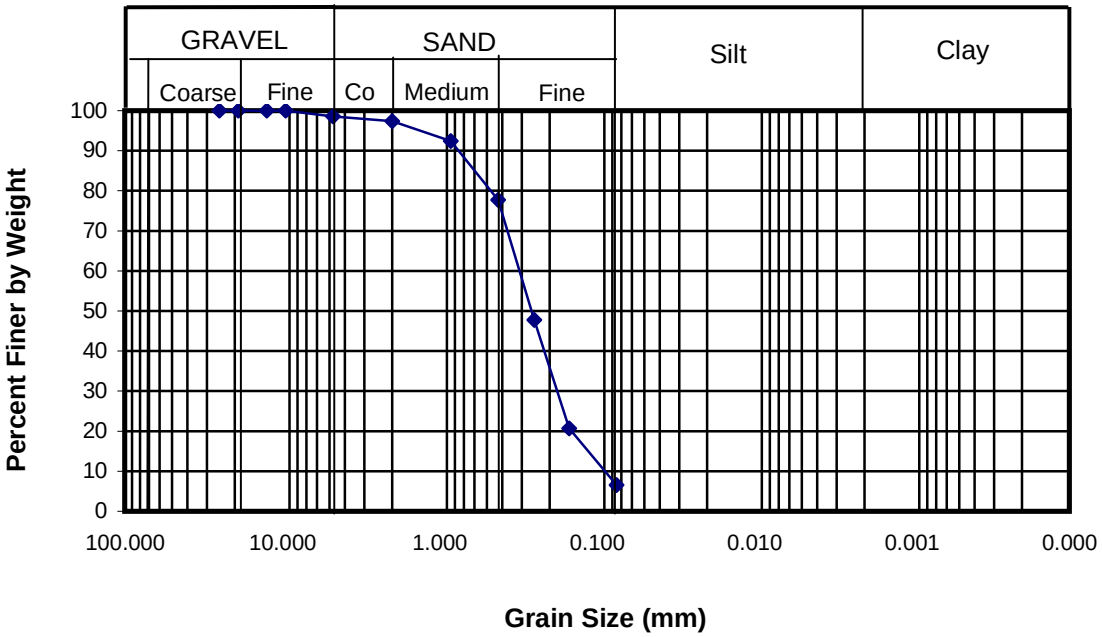
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-020 (S14A)
Sample Depth:	68.5 to 69.5 feet
Sample Description:	SAND (SP-SM), Gray, Fine to Medium, Trace Silt, Trace Fine Gravel
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	98.6
10	97.4
20	92.4
40	77.7
60	47.7
100	20.7
200	6.6



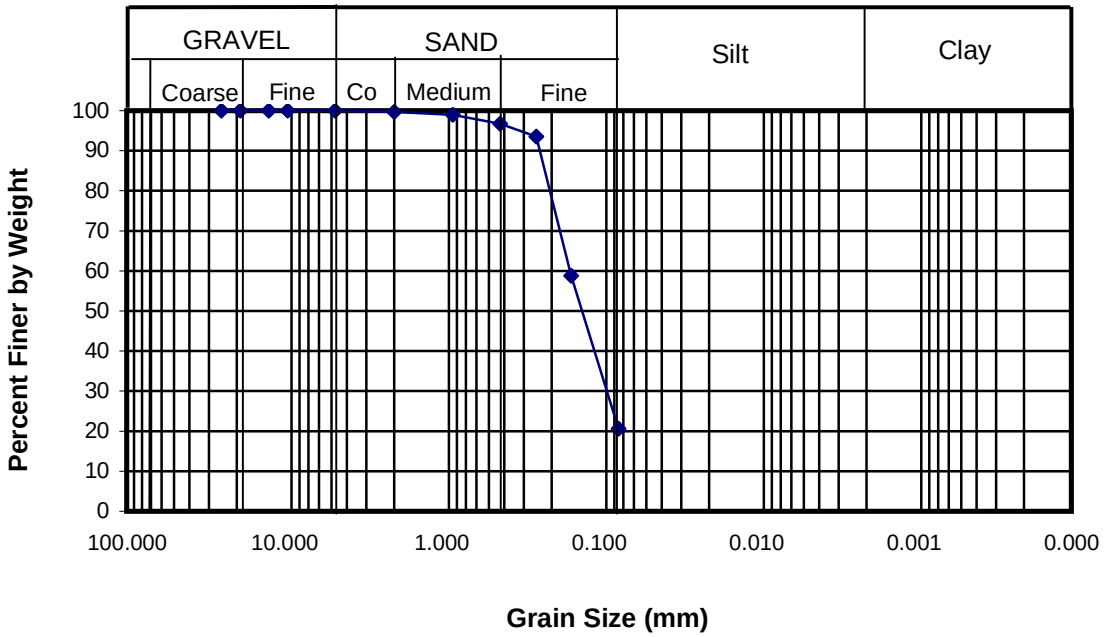
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**Midtown Tunnel**
Client:	**PB Americas**
Project Number:	4955-110
Sample Number:	10BH-020 (S15)
Sample Depth:	73.5 to 75.5 feet
Sample Description:	Silty SAND (SM), Gray, Fine, Trace Clay, Trace Shell Fragments
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	99.6
20	98.9
40	96.7
60	93.5
100	58.8
200	20.6



Summary Of Laboratory Tests

Project Number: 10613051 Task 21

Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	pH	Oxidation Reduction Potential (mV)	Resistivity (ohm-cm)	Sulfides
Composite Sample 10BH-001/002 /003/004	4.0 - 40.0	Bag	Gray, silty SAND, SM (VISUAL)	4.3	236	930	0
Composite Sample 10BH-002/004	8.0 - 40.0	Bag	Gray, fat CLAY, trace sand, CH (VISUAL)	5.9	140	150	0
Composite Sample 10BH-003	23.0 - 35.0	Bag	Gray, fat CLAY, trace sand, CH (VISUAL)	5.6	167	130	0
Composite Sample 10BH-013	23.0 - 40.0	Bag	Gray, fat CLAY, trace sand, CH (VISUAL)	5.3	191	160	0
Composite Sample 10BH-014/015/016	4.0 - 40.0	Bag	Orange brown and gray, SAND with silt, SP-SM (VISUAL)	5.1	250	1400	0
Composite Sample 10BH-016	18.0 - 29.0	Bag	Gray, fat CLAY, trace sand, CH (VISUAL)	3.2	390	340	0
Composite Sample 10BH-021	13.0 - 35.0	Bag	Gray, fat CLAY, trace sand, CH (VISUAL)	5.2	141	430	0

Notes:
1. Soil tests in general accordance with ASTM standards.
2. Soil classifications are in general accordance with ASTM D2487(as applicable), based on testing indicated and visual classification.
3. Key to abbreviations: NP=Non-Plastic; -- indicates no test performed

Schnabel ENGINEERING

Project: MTT, DTT & MLK Expressway Project

Norfolk & Portsmouth, VA

DYNAMIC LAB SUMMARY CORROSION SERIES RESULTS.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 11/8/10

Summary Of Laboratory Tests

Project Number: 10613051 Task 21

Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	pH	Oxidation Reduction Potential (mV)	Resistivity (ohm-cm)	Sulfides
Composite Sample 10BH-022/023	4.0 - 25.0	Bag	Gray, fat CLAY, trace sand, CH (VISUAL)	4.2	310	360	0

Notes:
1. Soil tests in general accordance with ASTM standards.
2. Soil classifications are in general accordance with ASTM D2487(as applicable), based on testing indicated and visual classification.
3. Key to abbreviations: NP=Non-Plastic; -- indicates no test performed

Schnabel ENGINEERING

Project: MTT, DTT & MLK Expressway Project

Norfolk & Portsmouth, VA

DYNAMIC LAB SUMMARY CORROSION SERIES RESULTS.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 11/8/10

PENNIMAN & BROWNE, INC.
CHEMISTS / ENGINEERS / INSPECTORS
INDUSTRIAL HYGIENE SERVICES

Prepared for:

Schnabel Engineering Associcates
Kerri Allgauer
1504 Woodlawn Drive
Baltimore, MD 21207

MTT & MLK Expressway Proj. Added Testing-10613051

Certificate of Analysis

11/8/2010

Sample Information			
Sample Number	201004711-01	Matrix	Soil
Sample ID	Composite Sample 10BH-001,-002,-003,-004,4' to 40'	Sample Date/Time	Not Provided
Description	Task 21	Sample Received	11/01/10 11:40
		Sampler	Client

Analysis	***Units***	***PQL***	***Results***	***Analyst***	***Date / Time Tested***	***Method***
Chloride ISE-soil	mg/Kg	10	63	BAS	11/05/2010 17:00	AASHTO T291

Sample Information			
Sample Number	201004711-02	Matrix	Soil
Sample ID	10BH-003, 23' to 35'	Sample Date/Time	Not Provided
Description	Task 21	Sample Received	11/01/10 11:40
		Sampler	Client

Analysis	***Units***	***PQL***	***Results***	***Analyst***	***Date / Time Tested***	***Method***
Chloride ISE-soil	mg/Kg	10	540	BAS	11/05/2010 17:00	AASHTO T291

Sample Information			
Sample Number	201004711-03	Matrix	Soil
Sample ID	Composite Sample 10BH-002,-004, 8' to 40'	Sample Date/Time	Not Provided
Description	Task 21	Sample Received	11/01/10 11:40
		Sampler	Client

Analysis	***Units***	***PQL***	***Results***	***Analyst***	***Date / Time Tested***	***Method***
Chloride ISE-soil	mg/Kg	10	140	BAS	11/05/2010 17:00	AASHTO T291

Sample Information			
Sample Number	201004711-04	Matrix	Soil
Sample ID	10BH-013, 23' to 40'	Sample Date/Time	Not Provided
Description	Task 21	Sample Received	11/01/10 11:40
		Sampler	Client

Analysis	***Units***	***PQL***	***Results***	***Analyst***	***Date / Time Tested***	***Method***
Chloride ISE-soil	mg/Kg	10	440	BAS	11/05/2010 17:00	AASHTO T291

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PENNIMAN & BROWNE, INC.
CHEMISTS / ENGINEERS / INSPECTORS
INDUSTRIAL HYGIENE SERVICES

Prepared for:

Schnabel Engineering Associcates
Kerri Allgauer
1504 Woodlawn Drive
Baltimore, MD 21207

MTT & MLK Expressway Proj. Added Testing-10613051

Certificate of Analysis

11/8/2010

Sample Information			
Sample Number	201004711-05	Matrix	Soil
Sample ID	Composite Sample 10BH-014,-015,-016, 4' to 40'	Sample Date/Time	Not Provided
Description	Task 21	Sample Received	11/01/10 11:40
		Sampler	Client

Analysis	***Units***	***PQL***	***Results***	***Analyst***	***Date / Time Tested***	***Method***
Chloride ISE-soil	mg/Kg	10	35	BAS	11/05/2010 17:00	AASHTO T291

Sample Information			
Sample Number	201004711-06	Matrix	Soil
Sample ID	10BH-016, 18'-29'	Sample Date/Time	Not Provided
Description	Task 21	Sample Received	11/01/10 11:40
		Sampler	Client

Analysis	***Units***	***PQL***	***Results***	***Analyst***	***Date / Time Tested***	***Method***
Chloride ISE-soil	mg/Kg	10	27	BAS	11/05/2010 17:00	AASHTO T291

Sample Information			
Sample Number	201004711-07	Matrix	Soil
Sample ID	10BH-021 13' to 35'	Sample Date/Time	Not Provided
Description	Task 21	Sample Received	11/01/10 11:40
		Sampler	Client

Analysis	***Units***	***PQL***	***Results***	***Analyst***	***Date / Time Tested***	***Method***
Chloride ISE-soil	mg/Kg	10	120	BAS	11/05/2010 17:00	AASHTO T291

Sample Information			
Sample Number	201004711-08	Matrix	Soil
Sample ID	Composite Sample 10BH-022,-023 4' to 25'	Sample Date/Time	Not Provided
Description	Task 21	Sample Received	11/01/10 11:40
		Sampler	Client

Analysis	***Units***	***PQL***	***Results***	***Analyst***	***Date / Time Tested***	***Method***
Chloride ISE-soil	mg/Kg	10	330	BAS	11/05/2010 17:00	AASHTO T291

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PENNIMAN & BROWNE, INC.
CHEMISTS / ENGINEERS / INSPECTORS
INDUSTRIAL HYGIENE SERVICES

Prepared for:

Schnabel Engineering Associcates
Kerri Allgauer
1504 Woodlawn Drive
Baltimore, MD 21207

MTT & MLK Expressway Proj. Added Testing-10613051

Certificate of Analysis

11/8/2010

Harry Holthaus - Quality Assurance Manager

Barbara Schroyer, Laboratory Director

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LABORATORY DATA SUMMARY

Project: Midtown Tunnel
Client: PB Americas, Inc.
Project Number: 4655-110

Number: 4955-110
Date: 10/05/10

SAMPLE NUMBER	DEPTH (FEET)	SAMPLE TYPE	CLASS.	CHLORIDE CONTENT (ppm)	SOLUBLE SULFATES (ppm)	RESISTIVITY (ohm-cm)	pH
10BH-005	52 to 59	SS COMPOSITE	SP-SM	1383.2	1564	1,960	2.97
10BH-005	64 to 79	SS COMPOSITE	SP-SM	1464.2	1206	2,230	3.32
10BH-008	36.5 to 43.5	SS COMPOSITE	SM	1536.5	6614	29,890	6.75
10BH-008	51.5 to 58.5	SS COMPOSITE	SC	1608.9	8530		
10BH-011	47 to 59	SS COMPOSITE	SM	2497.1	2660	23,770	6.49
10BH-011	64 to 69	SS COMPOSITE	SM	2191.4	3049	22,700	6.90
10BH-019	32 to 42	SS COMPOSITE	OH	1958.8	3786	59,180	5.57
10BH-020	53.5 to 55.5	SS	SM	1449.8	4708	-	-

Tests performed in accordance with applicable ASTM Standards.

etc.

Schnabel ENGINEERING

Unconfined Compression Test Report

ASTM D2166

Date: *1/0/1900*

Project: *MTT, DTT & MLK Exp. Project*

Location: *Portsmouth, VA*

Schnabel No.: *10613051.00.21*
Boring No.: *10BH-002*
Depth: *50-51.8 ft.*
Elevation: *-44.1 to -45.9 ft.*

Test Specimen Data	
Initial Diameter, in:	*2.882*
Initial Area, in^2:	*6.527*
Initial Height, in:	*5.826*
H/D Ratio:	*2.0*
Moisture Content, %:	*268.3*
Wet Unit Weight, pcf:	*69.2*
Dry Unit Weight, pcf:	*18.8*

Testing Information	
Test Procedure:	*ASTM D2166*
Type of Specimen:	*Tube Sample*
Load Cell No.:	*1018253*
Strain Rate, %/min.:	*1.0*

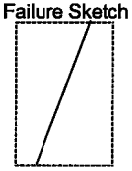
Remarks: *Upper UCS specimen; Oven Dried LL assigned but not performed as LL was NP; Organic content = 46.7%.*

Specimen Type: *Tube Sample*

Strength Data	
Strain at Failure, %:	*1.8*
Unconfined Strength (Qu), tsf:	*0.31*
Shear Strength (Su), tsf:	*0.16*

Reviewed by: *0*

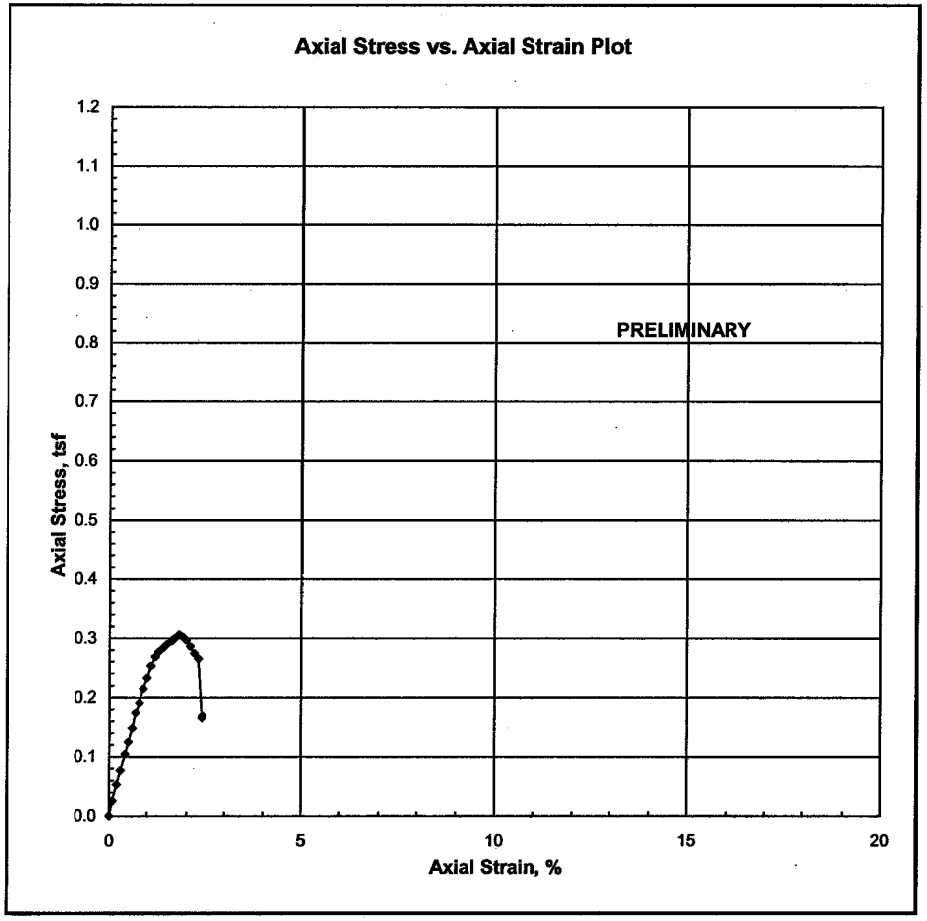
Failure Sketch



Soil Desc.: *PEAT (PT), contains fibrous material - dark brown and black*

LL, %:	*NP*	% < 200:	*54.1*
PI, %:	*NP*	Gs:	*2.26*

Test Data						
Reading No.	Axial Load (lbs)	Axial Displ. (in.)	Axial Strain (%)	Corrected Area[1] (in^2)	Axial Stress (psi)	Axial Stress (tsf)
Zero	0.0	0.000	0.0	6.53	0.0	0.00
1	2.3	0.005	0.1	6.53	0.4	0.03
2	4.8	0.011	0.2	6.54	0.7	0.05
3	7.0	0.017	0.3	6.55	1.1	0.08
4	9.5	0.024	0.4	6.55	1.4	0.10
5	11.4	0.029	0.5	6.56	1.7	0.13
6	13.5	0.035	0.6	6.57	2.1	0.15
7	15.9	0.040	0.7	6.57	2.4	0.17
8	17.4	0.046	0.8	6.58	2.6	0.19
9	19.6	0.052	0.9	6.59	3.0	0.21
10	21.3	0.058	1.0	6.59	3.2	0.23
11	23.2	0.064	1.1	6.60	3.5	0.25
12	24.6	0.070	1.2	6.61	3.7	0.27
13	25.4	0.075	1.3	6.61	3.8	0.28
14	26.0	0.081	1.4	6.62	3.9	0.28
15	26.6	0.087	1.5	6.63	4.0	0.29
16	27.1	0.093	1.6	6.63	4.1	0.29
17	27.7	0.099	1.7	6.64	4.2	0.30
18	28.3	0.105	1.8	6.65	4.3	0.31
19	28.0	0.110	1.9	6.65	4.2	0.30
20	27.4	0.116	2.0	6.66	4.1	0.30
21	26.5	0.122	2.1	6.67	4.0	0.29
22	25.4	0.128	2.2	6.67	3.8	0.27
23	24.6	0.134	2.3	6.68	3.7	0.27
24	15.4	0.140	2.4	6.69	2.3	0.17
25	15.7	0.141	2.4	6.69	2.3	0.17



Notes: 1. Right Cylinder Area Correction Method

Schnabel ENGINEERING

Unconfined Compression Test Report

ASTM D2166

Date: *1/0/1900*

Project: *MTT, DTT & MLK Exp. Project*

Location: *Portsmouth, VA*

Schnabel No.: *10613051.00.21*
Boring No.: *10BH-002*
Depth: *50-51.8 ft.*
Elevation: *-44.1 to -45.9*

Test Specimen Data	
Initial Diameter, in:	*2.867*
Initial Area, in^2:	*6.457*
Initial Height, in:	*5.812*
H/D Ratio:	*2.0*
Moisture Content, %:	*108.3*
Wet Unit Weight, pcf:	*81.3*
Dry Unit Weight, pcf:	*39.0*

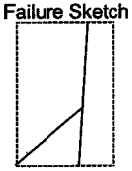
Testing Information	
Test Procedure:	*ASTM D2166*
Type of Specimen:	*Tube Sample*
Load Cell No.:	*1018253*
Strain Rate, %/min.:	*1.0*

Remarks: *Lower UCS specimen; developed vertical failure plane along a silt seam; ODLL assigned but not performed as LL was NP; Organic content = 46.7%.*

Specimen Type: *Tube Sample*

Strength Data	
Strain at Failure, %:	*4.9*
Unconfined Strength (Qu), tsf:	*0.87*
Shear Strength (Su), tsf:	*0.44*

Failure Sketch



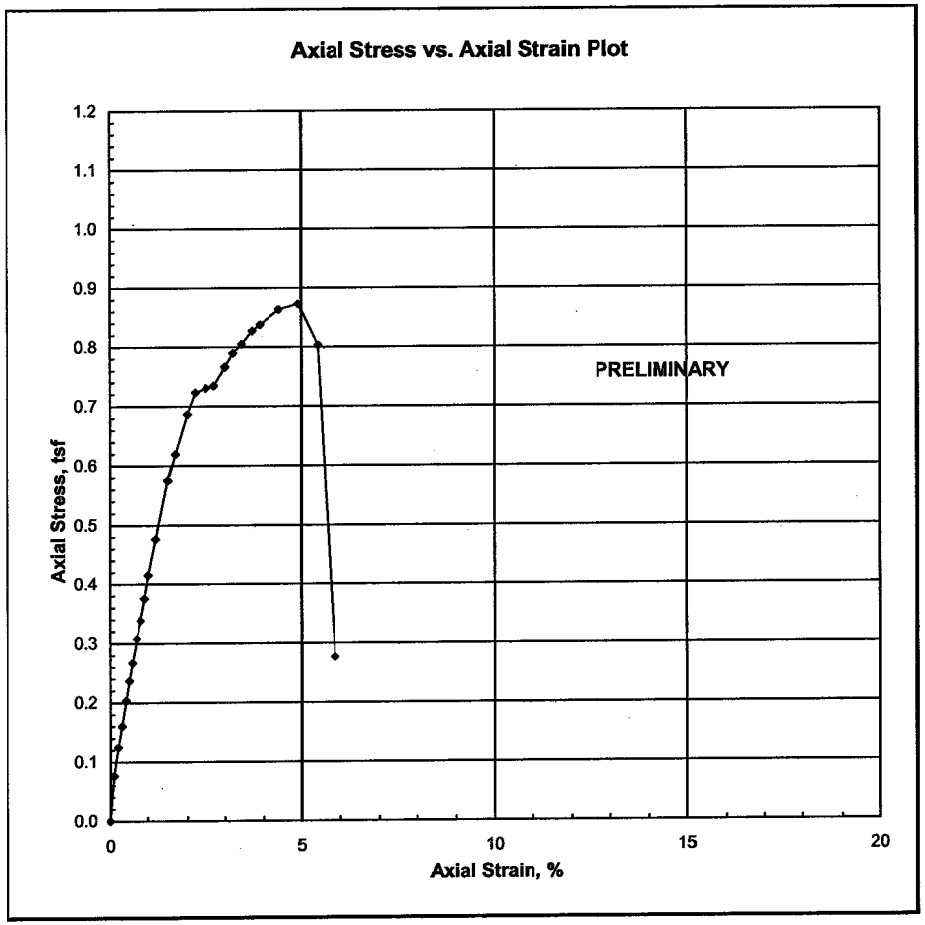
Reviewed by: *0*

Soil Desc.: *PEAT (PT), contains fibrous material - dark brown and black*

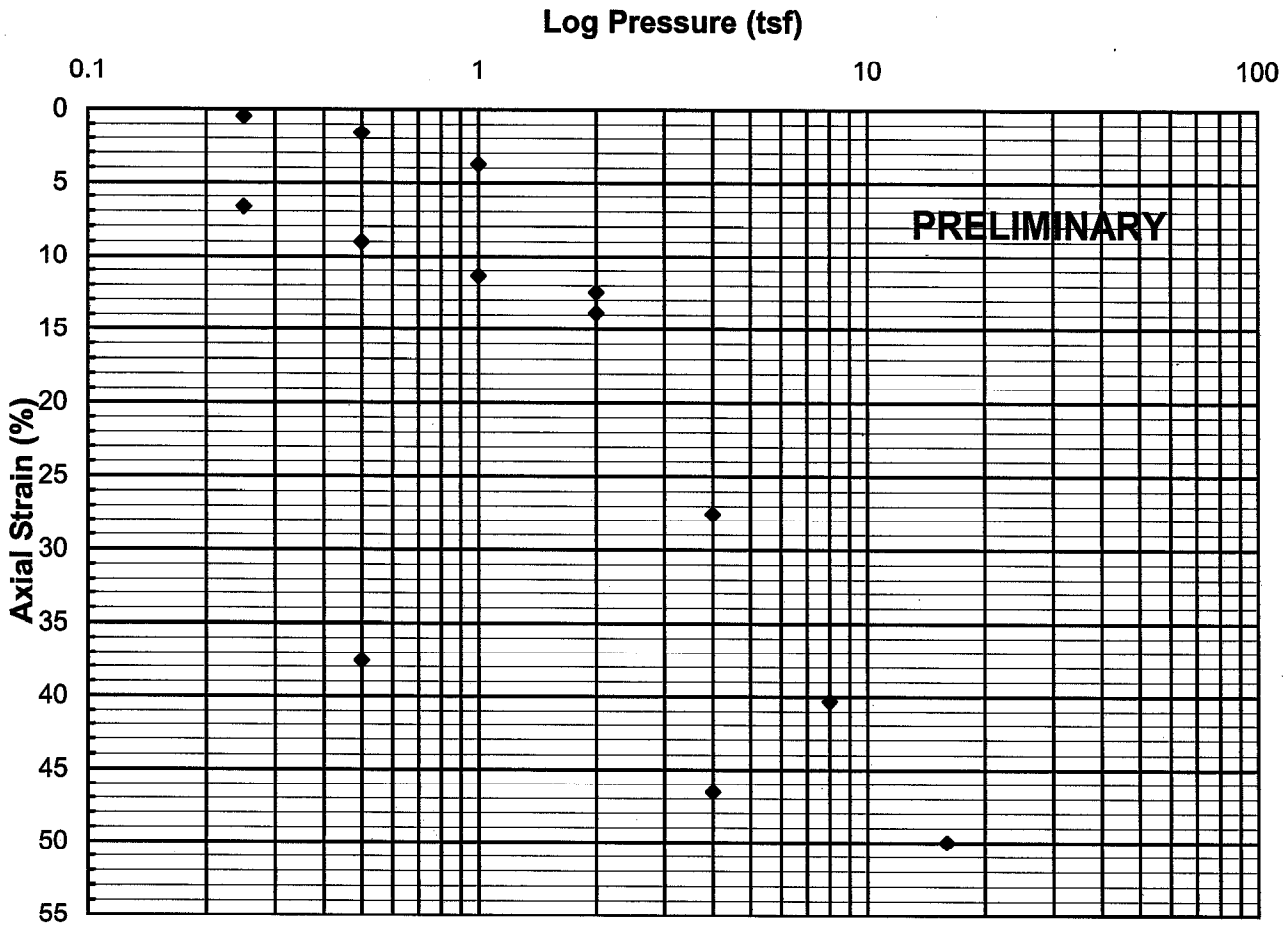
LL, %:	*NP*	% < 200:	*54.1*
PI, %:	*NP*	Gs:	*2.26*

Test Data

Reading No.	Axial Load (lbs)	Axial Displ. (in.)	Axial Strain (%)	Corrected Area[1] (in^2)	Axial Stress (psi)	Axial Stress (tsf)
Zero	0.0	0.000	0.0	6.46	0.0	0.00
1	6.8	0.006	0.1	6.46	1.1	0.08
2	11.2	0.012	0.2	6.47	1.7	0.12
3	14.4	0.018	0.3	6.48	2.2	0.16
4	18.3	0.024	0.4	6.48	2.8	0.20
5	21.3	0.029	0.5	6.49	3.3	0.24
6	24.1	0.034	0.6	6.50	3.7	0.27
7	27.8	0.041	0.7	6.50	4.3	0.31
8	30.6	0.047	0.8	6.51	4.7	0.34
9	34.0	0.053	0.9	6.52	5.2	0.38
10	37.6	0.059	1.0	6.52	5.8	0.41
11	43.2	0.070	1.2	6.54	6.6	0.48
12	52.4	0.088	1.5	6.56	8.0	0.58
13	56.5	0.099	1.7	6.57	8.6	0.62
14	62.8	0.117	2.0	6.59	9.5	0.69
15	66.3	0.129	2.2	6.60	10.0	0.72
16	67.2	0.146	2.5	6.62	10.1	0.73
17	67.7	0.158	2.7	6.64	10.2	0.73
18	70.8	0.175	3.0	6.66	10.6	0.77
19	73.1	0.187	3.2	6.67	11.0	0.79
20	74.7	0.200	3.4	6.69	11.2	0.80
21	77.0	0.216	3.7	6.71	11.5	0.83
22	78.2	0.228	3.9	6.72	11.6	0.84
23	81.0	0.257	4.4	6.76	12.0	0.86
24	82.3	0.286	4.9	6.79	12.1	0.87
25	76.1	0.315	5.4	6.83	11.1	0.80
26	26.4	0.341	5.9	6.86	3.8	0.28



Notes: 1. Right Cylinder Area Correction Method



Evaluation of Pp', Cer, and Cec relies on the design professional's engineering judgement and project details.

Probable Preconsolidation Pressure (Pp), tsf: 3.1			**Recompression Ratio (Cer):** 0.08
Type of Specimen: *Tube Sample*			**Compression Ratio (Cec):** 0.46
Description: *PEAT (PT), contains fibrous material - dark brown and black*			
LL: *NP*	**PI:** *NP*	**Gs:** *2.26*	**P_o' (tsf):** *0.00*
% < No. 200: *54.1*		**Test Method:** *ASTM D2435 Method A*	
Test Condition: *Inundated @ 0.05 tsf*			

	Initial	Final
Water Content, %	*183.6*	*106.1*
Void Ratio	*4.33*	*2.33*
Saturation, %	*96*	*100*
Dry Unit Weight, pcf	*26.5*	*42.4*

Remarks: *Organic content = 46.7%; Oven Dried LL assigned but not performed as LL was NP.*

Average Water Content of Trimmings, %: *171.7*

Schnabel ENGINEERING

Project: MTT, DTT & MLK Exp. Project

Location	*Portsmouth, VA*
Boring: *10BH-002*	**Schnabel No.:** *10613051.00.21*
Depth: *50.0 - 51.8 ft.*	**Elevation:** *-44.1 to -45.9 ft.*
Date: *1/0/1900*	**Reviewed by:** *0*

Consolidation Test Report

Consolidation Test Data Sheet

Consolidometer ID: 1 1/0/00

Schnabel Contract: 10613051.00.21

Project: MTT, DTT & MLK Exp. Project

Test Method: ASTM D2435 Method A

Test Condition: Inundated @ 0.05 tsf

Initial Height of Specimen (H_o), in.: 0.7467

Height of Solids (H_s), in.: 0.1402

Boring No.: 10BH-002

Depth: 50.0 - 51.8 ft.

Seating Press. (tsf): 0.05

Initial Dial Gauge Reading (D_o), in.: 0.0000

Reviewed by: 0

Pressure, P (tsf)	TimeReadings Required	Date Load Applied	Time Load Applied	Load Applied By	A: Final[1] Dial Reading, D_{fi} x 10^{-4} in.	B: Apparatus Correction[2], D_{ci} x 10^{-4} in.	C: Cumulative Change in Height[3], DH_i in.	D: Height of Voids[4], H_{vi} in.	Vertical Strain[5], e_i (%)	Void Ratio[6], e_i
0.25		9/2/2010	9:00	DWC	37	1	0.0036	0.6029	0.48	4.301
0.5		9/3/2010	9:00	DWC	126	3	0.0123	0.5942	1.65	4.239
1		9/4/2010	9:00	DWC	289	9	0.0280	0.5785	3.75	4.127
2		9/6/2010	9:00	CJS	944	13	0.0931	0.5134	12.47	3.662
1		9/7/2010	9:00	DWC	859	9	0.0850	0.5215	11.38	3.720
0.5		9/8/2010	9:00	DWC	676	3	0.0673	0.5392	9.01	3.847
0.25		9/9/2010	9:00	DWC	501	1	0.0500	0.5565	6.70	3.970
0.05		9/10/2010	9:00	DWC	232	0	0.0232	0.5833	3.11	4.161
2		9/11/2010	9:00	CJS	1049	13	0.1036	0.5029	13.87	3.588
4		9/12/2010	9:00	DWC	2078	21	0.2057	0.4008	27.55	2.859
8		9/13/2010	9:00	DWC	3043	33	0.3010	0.3055	40.31	2.179
16		9/14/2010	9:00	DWC	3776	43	0.3733	0.2332	49.99	1.664
4		9/15/2010	9:00	DWC	3498	21	0.3477	0.2588	46.56	1.846
0.5		9/16/2010	9:00	DWC	2809	3	0.2806	0.3259	37.58	2.325

Notes:
1. "Final" based on test method; 24 hrs for Method A, end of primary for Method B.
2. Correction value, for the current pressure, from the consolidometer's calibration curve.
3. $\Delta H = D_{fi} - D_o - D_{ci}$ = Col. A - D_o - Col. B
4. $H_{vi} = (H_o - H_s - D_o) - \Delta H$
5. $\varepsilon_i = (\Delta H / H_o) \times 100 = (\text{Col. C} / H_o) \times 100$
6. $e_i = H_{vi} / Hs$ = Col. D / Hs

Consol 5/2007 Rev. 4

Schnabel ENGINEERING

Load Time Readings

1/0/00

Project: MTT, DTT & MLK Exp. Project

Schnabel Contract: 10613051.00.21

Boring No.: 10BH-002 Depth: 50.0 - 51.8 ft.

Consol. ID: 1 Reviewed by: 0

Test Drainage Conditions: Double

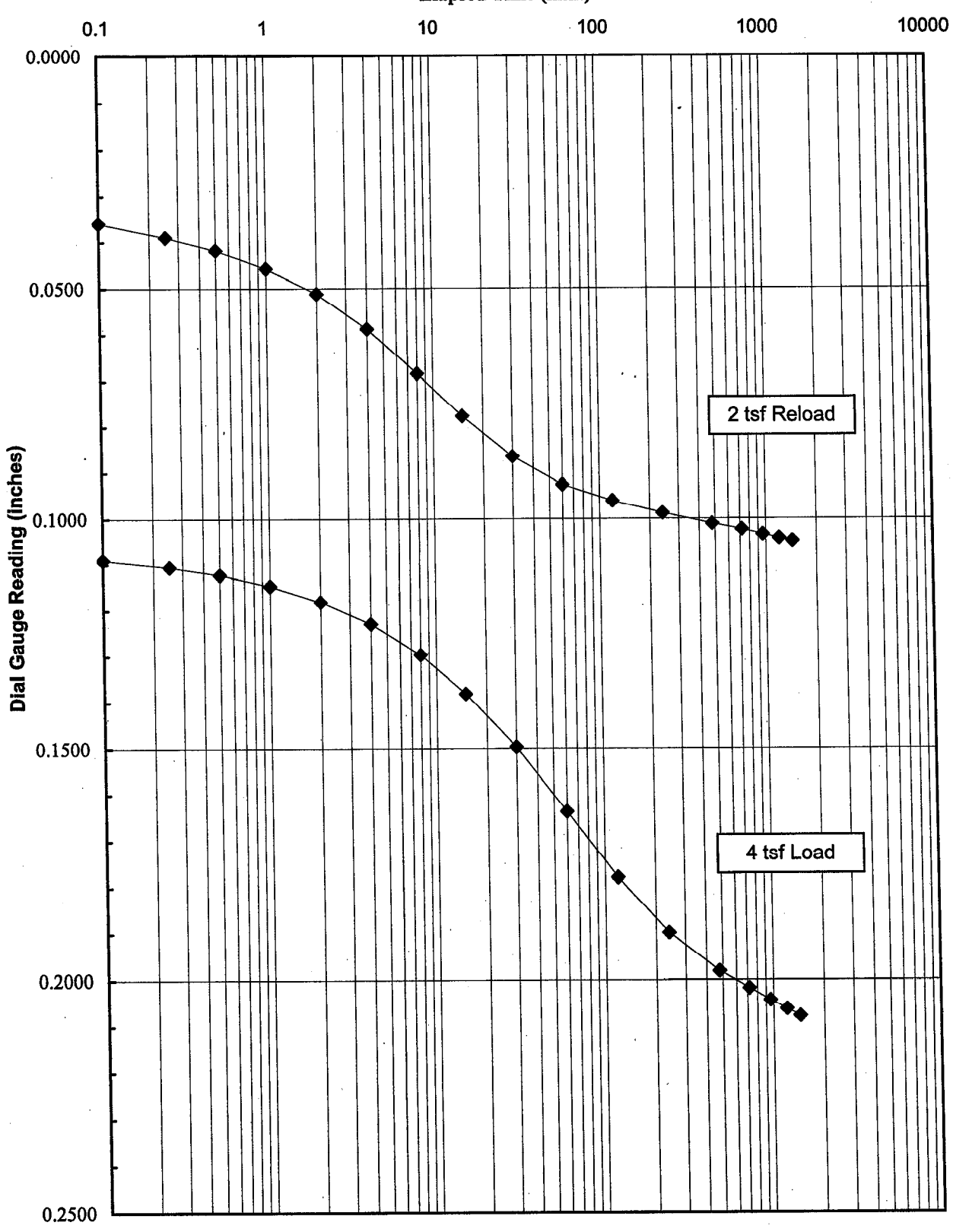
Elapsed Time (min.)	Dial Gauge Readings (inches)					
	2 tsf Reload 9/11/2010	4 tsf Load 9/12/2010				
0.1	0.0360	0.1091				
0.25	0.0390	0.1106				
0.5	0.0418	0.1122				
1	0.0457	0.1146				
2	0.0512	0.1181				
4	0.0588	0.1229				
8	0.0684	0.1297				
15	0.0776	0.1381				
30	0.0865	0.1497				
60	0.0926	0.1637				
120	0.0961	0.1779				
240	0.0988	0.1898				
480	0.1011	0.1982				
720	0.1024	0.2018				
960	0.1035	0.2044				
1200	0.1043	0.2063				
1440	0.1049	0.2078				
1680						
1920						
2160						
2400						
2640						
2880						

Schnabel ENGINEERING

Consolidation Time Curves

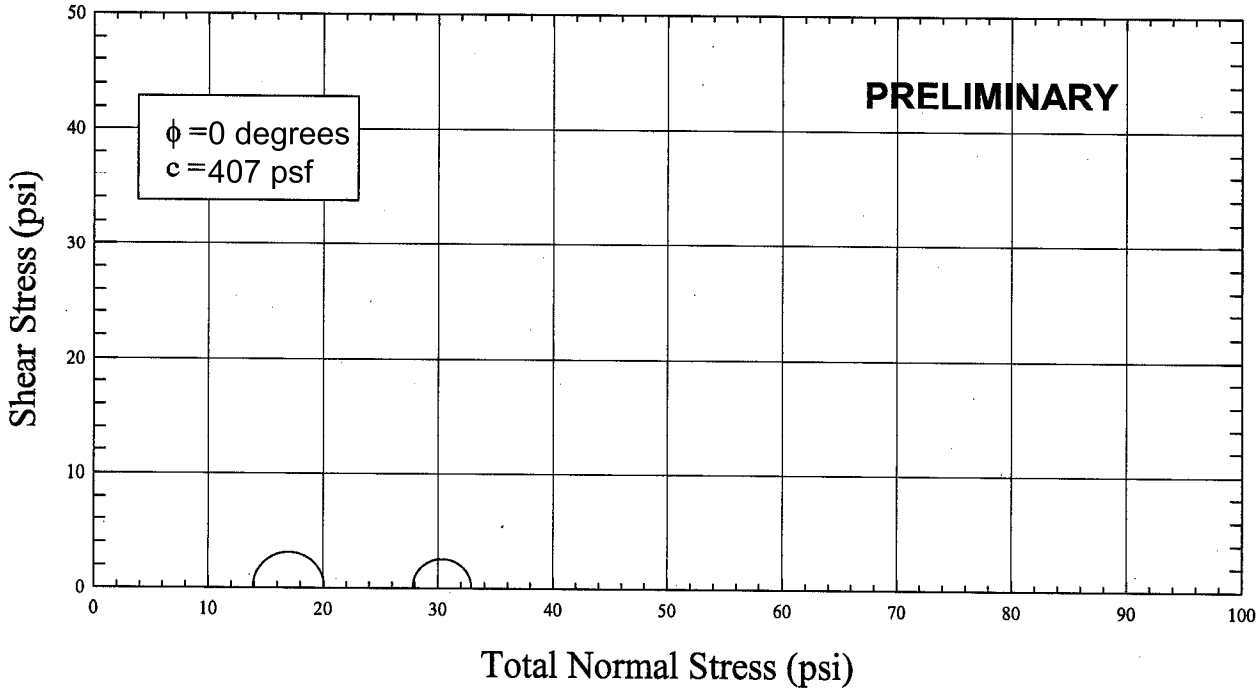
1/0/00

Project: MTT, DTT & MLK Exp. Project
Schnabel Contract: 10613051.00.21
Boring No.: 10BH-002 Depth: 50.0 - 51.8 ft.
Reviewed by: 0 Test Drainage Conditions: Double



Unconsolidated Undrained (UU) Triaxial Shear (ASTM D2850)

Mohr Stress Circles at Maximum Deviator Stress Criterion



Boring No.: *10BH-003* Depth: *30-32 ft* Elevation: *-25.4 to -27.4 ft* SEC Contract: *10613051.00.21* Date:
Sample Description: *FAT CLAY (CH) - gray* Reviewed By:
Specimen Type: *Tube Sample* Gs: *2.71* LL: *80* PI: *53* %<200: *98.6*

Schnabel ENGINEERING

MTT, DTT & MLK Exp. Project
Portsmouth, VA

Schnabel ENGINEERING

Unconsolidated Undrained Triaxial Compression Test

ASTM D2850

Project: *MTT, DTT & MLK Exp. Project*

Location: *Portsmouth, VA*

Schnabel Contract: *10613051.00.21* Date: *1/0/1900*

Boring No.: *10BH-003*

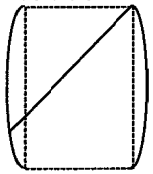
Depth: *30-32 ft.* Reviewed by: *0*

Elevation: *-25.4 to -27.4 ft.*

Confining Stress (psi): *13.9*

Soil Description: *FAT CLAY (CH) - gray*

Failure Sketch



Specimen Conditions	
Diameter (in)	2.856
Height (in)	5.784
Area (in^2)	6.41
Moisture (%):	59.7
Weight (lbs)	2.19
ρ_{wet} (pcf)	102.1
ρ_{dry} (pcf)	63.9
Void Ratio	1.64
Saturation, %	98

Shear Testing Conditions	
Cell Pressure (psi):	13.9
Rate of Strain (%/min):	1.0

Specimen Type: *Tube Sample*

Axial Strain at Failure (%): *5.95*

Compressive Strength (psi): *6.2*

Major Principal Stress (psi): *20.1*

Minor Principal Stress (psi): *13.9*

Liquid Limit: *80*

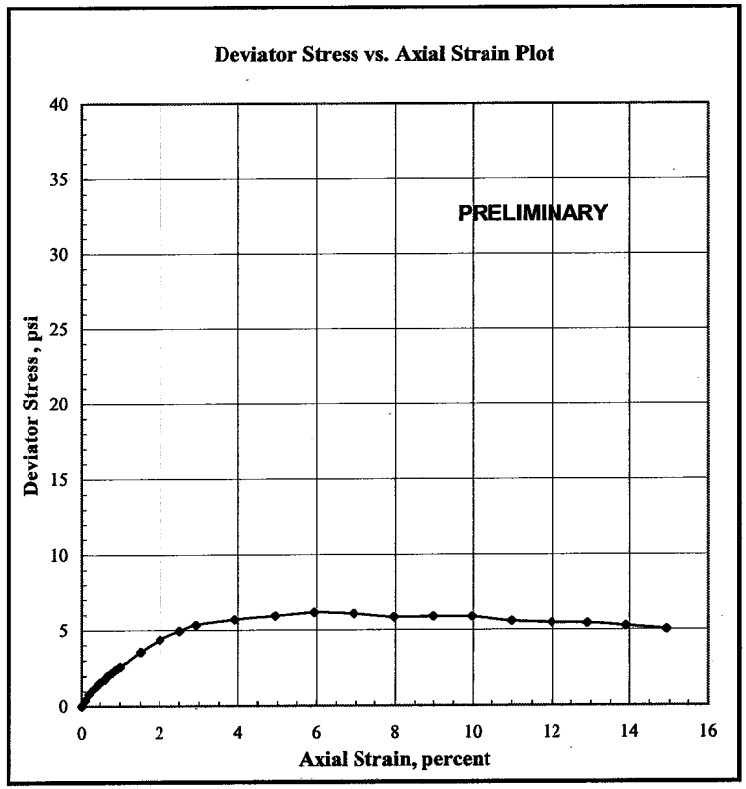
Plasticity Index: *53*

% finer that No. 200: *98.6*

Specific Gravity: *2.71*

Remarks:

Reading No.	Deviator Load (lbs)	Corrected Dev. Load[1] (lbs.)	Axial Displacement (in.)	Axial Strain (%)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	Deviator Stress (psi)
Initial	0.0	0.0	0.000	0.00	6.41	13.9	13.9	0.0
1	2.4	2.4	0.005	0.09	6.41	14.3	13.9	0.4
2	5.2	5.2	0.011	0.19	6.42	14.7	13.9	0.8
3	7.2	7.1	0.017	0.29	6.43	15.0	13.9	1.1
4	8.7	8.6	0.023	0.40	6.43	15.2	13.9	1.3
5	10.3	10.2	0.029	0.50	6.44	15.5	13.9	1.6
6	11.5	11.4	0.035	0.61	6.45	15.7	13.9	1.8
7	13.1	13.0	0.040	0.69	6.45	15.9	13.9	2.0
8	14.5	14.3	0.046	0.80	6.46	16.1	13.9	2.2
9	15.9	15.7	0.052	0.90	6.46	16.3	13.9	2.4
10	17.1	16.9	0.058	1.00	6.47	16.5	13.9	2.6
11	23.5	23.2	0.087	1.50	6.50	17.5	13.9	3.6
12	29.0	28.6	0.116	2.01	6.54	18.3	13.9	4.4
13	33.0	32.5	0.145	2.51	6.57	18.8	13.9	4.9
14	35.8	35.2	0.169	2.92	6.60	19.2	13.9	5.3
15	38.8	38.0	0.227	3.92	6.67	19.6	13.9	5.7
16	41.0	39.9	0.286	4.94	6.74	19.8	13.9	5.9
17	43.3	42.0	0.344	5.95	6.81	20.1	13.9	6.2
18	43.3	41.8	0.402	6.95	6.89	20.0	13.9	6.1
19	42.4	40.7	0.461	7.97	6.96	19.7	13.9	5.8
20	43.4	41.5	0.520	8.99	7.04	19.8	13.9	5.9
21	43.8	41.7	0.577	9.98	7.12	19.8	13.9	5.9
22	42.4	40.0	0.636	11.00	7.20	19.5	13.9	5.6
23	42.4	39.8	0.694	12.00	7.28	19.4	13.9	5.5
24	42.7	39.9	0.747	12.91	7.36	19.3	13.9	5.4
25	42.0	39.0	0.805	13.92	7.44	19.1	13.9	5.2
26	41.0	37.8	0.863	14.92	7.53	18.9	13.9	5.0



Notes: 1. Deviator load corrected for membrane effects.

2. Right Cylinder Correction Method

Schnabel ENGINEERING

Unconsolidated Undrained Triaxial Compression Test

ASTM D2850

Project: *MTT, DTT & MLK Exp. Project*

Location: *Portsmouth, VA*

Schnabel Contract: *10613051.00.21*
Boring No.: *10BH-003*
Depth: *30-32 ft.*
Elevation: *-25.4 to -27.4 ft.*
Confining Stress (psi): *27.8*

Date: *1/0/1900*
Reviewed by: *0*

Specimen Conditions	
Diameter (in)	2.859
Height (in)	5.816
Area (in^2)	6.42
Moisture (%):	63.5
Weight (lbs)	2.16
ρ_{wet} (pcf)	99.9
ρ_{dry} (pcf)	61.1
Void Ratio	1.77
Saturation, %	97

Shear Testing Conditions	
Cell Pressure (psi):	27.8
Rate of Strain (%/min):	1.0

Specimen Type: *Tube Sample*

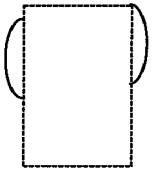
Axial Strain at Failure (%): *5.93*
Compressive Strength (psi): *5.1*
Major Principal Stress (psi): *32.9*
Minor Principal Stress (psi): *27.8*

Soil Description: *FAT CLAY (CH) - gray*

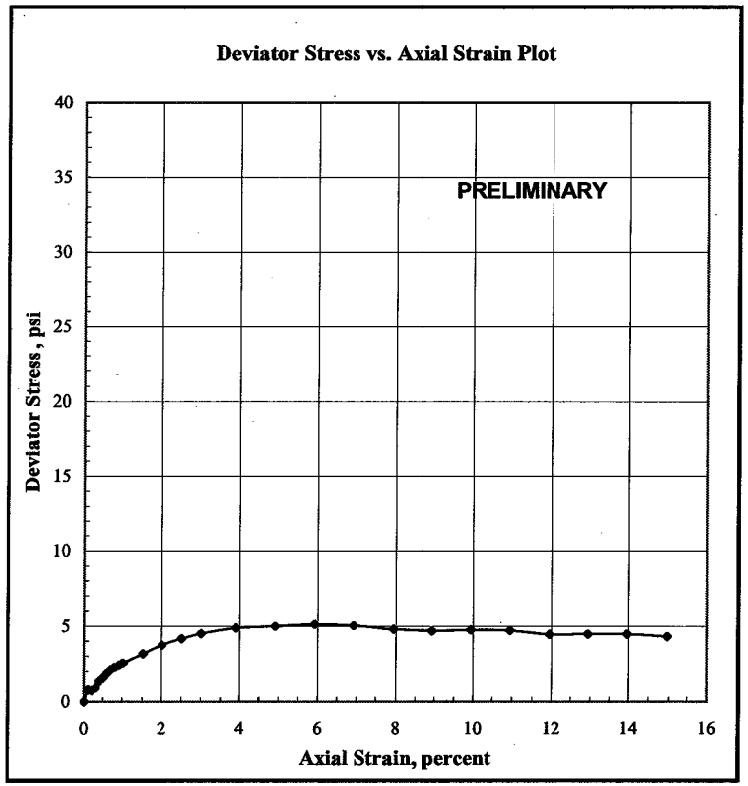
Liquid Limit: *80*
Plasticity Index: *53*
% finer that No. 200: *98.6*
Specific Gravity: *2.71*

Remarks:

Failure Sketch



Reading No.	Deviator Load (lbs)	Corrected Dev. Load[1] (lbs.)	Axial Displacement (in.)	Axial Strain (%)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	Deviator Stress (psi)
Initial	0.0	0.0	0.000	0.00	6.42	27.8	27.8	0.0
1	5.1	5.1	0.006	0.10	6.43	28.6	27.8	0.8
2	4.9	4.9	0.012	0.21	6.43	28.6	27.8	0.8
3	6.0	5.9	0.018	0.31	6.44	28.7	27.8	0.9
4	8.7	8.6	0.024	0.41	6.45	29.1	27.8	1.3
5	10.4	10.3	0.030	0.52	6.45	29.4	27.8	1.6
6	12.1	12.0	0.035	0.60	6.46	29.7	27.8	1.9
7	13.7	13.5	0.041	0.70	6.47	29.9	27.8	2.1
8	14.9	14.7	0.047	0.81	6.47	30.1	27.8	2.3
9	15.8	15.6	0.053	0.91	6.48	30.2	27.8	2.4
10	16.8	16.6	0.059	1.01	6.49	30.4	27.8	2.6
11	21.0	20.7	0.088	1.51	6.52	31.0	27.8	3.2
12	24.9	24.5	0.117	2.01	6.55	31.5	27.8	3.7
13	28.0	27.5	0.146	2.51	6.59	32.0	27.8	4.2
14	30.5	29.9	0.175	3.01	6.62	32.3	27.8	4.5
15	33.6	32.8	0.228	3.92	6.68	32.7	27.8	4.9
16	34.8	33.7	0.286	4.92	6.75	32.8	27.8	5.0
17	36.2	34.9	0.345	5.93	6.83	32.9	27.8	5.1
18	36.2	34.7	0.403	6.93	6.90	32.8	27.8	5.0
19	35.3	33.6	0.462	7.94	6.98	32.6	27.8	4.8
20	35.1	33.2	0.520	8.94	7.05	32.5	27.8	4.7
21	36.1	34.0	0.578	9.94	7.13	32.6	27.8	4.8
22	36.4	34.0	0.637	10.95	7.21	32.5	27.8	4.7
23	35.1	32.5	0.695	11.95	7.29	32.3	27.8	4.5
24	35.9	33.1	0.753	12.95	7.38	32.3	27.8	4.5
25	36.5	33.5	0.812	13.96	7.46	32.3	27.8	4.5
26	35.9	32.7	0.870	14.96	7.55	32.1	27.8	4.3



Notes: 1. Deviator load corrected for membrane effects.
2. Right Cylinder Correction Method

Schnabel ENGINEERING

Unconfined Compression Test Report

ASTM D2166

Date: *1/0/1900*

Project: *MTT, DTT & MLK Exp. Project*

Location: *Portsmouth, VA*

Schnabel No.: *10613051.00.21*
Boring No.: *10BH-003*
Depth: *30-32 ft.*
Elevation: *-25.4 to -27.4 ft.*

Test Specimen Data	
Initial Diameter, in:	*2.865*
Initial Area, in^2:	*6.450*
Initial Height, in:	*5.755*
H/D Ratio:	*2.0*
Moisture Content, %:	*61.0*
Wet Unit Weight, pcf:	*101.9*
Dry Unit Weight, pcf:	*63.3*

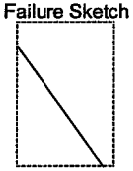
Testing Information	
Test Procedure:	*ASTM D2166*
Type of Specimen:	*Tube Sample*
Load Cell No.:	*1018253*
Strain Rate, %/min.:	*1.0*

Remarks:

Specimen Type:	*Tube Sample*

Strength Data	
Strain at Failure, %:	*7.0*
Unconfined Strength (Qu), tsf:	*0.18*
Shear Strength (Su), tsf:	*0.09*

Failure Sketch

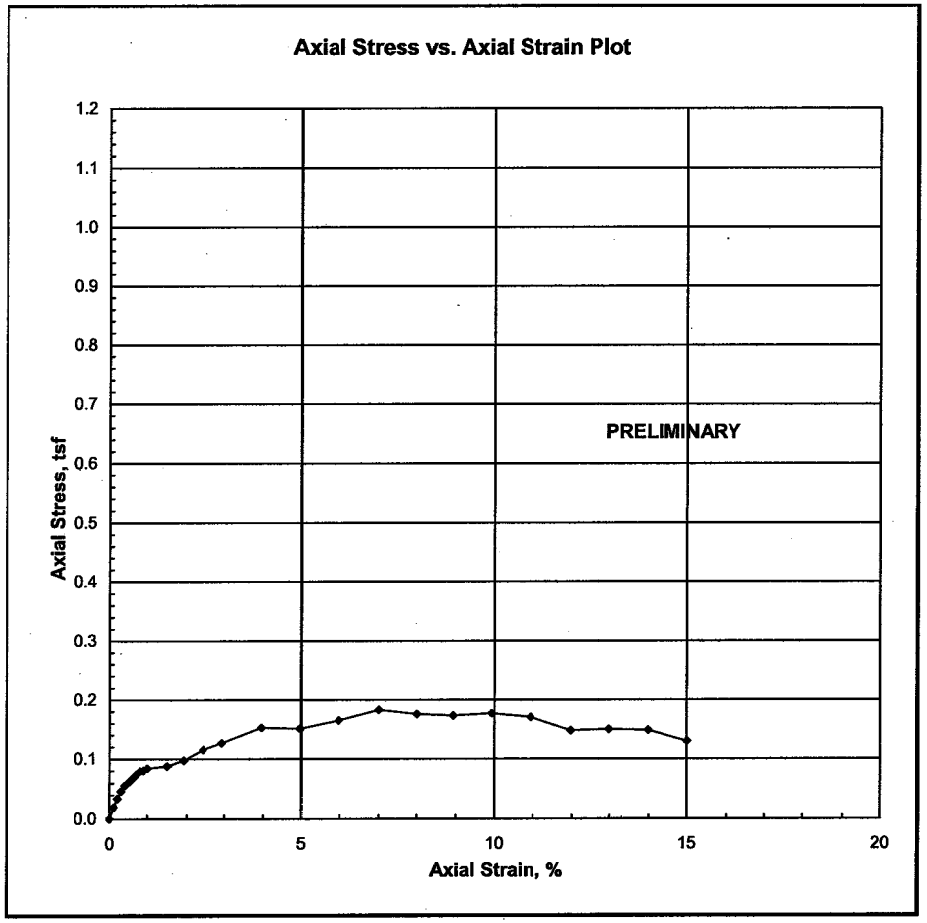


Reviewed by: *0*

Soil Desc.: *FAT CLAY (CH) - gray*

LL, %:	*80*	% < 200:	*98.6*
PI, %:	*53*	Gs:	*2.71*

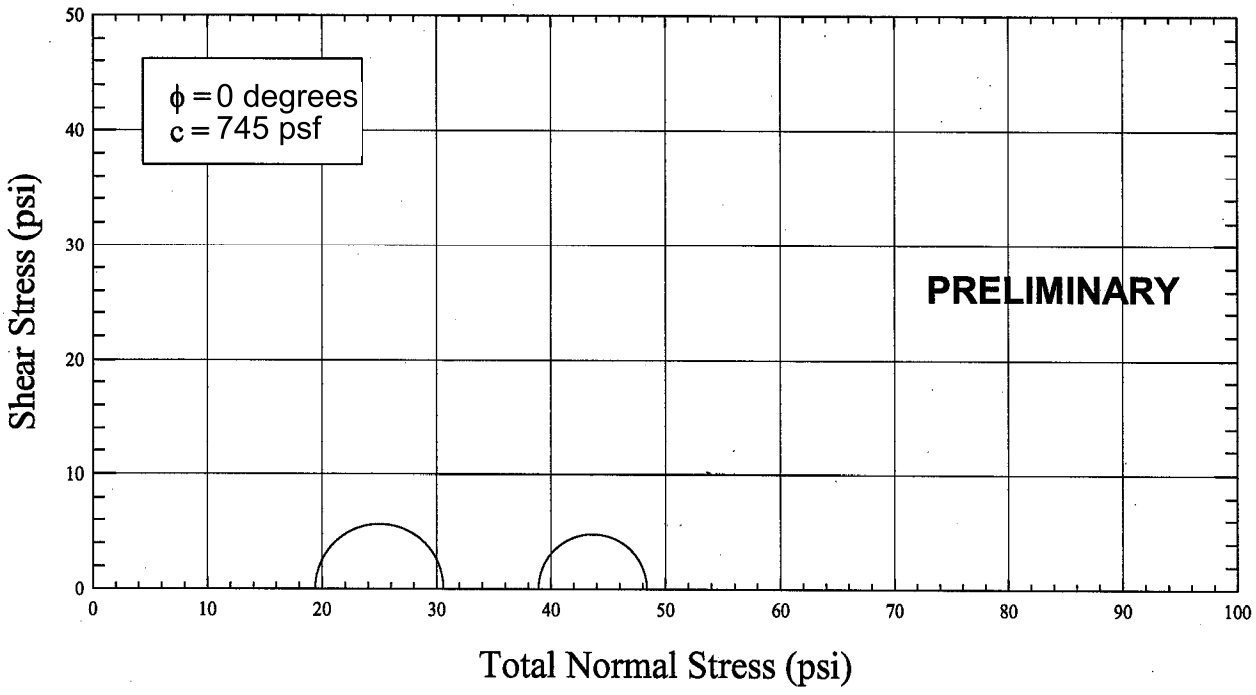
Test Data						
Reading No.	Axial Load (lbs)	Axial Displ. (in.)	Axial Strain (%)	Corrected Area[1] (in^2)	Axial Stress (psi)	Axial Stress (tsf)
Zero	0.0	0.000	0.0	6.45	0.0	0.00
1	1.7	0.006	0.1	6.46	0.3	0.02
2	3.0	0.012	0.2	6.46	0.5	0.03
3	4.1	0.017	0.3	6.47	0.6	0.05
4	5.0	0.023	0.4	6.48	0.8	0.06
5	5.6	0.029	0.5	6.48	0.9	0.06
6	6.1	0.035	0.6	6.49	0.9	0.07
7	6.7	0.041	0.7	6.50	1.0	0.07
8	7.2	0.047	0.8	6.50	1.1	0.08
9	7.3	0.052	0.9	6.51	1.1	0.08
10	7.6	0.058	1.0	6.52	1.2	0.08
11	8.0	0.087	1.5	6.55	1.2	0.09
12	8.9	0.111	1.9	6.58	1.4	0.10
13	10.6	0.140	2.4	6.61	1.6	0.12
14	11.7	0.169	2.9	6.65	1.8	0.13
15	14.2	0.228	4.0	6.72	2.1	0.15
16	14.2	0.286	5.0	6.79	2.1	0.15
17	15.7	0.344	6.0	6.86	2.3	0.16
18	17.6	0.403	7.0	6.94	2.5	0.18
19	17.1	0.461	8.0	7.01	2.4	0.18
20	17.0	0.514	8.9	7.08	2.4	0.17
21	17.6	0.572	9.9	7.16	2.5	0.18
22	17.1	0.630	10.9	7.24	2.4	0.17
23	15.0	0.689	12.0	7.33	2.0	0.15
24	15.4	0.747	13.0	7.41	2.1	0.15
25	15.4	0.805	14.0	7.50	2.1	0.15
26	13.6	0.864	15.0	7.59	1.8	0.13



Notes: 1. Right Cylinder Area Correction Method

Unconsolidated Undrained (UU) Triaxial Shear (ASTM D2850)

Mohr Stress Circles at Maximum Deviator Stress Criterion



Boring No.: *10BH-003* Depth: *50-52 ft* Elevation: *-45.4 to -47.4 ft* SEC Contract: *10613051.00.21* Date:
Sample Description: *ORGANIC CLAY (OH) - gray* Reviewed By:
Specimen Type: *Tube Sample* Gs: *2.72* LL: *95* PI: *65* %<200: *97.9* Organic Content: *2.2%*

Schnabel ENGINEERING

MTT, DTT & MLK Exp. Project
Portsmouth, VA

Schnabel ENGINEERING

Unconsolidated Undrained Triaxial Compression Test

ASTM D2850

Project: *MTT, DTT & MLK Exp. Project*

Location: *Portsmouth, VA*

Schnabel Contract: *10613051.00.21* Date: *1/0/1900*

Boring No.: *10BH-003*

Depth: *50-52 ft.* Reviewed by: *0*

Elevation: *-45.4 to -47.4 ft.*

Confining Stress (psi): *19.4*

Specimen Conditions	
Diameter (in)	2.872
Height (in)	5.762
Area (in^2)	6.48
Moisture (%):	65.9
Weight (lbs)	2.16
ρ_{wet} (pcf)	100.1
ρ_{dry} (pcf)	60.4
Void Ratio	1.81
Saturation, %	99

Shear Testing Conditions	
Cell Pressure (psi):	19.4
Rate of Strain (%/min):	1.0

Specimen Type: *Tube Sample*

Axial Strain at Failure (%): *2.93*

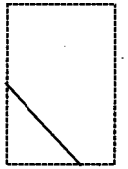
Compressive Strength (psi): *11.2*

Major Principal Stress (psi): *30.6*

Minor Principal Stress (psi): *19.4*

Soil Description: *ORGANIC CLAY (OH) - gray*

Failure Sketch



Liquid Limit: *95*

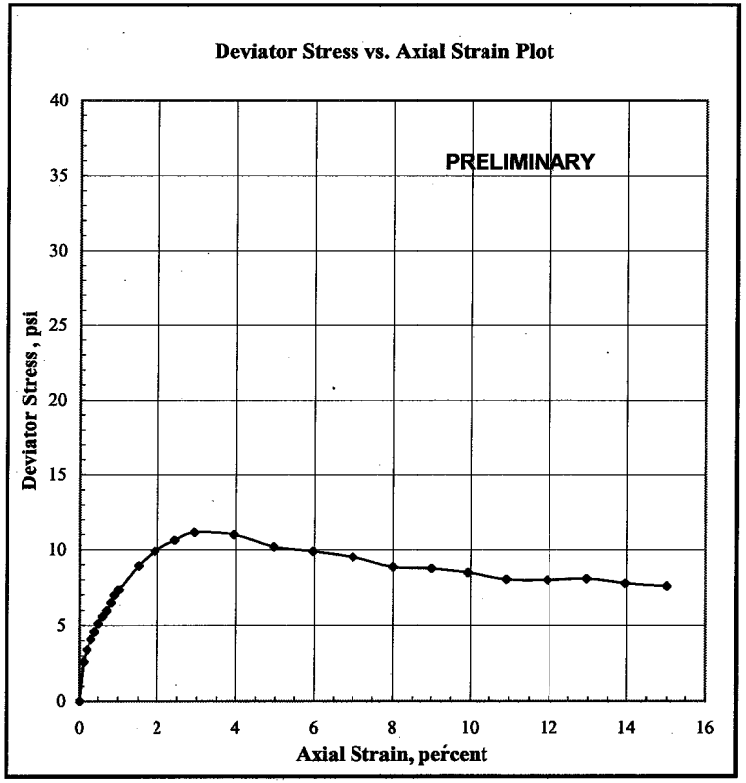
Plasticity Index: *65*

% finer that No. 200: *97.9*

Specific Gravity: *2.72*

Remarks: *Organic content = 2.2%.*

Reading No.	Deviator Load (lbs)	Corrected Dev. Load[1] (lbs.)	Axial Displacement (in.)	Axial Strain (%)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	Deviator Stress (psi)
Initial	0.0	0.0	0.000	0.00	6.48	19.4	19.4	0.0
1	16.9	16.9	0.006	0.10	6.49	22.0	19.4	2.6
2	22.2	22.2	0.012	0.21	6.50	22.8	19.4	3.4
3	26.6	26.5	0.017	0.30	6.50	23.5	19.4	4.1
4	29.9	29.8	0.023	0.40	6.51	24.0	19.4	4.6
5	33.3	33.2	0.029	0.50	6.51	24.5	19.4	5.1
6	36.4	36.3	0.035	0.61	6.52	25.0	19.4	5.6
7	39.0	38.8	0.041	0.71	6.53	25.4	19.4	6.0
8	42.5	42.3	0.047	0.82	6.54	25.9	19.4	6.5
9	45.7	45.5	0.052	0.90	6.54	26.4	19.4	7.0
10	48.1	47.9	0.058	1.01	6.55	26.7	19.4	7.3
11	59.0	58.7	0.087	1.51	6.58	28.3	19.4	8.9
12	65.8	65.4	0.111	1.93	6.61	29.3	19.4	9.9
13	71.1	70.6	0.140	2.43	6.64	30.0	19.4	10.6
14	75.1	74.5	0.169	2.93	6.68	30.6	19.4	11.2
15	75.1	74.2	0.228	3.96	6.75	30.4	19.4	11.0
16	70.5	69.4	0.286	4.96	6.82	29.6	19.4	10.2
17	69.4	68.1	0.344	5.97	6.89	29.3	19.4	9.9
18	67.8	66.3	0.403	6.99	6.97	28.9	19.4	9.5
19	64.1	62.4	0.461	8.00	7.05	28.3	19.4	8.9
20	64.2	62.2	0.519	9.01	7.12	28.1	19.4	8.7
21	63.0	60.8	0.572	9.93	7.20	27.9	19.4	8.5
22	60.7	58.3	0.630	10.93	7.28	27.4	19.4	8.0
23	61.3	58.7	0.689	11.96	7.36	27.4	19.4	8.0
24	62.8	60.0	0.747	12.96	7.45	27.5	19.4	8.1
25	61.6	58.6	0.805	13.97	7.53	27.2	19.4	7.8
26	61.0	57.8	0.864	15.00	7.63	27.0	19.4	7.6



Notes: 1. Deviator load corrected for membrane effects.

2. Right Cylinder Correction Method

Schnabel ENGINEERING

Unconsolidated Undrained Triaxial Compression Test

ASTM D2850

Project: *MTT, DTT & MLK Exp. Project*

Location: *Portsmouth, VA*

Schnabel Contract: *10613051.00.21* Date: *1/0/1900*

Boring No.: *10BH-003*

Depth: *50-52 ft.* Reviewed by: *0*

Elevation: *-45.4 to -47.4 ft.*

Confining Stress (psi): *38.9*

Specimen Conditions	
Diameter (in)	2.872
Height (in)	5.797
Area (in^2)	6.48
Moisture (%):	65.4
Weight (lbs)	2.18
ρ_{wet} (pcf)	100.2
ρ_{dry} (pcf)	60.6
Void Ratio	1.80
Saturation, %	99

Shear Testing Conditions	
Cell Pressure (psi):	38.9
Rate of Strain (%/min):	1.0

Specimen Type: *Tube Sample*

Axial Strain at Failure (%): *5.95*

Compressive Strength (psi): *9.5*

Major Principal Stress (psi): *48.4*

Minor Principal Stress (psi): *38.9*

Soil Description: *ORGANIC CLAY (OH) - gray*

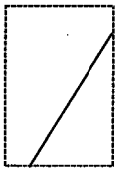
Liquid Limit: *95*

Plasticity Index: *65*

% finer that No. 200: *97.9*

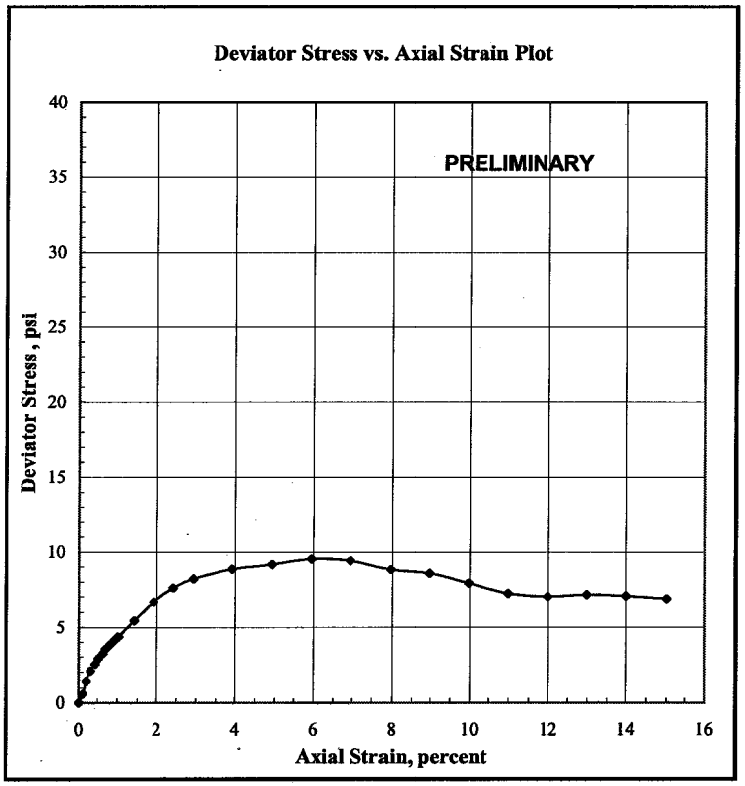
Specific Gravity: *2.72*

Failure Sketch



Remarks: *Organic content = 2.2%.*

Reading No.	Deviator Load (lbs)	Corrected Dev. Load[1] (lbs.)	Axial Displacement (in.)	Axial Strain (%)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	Deviator Stress (psi)
Initial	0.0	0.0	0.000	0.00	6.48	38.9	38.9	0.0
1	3.9	3.9	0.006	0.10	6.49	39.5	38.9	0.6
2	9.3	9.3	0.012	0.21	6.49	40.3	38.9	1.4
3	13.5	13.4	0.018	0.31	6.50	41.0	38.9	2.1
4	16.5	16.4	0.025	0.43	6.51	41.4	38.9	2.5
5	19.0	18.9	0.030	0.52	6.51	41.8	38.9	2.9
6	21.2	21.1	0.037	0.64	6.52	42.1	38.9	3.2
7	23.2	23.0	0.041	0.71	6.53	42.4	38.9	3.5
8	25.1	24.9	0.047	0.81	6.53	42.7	38.9	3.8
9	26.9	26.7	0.053	0.91	6.54	43.0	38.9	4.1
10	28.8	28.6	0.059	1.02	6.55	43.3	38.9	4.4
11	36.1	35.8	0.082	1.41	6.57	44.3	38.9	5.4
12	44.4	44.0	0.111	1.91	6.61	45.6	38.9	6.7
13	51.0	50.5	0.140	2.42	6.64	46.5	38.9	7.6
14	55.4	54.8	0.170	2.93	6.68	47.1	38.9	8.2
15	60.5	59.6	0.228	3.93	6.75	47.7	38.9	8.8
16	63.5	62.4	0.286	4.93	6.82	48.1	38.9	9.2
17	66.9	65.6	0.345	5.95	6.89	48.4	38.9	9.5
18	67.1	65.6	0.403	6.95	6.96	48.3	38.9	9.4
19	63.8	62.1	0.462	7.97	7.04	47.7	38.9	8.8
20	63.0	61.1	0.520	8.97	7.12	47.5	38.9	8.6
21	59.1	56.9	0.578	9.97	7.20	46.8	38.9	7.9
22	54.9	52.5	0.637	10.99	7.28	46.1	38.9	7.2
23	54.2	51.6	0.695	11.99	7.36	45.9	38.9	7.0
24	55.9	53.1	0.753	12.99	7.45	46.0	38.9	7.1
25	56.2	53.2	0.812	14.01	7.54	46.0	38.9	7.1
26	55.6	52.3	0.870	15.01	7.62	45.8	38.9	6.9



Notes: 1. Deviator load corrected for membrane effects.

2. Right Cylinder Correction Method

Schnabel ENGINEERING

Unconfined Compression Test Report

ASTM D2166

Date: *1/0/1900*

Project: *MTT, DTT & MLK Exp. Project*

Location: *Portsmouth, VA*

Schnabel No.: *10613051.00.21*
Boring No.: *10BH-003*
Depth: *50-52 ft.*
Elevation: *-45.4 to -47.4 ft.*

Test Specimen Data	
Initial Diameter, in:	*2.868*
Initial Area, in^2:	*6.463*
Initial Height, in:	*5.804*
H/D Ratio:	*2.0*
Moisture Content, %:	*63.6*
Wet Unit Weight, pcf:	*101.2*
Dry Unit Weight, pcf:	*61.9*

Testing Information	
Test Procedure:	*ASTM D2166*
Type of Specimen:	*Tube Sample*
Load Cell No.:	*1018253*
Strain Rate, %/min.:	*1.0*

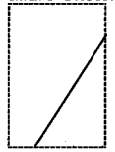
Remarks: *Organic content = 2.2%.*

Specimen Type: *Tube Sample*

Strength Data	
Strain at Failure, %:	*2.2*
Unconfined Strength (Qu), tsf:	*0.58*
Shear Strength (Su), tsf:	*0.29*

Reviewed by: *0*

Failure Sketch

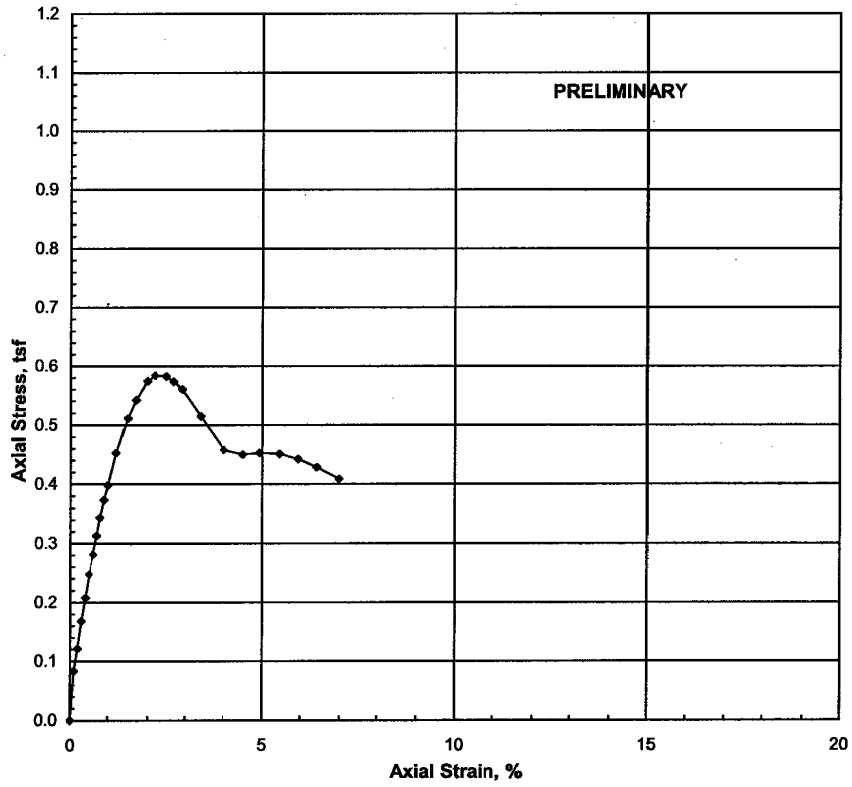


Soil Desc.: *ORGANIC CLAY (OH) - gray*

LL, %:	*95*	% < 200:	*97.9*
PI, %:	*65*	Gs:	*2.72*

Test Data						
Reading No.	Axial Load (lbs)	Axial Displ. (in.)	Axial Strain (%)	Corrected Area[1] (in^2)	Axial Stress (psi)	Axial Stress (tsf)
Zero	0.0	0.000	0.0	6.46	0.0	0.00
1	7.5	0.006	0.1	6.47	1.2	0.08
2	10.9	0.011	0.2	6.48	1.7	0.12
3	15.1	0.017	0.3	6.48	2.3	0.17
4	18.7	0.023	0.4	6.49	2.9	0.21
5	22.3	0.029	0.5	6.50	3.4	0.25
6	25.4	0.035	0.6	6.50	3.9	0.28
7	28.3	0.041	0.7	6.51	4.3	0.31
8	31.1	0.046	0.8	6.51	4.8	0.34
9	33.8	0.052	0.9	6.52	5.2	0.37
10	36.1	0.058	1.0	6.53	5.5	0.40
11	41.1	0.070	1.2	6.54	6.3	0.45
12	46.6	0.087	1.5	6.56	7.1	0.51
13	49.5	0.099	1.7	6.57	7.5	0.54
14	52.6	0.116	2.0	6.59	8.0	0.57
15	53.6	0.128	2.2	6.61	8.1	0.58
16	53.6	0.146	2.5	6.63	8.1	0.58
17	52.9	0.157	2.7	6.64	8.0	0.57
18	51.8	0.170	2.9	6.66	7.8	0.56
19	47.8	0.198	3.4	6.69	7.1	0.51
20	42.8	0.233	4.0	6.73	6.4	0.46
21	42.3	0.262	4.5	6.77	6.2	0.45
22	42.7	0.286	4.9	6.80	6.3	0.45
23	42.8	0.316	5.4	6.83	6.3	0.45
24	42.2	0.345	5.9	6.87	6.1	0.44
25	41.1	0.373	6.4	6.91	6.0	0.43
26	39.4	0.406	7.0	6.95	5.7	0.41

Axial Stress vs. Axial Strain Plot



Notes: 1. Right Cylinder Area Correction Method

Schnabel ENGINEERING

Unconfined Compression Test Report

ASTM D2166

Date: *1/0/1900*

Project: *MTT, DTT & MLK Exp. Project*

Location: *Portsmouth, VA*

Schnabel No.: *10613051.00.21*
Boring No.: *10BH-003*
Depth: *70-72 ft.*
Elevation: *-65.4 to -67.4 ft.*

Test Specimen Data	
Initial Diameter, in:	2.853
Initial Area, in^2:	6.394
Initial Height, in:	5.776
H/D Ratio:	2.0
Moisture Content, %:	69.7
Wet Unit Weight, pcf:	96.1
Dry Unit Weight, pcf:	56.7

Testing Information	
Test Procedure:	ASTM D2166
Type of Specimen:	Tube Sample
Load Cell No.:	1018253
Strain Rate, %/min.:	1.0

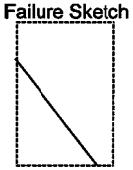
Remarks: *Upper UCS specimen; Oven Dried LL = 55; Organic content = 5.5%.*

Specimen Type:	Tube Sample

Strength Data	
Strain at Failure, %:	5.5
Unconfined Strength (Qu), tsf:	0.91
Shear Strength (Su), tsf:	0.46

Reviewed by: *0*

Failure Sketch

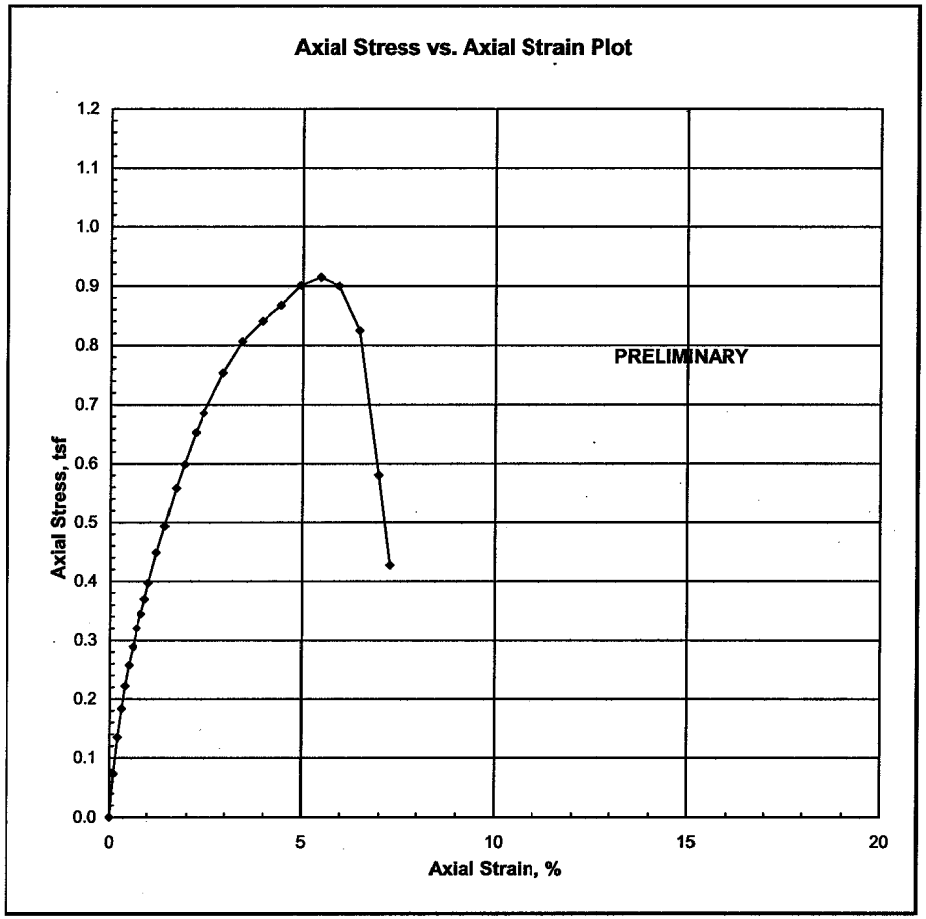


Soil Desc.: *ORGANIC CLAY (OH) - gray*

LL, %:	103	% < 200:	97.5
PI, %:	64	Gs:	2.65

Test Data

Reading No.	Axial Load (lbs)	Axial Displ. (in.)	Axial Strain (%)	Corrected Area[1] (in^2)	Axial Stress (psi)	Axial Stress (tsf)
Zero	0.0	0.000	0.0	6.39	0.0	0.00
1	6.5	0.006	0.1	6.40	1.0	0.07
2	12.0	0.012	0.2	6.41	1.9	0.13
3	16.3	0.018	0.3	6.41	2.5	0.18
4	19.8	0.023	0.4	6.42	3.1	0.22
5	23.0	0.029	0.5	6.43	3.6	0.26
6	25.8	0.035	0.6	6.43	4.0	0.29
7	28.6	0.041	0.7	6.44	4.4	0.32
8	30.8	0.047	0.8	6.45	4.8	0.34
9	33.1	0.053	0.9	6.45	5.1	0.37
10	35.6	0.058	1.0	6.46	5.5	0.40
11	40.3	0.070	1.2	6.47	6.2	0.45
12	44.4	0.082	1.4	6.49	6.8	0.49
13	50.4	0.099	1.7	6.51	7.7	0.56
14	54.2	0.111	1.9	6.52	8.3	0.60
15	59.3	0.128	2.2	6.54	9.1	0.65
16	62.4	0.140	2.4	6.55	9.5	0.69
17	68.9	0.169	2.9	6.59	10.5	0.75
18	74.1	0.198	3.4	6.62	11.2	0.81
19	77.7	0.228	3.9	6.66	11.7	0.84
20	80.6	0.257	4.4	6.69	12.0	0.87
21	84.2	0.286	5.0	6.73	12.5	0.90
22	85.9	0.315	5.5	6.76	12.7	0.91
23	85.0	0.344	6.0	6.80	12.5	0.90
24	78.3	0.374	6.5	6.84	11.5	0.82
25	55.4	0.403	7.0	6.87	8.1	0.58
26	40.9	0.420	7.3	6.90	5.9	0.43



Notes: 1. Right Cylinder Area Correction Method

Schnabel ENGINEERING

Unconfined Compression Test Report

ASTM D2166

Project: *MTT, DTT & MLK Exp. Project*

Date: *1/0/1900*

Location: *Portsmouth, VA*

Schnabel No.: *10613051.00.21*
Boring No.: *10BH-003*
Depth: *70-72 ft.*
Elevation: *-65.4 to -67.4 ft.*

Test Specimen Data	
Initial Diameter, in:	2.851
Initial Area, in^2:	6.386
Initial Height, in:	5.821
H/D Ratio:	2.0
Moisture Content, %:	69.3
Wet Unit Weight, pcf:	96.1
Dry Unit Weight, pcf:	56.8

Testing Information	
Test Procedure:	ASTM D2166
Type of Specimen:	Tube Sample
Load Cell No.:	1018253
Strain Rate, %/min.:	1.0

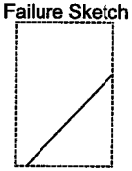
Remarks: *Lower UCS specimen; Oven Dried LL = 55; Organic content = 5.5%.*

Specimen Type:	Tube Sample

Strength Data	
Strain at Failure, %:	6.0
Unconfined Strength (Qu), tsf:	1.00
Shear Strength (Su), tsf:	0.50

Reviewed by: *0*

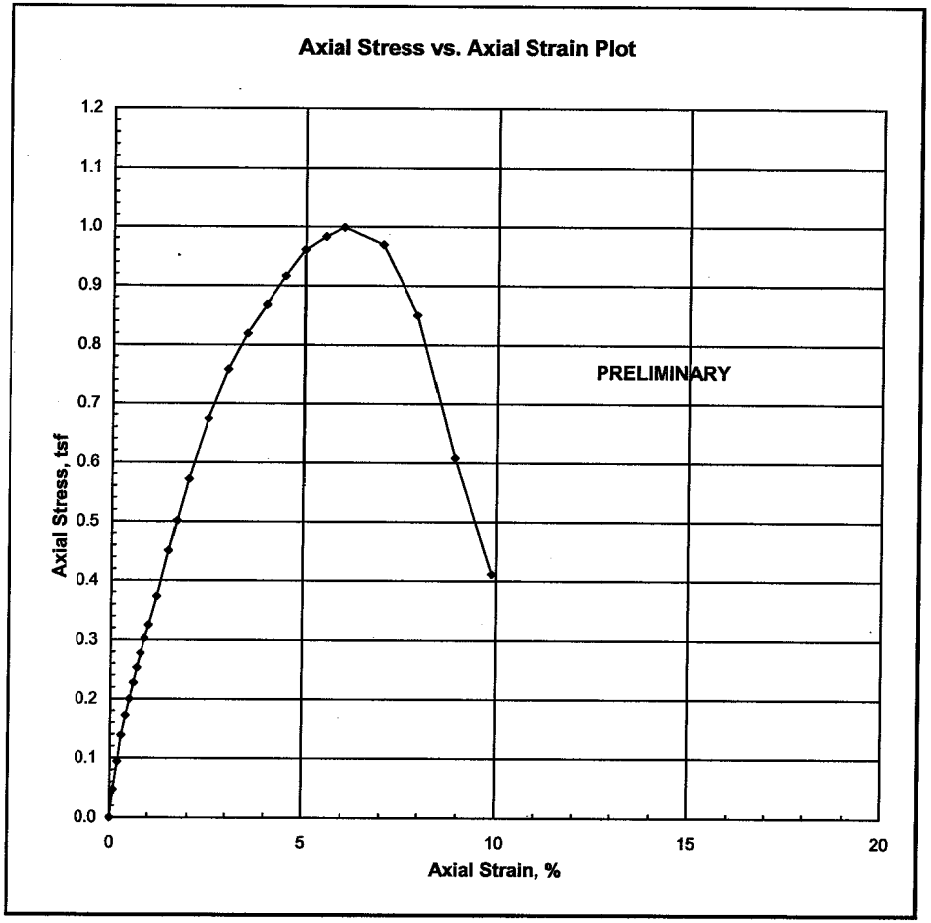
Failure Sketch



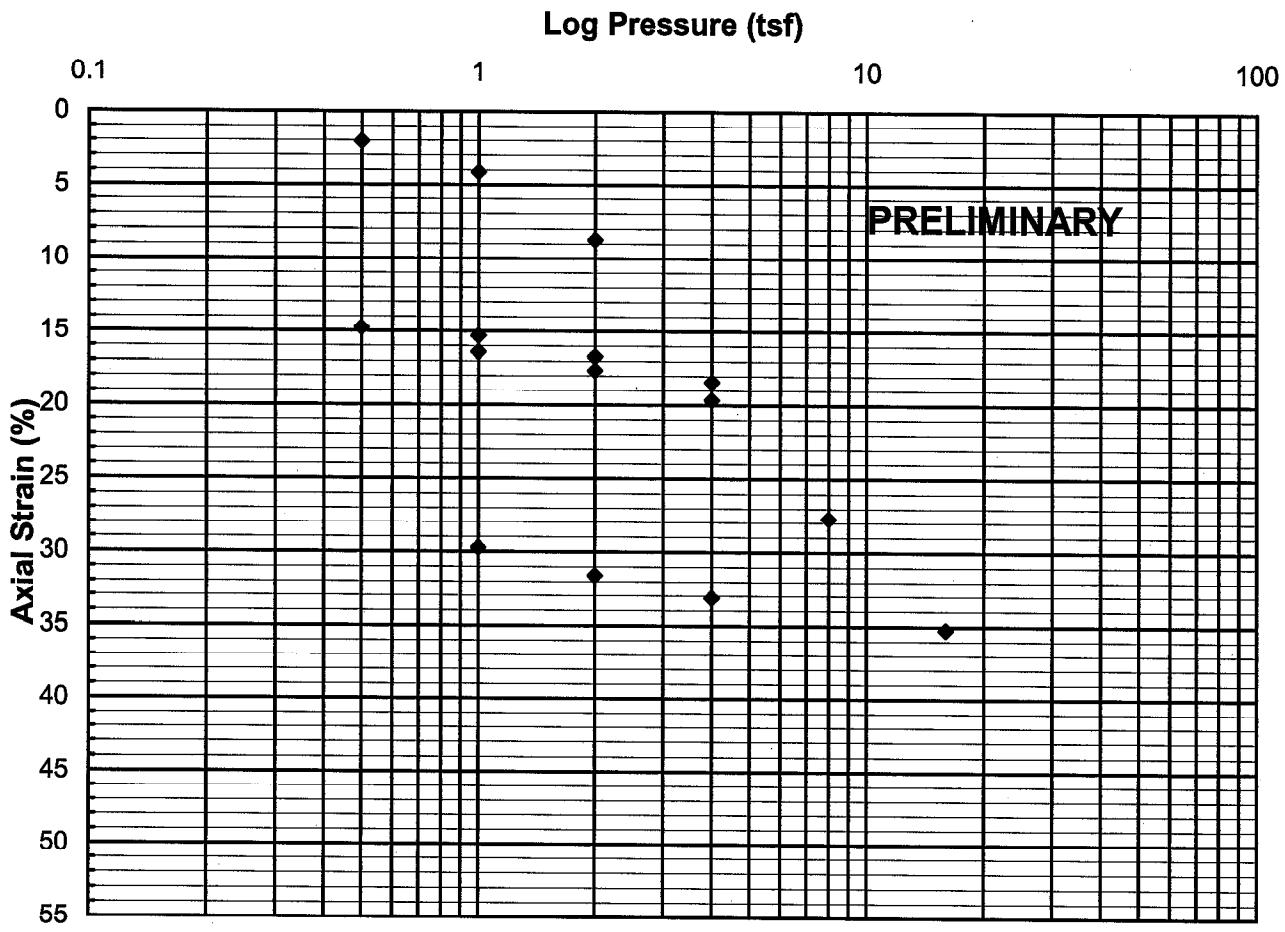
Soil Desc.: *ORGANIC CLAY (OH) - gray*

LL, %:	103	% < 200:	97.5
PI, %:	64	Gs:	2.65

Test Data						
Reading No.	Axial Load (lbs)	Axial Displ. (in.)	Axial Strain (%)	Corrected Area[1] (in^2)	Axial Stress (psi)	Axial Stress (tsf)
Zero	0.0	0.000	0.0	6.39	0.0	0.00
1	4.1	0.005	0.1	6.39	0.6	0.05
2	8.4	0.011	0.2	6.40	1.3	0.09
3	12.3	0.017	0.3	6.41	1.9	0.14
4	15.3	0.023	0.4	6.41	2.4	0.17
5	17.8	0.029	0.5	6.42	2.8	0.20
6	20.3	0.035	0.6	6.43	3.2	0.23
7	22.6	0.040	0.7	6.43	3.5	0.25
8	24.8	0.046	0.8	6.44	3.9	0.28
9	27.1	0.052	0.9	6.44	4.2	0.30
10	29.1	0.058	1.0	6.45	4.5	0.32
11	33.5	0.070	1.2	6.46	5.2	0.37
12	40.6	0.087	1.5	6.48	6.3	0.45
13	45.2	0.099	1.7	6.50	7.0	0.50
14	51.7	0.116	2.0	6.52	7.9	0.57
15	61.3	0.145	2.5	6.55	9.4	0.67
16	69.3	0.175	3.0	6.58	10.5	0.76
17	75.3	0.204	3.5	6.62	11.4	0.82
18	80.2	0.233	4.0	6.65	12.1	0.87
19	85.1	0.262	4.5	6.69	12.7	0.92
20	89.7	0.291	5.0	6.72	13.3	0.96
21	92.3	0.321	5.5	6.76	13.7	0.98
22	94.3	0.350	6.0	6.80	13.9	1.00
23	92.5	0.408	7.0	6.87	13.5	0.97
24	81.9	0.461	7.9	6.94	11.8	0.85
25	59.2	0.519	8.9	7.01	8.4	0.61
26	40.5	0.576	9.9	7.09	5.7	0.41



Notes: 1. Right Cylinder Area Correction Method



Evaluation of Pp', Cer, and Cec relies on the design professional's engineering judgement and project details.

Probable Preconsolidation Pressure (Pp), tsf: 3.2			**Recompression Ratio (Cer):** 0.04
Type of Specimen: *Tube Sample*			**Compression Ratio (Cec):** 0.32
Description: *ORGANIC CLAY (OH) - gray*			
LL: *103*	**PI:** *64*	**Gs:** *2.65*	**P_o' (tsf):** *0.00*
% < No. 200: *97.5*		**Test Method:** *ASTM D2435 Method A*	
Test Condition: *Inundated @ 0.05 tsf*			

	Initial	Final
Water Content, %	73.1	44.2
Void Ratio	2.02	1.12
Saturation, %	96	100
Dry Unit Weight, pcf	54.7	77.9

Remarks: *Organic content = 5.5%; Oven Dried LL = 55.*

Average Water Content of Trimmings, %: *70.0*

Schnabel ENGINEERING

Project: MTT, DTT & MLK Exp. Project

Location	*Portmouth, VA*		
Boring:	*10BH-003*	**Schnabel No.:**	*10613051.00.21*
Depth:	*70-72 ft.*	**Elevation:**	*-65.4 to -67.4 ft.*
Date:	*1/0/1900*	**Reviewed by:**	*0*

Consolidation Test Report

Consolidation Test Data Sheet

Consolidometer ID: 2 1/0/00

Schnabel Contract: 10613051.00.21

Project: MTT, DTT & MLK Exp. Project

Test Method: ASTM D2435 Method A

Test Condition: Inundated @ 0.05 tsf

Initial Height of Specimen (H_o), in.: 0.7466

Height of Solids (H_s), in.: 0.2471

Boring No.: 10BH-003

Depth: 70-72 ft.

Seating Press. (tsf): 0.05

Initial Dial Gauge Reading (D_o), in.: 0.0000

Reviewed by: 0

Pressure, P (tsf)	TimeReadings Required	Date Load Applied	Time Load Applied	Load Applied By	A: Final[1] Dial Reading, D_{fi} x 10^{-4} in.	B: Apparatus Correction[2], D_{ci} x 10^{-4} in.	C: Cumulative Change in Height[3], DH_i in.	D: Height of Voids[4], H_{vi} in.	Vertical Strain[5], e_i (%)	Void Ratio[6], e_i
0.5		9/21/2010	9:05	DWC	161	6	0.0155	0.4840	2.08	1.959
1		9/22/2010	9:05	DWC	318	9	0.0309	0.4686	4.14	1.896
2		9/23/2010	9:05	DWC	667	15	0.0652	0.4343	8.73	1.758
4		9/24/2010	9:05	DWC	1395	21	0.1374	0.3621	18.40	1.465
2		9/25/2010	9:05	CJS	1332	15	0.1317	0.3678	17.64	1.488
1		9/27/2010	9:05	DWC	1235	9	0.1226	0.3769	16.42	1.525
0.5		9/28/2010	9:05	DWC	1110	6	0.1104	0.3891	14.79	1.575
1		9/29/2010	9:05	DWC	1153	9	0.1144	0.3851	15.32	1.558
2		9/30/2010	9:05	DWC	1263	15	0.1248	0.3747	16.72	1.516
4		10/1/2010	9:05	DWC	1489	21	0.1468	0.3527	19.66	1.427
8		10/2/2010	9:05	DWC	2097	26	0.2071	0.2924	27.74	1.183
16		10/4/2010	9:05	DWC	2664	33	0.2631	0.2364	35.24	0.957
4		10/5/2010	9:05	DWC	2496	21	0.2475	0.2520	33.15	1.020
2		10/6/2010	9:05	DWC	2373	15	0.2358	0.2637	31.58	1.067
1		10/7/2010	9:05	DWC	2229	9	0.2220	0.2775	29.74	1.123

Notes:
1. "Final" based on test method; 24 hrs for Method A, end of primary for Method B.
2. Correction value, for the current pressure, from the consolidometer's calibration curve.
3. $\Delta H = D_{fi} - D_o - D_{ci}$ = Col. A - D_o - Col. B
4. $H_{vi} = (H_o - H_s - D_0) - \Delta H$
5. $\varepsilon_i = (\Delta H / H_o) \times 100$ = (Col. C / H_o) x 100
6. $e_i = H_{vi} / Hs$ = Col. D / Hs

Consol 5/2007 Rev. 4

Schnabel ENGINEERING

Load Time Readings

1/0/00

Project: MTT, DTT & MLK Exp. Project

Schnabel Contract: 10613051.00.21

Boring No.: 10BH-003 Depth: 70-72 ft.

Consol. ID: 2 Reviewed by: 0

Test Drainage Conditions: Double

Elapsed Time (min.)	Dial Gauge Readings (inches)					
	4 tsf Reload 10/1/2010	8 tsf Load 10/2/2010				
0.1	0.1282	0.1521				
0.25	0.1289	0.1534				
0.5	0.1298	0.1550				
1	0.1310	0.1572				
2	0.1326	0.1603				
4	0.1345	0.1647				
8	0.1368	0.1707				
15	0.1390	0.1774				
30	0.1409	0.1855				
60	0.1424	0.1927				
120	0.1439	0.1983				
240	0.1454	0.2024				
480	0.1470	0.2056				
720	0.1477	0.2072				
960	0.1482	0.2084				
1200	0.1486	0.2092				
1440	0.1489	0.2097				
1680		0.2103				
1920		0.2107				
2160		0.2111				
2400		0.2113				
2640		0.2117				
2880		0.2119				

Schnabel ENGINEERING

Consolidation Time Curves

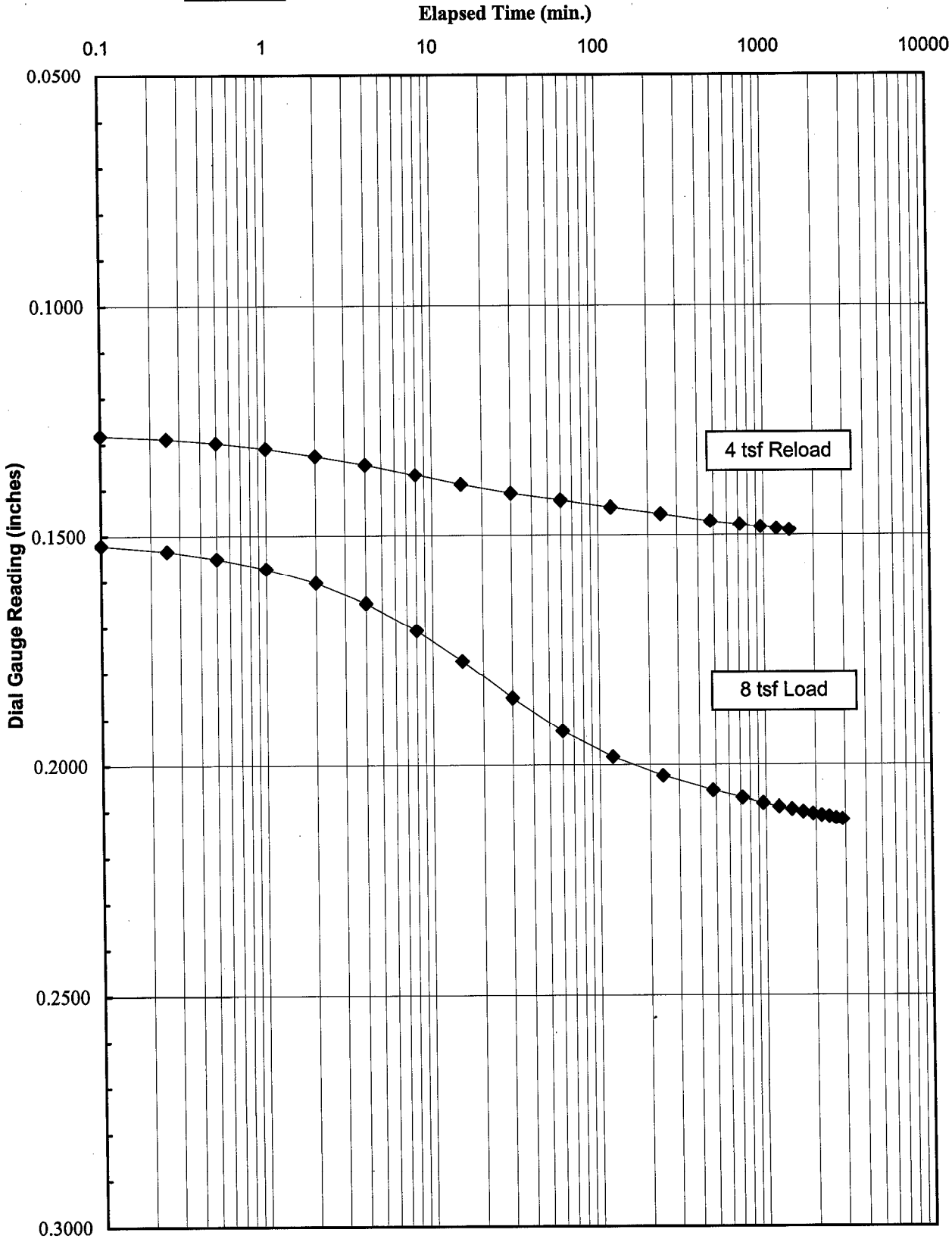
1/0/00

Project: MTT, DTT & MLK Exp. Project

Schnabel Contract: 10613051.00.21

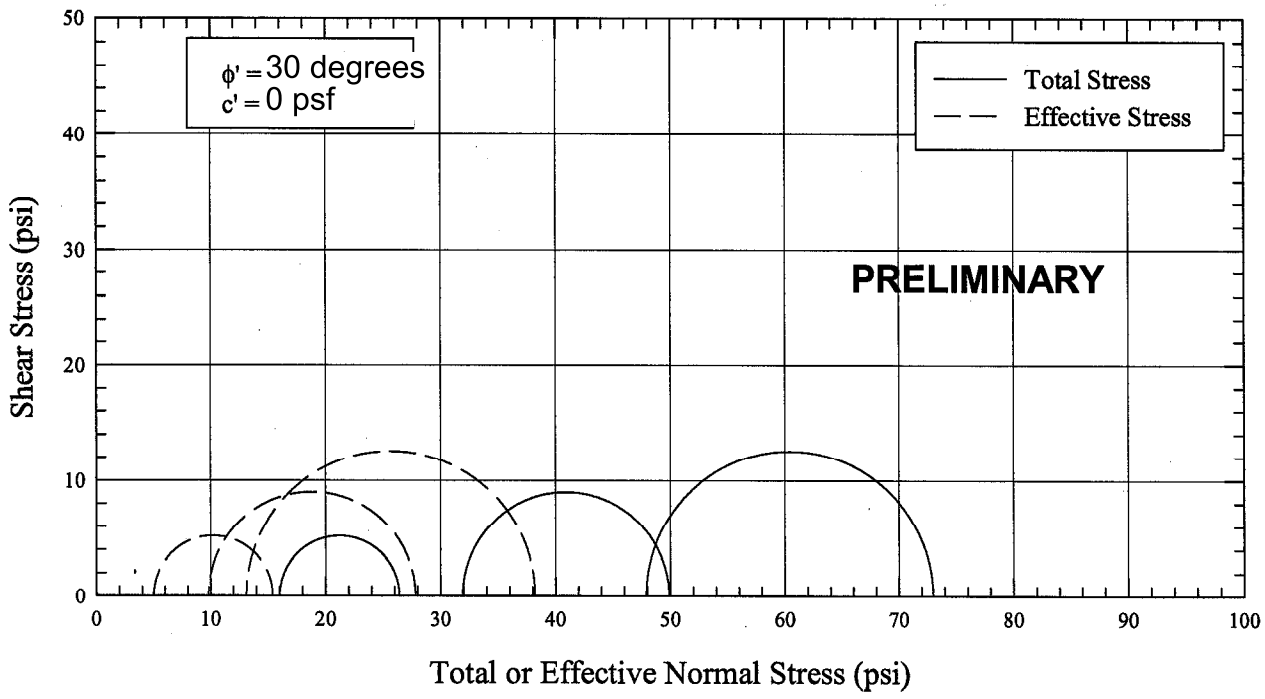
Boring No.: 10BH-003 Depth: 70-72 ft.

Reviewed by: 0 Test Drainage Conditions: Double

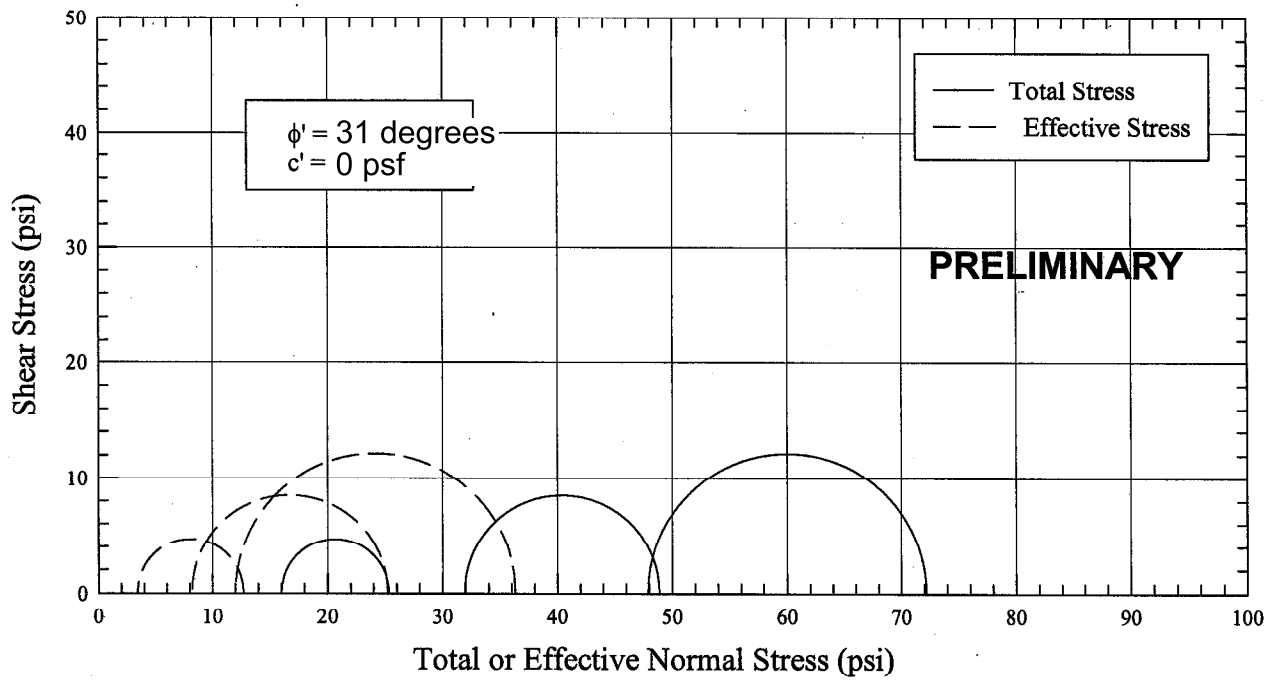


Consolidated Undrained (CU) Triaxial Shear (ASTM D4767)

Mohr Stress Circles at Maximum Deviator Stress Criterion



Mohr Stress Circles at Maximum Principal Stress Ratio Criterion

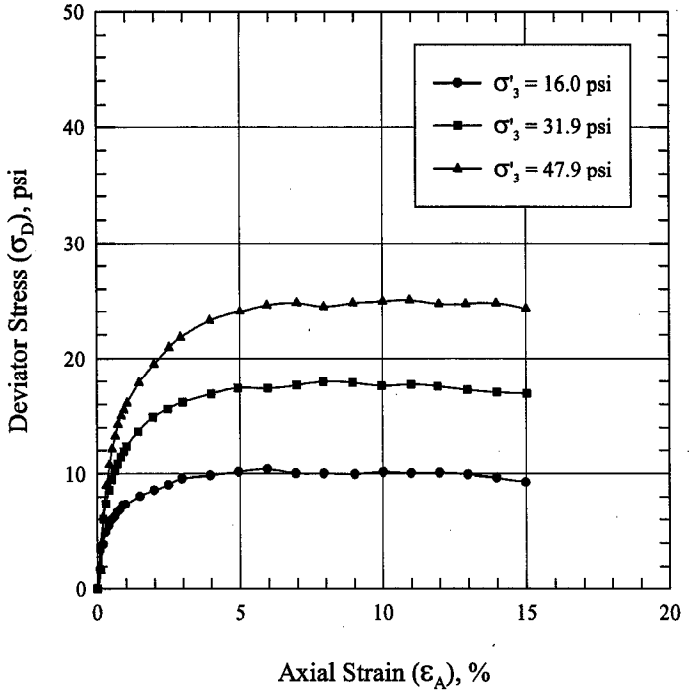


Boring No.: *10BH-004* Depth: *35-37 ft* Elevation: *-29.1 to -31.1 ft* SEC Contract: *10613051.00.21* Date:
Sample Description: *FAT CLAY (CH) - gray* Reviewed By:
Specimen Type: *Tube Sample* Gs: *2.72* LL: *97* PI: *65* %<200: *98.8*

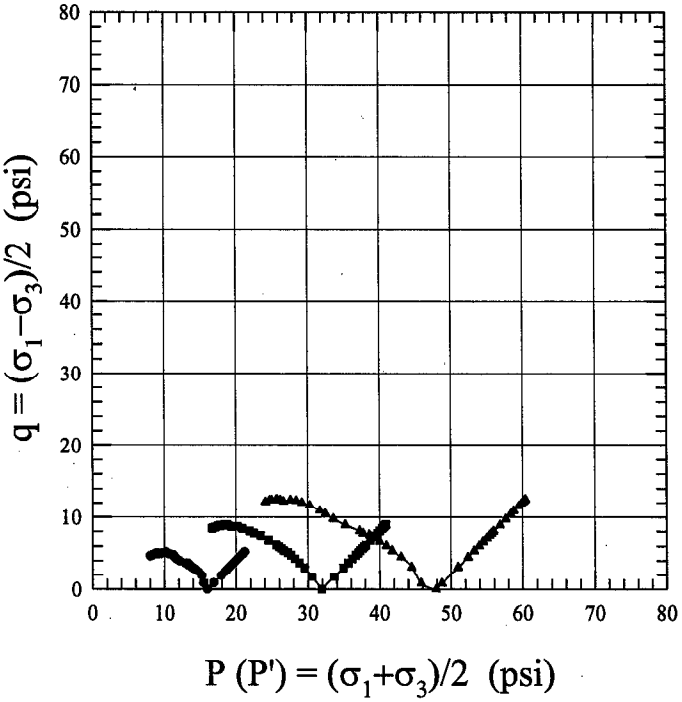
Schnabel ENGINEERING

MTT, DTT & MLK Exp. Project
Portsmouth, VA

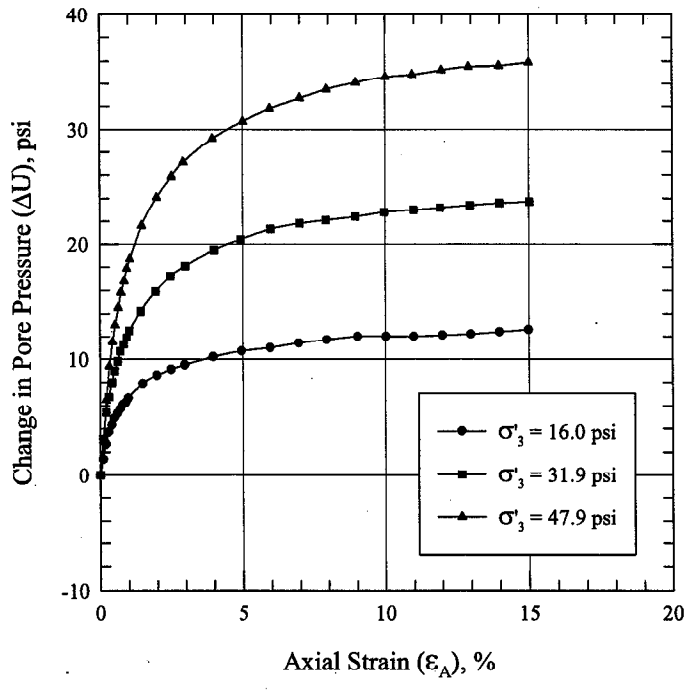
Deviator Stress vs. Axial Strain



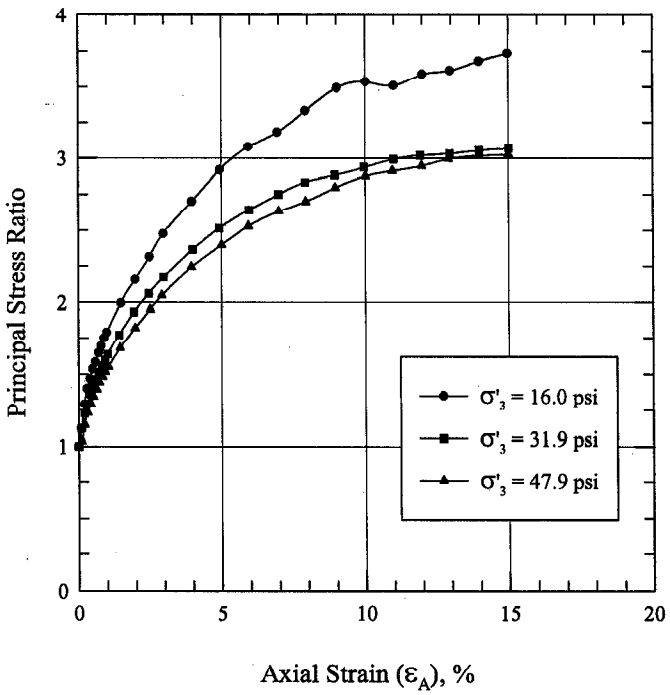
Stress Paths



Change in Pore Pressure vs. Axial Strain



Principal Stress Ratio vs. Axial Strain



Boring No.: *10BH-004* Depth: *35-37 ft* Elevation: *-29.1 to -31.1 ft* SEC Contract: *10613051.00.21* Date:

Sample Description: *FAT CLAY (CH) - gray* Reviewed By:

Specimen Type: *Tube Sample* Specific Gravity: *2.72* LL: *97* PI: *65* %<200: *98.8*

Schnabel ENGINEERING

MTT, DTT & MLK Exp. Prjoect
Portsmouth, VA

Schnabel ENGINEERING

Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *MTT, DTT & MLK Exp. Project*

Location: *Portsmouth, VA*

Schnabel Contract: *10613051.00.21*
Boring No.: *10BH-004*
Depth: *35-37 ft.*
Elevation: *-29.1 to -31.1 ft.*
Confining Stress (psi): *16.0*

Date:

Reviewed by: *0*

	Specimen Conditions	
	Initial	Consolidated
Diameter (in)	2.798	2.68
Height (in)	5.781	5.60
Area (in^2)	6.15	5.65
Moisture (%)	72.2	
W_{solids} (lbs)	1.15	
ρ_{wet} (pcf)	96.2	
ρ_{dry} (pcf)	55.9	62.8
Void Ratio	2.04	1.70
Saturation, %	96	91

Shear Testing Conditions	
Cell Pressure (psi):	21.0
Back Pressure (psi):	5.0
Eff. Confining Stress (psi):	16.0
Final B check	0.96
t_{50} (min.):	77.9
Rate of Strain (%/min):	0.00478

Filter strips used? *YES*

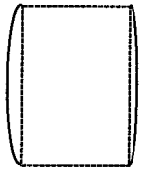
Specimen Type: *Tube Sample*

Soil Description: *FAT CLAY (CH) - gray*

Liquid Limit: *97*
Plasticity Index: *65*
% finer that No. 200: *98.8*
Specific Gravity: *2.72*

Remarks:

Failure Sketch



Reading No.	Deviator Load (lbs)	Corrected[1] Dev. Load (lbs.)	Axial Deformation (in.)	Axial Strain (%)	Pore Pressure (psi)	Change in Pore Press. (psi)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	Deviator Stress (psi)	Principal Stress Ratio	A_{bar}	P (psi)	P' (psi)	q (psi)
Zero	0.0	0.0	0.000	0.00	5.0	0.0	5.65	16.0	16.0	16.0	16.0	0.0	1.00	0.00	16.0	16.0	0.0
1	10.2	10.1	0.005	0.09	6.4	1.4	5.66	17.8	16.0	16.4	14.6	1.8	1.12	0.78	16.9	15.5	0.9
2	22.2	22.0	0.011	0.20	7.7	2.7	5.66	19.9	16.0	17.2	13.3	3.9	1.29	0.70	17.9	15.2	1.9
3	28.2	27.9	0.016	0.29	8.7	3.7	5.67	20.9	16.0	17.2	12.3	4.9	1.40	0.75	18.5	14.8	2.5
4	31.5	31.0	0.022	0.39	9.3	4.3	5.67	21.5	16.0	17.2	11.7	5.5	1.47	0.79	18.7	14.4	2.7
5	34.3	33.7	0.027	0.48	9.9	4.9	5.68	21.9	16.0	17.0	11.1	5.9	1.54	0.82	19.0	14.1	3.0
6	36.1	35.4	0.033	0.59	10.3	5.3	5.69	22.2	16.0	16.9	10.7	6.2	1.58	0.85	19.1	13.8	3.1
7	38.7	37.9	0.039	0.70	10.7	5.7	5.69	22.7	16.0	17.0	10.3	6.7	1.65	0.86	19.3	13.6	3.3
8	40.0	39.1	0.044	0.79	11.1	6.1	5.70	22.9	16.0	16.8	9.9	6.9	1.69	0.89	19.4	13.3	3.4
9	42.5	41.4	0.050	0.89	11.3	6.3	5.70	23.3	16.0	17.0	9.7	7.3	1.75	0.87	19.6	13.3	3.6
10	43.0	41.8	0.055	0.98	11.7	6.7	5.71	23.3	16.0	16.6	9.3	7.3	1.79	0.91	19.7	13.0	3.7
11	47.9	46.2	0.083	1.48	12.9	7.9	5.74	24.0	16.0	16.1	8.1	8.0	1.99	0.98	20.0	12.1	4.0
12	51.8	49.5	0.111	1.98	13.6	8.6	5.77	24.6	16.0	16.0	7.4	8.6	2.16	1.00	20.3	11.7	4.3
13	55.0	52.5	0.139	2.48	14.1	9.1	5.80	25.1	16.0	16.0	6.9	9.1	2.31	1.00	20.5	11.4	4.5
14	58.4	55.9	0.166	2.96	14.5	9.5	5.82	25.6	16.0	16.1	6.5	9.6	2.48	0.99	20.8	11.3	4.8
15	60.8	58.0	0.222	3.96	15.2	10.2	5.89	25.9	16.0	15.7	5.8	9.9	2.70	1.03	20.9	10.7	4.9
16	63.4	60.4	0.277	4.94	15.7	10.7	5.95	26.2	16.0	15.5	5.3	10.2	2.92	1.05	21.1	10.4	5.1
17	65.6	62.4	0.333	5.94	16.0	11.0	6.01	26.4	16.0	15.4	5.0	10.4	3.08	1.06	21.2	10.2	5.2
18	64.3	60.9	0.389	6.94	16.4	11.4	6.07	26.0	16.0	14.6	4.6	10.0	3.18	1.14	21.0	9.6	5.0
19	65.1	61.5	0.444	7.93	16.7	11.7	6.14	26.0	16.0	14.3	4.3	10.0	3.33	1.17	21.0	9.3	5.0
20	65.7	61.9	0.505	9.02	17.0	12.0	6.21	26.0	16.0	14.0	4.0	10.0	3.49	1.20	21.0	9.0	5.0
21	67.7	63.7	0.561	10.01	17.0	12.0	6.28	26.1	16.0	14.1	4.0	10.1	3.54	1.18	21.1	9.1	5.1
22	67.9	63.7	0.616	11.00	17.0	12.0	6.35	26.0	16.0	14.0	4.0	10.0	3.51	1.20	21.0	9.0	5.0
23	69.2	64.8	0.672	12.00	17.1	12.1	6.42	26.1	16.0	14.0	3.9	10.1	3.59	1.20	21.0	8.9	5.0
24	69.1	64.5	0.727	12.98	17.2	12.2	6.49	25.9	16.0	13.7	3.8	9.9	3.61	1.23	21.0	8.8	5.0
25	68.2	63.4	0.783	13.98	17.4	12.4	6.57	25.7	16.0	13.3	3.6	9.7	3.68	1.28	20.8	8.4	4.8
26	66.8	61.8	0.839	14.98	17.6	12.6	6.65	25.3	16.0	12.7	3.4	9.3	3.74	1.35	20.6	8.0	4.6

Notes: 1. Deviator load corrected for membrane and filter cage (if applicable) effects.
2. Right Cylinder Correction Method

Schnabel ENGINEERING

Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *MTT, DTT & MLK Exp. Project*

Location: *Portsmouth, VA*

Schnabel Contract: *10613051.00.21*
Boring No.: *10BH-004*
Depth: *35-37 ft.*
Elevation: *-29.1 to -31.1 ft.*
Confining Stress (psi): *31.9*

Date:

Reviewed by: *0*

	Specimen Conditions	
	Initial	Consolidated
Diameter (in)	2.824	2.66
Height (in)	5.807	5.40
Area (in^2)	6.27	5.56
Moisture (%)	70.7	
W_{solids} (lbs)	1.19	
ρ_{wet} (pcf)	96.8	
ρ_{dry} (pcf)	56.7	68.8
Void Ratio	1.99	1.47
Saturation, %	97	93

Shear Testing Conditions	
Cell Pressure (psi):	46.9
Back Pressure (psi):	15.0
Eff. Confining Stress (psi):	31.9
Final B check	0.96
t_{50} (min.):	71.7
Rate of Strain (%/min):	0.00478

Filter strips used? *YES*

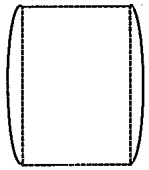
Specimen Type: *Tube Sample*

Soil Description: *FAT CLAY (CH) - gray*

Liquid Limit: *97*
Plasticity Index: *65*
% finer that No. 200: *98.8*
Specific Gravity: *2.72*

Remarks:

Failure Sketch



Reading No.	Deviator Load (lbs)	Corrected[1] Dev. Load (lbs.)	Axial Deformation (in.)	Axial Strain (%)	Pore Pressure (psi)	Change in Pore Press. (psi)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	Deviator Stress (psi)	Principal Stress Ratio	A_{bar}	P (psi)	P' (psi)	q (psi)
Zero	0.0	0.0	0.000	0.00	15.0	0.0	5.56	31.9	31.9	31.9	31.9	0.0	1.00	0.00	31.9	31.9	0.0
1	19.9	19.8	0.005	0.09	18.1	3.1	5.56	35.5	31.9	32.4	28.8	3.6	1.12	0.87	33.7	30.6	1.8
2	33.9	33.7	0.011	0.20	20.4	5.4	5.57	37.9	31.9	32.5	26.5	6.0	1.23	0.89	34.9	29.5	3.0
3	41.6	41.3	0.016	0.30	21.8	6.8	5.57	39.3	31.9	32.5	25.1	7.4	1.29	0.92	35.6	28.8	3.7
4	48.6	48.1	0.022	0.41	23.0	8.0	5.58	40.5	31.9	32.5	23.9	8.6	1.36	0.93	36.2	28.2	4.3
5	53.9	53.3	0.027	0.50	24.0	9.0	5.58	41.4	31.9	32.4	22.9	9.5	1.42	0.94	36.7	27.7	4.8
6	58.1	57.4	0.033	0.61	24.8	9.8	5.59	42.2	31.9	32.4	22.1	10.3	1.46	0.95	37.0	27.2	5.1
7	61.5	60.7	0.038	0.70	25.7	10.7	5.60	42.7	31.9	32.0	21.2	10.8	1.51	0.99	37.3	26.6	5.4
8	65.1	64.1	0.044	0.81	26.3	11.3	5.60	43.3	31.9	32.0	20.6	11.4	1.56	0.99	37.6	26.3	5.7
9	67.9	66.8	0.050	0.93	26.9	11.9	5.61	43.8	31.9	31.9	20.0	11.9	1.60	1.00	37.9	26.0	6.0
10	70.7	69.5	0.055	1.02	27.5	12.5	5.61	44.3	31.9	31.8	19.4	12.4	1.64	1.01	38.1	25.6	6.2
11	78.7	77.0	0.077	1.43	29.2	14.2	5.64	45.6	31.9	31.4	17.7	13.7	1.77	1.04	38.7	24.5	6.8
12	86.7	84.4	0.105	1.94	30.9	15.9	5.67	46.8	31.9	30.9	16.0	14.9	1.93	1.07	39.3	23.4	7.4
13	91.4	89.0	0.133	2.46	32.2	17.2	5.70	47.5	31.9	30.3	14.7	15.6	2.06	1.10	39.7	22.5	7.8
14	95.4	92.9	0.161	2.98	33.1	18.1	5.73	48.1	31.9	30.0	13.8	16.2	2.17	1.12	40.0	21.9	8.1
15	100.7	97.9	0.216	4.00	34.5	19.5	5.79	48.8	31.9	29.3	12.4	16.9	2.36	1.15	40.4	20.9	8.5
16	104.8	101.9	0.266	4.93	35.4	20.4	5.84	49.3	31.9	28.9	11.5	17.4	2.52	1.17	40.6	20.2	8.7
17	106.0	102.9	0.322	5.96	36.3	21.3	5.91	49.3	31.9	28.0	10.6	17.4	2.64	1.22	40.6	19.3	8.7
18	108.9	105.5	0.377	6.98	36.8	21.8	5.97	49.6	31.9	27.8	10.1	17.7	2.75	1.23	40.7	18.9	8.8
19	112.0	108.5	0.427	7.91	37.1	22.1	6.03	49.9	31.9	27.8	9.8	18.0	2.83	1.23	40.9	18.8	9.0
20	112.9	109.2	0.483	8.94	37.4	22.4	6.10	49.8	31.9	27.4	9.5	17.9	2.88	1.25	40.8	18.4	8.9
21	112.7	108.8	0.538	9.96	37.8	22.8	6.17	49.5	31.9	26.7	9.1	17.6	2.94	1.29	40.7	17.9	8.8
22	114.9	110.7	0.594	11.00	38.0	23.0	6.24	49.6	31.9	26.6	8.9	17.7	2.99	1.30	40.8	17.8	8.9
23	115.2	110.9	0.644	11.92	38.2	23.2	6.31	49.5	31.9	26.3	8.7	17.6	3.02	1.32	40.7	17.5	8.8
24	114.8	110.2	0.700	12.96	38.4	23.4	6.38	49.2	31.9	25.8	8.5	17.3	3.03	1.36	40.5	17.1	8.6
25	114.9	110.1	0.755	13.98	38.6	23.6	6.46	49.0	31.9	25.4	8.3	17.1	3.05	1.38	40.4	16.8	8.5
26	115.8	110.8	0.811	15.02	38.7	23.7	6.54	48.9	31.9	25.2	8.2	17.0	3.07	1.40	40.4	16.7	8.5

Notes: 1. Deviator load corrected for membrane and filter cage (if applicable) effects.
2. Right Cylinder Correction Method

Schnabel ENGINEERING

Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *MTT, DTT & MLK Exp. Project*

Location: *Portsmouth, VA*

Schnabel Contract: *10613051.00.21*
Boring No.: *10BH-004*
Depth: *35-37 ft.*
Elevation: *-29.1 to -31.1 ft.*
Confining Stress (psi): *47.9*

Date:

Reviewed by: *0*

	Specimen Conditions	
	Initial	Consolidated
Diameter (in)	2.794	2.60
Height (in)	5.814	5.33
Area (in^2)	6.13	5.32
Moisture (%)	70.0	
W_{solids} (lbs)	1.19	
ρ_{wet} (pcf)	98.1	
ρ_{dry} (pcf)	57.7	72.5
Void Ratio	1.94	1.34
Saturation, %	98	99

Shear Testing Conditions	
Cell Pressure (psi):	57.9
Back Pressure (psi):	10.0
Eff. Confining Stress (psi):	47.9
Final B check	0.96
t_{50} (min.):	83.7
Rate of Strain (%/min):	0.00478

Filter strips used? *YES*

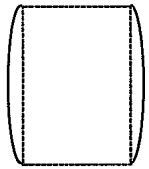
Specimen Type: *Tube Sample*

Soil Description: *FAT CLAY (CH) - gray*

Liquid Limit: *97*
Plasticity Index: *65*
% finer that No. 200: *98.8*
Specific Gravity: *2.72*

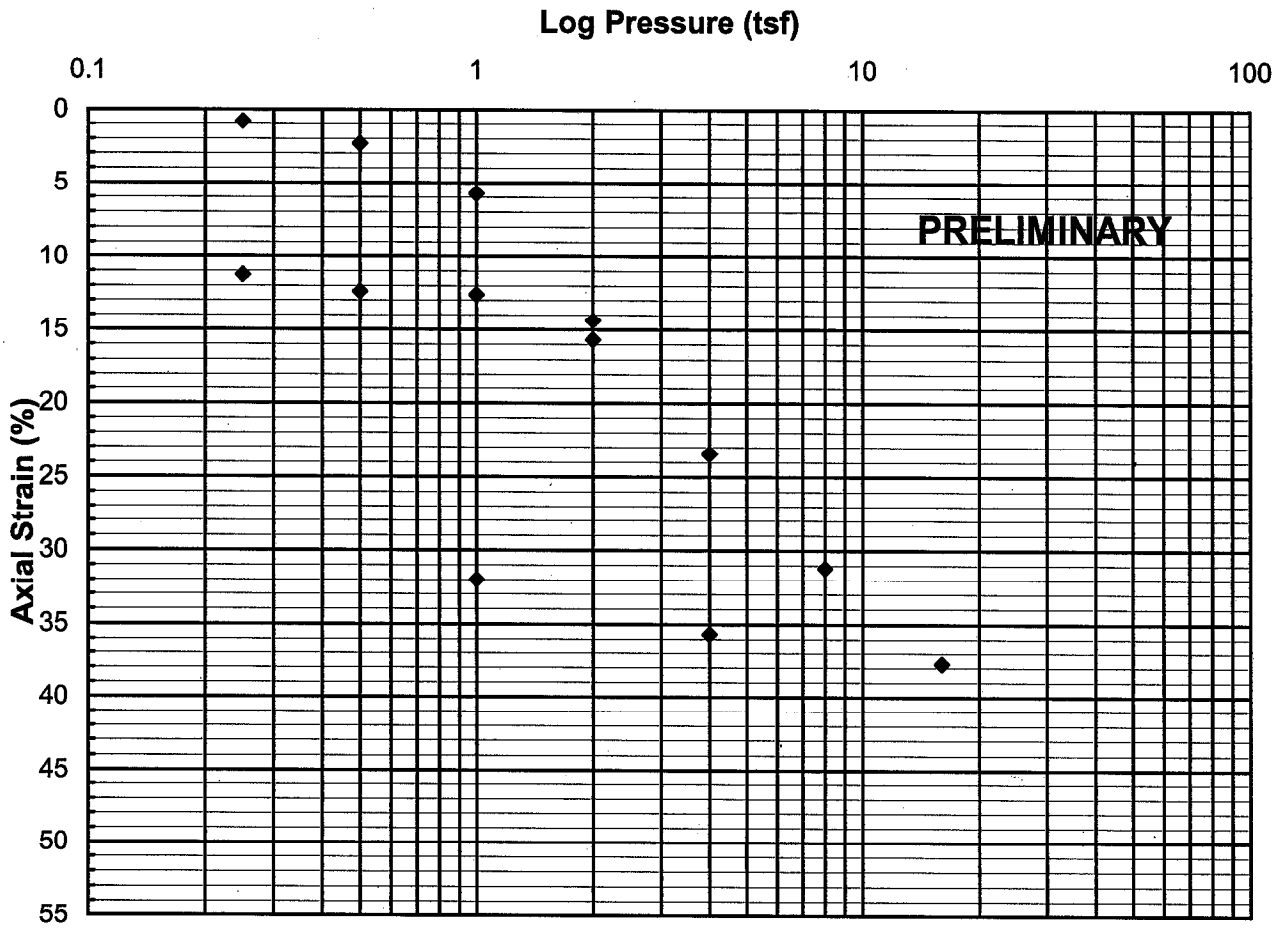
Remarks:

Failure Sketch



Reading No.	Deviator Load (lbs)	Corrected[1] Dev. Load (lbs.)	Axial Deformation (in.)	Axial Strain (%)	Pore Pressure (psi)	Change in Pore Press. (psi)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	Deviator Stress (psi)	Principal Stress Ratio	A_{bar}	P (psi)	P' (psi)	q (psi)
Zero	0.0	0.0	0.000	0.00	10.0	0.0	5.32	47.9	47.9	47.9	47.9	0.0	1.00	0.00	47.9	47.9	0.0
1	9.0	8.9	0.006	0.11	12.9	2.9	5.33	49.6	47.9	46.7	45.0	1.7	1.04	1.74	48.7	45.8	0.8
2	33.3	33.1	0.011	0.21	16.5	6.5	5.33	54.1	47.9	47.6	41.4	6.2	1.15	1.05	51.0	44.5	3.1
3	48.6	48.2	0.017	0.32	19.4	9.4	5.34	56.9	47.9	47.5	38.5	9.0	1.23	1.04	52.4	43.0	4.5
4	58.0	57.5	0.023	0.43	21.5	11.5	5.35	58.7	47.9	47.2	36.4	10.8	1.30	1.07	53.3	41.8	5.4
5	65.5	64.9	0.028	0.53	23.0	13.0	5.35	60.0	47.9	47.0	34.9	12.1	1.35	1.07	54.0	41.0	6.1
6	71.8	71.1	0.034	0.64	24.5	14.5	5.36	61.2	47.9	46.7	33.4	13.3	1.40	1.09	54.5	40.0	6.6
7	77.3	76.4	0.039	0.73	25.8	15.8	5.36	62.2	47.9	46.4	32.1	14.3	1.44	1.11	55.0	39.2	7.1
8	81.5	80.5	0.045	0.84	26.8	16.8	5.37	62.9	47.9	46.1	31.1	15.0	1.48	1.12	55.4	38.6	7.5
9	84.4	83.3	0.050	0.94	27.9	17.9	5.37	63.4	47.9	45.5	30.0	15.5	1.52	1.15	55.7	37.8	7.8
10	87.9	86.7	0.056	1.05	28.7	18.7	5.38	64.0	47.9	45.3	29.2	16.1	1.55	1.16	56.0	37.3	8.1
11	98.2	96.5	0.078	1.46	31.6	21.6	5.40	65.8	47.9	44.2	26.3	17.9	1.68	1.21	56.8	35.2	8.9
12	108.3	106.0	0.106	1.99	34.1	24.1	5.43	67.4	47.9	43.3	23.8	19.5	1.82	1.23	57.7	33.6	9.8
13	116.7	114.3	0.134	2.51	35.9	25.9	5.46	68.8	47.9	42.9	22.0	20.9	1.95	1.24	58.4	32.5	10.5
14	121.9	119.4	0.156	2.93	37.1	27.1	5.48	69.7	47.9	42.6	20.8	21.8	2.05	1.24	58.8	31.7	10.9
15	131.5	128.8	0.211	3.96	39.2	29.2	5.54	71.1	47.9	41.9	18.7	23.2	2.24	1.26	59.5	30.3	11.6
16	137.6	134.7	0.267	5.01	40.7	30.7	5.60	71.9	47.9	41.2	17.2	24.0	2.40	1.28	59.9	29.2	12.0
17	142.4	139.3	0.317	5.95	41.8	31.8	5.66	72.5	47.9	40.7	16.1	24.6	2.53	1.29	60.2	28.4	12.3
18	145.3	142.0	0.373	7.00	42.7	32.7	5.72	72.7	47.9	40.0	15.2	24.8	2.63	1.32	60.3	27.6	12.4
19	145.1	141.6	0.423	7.93	43.5	33.5	5.78	72.4	47.9	38.9	14.4	24.5	2.70	1.37	60.1	26.6	12.2
20	148.7	145.0	0.478	8.97	44.1	34.1	5.85	72.7	47.9	38.6	13.8	24.8	2.80	1.37	60.3	26.2	12.4
21	151.5	147.6	0.534	10.02	44.6	34.6	5.91	72.9	47.9	38.3	13.3	25.0	2.88	1.39	60.4	25.8	12.5
22	153.9	149.8	0.584	10.95	44.8	34.8	5.98	73.0	47.9	38.2	13.1	25.1	2.91	1.39	60.4	25.6	12.5
23	153.8	149.5	0.639	11.99	45.2	35.2	6.05	72.6	47.9	37.4	12.7	24.7	2.95	1.42	60.3	25.1	12.4
24	155.7	151.2	0.689	12.92	45.5	35.5	6.11	72.6	47.9	37.1	12.4	24.7	3.00	1.43	60.3	24.8	12.4
25	158.1	153.4	0.745	13.97	45.6	35.6	6.19	72.7	47.9	37.1	12.3	24.8	3.02	1.44	60.3	24.7	12.4
26	157.1	152.2	0.800	15.01	45.9	35.9	6.26	72.2	47.9	36.3	12.0	24.3	3.03	1.48	60.1	24.2	12.2

Notes: 1. Deviator load corrected for membrane and filter cage (if applicable) effects.
2. Right Cylinder Correction Method



Evaluation of Pp', Cer, and Cec relies on the design professional's engineering judgement and project details.

Probable Preconsolidation Pressure (Pp), tsf: 2.0				**Recompression Ratio (Cer):** 0.04		
Type of Specimen: *Tube Sample*				**Compression Ratio (Cec):** 0.32		
Description: *FAT CLAY (CH) - gray*					**Initial**	**Final**
				Water Content, %	*75.8*	*40.8*
LL: *97*	**PI:** *65*	**Gs:** *2.72*	**P_o' (tsf):** *0.00*	**Void Ratio**	*2.03*	*1.06*
% < No. 200: *98.8*		**Test Method:** *ASTM D2435 Method A*		**Saturation, %**	*100*	*100*
Test Condition: *Inundated @ 0.05 tsf*				**Dry Unit Weight, pcf**	*56.0*	*82.3*
Remarks:				**Project:** MTT, DTT & MLK Exp. Project		
Average Water Content of Trimmings, %: *70.3*				**Location** *Portsmouth, VA*		
				Boring: *10BH-004*	**Schnabel No.:** *10613051.00.21*	
				Depth: *35-37 ft.*	**Elevation:** *-29.1 to -31.1 ft.*	
				Date: *1/0/1900*	**Reviewed by:** *0*	

Schnabel ENGINEERING

Consolidation Test Report

Consolidation Test Data Sheet

Consolidometer ID: *4* 1/0/00

Schnabel Contract: *10613051.00.21*

Test Method: *ASTM D2435 Method A*

Project: *MTT, DTT & MLK Exp. Project*

Test Condition: *Inundated @ 0.05 tsf*

Initial Height of Specimen (H_o), in.: 0.7477

Height of Solids (H_s), in.: 0.2466

Boring No.: *10BH-004*

Depth: *35-37 ft.*

Seating Press. (tsf): 0.05

Initial Dial Gauge Reading (D_o), in.: 0.0000

Reviewed by: 0

Pressure, P (tsf)	Time Readings Required	Date Load Applied	Time Load Applied	Load Applied By	A: Final[1] Dial Reading, D_{fi} x 10^{-4} in.	B: Apparatus Correction[2], D_{ci} x 10^{-4} in.	C: Cumulative Change in Height[3], DH_i in.	D: Height of Voids[4], H_{vi} in.	Vertical Strain[5], e_i (%)	Void Ratio[6], e_i
0.25		9/9/2010	9:15	DWC	68	8	0.0060	0.4951	0.80	2.007
0.5		9/10/2010	9:15	DWC	193	19	0.0174	0.4837	2.33	1.961
1		9/11/2010	9:15	CJS	459	28	0.0431	0.4580	5.76	1.857
2		9/12/2010	9:15	DWC	1111	35	0.1076	0.3935	14.39	1.595
0.5		9/13/2010	9:15	DWC	946	19	0.0927	0.4084	12.40	1.656
0.25		9/14/2010	9:15	DWC	850	8	0.0842	0.4169	11.26	1.690
1		9/15/2010	9:15	DWC	971	28	0.0943	0.4068	12.61	1.649
2		9/16/2010	9:15	DWC	1209	35	0.1174	0.3837	15.70	1.556
4		9/17/2010	9:15	DWC	1793	41	0.1752	0.3259	23.43	1.321
8		9/18/2010	9:15	DWC	2382	49	0.2333	0.2678	31.20	1.086
16		9/20/2010	9:15	DWC	2881	60	0.2821	0.2190	37.73	0.888
4		9/21/2010	9:15	DWC	2709	41	0.2668	0.2343	35.68	0.950
1		9/22/2010	9:15	DWC	2422	28	0.2394	0.2617	32.02	1.061

Notes:
1. "Final" based on test method; 24 hrs for Method A, end of primary for Method B.
2. Correction value, for the current pressure, from the consolidometer's calibration curve.
3. $\Delta H = D_{fi} - D_o - D_{ci}$ = Col. A - D_o - Col. B
4. $H_{vi} = (H_o - H_s - D_0) - \Delta H$
5. $\varepsilon_i = (\Delta H / H_o) \times 100$ = (Col. C / H_o) x 100
6. $e_i = H_{vi} / Hs$ = Col. D / Hs

Consol 5/2007 Rev. 4

Schnabel ENGINEERING

Load Time Readings

1/0/00

Project: MTT, DTT & MLK Exp. Project

Schnabel Contract: 10613051.00.21

Boring No.: 10BH-004 Depth: 35-37 ft.

Consol. ID: 4 Reviewed by: 0

Test Drainage Conditions: Double

Elapsed Time (min.)	Dial Gauge Readings (inches)					
	2 tsf Reload 9/16/2010	4 tsf Load 9/17/2010				
0.1	0.0983	0.1229				
0.25	0.0989	0.1241				
0.5	0.0996	0.1254				
1	0.1007	0.1273				
2	0.1022	0.1302				
4	0.1043	0.1342				
8	0.1070	0.1399				
15	0.1096	0.1466				
30	0.1118	0.1548				
60	0.1135	0.1622				
120	0.1150	0.1677				
240	0.1165	0.1719				
480	0.1182	0.1753				
720	0.1192	0.1769				
960	0.1198	0.1778				
1200	0.1203	0.1786				
1440	0.1209	0.1793				
1680						
1920						
2160						
2400						
2640						
2880						

Schnabel ENGINEERING

Consolidation Time Curves

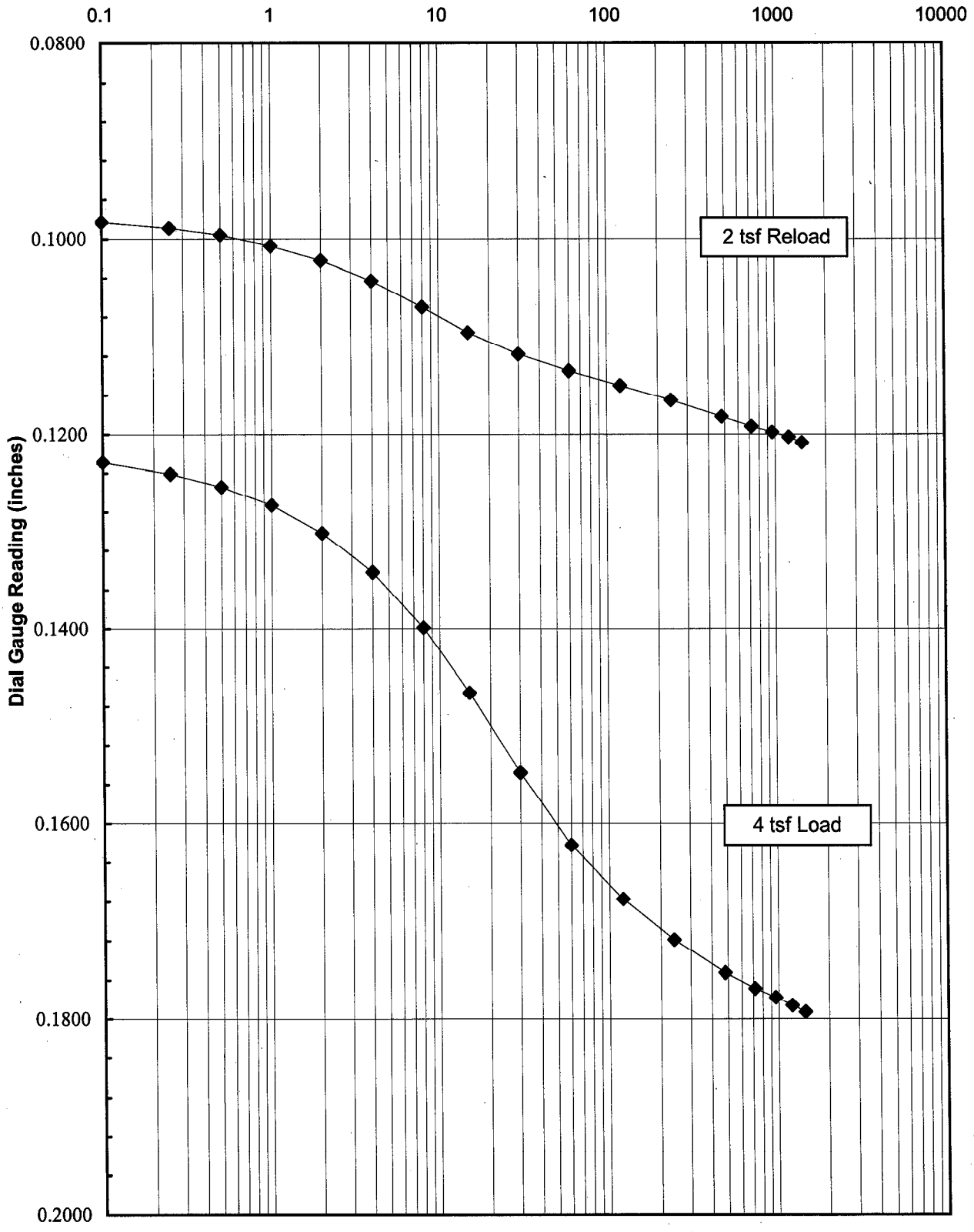
1/0/00

Project: MTT, DTT & MLK Exp. Project

Schnabel Contract: 10613051.00.21

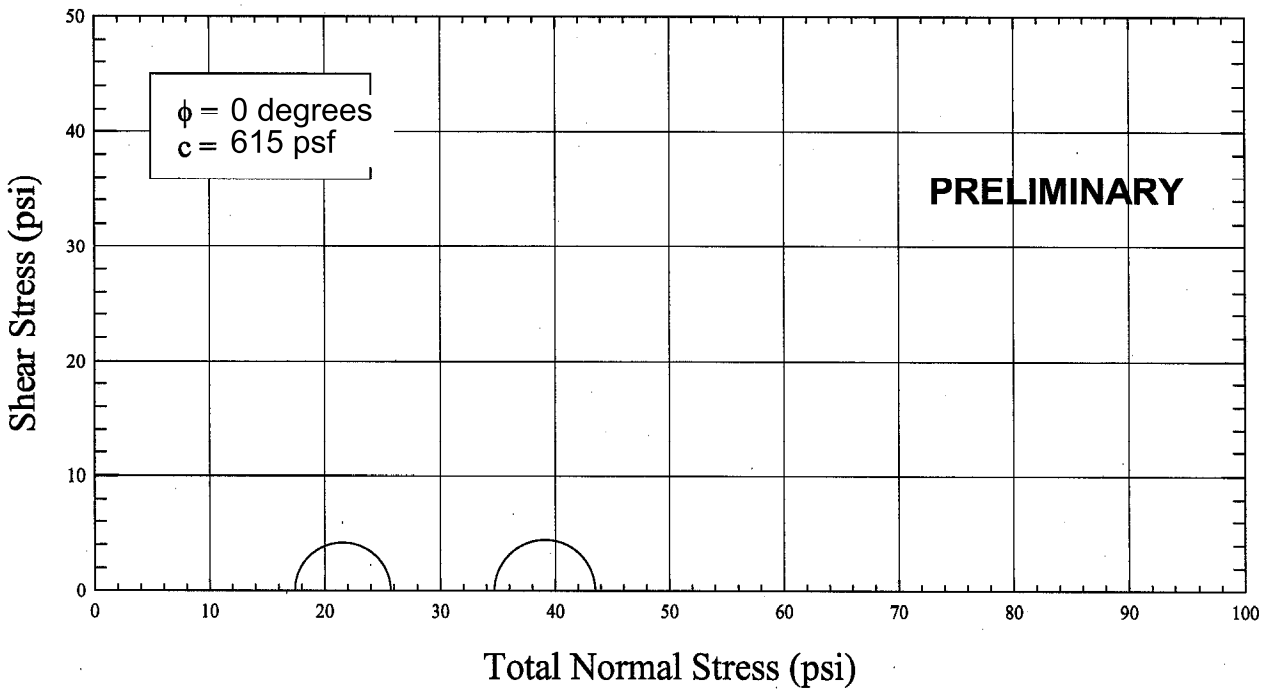
Boring No.: 10BH-004 Depth: 35-37 ft.

Reviewed by: 0 Test Drainage Conditions: Double



Unconsolidated Undrained (UU) Triaxial Shear (ASTM D2850)

Mohr Stress Circles at Maximum Deviator Stress Criterion



Boring No.: *10BH-004* Depth: *40-42 ft* Elevation: *-34.1 to -36.1 ft* SEC Contract: *10613051.00.21* Date:
Sample Description: *FAT CLAY (CH) - gray* Reviewed By:
Specimen Type: *Tube Sample* Gs: *2.73* LL: *99* PI: *66* %<200: *98.4*

Schnabel ENGINEERING

MTT, DTT & MLK Exp. Project
Portsmouth, VA

Schnabel ENGINEERING

Unconsolidated Undrained Triaxial Compression Test

ASTM D2850

Project: *MTT, DTT & MLK Exp. Project*

Location: *Portsmouth, VA*

Schnabel Contract: *10613051.00.21*
Boring No.: *10BH-004*
Depth: *40-42 ft.*
Elevation: *-34.1 to -36.1 ft.*
Confining Stress (psi): *17.4*

Date: *1/0/1900*
Reviewed by: *0*

Specimen Conditions	
Diameter (in)	2.862
Height (in)	5.816
Area (in^2)	6.43
Moisture (%):	80.2
Weight (lbs)	2.06
ρ_{wet} (pcf)	95.3
ρ_{dry} (pcf)	52.9
Void Ratio	2.22
Saturation, %	99

Shear Testing Conditions	
Cell Pressure (psi):	17.4
Rate of Strain (%/min):	1.0

Specimen Type: *Tube Sample*

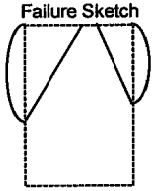
Axial Strain at Failure (%): *3.92*
Compressive Strength (psi): *8.3*
Major Principal Stress (psi): *25.7*
Minor Principal Stress (psi): *17.4*

Soil Description: *FAT CLAY (CH) - gray*

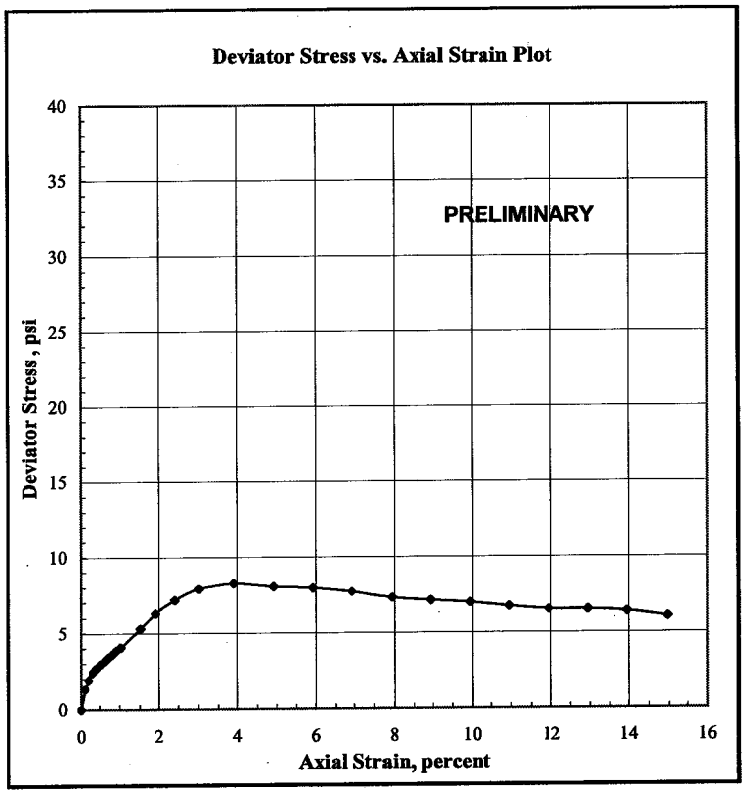
Liquid Limit: *99*
Plasticity Index: *66*
% finer that No. 200: *98.4*
Specific Gravity: *2.73*

Remarks:

Failure Sketch



Reading No.	Deviator Load (lbs)	Corrected Dev. Load[1] (lbs.)	Axial Displacement (in.)	Axial Strain (%)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	Deviator Stress (psi)
Initial	0.0	0.0	0.000	0.00	6.43	17.4	17.4	0.0
1	8.9	8.9	0.006	0.10	6.44	18.8	17.4	1.4
2	12.5	12.5	0.012	0.21	6.45	19.3	17.4	1.9
3	15.3	15.2	0.018	0.31	6.45	19.8	17.4	2.4
4	17.3	17.2	0.024	0.41	6.46	20.1	17.4	2.7
5	19.3	19.2	0.031	0.53	6.47	20.4	17.4	3.0
6	20.9	20.8	0.037	0.64	6.48	20.6	17.4	3.2
7	22.1	21.9	0.041	0.70	6.48	20.8	17.4	3.4
8	23.5	23.3	0.047	0.81	6.49	21.0	17.4	3.6
9	25.2	25.0	0.053	0.91	6.49	21.3	17.4	3.9
10	26.6	26.4	0.059	1.01	6.50	21.5	17.4	4.1
11	34.9	34.6	0.088	1.51	6.53	22.7	17.4	5.3
12	41.6	41.2	0.111	1.91	6.56	23.7	17.4	6.3
13	47.8	47.3	0.140	2.41	6.59	24.6	17.4	7.2
14	53.1	52.5	0.175	3.01	6.63	25.3	17.4	7.9
15	56.2	55.4	0.228	3.92	6.70	25.7	17.4	8.3
16	55.6	54.5	0.286	4.92	6.77	25.5	17.4	8.1
17	55.7	54.4	0.345	5.93	6.84	25.4	17.4	8.0
18	54.7	53.2	0.403	6.93	6.91	25.1	17.4	7.7
19	52.8	51.1	0.462	7.94	6.99	24.7	17.4	7.3
20	52.2	50.3	0.520	8.94	7.07	24.5	17.4	7.1
21	51.9	49.8	0.578	9.94	7.14	24.4	17.4	7.0
22	50.9	48.5	0.637	10.95	7.23	24.1	17.4	6.7
23	50.1	47.5	0.695	11.95	7.31	23.9	17.4	6.5
24	50.8	48.0	0.753	12.95	7.39	23.9	17.4	6.5
25	50.6	47.6	0.812	13.96	7.48	23.8	17.4	6.4
26	48.9	45.7	0.870	14.96	7.57	23.4	17.4	6.0



Notes: 1. Deviator load corrected for membrane effects.
2. Right Cylinder Correction Method

Schnabel ENGINEERING

Unconsolidated Undrained Triaxial Compression Test

ASTM D2850

Project: *MTT, DTT & MLK Exp. Project*

Location: *Portsmouth, VA*

Schnabel Contract: *10613051.00.21* Date: *1/0/1900*

Boring No.: *10BH-004*

Depth: *40-42 ft.* Reviewed by: *0*

Elevation: *-34.1 to -36.1 ft.*

Confining Stress (psi): *34.7*

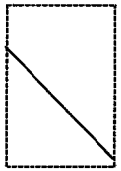
Specimen Conditions	
Diameter (in)	2.855
Height (in)	5.794
Area (in^2)	6.40
Moisture (%):	77.9
Weight (lbs)	2.07
ρ_{wet} (pcf)	96.3
ρ_{dry} (pcf)	54.1
Void Ratio	2.15
Saturation, %	99

Shear Testing Conditions	
Cell Pressure (psi):	34.7
Rate of Strain (%/min):	1.0

Specimen Type: *Tube Sample*

Soil Description: *FAT CLAY (CH) - gray*

Failure Sketch



Liquid Limit: *99*

Plasticity Index: *66*

% finer that No. 200: *98.4*

Specific Gravity: *2.73*

Axial Strain at Failure (%): *5.94*

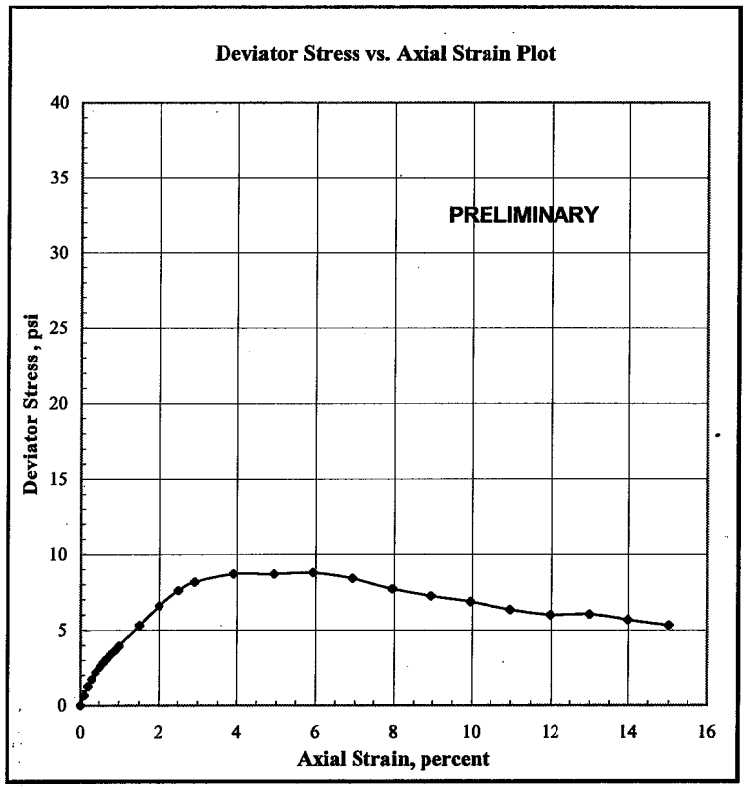
Compressive Strength (psi): *8.8*

Major Principal Stress (psi): *43.5*

Minor Principal Stress (psi): *34.7*

Remarks:

Reading No.	Deviator Load (lbs)	Corrected Dev. Load[1] (lbs.)	Axial Displacement (in.)	Axial Strain (%)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	Deviator Stress (psi)
Initial	0.0	0.0	0.000	0.00	6.40	34.7	34.7	0.0
1	4.2	4.2	0.005	0.09	6.41	35.4	34.7	0.7
2	8.1	8.1	0.011	0.19	6.42	36.0	34.7	1.3
3	11.1	11.0	0.017	0.29	6.42	36.4	34.7	1.7
4	13.9	13.8	0.023	0.40	6.43	36.8	34.7	2.1
5	16.2	16.1	0.029	0.50	6.44	37.2	34.7	2.5
6	18.4	18.3	0.035	0.60	6.44	37.5	34.7	2.8
7	20.1	20.0	0.040	0.69	6.45	37.8	34.7	3.1
8	22.1	21.9	0.046	0.79	6.45	38.1	34.7	3.4
9	23.8	23.6	0.052	0.90	6.46	38.4	34.7	3.7
10	25.8	25.6	0.058	1.00	6.47	38.7	34.7	4.0
11	34.9	34.6	0.087	1.50	6.50	40.0	34.7	5.3
12	43.4	43.0	0.116	2.00	6.53	41.3	34.7	6.6
13	50.4	49.9	0.145	2.50	6.57	42.3	34.7	7.6
14	54.5	53.9	0.169	2.92	6.60	42.9	34.7	8.2
15	58.8	58.0	0.227	3.92	6.66	43.4	34.7	8.7
16	59.6	58.5	0.286	4.94	6.74	43.4	34.7	8.7
17	61.0	59.7	0.344	5.94	6.81	43.5	34.7	8.8
18	59.3	57.8	0.402	6.94	6.88	43.1	34.7	8.4
19	55.3	53.6	0.461	7.96	6.96	42.4	34.7	7.7
20	52.8	50.9	0.519	8.96	7.03	41.9	34.7	7.2
21	50.9	48.8	0.577	9.96	7.11	41.6	34.7	6.9
22	47.9	45.5	0.636	10.98	7.19	41.0	34.7	6.3
23	46.2	43.6	0.694	11.98	7.27	40.7	34.7	6.0
24	47.2	44.4	0.753	13.00	7.36	40.7	34.7	6.0
25	45.3	42.3	0.811	14.00	7.45	40.4	34.7	5.7
26	43.3	40.1	0.869	15.00	7.53	40.0	34.7	5.3



Notes: 1. Deviator load corrected for membrane effects.

2. Right Cylinder Correction Method

Schnabel ENGINEERING

Unconfined Compression Test Report

ASTM D2166

Date: *1/0/1900*

Project: *MTT, DTT & MLK Exp. Project*

Location: *Portsmouth, VA*

Schnabel No.: *10613051.00.21*
Boring No.: *10BH-004*
Depth: *40-42 ft.*
Elevation: *-34.1 to -36.1 ft.*

Test Specimen Data	
Initial Diameter, in:	*2.844*
Initial Area, in^2:	*6.353*
Initial Height, in:	*5.798*
H/D Ratio:	*2.0*
Moisture Content, %:	*79.7*
Wet Unit Weight, pcf:	*94.9*
Dry Unit Weight, pcf:	*52.8*

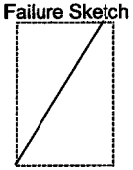
Testing Information	
Test Procedure:	*ASTM D2166*
Type of Specimen:	*Tube Sample*
Load Cell No.:	*1018253*
Strain Rate, %/min.:	*1.0*

Remarks:

Specimen Type:	*Tube Sample*

Strength Data	
Strain at Failure, %:	*5.9*
Unconfined Strength (Qu), tsf:	*0.37*
Shear Strength (Su), tsf:	*0.19*

Failure Sketch

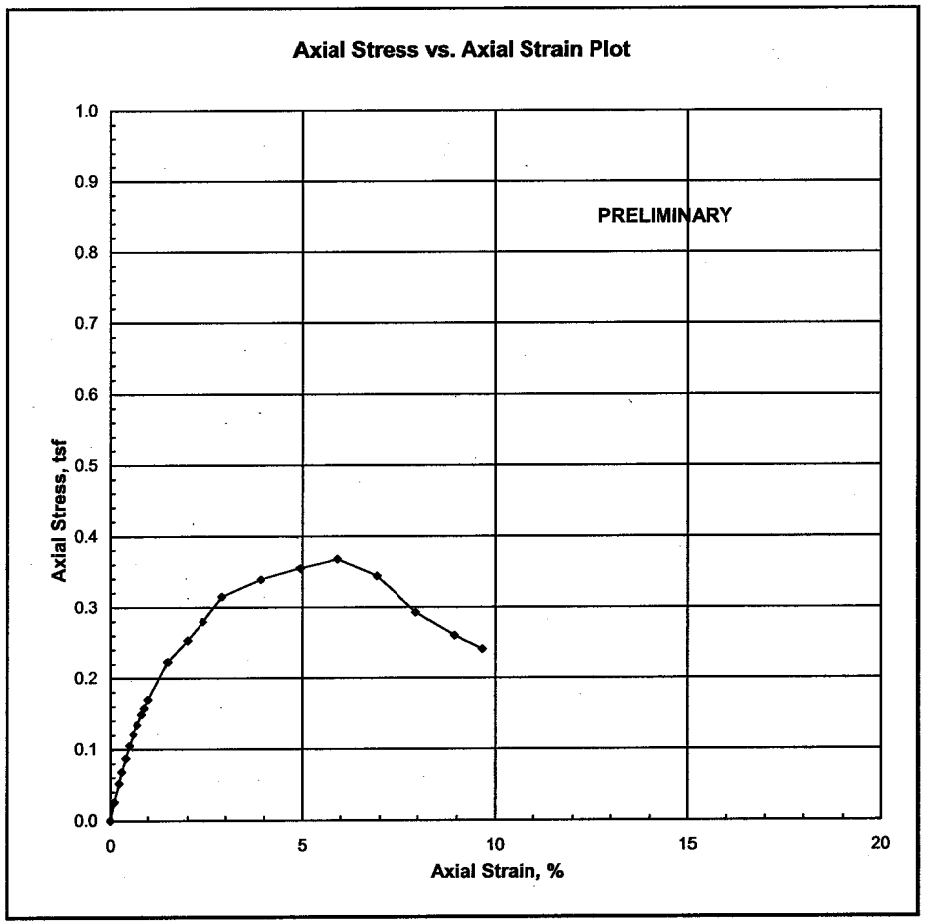


Reviewed by: *0*

Soil Desc.: *FAT CLAY (CH) - gray*

LL, %:	*99*	% < 200:	*98.4*
PI, %:	*66*	Gs:	*2.73*

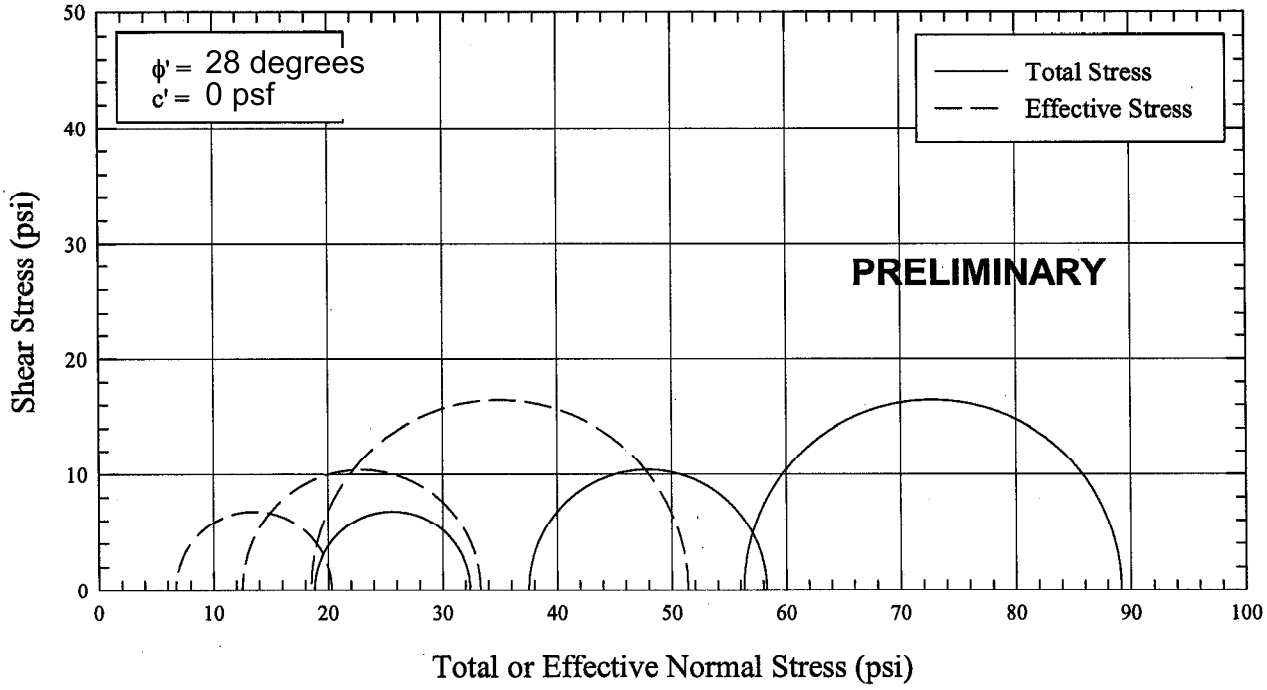
Test Data						
Reading No.	Axial Load (lbs)	Axial Displ. (in.)	Axial Strain (%)	Corrected Area[1] (in^2)	Axial Stress (psi)	Axial Stress (tsf)
Zero	0.0	0.000	0.0	6.35	0.0	0.00
1	2.3	0.006	0.1	6.36	0.4	0.03
2	4.6	0.013	0.2	6.37	0.7	0.05
3	6.0	0.017	0.3	6.37	0.9	0.07
4	7.7	0.023	0.4	6.38	1.2	0.09
5	9.3	0.029	0.5	6.38	1.5	0.10
6	10.7	0.035	0.6	6.39	1.7	0.12
7	11.9	0.041	0.7	6.40	1.9	0.13
8	13.2	0.048	0.8	6.41	2.1	0.15
9	14.0	0.052	0.9	6.41	2.2	0.16
10	15.1	0.058	1.0	6.42	2.4	0.17
11	20.0	0.087	1.5	6.45	3.1	0.22
12	22.8	0.116	2.0	6.48	3.5	0.25
13	25.3	0.140	2.4	6.51	3.9	0.28
14	28.6	0.169	2.9	6.54	4.4	0.31
15	31.1	0.227	3.9	6.61	4.7	0.34
16	32.9	0.287	4.9	6.68	4.9	0.35
17	34.5	0.344	5.9	6.75	5.1	0.37
18	32.6	0.402	6.9	6.83	4.8	0.34
19	28.0	0.461	8.0	6.90	4.1	0.29
20	25.2	0.519	9.0	6.98	3.6	0.26
21	23.5	0.561	9.7	7.03	3.3	0.24
22	23.5	0.561	9.7	7.03	3.3	0.24
23	23.5	0.561	9.7	7.03	3.3	0.24
24	23.5	0.561	9.7	7.03	3.3	0.24
25	23.5	0.561	9.7	7.03	3.3	0.24
26	23.5	0.561	9.7	7.03	3.3	0.24



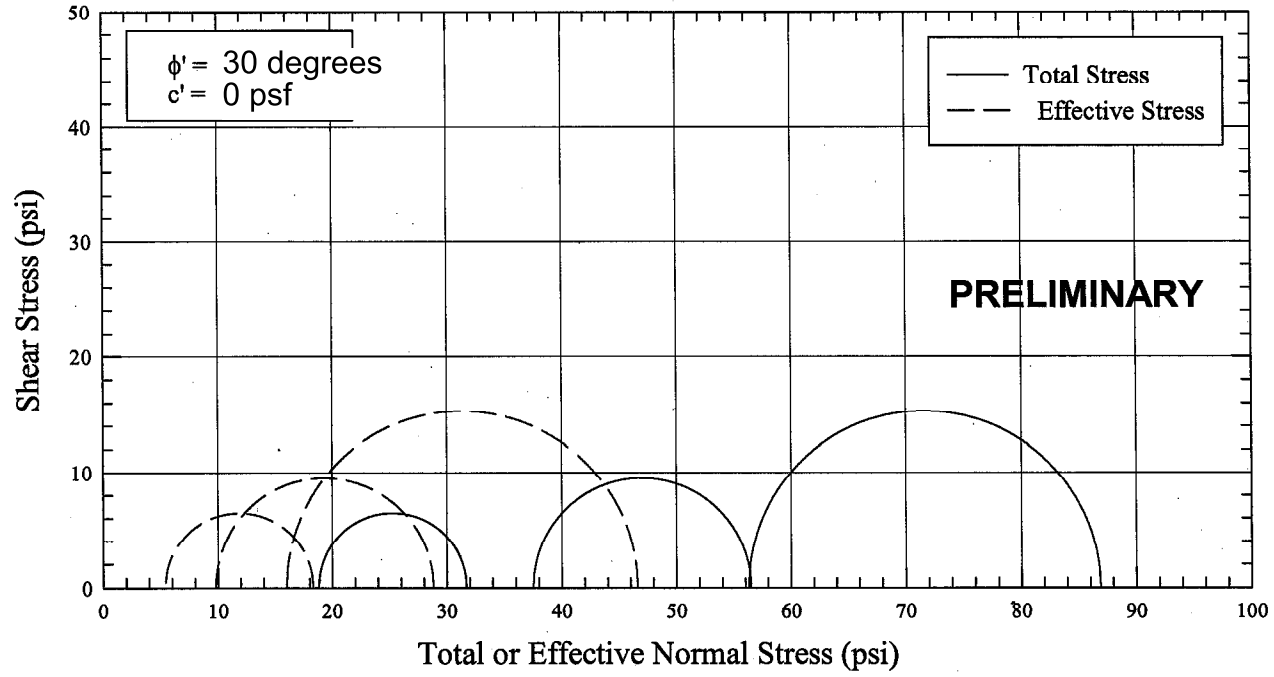
Notes: 1. Right Cylinder Area Correction Method

Consolidated Undrained (CU) Triaxial Shear (ASTM D4767)

Mohr Stress Circles at Maximum Deviator Stress Criterion



Mohr Stress Circles at Maximum Principal Stress Ratio Criterion

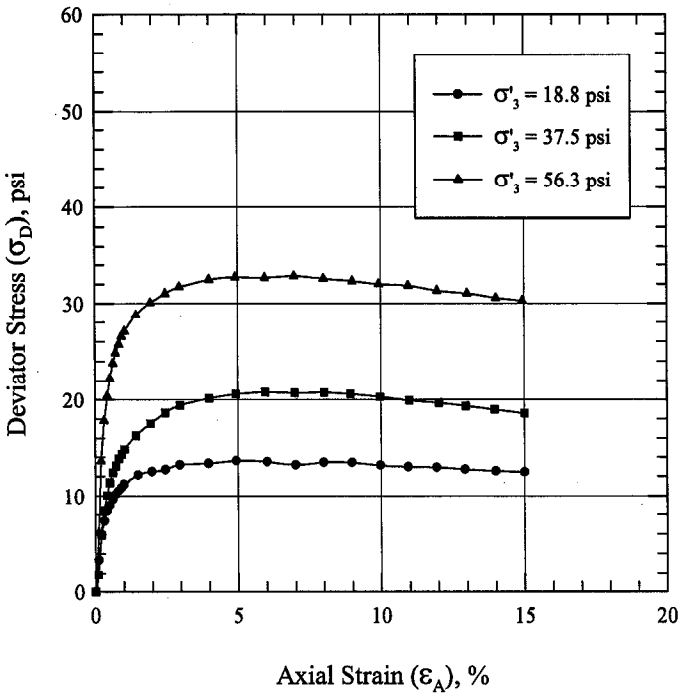


Boring No.: *10BH-004* Depth: *45-47 ft* Elevation: *-39.1 to -41.1 ft* SEC Contract: *10613051.00.21* Date:
Sample Description: *FAT CLAY WITH SAND (CH) - gray* Reviewed By:
Specimen Type: *Tube Sample* Gs: *2.70* LL: *52* PI: *28* %<200: *70.3*

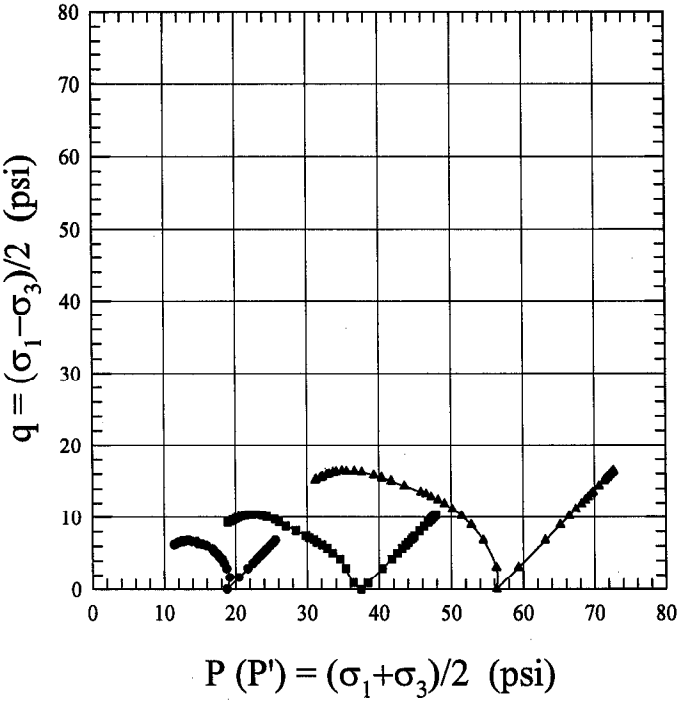
Schnabel ENGINEERING

MTT, DTT & MLK Exp. Project
Portsmouth, VA

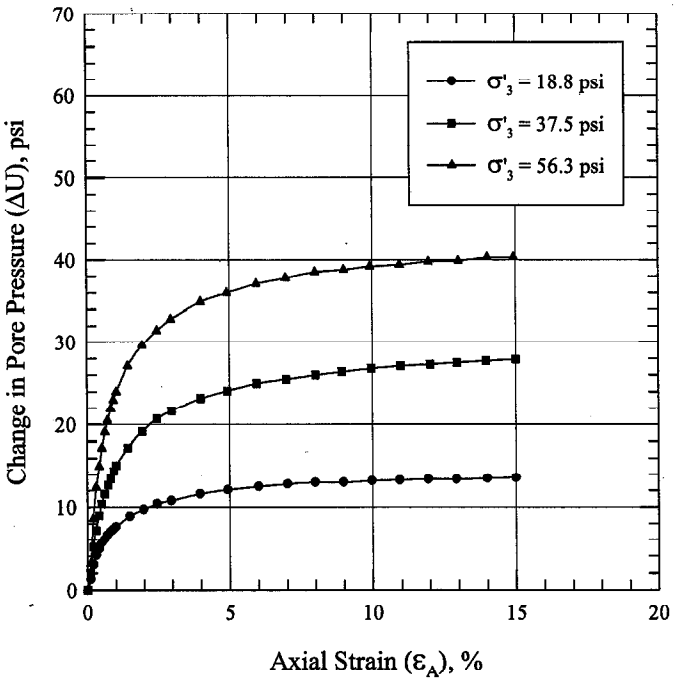
Deviator Stress vs. Axial Strain



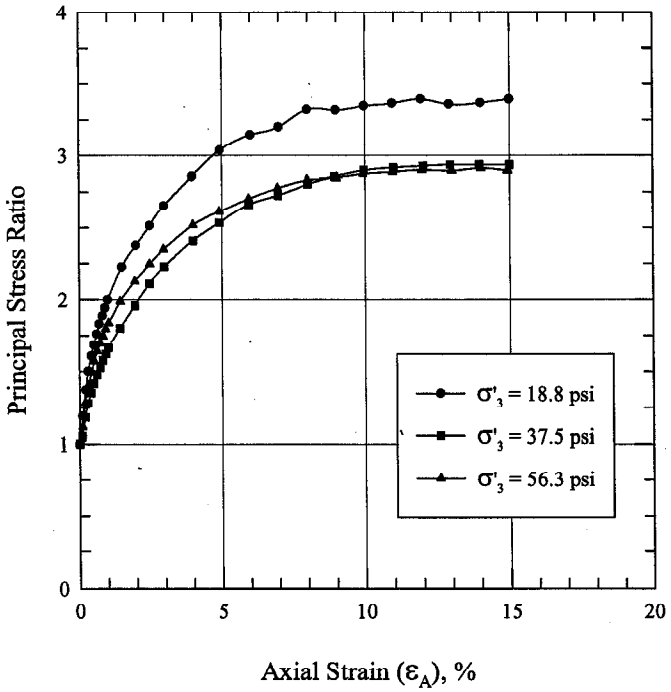
Stress Paths



Change in Pore Pressure vs. Axial Strain



Principal Stress Ratio vs. Axial Strain



Boring No.: *10BH-004* Depth: *45-47 ft* Elevation: *-39.1 to -41.1 ft* SEC Contract: *10613051.00.21* Date:

Sample Description: *FAT CLAY WITH SAND (CH) - gray* Reviewed By:

Specimen Type: *Tube Sample* Specific Gravity: 2.70 LL: *52* PI: *28* %<200: *70.3*

Schnabel ENGINEERING

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Portsmouth, VA

Schnabel ENGINEERING

Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *MTT, DTT & MLK Exp. Project*

Location: *Portsmouth, VA*

Schnabel Contract: *10613051.00.21*
Boring No.: *10BH-004*
Depth: *45-47 ft.*
Elevation: *-39.1 to -41.1 ft.*
Confining Stress (psi): *18.8*

Date:

Reviewed by: *0*

	Specimen Conditions	
	Initial	Consolidated
Diameter (in)	2.842	2.75
Height (in)	5.804	5.64
Area (in^2)	6.35	5.94
Moisture (%)	47.6	
W_{solids} (lbs)	1.50	
ρ_{wet} (pcf)	103.6	
ρ_{dry} (pcf)	70.2	77.2
Void Ratio	1.40	1.18
Saturation, %	92	100

Shear Testing Conditions	
Cell Pressure (psi):	33.8
Back Pressure (psi):	15.0
Eff. Confining Stress (psi):	18.8
Final B check	0.96
t_{50} (min.):	24.2
Rate of Strain (%/min):	0.0166

Filter strips used? *YES*

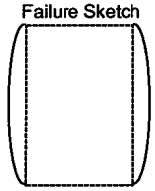
Specimen Type: *Tube Sample*

Soil Description: *FAT CLAY WITH SAND (CH) - gray*

Liquid Limit: *52*
Plasticity Index: *28*
% finer that No. 200: *70.3*
Specific Gravity: *2.70*

Remarks:

Failure Sketch



Reading No.	Deviator Load (lbs)	Corrected[1] Dev. Load (lbs.)	Axial Deformation (in.)	Axial Strain (%)	Pore Pressure (psi)	Change in Pore Press. (psi)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	Deviator Stress (psi)	Principal Stress Ratio	A_{bar}	P (psi)	P' (psi)	q (psi)
Zero	0.0	0.0	0.000	0.00	15.0	0.0	5.94	18.8	18.8	18.8	18.8	0.0	1.00	0.00	18.8	18.8	0.0
1	20.1	20.0	0.006	0.11	16.3	1.3	5.95	22.2	18.8	20.9	17.5	3.4	1.19	0.39	20.5	19.2	1.7
2	35.4	35.1	0.012	0.21	18.0	3.0	5.96	24.7	18.8	21.7	15.8	5.9	1.37	0.51	21.8	18.8	3.0
3	44.2	43.8	0.017	0.30	19.1	4.1	5.96	26.2	18.8	22.1	14.7	7.4	1.50	0.56	22.5	18.4	3.7
4	50.7	50.2	0.023	0.41	19.9	4.9	5.97	27.2	18.8	22.3	13.9	8.4	1.61	0.58	23.0	18.1	4.2
5	54.5	53.9	0.028	0.50	20.6	5.6	5.97	27.8	18.8	22.2	13.2	9.0	1.68	0.62	23.3	17.7	4.5
6	58.5	57.8	0.034	0.60	21.1	6.1	5.98	28.5	18.8	22.4	12.7	9.7	1.76	0.63	23.6	17.5	4.8
7	61.6	60.8	0.039	0.69	21.6	6.6	5.98	29.0	18.8	22.4	12.2	10.2	1.83	0.65	23.9	17.3	5.1
8	63.8	62.9	0.045	0.80	22.0	7.0	5.99	29.3	18.8	22.3	11.8	10.5	1.89	0.67	24.0	17.0	5.2
9	66.0	65.0	0.050	0.89	22.3	7.3	6.00	29.6	18.8	22.3	11.5	10.8	1.94	0.67	24.2	16.9	5.4
10	68.2	67.0	0.056	0.99	22.6	7.6	6.00	30.0	18.8	22.4	11.2	11.2	2.00	0.68	24.4	16.8	5.6
11	75.0	73.2	0.084	1.49	23.9	8.9	6.03	30.9	18.8	22.0	9.9	12.1	2.23	0.73	24.9	16.0	6.1
12	78.2	75.9	0.112	1.99	24.7	9.7	6.06	31.3	18.8	21.6	9.1	12.5	2.37	0.78	25.1	15.4	6.3
13	79.9	77.4	0.139	2.47	25.4	10.4	6.09	31.5	18.8	21.1	8.4	12.7	2.51	0.82	25.2	14.8	6.4
14	83.5	80.9	0.167	2.96	25.8	10.8	6.12	32.0	18.8	21.2	8.0	13.2	2.65	0.82	25.4	14.6	6.6
15	85.4	82.6	0.223	3.96	26.6	11.6	6.19	32.2	18.8	20.6	7.2	13.4	2.85	0.87	25.5	13.9	6.7
16	88.2	85.2	0.278	4.93	27.1	12.1	6.25	32.4	18.8	20.3	6.7	13.6	3.04	0.89	25.6	13.5	6.8
17	88.7	85.5	0.339	6.01	27.5	12.5	6.32	32.3	18.8	19.8	6.3	13.5	3.15	0.92	25.6	13.1	6.8
18	87.8	84.4	0.395	7.01	27.8	12.8	6.39	32.0	18.8	19.2	6.0	13.2	3.20	0.97	25.4	12.6	6.6
19	90.6	87.0	0.450	7.98	28.0	13.0	6.46	32.3	18.8	19.3	5.8	13.5	3.32	0.97	25.5	12.5	6.7
20	91.6	87.8	0.506	8.97	28.0	13.0	6.53	32.2	18.8	19.2	5.8	13.4	3.32	0.97	25.5	12.5	6.7
21	90.8	86.8	0.562	9.97	28.2	13.2	6.60	31.9	18.8	18.7	5.6	13.1	3.35	1.00	25.4	12.2	6.6
22	91.0	86.8	0.617	10.94	28.3	13.3	6.67	31.8	18.8	18.5	5.5	13.0	3.36	1.02	25.3	12.0	6.5
23	91.7	87.3	0.673	11.94	28.4	13.4	6.75	31.7	18.8	18.3	5.4	12.9	3.40	1.04	25.3	11.9	6.5
24	91.5	86.9	0.728	12.91	28.4	13.4	6.82	31.5	18.8	18.1	5.4	12.7	3.36	1.05	25.2	11.8	6.4
25	91.6	86.7	0.789	13.99	28.5	13.5	6.91	31.4	18.8	17.9	5.3	12.6	3.37	1.08	25.1	11.6	6.3
26	92.1	87.0	0.845	14.99	28.6	13.6	6.99	31.3	18.8	17.7	5.2	12.5	3.39	1.09	25.0	11.4	6.2

Notes: 1. Deviator load corrected for membrane and filter cage (if applicable) effects.
2. Right Cylinder Correction Method

Schnabel ENGINEERING

Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *MTT, DTT & MLK Exp. Project*

Location: *Portsmouth, VA*

Schnabel Contract: *10613051.00.21*
Boring No.: *10BH-004*
Depth: *45-47 ft.*
Elevation: *-39.1 to -41.1 ft.*
Confining Stress (psi): *37.5*

Date:

Reviewed by: *0*

	Specimen Conditions	
	Initial	Consolidated
Diameter (in)	2.841	2.65
Height (in)	5.791	5.41
Area (in^2)	6.34	5.53
Moisture (%)	61.2	
W_{solids} (lbs)	1.33	
ρ_{wet} (pcf)	101.0	
ρ_{dry} (pcf)	62.6	76.8
Void Ratio	1.69	1.19
Saturation, %	98	100

Shear Testing Conditions	
Cell Pressure (psi):	52.5
Back Pressure (psi):	15.0
Eff. Confining Stress (psi):	37.5
Final B check	1.00
t_{50} (min.):	63.3
Rate of Strain (%/min):	0.0063

Filter strips used? *YES*

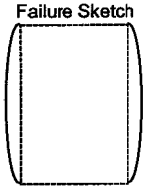
Specimen Type: *Tube Sample*

Soil Description: *FAT CLAY WITH SAND (CH) - gray*

Liquid Limit: *52*
Plasticity Index: *28*
% finer that No. 200: *70.3*
Specific Gravity: *2.70*

Remarks:

Failure Sketch



Reading No.	Deviator Load (lbs)	Corrected[1] Dev. Load (lbs.)	Axial Deformation (in.)	Axial Strain (%)	Pore Pressure (psi)	Change in Pore Press. (psi)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	Deviator Stress (psi)	Principal Stress Ratio	A_{bar}	P (psi)	P' (psi)	q (psi)
Zero	0.0	0.0	0.000	0.00	15.0	0.0	5.53	37.5	37.5	37.5	37.5	0.0	1.00	0.00	37.5	37.5	0.0
1	10.1	10.0	0.005	0.09	17.0	2.0	5.54	39.3	37.5	37.3	35.5	1.8	1.05	1.11	38.4	36.4	0.9
2	33.1	32.9	0.011	0.20	20.1	5.1	5.54	43.4	37.5	38.3	32.4	5.9	1.18	0.86	40.5	35.4	3.0
3	47.7	47.4	0.016	0.30	22.2	7.2	5.55	46.0	37.5	38.8	30.3	8.5	1.28	0.84	41.8	34.6	4.3
4	56.5	56.0	0.022	0.41	24.0	9.0	5.56	47.6	37.5	38.6	28.5	10.1	1.35	0.89	42.5	33.5	5.0
5	63.8	63.2	0.027	0.50	25.4	10.4	5.56	48.9	37.5	38.5	27.1	11.4	1.42	0.91	43.2	32.8	5.7
6	69.8	69.1	0.033	0.61	26.6	11.6	5.57	49.9	37.5	38.3	25.9	12.4	1.48	0.93	43.7	32.1	6.2
7	73.9	73.1	0.039	0.72	27.7	12.7	5.57	50.6	37.5	37.9	24.8	13.1	1.53	0.97	44.1	31.4	6.6
8	78.3	77.3	0.044	0.81	28.5	13.5	5.58	51.4	37.5	37.9	24.0	13.9	1.58	0.97	44.4	30.9	6.9
9	81.2	80.1	0.050	0.92	29.4	14.4	5.58	51.8	37.5	37.4	23.1	14.3	1.62	1.00	44.7	30.3	7.2
10	84.2	83.0	0.055	1.02	30.1	15.1	5.59	52.3	37.5	37.2	22.4	14.8	1.66	1.02	44.9	29.8	7.4
11	93.0	91.3	0.077	1.42	32.2	17.2	5.61	53.8	37.5	36.6	20.3	16.3	1.80	1.06	45.6	28.4	8.1
12	101.2	98.9	0.105	1.94	34.2	19.2	5.64	55.0	37.5	35.8	18.3	17.5	1.96	1.10	46.3	27.1	8.8
13	108.2	105.8	0.133	2.46	35.7	20.7	5.67	56.1	37.5	35.4	16.8	18.6	2.11	1.11	46.8	26.1	9.3
14	113.3	110.8	0.161	2.98	36.7	21.7	5.70	56.9	37.5	35.2	15.8	19.4	2.23	1.12	47.2	25.5	9.7
15	118.9	116.2	0.216	3.99	38.2	23.2	5.76	57.7	37.5	34.5	14.3	20.2	2.41	1.15	47.6	24.4	10.1
16	122.6	119.7	0.266	4.92	39.1	24.1	5.82	58.1	37.5	34.0	13.4	20.6	2.53	1.17	47.8	23.7	10.3
17	125.4	122.3	0.322	5.95	40.0	25.0	5.88	58.3	37.5	33.3	12.5	20.8	2.66	1.20	47.9	22.9	10.4
18	126.5	123.2	0.377	6.97	40.5	25.5	5.95	58.2	37.5	32.7	12.0	20.7	2.73	1.23	47.9	22.4	10.4
19	128.3	124.7	0.433	8.01	41.0	26.0	6.01	58.2	37.5	32.2	11.5	20.7	2.80	1.25	47.9	21.9	10.4
20	128.8	125.1	0.483	8.93	41.4	26.4	6.08	58.1	37.5	31.7	11.1	20.6	2.85	1.28	47.8	21.4	10.3
21	128.7	124.8	0.539	9.96	41.8	26.8	6.15	57.8	37.5	31.0	10.7	20.3	2.90	1.32	47.6	20.8	10.1
22	128.0	123.9	0.594	10.98	42.1	27.1	6.22	57.4	37.5	30.3	10.4	19.9	2.92	1.36	47.5	20.4	10.0
23	128.0	123.6	0.650	12.02	42.3	27.3	6.29	57.2	37.5	29.9	10.2	19.7	2.93	1.39	47.3	20.0	9.8
24	127.5	123.0	0.700	12.94	42.5	27.5	6.36	56.8	37.5	29.3	10.0	19.3	2.93	1.42	47.2	19.7	9.7
25	126.7	122.0	0.755	13.96	42.7	27.7	6.43	56.5	37.5	28.8	9.8	19.0	2.94	1.46	47.0	19.3	9.5
26	125.9	120.9	0.811	14.99	42.9	27.9	6.51	56.1	37.5	28.2	9.6	18.6	2.94	1.50	46.8	18.9	9.3

Notes: 1. Deviator load corrected for membrane and filter cage (if applicable) effects.
2. Right Cylinder Correction Method

Schnabel ENGINEERING

Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *MTT, DTT & MLK Exp. Project*

Location: *Portsmouth, VA*

Schnabel Contract: *10613051.00.21*
Boring No.: *10BH-004*
Depth: *45-47 ft.*
Elevation: *-39.1 to -41.1 ft.*
Confining Stress (psi): *56.3*

Date:

Reviewed by: *0*

	Specimen Conditions	
	Initial	Consolidated
Diameter (in)	2.838	2.76
Height (in)	5.814	5.43
Area (in^2)	6.33	5.98
Moisture (%)	42.9	
W_{solids} (lbs)	1.58	
ρ_{wet} (pcf)	106.3	
ρ_{dry} (pcf)	74.4	84.3
Void Ratio	1.27	1.00
Saturation, %	92	91

Shear Testing Conditions	
Cell Pressure (psi):	71.3
Back Pressure (psi):	15.0
Eff. Confining Stress (psi):	56.3
Final B check	0.96
t_{50} (min.):	9.5
Rate of Strain (%/min):	0.0423

Filter strips used? *YES*

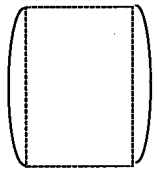
Specimen Type: *Tube Sample*

Soil Description: *FAT CLAY WITH SAND (CH) - gray*

Liquid Limit: *52*
Plasticity Index: *28*
% finer that No. 200: *70.3*
Specific Gravity: *2.70*

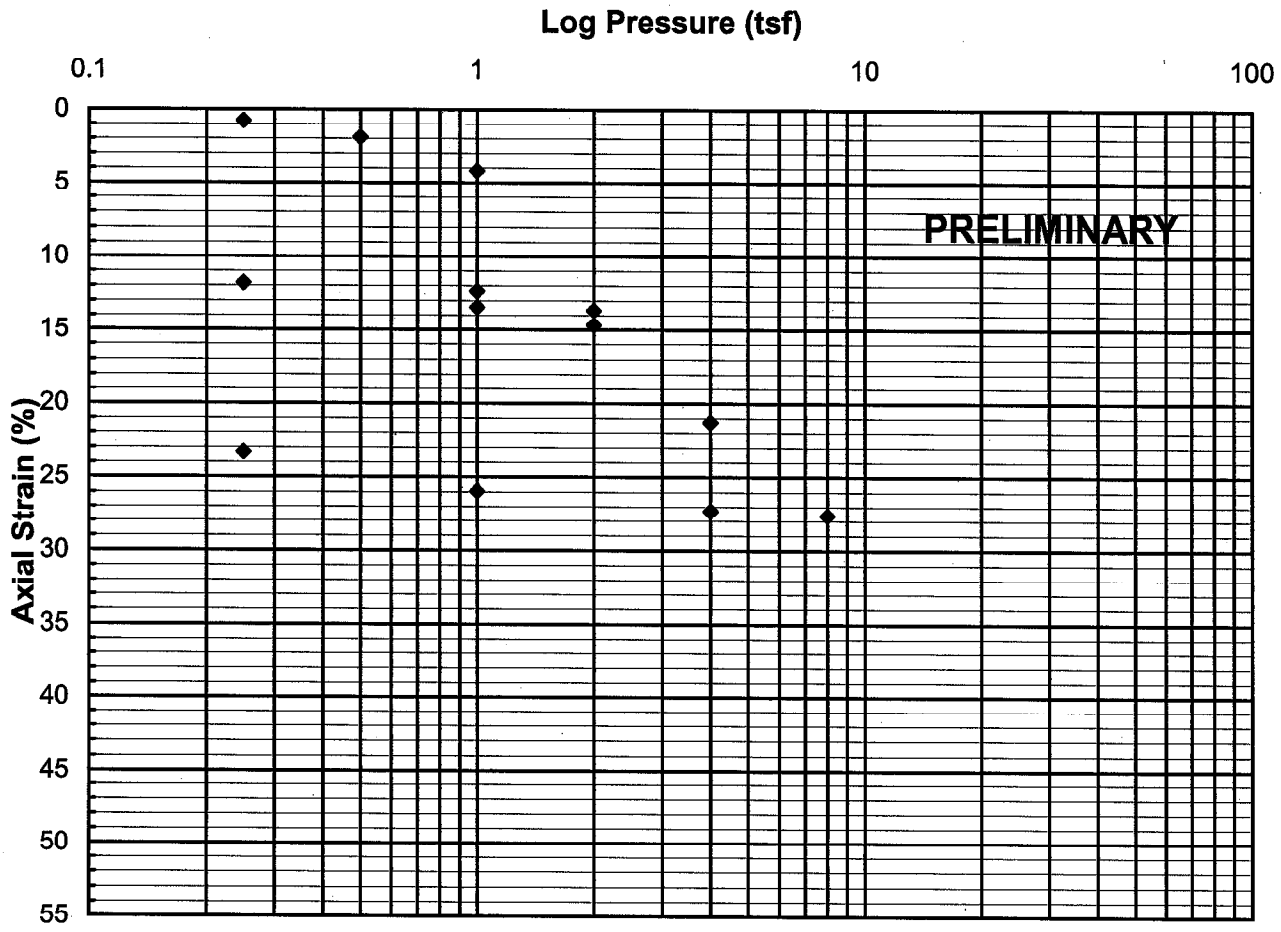
Remarks:

Failure Sketch



Reading No.	Deviator Load (lbs)	Corrected[1] Dev. Load (lbs.)	Axial Deformation (in.)	Axial Strain (%)	Pore Pressure (psi)	Change in Pore Press. (psi)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	Deviator Stress (psi)	Principal Stress Ratio	A_{bar}	P (psi)	P' (psi)	q (psi)
Zero	0.0	0.0	0.000	0.00	15.0	0.0	5.98	56.3	56.3	56.3	56.3	0.0	1.00	0.00	56.3	56.3	0.0
1	36.9	36.8	0.006	0.11	18.1	3.1	5.98	62.4	56.3	59.3	53.2	6.1	1.12	0.50	59.4	56.3	3.1
2	81.7	81.5	0.011	0.20	23.6	8.6	5.99	69.9	56.3	61.3	47.7	13.6	1.29	0.63	63.1	54.5	6.8
3	107.1	106.7	0.017	0.31	27.4	12.4	5.99	74.1	56.3	61.7	43.9	17.8	1.41	0.70	65.2	52.8	8.9
4	122.7	122.2	0.023	0.42	30.0	15.0	6.00	76.7	56.3	61.7	41.3	20.4	1.49	0.74	66.5	51.5	10.2
5	134.1	133.5	0.028	0.52	32.2	17.2	6.01	78.5	56.3	61.3	39.1	22.2	1.57	0.77	67.4	50.2	11.1
6	143.9	143.2	0.034	0.63	34.1	19.1	6.01	80.1	56.3	61.0	37.2	23.8	1.64	0.80	68.2	49.1	11.9
7	150.5	149.7	0.039	0.72	35.5	20.5	6.02	81.2	56.3	60.7	35.8	24.9	1.69	0.82	68.7	48.2	12.4
8	155.9	154.9	0.045	0.83	36.9	21.9	6.03	82.0	56.3	60.1	34.4	25.7	1.75	0.85	69.2	47.3	12.9
9	161.2	160.1	0.050	0.92	38.0	23.0	6.03	82.8	56.3	59.8	33.3	26.5	1.80	0.87	69.6	46.6	13.3
10	164.8	163.6	0.056	1.03	39.0	24.0	6.04	83.4	56.3	59.4	32.3	27.1	1.84	0.89	69.8	45.8	13.5
11	176.2	174.5	0.078	1.44	42.1	27.1	6.06	85.1	56.3	58.0	29.2	28.8	1.99	0.94	70.7	43.6	14.4
12	185.6	183.3	0.106	1.95	44.6	29.6	6.09	86.4	56.3	56.8	26.7	30.1	2.13	0.98	71.3	41.7	15.0
13	192.6	190.1	0.134	2.47	46.4	31.4	6.13	87.3	56.3	55.9	24.9	31.0	2.25	1.01	71.8	40.4	15.5
14	197.8	195.2	0.161	2.97	47.8	32.8	6.16	88.0	56.3	55.2	23.5	31.7	2.35	1.03	72.2	39.4	15.9
15	204.9	202.1	0.217	4.00	49.9	34.9	6.22	88.8	56.3	53.9	21.4	32.5	2.52	1.07	72.5	37.6	16.2
16	208.7	205.7	0.267	4.92	51.0	36.0	6.29	89.0	56.3	53.0	20.3	32.7	2.61	1.10	72.7	36.7	16.4
17	210.9	207.7	0.323	5.95	52.1	37.1	6.35	89.0	56.3	51.9	19.2	32.7	2.70	1.13	72.6	35.5	16.3
18	214.4	211.0	0.378	6.96	52.8	37.8	6.42	89.2	56.3	51.4	18.5	32.9	2.78	1.15	72.7	34.9	16.4
19	215.2	211.6	0.434	7.99	53.5	38.5	6.50	88.9	56.3	50.4	17.8	32.6	2.83	1.18	72.6	34.1	16.3
20	216.2	212.4	0.489	9.01	53.8	38.8	6.57	88.6	56.3	49.8	17.5	32.3	2.85	1.20	72.5	33.7	16.2
21	216.4	212.4	0.539	9.93	54.2	39.2	6.63	88.3	56.3	49.1	17.1	32.0	2.87	1.22	72.3	33.1	16.0
22	218.0	213.8	0.595	10.96	54.4	39.4	6.71	88.2	56.3	48.8	16.9	31.9	2.88	1.24	72.2	32.8	15.9
23	217.1	212.7	0.650	11.97	54.8	39.8	6.79	87.6	56.3	47.8	16.5	31.3	2.90	1.27	72.0	32.2	15.7
24	217.9	213.2	0.706	13.00	54.9	39.9	6.87	87.3	56.3	47.4	16.4	31.0	2.89	1.29	71.8	31.9	15.5
25	217.4	212.5	0.761	14.02	55.3	40.3	6.95	86.9	56.3	46.6	16.0	30.6	2.91	1.32	71.6	31.3	15.3
26	217.9	212.8	0.811	14.94	55.3	40.3	7.03	86.6	56.3	46.3	16.0	30.3	2.89	1.33	71.4	31.1	15.1

Notes: 1. Deviator load corrected for membrane and filter cage (if applicable) effects.
2. Right Cylinder Correction Method



Evaluation of Pp', Cer, and Cec relies on the design professional's engineering judgement and project details.

Probable Preconsolidation Pressure (Pp), tsf: 2.1				**Recompression Ratio (Cer):** 0.04	
Type of Specimen: *Tube Sample*				**Compression Ratio (Cec):** 0.28	
Description: *FAT CLAY WITH SAND (CH) - gray*					**Initial** / **Final**
				Water Content, %	*55.8* / *35.8*
LL: *52*	**PI:** *28*	**Gs:** *2.70*	**P_o' (tsf):** *0.00*	**Void Ratio**	*1.52* / *0.93*
% < No. 200: *70.3*		**Test Method:** *ASTM D2435 Method A*		**Saturation, %**	*99* / *100*
Test Condition: *Inundated @ 0.05 tsf*				**Dry Unit Weight, pcf**	*66.8* / *87.1*
Remarks:				**Project:** MTT, DTT & MLK Exp. Project	
Average Water Content of Trimmings, %: *50.0*				**Location** *Portsmouth, VA*	
Schnabel ENGINEERING				**Boring:** *10BH-004*	**Schnabel No.:** *10613051.00.21*
				Depth: *45-47 ft.*	**Elevation:** *-39.1 to -41.1 ft.*
				Date: *1/0/1900*	**Reviewed by:** *0*
				Consolidation Test Report	

Consolidation Test Data Sheet

Consolidometer ID: 1 1/0/00

Schnabel Contract: 10613051.00.21

Project: MTT, DTT & MLK Exp. Project

Test Method: ASTM D2435 Method A

Test Condition: Inundated @ 0.05 tsf

Initial Height of Specimen (H_o), in.: 0.7482

Height of Solids (H_s), in.: 0.2965

Boring No.: 10BH-004

Depth: 45-47 ft.

Seating Press. (tsf): 0.05

Initial Dial Gauge Reading (D_o), in.: 0.0000

Reviewed by: 0

Pressure, P (tsf)	TimeReadings Required	Date Load Applied	Time Load Applied	Load Applied By	A: Final[1] Dial Reading, D_{fi} x 10^{-4} in.	B: Apparatus Correction[2], D_{ci} x 10^{-4} in.	C: Cumulative Change in Height[3], DH_i in.	D: Height of Voids[4], H_{vi} in.	Vertical Strain[5], e_i (%)	Void Ratio[6], e_i
0.25		9/18/2010	9:00	DWC	60	1	0.0059	0.4457	0.79	1.503
0.5		9/20/2010	9:00	DWC	147	3	0.0144	0.4372	1.92	1.474
1		9/21/2010	9:00	DWC	323	9	0.0314	0.4202	4.20	1.417
2		9/22/2010	9:00	DWC	1036	13	0.1023	0.3493	13.67	1.178
1		9/23/2010	9:00	DWC	1016	9	0.1007	0.3509	13.46	1.183
0.25		9/24/2010	9:00	DWC	885	1	0.0884	0.3632	11.82	1.225
1		9/25/2010	9:00	CJS	935	9	0.0926	0.3590	12.38	1.211
2		9/27/2010	9:00	DWC	1113	13	0.1100	0.3416	14.70	1.152
4		9/28/2010	9:00	DWC	1614	21	0.1593	0.2923	21.29	0.986
8		9/29/2010	9:00	DWC	2099	33	0.2066	0.2450	27.61	0.826
4		9/30/2010	9:00	DWC	2064	21	0.2043	0.2473	27.31	0.834
1		10/1/2010	9:00	DWC	1951	9	0.1942	0.2574	25.96	0.868
0.25		10/2/2010	9:00	DWC	1746	1	0.1745	0.2771	23.32	0.935

Notes:

1 "Final" based on test method; 24 hrs for Method A, end of primary for Method B.

2 Correction value, for the current pressure, from the consolidometer's calibration curve.

3 $\Delta H = D_{fi} - D_o - D_{ci}$ = Col. A - D_o - Col. B

4 $H_{vi} = (H_o - H_s - D_0) - \Delta H$

5 $\varepsilon_i = (\Delta H / H_o) \times 100$ = (Col. C / H_o) x 100

6 $e_i = H_{vi} / Hs$ = Col. D / Hs

Consol 5/2007 Rev. 4

Schnabel ENGINEERING

Load Time Readings

1/0/00

Project: MTT, DTT & MLK Exp. Project

Schnabel Contract: 10613051.00.21

Boring No.: 10BH-004 Depth: 45-47 ft.

Consol. ID: 1 Reviewed by: 0

Test Drainage Conditions: Double

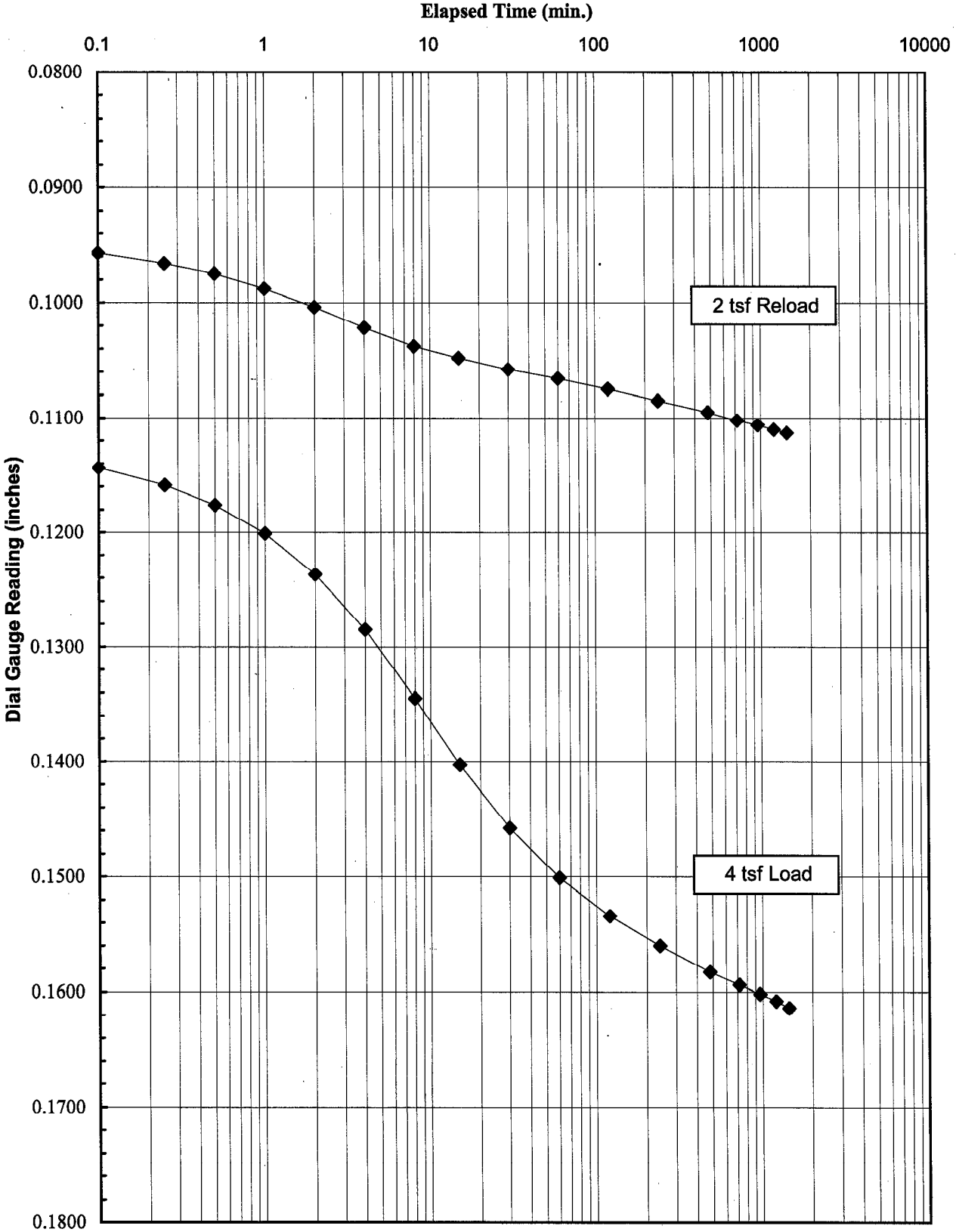
Elapsed Time (min.)	Dial Gauge Readings (inches)					
	2 tsf Reload 9/27/2010	4 tsf Load 9/28/2010				
0.1	0.0957	0.1144				
0.25	0.0966	0.1159				
0.5	0.0975	0.1176				
1	0.0988	0.1201				
2	0.1004	0.1237				
4	0.1022	0.1285				
8	0.1038	0.1345				
15	0.1048	0.1403				
30	0.1058	0.1458				
60	0.1066	0.1501				
120	0.1075	0.1534				
240	0.1085	0.1560				
480	0.1095	0.1583				
720	0.1102	0.1594				
960	0.1106	0.1602				
1200	0.1110	0.1608				
1440	0.1113	0.1614				
1680						
1920						
2160						
2400						
2640						
2880						

Schnabel ENGINEERING

Consolidation Time Curves

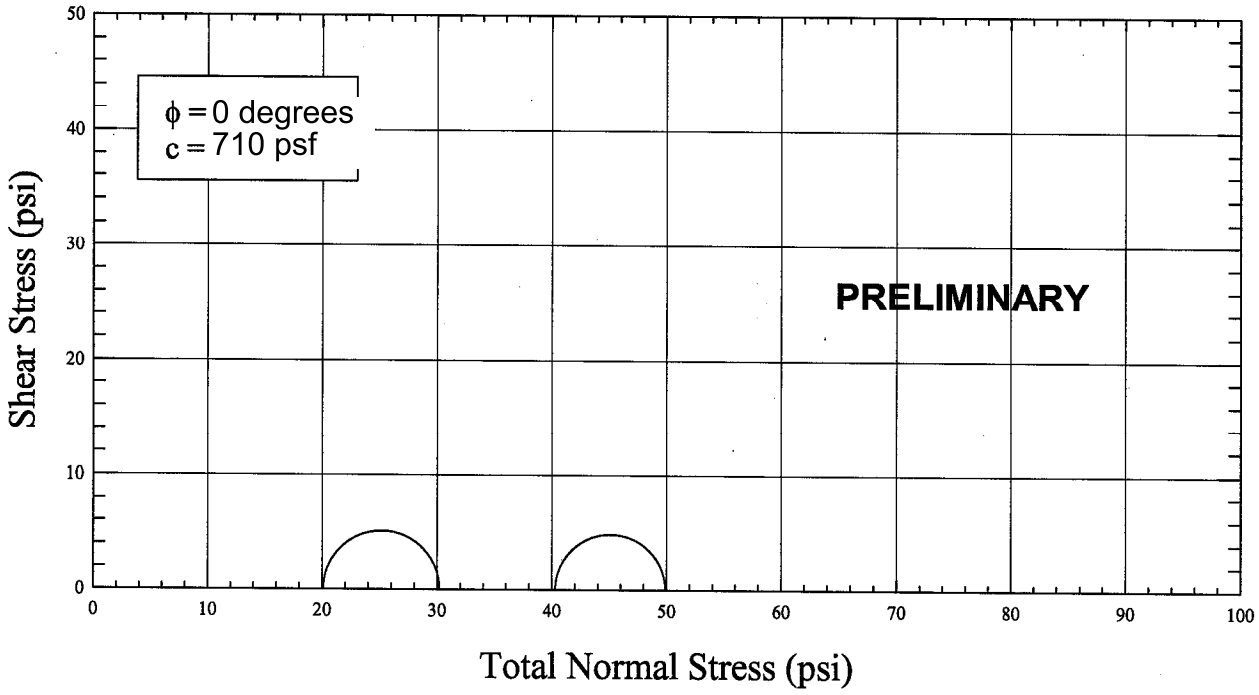
1/0/00

Project: MTT, DTT & MLK Exp. Project
Schnabel Contract: 10613051.00.21
Boring No.: 10BH-004 Depth: 45-47 ft.
Reviewed by: 0 Test Drainage Conditions: Double



Unconsolidated Undrained (UU) Triaxial Shear (ASTM D2850)

Mohr Stress Circles at Maximum Deviator Stress Criterion



Boring No.: *10BH-004* Depth: *50-52 ft* Elevation: *-44.1 to -46.1 ft* SEC Contract: *10613051.00.21* Date:
Sample Description: *SANDY FAT CLAY (CH) - gray* Reviewed By:
Specimen Type: *Tube Sample* Gs: *2.69* LL: *67* PI: *45* %<200: *60.3*

Schnabel ENGINEERING

MTT, DTT & MLK Exp. Project
Portsmouth, VA

Schnabel ENGINEERING

Unconsolidated Undrained Triaxial Compression Test

ASTM D2850

Project: *MTT, DTT & MLK Exp. Project*

Location: *Portsmouth, VA*

Schnabel Contract: *10613051.00.21* Date: *1/0/1900*

Boring No.: *10BH-004*

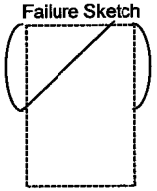
Depth: *50-52 ft.* Reviewed by: *0*

Elevation: *-44.1 to -46.1 ft.*

Confining Stress (psi): *20.1*

Soil Description: *SANDY FAT CLAY (CH) - gray*

Failure Sketch



Specimen Conditions	
Diameter (in)	2.874
Height (in)	5.792
Area (in^2)	6.49
Moisture (%):	43.7
Weight (lbs)	2.35
ρ_{wet} (pcf)	108.0
ρ_{dry} (pcf)	75.2
Void Ratio	1.23
Saturation, %	95

Shear Testing Conditions	
Cell Pressure (psi):	20.1
Rate of Strain (%/min):	1.0

Specimen Type: *Tube Sample*

Axial Strain at Failure (%): *3.94*

Compressive Strength (psi): *10.1*

Major Principal Stress (psi): *30.2*

Minor Principal Stress (psi): *20.1*

Liquid Limit: *67*

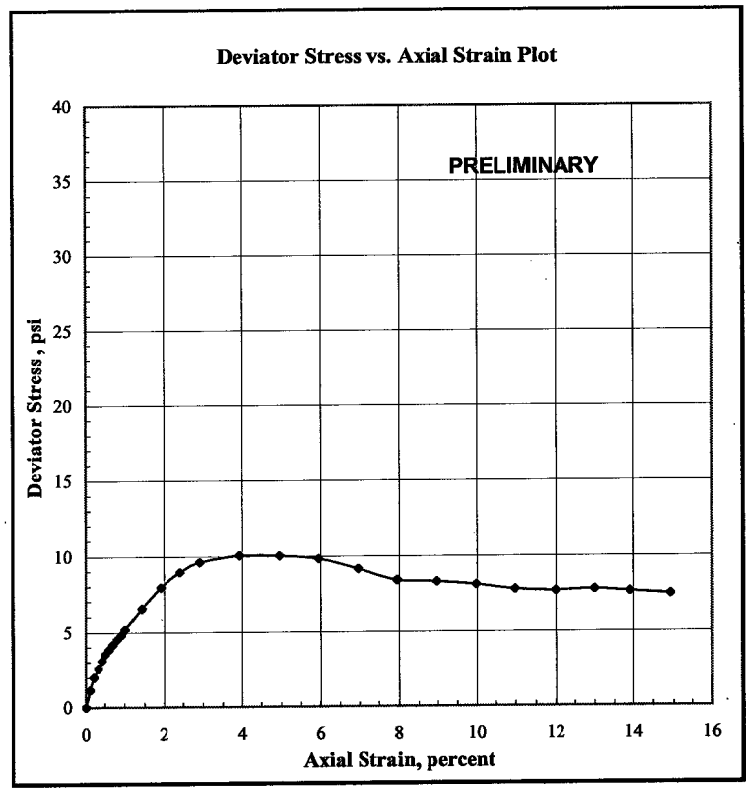
Plasticity Index: *45*

% finer that No. 200: *60.3*

Specific Gravity: *2.69*

Remarks:

Reading No.	Deviator Load (lbs)	Corrected Dev. Load[1] (lbs.)	Axial Displacement (in.)	Axial Strain (%)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	Deviator Stress (psi)
Initial	0.0	0.0	0.000	0.00	6.49	20.1	20.1	0.0
1	7.6	7.6	0.006	0.10	6.50	21.3	20.1	1.2
2	13.1	13.1	0.012	0.21	6.50	22.1	20.1	2.0
3	17.0	16.9	0.019	0.33	6.51	22.7	20.1	2.6
4	20.2	20.1	0.024	0.41	6.52	23.2	20.1	3.1
5	22.9	22.8	0.029	0.50	6.52	23.6	20.1	3.5
6	25.2	25.1	0.035	0.60	6.53	23.9	20.1	3.8
7	27.4	27.2	0.041	0.71	6.54	24.3	20.1	4.2
8	29.6	29.4	0.047	0.81	6.54	24.6	20.1	4.5
9	31.7	31.5	0.053	0.92	6.55	24.9	20.1	4.8
10	34.2	34.0	0.059	1.02	6.56	25.3	20.1	5.2
11	43.3	43.0	0.083	1.43	6.58	26.6	20.1	6.5
12	52.9	52.5	0.111	1.92	6.62	28.0	20.1	7.9
13	60.1	59.6	0.140	2.42	6.65	29.1	20.1	9.0
14	64.9	64.3	0.169	2.92	6.68	29.7	20.1	9.6
15	68.8	67.9	0.228	3.94	6.75	30.2	20.1	10.1
16	69.5	68.4	0.287	4.96	6.83	30.1	20.1	10.0
17	69.1	67.8	0.345	5.96	6.90	29.9	20.1	9.8
18	65.3	63.8	0.403	6.96	6.97	29.2	20.1	9.1
19	60.8	59.1	0.461	7.96	7.05	28.5	20.1	8.4
20	61.0	59.1	0.520	8.98	7.13	28.4	20.1	8.3
21	60.4	58.2	0.578	9.98	7.21	28.2	20.1	8.1
22	59.0	56.6	0.636	10.98	7.29	27.9	20.1	7.8
23	59.1	56.5	0.695	12.00	7.37	27.8	20.1	7.7
24	60.8	58.0	0.753	13.00	7.46	27.9	20.1	7.8
25	60.5	57.5	0.806	13.92	7.54	27.7	20.1	7.6
26	60.1	56.9	0.864	14.92	7.63	27.6	20.1	7.5



Notes: 1. Deviator load corrected for membrane effects.

2. Right Cylinder Correction Method

Schnabel ENGINEERING

Unconsolidated Undrained Triaxial Compression Test

ASTM D2850

Project: *MTT, DTT & MLK Exp. Project*

Location: *Portsmouth, VA*

Schnabel Contract: *10613051.00.21*
Boring No.: *10BH-004*
Depth: *50-52 ft.*
Elevation: *-44.1 to -46.1 ft.*
Confining Stress (psi): *40.3*

Date: *1/0/1900*
Reviewed by: *0*

Specimen Conditions	
Diameter (in)	2.875
Height (in)	5.846
Area (in^2)	6.49
Moisture (%):	41.4
Weight (lbs)	2.38
ρ_{wet} (pcf)	108.3
ρ_{dry} (pcf)	76.6
Void Ratio	1.19
Saturation, %	93

Shear Testing Conditions	
Cell Pressure (psi):	40.3
Rate of Strain (%/min):	1.0

Specimen Type: *Tube Sample*

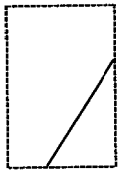
Axial Strain at Failure (%): *4.00*
Compressive Strength (psi): *9.6*
Major Principal Stress (psi): *49.9*
Minor Principal Stress (psi): *40.3*

Soil Description: *SANDY FAT CLAY (CH) - gray*

Liquid Limit: *64*
Plasticity Index: *45*
% finer that No. 200: *60.3*
Specific Gravity: *2.69*

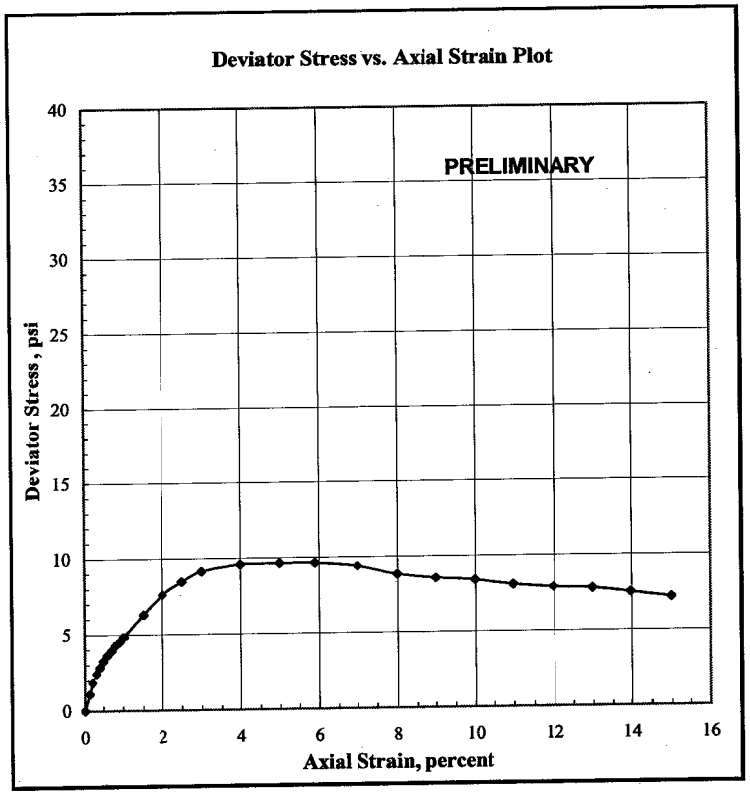
Remarks:

Failure Sketch



Reading No.	Deviator Load (lbs)	Corrected Dev. Load[1] (lbs.)	Axial Displacement (in.)	Axial Strain (%)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	Deviator Stress (psi)
Initial	0.0	0.0	0.000	0.00	6.49	40.3	40.3	0.0
1	7.2	7.2	0.007	0.12	6.50	41.4	40.3	1.1
2	12.0	12.0	0.012	0.21	6.51	42.1	40.3	1.8
3	15.7	15.6	0.018	0.31	6.51	42.7	40.3	2.4
4	18.5	18.4	0.024	0.41	6.52	43.1	40.3	2.8
5	21.2	21.1	0.029	0.50	6.52	43.5	40.3	3.2
6	23.8	23.7	0.035	0.60	6.53	43.9	40.3	3.6
7	25.7	25.5	0.041	0.70	6.54	44.2	40.3	3.9
8	28.2	28.0	0.047	0.80	6.54	44.6	40.3	4.3
9	29.7	29.5	0.053	0.91	6.55	44.8	40.3	4.5
10	31.9	31.7	0.059	1.01	6.56	45.1	40.3	4.8
11	41.9	41.6	0.088	1.51	6.59	46.6	40.3	6.3
12	50.9	50.5	0.117	2.00	6.62	47.9	40.3	7.6
13	56.9	56.4	0.146	2.50	6.66	48.8	40.3	8.5
14	61.9	61.3	0.175	2.99	6.69	49.5	40.3	9.2
15	65.7	64.8	0.234	4.00	6.76	49.9	40.3	9.6
16	66.9	65.8	0.292	5.00	6.83	49.9	40.3	9.6
17	67.7	66.4	0.345	5.90	6.90	49.9	40.3	9.6
18	67.1	65.6	0.409	7.00	6.98	49.7	40.3	9.4
19	64.0	62.3	0.467	7.99	7.06	49.1	40.3	8.8
20	62.9	60.9	0.526	9.00	7.13	48.8	40.3	8.5
21	62.7	60.5	0.584	9.99	7.21	48.7	40.3	8.4
22	61.2	58.8	0.642	10.98	7.29	48.4	40.3	8.1
23	60.7	58.1	0.701	11.99	7.38	48.2	40.3	7.9
24	61.0	58.2	0.759	12.98	7.46	48.1	40.3	7.8
25	59.7	56.7	0.817	13.98	7.55	47.8	40.3	7.5
26	58.0	54.8	0.876	14.99	7.64	47.5	40.3	7.2

Notes: 1. Deviator load corrected for membrane effects.
2. Right Cylinder Correction Method



Schnabel ENGINEERING

Unconfined Compression Test Report

ASTM D2166

Date: *1/0/1900*

Project: *MTT, DTT & MLK Exp. Project*

Location: *Portsmouth, VA*

Schnabel No.: *10613051.00.21*
Boring No.: *10BH-004*
Depth: *50-52 ft.*
Elevation: *-44.1 to -46.1 ft.*

Test Specimen Data	
Initial Diameter, in:	*2.848*
Initial Area, in^2:	*6.371*
Initial Height, in:	*5.825*
H/D Ratio:	*2.0*
Moisture Content, %:	*47.6*
Wet Unit Weight, pcf:	*105.2*
Dry Unit Weight, pcf:	*71.3*

Testing Information	
Test Procedure:	*ASTM D2166*
Type of Specimen:	*Tube Sample*
Load Cell No.:	*1018253*
Strain Rate, %/min.:	*1.0*

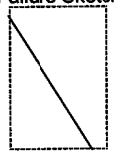
Remarks:

Specimen Type: *Tube Sample*

Strength Data	
Strain at Failure, %:	*3.0*
Unconfined Strength (Qu), tsf:	*0.35*
Shear Strength (Su), tsf:	*0.18*

Reviewed by: *0*

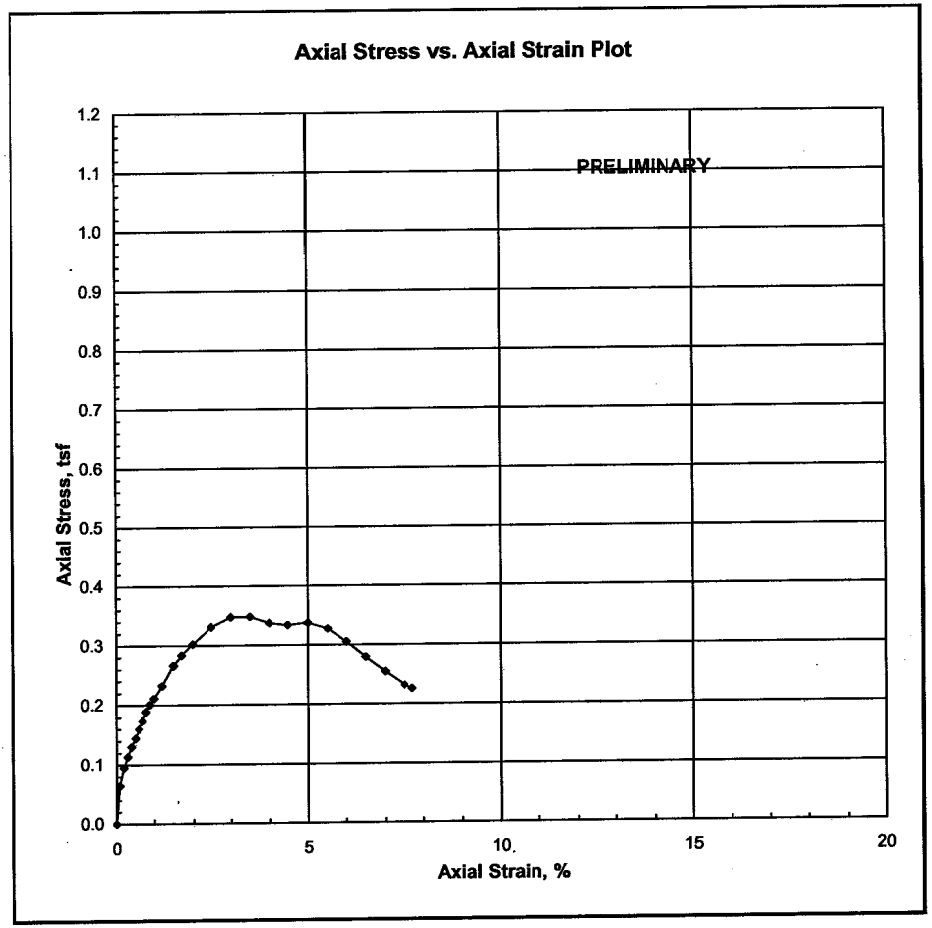
Failure Sketch



Soil Desc.: *SANDY FAT CLAY (CH) - gray*

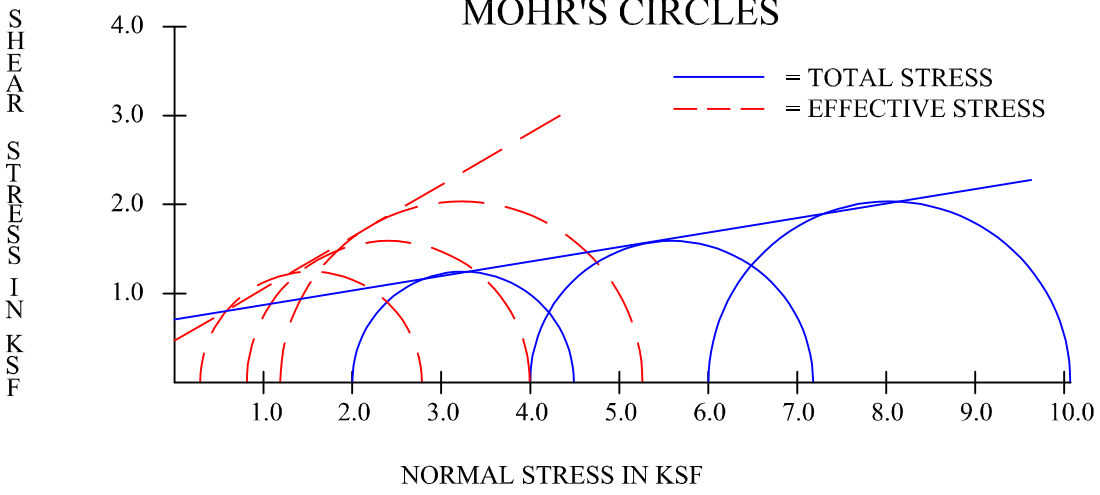
LL, %:	*67*	% < 200:	*60.3*
PI, %:	*45*	Gs:	*2.69*

Test Data						
Reading No.	Axial Load (lbs)	Axial Displ. (in.)	Axial Strain (%)	Corrected Area[1] (in^2)	Axial Stress (psi)	Axial Stress (tsf)
Zero	0.0	0.000	0.0	6.37	0.0	0.00
1	5.7	0.005	0.1	6.38	0.9	0.06
2	8.4	0.011	0.2	6.38	1.3	0.09
3	10.1	0.017	0.3	6.39	1.6	0.11
4	11.6	0.023	0.4	6.40	1.8	0.13
5	12.9	0.029	0.5	6.40	2.0	0.15
6	14.3	0.035	0.6	6.41	2.2	0.16
7	15.5	0.040	0.7	6.41	2.4	0.17
8	16.8	0.046	0.8	6.42	2.6	0.19
9	17.9	0.052	0.9	6.43	2.8	0.20
10	18.8	0.058	1.0	6.43	2.9	0.21
11	20.8	0.070	1.2	6.45	3.2	0.23
12	23.9	0.087	1.5	6.47	3.7	0.27
13	25.5	0.099	1.7	6.48	3.9	0.28
14	27.3	0.116	2.0	6.50	4.2	0.30
15	30.0	0.145	2.5	6.53	4.6	0.33
16	31.7	0.175	3.0	6.57	4.8	0.35
17	31.9	0.204	3.5	6.60	4.8	0.35
18	31.1	0.233	4.0	6.64	4.7	0.34
19	30.9	0.262	4.5	6.67	4.6	0.33
20	31.4	0.291	5.0	6.71	4.7	0.34
21	30.6	0.321	5.5	6.74	4.5	0.33
22	28.7	0.350	6.0	6.78	4.2	0.30
23	26.4	0.379	6.5	6.81	3.9	0.28
24	24.2	0.408	7.0	6.85	3.5	0.25
25	22.1	0.437	7.5	6.89	3.2	0.23
26	21.6	0.449	7.7	6.90	3.1	0.23



Notes: 1. Right Cylinder Area Correction Method

MOHR'S CIRCLES



FAILURE PICTURES



Pt.1

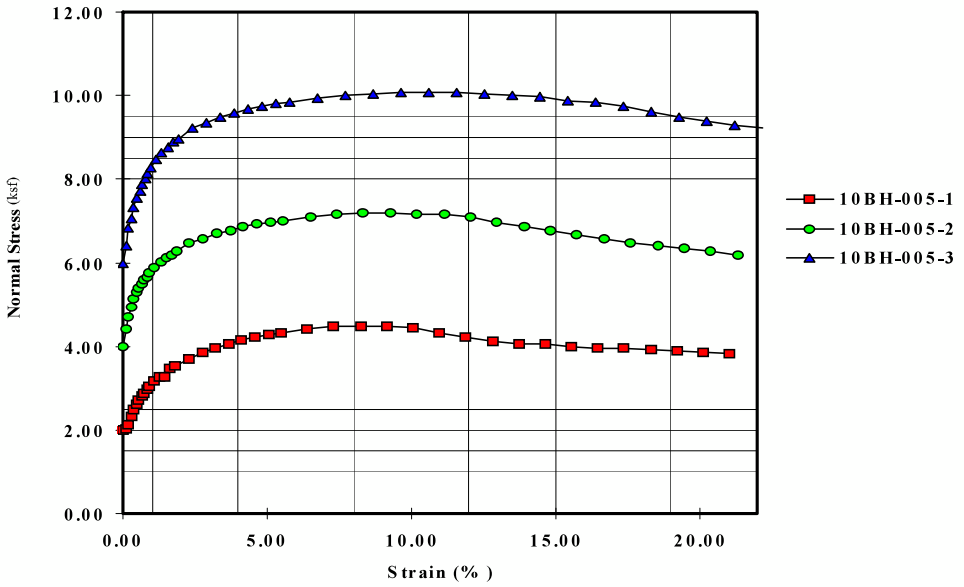


Pt.2



Pt.3

STRESS-STRAIN GRAPH
10BH-005 (P2) at 45 to 47 feet



SAMPLE NO.	Pt.1	Pt.2	Pt.3
Confining Pressure, ksf	2.00	4.00	6.00
Initial Length, In.	5.78	5.77	5.78
Initial Diameter, In.	2.81	2.84	2.84
Wet Unit Weight, pcf	81.2	90.2	87.4
Moisture Content, %	92.9	92.16	86.36
Initial Void Ratio	2.771	2.383	2.385
Initial Percent Saturation, %	85.28	98.40	92.11
Initial Area, Sq. In.	6.196	6.341	6.345
Liquid Limit, LL	169		
Plastic Limit, PL	48		
Specific Gravity	2.544		
Cohesion, ksf	0.71		
Angle of Shear Resistance (ϕ)	9		

TRIAXIAL COMPRESSION TEST

PROJECT	MIDTOWN TUNNEL NORFOLK, VA
PROJECT NO.	4955-110
TYPE OF SPECIMEN	PISTON
SAMPLE NO.	10BH-005 (P2)
DEPTH	45 to 47 Feet
SOIL DESCRIPTION	ORGANIC CLAY (OH), Dark Brown, with Silt, with Fine to Medium Sand
TEST METHOD	ASTM D4767, CU Triaxial
RATE OF SHEAR	0.002 in./min.

ENGINEERING AND TESTING CONSULTANTS

ENGINEERING AND TESTING CONSULTANTS, INC.
TRIAXIAL SHEAR TEST

Project Name: Midtown Tunnel
Project Number: 4955-110
Boring Number: 10BH-005 (P2) @ 66 to 68 Feet (Top), Pt.1
Sample Description: Organic CLAY (OH), Dark Brown, with Silt, with Fine to Medium Sand

CONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAIN CONTROL

P R O P E R T I E S

SPECIFIC GRAVITY	= 2.544	
LIQUID LIMIT	= 169	
PLASTIC LIMIT	= 48	
MEASURED VOLUME CHANGE	= -4.985	IN3
CELL PRESSURE	= 5.66	KSF
CONSOLIDATION PRESSURE	= 2.00	KSF

PROPERTY	INITIAL	CONSOLIDATED	
HEIGHT	= 5.776	5.464	INCHES
VOID RATIO	= 2.771	2.246	
AREA	= 6.196	5.637	SQ. IN.
PERCENT MOISTURE	= 92.90	88.29	PERCENT
WET DENSITY	= 81.20	92.08	PCF
DRY DENSITY	= 42.09	48.91	PCF
PERCENT SATURATION	= 85.28	100.01	PERCENT

NOTE - CONSOLIDATED PROPERTIES CALCULATED FROM MEASURED VOLUME CHANGE

O U T P U T D A T A

READING NUMBER	STRAIN (IN/IN)	SHEAR STRAIN	VOLUME STRAIN (CC/CC)	VOID RATIO	A FACTOR
1	.000000	.000000	.0000	2.245	.000
2	.000915	.000915	.0000	2.245	3.567
3	.001830	.001830	.0000	2.245	1.169
4	.002745	.002745	.0000	2.245	.891
5	.003660	.003660	.0000	2.245	.772
6	.004575	.004575	.0000	2.245	.765
7	.005490	.005490	.0000	2.245	.747
8	.006405	.006405	.0000	2.245	.725
9	.007321	.007321	.0000	2.245	.747
10	.008236	.008236	.0000	2.245	.752
11	.009151	.009151	.0000	2.245	.737
12	.010981	.010981	.0000	2.245	.727
13	.012811	.012811	.0000	2.245	.733
14	.014641	.014641	.0000	2.245	.787
15	.016471	.016471	.0000	2.245	.720
16	.018301	.018301	.0000	2.245	.722
17	.022877	.022877	.0000	2.245	.724
18	.027452	.027452	.0000	2.245	.722
19	.032027	.032027	.0000	2.245	.721
20	.036603	.036603	.0000	2.245	.721

21	.041178	.041178	.0000	2.245	.712
22	.045753	.045753	.0000	2.245	.712
23	.050329	.050329	.0000	2.245	.706
24	.054904	.054904	.0000	2.245	.705
25	.064055	.064055	.0000	2.245	.708
26	.073205	.073205	.0000	2.245	.693
27	.082356	.082356	.0000	2.245	.688
28	.091507	.091507	.0000	2.245	.691
29	.100657	.100657	.0000	2.245	.702
30	.109808	.109808	.0000	2.245	.694
31	.118959	.118959	.0000	2.245	.701
32	.128109	.128109	.0000	2.245	.710
33	.137260	.137260	.0000	2.245	.723
34	.146411	.146411	.0000	2.245	.728
35	.155561	.155561	.0000	2.245	.733
36	.164712	.164712	.0000	2.245	.736
37	.173863	.173863	.0000	2.245	.733
38	.183013	.183013	.0000	2.245	.722
39	.192164	.192164	.0000	2.245	.704
40	.201315	.201315	.0000	2.245	.692
41	.210465	.210465	.0000	2.245	.688

READING NUMBER	SIG1 (KSF)	PWP (KSF)	EFF SIG1 (KSF)	EFF SIG3 (KSF)	TOTAL STRESS RATIO	EFF STRESS RATIO	Q (KSF) CAMBRIDGE	P (KSF) PARAMETERS	Q/P
1	2.00	.07	1.93	1.93	1.00	1.00	.00	1.93	.00
2	2.02	.09	1.94	1.91	1.01	1.01	.02	1.92	.01
3	2.13	.16	1.98	1.84	1.07	1.07	.13	1.89	.07
4	2.32	.29	2.03	1.71	1.16	1.19	.32	1.82	.18
5	2.48	.37	2.11	1.63	1.24	1.30	.48	1.79	.27
6	2.60	.46	2.14	1.54	1.30	1.39	.60	1.74	.35
7	2.71	.53	2.18	1.47	1.36	1.49	.71	1.70	.42
8	2.81	.59	2.22	1.41	1.41	1.58	.81	1.68	.48
9	2.89	.66	2.22	1.34	1.44	1.66	.89	1.63	.54
10	2.96	.72	2.24	1.28	1.48	1.75	.96	1.60	.60
11	3.03	.76	2.27	1.24	1.52	1.84	1.03	1.58	.65
12	3.17	.85	2.32	1.15	1.58	2.01	1.17	1.54	.76
13	3.28	.94	2.34	1.06	1.64	2.20	1.28	1.49	.86
14	3.28	1.01	2.27	.99	1.64	2.29	1.28	1.42	.90
15	3.46	1.05	2.41	.95	1.73	2.54	1.46	1.44	1.02
16	3.52	1.09	2.42	.91	1.76	2.67	1.52	1.41	1.07
17	3.71	1.24	2.47	.76	1.85	3.24	1.71	1.33	1.28
18	3.85	1.34	2.51	.66	1.93	3.80	1.85	1.28	1.45
19	3.96	1.41	2.55	.59	1.98	4.32	1.96	1.24	1.58
20	4.06	1.48	2.57	.52	2.03	4.98	2.06	1.20	1.71
21	4.14	1.53	2.62	.47	2.07	5.52	2.14	1.19	1.80
22	4.22	1.58	2.64	.42	2.11	6.35	2.22	1.16	1.92
23	4.28	1.61	2.67	.39	2.14	6.90	2.28	1.15	1.99
24	4.33	1.64	2.68	.36	2.16	7.49	2.33	1.13	2.05
25	4.40	1.70	2.70	.30	2.20	8.97	2.40	1.10	2.18
26	4.47	1.71	2.76	.29	2.24	9.63	2.47	1.11	2.23
27	4.49	1.71	2.78	.29	2.25	9.69	2.49	1.12	2.23
28	4.48	1.71	2.77	.29	2.24	9.65	2.48	1.11	2.23
29	4.44	1.71	2.73	.29	2.22	9.52	2.44	1.10	2.22

30	4.32	1.61	2.71	.39	2.16	7.00	2.32	1.16	2.00
31	4.22	1.56	2.66	.44	2.11	5.98	2.22	1.18	1.87
32	4.13	1.51	2.62	.49	2.06	5.36	2.13	1.20	1.78
33	4.07	1.50	2.57	.50	2.03	5.12	2.07	1.19	1.74
34	4.04	1.48	2.55	.52	2.02	4.94	2.04	1.20	1.70
35	4.00	1.47	2.54	.53	2.00	4.77	2.00	1.20	1.67
36	3.97	1.45	2.52	.55	1.99	4.62	1.97	1.20	1.64
37	3.95	1.43	2.52	.57	1.97	4.39	1.95	1.22	1.59
38	3.91	1.38	2.53	.62	1.96	4.10	1.91	1.26	1.52
39	3.88	1.32	2.56	.68	1.94	3.79	1.88	1.30	1.44
40	3.85	1.28	2.57	.72	1.93	3.58	1.85	1.34	1.39
41	3.82	1.25	2.57	.75	1.91	3.44	1.82	1.35	1.34

ENGINEERING AND TESTING CONSULTANTS, INC.
TRIAXIAL SHEAR TEST

Project Name: Midtown Tunnel
Project Number: 4955-110
Boring Number: 10BH-005 (P2) @ 66 to 68 Feet (Middle), Pt.2
Sample Description: Organic CLAY (OH), Dark Brown, with Silt, with Fine to Medium Sand

CONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAIN CONTROL

P R O P E R T I E S

SPECIFIC GRAVITY = 2.544
LIQUID LIMIT = 169
PLASTIC LIMIT = 48
MEASURED VOLUME CHANGE = -5.952 IN3
CELL PRESSURE = 7.64 KSF
CONSOLIDATION PRESSURE = 4.00 KSF

PROPERTY		INITIAL	CONSOLIDATED	
HEIGHT	=	5.769	5.395	INCHES
VOID RATIO	=	2.383	1.832	
AREA	=	6.341	5.677	SQ. IN.
PERCENT MOISTURE	=	92.16	72.03	PERCENT
WET DENSITY	=	90.18	96.42	PCF
DRY DENSITY	=	46.93	56.05	PCF
PERCENT SATURATION	=	98.40	100.01	PERCENT

NOTE - CONSOLIDATED PROPERTIES CALCULATED FROM MEASURED VOLUME CHANGE

O U T P U T D A T A

READING NUMBER	STRAIN (IN/IN)	SHEAR STRAIN	VOLUME STRAIN (CC/CC)	VOID RATIO	A FACTOR
1	.000000	.000000	.0000	1.831	.000
2	.000927	.000927	.0000	1.831	1.091
3	.001853	.001853	.0000	1.831	.987
4	.002780	.002780	.0000	1.831	.899
5	.003707	.003707	.0000	1.831	.860
6	.004634	.004634	.0000	1.831	.828
7	.005560	.005560	.0000	1.831	.827
8	.006487	.006487	.0000	1.831	.825
9	.007414	.007414	.0000	1.831	.826
10	.008341	.008341	.0000	1.831	.829
11	.009267	.009267	.0000	1.831	.817
12	.011121	.011121	.0000	1.831	.825
13	.012974	.012974	.0000	1.831	.825
14	.014828	.014828	.0000	1.831	.837
15	.016681	.016681	.0000	1.831	.841
16	.018535	.018535	.0000	1.831	.837
17	.023168	.023168	.0000	1.831	.853
18	.027802	.027802	.0000	1.831	.875

19	.032436	.032436	.0000	1.831	.875
20	.037069	.037069	.0000	1.831	.892
21	.041703	.041703	.0000	1.831	.903
22	.046337	.046337	.0000	1.831	.911
23	.050970	.050970	.0000	1.831	.922
24	.055604	.055604	.0000	1.831	.929
25	.064871	.064871	.0000	1.831	.938
26	.074139	.074139	.0000	1.831	.964
27	.083406	.083406	.0000	1.831	.987
28	.092673	.092673	.0000	1.831	1.002
29	.101940	.101940	.0000	1.831	1.023
30	.111208	.111208	.0000	1.831	1.042
31	.120475	.120475	.0000	1.831	1.072
32	.129742	.129742	.0000	1.831	1.112
33	.139010	.139010	.0000	1.831	1.146
34	.148277	.148277	.0000	1.831	1.179
35	.157544	.157544	.0000	1.831	1.202
36	.166812	.166812	.0000	1.831	1.236
37	.176079	.176079	.0000	1.831	1.272
38	.185346	.185346	.0000	1.831	1.309
39	.194614	.194614	.0000	1.831	1.345
40	.203881	.203881	.0000	1.831	1.374
41	.213148	.213148	.0000	1.831	1.433

READING NUMBER	SIG1 (KSF)	PWP (KSF)	EFF SIG1 (KSF)	EFF SIG3 (KSF)	TOTAL STRESS RATIO	EFF STRESS RATIO	Q (KSF) CAMBRIDGE	P (KSF) PARAMETERS	Q/P
1	4.00	.14	3.86	3.86	1.00	1.00	.00	3.86	.00
2	4.40	.43	3.96	3.57	1.10	1.11	.39	3.70	.11
3	4.71	.71	4.01	3.29	1.18	1.22	.71	3.53	.20
4	4.94	.85	4.10	3.15	1.24	1.30	.94	3.47	.27
5	5.14	.98	4.16	3.02	1.28	1.38	1.14	3.40	.33
6	5.29	1.07	4.22	2.93	1.32	1.44	1.29	3.36	.38
7	5.39	1.15	4.24	2.85	1.35	1.49	1.39	3.31	.42
8	5.50	1.24	4.26	2.76	1.38	1.54	1.50	3.26	.46
9	5.59	1.31	4.27	2.69	1.40	1.59	1.58	3.22	.49
10	5.67	1.38	4.28	2.62	1.42	1.64	1.67	3.17	.53
11	5.74	1.43	4.32	2.57	1.44	1.68	1.74	3.16	.55
12	5.88	1.56	4.33	2.45	1.47	1.77	1.88	3.07	.61
13	6.01	1.66	4.35	2.34	1.50	1.86	2.01	3.01	.67
14	6.11	1.77	4.34	2.23	1.53	1.95	2.11	2.93	.72
15	6.19	1.84	4.35	2.16	1.55	2.02	2.19	2.89	.76
16	6.29	1.92	4.37	2.09	1.57	2.10	2.29	2.85	.80
17	6.46	2.10	4.36	1.90	1.62	2.30	2.46	2.72	.91
18	6.58	2.26	4.32	1.74	1.65	2.49	2.58	2.60	.99
19	6.70	2.36	4.34	1.64	1.67	2.65	2.70	2.54	1.06
20	6.78	2.48	4.30	1.52	1.69	2.82	2.78	2.45	1.13
21	6.87	2.59	4.28	1.41	1.72	3.04	2.87	2.36	1.21
22	6.92	2.66	4.26	1.34	1.73	3.19	2.92	2.31	1.27
23	6.97	2.74	4.23	1.26	1.74	3.35	2.97	2.25	1.32
24	7.01	2.79	4.21	1.21	1.75	3.49	3.00	2.21	1.36
25	7.10	2.91	4.19	1.09	1.77	3.84	3.10	2.12	1.46
26	7.15	3.04	4.11	.96	1.79	4.27	3.15	2.01	1.57

27	7.18	3.14	4.04	.86	1.79	4.69	3.18	1.92	1.65
28	7.18	3.18	3.99	.82	1.79	4.88	3.18	1.88	1.69
29	7.17	3.24	3.93	.76	1.79	5.17	3.17	1.82	1.74
30	7.16	3.30	3.87	.70	1.79	5.50	3.16	1.76	1.80
31	7.08	3.30	3.78	.70	1.77	5.38	3.08	1.73	1.78
32	6.96	3.30	3.67	.70	1.74	5.22	2.96	1.69	1.75
33	6.86	3.28	3.58	.72	1.72	4.99	2.86	1.67	1.71
34	6.76	3.25	3.50	.75	1.69	4.70	2.76	1.67	1.66
35	6.66	3.20	3.46	.80	1.66	4.31	2.66	1.69	1.57
36	6.57	3.18	3.39	.82	1.64	4.15	2.57	1.68	1.54
37	6.49	3.17	3.32	.83	1.62	3.99	2.49	1.66	1.50
38	6.41	3.15	3.26	.85	1.60	3.84	2.41	1.65	1.46
39	6.34	3.15	3.19	.85	1.59	3.77	2.34	1.63	1.44
40	6.28	3.14	3.14	.86	1.57	3.65	2.28	1.62	1.41
41	6.18	3.12	3.06	.88	1.54	3.49	2.18	1.60	1.36

ENGINEERING AND TESTING CONSULTANTS, INC.
TRIAXIAL SHEAR TEST

Project Name: Midtown Tunnel
Project Number: 4955-110
Boring Number: 10BH-005 (P2) @ 66 to 68 Feet (Bottom), Pt.3
Sample Description: Organic CLAY (OH), Dark Brown, with Silt, with Fine to Medium Sand

CONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAIN CONTROL

P R O P E R T I E S

SPECIFIC GRAVITY	= 2.544	
LIQUID LIMIT	= 169	
PLASTIC LIMIT	= 48	
MEASURED VOLUME CHANGE	= -8.664	IN3
CELL PRESSURE	= 9.60	KSF
CONSOLIDATION PRESSURE	= 6.00	KSF

PROPERTY		INITIAL	CONSOLIDATED	
HEIGHT	=	5.776	5.180	INCHES
VOID RATIO	=	2.385	1.585	
AREA	=	6.345	5.403	SQ. IN.
PERCENT MOISTURE	=	86.36	62.31	PERCENT
WET DENSITY	=	87.39	99.68	PCF
DRY DENSITY	=	46.89	61.41	PCF
PERCENT SATURATION	=	92.11	100.02	PERCENT

NOTE - CONSOLIDATED PROPERTIES CALCULATED FROM MEASURED VOLUME CHANGE

O U T P U T D A T A

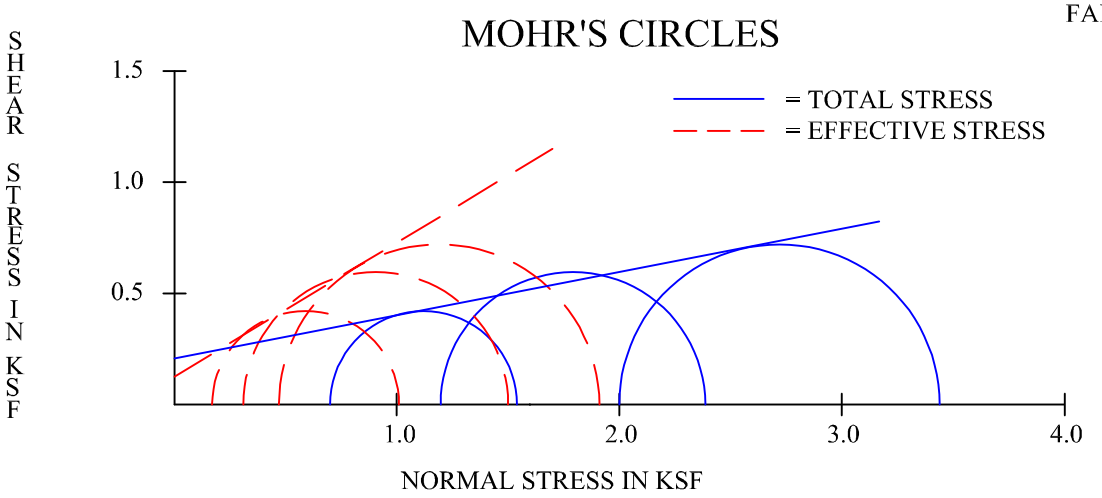
READING NUMBER	STRAIN (IN/IN)	SHEAR STRAIN	VOLUME STRAIN (CC/CC)	VOID RATIO	A FACTOR
1	.000000	.000000	.0000	1.584	.000
2	.000965	.000965	.0000	1.584	1.267
3	.001930	.001930	.0000	1.584	.989
4	.002896	.002896	.0000	1.584	1.019
5	.003861	.003861	.0000	1.584	.949
6	.004826	.004826	.0000	1.584	.930
7	.005791	.005791	.0000	1.584	.929
8	.006756	.006756	.0000	1.584	.915
9	.007722	.007722	.0000	1.584	.911
10	.008687	.008687	.0000	1.584	.914
11	.009652	.009652	.0000	1.584	.895
12	.011582	.011582	.0000	1.584	.910
13	.013513	.013513	.0000	1.584	.910
14	.015443	.015443	.0000	1.584	.922
15	.017374	.017374	.0000	1.584	.939
16	.019304	.019304	.0000	1.584	.921
17	.024130	.024130	.0000	1.584	.934
18	.028956	.028956	.0000	1.584	.982

19	.033782	.033782	.0000	1.584	.999
20	.038608	.038608	.0000	1.584	1.012
21	.043434	.043434	.0000	1.584	1.021
22	.048260	.048260	.0000	1.584	1.036
23	.053086	.053086	.0000	1.584	1.053
24	.057912	.057912	.0000	1.584	1.073
25	.067564	.067564	.0000	1.584	1.085
26	.077216	.077216	.0000	1.584	1.104
27	.086868	.086868	.0000	1.584	1.122
28	.096520	.096520	.0000	1.584	1.141
29	.106171	.106171	.0000	1.584	1.162
30	.115823	.115823	.0000	1.584	1.181
31	.125475	.125475	.0000	1.584	1.205
32	.135127	.135127	.0000	1.584	1.230
33	.144779	.144779	.0000	1.584	1.246
34	.154431	.154431	.0000	1.584	1.275
35	.164083	.164083	.0000	1.584	1.292
36	.173735	.173735	.0000	1.584	1.329
37	.183387	.183387	.0000	1.584	1.360
38	.193039	.193039	.0000	1.584	1.405
39	.202691	.202691	.0000	1.584	1.432
40	.212343	.212343	.0000	1.584	1.459
41	.221995	.221995	.0000	1.584	1.480

READING NUMBER	SIG1 (KSF)	PWP (KSF)	EFF SIG1 (KSF)	EFF SIG3 (KSF)	TOTAL STRESS RATIO	EFF STRESS RATIO	Q (KSF) CAMBRIDGE	P (KSF) PARAMETERS	Q/P
1	6.00	.26	5.74	5.74	1.00	1.00	.00	5.74	.00
2	6.41	.52	5.89	5.48	1.07	1.07	.41	5.62	.07
3	6.83	.82	6.01	5.18	1.14	1.16	.83	5.45	.15
4	7.06	1.08	5.98	4.92	1.18	1.22	1.06	5.27	.20
5	7.33	1.27	6.07	4.73	1.22	1.28	1.33	5.18	.26
6	7.55	1.44	6.11	4.56	1.26	1.34	1.55	5.07	.30
7	7.72	1.60	6.12	4.40	1.29	1.39	1.72	4.97	.35
8	7.89	1.73	6.16	4.27	1.31	1.44	1.89	4.90	.39
9	8.02	1.84	6.18	4.16	1.34	1.49	2.02	4.83	.42
10	8.14	1.96	6.18	4.04	1.36	1.53	2.14	4.75	.45
11	8.28	2.04	6.24	3.95	1.38	1.58	2.28	4.72	.48
12	8.47	2.25	6.22	3.75	1.41	1.66	2.47	4.58	.54
13	8.63	2.39	6.23	3.61	1.44	1.73	2.63	4.48	.59
14	8.76	2.55	6.21	3.45	1.46	1.80	2.76	4.37	.63
15	8.88	2.71	6.18	3.29	1.48	1.88	2.88	4.25	.68
16	8.97	2.74	6.23	3.26	1.49	1.91	2.97	4.25	.70
17	9.21	3.00	6.21	3.00	1.53	2.07	3.21	4.07	.79
18	9.34	3.28	6.06	2.72	1.56	2.23	3.34	3.83	.87
19	9.47	3.47	6.00	2.53	1.58	2.37	3.47	3.69	.94
20	9.58	3.63	5.95	2.37	1.60	2.51	3.58	3.57	1.01
21	9.68	3.76	5.92	2.24	1.61	2.64	3.68	3.47	1.06
22	9.75	3.89	5.86	2.11	1.63	2.78	3.75	3.36	1.12
23	9.80	4.00	5.80	2.00	1.63	2.90	3.80	3.26	1.17
24	9.85	4.13	5.72	1.87	1.64	3.06	3.85	3.15	1.22
25	9.94	4.28	5.66	1.72	1.66	3.29	3.94	3.04	1.30
26	9.99	4.41	5.58	1.59	1.67	3.50	3.99	2.92	1.37

27	10.04	4.54	5.50	1.46	1.67	3.76	4.04	2.81	1.44
28	10.06	4.64	5.43	1.36	1.68	3.98	4.06	2.72	1.50
29	10.06	4.72	5.34	1.28	1.68	4.19	4.07	2.63	1.55
30	10.07	4.81	5.26	1.19	1.68	4.42	4.07	2.55	1.60
31	10.05	4.88	5.17	1.12	1.68	4.63	4.05	2.47	1.64
32	10.02	4.95	5.07	1.05	1.67	4.85	4.03	2.39	1.69
33	9.97	4.95	5.02	1.05	1.66	4.80	3.97	2.37	1.68
34	9.88	4.95	4.93	1.05	1.65	4.72	3.88	2.34	1.66
35	9.83	4.95	4.88	1.05	1.64	4.67	3.83	2.32	1.65
36	9.73	4.95	4.77	1.05	1.62	4.56	3.73	2.29	1.63
37	9.61	4.91	4.70	1.09	1.60	4.32	3.61	2.29	1.58
38	9.47	4.88	4.59	1.12	1.58	4.11	3.47	2.28	1.53
39	9.38	4.84	4.54	1.16	1.56	3.91	3.38	2.29	1.48
40	9.30	4.81	4.49	1.19	1.55	3.77	3.30	2.29	1.44
41	9.22	4.77	4.45	1.23	1.54	3.61	3.22	2.31	1.40

MOHR'S CIRCLES



FAILURE PICTURES



Pt.1

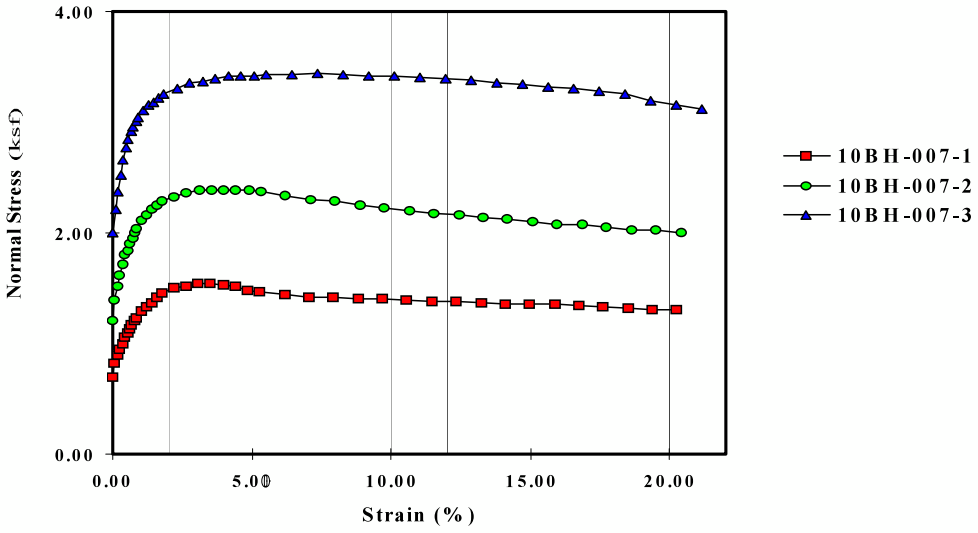


Pt.2



Pt.3

STRESS-STRAIN GRAPH
10BH-007 (P1) at 14 to 16 feet



SAMPLE NO.	Pt.1	Pt.2	Pt.3
Confining Pressure, ksf	0.70	1.20	2.00
Initial Length, In.	5.78	5.78	5.78
Initial Diameter, In.	2.84	2.83	2.80
Wet Unit Weight, pcf	93.98	95.99	99.28
Moisture Content, %	83.52	66.40	75.21
Initial Void Ratio	2.095	1.748	1.797
Initial Percent Saturation, %	101.25	96.51	106.30
Initial Area, Sq. In.	6.348	6.304	6.152
Liquid Limit, LL	98		
Plastic Limit, PL	58		
Specific Gravity	2.540		
Cohesion, ksf	0.21		
Angle of Shear Resistance (ϕ)	11		

TRIAXIAL COMPRESSION TEST

PROJECT	MIDTOWN TUNNEL NORFOLK, VA
PROJECT NO.	4955-110
TYPE OF SPECIMEN	PISTON
SAMPLE NO.	10BH-007 (P1)
DEPTH	14 to 16 Feet
SOIL DESCRIPTION	ORGANIC CLAY (OH), Dark Gray and Brown, with Silt, with Fine Sand
TEST METHOD	ASTM D4767, CU Triaxial
RATE OF SHEAR	0.002 in./min.

ENGINEERING AND TESTING CONSULTANTS

ENGINEERING AND TESTING CONSULTANTS, INC.
TRIAXIAL SHEAR TEST

Project Name: Midtown Tunnel
Project Number: 4955-110
Boring Number: 10BH-007 (P1) @ 66 to 68 Feet (Top), Pt.1
Sample Description: Organic CLAY (OH), Dark Gray and Brown, with Silt, with Fine Sand

CONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAIN CONTROL

P R O P E R T I E S

SPECIFIC GRAVITY = 2.540
LIQUID LIMIT = 98
PLASTIC LIMIT = 58
MEASURED VOLUME CHANGE = -1.818 IN3
CELL PRESSURE = 4.31 KSF
CONSOLIDATION PRESSURE = .70 KSF

PROPERTY	INITIAL	CONSOLIDATED	
HEIGHT	= 5.779	5.679	INCHES
VOID RATIO	= 2.095	1.942	
AREA	= 6.348	6.140	SQ. IN.
PERCENT MOISTURE	= 83.52	76.45	PERCENT
WET DENSITY	= 93.98	95.07	PCF
DRY DENSITY	= 51.21	53.88	PCF
PERCENT SATURATION	= 101.25	100.00	PERCENT

NOTE - CONSOLIDATED PROPERTIES CALCULATED FROM MEASURED VOLUME CHANGE

O U T P U T D A T A

READING NUMBER	STRAIN (IN/IN)	SHEAR STRAIN	VOLUME STRAIN (CC/CC)	VOID RATIO	A FACTOR
1	.000000	.000000	.0000	1.941	.000
2	.000881	.000881	.0000	1.941	1.359
3	.001761	.001761	.0000	1.941	1.157
4	.002642	.002642	.0000	1.941	1.056
5	.003522	.003522	.0000	1.941	.948
6	.004403	.004403	.0000	1.941	.897
7	.005283	.005283	.0000	1.941	.878
8	.006164	.006164	.0000	1.941	.839
9	.007044	.007044	.0000	1.941	.797
10	.007925	.007925	.0000	1.941	.773
11	.008805	.008805	.0000	1.941	.789
12	.010566	.010566	.0000	1.941	.733
13	.012327	.012327	.0000	1.941	.726
14	.014088	.014088	.0000	1.941	.707
15	.015849	.015849	.0000	1.941	.678
16	.017610	.017610	.0000	1.941	.670
17	.022013	.022013	.0000	1.941	.648
18	.026415	.026415	.0000	1.941	.629

19	.030818	.030818	.0000	1.941	.623
20	.035220	.035220	.0000	1.941	.630
21	.039623	.039623	.0000	1.941	.625
22	.044025	.044025	.0000	1.941	.624
23	.048428	.048428	.0000	1.941	.629
24	.052830	.052830	.0000	1.941	.620
25	.061635	.061635	.0000	1.941	.642
26	.070441	.070441	.0000	1.941	.656
27	.079246	.079246	.0000	1.941	.668
28	.088051	.088051	.0000	1.941	.675
29	.096856	.096856	.0000	1.941	.681
30	.105661	.105661	.0000	1.941	.688
31	.114466	.114466	.0000	1.941	.695
32	.123271	.123271	.0000	1.941	.702
33	.132076	.132076	.0000	1.941	.709
34	.140881	.140881	.0000	1.941	.716
35	.149686	.149686	.0000	1.941	.723
36	.158491	.158491	.0000	1.941	.731
37	.167296	.167296	.0000	1.941	.743
38	.176101	.176101	.0000	1.941	.730
39	.184906	.184906	.0000	1.941	.741
40	.193711	.193711	.0000	1.941	.749
41	.202516	.202516	.0000	1.941	.757

READING NUMBER	SIG1 (KSF)	PWP (KSF)	EFF SIG1 (KSF)	EFF SIG3 (KSF)	TOTAL STRESS RATIO	EFF STRESS RATIO	Q (KSF) CAMBRIDGE	P (KSF) PARAMETERS	Q/P
1	.70	.07	.63	.63	1.00	1.00	.00	.63	.00
2	.82	.16	.66	.54	1.17	1.21	.12	.58	.20
3	.89	.22	.67	.48	1.27	1.38	.19	.55	.34
4	.94	.26	.68	.44	1.35	1.55	.24	.52	.47
5	1.00	.29	.71	.41	1.43	1.74	.30	.51	.59
6	1.05	.32	.74	.38	1.50	1.92	.35	.50	.70
7	1.09	.35	.75	.35	1.56	2.11	.39	.49	.81
8	1.13	.36	.77	.34	1.61	2.26	.43	.48	.89
9	1.17	.37	.79	.33	1.67	2.44	.47	.48	.97
10	1.20	.39	.81	.31	1.72	2.61	.50	.48	1.05
11	1.23	.42	.81	.28	1.75	2.87	.53	.46	1.15
12	1.29	.43	.86	.27	1.84	3.20	.59	.46	1.27
13	1.33	.46	.87	.24	1.91	3.65	.63	.45	1.41
14	1.37	.48	.90	.22	1.96	3.99	.67	.45	1.50
15	1.42	.49	.93	.21	2.03	4.43	.72	.45	1.60
16	1.45	.50	.95	.20	2.07	4.83	.75	.45	1.68
17	1.50	.52	.98	.18	2.14	5.40	.80	.45	1.78
18	1.52	.52	1.01	.18	2.18	5.54	.82	.46	1.81
19	1.54	.53	1.02	.17	2.20	5.83	.84	.45	1.85
20	1.54	.53	1.01	.17	2.21	6.06	.84	.45	1.88
21	1.53	.52	1.01	.18	2.18	5.56	.83	.46	1.81
22	1.51	.50	1.00	.20	2.15	5.12	.81	.46	1.74
23	1.48	.49	.99	.21	2.11	4.70	.78	.47	1.66
24	1.46	.48	.99	.22	2.09	4.40	.76	.48	1.59
25	1.44	.48	.96	.22	2.06	4.29	.74	.47	1.57
26	1.42	.48	.95	.22	2.03	4.22	.72	.47	1.55

27	1.41	.48	.93	.22	2.01	4.16	.71	.46	1.54
28	1.40	.48	.93	.22	2.01	4.13	.70	.46	1.53
29	1.40	.48	.92	.22	2.00	4.10	.70	.46	1.52
30	1.39	.48	.91	.22	1.99	4.07	.69	.45	1.52
31	1.38	.48	.91	.22	1.98	4.04	.68	.45	1.51
32	1.38	.48	.90	.22	1.97	4.01	.68	.45	1.50
33	1.37	.48	.89	.22	1.96	3.98	.67	.45	1.49
34	1.36	.48	.89	.22	1.95	3.95	.66	.45	1.49
35	1.36	.48	.88	.22	1.94	3.92	.66	.44	1.48
36	1.35	.48	.87	.22	1.93	3.89	.65	.44	1.47
37	1.34	.48	.86	.22	1.91	3.84	.64	.44	1.46
38	1.33	.46	.87	.24	1.90	3.63	.63	.45	1.40
39	1.32	.46	.86	.24	1.89	3.60	.62	.45	1.39
40	1.31	.46	.85	.24	1.88	3.57	.61	.44	1.38
41	1.31	.46	.85	.24	1.87	3.54	.61	.44	1.38

ENGINEERING AND TESTING CONSULTANTS, INC.
TRIAXIAL SHEAR TEST

Project Name: Midtown Tunnel
Project Number: 4955-110
Boring Number: 10BH-007 (P1) @ 66 to 68 Feet (Middle), Pt.2
Sample Description: Organic CLAY (OH), Dark Gray and Brown, with Silt, with Fine Sand

CONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAIN CONTROL

P R O P E R T I E S

SPECIFIC GRAVITY = 2.540
LIQUID LIMIT = 98
PLASTIC LIMIT = 58
MEASURED VOLUME CHANGE = -2.398 IN3
CELL PRESSURE = 4.81 KSF
CONSOLIDATION PRESSURE = 1.20 KSF

PROPERTY		INITIAL	CONSOLIDATED	
HEIGHT	=	5.775	5.640	INCHES
VOID RATIO	=	1.748	1.567	
AREA	=	6.304	6.030	SQ. IN.
PERCENT MOISTURE	=	66.40	61.68	PERCENT
WET DENSITY	=	95.99	99.84	PCF
DRY DENSITY	=	57.68	61.75	PCF
PERCENT SATURATION	=	96.51	100.00	PERCENT

NOTE - CONSOLIDATED PROPERTIES CALCULATED FROM MEASURED VOLUME CHANGE

O U T P U T D A T A

READING NUMBER	STRAIN (IN/IN)	SHEAR STRAIN	VOLUME STRAIN (CC/CC)	VOID RATIO	A FACTOR
1	.000000	.000000	.0000	1.566	.000
2	.000887	.000887	.0000	1.566	1.071
3	.001773	.001773	.0000	1.566	.854
4	.002660	.002660	.0000	1.566	.780
5	.003546	.003546	.0000	1.566	.754
6	.004433	.004433	.0000	1.566	.716
7	.005320	.005320	.0000	1.566	.738
8	.006206	.006206	.0000	1.566	.705
9	.007093	.007093	.0000	1.566	.707
10	.007979	.007979	.0000	1.566	.703
11	.008866	.008866	.0000	1.566	.706
12	.010639	.010639	.0000	1.566	.689
13	.012412	.012412	.0000	1.566	.690
14	.014185	.014185	.0000	1.566	.713
15	.015959	.015959	.0000	1.566	.713
16	.017732	.017732	.0000	1.566	.715
17	.022165	.022165	.0000	1.566	.718
18	.026598	.026598	.0000	1.566	.719

19	.031031	.031031	.0000	1.566	.726
20	.035464	.035464	.0000	1.566	.751
21	.039896	.039896	.0000	1.566	.765
22	.044329	.044329	.0000	1.566	.780
23	.048762	.048762	.0000	1.566	.788
24	.053195	.053195	.0000	1.566	.796
25	.062061	.062061	.0000	1.566	.833
26	.070927	.070927	.0000	1.566	.873
27	.079793	.079793	.0000	1.566	.907
28	.088659	.088659	.0000	1.566	.944
29	.097525	.097525	.0000	1.566	.976
30	.106391	.106391	.0000	1.566	1.007
31	.115256	.115256	.0000	1.566	1.022
32	.124122	.124122	.0000	1.566	1.033
33	.132988	.132988	.0000	1.566	1.057
34	.141854	.141854	.0000	1.566	1.080
35	.150720	.150720	.0000	1.566	1.103
36	.159586	.159586	.0000	1.566	1.124
37	.168452	.168452	.0000	1.566	1.146
38	.177318	.177318	.0000	1.566	1.168
39	.186184	.186184	.0000	1.566	1.192
40	.195049	.195049	.0000	1.566	1.215
41	.203915	.203915	.0000	1.566	1.240

READING NUMBER	SIG1 (KSF)	PWP (KSF)	EFF SIG1 (KSF)	EFF SIG3 (KSF)	TOTAL STRESS RATIO	EFF STRESS RATIO	Q (KSF) CAMBRIDGE	P (KSF) PARAMETERS	Q/P
1	1.20	.07	1.13	1.13	1.00	1.00	.00	1.13	.00
2	1.39	.20	1.19	1.00	1.16	1.19	.19	1.06	.18
3	1.52	.27	1.25	.93	1.27	1.34	.32	1.03	.31
4	1.62	.33	1.29	.87	1.35	1.49	.42	1.01	.42
5	1.71	.39	1.33	.81	1.43	1.63	.51	.98	.52
6	1.80	.43	1.37	.77	1.50	1.79	.60	.97	.62
7	1.84	.48	1.37	.72	1.54	1.89	.64	.94	.69
8	1.90	.50	1.41	.70	1.59	2.00	.70	.94	.75
9	1.95	.53	1.42	.67	1.63	2.13	.75	.92	.82
10	2.00	.56	1.44	.64	1.67	2.25	.80	.90	.88
11	2.04	.59	1.44	.61	1.70	2.37	.84	.89	.94
12	2.11	.63	1.48	.57	1.76	2.59	.91	.88	1.04
13	2.16	.66	1.50	.54	1.80	2.79	.96	.86	1.12
14	2.21	.72	1.49	.48	1.84	3.10	1.01	.82	1.24
15	2.25	.75	1.50	.45	1.88	3.33	1.05	.80	1.31
16	2.29	.78	1.51	.42	1.91	3.57	1.09	.78	1.39
17	2.32	.81	1.51	.39	1.93	3.85	1.12	.77	1.46
18	2.36	.84	1.53	.36	1.97	4.19	1.16	.75	1.55
19	2.39	.86	1.52	.34	1.99	4.54	1.19	.73	1.62
20	2.39	.89	1.49	.31	1.99	4.87	1.19	.70	1.69
21	2.38	.91	1.48	.29	1.99	5.05	1.18	.69	1.72
22	2.38	.92	1.46	.28	1.98	5.25	1.18	.67	1.76
23	2.38	.93	1.45	.27	1.98	5.35	1.18	.66	1.78
24	2.37	.94	1.44	.26	1.98	5.46	1.17	.66	1.79
25	2.34	.95	1.39	.25	1.95	5.58	1.14	.63	1.81
26	2.30	.96	1.34	.23	1.92	5.70	1.10	.60	1.83

27	2.28	.98	1.30	.22	1.90	5.89	1.08	.58	1.86
28	2.25	.99	1.26	.21	1.88	6.11	1.05	.56	1.89
29	2.22	1.00	1.22	.20	1.85	6.16	1.02	.54	1.90
30	2.20	1.01	1.19	.19	1.83	6.22	1.00	.52	1.91
31	2.18	1.00	1.18	.20	1.82	5.92	.98	.52	1.86
32	2.16	.99	1.17	.21	1.80	5.66	.96	.53	1.83
33	2.14	.99	1.14	.21	1.78	5.56	.94	.52	1.81
34	2.12	.99	1.13	.21	1.77	5.46	.92	.51	1.79
35	2.10	.99	1.11	.21	1.75	5.37	.90	.51	1.78
36	2.08	.99	1.09	.21	1.74	5.29	.88	.50	1.77
37	2.07	.99	1.07	.21	1.72	5.21	.87	.49	1.75
38	2.05	.99	1.06	.21	1.71	5.13	.85	.49	1.74
39	2.03	.99	1.04	.21	1.69	5.04	.83	.48	1.72
40	2.02	.99	1.02	.21	1.68	4.96	.82	.48	1.71
41	2.00	.99	1.01	.21	1.67	4.89	.80	.47	1.69

ENGINEERING AND TESTING CONSULTANTS, INC.
TRIAXIAL SHEAR TEST

Project Name: Midtown Tunnel
Project Number: 4955-110
Boring Number: 10BH-007 (P1) @ 66 to 68 Feet (Bottom), Pt.3
Sample Description: Organic CLAY (OH), Dark Gray and Brown, with Silt, with Fine Sand

CONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAIN CONTROL

P R O P E R T I E S

SPECIFIC GRAVITY	= 2.540	
LIQUID LIMIT	= 98	
PLASTIC LIMIT	= 58	
MEASURED VOLUME CHANGE	= -5.424	IN3
CELL PRESSURE	= 5.60	KSF
CONSOLIDATION PRESSURE	= 2.00	KSF

PROPERTY	INITIAL	CONSOLIDATED	
HEIGHT	= 5.779	5.432	INCHES
VOID RATIO	= 1.797	1.370	
AREA	= 6.152	5.546	SQ. IN.
PERCENT MOISTURE	= 75.21	53.95	PERCENT
WET DENSITY	= 99.28	102.94	PCF
DRY DENSITY	= 56.66	66.87	PCF
PERCENT SATURATION	= 106.30	100.01	PERCENT

NOTE - CONSOLIDATED PROPERTIES CALCULATED FROM MEASURED VOLUME CHANGE

O U T P U T D A T A

READING NUMBER	STRAIN (IN/IN)	SHEAR STRAIN	VOLUME STRAIN (CC/CC)	VOID RATIO	A FACTOR
1	.000000	.000000	.0000	1.370	.000
2	.000920	.000920	.0000	1.370	.681
3	.001841	.001841	.0000	1.370	.768
4	.002761	.002761	.0000	1.370	.773
5	.003682	.003682	.0000	1.370	.760
6	.004602	.004602	.0000	1.370	.769
7	.005523	.005523	.0000	1.370	.770
8	.006443	.006443	.0000	1.370	.801
9	.007364	.007364	.0000	1.370	.822
10	.008284	.008284	.0000	1.370	.808
11	.009204	.009204	.0000	1.370	.829
12	.011045	.011045	.0000	1.370	.839
13	.012886	.012886	.0000	1.370	.846
14	.014727	.014727	.0000	1.370	.865
15	.016568	.016568	.0000	1.370	.873
16	.018409	.018409	.0000	1.370	.885
17	.023011	.023011	.0000	1.370	.905
18	.027613	.027613	.0000	1.370	.927

19	.032215	.032215	.0000	1.370	.945
20	.036818	.036818	.0000	1.370	.965
21	.041420	.041420	.0000	1.370	.980
22	.046022	.046022	.0000	1.370	.994
23	.050624	.050624	.0000	1.370	1.010
24	.055226	.055226	.0000	1.370	1.024
25	.064431	.064431	.0000	1.370	1.043
26	.073635	.073635	.0000	1.370	1.063
27	.082840	.082840	.0000	1.370	1.087
28	.092044	.092044	.0000	1.370	1.115
29	.101249	.101249	.0000	1.370	1.133
30	.110453	.110453	.0000	1.370	1.147
31	.119657	.119657	.0000	1.370	1.160
32	.128862	.128862	.0000	1.370	1.181
33	.138066	.138066	.0000	1.370	1.203
34	.147271	.147271	.0000	1.370	1.223
35	.156475	.156475	.0000	1.370	1.242
36	.165679	.165679	.0000	1.370	1.263
37	.174884	.174884	.0000	1.370	1.283
38	.184088	.184088	.0000	1.370	1.315
39	.193293	.193293	.0000	1.370	1.379
40	.202497	.202497	.0000	1.370	1.426
41	.211701	.211701	.0000	1.370	1.462

READING NUMBER	SIG1 (KSF)	PWP (KSF)	EFF SIG1 (KSF)	EFF SIG3 (KSF)	TOTAL STRESS RATIO	EFF STRESS RATIO	Q (KSF) CAMBRIDGE	P (KSF) PARAMETERS	Q/P
1	2.00	.03	1.97	1.97	1.00	1.00	.00	1.97	.00
2	2.21	.14	2.07	1.86	1.11	1.11	.21	1.93	.11
3	2.37	.29	2.09	1.71	1.19	1.22	.37	1.84	.20
4	2.52	.40	2.12	1.60	1.26	1.33	.52	1.77	.29
5	2.66	.50	2.16	1.50	1.33	1.44	.66	1.72	.39
6	2.77	.59	2.18	1.41	1.38	1.54	.77	1.67	.46
7	2.84	.65	2.19	1.35	1.42	1.62	.84	1.63	.51
8	2.92	.73	2.18	1.27	1.46	1.72	.92	1.57	.58
9	2.96	.79	2.17	1.21	1.48	1.80	.96	1.53	.63
10	3.01	.82	2.19	1.18	1.51	1.86	1.01	1.52	.67
11	3.04	.86	2.18	1.14	1.52	1.92	1.04	1.48	.70
12	3.10	.92	2.18	1.08	1.55	2.02	1.10	1.44	.76
13	3.15	.97	2.18	1.03	1.57	2.12	1.15	1.41	.81
14	3.18	1.02	2.16	.98	1.59	2.21	1.18	1.37	.86
15	3.22	1.07	2.15	.93	1.61	2.31	1.22	1.34	.91
16	3.25	1.11	2.14	.89	1.63	2.40	1.25	1.31	.96
17	3.30	1.18	2.12	.82	1.65	2.59	1.30	1.25	1.04
18	3.35	1.25	2.10	.75	1.67	2.81	1.35	1.20	1.13
19	3.37	1.30	2.07	.70	1.69	2.95	1.37	1.16	1.18
20	3.39	1.34	2.05	.66	1.69	3.10	1.39	1.12	1.23
21	3.41	1.38	2.03	.62	1.70	3.28	1.41	1.09	1.30
22	3.42	1.41	2.01	.59	1.71	3.41	1.42	1.06	1.34
23	3.42	1.44	1.98	.56	1.71	3.54	1.42	1.03	1.38
24	3.43	1.47	1.96	.53	1.72	3.70	1.43	1.01	1.42
25	3.43	1.50	1.94	.50	1.72	3.85	1.43	.98	1.46
26	3.44	1.53	1.91	.47	1.72	4.03	1.44	.95	1.51

27	3.43	1.56	1.87	.44	1.71	4.21	1.43	.92	1.55
28	3.42	1.58	1.84	.42	1.71	4.41	1.42	.89	1.60
29	3.41	1.60	1.81	.40	1.70	4.51	1.41	.87	1.62
30	3.40	1.61	1.79	.39	1.70	4.55	1.40	.86	1.63
31	3.39	1.61	1.78	.39	1.69	4.59	1.39	.85	1.63
32	3.38	1.63	1.75	.37	1.69	4.69	1.38	.83	1.65
33	3.36	1.63	1.72	.37	1.68	4.71	1.36	.82	1.66
34	3.34	1.64	1.70	.36	1.67	4.74	1.34	.81	1.66
35	3.32	1.64	1.68	.36	1.66	4.68	1.32	.80	1.65
36	3.30	1.64	1.66	.36	1.65	4.62	1.30	.79	1.64
37	3.28	1.64	1.64	.36	1.64	4.57	1.28	.78	1.63
38	3.25	1.64	1.61	.36	1.62	4.48	1.25	.77	1.61
39	3.19	1.64	1.55	.36	1.59	4.32	1.19	.76	1.58
40	3.15	1.64	1.51	.36	1.57	4.21	1.15	.74	1.55
41	3.12	1.64	1.48	.36	1.56	4.13	1.12	.73	1.53

Engineering and Testing Consultants, Inc.

UNCONSOLIDATED, UNDRAINED COMPRESSIVE STRENGTH OF COHESIVE SOILS
ASTM D 2850

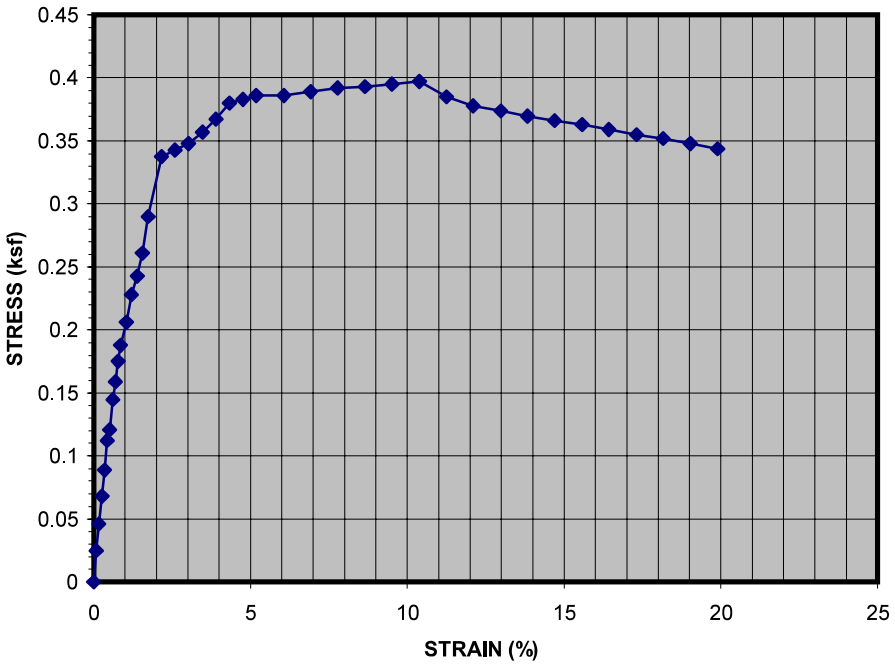
Project Name:	**Midtown Tunnel**
Number:	4955-110
Sample Number:	10BH-009 (P2) Point 1
Sample Depth:	23 to 25 feet (Middle)
Sample Description:	CLAY (CH), Dark Gray, with Silt, Trace Fine Sand
Sample Type:	Piston

Failure Photo



Deviator Stress:	**0.40 ksf**
Strain at Failure:	**10.4 %**

Rate of Strain:	1.0	%	Confining Pressure:	1.2	ksf
Avg. Sample Height:	5.781	Inches	Void Ratio:	2.318	
Avg. Sample Diameter:	2.832	Inches	Initial Area:	6.301	In²
Wet Density:	93.9	pcf	Specific Gravity:	2.525	
Dry Density:	47.5	pcf	Liquid Limit:	113	
Moisture Content:	97.8	%	Plastic Limit:	27	
Saturation:	106.52	%	Plastic Index:	86	



ENGINEERING AND TESTING CONSULTANTS, INC.
TRIAXIAL SHEAR TEST

Project Name: Midtown Tunnel
Project Number: 4955-110
Boring Number: 10BH-009 (P2) @ 23 to 25 feet
Sample Description: CLAY (CH), Dark Gray, with Silt, Trace Fine Sand

UNCONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAIN CONTROL

P R O P E R T I E S

SPECIFIC GRAVITY	=	2.525
LIQUID LIMIT	=	113
PLASTIC LIMIT	=	27
INITIAL LENGTH	=	5.78 INCHES
VOID RATIO	=	2.318
INITIAL AREA	=	6.301 SQ. IN.
MOISTURE CONTENT	=	97.78 PERCENT
WET DENSITY	=	93.92 PCF
DRY DENSITY	=	47.49 PCF
PERCENT SATURATION	=	106.52 PERCENT
CELL PRESSURE	=	1.20 KSF

I N P U T D A T A		O U T P U T D A T A		
DEF	LOAD CELL	STRAIN	V.STRESS	T.STRESS
INCHES	DIV	IN/IN	KSF	KSF
.000000	.0	.000000	.000	1.200
.005000	1.1	.000865	.025	1.225
.010000	2.0	.001730	.046	1.245
.015000	3.0	.002595	.068	1.268
.020000	3.9	.003460	.089	1.288
.025000	4.9	.004325	.112	1.311
.030000	5.3	.005189	.121	1.320
.035000	6.4	.006054	.145	1.345
.040000	7.0	.006919	.159	1.358
.045000	7.7	.007784	.175	1.374
.050000	8.3	.008649	.188	1.388
.060000	9.1	.010379	.206	1.405
.070000	10.1	.012109	.228	1.428
.080000	10.8	.013838	.243	1.443
.090000	11.6	.015568	.261	1.461
.100000	12.9	.017298	.290	1.489
.125000	15.1	.021623	.338	1.537
.150000	15.4	.025947	.343	1.542
.175000	15.7	.030272	.348	1.547
.200000	16.2	.034596	.357	1.557
.225000	16.7	.038921	.367	1.566
.250000	17.4	.043245	.380	1.580
.275000	17.6	.047570	.383	1.583
.300000	17.8	.051894	.386	1.585
.350000	18.0	.060543	.386	1.586
.400000	18.3	.069192	.389	1.589
.450000	18.6	.077841	.392	1.592

 10BH-009 (P2) @ 23 to 25 feet pt. 1, UU

.500000	18.8	.086490	.393	1.592
.550000	19.1	.095139	.395	1.595
.600000	19.4	.103788	.397	1.597
.650000	19.0	.112437	.385	1.585
.700000	18.8	.121086	.378	1.577
.750000	18.8	.129735	.374	1.573
.800000	18.8	.138384	.370	1.570
.850000	18.8	.147033	.366	1.566
.900000	18.8	.155682	.363	1.562
.950000	18.8	.164331	.359	1.559
1.000000	18.8	.172980	.355	1.555
1.050000	18.8	.181629	.352	1.551
1.100000	18.8	.190279	.348	1.547
1.150000	18.8	.198928	.344	1.544

Engineering and Testing Consultants, Inc.

UNCONSOLIDATED, UNDRAINED COMPRESSIVE STRENGTH OF COHESIVE SOILS
ASTM D 2850

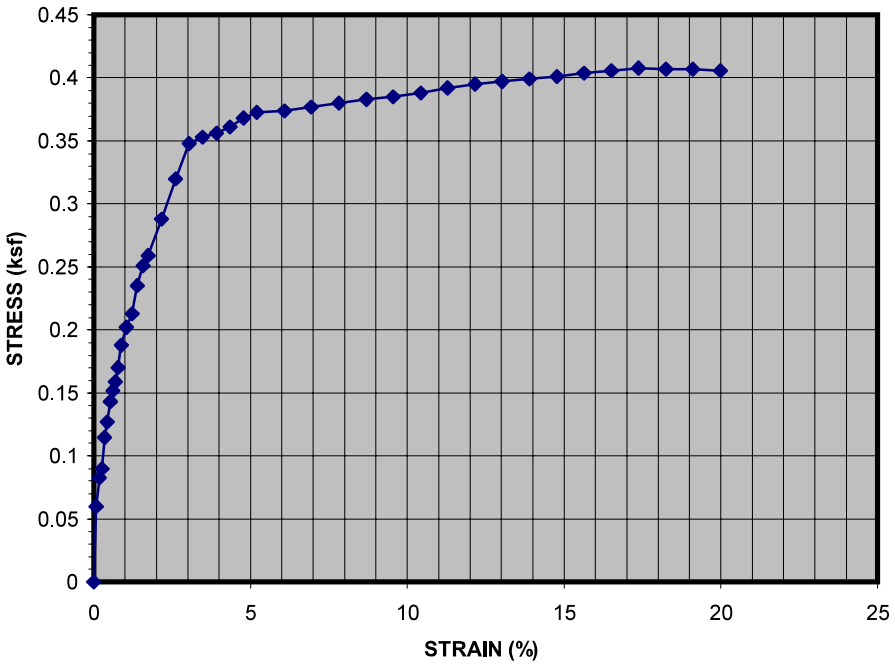
Project Name:	**Midtown Tunnel**
Number:	4955-110
Sample Number:	10BH-009 (P2) Point 2
Sample Depth:	23 to 25 feet (Top)
Sample Description:	CLAY (CH), Dark Gray, with Silt, Trace Fine Sand
Sample Type:	Piston

Failure Photo



Deviator Stress:	**0.41 ksf**
Strain at Failure:	**17.4 %**

Rate of Strain:	1.0	%	Confining Pressure:	2.4	ksf
Avg. Sample Height:	5.757	Inches	Void Ratio:	2.057	
Avg. Sample Diameter:	2.814	Inches	Initial Area:	6.218	In²
Wet Density:	96.3	pcf	Specific Gravity:	2.525	
Dry Density:	52.0	pcf	Liquid Limit:	113	
Moisture Content:	85.3	%	Plastic Limit:	27	
Saturation:	104.86	%	Plastic Index:	86	



ENGINEERING AND TESTING CONSULTANTS, INC.
TRIAXIAL SHEAR TEST

Project Name: Midtown Tunnel
Project Number: 4955-110
Boring Number: 10BH-009 P2 @ 23 to 25 feet Pt. 2
Sample Description: CLAY (CH), Dark Gray, with Silt, Trace Fine Sand

UNCONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAIN CONTROL

P R O P E R T I E S

SPECIFIC GRAVITY	= 2.525	
LIQUID LIMIT	= 113	
PLASTIC LIMIT	= 27	
INITIAL LENGTH	= 5.76	INCHES
VOID RATIO	= 2.057	
INITIAL AREA	= 6.218	SQ. IN.
MOISTURE CONTENT	= 85.41	PERCENT
WET DENSITY	= 95.57	PCF
DRY DENSITY	= 51.55	PCF
PERCENT SATURATION	= 104.86	PERCENT
CELL PRESSURE	= 2.40	KSF

I N P U T D A T A		O U T P U T D A T A		
DEF	LOAD CELL	STRAIN	V.STRESS	T.STRESS
INCHES	DIV	IN/IN	KSF	KSF
.000000	.0	.000000	.000	2.400
.005000	2.6	.000869	.060	2.461
.010000	3.6	.001737	.083	2.484
.015000	3.9	.002606	.090	2.491
.020000	5.0	.003474	.115	2.516
.025000	5.5	.004343	.127	2.527
.030000	6.2	.005211	.143	2.543
.035000	6.6	.006080	.152	2.552
.040000	6.9	.006948	.159	2.559
.045000	7.4	.007817	.170	2.571
.050000	8.2	.008686	.188	2.589
.060000	8.8	.010423	.202	2.602
.070000	9.3	.012160	.213	2.613
.080000	10.3	.013897	.235	2.636
.090000	11.0	.015634	.251	2.651
.100000	11.4	.017371	.259	2.660
.125000	12.7	.021714	.288	2.688
.150000	14.2	.026057	.320	2.721
.175000	15.5	.030400	.348	2.749
.200000	15.8	.034742	.353	2.754
.225000	16.0	.039085	.356	2.757
.250000	16.3	.043428	.361	2.762
.275000	16.7	.047771	.368	2.769
.300000	17.0	.052113	.373	2.774
.350000	17.2	.060799	.374	2.775
.400000	17.5	.069485	.377	2.778
.450000	17.8	.078170	.380	2.780
.500000	18.1	.086856	.383	2.783

.550000	18.4	.095541	.385	2.786
.600000	18.7	.104227	.388	2.788
.650000	19.1	.112913	.392	2.793
.700000	19.4	.121598	.395	2.795
.750000	19.7	.130284	.397	2.797
.800000	20.0	.138969	.399	2.799
.850000	20.3	.147655	.401	2.801
.900000	20.7	.156340	.404	2.805
.950000	21.0	.165026	.406	2.807
1.000000	21.3	.173712	.408	2.808
1.050000	21.5	.182397	.407	2.808
1.100000	21.7	.191083	.407	2.807
1.150000	21.9	.199768	.406	2.806

Consolidation Test

One Dimensional

Engineering and Testing Consultants, Inc.

etc.

Project Data

Project: **Midtown Tunnel** Client: **PB Americas, Inc.**

Project Number: 4955-110 Date: 9/29/2010

Sample Data

Boring: **10BH-009 (P2)** Depth: **23 to 25** feet (bottom)

Sample Classification: **CLAY (CH), Dark Gray, with Silt, Trace Organics and Shell Fragments**

Specific Gravity =	**2.525**	Volume of Sample (Cu. In.) =	**4.91**
Wet Sample Weight (gm) =	**117.31**	Initial Wet Unit Weight (pcf) =	**90.8**
Diameter of Sample (in.) =	**2.5**	Initial Dry Unit Weight (pcf) =	**49.2**
Sample Thickness (in.) =	**1.0**	Initial Saturation (%) =	**97.0**
Initial Water Content (%) =	**84.6**	Initial Void Ratio =	**2.203**

Test Method

Load Sample Inundated (ksf) =	**0**	Method =	**Square Root of Time**
Drainage =	**Double**	Stone Corrections =	**None**
Initial Gauge Reading =	**0.5009**		

Data Reduction including Initial, Primary, & Secondary Consolidation

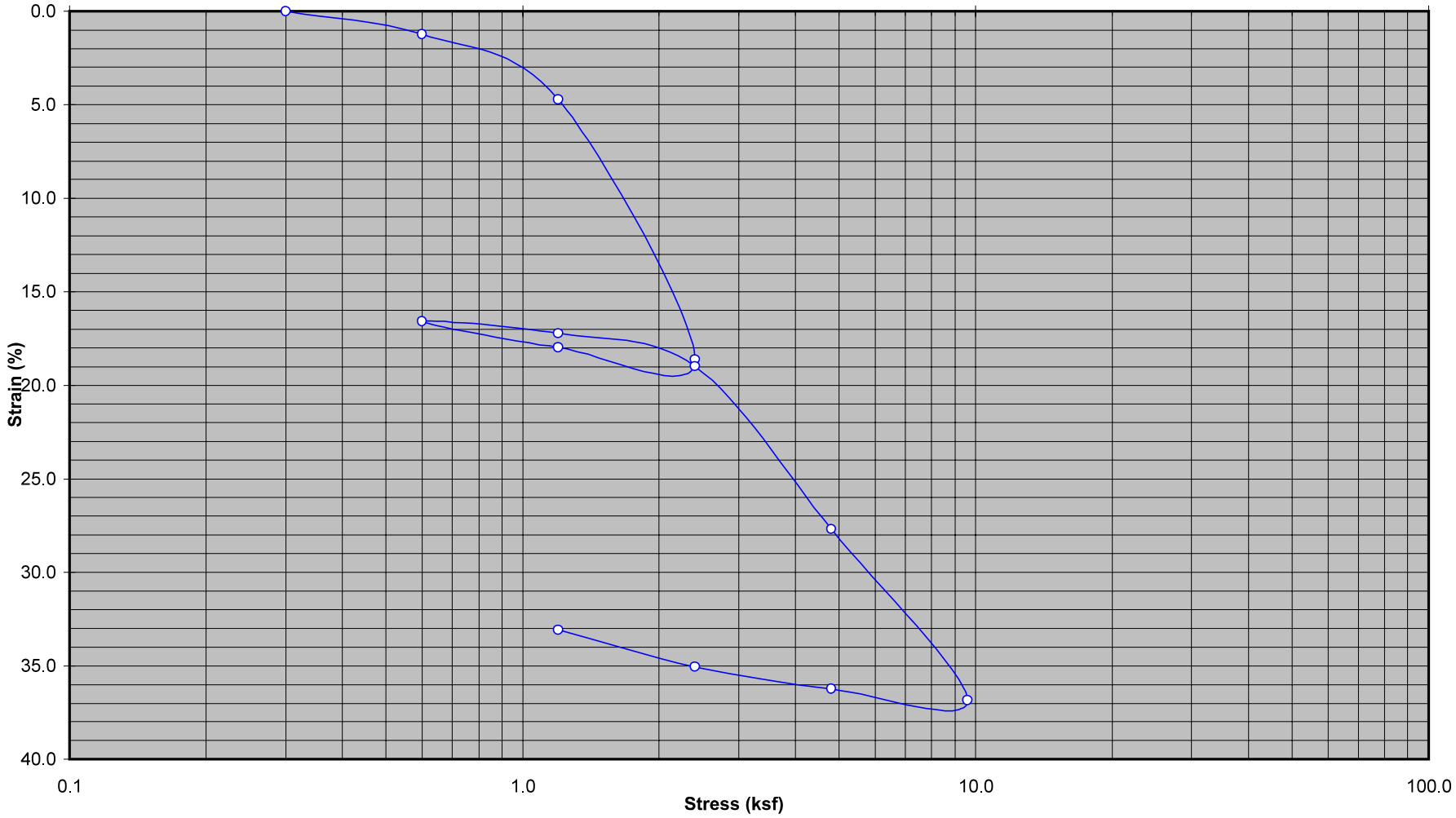
Stress (ksf)	D0 (%)	D90 (inch)	Dend (inch)	T90 (minutes)	Sample Height at Dend	% Initial	% Secondary
0.30	0.5000	0.4961	0.4952	3.1	0.9952	16	8
0.60	0.4959	0.4860	0.4829	3.1	0.9829	7	16
1.20	0.4805	0.4613	0.4480	4.0	0.9480	10	32
2.40	0.4423	0.3610	0.3089	51.1	0.8089	6	31
1.20	0.3103	0.3142	0.3155	5.8	0.8155	24	13
0.60	0.3158	0.3255	0.3293	21.2	0.8293	3	20
1.20	0.3288	0.3245	0.3230	7.0	0.8230	9	16
2.40	0.3222	0.3110	0.3053	9.6	0.8053	6	25
4.80	0.3046	0.2364	0.2184	49.0	0.7184	1	12
9.60	0.2175	0.1492	0.1268	44.9	0.6268	1	16
4.80	0.1272	0.1315	0.1329	5.3	0.6329	8	15
2.40	0.1333	0.1420	0.1446	16.8	0.6446	4	14
1.20	0.1449	0.1597	0.1645	73.1	0.6645	2	16

Data Output

Stress (ksf)	Strain (%)	Void Ratio	av	Cv (Sq. Ft./Day)	Permeability (Feet/Day)	Constrained Modulus (Kip/Sq.Ft.)	Cc
0.30	0.00	2.169					
0.60	1.23	2.130	1.30E-01	0.661	1.71E-03	24	0.129
1.20	4.72	2.019	1.84E-01	0.476	1.81E-03	16	0.367
2.40	18.63	1.578	3.67E-01	0.027	2.41E-04	7	1.464
1.20	17.97	1.599	1.74E-02	0.243	1.02E-04	149	0.069
0.60	16.59	1.643	7.29E-02	0.069	1.18E-04	36	0.145
1.20	17.22	1.623	3.33E-02	0.205	1.62E-04	79	0.066
2.40	18.99	1.567	4.67E-02	0.143	1.63E-04	55	0.186
4.80	27.68	1.292	1.15E-01	0.022	6.98E-05	20	0.915
9.60	36.84	1.001	6.05E-02	0.019	3.50E-05	33	0.964
4.80	36.23	1.021	4.03E-03	0.160	1.99E-05	502	0.064
2.40	35.06	1.058	1.54E-02	0.052	2.46E-05	133	0.123
1.20	33.07	1.121	5.25E-02	0.013	1.98E-05	40	0.209
						Cc =	1.464

One Dimensional Consolidation Test

Stress Versus Strain Plot



Initial Wet Unit Weight (pcf) =	**90.8**	Project:	**Midtown Tunnel**
Initial Dry Unit Weight (pcf) =	**49.2**	Client:	PB Americas, Inc.
Initial Water Content (%) =	**84.6**	Project Number:	4955-110
Initial Saturation (%) =	**97.0**		
Specific Gravity =	**2.525**	Sample Description:	CLAY (CH), Dark Gray, with Silt, Trace Organics and Shell Fragments
Initial Void Ratio =	**2.203**	**Boring:**	**10BH-009 (P2)** Depth: **23 to 25** feet (Bottom)

etc.

Engineering and Testing Consultants, Inc.

UNCONSOLIDATED, UNDRAINED COMPRESSIVE STRENGTH OF COHESIVE SOILS
ASTM D 2850

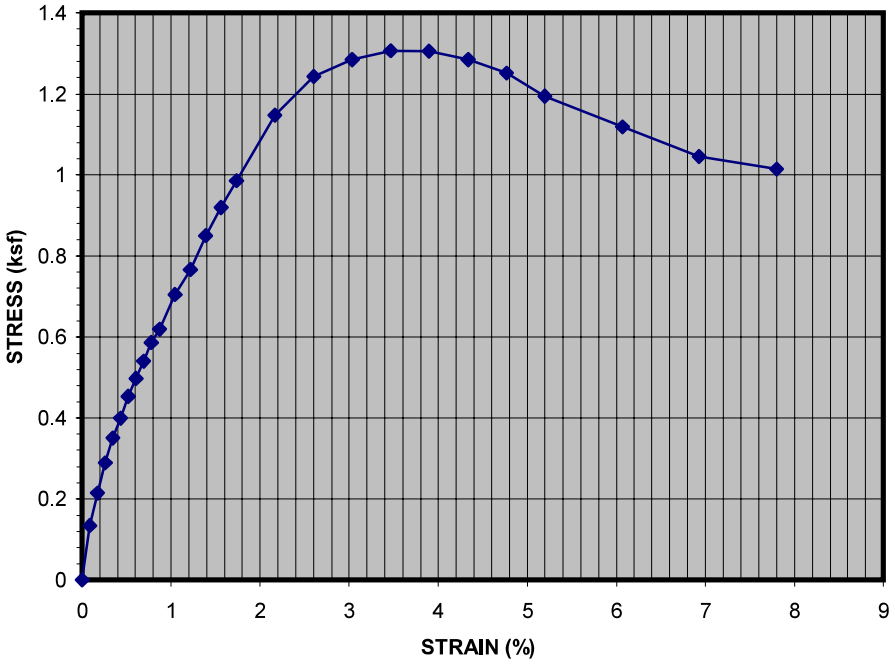
Project Name:	**Midtown Tunnel**
Number:	4955-110
Sample Number:	10BH-009 (P3) Point 1
Sample Depth:	43 to 45 feet (Middle)
Sample Description:	CLAY (CH), Dark Gray, with Silt, Trace Fine Sand
Sample Type:	Piston

Failure Photo



Deviator Stress:	**1.31 ksf**
Strain at Failure:	**3.5 %**

Rate of Strain:	1.0 %	Confining Pressure:	2.0 ksf
Avg. Sample Height:	5.770 Inches	Void Ratio:	2.086
Avg. Sample Diameter:	2.813 Inches	Initial Area:	6.216 In²
Wet Density:	96.9 pcf	Specific Gravity:	2.629
Dry Density:	54.0 pcf	Liquid Limit:	115
Moisture Content:	79.4 %	Plastic Limit:	33
Saturation:	100.06 %	Plastic Index:	82



ENGINEERING AND TESTING CONSULTANTS, INC.
TRIAXIAL SHEAR TEST

Project Name: Midtown Tunnel
Project Number: 4955-110
Boring Number: 10BH-009 (P3) Point 1 @ 43 to 45 feet (Middle)
Sample Description: CLAY (CH), Dark Gray, with Silt, Trace Fine Sand

UNCONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAIN CONTROL

P R O P E R T I E S

SPECIFIC GRAVITY	= 2.629	
LIQUID LIMIT	= 115	
PLASTIC LIMIT	= 33	
INITIAL LENGTH	= 5.77	INCHES
VOID RATIO	= 2.086	
INITIAL AREA	= 6.216	SQ. IN.
MOISTURE CONTENT	= 79.38	PERCENT
WET DENSITY	= 95.37	PCF
DRY DENSITY	= 53.17	PCF
PERCENT SATURATION	= 100.06	PERCENT
CELL PRESSURE	= 2.00	KSF

I N P U T D A T A		O U T P U T D A T A		
DEF INCHES	LOAD CELL DIV	STRAIN IN/IN	V.STRESS KSF	T.STRESS KSF
.000000	.0	.000000	.000	2.000
.005000	5.8	.000867	.134	2.134
.010000	9.3	.001733	.215	2.215
.015000	12.5	.002600	.289	2.289
.020000	15.2	.003466	.351	2.351
.025000	17.3	.004333	.399	2.399
.030000	19.7	.005199	.454	2.454
.035000	21.6	.006066	.497	2.497
.040000	23.5	.006932	.541	2.541
.045000	25.5	.007799	.586	2.586
.050000	27.0	.008665	.620	2.620
.060000	30.7	.010398	.704	2.704
.070000	33.5	.012131	.767	2.767
.080000	37.2	.013864	.850	2.850
.090000	40.3	.015597	.919	2.919
.100000	43.3	.017330	.986	2.986
.125000	50.6	.021663	1.147	3.147
.150000	55.1	.025995	1.243	3.243
.175000	57.2	.030328	1.285	3.285
.200000	58.4	.034660	1.306	3.306
.225000	58.6	.038993	1.305	3.305
.250000	58.0	.043325	1.285	3.286
.275000	56.7	.047658	1.251	3.251
.300000	54.4	.051990	1.195	3.195
.350000	51.4	.060655	1.118	3.119
.400000	48.5	.069320	1.046	3.046
.450000	47.5	.077985	1.015	3.015
.500000	47.0	.086650	.994	2.995

Engineering and Testing Consultants, Inc.

UNCONSOLIDATED, UNDRAINED COMPRESSIVE STRENGTH OF COHESIVE SOILS
ASTM D 2850

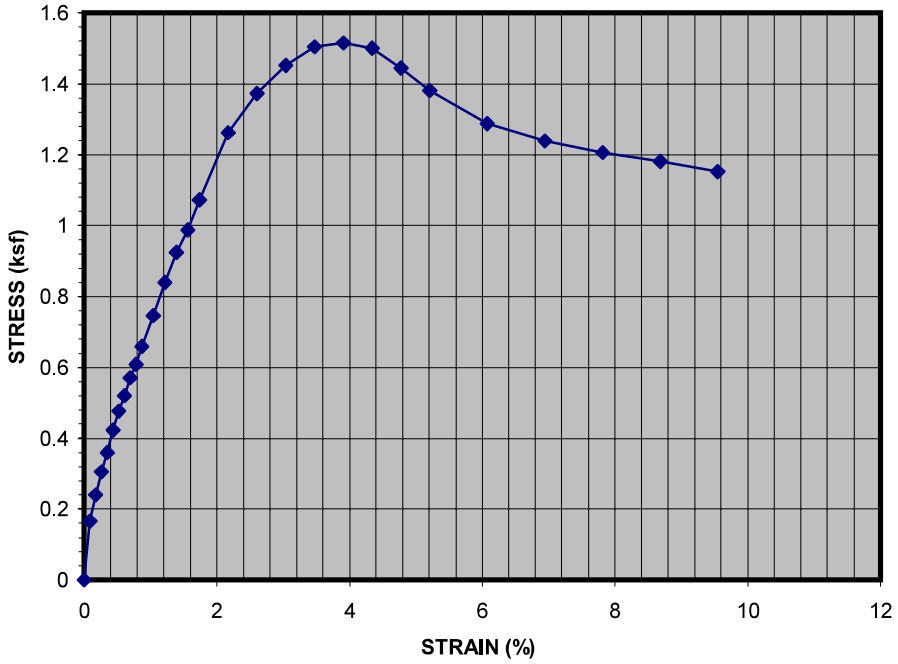
Project Name:	**Midtown Tunnel**
Number:	4955-110
Sample Number:	10BH-009 (P3) Point 2
Sample Depth:	43 to 45 feet (Bottom)
Sample Description:	CLAY (CH), Dark Gray, with Silt, Trace Fine Sand
Sample Type:	Piston

Failure Photos



Deviator Stress:	**1.52 ksf**
Strain at Failure:	**3.9 %**

Rate of Strain:	1.0 %	Confining Pressure:	4.0 ksf
Avg. Sample Height:	5.760 Inches	Void Ratio:	2.125
Avg. Sample Diameter:	2.826 Inches	Initial Area:	6.271 In²
Wet Density:	96.1 pcf	Specific Gravity:	2.629
Dry Density:	52.5 pcf	Liquid Limit:	115
Moisture Content:	82.9 %	Plastic Limit:	33
Saturation:	102.63 %	Plastic Index:	82



ENGINEERING AND TESTING CONSULTANTS, INC.
TRIAXIAL SHEAR TEST

Project Name: Midtown Tunnel
Project Number: 4955-110
Boring Number: 10BH-009 (P3) Point 2 @ 43 to 45 feet (Bottom)
Sample Description: CLAY (CH), Dark Gray, with Silt, Trace Fine Sand

UNCONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAIN CONTROL

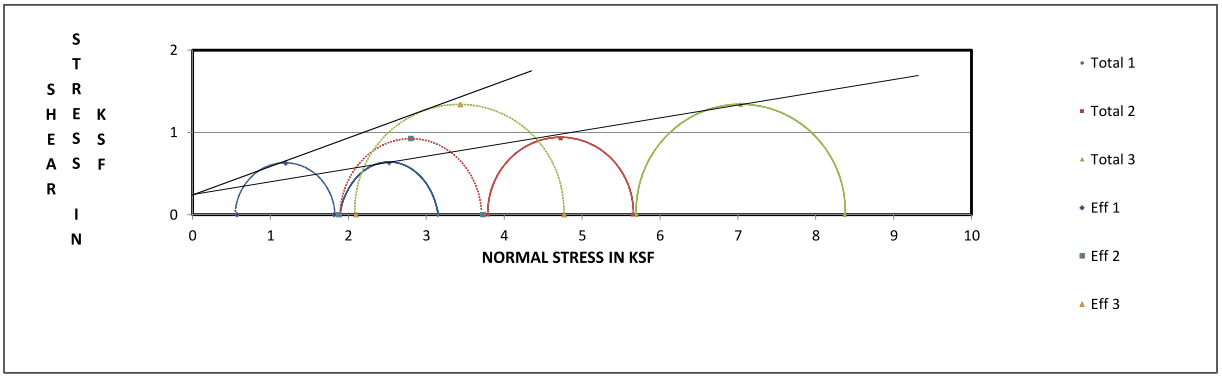
P R O P E R T I E S

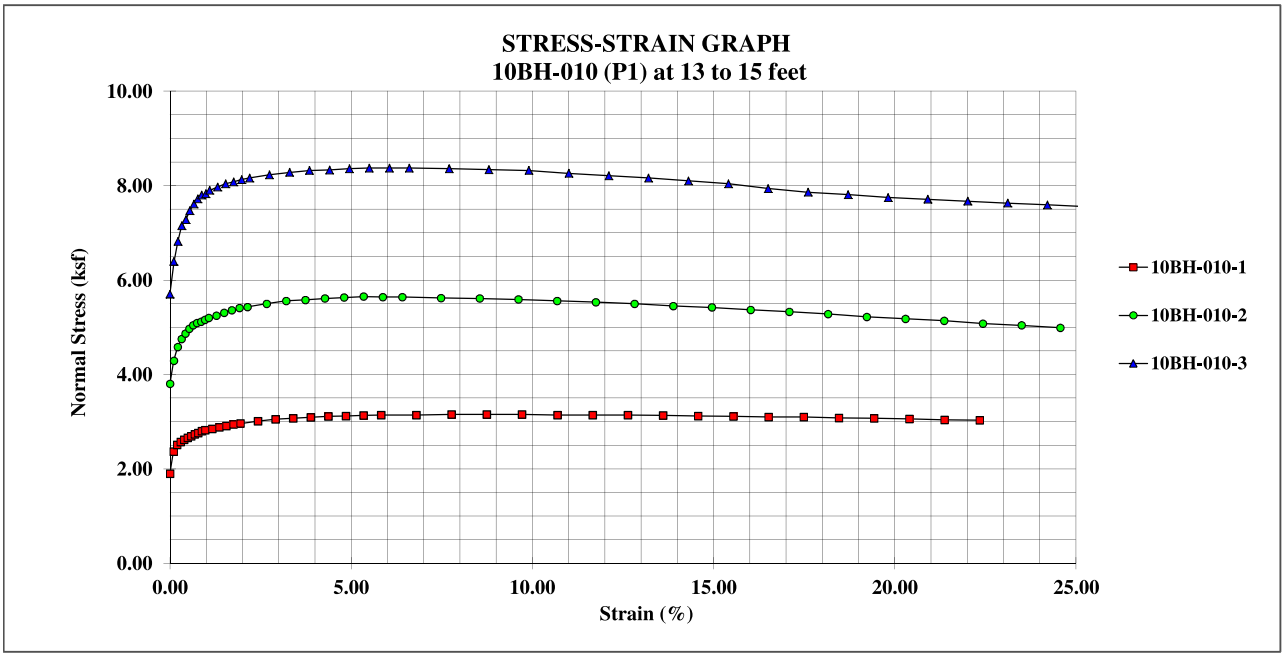
SPECIFIC GRAVITY	= 2.629	
LIQUID LIMIT	= 115	
PLASTIC LIMIT	= 33	
INITIAL LENGTH	= 5.76	INCHES
VOID RATIO	= 2.125	
INITIAL AREA	= 6.271	SQ. IN.
MOISTURE CONTENT	= 82.94	PERCENT
WET DENSITY	= 96.05	PCF
DRY DENSITY	= 52.50	PCF
PERCENT SATURATION	= 102.63	PERCENT
CELL PRESSURE	= 4.00	KSF

I N P U T D A T A		O U T P U T D A T A		
DEF	LOAD CELL	STRAIN	V.STRESS	T.STRESS
INCHES	DIV	IN/IN	KSF	KSF
.000000	.0	.000000	.000	4.000
.005000	7.3	.000868	.167	4.168
.010000	10.5	.001736	.241	4.241
.015000	13.3	.002604	.305	4.305
.020000	15.7	.003472	.359	4.360
.025000	18.5	.004340	.423	4.423
.030000	20.9	.005208	.477	4.478
.035000	22.8	.006076	.520	4.521
.040000	25.0	.006944	.570	4.570
.045000	26.7	.007813	.608	4.609
.050000	29.0	.008681	.660	4.660
.060000	32.8	.010417	.745	4.746
.070000	37.0	.012153	.839	4.840
.080000	40.8	.013889	.924	4.924
.090000	43.7	.015625	.988	4.988
.100000	47.5	.017361	1.072	5.072
.125000	56.2	.021701	1.263	5.263
.150000	61.4	.026042	1.373	5.374
.175000	65.2	.030382	1.452	5.452
.200000	67.9	.034722	1.505	5.505
.225000	68.7	.039063	1.516	5.516
.250000	68.3	.043403	1.500	5.501
.275000	66.1	.047743	1.445	5.446
.300000	63.5	.052083	1.382	5.383
.350000	59.7	.060764	1.288	5.288
.400000	58.0	.069444	1.239	5.240
.450000	57.0	.078125	1.207	5.207

.500000	56.3	.086806	1.181	5.181
.550000	55.5	.095486	1.153	5.153
.600000	55.0	.104167	1.131	5.132
.650000	54.7	.112847	1.114	5.115
.700000	54.3	.121528	1.095	5.096

MOHR'S CIRCLES





SAMPLE NUMBER	Point 1	Point 2	Point 3
Confining Pressure, ksf	1.90	3.80	5.70
Initial Length, In.	5.77	5.78	5.78
Initial Diameter, In.	2.83	2.79	2.77
Wet Unit Weight, pcf	95.63	95.29	96.96
Moisture Content, %	79.28	91.46	94.31
Initial Void Ratio	2.121	2.345	2.336
Initial Percent Saturation, %	99.72	104.05	107.70
Initial Area, Sq. In.	6.269	6.092	6.009
Liquid Limit, LL	86		
Plastic Limit, PL	30		
Specific Gravity	2.668		
Cohesion, ksf	0.22		
Angle of Shear Resistance, ϕ	9		

TRIAXIAL COMPRESSION TEST

PROJECT	MIDTOWN TUNNEL
	NORFOLK, VA
PROJECT NUMBER	4955-110
TYPE OF SPECIMEN	PISTON
SAMPLE NUMBER	10BH-010 (P1)
DEPTH	13 to 15 feet
SOIL DESCRIPTION	CLAY (CH), Dark Gray, with Silt,
	Trace Fine Sand
TEST METHOD	ASTM D4767, CU Triaxial
RATE OF SHEAR	0.002 in./min.

ENGINEERING AND TESTING CONSULTANTS, INC.

ENGINEERING AND TESTING CONSULTANTS, INC.
TRIAXIAL SHEAR TEST

Project Name: Midtown Tunnel
Project Number: 4955-110
Boring Number: 10BH-010 (P1) @ 13 to 15 Feet (Top), Pt.1
Sample Description: CLAY (CH), Dark Gray, with Silt, Trace Fine Sand

CONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAIN CONTROL

P R O P E R T I E S

SPECIFIC GRAVITY = 2.668
LIQUID LIMIT = 86
PLASTIC LIMIT = 30
MEASURED VOLUME CHANGE = -8.804 IN3
CELL PRESSURE = 4.59 KSF
CONSOLIDATION PRESSURE = 1.90 KSF

PROPERTY		INITIAL	CONSOLIDATED	
HEIGHT	=	5.766	5.147	INCHES
VOID RATIO	=	2.121	1.361	
AREA	=	6.269	5.313	SQ. IN.
PERCENT MOISTURE	=	79.28	51.02	PERCENT
WET DENSITY	=	95.63	106.49	PCF
DRY DENSITY	=	53.34	70.52	PCF
PERCENT SATURATION	=	99.72	100.02	PERCENT

NOTE - CONSOLIDATED PROPERTIES CALCULATED FROM MEASURED VOLUME CHANGE

O U T P U T D A T A

READING NUMBER	STRAIN (IN/IN)	SHEAR STRAIN	VOLUME STRAIN (CC/CC)	VOID RATIO	A FACTOR
1	.000000	.000000	.0000	1.360	.000
2	.000971	.000971	.0000	1.360	.550
3	.001943	.001943	.0000	1.360	.663
4	.002914	.002914	.0000	1.360	.688
5	.003886	.003886	.0000	1.360	.734
6	.004857	.004857	.0000	1.360	.758
7	.005829	.005829	.0000	1.360	.762
8	.006800	.006800	.0000	1.360	.766
9	.007772	.007772	.0000	1.360	.770
10	.008743	.008743	.0000	1.360	.786
11	.009715	.009715	.0000	1.360	.794
12	.011658	.011658	.0000	1.360	.786
13	.013601	.013601	.0000	1.360	.832
14	.015543	.015543	.0000	1.360	.838
15	.017486	.017486	.0000	1.360	.857
16	.019429	.019429	.0000	1.360	.866
17	.024287	.024287	.0000	1.360	.882

18	.029144	.029144	.0000	1.360	.904
19	.034001	.034001	.0000	1.360	.935
20	.038859	.038859	.0000	1.360	.953
21	.043716	.043716	.0000	1.360	.965
22	.048573	.048573	.0000	1.360	.979
23	.053431	.053431	.0000	1.360	.996
24	.058288	.058288	.0000	1.360	.998
25	.068003	.068003	.0000	1.360	1.018
26	.077717	.077717	.0000	1.360	1.036
27	.087432	.087432	.0000	1.360	1.048
28	.097147	.097147	.0000	1.360	1.060
29	.106861	.106861	.0000	1.360	1.086
30	.116576	.116576	.0000	1.360	1.114
31	.126291	.126291	.0000	1.360	1.117
32	.136006	.136006	.0000	1.360	1.130
33	.145720	.145720	.0000	1.360	1.144
34	.155435	.155435	.0000	1.360	1.157
35	.165150	.165150	.0000	1.360	1.171
36	.174864	.174864	.0000	1.360	1.183
37	.184579	.184579	.0000	1.360	1.197
38	.194294	.194294	.0000	1.360	1.218
39	.204008	.204008	.0000	1.360	1.231
40	.213723	.213723	.0000	1.360	1.248
41	.223438	.223438	.0000	1.360	1.264

READING NUMBER	SIG1 (KSF)	PWP (KSF)	EFF SIG1 (KSF)	EFF SIG3 (KSF)	TOTAL STRESS RATIO	EFF STRESS RATIO	Q (KSF) CAMBRIDGE	P (KSF) PARAMETERS	Q/P
1	1.90	.12	1.78	1.78	1.00	1.00	.00	1.78	.00
2	2.37	.26	2.11	1.64	1.25	1.29	.47	1.80	.26
3	2.51	.40	2.10	1.50	1.32	1.41	.61	1.70	.36
4	2.57	.46	2.11	1.44	1.35	1.46	.67	1.66	.40
5	2.62	.53	2.09	1.37	1.38	1.53	.73	1.61	.45
6	2.66	.58	2.08	1.32	1.40	1.57	.76	1.58	.48
7	2.69	.60	2.09	1.29	1.42	1.61	.79	1.56	.51
8	2.73	.63	2.09	1.27	1.43	1.65	.83	1.54	.54
9	2.76	.66	2.10	1.24	1.45	1.69	.86	1.52	.56
10	2.80	.71	2.09	1.19	1.47	1.75	.90	1.49	.60
11	2.82	.73	2.09	1.16	1.49	1.79	.92	1.47	.63
12	2.85	.75	2.10	1.15	1.50	1.83	.95	1.47	.65
13	2.88	.82	2.06	1.08	1.52	1.91	.99	1.41	.70
14	2.91	.85	2.06	1.05	1.53	1.96	1.01	1.39	.73
15	2.94	.89	2.05	1.01	1.55	2.03	1.04	1.35	.77
16	2.96	.92	2.04	.98	1.56	2.09	1.06	1.33	.80
17	3.01	.98	2.03	.92	1.58	2.21	1.11	1.29	.86
18	3.05	1.04	2.01	.86	1.60	2.33	1.15	1.24	.92
19	3.07	1.09	1.97	.80	1.62	2.45	1.17	1.19	.98
20	3.09	1.14	1.95	.76	1.63	2.56	1.19	1.16	1.03
21	3.11	1.17	1.94	.73	1.64	2.65	1.21	1.14	1.06
22	3.12	1.20	1.92	.70	1.64	2.73	1.22	1.11	1.10
23	3.13	1.22	1.90	.68	1.65	2.82	1.23	1.08	1.13
24	3.14	1.24	1.90	.66	1.65	2.88	1.24	1.07	1.15
25	3.14	1.27	1.88	.63	1.65	2.97	1.24	1.05	1.19

10BH-010 P1 @ 13 to 15 feet pt. 2, CU

26	3.15	1.30	1.85	.60	1.66	3.07	1.25	1.02	1.23
27	3.15	1.31	1.84	.59	1.66	3.12	1.25	1.01	1.24
28	3.15	1.32	1.82	.57	1.66	3.17	1.25	.99	1.26
29	3.14	1.35	1.79	.55	1.66	3.28	1.25	.96	1.30
30	3.14	1.38	1.76	.52	1.65	3.40	1.24	.93	1.33
31	3.14	1.38	1.75	.52	1.65	3.39	1.24	.93	1.33
32	3.13	1.39	1.74	.51	1.65	3.41	1.23	.92	1.34
33	3.12	1.40	1.72	.50	1.64	3.43	1.22	.91	1.34
34	3.11	1.40	1.71	.50	1.64	3.45	1.21	.90	1.35
35	3.10	1.41	1.69	.49	1.63	3.47	1.20	.89	1.35
36	3.10	1.42	1.68	.48	1.63	3.47	1.20	.88	1.36
37	3.08	1.42	1.66	.48	1.62	3.46	1.18	.88	1.35
38	3.07	1.43	1.64	.47	1.62	3.47	1.17	.86	1.35
39	3.06	1.43	1.63	.47	1.61	3.44	1.16	.86	1.35
40	3.04	1.43	1.61	.47	1.60	3.44	1.14	.85	1.35
41	3.03	1.43	1.60	.47	1.60	3.43	1.13	.84	1.34

ENGINEERING AND TESTING CONSULTANTS, INC.
TRIAXIAL SHEAR TEST

Project Name: Midtown Tunnel
Project Number: 4955-110
Boring Number: 10BH-010 (P1) @ 13 to 15 Feet (Middle), Pt.2
Sample Description: CLAY (CH), Dark Gray, with Silt, Trace Fine Sand

CONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAIN CONTROL

P R O P E R T I E S

SPECIFIC GRAVITY	= 2.668	
LIQUID LIMIT	= 86	
PLASTIC LIMIT	= 30	
MEASURED VOLUME CHANGE	= -12.739	IN3
CELL PRESSURE	= 6.68	KSF
CONSOLIDATION PRESSURE	= 3.80	KSF

PROPERTY	INITIAL	CONSOLIDATED	
HEIGHT	= 5.775	4.683	INCHES
VOID RATIO	= 2.345	1.134	
AREA	= 6.092	4.793	SQ. IN.
PERCENT MOISTURE	= 91.46	42.51	PERCENT
WET DENSITY	= 95.29	111.19	PCF
DRY DENSITY	= 49.77	78.02	PCF
PERCENT SATURATION	= 104.05	100.03	PERCENT

NOTE - CONSOLIDATED PROPERTIES CALCULATED FROM MEASURED VOLUME CHANGE

O U T P U T D A T A

READING NUMBER	STRAIN (IN/IN)	SHEAR STRAIN	VOLUME STRAIN (CC/CC)	VOID RATIO	A FACTOR
1	.000000	.000000	.0000	1.133	.000
2	.001068	.001068	.0000	1.133	.089
3	.002136	.002136	.0000	1.133	.351
4	.003203	.003203	.0000	1.133	.471
5	.004271	.004271	.0000	1.133	.537
6	.005339	.005339	.0000	1.133	.579
7	.006407	.006407	.0000	1.133	.606
8	.007475	.007475	.0000	1.133	.647
9	.008542	.008542	.0000	1.133	.675
10	.009610	.009610	.0000	1.133	.708
11	.010678	.010678	.0000	1.133	.719
12	.012814	.012814	.0000	1.133	.782
13	.014949	.014949	.0000	1.133	.800
14	.017085	.017085	.0000	1.133	.823
15	.019220	.019220	.0000	1.133	.833
16	.021356	.021356	.0000	1.133	.856
17	.026695	.026695	.0000	1.133	.904

18	.032034	.032034	.0000	1.133	.939
19	.037373	.037373	.0000	1.133	.981
20	.042712	.042712	.0000	1.133	.999
21	.048051	.048051	.0000	1.133	1.014
22	.053390	.053390	.0000	1.133	1.036
23	.058729	.058729	.0000	1.133	1.061
24	.064068	.064068	.0000	1.133	1.088
25	.074746	.074746	.0000	1.133	1.122
26	.085424	.085424	.0000	1.133	1.156
27	.096102	.096102	.0000	1.133	1.192
28	.106780	.106780	.0000	1.133	1.234
29	.117458	.117458	.0000	1.133	1.273
30	.128136	.128136	.0000	1.133	1.303
31	.138814	.138814	.0000	1.133	1.353
32	.149492	.149492	.0000	1.133	1.380
33	.160170	.160170	.0000	1.133	1.424
34	.170848	.170848	.0000	1.133	1.453
35	.181526	.181526	.0000	1.133	1.495
36	.192203	.192203	.0000	1.133	1.558
37	.202881	.202881	.0000	1.133	1.611
38	.213559	.213559	.0000	1.133	1.658
39	.224237	.224237	.0000	1.133	1.726
40	.234915	.234915	.0000	1.133	1.781
41	.245593	.245593	.0000	1.133	1.854

READING NUMBER	SIG1 (KSF)	PWP (KSF)	EFF SIG1 (KSF)	EFF SIG3 (KSF)	TOTAL STRESS RATIO	EFF STRESS RATIO	Q (KSF) CAMBRIDGE	P (KSF) PARAMETERS	Q/P
1	3.80	-.22	4.02	4.02	1.00	1.00	.00	4.02	.00
2	4.29	.04	4.24	3.76	1.13	1.13	.49	3.92	.12
3	4.58	.27	4.30	3.53	1.20	1.22	.78	3.79	.21
4	4.75	.45	4.30	3.35	1.25	1.28	.95	3.67	.26
5	4.87	.58	4.30	3.22	1.28	1.33	1.07	3.58	.30
6	4.97	.68	4.29	3.12	1.31	1.37	1.17	3.51	.33
7	5.04	.75	4.29	3.05	1.33	1.40	1.24	3.46	.36
8	5.09	.84	4.26	2.96	1.34	1.44	1.29	3.40	.38
9	5.12	.89	4.23	2.91	1.35	1.45	1.32	3.35	.39
10	5.16	.96	4.20	2.84	1.36	1.48	1.36	3.29	.41
11	5.20	1.01	4.19	2.79	1.37	1.50	1.40	3.26	.43
12	5.25	1.14	4.12	2.66	1.38	1.55	1.45	3.15	.46
13	5.31	1.21	4.10	2.59	1.40	1.58	1.51	3.09	.49
14	5.36	1.28	4.08	2.52	1.41	1.62	1.56	3.04	.51
15	5.41	1.34	4.07	2.46	1.42	1.65	1.61	3.00	.54
16	5.43	1.40	4.03	2.40	1.43	1.68	1.63	2.95	.55
17	5.50	1.54	3.96	2.26	1.45	1.75	1.70	2.83	.60
18	5.56	1.66	3.91	2.14	1.46	1.82	1.76	2.73	.65
19	5.58	1.74	3.83	2.06	1.47	1.86	1.77	2.65	.67
20	5.61	1.81	3.80	1.99	1.48	1.91	1.81	2.59	.70
21	5.63	1.86	3.77	1.94	1.48	1.94	1.83	2.55	.72
22	5.65	1.92	3.73	1.88	1.49	1.98	1.85	2.50	.74
23	5.64	1.96	3.69	1.84	1.49	2.00	1.84	2.46	.75
24	5.64	2.00	3.64	1.80	1.48	2.02	1.84	2.41	.76
25	5.62	2.04	3.58	1.76	1.48	2.04	1.82	2.36	.77

10BH-010 P1 @ 13 to 15 feet pt. 2, CU

26	5.61	2.09	3.52	1.71	1.48	2.05	1.81	2.31	.78
27	5.59	2.13	3.46	1.67	1.47	2.07	1.79	2.26	.79
28	5.56	2.17	3.39	1.63	1.46	2.08	1.76	2.21	.80
29	5.53	2.20	3.33	1.60	1.46	2.08	1.73	2.17	.80
30	5.50	2.22	3.28	1.58	1.45	2.07	1.70	2.15	.79
31	5.45	2.23	3.22	1.57	1.43	2.05	1.65	2.12	.78
32	5.42	2.23	3.18	1.57	1.43	2.03	1.62	2.11	.77
33	5.37	2.23	3.13	1.57	1.41	2.00	1.57	2.09	.75
34	5.33	2.22	3.11	1.58	1.40	1.96	1.52	2.09	.73
35	5.28	2.22	3.06	1.58	1.39	1.94	1.48	2.08	.71
36	5.22	2.22	3.01	1.58	1.37	1.90	1.42	2.06	.69
37	5.18	2.22	2.96	1.58	1.36	1.87	1.38	2.04	.67
38	5.14	2.22	2.92	1.58	1.35	1.84	1.34	2.03	.66
39	5.08	2.22	2.87	1.58	1.34	1.81	1.28	2.01	.64
40	5.04	2.22	2.83	1.58	1.33	1.79	1.24	2.00	.62
41	4.99	2.22	2.78	1.58	1.31	1.75	1.19	1.98	.60

ENGINEERING AND TESTING CONSULTANTS, INC.
TRIAXIAL SHEAR TEST

Project Name: Midtown Tunnel
Project Number: 4955-110
Boring Number: 10BH-010 (P1) @ 13 to 15 Feet (Bottom), Pt.3
Sample Description: CLAY (CH), Dark Gray, with Silt, Trace Fine Sand

CONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAIN CONTROL

P R O P E R T I E S

SPECIFIC GRAVITY	= 2.668	
LIQUID LIMIT	= 86	
PLASTIC LIMIT	= 30	
MEASURED VOLUME CHANGE	= -13.551	IN3
CELL PRESSURE	= 8.85	KSF
CONSOLIDATION PRESSURE	= 5.70	KSF

PROPERTY	INITIAL	CONSOLIDATED	
HEIGHT	= 5.776	4.543	INCHES
VOID RATIO	= 2.336	1.034	
AREA	= 6.009	4.657	SQ. IN.
PERCENT MOISTURE	= 94.31	38.76	PERCENT
WET DENSITY	= 96.96	113.59	PCF
DRY DENSITY	= 49.90	81.86	PCF
PERCENT SATURATION	= 107.70	100.04	PERCENT

NOTE - CONSOLIDATED PROPERTIES CALCULATED FROM MEASURED VOLUME CHANGE

O U T P U T D A T A

READING NUMBER	STRAIN (IN/IN)	SHEAR STRAIN	VOLUME STRAIN (CC/CC)	VOID RATIO	A FACTOR
1	.000000	.000000	.0000	1.033	.000
2	.001101	.001101	.0000	1.033	1.214
3	.002201	.002201	.0000	1.033	1.050
4	.003302	.003302	.0000	1.033	1.001
5	.004403	.004403	.0000	1.033	1.010
6	.005503	.005503	.0000	1.033	.985
7	.006604	.006604	.0000	1.033	.988
8	.007704	.007704	.0000	1.033	1.006
9	.008805	.008805	.0000	1.033	1.008
10	.009906	.009906	.0000	1.033	1.039
11	.011006	.011006	.0000	1.033	1.051
12	.013208	.013208	.0000	1.033	1.059
13	.015409	.015409	.0000	1.033	1.066
14	.017610	.017610	.0000	1.033	1.087
15	.019812	.019812	.0000	1.033	1.096
16	.022013	.022013	.0000	1.033	1.125
17	.027516	.027516	.0000	1.033	1.161

18	.033019	.033019	.0000	1.033	1.194
19	.038522	.038522	.0000	1.033	1.219
20	.044026	.044026	.0000	1.033	1.246
21	.049529	.049529	.0000	1.033	1.267
22	.055032	.055032	.0000	1.033	1.293
23	.060535	.060535	.0000	1.033	1.319
24	.066039	.066039	.0000	1.033	1.345
25	.077045	.077045	.0000	1.033	1.385
26	.088051	.088051	.0000	1.033	1.421
27	.099058	.099058	.0000	1.033	1.452
28	.110064	.110064	.0000	1.033	1.499
29	.121071	.121071	.0000	1.033	1.541
30	.132077	.132077	.0000	1.033	1.579
31	.143083	.143083	.0000	1.033	1.618
32	.154090	.154090	.0000	1.033	1.666
33	.165096	.165096	.0000	1.033	1.750
34	.176103	.176103	.0000	1.033	1.822
35	.187109	.187109	.0000	1.033	1.869
36	.198116	.198116	.0000	1.033	1.929
37	.209122	.209122	.0000	1.033	1.974
38	.220128	.220128	.0000	1.033	2.022
39	.231135	.231135	.0000	1.033	2.065
40	.242141	.242141	.0000	1.033	2.111
41	.253148	.253148	.0000	1.033	2.150

READING NUMBER	SIG1 (KSF)	PWP (KSF)	EFF SIG1 (KSF)	EFF SIG3 (KSF)	TOTAL STRESS RATIO	EFF STRESS RATIO	Q (KSF) CAMBRIDGE	P (KSF) PARAMETERS	Q/P
1	5.70	.52	5.18	5.18	1.00	1.00	.00	5.18	.00
2	6.39	.84	5.55	4.86	1.12	1.14	.69	5.09	.13
3	6.82	1.18	5.64	4.52	1.20	1.25	1.12	4.89	.23
4	7.15	1.45	5.70	4.25	1.25	1.34	1.45	4.73	.31
5	7.28	1.60	5.68	4.10	1.28	1.39	1.58	4.63	.34
6	7.47	1.74	5.73	3.96	1.31	1.45	1.77	4.55	.39
7	7.61	1.89	5.72	3.81	1.33	1.50	1.91	4.45	.43
8	7.72	2.03	5.69	3.67	1.35	1.55	2.02	4.34	.46
9	7.80	2.12	5.68	3.58	1.37	1.59	2.10	4.28	.49
10	7.83	2.22	5.61	3.48	1.37	1.61	2.13	4.19	.51
11	7.90	2.32	5.59	3.38	1.39	1.65	2.20	4.12	.54
12	7.97	2.40	5.56	3.29	1.40	1.69	2.27	4.05	.56
13	8.04	2.49	5.54	3.21	1.41	1.73	2.34	3.99	.59
14	8.08	2.59	5.49	3.11	1.42	1.77	2.38	3.90	.61
15	8.13	2.66	5.46	3.04	1.43	1.80	2.43	3.85	.63
16	8.16	2.76	5.39	2.93	1.43	1.84	2.46	3.75	.65
17	8.23	2.94	5.29	2.76	1.44	1.92	2.53	3.60	.70
18	8.28	3.08	5.20	2.62	1.45	1.99	2.58	3.48	.74
19	8.32	3.20	5.12	2.50	1.46	2.05	2.62	3.38	.78
20	8.33	3.28	5.05	2.42	1.46	2.09	2.63	3.29	.80
21	8.36	3.37	4.99	2.33	1.47	2.14	2.66	3.22	.83
22	8.37	3.46	4.92	2.24	1.47	2.19	2.67	3.13	.85
23	8.37	3.53	4.85	2.17	1.47	2.23	2.67	3.06	.87
24	8.37	3.60	4.77	2.10	1.47	2.27	2.67	2.99	.89
25	8.36	3.69	4.67	2.01	1.47	2.32	2.66	2.90	.92

26	8.34	3.76	4.59	1.94	1.46	2.36	2.64	2.82	.94
27	8.32	3.80	4.51	1.90	1.46	2.38	2.62	2.77	.94
28	8.26	3.84	4.42	1.85	1.45	2.38	2.56	2.71	.95
29	8.21	3.87	4.34	1.83	1.44	2.38	2.51	2.66	.94
30	8.16	3.89	4.27	1.81	1.43	2.36	2.46	2.63	.93
31	8.10	3.89	4.21	1.81	1.42	2.33	2.40	2.61	.92
32	8.04	3.90	4.14	1.80	1.41	2.30	2.34	2.58	.91
33	7.94	3.93	4.01	1.77	1.39	2.27	2.24	2.52	.89
34	7.86	3.95	3.92	1.75	1.38	2.23	2.16	2.48	.87
35	7.81	3.95	3.86	1.75	1.37	2.20	2.11	2.46	.86
36	7.75	3.96	3.79	1.74	1.36	2.18	2.05	2.42	.85
37	7.71	3.97	3.74	1.73	1.35	2.17	2.01	2.40	.84
38	7.67	3.99	3.68	1.71	1.35	2.15	1.97	2.37	.83
39	7.63	3.99	3.64	1.71	1.34	2.13	1.93	2.35	.82
40	7.59	3.99	3.60	1.71	1.33	2.10	1.89	2.34	.81
41	7.55	3.99	3.56	1.71	1.33	2.08	1.85	2.33	.80

Engineering and Testing Consultants, Inc.

UNCONSOLIDATED, UNDRAINED COMPRESSIVE STRENGTH OF COHESIVE SOILS
ASTM D 2850

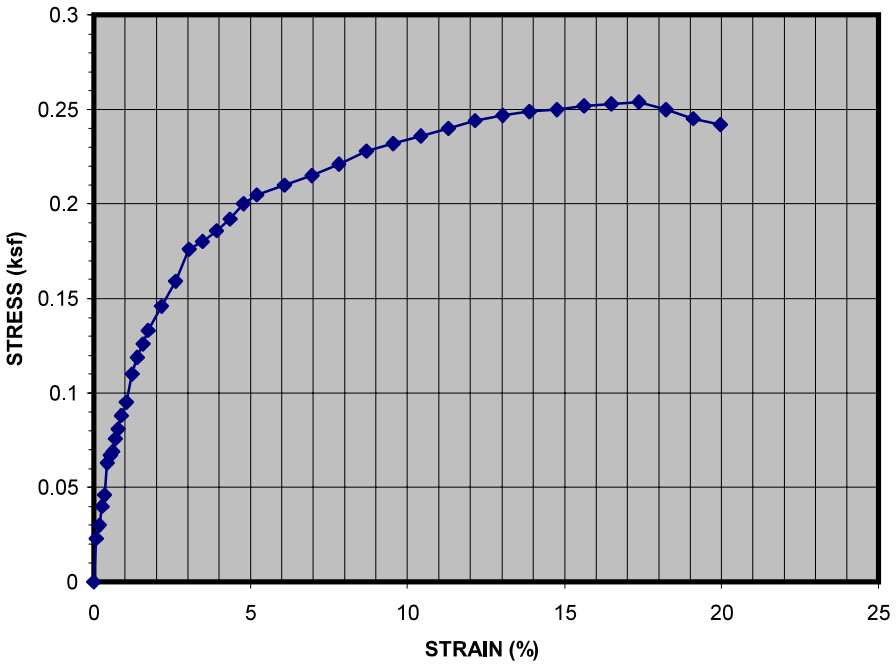
Project Name:	**Midtown Tunnel**
Number:	4955-110
Sample Number:	10BH-011 (P1) Point 1
Sample Depth:	10 to 12 feet (Middle)
Sample Description:	CLAY (CH), Dark Gray, with Silt, Trace Fine Sand
Sample Type:	Piston

Failure Photo



Deviator Stress:	**0.25 ksf**
Strain at Failure:	**17.4 %**

Rate of Strain:	1.0	%	Confining Pressure:	0.4	ksf
Avg. Sample Height:	5.758	Inches	Void Ratio:	2.383	
Avg. Sample Diameter:	2.805	Inches	Initial Area:	6.180	In²
Wet Density:	93.8	pcf	Specific Gravity:	2.585	
Dry Density:	47.7	pcf	Liquid Limit:	101	
Moisture Content:	96.6	%	Plastic Limit:	23	
Saturation:	104.81	%	Plastic Index:	78	



ENGINEERING AND TESTING CONSULTANTS, INC.
TRIAXIAL SHEAR TEST

Project Name: Midtown Tunnel
Project Number: 4955-110
Boring Number: 10BH-011 (P1) Point 1 @ 10 to 12 feet (Middle)
Sample Description: CLAY (CH), Dark Gray, with Silt, Trace Fine Sand

UNCONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAIN CONTROL

P R O P E R T I E S

SPECIFIC GRAVITY	= 2.585	
LIQUID LIMIT	= 101	
PLASTIC LIMIT	= 23	
INITIAL LENGTH	= 5.76	INCHES
VOID RATIO	= 2.383	
INITIAL AREA	= 6.180	SQ. IN.
MOISTURE CONTENT	= 96.60	PERCENT
WET DENSITY	= 93.75	PCF
DRY DENSITY	= 47.69	PCF
PERCENT SATURATION	= 104.81	PERCENT
CELL PRESSURE	= .40	KSF

I N P U T D A T A		O U T P U T D A T A		
DEF	LOAD CELL	STRAIN	V.STRESS	T.STRESS
INCHES	DIV	IN/IN	KSF	KSF
.000000	.0	.000000	.000	.400
.005000	1.0	.000868	.023	.424
.010000	1.3	.001737	.030	.431
.015000	1.7	.002605	.040	.440
.020000	2.0	.003473	.046	.447
.025000	2.7	.004342	.063	.463
.030000	2.9	.005210	.067	.468
.035000	3.0	.006078	.069	.470
.040000	3.3	.006946	.076	.477
.045000	3.5	.007815	.081	.481
.050000	3.8	.008683	.088	.488
.060000	4.1	.010420	.095	.495
.070000	4.8	.012156	.110	.511
.080000	5.2	.013893	.119	.520
.090000	5.5	.015630	.126	.526
.100000	5.8	.017366	.133	.533
.125000	6.4	.021708	.146	.546
.150000	7.0	.026049	.159	.559
.175000	7.8	.030391	.176	.577
.200000	8.0	.034732	.180	.580
.225000	8.3	.039074	.186	.586
.250000	8.6	.043415	.192	.592
.275000	9.0	.047757	.200	.600
.300000	9.3	.052098	.205	.606
.350000	9.6	.060781	.210	.610
.400000	9.9	.069465	.215	.615
.450000	10.3	.078148	.221	.622

.500000	10.7	.086831	.228	.628
.550000	11.0	.095514	.232	.632
.600000	11.3	.104197	.236	.636
.650000	11.6	.112880	.240	.640
.700000	11.9	.121563	.244	.644
.750000	12.2	.130246	.247	.648
.800000	12.4	.138929	.249	.649
.850000	12.6	.147612	.250	.651
.900000	12.8	.156295	.252	.652
.950000	13.0	.164978	.253	.653
1.000000	13.2	.173661	.254	.654
1.050000	13.1	.182344	.250	.650
1.100000	13.0	.191028	.245	.645
1.150000	13.0	.199711	.242	.643

Engineering and Testing Consultants, Inc.

UNCONSOLIDATED, UNDRAINED COMPRESSIVE STRENGTH OF COHESIVE SOILS
ASTM D 2850

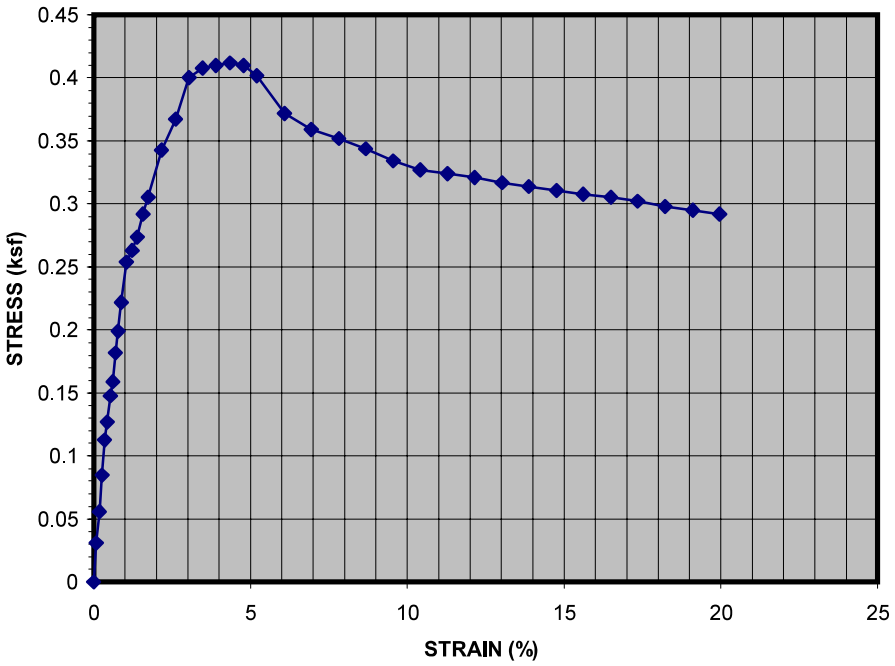
Project Name:	**Midtown Tunnel**
Number:	4955-110
Sample Number:	10BH-011 (P1) Point 2
Sample Depth:	10 to 12 feet (Bottom)
Sample Description:	CLAY (CH), Dark Gray, with Silt, Trace Fine Sand
Sample Type:	Piston

Failure Photo



Deviator Stress:	**0.41 ksf**
Strain at Failure:	**4.3 %**

Rate of Strain:	1.0	%	Confining Pressure:	0.8	ksf
Avg. Sample Height:	5.761	Inches	Void Ratio:	2.193	
Avg. Sample Diameter:	2.790	Inches	Initial Area:	6.115	In²
Wet Density:	96.5	pcf	Specific Gravity:	2.585	
Dry Density:	50.5	pcf	Liquid Limit:	101	
Moisture Content:	90.9	%	Plastic Limit:	23	
Saturation:	107.18	%	Plastic Index:	78	



ENGINEERING AND TESTING CONSULTANTS, INC.
TRIAXIAL SHEAR TEST

Project Name: Midtown Tunnel
Project Number: 4955-110
Boring Number: 10BH-011 (P1) Point 2 @ 10 to 12 feet (Bottom)
Sample Description: CLAY (CH), Dark Gray, with Silt, Trace Fine Sand

UNCONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAIN CONTROL

P R O P E R T I E S

SPECIFIC GRAVITY	= 2.585	
LIQUID LIMIT	= 101	
PLASTIC LIMIT	= 23	
INITIAL LENGTH	= 5.76	INCHES
VOID RATIO	= 2.193	
INITIAL AREA	= 6.115	SQ. IN.
MOISTURE CONTENT	= 90.94	PERCENT
WET DENSITY	= 96.45	PCF
DRY DENSITY	= 50.51	PCF
PERCENT SATURATION	= 107.18	PERCENT
CELL PRESSURE	= .80	KSF

I N P U T D A T A		O U T P U T D A T A		
DEF	LOAD CELL	STRAIN	V.STRESS	T.STRESS
INCHES	DIV	IN/IN	KSF	KSF
.000000	.0	.000000	.000	.801
.005000	1.3	.000868	.031	.831
.010000	2.4	.001736	.056	.857
.015000	3.6	.002604	.085	.885
.020000	4.8	.003471	.113	.913
.025000	5.4	.004339	.127	.927
.030000	6.3	.005207	.148	.948
.035000	6.8	.006075	.159	.960
.040000	7.8	.006943	.182	.983
.045000	8.5	.007811	.199	.999
.050000	9.5	.008679	.222	1.022
.060000	10.9	.010414	.254	1.055
.070000	11.3	.012150	.263	1.064
.080000	11.8	.013886	.274	1.075
.090000	12.6	.015621	.292	1.093
.100000	13.2	.017357	.305	1.106
.125000	14.9	.021696	.343	1.144
.150000	16.0	.026036	.367	1.168
.175000	17.6	.030375	.400	1.203
.200000	17.7	.034714	.408	1.203
.225000	17.8	.039053	.410	1.203
.250000	17.9	.043393	.412	1.204
.275000	18.0	.047732	.410	1.204
.300000	18.2	.052071	.402	1.207
.350000	16.8	.060750	.372	1.172
.400000	16.4	.069428	.359	1.160
.450000	16.2	.078107	.352	1.152

 10BH-011 (P1) @ 10 to 12 feet pt. 2, UU

.500000	16.0	.086785	.344	1.145
.550000	15.7	.095464	.334	1.135
.600000	15.5	.104143	.327	1.128
.650000	15.5	.112821	.324	1.124
.700000	15.5	.121500	.321	1.121
.750000	15.5	.130178	.317	1.118
.800000	15.5	.138857	.314	1.115
.850000	15.5	.147535	.311	1.112
.900000	15.5	.156214	.308	1.109
.950000	15.5	.164892	.305	1.105
1.000000	15.5	.173571	.302	1.102
1.050000	15.5	.182249	.298	1.099
1.100000	15.5	.190928	.295	1.096
1.150000	15.5	.199607	.292	1.093

Consolidation Test

One Dimensional

Engineering and Testing Consultants, Inc.

etc.

Project Data

Project: **Midtown Tunnel** Client: **PB Americas, Inc.**

Project Number: 4955-110 Date: 9/29/2010

Sample Data

Boring: **10BH-011 (P1)** Depth: **10 to 12** feet (middle)

Sample Classification: **CLAY (CH), Dark Gray, with Silt, Trace Organics**

Specific Gravity =	**2.585**	Volume of Sample (Cu. In.) =	**4.91**
Wet Sample Weight (gm) =	**119.48**	Initial Wet Unit Weight (pcf) =	**92.5**
Diameter of Sample (in.) =	**2.5**	Initial Dry Unit Weight (pcf) =	**50.0**
Sample Thickness (in.) =	**1.0**	Initial Saturation (%) =	**98.7**
Initial Water Content (%) =	**85.0**	Initial Void Ratio =	**2.227**

Test Method

Load Sample Inundated (ksf) =	**0**	Method =	**Square Root of Time**
Drainage =	**Double**	Stone Corrections =	**None**
Initial Gauge Reading =	**0.8459**		

Data Reduction including Initial, Primary, & Secondary Consolidation

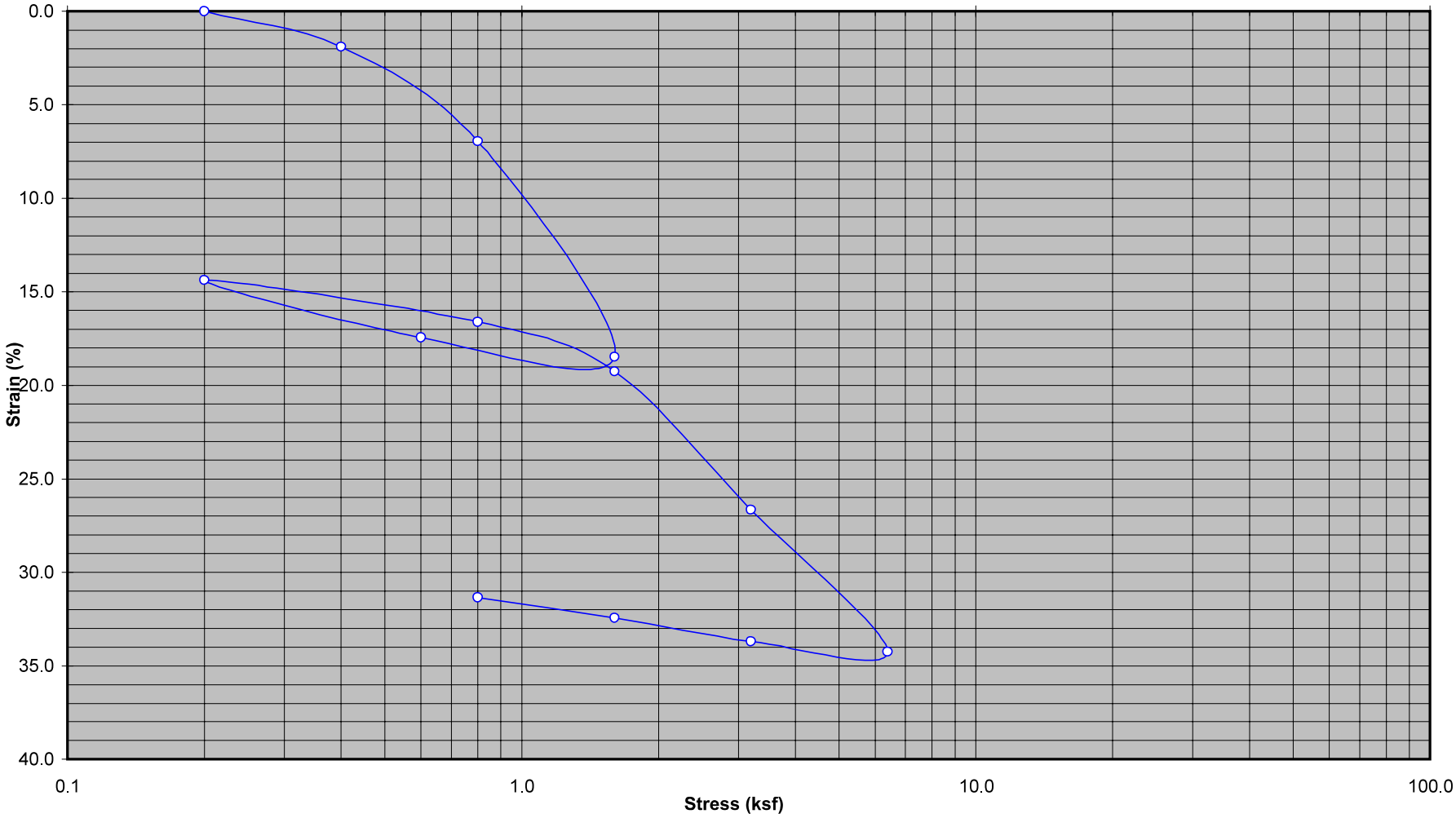
Stress (ksf)	D0 (%)	D90 (inch)	Dend (inch)	T90 (minutes)	Sample Height at Dend	% Initial	% Secondary
0.20	0.8455	0.8435	0.8416	3.6	0.9961	9	39
0.40	0.8408	0.8289	0.8226	9.3	0.9771	6	26
0.80	0.8194	0.7778	0.7721	66.0	0.9266	6	2
1.60	0.7694	0.6775	0.6569	144.6	0.8114	3	9
0.60	0.6572	0.6640	0.6672	7.6	0.8217	4	24
0.20	0.6677	0.6908	0.6979	86.5	0.8524	2	15
0.80	0.6966	0.6800	0.6756	17.2	0.8301	7	11
1.60	0.6749	0.6539	0.6490	29.7	0.8035	3	10
3.20	0.6478	0.5830	0.5750	72.3	0.7295	2	1
6.40	0.5618	0.5082	0.4990	44.2	0.6535	18	4
3.20	0.4993	0.5037	0.5046	5.3	0.6591	6	7
1.60	0.5048	0.5130	0.5173	13.0	0.6718	2	27
0.80	0.5174	0.5230	0.5280	29.0	0.6825	2	41

Data Output

Stress (ksf)	Strain (%)	Void Ratio	av	Cv (Sq. Ft./Day)	Permeability (Feet/Day)	Constrained Modulus (Kip/Sq.Ft.)	Cc
0.20	0.00	2.176					
0.40	1.90	2.116	3.02E-01	0.218	1.32E-03	10	0.200
0.80	6.95	1.956	4.01E-01	0.028	2.33E-04	7	0.533
1.60	18.47	1.590	4.57E-01	0.010	1.06E-04	6	1.216
0.60	17.44	1.622	3.27E-02	0.188	1.47E-04	80	0.077
0.20	14.37	1.720	2.44E-01	0.018	9.96E-05	11	0.204
0.80	16.60	1.649	1.18E-01	0.085	2.36E-04	22	0.118
1.60	19.26	1.565	1.06E-01	0.046	1.18E-04	24	0.281
3.20	26.66	1.329	1.47E-01	0.016	6.14E-05	16	0.781
6.40	34.26	1.088	7.54E-02	0.020	4.62E-05	28	0.802
3.20	33.70	1.106	5.56E-03	0.174	2.86E-05	379	0.059
1.60	32.43	1.146	2.52E-02	0.074	5.39E-05	85	0.134
0.80	31.36	1.180	4.25E-02	0.034	4.14E-05	51	0.113
						Cc =	1.216

One Dimensional Consolidation Test

Stress Versus Strain Plot



Initial Wet Unit Weight (pcf) =	**92.5**	Project:	**Midtown Tunnel**
Initial Dry Unit Weight (pcf) =	**50.0**	Client:	PB Americas, Inc.
Initial Water Content (%) =	**85.0**	Project Number:	4955-110
Initial Saturation (%) =	**98.7**		
Specific Gravity =	**2.585**	Sample Description:	CLAY (CH), Dark Gray, with Silt, Trace Organics
Initial Void Ratio =	**2.227**	**Boring:**	**10BH-011 (P1)** Depth: **10 to 12** feet (Middle)

etc.

Engineering and Testing Consultants, Inc.

UNCONSOLIDATED, UNDRAINED COMPRESSIVE STRENGTH OF COHESIVE SOILS
ASTM D 2850

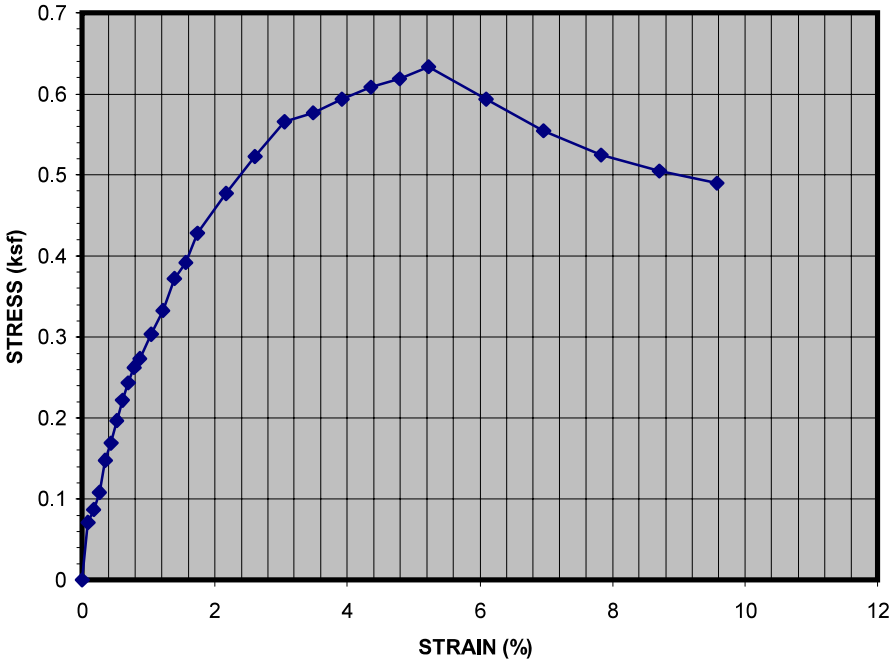
Project Name:	**Midtown Tunnel**
Number:	4955-110
Sample Number:	10BH-011 (P2) Point 1
Sample Depth:	25 to 27 feet (Middle)
Sample Description:	CLAY (CH), Dark Gray, with Silt, Trace Fine Sand
Sample Type:	Piston

Failure Photo



Deviator Stress:	**0.63 ksf**
Strain at Failure:	**5.2 %**

Rate of Strain:	1.0	%	Confining Pressure:	1.1	ksf
Avg. Sample Height:	5.744	Inches	Void Ratio:	1.881	
Avg. Sample Diameter:	2.790	Inches	Initial Area:	6.114	In²
Wet Density:	100.2	pcf	Specific Gravity:	2.655	
Dry Density:	57.5	pcf	Liquid Limit:	100	
Moisture Content:	74.2	%	Plastic Limit:	26	
Saturation:	104.77	%	Plastic Index:	74	



ENGINEERING AND TESTING CONSULTANTS, INC.
TRIAXIAL SHEAR TEST

Project Name: Midtown Tunnel
Project Number: 4955-110
Boring Number: 10BH-011 (P2) Point 1 @ 25 to 27 feet (Middle)
Sample Description: CLAY (CH), Dark Gray, with Silt, Trace Fine Sand

UNCONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAIN CONTROL

P R O P E R T I E S

SPECIFIC GRAVITY	= 2.655	
LIQUID LIMIT	= 100	
PLASTIC LIMIT	= 26	
INITIAL LENGTH	= 5.74	INCHES
VOID RATIO	= 1.881	
INITIAL AREA	= 6.114	SQ. IN.
MOISTURE CONTENT	= 74.24	PERCENT
WET DENSITY	= 100.19	PCF
DRY DENSITY	= 57.50	PCF
PERCENT SATURATION	= 104.77	PERCENT
CELL PRESSURE	= 1.10	KSF

I N P U T D A T A		O U T P U T D A T A		
DEF INCHES	LOAD CELL DIV	STRAIN IN/IN	V.STRESS KSF	T.STRESS KSF
.000000	.0	.000000	.000	1.100
.005000	3.0	.000870	.071	1.171
.010000	3.7	.001741	.087	1.187
.015000	4.6	.002611	.108	1.208
.020000	6.3	.003482	.148	1.248
.025000	7.2	.004352	.169	1.269
.030000	8.4	.005223	.197	1.297
.035000	9.5	.006093	.222	1.323
.040000	10.4	.006963	.243	1.343
.045000	11.2	.007834	.262	1.362
.050000	11.7	.008704	.273	1.373
.060000	13.0	.010445	.303	1.403
.070000	14.3	.012186	.333	1.433
.080000	16.0	.013927	.372	1.472
.090000	16.9	.015668	.392	1.492
.100000	18.5	.017408	.428	1.528
.125000	20.7	.021761	.477	1.577
.150000	22.8	.026113	.523	1.623
.175000	24.8	.030465	.566	1.667
.200000	25.4	.034817	.577	1.678
.225000	26.2	.039169	.593	1.693
.250000	27.0	.043521	.608	1.708
.275000	27.6	.047873	.619	1.719
.300000	28.4	.052225	.634	1.734
.350000	26.8	.060930	.593	1.693
.400000	26.7	.069634	.555	1.685
.450000	24.2	.078338	.525	1.626

.500000	23.5	.087042	.505	1.605
.550000	23.0	.095747	.490	1.590
.600000	22.6	.104451	.477	1.577
.650000	22.2	.113155	.464	1.564
.700000	22.0	.121859	.455	1.555

Engineering and Testing Consultants, Inc.

UNCONSOLIDATED, UNDRAINED COMPRESSIVE STRENGTH OF COHESIVE SOILS
ASTM D 2850

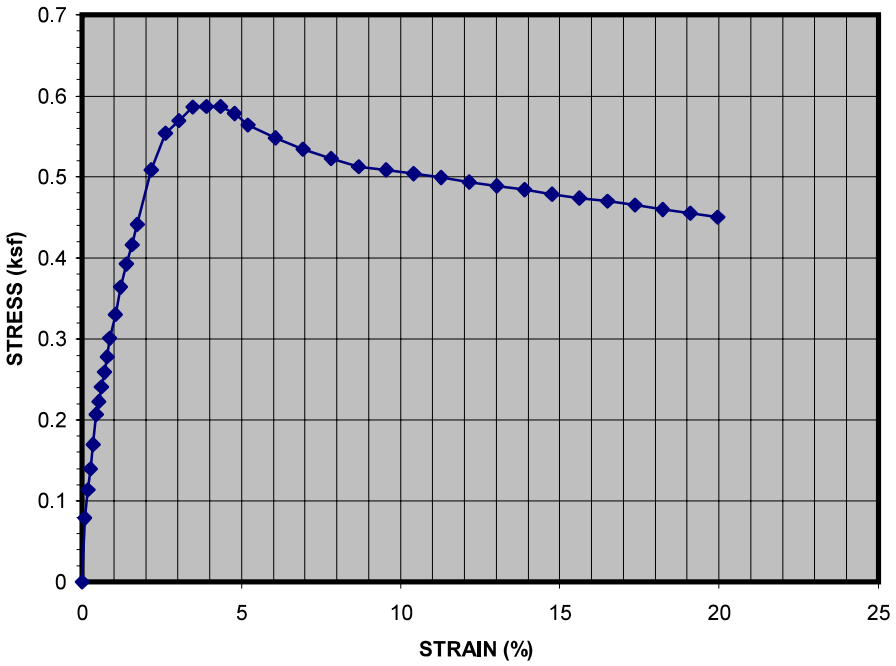
Project Name:	**Midtown Tunnel**
Number:	4955-110
Sample Number:	10BH-011 (P2) Point 2
Sample Depth:	25 to 27 feet (Bottom)
Sample Description:	CLAY (CH), Dark Gray, with Silt, Trace Fine Sand
Sample Type:	Piston

Failure Photo



Deviator Stress:	**0.59 ksf**
Strain at Failure:	**5.2 %**

Rate of Strain:	1.0 %	Confining Pressure:	2.2 ksf
Avg. Sample Height:	5.761 Inches	Void Ratio:	2.070
Avg. Sample Diameter:	2.803 Inches	Initial Area:	6.172 In²
Wet Density:	99.2 pcf	Specific Gravity:	2.655
Dry Density:	56.0 pcf	Liquid Limit:	100
Moisture Content:	77.1 %	Plastic Limit:	26
Saturation:	98.87 %	Plastic Index:	74



ENGINEERING AND TESTING CONSULTANTS, INC.
TRIAXIAL SHEAR TEST

Project Name: Midtown Tunnel
Project Number: 4955-110
Boring Number: 10BH-011 (P2) Point 2 @ 25 to 27 feet (Bottom)
Sample Description: CLAY (CH), Dark Gray, with Silt, Trace Fine Sand

UNCONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAIN CONTROL

P R O P E R T I E S

SPECIFIC GRAVITY	=	2.655
LIQUID LIMIT	=	100
PLASTIC LIMIT	=	26
INITIAL LENGTH	=	5.76 INCHES
VOID RATIO	=	2.070
INITIAL AREA	=	6.172 SQ. IN.
MOISTURE CONTENT	=	77.09 PERCENT
WET DENSITY	=	95.56 PCF
DRY DENSITY	=	53.97 PCF
PERCENT SATURATION	=	98.87 PERCENT
CELL PRESSURE	=	2.20 KSF

I N P U T D A T A		O U T P U T D A T A		
DEF	LOAD CELL	STRAIN	V.STRESS	T.STRESS
INCHES	DIV	IN/IN	KSF	KSF
.000000	.0	.000000	.000	2.200
.005000	3.4	.000868	.079	2.280
.010000	4.9	.001736	.114	2.314
.015000	6.0	.002604	.140	2.340
.020000	7.3	.003472	.170	2.370
.025000	8.9	.004340	.207	2.407
.030000	9.6	.005207	.223	2.423
.035000	10.4	.006075	.241	2.441
.040000	11.2	.006943	.259	2.460
.045000	12.0	.007811	.278	2.478
.050000	13.0	.008679	.301	2.501
.060000	14.3	.010415	.330	2.530
.070000	15.8	.012151	.364	2.564
.080000	17.1	.013886	.393	2.594
.090000	18.1	.015622	.416	2.616
.100000	19.3	.017358	.442	2.643
.125000	22.3	.021698	.509	2.709
.150000	24.4	.026037	.554	2.755
.175000	25.2	.030377	.570	2.770
.200000	26.0	.034716	.586	2.786
.225000	26.2	.039056	.587	2.788
.250000	26.3	.043395	.587	2.787
.275000	26.0	.047735	.578	2.778
.300000	25.5	.052074	.564	2.764
.350000	25.0	.060753	.548	2.748
.400000	24.6	.069432	.534	2.734
.450000	24.3	.078111	.523	2.723

 10BH-011 @ 25 to 27 feet pt. 2, UU

.500000	24.1	.086790	.513	2.714
.550000	24.1	.095470	.509	2.709
.600000	24.1	.104149	.504	2.704
.650000	24.1	.112828	.499	2.699
.700000	24.1	.121507	.494	2.694
.750000	24.1	.130186	.489	2.689
.800000	24.1	.138865	.484	2.685
.850000	24.1	.147544	.479	2.680
.900000	24.1	.156223	.474	2.675
.950000	24.1	.164902	.470	2.670
1.000000	24.1	.173581	.465	2.665
1.050000	24.1	.182260	.460	2.660
1.100000	24.1	.190939	.455	2.655
1.150000	24.1	.199618	.450	2.650

Consolidation Test

One Dimensional

Engineering and Testing Consultants, Inc.

etc.

Project Data

Project: **Midtown Tunnel** Client: **PB Americas, Inc.**

Project Number: 4955-110 Date: 9/29/2010

Sample Data

Boring: **10BH-011 (P2)** Depth: **25 to 27** feet (middle)

Sample Classification: **CLAY (CH), Dark Gray, with Silt**

Specific Gravity =	**2.655**	Volume of Sample (Cu. In.) =	**4.91**
Wet Sample Weight (gm) =	**120.53**	Initial Wet Unit Weight (pcf) =	**93.3**
Diameter of Sample (in.) =	**2.5**	Initial Dry Unit Weight (pcf) =	**50.5**
Sample Thickness (in.) =	**1.0**	Initial Saturation (%) =	**98.6**
Initial Water Content (%) =	**84.6**	Initial Void Ratio =	**2.278**

Test Method

Load Sample Inundated (ksf) =	**0**	Method =	**Square Root of Time**
Drainage =	**Double**	Stone Corrections =	**None**
Initial Gauge Reading =	**0.8501**		

Data Reduction including Initial, Primary, & Secondary Consolidation

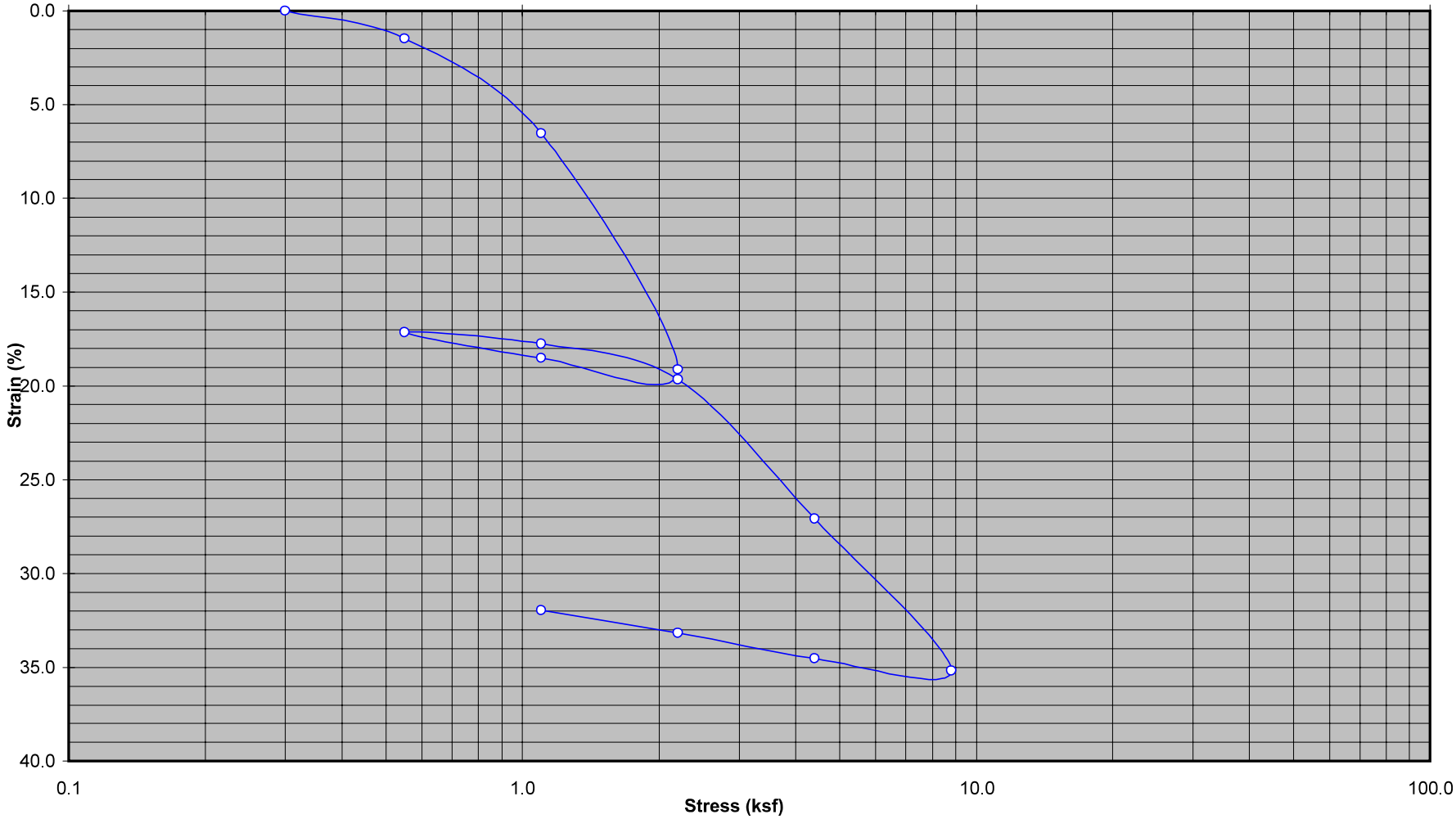
Stress (ksf)	D0 (%)	D90 (inch)	Dend (inch)	T90 (minutes)	Sample Height at Dend	% Initial	% Secondary
0.30	0.8483	0.8458	0.8437	4.0	0.9954	28	28
0.55	0.8428	0.8331	0.8289	8.0	0.9806	8	21
1.10	0.8262	0.7900	0.7785	39.1	0.9302	6	15
2.20	0.7778	0.6752	0.6524	124.3	0.8041	1	9
1.10	0.6528	0.6570	0.6587	7.6	0.8104	8	20
0.55	0.6588	0.6701	0.6723	38.0	0.8240	1	7
1.10	0.6721	0.6670	0.6661	13.0	0.8178	3	5
2.20	0.6656	0.6522	0.6472	17.2	0.7989	3	19
4.40	0.6468	0.5822	0.5730	55.5	0.7247	1	3
8.80	0.5555	0.5010	0.4921	47.6	0.6438	22	4
4.40	0.4927	0.4970	0.4984	4.0	0.6501	11	15
2.20	0.4987	0.5084	0.5120	19.8	0.6637	3	19
1.10	0.5121	0.5205	0.5240	46.2	0.6757	1	21

Data Output

Stress (ksf)	Strain (%)	Void Ratio	av	Cv (Sq. Ft./Day)	Permeability (Feet/Day)	Constrained Modulus (Kip/Sq.Ft.)	Cc
0.30	0.00	2.234					
0.55	1.48	2.186	1.91E-01	0.255	9.55E-04	17	0.182
1.10	6.52	2.023	2.96E-01	0.047	2.87E-04	10	0.541
2.20	19.13	1.615	3.71E-01	0.011	9.75E-05	7	1.355
1.10	18.50	1.635	1.85E-02	0.183	8.03E-05	142	0.068
0.55	17.14	1.679	8.00E-02	0.038	7.05E-05	34	0.146
1.10	17.76	1.659	3.65E-02	0.109	9.33E-05	73	0.067
2.20	19.65	1.598	5.56E-02	0.079	1.05E-04	47	0.203
4.40	27.07	1.358	1.09E-01	0.020	5.79E-05	22	0.797
8.80	35.16	1.097	5.95E-02	0.018	3.27E-05	35	0.869
4.40	34.53	1.117	4.63E-03	0.224	3.06E-05	457	0.068
2.20	33.17	1.161	2.00E-02	0.047	2.72E-05	108	0.146
1.10	31.97	1.200	3.53E-02	0.021	2.10E-05	62	0.129
						Cc =	1.355

One Dimensional Consolidation Test

Stress Versus Strain Plot

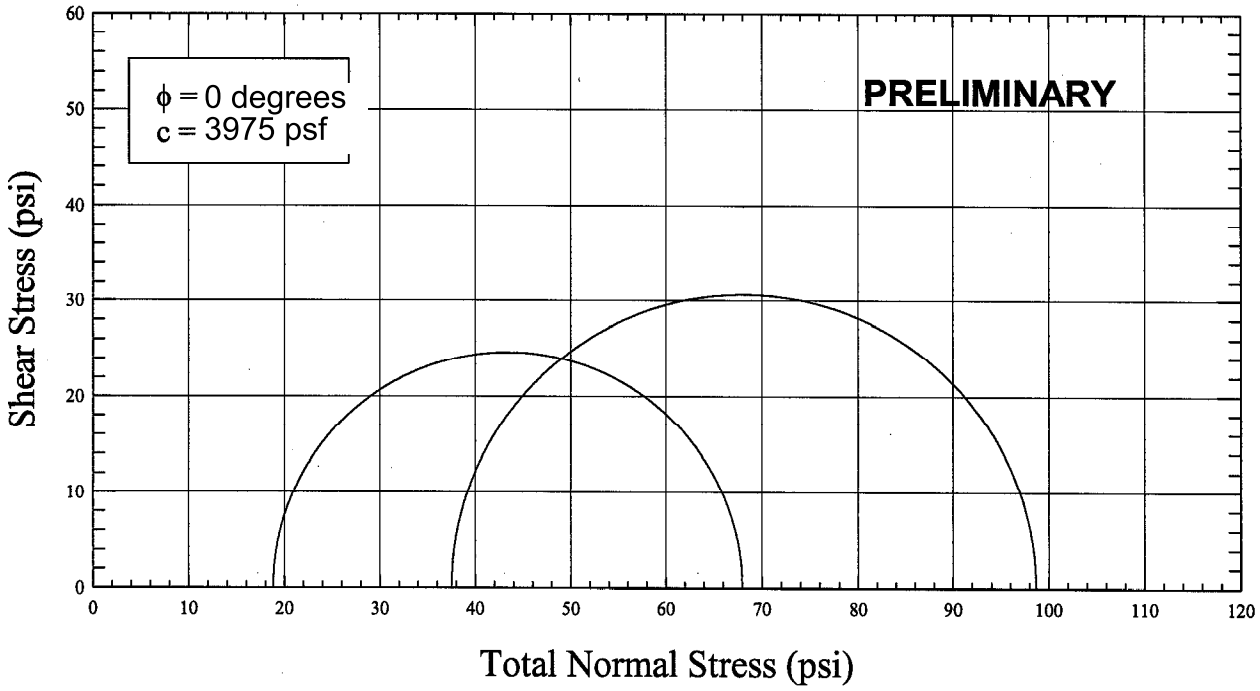


Initial Wet Unit Weight (pcf) =	**93.3**	Project:	**Midtown Tunnel**
Initial Dry Unit Weight (pcf) =	**50.5**	Client:	PB Americas, Inc.
Initial Water Content (%) =	**84.6**	Project Number:	4955-110
Initial Saturation (%) =	**98.6**		
Specific Gravity =	**2.655**	Sample Description:	CLAY (CH), Dark Gray, with Silt
Initial Void Ratio =	**2.278**	**Boring:**	**10BH-011 (P2)** Depth: **25 to 27** feet (Middle)

etc.

Unconsolidated Undrained (UU) Triaxial Shear (ASTM D2850)

Mohr Stress Circles at Maximum Deviator Stress Criterion



Boring No.: *10BH-012* Depth: *63-65 ft* Elevation: *-69.0 to -71.0 ft* SEC Contract: *10613051.00.21* Date:
Sample Description: *SILTY SAND (SM), fine to medium, contains shells - gray* Reviewed By:
Specimen Type: *Tube Sample* Gs: *2.71* LL: *NP* PI: *NP* %<200: *20.0*

Schnabel ENGINEERING

MTT, DTT & MLK Exp. Project
Elizabeth River, VA

Schnabel ENGINEERING

Unconsolidated Undrained Triaxial Compression Test

ASTM D2850

Project: *MTT, DTT & MLK Exp. Project*

Location: *Elizabeth River*

Schnabel Contract: *10613051.00.21* Date: *1/0/1900*

Boring No.: *10BH-012*

Depth: *63-65 ft.* Reviewed by: *0*

Elevation: *-69.0 to -71.0 ft.*

Confining Stress (psi): *18.8*

Specimen Conditions	
Diameter (in)	2.874
Height (in)	5.816
Area (in^2)	6.49
Moisture (%):	27.5
Weight (lbs)	2.59
ρ_{wet} (pcf)	118.5
ρ_{dry} (pcf)	93.0
Void Ratio	0.82
Saturation, %	91

Shear Testing Conditions	
Cell Pressure (psi):	18.8
Rate of Strain (%/min):	1.0

Specimen Type: *Tube Sample*

Axial Strain at Failure (%): *9.94*

Compressive Strength (psi): *49.2*

Major Principal Stress (psi): *68.0*

Minor Principal Stress (psi): *18.8*

Soil Description: *SILTY SAND (SM), fine to medium, contains shells - gray*

Liquid Limit: *NP*

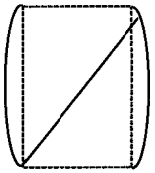
Plasticity Index: *NP*

% finer that No. 200: *20.0*

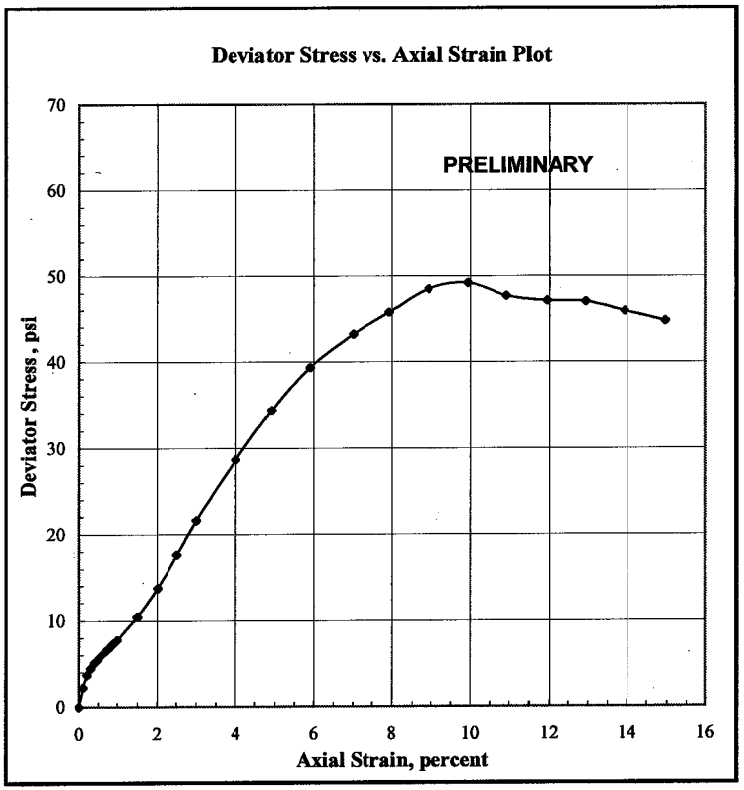
Specific Gravity: *2.71*

Remarks:

Failure Sketch



Reading No.	Deviator Load (lbs)	Corrected Dev. Load[1] (lbs.)	Axial Displacement (in.)	Axial Strain (%)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	Deviator Stress (psi)
Initial	0.0	0.0	0.000	0.00	6.49	18.8	18.8	0.0
1	14.8	14.8	0.006	0.10	6.50	21.1	18.8	2.3
2	24.2	24.2	0.012	0.21	6.50	22.5	18.8	3.7
3	29.0	28.9	0.017	0.29	6.51	23.2	18.8	4.4
4	33.5	33.4	0.023	0.40	6.52	23.9	18.8	5.1
5	36.6	36.5	0.029	0.50	6.52	24.4	18.8	5.6
6	39.7	39.6	0.035	0.60	6.53	24.9	18.8	6.1
7	42.5	42.3	0.041	0.70	6.54	25.3	18.8	6.5
8	45.5	45.3	0.047	0.81	6.54	25.7	18.8	6.9
9	48.1	47.9	0.052	0.89	6.55	26.1	18.8	7.3
10	51.2	51.0	0.058	1.00	6.56	26.6	18.8	7.8
11	69.1	68.8	0.087	1.50	6.59	29.2	18.8	10.4
12	91.4	91.0	0.117	2.01	6.62	32.5	18.8	13.7
13	117.8	117.3	0.146	2.51	6.66	36.4	18.8	17.6
14	145.1	144.4	0.175	3.01	6.69	40.4	18.8	21.6
15	194.6	193.7	0.233	4.01	6.76	47.5	18.8	28.7
16	235.5	234.4	0.286	4.92	6.83	53.1	18.8	34.3
17	272.7	271.4	0.344	5.91	6.90	58.1	18.8	39.3
18	303.0	301.5	0.408	7.02	6.98	62.0	18.8	43.2
19	324.2	322.5	0.461	7.93	7.05	64.6	18.8	45.8
20	347.4	345.5	0.519	8.92	7.13	67.3	18.8	48.5
21	356.5	354.3	0.578	9.94	7.21	68.0	18.8	49.2
22	349.7	347.3	0.636	10.94	7.29	66.5	18.8	47.7
23	349.7	347.1	0.695	11.95	7.37	65.9	18.8	47.1
24	353.3	350.5	0.753	12.95	7.46	65.8	18.8	47.0
25	349.2	346.2	0.811	13.94	7.54	64.7	18.8	45.9
26	344.6	341.4	0.870	14.96	7.63	63.5	18.8	44.7



Notes: 1. Deviator load corrected for membrane effects.

2. Right Cylinder Correction Method

Schnabel ENGINEERING

Unconsolidated Undrained Triaxial Compression Test

ASTM D2850

Project: *MTT, DTT & MLK Exp. Project*

Location: *Elizabeth River*

Schnabel Contract: *10613051.00.21* Date: *1/0/1900*

Boring No.: *10BH-012*

Depth: *63-65 ft.* Reviewed by: *0*

Elevation: *-69.0 to -71.0 ft.*

Confining Stress (psi): *37.5*

Specimen Conditions	
Diameter (in)	2.893
Height (in)	5.799
Area (in^2)	6.57
Moisture (%):	29.2
Weight (lbs)	2.61
ρ_{wet} (pcf)	118.3
ρ_{dry} (pcf)	91.6
Void Ratio	0.85
Saturation, %	93

Shear Testing Conditions	
Cell Pressure (psi):	37.5
Rate of Strain (%/min):	1.0

Specimen Type: *Tube Sample*

Axial Strain at Failure (%): *7.95*

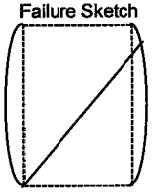
Compressive Strength (psi): *61.2*

Major Principal Stress (psi): *98.7*

Minor Principal Stress (psi): *37.5*

Soil Description: *SILTY SAND (SM), fine to medium, contains shells - gray*

Failure Sketch



Liquid Limit: *NP*

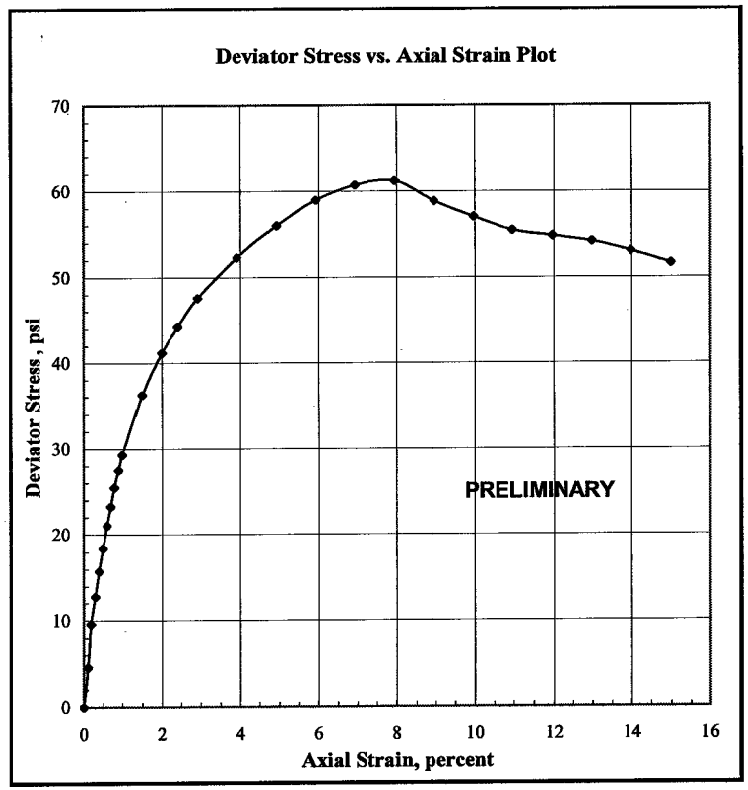
Plasticity Index: *NP*

% finer that No. 200: *20.0*

Specific Gravity: *2.71*

Remarks:

Reading No.	Deviator Load (lbs)	Corrected Dev. Load[1] (lbs.)	Axial Displacement (in.)	Axial Strain (%)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	Deviator Stress (psi)
Initial	0.0	0.0	0.000	0.00	6.57	37.5	37.5	0.0
1	30.2	30.2	0.006	0.10	6.58	42.1	37.5	4.6
2	63.2	63.2	0.011	0.19	6.59	47.1	37.5	9.6
3	84.3	84.2	0.017	0.29	6.59	50.3	37.5	12.8
4	104.1	104.0	0.023	0.40	6.60	53.3	37.5	15.8
5	121.7	121.6	0.029	0.50	6.61	55.9	37.5	18.4
6	139.3	139.2	0.035	0.60	6.61	58.5	37.5	21.0
7	154.2	154.0	0.041	0.71	6.62	60.8	37.5	23.3
8	169.0	168.8	0.046	0.79	6.63	63.0	37.5	25.5
9	182.4	182.2	0.052	0.90	6.63	65.0	37.5	27.5
10	194.8	194.6	0.058	1.00	6.64	66.8	37.5	29.3
11	242.0	241.7	0.087	1.50	6.68	73.7	37.5	36.2
12	276.8	276.4	0.116	2.00	6.71	78.7	37.5	41.2
13	298.5	298.0	0.140	2.41	6.74	81.7	37.5	44.2
14	322.7	322.1	0.169	2.91	6.77	85.1	37.5	47.6
15	358.7	357.8	0.227	3.91	6.84	89.8	37.5	52.3
16	388.2	387.1	0.286	4.93	6.92	93.5	37.5	56.0
17	413.1	411.8	0.344	5.93	6.99	96.4	37.5	58.9
18	430.4	428.9	0.402	6.93	7.06	98.2	37.5	60.7
19	438.8	437.1	0.461	7.95	7.14	98.7	37.5	61.2
20	426.7	424.7	0.519	8.95	7.22	96.3	37.5	58.8
21	418.3	416.1	0.578	9.97	7.30	94.5	37.5	57.0
22	411.7	409.3	0.636	10.97	7.38	92.9	37.5	55.4
23	411.6	409.0	0.694	11.97	7.47	92.3	37.5	54.8
24	412.1	409.3	0.753	12.98	7.56	91.7	37.5	54.2
25	408.6	405.5	0.811	13.99	7.64	90.6	37.5	53.1
26	402.7	399.4	0.869	14.99	7.73	89.1	37.5	51.6



Notes: 1. Deviator load corrected for membrane effects.

2. Right Cylinder Correction Method

Schnabel ENGINEERING

Unconfined Compression Test Report

ASTM D2166

Date: *1/0/1900*

Project: *MTT, DTT & MLK Exp. Project*

Location: *Elizabeth River*

Schnabel No.: *10613051.00.21*
Boring No.: *10BH-012*
Depth: *63-65 ft.*
Elevation: *-69.0 to -71.0 ft.*

Test Specimen Data	
Initial Diameter, in:	*2.875*
Initial Area, in^2:	*6.496*
Initial Height, in:	*5.774*
H/D Ratio:	*2.0*
Moisture Content, %:	*29.3*
Wet Unit Weight, pcf:	*119.6*
Dry Unit Weight, pcf:	*92.6*

Testing Information	
Test Procedure:	*ASTM D2166*
Type of Specimen:	*Tube Sample*
Load Cell No.:	*1018253*
Strain Rate, %/min.:	*1.0*

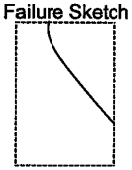
Remarks:

Specimen Type:	*Tube Sample*

Strength Data	
Strain at Failure, %:	*2.9*
Unconfined Strength (Qu), tsf:	*0.73*
Shear Strength (Su), tsf:	*0.37*

Reviewed by: *0*

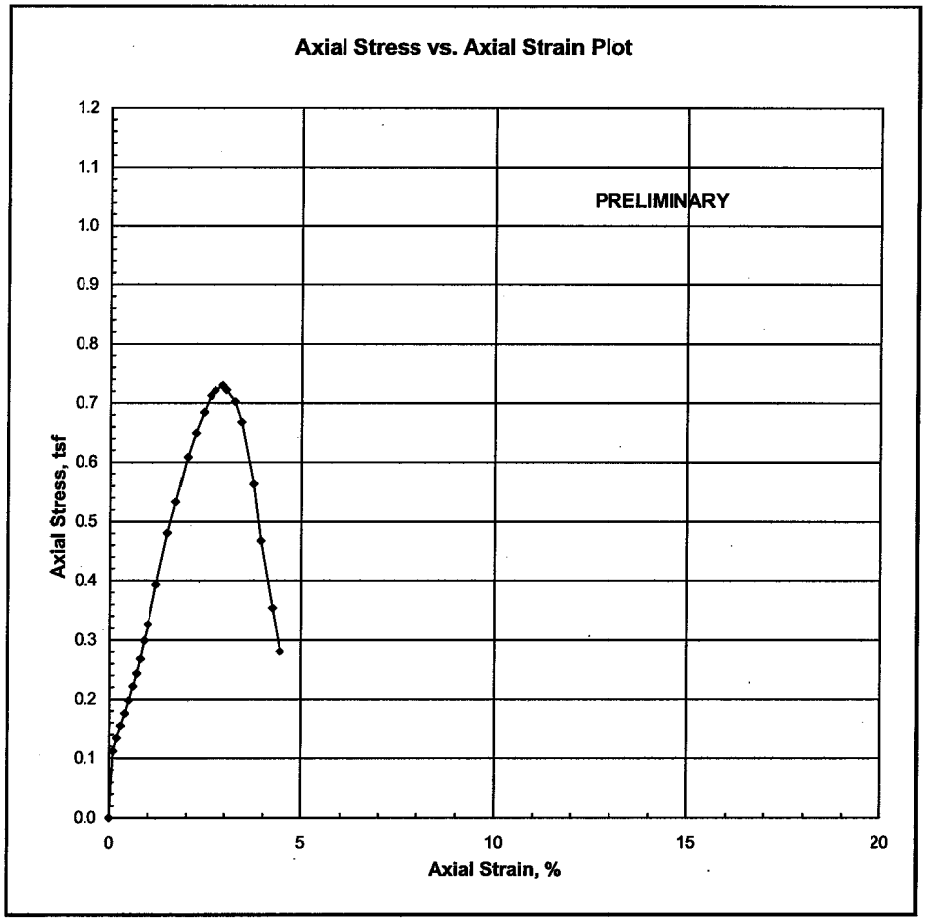
Failure Sketch



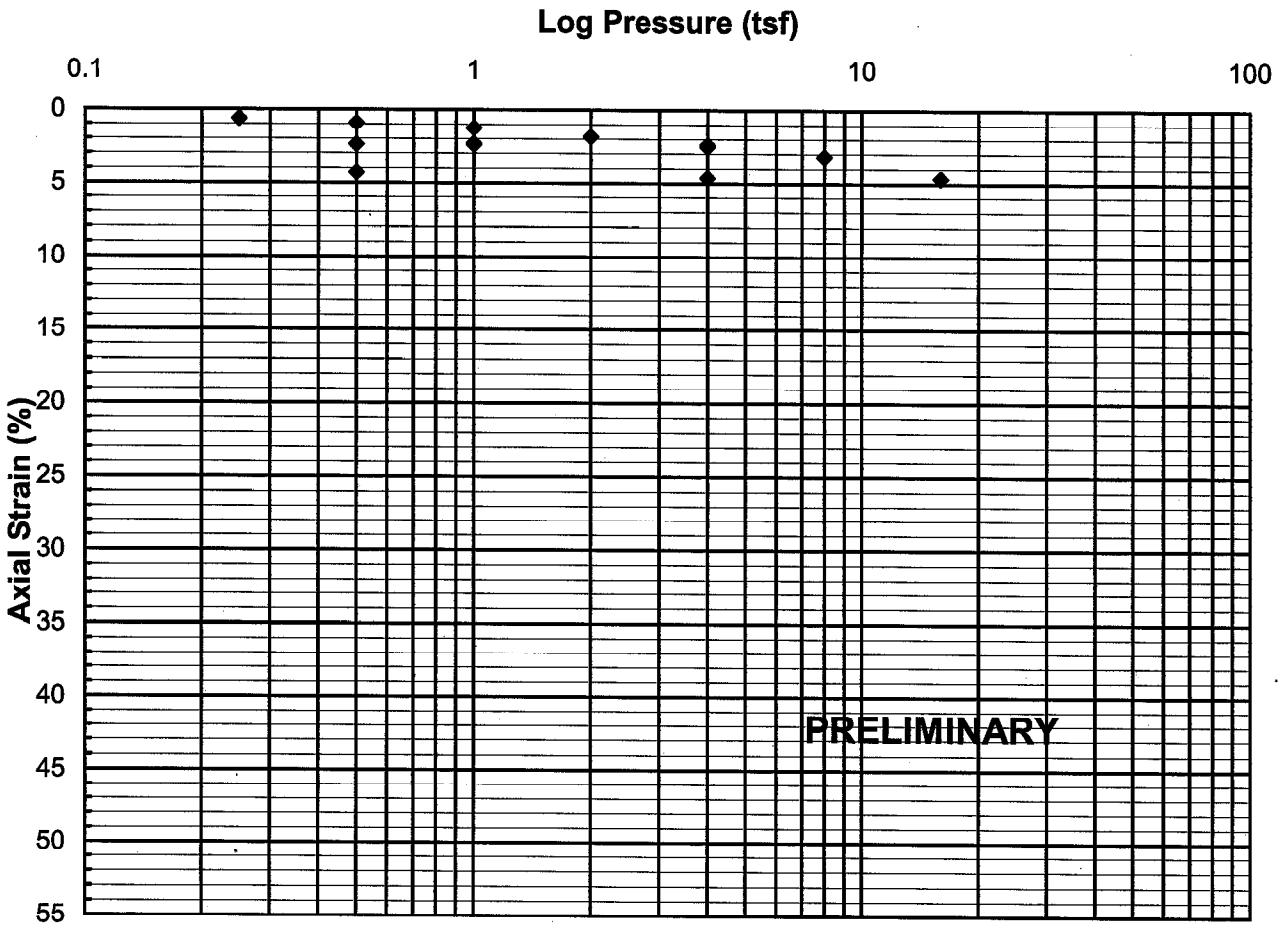
Soil Desc.: *SILTY SAND (SM), fine to medium, contains shells - gray*

LL, %:	*NP*	% < 200:	*20.0*
PI, %:	*NP*	Gs:	*2.71*

Test Data						
Reading No.	Axial Load (lbs)	Axial Displ. (in.)	Axial Strain (%)	Corrected Area[1] (in^2)	Axial Stress (psi)	Axial Stress (tsf)
Zero	0.0	0.000	0.0	6.50	0.0	0.00
1	10.1	0.006	0.1	6.50	1.6	0.11
2	12.1	0.011	0.2	6.51	1.9	0.13
3	14.0	0.017	0.3	6.51	2.1	0.15
4	15.9	0.023	0.4	6.52	2.4	0.18
5	17.9	0.029	0.5	6.53	2.7	0.20
6	20.1	0.035	0.6	6.54	3.1	0.22
7	22.1	0.041	0.7	6.54	3.4	0.24
8	24.4	0.046	0.8	6.55	3.7	0.27
9	27.2	0.052	0.9	6.55	4.1	0.30
10	29.7	0.058	1.0	6.56	4.5	0.33
11	35.9	0.070	1.2	6.58	5.5	0.39
12	44.0	0.087	1.5	6.59	6.7	0.48
13	48.9	0.099	1.7	6.61	7.4	0.53
14	56.0	0.116	2.0	6.63	8.4	0.61
15	59.9	0.128	2.2	6.64	9.0	0.65
16	63.3	0.140	2.4	6.66	9.5	0.68
17	66.0	0.151	2.6	6.67	9.9	0.71
18	66.9	0.157	2.7	6.68	10.0	0.72
19	67.8	0.169	2.9	6.69	10.1	0.73
20	67.2	0.175	3.0	6.70	10.0	0.72
21	65.5	0.188	3.3	6.71	9.8	0.70
22	62.4	0.198	3.4	6.73	9.3	0.67
23	52.8	0.216	3.7	6.75	7.8	0.56
24	43.9	0.227	3.9	6.76	6.5	0.47
25	33.3	0.245	4.2	6.78	4.9	0.35
26	26.5	0.257	4.5	6.80	3.9	0.28



Notes: 1. Right Cylinder Area Correction Method



Evaluation of Pp', Cer, and Cec relies on the design professional's engineering judgement and project details.

Probable Preconsolidation Pressure (Pp), tsf: N/A			**Recompression Ratio (Cer):** N/A
Type of Specimen: *Tube Sample*			**Compression Ratio (Cec):** N/A
Description: *SILTY SAND (SM), fine to medium, contains shells - gray*			
LL: *NP*	**PI:** *NP*	**Gs:** *2.71*	**P_o' (tsf):** *0.00*
% < No. 200: *20.0*		**Test Method:** *ASTM D2435 Method A*	
Test Condition: *Inundated @ 0.05tsf*			

	Initial	Final
Water Content, %	*29.1*	*27.8*
Void Ratio	*0.81*	*0.73*
Saturation, %	*97*	*100*
Dry Unit Weight, pcf	*93.3*	*97.5*

Remarks:

Average Water Content of Trimmings, %: *29.2*

Schnabel ENGINEERING

Project: MTT, DTT & MLK Exp. Project

Location	*Elizabeth River*		
Boring:	*10BH-012*	**Schnabel No.:**	*10613051.00.21*
Depth:	*63-65 ft.*	**Elevation:**	*-69.0 to -71.0 ft.*
Date:	*1/0/1900*	**Reviewed by:**	*0*

Consolidation Test Report

Consolidation Test Data Sheet

Consolidometer ID: 1 1/0/00

Schnabel Contract: 10613051.00.21

Project: MTT, DTT & MLK Exp. Project

Test Method: ASTM D2435 Method A

Test Condition: Inundated @ 0.05tsf

Initial Height of Specimen (H_o), in.: 0.7472

Height of Solids (H_s), in.: 0.4123

Boring No.: 10BH-012

Depth: 63-65 ft.

Seating Press. (tsf): 0.05

Initial Dial Gauge Reading (D_o), in.: 0.0000

Reviewed by: 0

Pressure, P (tsf)	TimeReadings Required	Date Load Applied	Time Load Applied	Load Applied By	A: Final[1] Dial Reading, D_{fi} x 10^{-4} in.	B: Apparatus Correction[2], D_{ci} x 10^{-4} in.	C: Cumulative Change in Height[3], DH_i in.	D: Height of Voids[4], H_{vi} in.	Vertical Strain[5], e_i (%)	Void Ratio[6], e_i
0.25		10/5/2010	9:00	DWC	48	1	0.0047	0.3302	0.63	0.801
0.5		10/6/2010	9:00	DWC	71	3	0.0068	0.3281	0.91	0.796
1		10/7/2010	9:00	DWC	103	9	0.0094	0.3255	1.26	0.790
2		10/8/2010	9:00	DWC	152	13	0.0139	0.3210	1.86	0.779
4		10/9/2010	9:00	CJS	202	21	0.0181	0.3168	2.42	0.768
1		10/11/2010	9:00	TTM	189	9	0.0180	0.3169	2.41	0.769
0.5		10/12/2010	9:00	TTM	182	3	0.0179	0.3170	2.40	0.769
1		10/13/2010	9:00	TTM	183	9	0.0174	0.3175	2.33	0.770
4		10/14/2010	9:00	DWC	211	21	0.0190	0.3159	2.54	0.766
8		10/15/2010	9:00	DWC	272	33	0.0239	0.3110	3.20	0.754
16		10/16/2010	9:00	DWC	391	43	0.0348	0.3001	4.66	0.728
4		10/18/2010	9:00	DWC	367	21	0.0346	0.3003	4.63	0.728
0.5		10/19/2010	9:00	DWC	324	3	0.0321	0.3028	4.30	0.735

Notes:
1. "Final" based on test method; 24 hrs for Method A, end of primary for Method B.
2. Correction value, for the current pressure, from the consolidometer's calibration curve.
3. $\Delta H = D_{fi} - D_o - D_{ci}$ = Col. A - D_o - Col. B
4. $H_{vi} = (H_o - H_s - D_0) - \Delta H$
5. $\varepsilon_i = (\Delta H / H_o) \times 100$ = (Col. C / H_o) x 100
6. $e_i = H_{vi} / Hs$ = Col. D / Hs

Consol 5/2007 Rev. 4

Schnabel ENGINEERING

Load Time Readings

1/0/00

Project: MTT, DTT & MLK Exp. Project

Schnabel Contract: 10613051.00.21

Boring No.: 10BH-012 Depth: 63-65 ft.

Consol. ID: 1 Reviewed by: 0

Test Drainage Conditions: Double

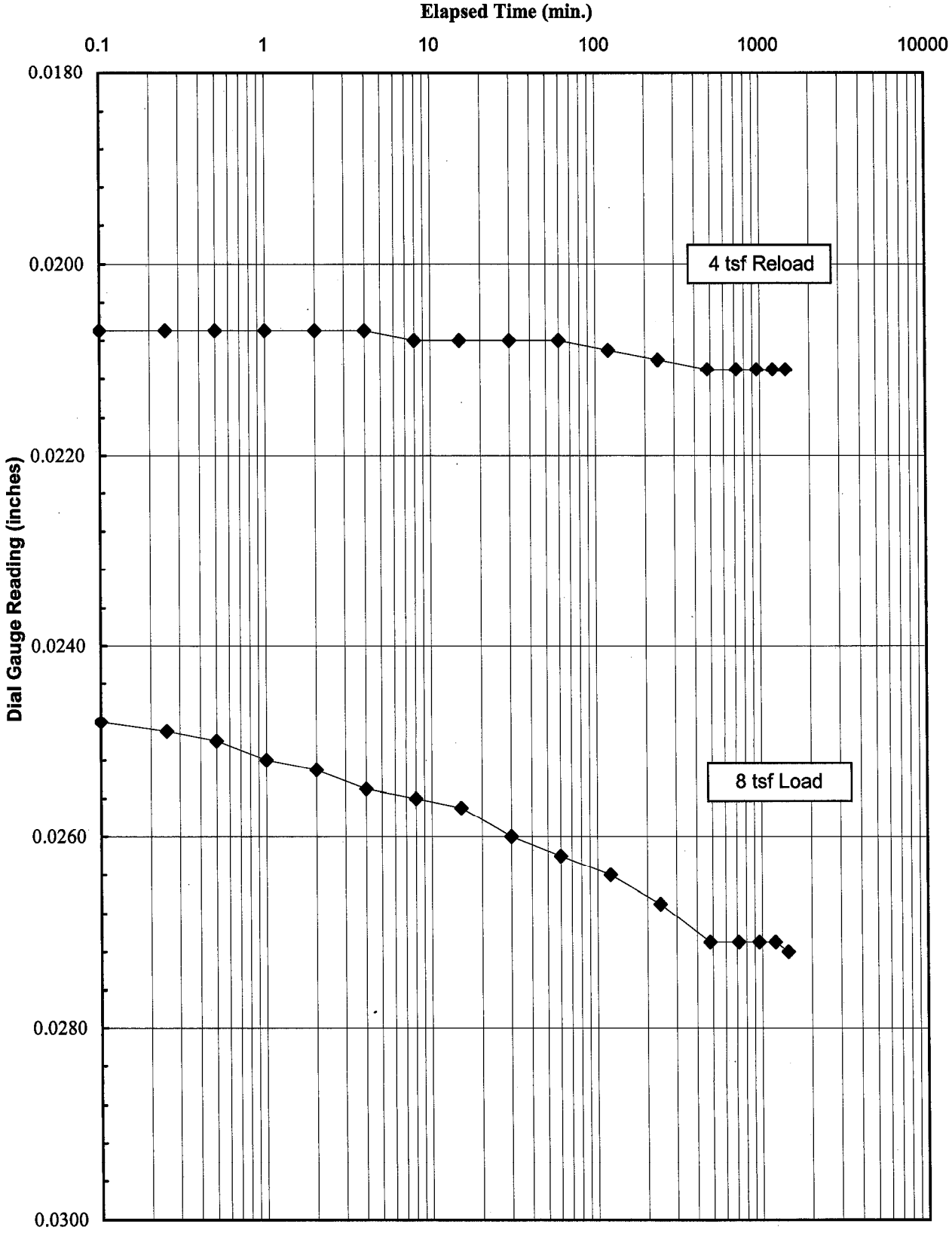
Elapsed Time (min.)	Dial Gauge Readings (inches)					
	4 tsf Reload 10/14/2010	8 tsf Load 10/15/2010				
0.1	0.0207	0.0248				
0.25	0.0207	0.0249				
0.5	0.0207	0.0250				
1	0.0207	0.0252				
2	0.0207	0.0253				
4	0.0207	0.0255				
8	0.0208	0.0256				
15	0.0208	0.0257				
30	0.0208	0.0260				
60	0.0208	0.0262				
120	0.0209	0.0264				
240	0.0210	0.0267				
480	0.0211	0.0271				
720	0.0211	0.0271				
960	0.0211	0.0271				
1200	0.0211	0.0271				
1440	0.0211	0.0272				
1680						
1920						
2160						
2400						
2640						
2880						

Schnabel ENGINEERING

Consolidation Time Curves

1/0/00

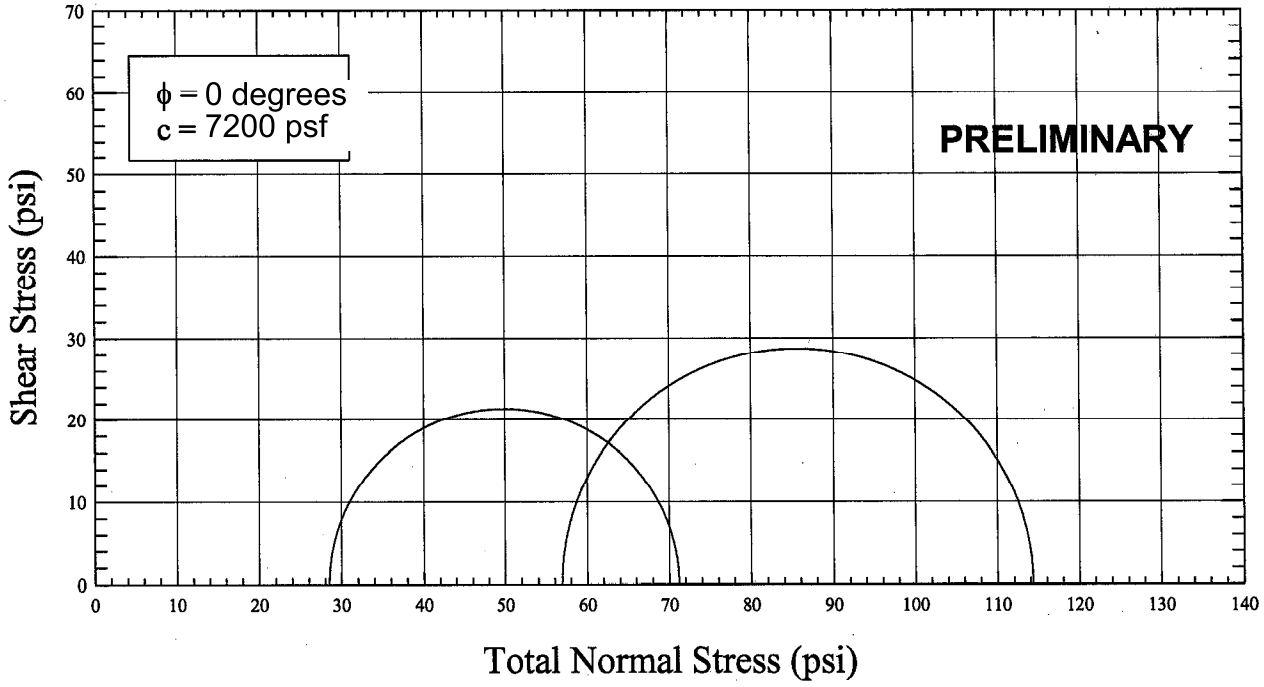
Project: MTT, DTT & MLK Exp. Project
Schnabel Contract: 10613051.00.21
Boring No.: 10BH-012 Depth: 63-65 ft.
Reviewed by: 0 Test Drainage Conditions: Double



Consol 5/2007 Rev. 4

Unconsolidated Undrained (UU) Triaxial Shear (ASTM D2850)

Mohr Stress Circles at Maximum Deviator Stress Criterion



Boring No.: *10BH-012* Depth: *88-90 ft* Elevation: *-88 to -90 ft* SEC Contract: *10613051.00.21* Date:
Sample Description: *SILTY SAND (SM), fine to medium, contains mica and shells - gray* Reviewed By:
Specimen Type: *Tube Sample* Gs: *2.72* LL: *NP* PI: *NP* %<200: *30.8*

Schnabel ENGINEERING

MTT, DTT & MLK Exp. Project
Elizabeth River, VA

Schnabel ENGINEERING

Unconsolidated Undrained Triaxial Compression Test

ASTM D2850

Project: *MTT, DTT & MLK Exp. Project*

Location: *Elizabeth River*

Schnabel Contract: *10613051.00.21* Date: *1/0/1900*

Boring No.: *10BH-012*

Depth: *88-90 ft.* Reviewed by: *0*

Elevation: *-94.0 to - 96.0 ft.*

Confining Stress (psi): *28.5*

Specimen Conditions	
Diameter (in)	2.886
Height (in)	5.807
Area (in^2)	6.54
Moisture (%):	32.4
Weight (lbs)	2.56
ρ_{wet} (pcf)	116.6
ρ_{dry} (pcf)	88.1
Void Ratio	0.93
Saturation, %	95

Shear Testing Conditions	
Cell Pressure (psi):	28.5
Rate of Strain (%/min):	1.0

Specimen Type: *Tube Sample*

Axial Strain at Failure (%): *14.98*

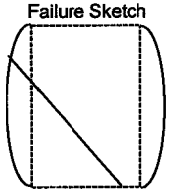
Compressive Strength (psi): *42.7*

Major Principal Stress (psi): *71.2*

Minor Principal Stress (psi): *28.5*

Soil Description: *SILTY SAND (SM), fine to medium, contains mica and shells - gray*

Failure Sketch



Liquid Limit: *NP*

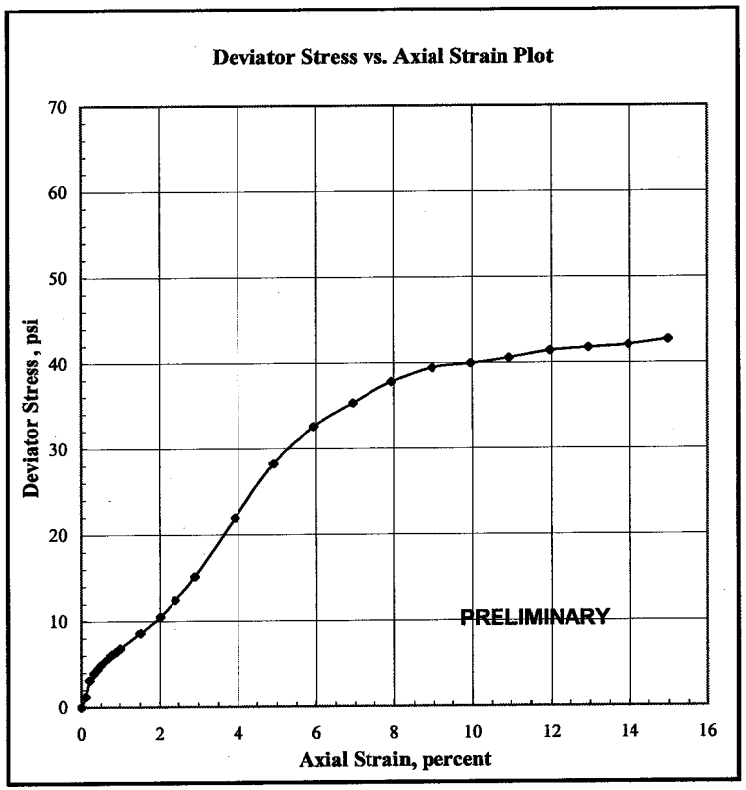
Plasticity Index: *NP*

% finer that No. 200: *30.8*

Specific Gravity: *2.72*

Remarks:

Reading No.	Deviator Load (lbs)	Corrected Dev. Load[1] (lbs.)	Axial Displacement (in.)	Axial Strain (%)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	Deviator Stress (psi)
Initial	0.0	0.0	0.000	0.00	6.54	28.5	28.5	0.0
1	8.1	8.1	0.006	0.10	6.55	29.7	28.5	1.2
2	20.5	20.5	0.012	0.21	6.56	31.6	28.5	3.1
3	25.7	25.6	0.018	0.31	6.56	32.4	28.5	3.9
4	29.1	29.0	0.024	0.41	6.57	32.9	28.5	4.4
5	32.5	32.4	0.029	0.50	6.58	33.4	28.5	4.9
6	35.2	35.1	0.035	0.60	6.58	33.8	28.5	5.3
7	37.7	37.5	0.041	0.71	6.59	34.2	28.5	5.7
8	40.5	40.3	0.047	0.81	6.60	34.6	28.5	6.1
9	42.6	42.4	0.053	0.91	6.60	34.9	28.5	6.4
10	45.3	45.1	0.059	1.02	6.61	35.3	28.5	6.8
11	57.4	57.1	0.088	1.52	6.64	37.1	28.5	8.6
12	70.5	70.1	0.117	2.01	6.68	39.0	28.5	10.5
13	84.0	83.5	0.140	2.41	6.70	41.0	28.5	12.5
14	102.7	102.1	0.169	2.91	6.74	43.6	28.5	15.1
15	150.2	149.3	0.228	3.93	6.81	50.4	28.5	21.9
16	195.6	194.5	0.286	4.93	6.88	56.8	28.5	28.3
17	227.5	226.2	0.345	5.94	6.96	61.0	28.5	32.5
18	249.3	247.8	0.403	6.94	7.03	63.7	28.5	35.2
19	270.1	268.4	0.461	7.94	7.11	66.3	28.5	37.8
20	285.2	283.3	0.520	8.95	7.19	67.9	28.5	39.4
21	292.4	290.2	0.578	9.95	7.27	68.4	28.5	39.9
22	300.5	298.1	0.636	10.95	7.35	69.1	28.5	40.6
23	310.5	307.9	0.695	11.97	7.43	69.9	28.5	41.4
24	316.5	313.7	0.753	12.97	7.52	70.2	28.5	41.7
25	323.2	320.2	0.812	13.98	7.61	70.6	28.5	42.1
26	331.8	328.5	0.870	14.98	7.70	71.2	28.5	42.7



Notes: 1. Deviator load corrected for membrane effects.

2. Right Cylinder Correction Method

Schnabel ENGINEERING

Unconsolidated Undrained Triaxial Compression Test

ASTM D2850

Project: *MTT, DTT & MLK Exp. Project*

Location: *Elizabeth River*

Schnabel Contract: *10613051.00.21* Date: *1/0/1900*

Boring No.: *10BH-012*

Depth: *88-90 ft.* Reviewed by: *0*

Elevation: *-94.0 to -96.0 ft.*

Confining Stress (psi): *56.9*

Specimen Conditions	
Diameter (in)	2.886
Height (in)	5.804
Area (in^2)	6.54
Moisture (%):	31.9
Weight (lbs)	2.56
ρ_{wet} (pcf)	116.4
ρ_{dry} (pcf)	88.2
Void Ratio	0.92
Saturation, %	94

Shear Testing Conditions	
Cell Pressure (psi):	56.9
Rate of Strain (%/min):	1.0

Specimen Type: *Tube Sample*

Axial Strain at Failure (%): *9.96*

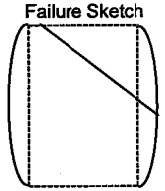
Compressive Strength (psi): *57.4*

Major Principal Stress (psi): *114.3*

Minor Principal Stress (psi): *56.9*

Soil Description: *SILTY SAND (SM), fine to medium, contains mica and shells - gray*

Failure Sketch



Liquid Limit: *NP*

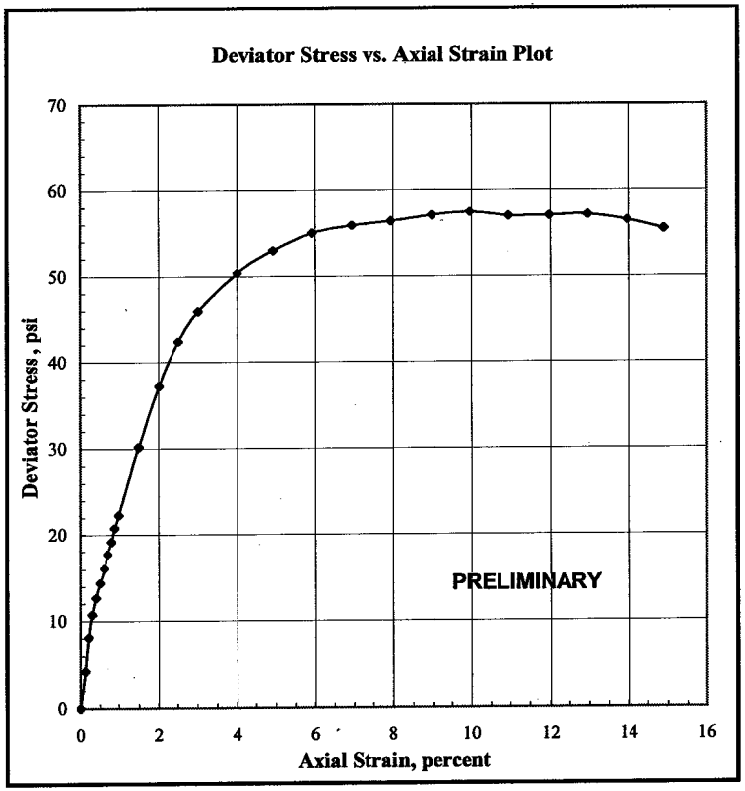
Plasticity Index: *NP*

% finer that No. 200: *30.8*

Specific Gravity: *2.72*

Remarks:

Reading No.	Deviator Load (lbs)	Corrected Dev. Load[1] (lbs.)	Axial Displacement (in.)	Axial Strain (%)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	Deviator Stress (psi)
Initial	0.0	0.0	0.000	0.00	6.54	56.9	56.9	0.0
1	28.0	28.0	0.007	0.12	6.55	61.2	56.9	4.3
2	53.2	53.2	0.012	0.21	6.56	65.0	56.9	8.1
3	70.5	70.4	0.017	0.29	6.56	67.6	56.9	10.7
4	83.3	83.2	0.023	0.40	6.57	69.6	56.9	12.7
5	94.9	94.8	0.029	0.50	6.58	71.3	56.9	14.4
6	106.1	106.0	0.036	0.62	6.58	73.0	56.9	16.1
7	116.7	116.5	0.041	0.71	6.59	74.6	56.9	17.7
8	126.5	126.3	0.047	0.81	6.60	76.1	56.9	19.2
9	137.4	137.2	0.052	0.90	6.60	77.7	56.9	20.8
10	147.5	147.3	0.058	1.00	6.61	79.2	56.9	22.3
11	200.9	200.6	0.087	1.50	6.64	87.1	56.9	30.2
12	249.2	248.8	0.117	2.02	6.68	94.2	56.9	37.3
13	285.3	284.8	0.146	2.52	6.71	99.3	56.9	42.4
14	310.6	309.9	0.175	3.02	6.75	102.8	56.9	45.9
15	344.2	343.3	0.233	4.01	6.82	107.3	56.9	50.4
16	365.7	364.6	0.286	4.93	6.88	109.9	56.9	53.0
17	383.9	382.6	0.344	5.93	6.96	111.9	56.9	55.0
18	394.5	393.0	0.403	6.94	7.03	112.8	56.9	55.9
19	402.6	400.9	0.461	7.94	7.11	113.3	56.9	56.4
20	412.1	410.1	0.521	8.98	7.19	114.0	56.9	57.1
21	419.5	417.3	0.578	9.96	7.27	114.3	56.9	57.4
22	421.3	418.9	0.636	10.96	7.35	113.9	56.9	57.0
23	426.7	424.1	0.695	11.97	7.43	114.0	56.9	57.1
24	432.5	429.7	0.753	12.97	7.52	114.0	56.9	57.1
25	432.8	429.8	0.811	13.97	7.61	113.4	56.9	56.5
26	429.7	426.5	0.865	14.90	7.69	112.4	56.9	55.5



Notes: 1. Deviator load corrected for membrane effects.

2. Right Cylinder Correction Method

Schnabel ENGINEERING

Unconfined Compression Test Report

ASTM D2166

Project: *MTT, DTT & MLK Exp. Project*

Schnabel No.: *10613051.00.21*
Boring No.: *10BH-012*
Depth: *88-90 ft.*
Elevation: *-94.0 to -96.0 ft.*

Date: *1/0/1900*

Location: *Elizabeth River*

Test Specimen Data	
Initial Diameter, in:	2.883
Initial Area, in^2:	6.532
Initial Height, in:	5.805
H/D Ratio:	2.0
Moisture Content, %:	34.9
Wet Unit Weight, pcf:	116.3
Dry Unit Weight, pcf:	86.2

Testing Information	
Test Procedure:	ASTM D2166
Type of Specimen:	Tube Sample
Load Cell No.:	1018253
Strain Rate, %/min.:	1.0

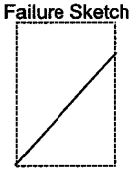
Remarks:

Specimen Type:	Tube Sample

Strength Data	
Strain at Failure, %:	5.4
Unconfined Strength (Qu), tsf:	0.79
Shear Strength (Su), tsf:	0.40

Reviewed by: *0*

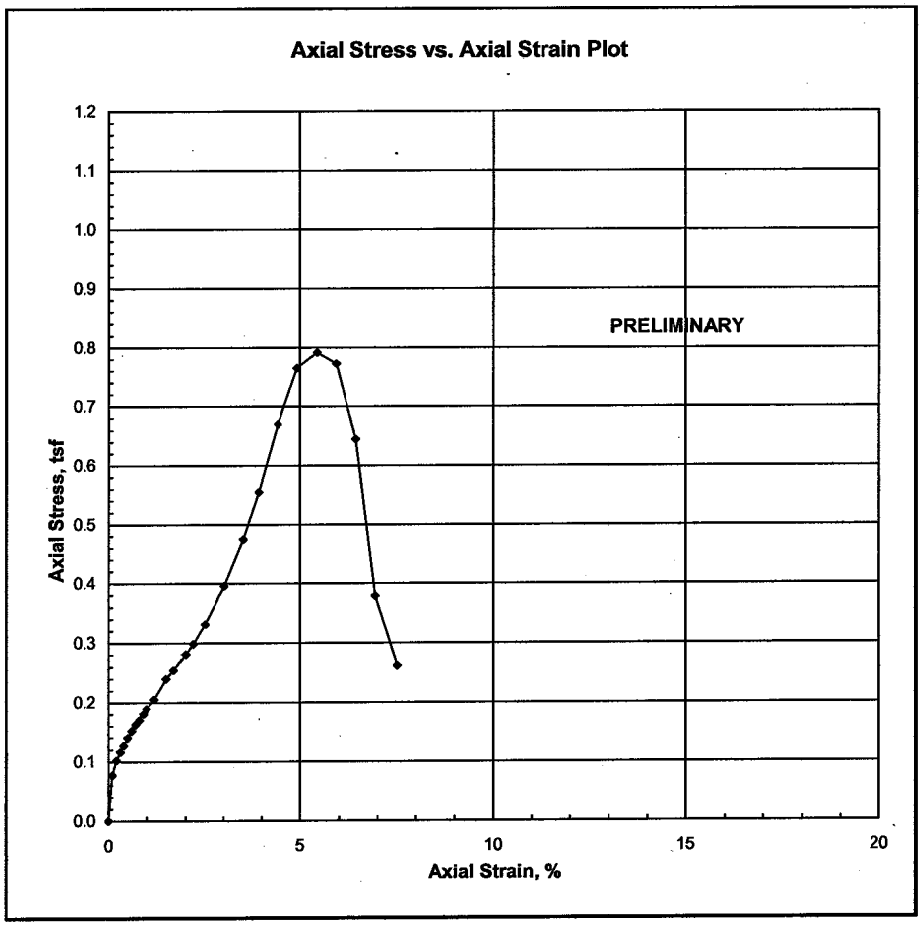
Failure Sketch



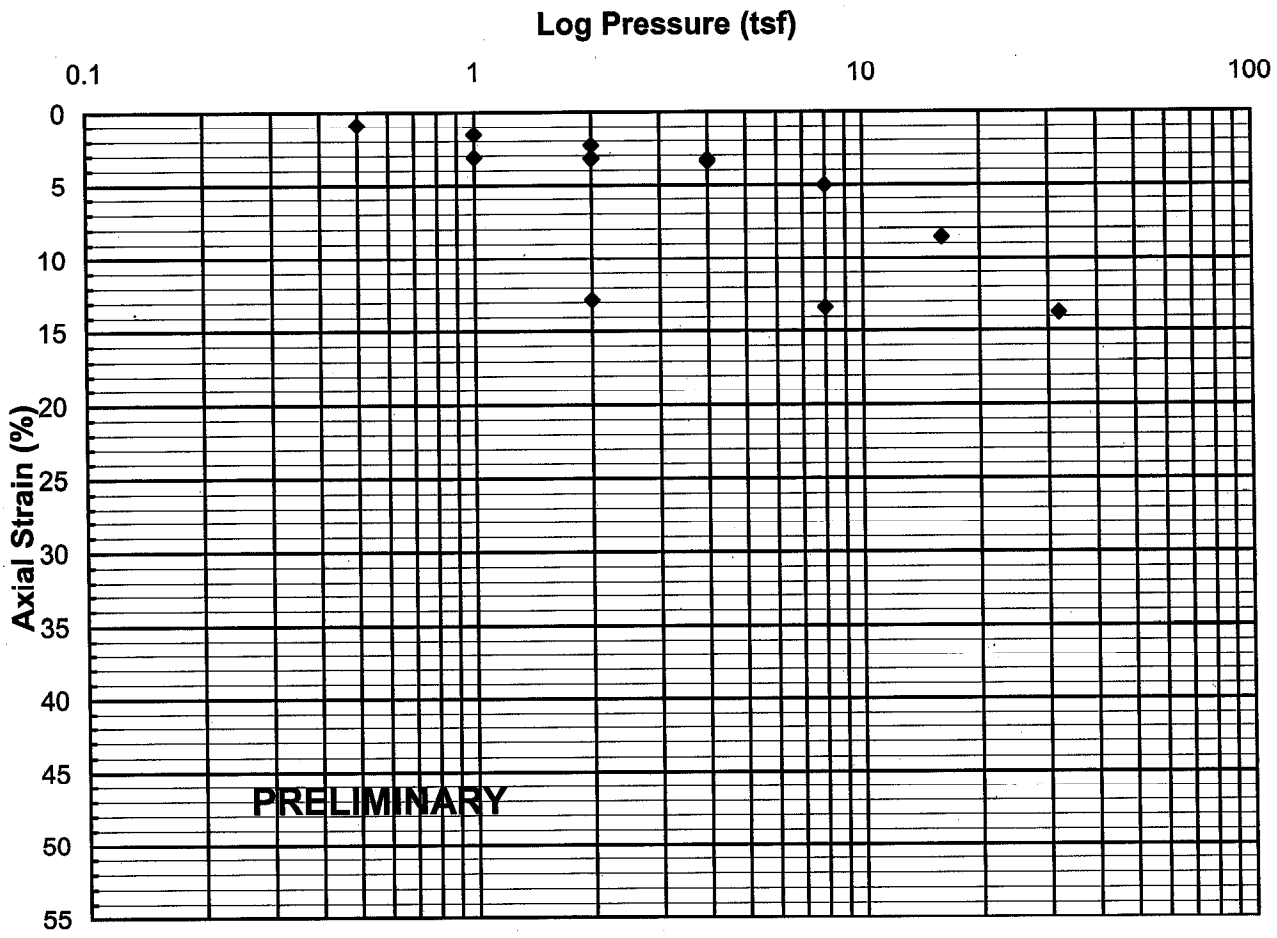
Soil Desc.: *SILTY SAND (SM), fine to medium, contains mica and shells - gray*

LL, %:	NP	% < 200:	30.8
PI, %:	NP	Gs:	2.72

Test Data						
Reading No.	Axial Load (lbs)	Axial Displ. (in.)	Axial Strain (%)	Corrected Area[1] (in^2)	Axial Stress (psi)	Axial Stress (tsf)
Zero	0.0	0.000	0.0	6.53	0.0	0.00
1	7.0	0.006	0.1	6.54	1.1	0.08
2	9.3	0.012	0.2	6.55	1.4	0.10
3	10.6	0.018	0.3	6.55	1.6	0.12
4	11.6	0.023	0.4	6.56	1.8	0.13
5	12.7	0.029	0.5	6.56	1.9	0.14
6	13.8	0.035	0.6	6.57	2.1	0.15
7	14.8	0.041	0.7	6.58	2.2	0.16
8	15.5	0.047	0.8	6.59	2.4	0.17
9	16.5	0.053	0.9	6.59	2.5	0.18
10	17.3	0.058	1.0	6.60	2.6	0.19
11	18.8	0.070	1.2	6.61	2.8	0.20
12	22.1	0.088	1.5	6.63	3.3	0.24
13	23.5	0.099	1.7	6.65	3.5	0.25
14	26.0	0.117	2.0	6.67	3.9	0.28
15	27.7	0.128	2.2	6.68	4.1	0.30
16	30.8	0.146	2.5	6.70	4.6	0.33
17	37.0	0.175	3.0	6.73	5.5	0.40
18	44.6	0.204	3.5	6.77	6.6	0.47
19	52.4	0.228	3.9	6.80	7.7	0.55
20	63.6	0.257	4.4	6.83	9.3	0.67
21	73.0	0.286	4.9	6.87	10.6	0.77
22	75.9	0.315	5.4	6.91	11.0	0.79
23	74.5	0.344	5.9	6.94	10.7	0.77
24	62.5	0.374	6.4	6.98	9.0	0.64
25	36.9	0.403	6.9	7.02	5.3	0.38
26	25.7	0.436	7.5	7.06	3.6	0.26



Notes: 1. Right Cylinder Area Correction Method



Evaluation of Pp', Cer, and Cec relies on the design professional's engineering judgement and project details.

Probable Preconsolidation Pressure (Pp), tsf: N/A	**Recompression Ratio (Cer):** N/A
Type of Specimen: *Tube Sample*	**Compression Ratio (Cec):** N/A
Description: *SILTY SAND (SM), fine to medium, contains mica and shells - gray*	
LL: *NP* **PI:** *NP* **Gs:** *2.72* **P_o' (tsf):** *0.00*	
% < No. 200: *30.8* **Test Method:** *ASTM D2435 Method A*	
Test Condition: *Inundated @ 0.05 tsf*	

	Initial	Final
Water Content, %	35.7	29.0
Void Ratio	0.99	0.74
Saturation, %	98	100
Dry Unit Weight, pcf	85.2	97.7

Remarks:

Average Water Content of Trimmings, %: *34.9*

Schnabel ENGINEERING

Project: MTT, DTT & MLK Exp. Project

Location *Elizabeth River*

Boring: *10BH-012* **Schnabel No.:** *10613051.00.21*

Depth: *88-90 ft.* **Elevation:** *-94.0 to -96.0 ft.*

Date: *1/0/1900* **Reviewed by:** *0*

Consolidation Test Report

Consolidation Test Data Sheet

Consolidometer ID: 2 1/0/00

Schnabel Contract: 10613051.00.21

Project: MTT, DTT & MLK Exp. Project

Test Method: ASTM D2435 Method A

Test Condition: Inundated @ 0.05 tsf

Initial Height of Specimen (H_o), in.: 0.7465

Height of Solids (H_s), in.: 0.3746

Boring No.: 10BH-012

Depth: 88-90 ft.

Seating Press. (tsf): 0.05

Initial Dial Gauge Reading (D_o), in.: 0.0000

Reviewed by: 0

Pressure, P (tsf)	Time Readings Required	Date Load Applied	Time Load Applied	Load Applied By	A: Final[1] Dial Reading, D_{fi} x 10^{-4} in.	B: Apparatus Correction[2], D_{ci} x 10^{-4} in.	C: Cumulative Change in Height[3], DH_i in.	D: Height of Voids[4], H_{vi} in.	Vertical Strain[5], e_i (%)	Void Ratio[6], e_i
0.5		10/9/2010	9:05	CJS	73	6	0.0067	0.3652	0.90	0.975
1		10/11/2010	9:05	TTM	126	9	0.0117	0.3602	1.57	0.961
2		10/12/2010	9:05	TTM	187	15	0.0172	0.3547	2.30	0.947
4		10/13/2010	9:05	TTM	266	21	0.0245	0.3474	3.28	0.927
2		10/14/2010	9:05	DWC	257	15	0.0242	0.3477	3.24	0.928
1		10/15/2010	9:05	DWC	242	9	0.0233	0.3486	3.12	0.930
2		10/16/2010	9:05	DWC	251	15	0.0236	0.3483	3.16	0.930
4		10/18/2010	9:05	DWC	276	21	0.0255	0.3464	3.42	0.925
8		10/19/2010	9:05	DWC	401	26	0.0375	0.3344	5.02	0.893
16		10/20/2010	9:05	DWC	672	33	0.0639	0.3080	8.56	0.822
32		10/21/2010	9:05	DWC	1070	45	0.1025	0.2694	13.73	0.719
8		10/22/2010	9:05	DWC	1024	26	0.0998	0.2721	13.37	0.726
2		10/23/2010	9:05	CJS	974	15	0.0959	0.2760	12.85	0.737

Notes:
1. "Final" based on test method; 24 hrs for Method A, end of primary for Method B.
2. Correction value, for the current pressure, from the consolidometer's calibration curve.
3. $\Delta H = D_{fi} - D_o - D_{ci}$ = Col. A - D_o - Col. B
4. $H_{vi} = (H_o - H_s - D_0) - \Delta H$
5. $\varepsilon_i = (\Delta H / H_o) \times 100$ = (Col. C / H_o) x 100
6. $e_i = H_{vi} / Hs$ = Col. D / Hs

Consol 5/2007 Rev. 4

Schnabel ENGINEERING

Load Time Readings

1/0/00

Project: MTT, DTT & MLK Exp. Project

Schnabel Contract: 10613051.00.21

Boring No.: 10BH-012 Depth: 88-90 ft.

Consol. ID: 2 Reviewed by: 0

Test Drainage Conditions: Double

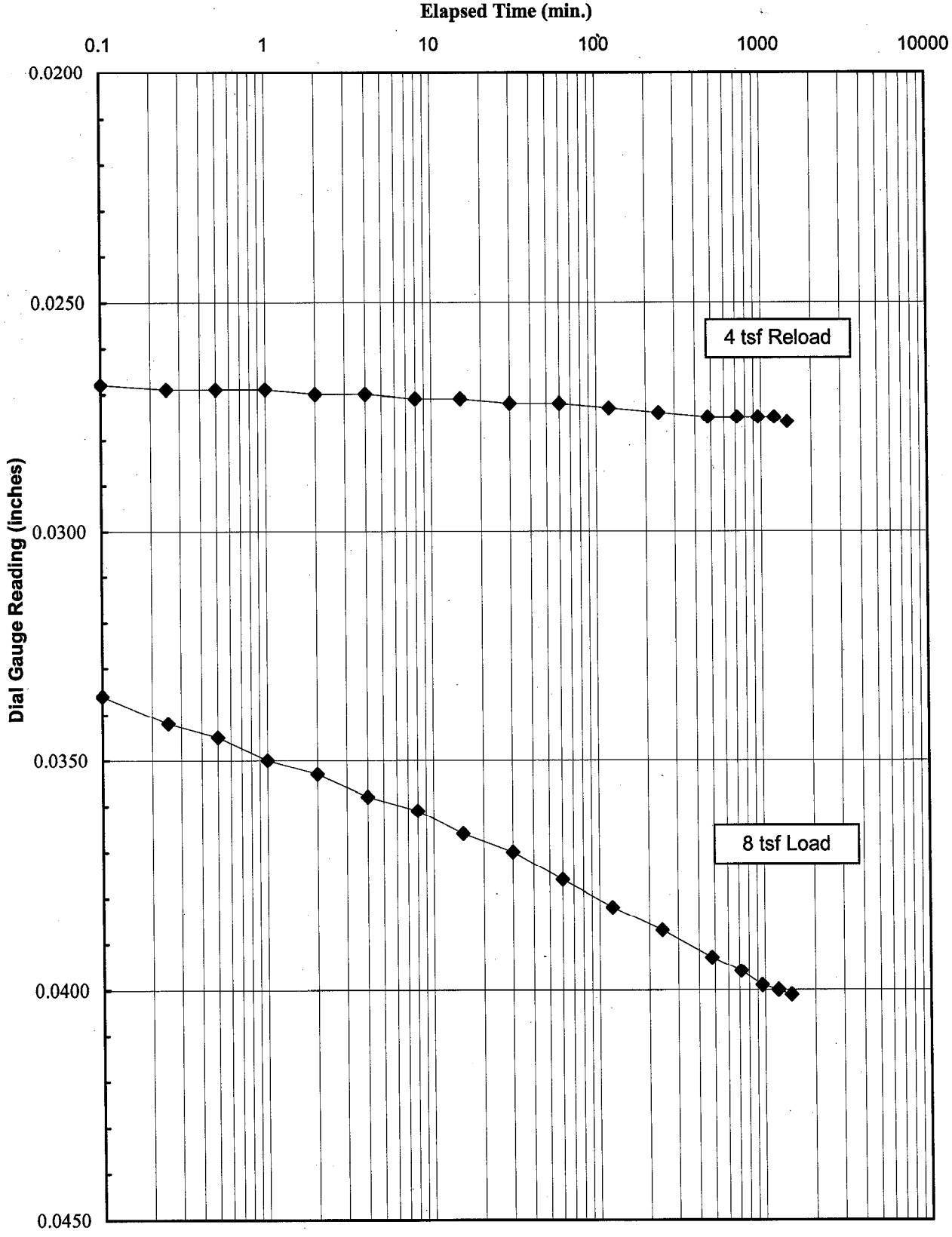
Elapsed Time (min.)	Dial Gauge Readings (inches)					
	4 tsf Reload 10/18/2010	8 tsf Load 10/19/2010				
0.1	0.0268	0.0336				
0.25	0.0269	0.0342				
0.5	0.0269	0.0345				
1	0.0269	0.0350				
2	0.0270	0.0353				
4	0.0270	0.0358				
8	0.0271	0.0361				
15	0.0271	0.0366				
30	0.0272	0.0370				
60	0.0272	0.0376				
120	0.0273	0.0382				
240	0.0274	0.0387				
480	0.0275	0.0393				
720	0.0275	0.0396				
960	0.0275	0.0399				
1200	0.0275	0.0400				
1440	0.0276	0.0401				
1680						
1920						
2160						
2400						
2640						
2880						

Schnabel ENGINEERING

Consolidation Time Curves

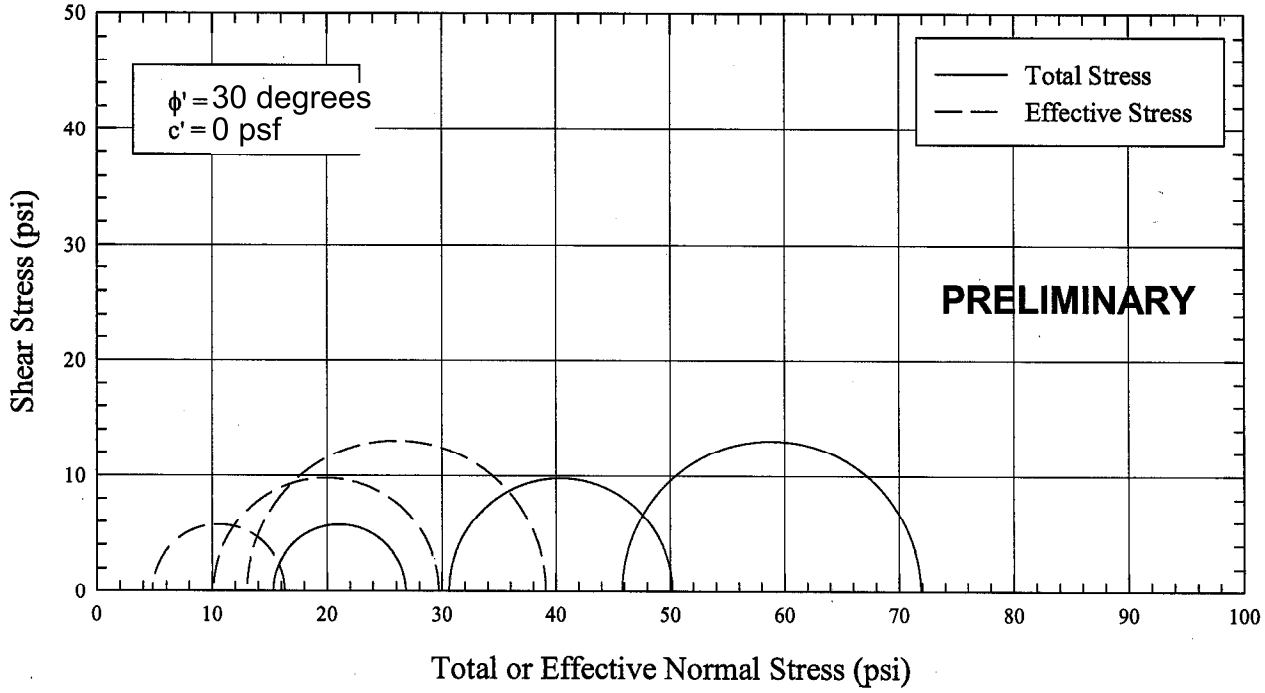
1/0/00

Project: MTT, DTT & MLK Exp. Project
Schnabel Contract: 10613051.00.21
Boring No.: 10BH-012 Depth: 88-90 ft.
Reviewed by: 0 Test Drainage Conditions: Double

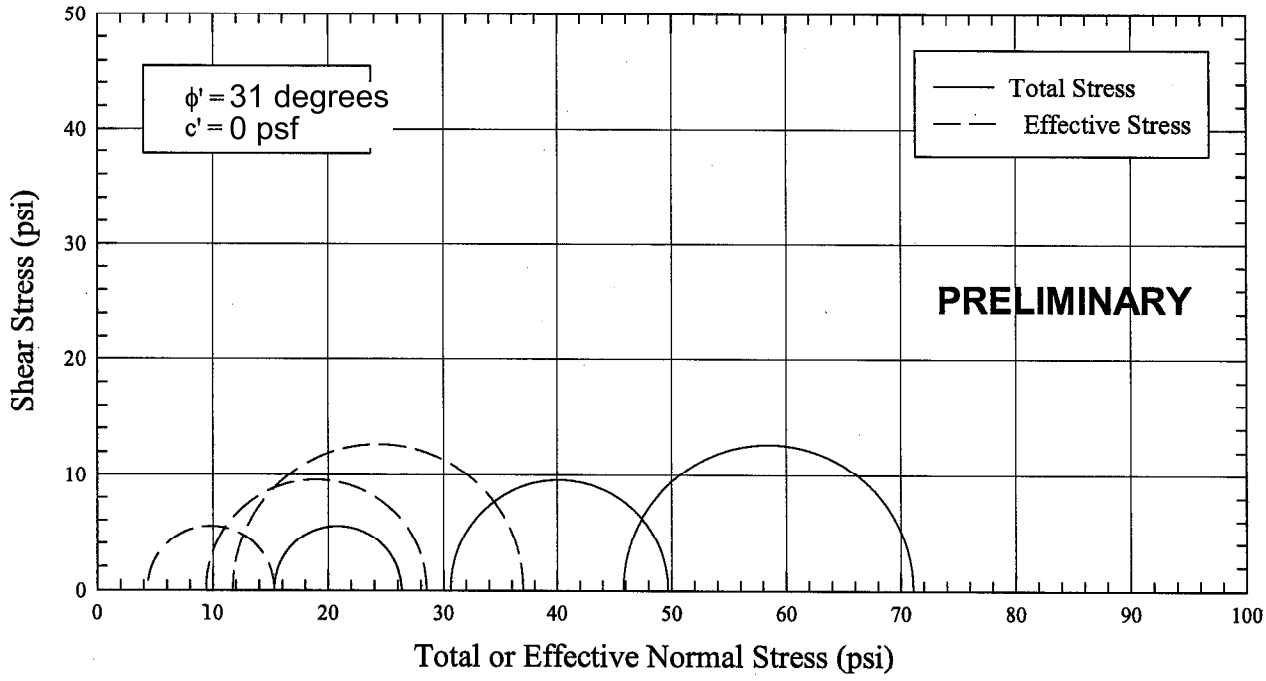


Consolidated Undrained (CU) Triaxial Shear (ASTM D4767)

Mohr Stress Circles at Maximum Deviator Stress Criterion



Mohr Stress Circles at Maximum Principal Stress Ratio Criterion

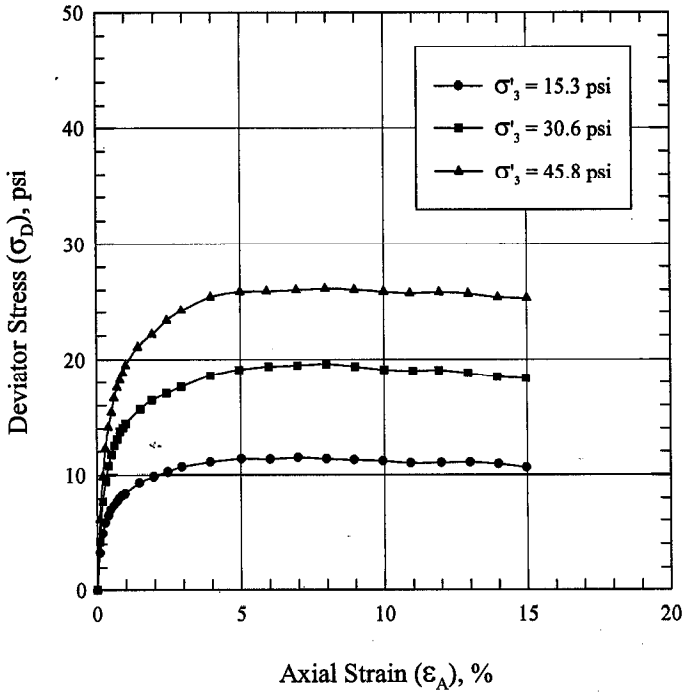


Boring No.: *10BH-013* Depth: *35-37 ft* Elevation: *-31.2 to -33.2 ft* SEC Contract: *10613051.00.21* Date:
Sample Description: *FAT CLAY (CH) - light gray* Reviewed By:
Specimen Type: *Tube Sample* Gs: *2.70* LL: *68* PI: *42* %<200: *94.5*

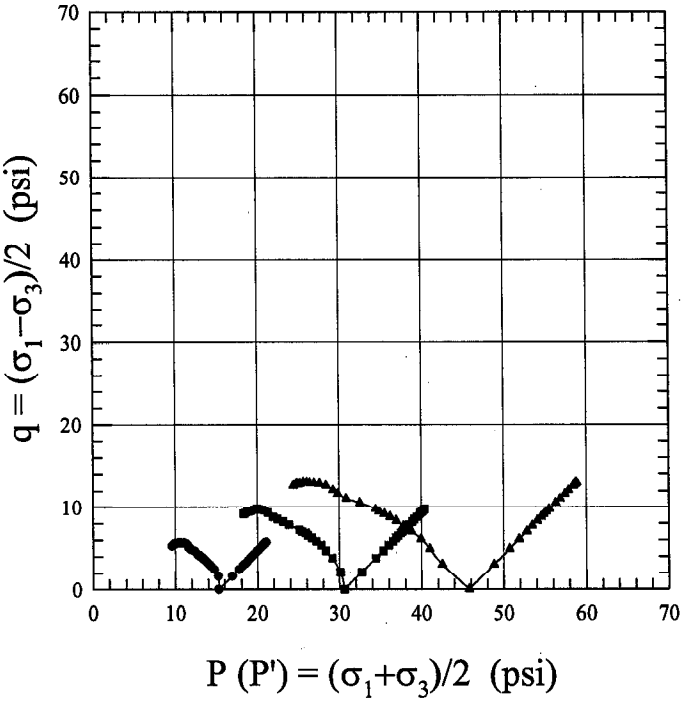
Schnabel ENGINEERING

MTT, DTT & MLK Exp. Project
Norfolk, VA

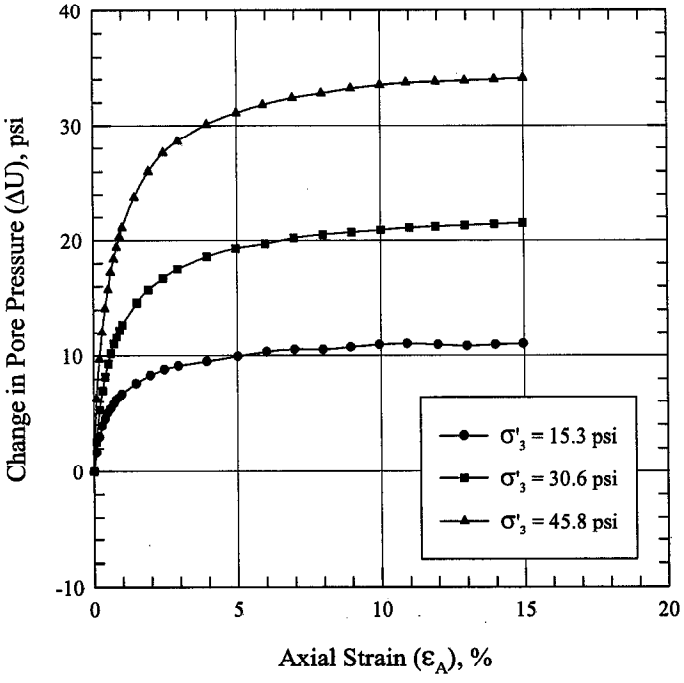
Deviator Stress vs. Axial Strain



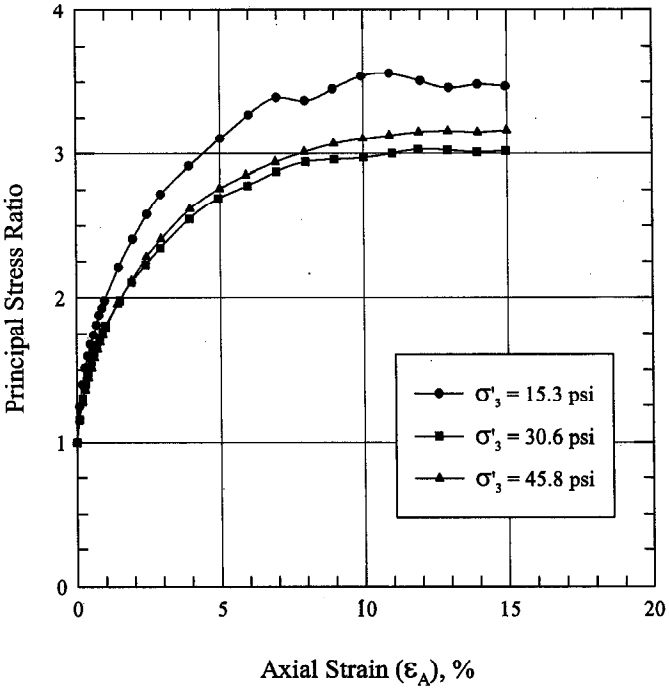
Stress Paths



Change in Pore Pressure vs. Axial Strain



Principal Stress Ratio vs. Axial Strain



Boring No.: *10BH-013* Depth: *35-37 ft* Elevation: *-31.2 to -33.2 ft* SEC Contract: *10613051.00.21* Date:

Sample Description: *FAT CLAY (CH) - light gray* Reviewed By:

Specimen Type: *Tube Sample* Specific Gravity: 2.70 LL: *68* PI: *42* %<200: *94.5*

Schnabel ENGINEERING

MTT, DTT & MLK Exp. Prjoect
Norfolk, VA

Schnabel ENGINEERING

Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *MTT, DTT & MLK Exp. Project*

Location: *Norfolk, VA*

Schnabel Contract: *10613051.00.21*
Boring No.: *10BH-013*
Depth: *35-37 ft.*
Elevation: *-31.2 to -33.2 ft.*
Confining Stress (psi): *15.3*

Date:

Reviewed by: *0*

	Specimen Conditions	
	Initial	Consolidated
Diameter (in)	2.828	2.79
Height (in)	5.811	5.64
Area (in^2)	6.28	6.10
Moisture (%)	51.4	
W_{solids} (lbs)	1.47	
ρ_{wet} (pcf)	105.0	
ρ_{dry} (pcf)	69.4	73.5
Void Ratio	1.43	1.29
Saturation, %	97	92

Shear Testing Conditions	
Cell Pressure (psi):	25.3
Back Pressure (psi):	10.0
Eff. Confining Stress (psi):	15.3
Final B check	0.96
t_{50} (min.):	27.6
Rate of Strain (%/min):	0.00614

Filter strips used? *YES*

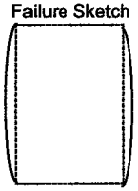
Specimen Type: *Tube Sample*

Soil Description: *FAT CLAY (CH) - light gray*

Liquid Limit: *68*
Plasticity Index: *42*
% finer that No. 200: *94.5*
Specific Gravity: *2.70*

Remarks:

Failure Sketch



Reading No.	Deviator Load (lbs)	Corrected[1] Dev. Load (lbs.)	Axial Deformation (in.)	Axial Strain (%)	Pore Pressure (psi)	Change in Pore Press. (psi)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	Deviator Stress (psi)	Principal Stress Ratio	A_{bar}	P (psi)	P' (psi)	q (psi)
Zero	0.0	0.0	0.000	0.00	10.0	0.0	6.10	15.3	15.3	15.3	15.3	0.0	1.00	0.00	15.3	15.3	0.0
1	20.0	19.9	0.005	0.09	11.7	1.7	6.11	18.6	15.3	16.9	13.6	3.3	1.24	0.52	16.9	15.2	1.6
2	30.1	29.9	0.011	0.19	13.0	3.0	6.12	20.2	15.3	17.2	12.3	4.9	1.40	0.61	17.7	14.7	2.4
3	35.9	35.6	0.016	0.28	13.9	3.9	6.12	21.1	15.3	17.2	11.4	5.8	1.51	0.67	18.2	14.3	2.9
4	39.7	39.2	0.022	0.39	14.5	4.5	6.13	21.7	15.3	17.2	10.8	6.4	1.59	0.70	18.5	14.0	3.2
5	43.1	42.5	0.027	0.48	15.0	5.0	6.13	22.2	15.3	17.2	10.3	6.9	1.67	0.72	18.8	13.8	3.5
6	45.6	44.9	0.033	0.58	15.4	5.4	6.14	22.6	15.3	17.2	9.9	7.3	1.74	0.74	19.0	13.6	3.7
7	48.1	47.3	0.039	0.69	15.8	5.8	6.15	23.0	15.3	17.2	9.5	7.7	1.81	0.75	19.1	13.3	3.8
8	50.1	49.2	0.044	0.78	16.2	6.2	6.15	23.3	15.3	17.1	9.1	8.0	1.88	0.78	19.3	13.1	4.0
9	51.9	50.8	0.050	0.89	16.4	6.4	6.16	23.6	15.3	17.2	8.9	8.3	1.93	0.78	19.4	13.0	4.1
10	52.9	51.7	0.055	0.97	16.7	6.7	6.16	23.7	15.3	17.0	8.6	8.4	1.98	0.80	19.5	12.8	4.2
11	59.5	57.8	0.083	1.47	17.6	7.6	6.20	24.6	15.3	17.0	7.7	9.3	2.21	0.82	20.0	12.4	4.7
12	63.6	61.3	0.111	1.97	18.3	8.3	6.23	25.1	15.3	16.8	7.0	9.8	2.41	0.84	20.2	11.9	4.9
13	66.7	64.2	0.139	2.46	18.8	8.8	6.26	25.6	15.3	16.8	6.5	10.3	2.58	0.86	20.4	11.6	5.1
14	69.6	67.0	0.166	2.94	19.1	9.1	6.29	26.0	15.3	16.9	6.2	10.7	2.72	0.85	20.6	11.5	5.3
15	73.2	70.4	0.222	3.93	19.5	9.5	6.35	26.4	15.3	16.9	5.8	11.1	2.91	0.86	20.8	11.3	5.5
16	76.0	73.0	0.283	5.02	19.9	9.9	6.43	26.7	15.3	16.8	5.4	11.4	3.10	0.87	21.0	11.1	5.7
17	76.9	73.7	0.339	6.01	20.3	10.3	6.49	26.6	15.3	16.3	5.0	11.3	3.27	0.91	21.0	10.7	5.7
18	78.7	75.3	0.394	6.98	20.5	10.5	6.56	26.8	15.3	16.3	4.8	11.5	3.39	0.92	21.0	10.5	5.7
19	79.0	75.4	0.450	7.97	20.5	10.5	6.63	26.7	15.3	16.2	4.8	11.4	3.37	0.92	21.0	10.5	5.7
20	79.4	75.6	0.505	8.95	20.7	10.7	6.70	26.6	15.3	15.9	4.6	11.3	3.45	0.95	20.9	10.2	5.6
21	79.8	75.8	0.561	9.94	20.9	10.9	6.78	26.5	15.3	15.6	4.4	11.2	3.54	0.98	20.9	10.0	5.6
22	79.7	75.5	0.616	10.92	21.0	11.0	6.85	26.3	15.3	15.3	4.3	11.0	3.56	1.00	20.8	9.8	5.5
23	81.0	76.5	0.677	12.00	20.9	10.9	6.94	26.3	15.3	15.4	4.4	11.0	3.51	0.99	20.8	9.9	5.5
24	82.3	77.6	0.733	12.99	20.8	10.8	7.02	26.4	15.3	15.6	4.5	11.1	3.46	0.98	20.8	10.0	5.5
25	82.4	77.5	0.789	13.98	20.9	10.9	7.10	26.2	15.3	15.3	4.4	10.9	3.48	1.00	20.8	9.9	5.5
26	81.3	76.2	0.844	14.96	21.0	11.0	7.18	25.9	15.3	14.9	4.3	10.6	3.47	1.04	20.6	9.6	5.3

Notes: 1. Deviator load corrected for membrane and filter cage (if applicable) effects.
2. Right Cylinder Correction Method

Schnabel ENGINEERING

Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *MTT, DTT & MLK Exp. Project*

Location: *Norfolk, VA*

Schnabel Contract: *10613051.00.21*
Boring No.: *10BH-013*
Depth: *35-37 ft.*
Elevation: *-31.2 to -33.2 ft.*
Confining Stress (psi): *30.6*

Date:

Reviewed by: *0*

	Specimen Conditions	
	Initial	Consolidated
Diameter (in)	2.840	2.69
Height (in)	5.818	5.50
Area (in^2)	6.34	5.67
Moisture (%)	52.1	
W_{solids} (lbs)	1.45	
ρ_{wet} (pcf)	103.5	
ρ_{dry} (pcf)	68.1	80.5
Void Ratio	1.47	1.09
Saturation, %	95	96

Shear Testing Conditions	
Cell Pressure (psi):	40.6
Back Pressure (psi):	10.0
Eff. Confining Stress (psi):	30.6
Final B check	0.96
t_{50} (min.):	59.6
Rate of Strain (%/min):	0.00614

Filter strips used? *YES*

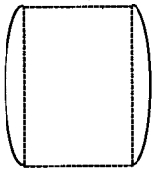
Specimen Type: *Tube Sample*

Soil Description: *FAT CLAY (CH) - light gray*

Liquid Limit: *68*
Plasticity Index: *42*
% finer that No. 200: *94.5*
Specific Gravity: *2.70*

Remarks:

Failure Sketch



Reading No.	Deviator Load (lbs)	Corrected[1] Dev. Load (lbs.)	Axial Deformation (in.)	Axial Strain (%)	Pore Pressure (psi)	Change in Pore Press. (psi)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	Deviator Stress (psi)	Principal Stress Ratio	A_{bar}	P (psi)	P' (psi)	q (psi)
Zero	0.0	0.0	0.000	0.00	10.0	0.0	5.67	30.6	30.6	30.6	30.6	0.0	1.00	0.00	30.6	30.6	0.0
1	24.1	24.0	0.005	0.09	12.6	2.6	5.67	34.8	30.6	32.2	28.0	4.2	1.15	0.61	32.7	30.1	2.1
2	43.9	43.7	0.011	0.20	15.3	5.3	5.68	38.3	30.6	33.0	25.3	7.7	1.30	0.69	34.4	29.1	3.8
3	54.2	53.8	0.017	0.31	17.0	7.0	5.68	40.1	30.6	33.1	23.6	9.5	1.40	0.74	35.3	28.3	4.7
4	61.8	61.3	0.022	0.40	18.2	8.2	5.69	41.4	30.6	33.2	22.4	10.8	1.48	0.76	36.0	27.8	5.4
5	67.5	66.9	0.028	0.51	19.3	9.3	5.70	42.3	30.6	33.0	21.3	11.7	1.55	0.79	36.5	27.2	5.9
6	72.1	71.4	0.033	0.60	20.2	10.2	5.70	43.1	30.6	32.9	20.4	12.5	1.61	0.81	36.9	26.7	6.3
7	75.6	74.8	0.039	0.71	21.0	11.0	5.71	43.7	30.6	32.7	19.6	13.1	1.67	0.84	37.1	26.1	6.5
8	79.5	78.6	0.044	0.80	21.6	11.6	5.71	44.4	30.6	32.8	19.0	13.8	1.72	0.84	37.5	25.9	6.9
9	81.6	80.5	0.050	0.91	22.2	12.2	5.72	44.7	30.6	32.5	18.4	14.1	1.77	0.87	37.6	25.4	7.0
10	83.9	82.7	0.055	1.00	22.7	12.7	5.72	45.0	30.6	32.3	17.9	14.4	1.81	0.88	37.8	25.1	7.2
11	92.1	90.3	0.083	1.51	24.6	14.6	5.75	46.3	30.6	31.7	16.0	15.7	1.98	0.93	38.4	23.8	7.8
12	97.4	95.1	0.105	1.91	25.7	15.7	5.78	47.1	30.6	31.4	14.9	16.5	2.11	0.95	38.8	23.1	8.2
13	101.5	99.1	0.133	2.42	26.7	16.7	5.81	47.7	30.6	31.0	13.9	17.1	2.23	0.98	39.1	22.4	8.5
14	105.4	102.9	0.161	2.93	27.5	17.5	5.84	48.2	30.6	30.7	13.1	17.6	2.34	0.99	39.4	21.9	8.8
15	112.4	109.6	0.217	3.95	28.6	18.6	5.90	49.2	30.6	30.6	12.0	18.6	2.55	1.00	39.9	21.3	9.3
16	116.9	113.9	0.272	4.95	29.3	19.3	5.96	49.7	30.6	30.4	11.3	19.1	2.69	1.01	40.2	20.9	9.6
17	120.0	116.8	0.328	5.97	29.7	19.7	6.03	50.0	30.6	30.3	10.9	19.4	2.78	1.02	40.3	20.6	9.7
18	122.1	118.7	0.383	6.97	30.2	20.2	6.09	50.1	30.6	29.9	10.4	19.5	2.87	1.04	40.3	20.1	9.7
19	124.4	120.8	0.439	7.99	30.5	20.5	6.16	50.2	30.6	29.7	10.1	19.6	2.94	1.04	40.4	19.9	9.8
20	124.5	120.7	0.494	8.99	30.7	20.7	6.23	50.0	30.6	29.3	9.9	19.4	2.96	1.07	40.3	19.6	9.7
21	124.4	120.4	0.550	10.01	30.9	20.9	6.30	49.7	30.6	28.8	9.7	19.1	2.97	1.09	40.2	19.3	9.6
22	125.2	121.0	0.605	11.01	31.1	21.1	6.37	49.6	30.6	28.5	9.5	19.0	3.00	1.11	40.1	19.0	9.5
23	127.0	122.6	0.655	11.92	31.2	21.2	6.43	49.7	30.6	28.5	9.4	19.1	3.03	1.11	40.1	18.9	9.5
24	127.0	122.4	0.711	12.94	31.3	21.3	6.51	49.4	30.6	28.1	9.3	18.8	3.02	1.13	40.0	18.7	9.4
25	126.5	121.7	0.767	13.96	31.4	21.4	6.59	49.1	30.6	27.7	9.2	18.5	3.01	1.16	39.8	18.4	9.2
26	127.3	122.3	0.822	14.96	31.5	21.5	6.66	49.0	30.6	27.5	9.1	18.4	3.02	1.17	39.8	18.3	9.2

Notes: 1. Deviator load corrected for membrane and filter cage (if applicable) effects.
2. Right Cylinder Correction Method

Schnabel ENGINEERING

Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *MTT, DTT & MLK Exp. Project*

Location: *Norfolk, VA*

Schnabel Contract: *10613051.00.21*
Boring No.: *10BH-013*
Depth: *35-37 ft.*
Elevation: *-31.2 to -33.2 ft.*
Confining Stress (psi): *45.8*

Date:

Reviewed by: *0*

	Specimen Conditions	
	Initial	Consolidated
Diameter (in)	2.849	2.69
Height (in)	5.811	5.44
Area (in^2)	6.38	5.67
Moisture (%)	51.4	
W_{solids} (lbs)	1.49	
ρ_{wet} (pcf)	105.5	
ρ_{dry} (pcf)	69.7	83.7
Void Ratio	1.42	1.01
Saturation, %	98	95

Shear Testing Conditions	
Cell Pressure (psi):	55.8
Back Pressure (psi):	10.0
Eff. Confining Stress (psi):	45.8
Final B check	0.96
t_{50} (min.):	65.1
Rate of Strain (%/min):	0.00614

Filter strips used? *YES*

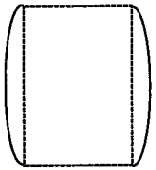
Specimen Type: *Tube Sample*

Soil Description: *FAT CLAY (CH) - light gray*

Liquid Limit: *68*
Plasticity Index: *42*
% finer that No. 200: *94.5*
Specific Gravity: *2.70*

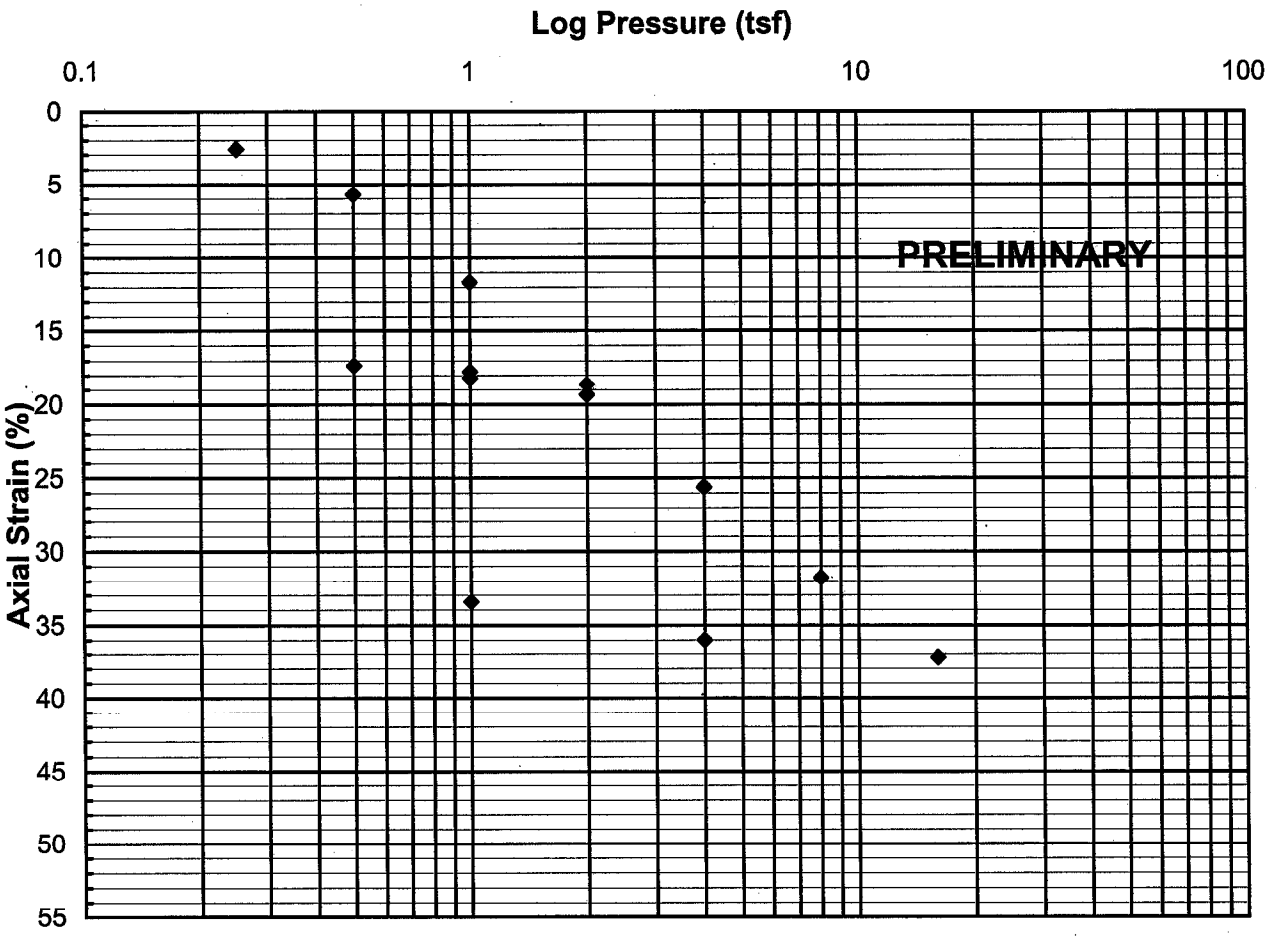
Remarks:

Failure Sketch



Reading No.	Deviator Load (lbs)	Corrected[1] Dev. Load (lbs.)	Axial Deformation (in.)	Axial Strain (%)	Pore Pressure (psi)	Change in Pore Press. (psi)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	Deviator Stress (psi)	Principal Stress Ratio	A_{bar}	P (psi)	P' (psi)	q (psi)
Zero	0.0	0.0	0.000	0.00	10.0	0.0	5.67	45.8	45.8	45.8	45.8	0.0	1.00	0.00	45.8	45.8	0.0
1	34.6	34.5	0.005	0.09	16.3	6.3	5.68	51.9	45.8	45.6	39.5	6.1	1.15	1.04	48.8	42.5	3.0
2	56.3	56.1	0.011	0.20	19.7	9.7	5.68	55.7	45.8	46.0	36.1	9.9	1.27	0.98	50.7	41.0	4.9
3	70.1	69.8	0.016	0.29	22.0	12.0	5.69	58.1	45.8	46.1	33.8	12.3	1.36	0.98	51.9	39.9	6.1
4	80.9	80.4	0.022	0.40	24.1	14.1	5.70	59.9	45.8	45.8	31.7	14.1	1.45	1.00	52.9	38.8	7.1
5	88.5	87.9	0.028	0.51	25.7	15.7	5.70	61.2	45.8	45.5	30.1	15.4	1.51	1.02	53.5	37.8	7.7
6	95.7	95.0	0.033	0.61	27.2	17.2	5.71	62.4	45.8	45.2	28.6	16.6	1.58	1.03	54.1	36.9	8.3
7	101.3	100.5	0.039	0.72	28.4	18.4	5.71	63.4	45.8	45.0	27.4	17.6	1.64	1.05	54.6	36.2	8.8
8	105.1	104.1	0.044	0.81	29.4	19.4	5.72	64.0	45.8	44.6	26.4	18.2	1.69	1.07	54.9	35.5	9.1
9	108.8	107.7	0.050	0.92	30.3	20.3	5.73	64.6	45.8	44.3	25.5	18.8	1.74	1.08	55.2	34.9	9.4
10	112.9	111.7	0.055	1.01	31.1	21.1	5.73	65.3	45.8	44.2	24.7	19.5	1.79	1.08	55.5	34.4	9.7
11	123.0	121.3	0.078	1.43	33.8	23.8	5.76	66.9	45.8	43.1	22.0	21.1	1.96	1.13	56.3	32.5	10.5
12	130.3	128.0	0.105	1.93	36.0	26.0	5.78	67.9	45.8	41.9	19.8	22.1	2.12	1.17	56.9	30.9	11.1
13	138.1	135.7	0.133	2.44	37.6	27.6	5.82	69.1	45.8	41.5	18.2	23.3	2.28	1.18	57.5	29.9	11.7
14	144.0	141.5	0.161	2.96	38.6	28.6	5.85	70.0	45.8	41.4	17.2	24.2	2.41	1.18	57.9	29.3	12.1
15	152.8	150.0	0.216	3.97	40.1	30.1	5.91	71.2	45.8	41.1	15.7	25.4	2.62	1.19	58.5	28.4	12.7
16	157.3	154.3	0.272	5.00	41.1	31.1	5.97	71.6	45.8	40.5	14.7	25.8	2.76	1.20	58.7	27.6	12.9
17	159.4	156.3	0.322	5.92	41.8	31.8	6.03	71.7	45.8	39.9	14.0	25.9	2.85	1.23	58.8	27.0	13.0
18	161.9	158.5	0.378	6.95	42.4	32.4	6.10	71.8	45.8	39.4	13.4	26.0	2.94	1.25	58.8	26.4	13.0
19	164.6	161.0	0.433	7.96	42.8	32.8	6.16	71.9	45.8	39.1	13.0	26.1	3.01	1.26	58.9	26.1	13.1
20	166.1	162.3	0.489	8.99	43.2	33.2	6.23	71.8	45.8	38.6	12.6	26.0	3.07	1.27	58.8	25.6	13.0
21	167.0	163.0	0.544	10.00	43.5	33.5	6.30	71.7	45.8	38.2	12.3	25.9	3.10	1.30	58.7	25.2	12.9
22	168.1	163.9	0.594	10.92	43.7	33.7	6.37	71.5	45.8	37.8	12.1	25.7	3.13	1.31	58.7	25.0	12.9
23	170.7	166.3	0.650	11.94	43.8	33.8	6.44	71.6	45.8	37.8	12.0	25.8	3.15	1.31	58.7	24.9	12.9
24	172.0	167.4	0.705	12.96	43.9	33.9	6.52	71.5	45.8	37.6	11.9	25.7	3.16	1.32	58.6	24.7	12.8
25	172.2	167.4	0.761	13.98	44.0	34.0	6.60	71.2	45.8	37.2	11.8	25.4	3.15	1.34	58.5	24.5	12.7
26	174.0	169.0	0.816	15.00	44.1	34.1	6.67	71.1	45.8	37.0	11.7	25.3	3.16	1.35	58.5	24.4	12.7

Notes: 1. Deviator load corrected for membrane and filter cage (if applicable) effects.
2. Right Cylinder Correction Method



Evaluation of Pp', Cer, and Cec relies on the design professional's engineering judgement and project details.

Probable Preconsolidation Pressure (Pp), tsf: 1.1					**Recompression Ratio (Cer):** 0.03	
Type of Specimen: *Tube Sample*					**Compression Ratio (Cec):** 0.22	
Description: *FAT CLAY (CH) - light gray*						**Initial** / **Final**
					Water Content, %	*64.2* / *32.3*
LL: *68*	**PI:** *42*	**Gs:** *2.70*	**P_o' (tsf):** *0.00*		**Void Ratio**	*1.76* / *0.84*
% < No. 200: *94.5*		**Test Method:** *ASTM D2435 Method A*			**Saturation, %**	*98* / *100*
Test Condition: *Inundated @ 0.05 tsf*					**Dry Unit Weight, pcf**	*61.0* / *91.7*
Remarks:					**Project:** MTT, DTT & MLK Exp. Project	
Average Water Content of Trimmings, %: *59.9*					**Location** *Norfolk, VA*	
Schnabel ENGINEERING					**Boring:** *10BH-013*	**Schnabel No.:** *10613051.00.21*
					Depth: *35-37 ft.*	**Elevation:** *-31.2 to -33.2 ft.*
					Date: *1/0/1900*	**Reviewed by:** *0*
					Consolidation Test Report	

Consolidation Test Data Sheet

Consolidometer ID: 2 1/0/00

Schnabel Contract: 10613051.00.21

Project: MTT, DTT & MLK Exp. Project

Test Method: *ASTM D2435 Method A*

Test Condition: *Inundated @ 0.05 tsf*

Initial Height of Specimen (H_o), in.: 0.7508

Height of Solids (H_s), in.: 0.2719

Boring No.: *10BH-013*

Depth: *35-37 ft.*

Seating Press. (tsf): 0.05

Initial Dial Gauge Reading (D_o), in.: 0.0001

Reviewed by: 0

Pressure, P (tsf)	TimeReadings Required	Date Load Applied	Time Load Applied	Load Applied By	A: Final[1] Dial Reading, D_{fi} x 10^{-4} in.	B: Apparatus Correction[2], D_{ci} x 10^{-4} in.	C: Cumulative Change in Height[3], DH_i in.	D: Height of Voids[4], H_{vi} in.	Vertical Strain[5], e_i (%)	Void Ratio[6], e_i
0.25		9/4/2010	9:05	DWC	201	3	0.0197	0.4590	2.62	1.688
0.5		9/6/2010	9:05	CJS	438	6	0.0431	0.4356	5.74	1.602
1		9/7/2010	9:05	DWC	887	9	0.0877	0.3910	11.68	1.438
2		9/8/2010	9:05	DWC	1415	15	0.1399	0.3388	18.63	1.246
1		9/9/2010	9:05	DWC	1374	9	0.1364	0.3423	18.17	1.259
0.5		9/10/2010	9:05	DWC	1308	6	0.1301	0.3486	17.33	1.282
1		9/11/2010	9:05	CJS	1342	9	0.1332	0.3455	17.74	1.271
2		9/12/2010	9:05	DWC	1469	15	0.1453	0.3334	19.35	1.226
4		9/13/2010	9:05	DWC	1944	21	0.1922	0.2865	25.60	1.054
8		9/14/2010	9:05	DWC	2414	26	0.2387	0.2400	31.79	0.883
16		9/15/2010	9:05	DWC	2830	33	0.2796	0.1991	37.24	0.732
4		9/16/2010	9:05	DWC	2725	21	0.2703	0.2084	36.00	0.766
1		9/17/2010	9:05	DWC	2521	9	0.2511	0.2276	33.45	0.837

Notes:

1 "Final" based on test method; 24 hrs for Method A, end of primary for Method B.

2 Correction value, for the current pressure, from the consolidometer's calibration curve.

3 $\Delta H = D_{fi} - D_o - D_{ci}$ = Col. A - D_o - Col. B

4 $H_{vi} = (H_o - H_s - D_0) - \Delta H$

5 $\varepsilon_i = (\Delta H / H_o) \times 100$ = (Col. C / H_o) x 100

6 $e_i = H_{vi} / Hs$ = Col. D / Hs

Consol 5/2007 Rev. 4

Schnabel ENGINEERING

Load Time Readings

1/0/00

Project: MTT, DTT & MLK Exp. Project

Schnabel Contract: 10613051.00.21

Boring No.: 10BH-013 Depth: 35-37 ft.

Consol. ID: 2 Reviewed by: 0

Test Drainage Conditions: Double

Elapsed Time (min.)	Dial Gauge Readings (inches)					
	2 tsf Reload 9/12/2010	4 tsf Load 9/13/2010				
0.1	0.1353	0.1488				
0.25	0.1358	0.1500				
0.5	0.1364	0.1512				
1	0.1371	0.1531				
2	0.1382	0.1558				
4	0.1393	0.1598				
8	0.1406	0.1650				
15	0.1414	0.1709				
30	0.1422	0.1772				
60	0.1430	0.1823				
120	0.1437	0.1860				
240	0.1445	0.1888				
480	0.1453	0.1912				
720	0.1457	0.1925				
960	0.1462	0.1934				
1200	0.1465	0.1940				
1440	0.1469	0.1944				
1680						
1920						
2160						
2400						
2640						
2880						

Schnabel ENGINEERING

Consolidation Time Curves

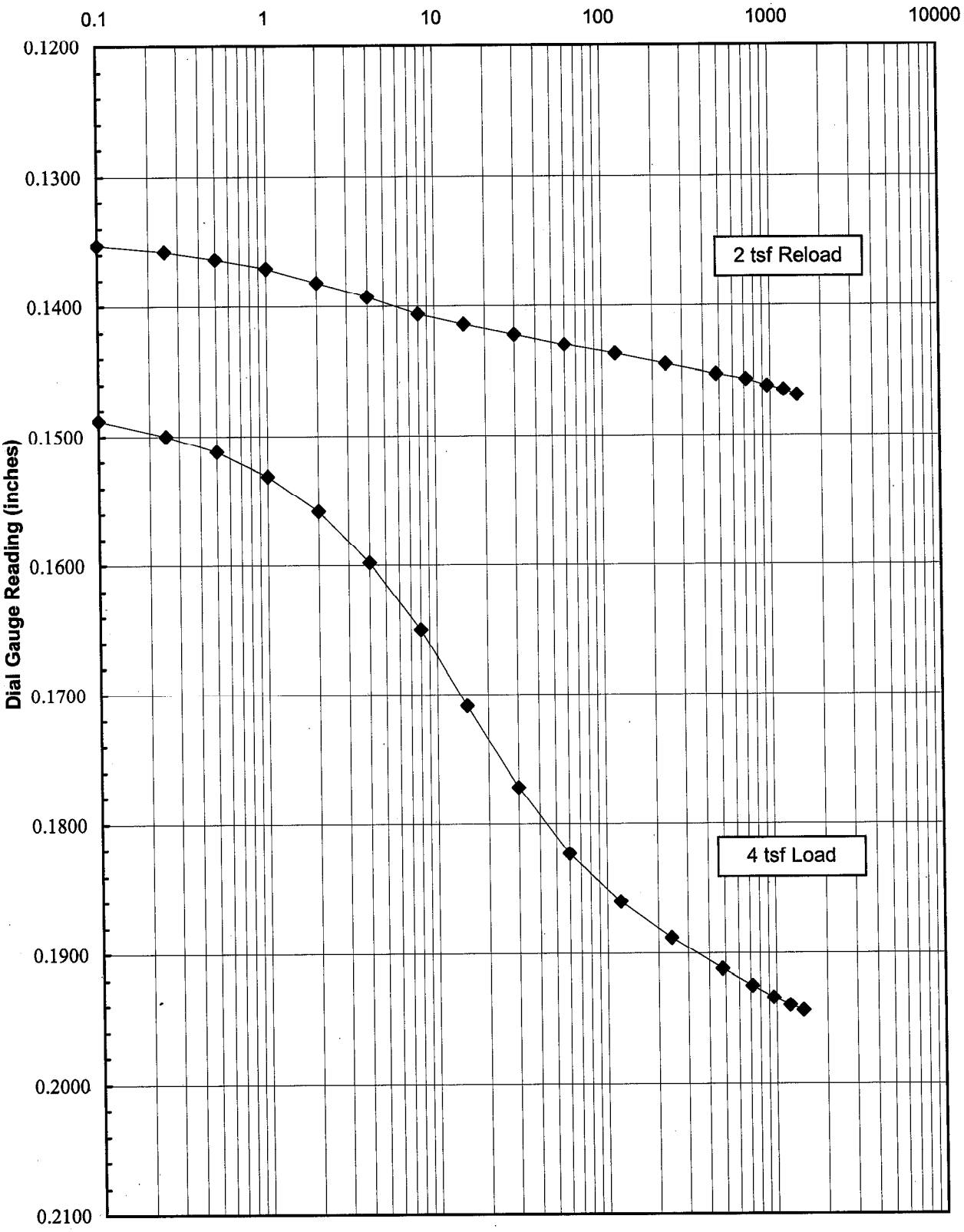
1/0/00

Project: MTT, DTT & MLK Exp. Project

Schnabel Contract: 10613051.00.21

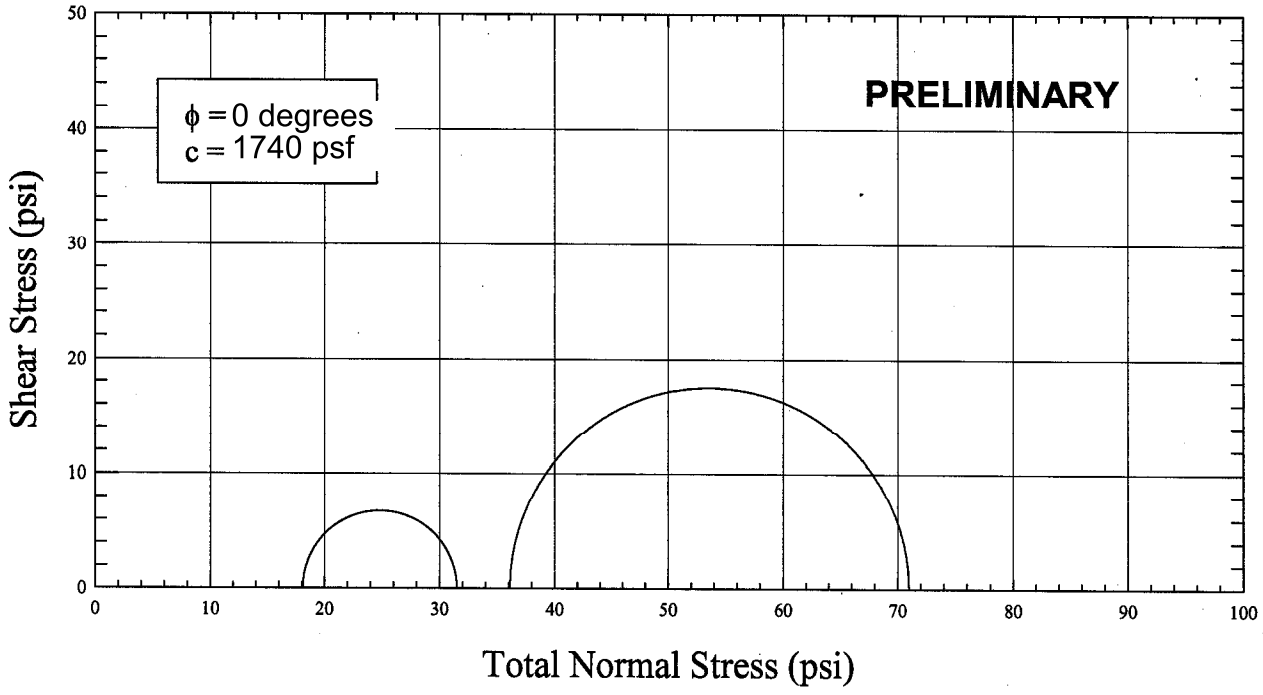
Boring No.: 10BH-013 Depth: 35-37 ft.

Reviewed by: 0 Test Drainage Conditions: Double



Unconsolidated Undrained (UU) Triaxial Shear (ASTM D2850)

Mohr Stress Circles at Maximum Deviator Stress Criterion



Boring No.: *10BH-013* Depth: *45-47 ft* Elevation: *-41.2 to -43.2 ft* SEC Contract: *10613051.00.21* Date:
Sample Description: *SILTY SAND (SM), fine to medium, contains fibr. organics - gray* Reviewed By:
Specimen Type: *Tube Sample* Gs: *2.58* LL: *112 / --* PI: *60 / --* %<200: *39.5 / 19.4*

Schnabel ENGINEERING

MTT, DTT & MLK Exp. Project
Norfolk, VA

Schnabel ENGINEERING

Unconsolidated Undrained Triaxial Compression Test

ASTM D2850

Project: *MTT, DTT & MLK Exp. Project*

Location: *Norfolk, VA*

Schnabel Contract: *10613051.00.21* Date: *1/0/1900*

Boring No.: *10BH-013*

Depth: *45-46 ft.* Reviewed by: *0*

Elevation: *-41.2 to -42.2 ft.*

Confining Stress (psi): *18.1*

Specimen Conditions	
Diameter (in)	2.865
Height (in)	5.823
Area (in^2)	6.45
Moisture (%):	42.7
Weight (lbs)	2.45
ρ_{wet} (pcf)	112.8
ρ_{dry} (pcf)	79.1
Void Ratio	1.04
Saturation, %	100

Shear Testing Conditions	
Cell Pressure (psi):	18.1
Rate of Strain (%/min):	1.0

Specimen Type: *Tube Sample*

Axial Strain at Failure (%): *9.93*

Compressive Strength (psi): *13.4*

Major Principal Stress (psi): *31.5*

Minor Principal Stress (psi): *18.1*

Soil Description: *SILTY SAND (SM), fine to medium, contains fibrous organics - gray and brown*

Liquid Limit: *112*

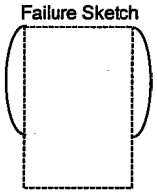
Plasticity Index: *60*

% finer that No. 200: *39.5*

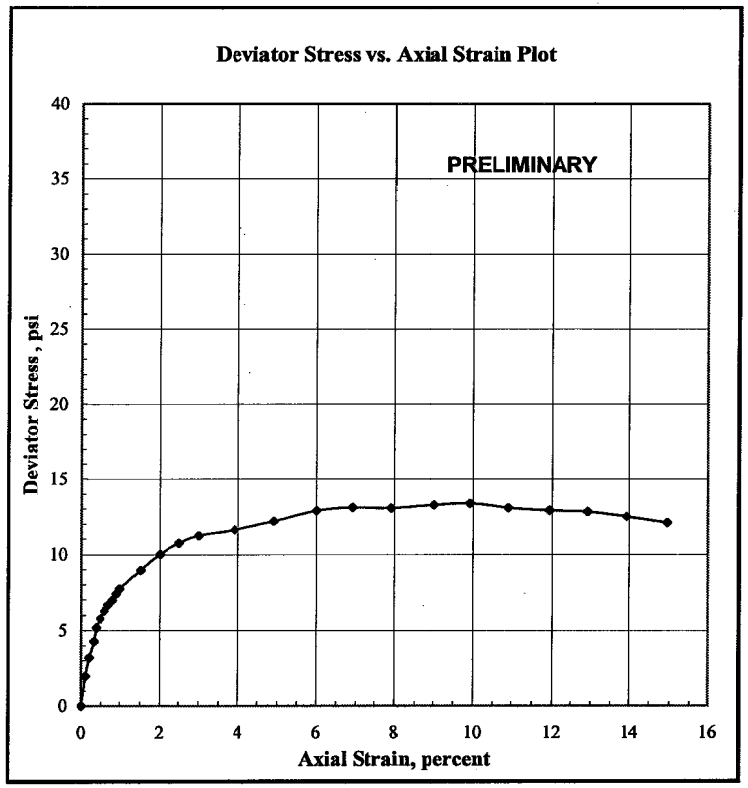
Specific Gravity: *2.58*

Remarks:

Failure Sketch



Reading No.	Deviator Load (lbs)	Corrected Dev. Load[1] (lbs.)	Axial Displacement (in.)	Axial Strain (%)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	Deviator Stress (psi)
Initial	0.0	0.0	0.000	0.00	6.45	18.1	18.1	0.0
1	12.8	12.8	0.006	0.10	6.46	20.1	18.1	2.0
2	20.7	20.7	0.012	0.21	6.46	21.3	18.1	3.2
3	27.7	27.6	0.019	0.33	6.47	22.4	18.1	4.3
4	33.6	33.5	0.023	0.39	6.47	23.3	18.1	5.2
5	37.5	37.4	0.029	0.50	6.48	23.9	18.1	5.8
6	40.8	40.7	0.035	0.60	6.49	24.4	18.1	6.3
7	43.5	43.3	0.041	0.70	6.50	24.8	18.1	6.7
8	45.5	45.3	0.047	0.81	6.50	25.1	18.1	7.0
9	48.3	48.1	0.053	0.91	6.51	25.5	18.1	7.4
10	50.5	50.3	0.058	1.00	6.51	25.8	18.1	7.7
11	58.9	58.6	0.088	1.51	6.55	27.0	18.1	8.9
12	66.3	65.9	0.117	2.01	6.58	28.1	18.1	10.0
13	71.5	71.0	0.146	2.51	6.62	28.8	18.1	10.7
14	75.4	74.8	0.175	3.01	6.65	29.3	18.1	11.2
15	78.9	78.1	0.228	3.92	6.71	29.7	18.1	11.6
16	83.8	82.7	0.286	4.91	6.78	30.3	18.1	12.2
17	89.7	88.4	0.350	6.01	6.86	31.0	18.1	12.9
18	92.3	90.8	0.403	6.92	6.93	31.2	18.1	13.1
19	93.2	91.5	0.461	7.92	7.00	31.2	18.1	13.1
20	96.0	94.1	0.525	9.02	7.09	31.4	18.1	13.3
21	97.9	95.8	0.578	9.93	7.16	31.5	18.1	13.4
22	97.1	94.7	0.636	10.92	7.24	31.2	18.1	13.1
23	97.1	94.5	0.695	11.94	7.32	31.0	18.1	12.9
24	97.8	95.0	0.753	12.93	7.41	30.9	18.1	12.8
25	96.7	93.7	0.811	13.93	7.49	30.6	18.1	12.5
26	95.0	91.8	0.870	14.94	7.58	30.2	18.1	12.1



Notes: 1. Deviator load corrected for membrane effects.

2. Right Cylinder Correction Method

Schnabel ENGINEERING

Unconsolidated Undrained Triaxial Compression Test

ASTM D2850

Project: *MTT, DTT & MLK Exp. Project*

Location: *Norfolk, VA*

Schnabel Contract: *10613051.00.21* Date: *1/0/1900*

Boring No.: *10BH-013*

Depth: *46-47 ft.* Reviewed by: *0*

Elevation: *-42.2 to -43.2 ft.*

Confining Stress (psi): *36.1*

Specimen Conditions	
Diameter (in)	2.872
Height (in)	5.777
Area (in^2)	6.48
Moisture (%):	22.8
Weight (lbs)	2.62
ρ_{wet} (pcf)	120.8
ρ_{dry} (pcf)	98.3
Void Ratio	0.64
Saturation, %	92

Shear Testing Conditions	
Cell Pressure (psi):	36.1
Rate of Strain (%/min):	1.0

Specimen Type: *Tube Sample*

Axial Strain at Failure (%): *10.01*

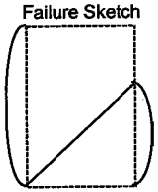
Compressive Strength (psi): *34.9*

Major Principal Stress (psi): *71.0*

Minor Principal Stress (psi): *36.1*

Soil Description: *SILTY SAND (SM), fine to medium - gray*

Failure Sketch



Liquid Limit: --

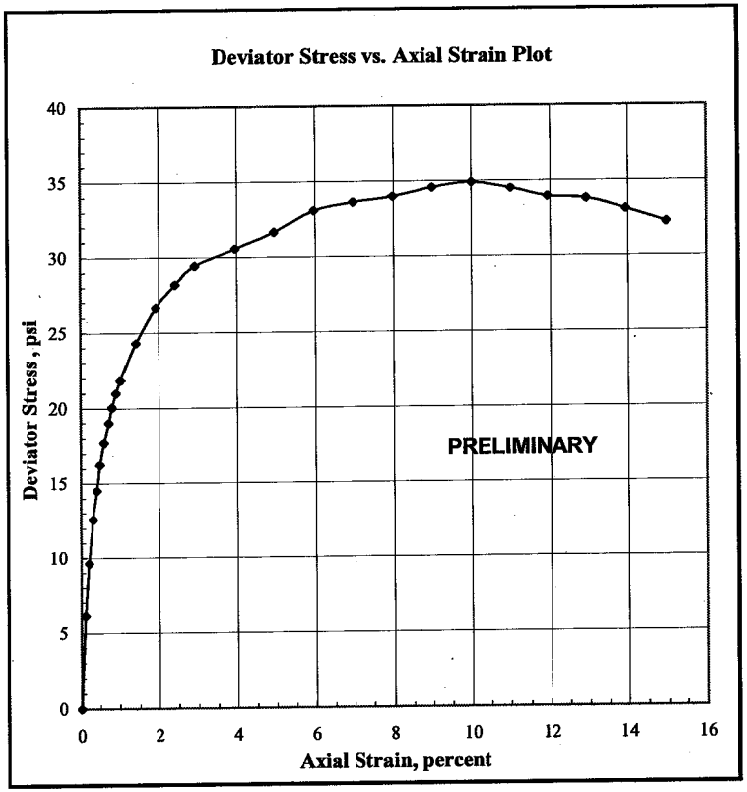
Plasticity Index: --

% finer that No. 200: *19.4*

Specific Gravity: *2.58*

Remarks: *Change in material from lower confining stress test specimen; Gs assumed.*

Reading No.	Deviator Load (lbs)	Corrected Dev. Load[1] (lbs.)	Axial Displacement (in.)	Axial Strain (%)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	Deviator Stress (psi)
Initial	0.0	0.0	0.000	0.00	6.48	36.1	36.1	0.0
1	39.8	39.8	0.006	0.10	6.49	42.2	36.1	6.1
2	62.4	62.4	0.012	0.21	6.50	45.7	36.1	9.6
3	81.8	81.7	0.018	0.31	6.50	48.7	36.1	12.6
4	94.5	94.4	0.024	0.42	6.51	50.6	36.1	14.5
5	105.8	105.7	0.029	0.50	6.51	52.3	36.1	16.2
6	115.5	115.4	0.035	0.61	6.52	53.8	36.1	17.7
7	124.3	124.1	0.042	0.73	6.53	55.1	36.1	19.0
8	131.2	131.0	0.047	0.81	6.54	56.1	36.1	20.0
9	137.6	137.4	0.053	0.92	6.54	57.1	36.1	21.0
10	143.2	143.0	0.059	1.02	6.55	57.9	36.1	21.8
11	160.1	159.8	0.082	1.42	6.58	60.4	36.1	24.3
12	176.5	176.1	0.111	1.92	6.61	62.7	36.1	26.6
13	187.7	187.2	0.140	2.42	6.64	64.3	36.1	28.2
14	197.0	196.4	0.169	2.93	6.68	65.5	36.1	29.4
15	207.0	206.1	0.229	3.96	6.75	66.6	36.1	30.5
16	216.9	215.8	0.286	4.95	6.82	67.7	36.1	31.6
17	229.2	227.9	0.345	5.97	6.89	69.2	36.1	33.1
18	235.7	234.2	0.403	6.98	6.97	69.7	36.1	33.6
19	241.0	239.3	0.461	7.98	7.04	70.1	36.1	34.0
20	248.2	246.2	0.520	9.00	7.12	70.7	36.1	34.6
21	253.6	251.4	0.578	10.01	7.20	71.0	36.1	34.9
22	253.6	251.2	0.636	11.01	7.28	70.6	36.1	34.5
23	252.4	249.8	0.689	11.93	7.36	70.0	36.1	33.9
24	254.4	251.6	0.747	12.93	7.44	69.9	36.1	33.8
25	252.4	249.4	0.806	13.95	7.53	69.2	36.1	33.1
26	249.0	245.8	0.864	14.96	7.62	68.3	36.1	32.2



Notes: 1. Deviator load corrected for membrane effects.

2. Right Cylinder Correction Method

Schnabel ENGINEERING

Unconfined Compression Test Report

ASTM D2166

Date: *1/0/1900*

Project: *MTT, DTT & MLK Exp. Project*

Location: *Norfolk, VA*

Schnabel No.: *10613051.00.21*
Boring No.: *10BH-013*
Depth: *45-46 ft.*
Elevation: *-41.2 to -42.2 ft.*

Test Specimen Data	
Initial Diameter, in:	*2.858*
Initial Area, in^2:	*6.419*
Initial Height, in:	*5.814*
H/D Ratio:	*2.0*
Moisture Content, %:	*77.9*
Wet Unit Weight, pcf:	*96.3*
Dry Unit Weight, pcf:	*54.1*

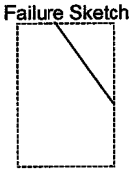
Testing Information	
Test Procedure:	*ASTM D2166*
Type of Specimen:	*Tube Sample*
Load Cell No.:	*1018253*
Strain Rate, %/min.:	*1.0*

Remarks:

Specimen Type:	*Tube Sample*

Strength Data	
Strain at Failure, %:	*4.5*
Unconfined Strength (Qu), tsf:	*0.74*
Shear Strength (Su), tsf:	*0.37*

Failure Sketch

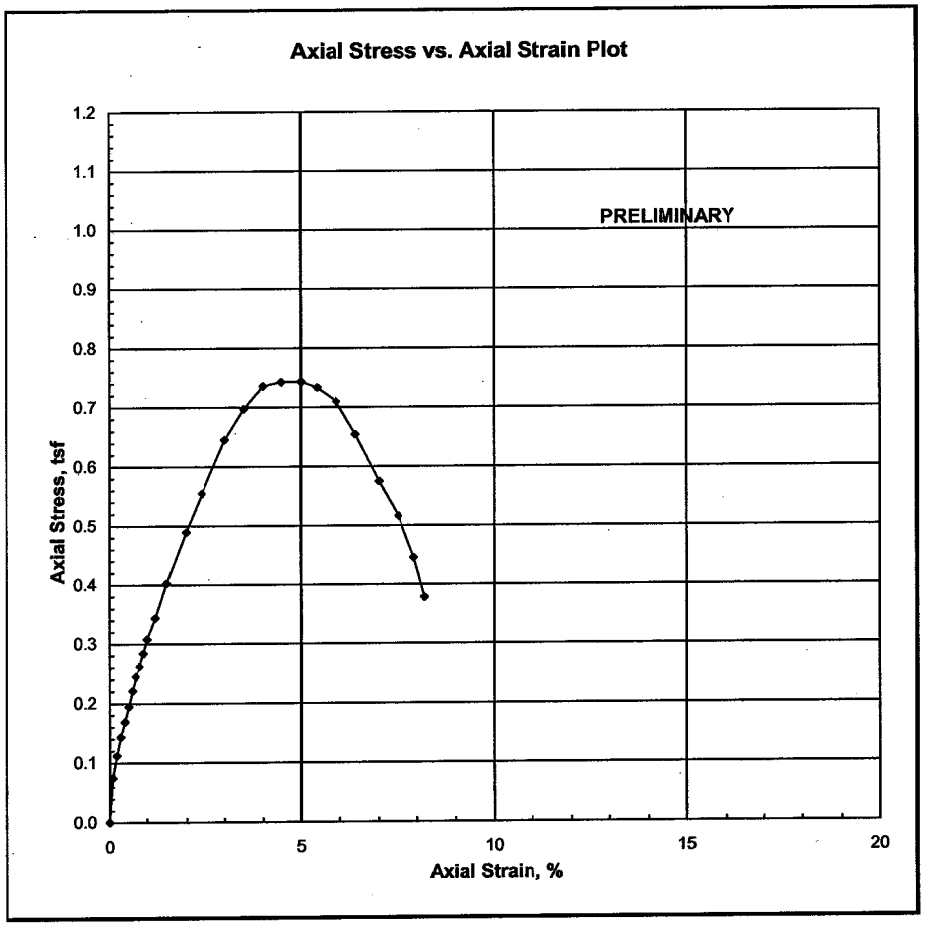


Reviewed by: *0*

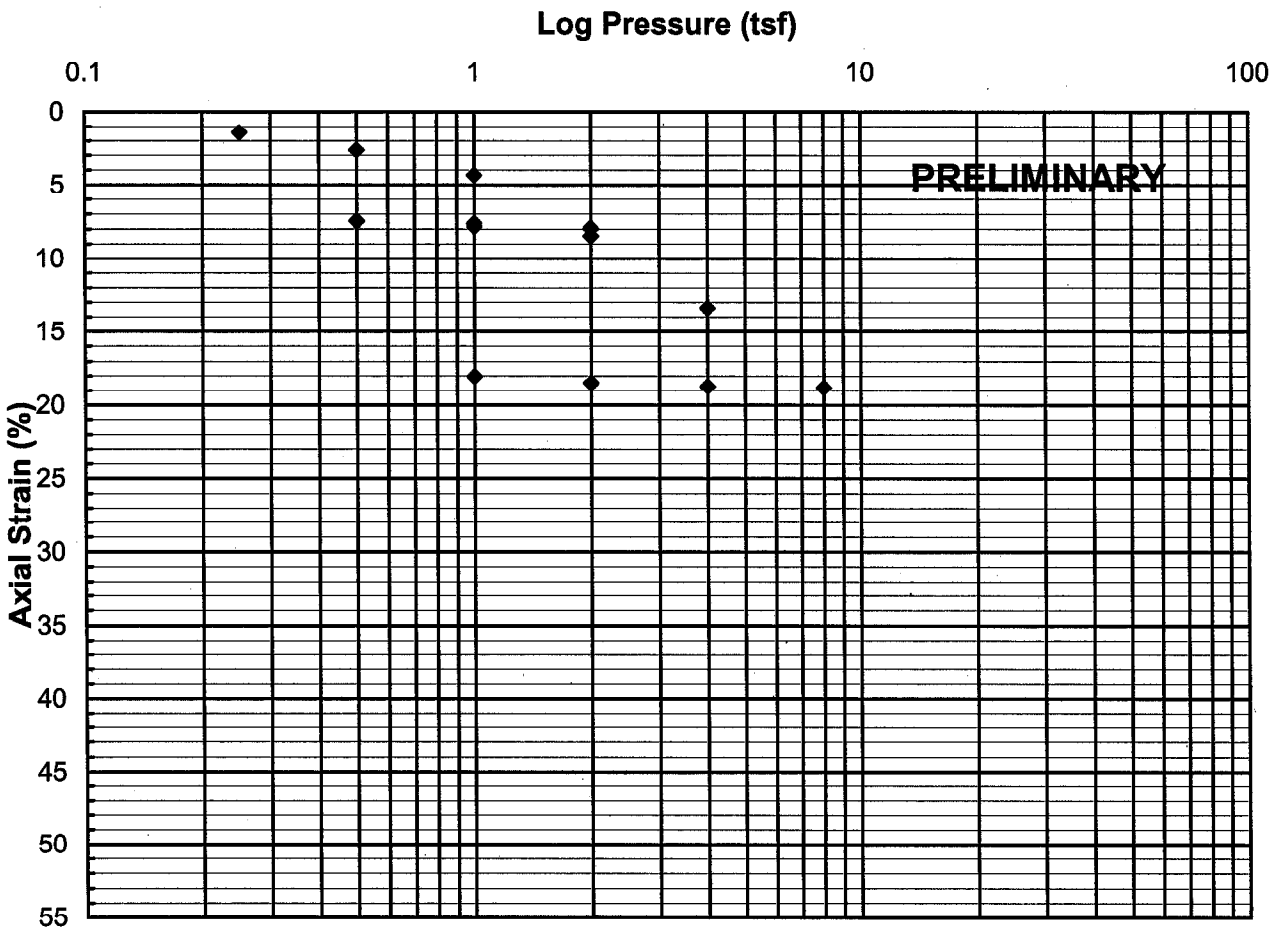
Soil Desc.: *SILTY SAND (SM), fine to medium, contains fibrous organics - gray*

LL, %:	*112*	% < 200:	*39.5*
PI, %:	*60*	Gs:	*2.58*

Test Data						
Reading No.	Axial Load (lbs)	Axial Displ. (in.)	Axial Strain (%)	Corrected Area[1] (in^2)	Axial Stress (psi)	Axial Stress (tsf)
Zero	0.0	0.000	0.0	6.42	0.0	0.00
1	6.7	0.005	0.1	6.42	1.0	0.08
2	10.0	0.011	0.2	6.43	1.6	0.11
3	12.8	0.017	0.3	6.44	2.0	0.14
4	15.1	0.023	0.4	6.44	2.3	0.17
5	17.4	0.029	0.5	6.45	2.7	0.19
6	19.8	0.035	0.6	6.46	3.1	0.22
7	22.0	0.040	0.7	6.46	3.4	0.25
8	23.5	0.046	0.8	6.47	3.6	0.26
9	25.5	0.052	0.9	6.48	3.9	0.28
10	27.7	0.058	1.0	6.48	4.3	0.31
11	31.0	0.070	1.2	6.50	4.8	0.34
12	36.4	0.087	1.5	6.52	5.6	0.40
13	44.5	0.116	2.0	6.55	6.8	0.49
14	50.7	0.140	2.4	6.58	7.7	0.55
15	59.3	0.175	3.0	6.62	9.0	0.65
16	64.4	0.204	3.5	6.65	9.7	0.70
17	68.3	0.233	4.0	6.69	10.2	0.74
18	69.3	0.262	4.5	6.72	10.3	0.74
19	69.7	0.291	5.0	6.76	10.3	0.74
20	69.1	0.315	5.4	6.79	10.2	0.73
21	67.2	0.344	5.9	6.82	9.8	0.71
22	62.3	0.373	6.4	6.86	9.1	0.65
23	55.1	0.408	7.0	6.90	8.0	0.57
24	49.7	0.437	7.5	6.94	7.2	0.52
25	43.1	0.461	7.9	6.97	6.2	0.45
26	36.7	0.477	8.2	6.99	5.2	0.38



Notes: 1. Right Cylinder Area Correction Method



Evaluation of Pp', Cer, and Cec relies on the design professional's engineering judgement and project details.

Probable Preconsolidation Pressure (Pp), tsf: 2.8				**Recompression Ratio (Cer):** 0.01	
Type of Specimen: *Tube Sample*				**Compression Ratio (Cec):** 0.18	
Description: *SILTY SAND (SM), fine to medium, contains fibrous organics - gray*					**Initial** / **Final**
				Water Content, %	*45.2* / *33.8*
LL: *112*	**PI:** *60*	**Gs:** *2.58*	**P_o' (tsf):** *0.00*	**Void Ratio**	*1.25* / *0.85*
% < No. 200: *39.5*		**Test Method:** *ASTM D2435 Method A*		**Saturation, %**	*93* / *100*
Test Condition: *Inundated @ 0.05 tsf*				**Dry Unit Weight, pcf**	*71.4* / *87.2*
Remarks:				**Project:** MTT, DTT & MLK Exp. Project	
Average Water Content of Trimmings, %: *47.7*				**Location** *Norfolk, VA*	
Schnabel ENGINEERING				**Boring:** *10BH-013*	**Schnabel No.:** *10613051.00.21*
				Depth: *45-46 ft.*	**Elevation:** *-41.2 to -42.2 ft.*
				Date: *1/0/1900*	**Reviewed by:** *0*
				Consolidation Test Report	

Consolidation Test Data Sheet

Consolidometer ID: 5 1/0/00

Schnabel Contract: 10613051.00.21

Project: MTT, DTT & MLK Exp. Project

Test Method: ASTM D2435 Method A

Test Condition: Inundated @ 0.05 tsf

Initial Height of Specimen (H_o), in.: 0.7456

Height of Solids (H_s), in.: 0.3309

Boring No.: 10BH-013

Depth: 45-46 ft.

Seating Press. (tsf): 0.05

Initial Dial Gauge Reading (D_o), in.: 0.0011

Reviewed by: 0

Pressure, P (tsf)	Time Readings Required	Date Load Applied	Time Load Applied	Load Applied By	A: Final[1] Dial Reading, D_{fi} x 10^{-4} in.	B: Apparatus Correction[2], D_{ci} x 10^{-4} in.	C: Cumulative Change in Height[3], DH_i in.	D: Height of Voids[4], H_{vi} in.	Vertical Strain[5], e_i (%)	Void Ratio[6], e_i
0.25		9/10/2010	DWC	9:20	126	7	0.0108	0.4027	1.45	1.217
0.5		9/11/2010	CJS	9:20	223	15	0.0197	0.3938	2.64	1.190
1		9/12/2010	DWC	9:20	358	23	0.0324	0.3811	4.35	1.152
2		9/13/2010	DWC	9:20	636	31	0.0594	0.3541	7.97	1.070
1		9/14/2010	DWC	9:20	619	23	0.0585	0.3550	7.85	1.073
0.5		9/15/2010	DWC	9:20	584	15	0.0558	0.3577	7.48	1.081
1		9/16/2010	DWC	9:20	604	23	0.0570	0.3565	7.65	1.077
2		9/17/2010	DWC	9:20	674	31	0.0632	0.3503	8.48	1.059
4		9/18/2010	DWC	9:20	1047	38	0.0998	0.3137	13.39	0.948
8		9/20/2010	DWC	9:20	1458	46	0.1401	0.2734	18.79	0.826
4		9/21/2010	DWC	9:20	1444	38	0.1395	0.2740	18.71	0.828
2		9/22/2010	DWC	9:20	1419	31	0.1377	0.2758	18.47	0.834
1		9/23/2010	DWC	9:20	1379	23	0.1345	0.2790	18.04	0.843

Notes:
1. "Final" based on test method; 24 hrs for Method A, end of primary for Method B.
2. Correction value, for the current pressure, from the consolidometer's calibration curve.
3. $\Delta H = D_{fi} - D_o - D_{ci}$ = Col. A - D_o - Col. B
4. $H_{vi} = (H_o - H_s - D_o) - \Delta H$
5. $\varepsilon_i = (\Delta H / H_o) \times 100$ = (Col. C / H_o) x 100
6. $e_i = H_{vi} / Hs$ = Col. D / Hs

Consol 5/2007 Rev. 4

Schnabel ENGINEERING

Load Time Readings

1/0/00

Project: MTT, DTT & MLK Exp. Project

Schnabel Contract: 10613051.00.21

Boring No.: 10BH-013 Depth: 45-46 ft.

Consol. ID: 5 Reviewed by: 0

Test Drainage Conditions: Double

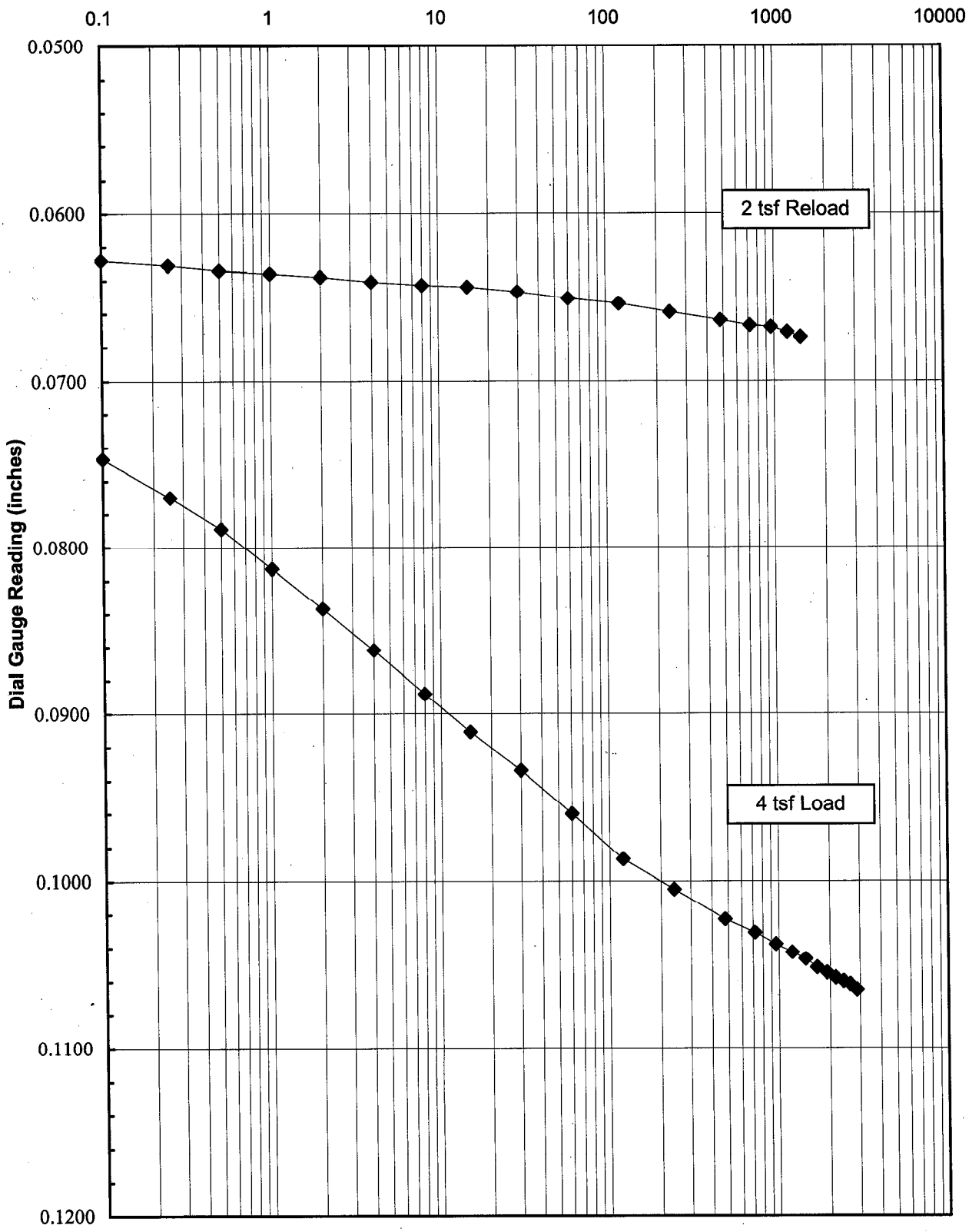
Elapsed Time (min.)	Dial Gauge Readings (inches)					
	2 tsf Reload 9/17/2010	4 tsf Load 9/18/2010				
0.1	0.0628	0.0747				
0.25	0.0631	0.0770				
0.5	0.0634	0.0789				
1	0.0636	0.0813				
2	0.0638	0.0837				
4	0.0641	0.0862				
8	0.0643	0.0888				
15	0.0644	0.0911				
30	0.0647	0.0934				
60	0.0651	0.0960				
120	0.0654	0.0987				
240	0.0659	0.1005				
480	0.0664	0.1023				
720	0.0667	0.1031				
960	0.0668	0.1038				
1200	0.0671	0.1043				
1440	0.0674	0.1047				
1680		0.1052				
1920		0.1055				
2160		0.1058				
2400		0.1060				
2640		0.1062				
2880		0.1065				

Schnabel ENGINEERING

Consolidation Time Curves

1/0/00

Project: MTT, DTT & MLK Exp. Project
Schnabel Contract: 10613051.00.21
Boring No.: 10BH-013 Depth: 45-46 ft.
Reviewed by: 0 Test Drainage Conditions: Double



Schnabel ENGINEERING

Unconsolidated Undrained Triaxial Compression Test

ASTM D2850

Project: *MTT, DTT & MLK Exp. Project*

Location: *Norfolk, VA*

Schnabel Contract: *10613051.00.21* Date: *1/0/1900*

Boring No.: *10BH-014*

Depth: *20-22 ft.* Reviewed by: *0*

Elevation: *-16.2 to -18.2 ft.*

Confining Stress (psi): *9.0*

Specimen Conditions	
Diameter (in)	2.826
Height (in)	5.809
Area (in^2)	6.28
Moisture (%):	66.9
Weight (lbs)	2.11
ρ_{wet} (pcf)	100.1
ρ_{dry} (pcf)	60.0
Void Ratio	1.81
Saturation, %	100

Shear Testing Conditions	
Cell Pressure (psi):	9.0
Rate of Strain (%/min):	1.0

Specimen Type: *Tube Sample*

Axial Strain at Failure (%): *13.96*

Compressive Strength (psi): *4.8*

Major Principal Stress (psi): *13.8*

Minor Principal Stress (psi): *9.0*

Soil Description: *FAT CLAY (CH), contains gravel - gray*

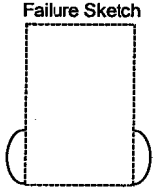
Liquid Limit: *91*

Plasticity Index: *59*

% finer that No. 200: *85.1*

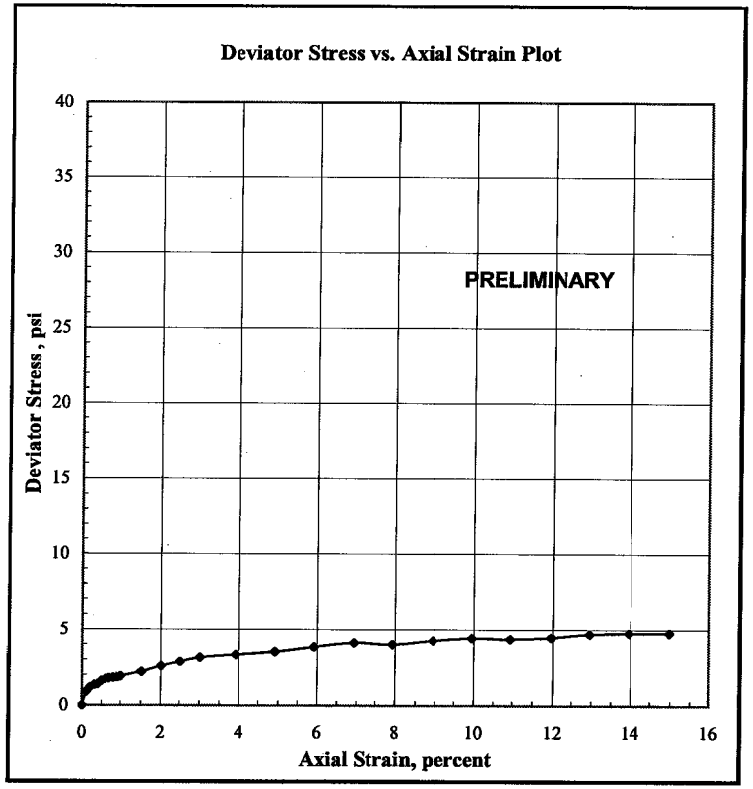
Specific Gravity: *2.70*

Failure Sketch



Remarks: *Gs assumed.*

Reading No.	Deviator Load (lbs)	Corrected Dev. Load[1] (lbs.)	Axial Displacement (in.)	Axial Strain (%)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	Deviator Stress (psi)
Initial	0.0	0.0	0.000	0.00	6.28	9.0	9.0	0.0
1	5.8	5.8	0.006	0.10	6.28	9.9	9.0	0.9
2	7.5	7.5	0.012	0.21	6.29	10.2	9.0	1.2
3	8.6	8.5	0.018	0.31	6.30	10.4	9.0	1.4
4	8.9	8.8	0.023	0.40	6.30	10.4	9.0	1.4
5	10.2	10.1	0.029	0.50	6.31	10.6	9.0	1.6
6	11.1	11.0	0.035	0.60	6.31	10.7	9.0	1.7
7	11.4	11.2	0.041	0.71	6.32	10.8	9.0	1.8
8	11.7	11.5	0.047	0.81	6.33	10.8	9.0	1.8
9	11.9	11.7	0.053	0.91	6.33	10.8	9.0	1.8
10	12.3	12.1	0.058	1.00	6.34	10.9	9.0	1.9
11	14.4	14.1	0.088	1.51	6.37	11.2	9.0	2.2
12	17.0	16.6	0.117	2.01	6.41	11.6	9.0	2.6
13	18.9	18.4	0.146	2.51	6.44	11.9	9.0	2.9
14	20.9	20.3	0.175	3.01	6.47	12.1	9.0	3.1
15	22.6	21.8	0.228	3.92	6.53	12.3	9.0	3.3
16	24.3	23.3	0.286	4.92	6.60	12.5	9.0	3.5
17	26.8	25.5	0.344	5.92	6.67	12.8	9.0	3.8
18	29.1	27.6	0.403	6.94	6.74	13.1	9.0	4.1
19	29.0	27.3	0.461	7.94	6.82	13.0	9.0	4.0
20	31.2	29.3	0.520	8.95	6.89	13.2	9.0	4.2
21	33.0	30.9	0.578	9.95	6.97	13.4	9.0	4.4
22	33.0	30.7	0.636	10.95	7.05	13.4	9.0	4.4
23	34.4	31.8	0.695	11.96	7.13	13.5	9.0	4.5
24	36.6	33.8	0.753	12.96	7.21	13.7	9.0	4.7
25	37.7	34.7	0.811	13.96	7.29	13.8	9.0	4.8
26	38.3	35.1	0.870	14.98	7.38	13.8	9.0	4.8



Notes: 1. Deviator load corrected for membrane effects.

2. Right Cylinder Correction Method

Schnabel ENGINEERING

Unconfined Compression Test Report

ASTM D2166

Date: *1/0/1900*

Project: *MTT, DTT & MLK Exp. Project*

Location: *Norfolk, VA*

Schnabel No.: *10613051.00.21*
Boring No.: *10BH-014*
Depth: *20-22 ft.*
Elevation: *-16.2 to -18.2 ft.*

Test Specimen Data	
Initial Diameter, in:	*2.801*
Initial Area, in^2:	*6.162*
Initial Height, in:	*5.808*
H/D Ratio:	*2.1*
Moisture Content, %:	*58.4*
Wet Unit Weight, pcf:	*98.1*
Dry Unit Weight, pcf:	*61.9*

Testing Information	
Test Procedure:	*ASTM D2166*
Type of Specimen:	*Tube Sample*
Load Cell No.:	*1018253*
Strain Rate, %/min.:	*1.0*

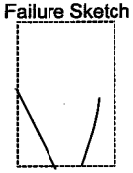
Remarks: *Gs assumed.*

Specimen Type:	*Tube Sample*

Strength Data	
Strain at Failure, %:	*5.9*
Unconfined Strength (Qu), tsf:	*0.43*
Shear Strength (Su), tsf:	*0.22*

Reviewed by: *0*

Failure Sketch

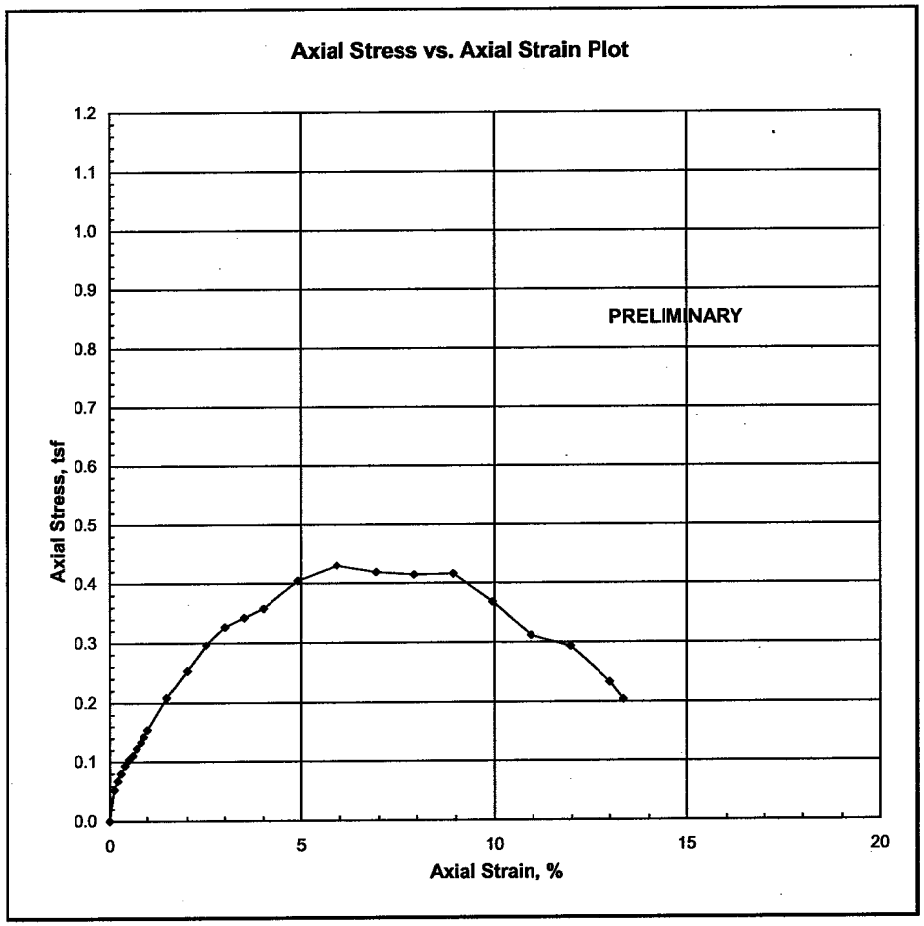


Soil Desc.: *FAT CLAY (CH), contains gravel - gray*

LL, %:	*91*	% < 200:	*85.1*
PI, %:	*59*	Gs:	*2.70*

Test Data

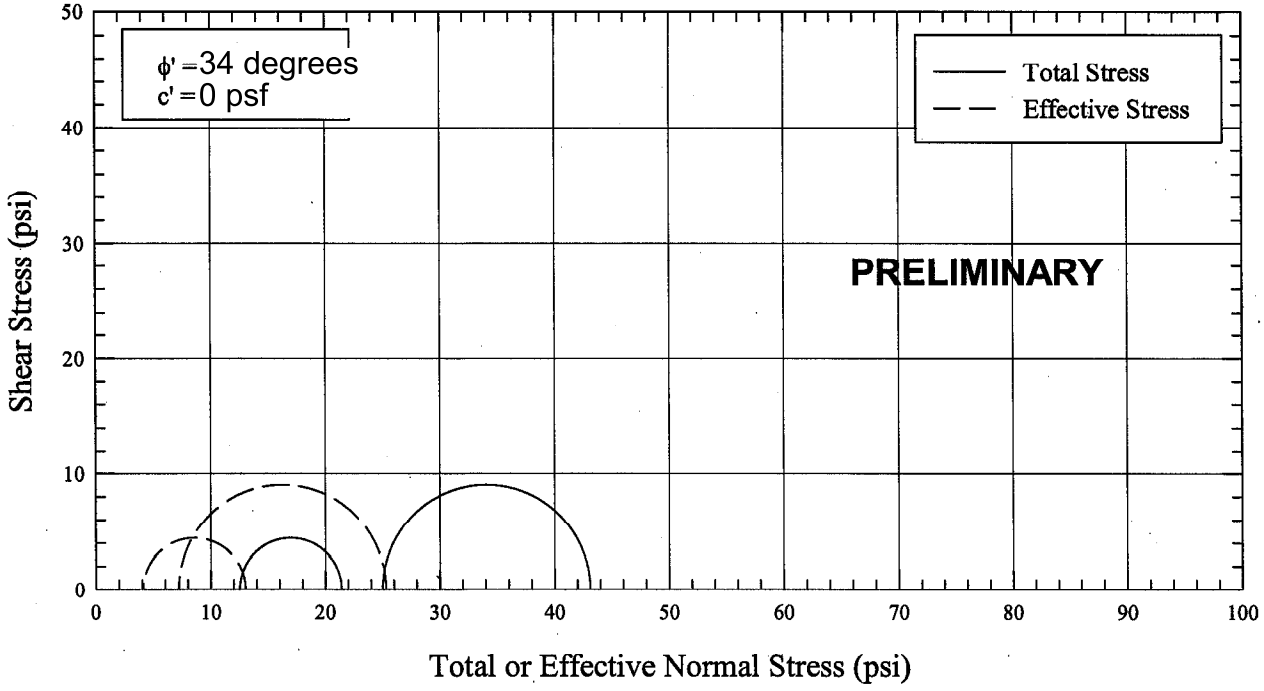
Reading No.	Axial Load (lbs)	Axial Displ. (in.)	Axial Strain (%)	Corrected Area[1] (in^2)	Axial Stress (psi)	Axial Stress (tsf)
Zero	0.0	0.000	0.0	6.16	0.0	0.00
1	4.5	0.007	0.1	6.17	0.7	0.05
2	5.8	0.012	0.2	6.17	0.9	0.07
3	6.9	0.017	0.3	6.18	1.1	0.08
4	8.0	0.023	0.4	6.19	1.3	0.09
5	8.9	0.029	0.5	6.19	1.4	0.10
6	9.5	0.035	0.6	6.20	1.5	0.11
7	10.6	0.041	0.7	6.21	1.7	0.12
8	11.5	0.048	0.8	6.21	1.9	0.13
9	12.3	0.052	0.9	6.22	2.0	0.14
10	13.3	0.058	1.0	6.22	2.1	0.15
11	18.1	0.087	1.5	6.26	2.9	0.21
12	22.1	0.117	2.0	6.29	3.5	0.25
13	26.0	0.146	2.5	6.32	4.1	0.30
14	28.8	0.175	3.0	6.35	4.5	0.33
15	30.4	0.204	3.5	6.39	4.8	0.34
16	31.9	0.233	4.0	6.42	5.0	0.36
17	36.4	0.286	4.9	6.48	5.6	0.40
18	39.1	0.344	5.9	6.55	6.0	0.43
19	38.5	0.403	6.9	6.62	5.8	0.42
20	38.5	0.461	7.9	6.69	5.8	0.41
21	39.1	0.519	8.9	6.77	5.8	0.42
22	35.0	0.578	10.0	6.84	5.1	0.37
23	29.9	0.636	10.9	6.92	4.3	0.31
24	28.5	0.695	12.0	7.00	4.1	0.29
25	22.9	0.755	13.0	7.08	3.2	0.23
26	20.1	0.775	13.3	7.11	2.8	0.20



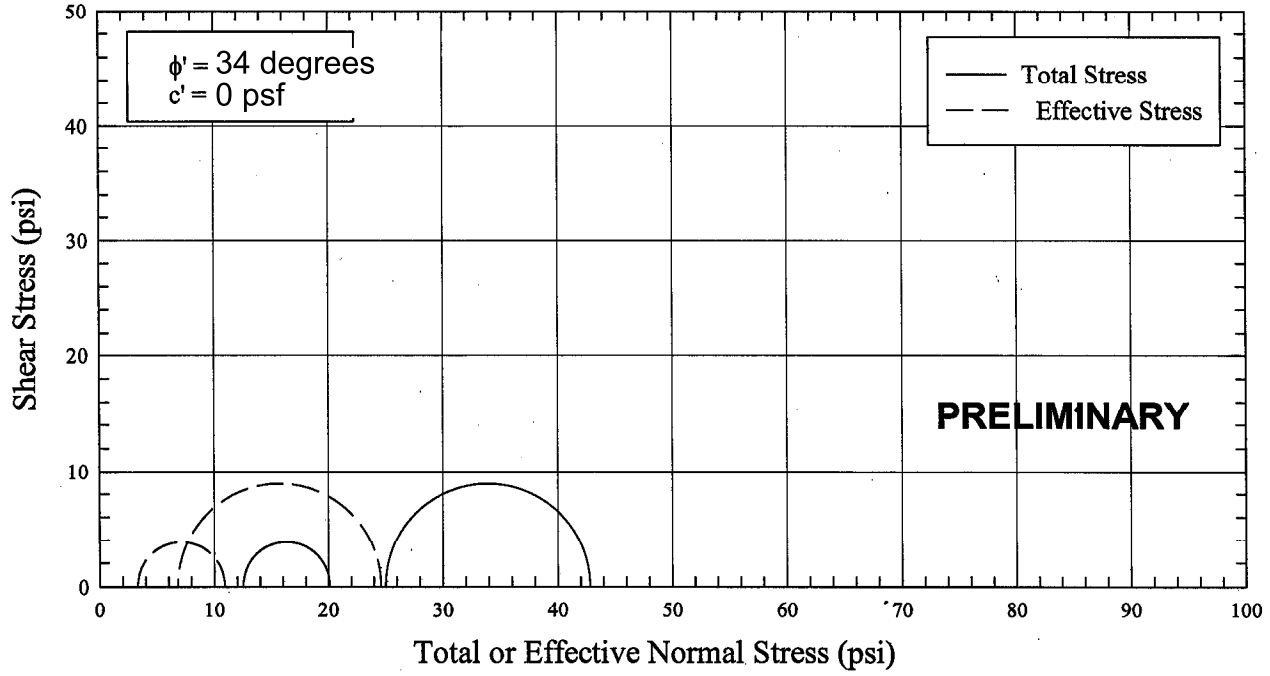
Notes: 1. Right Cylinder Area Correction Method

Consolidated Undrained (CU) Triaxial Shear (ASTM D4767)

Mohr Stress Circles at Maximum Deviator Stress Criterion



Mohr Stress Circles at Maximum Principal Stress Ratio Criterion

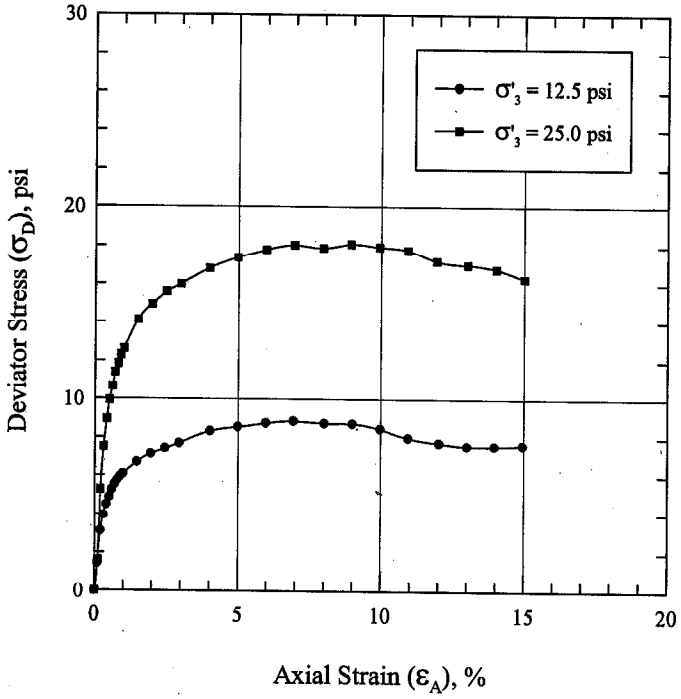


Boring No.: *10BH-014* Depth: *30-32 ft* Elevation: *-26.2 to -28.2 ft* SEC Contract: *10613051.00.21* Date:
Sample Description: *FAT CLAY (CH) - gray* Reviewed By:
Specimen Type: *Tube Sample* Gs: *2.70* LL: *59* PI: *37* %<200: *79.3*

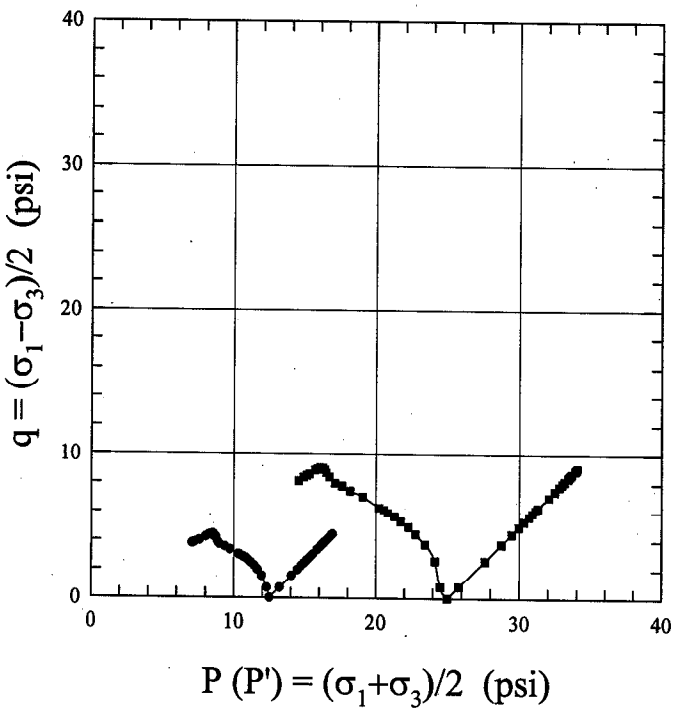
Schnabel ENGINEERING

MTT, DTT & MLK Exp. Project
Norfolk, VA

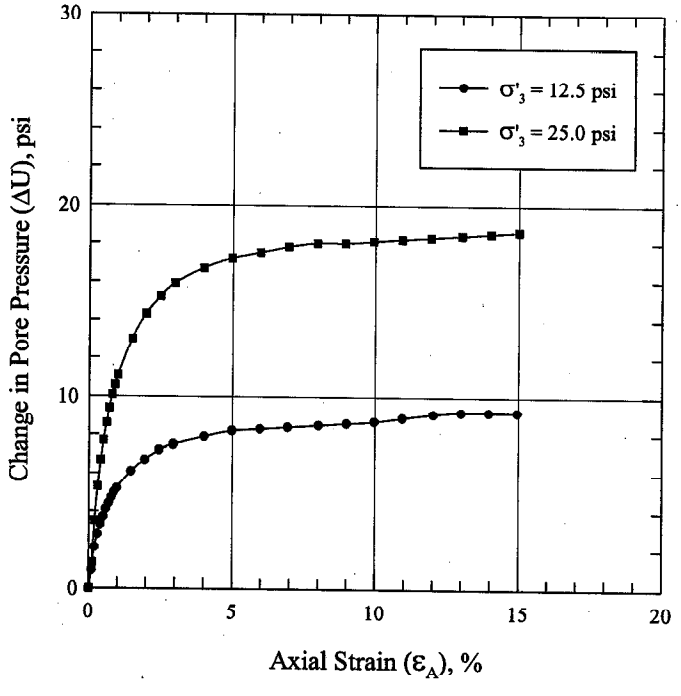
Deviator Stress vs. Axial Strain



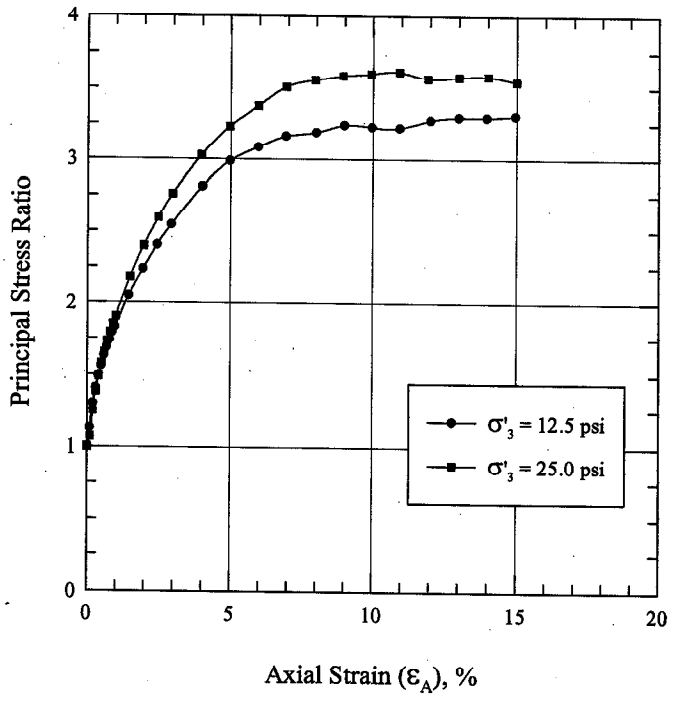
Stress Paths



Change in Pore Pressure vs. Axial Strain



Principal Stress Ratio vs. Axial Strain



Boring No.: *10BH-014* Depth: *30-32 ft* Elevation: *-26.2 to -28.2 ft* SEC Contract: *10613051.00.21* Date:

Sample Description: *FAT CLAY WITH SAND (CH) - gray* Reviewed By:

Specimen Type: *Tube Sample* Specific Gravity: *2.70* LL: *59* PI: *37* %<200: *79.3*

Schnabel ENGINEERING

MTT, DTT & MLK Exp. Project
Norfolk, VA

Schnabel ENGINEERING

Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *MTT, DTT & MLK Exp. Project*

Location: *Norfolk, VA*

Schnabel Contract: *10613051.00.21*
Boring No.: *10BH-014*
Depth: *30-32 ft.*
Elevation: *-26.2 to -28.2 ft.*
Confining Stress (psi): *12.5*

Date:

Reviewed by: *0*

	Specimen Conditions	
	Initial	Consolidated
Diameter (in)	2.832	2.76
Height (in)	5.820	5.69
Area (in^2)	6.30	5.99
Moisture (%)	62.7	
W_{solids} (lbs)	1.36	
ρ_{wet} (pcf)	103.9	
ρ_{dry} (pcf)	63.9	68.8
Void Ratio	1.64	1.45
Saturation, %	100	89

Shear Testing Conditions	
Cell Pressure (psi):	22.5
Back Pressure (psi):	10.0
Eff. Confining Stress (psi):	12.5
Final B check	1.00
t_{50} (min.):	58.4
Rate of Strain (%/min):	0.0069

Filter strips used? *YES*

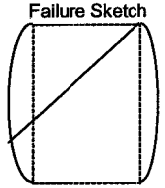
Specimen Type: *Tube Sample*

Soil Description: *FAT CLAY WITH SAND (CH) - gray*

Liquid Limit: *59*
Plasticity Index: *37*
% finer that No. 200: *79.3*
Specific Gravity: *2.70*

Remarks:

Failure Sketch



Reading No.	Deviator Load (lbs)	Corrected[1] Dev. Load (lbs.)	Axial Deformation (in.)	Axial Strain (%)	Pore Pressure (psi)	Change in Pore Press. (psi)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	Deviator Stress (psi)	Principal Stress Ratio	A_{bar}	P (psi)	P' (psi)	q (psi)
Zero	0.0	0.0	0.000	0.00	10.0	0.0	5.99	12.5	12.5	12.5	12.5	0.0	1.00	0.00	12.5	12.5	0.0
1	8.7	8.6	0.005	0.09	10.9	0.9	5.99	13.9	12.5	13.0	11.6	1.4	1.12	0.83	13.2	12.3	0.7
2	18.8	18.6	0.011	0.19	12.1	2.1	6.00	15.6	12.5	13.5	10.4	3.1	1.30	0.68	14.0	11.9	1.5
3	24.0	23.6	0.017	0.30	12.8	2.8	6.00	16.4	12.5	13.6	9.7	3.9	1.41	0.71	14.5	11.7	2.0
4	27.4	26.9	0.022	0.39	13.3	3.3	6.01	17.0	12.5	13.7	9.2	4.5	1.49	0.74	14.7	11.4	2.2
5	29.9	29.3	0.028	0.49	13.7	3.7	6.02	17.4	12.5	13.7	8.8	4.9	1.55	0.76	14.9	11.2	2.4
6	32.3	31.6	0.033	0.58	14.1	4.1	6.02	17.7	12.5	13.6	8.4	5.2	1.62	0.78	15.1	11.0	2.6
7	34.2	33.4	0.039	0.69	14.4	4.4	6.03	18.0	12.5	13.6	8.1	5.5	1.68	0.79	15.3	10.9	2.8
8	35.6	34.7	0.044	0.77	14.7	4.7	6.03	18.2	12.5	13.5	7.8	5.7	1.74	0.82	15.4	10.7	2.9
9	36.9	35.9	0.050	0.88	15.0	5.0	6.04	18.4	12.5	13.4	7.5	5.9	1.79	0.84	15.5	10.5	3.0
10	37.8	36.7	0.055	0.97	15.2	5.2	6.05	18.6	12.5	13.4	7.3	6.1	1.83	0.86	15.5	10.3	3.0
11	42.4	40.7	0.083	1.46	16.1	6.1	6.08	19.2	12.5	13.1	6.4	6.7	2.05	0.91	15.8	9.7	3.3
12	45.9	43.6	0.111	1.95	16.7	6.7	6.11	19.6	12.5	12.9	5.8	7.1	2.23	0.94	16.1	9.4	3.6
13	48.0	45.5	0.139	2.44	17.2	7.2	6.14	19.9	12.5	12.7	5.3	7.4	2.40	0.97	16.2	9.0	3.7
14	50.1	47.5	0.167	2.94	17.5	7.5	6.17	20.2	12.5	12.7	5.0	7.7	2.54	0.97	16.4	8.9	3.9
15	54.7	51.9	0.228	4.01	17.9	7.9	6.24	20.8	12.5	12.9	4.6	8.3	2.81	0.95	16.7	8.8	4.2
16	56.8	53.8	0.283	4.98	18.2	8.2	6.30	21.0	12.5	12.8	4.3	8.5	2.99	0.96	16.8	8.6	4.3
17	58.9	55.7	0.339	5.96	18.3	8.3	6.37	21.3	12.5	13.0	4.2	8.8	3.08	0.95	16.9	8.6	4.4
18	60.4	57.0	0.394	6.93	18.4	8.4	6.43	21.4	12.5	13.0	4.1	8.9	3.16	0.95	16.9	8.5	4.4
19	60.6	57.0	0.455	8.00	18.5	8.5	6.51	21.3	12.5	12.8	4.0	8.8	3.19	0.97	16.9	8.4	4.4
20	61.3	57.5	0.511	8.99	18.6	8.6	6.58	21.2	12.5	12.6	3.9	8.7	3.24	0.98	16.9	8.3	4.4
21	60.3	56.3	0.567	9.97	18.7	8.7	6.65	21.0	12.5	12.3	3.8	8.5	3.23	1.03	16.7	8.0	4.2
22	58.0	53.8	0.622	10.94	18.9	8.9	6.72	20.5	12.5	11.6	3.6	8.0	3.22	1.11	16.5	7.6	4.0
23	57.1	52.6	0.683	12.01	19.1	9.1	6.80	20.2	12.5	11.1	3.4	7.7	3.28	1.18	16.4	7.3	3.9
24	56.8	52.1	0.739	13.00	19.2	9.2	6.88	20.1	12.5	10.9	3.3	7.6	3.30	1.21	16.3	7.1	3.8
25	57.6	52.7	0.794	13.97	19.2	9.2	6.96	20.1	12.5	10.9	3.3	7.6	3.30	1.21	16.3	7.1	3.8
26	58.7	53.6	0.850	14.95	19.2	9.2	7.04	20.1	12.5	10.9	3.3	7.6	3.31	1.21	16.3	7.1	3.8

Notes: 1. Deviator load corrected for membrane and filter cage (if applicable) effects.
2. Right Cylinder Correction Method

Schnabel ENGINEERING

Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *MTT, DTT & MLK Exp. Project*

Location: *Norfolk, VA*

Schnabel Contract: *10613051.00.21*
Boring No.: *10BH-014*
Depth: *30-32 ft.*
Elevation: *-26.2 to -28.2 ft.*
Confining Stress (psi): *25.0*

Date:

Reviewed by: *0*

	Specimen Conditions	
	Initial	Consolidated
Diameter (in)	2.825	2.72
Height (in)	5.807	5.59
Area (in^2)	6.27	5.82
Moisture (%)	48.3	
W_{solids} (lbs)	1.52	
ρ_{wet} (pcf)	107.2	
ρ_{dry} (pcf)	72.3	80.8
Void Ratio	1.33	1.08
Saturation, %	98	96

Shear Testing Conditions	
Cell Pressure (psi):	35.0
Back Pressure (psi):	10.0
Eff. Confining Stress (psi):	25.0
Final B check	0.96
t_{50} (min.):	50.7
Rate of Strain (%/min):	0.00789

Filter strips used? *YES*

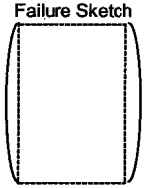
Specimen Type: *Tube Sample*

Soil Description: *FAT CLAY WITH SAND (CH) - gray*

Liquid Limit: *59*
Plasticity Index: *37*
% finer that No. 200: *79.3*
Specific Gravity: *2.70*

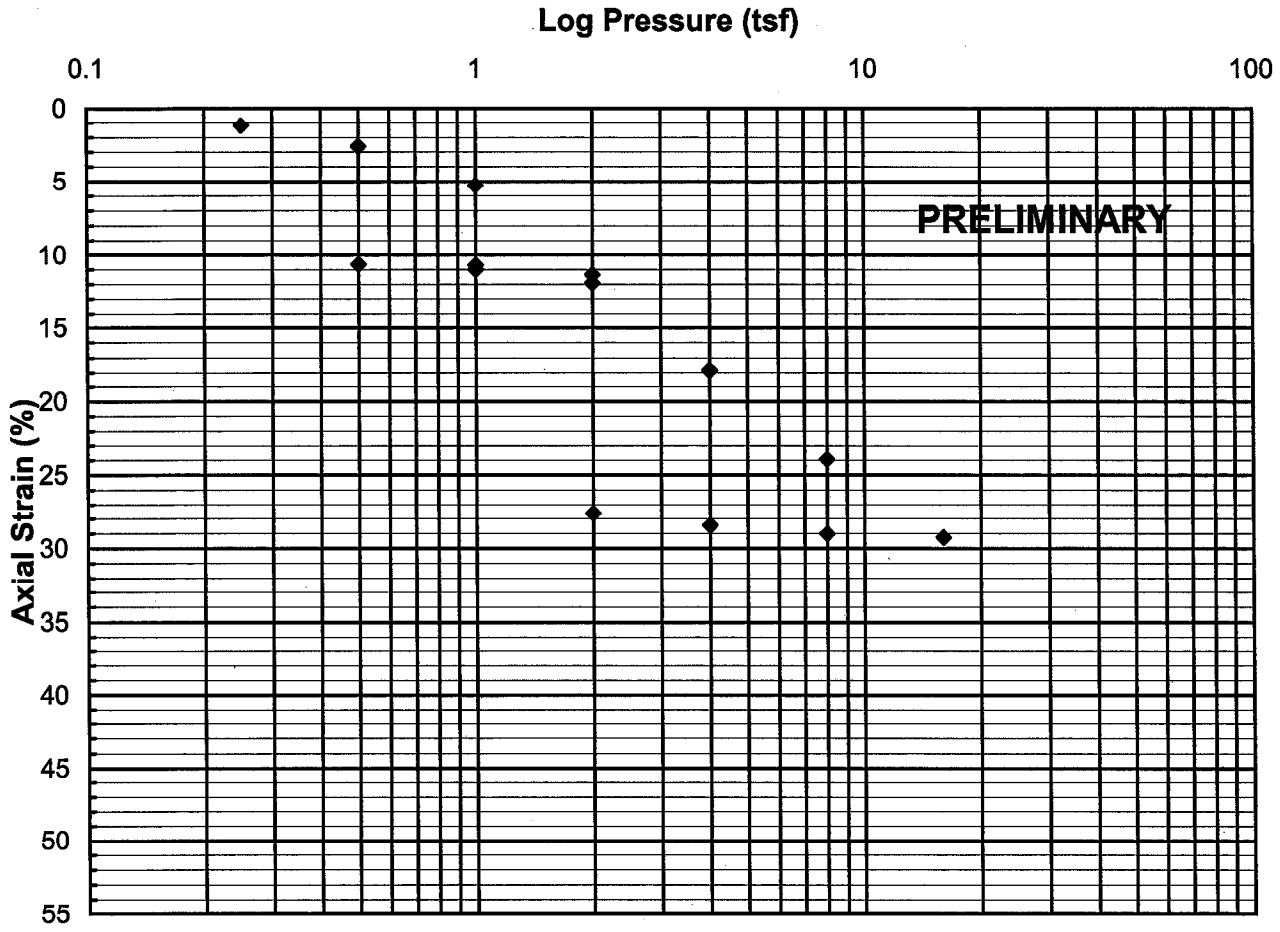
Remarks:

Failure Sketch



Reading No.	Deviator Load (lbs)	Corrected[1] Dev. Load (lbs.)	Axial Deformation (in.)	Axial Strain (%)	Pore Pressure (psi)	Change in Pore Press. (psi)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	Deviator Stress (psi)	Principal Stress Ratio	A_{bar}	P (psi)	P' (psi)	q (psi)
Zero	0.0	0.0	0.000	0.00	10.0	0.0	5.82	25.0	25.0	25.0	25.0	0.0	1.00	0.00	25.0	25.0	0.0
1	9.6	9.5	0.006	0.11	11.3	1.3	5.83	26.6	25.0	25.3	23.7	1.6	1.07	0.80	25.8	24.5	0.8
2	31.0	30.8	0.011	0.20	13.5	3.5	5.83	30.3	25.0	26.8	21.5	5.3	1.25	0.66	27.6	24.1	2.6
3	44.3	43.9	0.017	0.30	15.3	5.3	5.84	32.5	25.0	27.2	19.7	7.5	1.38	0.70	28.8	23.5	3.8
4	52.8	52.3	0.023	0.41	16.7	6.7	5.84	34.0	25.0	27.3	18.3	9.0	1.49	0.75	29.5	22.8	4.5
5	58.7	58.1	0.028	0.50	17.7	7.7	5.85	34.9	25.0	27.2	17.3	9.9	1.57	0.77	30.0	22.3	5.0
6	63.2	62.5	0.034	0.61	18.6	8.6	5.85	35.7	25.0	27.1	16.4	10.7	1.65	0.81	30.3	21.7	5.3
7	67.6	66.8	0.039	0.70	19.4	9.4	5.86	36.4	25.0	27.0	15.6	11.4	1.73	0.82	30.7	21.3	5.7
8	70.5	69.6	0.045	0.80	20.1	10.1	5.87	36.9	25.0	26.8	14.9	11.9	1.80	0.85	30.9	20.8	5.9
9	73.3	72.2	0.050	0.89	20.6	10.6	5.87	37.3	25.0	26.7	14.4	12.3	1.85	0.86	31.2	20.6	6.2
10	75.3	74.1	0.056	1.00	21.1	11.1	5.88	37.6	25.0	26.5	13.9	12.6	1.91	0.88	31.3	20.2	6.3
11	85.2	83.4	0.084	1.50	23.0	13.0	5.91	39.1	25.0	26.1	12.0	14.1	2.18	0.92	32.1	19.1	7.1
12	91.0	88.7	0.111	1.98	24.3	14.3	5.94	39.9	25.0	25.6	10.7	14.9	2.40	0.96	32.5	18.2	7.5
13	95.5	93.0	0.139	2.48	25.2	15.2	5.97	40.6	25.0	25.4	9.8	15.6	2.59	0.97	32.8	17.6	7.8
14	98.5	95.9	0.167	2.99	25.9	15.9	6.00	41.0	25.0	25.1	9.1	16.0	2.76	0.99	33.0	17.1	8.0
15	104.7	101.9	0.223	3.99	26.7	16.7	6.06	41.8	25.0	25.1	8.3	16.8	3.03	0.99	33.4	16.7	8.4
16	109.4	106.4	0.278	4.97	27.2	17.2	6.12	42.4	25.0	25.2	7.8	17.4	3.23	0.99	33.7	16.5	8.7
17	113.3	110.1	0.334	5.97	27.5	17.5	6.19	42.8	25.0	25.3	7.5	17.8	3.37	0.98	33.9	16.4	8.9
18	116.3	112.9	0.389	6.95	27.8	17.8	6.25	43.1	25.0	25.3	7.2	18.1	3.51	0.99	34.0	16.2	9.0
19	116.7	113.1	0.445	7.95	28.0	18.0	6.32	42.9	25.0	24.9	7.0	17.9	3.56	1.01	33.9	15.9	8.9
20	119.5	115.7	0.500	8.94	28.0	18.0	6.39	43.1	25.0	25.1	7.0	18.1	3.59	0.99	34.1	16.1	9.1
21	120.0	116.0	0.556	9.94	28.1	18.1	6.46	43.0	25.0	24.9	6.9	18.0	3.60	1.01	34.0	15.9	9.0
22	120.4	116.2	0.611	10.92	28.2	18.2	6.53	42.8	25.0	24.6	6.8	17.8	3.62	1.02	33.9	15.7	8.9
23	118.1	113.7	0.667	11.92	28.3	18.3	6.61	42.2	25.0	23.9	6.7	17.2	3.57	1.06	33.6	15.3	8.6
24	118.5	113.9	0.728	13.01	28.4	18.4	6.69	42.0	25.0	23.6	6.6	17.0	3.58	1.08	33.5	15.1	8.5
25	118.5	113.7	0.784	14.01	28.5	18.5	6.77	41.8	25.0	23.3	6.5	16.8	3.58	1.10	33.4	14.9	8.4
26	116.6	111.6	0.839	15.00	28.6	18.6	6.85	41.3	25.0	22.7	6.4	16.3	3.55	1.14	33.1	14.5	8.1

Notes: 1. Deviator load corrected for membrane and filter cage (if applicable) effects.
2. Right Cylinder Correction Method



Evaluation of Pp', Cer, and Cec relies on the design professional's engineering judgement and project details.

Probable Preconsolidation Pressure (Pp), tsf: 1.9			**Recompression Ratio (Cer):** 0.04
Type of Specimen: *Tube Sample*			**Compression Ratio (Cec):** 0.21
Description: *FAT CLAY WITH SAND (CH) - gray*			
LL: *59*	**PI:** *37*	**Gs:** *2.70*	**P_o' (tsf):** *0.00*
% < No. 200: *79.3*		**Test Method:** *ASTM D2435 Method A*	
Test Condition: *Inundated @ 0.05 tsf*			

	Initial	Final
Water Content, %	*49.2*	*27.2*
Void Ratio	*1.36*	*0.71*
Saturation, %	*97*	*100*
Dry Unit Weight, pcf	*71.3*	*98.4*

Remarks:

Project: MTT, DTT & MLK Exp. Project

Average Water Content of Trimmings, %: *48.7*

Location *Norfolk, VA*

Boring:	*10BH-014*	**Schnabel No.:**	*10613051.00.21*
Depth:	*30-32 ft.*	**Elevation:**	*-26.2 to -28.2 ft.*
Date:	*1/0/1900*	**Reviewed by:**	*0*

Schnabel ENGINEERING

Consolidation Test Report

Consolidation Test Data Sheet

Consolidometer ID: 4 1/0/00

Schnabel Contract: 10613051.00.21

Test Method: *ASTM D2435 Method A*

Project: *MTT, DTT & MLK Exp. Project*

Test Condition: *Inundated @ 0.05 tsf*

Initial Height of Specimen (H_o), in.: 0.7543

Boring No.: *10BH-014*

Height of Solids (H_s), in.: 0.3191

Depth: *30-32 ft.*

Seating Press. (tsf): 0.05

Initial Dial Gauge Reading (D_o), in.: 0.0008

Reviewed by: 0

Pressure, P (tsf)	TimeReadings Required	Date Load Applied	Time Load Applied	Load Applied By	A: Final[1] Dial Reading, D_{fi} x 10^{-4} in.	B: Apparatus Correction[2], D_{ci} x 10^{-4} in.	C: Cumulative Change in Height[3], DH_i in.	D: Height of Voids[4], H_{vi} in.	Vertical Strain[5], e_i (%)	Void Ratio[6], e_i
0.25		9/25/2010	9:15	CJS	105	8	0.0089	0.4255	1.18	1.333
0.5		9/27/2010	9:15	DWC	225	19	0.0198	0.4146	2.63	1.299
1		9/28/2010	9:15	DWC	434	28	0.0398	0.3946	5.28	1.237
2		9/29/2010	9:15	DWC	899	35	0.0856	0.3488	11.35	1.093
1		9/30/2010	9:15	DWC	866	28	0.0830	0.3514	11.00	1.101
0.5		10/1/2010	9:15	DWC	831	19	0.0804	0.3540	10.66	1.109
1		10/2/2010	9:15	DWC	843	28	0.0807	0.3537	10.70	1.108
2		10/4/2010	9:15	DWC	943	35	0.0900	0.3444	11.93	1.079
4		10/5/2010	9:15	DWC	1394	41	0.1345	0.2999	17.83	0.940
8		10/6/2010	9:15	DWC	1862	49	0.1805	0.2539	23.93	0.796
16		10/7/2010	9:15	DWC	2275	60	0.2207	0.2137	29.26	0.670
8		10/8/2010	9:15	DWC	2245	49	0.2188	0.2156	29.01	0.676
4		10/9/2010	9:15	CJS	2195	41	0.2146	0.2198	28.45	0.689
2		10/11/2010	9:15	TTM	2126	35	0.2083	0.2261	27.62	0.709

Notes:
1. "Final" based on test method; 24 hrs for Method A, end of primary for Method B.
2. Correction value, for the current pressure, from the consolidometer's calibration curve.
3. $\Delta H = D_{fi} - D_o - D_{ci}$ = Col. A - D_o - Col. B
4. $H_{vi} = (H_o - H_s - D_0) - \Delta H$
5. $\varepsilon_i = (\Delta H / H_o) \times 100$ = (Col. C / H_o) x 100
6. $e_i = H_{vi} / Hs$ = Col. D / Hs

Consol 5/2007 Rev. 4

Schnabel ENGINEERING

Load Time Readings

1/0/00

Project: MTT, DTT & MLK Exp. Project

Schnabel Contract: 10613051.00.21

Boring No.: 10BH-014 Depth: 30-32 ft.

Consol. ID: 4 Reviewed by: 0

Test Drainage Conditions: Double

Elapsed Time (min.)	Dial Gauge Readings (inches)					
	2 tsf Reload 10/4/2010	4 tsf Load 10/5/2010				
0.1	0.0856	0.0968				
0.25	0.0861	0.0982				
0.5	0.0866	0.0996				
1	0.0872	0.1016				
2	0.0880	0.1046				
4	0.0888	0.1086				
8	0.0895	0.1135				
15	0.0901	0.1187				
30	0.0906	0.1239				
60	0.0911	0.1280				
120	0.0917	0.1312				
240	0.0924	0.1339				
480	0.0932	0.1364				
720	0.0935	0.1376				
960	0.0938	0.1384				
1200	0.0940	0.1390				
1440	0.0943	0.1394				
1680						
1920						
2160						
2400						
2640						
2880						

Schnabel ENGINEERING

Consolidation Time Curves

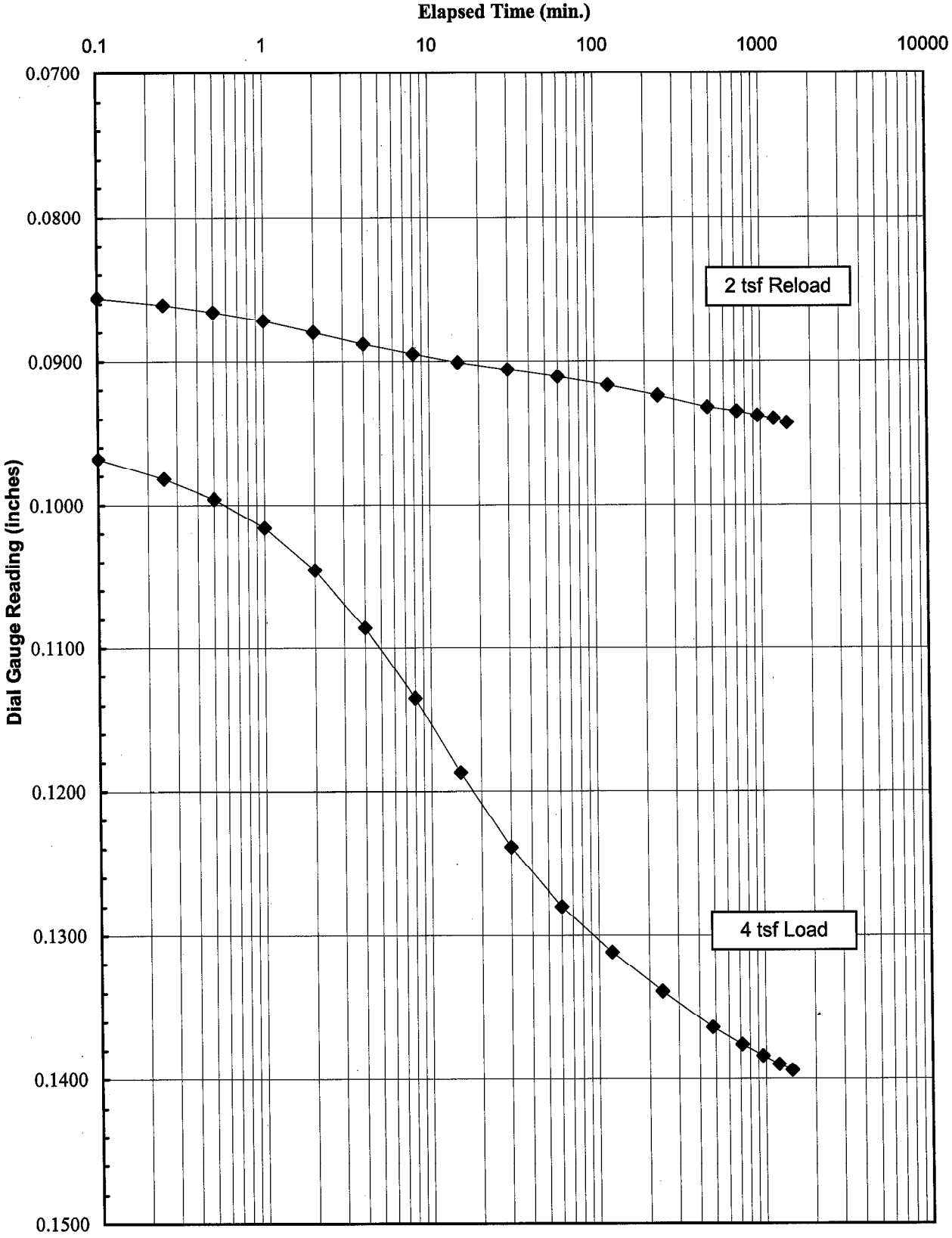
1/0/00

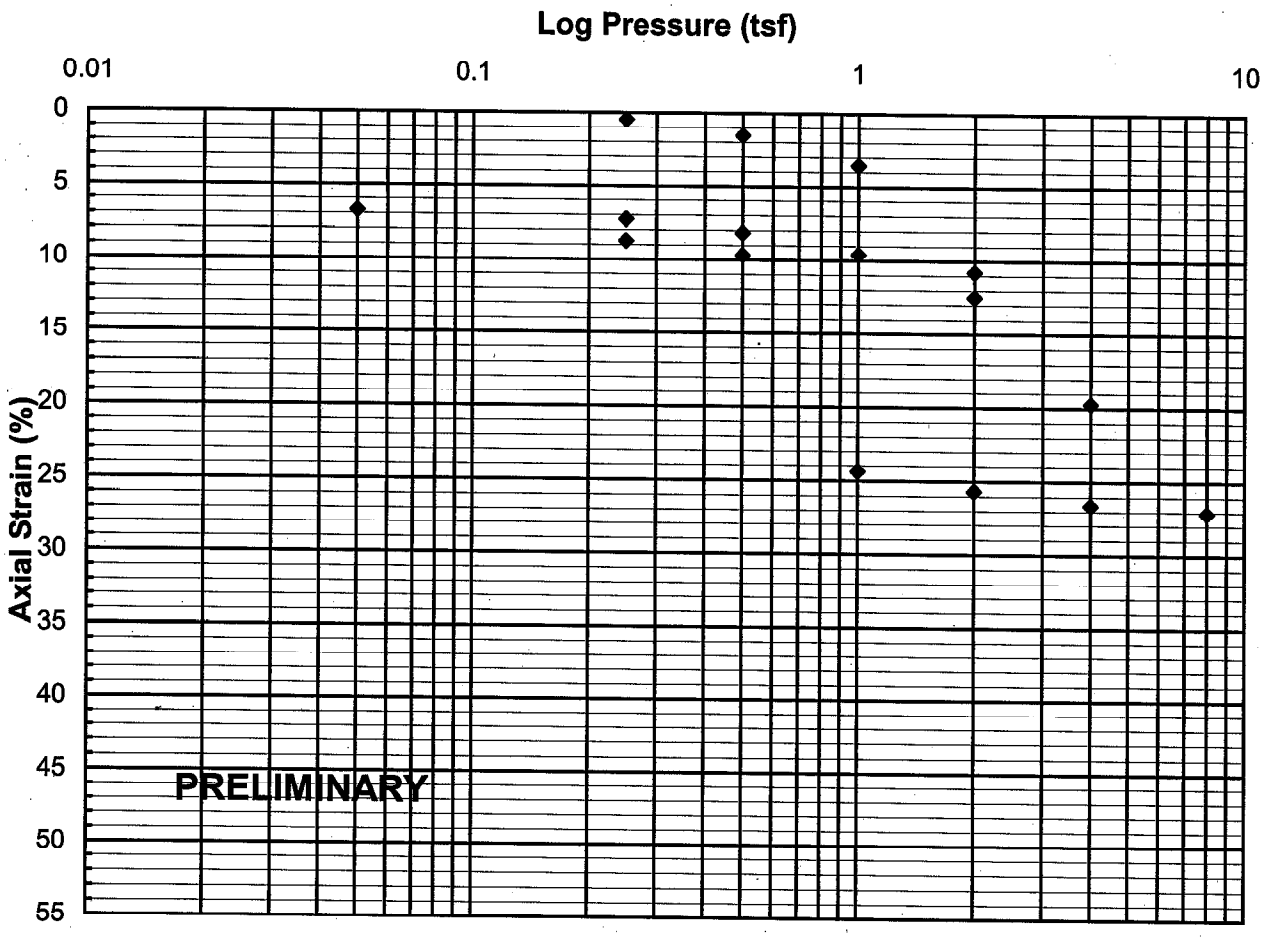
Project: MTT, DTT & MLK Exp. Project

Schnabel Contract: 10613051.00.21

Boring No.: 10BH-014 Depth: 30-32 ft.

Reviewed by: 0 Test Drainage Conditions: Double





Evaluation of Pp', Cer, and Cec relies on the design professional's engineering judgement and project details.

Probable Preconsolidation Pressure (Pp), tsf: 2.3				**Recompression Ratio (Cer):** 0.03	
Type of Specimen: *Tube Sample*				**Compression Ratio (Cec):** 0.27	
Description: *SANDY ORGANIC CLAY (OH) - gray*					**Initial** / **Final**
LL: *69*	**PI:** *45*	**Gs:** *2.66*	**P_o' (tsf):** *0.00*	**Water Content, %**	*60.7* / *39.5*
% < No. 200: *66.6*		**Test Method:** *ASTM D2435 Method A*		**Void Ratio**	*1.62* / *0.98*
Test Condition: *Inundated @ 0.05 tsf*				**Saturation, %**	*100* / *100*
				Dry Unit Weight, pcf	*63.3* / *83.7*
Remarks: *Organic content = 2.7%; Oven Dried LL = 39.*				**Project:** MTT, DTT & MLK Exp. Project	
Average Water Content of Trimmings, %: *58.8*				**Location** *Norfolk, VA*	
Schnabel ENGINEERING				**Boring:** *10BH-014*	**Schnabel No.:** *10613051.00.21*
				Depth: *35-37 ft.*	**Elevation:** *-31.2 to -33.2 ft.*
				Date: *1/0/1900*	**Reviewed by:** *0*
				Consolidation Test Report	

Consolidation Test Data Sheet

Consolidometer ID: *3* 1/0/00

Schnabel Contract: *10613051.00.21*

Test Method: *ASTM D2435 Method A*

Project: *MTT, DTT & MLK Exp. Project*

Test Condition: *Inundated @ 0.05 tsf*

Initial Height of Specimen (H_o), in.: 0.7459

Height of Solids (H_s), in.: 0.2847

Boring No.: *10BH-014*

Depth: *35-37 ft.*

Seating Press. (tsf): 0.05

Initial Dial Gauge Reading (D_o), in.: 0.0000

Reviewed by: 0

Pressure, P (tsf)	TimeReadings Required	Date Load Applied	Time Load Applied	Load Applied By	A: Final[1] Dial Reading, D_{fi} x 10^{-4} in.	B: Apparatus Correction[2], D_{ci} x 10^{-4} in.	C: Cumulative Change in Height[3], DH_i in.	D: Height of Voids[4], H_{vi} in.	Vertical Strain[5], e_i (%)	Void Ratio[6], e_i
0.25		9/22/2010	9:10	DWC	51	15	0.0036	0.4575	0.48	1.607
0.5		9/23/2010	9:10	DWC	137	22	0.0115	0.4496	1.54	1.579
1		9/24/2010	9:10	DWC	293	28	0.0265	0.4346	3.55	1.526
2		9/25/2010	9:10	CJS	838	34	0.0804	0.3807	10.78	1.337
0.5		9/27/2010	9:10	DWC	744	22	0.0722	0.3889	9.68	1.366
0.25		9/28/2010	9:10	DWC	666	15	0.0651	0.3960	8.73	1.391
0.05		9/29/2010	9:10	DWC	511	5	0.0506	0.4105	6.78	1.442
0.25		9/30/2010	9:10	DWC	559	15	0.0544	0.4067	7.29	1.428
0.5		10/1/2010	9:10	DWC	631	22	0.0609	0.4002	8.17	1.406
1		10/2/2010	9:10	DWC	743	28	0.0715	0.3896	9.59	1.368
2		10/4/2010	9:10	DWC	965	34	0.0931	0.3680	12.48	1.292
4		10/5/2010	9:10	DWC	1511	39	0.1472	0.3139	19.74	1.102
8		10/6/2010	9:10	DWC	2069	46	0.2023	0.2588	27.12	0.909
4		10/7/2010	9:10	DWC	2024	39	0.1985	0.2626	26.61	0.922
2		10/8/2010	9:10	DWC	1949	34	0.1915	0.2696	25.68	0.947
1		10/9/2010	9:10	CJS	1845	28	0.1817	0.2794	24.36	0.981

Notes:
1. "Final" based on test method; 24 hrs for Method A, end of primary for Method B.
2. Correction value, for the current pressure, from the consolidometer's calibration curve.
3. $\Delta H = D_{fi} - D_o - D_{ci}$ = Col. A - D_o - Col. B
4. $H_{vi} = (H_o - H_s - D_o) - \Delta H$
5. $\varepsilon_i = (\Delta H / H_o) \times 100$ = (Col. C / H_o) x 100
6. $e_i = H_{vi} / Hs$ = Col. D / Hs

Schnabel ENGINEERING

Load Time Readings

1/0/00

Project: MTT, DTT & MLK Exp. Project

Schnabel Contract: 10613051.00.21

Boring No.: 10BH-014 Depth: 35-37 ft.

Consol. ID: 3 Reviewed by: 0

Test Drainage Conditions: Double

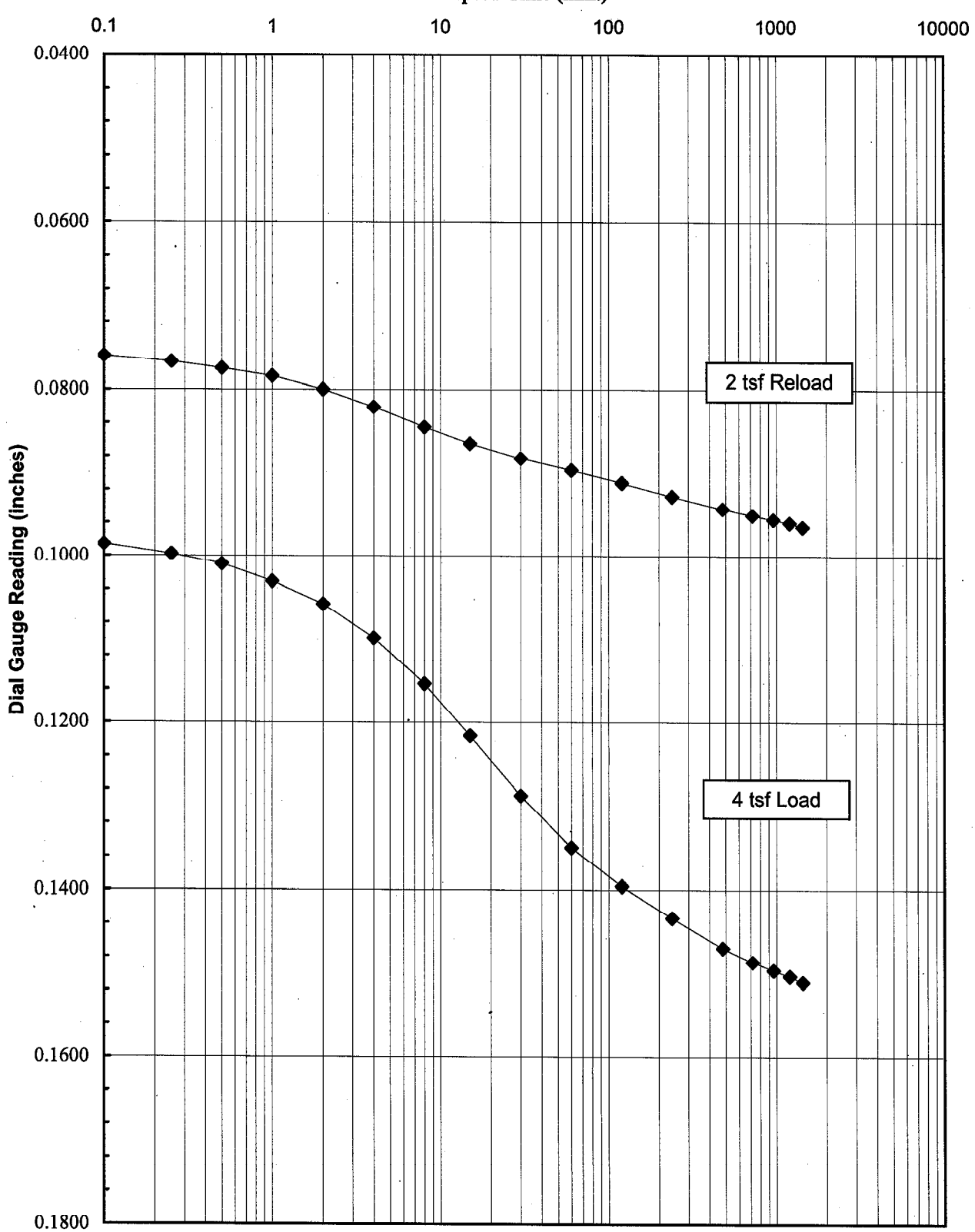
Elapsed Time (min.)	Dial Gauge Readings (inches)					
	2 tsf Reload 10/4/2010	4 tsf Load 10/5/2010				
0.1	0.0760	0.0986				
0.25	0.0767	0.0998				
0.5	0.0775	0.1010				
1	0.0784	0.1031				
2	0.0800	0.1058				
4	0.0821	0.1099				
8	0.0845	0.1154				
15	0.0865	0.1216				
30	0.0883	0.1288				
60	0.0897	0.1350				
120	0.0912	0.1396				
240	0.0928	0.1434				
480	0.0943	0.1470				
720	0.0951	0.1487				
960	0.0956	0.1497				
1200	0.0960	0.1504				
1440	0.0965	0.1511				
1680						
1920						
2160						
2400						
2640						
2880						

Schnabel ENGINEERING

Consolidation Time Curves

1/0/00

Project: MTT, DTT & MLK Exp. Project
Schnabel Contract: 10613051.00.21
Boring No.: 10BH-014 Depth: 35-37 ft.
Reviewed by: 0 Test Drainage Conditions: Double



Schnabel ENGINEERING

Unconsolidated Undrained Triaxial Compression Test

ASTM D2850

Project: *MTT, DTT & MLK Exp. Project*

Location: *Norfolk, VA*

Schnabel Contract: *10613051.00.21* Date: *1/0/1900*

Boring No.: *10BH-014*

Depth: *35-37 ft.* Reviewed by: *0*

Elevation: *-31.2 to -33.2 ft,*

Confining Stress (psi): *15.3*

Specimen Conditions	
Diameter (in)	2.840
Height (in)	5.813
Area (in^2)	6.34
Moisture (%):	59.7
Weight (lbs)	2.15
ρ_{wet} (pcf)	101.0
ρ_{dry} (pcf)	63.2
Void Ratio	1.62
Saturation, %	98

Shear Testing Conditions	
Cell Pressure (psi):	15.3
Rate of Strain (%/min):	1.0

Specimen Type: *Tube Sample*

Axial Strain at Failure (%): *5.88*

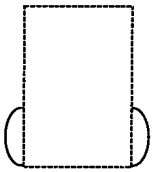
Compressive Strength (psi): *7.9*

Major Principal Stress (psi): *23.2*

Minor Principal Stress (psi): *15.3*

Soil Description: *SANDY ORGANIC CLAY (OH) - gray*

Failure Sketch



Liquid Limit: *69*

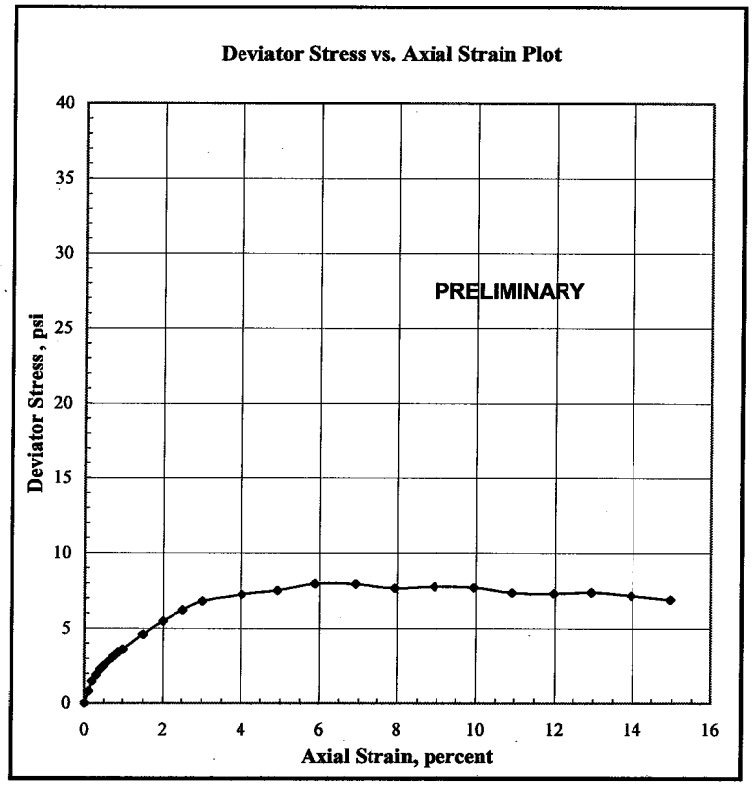
Plasticity Index: *45*

% finer that No. 200: *66.6*

Specific Gravity: *2.66*

Remarks: *Organic Content = 2.7%; Oven Dried LL = 39.*

Reading No.	Deviator Load (lbs)	Corrected Dev. Load[1] (lbs.)	Axial Displacement (in.)	Axial Strain (%)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	Deviator Stress (psi)
Initial	0.0	0.0	0.000	0.00	6.34	15.3	15.3	0.0
1	5.1	5.1	0.006	0.10	6.34	16.1	15.3	0.8
2	9.5	9.5	0.011	0.19	6.35	16.8	15.3	1.5
3	12.1	12.0	0.017	0.29	6.36	17.2	15.3	1.9
4	14.5	14.4	0.023	0.40	6.36	17.6	15.3	2.3
5	16.3	16.2	0.029	0.50	6.37	17.8	15.3	2.5
6	17.9	17.8	0.035	0.60	6.38	18.1	15.3	2.8
7	19.4	19.2	0.041	0.71	6.38	18.3	15.3	3.0
8	20.7	20.5	0.046	0.79	6.39	18.5	15.3	3.2
9	22.1	21.9	0.052	0.89	6.40	18.7	15.3	3.4
10	23.3	23.1	0.059	1.00	6.40	18.9	15.3	3.6
11	29.9	29.6	0.087	1.50	6.43	19.9	15.3	4.6
12	35.9	35.5	0.116	2.00	6.47	20.8	15.3	5.5
13	40.9	40.4	0.146	2.51	6.50	21.5	15.3	6.2
14	45.0	44.4	0.175	3.01	6.54	22.1	15.3	6.8
15	48.7	47.8	0.233	4.01	6.60	22.5	15.3	7.2
16	51.2	50.1	0.286	4.92	6.67	22.8	15.3	7.5
17	54.8	53.5	0.342	5.88	6.73	23.2	15.3	7.9
18	55.5	54.0	0.402	6.92	6.81	23.2	15.3	7.9
19	54.5	52.8	0.461	7.93	6.88	23.0	15.3	7.7
20	55.9	54.0	0.519	8.93	6.96	23.1	15.3	7.8
21	56.3	54.2	0.578	9.94	7.04	23.0	15.3	7.7
22	54.8	52.5	0.636	10.94	7.12	22.7	15.3	7.4
23	55.1	52.5	0.696	11.97	7.20	22.6	15.3	7.3
24	56.6	53.8	0.753	12.95	7.28	22.7	15.3	7.4
25	55.9	52.9	0.812	13.97	7.37	22.5	15.3	7.2
26	54.6	51.4	0.869	14.95	7.45	22.2	15.3	6.9



Notes: 1. Deviator load corrected for membrane effects.

2. Right Cylinder Correction Method

Schnabel ENGINEERING

Unconfined Compression Test Report

ASTM D2166

Project: *MTT, DTT & MLK Exp. Project*

Schnabel No.: *10613051.00.21*
Boring No.: *10BH-014*
Depth: *35-37 ft.*
Elevation: *-31.2 to -33.2 ft.*

Date: *1/0/1900*

Location: *Norfolk, VA*

Test Specimen Data	
Initial Diameter, in:	*2.847*
Initial Area, in^2:	*6.369*
Initial Height, in:	*5.803*
H/D Ratio:	*2.0*
Moisture Content, %:	*54.8*
Wet Unit Weight, pcf:	*104.8*
Dry Unit Weight, pcf:	*67.7*

Testing Information	
Test Procedure:	*ASTM D2166*
Type of Specimen:	*Tube Sample*
Load Cell No.:	*1018253*
Strain Rate, %/min.:	*1.0*

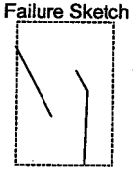
Remarks: *Organic content = 2.7%; Oven Dried LL = 39.*

Specimen Type: *Tube Sample*

Strength Data	
Strain at Failure, %:	*5.9*
Unconfined Strength (Qu), tsf:	*0.60*
Shear Strength (Su), tsf:	*0.30*

Reviewed by: *0*

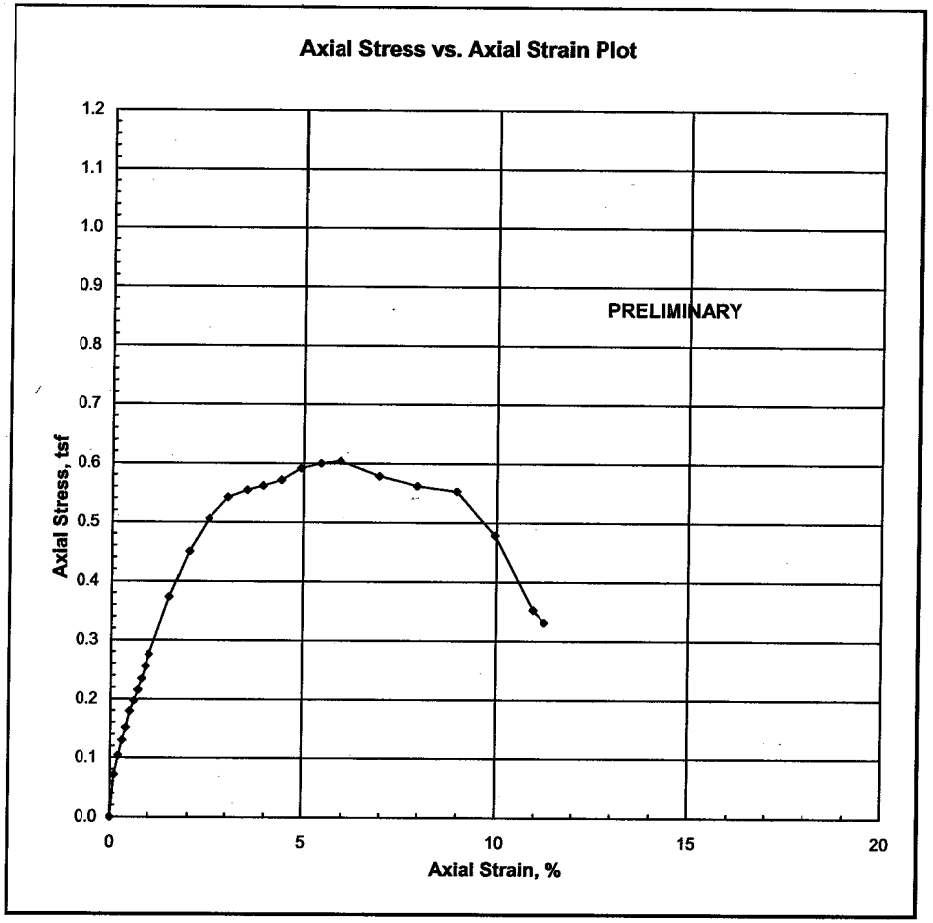
Failure Sketch



Soil Desc.: *SANDY ORGANIC CLAY (OH) - gray*

LL, %:	*69*	% < 200:	*66.6*
PI, %:	*45*	Gs:	*2.66*

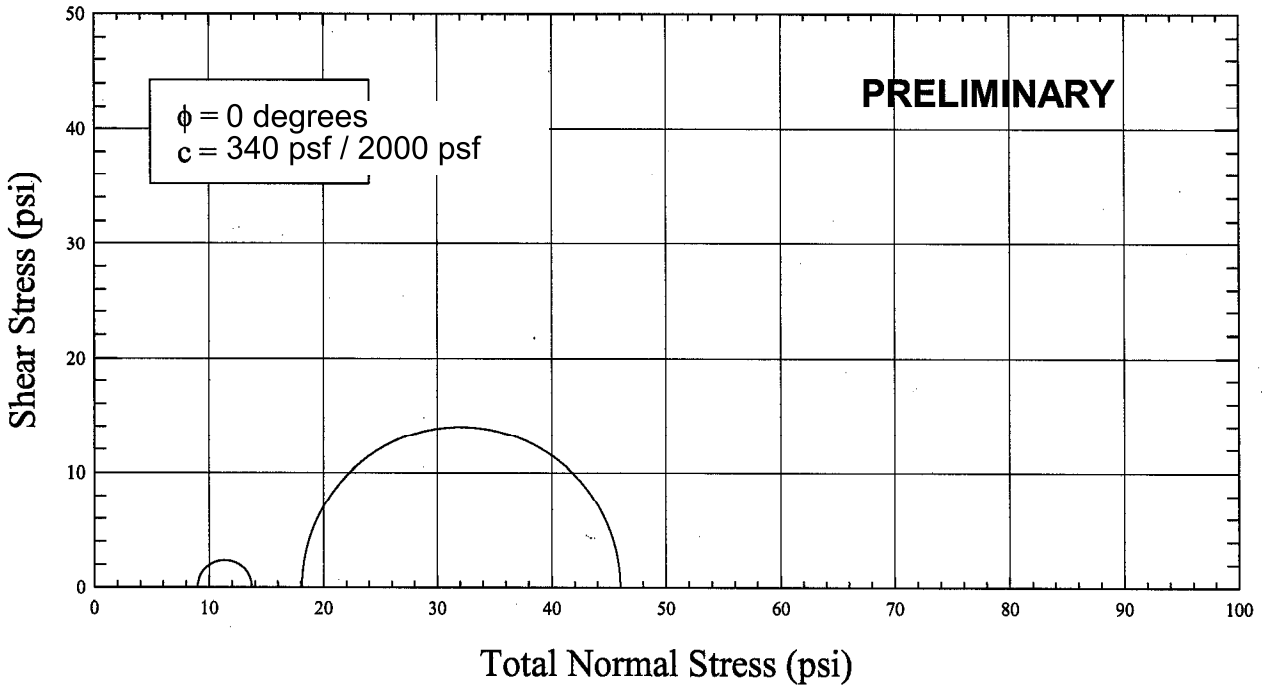
Test Data						
Reading No.	Axial Load (lbs)	Axial Displ. (in.)	Axial Strain (%)	Corrected Area[1] (in^2)	Axial Stress (psi)	Axial Stress (tsf)
Zero	0.0	0.000	0.0	6.37	0.0	0.00
1	6.3	0.006	0.1	6.38	1.0	0.07
2	9.2	0.012	0.2	6.38	1.4	0.10
3	11.5	0.018	0.3	6.39	1.8	0.13
4	13.4	0.023	0.4	6.39	2.1	0.15
5	15.9	0.029	0.5	6.40	2.5	0.18
6	17.5	0.035	0.6	6.41	2.7	0.20
7	19.2	0.041	0.7	6.41	3.0	0.22
8	20.9	0.047	0.8	6.42	3.3	0.23
9	22.8	0.053	0.9	6.43	3.5	0.26
10	24.6	0.058	1.0	6.43	3.8	0.28
11	33.5	0.088	1.5	6.47	5.2	0.37
12	40.6	0.117	2.0	6.50	6.2	0.45
13	45.9	0.146	2.5	6.53	7.0	0.51
14	49.4	0.175	3.0	6.57	7.5	0.54
15	50.8	0.204	3.5	6.60	7.7	0.55
16	51.7	0.228	3.9	6.63	7.8	0.56
17	52.9	0.257	4.4	6.66	7.9	0.57
18	55.0	0.286	4.9	6.70	8.2	0.59
19	56.1	0.315	5.4	6.73	8.3	0.60
20	56.8	0.344	5.9	6.77	8.4	0.60
21	55.0	0.403	6.9	6.84	8.0	0.58
22	54.0	0.461	7.9	6.92	7.8	0.56
23	53.7	0.520	9.0	7.00	7.7	0.55
24	47.0	0.578	10.0	7.07	6.6	0.48
25	35.0	0.636	11.0	7.15	4.9	0.35
26	33.0	0.654	11.3	7.18	4.6	0.33



Notes: 1. Right Cylinder Area Correction Method

Unconsolidated Undrained (UU) Triaxial Shear (ASTM D2850)

Mohr Stress Circles at Maximum Deviator Stress Criterion



Boring No.: *10BH-015* Depth: *15-17 ft* Elevation: *-9.0 to -11.0 ft* SEC Contract: *10613051.00.21* Date:
Sample Description: *FAT CLAY (CH) - gray / POORLY GRADED SAND WITH CLAY (SP-SC) - gray* Reviewed By:
Specimen Type: *Tube Sample* Gs: *2.70 / 2.65 (both assumed)* LL: *79 / --* PI: *52 / --* %<200: *96.6 / 12.0*

Schnabel ENGINEERING

MTT, DTT & MLK Exp. Project
Norfolk, VA

Schnabel ENGINEERING

Unconsolidated Undrained Triaxial Compression Test

ASTM D2850

Project: *MTT, DTT & MLK Exp. Project*

Location: *Norfolk, VA*

Schnabel Contract: *10613051.00.21* Date: *1/0/1900*

Boring No.: *10BH-015*

Depth: *15-16 ft.* Reviewed by: *0*

Elevation: *-9.0 to -10.0 ft.*

Confining Stress (psi): *9.0*

Specimen Conditions	
Diameter (in)	2.801
Height (in)	5.773
Area (in^2)	6.17
Moisture (%):	68.1
Weight (lbs)	2.22
ρ_{wet} (pcf)	107.7
ρ_{dry} (pcf)	64.1
Void Ratio	1.63
Saturation, %	100

Shear Testing Conditions	
Cell Pressure (psi):	9.0
Rate of Strain (%/min):	1.0

Specimen Type: *Tube Sample*

Axial Strain at Failure (%): *5.98*

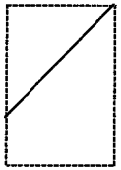
Compressive Strength (psi): *4.7*

Major Principal Stress (psi): *13.7*

Minor Principal Stress (psi): *9.0*

Soil Description: *FAT CLAY (CH) - gray*

Failure Sketch



Liquid Limit: *79*

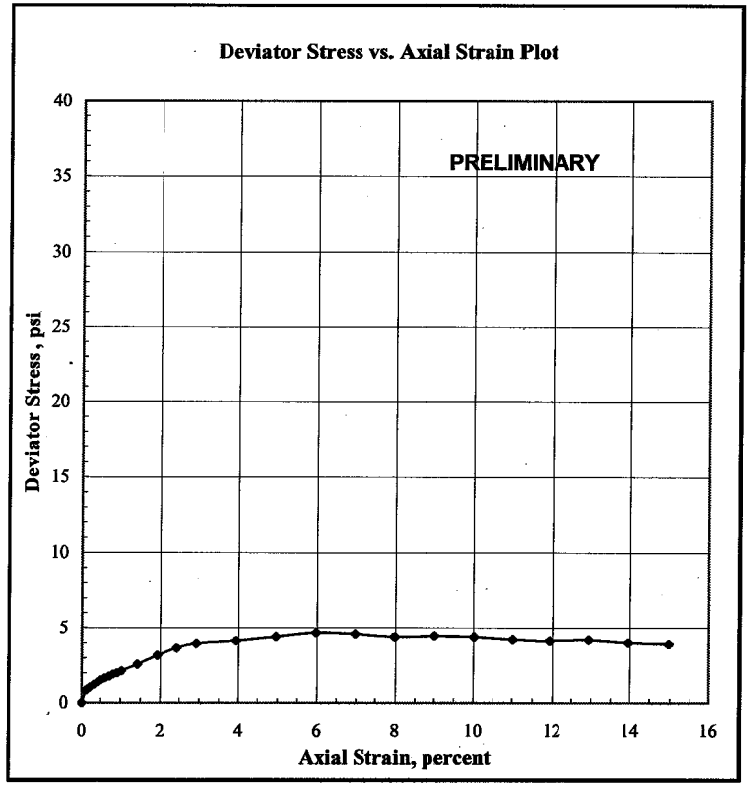
Plasticity Index: *52*

% finer that No. 200: *96.6*

Specific Gravity: *2.70*

Remarks: *Gs assumed.*

Reading No.	Deviator Load (lbs)	Corrected Dev. Load[1] (lbs.)	Axial Displacement (in.)	Axial Strain (%)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	Deviator Stress (psi)
Initial	0.0	0.0	0.000	0.00	6.17	9.0	9.0	0.0
1	5.3	5.3	0.006	0.10	6.17	9.9	9.0	0.9
2	6.5	6.5	0.012	0.21	6.18	10.0	9.0	1.0
3	7.7	7.6	0.018	0.31	6.18	10.2	9.0	1.2
4	8.8	8.7	0.024	0.42	6.19	10.4	9.0	1.4
5	9.6	9.5	0.029	0.50	6.20	10.5	9.0	1.5
6	10.5	10.4	0.035	0.61	6.20	10.7	9.0	1.7
7	11.2	11.0	0.041	0.71	6.21	10.8	9.0	1.8
8	12.1	11.9	0.047	0.81	6.22	10.9	9.0	1.9
9	12.7	12.5	0.053	0.92	6.22	11.0	9.0	2.0
10	13.5	13.3	0.059	1.02	6.23	11.1	9.0	2.1
11	16.5	16.2	0.082	1.42	6.25	11.6	9.0	2.6
12	20.4	20.0	0.111	1.92	6.29	12.2	9.0	3.2
13	23.6	23.1	0.140	2.42	6.32	12.7	9.0	3.7
14	25.8	25.2	0.169	2.93	6.35	13.0	9.0	4.0
15	27.4	26.6	0.228	3.95	6.42	13.1	9.0	4.1
16	29.8	28.8	0.286	4.95	6.49	13.4	9.0	4.4
17	31.9	30.6	0.345	5.98	6.56	13.7	9.0	4.7
18	31.9	30.4	0.403	6.98	6.63	13.6	9.0	4.6
19	31.2	29.5	0.461	7.99	6.70	13.4	9.0	4.4
20	32.2	30.3	0.520	9.01	6.78	13.5	9.0	4.5
21	32.3	30.2	0.578	10.01	6.85	13.4	9.0	4.4
22	31.6	29.3	0.636	11.02	6.93	13.2	9.0	4.2
23	31.6	29.1	0.689	11.93	7.00	13.2	9.0	4.2
24	32.5	29.8	0.747	12.94	7.08	13.2	9.0	4.2
25	31.7	28.8	0.806	13.96	7.17	13.0	9.0	4.0
26	31.7	28.5	0.864	14.97	7.25	12.9	9.0	3.9



Notes: 1. Deviator load corrected for membrane effects.

2. Right Cylinder Correction Method

Schnabel ENGINEERING

Unconsolidated Undrained Triaxial Compression Test

ASTM D2850

Project: *MTT, DTT & MLK Exp. Project*

Location: *Norfolk, VA*

Schnabel Contract: *10613051.00.21* Date: *1/0/1900*

Boring No.: *10BH-015*

Depth: *16-17 ft.* Reviewed by: *0*

Elevation: *-10.0 to -11.0 ft.*

Confining Stress (psi): *18.1*

Specimen Conditions	
Diameter (in)	2.878
Height (in)	5.812
Area (in^2)	6.51
Moisture (%):	27.9
Weight (lbs)	2.64
ρ_{wet} (pcf)	120.9
ρ_{dry} (pcf)	94.5
Void Ratio	0.75
Saturation, %	99

Shear Testing Conditions	
Cell Pressure (psi):	18.1
Rate of Strain (%/min):	1.0

Specimen Type: *Tube Sample*

Axial Strain at Failure (%): *14.99*

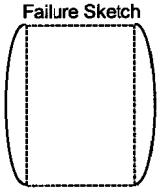
Compressive Strength (psi): *27.9*

Major Principal Stress (psi): *46.0*

Minor Principal Stress (psi): *18.1*

Soil Description: *POORLY GRADED SAND WITH CLAY (SP-SC), fine to medium - gray*

Failure Sketch



Liquid Limit: –

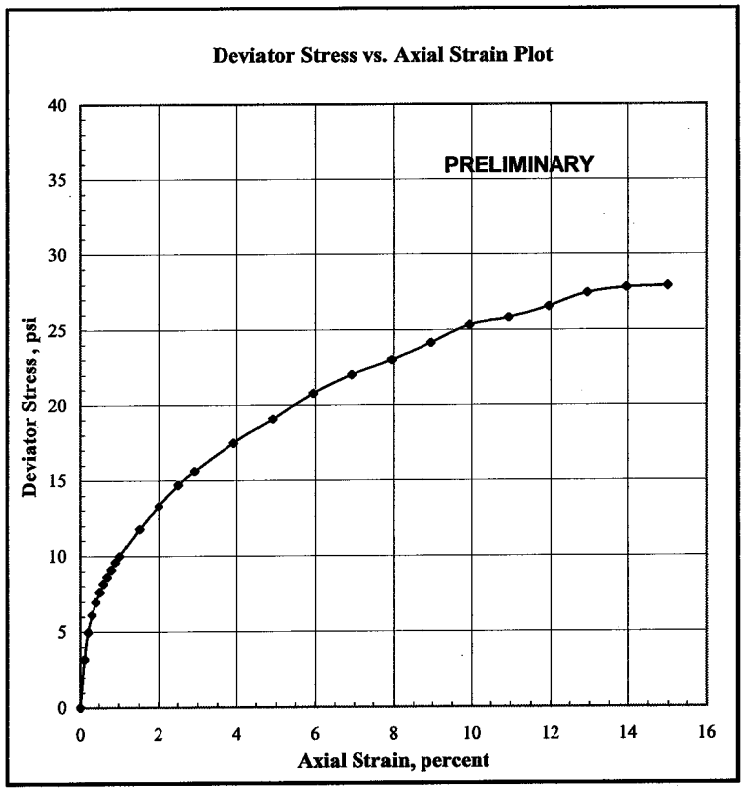
Plasticity Index: –

% finer that No. 200: *12.0*

Specific Gravity: *2.65*

Remarks: *Change in material from lower confining stress test specimen; Gs assumed.*

Reading No.	Deviator Load (lbs)	Corrected Dev. Load[1] (lbs.)	Axial Displacement (in.)	Axial Strain (%)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	Deviator Stress (psi)
Initial	0.0	0.0	0.000	0.00	6.51	18.1	18.1	0.0
1	20.8	20.8	0.006	0.10	6.51	21.3	18.1	3.2
2	32.5	32.5	0.012	0.21	6.52	23.1	18.1	5.0
3	40.0	39.9	0.018	0.31	6.53	24.2	18.1	6.1
4	45.6	45.5	0.024	0.41	6.53	25.1	18.1	7.0
5	49.9	49.8	0.030	0.52	6.54	25.7	18.1	7.6
6	53.5	53.4	0.035	0.60	6.55	26.3	18.1	8.2
7	56.6	56.4	0.041	0.71	6.55	26.7	18.1	8.6
8	59.7	59.5	0.047	0.81	6.56	27.2	18.1	9.1
9	63.0	62.8	0.053	0.91	6.57	27.7	18.1	9.6
10	65.7	65.5	0.059	1.02	6.57	28.1	18.1	10.0
11	78.0	77.7	0.088	1.51	6.61	29.9	18.1	11.8
12	88.5	88.1	0.117	2.01	6.64	31.4	18.1	13.3
13	98.6	98.1	0.146	2.51	6.67	32.8	18.1	14.7
14	105.2	104.6	0.170	2.92	6.70	33.7	18.1	15.6
15	119.2	118.3	0.228	3.92	6.77	35.6	18.1	17.5
16	131.5	130.4	0.286	4.92	6.84	37.2	18.1	19.1
17	144.9	143.6	0.346	5.95	6.92	38.9	18.1	20.8
18	155.4	153.9	0.403	6.93	6.99	40.1	18.1	22.0
19	164.2	162.5	0.462	7.95	7.07	41.1	18.1	23.0
20	174.4	172.5	0.521	8.96	7.15	42.2	18.1	24.1
21	185.0	182.8	0.578	9.94	7.22	43.4	18.1	25.3
22	190.9	188.5	0.637	10.96	7.31	43.9	18.1	25.8
23	198.7	196.1	0.695	11.96	7.39	44.6	18.1	26.5
24	208.0	205.2	0.753	12.95	7.47	45.6	18.1	27.5
25	213.3	210.3	0.812	13.97	7.56	45.9	18.1	27.8
26	216.8	213.5	0.871	14.99	7.65	46.0	18.1	27.9



Notes: 1. Deviator load corrected for membrane effects.

2. Right Cylinder Correction Method

Schnabel ENGINEERING

Unconfined Compression Test Report

ASTM D2166

Project: *MTT, DTT & MLK Exp. Project*

Date: *1/0/1900*

Location: *Norfolk, VA*

Schnabel No.: *10613051.00.21*
Boring No.: *10BH-015*
Depth: *15-16 ft.*
Elevation: *-9.0 to -10.0 ft.*

Test Specimen Data	
Initial Diameter, in:	2.806
Initial Area, in^2:	6.184
Initial Height, in:	5.798
H/D Ratio:	2.1
Moisture Content, %:	62.8
Wet Unit Weight, pcf:	98.3
Dry Unit Weight, pcf:	60.4

Testing Information	
Test Procedure:	ASTM D2166
Type of Specimen:	Tube Sample
Load Cell No.:	1018253
Strain Rate, %/min.:	1.0

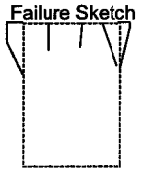
Remarks: *Gs assumed.*

Specimen Type: *Tube Sample*

Strength Data	
Strain at Failure, %:	5.9
Unconfined Strength (Qu), tsf:	0.25
Shear Strength (Su), tsf:	0.13

Reviewed by: *0*

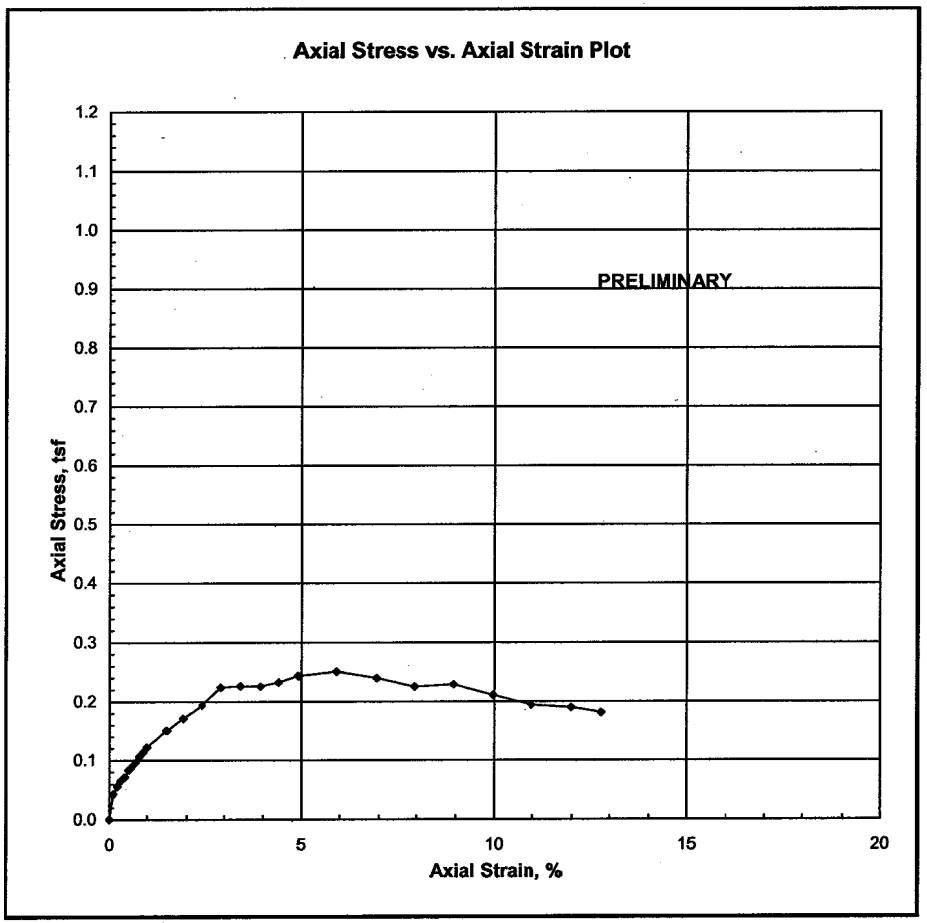
Failure Sketch



Soil Desc.: *FAT CLAY (CH) - gray*

LL, %:	79	% < 200:	96.6
PI, %:	52	Gs:	2.70

Test Data						
Reading No.	Axial Load (lbs)	Axial Displ. (in.)	Axial Strain (%)	Corrected Area[1] (in^2)	Axial Stress (psi)	Axial Stress (tsf)
Zero	0.0	0.000	0.0	6.18	0.0	0.00
1	3.7	0.006	0.1	6.19	0.6	0.04
2	4.8	0.012	0.2	6.20	0.8	0.06
3	5.6	0.017	0.3	6.20	0.9	0.07
4	6.2	0.023	0.4	6.21	1.0	0.07
5	7.2	0.029	0.5	6.22	1.2	0.08
6	7.8	0.035	0.6	6.22	1.3	0.09
7	8.4	0.041	0.7	6.23	1.3	0.10
8	9.2	0.047	0.8	6.23	1.5	0.11
9	9.8	0.052	0.9	6.24	1.6	0.11
10	10.6	0.058	1.0	6.25	1.7	0.12
11	13.1	0.087	1.5	6.28	2.1	0.15
12	15.0	0.111	1.9	6.30	2.4	0.17
13	17.0	0.140	2.4	6.34	2.7	0.19
14	19.8	0.169	2.9	6.37	3.1	0.22
15	20.1	0.198	3.4	6.40	3.1	0.23
16	20.2	0.228	3.9	6.44	3.1	0.23
17	20.9	0.257	4.4	6.47	3.2	0.23
18	22.0	0.286	4.9	6.51	3.4	0.24
19	22.9	0.344	5.9	6.57	3.5	0.25
20	22.1	0.403	7.0	6.65	3.3	0.24
21	21.0	0.461	8.0	6.72	3.1	0.23
22	21.6	0.519	9.0	6.79	3.2	0.23
23	20.1	0.578	10.0	6.87	2.9	0.21
24	18.7	0.636	11.0	6.95	2.7	0.19
25	18.5	0.695	12.0	7.03	2.6	0.19
26	17.8	0.741	12.8	7.09	2.5	0.18



Notes: 1. Right Cylinder Area Correction Method

1.1.5 Geotechnical Conditions - New Midtown Tunnel - Fugro Subsurface Data - Non-PB

FUGRO ATLANTIC

-VOLUME 1-
OVERVIEW REPORT
PROPOSED MIDTOWN SECOND PARALLEL TUNNEL

Prepared for:
VIRGINIA DEPARTMENT OF TRANSPORTATION

November 2008
Fugro Project No. 3602.001



FUGRO ATLANTIC

-VOLUME 1-

OVERVIEW REPORT
PROPOSED MIDTOWN SECOND PARALLEL TUNNEL

Prepared for:
VIRGINIA DEPARTMENT OF TRANSPORTATION

November 2008
Fugro Project No. 3602.001

FUGRO ATLANTIC

World Trade Center
101 West Main Street, Suite 350
Norfolk, Virginia 23510
Tel: (757) 625-3350
Fax: (757) 625-3352

November 17, 2008
Project No. 3602.001

Virginia Department of Transportation
1221 E. Broad Street
Richmond, Virginia 23219

Attention: Mr. Raymond Partridge, Project Manager, Innovative Project Delivery

Subject: Volume 1 - Overview Report, Proposed Midtown Second Parallel Tunnel

Dear Mr. Partridge:

Fugro Atlantic (Fugro) has completed an integrated marine site exploration program and the Virginia Department of Transportation (VDOT) has completed a land geotechnical site exploration program in support of VDOT's proposed Midtown Second Parallel Tunnel. The result is a series of volumes which detail the geotechnical, geophysical, and hydrographic exploration completed in support of the proposed tunnel. In general, either a data or site characterization report was prepared for each main task. The purpose of this report is to serve as an executive summary which will synopsize the work completed, the subsurface conditions explored, and the design and construction considerations identified.

It has been a pleasure working with you through this phase of the project. We look forward to the opportunity to provide continued support as the project progresses.

Sincerely,

FUGRO ATLANTIC

Matthew Q. Pollard
Project Engineer

Kevin R. Smith
Senior Engineering Geologist

Thomas W. McNeilan, P.E.
Vice President

COMMONWEALTH OF VIRGINIA
THOMAS WILLIAM MCNEILAN
Lic. No. 44952
PROFESSIONAL ENGINEER

Copies Submitted: (4) Addressee and PDF provided on CD

(1) Mr. John Daoulas, P.E., Senior Geotechnical Engineer for Special Projects, VDOT

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1.0 INTRODUCTION

1.1 SECOND PARALLEL TUNNEL PROJECT OVERVIEW

The proposed Midtown Second Parallel Tunnel is a main component of the Downtown Tunnel/Midtown Tunnel/MLK Extension Project, a major infrastructure improvement project aimed at providing increased capacity for east-west travel across the Elizabeth River. The Second Parallel Tunnel will extend between: 1) U.S. Route 58 and Interstate 264 in Portsmouth, and 2) Brambleton Avenue/Hampton Boulevard in Norfolk. The existing Midtown Tunnel first opened to traffic in 1962 and provides one lane of travel in each direction. The second tunnel will provide two westbound travel lanes, allowing the existing tunnel to accommodate two lanes of eastbound traffic. Additionally, the second tunnel will provide increased flexibility for redirecting traffic during maintenance operations and emergency situations.

Currently, significant traffic congestion occurs at the tunnel during both the morning and evening peak periods. Preliminary information provided by Virginia Department of Transportation (VDOT) indicates that the second tunnel will be located northwest (downstream) of, and parallel to, the existing tunnel, following a similar vertical alignment. The general project area extends from near the intersection of Brambleton Avenue and Route 58 in Norfolk to just past the Seaboard Avenue crossing of Route 58 in Portsmouth, a distance of approximately 1 mile. VDOT has defined the project area to extend 300 feet northwest (downstream) of the northern edge of the existing tunnel. The project vicinity is shown on Figure 1. Also shown on Figure 1 are the extents of the site characterization reports for the respective locales.

1.2 SCOPE OF WORK

The Midtown Second Parallel Tunnel marine exploration program involved the collection and integration of geotechnical, hydrographic (river bottom charting), and geophysical (seismic reflection) data within the project area. The marine exploration program was designed to conduct a series of complimentary, multidisciplinary investigations that acquired data which, when integrated, allow for characterization of the site's river bottom and sub-bottom conditions. Likewise, the land geotechnical site exploration program performed by VDOT was designed to conduct a series of explorations for characterization of the subsurface conditions near the Norfolk and Portsmouth approaches of the proposed second tunnel.

Fugro's services for the Midtown Second Parallel Tunnel were completed in general accordance with our proposal dated January 7, 2008. The execution of that scope of work was authorized by amendments of the contract between the VPA and the Craney Island Design Partners, LLC and the associated subcontract between the CIDP and Fugro Atlantic.

1.2.1 Reporting

There are seven volumes that comprise the geotechnical site characterization and data reporting for the various phases of site exploration, as shown on Figure 2. The site characterization reports (Volumes 2, 3, and 4) provide descriptions of the site, subsurface stratigraphy and conditions, and key geotechnical soil properties of the sediments following the

regional geologic description. The geotechnical data reports (Volumes 2, 3, and 5) provide descriptions of the methods used, factual data in the form of boring logs, CPT sounding logs, and in situ and laboratory test data. The bottom charting and seismic survey reports (Volumes 6 and 7, respectively) provide descriptions and findings of the various methods used. This report (Volume 1) provides a general overview of the sites conditions based on the information contained in the other six reports (volumes).

1.2.2 Field Exploration Program

Field exploration began with marine survey activities on February 14, 2008. The final work of the land site exploration was completed on September 17, 2008. The completed scope of exploration includes the following components:

Performed by Fugro

- River Bottom Charting Marine Survey - Activities included: 1) multibeam and single beam bathymetry, 2) side scan sonar, and 3) magnetometer data collection.
- Geophysical Marine Survey - Approximately 18 nautical miles of seismic reflection data collected.
- Marine Borings - Ten marine borings, advanced to depths ranging from 79 to 127 feet below the river bottom.
- Marine Cone Penetration Test (CPT) - 40 CPT soundings advanced 15 to 98 feet below the river bottom.
- Marine T-Bar and Vane Shear - Four T-Bar soundings and four vane shear profiles completed 10 to 40 feet below the river bottom.

Performed by NXL, Inc. under subcontract to Fugro

- Land Survey - Surveyed shore crossings of utilities and several features of the existing Midtown Tunnel structure.

Performed by VDOT

- Land Borings - Nine hollow stem auger borings advanced to depths ranging from 41 to 101 feet below the ground surface.
- Land CPT - Nine CPT soundings advanced to depths ranging from 9 to 113 feet below the ground surface.

Performed by Marshall Miller and Associates (performed under separate contract to VDOT)

- Environmental Sampling – Environmental sampling and testing were performed for planning future dredge/excavation material handling/disposal (MMA, 2008a and 2008b).
- Groundwater Monitoring Wells - Seven permanent groundwater monitoring wells constructed with screen depths extending to a maximum 65 feet below the ground surface (MMA, 2008b).

The locations of the explorations are shown on Figure 3 and Chart 1.

1.2.3 Review of Existing Data

A geotechnical study was conducted at the site in the late 1950s and 1960 in anticipation of the original tunnel construction. The study included borings on both the Norfolk and Portsmouth sides of the river, plus nine marine borings advanced to depths about 100 feet below the river bottom. Historical explorations are shown together with 2008 explorations on exploration location maps and cross sections in each of the site characterization reports. Boring logs were provided to Fugro from the late 1950s/1960 investigation; however, do not contain laboratory test data. Attempts to retrieve historical reports, which contain such information, by Fugro and VDOT, were unsuccessful.

We reviewed readily available engineering design drawings, maps, charts, and aerial photographs in an effort to understand the historical development of the site. Historical progression of shoreline development and navigation channel dredge depths at the project site is displayed on Chart 2. This chart shows the development of the Elizabeth River site as documented on four historical NOAA charts from years 1894, 1930, 1969, and 2008. These four charts illustrate key development and demolition events which impact the site, as discussed in the various site characterization reports - Volumes 2 through 4 (Fugro 2008d-f).

2.0 SUMMARY OF FINDINGS

2.1 SIGNIFICANCE OF GEOTECHNICAL ISSUES

Subsurface conditions vary across the site (i.e., across the river from Portsmouth to Norfolk), and are primarily formed in marine and fluvial-estuarine environments. The proposed Second Tunnel Project Area is located in an area underlain by extensive clay deposits. Many major design and construction decisions and costs for the proposed tunnel will be influenced by the subsurface conditions that underlie the project area.

2.2 AVAILABILITY AND APPLICABILITY OF DATA

Although data from past explorations at the site are limited, the new data provide high quality and comprehensive geotechnical, hydrographic, and geophysical survey data. Data were acquired during the 2008 site investigation program using state of the practice procedures and equipment as described in relevant volumes of this series of seven reports.

Our reports and figures present the 2008 explorations and available historical borings. During our data review and comparison of the older and newer explorations, we found both general similarities and apparent differences between the two data sets. Stratigraphic contacts and geologic features or trends between the two data sets are in fair agreement. For example, the top of the Yorktown Formation and incised channel features agree fairly well between the two data sets. Therefore, the newer data validate the use of the older data in defining stratigraphic contacts.

However, soil classifications of materials in respective stratigraphic units differ between the older and newer explorations. For example, several older borings classify materials in the

Yorktown Formation as clay or silt while soil classifications of the same unit in the newer explorations generally consist of silty to clayey sand. There are also differences between the classifications of the alluvium. Older borings generally classify the alluvial materials as silt while newer borings generally classify the material as clay or organic clay. Laboratory test data from the older borings were not available for us to review. Therefore, any explanation of the differences in soil classifications would be speculative.

A comparison engineering and in situ test data was limited to standard penetration test N-values. Uncorrected N-values from the older and newer borings are comparable for respective stratigraphic units. Other engineering data including laboratory and in situ (field vane) test data from the historical borings were not available for us to review. However, this series of reports (Fugro 2008a-g) provides results and procedural documentation for the comprehensive 2008 geotechnical testing program completed by VDOT and Fugro.

2.3 SUBSURFACE STRATIGRAPHY AND FEATURES

The subsurface stratigraphy within the proposed Midtown Second Parallel Tunnel project area is displayed on 5 subsurface cross-sections. Subsurface cross-sections displaying classification test results are presented on Chart 3. Longitudinal subsurface cross-sections are oriented in a SW-NE direction and drawn looking NW (downstream) through the proposed project area and existing tunnel alignment. Section A-A' is located outside of the proposed dredge cut, and C-C' is through the existing tunnel alignment. Three transverse subsurface cross sections (labeled according to their number in the respective site characterization reports) are oriented in a NW-SE direction and drawn looking NE (towards Norfolk) across the proposed project area. Figure 4 presents typical stratigraphic sections for the Portsmouth onshore, Elizabeth River, and Norfolk onshore project areas.

The interpreted principal strata, in descending sequence, include:

- Artificial Fill (af). In the Norfolk and Portsmouth onshore areas, artificial fill was primarily encountered in areas reclaimed from the Elizabeth River or tributary drainages. In the Elizabeth River, artificial fill was encountered primarily in two areas. Trench backfill material placed during the first tunnel construction was encountered in the area parallel to the existing tunnel. Explorations and seismic data in the shoal area located northwest of the existing tunnel and on the Norfolk side of the Navigation Channel encountered a thin, surficial layer of artificial fill material.
- Alluvium (Qal). Alluvium was encountered across the site. In the river, it typically consisted of fine-grained material. On land, the unit also consisted of a discernable, upper unit comprised of coarse-grained material.
- Sand Bridge Formation (Qsb). This unit is mapped as the surficial unit throughout most of Norfolk. However, within our study area, only a few of the historical borings encountered it on the north side of the former Tarrant Creek drainage and east of the small, south-trending drainage that formerly fed into Tarrant Creek. It generally classifies as a coarse-grained material with varying amounts of fines. We note that this unit is mapped in other literature as the Tabb Formation.
- Norfolk Formation (Qn). Norfolk Formation was encountered across the site. It typically consisted of fluvial-estaurine and brackish marine fine sand deposits with appreciable amounts of fines. We note that this unit is mapped in other literature as the Tabb Formation.
- Yorktown Formation Sand (Ty_s). Yorktown Formation Sand was encountered across most of the site. It was encountered at shallower depths on land than in the river and consisted of fine sand with appreciable fines content. The amount of fines generally increases with depth.
- Yorktown Formation Clay (Ty_c). Yorktown Formation Clay was encountered in the three deeper 2008 marine borings and three historical borings located within the navigation channel. It consisted of high-plasticity clay.

3.0 OBSERVATIONS AND IMPLICATIONS

3.1 GENERAL VARIATIONS ALONG AND ACROSS TUNNEL ALIGNMENT

Natural and anthropogenic processes have created subsurface conditions where the stratigraphy and layer thicknesses vary across the site. The conditions underlying the project alignment and their variability have important implications such as:

- The thickness of comparatively soft and compressible sediments is variable across the site. Fluvial processes have incised down into underlying granular sediments and created channel features. Thus, the stratigraphic contact between the alluvial and underlying granular sediments is irregular. Since, the alluvial deposits are often

composed of soft clay, the variability of the thickness of soft sediments has direct implications for foundation bearing, settlement, and stability of structures.

- The elevation of the top of Yorktown stratum is variable across the site. This is one of the determining factors relative to the choice of the most appropriate and cost-effective pile size and length for pile-supported tunnel structure options. Generally below the Elizabeth River, the top of the Yorktown is between El. -90 and -75 feet MLLW. Beneath the Portsmouth onshore area, the Yorktown surface is generally between El. -40 and -30 feet. Cross section A-A' illustrates this deeper-to-shallower transition (from the River to the Portsmouth area) between borings B-16 and B-15. Beneath the Norfolk flank of the river and onshore area, the Yorktown surface is generally between El. -50 and -35 feet. This deeper-to-shallower transition (from the River to the Norfolk area) is illustrated on cross section A-A' between explorations CPTs C-25 and C-27. Other localized variations in elevation of the Yorktown surface are present as well. Those variations in the elevation of the top of the Yorktown surface should be considered during design.
- The stability of dredge cuts for placement of the new tunnel will depend upon the slope of the cut and the shear strength of the sediments. Steeper cut slopes may reduce the volume of material to be disposed of and amount of backfill required, thus reducing costs associated with dredging, dredge material disposal, and acquiring backfill materials. The design of dredge cut dimensions should consider the shear strength and variable thickness of the soft clay and, if the cut is anticipated to intercept fill from the existing tunnel, the lower shear strength of the fill. Moreover, dredge cuts should be designed to avoid adversely affecting other nearby structures.
- Scour features are observed above the existing tunnel. Depressions are observed on the river bottom, within the navigation channel, above the tunnel, which suggests that backfill materials may erode over the lifetime of the project.

The subsurface materials and conditions vary perpendicular to the existing tunnel, due to the excavated cut for the existing tunnel. The comparison of the conditions encountered by the marine exploration with the design dredge cut for the existing tunnel are discussed in the Elizabeth River Site Characterization Report (Fugro 2008d).

Other important site considerations include:

- The location of construction remnants near the proposed alignment.
- The location of existing utilities.

3.2 SPECIFIC SITE AND SUBSURFACE FEATURES AND THEIR IMPLICATIONS

Projects involving excavation and construction of a tunnel are subject to risks associated with materials encountered and their behavior during construction and the project's lifetime. This section identifies several key features that should be considered during design and construction of the new tunnel. At this time, we do not know the location of the final alignment

and design for the new tunnel, therefore considerations for design and construction may not be limited to those identified in this list.

The locations of twelve specific subsurface key features and conditions identified during site exploration activities are shown on Figure 6. Two additional features not shown on the map is also listed below. These key features are generally numbered from SW (Portsmouth) to the NE (Norfolk). The following describes each feature identified on Figure 6 and discusses its implication.

Feature 1 is an area of historical settlement along the Portsmouth tunnel entrance approach roadway. Evidence of settlement is visible in pavement and the highway's retaining wall. Photographs are presented in Volume 3 – the Portsmouth Site Characterization Report. Based on review of the geotechnical data presented on the Portsmouth cross sections (see cross section C-C' on Chart 3 of this report) we note that the roadway and retaining wall intercept a soft clay unit (Qal_f). Therefore, one explanation is that the settlement is occurring because the roadway and retaining wall foundations are founded on or just above the soft, compressible clay unit. The 2008 explorations (e.g. CPT-40) also encountered shallow, soft compressible soils within the future alignment area. Design of the new tunnel, retaining walls, and roadways, where founded on or above the soft compressible soils will need to consider this in the design.

Feature 2 along the Portsmouth bank of the river in the project area was shaped by the development of Pinner Point. Remnants of the former Southern Railroad Pier No. 4 are observed to the north of the existing tunnel and may impact future construction activities. Side scan sonar images show a field of piles cut off. Many piles are cut off near the river bottom while some extend above the river bottom and can be seen at the water surface during low tide. We believe they are timber piles. The existing piles in this area were so numerous that it precluded subsurface exploration in this area.

Feature 3 is an abandoned heap of piles is observed above the existing tunnel alignment near the Portsmouth shoreline. Future site surveys and subsurface investigations should consider the presence of these (piles) and other obstructions. These obstructions may pose a navigation hazard to vessels in this area. Construction plans should also consider the presence of various debris on the river bed. Please refer to Bottom Charting Report and Site Characterization Reports for further discussion.

Feature 4 is an area where several piles cut off below the water surface are identified adjacent to the existing tunnel alignment near the Portsmouth shoreline. We note that there are other river bottom obstructions identified throughout the study. Future site surveys and subsurface investigations should consider the presence of these and other obstructions. Construction plans should also consider the presence of various debris on the river bed. Please refer to Bottom Charting Report and Site Characterization Reports for further discussion.

Feature 5 consists of several circular depressions in the river bottom above the existing Midtown Tunnel in the middle of the river. The features range in width from about 45 feet to about 150 feet wide and are up to 10 feet deep. The features appear to be within the footprint

of the dredge cut footprint and edges of the depressions coincide with the dredge cut footprint. Based on their shape and character, the features appear to be created by scouring. Scouring above the existing tunnel may result from differences in engineering properties, such as frictional characteristics, between the tunnel trench backfill material and surrounding native materials. New tunnel construction should consider the effect of localized scouring.

Feature 6 is a linear feature lying on the river bottom northwest of the Navigation Channel and piles are observed. The linear feature trends northeast-southwest, parallel to the existing tunnel. The location of this feature correlates well with the location of the City of Norfolk's 30-inch diameter water pipeline. The pipeline from the Norfolk shoreline to the point where piles were observed was surface laid. It was cut and covered across the navigation channel until daylighting again near the Portsmouth river bank. Design of the new tunnel project will have to consider the presence of the water pipeline and its related structures.

Feature 7 represents the location of a deeply incised paleochannel that is infilled with soft clay at least 75 feet thick. This channel indicates an area where the Norfolk and Yorktown Formations were incised by fluvial processes. The thalweg of this paleochannel is as low as El. -85 feet and the infill represents one of the thickest soft clay profiles encountered by the explorations. This feature is shown on Figures 5-3b and 5-3l in Volume 4 - Elizabeth River Site Characterization Report (Fugro 2008d). This feature should be considered during future exploration and design of the new tunnel in the area of the final tunnel alignment.

Feature 8 outlines an area that includes a shoal and shallow access channel. The shoal is present on charts that predate the existing tunnel but is capped with a few feet of silty sand to sandy silt inferred to be artificial fill. Seismic reflection data indicate the sandy material has a flat bottom. The access channel is about 10 feet deep and according to VDOT personnel, it was believed to have been dredged to allow barge access during construction of the original tunnel. The fill material that caps the shoal may be useful material for future construction and backfill. Our explorations within this material were limited to CPTs, therefore grain size properties of this material are unknown. The shallow access channel may provide adequate access for future geotechnical or geophysical investigations. Based on survey data, cut-slopes along this shoal in some areas are between 2h:1v and 3h:1v.

Feature 9 is the approximate location of the Hampton Roads Sanitation District's (HRSD) 48-inch-diamter forced sewer main pipeline. Prior to our investigation we notified MISS Utility of our intent to conduct subsurface explorations. Through this notification process, Fugro coordinated with utility companies that owned and operated utilities within our proposed work area to delineate their utility locations. HRSD representatives provided locating markings for the sewer pipeline that were surveyed during the land survey program. The pipeline is approximately 100 feet northwest of the water pipeline and was constructed using horizontal, directional drilling methods. It is approximately 25 feet below the river bottom. This utility may also impact the design and construction of the new tunnel.

Feature 10 is the approximate location of City of Norfolk's 30-inch-diameter water main pipeline. Utility locators delineated the shore crossings and a few hundred feet of the overland alignments. The utility markings were surveyed during the land survey program. Methods were

used to locate the pipelines in the river as well. Refer to Volume 4 - Elizabeth River Site Characterization Report, and Volume 6 - Bottom Charting Data Report (Fugro 2008b and 2008d) for more details. Design of the new tunnel project will have to consider the presence of the water pipeline and its related structures.

Feature 11 represents the approximate location of the dredge cut's footprint from construction of the existing tunnel. Design plans indicate materials of various type were to be used as backfill. Geotechnical explorations encountered primarily soft, fine-grained sediments with undrained shear strength lower than the underlying native materials. The transition from soft artificial fill materials into the underlying native materials is more readily observable in T-bar soundings than CPT soundings. T-bars have a larger surface area (approximately 10 times greater) than CPTs and therefore are more sensitive to penetration resistance. This makes the T-bar a more ideal tool for in situ measurements in soft soils and for observing the transition from fill to native soils than can typically be obtained using CPT soundings. If a dredge cut for the tunnel will intercept the existing dredge cut and fill from the existing tunnel, the undrained shear strength of the existing fill that is generally considerably weaker than the surrounding natural soils will need to be considered when designing the slope of the cut and maintaining the lateral stability of the existing tunnel.

Feature 12 corresponds to the area along the Norfolk shoreline where historic land reclamations have buried the natural condition associated with the former Tarrant Creek drainage. The mouth of this former drainage is approximately aligned with the location of the existing tunnel's Norfolk shore crossing. The new tunnel alignment will cross the shore north of the existing tunnel and may encounter different conditions than those faced during the first tunnel construction. Several 2008 explorations in Norfolk were terminated prior to encountering Yorktown Formation in this vicinity. Also, a north-south trending drainage (depicted as Feature 12 on Figure 6) was present in Norfolk. This feature is a north-south trending tributary that fed into Tarrant Creek (refer to 1894 NOAA Chart shown on Figure 2-3 and Chart 2 of the Volume 2 - Norfolk Characterization Report [Fugro 2008]). Historical boring S-11 is located within this tributary and did not encounter the upper coarse-grained unit (Qal_c) generally encountered elsewhere in the Norfolk onshore explorations. Instead, boring S-11 encountered artificial fill overlying soft fine-grained material. It is likely that the tributary eroded the upper alluvium unit (Qal_c) and the upper alluvium unit may not be present further northward in that drainage. Therefore, if future project components (e.g. roadway or retaining walls) plan to traverse that former drainage, future geotechnical exploration should be performed to investigate subsurface conditions to verify whether soft compressible soils exist that could affect shallow structures. .

Feature 13 (not shown on map) is the soft, compressible clay of the Alluvium encountered by nearly all explorations in the Portsmouth, Elizabeth River, and Norfolk areas of the project. This unit is displayed on cross sections (Figure 5 and Chart 3) as red. The design and construction of the new tunnel and related structures should consider this unit where encountered by or founded above the stratigraphic unit.

Feature(s) 14 (not shown on map) are potentially buried abandoned obstructions associated with structures of the former Pinners Point Wastewater Treatment Plant (PPWWTP) located in Portsmouth. The former PPWWTP location and facility are described in Marshall

Miller and Associates (MMA) Phase II Environmental Site Assessment Report (MMA, 2008b). Based on information provided by MMA, we display the area where the former sludge ponds and digestion tanks were located as a blue hachured area on the lower right map inset titled "2008 Chart" of Chart 2 in this report. We note that a drawing provided to Fugro by the Portsmouth Marine Terminal (included as Appendix D of the Elizabeth River Site Characterization Report [Fugro, 2008d]) show several utilities, including outfalls that may have been related to the former PPWWTP. It is unclear whether those outfalls have been abandoned in place. Several of the outfall locations conflict with the future tunnel alignment. Design and construction planning should take into consideration that buried obstructions may exist under Portsmouth segment of the future tunnel alignment. Further investigation may provide additional information about the location or presence of buried obstructions. Examples of various types of investigations are provided in the following list (but are not limited to this list). The feasibility of each investigation should be evaluated prior to conducting the investigation.

- Conduct additional research to locate as-built drawings for the PPWWTP and demolition documents
- Ground penetrating radar survey
- Seismic reflection survey
- Electromagnetic survey
- Use a CPT truck to push a probe (cone rods with a dummy head) to located obstructions. Investigation could be conducted along transects oriented perpendicular to suspected obstruction locations or conducted in a grid pattern.
- Drill soil borings
- Pot-holing with conventional equipment if obstructions are shallow enough.

4.0 LIMITATIONS

4.1 LOCATION OF EXISTING TUNNEL AND WATER PIPELINE

The depicted location (as shown on the Figures and Charts presented in the various volumes of the reports prepared by Fugro) of the tunnel and its centerline are not for usage in construction planning or design. Prior to our site investigation, we recognized that high quality as-built drawings or electronic files documenting the locations of the existing tunnel and water pipeline were not available. Therefore, we carried out a marine and land survey as described herein and other reports listed in Figure 2 to ground-truth historical drawings and assist us in defining a safe work area for the marine geotechnical boring and sounding exploration.

Limitations of precision and accuracy for respective methods used to infer and interpret the tunnel and pipeline locations are described where applicable. In general, methodologies using geophysical technology may not provide adequate precision and accuracy for the design and construction planning of the second parallel tunnel. An understanding of the capability and limitation of the geophysical technology employed is required to optimize the data they provide and reduce the chance of misusing their data. We note that additional surveys or investigations may be required to document the locations of the water pipeline and existing tunnel to support

design and construction planning. Several examples of options for additional ground truthing follow:

- Survey the inner diameter of the existing tunnel to aid in establishing survey-grade data of the centerline and tunnel location;
- Use a diver to jet probe and locate the water pipeline and tunnel;
- Additional, denser spacing of geophysical (subbottom and magnetometer) surveys; and/or
- Contact the City of Norfolk to inquire and obtain any as-built or construction and maintenance related surveys.

We note that during our initial inquiry to City of Norfolk staff through the MISS Utility notification process, the City of Norfolk representative we met indicated that they were not aware of survey data which documented as-built conditions of the pipeline. However, during our survey, a construction barge with divers appeared to be conducting work on the pipeline.

4.2 REPORT USE

This report has been prepared for the exclusive use of the Virginia Department of Transportation (VDOT) and its agents specifically for the proposed Downtown Tunnel/Midtown Tunnel/MLK Extension Project, located in Portsmouth and Norfolk, Virginia. The data, findings, and conclusions presented herein were prepared in accordance with generally accepted geotechnical engineering practices of the project region.

VDOT makes no warranties or representations as to this report or any surveys, data, reports or other information provided by VDOT or other persons, affecting the project Right of Way or surrounding locations. Such information is for reference only and has not been verified by VDOT, and the responsible party must conduct all surveys, studies and assessments as it deems appropriate for the actual design, estimating, scheduling, financing, construction, operations and maintenance of the project.

4.3 POTENTIAL VARIATIONS IN SUBSURFACE CONDITIONS

Earth materials can vary in type, strength, and other geotechnical properties between points of observation and exploration. Therefore, we do not and cannot have a complete knowledge of the subsurface conditions underlying the site. The geotechnical exploration logs included in this series of reports, depict subsurface soil and ground water conditions at the specific locations where the geotechnical explorations were performed. These conditions may vary at other locations beyond, or between, these specific locations. Accordingly, Fugro does not warrant or guarantee that the information provided on the logs, or in this report, can be projected as indicative of conditions beyond the limits of the geotechnical explorations, and any such projection is purely interpretive. Cross sections depict stratigraphic conditions that at locations between or beyond exploration locations are subject to confirmation (to the extent possible) based on the conditions revealed during construction. In addition, the ground water

levels recorded on the boring or monitoring well logs indicate the ground water conditions that existed at the time of the investigation. Ground water levels may vary considerably, with time, according to prevailing climate, rainfall, surface run-off, evaporation, construction, and other such factors.

The geotechnical exploration logs are made available to bidders in order that they may have access to subsurface data identical to that which is possessed by VDOT, and are not intended as a substitute for personal investigation, interpretation and judgment by others. Also, the information contained herein represents explorations that were performed by Fugro and VDOT and may not represent all of the exploration performed on the project, particularly if consultant designers performed work under self contained geotechnical/design contracts.

4.4 LOCAL PRACTICE

In performing our professional services we have used generally accepted geologic and geotechnical engineering principles and have applied that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers currently practicing in this or similar localities. No other warranty, express or implied, is made as to the professional advice included in this report.

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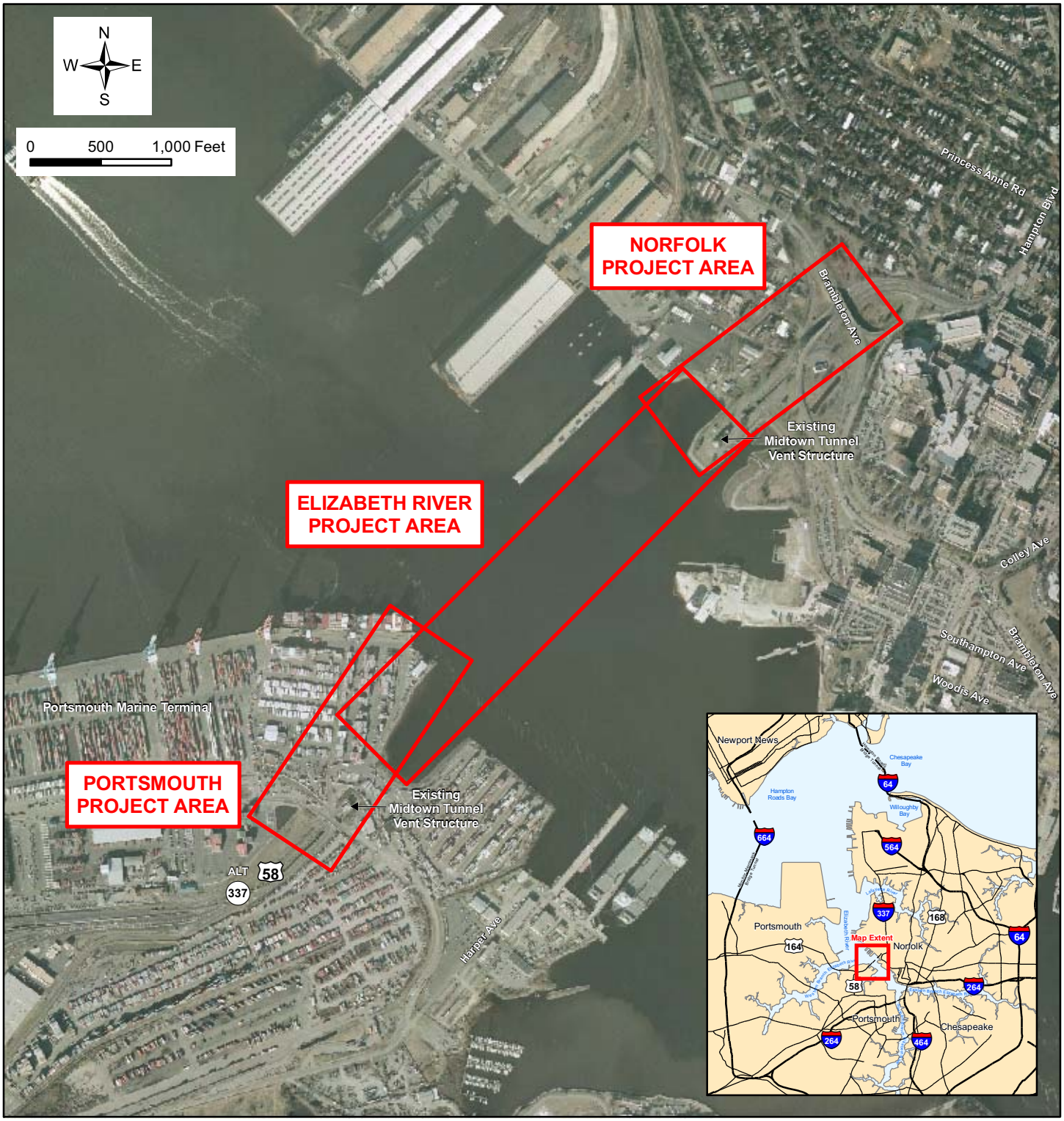

Aerial Photo Source: Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <<http://datagateway.nrcs.usda.gov/>>

OVERVIEW REPORT
PROJECT VICINITY MAP
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 1

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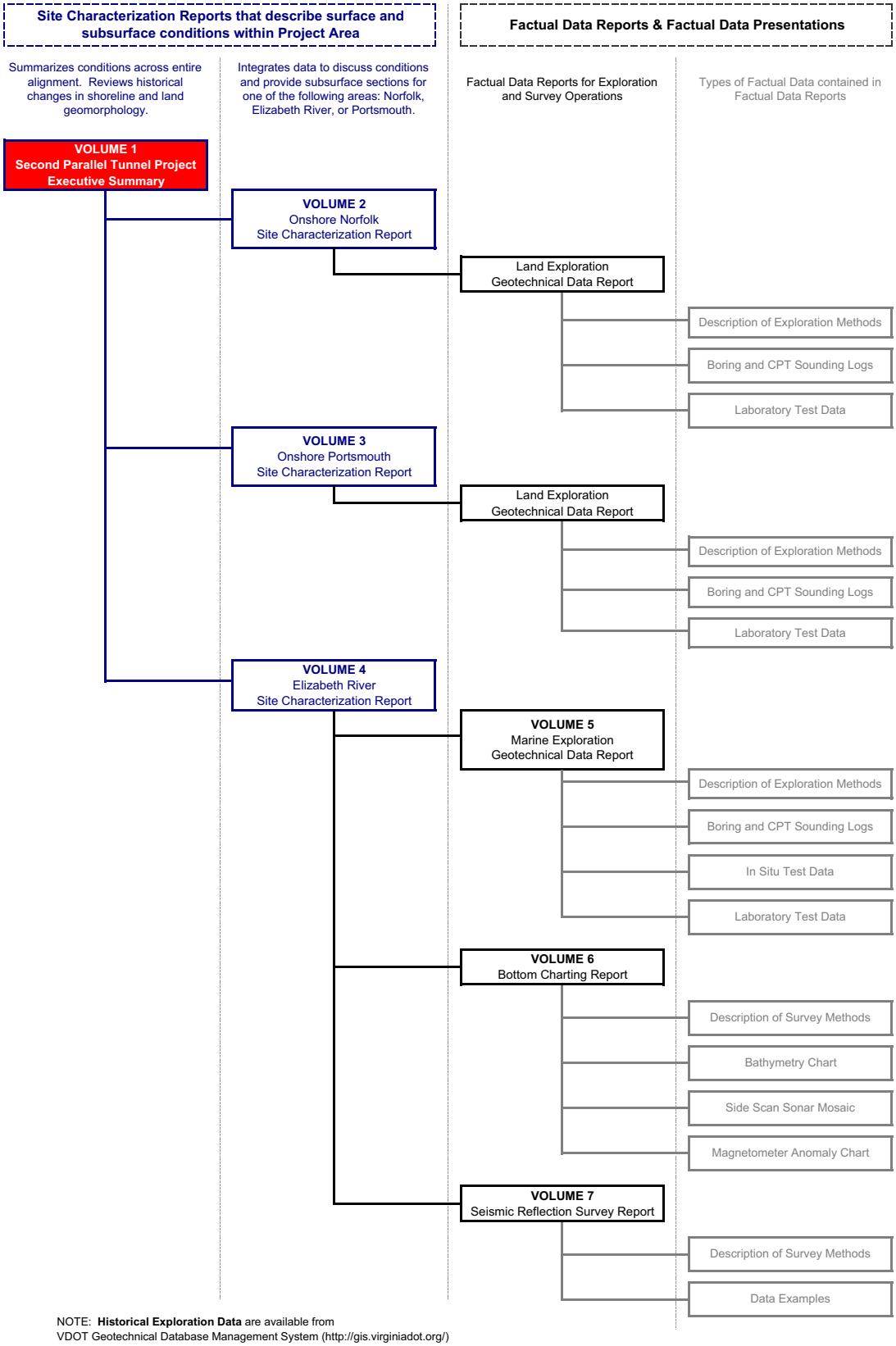


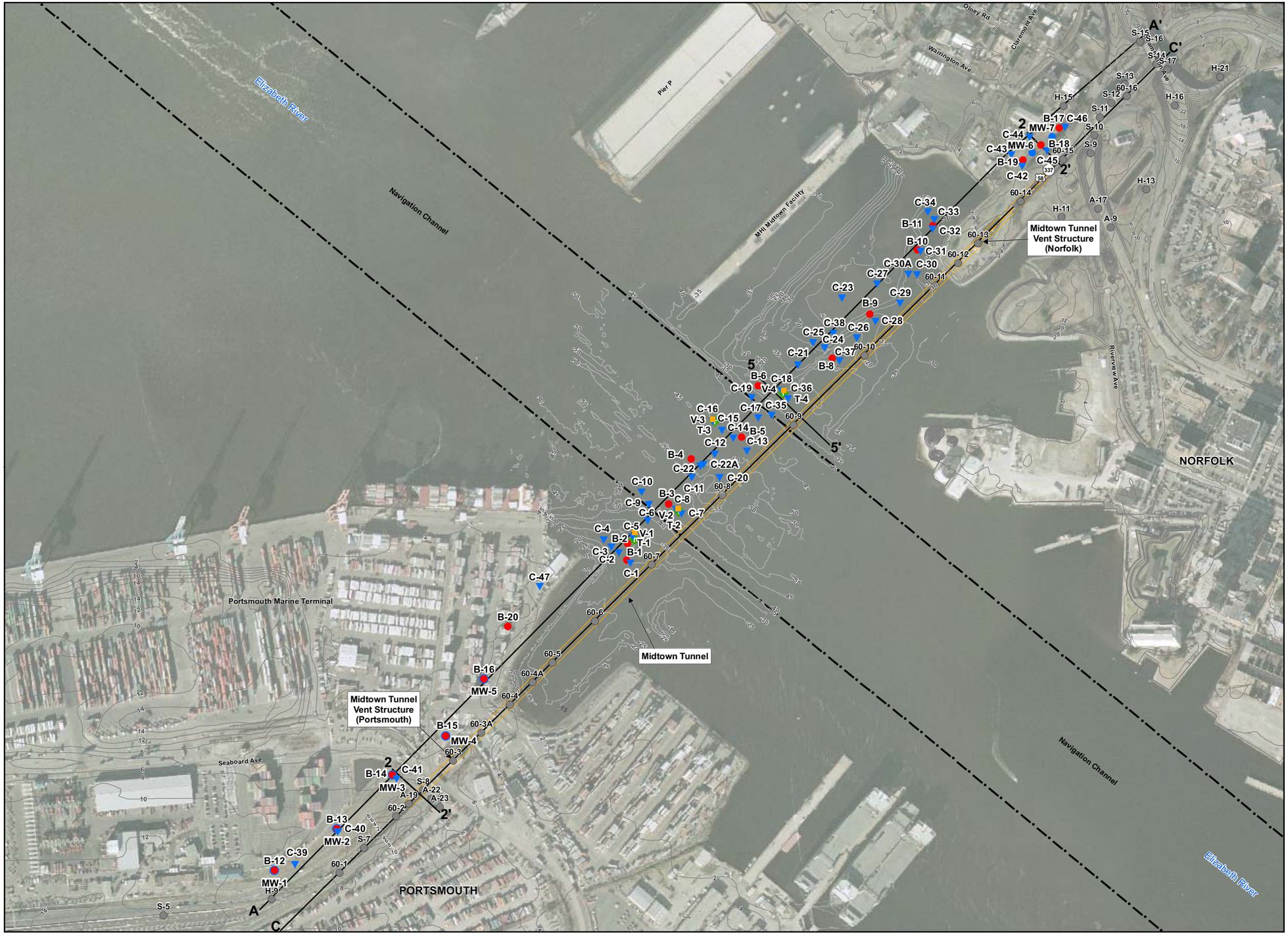
NOTE: **Historical Exploration Data** are available from
VDOT Geotechnical Database Management System (http://gis.virginiadot.org/)

GEOTECHNICAL REPORT ORGANIZATION

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 2

Virginia Department of Transportation
Project No. 3602.001



LEGEND

Exploration Locations

- C-38 — 2008 Fugro (Marine) and VDOT (Land) CPT
- B-11 — 2008 Fugro (Marine) and VDOT (Land) Boring
- MW-6 — 2008 MMA Monitoring Well
- T-4 — 2008 Fugro T-bar
- V-4 — 2008 Fugro Vane Shear
- B-11 — 1957 - 1960 Historical Boring
- A——A' Cross Section Location

1999 Portsmouth Topographic Survey (NAVD 88)
Source: U.S. Geological Survey, EROS Data Center National Elevation Dataset (NED), Norfolk South VA, 1999

Topographic Contour in Feet (NAVD 88)
Contour interval is 2 ft.

2000 Norfolk Topographic Survey (NAVD 88)
Source: City of Norfolk, 2000 Photogrametric Survey

Topographic Contour in Feet (NAVD 88)
Contour interval is 2 ft.

Elizabeth River Bathymetry (MLLW, feet)
Source: 2008 Multibeam Survey (Fugro, 2008b)
Refer to notes for vertical datum.

Bathymetric Contour in Feet (MLLW)
Contour interval is 5 ft.

Approximate Location of Midtown Tunnel
Not for design or construction planning
(Refer to Section 7.1 in text)

NOTE

1) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

N
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0 300 600 Feet

GEOTECHNICAL EXPLORATION AND CROSS SECTION LOCATIONS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 3

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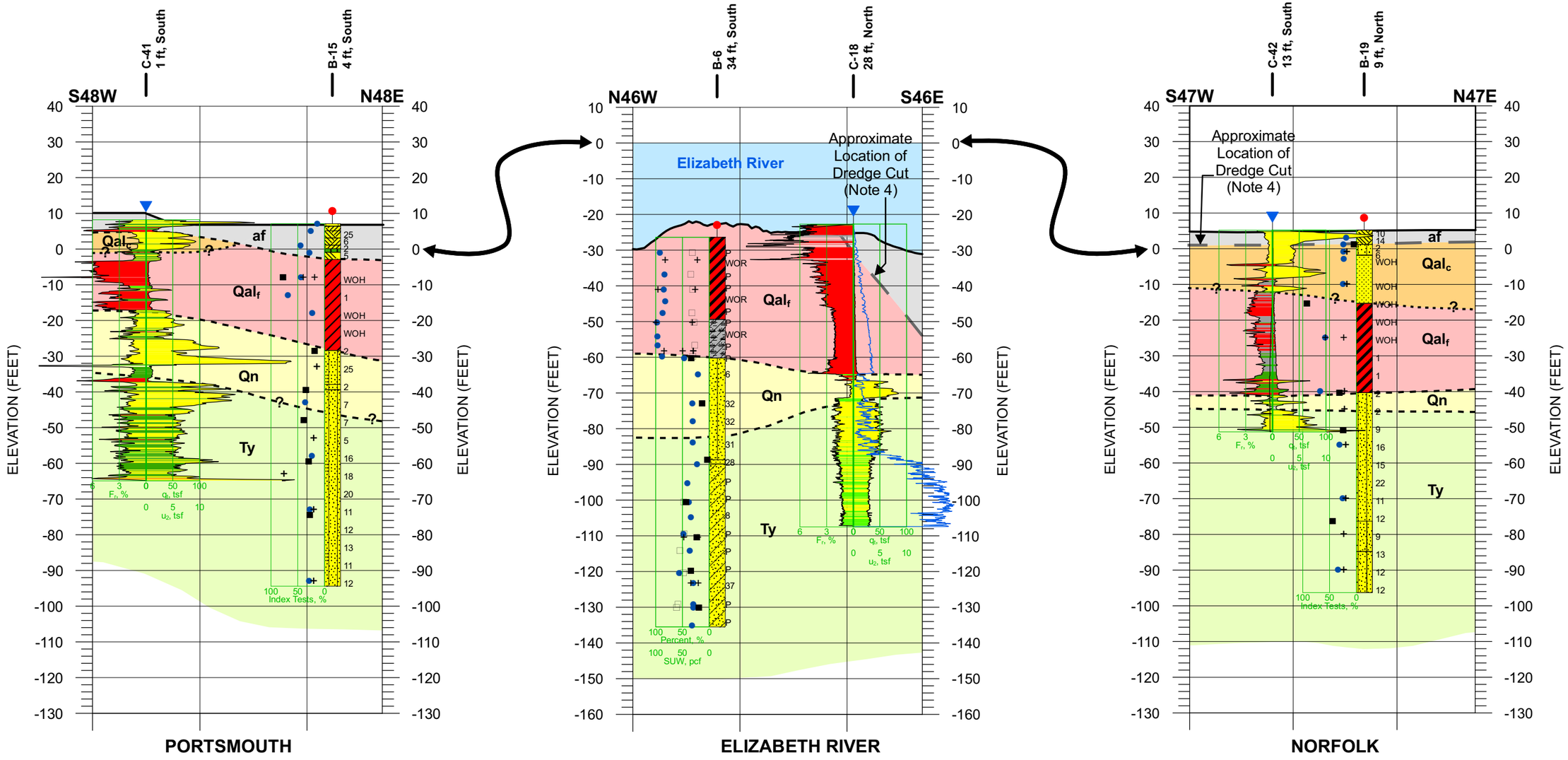

NOTES:

1) Bathymetric data from 2008 multibeam and single beam surveys. Refer to Fugro (2008b) for description of surveys. Portsmouth topographic data from U.S. Geological Survey's National Elevation Dataset (NED). Norfolk topographic data from City of Norfolk 2000 photgrammetic survey.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

LEGEND

Stratigraphic Units

- Elizabeth River
- Artificial Fill (af)
- Alluvium (Qal_c) - loose to medium dense silty sand
- Alluvium (Qal_f) - Beneath Elizabeth River: very soft to soft clay; Beneath Portsmouth and Norfolk onshore areas: soft to firm clay
- Sandbridge (Qsb) - loose to medium dense silty sand
- Norfolk (Qn) - loose to medium dense sand
- Yorktown (Ty_s) - silty clayey fine sand
- Yorktown (Ty_c) - stiff clay

Explorations

- 2008 VDOT (Land) and Fugro (Marine) CPT
- 2008 VDOT (Land) and Fugro (Marine) Boring

TYPICAL STRATIGRAPHIC SECTIONS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 4

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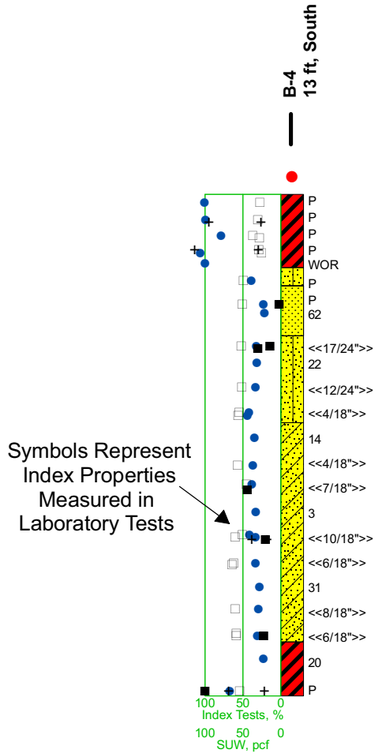
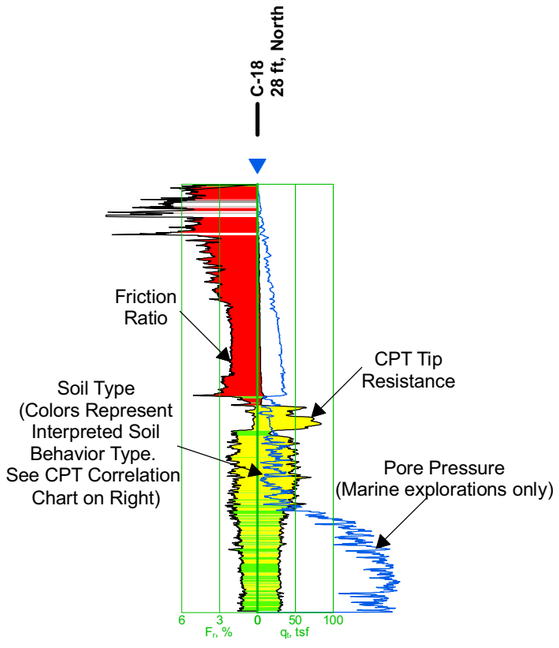


SOIL BORING LITHOLOGY WITH INDEX TESTS MEASURED IN LABORATORY AND RAW BLOW COUNTS

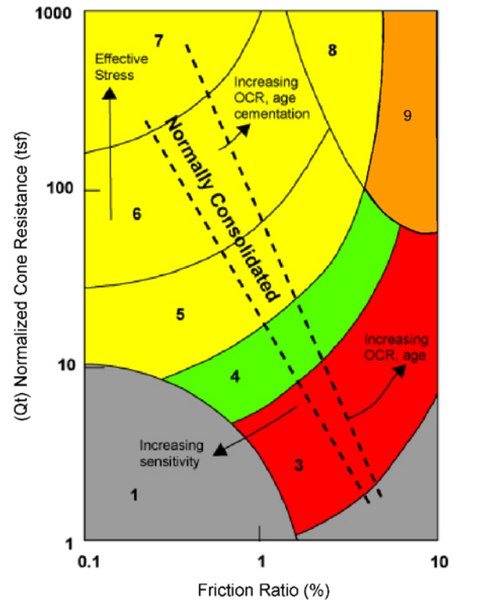
INDEX PROPERTIES SYMBOLS

- Submerged Unit Weight
- Percent Passing #200 Sieve
- Plastic Limit
- Liquid Limit
- Water Content



CPT SOUNDING WITH FRICTION RATIO, AND TIP RESISTANCE

MARINE CPT SOIL CLASSIFICATIONS



Zone	Soil Behavior Type	U.S.C.S.
1	Sensitive Fine-grained	OL-CH
2	Organic Material	OL-OH
3	Clay to Silty Clay	CL-CH
4	Clayey Silt to Silty Clay	MH-CL
5	Silty Sand to Sandy Silt	SM-ML
6	Sand to Silty Sand	SP-SM
7	Gravelly Sand to Sand	GP-SP
8	Sand to Clayey Sand	SP-SC
9	Very Stiff Fine-grained*	CH-CL

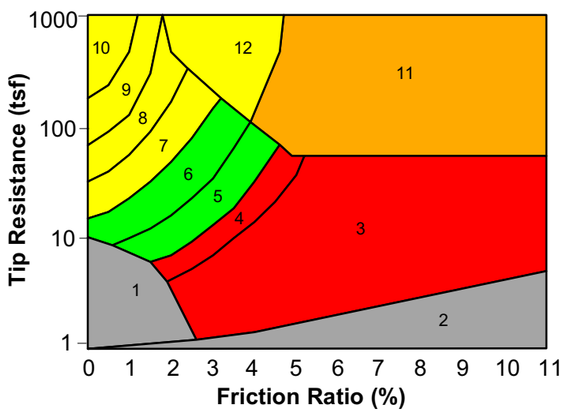
*overconsolidated or cemented

CPT CORRELATION CHART ROBERTSON, 1990

SOIL TYPES

- Well graded GRAVEL (GW)
- Poorly graded GRAVEL (GP)
- GRAVEL with sand (GW)
- GRAVEL with clay (GW)
- Clayey GRAVEL (GC)
- GRAVEL with silt (GW)
- Silty GRAVEL (GM)
- Well graded SAND (SW)
- Poorly graded SAND (SP)
- SAND with gravel (SW)
- SAND with clay (SW-SC)
- Clayey SAND (SC)
- Silty SAND (SM)
- SAND with silt (SW-SM)
- Fat CLAY (CH)
- Sandy fat CLAY (CH)
- Lean CLAY (CL)
- Sandy lean CLAY (CL)
- Silty CLAY (CL-ML)
- Elastic SILT (MH)
- SILT (ML)
- Sandy SILT (ML)
- Clayey SILT (ML/CL)
- Highly plastic ORGANICS (OH)
- Low plasticity ORGANICS (OL)
- SANDSTONE (Rx)
- SILTSTONE (Rx)
- CLAYSTONE (Rx)
- MUDSTONE (Rx)
- Conglomerate (Rx)
- Interbedded Rock Strata (Rx)
- Pavement

LAND CPT SOIL CLASSIFICATIONS



Zone	Soil Behavior Type	U.S.C.S.
1	Sensitive Fine-grained	OL-CH
2	Organic Material	OL-OH
3	Clay	CH
4	Silty Clay to Clay	CL-CH
5	Clayey Silt to Silty Clay	MH-CL
6	Sandy Silt to Clayey Silt	ML-MH
7	Silty Sand to Sandy Silt	SM-ML
8	Sand to Silty Sand	SM-SP
9	Sand	SW-SP
10	Gravelly Sand to Sand	SW-GW
11	Very Stiff Fine-grained *	CH-CL
12	Sand to Clayey Sand *	SC-SM

*overconsolidated or cemented

CPT CORRELATION CHART (Robertson and Campanella, 1988)

KEY TO SUBSURFACE CROSS SECTIONS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5

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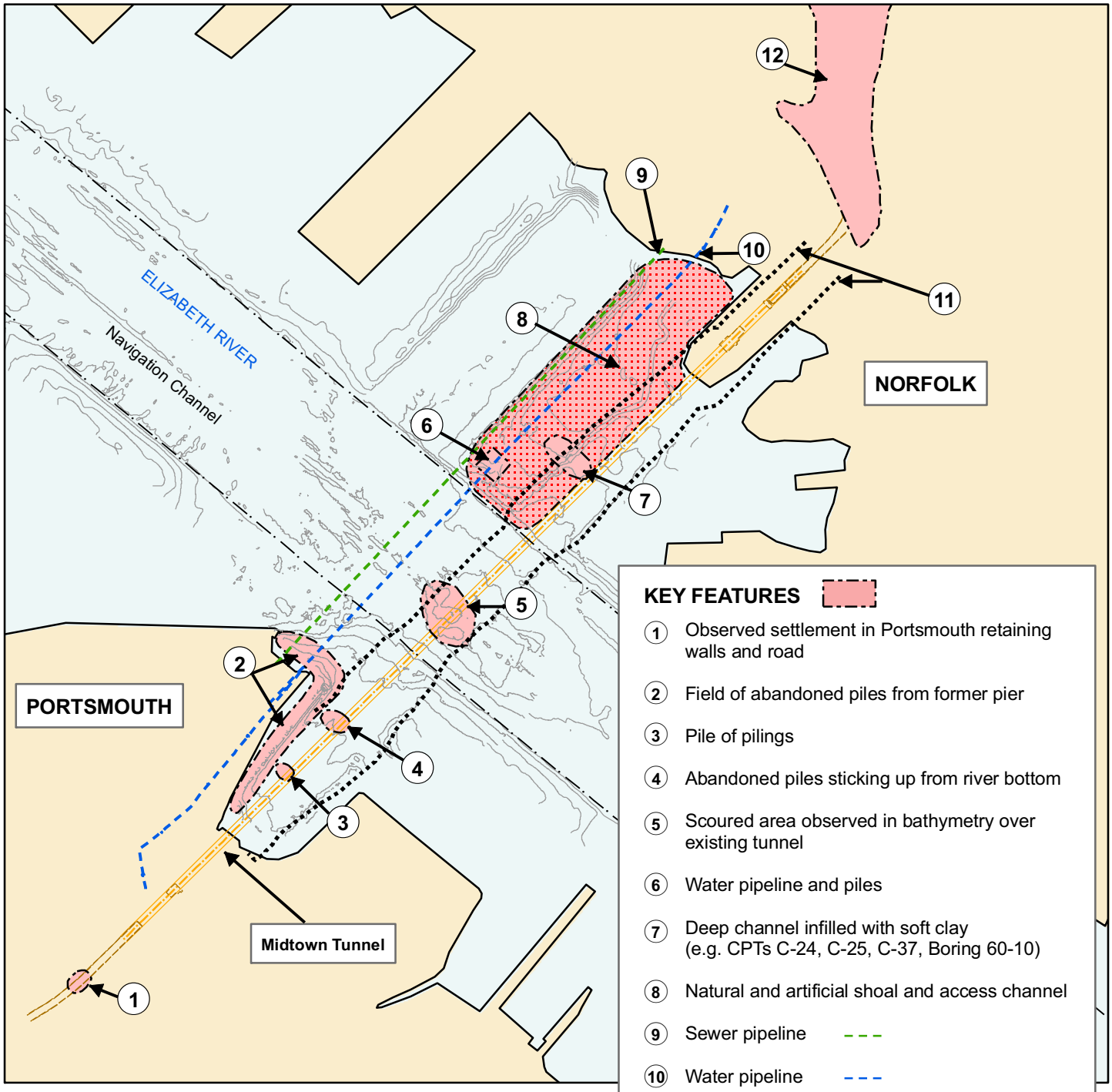

KEY FEATURES

1. Observed settlement in Portsmouth retaining walls and road
2. Field of abandoned piles from former pier
3. Pile of pilings
4. Abandoned piles sticking up from river bottom
5. Scoured area observed in bathymetry over existing tunnel
6. Water pipeline and piles
7. Deep channel infilled with soft clay (e.g. CPTs C-24, C-25, C-37, Boring 60-10)
8. Natural and artificial shoal and access channel
9. Sewer pipeline
10. Water pipeline
11. Approximate Location of Dredge Cut
12. Channel infilled with soft fine-grained layers from former drainage of Tarrant Creek

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0 350 700 Feet

KEY FEATURES
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\08-Overview Report\MXD\Figures\Fig-6_Key_Features.mxd, 11/17/08, kstevens

CHARTS



Spring 2008 Explorations Conducted by Fugro Atlantic Under Contract to VDOT

Fugro Boring Designation	VDOT Boring Designation	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet) Northing	Easting	River Bottom Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
B-1		3/4/2008	3478955	12122033	-29.1	78.6	-107.7
B-2		3/3/2008	3479050	12122036	-29.6	98.3	-127.9
B-3		3/2/2008	3479246	12122243	-47.2	109.1	-156.3
B-4		3/1/2008	3479474	12122356	-48.2	99.3	-147.5
B-5		3/2/2008	3479583	12122610	-45.9	127.2	-173.1
B-6		2/29/2008	3479839	12122894	-26.1	109.1	-135.2
B-8		2/26/2008	3479680	12123065	-23.0	99.3	-122.3
B-9		2/27/2008	3480199	12123264	-11.9	88.9	-100.8
B-10		2/28/2008	3480522	12123492	-10.9	88.9	-99.8
B-11		2/29/2008	3480644	12123570	-11.0	79.1	-90.1

Note: B-7 was deleted from the drilling program.

Fugro CPT Designation	VDOT CPT Designation	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet) Northing	Easting	River Bottom Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
C-1		4/25/2008	3478945	12122051	-29.6	85.3	-114.8
C-2		4/25/2008	3478998	12121993	-27.3	85.3	-112.6
C-3		4/25/2008	3479027	12121957	-25.8	85.3	-111.1
C-4		4/25/2008	3479063	12121918	-26.7	85.3	-112.0
C-5		4/26/2008	3479090	12122063	-32.0	82.4	-114.4
C-6		4/26/2008	3479159	12122138	-37.5	79.5	-117.0
C-7		4/28/2008	3479194	12122308	-47.9	80.9	-128.9
C-8		4/28/2008	3479218	12122280	-47.8	78.0	-125.8
C-9		4/27/2008	3479240	12122145	-44.3	80.1	-124.4
C-10		4/27/2008	3479302	12122108	-46.9	83.7	-130.6
C-11		4/27/2008	3479376	12122360	-49.7	84.6	-134.3
C-12		4/27/2008	3479495	12122475	-47.6	84.6	-132.2
C-13		4/27/2008	3479508	12122637	-47.7	82.8	-130.5
C-14		4/27/2008	3479574	12122568	-45.6	84.1	-129.7
C-15		4/27/2008	3479613	12122512	-44.9	81.5	-126.4
C-16		4/27/2008	3479658	12122446	-44.8	84.6	-129.6
C-17		4/27/2008	3479676	12122694	-42.0	15.3	-57.4
C-18		4/25/2008	3479813	12122810	-22.0	84.8	-106.8
C-19		4/27/2008	3479778	12122660	-38.9	84.9	-123.8
C-20		4/28/2008	3479376	12122500	-51.5	76.5	-128.0
C-21		4/25/2008	3479941	12122893	-12.9	84.3	-97.2
C-22		4/28/2008	3479433	12122463	-47.8	26.6	-74.4
C-22A		4/28/2008	3479441	12122419	-48.0	74.9	-122.9
C-23		4/26/2008	3480276	12123114	-3.7	85.3	-89.0
C-24		4/25/2008	3480027	12122927	-9.3	74.8	-84.1
C-25		4/25/2008	3480052	12122969	-8.6	77.6	-86.2
C-26		4/24/2008	3480077	12123189	-20.5	81.5	-102.0
C-27		4/26/2008	3480348	12123290	-4.3	85.1	-89.4
C-28		4/24/2008	3480161	12122922	-17.0	91.6	-108.6
C-29		4/25/2008	3480250	12123405	-11.3	94.5	-95.8
C-30		4/24/2008	3480394	12123499	-10.4	24.9	-35.3
C-30A		4/24/2008	3480396	12123446	-10.2	97.6	-107.8
C-31		4/24/2008	3480511	12123508	-11.0	25.3	-36.3
C-32		4/24/2008	3480622	12123569	-10.9	84.8	-95.7
C-33		4/24/2008	3480672	12123577	-10.8	85.3	-96.1
C-34		4/25/2008	3480709	12123545	-10.8	46.8	-57.6
C-35		4/28/2008	3479687	12122751	-39.5	85.0	-124.5
C-36		4/28/2008	3479773	12122843	-30.1	85.8	-66.9
C-37		4/30/2008	3479961	12123101	-23.5	58.5	-82.0
C-38		4/30/2008	3480099	12123071	-7.3	85.2	-92.5

Fugro T-Bar Designation	VDOT T-Bar Designation	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet) Northing	Easting	River Bottom Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)	Cyclic Test Depths (feet)
T-1		4/29/2008	3479069	12122713	-32.6	0.0	-32.6	8.4, 18.2, 28.1, 32.3
T-2		4/29/2008	3479211	12122294	-47.7	0.0	-47.7	7.7, 12.6
T-3		4/28/2008	3479604	12122478	-44.3	0.0	-44.3	5.7, 10.7
T-4		4/28/2008	3479804	12122819	-23.5	0.0	-23.5	7.4, 17.2, 27.1, 36.9

Fugro Vane Shear Designation	VDOT Vane Shear Designation	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet) Northing	Easting	River Bottom Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)	Test Depths (feet) "R" indicates remold test was performed
V-1		4/29/2008	3479104	12122073	-31.9	31.3	-63.2	10.6 R, 23.1 R, 31.3 R
V-2		4/29/2008	3479223	12122291	-48.4	9.8	-58.2	9.8 R
V-3		4/29/2008	3479672	12122464	-44.1	11.4	-55.5	6.6 R, 11.4 R
V-4		4/29/2008	3479817	12122622	-21.7	39.8	-61.5	10.3, 20.1, 29.9, 39.8

VDOT 2008 Onshore Norfolk Explorations

Fugro Boring Designation	VDOT Boring Designation	Completion Date	Coordinates Virginia State Plane South Zone (NAD 83, feet) Northing	Easting	Ground Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
B-17	08BH-017	7/1/2008	3481135	12124204	6.9	41.5	-34.6
B-18	08BH-018	7/2/2008	3481049	12124112	6.5	61.5	-55.0
B-19	08BH-019	7/8/2008	3480977	12124023	5.2	101.5	-96.3

Fugro CPT Designation	VDOT CPT Designation	Completion Date	Coordinates (feet) Virginia State Zone South, NAD 83 Northing	Easting	Ground Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
C-42	08CP-042	9/15/2008	3480938	12124019	5.2	56.4	-51.3
C-43	08CP-043	9/15/2008	3480996	12123964	5.0	42.2	-37.2
C-44	08CP-044	9/15/2008	3481084	12124056	5.7	36.3	-30.5
C-45	08CP-045	9/15/2008	3481017	12124142	6.1	68.1	-62.0
C-46	08CP-046	9/15/2008	3481135	12124234	6.6	31.0	-24.4

VDOT 2008 Onshore Portsmouth Explorations

Fugro Boring Designation	VDOT Boring Designation	Completion Date	Coordinates Virginia State Plane South Zone (NAD 83, feet) Northing	Easting	Ground Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
B-12	08BH-012	6/13/2008	3477408	12120055	10.2	41.4	-31.2
B-13	08BH-013	6/16/2008	3477616	12120578	9.9	61.5	-51.6
B-14	08BH-014	6/11/2008	3477887	12120856	9.1	101.5	-92.4
B-15	08BH-015	6/25/2008	3478083	12121125	7.2	101.5	-94.3
B-16	08BH-016	6/26/2008	3478370	12121316	6.9	101.5	-94.6
B-20	08BH-020	7/9/2008	3478631	12121437	6.9	101.5	-94.6

Fugro CPT Designation	VDOT CPT Designation	Completion Date	Coordinates (feet) Virginia State Zone South, NAD 83 Northing	Easting	Ground Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
C-39	08CP-039	9/12/2008	3477433	12120368	9.1	9.4	-0.3
C-40	08CP-040	9/12/2008	3477597	12120583	9.0	62.8	-53.9
C-41	08CP-041	9/12/2008	3477863	12120878	8.2	73.2	-64.9
C-47	08CP-047	9/17/2008	3478629	12121597	6.2	113.4	-107.1

LEGEND

Geotechnical Explorations

- B-09 — 2008 Fugro Boring Location
- C-23 — 2008 Fugro CPT Location
- T-4 — 2008 Fugro T-Bar Location
- V-4 — 2008 Fugro Vane Shear Location
- MW-1 — 2008 MMA Monitoring Well
- B-14 — 2008 VDOT Boring Location
- C-40 — 2008 VDOT CPT Location
- 60-15 — Historical VDOT Boring Location

Bathymetry (MLLW, feet)
Refer to notes for vertical datum.

- Bathymetric Contour in Feet (MLLW) Contour interval is 5 ft.

Bathymetric Data Boundaries and Sources

- Fugro (MB-2008): Multibeam Bathymetry Data — Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM ES3 Multibeam echosounder (240 Khz - 120 degree swath).
- Fugro (SB-2008): Single Beam Bathymetry Data — Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM Echotrak Dual Frequency echosounder (200/28 kHz)
- Area Obstructed During Fugro 2008 Survey
- Approximate Location of Midtown Tunnel — Not for design or construction planning (Refer to Section 7.1 in text)

NOTES

1) Coordinate Grid: Virginia State Plane, South Zone, NAD 83, Feet
2) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>
3) Reference to Mean Lower Low Water (MLLW), 1983-2001 Tidal Epoch, is based on observations performed and published by the National Oceanic and Atmospheric Administration, National Ocean Service (NOAA/NOS). Tidal Bench Mark 8638610 at Sewells Point, Hampton Roads, was used as the MLLW constraint for this project.

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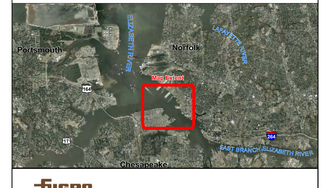
GEODETIC INFORMATION

SPHEROID:	GRS 1980
SEMI-MAJOR AXIS:	6,378,137.000
SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.257222101
ECCENTRICITY²:	0.006694380
PROJECTION:	LAMBERT CONFORMAL CONIC
ZONE:	VIRGINIA SOUTH
LONGITUDE OF ORIGIN:	36.3°
FALSE EASTING:	11,482,916
FALSE NORTHING:	3,280,833



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EXPLORATION LOCATION MAP
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

0 200 400 Feet

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Nov. 2008	For Report Submittal	KWS	ADB	KRS
2					
3					

JOB NUMBER: 3602.001 CHART NO.: 1

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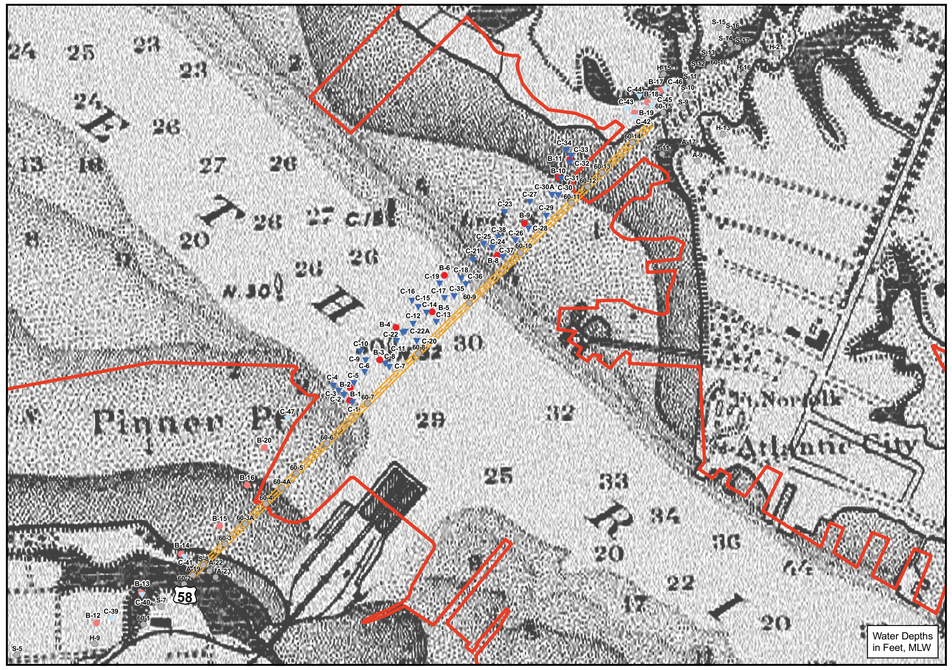
1894 CHART



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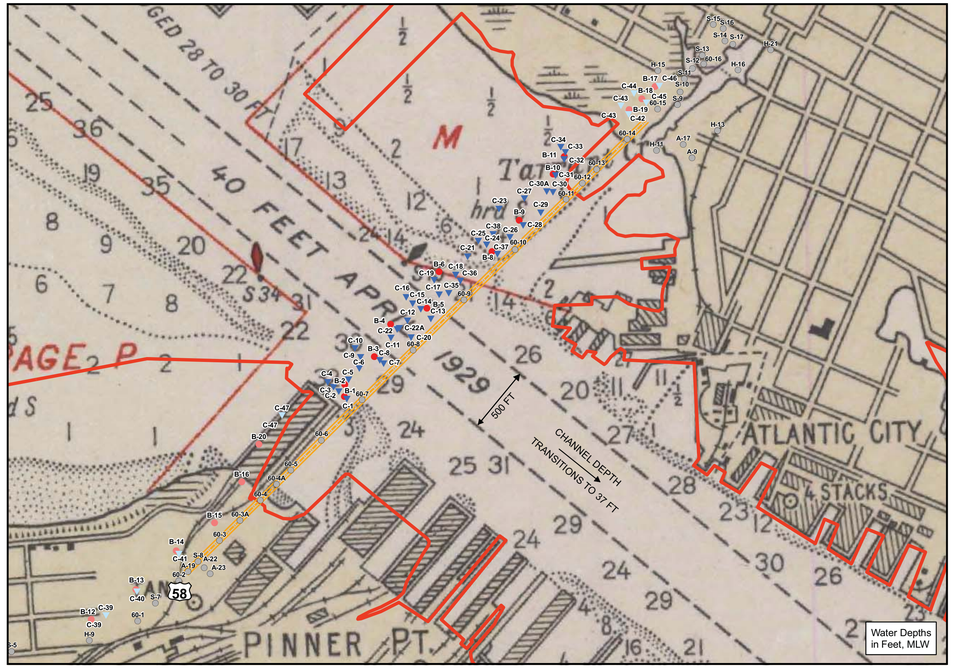
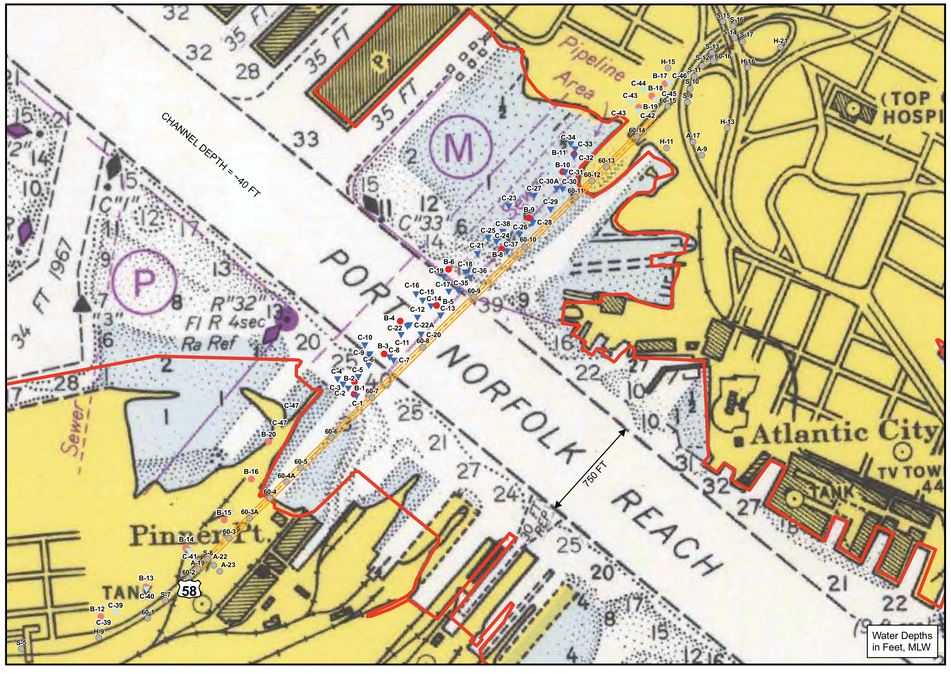
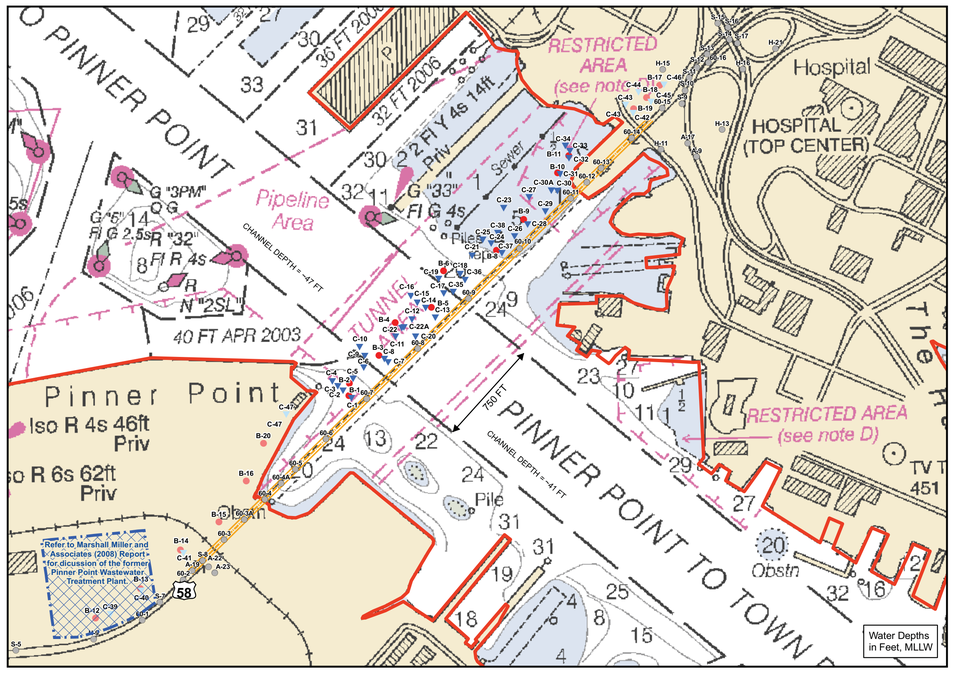


1969 CHART



2008 CHART



LEGEND

- Current Shoreline (digitized from 2005 aerial photograph)
- Approximate Location of Midtown Tunnel (Refer to Section 4.1 in text)

Explorations

- B-9 — 2008 Fugro Marine Boring Location
- C-23 — 2008 Fugro Marine CPT Location
- B-17 — 2008 VDOT Land Boring Location
- C-43 — 2008 VDOT Land CPT Location
- 60-15 — Historical VDOT Boring Location

LIST OF MAPS AND AERIAL PHOTOS REVIEWED
Highlighted maps/photos are shown on this chart

Year	Map/Photo	Scale
1887	Sanborn Map & Publishing Co., Norfolk Virginia	1:2,400
1888	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1893	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1894	NOAA Chart BiC-45, Hampton Roads	1:20,000
1898	Sanborn Map & Publishing Co., Norfolk Virginia	1:9600
1903	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1910	Sanborn Map & Publishing Co., Norfolk Virginia, Vo. 1	1:9,600
1915	NOAA Chart No. 400, Hampton Roads	1:20,000
1920	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1921	Sanborn Map & Publishing Co., Norfolk Virginia, Vo. 3	1:9,600
1923	NOAA Chart No. 400, Hampton Roads	1:20,000
1924	NOAA Chart No. 400, Hampton Roads	1:20,000
1926	NOAA Chart No. 400, Hampton Roads	1:20,000
1928	NOAA Chart No. 400, Hampton Roads	1:20,000
1930	NOAA Chart No. 400, Hampton Roads	1:20,000
1932	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1959	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1968	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1969	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1975	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
1994	Digital Ortho Quarter Quadrangle, USGS Geological Survey	1.0 m/pixel
2005	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
2005	Ortho-Rectified Chesapeake Aerial Imagery	0.5 m/pixel
2008	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000

NOTES

1) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

2) Information listed in "Elizabeth River Channel Depths" table on NOAA Chart 12253_1 (2008) indicates navigation channel project water depth is 45 ft (MLLW). Navigation channel project water depth is depth which channel has been approved to be dredged for navigation purposes. However, 2008 bathymetric survey indicates water depth in channel northwest of tunnel is approximately 47 ft (MLLW), and southeast of tunnel it is approximately 41 ft MLLW.

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SPHEROID:	GRS 1980
SEMI-MAJOR AXIS:	6,378,137.000
SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.25722101
ECCENTRICITY²:	0.006694380
PROJECTION:	LAMBERT CONFORMAL CONIC
ZONE:	VIRGINIA SOUTH
LONGITUDE OF ORIGIN:	36.3°
FALSE EASTING:	11,482,916
FALSE NORTHING:	3,280,833

N W E S



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ELIZABETH RIVER SITE DEVELOPMENT

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

0 500 1,000 Feet

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Oct. 2008	Report Submittal	KCS	KRS	KRS
2					
3					

JOB NUMBER: 3602.001 CHART NO.: 2

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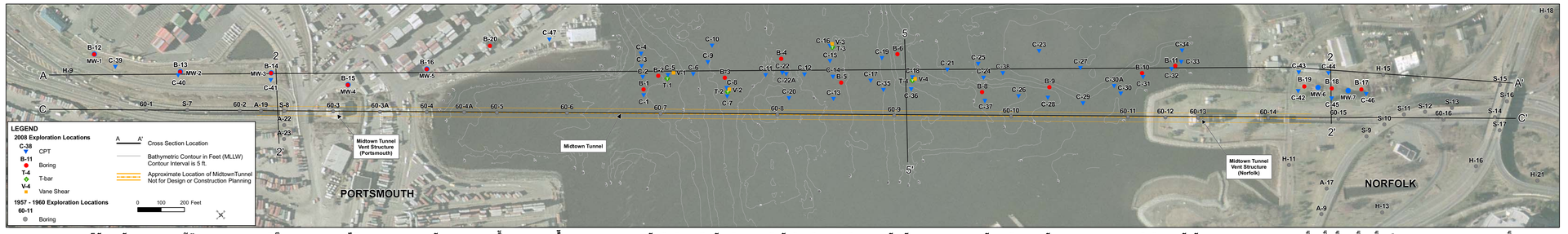
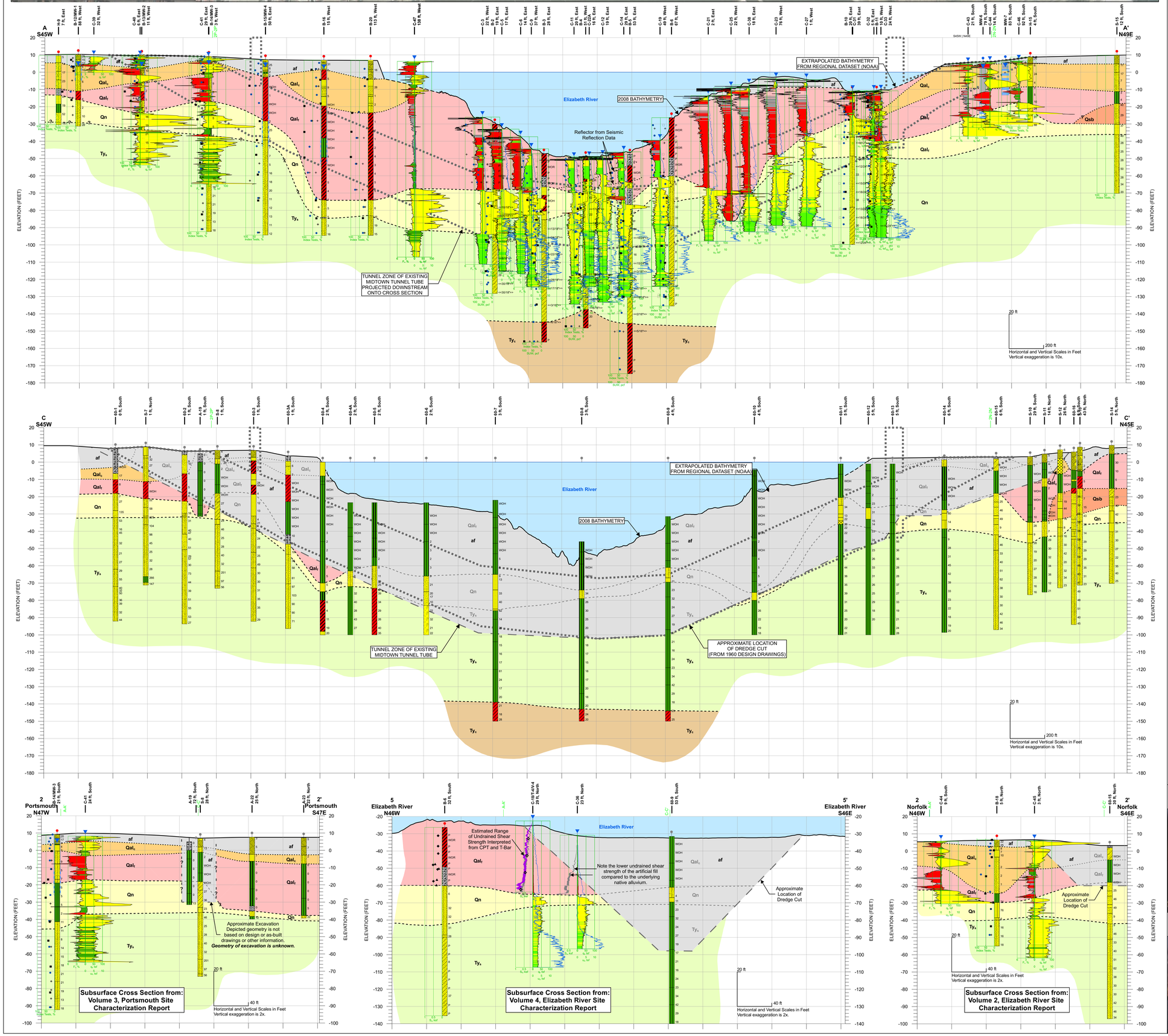
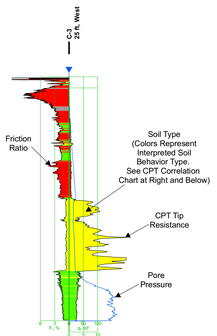


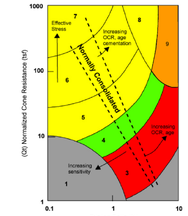


KEY TO CPT SOUNDINGS



CPT SOUNDING WITH FRICTION RATIO, PORE PRESSURE, AND TIP RESISTANCE

MARINE CPT SOIL CLASSIFICATIONS

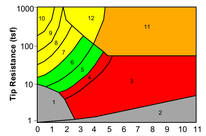


Zone	Soil Behavior Type	U.S.C.S.
1	Sensitive Fine-grained	OL-CH
2	Organic Material	OL-OH
3	Clay to Silty Clay	CL-CH
4	Clayey Silt to Silty Clay	MH-CL
5	Silty Sand to Sandy Silt	SM-ML
6	Sand to Silty Sand	SP-SM
7	Gravelly Sand to Sand	GP-SP
8	Sand to Clayey Sand	SP-SC
9	Very Stiff Fine-grained*	CH-CL

*overconsolidated or cemented

CPT CORRELATION CHART ROBERTSON, 1990

LAND CPT SOIL CLASSIFICATIONS

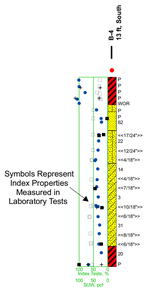


Zone	Soil Behavior Type	U.S.C.S.
1	Sensitive Fine-grained	OL-CH
2	Organic Material	OL-OH
3	Clay	CH
4	Silty Clay to Clay	CL-CH
5	Clayey Silt to Silty Clay	MH-CL
6	Sandy Silt to Clayey Silt	ML-MH
7	Silty Sand to Sandy Silt	SM-ML
8	Sand to Silty Sand	SM-SP
9	Sand	SW-SP
10	Gravelly Sand to Sand	SW-GW
11	Very Stiff Fine-grained *	CH-CL
12	Sand to Clayey Sand *	SC-SM

*overconsolidated or cemented

CPT CORRELATION CHART (Robertson and Campanella, 1988)

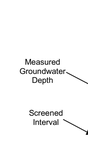
KEY TO BORINGS



SOIL BORING LITHOLOGY WITH INDEX TESTS MEASURED IN LABORATORY AND RAW BLOW COUNTS

SOIL TYPES

- Well graded GRAVEL (GW)
- Poorly graded GRAVEL (GP)
- GRAVEL with sand (GW)
- GRAVEL with clay (GW)
- Clayey GRAVEL (GC)
- GRAVEL with silt (GW)
- Silty GRAVEL (GM)
- Well graded SAND (SW)
- Poorly graded SAND (SP)
- SAND with gravel (SW)
- SAND with clay (SW-SC)
- Clayey SAND (SC)
- Silty SAND (SM)
- SAND with silt (SW-SM)
- Fat CLAY (CH)
- Sandy fat CLAY (CH)
- Lean CLAY (CL)
- Sandy lean CLAY (CL)
- Silty CLAY (CL-ML)
- Elastic SILT (MH)
- SILT (ML)
- Sandy SILT (ML)
- Clayey SILT (ML/CL)
- Highly plastic ORGANICS (OH)
- Low plasticity ORGANICS (OL)
- SANDSTONE (Rx)
- SILTSTONE (Rx)
- CLAYSTONE (Rx)
- MUDSTONE (Rx)
- Conglomerate (Rx)
- Interbedded Rock Strata (Rx)
- Pavement



GROUND WATER MONITORING WELL

LEGEND

Stratigraphic Units

- Elizabeth River
- Artificial Fill (af)
- Alluvium (Qal_c) - loose to medium dense silty sand
- Alluvium (Qal_f) - Beneath Elizabeth River: very soft to soft clay; Beneath Portsmouth and Norfolk onshore areas: soft to firm clay
- Sandbridge (Qsb) - loose to medium dense silty sand
- Norfolk (Qn) - loose to medium dense sand
- Yorktown (Ty_s) - silty clayey fine sand
- Yorktown (Ty_c) - stiff clay

Explorations

- 2008 Fugro (Marine) and VDOT (Land) CPT
- 2008 Fugro (Marine) and VDOT (Land) Boring
- 2008 MMA (Land) Monitoring Well
- 1957 - 1960 Historical Boring

Index Properties Symbols

- Submerged Unit Weight
- Percent Passing #200 Sieve
- Plastic Limit
- Liquid Limit
- Water Content

Shear Strength Properties Symbols

- Unconsolidated Undrained (UU)
- Laboratory/Miniature Vane (MV)
- Remote Vane (RV)
- Torvane (TV)
- Pocket Pen (PP)

NOTES:

1) Elevation reference to mean lower low water (MLLW).
2) Bathymetric data from 2008 multibeam and single beam surveys. Refer to Fugro (2008b) for description of surveys. Portsmouth topographic data from U.S. Geological Survey's National Elevation Dataset (NED). Norfolk topographic data from City of Norfolk 2000 photgrammetric survey.
3) Approximate location of dredge cut based on 1960 design drawings, and where adequate data is available, based on 2008 geotechnical and geophysical data.
4) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

VIEW FROM BARGE DECK, SHOWING ROSON CPT UNIT, CRANE, SPUD LIFTING EQUIPMENT, AND *BUNNY C* TUGBOAT



MARINE DRILLING OPERATIONS



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SUBSURFACE CROSS SECTIONS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Nov. 2008	For Report Submittal	KWS	KRS	KRS
2					
3					

JOB NUMBER: 3602.001 CHART NO.: 3

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FUGRO ATLANTIC

-VOLUME 2-
ONSHORE NORFOLK
SITE CHARACTERIZATION REPORT
PROPOSED MIDTOWN SECOND PARALLEL TUNNEL

Prepared for:
VIRGINIA DEPARTMENT OF TRANSPORTATION

October 2008
Fugro Project No. 3602.001



FUGRO ATLANTIC

World Trade Center
101 West Main Street, Suite 350
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October 31, 2008
Project No. 3602.001

Virginia Department of Transportation
1221 E. Broad Street
Richmond, Virginia 23219

Attention: Mr. Raymond Partridge, Project Manager, Innovative Project Delivery

Subject: Volume 2, Onshore Norfolk Site Characterization, Proposed Midtown Second Parallel Tunnel

Dear Mr. Partridge:

VDOT has recently completed a land geotechnical site exploration program for the proposed Midtown Second Parallel Tunnel on both banks of the Elizabeth River, in Norfolk to the north, and Portsmouth to the south. This report interprets the findings of the land site explorations in Norfolk. This report also presents geotechnical data in the form of Boring and CPT logs, as well as laboratory test plots. The data obtained during the various exploration programs will assist in the characterization of the subsurface conditions, stratigraphy, and sediment characteristics at the site of the proposed Midtown Second Parallel Tunnel.

It has been a pleasure working with you through this phase of the project. We look forward to the opportunity to provide continued support as the project progresses.

Sincerely,

FUGRO ATLANTIC

Matthew Q. Pollard
Project Engineer

Kevin R. Smith
Senior Engineering Geologist

Thomas W. McNeilan, P.E.
Vice President

COMMONWEALTH OF VIRGINIA
THOMAS WILLIAM MCNEILAN
Lic. No. 44962
PROFESSIONAL ENGINEER

Copies Submitted: (4) Addressee and PDF provided on CD

(1) Mr. John Daoulas, P.E., Senior Geotechnical Engineer for Special Projects, VDOT

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1.0 INTRODUCTION

1.1 PROJECT OVERVIEW

1.1.1 General

The proposed Midtown Second Parallel Tunnel is a main component of the major infrastructure improvement project aimed at providing increased capacity for east-west travel across the Elizabeth River. The Second Parallel Tunnel will extend between: 1) U.S. Route 58 and Interstate 264 in Portsmouth, and 2) Brambleton Avenue/Hampton Boulevard in Norfolk. The existing Midtown Tunnel first opened to traffic in 1962 and provides one lane of travel in each direction. The second tunnel will provide two westbound travel lanes, allowing the existing tunnel to accommodate two lanes of eastbound traffic. Additionally, the second tunnel will provide increased flexibility for redirecting traffic during maintenance operations and emergency situations.

The original tunnel and interchange design from the 1960s anticipated that a second tunnel would be built to the north of the existing tunnel. A second tunnel in this configuration and arrangement can be accommodated on the Norfolk side of the river with relatively minor engineering adjustments to the present interchange. In the city of Portsmouth, the MLK Freeway is a north-south, four-lane link that provides access to the City of Norfolk via the Midtown Tunnel. The MLK Freeway Extension, a component of the overall infrastructure improvement project, will extend the freeway to the south and provide a direct, limited access connection from I-264 to the Midtown Tunnel.

Currently, significant traffic congestion occurs at the tunnel during both the morning and evening peak periods. Preliminary information provided by Virginia Department of Transportation (VDOT) indicates that the second tunnel will be located northwest (downstream) of, and parallel to, the existing tunnel, following a similar vertical alignment. VDOT has defined the project area to extend 300 feet northwest (downstream) of the northern edge of the existing tunnel. The project vicinity is shown on Figure 1-1; however, select explorations that fall outside the boundaries shown on Figure 1 are included.

1.1.2 Authorization

Fugro's services for the Midtown Second Parallel Tunnel were completed in general accordance with our proposal, dated January 7, 2008. The execution of that scope of work was authorized by amendments of the contract between the VPA and the Craney Island Design Partners, LLC and the associated subcontract between the CIDP and Fugro Atlantic.

1.2 SCOPE OF WORK

1.2.1 Reporting

The purpose of this site characterization report is to evaluate the geotechnical conditions in Norfolk in the vicinity of the Midtown Tunnel based on subsurface exploration performed by

VDOT. The current report is part of a series of geotechnical exploration and survey activities for the Second Parallel Tunnel. Figure 1-2 shows the organization of the various reports that are being prepared for the geotechnical exploration and surveys for the project.

1.2.2 Site Exploration and Laboratory Testing

The land geotechnical site exploration program was designed to conduct a series of explorations that would allow for characterization of the subsurface conditions near the Norfolk approach of the proposed second tunnel. VDOT's land geotechnical exploration and laboratory testing program consisted of three components: 1) drilling and sampling from June 11 through July 9, 2008 using VDOT's truck-mounted drill rig, 2) cone penetration test (CPT) soundings from September 12 through September 17, 2008 using VDOT's truck-mounted CPT rig, and 3) laboratory testing of samples collected during the drilling operations.

The land geotechnical field program on the Norfolk side of the river included the following explorations, as shown on Figure 1-3, and listed in Table 4-1:

- 3 hollow stem auger borings (B-17 through B-19), advanced to depths ranging from 41 to 101 feet below the ground surface; and
- 5 CPT soundings (C-42 through C-46) advanced 31 to 68 feet below the ground surface.
- 2 groundwater monitoring wells (MW-6 and MW-7) were installed to depths of 20 and 35 feet below the ground surface by Marshall Miller and Associates (MMA). A description of the well construction details and groundwater measurements are provided in a report prepared by MMA (2008).

The laboratory testing program included the following index property tests:

- Moisture Content,
- Atterberg Limits, and
- Grain Size Distribution.

1.3 PROJECT DATUMS

The vertical datum used by VDOT during data acquisition of the land site exploration program was North American Vertical Datum of 1988. For reporting and charting, vertical units were converted to reference the vertical datum Mean Lower Low Water (MLLW). A factor of 1.60 feet used to convert from NAVD 88 to MLLW was obtained from the National Oceanic and Atmospheric Administration (NOAA) tide gauge Station No. 8638610 (1983-2001 tidal epoch) located at Sewells Point, Hampton Roads. Horizontal coordinates used in this report are in Virginia State Plane, South Zone, NAD 83, feet.



Aerial Photo Source: Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <<http://datagateway.nrcs.usda.gov/>>

PROJECT VICINITY MAP
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 1-1

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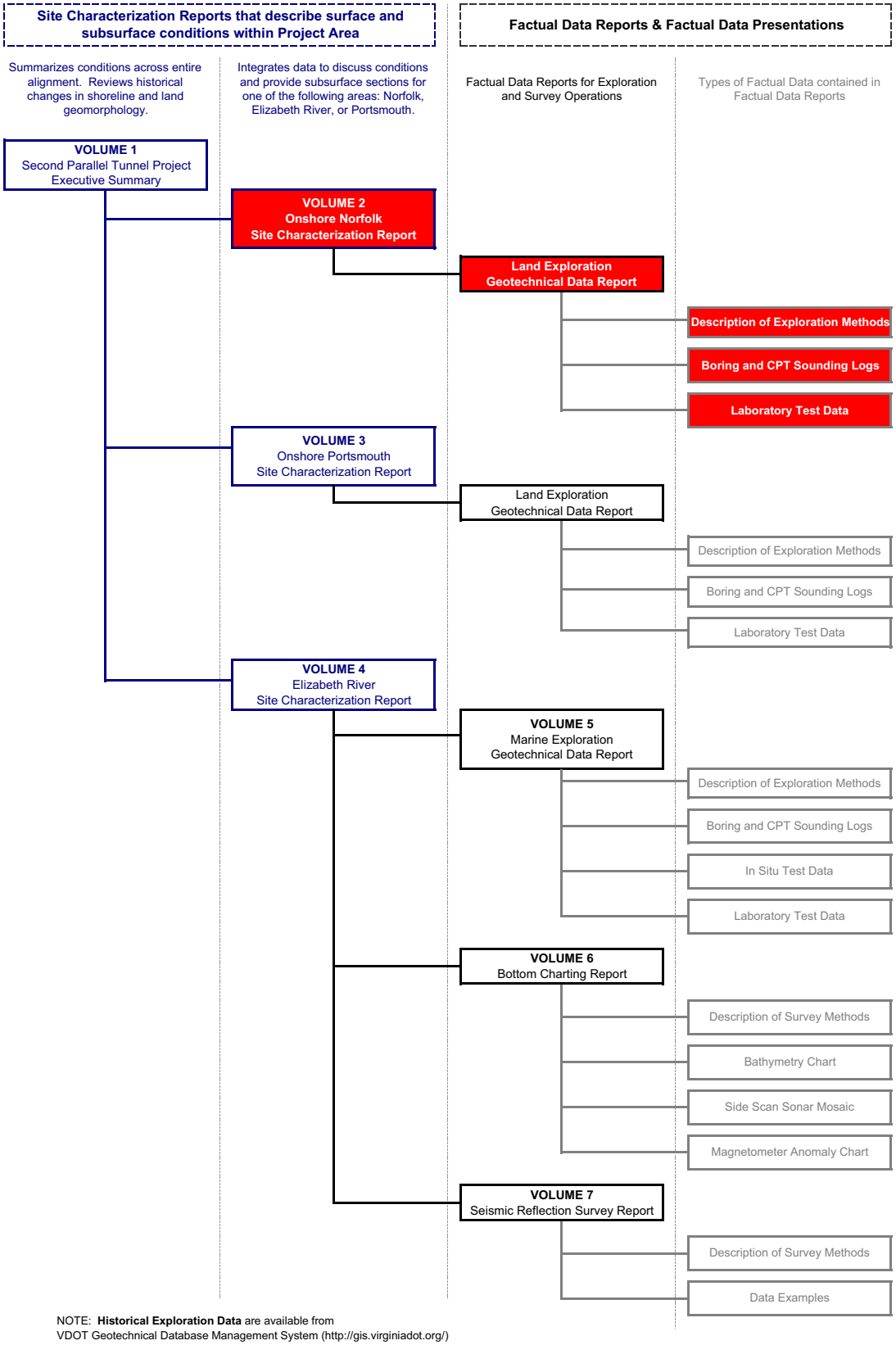

NOTE: **Historical Exploration Data** are available from
VDOT Geotechnical Database Management System (http://gis.virginiadot.org/)

GEOTECHNICAL REPORT ORGANIZATION

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 1-2



Aerial Photo Source: Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <<http://datagateway.nrcs.usda.gov/>>

GEOTECHNICAL EXPLORATION AND CROSS SECTION LOCATIONS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

N
W E
S

0 300 600 Feet

FIGURE 1-3

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\06-Norfolk_SiteCharMXD\Figures\Fig-1-3_Exploration_Location_Map.mxd, 11/07/08, kstevens

2.0 HISTORICAL ACTIVITIES

We reviewed readily available engineering design drawings, maps, charts, and aerial photographs in an effort to understand the historical development of the site. Information displayed on those documents provides information about (1) where structures may exist on the site and (2) historical site development. When put in a chronologic sequence, the documents provide insight when structures may have been abandoned and where potential remnants may exist. This information provides valuable insight when reviewing the project's geotechnical and geophysical data and understanding the site's current conditions. Table 2-1 lists the documents reviewed. The following discussion provides a summary of our data review and understanding of the Elizabeth River development since 1887 (the date of the earliest available information).

Table 2-1. Data Reviewed

Year	Map/Photo	Scale
1887	Sanborn Map & Publishing Co., Norfolk Virginia	1:2,400
1888	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1893	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1894	NOAA Chart BiC-45, Hampton Roads	1:20,000
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1910	Sanborn Map & Publishing Co., Norfolk Virginia, Vol. 1	1:9,600
1915	NOAA Chart No. 400, Hampton Roads	1:20,000
1920	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1921	Sanborn Map & Publishing Co., Norfolk Virginia, Vol. 3	1:9,600
1923	NOAA Chart No. 400, Hampton Roads	1:20,000
1924	NOAA Chart No. 400, Hampton Roads	1:20,000
1926	NOAA Chart No. 400, Hampton Roads	1:20,000
1928	NOAA Chart No. 400, Hampton Roads	1:20,000
1930	NOAA Chart No. 400, Hampton Roads	1:20,000
1932	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1959	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1960	Elizabeth River Tunnel Commission, Second Elizabeth River Tunnel and Approaches	-
1967	Sewer Pipelines, Hampton Roads Sanitation District	-
1968	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1969	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1974	Water Pipelines, Department of Utilities, City of Norfolk	-
1975	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
1993	Master Land Use Plans, Portsmouth Marine Terminal, Virginia Port Authority	-

Table 2-1. Continued

Year	Map/Photo	Scale
1994	Digital Ortho Quarter Quadrangle, USGS Geological Survey	1.0 m/pixel
2005	NOAA chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
2006	Ortho-Rectified Chesapeake Aerial Imagery	0.5 m/pixel

Data listed above are not included as appendices, but where relevant, are displayed on figures and charts.

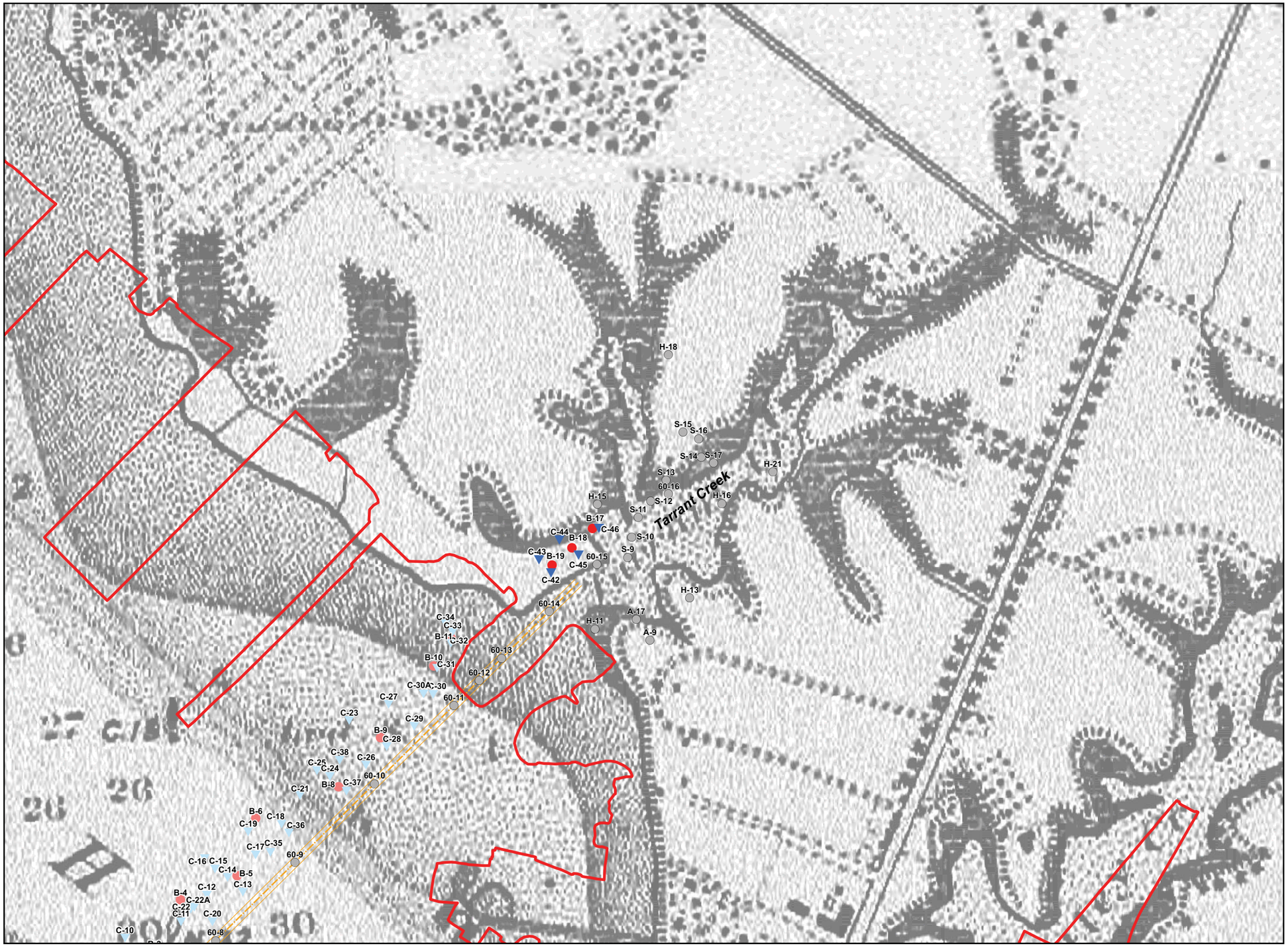
2.1 RIVERFRONT DEVELOPMENT

Figure 2-1 displays the current shoreline and 2008 explorations overlain on the 1894 morphology of the site. The surrounding low-lying areas and tributaries of the former Tarrant Creek are seen in the middle of the figure. Figure 2-2 displays the following four interpreted morphological areas from 1894 overlain on a recent aerial photograph of the site:

- Fluvial (FL) - active stream area with standing water.
- Mud Flats (MF) - area depicted low lying areas along the shoreline that were likely subjected to tidal inundation
- Lowland (LL) - low lying area between shoreline or mudflats and upland areas, and
- Upland (UL) - area delineated by dashed line on map, inferred to represent break in topography. Most development (e.g. roadways and buildings) is placed in the Upland area.

Figure 2-3 displays the development of the site along the bank of the Elizabeth River in Norfolk in the form of four historical NOAA charts from years 1894, 1930, 1969, and 2008. The 1894 chart shows the current shoreline with respect to Tarrant Creek. Though not shown on Figure 2-3, the NE-SW trending drainage is visible as late as 1959 on the charts and coincides well with the alignment of the existing tunnel. The shoreline charted on the 1969 map, post construction of the existing tunnel, coincides well with the current shoreline in the project area.

Figure 2-4 displays the footprint of large historical fill areas at the site. Episodic fills were interpreted through the comparison of shorelines displayed on NOAA charts. Based on review of the charts listed in Table 2-1, there appears to be at least three fill bodies within the former Tarrant Creek area. The depth of fill necessary to reclaim land may be greatest in the Fluvial morphological areas, and least in Upland areas.



LEGEND

- Current Shoreline (digitized from 2005 aerial photograph)
- Approximate Location of Midtown Tunnel (Refer to Section 7.1 in text)
- B-19 — 2008 VDOT Land Boring Location
- C-42 — 2008 VDOT Land CPT Location
- B-09 — 2008 Fugro Marine Boring Location
- C-34 — 2008 Fugro Marine CPT Location
- S-11 — Historical VDOT Boring Location

LIST OF MAPS AND AERIAL PHOTOS REVIEWED
Highlighted maps/photos are shown on this chart

Year	Map/Photo	Scale
1887	Sanborn Map & Publishing Co., Norfolk Virginia	1:2,400
1888	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1893	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1894	NOAA Chart BIC-45, Hampton Roads	1:20,000
1898	Sanborn Map & Publishing Co., Norfolk Virginia	1:9600
1903	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1910	Sanborn Map & Publishing Co., Norfolk Virginia, Vo. 1	1:9,600
1915	NOAA Chart No. 400, Hampton Roads	1:20,000
1920	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1921	Sanborn Map & Publishing Co., Norfolk Virginia, Vo. 3	1:9,600
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1924	NOAA Chart No. 400, Hampton Roads	1:20,000
1926	NOAA Chart No. 400, Hampton Roads	1:20,000
1928	NOAA Chart No. 400, Hampton Roads	1:20,000
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1959	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1968	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1969	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1975	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
1994	Digital Ortho Quarter Quadrangle, USGS Geological Survey	1.0 m/pixel
2005	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
2005	Ortho-Rectified Chesapeake Aerial Imagery	0.5 m/pixel
2008	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000

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1894 MORPHOLOGY MAP
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 2-1

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\06-Norfolk_SiteChar\MXD\Fig-2-1_1894_Morphology_Map.mxd, 10/31/08, kstevens

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\06-Norfolk_SiteChar\MXD\Fig-2-2_1894_Interp.mxd, 10/31/08, kstevens



LEGEND

1894 Interpreted Morphological Areas
See the table below for source used as basis of interpretation.

- Fluvial (FL)- Unknown material types
- Mud Flats (MF)- Likely fine-grained sediments with organics
- Lowlands (LL)- Unknown material types
- Uplands (UL)- Likely sandy materials
- Current Shoreline (digitized from 2005 aerial photograph)
- Approximate Location of Midtown Tunnel (Refer to Section 7.1 in text)
- B-19 — 2008 VDOT Land Boring Location
- C-42 — 2008 VDOT Land CPT Location
- B-09 — 2008 Fugro Marine Boring Location
- C-34 — 2008 Fugro Marine CPT Location
- S-11 — Historical VDOT Boring Location

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1898	Sanborn Map & Publishing Co., Norfolk Virginia	1:9600
1903	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1910	Sanborn Map & Publishing Co., Norfolk Virginia, Vo. 1	1:9,600
1915	NOAA Chart No. 400, Hampton Roads	1:20,000
1920	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1921	Sanborn Map & Publishing Co., Norfolk Virginia, Vo. 3	1:9,600
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1924	NOAA Chart No. 400, Hampton Roads	1:20,000
1926	NOAA Chart No. 400, Hampton Roads	1:20,000
1928	NOAA Chart No. 400, Hampton Roads	1:20,000
1930	NOAA Chart No. 400, Hampton Roads	1:20,000
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1959	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1968	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1969	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1975	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
1994	Digital Ortho Quarter Quadrangle, USGS Geological Survey	1.0 m/pixel
2005	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
2005	Ortho-Rectified Chesapeake Aerial Imagery	0.5 m/pixel
2008	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000

NOTE

1) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

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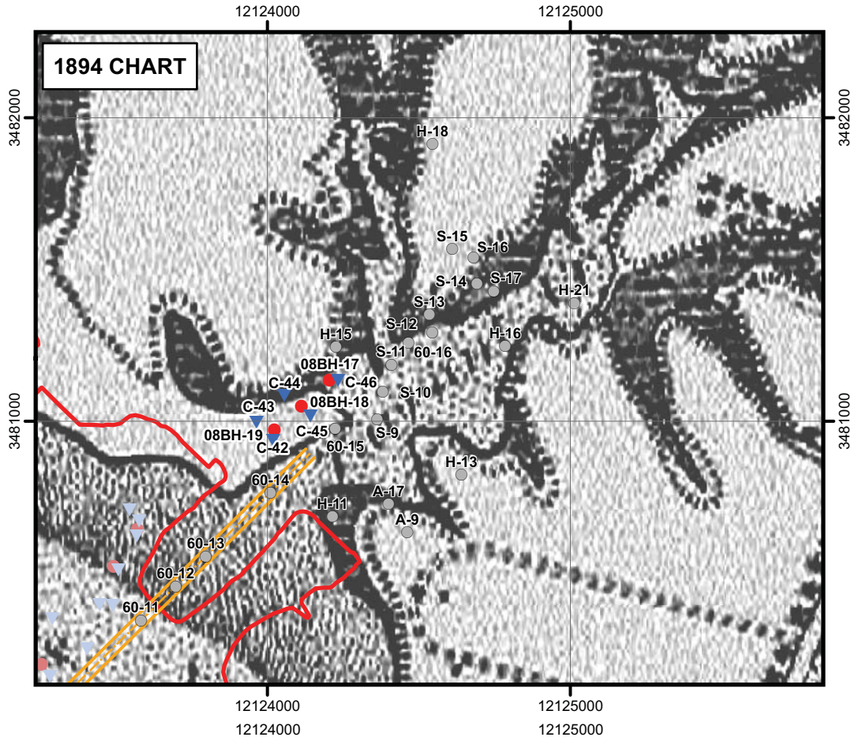
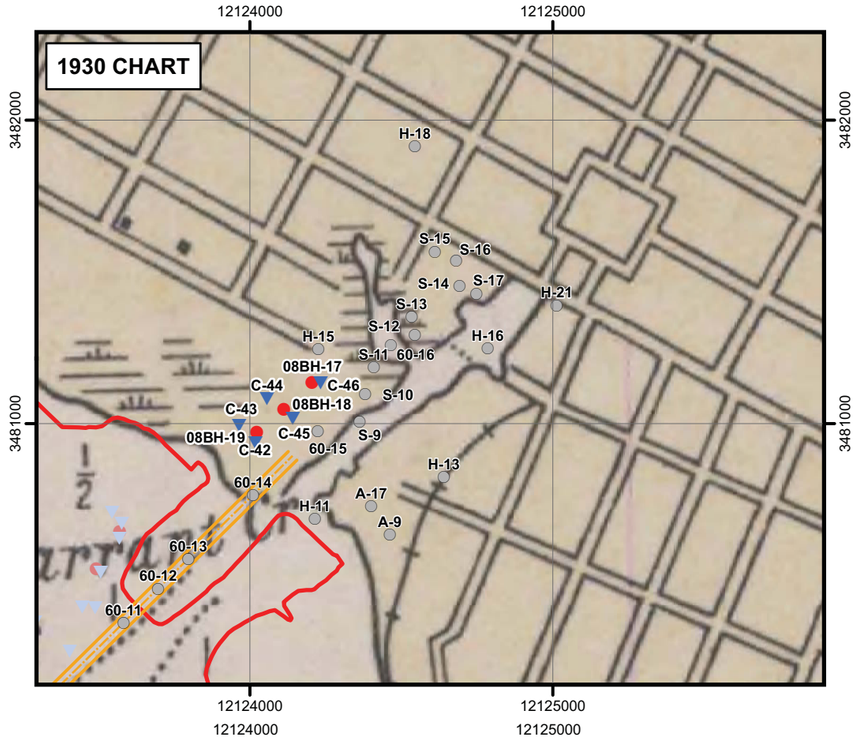
1894 MORPHOLOGY INTERPRETATION

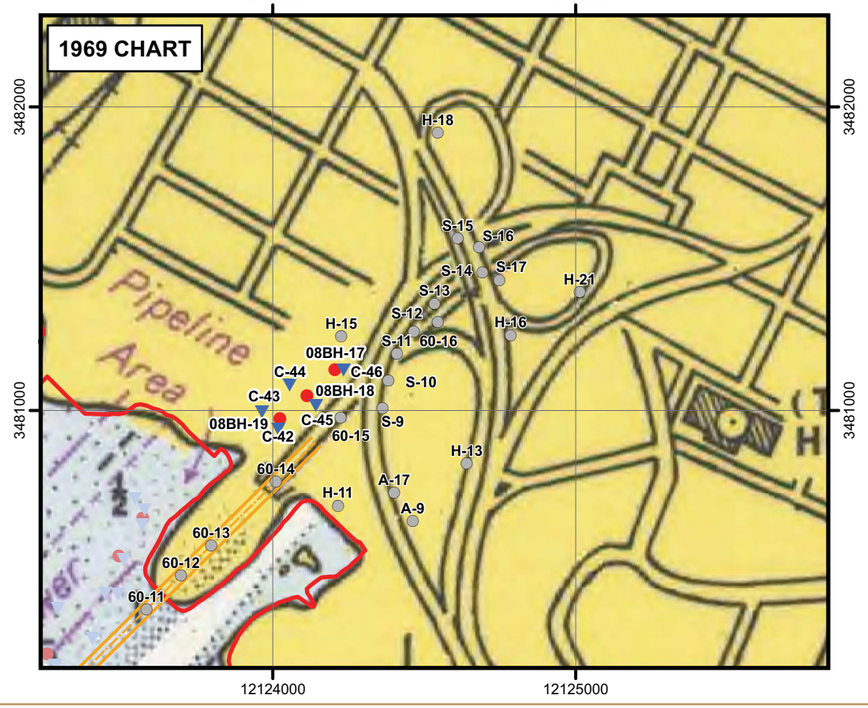
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

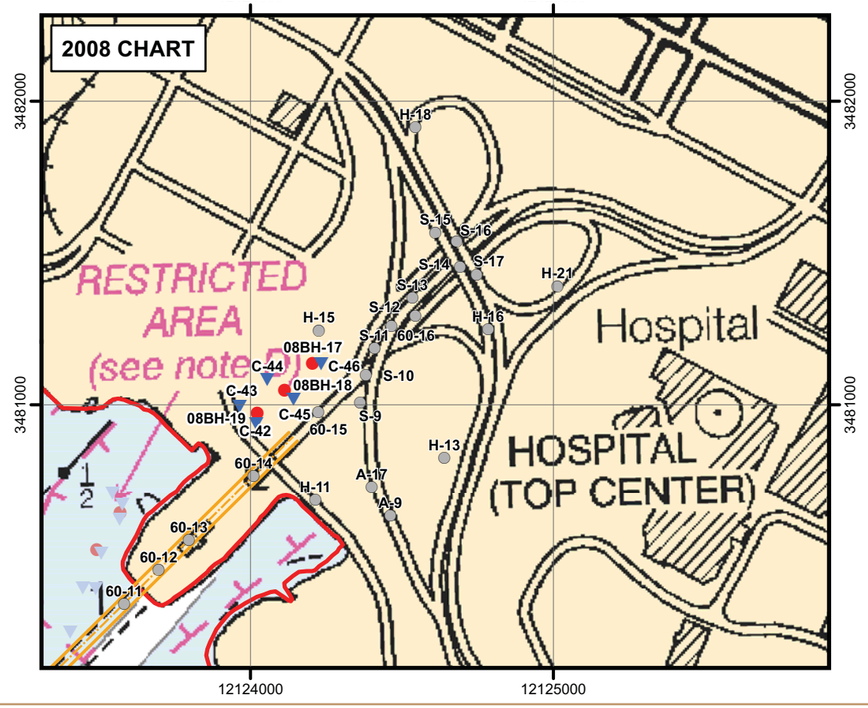
FIGURE 2-2

Virginia Department of Transportation
Project No. 3602.001









LEGEND

- Current Shoreline (digitized from 2005 aerial photograph)
- Approximate Location of Midtown Tunnel (Refer to Section 7.1 in text)
- B-19 — 2008 VDOT Land Boring Location
- C-42 — 2008 VDOT Land CPT Location
- 2008 Fugro Marine Boring Location
- 2008 Fugro Marine CPT Location
- S-11 — Historical VDOT Boring Location

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1893	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1894	NOAA Chart BiC-45, Hampton Roads	1:20,000
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1968	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1969	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1975	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
1994	Digital Ortho Quarter Quadrangle, USGS Geological Survey	1.0 m/pixel
2005	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
2005	Ortho-Rectified Chesapeake Aerial Imagery	0.5 m/pixel
2008	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000

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NORFOLK SITE DEVELOPMENT
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 2-3

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LEGEND

Historical Fill

Date when fill was first documented.
Refer to the table below for historical charts used to map fill bodies. See Note 1.

- Artificial Fill (af), 1969
- Artificial Fill (af), 1959
- Artificial Fill (af), 1930
- Current Shoreline (digitized from 2005 aerial photograph)
- Approximate Location of Midtown Tunnel (Refer to Section 7.1 in text)
- B-19 — 2008 VDOT Land Boring Location
- C-42 — 2008 VDOT Land CPT Location
- B-09 — 2008 Fugro Marine Boring Location
- C-34 — 2008 Fugro Marine CPT Location
- S-11 — Historical VDOT Boring Location

LIST OF MAPS AND AERIAL PHOTOS REVIEWED
Highlighted maps/photos are shown on this chart

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1893	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
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1898	Sanborn Map & Publishing Co., Norfolk Virginia	1:9600
1903	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1910	Sanborn Map & Publishing Co., Norfolk Virginia, Vo. 1	1:9,600
1915	NOAA Chart No. 400, Hampton Roads	1:20,000
1920	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1921	Sanborn Map & Publishing Co., Norfolk Virginia, Vo. 3	1:9,600
1923	NOAA Chart No. 400, Hampton Roads	1:20,000
1924	NOAA Chart No. 400, Hampton Roads	1:20,000
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1968	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1969	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1975	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
1994	Digital Ortho Quarter Quadrangle, USGS Geological Survey	1.0 m/pixel
2005	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
2005	Ortho-Rectified Chesapeake Aerial Imagery	0.5 m/pixel
2008	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000

NOTES

1) Historical Fill data indicates year of map in which the fill first appeared on the referenced NOAA Chart. For example, "af, 1959" body first appeared on the 1959 map and was placed sometime between 1930 and 1959.

2) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

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HISTORICAL FILL AREAS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 2-4

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3.0 SITE CONDITIONS

The site is located on the bank of the Elizabeth River in Norfolk, adjacent to Highway 58. Existing topography at the site is shown on Figure 1-3. The project site is generally flat, with ground elevations (El.) between 2 and 8 feet on the MHI Midtown Facility property, however, ground elevations at the site range as high as about 30 feet near the Brambleton overpass. Contours typically follow areas that have been cut or filled for construction of the roadways. A swale is evident in the area of the Norfolk City water pipeline shore crossing, but natural slopes, mounds, or swales are not discernable in this highly developed site.

3.1 OBSTRUCTIONS

Types of obstructions within the area on land identified during our surveys included the water and sewer pipelines. Historical fill areas to the immediate northwest of the existing tunnel indicated on Figure 2-4 suggest the presence of artificial fill in areas that may be impacted by the proposed second tunnel.

3.1.1 Data Review

We reviewed readily available engineering drawings, nautical charts, maps, and aerial photographs and identified several utilities within the project area. Table 2-1 lists the various information that we reviewed which includes drawings of various utilities within the project area.

3.1.2 Land Survey

Prior to our initiating the marine subsurface investigation Fugro notified MISS Utility of our intent to conduct subsurface explorations. Through this notification process, Fugro coordinated with utility companies that owned and operated utilities within our proposed work area to delineate their utility locations. Specifically, the City of Norfolk and Hampton Roads Sanitation District (HRSD) owned pipelines within the work area. Their utility locators delineated the shore crossings and a few hundred feet of the overland alignments. Figures 3-1a through 3-1c show the water pipeline at the shore crossing and the delineations made for the water and sewer pipelines.

Under subcontract to Fugro, NXL, Inc. surveyed those markings and several features of the existing Midtown Tunnel structure, as shown on Figure 3-2. This information was used to assist us in locating the respective structures. Refer to our Bottom Charting Data Report (Fugro, 2008b) for further discussion of those activities.



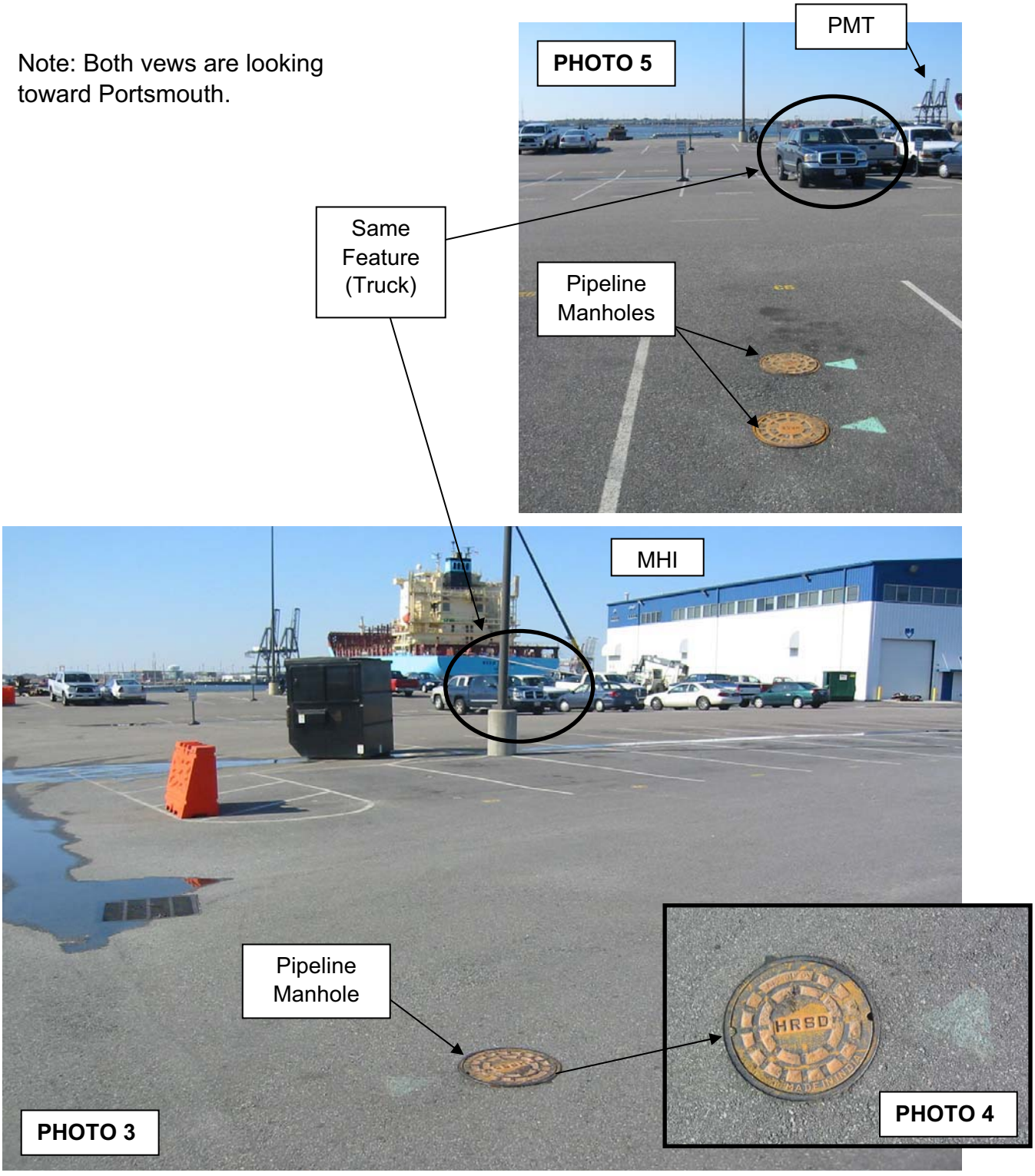
PHOTO 2: Pipeline and markings. Looking toward Portsmouth (southwest).



PHOTO 1: Pipeline markings looking toward Portsmouth (southwest).

PHOTOGRAPHS OF WATER PIPELINE AND LOCATION MARKINGS
Norfolk Land Survey
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

Note: Both vews are looking toward Portsmouth.



PHOTOGRAPHS OF SEWER PIPELINE LOCATION MARKINGS
Norfolk Land Survey
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

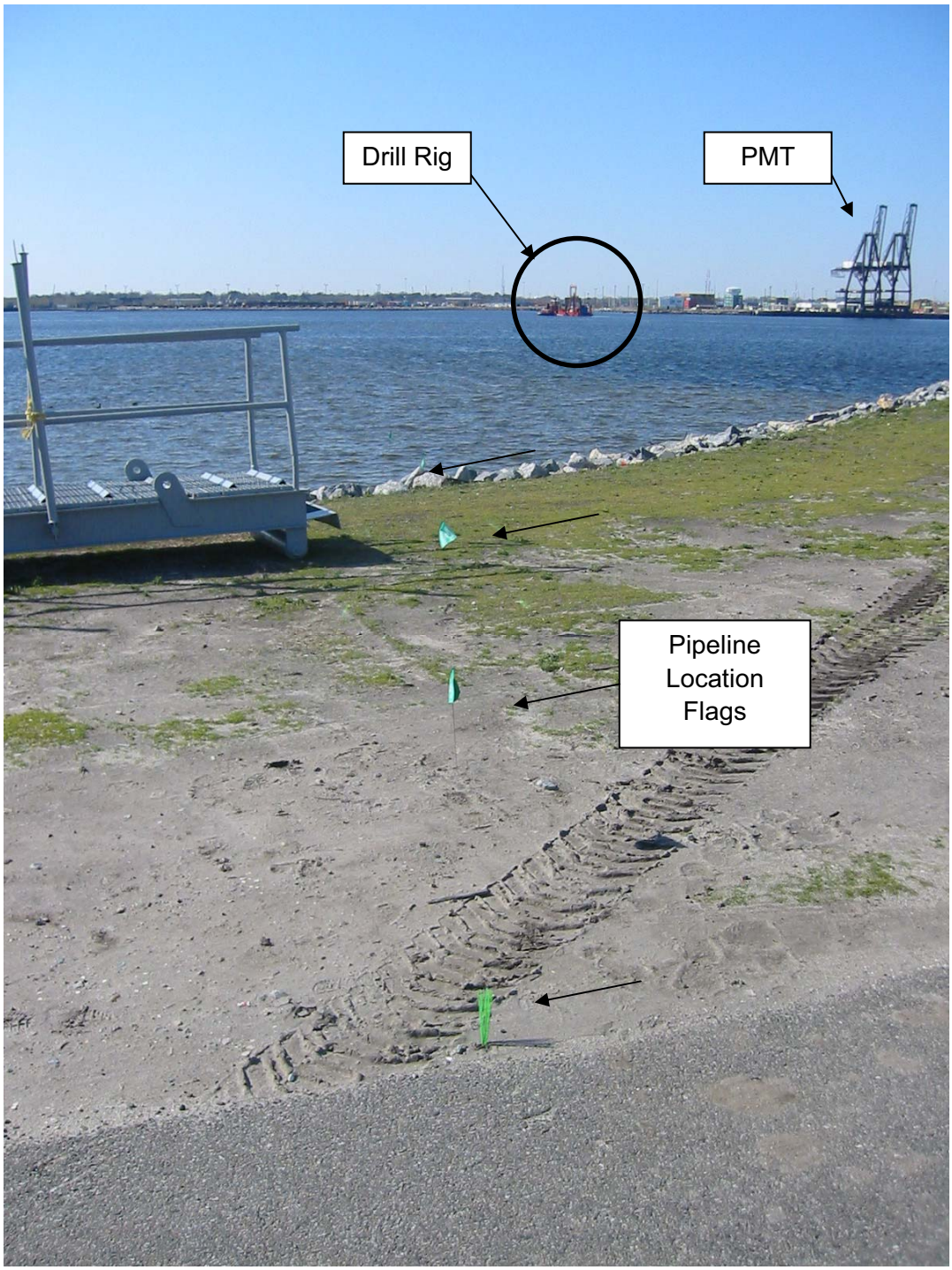
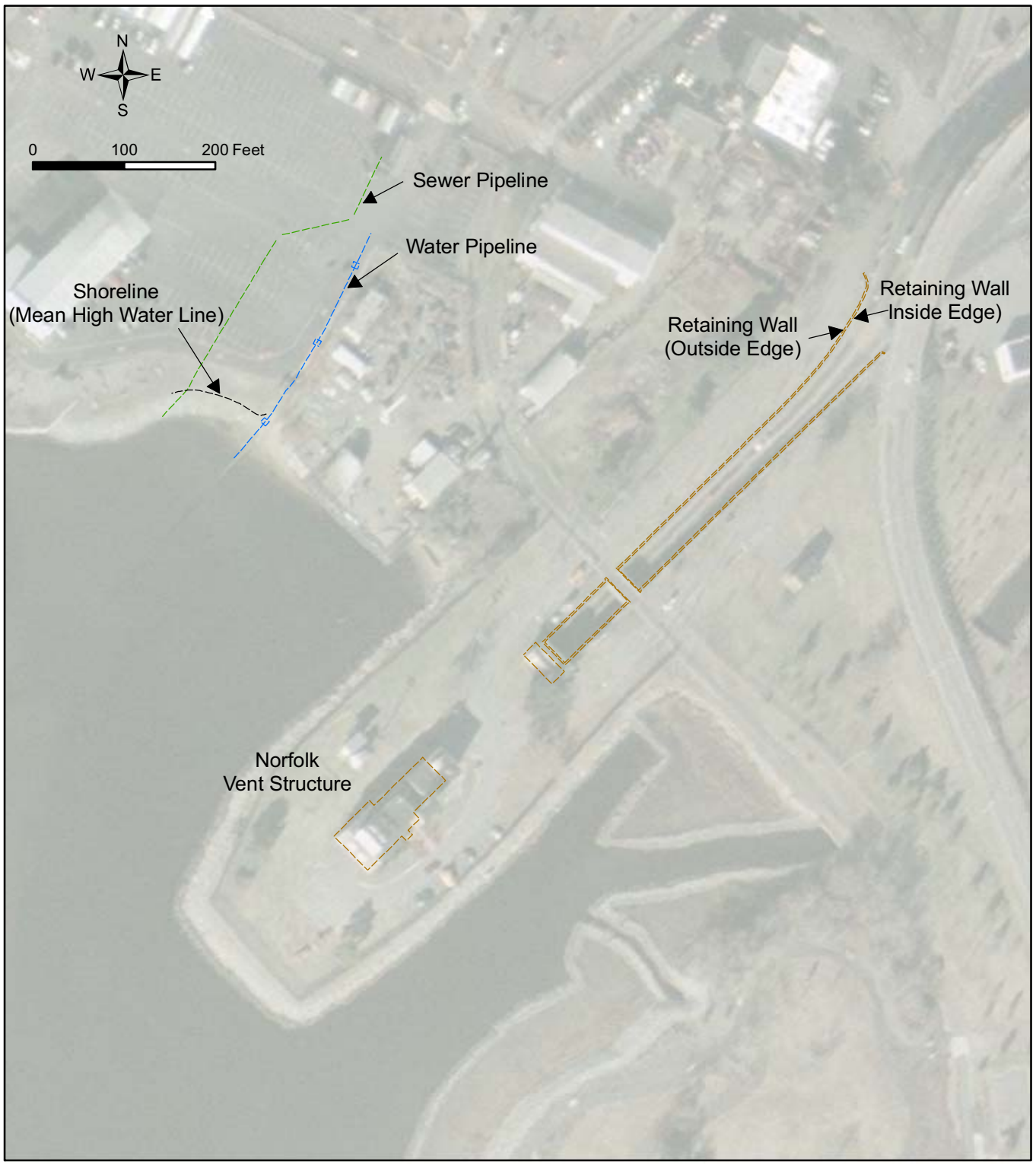


PHOTO 6: View is looking toward Portsmouth (southeast) from MHI facility.

PHOTOGRAPH OF SEWER PIPELINE LOCATION MARKINGS
Norfolk Land Survey
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia



Aerial Photo Source: Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000)
<<http://datagateway.nrcs.usda.gov/>>

NORFOLK LAND SURVEY
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 3-2

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\05-ER_SiteChar\MXD\Figures\Fig-3-6a_Norf_LandSurvey.mxd, 10/17/08, kspencer

4.0 SUBSURFACE INVESTIGATION

4.1 EXPLORATIONS

The subsurface stratigraphy was explored primarily through the use of geotechnical borings and CPT soundings. Samples were recovered at regular intervals during the advancement of each borehole. CPT soundings provided a continuous and rapid measurement of soils below the ground surface. Table 4-1 below summarizes all of the 2008 exploration data. VDOT's land explorations located in Norfolk are highlighted.

Table 4-1. Exploration Data

Boring Designation	Locale	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet)		River Bottom/Ground Surface Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
			Northing	Easting			
B-1	Marine	3/4/2008	3478965	12122033	-29.1	78.6	-107.7
B-2	Marine	3/3/2008	3479050	12122036	-29.6	98.3	-127.9
B-3	Marine	3/2/2008	3479246	12122243	-47.2	109.1	-156.3
B-4	Marine	3/1/2008	3479474	12122356	-48.2	99.3	-147.5
B-5	Marine	3/2/2008	3479583	12122610	-45.9	127.2	-173.1
B-6	Marine	2/25/2008	3479839	12122694	-26.1	109.1	-135.2
B-8	Marine	2/26/2008	3479980	12123065	-23.0	99.3	-122.3
B-9	Marine	2/27/2008	3480199	12123254	-11.9	88.9	-100.8
B-10	Marine	2/28/2008	3480522	12123492	-10.9	88.9	-99.8
B-11	Marine	2/29/2008	3480644	12123570	-11.0	79.1	-90.1
B-12	Land	6/13/2008	3477408	12120265	+10.2	41.4	-31.2
B-13	Land	6/16/2008	3477616	12120578	+9.9	61.5	-51.6
B-14	Land	6/11/2008	3477887	12120856	+9.1	101.5	-92.4
B-15	Land	6/25/2008	3478083	12121125	+7.2	101.5	-94.3
B-16	Land	6/26/2008	3478370	12121316	+6.9	101.5	-94.6
B-17	Land	7/1/2008	3481135	12124204	+6.9	41.5	-34.6
B-18	Land	7/2/2008	3481049	12124112	+6.5	61.5	-55.0
B-19	Land	7/8/2008	3480972	12124023	+5.2	101.5	-96.3
B-20	Land	7/9/2008	3478631	12121437	+6.9	101.5	-94.6

Note: B-7 was deleted from the drilling program.

CPT Designation	Locale	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet)		River Bottom/Ground Surface Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
			Northing	Easting			
C-1	Marine	4/25/2008	3478945	12122051	-29.5	85.3	-114.8
C-2	Marine	4/25/2008	3478998	12121993	-27.3	85.3	-112.6
C-3	Marine	4/25/2008	3479027	12121957	-25.8	85.3	-111.1
C-4	Marine	4/25/2008	3479063	12121918	-26.7	85.3	-112.0
C-5	Marine	4/26/2008	3479080	12122063	-32.0	82.4	-114.4

Table 4-1. Continued

CPT Designation	Locale	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet)		River Bottom/Ground Surface Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
			Northing	Easting			
C-6	Marine	4/26/2008	3479159	12122138	-37.5	79.5	-117.0
C-7	Marine	4/28/2008	3479194	12122308	-47.9	80.9	-128.9
C-8	Marine	4/28/2008	3479218	12122280	-47.8	78.0	-125.8
C-9	Marine	4/27/2008	3479240	12122145	-44.3	80.1	-124.4
C-10	Marine	4/27/2008	3479302	12122108	-46.9	83.7	-130.6
C-11	Marine	4/27/2008	3479376	12122360	-49.7	84.6	-134.3
C-12	Marine	4/27/2008	3479495	12122475	-47.6	84.6	-132.2
C-13	Marine	4/27/2008	3479508	12122637	-47.7	82.8	-130.5
C-14	Marine	4/27/2008	3479574	12122568	-45.6	84.1	-129.7
C-15	Marine	4/27/2008	3479613	12122512	-44.9	81.5	-126.4
C-16	Marine	4/27/2008	3479658	12122466	-44.8	84.8	-129.6
C-17	Marine	4/27/2008	3479676	12122694	-42.0	15.3	-57.4
C-18	Marine	4/25/2008	3479813	12122810	-22.0	84.8	-106.8
C-19	Marine	4/27/2008	3479778	12122660	-38.9	84.9	-123.8
C-20	Marine	4/28/2008	3479376	12122500	-51.5	76.5	-128.0
C-21	Marine	4/25/2008	3479941	12122893	-12.9	84.3	-97.2
C-22	Marine	4/28/2008	3479433	12122403	-47.8	26.6	-74.4
C-22A	Marine	4/28/2008	3479441	12122419	-48.0	74.9	-122.9
C-23	Marine	4/26/2008	3480276	12123114	-3.7	85.3	-89.0
C-24	Marine	4/25/2008	3480027	12123027	-9.3	74.8	-84.1
C-25	Marine	4/25/2008	3480052	12122969	-8.6	77.6	-86.2
C-26	Marine	4/24/2008	3480077	12123189	-20.5	81.5	-102.0
C-27	Marine	4/26/2008	3480348	12123290	-4.3	85.1	-89.4
C-28	Marine	4/24/2008	3480161	12123282	-17.0	91.6	-108.6
C-29	Marine	4/25/2008	3480250	12123405	-11.3	84.5	-95.8
C-30	Marine	4/24/2008	3480394	12123489	-10.4	24.9	-35.3
C-30A	Marine	4/24/2008	3480396	12123446	-10.2	97.6	-107.8
C-31	Marine	4/24/2008	3480511	12123508	-11.0	25.3	-36.3
C-32	Marine	4/24/2008	3480622	12123569	-10.9	84.8	-95.7
C-33	Marine	4/24/2008	3480672	12123577	-10.8	85.3	-96.1
C-34	Marine	4/25/2008	3480709	12123545	-10.8	46.8	-57.6
C-35	Marine	4/28/2008	3479687	12122761	-39.5	85.0	-124.5
C-36	Marine	4/28/2008	3479773	12122843	-30.1	65.8	-95.9
C-37	Marine	4/30/2008	3479961	12123101	-23.5	58.5	-82.0
C-38	Marine	4/30/2008	3480099	12123071	-7.3	85.2	-92.5
C-39	Land	9/12/2008	3477433	12120368	+9.1	9.4	-0.3
C-40	Land	9/12/2008	3477597	12120583	+9.0	62.8	-53.9
C-41	Land	9/12/2008	3477863	12120878	+8.2	73.2	-64.9
C-42	Land	9/15/2008	3480938	12124019	+5.2	56.4	-51.3

Table 4-1. Continued

CPT Designation	Locale	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet)		River Bottom/Ground Surface Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
			Northing	Easting			
C-43	Land	9/15/2008	3480996	12123964	+5.0	42.2	-37.2
C-44	Land	9/15/2008	3481084	12124056	+5.7	36.3	-30.5
C-45	Land	9/15/2008	3481017	12124142	+6.1	68.1	-62.0
C-46	Land	9/15/2008	3481135	12124234	+6.6	31.0	-24.4
C-47	Land	9/17/2008	3478829	12121597	+6.2	113.4	-107.1

Explorations listed below were conducted as part of the marine geotechnical program

Fugro T-Bar Designation	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet)		River Bottom Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)	Cyclic Test Depths (feet)
		Northing	Easting				
T-1	4/29/2008	3479069	12122071	-32.6	33.1	-65.7	8.4, 18.2, 28.1, 32.3
T-2	4/29/2008	3479211	12122294	-47.7	13.4	-61.1	7.7, 12.6
T-3	4/28/2008	3479663	12122476	-44.3	11.5	-55.8	5.7, 10.7
T-4	4/28/2008	3479804	12122819	-23.5	37.7	-61.2	7.4, 17.2, 27.1, 36.9

Fugro Vane Shear Designation	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet)		River Bottom Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)	Test Depths (feet) "R" indicates remold test was performed
		Northing	Easting				
V-1	4/29/2008	3479104	12122073	-31.9	31.3	-63.2	10.6 R, 23.1 R, 31.3 R
V-2	4/29/2008	3479223	12122291	-48.4	9.8	-58.2	9.8 R
V-3	4/29/2008	3479672	12122464	-44.1	11.4	-55.5	6.5 R, 11.4 R
V-4	4/29/2008	3479817	12122822	-21.7	39.8	-61.5	10.3, 20.1, 29.9, 39.8

4.2 HISTORICAL GEOTECHNICAL INFORMATION

A geotechnical study was conducted at the site in the late 1950s to early 1960s in anticipation of the original tunnel construction. Both land and marine borings were performed. Land borings were advanced to depths ranging between about 30 and 100 feet, and marine borings to about 100 feet. Borings from this investigation (shown on Figure 1-3) do not contain laboratory test data. Attempts to access historical reports, which contain such information, by Fugro and VDOT, were unsuccessful.

5.0 LABORATORY TESTING AND SUBSURFACE CONDITIONS

5.1 LABORATORY TESTING

A geotechnical laboratory program was conducted on samples recovered from the land borings. Once drilling operations were complete, testing was performed at VDOT's laboratory in Suffolk, Virginia. A summary of laboratory test results is presented on Figures B-1a to B-1b. Laboratory tests included:

- Moisture content determinations,
- Atterberg Limits, and
- Grain Size Distribution (Sieve Analyses) tests.

Descriptions of laboratory test procedures are provided in the following sections.

5.1.1 Moisture

Moisture contents were determined in general accordance with AASHTO method T-265. Moisture contents are presented on the Logs of Borings and Test Results (Figures A-2 to A-4c) and the Summaries of Laboratory Test Results (Figures B-1a to B-1b).

5.1.2 Particle Size Analyses

Particle Size Analyses were performed on several samples of coarse- and fine-grained material in general accordance with AASHTO method T-27. Grain size curves are presented on Figure B-2a through -2d.

5.1.3 Atterberg Limits

Liquid and plastic limits, collectively termed Atterberg Limits, were determined in accordance with AASHTO method T-89, and T-90, respectively. Atterberg Limits test results are presented on the Plasticity Chart on Figure B-3.

5.2 REGIONAL GEOLOGY

The project area is located in the Coastal Plain physiographic province. Flat-lying plains and terraces dominate the landscape. The Coastal Plain is underlain by a wedge of Cretaceous to Holocene age sediments that thicken to the east and pinch out at the Fall Line approximately 70 miles west of the project area. Jurassic-Triassic age basement rocks lie approximately 1,800 feet beneath the site. The wedge of Cretaceous and younger sediments were deposited as a result of multiple marine transgressions and regressions. Sediments within the upper 150 feet beneath the site are Pliocene to Recent in age. The Pliocene and younger sediments have been deposited and subsequently eroded in places during the rising and falling sea levels that resulted from glacial and interglacial periods. Figure 5-1 presents a geologic map of the area and Figure 5-2 presents a geologic cross section. We acknowledge that the Norfolk and

Sandbridge Formations shown in Figures 5-1 and 5-2 are referred to in more recent publications as the Tabb Formation.

5.3 OVERVIEW OF PRINCIPAL STRATIGRAPHIC UNITS

VDOT's 2008 land site investigation program explorations in Norfolk encountered subsurface conditions beneath the proposed project area primarily consisting of interbedded medium dense sandy fills with various amounts of silts and clays. Beneath the fill, explorations encountered interbedded very soft to soft Alluvium (Qal). Several historical borings within the northeastern portion of the site encountered loose to medium dense silty sand of the Late Pleistocene Sand Bridge Formation below the Alluvium. Below the Sand Bridge Formation or areas where it is absent, loose to medium dense granular material of the Late Pleistocene Norfolk Formation (Qn) underlies the Alluvium. Beneath the Norfolk Formation lie the Yorktown Formation, primarily horizontally-bedded, Pliocene granular sediments.

The subsurface stratigraphy within the proposed project area is displayed on six subsurface cross sections. Subsurface cross sections displaying classification test results are presented on Figures 5-3a through 5-3g. A key to the symbolism used on those sections is shown on Figure 5-4.

Longitudinal subsurface cross sections are oriented in a SW-NE direction and drawn looking NW through the proposed project area. A-A' is located approximately 200 feet northwest of the existing tunnel, B-B' approximately 100 feet northwest of the existing tunnel, and C-C' is through the existing tunnel alignment. Please note C-C' is split in two and joined by a matchline for presentation as figures C-C' and C'-C". Transverse Sections 1-1' through 3-3' are oriented in a NW-SE and drawn looking NE across the proposed project area.

The interpreted strata, in descending sequence, include:

Artificial Fill (Af). Several explorations northwest of the existing tunnel alignment (e.g. cross section A-A') encountered a thin layer of artificial fill associated with historical development activities (see Figures 2-3 and 2-4) that infilled the Tarrant Creek drainage basin, e construction materials used during construction of the tunnel and surrounding facilities. The 2008 explorations encountered fills up to about 5 feet thick. Artificial fill materials are inferred to be thicker in areas near the existing tunnel (as shown on the cross sections) based on our review of the 1960 design drawings that depict a proposed excavation for the tunnel construction. We have transferred that design excavation information onto the cross sections. Explorations which penetrated the artificial fill placed during the first tunnel construction are shown on Figures 5-3b, and 5-3c. The thickness of artificial fill placed in the original dredge cut ranges between several to 50 feet.

Physical samples from borings of the fill material generally classified as Silty Fine Sand (SM) with medium sand. The 2008 and historical borings also encountered various debris within the fill materials. The fill is interpreted to extend down to about El. 0 to +3 feet (re: MLLW datum) at the 2008 land borings explored. CPT explorations also encountered sediments inferred to be fill material. The 2008 land CPTs encountered primarily coarse-grained

sediments with varying amounts of fine-grained materials in the surficial fill. The transition from fill into the underlying material is subtle but distinct. VDOT land CPTs did not collect pore pressure data, however, tip resistance and sleeve friction are higher in the upper several feet. Additionally, the fill material is less homogenous than the underlying Holocene alluvium.

The fill materials likely consist of engineered fills near critical tunnel structures and non-engineered materials placed since the late 1800's. The 2008 explorations were conducted in an area where a fill body was placed sometime between 1894 and 1930 (Figures 2-3 and 2-4). At least two other fill bodies placed may be present in the project area as shown on Figure 2-4. Those two fill bodies were placed between 1930 and 1959, and 1959 and 1969. It is unknown whether they were placed during one event or during several events.

Alluvium (Qal_c) - Coarse-Grained Upper Unit. Alluvium is separated into upper coarse- and lower fine-grained stratigraphic units. The upper unit, coarse-grained alluvium classifies predominantly as Fine Sand (SP) to Silty Fine Sand (SM) and is considered to be deposited in a fluvial-estuarine environment. In areas that coincide with Mud Flats and Lowlands, interbedded materials which include Sandy Clay (CL), to Silt (ML) were encountered near El. 0 ft. These interbedded fine-grained layers are typically less than two feet thick. The upper coarse-grained unit is typically 5 to 23 feet thick and extends down to about El. -20 feet. It is thickest along cross section B-B' and has channel-like appearance (concave lower contact) that is bisected by the transverse (numeric) cross sections. The unit appears to pinch out in the river (between Elizabeth River cross sections 8-8' and 9-9') and to the south by cross section C-C' or the former location of Tarrant Creek.

Alluvium (Qal_f) - Fine-Grained Lower Unit. A fine-grained unit was encountered below the coarse-grained unit. This material generally classified as very soft to soft to Clay (CL/CH) with some organics. This unit is inferred to be deposited in a low energy fluvial-esturarine or lagoonal environment. Although this unit was deposited contemporaneously with the soft fine-grained alluvium encountered in the river, it has slightly different engineering properties. For example, the plasticity indices and liquid limits are 30 to 50 percent lower than the clay encountered in the river. This unit is ranges from about 10 feet to almost 30 feet thick and extends down to as deep as El. -40 feet at the locations of the 2008 explorations.

Sand Bridge Formation (Qsb). This unit is mapped as the surficial unit throughout most of this part of the city. However, within our study area, only a few of the historical borings encountered it in the subsurface in the northeastern portion of the site. It was encountered on the north side of the former Tarrant Creek drainage and east of the small, south-trending drainage that formerly fed into Tarrant Creek. It generally classifies as a Fine to Coarse Sand (SW), Sand with Silt (SPSM), or Clayey Sand (SC). Where encountered, it typically is 10 to 15 feet thick and extends down to about El. -31 feet. Uncorrected blow count N-values typically range from 7 to 64 with most between 23 and 34. Unfortunately laboratory test results from the historical borings are not available and the 2008 borings did not encounter this material. Therefore, characterization discussion of this unit is limited to this section of the report.

Norfolk Formation (Qn). The predominantly fine-grained Alluvium or where the Sand Bridge is present, is underlain by a zone of granular Pleistocene age fluvial-estaurine and

brackish marine deposits that classify primarily as Silty Fine Sand (SM) to Fine Sand (SP). . The thickness of this stratum varies between about 5 and 20 feet at the locations explored.

Yorktown Formation Sand (Ty). Granular material of the Pliocene age Yorktown Formation classified as Silty to Clayey Fine Sand (SM to SC). The top of this stratum was encountered between El. -39 to -50 feet. It was encountered to the maximum depth explored with the geotechnical explorations.

5.4 GROUNDWATER

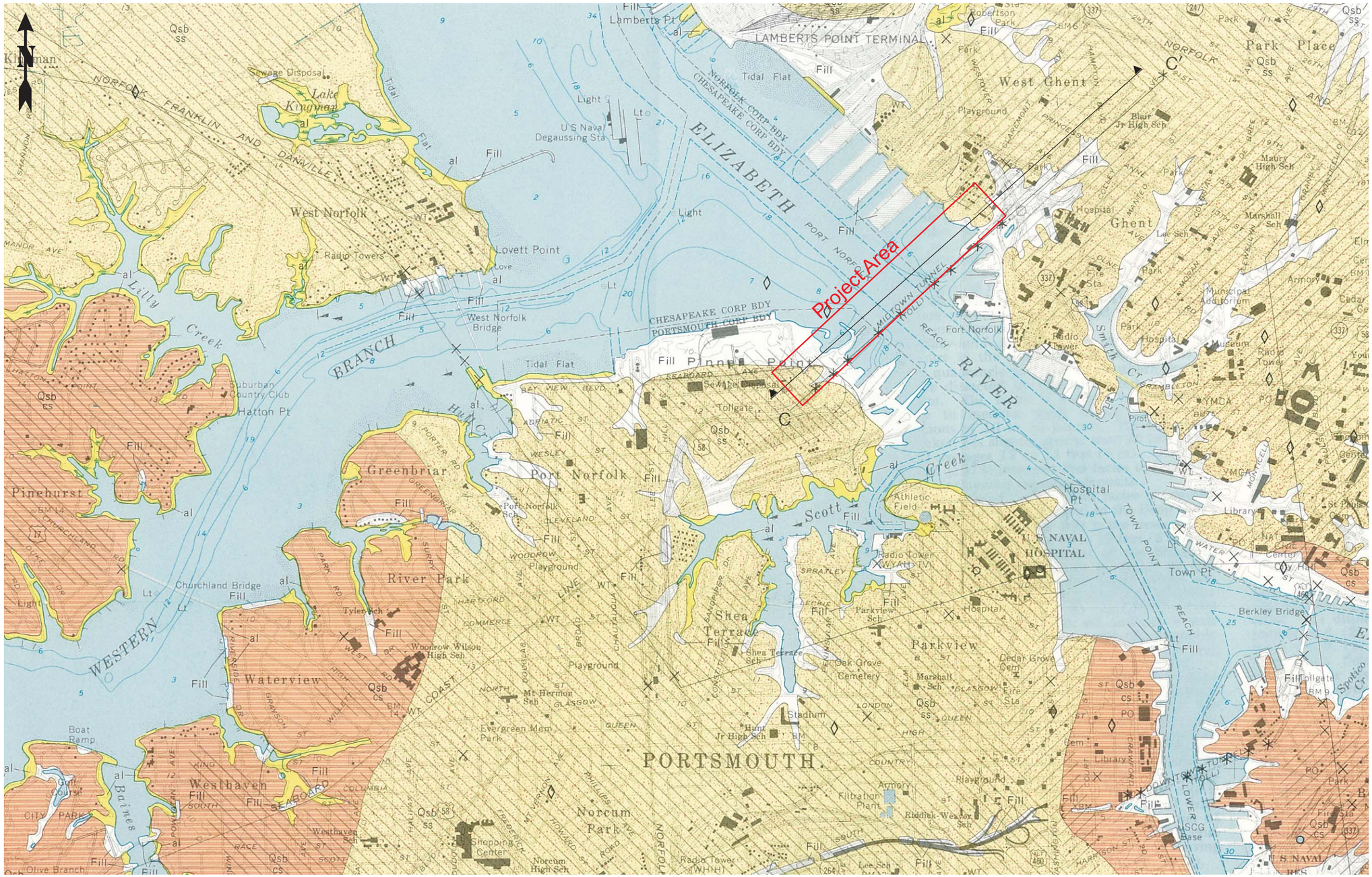
Marshall Miller and Associates (MMA) constructed permanent groundwater monitoring wells at seven boreholes (two on the Norfolk side of the river) near the Midtown Tunnel as shown on Figure 1-3 and Chart 1. The wells were constructed using 2-inch-diameter polyvinyl chloride (PVC) piping attached to a section of slotted (0.010-inch) screen. The wells were set with clean silica sand (No. 2) that extended 2 feet above the top of screen before bentonite was placed in the well to the surface. At the surface, the wellheads were completed with an 8-inch-diameter access vault/lid set in a concrete pad. On July 15-16, 2008, the seven wells were developed of approximately three well volumes of groundwater per well with a Grundfos® pump. On July 17, 2008, the wells were purged an additional three well volumes, then sampled using disposable plastic bailers. Table 5-1 summarizes the 2008 well data. Wells located in Norfolk are highlighted in the table. Additional information about the wells and water level measurements are provided in the MMA (2008) report.

Table 5-1. Summary of Groundwater Monitoring Wells

Well	Riser Depth Interval (feet)	Screen Depth Interval (feet)	Depth to Groundwater (feet)
MW-1 (08BH-012)	0-5	5-15	6.40
MW-2 (08BH-013)	0-10	10-25	6.42
MW-3 (08BH-014)	0-20	20-35	4.75
MW-4 (08BH-015)	0-30	30-50	3.95
MW-5 (08BH-016)	0-45	45-65	4.90
MW-6 (Between (08BH-018 and 08BH-019)	0-20	20-35	3.73
MW-7 (Between (08BH-018 and 08BH-017)	0-5	5-20	3.64

* Data provided to Fugro by Marshall Miller and Associates, 10/31/08

Based on groundwater elevations measured in July for this study, we believe groundwater is present at about El. 1 to 2 feet, or about 3 to 4 feet below the existing ground surface. Groundwater elevations between about El. -1 to -3 (depths ranging between 6 and 8 feet) were observed in VDOT's boreholes 08BH-017 to 08BH-019 for this study in July 2008. However, these were initial groundwater measurements and no long-term static measurements were taken.



GEOLOGIC LEGEND

QUATERNARY

HOLOCENE

al — **Alluvium, sand, and marsh sediment**: Estuarine-beach, tidal marsh, and fluvial silt, sand, and clay with organic material (peat) abundant in tidal marshes.

PLEISTOCENE

Qsb (cs, ss, sc) — **Sand Bridge Formation:** Upper member; facies-cs, tidal channel, clayey sand; ss, shoal lagoonal, silty sand; and sc, lagoonal, silty clay. (Lower member included with upper member).

Qn ss — **Norfolk Formation:** Upper member, facies-ss, brackish marine silty sand; (Lower member included with upper member).

TERTIARY

PLIOCENE

Ty — **Yorktown Formation (in Section C-C', only)**: near shore marine fossiliferous, silty, coarse sand and coquina.

0 1000 2000 feet

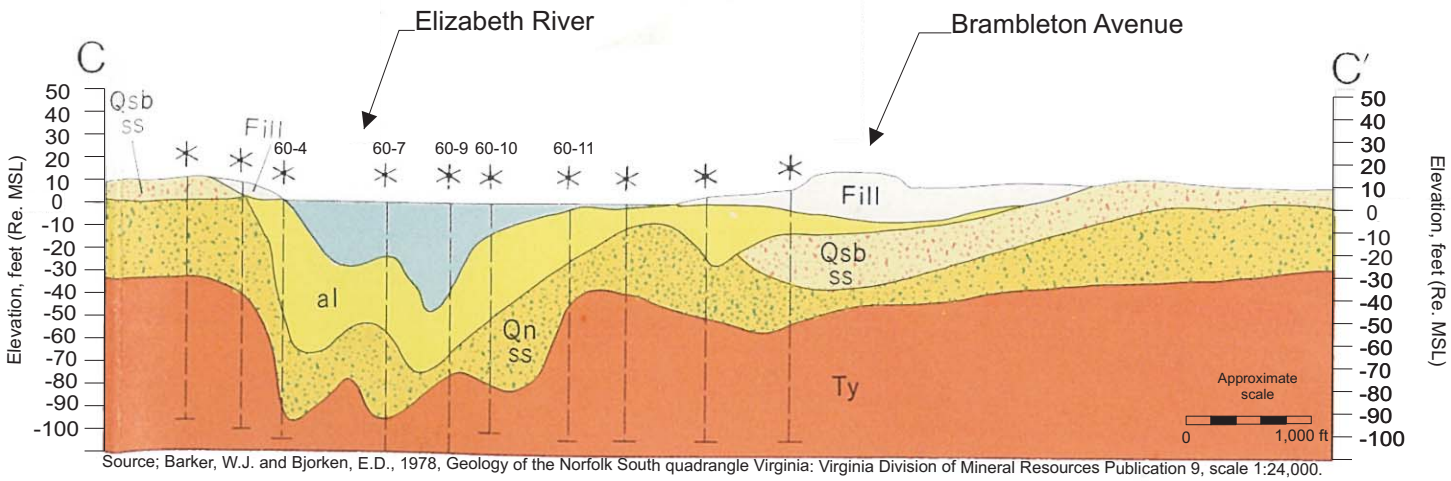
CONTOUR INTERVAL 5 FEET, DATUM IS MEAN SEA LEVEL, DEPTH CURVES AND SOUNDINGS IN FEET - DATUM IS MEAN LOW WATER
Shoreline shown represents the approximate line is mean high water; the mean range of tide is approximately 2.5 feet.

Source: Barker, W.J. and Bjorken, E.D., 1978, Geology of the Norfolk south quadrangle Virginia: Virginia Division of Mineral Resources Publication 9, scale 1:24,000

Note:
Refer to Figure 5-2 for cross section C-C'.

GEOLOGIC MAP
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-1

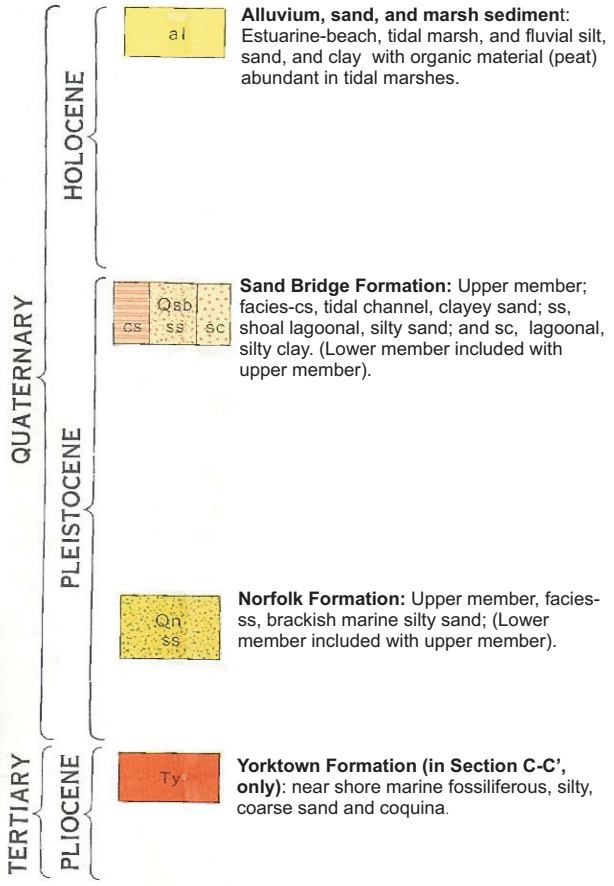


Source; Barker, W.J. and Bjorken, E.D., 1978, Geology of the Norfolk South quadrangle Virginia: Virginia Division of Mineral Resources Publication 9, scale 1:24,000.

Note:

Cross Section C-C' is located approximately along alignment of existing tunnel. Refer to Figure A-1 for location. Cross section is from geologic map published in 1978. Subsurface conditions shown on cross section reflect the authors' (Barker and Bjorken) interpretations at time of publication. This cross section DOES NOT INCLUDE post-1978 INFORMATION OR INTERPRETATION BASED ON MORE RECENT DATA (e.g. 2008 explorations). Borings shown on map are presumed to be from 1960.

GEOLOGIC LEGEND



Alluvium, sand, and marsh sediment: Estuarine-beach, tidal marsh, and fluvial silt, sand, and clay with organic material (peat) abundant in tidal marshes.

Sand Bridge Formation: Upper member; facies-cs, tidal channel, clayey sand; ss, shoal lagoonal, silty sand; and sc, lagoonal, silty clay. (Lower member included with upper member).

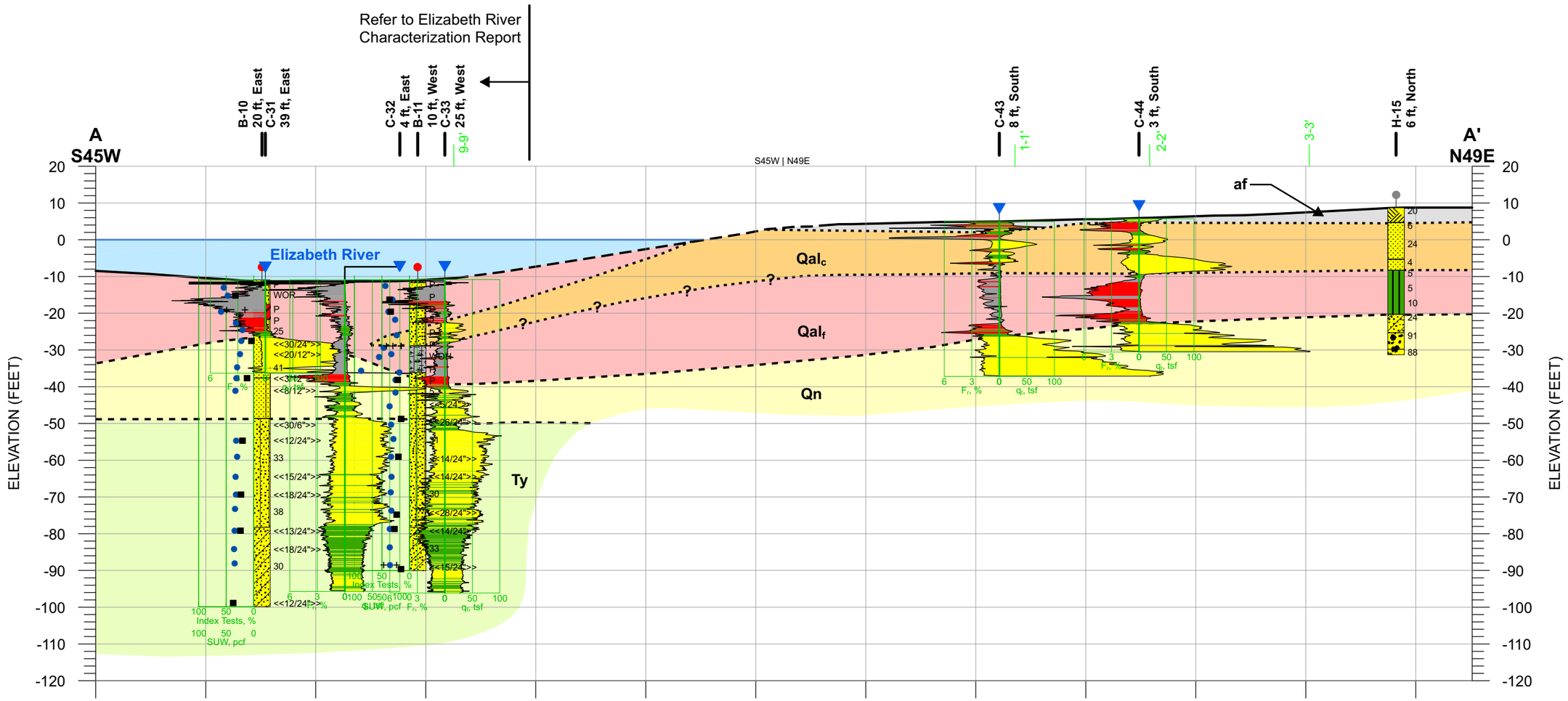
Norfolk Formation: Upper member, facies-ss, brackish marine silty sand; (Lower member included with upper member).

Yorktown Formation (in Section C-C', only): near shore marine fossiliferous, silty, coarse sand and coquina.

GEOLOGIC CROSS SECTION

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-2



NOTES:

1) Bathymetric data from 2008 multibeam and single beam surveys. Refer to Fugro (2008b) for description of surveys. Topographic data from City of Norfolk 2000 photogrammetric survey.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-4 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

LEGEND

Stratigraphic Units

- Elizabeth River
- Artificial Fill (af)
- Alluvium (Qal$_c$) - loose to medium dense silty sand
- Alluvium (Qal$_f$) - soft to firm clay
- Norfolk (Qn) - loose to medium sand
- Yorktown (Ty) - silty fine sand

Explorations

- 2008 VDOT (Land) and Fugro (Marine) CPT
- 2008 VDOT (Land) and Fugro (Marine) Boring
- 1957-1960 Historical Boring

30 ft
100 ft
Horizontal and Vertical Scales
Vertical exaggeration is ~3x.

SUBSURFACE CROSS SECTION A-A' WITH CLASSIFICATION RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3a

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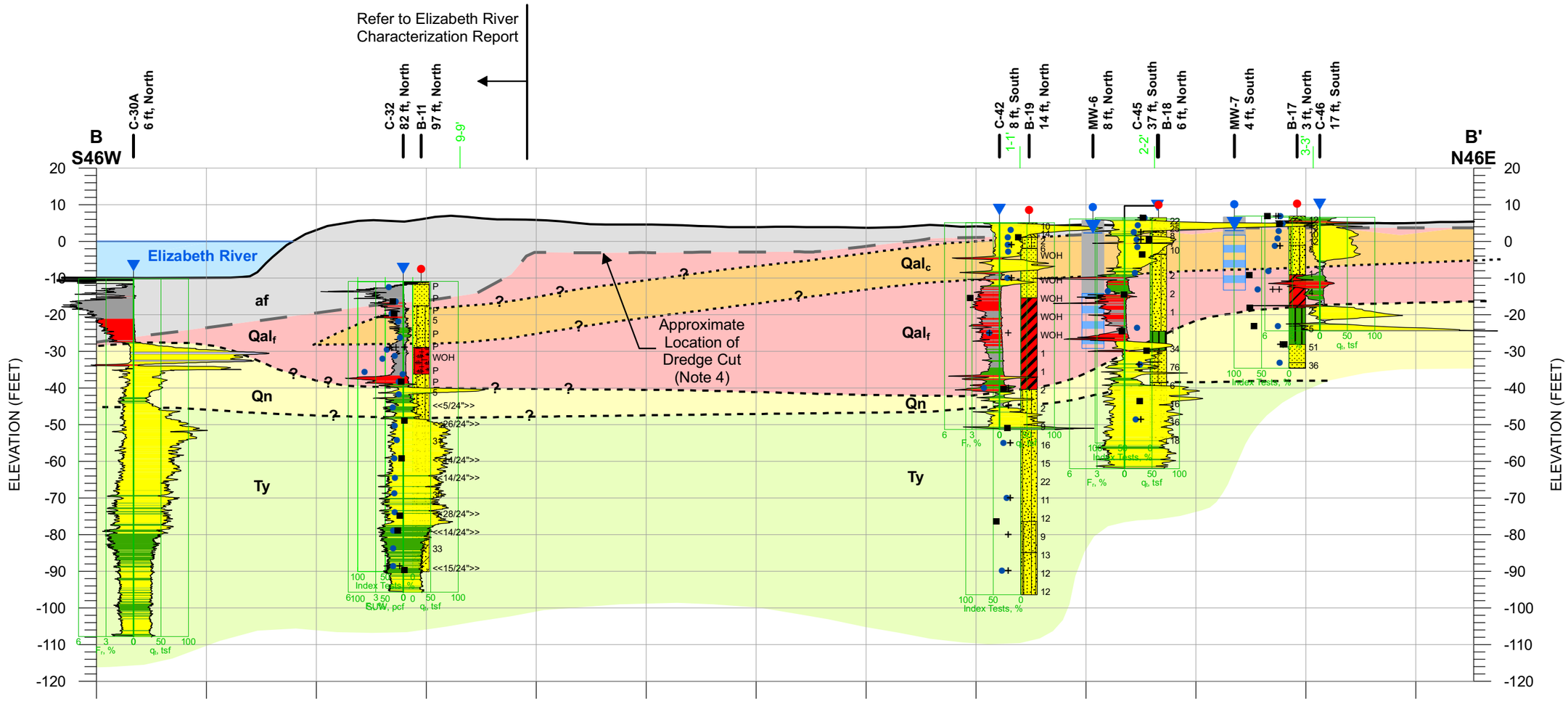

NOTES:

1) Bathymetric data from 2008 multibeam and single beam surveys. Refer to Fugro (2008b) for description of surveys. Topographic data from City of Norfolk 2000 photogrammetric survey.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-4 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

LEGEND

Stratigraphic Units

- Elizabeth River
- Artificial Fill (af)
- Alluvium (Qal_c) - loose to medium dense silty sand
- Alluvium (Qal_f) - soft to firm clay
- Norfolk (Qn) - loose to medium sand
- Yorktown (Ty) - silty fine sand

Explorations

- 2008 VDOT (Land) and Fugro (Marine) CPT
- 2008 VDOT (Land) and Fugro (Marine) Boring
- 2008 MMA (Land) Monitoring Well

30 ft
100 ft
Horizontal and Vertical Scales
Vertical exaggeration is ~3x.

SUBSURFACE CROSS SECTION B-B' WITH CLASSIFICATION RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3b

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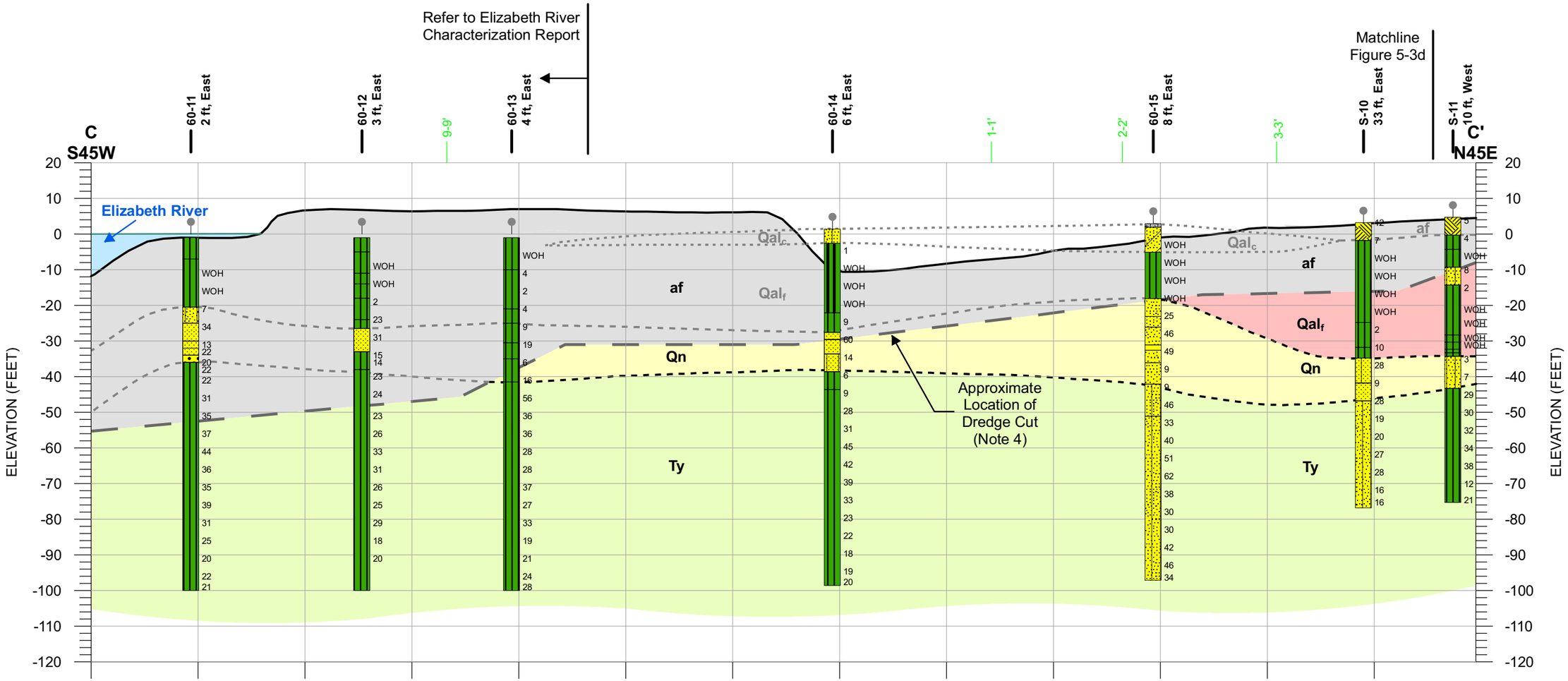

NOTES:

1) Bathymetric data from 2008 multibeam and single beam surveys. Refer to Fugro (2008b) for description of surveys. Topographic data from City of Norfolk 2000 photogrammetric survey.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-4 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

LEGEND

Stratigraphic Units

- Elizabeth River
- Artificial Fill (af)
- Alluvium (Qal_c) - loose to medium dense silty sand
- Alluvium (Qal_f) - soft to firm clay
- Norfolk (Qn) - loose to medium sand
- Yorktown (Ty) - silty fine sand

Explorations

- 1957-1960 Historical Boring

30 ft
100 ft
Horizontal and Vertical Scales
Vertical exaggeration is ~3x.

SUBSURFACE CROSS SECTION C-C' WITH CLASSIFICATION RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3c

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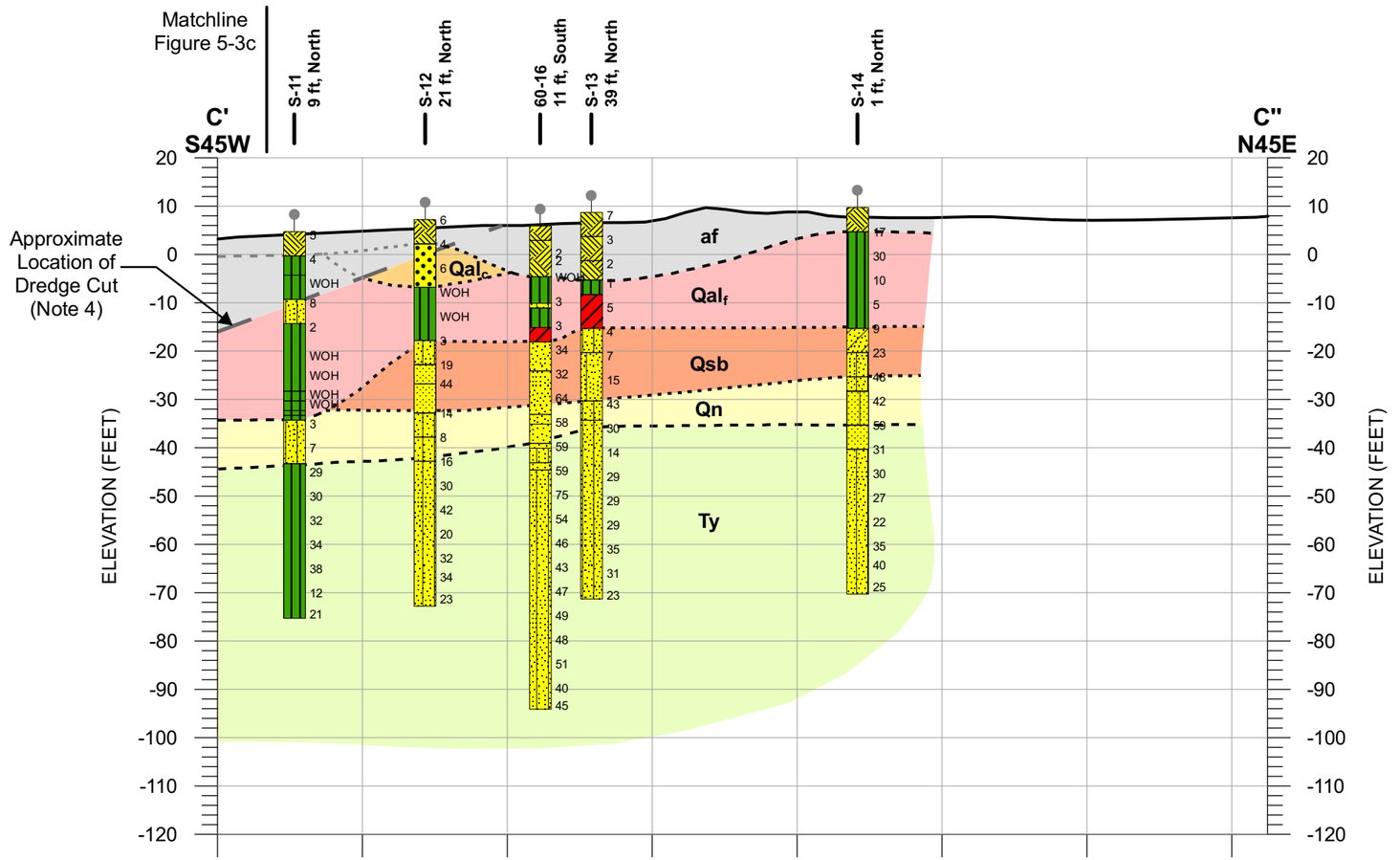

LEGEND

Stratigraphic Units

- Artificial Fill (af)
- Alluvium (Qal_c) - loose to medium dense silty sand
- Alluvium (Qal_f) - soft to firm clay
- Sandbridge (Qsb) - silty sand
- Norfolk (Qn) - loose to medium sand
- Yorktown (Ty) - silty fine sand

Explorations

- 1957-1960 Historical Boring

NOTES:

1) Bathymetric data from 2008 multibeam and single beam surveys. Refer to Fugro (2008b) for description of surveys. Topographic data from City of Norfolk 2000 photogrammetric survey.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-4 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

30 ft
100 ft
Horizontal and Vertical Scales
Vertical exaggeration is ~3x.

SUBSURFACE CROSS SECTION C'-C" WITH CLASSIFICATION RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3d

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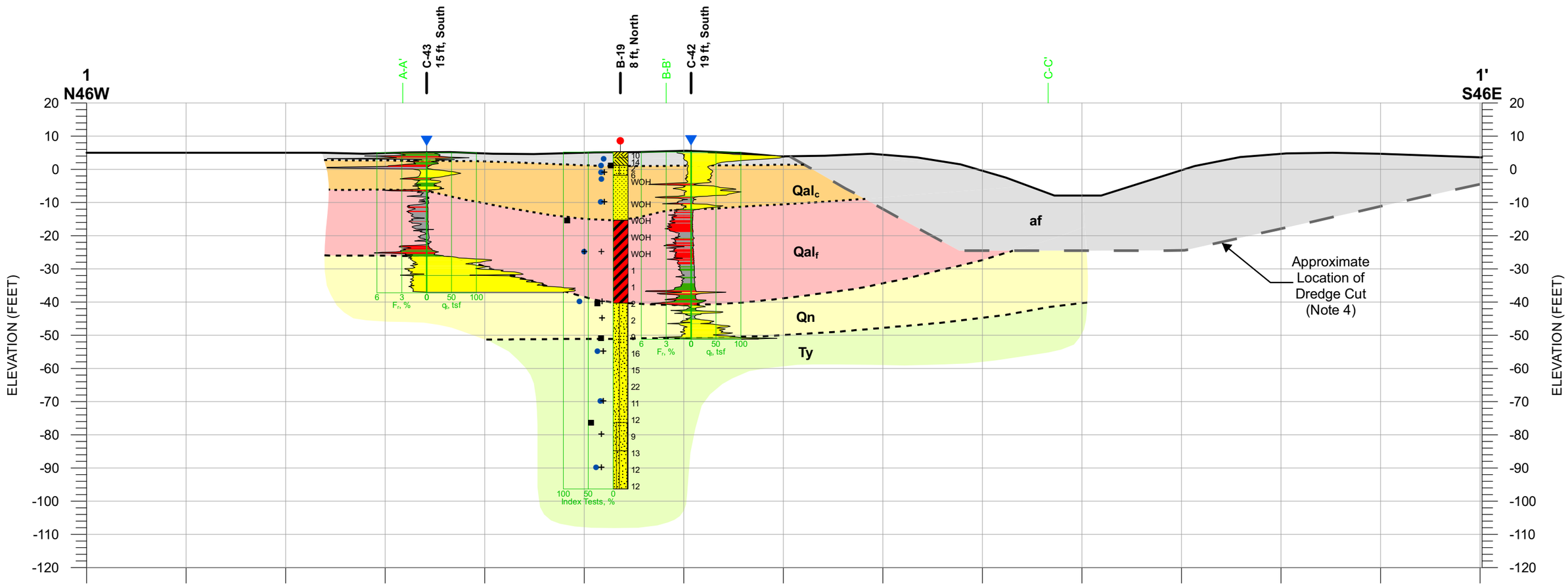

NOTES:

1) Bathymetric data from 2008 multibeam and single beam surveys. Refer to Fugro (2008b) for description of surveys. Topographic data from City of Norfolk 2000 photogrammetric survey.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-4 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

LEGEND

Stratigraphic Units

- Artificial Fill (af)
- Alluvium (Qal_c) - loose to medium dense silty sand
- Alluvium (Qal_f) - soft to firm clay
- Norfolk (Qn) - loose to medium sand
- Yorktown (Ty) - silty fine sand

Explorations

- 2008 VDOT (Land) and Fugro (Marine) CPT
- 2008 VDOT (Land) and Fugro (Marine) Boring

30 ft
30 ft
Horizontal and Vertical Scales
No vertical exaggeration.

SUBSURFACE CROSS SECTION 1-1' WITH CLASSIFICATION RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3e

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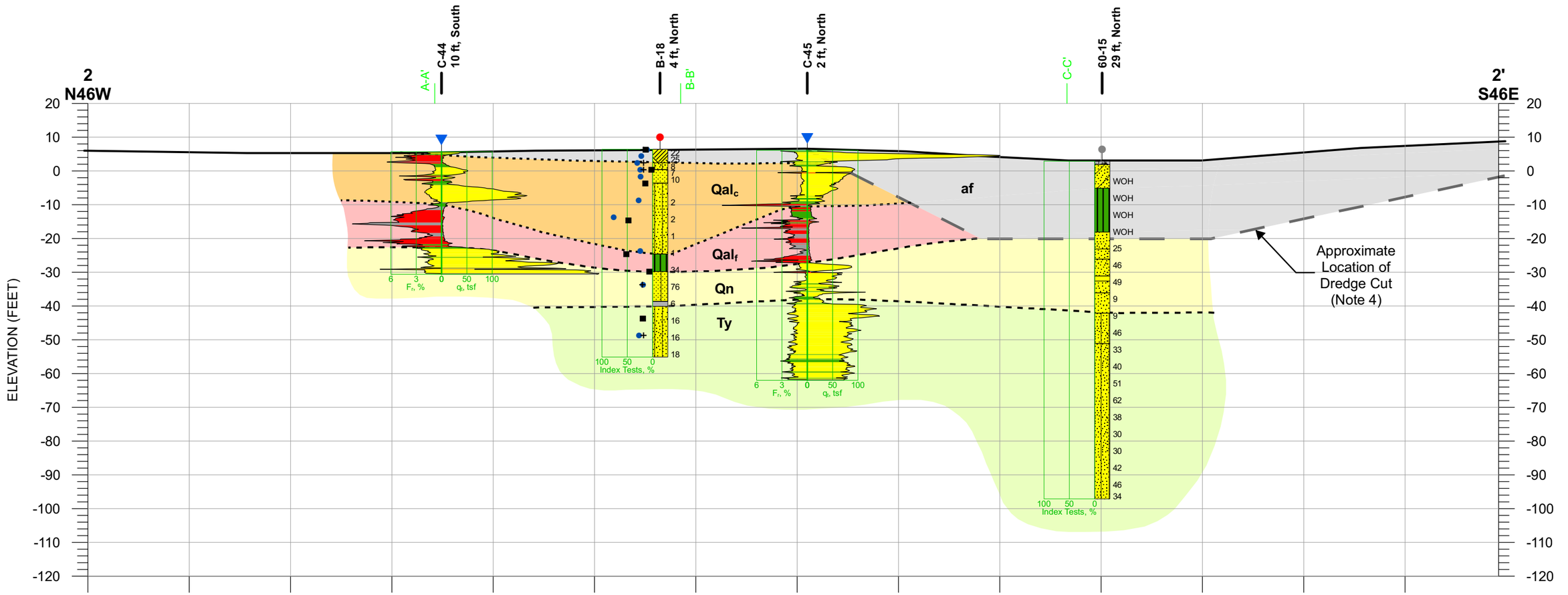

NOTES:

1) Bathymetric data from 2008 multibeam and single beam surveys. Refer to Fugro (2008b) for description of surveys. Topographic data from City of Norfolk 2000 photogrammetric survey.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-4 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

LEGEND

Stratigraphic Units

- Artificial Fill (af)
- Alluvium (Qal$_c$) - loose to medium dense silty sand
- Alluvium (Qal$_f$) - soft to firm clay
- Norfolk (Qn) - loose to medium sand
- Yorktown (Ty) - silty fine sand

Explorations

- 2008 VDOT (Land) and Fugro (Marine) CPT
- 2008 VDOT (Land) and Fugro (Marine) Boring
- 1957-1960 Historical Boring

30 ft
30 ft
Horizontal and Vertical Scales
No vertical exaggeration.

SUBSURFACE CROSS SECTION 2-2' WITH CLASSIFICATION RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3f

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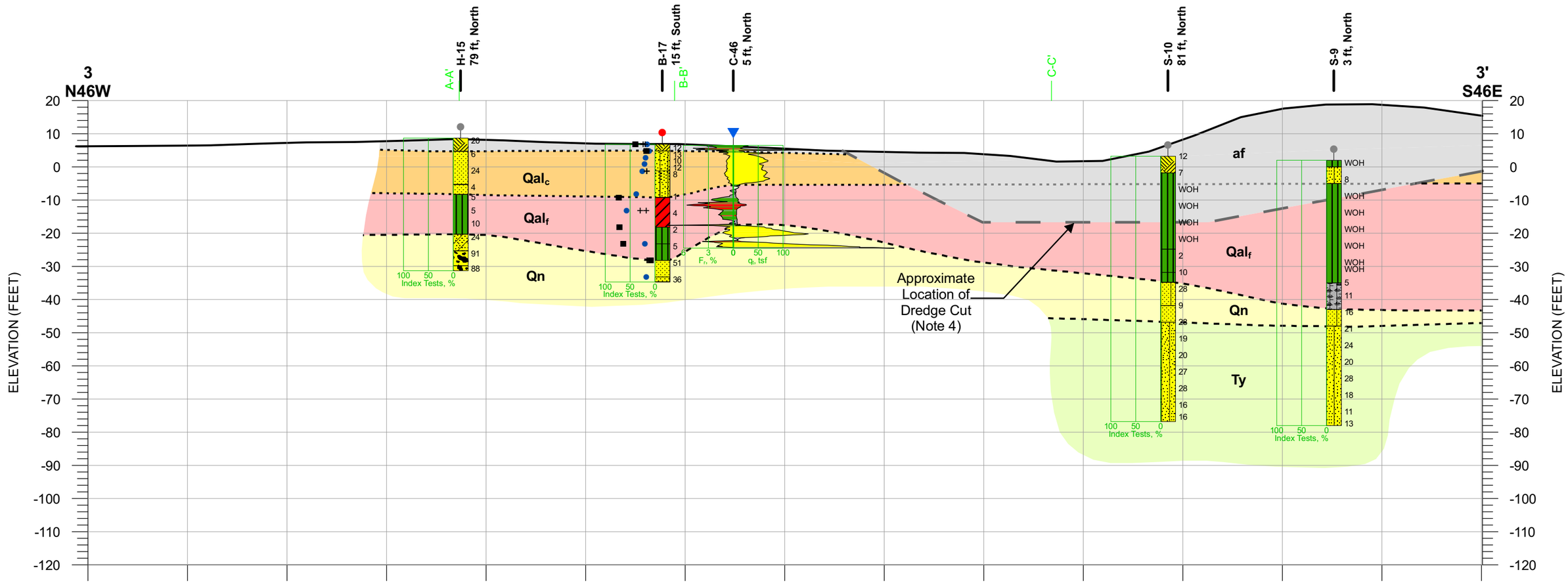

NOTES:

1) Bathymetric data from 2008 multibeam and single beam surveys. Refer to Fugro (2008b) for description of surveys. Topographic data from City of Norfolk 2000 photogrammetric survey.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-4 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

LEGEND

Stratigraphic Units

- Artificial Fill (af)
- Alluvium (Qal_c) - loose to medium dense silty sand
- Alluvium (Qal_f) - soft to firm clay
- Norfolk (Qn) - loose to medium sand
- Yorktown (Ty) - silty fine sand

Explorations

- 2008 VDOT (Land) and Fugro (Marine) CPT
- 2008 VDOT (Land) and Fugro (Marine) Boring
- 1957-1960 Historical Boring

30 ft
30 ft
Horizontal and Vertical Scales
No vertical exaggeration.

SUBSURFACE CROSS SECTION 3-3' WITH CLASSIFICATION RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3g

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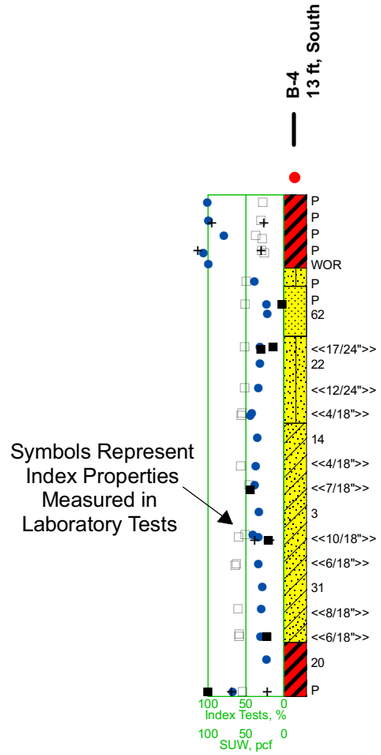


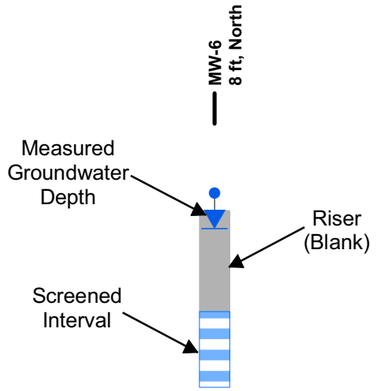
SOIL BORING LITHOLOGY WITH INDEX TESTS MEASURED IN LABORATORY AND RAW BLOW COUNTS

INDEX PROPERTIES SYMBOLS

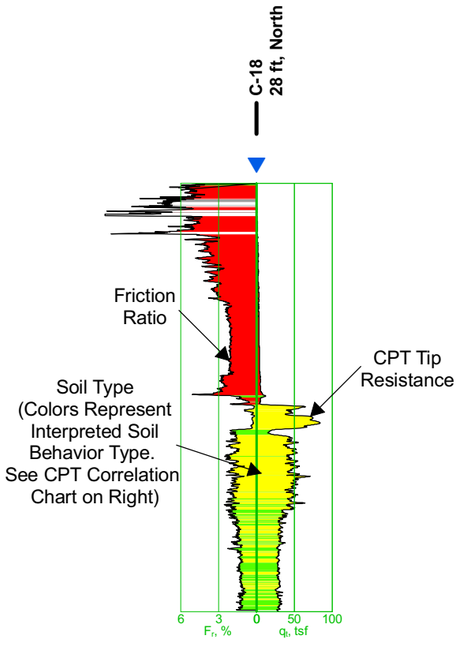
- Submerged Unit Weight
- Percent Passing #200 Sieve
- Plus Plastic Limit
- Plus Liquid Limit
- Water Content

SOIL TYPES

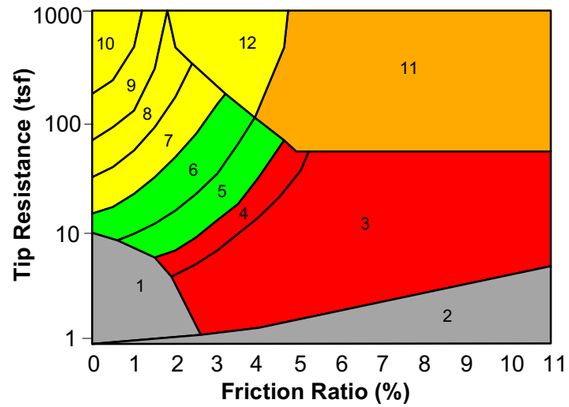
- Well graded GRAVEL (GW)
- Poorly graded GRAVEL (GP)
- GRAVEL with sand (GW)
- GRAVEL with clay (GW)
- Clayey GRAVEL (GC)
- GRAVEL with silt (GW)
- Silty GRAVEL (GM)
- Well graded SAND (SW)
- Poorly graded SAND (SP)
- SAND with gravel (SW)
- SAND with clay (SW-SC)
- Clayey SAND (SC)
- Silty SAND (SM)
- SAND with silt (SW-SM)
- Fat CLAY (CH)
- Sandy fat CLAY (CH)
- Lean CLAY (CL)
- Sandy lean CLAY (CL)
- Silty CLAY (CL-ML)
- Elastic SILT (MH)
- SILT (ML)
- Sandy SILT (ML)
- Clayey SILT (ML/CL)
- Highly plastic ORGANICS (OH)
- Low plasticity ORGANICS (OL)
- SANDSTONE (Rx)
- SILTSTONE (Rx)
- CLAYSTONE (Rx)
- MUDSTONE (Rx)
- Conglomerate (Rx)
- Interbedded Rock Strata (Rx)
- Pavement



GROUND WATER MONITORING WELL



CPT SOUNDING WITH FRICTION RATIO, AND TIP RESISTANCE



Zone	Soil Behavior Type	U.S.C.S.
1	Sensitive Fine-grained	OL-CH
2	Organic Material	OL-OH
3	Clay	CH
4	Silty Clay to Clay	CL-CH
5	Clayey Silt to Silty Clay	MH-CL
6	Sandy Silt to Clayey Silt	ML-MH
7	Silty Sand to Sandy Silt	SM-ML
8	Sand to Silty Sand	SM-SP
9	Sand	SW-SP
10	Gravelly Sand to Sand	SW-GW
11	Very Stiff Fine-grained *	CH-CL
12	Sand to Clayey Sand *	SC-SM

*overconsolidated or cemented

CPT CORRELATION CHART (Robertson and Campanella, 1988)

KEY TO SUBSURFACE CROSS SECTIONS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-4

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6.0 ENGINEERING SOIL PROPERTIES

Sediment properties and conditions exist that are relevant to the Midtown Second Parallel Tunnel project area, particularly the defining sediment types and in situ conditions of material that may serve as a tunnel foundation. Relevant sediment properties for the various geologic materials encountered within the project area are discussed in detail in the following paragraphs. The data concerning engineering soil properties included in this section were evaluated as part of the field investigation and laboratory testing programs completed by VDOT for this site characterization study. As mentioned in Section 4.2, borings performed in the late 1950s to early 1960s in anticipation of the original tunnel construction (shown on Figure 1-3) do not contain laboratory test data, and thus are not included in this discussion. The soil properties and summary plots of pertinent soil parameters presented in this section are divided into four principal stratigraphic units:

- Artificial Fill Material;
- Alluvium;
  - coarse-grained,
  - fine-grained,
- Norfolk Formation; and
- Yorktown Formation Sand.

Data from each laboratory test result are indicated on individual figures in Appendix B to graphically illustrate the variations in engineering soil properties throughout the soil profiles. Much of this information is also presented on the Log of Boring and Test Results for each individual exploration as presented in Appendix A of this report. A Summary of Laboratory Test Results for land borings performed in Norfolk for the proposed Midtown Second Parallel Tunnel project area is presented on Figures B-1a and B-1b.

6.1.1 Grain Size

Granular material was predominantly encountered as Holocene and Pliocene aged sediment at and beneath the ground surface to the maximum depth explored during this field program. The grain size characteristics of the sediments underlying the site are summarized on the following illustrations:

- Figure 6-1: Grain Size Curve Envelopes,
- Figure 6-2: Percent Passing the No. 200 Sieve versus Elevation,
- Figure 6-3: Percent Passing the No. 200 Sieve versus Depth,
- Figure 6-4: Mean Grain Size (D_{50}) versus Elevation, and
- Figure 6-5: Mean Grain Size (D_{50}) versus Depth.

- Artificial Fill: Limited testing of fines content (percentage of material passing the No. 200 sieve) was performed on samples of Artificial Fill. Results from two tests were 13 and 38 percent.
- Coarse-Grained Alluvium: Fines content varies between 2.0 and 47.0 percent, but generally less than 20 percent. Coarse-grained alluvium samples evaluated for grain

size range in classification from Silty Fine Sand (SM) to Fine Sand (SP). Limited laboratory test results indicate a range of median grain-size between 0.08 and 0.30 mm.

- Fine-Grained Alluvium: Fines content varies between 51.0 and 92.0 percent. Fine-grained alluvium samples evaluated for grain size classify as Lean Clay (CL) with varying amounts of fine sand. No median grain-size results are available this material.
- Norfolk Formation: Fines content varies between 7.0 and 71.0 percent, and samples evaluated for grain size classify as Sandy Silt (ML) to Silty Fine Sand (SM) to Fine to Medium Sand (SP). Laboratory test results indicate a range of mean grain-size between 0.15 mm and 0.40 mm.
- Yorktown Sand: Fines content of the Yorktown Sand samples vary between 18 and 44 percent. The samples classify as Silty Fine Sand (SM). Laboratory test results indicate a range of mean grain-size between 0.08 mm and 0.13 mm.

6.1.2 In Situ Water (Moisture) Content

Data showing the in situ water content are plotted versus elevation and depth on the following illustrations:

- Figure 6-6: Moisture Content versus Elevation, and
- Figure 6-7: Moisture Content versus Depth.

Measured water contents are summarized by stratigraphic unit on Figures 6-6 and 6-7. Typical ranges measured in the various stratigraphic units are as follows:

- Artificial Fill: water content is measured between 10 and 30 percent, based on 5 samples,
- Coarse-Grained Alluvium: water content is measured between 11 and 76 percent, but generally between about 20 and 30 percent,
- Fine -Grained Alluvium: water content is measured between 57 and 67 percent,
- Norfolk Formation: water content measured between 17 and 20 percent,
- Yorktown Sand: water content measured between 25 and 34 percent.

6.1.3 Plasticity

The plasticity of fine-grained soil is summarized on:

- Figure 6-8: Atterberg Limits versus Elevation,
- Figure 6-9: Atterberg Limits versus Depth, and
- Figure 6-10: Plasticity Chart.

The fine-grained soil primarily consists of low to high plasticity clay. As shown on Figure 6-10, the Atterberg limit test data plot above the A-line of the plasticity chart, signifying the

presence of primarily clayey material throughout the depth explored. Limited Atterberg limit test data are summarized as follows:

- Fine-Grained Alluvium: Liquid limits (LL) range between 29 and 57, and the plasticity indices (PI) vary between 12 and 34.

6.1.4 In Situ Condition of Granular Sediments

Relative density is an important factor that affects the strength of sands. Relative density (D_r) is defined as the ratio of the difference between the in situ void ratio and the maximum void ratio to the difference between the maximum and minimum void ratios. Data indicative of in situ condition of the granular sediments underlying the site are summarized on:

- Figure 6-11: Blow Count (SPT N-Value) versus Elevation, and
- Figure 6-12: Blow Count (SPT N-Value) versus Depth.

An important method of estimating the in situ relative density of granular materials is the correlation of SPT blow count per foot (N-values) obtained from field sampling techniques. Figures 6-11 and 6-12 presents the equivalent N-value profiles of the stratigraphic units as determined in the field for the Standard Penetration Test (SPT). The data presented on Figures 6-11 and 6-12 have not been adjusted to account for overburden pressure, test efficiency, or for the energy dissipation effects through the long rod length for the land borings. We have used the following categories for relative density, based on Terzaghi and Peck (1967) and Lambe and Whitman (1969), as shown in Table 6-1 below.

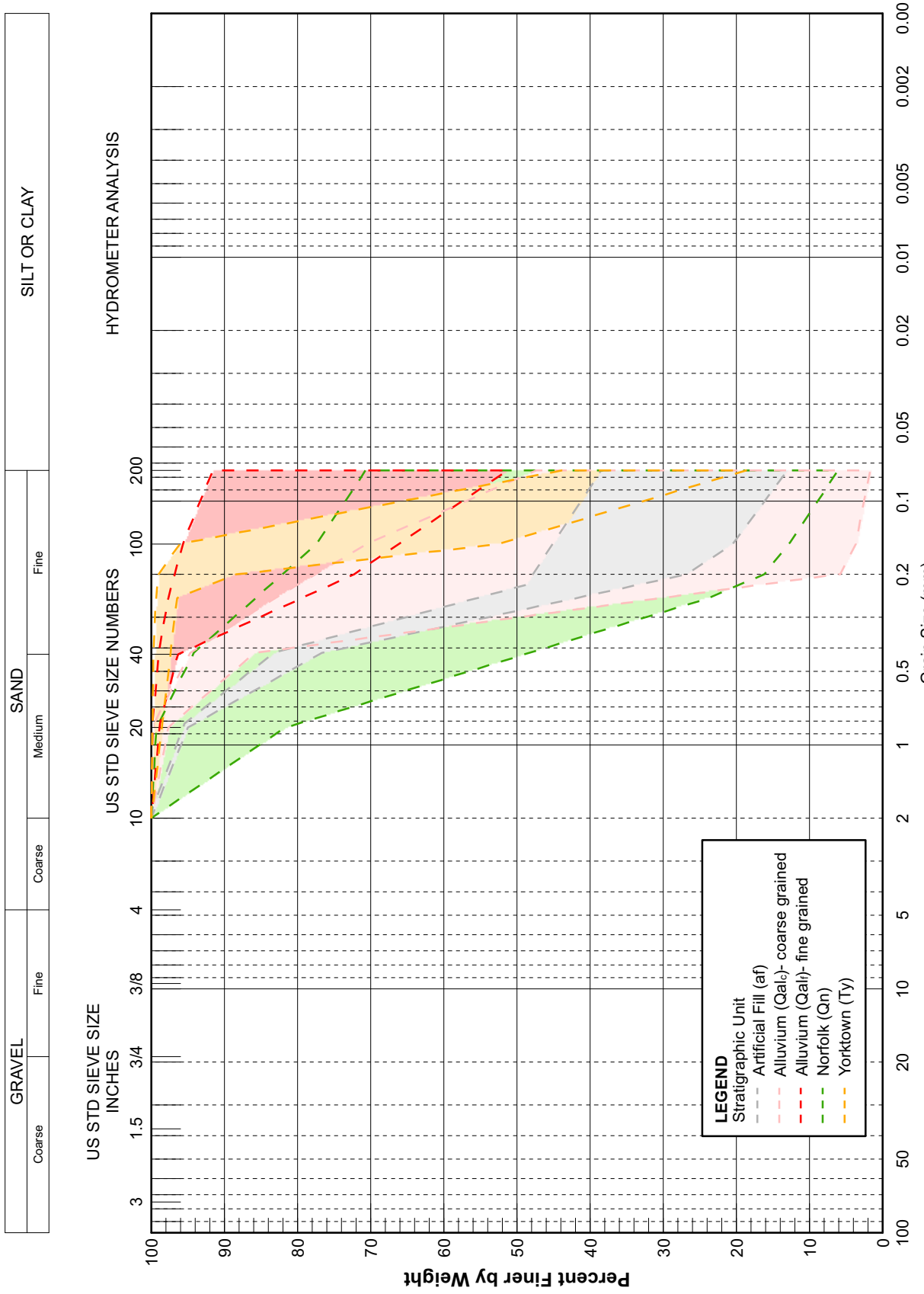
Table 6-1. SPT N-Value Correlations with Relative Density

SPT N-Value	Relative Density	D_r (%)
0 to 4	Very loose	0 to 15
5 to 10	Loose	15 to 35
11 to 30	Medium dense	35 to 65
31 to 50	Dense	65 to 85
> 50	Very dense	85 to 100

Table 6-2 below shows the typical ranges of sampler blow counts with relative densities, correlated to SPT N-values for the various subsurface strata:

Table 6-2. Relative Densities of Principal Stratigraphic Units

Principal Stratigraphic Unit	Typical Range of N-Values	Relative Density correlated to SPT N-values
Artificial Fill (Af)	10-25	35 to 60%
Alluvium (Qal_c) coarse-grained	5-13	15 to 40%
Alluvium (Qal_f) fine-grained	<1-3	N/A
Norfolk Formation (Qn)	<1-76	5 to >85%
Yorktown Sand (Tys)	10-20	35 to 50%



GRAIN SIZE CURVE ENVELOPES
VDOT 2008 Onshore Norfolk Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-1

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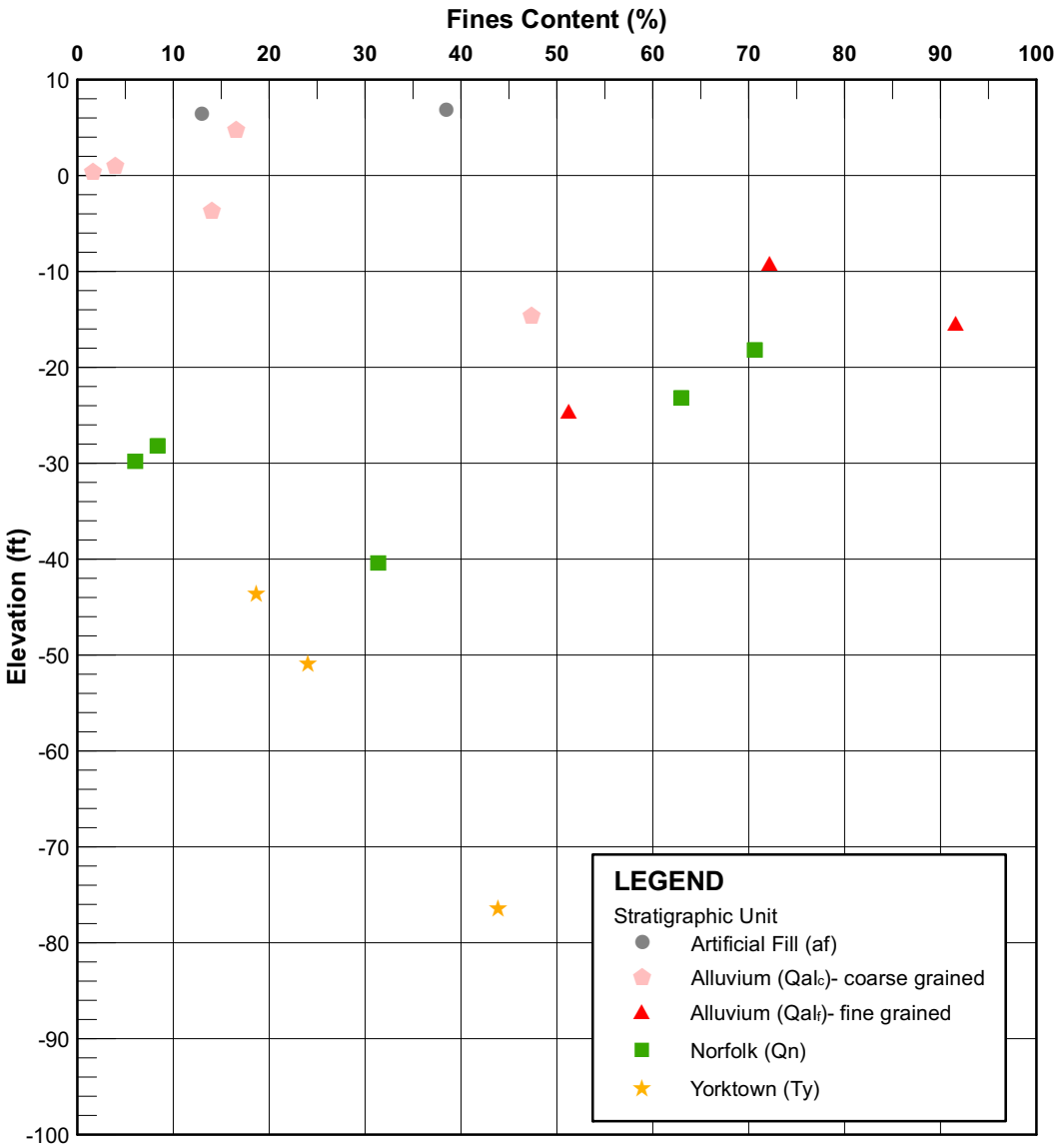

PERCENT PASSING NO. 200 SIEVE (FINES CONTENT) VERSUS ELEVATION
VDOT 2008 Onshore Norfolk Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-2

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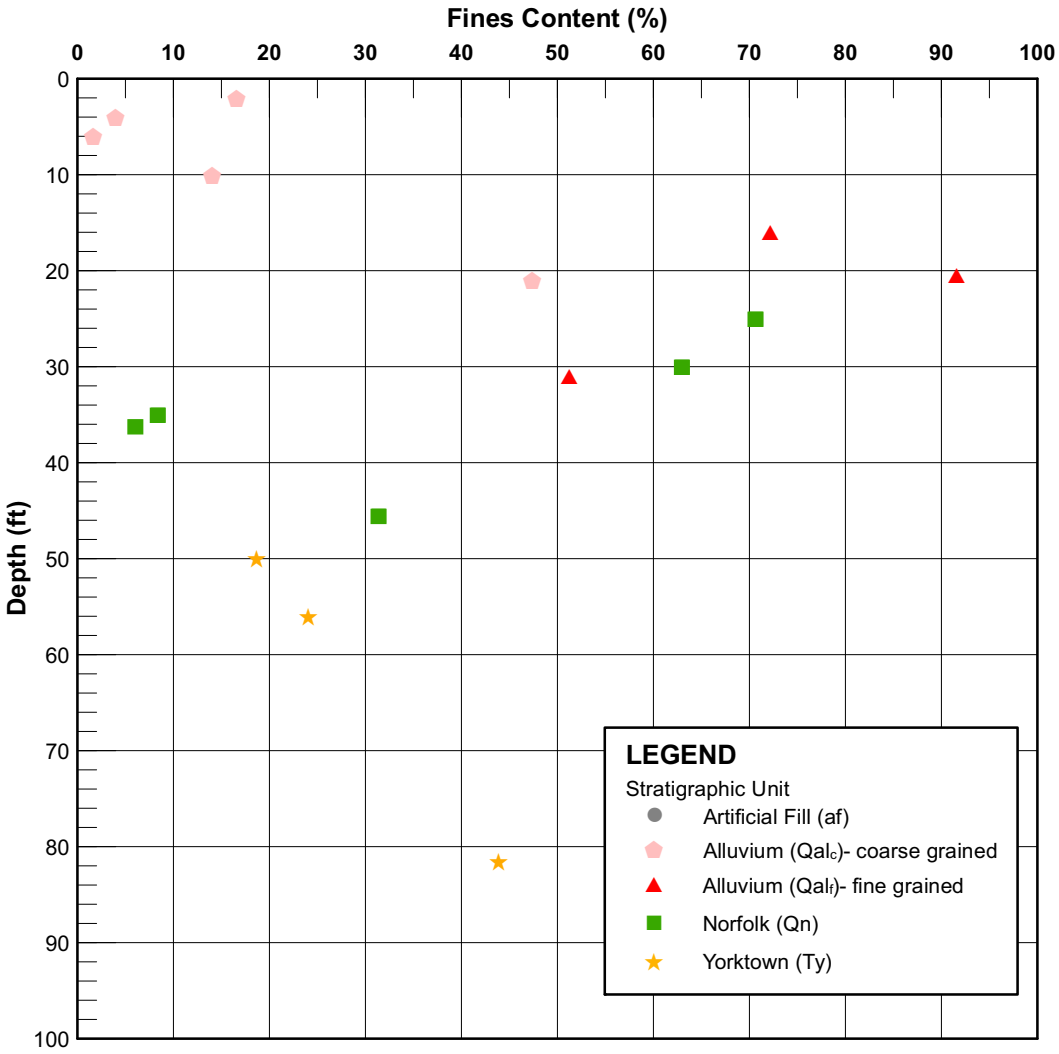

PERCENT PASSING NO. 200 SIEVE (FINES CONTENT) VERSUS DEPTH
VDOT 2008 Onshore Norfolk Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-3

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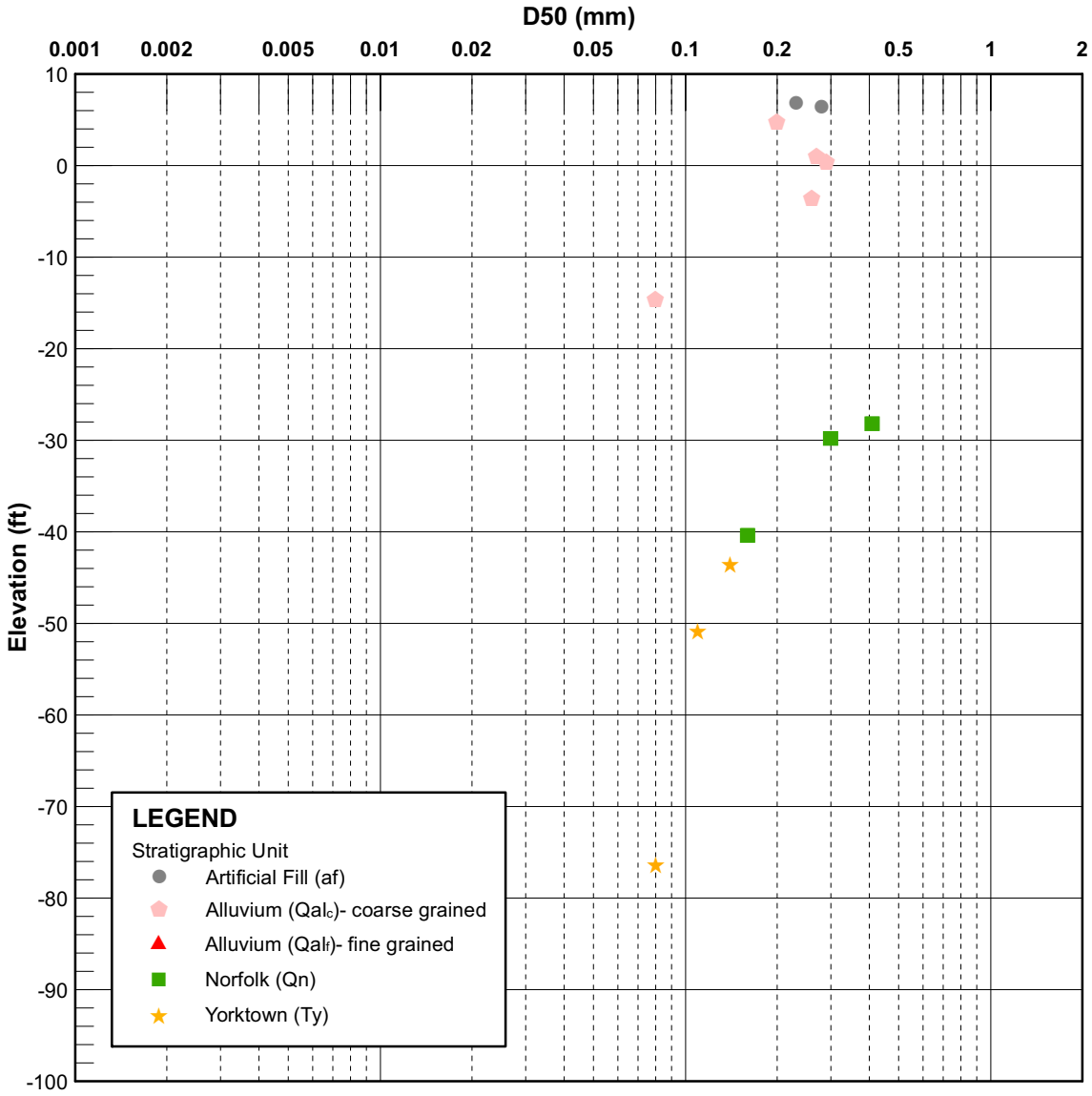

MEDIAN GRAIN SIZE (D_{50}) VERSUS ELEVATION
VDOT 2008 Onshore Norfolk Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-4

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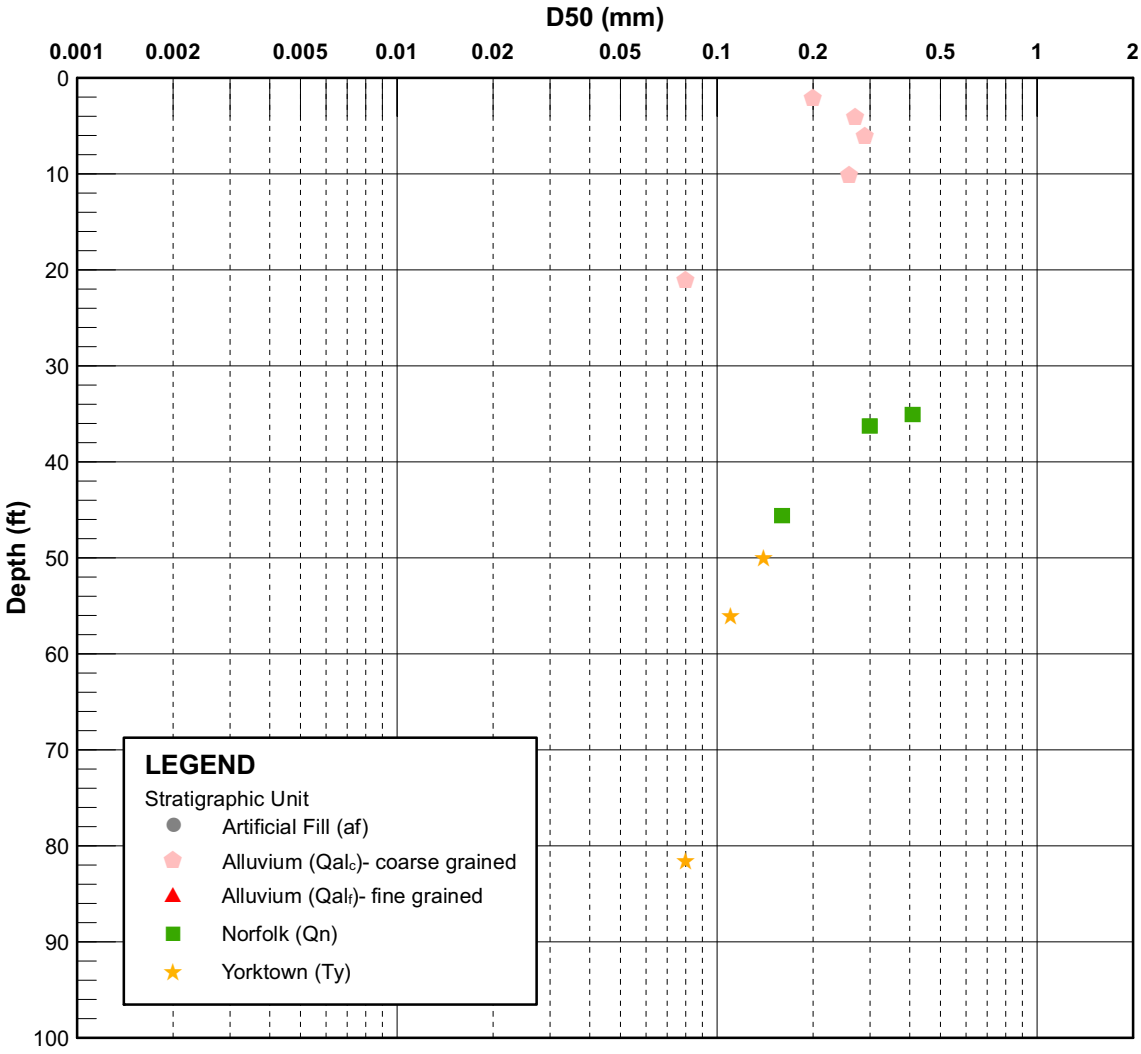

MEDIAN GRAIN SIZE (D_{50}) VERSUS DEPTH
VDOT 2008 Onshore Norfolk Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-5

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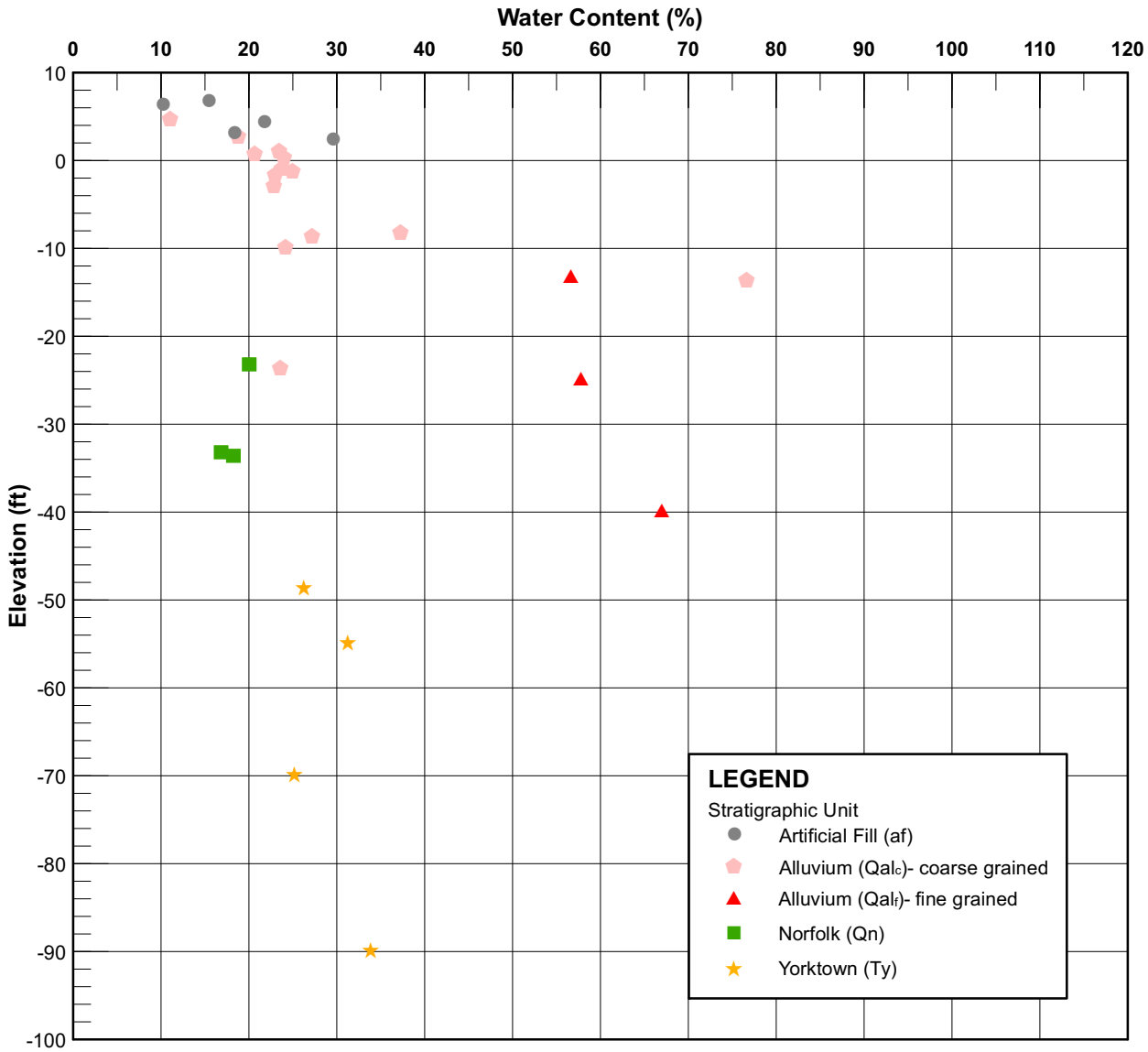

WATER CONTENT VERSUS ELEVATION
VDOT 2008 Onshore Norfolk Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-6

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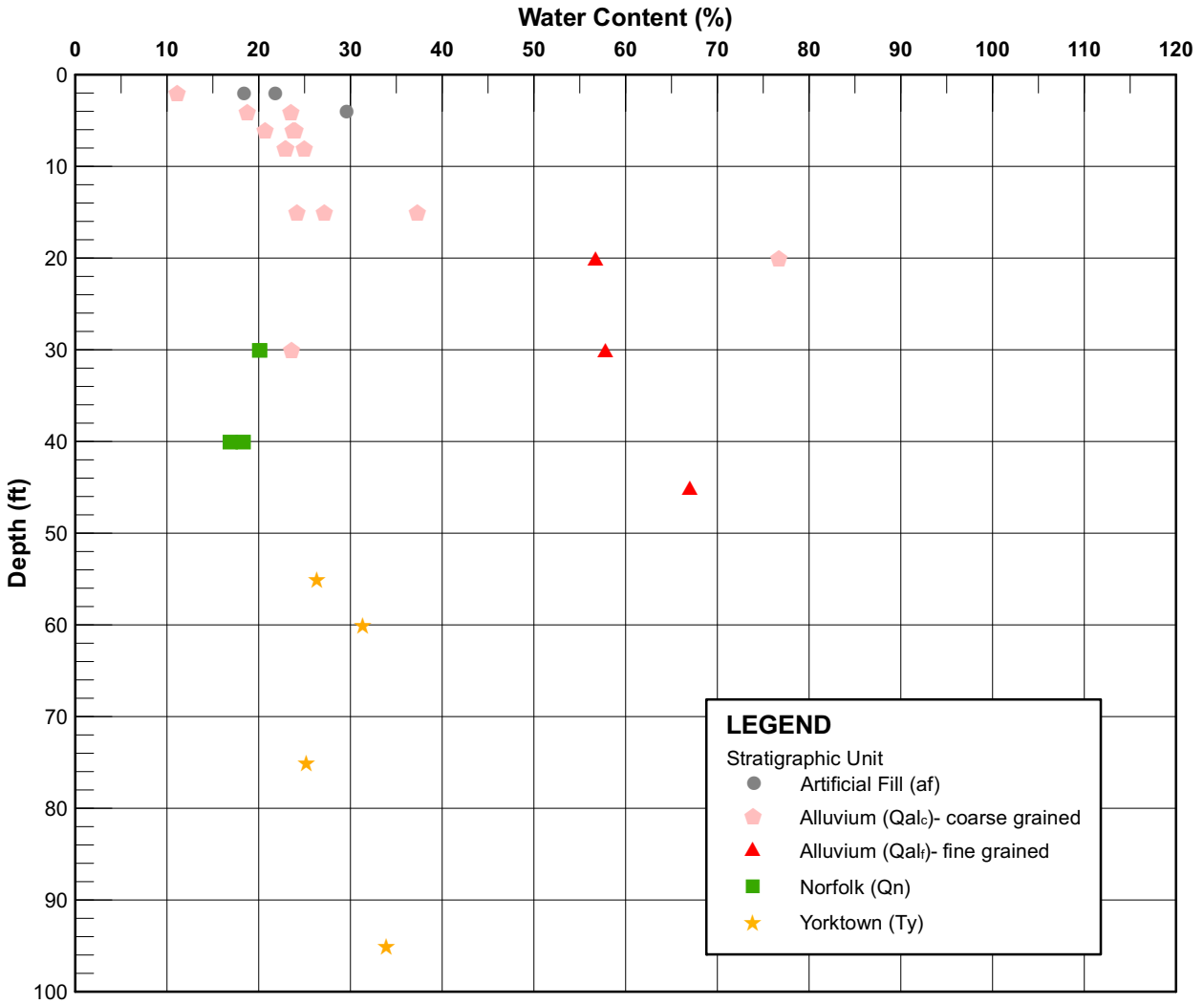

WATER CONTENT VERSUS DEPTH
VDOT 2008 Onshore Norfolk Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-7

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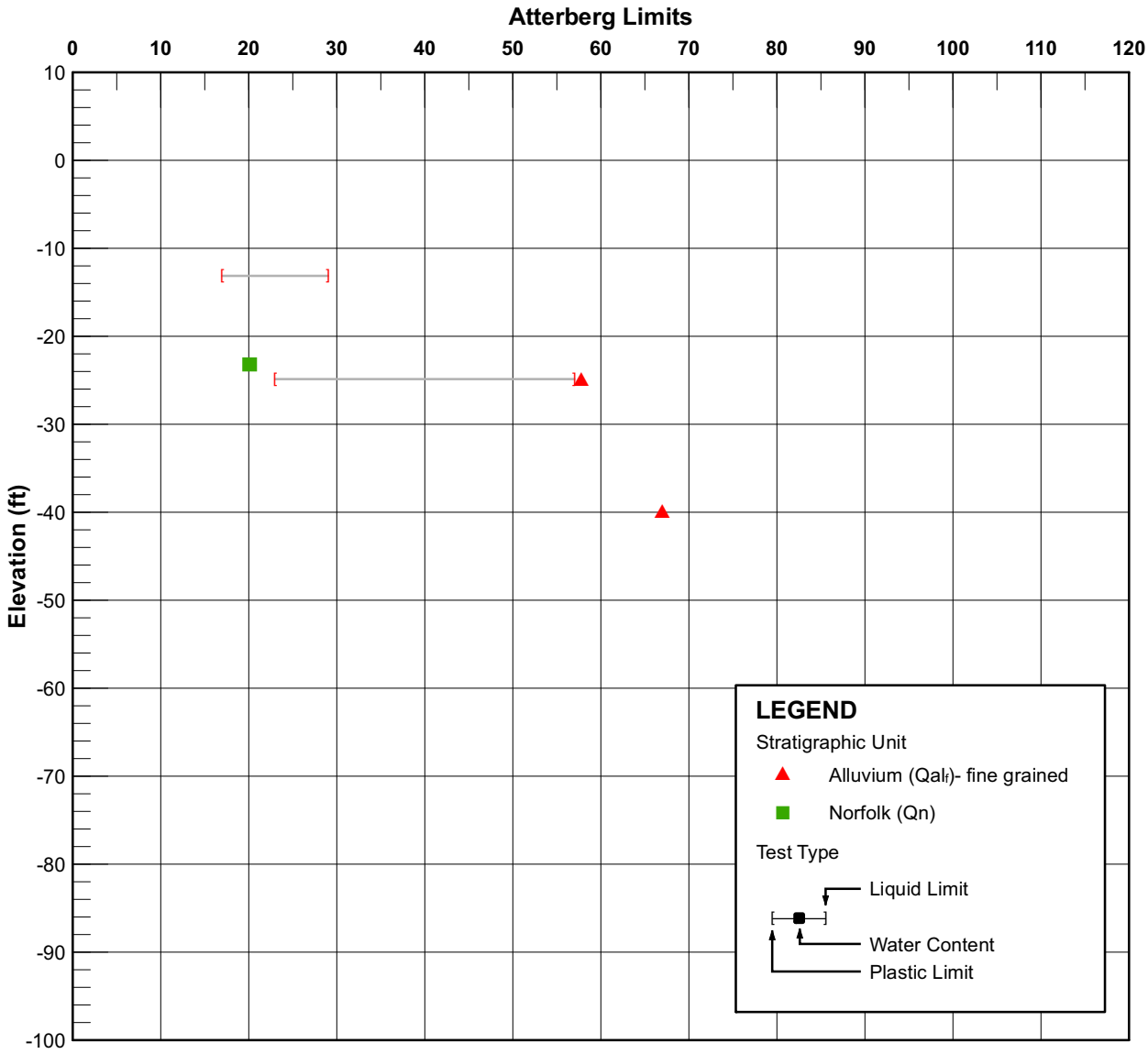

ATTERBERG LIMITS VERSUS ELEVATION
VDOT 2008 Onshore Norfolk Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-8

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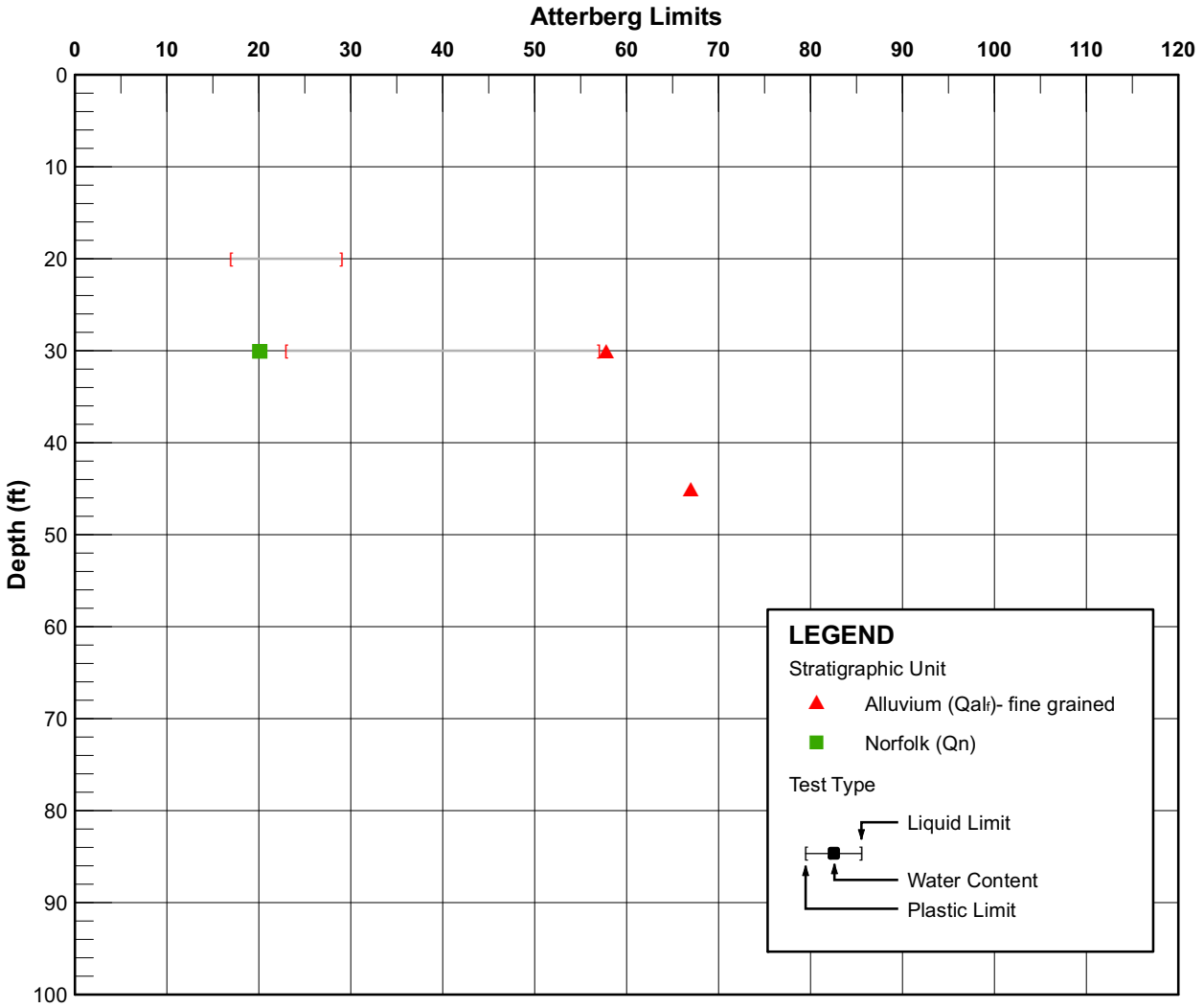

ATTERBERG LIMITS VERSUS DEPTH
VDOT 2008 Onshore Norfolk Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-9

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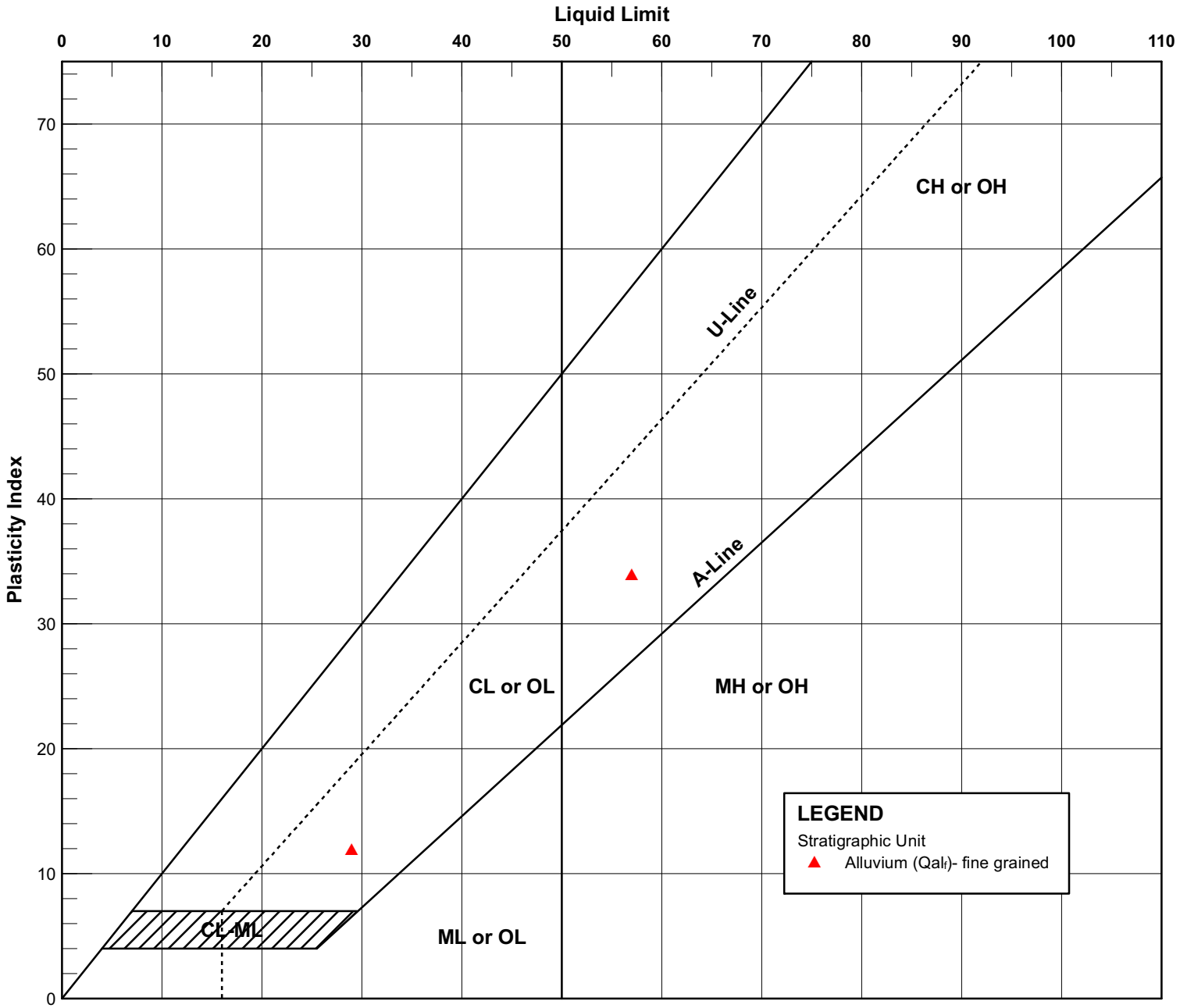
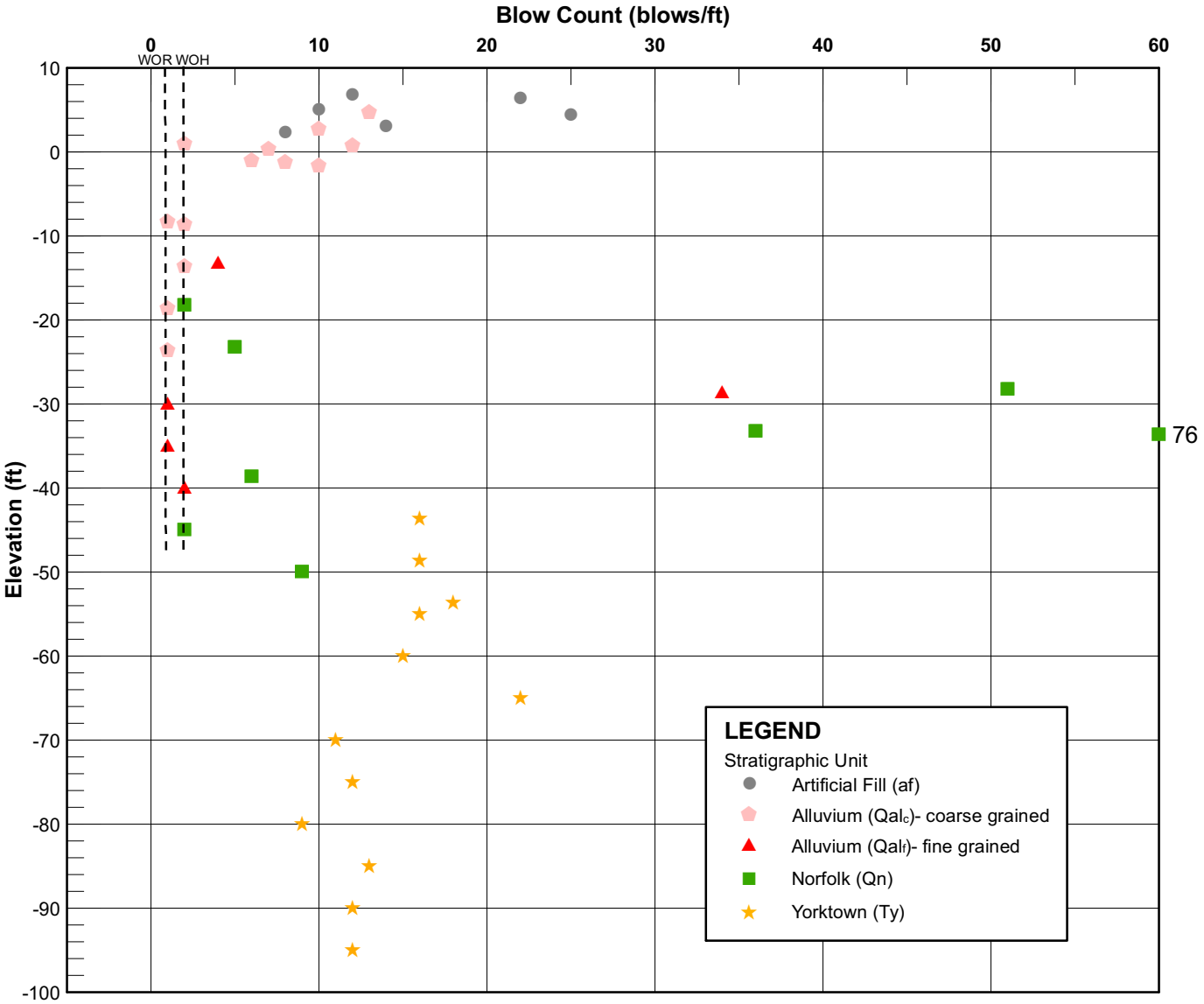


PLASTICITY CHART
VDOT 2008 Onshore Norfolk Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-10

Virginia Department of Trasportation
Project No. 3602.001



Notes:
1) SPT uncorrected N-values obtained using 140-pound hammer dropped 30 inches.
2) WOR = weight of rod
3) WOH = weight of hammer

BLOW COUNTS (SPT N-VALUES) VERSUS ELEVATION
VDOT 2008 Onshore Norfolk Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-11

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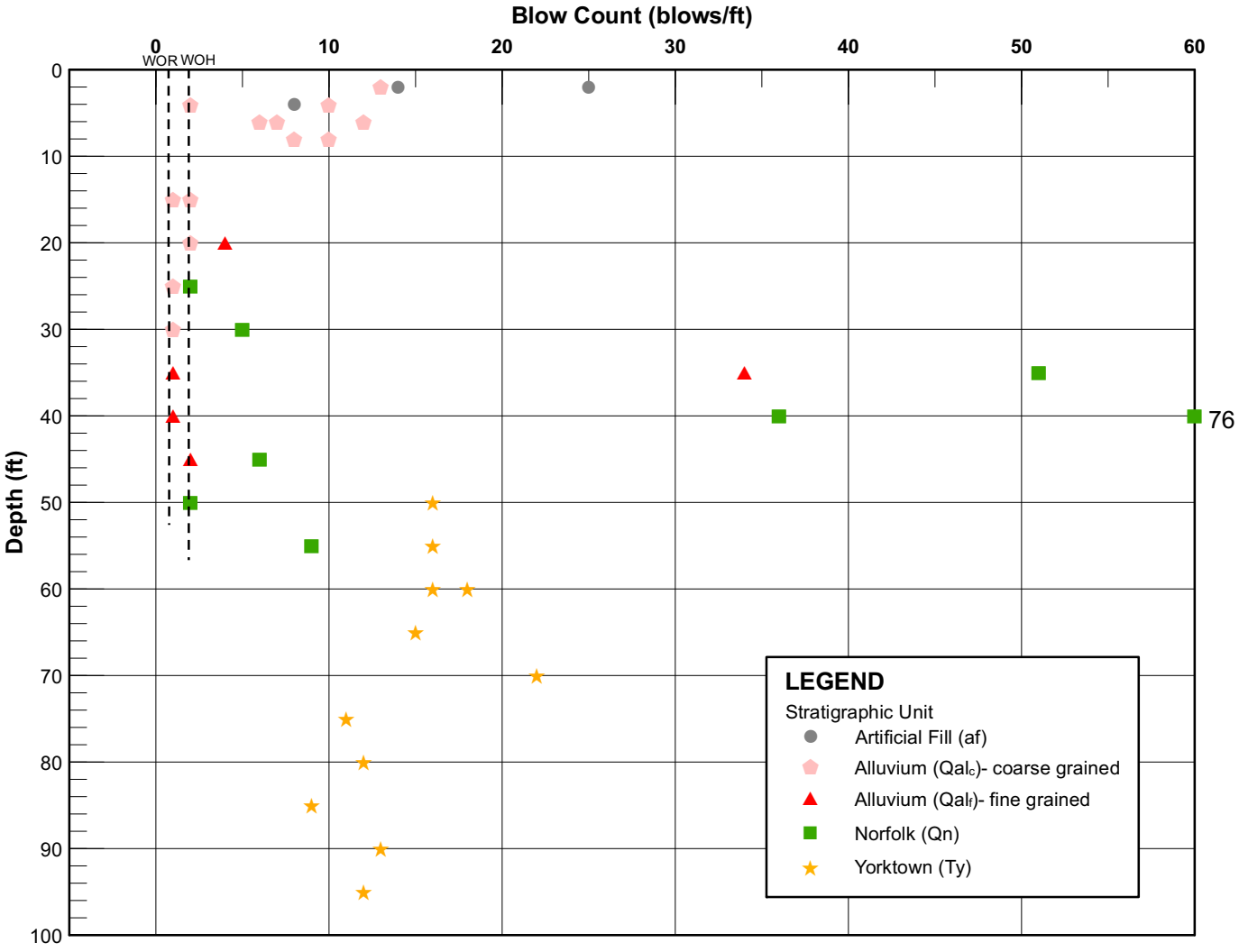

Notes:
1) SPT uncorrected N-values obtained using 140-pound hammer dropped 30 inches.
2) WOR = weight of rod
3) WOH = weight of hammer

BLOW COUNTS (SPT N-VALUES) VERSUS DEPTH
VDOT 2008 Onshore Norfolk Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-12

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7.0 LIMITATIONS

7.1 LOCATION OF EXISTING TUNNEL AND WATER PIPELINE

The depicted location of the tunnel and centerline are not for usage in construction planning or design. Prior to our site investigation, we recognized that high quality as-built drawings or electronic files documenting the locations of the existing tunnel and water pipeline were not available. Therefore, we carried out a marine and land survey as described herein and other reports listed in Figure 1-2 to ground-truth historical drawings and assist us in defining a safe work area for the geotechnical boring and sounding exploration.

Limitations of precision and accuracy for respective methods used to infer and interpret the tunnel and pipeline locations are described where applicable. In general, methodologies using geophysical technology may not provide adequate precision and accuracy for the design and construction planning of the second parallel tunnel. An understanding of the capability and limitation of the geophysical technology employed is required to optimize the data they provide and reduce the chance of misusing their data. We note that additional surveys or investigations may be required to document the locations of the water pipeline and existing tunnel to support design and construction planning. Several examples of options for additional ground truthing follow:

- Survey the inner diameter of the existing tunnel to aid in establishing survey-grade data of the centerline and tunnel location;
- Use a diver to jet probe and locate the water pipeline and tunnel;
- Additional, denser spacing of geophysical (subbottom and magnetometer) surveys; or
- Contact the City of Norfolk to inquire and obtain any as-built or construction and maintenance related surveys. We note that during our initial inquiry to City of Norfolk staff through the MISS Utility notification process, the City of Norfolk representative we met indicated that they were not aware of survey data which documented as-built conditions of the pipeline. However, during our survey, a construction barge with divers appeared to be conducting work on the pipeline.

7.2 REPORT USE

This report has been prepared for the exclusive use of the Virginia Department of Transportation and its agents for the specific application to the Midtown Second Parallel Tunnel project, located in Portsmouth and Norfolk, Virginia. In our opinion, the data, findings, conclusions, professional opinions, and recommendations presented herein were prepared in accordance with generally accepted geotechnical engineering practices of the project region.

Although information contained in this report may be of some use for other purposes, it may not contain sufficient information for other parties or uses. If any changes are made to the project as described in this report, the conclusions and recommendations in this report shall not be considered valid unless the changes are reviewed and the conclusions and recommendations of this report are modified or validated in writing by Fugro. This report and

the figures contained in this report are intended for input to project design; they are not intended to act as construction drawings or specifications.

7.3 POTENTIAL VARIATIONS IN SUBSURFACE CONDITIONS

Earth materials can vary in type, strength, and other geotechnical properties between points of observation and exploration. Therefore, we do not and cannot have a complete knowledge of the subsurface conditions underlying the site. The conclusions and recommendations presented in this report are based on the findings at the points of exploration, interpolation, and extrapolation of information between and beyond the points of observation, and are subject to confirmation (to the extent possible) based on the conditions revealed during construction.

7.4 LOCAL PRACTICE

In performing our professional services, in our opinion, we have used generally accepted geologic and geotechnical engineering principles and have applied that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers currently practicing in this or similar localities. No other warranty, express or implied, is made as to the professional advice included in this report.

8.0 REFERENCES

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Fugro Atlantic (Fugro) (2008a), Geotechnical Data Report, Marine Drilling, In Situ Testing, and Laboratory Testing, Proposed Midtown Second Parallel Tunnel, prepared for Virginia Department of Transportation, Fugro Atlantic Project No. 3602.001.

Fugro (2008b), Bottom Charting Data Report, Proposed Midtown Second Parallel Tunnel, prepared for Virginia Department of Transportation, Fugro Atlantic Project No. 3602.001.

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APPENDIX A
SUBSURFACE EXPLORATION

SOIL TYPES


GW- Well-Graded Gravel


GP- Poorly-Graded Gravel


SW- Well-Graded Sand


SP- Poorly Graded Sand


SW-SM- Well-Graded Sand with silt


SP-SM- Poorly-Graded Sand with silt


SM- Silty Sand


SW-SC - Well-Graded Sand with clay


SC- Clayey Sand


SC-SM- Silty Clayey Sand


ML- Silt


CL- Lean Clay


OL- Organic Silt


MH- Elastic Silt


CH- Fat Clay


OH- Organic Clay


PT- Peat


SE- Shell Bed


TOPS- Topsoil


FL- Fill


No recovery


ASPH- Asphalt concrete pavement

SAMPLERS


SPT


No Recovery

WATER LEVEL SYMBOLS


Initial or perched water level

Final ground water level

SPT AND MODIFIED CALIFORNIA LINER SAMPLERS

SPT N-values obtained using 140-pound donut hammer dropped 30 inches, operated by a wireline winch.

WOR	Sample advanced with the weight of drilling rods.
WOR	Sample advanced with the weight of 140-pound donut hammer.
5, 10, 10	Standard Penetration Test hammer blows.
86/11”	Number of blows required to produce the indicated penetration after an initial 6” seating.
Ref/3”	50 blows produced the indicated penetration during the initial 6” interval.

KEY TO TERMS AND SYMBOLS USED ON BORING LOGS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: Cities of Portsmouth/Norfolk
STRUCTURE: Tunnel

08BH-017
PAGE 1 OF 1

STATION: OFFSET:
LATITUDE: 36.863028 °N LONGITUDE: 76.307747 °W
SURFACE ELEVATION: 5.3 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07-01-08 - 07-01-08
Drilling Method(s): HSA
SPT Method: Automatic Hammer
Other Test(s): None
Driller: D. Baker
Logger: J. Deusebio

GROUND WATER
▽ FIRST ENCOUNTERED AT: 8.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND / SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP STRATA	ROCK: DIP JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
0	5	3 6 6	80	0						0.0 / 5.3 **ARTIFICIAL FILL (af)** Gray, brown, red, and black silty fine sand with medium sand FILL, with rubble and clayey organics, moist, firm. **FL**	23	4	15.5
2		3 6 7	80	2							16	NP	11.1
4		3 5 5	100	4						2.0 / 3.3 **ALLUVIUM (Qal)** Tan, silty fine SAND, moist, loose to medium dense. **SM**			18.8
6	0	5 5 7	100	6						-with trace of organics below 6.0'			20.7
8		4 4 4	100	8							16	NP	25.0
10	-5			10									
12													
14													
16	-10	2 1 WOH	100	15 16.5									37.3
18										16.0 / -10.7 Gray, CLAY with sand, wet, soft. **CL**			
20	-15	WOH 2 2	100	20 21.5							29	12	56.7
22													
24													
26	-20	1 1 1	90	25 26.5						25.0 / -19.7 **NORFOLK FORMATION (Qn)** Dark gray to black, SILT with sand and organics, moist, very loose. **ML**	NP	NP	
28													
30	-25	1 1 4	100	30 31.5						30.0 / -24.7 Gray, green, and brown, Sandy SILT, moist, loose. **ML**	NP	NP	20.1
32													
34													
36	-30	11 22 29	100	35 36.5						35.0 / -29.7 Brown, red, and green, fine to medium SAND with silt, pebbles, moist, dense to very dense. **SP**	15	NP	
38													
40	-35	9 17 19	100	40 41.5									16.9
										End of Boring.			

REMARKS: RIG TYPE: Drill Truck.

PAGE 1 OF 1
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FIGURE A-2

Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: Cities of Portsmouth/Norfolk
STRUCTURE: Tunnel

08BH-018
PAGE 1 OF 2

STATION: OFFSET:
LATITUDE: 36.862797 °N LONGITUDE: 76.308069 °W
SURFACE ELEVATION: 4.9 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07-02-08 - 07-02-08
Drilling Method(s): HSA
SPT Method: Automatic Hammer
Other Test(s): None
Driller: D. Baker
Logger: J. Deusebio

GROUND WATER
▽ FIRST ENCOUNTERED AT: 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
0	4.9										0.0 / 4.9 **ARTIFICIAL FILL (af)** Gray to gray black, fine to medium SAND with silt, with cinders, coal, glass, rock fragments, cement fragments, rubble, and organic matter. Distinct petroleum odor, moist, loose to medium dense. **FL**	17	NP	10.3
2		5 9 13	100		0 2									21.8
4		17 15 10	100		2 4									
6	0	6 4 4	80		4 6							17	NP	29.6
8	-5	3 3 4	100		6 8						6.0 / -1.1 **ALLUVIUM (Qal)** Tan and gray, fine SAND, with a trace of medium sand, wet, loose. **SP**	17	NP	24.0
10		3 4 6	100		8 10									23.0
12											10.0 / -5.1 Medium dark gray, silty fine SAND with a trace of medium sand, with fine shell fragments, wet, very loose. **SM**			
14														
16	-10	1 1 1	85		15 16.5							NP	NP	27.2
18														
20	-15	1 1 1	90		20 21.5						-with a trace of organics below 21.0'			76.7
22														
24														
26	-20	WOH WOH 1	100		25 26.5							NP	NP	
28														
30	-25	WOH WOH 1	100		30 31.5							NP	NP	23.6
32											31.0 / -26.1 Brown and gray, sandy SILT, with a trace of organics, wet, very loose. **ML**			
34														
36	-30	7 13 21	100		35 36.5									
38											36.2 / -31.3 **NORFOLK FORMATION (Qn)** Gray green with dark green bands, fine to medium SAND, with silt and a trace of shell fragments, moist, dense. **SP-SM**			
40	-35													

REMARKS: RIG TYPE: Drill Truck.

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FIGURE A-3a

Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: Cities of Portsmouth/Norfolk
STRUCTURE: Tunnel

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PAGE 2 OF 2

STATION: OFFSET:
LATITUDE: 36.862797 °N LONGITUDE: 76.308069 °W
SURFACE ELEVATION: 4.9 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07-02-08 - 07-02-08
Drilling Method(s): HSA
SPT Method: Automatic Hammer
Other Test(s): None
Driller: D. Baker
Logger: J. Deusebio

GROUND WATER
▽ FIRST ENCOUNTERED AT: 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
42		20 35 41	100		40 – 41.5							20	NP	18.3
44														
46	-40	2 2 4	0		45 – 46.5						45.0 / -40.1 Washed hole/no recovery. 46.5 / -41.6 **YORKTOWN FORMATION (Ty)** Gray green, silty fine SAND, with a trace of fine shell fragments, moist, loose to medium dense. **SM**			
48														
50	-45	2 6 10	100		50 – 51.5									
52														
54														
56	-50	3 6 10	100		55 – 56.5							17	NP	26.3
58														
60	-55	3 7 11	100		60 – 61.5						End of Boring.			

REMARKS: RIG TYPE: Drill Truck.

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FIGURE A-3b

Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: Cities of Portsmouth/Norfolk
STRUCTURE: Tunnel

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STATION: OFFSET:
LATITUDE: 36.862592 °N LONGITUDE: 76.308381 °W
SURFACE ELEVATION: 3.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07-08-08 - 07-08-08
Drilling Method(s): HSA
SPT Method: Automatic Hammer
Other Test(s): None
Driller: D. Baker
Logger: J. Deusebio

GROUND WATER
▽ FIRST ENCOUNTERED AT: 7.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND / SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP STRATA	ROCK: DIP JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
0	3.6	1 3 7	75	0 – 2						0.0 / 3.6 **ARTIFICIAL FILL (af)** Gray brown, fine sand FILL, with organics, rubble, and coal fragments, moist, loose. **FL**			
2		7 9 5	90	2 – 4									18.4
4	0	1 1 1	70	4 – 6						1.7 / 1.9 Tan, fine silty sand FILL, with rock and concrete fragments, moist, firm. **FL**			23.5
6		2 2 4	100	6 – 8						4.0 / -0.4 **ALLUVIUM (Qal)** Gray and tan, silty fine SAND, moist, loose. **SM**	17	NP	23.8
8	-5	WOH WOH WOH	100	8 – 10						7.0 / -3.4 Gray and tan, fine SAND with a trace of medium sand, wet, loose. **SP**			22.9
10													
12													
14	-10												
16		WOH WOH WOH	100	15 – 16.5							17	NP	24.2
18	-15												
20		WOH WOH WOH	100	20 – 21.5						20.5 / -16.9 Gray to dark gray, fat CLAY, with a trace of fine sand and trace of shell fragments, wet, very soft. **CH**			
22													
24	-20												
26		WOH WOH WOH	100	25 – 26.5									
28	-25												
30		WOH WOH WOH	100	30 – 31.5							57	34	57.8
32													
34	-30												
36		WOH WOH 1	100	35 – 36.5									
38	-35												
40													

REMARKS: RIG TYPE: Drill Truck.

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FIGURE A-4a

Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: Cities of Portsmouth/Norfolk
STRUCTURE: Tunnel

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PAGE 2 OF 3

STATION: OFFSET:
LATITUDE: 36.862592 °N LONGITUDE: 76.308381 °W
SURFACE ELEVATION: 3.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07-08-08 - 07-08-08
Drilling Method(s): HSA
SPT Method: Automatic Hammer
Other Test(s): None
Driller: D. Baker
Logger: J. Deusebio

GROUND WATER
▽ FIRST ENCOUNTERED AT: 7.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
42		WOH WOH 1	100		40 41.5									
44	-40													
46		WOH 1 1	100		45 46.5						45.5 / -41.9 **NORFOLK FORMATION (Qn)** Dark gray, silty fine SAND with a trace of medium sand and organics, wet, loose to medium dense. **SM** -with a trace of medium sand and organics, 46.5' to 56.0'	22	NP	67.0
48	-45													
50		WOH WOH 2	100		50 51.5						-moist below 50.0'	22	NP	
52														
54	-50													
56		2 4 5	100		55 56.5						56.0 / -52.4 **YORKTOWN FORMATION (Ty)** Gray green, silty fine SAND, with a trace of fine shell fragments **SM**			
58	-55													
60		3 6 10	100		60 61.5							19	NP	31.3
62														
64	-60													
66		4 6 9	100		65 66.5									
68														
70	-65													
72		4 10 12	100		70 71.5									
74	-70													
76		2 2 9	100		75 76.5							19	NP	25.2
78	-75													
80														

FIELD DESCRIPTION OF STRATA

REMARKS: RIG TYPE: Drill Truck.

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FIGURE A-4b

Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: Cities of Portsmouth/Norfolk
STRUCTURE: Tunnel

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STATION: OFFSET:
LATITUDE: 36.862592 °N LONGITUDE: 76.308381 °W
SURFACE ELEVATION: 3.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07-08-08 - 07-08-08
Drilling Method(s): HSA
SPT Method: Automatic Hammer
Other Test(s): None
Driller: D. Baker
Logger: J. Deusebio

GROUND WATER
▽ FIRST ENCOUNTERED AT: 7.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND / SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP STRATA	ROCK: DIP JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
82		3 5 7	100	80 – 81.5									
84	-80												
86		3 4 5	100	85 – 86.5							23	NP	
88	-85												
90		4 6 7	100	90 – 91.5									
92													
94	-90												
96		2 5 7	100	95 – 96.5							23	NP	33.9
98	-95												
100		4 5 7	100	100 – 101.5						End of Boring.			

REMARKS: RIG TYPE: Drill Truck.

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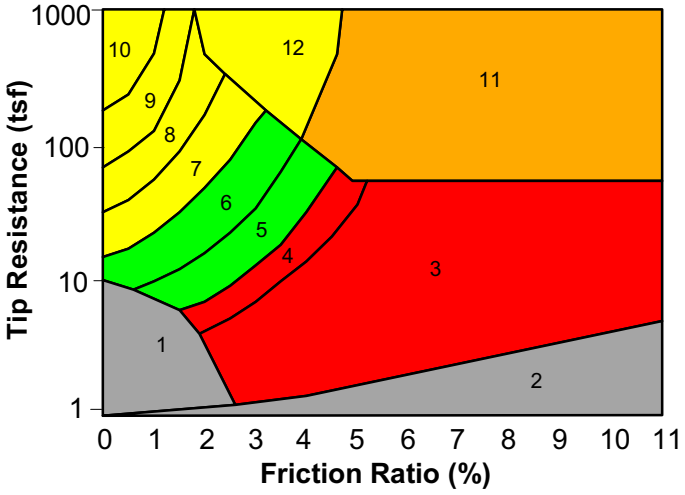
FIGURE A-4c



Zone	Soil Behavior Type	U.S.C.S.
1	Sensitive Fine-grained	OL-CH
2	Organic Material	OL-OH
3	Clay	CH
4	Silty Clay to Clay	CL-CH
5	Clayey Silt to Silty Clay	MH-CL
6	Sandy Silt to Clayey Silt	ML-MH
7	Silty Sand to Sandy Silt	SM-ML
8	Sand to Silty Sand	SM-SP
9	Sand	SW-SP
10	Gravelly Sand to Sand	SW-GW
11	Very Stiff Fine-grained *	CH-CL
12	Sand to Clayey Sand *	SC-SM

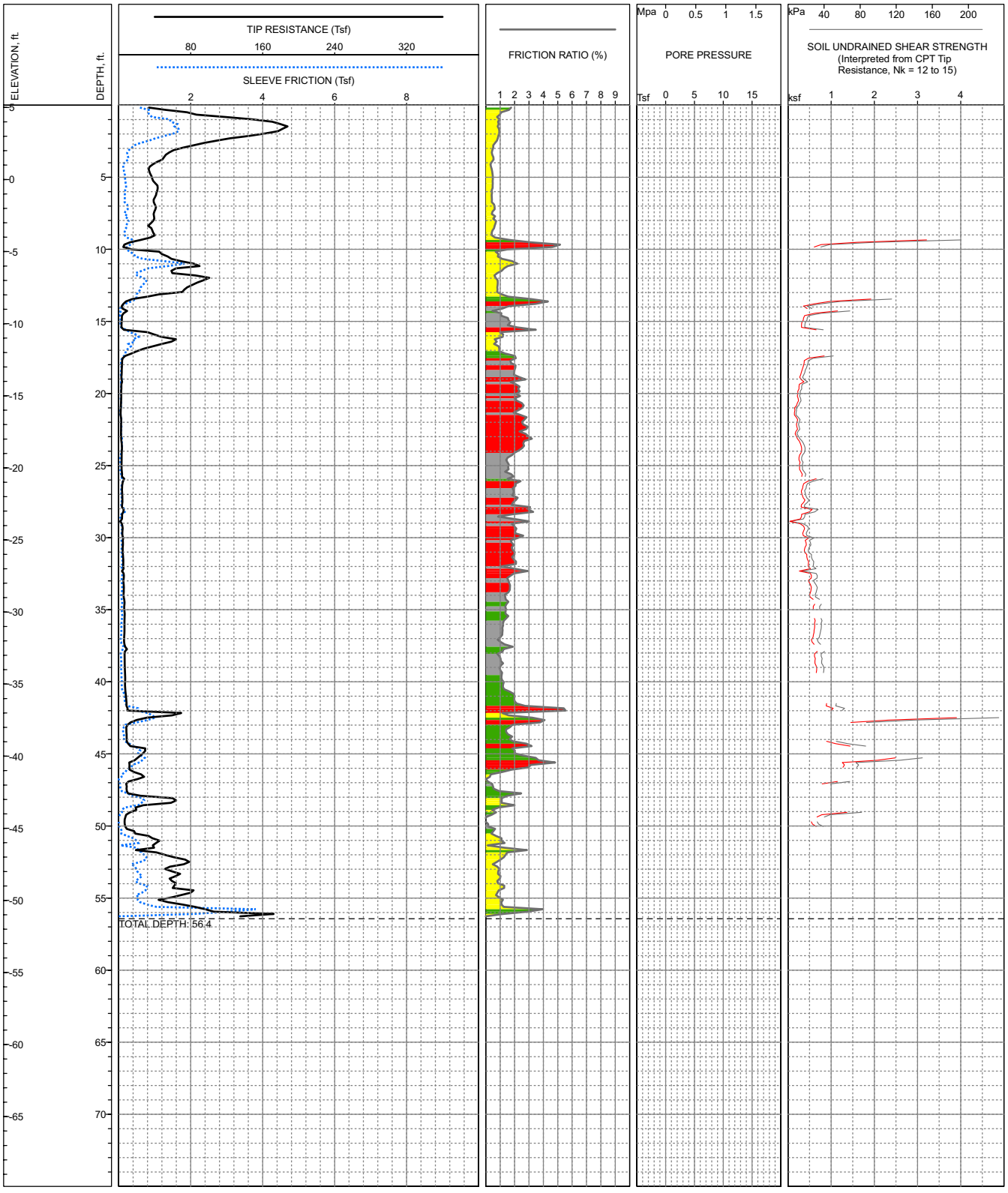
*overconsolidated or cemented

CPT CORRELATION CHART
(Robertson and Campanella, 1988)

KEY TO CPT LOGS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE A-5

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\06-Norfolk_SiteCharMXD\Figures\Fig-A-5_Key_to_CPT_Logs.mxd, 11/07/08, kstevens



COORDINATES: E: 12,124,019 N: 3,480,938 Virginia State Plane, South Zone, NAD83, feet
GROUND SURFACE EL: 5.2ft +/- (MLLW)
COMPLETION DEPTH: 56.4ft
TEST DATE: 9/15/2008
Soil classification based on R&C (1988)

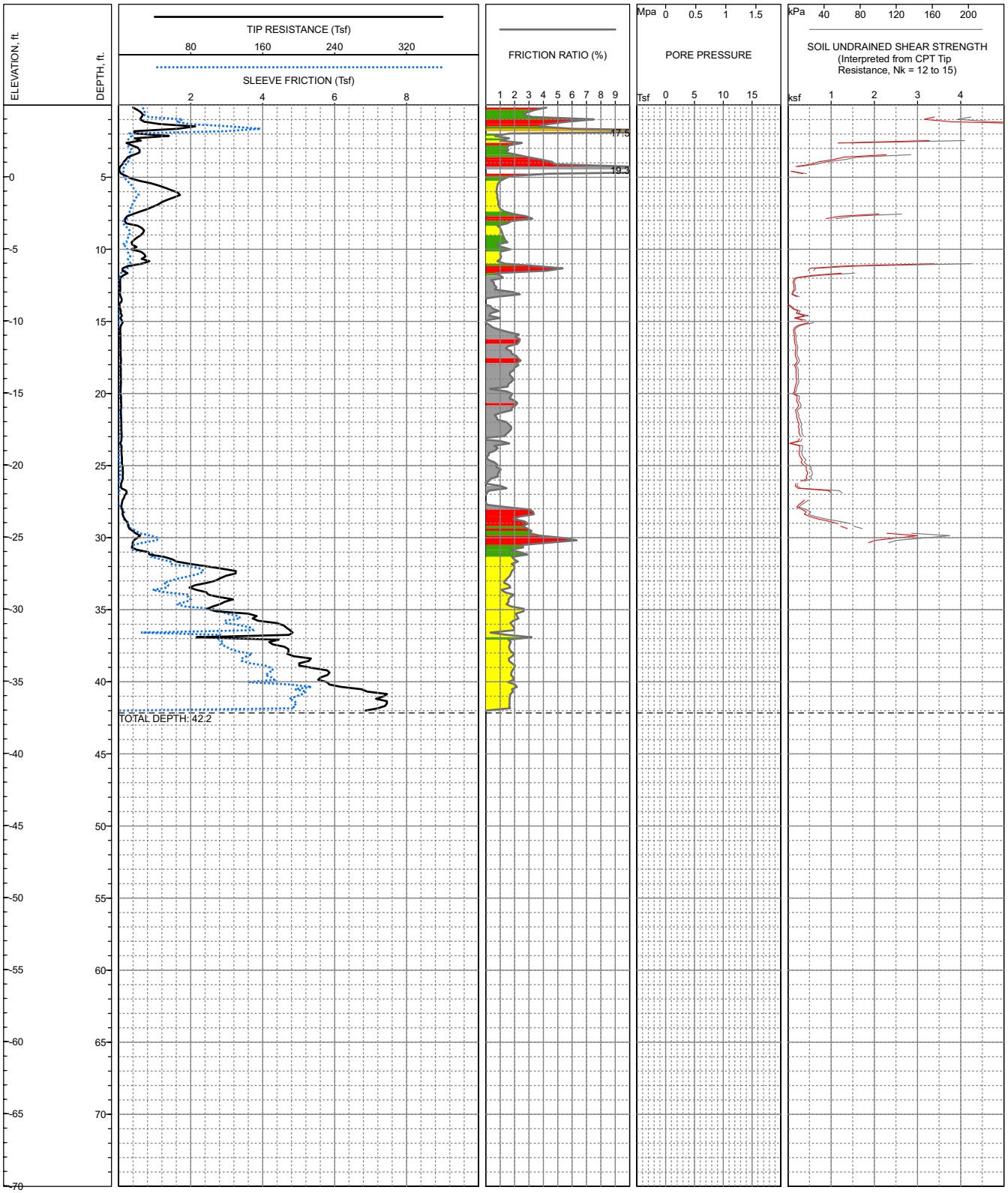
EXPLORATION METHOD: Cone Penetrometer
CONE AREA: 10cm^2
PERFORMED BY: VDOT

LOG OF CPT C-42

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE A-6

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Land\Logs\MXD\CPT_Logs_RC88.mxd,11/06/2008,kstevens



COORDINATES: E: 12,123,964 N: 3,480,996 Virginia State Plane, South Zone, NAD83, feet
GROUND SURFACE EL: 5.0ft +/- (MLLW)
COMPLETION DEPTH: 42.2ft
TEST DATE: 9/15/2008
Soil classification based on R&C (1988)

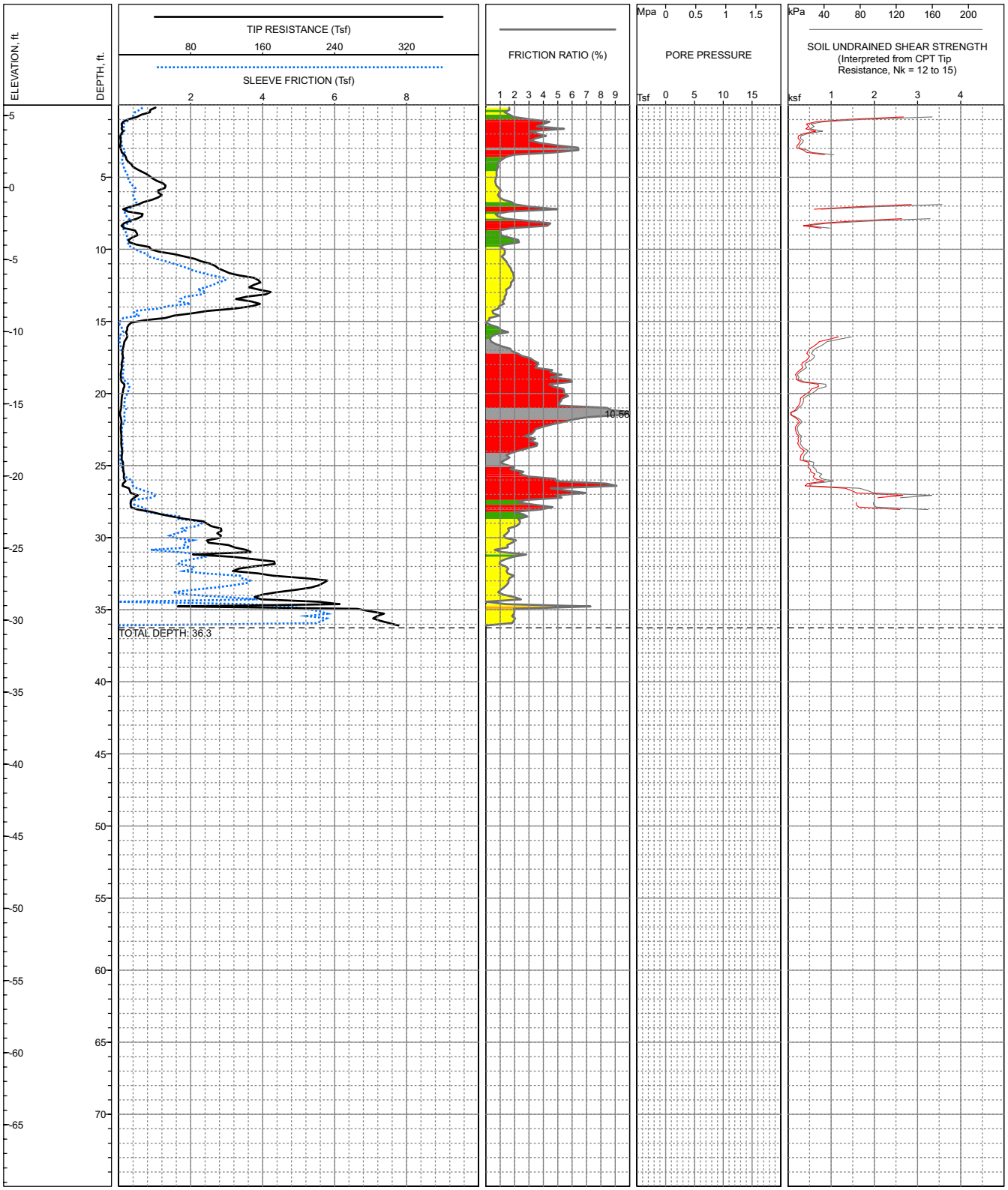
EXPLORATION METHOD: Cone Penetrometer
CONE AREA: 10cm^2
PERFORMED BY: VDOT

LOG OF CPT C-43

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE A-7

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Land\Logs\MXD\CPT_Logs_RC88.mxd,11/06/2008,kstevens



COORDINATES: E: 12,124,056 N: 3,481,084 Virginia State Plane, South Zone, NAD83, feet
GROUND SURFACE EL: 5.7ft +/- (MLLW)
COMPLETION DEPTH: 36.3ft
TEST DATE: 9/15/2008
Soil classification based on R&C (1988)

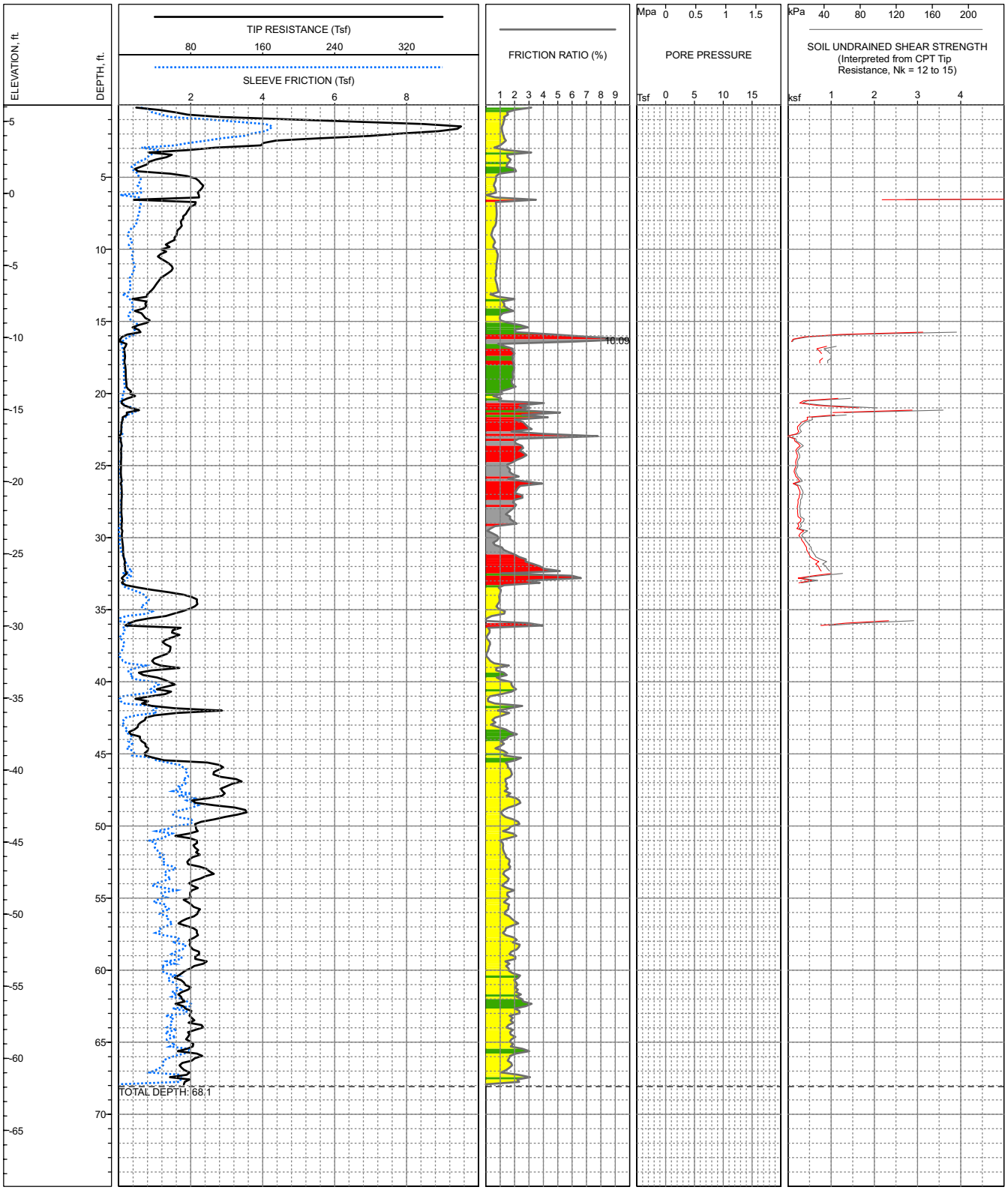
EXPLORATION METHOD: Cone Penetrometer
CONE AREA: 10cm^2
PERFORMED BY: VDOT

LOG OF CPT C-44

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE A-8

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Land\Logs\MXD\CPT_Logs_RC88.mxd,11/06/2008,kstevens



COORDINATES: E: 12,124,142 N: 3,481,017 Virginia State Plane, South Zone, NAD83, feet
GROUND SURFACE EL: 6.1ft +/- (MLLW)
COMPLETION DEPTH: 68.1ft
TEST DATE: 9/15/2008
Soil classification based on R&C (1988)

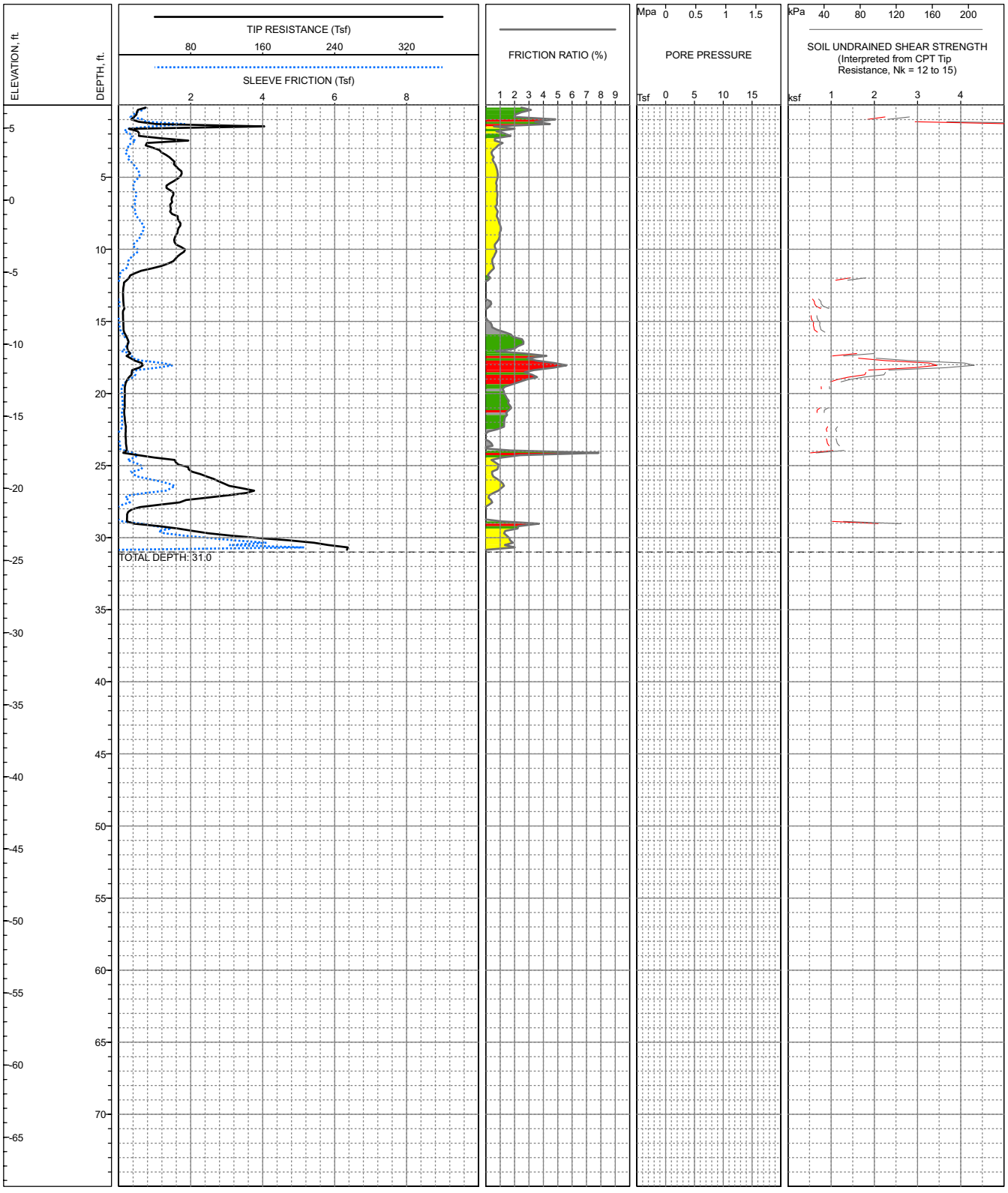
EXPLORATION METHOD: Cone Penetrometer
CONE AREA: 10cm^2
PERFORMED BY: VDOT

LOG OF CPT C-45

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE A-9

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Land\Logs\MXD\CPT_Logs_RC88.mxd,11/06/2008,kstevens



COORDINATES: E: 12,124,234 N: 3,481,135 Virginia State Plane, South Zone, NAD83, feet
GROUND SURFACE EL: 6.6ft +/- (MLLW)
COMPLETION DEPTH: 31.0ft
TEST DATE: 9/15/2008
Soil classification based on R&C (1988)

EXPLORATION METHOD: Cone Penetrometer
CONE AREA: 10cm^2
PERFORMED BY: VDOT

LOG OF CPT C-46

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE A-10

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Land\Logs\MXD\CPT_Logs_RC88.mxd,11/06/2008,kstevens

APPENDIX B
LABORATORY TESTING

DRILL HOLE	DEPTH, ft	DEPTH INTERVAL, ft	SAMPLE NUMBER	MATERIAL DESCRIPTION	UWW pcf	UDW pcf	MC %	FINES %	ATTERBERG LIMITS		COMPACTION TEST		DIRECT SHEAR		COMPRESSIVE STRENGTH TESTS		CORROSIVITY TESTS				D50 (mm)	EXPANSION INDEX	SAND EQUIVALENT (SE)	SPECIFIC GRAVITY
									LL	PI	MAX DD pcf	OPT MC %	C ksf	PHI deg	Qu, ksf	S_u (Cell Prs.) ksf	R	pH	Cl	So_4 (%)				
B-17	0.0	0 - 2.0		Silty Fine SAND (SM) with medium sand			16	39	23	4											0.23			
B-17	2.0	2.0 - 16.0		Silty Fine SAND (SM)			11	17	16	NP											0.2			
B-17	4.0			Silty Fine SAND (SM)			19																	
B-17	6.0			Silty Fine SAND (SM)			21																	
B-17	8.0			Silty Fine SAND (SM)			25		16	NP														
B-17	15.0			Silty Fine SAND (SM)			37																	
B-17	16.0	16.0 - 25.0		CLAY (CL) with sand				72																
B-17	20.0			Lean CLAY (CL)			57		29	12														
B-17	25.0	25.0 - 30.0		SILT (ML) with sand				71	NP	NP														
B-17	30.0	30.0 - 35.0		Sandy SILT (ML)			20	63	NP	NP														
B-17	35.0	35.0 - 41.5		Fine to Medium SAND (SP) with silt				8	15	NP											0.41			
B-17	40.0			Fine to Medium SAND (SP) with silt			17																	
B-18	0.0	0 - 6.0		Silty Fine SAND (SM) with medium sand			10	13	17	NP											0.28			
B-18	2.0			Silty Fine SAND (SM) with medium sand			22																	
B-18	4.0			Silty Fine SAND (SM) with medium sand			30		17	NP														
B-18	6.0	6.0 - 10.0		Fine SAND (SP) with a trace of medium sand			24	2	17	NP											0.29			
B-18	8.0			Fine SAND (SP) with a trace of medium sand			23																	
B-18	10.0	10.0 - 21.0		Silty Fine SAND (SM) with a trace of medium sand				14													0.26			
B-18	15.0			Silty Fine SAND (SM) with a trace of medium sand			27		NP	NP														
B-18	20.0			Silty Fine SAND (SM) with a trace of medium sand			77																	
B-18	21.0	21.0 - 31.0		Silty Fine SAND (SM)				47													0.08			
B-18	25.0			Silty Fine SAND (SM)					NP	NP														
B-18	30.0			Silty Fine SAND (SM)			24		NP	NP														
B-18	31.0	31.0 - 36.2		Sandy SILT (ML)				51																
B-18	35.0			Sandy SILT (ML)																				
B-18	36.2	36.2 - 45.0		Fine to Medium SAND with silt (SP-SM)				6													0.3			
B-18	40.0			Fine to Medium SAND with silt (SP-SM)			18		20	NP														
B-18	50.0	50.0 - 61.5		Silty Fine SAND (SM)				19													0.14			
B-18	55.0			Silty Fine SAND (SM)			26		17	NP														
B-19	2.0			Silty Fine SAND (SM)			18																	

SUMMARY OF LABORATORY TEST RESULTS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

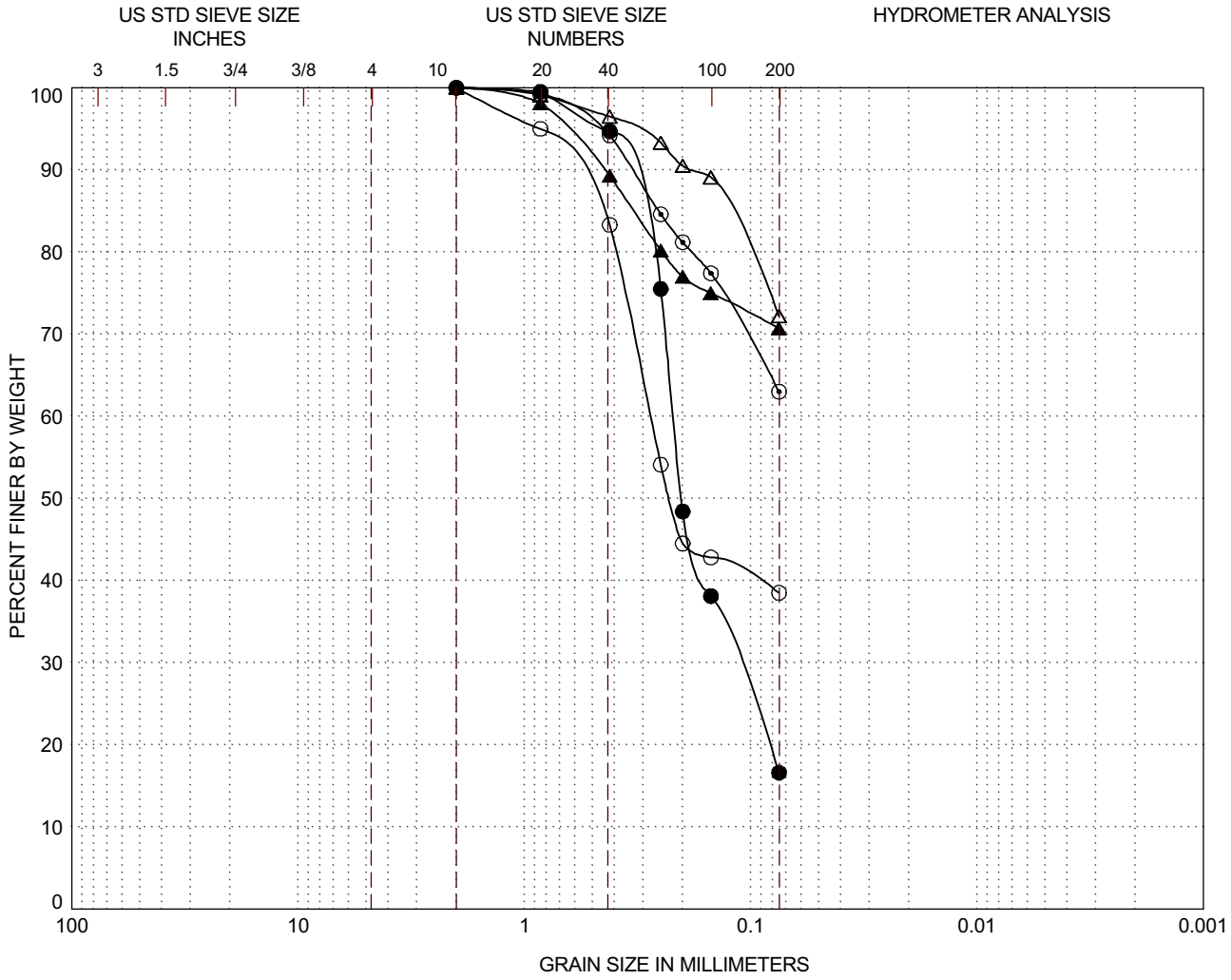
FIGURE B-1a

DRILL HOLE	DEPTH, ft	DEPTH INTERVAL, ft	SAMPLE NUMBER	MATERIAL DESCRIPTION	UWW pcf	UDW pcf	MC %	FINES %	ATTERBERG LIMITS		COMPACTION TEST		DIRECT SHEAR		COMPRESSIVE STRENGTH TESTS		CORROSIVITY TESTS				D50 (mm)	EXPANSION INDEX	SAND EQUIVALENT (SE)	SPECIFIC GRAVITY
									LL	PI	MAX DD pcf	OPT MC %	C ksf	PHI deg	Qu, ksf	S_u (Cell Prs.) ksf	R	pH	Cl	So_4 (%)				
B-19	4.0	4.0 - 20.5		Fine SAND (SP) with a trace of medium sand			24	4													0.27			
B-19	6.0			Silty Fine SAND (SM)			24		17	NP														
B-19	8.0			Fine SAND (SP) with a trace of medium sand			23																	
B-19	15.0			Fine SAND (SP) with a trace of medium sand			24		17	NP														
B-19	20.5	20.5 - 45.5		Fat CLAY (CH)				92																
B-19	25.0			Fat CLAY (CH)																				
B-19	30.0			Fat CLAY (CH)			58		57	34														
B-19	45.0			Fat CLAY (CH)			67		22	NP														
B-19	45.5	45.5 - 56.0		Silty Fine SAND (SM) with a trace of medium sand				31													0.16			
B-19	50.0			Silty Fine SAND (SM) with a trace of medium sand					22	NP														
B-19	56.0	56.0 - 81.5		Silty Fine SAND (SM)				24													0.11			
B-19	60.0			Silty Fine SAND (SM)			31		19	NP														
B-19	75.0			Silty Fine SAND (SM)			25		19	NP														
B-19	81.5	81.5 - 101.5		Silty Fine SAND (SM)				44													0.08			
B-19	85.0			Silty Fine SAND (SM)					23	NP														
B-19	95.0			Silty Fine SAND (SM)			34		23	NP														

SUMMARY OF LABORATORY TEST RESULTS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-1b

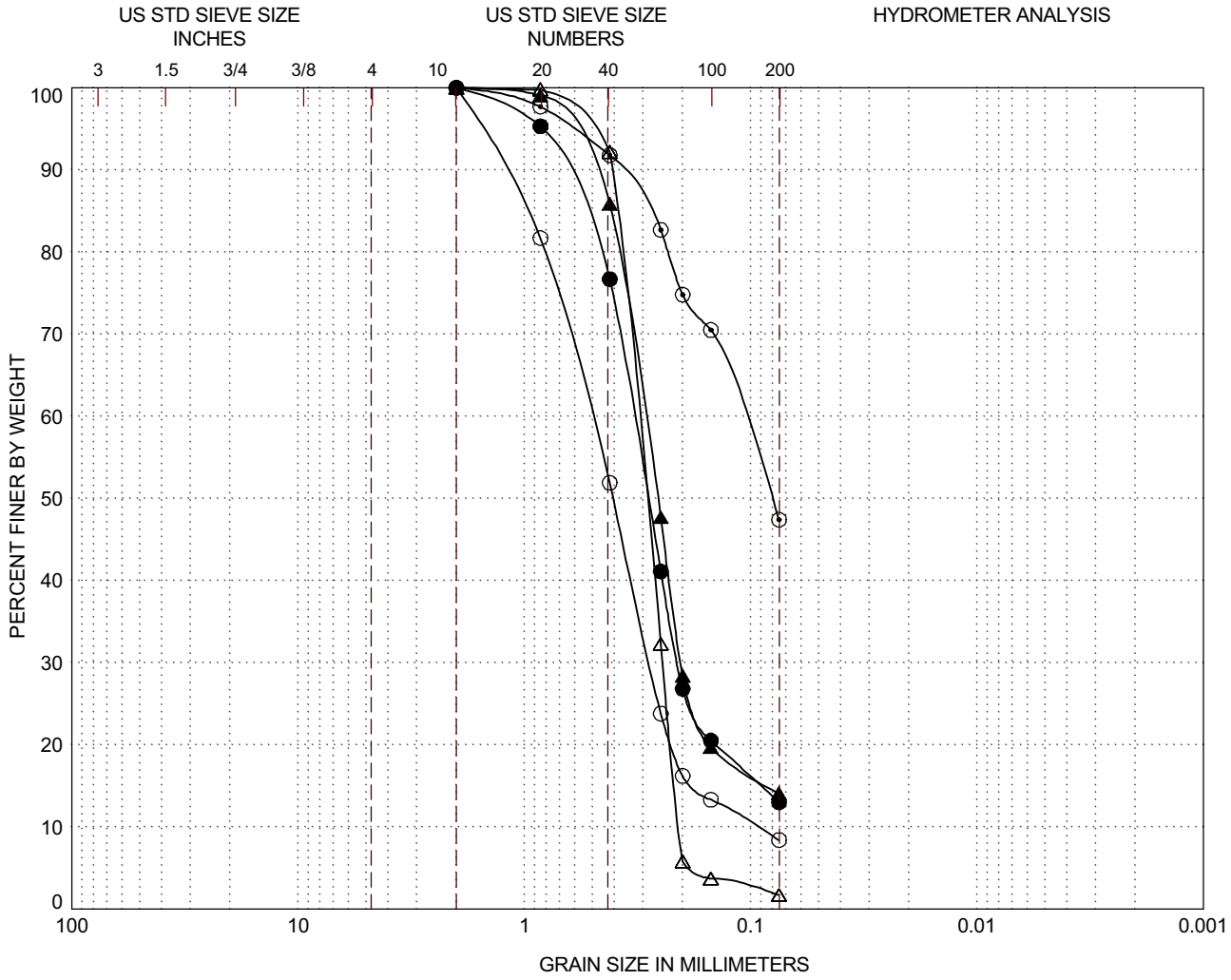


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND			CLASSIFICATION	Cc	Cu	FC(%)	D50
	(location)	(depth interval,ft)					
○	B-17	0 - 2.0	Silty Fine SAND (SM) with medium sand			38.5	0.23
●	B-17	2.0 - 16.0	Silty Fine SAND (SM)			16.6	0.20
△	B-17	16.0 - 25.0	CLAY (CL) with sand			72.2	
▲	B-17	25.0 - 30.0	SILT (ML) with sand			70.7	
⊙	B-17	30.0 - 35.0	Sandy SILT (ML)			63.0	

GRAIN SIZE CURVES
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-2a

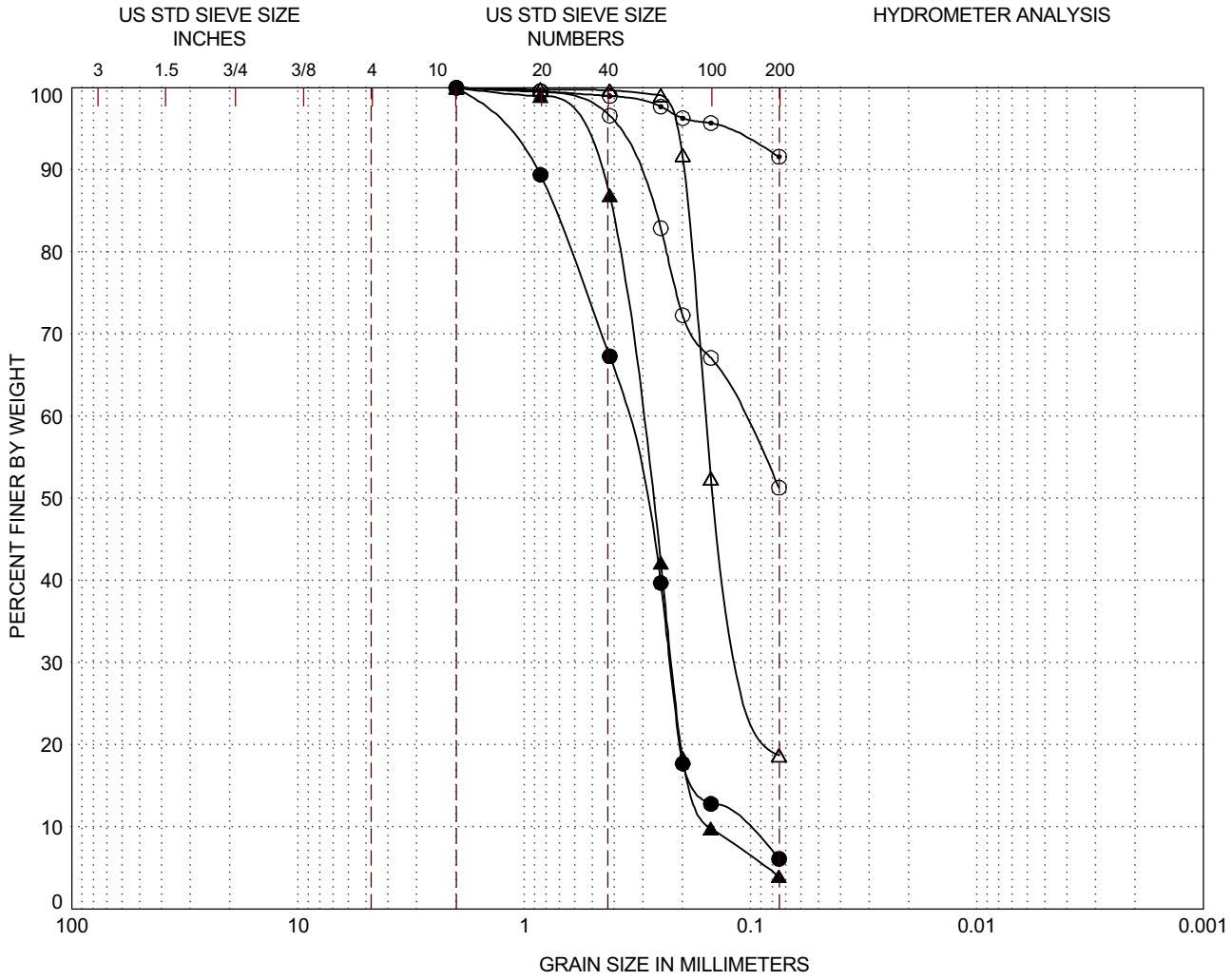


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND			CLASSIFICATION	Cc	Cu	FC(%)	D50
	(location)	(depth interval,ft)					
○	B-17	35.0 - 41.5	Fine to Medium SAND (SP) with silt	1.6	5.4	8.4	0.41
●	B-18	0 - 6.0	Silty Fine SAND (SM) with medium sand			13.0	0.28
△	B-18	6.0 - 10.0	Fine SAND (SP) with a trace of medium sand	0.9	1.5	1.7	0.29
▲	B-18	10.0 - 21.0	Silty Fine SAND (SM) with a trace of medium sand			14.1	0.26
⊙	B-18	21.0 - 31.0	Silty Fine SAND (SM)			47.4	0.08

GRAIN SIZE CURVES
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-2b

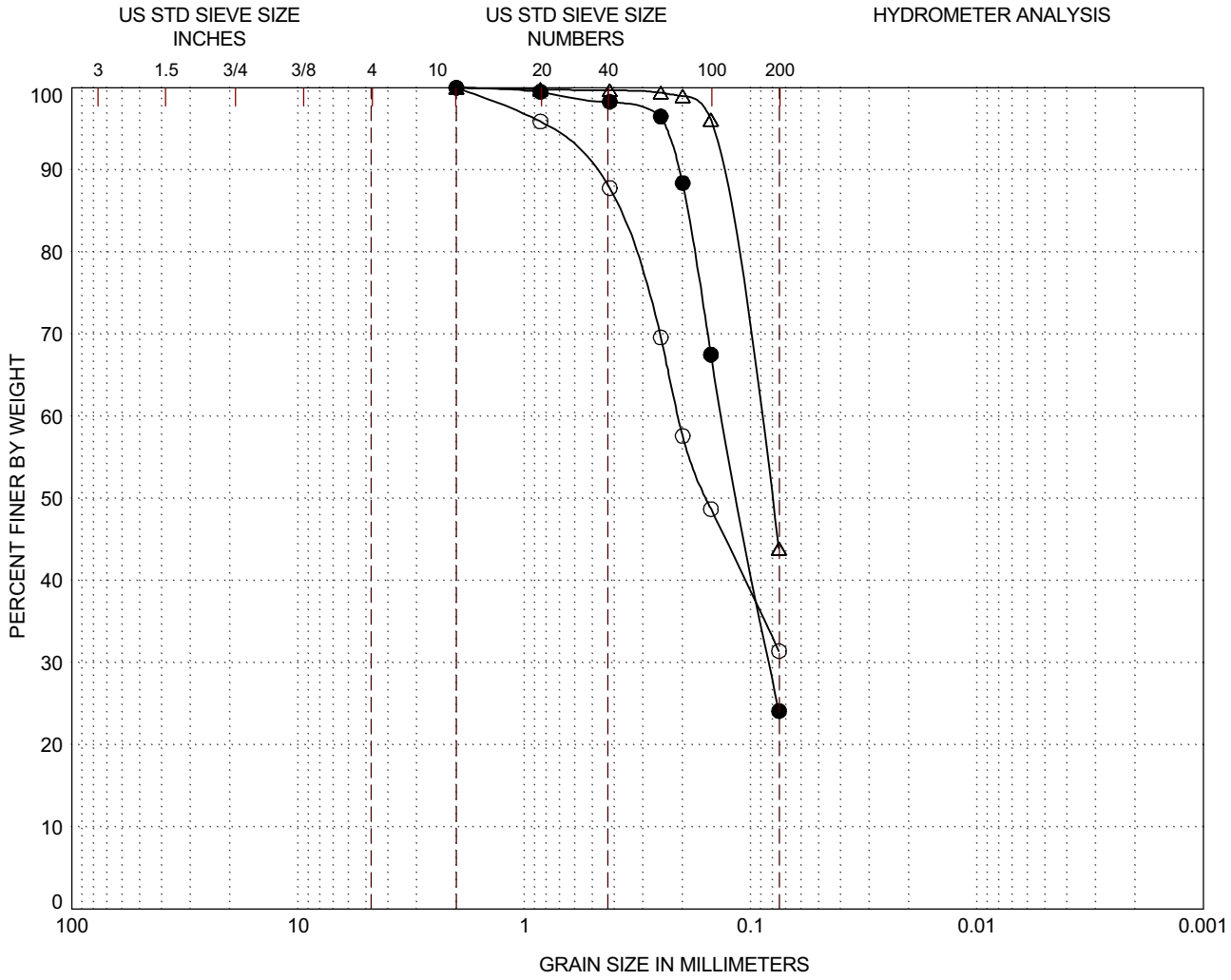


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND			CLASSIFICATION	Cc	Cu	FC(%)	D50
	(location)	(depth interval,ft)					
○	B-18	31.0 - 36.2	Sandy SILT (ML)			51.3	
●	B-18	36.2 - 45.0	Fine to Medium SAND (SP) with silt	1.2	3.3	6.1	0.30
△	B-18	50.0 - 61.5	Silty Fine SAND (SM)			18.7	0.14
▲	B-19	4.0 - 20.5	Fine SAND (SP) with a trace of medium sand	1.1	2.0	4.0	0.27
⊙	B-19	20.5 - 45.5	Fat CLAY (CH)			91.6	

GRAIN SIZE CURVES
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-2c

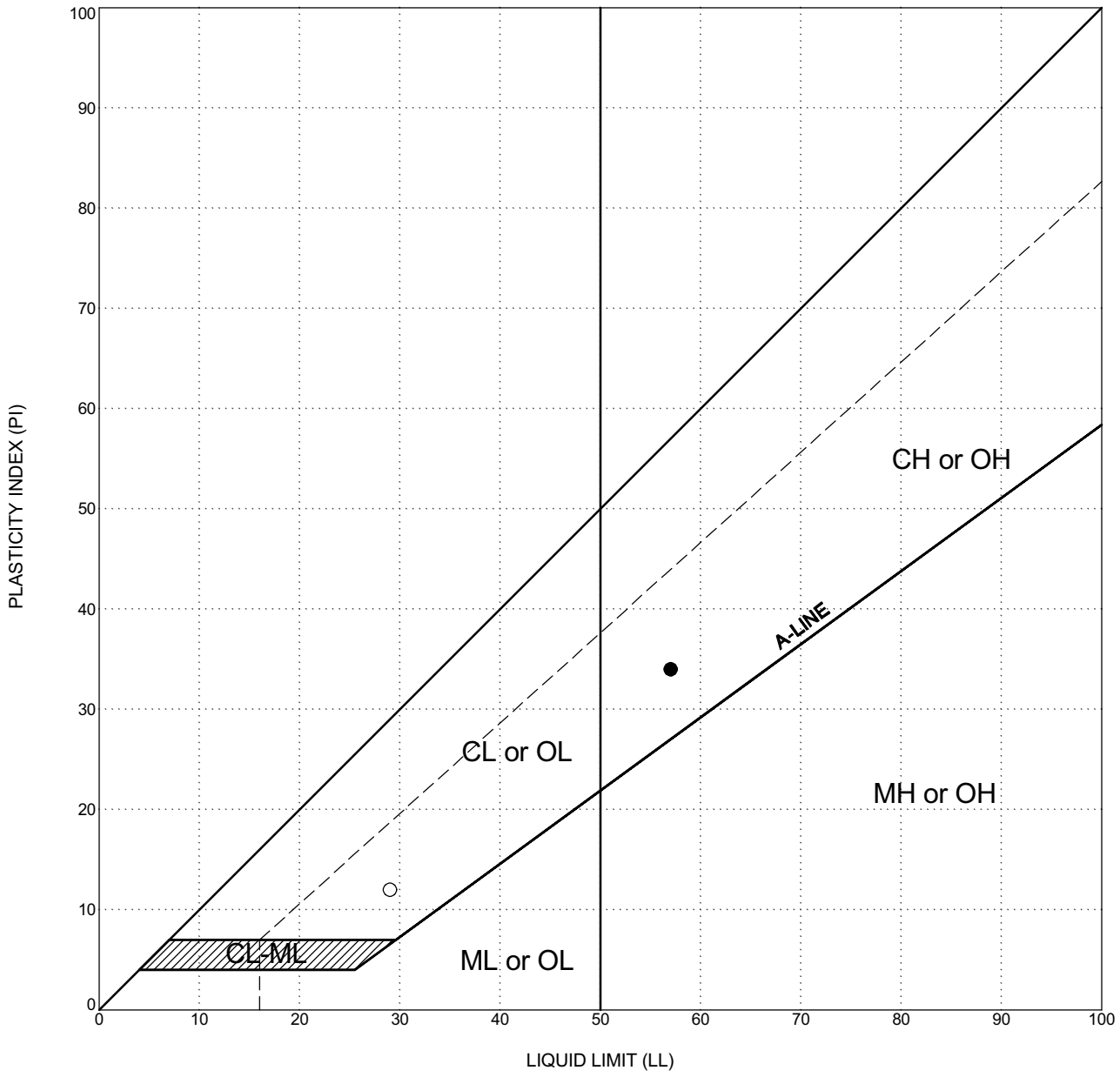


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND			CLASSIFICATION	Cc	Cu	FC(%)	D50
	(location)	(depth interval,ft)					
○	B-19	45.5 - 56.0	Silty Fine SAND (SM) with a trace of medium sand			31.4	0.16
●	B-19	56.0 - 81.5	Silty Fine SAND (SM)			24.1	0.11
△	B-19	81.5 - 101.5	Silty Fine SAND (SM)			43.9	0.08

GRAIN SIZE CURVES
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-2d



LEGEND			CLASSIFICATION	ATTERBERG LIMITS TEST RESULTS		
	location	depth, ft		LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)
○	B-17	20.0	Lean CLAY (CL)	29	17	12
●	B-19	30.0	Fat CLAY (CH)	57	23	34

PLASTICITY CHART
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-3

CHARTS



VDOT 2008 Onshore Norfolk Explorations

Fugro Boring Designation	VDOT Boring Designation	Completion Date	Coordinates Virginia State Plane South Zone (NAD 83, feet) Northing	Easting	Ground Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
B-17	08BH-017	7/1/2008	3481135	12124204	6.9	41.5	-34.6
B-18	08BH-018	7/2/2008	3481049	12124112	6.5	61.5	-55.0
B-19	08BH-019	7/8/2008	3480972	12124023	5.2	101.5	-96.3

Fugro CPT Designation	VDOT CPT Designation	Completion Date	Coordinates (feet) Virginia State Zone South, NAD 83 Northing	Easting	Ground Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
C-42	08CP-042	9/15/2008	3480938	12124019	5.2	56.4	-51.3
C-43	08CP-043	9/15/2008	3480996	12123964	5.0	42.2	-37.2
C-44	08CP-044	9/15/2008	3481084	12124056	5.7	36.3	-30.5
C-45	08CP-045	9/15/2008	3481017	12124142	6.1	68.1	-62.0
C-46	08CP-046	9/15/2008	3481135	12124234	6.6	31.0	-24.4

LEGEND

Geotechnical Explorations

- B-14 — 2008 VDOT Boring Location
- C-40 — 2008 VDOT CPT Location
- MW-1 — MMA 2008 Monitoring Well
- B-09 — 2008 Fugro Boring Location
- C-23 — 2008 Fugro CPT Location
- T-4 — 2008 Fugro T-Bar Location
- V-4 — 2008 Fugro Vane Shear Location
- 60-15 — Historical VDOT Boring Location

2000 Norfolk Topographic Survey (NAD 88)

Topographic Contour in Feet (NAVD 88)
Contour interval is 2 ft.

Elizabeth River Bathymetry (MLLW, feet)

Refer to notes for vertical datum.

Bathymetric Contour in Feet (MLLW)
Contour interval is 5 ft.

Approximate Location of Midtown Tunnel
Not for design or construction planning
(Refer to Section 7.1 in text)

NOTES

1) Coordinate Grid: Virginia State Plane, South Zone, NAD 83, Feet
2) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>
3) Reference to Mean Lower Low Water (MLLW), 1983-2001 Tidal Epoch, is based on observations performed and published by the National Oceanic and Atmospheric Administration, National Ocean Service (NOAA/NOS). Tidal Bench Mark 8638610 at Sewells Point, Hampton Roads, was used as the MLLW constraint for this project.

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GEODETIC INFORMATION

SPHEROID:	GRS 1980
SEMI-MAJOR AXIS:	6,378,137.000
SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.25722101
ECCENTRICITY^2:	0.006694380
PROJECTION:	LAMBERT CONFORMAL CONIC
ZONE:	VIRGINIA SOUTH
LONGITUDE OF ORIGIN:	36.3^0
FALSE EASTING:	11,482,916
FALSE NORTHING:	3,280,833



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www.fugroatlantic.com

EXPLORATION LOCATION MAP
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

0 100 200 Feet

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Nov. 2008	Report Submittal	KCS	KRS	KRS
2					
3					

JOB NUMBER: 3602.001 CHART NO.: 1

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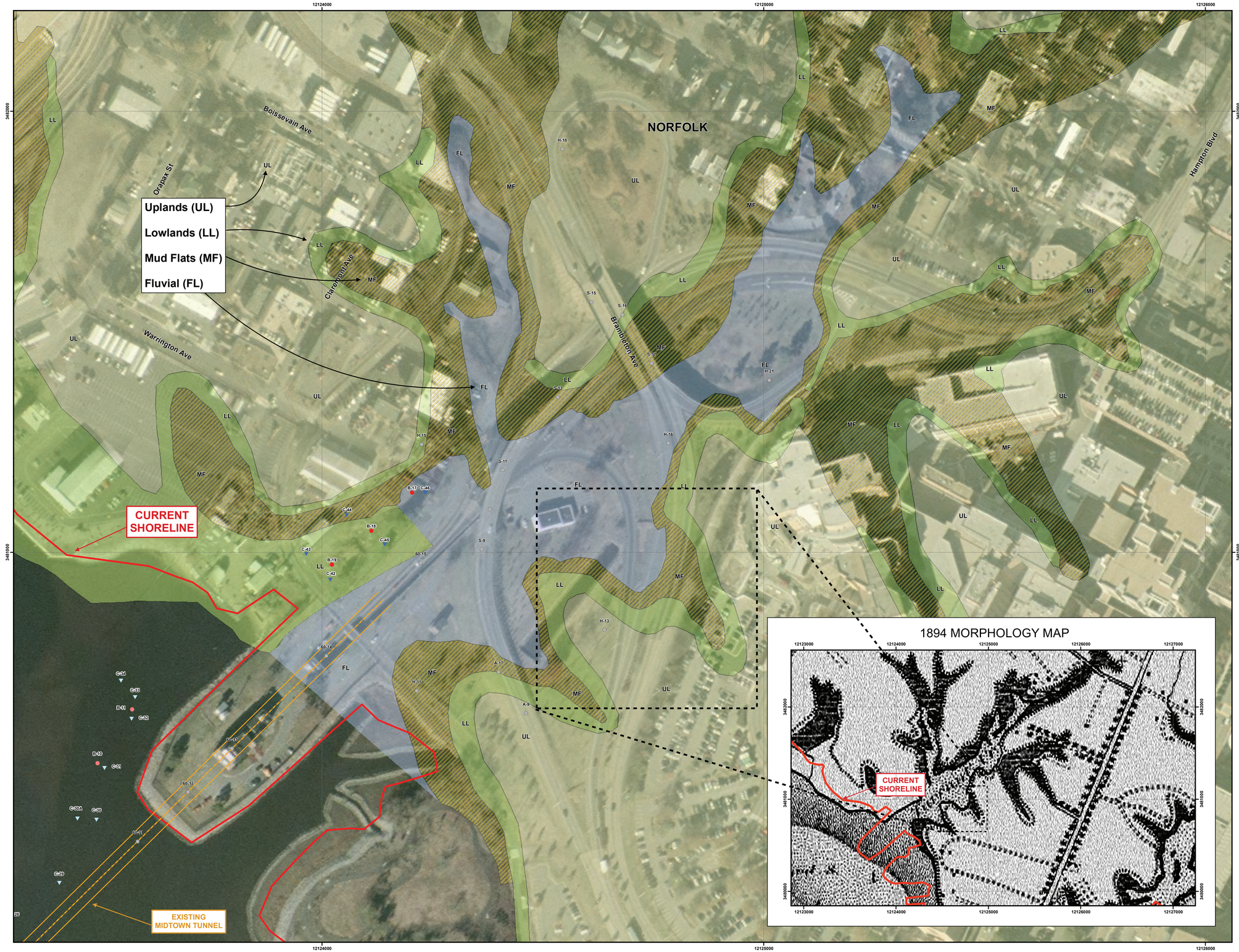

LEGEND

1894 Interpreted Morphological Areas
See the table below for source used as basis of interpretation.

- Fluvial (FL)- Unknown material types
- Mud Flats (MF)- Likely fine-grained sediments with organics
- Lowlands (LL)- Unknown material types
- Uplands (UL)- Likely sandy materials

VDOT Land Exploration Locations

- B-18 — Boring
- C-43 — CPT

Fugro Marine Exploration Locations

- 0B-09 — Boring
- C-23 — CPT

1960 Exploration Locations

- 60-15 — Boring (by others)
- Current Shoreline (digitized from 2005 aerial photograph)
- Approximate Location of Midtown Tunnel (Refer to Section 7.1 in text)

LIST OF MAPS AND AERIAL PHOTOS REVIEWED
Highlighted maps/photos are shown on this chart

Year	Map/Photo	Scale
1887	Sanborn Map & Publishing Co., Norfolk Virginia	1:2,400
1888	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1893	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1894	NOAA Chart BIC-45, Hampton Roads	1:20,000
1898	Sanborn Map & Publishing Co., Norfolk Virginia	1:9600
1903	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1910	Sanborn Map & Publishing Co., Norfolk Virginia, Vo. 1	1:9,600
1915	NOAA Chart No. 400, Hampton Roads	1:20,000
1920	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1921	Sanborn Map & Publishing Co., Norfolk Virginia, Vo. 3	1:9,600
1923	NOAA Chart No. 400, Hampton Roads	1:20,000
1924	NOAA Chart No. 400, Hampton Roads	1:20,000
1926	NOAA Chart No. 400, Hampton Roads	1:20,000
1928	NOAA Chart No. 400, Hampton Roads	1:20,000
1930	NOAA Chart No. 400, Hampton Roads	1:20,000
1932	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1959	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1968	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1969	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1975	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
1994	Digital Ortho Quarter Quadrangle, USGS Geological Survey	1.0 m/pixel
2005	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
2005	Ortho-Rectified Chesapeake Aerial Imagery	0.5 m/pixel
2008	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000

NOTES

1) Coordinate Grid: Virginia State Plane, South Zone, NAD 83, Feet

2) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

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1894 MORPHOLOGY INTERPRETATION
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

0 100 200 Feet

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Nov. 2008	Report Submittal	KCS	KRS	KRS
2					
3					

JOB NUMBER: 3602.001 CHART NO.: 2

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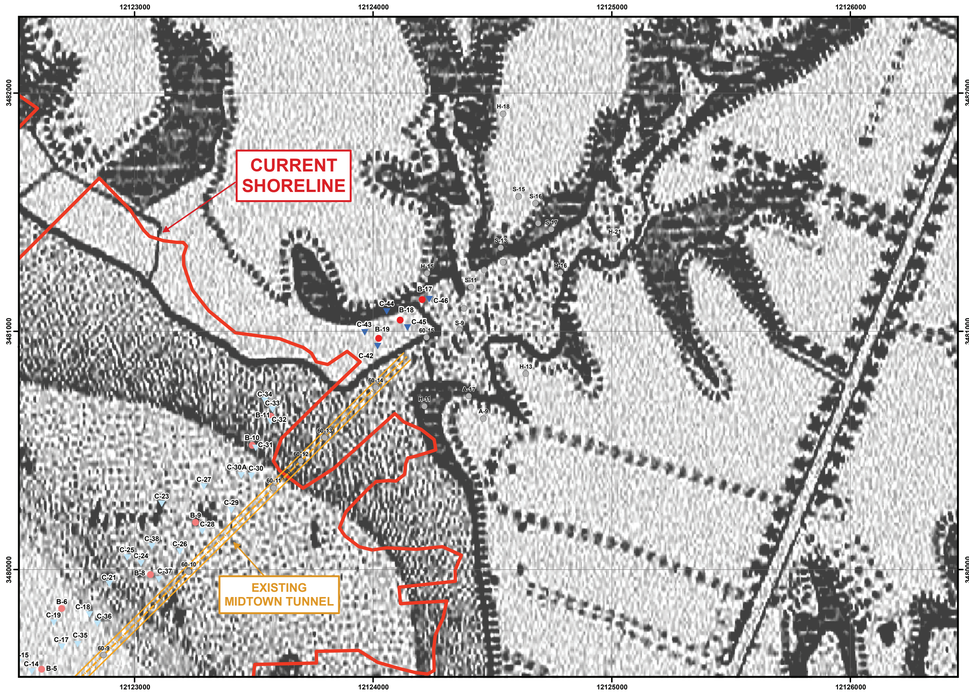
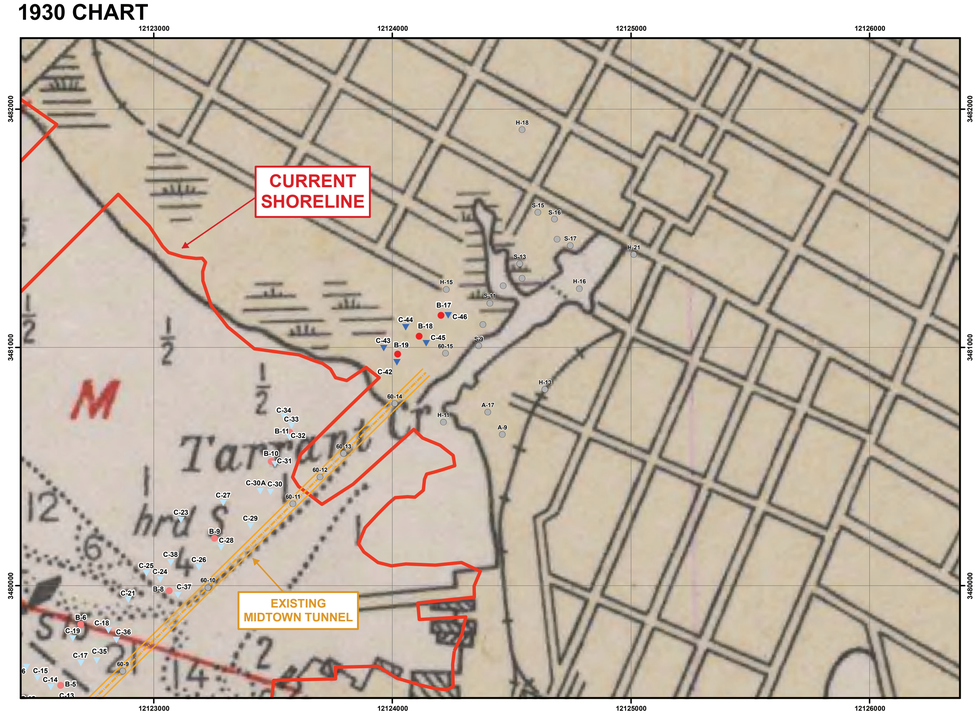
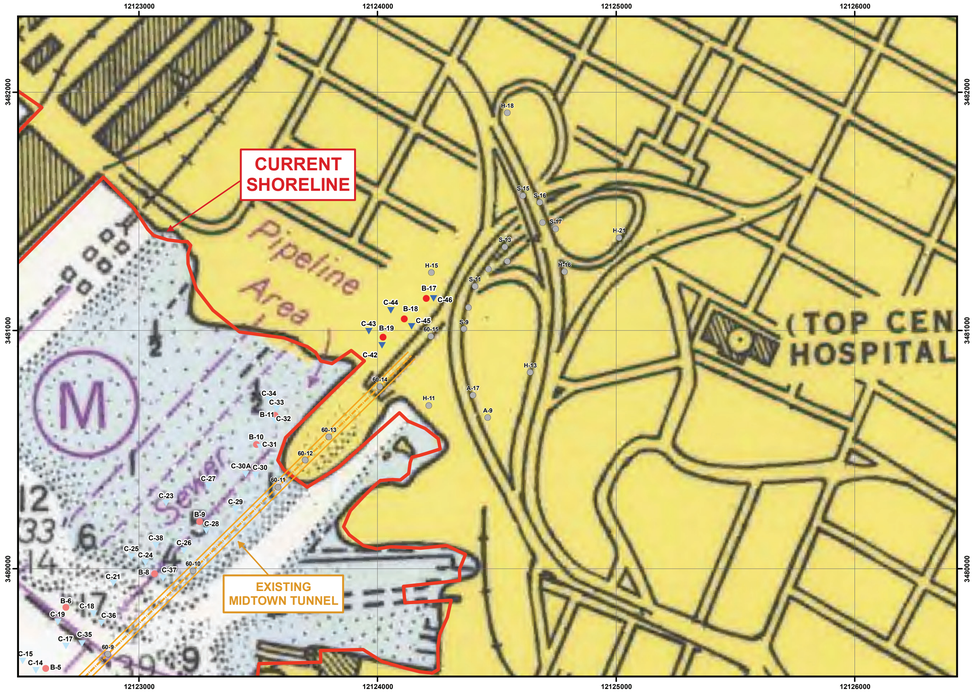
1894 CHART



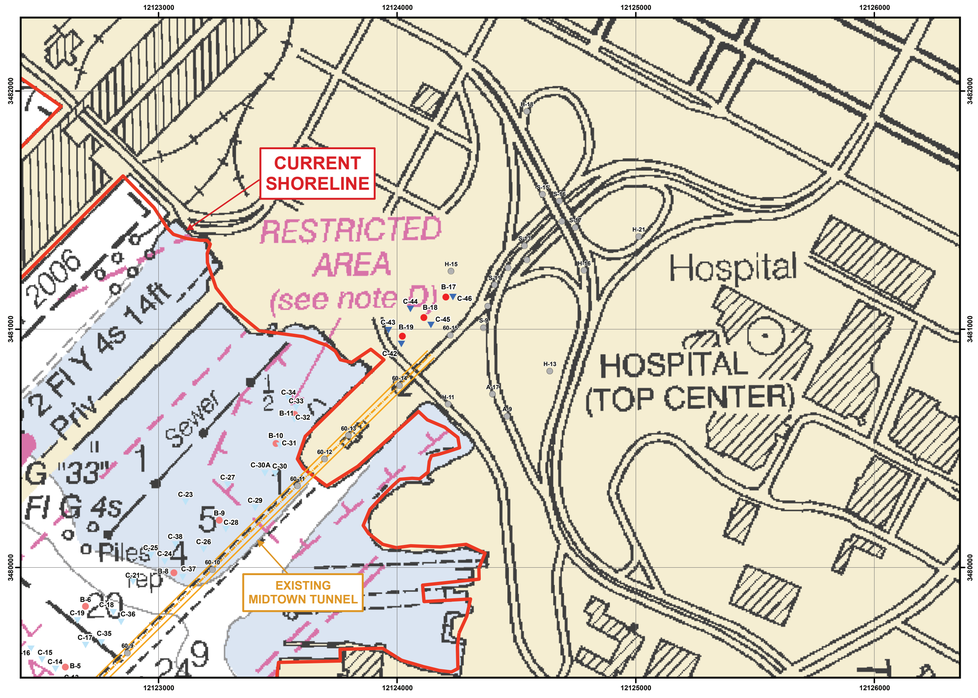
1930 CHART



1969 CHART



2008 CHART



LEGEND

VDOT Land Exploration Locations

- B-18 — Boring
- C-43 — CPT

Fugro Marine Exploration Locations

- B-9 — Boring
- C-23 — CPT

1960 Exploration Locations

- 60-15 — Boring (by others)
- Current Shoreline (digitized from 2005 aerial photograph)
- Approximate Location of Midtown Tunnel (Refer to Section 7.1 in text)

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1924	NOAA Chart No. 400, Hampton Roads	1:20,000
1926	NOAA Chart No. 400, Hampton Roads	1:20,000
1928	NOAA Chart No. 400, Hampton Roads	1:20,000
1930	NOAA Chart No. 400, Hampton Roads	1:20,000
1932	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1959	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1968	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
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1994	Digital Ortho Quarter Quadrangle, USGS Geological Survey	1.0 m/pixel
2005	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
2005	Ortho-Rectified Chesapeake Aerial Imagery	0.5 m/pixel
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NOTES

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ZONE:	VIRGINIA SOUTH
LONGITUDE OF ORIGIN:	36.3°
FALSE EASTING:	11,482,916
FALSE NORTHING:	3,280,833

N W E S



FUGRO ATLANTIC
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Fax: (757) 625-3352
www.fugroatlantic.com

NORFOLK SITE DEVELOPMENT
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

0 300 600 Feet

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Nov. 2008	Report Submittal	KCS	KRS	KRS
2					
3					

JOB NUMBER: 3602.001 CHART NO.: 3

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LEGEND

Historical Fill
Date when fill was first documented.
Refer to the table below for historical charts used to map fill bodies.

- Artificial Fill (af), 1969
- Artificial Fill (af), 1959
- Artificial Fill (af), 1930

Data indicates year of map in which the fill first appeared on the map. For example, "Fill, 1959" body first appeared on the 1959 map and was placed sometime between 1930 and 1959.

VDOT Land Exploration Locations

- B-18 Boring
- C-43 CPT

Fugro Marine Exploration Locations

- 0B-09 Boring
- C-23 CPT

1960 Exploration Locations

- 60-15 Boring (by others)
- Current Shoreline (digitized from 2005 aerial photograph)
- Approximate Location of Midtown Tunnel (Refer to Section 7.1 in text)

LIST OF MAPS AND AERIAL PHOTOS REVIEWED
Highlighted maps/photos are shown on this chart

Year	Map/Photo	Scale
1887	Sanborn Map & Publishing Co., Norfolk Virginia	1:2,400
1888	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1893	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1894	NOAA Chart BIC-45, Hampton Roads	1:20,000
1898	Sanborn Map & Publishing Co., Norfolk Virginia	1:9600
1903	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1910	Sanborn Map & Publishing Co., Norfolk Virginia, Vo. 1	1:9,600
1915	NOAA Chart No. 400, Hampton Roads	1:20,000
1920	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1921	Sanborn Map & Publishing Co., Norfolk Virginia, Vo. 3	1:9,600
1923	NOAA Chart No. 400, Hampton Roads	1:20,000
1924	NOAA Chart No. 400, Hampton Roads	1:20,000
1926	NOAA Chart No. 400, Hampton Roads	1:20,000
1928	NOAA Chart No. 400, Hampton Roads	1:20,000
1930	NOAA Chart No. 400, Hampton Roads	1:20,000
1932	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1959	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1968	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1969	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1975	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
1994	Digital Ortho Quarter Quadrangle, USGS Geological Survey	1.0 m/pixel
2005	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
2005	Ortho-Rectified Chesapeake Aerial Imagery	0.5 m/pixel
2008	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000

NOTES

1) Coordinate Grid: Virginia State Plane, South Zone, NAD 83, Feet

2) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

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GEODETIC INFORMATION

SPHEROID:	GRS 1980
SEMI-MAJOR AXIS:	6,378,137.000
SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.25722101
ECCENTRICITY^2:	0.006694380
PROJECTION:	LAMBERT CONFORMAL CONIC
ZONE:	VIRGINIA SOUTH
LONGITUDE OF ORIGIN:	36.3°
FALSE EASTING:	11,482,916
FALSE NORTHING:	3,280,833



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HISTORICAL FILL AREAS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

0 100 200 Feet

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Nov. 2008	Report Submittal	KCS	KRS	KRS
2					
3					

JOB NUMBER: 3602.001 CHART NO.: 4

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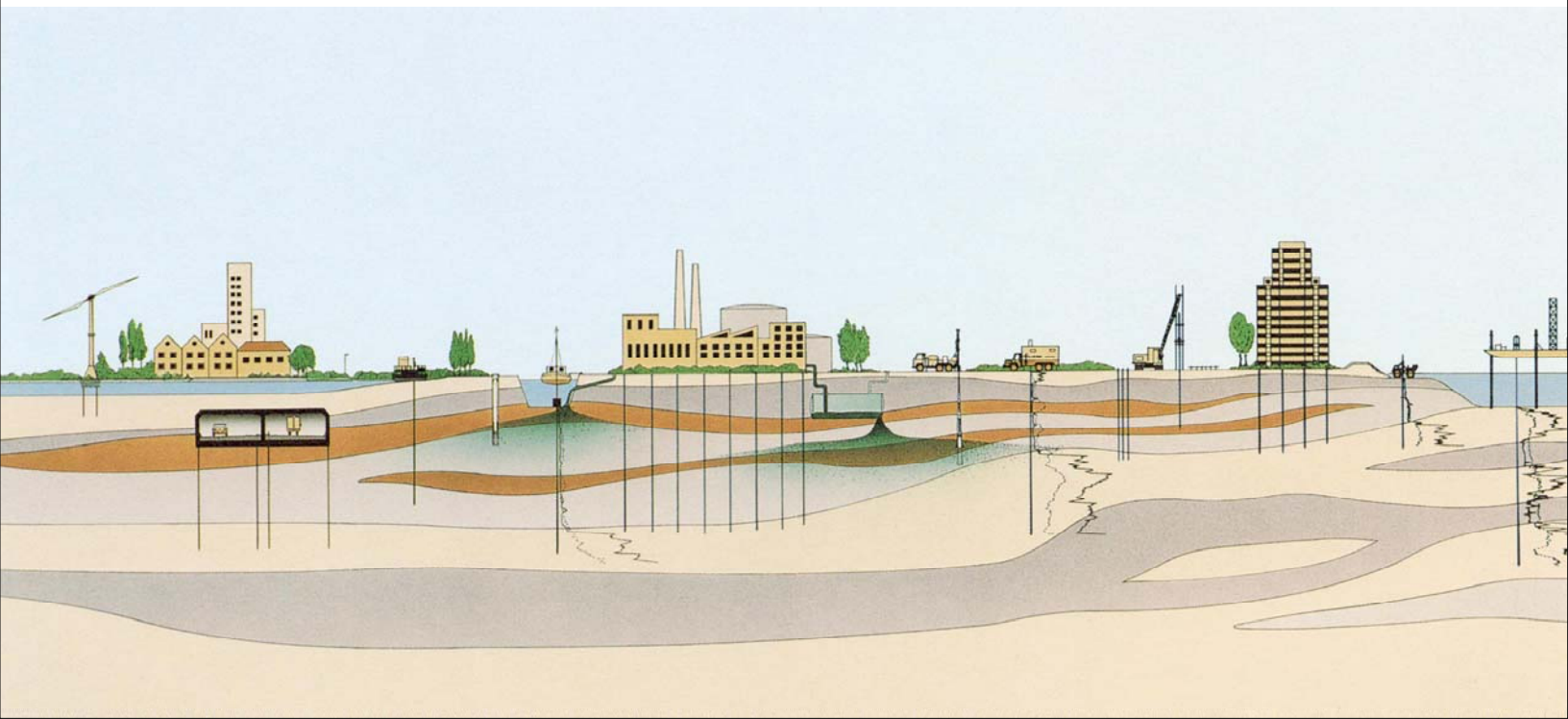
FUGRO ATLANTIC

-VOLUME 3-
ONSHORE PORTSMOUTH
SITE CHARACTERIZATION REPORT
PROPOSED MIDTOWN SECOND PARALLEL TUNNEL

Prepared for:
VIRGINIA DEPARTMENT OF TRANSPORTATION

October 2008
Fugro Project No. 3602.001



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October 31, 2008
Project No. 3602.001

Virginia Department of Transportation
1221 E. Broad Street
Richmond, Virginia 23219

Attention: Mr. Raymond Partridge, Project Manager, Innovative Project Delivery

Subject: Volume 3, Onshore Portsmouth Site Characterization, Proposed Midtown Second Parallel Tunnel

Dear Mr. Partridge:

Virginia Department of Transportation (VDOT) has recently completed a land geotechnical site exploration program for the proposed Midtown Second Parallel Tunnel on both banks of the Elizabeth River, in Norfolk to the north and Portsmouth to the south. This report interprets the findings of land site explorations in Portsmouth. This report also presents geotechnical data in the form of boring and cone penetrometer test logs, as well as laboratory test plots. The data obtained during the various exploration programs will assist in the characterization of the subsurface conditions, stratigraphy, and sediment characteristics at the site of the proposed Midtown Second Parallel Tunnel.

It has been a pleasure working with you through this phase of the project. We look forward to the opportunity to provide continued support as the project progresses.

Sincerely,

FUGRO ATLANTIC

Matthew Q. Pollard
Project Engineer

Kevin R. Smith
Senior Engineering Geologist

Thomas W. McNeilan, P.E.
Vice President

COMMONWEALTH OF VIRGINIA
THOMAS WILLIAM MCNEILAN
Lic. No. 44092
PROFESSIONAL ENGINEER

Copies Submitted: (4) Addressee and PDF provided on CD
(1) Mr. John Daoulas, P.E., Senior Geotechnical Engineer for Special Projects, VDOT

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1.0 INTRODUCTION

1.1 PROJECT OVERVIEW

1.1.1 General

The proposed Midtown Second Parallel Tunnel is a main component of the major infrastructure improvement project aimed at providing increased capacity for east-west travel across the Elizabeth River. The Second Parallel Tunnel will extend between: 1) U.S. Route 58 and Interstate 264 in Portsmouth, and 2) Brambleton Avenue/Hampton Boulevard in Norfolk. The existing Midtown Tunnel first opened to traffic in 1962 and provides one lane of travel in each direction. The second tunnel will provide two westbound travel lanes, allowing the existing tunnel to accommodate two lanes of eastbound traffic. Additionally, the second tunnel will provide increased flexibility for redirecting traffic during maintenance operations and emergency situations.

The original tunnel and interchange design from the 1960s anticipated that a second tunnel would be built to the north of the existing tunnel. A second tunnel in this configuration and arrangement can be accommodated on the Norfolk side of the river with relatively minor engineering adjustments to the present interchange. In the city of Portsmouth, the MLK Freeway is a north-south, four-lane link that provides access to the City of Norfolk via the Midtown Tunnel. The MLK Freeway Extension, a component of the overall infrastructure improvement project, will extend the freeway to the south and provide a direct, limited access connection from I-264 to the Midtown Tunnel.

Currently, significant traffic congestion occurs at the tunnel during both the morning and evening peak periods. Preliminary information provided by Virginia Department of Transportation (VDOT) indicates that the second tunnel will be located northwest (downstream) of, and parallel to, the existing tunnel, following a similar vertical alignment. VDOT has defined the project area to extend 300 feet northwest (downstream) of the northern edge of the existing tunnel. The project vicinity is shown on Figure 1-1; however, select explorations that fall outside the boundaries shown on Figure 1 are included.

1.1.2 Authorization

Fugro's services for the Midtown Second Parallel Tunnel were completed in general accordance with our proposal, dated January 7, 2008. The execution of that scope of work was authorized by amendments of the contract between the Virginia Port Authority (VPA) and the Craney Island Design Partners, LLC, and the associated subcontract between the CIDP and Fugro Atlantic.

1.2 SCOPE OF WORK

1.2.1 Reporting

The purpose of this site characterization report is to evaluate the geotechnical conditions in Portsmouth in the vicinity of the Midtown Tunnel based on subsurface exploration performed by VDOT. The current report is part of a series of geotechnical exploration and survey activities for the Second Parallel Tunnel. Figure 1-2 shows the organization of the various reports that are being prepared for the geotechnical exploration and surveys for the project.

1.2.2 Site Exploration and Laboratory Testing

The land geotechnical site exploration program was designed to conduct a series of explorations that would allow for characterization of the subsurface conditions near the Portsmouth approach of the proposed second tunnel. VDOT's land geotechnical exploration and laboratory testing program consisted of three components: 1) drilling and sampling from June 11 through July 9, 2008 using VDOT's truck-mounted drill rig, 2) cone penetration test (CPT) soundings from September 12 through September 17, 2008 using VDOT's truck-mounted CPT rig, and 3) laboratory testing of samples collected during the drilling operations.

The land geotechnical field program on the Portsmouth side of the river included the following explorations, as shown on Figure 1-3, Chart 1, and listed in Table 4-1:

- 6 hollow-stem-auger borings (B-12 through B-16, and B-20), advanced to depths ranging from 41 to 101 feet below the ground surface;
- 4 CPT soundings (C-39 through C-41, and C-47) advanced 9.4 to 113.4 feet below the river bottom.
- 5 groundwater monitoring wells (MW-1 through MW-5) were installed to depths of 15 to 65 feet below the ground surface by Marshall Miller and Associates (MMA). A description of the well construction details and groundwater measurements are provided in a report prepared by MMA (2008).

The laboratory program included the following index property tests:

- Moisture Content,
- Atterberg Limits, and
- Grain Size Distribution.

1.3 PROJECT DATUMS

The vertical datum used by VDOT during data acquisition of the land site exploration program was North American Vertical Datum of 1988. For reporting and charting, vertical units were converted to reference the vertical datum Mean Lower Low Water (MLLW). A factor of 1.60 feet used to convert from NAVD 88 to MLLW was obtained from the National Oceanic and Atmospheric Administration (NOAA) tide gauge Station No. 8638610 (1983-2001 tidal epoch)

located at Sewells Point, Hampton Roads. Horizontal coordinates used in this report are in Virginia State Plane, South Zone, NAD 83, feet.



Aerial Photo Source: Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <<http://datagateway.nrcs.usda.gov/>>

PROJECT VICINITY MAP
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 1-1

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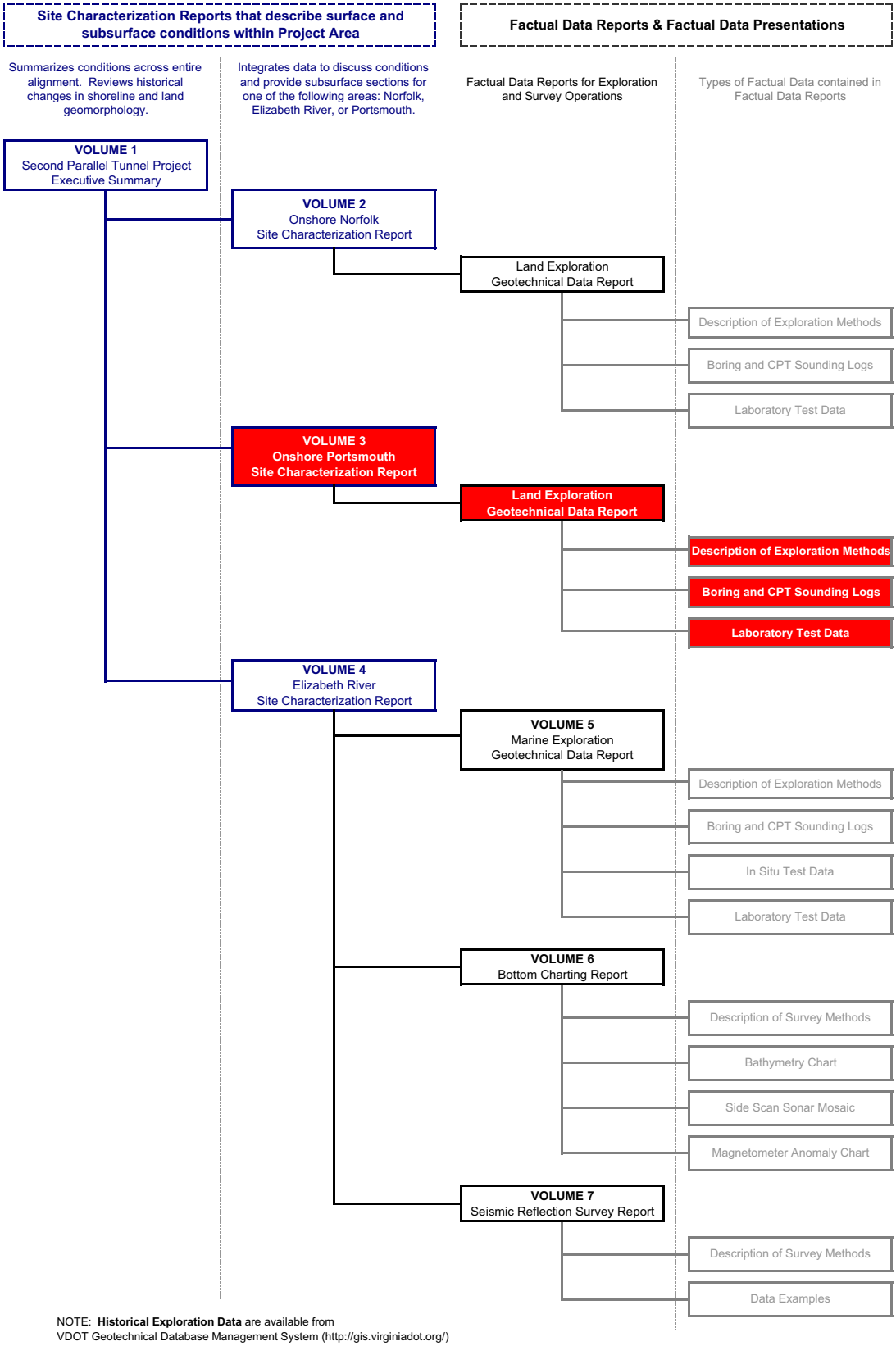

NOTE: **Historical Exploration Data** are available from
VDOT Geotechnical Database Management System (http://gis.virginiadot.org/)

GEOTECHNICAL REPORT ORGANIZATION

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 1-2



Aerial Photo Source: Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <<http://datagateway.nrcs.usda.gov/>>

GEOTECHNICAL EXPLORATION AND CROSS SECTION LOCATIONS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

N
W E
S

0 400 800 Feet

FIGURE 1-3

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2.0 HISTORICAL ACTIVITIES

We reviewed readily available engineering design drawings, maps, charts, and aerial photographs in an effort to understand the historical development of the site. Information displayed on those documents provides information about (1) where structures may exist on the site and (2) historical site development. When put in a chronologic sequence, the documents provide insight when structures may have been abandoned and where potential remnants may exist. This information provides valuable insight when reviewing the project's geotechnical and geophysical data and understanding the site's current conditions. Table 2-1 lists the documents reviewed. The following discussion provides a summary of our data review and understanding of the Elizabeth River development since 1887 (the date of the earliest available information).

Table 2-1. Data Reviewed

Year	Map/Photo	Scale
1887	Sanborn Map & Publishing Co., Norfolk Virginia	1:2,400
1888	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1893	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1894	NOAA Chart BiC-45, Hampton Roads	1:20,000
1898	Sanborn Map & Publishing Co., Norfolk Virginia	1:9,600
1903	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1910	Sanborn Map & Publishing Co., Norfolk Virginia, Vol. 1	1:9,600
1915	NOAA Chart No. 400, Hampton Roads	1:20,000
1920	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1921	Sanborn Map & Publishing Co., Norfolk Virginia, Vol. 3	1:9,600
1923	NOAA Chart No. 400, Hampton Roads	1:20,000
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1926	NOAA Chart No. 400, Hampton Roads	1:20,000
1928	NOAA Chart No. 400, Hampton Roads	1:20,000
1930	NOAA Chart No. 400, Hampton Roads	1:20,000
1932	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1959	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1960	Elizabeth River Tunnel Commission, Second Elizabeth River Tunnel and Approaches	-
1967	Sewer Pipelines, Hampton Roads Sanitation District	-
1968	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1969	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1974	Water Pipelines, Department of Utilities, City of Norfolk	-
1975	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
1993	Master Land Use Plans, Portsmouth Marine Terminal, Virginia Port Authority	-

Table 2-1. Data Reviewed - Continued

Year	Map/Photo	Scale
1994	Digital Ortho Quarter Quadrangle, USGS Geological Survey	1.0 m/pixel
2005	NOAA chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
2006	Ortho-Rectified Chesapeake Aerial Imagery	0.5 m/pixel

Data listed above are not included as appendices, but where relevant, are displayed on figures and charts.

2.1 RIVERFRONT DEVELOPMENT

Figure 2-1 displays the current shoreline and 2008 explorations overlain on the 1894 morphology of the site. Several rail lines are observed connecting a pier at Pinner Point near the middle of the figure. The lines converge to cross dark or heavily-inked portions of the chart before again separating to serve the various sides of the pier extending approximately 1300 feet into the Elizabeth River. This dark, low-lying area was a drainage likely filled with fine-grained sediments. Figure 2-2 displays the following three interpreted morphological areas from 1894 overlain on a recent aerial photograph of the site:

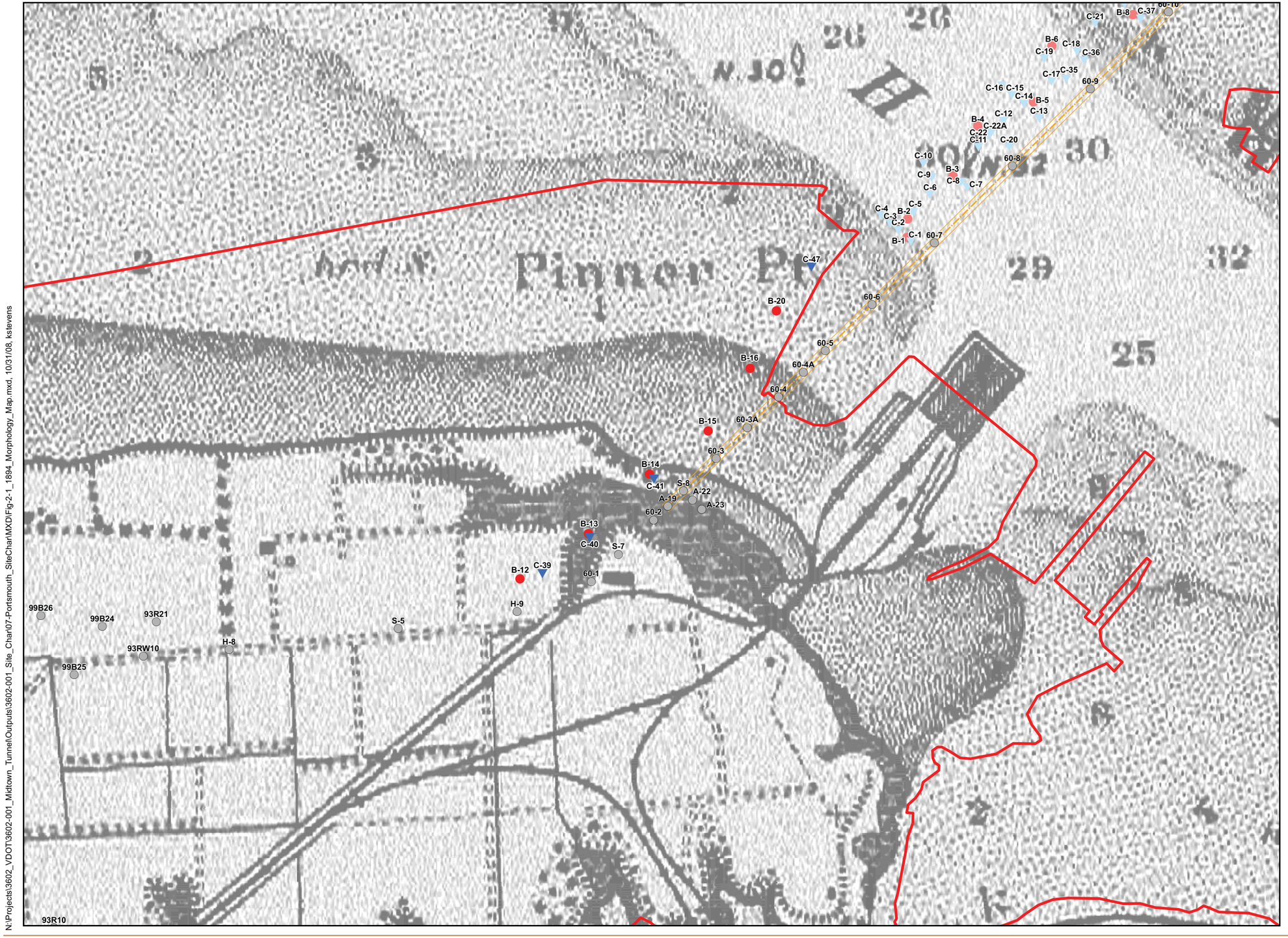
- Mud Flats (MF) -low lying areas depicted along the shoreline that were likely subjected to tidal inundation
- Lowland (LL) - low lying area between shoreline or mudflats and upland areas, and
- Upland (UL) - area delineated by dashed line on map, inferred to represent break in topography. Most development (e.g. roadways and buildings) is placed in the Upland area.

We reviewed information listed in Table 2-1 and observed significant shoreline changes in the Pinner Point area. Figure 2-3 displays four historical NOAA charts from years 1894, 1930, 1969, and 2008 which are representative of those typical shorelines. We note that the piers immediately north and south of the existing tunnel alignment are shown on both 1915 and 1930 charts. However, we selected to present the 1930 chart because it depicts the location of former piers adjacent to the existing tunnel more accurately than the 1915. The 1894 chart shows the current shoreline with respect to the shoreline at that time. The dark areas in the SW corner of the inset outline the drainage mentioned above. Between 1894 and 1915 Pinner Point was further developed to serve shipping and rail transportation, as evidenced by the construction of additional rail lines and piers. Land was also reclaimed from the Elizabeth River during this period of time. Between 1959 and 1969 the two piers directly north and south of the existing tunnel were partially demolished, and additional land was reclaimed leaving what appears to be a shallow harbor to the north. The last inset shows the current configuration of the site in Portsmouth. Piers to serve shipping needs have been replaced by berths created from reclaimed land.

Figure 2-4 displays the footprint of historical fills at the site through the comparison of shorelines displayed on NOAA charts. Based on review of the charts listed in Table 2-1, there appears to be at least four fill bodies within the Pinner Point area. Fill documented on the 1915

chart allowed piers to reach further into the river near the present-day navigation channel. The development of the site post-1915 is marked by expansion on the north-facing river bank.

The former Pinner Point Wastewater Treatment Plant was located to the northwest of 2008 VDOT land borings B-12 and B-13. Abandoned pipeline outfalls from this facility traverse the work area. Refer to Appendix D of the Elizabeth River Site Characterization Report (Fugro, 2008c) for a map of Portsmouth Marine Terminal facilities. Also refer to Marshall Miller & Associates (2008) for additional details about the treatment plant.



LEGEND

- Current Shoreline (digitized from 2005 aerial photograph)
- Approximate Location of Midtown Tunnel (Refer to Section 7.1 in text)
- B-19 — 2008 VDOT Land Boring Location
- C-42 — 2008 VDOT Land CPT Location
- B-09 — 2008 Fugro Marine Boring Location
- C-34 — 2008 Fugro Marine CPT Location
- S-11 — Historical VDOT Boring Location

LIST OF MAPS AND AERIAL PHOTOS REVIEWED
Highlighted maps/photos are shown on this chart

Year	Map/Photo	Scale
1887	Sanborn Map & Publishing Co., Norfolk Virginia	1:2,400
1888	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1893	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
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1930	NOAA Chart No. 400, Hampton Roads	1:20,000
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1959	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
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1994	Digital Ortho Quarter Quadrangle, USGS Geological Survey	1.0 m/pixel
2005	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
2005	Ortho-Rectified Chesapeake Aerial Imagery	0.5 m/pixel
2008	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000

N
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0 450 900 Feet

1894 MORPHOLOGY MAP
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 2-1

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LEGEND

1894 Interpreted Morphological Areas
See the table below for source used as basis of interpretation.

- Fluvial (FL)- Unknown material types
- Mud Flats (MF)- Likely fine-grained sediments with organics
- Lowlands (LL)- Unknown material types
- Uplands (UL)- Likely sandy materials
- Current Shoreline (digitized from 2005 aerial photograph)
- Approximate Location of Midtown Tunnel (Refer to Section 7.1 in text)
- B-19 — 2008 VDOT Land Boring Location
- C-42 — 2008 VDOT Land CPT Location
- B-09 — 2008 Fugro Marine Boring Location
- C-34 — 2008 Fugro Marine CPT Location
- S-11 — Historical VDOT Boring Location

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1898	Sanborn Map & Publishing Co., Norfolk Virginia	1:9600
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1921	Sanborn Map & Publishing Co., Norfolk Virginia, Vo. 3	1:9,600
1923	NOAA Chart No. 400, Hampton Roads	1:20,000
1924	NOAA Chart No. 400, Hampton Roads	1:20,000
1926	NOAA Chart No. 400, Hampton Roads	1:20,000
1928	NOAA Chart No. 400, Hampton Roads	1:20,000
1930	NOAA Chart No. 400, Hampton Roads	1:20,000
1932	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1959	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1968	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1969	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1975	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
1994	Digital Ortho Quarter Quadrangle, USGS Geological Survey	1.0 m/pixel
2005	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
2005	Ortho-Rectified Chesapeake Aerial Imagery	0.5 m/pixel
2008	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000

NOTE

1) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

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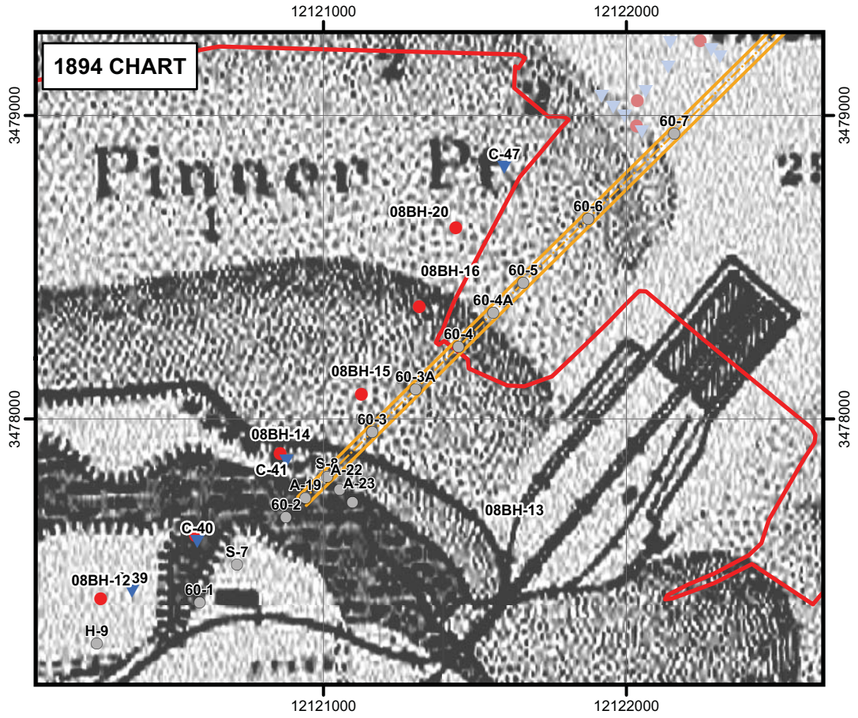
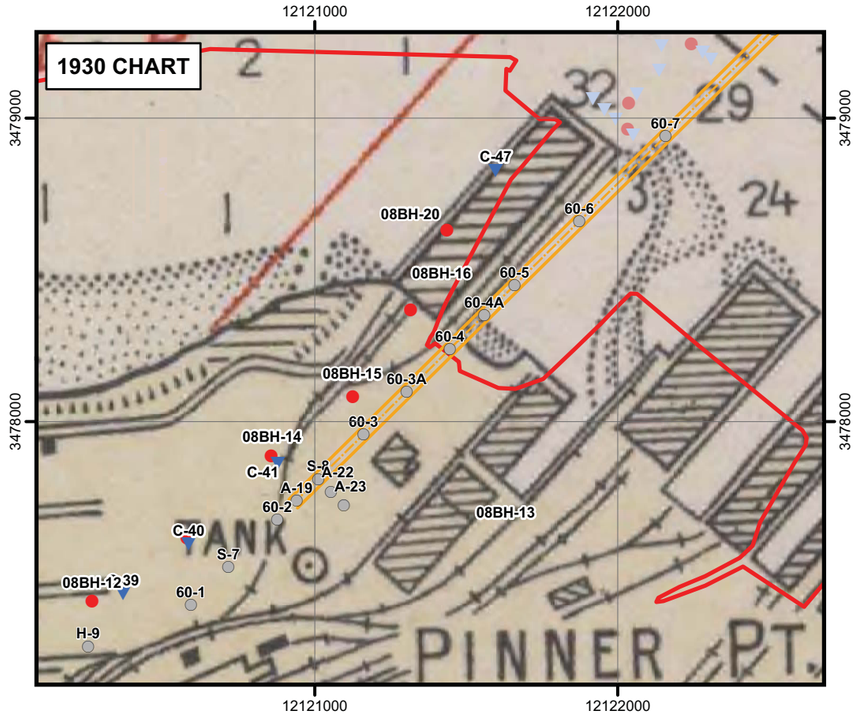
1894 MORPHOLOGY INTERPRETATION

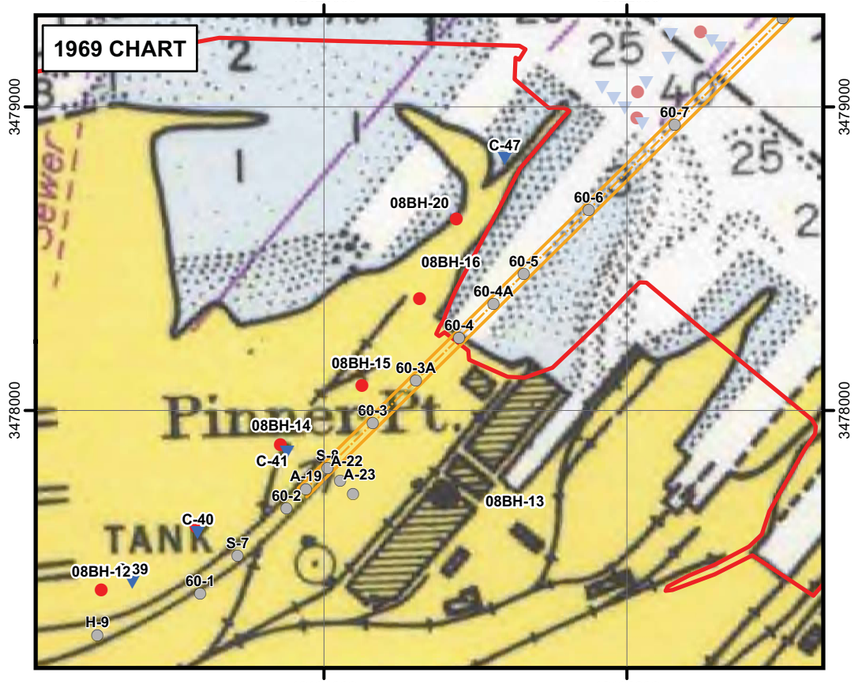
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

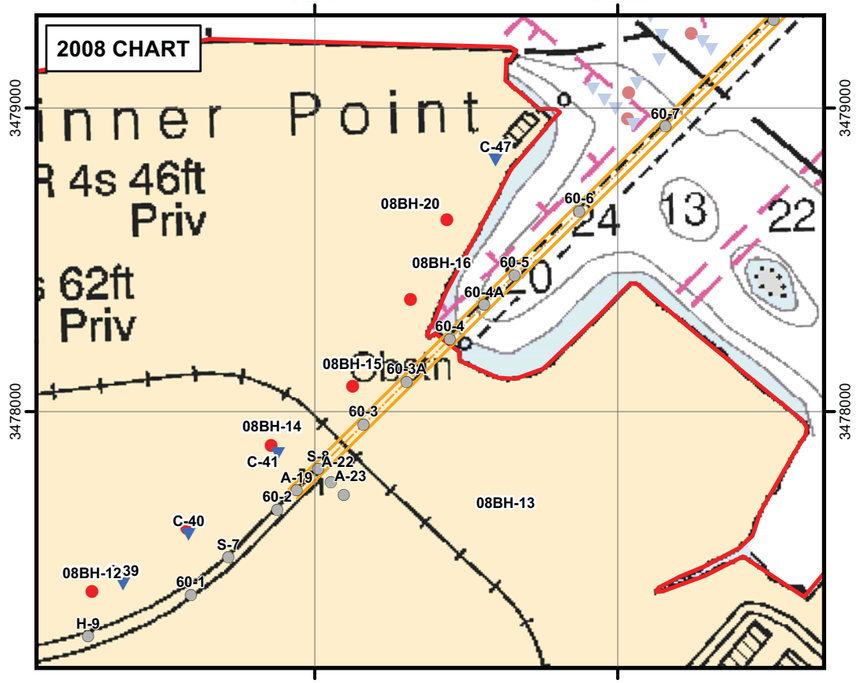
FIGURE 2-2

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\07-Portsmouth_SiteCharMXD\Fig-2-2_1894_Interp.mxd, 10/31/08, kstevens









LEGEND

- Current Shoreline (digitized from 2005 aerial photograph)
- Approximate Location of Midtown Tunnel (Refer to Section 7.1 in text)
- B-19 — 2008 VDOT Land Boring Location
- C-42 — 2008 VDOT Land CPT Location
- 2008 Fugro Marine Boring Location
- 2008 Fugro Marine CPT Location
- S-11 — Historical VDOT Boring Location

LIST OF MAPS AND AERIAL PHOTOS REVIEWED
Highlighted maps/photos are shown on this chart

Year	Map/Photo	Scale
1887	Sanborn Map & Publishing Co., Norfolk Virginia	1:2,400
1888	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1893	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1894	NOAA Chart BiC-45, Hampton Roads	1:20,000
1898	Sanborn Map & Publishing Co., Norfolk Virginia	1:9600
1903	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1910	Sanborn Map & Publishing Co., Norfolk Virginia, Vo. 1	1:9,600
1915	NOAA Chart No. 400, Hampton Roads	1:20,000
1920	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1921	Sanborn Map & Publishing Co., Norfolk Virginia, Vo. 3	1:9,600
1923	NOAA Chart No. 400, Hampton Roads	1:20,000
1924	NOAA Chart No. 400, Hampton Roads	1:20,000
1926	NOAA Chart No. 400, Hampton Roads	1:20,000
1928	NOAA Chart No. 400, Hampton Roads	1:20,000
1930	NOAA Chart No. 400, Hampton Roads	1:20,000
1932	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1959	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1968	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1969	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1975	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
1994	Digital Ortho Quarter Quadrangle, USGS Geological Survey	1.0 m/pixel
2005	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
2005	Ortho-Rectified Chesapeake Aerial Imagery	0.5 m/pixel
2008	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000

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PORTSMOUTH SITE DEVELOPMENT
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 2-3

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\07-Portsmouth_SiteCharMXD\Fig-2-3_Portsmouth_SiteDevelopment.mxd, 11/05/08, kstevens



N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\07-Portsmouth_SiteChar\MXD\Fig-2-4_Historical_Fill_Areas.mxd, 10/31/08, kstevens

LEGEND

Historical Fill: Date when fill was first documented. Refer to the table below for historical charts used to map fill bodies. See Note 1.

- Artificial Fill (af), 1969
- Artificial Fill (af), 1959
- Artificial Fill (af), 1930
- Artificial Fill (af), 1915
- Current Shoreline (digitized from 2005 aerial photograph)
- Approximate Location of Midtown Tunnel (Refer to Section 7.1 in text)
- B-19 — 2008 VDOT Land Boring Location
- C-42 — 2008 VDOT Land CPT Location
- B-09 — 2008 Fugro Marine Boring Location
- C-34 — 2008 Fugro Marine CPT Location
- S-11 — Historical VDOT Boring Location

LIST OF MAPS AND AERIAL PHOTOS REVIEWED
Highlighted maps/photos are shown on this chart

Year	Map/Photo	Scale
1887	Sanborn Map & Publishing Co., Norfolk Virginia	1:2,400
1888	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1893	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1894	NOAA Chart BIC-45, Hampton Roads	1:20,000
1898	Sanborn Map & Publishing Co., Norfolk Virginia	1:9600
1903	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1910	Sanborn Map & Publishing Co., Norfolk Virginia, Vo. 1	1:9,600
1915	NOAA Chart No. 400, Hampton Roads	1:20,000
1920	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1921	Sanborn Map & Publishing Co., Norfolk Virginia, Vo. 3	1:9,600
1923	NOAA Chart No. 400, Hampton Roads	1:20,000
1924	NOAA Chart No. 400, Hampton Roads	1:20,000
1926	NOAA Chart No. 400, Hampton Roads	1:20,000
1928	NOAA Chart No. 400, Hampton Roads	1:20,000
1930	NOAA Chart No. 400, Hampton Roads	1:20,000
1932	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1959	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1968	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1969	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1975	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
1994	Digital Ortho Quarter Quadrangle, USGS Geological Survey	1.0 m/pixel
2005	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
2005	Ortho-Rectified Chesapeake Aerial Imagery	0.5 m/pixel
2008	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000

NOTES

1) Historical Fill data indicates year of map in which the fill first appeared on the referenced NOAA Chart. For example, "af, 1959" body first appeared on the 1959 map and was placed sometime between 1930 and 1959.

2) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

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HISTORICAL FILL AREAS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 2-4

3.0 SITE CONDITIONS

The site is located on the bank of the Elizabeth River in Portsmouth, adjacent to Highway 58 and is generally flat. Topography is shown on Figure 1-3 and Chart 1 and is primarily shaped by historical land reclamation events. The 6-foot which follows the bend in Seaboard Avenue generally coincides with the 1894 shoreline shown on Figure 2-1, and the inshore fills - reclaimed land margin shown on Figure 2-4. The 1969 fill boundary in the Portsmouth Marine Terminal to the northwest coincides well with the topographical high shown on Chart 1. Ground elevations (converted to MLLW) measured by VDOT at locations of the 2008 Portsmouth land borings range between about 5.5 and 8.5 feet.

3.1 OBSTRUCTIONS

Types of obstructions within the area on land identified during our surveys included the water and sewer pipelines. Pier construction and historical fill areas to the immediate northwest of the existing tunnel indicated on Figure 2-4 suggest the presence of pier remnants and artificial fill in areas that may be impacted by the proposed second tunnel.

3.1.1 Data Review

We reviewed readily available engineering drawings, nautical charts, maps, and aerial photographs and identified several utilities within the project area. Table 2-1 lists various pieces of information that we reviewed which includes drawings of various utilities within the project area.

3.1.2 Land Survey

Prior to our initiating the marine subsurface investigation we notified MISS Utility of our intent to conduct subsurface explorations. Through this notification process, Fugro coordinated with utility companies that owned and operated utilities within our proposed work area to delineate their utility locations. Specifically, the City of Norfolk and Hampton Roads Sanitation District (HRSD) owned pipelines within the work area. Their utility locators delineated the shore crossings and a few hundred feet of the overland alignments. Figures 3-1a through 3-1d show the water pipeline at the shore crossing and the delineations made for the water and sewer pipelines.

Under subcontract to Fugro, NXL, Inc. surveyed those markings and several features of the existing Midtown Tunnel structure. Surveyed areas are shown on Figures 3-2. This information was used to assist us in locating the respective structures. Refer to our Bottom Charting Data Report (Fugro, 2008b) for further discussion of those activities.

3.2 OBSERVATIONS

Figures 3-3a and 3-3b display photographs taken on June 16, 2008 during the land drilling operations in Portsmouth. Photo 1 was taken from a vehicle approaching the tunnel entrance on Highway 58. Features displaying the settlement of the road and retaining wall structure are identified. Photo 2, looking north toward the Portsmouth Marine Terminal, displays the relative displacement in the retaining wall. Photo 3 indicates the areas of observed offset between wall sections and the maximum observed apparent settlement.



PHOTO 7: 30-inch diameter water pipeline landfall on Portsmouth shore. View is looking downstream (northwest).

PHOTOGRAPHS OF WATER PIPELINE LANDFALL
Portsmouth Land Survey
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 3-1a

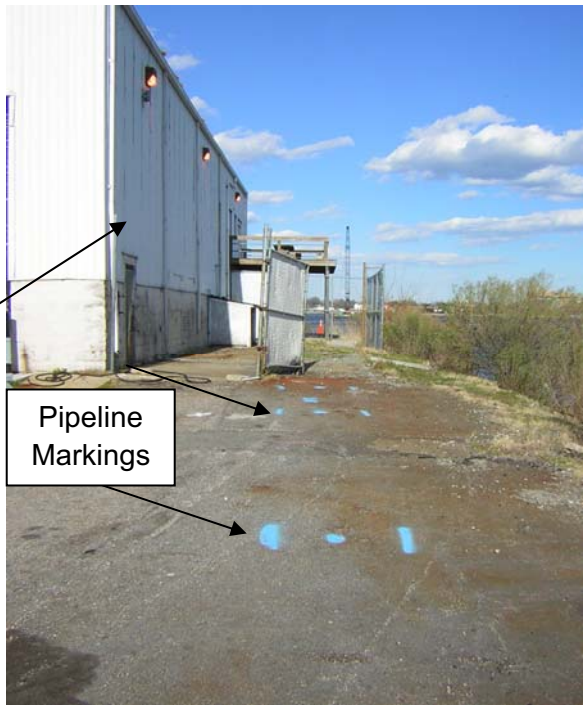


PHOTO 9: View looking toward Norfolk (northeast).

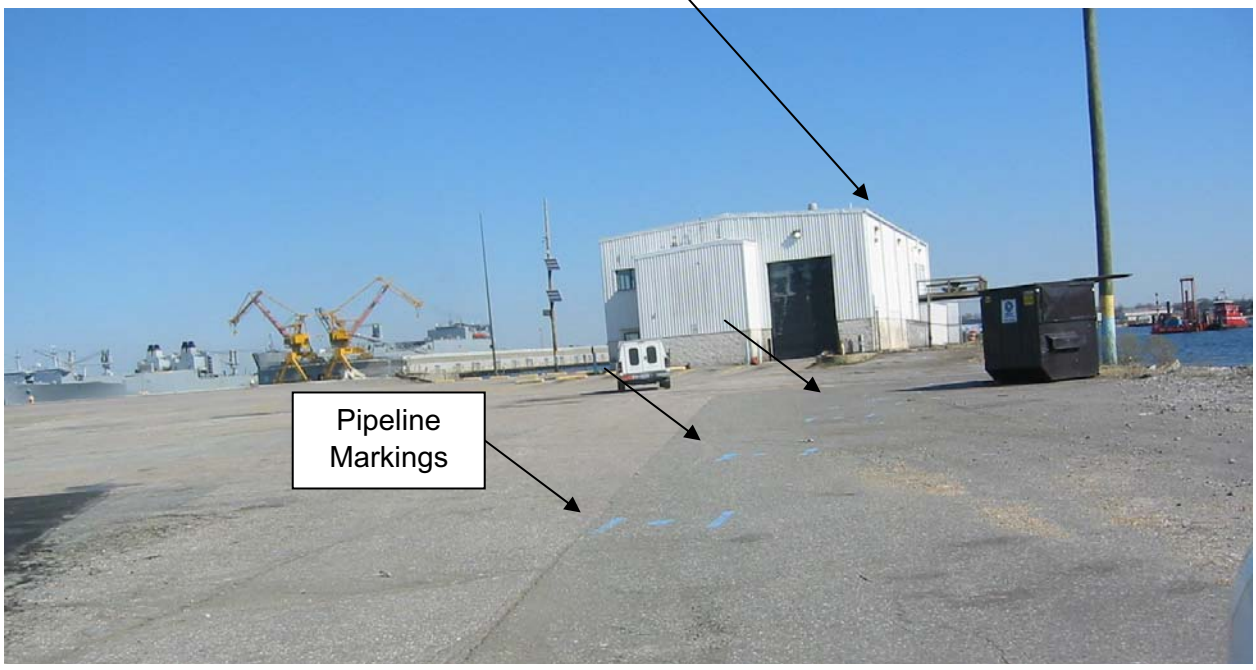


PHOTO 8: View looking toward Norfolk (northeast) across PMT parking lot.

PHOTOGRAPHS OF WATER PIPELINE LOCATION MARKINGS
Portsmouth Land Survey
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

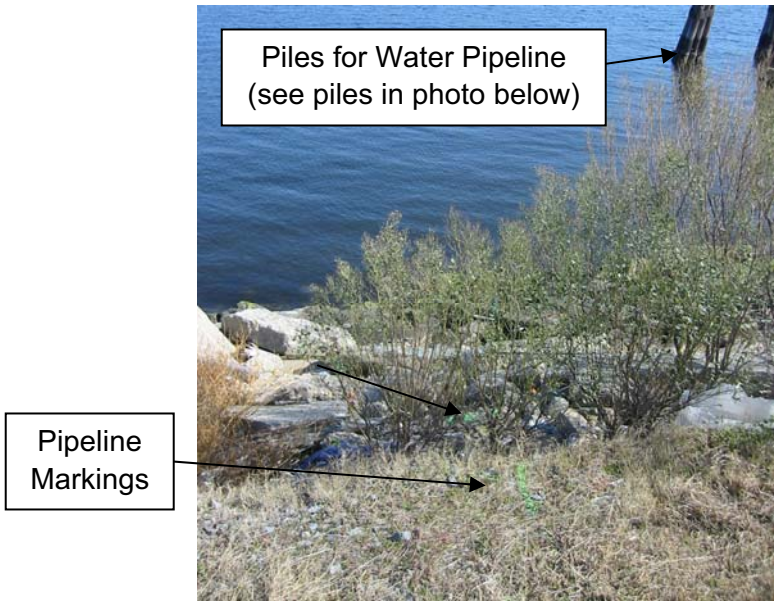


PHOTO 11: View looking toward Norfolk (northeast)

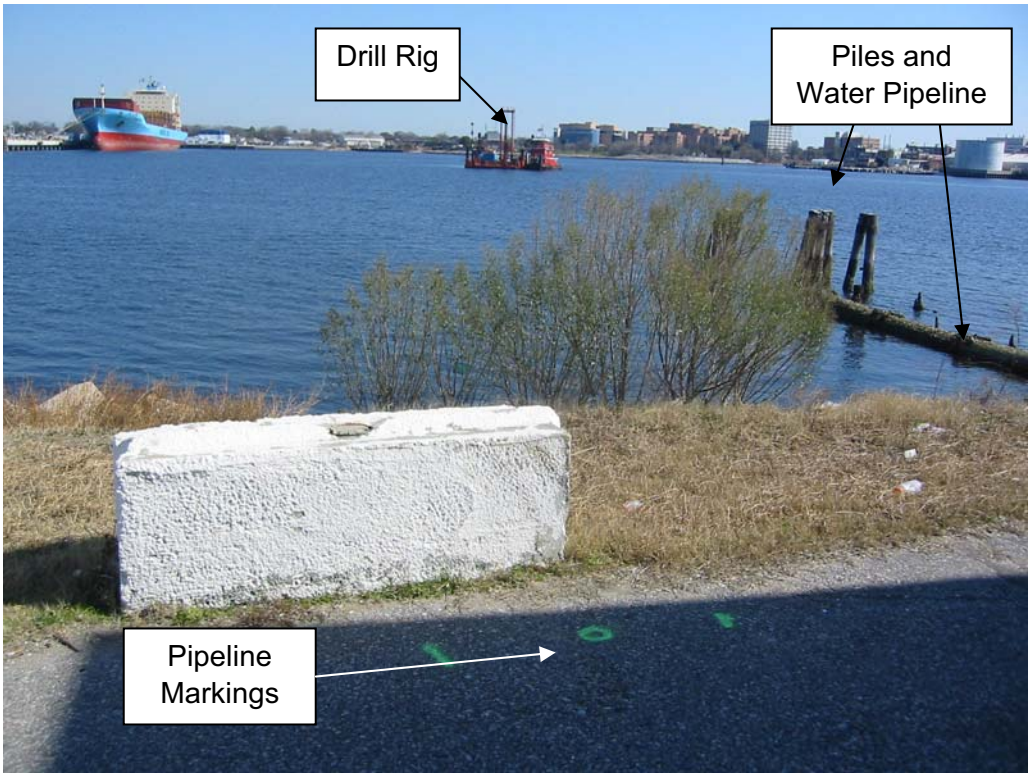


PHOTO 10: View looking toward Norfolk (northeast) across Elizabeth River

PHOTOGRAPHS OF SEWER PIPELINE LOCATION MARKINGS
Portsmouth Land Survey
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

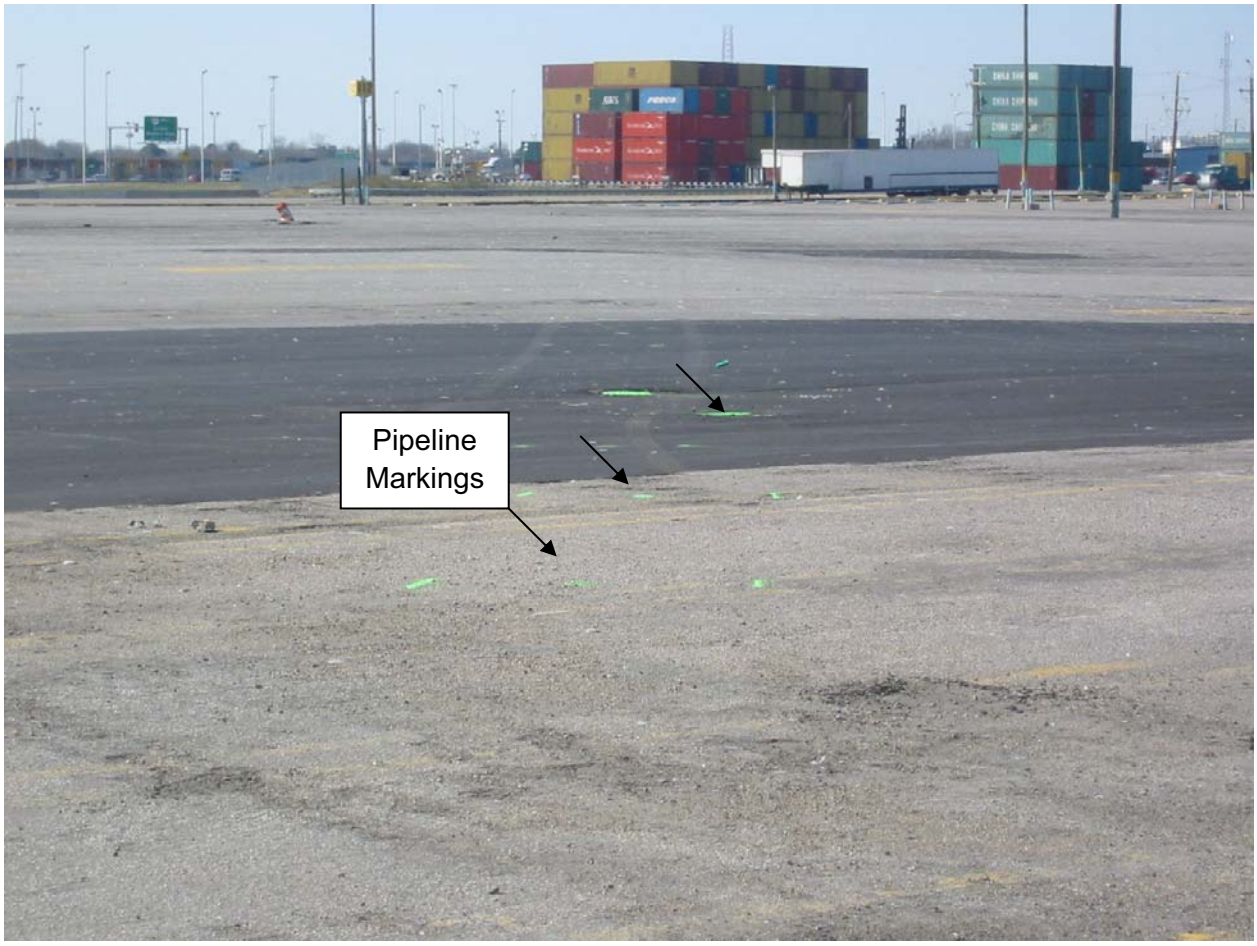
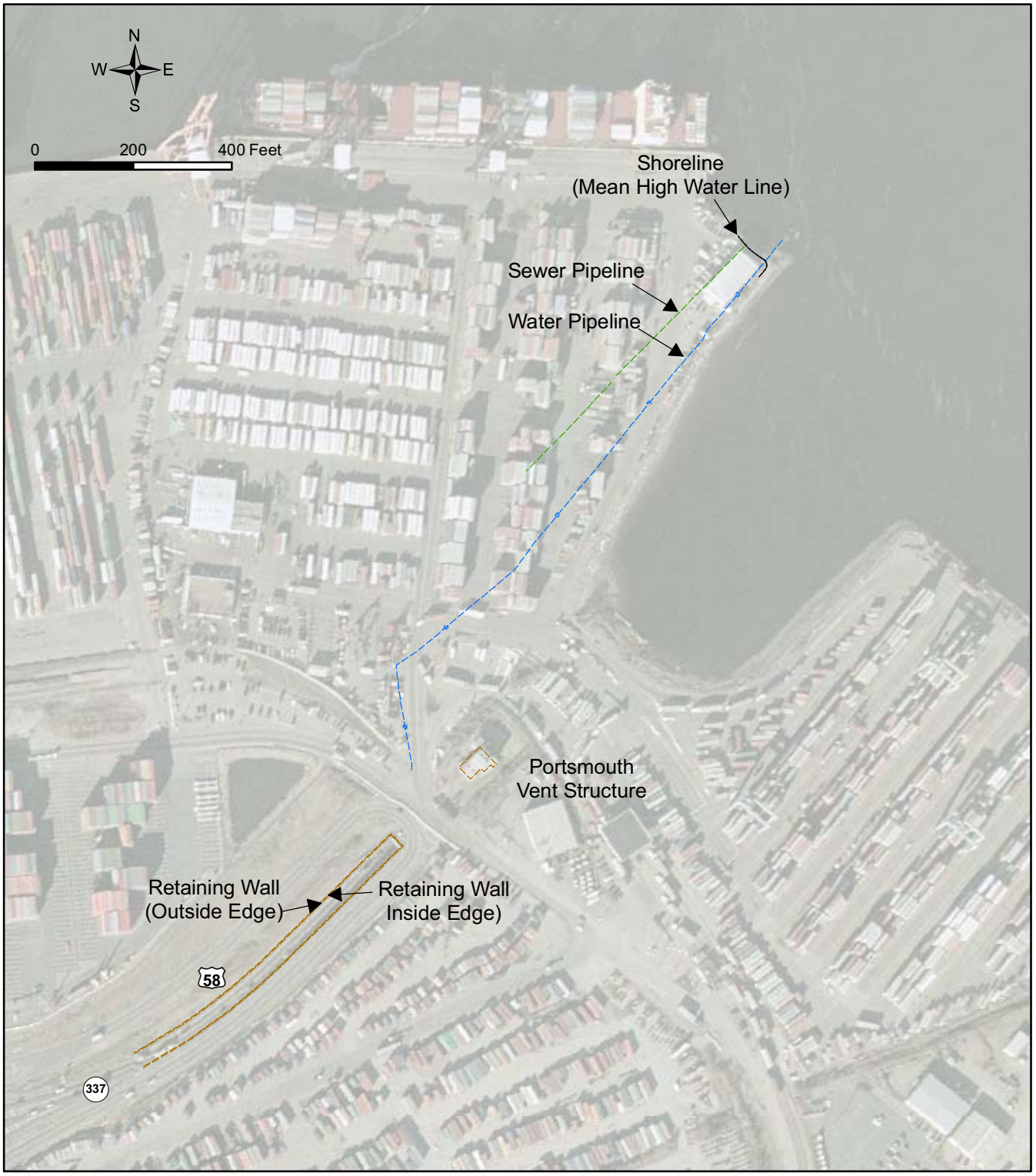


PHOTO 12: View looking toward Portsmouth (southwest) across the PMT parking lot from the approximate pipeline shore crossing location.

PHOTOGRAPHS OF SEWER PIPELINE LOCATION MARKINGS
Portsmouth Land Survey
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia



Aerial Photo Source: Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <<http://datagateway.nrcs.usda.gov/>>

PORTSMOUTH LAND SURVEY
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 3-2

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4.0 SUBSURFACE INVESTIGATION

4.1 EXPLORATIONS

The subsurface stratigraphy was explored primarily through the use of geotechnical borings and CPT soundings. Samples were recovered at regular intervals during the advancement of each borehole. CPT soundings provided a continuous and rapid measurement of soils below the groundsurface. Table 4-1 below summarizes all of the 2008 exploration data. VDOT's land explorations located in Portsmouth are highlighted.

Table 4-1. Exploration Data

Boring Designation	Locale	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet)		River Bottom/Ground Surface Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
			Northing	Easting			
B-1	Marine	3/4/2008	3478965	12122033	-29.1	78.6	-107.7
B-2	Marine	3/3/2008	3479050	12122036	-29.6	98.3	-127.9
B-3	Marine	3/2/2008	3479246	12122243	-47.2	109.1	-156.3
B-4	Marine	3/1/2008	3479474	12122356	-48.2	99.3	-147.5
B-5	Marine	3/2/2008	3479583	12122610	-45.9	127.2	-173.1
B-6	Marine	2/25/2008	3479839	12122694	-26.1	109.1	-135.2
B-8	Marine	2/26/2008	3479980	12123065	-23.0	99.3	-122.3
B-9	Marine	2/27/2008	3480199	12123254	-11.9	88.9	-100.8
B-10	Marine	2/28/2008	3480522	12123492	-10.9	88.9	-99.8
B-11	Marine	2/29/2008	3480644	12123570	-11.0	79.1	-90.1
B-12	Land	6/13/2008	3477408	12120265	+10.2	41.4	-31.2
B-13	Land	6/16/2008	3477616	12120578	+9.9	61.5	-51.6
B-14	Land	6/11/2008	3477887	12120856	+9.1	101.5	-92.4
B-15	Land	6/25/2008	3478083	12121125	+7.2	101.5	-94.3
B-16	Land	6/26/2008	3478370	12121316	+6.9	101.5	-94.6
B-17	Land	7/1/2008	3481135	12124204	+6.9	41.5	-34.6
B-18	Land	7/2/2008	3481049	12124112	+6.5	61.5	-55.0
B-19	Land	7/8/2008	3480972	12124023	+5.2	101.5	-96.3
B-20	Land	7/9/2008	3478631	12121437	+6.9	101.5	-94.6

Note: B-7 was deleted from the drilling program.

Table 4-1. Exploration Data - Continued

CPT Designation	Locale	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet)		River Bottom/Ground Surface Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
			Northing	Easting			
C-1	Marine	4/25/2008	3478945	12122051	-29.5	85.3	-114.8
C-2	Marine	4/25/2008	3478998	12121993	-27.3	85.3	-112.6
C-3	Marine	4/25/2008	3479027	12121957	-25.8	85.3	-111.1
C-4	Marine	4/25/2008	3479063	12121918	-26.7	85.3	-112.0
C-5	Marine	4/26/2008	3479080	12122063	-32.0	82.4	-114.4
C-6	Marine	4/26/2008	3479159	12122138	-37.5	79.5	-117.0
C-7	Marine	4/28/2008	3479194	12122308	-47.9	80.9	-128.9
C-8	Marine	4/28/2008	3479218	12122280	-47.8	78.0	-125.8
C-9	Marine	4/27/2008	3479240	12122145	-44.3	80.1	-124.4
C-10	Marine	4/27/2008	3479302	12122108	-46.9	83.7	-130.6
C-11	Marine	4/27/2008	3479376	12122360	-49.7	84.6	-134.3
C-12	Marine	4/27/2008	3479495	12122475	-47.6	84.6	-132.2
C-13	Marine	4/27/2008	3479508	12122637	-47.7	82.8	-130.5
C-14	Marine	4/27/2008	3479574	12122568	-45.6	84.1	-129.7
C-15	Marine	4/27/2008	3479613	12122512	-44.9	81.5	-126.4
C-16	Marine	4/27/2008	3479658	12122466	-44.8	84.8	-129.6
C-17	Marine	4/27/2008	3479676	12122694	-42.0	15.3	-57.4
C-18	Marine	4/25/2008	3479813	12122810	-22.0	84.8	-106.8
C-19	Marine	4/27/2008	3479778	12122660	-38.9	84.9	-123.8
C-20	Marine	4/28/2008	3479376	12122500	-51.5	76.5	-128.0
C-21	Marine	4/25/2008	3479941	12122893	-12.9	84.3	-97.2
C-22	Marine	4/28/2008	3479433	12122403	-47.8	26.6	-74.4
C-22A	Marine	4/28/2008	3479441	12122419	-48.0	74.9	-122.9
C-23	Marine	4/26/2008	3480276	12123114	-3.7	85.3	-89.0
C-24	Marine	4/25/2008	3480027	12123027	-9.3	74.8	-84.1
C-25	Marine	4/25/2008	3480052	12122969	-8.6	77.6	-86.2
C-26	Marine	4/24/2008	3480077	12123189	-20.5	81.5	-102.0
C-27	Marine	4/26/2008	3480348	12123290	-4.3	85.1	-89.4
C-28	Marine	4/24/2008	3480161	12123282	-17.0	91.6	-108.6
C-29	Marine	4/25/2008	3480250	12123405	-11.3	84.5	-95.8
C-30	Marine	4/24/2008	3480394	12123489	-10.4	24.9	-35.3
C-30A	Marine	4/24/2008	3480396	12123446	-10.2	97.6	-107.8
C-31	Marine	4/24/2008	3480511	12123508	-11.0	25.3	-36.3
C-32	Marine	4/24/2008	3480622	12123569	-10.9	84.8	-95.7
C-33	Marine	4/24/2008	3480672	12123577	-10.8	85.3	-96.1
C-34	Marine	4/25/2008	3480709	12123545	-10.8	46.8	-57.6
C-35	Marine	4/28/2008	3479687	12122761	-39.5	85.0	-124.5
C-36	Marine	4/28/2008	3479773	12122843	-30.1	65.8	-95.9

Table 4-1. Exploration Data - Continued

CPT Designation	Locale	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet)		River Bottom/Ground Surface Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
C-37	Marine	4/30/2008	3479961	12123101	-23.5	58.5	-82.0
C-38	Marine	4/30/2008	3480099	12123071	-7.3	85.2	-92.5
C-39	Land	9/12/2008	3477433	12120368	+9.1	9.4	-0.3
C-40	Land	9/12/2008	3477597	12120583	+9.0	62.8	-53.9
C-41	Land	9/12/2008	3477863	12120878	+8.2	73.2	-64.9
C-42	Land	9/15/2008	3480938	12124019	+5.2	56.4	-51.3
C-43	Land	9/15/2008	3480996	12123964	+5.0	42.2	-37.2
C-44	Land	9/15/2008	3481084	12124056	+5.7	36.3	-30.5
C-45	Land	9/15/2008	3481017	12124142	+6.1	68.1	-62.0
C-46	Land	9/15/2008	3481135	12124234	+6.6	31.0	-24.4
C-47	Land	9/17/2008	3478829	12121597	+6.2	113.4	-107.1

Explorations listed below were conducted as part of the marine geotechnical program

Fugro T-Bar Designation	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet)		River Bottom Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)	Cyclic Test Depths (feet)
		Northing	Easting				
T-1	4/29/2008	3479069	12122071	-32.6	33.1	-65.7	8.4, 18.2, 28.1, 32.3
T-2	4/29/2008	3479211	12122294	-47.7	13.4	-61.1	7.7, 12.6
T-3	4/28/2008	3479663	12122476	-44.3	11.5	-55.8	5.7, 10.7
T-4	4/28/2008	3479804	12122819	-23.5	37.7	-61.2	7.4, 17.2, 27.1, 36.9

Fugro Vane Shear Designation	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet)		River Bottom Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)	Test Depths (feet) "R" indicates remold test was performed
		Northing	Easting				
V-1	4/29/2008	3479104	12122073	-31.9	31.3	-63.2	10.6 R, 23.1 R, 31.3 R
V-2	4/29/2008	3479223	12122291	-48.4	9.8	-58.2	9.8 R
V-3	4/29/2008	3479672	12122464	-44.1	11.4	-55.5	6.5 R, 11.4 R
V-4	4/29/2008	3479817	12122822	-21.7	39.8	-61.5	10.3, 20.1, 29.9, 39.8

4.2 HISTORICAL GEOTECHNICAL INFORMATION

A geotechnical study was conducted at the site in the late 1950s to early 1960s in anticipation of the original tunnel construction. Both land and marine borings were performed. Land borings were advanced to depths ranging between about 30 and 100 feet, and marine

borings to about 100 feet. Borings from this investigation (shown on Figure 1-3) do not contain laboratory test data. Attempts to access historical reports, which contain such information, by Fugro and VDOT were unsuccessful.

5.0 LABORATORY TESTING AND SUBSURFACE CONDITIONS

5.1 LABORATORY TESTING

A geotechnical laboratory program was conducted on samples recovered from the land borings. Once drilling operations were complete, testing was performed at VDOT's laboratory in Suffolk, Virginia. A summary of laboratory test results is presented on Figures B-1a to B-1d. Laboratory tests included:

- Moisture content determinations,
- Atterberg Limits, and
- Grain Size Distribution (Sieve Analyses) tests.

Descriptions of laboratory test procedures are provided in the following sections.

5.1.1 Moisture

Moisture contents were determined in general accordance with AASHTO method T-265. Moisture contents are presented on the Logs of Borings and Test Results (Figures A-2 to A-7c) and the Summaries of Laboratory Test Results (Figures B-1a to B-1d).

5.1.2 Particle Size Analyses

Particle Size Analyses were performed on several samples of coarse- and fine-grained material in general accordance with AASHTO method T-27. Grain size curves are presented on Figure B-2a through B-2h.

5.1.3 Atterberg Limits

Liquid and plastic limits, collectively termed Atterberg Limits, were determined in accordance with AASHTO method T-89, and T-90, respectively. Atterberg Limits test results are presented on the Plasticity Charts on Figures B-3a and -3b.

5.2 REGIONAL GEOLOGY

The project area is located in the Coastal Plain physiographic province. Flat-lying plains and terraces dominate the landscape. The Coastal Plain is underlain by a wedge of Cretaceous to Holocene age sediments that thicken to the east and pinch out at the Fall Line approximately 70 miles west of the project area. Jurassic-Triassic age basement rocks lie approximately 1,800 feet beneath the site. The wedge of Cretaceous and younger sediments were deposited as a result of multiple marine transgressions and regressions. Sediments within the upper 150 feet beneath the site are Pliocene to Recent in age. The Pliocene and younger sediments have been deposited and subsequently eroded in places during the rising and falling sea levels that resulted from glacial and interglacial periods. Figure 5-1 presents a geologic map of the area and Figure 5-2 presents a geologic cross section. We acknowledge that the Norfolk and Sand

Bridge Formations shown in Figures 5-1 and 5-2 are referred to in more recent publications as the Tabb Formation.

5.3 OVERVIEW OF PRINCIPAL STRATIGRAPHIC UNITS

VDOT's 2008 land site investigation program explorations in Portsmouth encountered subsurface conditions beneath the proposed project area primarily consisting of interbedded medium dense sandy fills with varying amounts of silt and clay. In addition, cinders, brick rubble, and crushed aggregate were encountered in the fill. Beneath the fill, explorations encountered interbedded Alluvium (Qal) comprised of very soft to soft clays and medium dense sands with varying amounts of silt. Loose to medium dense granular material of the Late Pleistocene Norfolk Formation (Qn) underlies the Alluvium. Beneath the Norfolk Formation lies the Pliocene Yorktown Formation which are primarily granular marine sediments.

The subsurface stratigraphy within the proposed project area is displayed on seven subsurface cross sections. Subsurface cross sections displaying classification test results are presented on Figures 5-3a through 5-3i. A key to the symbolism used on those sections is shown on Figure 5-4.

Longitudinal subsurface cross sections are oriented in a SW-NE direction and drawn looking NW through the proposed project area. A-A' is located approximately 200 feet northwest of the existing tunnel, and C-C' is through the existing tunnel alignment. Please note that each longitudinal cross section is split in two and joined by a matchline for presentation as figures, e.g., A-A' is presented as A-A' and A'-A". Transverse Sections 1-1' through 5-5' are oriented in a NW-SE and drawn looking NE across the proposed project area.

The interpreted strata, in descending sequence, include:

Artificial Fill (Af). Artificial fill comprises most of the surficial material within the Portsmouth project area. Based on a review of the exploration data, historical maps, and drawings, large artificial fill bodies within the project area can be broadly grouped into the following types.

- Reclaimed Land: Areas reclaimed as part of large shoreline developments are shown on Figure 2-4. These areas were mapped by reviewing shoreline changes on charts and photos listed in Table 2-1. Significant reclamation events occurred between 1894 and 1915, 1915 and 1969. It is unknown whether they were placed during one event or during several events. A third fill on the north-facing shoreline, placed sometime between 1930 and 1959, is also shown on Figure 2-4.
- Inshore Fills: Fills placed in low lying areas such as the drainage shown on Figure 2-1 and interpreted to be Mud Flats on Figure 2-2.
- Midtown Tunnel Construction Fill: Figures 5-3c and 5-3d, 5-3g, 5-3h, and 5-3j show the inferred fill body based on the 1960 design dredge cut.
- Surficial Development and Utility Fills: The location, thickness, and character of fills associated with other former facilities, grading for current facilities, abandoned or

operating utilities is unknown. For information about the Pinner Point Wastewater Treatment Plant refer to the report prepared by MMA (2008). Based on discussions with Portsmouth Marine Terminal representatives indicate that utilities may have existing within the project area and abandoned in place.

A description of the fill encountered by the explorations and the character of the fill is provided in the following. Several explorations northwest of the existing tunnel alignment (e.g. cross section A-A') encountered a layer of artificial fill associated with historical development activities (see Figures 2-3 and 2-4) that infilled the low-lying areas of the former drainage (mudflat area) shown on Figures 2-1 and 2-2, and contributed to the land reclamation efforts of the present Portsmouth Marine Terminal. The 2008 explorations encountered fills up to about 16 feet thick within those fill body areas.

Midtown tunnel construction fill materials are inferred to be thicker in areas near the tunnel (as shown on the cross sections). The location of excavation cut for the existing tunnel is based on our review of the 1960 design drawings that depict a proposed excavation for the tunnel construction. Explorations which penetrated the artificial fill placed during the first tunnel construction are shown on Figures 5-3b, and 5-3c. The thickness of artificial fill placed in the original dredge cut ranges between several to about 70 feet.

Physical samples from borings of the fill material generally classified as Silty Fine Sand (SM) with medium sand. The 2008 and historical borings also encountered various debris within the fill materials. The fill is interpreted to extend down to between about El. - 8 feet and 2 feet (re: MLLW datum) at the 2008 land borings explored. CPT explorations also encountered sediments inferred to be fill material. The 2008 land CPTs encountered primarily coarse-grained sediments with varying amounts of fine-grained materials in the surficial fill. The transition from fill into the underlying material is subtle but distinct. VDOT land CPTs did not collect pore pressure data, however, tip resistance and sleeve friction are higher in the upper several feet. In summary, the fill material is highly variable in thickness, material type, and engineering character.

Alluvium (Qal_c) - Coarse-Grained Upper Unit. Alluvium is separated into upper coarse- and lower fine-grained stratigraphic units. The upper unit, coarse-grained alluvium classifies predominantly as Fine Sand (SP) with silt to Silty Fine Sand (SM) and is considered to be deposited in a fluvial-estuarine environment. The upper coarse-grained unit is typically 5 to 12 feet thick and extends down to about El. -10 feet at explorations within inshore fill areas. The coarse-grained unit is typically is between several and 20 feet thick in reclaimed land areas. As shown on Figure 5-3b, it is thickest along cross section A'-A" where it is 16 feet thick. It is thinnest in the former mud flat area (Figures 2-1 and 2-2) and locally absent at Boring B-15.

Alluvium (Qal_f) - Fine-Grained Lower Unit. A fine-grained unit was encountered below the coarse-grained unit. This material generally classified as very soft to soft to Clay (CL/CH) with some organics. This unit is inferred to be deposited in a low energy fluvial-estuarine or lagoon environment. Although this unit was deposited contemporaneously with the soft fine-grained alluvium encountered in the river, it has slightly different engineering properties. For example, the plasticity indices and liquid limits are 30 to 50 percent lower than the clay

encountered in the river. This unit is ranges from about 5 feet to almost 30 feet thick and extends down to as deep as El. -40 feet at the locations of the 2008 explorations.

Norfolk Formation (Qn). The predominantly fine-grained Alluvium is underlain by a zone of granular Pleistocene age fluvial-estaurine and brackish marine deposits that classify primarily as Silty Fine Sand (SM) to Fine Sand (SP). The thickness of this stratum varies between about 10 and 20 feet at the locations explored.

Yorktown Formation Sand (Ty). Granular material of the Pliocene age Yorktown Formation classified as Silty to Clayey Fine Sand (SM to SC). The top of this stratum was encountered between El. -38 to -86 feet. It was encountered to the maximum depth explored within the geotechnical explorations. The top of this unit appears to rise from El. -82 feet at boring B-16 to about El. -42 feet at B-15. We note that N-values of 7, 7, and 5 in the upper portion of this unit in boring B-15 appear to be low. However, visual descriptions of (e.g. soil type, color, and presence of shell fragments) of this material over this depth interval at boring B-15 are consistent with that of the typical Yorktown material. It is uncertain whether the blow counts are representative of the material or whether they were influenced by other factors (e.g. unstable bottom hole conditions or running sand).

5.4 GROUNDWATER

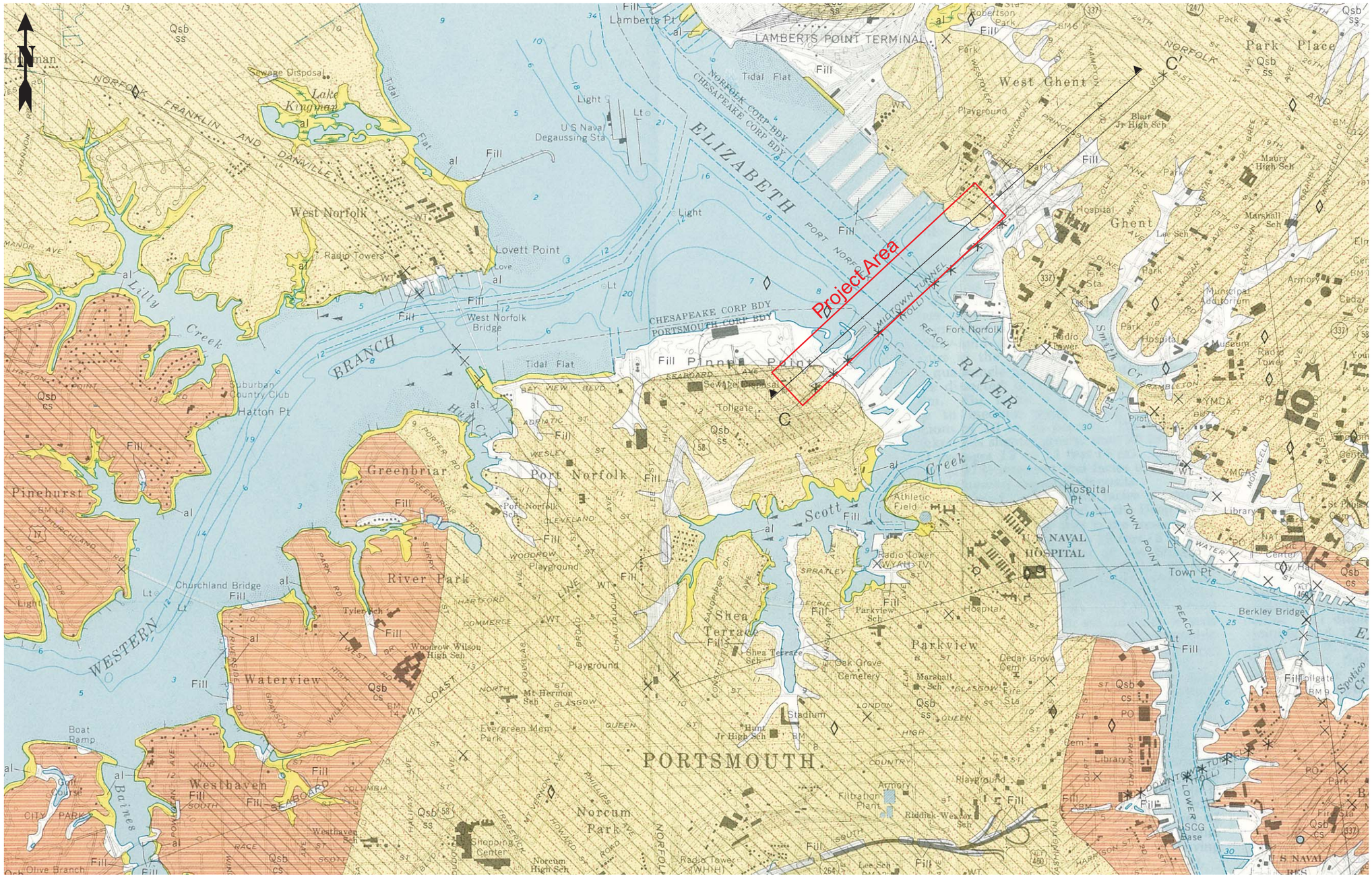
Marshall Miller and Associates (MMA) constructed permanent groundwater monitoring wells at seven boreholes near the Midtown Tunnel (5 on the Portsmouth side of the river) as shown on Figure 1-3 and Chart 1. The wells were constructed using two-inch diameter polyvinyl chloride (PVC) piping attached to a section of slotted (0.010-inch) screen. The wells were set with clean silica sand (No. 2) that extended two feet above the top of screen before bentonite was placed in the well to the surface. At the surface, the wellheads were completed with an 8-inch-diameter access vault/lid set in a concrete pad. On July 15-16, 2008, the seven wells were developed of approximately three well volumes of groundwater per well with a Grundfos® pump. On July 17, 2008, the wells were purged an additional three well volumes, then sampled using disposable plastic bailers. Table 5-1 summarizes the 2008 well data. Wells located in Portsmouth are highlighted in the table. Additional information about the wells and water level measurements are provided in the MMA (2008) report.

Table 5-1. Summary of Groundwater Monitoring Wells

Well	Riser Depth Interval (feet)	Screen Depth Interval (feet)	Depth to Groundwater (feet)
MW-1 (08BH-012)	0-5	5-15	6.40
MW-2 (08BH-013)	0-10	10-25	6.42
MW-3 (08BH-014)	0-20	20-35	4.75
MW-4 (08BH-015)	0-30	30-50	3.95
MW-5 (08BH-016)	0-45	45-65	4.90
MW-6 (Between (08BH-018 and 08BH-019)	0-20	20-35	3.73
MW-7 (Between (08BH-018 and 08BH-017)	0-5	5-20	3.64

*Data provided to Fugro by Marshall Miller and Associates, October 31, 2008

Based on groundwater elevations estimated in measured in July for this study, we believe groundwater is present at about El. 0 to 3 feet, or about 5 to 6.5 feet below the existing ground surface. Groundwater elevations between about El. -1 to -10 (depths ranging between about 6 and 16 feet) were observed in VDOT's boreholes 08BH-012 to 08BH-016 for this study in June 2008. However, these were initial groundwater measurements and no long-term static measurements were taken.



GEOLOGIC LEGEND

QUATERNARY

HOLOCENE

al — **Alluvium, sand, and marsh sediment**: Estuarine-beach, tidal marsh, and fluvial silt, sand, and clay with organic material (peat) abundant in tidal marshes.

PLEISTOCENE

Qsb (cs, ss, sc) — **Sand Bridge Formation:** Upper member; facies-cs, tidal channel, clayey sand; ss, shoal lagoonal, silty sand; and sc, lagoonal, silty clay. (Lower member included with upper member).

Qn ss — **Norfolk Formation:** Upper member, facies-ss, brackish marine silty sand; (Lower member included with upper member).

TERTIARY

PLIOCENE

Ty — **Yorktown Formation (in Section C-C', only)**: near shore marine fossiliferous, silty, coarse sand and coquina.

0 1000 2000 feet

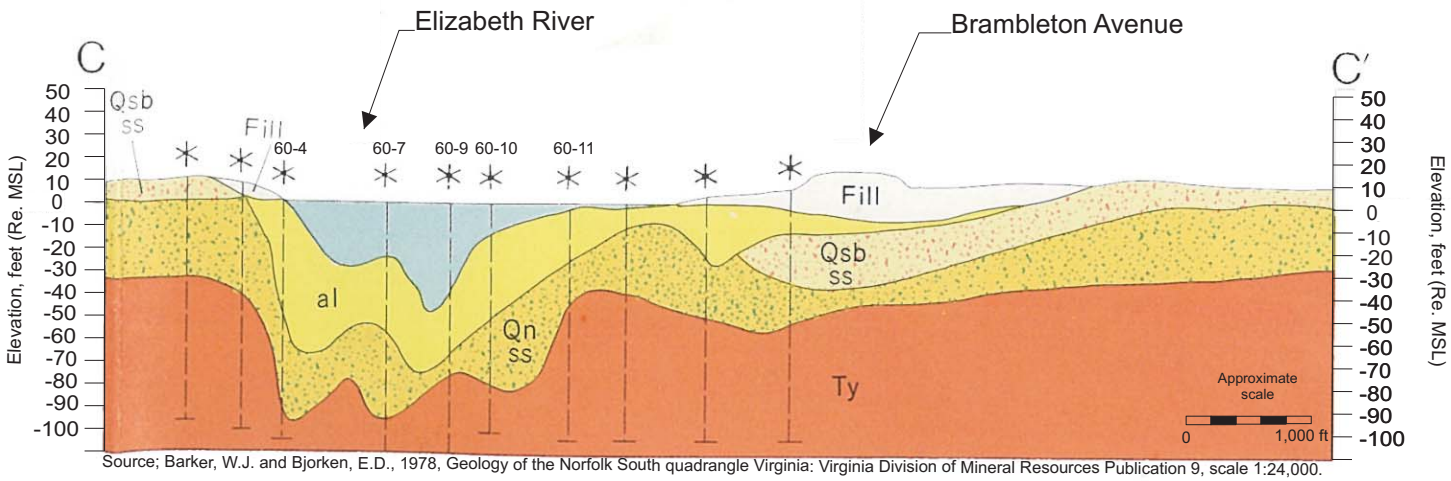
CONTOUR INTERVAL 5 FEET, DATUM IS MEAN SEA LEVEL, DEPTH CURVES AND SOUNDINGS IN FEET - DATUM IS MEAN LOW WATER
Shoreline shown represents the approximate line is mean high water; the mean range of tide is approximately 2.5 feet.

Source: Barker, W.J. and Bjorken, E.D., 1978, Geology of the Norfolk south quadrangle Virginia: Virginia Division of Mineral Resources Publication 9, scale 1:24,000

Note:
Refer to Figure 5-2 for cross section C-C'.

GEOLOGIC MAP
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-1

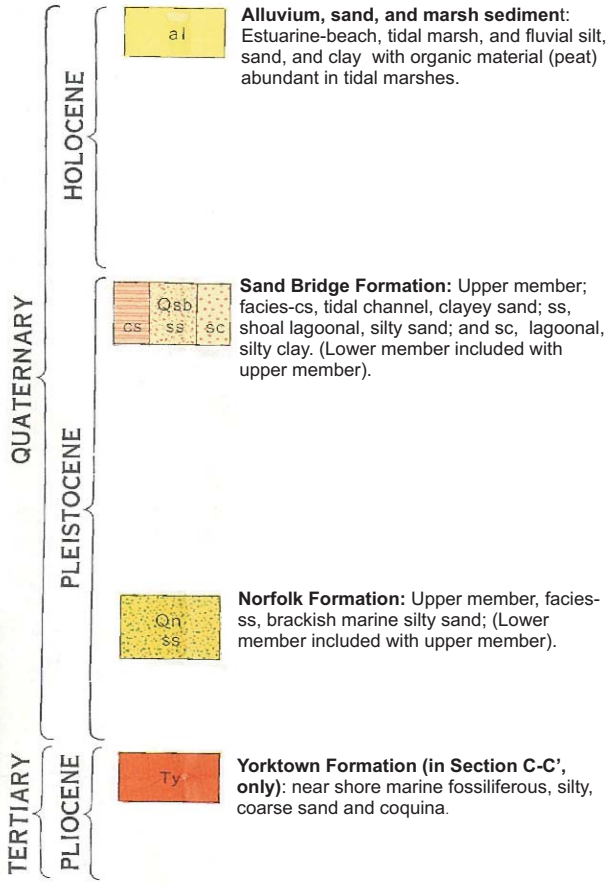


Source; Barker, W.J. and Bjorken, E.D., 1978, Geology of the Norfolk South quadrangle Virginia: Virginia Division of Mineral Resources Publication 9, scale 1:24,000.

Note:

Cross Section C-C' is located approximately along alignment of existing tunnel. Refer to Figure A-1 for location. Cross section is from geologic map published in 1978. Subsurface conditions shown on cross section reflect the authors' (Barker and Bjorken) interpretations at time of publication. This cross section DOES NOT INCLUDE post-1978 INFORMATION OR INTERPRETATION BASED ON MORE RECENT DATA (e.g. 2008 explorations). Borings shown on map are presumed to be from 1960.

GEOLOGIC LEGEND



Alluvium, sand, and marsh sediment: Estuarine-beach, tidal marsh, and fluvial silt, sand, and clay with organic material (peat) abundant in tidal marshes.

Sand Bridge Formation: Upper member; facies-cs, tidal channel, clayey sand; ss, shoal lagoonal, silty sand; and sc, lagoonal, silty clay. (Lower member included with upper member).

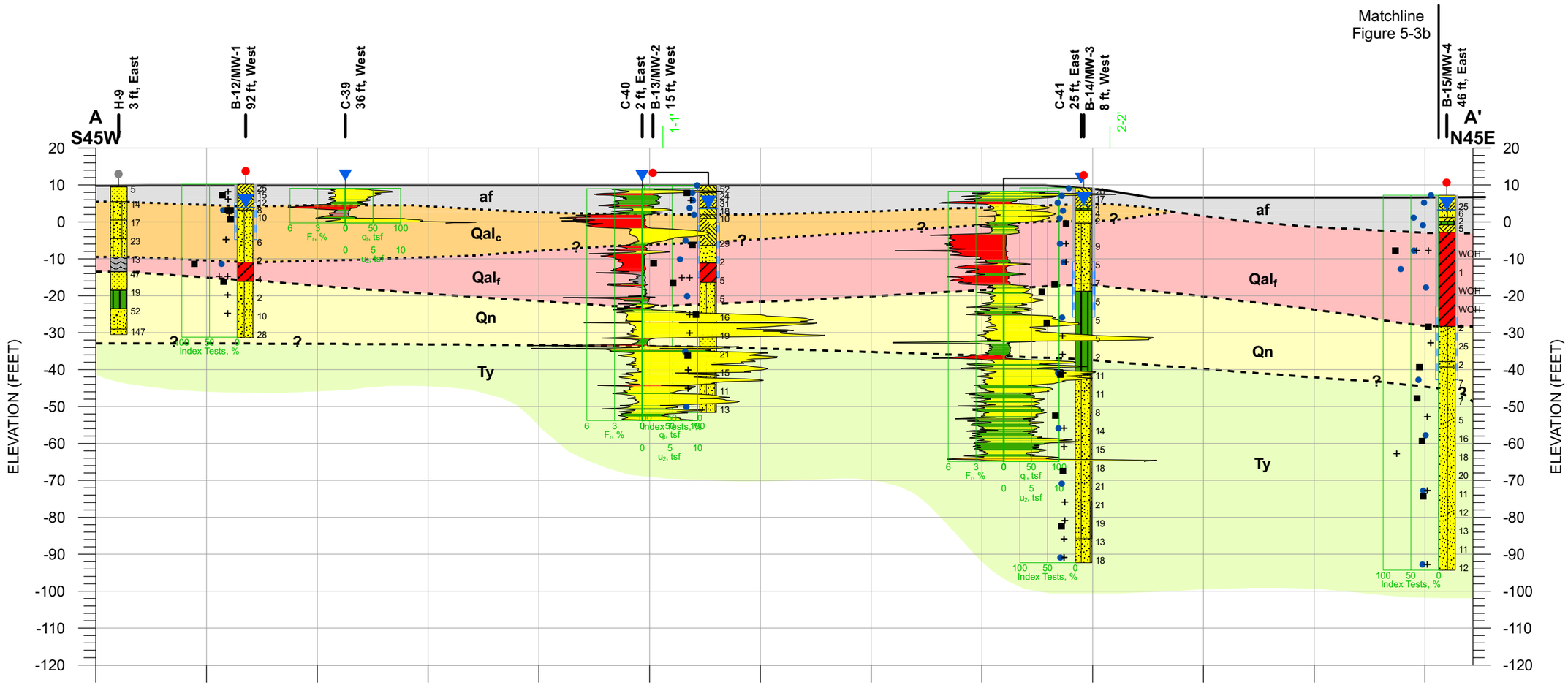
Norfolk Formation: Upper member, facies-ss, brackish marine silty sand; (Lower member included with upper member).

Yorktown Formation (in Section C-C', only): near shore marine fossiliferous, silty, coarse sand and coquina.

GEOLOGIC CROSS SECTION

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-2



NOTES:

1) Bathymetric data from 2008 multibeam and single beam surveys. Refer to Fugro (2008b) for description of surveys. Topographic data from U.S. Geological Survey's National Elevation Dataset (NED).

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-4 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

LEGEND

Stratigraphic Units

- Artificial Fill (af)
- Alluvium (Qal_c) - loose to medium dense silty sand
- Alluvium (Qal_f) - soft to firm clay
- Norfolk (Qn) - loose to medium sand
- Yorktown (Ty) - silty fine sand

Explorations

- 2008 VDOT (Land) and Fugro (Marine) CPT
- 2008 VDOT (Land) and Fugro (Marine) Boring
- 2008 MMA (Land) Monitoring Well
- 1957-1960 Historical Boring

30 ft
100 ft
Horizontal and Vertical Scales
Vertical exaggeration is ~3x.

SUBSURFACE CROSS SECTION A-A' WITH CLASSIFICATION RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3a

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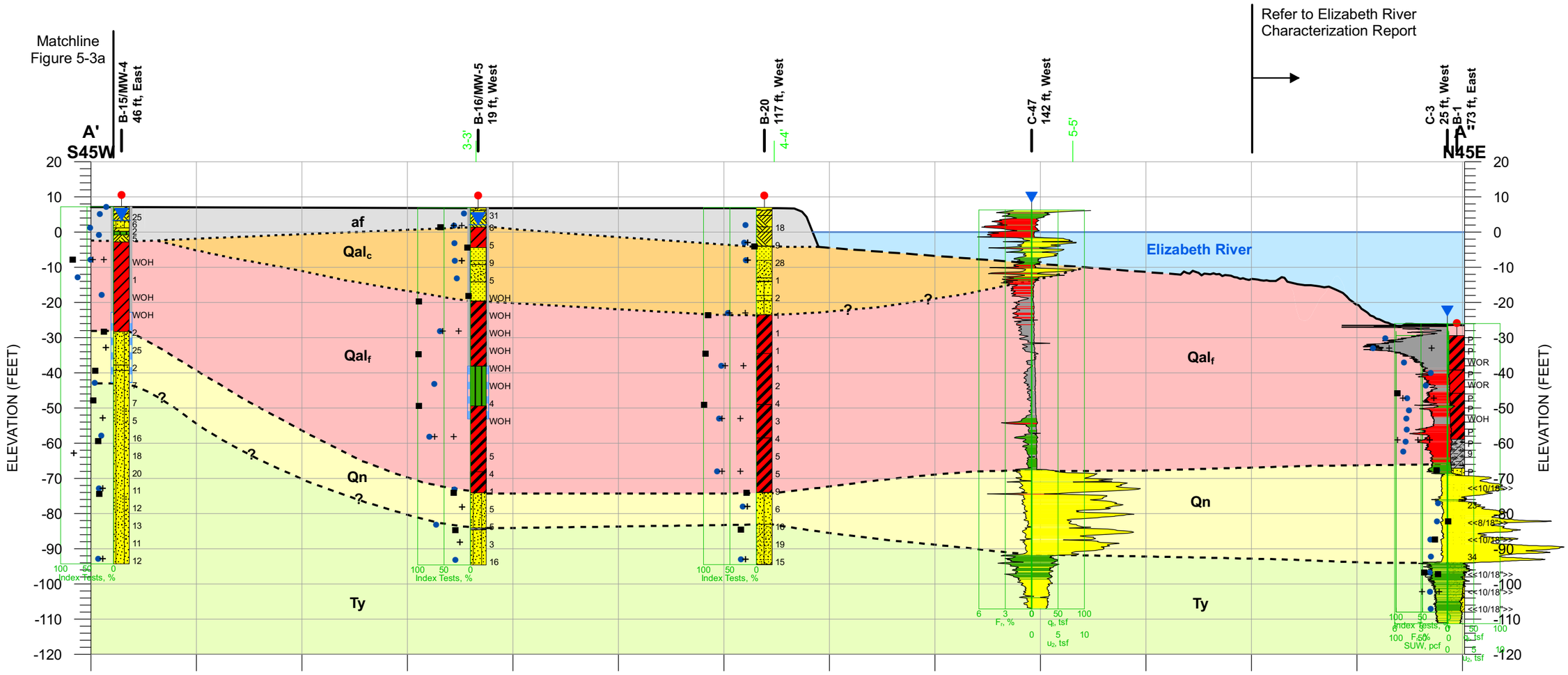

NOTES:

1) Bathymetric data from 2008 multibeam and single beam surveys. Refer to Fugro (2008b) for description of surveys. Topographic data from U.S. Geological Survey's National Elevation Dataset (NED).

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-4 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

LEGEND

Stratigraphic Units

- Elizabeth River
- Artificial Fill (af)
- Alluvium (Qal_c) - loose to medium dense silty sand
- Alluvium (Qal_f) - soft to firm clay
- Norfolk (Qn) - loose to medium sand
- Yorktown (Ty) - silty fine sand

Explorations

- 2008 VDOT (Land) and Fugro (Marine) CPT
- 2008 VDOT (Land) and Fugro (Marine) Boring
- 2008 MMA (Land) Monitoring Well

30 ft
100 ft
Horizontal and Vertical Scales
Vertical exaggeration is ~3x.

SUBSURFACE CROSS SECTION A'-A" WITH CLASSIFICATION RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3b

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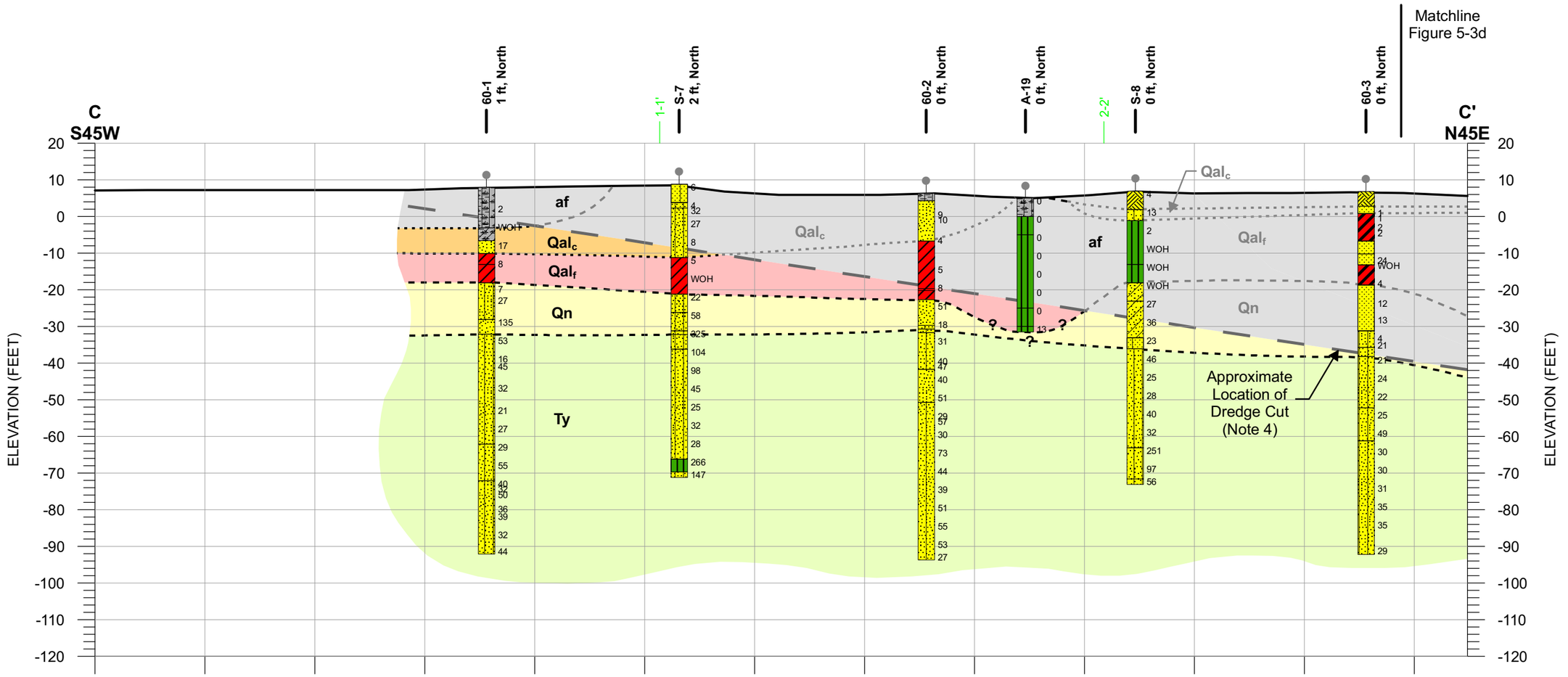

NOTES:

1) Bathymetric data from 2008 multibeam and single beam surveys. Refer to Fugro (2008b) for description of surveys. Topographic data from U.S. Geological Survey's National Elevation Dataset (NED).

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-4 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

LEGEND

Stratigraphic Units

- Artificial Fill (af)
- Alluvium (Qal_c) - loose to medium dense silty sand
- Alluvium (Qal_f) - soft to firm clay
- Norfolk (Qn) - loose to medium sand
- Yorktown (Ty) - silty fine sand

Explorations

- 1957-1960 Historical Boring

30 ft
100 ft
Horizontal and Vertical Scales
Vertical exaggeration is ~3x.

SUBSURFACE CROSS SECTION C-C'
WITH CLASSIFICATION RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3c

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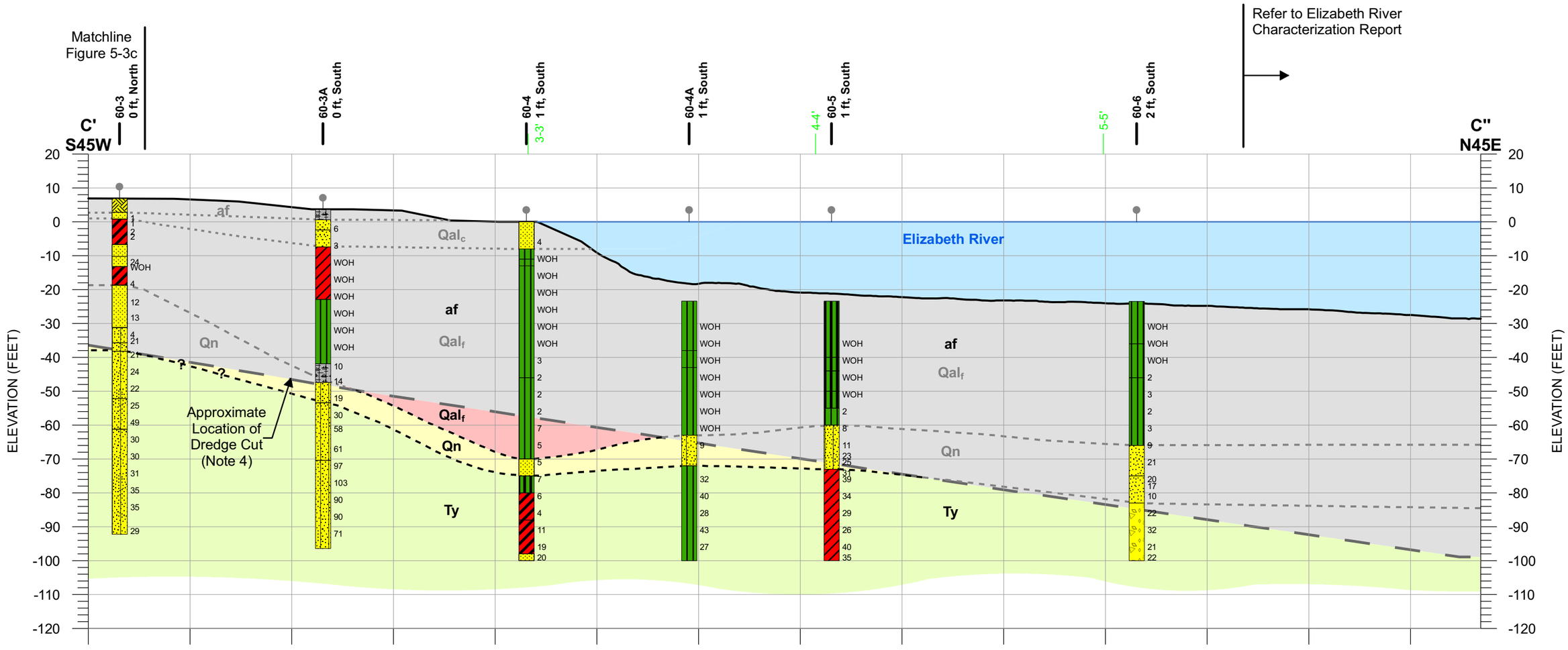

NOTES:

1) Bathymetric data from 2008 multibeam and single beam surveys. Refer to Fugro (2008b) for description of surveys. Topographic data from U.S. Geological Survey's National Elevation Dataset (NED).

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-4 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

LEGEND

Stratigraphic Units

- Elizabeth River
- Artificial Fill (af)
- Alluvium (Qal_f) - soft to firm clay
- Norfolk (Qn) - loose to medium sand
- Yorktown (Ty) - silty fine sand

Explorations

- 1957-1960 Historical Boring

30 ft
100 ft
Horizontal and Vertical Scales
Vertical exaggeration is ~3x.

SUBSURFACE CROSS SECTION C'-C" WITH CLASSIFICATION RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3d

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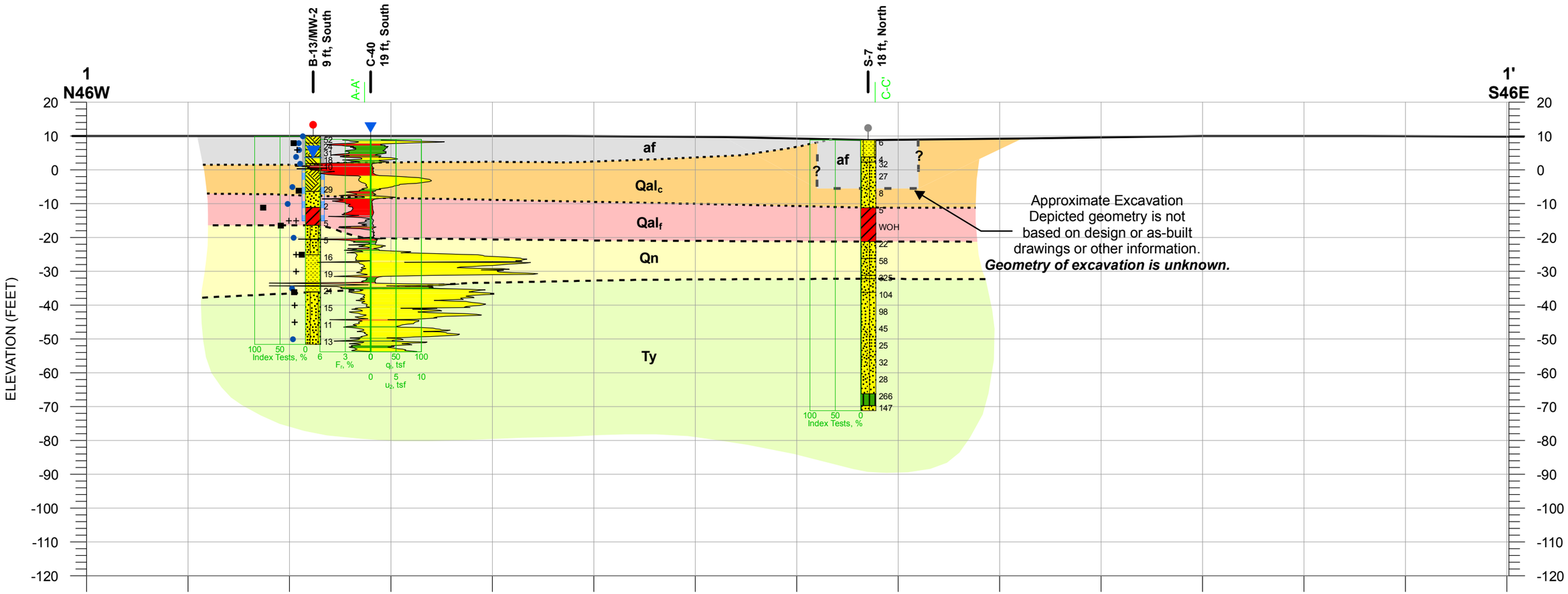

NOTES:

1) Bathymetric data from 2008 multibeam and single beam surveys. Refer to Fugro (2008b) for description of surveys. Topographic data from City of Norfolk 2000 photogrammetric survey.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-4 for key to symbolism used on cross sections.

LEGEND

Stratigraphic Units

- Artificial Fill (af)
- Alluvium (Qal$_c$) - loose to medium dense silty sand
- Alluvium (Qal$_f$) - soft to firm clay
- Norfolk (Qn) - loose to medium sand
- Yorktown (Ty) - silty fine sand

Explorations

- 2008 VDOT (Land) and Fugro (Marine) CPT
- 2008 VDOT (Land) and Fugro (Marine) Boring
- 2008 MMA (Land) Monitoring Well
- 1957-1960 Historical Boring

30 ft
30 ft
Horizontal and Vertical Scales
No vertical exaggeration.

SUBSURFACE CROSS SECTION 1-1' WITH CLASSIFICATION RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3e

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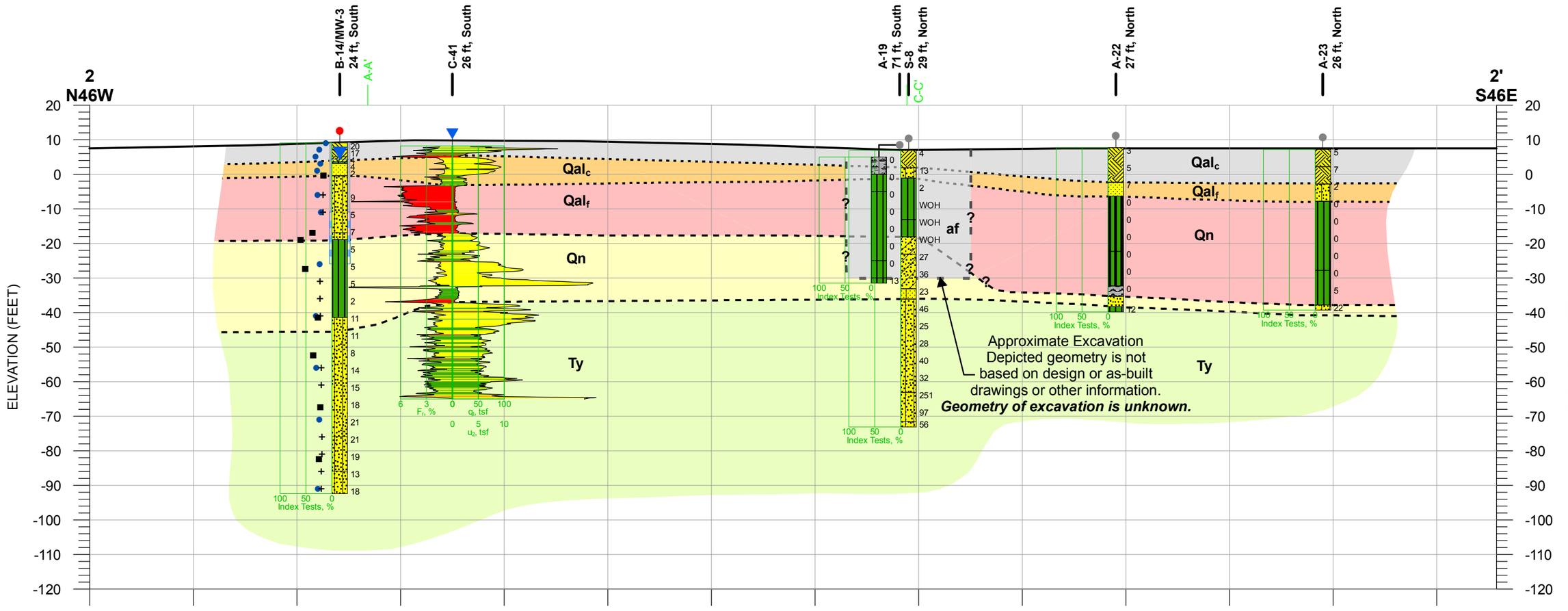

NOTES:

1) Bathymetric data from 2008 multibeam and single beam surveys. Refer to Fugro (2008b) for description of surveys. Topographic data from City of Norfolk 2000 photogrammetric survey.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-4 for key to symbolism used on cross sections.

LEGEND

Stratigraphic Units

- Artificial Fill (af)
- Alluvium (Qal_c) - loose to medium dense silty sand
- Alluvium (Qal_f) - soft to firm clay
- Norfolk (Qn) - loose to medium sand
- Yorktown (Ty) - silty fine sand

Explorations

- 2008 VDOT (Land) and Fugro (Marine) CPT
- 2008 VDOT (Land) and Fugro (Marine) Boring
- 2008 MMA (Land) Monitoring Well
- 1957-1960 Historical Boring

30 ft
30 ft
Horizontal and Vertical Scales
No vertical exaggeration.

SUBSURFACE CROSS SECTION 2-2' WITH CLASSIFICATION RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3f

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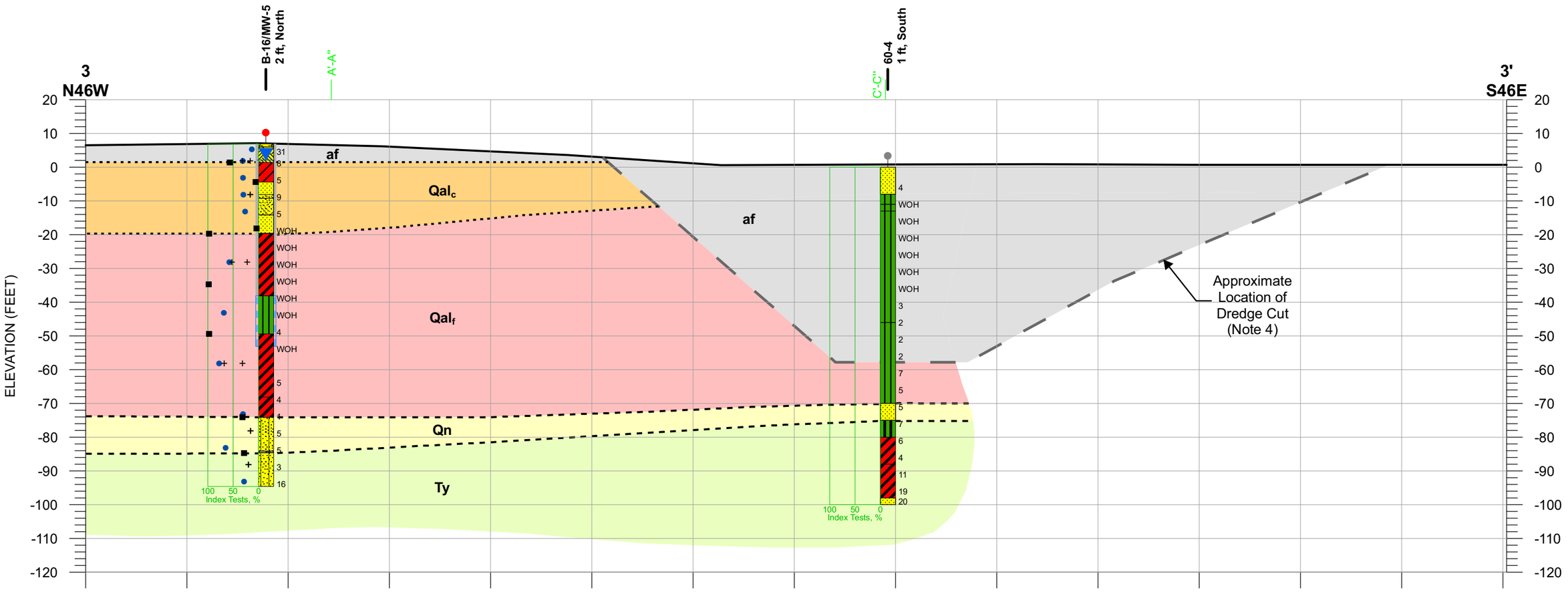

NOTES:

1) Bathymetric data from 2008 multibeam and single beam surveys. Refer to Fugro (2008b) for description of surveys. Topographic data from City of Norfolk 2000 photogrammetric survey.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-4 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

LEGEND

Stratigraphic Units

- Artificial Fill (af)
- Alluvium (Qal_c) - loose to medium dense silty sand
- Alluvium (Qal_f) - soft to firm clay
- Norfolk (Qn) - loose to medium sand
- Yorktown (Ty) - silty fine sand

Explorations

- 2008 VDOT (Land) and Fugro (Marine) Boring
- 2008 MMA (Land) Monitoring Well
- 1957-1960 Historical Boring

30 ft
30 ft
Horizontal and Vertical Scales
No vertical exaggeration.

SUBSURFACE CROSS SECTION 3-3' WITH CLASSIFICATION RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3g

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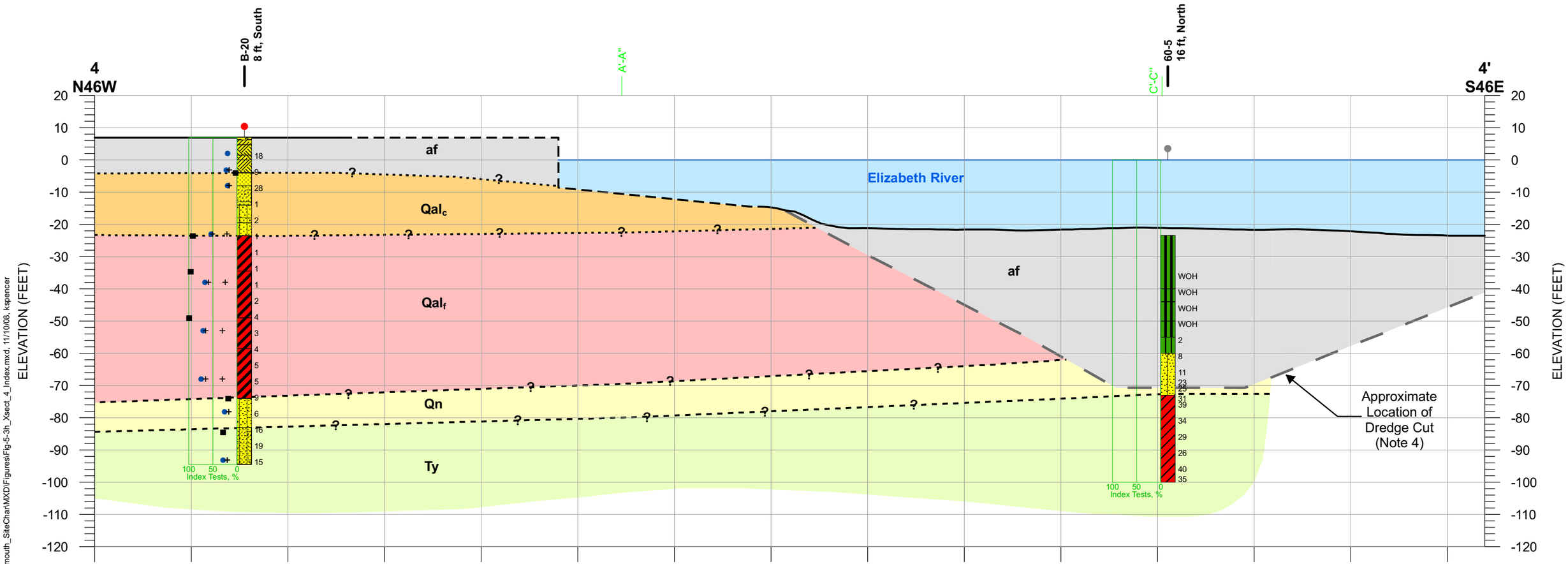

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NOTES:

1) Bathymetric data from 2008 multibeam and single beam surveys. Refer to Fugro (2008b) for description of surveys. Topographic data from U.S. Geological Survey's National Elevation Dataset (NED).

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-4 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

LEGEND

Stratigraphic Units

- Elizabeth River
- Artificial Fill (af)
- Alluvium (Qal$_c$) - loose to medium dense silty sand
- Alluvium (Qal$_f$) - soft to firm clay
- Norfolk (Qn) - loose to medium sand
- Yorktown (Ty) - silty fine sand

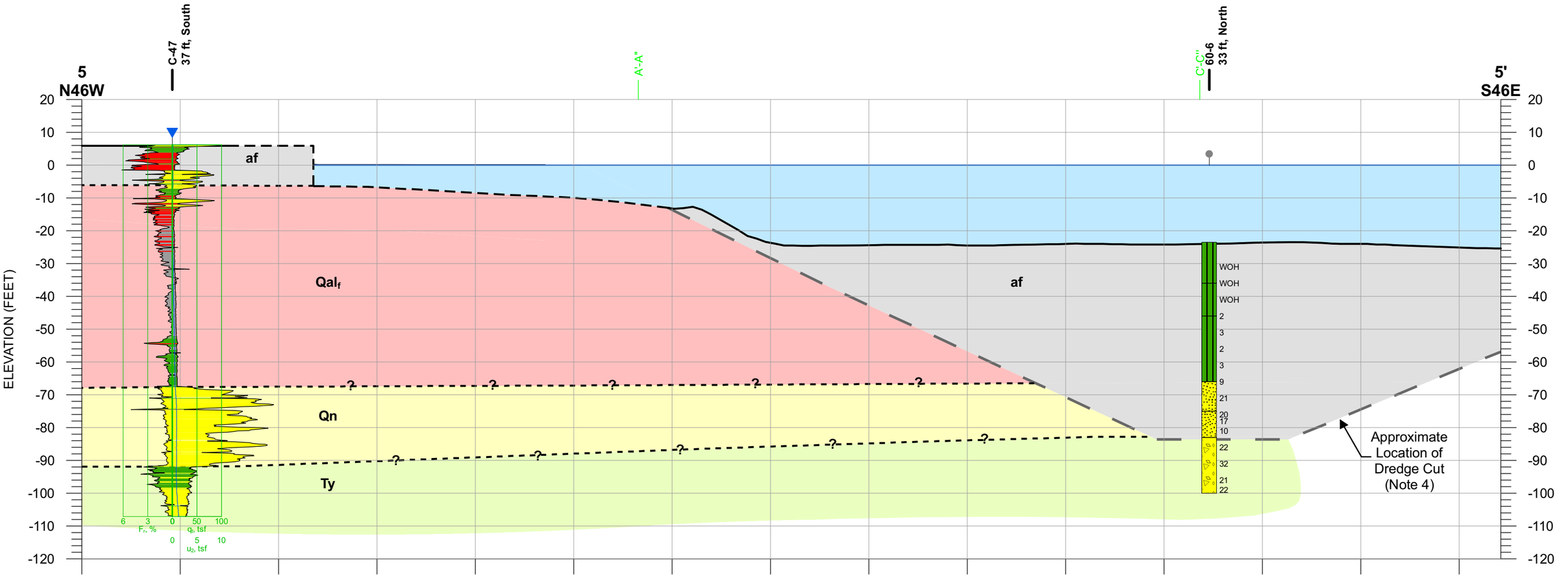
Explorations

- 2008 VDOT (Land) and Fugro (Marine) Boring
- 1957-1960 Historical Boring

30 ft
30 ft
Horizontal and Vertical Scales
No vertical exaggeration.

SUBSURFACE CROSS SECTION 4-4' WITH CLASSIFICATION RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3h



NOTES:

1) Bathymetric data from 2008 multibeam and single beam surveys. Refer to Fugro (2008b) for description of surveys. Topographic data from U.S. Geological Survey's National Elevation Dataset (NED).

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-4 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

LEGEND

Stratigraphic Units

- Elizabeth River
- Artificial Fill (af)
- Alluvium (Qal$_f$) - soft to firm clay
- Norfolk (Qn) - loose to medium sand
- Yorktown (Ty) - silty fine sand

Explorations

- 2008 VDOT (Land) and Fugro (Marine) CPT
- 1957-1960 Historical Boring

30 ft
30 ft
Horizontal and Vertical Scales
No vertical exaggeration.

SUBSURFACE CROSS SECTION 5-5' WITH CLASSIFICATION RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3i

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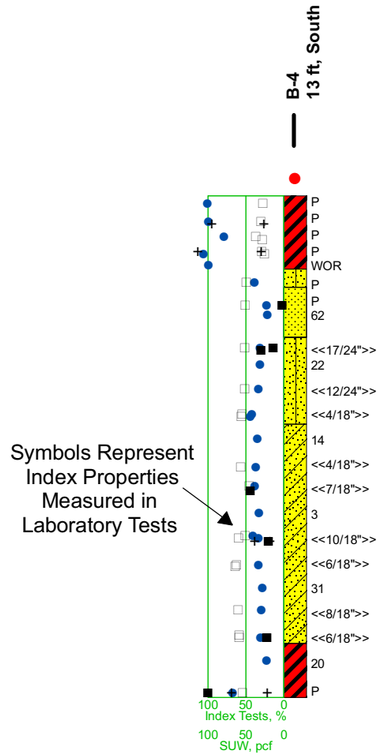


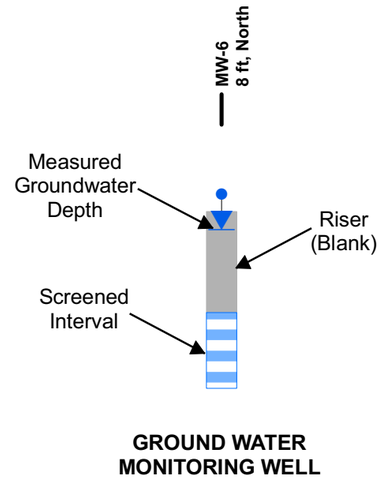
SOIL BORING LITHOLOGY WITH INDEX TESTS MEASURED IN LABORATORY AND RAW BLOW COUNTS

INDEX PROPERTIES SYMBOLS

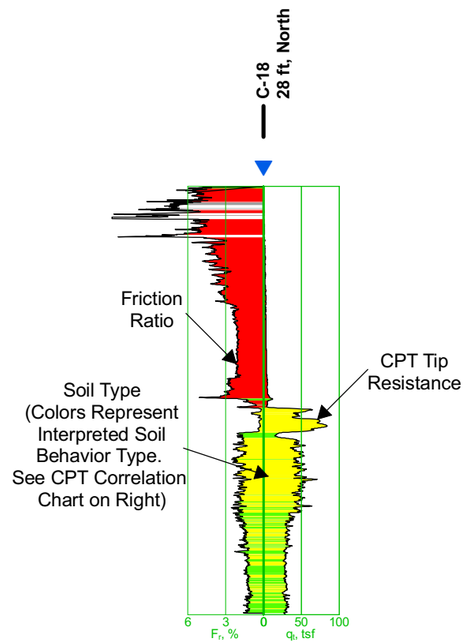
- Submerged Unit Weight
- Percent Passing #200 Sieve
- Plastic Limit
- Liquid Limit
- Water Content

SOIL TYPES

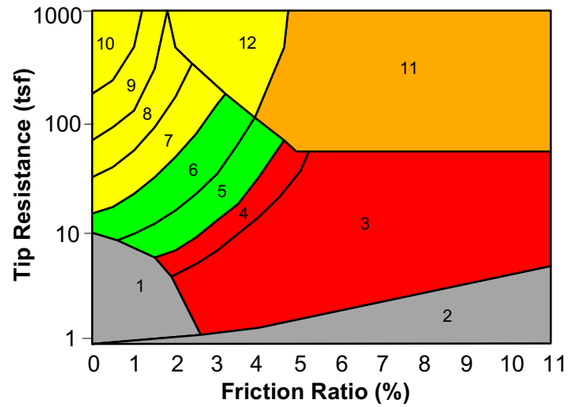
- Well graded GRAVEL (GW)
- Poorly graded GRAVEL (GP)
- GRAVEL with sand (GW)
- GRAVEL with clay (GW)
- Clayey GRAVEL (GC)
- GRAVEL with silt (GW)
- Silty GRAVEL (GM)
- Well graded SAND (SW)
- Poorly graded SAND (SP)
- SAND with gravel (SW)
- SAND with clay (SW-SC)
- Clayey SAND (SC)
- Silty SAND (SM)
- SAND with silt (SW-SM)
- Fat CLAY (CH)
- Sandy fat CLAY (CH)
- Lean CLAY (CL)
- Sandy lean CLAY (CL)
- Silty CLAY (CL-ML)
- Elastic SILT (MH)
- SILT (ML)
- Sandy SILT (ML)
- Clayey SILT (ML/CL)
- Highly plastic ORGANICS (OH)
- Low plasticity ORGANICS (OL)
- SANDSTONE (Rx)
- SILTSTONE (Rx)
- CLAYSTONE (Rx)
- MUDSTONE (Rx)
- Conglomerate (Rx)
- Interbedded Rock Strata (Rx)
- Pavement



GROUND WATER MONITORING WELL



CPT SOUNDING WITH FRICTION RATIO, AND TIP RESISTANCE



Zone	Soil Behavior Type	U.S.C.S.
1	Sensitive Fine-grained	OL-CH
2	Organic Material	OL-OH
3	Clay	CH
4	Silty Clay to Clay	CL-CH
5	Clayey Silt to Silty Clay	MH-CL
6	Sandy Silt to Clayey Silt	ML-MH
7	Silty Sand to Sandy Silt	SM-ML
8	Sand to Silty Sand	SM-SP
9	Sand	SW-SP
10	Gravelly Sand to Sand	SW-GW
11	Very Stiff Fine-grained *	CH-CL
12	Sand to Clayey Sand *	SC-SM

*overconsolidated or cemented

CPT CORRELATION CHART (Robertson and Campanella, 1988)

KEY TO SUBSURFACE CROSS SECTIONS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-4

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6.0 ENGINEERING SOIL PROPERTIES

Sediment properties and conditions exist that are relevant to the Midtown Second Parallel Tunnel project area, particularly the defining sediment types and in situ conditions of material that may serve as a tunnel foundation. Relevant sediment properties for the various geologic materials encountered within the project area are discussed in detail in the following paragraphs. The data concerning engineering soil properties included in this section were evaluated as part of the field investigation and laboratory testing programs completed for this site characterization study. As mentioned in Section 4.2, borings performed in the late 1950s to early 1960s in anticipation of the original tunnel construction (shown on Figure 1-3) do not contain laboratory test data, and thus are not included in this discussion. The soil properties and summary plots of pertinent soil parameters presented in this section are divided into four principal stratigraphic units:

- Artificial Fill Material;
- Alluvium;
  - coarse-grained,
  - fine-grained,
- Norfolk Formation; and
- Yorktown Formation Sand.

Data from each laboratory test result are indicated on individual figures in Appendix B to graphically illustrate the variations in engineering soil properties throughout the soil profiles. Much of this information is also presented on the Log of Boring and Test Results for each individual exploration as presented in Appendix A of this report. A Summary of Laboratory Test Results for land borings performed in Portsmouth for the proposed Midtown Second Parallel Tunnel project area is presented on Figures B-1a through B-1d.

6.1.1 Grain Size

Granular material was predominantly encountered as the Holocene aged sediment at and beneath the seafloor to the maximum depth explored during this field program. The grain size characteristics of the sediments underlying the site are summarized on the following illustrations:

- Figure 6-1: Grain Size Curve Envelopes,
- Figure 6-2: Percent Passing the No. 200 Sieve versus Elevation,
- Figure 6-3: Percent Passing the No. 200 Sieve versus Depth,
- Figure 6-4: Mean Grain Size (D_{50}) versus Elevation, and
- Figure 6-5: Mean Grain Size (D_{50}) versus Depth.
- Artificial Fill: Limited testing of fines content (percentage of material passing the No. 200 sieve) was performed on samples of Artificial Fill. Results from three tests

ranged between 13 and 26 percent. Laboratory test results indicate a range of mean grain-size between 0.11 mm and 0.25 mm.

- Coarse-Grained Alluvium: Fines content varies between 3.0 and 56.0 percent, but generally less than about 15 percent. Coarse-grained alluvium samples evaluated for grain size range in classification from Silty Fine Sand (SM) to Fine to Medium Sand (SP). Limited laboratory test results indicate a range of median grain-size between 0.12 and 0.35 mm.
- Fine-Grained Alluvium: Fines content varies between 16.0 and 99.0 percent, but generally greater than about 75 percent. Fine-grained alluvium samples evaluated for grain size classify as Lean Clay (CL) with varying amounts of fine sand. One laboratory test result indicates a median grain-size of 0.13 mm.
- Norfolk Formation: Fines content varies between 7.0 and 60.0 percent, and samples evaluated for grain size classify as Silt (ML) with sand to Silty Fine Sand (SM). Laboratory test results indicate a range of mean grain-size between 0.08 mm and 0.32 mm.
- Yorktown Sand: Fines content of the Yorktown Sand samples vary between 22 and 38 percent. The samples classify primarily as Silty Fine Sand (SM). Laboratory test results indicate a range of mean grain-size between 0.10 mm and 0.20 mm.

6.1.2 In Situ Water (Moisture) Content

Data showing the in situ water content are plotted versus elevation and depth on the following illustrations:

- Figure 6-6: Moisture Content versus Elevation, and
- Figure 6-7: Moisture Content versus Depth.

Measured water contents are summarized by stratigraphic unit on Figures 6-6 and 6-7. Typical ranges measured in the various stratigraphic units are as follows:

- Artificial Fill: water content is measured between 10 and 44 percent,
- Coarse-Grained Alluvium: water content is measured between 19 and 53 percent, but generally between about 20 and 30 percent,
- Fine -Grained Alluvium: water content is measured between 21 and 77 percent,
- Norfolk Formation: water content measured between 23 and 65 percent, but generally between about 25 and 35 percent,
- Yorktown Sand: water content measured between 23 and 30 percent.

6.1.3 Plasticity

The plasticity of fine-grained soil is summarized on:

- Figure 6-8: Atterberg Limits versus Elevation,
- Figure 6-9: Atterberg Limits versus Depth, and

- Figure 6-10: Plasticity Chart.

The fine-grained soil primarily consists of low to high plasticity clay. As shown on Figure 6-10, the Atterberg limit test data plot above the A-line of the plasticity chart, signifying the presence of primarily clayey material throughout the depth explored. Limited Atterberg limit test data are summarized as follows:

- Coarse-Grained Alluvium: One test result indicates a liquid limit (LL) of 52, and a plasticity indix (PI) of 30.
- Fine-Grained Alluvium: Measured liquid limits (LL) range between 32 and 67, and plasticity indices (PI) range between 14 and 36. Samples classify as Lean Clay (CL) and Fat Clay (CH).

6.1.4 In Situ Condition of Granular Sediments

Relative density is an important factor that affects the strength of sands. Relative density (D_r) is defined as the ratio of the difference between the in situ void ratio and the maximum void ratio to the difference between the maximum and minimum void ratios. Data indicative of in situ condition of the granular sediments underlying the site are summarized on:

- Figure 6-11: Blow Count (SPT N-Value) versus Elevation, and
- Figure 6-12: Blow Count (SPT N-Value) versus Depth.

An important method of estimating the in situ relative density of granular materials is the correlation of SPT blow count per foot (N-values) obtained from field sampling techniques. Figures 6-11 and 6-12 presents the equivalent N-value profiles of the stratigraphic units as determined in the field for the Standard Penetration Test (SPT). The data presented on Figures 6-11 and 6-12 have not been adjusted to account for overburden pressure, test efficiency, or for the energy dissipation effects through the long rod length for the marine borings. We have used the following categories for relative density, based on Terzaghi and Peck (1967) and Lambe and Whitman (1969), as shown in Table 6-1 below.

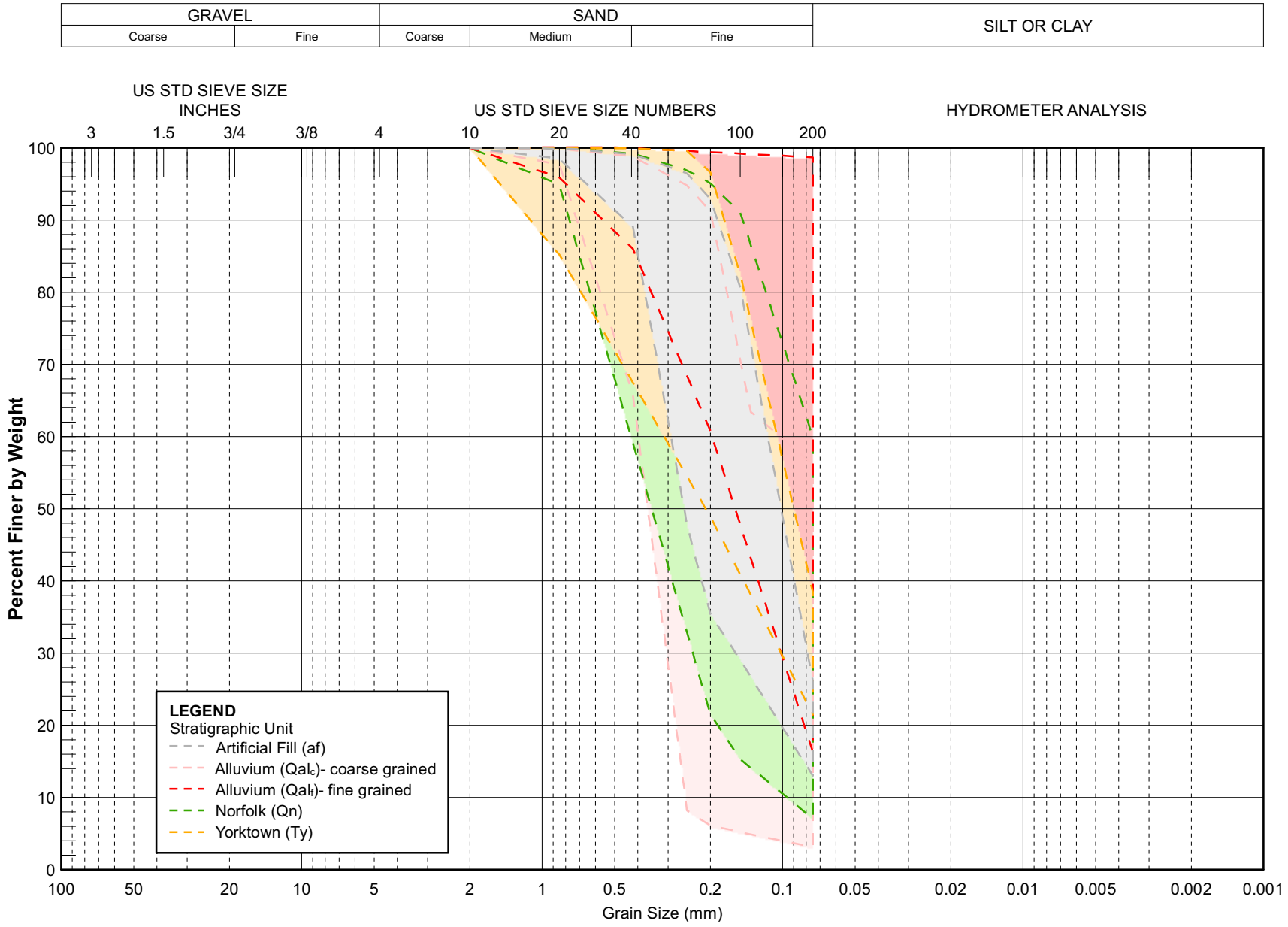
Table 6-1. SPT N-Value Correlations with Relative Density

SPT N-Value	Relative Density	D_r (%)
0 to 4	Very loose	0 to 15
5 to 10	Loose	15 to 35
11 to 30	Medium dense	35 to 65
31 to 50	Dense	65 to 85
> 50	Very dense	85 to 100

Table 6-2 below shows the typical ranges of sampler blow counts with relative densities, correlated to SPT N-values for the various subsurface strata:

Table 6-2. Relative Densities of Principal Stratigraphic Units

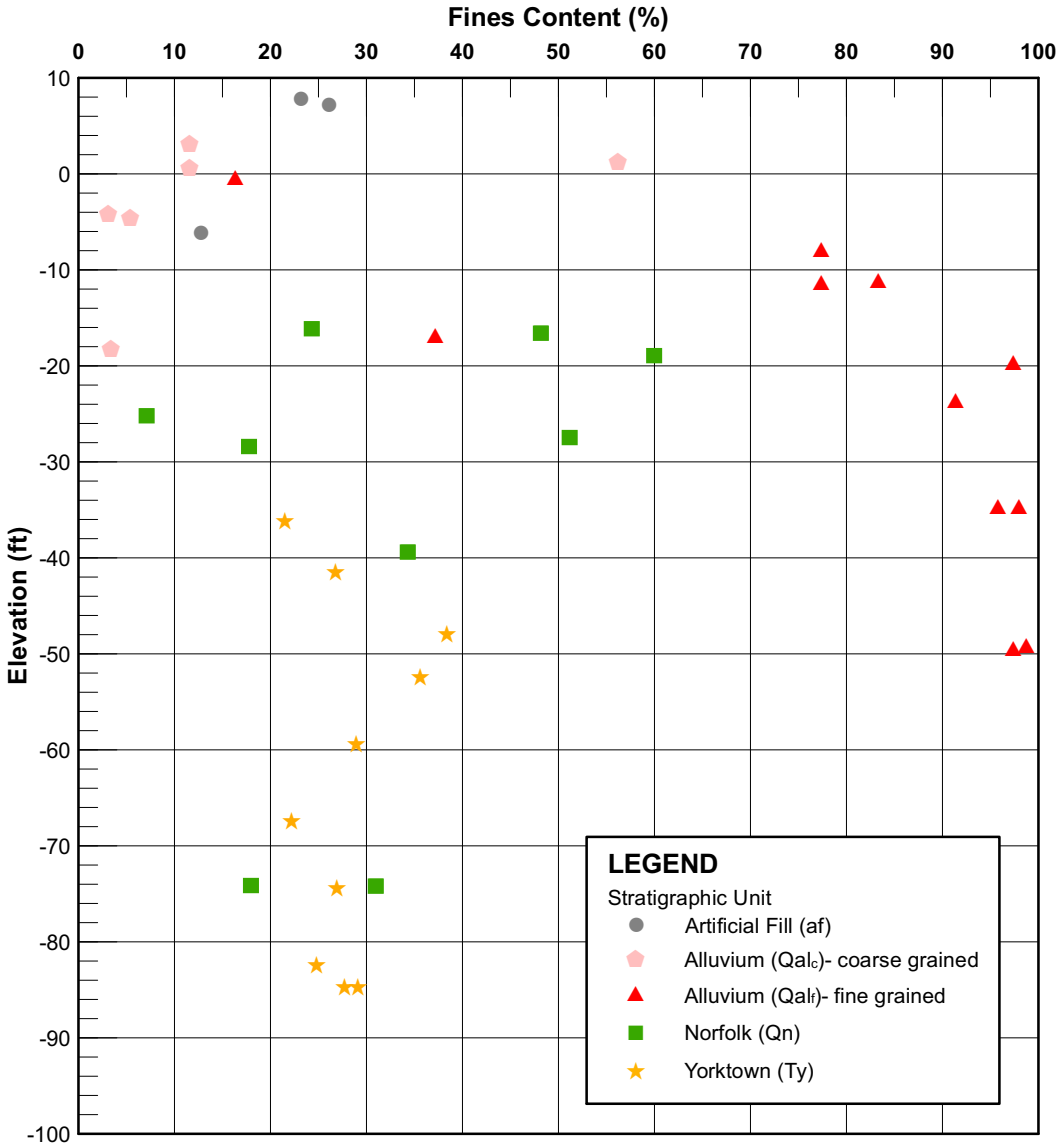
Principal Stratigraphic Unit	Typical Range of N-Values	Relative Density correlated to SPT N-values
Artificial Fill (Af)	5-25	5 to 60%
Alluvium (Qal_c) coarse-grained	<1-10	5 to 35%
Alluvium (Qal_f) fine-grained	<1-5	N/A
Norfolk Formation (Qn)	<1-25	5 to 60%
Yorktown Sand (Tys)	10-20	35 to 50%



GRAIN SIZE CURVE ENVELOPES
VDOT 2008 Onshore Portsmouth Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-1

Virginia Department of Trasportation
Project No. 3602.001



PERCENT PASSING NO. 200 SIEVE (FINES CONTENT) VERSUS ELEVATION
VDOT 2008 Onshore Portsmouth Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-2

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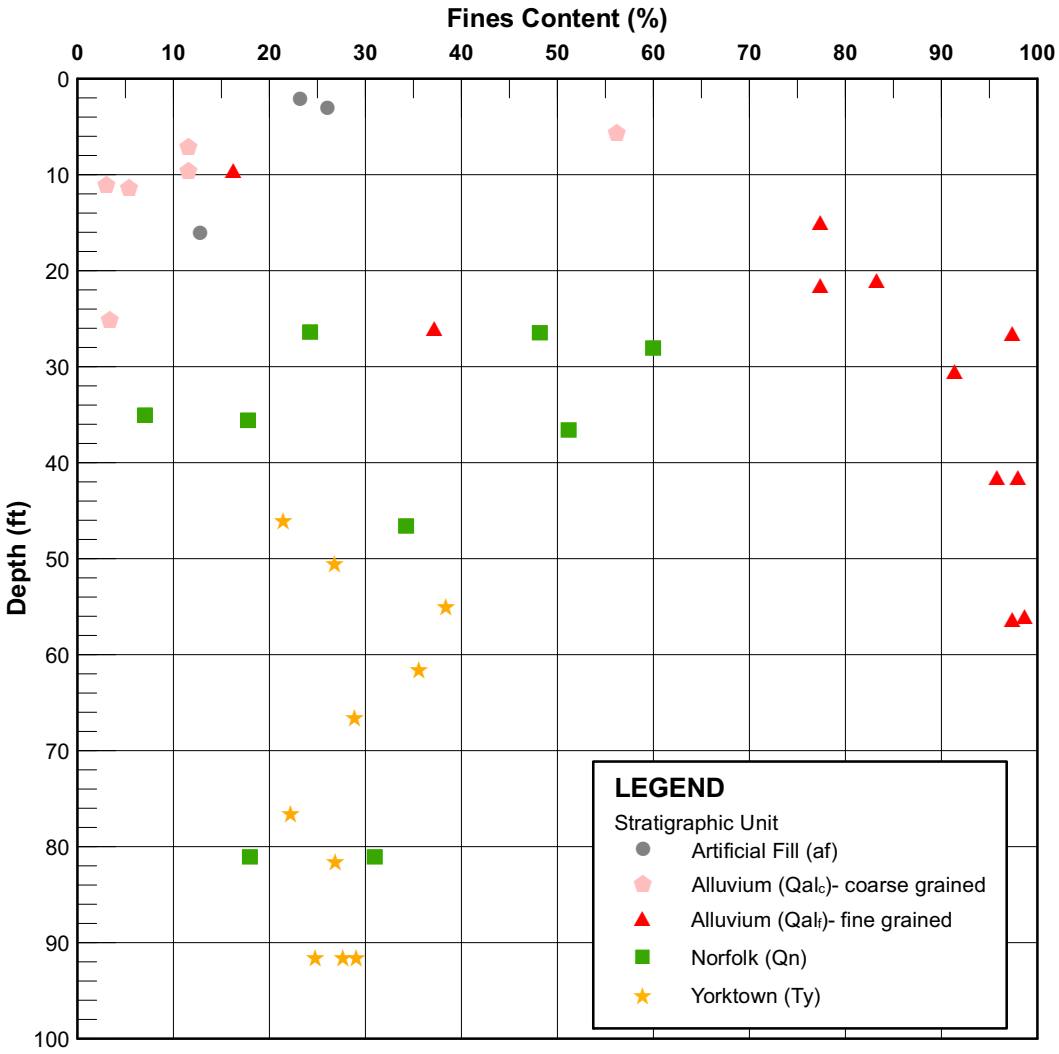

PERCENT PASSING NO. 200 SIEVE (FINES CONTENT) VERSUS DEPTH
VDOT 2008 Onshore Portsmouth Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-3

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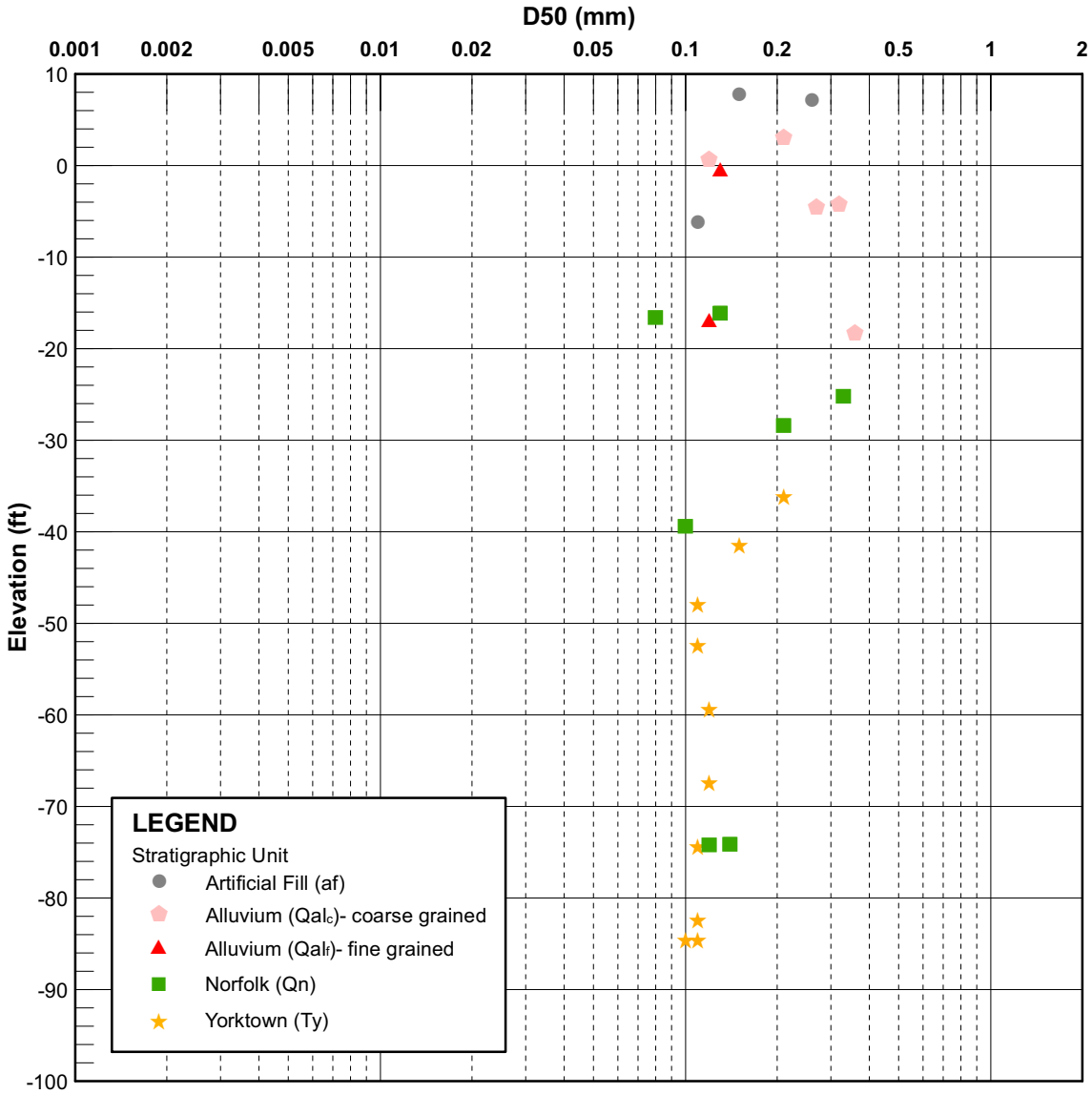

MEDIAN GRAIN SIZE (D_{50}) VERSUS ELEVATION
VDOT 2008 Onshore Portsmouth Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-4

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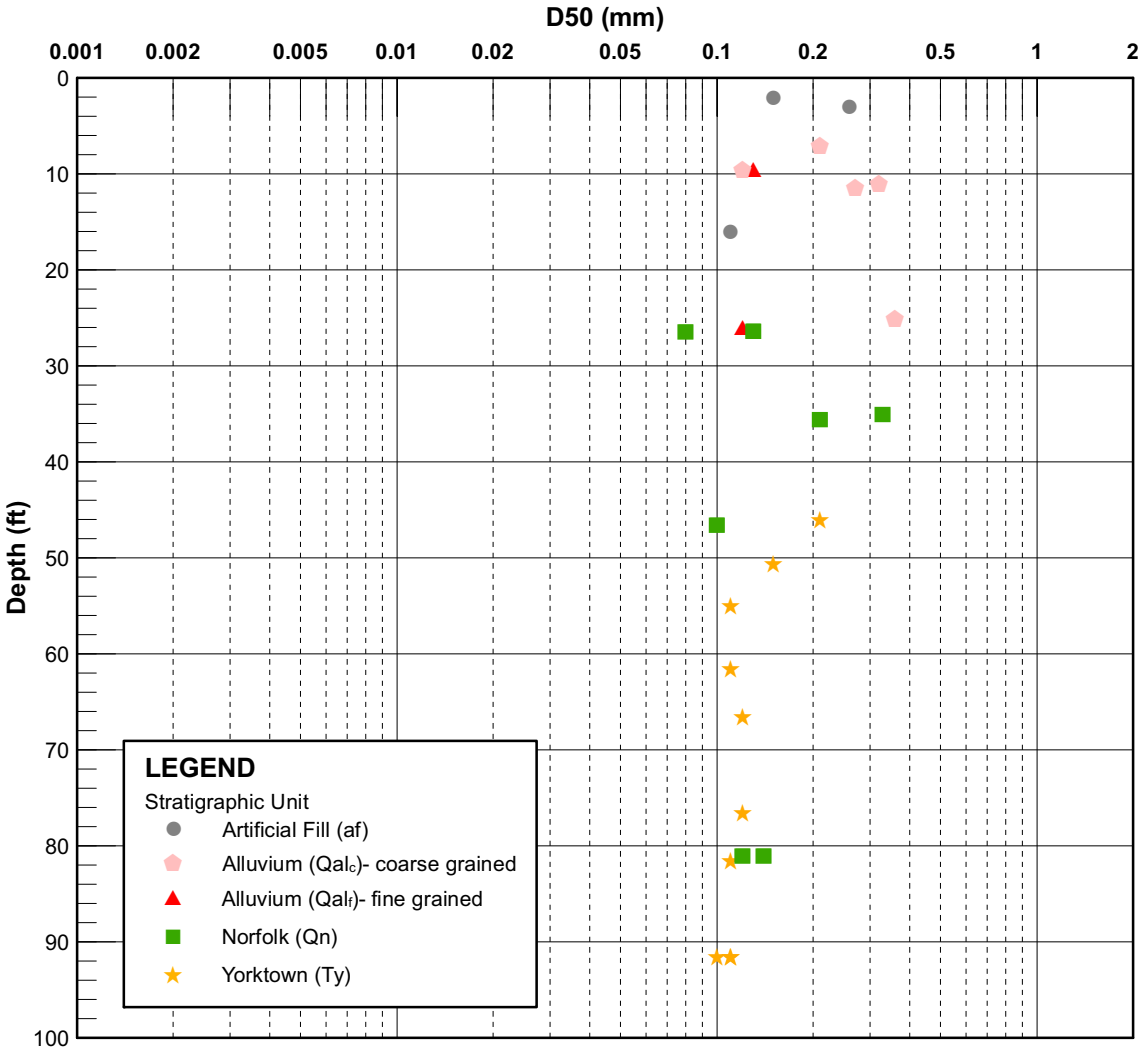

MEDIAN GRAIN SIZE (D_{50}) VERSUS DEPTH
VDOT 2008 Onshore Portsmouth Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-5

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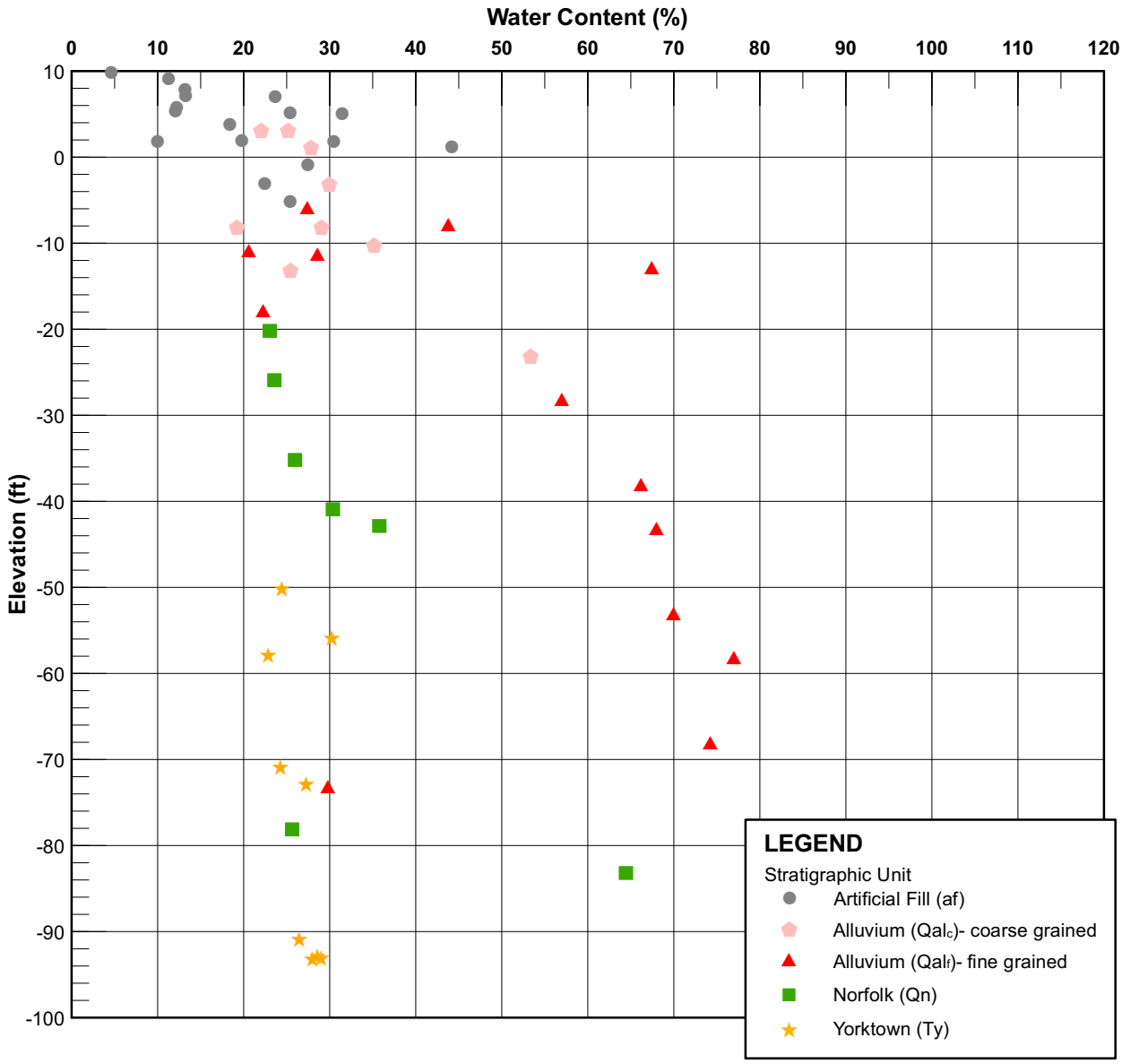

WATER CONTENT VERSUS ELEVATION
VDOT 2008 Onshore Portsmouth Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-6

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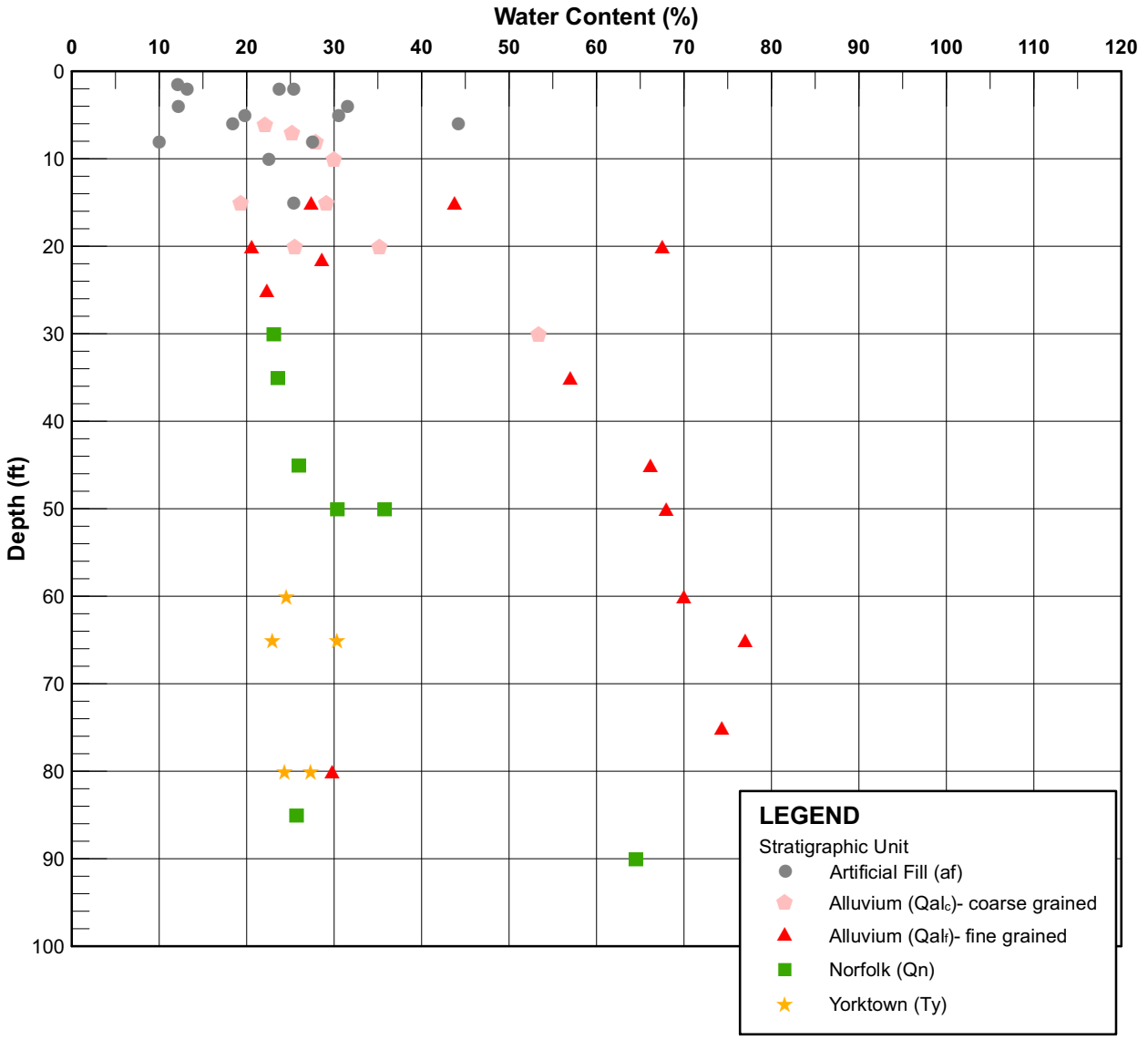

WATER CONTENT VERSUS DEPTH
VDOT 2008 Onshore Portsmouth Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-7

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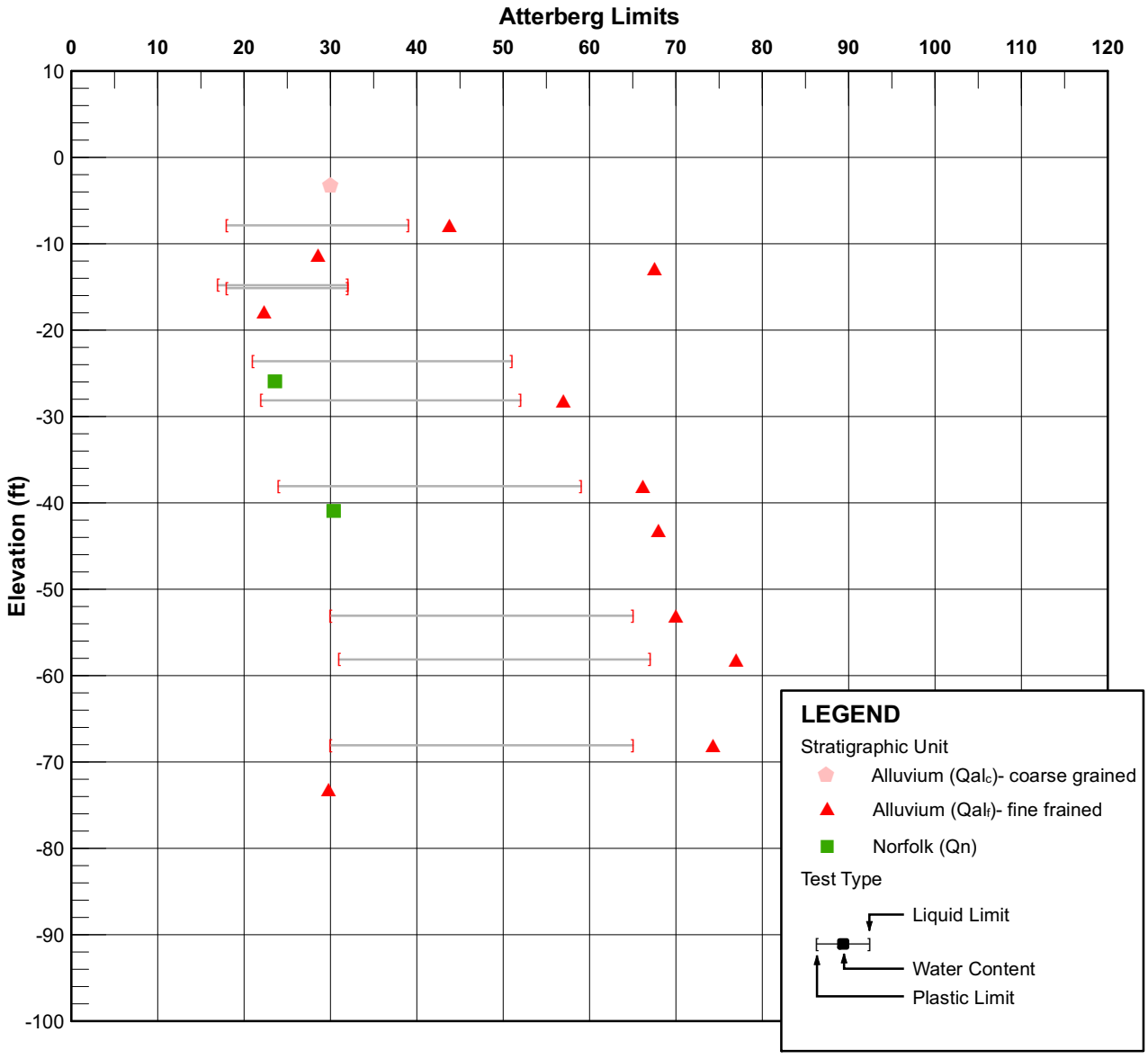

ATTERBERG LIMITS VERSUS ELEVATION
VDOT 2008 Onshore Portsmouth Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-8

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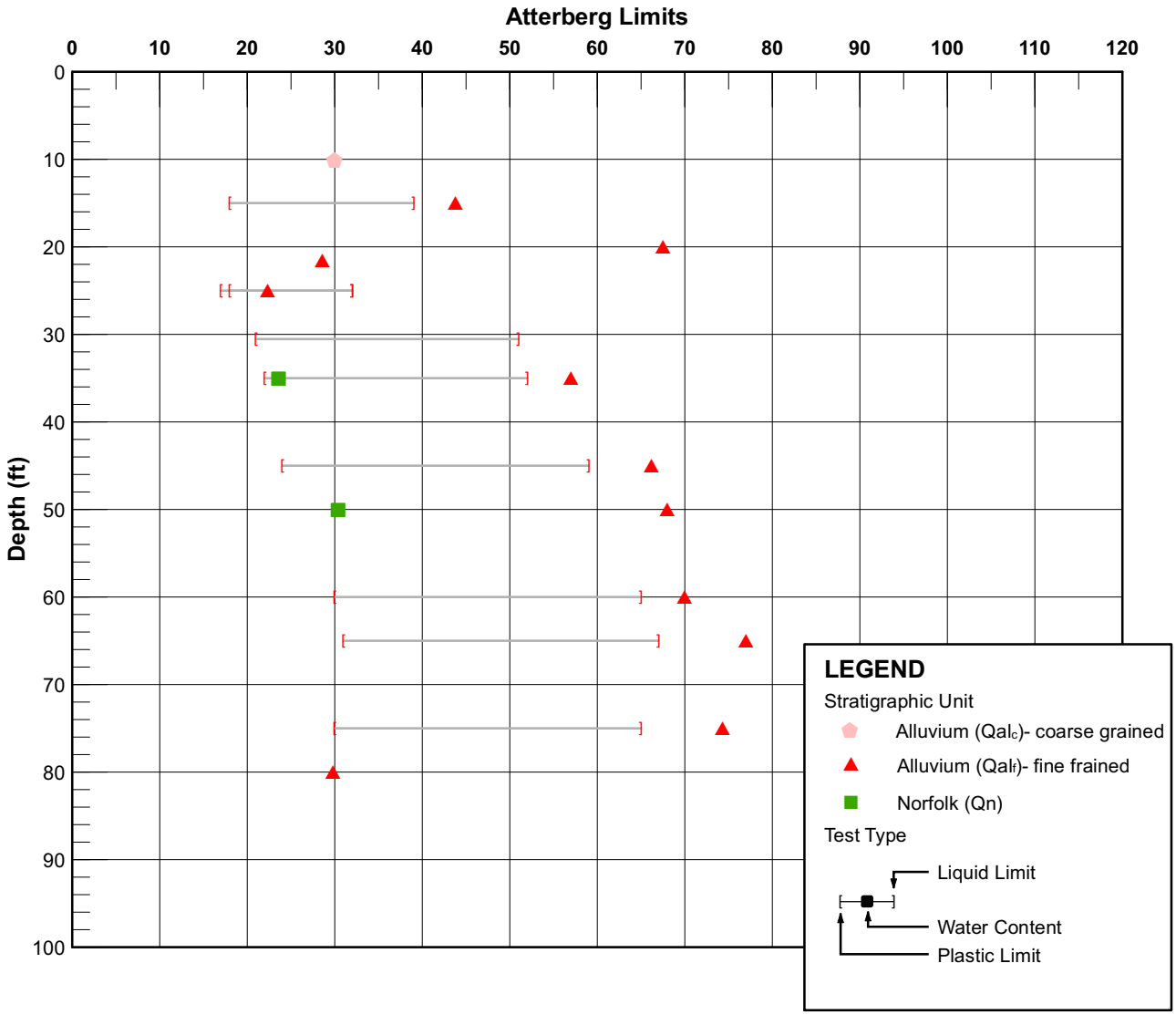

ATTERBERG LIMITS VERSUS DEPTH
VDOT 2008 Onshore Portsmouth Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-9

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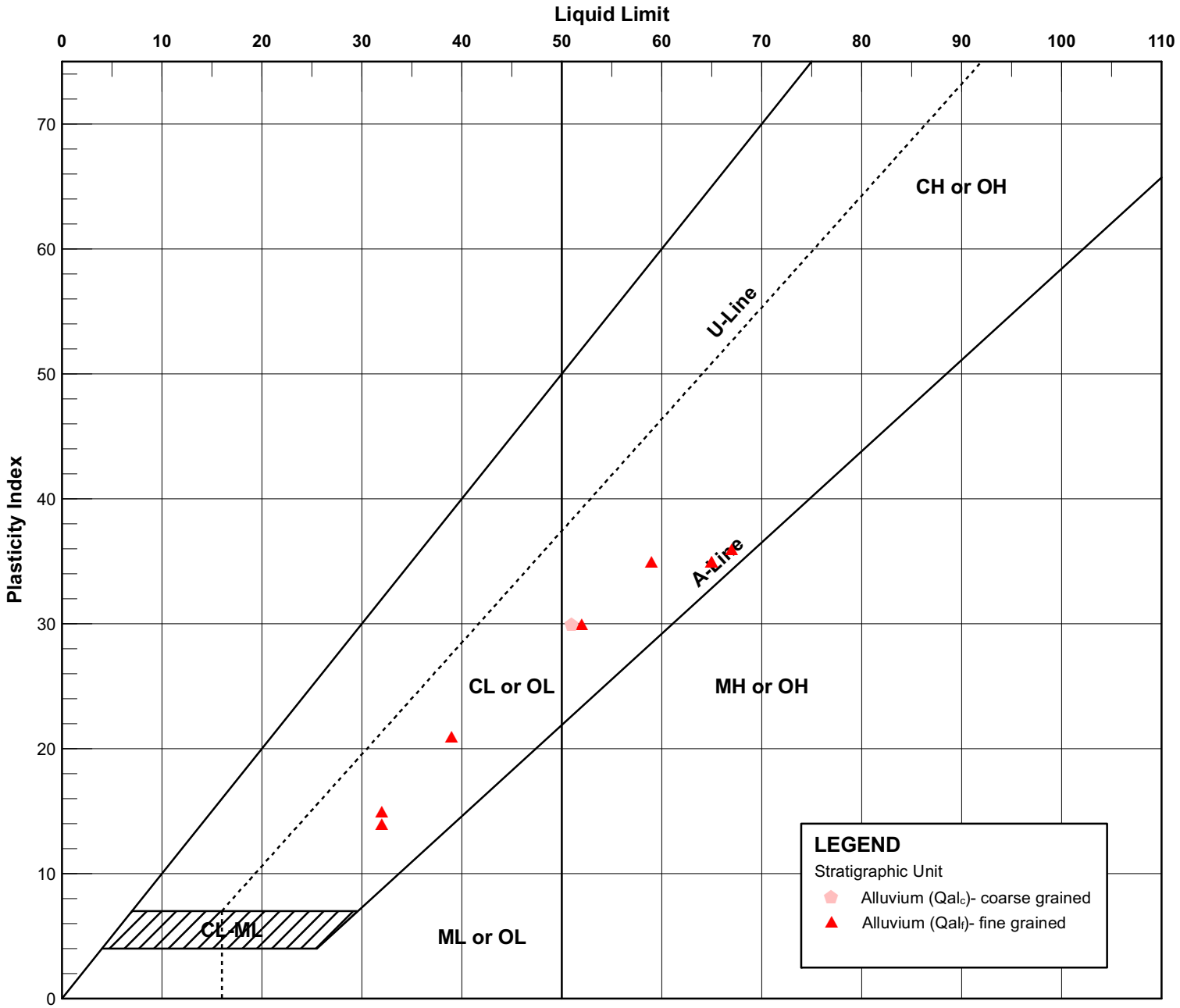
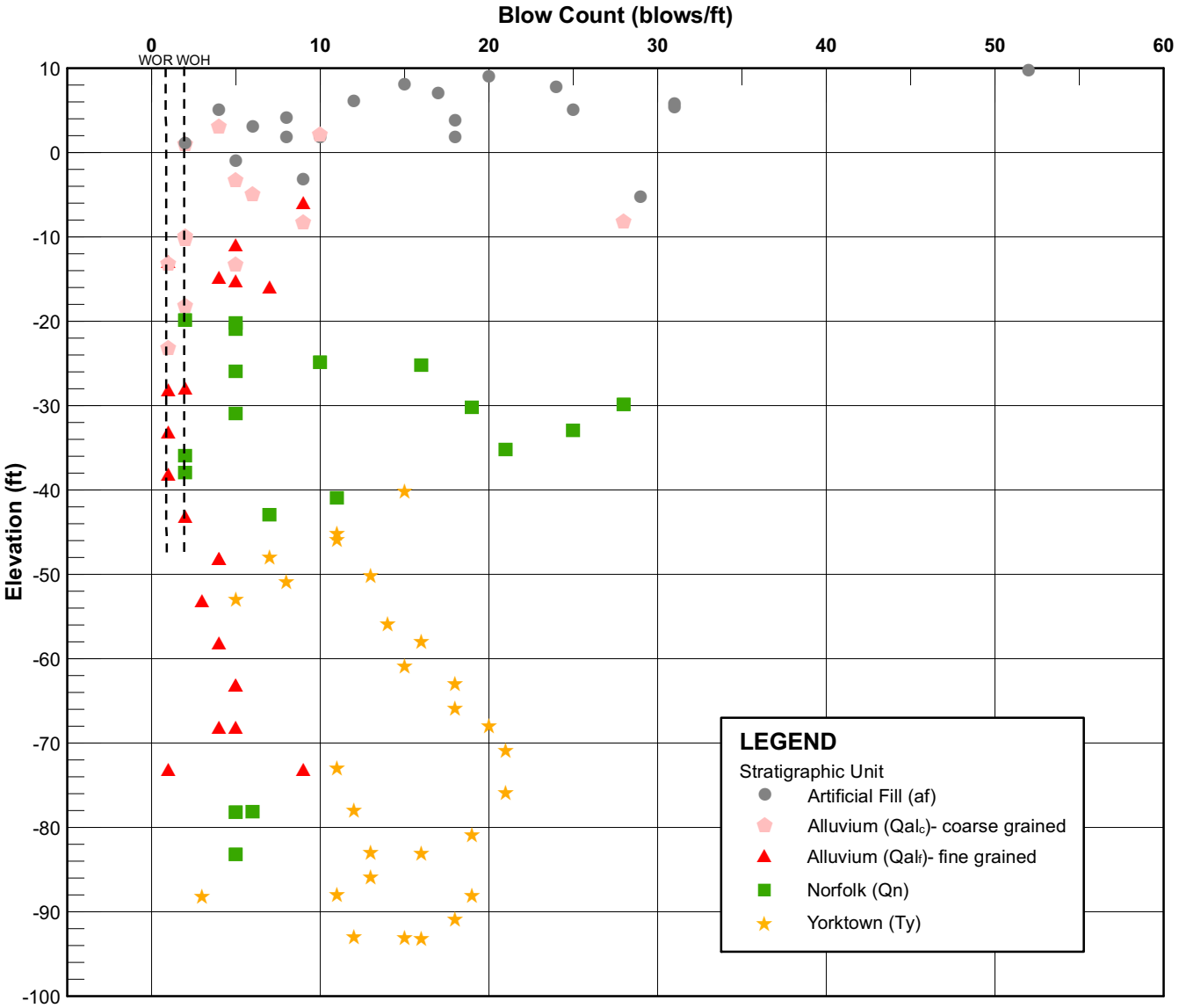


PLASTICITY CHART
VDOT 2008 Onshore Portsmouth Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-10

Virginia Department of Trasportation
Project No. 3602.001



Notes:
1) SPT uncorrected N-values obtained using 140-pound hammer dropped 30 inches.
2) WOR = weight of rod
3) WOH = weight of hammer

BLOW COUNTS (SPT N-VALUES) VERSUS ELEVATION
VDOT 2008 Onshore Portsmouth Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-11

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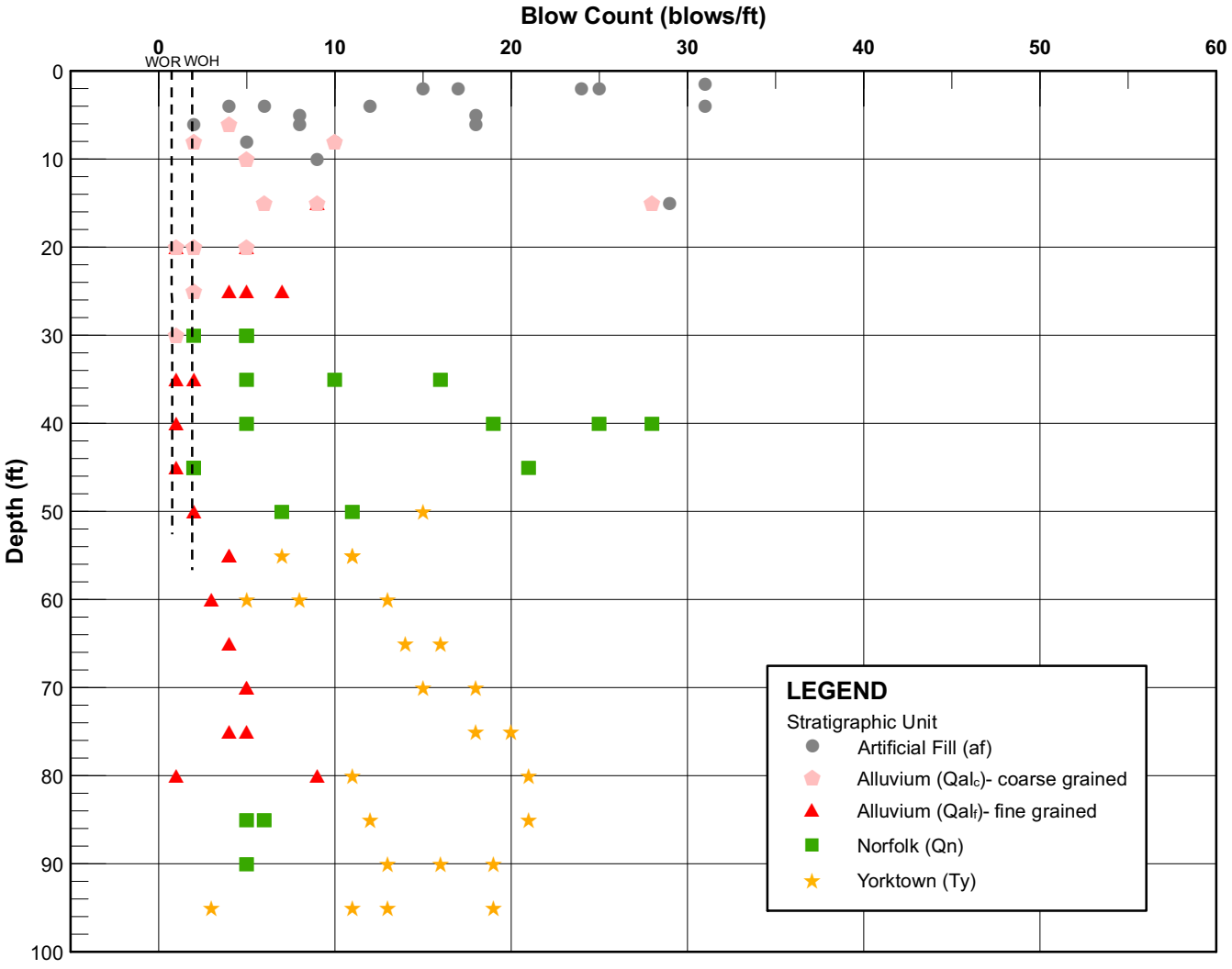

Notes:
1) SPT uncorrected N-values obtained using 140-pound hammer dropped 30 inches.
2) WOR = weight of rod
3) WOH = weight of hammer

BLOW COUNTS (SPT N-VALUES) VERSUS DEPTH
VDOT 2008 Onshore Portsmouth Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-12

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7.0 LIMITATIONS

7.1 LOCATION OF EXISTING TUNNEL AND WATER PIPELINE

The depicted location of the tunnel and centerline are not for usage in construction planning or design. Prior to our site investigation, we recognized that high quality as-built drawings or electronic files documenting the locations of the existing tunnel and water pipeline were not available. Therefore, we carried out a marine and land survey as described herein and other reports listed in Figure 1-2 to ground-truth historical drawings and assist us in defining a safe work area for the geotechnical boring and sounding exploration.

Limitations of precision and accuracy for respective methods used to infer and interpret the tunnel and pipeline locations are described where applicable. In general, methodologies using geophysical technology may not provide adequate precision and accuracy for the design and construction planning of the second parallel tunnel. An understanding of the capability and limitation of the geophysical technology employed is required to optimize the data they provide and reduce the chance of misusing their data. We note that additional surveys or investigations may be required to document the locations of the water pipeline and existing tunnel to support design and construction planning. Several examples of options for additional ground truthing follow:

- Survey the inner diameter of the existing tunnel to aid in establishing survey-grade data of the centerline and tunnel location;
- Use a diver to jet probe and locate the water pipeline and tunnel;
- Additional, denser spacing of geophysical (subbottom and magnetometer) surveys; or
- Contact the City of Norfolk to inquire and obtain any as-built or construction and maintenance related surveys. We note that during our initial inquiry to City of Norfolk staff through the MISS Utility notification process, the City of Norfolk representative we met indicated that they were not aware of survey data which documented as-built conditions of the pipeline. However, during our survey, a construction barge with divers appeared to be conducting work on the pipeline.

7.2 REPORT USE

This report has been prepared for the exclusive use of the Virginia Department of Transportation and its agents for the specific application to the Midtown Second Parallel Tunnel project, located in Portsmouth and Norfolk, Virginia. In our opinion, the data, findings, conclusions, professional opinions, and recommendations presented herein were prepared in accordance with generally accepted geotechnical engineering practices of the project region.

Although information contained in this report may be of some use for other purposes, it may not contain sufficient information for other parties or uses. If any changes are made to the project as described in this report, the conclusions and recommendations in this report shall not be considered valid unless the changes are reviewed and the conclusions and

recommendations of this report are modified or validated in writing by Fugro. This report and the figures contained in this report are intended for input to project design; they are not intended to act as construction drawings or specifications.

7.3 POTENTIAL VARIATIONS IN SUBSURFACE CONDITIONS

Earth materials can vary in type, strength, and other geotechnical properties between points of observation and exploration. Therefore, we do not and cannot have a complete knowledge of the subsurface conditions underlying the site. The conclusions and recommendations presented in this report are based on the findings at the points of exploration, interpolation, and extrapolation of information between and beyond the points of observation, and are subject to confirmation (to the extent possible) based on the conditions revealed during construction.

7.4 LOCAL PRACTICE

In performing our professional services, in our opinion, we have used generally accepted geologic and geotechnical engineering principles and have applied that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers currently practicing in this or similar localities. No other warranty, express or implied, is made as to the professional advice included in this report.

8.0 REFERENCES

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APPENDIX A
SUBSURFACE EXPLORATION

SOIL TYPES


GW- Well-Graded Gravel


GP- Poorly-Graded Gravel


SW- Well-Graded Sand


SP- Poorly Graded Sand


SW-SM- Well-Graded Sand with silt


SP-SM- Poorly-Graded Sand with silt


SM- Silty Sand


SW-SC - Well-Graded Sand with clay


SC- Clayey Sand


SC-SM- Silty Clayey Sand


ML- Silt


CL- Lean Clay


OL- Organic Silt


MH- Elastic Silt


CH- Fat Clay


OH- Organic Clay


PT- Peat


SE- Shell Bed


TOPS- Topsoil


FL- Fill


No recovery


ASPH- Asphalt concrete pavement

SAMPLERS


SPT


No Recovery

WATER LEVEL SYMBOLS


Initial or perched water level

Final ground water level

SPT AND MODIFIED CALIFORNIA LINER SAMPLERS

SPT N-values obtained using 140-pound donut hammer dropped 30 inches, operated by a wireline winch.

WOR	Sample advanced with the weight of drilling rods.
WOR	Sample advanced with the weight of 140-pound donut hammer.
5, 10, 10	Standard Penetration Test hammer blows.
86/11”	Number of blows required to produce the indicated penetration after an initial 6” seating.
Ref/3”	50 blows produced the indicated penetration during the initial 6” interval.

KEY TO TERMS AND SYMBOLS USED ON BORING LOGS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: Cities of Portsmouth/Norfolk
STRUCTURE: Tunnel

08BH-012
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STATION: OFFSET:
LATITUDE: 36.853044 °N LONGITUDE: 76.321503 °W
SURFACE ELEVATION: 8.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 06-13-08 - 06-13-08
Drilling Method(s): HSA
SPT Method: Automatic Hammer
Other Test(s): None
Driller: D. Baker
Logger: B. Brinkley

GROUND WATER
▽ FIRST ENCOUNTERED AT: 9.5 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP STRATA	ROCK: DIP JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
					0						0.0 / 8.6 **ARTIFICIAL FILL (af)**			5.9
2		9 12 13			2						Gray and yellow, silty fine sand FILL, with coal fragments and cement residue, with a trace of clay, moist, medium dense. **FL**	16	NP	7.8
4	5	5 5 10			4						3.0 / 5.6 Brown and gray, silty fine sand FILL with a trace of medium sand, with a trace of organics, moist, medium dense. **FL**	16	NP	15.3
6		4 5 7			6						-loose below 6.0' **FL**	14	NP	18.7
8		4 5 3			8						7.0 / 1.6 **ALLUVIUM (Qal)**			
10	0	3 5 5			10						Yellow, brown and gray, silty fine SAND, moist, loose. **SM** -gray, wet below 9.5'	14	NP	25.2
12														
14	-5													
16		6 3 3			15 16.5							20	NP	28.6
18														
20	-10	1 1 1			20 21.5						21.2 / -12.5 Gray, CLAY, with fine sand, moist, soft. **CL**			
22														
24	-15													
26		5 2 2			25 26.5							32	15	28.0
28											26.3 / -17.7 **NORFOLK FORMATION (Qn)**			
30	-20	2 1 1			30 31.5						Gray, silty fine SAND, moist, very loose to loose. **SM**	17	NP	22.4
32														
34	-25													
36		4 4 6			35 36.5							17	NP	
38	-30													
40		6 12 16			40 41.5								NP	19.6
											-yellow brown, medium dense below 41.2'			
											End of Boring.			

REMARKS: RIG TYPE: CME-550.

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FIGURE A-2

Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: Cities of Portsmouth/Norfolk
STRUCTURE: Tunnel

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PAGE 1 OF 2

STATION: OFFSET:
LATITUDE: 36.853594 °N LONGITUDE: 76.320417 °W
SURFACE ELEVATION: 8.3 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 06-16-08 - 06-16-08
Drilling Method(s): HSA
SPT Method: Automatic Hammer
Other Test(s): None
Driller: D. Baker
Logger: J. Deusebio

GROUND WATER
▽ FIRST ENCOUNTERED AT: 16.3 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
2	5	14 25 27			0						0.0 / 8.3 **ARTIFICIAL FILL (af)** Medium gray, fine to coarse sand FILL, with cinders, brick rubble, cement residue, coal, ash, and crushed aggregate, moist, compact. **FL**			4.6
4		11 12 12			2									13.2
6		12 14 17			4						2.0 / 6.3 Gray to brown, silty fine sand with a trace of medium sand FILL, with cement residue, clay balls, organics, and fine aggregate ; trace of shell, moist, firm. **FL**	16	NP	12.2
8	0	10 9 9			6									18.4
10		5 3 7			8						4.0 / 4.3 Stratified gray, green and black, silty fine sand FILL, with organics, moist, firm. **FL**			10.0
12					10						6.0 / 2.3 Gray-brown, silty fine to medium sand FILL, with cement residue, large fragments of coal and wood, crushed aggregate, moist, firm. **FL**			
14	-5										8.0 / 0.3 Stratified gray, green and black, fine to coarse sand FILL, with coal fragments, cinders, organics, crushed aggregate, moist, loose. **FL**			
16 ▽		19 19 10			15									25.4
18	-10				16.5						9.0 / -0.7 Gray and tan, silty fine sand FILL, with crushed aggregate, moist, firm. **FL**			
20		1 1 1			20						16.3 / -8.0 **ALLUVIUM (Qal)** Tan, silty fine SAND, wet, medium dense. **SM**			35.2
22					21.5						21.0 / -12.7 Gray, CLAY, with fine sand, moist, soft. **CL**			
24	-15													
26		2 3 2			25							32	14	
28	-20				26.5						26.3 / -18.0 **NORFOLK FORMATION (Qn)** Gray and yellow, silty fine SAND, moist, loose. **SM**			
30		3 2 3			30								NP	23.1
32					31.5									
34	-25													
36		3 6 10			35						35.0 / -26.7 Brown, fine to medium SAND with silt, moist, medium dense. **SP**	18	NP	
38	-30				36.5									
40														

REMARKS: RIG TYPE: CME-550.

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FIGURE A-3a

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PROJECT #: 0058-965-108, PE 101
LOCATION: Cities of Portsmouth/Norfolk
STRUCTURE: Tunnel

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STATION: OFFSET:
LATITUDE: 36.853594 °N LONGITUDE: 76.320417 °W
SURFACE ELEVATION: 8.3 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 06-16-08 - 06-16-08
Drilling Method(s): HSA
SPT Method: Automatic Hammer
Other Test(s): None
Driller: D. Baker
Logger: J. Deusebio

GROUND WATER
▽ FIRST ENCOUNTERED AT: 16.3 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
42		5 14 5			40 – 41.5							18	NP	
	-35													
44														
46		8 8 13			45 – 46.5									26.0
48	-40										46.0 / -37.7 **YORKTOWN FORMATION (Ty)** Gray green, silty fine SAND, with high concentrations of shell fragments, moist, firm. **SM**			
50		7 10 5			50 – 51.5							21	NP	
52														
	-45													
54														
56		11 6 5			55 – 56.5							21	NP	
58	-50													
60		4 6 7			60 – 61.5									24.5
											End of Boring.			

REMARKS: RIG TYPE: CME-550.

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FIGURE A-3b

Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: Cities of Portsmouth/Norfolk
STRUCTURE: Tunnel

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STATION: OFFSET:
LATITUDE: 36.854322 °N LONGITUDE: 76.319444 °W
SURFACE ELEVATION: 7.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 06-11-08 - 06-11-08
Drilling Method(s): HSA
SPT Method: Automatic Hammer
Other Test(s): None
Driller: D. Baker
Logger: J. Deusebio

GROUND WATER
▽ FIRST ENCOUNTERED AT: 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
2	5	8 11 9			0						0.0 / 7.6 **ARTIFICIAL FILL (af)** Dark gray to gray black, silty fine sand FILL, with crushed aggregate and organics, moist, firm. **FL**			11.3
4		6 7 10			2									23.7
6		4 2 2			4						2.0 / 5.6 Dark gray, silty fine sand FILL, with some clay, shell fragments, brick rubble, and organics, moist, firm. **FL**			31.5
8	0	1 1 3			6						4.0 / 3.6 Black and gray, coarse sand FILL, with crushed aggregate, crushed shell, rubble, and organics. Oily texture/possible contamination, moist, loose. **FL**			22.1
10		WOH 1 1			8									27.9
12	-5				10						5.5 / 2.1 **ALLUVIUM (Qal)** Dark gray, clayey SILT, with some fine sand, moist, soft. **ML**			
14											6.0 / 1.6 Gray and tan, silty fine to medium SAND, with clay balls and isolated concentrations of organics (peat), wet, loose. **SP**			
16		1 4 5			15						9.5 / -1.9 Light gray, silty fine SAND, moist, very loose. **SM**	17	NP	27.4
18	-10				16.5									
20		1 3 2			20							17	NP	20.6
22	-15				21.5									
24					25									
26		1 2 5			26.5						26.0 / -18.4 Red and brown, silty fine SAND with a trace of medium sand, with trace of clay and iron concretions, moist, loose. **SM**			
28	-20										28.0 / -20.4 **NORFOLK FORMATION (Qn)** Gray green, sandy SILT, wet, loose. **ML**			
30		2 2 3			30							25	5	
32	-25				31.5									
34					35									
36		1 1 4			36.5									23.6
38	-30										-gray and brown, 36.5' to 41.5'			
40														

REMARKS: RIG TYPE: CME-550.

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FIGURE A-4a

Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: Cities of Portsmouth/Norfolk
STRUCTURE: Tunnel

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STATION: OFFSET:
LATITUDE: 36.854322 °N LONGITUDE: 76.319444 °W
SURFACE ELEVATION: 7.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 06-11-08 - 06-11-08
Drilling Method(s): HSA
SPT Method: Automatic Hammer
Other Test(s): None
Driller: D. Baker
Logger: J. Deusebio

GROUND WATER
▽ FIRST ENCOUNTERED AT: 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
42	-35	2 2 3			40 41.5						-dark gray below 41.5'	23	NP	
44														
46		WOH WOH 2			45 46.5							23	NP	
48	-40													
50		1 3 8			50 51.5							22	NP	30.4
52	-45										50.5 / -42.9 **YORKTOWN FORMATION (Ty)** Light gray to white, silty fine SAND, with shell fragments, moist, medium dense. **SM**			
54														
56		2 5 6			55 56.5						-gray green, below 55.0'			
58	-50													
60		3 3 5			60 61.5									
62	-55													
64														
66		3 5 9			65 66.5							20	NP	30.3
68	-60													
70		5 6 9			70 71.5							20	NP	
72	-65													
74														
76		4 6 12			75 76.5									
78	-70													
80														

REMARKS: RIG TYPE: CME-550.

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FIGURE A-4b

Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: Cities of Portsmouth/Norfolk
STRUCTURE: Tunnel

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STATION: OFFSET:
LATITUDE: 36.854322 °N LONGITUDE: 76.319444 °W
SURFACE ELEVATION: 7.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 06-11-08 - 06-11-08
Drilling Method(s): HSA
SPT Method: Automatic Hammer
Other Test(s): None
Driller: D. Baker
Logger: J. Deusebio

GROUND WATER
▽ FIRST ENCOUNTERED AT: 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
82	-75	3 7 14			80 – 81.5									24.3
84														
86		3 7 14			85 – 86.5							19	NP	
88	-80													
90		3 7 12			90 – 91.5							19	NP	
92	-85													
94														
96		3 5 8			95 – 96.5						-shell fragments being replaced by more whole shells below 95'	20	NP	
98	-90													
100		3 7 11			100 – 101.5							20	NP	26.5
											End of Boring.			

REMARKS: RIG TYPE: CME-550.

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FIGURE A-4c

Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: Cities of Portsmouth/Norfolk
STRUCTURE: Tunnel

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PAGE 1 OF 3

STATION: OFFSET:
LATITUDE: 36.854842 °N LONGITUDE: 76.318511 °W
SURFACE ELEVATION: 5.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 06-25-08 - 06-25-08
Drilling Method(s): HSA
SPT Method: Automatic Hammer
Other Test(s): None
Driller: D. Baker
Logger: J. Deusebio

GROUND WATER
▽ FIRST ENCOUNTERED AT: 8.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP STRATA	ROCK: DIP JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
0	5				0						0.0 / 5.6 Asphalt concrete PAVEMENT. **ASPH**			13.3
2		8 7 18	85		2						0.7 / 4.9 **ARTIFICIAL FILL (af)** Sand and aggregate subbase mix. FILL. **FL**			25.4
4		7 3 3	10		4						2.0 / 3.6 Brown sand FILL, with coal and pea gravel. Heavy rubble layer in bottom 6.0" of sample tube, moist, firm. **FL**			
6	0	2 1 1	70		6									44.2
8		3 3 2	100		8						4.0 / 1.6 No recovery. Rock fragment blocked retainer.			27.5
10	-5				10						6.0 / -0.4 Gray and brown, laminated fine sand FILL, with layer of loose aggregate at base, moist, loose. **FL**			
12											7.0 / -1.4 Gray SILT, with trace of fine sand, moist, soft. **ML**			
14											8.0 / -2.4 Gray, silty fine sand FILL, interbedded with black, clayey sand, crushed aggregate, organics, shell fragments, and creosoted wood fragments, wet, loose. **FL**			
16	-10	1 WOH WOH	100		15 16.5						10.0 / -4.4 **ALLUVIUM (Qal)** Medium gray to medium dark gray, CLAY, with fine sand, and trace of organics, wet, very soft. **CL**	39	21	43.8
18														
20	-15	WOH 1 WOH	100		20 21.5									67.5
22														
24														
26	-20	WOH WOH WOH	100		25 26.5									22.3
28														
30	-25	WOH WOH WOH	100		30 31.5									
32														
34														
36	-30	2 1 1	100		35 36.5						35.5 / -29.9 **NORFOLK FORMATION (Qn)** Tan and yellow, silty fine SAND with a trace of medium sand, wet, very loose to loose. **SM**			
38														
40														

REMARKS: RIG TYPE: CME-550.

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FIGURE A-5a

Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: Cities of Portsmouth/Norfolk
STRUCTURE: Tunnel

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PAGE 2 OF 3

STATION: OFFSET:
LATITUDE: 36.854842 °N LONGITUDE: 76.318511 °W
SURFACE ELEVATION: 5.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 06-25-08 - 06-25-08
Drilling Method(s): HSA
SPT Method: Automatic Hammer
Other Test(s): None
Driller: D. Baker
Logger: J. Deusebio

GROUND WATER
▽ FIRST ENCOUNTERED AT: 8.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
40	-35	4 9 16	100		40 41.5						-medium dense at 40.0'	14	NP	
45	-40	11 1 1	0		45 46.5						45.0 / -39.4 No recovery. Washed hole. 46.5 / -40.9 -gray-brown 46.5' to 55.0' -with shell fragments below 46.5 **SM**			
50	-45	2 3 4	85		50 51.5							NP	NP	35.8
55	-50	1 2 5	100		55 56.5						55.0 / -49.4 **YORKTOWN FORMATION (Ty)** -blue-gray to gray-green 55.0' to 65.0' **SM**			
60	-55	2 2 3	100		60 61.5							20	NP	
65	-60	4 7 9	100		65 66.5						-medium dense, gray-green below 65.0'			22.9
70	-65	10 9 9	100		70 71.5							75	NP	
75	-70	3 6 14	100		75 76.5									

REMARKS: RIG TYPE: CME-550.

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FIGURE A-5b

Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: Cities of Portsmouth/Norfolk
STRUCTURE: Tunnel

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STATION: OFFSET:
LATITUDE: 36.854842 °N LONGITUDE: 76.318511 °W
SURFACE ELEVATION: 5.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 06-25-08 - 06-25-08
Drilling Method(s): HSA
SPT Method: Automatic Hammer
Other Test(s): None
Driller: D. Baker
Logger: J. Deusebio

GROUND WATER
▽ FIRST ENCOUNTERED AT: 8.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
80	-75	2 4 7	100		80 – 81.5							20	NP	27.3
82														
84														
86	-80	1 4 8	100		85 – 86.5									
88														
90	-85	3 4 9	100		90 – 91.5									
92														
94														
96	-90	1 3 8	100		95 – 96.5									
98														
100	-95	3 5 7	100		100 – 101.5						End of Boring.	20	NP	28.6

REMARKS: RIG TYPE: CME-550.

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08BH-015

SPT_LOG:VDOT08BOR.GPJ:8.1.016:050908:11/6/08

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FIGURE A-5c

Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: Cities of Portsmouth/Norfolk
STRUCTURE: Tunnel

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STATION: OFFSET:
LATITUDE: 36.855617 °N LONGITUDE: 76.317836 °W
SURFACE ELEVATION: 5.3 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 06-26-08 - 06-26-08
Drilling Method(s): HSA
SPT Method: Automatic Hammer
Other Test(s): None
Driller: D. Baker
Logger: J. Deusebio

GROUND WATER
▽ FIRST ENCOUNTERED AT: 15.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND / SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP STRATA	ROCK: DIP JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
0	5									0.0 / 5.3 Asphalt concrete PAVEMENT. **ASPH**			
2		6 21 10	90	1.5 3						0.8 / 4.5 **ARTIFICIAL FILL (af)** Brown, sand and aggregate subbase mix, FILL. **FL**			12.1
4													
6	0	1 3 5	50	5 6.5						1.5 / 3.8 Black, sand FILL, with coal, asphalt fragments, rubble, and organics, moist, compact. **FL**	31	15	30.5
8										5.5 / -0.2 **ALLUVIUM (Qal)** Medium gray, CLAY, with fine sand, and trace of shell fragments, moist, firm. **CL**			
10	-5	1 2 3	100	10 11.5									30.0
12										11.3 / -6.0 Tan and gray, fine SAND with silt, moist, loose. **SP**			
14													
16	-10	3 3 6	100	15 16.5							16	NP	29.1
18													
20	-15	WOH 2 3	100	20 21.5							NP	NP	25.5
22										21.0 / -15.7 Gray, fine to medium SAND, wet, loose. **SP**			
24													
26	-20	WOH WOH WOH	50	25 26.5									
28										26.5 / -21.2 Dark gray, fat CLAY, with trace of shell fragments, wet, very soft. **CH**			
30	-25	WOH WOH WOH	100	30 31.5									
32													
34													
36	-30	WOH WOH WOH	100	35 36.5							52	30	57.0
38													
40													

REMARKS: RIG TYPE: CME-550.

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08BH-016

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FIGURE A-6a

Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: Cities of Portsmouth/Norfolk
STRUCTURE: Tunnel

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STATION: OFFSET:
LATITUDE: 36.855617 °N LONGITUDE: 76.317836 °W
SURFACE ELEVATION: 5.3 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 06-26-08 - 06-26-08
Drilling Method(s): HSA
SPT Method: Automatic Hammer
Other Test(s): None
Driller: D. Baker
Logger: J. Deusebio

GROUND WATER
▽ FIRST ENCOUNTERED AT: 15.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
40	-35	WOH WOH WOH	100		40 41.5									
45	-40	WOH WOH WOH	100		45 46.5						45.0 / -39.7 Dark gray, SILT, with trace of shell fragments, moist, very soft. **ML**			
50	-45	WOH WOH WOH	100		50 51.5							NP	NP	68.0
55	-50	WOH 2 2	100		55 56.5						-soft below 55.0'			
60	-55	WOH WOH WOH	100		60 61.5						56.3 / -51.0 Dark gray to gray black, fat CLAY, with concentrated deposits of brown organics (peat), moist, very soft to soft. **CH**			
65	-60	WOH WOH 1	100		65 66.5							67	36	77.0
70	-65	3 3 2	100		70 71.5						-firm at 70.0'			
75	-70	1 2 2	100		75 76.5									

REMARKS: RIG TYPE: CME-550.

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FIGURE A-6b

Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: Cities of Portsmouth/Norfolk
STRUCTURE: Tunnel

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STATION: OFFSET:
LATITUDE: 36.855617 °N LONGITUDE: 76.317836 °W
SURFACE ELEVATION: 5.3 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 06-26-08 - 06-26-08
Drilling Method(s): HSA
SPT Method: Automatic Hammer
Other Test(s): None
Driller: D. Baker
Logger: J. Deusebio

GROUND WATER
▽ FIRST ENCOUNTERED AT: 15.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
82	-75	WOH, WOH, 1	100		80 – 81.5						81.0 / -75.7 **NORFOLK FORMATION (Qn)** Gray, silty fine SAND, with trace of clay, and a trace of shell fragments, moist, very loose to loose. **SM**			29.8
84														
86	-80	WOH, 3, 2	100		85 – 86.5							15	NP	
88														
90	-85	1, 2, 3	100		90 – 91.5									64.5
92											91.0 / -85.7 Dark brown, ORGANICS, with clay, moist, medium stiff. **OL**			
94											91.5 / -86.2 **YORKTOWN FORMATION (Ty)** Dark gray to gray green, silty fine SAND, with some clay, trace of shell fragments, trace of organics, moist, very loose to loose. **SM**			
96	-90	WOH, 1, 2	100		95 – 96.5							19	NP	
98														
100	-95	4, 5, 11	100		100 – 101.5						-medium dense below 100.0'			28.0
											End of Boring.			

REMARKS: RIG TYPE: CME-550.

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FIGURE A-6c

Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: Cities of Portsmouth/Norfolk
STRUCTURE: Tunnel

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STATION: OFFSET:
LATITUDE: 36.856328 °N LONGITUDE: 76.317403 °W
SURFACE ELEVATION: 5.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07-09-08 - 07-09-08
Drilling Method(s): HSA
SPT Method: Automatic Hammer
Other Test(s): None
Driller: B. Riggins
Logger: J. Deusebio

GROUND WATER
▽ FIRST ENCOUNTERED AT: 10.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND / SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP STRATA	ROCK: DIP JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
0	5									0.0 / 5.4 Asphalt Concrete PAVEMENT. **ASPH**			
										0.8 / 4.6 **ARTIFICIAL FILL (af)** Green, fine sand with aggregate FILL, moist. **FL**			
										2.3 / 3.1 Black, silty clay FILL, with rubble, moist. **FL**			
6	0	3 8 10	100	5 – 6.5									19.8
										5.5 / -0.1 Gray brown, fine sand FILL, with wood chips, glass fragments, shell fragments, and organics, moist, firm. **FL**			
										7.0 / -1.6 Gray black, fine to medium sand FILL, with rock fragments, and creosoted wood fragments, moist, firm. **FL**			
10 ▽	-5	6 4 5	100	10 – 11.5							16	NP	22.5
										11.0 / -5.6 **ALLUVIUM (Qal)** Gray and tan, fine SAND with medium sand, wet, loose. **SP**			
16	-10	19 15 13	100	15 – 16.5							16	NP	19.3
20	-15	3 1 WOH	5	20 – 21.5									
										21.0 / -15.6 Gray, very fine, silty SAND, wet, loose. **SM**			
26	-20	WOH 1 1	0	25 – 26.5						25.0 / -19.6 No Recovery.			
										26.5 / -21.1 Gray, very fine, silty SAND, wet, loose. **SM**			
30	-25	WOH WOH 1	100	30 – 31.5									
										30.5 / -25.1 Gray, fat CLAY, with a trace of fine sand and shell fragments, wet, very soft. **CH**	51	30	53.4
36	-30	WOH WOH 1	100	35 – 36.5									

REMARKS: RIG TYPE: Drill Truck.

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FIGURE A-7a

Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: Cities of Portsmouth/Norfolk
STRUCTURE: Tunnel

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STATION: OFFSET:
LATITUDE: 36.856328 °N LONGITUDE: 76.317403 °W
SURFACE ELEVATION: 5.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07-09-08 - 07-09-08
Drilling Method(s): HSA
SPT Method: Automatic Hammer
Other Test(s): None
Driller: B. Riggins
Logger: J. Deusebio

GROUND WATER
▽ FIRST ENCOUNTERED AT: 10.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
42	-35	WOH WOH 1	100		40 41.5									
44														
46	-40	WOH WOH 1	100		45 46.5							59	35	66.2
48														
50	-45	WOH 1 1	100		50 51.5						-soft, 50.0' to 70.0'			
52														
54														
56	-50	1 2 2	100		55 56.5						-with organics below 55.0'			
58														
60	-55	WOH 1 2	100		60 61.5							65	35	70.0
62														
64														
66	-60	1 2 2	100		65 66.5									
68														
70	-65	1 2 3	100		70 71.5						-firm below 70.0'			
72														
74														
76	-70	1 2 3	100		75 76.5							65	35	74.3
78														
80														

REMARKS: RIG TYPE: Drill Truck.

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FIGURE A-7b

Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: Cities of Portsmouth/Norfolk
STRUCTURE: Tunnel

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STATION: OFFSET:
LATITUDE: 36.856328 °N LONGITUDE: 76.317403 °W
SURFACE ELEVATION: 5.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07-09-08 - 07-09-08
Drilling Method(s): HSA
SPT Method: Automatic Hammer
Other Test(s): None
Driller: B. Riggins
Logger: J. Deusebio

GROUND WATER
▽ FIRST ENCOUNTERED AT: 10.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
80	-75	3 4 5	100		80 – 81.5						81.0 / -75.6 **NORFOLK FORMATION (Qn)** Gray green, silty fine SAND, wet, loose. **SM** -with shell fragments at 81.0'			
85	-80	3 4 2	100		85 – 86.5							17	NP	25.7
90	-85	4 6 10	100		90 – 91.5						90.0 / -84.6 **YORKTOWN FORMATION (Ty)** Grey green, silty fine SAND, with shell fragments, medium dense **SM**			
95	-90	4 7 12	100		95 – 96.5									
100	-95	3 5 10	100		100 – 101.5							20	NP	29.0
											End of Boring.			

REMARKS: RIG TYPE: Drill Truck.

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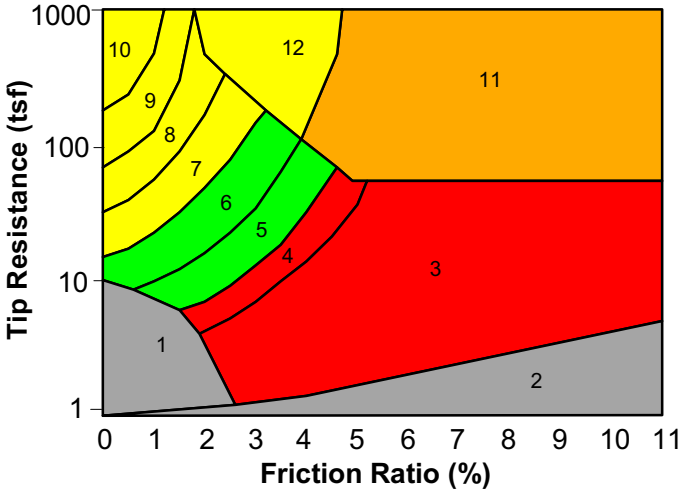
FIGURE A-7c



Zone	Soil Behavior Type	U.S.C.S.
1	Sensitive Fine-grained	OL-CH
2	Organic Material	OL-OH
3	Clay	CH
4	Silty Clay to Clay	CL-CH
5	Clayey Silt to Silty Clay	MH-CL
6	Sandy Silt to Clayey Silt	ML-MH
7	Silty Sand to Sandy Silt	SM-ML
8	Sand to Silty Sand	SM-SP
9	Sand	SW-SP
10	Gravelly Sand to Sand	SW-GW
11	Very Stiff Fine-grained *	CH-CL
12	Sand to Clayey Sand *	SC-SM

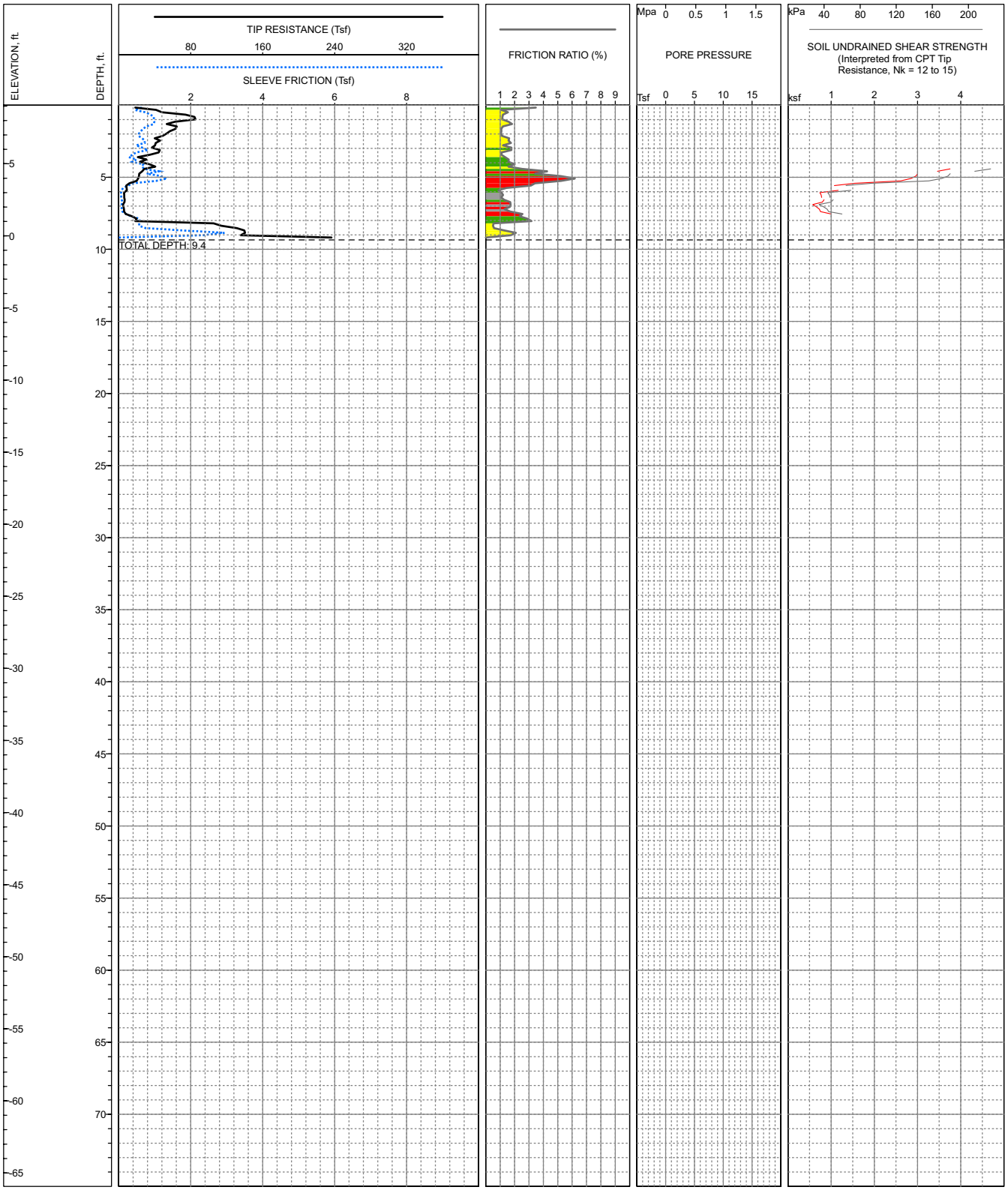
*overconsolidated or cemented

CPT CORRELATION CHART
(Robertson and Campanella, 1988)

KEY TO CPT LOGS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE A-8

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\07-Portsmouth_SiteChar\MXD\Figures\Fig-A-8_Key_to_CPT_Logs.mxd, 11/07/08, kstevens



COORDINATES: E: 12,120,368 N: 3,477,433 Virginia State Plane, South Zone, NAD83, feet
GROUND SURFACE EL: 9.1ft +/- (MLLW)
COMPLETION DEPTH: 9.4ft
TEST DATE: 9/12/2008
Soil classification based on R&C (1988)

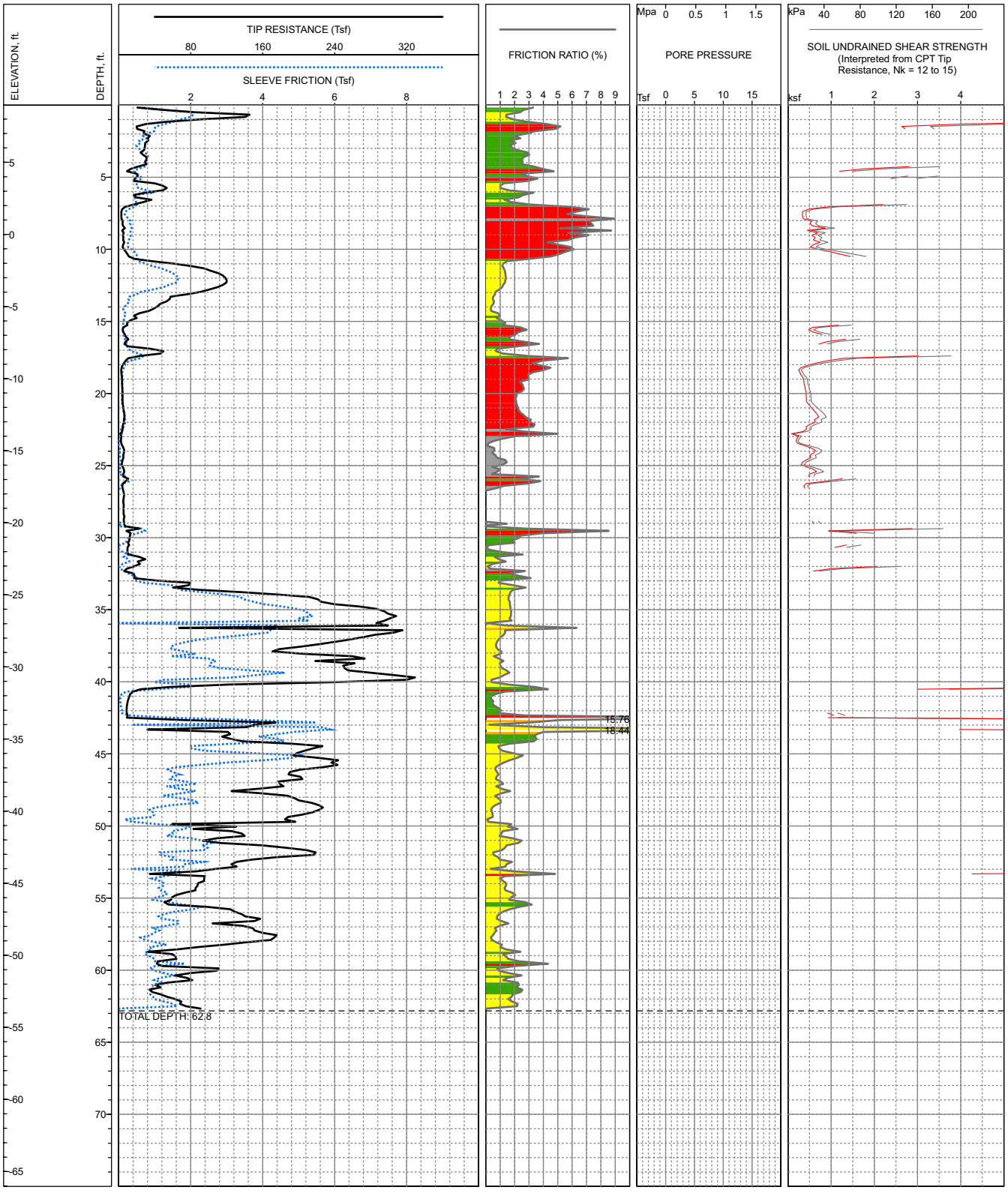
EXPLORATION METHOD: Cone Penetrometer
CONE AREA: 10cm^2
PERFORMED BY: VDOT

LOG OF CPT C-39

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE A-9

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Land\Logs\MXD\CPT_Logs_RC88.mxd,11/06/2008,kstevens



COORDINATES: E: 12,120,583 N: 3,477,597 Virginia State Plane, South Zone, NAD83, feet
GROUND SURFACE EL: 9.0ft +/- (MLLW)
COMPLETION DEPTH: 62.8ft
TEST DATE: 9/12/2008
Soil classification based on R&C (1988)

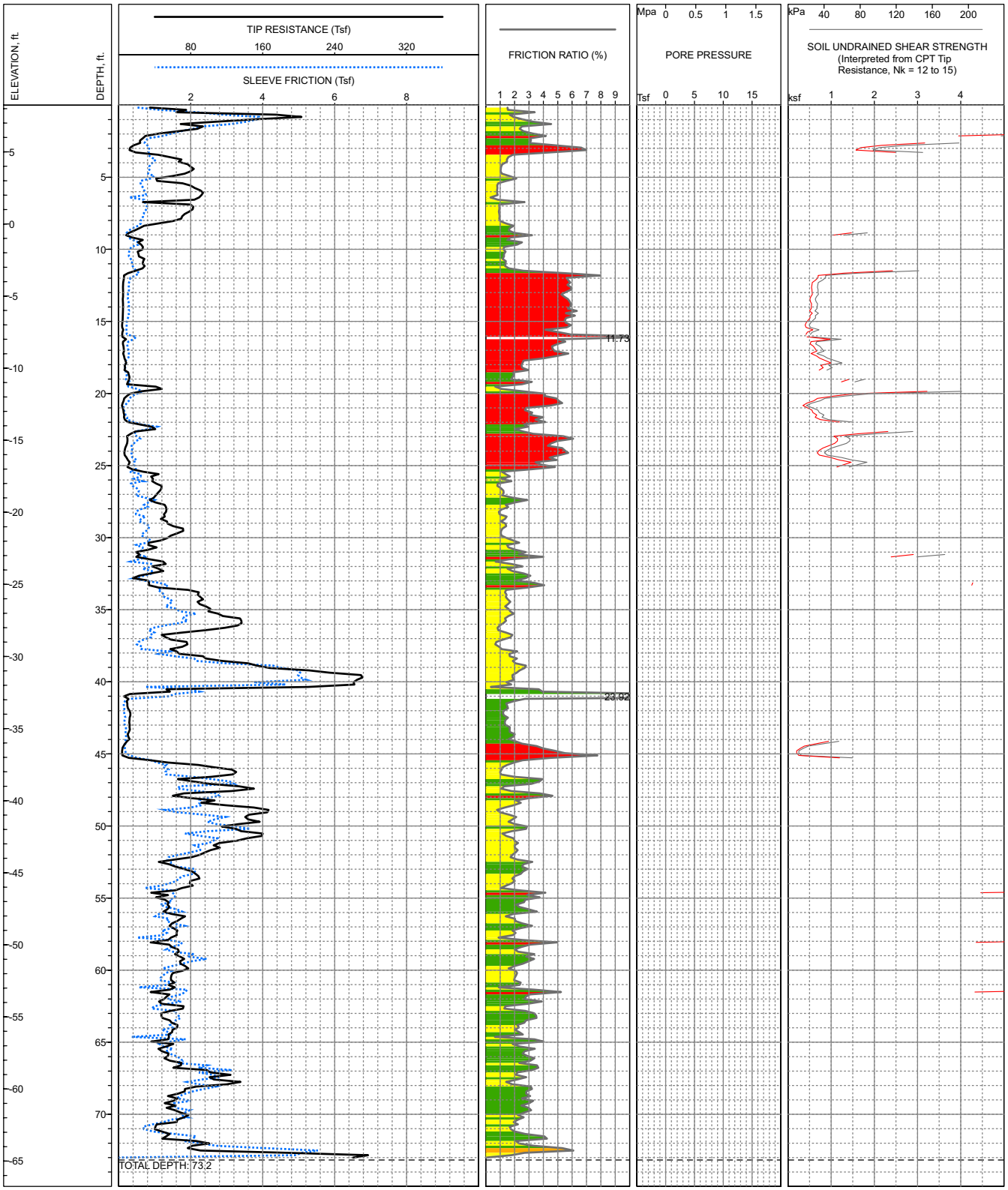
EXPLORATION METHOD: Cone Penetrometer
CONE AREA: 10cm^2
PERFORMED BY: VDOT

LOG OF CPT C-40

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE A-10

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Land\Logs\MXD\CPT_Logs_RC88.mxd,11/06/2008,kstevens



COORDINATES: E: 12,120,878 N: 3,477,863 Virginia State Plane, South Zone, NAD83, feet
GROUND SURFACE EL: 8.2ft +/- (MLLW)
COMPLETION DEPTH: 73.2ft
TEST DATE: 9/12/2008
Soil classification based on R&C (1988)

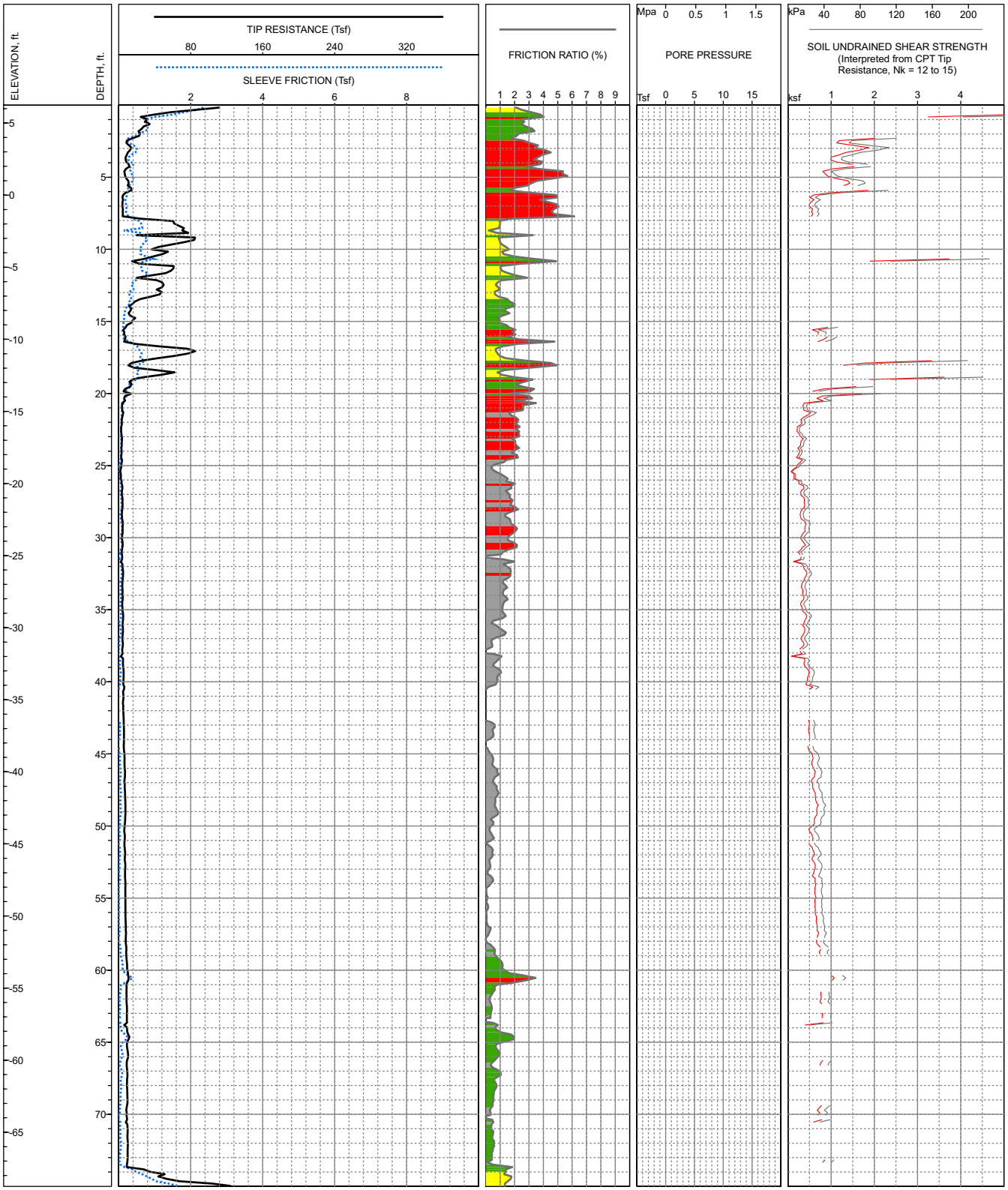
EXPLORATION METHOD: Cone Penetrometer
CONE AREA: 10cm^2
PERFORMED BY: VDOT

LOG OF CPT C-41

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE A-11

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Land\Logs\MXD\CPT_Logs_RC88.mxd,11/06/2008,kstevens



COORDINATES: E: 12,121,597 N: 3,478,829 Virginia State Plane, South Zone, NAD83, feet
GROUND SURFACE EL: 6.2ft +/- (MLLW)
COMPLETION DEPTH: 113.4ft
TEST DATE: 9/17/2008
Soil classification based on R&C (1988)

EXPLORATION METHOD: Cone Penetrometer
CONE AREA: 10cm^2
PERFORMED BY: VDOT

LOG OF CPT C-47

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE A-12

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Land\Logs\MXD\CPT_Logs_RC88.mxd,11/06/2008,kstevens

APPENDIX B
LABORATORY TESTING

DRILL HOLE	DEPTH, ft	DEPTH INTERVAL, ft	SAMPLE NUMBER	MATERIAL DESCRIPTION	UWW pcf	UDW pcf	MC %	FINES %	ATTERBERG LIMITS		COMPACTION TEST		DIRECT SHEAR		COMPRESSIVE STRENGTH TESTS		CORROSIVITY TESTS				D50 (mm)	EXPANSION INDEX	SAND EQUIVALENT (SE)	SPECIFIC GRAVITY
									LL	PI	MAX DD pcf	OPT MC %	C ksf	PHI deg	Qu, ksf	S_u (Cell Prs.) ksf	R	pH	Cl	So_4 (%)				
B-12	2.0			Silty Fine SAND (SM)					16	NP														
B-12	3.0	3.0 - 7.0		Silty Fine SAND (SM) with a trace of medium sand				26													0.26			
B-12	4.0			Silty Fine SAND (SM) with a trace of medium sand					16	NP														
B-12	7.0	7.0 - 9.5		Silty Fine SAND (SM)			25	17	14	NP											0.21			
B-12	8.0			Silty Fine SAND (SM)					14	NP														
B-12	9.5	9.5 - 21.0		Silty Fine SAND (SM)				12													0.12			
B-12	15.0			Silty Fine SAND (SM)					20	NP														
B-12	21.5	21.5 - 26.3		CLAY with sand (CL)			29	77																
B-12	25.0			Lean CLAY (CL) with sand					32	15														
B-12	26.3	26.3 - 41.5		Silty Fine SAND (SM)				24													0.13			
B-12	30.0			Silty Fine SAND (SM)					17	NP														
B-12	35.0			Silty Fine SAND (SM)					17	NP														
B-13	0.0			Fine to Coarse SAND (SP)			5																	
B-13	2.0	2.0 - 9.0		Silty Fine SAND (SM) with a trace of medium sand			13	23													0.15			
B-13	4.0			Silty Fine SAND (SM)			12		16	NP														
B-13	6.0			Fine to Medium SAND (SP)			18																	
B-13	8.0			Fine to Coarse SAND (SP)			10																	
B-13	15.0			Silty Fine SAND (SM)			25																	
B-13	16.0	16.0 - 21.0		Silty Fine SAND (SM)				13													0.11			
B-13	20.0			Silty Fine SAND (SM)			35																	
B-13	21.0	21.0 - 26.4		CLAY with sand (CL)				83																
B-13	25.0			Lean CLAY (CL) with fine sand					32	14														
B-13	26.4	26.4 - 35.0		Silty Fine SAND (SM)				48													0.08			
B-13	30.0			Silty Fine SAND (SM)			23																	
B-13	35.0	35.0 - 46.0		Fine to Medium SAND (SP) with silt				7	18	NP											0.33			
B-13	40.0			Fine to Medium SAND (SP) with silt					18	NP														
B-13	45.0			Fine to Medium SAND (SP) with silt			26																	
B-13	46.0	46.0 - 61.5		Silty Fine SAND (SM)				22													0.21			
B-13	50.0			Silty Fine SAND (SM)					21	NP														
B-13	55.0			Silty Fine SAND (SM)					21	NP														

SUMMARY OF LABORATORY TEST RESULTS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-1a

DRILL HOLE	DEPTH, ft	DEPTH INTERVAL, ft	SAMPLE NUMBER	MATERIAL DESCRIPTION	UWW pcf	UDW pcf	MC %	FINES %	ATTERBERG LIMITS		COMPACTION TEST		DIRECT SHEAR		COMPRESSIVE STRENGTH TESTS		CORROSIVITY TESTS				D50 (mm)	EXPANSION INDEX	SAND EQUIVALENT (SE)	SPECIFIC GRAVITY
									LL	PI	MAX DD pcf	OPT MC %	C ksf	PHI deg	Qu, ksf	S_u (Cell Prs.) ksf	R	pH	Cl	So_4 (%)				
B-13	60.0			Silty Fine SAND (SM)			25																	
B-14	0.0			Silty Fine SAND (SM)			11																	
B-14	2.0			Silty Fine SAND (SM)			24																	
B-14	4.0			Poorly-graded SAND (SP)			32																	
B-14	6.0			Silty Fine SAND (SM) to Medium Sand (SP)			22																	
B-14	8.0			Silty Fine SAND (SM) to Medium Sand (SP)			28																	
B-14	9.5	9.5 - 26.0		Silty Fine SAND (SM)				16													0.13			
B-14	15.0			Silty Fine SAND (SM)			27		17	NP														
B-14	20.0			Silty Fine SAND (SM)			21		17	NP														
B-14	26.0	26.0 - 28.0		Silty Fine SAND (SM) with a trace of medium sand				37													0.12			
B-14	28.0	28.0 - 36.5		Sandy SILT (ML)				60																
B-14	35.0			Sandy SILT (ML)			24																	
B-14	36.5	36.5 - 50.0		Sandy SILT (ML)				51																
B-14	40.0			Sandy SILT (ML)					23	NP														
B-14	45.0			Sandy SILT (ML)					23	NP														
B-14	50.0			Sandy SILT (ML)			30		22	NP														
B-14	50.5	50.5 - 61.5		Silty Fine SAND (SM)				27													0.15			
B-14	61.5	61.5 - 76.5		Silty Fine SAND (SM)				36													0.11			
B-14	65.0			Silty Fine SAND (SM)			30		20	NP														
B-14	70.0			Silty Fine SAND (SM)					20	NP														
B-14	76.5	76.5 - 91.5		Silty Fine SAND (SM)				22													0.12			
B-14	80.0			Silty Fine SAND (SM)			24																	
B-14	85.0			Silty Fine SAND (SM)					19	NP														
B-14	90.0			Silty Fine SAND (SM)					19	NP														
B-14	91.5	91.5 - 101.5		Silty Fine SAND (SM)				25													0.11			
B-14	95.0			Silty Fine SAND (SM)					20	NP														
B-14	100.0			Silty Fine SAND (SM)			27		20	NP														
B-15	0.0			Asphalt concrete PAVEMENT (ASPH)			13																	
B-15	2.0			SAND (SP) with gravel			25																	
B-15	6.0			Fine SAND (SP)			44																	

SUMMARY OF LABORATORY TEST RESULTS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-1b

DRILL HOLE	DEPTH, ft	DEPTH INTERVAL, ft	SAMPLE NUMBER	MATERIAL DESCRIPTION	UWW pcf	UDW pcf	MC %	FINES %	ATTERBERG LIMITS		COMPACTION TEST		DIRECT SHEAR		COMPRESSIVE STRENGTH TESTS		CORROSIVITY TESTS				D50 (mm)	EXPANSION INDEX	SAND EQUIVALENT (SE)	SPECIFIC GRAVITY
									LL	PI	MAX DD pcf	OPT MC %	C ksf	PHI deg	Qu, ksf	S_u (Cell Prs.) ksf	R	pH	Cl	So_4 (%)				
B-15	8.0			Silty Fine SAND (SM)			28																	
B-15	15.0	15.0 - 35.5		Lean CLAY (CL) with fine sand			44	77	39	21														
B-15	20.0			Lean CLAY (CL) with fine sand			68																	
B-15	25.0			Lean CLAY (CL) with fine sand			22																	
B-15	35.5	35.5 - 41.5		Silty Fine SAND (SM) with a trace of medium sand				18													0.21			
B-15	40.0			Silty Fine SAND (SM) with a trace of medium sand					14	NP														
B-15	46.5	46.5 - 55.0		Silty Fine SAND (SM)				34													0.10			
B-15	50.0			Silty Fine SAND (SM)			36		NP	NP														
B-15	55.0	55.0 - 66.5		Silty Fine SAND (SM)				38													0.11			
B-15	60.0			Silty Fine SAND (SM)					20	NP														
B-15	65.0			Silty Fine SAND (SM)			23																	
B-15	66.5	66.5 - 81.5		Silty Fine SAND (SM)				29													0.12			
B-15	70.0			Silty Fine SAND (SM)					75	NP														
B-15	80.0			Silty Fine SAND (SM)			27		20	NP														
B-15	81.5	81.5 - 101.5		Silty Fine SAND (SM)				27													0.11			
B-15	100.0			Silty Fine SAND (SM)			29		20	NP														
B-16	1.5			SAND (SP)			12																	
B-16	5.0			Lean CLAY (CL)			31		31	15														
B-16	5.5	5.5 - 11.3		CLAY (CL) with sand				56																
B-16	10.0			CLAY (CL) with sand			30																	
B-16	11.3	11.3 - 21.0		Fine SAND (SP) with silt				5													0.27			
B-16	15.0			Fine SAND (SP) with silt			29		16	NP														
B-16	20.0			Fine SAND (SP) with silt			26		NP	NP														
B-16	25.0	25.0 - 26.5		Fine to Medium SAND (SP)				3													0.36			
B-16	26.5	26.5 - 41.5		Fat CLAY (CH)				97																
B-16	35.0			Fat CLAY (CH)			57		52	30														
B-16	41.5	41.5 - 56.3		Fat CLAY (CH)				98																
B-16	50.0			SILT (ML)			68		NP	NP														
B-16	56.3	56.3 - 81.0		Fat CLAY (CH)				97																
B-16	65.0			Fat CLAY (CH)			77		67	36														

SUMMARY OF LABORATORY TEST RESULTS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-1c

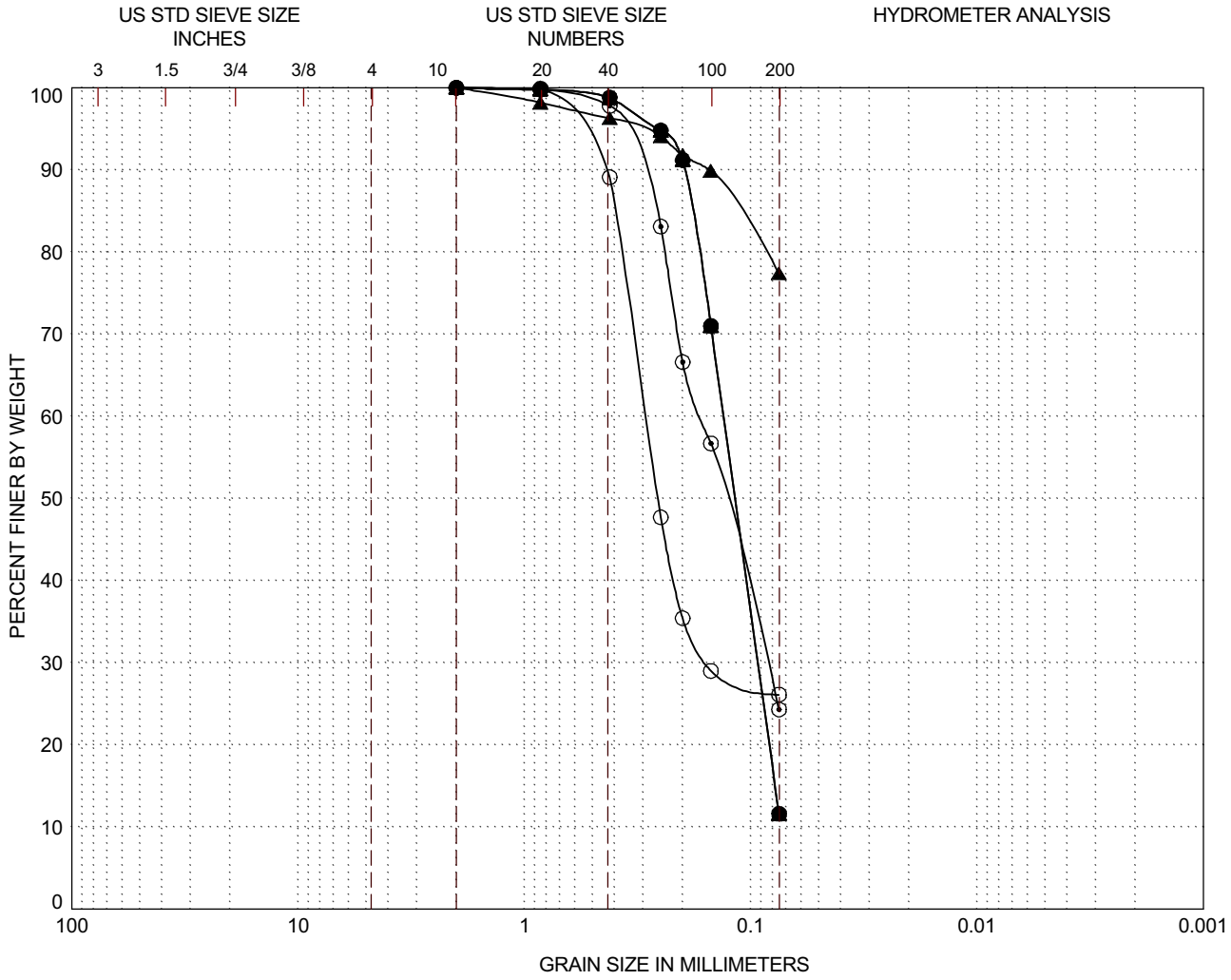
DRILL HOLE	DEPTH, ft	DEPTH INTERVAL, ft	SAMPLE NUMBER	MATERIAL DESCRIPTION	UWW pcf	UDW pcf	MC %	FINES %	ATTERBERG LIMITS		COMPACTION TEST		DIRECT SHEAR		COMPRESSIVE STRENGTH TESTS		CORROSIVITY TESTS				D50 (mm)	EXPANSION INDEX	SAND EQUIVALENT (SE)	SPECIFIC GRAVITY
									LL	PI	MAX DD pcf	OPT MC %	C ksf	PHI deg	Qu, ksf	S_u (Cell Prs.) ksf	R	pH	Cl	So_4 (%)				
B-16	80.0			Fat CLAY (CH)			30																	
B-16	81.0	81.0 - 91.0		Silty Fine SAND (SM)				31													0.12			
B-16	85.0			Silty Fine SAND (SM)					15	NP														
B-16	90.0			Silty Fine SAND (SM)			65																	
B-16	91.5	91.5 - 101.5		Silty Fine SAND (SM)				28													0.11			
B-16	95.0			Silty Fine SAND (SM)					19	NP														
B-16	100.0			Silty Fine SAND (SM)			28																	
B-20	5.0			Silty CLAY (CL-ML)			20																	
B-20	10.0			Fine to Medium SAND (SP)			23		16	NP														
B-20	11.0	11.0 - 21.0		Fine SAND (SP) with medium sand				3													0.32			
B-20	15.0			Fine SAND (SP) with medium sand			19		16	NP														
B-20	30.0			Fat CLAY (CH)			53																	
B-20	30.5	30.5 - 41.5		Fat CLAY (CH)				91	51	30														
B-20	41.5	41.5 - 56.0		Fat CLAY (CH)				96																
B-20	45.0			Fat CLAY (CH)			66		59	35														
B-20	56.0	56.0 - 81.0		Fat CLAY (CH)				99																
B-20	60.0			Fat CLAY (CH)			70		65	35														
B-20	75.0			Fat CLAY (CH)			74		65	35														
B-20	81.0	81.0 - 91.5		Silty Fine SAND (SM)				18													0.14			
B-20	85.0			Silty Fine SAND (SM)			26		17	NP														
B-20	91.5	91.5 - 101.5		Silty Fine SAND (SM)				29													0.1			
B-20	100.0			Silty Fine SAND (SM)			29		20	NP														

SUMMARY OF LABORATORY TEST RESULTS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-1d

LAB SUMMARY- NORFOLK SAND SEARCH N:\PROJECTS\3602_VDOT\3602-001_MIDTOWN_TUNNEL\EXPLORATIONS\GINT\2008\LAND\VDA08B.GPJ_ 11/12/08 12:39 PM-cab

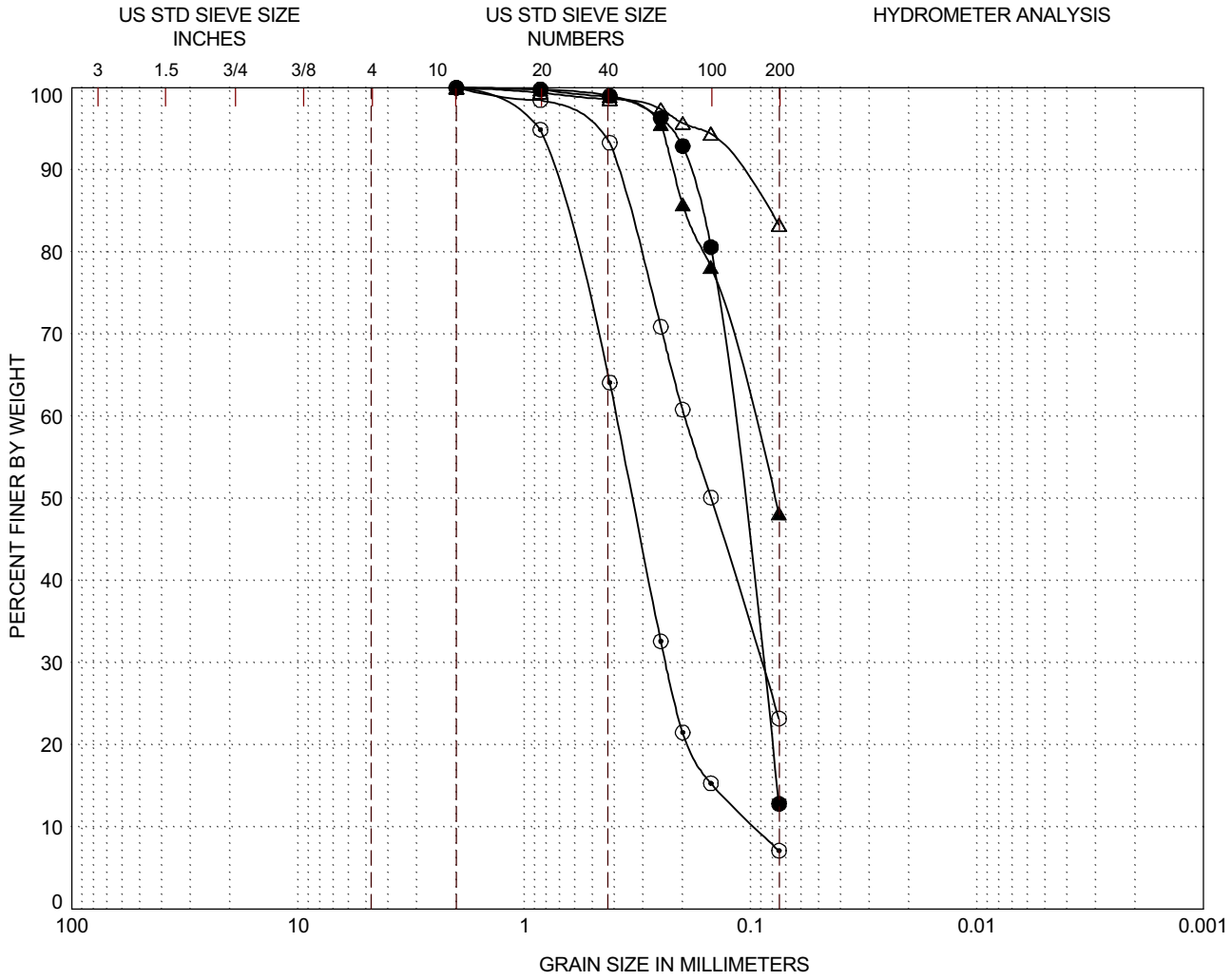


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND			CLASSIFICATION	Cc	Cu	FC(%)	D50
	(location)	(depth interval,ft)					
○	B-12	3.0 - 7.0	Silty Fine SAND (SM) with a trace of medium sand			26.1	0.26
●	B-12	7.0 - 9.5	Silty Fine SAND (SM)	0.9	1.8	17.3	0.21
△	B-12	9.5 - 21.0	Silty Fine SAND (SM)	0.9	1.8	11.6	0.12
▲	B-12	21.5 - 26.3	CLAY with sand (CL)			77.4	
⊙	B-12	26.3 - 41.5	Silty Fine SAND (SM)			24.3	0.13

GRAIN SIZE CURVES
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-2a

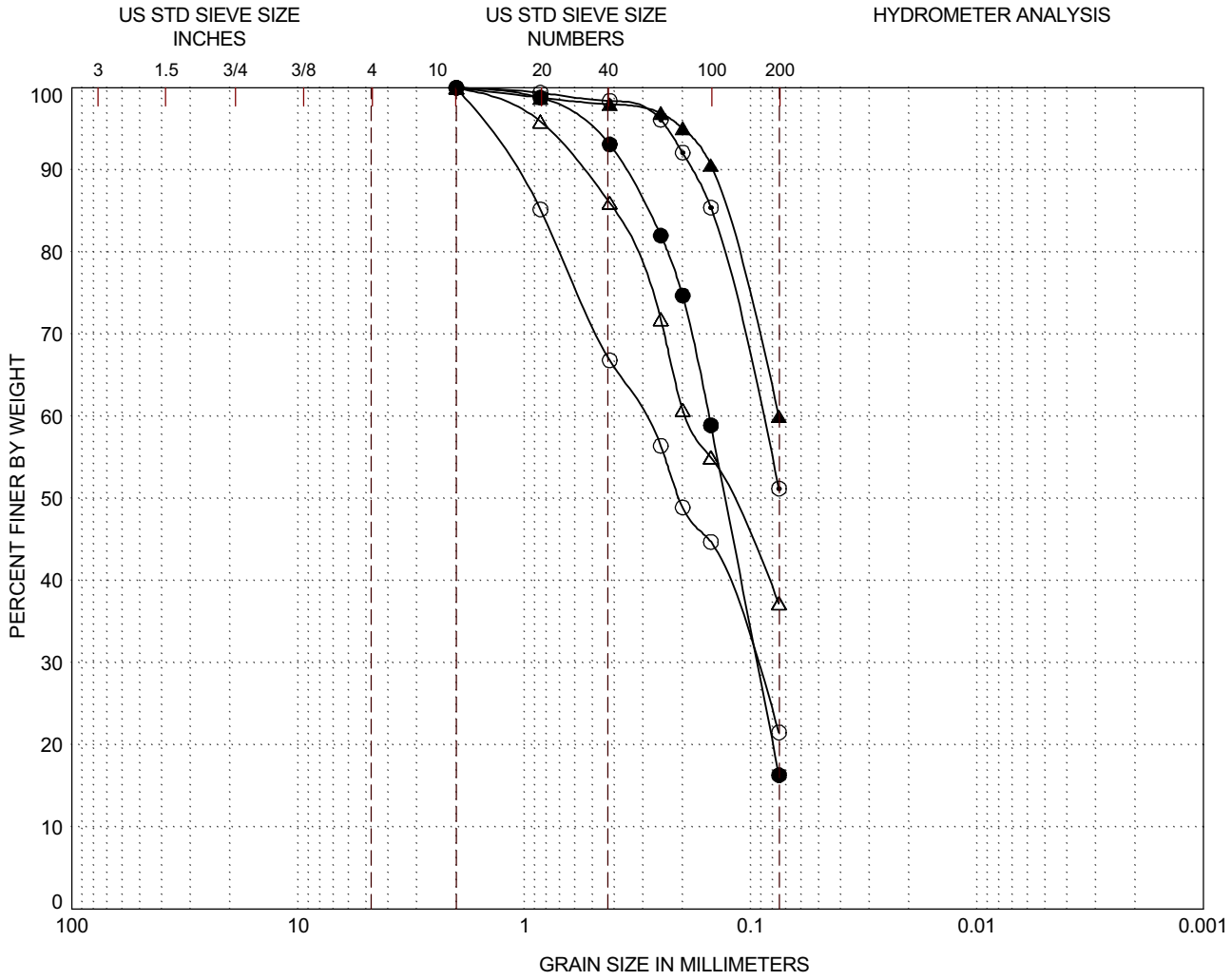


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND			CLASSIFICATION	Cc	Cu	FC(%)	D50
	(location)	(depth interval,ft)					
○	B-13	2.0 - 9.0	Silty Fine SAND (SM) with a trace of medium sand			23.2	0.15
●	B-13	16.0 - 21.0	Silty Fine SAND (SM)			12.8	0.11
△	B-13	21.0 - 26.4	CLAY with sand (CL)			83.3	
▲	B-13	26.4 - 35.0	Silty Fine SAND (SM)			48.2	0.08
⊙	B-13	35.0 - 46.0	Fine to Medium SAND (SP) with silt	1.5	4.1	7.1	0.33

GRAIN SIZE CURVES
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

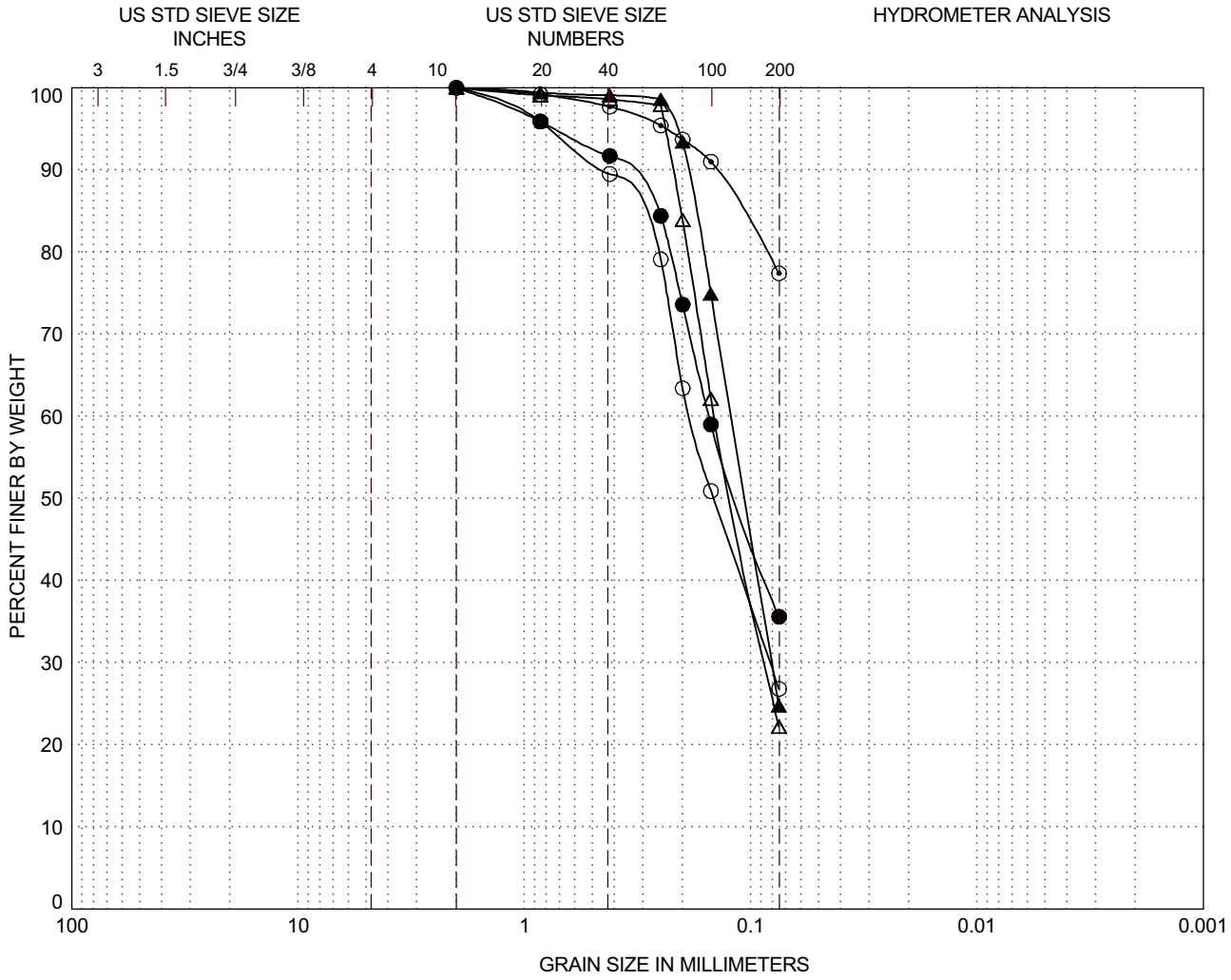
FIGURE B-2b



LEGEND	(location)	(depth interval,ft)	CLASSIFICATION	Cc	Cu	FC(%)	D50
○	B-13	46.0 - 61.5	Silty Fine SAND (SM)			21.5	0.21
●	B-14	9.5 - 26.0	Silty Fine SAND (SM)			16.3	0.13
△	B-14	26.0 - 28.0	Silty Fine SAND (SM) with a trace of medium sand			37.2	0.12
▲	B-14	28.0 - 36.5	Sandy SILT (ML)			60.0	
⊙	B-14	36.5 - 50.0	Sandy SILT (ML)			51.2	

GRAIN SIZE CURVES
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-2c

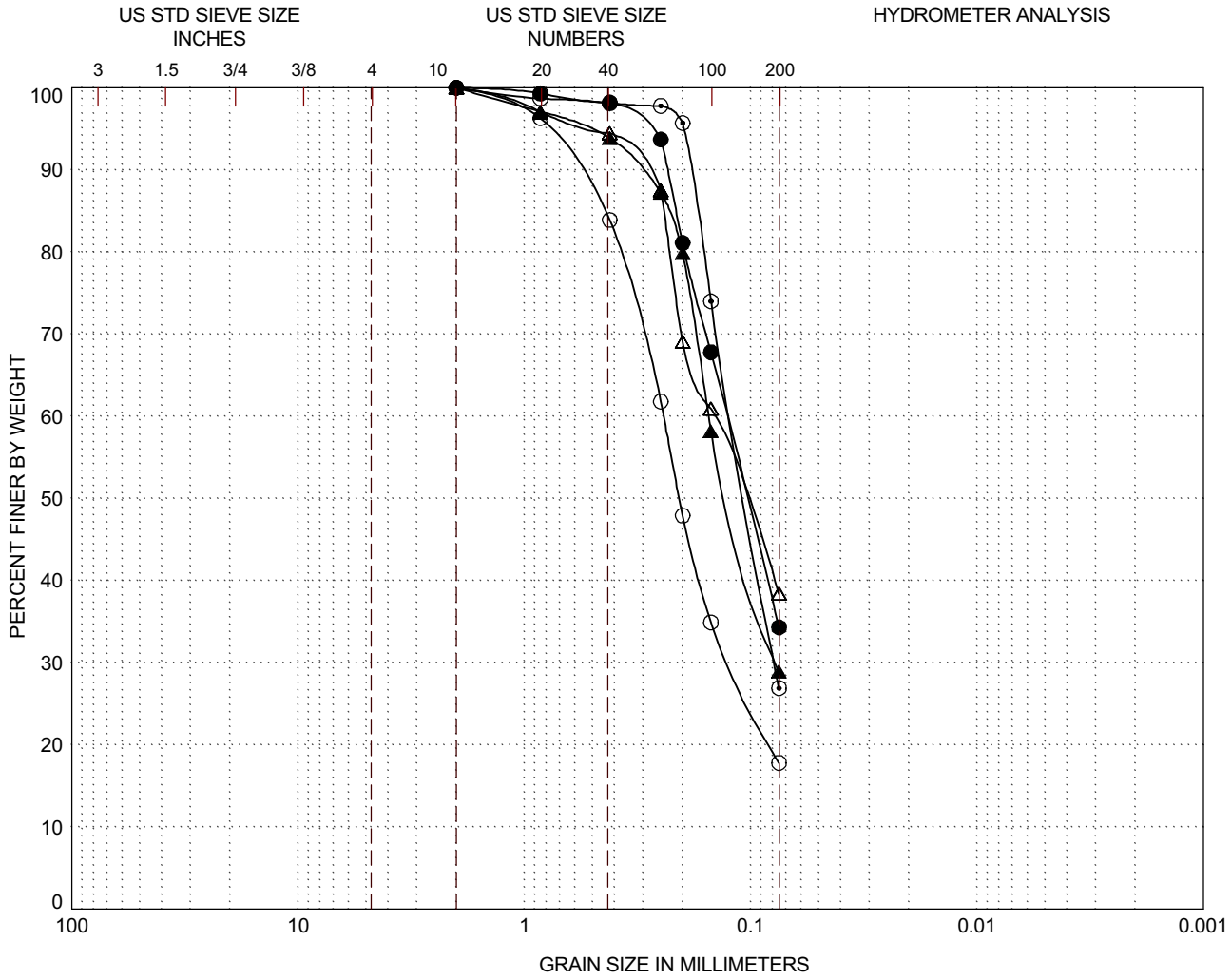


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND			CLASSIFICATION	Cc	Cu	FC(%)	D50
	(location)	(depth interval,ft)					
○	B-14	50.5 - 61.5	Silty Fine SAND (SM)			26.8	0.15
●	B-14	61.5 - 76.5	Silty Fine SAND (SM)			35.6	0.11
△	B-14	76.5 - 91.5	Silty Fine SAND (SM)			22.2	0.12
▲	B-14	91.5 - 101.5	Silty Fine SAND (SM)			24.8	0.11
⊙	B-15	15.0 - 35.5	Lean CLAY (CL) with fine sand			77.4	

GRAIN SIZE CURVES
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-2d

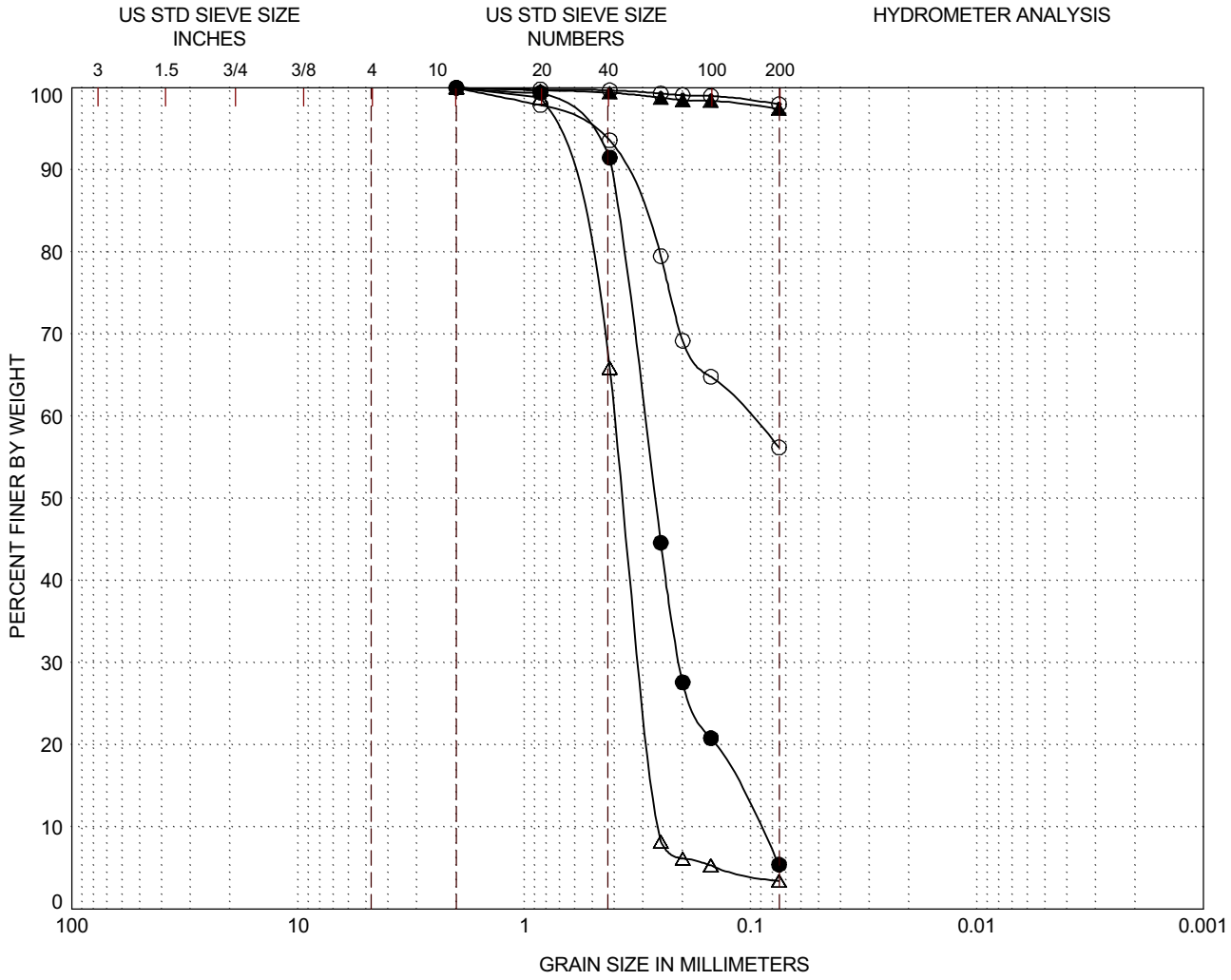


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND			CLASSIFICATION	Cc	Cu	FC(%)	D50
	(location)	(depth interval,ft)					
○	B-15	35.5 - 41.5	Silty Fine SAND (SM) with a trace of medium sand			17.8	0.21
●	B-15	46.5 - 55.0	Silty Fine SAND (SM)			34.4	0.10
△	B-15	55.0 - 66.5	Silty Fine SAND (SM)			38.4	0.11
▲	B-15	66.5 - 81.5	Silty Fine SAND (SM)			28.9	0.12
⊙	B-15	81.5 - 101.5	Silty Fine SAND (SM)			26.9	0.11

GRAIN SIZE CURVES
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-2e

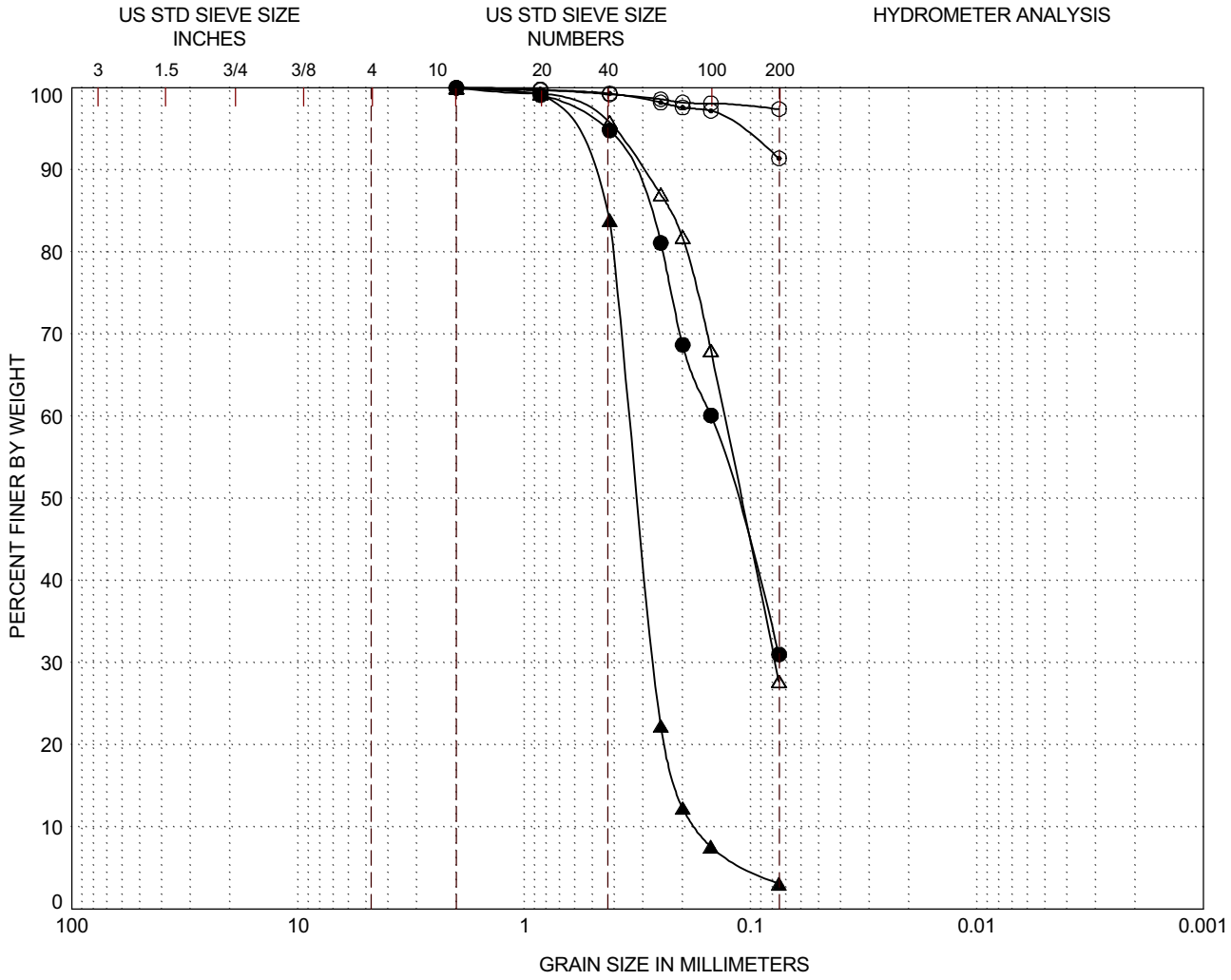


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND			CLASSIFICATION	Cc	Cu	FC(%)	D50
	(location)	(depth interval,ft)					
○	B-16	5.5 - 11.3	CLAY (CL) with sand			56.2	
●	B-16	11.3 - 21.0	Fine SAND (SP) with silt	1.6	3.2	5.4	0.27
△	B-16	25.0 - 26.5	Fine to Medium SAND (SP)	0.9	1.6	3.4	0.36
▲	B-16	26.5 - 41.5	Fat CLAY (CH)			97.4	
⊙	B-16	41.5 - 56.3	Fat CLAY (CH)			98.0	

GRAIN SIZE CURVES
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-2f

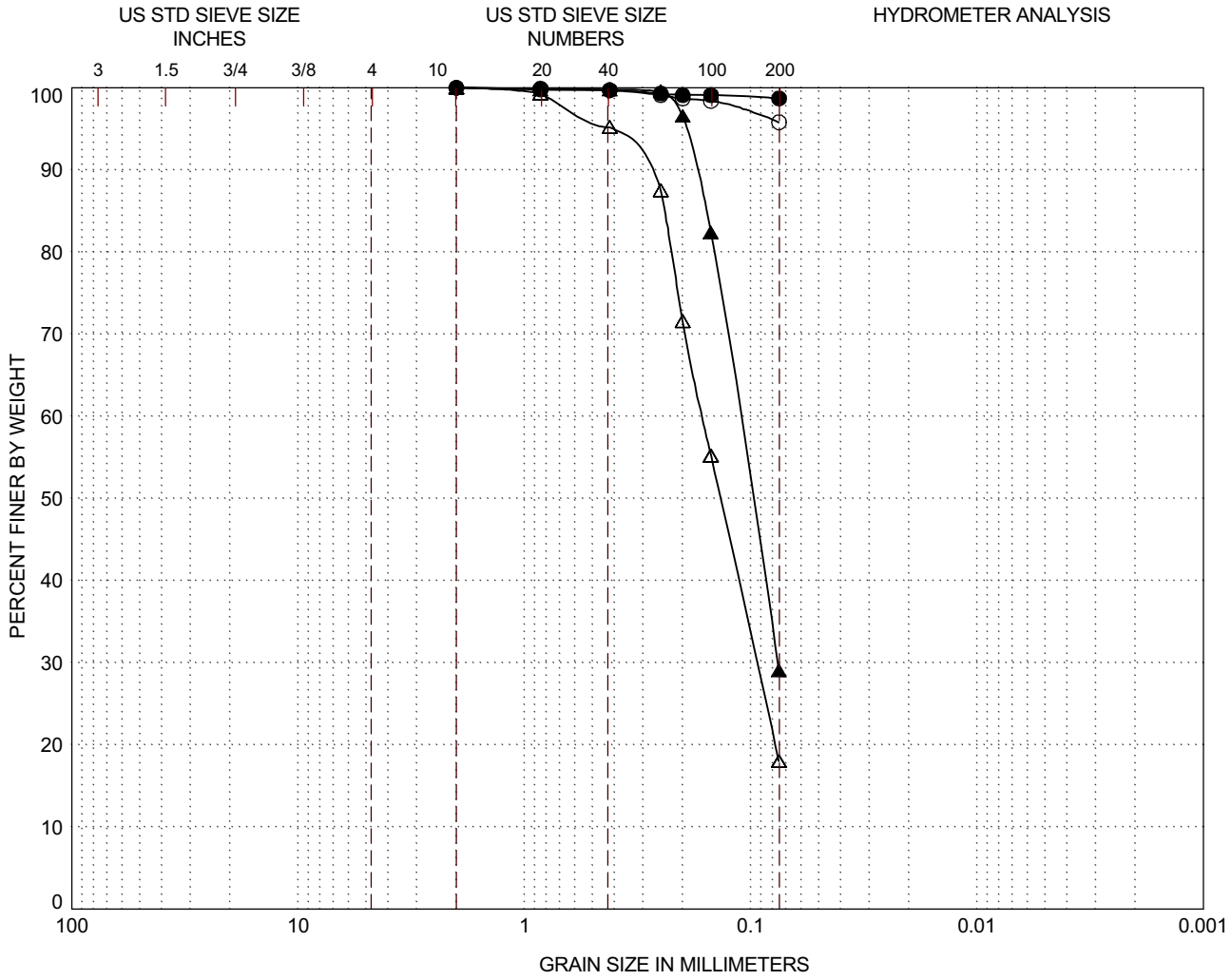


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND			CLASSIFICATION	Cc	Cu	FC(%)	D50
	(location)	(depth interval,ft)					
○	B-16	56.3 - 81.0	Fat CLAY (CH)			97.4	
●	B-16	81.0 - 91.0	Silty Fine SAND (SM)			31.0	0.12
△	B-16	91.5 - 101.5	Silty Fine SAND (SM)			27.7	0.11
▲	B-20	11.0 - 21.0	Fine SAND (SP) with medium sand	1.2	2.0	3.1	0.32
⊙	B-20	30.5 - 41.5	Fat CLAY (CH)			91.4	

GRAIN SIZE CURVES
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-2g

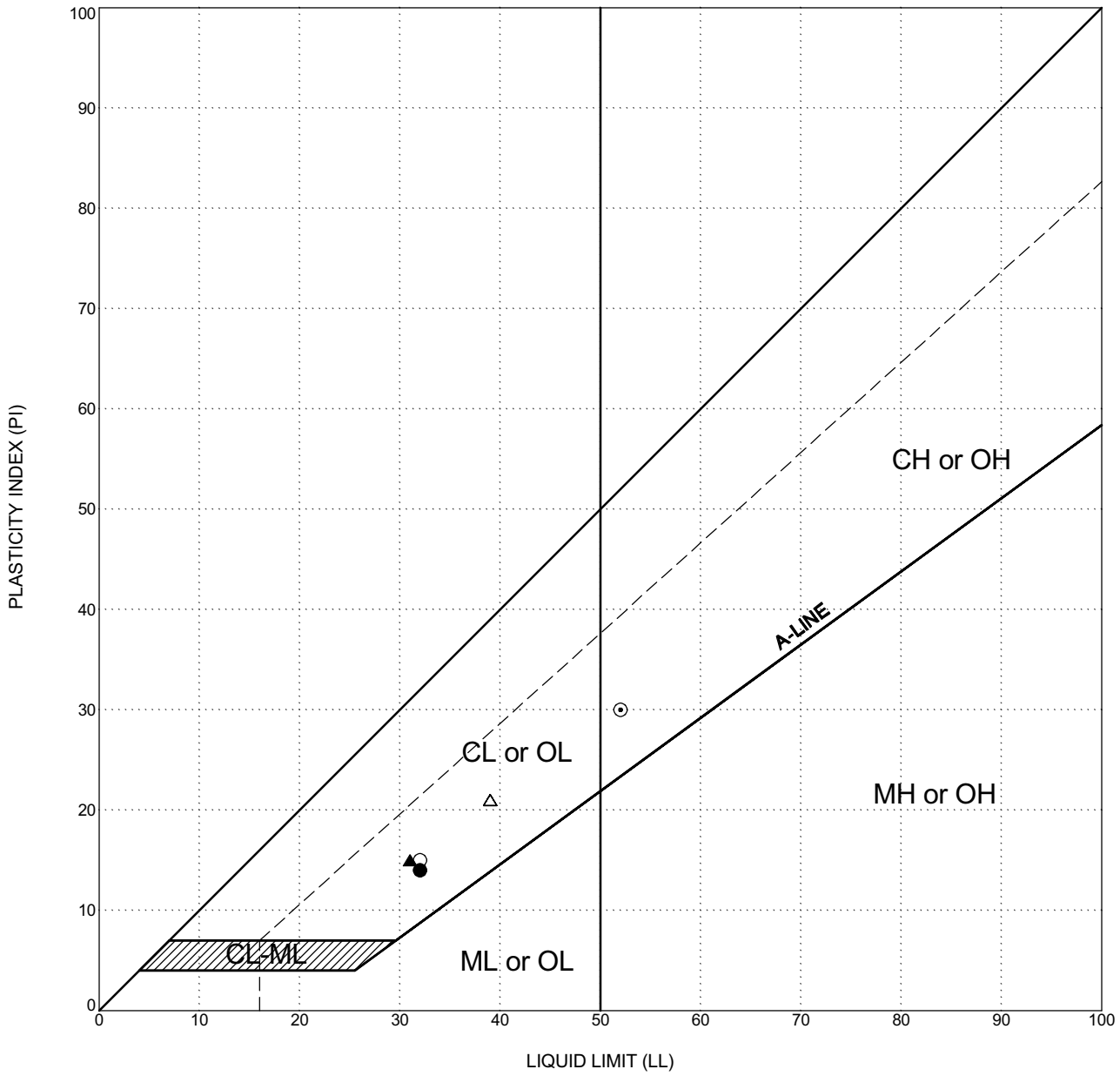


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND			CLASSIFICATION	Cc	Cu	FC(%)	D50
	(location)	(depth interval,ft)					
○	B-20	41.5 - 56.0	Fat CLAY (CH)			95.8	
●	B-20	56.0 - 81.0	Fat CLAY (CH)			98.7	
△	B-20	81.0 - 91.5	Silty Fine SAND (SM)			18.0	0.14
▲	B-20	91.5 - 101.5	Silty Fine SAND (SM)			29.1	0.10

GRAIN SIZE CURVES
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

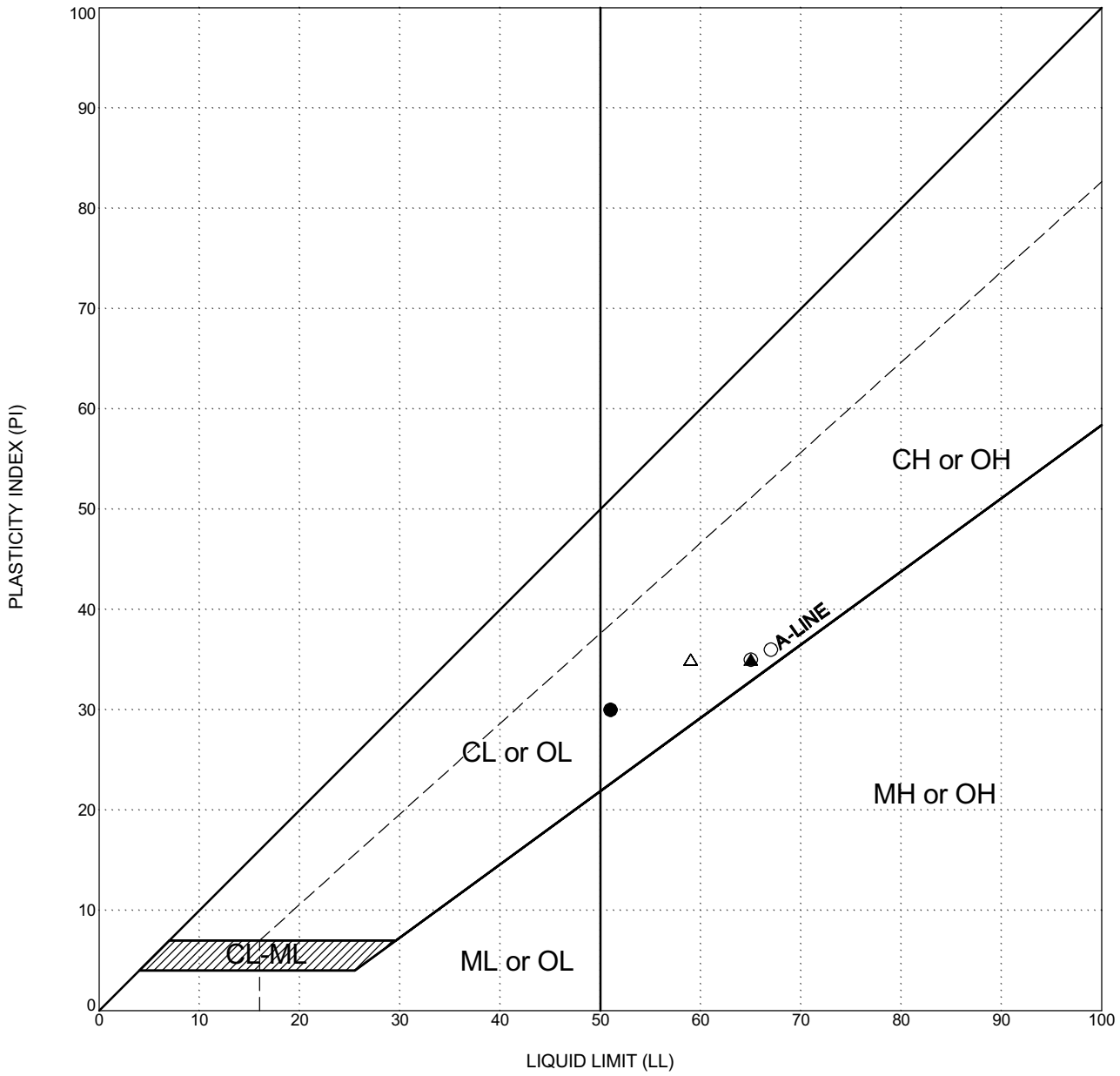
FIGURE B-2h



LEGEND			CLASSIFICATION	ATTERBERG LIMITS TEST RESULTS		
	location	depth, ft		LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)
○	B-12	25.0	Lean CLAY (CL) with sand	32	17	15
●	B-13	25.0	Lean CLAY (CL) with fine sand	32	18	14
△	B-15	15.0	Lean CLAY (CL) with fine sand	39	18	21
▲	B-16	5.0	Lean CLAY (CL)	31	16	15
⊙	B-16	35.0	Fat CLAY (CH)	52	22	30

PLASTICITY CHART
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-3a

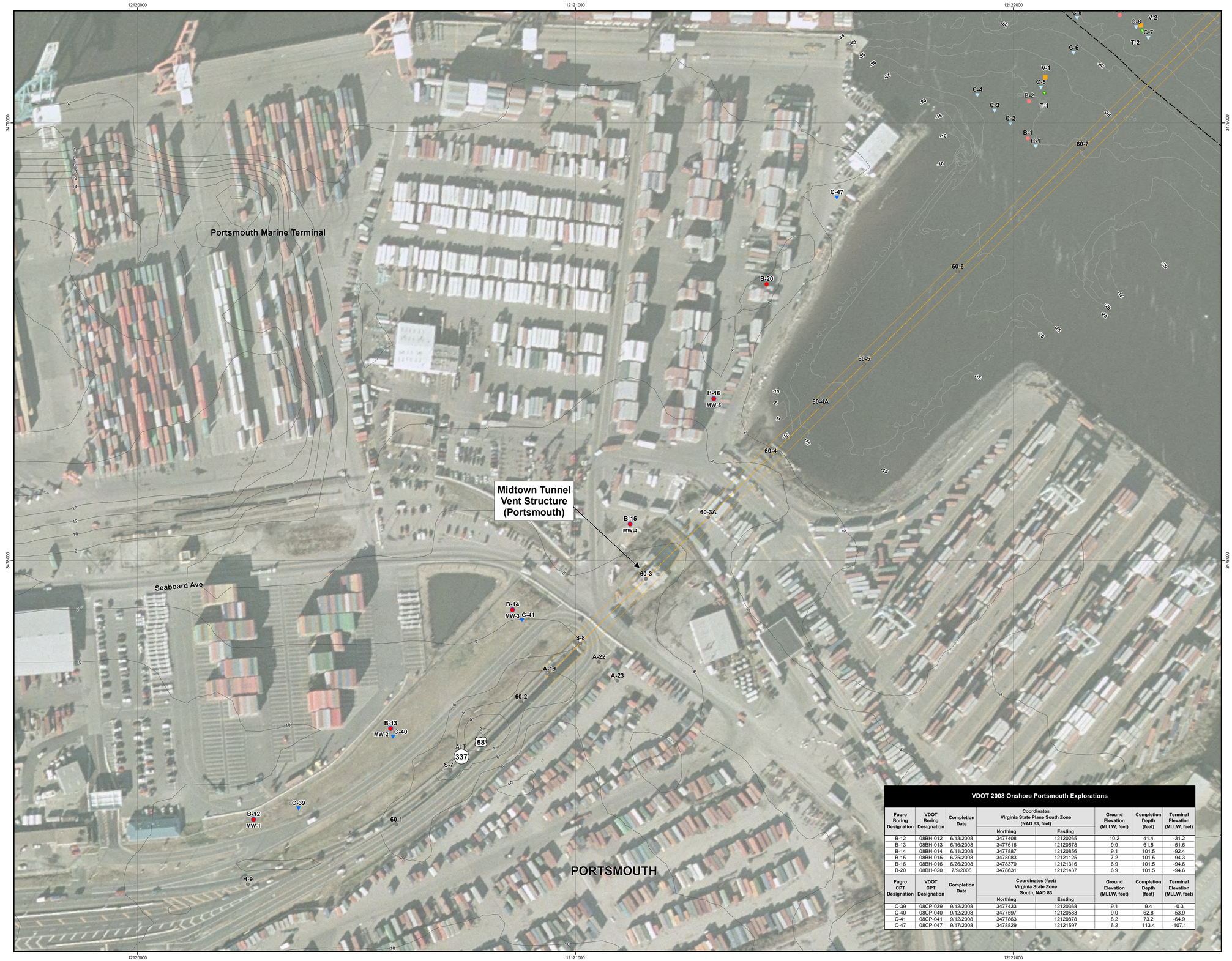


LEGEND			CLASSIFICATION	ATTERBERG LIMITS TEST RESULTS		
	location	depth, ft		LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)
○	B-16	65.0	Fat CLAY (CH)	67	31	36
●	B-20	30.0	Fat CLAY (CH)	51	21	30
△	B-20	45.0	Fat CLAY (CH)	59	24	35
▲	B-20	60.0	Fat CLAY (CH)	65	30	35
⊙	B-20	75.0	Fat CLAY (CH)	65	30	35

PLASTICITY CHART
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-3b

CHARTS



LEGEND

Geotechnical Explorations

- B-14 — 2008 VDOT Boring Location
- C-40 — 2008 VDOT CPT Location
- MW-1 — MMA 2008 Monitoring Well
- B-09 — 2008 Fugro Boring Location
- C-23 — 2008 Fugro CPT Location
- T-4 — 2008 Fugro T-Bar Location
- V-4 — 2008 Fugro Vane Shear Location
- 60-15 — Historical VDOT Boring Location

1999 Portsmouth Topographic Survey (NAVD 88)
Source: U.S. Geological Survey, EROS Data Center National Elevation Dataset (NED), Norfolk South VA, 1999

Topographic Contour in Feet (NAVD 88)
Contour interval is 2 ft.

Elizabeth River Bathymetry (MLLW, feet)
Source: 2008 Multibeam Survey (Fugro, 2008b)
Refer to notes for vertical datum.

Bathymetric Contour in Feet (MLLW)
Contour interval is 5 ft.

Approximate Location of Midtown Tunnel
Not for design or construction planning
(Refer to Section 7.1 in text)

NOTES

1) Coordinate Grid: Virginia State Plane, South Zone, NAD 83, Feet
2) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>
3) Reference to Mean Lower Low Water (MLLW), 1983-2001 Tidal Epoch, is based on observations performed and published by the National Oceanic and Atmospheric Administration, National Ocean Service (NOAA/NOS). Tidal Bench Mark 8638610 at Sewells Point, Hampton Roads, was used as the MLLW constraint for this project.

VDOT 2008 Onshore Portsmouth Explorations

Fugro Boring Designation	VDOT Boring Designation	Completion Date	Coordinates Virginia State Plane South Zone (NAD 83, feet) Northing	Coordinates Virginia State Plane South Zone (NAD 83, feet) Easting	Ground Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
B-12	08BH-012	6/13/2008	3477408	12120265	10.2	41.4	-31.2
B-13	08BH-013	6/16/2008	3477616	12120578	9.9	61.5	-51.6
B-14	08BH-014	6/11/2008	3477887	12120856	9.1	101.5	-92.4
B-15	08BH-015	6/25/2008	3478083	12121125	7.2	101.5	-94.3
B-16	08BH-016	6/26/2008	3478370	12121316	6.9	101.5	-94.6
B-20	08BH-020	7/9/2008	3478631	12121437	6.9	101.5	-94.6

Fugro CPT Designation	VDOT CPT Designation	Completion Date	Coordinates (feet) Virginia State Zone South, NAD 83 Northing	Coordinates (feet) Virginia State Zone South, NAD 83 Easting	Ground Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
C-39	08CP-039	9/12/2008	3477433	12120368	9.1	9.4	-0.3
C-40	08CP-040	9/12/2008	3477597	12120583	9.0	62.8	-53.9
C-41	08CP-041	9/12/2008	3477863	12120878	8.2	73.2	-64.9
C-47	08CP-047	9/17/2008	3478829	12121597	6.2	113.4	-107.1

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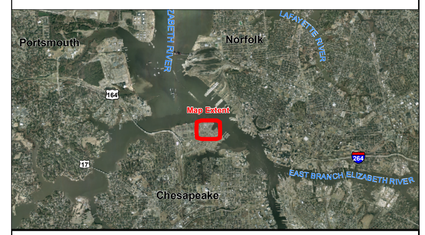
GEODETIC INFORMATION

SPHEROID:	GRS 1980
SEMI-MAJOR AXIS:	6,378,137.000
SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.25722101
ECCENTRICITY²:	0.006694380
PROJECTION:	LAMBERT CONFORMAL CONIC
ZONE:	VIRGINIA SOUTH
LONGITUDE OF ORIGIN:	36.3°
FALSE EASTING:	11,482,916
FALSE NORTHING:	3,280,833

N W E S



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EXPLORATION LOCATION MAP
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

0 100 200 Feet

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Nov. 2008	Report Submittal	KCS	KRS	KRS
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3					

JOB NUMBER: 3602.001 CHART NO.: 1

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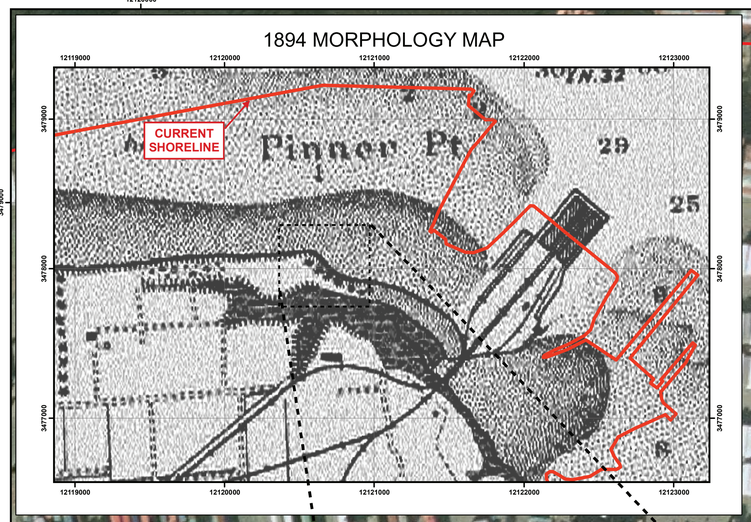

LEGEND

1894 Interpreted Morphology
See the table below for source used as basis of interpretation.

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- Lowlands (LL)- Unknown material types
- Uplands (UL)- Likely sandy materials

VDOT Land Exploration Locations

- B-18 — Boring
- C-43 — CPT

Fugro Marine Exploration Locations

- 0B-09 — Boring
- C-23 — CPT

1960 Exploration Locations

- 60-15 — Boring (by others)
- Current Shoreline (digitized from 2005 aerial photograph)
- Approximate Location of Midtown Tunnel (Refer to Section 7.1 in text)

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Highlighted maps/photos are shown on this chart

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NOTES

1) Coordinate Grid: Virginia State Plane, South Zone, NAD 83, Feet

2) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

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1894 MORPHOLOGY INTERPRETATION
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

0 100 200 Feet

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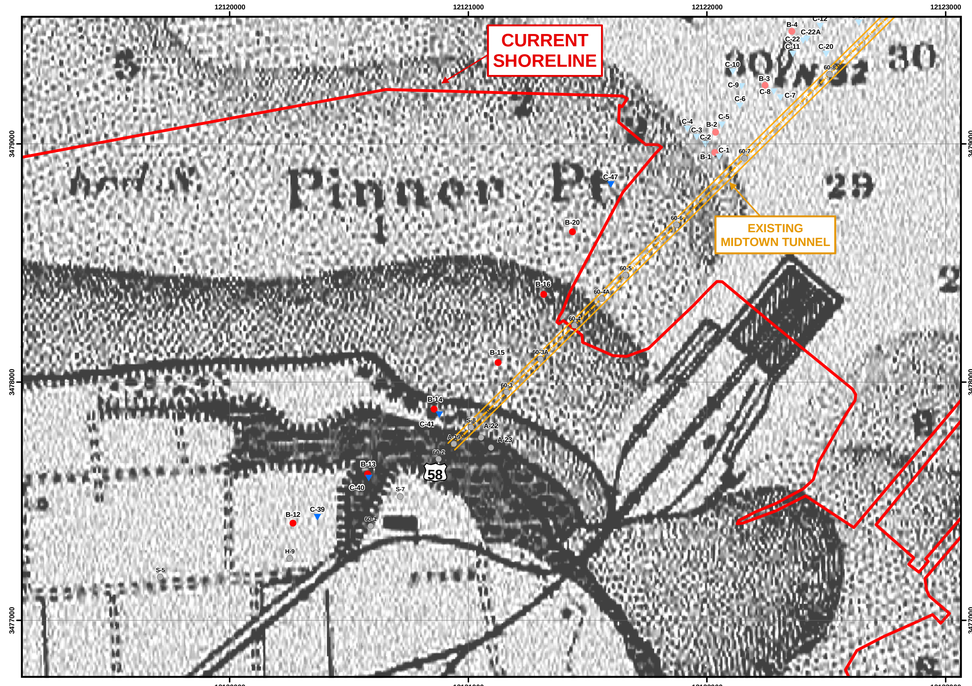
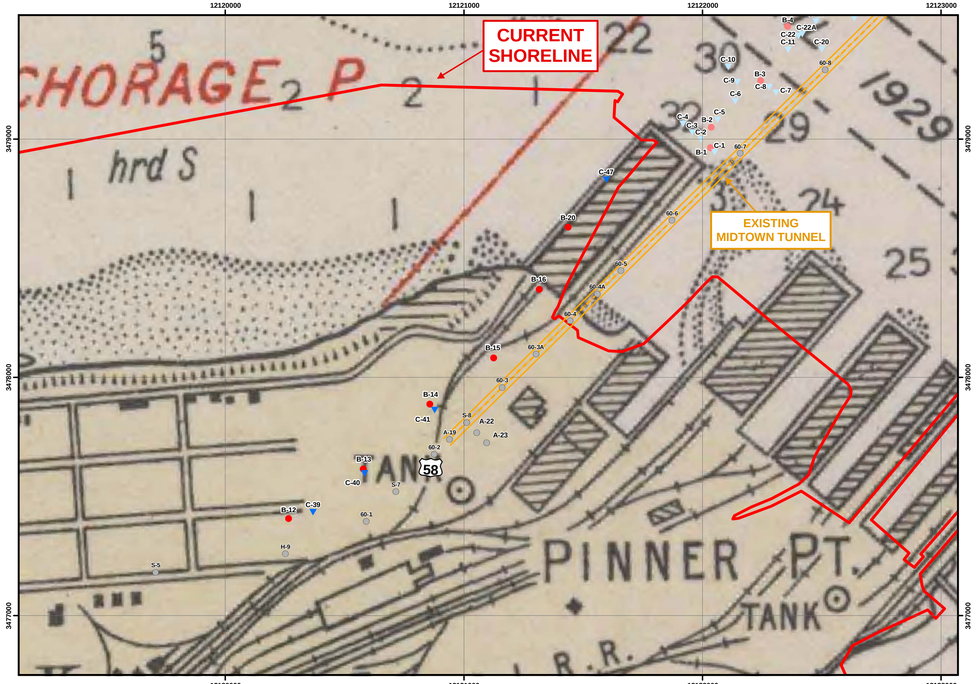
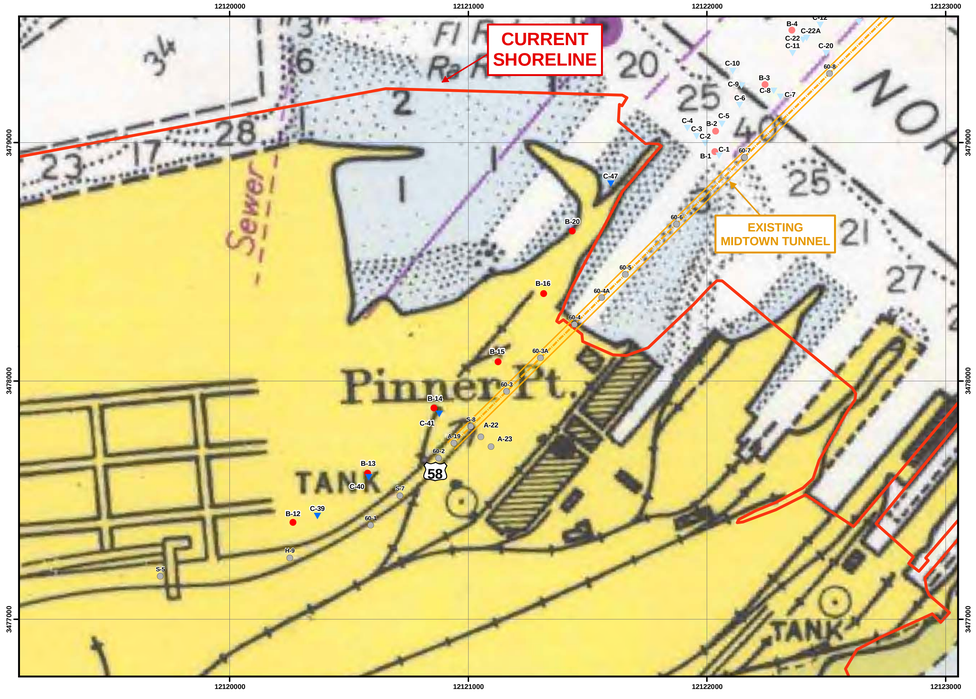
1894 CHART



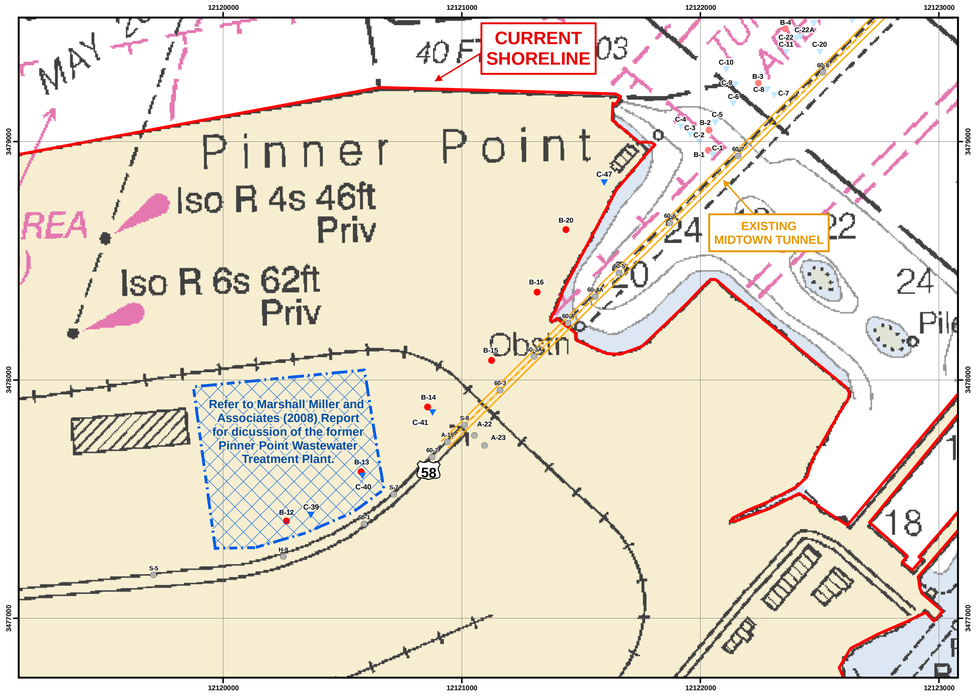
1930 CHART



1969 CHART



2008 CHART



LEGEND

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Fugro Marine Exploration Locations

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- C-23 — CPT

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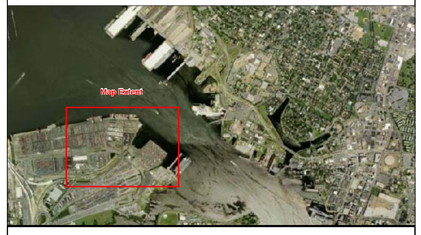

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PORTSMOUTH SITE DEVELOPMENT
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

0 300 600 Feet

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Nov. 2008	Report Submittal	KCS	KRS	KRS
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JOB NUMBER: 3602.001 CHART NO.: 3

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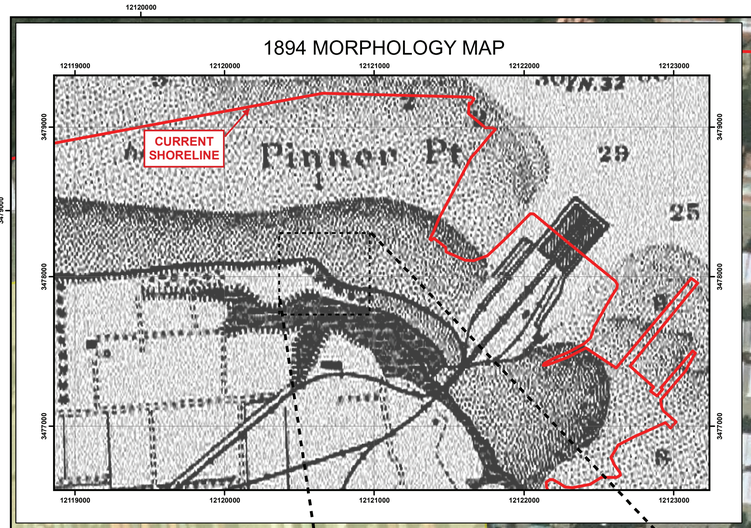

CURRENT SHORELINE

af 1969

af 1915

EXISTING MIDTOWN TUNNEL

DATE INDICATES DATE OF MAP WHEN FILL WAS FIRST DOCUMENTED

Former Railroad Pier No. 4

Former Railroad Pier No. 2

af 1959

af 1969

af 1930

af 1915

RECLAIMED LAND
INSHORE FILLS

UL

LL

MF

ORIGINAL SHORELINE

Uplands (UL)

Lowlands (LL)

Mud Flats (MF)

12120000 12121000 12122000

3479000 3478000 3477000

LEGEND

1894 Interpreted Morphology
See the table below for source used as basis of interpretation.

- Mud Flats (MF)- Likely fine-grained sediments with organics
- Lowlands (LL)- Unknown material types
- Uplands (UL)- Likely sandy materials

Historical Fill
Date when fill was first documented.
Refer to the table below for historical charts used to map fill bodies.

- Artificial Fill (af), 1969
- Artificial Fill (af), 1959
- Artificial Fill (af), 1930
- Artificial Fill (af), 1915

Data indicates year of map in which the fill first appeared on the map.
For example, "Fill, 1959" body first appeared on the 1959 map and was placed sometime between 1930 and 1959.

VDOT Land Exploration Locations

- B-18: Boring
- C-43: CPT

Fugro Marine Exploration Locations

- 08-09: Boring
- C-23: CPT

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1894 MORPHOLOGY AND SUMMARY OF HISTORICAL FILL AREAS PORTSMOUTH

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

0 100 200 Feet

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
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JOB NUMBER: 3602.001 CHART NO.: 4

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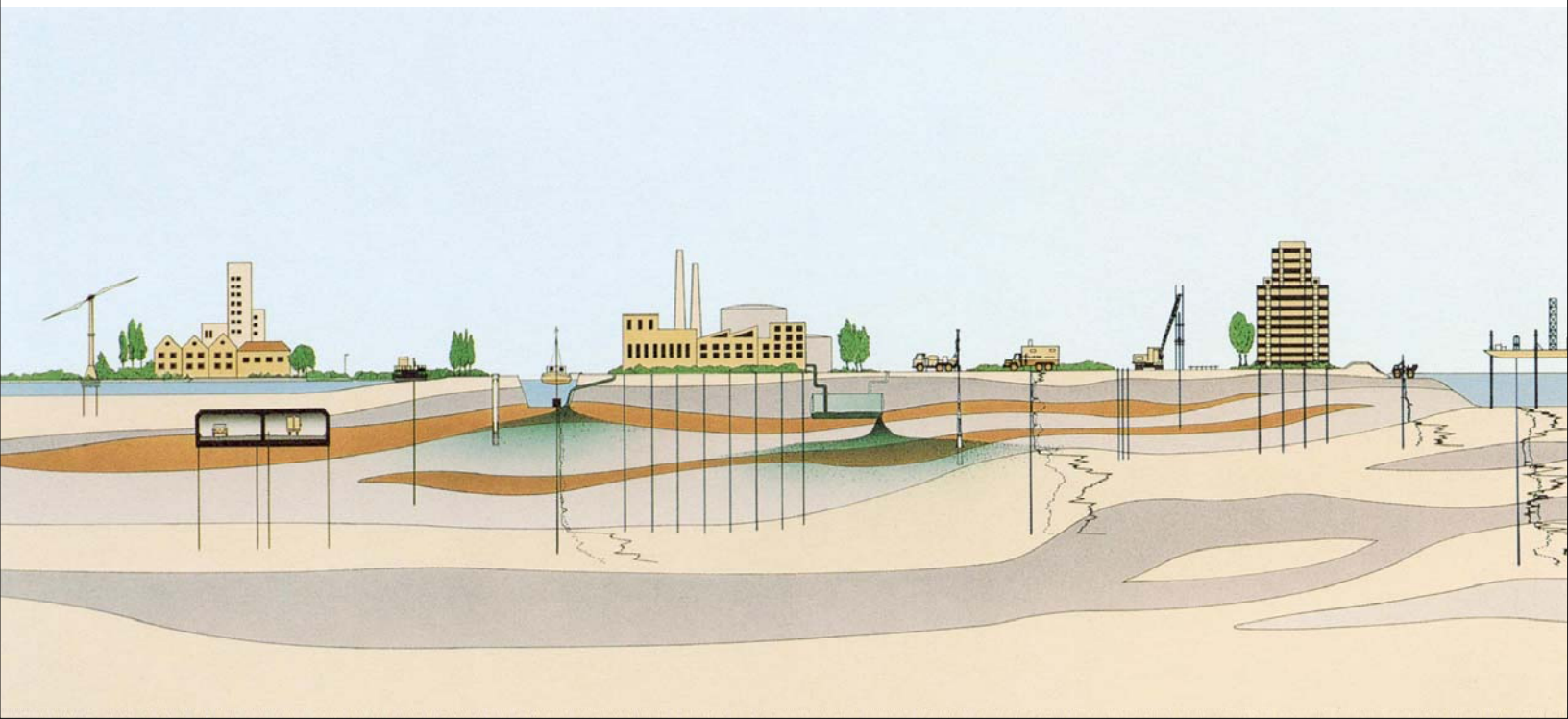
-VOLUME 4-
ELIZABETH RIVER
SITE CHARACTERIZATION REPORT
PROPOSED MIDTOWN SECOND PARALLEL TUNNEL

Prepared for:
VIRGINIA DEPARTMENT OF TRANSPORTATION

October 2008
Fugro Project No. 3602.001



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World Trade Center
101 West Main Street, Suite 350
Norfolk, Virginia 23510
Tel: (757) 625-3350
Fax: (757) 628-8244

October 21, 2008
Project No. 3602.001

Virginia Department of Transportation
1221 E. Broad Street
Richmond, Virginia 23219

Attention: Mr. Raymond Partridge, Project Manager, Innovative Project Delivery

Subject: Volume 4, Elizabeth River Site Characterization Report, Proposed Midtown Second Parallel Tunnel

Dear Mr. Partridge:

Fugro Atlantic (Fugro) has completed an extensive marine survey and geotechnical site exploration program in support of the Virginia Department of Transportation's (VDOT) proposed Midtown Second Parallel Tunnel. The data obtained during the exploration will assist in the characterization of the river bottom conditions, subsurface stratigraphy, and sediment characteristics at the site of the proposed Midtown Second Parallel Tunnel. This report characterizes the findings of the integrated marine site investigation, which consisted of: 1) geotechnical explorations, 2) a hydrographic survey, and 3) a seismic reflection survey. Factual data reports (under separate covers) present: geotechnical data in the form of Boring, CPT, and T-Bar logs, as well as vane shear and laboratory test plots; hydrographic data in the form of bathymetry charts, side scan sonar mosaics, and magnetometer anomaly charts; and seismic reflection data in the form of examples.

It has been a pleasure working with you through this phase of the project. We look forward to the opportunity to provide continued support as the project progresses.

Sincerely,

FUGRO ATLANTIC

Matthew Q. Pollard, P.E.
Project Engineer

Kevin R. Smith, P.G.
Senior Engineering Geologist

Thomas W. McNeilan, P.E.
Vice President

COMMONWEALTH OF VIRGINIA
THOMAS WILLIAM MCNEILAN
Lic. No. 44952
PROFESSIONAL ENGINEER

Copies Submitted: (4) Addressee and PDF provided on CD
(1) Mr. John Daoulas, P.E., Senior Geotechnical Engineer for Special Projects, VDOT

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APPENDICES

APPENDIX A ELIZABETH RIVER TUNNEL COMMISSION SECOND ELIZABETH RIVER TUNNEL AND APPROACHES 1960 DRAWINGS

APPENDIX B SEWER PIPELINES, HAMPTON ROADS SANITATION DISTRICT 1967 DRAWINGS

APPENDIX C WATER PIPELINES, DEPARTMENT OF UTILITIES CITY OF NORFOLK 1974 DRAWINGS

APPENDIX D MASTER LAND USE PLANS, PORTSMOUTH MARINE TERMINAL VIRGINIA PORT AUTHORITY 1193 DRAWINGS

1.0 INTRODUCTION

1.1 PROJECT OVERVIEW

The proposed Midtown Second Parallel Tunnel is a main component of the major infrastructure improvement project aimed at providing increased capacity for east-west travel across the Elizabeth River. The Second Parallel Tunnel will extend between: 1) U.S. Route 58 and Interstate 264 in Portsmouth, and 2) Brambleton Avenue/Hampton Boulevard in Norfolk. The existing Midtown Tunnel first opened to traffic in 1962 and provides one lane of travel in each direction. The second tunnel will provide two westbound travel lanes, allowing the existing tunnel to accommodate two lanes of eastbound traffic. Additionally, the second tunnel will provide increased flexibility for redirecting traffic during maintenance operations and emergency situations.

The original tunnel and interchange design from the 1960s anticipated that a second tunnel would be built to the north of the existing tunnel. A second tunnel in this configuration and arrangement can be accommodated on the Norfolk side of the river with relatively minor engineering adjustments to the present interchange. In the city of Portsmouth, the MLK Freeway is a north-south, four-lane link that provides access to the City of Norfolk via the Midtown Tunnel. The MLK Freeway Extension, a component of the overall infrastructure improvement project, will extend the freeway to the south and provide a direct, limited access connection from I-264 to the Midtown Tunnel.

Currently, significant traffic congestion occurs at the tunnel during both the morning and evening peak periods. Preliminary information provided by Virginia Department of Transportation (VDOT) indicates that the second tunnel will be located northwest (downstream) of, and parallel to, the existing tunnel, following a similar vertical alignment. VDOT has defined the project area to extend 300 feet northwest (downstream) of the northern edge of the existing tunnel. The project vicinity is shown on Figure 1-1.

The current report is part of a series of geotechnical exploration and survey activities for the Second Parallel Tunnel. Figure 1-2 shows the organization of the various reports that are being prepared for the geotechnical exploration and surveys for the project.

1.2 SCOPE OF WORK

The Midtown Second Parallel Tunnel marine exploration program involved the collection and integration of geotechnical, hydrographic (river bottom charting), and geophysical (seismic reflection) data within the project area. The marine exploration program was designed to conduct a series of complimentary, multidisciplinary investigations that acquired data which, when integrated together, allow for characterization of the site's river bottom and sub-bottom conditions. The scope of work performed as part of this program is described in this section.

1.2.1 Marine Geotechnical Exploration and Laboratory Testing Program

The marine geotechnical exploration and laboratory testing program consisted of three major components: 1) marine drilling and sampling from February 24, 2008 through March 4, 2008 using Fugro Seacore's *Skate 2D* jack-up platform, 2) cone penetration test (CPT), T-bar, and vane shear testing from April 24, 2008 through April 30, 2008 using Fugro Alluvial Offshore Limited's Roson in situ testing system, and 3) onboard and onshore laboratory testing of samples collected during the drilling operations.

The marine geotechnical field program included the following explorations, as shown on Figure 1-3, Chart 1, and listed in Table 4-1:

- 10 marine borings, advanced to depths ranging from 79 to 127 feet below the river bottom;
- 40 CPT soundings advanced 15 to 98 feet below the river bottom;
- 4 T-Bar soundings advanced 12 to 38 feet below the river bottom; and
- 4 vane shear test profiles advanced 10 to 40 feet below the river bottom.

The laboratory program included the following types of tests:

- Index Properties (Moisture, Density, Atterberg Limits, Grain Size Distribution, Specific Gravity, Organic Content);
- Corrosivity (Resistivity, pH, Chloride Content, Sulfate Content);
- Onboard Strength Tests (Pocket Penetrometer, Torvane, Minivane, UU Triaxial);
- Advanced Strength Tests (Direct Shear, CD and CU Triaxial); and
- Compressibility (Incremental and CRS Consolidation).

A description of the field program, laboratory testing procedures, exploration logs, and results from the in situ and laboratory tests are provided on our Geotechnical Data Report (Fugro, 2008a).

1.2.2 River Bottom Charting

The river bottom charting survey was conducted from February 14 through 21, 2008. Figure 1-4 shows the extents of the respective surveys.

The river bottom charting survey was conducted in advance of the seismic reflection survey and geotechnical investigation to document water depths, map the river bottom, and identify obstructions within the project area. For this phase of work, McKim & Creed under subcontract to Fugro collected a suite of bathymetric, side scan sonar, and magnetometer data from their survey vessels *S/V Clock* and *S/V Philly II*. Bathymetric data were collected using a multibeam echosounder for about 75 percent of the area, while the balance of the survey was performed using a single beam echosounder in shallow water areas near the Norfolk shoreline.

A description of the river bottom charting survey and charts which present the survey data are provided on our River Bottom Charting Data Report (Fugro, 2008b).

1.2.2.1 Limited Shoreline Land Survey

To support the marine survey program, a limited conventional land survey was conducted along the Norfolk and Portsmouth shorelines. The survey was conducted on February 21 and 29, 2008, by NXL, Inc., under subcontract to Fugro. The purpose of the land survey was to locate (relative to the project's horizontal datum) various existing Midtown Tunnel structures and the shore crossings of the City of Norfolk's 30-inch-diameter water pipeline and Hampton Roads Sanitation District's 42-inch-diameter sewer pipeline. The land survey information was used to assist locating the respective features during the marine survey program and identify safe locations for the geotechnical subsurface explorations.

1.2.3 Seismic Reflection Survey

Seismic reflection records are produced when an acoustic energy source generates a pulse of sound that travels through the water column and penetrates into the seabed. The media (water, sediment, rock) through which the sound passes affects the acoustic signal in various ways. The more dense a medium, the faster is the speed of sound, and thus as the wave front passes through materials with different densities, its rate of progress varies. At the interface between layers of different velocities (velocity contrasts or reflectors), some of the energy is reflected. These reflections are detected by the hydrophone array.

The seismic reflection survey for the Midtown Second Parallel Tunnel was conducted between February 21 and 27, 2008 by Fugro aboard McKim & Creed's survey vessel. The seismic survey operated two systems simultaneously: 1) a subbottom Chirp profiler, and 2) a single-plate boomer source with multichannel hydrophone array. The smaller Chirp system was used to image the upper few tens of feet of sediment, while the larger boomer system was used to image the sediment sequence down to more than 200-ft-depth.

The survey was conducted along a predefined grid of track-lines that totaled 18 nautical miles. Vessel trackline locations are shown on Figure 1-5. Two sets of survey track-lines traverse the survey area. One set is a grid of densely- spaced track-lines run normal to each other, which encompass the existing tunnel and proposed tunnel area (approximately 1,000 feet in the upstream and downstream direction). Those track-lines include the 100 series of track-lines, oriented parallel to the existing tunnel and the 200 series of track-lines oriented parallel to the river. The objective of those track-lines is to provide data coverage and subsurface information for the proposed second parallel tunnel alignment.

The other 300 series track-lines extend beyond the immediate proposed second parallel tunnel area and, when possible, were run normal to each other. Due to the narrow width of the river and other obstructions, some of the regional 300 series track-lines were run at oblique angles to each other. The purpose of the regional track-lines is to provide a framework that allows a correlation between regional conditions and the proposed future alignment.

A description of the seismic data acquisition and post-processing procedures are provided the Seismic Reflection Data Report (Fugro. 2008c).

1.3 PROJECT DATUMS

Positioning information during all survey operations were output from a Real Time Kinematic GPS and logged as State Plane (Virginia South, feet) grid coordinates with the following spheroidal projection and projection parameters:

Datum	NAD83
Spheroid	GRS80
Semi-major Axis	6,378,137.000 m
Semi-minor Axis	6,356,752.314 m
Inverse Flattening	298.2572235630
Eccentricity^2	0.006694379990141
Projection	Lambert Conformal Conic
Grid	Lambert Conformal Conic (NAD83)
Zone	Virginia South (feet)
Latitude of Origin	36° 19'59.998"
Longitude of Origin	-78° 50' 00.000" W
False Easting	11,482,916.667 ft
False Northing	3,280,833333 ft
Scale Factor	0.3048
Convergence	World Standard

The vertical datum used during data acquisition of the field survey was North American Vertical Datum of 1988. Units used during the field survey were as follows:

- Linear units were feet,
- Angular units were degrees (°), and
- Time was recorded as local time in the field logs.

For reporting and charting, vertical units were converted to reference the vertical datum Mean Lower Low Water (MLLW). Measured water depths were corrected to MLLW based upon tidal data obtained from the National Oceanic and Atmospheric Administration tide gauge Station No. 8638610 (1983 through 2001 tidal epoch) located at Sewells Point, Hampton Road.

1.4 AUTHORIZATION

Fugro's marine survey and geotechnical site exploration program in support of the VDOT proposed Midtown Second Parallel Tunnel project was authorized by an Interagency Agreement between the Virginia Port Authority (VPA) and VDOT. Fugro's services for the Second Parallel Tunnel were completed in general accordance with our proposal, dated January 7, 2008. The execution of that scope of work was authorized by amendments of the contract between the VPA and the Craney Island Design Partners, LLC and the associated subcontract between the CIDP and Fugro Atlantic.



Aerial Photo Source: Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <<http://datagateway.nrcs.usda.gov/>>

PROJECT VICINITY MAP
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 1-1

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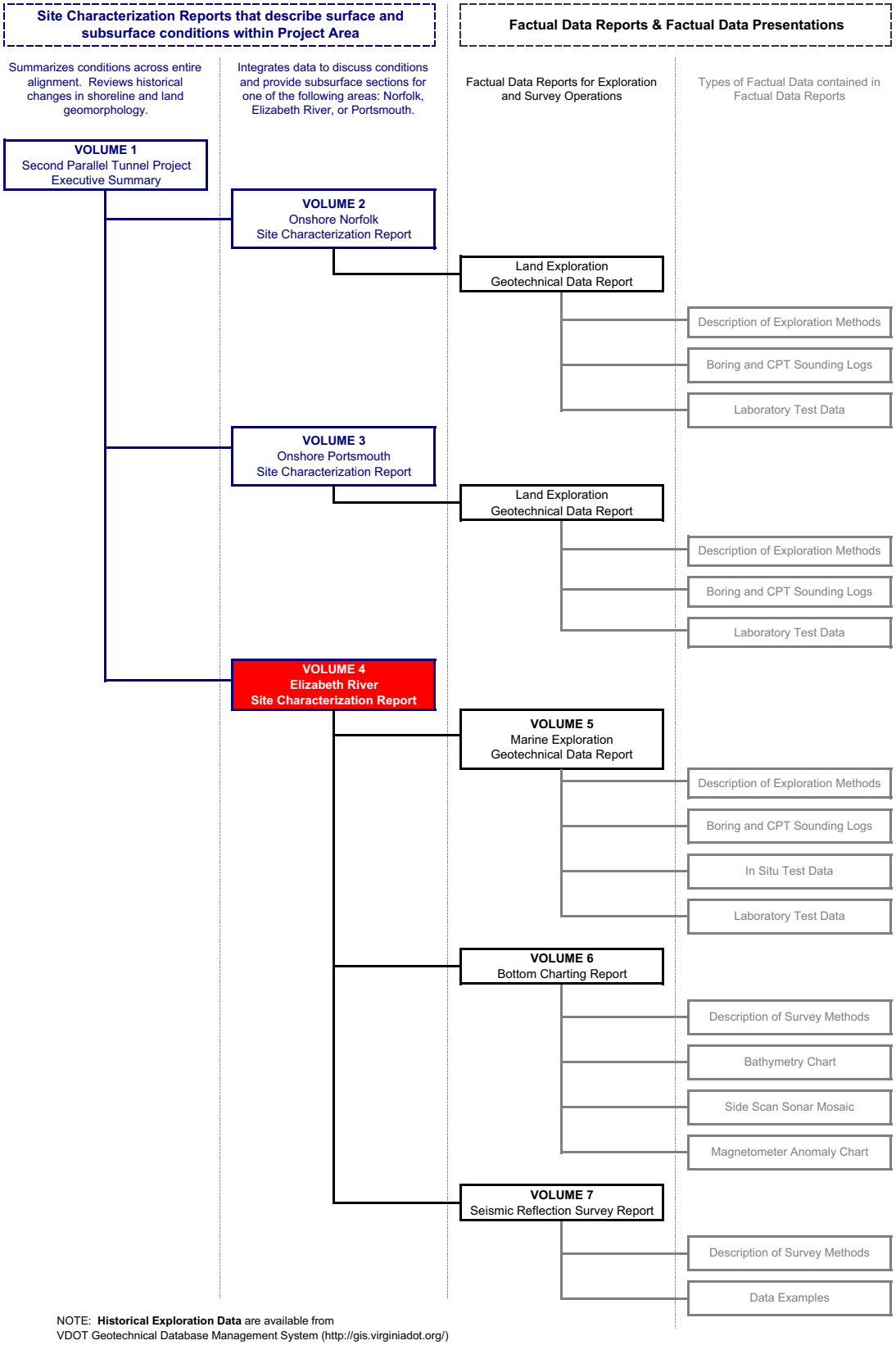

NOTE: **Historical Exploration Data** are available from
VDOT Geotechnical Database Management System (http://gis.virginiadot.org/)

GEOTECHNICAL REPORT ORGANIZATION

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 1-2



LEGEND

2008 Fugro Marine Exploration Locations

- C-38 ▼ CPT
- B-11 ● Boring
- T-4 ◆ T-bar
- V-4 ■ Vane Shear

1960 Exploration Locations

- B-11 ● Boring (by others)
- Cross Section Location
- Bathymetric Contour in Feet (MLLW) Contour interval is 5 ft.
- Approximate Location of Midtown Tunnel Not for design or construction planning (Refer to Section 7.1 in text)

NOTE

1) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

N
W E
S

0 300 600 Feet

MARINE GEOTECHNICAL EXPLORATION AND CROSS SECTION LOCATIONS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 1-3

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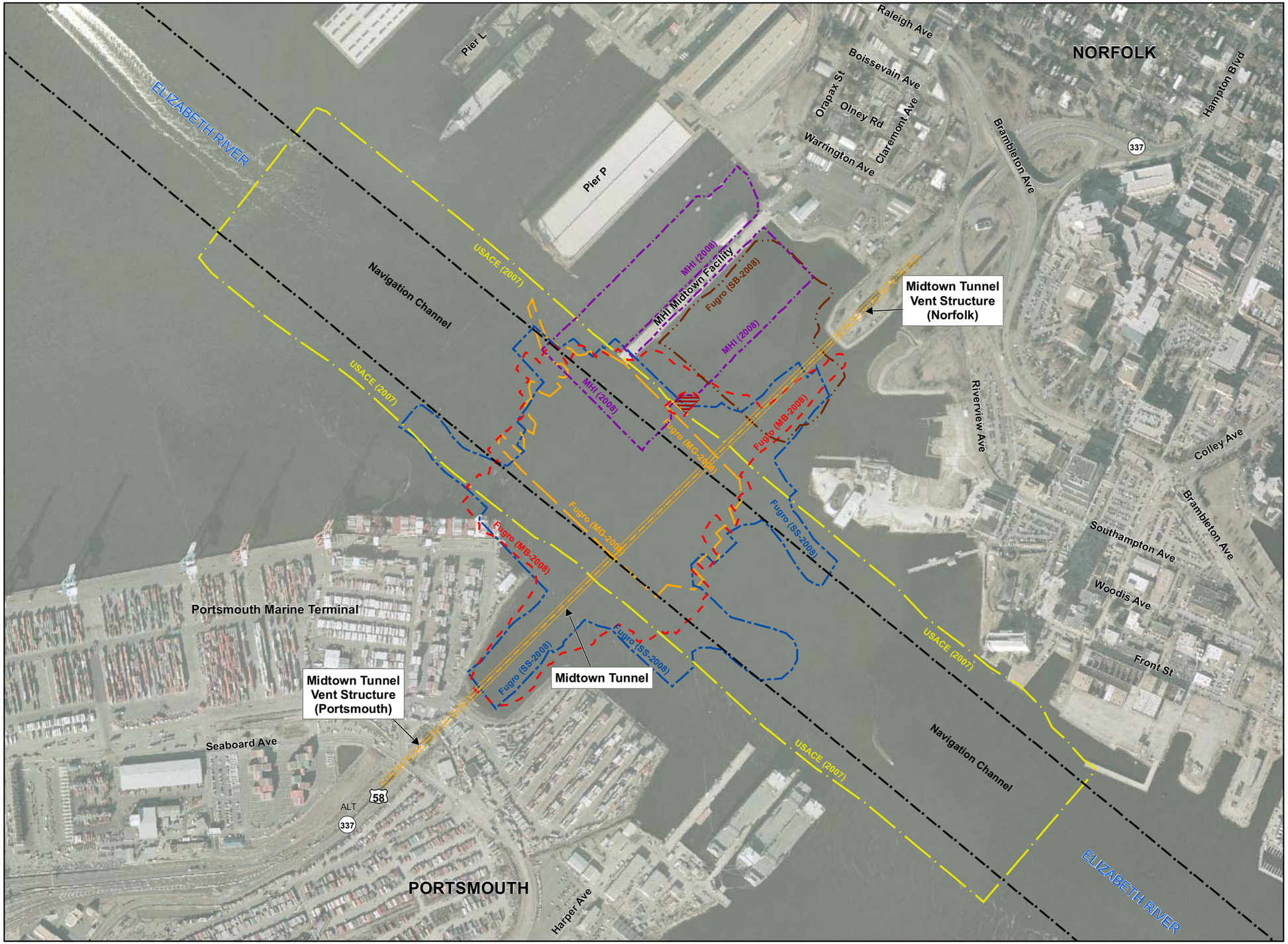

LEGEND

Survey Boundaries and Data Sources
Data From Midtown Second Parallel Tunnel Project

- Fugro (MB-2008): Multibeam Bathymetry Data Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM ES3 Multibeam echosounder (240 Khz - 120 degree swath).
- Fugro (SB-2008): Single Beam Bathymetry Data Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM Echotrak Dual Frequency echosounder (200/28 kHz)
- Fugro (SS-2008): Side Scan Sonar Data Surveyed by McKim & Creed between February 13th and 22nd, 2008, using a Marine Sonics Side Scan Sonar system (600 kHz).
- Fugro (MG-2008): Magnetometer Data Surveyed by McKim & Creed between February 13th and 22nd, 2008, using a Marine Magnetics Sea SPY magnetometer.

Data From Other Area Projects

- MHI (2008): Marine Hydraulics International, Inc. Single Beam Bathymetry Data Surveyed by Waterway Surveys & Engineering, Ltd. at Lamberts Point between February 6th and 7th, 2008.
- USACE (2007): U.S. Army Corps of Engineers Multibeam Bathymetry Data Surveyed by United States Army Corps of Engineers- Norfolk District on March 26, 2007.
- Area Obstructed During Fugro 2008 Survey
- Approximate Location of Midtown Tunnel Not for design or construction planning (Refer to Section 7.1 in text)

NOTE

1) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

N
W E
S

0 600 1,200 Feet

RIVER BOTTOM CHARTING SURVEYS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 1-4

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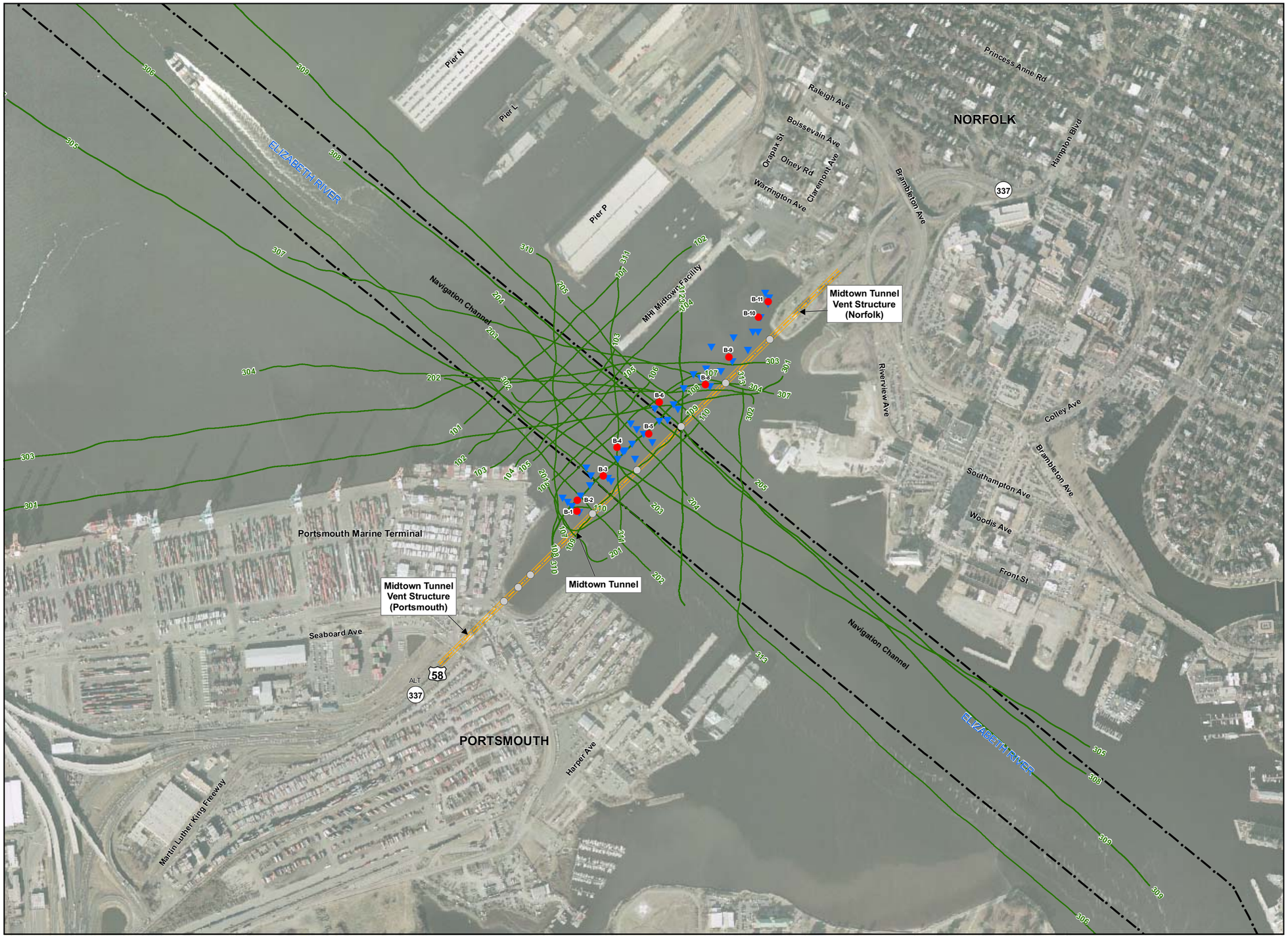
Virginia Department of Transportation
Project No. 3602.001



LEGEND

313 — Marine Seismic Reflection Lines
Number is survey line number.

2008 Exploration Locations

- CPT
- B-11 Boring

1960 Exploration Locations

- Boring (by others)
- Approximate Location of Midtown Tunnel
  Not for design or construction planning.
  (Refer to Section 7.1 in text)

NOTES

1) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

2) Geophysical survey utilized 1) a 3.5 kHz high-resolution subbottom profiler and 2) a boomer source with multi-channel hydrophone array seismic reflection system.

3) Ship tracklines 301, 303, 305, 306, and 309 extend beyond extent shown on figure.

N
W E
S

0 800 1,600 Feet

SEISMIC REFLECTION SURVEY
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 1-5

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2.0 HISTORICAL ACTIVITIES

We reviewed readily available engineering design drawings, maps, charts, and aerial photographs in an effort to understand the historical development of the site. Information displayed on those documents provides information about: 1) where structures may exist on the site and 2) historical site development. When put in a chronologic sequence, the documents provide insight when structures may have been abandoned and where potential remnants may exist. This information provides valuable insight when reviewing the project's geotechnical and geophysical data and understanding the site's current conditions. Selected documents are included in this report as the appendices listed in Table 2-1. Table 2-2 lists the documents reviewed. The following discussion provides a summary of our data review and understanding of the Elizabeth River development since 1888 (the date of the earliest available information).

Table 2-1. Data Reviewed Included as Appendices

Year	Drawing Set	Appendix
1960	Elizabeth River Tunnel Commission, Second Elizabeth River Tunnel and Approaches	A
1967	Sewer Pipelines, Hampton Roads Sanitation District	B
1974	Water Pipelines, Department of Utilities, City of Norfolk	C
1993	Master Land Use Plans, Portsmouth Marine Terminal, Virginia Port Authority	D

Table 2-2. Data Reviewed

Year	Map/Photo	Scale
1887	Sanborn Map & Publishing Co., Norfolk Virginia	1:2,400
1888	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1893	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1894	NOAA Chart BiC-45, Hampton Roads	1:20,000
1898	Sanborn Map & Publishing Co., Norfolk Virginia	1:9,600
1903	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1910	Sanborn Map & Publishing Co., Norfolk Virginia, Vol. 1	1:9,600
1915	NOAA Chart No. 400, Hampton Roads	1:20,000
1920	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1921	Sanborn Map & Publishing Co., Norfolk Virginia, Vol. 3	1:9,600
1923	NOAA Chart No. 400, Hampton Roads	1:20,000
1924	NOAA Chart No. 400, Hampton Roads	1:20,000
1926	NOAA Chart No. 400, Hampton Roads	1:20,000
1928	NOAA Chart No. 400, Hampton Roads	1:20,000
1930	NOAA Chart No. 400, Hampton Roads	1:20,000

Table 2-2. Data Review - Continued

Year	Map/Photo	Scale
1932	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1959	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1968	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1969	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1975	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
1994	Digital Ortho Quarter Quadrangle, USGS Geological Survey	1.0 m/pixel
2005	NOAA chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
2006	Ortho-Rectified Chesapeake Aerial Imagery	0.5 m/pixel

Data listed above are not included as appendices, but where relevant, are displayed on figures and charts.

2.1 NAVIGATION CHANNEL DREDGING AND RIVERFRONT DEVELOPMENT

Norfolk and Portsmouth are bordered by bodies of water which are and have been for hundreds of years vital to the local economies. The Elizabeth River is a vital link for commercial and military traffic, as well as for recreational vessels transiting the Atlantic Intercoastal Waterway. Development of the project area is summarized in Table 2-3 below. In addition, historical progression of dredge depths and shoreline development at the project site are displayed via inset charts on Figure 2-1. This figure depicts the development of the Elizabeth River site in the form of four historical NOAA charts from years 1894, 1930, 1969, and 2008. These four charts illustrate key development and demolition events which impact the site.

- The 1894 chart shows navigation channel depth at about 30 feet, and the presence of a rail pier south of the existing tunnel location (Portsmouth side).
- By 1915, railroad piers were present both north and south of the existing tunnel alignment; however, the 1930 chart is shown because we believe it depicts the old rail piers in relation to the current shoreline more accurately. Though not labeled on the charts, these piers are believed to be the former Southern Railroad Piers Nos. 4 and 2, respectively.
- The 1930 chart shows a 500-foot-wide navigation channel to a depth of 40 feet.
- The 1969 chart suggests that the pier directly north of the existing tunnel alignment (former Southern Railroad Pier No. 4) underwent at least partial demolition. Though first appearing on the 1959 chart, the 1969 chart depicts the locations of the water and sewer lines ("Pipeline Area"), which cross the river, and the Norfolk approach of the existing tunnel.
- Today, the United States Army Corps of Engineers (USACE) maintains the 750-foot-wide navigable channel of the Elizabeth River in the project area to a minimum depth of about 55 feet.

Table 2-3. Elizabeth River Development

Year	Map/Photo	Channel Development (Approximate values in feet)		Riverfront Development
		Depth	Width	
1887	Sanborn Map & Publishing Co., Norfolk Virginia			N/A
1888	Sanborn Map & Publishing Co., Portsmouth Virginia			N/A
1893	Sanborn Map & Publishing Co., Portsmouth Virginia			N/A
1894	NOAA Chart BiC-45, Hampton Roads	26 to 36 (MLW)	1,000	
1898	Sanborn Map & Publishing Co., Norfolk Virginia			N/A
1903	Sanborn Map & Publishing Co., Portsmouth Virginia			Portsmouth: Large amount of fill placement to develop Pinners Pt. and four piers.
1910	Sanborn Map & Publishing Co., Norfolk Virginia, Vol. 1			Norfolk: Colley Creek filled (length of ~1,500 ft). Docks south of future tunnel opening.
1915	NOAA Chart No. 400, Hampton Roads	35 (MLW, survey date - 1913)	400	Norfolk: Tarrant Creek tributaries filled to one single branch. Portsmouth: Number of piers increased to 7 from 4.
1920	Sanborn Map & Publishing Co., Portsmouth Virginia			None
1921	Sanborn Map & Publishing Co., Norfolk Virginia, Vol. 3			Norfolk: Tributaries of Smith Creek filled (length= ~ 1,800 ft); Norfolk & Western Railway Piers L and S built (west of future tunnel).
1923	NOAA Chart No. 400, Hampton Roads	40 (MLW)	400	Norfolk: Another small portion filled up the center of Smith Creek (length= ~1,200 ft); Norfolk & Western Railway Pier N built.
1924	NOAA Chart No. 400, Hampton Roads	40 (MLW)	400	None
1926	NOAA Chart No. 400, Hampton Roads	34 MLW (survey date - 1925)	500	None

Table 2-3. Elizabeth River Development Continued

Year	Map/Photo	Channel Development (Approximate values in feet)		Riverfront Development
		Depth	Width	
1928	NOAA Chart No. 400, Hampton Roads	37 (survey- 1927)	500	Tributary on Norfolk side cut into west edge of Tarrant Creek. Material infill on Portsmouth side (west of westernmost pier).
1930	NOAA Chart No. 400, Hampton Roads	40 (MLW, survey date - 1929)	500	None
1932	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	40 (MLW)	750	Dredging just below Pinner Pt. to 12ft.
1959	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	38 (MLW)	750	Norfolk: Infill of Tarrant Creek tributary Pier demolished south of Tarrant Creek. Portsmouth: Material filled in north Pinner Pt. and between railroad tracks in southeast Pinner Pt. Lambert Creek filled and piers N, L, S modified.
1968	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	40 (MLW, survey date - 1/68)	750	Norfolk: Pier P built; infill of Tarrant Creek for Midtown Tunnel; infill in Scott Creek for Brambleton Ave. bridge. Portsmouth: Pier demolished and infill of material North Pinner Pt. and South Pinner Pt.; Piers modified.
1969	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	40 (MLW, survey date - 5/68)	750	None
1975	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	40 (MLW, survey date - 5/74)	750	Norfolk: Slight land modification southeast of Midtown Tunnel opening. Portsmouth: Increased dredging north of Pinner Pt. and spit development in northwest Pinner Pt. (location of demolished pier).
1994	Digital Ortho Quarter Quadrangle, USGS Geological Survey			

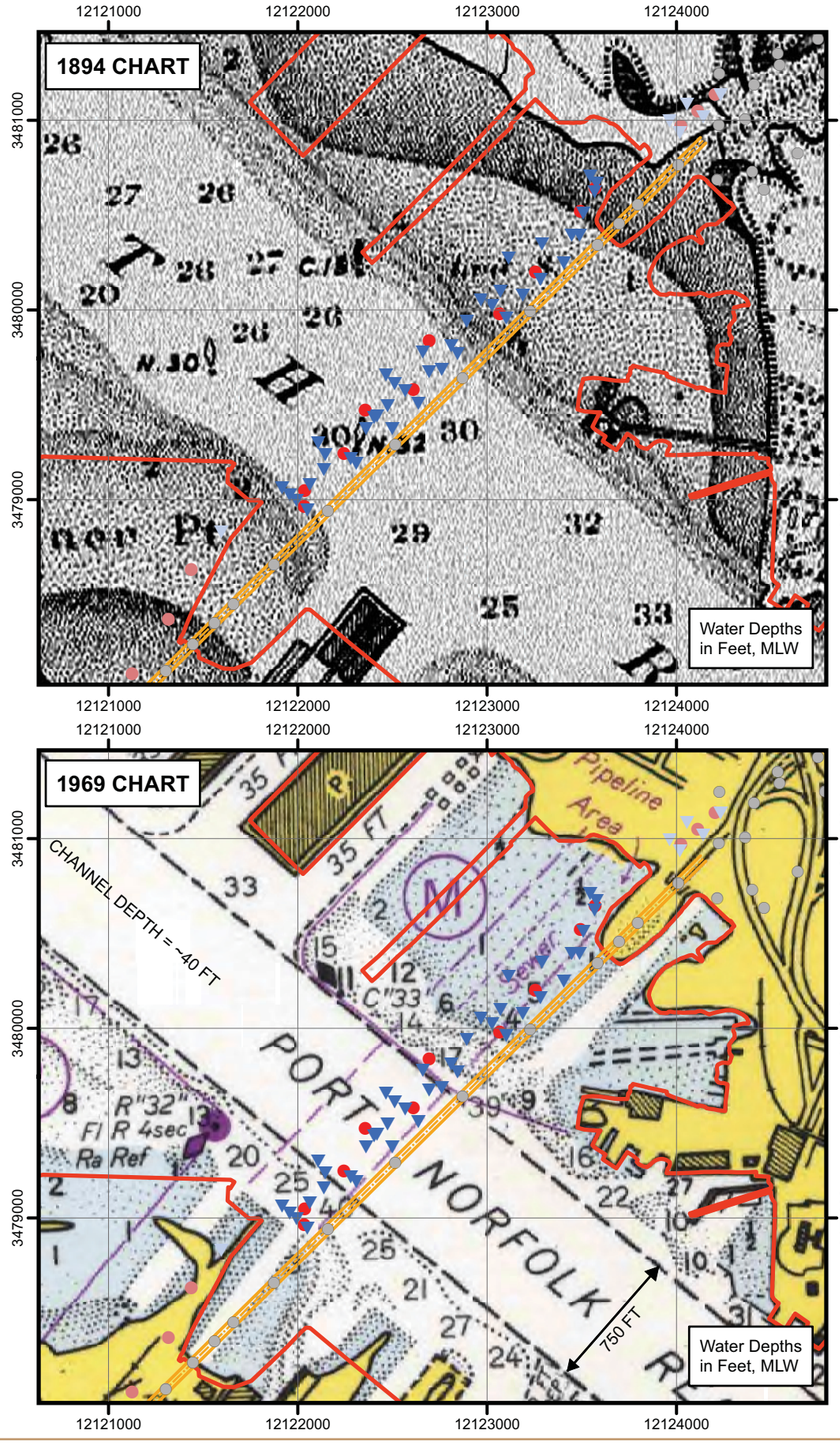
Table 2-3. Elizabeth River Continued

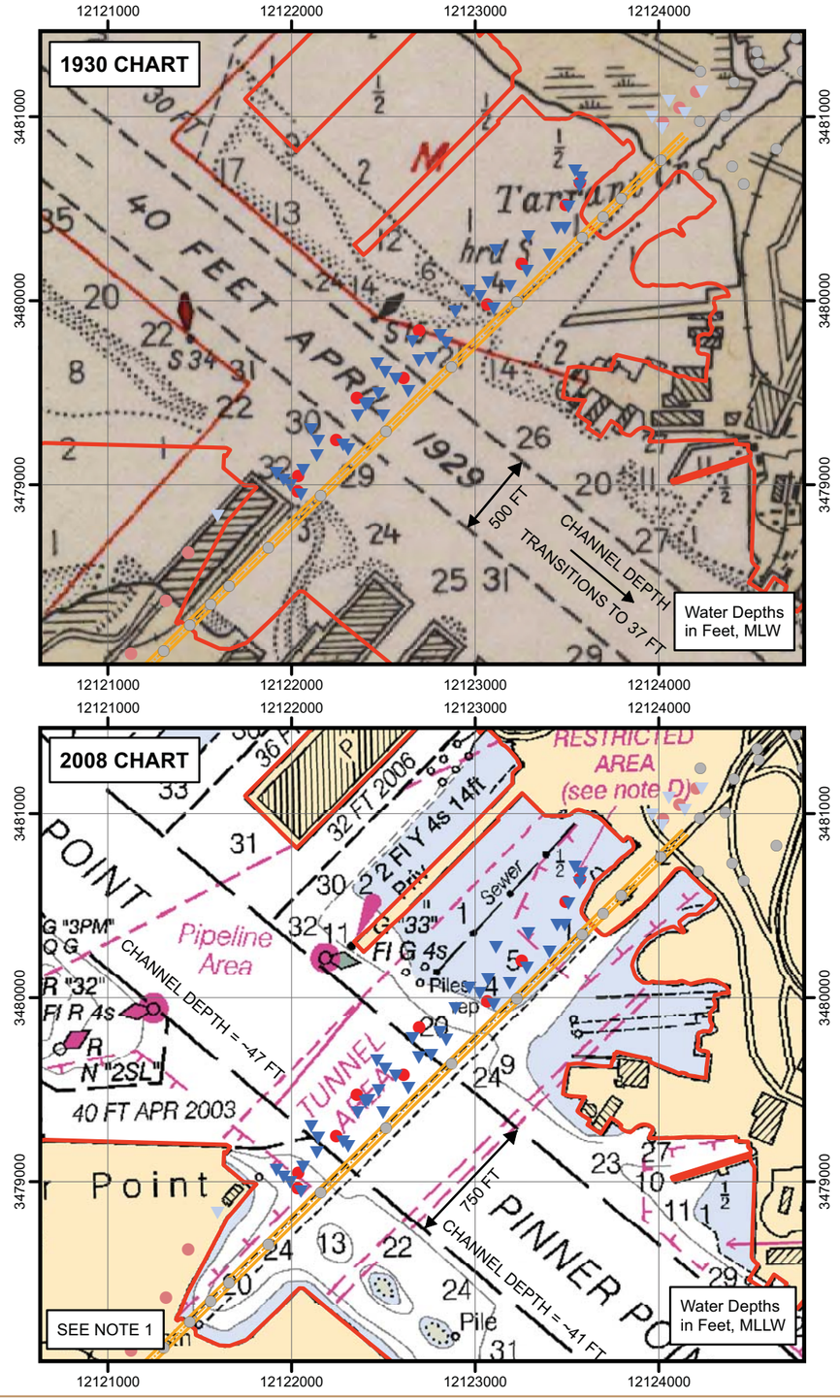
Year	Map/Photo	Channel Development (Approximate values in feet)		Riverfront Development
		Depth	Width	
2005	NOAA chart No. 12253, Norfolk Harbor and Elizabeth River	40 (MLLW)	750	Norfolk: Pier L shortened and Pier S demolished; small pier built northwest of tunnel and sewer lines. Portsmouth: Large modifications to Pinner Pt.; large amount of infill (north and south of tunnel opening) and pier modifications.
2006	Ortho-Rectified Chesapeake Aerial Imagery			Norfolk: Extension of pier northwest of Midtown Tunnel
2008	NOAA chart No. 12253_1, Norfolk Harbor and Elizabeth River	44 (MLLW) downstream, 39 upstream (survey date 3/07)	750	None
2008	Fugro Bathymetric Survey	47 (MLLW) downstream, 41 upstream	750	None

MLW = Mean Low Water

2.2 FIRST TUNNEL CONSTRUCTION

Waterways critical to naval operations cannot be blocked by a bridge collapse in the event of disaster or war. The presence of Norfolk Navy Base (downstream), and Norfolk Naval Shipyard (upstream) necessitated the need for a tunnel versus bridge at this site. The Midtown Tunnel opened to traffic in September 1962. The method of construction was immersed tube cut-and-cover. Design drawings from 1960 (Appendix A) show dredge cuts laid back at between 1.5 and 2.0:1.0 (horizontal to vertical). Evidence gathered during our 2008 site investigation suggests that the dredge cuts for the tunnel were flatter, constructed between approximately 2.0 and 3.5:1.0 (this will be discussed in greater detail in Section 3.5.4 below). Tunnel segments were built offsite, floated and sunk into place, welded together, and drained. Design drawings show the tunnel bottom resting on a coarse foundation with special backfill to the tunnel springline. Ordinary backfill is shown placed to a minimum cover of 5 feet. Design drawings also show a 5-foot-thick stone blanket on the Portsmouth approach for protection against tunnel roof penetration.





LEGEND

- Current Shoreline (digitized from 2005 aerial photograph)
- Approximate Location of Midtown Tunnel (Refer to Section 7.1 in text)
- 2008 Fugro Marine Boring Location
- 2008 Fugro Marine CPT Location
- 2008 VDOT Land Boring Location
- 2008 VDOT Land CPT Location
- Historical VDOT Boring Location

LIST OF MAPS AND AERIAL PHOTOS REVIEWED
Highlighted maps/photos are shown on this chart

Year	Map/Photo	Scale
1887	Sanborn Map & Publishing Co., Norfolk Virginia	1:2,400
1888	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1893	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1894	NOAA Chart BIC-45, Hampton Roads	1:20,000
1898	Sanborn Map & Publishing Co., Norfolk Virginia	1:9600
1903	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1910	Sanborn Map & Publishing Co., Norfolk Virginia, Vo. 1	1:9,600
1915	NOAA Chart No. 400, Hampton Roads	1:20,000
1920	Sanborn Map & Publishing Co., Portsmouth Virginia	1:600
1921	Sanborn Map & Publishing Co., Norfolk Virginia, Vo. 3	1:9,600
1923	NOAA Chart No. 400, Hampton Roads	1:20,000
1924	NOAA Chart No. 400, Hampton Roads	1:20,000
1926	NOAA Chart No. 400, Hampton Roads	1:20,000
1928	NOAA Chart No. 400, Hampton Roads	1:20,000
1930	NOAA Chart No. 400, Hampton Roads	1:20,000
1932	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1959	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1968	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1969	NOAA Chart No. 452, Norfolk Harbor and Elizabeth River	1:20,000
1975	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
1994	Digital Ortho Quarter Quadrangle, USGS Geological Survey	1.0 m/pixel
2005	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000
2005	Ortho-Rectified Chesapeake Aerial Imagery	0.5 m/pixel
2008	NOAA Chart No. 12253, Norfolk Harbor and Elizabeth River	1:20,000

NOTE

1) Information listed in "Elizabeth River Channel Depths" table on NOAA Chart 12253_1 (2008) indicates navigation channel project water depth is 45 ft (MLLW). Navigation channel project water depth is depth which channel has been approved to be dredged for navigation purposes. However, 2008 bathymetric survey indicates water depth in channel northwest of tunnel is approximately 47 ft (MLLW), and southeast of tunnel it is approximately 41 ft MLLW.

N
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S

0 800 1,600 Feet

ELIZABETH RIVER SITE DEVELOPMENT
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 2-1

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\05-ER_SiteChar\MXD\Figures\Fig-2-1_ElizRiver_Site_Development.mxd, 10/29/08, kstevens

3.0 RIVER BOTTOM CONDITIONS

3.1 BATHYMETRIC DATA SET

Bathymetry data for the project site were collected by both multibeam and single beam bathymetric systems. Where adequate water depth was present, the principal sounding data were acquired with the multibeam system. A single beam survey was conducted in the near shore area along the Norfolk side of the river where the water depth was too shallow to safely operate the multibeam system. A description of the bathymetry survey procedures and charts are provided in the Bottom Charting Data Report (Fugro, 2008b).

Bathymetric data from two other recent area surveys performed for projects unrelated to the Midtown Tunnel Second Parallel Tunnel project were obtained (by Fugro) to supplement as regional data. One data set was surveyed by the USACE on March 26, 2007, and used a multibeam system to survey the navigation channel and flanks of the channel. The other data set was surveyed by Waterway Survey and Engineering, Ltd. on February 6 and 7, 2008, for the berth area at the Marine Hydraulics International, Inc. facility. This survey is presumed to have been completed using a single beam system. Both data sets are referenced to MLLW and were incorporated by Fugro with the project data acquired by McKim & Creed to provide regional bathymetric data used for charting. The extents of the surveys are shown on Figure 1-4

3.2 BATHYMETRY

The existing Midtown Tunnel crosses the Elizabeth River where water depths range from less than five to approximately 55 feet (reference to MLLW), as shown on Figure 3-1 and Chart 2. Figure 3-2 presents a sun-illuminated shaded relief of the bathymetry. The navigation channel (deepest location) lies approximately midway between the two tunnel approaches and has a width of approximately 800 feet. Within the navigation channel and northwest of the existing tunnel the water depth is generally between 45 and 50 feet, and between 40 and 45 feet southeast of the tunnel. Deepening observed downstream of the tunnel is consistent with recent NOAA charts. Locally, above the existing tunnel the water depth exceeds 55 feet and at one location directly above the tunnel it is up to 60 feet deep. It appears that at that particular location, this localized deep area may be caused by scouring (refer to Section 3.4).

3.3 RIVER BOTTOM SLOPE GRADIENT

The river bottom is highly variable throughout the project area, as shown on Figure 3-3. Isobaths typically orient northwest-southeast following both the riverbanks and dredge cuts of the navigation channel. Natural slopes are not discernable in this highly utilized and developed portion of the river. Within the navigation channel limits, in water depths ranging between 50 and 55 feet, the river bottom is generally flat with slopes range between approximately 0 and 5 percent. The percent slope typically ranges between about 10 to 20 in the constructed slopes of the navigation channel, though approaches 50 in some areas near the toe of the slope. Outside the navigation channel, in areas disturbed during the 1960s construction of the existing tunnel, isobaths typically orient northeast-southwest, and the river bottom is variable. Percent slopes

here range from about 2 to 10 in the backfill above the existing tunnel, and to between 25 and 50 along the dredge cut on the Norfolk side of the river created during tunnel construction.

3.4 BATHYMETRIC FEATURES

Most of the bathymetric features observed in the bathymetric contours, sun-illuminated shaded relief, and slope gradient map were created by dredging activities that maintained the navigation channel, allowed access to berths, or were created during construction of various infrastructure (e.g. pipelines, tunnel, etc.). Several notable bathymetric features within the proposed second tunnel alignment area are described as follows.

Feature A (Figure 3-4a). Outside the navigation channel in the Norfolk side of the river, the river bottom shoals up to a water depth of less than 5 feet MLLW. This shoal area is elongated and oriented parallel to the existing tunnel. It is offset approximately 100 feet northwest of the existing tunnel with a shallow channel in between that has a water depth of least 10 feet. According to VDOT personnel, this 100 foot-wide area may have been dredged out to provide access for a construction barge(s) during construction of the existing tunnel. The westward edge of this dredge cut is highlighted on the shaded relief map shown on Figure 3-2 and the slope gradient map shown on Figure 3-3. Detailed images of this feature are shown on Figure 3-4.

Feature B (Figure 3-4a). A linear feature lying on the river bottom northwest of the Navigation Channel is observed in the single beam and multibeam survey data. The feature trends northeast-southwest, parallel to the existing tunnel. The location of this feature correlates well with the location of the City of Norfolk's 30-inch diameter water pipeline as depicted on various drawings (Appendices A, B, and C).

Feature C (Figure 3-4b). Several circular depressions are observed in the river bottom above the existing midtown tunnel in the middle of the river. The features range in width from about 45 feet to about 150 feet wide and are up to 10 feet deep. Based on their shape and character, the features appear to be created by scouring. Scouring above the existing tunnel may result from differences in engineering properties, such as frictional characteristics, between the tunnel trench backfill material and surrounding native materials.

Feature D (Figure 3-4b). Another circular depression is observed on the Portsmouth side of the Navigation Channel. The feature is highlighted by the circular, enclosed 50-foot contour. Its location correlates well with the alignment of the water pipeline as depicted on various drawings (Appendices A, B, and C). It is probable that is the exit area for the water pipeline as the alignment enters the subsurface via a cut-and-cover trench used to bury the pipeline in the subsurface beneath the Navigation Channel during its construction.

3.5 OBSTRUCTIONS

Obstructions in the project area are present on the river bottom and in the subsurface. Some of the obstructions were known to exist prior to our marine investigation and numerous others were identified during our investigation. In preparation for our marine investigation we

reviewed readily available engineering drawings, nautical charts, maps, and aerial photographs and identified several utilities located within the project area. Tables 2-1 and 2-2 list the various information that we reviewed.

During the data review process, we recognized that high quality as-built drawings or electronic files documenting the locations of the several prominent utilities (e.g. existing tunnel and water pipeline) were not available. Therefore, we carried out a marine and land survey as described herein and other reports listed in Figure 1-2 to ground-truth historical drawings, map the river bottom, and assist us in defining a safe work area for the geotechnical boring and sounding exploration.

Obstructions within the area identified during our surveys include the existing tunnel, water and sewer pipelines, abandoned pilings lying on the river bottom, pilings cut off near the river bottom, some pilings that extend up to 6 feet above the river bottom, tires, and other debris.

Several of the prominent obstructions identified during our data review are listed in Table 3-1. We include several relevant drawings in Appendices A, B, C, and D (also listed in Table 2-1) which depict locations of various utilities within the project area.

Table 3-1. Prominent Obstructions in Project Area

Utility	Owner Operator	Location Relevant to Existing Tunnel	Description	Data Type In Which Feature is Observed (Figure Number of Data Examples)
Midtown Tunnel	VDOT		40-foot diameter pre-cast concrete tube constructed using cut-and-cover method in 1960. Exits subsurface at shore crossings of Elizabeth River and was covered (per design plan) during construction with a minimum of 5-feet of material.	Aerial Photo (Figures 3-6a and 3-6b) Land Survey (Figures 3-6a and 3-6b) Magnetometer (Figure 3-8) Seismic Reflection (Figure 3-10a/b, 3-11a/b, and 3-12/ab) Summary on Chart 3
30-inch diameter water pipeline	City of Norfolk	Approximately 325 feet northwest (downstream)	Pipeline is exposed at shore crossings; partially surface laid from shore crossings Navigation Channel, buried beneath Navigation Channel, and believed to be constructed using cut-and-cover method.	Aerial Photo (Chart 3) Land Survey (Figures 3-5a through 3-5g, 3-6a and 3-6b) Side Scan Sonar (Figure 3-7a and Chart 3) Magnetometer (Figure 3-8) Summary on Chart 3

Table 3-1. Prominent Obstructions in Project Area - Continued

Abandoned pier with piles cut off at river bottom	Unknown	Approximately 50 to 60 feet northwest (downstream) of the Portsmouth tunnel approach. Location currently is Portsmouth Marine Terminal	Field of wooden piles cut off near river bottom. Feature was labeled on historical maps as "Former Railroad Southern Pier No. 4."	Side Scan Sonar (Figure 3-7a and 3-7b, Chart 3)
48-inch-diameter forced sewer main pipeline	Hampton Roads Sanitation District	Approximately 430 feet northwest (downstream)	Pipeline is buried approximately 25 feet below the river bottom and was installed using a horizontally directional drilling method.	Land Survey (Figures 3-5a through 3-5g, 3-6a and 3-6b)
Outfall pipes	Formally Portsmouth Wastewater Treatment Plant , City of Portsmouth	Numerous outfalls that are believed to have been abandoned in place (at least in part) beneath the site that is currently the Portsmouth Marine Terminal. Distance from existing tunnel varies but some may be within 200 feet.	It is unknown whether the drawing included in Appendix D displays all of the outfalls from the former treatment plant. Design drawings of the treatment plant were not readily available.	

This section first provides a short description of each survey that Fugro conducted. Detailed descriptions of the surveys are provided in their respective data reports (Fugro, 2008b and 2008c). Following the survey descriptions, this section then provides a description of the various obstructions we located via the various surveys.

3.5.1 Land Survey

Prior to our subsurface investigation we notified MISS Utility of our intent to conduct subsurface explorations. Through this notification process, Fugro coordinated with utility companies that owned and operated utilities within our proposed work area to delineate their utility locations. Specifically, the City of Norfolk and Hampton Roads Sanitation District (HRSD) owned pipelines within our work area. Their utility locators delineated the shore crossings and a few hundred feet of the overland alignments. Figures 3-5a through 3-5g show the water pipeline at the shore crossing and the delineations made for the water and sewer pipelines.

Under subcontract to Fugro, NXL, Inc. surveyed those markings and several features of the existing Midtown Tunnel structure. Surveyed areas are shown on Figures 3-6a and 3-6b. This information was used to assist us in locating the respective structures. Refer to our Bottom Charting Data Report (Fugro, 2008b) for further discussion of those activities.

3.5.2 Side Scan Sonar Survey

A Marine Sonic Technology, Ltd. Sea Scan digital 600 kHz side scan sonar system was used to provide near photographic sonic images of the project area. The survey was conducted by McKim & Creed under subcontract to Fugro. The sonar towfish was towed across the area

at various depths, depending on water depth. Due to the nature of towed equipment, access to very shallow water was limited. The side scan sonar survey area is shown of Figure 1-4.

The resulting images were reviewed for possible obstructions and a list of these targets with position, description, and their approximate dimensions is provided as Table 3-2. The locations of the targets are shown on Chart 3. Selected images of side scan sonar targets are provided on Figures 3-7a and 3-7b. Additional information about the side scan sonar is provided in the River Bottom Charting Data Report (Fugro, 2008b).

Table 3-2. Summary of Side Scan Sonar Targets

Target	Northing	Easting	Approximate Target Dimensions (feet)	Interpreted Target
ST-1	12121321	3479961	Height: 5.9	Unknown
ST-2	12121539	3478397	Height: 1.0	Edge of pilings
ST-3	12121540	3478394	Height: 1.1 Width: 30.9	Edge of numerous pilings, extend to shore side and ahead
ST-4	12121556	3478313	Height: 1.1 Length: 86.4 Width: 54.7	Center of group of pilings and debris, height varies, extends to shore
ST-5	12121684	3478534	Height: 4.6 Length: 79.2 Width: 30.9	Group of scattered pilings, some may be upright, leaning or lying flat
ST-6	12121684	3478532	Height: 1.6	Fallen pilings
ST-7	12121688	3479545	Height: 1.8	Debris
ST-8	12121730	3478561	Height: 0.6 Length: 12.5 Width: 1.0	Unknown object on seafloor
ST-9	12121732	3478487	Height: 0.6 Length: 132.9 Width: 60.6	Field of fallen pilings
ST-10	12121782	3478675	Height: 0.8 Width: 49.2	Edge of numerous pilings, extends to shore and both directions parallel to shore
ST-11	12121783	3478676	Height: 0.8	Edge of pilings
ST-12	12121890	3478786	Height: 0.6	Edge of pilings
ST-13	12121901	3478795	Height: 0.6 Width: 36.5	Edge of numerous pilings, extends to shore and both directions parallel to shore
ST-14	12121904	3478743	Height: 6.4 Length: 1.7 Width: 0.6	Appears to be a piling at or near the surface
ST-15	12122058	3478934	Height: 0.0 Length: 14.2 Width: 0.8	Unknown object on seafloor
ST-16	12122070	3480142	Unknown	Unknown
ST-17	12122101	3480175	Height: 0.4 Length: 7.1 Width: 1.8	Unknown item on seafloor
ST-18	12122101	3480175	Height: 0.8 Length: 4.5 Width: 1.6	Unknown

Table 3-2. Summary of Side Scan Sonar Targets - Continued

Target	Northing	Easting	Approximate Target Dimensions (feet)	Interpreted Target
ST-19	12122106	3479050	Height: 0.1 Length: 2.2 Width: 6.0	Unknown object on seafloor
ST-20	12122125	3479627	Height: 1.7 Length: 12.8	Unknown
ST-21	12122212	3480007	Height: 0.4 Length: 14.9 Width: 0.5	Unknown
ST-22	12122228	3480031	Height: 0.4 Length: 28.2 Width: 0.7	Item on seafloor, perhaps piling or log
ST-23	12122228	3480030	Height: 0.9 Length: 25.1 Width: 0.5	Unknown
ST-24	12122232	3479909	Height: 1.0	Tire(?)
ST-25	12122274	3478785	Height: 3.6 Length: 4.4 Width: 14.1	Tall piling
ST-26	12122430	3479816	Height: 1.5 Length: 70.5 Width: 35.1	Debris field
ST-27	12122451	3479813	Height: 1.1 Length: 79.2 Width: 60.9	Center of several unknown objects on seafloor, appear to be lying flat, misc. debris
ST-28	12122454	3479000	Height: 1.4 Length: 10.7 Width: 1.9	Debris
ST-29	12122481	3478602	Height: 1.4	Corner of pilings
ST-30	12122601	3478512	Height: 0.4	Corner of pilings
ST-31	12122639	3478429	Height: 0.5	Corner of pilings
ST-32	12122669	3478505	Height: 0.5	Piling
ST-33	12122715	3478473	Height: 0.5	Piling
ST-34	12122733	3479936	Height: 3.6	Possible tall piling
ST-35	12122856	3479848	Height: 0.8 Length: 46.8 Width: 35.6	Difficult to identify, probable scour or gouging
ST-36	12122863	3479848	Height: 0.8	Unknown - smeared by turning
ST-37	12122910	3478374	Height: 1.1 Length: 21.6 Width: 18.8	Debris
ST-38	12122927	3479784	Height: 0.8	Unknown
ST-39	12122928	3478355	Height: 0.9 Length: 7.9	Unknown
ST-40	12122958	3479745	Height: 1.6	Scour features(?)
ST-41	12122960	3479738	Height: 0.7 Length: 0.8 Width: 8.5	Item on seafloor, piling or log
ST-42	12122961	3479747	Height: 0.2 Length: 67.9 Width: 7.3	Looks like scouring

Table 3-2. Summary of Side Scan Sonar Targets - Continued

Target	Northing	Easting	Approximate Target Dimensions (feet)	Interpreted Target
ST-43	12123011	3479817	Height: 0.3 Length: 32.1 Width: 0.7	Looks like scouring
ST-44	12123015	3479568	Height: 0.7 Length: 48.0 Width: 12.2	Several items on seafloor, unknown debris
ST-45	12123018	3479725	Height: 0.5 Length: 24.7 Width: 3.1	Unknown item on seafloor
ST-46	12123018	3479725	Height: 1.2	Unknown
ST-47	12123020	3479834	Height: 1.0	Unknown
ST-48	12123029	3479651	Height: 1.0 Length: 18.2 Width: 1.0	Unknown
ST-49	12123030	3479616	Height: 2.3 Length: 29.1 Width: 17.1	Debris
ST-50	12123079	3479681	Height: 0.4 Length: 16.1 Width: 3.8	Unknown debris
ST-51	12123091	3478212	Height: 0.6	Debris area
ST-52	12123141	3479839	Height: 0.7	Unknown
ST-53	12123155	3479724	Height: 0.1	Piling(?)
ST-54	12123185	3478275	Height: 0.6	Debris and pilings area
ST-55	12123191	3479708	Height: 1.2	Unknown
ST-56	12123217	3479773	Height: 1.1	Unknown
ST-57	12123222	3478112	Height: 0.7	Edge
ST-58	12123275	3478162	Height: 7.8	Corner debris / pilings field
ST-59	12123283	3478069	Height: 0.7	Edge
ST-60	12123331	3478120	Height: 4.0	Corner debris / pilings field
ST-61	12123518	3477883	Height: 1.9 Width: 28.7	Unknown
ST-62	12121930	3477883	Width:≤2.0	Abandoned pile
ST-63	12121956	3477883	Width:≤2.0	Abandoned pile
ST-64	12121991	3477883	Width:≤2.0	Abandoned pile
ST-65	12122663	3479972	Length: 92 Width: 23	Water pipeline and piles

3.5.3 Magnetometer Survey

The objective of the magnetometer survey is to identify metallic obstructions on or immediately below the river bottom. Locations of ferrous debris and pipelines may be identified in magnetometer surveys by the presence of magnetic anomalies. Ideally, to locate linear objects, survey lines are run perpendicular to the linear bodies. Taking into consideration that the tunnel and two known pipelines traverse the river parallel to each other, magnetometer survey lines were oriented perpendicular to those structures, or parallel to the axis of the river,

and spaced about 25-feet apart. The survey was conducted by McKim & Creed under subcontract to Fugro. Figure 1-4 shows the survey area and Figure 3-8 presents the magnetometer survey and locations of magnetic anomalies.

A Marine Magnetics SeaSPY magnetometer was used to measure the ambient magnetic field across the project area from the stern of the *S/V Clock* via a tow cable. A Marine Magnetics' magnetometer measures the ambient magnetic field using a specialized branch of nuclear magnetic resonance technology applied specifically to hydrogen nuclei producing very high sensitivity and accuracy. The sensor is reported to have an absolute accuracy of 0.2 ηT and a counter sensitivity of 0.001 ηT. Additional information about the survey is provided in our River Bottom Charting Data Report (Fugro, 2008b).

3.5.4 Seismic Reflection Survey

As described in Section 1.2.3, the seismic reflection survey used two systems: 1) a subbottom Chirp profiler, and 2) a single-plate boomer source with multichannel hydrophone array. Figure 1-5 presents the seismic survey vessel tracklines. Features related to obstructions can be observed in data from both systems.

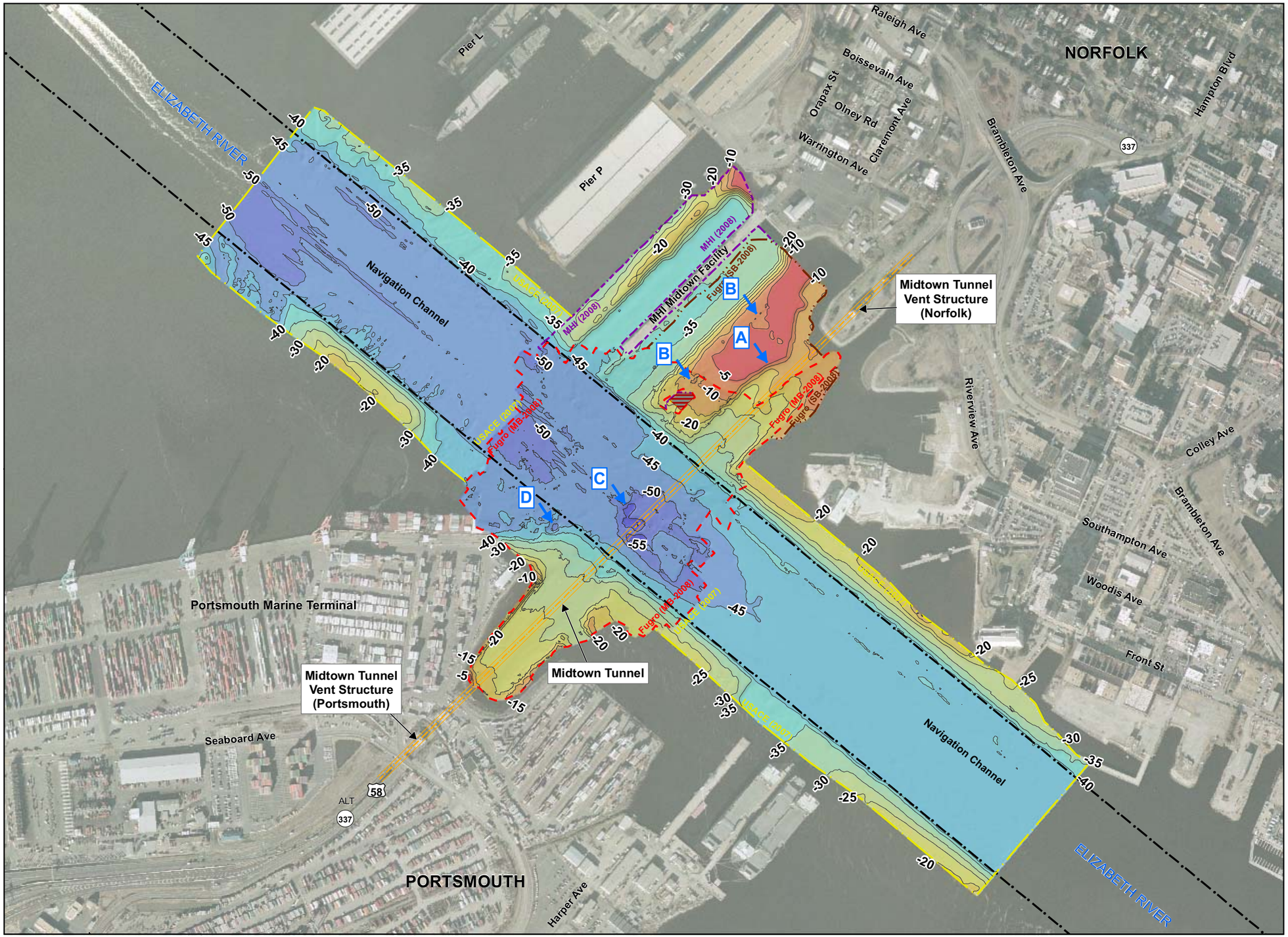
City of Norfolk Water Pipeline. Figure 3-9 presents an example of a Chirp seismic record that shows the water pipeline lying on the river bottom. Figures 3-10a and 3-10b present an uninterpreted and interpreted, respectively, Chirp seismic record from an area of the water pipeline that was constructed using a cut-and-cover technique. The dredge cut slopes and top of the backfill from the water pipeline appear as prominent reflectors. Also, one of the dredge cut slopes from the existing tunnel also appears as a prominent reflector. Chart 3 presents a summary of the inferred water pipeline locations from the seismic data. If the water pipeline was surface laid and was clearly discernable on the seismic data (e.g. Figure 3-9) we provided the location for the center of the feature. If the feature observed in the seismic data was a "cut-and-cover" feature (e.g. Figure 3.-10a and 3-10b) or disturbed reflectors, we then provide the width of the trench or disturbed reflectors and infer the center of those features to be where the water pipeline was constructed. This information is provided on Chart 3.

Existing Midtown Tunnel. Features associated with the largest subsurface structures in the area are observed in the boomer and Chirp seismic data. Figures 3-11a, 3-11b, 3-12a, and 3-12b present typical examples of data with features associated with the tunnel. Most records that traverse the existing tunnel location exhibit seismic character changes through the tunnel zone that can be attributed to the acoustic properties of the tunnel and varying dredge fill material. These features are typically disruptive reflectors within the tunnel zone and a few lines contain parabolic diffractive reflectors (inverted "U"-shaped) that are classic seismic signatures of tunnels and pipelines. Figures 3-11a and 3-11b (Line 203) is an example of a seismic record that displays parabolic signal diffractions within the tunnel zone.

A few seismic lines display dipping reflectors that are inferred to be the dredge cut slope from the original tunnel construction. In order to assess the true dip of a dipping surface, the seismic line should be oriented perpendicular to the dipping surface. Otherwise, the measured apparent dip needs to be corrected to true dip. Additionally, the conversion from time to depth

is dependant upon the assumed seismic velocity. Based on the seismic data we reviewed, and focusing on lines oriented perpendicular to the tunnel alignment, we estimate that the excavation surface is approximately 3h:1v to 4h:1v. Figures 3-12a and 3-12b (Line 204) presents an example from line 204 which displays the inferred slope cut.

HRSD Sewer Pipeline. During our seismic data review, we did not identify any discernable features associated with this utility. At some locations, there appear to be disrupted reflectors but it is difficult to say with a high level of confidence that those features are related to the pipeline. It is likely that the sewer pipeline could not be imaged in the boomer seismic data due to the vertical data resolution and signal attenuation in near-surface sediments. Additionally, the sewer pipeline is buried below the depth the Chirp data was able to reliably image.



LEGEND

Bathymetry (MLLW, feet)
Refer to notes for vertical datum.

- 0 to -5
- -5 to -10
- -10 to -15
- -15 to -20
- -20 to -25
- -25 to -30
- -30 to -35
- -35 to -40
- -40 to -45
- -45 to -50
- -50 to -55
- Deeper than -55

Bathymetric Contour in Feet (MLLW)
Contour interval is 5 ft.

A — Bathymetric Feature
(Refer to Figure 3-4a and 3-4b for detail)

Bathymetric Data Boundaries and Sources

Fugro (MB-2008): Multibeam Bathymetry Data Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM ES3 Multibeam echosounder (240 Khz - 120 degree swath).

Fugro (SB-2008): Single Beam Bathymetry Data Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM Echotrak Dual Frequency echosounder (200/28 kHz)

MHI (2008): Marine Hydraulics International, Inc. Single Beam Bathymetry Data Surveyed by Waterway Surveys & Engineering, Ltd. at Lamberts Point between February 6th and 7th, 2008.

USACE (2007): U.S. Army Corps of Engineers Multibeam Bathymetry Data Surveyed by United States Army Corps of Engineers- Norfolk District on March 26, 2007.

Area Obstructed During Fugro 2008 Survey

Approximate Location of Midtown Tunnel
Not for design or construction planning
(Refer to Section 7.1 in text)

NOTES

1) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

2) Reference to Mean Lower Low Water (MLLW), 1983-2001 Tidal Epoch, is based on observations performed and published by the National Oceanic and Atmospheric Administration, National Ocean Service (NOAA/NOS). Tidal Bench Mark 8638610 at Sewells Point, Hampton Roads, was used as the MLLW constraint for this project.

0 300 600 Feet

N W E S

BATHYMETRY
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 3-1

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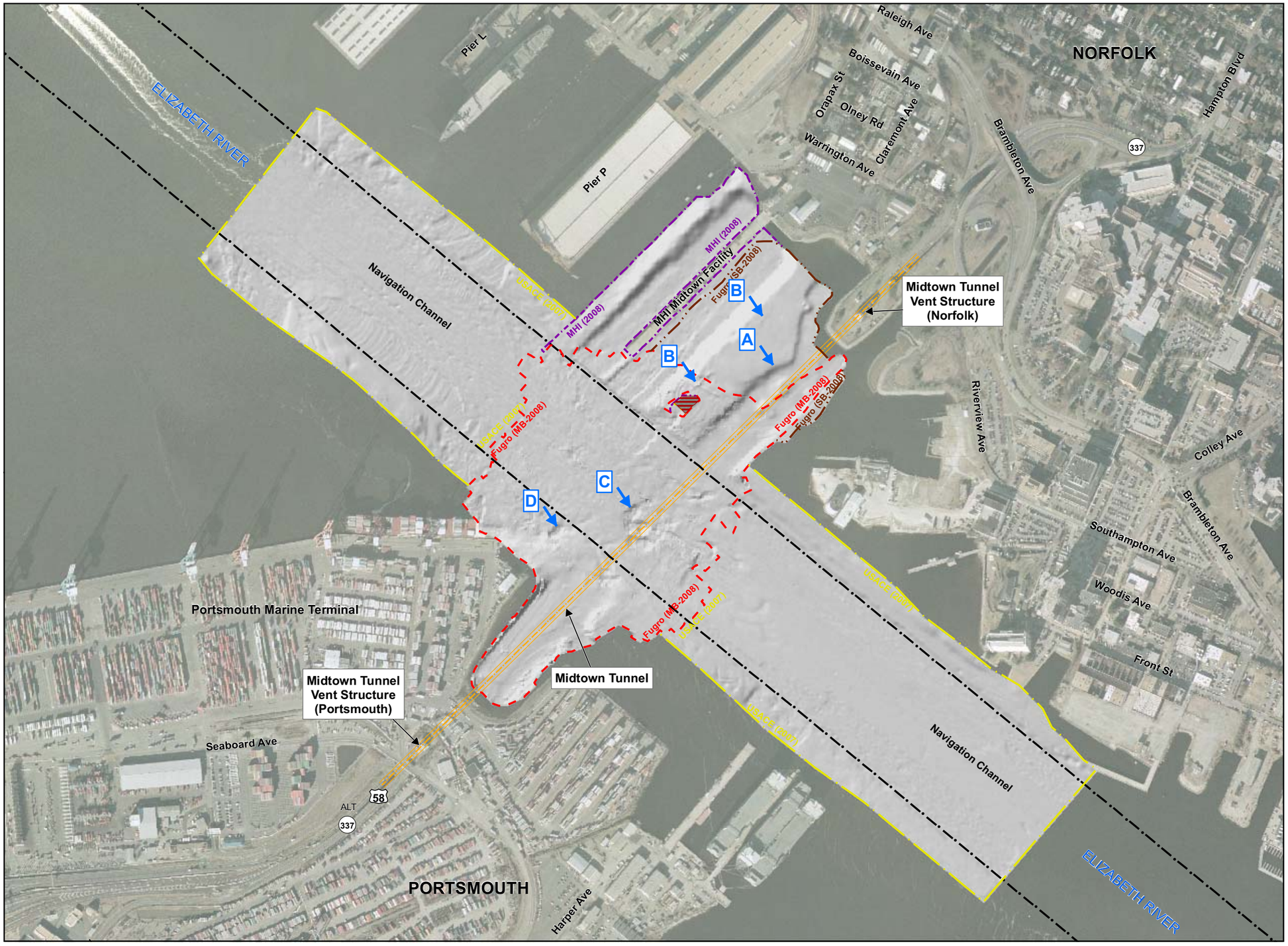

LEGEND

Sun-Illuminated Shaded Relief
Calculated from Bathymetric Data using
Sun Azimuth of 315 Degrees
and Altitude of 45 Degrees

A — Bathymetric Feature
(Refer to Figure 3-4a and 3-4b for detail)

Bathymetric Data Boundaries and Sources

- Fugro (MB-2008): Multibeam Bathymetry Data Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM ES3 Multibeam echosounder (240 Khz - 120 degree swath).
- Fugro (SB-2008): Single Beam Bathymetry Data Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM Echotrak Dual Frequency echosounder (200/28 kHz)
- MHI (2008): Marine Hydraulics International, Inc. Single Beam Bathymetry Data Surveyed by Waterway Surveys & Engineering, Ltd. at Lamberts Point between February 6th and 7th, 2008.
- USACE (2007): U.S. Army Corps of Engineers Multibeam Bathymetry Data Surveyed by United States Army Corps of Engineers- Norfolk District on March 26, 2007.
- Area Obstructed During Fugro 2008 Survey
- Approximate Location of Midtown Tunnel Not for design or construction planning (Refer to Section 7.1 in text)

NOTES

1) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

2) Reference to Mean Lower Low Water (MLLW), 1983-2001 Tidal Epoch, is based on observations performed and published by the National Oceanic and Atmospheric Administration, National Ocean Service (NOAA/NOS). Tidal Bench Mark 8638610 at Sewells Point, Hampton Roads, was used as the MLLW constraint for this project.

N
W E
S

0 600 1,200 Feet

SUN-ILLUMINATED SHADED RELIEF
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 3-2

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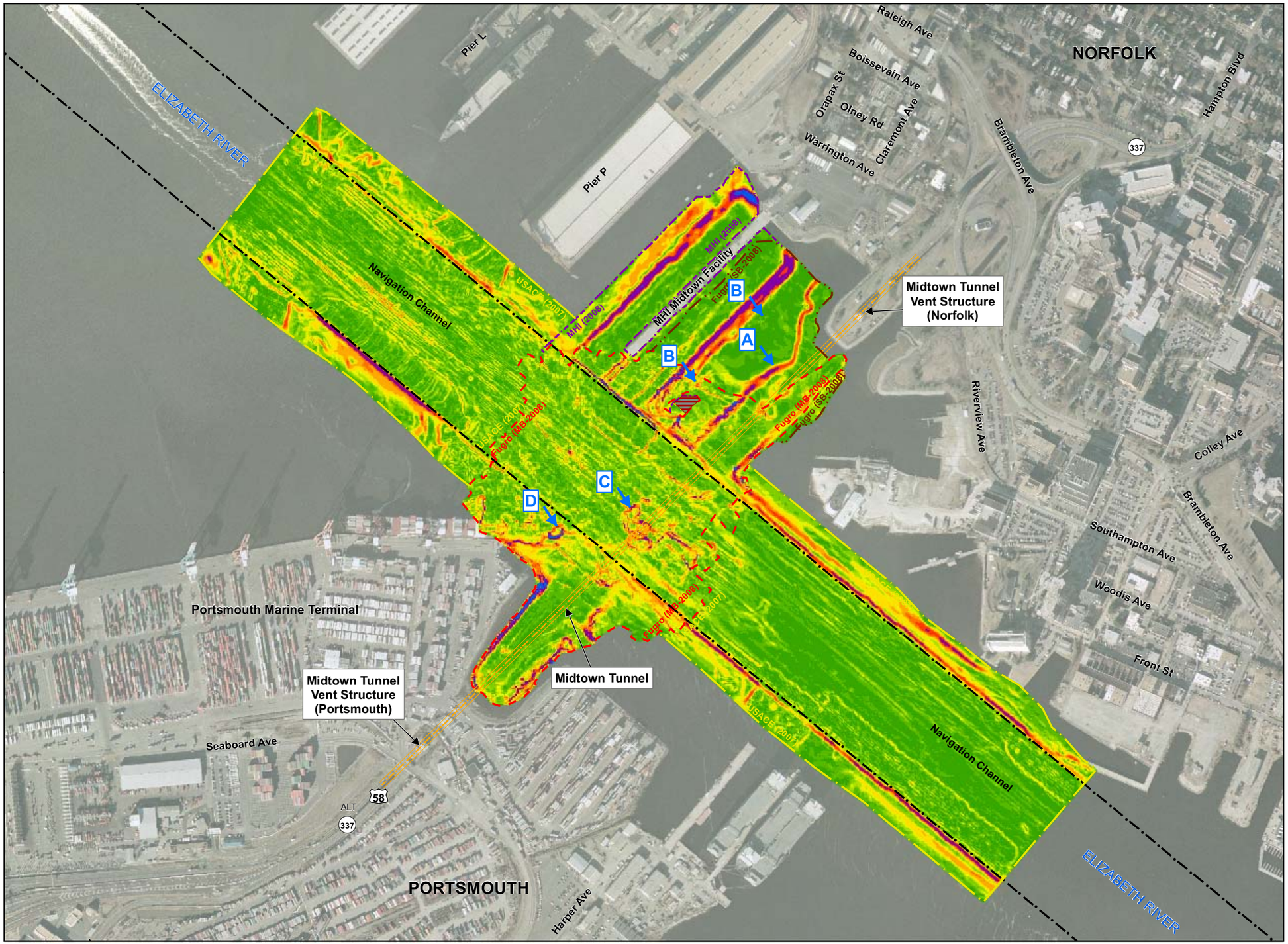


LEGEND

Slope Gradient of River Bottom
Calculated from Bathymetric Data

Percent	Degrees	Horizontal to Vertical Ratio (H:V)
0 - 2	0 - 1.1	
2 - 4	1.1 - 2.3	
4 - 6	2.3 - 3.4	20:1
6 - 8	3.4 - 4.6	
8 - 10	4.6 - 5.7	10:1
10 - 15	5.7 - 8.5	
15 - 25	8.5 - 14.0	4:1
25 - 30	14.0 - 16.7	
30 - 35	16.7 - 19.3	3:1
48 - 52	25.6 - 27.5	2:1

A — Bathymetric Feature
(Refer to Figure 3-4a and 3-4b for detail)

Bathymetric Data Boundaries and Sources

Fugro (MB-2008): Multibeam Bathymetry Data Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM ES3 Multibeam echosounder (240 Khz - 120 degree swath).

Fugro (SB-2008): Single Beam Bathymetry Data Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM Echotrak Dual Frequency echosounder (200/28 kHz)

MHI (2008): Marine Hydraulics International, Inc. Single Beam Bathymetry Data Surveyed by Waterway Surveys & Engineering, Ltd. at Lamberts Point between February 6th and 7th, 2008.

USACE (2007): U.S. Army Corps of Engineers Multibeam Bathymetry Data Surveyed by United States Army Corps of Engineers- Norfolk District on March 26, 2007.

Area Obstructed During Fugro 2008 Survey

Approximate Location of Midtown Tunnel
Not for design or construction planning
(Refer to Section 7.1 in text)

NOTES

1) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

2) Reference to Mean Lower Low Water (MLLW), 1983-2001 Tidal Epoch, is based on observations performed and published by the National Oceanic and Atmospheric Administration, National Ocean Service (NOAA/NOS). Tidal Bench Mark 8638610 at Sewells Point, Hampton Roads, was used as the MLLW constraint for this project.

0 300 600 Feet

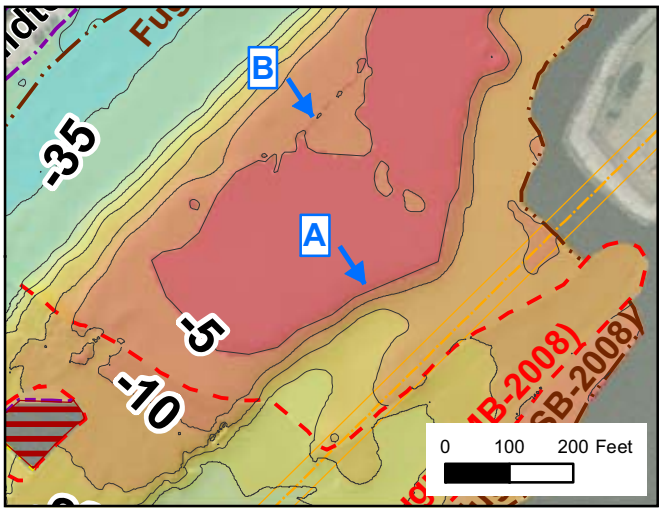
N W E S

RIVER BOTTOM SLOPE GRADIENT
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

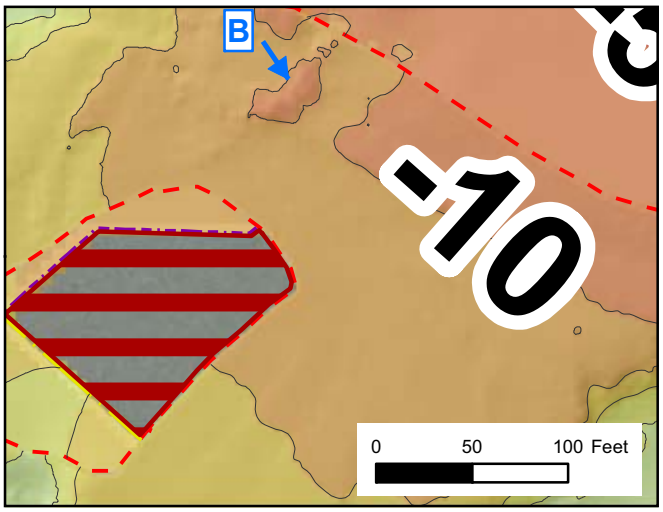
FIGURE 3-3

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\05-ER_SiteChar\MXD\Figures\Fig-3-3_Slope_Gradient.mxd, 10/17/08, kspencer

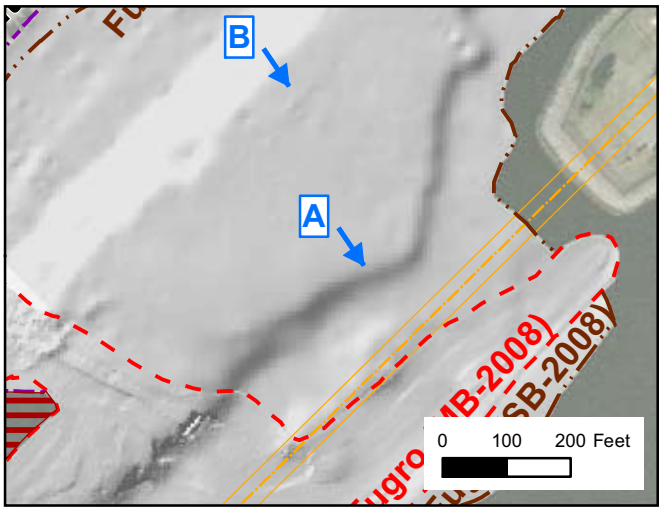
BATHYMETRIC CONTOURS



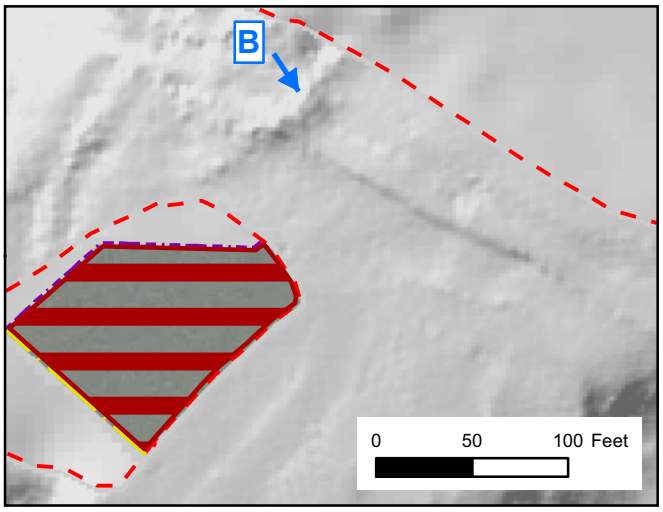
BATHYMETRIC CONTOURS



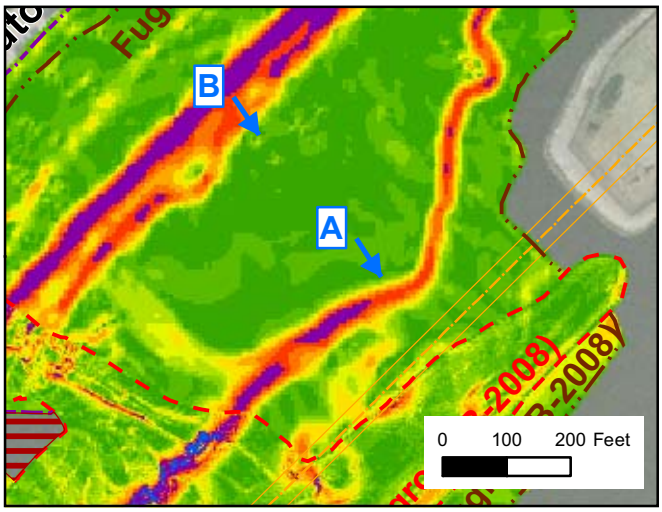
SUN-ILLUMINATED SHADED RELIEF



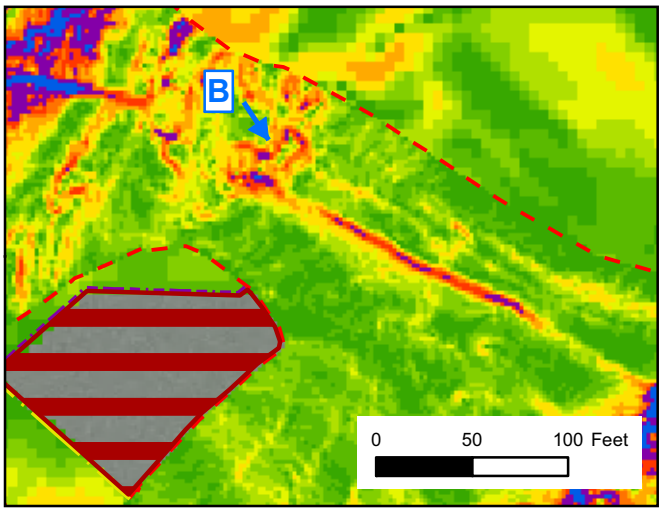
SUN-ILLUMINATED SHADED RELIEF



SLOPE GRADIENT



SLOPE GRADIENT

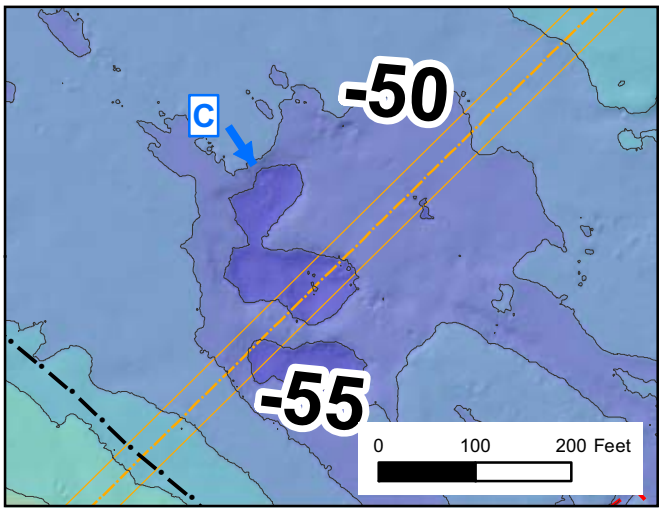


SELECTED BATHYMETRIC FEATURES
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

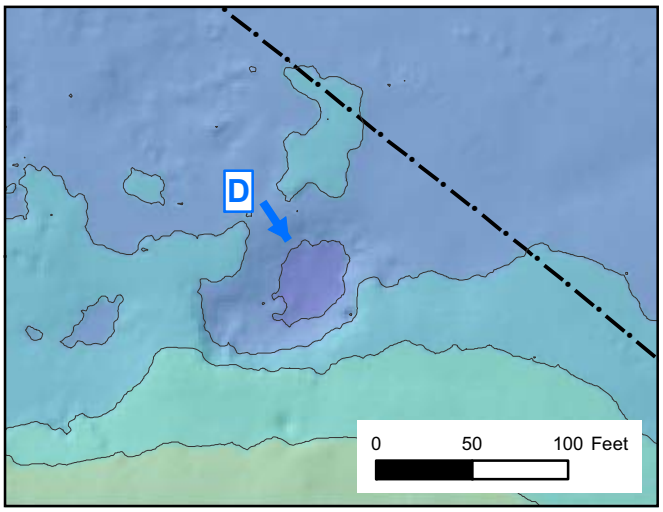
FIGURE 3-4a

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\05-ER_SiteCharMXD\Figures\Fig-3-4a_Bathymetry_Features.mxd, 10/17/08, kspencer

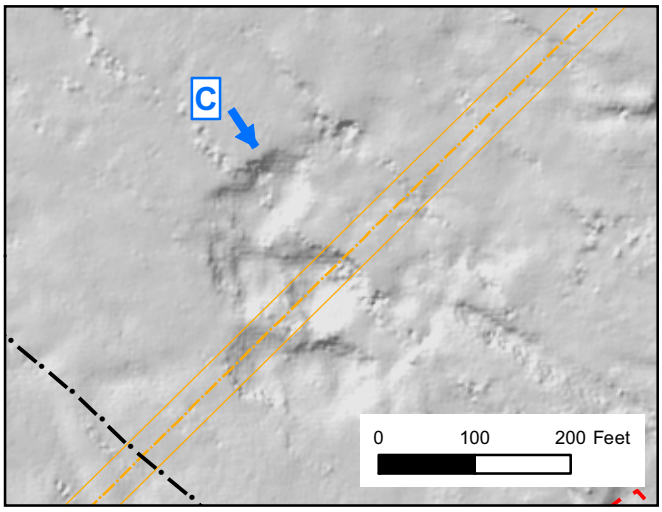
BATHYMETRIC CONTOURS



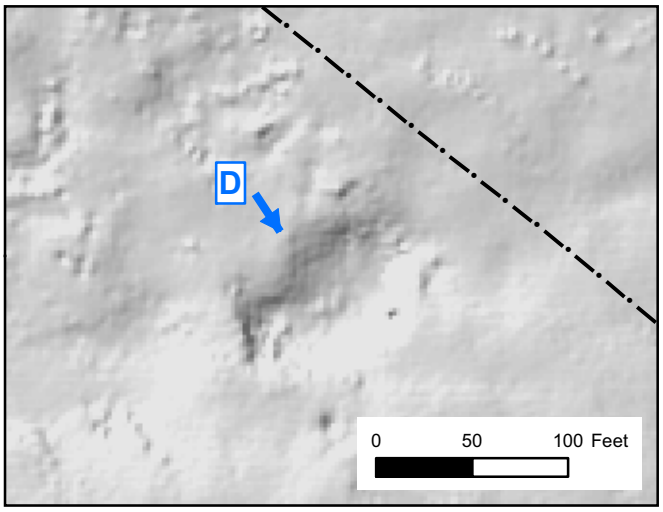
BATHYMETRIC CONTOURS



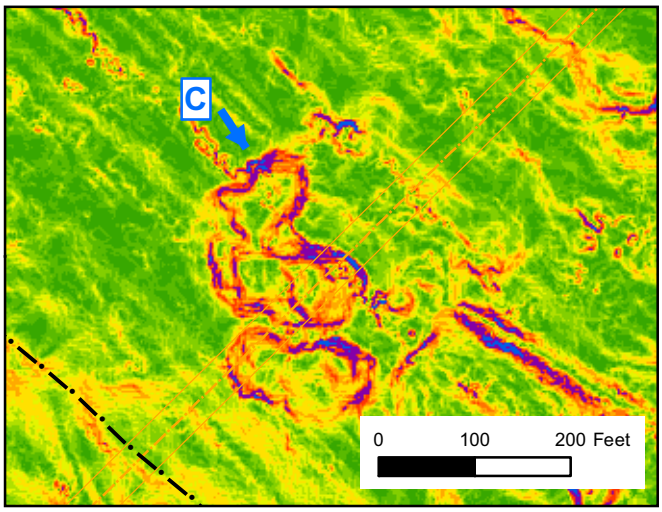
SUN-ILLUMINATED SHADED RELIEF



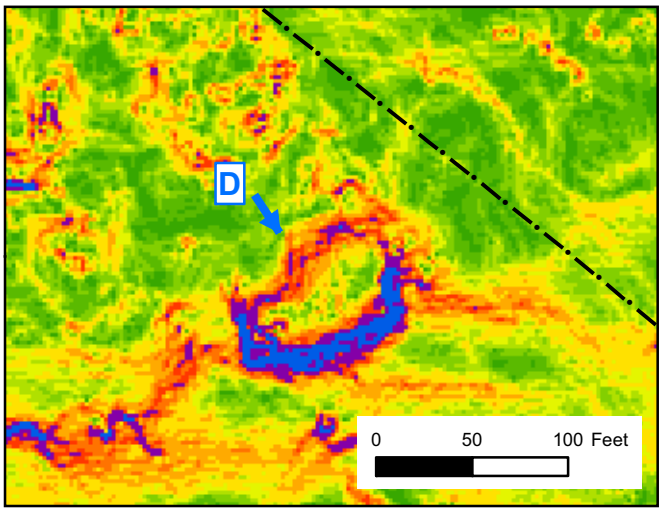
SUN-ILLUMINATED SHADED RELIEF



SLOPE GRADIENT



SLOPE GRADIENT



SELECTED BATHYMETRIC FEATURES
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 3-4b

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\05-ER_SiteCharMXD\Figures\Fig-3-4b_Bathymetry_Features.mxd, 10/17/08, kspencer



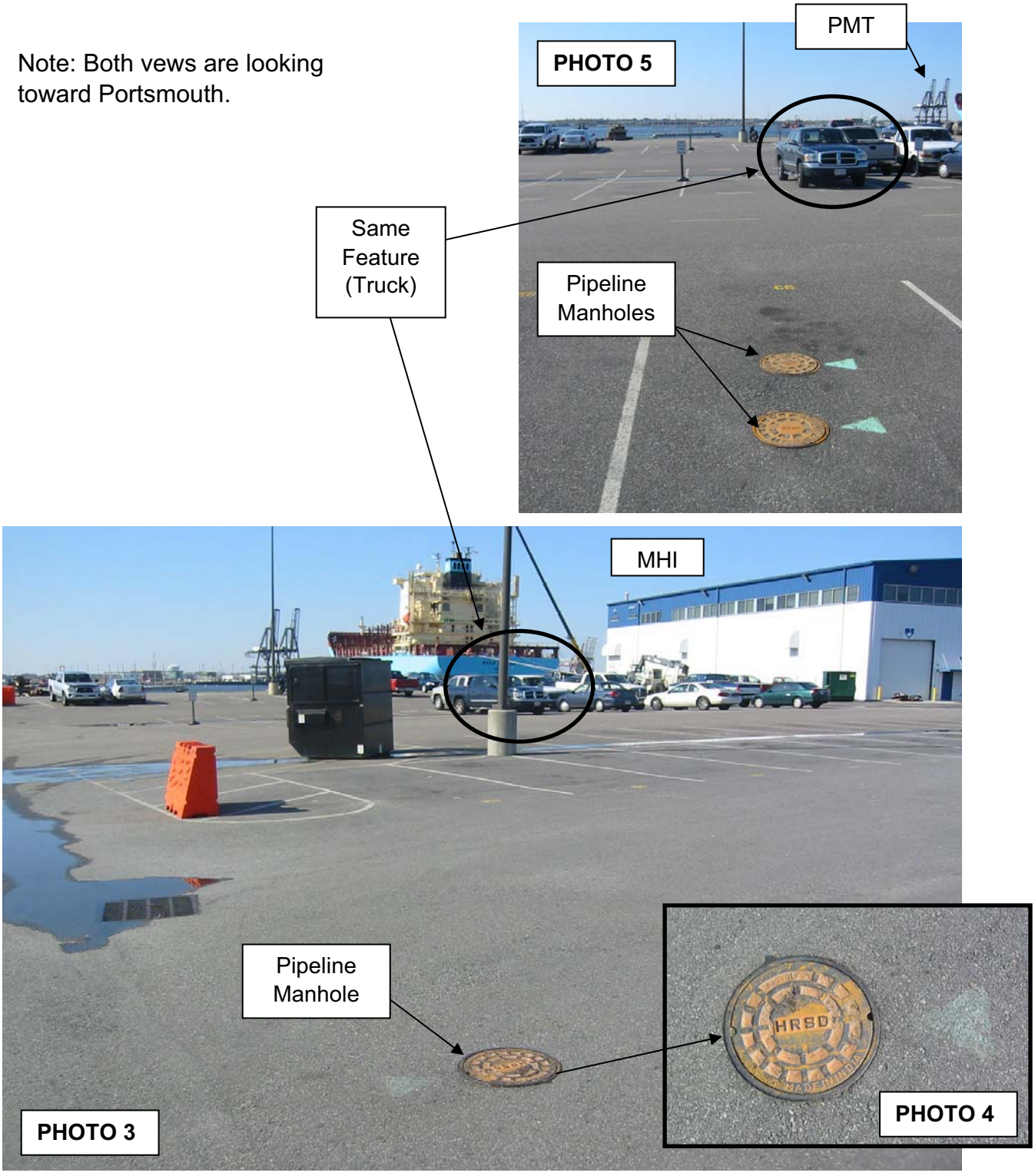
PHOTO 2: Pipeline and markings. Looking toward Portsmouth (southwest).



PHOTO 1: Pipeline markings looking toward Portsmouth (southwest).

PHOTOGRAPHS OF WATER PIPELINE AND LOCATION MARKINGS
Norfolk Land Survey
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

Note: Both vews are looking toward Portsmouth.



PHOTOGRAPHS OF SEWER PIPELINE LOCATION MARKINGS
Norfolk Land Survey
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

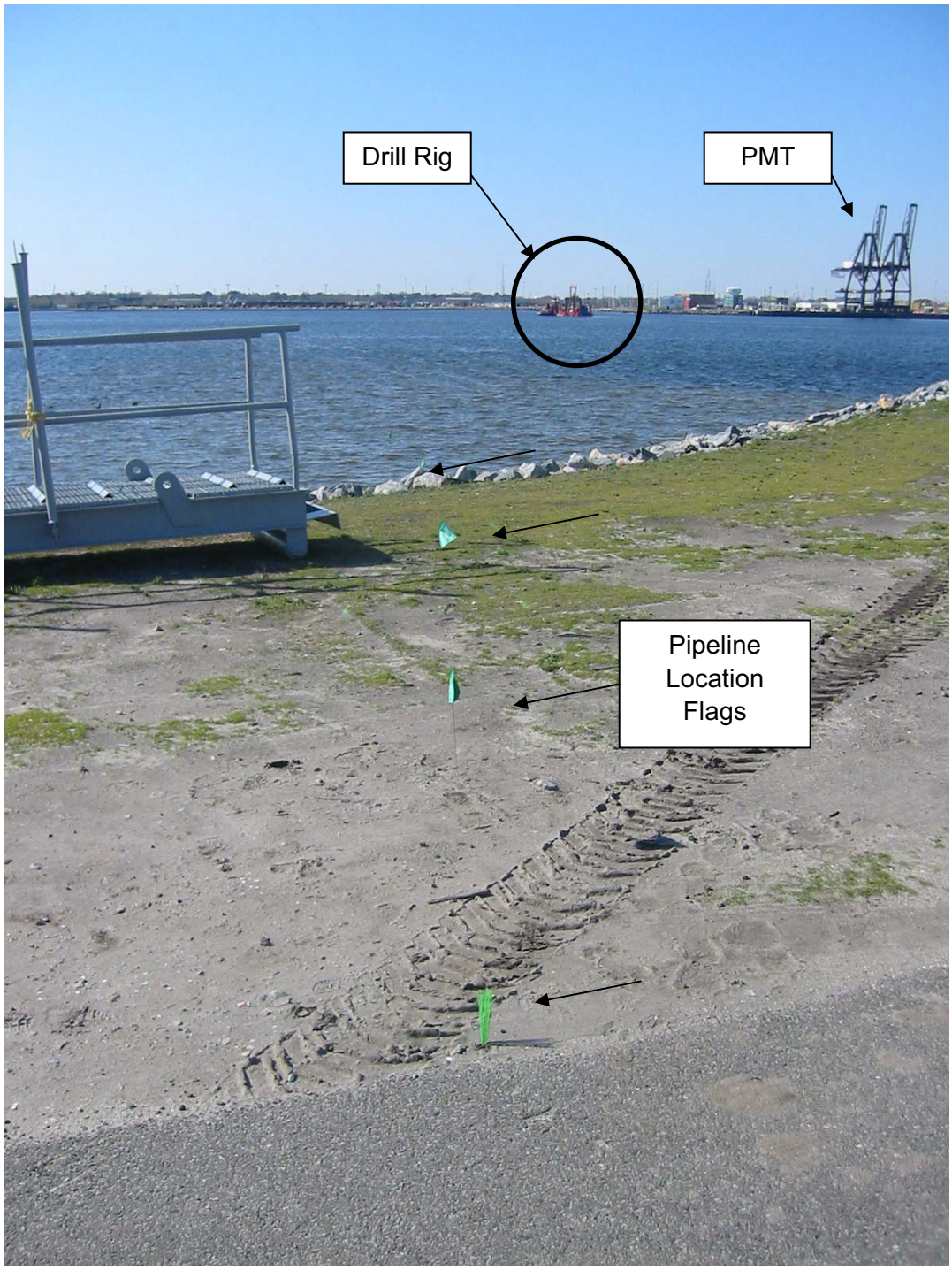


PHOTO 6: View is looking toward Portsmouth (southeast) from MHI facility.

PHOTOGRAPH OF SEWER PIPELINE LOCATION MARKINGS
Norfolk Land Survey
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

PHOTO 7: 30-inch diameter water pipeline landfall on Portsmouth shore. View is looking downstream (northwest).

PHOTOGRAPHS OF WATER PIPELINE LANDFALL
Portsmouth Land Survey
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 3-5d

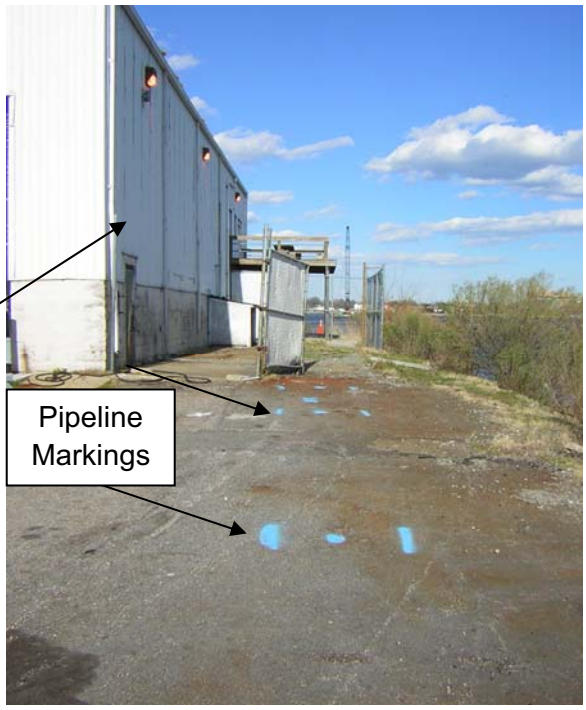


PHOTO 9: View looking toward Norfolk (northeast).

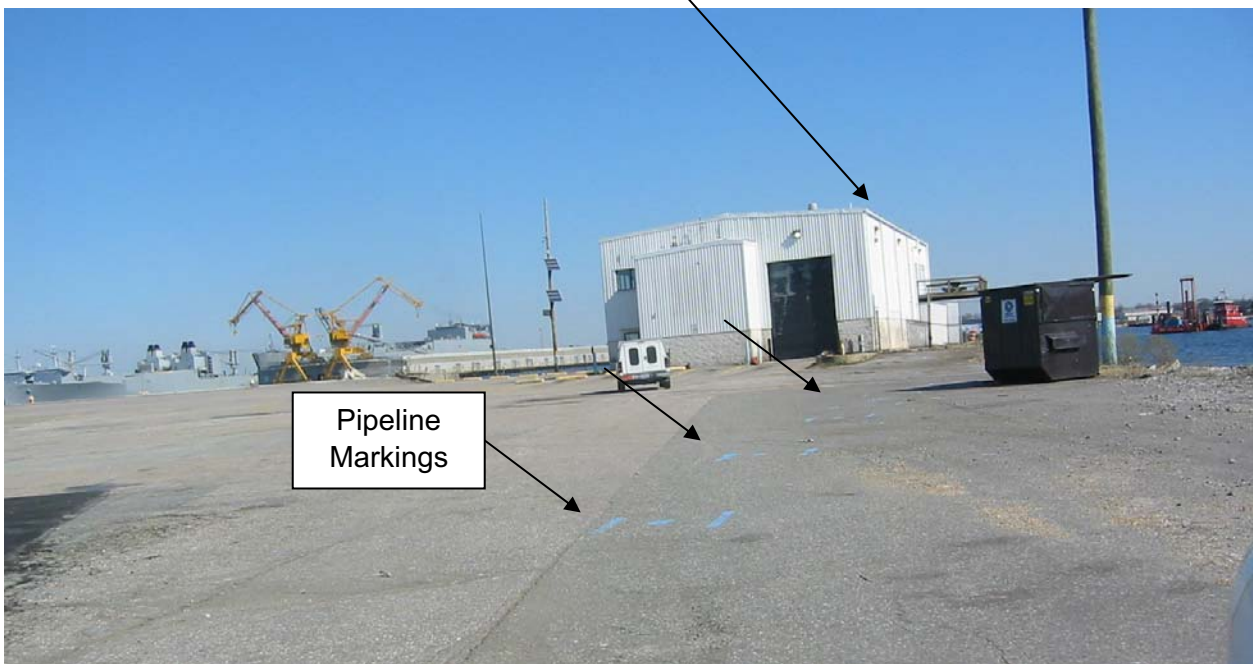


PHOTO 8: View looking toward Norfolk (northeast) across PMT parking lot.

PHOTOGRAPHS OF WATER PIPELINE LOCATION MARKINGS
Portsmouth Land Survey
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

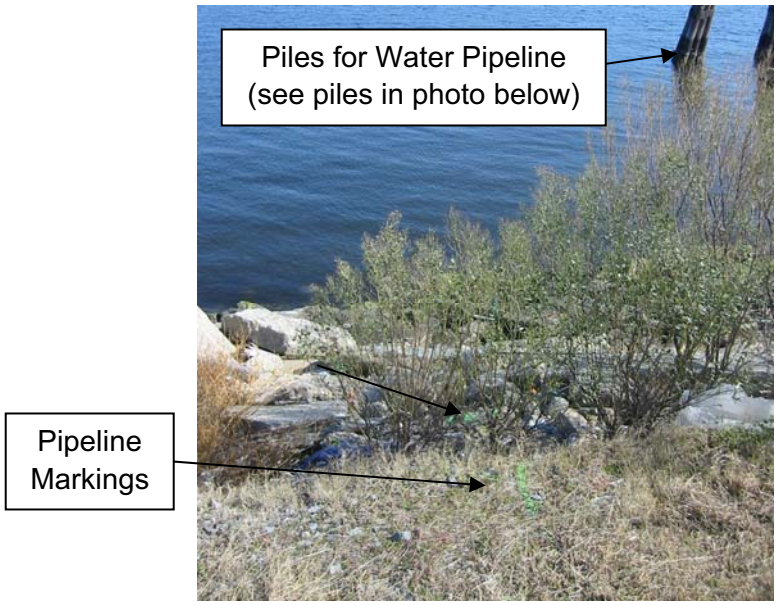


PHOTO 11: View looking toward Norfolk (northeast)

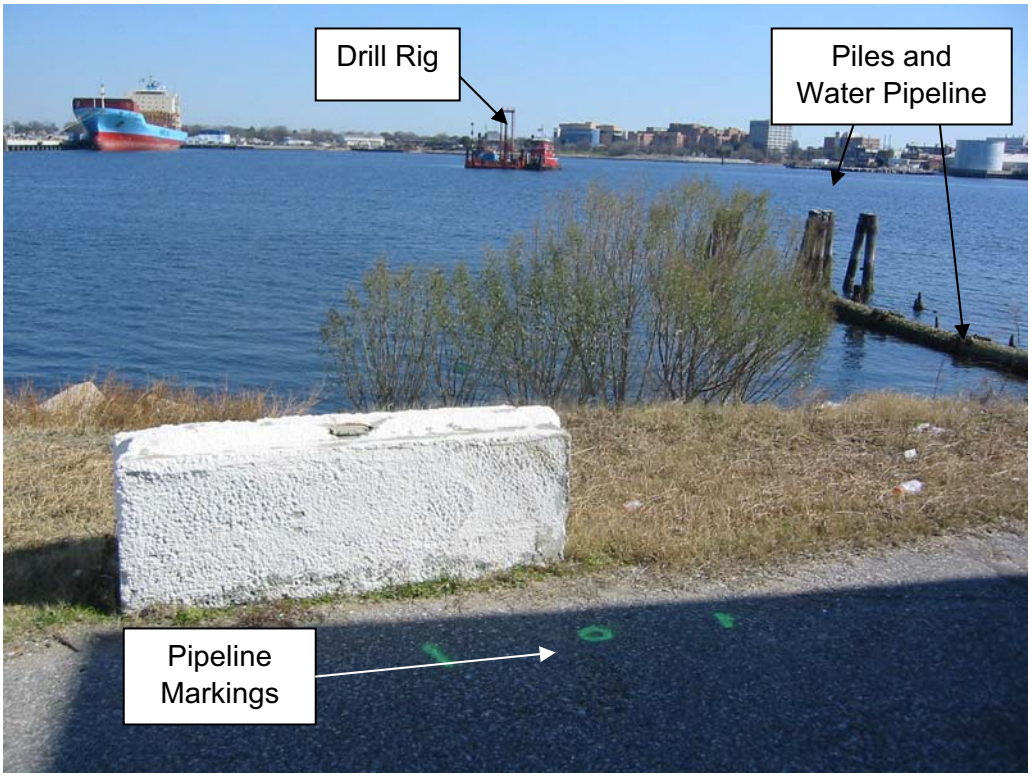


PHOTO 10: View looking toward Norfolk (northeast) across Elizabeth River

PHOTOGRAPHS OF SEWER PIPELINE LOCATION MARKINGS
Portsmouth Land Survey
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

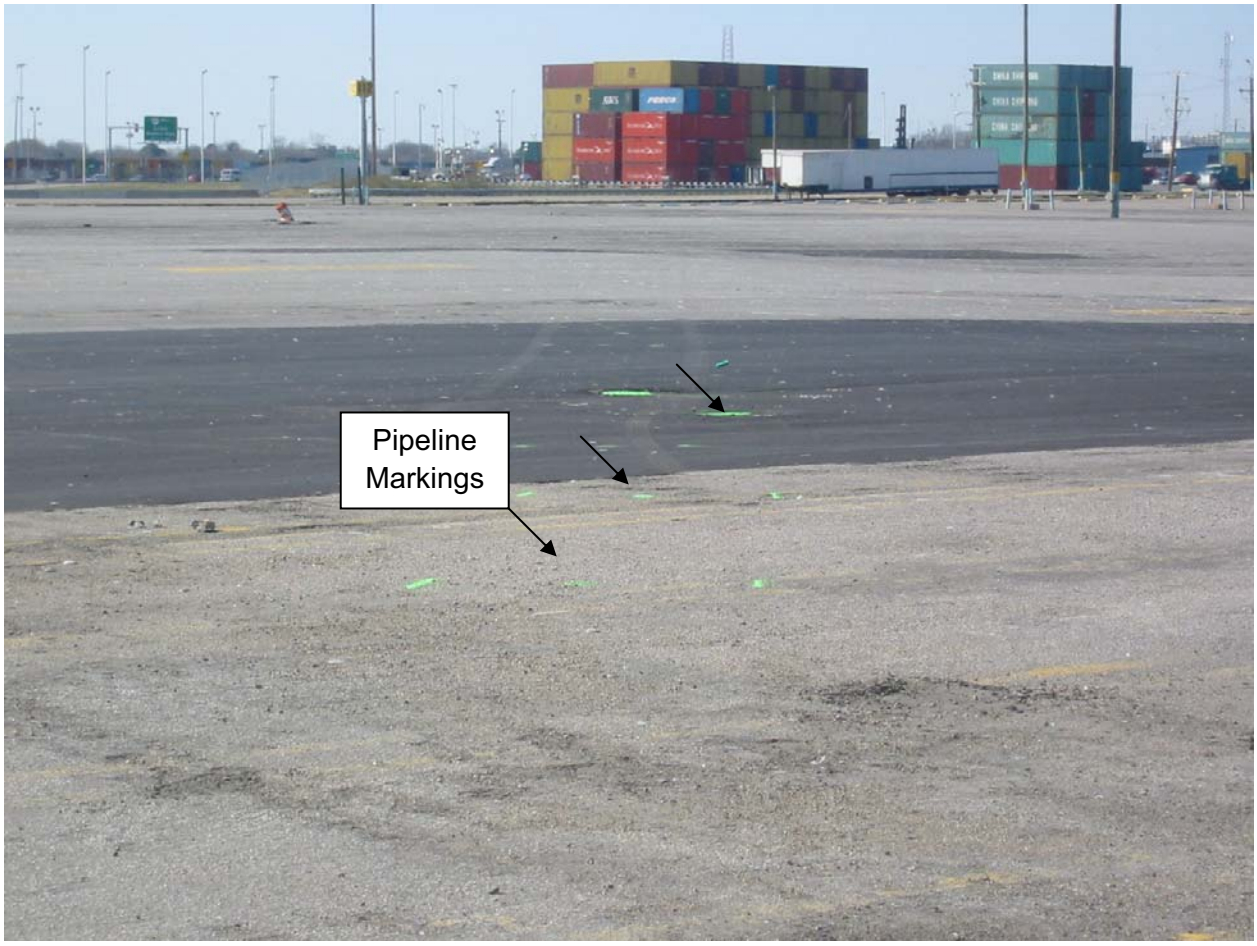
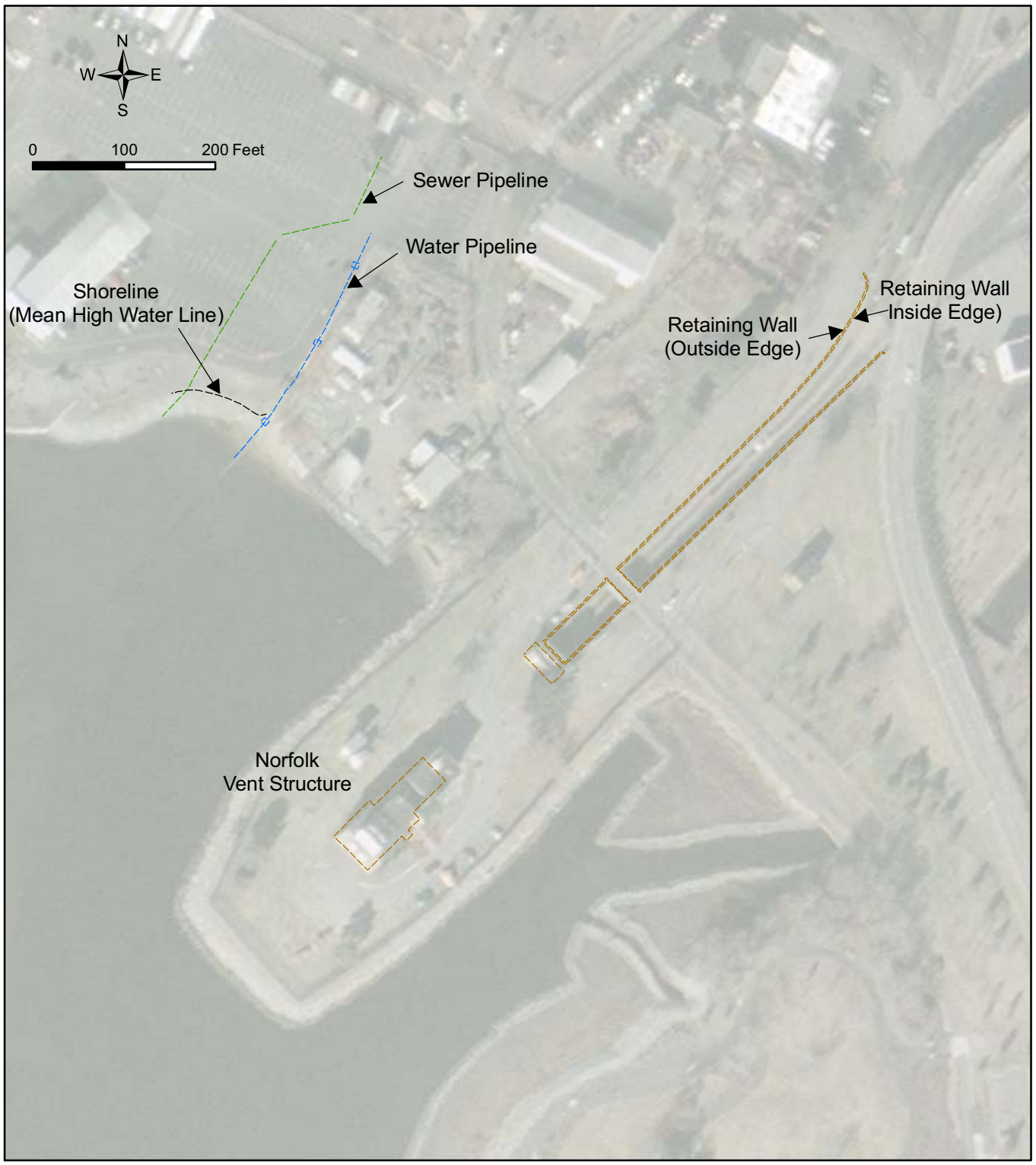


PHOTO 12: View looking toward Portsmouth (southwest) across the PMT parking lot from the approximate pipeline shore crossing location.

PHOTOGRAPHS OF SEWER PIPELINE LOCATION MARKINGS
Portsmouth Land Survey
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

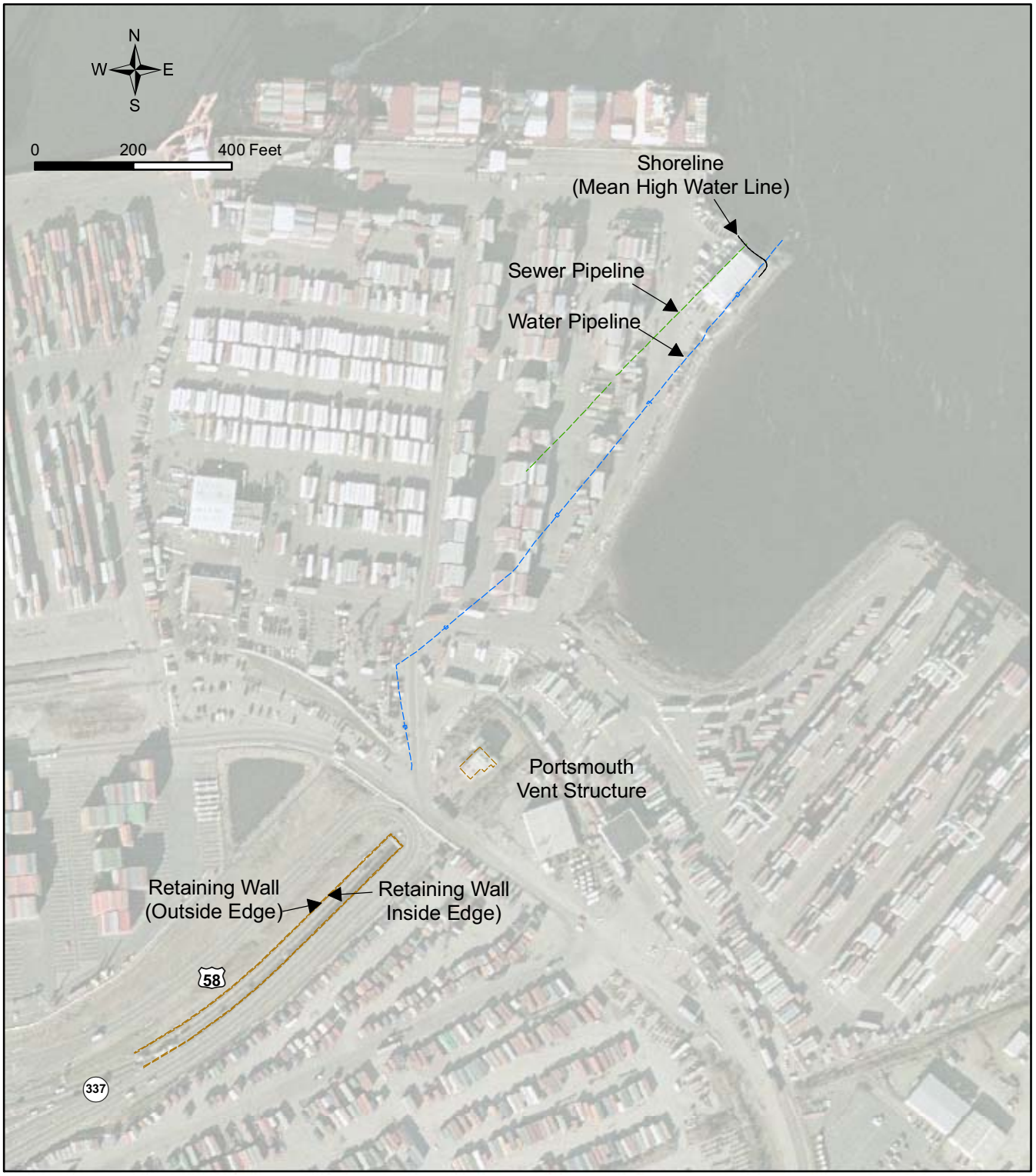


Aerial Photo Source: Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <<http://datagateway.nrcs.usda.gov/>>

NORFOLK LAND SURVEY
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 3-6a

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\05-ER_SiteChar\MXD\Figures\Fig-3-6a_Norf_LandSurvey.mxd, 10/17/08, kspencer



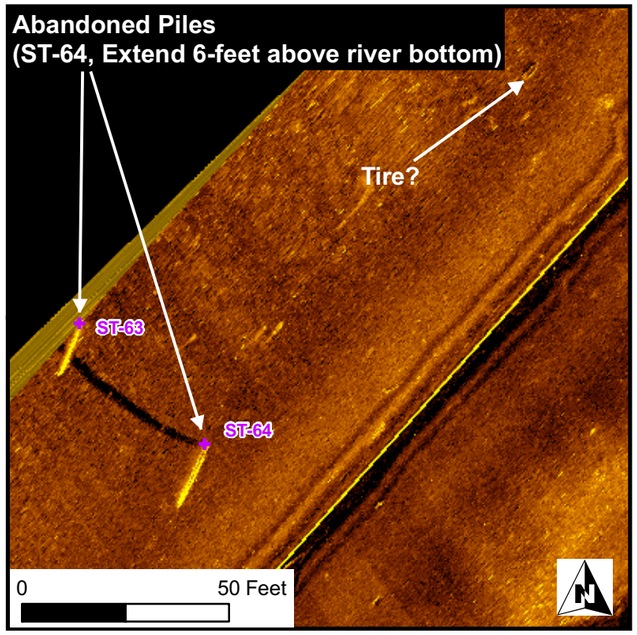
Aerial Photo Source: Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <<http://datagateway.nrcs.usda.gov/>>

PORTSMOUTH LAND SURVEY
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

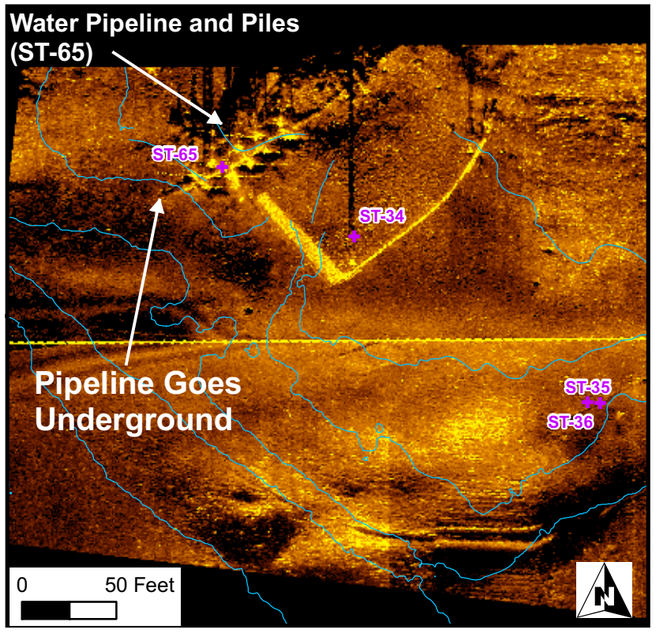
FIGURE 3-6b

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\05-ER_SiteChar\MXD\Figures\Fig-3-6b_Port_LandSurvey.mxd, 10/17/08, kspencer

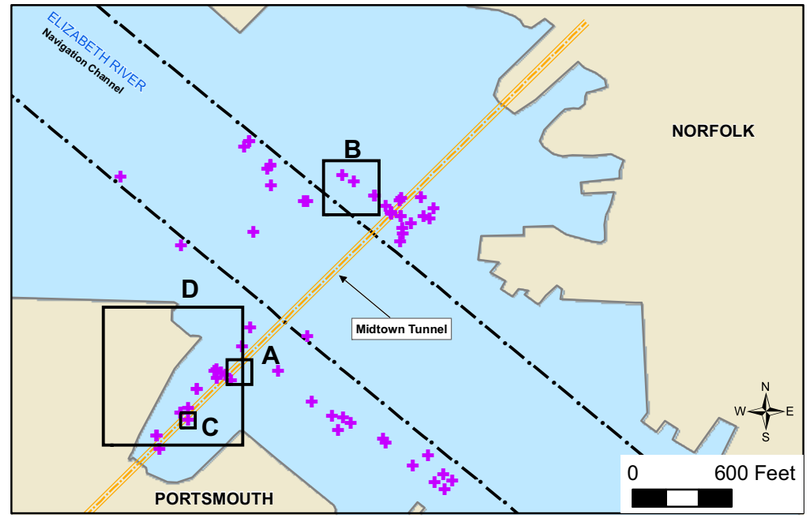
Inset A



Inset B



KEY MAP



LEGEND

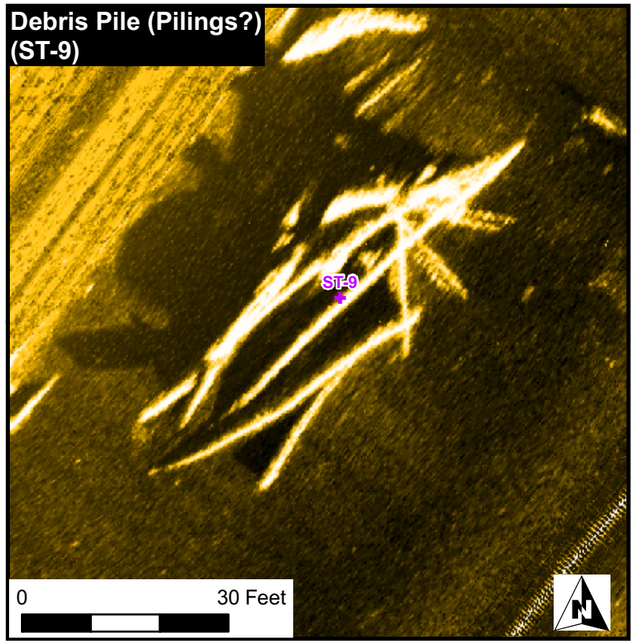
ST-2 — Sonar Target (refer to text for descriptions)

Approximate Location of Midtown Tunnel
Not for design or construction planning
(Refer to Section 7.1 in text)

Bathymetric Contour in Feet (MLLW)
Contour interval is 5 ft.

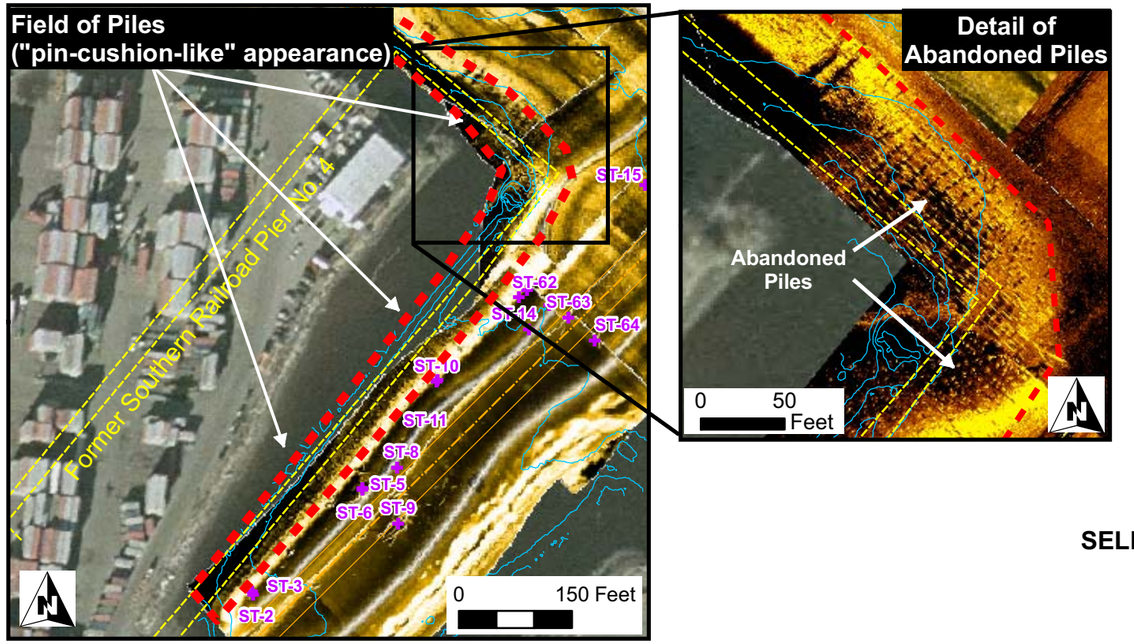
Refer to Notes 3 and 4 below for survey references and notes.

Inset C



SEE FUGRO (2008b) FOR SIDE SCAN MOSAIC

Inset D



REFER TO FIGURE 3-7b FOR DETAIL
OF PORTSMOUTH TUNNEL APPROACH

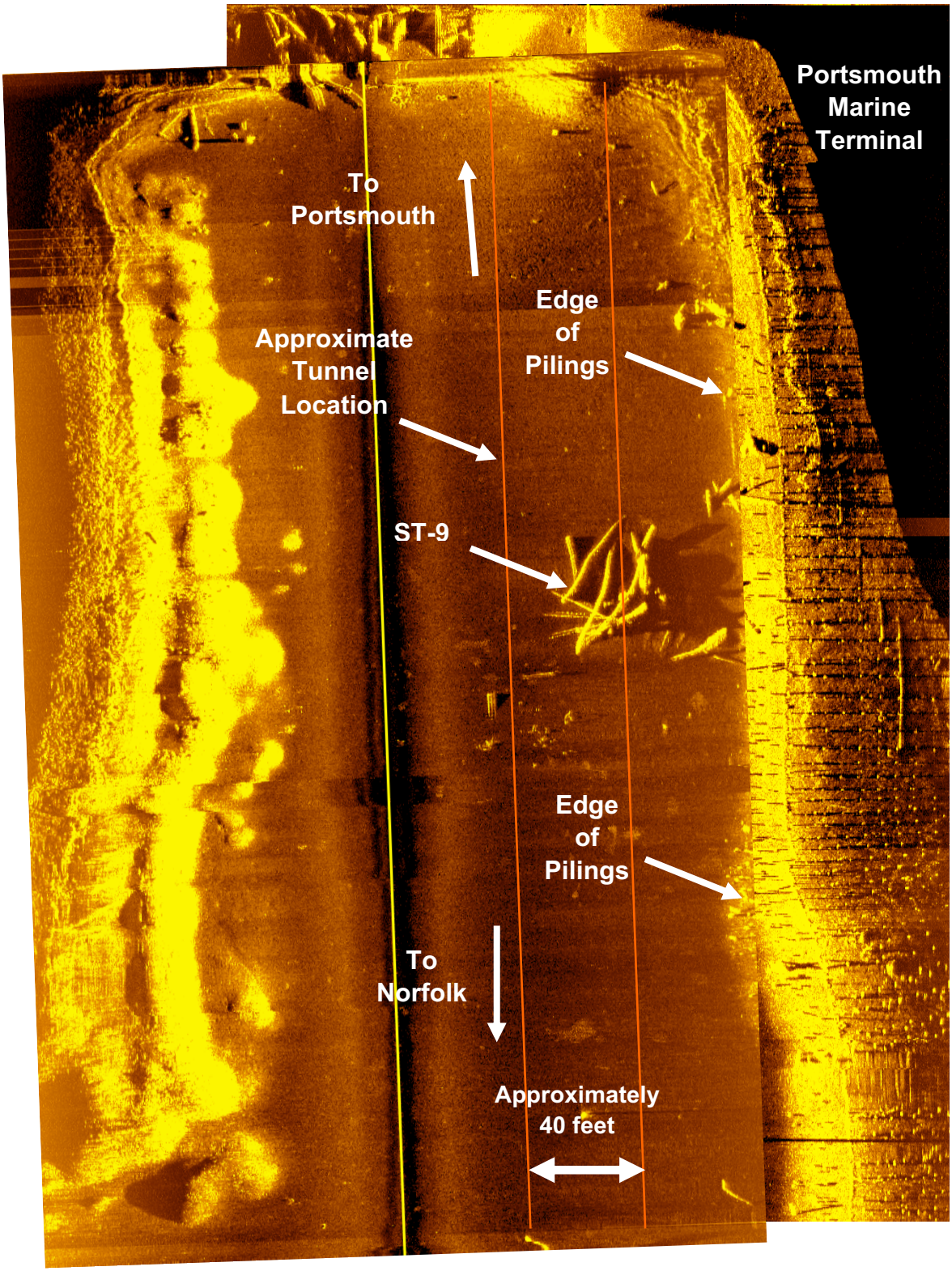
NOTES

1) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>
2) Side scan sonar survey conducted by McKim & Creed between February 13th and 22nd, 2008, using a Marine Sonics Side Scan Sonar system (600 kHz).
3) Bathymetric Data Sources:
   a) Fugro (MB-2008): Multibeam Bathymetry Data
   b) Fugro (SB-2008): Single Beam Bathymetry Data
   c) MHI (2008): Marine Hydraulics International, Inc. Single Beam Bathymetry Data
   d) USACE (2007): U.S. Army Corps of Engineers Multibeam Bathymetry Data
4) Reference to Mean Lower Low Water (MLLW), 1983-2001 Tidal Epoch, (NOAA/NOS). Tidal Bench Mark 8638610 at Sewells Point, Hampton Roads

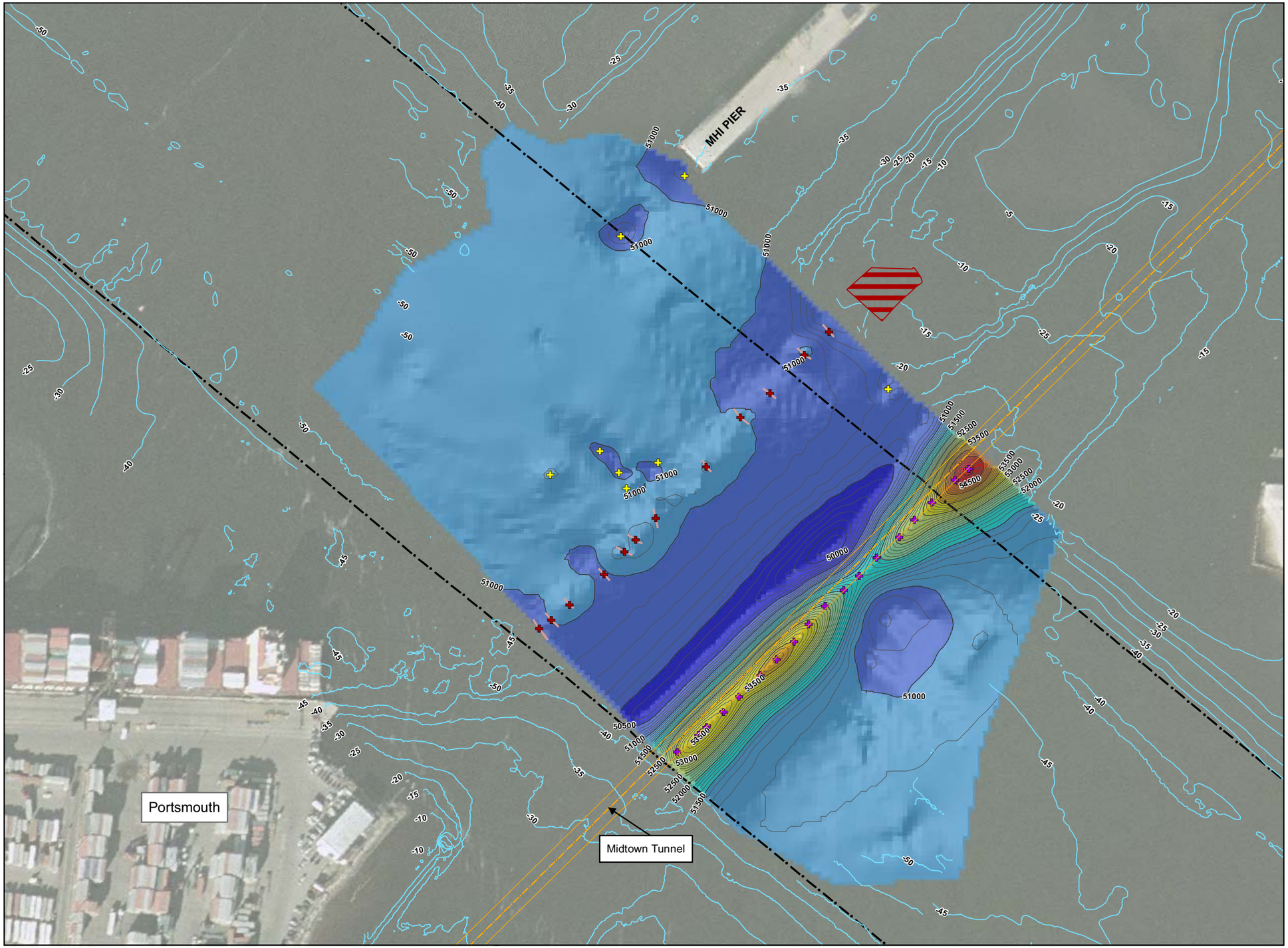
SELECTED SIDE SCAN SONAR TARGETS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 3-7a

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\05-ER_SiteCharMXD\Figures\Fig-3-7a_SSS.mxd 10/20/08, ksmith



SELECTED SIDE SCAN SONAR TARGETS
Portsmouth Nearshore Area
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia



LEGEND

Magnetic Anomalies

- Inferred Midtown Tunnel Location
- Inferred Water Pipeline Location
  Pink line represents width of anomaly (uncertainty of pipeline location). Refer to Figure 11 and discussion in Fugro (2008b).
- Unknown
- Magnetometer Contour
  Major contour interval is 500 nT.
  Minor contour interval is 100 nT.

Magnetometer Data (nT)

- Less than 50,500
- 50,500 - 51,000
- 51,000 - 51,500
- 51,500 - 52,000
- 52,000 - 52,500
- 52,500 - 53,000
- 53,000 - 53,500
- 53,500 - 54,000
- 54,000 - 54,500
- 54,500 - 55,200

- Bathymetric Contour in Feet (MLLW)
  Contour interval is 5 ft.
  Refer to Fugro 2008b for bathymetric survey extents.
  Refer to Notes 3 and 4 below for survey references and notes.
- Area Obstructed During Fugro 2008 Survey
- Approximate Location of Midtown Tunnel
  Not for design or construction planning
  (Refer to Section 7.1 in text)

NOTES

1) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>
2) Magnetometer Survey Instrumentation:
   Marine Magnetics Corp., SeaSPY Overhauser Total Field Magnetometer
3) Bathymetric Data Sources:
   a) Fugro (MB-2008): Multibeam Bathymetry Data
   b) Fugro (SB-2008): Single Beam Bathymetry Data
   c) MHI (2008): Marine Hydraulics International, Inc. Single Beam Bathymetry Data
   d) USACE (2007): U.S. Army Corps of Engineers Multibeam Bathymetry Data
4) Reference to Mean Lower Low Water (MLLW), 1983-2001 Tidal Epoch, (NOAA/NOS). Tidal Bench Mark 8638610 at Sewells Point, Hampton Roads

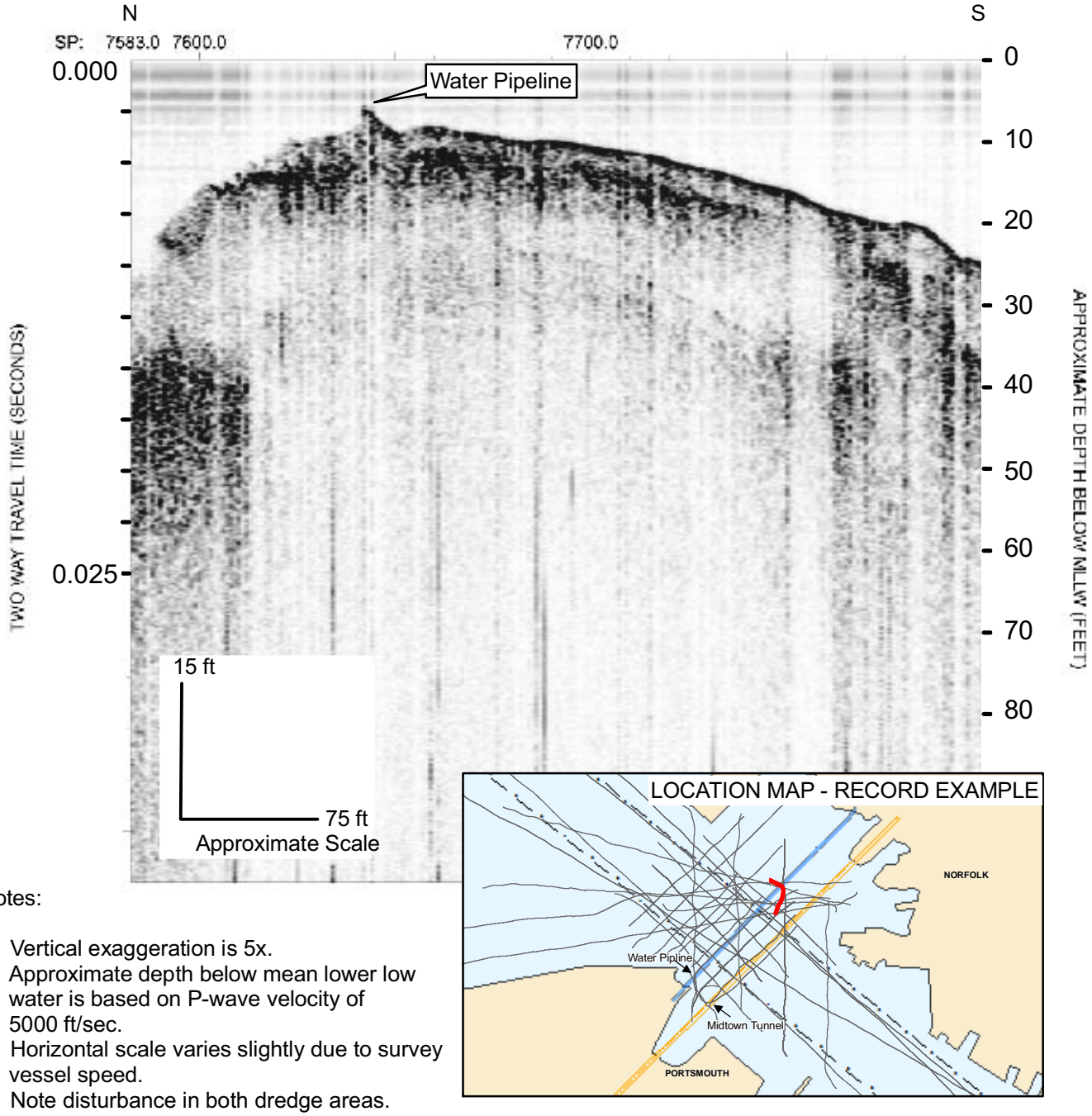
0 100 200 Feet

N
W E
S

MAGNETOMETER SURVEY
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 3-8

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\05-ER_SiteChar\MXD\Figures\Fig-3-8_Magnetometer_11x17.mxd, 10/22/08, kspencer



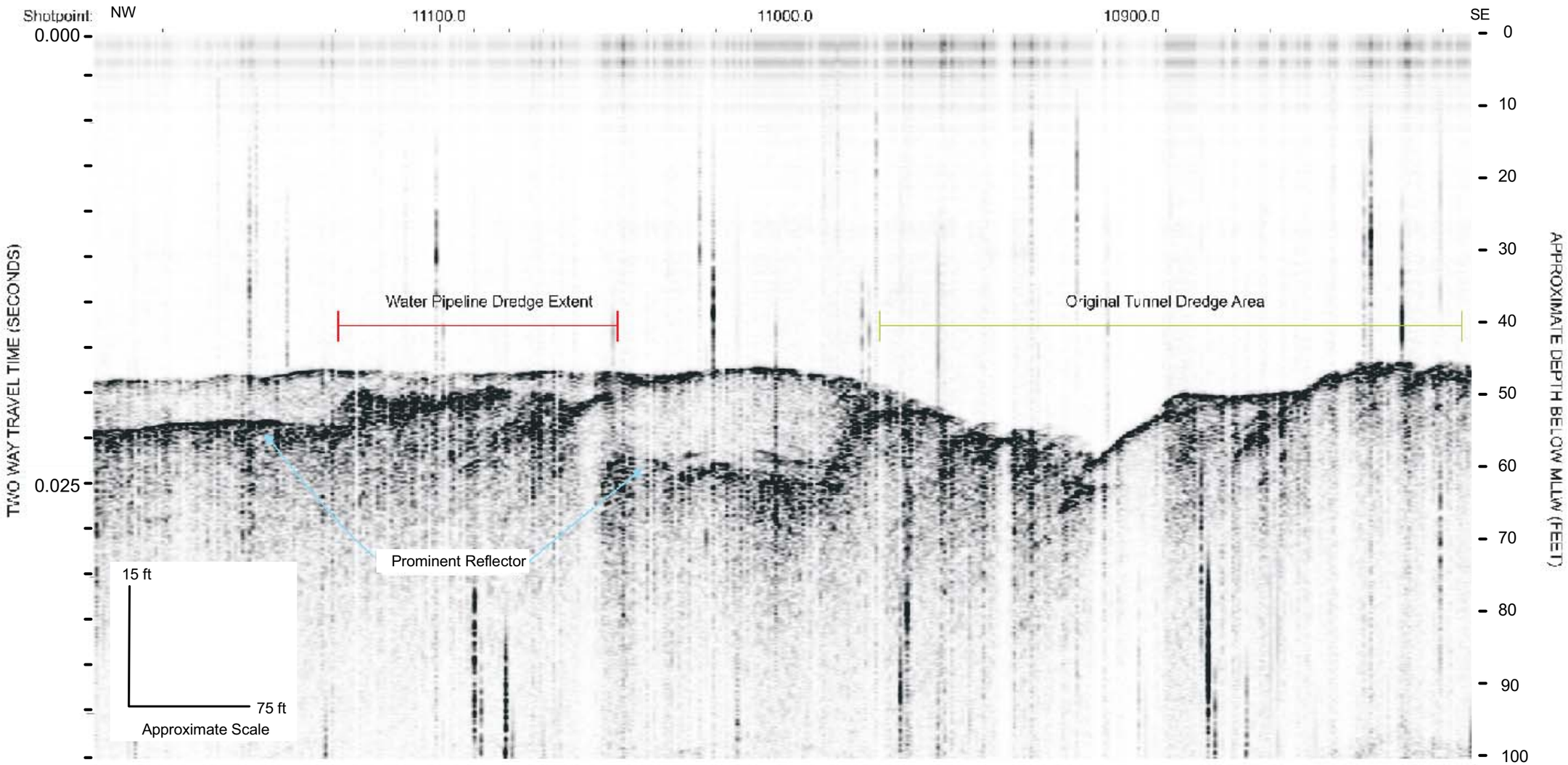
Notes:

1) Vertical exaggeration is 5x.
2) Approximate depth below mean lower low water is based on P-wave velocity of 5000 ft/sec.
3) Horizontal scale varies slightly due to survey vessel speed.
4) Note disturbance in both dredge areas.

CHIRP SEISMIC RECORD EXAMPLE OF LINE 313
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

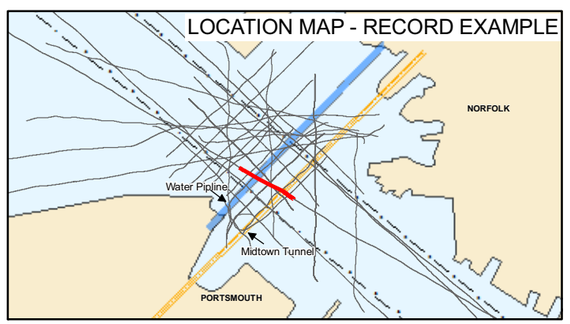
FIGURE 3-9

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\05-ER_SiteChar\MXD\Figures\Fig-3-9_Chirp_Line312.mxd, 10/20/08, ksmith



Notes:

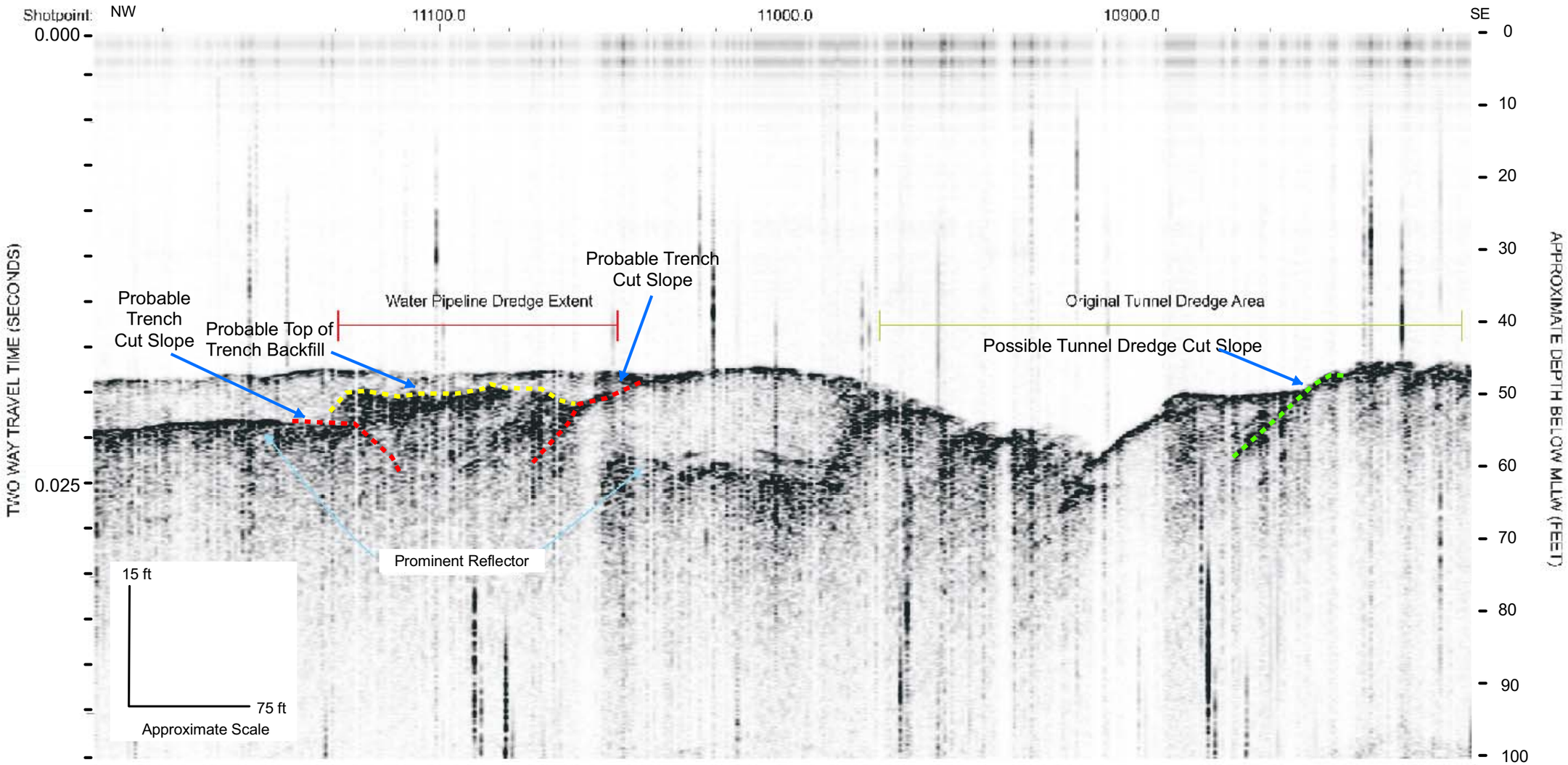
1) Vertical exaggeration is 5x.
2) Approximate depth below mean lower low water is based on P-wave velocity of 5000 ft/sec.
3) Horizontal scale varies slightly due to survey vessel speed.
4) Note disturbance in both dredge areas.



CHIRP SEISMIC RECORD EXAMPLE OF LINE 305
Uninterpreted
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

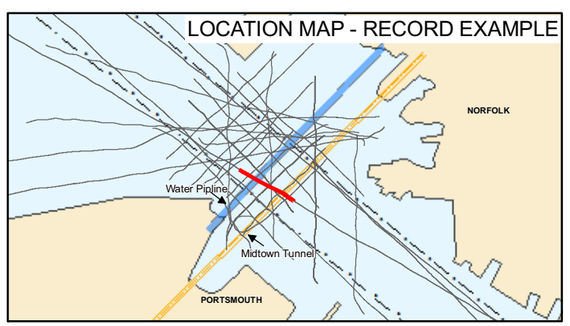
FIGURE 3-10a

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\04-Seismic\MXD\Fig-6_Chirp_Line305.mxd, 08/29/08, ksmith



Notes:

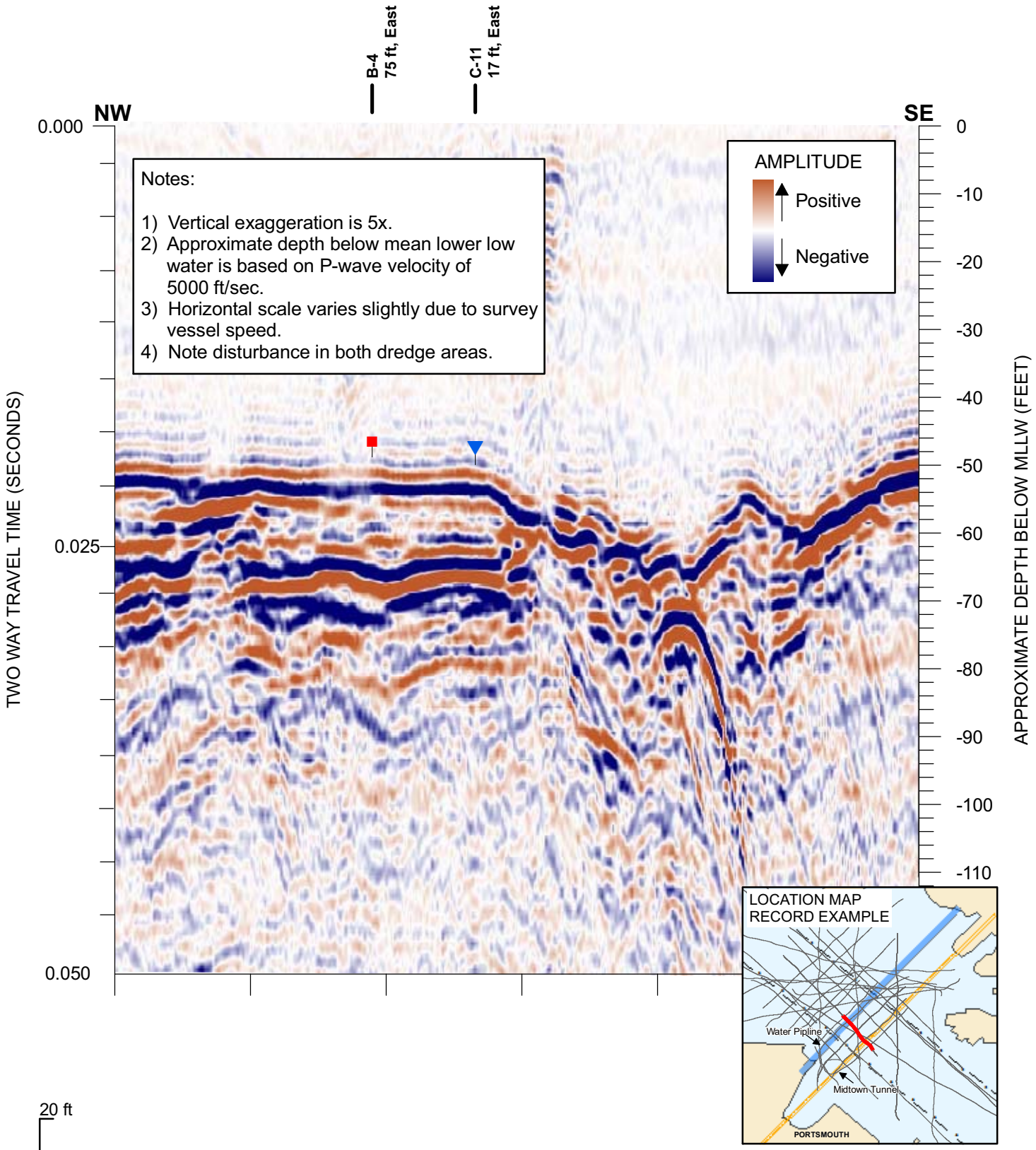
1) Vertical exaggeration is 5x.
2) Approximate depth below mean lower low water is based on P-wave velocity of 5000 ft/sec.
3) Horizontal scale varies slightly due to survey vessel speed.
4) Note disturbance in both dredge areas.



CHIRP SEISMIC RECORD EXAMPLE OF LINE 305
Interpreted
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 3-10b

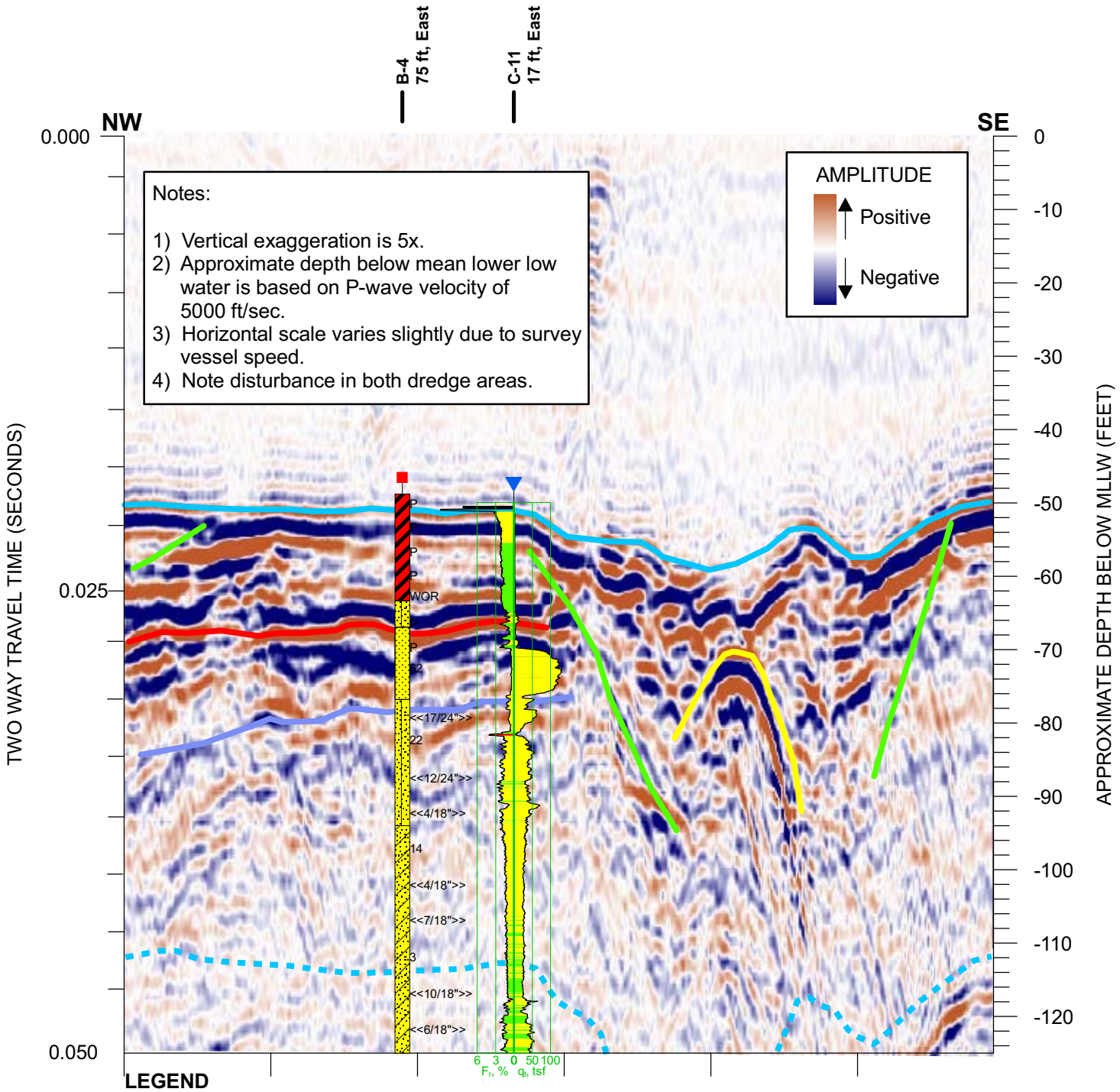
N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\04-Seismic\MXD\Fig-6_Chirp_Line305.mxd, 08/29/08, ksmith



BOOMER SESIMIC RECORD EXAMPLE OF LINE 203
Uninterpreted
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 3-11a

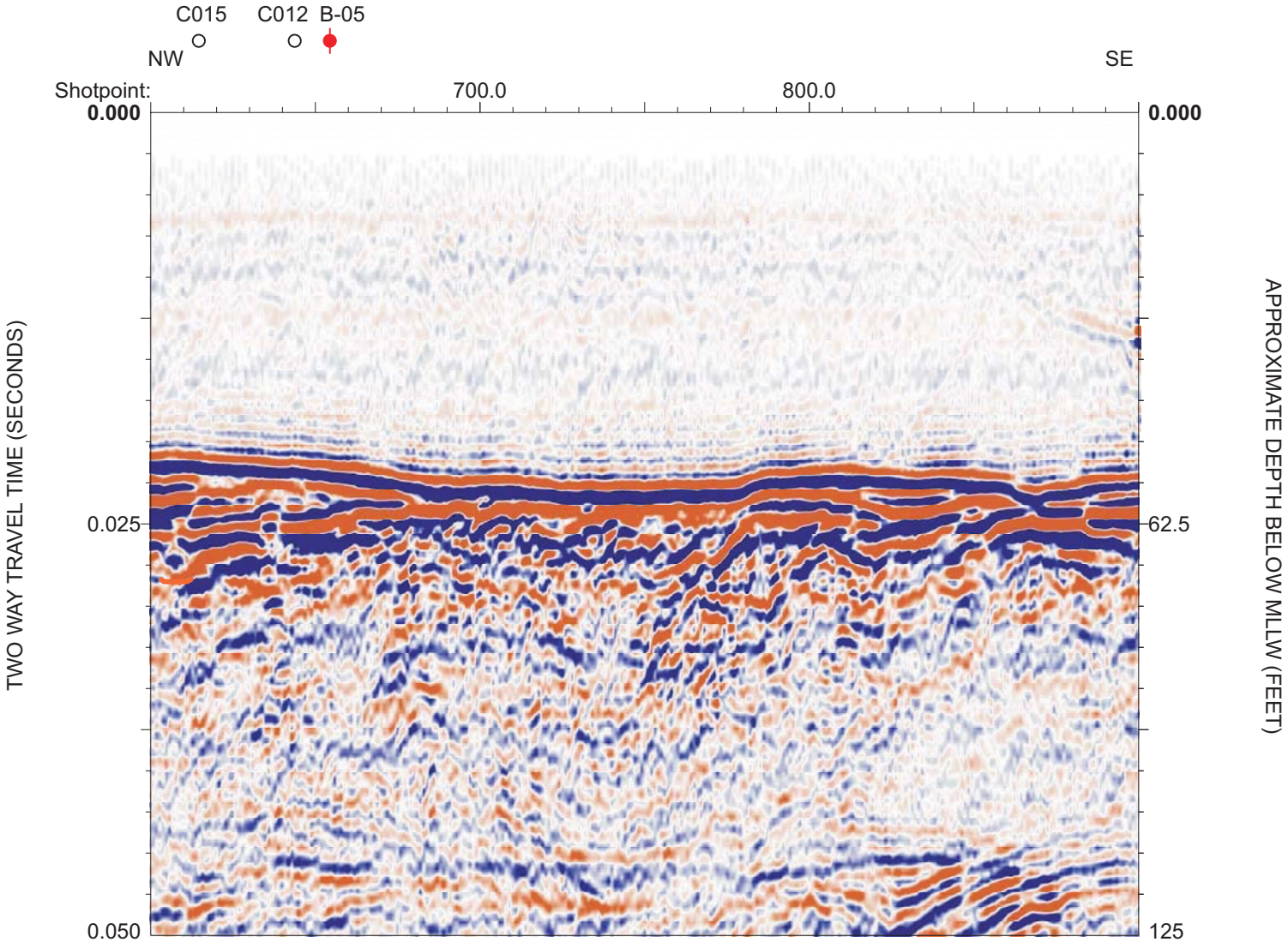
N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\05-ER_SiteChar\MXD\Figures\Fig-3-11a_BLine-203.mxd, 11/11/08, ksmith



BOOMER SESIMIC RECORD EXAMPLE OF LINE 203
Interpreted
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 3-11b

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\05-ER_SiteChar\MXD\Figures\Fig-5-11_Gas.mxd, 11/03/08, kstevens



25’

100’

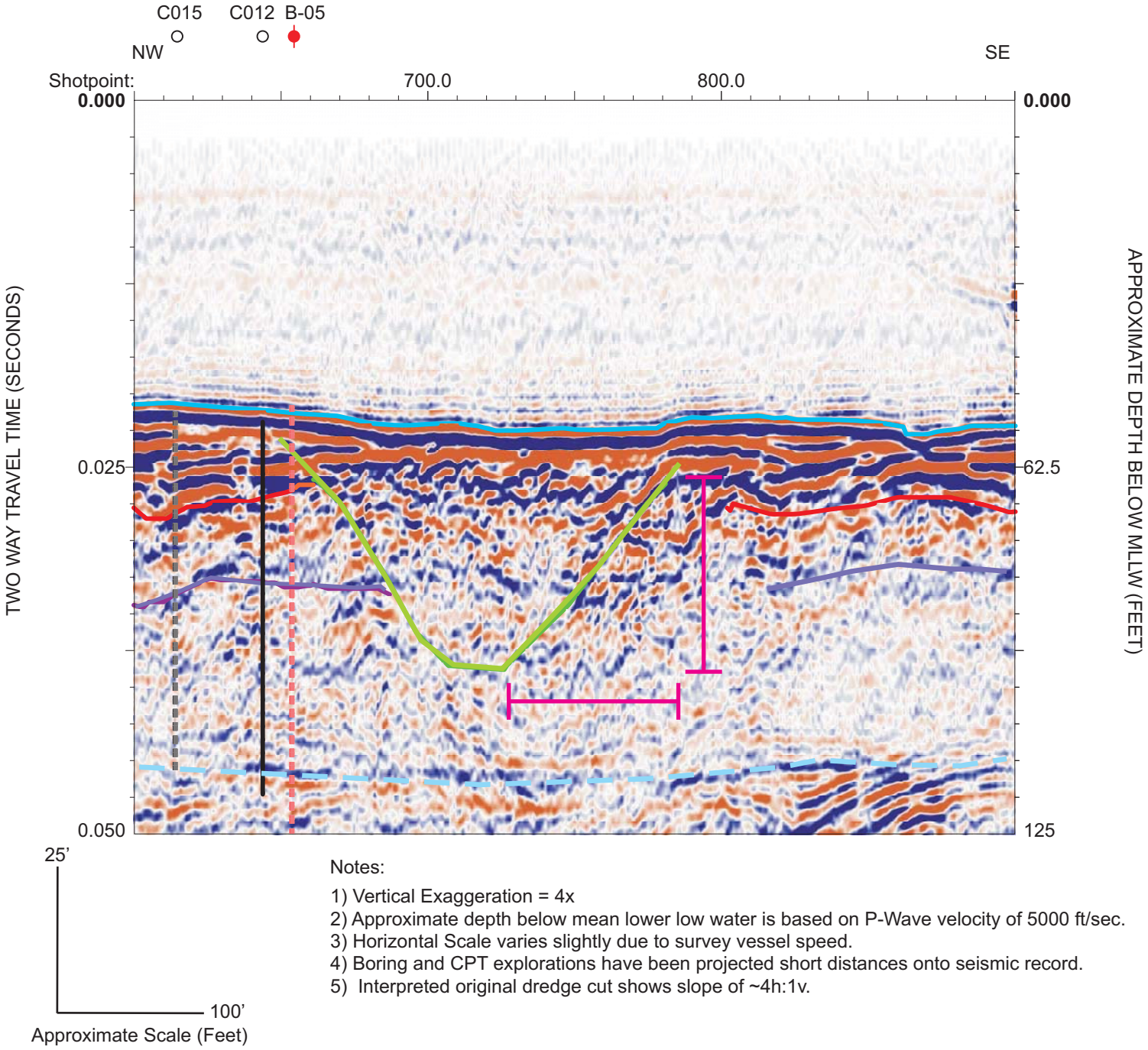
Approximate Scale (Feet)

Notes:

1) Vertical Exaggeration = 4x
2) Approximate depth below mean lower low water is based on P-Wave velocity of 5000 ft/sec.
3) Horizontal Scale varies slightly due to survey vessel speed.
4) Boring and CPT explorations have been projected short distances onto seismic record.
5) Interpreted original dredge cut shows slope of ~4h:1v.

BOOMER SEISMIC RECORD EXAMPLE OF LINE 204
Uninterpreted
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 3-12a



Notes:

1) Vertical Exaggeration = 4x
2) Approximate depth below mean lower low water is based on P-Wave velocity of 5000 ft/sec.
3) Horizontal Scale varies slightly due to survey vessel speed.
4) Boring and CPT explorations have been projected short distances onto seismic record.
5) Interpreted original dredge cut shows slope of ~4h:1v.

LEGEND

- River Bottom
- River Bottom Multiple
- Interpreted Dredge Cut

Mapped Reflectors and Interpreted Stratigraphic Contacts

- Reflector A (Base of Quaternary Alluvium/Top of Norfolk Formation)
- Reflector B (Base of Norfolk Formation/Top of Yorktown Formation

BOOMER SEISMIC RECORD EXAMPLE OF LINE 204
Interpreted
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 3-12b

4.0 SUBSURFACE INVESTIGATION

4.1 EXPLORATIONS

The subsurface stratigraphy was explored primarily through the use of geotechnical borings and CPT soundings (Figure 1-3 and Chart 1). Samples were recovered at regular intervals during the advancement of each borehole. CPT soundings provided a continuous and rapid measurement of soils below the river bottom. Additionally, T-bar soundings and vane shear tests were performed to assess strength properties of fine-grained soil. Table 4-1 below summarizes all of the 2008 exploration data, however only the highlighted explorations are relevant to this report.

Table 4.1. Exploration Data

Boring Designation	Locale	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet)		River Bottom/Ground Surface Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
			Northing	Easting			
B-1	Marine	3/4/2008	3478965	12122033	-29.1	78.6	-107.7
B-2	Marine	3/3/2008	3479050	12122036	-29.6	98.3	-127.9
B-3	Marine	3/2/2008	3479246	12122243	-47.2	109.1	-156.3
B-4	Marine	3/1/2008	3479474	12122356	-48.2	99.3	-147.5
B-5	Marine	3/2/2008	3479583	12122610	-45.9	127.2	-173.1
B-6	Marine	2/25/2008	3479839	12122694	-26.1	109.1	-135.2
B-8	Marine	2/26/2008	3479980	12123065	-23.0	99.3	-122.3
B-9	Marine	2/27/2008	3480199	12123254	-11.9	88.9	-100.8
B-10	Marine	2/28/2008	3480522	12123492	-10.9	88.9	-99.8
B-11	Marine	2/29/2008	3480644	12123570	-11.0	79.1	-90.1
B-12	*Land*	*6/13/2008*	*3477408*	*12120265*	*+10.2*	*41.4*	*-31.2*
B-13	*Land*	*6/16/2008*	*3477616*	*12120578*	*+9.9*	*61.5*	*-51.6*
B-14	*Land*	*6/11/2008*	*3477887*	*12120856*	*+9.1*	*101.5*	*-92.4*
B-15	*Land*	*6/25/2008*	*3478083*	*12121125*	*+7.2*	*101.5*	*-94.3*
B-16	*Land*	*6/26/2008*	*3478370*	*12121316*	*+6.9*	*101.5*	*-94.6*
B-17	*Land*	*7/1/2008*	*3481135*	*12124204*	*+6.9*	*41.5*	*-34.6*
B-18	*Land*	*7/2/2008*	*3481049*	*12124112*	*+6.5*	*61.5*	*-55.0*
B-19	*Land*	*7/8/2008*	*3480972*	*12124023*	*+5.2*	*101.5*	*-96.3*
B-20	*Land*	*7/9/2008*	*3478631*	*12121437*	*+6.9*	*101.5*	*-94.6*

Note: B-7 was deleted from the drilling program.

Table 4.1. Exploration Data - Continued

CPT Designation	Locale	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet)		River Bottom/Ground Surface Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
			Northing	Easting			
C-1	Marine	4/25/2008	3478945	12122051	-29.5	85.3	-114.8
C-2	Marine	4/25/2008	3478998	12121993	-27.3	85.3	-112.6
C-3	Marine	4/25/2008	3479027	12121957	-25.8	85.3	-111.1
C-4	Marine	4/25/2008	3479063	12121918	-26.7	85.3	-112.0
C-5	Marine	4/26/2008	3479080	12122063	-32.0	82.4	-114.4
C-6	Marine	4/26/2008	3479159	12122138	-37.5	79.5	-117.0
C-7	Marine	4/28/2008	3479194	12122308	-47.9	80.9	-128.9
C-8	Marine	4/28/2008	3479218	12122280	-47.8	78.0	-125.8
C-9	Marine	4/27/2008	3479240	12122145	-44.3	80.1	-124.4
C-10	Marine	4/27/2008	3479302	12122108	-46.9	83.7	-130.6
C-11	Marine	4/27/2008	3479376	12122360	-49.7	84.6	-134.3
C-12	Marine	4/27/2008	3479495	12122475	-47.6	84.6	-132.2
C-13	Marine	4/27/2008	3479508	12122637	-47.7	82.8	-130.5
C-14	Marine	4/27/2008	3479574	12122568	-45.6	84.1	-129.7
C-15	Marine	4/27/2008	3479613	12122512	-44.9	81.5	-126.4
C-16	Marine	4/27/2008	3479658	12122466	-44.8	84.8	-129.6
C-17	Marine	4/27/2008	3479676	12122694	-42.0	15.3	-57.4
C-18	Marine	4/25/2008	3479813	12122810	-22.0	84.8	-106.8
C-19	Marine	4/27/2008	3479778	12122660	-38.9	84.9	-123.8
C-20	Marine	4/28/2008	3479376	12122500	-51.5	76.5	-128.0
C-21	Marine	4/25/2008	3479941	12122893	-12.9	84.3	-97.2
C-22	Marine	4/28/2008	3479433	12122403	-47.8	26.6	-74.4
C-22A	Marine	4/28/2008	3479441	12122419	-48.0	74.9	-122.9
C-23	Marine	4/26/2008	3480276	12123114	-3.7	85.3	-89.0
C-24	Marine	4/25/2008	3480027	12123027	-9.3	74.8	-84.1
C-25	Marine	4/25/2008	3480052	12122969	-8.6	77.6	-86.2
C-26	Marine	4/24/2008	3480077	12123189	-20.5	81.5	-102.0
C-27	Marine	4/26/2008	3480348	12123290	-4.3	85.1	-89.4
C-28	Marine	4/24/2008	3480161	12123282	-17.0	91.6	-108.6
C-29	Marine	4/25/2008	3480250	12123405	-11.3	84.5	-95.8
C-30	Marine	4/24/2008	3480394	12123489	-10.4	24.9	-35.3
C-30A	Marine	4/24/2008	3480396	12123446	-10.2	97.6	-107.8
C-31	Marine	4/24/2008	3480511	12123508	-11.0	25.3	-36.3
C-32	Marine	4/24/2008	3480622	12123569	-10.9	84.8	-95.7
C-33	Marine	4/24/2008	3480672	12123577	-10.8	85.3	-96.1
C-34	Marine	4/25/2008	3480709	12123545	-10.8	46.8	-57.6
C-35	Marine	4/28/2008	3479687	12122761	-39.5	85.0	-124.5
C-36	Marine	4/28/2008	3479773	12122843	-30.1	65.8	-95.9
C-37	Marine	4/30/2008	3479961	12123101	-23.5	58.5	-82.0

Table 4.1. Exploration Data - Continued

C-38	Marine	4/30/2008	3480099	12123071	-7.3	85.2	-92.5
C-39	*Land*	*9/12/2008*	*3477433*	*12120368*	*+9.1*	*9.4*	*-0.3*
C-40	*Land*	*9/12/2008*	*3477597*	*12120583*	*+9.0*	*62.8*	*-53.9*
C-41	*Land*	*9/12/2008*	*3477863*	*12120878*	*+8.2*	*73.2*	*-64.9*
C-42	*Land*	*9/15/2008*	*3480938*	*12124019*	*+5.2*	*56.4*	*-51.3*
C-43	*Land*	*9/15/2008*	*3480996*	*12123964*	*+5.0*	*42.2*	*-37.2*
C-44	*Land*	*9/15/2008*	*3481084*	*12124056*	*+5.7*	*36.3*	*-30.5*
C-45	*Land*	*9/15/2008*	*3481017*	*12124142*	*+6.1*	*68.1*	*-62.0*
C-46	*Land*	*9/15/2008*	*3481135*	*12124234*	*+6.6*	*31.0*	*-24.4*
C-47	*Land*	*9/17/2008*	*3478829*	*12121597*	*+6.2*	*113.4*	*-107.1*

Explorations listed below were conducted as part of the marine geotechnical program

Fugro T-Bar Designation	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet)		River Bottom Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)	Cyclic Test Depths (feet)
		Northing	Easting				
T-1	4/29/2008	3479069	12122071	-32.6	33.1	-65.7	8.4, 18.2, 28.1, 32.3
T-2	4/29/2008	3479211	12122294	-47.7	13.4	-61.1	7.7, 12.6
T-3	4/28/2008	3479663	12122476	-44.3	11.5	-55.8	5.7, 10.7
T-4	4/28/2008	3479804	12122819	-23.5	37.7	-61.2	7.4, 17.2, 27.1, 36.9

Fugro Vane Shear Designation	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet)		River Bottom Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)	Test Depths (feet) "R" indicates remold test was performed
		Northing	Easting				
V-1	4/29/2008	3479104	12122073	-31.9	31.3	-63.2	10.6 **R,** 23.1 **R,** 31.3 **R**
V-2	4/29/2008	3479223	12122291	-48.4	9.8	-58.2	9.8 **R**
V-3	4/29/2008	3479672	12122464	-44.1	11.4	-55.5	6.5 **R,** 11.4 **R**
V-4	4/29/2008	3479817	12122822	-21.7	39.8	-61.5	10.3, 20.1, 29.9, 39.8

4.2 HISTORICAL GEOTECHNICAL INFORMATION

A geotechnical study was conducted at the site in 1960 in anticipation of the original tunnel construction. 12 marine borings were advanced to depths about 100 feet below the river bottom. Boring logs from the 1960 investigation (shown on Charts 4a and 5a) do not contain laboratory test data. Attempts to access historical reports, which contain such information, by Fugro and VDOT, were unsuccessful.

4.3 SUMMARY OF SEISMIC DATA REFLECTION REVIEW

The seismic data were loaded into SMT's Kingdom Suite interpretive software program. Available geotechnical data, cultural data (including utilities, locations of abandoned piers, tunnel, and shoreline), and bathymetric data were also integrated into the software program to assist the data review. During collaborative working sessions between VDOT and Fugro Atlantic, the data were reviewed and evaluated to identify value that the data may add to the project. In general, we found the data useful to:

- Characterize subsurface geology and conditions,
- Identify and locate subsurface structures, and
- Infer as-built conditions of the existing tunnel.

The following discussion provides a description of the various features observed in the data, degree of correlation with geotechnical and cultural data, and our estimate of the uncertainty of the respective interpretations.

5.0 SUBSURFACE CONDITIONS

5.1 REGIONAL GEOLOGY

The project area is located in the Coastal Plain physiographic province. Flat-lying plains and terraces dominate the landscape. The Coastal Plain is underlain by a wedge of Cretaceous to Holocene age sediments that thicken to the east and pinch out at the Fall Line approximately 70 miles west of the project area. Jurassic-Triassic age basement rocks lie approximately 1,800 feet beneath the site. The wedge of Cretaceous and younger sediments were deposited as a result of multiple marine transgressions and regressions. Sediments within the upper 150 feet beneath the site are Pliocene to Recent in age. The Pliocene and younger sediments have been deposited and subsequently eroded in places during the rising and falling sea levels that resulted from glacial and interglacial periods. Figure 5-1 presents a geologic map of the area and Figure 5-2 presents a geologic cross section. We acknowledge that the Norfolk and Sandbridge Formations shown in Figures 5-1 and 5-2 are referred to in more recent publications as the Tabb Formation.

5.2 OVERVIEW OF PRINCIPAL STRATIGRAPHIC UNITS

Our 2008 site investigation program explorations encountered subsurface conditions beneath the proposed project area primarily consisting of interbedded extremely soft to soft Alluvium (Qal) overlying loose to medium dense granular material of the late Pleistocene Norfolk Formation (Qn). Beneath the Norfolk Formation lie two units of the Yorktown Formation, primarily horizontally-bedded, Pliocene sediments of differing composition.

The subsurface stratigraphy within the proposed Midtown Second Parallel Tunnel project area is displayed on 12 subsurface cross-sections. Subsurface cross-sections displaying classification test results are presented on Charts 4a-b, and Figures 5-3a through 5-3o. Cross-sections displaying undrained shear strength test results are presented on Charts 5a-b, and Figures 5-4a through 5-4o. Please note that each longitudinal cross section is split in two and joined by a matchline for presentation as figures, e.g., A-A' is presented as A-A' and A'-A". A key to the symbolism used on those sections is shown on Figure 5-5.

Longitudinal subsurface cross-sections are oriented in a southwest-northeast direction and drawn looking northwest through the proposed project area and existing tunnel alignment. A-A' is located outside of the proposed dredge cut, B-B' is within the proposed dredge cut, and C-C' is through the existing tunnel alignment. Transverse Sections 1-1' through 9-9' are oriented in a northwest-southeast direction and drawn looking northeast across the proposed project area.

The interpreted strata, in descending sequence, include:

Artificial Fill (Af). Artificial fill was encountered by the marine explorations in two areas. Several explorations along the existing tunnel alignment (e.g. cross section B-B' and the transverse cross sections 1-1' through 9-9') encountered a wedge shaped body of fill associated with the construction materials used during construction of the tunnel. The thickness increases

towards the southeast and the maximum thickness encountered was about 30 feet. Based on review of the design drawings, the fill may be up to 70 feet thick near the center of the tunnel alignment.

Physical samples from borings of the fill material classified as Silty Fine Sand (SM) and Poorly-graded Sand with Silt (SP-SM). It is interpreted to extend down to about El. -19 to 28 feet (re: MLLW datum) at the locations explored. CPT explorations also encountered the fill material. The 2008 marine CPTs encountered primarily fine-grained sediments with varying amounts of sandy materials. The transition from fill into the underlying material is subtle but distinct. CPT pore pressure, tip resistance, and interpreted undrained shear strength are lower in the fill materials. Additionally, the fill material is less homogenous than the underlying Holocene alluvium.

A second area of possible fill material was encountered in the shoal area (water depth shallower than 15 feet) northeast of the Navigation Channel in the Norfolk side of the river. CPTs C-21, C-23, C-25, C-27, and C-38 encountered up to 8 feet of loose, silty sand to sandy silt material. It is possible that this material may be side cast material during construction of the tunnel and may be limited to this general shoal area.

Alluvium (Qal). Predominantly Fat Clay (CH) and Organic Clay (OH) were encountered in all of the explorations. In addition, the Holocene age Alluvium contains interbedded materials which include Sandy Clay (CL), and Silty Fine to Fine Sand (SM to SP). These interbedded sandy layers range in thickness between several feet to about 10 feet. Several sandy interbeds correlate with nested channels observed in seismic reflection data (see cross sections A-A' and Figures 5-6c and 5-6d). For example sandy layers in CPTs C-11, C-12, C-22A, and C-14 along cross section A-A' correlate well with reflectors in the seismic data that are inferred to be nested channels. Along the Norfolk flank of the river, there appears to be a coarse-grained layer that extends from the onshore area and pinches-out in the river between cross sections 9-9' and 8-8'. The coarse-grained layer classifies predominantly as Silty Fine to Fine Sand (SM to SP).

Overall the Alluvium is generally about 20 to 25 feet thick within the Navigation Channel; between 50 and 60 feet thick on the Portsmouth side of the Navigation Channel; and typically 20 to 40 feet thick on the Norfolk side except where a channel appears to have incised into the underlying sediments at about CPT C-25 where the alluvium is about 70 feet thick.

The Alluvium extends down to between elevation (El.) -60 to -82 feet in Borings 1 through 8, and to between about El. -25 and -36 feet in Borings 9 through 11. At the lowest point encountered by our explorations (CPT C-25) extends as deep as El. -86 feet. In the area of CPTC-25, the quality of the seismic data was affected by the water bottom multiple, energy reflected by the tunnel, and the dredge cut and as a result did not clearly image this feature.

Norfolk Formation (Qn). The predominantly fine-grained Alluvium is underlain by a zone of granular Pleistocene age fluvial-estaurine and brackish marine deposits that classify primarily as Silty Fine Sand (SM) to Fine Sand (SP). This material appears to have been incised by fluvial processes at approximate location CPT C-25 (see cross section A'-A" on Figure 5-3b and 5-4b). This channel feature is approximately 25-feet deep and 250 to 300 feet

wide. The thickness of this stratum varies between about 3 and 30 feet at the locations explored.

Yorktown Formation Sand (Ty). Granular material of the Pliocene age Yorktown Formation classified as Silty to Clayey Fine Sand (SM to SC). This stratum was encountered between El. -77 and -98 feet in Borings 1 through 8, and at about -50 feet in Borings 9 through 11.

Yorktown Formation Clay (Ty). Fine-grained Yorktown Formation was encountered in the borings located within the navigation channel, B-3 through -5. These exploration locations correspond to area of lowest river bottom elevation within the project area. Samples of this material classified as Fat Clay (CH). This stratum was encountered between El. -137 to -145 feet and extended down to the maximum depth explored, El. -175 feet.

5.2.1 Seismic Reflection Subsurface Conditions

Subsurface conditions are interpreted from seismic data by mapping seismic reflectors and correlating them with published scientific data and geotechnical explorations within the project area. Where present, geological relationships such as unconformities, sedimentary depositional patterns, and unit geometry can be important distinguishing patterns on the seismic records. Seismic data attributes such as reflection amplitude, phase, frequency, and interval velocities also may be indicators of specific geologic units or horizon continuity. The amplitude of the reflection and the phase polarity of the wavelet are influenced by the acoustic impedance contrast between subsurface material layers as the seismic energy travels away from the source. The acoustic impedance of a material layer is the product of the layer's average density and longitudinal wave velocity. A positive impedance contrast occurs when a lower impedance layer overlies a layer with a higher acoustic impedance. The greater the contrast in acoustic impedance the higher the amplitude of the reflection. A negative impedance contrast occurs when a higher impedance layer overlies a lower impedance layer. A positive impedance contrast will yield a positive reflection while a negative impedance contrast will yield a negative reflection. At this site, both positive and negative amplitude reflectors are present and can be mapped.

Seismic data are recorded as reflection times. Conversion from time to depth for correlation with boring data generally requires knowledge of velocity of sound in the subsurface soils and rocks. The velocity of sound will vary in a three-dimensional manner in any area as a function of changes in soil and rock properties, including pore materials such as water, gas, or hydrocarbons. However, over a relatively small area, a specific soil or rock unit often exhibits only minor internal velocity variations, and an average velocity can be assigned to each soil/rock unit in the sequence. Based on existing site conditions, a subsurface longitudinal wave velocity of 5,000 ft/second was assigned to near-surface materials in the surface area.

In general we found a good correlation of the reflectors with geotechnical data. Specifically, Boomer Line 108 traverses the Elizabeth River in approximately the same location as the new proposed tunnel, and serves as a representative seismic cross section across the Elizabeth River. Figures 5-6a through 5-6d show boomer Line 108 with geotechnical boring and

CPT data superimposed over the seismic data to show correlation between the geotechnical and seismic data sets. The following discusses the various stratigraphic interfaces that may be correlated with geotechnical data.

5.2.2 Reflector A (Base of the Quaternary Alluvium)

Barker and Bjorken (1974) map the surficial stratigraphic unit as Quaternary aged alluvium (Qal). The Alluvium overlies a sand facies of the lower member of the Norfolk Formation. We observed a series of subparallel reflectors that correlate well with the presumed depositional environment and alluvium material as interpreted from geotechnical explorations in the project area. The base of these reflectors has a strong positive amplitude reflection, indicating a material transition from the alluvium to underlying Norfolk Formation. Figures 5-7a and 5-7b show an example of the interpreted base of Quaternary Alluvium on Boomer Line 204. The subparallel reflectors interpreted as the base of Quaternary Alluvium are present on multiple seismic lines within the project area. Figure 5-8 shows an extent map of Reflector A mapped from the boomer seismic data.

5.2.3 Reflector B (Top of the Yorktown Formation)

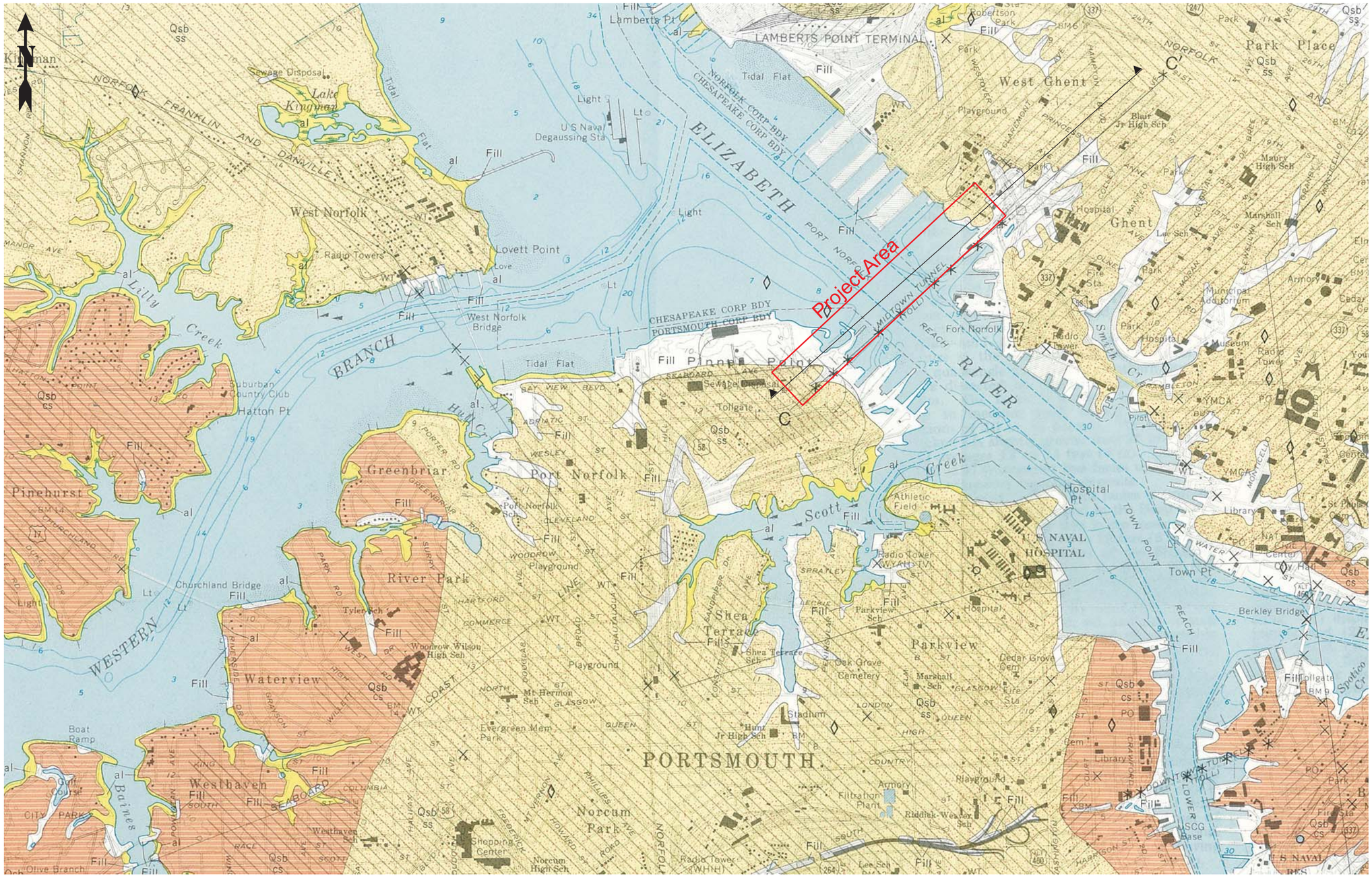
Barker and Bjorken (1974) map the stratigraphic unit that underlies the alluvium as the lower member of the Norfolk Formation. These sediments are granular and comprised of sand with variable amounts of silt. This unit is mapped as overlying the Pliocene age Yorktown Formation as shown on Figure 5-6b and 5-7b. The interpreted reflector that correlates to the top of the Yorktown Formation from geotechnical explorations has negative amplitude, due to a negative acoustic impedance contrast between the overlying Norfolk Formation and the Yorktown Formation. This is attributed to the Norfolk Formation having a higher average density than the underlying Yorktown Formation. Unfortunately, the first seafloor multiple, a consequence of seismic energy being reflected from the seafloor, traveling back to the sea surface, and traveling again to the seafloor and back to the sea surface, obscures much of the data at and beneath the depths where the top of the Yorktown Formation is presumed to lie. Thus, much of the mapped Top or Yorktown Formation is inferred over the project area, and may require additional geotechnical explorations or seismic surveys to be better constrained. Figure 5-9 shows an extent map of Reflector B mapped from the boomer seismic data.

5.2.4 Biogenic Gas

The presence of biogenic gas is common within Quaternary sediments in the Chesapeake Bay area. Due to processing techniques applied to the seismic data, gas appears as a strong negative amplitude reflector, and due to rapid acoustic signal attenuation in gassy sediments, areas beneath these sediments are not imaged. Figure 5-10 shows a Boomer seismic record where gas is interpreted. The majority of biogenic gas observed in the seismic data is confined to the Quaternary Alluvium sediments near the seafloor. Figure 11 shows a location map where gas may exist in the project area based on review of the seismic data.

5.3 LIMITATIONS OF SEISMIC DATA

The characteristics of the seismic data place limitations on its use to assess seafloor and sub-seafloor geologic conditions. The dominant frequency of the entire data volume provided is judged to range between 300 Hz and 1,000 Hz in the upper 1 second TWT below seafloor and the estimated limit of separability ($\lambda/4$) ranges between 5 feet and 50 feet, assuming an average sediment column velocity of 5,000 ft/sec for the near-surface sediments. The limit of separability is a measure of the vertical resolution of the data and is defined as acoustic wavelength (λ) divided by 4, and indicates the minimum bed thickness required to resolve the top and base of the bed as separate reflectors. Beds thinner than the local limit of separability may be detected in the seismic record, but may not be resolved in true thickness or lateral extent. Given these resolution limitations, thin stratigraphic bedding and man-made features and obstructions thinner than the limit of separability cannot be detected with the boomer seismic reflection data set.



0 1000 2000 feet

CONTOUR INTERVAL 5 FEET, DATUM IS MEAN SEA LEVEL, DEPTH CURVES AND SOUNDINGS IN FEET - DATUM IS MEAN LOW WATER
Shoreline shown represents the approximate line is mean high water; the mean range of tide is approximately 2.5 feet.

Source: Barker, W.J. and Bjorken, E.D., 1978, Geology of the Norfolk south quadrangle Virginia: Virginia Division of Mineral Resources Publication 9, scale 1:24,000

GEOLOGIC LEGEND

QUATERNARY — HOLOCENE

- al — **Alluvium, sand, and marsh sediment**: Estuarine-beach, tidal marsh, and fluvial silt, sand, and clay with organic material (peat) abundant in tidal marshes.

QUATERNARY — PLEISTOCENE

- Qsb (cs, ss, sc) — **Sand Bridge Formation:** Upper member; facies-cs, tidal channel, clayey sand; ss, shoal lagoonal, silty sand; and sc, lagoonal, silty clay. (Lower member included with upper member).
- Qn (ss) — **Norfolk Formation:** Upper member, facies-ss, brackish marine silty sand; (Lower member included with upper member).

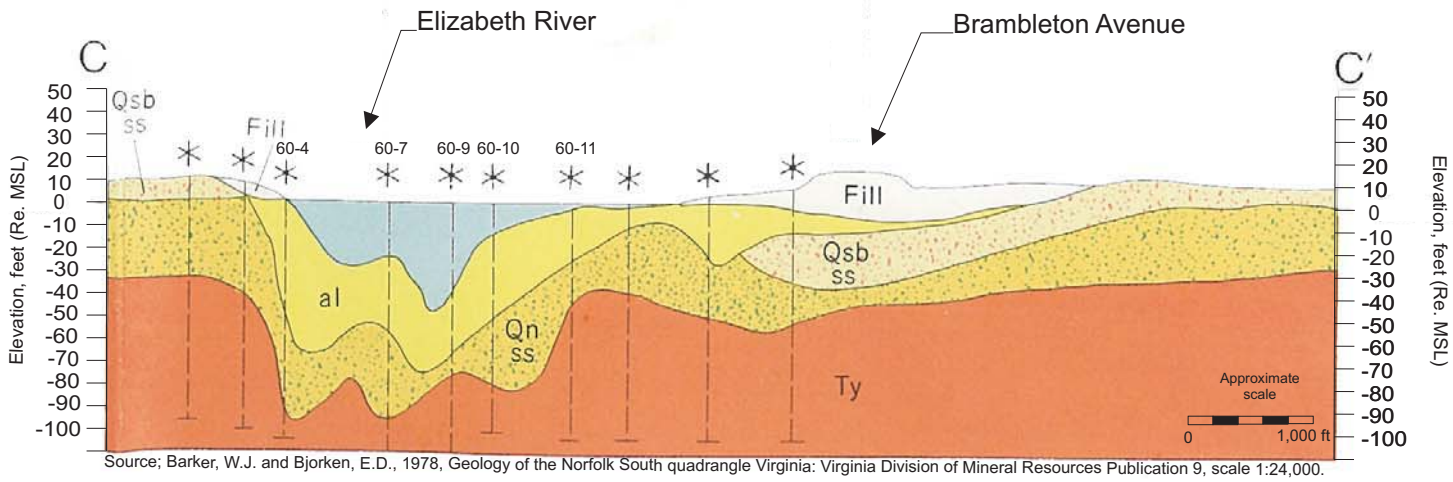
TERTIARY — PLIOCENE

- Ty — **Yorktown Formation (in Section C-C', only)**: near shore marine fossiliferous, silty, coarse sand and coquina.

GEOLOGIC MAP
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

Note:
Refer to Figure A-2 for Cross section C-C'.

FIGURE 5-1

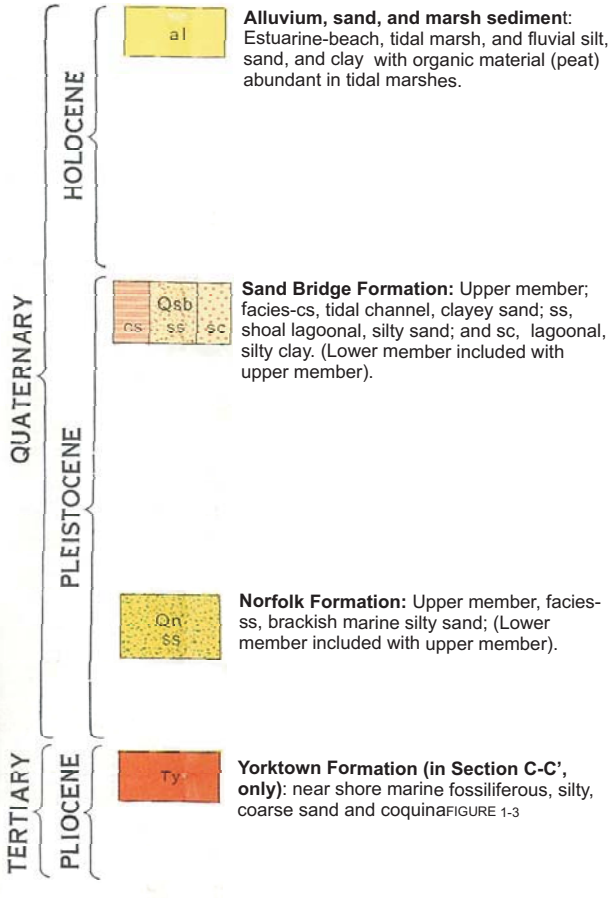


Source; Barker, W.J. and Bjorken, E.D., 1978, Geology of the Norfolk South quadrangle Virginia: Virginia Division of Mineral Resources Publication 9, scale 1:24,000.

Note:

Cross Section C-C' is located approximately along alignment of existing tunnel. Refer to Figure A-1 for location. Cross section is from geologic map published in 1978. Subsurface conditions shown on cross section reflect the authors' (Barker and Bjorken) interpretations at time of publication. This cross section DOES NOT INCLUDE post-1978 INFORMATION OR INTERPRETATION BASED ON MORE RECENT DATA (e.g. 2008 explorations). Borings shown on map are presumed to be from 1960.

GEOLOGIC LEGEND



Alluvium, sand, and marsh sediment: Estuarine-beach, tidal marsh, and fluvial silt, sand, and clay with organic material (peat) abundant in tidal marshes.

Sand Bridge Formation: Upper member; facies-cs, tidal channel, clayey sand; ss, shoal lagoonal, silty sand; and sc, lagoonal, silty clay. (Lower member included with upper member).

Norfolk Formation: Upper member, facies-ss, brackish marine silty sand; (Lower member included with upper member).

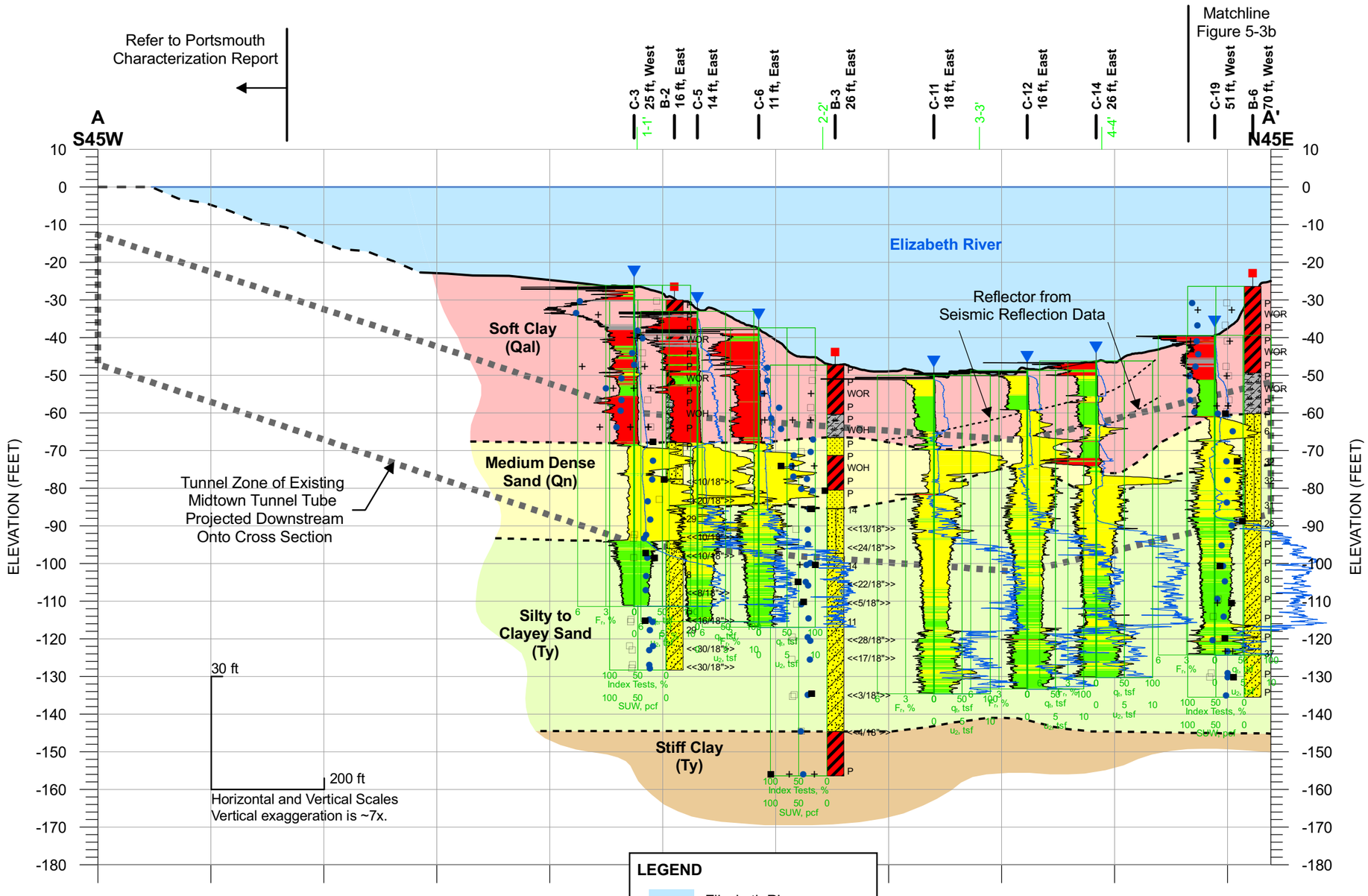
Yorktown Formation (in Section C-C', only): near shore marine fossiliferous, silty, coarse sand and coquina

FIGURE 1-3

GEOLOGIC CROSS SECTION

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-2



LEGEND

- Elizabeth River
- Soft Clay (Qal)
- Medium Dense Sand (Qn)
- Silty to Clayey Sand (Ty)
- Stiff Clay (Ty)

NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-5 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

SUBSURFACE CROSS SECTION A-A'
WITH CLASSIFICATION TEST RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3a

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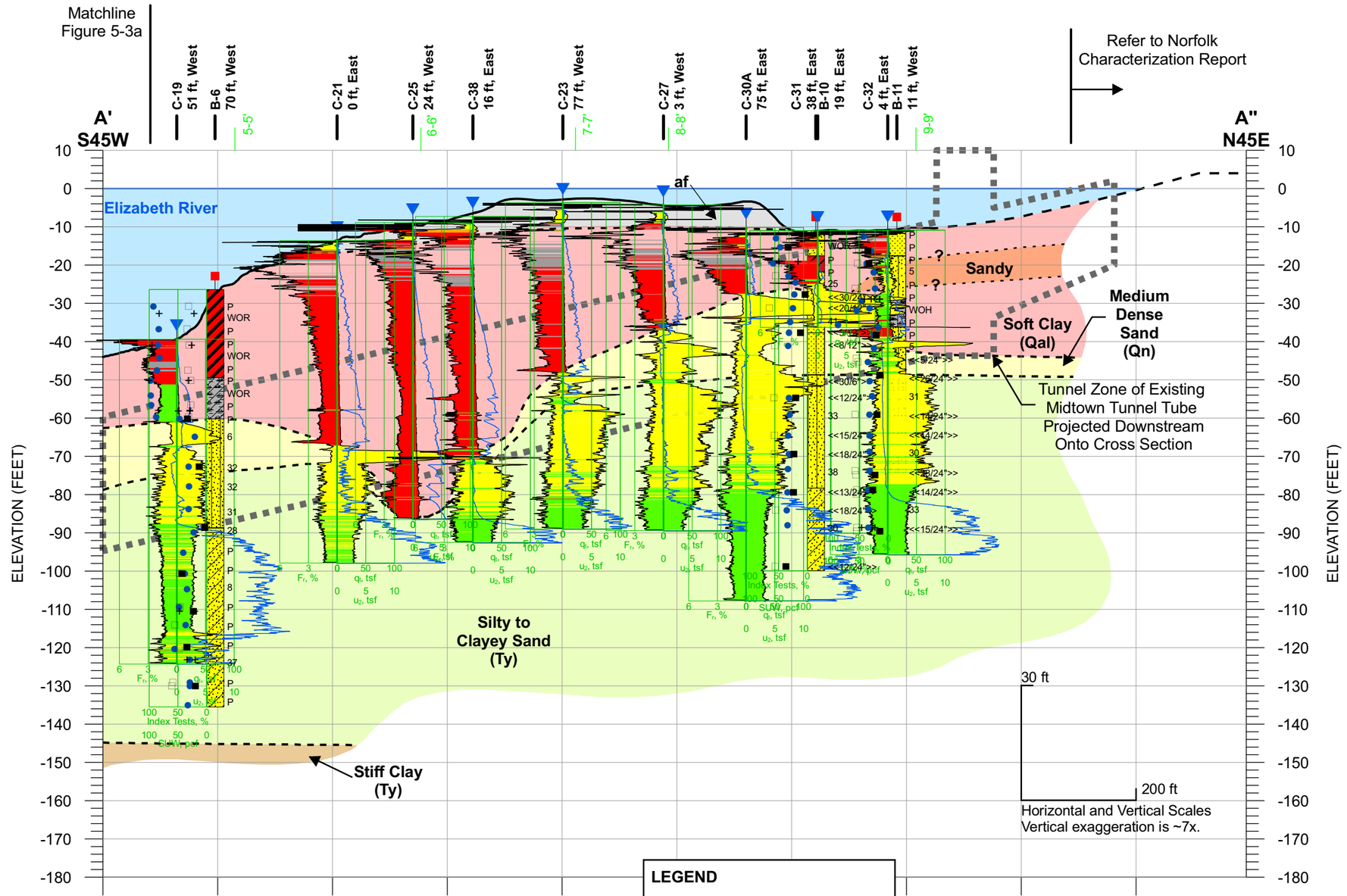

LEGEND

- Elizabeth River
- Soft Clay (Qal)
- Medium Dense Sand (Qn)
- Silty to Clayey Sand (Ty)
- Stiff Clay (Ty)

NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-5 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

SUBSURFACE CROSS SECTION A'-A"
WITH CLASSIFICATION TEST RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3b

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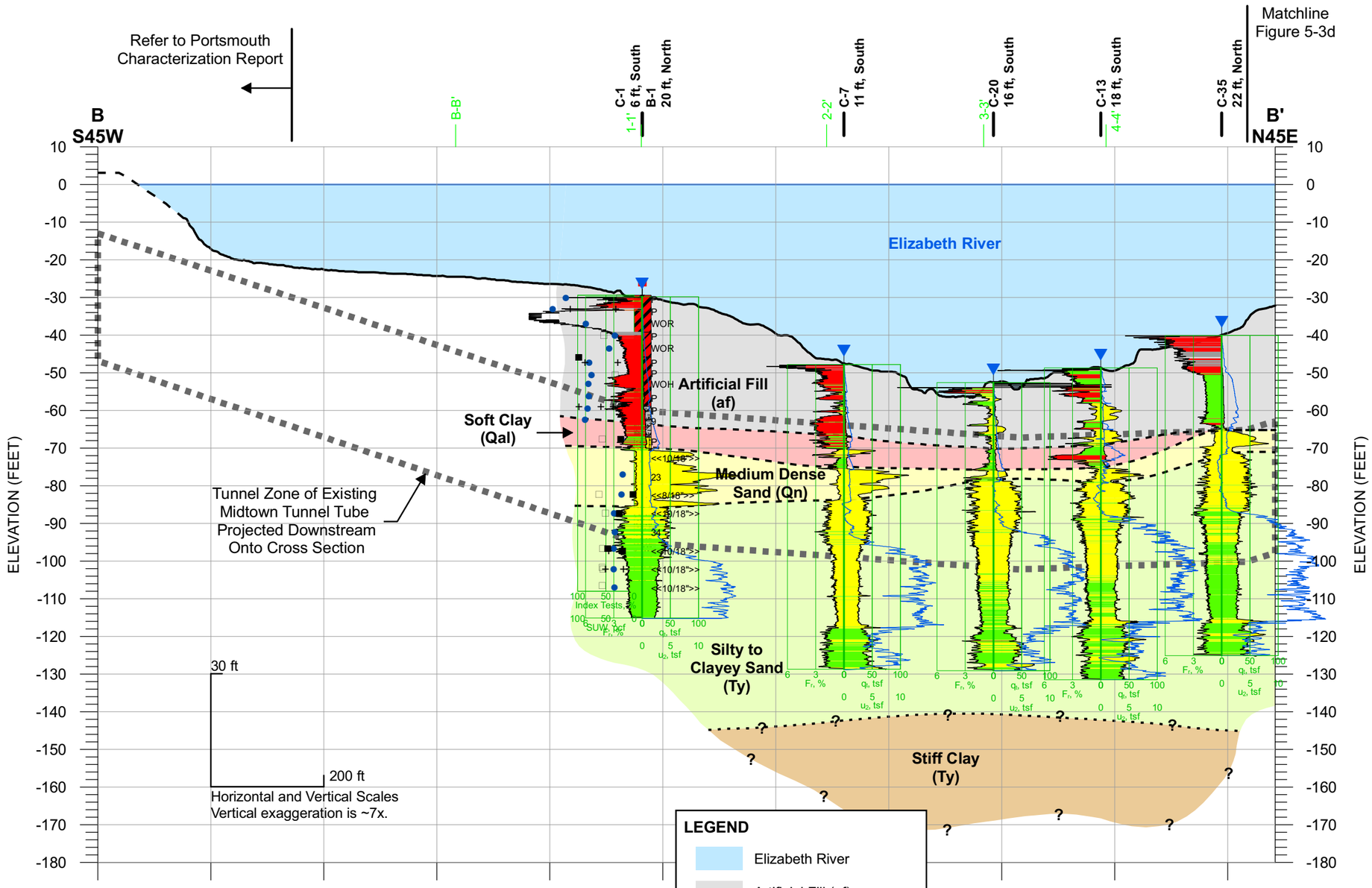

NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-5 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

SUBSURFACE CROSS SECTION B-B'
WITH CLASSIFICATION TEST RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3c

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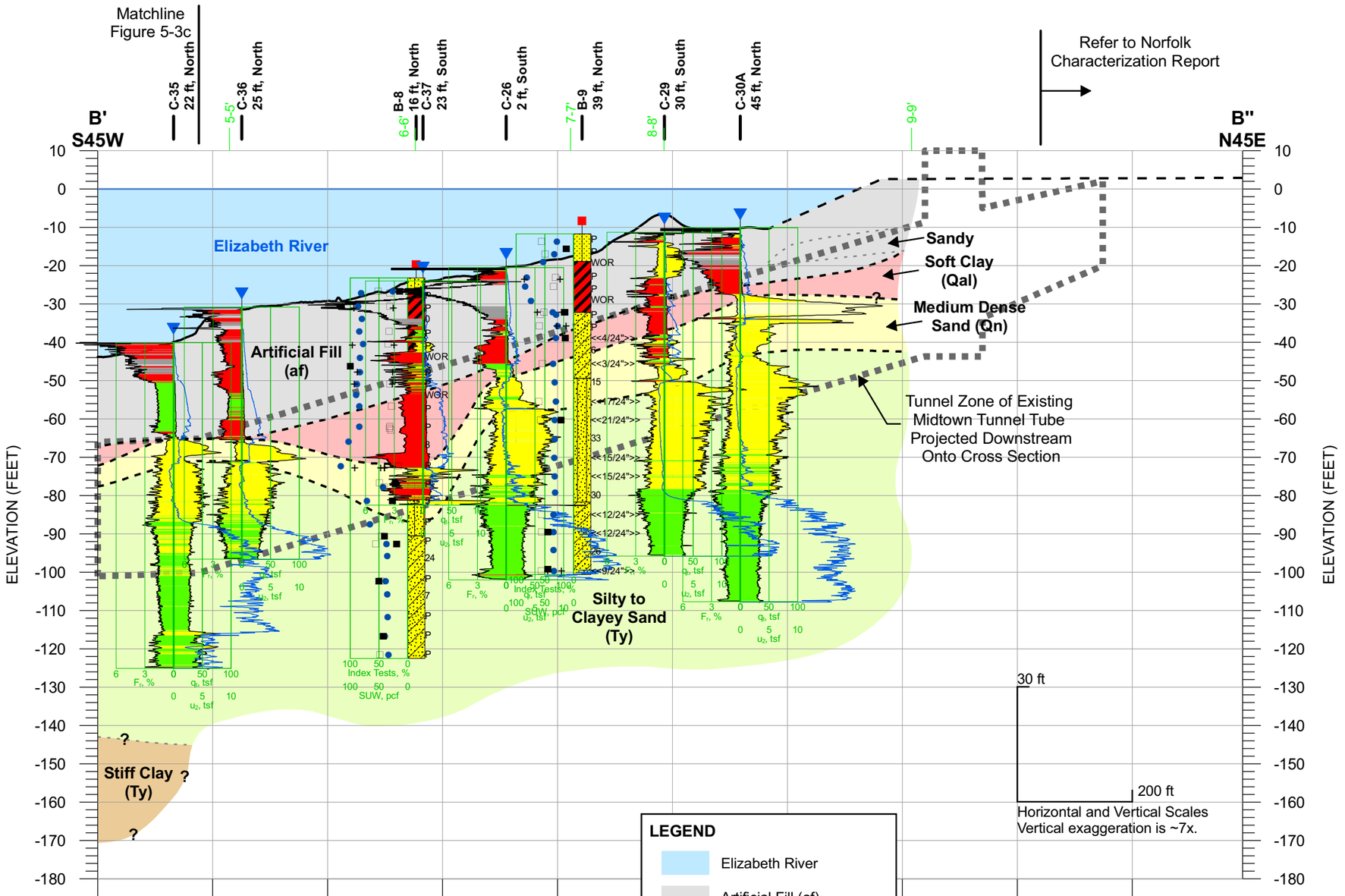

NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-5 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

SUBSURFACE CROSS SECTION B'-B"
WITH CLASSIFICATION TEST RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3d

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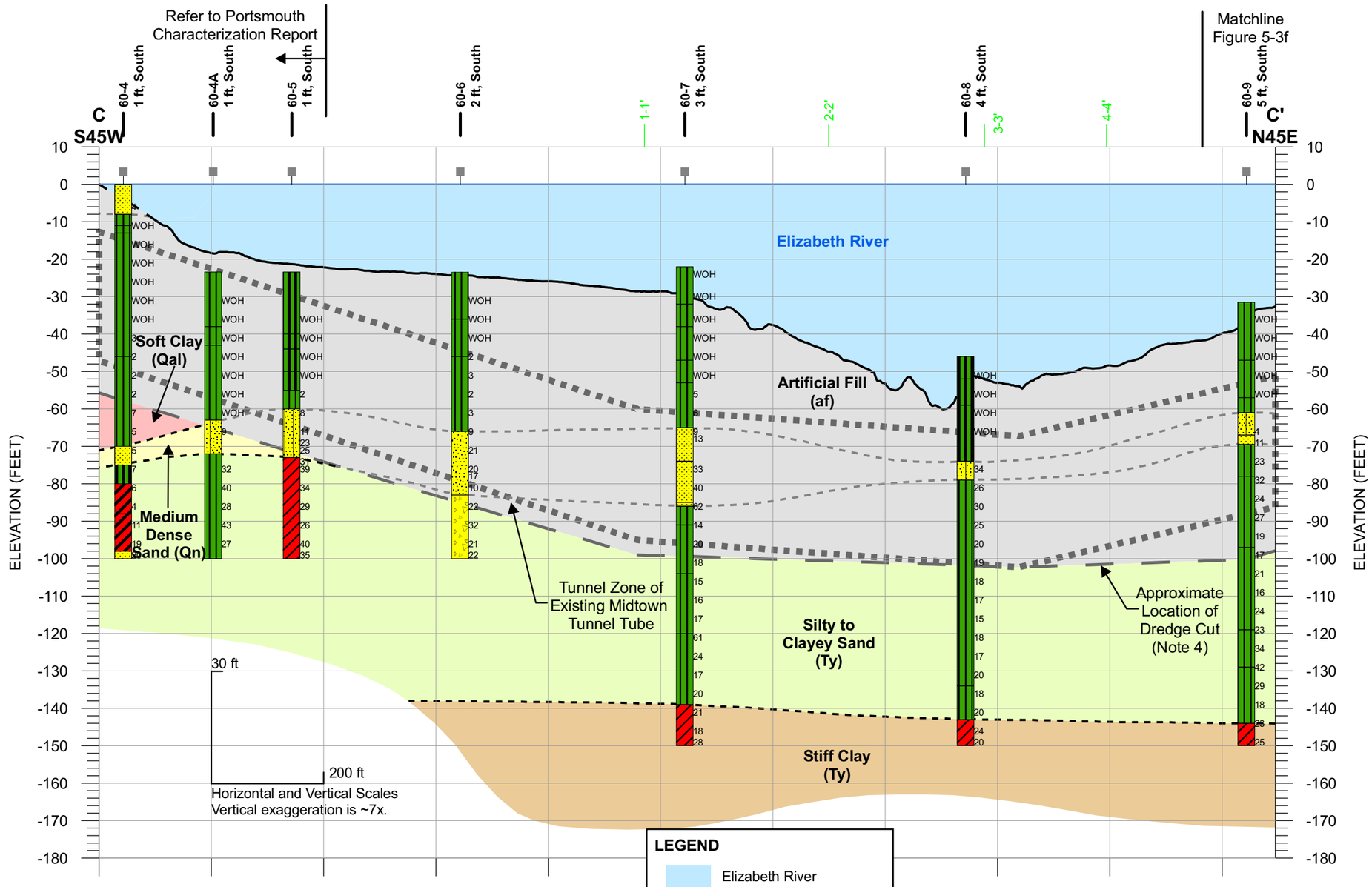

LEGEND

- Elizabeth River
- Artificial Fill (af)
- Soft Clay (Qal)
- Medium Dense Sand (Qn)
- Silty to Clayey Sand (Ty)
- Stiff Clay (Ty)

NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.
2) Elevation reference to mean lower low water (MLLW).
3) Refer to Figure 5-5 for key to symbolism used on cross sections.
4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

SUBSURFACE CROSS SECTION C-C' WITH CLASSIFICATION TEST RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3e

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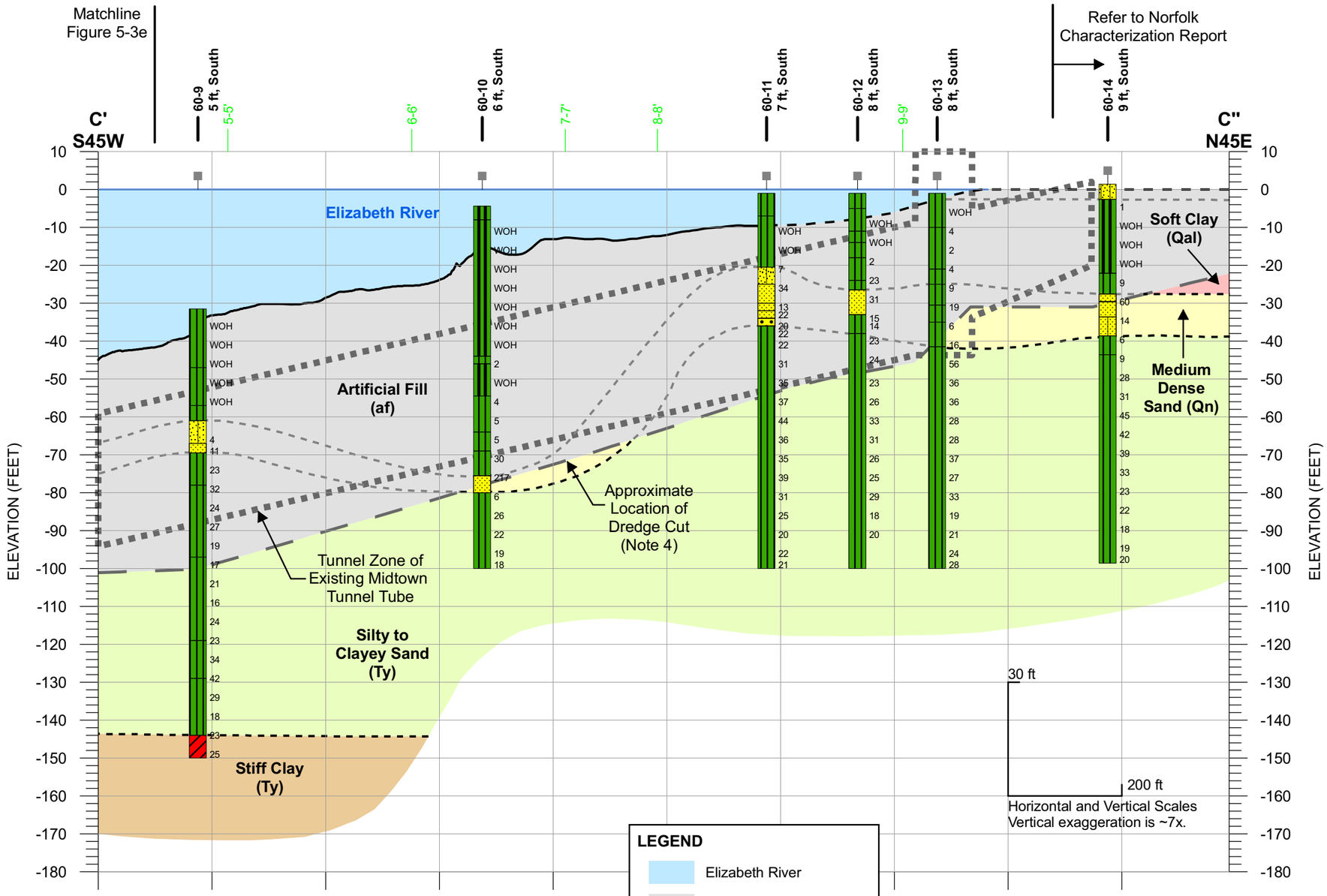

LEGEND

- Elizabeth River
- Artificial Fill (af)
- Soft Clay (Qal)
- Medium Dense Sand (Qn)
- Silty to Clayey Sand (Ty)
- Stiff Clay (Ty)

NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-5 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

SUBSURFACE CROSS SECTION C'-C" WITH CLASSIFICATION TEST RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3f

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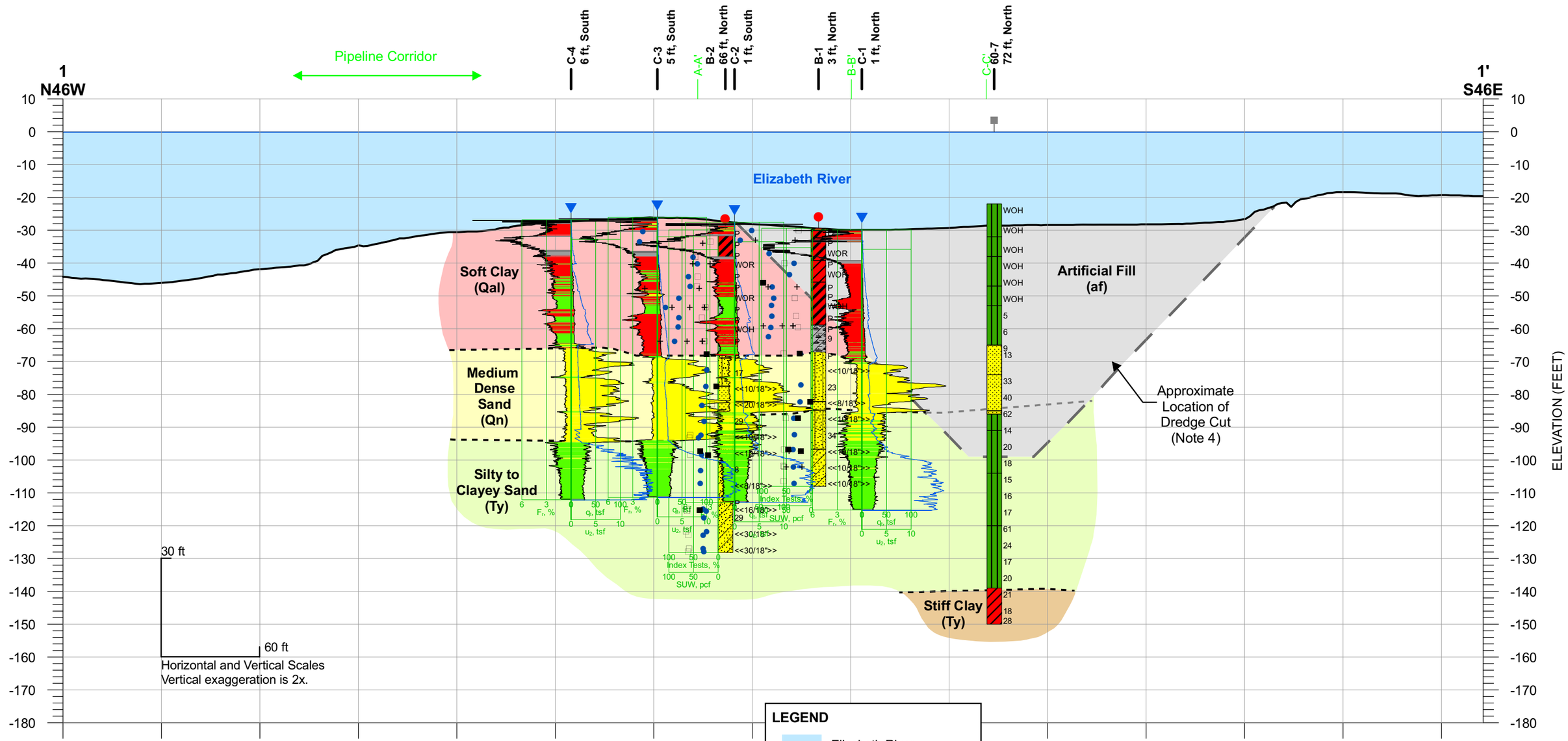

LEGEND

- Elizabeth River
- Artificial Fill (af)
- Soft Clay (Qal)
- Medium Dense Sand (Qn)
- Silty to Clayey Sand (Ty)
- Stiff Clay (Ty)

NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-5 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

SUBSURFACE CROSS SECTION 1-1'
WITH CLASSIFICATION TEST RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3g

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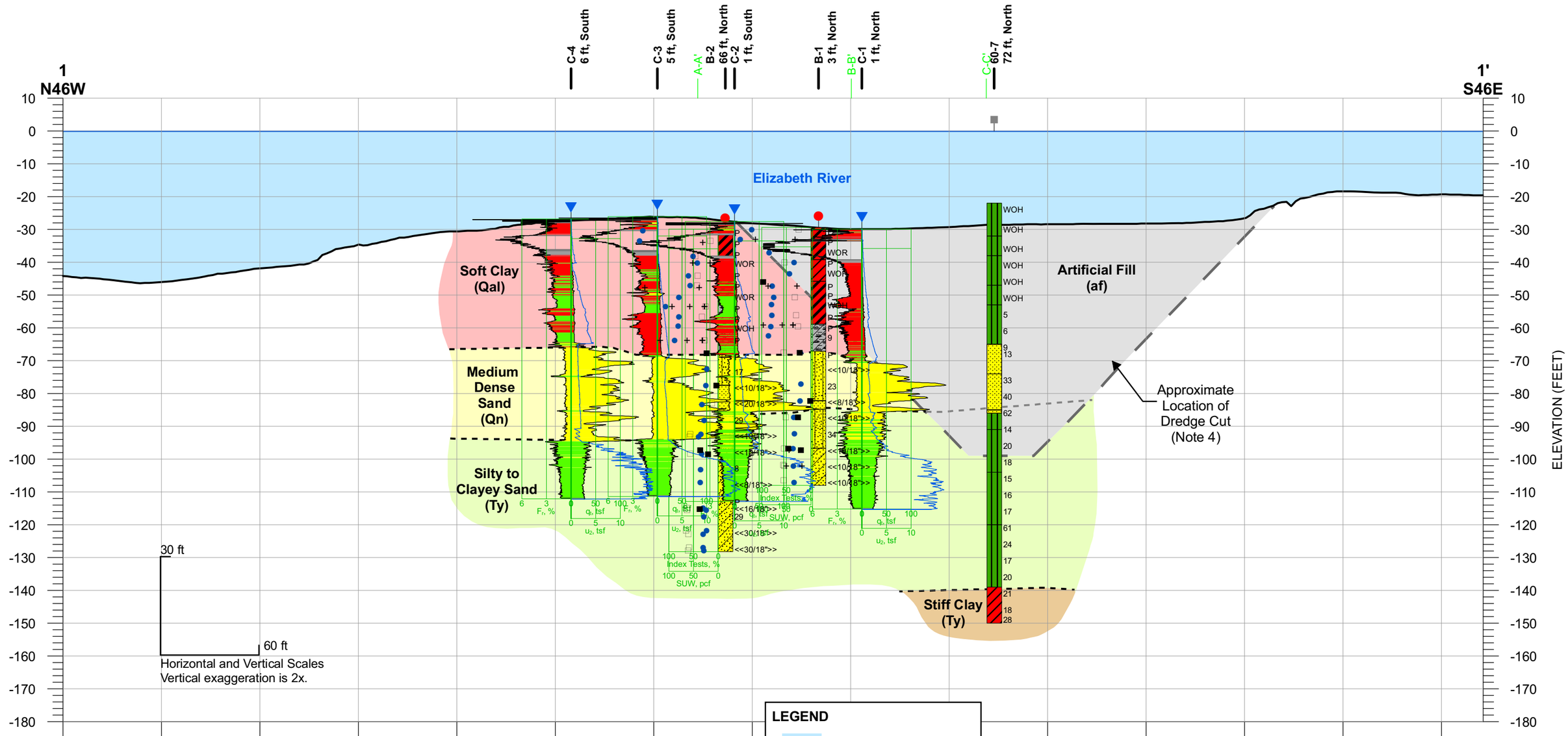

LEGEND

- Elizabeth River
- Artificial Fill (af)
- Soft Clay (Qal)
- Medium Dense Sand (Qn)
- Silty to Clayey Sand (Ty)
- Stiff Clay (Ty)

NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-5 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

SUBSURFACE CROSS SECTION 1-1'
WITH CLASSIFICATION TEST RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3g

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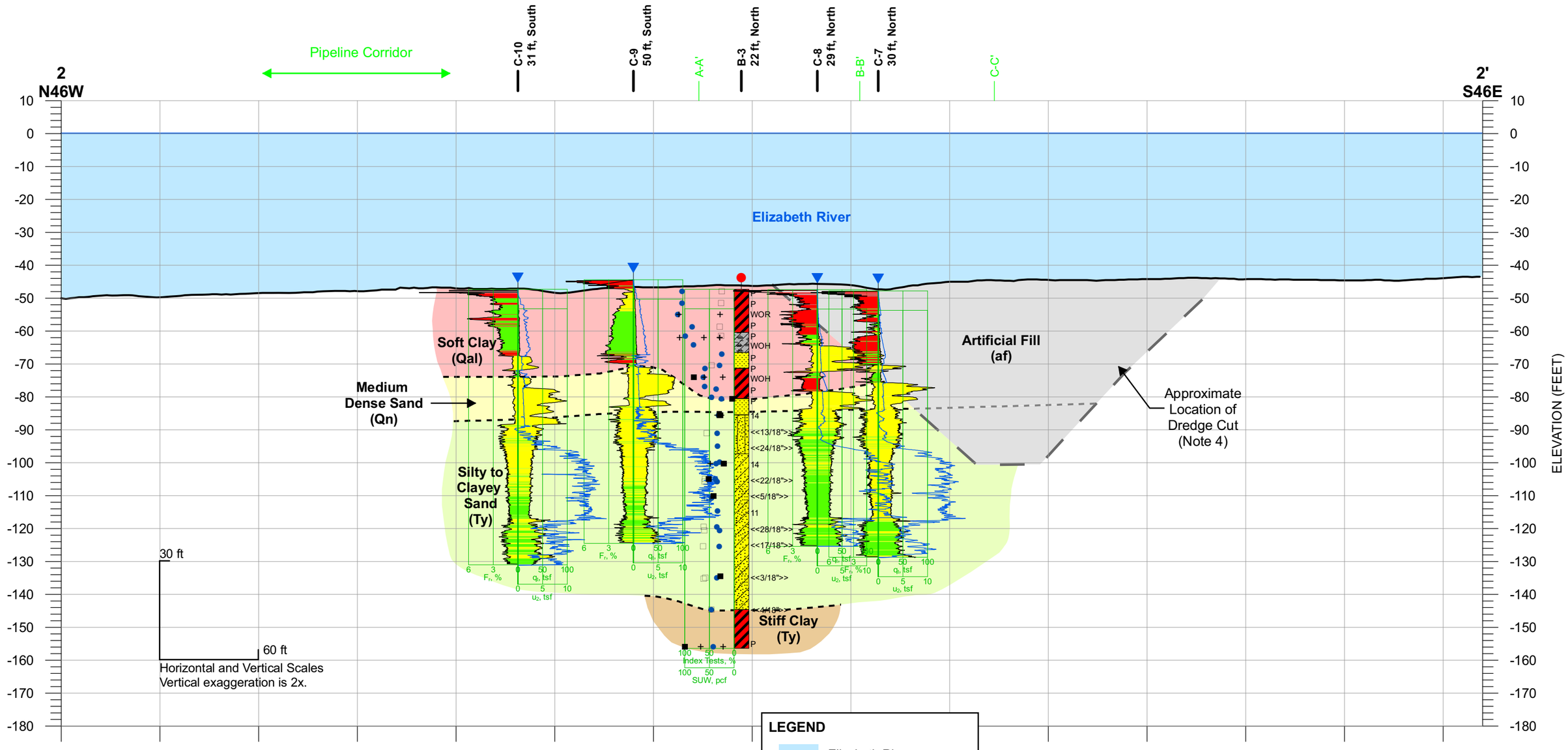

LEGEND

- Elizabeth River
- Artificial Fill (af)
- Soft Clay (Qal)
- Medium Dense Sand (Qn)
- Silty to Clayey Sand (Ty)
- Stiff Clay (Ty)

NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-5 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

SUBSURFACE CROSS SECTION 2-2'
WITH CLASSIFICATION TEST RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3h

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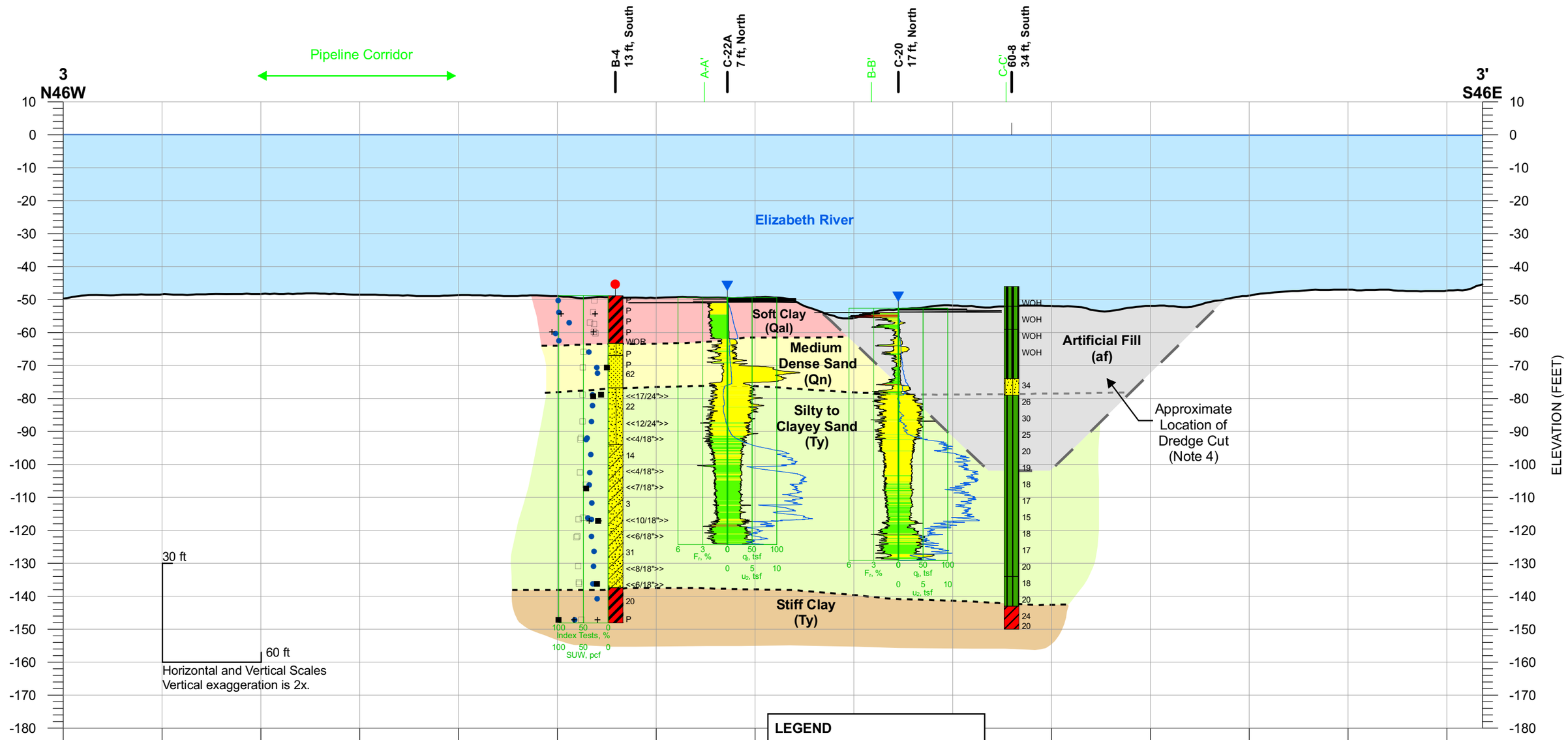

LEGEND

- Elizabeth River
- Artificial Fill (af)
- Soft Clay (Qal)
- Medium Dense Sand (Qn)
- Silty to Clayey Sand (Ty)
- Stiff Clay (Ty)

NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-5 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

SUBSURFACE CROSS SECTION 3-3'
WITH CLASSIFICATION TEST RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3i

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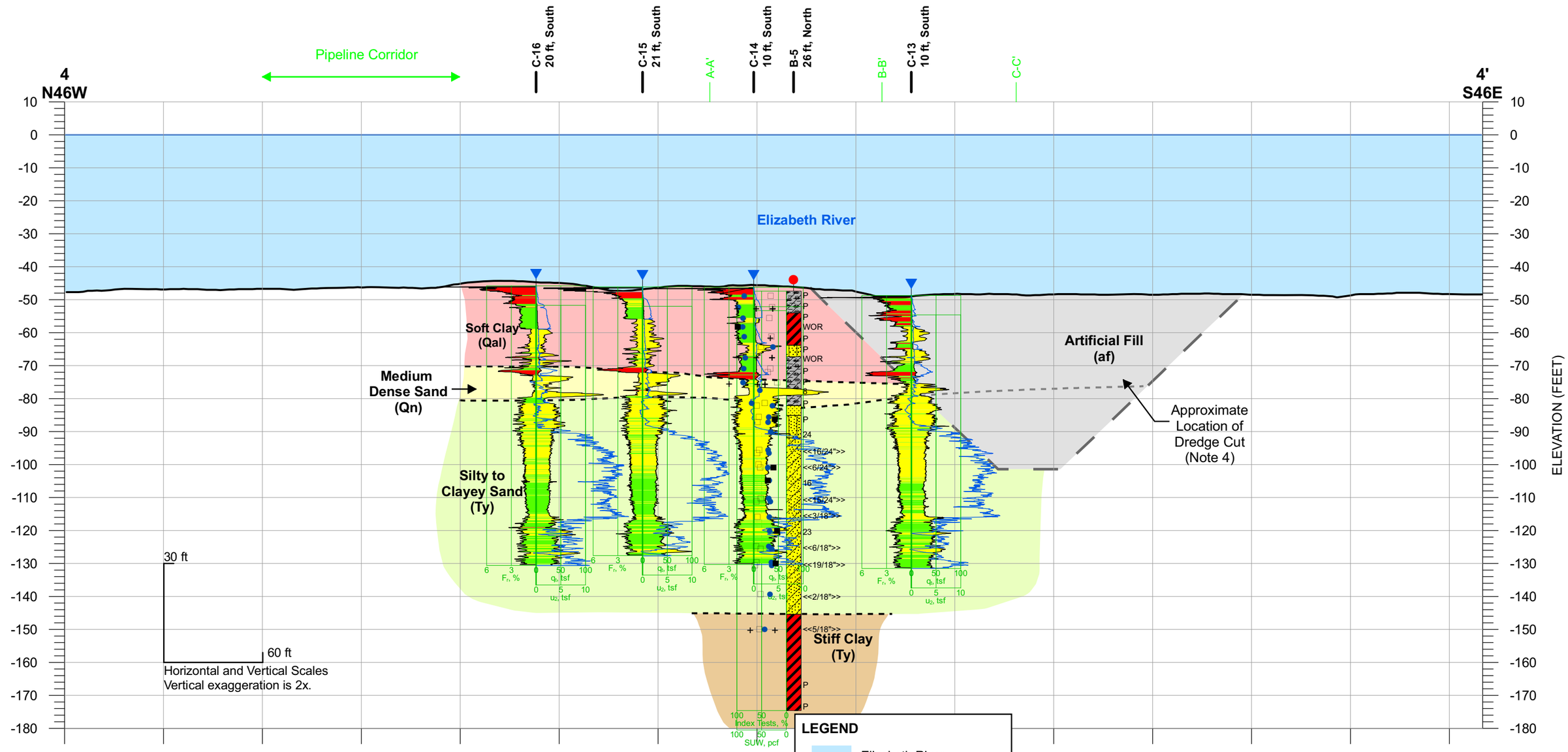

LEGEND

- Elizabeth River
- Artificial Fill (af)
- Soft Clay (Qal)
- Medium Dense Sand (Qn)
- Silty to Clayey Sand (Ty)
- Stiff Clay (Ty)

NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-5 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

SUBSURFACE CROSS SECTION 4-4'
WITH CLASSIFICATION TEST RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3j

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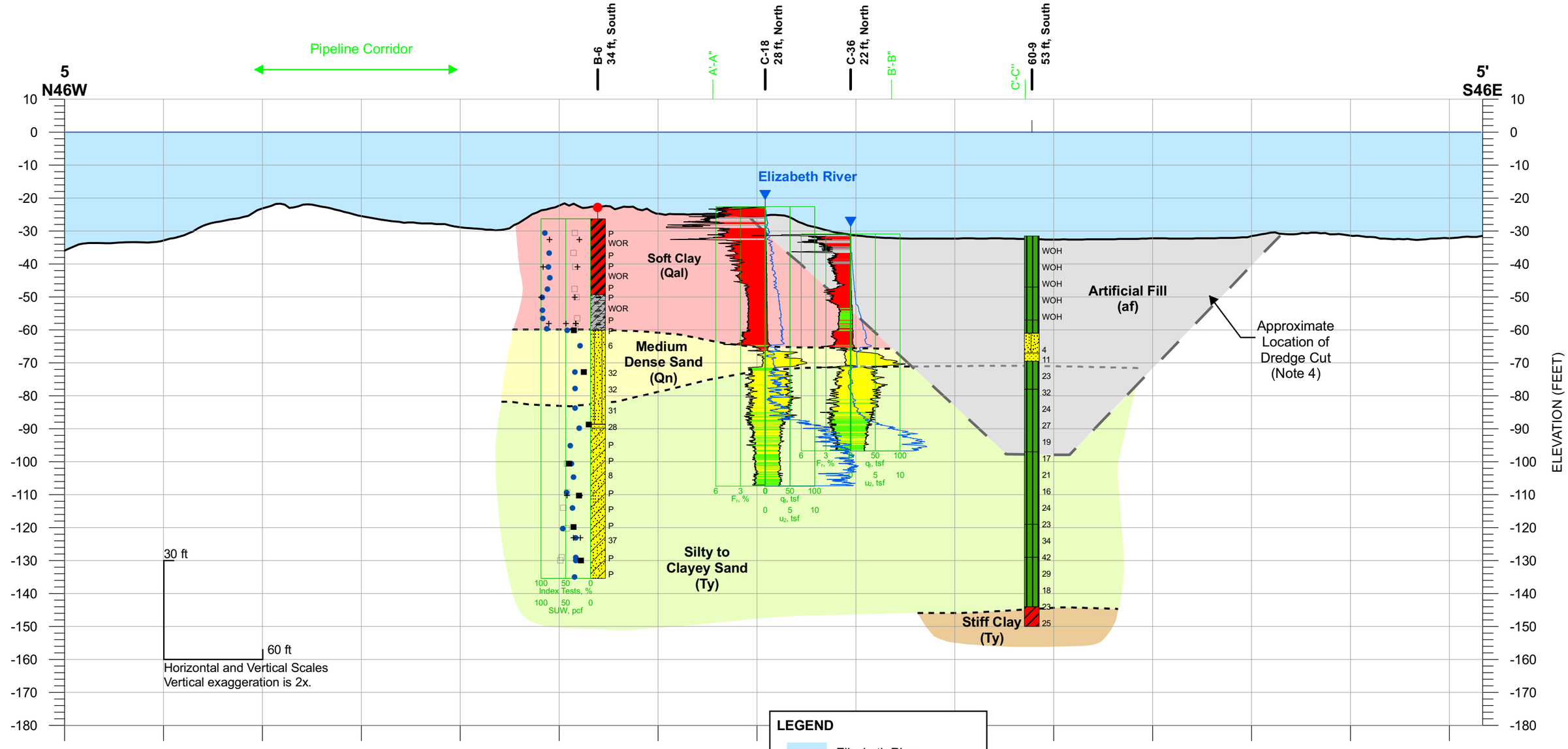

LEGEND

- Elizabeth River
- Artificial Fill (af)
- Soft Clay (Qal)
- Medium Dense Sand (Qn)
- Silty to Clayey Sand (Ty)
- Stiff Clay (Ty)

NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-5 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

SUBSURFACE CROSS SECTION 5-5'
WITH CLASSIFICATION TEST RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3k

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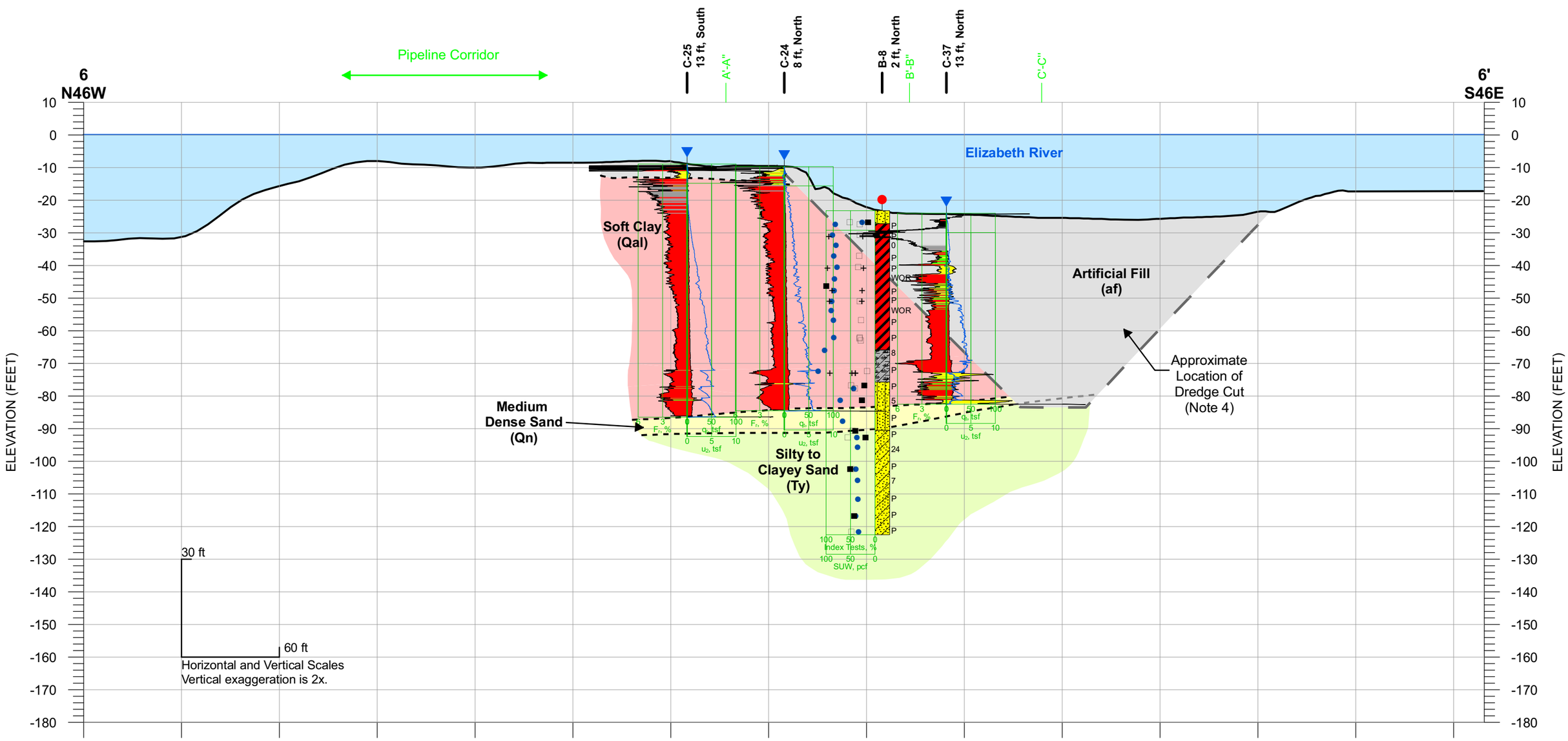

NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-5 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

LEGEND

- Elizabeth River
- Artificial Fill (af)
- Soft Clay (Qal)
- Medium Dense Sand (Qn)
- Silty to Clayey Sand (Ty)

SUBSURFACE CROSS SECTION 6-6'
WITH CLASSIFICATION TEST RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3l

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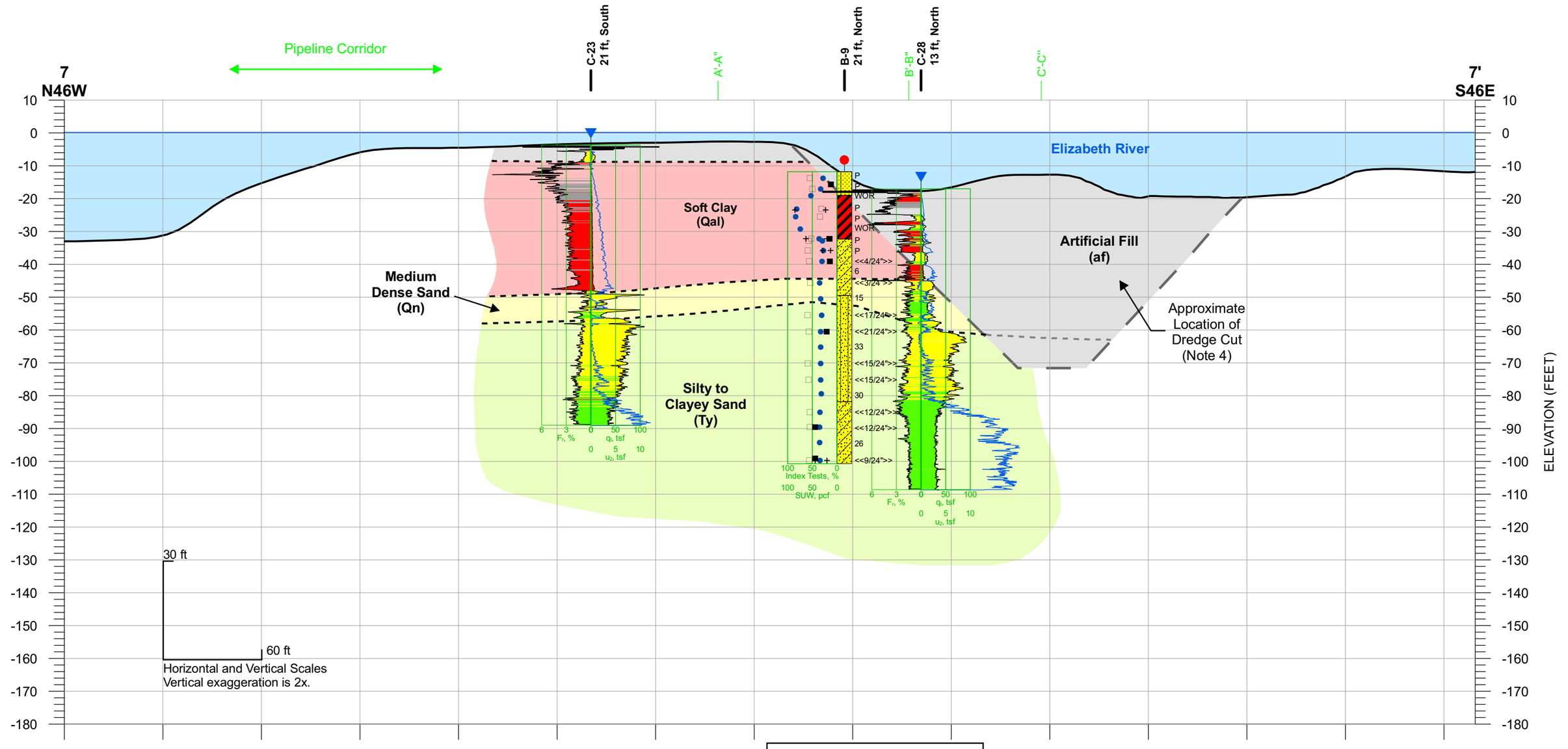

LEGEND

- Elizabeth River
- Artificial Fill (af)
- Soft Clay (Qal)
- Medium Dense Sand (Qn)
- Silty to Clayey Sand (Ty)

NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.
2) Elevation reference to mean lower low water (MLLW).
3) Refer to Figure 5-5 for key to symbolism used on cross sections.
4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

SUBSURFACE CROSS SECTION 7-7'
WITH CLASSIFICATION TEST RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3m

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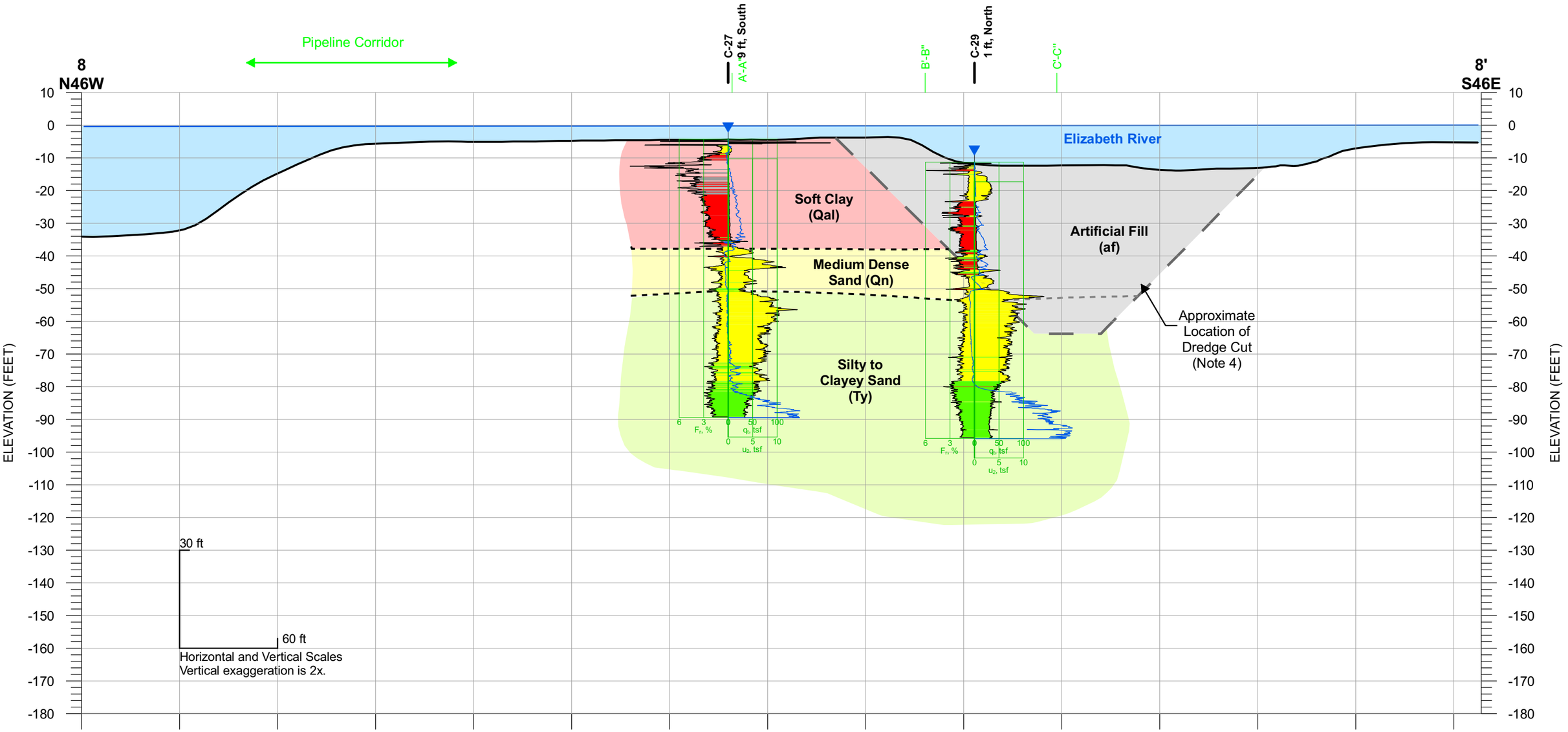

LEGEND

- Elizabeth River
- Artificial Fill (af)
- Soft Clay (Qal)
- Medium Dense Sand (Qn)
- Silty to Clayey Sand (Ty)

NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.
2) Elevation reference to mean lower low water (MLLW).
3) Refer to Figure 5-5 for key to symbolism used on cross sections.
4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

SUBSURFACE CROSS SECTION 8-8' WITH CLASSIFICATION TEST RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3n

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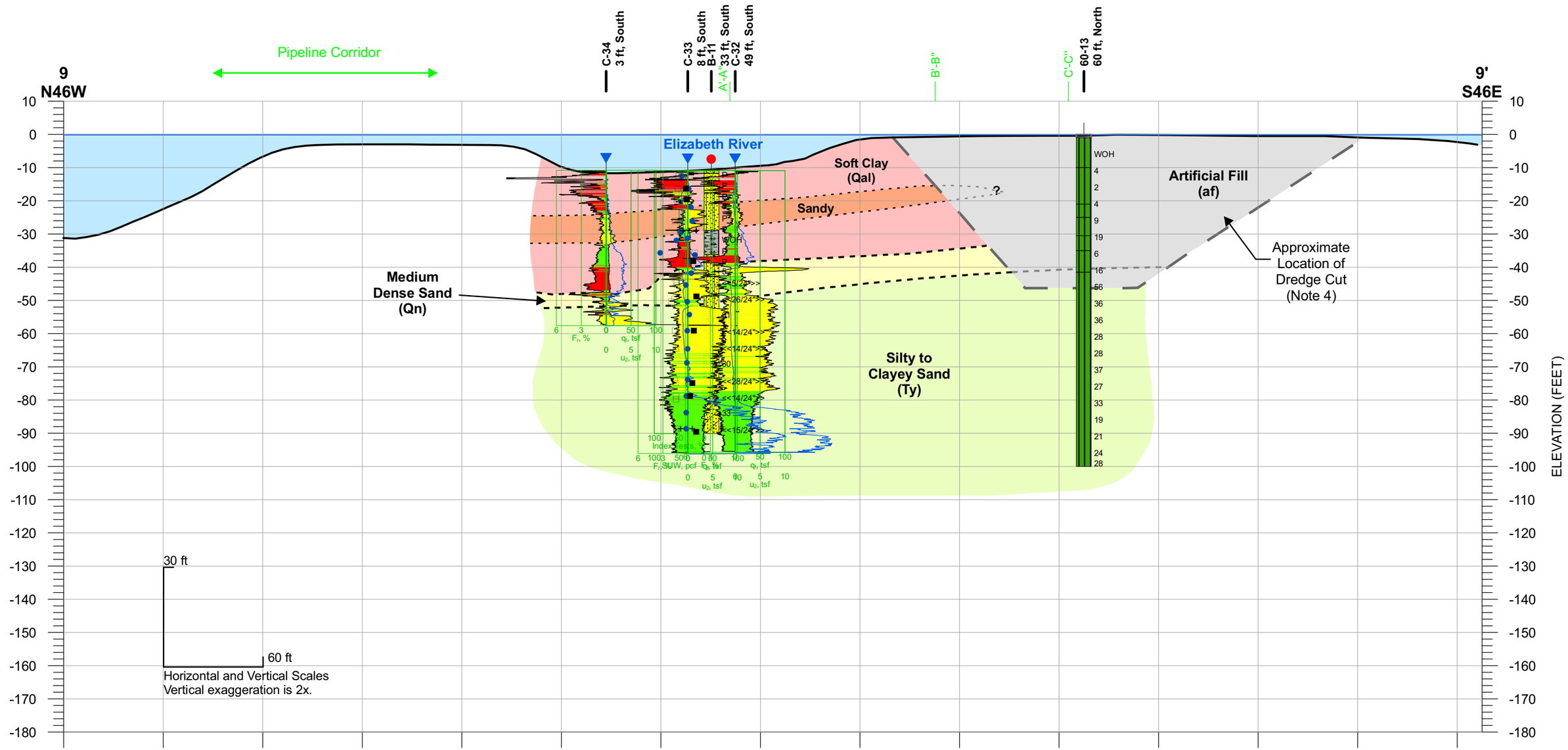

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NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-5 for key to symbolism used on cross sections.

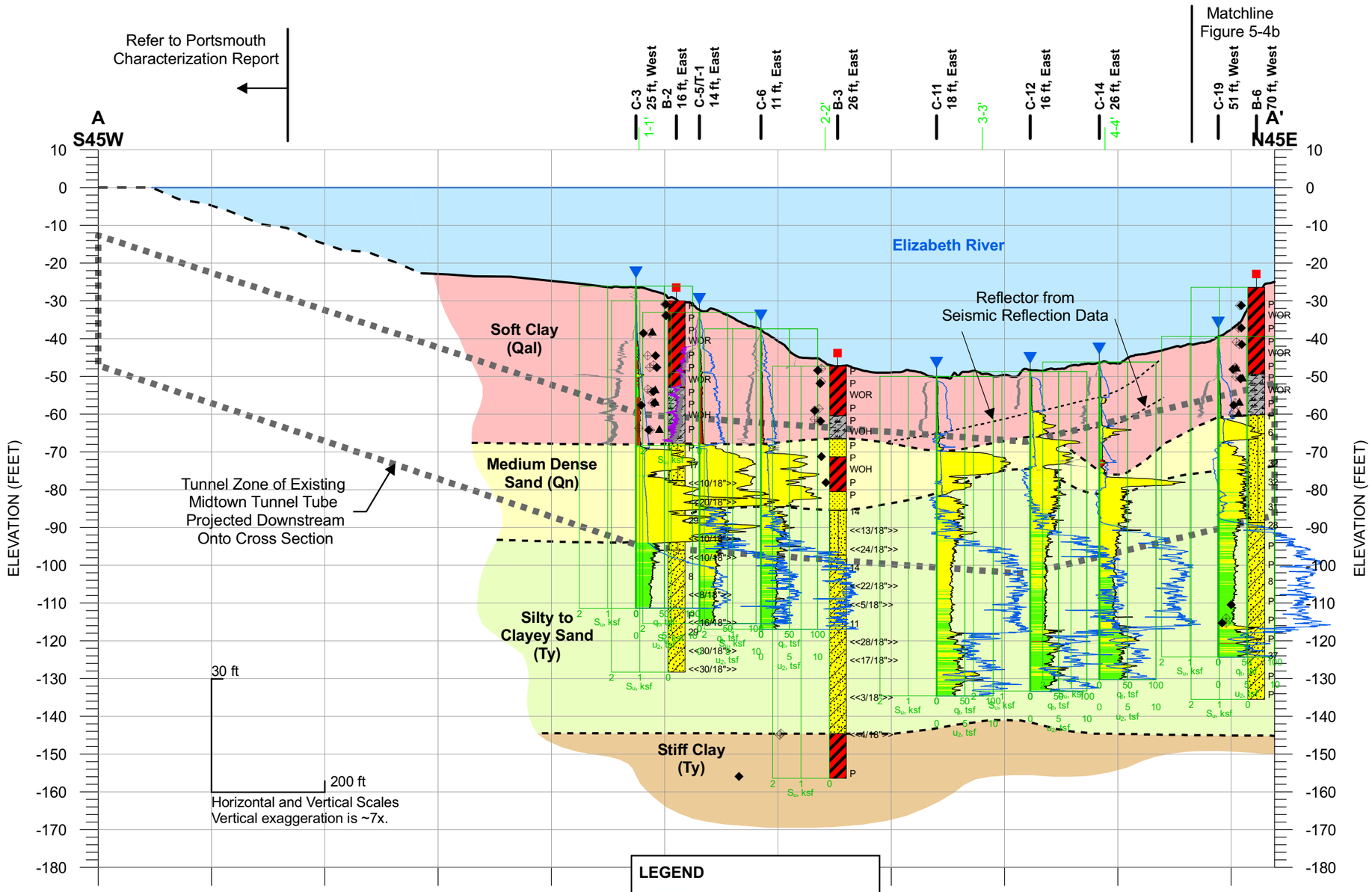
4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

LEGEND

- Elizabeth River
- Artificial Fill (af)
- Soft Clay (Qal)
- Medium Dense Sand (Qn)
- Silty to Clayey Sand (Ty)

SUBSURFACE CROSS SECTION 9-9'
WITH CLASSIFICATION TEST RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-3o



NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-5 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

**SUBSURFACE CROSS SECTION A-A'
WITH UNDRAINED SHEAR STRENGTH**
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-4a

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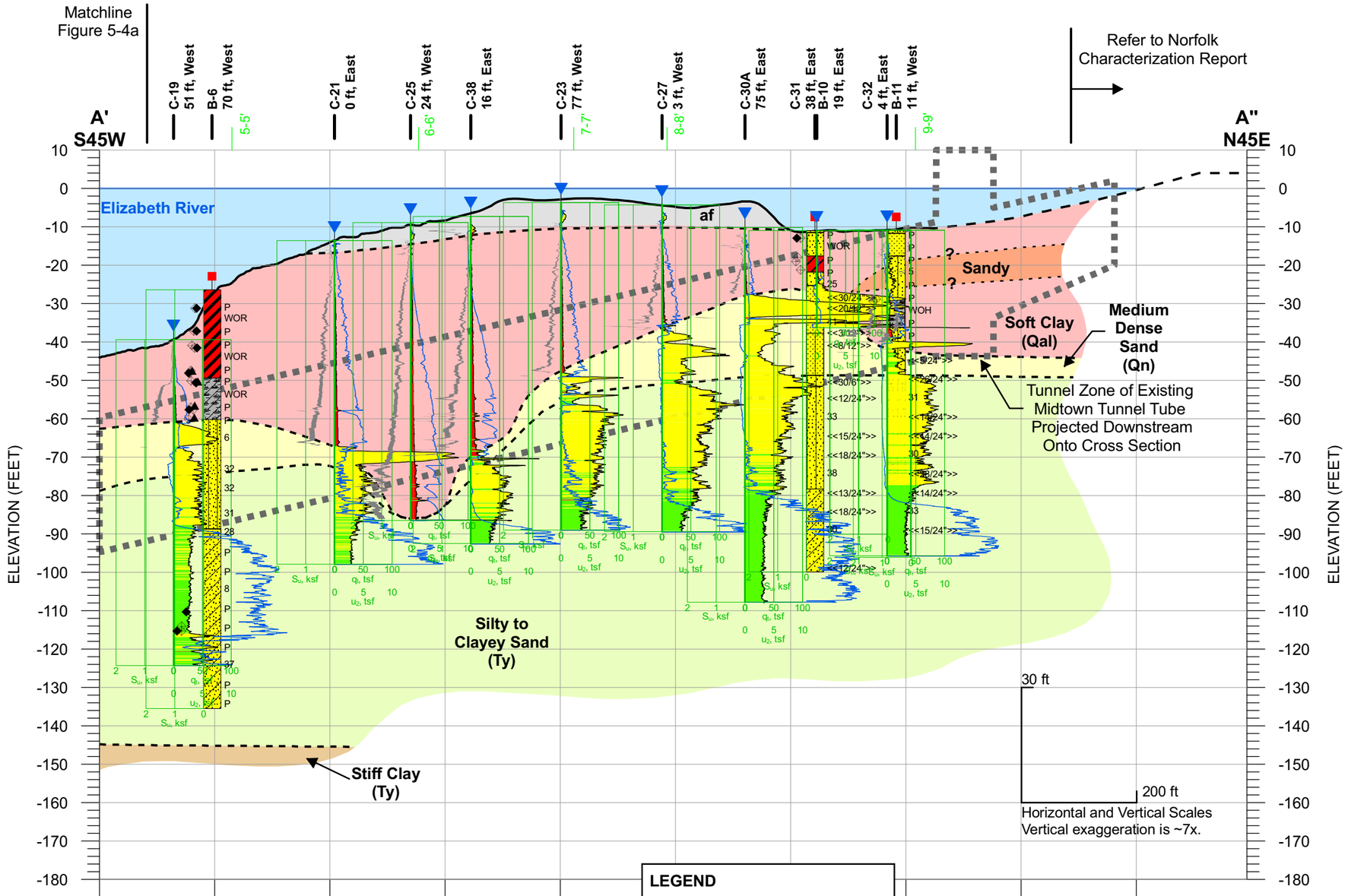

LEGEND

- Elizabeth River
- Soft Clay (Qal)
- Medium Dense Sand (Qn)
- Silty to Clayey Sand (Ty)
- Stiff Clay (Ty)

NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-5 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

SUBSURFACE CROSS SECTION A'-A"
WITH UNDRAINED SHEAR STRENGTH
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-4b

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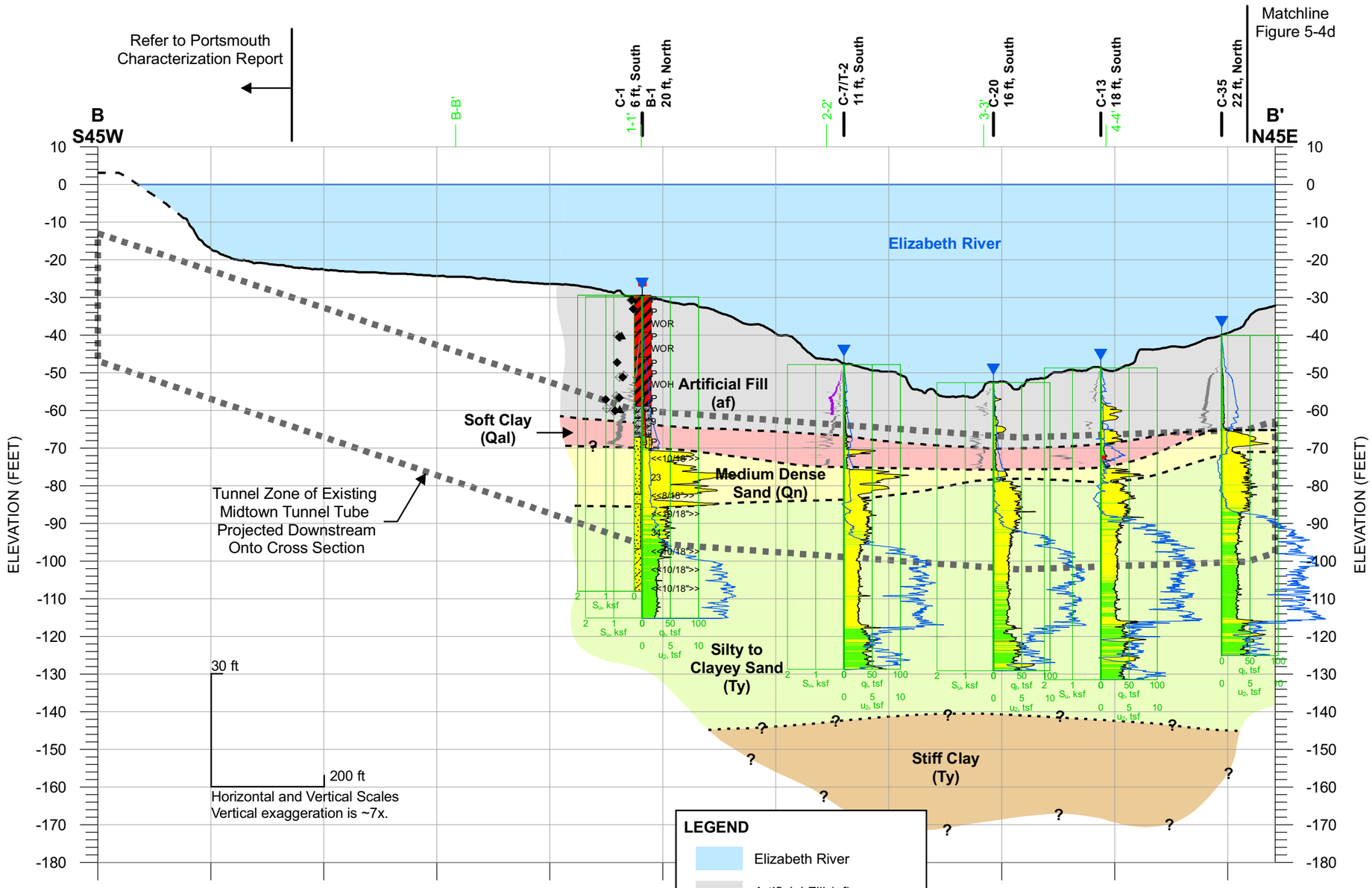

NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-5 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

SUBSURFACE CROSS SECTION B-B' WITH UNDRAINED SHEAR STRENGTH
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-4c

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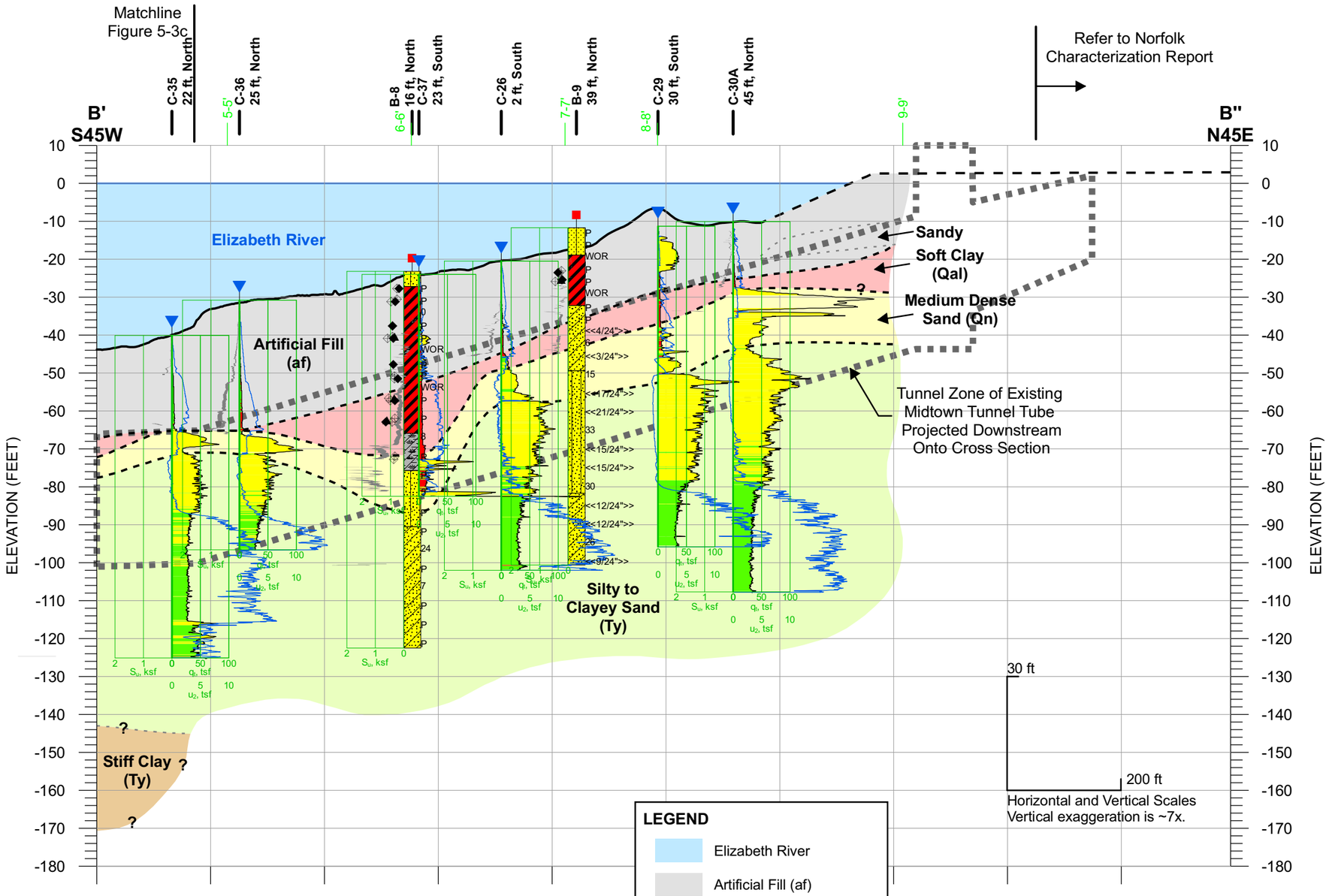

NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-5 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

SUBSURFACE CROSS SECTION B'-B"
WITH UNDRAINED SHEAR STRENGTH
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-4d

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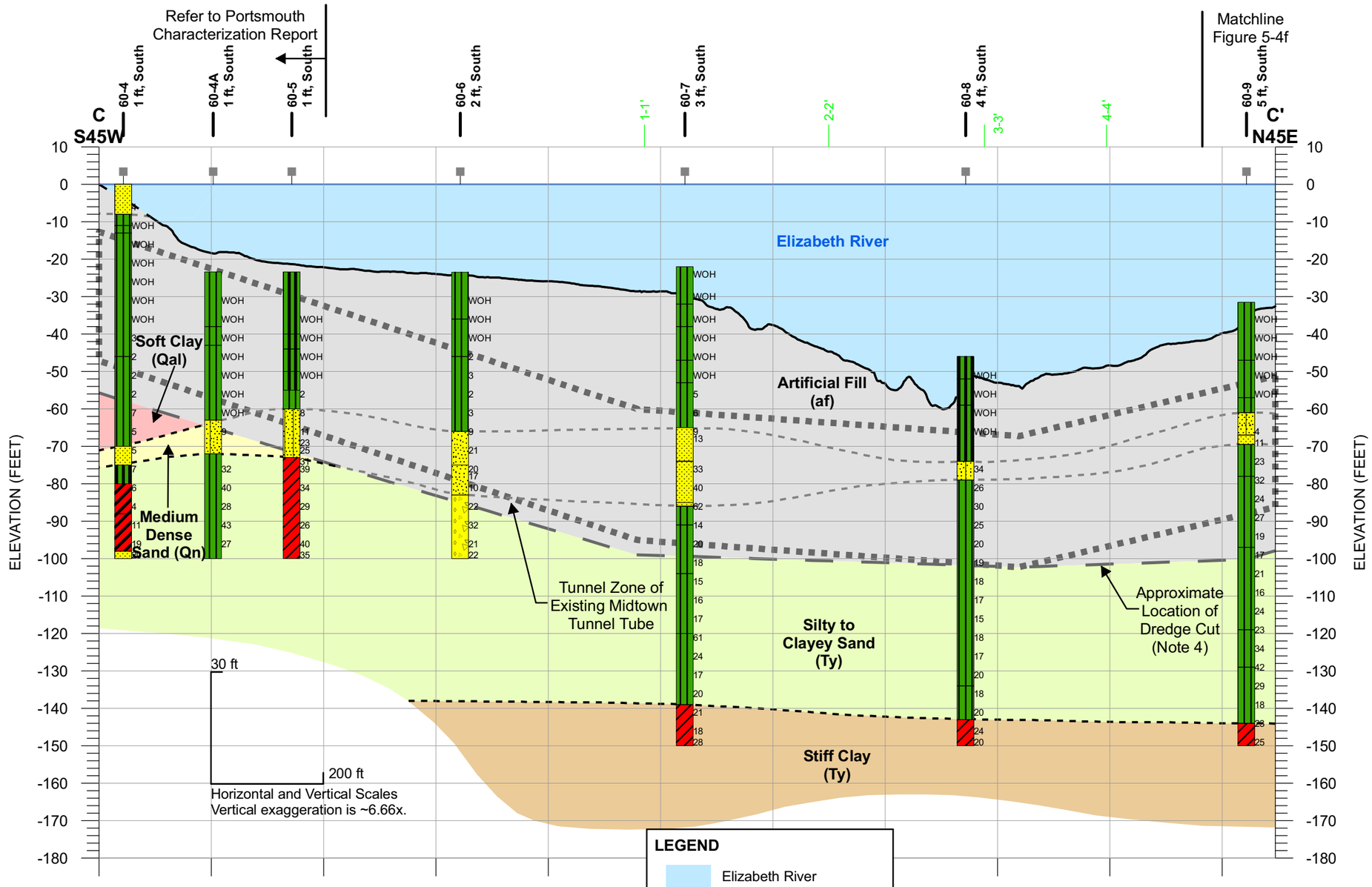

LEGEND

- Elizabeth River
- Artificial Fill (af)
- Soft Clay (Qal)
- Medium Dense Sand (Qn)
- Silty to Clayey Sand (Ty)
- Stiff Clay (Ty)

NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.
2) Elevation reference to mean lower low water (MLLW).
3) Refer to Figure 5-5 for key to symbolism used on cross sections.
4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

SUBSURFACE CROSS SECTION C-C' WITH UNDRAINED SHEAR STRENGTH
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-4e

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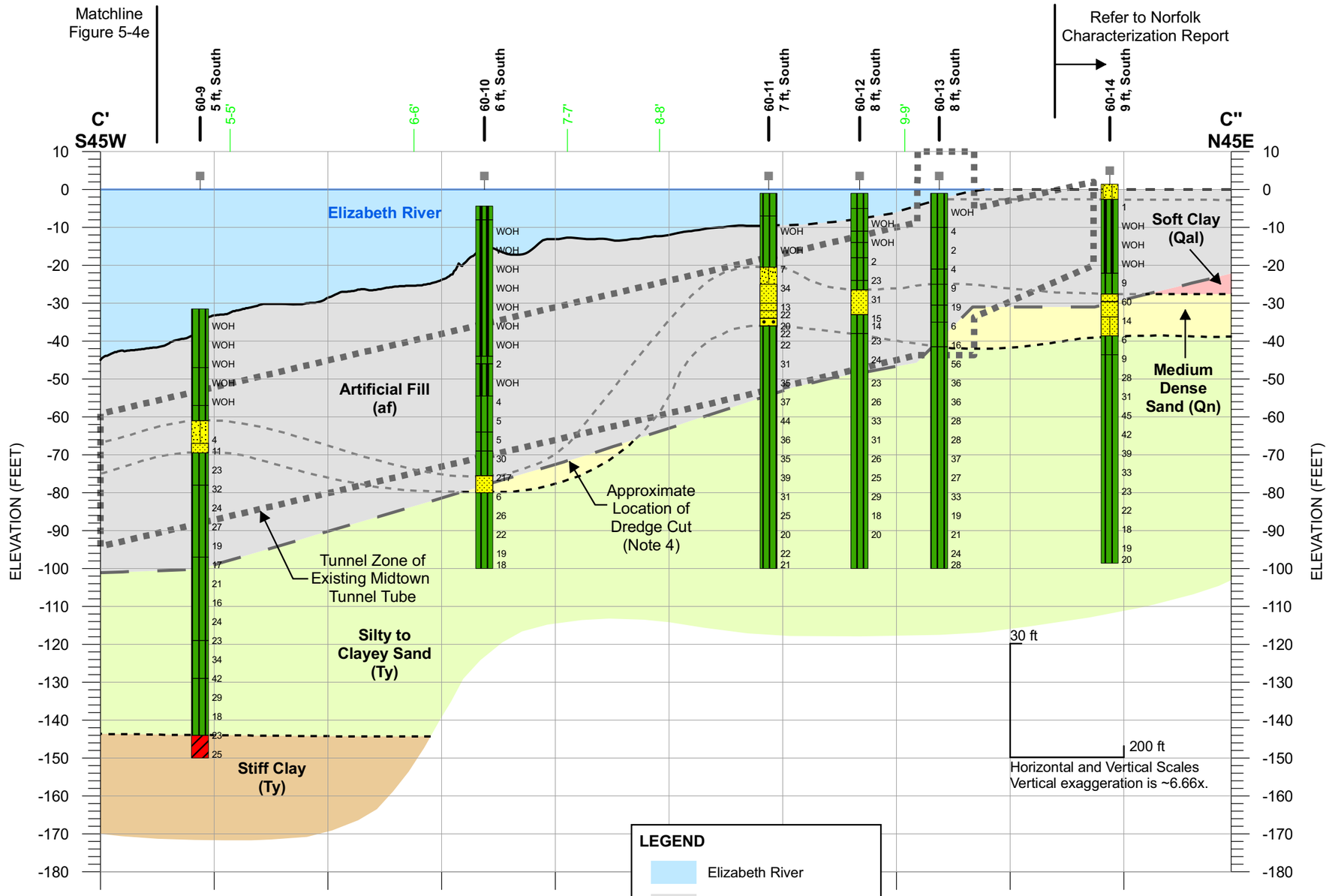

LEGEND

- Elizabeth River
- Artificial Fill (af)
- Soft Clay (Qal)
- Medium Dense Sand (Qn)
- Silty to Clayey Sand (Ty)
- Stiff Clay (Ty)

NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-5 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

SUBSURFACE CROSS SECTION C'-C" WITH UNDRAINED SHEAR STRENGTH
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-4f

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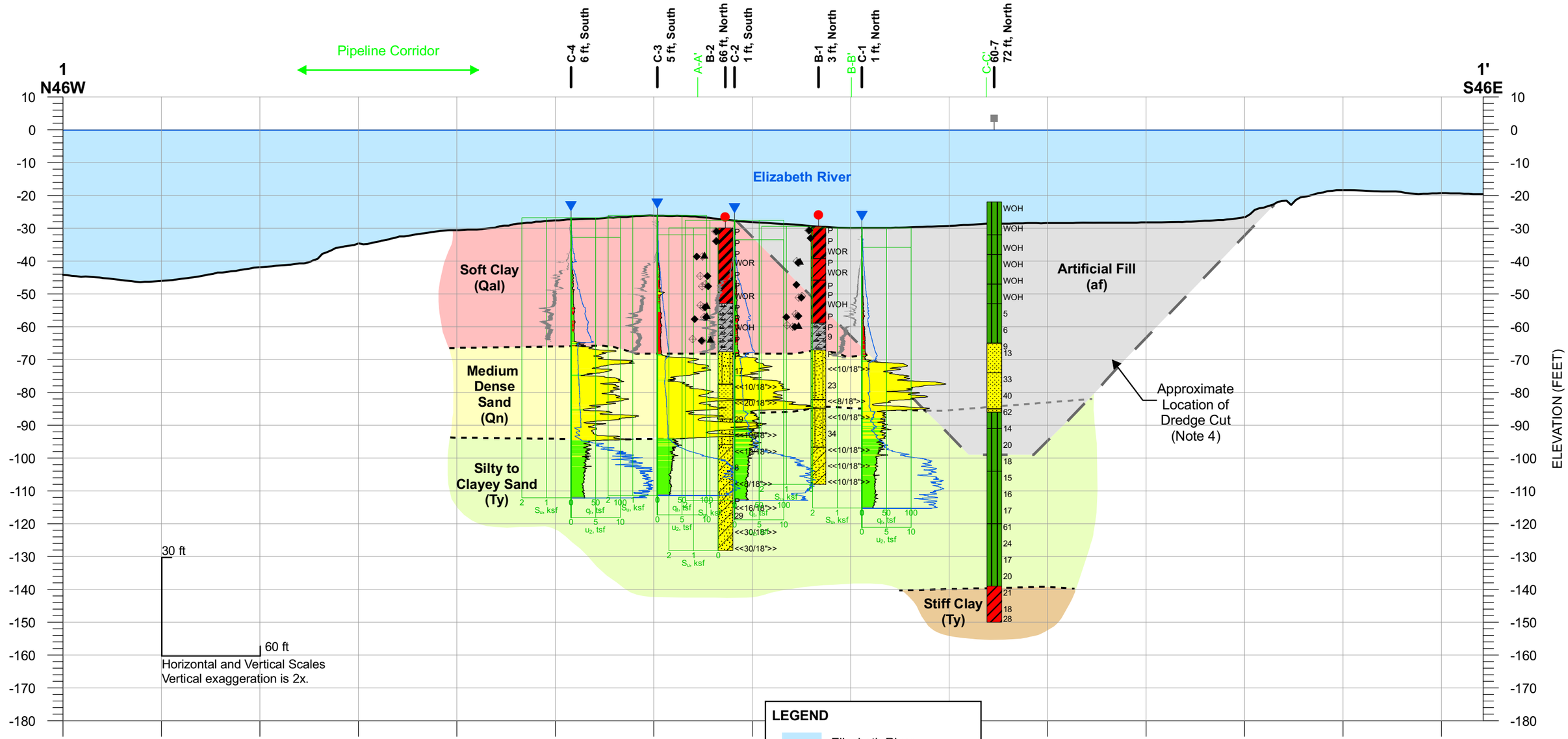

LEGEND

- Elizabeth River
- Artificial Fill (af)
- Soft Clay (Qal)
- Medium Dense Sand (Qn)
- Silty to Clayey Sand (Ty)
- Stiff Clay (Ty)

NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-5 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

SUBSURFACE CROSS SECTION 1-1' WITH UNDRAINED SHEAR STRENGTH
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-4g

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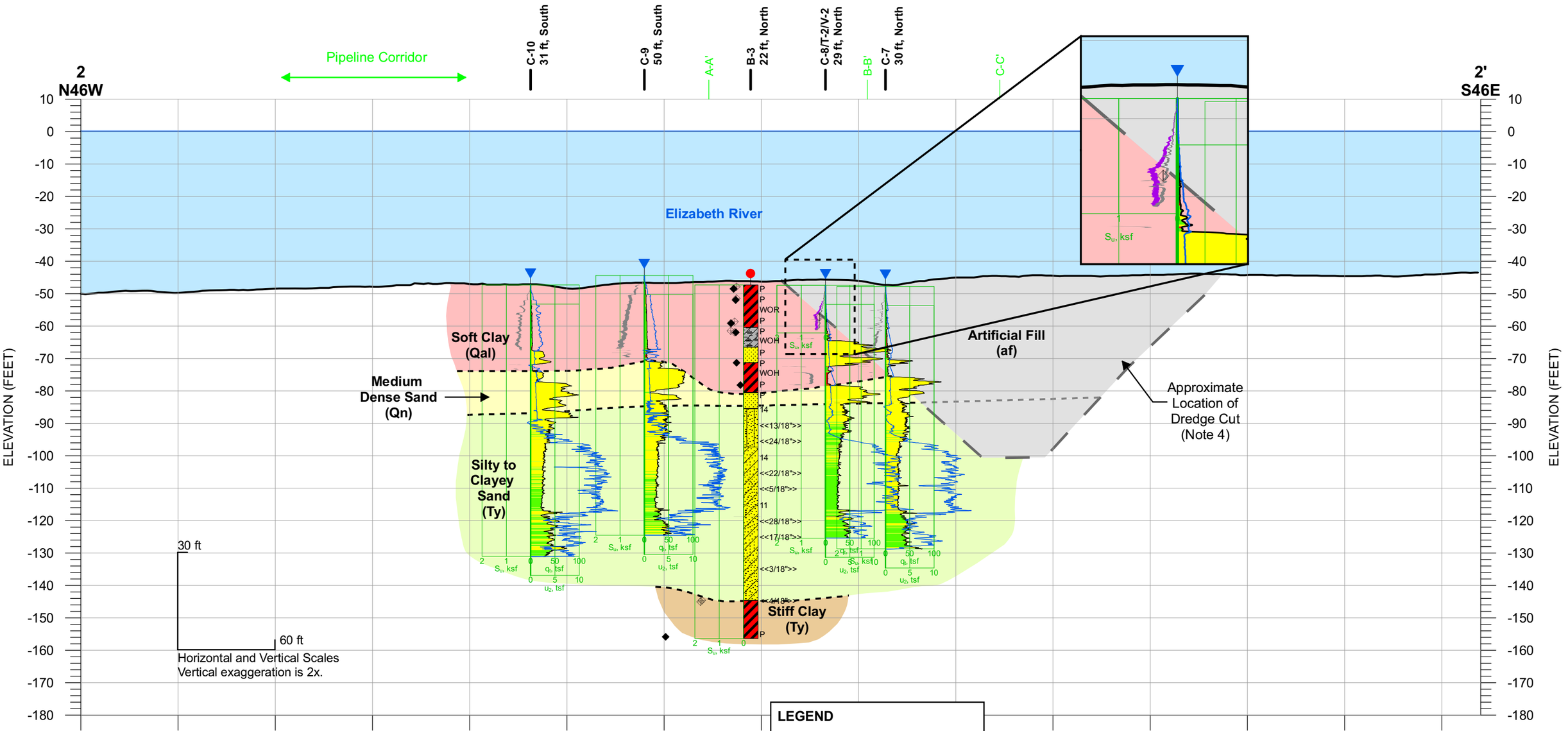

NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-5 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

SUBSURFACE CROSS SECTION 2-2'
WITH UNDRAINED SHEAR STRENGTH
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-4h

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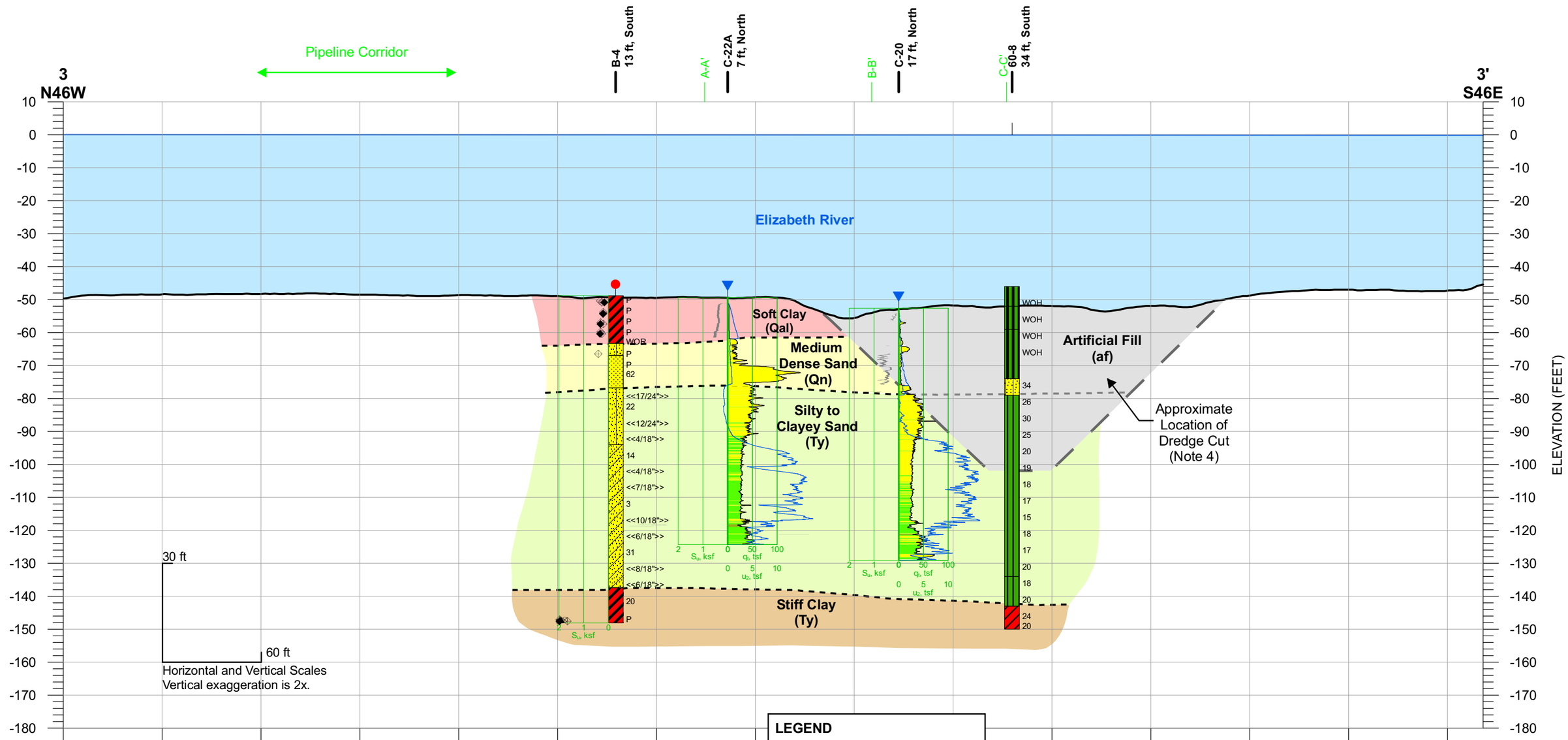

NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-5 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

SUBSURFACE CROSS SECTION 3-3' WITH UNDRAINED SHEAR STRENGTH
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-4i

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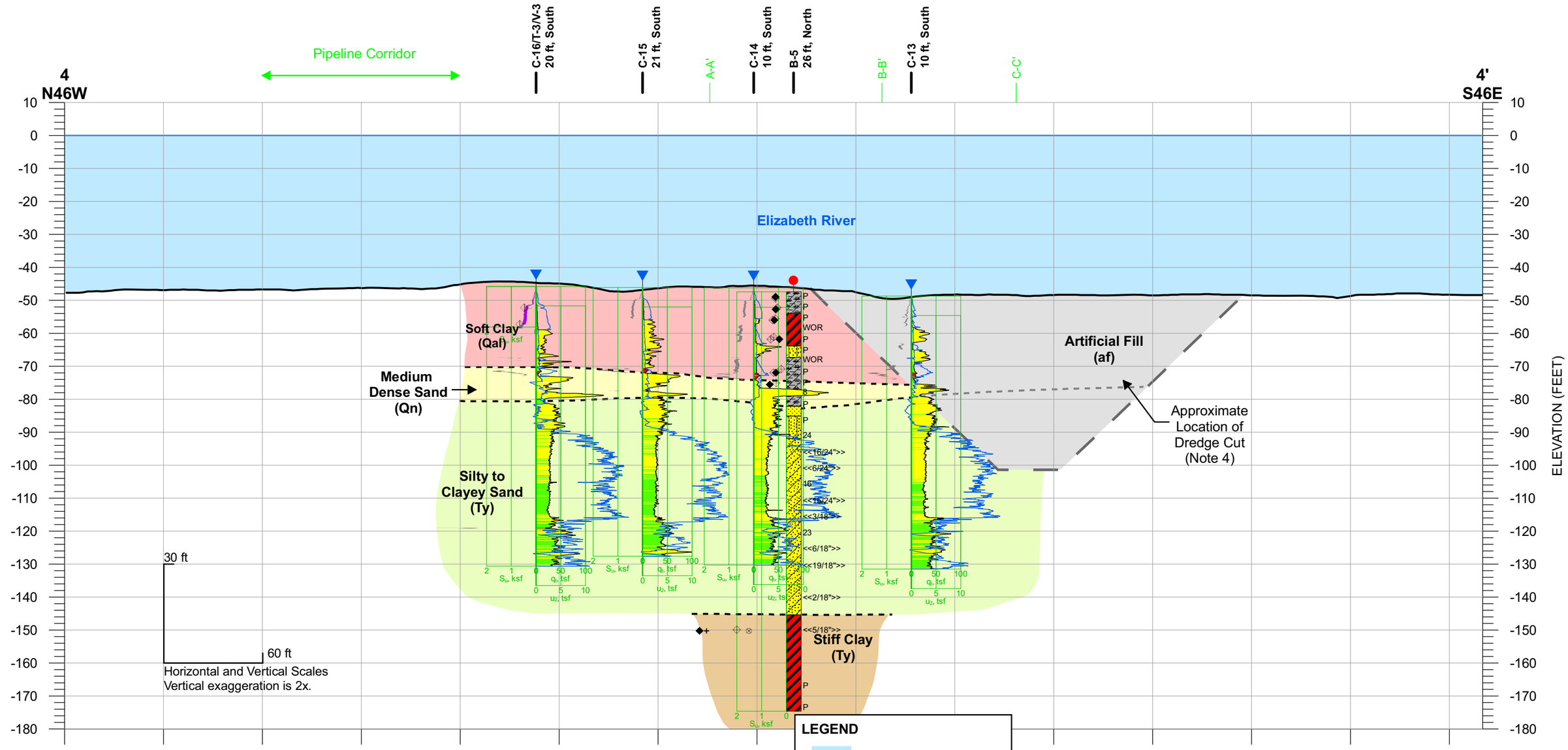

LEGEND

- Elizabeth River
- Artificial Fill (af)
- Soft Clay (Qal)
- Medium Dense Sand (Qn)
- Silty to Clayey Sand (Ty)
- Stiff Clay (Ty)

NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-5 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

SUBSURFACE CROSS SECTION 4-4'
WITH UNDRAINED SHEAR STRENGTH
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-4j

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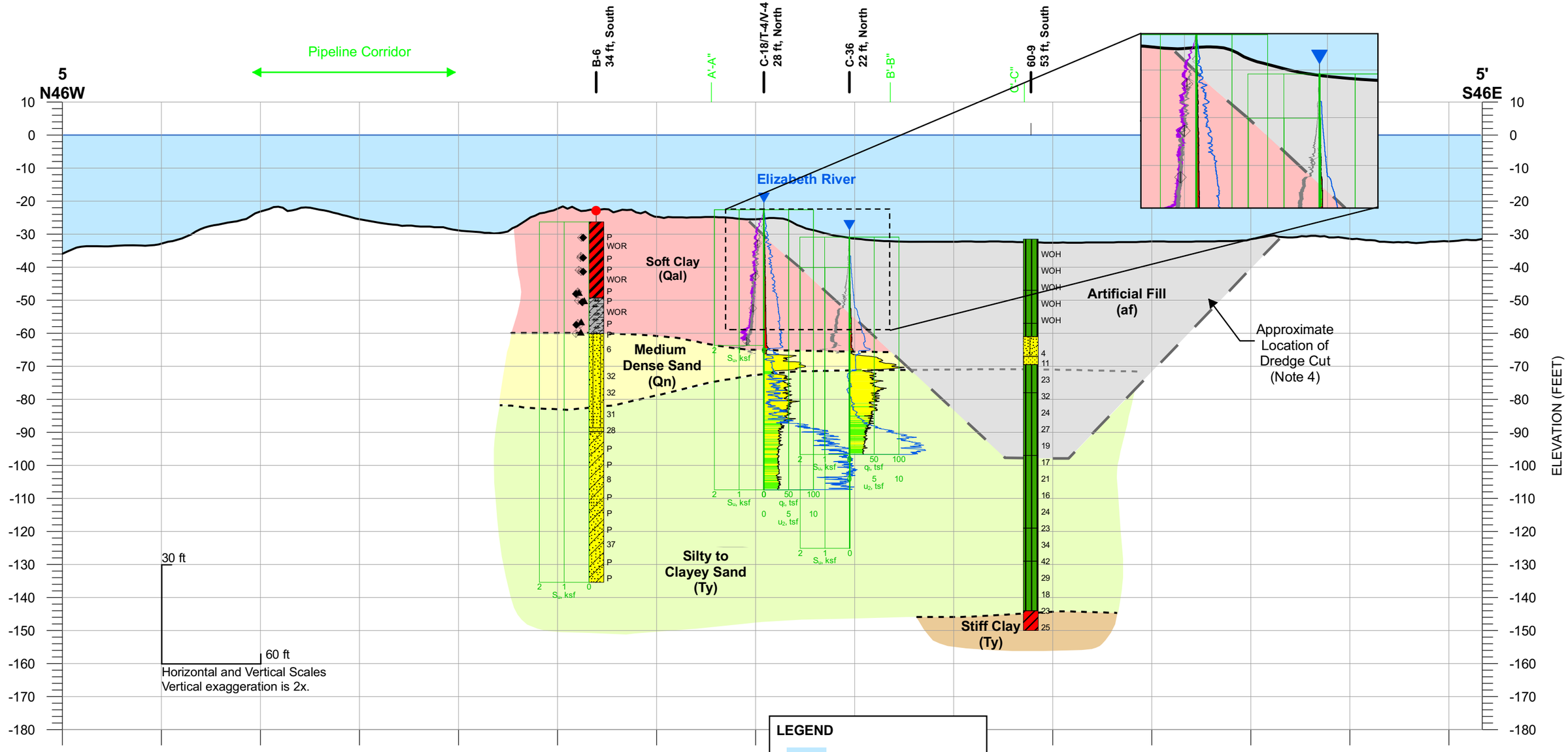

NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-5 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

LEGEND

- Elizabeth River
- Artificial Fill (af)
- Soft Clay (Qal)
- Medium Dense Sand (Qn)
- Silty to Clayey Sand (Ty)
- Stiff Clay (Ty)

SUBSURFACE CROSS SECTION 5-5' WITH UNDRAINED SHEAR STRENGTH
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-4k

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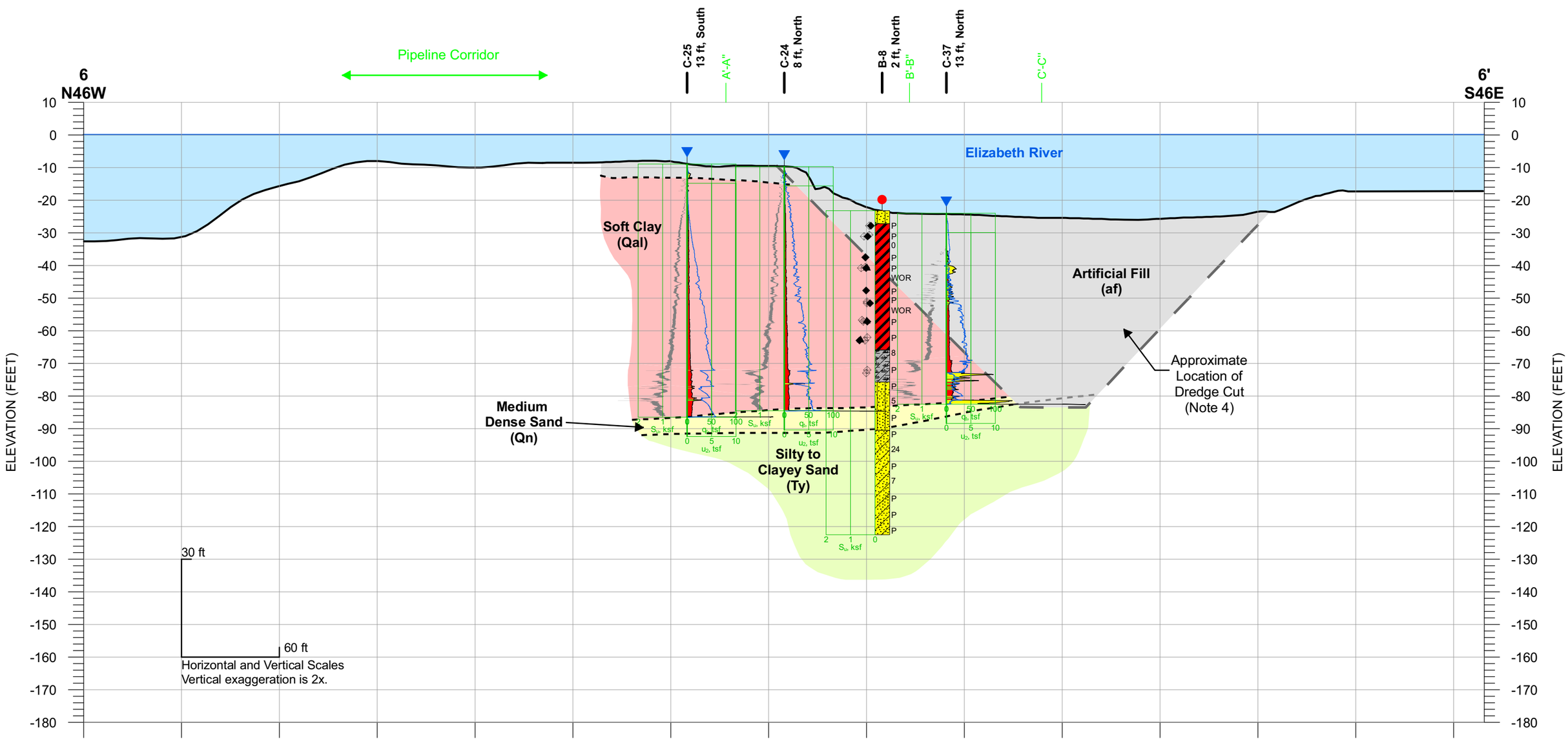

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NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-5 for key to symbolism used on cross sections.

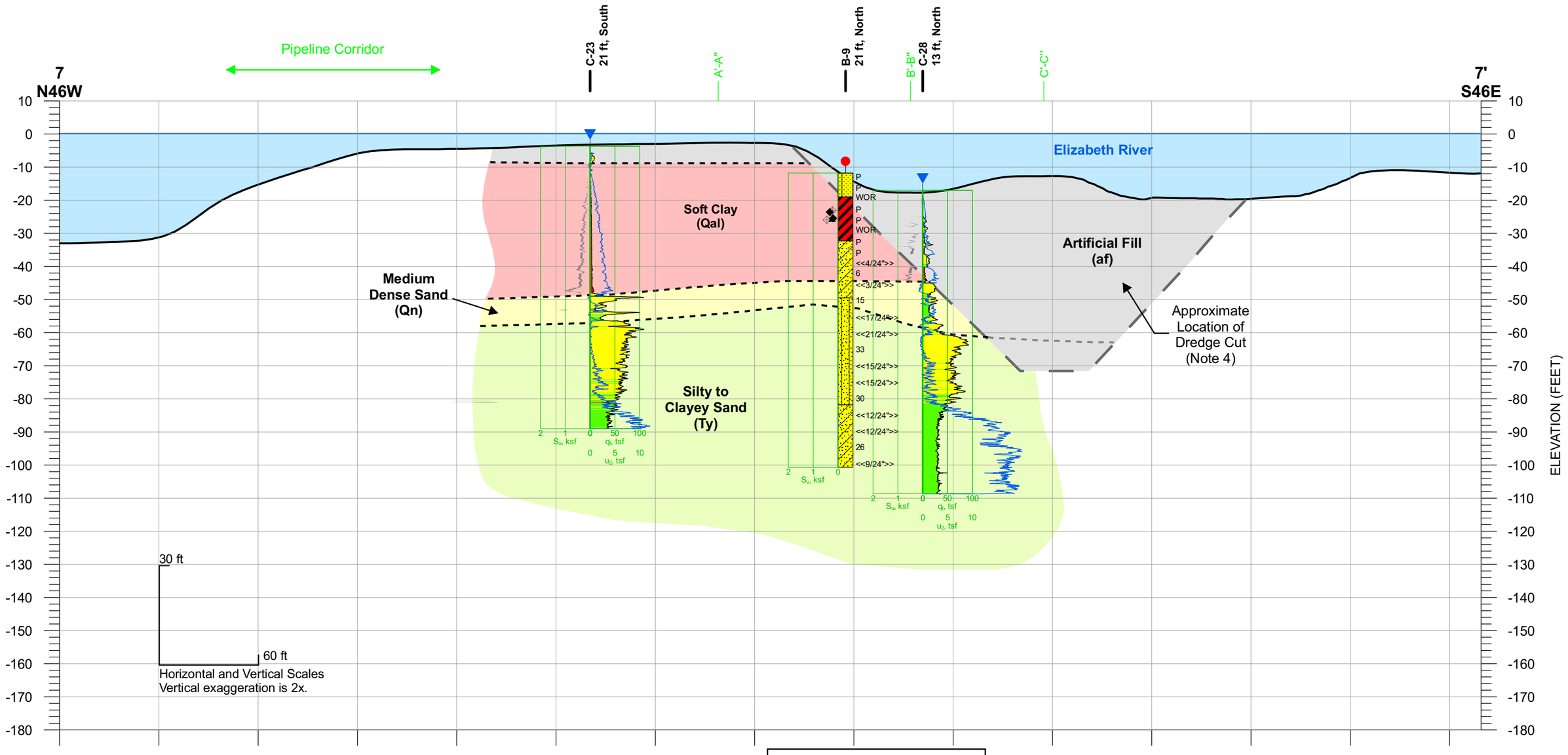
4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

LEGEND

- Elizabeth River
- Artificial Fill (af)
- Soft Clay (Qal)
- Medium Dense Sand (Qn)
- Silty to Clayey Sand (Ty)

SUBSURFACE CROSS SECTION 6-6'
WITH UNDRAINED SHEAR STRENGTH
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-4I



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LEGEND

- Elizabeth River
- Artificial Fill (af)
- Soft Clay (Qal)
- Medium Dense Sand (Qn)
- Silty to Clayey Sand (Ty)

NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

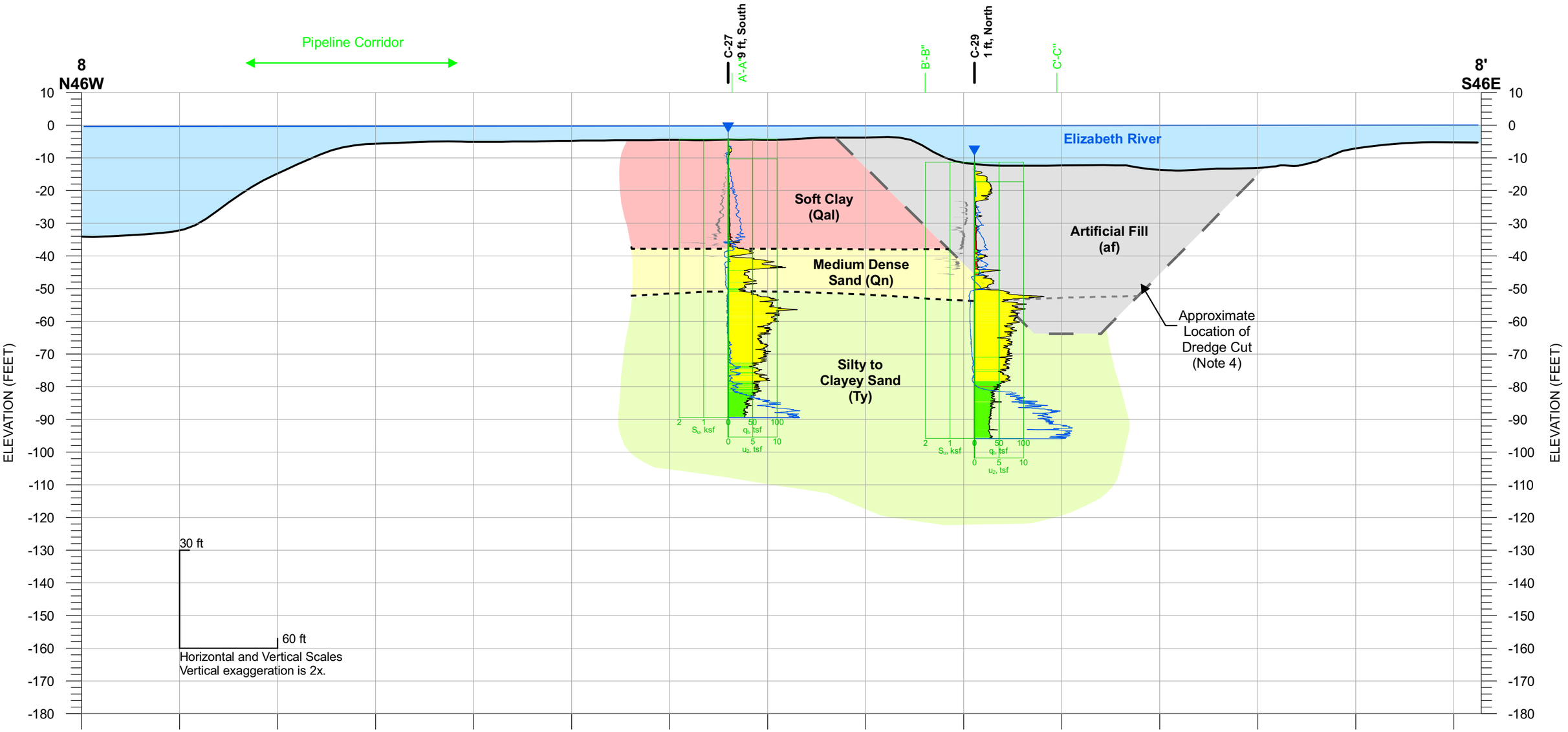
2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-5 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

SUBSURFACE CROSS SECTION 7-7'
WITH UNDRAINED SHEAR STRENGTH
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-4m



NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-5 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

LEGEND

- Elizabeth River
- Artificial Fill (af)
- Soft Clay (Qal)
- Medium Dense Sand (Qn)
- Silty to Clayey Sand (Ty)

SUBSURFACE CROSS SECTION 8-8' WITH UNDRAINED SHEAR STRENGTH
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-4n

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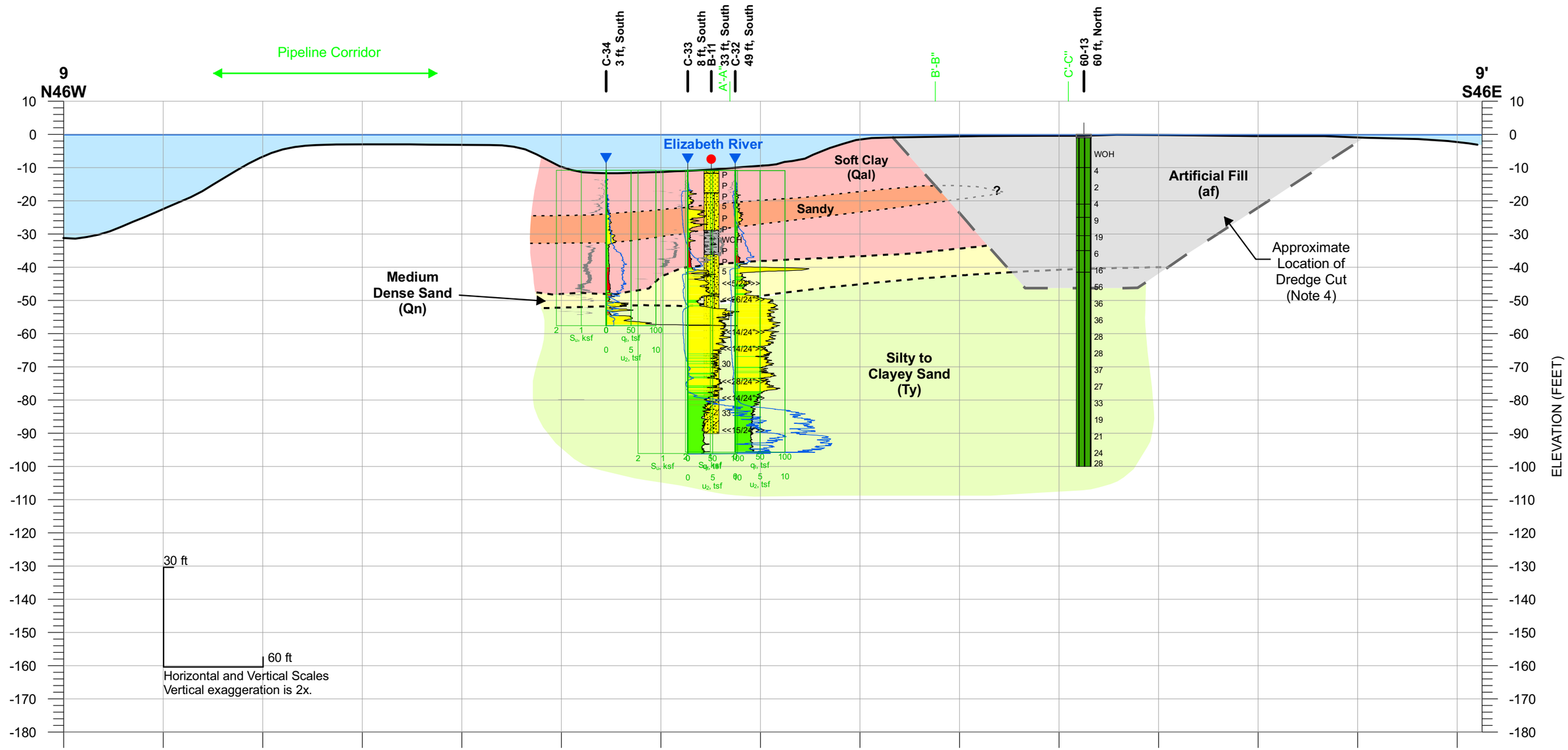

NOTES:

1) Bathymetric data (solid line) from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

2) Elevation reference to mean lower low water (MLLW).

3) Refer to Figure 5-5 for key to symbolism used on cross sections.

4) Approximate location of dredge cut based on 1960 design drawings and, where adequate data is available, based on 2008 geotechnical and geophysical data.

LEGEND

- Elizabeth River
- Artificial Fill (af)
- Soft Clay (Qal)
- Medium Dense Sand (Qn)
- Silty to Clayey Sand (Ty)

SUBSURFACE CROSS SECTION 9-9'
WITH UNDRAINED SHEAR STRENGTH
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-4o

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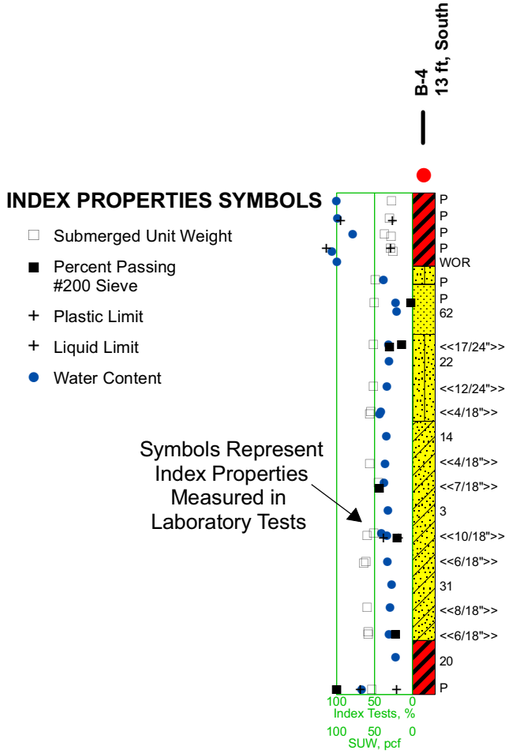
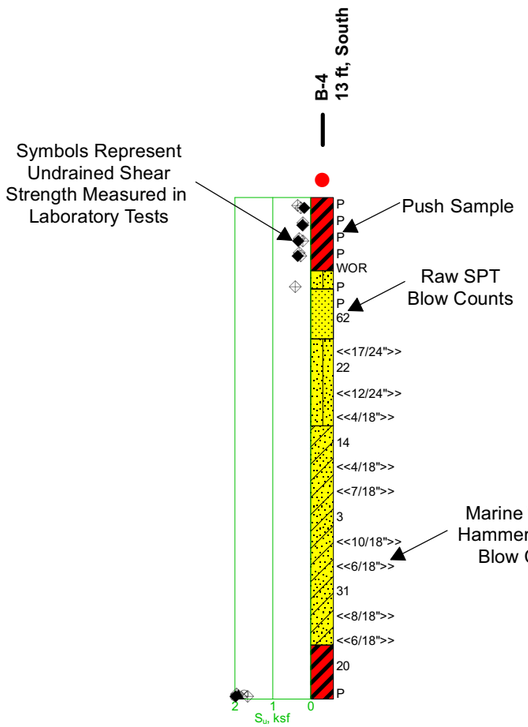


SOIL BORING LITHOLOGY WITH INDEX TESTS MEASURED IN LABORATORY AND RAW BLOW COUNTS



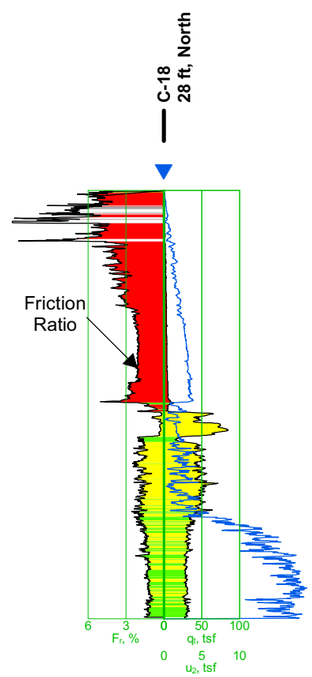
SOIL BORING LITHOLOGY WITH UNDRAINED SHEAR STRENGTH AND RAW BLOW COUNTS

SOIL TYPES

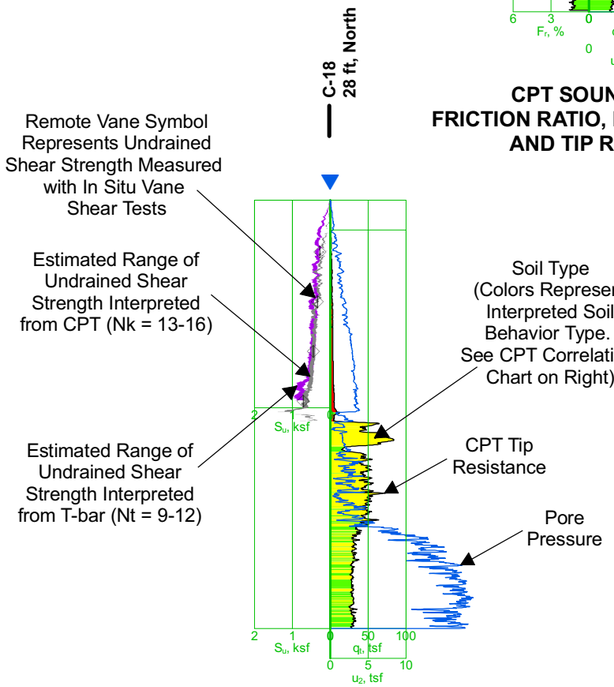
- Well graded GRAVEL (GW)
- Poorly graded GRAVEL (GP)
- GRAVEL with sand (GW)
- GRAVEL with clay (GW)
- Clayey GRAVEL (GC)
- GRAVEL with silt (GW)
- Silty GRAVEL (GM)
- Well graded SAND (SW)
- Poorly graded SAND (SP)
- SAND with gravel (SW)
- SAND with clay (SW-SC)
- Clayey SAND (SC)
- Silty SAND (SM)
- SAND with silt (SW-SM)
- Fat CLAY (CH)
- Sandy fat CLAY (CH)
- Lean CLAY (CL)
- Sandy lean CLAY (CL)
- Silty CLAY (CL-ML)
- Elastic SILT (MH)
- SILT (ML)
- Sandy SILT (ML)
- Clayey SILT (ML/CL)
- Highly plastic ORGANICS (OH)
- Low plasticity ORGANICS (OL)
- SANDSTONE (Rx)
- SILTSTONE (Rx)
- CLAYSTONE (Rx)
- MUDSTONE (Rx)
- Conglomerate (Rx)
- Interbedded Rock Strata (Rx)
- Pavement

SHEAR PROPERTIES SYMBOLS

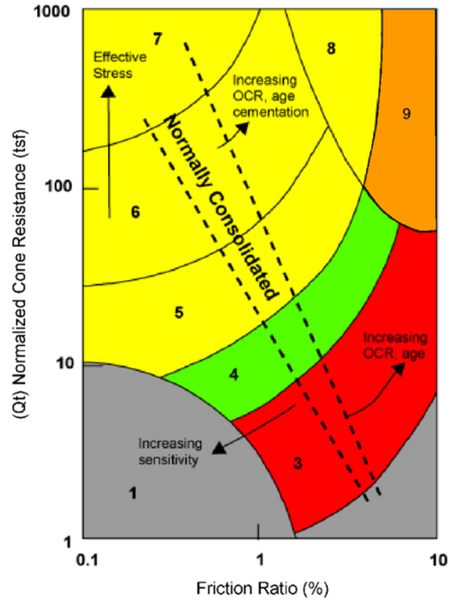
- ▲ Unconsolidated Undrained (UU)
- ◆ Laboratory/Miniature Vane (MV)
- ◇ Remote Vane (RV)
- ⊕ Torvane (TV)
- ⊗ Pocket Pen (PP)
- \+ Soil Strength Exceeds Instrument's Maximum Measurable Strength. Symbol Indicates Instrument's Maximum Measurable Strength Value.



CPT SOUNDING WITH FRICTION RATIO, PORE PRESSURE, AND TIP RESISTANCE



CPT SOUNDING WITH UNDRAINED SHEAR STRENGTH, PORE PRESSURE, AND TIP RESISTANCE



Zone	Soil Behavior Type	U.S.C.S.
1	Sensitive Fine-grained	OL-CH
2	Organic Material	OL-OH
3	Clay to Silty Clay	CL-CH
4	Clayey Silt to Silty Clay	MH-CL
5	Silty Sand to Sandy Silt	SM-ML
6	Sand to Silty Sand	SP-SM
7	Gravelly Sand to Sand	GP-SP
8	Sand to Clayey Sand	SP-SC
9	Very Stiff Fine-grained*	CH-CL

*overconsolidated or cemented

CPT CORRELATION CHART ROBERTSON, 1990

KEY TO SUBSURFACE CROSS SECTIONS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-5

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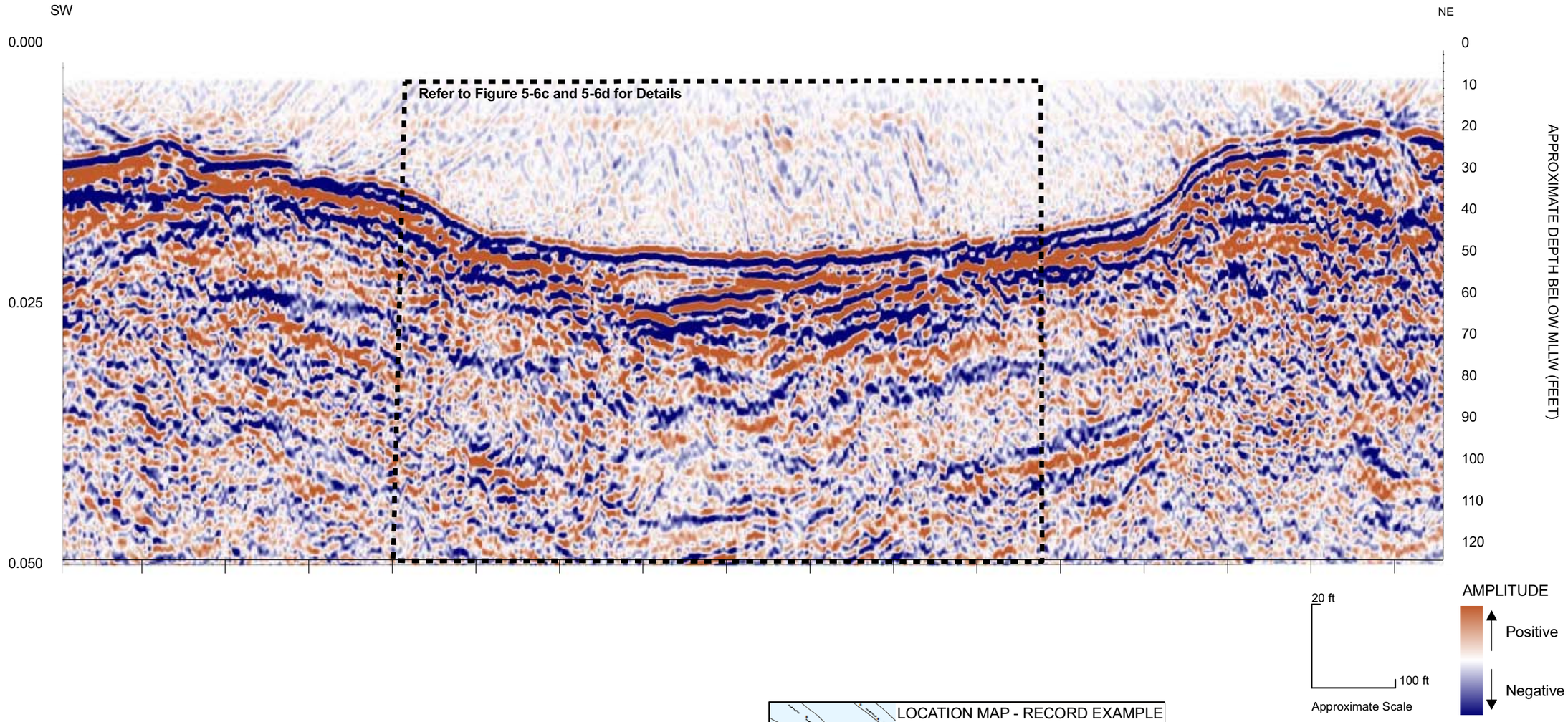

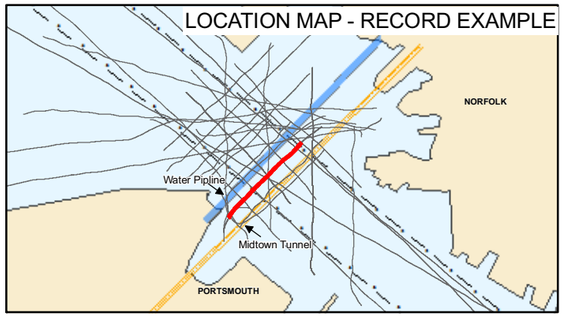

Notes:

1) Vertical exaggeration is 5x.
2) Approximate depth below mean lower low water is based on P-wave velocity of 5,000 ft/sec.
3) Horizontal scale varies slightly due to survey vessel speed.

BOOMER SEISMIC RECORD EXAMPLE OF LINE 108
Uninterpreted
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-6a

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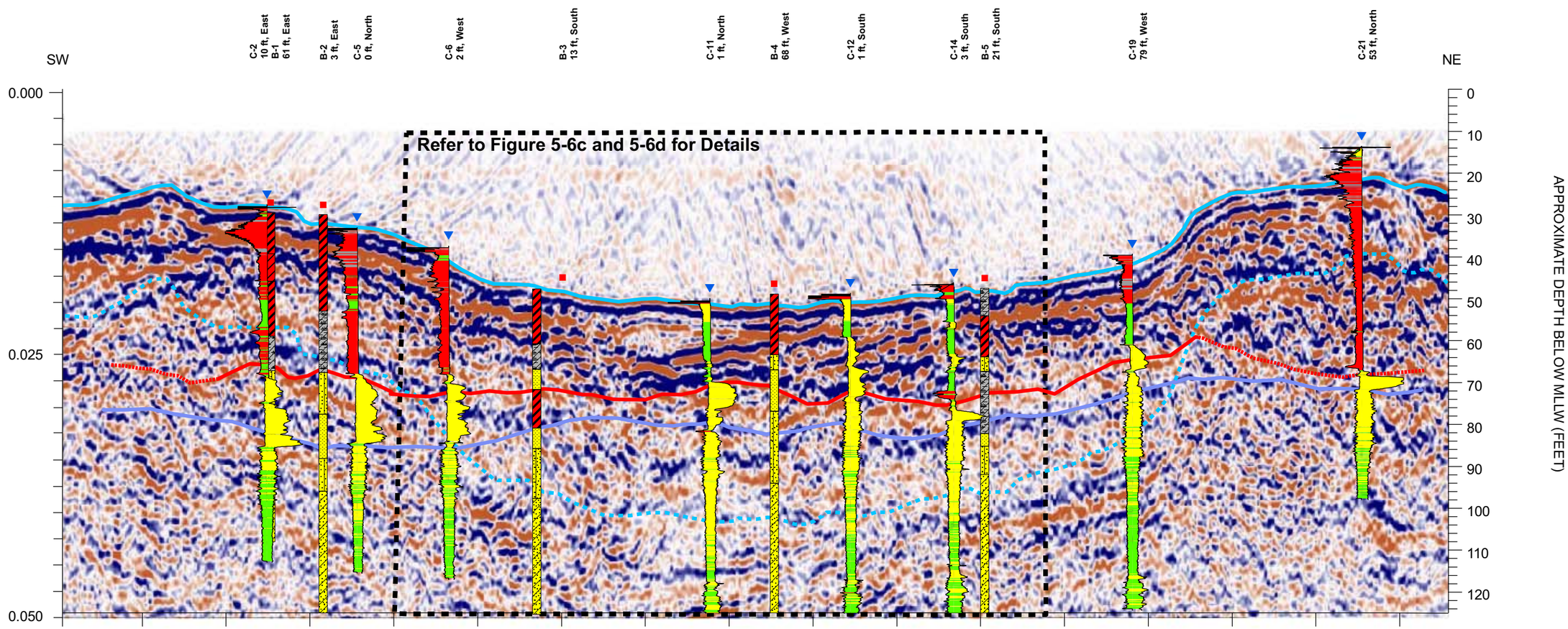


LEGEND

River Bottom

River Bottom Multiple

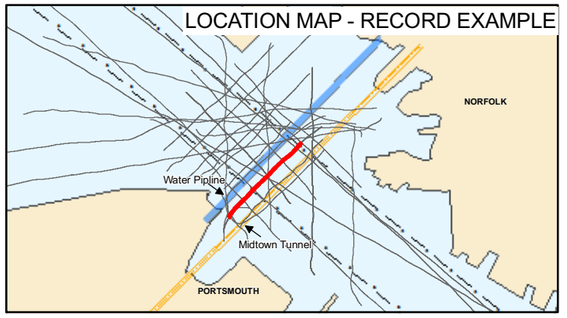
Mapped Reflectors and Interpreted Stratigraphic Contacts

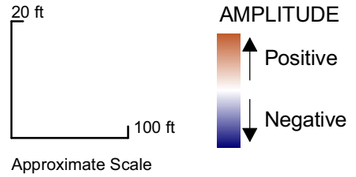
Reflector A (Base of Quaternary Alluvium/Top of Norfolk Formation)

Reflector B (Base of Norfolk Formation/Top of Yorktown Formation)

Notes:

1) Vertical exaggeration is 5x.
2) Approximate depth below mean lower low water is based on P-wave velocity of 5,000 ft/sec.
3) Horizontal scale varies slightly due to survey vessel speed.
4) Boring and CPT explorations have been projected short distances onto sesimic record.





BOOMER SEISMIC RECORD EXAMPLE OF LINE 108
Interpreted
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-6b

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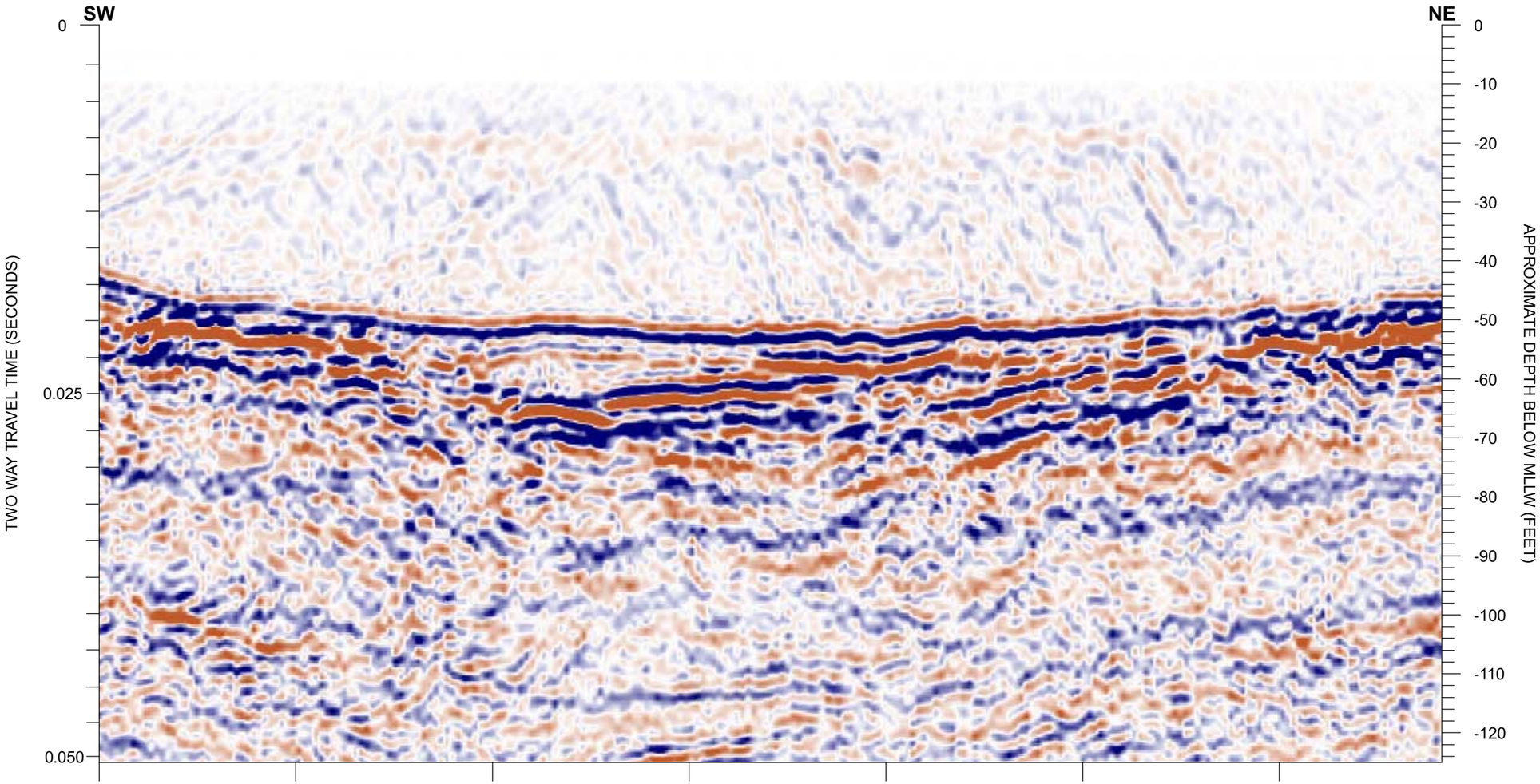
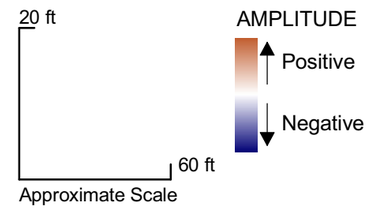
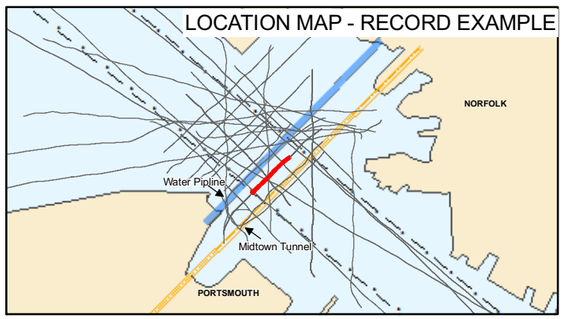


Notes:

1) Vertical exaggeration is 5x.
2) Approximate depth below mean lower low water is based on P-wave velocity of 5,000 ft/sec.
3) Horizontal scale varies slightly due to survey vessel speed.
4) Boring and CPT explorations have been projected short distances onto sesimic record.





BOOMER SEISMIC RECORD EXAMPLE OF LINE 108
Uninterpreted
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-6c

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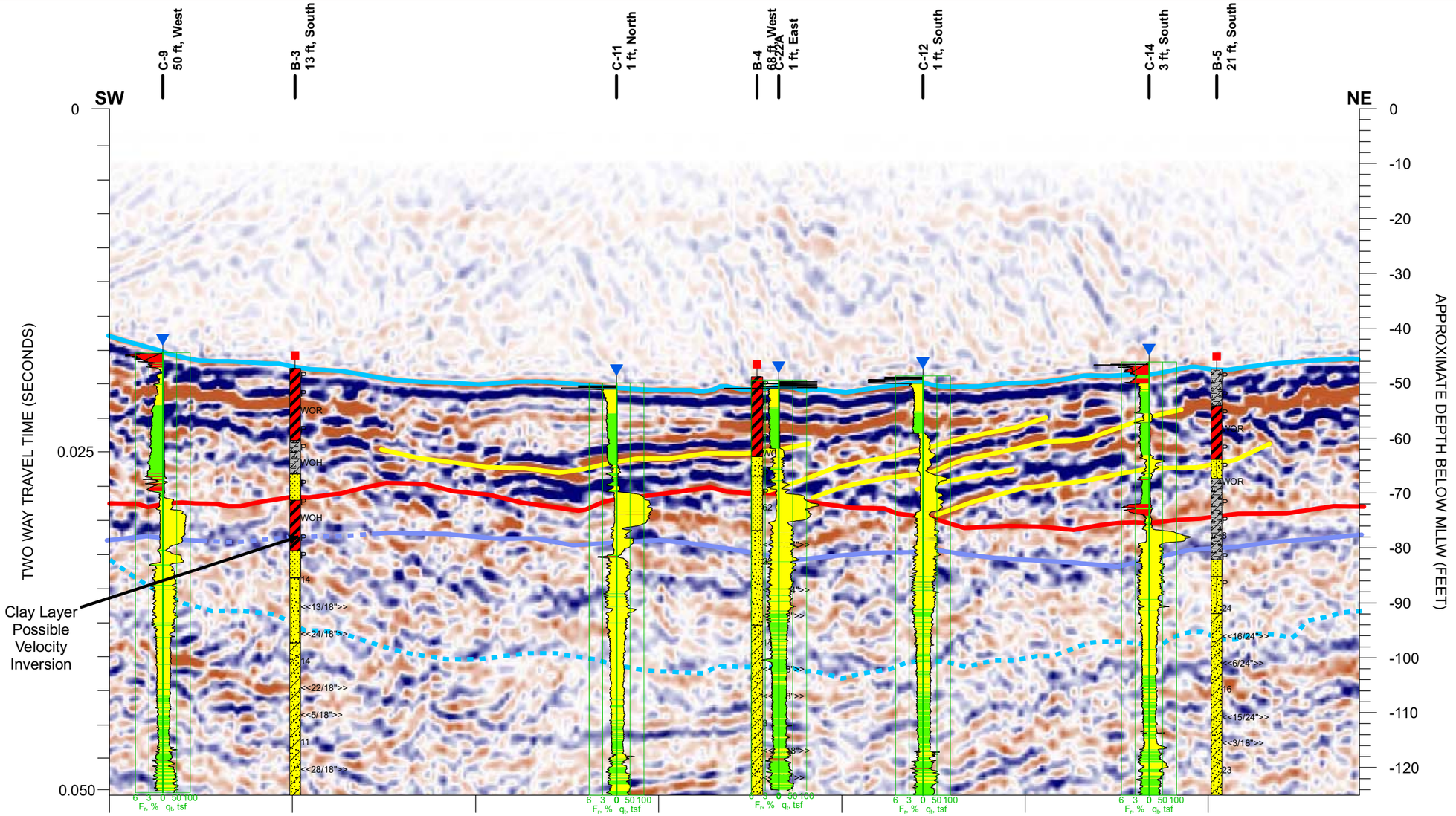
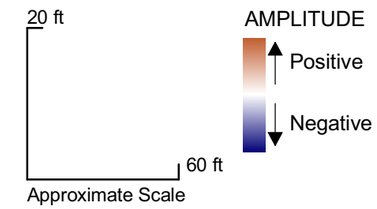


Notes:

1) Vertical exaggeration is 5x.
2) Approximate depth below mean lower low water is based on P-wave velocity of 5,000 ft/sec.
3) Horizontal scale varies slightly due to survey vessel speed.
4) Boring and CPT explorations have been projected short distances onto sesimic record.

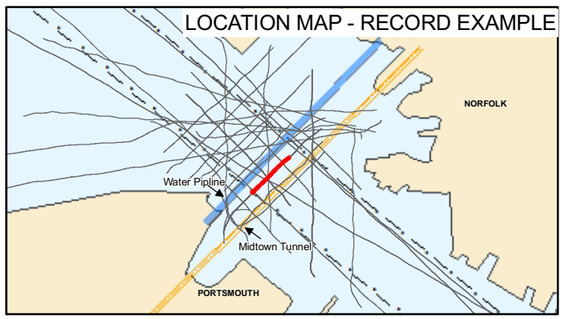


LEGEND

- River Bottom
- River Bottom Multiple

Mapped Reflectors and Interpreted Stratigraphic Contacts

- Reflector A (Base of Quaternary Alluvium/Top of Norfolk Formation)
- Reflector B (Base of Norfolk Formation/Top of Yorktown Formation)
- Positive Amplitude Reflector that Correlates to Top of Sandy Layers within Alluvium Slight concavity and truncation or unconformity on above and below reflectors suggest they are channel features.



BOOMER SEISMIC RECORD EXAMPLE OF LINE 108
Interpreted
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-6d

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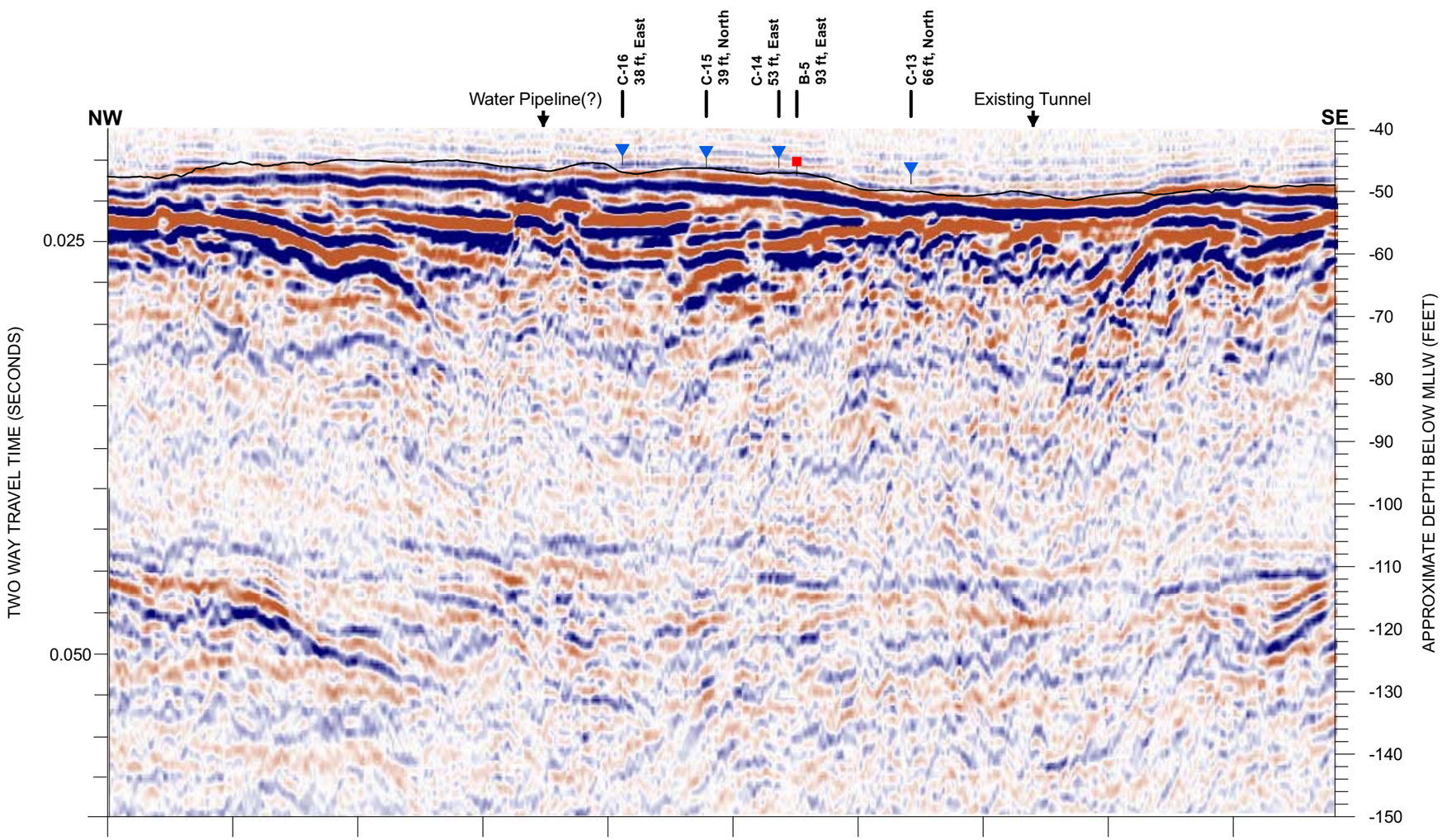
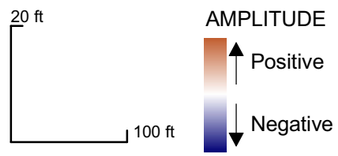
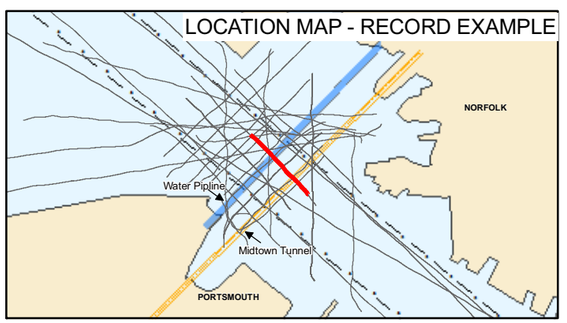


Notes:

1) Vertical exaggeration is 5x.
2) Approximate depth below mean lower low water is based on P-wave velocity of 5,000 ft/sec.
3) Horizontal scale varies slightly due to survey vessel speed.
4) Boring and CPT explorations have been projected short distances onto sesimic record.



Approximate Scale



BOOMER SEISMIC RECORD EXAMPLE OF LINE 204
Uninterpreted
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-7a

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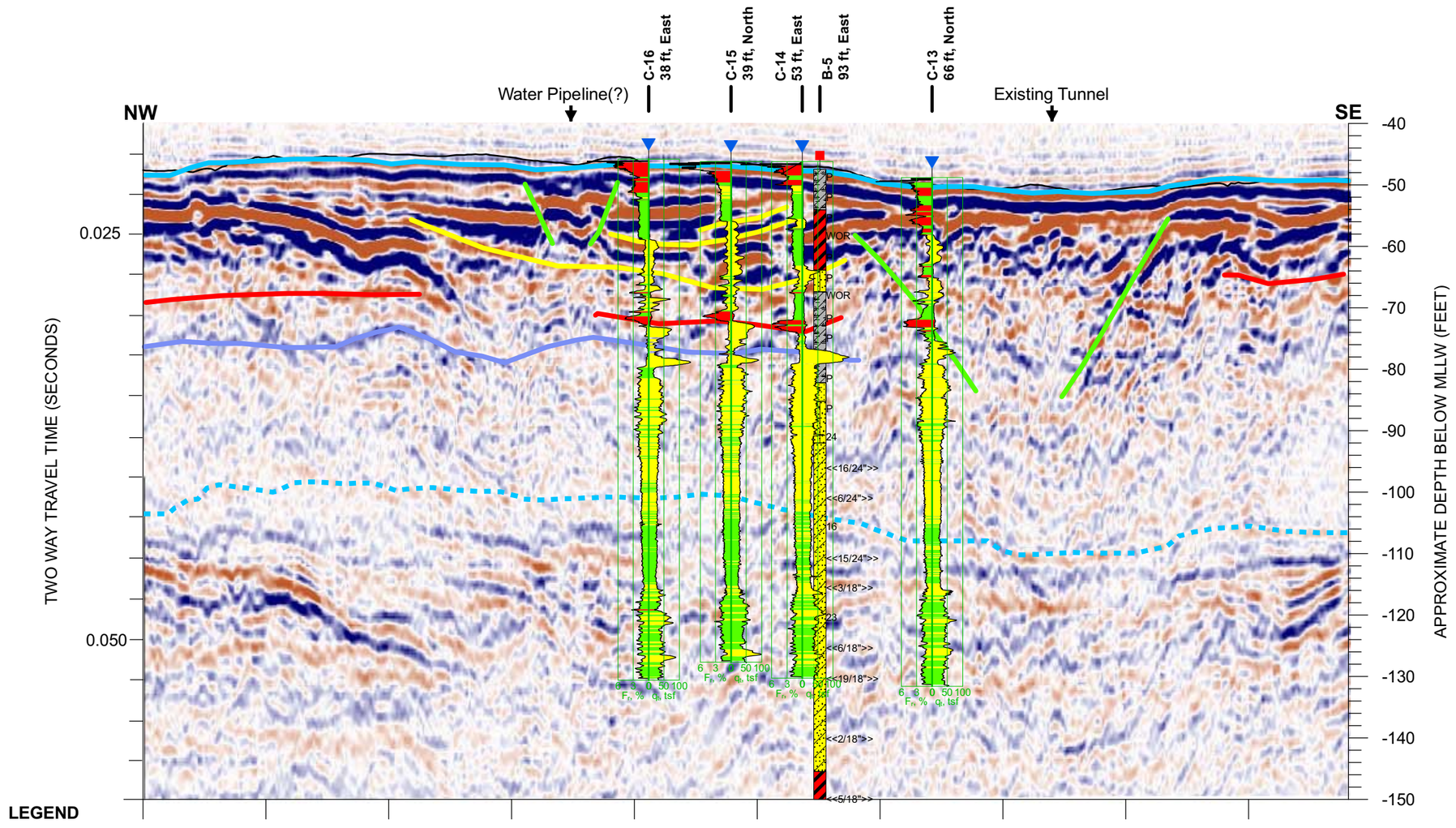
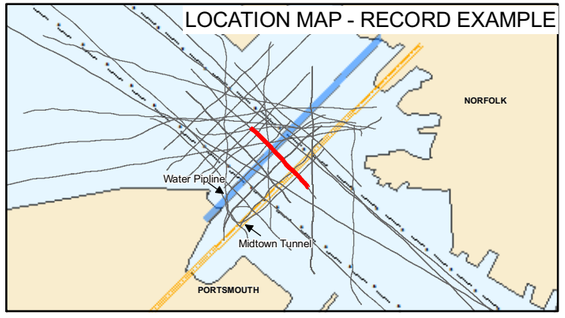


LEGEND

- River Bottom
- River Bottom Multiple

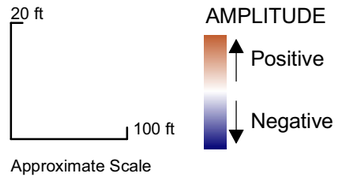
Mapped Reflectors and Interpreted Stratigraphic Contacts

- Reflector A (Base of Quaternary Alluvium/Top of Norfolk Formation)
- Reflector B (Base of Norfolk Formation/Top of Yorktown Formation)
- Positive Amplitude Reflector that Correlates to Top of Sandy Layers within Alluvium Slight concavity and truncation or unconformity on above and below reflectors suggest they are channel features.
- Truncated Reflectors - Probably Dredge Cut



Notes:

1) Vertical exaggeration is 5x.
2) Approximate depth below mean lower low water is based on P-wave velocity of 5,000 ft/sec.
3) Horizontal scale varies slightly due to survey vessel speed.
4) Boring and CPT explorations have been projected short distances onto sesimic record.



BOOMER SEISMIC RECORD EXAMPLE OF LINE 204
Interpreted
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-7b

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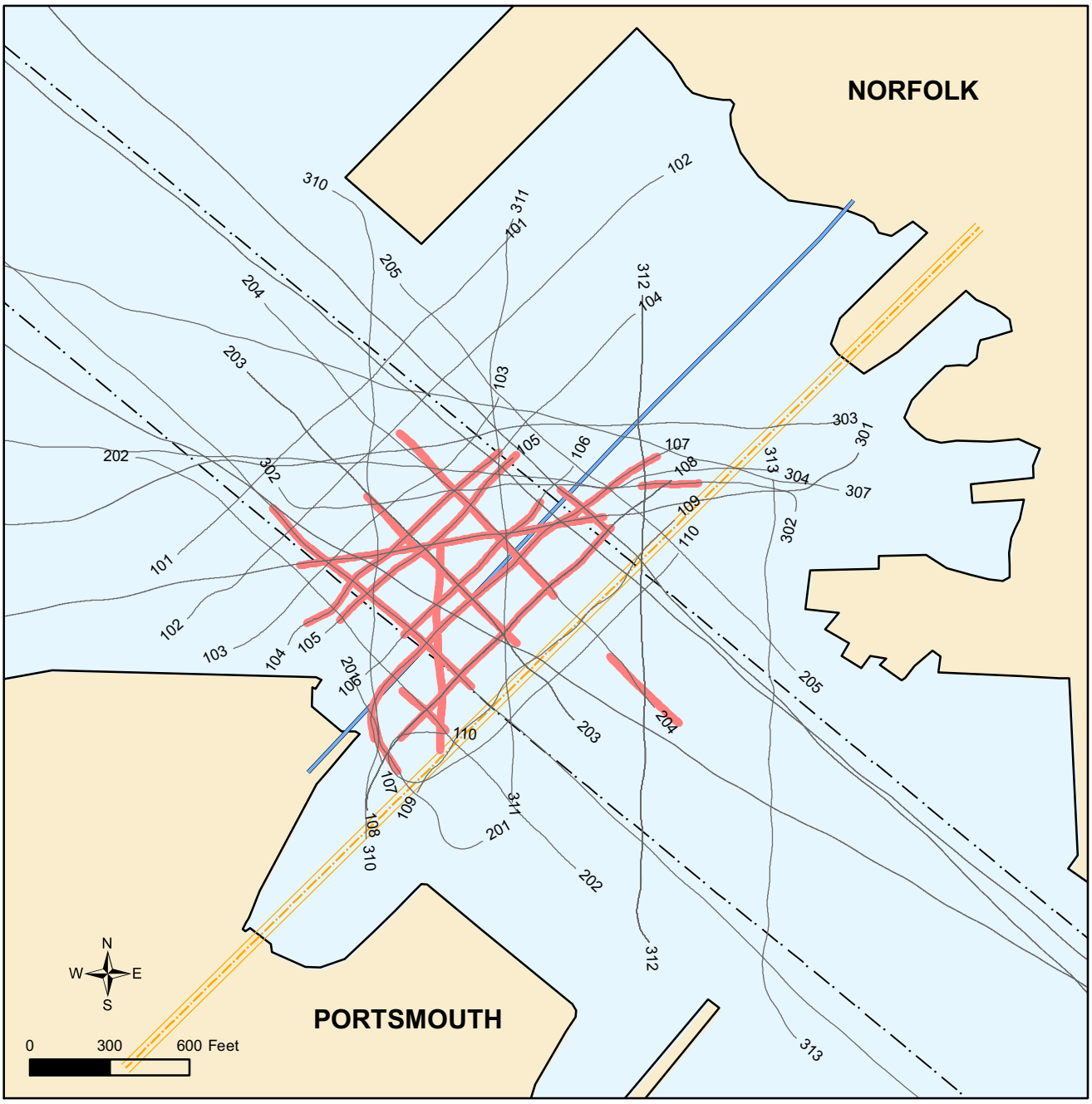


LEGEND

313 — Marine Seismic Reflection Lines
Number is survey line number.

Area of Mappable Reflector

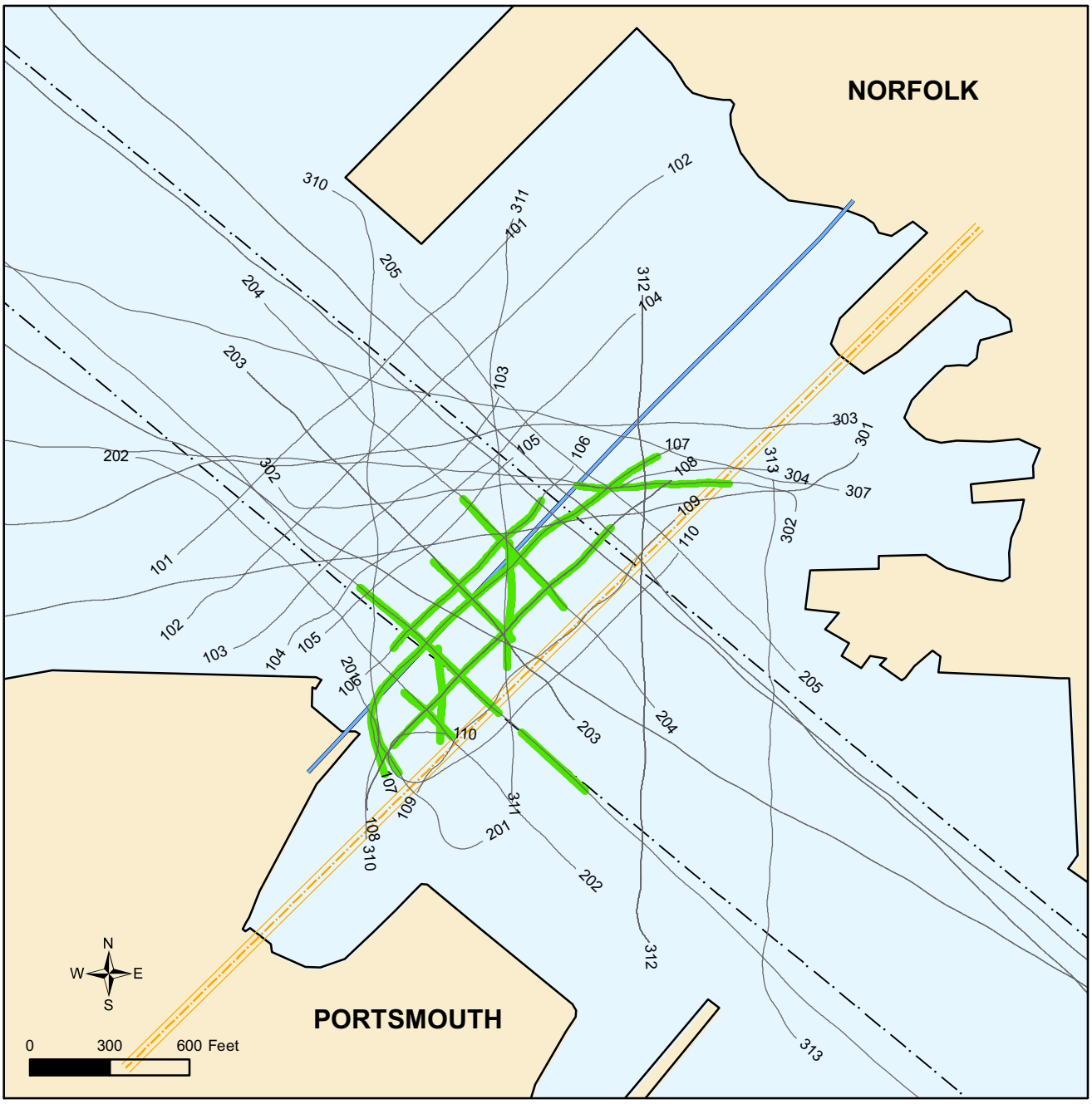
Approximate Location of Midtown Tunnel
Not for design or construction planning.
(Refer to Section 7.1 in text)

AREA OF MAPPABLE REFLECTOR A

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-8

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\05-ER_SiteCharMXD\Figures\Fig-5-8_Mappable_Reflector-A.mxd, 11/03/08, kstevens



LEGEND

313 — Marine Seismic Reflection Lines
Number is survey line number.

Area of Mappable Reflector

Approximate Location of Midtown Tunnel
Not for design or construction planning.
(Refer to Section 7.1 in text)

AREA OF MAPPABLE REFLECTOR B

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-9

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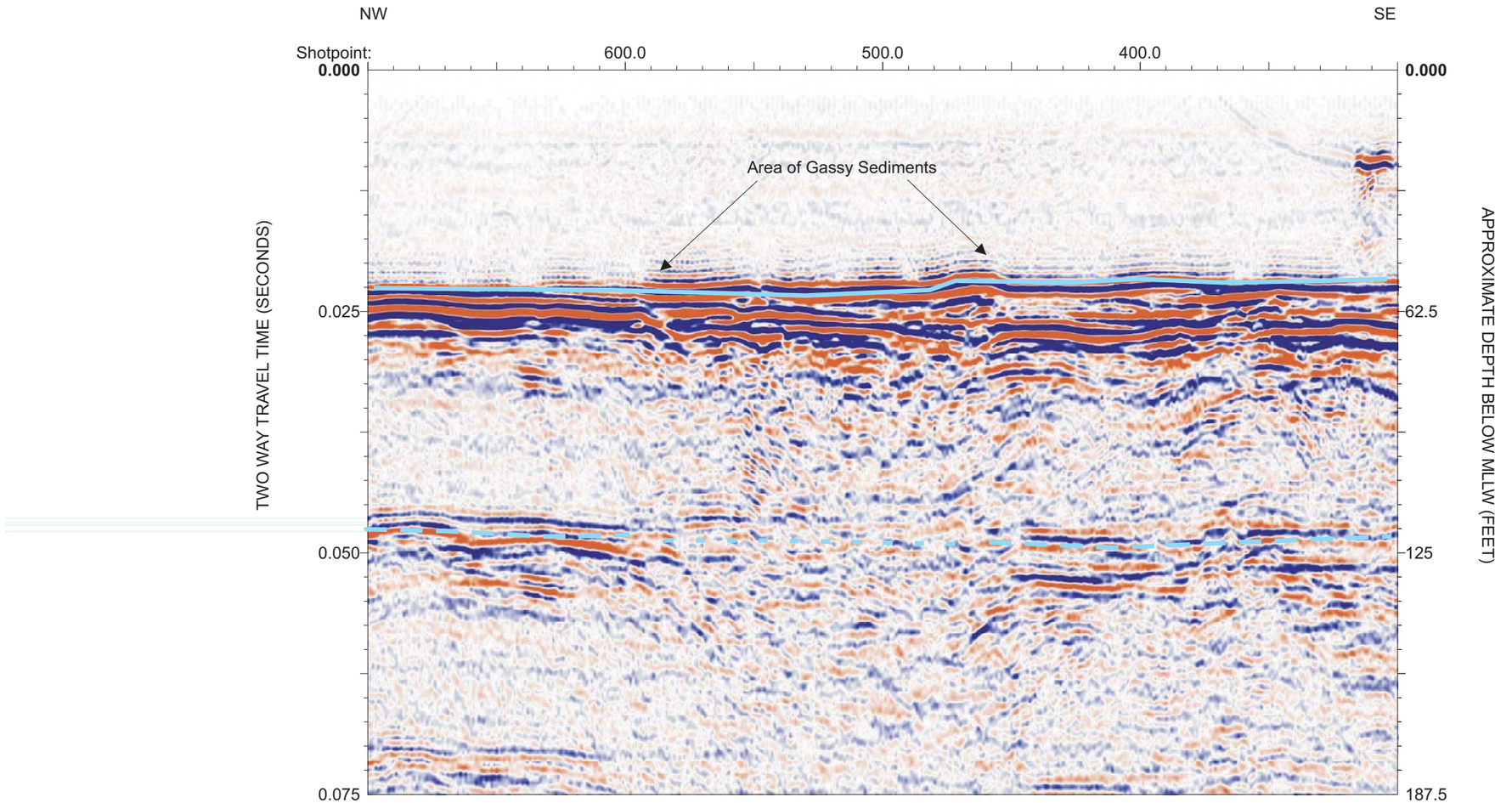


30’

150’

Approximate Scale (Feet)

Notes:

1) Vertical Exaggeration = 5x.
2) Approximate depth below mean lower low water is based on P-Wave velocity of 5,000 ft/sec.
3) Horizontal Scale varies slightly due to survey vessel speed.

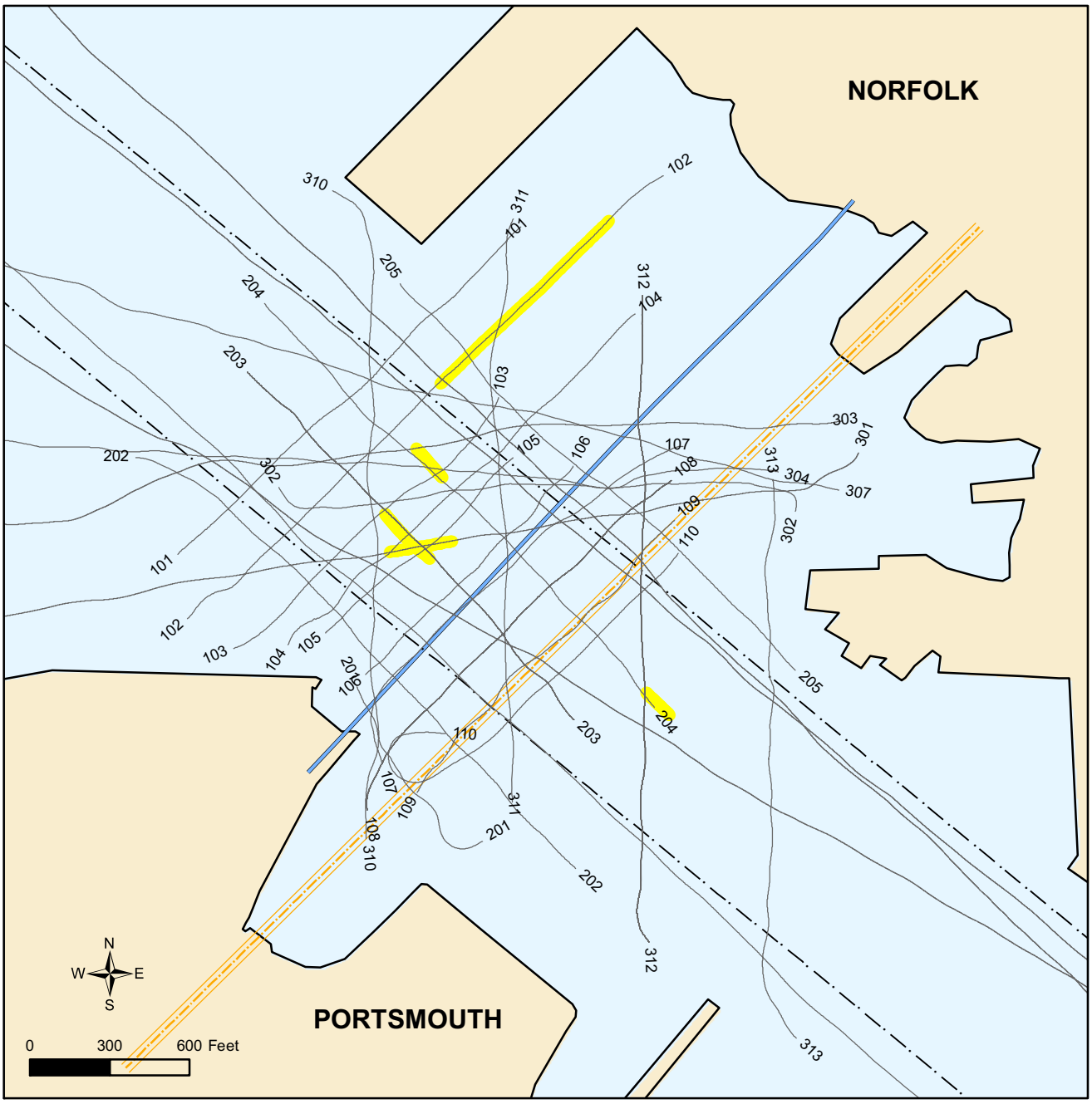
LEGEND

River Bottom

River Bottom Multiple (Dashed Where Gas Interferes with Multiple)

BOOMER SEISMIC RECORD EXAMPLE OF LINE 203
Ininterpreted
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-10



LEGEND

313 — Marine Seismic Reflection Lines
Number is survey line number.

Area with High Amplitude Negative Reflectors Inferred to be Gas

Approximate Location of Midtown Tunnel
Not for design or construction planning.
(Refer to Section 7.1 in text)

AREAS OF POTENTIAL BIOGENIC GAS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5-11

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6.0 ENGINEERING SOIL PROPERTIES

Soil property data included in this section is based on field and laboratory testing completed for this marine field program. Field data, primarily boring samples and CPT soundings, were used to discretize the subsurface at the site. Engineering properties and sediment characteristics presented in this section are divided into the following subsections:

- Grain size,
- In Situ Water (Moisture) Content and Unit Weights,
- Plasticity,
- Undrained Shear Strength of Fine-Grained sediments,
- In Situ Condition of Granular Sediments,
- Organic Content of sediments,
- Corrosivity of sediments, and
- Consolidation characteristics of fine-grained sediments.

Data from each laboratory test result are indicated on individual figures to graphically illustrate the variations in engineering soil properties throughout the soil profiles. Much of this information is also presented on the Log of Boring and Test Results for each individual exploration as presented in Appendix A of the Marine Exploration Geotechnical Data Report (Fugro 2008a). A Summary of Laboratory Test Results for marine borings performed for the proposed Midtown Second Parallel Tunnel project area is presented in Appendix E of the aforementioned document.

6.1 GRAIN SIZE

Granular material was predominantly encountered as Holocene to Pliocene aged sediment at and beneath the seafloor to the maximum depth explored during this field program. The grain size characteristics of the sediments underlying the site are summarized on the following illustrations:

- Figure 6-1: Grain Size Curve Envelopes,
- Figure 6-2: Percent Passing the No. 200 Sieve versus Elevation,
- Figure 6-3: Percent Passing the No. 200 Sieve versus Depth,
- Figure 6-4: Mean Grain Size (D50) versus Elevation, and
- Figure 6-5: Mean Grain Size (D_{50}) versus Depth.
- Artificial Fill: Limited testing of fines content (percentage of material passing the No. 200 sieve) varies between 12.0 and 14.0 percent between a depth of 0 and 7.2 feet. Artificial Fill samples evaluated for grain size classify as Poorly-graded Sand with silt (SP-SM) to Silty Fine Sand (SM). One laboratory test result indicates a range of mean grain-size of 0.20 mm.

- Alluvium: Fines content varies between 15.0 and 99.0 percent. Alluvium samples evaluated for grain size range in classification from Fat Clay (CH) and Organic Clay (OH) to Fine Sand (SP). Limited laboratory test results indicate a maximum mean grain-size of 0.020 mm.
- Norfolk Formation: Fines content varies between 1.0 and 33.0 percent, and samples evaluated for grain size classify as Silty Fine Sand (SM) to Fine to Medium Sand (SP). Laboratory test results indicate a range of mean grain-size between 0.10 mm and 0.61 mm.
- Yorktown Sand: Fines content of the Yorktown Sand samples vary between 14 and 51 percent. The samples classify as Silty to Clayey Fine Sand (SM to SC). Laboratory test results indicate a range of mean grain-size between 0.07 mm and 0.18 mm.
- Yorktown Clay: Fines content exceed 99 percent on the limited samples that were tested. Yorktown Clay samples classify as Fat Clay (CH).

6.2 IN SITU WATER (MOISTURE) CONTENT AND UNIT WEIGHTS

Data showing the in situ water content, unit total, submerged, and dry weight are plotted versus elevation on the following illustrations:

- Figure 6-6: Moisture Content versus Elevation,
- Figure 6-7: Moisture Content versus Depth,
- Figure 6-8: Total and Submerged Unit Weights versus Elevation,
- Figure 6-9: Total and Submerged Unit Weights versus Depth,
- Figure 6-10: Dry Unit Weight versus Elevation, and
- Figure 6-11: Dry Unit Weight versus Depth.

Water Content. Measured water contents are summarized by stratigraphic unit on Figures 6-6 and 6-7. Typical ranges measured in the various stratigraphic units are as follows:

- Artificial Fill: water content is measured between 26 and 52 percent, based on 4 samples from 2 borings,
- Alluvium: water content is measured between 23 and 159 percent. Water content results appear to cluster in two groups. Results from samples collected in borings near the river banks range between approximately 23 and 60 percent, while results from samples collected in borings near the navigation channel range between are generally greater than about 75 percent,
- Norfolk Formation: water content measured between 18 and 71 percent, but generally between about 20 and 35 percent,
- Yorktown Sand: water content measured between 22 and 56 percent, but generally between about 30 and 40 percent, and

- Yorktown Clay: water content measured between 22 and 67 percent, but generally between about 40 and 50 percent.

Unit Weights. The measured total and submerged unit weight from selected samples are summarized on Figures 6-8 and 6-9. A unit weight of water of 63 pounds per cubic foot (pcf) was used for the brackish water present in the Elizabeth River. The measured dry unit weight from selected samples is summarized on Figures 6-10 and 6-11. The typical range of unit weight data can be summarized as follows:

- Artificial Fill: measured total and submerged unit weights within samples encountered in borings range between 112 to 117 pcf, and 49 to 54 pcf, respectively. Measured dry unit weights range between 84 and 92 pcf.
- Alluvium: measured total and submerged unit weights range from 78 to 121 pcf, and 15 to 58 pcf, respectively. Measured dry unit weights range between 30 and 98 pcf.
- Norfolk Formation: Measured total and submerged unit weights range from 74 to 128 pcf, and 11 to 65 pcf, respectively. Measured dry unit weights range between 56 and 103 pcf. The low total, submerged, and dry unit weight values of 74, 11, and 56 pcf, respectively, resulted from tests performed on an organic/peat sample.
- Yorktown Sand: Measured total and submerged unit weights from 107 to 128 pcf, and 44 to 65 pcf, respectively. Measured dry unit weights range between 71 and 103 pcf.
- Yorktown Clay: Measured total and submerged unit weights range from 108 to 116 pcf, and 45 to 53 pcf, respectively. Measured dry unit weights range between 69 and 81 pcf.

6.3 PLASTICITY

The plasticity of fine-grained soil is summarized on:

- Figure 6-12: Atterberg Limits versus Elevation,
- Figure 6-13: Atterberg Limits versus Depth, and
- Figure 6-14: Plasticity Chart.

The fine-grained soil primarily consists of low to high plasticity clay. As shown on Figure 6-14, the Atterberg limit test data plot above the A-line of the plasticity chart, signifying the presence of primarily clayey material throughout the depth explored. Atterberg limit test data are summarized as follows:

- Artificial Fill: Atterberg Limits were not performed within the granular, non-natural Artificial Fill.
- Alluvium: Liquid limits (LL) range between 30 and 148, and the plasticity indices (PI) vary between 7 and 110.

- Norfolk Formation: Within the Norfolk Formation, one sample was tested. It had a measured liquid limit (LL) of 29 and a plasticity index (PI) of 17 and classifies as Lean Clay (CL).
- Yorktown Sand: Liquid limits (LL) range between 34 and 50, and the plasticity indices (PI) vary between 14 and 32.
- Yorktown Clay: Liquid limits (LL) range between 67 and 73, and the plasticity indices (PI) vary between 45 and 50.

6.4 UNDRAINED SHEAR STRENGTH OF FINE-GRAINED SEDIMENTS

The majority of undrained shear strength testing was performed on the fine-grained Alluvium sediments. Laboratory testing included unconsolidated undrained triaxial, minivane, and torvane testing. In situ remote vane testing was performed concurrent with the drilling and sampling operations. The undrained shear strengths of fine-grained soils measured with laboratory and in situ tests are presented on:

- Figure 6-15: Undrained Shear Strength versus Elevation, and
- Figure 6-16: Undrained Shear Strength versus Depth.

The undrained shear strengths of fine-grained soils interpreted from CPT and T-bar soundings are presented on:

- Figure 6-17: Undrained Shear Strength versus Elevation, and
- Figure 6-18: Undrained Shear Strength versus Depth.

Within the upper approximately 40 feet of extremely soft to soft Alluvium, laboratory and in situ undrained shear strength test measurements typically range between 200 and 700 pounds per square foot (psf), as shown on Figure 6-16. As shown on Figure 6-18, the undrained shear strength, as estimated from the CPT and T-bar data, generally increases linearly with depth. Based on assumed ranges of Nk (12 to 15 for CPT, and 9 to 12 for T-bar) the rate of undrained shear strength increase estimated from CPT and T-bar data is about 15 to 25 psf/foot. Limited laboratory undrained shear strength tests were performed on samples of Yorktown fine-grained sediments in the depth range between about 95 and 110 feet. The results range between approximately 1,700 and 3,500 psf.

The "T"-bar comprises a short cylindrical bar that is attached perpendicularly to the penetrometer rods. As it is pushed into the soil a load cell situated immediately behind the bar measures the resistance. T-bars are well suited at defining very soft materials due to their increased dimensions in comparison with CPTs. The T-bar's increased size leads to increased resistance. The higher resistances generated in soft soil, combined with a more rigorous analytical solution of the failure mechanism, enhance the ability to interpret undrained shear strength of very soft to soft material. This makes it effective at differentiating between tunnel backfill and very soft to soft Alluvium at the site. Figure 6-19 displays two examples where interpreted undrained shear strength from both T-bar and CPT data assist in characterizing strength of the two materials and defining the original tunnel's dredge cut. As observed on the

example from Cross Section 2-2', subtle in situ data changes indicating the contact between backfill and Alluvium becomes heightened through the use of the T-bar. The second example from Cross Section 5-5' displays the effectiveness of T-bar data in the interpretation of shear strength in the soft surficial material (about 10- to 15-foot depth).

Due to the elevation change and differing overconsolidation states from one end of the site to the other, the site was discretized to evaluate trends visible in the undrained shear strength data. The three zones, or divisions, are as follows, and reference the following explorations:

1. Portsmouth Side (includes all explorations southwest of and including C-6),
2. Navigation Channel (includes all explorations northeast of C-6 to C-19), and
3. Norfolk Side (includes all explorations northeast of and including B-6).

Figures 6-20 through 6-22 display strengths interpreted from CPT and T-bar soundings performed in each respective zone as follows:

- Figure 6-20: Undrained Shear Strength versus Elevation, Zone 1 - Portsmouth,
- Figure 6-21: Undrained Shear Strength versus Elevation, Zone 2 - Navigation Channel, and
- Figure 6-22: Undrained Shear Strength versus Elevation, Zone 3 - Norfolk.

6.5 IN SITU CONDITION OF GRANULAR SEDIMENTS

Relative density is an important factor that affects the strength of sands. Relative density (D_r) is defined as the ratio of the difference between the in situ void ratio and the maximum void ratio to the difference between the maximum and minimum void ratios. Data indicative of in situ condition of the granular sediments underlying the site are summarized on:

- Figure 6-23: Blow Count (SPT N-Value) versus Elevation, and
- Figure 6-24: Blow Count (SPT N-Value) versus Depth.

An important method of estimating the in situ relative density of granular materials is the correlation of SPT blow count per foot (N-values) obtained from field sampling techniques. Figures 6-23 and 6-24 present the equivalent N-value profiles of the stratigraphic units as determined in the field for the Standard Penetration Test (SPT). The data presented have not been adjusted to account for overburden pressure, test efficiency, or for the energy dissipation effects through the long rod length for the marine borings. We have used the following categories for relative density, based on Terzaghi and Peck (1967) and Lambe and Whitman (1969), as shown in Table 6-1 below.

Table 6-1. SPT-N Value Correlations with Relative Density

SPT N-Value	Relative Density	D_r (%)
0 to 4	Very loose	0 to 15
5 to 10	Loose	15 to 35
11 to 30	Medium dense	35 to 65
31 to 50	Dense	65 to 85
> 50	Very dense	85 to 100

Table 6-2 below shows the typical ranges of sampler blow counts with relative densities, correlated to SPT N-values for the various subsurface strata:

Table 6-2. Relative Densities of Principal Stratigraphic Units

Principal Stratigraphic Unit	Typical Range of N-Values	Relative Density correlated to SPT N-values
Artificial Fill (Af)	< 1*	0 to 15%
Alluvium (Qal)	< 1 to 9	0 to 30%
Norfolk Formation (Qn)	5 to 41	15 to 75%
Yorktown Sand (Tys)	7 to 38	25 to 70%
Yorktown Clay (Tyc)	20*	50%

*Based on one sample

6.6 ORGANIC CONTENT OF SEDIMENTS

The organic content of sediments can be a factor in their sensitivity to disturbances such as tunneling or excavation activities. Organic-rich soils are often susceptible to significant decreases in shear strength and alterations in porosity due to rapid weathering once they are disturbed. Several selected samples were tested for organic content. In addition, when soils were suspected of having appreciable organic content, a liquid limit test was performed on 2 samples of the soil: one on an air-dried sample, and the second on an oven-dried sample. If the ratio of the oven-dried liquid limit value to the air-dried liquid limit value was less than 0.75, the soil was classified as organic silt (OL) or organic clay (OH). The results of the laboratory testing are presented in Table 6-3 below:

Table 6-3. Organic Matter Content

Boring Designation	Depth below river bottom (ft)	Material Type	Organic Content (%)*	Liquid Limit, LL (oven-dry)	Liquid Limit, LL (air-dry)	LL Ratio oven:air dry (%)
B-1	29.6	Organic CLAY (OH)	6.9	58	97	60
B-2	23.5	Organic CLAY (OH)	10.6	57	93	61
B-2	33.8	Organic CLAY (OH)	9.5	63	117	54
B-3	14.6	Organic CLAY (OH)	7.8	61	110	55
B-5	5.3	Organic CLAY (OH)	7.5	61	99	62
B-5	20.2	Organic CLAY (OH)	6.2	60	96	63
B-5	28.2	Organic CLAY (OH)	17.9	58	115	50
B-6	31.7	Organic CLAY (OH)	13.2	49	84	58
B-8	49.6	Organic SILT (OH)	16.0	47	92	51
B-11	17.9	Organic CLAY (OL)	2.1	-	-	-

*Loss of Ignition method. Content by weight.

Nine out of ten samples tested contained more than 5.0 percent organic matter content by weight. These would be considered having appreciable organic material.

6.7 CORROSIVITY PROPERTIES OF SEDIMENTS

To provide a preliminary evaluation of the potential corrosivity of sediments within the proposed tunnel alignment, laboratory resistivity, pH, sulfate, and chloride tests were performed on selected samples. The results of the laboratory tests are presented below in Table 6-4 and within the Summary of Laboratory Test Results presented in the Marine Geotechnical Data Report (Fugro 2008a).

Table 6-4. Corrosivity Measurements

Boring Designation	Depth below river bottom (ft)	Material Type	Measured pH	Resistivity (ohms-cm)	Cl (ppm)	SO_4 (%)
B-1	26.7	Fat CLAY (CH)	5	55	5180	5250
B-2	62.9	Silty Fine SAND (SM)	7.2	93	2199	3750
B-3	11.8	Fat CLAY (CH)	5	49	8397	4750
B-4	43.7	Silty Fine SAND (SM)	7	104	1833	3500
B-5	34.7	Fine SAND (SP)	4.2	120	1462	1750
B-6	88.9	Clayey Fine SAND (SC)	6.4	120	1300	6000
B-8	42.7	Organic SILT (OH)	5.3	-	9097	6000
B-9	13.7	Fat CLAY (CH)	6.4	55	7398	2875
B-9	58.4	Silty Fine SAND (SM)	7.1	76	2899	4250
B-10	20.2	Medium SAND (SP)	7.9	147	1699	310
B-11	53.5	Silty Fine SAND (SM)	7.1	180	387	2500

Test results indicate that the pH of the tested samples is generally acidic to neutral with the exception of several slightly alkaline samples. Measured pH ranged from 4.2 to 7.9. Resistivity measurements were between 49 and 180 ohms-cm. Chloride content was measured between 387 and 9,097 parts per million (ppm). Sulfate content measurements ranged from 0.031 percent to 0.60 percent.

6.8 CONSOLIDATION CHARACTERISTICS OF FINE-GRAINED SEDIMENTS

The consolidation characteristics of the fine-grained sediments in vicinity of the proposed tunnel alignment were evaluated using the results of three one-dimensional consolidation tests (presented previously in Appendix E of the Marine Geotechnical Data Report) and empirical relationships based on plasticity, liquidity index and the ratio of measured undrained shear strength to effective overburden pressure (Su/p_o').

State of Consolidation. Comparisons of effective preconsolidation pressure to vertical effective overburden pressures suggest that subsurface materials are, in general, overconsolidated with respect to the current effective overburden pressures, i.e., that past maximum pressures are greater than existing overburden pressures. Overconsolidation ratios (OCRs) in the alluvial materials ranged from 1.1 to 1.4. The OCR measured for one sample of the deeper Yorktown clay was 1.6.

Compressibility. For the upper alluvial materials, interpreted compression ratios (C_c) ranged from 0.68 to 0.84. The interpreted recompression ratio (C_r) was 0.14. C_c and C_r values for the deeper Yorktown clay were interpreted to be 0.46 and 0.11, respectively.

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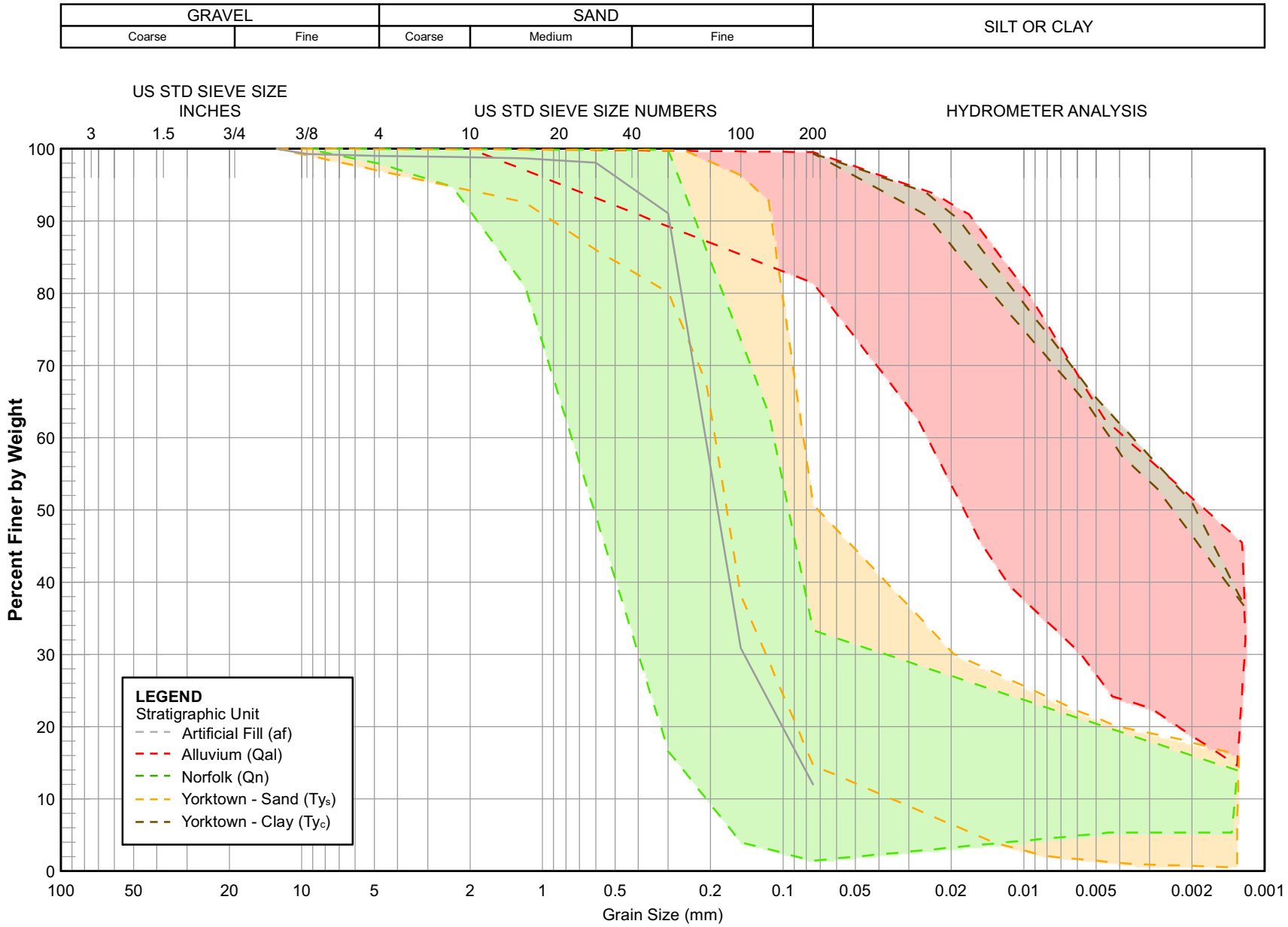
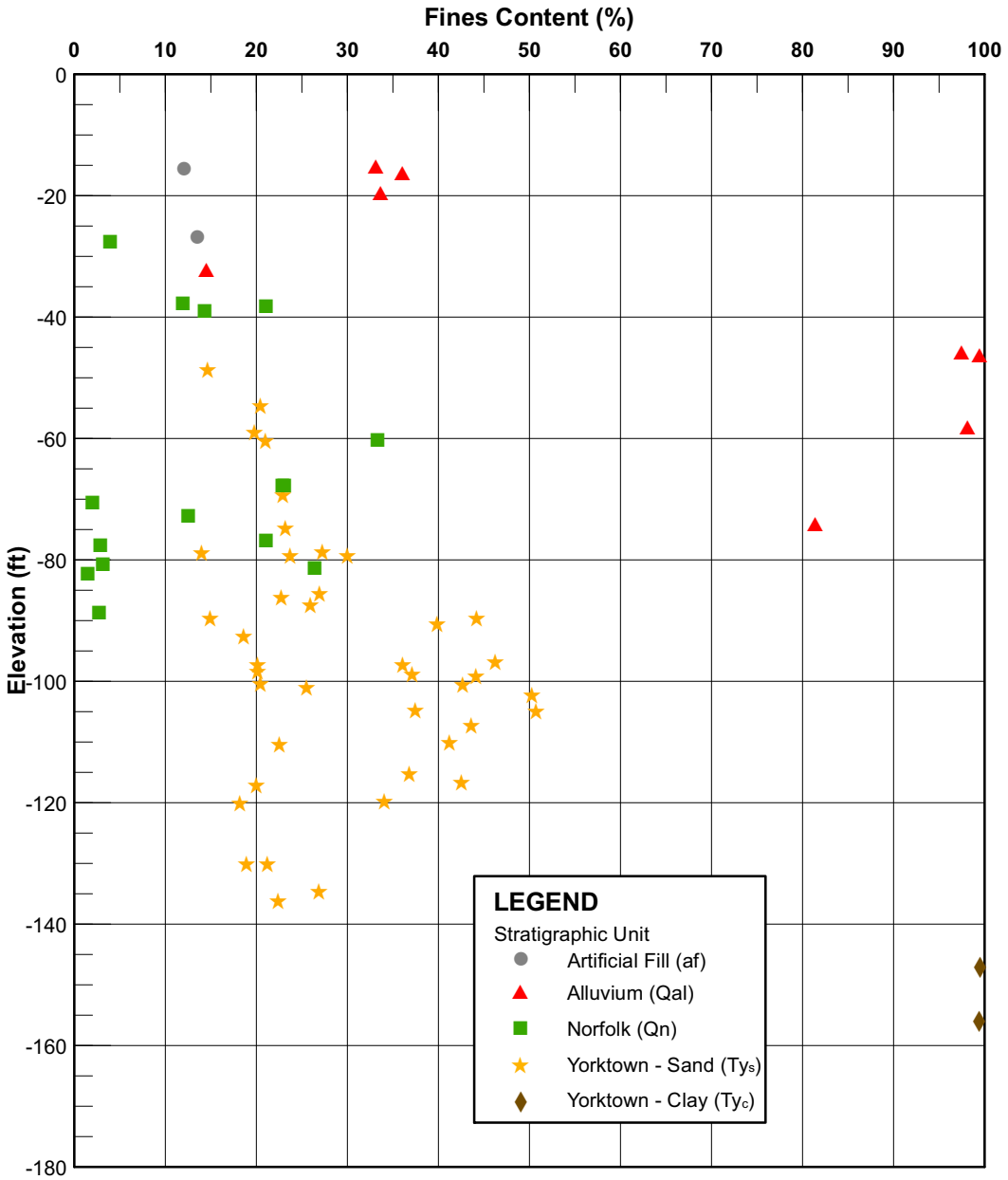


GRAIN SIZE ENVELOPES
2008 Marine Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-1

Virginia Department of Trasportation
Project No. 3602.001



PERCENT PASSING NO. 200 SIEVE VERSUS ELEVATION
2008 Marine Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-2

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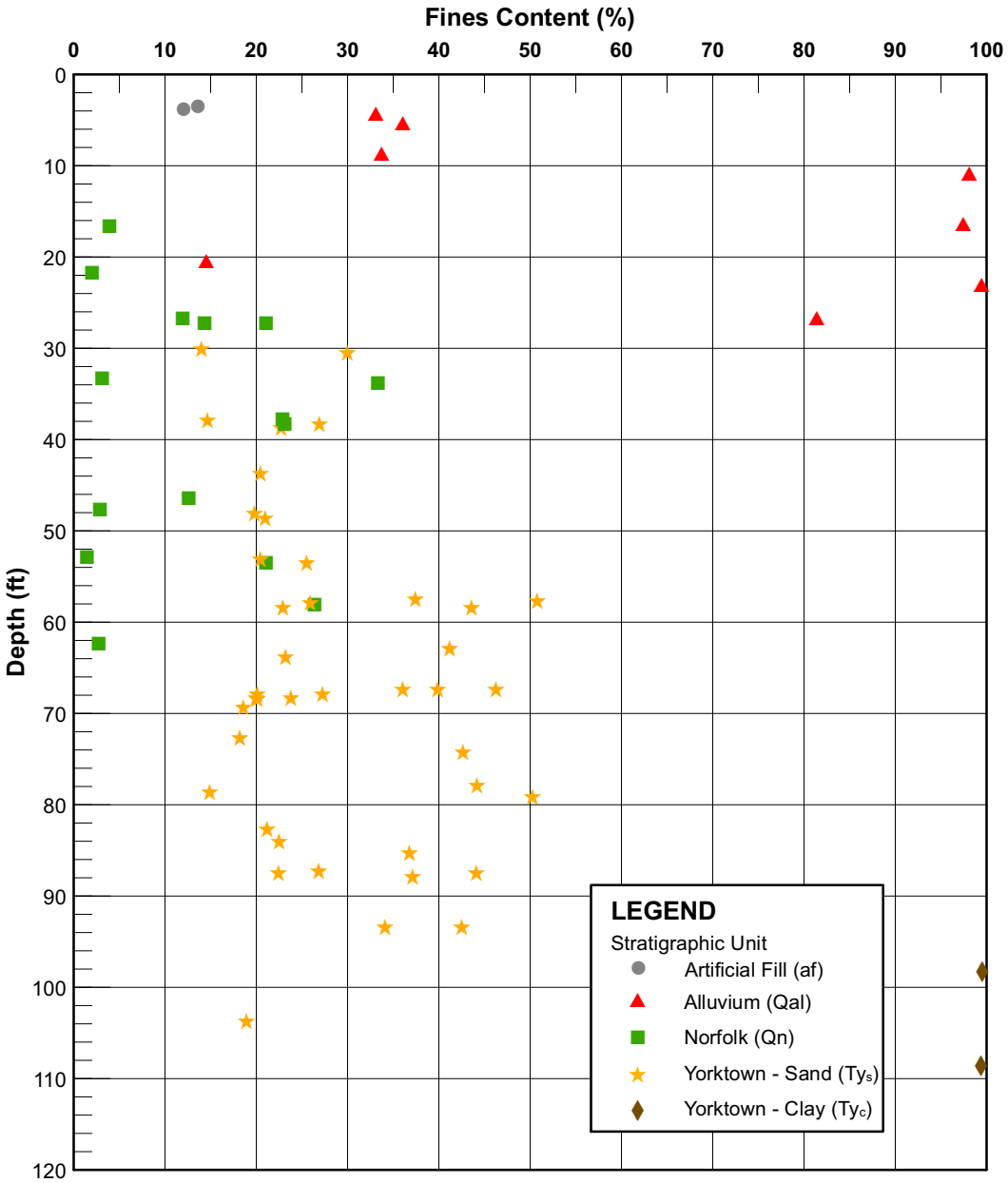

PERCENT PASSING NO. 200 SIEVE VERSUS DEPTH
2008 Marine Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-3

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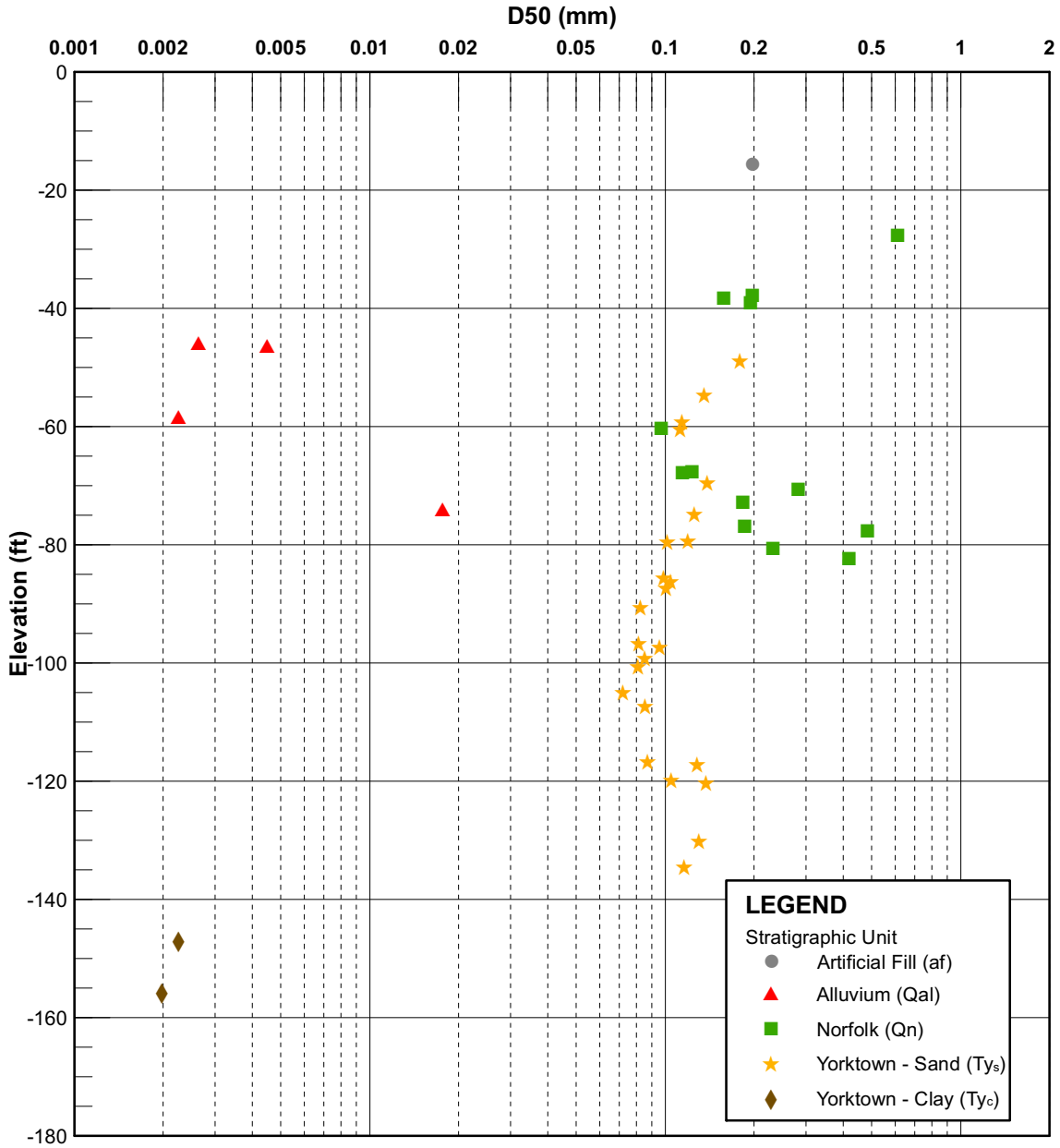

MEDIAN GRAIN SIZE (D_{50}) VERSUS ELEVATION
2008 Marine Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-4

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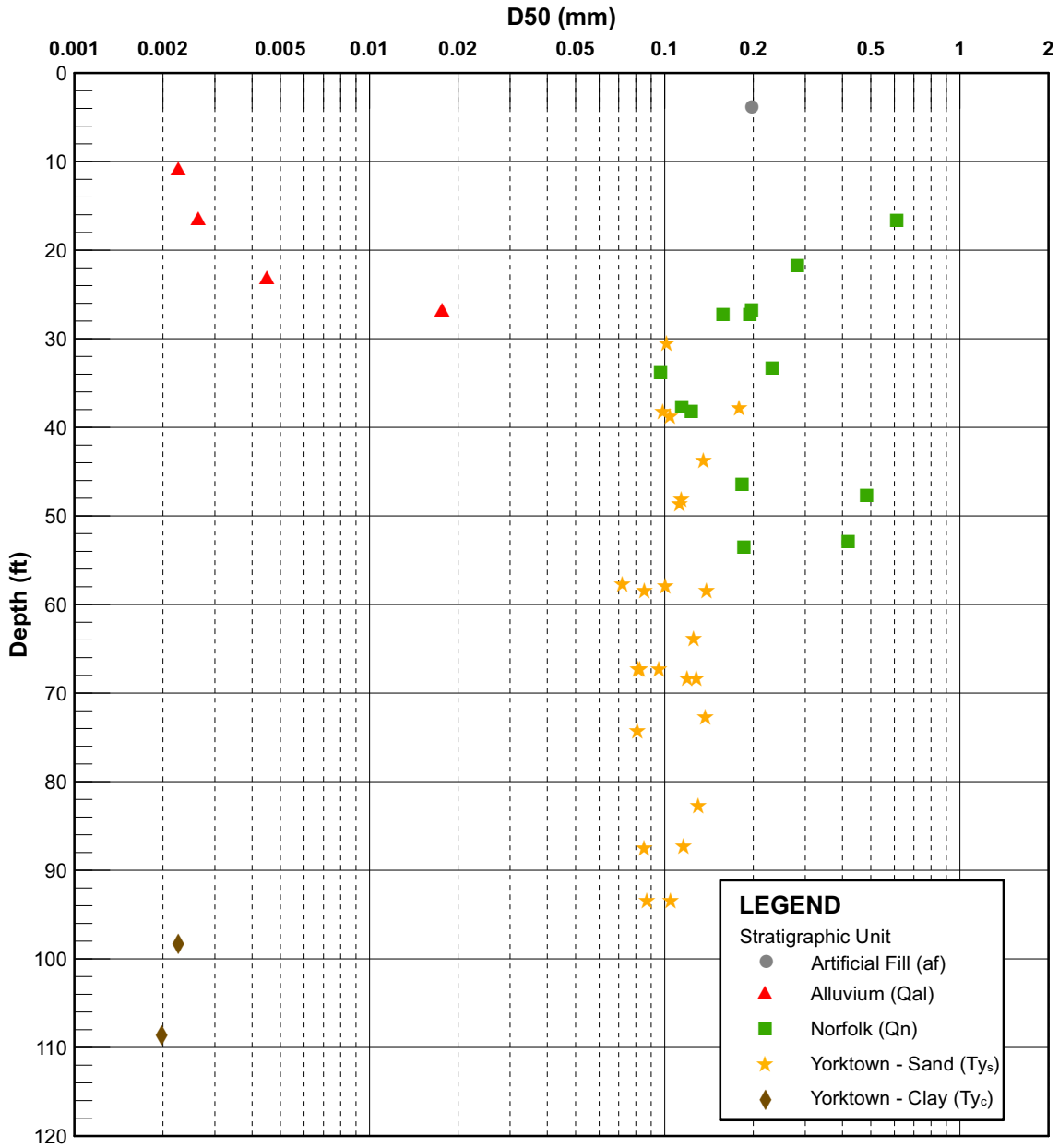

MEDIAN GRAIN SIZE (D_{50}) VERSUS DEPTH
2008 Marine Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-5

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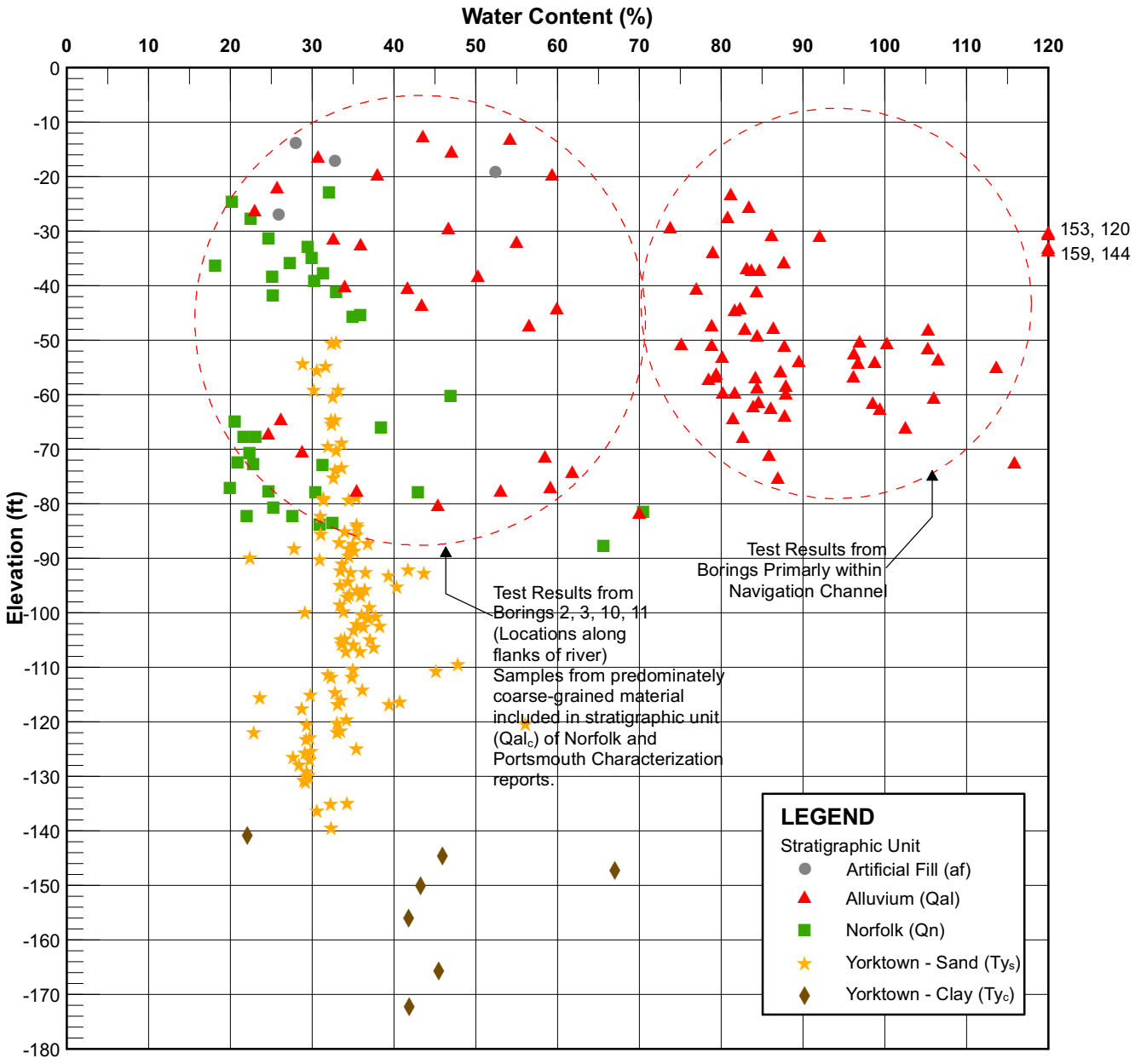

WATER CONTENT VERSUS ELEVATION
2008 Marine Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-6

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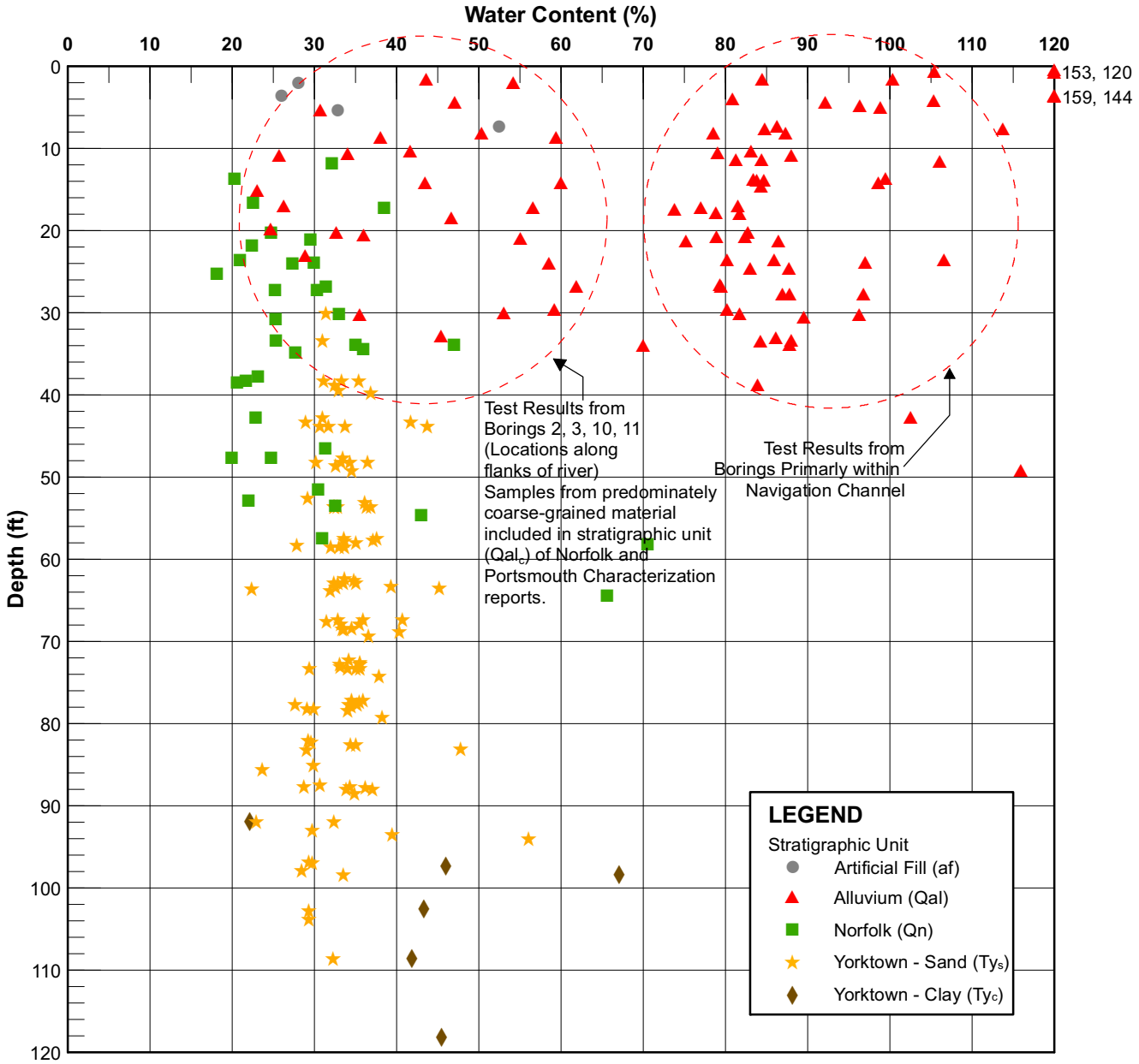

WATER CONTENT VERSUS DEPTH
2008 Marine Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-7

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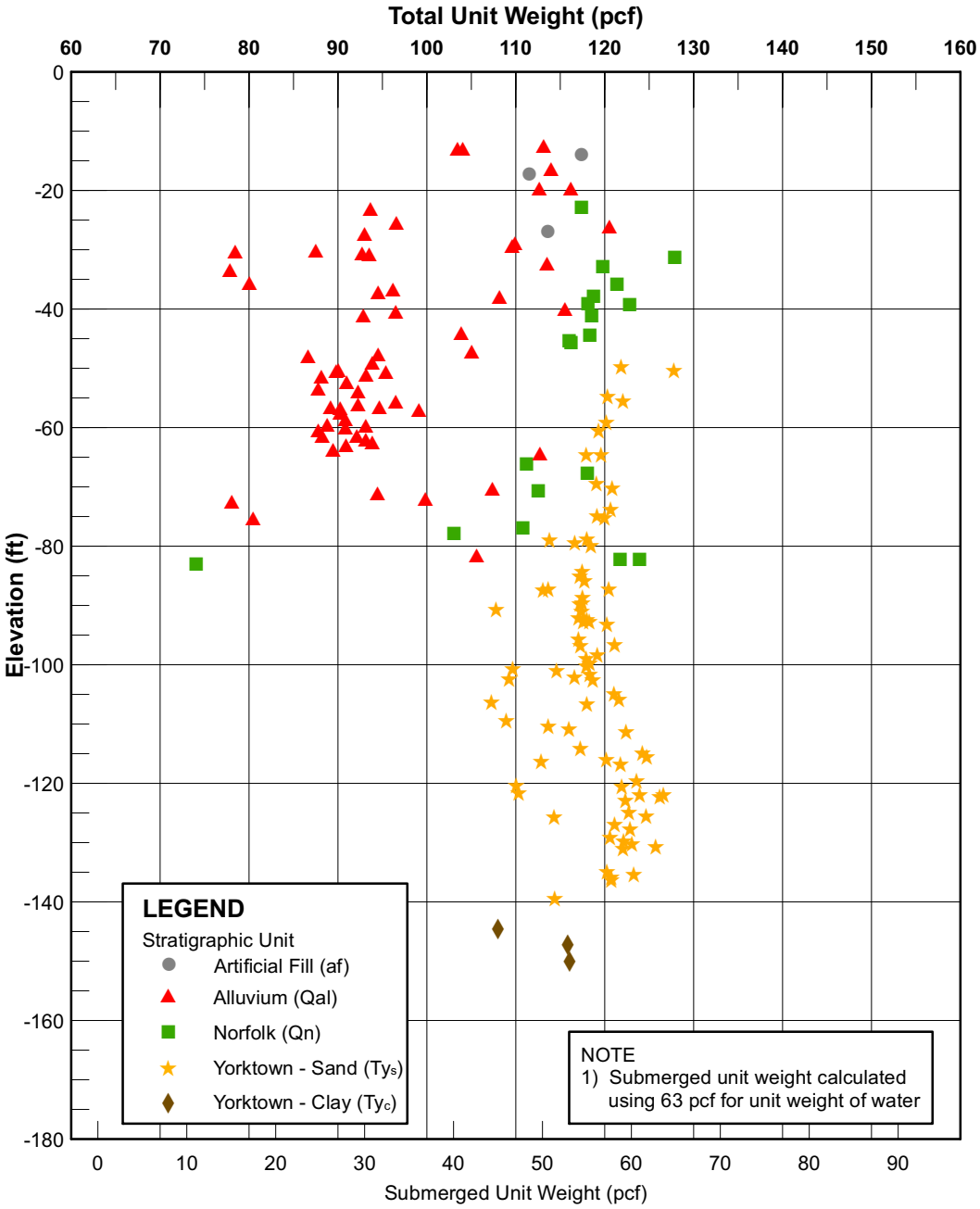

TOTAL AND SUBMERGED UNIT WEIGHT VERSUS ELEVATION
2008 Marine Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-8

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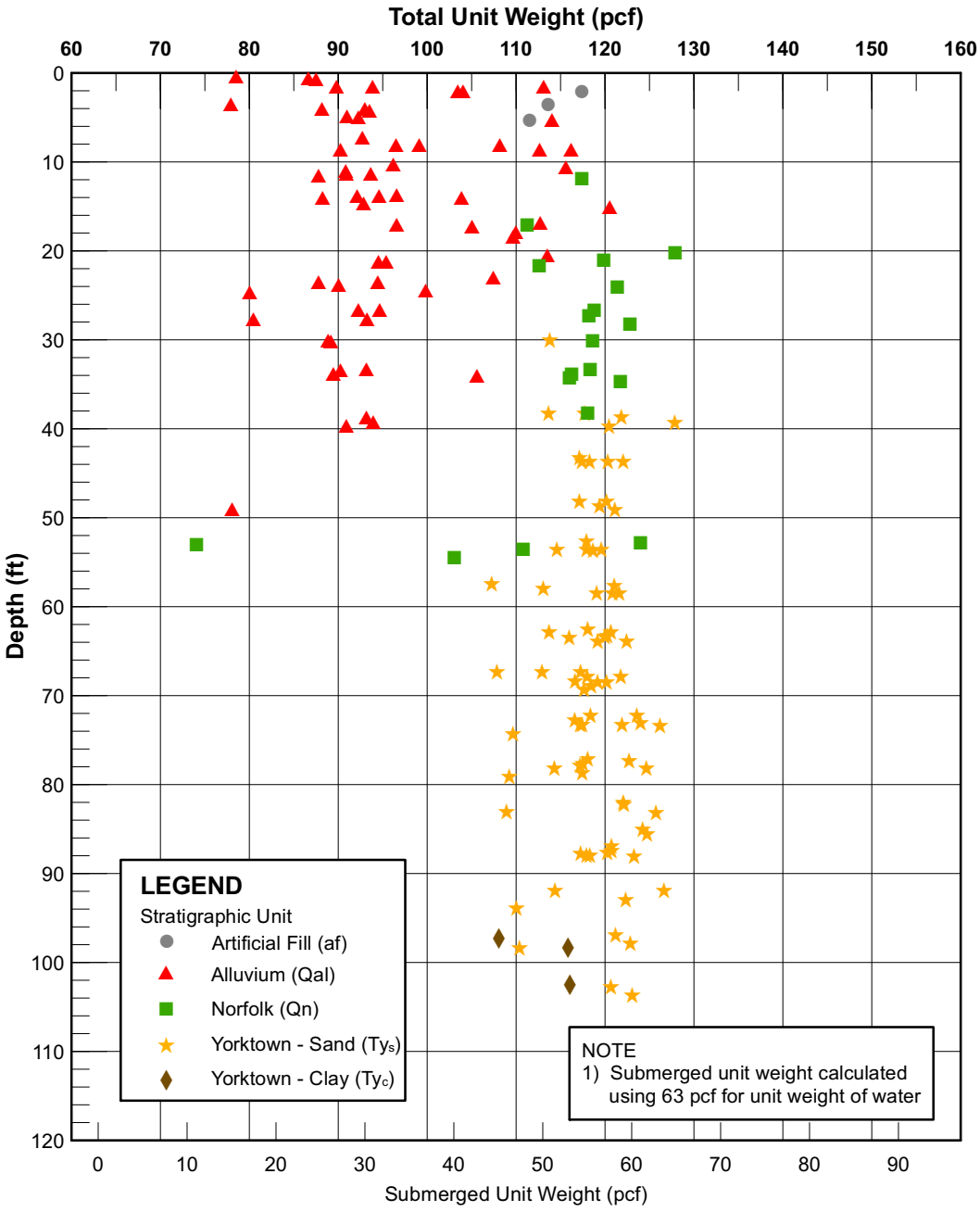

TOTAL AND SUBMERGED UNIT WEIGHT VERSUS DEPTH
2008 Marine Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-9

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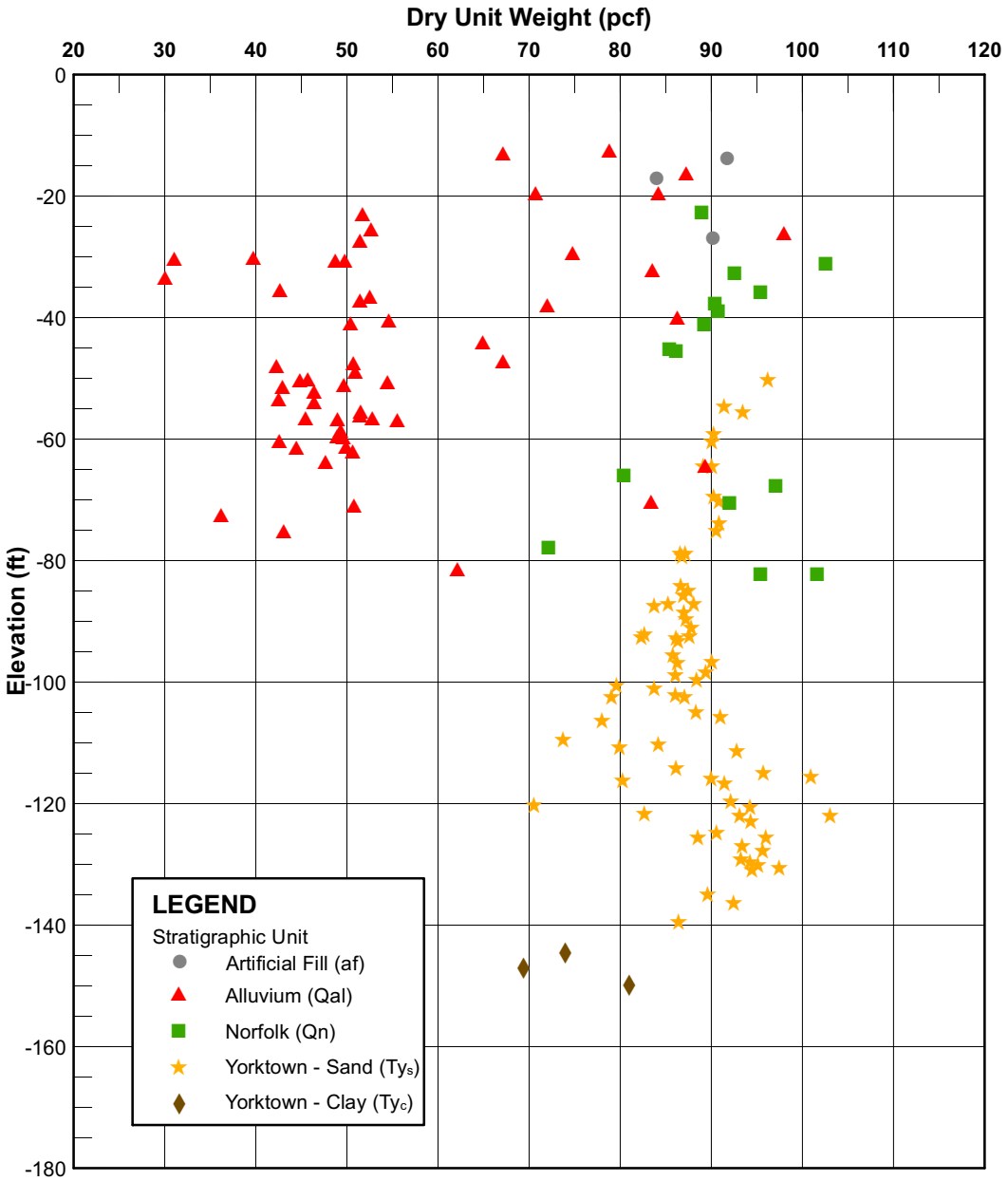

DRY UNIT WEIGHT VERSUS ELEVATION
2008 Marine Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-10

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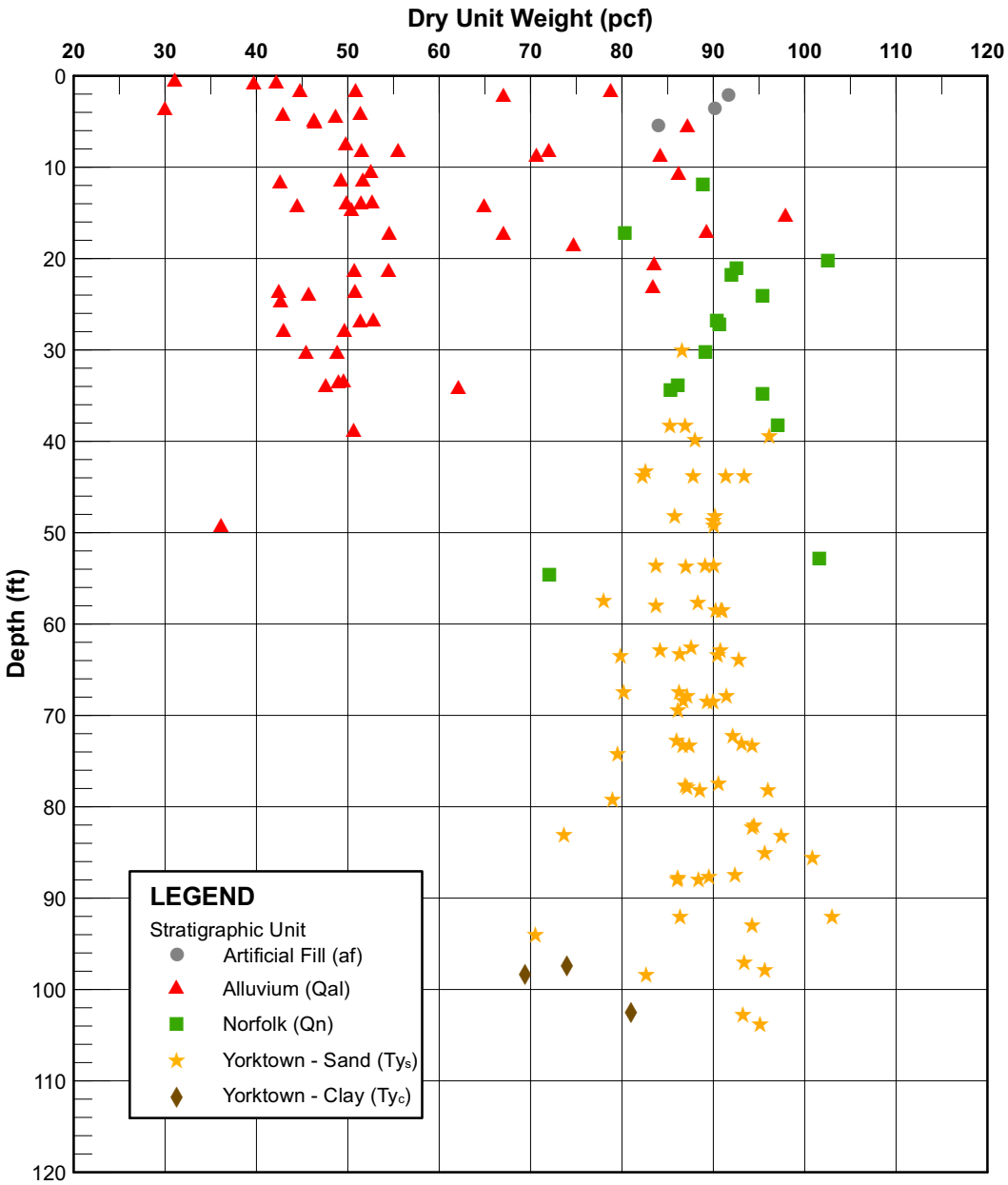

DRY UNIT WEIGHT VERSUS DEPTH
2008 Marine Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-11

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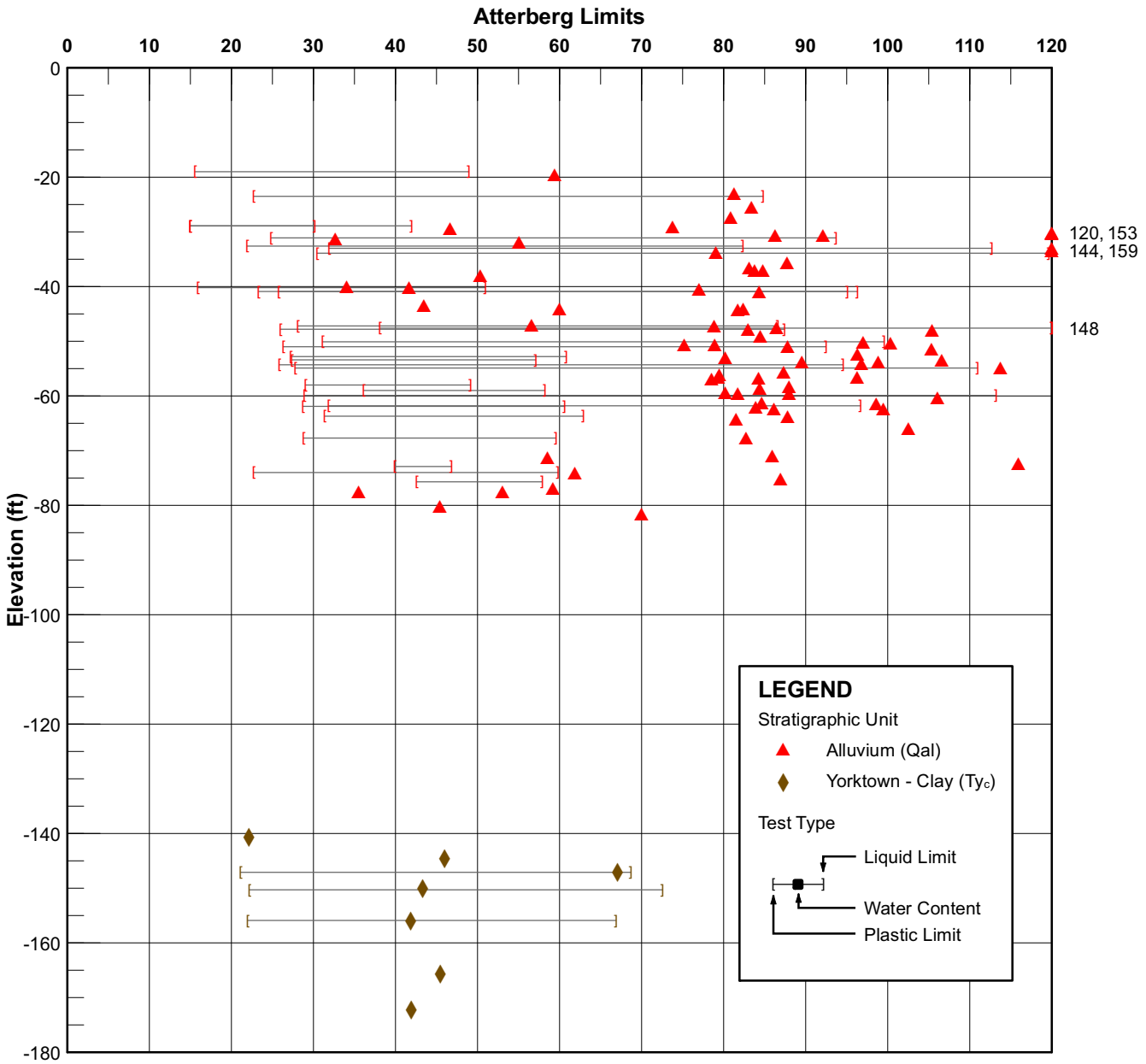

ATTERBERG LIMITS VERSUS ELEVATION
2008 Marine Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-12

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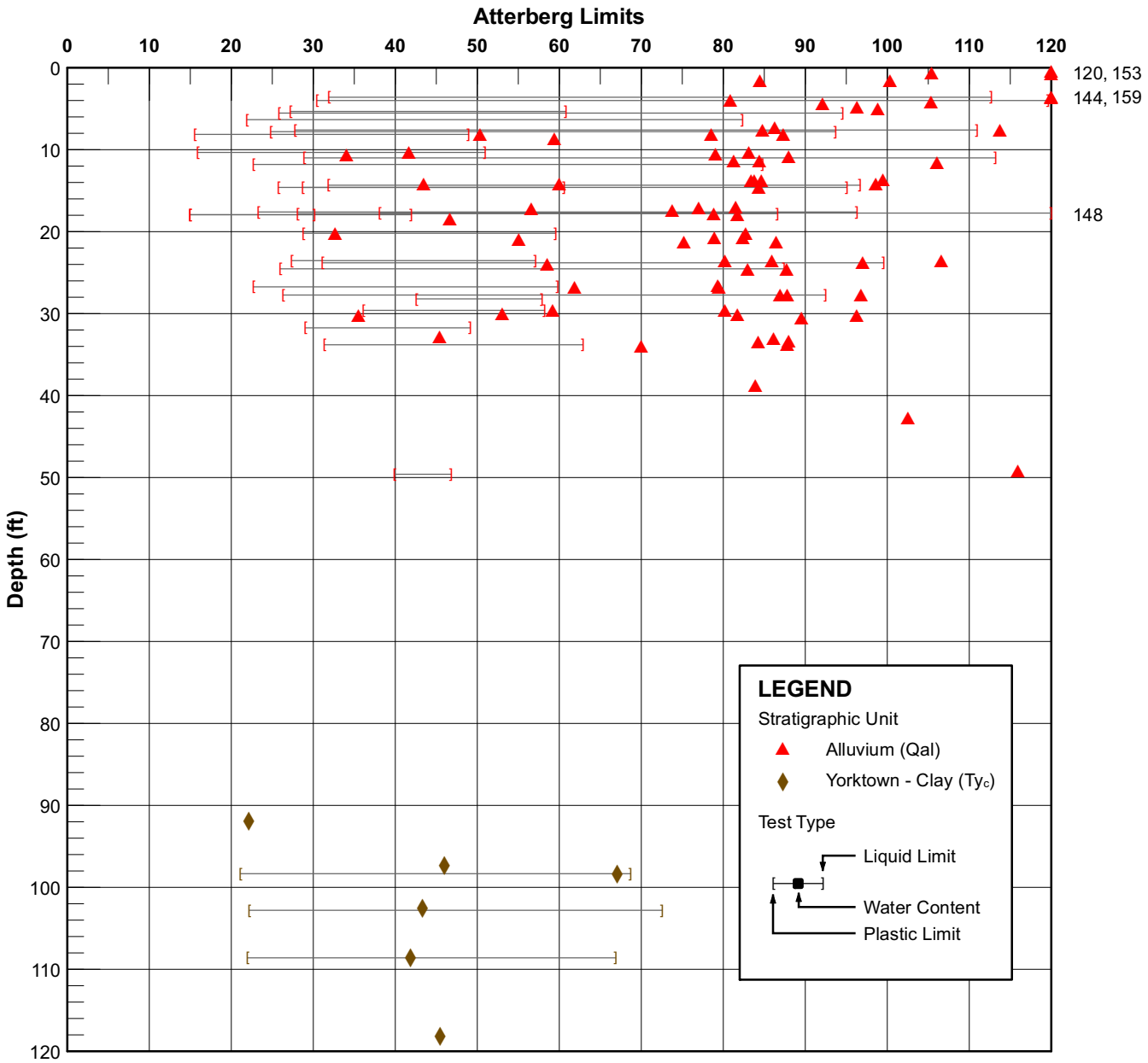

ATTERBERG LIMITS VERSUS DEPTH
2008 Marine Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-13

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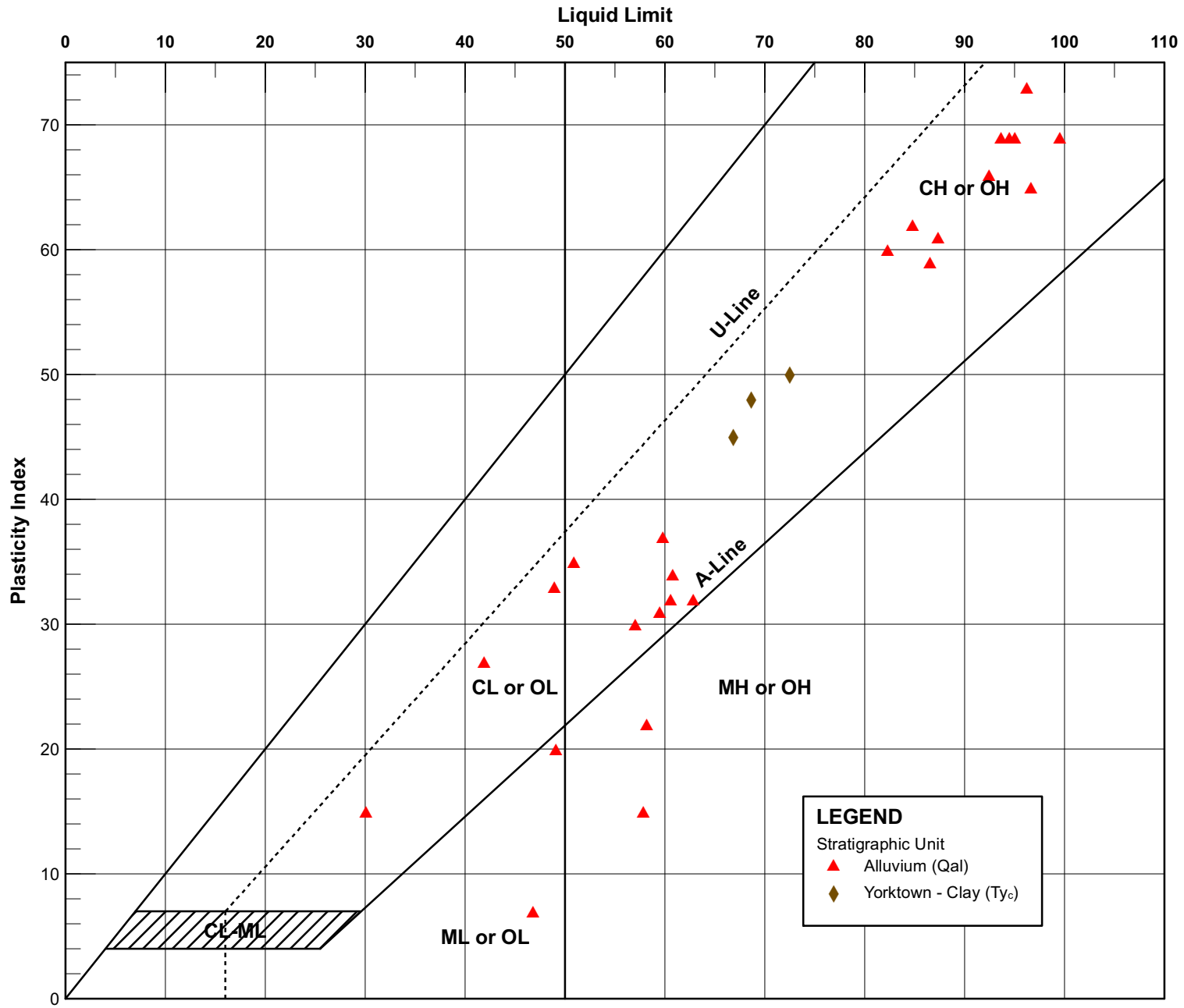
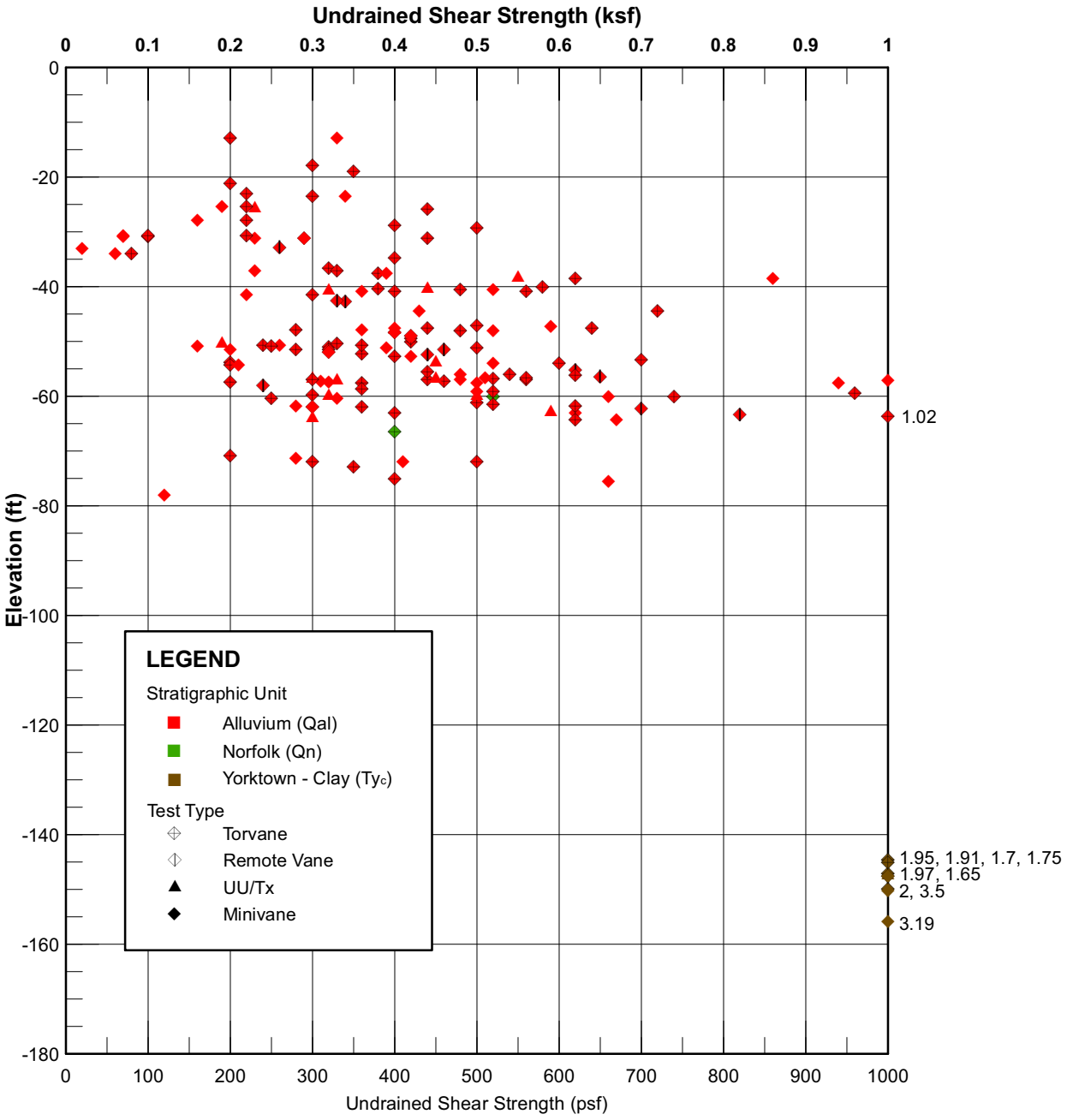


PLASTICITY CHART
2008 Marine Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-14

Virginia Department of Transportation
Project No. 3602.001



UNDRAINED SHEAR STRENGTH VERSUS ELEVATION
2008 Marine Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-15

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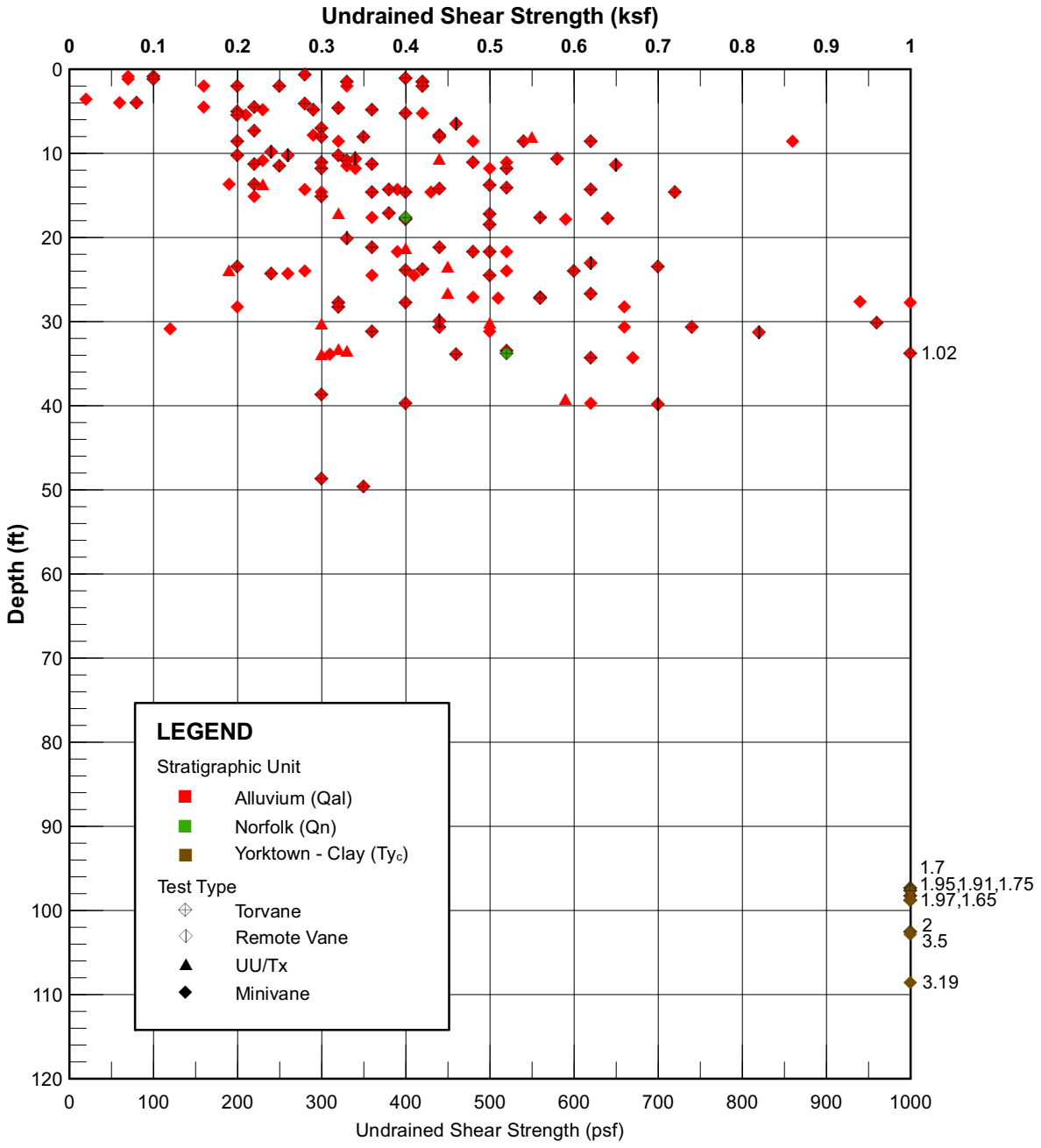

UNDRAINED SHEAR STRENGTH VERSUS DEPTH
2008 Marine Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-16

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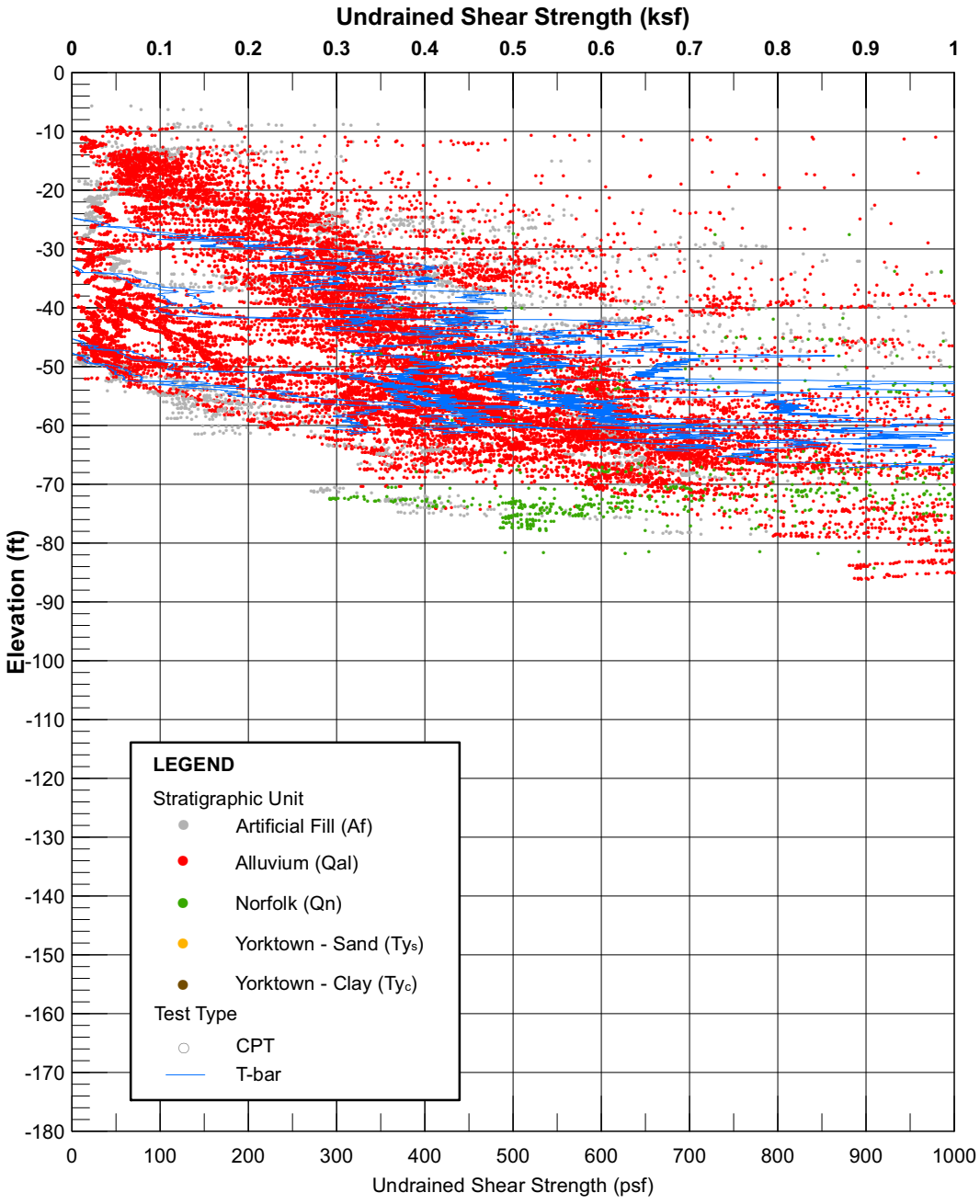

NOTES
1) Nk values of 12 and 15 used to provide a range of interpreted undrained shear strength from CPT data.
2) Nk values of 9 and 12 used to provide a range of interpreted undrained shear strength from T-bar data.

UNDRAINED SHEAR STRENGTH VERSUS ELEVATION
Interpreted Strengths from CPT and T-bar Soundings
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-17

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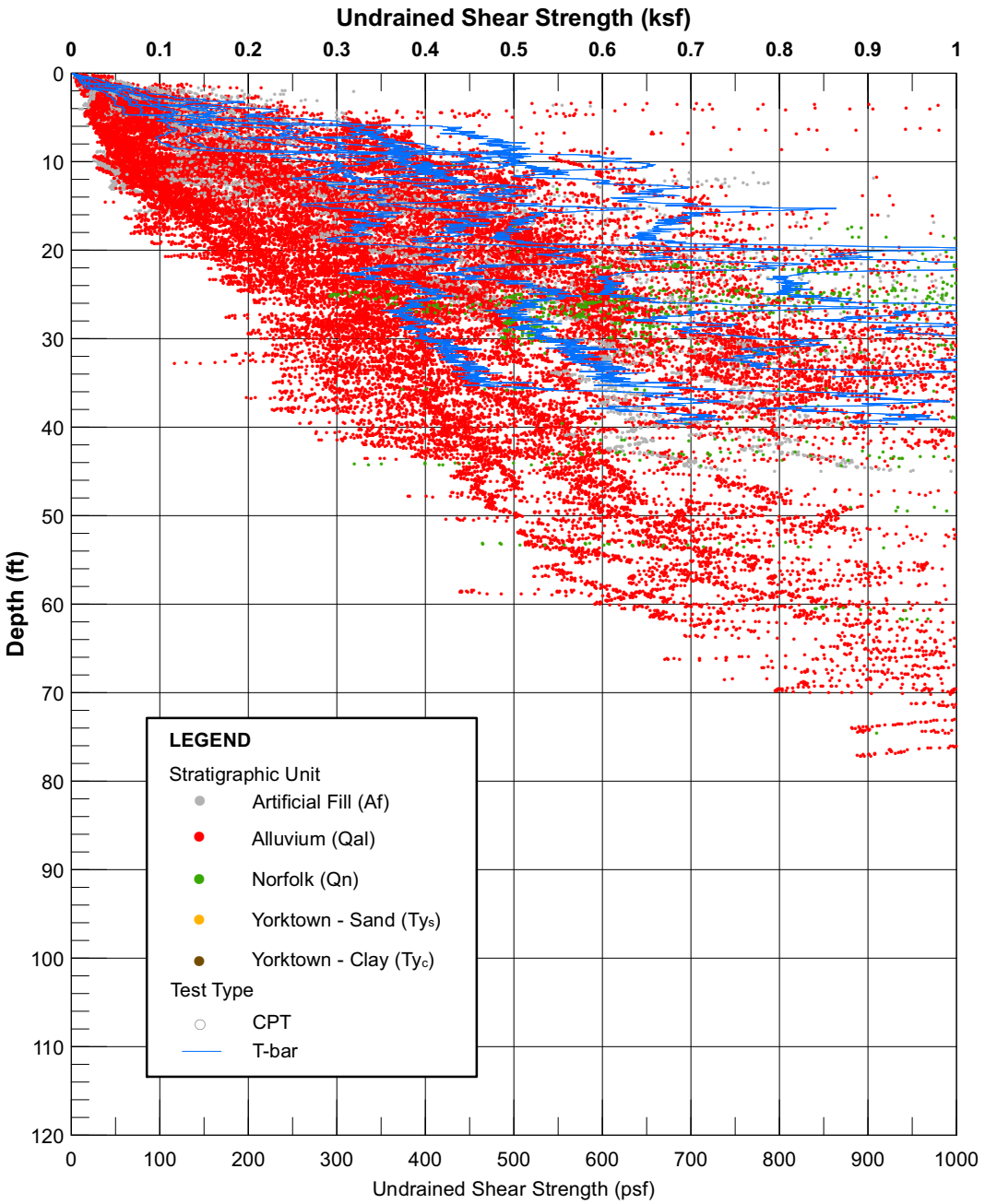

NOTES
1) Nk values of 12 and 15 used to provide a range of interpreted undrained shear strength from CPT data.
2) Nk values of 9 and 12 used to provide a range of interpreted undrained shear strength from T-bar data.

UNDRAINED SHEAR STRENGTH VERSUS DEPTH
Interpreted Strengths from CPT and T-bar Soundings
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-18

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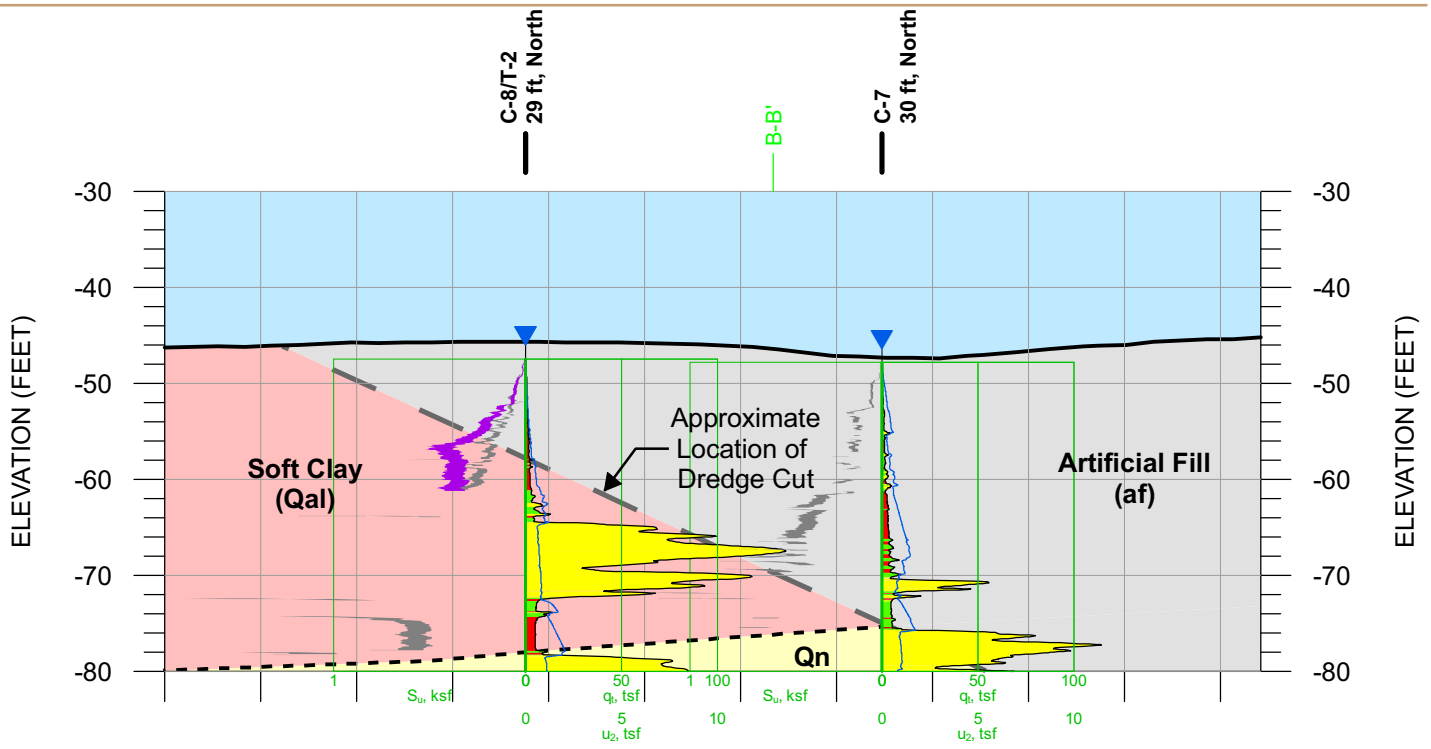
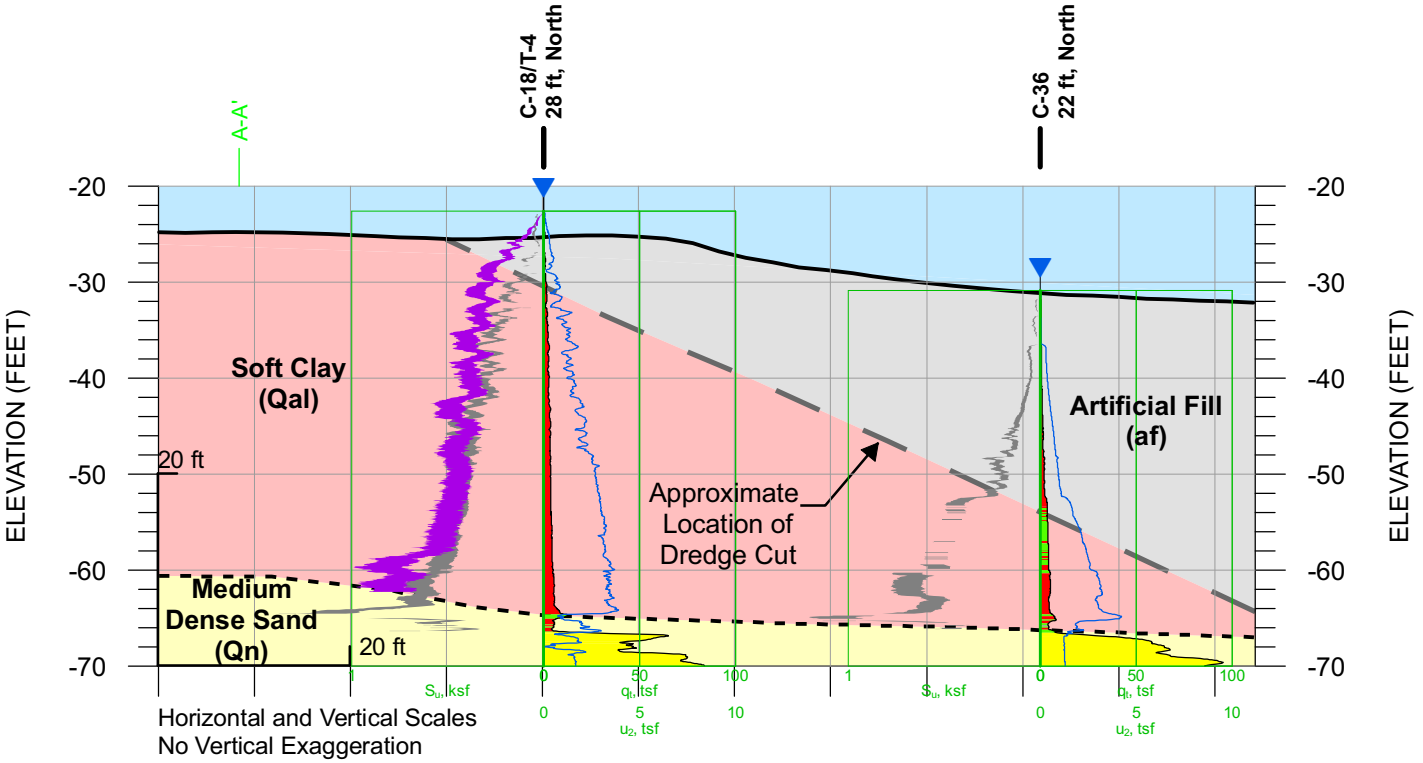


EXAMPLE FROM CROSS-SECTION 2-2' (FIGURE 5-4h)



EXAMPLE FROM CROSS-SECTION 5-5' (FIGURE 5-4k)

INTERPRETED UNDRAINED SHEAR STRENGTH EXAMPLES

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-19

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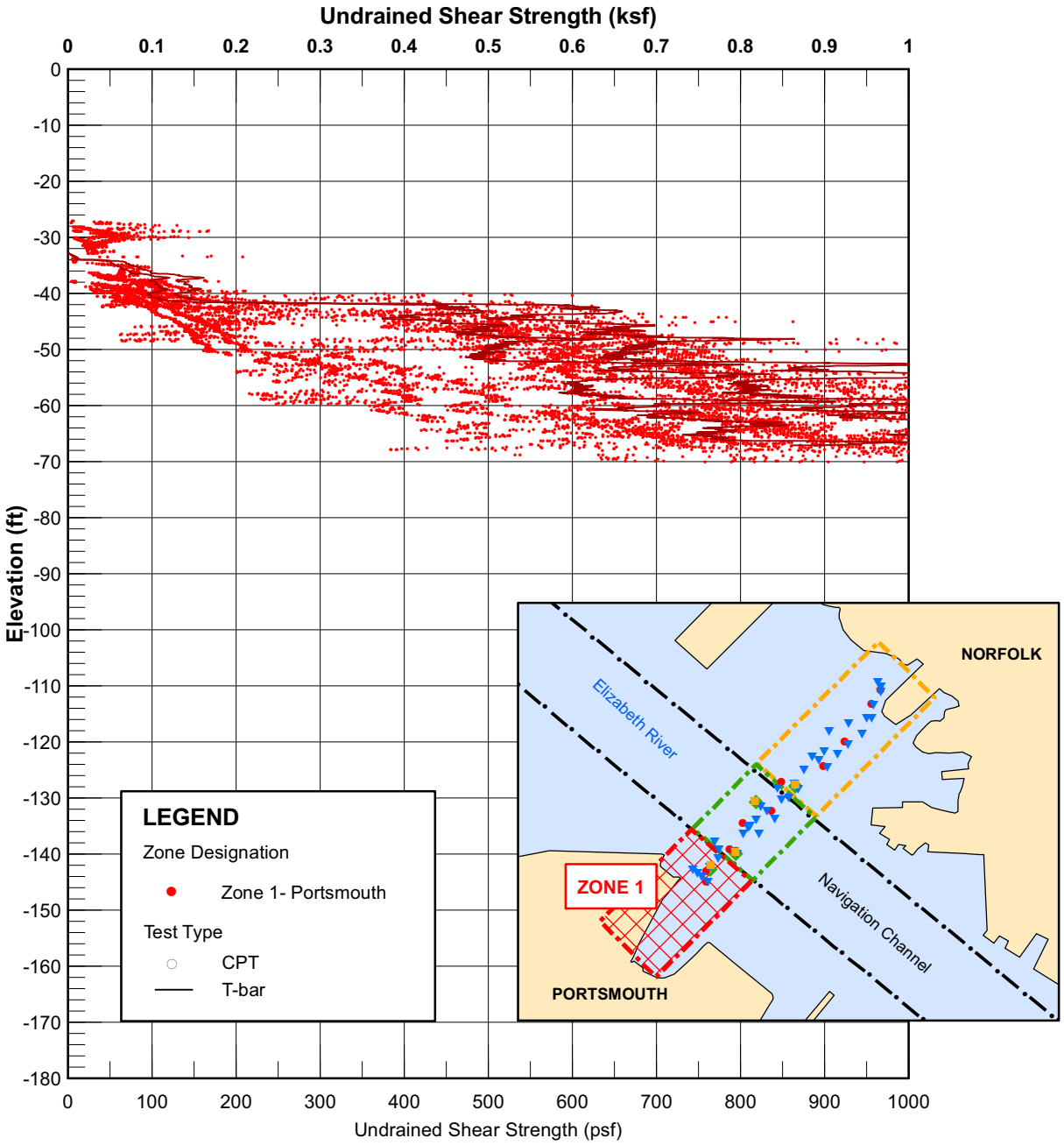

NOTES
1) Nk values of 12 and 15 used to provide a range of interpreted undrained shear strength from CPT data.
2) Nk values of 9 and 12 used to provide a range of interpreted undrained shear strength from T-bar data.

UNDRAINED SHEAR STRENGTH VERSUS ELEVATION
Interpreted Strengths from CPT and T-bar Soundings
Zone 1- Portsmouth Side
2008 Marine Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-20

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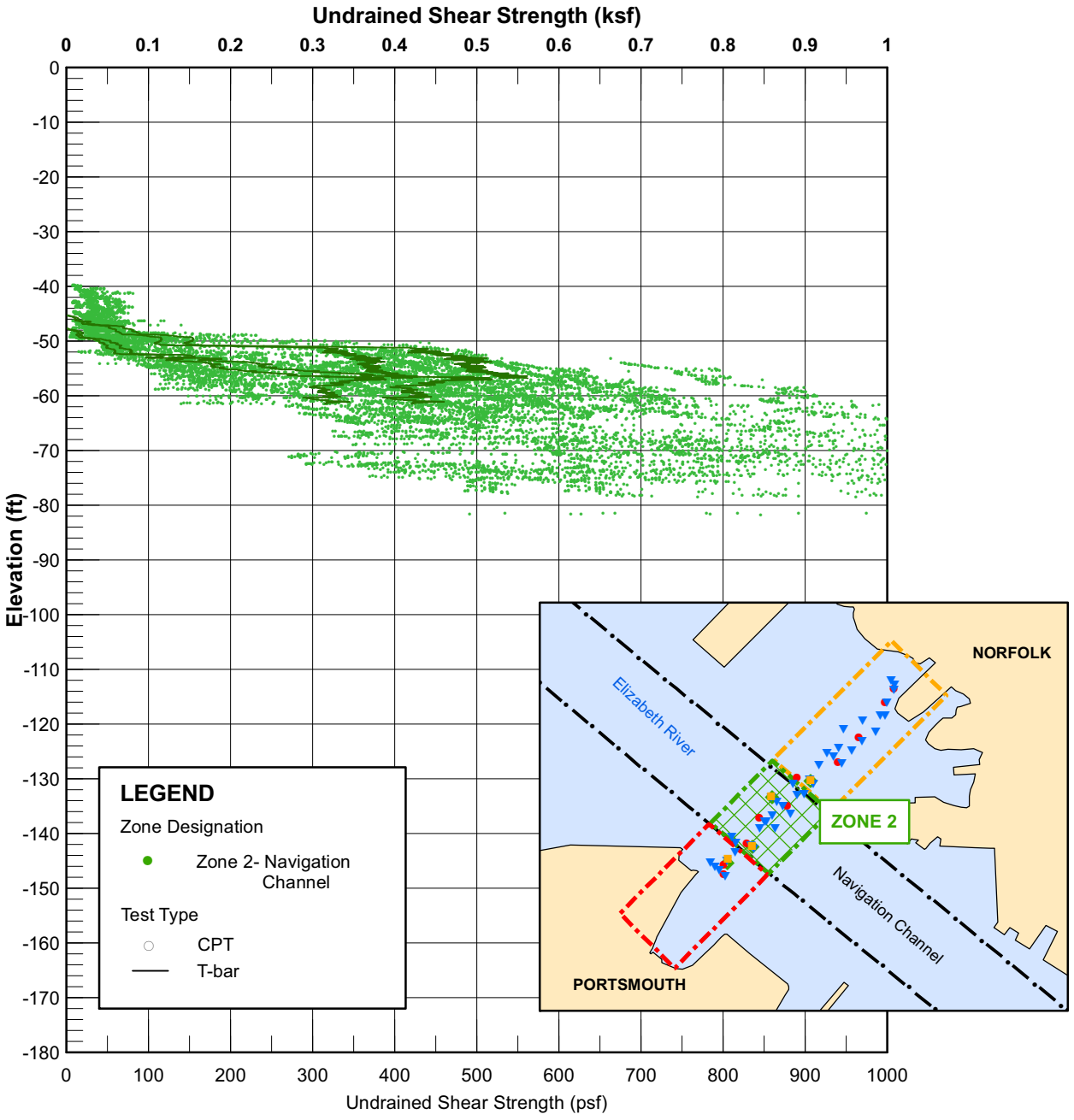

NOTES
1) Nk values of 12 and 15 used to provide a range of interpreted undrained shear strength from CPT data.
2) Nk values of 9 and 12 used to provide a range of interpreted undrained shear strength from T-bar data.

UNDRAINED SHEAR STRENGTH VERSUS ELEVATION
Interpreted Strengths from CPT and T-bar Soundings
Zone 2- Navigation Channel
2008 Marine Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-21

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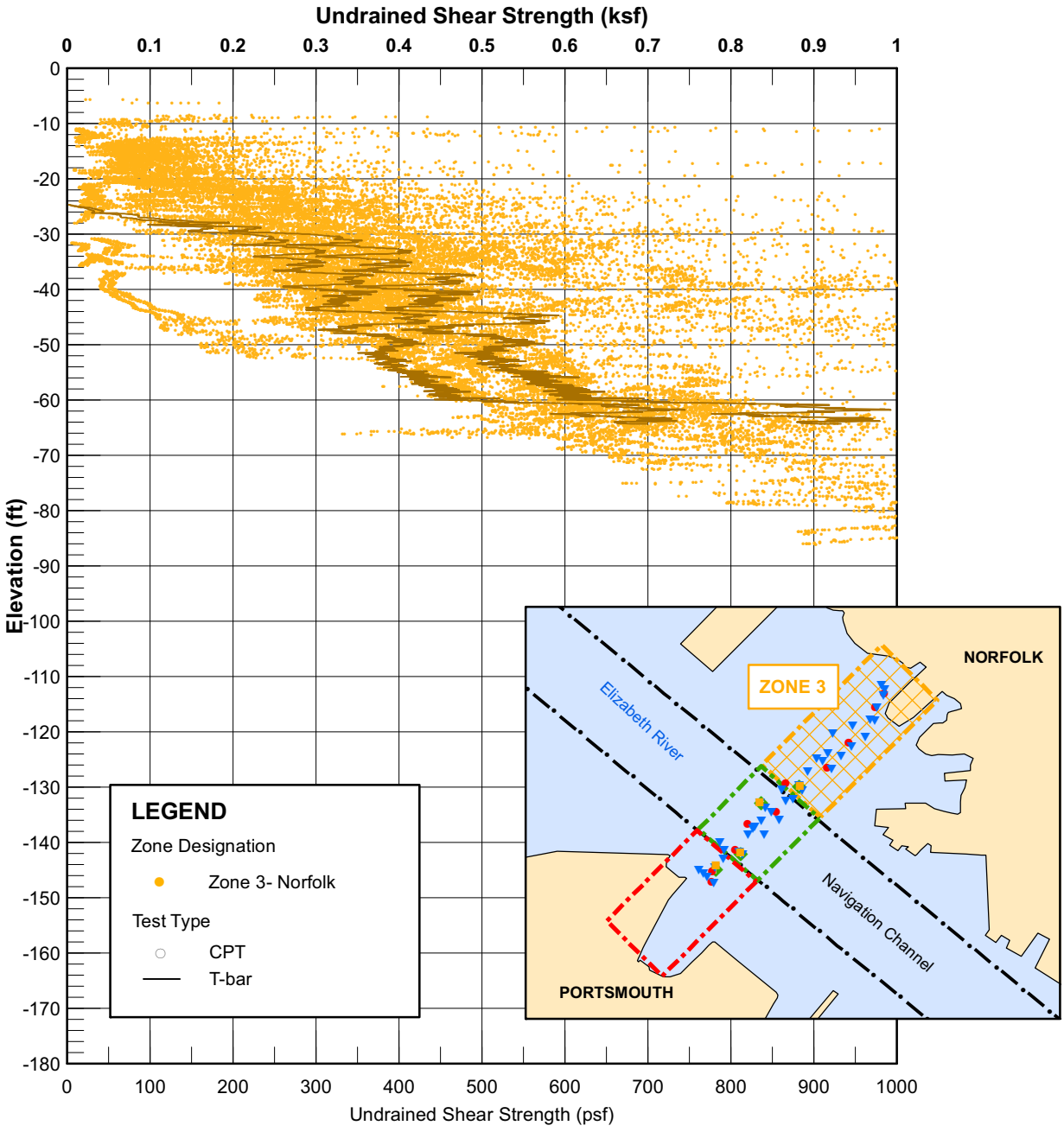

NOTES
1) Nk values of 12 and 15 used to provide a range of interpreted undrained shear strength from CPT data.
2) Nk values of 9 and 12 used to provide a range of interpreted undrained shear strength from T-bar data.

UNDRAINED SHEAR STRENGTH VERSUS ELEVATION
Interpreted Strengths from CPT and T-bar Soundings
Zone 3- Norfolk Side
2008 Marine Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-22

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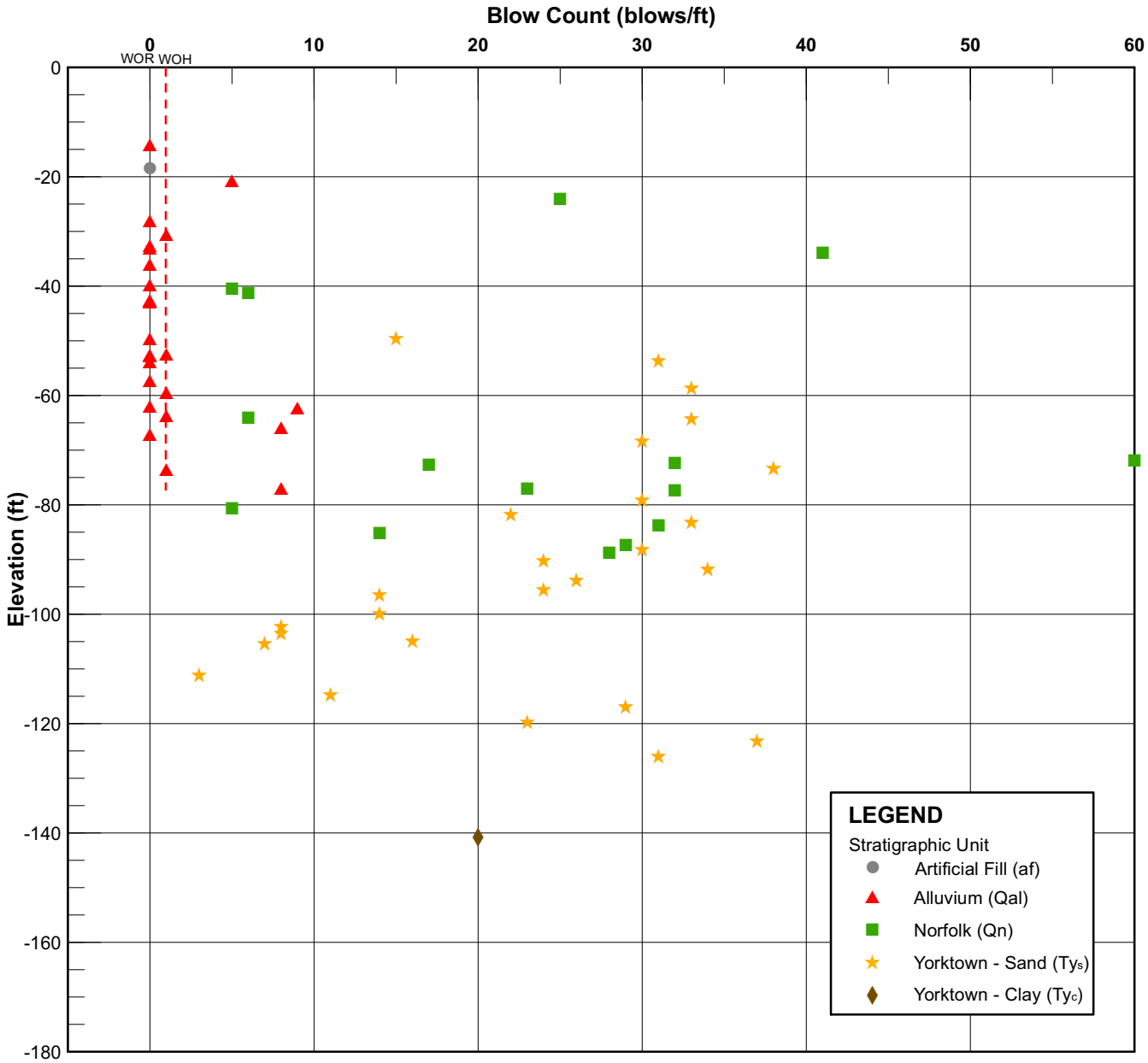
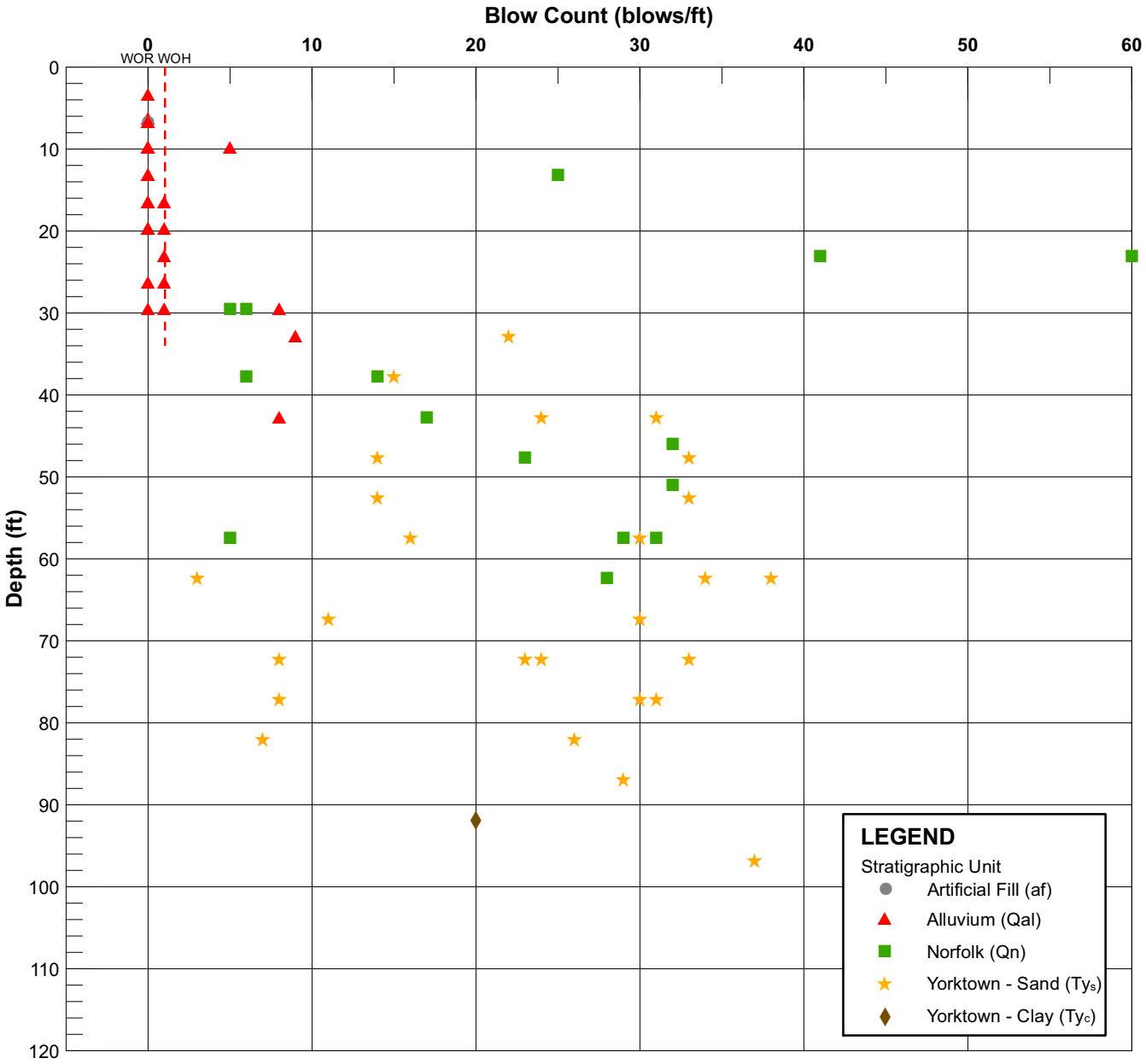


NOTES
1) SPT uncorrected N-values obtained using 140-pound donut hammer dropped 30 inches, operated by a wireline winch.
2) WOR = weight of rod
3) WOH = weight of hammer

BLOW COUNTS (SPT N-VALUES) VERSUS ELEVATION
2008 Marine Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-23

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\05-ER_SiteChar\MXD\Figures\Fig-6-23_BC_Elev.mxd, 10/21/08, kstevens



NOTES
1) SPT uncorrected N-values obtained using 140-pound donut hammer dropped 30 inches, operated by a wireline winch.
2) WOR = weight of rod
3) WOH = weight of hammer

BLOW COUNTS (SPT N-VALUES) VERSUS DEPTH
2008 Marine Explorations
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6-24

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\05-ER_SiteCharMXD\Figures\Fig-6-24_BC_Depth.mxd, 10/21/08, kstevens

7.0 LIMITATIONS

7.1 LOCATION OF EXISTING TUNNEL AND WATER PIPELINE

The depicted location of the tunnel and centerline are not for usage in construction planning or design. Prior to our site investigation, we recognized that high quality as-built drawings or electronic files documenting the locations of the existing tunnel and water pipeline were not available. Therefore, we carried out a marine and land survey as described herein and other reports listed in Figure 2 to ground-truth historical drawings and assist us in defining a safe work area for the geotechnical boring and sounding exploration.

Limitations of precision and accuracy for respective methods used to infer and interpret the tunnel and pipeline locations are described where applicable. In general, methodologies using geophysical technology may not provide adequate precision and accuracy for the design and construction planning of the second parallel tunnel. An understanding of the capability and limitation of the geophysical technology employed is required to optimize the data they provide and reduce the chance of misusing their data. We note that additional surveys or investigations may be required to document the locations of the water pipeline and existing tunnel to support design and construction planning. Several examples of options for additional ground truthing follow:

- Survey the inner diameter of the existing tunnel to aid in establishing survey-grade data of the centerline and tunnel location;
- Use a diver to jet probe and locate the water pipeline and tunnel;
- Additional, denser spacing of geophysical (subbottom and magnetometer) surveys; or
- Contact the City of Norfolk to inquire and obtain any as-built or construction and maintenance related surveys. We note that during our initial inquiry to City of Norfolk staff through the MISS Utility notification process, the City of Norfolk representative we met indicated that they were not aware of survey data which documented as-built conditions of the pipeline. However, during our survey, a construction barge with divers appeared to be conducting work on the pipeline.

7.2 REPORT USE

This report has been prepared for the exclusive use of VDOT and its agents for the specific application to the Midtown Second Parallel Tunnel project, located in Portsmouth and Norfolk, Virginia. In our opinion, the data, findings, conclusions, professional opinions, and recommendations presented herein were prepared in accordance with generally accepted geotechnical engineering practices of the project region.

Although information contained in this report may be of some use for other purposes, it may not contain sufficient information for other parties or uses. If any changes are made to the project as described in this report, the conclusions and recommendations in this report shall not be considered valid unless the changes are reviewed and the conclusions and

recommendations of this report are modified or validated in writing by Fugro. This report and the figures contained in this report are intended for input to project design; they are not intended to act as construction drawings or specifications.

7.3 POTENTIAL VARIATIONS IN SUBSURFACE CONDITIONS

Earth materials can vary in type, strength, and other geotechnical properties between points of observation and exploration. Therefore, we do not and cannot have a complete knowledge of the subsurface conditions underlying the site. The conclusions and recommendations presented in this report are based on the findings at the points of exploration, interpolation, and extrapolation of information between and beyond the points of observation, and are subject to confirmation (to the extent possible) based on the conditions revealed during construction.

7.4 LOCAL PRACTICE

In performing our professional services, in our opinion, we have used generally accepted geologic and geotechnical engineering principles and have applied that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers currently practicing in this or similar localities. No other warranty, express or implied, is made as to the professional advice included in this report.

8.0 REFERENCES

Barker, W.J. and Bjorken, E.D. (1978), Geology of the Norfolk south Quadrangle Virginia, Virginia Division of Mineral Resources Publication 9.

Fugro Atlantic (Fugro) (2008a), Geotechnical Data Report, Marine Drilling, In Situ Testing, and Laboratory Testing, Proposed Midtown Second Parallel Tunnel, prepared for Virginia Department of Transportation, Fugro Atlantic Project No. 3602.001.

_____ (2008b), Bottom Charting Data Report, Proposed Midtown Second Parallel Tunnel, prepared for Virginia Department of Transportation, Fugro Atlantic Project No. 3602.001.

_____ (2008c), Seismic Reflection Survey Report, prepared for Virginia Department of Transportation, Fugro Atlantic Project No. 3602.001.

Lambe, T. W., and R. V. Whitman (1969), Soil Mechanics, John Wiley and Sons.

Terzaghi, K., and R. B. Peck (1967), Soil Mechanics in Engineering Practice, Wiley International.

CHART



Spring 2008 Explorations
Conducted by Fugro Atlantic Under Contract to VDOT

Fugro Boring Designation	VDOT Boring Designation	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet) Northing	Coordinates Virginia State Plane South (NAD 83, feet) Easting	River Bottom Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
B-1		3/4/2008	3478965	12122033	-29.1	78.6	-107.7
B-2		3/3/2008	3479050	12122036	-29.6	98.3	-127.9
B-3		3/2/2008	3479246	12122243	-47.2	109.1	-156.3
B-4		3/1/2008	3479474	12122356	-48.2	99.3	-147.5
B-5		3/2/2008	3479583	12122615	-45.9	127.2	-173.1
B-6		2/25/2008	3479839	12122894	-26.1	109.1	-135.2
B-8		2/26/2008	3479980	12123065	-23.0	99.3	-122.3
B-9		2/27/2008	3480199	12122254	-11.9	88.9	-100.8
B-10		2/28/2008	3480522	12123492	-10.9	88.9	-99.8
B-11		2/29/2008	3480644	12123570	-11.0	79.1	-90.1

Note: B-7 was deleted from the drilling program.

Fugro CPT Designation	VDOT CPT Designation	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet) Northing	Coordinates Virginia State Plane South (NAD 83, feet) Easting	River Bottom Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
C-1		4/25/2008	3478945	12122051	-29.5	85.3	-114.8
C-2		4/25/2008	3478998	12121993	-27.3	85.3	-112.6
C-3		4/25/2008	3479027	12121957	-25.8	85.3	-111.1
C-4		4/25/2008	3479063	12121918	-26.7	85.3	-112.0
C-5		4/26/2008	3479080	12122063	-32.0	82.4	-114.4
C-6		4/26/2008	3479159	12122138	-37.5	79.5	-117.0
C-7		4/28/2008	3479194	12122308	-47.9	80.9	-128.9
C-8		4/28/2008	3479218	12122280	-47.8	78.0	-125.8
C-9		4/27/2008	3479242	12122145	-44.3	80.1	-124.4
C-10		4/27/2008	3479302	12122108	-46.9	83.7	-130.6
C-11		4/27/2008	3479376	12122360	-49.7	84.6	-134.3
C-12		4/27/2008	3479495	12122475	-47.6	84.6	-132.2
C-13		4/27/2008	3479508	12122637	-47.7	82.8	-130.5
C-14		4/27/2008	3479574	12122998	-45.6	84.1	-129.7
C-15		4/27/2008	3479613	12122512	-44.9	81.5	-126.4
C-16		4/27/2008	3479658	12122466	-44.8	84.8	-129.6
C-17		4/27/2008	3479676	12122684	-42.0	15.3	-57.4
C-18		4/25/2008	3479813	12122813	-22.0	84.8	-106.8
C-19		4/27/2008	3479778	12122660	-38.9	84.9	-123.8
C-20		4/28/2008	3479376	12122500	-51.5	76.5	-128.0
C-21		4/25/2008	3479941	12122893	-12.9	84.3	-97.2
C-22		4/28/2008	3479433	12122403	-47.8	26.6	-74.4
C-22A		4/28/2008	3479441	12122419	-48.0	74.9	-122.9
C-23		4/26/2008	3480276	12123114	-3.7	85.3	-89.0
C-24		4/25/2008	3480027	12123027	-9.3	74.8	-84.1
C-25		4/25/2008	3480052	12122969	-8.6	77.6	-86.2
C-26		4/24/2008	3480077	12123189	-20.5	81.5	-102.0
C-27		4/26/2008	3480348	12123290	-4.3	85.1	-89.4
C-28		4/24/2008	3480161	12123282	-17.0	91.6	-108.6
C-29		4/25/2008	3480250	12123405	-11.3	84.5	-95.8
C-30		4/24/2008	3480394	12123489	-10.4	24.9	-35.3
C-30A		4/24/2008	3480396	12123446	-10.2	97.6	-107.8
C-31		4/24/2008	3480511	12123508	-11.0	35.3	-46.3
C-32		4/24/2008	3480622	12123569	-10.9	84.8	-95.7
C-33		4/24/2008	3480672	12123577	-10.8	85.3	-96.1
C-34		4/25/2008	3480709	12123645	-10.8	46.8	-57.6
C-35		4/28/2008	3479687	12122751	-39.5	85.0	-124.5
C-36		4/28/2008	3479773	12122843	-30.1	65.8	-95.9
C-37		4/30/2008	3479961	12123101	-23.5	58.5	-82.0
C-38		4/30/2008	3480099	12123071	-7.3	85.2	-92.5

Fugro T-Bar Designation	VDOT T-Bar Designation	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet) Northing	Coordinates Virginia State Plane South (NAD 83, feet) Easting	River Bottom Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)	Cyclic Test Depths (feet)
T-1		4/29/2008	3479069	12122071	-32.6	0.0	-32.6	8.4, 19.2, 28.1, 32.3
T-2		4/29/2008	3479211	12122294	-47.7	0.0	-47.7	7.7, 12.6
T-3		4/28/2008	3479663	12122476	-44.3	0.0	-44.3	5.7, 10.7
T-4		4/28/2008	3479804	12122819	-23.5	0.0	-23.5	7.4, 17.2, 27.1, 36.9

Fugro Vane Shear Designation	VDOT Vane Shear Designation	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet) Northing	Coordinates Virginia State Plane South (NAD 83, feet) Easting	River Bottom Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)	Test Depths (feet) "R" indicates remold test was performed
V-1		4/29/2008	3479104	12122073	-31.9	31.3	-63.2	10.6 **R**, 23.1 **R**, 31.3 **R**
V-2		4/29/2008	3479223	12122291	-48.4	9.8	-58.2	9.8 **R**
V-3		4/29/2008	3479672	12122464	-44.1	11.4	-55.5	6.6 **R**, 11.4 **R**
V-4		4/29/2008	3479817	12122822	-21.7	39.8	-61.5	10.3, 20.1, 29.9, 39.8

LEGEND

Geotechnical Explorations

- B-09 — 2008 Fugro Boring Location
- C-23 — 2008 Fugro CPT Location
- T-4 — 2008 Fugro T-Bar Location
- V-4 — 2008 Fugro Vane Shear Location
- B-14 — 2008 VDOT Boring Location
- C-40 — 2008 VDOT CPT Location
- 60-15 — Historical VDOT Boring Location

Bathymetry (MLLW, feet)
Refer to notes for vertical datum.

- Bathymetric Contour in Feet (MLLW)
  Contour interval is 5 ft.

Bathymetric Data Boundaries and Sources

- Fugro (MB-2008): Multibeam Bathymetry Data
  Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM ES3 Multibeam echosounder (240 Khz - 120 degree swath).
- Fugro (SB-2008): Single Beam Bathymetry Data
  Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM Echotrak Dual Frequency echosounder (200/28 kHz)
- Area Obstructed During Fugro 2008 Survey
- Approximate Location of Midtown Tunnel
  Not for design or construction planning
  (Refer to Section 7.1 in text)

NOTES

1) Coordinate Grid: Virginia State Plane, South Zone, NAD 83, Feet

2) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

3) Reference to Mean Lower Low Water (MLLW), 1983-2001 Tidal Epoch, is based on observations performed and published by the National Oceanic and Atmospheric Administration, National Ocean Service (NOAA/NOS). Tidal Bench Mark 8638610 at Sewells Point, Hampton Roads, was used as the MLLW constraint for this project.

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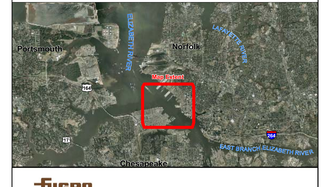
GEODETIC INFORMATION

SPHEROID:	GRS 1980
SEMI-MAJOR AXIS:	6,378,137.000
SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.257222101
ECCENTRICITY*:	0.08484263051
PROJECTION:	LAMBERT CONFORMAL CONIC
ZONE:	VIRGINIA SOUTH
LONGITUDE OF ORIGIN:	36.3°
FALSE EASTING:	11,482,916
FALSE NORTHING:	3,280,833



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EXPLORATION LOCATION MAP
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

0 200 400 Feet

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Oct. 2008	For Report Submittal	KWS	ADB	KRS
2					
3					

JOB NUMBER: 3602.001 CHART NO.: 1

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LEGEND

Bathymetry (MLLW, feet)
Refer to notes for vertical datum.

- 0 to -5
- -5 to -10
- -10 to -15
- -15 to -20
- -20 to -25
- -25 to -30
- -30 to -35
- -35 to -40
- -40 to -45
- -45 to -50
- -50 to -55
- Deeper than -55

Bathymetric Contour in Feet (MLLW)
Contour interval is 5 ft.

A Bathymetric Feature
(Refer to Figure 3-4a and 3-4b for detail)

Bathymetric Data Boundaries and Sources

Fugro (MB-2008): Multibeam Bathymetry Data
Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM ES3 Multibeam echosounder (240 Khz - 120 degree swath).

Fugro (SB-2008): Single Beam Bathymetry Data
Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM Echotrak Dual Frequency echosounder (200/28 kHz)

MHI (2008): Marine Hydraulics International, Inc.
Single Beam Bathymetry Data
Surveyed by Waterway Surveys & Engineering, Ltd. at Lamberts Point between February 6th and 7th, 2008.

USACE (2007): U.S. Army Corps of Engineers
Multibeam Bathymetry Data
Surveyed by United States Army Corps of Engineers-Norfolk District on March 26, 2007.

Area Obstructed During Fugro 2008 Survey

Approximate Location of Midtown Tunnel
Not for design or construction planning
(Refer to Section 7.1 in text)

NOTES

1) Coordinate Grid: Virginia State Plane, South Zone, NAD 83, Feet

2) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

3) Reference to Mean Lower Low Water (MLLW), 1983-2001 Tidal Epoch, is based on observations performed and published by the National Oceanic and Atmospheric Administration, National Ocean Service (NOAA/NOS). Tidal Bench Mark 8638610 at Sewells Point, Hampton Roads, was used as the MLLW constraint for this project.

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GEODETIC INFORMATION

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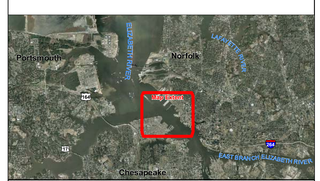
SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.25722101
ECCENTRICITY^2:	0.006694380
PROJECTION:	LAMBERT CONFORMAL CONIC
ZONE:	VIRGINIA SOUTH
LONGITUDE OF ORIGIN:	36.3°
FALSE EASTING:	11,482,916
FALSE NORTHING:	3,280,833

N W E S



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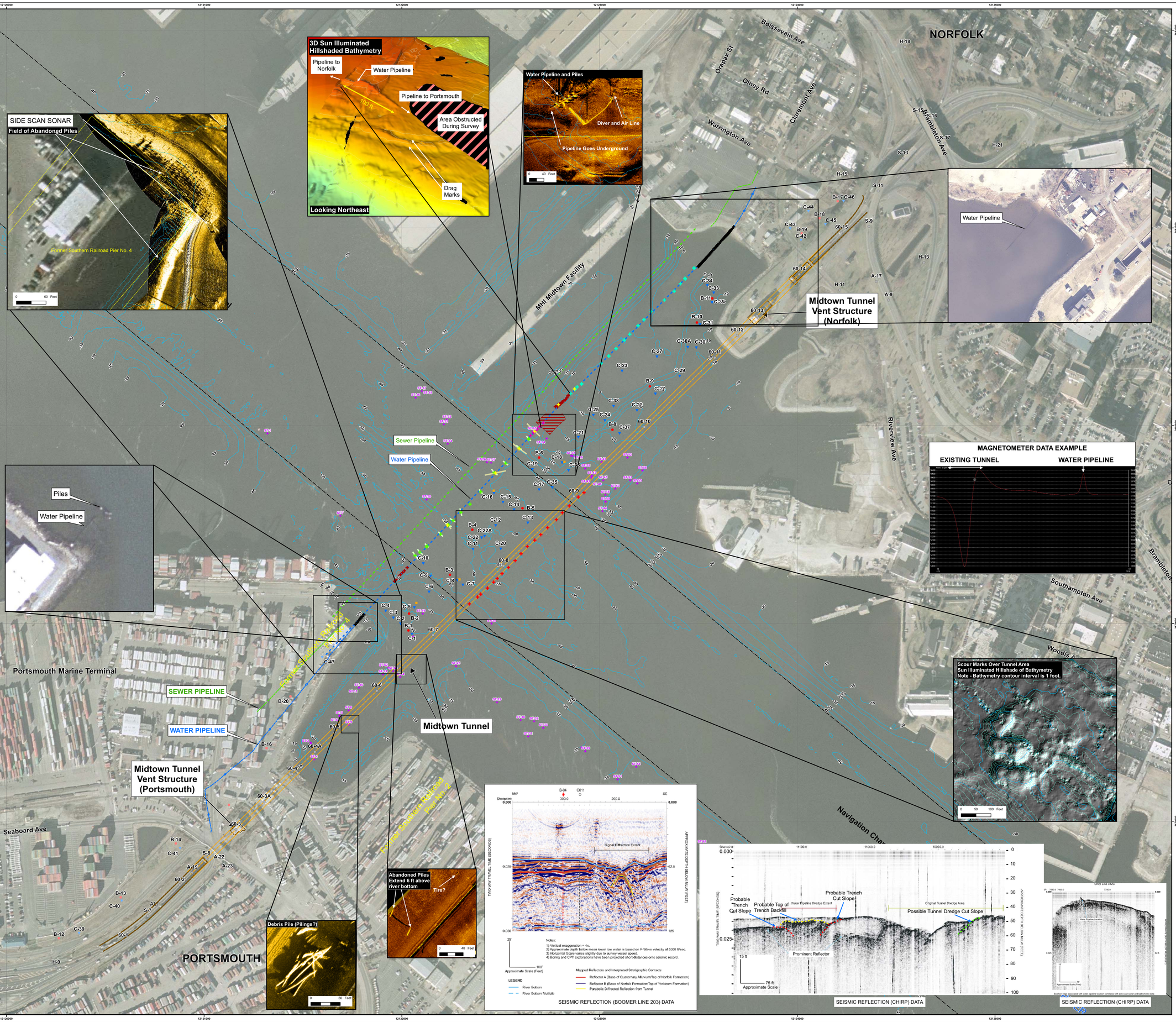
BATHYMETRY
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

SCALE= 1:2,400

0 100 200 400 Feet

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Oct. 2008	For Report Submittal	KCS	ADB	KRS
2					
3					

JOB NUMBER: 3602.001 CHART NO.: 2



LEGEND

Features and Geophysical Data Types Used to Interpret Approximate Locations

- Edge of Existing Tunnel From Magnetometer Data

Water Pipeline - Data Types

- Aerial Photograph
- Multibeam
- Single Beam
- Side Scan Sonar
- Magnetometer (bar reflects width of anomaly)
- Seismic Reflection (bar reflects width of trench or disrupted reflections)
- ST-2 Side Scan Sonar Target (refer to text for descriptions)

Geotechnical Explorations

- B-09 Fugro 2008 Boring Location
- C-23 Fugro 2008 CPT Location
- T-4 Fugro 2008 T-Bar Location
- V-4 Fugro 2008 Vane Shear Location
- B-14 VDOT 2008 Boring Location
- C-40 VDOT 2008 CPT Location
- 60-15 Historical VDOT Boring Location

Approximate Location of Midtown Tunnel Not for Design or Construction Planning Refer to Section 7.1 in the text.

Area Obstructed During Fugro 2008 Survey

Bathymetric Contour in Feet (MLLW) Contour interval is 5 ft.

SUMMARY OF 2008 GEOTECHNICAL EXPLORATIONS

Exploration Type	Number	Total Footage
MARINE		
Boring	10	978
CPT	40	3015
T-Bar	4	103
Vane Shear	4	92
LAND		
Boring	9	713
CPT	9	493
Monitoring Wells	7	--

SUMMARY OF 2008 GEOPHYSICAL SURVEYS

Survey Type	Acres	Nautical Miles
Multibeam	55.9	--
Singlebeam	17.1	--
Magnetometer	27.1	--
Side Scan Sonar	66.0	--
Seismic Reflection (Chirp)	--	18
Seismic Reflection (Boomer)	--	18

NOTES

1) Coordinate Grid: Virginia State Plane, South Zone, NAD 83, Feet.

2) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

3) Reference to Mean Lower Low Water (MLLW), 1983-2001 Tidal Epoch, is based on observations performed and published by the National Oceanic and Atmospheric Administration, National Ocean Service (NOAA/NOS). Tidal Bench Mark 8638610 at Sewells Point, Hampton Roads, was used as the MLLW constraint for this project.

4) Side scan sonar survey conducted by McKim & Creed between February 13th and 22nd, 2008, using a Marine Sonics Side Scan Sonar system (600 kHz).

5) Bathymetry data compiled from several sources:

a) Fugro (2008). Multibeam survey conducted by McKim & Creed between February 13th and 22nd, 2008, using an ODOM ES3 Multibeam echosounder (240 Khz - 120 degree swath). The multibeam survey was supplemented between February 13th and 22nd, 2008, using an ODOM Echotrak Dual Frequency echosounder (200/28 kHz).

b) Marine Hydraulics International, Inc. (2008). Surveyed by Waterway Surveys & Engineering, Ltd at Lamberts Point between February 6th and 7th, 2008. using a single beam system.

c) U.S. Army Corps of Engineers (2007). Surveyed by the USACE -Norfolk District on March 26, 2007 using a multibeam system.

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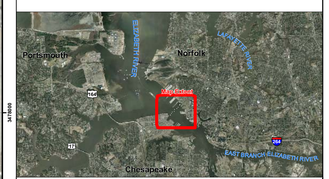
ECCENTRICITY:	0.0066943490
PROJECTION:	LAMBERT CONFORMAL CONIC
ZONE:	VIRGINIA SOUTH
LONGITUDE OF ORIGIN:	36.5
FALSE EASTING:	11,482,916
FALSE NORTHING:	3,280,833

N W E S



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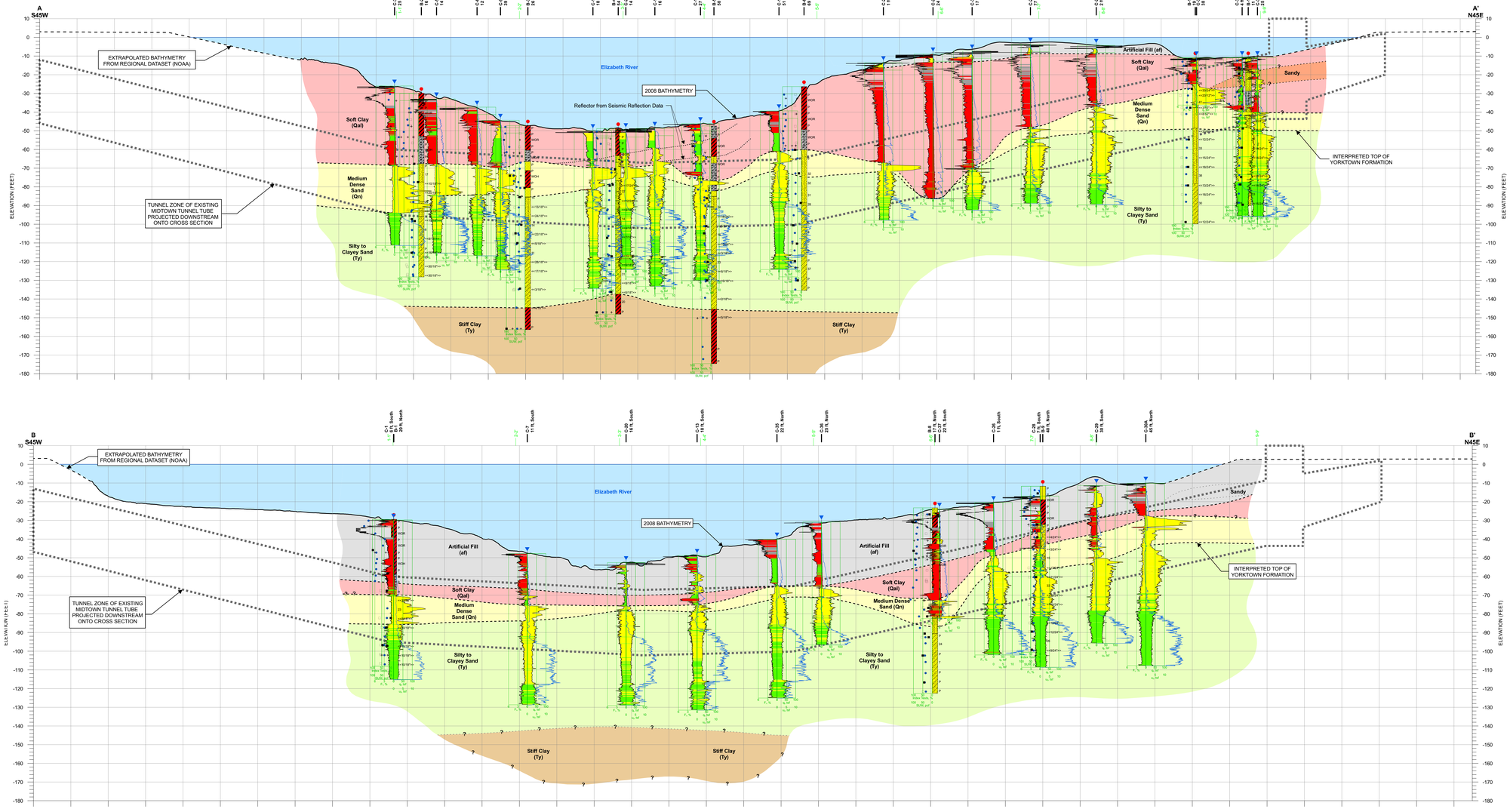
SELECTED SITE FEATURES
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

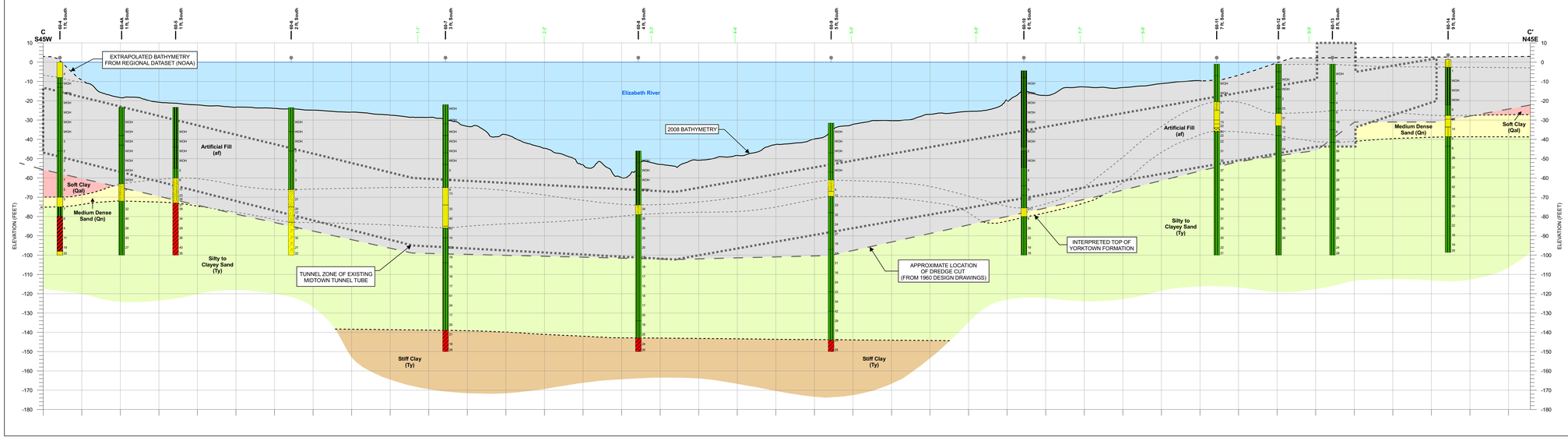
SCALE= 1:1,800

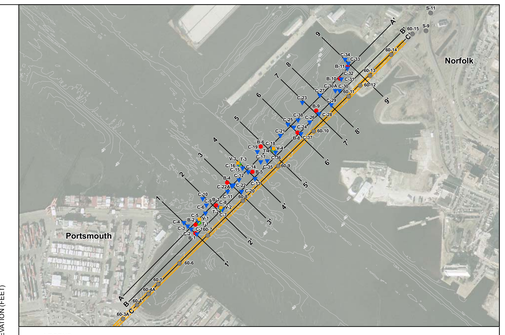
0 100 200 400 Feet

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Oct. 2008	For Report Submittal	KCS	ADB	KRS
2					
3					

JOB NUMBER: 3602.001 CHART NO.: 3







LEGEND

2008 Exploration Locations
- C-38 — CPT
- B-11 — Boring
- T-4 — T-bar
- V-4 — Vane Shear

1960 Exploration Locations
- 60-11 — Boring

Cross Section Location

Bathymetric Contour in Feet (MLLW) Contour Interval is 5 ft.

Approximate Location of Midtown Tunnel Not for Design or Construction Planning

0 250 500 1,000 Feet

NOTES:

1) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

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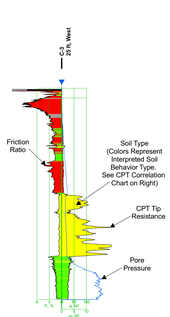
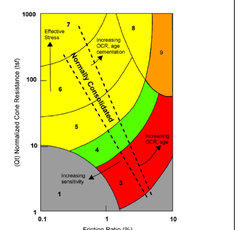
KEY TO CPT SOUNDINGS



CPT SOUNDING WITH FRICTION RATIO, PORE PRESSURE, AND TIP RESISTANCE



Zone	Soil Behavior Type	U.S.C.S.
1	Sensitive Fine-grained	OL-CH
2	Organic Material	OL-OH
3	Clay to Silty Clay	CL-CH
4	Clayey Silt to Silty Clay	MH-CL
5	Silty Sand to Sandy Silt	SM-ML
6	Sand to Silty Sand	SP-SM
7	Gravelly Sand to Sand	GP-SP
8	Sand to Clayey Sand	SP-SC
9	Very Stiff Fine-grained*	CH-CL

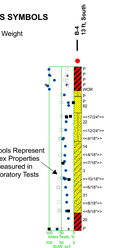
*overconsolidated or cemented

CPT CORRELATION CHART ROBERTSON, 1990

20 ft
100 ft
Horizontal and Vertical Scales in Feet
Vertical exaggeration is 5x.

KEY TO BORINGS

INDEX PROPERTIES SYMBOLS
- Submerged Unit Weight
- Percent Passing #200 Sieve
- Plastic Limit
- Liquid Limit
- Water Content



SOIL BORING LITHOLOGY WITH INDEX TESTS MEASURED IN LABORATORY AND RAW BLOW COUNTS

SOIL TYPES
- Well graded GRAVEL (GW)
- Poorly graded GRAVEL (GP)
- GRAVEL with sand (GW)
- GRAVEL with clay (GW)
- Clayey GRAVEL (GC)
- GRAVEL with silt (GW)
- Silty GRAVEL (GM)
- Well graded SAND (SW)
- Poorly graded SAND (SP)
- SAND with gravel (SW)
- SAND with clay (SW-SC)
- Clayey SAND (SC)
- Silty SAND (SM)
- SAND with silt (SW-SM)
- Fat CLAY (CH)
- Sandy fat CLAY (CH)
- Lean CLAY (CL)
- Sandy lean CLAY (CL)
- Silty CLAY (CL-ML)
- Elastic SILT (MH)
- SILT (ML)
- Sandy SILT (ML)
- Clayey SILT (ML/CL)
- Highly plastic ORGANICS (OH)
- Low plasticity ORGANICS (OL)
- SANDSTONE (Rk)
- SILTSTONE (Rk)
- CLAYSTONE (Rk)
- MUDSTONE (Rk)
- Conglomerate (Rk)
- Interbedded Rock Strata (Rk)
- Pavement

LEGEND
- Elizabeth River
- Artificial Fill (af)
- Soft Clay (Qal)
- Medium Dense Sand (Qn)
- Silty to Clayey Sand (Ty)
- Stiff Clay (Ty)

NOTES:

1) Elevation reference to mean lower low water (MLLW).

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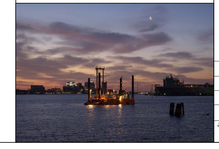
3) Approximate location of dredge cut based on 1960 design drawings, and where adequate data is available, based on 2008 geotechnical and geophysical data.

VIEW FROM BARGE DECK, SHOWING ROSON CPT UNIT, CRANE, SPUD LIFTING EQUIPMENT, AND *BUNNY C* TUGBOAT



CR2 DRILLING OPERATIONS



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GEODETIC INFORMATION

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ECCENTRICITY[1]:	0.006694380
PROJECTION:	LAMBERT CONFORMAL CONIC
ZONE:	VIRGINIA SOUTH
LATITUDE OF ORIGIN:	34°
FALSE EASTING:	11,482,916
FALSE NORTHING:	3,280,833

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SUBSURFACE CROSS SECTIONS WITH CLASSIFICATION TEST RESULTS

Midtown Second Parallel Tunnel Portsmouth to Norfolk, Virginia

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Oct. 2008	Report Submittal	KWS	KRS	KRS
2					
3					

JOB NUMBER: 3602.001

CHART NO.: 4a

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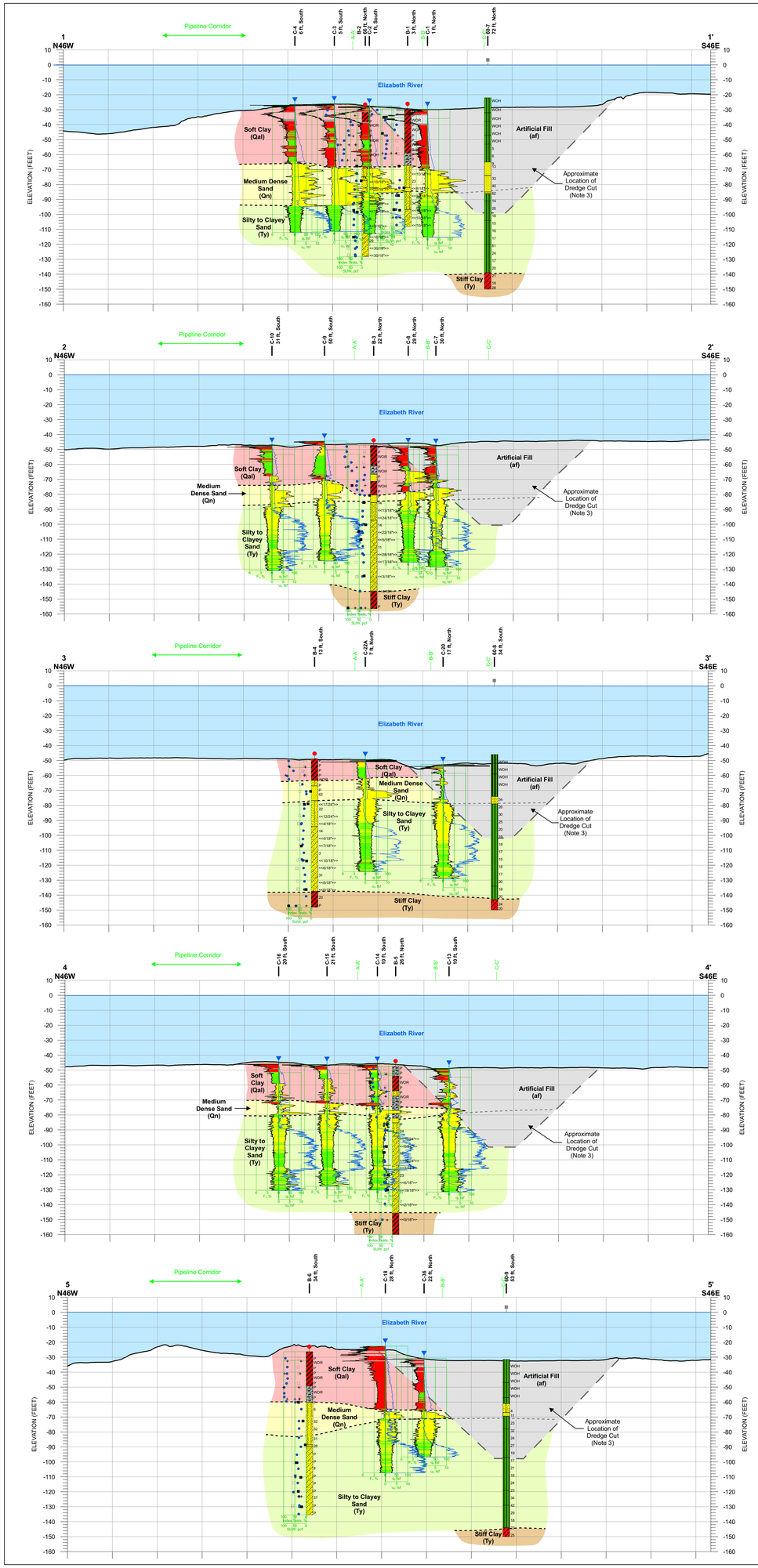

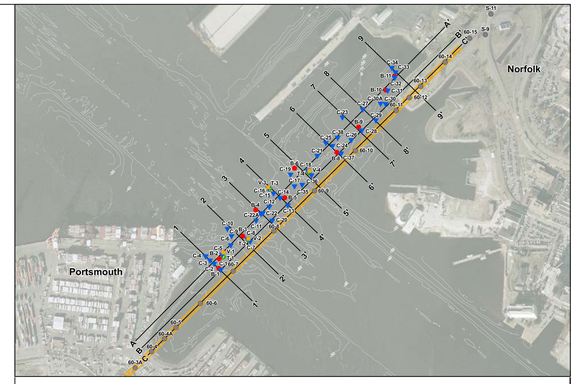

LEGEND

2008 Exploration Locations

- C-38 ▼ CPT
- B-11 ● Boring
- T-4 ◇ T-bar
- V-4 ■ Vane Shear

1960 Exploration Locations

- 60-11 ● Boring

- Cross Section Location
- Bathymetric Contour in Feet (MLLW) Contour Interval is 5 ft.
- Seismic Survey Track Line
- Approximate Location of Midtown Tunnel Not for Design or Construction Planning

0 250 500 1,000 Feet

NOTES:

1) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

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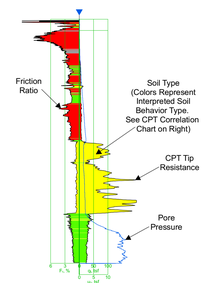
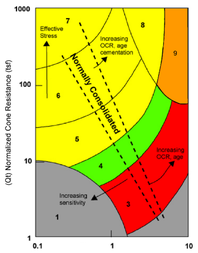
KEY TO CPT SOUNDINGS



CPT SOUNDING WITH FRICTION RATIO, PORE PRESSURE, AND TIP RESISTANCE



Zone	Soil Behavior Type	U.S.C.S.
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2	Organic Material	OL-OH
3	Clay to Silty Clay	CL-CH
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6	Sand to Silty Sand	SP-SM
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8	Sand to Clayey Sand	SP-SC
9	Very Stiff Fine-grained*	CH-CL

*overconsolidated or cemented

CPT CORRELATION CHART ROBERTSON, 1990

30 ft
60 ft
Horizontal and Vertical Scales in Feet
Vertical exaggeration is 2x.

KEY TO BORINGS

INDEX PROPERTIES SYMBOLS

- Submerged Unit Weight
- Percent Passing #200 Sieve
- Plastic Limit
- Liquid Limit
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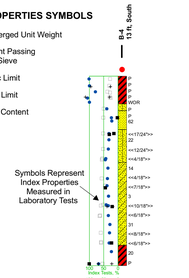

SOIL BORING LITHOLOGY WITH INDEX TESTS MEASURED IN LABORATORY AND RAW BLOW COUNTS

SOIL TYPES

- Well graded GRAVEL (GW)
- Poorly graded GRAVEL (GP)
- GRAVEL with sand (GW)
- GRAVEL with clay (GW)
- Clayey GRAVEL (GC)
- GRAVEL with silt (GW)
- Silty GRAVEL (GM)
- Well graded SAND (SW)
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- SAND with gravel (SW)
- SAND with clay (SW-SC)
- Clayey SAND (SC)
- Silty SAND (SM)
- SAND with silt (SW-SM)
- Fat CLAY (CH)
- Sandy fat CLAY (CH)
- Lean CLAY (CL)
- Sandy lean CLAY (CL)
- Silty CLAY (CL-ML)
- Elastic SILT (MH)
- SILT (ML)
- Sandy SILT (ML)
- Clayey SILT (ML/CL)
- Highly plastic ORGANICS (OH)
- Low plasticity ORGANICS (OL)
- SANDSTONE (Rx)
- SILTSTONE (Rx)
- CLAYSTONE (Rx)
- MUDSTONE (Rx)
- Conglomerate (Rx)
- Interbedded Rock Strata (Rx)
- Pavement

Legend

- Elizabeth River
- Artificial Fill (af)
- Soft Clay (Qal)
- Medium Dense Sand (Qn)
- Silty to Clayey Sand (Ty)
- Stiff Clay (Ty)

NOTES:

1) Elevation reference to mean lower low water (MLLW).

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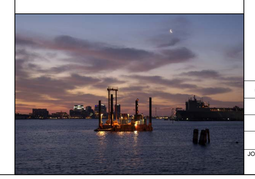
VIEW FROM BARGE DECK, SHOWING ROSON CPT UNIT, CRANE, SPUD LIFTING EQUIPMENT, AND *BUNNY C* TUGBOAT



CR2 DRILLING OPERATIONS



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SUBSURFACE CROSS SECTIONS WITH CLASSIFICATION TEST RESULTS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Oct. 2008	For Report Submittal	KWS	KRS	KRS
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3					

JOB NUMBER: 3602.001

CHART NO.: 4b

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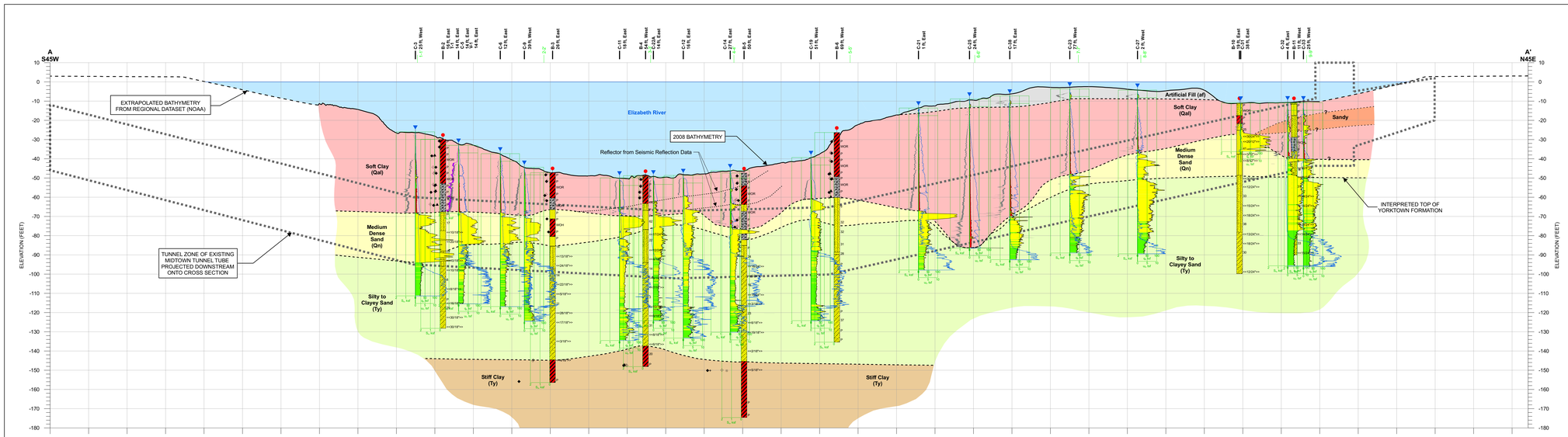

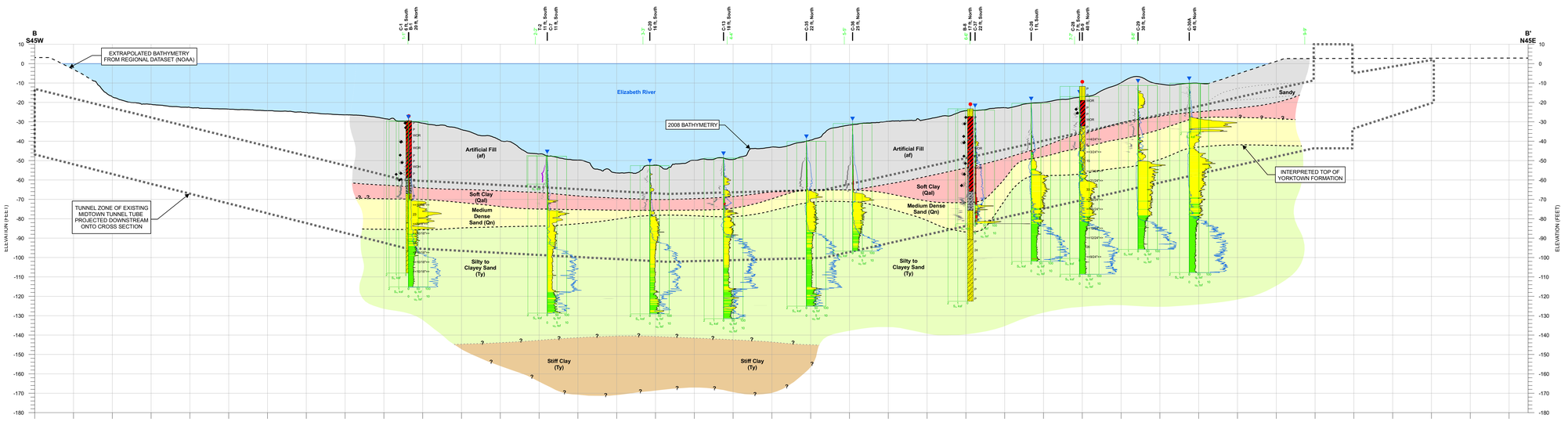

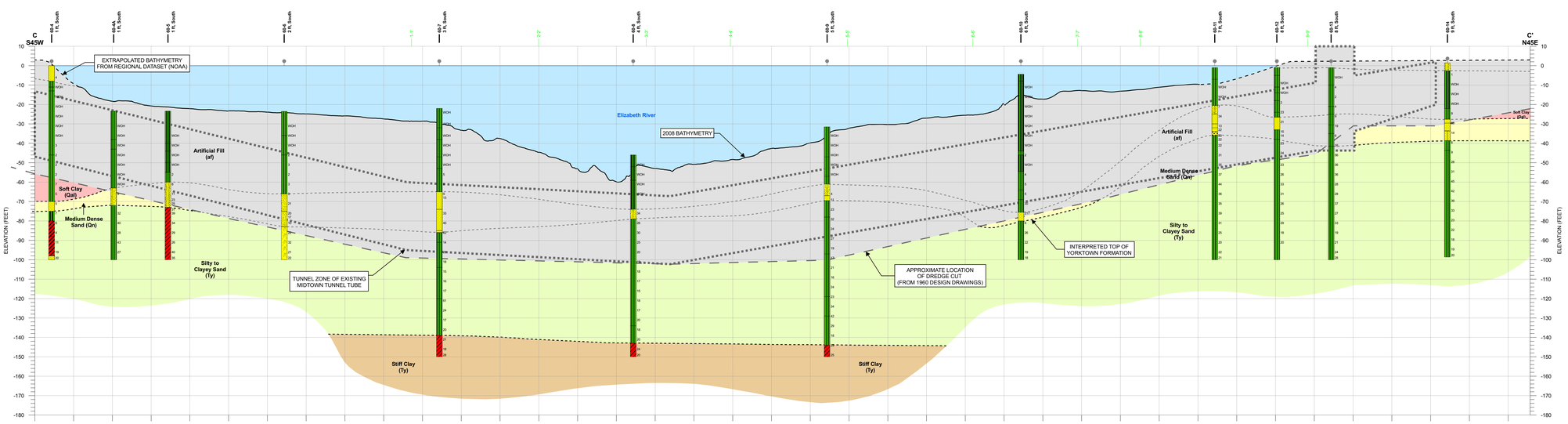

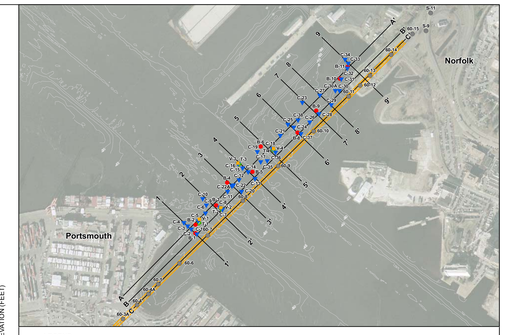

LEGEND

2008 Exploration Locations
- C-38 — CPT
- B-11 — Boring
- T-4 — T-bar
- V-4 — Vane Shear

1960 Exploration Locations
- 60-11 — Boring

Cross Section Location

Bathymetric Contour in Feet (MLLW)
Contour Interval is 5 ft.

Approximate Location of Midtown Tunnel
Not for Design or Construction Planning

0 250 500 1,000 Feet

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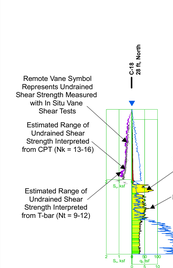
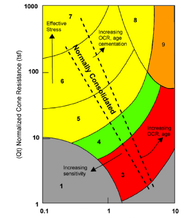
KEY TO CPT SOUNDINGS



CPT SOUNDING WITH FRICTION RATIO, PORE PRESSURE, AND TIP RESISTANCE



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*overconsolidated or cemented

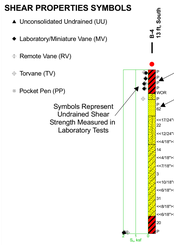
CPT CORRELATION CHART ROBERTSON, 1990



Horizontal and Vertical Scales in Feet
Vertical exaggeration is 5x.

KEY TO BORINGS

SHEAR PROPERTIES SYMBOLS
- Unconsolidated Undrained (UU)
- Laboratory/Miniature Vane (MV)
- Remote Vane (RV)
- Torvane (TV)
- Pocket Pen (PP)



SOIL BORING LITHOLOGY WITH UNDRAINED SHEAR STRENGTH AND RAW BLOW COUNTS

SOIL TYPES
- Well graded GRAVEL (GW)
- Poorly graded GRAVEL (GP)
- GRAVEL with sand (GW)
- GRAVEL with clay (GW)
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CR2 DRILLING OPERATIONS



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SUBSURFACE CROSS SECTIONS WITH UNDRAINED SHEAR STRENGTH

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Oct. 2008	For Report Submittal	KWS	KRS	KRS
2					
3					

JOB NUMBER: 3602.001

CHART NO.: 5a

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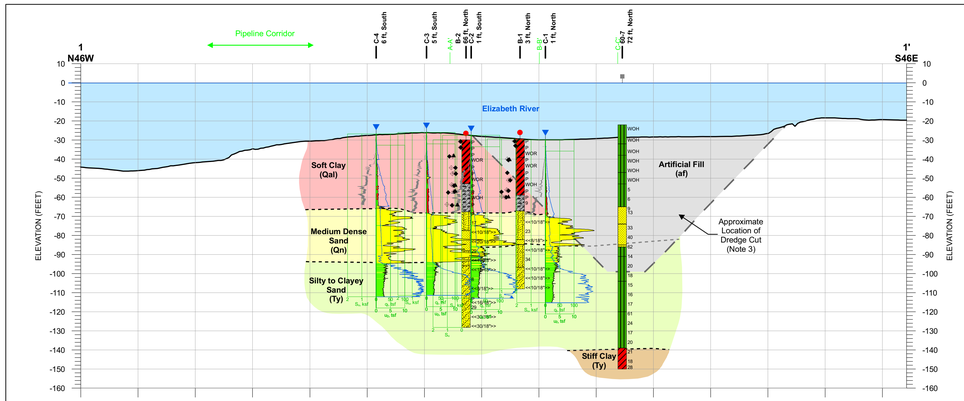
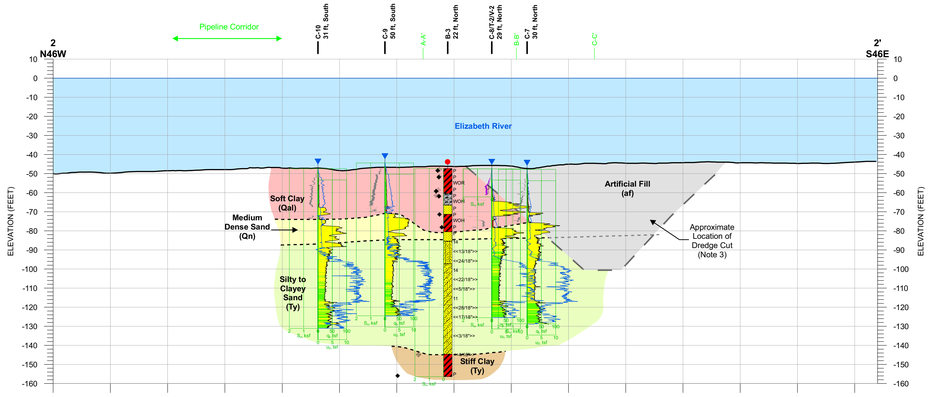
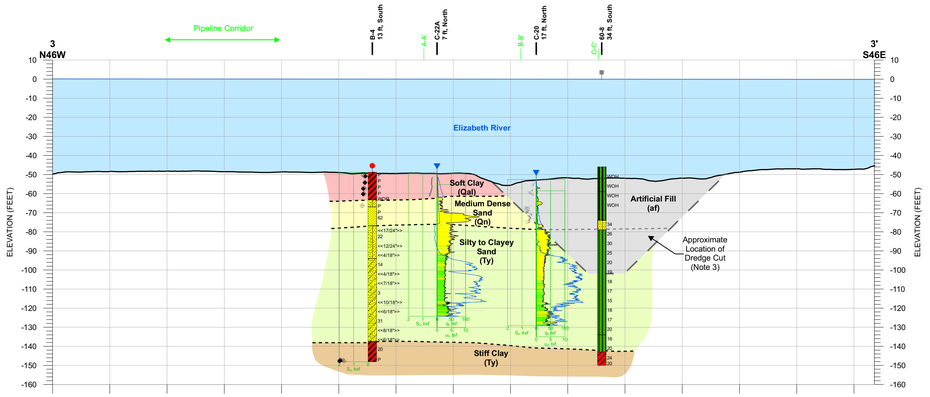
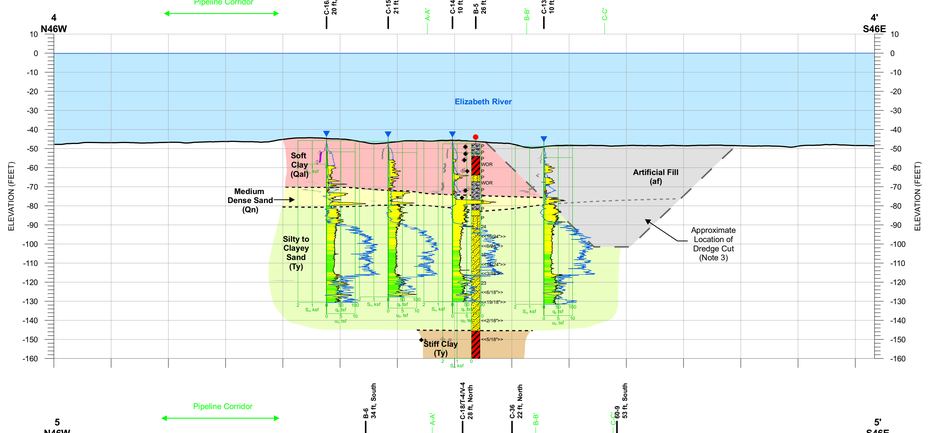
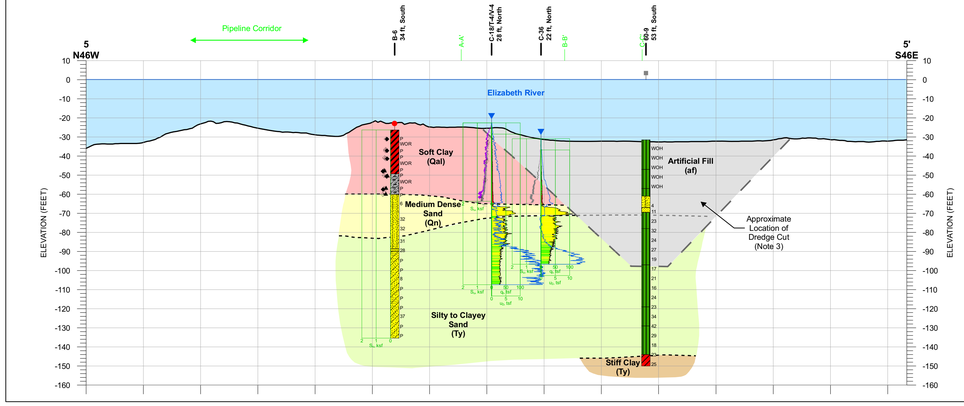
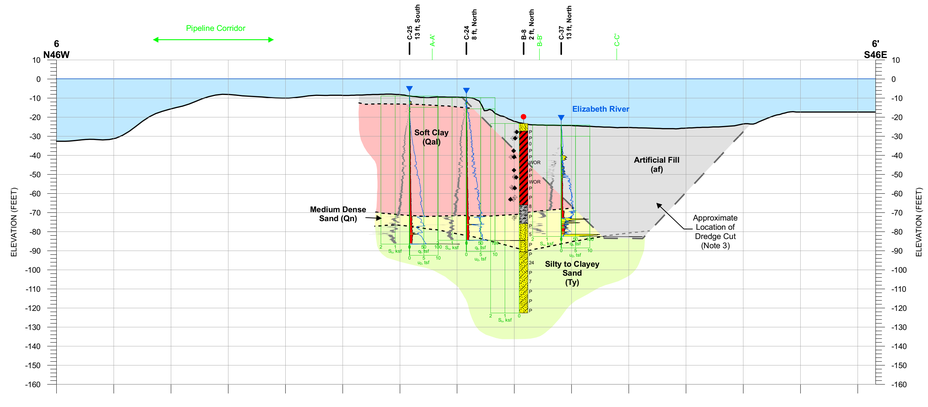


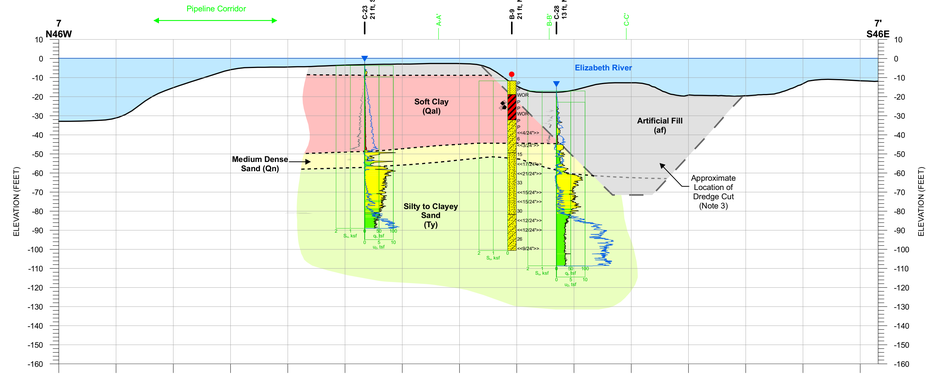


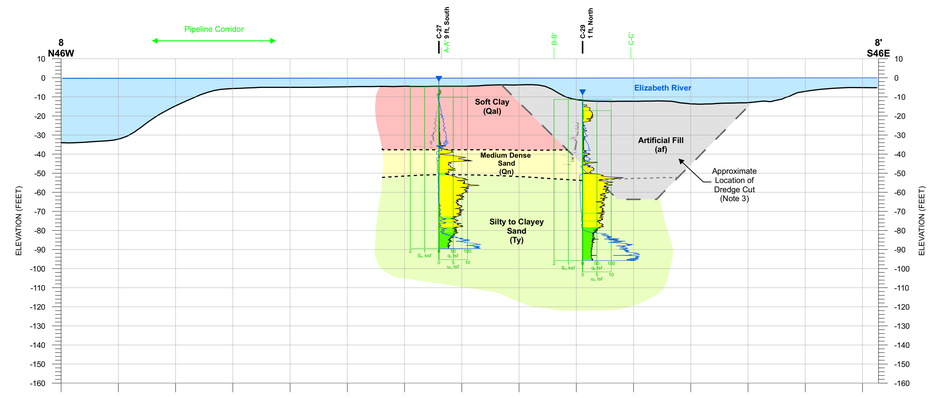


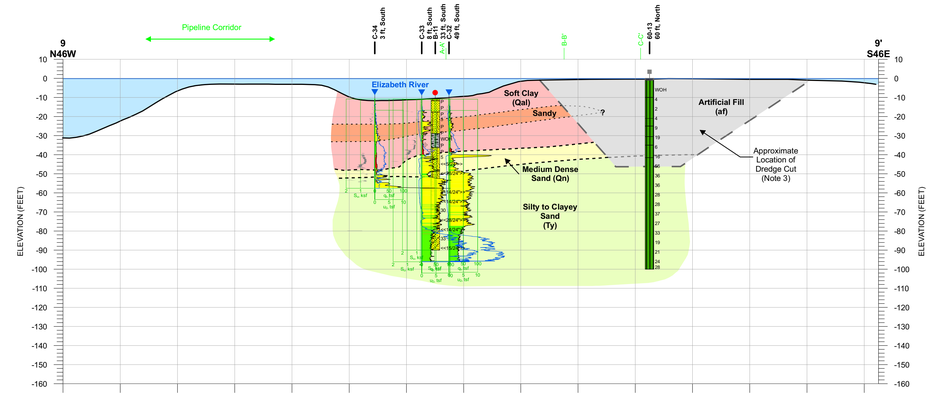


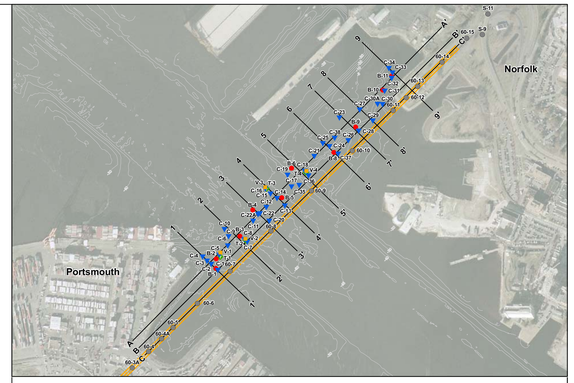












LEGEND

2008 Exploration Locations

- C-38 ▼ CPT
- B-11 ● Boring
- T-4 ◇ T-bar
- V-4 ■ Vane Shear

1960 Exploration Locations

- 60-11 ● Boring

Cross Section Location

Bathymetric Contour in Feet (MLLW) Contour Interval is 5 ft.

Approximate Location of Midtown Tunnel Not for Design or Construction Planning

N, W, E, S

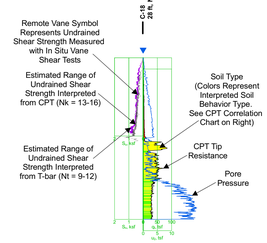
0 250 500 1,000 Feet

Notes:

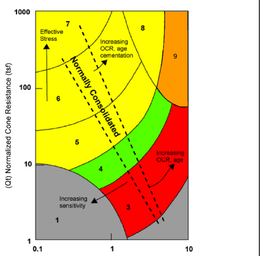
1) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

2) Bathymetric data from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

KEY TO CPT SOUNDINGS



CPT SOUNDING WITH FRICTION RATIO, PORE PRESSURE, AND TIP RESISTANCE



Zone	Soil Behavior Type	U.S.C.S.
1	Sensitive Fine-grained	OL-CH
2	Organic Material	OL-OH
3	Clay to Silty Clay	CL-CH
4	Clayey Silt to Silty Clay	MH-CL
5	Silty Sand to Sandy Silt	SM-ML
6	Sand to Silty Sand	SP-SM
7	Gravelly Sand to Sand	GP-SP
8	Sand to Clayey Sand	SP-SC
9	Very Stiff Fine-grained*	CH-CL

*overconsolidated or cemented

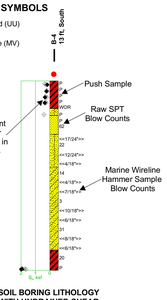
CPT CORRELATION CHART ROBERTSON, 1990

30 ft, 60 ft
Horizontal and Vertical Scales in Feet
Vertical exaggeration is 2x.

KEY TO BORINGS

SHEAR PROPERTIES SYMBOLS

- ▲ Unconsolidated Undrained (UU)
- ◆ Laboratory/Miniature Vane (MV)
- ↕ Remote Vane (RV)
- ✧ Torvane (TV)
- ✳ Pocket Pen (PP)



SOIL BORING LITHOLOGY WITH UNDRAINED SHEAR STRENGTH AND RAW BLOW COUNTS

SOIL TYPES

- Well-graded GRAVEL (GW)
- Poorly graded GRAVEL (GP)
- GRAVEL with sand (GW)
- GRAVEL with clay (GW)
- Clayey GRAVEL (GC)
- GRAVEL with silt (GW)
- Silty GRAVEL (GM)
- Well graded SAND (SW)
- Poorly graded SAND (SP)
- SAND with gravel (SW)
- SAND with clay (SW-SC)
- Clayey SAND (SC)
- Silty SAND (SM)
- SAND with silt (SW-SM)
- Fat CLAY (CH)
- Sandy fat CLAY (CH)
- Lean CLAY (CL)
- Sandy lean CLAY (CL)
- Silty CLAY (CL-ML)
- Elastic SILT (MH)
- SILT (ML)
- Sandy SILT (ML)
- Clayey SILT (ML/CL)
- Highly plastic ORGANICS (OH)
- Low plasticity ORGANICS (OL)
- SANDSTONE (Rx)
- SILTSTONE (Rx)
- CLAYSTONE (Rx)
- MUDSTONE (Rx)
- Conglomerate (Rx)
- Interbedded Rock Strata (Rx)
- Pavement

Legend

- Elizabeth River
- Artificial Fill (af)
- Soft Clay (Qal)
- Medium Dense Sand (Qn)
- Silty to Clayey Sand (Ty)
- Stiff Clay (Ty)

NOTES:

1) Elevation reference to mean lower low water (MLLW).

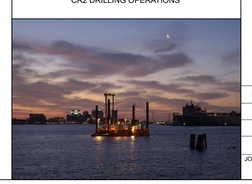
2) Bathymetric data from 2008 multibeam and single beam survey. Refer to Fugro (2008b) for description of surveys.

3) Approximate location of dredge cut based on 1960 design drawings, and where adequate data is available, based on 2008 geotechnical and geophysical data.

VIEW FROM BARGE DECK, SHOWING ROSON CPT UNIT, CRANE, SPUD LIFTING EQUIPMENT, AND *BUNNY C* TUGBOAT



CR2 DRILLING OPERATIONS



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GEODETIC INFORMATION

SPHEROID:	GRS 1980
SEMI-MAJOR AXIS:	6,378,137.000
SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.257222101
ECCENTRICITY^2:	0.006694380
PROJECTION:	LAMBERT CONFORMAL CONIC
ZONE:	VIRGINIA SOUTH
LONGITUDE OF ORIGIN:	36.3°
FALSE EASTING:	11,482,916
FALSE NORTHING:	3,280,833

FUGRO ATLANTIC
World Trade Center, Suite 350
101 West Main Street
Norfolk, Virginia 23510
Tel: (757) 625-3350
Fax: (757) 625-3352
www.fugroatlantic.com

SUBSURFACE CROSS SECTIONS WITH UNDRAINED SHEAR STRENGTH

Midtown Second Parallel Tunnel Portsmouth to Norfolk, Virginia

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Oct. 2008	For Report Submittal	KWS	KRS	KRS
2					
3					

JOB NUMBER: 3602.001

CHART NO.: 5b

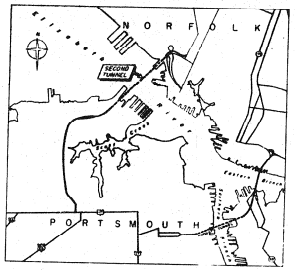
N:\Projects\3602_VDOT\3602-001 (Midtown_Tunnel)\Outputs\3602-001_Site_Char\HS\FIG\Cone\Soils_Transverse_Xsect_Shear_Strength.mxd, 10/21/08, kspencer

APPENDIX A
ELIZABETH RIVER TUNNEL COMMISSION
SECOND ELIZABETH RIVER TUNNEL AND APPROACHES
1960 DRAWINGS

ELIZABETH RIVER TUNNEL COMMISSION

SECOND ELIZABETH RIVER TUNNEL AND APPROACHES

CONTRACT NO. 1



SUBMITTED January 29, 1960
J. Michel Partner
PARSONS, BRINCKERHOFF, QUADE & DOUGLAS

APPROVED January 29-1960
CHAIRMAN - ELIZABETH RIVER TUNNEL COMMISSION

CONVENTIONAL SIGNS

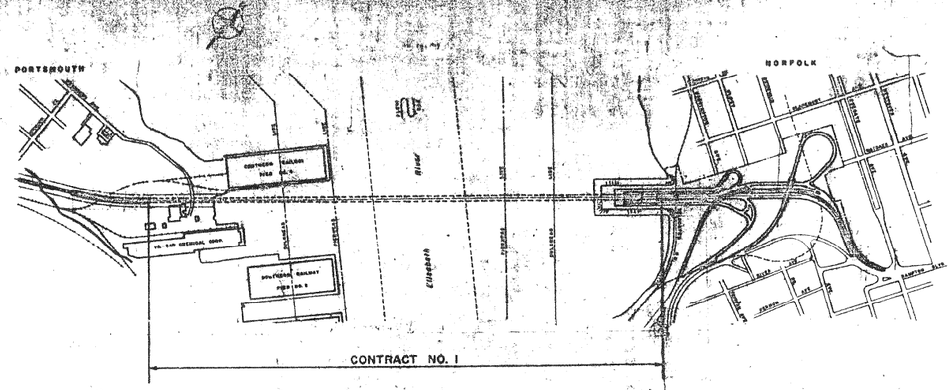
STATE LINE
COUNTY LINE
CITY, TOWN OR VILLAGE
RIGHT OF WAY LINE
FENCE LINE
UNFENCED PROPERTY LINE
FENCED PROPERTY LINE
TRAVELED WAY
GUARD RAIL
RETAINING WALL
RAILROADS
BASE OR SURVEY LINE

LEVEE OR EMBANKMENT
BRIDGES
CULVERTS
DROP INLET
TROLLEY POLES
POWER POLES
TELEPHONE OR TELEGRAPH POLES
MARSH
HEDGE
WOODS
GROUND ELEVATION
GRADE ELEVATION
POLES WITHIN CONSTRUCTION LIMITS

Sheet 1 of 14A 254-16

254-16-001

APPENDIX A-1a



LIST OF DRAWINGS

DWG. NO.	TITLE
	STRUCTURAL
	COVER SHEET
	INDEX (LOCATION PLAN AND LIST OF DRAWINGS)
S-1	GENERAL PLAN & PROFILE
S-1A	LAYOUT PLAN
S-1B	ALIGNMENT DATA
S-1C	CONTROL PLAN
S-1D	BORING LOGS - SHEET 1
S-1E	BORING LOGS - SHEET 2
S-1F	BORING LOGS - SHEET 3
S-2	TYPICAL SECTIONS - E.R.T.C. PORTSMOUTH
S-2A	TYPICAL SECTIONS - CONCOURSE & VALE PITS - CONCOURSE
S-3	TYPICAL SECTIONS
S-3A	CONCOURSE CROSS SECTIONS - SHEET 1
S-3B	CONCOURSE CROSS SECTIONS - SHEET 2
S-4	TYPICAL SECTION THROUGH PRECAST TUBES
S-4A	EXPANSION DETAILS OF PRECAST TUBES - LOWER SECTION
S-4B	EXPANSION DETAILS OF PRECAST TUBES - UPPER SECTION
S-4C	STEEL SHELL - PRECAST TUBE - TYPICAL SECTION & DETAILS
S-5	CONCRETE BUILDING
S-5A	ELEVATIONS OF PRECAST TUBES - SHEET 1
S-5B	ELEVATIONS OF PRECAST TUBES - SHEET 2
S-5C	TYPICAL JOINT BETWEEN PRECAST TUBES - SHELL DETAILS - SHEET 1
S-5D	TYPICAL JOINT BETWEEN PRECAST TUBES - SHELL DETAILS - SHEET 2
S-5E	CONCRETE JOINT BETWEEN PRECAST TUBES 2 & 3 - SHELL DETAILS - SHEET 1
S-5F	CONCRETE JOINT BETWEEN PRECAST TUBES 2 & 3 - SHELL DETAILS - SHEET 2
S-5G	CONCRETE JOINT BETWEEN PRECAST TUBES 2 & 3 - SHELL DETAILS - SHEET 3
S-5H	CONSTRUCTION WATCH - TUBES 1 & 2
S-5I	CONSTRUCTION WATCH - TUBES 1 & 2
S-5J	END PLATE DETAILS - TUBES 1 & 2
S-6	TYPICAL JOINT BETWEEN PRECAST TUBES - INTERIOR DETAILS - SHEET 1
S-6A	TYPICAL JOINT BETWEEN PRECAST TUBES - INTERIOR DETAILS - SHEET 2
S-6B	CONCRETE JOINT BETWEEN PRECAST TUBES 2 & 3 - INTERIOR DETAILS
S-6C	CONCRETE WATER TUBE DETAILS
S-7	PRECAST TUBE SHAFT & PUMP ROOM - PLAN & SECTIONS
S-7A	PRECAST TUBE SHAFT & PUMP ROOM - DETAILS - SHEET 1
S-7B	PRECAST TUBE SHAFT & PUMP ROOM - DETAILS - SHEET 2
S-8	LOCATION OF KICKS - LEDGE SIDE
S-8A	LOCATION OF KICKS - SIDEWALK SIDE
S-9	DETAILS OF KICKS
S-10	REINFORCING STEEL SCHEDULE
S-11	REINFORCING STEEL DETAILS
S-12	MISCELLANEOUS METAL DETAILS
S-13	EAST APPROACH STRUCTURES - GENERAL PLAN & PROFILE
S-14	EAST VENTILATION BUILDING - PLAN BELOW TUNNEL ROADWAY
S-15	EAST VENTILATION BUILDING - PLAN AT TUNNEL ROADWAY
S-16	EAST VENTILATION BUILDING - PLAN AT BASEMENT
S-17	EAST VENTILATION BUILDING - PLAN AT FIRST FLOOR
S-18	EAST VENTILATION BUILDING - TYPICAL SECTIONS & SIDEWALK SIDES
S-19	EAST VENTILATION BUILDING - TYPICAL SECTIONS - SHEET 1
S-20	EAST VENTILATION BUILDING - TYPICAL SECTIONS - SHEET 2

DWG. NO.	TITLE
	STRUCTURAL
S-47	EAST VENTILATION BUILDING - SUMP & PUMP ROOM DETAILS - SHEET 1
S-48	EAST VENTILATION BUILDING - SUMP & PUMP ROOM DETAILS - SHEET 2
S-49	EAST VENTILATION BUILDING - FRESH AIR SHAFT DETAILS
S-50	EAST VENTILATION BUILDING - CHIMNEY AND VENT DETAILS
S-51	EAST VENTILATION BUILDING - FAN ROOM DETAILS - SHEET 1
S-52	EAST VENTILATION BUILDING - FAN ROOM DETAILS & SCHEDULE
S-53	EAST VENTILATION BUILDING - DETAILS AT STAIRWELL
S-54	EAST VENTILATION BUILDING - MISCELLANEOUS DETAILS
S-55	EAST VENTILATION BUILDING - FAN EQUIPMENT DETAILS
S-56	APPROACH STRUCTURES - TYPICAL INTERIOR TUNNEL DETAILS
S-57	APPROACH STRUCTURES - MISCELLANEOUS METAL
S-58	EAST BOX CUT & COVER - PLAN AT ROADWAY
S-59	EAST BOX CUT & COVER - ELEVATION
S-60	EAST BOX CUT & COVER - TYPICAL SECTION & DETAILS
S-61	EAST BOX CUT & COVER - SECTIONS AS FORMED
S-62	PORTAL TUBE GATE - GENERAL ARRANGEMENT
S-63	PORTAL TUBE GATE - GATE ELEVATIONS & SECTIONS
S-64	PORTAL TUBE GATE - GATE DETAILS
S-65	PORTAL TUBE GATE - GATE SCALE & SILL
S-66	PORTAL TUBE GATE - MISCELLANEOUS DETAILS
S-67	PORTAL TUBE GATE - MACHINERY
S-68	PORTAL TUBE GATE - MACHINERY DETAILS
S-69	WEST APPROACH STRUCTURES - GENERAL PLAN & PROFILE
S-70	WEST BOX & COVER - PROFILE
S-71	WEST BOX & COVER - TYPICAL SECTION
S-72	WEST VENTILATION BLDG. - FLOOR PLANS
S-73	WEST VENTILATION BLDG. - ELEVATIONS & DETAILS
S-74	WEST VENTILATION BLDG. - PLANS AT STAIRWELLS
S-75	WEST VENTILATION BUILDING - DETAILS AT STAIRWELL
S-76	WEST BOX CUT & COVER - PLAN AT ROADWAY
S-77	WEST BOX CUT & COVER - ELEVATION
S-78	NICHE LOCATIONS
	MECHANICAL
M-1	TUNNEL WATER PIPING - PLAN AND PROFILE - SHEET 1
M-2	TUNNEL WATER PIPING - PLAN AND PROFILE - SHEET 2
M-3	TUNNEL WATER PIPING - PLAN AND PROFILE
M-4	TUNNEL WATER PIPING - PLAN AND PROFILE - SHEET 1
M-5	TUNNEL WATER PIPING - PLAN AND PROFILE - SHEET 2
M-6	TUNNEL WATER PIPING - SECTIONS AND DETAILS
M-7	TUNNEL WATER PIPING - SECTIONS AND DETAILS
M-8	TUNNEL WATER PIPING - PLAN AND PROFILE - SHEET 1
M-9	TUNNEL WATER PIPING - PLAN AND PROFILE - SHEET 2
M-10	TUNNEL WATER PIPING - SECTIONS AND DETAILS
M-11	TUNNEL WATER PIPING - SECTIONS AND DETAILS
M-12	TUNNEL WATER & DRAINAGE PIPING - FIRE HYDRANT PIPING AND DETAILS
M-13	TUNNEL WATER & DRAINAGE PIPING - CAST BOX CUT & COVER - VENT. BLDG. - PLAN & PROFILE

DWG. NO.	TITLE
	MECHANICAL
M-13	TUNNEL WATER & DRAINAGE PIPING - WEST BOX CUT & COVER - VENT. BLDG. - CUT & COVER PLAN - PROFILE - DETAILS
M-14	TUNNEL WATER & DRAINAGE PIPING - BOX CUT & COVER - CUT & COVER SECTIONS & DETAILS
M-15	EAST VENTILATION BLDG. - TUNNEL - BELOW TUNNEL PLANS
M-16	EAST VENTILATION BLDG. - BASEMENT - FIRST FLOOR PLANS & DETAILS
M-17	WEST VENTILATION BLDG. - TUNNEL - BELOW TUNNEL - BASM'T. - FIRST FLOOR PLANS
	ELECTRICAL
E-1	PRECAST TUBE NOS. 1& - ELEVATION - SIDEWALK SIDE
E-2	PRECAST TUBE NOS. 2 - ELEVATION - SIDEWALK SIDE
E-3	PRECAST TUBE NOS. 3 - ELEVATION - SIDEWALK SIDE
E-4	PRECAST TUBES NOS 4, 5 & 10 - ELEVATION - SIDEWALK SIDE
E-5	PRECAST TUBES NOS. 6, 7 & 9 - ELEVATION - SIDEWALK SIDE
E-6	PRECAST TUBE NOS. 6 - ELEVATION - SIDEWALK SIDE
E-7	PRECAST TUBE NOS. 11 - ELEVATION - SIDEWALK SIDE
E-8	PRECAST TUBE NOS. 1 - ELEVATION - LEDGE SIDE
E-9	PRECAST TUBE NOS. 2 - ELEVATION - LEDGE SIDE
E-10	PRECAST TUBE NOS. 3 - ELEVATION - LEDGE SIDE
E-11	PRECAST TUBES NOS. 4, 5, 7, 8, 9 & 10 - ELEVATION - LEDGE SIDE
E-12	PRECAST TUBE NOS. 11 - ELEVATION - LEDGE SIDE
E-13	DETAILS - SHEET 1
E-14	DETAILS - SHEET 2
E-15	TYPICAL COVES SECTIONS
E-16	WEST APPROACH STRUCTURES - ELEVATION - SIDEWALK & LEDGE SIDES
E-17	WEST VENTILATION BUILDING - PLANS
E-18	EAST APPROACH STRUCTURES - ELEVATION - SIDEWALK & LEDGE SIDES
E-19	EAST VENTILATION BUILDING - ROADWAY AND BELOW ROADWAY - POWER CONDUIT PLANS
E-20	EAST VENTILATION BUILDING - BASEMENT POWER CONDUIT PLAN - SHEET 1
E-21	EAST VENTILATION BUILDING - BASEMENT POWER CONDUIT PLAN - SHEET 2
E-22	EAST VENTILATION BUILDING - BASEMENT ROADWAY AND BELOW ROADWAY LIGHTING CONDUIT PLANS
E-23	EAST VENTILATION BUILDING - FIRST FLOOR LIGHTING CONDUIT PLAN
E-24	PORTAL TUBE GATE HOUSE - PLAN AND DETAILS
	ARCHITECTURAL
A-1	FIELD OFFICE - PLANS, ELEVATIONS AND SECTION

REV.	DATE	DESCRIPTION	BY

ELIZABETH RIVER TUNNEL COMMISSION

SECOND TUNNEL AND APPROACHES
BETWEEN NORFOLK AND PORTSMOUTH, VA.

CONTRACT NO. I
LOCATION PLAN
AND
LIST OF DRAWINGS

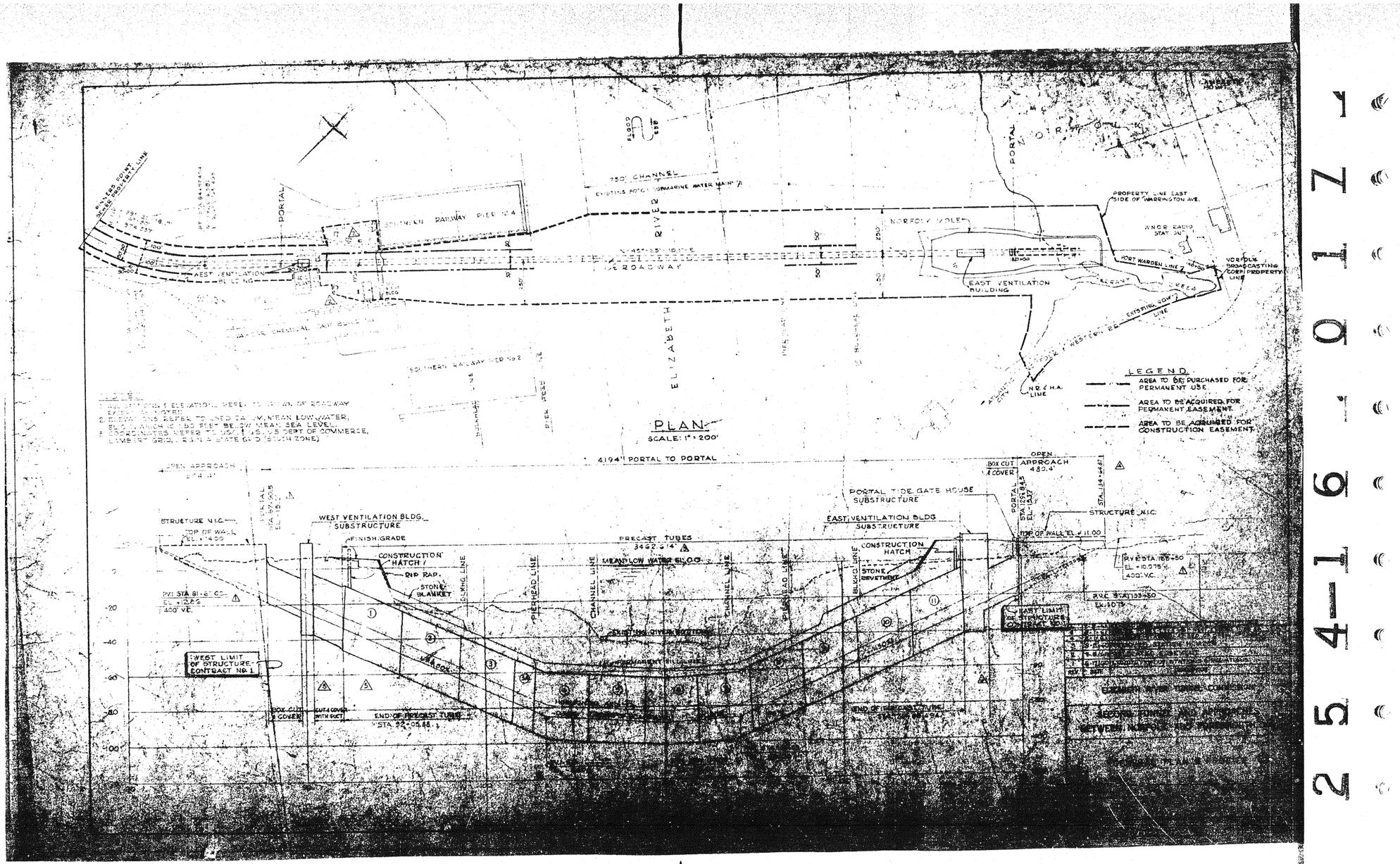
CONTRACT NO. I	SCALE	DATE JAN. 29, 1960
DRAWN	PARSONS, BRINCKERHOFF, QUADE & DOUGLAS	DRAWING NUMBER
CHECKED	ENGINEERS NEW YORK	INDEX

Sheet 3 of 142

254-16

254-16-7

APPENDIX A-1b



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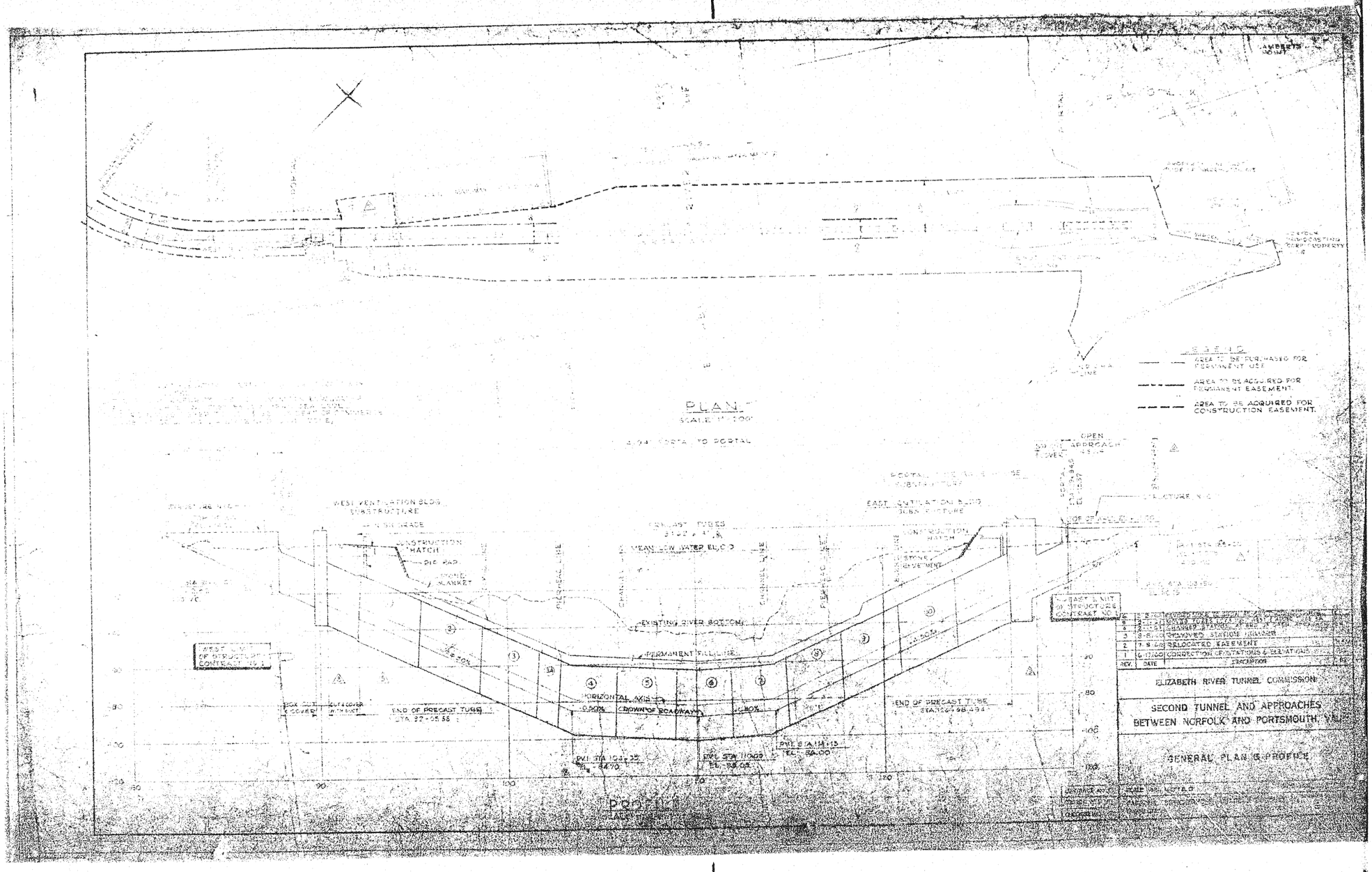

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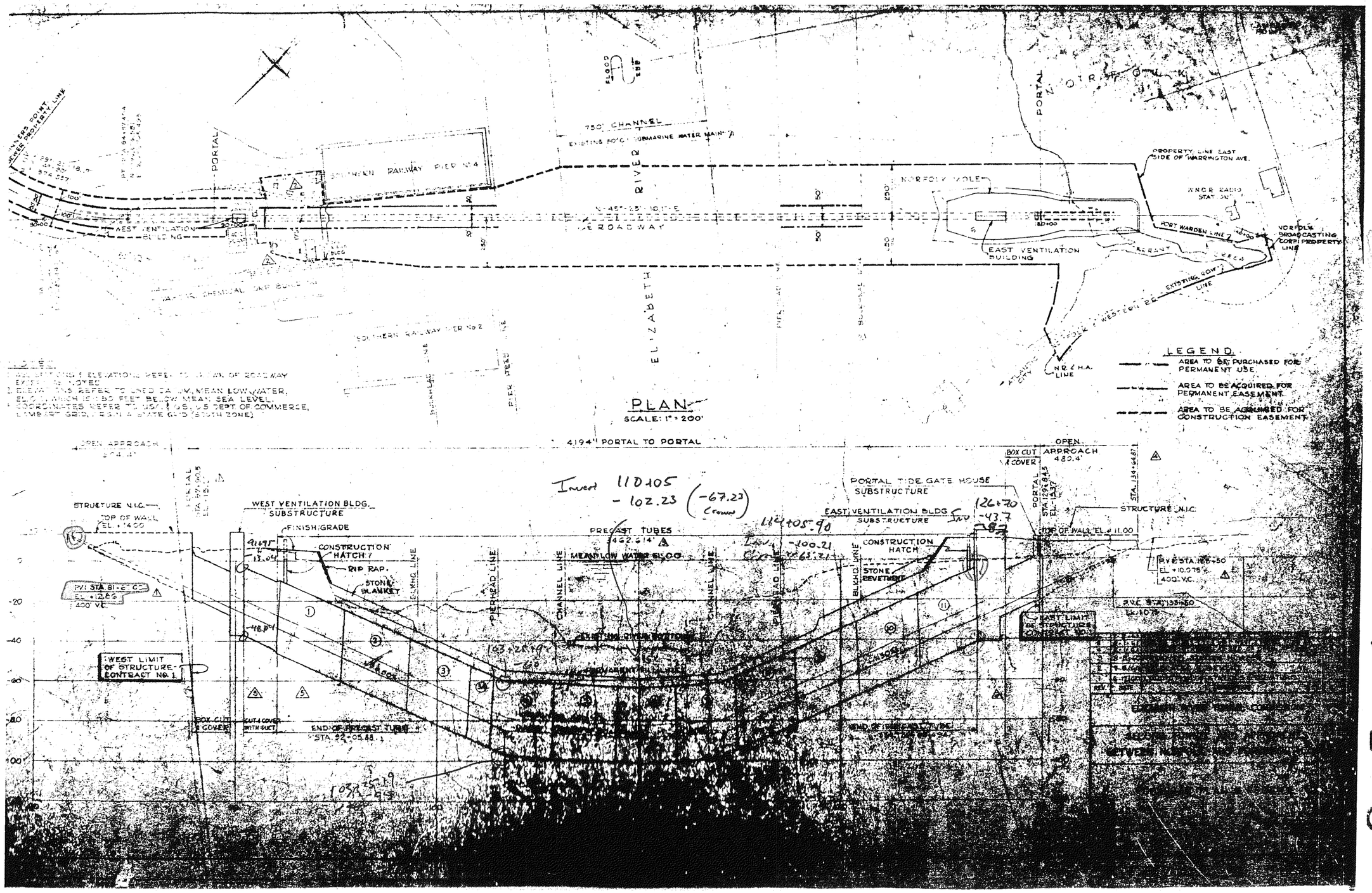
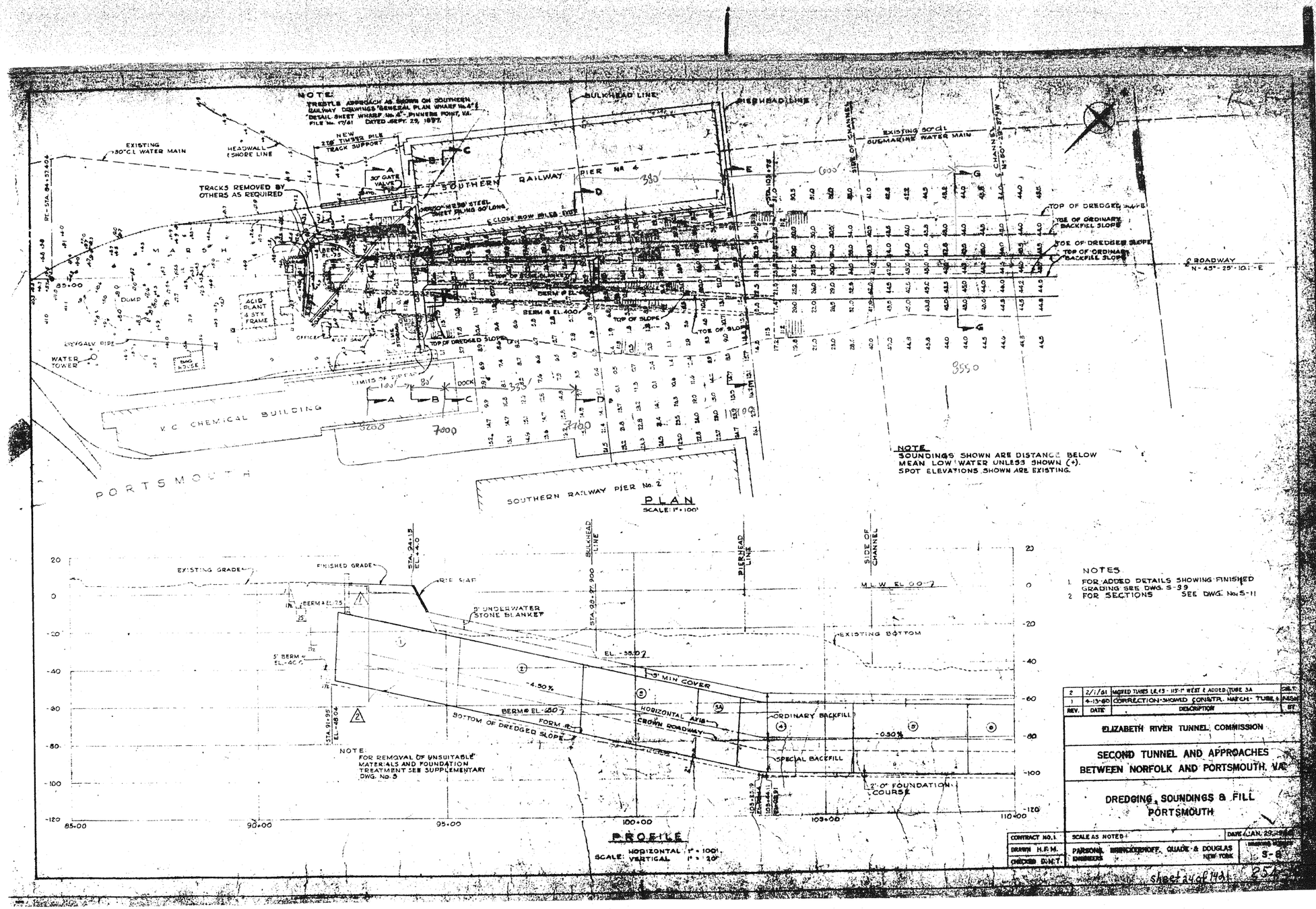


APPENDIX A-1e

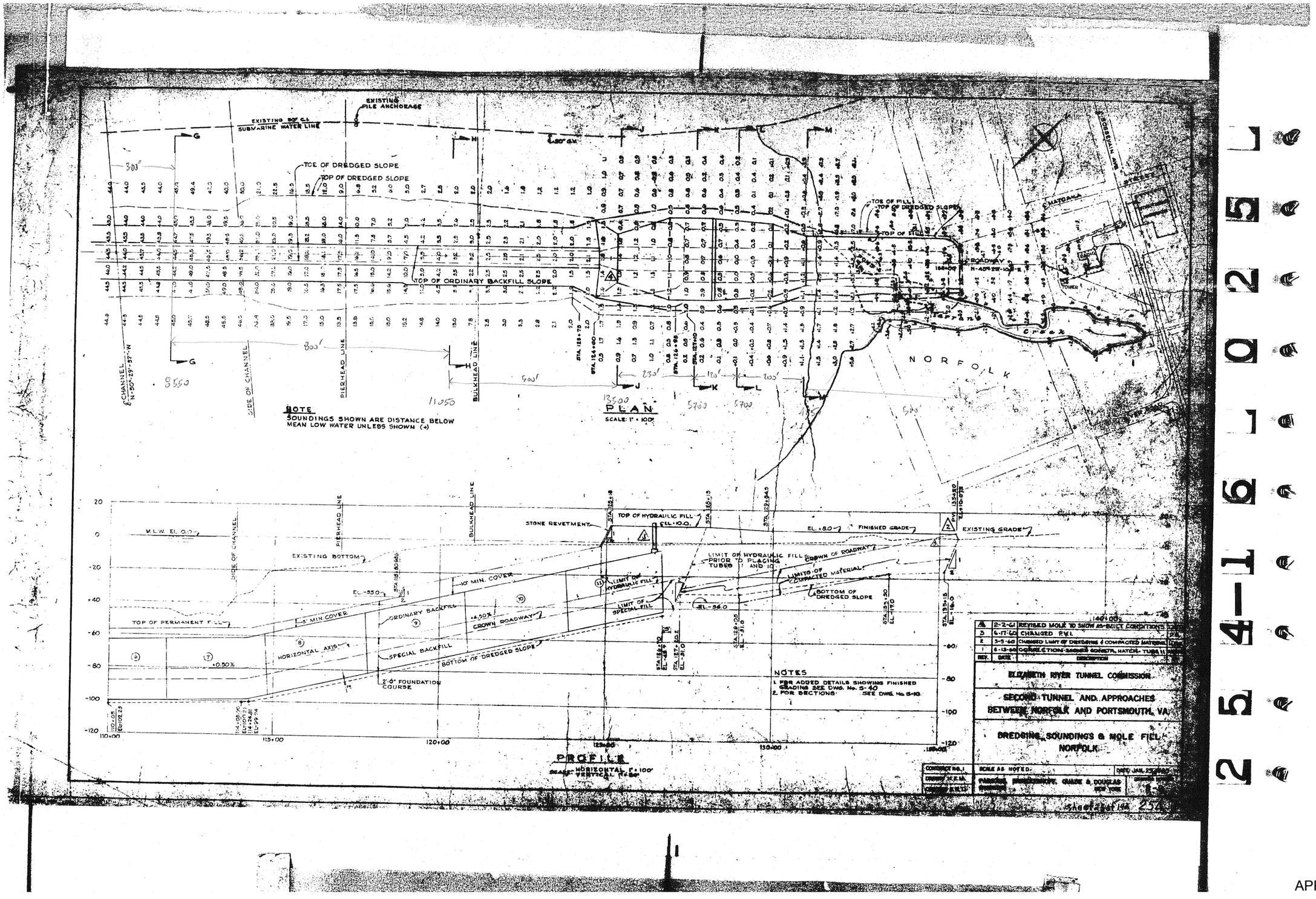
2 5 4-1 6 , 0 1 8

APPEDIX A-1f



2 5 4 - 1 6 - 0 2 4 1

APPENDIX A-1g



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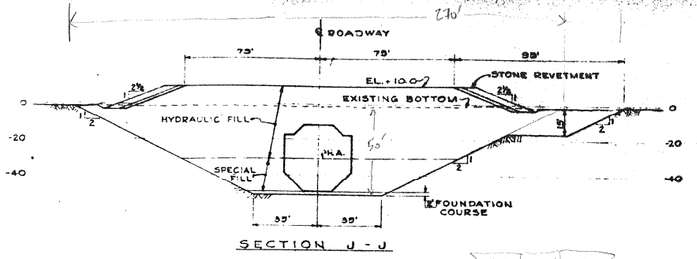
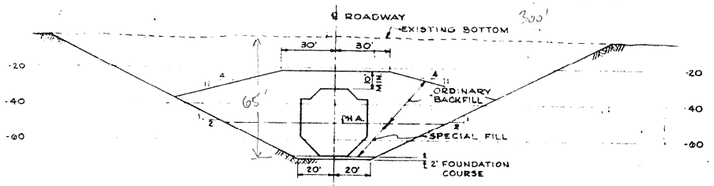


SECTION J - J

5000 | 3500 | 5000

13500 Ac

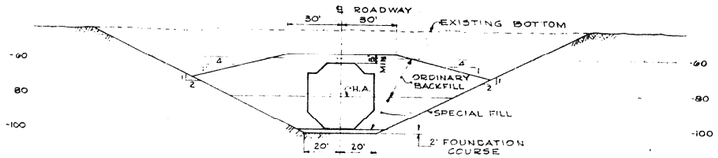


SECTION H - H

4225 | 7000 | 4225

11050 Ac

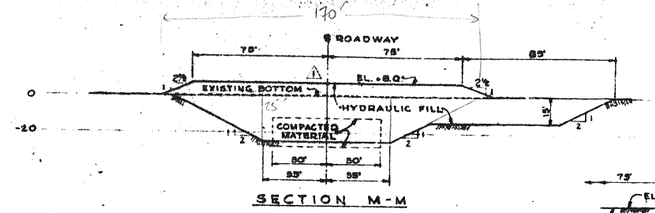
270'



SECTION G-G

3163 | 7240 | 3163

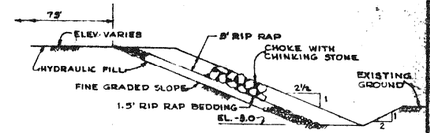
8526 Ac



SECTION M-M

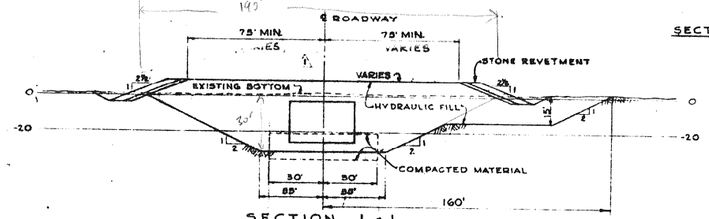
1250 | 1765 | 1250

4265 Ac



SECTION SHOWING STONE REVETMENT

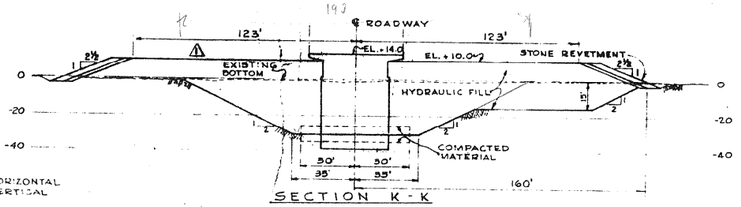
SCALE: 1" = 10'



SECTION L - L

720 | 2160 | 1440

5400 Ac



SCALE 1" = 30' { HORIZONTAL / VERTICAL

SECTION K - K

1400 | 2100 | 1400

5740 Ac

REV.	DATE	DESCRIPTION	BY
⚠	2-2-61	REVISED MOLE TO SHOW AS-BUILT CONDITIONS	L.A.S.

ELIZABETH RIVER TUNNEL COMMISSION

SECOND TUNNEL AND APPROACHES
BETWEEN NORFOLK AND PORTSMOUTH, VA.

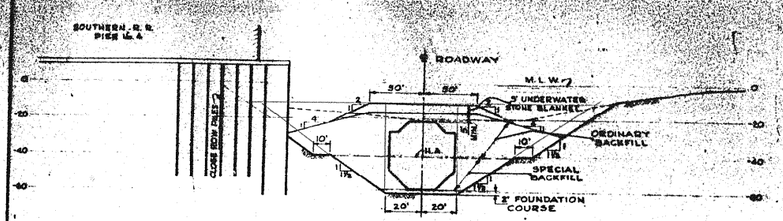
DREDGING CROSS SECTIONS
SHEET 1

CONTRACT NO. 1	SCALE AS SHOWN	DATE JAN. 25, 1960
DRAWN H.F.W.	PARSONS, BRINCKERHOFF, QUADE & DOUGLAS ENGINEERS NEW YORK	DRAWING NUMBER S-10
CHECKED D.M.T.		

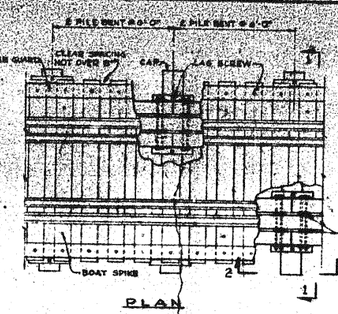
Sheet 6 of 142 254.16

254-16 6 9 2 1 6

APPENDIX A-1i

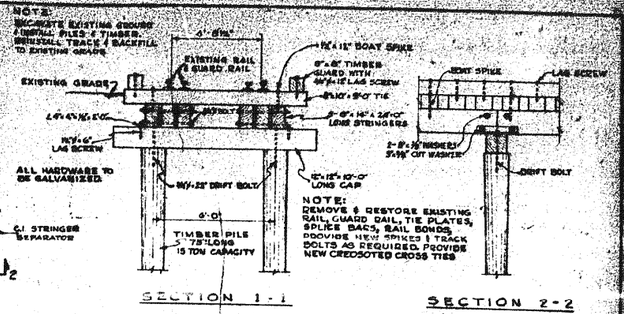


SECTION C-C



PLAN

NOTE:
EXCAVATE EXISTING GROUND TO INSTALL PILES & TIMBER. REINSTALL TRACK & BACKFILL TO EXISTING GRADE



SECTION 1-1

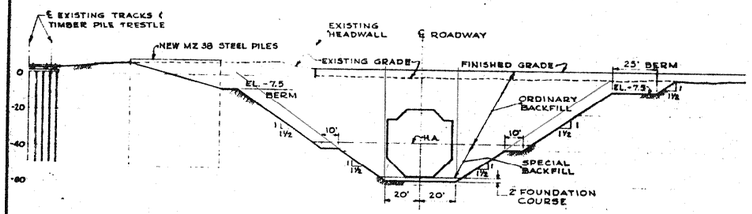
SECTION 2-2

NOTE:
REMOVE & RESTORE EXISTING RAIL, GUARD RAIL, TIE PLATES, SPLICE BARS, RAIL BONDS, PROVIDE NEW SPIKES & TRACK BOLTS AS REQUIRED. PROVIDE NEW CREOSOTED CROSS TIES

TIMBER PILE TRACK SUPPORT

SCALE: 3/8" = 1'-0"

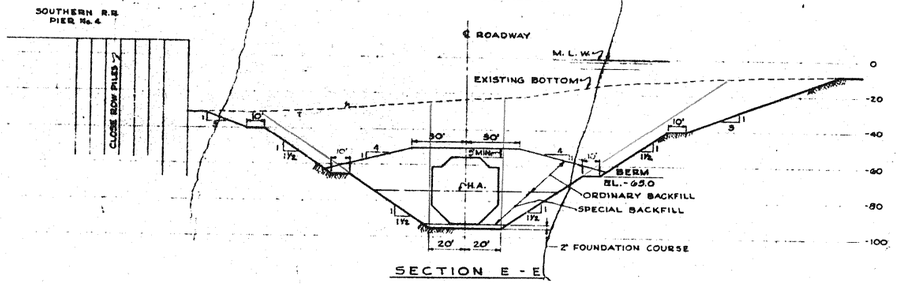
250 | 7000 | 7500



SECTION B-B

NOTE:
FOR REMOVAL OF UNSUITABLE MATERIALS AND FOUNDATION TREATMENT SEE SUPPLEMENTARY ENG. No. 5-3

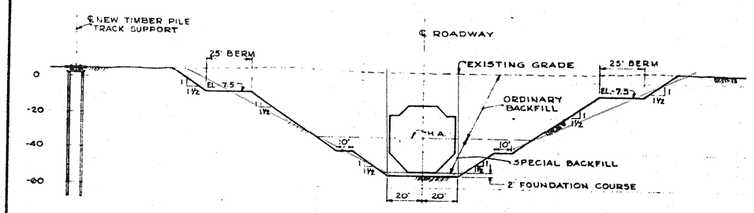
⚠



SECTION E-E

1200 | 7800 | 11400

11900 ft²

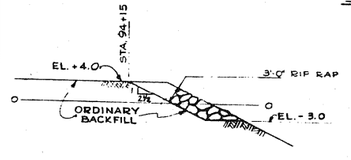


SECTION A-A

⚠

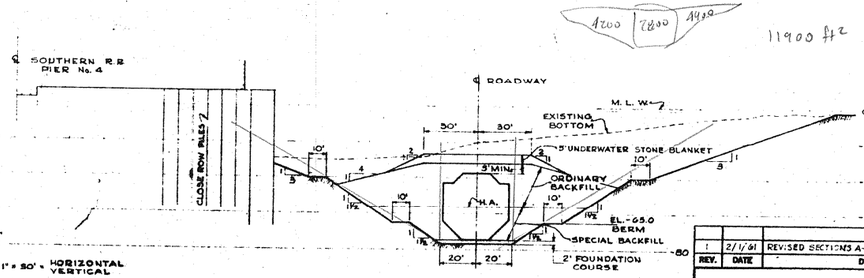
3000 | 2200 | 3000

9200



SECTION F-F
RIP RAP DETAIL
SCALE: 1" = 10'

SCALE: 1" = 50' = HORIZONTAL
VERTICAL



SECTION D-D

2000 | 2900 | 3300

7700 ft²

REV.	DATE	DESCRIPTION	BY
1	2/1/61	REVISED SECTIONS A-A & B-B & ADDED NOTE	DMT

ELIZABETH RIVER TUNNEL COMMISSION

SECOND TUNNEL AND APPROACHES BETWEEN NORFOLK AND PORTSMOUTH, VA.

DREDGING CROSS SECTIONS SHEET 2

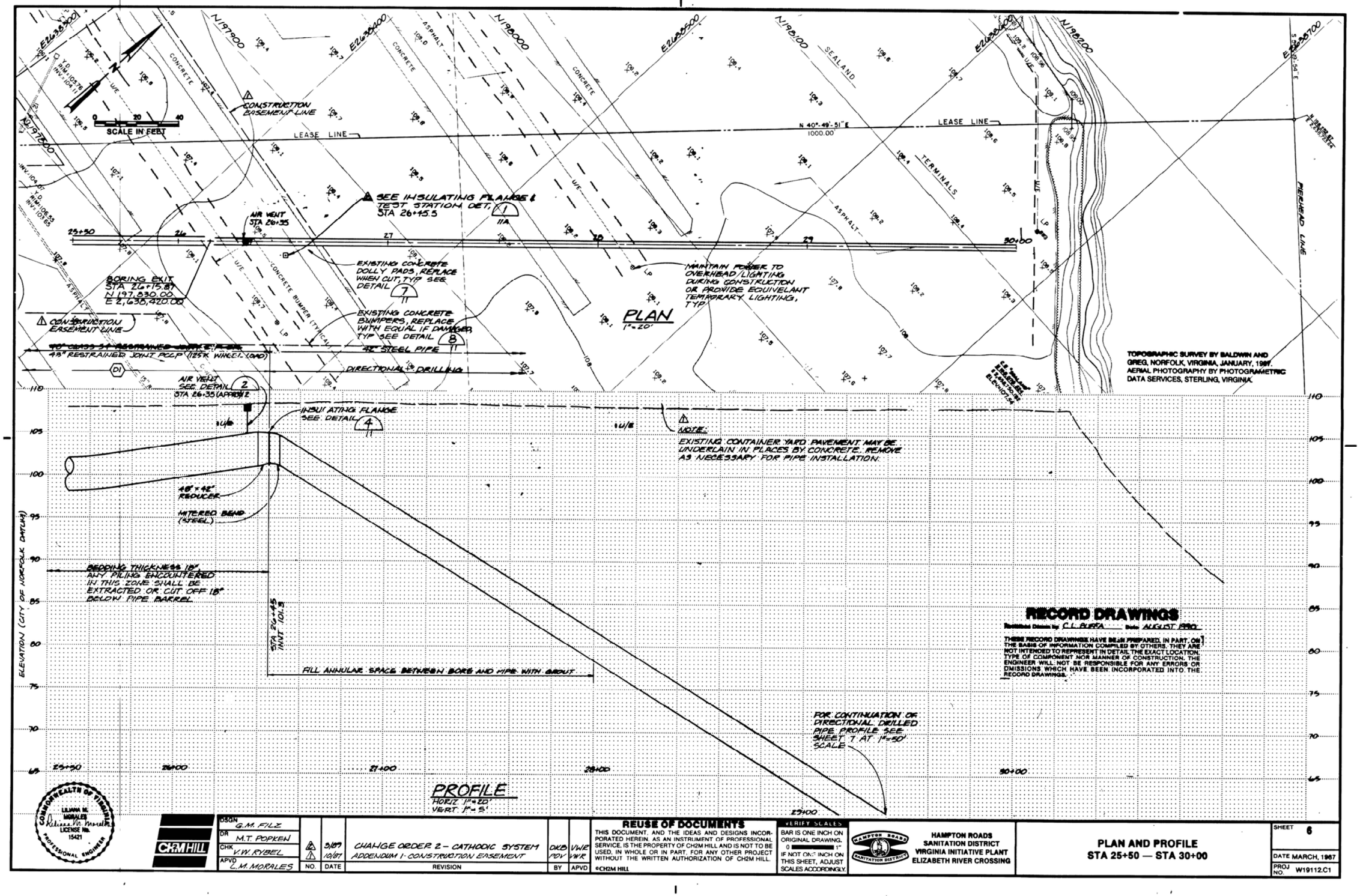
CONTRACT NO. 1 | SCALE AS SHOWN | DATE JAN. 6th, 1961

DESIGNED BY M. M. | PARSONS, BRINCKERHOFF, QUADE & DOUGLAS | NEW YORK

DRAWN BY J. H. S. | CHECKED

2 5 4 1 6

APPENDIX B
SEWER PIPELINES, HAMPTON ROADS SANITATION DISTRICT
1967 DRAWINGS



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Revisions Drawn by C.L. PUSEY Date AUGUST 1990

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COMMONWEALTH OF VIRGINIA — LILIANA M. MORALES — LICENSE NO. 15421 — PROFESSIONAL ENGINEER

CH2M HILL

DSGN	G.M. FILZ
DR	M.T. POPKEN
CHK	V.W. RYBEL
APVD	L.M. MORALES

NO.	DATE	REVISION	BY	APVD
2	3/89	CHANGE ORDER 2 – CATHODIC SYSTEM	DKB	VWR
1	10/87	ADDENDUM 1- CONSTRUCTION EASEMENT	PDV	VWR

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HAMPTON ROADS SANITATION DISTRICT

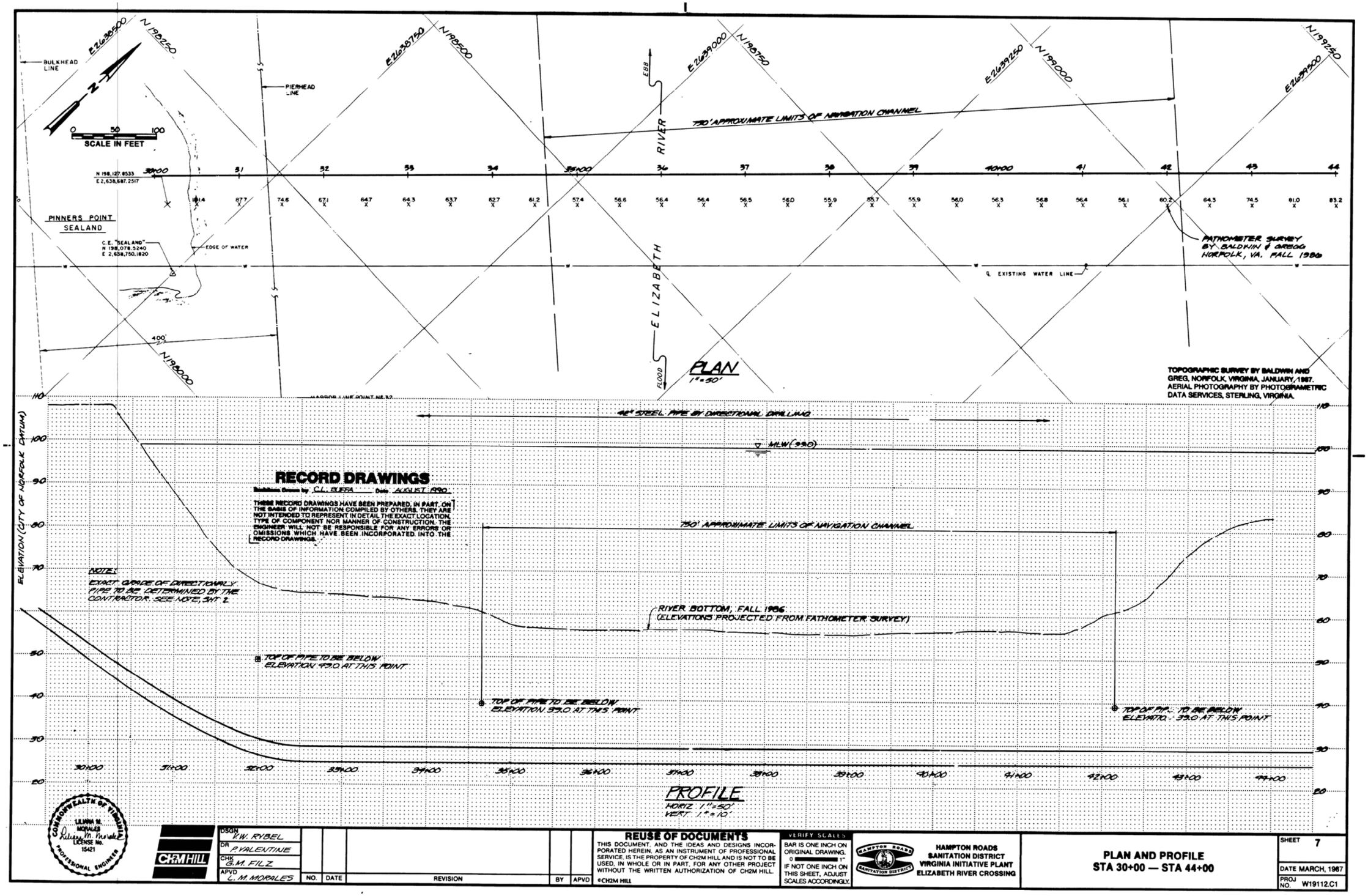
HAMPTON ROADS SANITATION DISTRICT
VIRGINIA INITIATIVE PLANT
ELIZABETH RIVER CROSSING

PLAN AND PROFILE
STA 25+50 — STA 30+00

SHEET 6

DATE MARCH, 1987

PROJ NO. W19112.C1



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LILIANA M. MORALES
License No. 15421
PROFESSIONAL ENGINEER

CH2MHILL

DSGN	V.W. RYBEL
DR	P.VALENTINE
CHK	G.M. FILZ
APVD	L.M. MORALES

NO.	DATE	REVISION	BY	APVD

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0 1"
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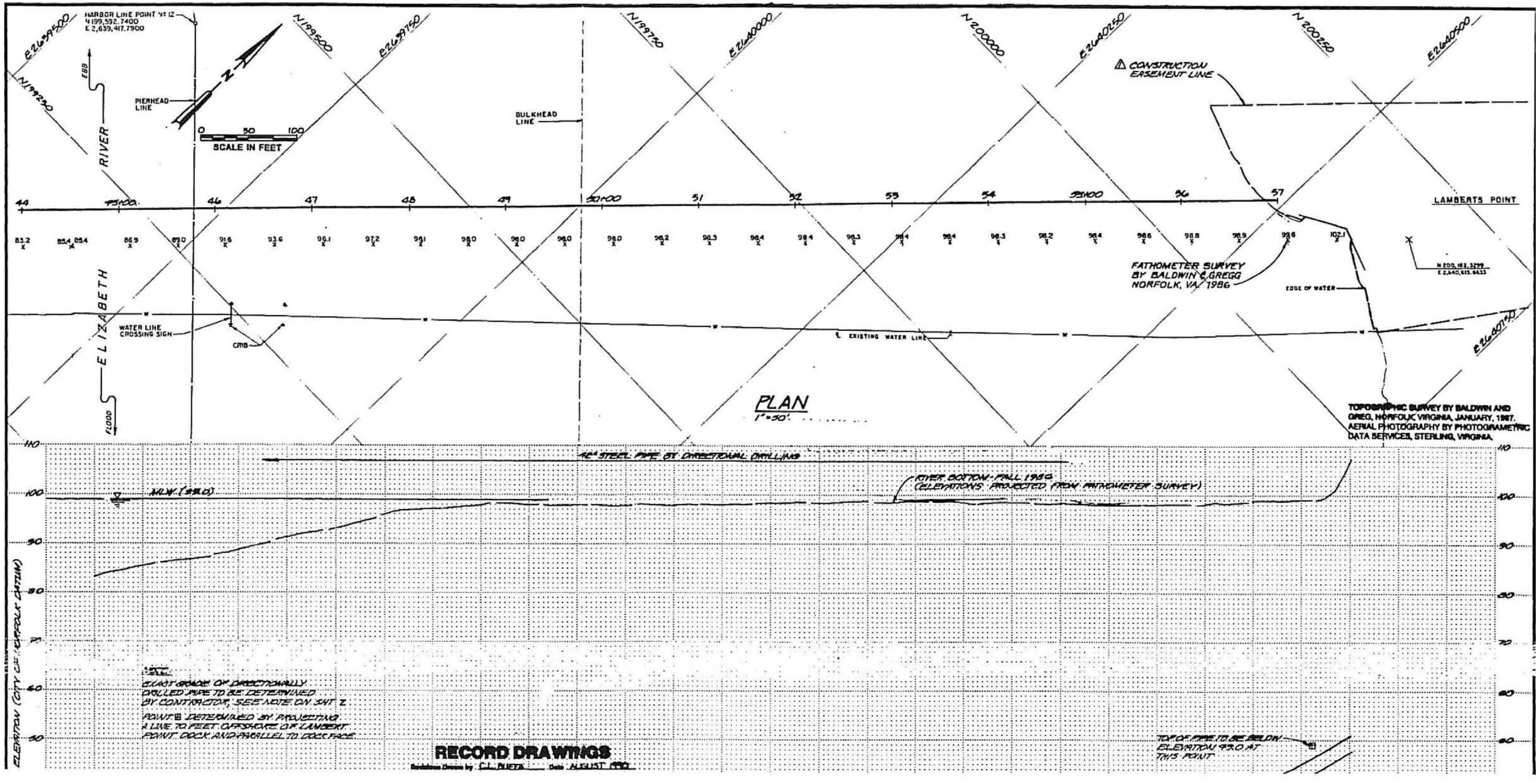
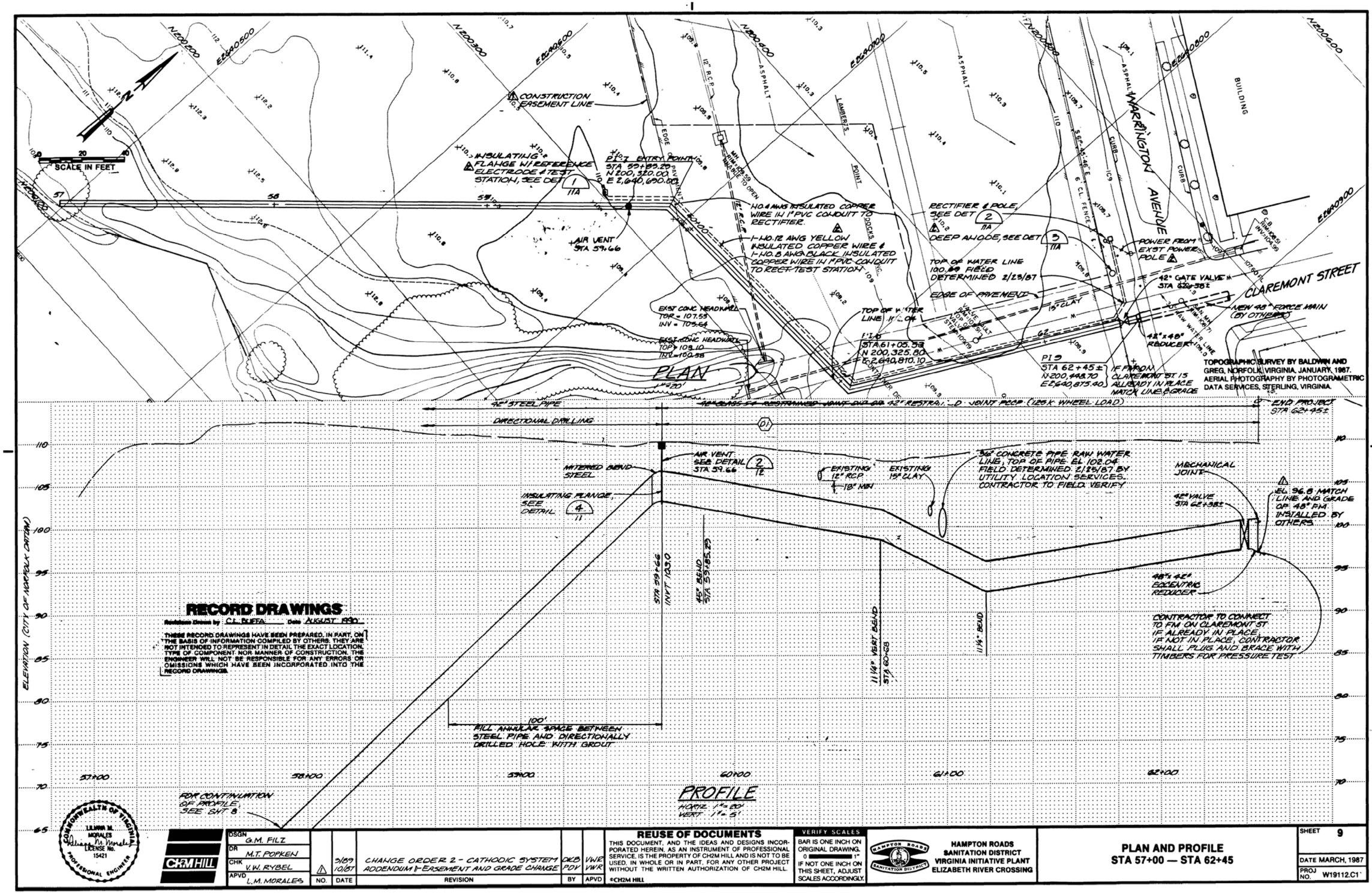
HAMPTON ROADS SANITATION DISTRICT
VIRGINIA INITIATIVE PLANT
ELIZABETH RIVER CROSSING

PLAN AND PROFILE
STA 30+00 — STA 44+00

SHEET 7
DATE MARCH, 1987
PROJ NO. W19112.C1


HARBOR LINE POINT No 12
N 199,592.7400
E 2,639,417.7900
PIERHEAD LINE
BULKHEAD LINE
SCALE IN FEET
RIVER
ELIZABETH
CONSTRUCTION EASEMENT LINE
LAMBERTS POINT
FATHOMETER SURVEY BY BALDWIN & GREGG NORFOLK, VA. 1986
EDGE OF WATER
WATER LINE CROSSING SIGN
CRIB
EXISTING WATER LINE
PLAN
1"=50'
TOPOGRAPHIC SURVEY BY BALDWIN AND GREG, NORFOLK, VIRGINIA, JANUARY, 1987.
AERIAL PHOTOGRAPHY BY PHOTOGRAMETRIC DATA SERVICES, STERLING, VIRGINIA.
42" STEEL PIPE BY DIRECTIONAL DRILLING
RIVER BOTTOM-FALL 1986 (ELEVATIONS PROJECTED FROM FATHOMETER SURVEY)
ELEVATION (CITY OF NORFOLK DATUM)
EXACT GRADE OF DIRECTIONALLY DRILLED PIPE TO BE DETERMINED BY CONTRACTOR, SEE NOTE ON SHT 2
POINT ⊞ DETERMINED BY PROJECTING A LINE 70 FEET OFFSHORE OF LAMBERT POINT DOCK AND PARALLEL TO DOCK FACE
TOP OF PIPE TO BE BELOW ELEVATION 93.0 AT THIS POINT
RECORD DRAWINGS
Revisions Drawn by C.L. BUFFA Date AUGUST 1990



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CH2M HILL

DSGN	G.M. FILZ
DR	M.T. POPKEN
CHK	V.W. RYBEL
APVD	L.M. MORALES

NO.	DATE	REVISION	BY	APVD
1	3/89 10/87	CHANGE ORDER 2 - CATHODIC SYSTEM ADDENDUM 1 - EASEMENT AND GRADE CHANGE	DLB PDV	VWR VWR

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HAMPTON ROADS SANITATION DISTRICT
VIRGINIA INITIATIVE PLANT
ELIZABETH RIVER CROSSING

PLAN AND PROFILE
STA 57+00 — STA 62+45

SHEET 9
DATE MARCH, 1987
PROJ NO. W19112.C1

APPENDIX C
WATER PIPELINES, DEPARTMENT OF UTILITIES
CITY OF NORFOLK
1974 DRAWINGS

NOTE: DETAIL DRAWING W.I.10243C NOT INCLUDED IN THIS APPENDIX. THIS DRAWING SHOWS PILE STRUCTURE DETAIL AND IS AVAILABLE AT THE CITY OF NORFOLK

B-13

D-13

WATER

WATER

ELIZABETH RIVER

C-14

SHEET INDEX

DEPT. OF UTILITIES

WATER

Rev 9-5-05

PLANIMETRIC MAP

CITY OF NORFOLK VIRGINIA

DATE OF PHOTOGRAPHY MARCH 1974 DATE OF MAPPING MARCH 1975

ABRAMS AERIAL SURVEY CORPORATION

LANSING, MICHIGAN

GRIDS BASED ON VIRGINIA STATE PLANE COORDINATE SYSTEM SOUTH ZONE

C-13

SCALE IN FEET

SHEET NO. C-13

A.A.S.C. 13591

C-12

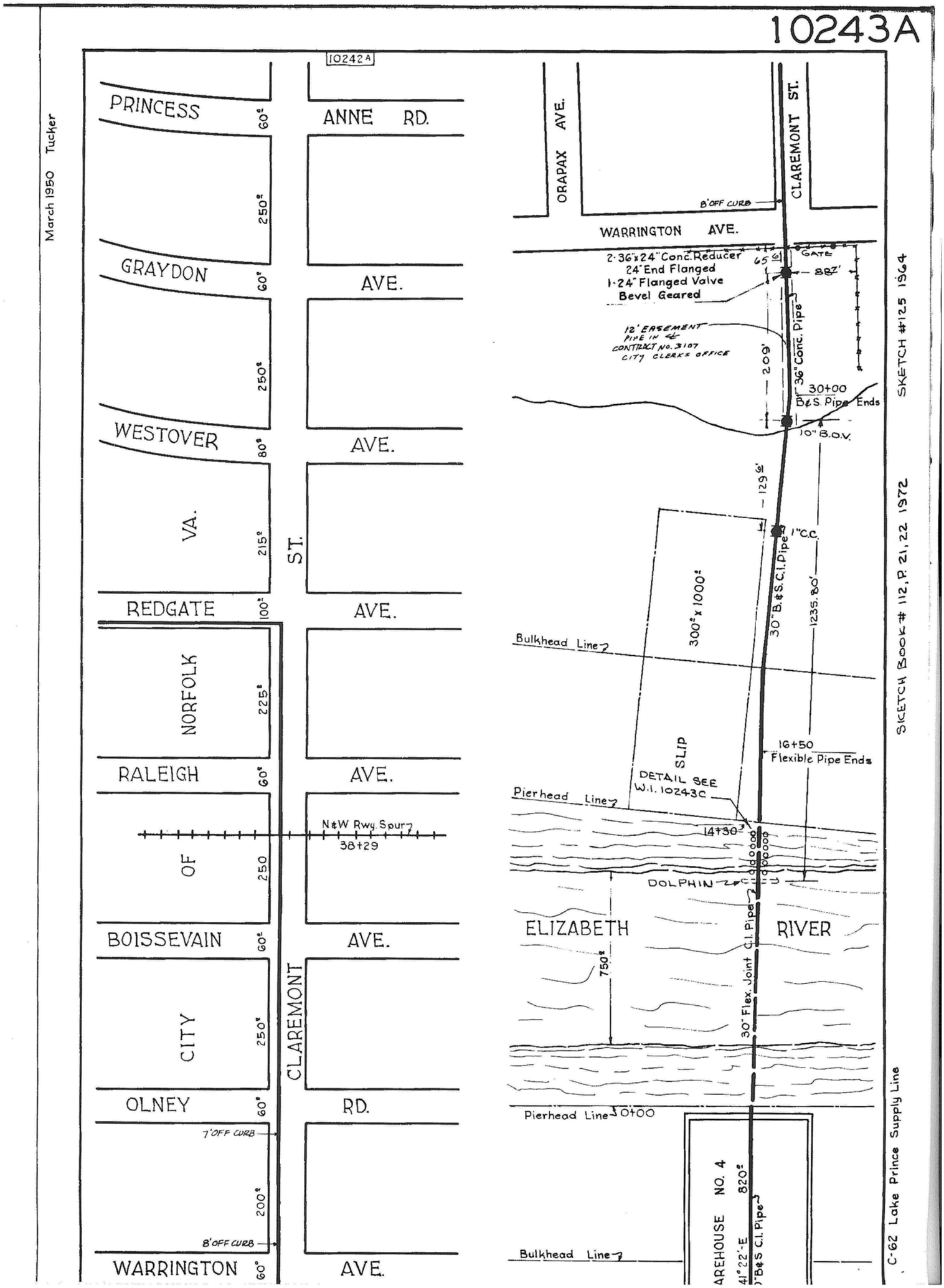
SHEET NO. C-13

B-13

D-13

APPENDIX C-1b

10243A


March 1950 Tucker
10242A
PRINCESS
ANNE RD.
GRAYDON
AVE.
WESTOVER
AVE.
VA.
ST.
REDGATE
AVE.
NORFOLK
RALEIGH
AVE.
N&W Rwy. Spur
38+29
OF
BOISSEVAIN
AVE.
CITY
CLAREMONT
OLNEY
RD.
7' OFF CURB
8' OFF CURB
WARRINGTON
AVE.
ORAPAX AVE.
CLAREMONT ST.
8' OFF CURB
WARRINGTON AVE.
2-36"x24" Conc. Reducer
24" End Flanged
1-24" Flanged Valve
Bevel Geared
GATE
12' EASEMENT
PIPE IN
CONTRACT No. 3107
CITY CLERKS OFFICE
36" Conc. Pipe
30+00
B&S Pipe Ends
10" B.O.V.
1"C.C.
30" B.&S.C.I. Pipe
300'x1000'
SLIP
DETAIL SEE
W.I. 10243C
Bulkhead Line
Pierhead Line
16+50
Flexible Pipe Ends
14+30
DOLPHIN
ELIZABETH
RIVER
C.I. Pipe
30" Flex. Joint
750'
Pierhead Line
10+00
Bulkhead Line
AREHOUSE NO. 4
820'
B&S C.I. Pipe
SKETCH #125 1964
SKETCH BOOK # 112, P. 21, 22 1972
C-62 Lake Prince Supply Line

APPENDIX D
MASTER LAND USE PLANS, PORTSMOUTH MARINE TERMINAL
VIRGINIA PORT AUTHORITY
1193 DRAWINGS

MASTER LAND USE PLANS
Virginia Port Authority
PORTSMOUTH MARINE TERMINAL

GRAPHIC SCALE
1 IN. = 100 FT.
100 0 100 200
SCALE IN FEET

ELIZABETH RIVER (WESTERN BRANCH)
EBB
FLOOD

MARGINAL WHARF

OUTFALL #11
OUTFALL #12
OUTFALL #13
OUTFALL #14
OUTFALL #15
OUTFALL #16

SEA LAND SERVICE TERMINAL

MARINE OPERATIONS BUILDING
PMT000126

PUMP STATION

MAINTENANCE AND REPAIR
PMT000127

TRANSIT SHED
PMT000128

OFFICE
PMT 000129

SANITARY PUMP STATION

RAMP

PUMP STATION

SEABOARD AVENUE

FORCE MAIN VALVE

JENT BLDG.

PUMP STATION

INSPECTION BLDG. & CANOPY
PMT000131

GATE HOUSE AND SCALE
PMT000132

EAST WATERFRONT

MOON ENGINEERING CO.

CITY OF PORTSMOUTH

VIRGINIA PORT AUTHORITY

MARTIN LUTHER KING FREEWAY

MIDTOWN TUNNEL

ELIZABETH RIVER (SOUTHERN BRANCH)
EBB
FLOOD

LEGEND

MANHOLE	●
SANITARY SEWER MAIN	8" SAN
STORM SEWER	8"
YARD DROP INLET	■
CURB DROP INLET	□
FLARED END SECTION	
HEADWALL	
SWALE	
FORCE MAIN	6"FM

TAB C-2

INDEX
STORM DRAINAGE AND SANITARY SEWERAGE
SHEET 14 OF 20

SEE SHEET 13 — MATCH LINE

SEE SHEET 16 — MATCH LINE

FILE: 9256/PMT-SH2 12-2-93 1-100
VIEW: PLOT
SCRIPT: TAB-C2

FUGRO ATLANTIC

-VOLUME 5-
GEOTECHNICAL DATA REPORT
MARINE DRILLING, IN SITU TESTING, AND LABORATORY TESTING
PROPOSED MIDTOWN SECOND PARALLEL TUNNEL

Prepared for:
VIRGINIA DEPARTMENT OF TRANSPORTATION

June 2008
Fugro Project No. 3602.001



FUGRO ATLANTIC

101 West Main Street, Suite 350
Norfolk, Virginia 23510
Tel: (757) 625-3350

June 30, 2008
Project No. 3602.001

Virginia Department of Transportation
1221 E. Broad Street
Richmond, Virginia 23219

Attention: Mr. Raymond Partridge, Project Manager, Innovative Project Delivery

Subject: Volume 5, Geotechnical Data Report, Marine Drilling, In Situ Testing, and Laboratory Testing, Proposed Midtown Second Parallel Tunnel

Dear Mr. Partridge:

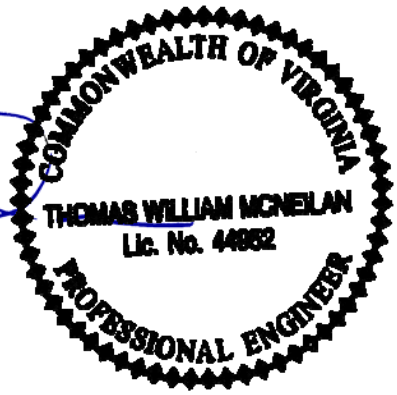
Fugro Atlantic (Fugro) has completed an extensive marine geotechnical exploration and laboratory testing program in support of the Virginia Department of Transportation (VDOT) proposed Midtown Second Parallel Tunnel. These services were performed in accordance with the scope of work developed in meetings between VDOT and Fugro, and our Subconsultant Agreement Amendment No. 2, dated February 5, 2008.

This report summarizes the results of the marine exploration phase, which consisted of: 1) marine borings, 2) in situ: cone penetration test (CPT) soundings, T-Bar soundings, and vane shear testing, and 3) laboratory testing. The data obtained during the exploration are presented in the form of Boring, CPT, and T-Bar logs, as well as vane shear and laboratory test plots. In addition, a discussion of the methods, equipment, and procedures used during the exploration, as well as tables summarizing the pertinent data, are provided.

It has been a pleasure working with you through this phase of the project. We look forward to the opportunity to provide continued support as the project progresses.

Sincerely,

FUGRO ATLANTIC



Matthew Q. Pollard
Project Engineer

Thomas W. McNeilan, P.E.
Vice President

Copies Submitted: (4) Addressee and PDF provided on CD

(1) Mr. John Daoulas, P.E., Senior Geotechnical Engineer for Special Projects, VDOT

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1.2 Scope of Work 1
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2.2 Geotechnical Platform 3
2.3 Positioning and Surveying 3
2.4 Drilling Methods and Equipment 4
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Geotechnical Report Organization 2
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Roson Photographs ..... 5a to 5d

CHART

Chart

Exploration Location Map 1

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1.0 INTRODUCTION

1.1 PROJECT OVERVIEW

The proposed Midtown Second Parallel Tunnel is a main component of the major infrastructure improvement project aimed at providing increased capacity for east-west travel across the Elizabeth River. The Second Parallel Tunnel will extend between: 1) U.S. Route 58 and Interstate 264 in Portsmouth, and 2) Brambleton Avenue/Hampton Boulevard in Norfolk. The existing Midtown Tunnel provides one lane of travel in each direction. Currently, significant traffic congestion occurs at the tunnel during both the morning and evening peak periods. The second tunnel will provide two westbound travel lanes, allowing the existing tunnel to accommodate two lanes of eastbound traffic. Additionally, the second tunnel will provide increased flexibility for redirecting traffic during maintenance operations and emergency situations.

Preliminary information provided by the Virginia Department of Transportation (VDOT) indicates that the second tunnel is to be located northwest (downstream) of, and parallel to, the existing tunnel. In addition, VDOT anticipates that the second tunnel will follow a similar vertical alignment as the existing first tunnel. VDOT has defined the project area to extend 300 feet northwest (downstream) of the northern edge of the existing tunnel. The project vicinity is shown on Figure 1.

The current report and marine exploration program are part of a series of geotechnical exploration and survey activities for the Second Parallel Tunnel. Figure 2 shows the organization of the various reports that are being prepared for the geotechnical exploration and surveys for the project.

1.2 SCOPE OF WORK

The Midtown Second Parallel Tunnel marine geotechnical exploration and laboratory testing program consisted of three major components: 1) marine drilling and sampling using Fugro Seacore's (FSC) *Skate 2D* jack-up platform, 2) cone penetration test (CPT), T-bar, and vane shear testing using Fugro Alluvial Offshore Limited's (FAOL) Roson in situ testing system, and 3) onboard and on-shore laboratory testing of samples collected during the drilling operations.

The field program included the following explorations:

- 10 marine borings, advanced to depths ranging from 79 to 127 feet below the river bottom;
- 40 CPT soundings advanced 15 to 98 feet below the river bottom;
- 4 T-Bar soundings advanced 12 to 38 feet below the river bottom; and
- 4 vane shear test profiles advanced 10 to 40 feet below the river bottom.

The laboratory program included the following types of tests:

- Index Properties (Moisture, Density, Atterberg Limits, Grain Size Distribution, Specific Gravity, Organic Content);
- Corrosivity (Resistivity, pH, Chloride Content, Sulfate Content);
- Onboard Strength Tests (Pocket Penetrometer, Torvane, Minivane, UU Triaxial);
- Advanced Strength Tests (Direct Shear, CD and CU Triaxial); and
- Compressibility (Incremental and CRS Consolidation).

1.3 PROJECT DATUMS

The horizontal datum were State Plane (Virginia South, feet) grid coordinates with the following spheroidal projection and projection parameters:

Datum	NAD83
Spheroid	NAD83
Semi-major Axis	6,378,137.000 m
Semi-minor Axis	6,356,752.314 m
Inverse Flattening	298.2572235630
Eccentricity2	0.006694379990141
Projection	Lambert Conformal Conic
Grid	Lambert Conformal Conic (NAD83)
Zone	Virginia South (feet)
Latitude of Origin	36° 19'59.998"
Longitude of Origin	-78° 50' 00.000" W
False Easting	11,482,916.667 ft
False Northing	3,280,833333 ft
Scale Factor	0.3048
Convergence	World Standard

The vertical datum reference for the marine exploration was Mean Lower Low Water (MLLW). Measured water depths were corrected to Mean Lower Low Water (MLLW) based upon tidal data obtained from the National Oceanic and Atmospheric Administration (NOAA) tide gauge Station No. 8638610 (1983 through 2001 tidal epoch) located at Sewells Point, Hampton Road, and later refined using multibeam bathymetric data.

1.4 AUTHORIZATION

Fugro marine survey and geotechnical site exploration program in support of the VDOT proposed Midtown Second Parallel Tunnel project was authorized by an Interagency Agreement between the Virginia Port Authority (VPA) and VDOT. Fugro's services for the Second Parallel Tunnel were completed in general accordance with our proposal, dated January 7, 2008. The execution of that scope of work was authorized by amendments of the contract between the VPA and the Craney Island Design Partners (CIDP), LLC and the associated subcontract between the CIDP and Fugro Atlantic.

2.0 MARINE DRILLING

2.1 SKATE 2D OPERATIONS

Marine borings were conducted within the project area to: 1) collect subsurface soil samples, 2) characterize stratigraphic variations at the site, and 3) collect Standard Penetration Test (SPT) results for comparison to 1960s era borings for the original Midtown Tunnel.

A total of 10 marine borings were conducted within the project area using Fugro's *Skate 2D* jack-up platform. Termination depths ranged from 78.6 to 127.2 feet below the river bottom, with water depths ranging from 11 to 48 feet. The locations of the borings are shown on Figure 3 and Chart 1.

Details of the equipment used for the project as well as drilling, sampling, and testing methods are presented in the following sections. A summary of the borings is presented in Figure A-1, which includes the completion date, coordinates, approximate water depth, completion depth, and terminal elevation. A key to the Boring Logs is presented in Figure A-2. Individual Boring Logs are presented on Figures A-3 to A-12. In addition to lithology, the logs include index properties and onboard strength test results. In addition to the marine boring log format provided on Figures A-3 through A-12, the boring results are also provided in standard VDOT log format on Figures A-13 through A-21.

2.2 GEOTECHNICAL PLATFORM

Marine drilling operations were conducted from FSC *Skate 2D* jack-up platform. The Skate series was designed and built by FSC to serve as compact, modular, container-transportable jack-up platforms that are especially suited for working in confined intertidal zones. The *Skate 2D* platform has a rapid deck elevating system and is equipped with four legs mounted externally to provide maximum stability. Due to the soft sediments underlying the project area, the *Skate 2D* was operated in spud mode rather than jack-up configuration at all but two exploration locations (B-10 and B-11).

The platform was used in its five container-module configuration, which provides a deck area measuring 48.0 feet (14.65 meters) by 39.6 feet (12.06 meters), and a surface area of 1901 square feet (176.7 square meters). The *Skate 2D* is equipped with a hydraulic thruster to provide self-propulsion and an outboard-driven personnel launch for crew changes.

In addition to drilling equipment, the *Skate 2D* is equipped with a container that serves as a workshop and galley. A second container was placed onboard to house laboratory testing equipment and to provide soil sample processing and packaging facilities. Photographs of the *Skate 2D* are presented on Figures 4a through 4c.

2.3 POSITIONING AND SURVEYING

Though the *Skate 2D* is self-propelled, a tugboat operated by a licensed captain was chosen to assist in positioning the platform and to maintain communications with passing vessels. At the request of the United States Coast Guard, the tugboat remained tied-off to the

platform while located over explorations within the limits of the heavily-traveled navigation channel of the Elizabeth River.

Vessel positioning was achieved using a differential Global Positioning System (DGPS) operated by Fugro's surveyors. Computer monitors were placed in the galley/office, as well as on the tugboat bridge, to observe the progress as the tugboat navigated the platform onto location. Once the *Skate 2D* was positioned, the spud legs were lowered to stabilize the platform. The final position was approved by the shift engineer and recorded by the surveyor. Spud leg locations were also recorded to avoid testing disturbed material during subsequent explorations.

The water depth at each location was measured prior to the start of drilling using a weighted tape measure. A tally of the drill rods required to reach the river bottom was also made. Measured water depths were corrected to Mean Lower Low Water (MLLW) based upon tidal data obtained from the National Oceanic and Atmospheric Administration (NOAA) tide gauge Station No. 8638610 (1983 through 2001 tidal epoch) located at Sewells Point, Hampton Road, and later refined using multibeam bathymetric data.

During drilling operations in spud mode, when the vessel was subject to tidal fluctuations, marks corresponding to the water depth at the start of drilling were made on one spud leg. As the drill string approached each sampling interval, the barge elevation relative to the initial mark on the fixed spud leg was observed. The required drill string length was adjusted accordingly so that samples were recovered at the specified penetrations below the river bottom.

2.4 DRILLING METHODS AND EQUIPMENT

The borings were drilled with a specialized, inshore marine CR2 drilling mast that consists of a multi-purpose twin A-frame measuring 39.4 feet by 6.9 feet. It is designed to reduce the unproductive, labor intensive operations normally associated with over-water drilling. The CR2 is fitted with a high-powered Dando 500 hydraulic power swivel for rotary drilling and coring. The rig, as well as associated drilling equipment, was provided and operated by FSC.

The borings for the project were performed using wet-rotary methods. Prior to commencement of drilling at each location, an 8-inch-outside diameter Seacore Heavy Duty (SHD) casing was lowered to the seafloor. This casing was fitted with a coring bit and also served as the drill pipe in the soft sediments present in the upper portions of the borings. Once stiffer materials were encountered, the boring was continued by use of either a coring bit or drag bit attached to a 5.5-inch outside diameter Geobor-S drill pipe, advanced through the larger diameter SHD casing.

Guar gum and bentonite-based drilling fluid were used to suspend and remove drill cuttings, as well as to provide lateral pressure to support the sides of the boreholes. Although an attempt was made to recirculate the drilling fluid inside the casing, a minimal amount was expelled onto the river bottom. The boreholes were abandoned without backfill or grouting, as per the contract scope of work.

Drilling operations were conducted under the technical guidance and observation of the Fugro shift engineer, who also described and packaged the recovered samples, and performed laboratory testing.

2.5 GEOTECHNICAL SAMPLING

The soil sampling interval was generally consistent throughout the marine drilling program. In the upper 33 feet (10 meters), samples were typically obtained at 3.3-foot (1-meter) intervals. Below this depth, the sampling interval was increased to 5 feet (1.5 meters) until the target depth. In the lower portions of the three deepest explorations (B-3, B-4 and B-5), the sampling interval was increased to 9.8 feet (3 meters) upon encountering the clays associated with the Yorktown Formation. These deeper borings were terminated after two samples of clay were obtained.

Several sampling procedures were used during the marine drilling program. The sampling methods and equipment are described below:

Table 1. Sampling Methods

Sampling Method	Sampler Description	Description of Sampling Method
Push Samples	3-inch-OD, 2.83-inch-ID	Push samples were obtained by pushing a thin-walled tube sampler into the soil using the weight of the drill string. After the boring was drilled to the desired depth, the drag bit (if in use) was raised from the borehole bottom and the sampler was lowered through the drill string until it latched into a catch ring above the drill bit. The sampler was then pushed about 2.5 feet (30 inches) into the formation by lowering the drill string. The sampler was retrieved using a wireline. The push sampler was typically used when sampling fine-grained material.
Wire Line Percussion Samples	2.25-inch-OD, 2.125-inch-ID & 2.5-inch-OD, 2.125-inch-ID,	Percussion samples were obtained by driving either a 2.215-in-ID by either 2.25-in.-OD thin-walled tube or 2.50-in.-OD thick-walled tube into coarse-grained sediments. The samplers were attached to a 175-pound sliding downhole hammer operated on a wireline (wireline sampler). The assembly was first lowered through the drill pipe until the sampler rested on the bottom of the borehole. The downhole hammer was then dropped approximately 5 feet a sufficient number of times to obtain either 18 or 24 inches of penetration, depending on the length of the sample tube, or until a maximum of 30 blows. The sampler was then retrieved with the wireline. Blowcounts for downhole percussion samples were recorded and are presented on the boring logs. Because the thin-walled tubes were repeatedly damaged during the first few attempts, the thick-walled tubes became the preferred sampler in coarse-grained materials for the remainder of the program.
SPT Samples	2-inch-OD, 1.375-inch-ID	The SPT sampler was attached to SPT sampling rods that were lowered through the drilling mud to the sample depth. The sampler was driven with a 140-pound donut hammer attached to the top of the sampling rods, dropping 30 inches. The hammer was operated on the same wireline system used for the percussion samples. Blowcounts were recorded over three consecutive 6-inch intervals and are presented on the boring logs. The test was performed in general conformance with standard test method ASTM D1586. Although the SPT sampling method is generally considered inferior to other sampling methods available, the SPT was used at approximately every third sample interval in order to provide a comparison to existing SPT data collected for the first Midtown Tunnel.

2.6 ENVIRONMENTAL SAMPLING

In accordance with the contract scope of work, environmental samples were collected concurrently with the geotechnical samples to assist in evaluating the subsurface chemistry of the existing soils. The environmental sampling was limited to the depth zone between the river bottom and base of the existing tunnel. Procedural guidelines and equipment necessary for the environmental sampling were provided by VDOT's environmental consultant.

At each boring location, the environmental sampling program included collecting composite samples over two defined zones. Two composite samples (one quart-sized plastic jar, one glass) were collected from sediments in the defined: 1) upper zone (upper 9 to 10 feet), and 2) lower zone (extending to the depth equal to the base of the existing tunnel). Small, 4-ounce glass jar samples were also collected at each specific sample depth interval.

Soil material for environmental sampling was split with that collected for geotechnical purposes. The samples were collected from materials not required for geotechnical testing using samplers and tools that had been cleaned and decontaminated in general accordance with the provided guidelines.

Environmental samples were packed in coolers with ice and delivered daily to a representative of the environmental consultant, adhering to proper chain-of-custody protocol. A sample of the drilling fluid was also provided near the completion of the drilling program.

2.7 SAMPLE PROCESSING

After recovering a sample, the shift engineer extruded, examined, and classified the recovered material. Representative portions of each sample were packed in plastic bags ("disturbed" samples) or wrapped in plastic wrap and aluminum foil and then sealed in plastic quart containers ("undisturbed" samples). Several fine-grained samples were saved in the sample tubes ("save tubes") using expandable packers and further sealed with wax. Those tubes were then capped and stored upright.

A significant amount of laboratory testing was performed onboard the drilling barge during sample processing. A discussion of the onboard laboratory test procedures and results is provided in Section 4.1 of this report.

Soil descriptions and onboard laboratory test results were entered into specialized geotechnical engineering software to generate preliminary boring logs and facilitate real-time updates to the Geographic Information System (GIS) project database.

3.0 IN SITU TESTING

3.1 ROSON OPERATIONS

In situ testing was conducted within the project area to: 1) collect a continuous record of subsurface stratigraphy, and 2) characterize the strength and stiffness of the soils at the site.

A total of 40 CPT soundings, 4 T-Bar soundings, and 4 vane shear profiles were conducted within the project area using FAOL's Roson in situ testing system. The locations of the in situ tests are shown on Figure 3 and Chart 1. Details of the equipment and methods used during the in situ testing program are presented in the following sections. Photographs of the Roson system are presented on Figures 5a to 5d.

3.2 ROSON SYSTEM

The Roson system is designed to evaluate in situ soil properties for a wide range of subsurface conditions and water depths. The unit consists of a tethered frame, with a base measuring 7.2 by 10.5 feet. The height of the unit is 8.5 feet. Due to the soft sediments underlying the project area, a 3-foot steel skirt was added to the base to provide greater stability. Additionally, for in situ testing locations in water depths greater than about 25 feet, a 15-foot mast was added to provide additional rod support. The system weighs approximately 22,000 pounds, with the ability to add weights to the frame for ballast.

A variety of in situ testing tools can be used with the Roson system, including CPT, T-Bar, and vane shear equipment. The selected tool is connected to 3.3-foot- (1 meter)-long, thick-walled, hollow sounding rods that are pushed into the soil by the frictional wheel-drive units. The modular, electric wheel-drive units are clamped to the sounding rods and provide continuous penetration. For the Midtown Second Parallel Tunnel project, 3 wheel-drive units were used, providing up to 27,000 pounds of thrust.

The unit is lowered to the river bottom using the crane mounted on the deployment barge. The Roson system is equipped with sensors that allow the system operator to monitor the pitch and roll of the frame. A communication cable transmits the measured signal from the unit to the on-deck, data acquisition system, which consists of specially designed software and equipment for real-time observation, data recording, and processing. A hydraulically-controlled, umbilical coiler is located on deck to deliver power to the wheel-drive system and provide a control interface to the unit. Once deployed to the river bottom, testing can be performed without disturbance from vessel movements.

3.3 DEPLOYMENT BARGE

Roson operations were performed aboard a chartered spud barge having a length of 120 feet, width of 55 feet, and a draft of 3 feet. A hydraulically-controlled cable winch system was used to raise and lower the two 90-foot-long spuds located on the starboard side of the barge.

A 140-foot boom crane was used to deploy the Roson unit. The crane was secured to the middle of the barge with turnbuckles attached to eyelets welded to the barge surface. The

barge deck also featured containers, which served as a workshop and system control/data collection area. An office trailer was also provided to house data processing and survey equipment.

3.4 POSITIONING AND SURVEYING

A tugboat operated by a licensed captain was used to position the spud barge and maintain communications with passing vessels. The tugboat remained tied off to the barge throughout operations.

Vessel positions at each location were obtained using a DGPS operated by Fugro's surveyors. Computer monitors were placed in the office trailer on the barge, as well as on the tugboat bridge, to observe the progress as the tugboat navigated the barge onto location. Once the vessel was positioned, the spuds were lowered to stabilize the barge. The final position was approved by the shift engineer and recorded by the surveyor. Spud leg locations were also recorded to avoid testing disturbed material during subsequent explorations.

Some locations had to be moved from the planned coordinates due to uneven river bottom conditions, which prevented the level positioning of the Roson system. The surveyor recorded the position of the Roson system on the river bottom each time it was deployed. The coordinates of the spuds were also recorded to ensure that future explorations would not be conducted in an area disturbed by an abandoned spud hole.

The water depth at each location was measured prior to the start of testing using a weighted tape measure. Measured water depths were corrected to MLLW based upon tidal data obtained from the National Oceanic and Atmospheric Administration (NOAA) tide gauge Station No. 8638610 (1983 through 2001 tidal epoch) located at Sewells Point, Hampton Road, and later refined using multibeam bathymetric data.

3.5 CPT SOUNDINGS

A total of 40 CPT soundings were conducted within the project area. Termination depths ranged from 15.3 to 97.6 feet below the river bottom, with water depths ranging from 4.8 feet to 56.0 feet. Soundings C-22 and C-30 were repeated after encountering refusal at depths substantially less than the planned termination depth. The locations of the CPT soundings are shown on Figure 3 and Chart 1.

Details of the CPT equipment and test methods used are described below. A summary of the CPT soundings is presented in Figure B-1, which includes the completion date, coordinates, river bottom elevation, completion depth, and terminal elevation of each CPT. A key to the CPT Logs is provided in Figure B-2. Individual CPT Logs are presented on Figures B-3 to B-42. The logs include records of tip resistance, sleeve friction, friction ratio, and pore pressure, as well as interpreted undrained shear strength, which was calculated from the measured tip resistance using N_k values of both 12 and 15. In addition to the marine CPT sounding log format provided on Figures B-3 through B-42, the CPT results are also provided in standard VDOT log format on Figures B-43 through B-82. The cone penetrometer is a 1.5-inch-

diameter cylindrical instrument mounted on the lower end of the sounding rods. The tip of the penetrometer features a 1.6 inch^2 (10 centimeter^2) cone. Above the cone is a pore pressure transducer (the u_2 position) with filter, followed by a 23.3 inch^2 (150 centimeter^2) friction sleeve. The penetrometer is equipped with internal sensors that measure cone resistance, sleeve friction, pore pressure, and inclination. Measurements were recorded at 1 second intervals. In accordance with ASTM D 5778, the cone penetrometer was advanced into the subsurface at a rate of 0.8 inches per second (2.0 centimeters per second).

The general test procedure involved the following steps:

1. Positioning of the barge at the test location;
2. Lowering of the Roson system to the river bottom;
3. Advancement of the penetrometer into the ground;
4. Retraction of the CPT rods and penetrometer; and
5. Retrieval of the Roson system to the barge deck.

Criteria for the termination of a test included: penetration to the desired stratigraphic layer, reaching the maximum thrust of the wheel-drive system, excessive or sudden increases in penetrometer inclination, and circumstances at the discretion of the CPT operator or shift engineer that posed a risk of damage to apparatus or safety of personnel. After the termination of each test, the preliminary electronic raw data files were transferred to the Fugro shift engineer for onboard field processing and QA/QC. Upon the engineer's verification of the quality of the data, the barge was moved to the next location.

3.6 T-BAR SOUNDINGS

Analogous to CPT soundings, T-Bar penetration soundings involve the in situ measurement of the resistance of soil to continuous penetration at a steady rate of a cylindrical rod (T-Bar penetrometer) positioned perpendicular to the lower end of sounding rods. T-Bar soundings are particularly useful for strength profiling of extremely soft to soft, relatively homogeneous, clays and silts.

Four T-Bar soundings were conducted adjacent to previously completed CPT locations. Termination depths ranged from 12 to 41 feet below the river bottom, with water depths ranging from 23 to 51 feet. Cyclic T-Bar tests were performed at selected depth intervals in each T-Bar sounding to evaluate remolded shear strengths and sensitivity. The locations of the T-Bar soundings are shown on Figure 3 and Chart 1.

A description of the T-Bar testing methods and equipment is provided below. A summary of the T-Bar soundings is presented in Figure C-1, which includes completion date, coordinates, approximate water depth, completion depth, terminal elevation, and cyclic test depths. Individual T-Bar logs are presented on Figures C-2 to C-5. The logs include continuous records of T-bar penetration resistance and pore pressure, as well as interpreted undrained shear strength, which was calculated from the measured tip resistance using N_t values of both 9 and 12. Also included on the logs is the friction ratio data from the adjacent CPT. It should be noted that unlike CPT soundings, the undrained shear strength interpreted from T-bar

penetration tests does not require corrections for overburden or pore water pressure as the test measures the resistance to full soil flow around the penetrometer.

The T-Bar soundings were performed using the Roson equipment described previously for CPT soundings. The cone penetrometer was replaced with the T-bar penetrometer, which measures penetration resistance and pore pressure. The T-Bar penetrometer measures 9.8 inches (250 mm) in length by 1.6 inches (40 mm) in diameter, with a projected cross-sectional base area of 15.5 inches^2 (10,000 mm^2) for the downward stroke. Pore pressure sensors are located at both the center of the T-Bar (below the sounding rod connection point) and at the end.

The upper limit of bearing resistance that can be measured by the T-Bar is approximately 10.4 tons per square foot (1 megapascal). To avoid damage to the T-Bar penetrometer, tests were conducted in the soft clays in the upper part of the soil profile and terminated before encountering denser sand layers. Therefore, all T-Bar soundings were conducted adjacent to a recently completed CPT sounding in order to determine the termination depth of each T-Bar sounding.

The procedure for conducting T-Bar soundings is similar to that of a CPT sounding. A penetration rate of 0.8 inches per second (2.0 centimeters per second), with a 1 second sampling interval was used. In addition to downward (push) penetration, the upward (pull) resistance of the T-Bar penetrometer is recorded during extraction. The effective cross sectional area of the T-bar penetrometer is reduced during retraction by an amount equal to the area of the sounding rod. Accordingly, the effective area of the T-bar during retraction is reduced to 14.0 inches^2 (9,000 mm^2).

In addition to standard push and pull T-Bar soundings, cyclic testing was performed at several depth intervals to evaluate remolded shear strengths and sensitivity. The cyclic tests involved cycling the penetrometer up and down over a stroke length of 1.6 feet (0.5 meters) for 5 to 10 cycles. Cyclic testing was performed during retraction so that a complete, uninterrupted profile could be obtained during the downward portion of the sounding.

3.7 VANE SHEAR TESTING

In situ vane shear testing was conducted during the river bottom testing program to directly measure the undrained shear strength of the soft clays at the site. A total of four vane shear test profiles were conducted within the project area. Vane shear testing was performed adjacent to previously completed CPT and T-Bar locations. Individual vane shear tests were typically performed at 10-foot intervals. Total test depths ranged from 10 to 40 feet below the river bottom, with water depths ranging from 17 feet to 50 feet. In addition, remolded tests were performed at several depths (typically corresponding to cyclic T-Bar test depths) to measure remolded shear strengths and sensitivity. The locations of the vane shear test profiles are shown on Figure 3 and Chart 1.

A description of the vane shear testing methods and equipment is provided below. A summary of the vane shear tests is presented in Figure D-1, which includes completion date,

coordinates, approximate water depth, test depths, and terminal elevation. Vane shear test results are presented on Figures D-2 to D-5. The figures include plots of torque versus rotation for the individual vane shear tests, as well as profiles of peak and remolded undrained shear strength with depth.

The vane shear tests were performed using a motorized in situ vane tool, which is attached to the end of the sounding rods used with the Roson system. The tool consists of a vane blade, electric motor to apply torque, a torque cell, and a vane carrier tool. During vane shear testing, a cruciform vane blade is pushed into the soil and rotated by applying torque to the shaft. The maximum torque measured during the test is used to calculate the undrained shear strength. The shear strength values presented in Appendix D do not include corrections for rate effects or soil anisotropy.

Rectangular blades of various sizes were used. The geometry of the vane blades has been standardized by ASTM D 2573. The height of the vane blade is twice the diameter of the blade. The size of the vane blade used was selected based on the expected shear strength (smaller vane blades used when higher shear strengths are anticipated). The dimensions of the vane blades used are summarized below.

Table 2. Vane Shear Blade Properties

Vane Blade	Height to Diameter Ratio	Vane Blade Diameter (inches)	Thickness of Blade (inches)	Diameter of Vane Rod (inches)	Area Ratio	Maximum Shear Strength (ksf)
A1	2	1.50	0.06	0.51	18.7	2.06
A2	2	2.00	0.06	0.51	12.5	0.86
A3	2	2.50	0.08	0.51	11.2	0.44

The general test procedure for Roson vane shear testing involved the following steps:

1. Positioning of the barge at the test location;
2. Lowering of the Roson system to the river bottom;
3. Advancement of the in situ vane tool into the soil until the vane blade is at the test depth. Penetration occurs at 0.8 inches per second (2.0 centimeters per second);
4. Before commencing the test, the vane blade is allowed to rest at the test depth with no rotation for 1 minute, allowing excess pore pressures generated during penetration to dissipate;
5. Rotation of the vane blade at 0.2 degrees per second. The test was terminated after 90 degrees of rotation, or at the shift engineer's discretion;
6. Advancement of the in situ vane tool to the next test depth;
7. Retraction of the sounding rods and in situ vane tool after completion of the deepest test, with each size vane blade, at each location; and
8. Retrieval of the Roson system to the barge deck.

Multiple vane shear tests were performed at each location to obtain a profile of shear versus depth. Typically, 90 degrees of rotation was achieved; however, some tests were terminated when the maximum working torque of the vane blade was exceeded.

In addition to the above procedure, remolded tests were performed at several depth intervals (typically corresponding to cyclic T-bar test depths). These tests were conducted directly after the initial test (i.e., after the initial 90 degrees of rotation) and involved two parts. The first phase of the test was the remolding process, in which the blade was rotated 720 degrees at a rate of approximately 0.6 degree per second. The second phase of the test was the actual remolded test, in which the blade was rotated 90 degrees at 0.2 degrees per second. The torque measured during this phase was used to calculate the remolded shear strength of the soil.

4.0 LABORATORY TESTING

A geotechnical laboratory program was conducted on samples recovered from the marine borings. The initial phase of testing was performed onboard the drilling platform. Once drilling operations were complete, additional testing was performed at Fugro's onshore laboratories in San Luis Obispo, California, Houston, Texas, and Corpus Christi, Texas.

A summary of laboratory test results is presented on Figures E-1a to E-1r. Descriptions of laboratory test procedures for both the onboard and onshore programs are provided in the following sections.

4.1 ONBOARD TESTING

Conducting geotechnical testing immediately upon sample retrieval is a routine component of Fugro's marine drilling operations. The "real-time" character of onboard testing has the following advantages:

- Allows quality control of the sample logging procedure by comparing sample visual descriptions with actual test data,
- Allows preparation of more complete field boring logs,
- Allows comparison of the engineering properties of sediments with those of adjacent borings in real time,
- Allows quality assurance of test assignments for more sophisticated and expensive consolidation and consolidated triaxial tests, and
- Allows field engineers to modify the drilling and sampling program in the field to optimize the exploration program.

Laboratory testing during drilling operations was performed in the lab container aboard the *Skate 2D* drilling platform. In addition to visual classification and sample description, the onboard laboratory testing program included the following types of tests:

- Moisture content determinations of all samples,
- Wet densities of all intact samples,
- Shear strength estimates of all suitable fine-grained samples using a torvane and pocket penetrometer,
- Miniature vane (MV) shear strength tests on all suitable fine-grained samples, and
- Unconsolidated-Undrained (UU) triaxial compression tests on selected fine-grained samples.

4.1.1 Moisture

Moisture contents were determined in general accordance with ASTM D 2216 for each recovered sample. The specimen was first weighed using a digital scale, and then dried in an oven maintained at approximately 110 degrees Celsius. The specimen was then re-weighed to determine the mass of oven-dried soil, and moisture contents were calculated. Moisture

contents are presented on the Logs of Borings and Test Results (Figures A-13 to A-22) and the Summaries of Laboratory Test Results (Figures E-1a to E-1r).

4.1.2 Density

Wet densities of intact soils collected from the tube samples were measured in general accordance with ASTM D 2937 by weighing specimens of known volume immediately after extrusion. Densities are presented on the Logs of Borings and Test Results (Figures A-13 to A-22) and the Summaries of Laboratory Test Results (Figures E-1a to E-1r).

4.1.3 Torvane

Torvane tests were performed on the majority of fine-grained samples. The torvane is a small hand-operated device consisting of a metal disc with thin, radial vanes projecting from one face. The device was pressed against the flat surface of the soil until the vanes were fully embedded. The calibrated device was then rotated through a torsional spring until the soil was sheared, providing an indication of undrained shear strength. Torvane results are presented on the Logs of Borings and Test Results (Figures A-13 to A-22).

4.1.4 Pocket Penetrometer

The pocket penetrometer was used for higher strength materials which exceeded the capacity of the torvane device. The test was performed by slowly pressing a 1/4-inch diameter flat-ended metal rod into the flat surface of the soil sample until it was embedded a predetermined distance. The resistance to penetration or unconfined compressive strength was recorded by a calibrated spring. Estimates of undrained shear strength could then be made. Pocket penetrometer results are presented on the Logs of Borings and Test Results (Figures A-13 to A-22).

4.1.5 Miniature Vane

Miniature Vane tests were performed in general accordance with ASTM D 4648 on all suitable fine-grained samples. To perform the miniature vane test, a small flat-bladed vane was inserted into an undisturbed fine-grained specimen. Torque was applied to the vane through a calibrated spring activated by a motorized pulley and belt system, which rotates the vane slowly until soil shear failure occurs. The shear strength of the soil is calculated using the torque transmitted through a calibrated torsional spring and the net rotation prior to shear failure.

For selected tests, remolded shear strengths were also measured by allowing the vane to continue rotating after the initial soil shear failure has occurred. These tests were terminated when the applied torque reached a constant value. Miniature Vane test results are presented on the Logs of Borings and Test Results (Figures A-13 to A-22) and the Summaries of Laboratory Test Results (Figures E-1a to E-1r).

4.1.6 UU Triaxial

Unconsolidated-Undrained (UU) triaxial tests were performed in general accordance with ASTM D 2850 on a total of 15 fine-grained samples. To perform the test, an undisturbed specimen was placed between two loading platens and enclosed in a thin rubber membrane. The specimen was placed in the triaxial cell and a confining pressure equal to at least the in situ effective overburden pressure was applied. The test specimen was not allowed to consolidate under this confining pressure prior to testing. The test specimen was then loaded axially to failure at a constant strain rate of 2 percent per hour, without permitting drainage of the specimen. The undrained shear strength was computed as one-half of the maximum observed deviator stress.

UU triaxial test results are presented on the Logs of Borings and Test Results (Figures A-13 to A-22) and the Summaries of Laboratory Test Results (Figures E-1a to E-1r), which also includes the applied confining pressure and strain observed at 50 percent of the peak shear stress (ε_{50}).

4.2 ONSHORE TESTING

Upon completion of the marine drilling operations and onboard testing, additional laboratory testing was performed to further aid in soil classification and characterization, and to evaluate the engineering properties of the materials encountered. Three different Fugro laboratories were used for various components of the testing program. Testing was assigned to the various labs as follows.

Index testing of coarse-grained samples was performed at the Fugro laboratory in San Luis Obispo, California. These index tests included:

- Atterberg Limits, and
- Grain Size Distribution, including Sieve Analyses and Hydrometer tests.

Index testing of fine-grained samples, as well as X-ray radiography, advanced strength and compressibility testing was performed at the Fugro laboratory in Houston, Texas. Specifically, the Houston laboratory performed the following tests:

- Atterberg Limits,
- Grain Size Distribution, including Sieve Analyses and Hydrometer tests,
- Organic Content,
- Specific Gravity,
- Direct Shear,
- Consolidated-Drained (CD) Triaxial,
- Consolidated-Undrained (CU) Triaxial,
- Incremental Consolidation, and
- Controlled Rate of Strain (CRS) Consolidation.

Corrosion testing was performed at the Fugro laboratory in Corpus Christi, Texas. The corrosion testing suite included the following:

- Resistivity,
- pH,
- Chloride Content, and
- Sulfate Content.

4.2.1 X-Ray Radiography

The save tube samples collected from the marine drilling program were X-rayed to evaluate the quality and amount of samples available for testing. The X-ray slides were examined to target specific intervals within the save tubes for advanced testing. Overall, the X-ray results indicate very good sample quality. Photographs taken of the X-ray films are presented on Figures E-2a to E-2c.

4.2.2 Particle Size Analyses

Particle Size Analyses were performed on several samples of coarse- and fine-grained material in general accordance with ASTM D 422. In general, sieve analyses of particle sizes greater than 0.075 mm (No. 200 sieve) were performed on coarse-grained samples. Hydrometer analyses were performed on both coarse- and fine-grained samples. Several coarse-grained samples were tested only for fines content (percent passing the No. 200 sieve). Grain size curves are presented on Figures E-3a to E-3j.

4.2.3 Atterberg Limits

Liquid and plastic limits, collectively termed Atterberg Limits, were determined for the majority of the fine-grained samples, as well as selected coarse-grained samples in general accordance with ASTM D 4318. Samples were prepared using the wet method when possible. For samples which were observed to contain considerable amounts of organic material, a second liquid limit test was performed on an oven-dried specimen for comparison with the original result. Atterberg Limits test results are presented on the Plasticity Charts on Figures E-4a to E-4j.

4.2.4 Specific Gravity

An evaluation of specific gravity was made for three fine-grained samples also selected for incremental consolidation testing. Specific gravity tests were performed in general accordance with ASTM D 854 using the moist specimen preparation procedure. Tests results are presented in the Summaries of Laboratory Test Results (Figures E-1a to E-1r).

4.2.5 Organic Content

Organic content tests were performed on 10 fine-grained samples observed to contain considerable amounts of organic material. The tests were performed in general accordance

with ASTM D 2974. The percent by weight of organic material was determined by comparing the weight of dry soil plus organic material to the weight of dry soil only after igniting the specimens in a 440-degree Celsius muffle furnace. Test results are presented in the Summaries of Laboratory Test Results (Figures E-1a to E-1r).

4.2.6 Direct Shear

Direct shear tests were performed in general accordance with ASTM D 3080 on three samples of coarse-grained material. Direct shear test specimens were trimmed to fit a shear box 1.9 inches in diameter and 1 inch in height. The shear box is comprised of two halves, one of which is displaced horizontally relative to the other during shear, forcing failure to occur on a horizontal plain at the mid-height of the specimen.

After saturating the specimen, a pre-determined normal load comparable to the in situ effective overburden pressure was applied. Time-deformation readings are taken to determine an appropriate shear rate to ensure fully drained conditions, and to verify that primary consolidation was complete. The specimen was then sheared to failure at a rate of 0.08 inches per minute. The test was then repeated on additional specimens under increased normal loads or confining pressures. Three tests were performed for each depth interval selected. The confining pressure applied to the specimens ranged from 0.5 to 5 kips per square foot (ksf).

Direct shear test results are presented on Figures E-5a to E-5p. Two types of figures are presented for each depth interval: 1) individual plots of shear stress and vertical displacement versus relative lateral displacement for each specimen, and 2) a plot of peak shear stress versus effective normal stress combining the three specimens.

4.2.7 CD Triaxial

Consolidated-Drained (CD) triaxial compression tests were performed on four samples of coarse-grained material. It should be noted that an ASTM standard for this test does not exist, however one is currently being developed. The tests were performed on samples recovered using either a 2.1-inch or 2.83-inch inside diameter tube sampler. Test specimens were trimmed down to a diameter of 2 inches, maintaining a height-to diameter ratio of 2. The trimmed specimen was carefully fitted with saturated filter paper strips around the perimeter of the specimen and placed between two loading platens. The specimen was covered by a thin rubber membrane placed in the triaxial cell.

To achieve specimen saturation, the system back pressure and cell pressure were slowly raised in simultaneous increments, maintaining a B-value (pore pressure parameter) of at least 95 percent. Once saturation was complete, the specimens were isotropically consolidated under confining pressures to the in situ effective overburden pressure. The confining pressure was slowly increased up to the maximum value to avoid premature failure of the specimen. Confining pressures ranged from 2.6 to 5.2 ksf.

After the consolidation phase was complete, the drainage lines were left open to allow dissipation of pore water pressures and specimen volume change during shear. The test

specimen was then sheared to failure under drained conditions by applying an axial load through the compression frame. Specimens were sheared at axial strain rates ranging from 0.14 to 2 percent per hour. The axial load was monitored by a load cell. Deformation was measured by Linear Variable Differential Transformers (LVDT). Specimen volume change readings were obtained using a calibrated burette. The data was continuously recorded using a computer-controlled data logger.

CD triaxial test results, in the form of shear stress versus axial strain and volume change versus axial strain, are presented on Figures E-6a to E-6d.

4.2.8 CU Triaxial

Single-point Consolidated-Undrained (CU) triaxial compression tests were performed on seven samples in general accordance with ASTM D 4767. The tests were performed on samples recovered using either a 2.1-inch or 2.83-inch inside diameter tube sampler. Test specimens were trimmed down to a diameter of 2 inches, maintaining a height to diameter ratio of 2. The trimmed specimen was carefully fitted with saturated filter paper strips around the perimeter of the specimen and placed between two loading platens. The specimen was covered by a thin rubber membrane placed in the triaxial cell.

To achieve specimen saturation, the system back pressure and cell pressure were slowly raised in simultaneous increments, maintaining a B-value (pore pressure parameter) of at least 95 percent. Once saturation was complete, the specimens were isotropically consolidated under confining pressures comparable to the in situ effective overburden pressure. The confining pressure was slowly increased up to the maximum value to avoid premature failure of the specimen. Confining pressures ranged from 2.6 to 5.2 ksf.

After the consolidation phase was complete, the drainage lines were closed to prevent dissipation of pore water pressures and specimen volume change during shear. The test specimen was then sheared to failure under undrained conditions by applying an axial load through the compression frame. Specimens were sheared at axial strain rates ranging from 0.09 to 1.2 percent per hour. The axial load was monitored by a load cell. Deformation was measured by LVDTs. Excess pore water pressures were measured using pore pressure transducers. The data was continuously recorded using a computer-controlled data logger.

Single-point CU triaxial test results are presented on Figures E-7a to E-7n. Two types of figures are presented for each depth interval: 1) a combined plot of shear stress versus both axial strain and effective average stress, and 2) a combined plot of both excess pore water pressure and stress obliquity versus axial strain.

In addition to single-point tests, three multi-specimen CU triaxial tests were performed on selected specimens from high-quality save tube samples. Three test specimens were trimmed from each save tube. Test procedures were similar to those used for the single-point tests. For the multi-specimen procedure, tests were performed using a series of three different confining pressures. The lowest confining pressure typically corresponded to the in situ

effective overburden pressure. Confining pressures were approximately doubled for each subsequent test and ranged from 0.7 to 20.8 ksf.

Multi-specimen CU triaxial test results are presented on Figures E-7o to E-7w. Here, three types of figures are presented for each depth interval: 1) a combined plot of shear stress versus both axial strain and effective average stress, 2) a combined plot of both excess pore water pressure and stress obliquity versus axial strain, and 3) a combined plot of peak shear stress versus both effective and total normal stresses (Mohr's Circles), in which all three test specimens are included.

4.2.9 Incremental Consolidation

Incremental consolidation tests were performed on three samples of fine-grained material selected from high-quality save tube samples in general accordance with ASTM D 2435. Test specimens were trimmed into 2.5-inch inside diameter stainless steel rings. The trimmed test specimen and ring were then placed in a loading cell between two porous stones.

After the cell was fully assembled, it was placed in a loading frame and a small seating load was applied. The specimen was then saturated prior to applying the initial load increment. Vertical loads were applied incrementally up to a maximum load of either 16 or 64 ksf, using a load increment ratio of two. LVDTs were used to measure vertical displacement continuously throughout the test. Prior to reaching the maximum load increment, an intermediate unload/reload cycle was applied to the specimens. Timed readings were taken at several of the load increments. Once the maximum loading stage was complete, test specimens were unloaded to further investigate rebound behavior.

Incremental consolidation test results, in the form of axial strain versus vertical effective stress, are presented on Figures E-8a to E-8c. Also plotted with those curves is the computed coefficient of consolidation at each vertical pressure.

4.2.10 CRS Consolidation

CRS consolidation tests were performed on four selected samples in general accordance with ASTM D 4186. CRS consolidation test specimens were trimmed into either 2-inch or 2.5-inch inside diameter stainless steel rings. The trimmed test specimen and ring were placed in a specially designed cell in which the base of the test specimen was sealed and the top of the test specimen was exposed to the saturating fluid. A porous stone was placed on top of the test specimen and the loading ram was brought into contact with the porous stone.

After the cell was fully assembled, it was placed in a loading frame and a small seating load was applied. The test specimen was then saturated. LVDTs were used to measure vertical displacement continuously throughout the test. A load cell and pore pressure transducer connected to the bottom of the specimen, through the test cell, measured vertical effective stress and excess pore pressure, respectively, throughout loading and unloading. An axial strain rate was selected to limit the ratio of maximum excess pore pressure to applied vertical pressure to less than 15 percent. The pore pressure ratio was continuously monitored

during the test, and the rate of strain was automatically adjusted to keep the pore pressure ratio within the specified limits. Typically, a maximum strain rate of 1 percent per hour was used. The maximum load applied to the specimens ranged form 37.9 to 188.1 ksf. The specimens were then unloaded to investigate rebound behavior.

CRS consolidation test results, in the form of axial strain versus vertical effective stress, are presented on Figures E-9a to E-9d. Also plotted with those curves is the computed coefficient of consolidation at each vertical pressure.

4.2.11 Corrosion

A suite of four corrosion tests were performed on 11 selected soil samples to assess corrosion potential. One sample consisted of a composite of three samples collected over a 3.6-foot depth interval. The tests included resistivity, pH, chloride content, and sulfate content.

Resistivity testing was performed in general accordance with ASTM G 57 using the Wenner Four-Electrode method. A stiff slurry of the sample was made by adding sufficient water to bring the sample to saturation. The sample was placed into a 4-point resistivity box and a voltage was imparted between the outer electrodes causing a current flow. The voltage drop between the inner electrodes was measured. Using the factors of the resistivity box, the resistivity was calculated in units of ohm-centimeters.

The pH tests were performed in general accordance with ASTM G 51. The pH was measured directly using a combination electrode with a temperature-compensating probe.

Chloride content testing was performed in general accordance with ASTM D 512. Sulfate content testing was performed in general accordance with ASTM D 516. To perform these tests, a soil extract was prepared using soil ground down until it passed a #10 sieve. Ten grams of soil and 90 milliliters of deionized water were added to a flask and mixed on a stirrer for 30 minutes. The sample was then covered and heated to 95 degrees Celsius on a heating plate for 4 hours, stirring every 30 minutes. The sample was cooled and a centrifuge was used to separate the water from the soil. The extracted water was vacuum filtered through a 0.45um filter.

For chloride content determinations, the extract is titrated with a mercuric nitrate solution to the end point and the chloride content is calculated. For sulfate content determinations, the sulfate ion in the extract is converted to a barium sulfate suspension. The resulting turbidity is determined by a spectrophotometer and compared to a standard curve to determine the sulfate concentration. Concentrations are reported in milligrams per kilogram (mg/kg).

Corrosion test results are presented on the Summaries of Laboratory Test Results (Figures E-1a to E-1r).

5.0 LIMITATIONS

5.1 REPORT USE

This report has been prepared for the exclusive use of the Virginia Department of Transportation and its agents for the specific application to the Midtown Second Parallel Tunnel project, located in Portsmouth and Norfolk, Virginia. In our opinion, the data, findings, conclusions, professional opinions, and recommendations presented herein were prepared in accordance with generally accepted geotechnical engineering practices of the project region.

Although information contained in this report may be of some use for other purposes, it may not contain sufficient information for other parties or uses. If any changes are made to the project as described in this report, the conclusions and recommendations in this report shall not be considered valid unless the changes are reviewed and the conclusions and recommendations of this report are modified or validated in writing by Fugro. This report and the figures contained in this report are intended for input to project design; they are not intended to act as construction drawings or specifications.

5.2 POTENTIAL VARIATIONS IN SUBSURFACE CONDITIONS

Earth materials can vary in type, strength, and other geotechnical properties between points of observation and exploration. Therefore, we do not and cannot have a complete knowledge of the subsurface conditions underlying the site. The conclusions and recommendations presented in this report are based on the findings at the points of exploration, interpolation, and extrapolation of information between and beyond the points of observation, and are subject to confirmation (to the extent possible) based on the conditions revealed during construction.

5.3 LOCAL PRACTICE

In performing our professional services, in our opinion, we have used generally accepted geologic and geotechnical engineering principles and have applied that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers currently practicing in this or similar localities. No other warranty, express or implied, is made as to the professional advice included in this report.

FIGURES

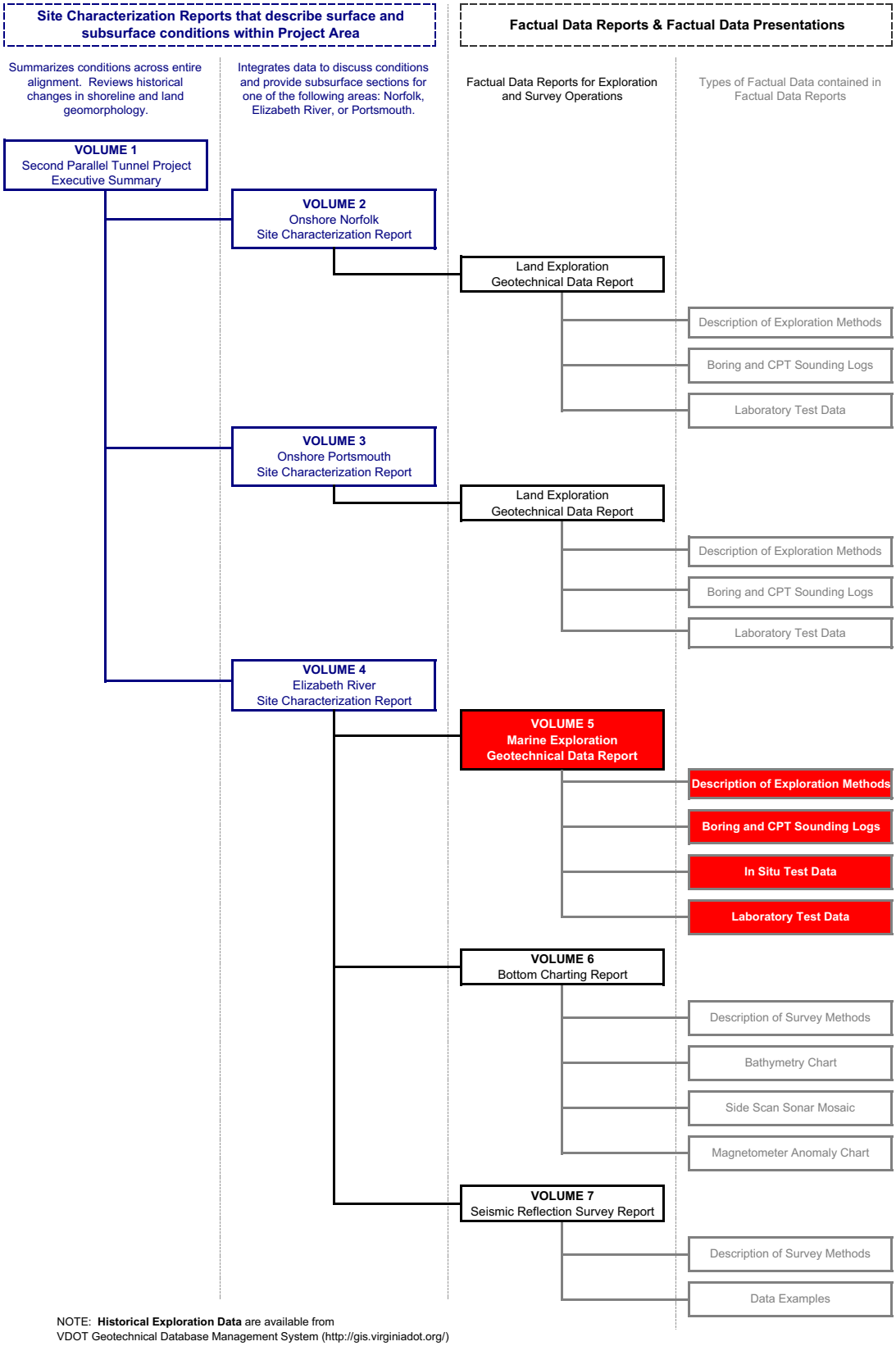


Aerial Photo Source: Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <<http://datagateway.nrcs.usda.gov/>>

PROJECT VICINITY MAP
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 1

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\03-GDR\MXD\Fig-1_Project_Vicinity_Map.mxd, 06/12/08, kspencer



NOTE: **Historical Exploration Data** are available from
VDOT Geotechnical Database Management System (http://gis.virginiadot.org/)

GEOTECHNICAL REPORT ORGANIZATION

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 2

Virginia Department of Transportation
Project No. 3602.001



N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\03-GDR\MXD\Fig-3_Exploration_Location_Map.mxd, 06/12/08, kspencer

LEGEND

2008 Fugro Marine Exploration Locations

C-38 ▼ CPT

B-11 ● Boring

T-4 T-bar

V-4 ■ Vane Shear

Bathymetric Contour in Feet (MLLW)
Contour interval is 5 ft.

Approximate Location of Midtown Tunnel
Not for design or construction planning
(Refer to Section 3.1 of Bottom Charting Report)

N
W E
S

SCALE = 1:3,600

0 150 300 600
Feet

EXPLORATION LOCATION MAP
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 3



PHOTO 1: DRILLING OPERATIONS (JACK-UP MODE)

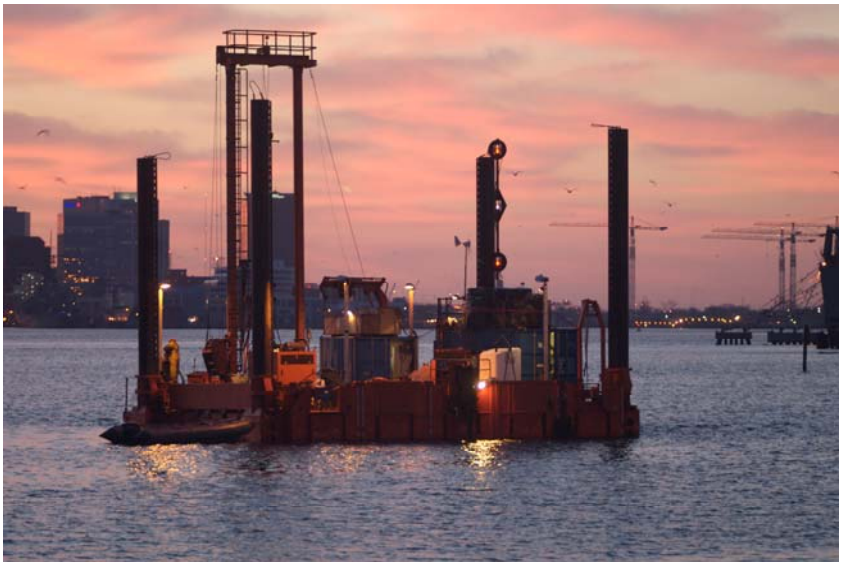


PHOTO 2: DRILLING OPERATIONS (SPUD MODE)

SKATE 2D PHOTOGRAPHS
Midtown Tunnel Second Tube
Portsmouth to Norfolk, Virginia

FIGURE 4a





PHOTO 3: MARINE CR2 DRILLING MAST AND SUPPORT TUGBOAT *TRANSPORTER*



PHOTO 4: SPT HAMMER

SKATE 2D PHOTOGRAPHS
Midtown Tunnel Second Tube
Portsmouth to Norfolk, Virginia

FIGURE 4b





PHOTO 5: ONBOARD GEOTECHNICAL LABORATORY



PHOTO 6: ONBOARD PROCESSING OF RECOVERED SAMPLES

SKATE 2D PHOTOGRAPHS
Midtown Tunnel Second Tube
Portsmouth to Norfolk, Virginia

FIGURE 4c

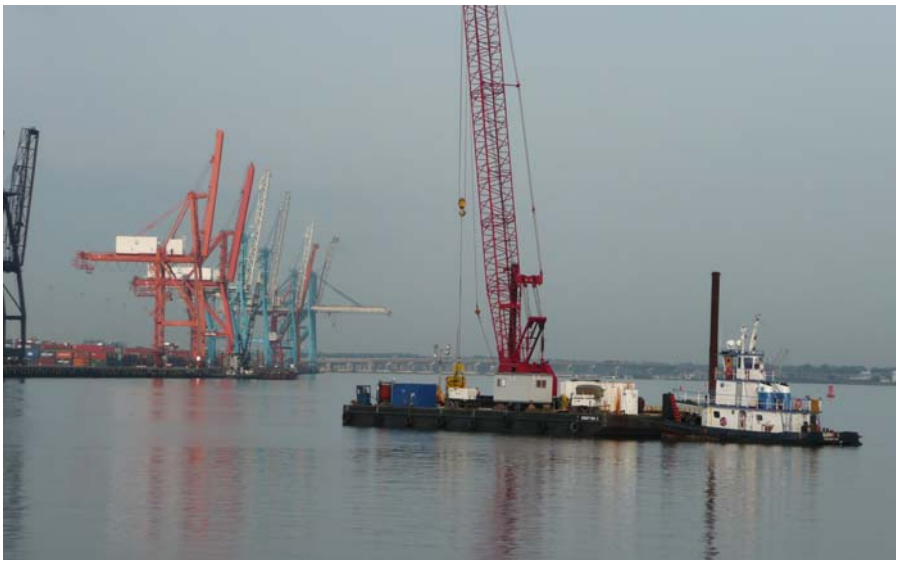


PHOTO 1: SPUD BARGE *CROFTON I* AND TUGBOAT *BUNNY C*



PHOTO 2: VIEW FROM BARGE DECK, SHOWING ROSON UNIT, CRANE, SPUD LIFTING EQUIPMENT, AND *BUNNY C*

ROSON PHOTOGRAPHS
Midtown Tunnel Second Tube
Portsmouth to Norfolk, Virginia

FIGURE 5a



PHOTO 3: ROSON UNIT IN SHALLOW AND DEEP WATER CONFIGURATIONS



PHOTO 4: CANTILEVERED WORKING PLATFORM AND UMBILICAL COILER

ROSON PHOTOGRAPHS
Midtown Tunnel Second Tube
Portsmouth to Norfolk, Virginia

FIGURE 5b



PHOTO 5: ROSON UNIT BEING DEPLOYED TO RIVER BOTTOM



PHOTO 6: ROSON UNIT BEING RETRIEVED TO DECK

ROSON PHOTOGRAPHS
Midtown Tunnel Second Tube
Portsmouth to Norfolk, Virginia

FIGURE 5c



PHOTO 7: CONE PENETROMETER FULLY RETRACTED FOR ON DECK INSPECTION AND SYSTEM CHECKS



PHOTO 8: IN SITU VANE SHEAR MOTOR AND BLADES

ROSON PHOTOGRAPHS
Midtown Tunnel Second Tube
Portsmouth to Norfolk, Virginia

FIGURE 5d

CHART



Spring 2008 Explorations Conducted by Fugro Atlantic Under Contract to VDOT

Fugro Boring Designation	VDOT Boring Designation	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet) Northing	Easting	River Bottom Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
B-1		3/4/2008	3478955	12122033	-29.1	78.6	-107.7
B-2		3/3/2008	3479050	12122036	-29.6	98.3	-127.9
B-3		3/2/2008	3479246	12122243	-47.2	109.1	-156.3
B-4		3/1/2008	3479474	12122356	-48.2	99.3	-147.5
B-5		3/2/2008	3479583	12122610	-45.9	127.2	-173.1
B-6		2/29/2008	3479839	12122894	-26.1	109.1	-135.2
B-8		2/26/2008	3479680	12123065	-23.0	99.3	-122.3
B-9		2/27/2008	3480199	12123264	-11.9	88.9	-100.8
B-10		2/28/2008	3480522	12123492	-10.9	88.9	-99.8
B-11		2/29/2008	3480644	12123570	-11.0	79.1	-90.1

Note: B-7 was deleted from the drilling program.

Fugro CPT Designation	VDOT CPT Designation	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet) Northing	Easting	River Bottom Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
C-1		4/25/2008	3478945	12122051	-29.6	85.3	-114.8
C-2		4/25/2008	3478998	12121993	-27.3	85.3	-112.6
C-3		4/25/2008	3479027	12121957	-25.8	85.3	-111.1
C-4		4/25/2008	3479063	12121918	-26.7	85.3	-112.0
C-5		4/26/2008	3479090	12122063	-32.0	82.4	-114.4
C-6		4/26/2008	3479159	12122138	-37.5	79.5	-117.0
C-7		4/28/2008	3479194	12122308	-47.9	80.9	-128.9
C-8		4/28/2008	3479218	12122280	-47.8	78.0	-125.8
C-9		4/27/2008	3479240	12122145	-44.3	80.1	-124.4
C-10		4/27/2008	3479302	12122158	-46.9	83.7	-130.6
C-11		4/27/2008	3479376	12122360	-49.7	84.6	-134.3
C-12		4/27/2008	3479495	12122475	-47.6	84.6	-132.2
C-13		4/27/2008	3479508	12122637	-47.7	82.8	-130.5
C-14		4/27/2008	3479574	12122568	-45.6	84.1	-129.7
C-15		4/27/2008	3479613	12122512	-44.9	81.5	-126.4
C-16		4/27/2008	3479658	12122446	-44.8	84.6	-129.6
C-17		4/27/2008	3479676	12122894	-42.0	15.3	-57.4
C-18		4/25/2008	3479813	12122810	-22.0	84.8	-106.8
C-19		4/27/2008	3479778	12122660	-38.9	84.9	-123.8
C-20		4/28/2008	3479376	12122930	-51.5	76.5	-128.0
C-21		4/25/2008	3479941	12122893	-12.9	84.3	-97.2
C-22		4/28/2008	3479433	12122463	-47.8	26.6	-74.4
C-22A		4/28/2008	3479441	12122419	-48.0	74.9	-122.9
C-23		4/26/2008	3480276	12123114	-3.7	85.3	-89.0
C-24		4/25/2008	3480027	12123027	-9.3	74.8	-84.1
C-25		4/25/2008	3480052	12122969	-8.6	77.6	-86.2
C-26		4/24/2008	3480077	12123189	-20.5	81.5	-102.0
C-27		4/26/2008	3480348	12123290	-4.3	85.1	-89.4
C-28		4/24/2008	3480161	12123282	-17.0	91.6	-108.6
C-29		4/25/2008	3480250	12123405	-11.3	84.5	-95.8
C-30		4/24/2008	3480394	12123489	-10.4	24.9	-35.3
C-30A		4/24/2008	3480396	12123446	-10.2	97.6	-107.8
C-31		4/24/2008	3480511	12123508	-11.0	25.3	-36.3
C-32		4/24/2008	3480622	12123569	-10.9	84.8	-95.7
C-33		4/24/2008	3480672	12123577	-10.8	85.3	-96.1
C-34		4/25/2008	3480709	12123545	-10.8	46.8	-57.6
C-35		4/28/2008	3479687	12122751	-39.5	85.0	-124.5
C-36		4/28/2008	3479773	12122843	-30.1	85.8	-66.9
C-37		4/30/2008	3479961	12123101	-23.5	58.5	-82.0
C-38		4/30/2008	3480099	12123071	-7.3	85.2	-92.5

Fugro T-Bar Designation	VDOT T-Bar Designation	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet) Northing	Easting	River Bottom Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)	Cyclic Test Depths (feet)
T-1		4/29/2008	3479069	12122114	-32.6	0.0	-32.6	8.4, 18.2, 28.1, 32.3
T-2		4/29/2008	3479211	12122294	-47.7	0.0	-47.7	7.7, 12.6
T-3		4/28/2008	3479604	12122478	-44.3	0.0	-44.3	5.7, 10.7
T-4		4/28/2008	3479804	12122819	-23.5	0.0	-23.5	7.4, 17.2, 27.1, 36.9

Fugro Vane Shear Designation	VDOT Vane Shear Designation	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet) Northing	Easting	River Bottom Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)	Test Depths (feet) "R" indicates remold test was performed
V-1		4/29/2008	3479104	12122073	-31.9	31.3	-63.2	10.6 R, 23.1 R, 31.3 R
V-2		4/29/2008	3479223	12122291	-48.4	9.8	-58.2	9.8 R
V-3		4/29/2008	3479672	12122464	-44.1	11.4	-55.5	6.6 R, 11.4 R
V-4		4/29/2008	3479817	12122622	-21.7	39.8	-61.5	10.3, 20.1, 29.9, 39.8

VDOT 2008 Onshore Norfolk Explorations

Fugro Boring Designation	VDOT Boring Designation	Completion Date	Coordinates Virginia State Plane South Zone (NAD 83, feet) Northing	Easting	Ground Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
B-17	08BH-017	7/1/2008	3481135	12124204	6.9	41.5	-34.6
B-18	08BH-018	7/2/2008	3481049	12124112	6.5	61.5	-55.0
B-19	08BH-019	7/8/2008	3480977	12124023	5.2	101.5	-96.3

Fugro CPT Designation	VDOT CPT Designation	Completion Date	Coordinates (feet) Virginia State Zone South, NAD 83 Northing	Easting	Ground Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
C-42	08CP-042	9/15/2008	3480938	12124019	5.2	56.4	-51.3
C-43	08CP-043	9/15/2008	3480996	12123964	5.0	42.2	-37.2
C-44	08CP-044	9/15/2008	3481084	12124056	5.7	36.3	-30.5
C-45	08CP-045	9/15/2008	3481017	12124142	6.1	68.1	-62.0
C-46	08CP-046	9/15/2008	3481135	12124234	6.6	31.0	-24.4

VDOT 2008 Onshore Portsmouth Explorations

Fugro Boring Designation	VDOT Boring Designation	Completion Date	Coordinates Virginia State Plane South Zone (NAD 83, feet) Northing	Easting	Ground Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
B-12	08BH-012	6/13/2008	3477408	12120265	10.2	41.4	-31.2
B-13	08BH-013	6/16/2008	3477616	12120578	9.9	61.5	-51.6
B-14	08BH-014	6/11/2008	3477887	12120856	9.1	101.5	-92.4
B-15	08BH-015	6/25/2008	3478083	12121125	7.2	101.5	-94.3
B-16	08BH-016	6/26/2008	3478370	12121316	6.9	101.5	-94.6
B-20	08BH-020	7/9/2008	3478631	12121437	6.9	101.5	-94.6

Fugro CPT Designation	VDOT CPT Designation	Completion Date	Coordinates (feet) Virginia State Zone South, NAD 83 Northing	Easting	Ground Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
C-39	08CP-039	9/12/2008	3477433	12120368	9.1	9.4	-0.3
C-40	08CP-040	9/12/2008	3477597	12120583	9.0	62.8	-53.9
C-41	08CP-041	9/12/2008	3477863	12120878	8.2	73.2	-64.9
C-47	08CP-047	9/17/2008	3478529	12121597	6.2	113.4	-107.1

LEGEND

Geotechnical Explorations

- B-09 — 2008 Fugro Boring Location
- C-23 — 2008 Fugro CPT Location
- T-4 — 2008 Fugro T-Bar Location
- V-4 — 2008 Fugro Vane Shear Location
- MW-1 — 2008 MMA Monitoring Well
- B-14 — 2008 VDOT Boring Location
- C-40 — 2008 VDOT CPT Location
- 60-15 — Historical VDOT Boring Location

Bathymetry (MLLW, feet)

Refer to notes for vertical datum.

- Bathymetric Contour in Feet (MLLW) Contour interval is 5 ft.

Bathymetric Data Boundaries and Sources

- Fugro (MB-2008): Multibeam Bathymetry Data — Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM ES3 Multibeam echosounder (240 Khz - 120 degree swath).
- Fugro (SB-2008): Single Beam Bathymetry Data — Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM Echotrak Dual Frequency echosounder (200/28 kHz)
- Area Obstructed During Fugro 2008 Survey
- Approximate Location of Midtown Tunnel — Not for design or construction planning (Refer to Section 7.1 in text)

NOTES

1) Coordinate Grid: Virginia State Plane, South Zone, NAD 83, Feet
2) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>
3) Reference to Mean Lower Low Water (MLLW), 1983-2001 Tidal Epoch, is based on observations performed and published by the National Oceanic and Atmospheric Administration, National Ocean Service (NOAA/NOS). Tidal Bench Mark 8638610 at Sewells Point, Hampton Roads, was used as the MLLW constraint for this project.

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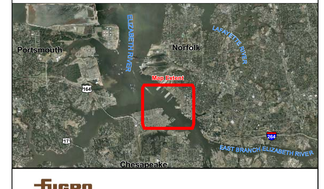
GEODETIC INFORMATION

SPHEROID:	GRS 1980
SEMI-MAJOR AXIS:	6,378,137.000
SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.257222101
ECCENTRICITY*:	0.08484263
PROJECTION:	LAMBERT CONFORMAL CONIC
ZONE:	VIRGINIA SOUTH
LONGITUDE OF ORIGIN:	36.3°
FALSE EASTING:	11,482,916
FALSE NORTHING:	3,280,833



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EXPLORATION LOCATION MAP
Midtown Second Parallel Tunnel Portsmouth to Norfolk, Virginia

0 200 400 Feet

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Nov. 2008	For Report Submittal	KWS	ADB	KRS
2					
3					

JOB NUMBER: 3602.001 CHART NO.: 1

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Output\3602-001_SR_ChartDB-Overview Report\MXD\Chart\Chart-1_Explorations_Location_Map.mxd, 11/10/08, ksevens

APPENDIX A
MARINE BORINGS

Fugro Boring Designation	VDOT Boring Designation	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet)		River Bottom Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
			Northing	Easting			
B-1		3/4/2008	3478965	12122033	-29.1	78.6	-107.7
B-2		3/3/2008	3479050	12122036	-29.6	98.3	-127.9
B-3		3/2/2008	3479246	12122243	-47.2	109.1	-156.3
B-4		3/1/2008	3479474	12122356	-48.2	99.3	-147.5
B-5		3/2/2008	3479583	12122610	-45.9	127.2	-173.1
B-6		2/25/2008	3479839	12122694	-26.1	109.1	-135.2
B-8		2/26/2008	3479980	12123065	-23.0	99.3	-122.3
B-9		2/27/2008	3480199	12123254	-11.9	88.9	-100.8
B-10		2/28/2008	3480522	12123492	-10.9	88.9	-99.8
B-11		2/29/2008	3480644	12123570	-11.0	79.1	-90.1

Note: B-7 was deleted from the drilling program.

SUMMARY OF MARINE BORINGS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE A-1

SOIL TYPES

- Well graded GRAVEL (GW)
- Poorly graded GRAVEL (GP)
- GRAVEL with sand (GP or GW)
- GRAVEL with clay (GP or GW)
- Clayey GRAVEL (GC)
- GRAVEL with silt (GP or GW)
- Silty GRAVEL (GM)
- Well graded SAND (SW)
- Poorly graded SAND (SP)
- SAND with gravel (SP or SW)
- SAND with clay (SP-SC)
- Clayey SAND (SC)
- Silty SAND (SM)
- SAND with silt (SP-SM)
- Fat CLAY (CH)
- Sandy Fat CLAY (CH)
- Lean Clay (CL)
- Sandy Lean CLAY (CL)
- Silty CLAY (CL-ML)
- Elastic SILT (MH)
- SILT (ML)
- Sandy SILT (ML)
- Clayey SILT (ML/CL)
- High Plasticity ORGANICS (OH)
- Low Plasticity ORGANICS (OL)
- SANDSTONE (Rx)
- SILTSTONE (Rx)
- CLAYSTONE (Rx)
- BASALT
- Interlayered SILTSTONE (Rx) and SANDSTONE (Rx)
- BOULDERS and COBBLES
- Asphalt Concrete
- Base Material

SAMPLERS AND IN SITU TESTS

- Thin-Walled Shelby Tube
- Piston Sampler
- Wireline
- Thick-Walled Shelby Tube
- Modified California
- Thick-Wall Wireline
- SPT
- Bulk Bag
- Liner Sample
- Downhole Vane Shear
- Downhole CPT

CLASSIFICATION TEST/BLOW COUNTS/ ROCK QUALITY AND CORING RATE

- ■ Percent Passing No. 200 Sieve
- ● Water Content (%)
- □ Submerged Unit Weight (KCF)
- ○ Theoretical Submerged Unit Weight (KCF)

Plastic Limit — Liquid Limit

- ⬟ Blow Count
- Rock Quality Designation (RQD)
- Rock Recovery Percent
- Coring Rate

STRENGTH TESTS

- ⊗ Pocket Penetrometer
- ⌖ Torvane
- ⌖ Remote Vane
- ◆ Miniature Vane
- ⟐ Residual Vane
- ▲ Unconsolidated Undrained Triaxial
- ▣ Unconfined Compression (soil)
- ◎ Point Load Test
- ■ Unconfined Compression (rock)
- ◇ △ (Open symbols indicate remolded tests)
- \+ Strength exceeds capacity of measuring device
- Fractures Per Foot
- CPT (Nk = 12 and 15)

KEY TO TERMS AND SYMBOLS USED ON BORING LOGS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE A-2a

TUBE, LINER, AND WIRELINE SAMPLERS

WOR	Liner sample advanced with the weight of drilling rods.
WOH	Liner sample advanced with the weight of a 175 pound hammer.
PUSH or SAVE	Pushed thin-walled 3" tube.
15/24"	Number of blows required to produce the indicated penetration using a 2-1/4" tube sampler. The sampler was driven with a 175-pound downhole hammer dropped approximately 5 ft.

Note: Refer to Plate A-1a for sampler symbols. Wireline and thick-wall wireline samples were driven.

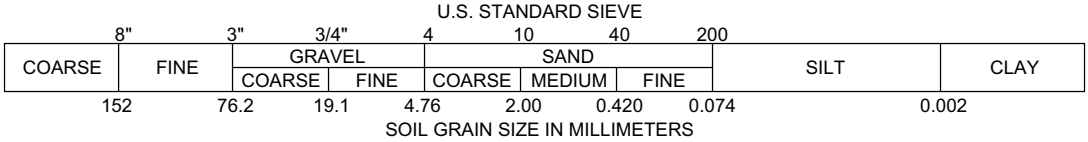
SPT AND MODIFIED CALIFORNIA LINER SAMPLERS

Samplers were driven with a 140 pound above deck hammer dropped approximately 2-1/2 feet.

20	Number of blows to produce 12" of penetration after the initial 6" of seating.
86/11"	Number of blows required to produce the indicated penetration after an initial 6" seating.
Ref/3"	50 blows produced the indicated penetration during the initial 6" interval.

Note: Refer to Plate A-1a for sampler symbols.

SOIL GRAIN SIZE



STRENGTH OF COHESIVE SOILS

Consistency	Undrained Shear Strenth, Kips Per Sq Ft
Extremely Soft	less than 0.125
Very Soft	0.125 to 0.25
Soft	0.25 to 0.50
Firm	0.50 to 1.00
Stiff	1.00 to 2.00
Very Stiff	2.00 to 4.00
Hard	greater than 4.00

DENSITY OF GRANULAR SOILS

Descriptive Term	Relative Density (%)*
Very Loose	less than 15
Loose	15 to 35
Medium Dense	35 to 65
Dense	65 to 85
Very Dense	greater than 85

* Estimated from samper driving record and PCPT tip resistance.

SOIL STRUCTURE

Slickensided	Having planes of weakness that appear slick and glossy. The degree of slickensidedness depends upon the spacing of slickensides and the ease of breaking along these planes.
Fissured	Containing shrinkage of relief crack, often filled with fine sand or silt, usually more or less vertical.
Pocket	Inclusion of material of different texture that is smaller than the diameter of the sample.
Parting	Inclusion less than 1/8 inch thick extending through the sample.
Seam	Inclusion 1/8 to 3 inches thick extending through the sample.
Layer	Inclusion greater than 3 inches thick extending through the sample.
Laminated	Soil sample composed of alternating partings or seams of different soil types.
Interlayered	Soil sample composed of alternating layers of different soil types.
Intermixed	Soil sample composed of pockets of different soil types and layered or laminated structure is not evident.
Calcareous	Having appreciable quantities of carbonate.

KEY TO TERMS AND SYMBOLS USED ON BORING LOGS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE A-2b

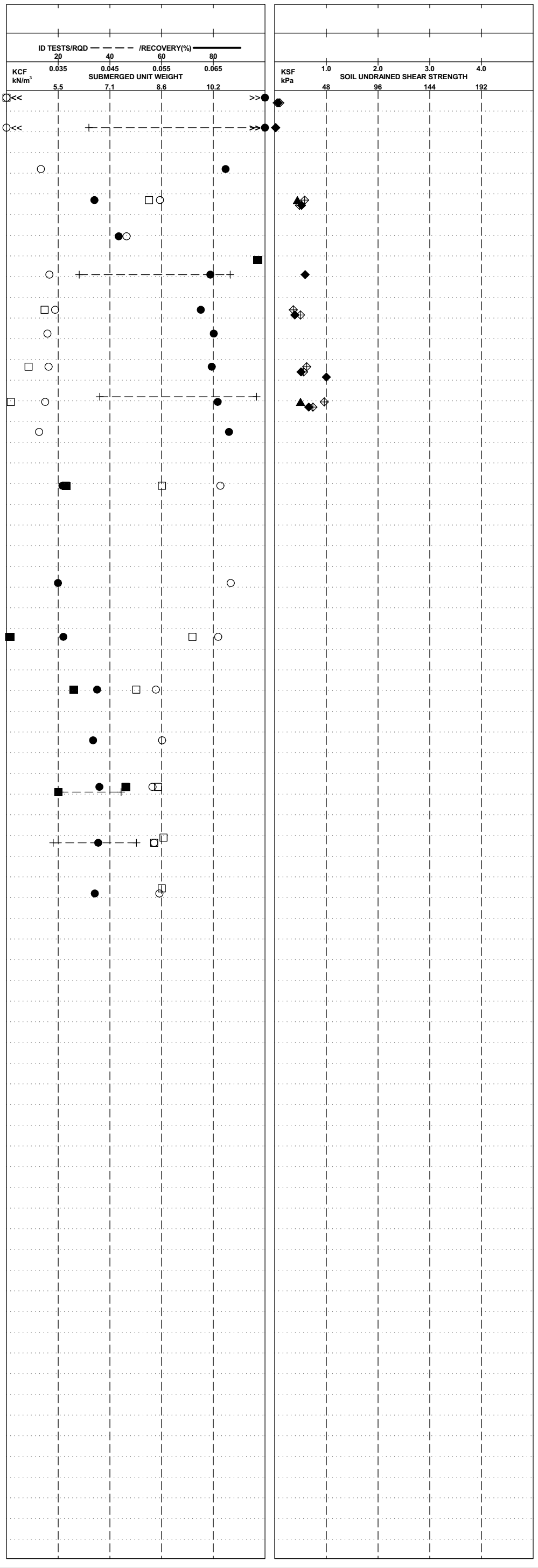
07/09/2008 13:48

PROJECT NO:	3602.001	**START DATE:**	3/3/2008
BORING:	B-1	**COMPLETION DATE:**	3/4/2008
DRILLER:	Fugro Seacore		
DRILLING METHOD:	Geobor		

Coordinates: N 3,478,965 E 12,122,033
Virginia State Plane, South Zone, NAD83, feet

MUDLINE ELEVATION: -29.4 ft +/- (rel. MLLW datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO.	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION
-30		1		PUSH	**ALLUVIUM (Qal)**
-32	2				Fat CLAY (CH): extremely soft, black, with a trace of shell fragments and fine sand, petroleum waste odor
-34	4	2		PUSH	
-36	6	3		WOR	
-38	8				
					9.8 ft
-40	10	4		PUSH	Sandy CLAY (CL): firm, gray to olive gray
-42	12				
-44	14	5		WOR	- with fine sand pockets and partings at 13.1'
					16.4 ft
-46	16	6		PUSH	Fat CLAY (CH): firm, gray to olive gray, with organic pockets (wood)
-48	18				
-50	20	7		PUSH	- with a trace of organic pockets (wood), 19.7' to 26.2'
-52	22				
-54	24	8		WOH	- faint creosote odor at 23'
-56	26	9		PUSH	- with organic pockets (wood/plant fiber) at 26.2'
-58	28				- 3" organic seam (wood) at 27.7'
					29.5 ft
-60	30	10		PUSH	Organic CLAY (OH): firm, gray to olive gray, with abundant organic pockets, partings, and seams (wood/plant fiber) at 29.5'
-62	32				
-64	34	11		9	
-66	36				
					37.7 ft
-68	38	12		PUSH	**NORFOLK FORMATION (Qn)**
-70	40				Silty Fine SAND (SM): medium dense, light gray to gray, with a trace of organics (stems/rootlets), with clay pockets
-72	42	13		10|18"	- no recovery at 42.7'
-74	44				
-76	46				- hard drilling noted at 45.3'
-78	48	14		23	
-80	50				
-82	52	15		8|18"	- loose, gray, with a trace of coarse sand at 52.5'
					52.8 ft
-84	54				Fine to Medium SAND (SP): medium dense, gray
					55.4 ft
-86	56				**YORKTOWN FORMATION (Ty)**
-88	58	16		10|18"	Silty Fine SAND (SM): medium dense, blueish gray, with shell fragments and a trace of clay pockets
-90	60				
-92	62	17		34	- dense, with fine shell partings and a light gray fine to medium sand parting at 62.8'
-94	64				
-96	66				
					67.3 ft
-98	68	18		10|18"	Clayey Fine SAND (SC): medium dense, blueish gray, with fine shell partings, possibly micaceous
-100	70				
-102	72	19		10|18"	- with clay pockets and fine shell particles, 72.2' to 78.6'
-104	74				
-106	76				
-108	78	20		10|18"	
					TD = 78.6'
-110	80				
-112	82				
-114	84				
-116	86				
-118	88				
-120	90				
-122	92				
-124	94				
-126	96				
-128	98				
-130	100				
-132	102				
-134	104				
-136	106				
-138	108				
-140	110				
-142	112				
-144	114				
-146	116				
-148	118				
-150	120				
-152	122				
-154	124				
-156	126				
-158	128				
-160	130				
-162	132				
-164	134				
-166	136				
-168	138				
-170	140				



CPT INTERVAL

The log and data presented are a simplification of actual conditions encountered at the time of sampling at the sample location. Subsurface conditions may differ at other locations and with the passage of time.

For symbol identification, refer to Key to Terms & Symbols Used on Logs.

LOG OF BORING AND TEST RESULTS

BORING B-1

Midtown Second Parallel Tunnel

FIGURE A-3

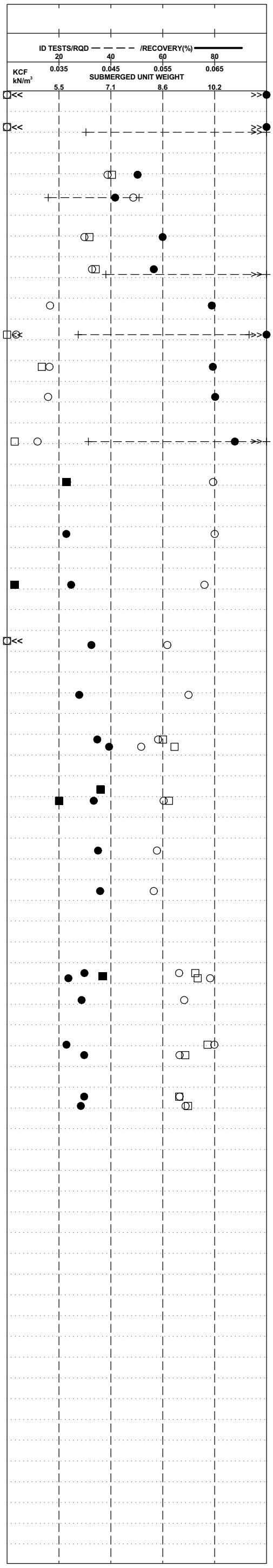
07/09/2008 13:48

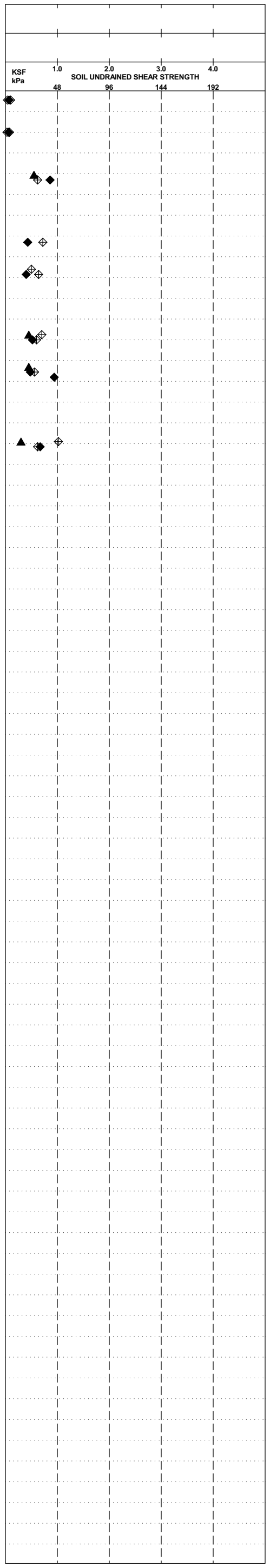
PROJECT NO:	3602.001	**START DATE:**	3/3/2008	**DRILLER:**	Fugro Seacore
BORING:	B-2	**COMPLETION DATE:**	3/3/2008	**DRILLING METHOD:**	Geobor

Coordinates: N 3,479,050 E 12,122,036
Virginia State Plane, South Zone, NAD83, feet

MUDLINE ELEVATION: -29.9 ft +/- (rel. MLLW datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO.	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION
		1	PUSH		**ALLUVIUM (Qal)**
-32	2				Fat CLAY (CH): extremely soft, black, with a petroleum waste odor
-34	4	2	PUSH		- with gray fine sand seams at 3.3'
-36	6				
-38	8	3	PUSH		
-40	10	4	WOR		- greenish gray to olive gray with fine sand pockets at 8.1'
-42	12				- firm below 8.1'
-44	14	5	PUSH		- sandy, 9.8' to 16.4'
-46	16				- with gray fine sand pockets and partings, 9.8' to 19.7'
-48	18	6	PUSH		- with a trace of organic pockets (wood debris), 13.1' to 19.7'
-50	20	7	WOR		
-52	22				*23.0 ft*
-54	24	8	PUSH		Organic CLAY (OH): firm, olive gray, with abundant organic pockets, partings, and seams (plant fiber, rootlets, and wood debris)
-56	26	9	PUSH		
-58	28				
-60	30	10	WOH		
-62	32				
-64	34	11	PUSH		
-66	36				
-68	38	12	PUSH		*37.7 ft* **NORFOLK FORMATION (Qn)** Silty Fine SAND (SM): loose to medium dense, gray - with clay and organic pockets at 38.0'
-70	40				
-72	42				
-74	44	13	17		- medium dense below 42.7' - with a large piece of wood debris at 44'
-76	46				
-78	48	14	10|18"		*47.6 ft* Fine to Medium SAND (SP): loose to medium dense, gray - with wood debris at 48'
-80	50				
-82	52	15	20|18"		- with a 12" black peat layer containing fine to medium gray sand seams at 53'
-84	54				
-86	56				
-88	58	16	29		- fine-grained, with black organic pockets and partings (peat and wood debris) at 57.4' *58.2 ft*
-90	60				**YORKTOWN FORMATION (Ty)** Silty Fine SAND (SM): medium dense, blueish gray, with shell fragments
-92	62	17	10|18"		- with a sand pocket at 63.0'
-94	64				
-96	66				*66.0 ft* Clayey Fine SAND (SC): medium dense, blueish gray, with shell fragments
-98	68	18	10|18"		
-100	70				
-102	72	19	8		
-104	74				
-106	76				
-108	78	20	8|18"		
-110	80				
-112	82	21	PUSH		
-114	84	22	16|18"		- increased fines content at 84.5'
-116	86				
-118	88	23	29		- with a 9" gray fine to medium sand layer at 86.9'
-120	90				
-122	92	24	30|18"		- with a 5" gray fine sand layer at 91.9' - dense below 91.9'
-124	94				
-126	96				
-128	98	25	30|18"		- with no shell fragments at 96.8'
-130	100				**TD = 98.3'**
-132	102				
-134	104				
-136	106				
-138	108				
-140	110				
-142	112				
-144	114				
-146	116				
-148	118				
-150	120				
-152	122				
-154	124				
-156	126				
-158	128				
-160	130				
-162	132				
-164	134				
-166	136				
-168	138				
-170	140				





CPT INTERVAL

The log and data presented are a simplification of actual conditions encountered at the time of sampling at the sample location. Subsurface conditions may differ at other locations and with the passage of time.

For symbol identification, refer to Key to Terms & Symbols Used on Logs.

LOG OF BORING AND TEST RESULTS

BORING B-2

Midtown Second Parallel Tunnel

FIGURE A-4

07/09/2008 13:49

PROJECT NO: 3602.001
BORING: B-3

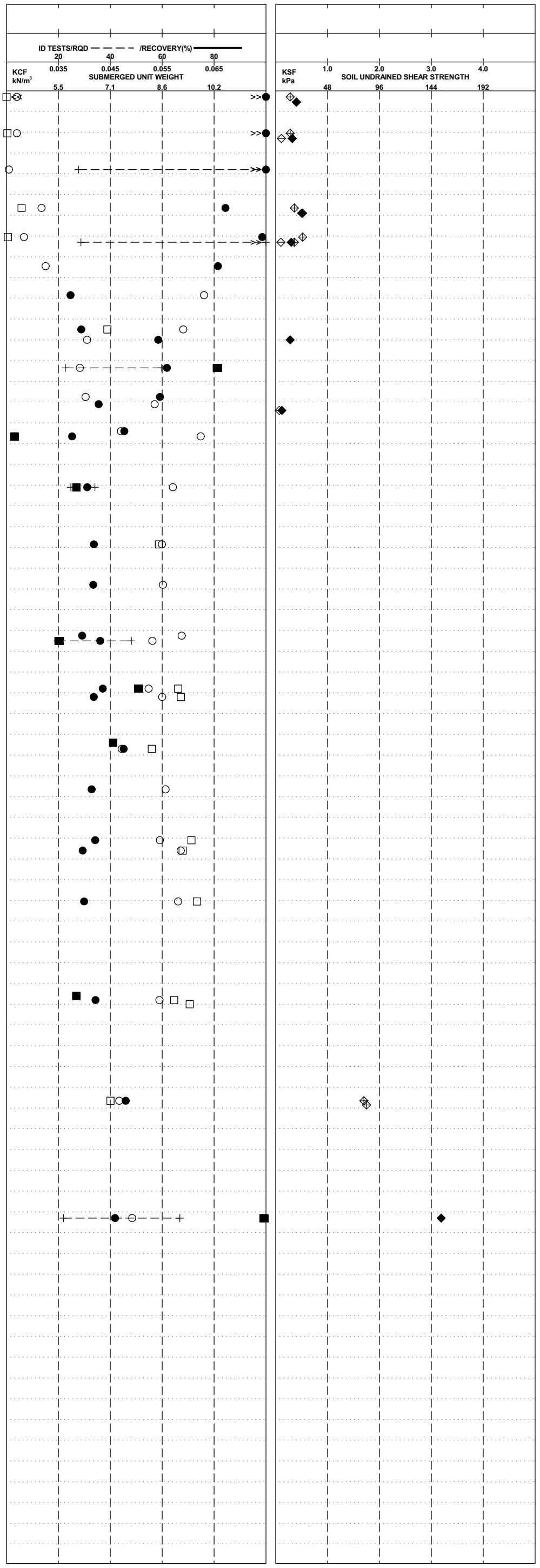
START DATE: 3/2/2008
COMPLETION DATE: 3/2/2008

DRILLER: Fugro Seacore
DRILLING METHOD: Geobor

Coordinates: N 3,479,246 E 12,122,243
Virginia State Plane, South Zone, NAD83, feet

MUDLINE ELEVATION: -47.3 ft +/- (rel. MLLW datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO.	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION
-48	2	1	PUSH		**ALLUVIUM (Qal)** Fat CLAY (CH): soft, gray to light brownish gray, with an organic odor and a 3" soft black fat clay seam
-50	4	2	PUSH		- slightly micaceous at 3.3'
-52	6				- with organic pockets (plant fiber, rootlets, and wood debris) to 13.1'
-54	8	3	WOR		
-56	10	4	PUSH		- with a strong organic odor at 9.8'
-58	12				13.1 ft
-60	14	5	PUSH		Organic CLAY (OH): soft, gray, with organic pockets and partings (plant fiber and wood debris)
-62	16	6	WOH		- with a trace of organics at 16.4'
-64	18				19.2 ft
-66	20	7	PUSH		Fine SAND (SP): loose, gray, with a trace of medium sand
-68	22				- with a 5" clay seam containing organic pockets at 20.6'
-70	24	8	PUSH		- with organic pockets, partings and seams (plant fiber and wood debris) at 23'
-72	26				24.0 ft Fat CLAY (CH): soft, gray, with a trace of silt, fine sand, and organic partings (plant fiber)
-74	28	9	WOH		- with a 1" thick brown clay seam at 27.5'
-76	30	10	PUSH		- with a 7" light gray fine sand layer containing organic pockets (wood debris and stems) at 30.2'
-78	32				33.2 ft
-80	34	11	PUSH		**NORFOLK FORMATION (Qn)** Fine SAND (SP): medium dense, light gray to gray
-82	36				
-84	38	12	14		- with shell fragments at 37.7'
-86	40				38.1 ft **YORKTOWN FORMATION (Ty)** Silty Fine SAND (SM): medium dense, blueish gray, with shell fragments
-88	42				
-90	44	13	13|18"		
-92	46				
-94	48	14	24|18"		
-96	50				50.0 ft Clayey Fine SAND (SC): medium dense, blueish gray, with shell fragments
-98	52				
-100	54	15	14		
-102	56				
-104	58	16	22|18"		- with fine sand pockets and partings at 57.5'
-106	60				
-108	62	17	5|18"		- increased fines content at 62.3'
-110	64				
-112	66				
-114	68	18	11		
-116	70				
-118	72	19	28|18"		
-120	74				
-122	76				
-124	78	20	17|18"		- micaceous at 77.1'
-126	80				
-128	82				
-130	84				
-132	86				
-134	88	21	3|18"		
-136	90				
-138	92				
-140	94				
-142	96				
-144	98	22	4|18"		97.3 ft **YORKTOWN FORMATION (Ty)** Fat CLAY (CH): stiff, olive gray
-146	100				- with a brown silty sand pocket at 98'
-148	102				
-150	104				
-152	106				
-154	108	23	PUSH		- very stiff at 106.6'
-156	110				**TD = 109.1'**
-158	112				
-160	114				
-162	116				
-164	118				
-166	120				
-168	122				
-170	124				
-172	126				
-174	128				
-176	130				
-178	132				
-180	134				
-182	136				
-184	138				
-186	140				
-188					



CPT INTERVAL

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For symbol identification, refer to Key to Terms & Symbols Used on Logs.

LOG OF BORING AND TEST RESULTS

BORING B-3

Midtown Second Parallel Tunnel

FIGURE A-5

07/09/2008 13:49

PROJECT NO:	3602.001	**START DATE:**	2/29/2008	**DRILLER:**	Fugro Seacore
BORING:	B-4	**COMPLETION DATE:**	3/1/2008	**DRILLING METHOD:**	Geobor

Coordinates: N 3,479,474 E 12,122,356
Virginia State Plane, South Zone, NAD83, feet

MUDLINE ELEVATION: -48.8 ft +/- (rel. MLLW datum)

MATERIAL DESCRIPTION

ALLUVIUM (Qal)
Fat CLAY (CH): soft, dark gray, with a trace of shell fragments and a slight organic odor

- dark gray to grayish brown below 10.8'

14.5 ft

NORFOLK FORMATION (Qn)
Silty Fine SAND (SM): medium dense, gray

- with a 5" soft, dark gray to grayish brown clay layer with black organic inclusions (fiber and wood) at 17.6'

18.1 ft

Fine SAND (SP): medium dense, gray
- with a trace of shell fragments at 19.7'
- fine- to medium-grained below 19.7'
- very dense at 23'

28.0 ft

YORKTOWN FORMATION (Ty)
Silty Fine SAND (SM): loose to medium dense, blueish gray, with shell fragments, intact shells, and fine shell particles (possibly mica)
- with brown clay pockets and partings, 31' to 31.5'

45.2 ft

Clayey Fine SAND (SC): loose to medium dense, blueish gray, with shell fragments
- increased fines content, 47.6' to 62.3'

- with 2" rounded gravel at 68.5'

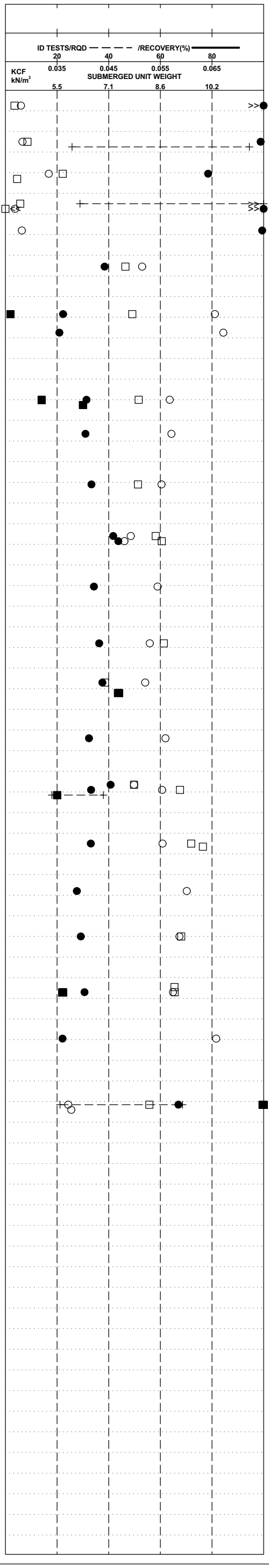
88.6 ft

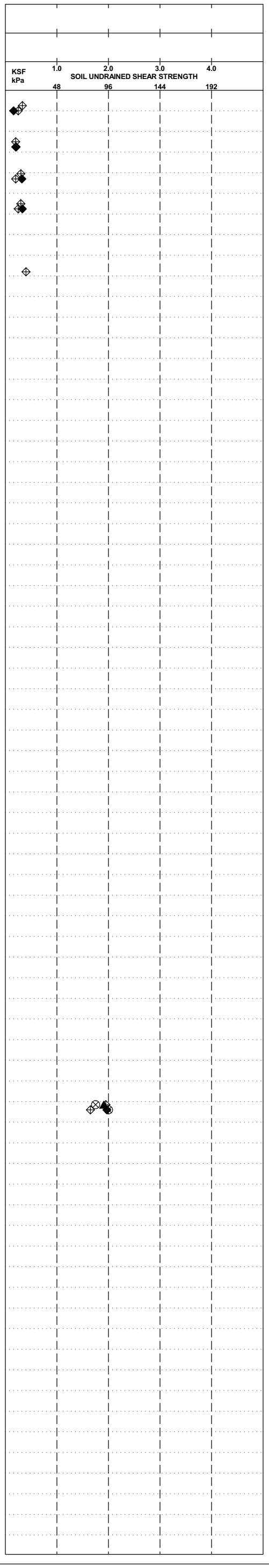
YORKTOWN FORMATION (Ty)
Fat CLAY (CH): stiff, olive gray

- with a 1.5" diameter gray clay pocket at 92.4'

TD = 99.3'

ELEVATION, ft	DEPTH, ft	SAMPLE NO.	SAMPLER	BLOW COUNT
-50	2	1	PUSH	
-52	4	2	PUSH	
-54	6			
-56	8	3	PUSH	
-58	10	4	PUSH	
-60	12			
-62	14	5		WOR
-64	16			
-66	18	6	PUSH	
-68	20	7	PUSH	
-70	22			
-72	24	8		62
-74	26			
-76	28			
-78	30	9		17|24"
-80	32			
-82	34	10		22
-84	36			
-86	38	11		12|24"
-88	40			
-90	42			
-92	44	12		4|18"
-94	46			
-96	48	13		14
-98	50			
-100	52			
-102	54	14		4|18"
-104	56			
-106	58	15		7|18"
-108	60			
-110	62			
-112	64	16		3
-114	66			
-116	68	17		10|18"
-118	70			
-120	72			
-122	74	18		6|18"
-124	76			
-126	78	19		31
-128	80			
-130	82	20		8|18"
-132	84			
-134	86			
-136	88	21		6|18"
-138	90			
-140	92	22		20
-142	94			
-144	96			
-146	98	23		PUSH
-148	100			
-150	102			
-152	104			
-154	106			
-156	108			
-158	110			
-160	112			
-162	114			
-164	116			
-166	118			
-168	120			
-170	122			
-172	124			
-174	126			
-176	128			
-178	130			
-180	132			
-182	134			
-184	136			
-186	138			
-188	140			
-190				





CPT INTERVAL

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For symbol identification, refer to Key to Terms & Symbols Used on Logs.

LOG OF BORING AND TEST RESULTS

BORING B-4

Midtown Second Parallel Tunnel

FIGURE A-6

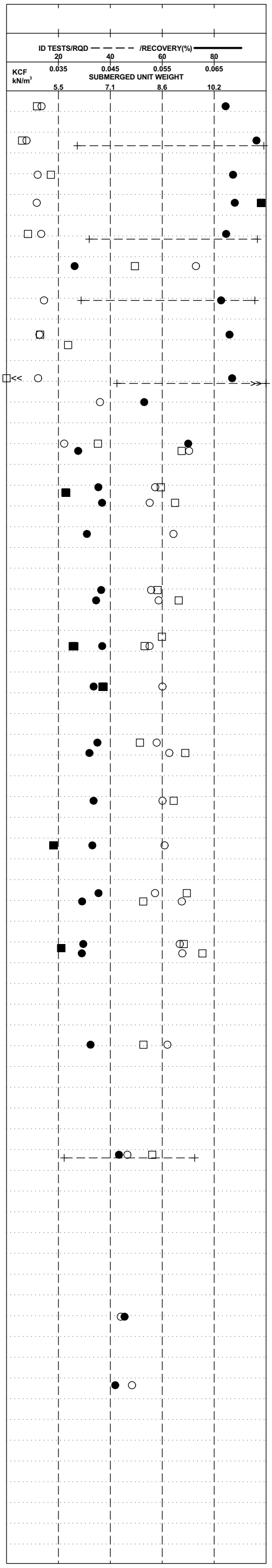
07/09/2008 13:49

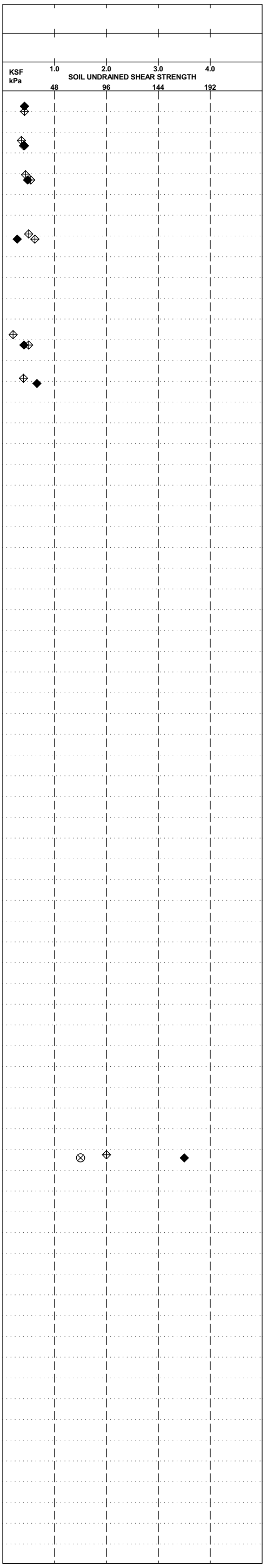
PROJECT NO:	3602.001	**START DATE:**	3/1/2008	**DRILLER:**	Fugro Seacore
BORING:	B-5	**COMPLETION DATE:**	3/2/2008	**DRILLING METHOD:**	Geobor

Coordinates: N 3,479,583 E 12,122,610
Virginia State Plane, South Zone, NAD83, feet

MUDLINE ELEVATION: -47.5 ft +/- (rel. MLLW datum)

ELEV, ft	DEPTH, ft	SAMPLE NO.	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION
-48	0	1	PUSH		**ALLUVIUM (Qal)**
-50	2				Organic CLAY (OH): soft, gray, with pockets, partings, and seams of organic matter (wood debris and fibrous material)
-52	4	2	PUSH		- with a faint organic odor to 9.8'
-54	6				- with a trace of shell fragments, 3.3' to 9.8'
					6.6 ft
-56	8	3	PUSH		Fat CLAY (CH): soft to firm, gray, with a trace of fine sand
-58	10	4	WOR		- with silty fine sand seams below 9.1'
-60	12				- with a 1" organic seam at 10.6'
-62	14	5	PUSH		- with sand pockets and partings at 13.1'
					16.4 ft
-64	16	6	PUSH		Silty Fine SAND (SM): loose, gray, with a trace of organic matter (wood debris)
-66	18				- with a 3" clay seam at 17.4'
					19.9 ft
-68	20	7	WOR		Organic CLAY (OH): soft, dark gray, with organic pockets (wood debris)
-70	22				
-72	24	8	PUSH		- with a 5" soft gray clay layer at 23'
-74	26	9	PUSH		- dark gray to brown, with calcareous nodules below 23.5'
-76	28				- soft to firm, interbedded gray and brown, with light gray fine sand partings and black organic matter (wood debris) at 26.2'
-78	30	10	8		- brown to dark brown at 29.5'
-80	32				- with light gray sand partings below 30.6'
-82	34	11	PUSH		- firm, dark brown, with sand seams at 33.8'
					34.7 ft
-84	36				**NORFOLK FORMATION (Qn)**
					Fine SAND (SP): loose, gray
					37.7 ft
-86	38	12	PUSH		**YORKTOWN FORMATION (Ty)**
-88	40				Silty Fine SAND (SM): loose to medium dense, blueish gray, with shell fragments
-90	42	13	24		
					44.5 ft
-92	44				Clayey Fine SAND (SC): loose to medium dense, blueish gray, with shell fragments
-94	46				
-96	48	14	16|24"		
-98	50				
-100	52	15	6|24"		- with a trace of clay pockets at 52.5'
-102	54				
-104	56				
-106	58	16	16		
-108	60				
-110	62	17	15|24"		
-112	64				
-114	66				
-116	68	18	3|18"		
-118	70				
-120	72	19	23		- dark gray at 72.2'
-122	74				- with abundant shell fragments at 73.5'
-124	76				
-126	78	20	6|18"		- with fine sand partings, 77' to 77.5'
-128	80				
-130	82	21	19|18"		- no shells, decreased fines content below 82'
-132	84				
-134	86				
-136	88				
-138	90				
-140	92	22	2|18"		
-142	94				
-144	96				
-146	98				
					98.0 ft
-148	100				**YORKTOWN FORMATION (Ty)**
-150	102	23	5|18"		Fat CLAY (CH): stiff to very stiff, olive gray
-152	104				- with sand partings at 101.7'
-154	106				
-156	108				
-158	110				
-160	112	24	PUSH		- no recovery at 111.5'
-162	114				
-164	116				
-166	118	25	PUSH		
-168	120				
-170	122	26	PUSH		- no recovery at 121.4'
-172	124				
-174	126	27	PUSH		
-176	128				**TD = 127.2'**
-178	130				
-180	132				
-182	134				
-184	136				
-186	138				
-188	140				





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LOG OF BORING AND TEST RESULTS

BORING B-5

Midtown Second Parallel Tunnel

FIGURE A-7

07/09/2008 13:49

PROJECT NO: 3602.001
BORING: B-6

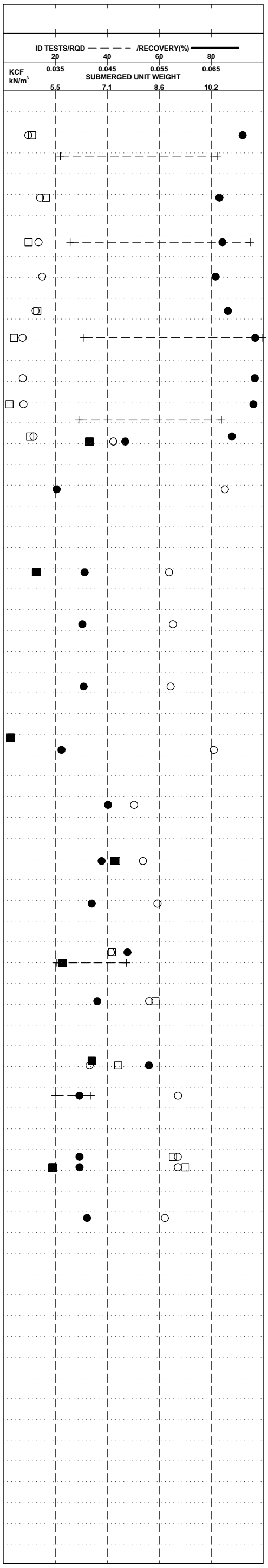
START DATE: 2/24/2008
COMPLETION DATE: 2/25/2008

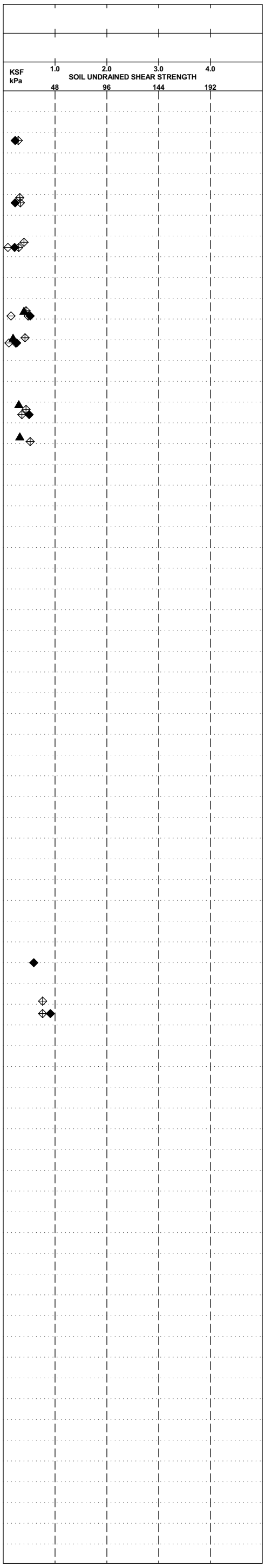
DRILLER: Fugro Seacore
DRILLING METHOD: Geobor

Coordinates: N 3,479,839 E 12,122,694
Virginia State Plane, South Zone, NAD83, feet

MUDLINE ELEVATION: -26.3 ft +/- (rel. MLLW datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO.	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION
-28	2				**ALLUVIUM (Qal)**
-30	4	1	PUSH		Fat CLAY (CH): soft, greenish gray to gray, no recovery at surface
-32	6	2	WOR		- with silty fine sand pockets and a trace of shell fragments at 3.3'
-34	8				
-36	10	3	PUSH		
-38	12				
-40	14	4	PUSH		- gray below 13.1'
-42	16				- with shell fragments at 14.6'
-44	18	5	WOR		
-46	20	6	PUSH		- micaceous, with a trace of shell and wood fragments at 19.7'
-48	22				*23.0 ft*
-50	24	7	PUSH		Organic CLAY (OH): soft, gray
-52	26				
-54	28	8	WOR		
-56	30	9	PUSH		
-58	32				- increasing organic matter below 31.0'
-60	34	10	PUSH		- with organic seams at 31.7'
-62	36				*33.8 ft*
-64	38	11	6		**NORFOLK FORMATION (Qn)**
-66	40				Silty Fine SAND (SM): loose, gray
-68	42				- with silt seams and organic pockets at 33.8'
-70	44	12	PUSH		- no recovery at 42.7'
-72	46	13	32		- dense below 45.9'
-74	48				
-76	50				
-78	52	14	32		
-80	54				
-82	56				
-84	58	15	31		
-86	60				
-88	62				*62.3 ft*
-90	64	16	28		Fine to Medium SAND (SP): medium dense, gray *63.5 ft*
-92	66				**YORKTOWN FORMATION (Ty)**
-94	68	17	PUSH		Clayey Fine SAND (SC): medium dense, blueish gray
-96	70				- dark gray, micaceous, with shell fragments at 67.3'
-98	72	18	PUSH		- micaceous, with a trace of shell fragments at 72.2'
-100	74				
-102	76				
-104	78	19	8		- loose, dark gray to gray, with shell fragments at 77.1'
-106	80				
-108	82	20	PUSH		- with a trace of clay pockets at 82'
-110	84				
-112	86				
-114	88	21	PUSH		- gray, with clay pockets 86.9' to 91.9'
-116	90				
-118	92	22	PUSH		- with shell fragments and a trace of clay seams at 91.9'
-120	94				
-122	96				
-124	98	23	37		- dense below 96.8'
-126	100				
-128	102	24	PUSH		
-130	104				
-132	106				
-134	108	25	PUSH		
-136	110				**TD = 109.1'**
-138	112				
-140	114				
-142	116				
-144	118				
-146	120				
-148	122				
-150	124				
-152	126				
-154	128				
-156	130				
-158	132				
-160	134				
-162	136				
-164	138				
-166	140				





CPT INTERVAL

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LOG OF BORING AND TEST RESULTS

BORING B-6

Midtown Second Parallel Tunnel

FIGURE A-8

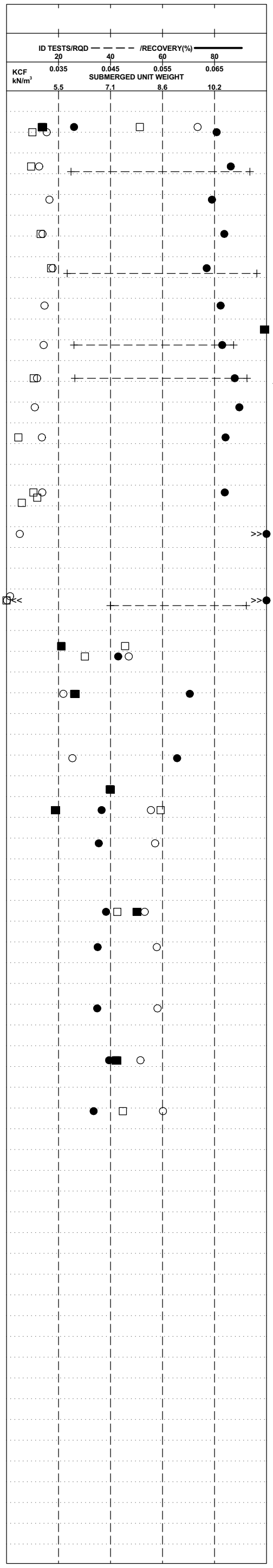
07/09/2008 13:49

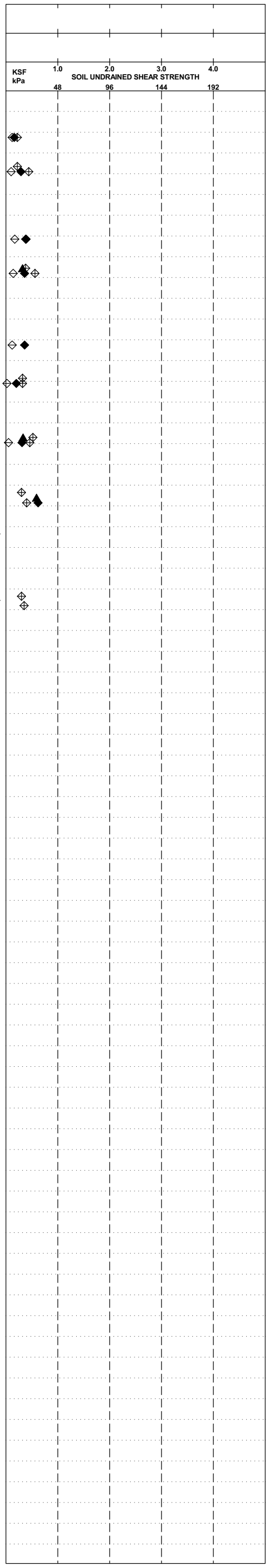
PROJECT NO:	3602.001	**START DATE:**	2/26/2008	**DRILLER:**	Fugro Seacore
BORING:	B-8	**COMPLETION DATE:**	2/26/2008	**DRILLING METHOD:**	Geobor

Coordinates: N 3,479,980 E 12,123,065
Virginia State Plane, South Zone, NAD83, feet

MUDLINE ELEVATION: -23.3 ft +/- (rel. MLLW datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO.	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION
-24	2	1	PUSH		**ARTIFICIAL FILL (af)** Silty Fine SAND (SM): loose, light gray, with shell fragments, no recovery at surface
-28	4	2	PUSH		4.0 ft **ALLUVIUM (Qal)** Fat CLAY (CH): very soft to soft, greenish gray, with a trace of fine sand
-30	6	3	PUSH		- with a trace of shell fragments, 6.6 to 9.1'
-34	10	4	WOR		
-36	12	5	PUSH		
-38	14	6	PUSH		- with a trace of shell fragments, 16.4 to 21.2'
-42	18	7	WOR		
-44	20	8	PUSH		
-46	22	9	PUSH		
-50	26	10	WOR		
-52	28	11	PUSH		- with organic pockets, slight organic odor at 32.8'
-56	32	12	PUSH		- mottled, with black organic partings and calcerous nodules at 37.7'
-60	36				
-62	38				42.7 ft
-66	42	13		8	Organic SILT (OH): soft, gray and black, with a 3" organic layer
-68	44				
-70	46				
-72	48	14	PUSH		mottled, brown and black organic pockets, partings, and seams, with vertical gray sandy silt and brown sandy clay seams below 47.6
-76	52	15	PUSH		52.5 ft **NORFOLK FORMATION (Qn)** Silty Fine SAND (SM): loose, gray - mottled with dark brown at 52.5'
-78	54				- with clay partings and organic pockets, 52.5' to 55'
-80	56				
-82	58	16		5	- with a trace of organics
-86	62	17	PUSH		- with organic pockets at 62.3'
-88	64				
-90	66				67.3 ft
-92	68	18	PUSH		**YORKTOWN FORMATION (Ty)** Clayey Fine SAND (SC): medium dense, blueish gray, with shell fragments and intact shells up to 1/4-inch-thick
-94	70				
-96	72	19		24	
-98	74				
-100	76				
-102	78	20	PUSH		
-104	80				
-106	82	21		7	- loose at 82'
-108	84				
-110	86				
-112	88	22	PUSH		
-114	90				
-116	92	23	PUSH		
-118	94				
-120	96				
-122	98	24	PUSH		
-124	100				**TD = 99.3'**
-126	102				
-128	104				
-130	106				
-132	108				
-134	110				
-136	112				
-138	114				
-140	116				
-142	118				
-144	120				
-146	122				
-148	124				
-150	126				
-152	128				
-154	130				
-156	132				
-158	134				
-160	136				
-162	138				
-164	140				





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LOG OF BORING AND TEST RESULTS

BORING B-8

Midtown Second Parallel Tunnel

FIGURE A-9

07/09/2008 13:49

PROJECT NO:	3602.001	**START DATE:**	2/26/2008	**DRILLER:**	Fugro Seacore
BORING:	B-9	**COMPLETION DATE:**	2/27/2008	**DRILLING METHOD:**	Geobor

Coordinates: N 3,480,199 E 12,123,254
Virginia State Plane, South Zone, NAD83, feet

MUDLINE ELEVATION: -11.7 ft +/- (rel. MLLW datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO.	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION
		1	PUSH		**ARTIFICIAL FILL (af)**
-14	2				Poorly-graded SAND with silt (SP-SM): loose, dark gray, black, and brown, mottled, with shell fragments, clay pockets, organic seams, and a strong organic odor
-16	4	2	PUSH		
-18	6	3	WOR		*7.2 ft*
-20	8				**ALLUVIUM (Qal)**
-22	10	4	PUSH		Fat CLAY (CH): very soft to soft, dark gray, with a trace of shell fragments to 13.1'
-24	12				
-26	14	5	PUSH		
-28	16	6	WOR		- with a trace of fine sand at 16.4'
-30	18				
-32	20	7	PUSH		- sandy, with shell fragments at 19.7' *20.5 ft*
-34	22				**NORFOLK FORMATION (Qn)**
-36	24	8	PUSH		Clayey Fine SAND (SC): loose, blueish gray and light brown, with shell fragments and oxidation stains and banding
-38	26	9	4|24"		- with a trace of organic matter (fine rootlets and wood fragments) at 23'
-40	28				- with small black inclusions, 23' to 32.8'
-42	30	10	6		- no recovery at 29.5'
-44	32				
-46	34	11	3|24"		- decreased fines content, with heavy oxidation stains and inclusions at 32.8'
-48	36				- yellowish brown and blueish gray, mottled below 32.8'
-50	38	12	15		*37.7 ft* **YORKTOWN FORMATION (Ty)**
-52	40				Silty Fine SAND (SM): medium dense, blueish gray
-54	42				
-56	44	13	17|24"		- with shell fragments, 42.7' to 70'
-58	46				
-60	48	14	21|24"		- with increased fines content, 47.6' to 57.4'
-62	50				
-64	52	15	33		- dense at 52.5'
-66	54				
-68	56				
-70	58	16	15|24"		- with a trace of clay pockets at 57.4'
-72	60				
-74	62	17	15|24"		
-76	64				
-78	66				
-80	68	18	30		
-82	70				*70.0 ft*
-84	72				Clayey Fine SAND (SC): medium dense, blueish gray, with shell fragments
-86	74	19	12|24"		- with a trace of clay pockets, at 72.2'
-88	76				
-90	78	20	12|24"		- with clay pockets and partings at 77.1'
-92	80				
-94	82	21	26		
-96	84				
-98	86				
-100	88	22	9|24"		- with a trace of clay pockets at 86.9'
-102	90				**TD = 88.9'**
-104	92				
-106	94				
-108	96				
-110	98				
-112	100				
-114	102				
-116	104				
-118	106				
-120	108				
-122	110				
-124	112				
-126	114				
-128	116				
-130	118				
-132	120				
-134	122				
-136	124				
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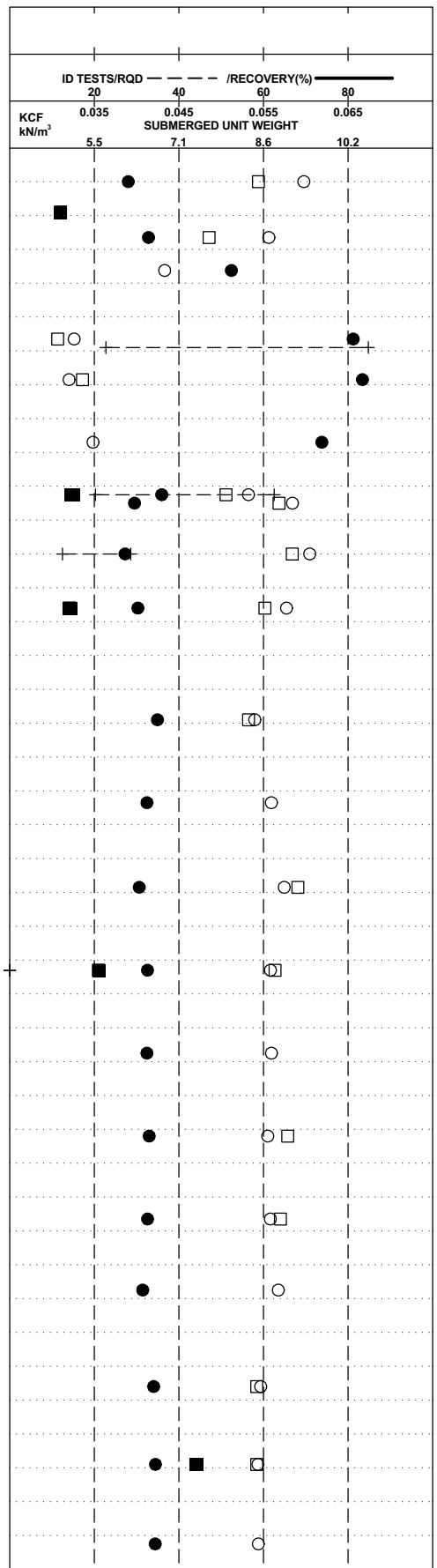
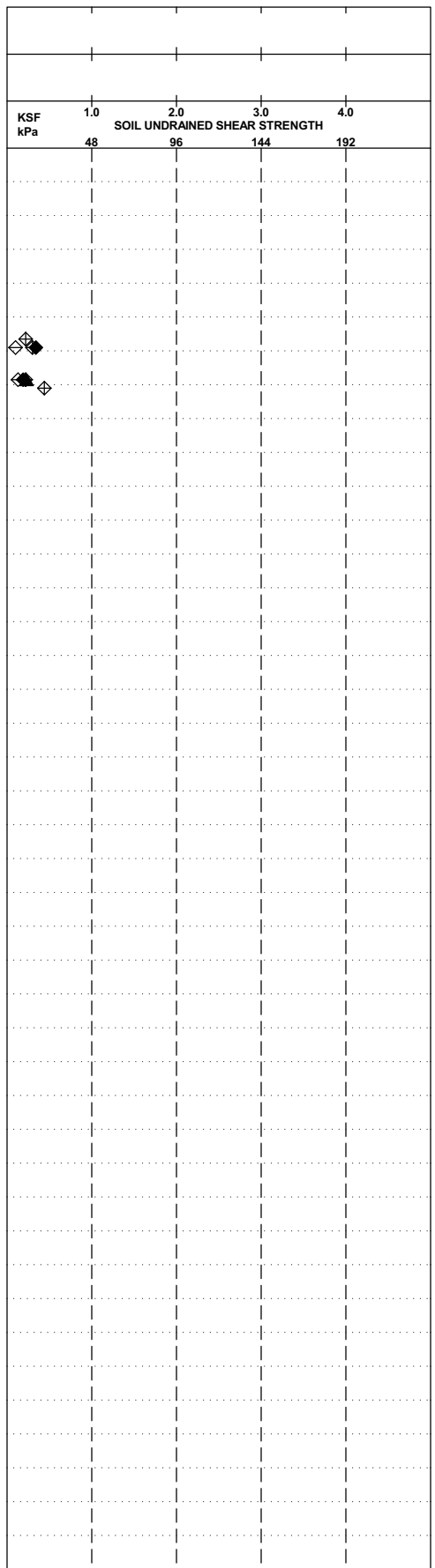
-148	136				
-150	138				
-152	140				





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The log and data presented are a simplification of actual conditions encountered at the time of sampling at the sample location. Subsurface conditions may differ at other locations and with the passage of time.

For symbol identification, refer to Key to Terms & Symbols Used on Logs.

LOG OF BORING AND TEST RESULTS

BORING B-9

Midtown Second Parallel Tunnel

FIGURE A-10

07/09/2008 13:49

PROJECT NO: 3602.001
BORING: B-10

START DATE: 2/27/2008
COMPLETION DATE: 2/28/2008

DRILLER: Fugro Seacore
DRILLING METHOD: Geobor

Coordinates: N 3,480,522 E 12,123,492
Virginia State Plane, South Zone, NAD83, feet

MUDLINE ELEVATION: -10.9 ft +/- (rel. MLLW datum)

SAMPLE NO.	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION
1	PUSH		**ALLUVIUM (Qal)** 0.5 ft SAND (SP): loose, gray and brown, with an organic odor
2	WOR		Silty Fine SAND (SM): loose, dark gray and black, with an organic odor - with a trace of shell fragments, 0.5' to 1.7' - with a 10" dark gray clay layer at 1.7'
3	PUSH		6.6 ft - with clay pockets below 3.3'
4	PUSH		Sandy CLAY (CL): soft, gray, with shell fragments and an organic odor - with a 3" shell layer at 7'
5		25	10.8 ft Silty Fine SAND (SM): medium dense, gray, with shell fragments - with clay partings to 12.3'
6		30|24"	14.3 ft **NORFOLK FORMATION (Qn)** Medium SAND (SP): medium dense to dense, light brownish yellow - with a 3" gray silt layer and a trace of shell fragments at 16.4'
7		20|12"	
8		41	- with a 5" gray silty sand layer and a trace of shell fragments at 23' - medium to coarse grained, 16.7' to 23.8'
9		3|12"	26.7 ft - with oxidation staining, 23.8' to 26.7'
10		8|12"	Poorly-graded SAND with silt (SP-SM): medium dense, gray with yellow and orange, oxidation staining, with rounded gravel - brownish yellow at 29.5'
11		29	- no recovery at 32.8'
12		30|6"	37.7 ft **YORKTOWN FORMATION (Ty)**
13		30|6"	Silty Fine SAND (SM): medium dense, blueish gray, with shell fragments and fine shell particles (possibly micaceous)
14		12|24"	- no recovery at 37.7'
15		33	- dense at 47.6'
16		15|24"	
17		18|24"	- with a trace of clay pockets at 57.4'
18		38	- dense at 62.3'
19		13|24"	67.3 ft Clayey Fine SAND (SC): medium dense, blueish gray, with a trace of clay pockets to 74.2'
20		18|24"	
21		30	
22		12|24"	- with a trace of clay pockets at 86.9'
			TD = 88.9'

ID TESTS/RQD — — — /RECOVERY(%) —
20 40 60 80

KCF kN/m³: 0.035 0.045 0.055 0.065
SUBMERGED UNIT WEIGHT
5.5 7.1 8.6 10.2

KSF kPa: 1.0 2.0 3.0 4.0
SOIL UNDRAINED SHEAR STRENGTH
48 96 144 192

CPT INTERVAL

FIGURE A-11

The log and data presented are a simplification of actual conditions encountered at the time of sampling at the sample location. Subsurface conditions may differ at other locations and with the passage of time.

For symbol identification, refer to Key to Terms & Symbols Used on Logs.

LOG OF BORING AND TEST RESULTS

BORING B-10

Midtown Second Parallel Tunnel

FUGRO

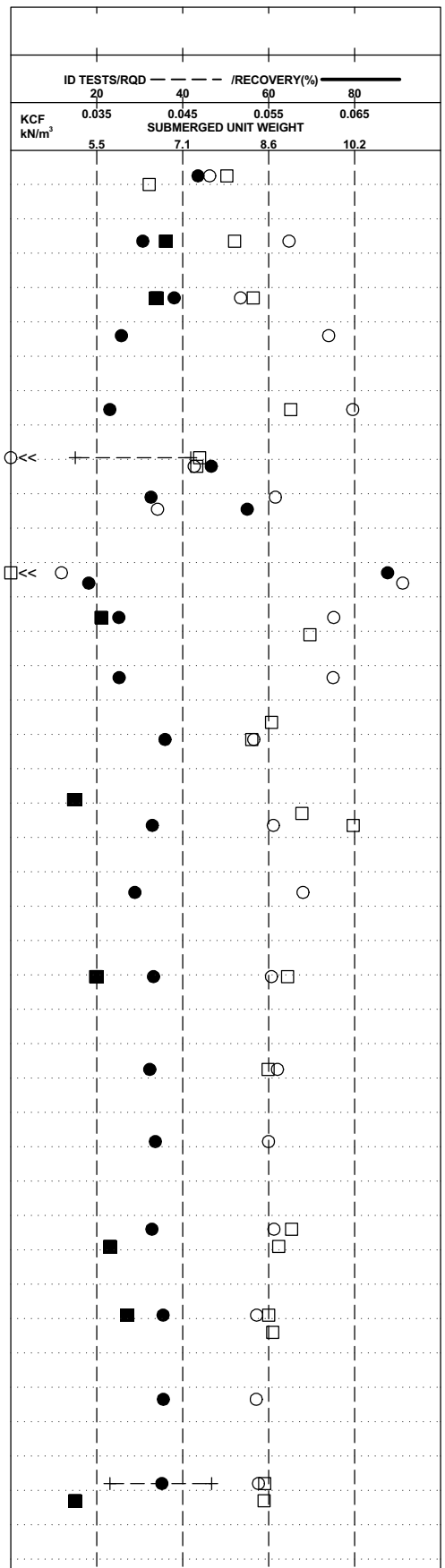
07/09/2008 13:49

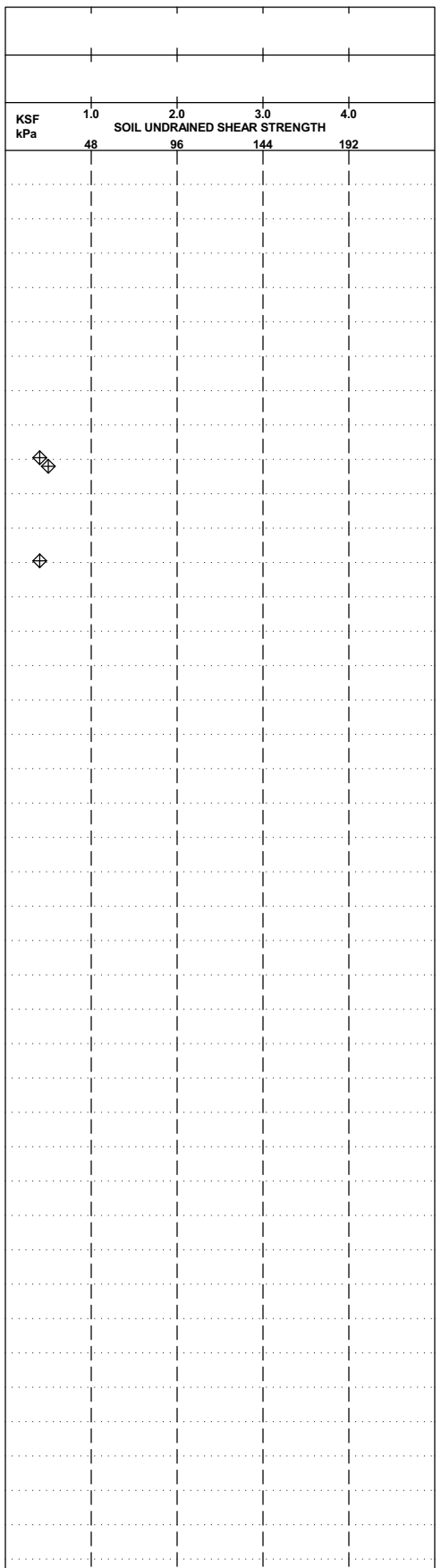
PROJECT NO:	3602.001	**START DATE:**	2/28/2008	**DRILLER:**	Fugro Seacore
BORING:	B-11	**COMPLETION DATE:**	2/29/2008	**DRILLING METHOD:**	Geobor

Coordinates: N 3,480,644 E 12,123,570
Virginia State Plane, South Zone, NAD83, feet

MUDLINE ELEVATION: -11.0 ft +/- (rel. MLLW datum)

SAMPLE NO.	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION
1	PUSH		**ALLUVIUM (Qal)** *0.7 ft*
			Silty SAND (SM): loose, black, with silt seams and an organic odor
2	PUSH		Fine SAND (SP): loose, gray to dark gray, with clay seams, shell fragments and an organic odor
			6.6 ft
3	PUSH		Silty Fine SAND (SM): loose, gray to dark gray, with shell fragments and an organic odor
4		5	- increased fines content at 6.6'
			- with silt partings at 9.8'
			- gray below 9.8'
5	PUSH		- medium dense, with abundant shell fragments at 13.1'
6	PUSH		- with clay layers at 16.4'
			17.9 ft
7		WOH	Organic CLAY (OL): soft to firm, dark gray, with black organic inclusions (wood and plant debris), a trace of shell fragments, and an organic odor
			- with a 12" silty fine sand layer at 19.7'
8	PUSH		
			with a 5" organic layer and gray silt partings at 24.6' *25.2 ft*
9	PUSH		**NORFOLK FORMATION (Qn)**
			Silty Fine SAND (SM): loose to medium dense, gray to blueish gray
10		5	- gray with a trace of shell fragments at 25.2'
			- with a trace of fine gravel, 25.2 to 29.5'
			- with a 3" well-graded gray sand layer at 30.5'
11		5|24"	
			- gray with yellow streaks at 34.0'
			37.7 ft
12		26|24"	**YORKTOWN FORMATION (Ty)**
			Silty Fine SAND (SM): loose to medium dense, blueish gray
13		31	- dense, with abundant shell fragments at 42.7'
14		14|24"	- with shell fragments and fine shell particles (possibly micaceous) below 47.6'
15		14|24"	
16		30	
17		28|24"	
			67.3 ft
18		14|24"	Clayey Fine SAND (SC): medium dense, blueish gray, with shell fragments
19		33	- dense at 72.2'
20		15|24"	- with a trace of clay pockets at 77.1'
			TD = 79.1'





CPT INTERVAL

The log and data presented are a simplification of actual conditions encountered at the time of sampling at the sample location. Subsurface conditions may differ at other locations and with the passage of time.

For symbol identification, refer to Key to Terms & Symbols Used on Logs.

LOG OF BORING AND TEST RESULTS

BORING B-11

Midtown Second Parallel Tunnel

FIGURE A-12

VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3478965
EASTING: 12122033
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -29.4 ft
VERTICAL DATUM: MLLW

B-1

FIELD DATA

Date(s) Drilled: 3/3/2008 - 3/4/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
						0									
		-30				0.7						0.0 / -29.4 Fat CLAY (CH) extremely soft black with a trace of shell fragments and fine sand, petroleum waste odor **CH**			120.3
	2		PUSH			1									
						2.5									
						3.3									
	4					3.6							113	81	143.7
			PUSH												
		-35				5.8									
	6					6.6									
						7.6									84.8
	8		WOR												
						8.6									
						9.8						9.8 / -39.2 Sandy CLAY (CL) firm gray to olive gray **CL**			
	10	-40				10.6									34.0
			PUSH												
	12					12.3									
						13.1						with fine sand pockets and partings at 13.1'			
	14		WOR			14.1									43.4
						15.1									
	16	-45				16.4						16.4 / -45.8 Fat CLAY (CH) firm gray to olive gray with organic pockets (wood) **CH**			
						17.8							87	59	78.9
	18		PUSH												
						19.65									
	20					19.7						with a trace of organic pockets (wood), 19.7' to 26.2'			
		-50													
			PUSH			21.2									75.2
	22					22.2									
						23						faint creosote odor at 23'			
	24		WOH			23.5									80.2
						24.5									
		-55													
	26					26.2						with organic pockets (wood/plant fiber) at 26.2'			
						26.7									79.4
			PUSH									3" organic seam (wood) at 27.7'			
	28					28.7									
						29.5							97	61	
	30														

REMARKS:

FIGURE A-13

Prepared By: A. Bro
Reviewed By: T. McNeilan

VDOT BORING LOG-061907 FA08BOR_VDOTLEGACY.GPJ 7/8/08

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VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3478965
EASTING: 12122033
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -29.4 ft
VERTICAL DATUM: MLLW

B-1

FIELD DATA

Date(s) Drilled: 3/3/2008 - 3/4/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
						29.6						29.5 / -58.9 Organic CLAY (OH) firm gray to olive gray with abundant organic pockets, partings, and seams (wood/plant fiber) at 29.5' **OH**			81.7
	32	-60	PUSH			30.1 32									
						32.8									
9	34		4 4 5			33 34.3									86.1
	36	-65													
	38					37.7 38.2						37.7 / -67.1 Silty Fine SAND (SM) medium dense light gray to gray with a trace of organics (stems/rootlets), with clay pockets **SM**			21.6
			PUSH												
	40	-70				40.2									
	42					42.7						no recovery at 42.7'			
	44		10/18"			44.2									
		-75										hard drilling noted at 45.3'			
	46														
						47.6									
23	48		7 6 17			49.1									19.9
	50	-80													
	52					52.5 52.8						loose, gray, with a trace of coarse sand at 52.5'			22.0
			8/18"									52.8 / -82.2 Fine to Medium SAND (SP) medium dense gray **SP**			
	54					54									
		-85										55.4 / -84.8 Silty Fine SAND (SM) medium dense blueish gray with shell fragments and a trace of clay pockets **SM**			
	56														
						57.4									
	58		10/18"			57.9 58.9									35.1
	60														

REMARKS:

FIGURE A-13

Prepared By: A. Bro
Reviewed By: T. McNeilan

VDOT BORING LOG-061907 FA08BOR_VDOTLEGACY.GPJ 7/8/08

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VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3478965
EASTING: 12122033
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -29.4 ft
VERTICAL DATUM: MLLW

B-1

FIELD DATA

Date(s) Drilled: 3/3/2008 - 3/4/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	62	-90													
34			5 13 21			62.3 62.8 63.8						dense, with fine shell partings and a light gray fine to medium sand parting at 62.8'			33.5
	64														
	66	-95													
						67.3						67.3 / -96.7			
	68		10/18"			67.8 68.8						Clayey Fine SAND (SC) medium dense blueish gray with fine shell partings, possibly micaceous **SC**	44	23	35.9
	70														
		-100				72.2									
	72		10/18"			72.7 73.7						with clay pockets and fine shell particles, 72.2' to 78.6'	50	32	35.5
	74														
		-105				77.1									
	76					77.6									
	78		10/18"			78.6									34.2

REMARKS:

FIGURE A-13

Prepared By: A. Bro
Reviewed By: T. McNeilan

VDOT BORING LOG-061907 FA08BOR_VDOTLEGACY.GPJ 7/8/08

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VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3479050
EASTING: 12122036
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -29.9 ft
VERTICAL DATUM: MLLW

B-2

FIELD DATA

Date(s) Drilled: 3/3/2008 - 3/3/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
						0									
						0.4						0.0 / -29.9 Fat CLAY (CH) extremely soft black with a petroleum waste odor **CH**			152.6
	2		PUSH												
						2.5									
						3.3									
						3.5						with gray fine sand seams at 3.3'			159.3
	4					4							120	90	
		-35	PUSH												
						5.8									
	6					6.6									
	8		PUSH			8.1						greenish gray to olive gray with fine sand pockets at 8.1' firm below 8.1'			50.3
						9.1									
						9.8						sandy, 9.8' to 16.4'			
	10	-40				10.3						with gray fine sand pockets and partings, 9.8' to 19.7'	51	35	41.7
			WOR			11.3									
	12														
						13.1						with a trace of organic pockets (wood debris), 13.1' to 19.7'			
	14					14.1									60.0
			PUSH												
		-45				15.6									
	16					16.4									
						17.2									56.6
			PUSH			17.7							148	110	
	18					18.9									
						19.7									
	20	-50				20.7									78.9
			WOR			21.7									
	22														
						23									
						23.5						23.0 / -52.9 Organic CLAY (OH) firm olive gray with abundant organic pockets, partings, and seams (plant fiber, rootlets, and wood debris) **OH**	93	66	106.6
	24		PUSH												
		-55				25.5									
	26					26.2									
						26.6									79.3
			PUSH												
	28					28.7									
						29.5									80.2
	30														

REMARKS:

FIGURE A-14

Prepared By: A. Bro
Reviewed By: T. McNeilan

B-2

VDOT BORING LOG-061907 FA08BOR_VDOTLEGACY.GPJ 7/8/08

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VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3479050
EASTING: 12122036
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -29.9 ft
VERTICAL DATUM: MLLW

B-2

FIELD DATA

Date(s) Drilled: 3/3/2008 - 3/3/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	30		WOH			31									
	32					32.8									
	34		PUSH			33.8							117	86	87.8
		-65				35.3									
	36														
	38					37.7						37.7 / -67.6 Silty Fine SAND (SM) loose to medium dense gray **SM** with clay and organic pockets at 38.0'			23.1
			PUSH												
	40	-70				40.2									
	42														
17			1 5 12			42.7 44.2						medium dense below 42.7' with a large piece of wood debris at 44'			22.8
	44														
		-75													
	46														
	48		10/18"			47.6 49.1						47.6 / -77.5 Fine to Medium SAND (SP) loose to medium dense gray **SP** with wood debris at 48'			24.7
	50	-80													
	52					52.5									
	54		20/18"			53.4 54						with a 12" black peat layer containing fine to medium gray sand seams at 53'			32.5
		-85													
	56														
						57.4						fine-grained, with black organic pockets and partings (peat and wood debris) at 57.4'			
29	58		4 10 19			58.2 58.9						58.2 / -88.1 Silty Fine SAND (SM) medium dense blueish gray with			27.8
	60														

REMARKS:

FIGURE A-14

Prepared By: A. Bro
Reviewed By: T. McNeilan

VDOT BORING LOG-061907 FA08BOR_VDOTLEGACY.GPJ 7/8/08

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VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3479050
EASTING: 12122036
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -29.9 ft
VERTICAL DATUM: MLLW

B-2

FIELD DATA

Date(s) Drilled: 3/3/2008 - 3/3/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	62					62.3						shell fragments **SM**			
			10/18"			62.5									34.8
						63.2						with a sand pocket at 63.0'			39.3
	64					63.8									
		-95													
	66											66.0 / -95.9			
												Clayey Fine SAND (SC) medium dense blueish gray with shell fragments **SC**			
						67.3									
	68		10/18"			68.4									33.4
						68.8									
	70	-100													
						72.2									
8			1												
	74		2			73.2									35.1
			6			73.7									
		-105													
	76														
						77.1									35.9
	78		8/18"												
						78.6									
	80	-110													
						82									
	82														
			PUSH												
	84					84.5						increased fines content at 84.5'			29.8
		-115				85									23.6
			16/18"			85.3									
	86					85.5									
						86									
						86.9									
29			3									with a 9" gray fine to medium sand layer at 86.9'			
	88		10			87.6									28.7
			19			88.4									
	90														

REMARKS:

FIGURE A-14

Prepared By: A. Bro
Reviewed By: T. McNeilan

VDOT BORING LOG-061907 FA08BOR_VDOTLEGACY.GPJ 7/8/08

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VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3479050
EASTING: 12122036
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -29.9 ft
VERTICAL DATUM: MLLW

B-2

FIELD DATA

Date(s) Drilled: 3/3/2008 - 3/3/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	92					91.9						with a 5" gray fine sand layer at 91.9'			22.9
			30/18"			92.9						dense below 91.9'			29.7
						93.4									
	94														
		-125													
	96														
						96.8									
						96.9						with no shell fragments at 96.8'			29.7
	98		30/18"			97.8									28.4
						98.3									

REMARKS:

FIGURE A-14

Prepared By: A. Bro
Reviewed By: T. McNeilan

VDOT BORING LOG-061907 FA08BOR_VDOTLEGACY.GPJ 7/8/08

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VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3479246
EASTING: 12122243
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -47.3 ft
VERTICAL DATUM: MLLW

B-3

FIELD DATA

Date(s) Drilled: 3/2/2008 - 3/2/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	0					0									
						0.6						0.0 / -47.3 Fat CLAY (CH) soft gray to light brownish gray with an organic odor and a 3" soft black fat clay seam **CH**			105.3
	2		PUSH												
		-50				2.5									
						3.3						slightly micaceous at 3.3'			
	4					4.1						with organic pockets (plant fiber, rootlets, and wood debris) to 13.1'			105.3
			PUSH												
	6					5.8									
						6.6									
		-55				7.6							111	83	113.7
	8		WOR												
						8.6									
	10					9.8						with a strong organic odor at 9.8'			
			PUSH												84.4
	12					11.3									
		-60				12.3									
						13.1						13.1 / -60.4 Organic CLAY (OH) soft gray with organic pockets and partings (plant fiber and wood debris) **OH**			
	14					14.1									98.6
			PUSH			14.6							110	81	
						15.6									
	16					16.4						with a trace of organics at 16.4'			
						16.9									81.5
		-65	WOH												
	18					17.9									
						19.7						19.2 / -66.5 Fine SAND (SP) loose gray with a trace of medium sand **SP**			24.7
	20														
			PUSH									with a 5" clay seam containing organic pockets at 20.6'			
	22					22.2									
		-70				23						with organic pockets, partings and seams (plant fiber and wood debris) at 23'			28.8
	24					24									58.5
			PUSH									24.0 / -71.3 Fat CLAY (CH) soft gray with a trace of silt, fine sand, and organic partings (plant fiber) **CH**			
	26					25.5									
						26.2									
						26.7							60	37	61.8
		-75	WOH												
	28					28.2						with a 1" thick brown clay seam at 27.5'			
						29.5									59.2
	30														

REMARKS:

FIGURE A-15

Prepared By: A. Bro
Reviewed By: T. McNeilan

VDOT BORING LOG-061907 FA08BOR_VDOTLEGACY.GPJ 7/8/08

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VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3479246
EASTING: 12122243
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -47.3 ft
VERTICAL DATUM: MLLW

B-3

FIELD DATA

Date(s) Drilled: 3/2/2008 - 3/2/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
			PUSH			30.2						with a 7" light gray fine sand layer containing organic pockets (wood debris and stems) at 30.2'			35.5
	32	-80				32									
						32.8									45.4
						33.3						33.2 / -80.5 Fine SAND (SP) medium dense light gray to gray **SP**			25.3
	34		PUSH												
						35.3									
	36														
		-85				37.7						with shell fragments at 37.7'			
14	38		3 4 10			38.2						38.2 / -85.5 Silty Fine SAND (SM) medium dense blueish gray with shell fragments **SM**	34	9	31.1
						39.2									
	40														
	42														
		-90				42.7									
			13/18"			43.7									33.7
	44					44.2									
	46														
		-95				47.6									33.4
	48		24/18"			49.1									
	50											50.0 / -97.3 Clayey Fine SAND (SC) medium dense blueish gray with shell fragments **SC**			
		-100				52.5									29.2
14			5 5 9			53							48	28	36.1
	54					54									
	56														
		-105				57.4						with fine sand pockets and partings at 57.5'			37.1
	58		22/18"			57.6 58.4									33.6
	60					58.9									

REMARKS:

FIGURE A-15

Prepared By: A. Bro
Reviewed By: T. McNeilan

VDOT BORING LOG-061907 FA08BOR_VDOTLEGACY.GPJ 7/8/08

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VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3479246
EASTING: 12122243
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -47.3 ft
VERTICAL DATUM: MLLW

B-3

FIELD DATA

Date(s) Drilled: 3/2/2008 - 3/2/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	62	-110	5/18"			62.3 62.8 63.4 63.8						increased fines content at 62.3'			45.2
	64														
	66														
11	68	-115	2 4 7			67.3 68.8									32.8
	70														
	72					72.2									34.2
	74	-120	28/18"			73.2 73.7									29.4
	76														
	78	-125	17/18"			77.1 78.1 78.6						micaceous at 77.1'			29.9
	80														
	82	-130													
	84														
	86														
	88	-135	3/18"			86.9 87.2 87.6 88.4									34.3
	90														

REMARKS:

FIGURE A-15

Prepared By: A. Bro
Reviewed By: T. McNeilan

VDOT BORING LOG-061907 FA08BOR_VDOTLEGACY.GPJ 7/8/08

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VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3479246
EASTING: 12122243
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -47.3 ft
VERTICAL DATUM: MLLW

B-3

FIELD DATA

Date(s) Drilled: 3/2/2008 - 3/2/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	92	-140													
	94														
	96														
						96.8									
	98	-145	4/18"			97.3						97.3 / -144.6 Fat CLAY (CH) stiff olive gray **CH** with a brown silty sand pocket at 98'			46.0
						98.3									
	100														
	102	-150													
	104														
	106					106.6						very stiff at 106.6'			
	108	-155	PUSH			108.6 109.1							67	45	41.8

REMARKS:

FIGURE A-15

Prepared By: A. Bro
Reviewed By: T. McNeilan

VDOT BORING LOG-061907 FA08BOR_VDOTLEGACY.GPJ 7/8/08

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VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3479474
EASTING: 12122356
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -48.8 ft
VERTICAL DATUM: MLLW

B-4

FIELD DATA

Date(s) Drilled: 2/29/2008 - 3/1/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	0					0						0.0 / -48.8 Fat CLAY (CH) soft dark gray with a trace of shell fragments and a slight organic odor **CH**			
	2	-50	PUSH			1.5 2.5 3.3									100.3
	4		PUSH			5 5.5							95	69	98.8
	6	-55				5.8 6.6									
	8		PUSH			8.1 9.1									78.5
	10					9.8 11									
	12	-60	PUSH			11.5 12.3						dark gray to grayish brown below 10.8'	113	84	106.1
	14		WOR			13.1 13.6 14.6									99.4
	16	-65				16.4						14.5 / -63.3 Silty Fine SAND (SM) medium dense gray **SM**			
	18		PUSH			17.1 18.9						with a 5" soft, dark gray to grayish brown clay layer with black organic inclusions (fiber and wood) at 17.6'			38.4
	20					19.7						18.1 / -66.9 Fine SAND (SP) medium dense gray **SP** with a trace of shell fragments at 19.7' fine- to medium-grained below 19.7'			
	22	-70	PUSH			21.7 22.2									22.3
62	24		4 14 48			23 23.5 24.5						very dense at 23'			20.9
	26	-75													
	28											28.0 / -76.8 Silty Fine SAND (SM) loose to medium dense blueish gray with shell fragments, intact shells, and fine shell particles			
	30					29.5									

REMARKS:

B-4

FIGURE A-16

Prepared By: A. Bro
Reviewed By: T. McNeilan

VDOT BORING LOG-061907 FA08BOR_VDOTLEGACY.GPJ 7/8/08

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VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3479474
EASTING: 12122356
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -48.8 ft
VERTICAL DATUM: MLLW

B-4

FIELD DATA

Date(s) Drilled: 2/29/2008 - 3/1/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	30														
	30.5		17/24"									(possibly mica) **SM**			31.4
	31.5	-80										with brown clay pockets and partings, 31' to 31.5'			
	32														
	32.8														
	33.3		4 8 14												31.0
	34														
	34.3														
	36	-85													
	37.7														
	38														33.3
	38.2		12/24"												
	39.7														
	40														
	42	-90													
	42.7														
	43.2														41.7
	43.7		4/18"												43.7
	44														
	44.2														
	46	-95										45.2 / -94.0 Clayey Fine SAND (SC) loose to medium dense blueish gray with shell fragments **SC**			
	47.6														
14	48		1 6 8									increased fines content, 47.6' to 62.3'			34.3
	48.1														
	49.1														
	50														
	52	-100													
	52.5														
	53.6		4/18"												36.3
	54														
	56	-105													
	57.4														37.6
	58		7/18"												
	58.4														
	58.9														
	60														

REMARKS:

FIGURE A-16

Prepared By: A. Bro
Reviewed By: T. McNeilan

VDOT BORING LOG-061907 FA08BOR_VDOTLEGACY.GPJ 7/8/08

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VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3479474
EASTING: 12122356
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -48.8 ft
VERTICAL DATUM: MLLW

B-4

FIELD DATA

Date(s) Drilled: 2/29/2008 - 3/1/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	62	-110													
3			1 0 3			62.3 62.8 63.8									32.4
	64														
	66	-115													
	68		10/18"			67.3 67.8 68.3 68.8						with 2" rounded gravel at 68.5'	38	20	40.7 33.2
	70														
	72	-120				72.2									
			6/18"			73 73.7									33.1
	74														
	76	-125													
31	78		5 9 22			77.1 77.6 78.6									27.7
	80														
	82	-130				82									29.2
			8/18"			83.5									
	84														
	86	-135				86.9									
			6/18"			87.4 88.4									30.6
	88														
	90											88.6 / -137.4 Fat CLAY (CH) stiff olive gray **CH**			

REMARKS:

FIGURE A-16

Prepared By: A. Bro
Reviewed By: T. McNeilan

VDOT BORING LOG-061907 FA08BOR_VDOTLEGACY.GPJ 7/8/08

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VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3479474
EASTING: 12122356
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -48.8 ft
VERTICAL DATUM: MLLW

Date(s) Drilled: 2/29/2008 - 3/1/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
		-140													
	92					91.9									22.1
20			5 9 11			93.4						with a 1.5" diameter gray clay pocket at 92.4'			
	94														
	96	-145				96.8									
	98		PUSH			98.3							69	48	67.0
						99.3									

REMARKS:

FIGURE A-16

Prepared By: A. Bro
Reviewed By: T. McNeilan

VDOT BORING LOG-061907 FA08BOR_VDOTLEGACY.GPJ 7/8/08

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VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3479583
EASTING: 12122610
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -47.5 ft
VERTICAL DATUM: MLLW

B-5

FIELD DATA

Date(s) Drilled: 3/1/2008 - 3/2/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
						0						0.0 / -47.5 Organic CLAY (OH) soft gray with pockets, partings, and seams of organic matter (wood debris and fibrous material) **OH**			
	2	-50	PUSH			1.5 2.5						with a faint organic odor to 9.8'			84.4
						3.3						with a trace of shell fragments, 3.3' to 9.8'			
	4		PUSH			4.8 5.3							99	72	96.3
	6					5.8 6.6						6.6 / -54.1 Fat CLAY (CH) soft to firm gray with a trace of fine sand **CH**			
	8	-55	PUSH			8.1 9.1						with silty fine sand seams below 9.1'			87.3
	10					9.8									
			WOR			10.8						with a 1" organic seam at 10.6'			88.0
	12	-60				11.8 13.1						with sand pockets and partings at 13.1'			
	14		PUSH			13.8 14.3							97	65	84.6
	16					15.6 16.4						16.4 / -63.9 Silty Fine SAND (SM) loose gray with a trace of organic matter (wood debris) **SM**			26.2
	18	-65	PUSH			16.9 18.9						with a 3" clay seam at 17.4'			
						19.7									
	20		WOR			20.2 21.2						19.9 / -67.4 Organic CLAY (OH) soft dark gray with organic pockets (wood debris) **OH**	96	67	82.7
	22	-70				23						with a 5" soft gray clay layer at 23'			
	24		PUSH			23.5						dark gray to brown, with calcareous nodules below 23.5'			85.9
						25.5 26.2						soft to firm, interbedded gray and brown, with light gray fine sand partings and black organic matter (wood debris) at 26.2'			
	26														
	28	-75	PUSH			27.7 28.2 28.7							115	72	86.9
	30					29.5									

REMARKS:

FIGURE A-17

Prepared By: A. Bro
Reviewed By: T. McNeilan

VDOT BORING LOG-061907 FA08BOR_VDOTLEGACY.GPJ 7/8/08

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VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3479583
EASTING: 12122610
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -47.5 ft
VERTICAL DATUM: MLLW

B-5

FIELD DATA

Date(s) Drilled: 3/1/2008 - 3/2/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
8	30		0 0 8			30 31						brown to dark brown at 29.5' with light gray sand partings below 30.6'			53.1
	32	-80				32.8									
	34		PUSH			34 34.7 35.3						firm, dark brown, with sand seams at 33.8'			70.0 27.6
	36											34.7 / -82.2 Fine SAND (SP) loose gray **SP**			
	38	-85				37.7 38.2 38.7						37.7 / -85.2 Silty Fine SAND (SM) loose to medium dense blueish gray with shell fragments **SM**			35.4
			PUSH			39.7 40.2									36.8
	40														
	42	-90				42.7									31.0
24	44		3 9 15			44.2						44.5 / -92.0 Clayey Fine SAND (SC) loose to medium dense blueish gray with shell fragments **SC**			
	46														
	48	-95	16/24"			47.6 48.1 49.1 49.6									36.5 34.5
	50														
	52	-100				52.5 53.5						with a trace of clay pockets at 52.5'			
	54		6/24"			54.5									36.9
	56														
16	58	-105	2 7 9			57.4 58.9									33.6
	60														

REMARKS:

FIGURE A-17

Prepared By: A. Bro
Reviewed By: T. McNeilan

VDOT BORING LOG-061907 FA08BOR_VDOTLEGACY.GPJ 7/8/08

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VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3479583
EASTING: 12122610
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -47.5 ft
VERTICAL DATUM: MLLW

B-5

FIELD DATA

Date(s) Drilled: 3/1/2008 - 3/2/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	62	-110				62.3									
			15/24"			62.8									35.0
	64					63.8									31.9
						64.3									
	66														
		-115				67.3									
	68		3/18"			68.4									33.6
						68.8									
	70														
	72					72.2									
23		-120	3			72.7						dark gray at 72.2'			33.1
			10												
	74		13			73.7						with abundant shell fragments at 73.5'			
	76														
						77.1									
		-125				77.3									35.4
	78		6/18"			78.1						with fine sand partings, 77' to 77.5'			29.1
						78.6									
	80														
	82					82.2						no shells, decreased fines content below 82'			29.6
		-130				82.6									
			19/18"			83.1									29.0
	84					83.7									
	86														
		-135													
	88														
	90														

REMARKS:

FIGURE A-17

Prepared By: A. Bro
Reviewed By: T. McNeilan

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VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3479583
EASTING: 12122610
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -47.5 ft
VERTICAL DATUM: MLLW

B-5

FIELD DATA

Date(s) Drilled: 3/1/2008 - 3/2/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	92	-140	2/18"			91.9 – 93.4									32.4
	94														
	96														
	98	-145										98.0 / -145.5 Fat CLAY (CH) stiff to very stiff olive gray **CH**			
	100														
	102					101.7 – 103.2						with sand partings at 101.7'	72	50	43.3
	104	-150	5/18"												
	106														
	108	-155													
	110														
	112					111.5						no recovery at 111.5'			
	114	-160	PUSH			114									
	116														
	118	-165				118.1									45.5
	120		PUSH												

REMARKS:

FIGURE A-17

Prepared By: A. Bro
Reviewed By: T. McNeilan

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PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3479583
EASTING: 12122610
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -47.5 ft
VERTICAL DATUM: MLLW

B-5

FIELD DATA

Date(s) Drilled: 3/1/2008 - 3/2/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	122	-170	PUSH			120.6 – 121.4						no recovery at 121.4'			
	124					123.9 – 124.7									41.9
	126		PUSH			127.2									

REMARKS:

FIGURE A-17

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Reviewed By: T. McNeilan

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PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3479839
EASTING: 12122694
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -26.3 ft
VERTICAL DATUM: MLLW

B-6

FIELD DATA

Date(s) Drilled: 2/24/2008 - 2/25/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
						0						0.0 / -26.3 Fat CLAY (CH) soft greenish gray to gray no recovery at surface **CH**			
	2		PUSH			2.5									
		-30				3.3						with silty fine sand pockets and a trace of shell fragments at 3.3'			
	4		PUSH			4.3									92.1
						5.8									
	6					6.3							82	60	
			WOR												
	8	-35				8.3									
						9.8									
	10					10.3									83.1
			PUSH												
	12					12.3									
						13.1						gray below 13.1'			
	14	-40				14.6						with shell fragments at 14.6'	95	69	84.3
						15.6									
	16					16.4									
			WOR												
	18					17.9									81.7
		-45				18.4									
	20					19.7						micaceous, with a trace of shell and wood fragments at 19.7'			
			PUSH			21.2									86.4
	22					22.2									
						23									
		-50				23.8						23.0 / -49.3 Organic CLAY (OH) soft gray **OH**	100	69	97.0
	24		PUSH			24.83									
	26					26.2									
			WOR												
	28					27.7									96.8
		-55				28.2									
						29.5									
	30														

REMARKS:

FIGURE A-18

Prepared By: A. Bro
Reviewed By: T. McNeilan

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PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3479839
EASTING: 12122694
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -26.3 ft
VERTICAL DATUM: MLLW

B-6

FIELD DATA

Date(s) Drilled: 2/24/2008 - 2/25/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
						30.2									96.2
			PUSH									increasing organic matter below 31.0' with organic seams at 31.7'	84	55	
	32					31.7									
						32									
						32.8									
						33.3									88.0
	34	-60				33.8									46.9
			PUSH									33.8 / -60.1 Silty Fine SAND (SM) loose gray **SM** with silt seams and organic pockets at 33.8'			
	36					35.3									
						37.7									
6	38		4 2 4			38.4									20.5
		-65				39.2									
	40														
	42					42.7						no recovery at 42.7'			
		-70													
	44					45.2									
						45.9									
32	46		5 12 20			46.4						dense below 45.9'			31.3
						47.4									
	48	-75													
	50														
						50.9									
32	52		5 16 16			51.4									30.4
						52.4									
	54	-80													
	56														
						57.4									30.9
31	58		5 10 21												
		-85				58.9									
	60														

REMARKS:

FIGURE A-18

Prepared By: A. Bro
Reviewed By: T. McNeilan

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PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3479839
EASTING: 12122694
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -26.3 ft
VERTICAL DATUM: MLLW

B-6

FIELD DATA

Date(s) Drilled: 2/24/2008 - 2/25/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	62					62.3						62.3 / -88.6			
28			6 10 18									Fine to Medium SAND (SP) medium dense gray **SP**			
	64	-90				63.5 63.8						63.5 / -89.8 Clayey Fine SAND (SC) medium dense blueish gray **SC**			22.4
	66														
	68					67.3						dark gray, micaceous, with shell fragments at 67.3'			
		-95	PUSH			68.8									40.3
	70					69.8									
	72					72.2						micaceous, with a trace of shell fragments at 72.2'			
		-100	PUSH			74.2									
	74					74.7									37.8
	76														
						77.1						loose, dark gray to gray, with shell fragments at 77.1'			
8	78		1 3 5			78.3									
		-105				78.6									34.0
	80														
	82					82						with a trace of clay pockets at 82'			
						83									47.8
		-110	PUSH			84							47	27	
	84					84.5									
	86														
						86.9						gray, with clay pockets 86.9' to 91.9'			
	88					87.7									36.2
		-115	PUSH												
	90					89.4									

REMARKS:

FIGURE A-18

Prepared By: A. Bro
Reviewed By: T. McNeilan

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VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3479839
EASTING: 12122694
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -26.3 ft
VERTICAL DATUM: MLLW

B-6

FIELD DATA

Date(s) Drilled: 2/24/2008 - 2/25/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	92					91.9						with shell fragments and a trace of clay seams at 91.9'			
		-120	PUSH			93.4									
	94					93.9									56.1
						94.4									
	96														
						96.8									
37			6									dense below 96.8'	34	14	29.3
	98		13												
		-125	24			98.3									
	100														
						101.7									
	102					102.7									29.3
			PUSH												
		-130				103.7									29.3
	104					104.2									
	106														
						106.6									
	108		PUSH												
		-135				108.6									32.3
						109.1									

REMARKS:

FIGURE A-18

Prepared By: A. Bro
Reviewed By: T. McNeilan

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PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3479980
EASTING: 12123065
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -23.3 ft
VERTICAL DATUM: MLLW

B-8

FIELD DATA

Date(s) Drilled: 2/26/2008 - 2/26/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	0					0						0.0 / -23.3 Silty Fine SAND (SM) loose light gray with shell fragments, no recovery at surface **SM**			
	2	-25	WOR			1.5									
						3.3									26.0
	4					3.5 4						4.0 / -27.3 Fat CLAY (CH) very soft to soft greenish gray with a trace of fine sand **CH**			80.8
			PUSH												
	6					5.8									
		-30				6.6						with a trace of shell fragments, 6.6 to 9.1'			
						7.3									86.3
	8		PUSH			7.8							94	69	
						9.1									
	10					9.8									
			WOR			10.5									79.0
		-35				11.3									
	12														
						13.1									
	14		PUSH			13.8									83.8
						15.6									
	16					16.4									
		-40				17.1						with a trace of shell fragments, 16.4 to 21.2'	96	73	77.0
	18		PUSH												
						18.9									
	20					19.7									
			WOR			20.7									82.4
		-45				21.2									
	22														
						23									
	24														
			PUSH			24.5							87	61	83.0
	26														
		-50				26.2 26.25									
	28		PUSH			27.7							92	66	87.8
						28.7									
	30					29.5									

REMARKS:

FIGURE A-19

Prepared By: A. Bro
Reviewed By: T. McNeilan

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PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3479980
EASTING: 12123065
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -23.3 ft
VERTICAL DATUM: MLLW

B-8

FIELD DATA

Date(s) Drilled: 2/26/2008 - 2/26/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	30	-55	WOR			30.5 – 31.5									89.5
	32					31.5 – 32.8						with organic pockets, slight organic odor at 32.8'			
	34		PUSH			32.8 – 35.3									84.2
	36	-60				35.3 – 37.7									
	38		PUSH			37.7 – 40.2						mottled, with black organic partings and calcerous nodules at 37.7'			83.9
	40					40.2 – 42.7									
	42	-65				42.7 – 44.2						42.7 / -66.0 Organic SILT (OH) soft gray and black with a 3" organic layer **OH**			102.5
8	44		3 4 4												
	46														
	48	-70	PUSH			47.6 – 49.1						mottled, brown and black organic pockets, partings, and seams, with vertical gray sandy silt and brown sandy clay seams below 47.6	92	52	115.9
	50					49.6 – 50.1									
	52	-75				52.5 – 53.5						52.5 / -75.8 Silty Fine SAND (SM) loose gray **SM** mottled with dark brown at 52.5'			
	54		PUSH			54.5 – 55						with clay partings and organic pockets, 52.5' to 55'			43.0
	56	-80													
5	58		2 1 4			57.4 – 58.1 – 58.9						with a trace of organics			70.5
	60														

REMARKS:

FIGURE A-19

Prepared By: A. Bro
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PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3479980
EASTING: 12123065
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -23.3 ft
VERTICAL DATUM: MLLW

B-8

FIELD DATA

Date(s) Drilled: 2/26/2008 - 2/26/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	62	-85				62.3						with organic pockets at 62.3'			
	64		PUSH			64.3 64.8									65.6
	66														
		-90				67.3						67.3 / -90.6 Clayey Fine SAND (SC) medium dense blueish gray with shell fragments and intact shells up to 1/4-inch-thick **SC**			
	68		PUSH			69.3 69.8									36.6
	70														
		-95				72.2									
24	72		4 11 13			72.5 73.7									35.5
	74														
	76														
		-100				77.1									
	78		PUSH			79.1 79.6									38.3
	80														
		-105				82									
7	82		1 1 6			82.5 83.5						loose at 82'			35.1
	84														
	86														
		-110				86.9									
	88		PUSH			88.4 89.4									34.9
	90														

REMARKS:

FIGURE A-19

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Reviewed By: T. McNeilan

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PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3479980
EASTING: 12123065
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -23.3 ft
VERTICAL DATUM: MLLW

B-8

FIELD DATA

Date(s) Drilled: 2/26/2008 - 2/26/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	92	-115				91.9									
			PUSH			93.4									39.5
	94					94.4									
	96	-120				96.8									
	98		PUSH			98.3									33.5
						99.3									

REMARKS:

FIGURE A-19

Prepared By: A. Bro
Reviewed By: T. McNeilan

VDOT BORING LOG-061907 FA08BOR_VDOTLEGACY.GPJ 7/8/08

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VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3480199
EASTING: 12123254
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -11.7 ft
VERTICAL DATUM: MLLW

B-9

FIELD DATA

Date(s) Drilled: 2/26/2008 - 2/27/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
						0						0.0 / -11.7 Poorly-graded SAND with silt (SP-SM) loose dark gray, black, and brown mottled, with shell fragments, clay pockets, organic seams, and a strong organic odor **SP-SM**			
	2		PUSH			2 2.5									28.0
		-15				3.3									
	4		PUSH			3.8 5.3									32.8
	6					5.8 6.6									
			WOR			7.25									52.4
	8	-20				8.1						7.2 / -18.9 Fat CLAY (CH) very soft to soft dark gray with a trace of shell fragments to 13.1' **CH**			
	10					9.8									
			PUSH			11.3 11.8							85	62	81.2
	12					12.3									
		-25				13.1									
	14					13.7									83.4
			PUSH			15.6									
	16					16.4						with a trace of fine sand at 16.4'			
			WOR			17.4									73.8
	18	-30				17.9									
						19.7						sandy, with shell fragments at 19.7'			
	20					20.5							63	43	36.0
			PUSH			21						20.5 / -32.2 Clayey Fine SAND (SC) loose blueish gray and light brown with shell fragments and oxidation stains and banding **SC**			29.5
	22					22.2									
		-35				23						with a trace of organic matter (fine rootlets and wood fragments) at 23'			
	24		PUSH			24						with small black inclusions, 23' to 32.8'	29	17	27.3
						25.5									
	26					26.2									
			4/24"			27.2									30.3
	28	-40				28.2									
						29.5									
	30														

REMARKS:

FIGURE A-20

Prepared By: A. Bro
Reviewed By: T. McNeilan

VDOT BORING LOG-061907 FA08BOR_VDOTLEGACY.GPJ 7/8/08

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VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3480199
EASTING: 12123254
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -11.7 ft
VERTICAL DATUM: MLLW

B-9

FIELD DATA

Date(s) Drilled: 2/26/2008 - 2/27/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
6			3 3 3			31						no recovery at 29.5'			
	32					32.8									
		-45										decreased fines content, with heavy oxidation stains and inclusions at 32.8'			
	34		3/24"			33.8									34.9
						34.8						yellowish brown and blueish gray, mottled below 32.8'			
	36														
	38					37.7									
15		-50	2 5 10			38.7 39.2						37.7 / -49.4 Silty Fine SAND (SM) medium dense blueish gray **SM**			32.5
	40														
	42					42.7									
		-55										with shell fragments, 42.7' to 70'			
	44		17/24"			43.7									30.6
						44.7									
	46														
	48					47.6						with increased fines content, 47.6' to 57.4'			
		-60											NP	NP	32.6
			21/24"			48.6									
	50					49.6									
	52					52.5						dense at 52.5'			
33		-65	6 12			53.5									32.4
	54		21			54									
	56														
						57.4						with a trace of clay pockets at 57.4'			
	58	-70	15/24"			58.4									33.0
						59.4									
	60														

REMARKS:

FIGURE A-20

Prepared By: A. Bro
Reviewed By: T. McNeilan

VDOT BORING LOG-061907 FA08BOR_VDOTLEGACY.GPJ 7/8/08

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VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3480199
EASTING: 12123254
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -11.7 ft
VERTICAL DATUM: MLLW

B-9

FIELD DATA

Date(s) Drilled: 2/26/2008 - 2/27/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	62					62.3									
		-75	15/24"			63.3									32.6
	64					64.3									
	66														
						67.3									
30	68	-80	5 12 18			67.5 68.8									31.5
	70											70.0 / -81.7 Clayey Fine SAND (SC) medium dense blueish gray with shell fragments **SC**			
	72					72.2						with a trace of clay pockets, at 72.2'			
		-85	12/24"			73.2									34.0
	74					74.2									
	76														
						77.1						with clay pockets and partings at 77.1'			
	78	-90	12/24"			77.8									34.5
						79.1									
	80														
						82									
26	82		6 12			82.5									34.4
		-95	14			83.5									
	84														
	86														
						86.9						with a trace of clay pockets at 86.9'			
	88	-100	9/24"			87.9							44	24	33.9
						88.9									

REMARKS:

FIGURE A-20

Prepared By: A. Bro
Reviewed By: T. McNeilan

VDOT BORING LOG-061907 FA08BOR_VDOTLEGACY.GPJ 7/8/08

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VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3480522
EASTING: 12123492
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -10.9 ft
VERTICAL DATUM: MLLW

B-10

FIELD DATA

Date(s) Drilled: 2/27/2008 - 2/28/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	0					0						0.0 / -10.9 SAND (SP) loose gray and brown with an organic odor **SP**			
	2		PUSH			2 2.5						0.5 / -11.4 Silty Fine SAND (SM) loose dark gray and black with an organic odor **SM** with a trace of shell fragments, 0.5' to 1.7' with a 10" dark gray clay layer at 1.7'			54.2
	4	-15	WOR			3.3 4.3 4.8						with clay pockets below 3.3'			47.1
	6					6.6						6.6 / -17.5 Sandy CLAY (CL) soft gray with shell fragments and an organic odor **CL** with a 3" shell layer at 7'			
	8		PUSH			8.1 8.6							49	33	
	10	-20				9.1 9.8									59.4
	12		PUSH			11.8 12.3						10.8 / -21.7 Silty Fine SAND (SM) medium dense gray with shell fragments **SM** with clay partings to 12.3'			32.1
25	14	-25	3 10 15			13.1 13.6 14.6						14.3 / -25.2 Medium SAND (SP) medium dense to dense light brownish yellow **SP**			20.2
	16					16.4 16.6						with a 3" gray silt layer and a trace of shell fragments at 16.4'			22.5
	18		30/24"			18.4									
	20	-30	20/12"			19.7 20.2 20.7									24.7
	22					23						with a 5" gray silty sand layer and a trace of shell fragments at 23' medium to coarse grained, 16.7' to 23.8'			
41	24	-35	4 15 26			23.8 24.5									29.9
	26					26.2 26.7									
	28		3/12"			27.2						with oxidation staining, 23.8' to 26.7'			31.4
	30	-40				29.5						26.7 / -37.6 Poorly-graded SAND with silt (SP-SM) medium dense gray with yellow and orange oxidation staining, with rounded gravel **SP-SM**			

REMARKS:

FIGURE A-21

Prepared By: A. Bro
Reviewed By: T. McNeilan

VDOT BORING LOG-061907 FA08BOR_VDOTLEGACY.GPJ 7/8/08

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VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3480522
EASTING: 12123492
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -10.9 ft
VERTICAL DATUM: MLLW

B-10

FIELD DATA

Date(s) Drilled: 2/27/2008 - 2/28/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
			8/12"			30.1 30.5						brownish yellow at 29.5'			33.0
	32					32.8						no recovery at 32.8'			
29	34	-45	8 13 16			34.3									
	36														
	38					37.7						37.7 / -48.6 Silty Fine SAND (SM) medium dense blueish gray with shell fragments and fine shell particles (possibly micaceous) **SM**			
		-50	30/6"			39.2 39.4									
	40		30/6"			39.48						no recovery at 37.7'			
	42					42.7									
	44	-55	12/24"			43.7 44.7							NP	NP	31.7
	46														
						47.6									
33	48		4 11			48.1						dense at 47.6'			30.2
		-60	22			49.1									
	50														
	52					52.5									
	54	-65	15/24"			53.5 54.5									32.8
	56														
	58					57.5						with a trace of clay pockets at 57.4'			
		-70	18/24"			58.4									31.9
	60					59.5									

REMARKS:

FIGURE A-21

Prepared By: A. Bro
Reviewed By: T. McNeilan

VDOT BORING LOG-061907 FA08BOR_VDOTLEGACY.GPJ 7/8/08

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VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3480522
EASTING: 12123492
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -10.9 ft
VERTICAL DATUM: MLLW

B-10

FIELD DATA

Date(s) Drilled: 2/27/2008 - 2/28/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	62					62.3									
38			3 13 25									dense at 62.3'			33.6
	64	-75				63.8									
	66														
						67.3						67.3 / -78.2 Clayey Fine SAND (SC) medium dense blueish gray with a trace of clay pockets to 74.2' **SC**			
	68		13/24"			68.3									34.5
		-80				69.3									
	70														
	72					72.2									
			18/24"			73.2									35.5
	74	-85				74.2									
	76														
						77.1									
30	78		5 13 17												34.5
		-90				78.6									
	80														
	82														
	84	-95													
	86					86.9						with a trace of clay pockets at 86.9'			
						87.9									
	88		12/24"			88.9									37.0

REMARKS:

FIGURE A-21

Prepared By: A. Bro
Reviewed By: T. McNeilan

VDOT BORING LOG-061907 FA08BOR_VDOTLEGACY.GPJ 7/8/08

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VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3480644
EASTING: 12123570
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -11.0 ft
VERTICAL DATUM: MLLW

B-11

FIELD DATA

Date(s) Drilled: 2/28/2008 - 2/29/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
						0						0.0 / -11.0 Silty SAND (SM) loose black with silt seams and an organic odor **SM**			
	2		PUSH			1.5									43.6
						2.5						0.7 / -11.7 Fine SAND (SP) loose gray to dark gray with clay seams, shell fragments and an organic odor **SP**			
	4	-15				3.3									
			PUSH			5.3									30.7
	6					5.8									
						6.6						6.6 / -17.6 Silty Fine SAND (SM) loose gray to dark gray with shell fragments and an organic odor **SM** increased fines content at 6.6'			
	8		PUSH			8.6									38.0
		-20				9.1									
	10		2			9.8						with silt partings at 9.8'			
5			3			10.8						gray below 9.8'			25.7
			2			11.3									
	12														
						13.1						medium dense, with abundant shell fragments at 13.1'			
	14	-25													
			PUSH			15.1									23.0
						15.6									
	16					16.4						with clay layers at 16.4'			
	18		PUSH			17.9							42	27	
						18.4						17.9 / -28.9 Organic CLAY (OL) soft to firm dark gray with black organic inclusions (wood and plant debris), a trace of shell fragments, and an organic odor **OL**			46.7
		-30				18.9									
	20					19.7						with a 12" silty fine sand layer at 19.7'			
						20.2									32.6
			WOH			20.9									55.0
	22					21.7									
						23									
	24	-35													
			PUSH			24.6						with a 5" organic layer and gray silt partings at 24.6'			87.7
						25.2									18.1
						25.5						25.2 / -36.2 Silty Fine SAND (SM) loose to medium dense gray to blueish gray **SM**			
	26					26.2						gray with a trace of shell fragments at 25.2'			
						27.2						with a trace of fine gravel, 25.2 to 29.5'			25.2
	28		PUSH												
		-40				28.7									
	30					29.5									

REMARKS:

FIGURE A-22

Prepared By: A. Bro
Reviewed By: T. McNeilan

VDOT BORING LOG-061907 FA08BOR_VDOTLEGACY.GPJ 7/8/08

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VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3480644
EASTING: 12123570
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -11.0 ft
VERTICAL DATUM: MLLW

B-11

FIELD DATA

Date(s) Drilled: 2/28/2008 - 2/29/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
5			2 2 3			30.7 31						with a 3" well-graded gray sand layer at 30.5'			25.2
	32					32.8									
	34	-45	5/24"			34.3 34.8						gray with yellow streaks at 34.0'			35.9
	36														
	38					37.7 37.8						37.7 / -48.7 Silty Fine SAND (SM) loose to medium dense blueish gray **SM**			
		-50	26/24"			39.3 39.7									32.9
	40														
	42					42.7									
31			5 12 19			43.2						dense, with abundant shell fragments at 42.7'			28.9
	44	-55				44.2									
	46														
	48					47.6 48.1						with shell fragments and fine shell particles (possibly micaceous) below 47.6'			33.2
		-60	14/24"			49.6									
	50														
	52					52.5									
	54	-65	14/24"			53.5 54.5									32.3
	56														
						57.4									
30	58		4 10 20			57.7									33.6
		-70				58.9									
	60														

REMARKS:

FIGURE A-22

Prepared By: A. Bro
Reviewed By: T. McNeilan

VDOT BORING LOG-061907 FA08BOR_VDOTLEGACY.GPJ 7/8/08

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VIRGINIA DEPARTMENT OF TRANSPORTATION

PROJECT #: 3602.001
PROJECT NAME: Midtown Second Parallel Tunnel
PROJECT LOCATION: Portsmouth to Norfolk, Virginia
STRUCTURE NUMBER:
PPMS:
BENCHMARK LOCATION:

NORTHING: 3480644
EASTING: 12123570
HORIZONTAL DATUM: VA South, NAD83
INCLINATION:
STATION:
OFFSET:
SURFACE ELEVATION: -11.0 ft
VERTICAL DATUM: MLLW

B-11

FIELD DATA

Date(s) Drilled: 2/28/2008 - 2/29/2008
Drilling Method(s): Geobor
SPT Method: Donut Hammer
Other Test(s):
Driller: Fugro Seacore
Inspector: A. Bro / J. Greenwald
Consultant: Fugro Atlantic

GROUND WATER

LAB DATA

SPT N Value	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL % RECOVERY	SAMPLING	SAMPLE INTERVAL	ROCK: CORE % RECOVERY	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP: STRATA	ROCK: DIP: JOINTS	LEGEND	DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	62					62.3									
			28/24"			62.8									32.8
	64	-75				63.8									
						64.3									
	66														
						67.3									
	68					67.8						67.3 / -78.3 Clayey Fine SAND (SC) medium dense blueish gray with shell fragments **SC**			35.4
			14/24"												
		-80				69.3									
	70														
						72.2									
	72		4			72.7						dense at 72.2'			35.5
33			13												
			30			73.7									
	74	-85													
	76														
						77.1									
						77.6						with a trace of clay pockets at 77.1'	47	24	35.2
	78		15/24"												
						78.6									
		-90				79.1									

REMARKS:

FIGURE A-22

Prepared By: A. Bro
Reviewed By: T. McNeilan

VDOT BORING LOG-061907 FA08BOR_VDOTLEGACY.GPJ 7/8/08

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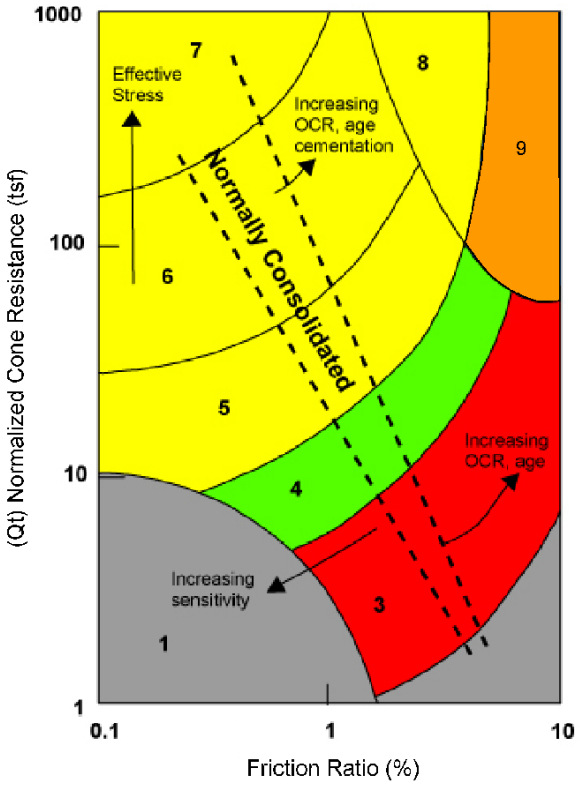
APPENDIX B
CPT SOUDINGS

Fugro CPT Designation	VDOT CPT Designation	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet)		River Bottom Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)
			Northing	Easting			
C-1		4/25/2008	3478945	12122051	-29.5	85.3	-114.8
C-2		4/25/2008	3478998	12121993	-27.3	85.3	-112.6
C-3		4/25/2008	3479027	12121957	-25.8	85.3	-111.1
C-4		4/25/2008	3479063	12121918	-26.7	85.3	-112.0
C-5		4/26/2008	3479080	12122063	-32.0	82.4	-114.4
C-6		4/26/2008	3479159	12122138	-37.5	79.5	-117.0
C-7		4/28/2008	3479194	12122308	-47.9	80.9	-128.9
C-8		4/28/2008	3479218	12122280	-47.8	78.0	-125.8
C-9		4/27/2008	3479240	12122145	-44.3	80.1	-124.4
C-10		4/27/2008	3479302	12122108	-46.9	83.7	-130.6
C-11		4/27/2008	3479376	12122360	-49.7	84.6	-134.3
C-12		4/27/2008	3479495	12122475	-47.6	84.6	-132.2
C-13		4/27/2008	3479508	12122637	-47.7	82.8	-130.5
C-14		4/27/2008	3479574	12122568	-45.6	84.1	-129.7
C-15		4/27/2008	3479613	12122512	-44.9	81.5	-126.4
C-16		4/27/2008	3479658	12122466	-44.8	84.8	-129.6
C-17		4/27/2008	3479676	12122694	-42.0	15.3	-57.4
C-18		4/25/2008	3479813	12122810	-22.0	84.8	-106.8
C-19		4/27/2008	3479778	12122660	-38.9	84.9	-123.8
C-20		4/28/2008	3479376	12122500	-51.5	76.5	-128.0
C-21		4/25/2008	3479941	12122893	-12.9	84.3	-97.2
C-22		4/28/2008	3479433	12122403	-47.8	26.6	-74.4
C-22A		4/28/2008	3479441	12122419	-48.0	74.9	-122.9
C-23		4/26/2008	3480276	12123114	-3.7	85.3	-89.0
C-24		4/25/2008	3480027	12123027	-9.3	74.8	-84.1
C-25		4/25/2008	3480052	12122969	-8.6	77.6	-86.2
C-26		4/24/2008	3480077	12123189	-20.5	81.5	-102.0
C-27		4/26/2008	3480348	12123290	-4.3	85.1	-89.4
C-28		4/24/2008	3480161	12123282	-17.0	91.6	-108.6
C-29		4/25/2008	3480250	12123405	-11.3	84.5	-95.8
C-30		4/24/2008	3480394	12123489	-10.4	24.9	-35.3
C-30A		4/24/2008	3480396	12123446	-10.2	97.6	-107.8
C-31		4/24/2008	3480511	12123508	-11.0	25.3	-36.3
C-32		4/24/2008	3480622	12123569	-10.9	84.8	-95.7
C-33		4/24/2008	3480672	12123577	-10.8	85.3	-96.1
C-34		4/25/2008	3480709	12123545	-10.8	46.8	-57.6
C-35		4/28/2008	3479687	12122761	-39.5	85.0	-124.5
C-36		4/28/2008	3479773	12122843	-30.1	65.8	-95.9
C-37		4/30/2008	3479961	12123101	-23.5	58.5	-82.0
C-38		4/30/2008	3480099	12123071	-7.3	85.2	-92.5

SUMMARY OF CPT SOUNDINGS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-1



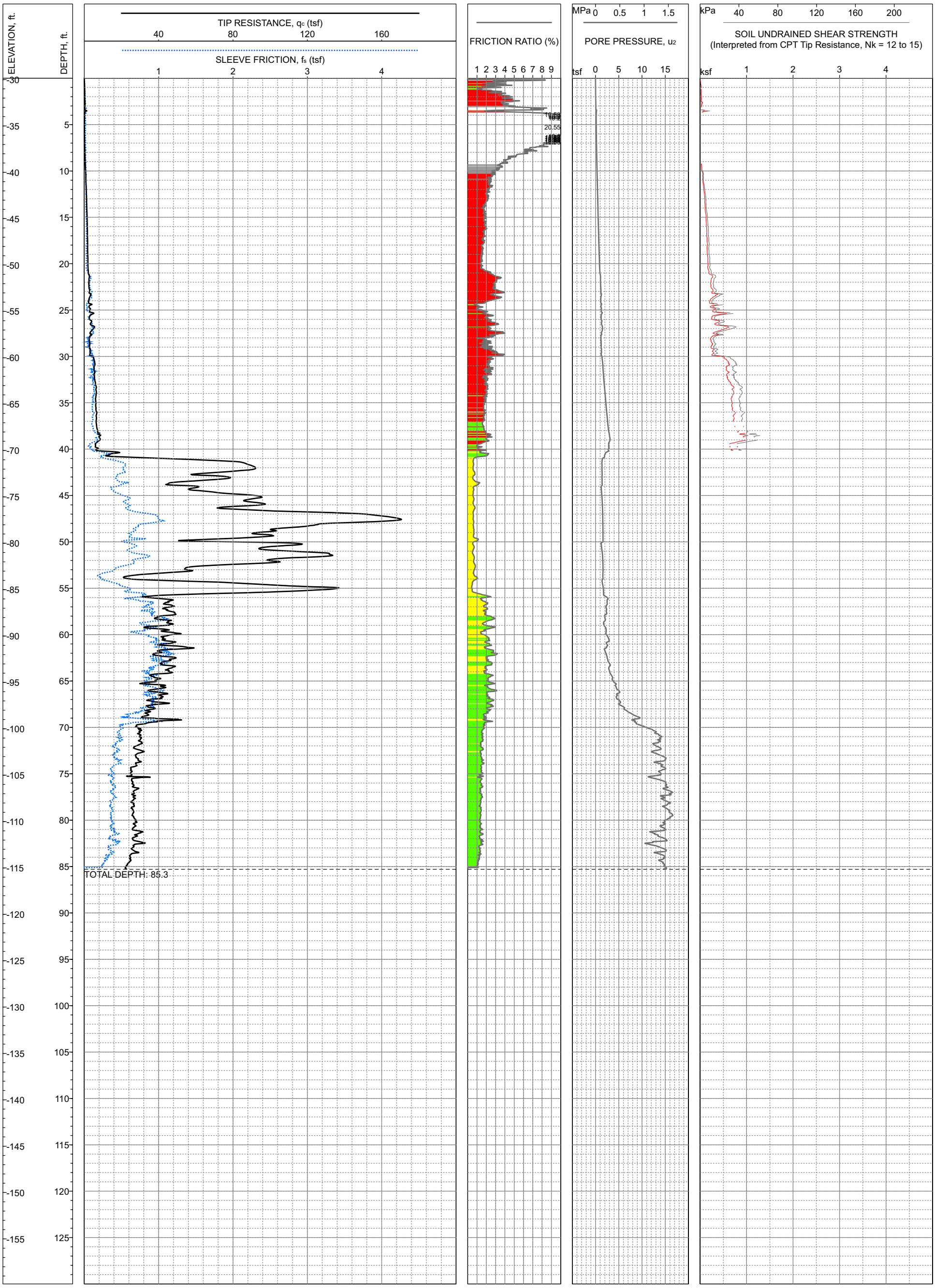
Zone	Soil Behavior Type	U.S.C.S.
1	Sensitive Fine-grained	OL-CH
2	Organic Material	OL-OH
3	Clay to Silty Clay	CL-CH
4	Clayey Silt to Silty Clay	MH-CL
5	Silty Sand to Sandy Silt	SM-ML
6	Sand to Silty Sand	SP-SM
7	Gravelly Sand to Sand	GP-SP
8	Sand to Clayey Sand	SP-SC
9	Very Stiff Fine-grained*	CH-CL

*overconsolidated or cemented

CPT CORRELATION CHART
ROBERTSON, 1990

KEY TO CPT LOGS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-2



COORDINATES: E: 12,122,051 N: 3,478,945 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -29.9ft +/- (MLLW)
COMPLETION DEPTH: 85.3ft
TEST DATE: 4/25/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1697
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

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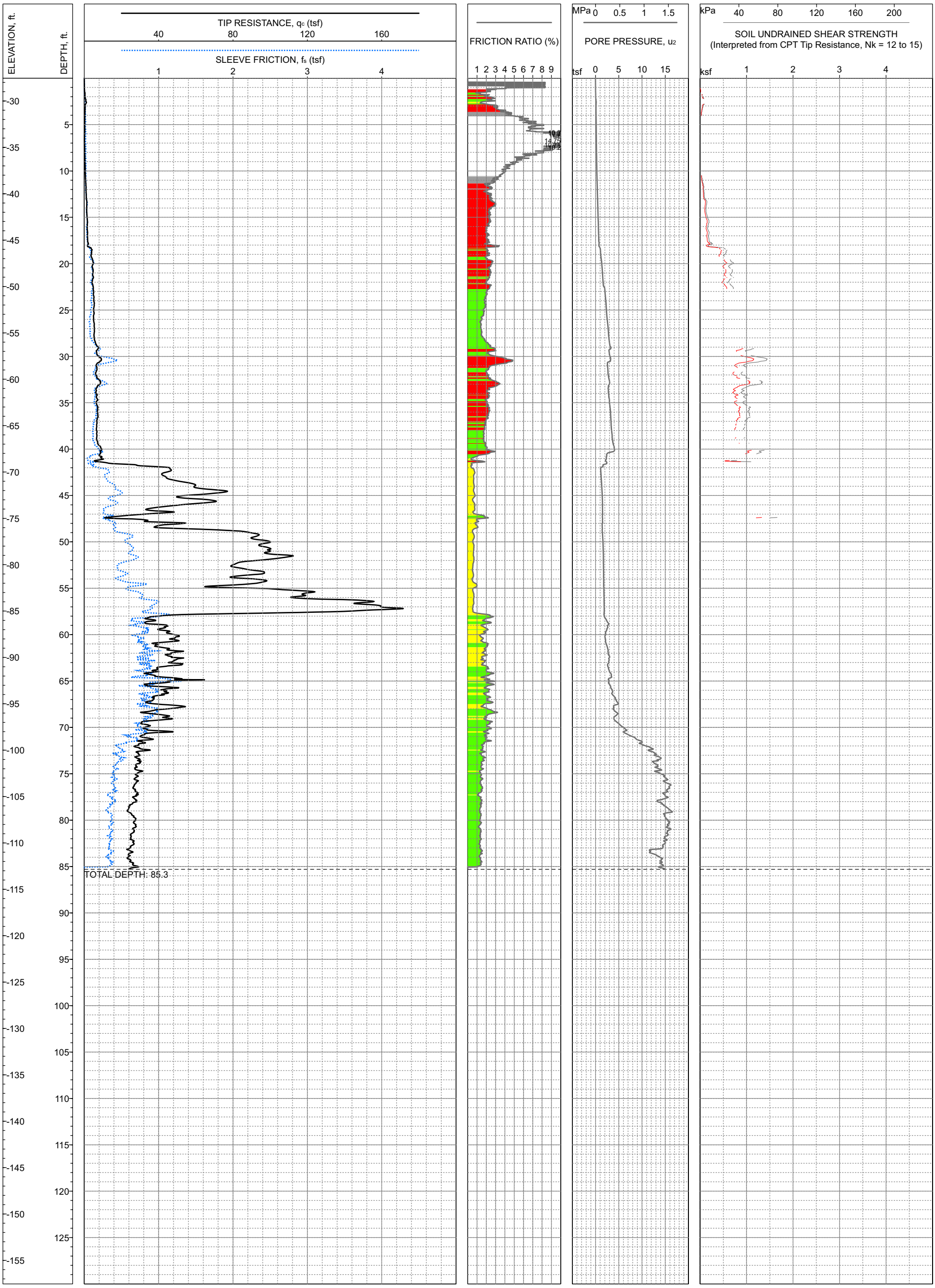
LOG OF CPT C-1
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-3



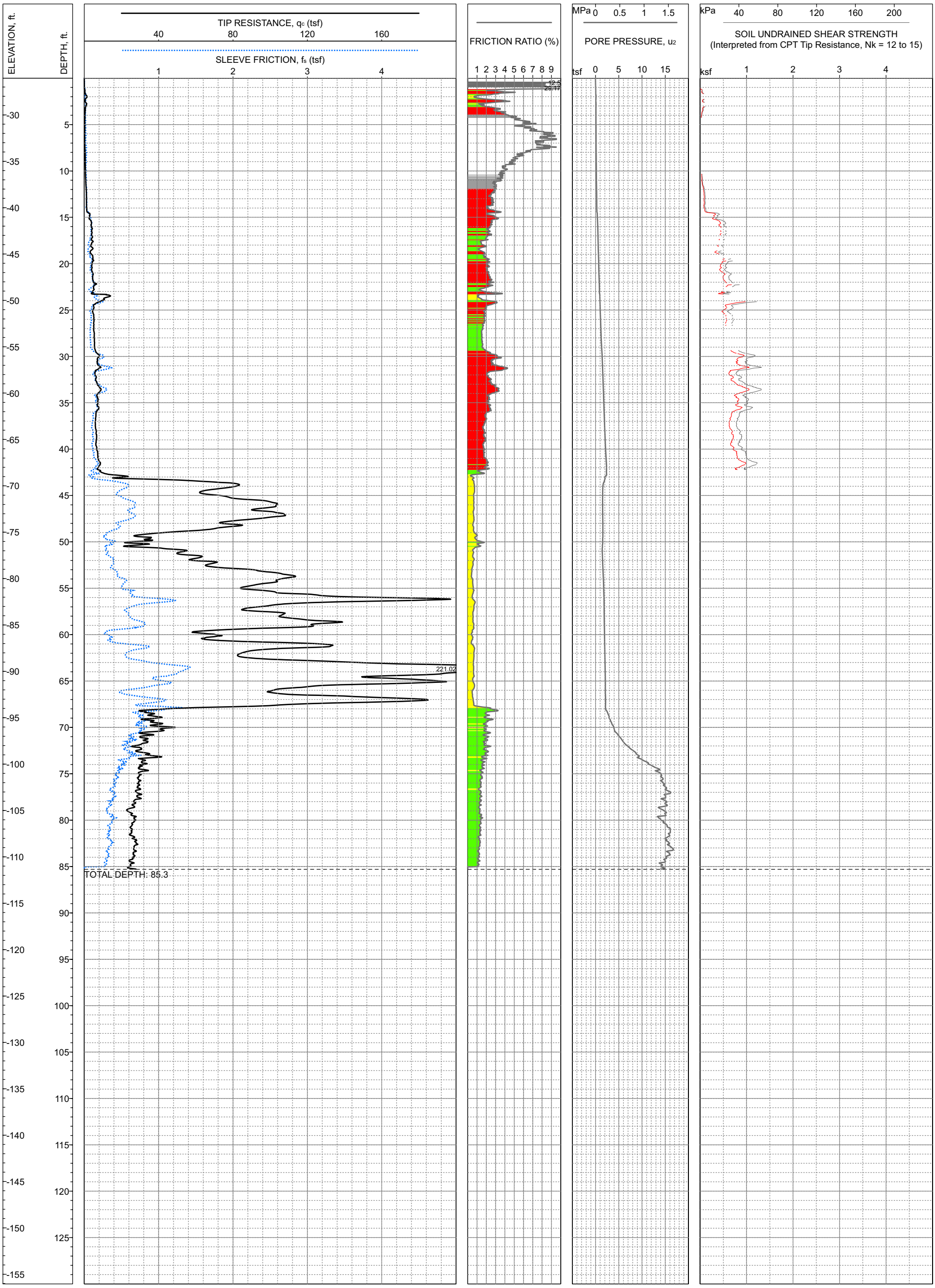
COORDINATES: E: 12,121,993 N: 3,478,998 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -27.5ft +/- (MLLW)
COMPLETION DEPTH: 85.3ft
TEST DATE: 4/25/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1698
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXD\Logs_CPT_FR90.mxd,06/10/2008,kspencer

LOG OF CPT C-2
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-4



COORDINATES: E: 12,121,957 N: 3,479,027 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -26.0ft +/- (MLLW)
COMPLETION DEPTH: 85.3ft
TEST DATE: 4/25/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1698
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

LOG OF CPT C-3
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-5

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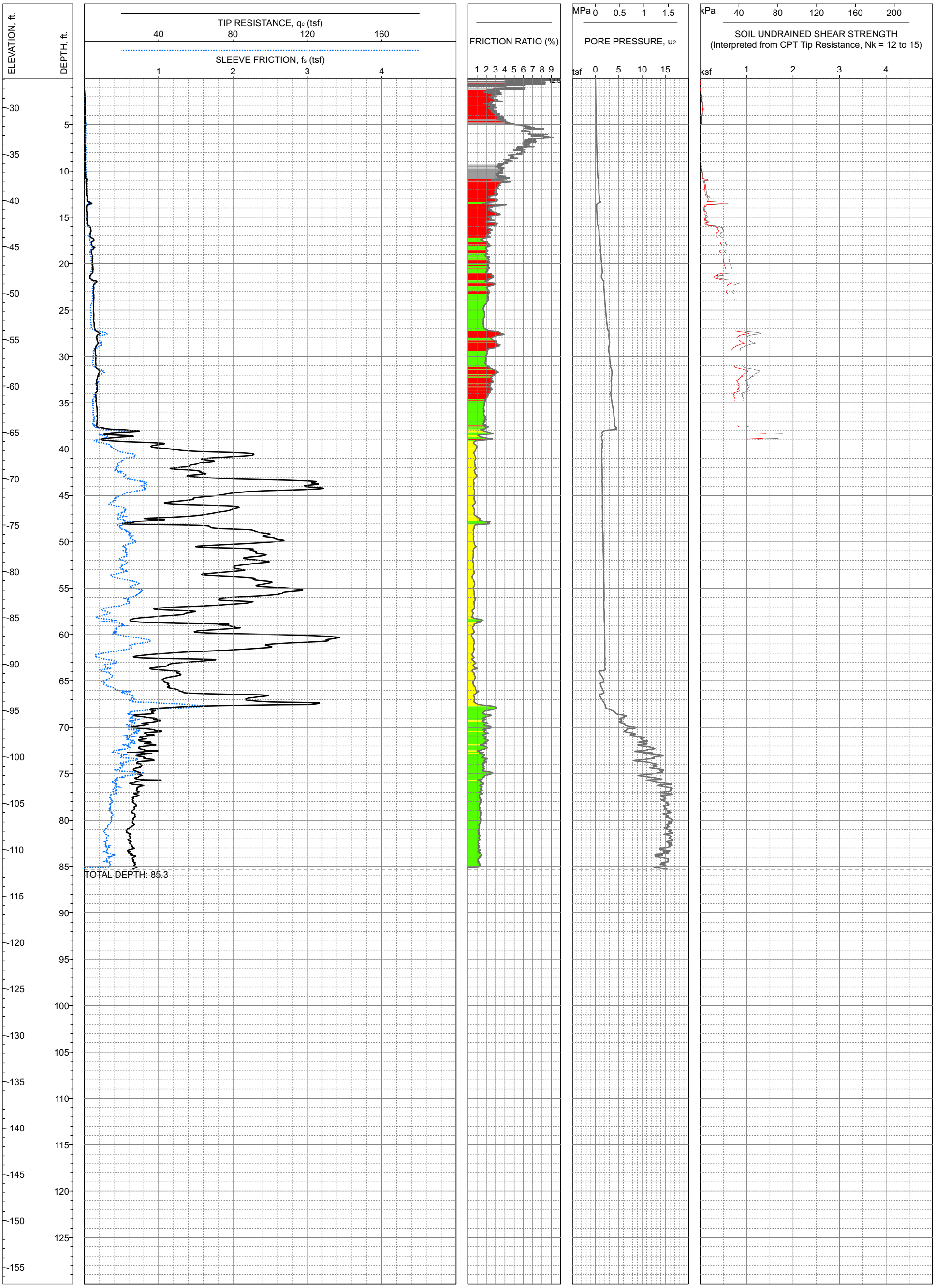


COORDINATES: E: 12,121,918 N: 3,479,063 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -26.8ft +/- (MLLW)
COMPLETION DEPTH: 85.3ft
TEST DATE: 4/25/2008
Soil Classification based on Robertson (1990)

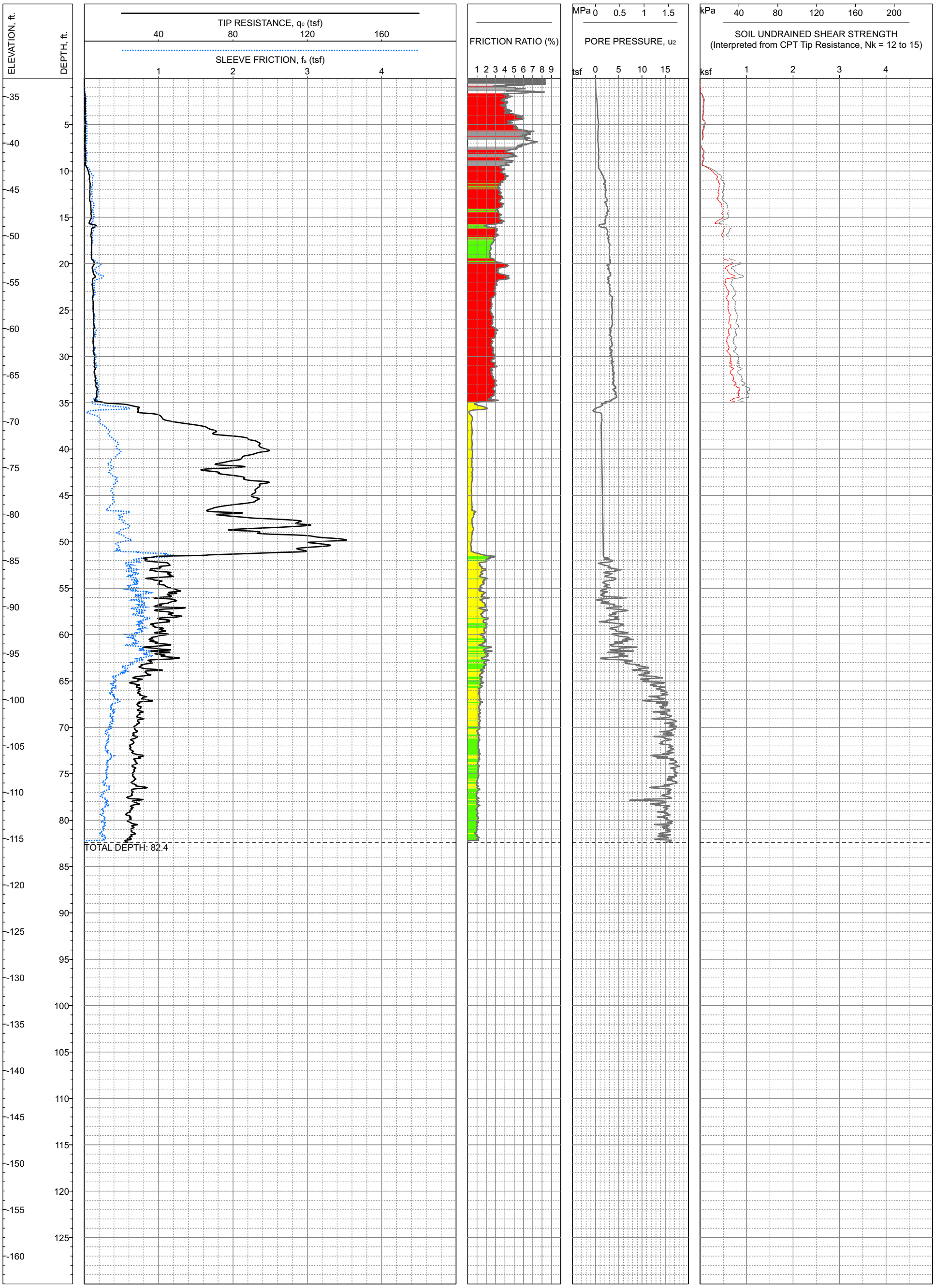
EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1698
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXD\Logs_CPT_FR90.mxd,06/10/2008,kspencer

LOG OF CPT C-4

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-6



COORDINATES: E: 12,122,063 N: 3,479,080 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -33.0ft +/- (MLLW)
COMPLETION DEPTH: 82.4ft
TEST DATE: 4/26/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1696
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

LOG OF CPT C-5
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-7

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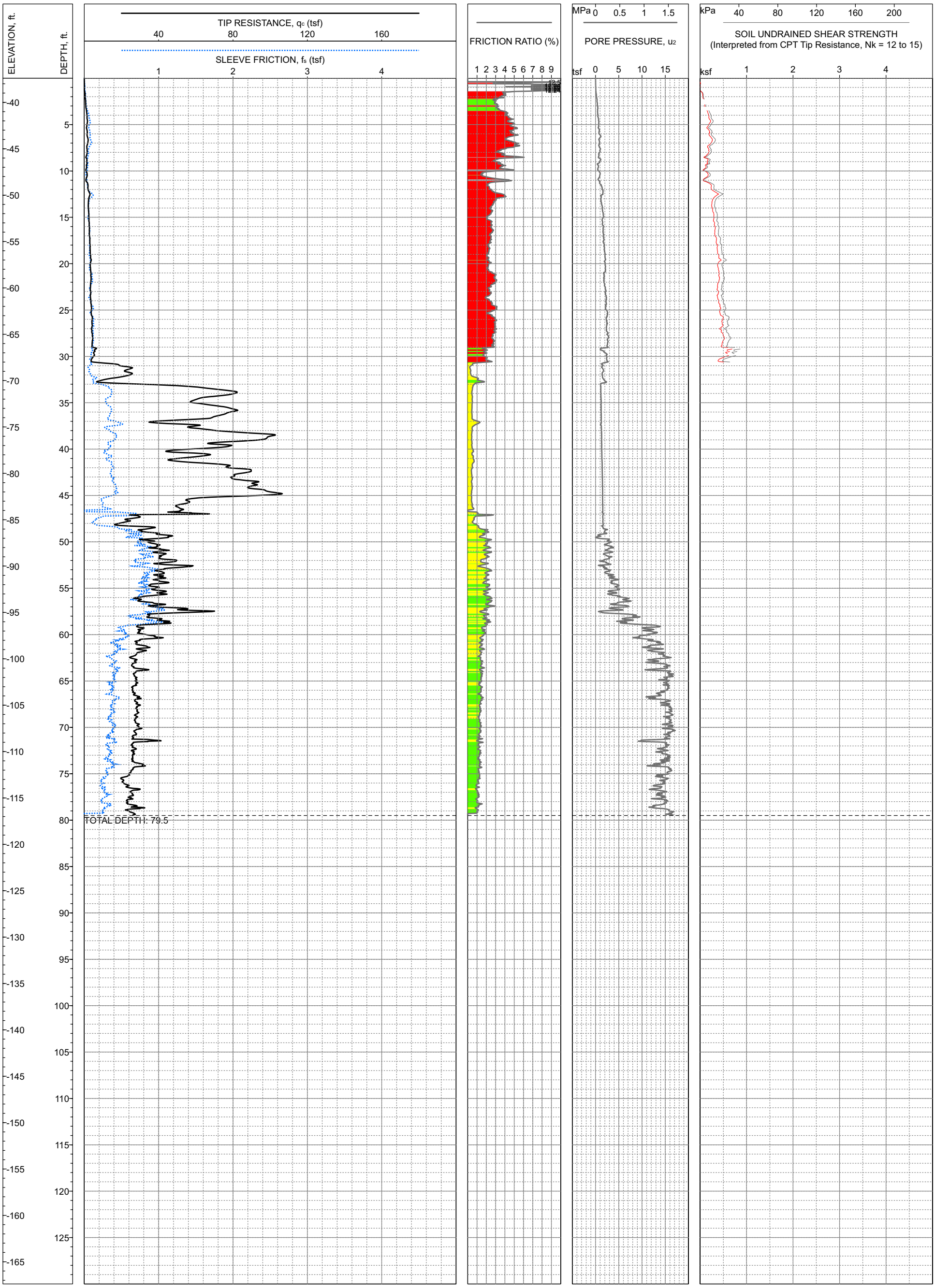
Virgina Department of Transportation
Project No. 3602.001



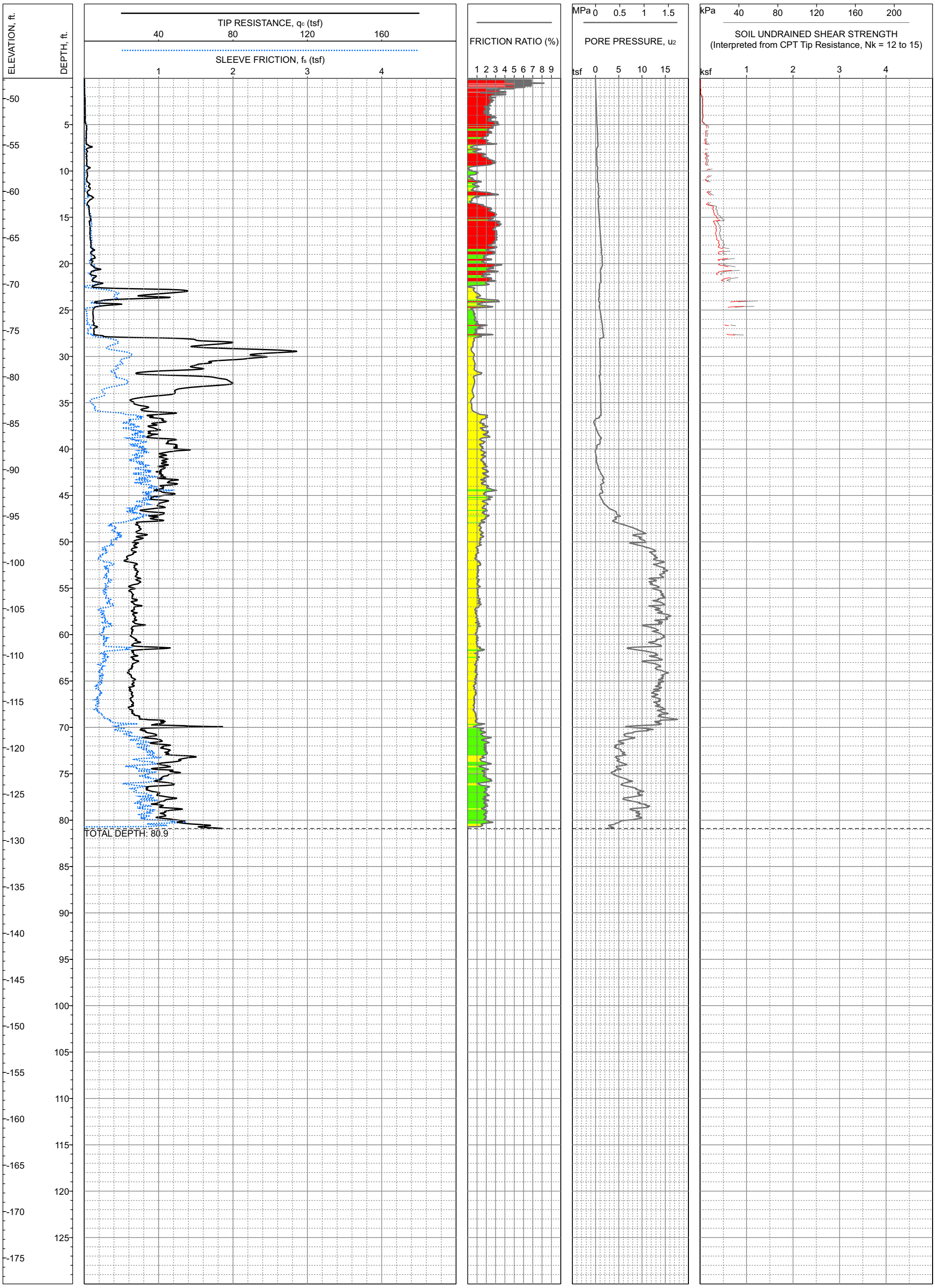
COORDINATES: E: 12,122,138 N: 3,479,159 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -37.4ft +/- (MLLW)
COMPLETION DEPTH: 79.5ft
TEST DATE: 4/26/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1697
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXDLogs_CPT_FR90.mxd,06/10/2008,kspencer

LOG OF CPT C-6
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-8



COORDINATES: E: 12,122,308 N: 3,479,194 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -47.8ft +/- (MLLW)
COMPLETION DEPTH: 80.9ft
TEST DATE: 4/28/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1697
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

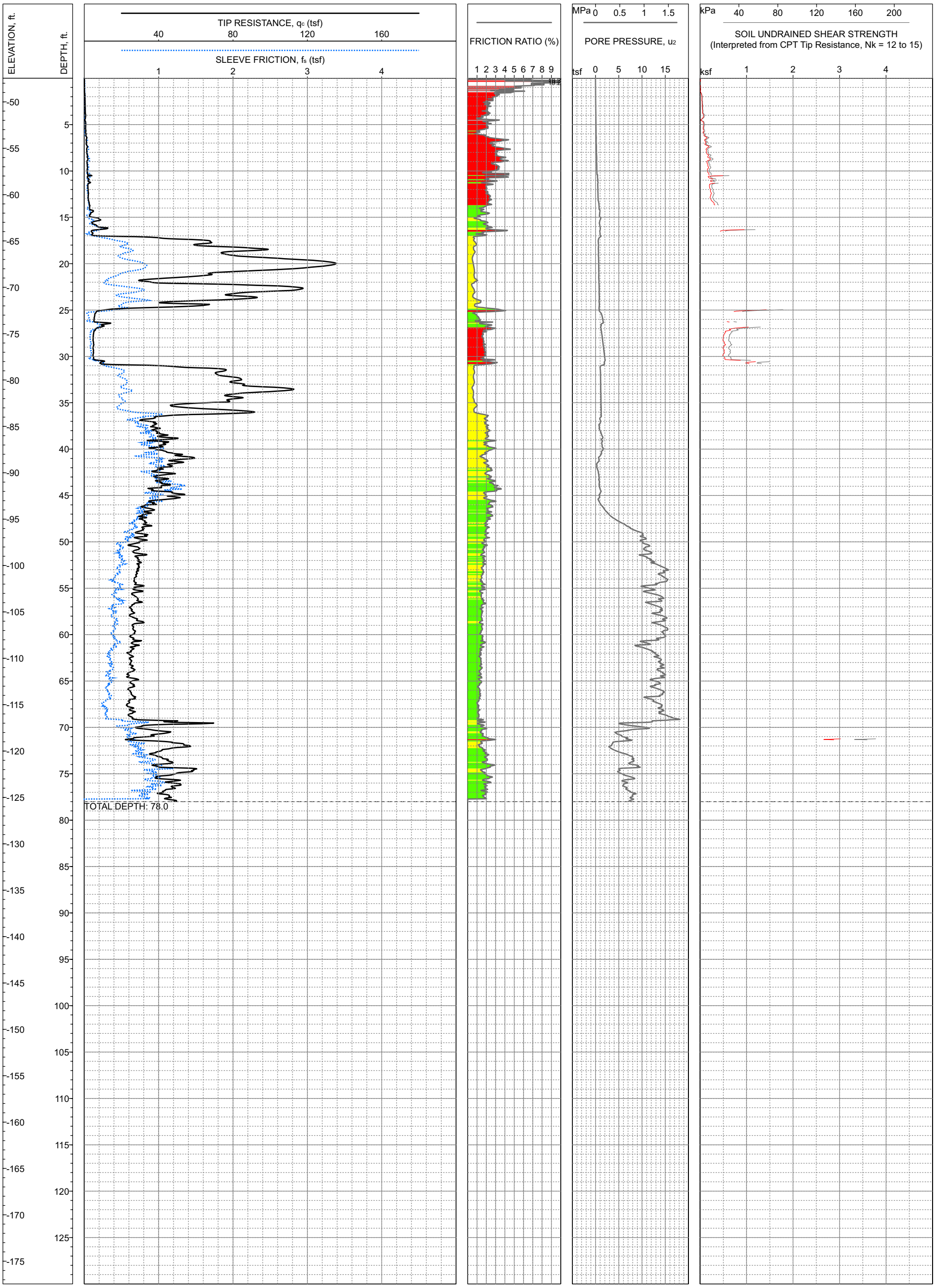
N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXD\Logs_CPT_FR90.mxd,06/10/2008,kspencer

LOG OF CPT C-7

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-9

Virgina Department of Transportation
Project No. 3602.001



COORDINATES: E: 12,122,280 N: 3,479,218 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -47.5ft +/- (MLLW)
COMPLETION DEPTH: 78.0ft
TEST DATE: 4/28/2008
Soil Classification based on Robertson (1990)

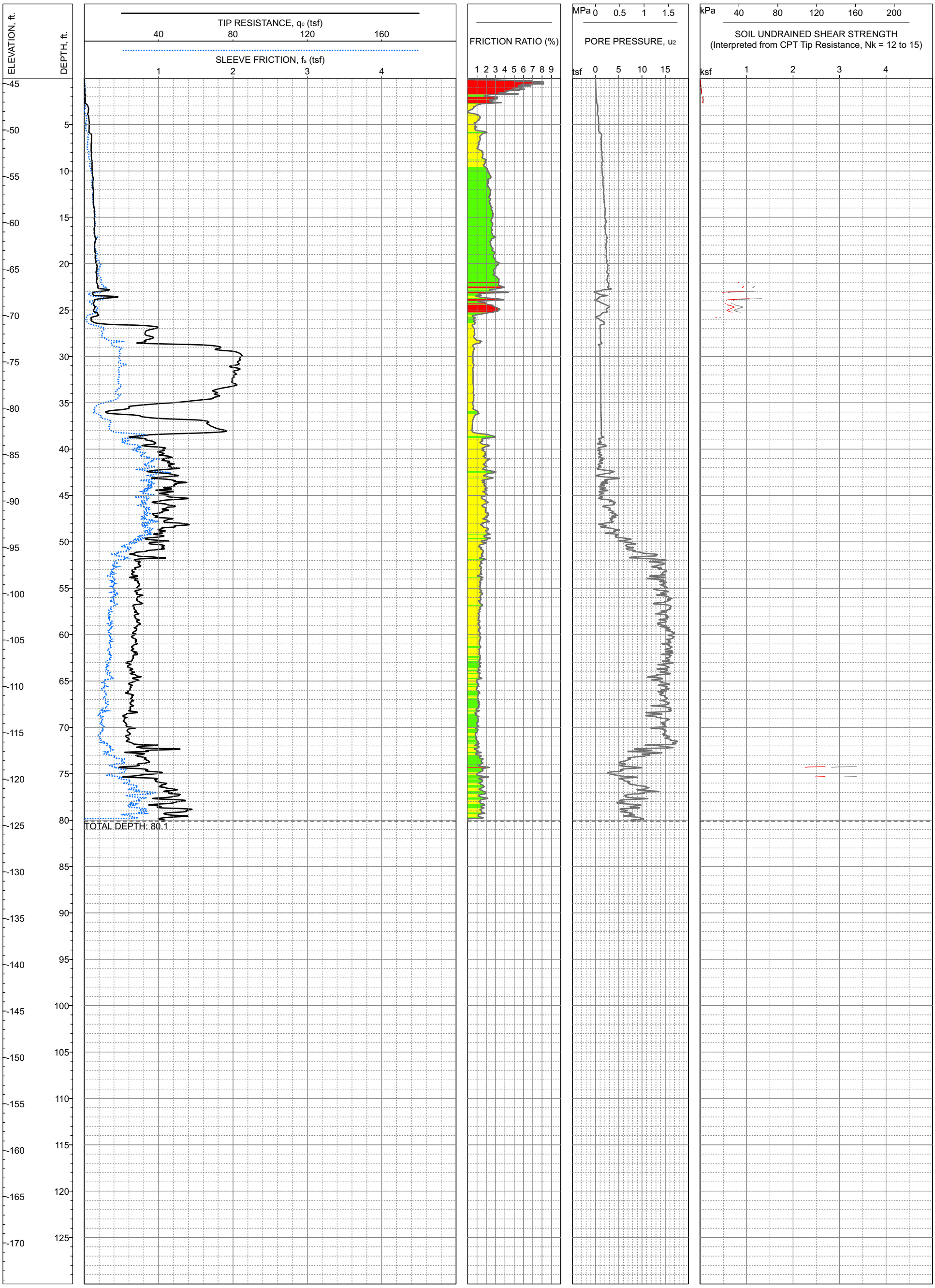
EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1697
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXDLogs_CPT_FR90.mxd,06/10/2008,kspencer

LOG OF CPT C-8
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-10

Virgina Department of Transportation
Project No. 3602.001



COORDINATES: E: 12,122,145 N: 3,479,240 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -44.4ft +/- (MLLW)
COMPLETION DEPTH: 80.1ft
TEST DATE: 4/27/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1697
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

LOG OF CPT C-9
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-11

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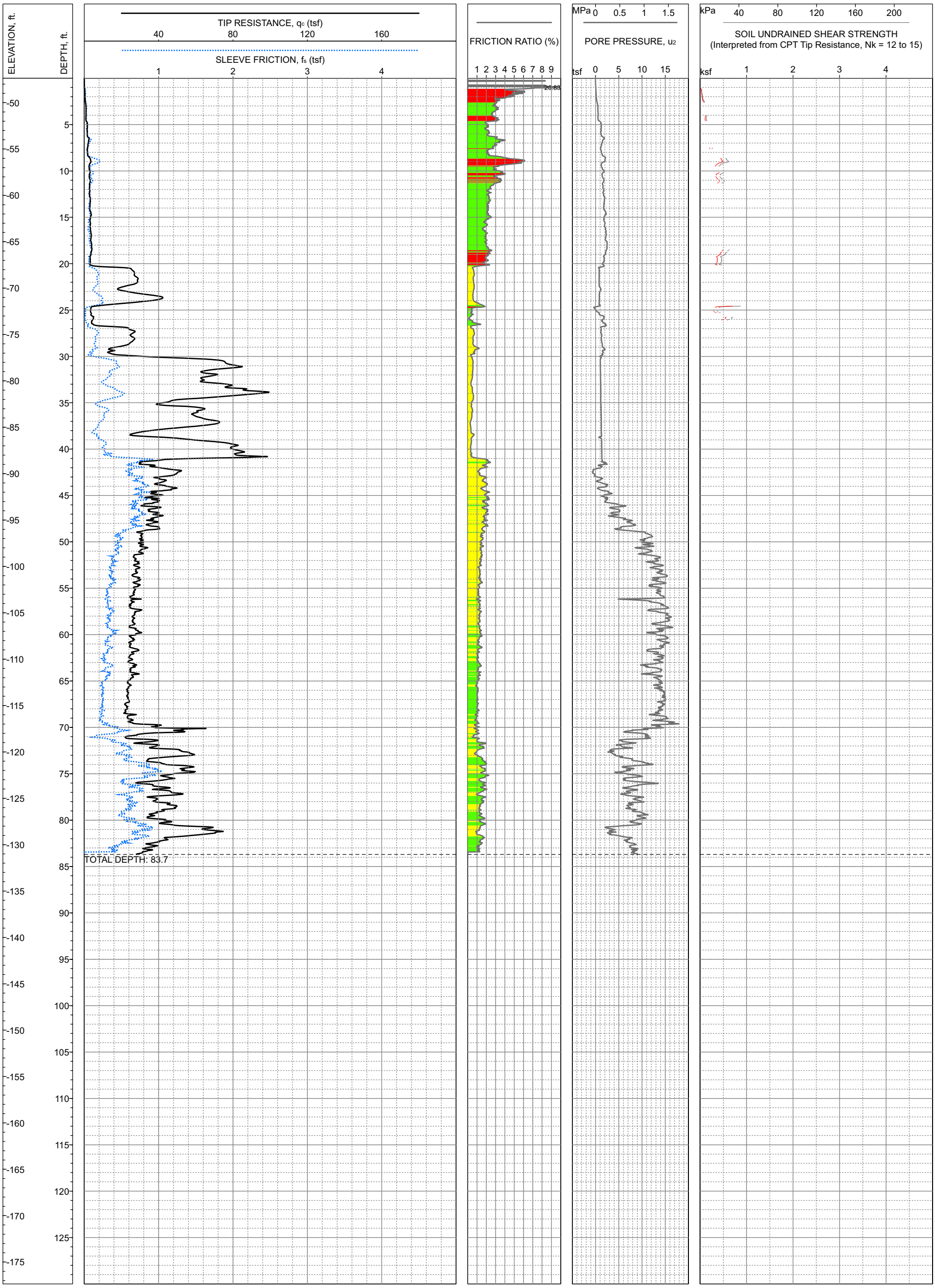

COORDINATES: E: 12,122,108 N: 3,479,302 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -47.4ft +/- (MLLW)
COMPLETION DEPTH: 83.7ft
TEST DATE: 4/27/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1697
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

LOG OF CPT C-10
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-12

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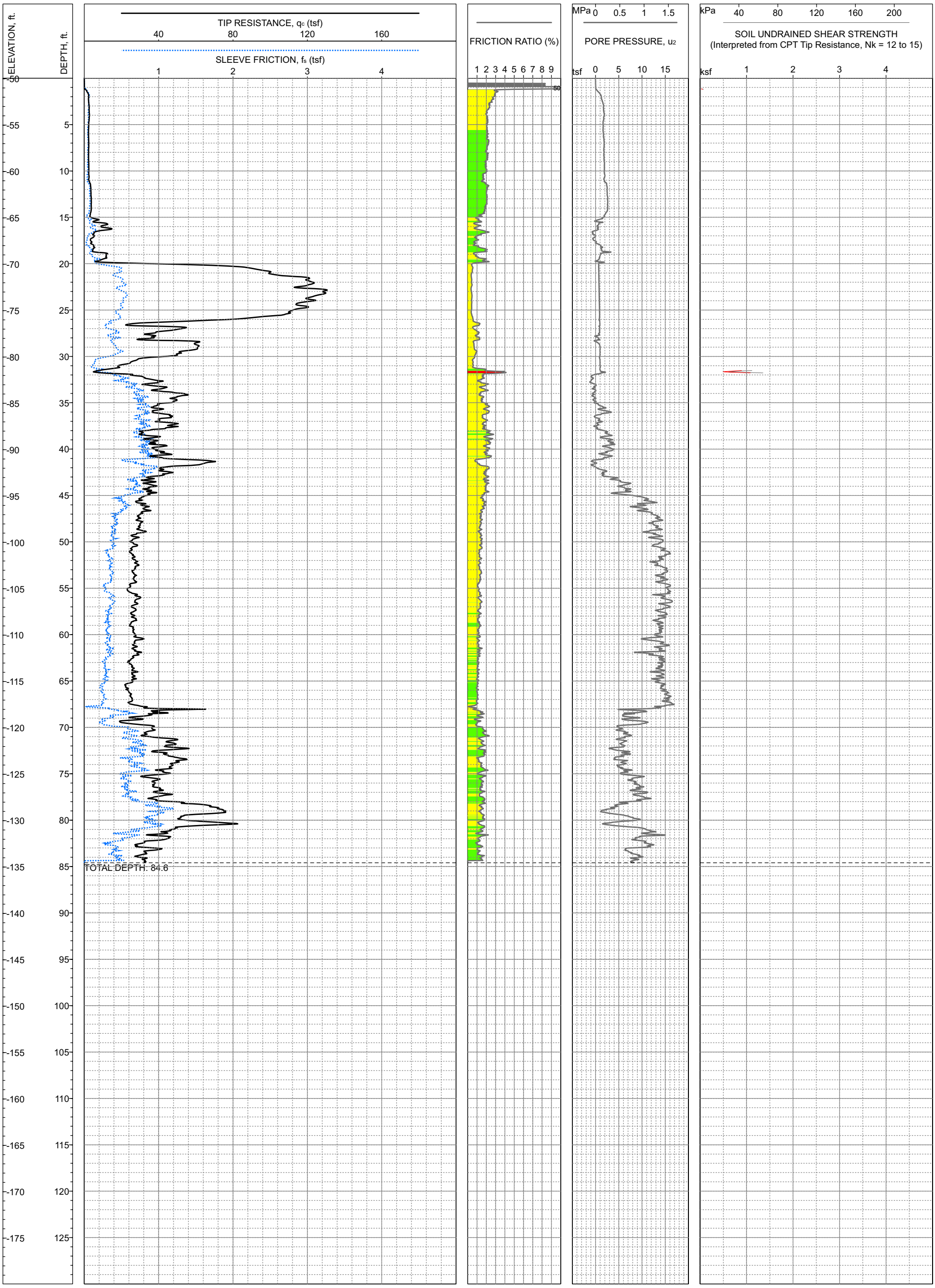


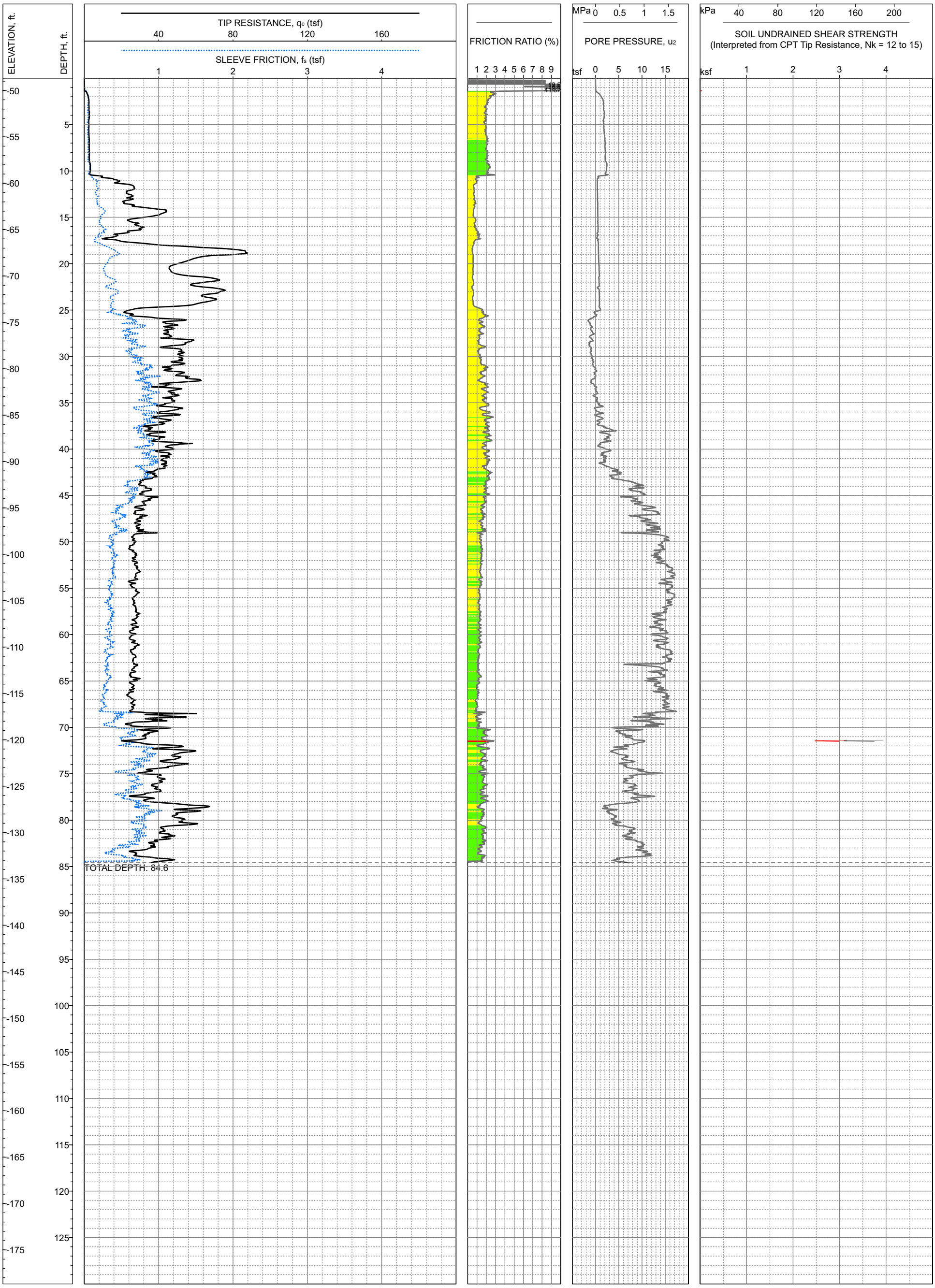
COORDINATES: E: 12,122,360 N: 3,479,376 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -49.9ft +/- (MLLW)
COMPLETION DEPTH: 84.6ft
TEST DATE: 4/27/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1697
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXD\Logs_CPT_FR90.mxd,06/10/2008,kspencer

LOG OF CPT C-11
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-13



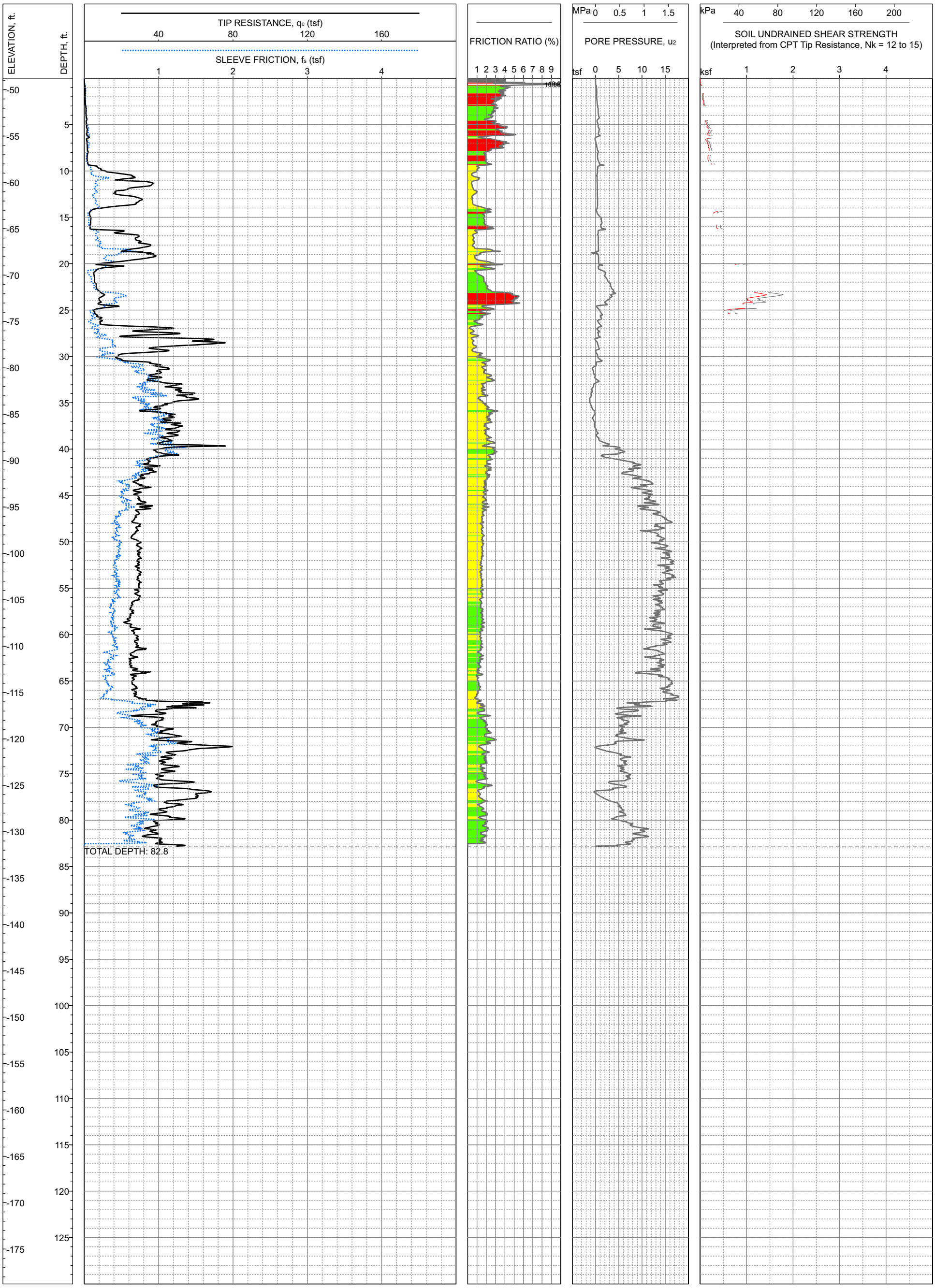
COORDINATES: E: 12,122,475 N: 3,479,495 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -48.7ft +/- (MLLW)
COMPLETION DEPTH: 84.6ft
TEST DATE: 4/27/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1697
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

LOG OF CPT C-12
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-14

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXD\Logs_CPT_FR90.mxd,06/10/2008,kspencer



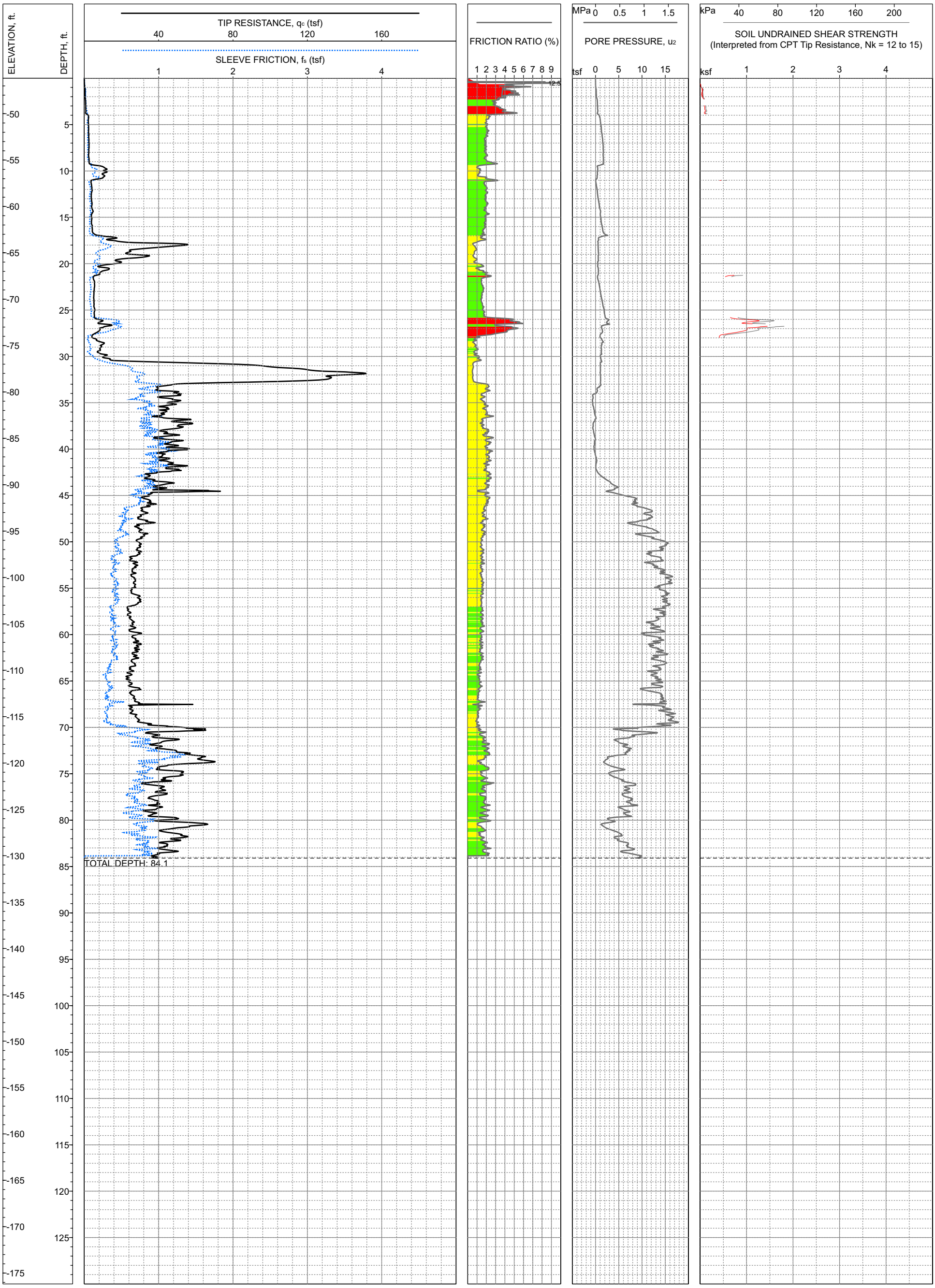
COORDINATES: E: 12,122,637 N: 3,479,508 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -48.8ft +/- (MLLW)
COMPLETION DEPTH: 82.8ft
TEST DATE: 4/27/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1697
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXD\Logs_CPT_FR90.mxd,06/10/2008,kspencer

LOG OF CPT C-13
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-15



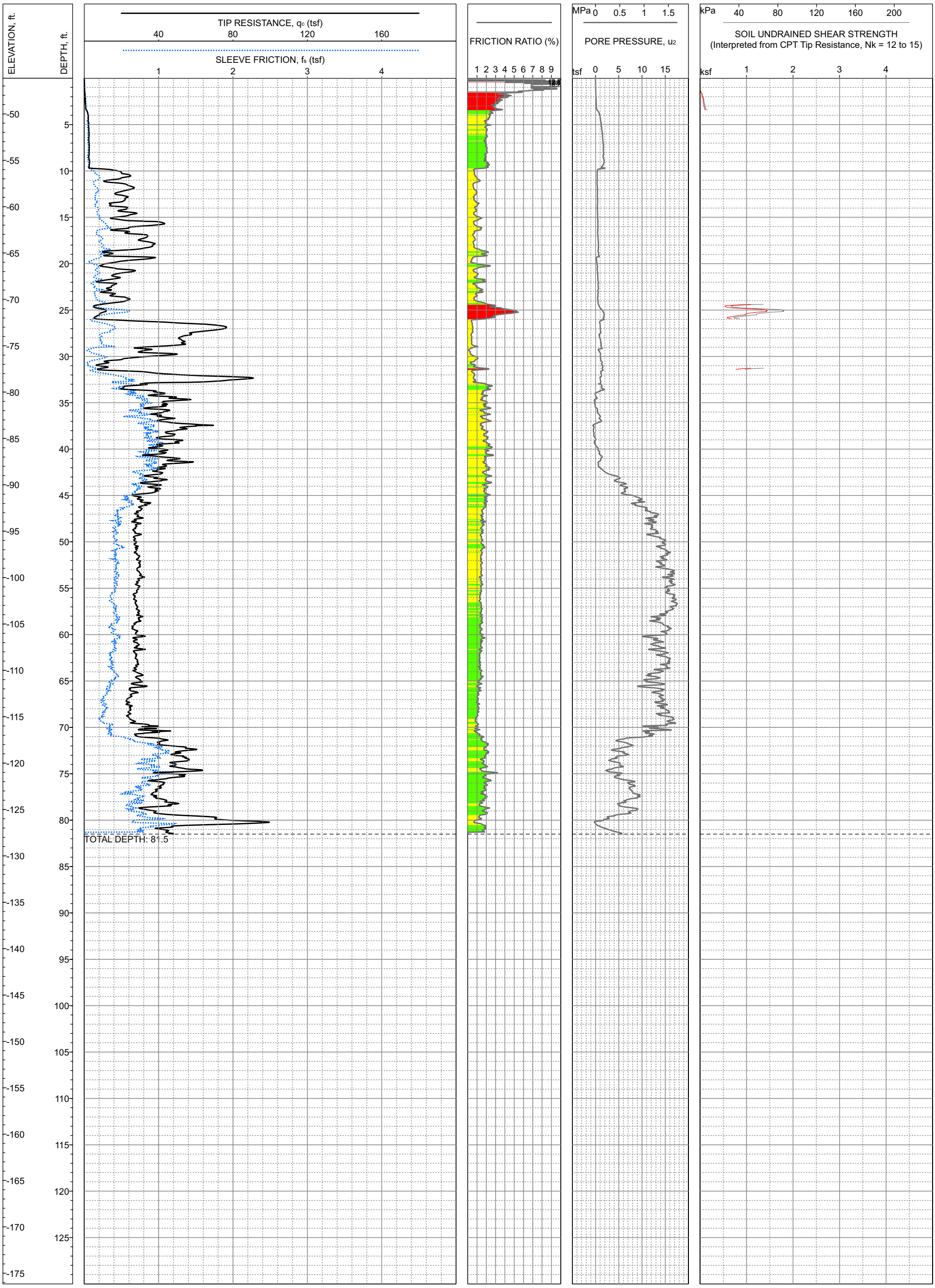
COORDINATES: E: 12,122,568 N: 3,479,574 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -46.2ft +/- (MLLW)
COMPLETION DEPTH: 84.1ft
TEST DATE: 4/27/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1697
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXD\Logs_CPT_FR90.mxd,06/10/2008,kspencer

LOG OF CPT C-14
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-16



COORDINATES: E: 12,122,512 N: 3,479,613 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -46.2ft +/- (MLLW)
COMPLETION DEPTH: 81.5ft
TEST DATE: 4/27/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1697
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

LOG OF CPT C-15
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-17

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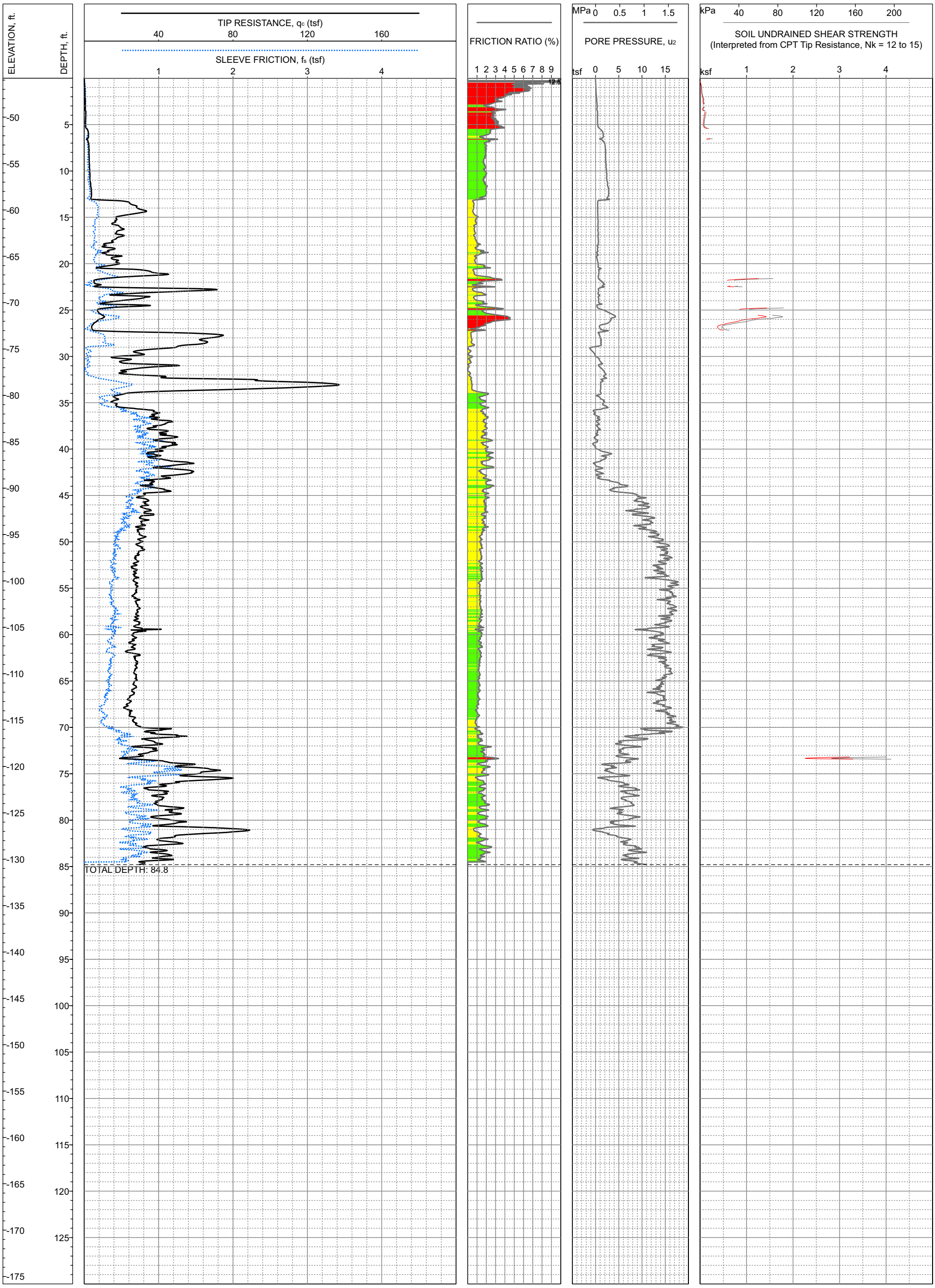
Virgina Department of Transportation
Project No. 3602.001



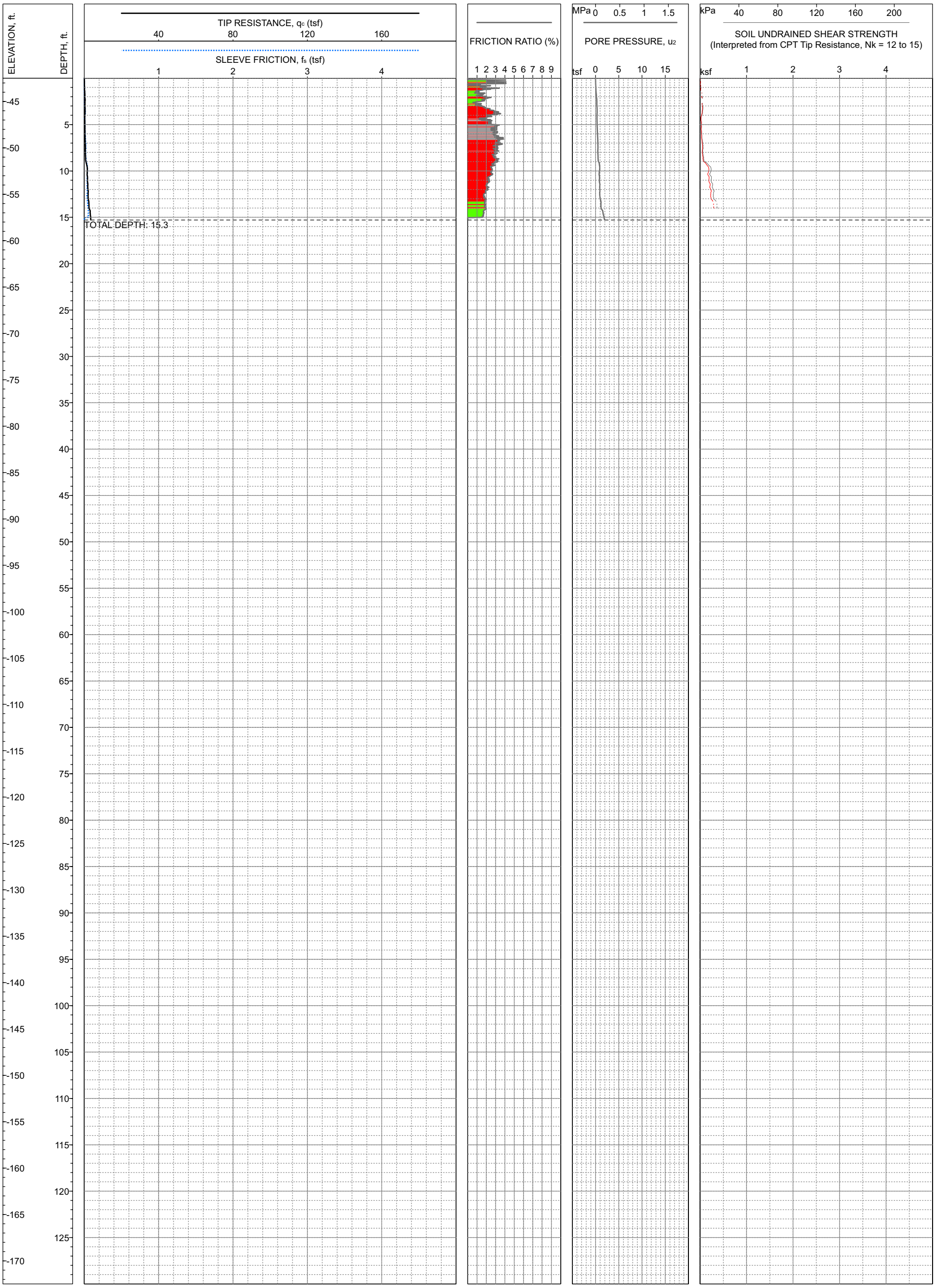
COORDINATES: E: 12,122,466 N: 3,479,658 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -45.8ft +/- (MLLW)
COMPLETION DEPTH: 84.8ft
TEST DATE: 4/27/2008

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1697

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXDLogs_CPT_FR90.mxd,06/10/2008,kspencer

LOG OF CPT C-16
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-18



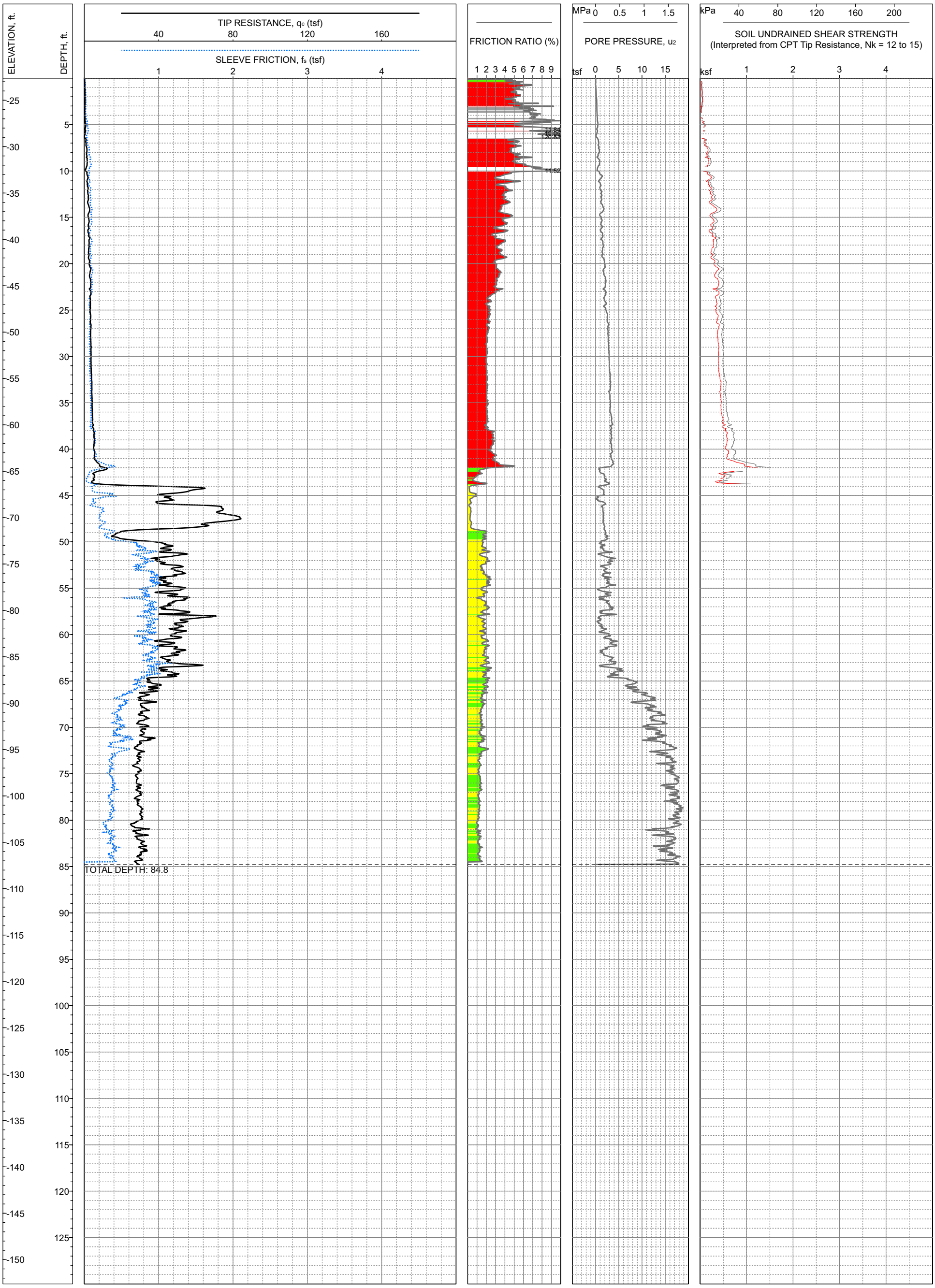
COORDINATES: E: 12,122,694 N: 3,479,676 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -42.5ft +/- (MLLW)
COMPLETION DEPTH: 15.3ft
TEST DATE: 4/27/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1697
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

LOG OF CPT C-17
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-19

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXD\Logs_CPT_FR90.mxd,06/10/2008,kspencer



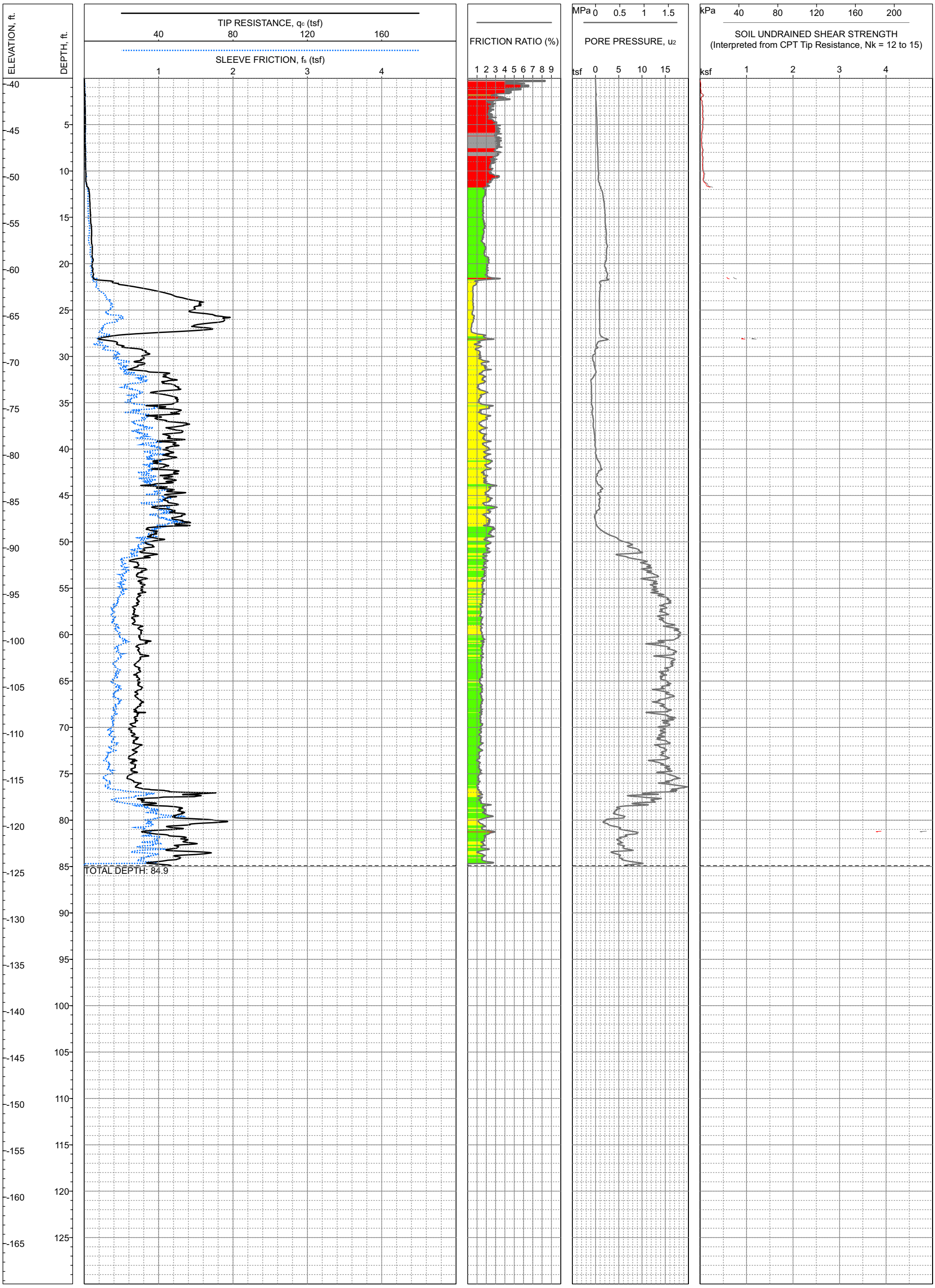
COORDINATES: E: 12,122,810 N: 3,479,813 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -22.6ft +/- (MLLW)
COMPLETION DEPTH: 84.8ft
TEST DATE: 4/25/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1696
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

LOG OF CPT C-18
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-20

N:\Projects\3602_VDOT\3602-001_Midtown_TunnelExplorations\CPT\2008\Logs\MXD\Logs_CPT_FR90.mxd,06/10/2008,kspencer



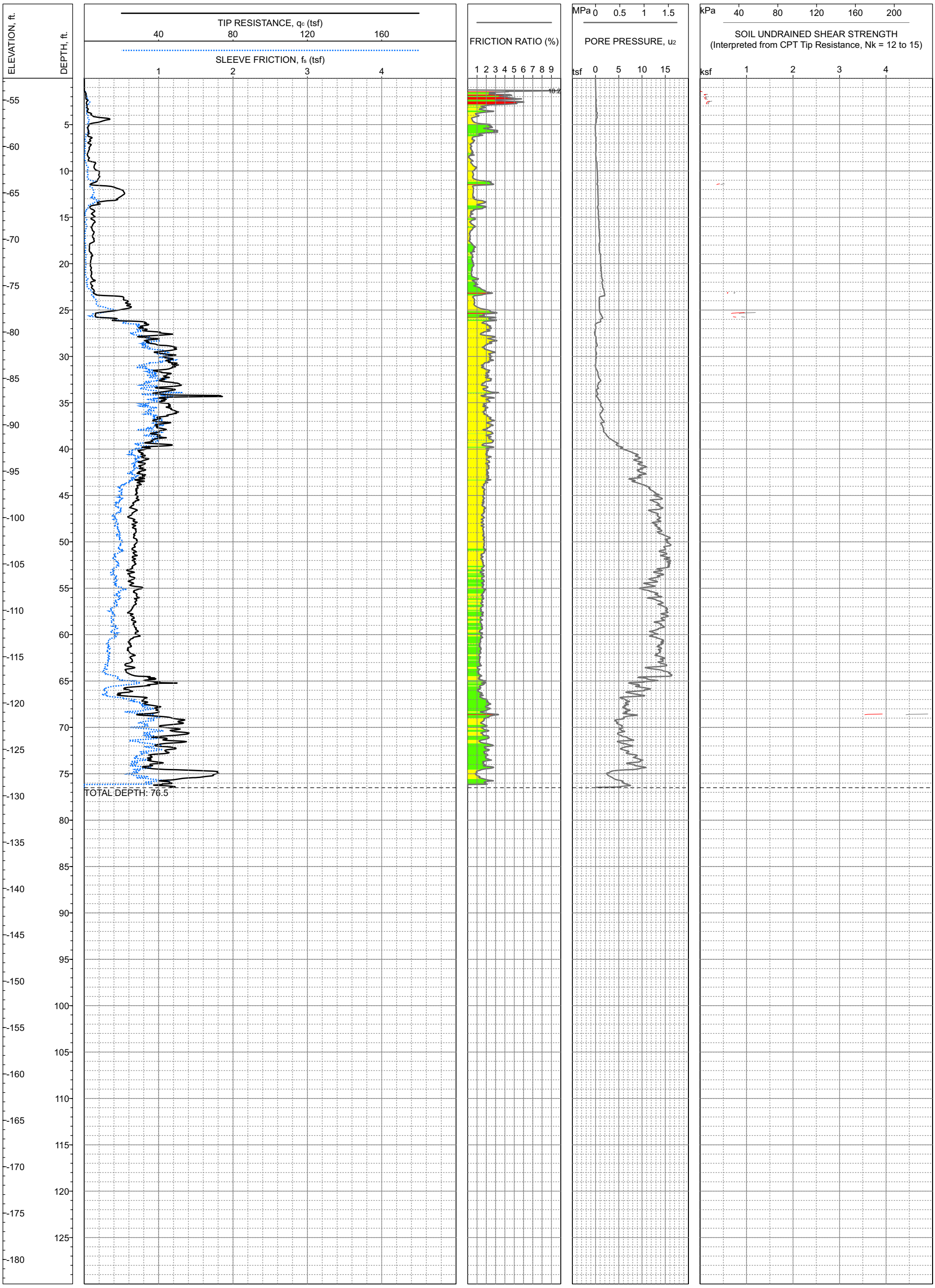
COORDINATES: E: 12,122,660 N: 3,479,778 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -39.4ft +/- (MLLW)
COMPLETION DEPTH: 84.9ft
TEST DATE: 4/27/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1697
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

LOG OF CPT C-19
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-21

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXDLogs_CPT_FR90.mxd,06/10/2008,kspencer



COORDINATES: E: 12,122,500 N: 3,479,376 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -52.6ft +/- (MLLW)
COMPLETION DEPTH: 76.5ft
TEST DATE: 4/28/2008
Soil Classification based on Robertson (1990)

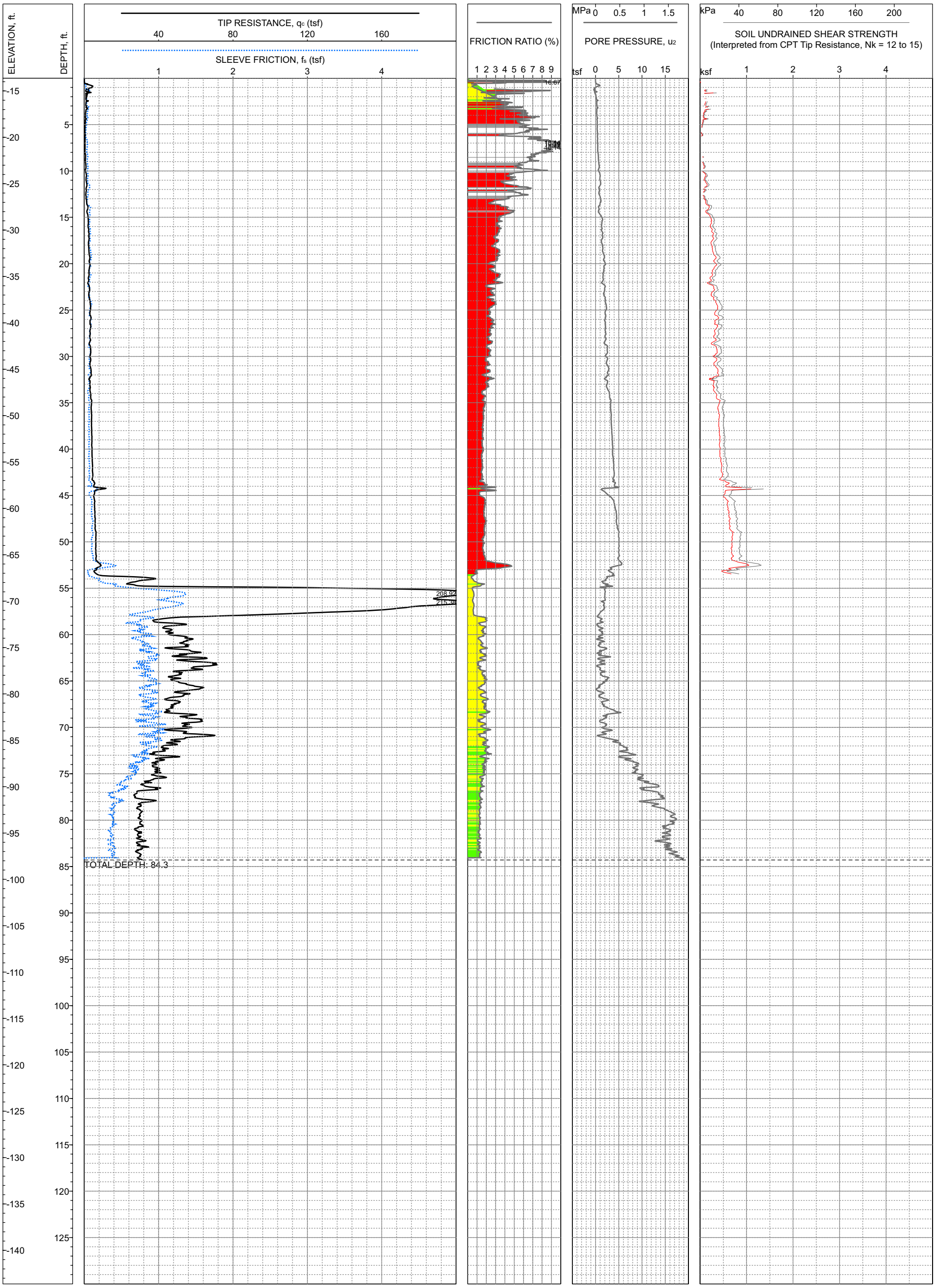
EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1697
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXD\Logs_CPT_FR90.mxd,06/10/2008,kspencer

LOG OF CPT C-20

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-22



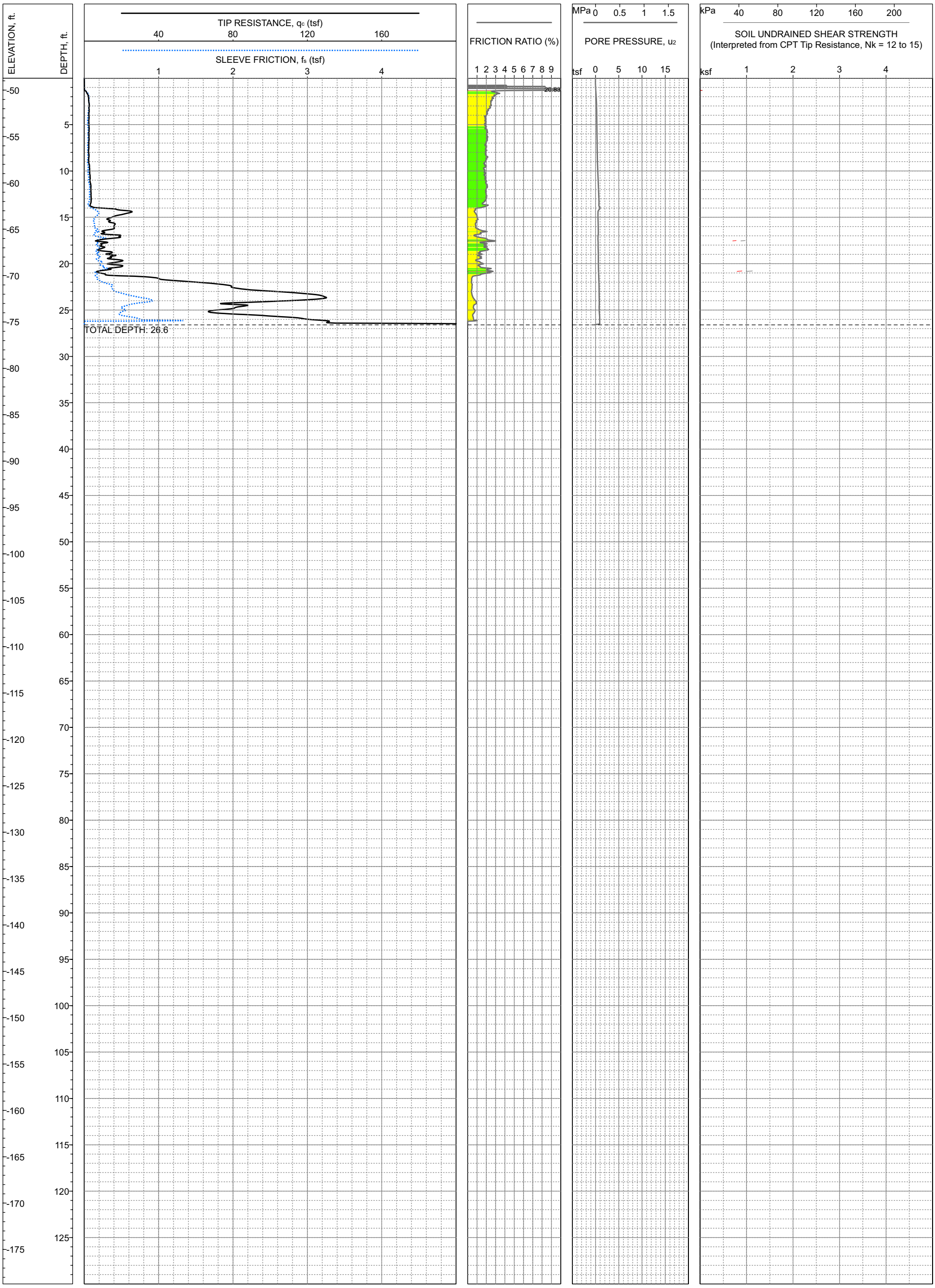
COORDINATES: E: 12,122,893 N: 3,479,941 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -13.6ft +/- (MLLW)
COMPLETION DEPTH: 84.3ft
TEST DATE: 4/25/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1696
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

LOG OF CPT C-21
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-23

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXD\Logs_CPT_FR90.mxd,06/10/2008,kspencer



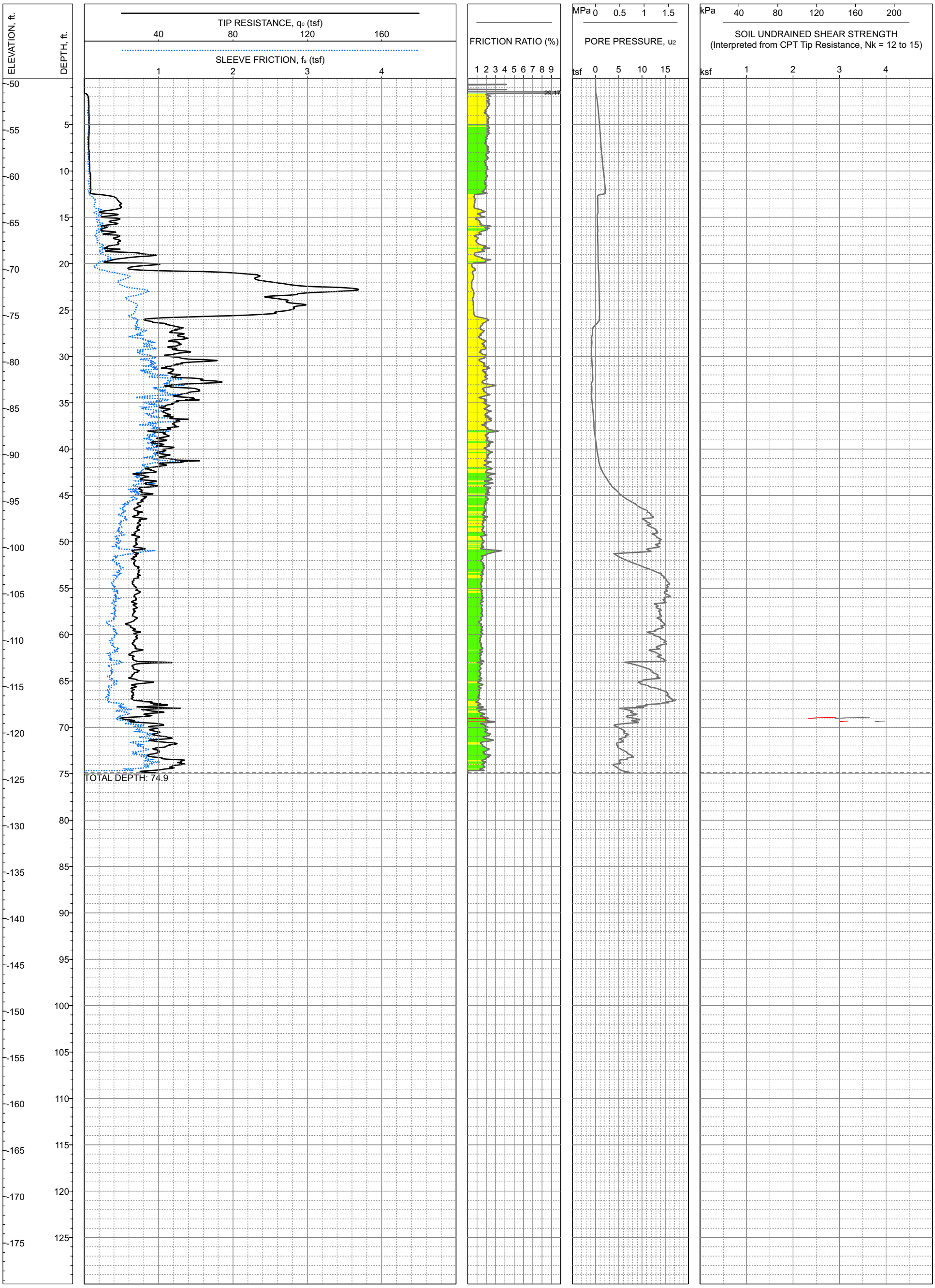
COORDINATES: E: 12,122,403 N: 3,479,433 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -48.7ft +/- (MLLW)
COMPLETION DEPTH: 26.6ft
TEST DATE: 4/28/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1697
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

LOG OF CPT C-22
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-24

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXDLogs_CPT_FR90.mxd,06/10/2008,kspencer



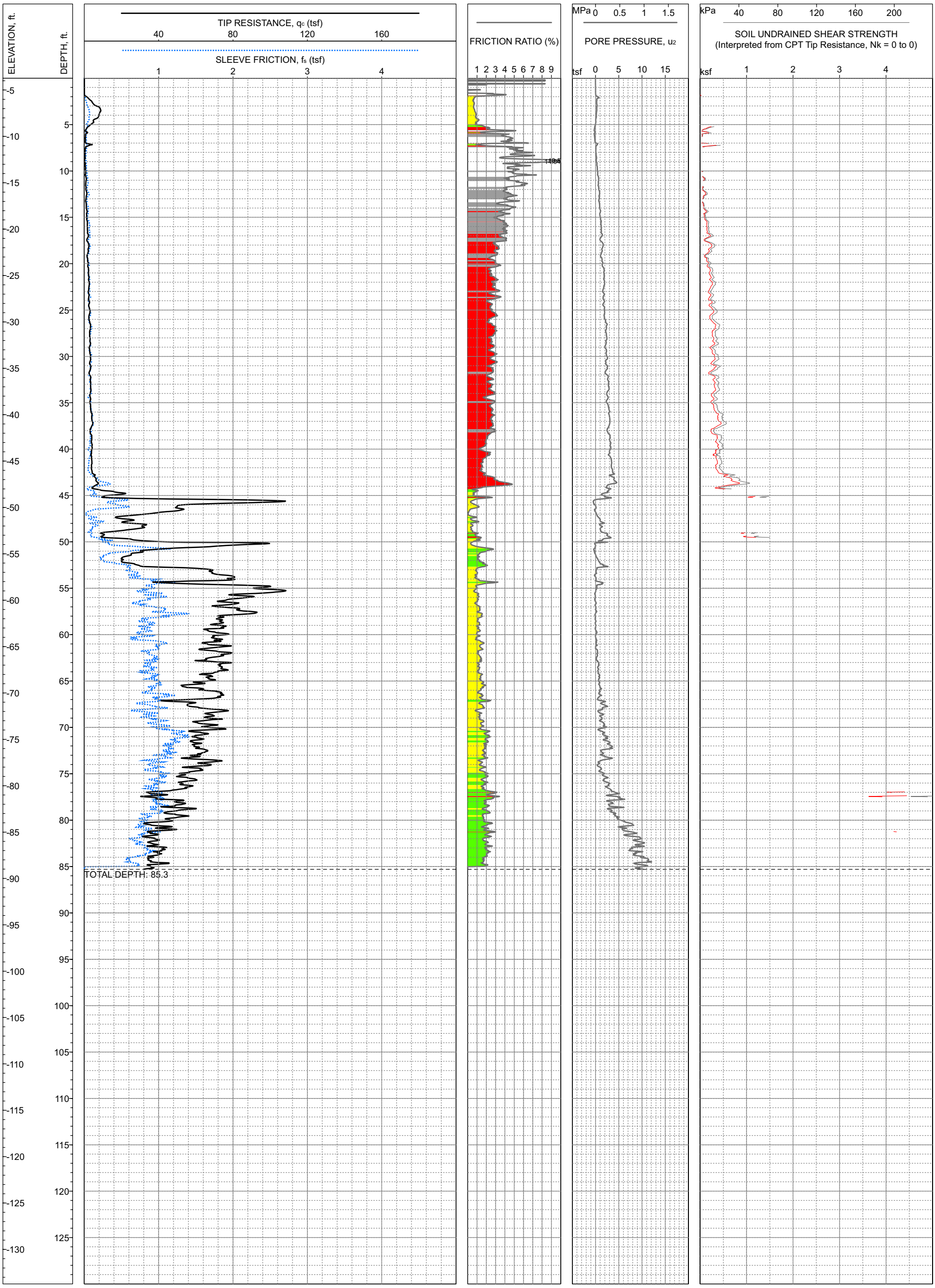
COORDINATES: E: 12,122,419 N: 3,479,441 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -49.4ft +/- (MLLW)
COMPLETION DEPTH: 74.9ft
TEST DATE: 4/28/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1697
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

LOG OF CPT C-22A
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-25

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXD\Logs_CPT_FR90.mxd,06/10/2008,kspencer



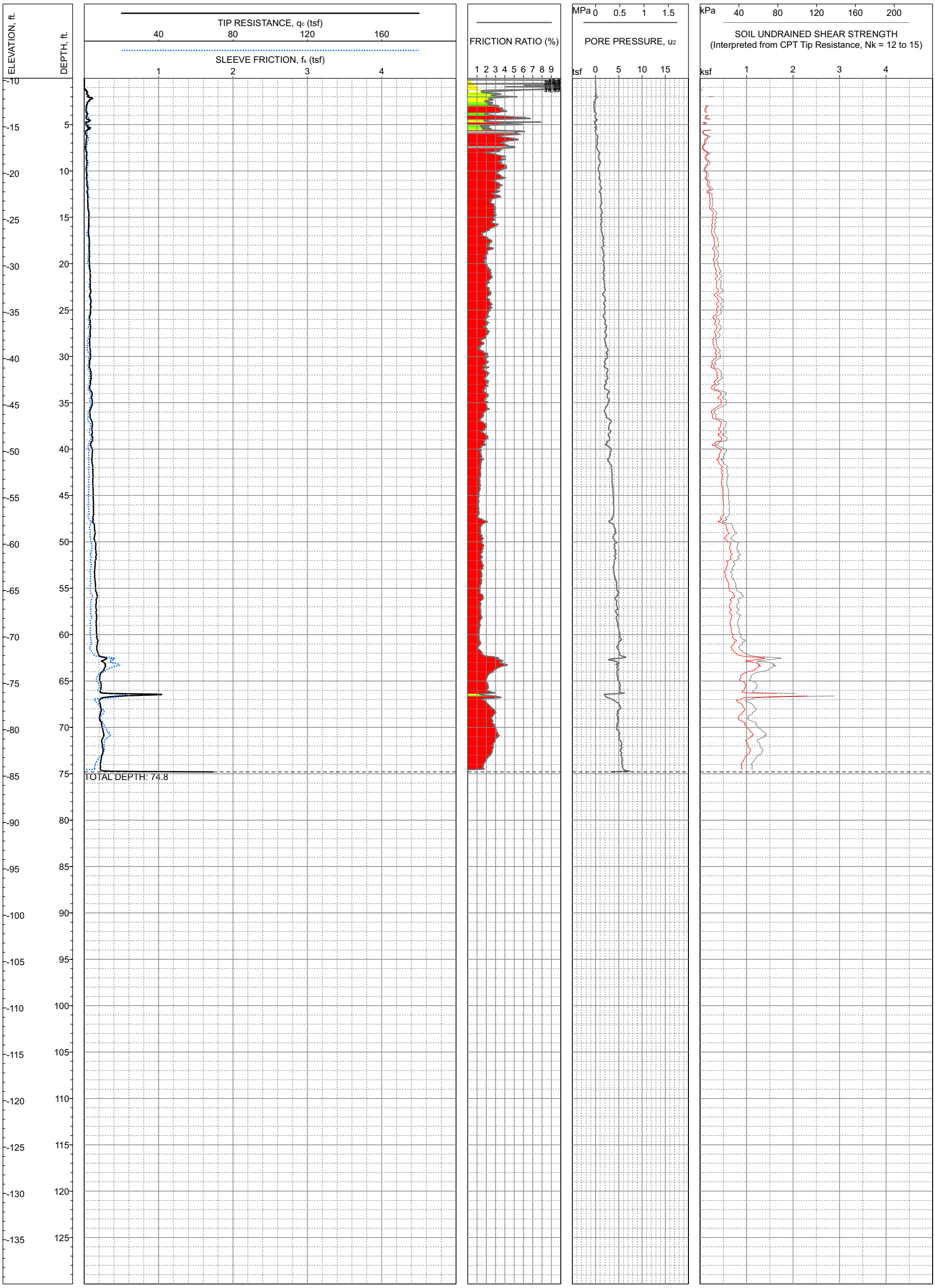
COORDINATES: E: 12,123,114 N: 3,480,276 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -3.7ft +/- (MLLW)
COMPLETION DEPTH: 85.3ft
TEST DATE: 4/26/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1696
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXDLogs_CPT_FR90.mxd,06/10/2008,kspencer

LOG OF CPT C-23
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-26



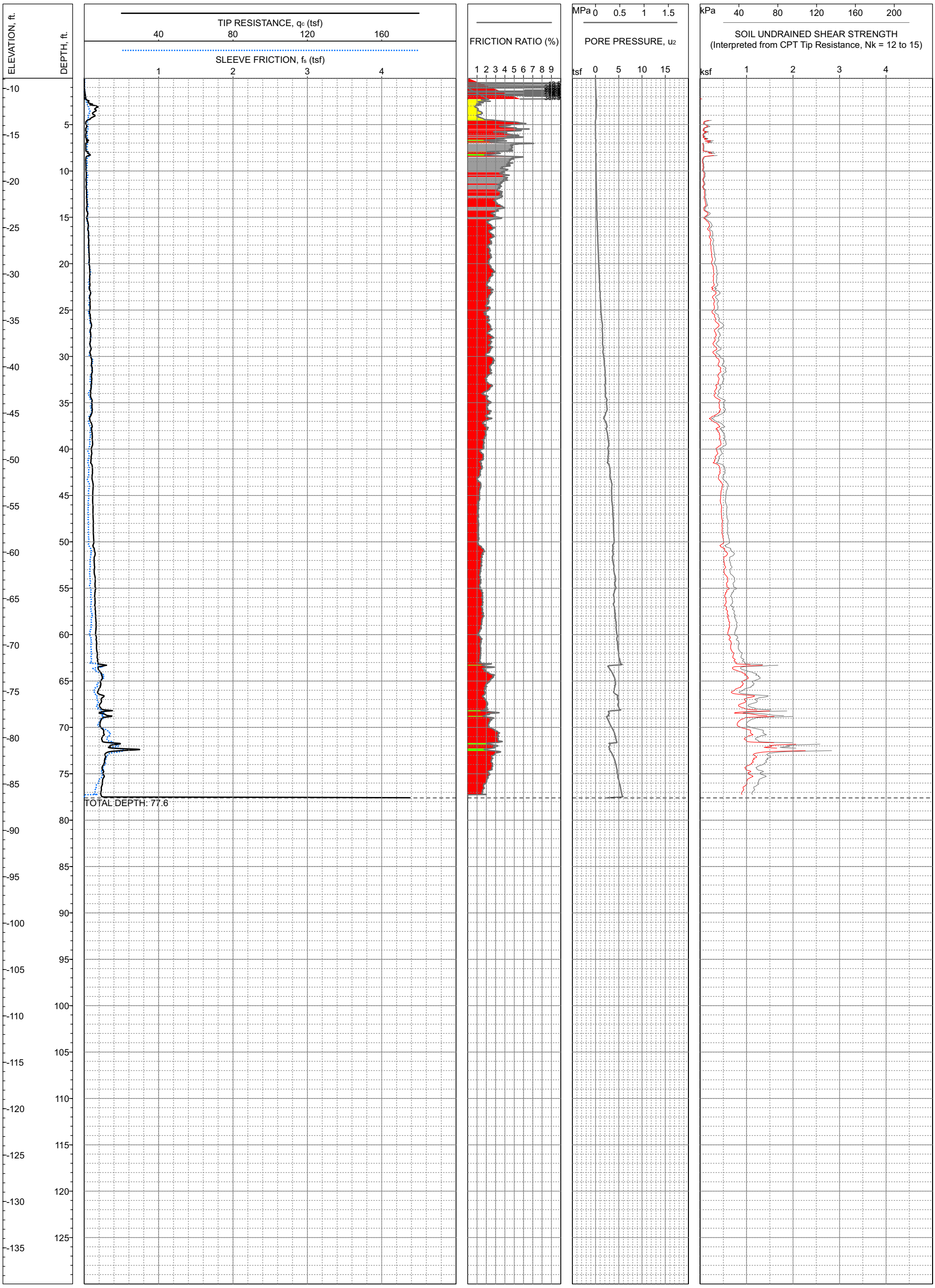
COORDINATES: E: 12,123,027 N: 3,480,027 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -9.8ft +/- (MLLW)
COMPLETION DEPTH: 74.8ft
TEST DATE: 4/25/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1698
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

LOG OF CPT C-24
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-27

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXDLogs_CPT_FR90.mxd,06/10/2008,kspencer



COORDINATES: E: 12,122,969 N: 3,480,052 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -8.9ft +/- (MLLW)
COMPLETION DEPTH: 77.6ft
TEST DATE: 4/25/2008
Soil Classification based on Robertson (1990)

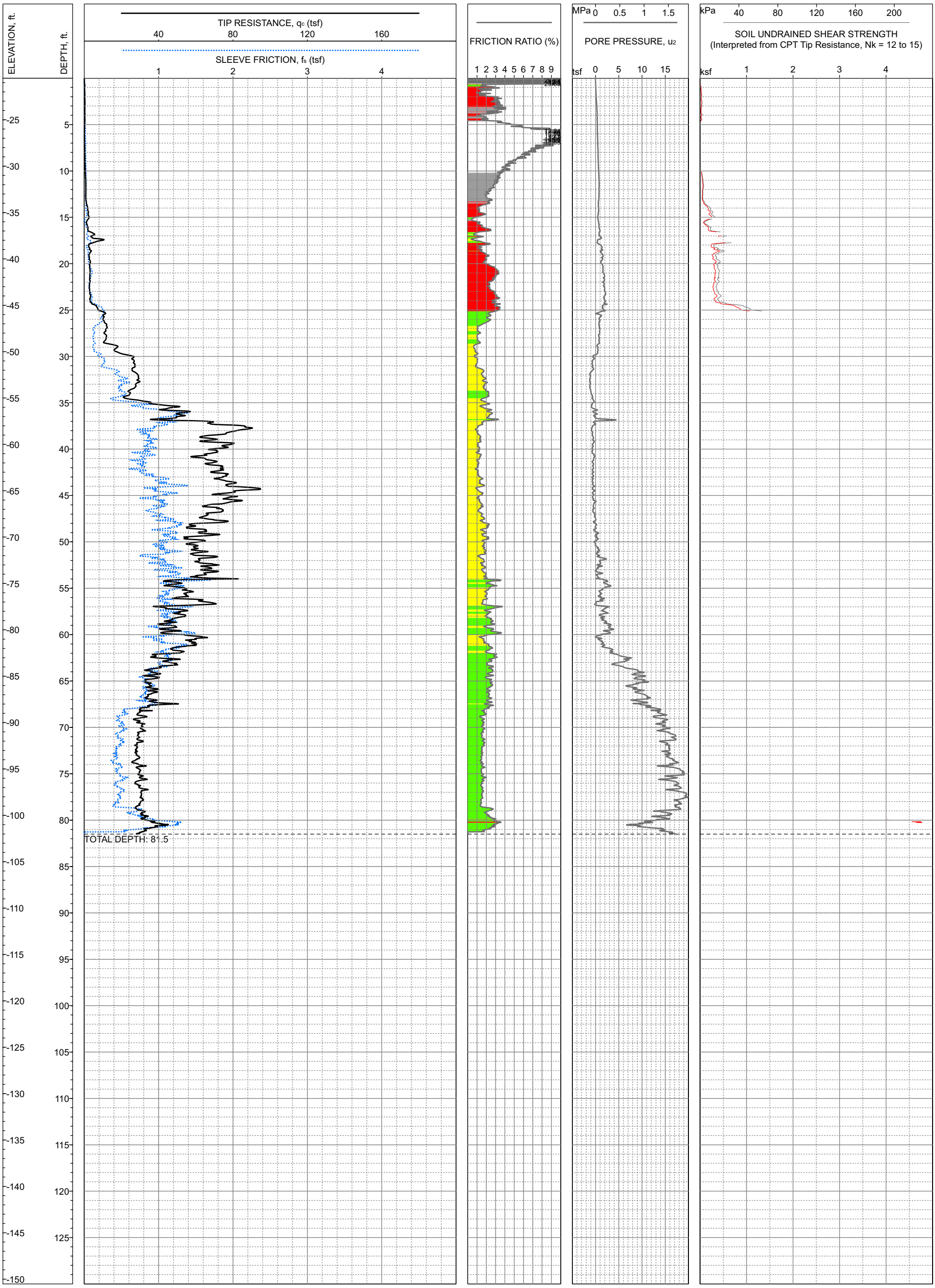
EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1698
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

LOG OF CPT C-25
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-28

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXD\Logs_CPT_FR90.mxd,06/10/2008,kspencer

Virgina Department of Transportation
Project No. 3602.001



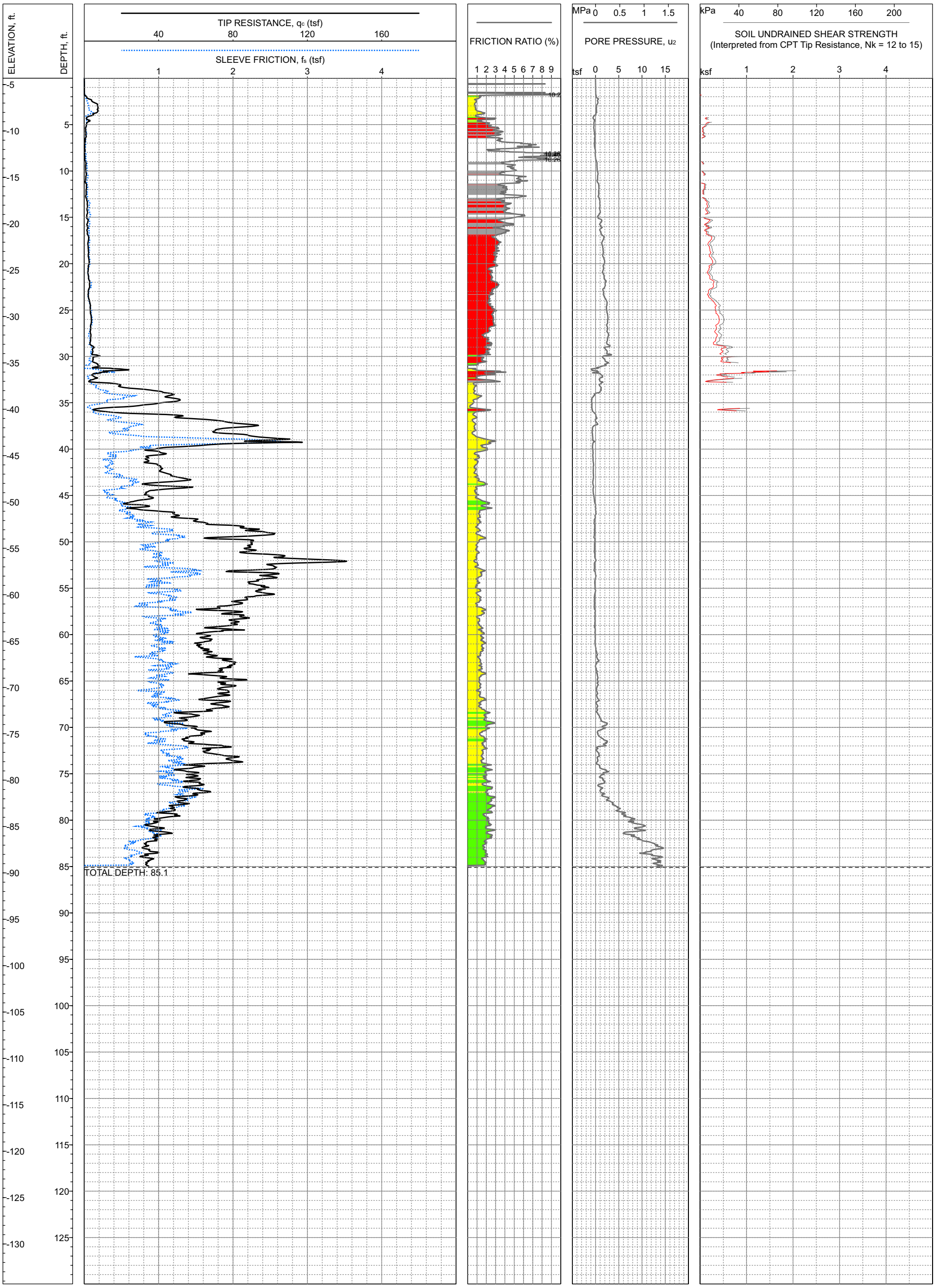
COORDINATES: E: 12,123,189 N: 3,480,077 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -20.5ft +/- (MLLW)
COMPLETION DEPTH: 81.5ft
TEST DATE: 4/24/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1698
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXD\Logs_CPT_FR90.mxd,06/10/2008,kspencer

LOG OF CPT C-26
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-29



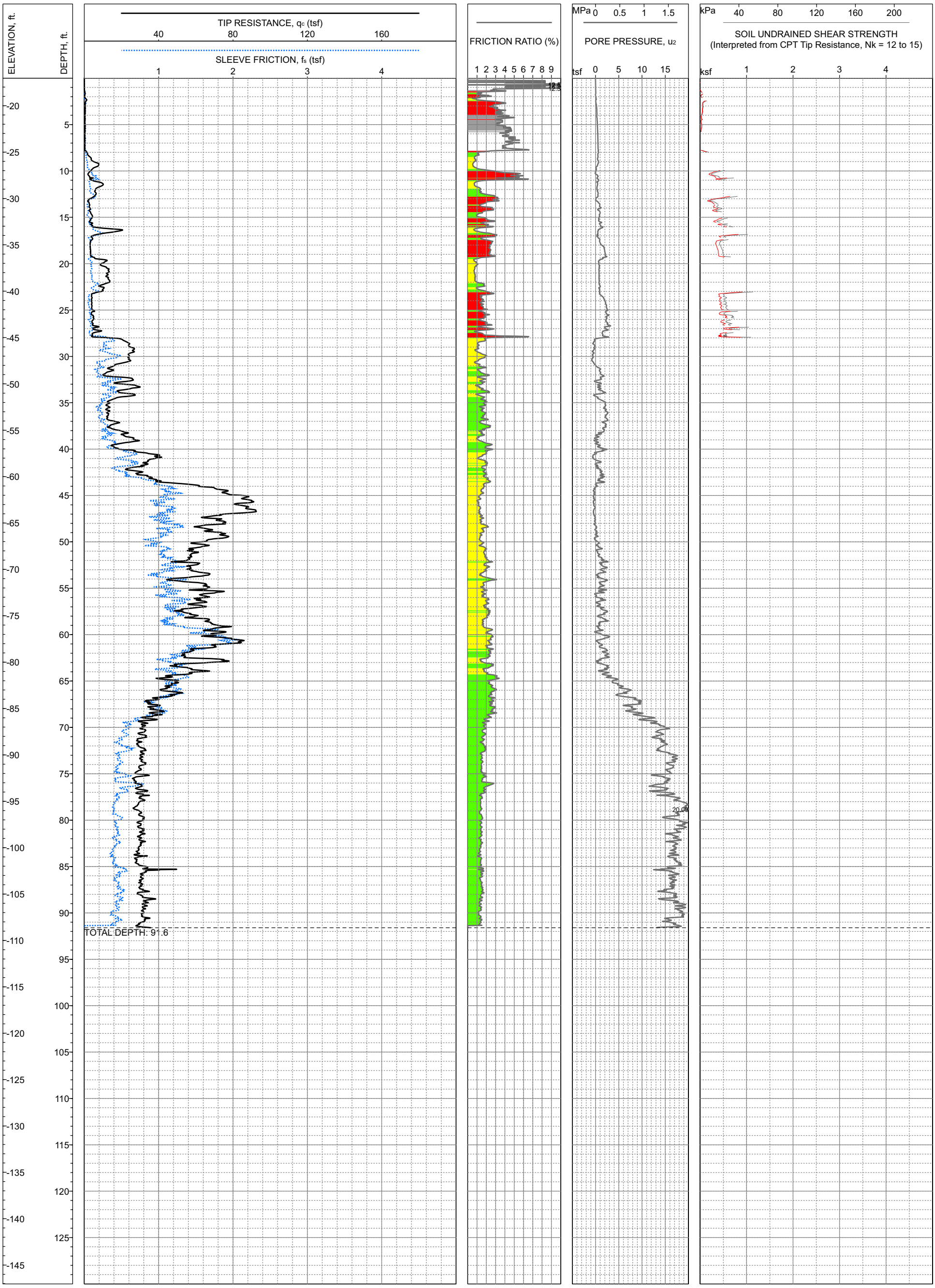
COORDINATES: E: 12,123,290 N: 3,480,348 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -4.3ft +/- (MLLW)
COMPLETION DEPTH: 85.1ft
TEST DATE: 4/26/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1696
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

LOG OF CPT C-27
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-30

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXD\Logs_CPT_FR90.mxd,06/10/2008,kspencer



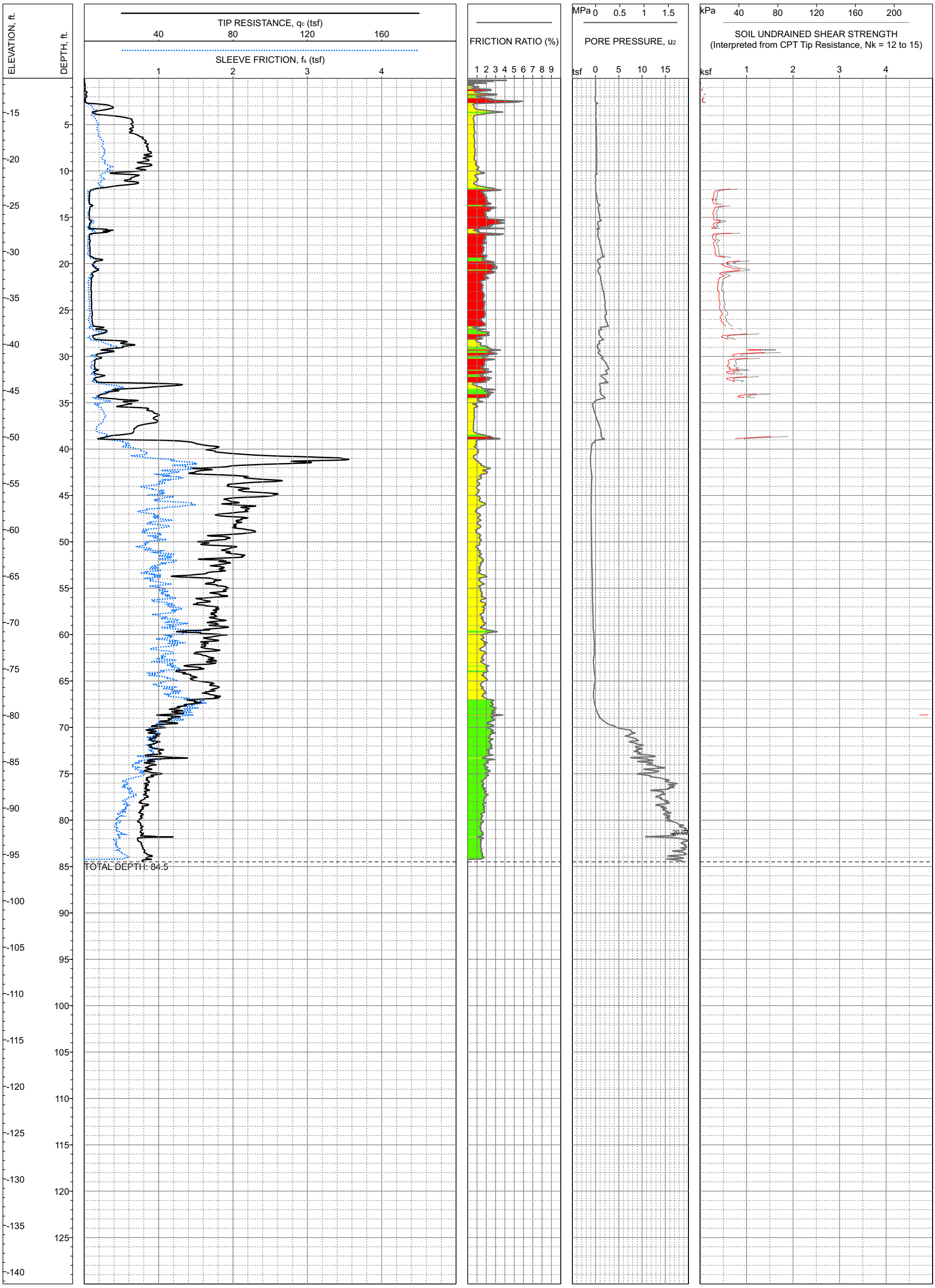
COORDINATES: E: 12,123,282 N: 3,480,161 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -17.0ft +/- (MLLW)
COMPLETION DEPTH: 91.6ft
TEST DATE: 4/24/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1698
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

LOG OF CPT C-28
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-31

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXDLogs_CPT_FR90.mxd,06/10/2008,kspencer



COORDINATES: E: 12,123,405 N: 3,480,250 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -11.3ft +/- (MLLW)
COMPLETION DEPTH: 84.5ft
TEST DATE: 4/25/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1698
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

LOG OF CPT C-29
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-32

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXD\Logs_CPT_FR90.mxd,06/10/2008,kspencer



COORDINATES: E: 12,123,489 N: 3,480,394 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -10.4ft +/- (MLLW)
COMPLETION DEPTH: 24.9ft
TEST DATE: 4/24/2008
Soil Classification based on Robertson (1990)

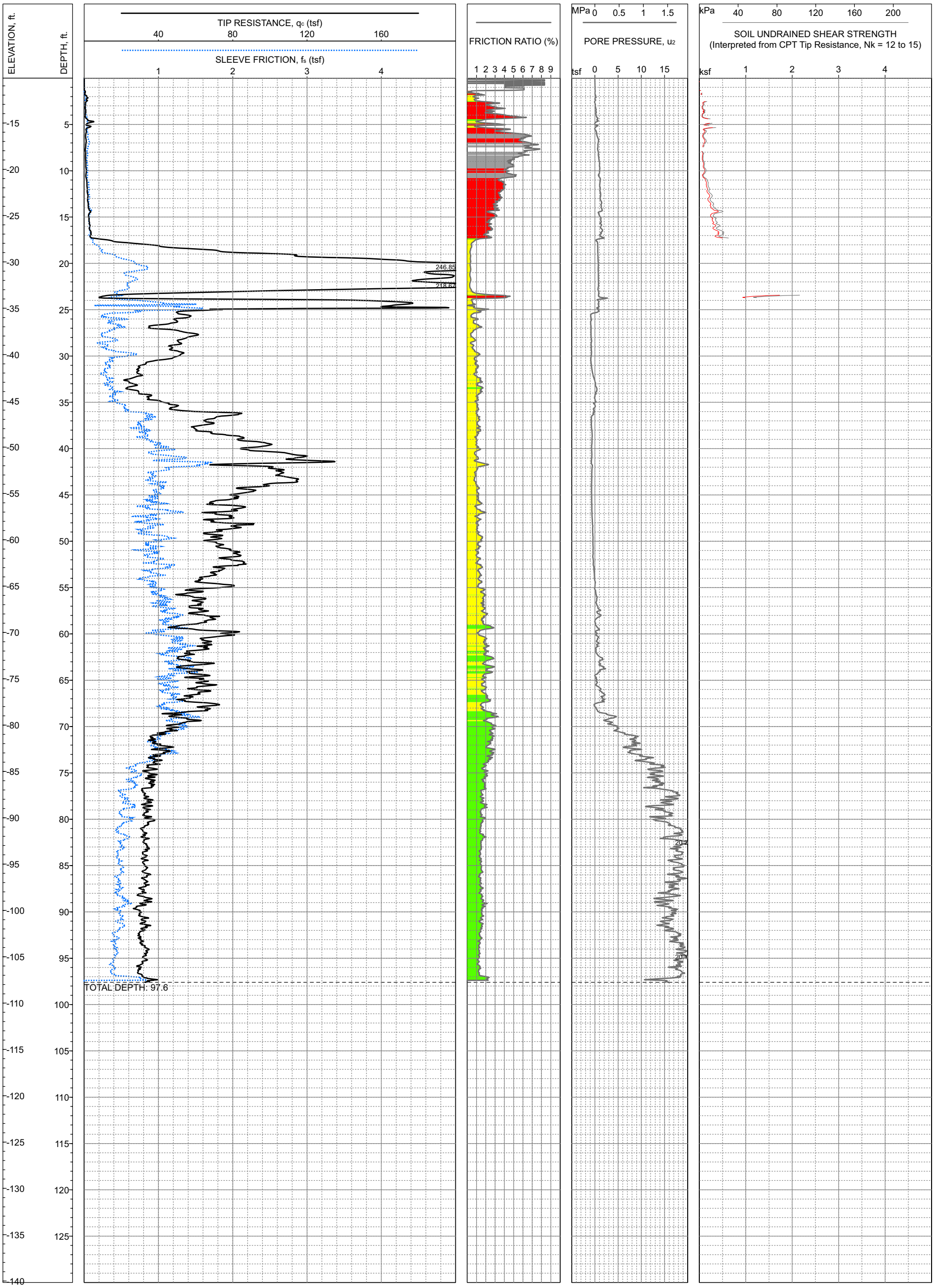
EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1698
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

LOG OF CPT C-30
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-33

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXDLogs_CPT_FR90.mxd,06/10/2008,kspencer

Virgina Department of Transportation
Project No. 3602.001



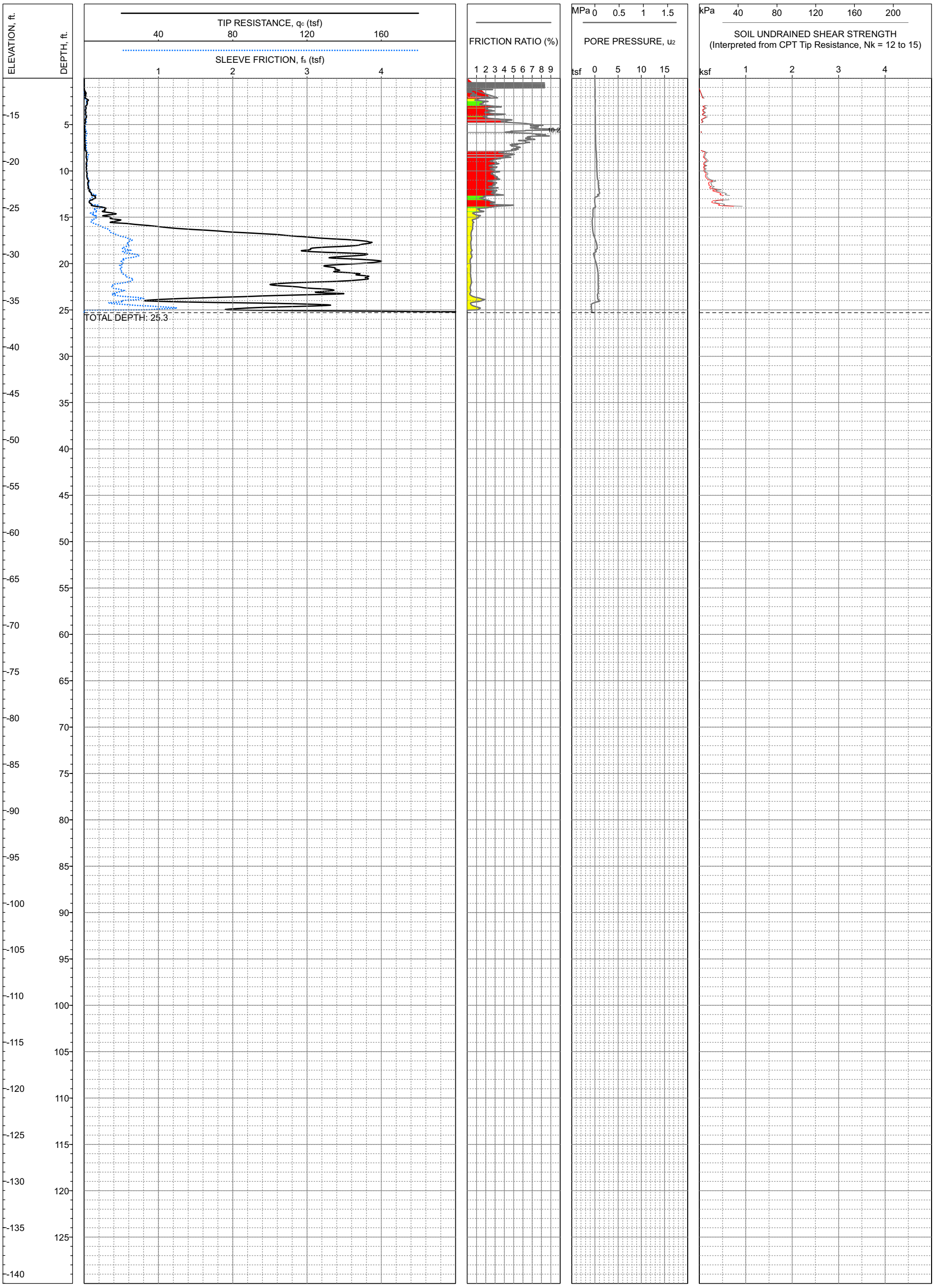
COORDINATES: E: 12,123,446 N: 3,480,396 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -10.2ft +/- (MLLW)
COMPLETION DEPTH: 97.6ft
TEST DATE: 4/24/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1698
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXDLogs_CPT_FR90.mxd,06/10/2008,kspencer

LOG OF CPT C-30A
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-34



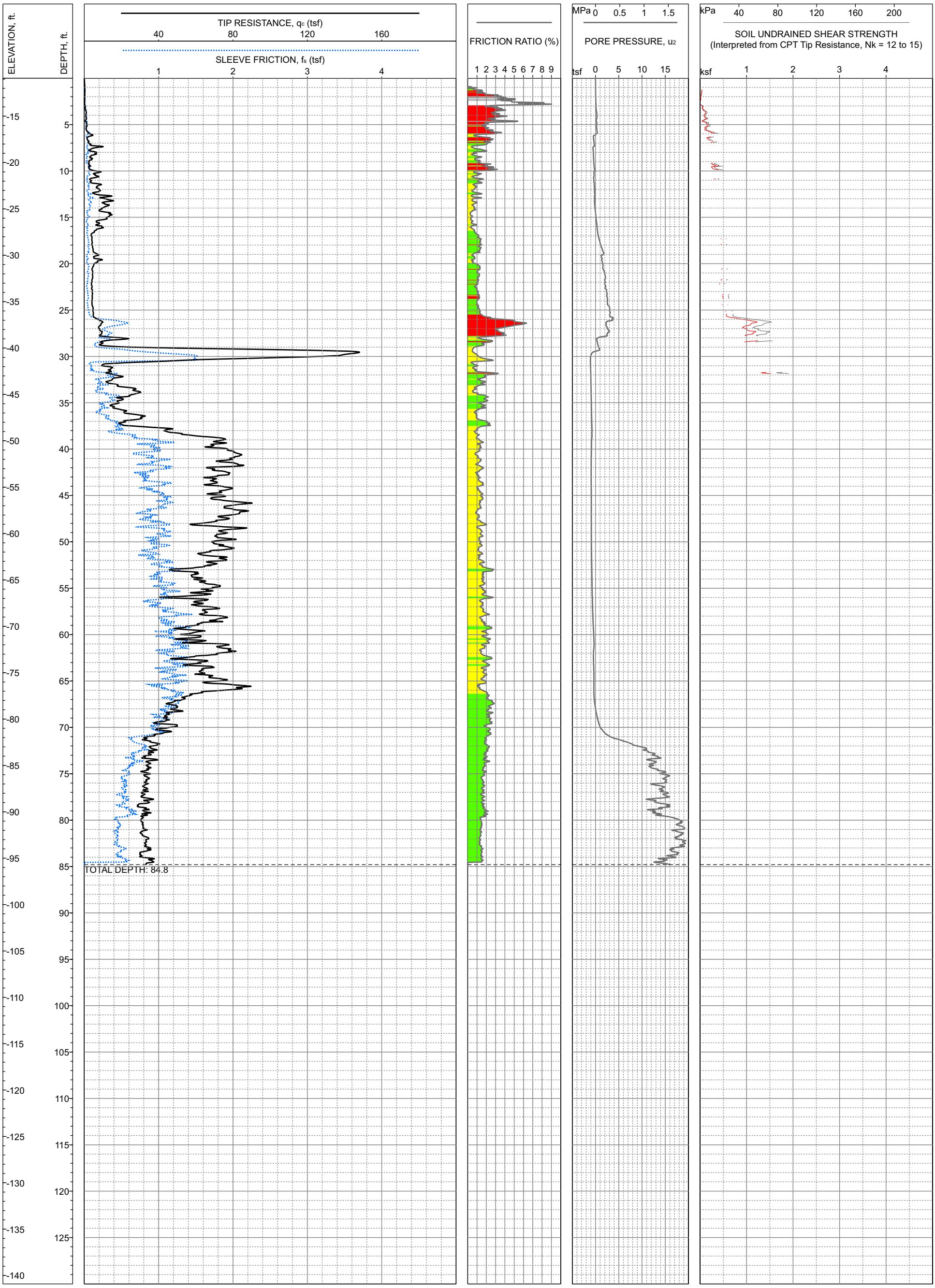
COORDINATES: E: 12,123,508 N: 3,480,511 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -11.0ft +/- (MLLW)
COMPLETION DEPTH: 25.3ft
TEST DATE: 4/24/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1698
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

LOG OF CPT C-31
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-35

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXD\Logs_CPT_FR90.mxd,06/10/2008,kspencer



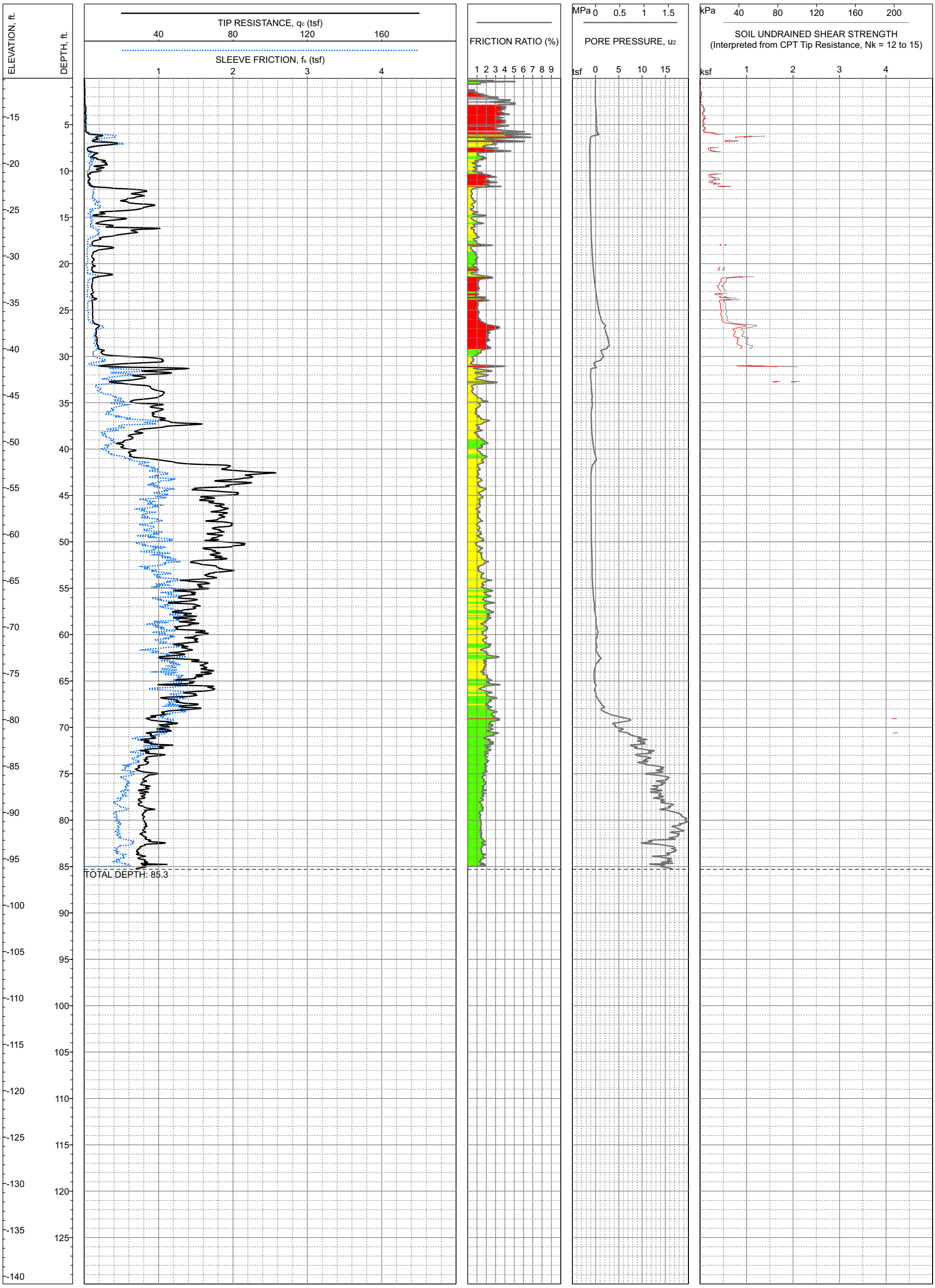
COORDINATES: E: 12,123,569 N: 3,480,622 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -10.9ft +/- (MLLW)
COMPLETION DEPTH: 84.8ft
TEST DATE: 4/24/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1698
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXD\Logs_CPT_FR90.mxd,06/10/2008,kspencer

LOG OF CPT C-32
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-36



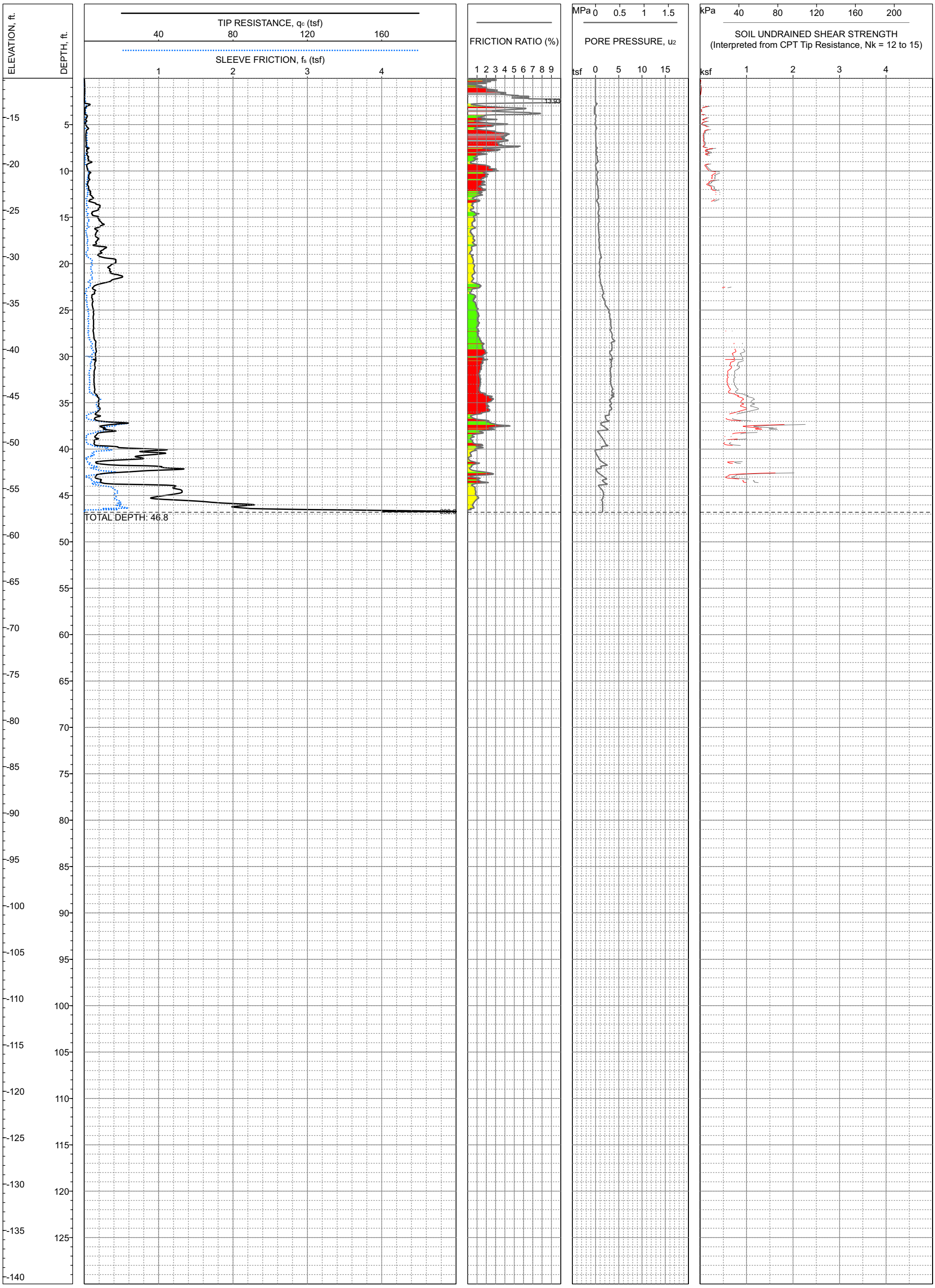
COORDINATES: E: 12,123,577 N: 3,480,672 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -10.8ft +/- (MLLW)
COMPLETION DEPTH: 85.3ft
TEST DATE: 4/24/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1698
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

LOG OF CPT C-33
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-37

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXD\Logs_CPT_FR90.mxd,06/10/2008,kspencer



COORDINATES: E: 12,123,545 N: 3,480,709 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -10.8ft +/- (MLLW)
COMPLETION DEPTH: 46.8ft
TEST DATE: 4/25/2008
Soil Classification based on Robertson (1990)

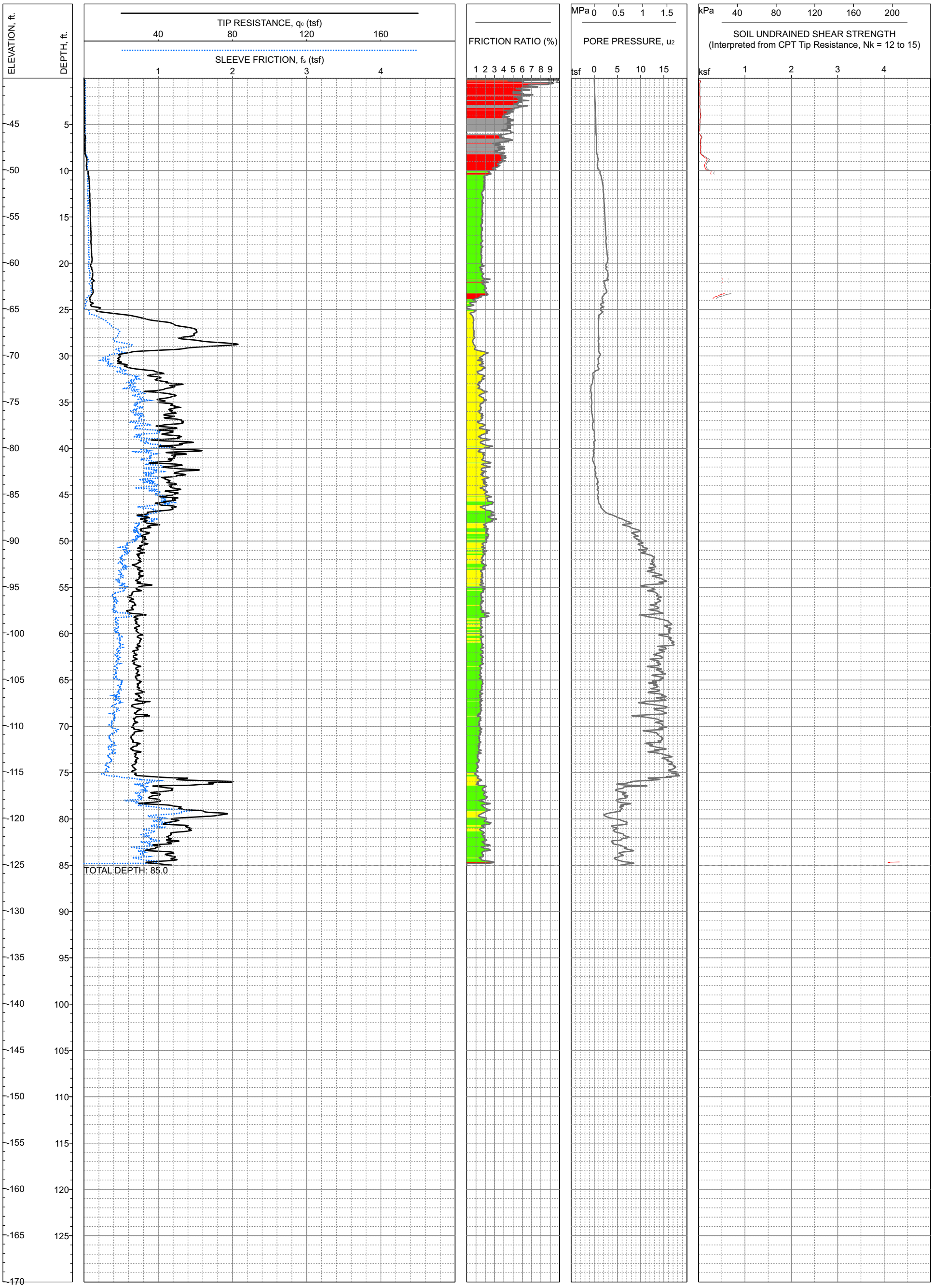
EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1698
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXD\Logs_CPT_FR90.mxd,06/10/2008,kspencer

LOG OF CPT C-34

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-38



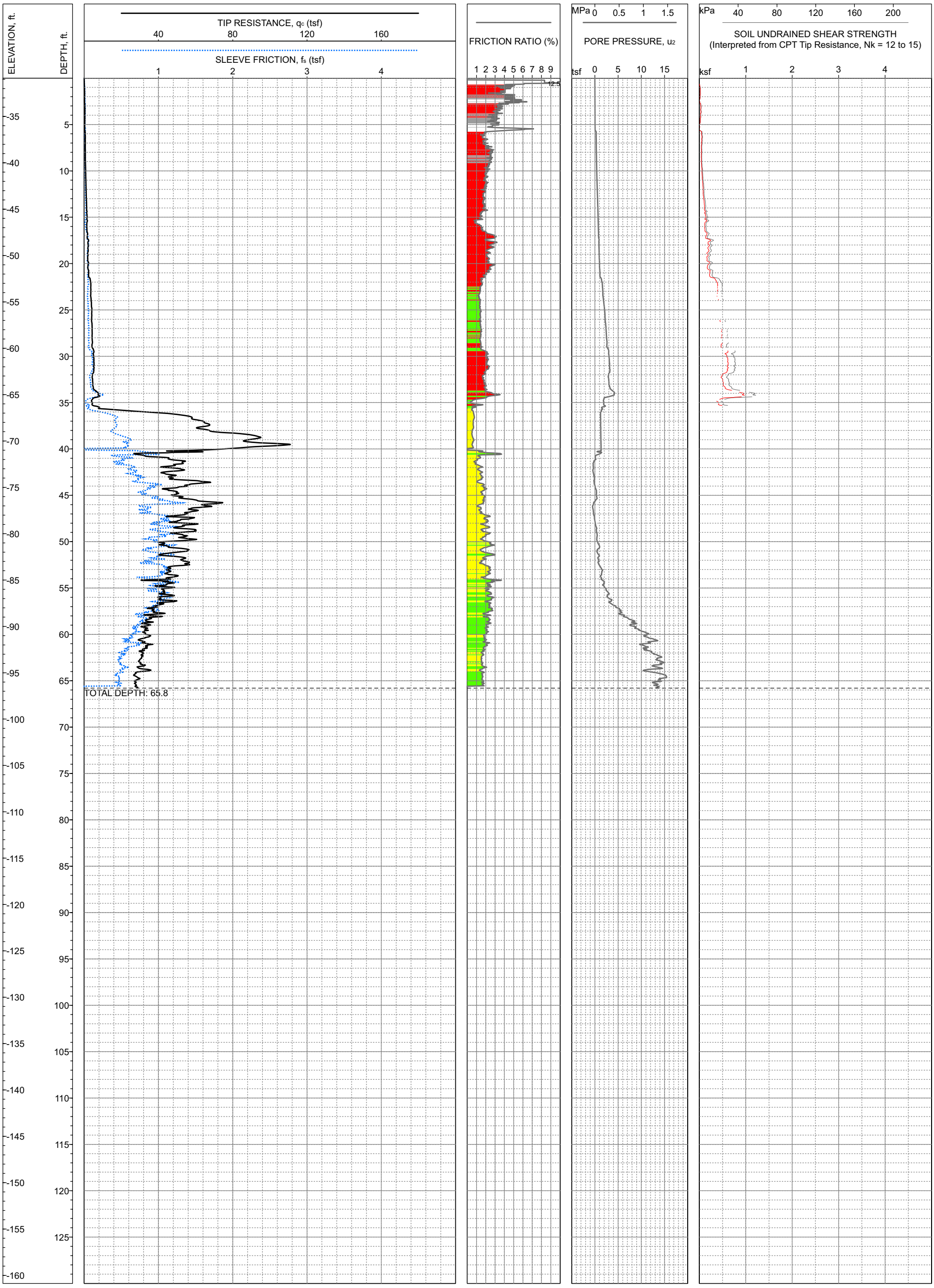
COORDINATES: E: 12,122,761 N: 3,479,687 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -40.1ft +/- (MLLW)
COMPLETION DEPTH: 85.0ft
TEST DATE: 4/28/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1697
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

LOG OF CPT C-35
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-39

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXDLogs_CPT_FR90.mxd,06/10/2008,kspencer



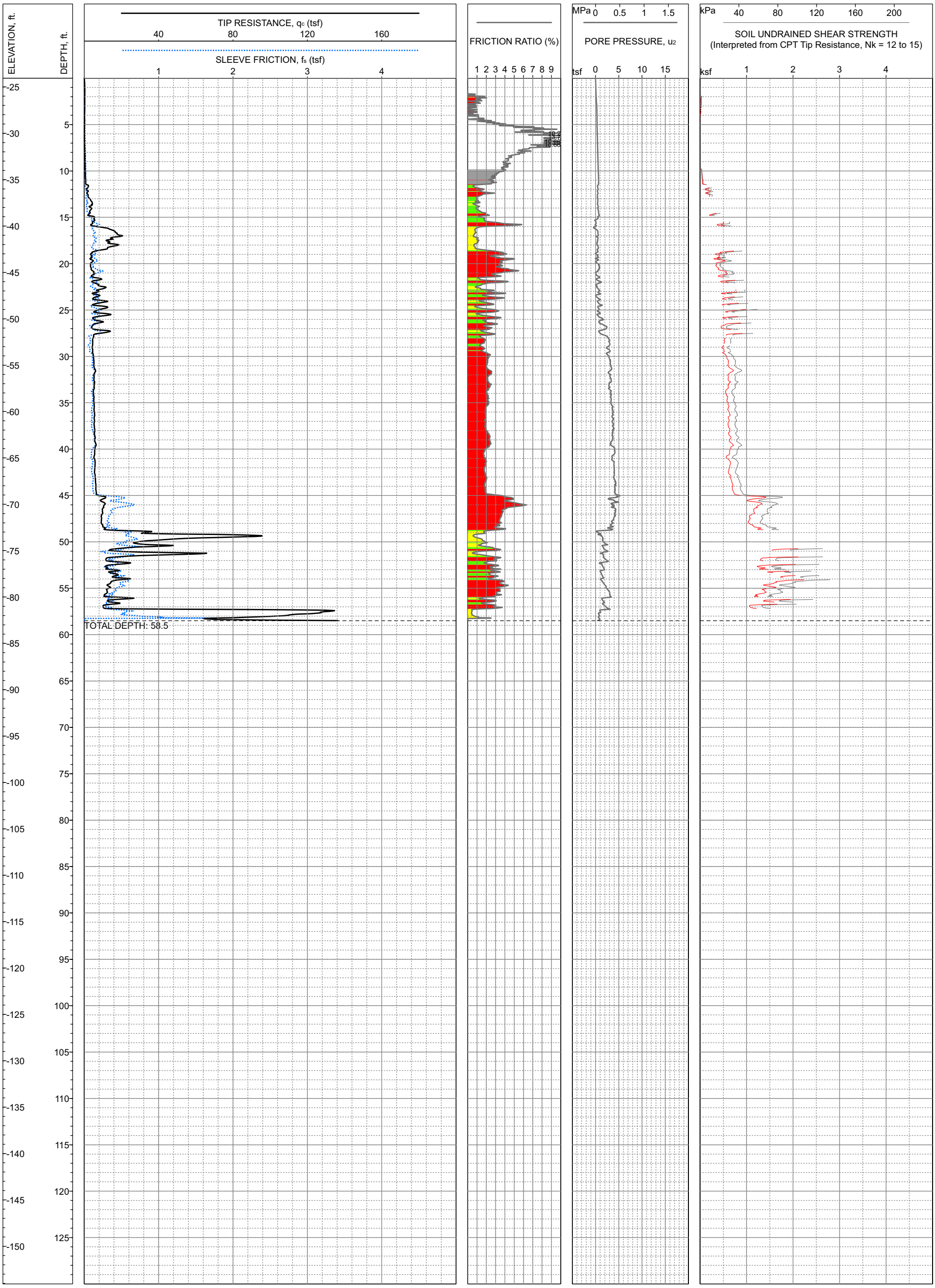
COORDINATES: E: 12,122,843 N: 3,479,773 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -30.9ft +/- (MLLW)
COMPLETION DEPTH: 65.8ft
TEST DATE: 4/28/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1698
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

LOG OF CPT C-36
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-40

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXD\Logs_CPT_FR90.mxd,06/10/2008,kspencer



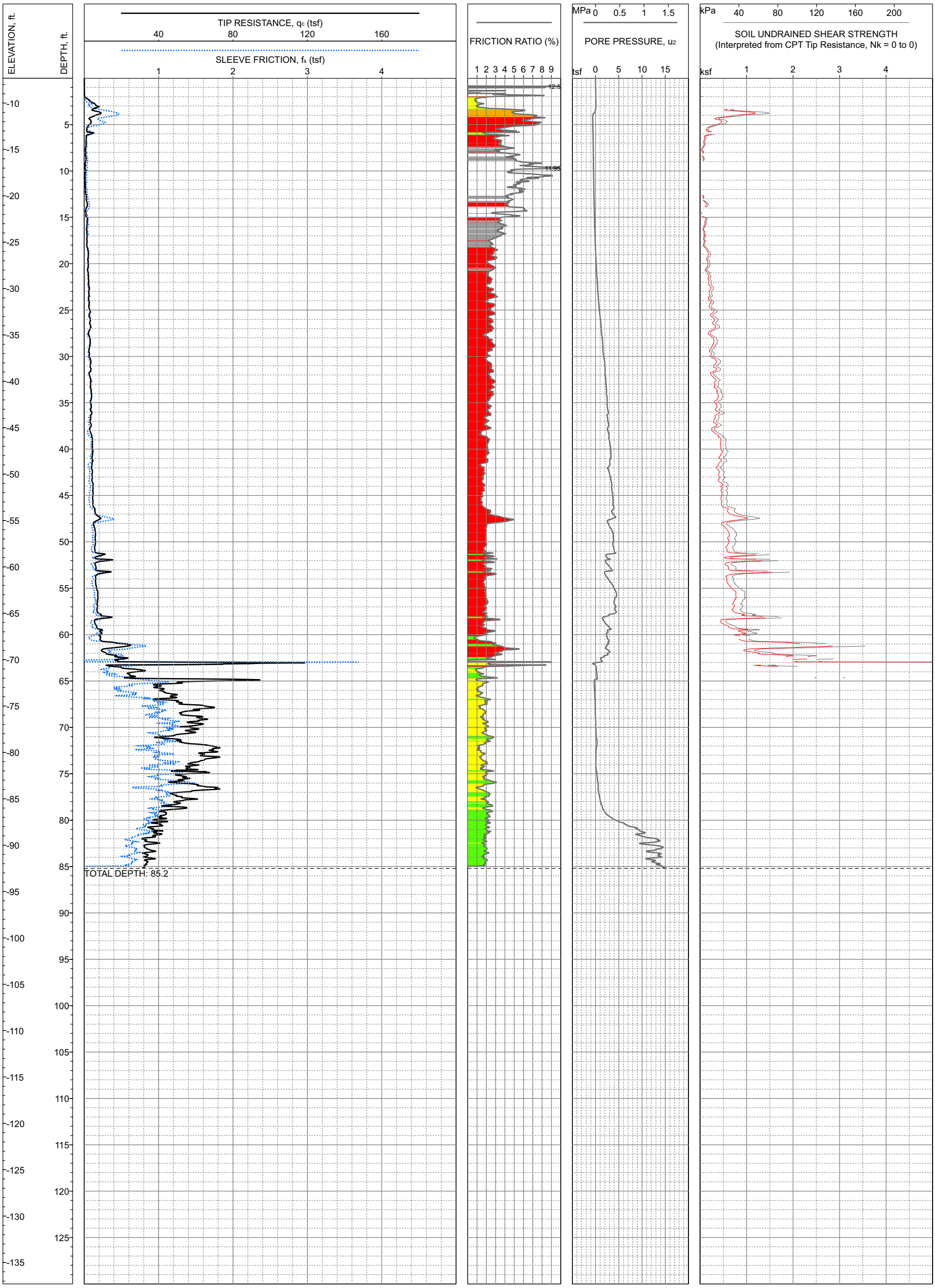
COORDINATES: E: 12,123,101 N: 3,479,961 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -24.1ft +/- (MLLW)
COMPLETION DEPTH: 58.5ft
TEST DATE: 4/30/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1698
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

LOG OF CPT C-37
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-41

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXD\Logs_CPT_FR90.mxd,06/10/2008,kspencer



COORDINATES: E: 12,123,071 N: 3,480,099 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -7.3ft +/- (MLLW)
COMPLETION DEPTH: 85.2ft
TEST DATE: 4/30/2008
Soil Classification based on Robertson (1990)

EXPLORATION METHOD: CPT
CONE AREA: 10cm^2
SERIAL NO.: 1706-1698
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

LOG OF CPT C-38
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE B-42

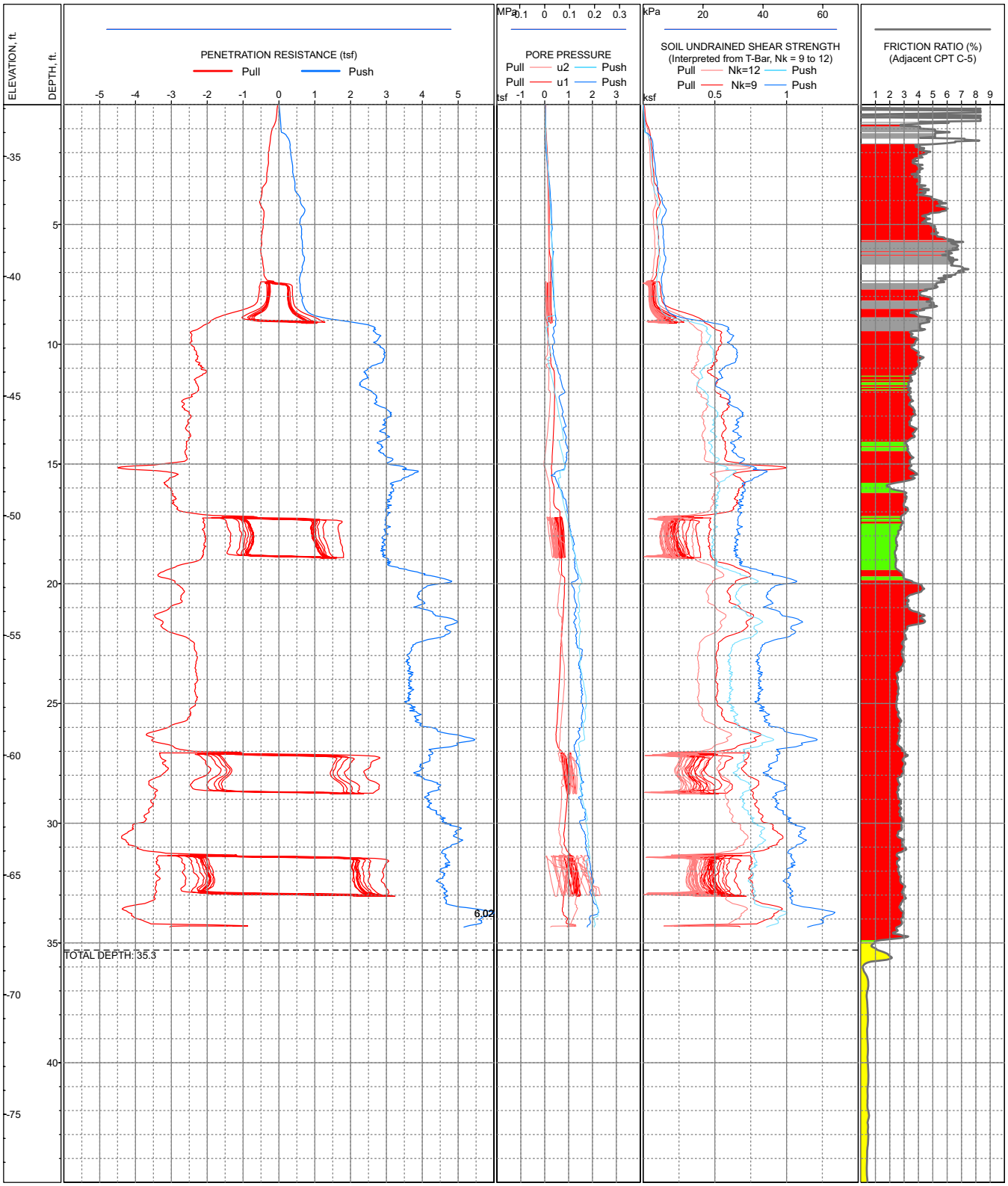
N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\CPT\2008\Logs\MXD\Logs_CPT_FR90.mxd,06/10/2008,kspencer

APPENDIX C
T-BAR SOUNDINGS

Fugro T-Bar Designation	VDOT T-Bar Designation	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet)		River Bottom Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)	Cyclic Test Depths (feet)
			Northing	Easting				
T-1		4/29/2008	3479069	12122071	-32.6	33.1	-65.7	8.4, 18.2, 28.1, 32.3
T-2		4/29/2008	3479211	12122294	-47.7	13.4	-61.1	7.7, 12.6
T-3		4/28/2008	3479663	12122476	-44.3	11.5	-55.8	5.7, 10.7
T-4		4/28/2008	3479804	12122819	-23.5	37.7	-61.2	7.4, 17.2, 27.1, 36.9

FIGURE C-1

SUMMARY OF T-BAR SOUNDINGS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia



COORDINATES: N: 3,479,069, E: 12,122,071 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -32.8 ft +/- MLLW
COMPLETION DEPTH: 35.3 ft
TEST DATE: 4/29/2008

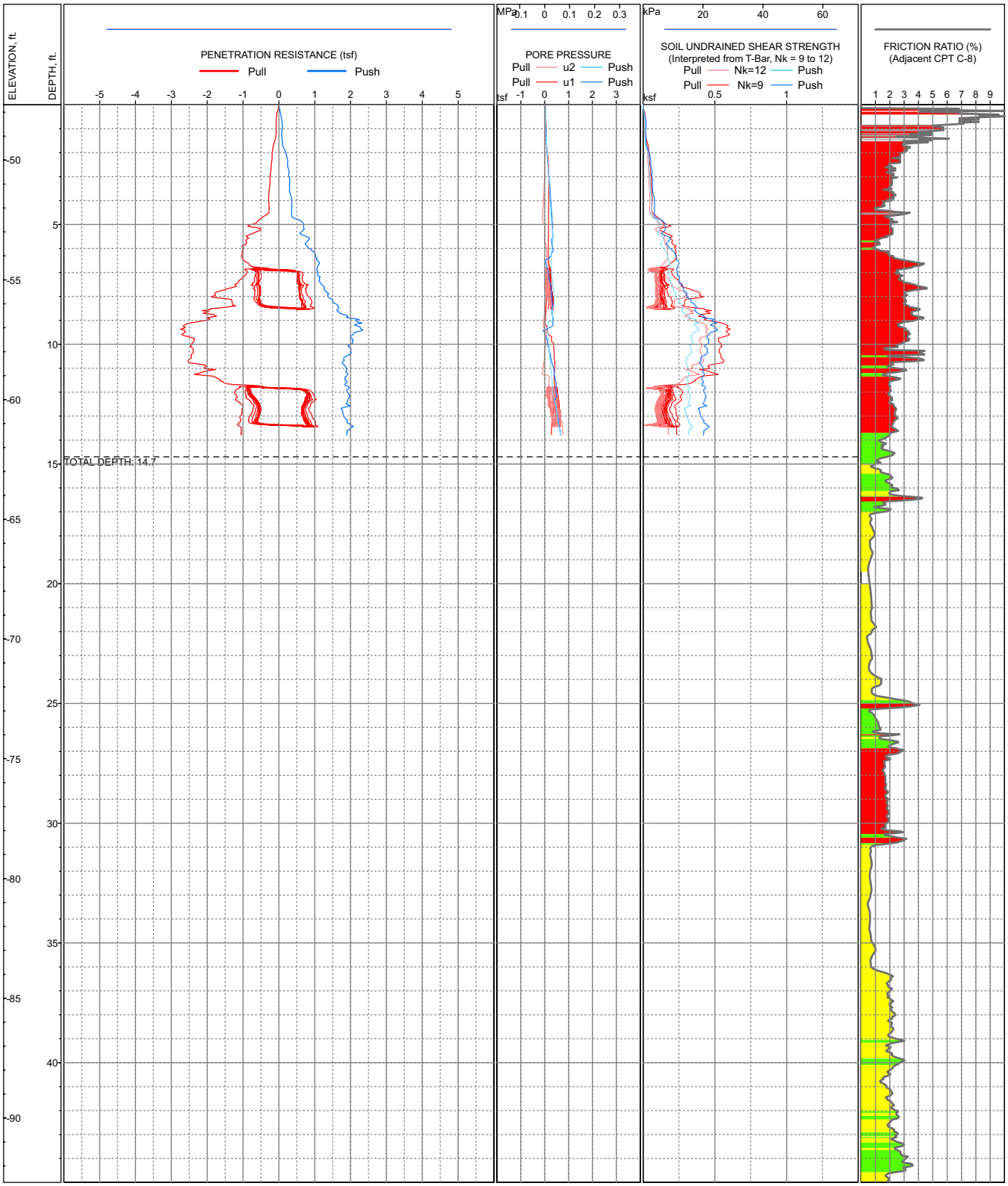
EXPLORATION METHOD: T-Bar Sounding
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

LOG OF T-BAR T-1

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE C-2

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\Tbar\2008\Logs\MXD\T-Bar_Logs.mxd,05/30/2008,ksmith



COORDINATES: N: 3,479,211, E: 12,122,294 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -47.7 ft +/- MLLW
COMPLETION DEPTH: 14.7 ft
TEST DATE: 4/29/2008

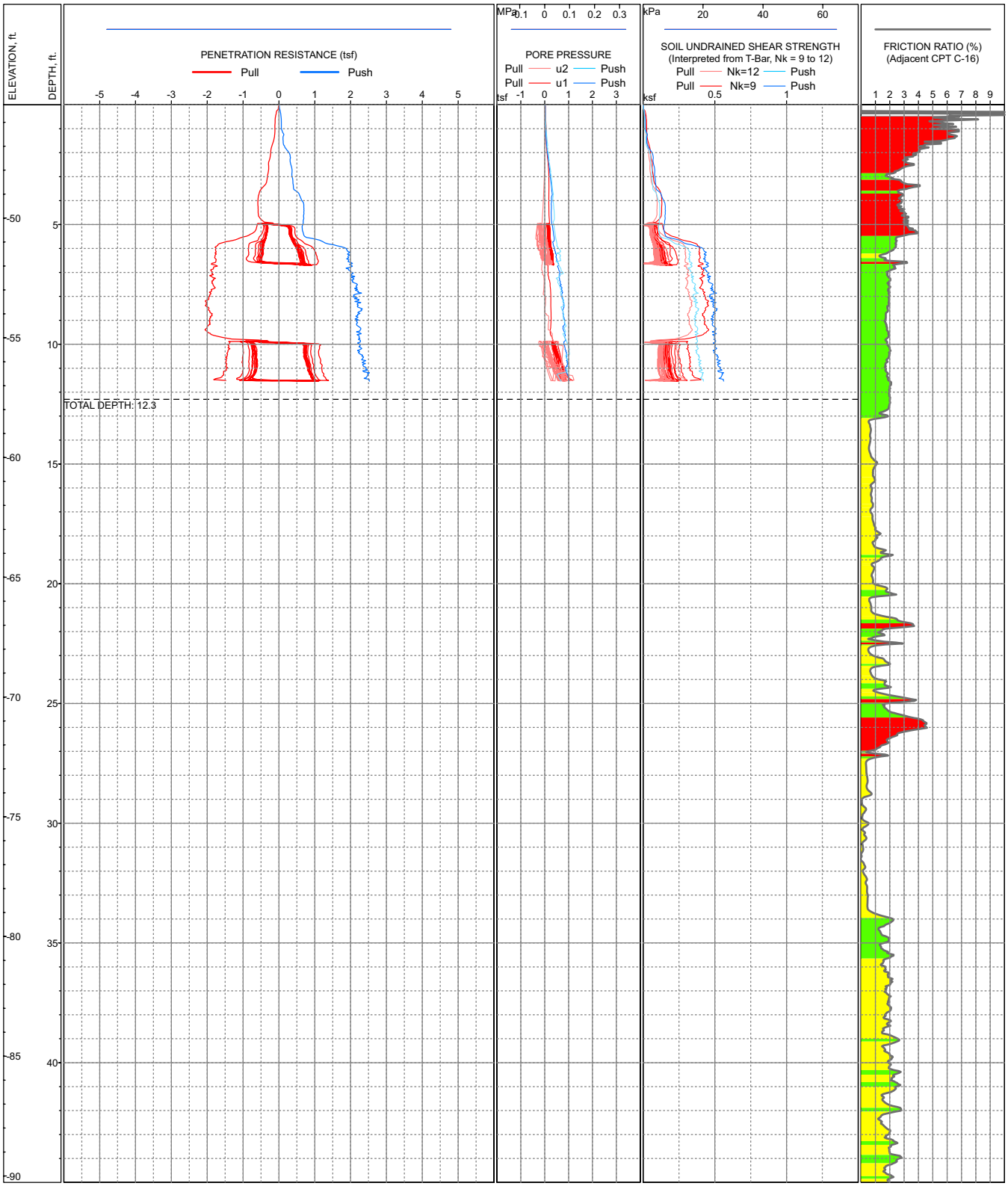
EXPLORATION METHOD: T-Bar Sounding
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

LOG OF T-BAR T-2

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE C-3

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\Tbar\2008\Logs\MXDT-Bar_Logs.mxd,05/30/2008,ksmith



COORDINATES: N: 3,479,663, E: 12,122,476 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -45.3 ft +/- MLLW
COMPLETION DEPTH: 12.3 ft
TEST DATE: 4/28/2008

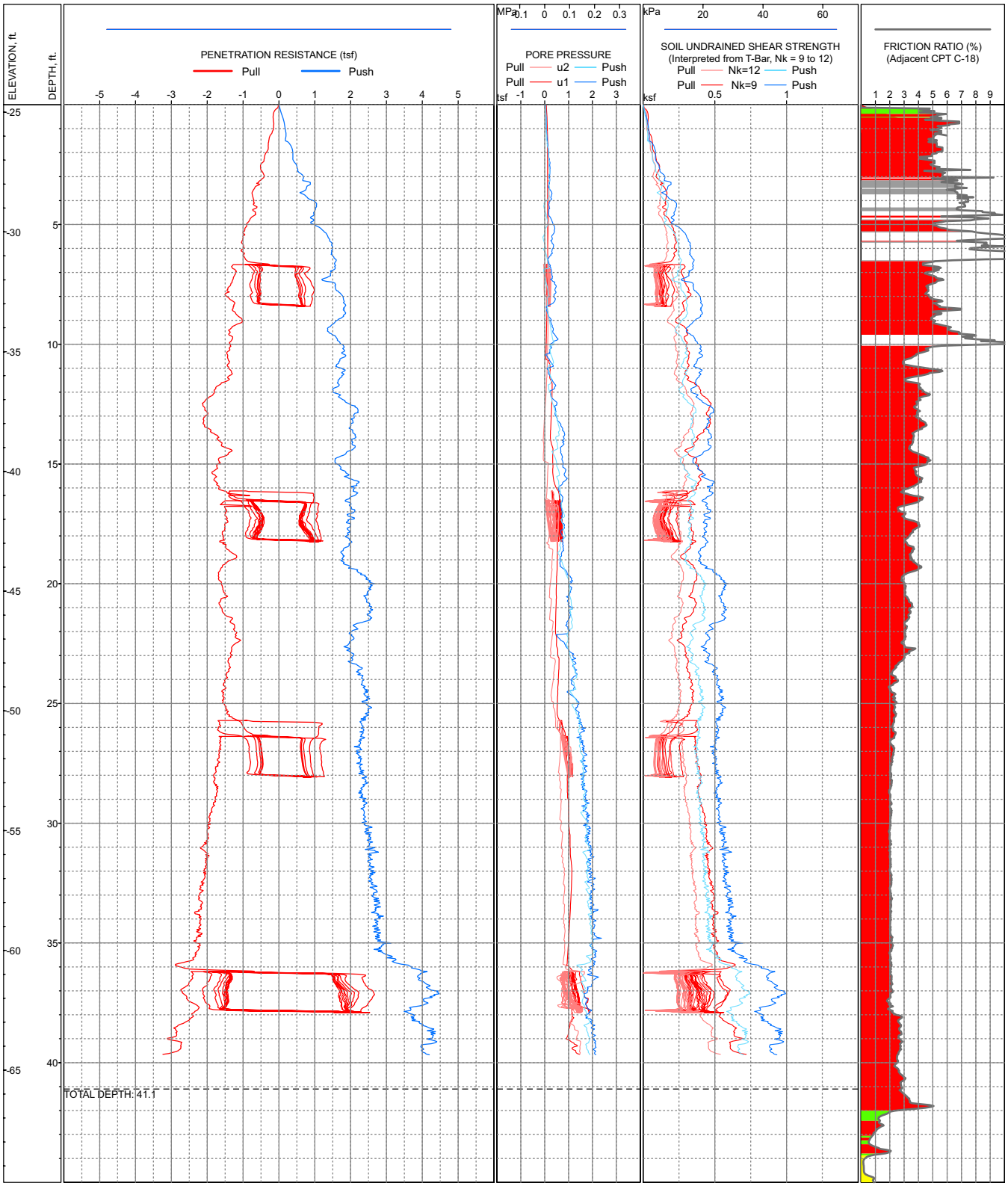
EXPLORATION METHOD: T-Bar Sounding
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

LOG OF T-BAR T-3

Midtown Tunnel Second Tube
Portsmouth to Norfolk, Virginia

FIGURE C-4

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\Tbar\2008\Logs\MXDT-Bar_Logs.mxd,05/30/2008,ksmith



COORDINATES: N: 3,479,804, E: 12,122,819 Virginia State Plane, South Zone, NAD83, feet
RIVER BOTTOM EL: -24.7 ft +/- MLLW
COMPLETION DEPTH: 41.1 ft
TESTDATE: 4/28/2008

EXPLORATION METHOD: T-Bar Sounding
PERFORMED BY: FAOL
REVIEWED BY: T. McNeilan, P.E.

LOG OF T-BAR T-4

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE C-5

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Explorations\Tbar\2008\Logs\MXDT-Bar_Logs.mxd,05/30/2008,ksmith

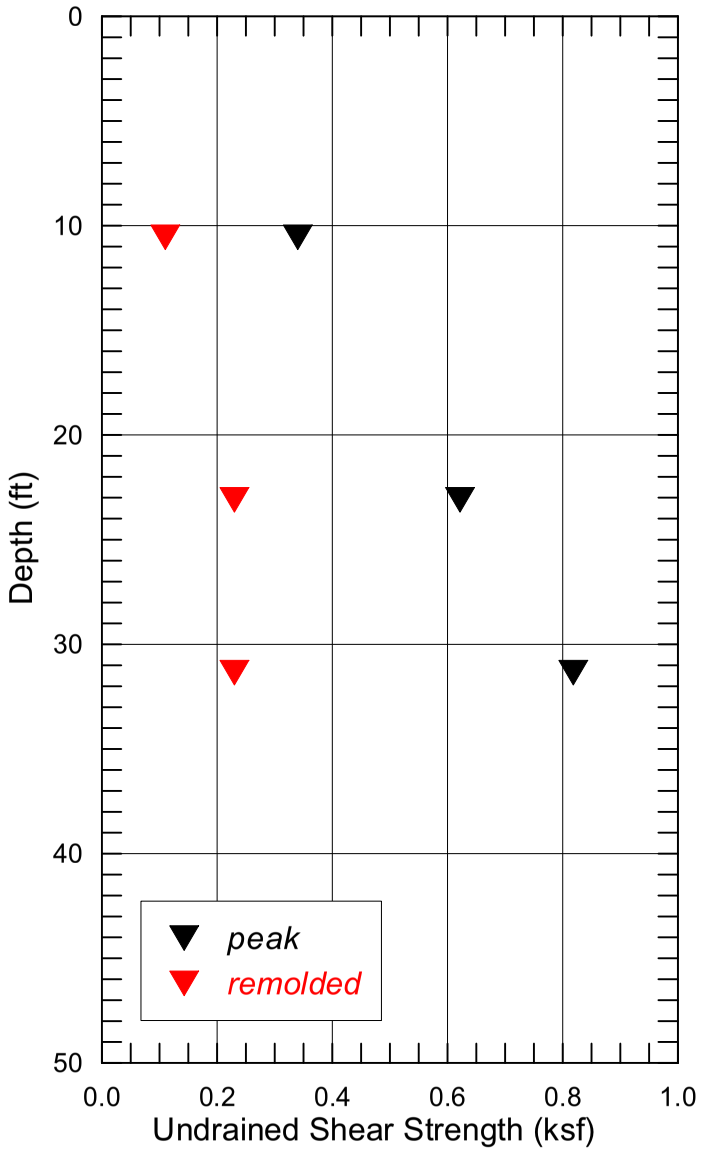
APPENDIX D
VANE SHEAR TESTS

Fugro Vane Shear Designation	VDOT Vane Shear Designation	Completion Date	Coordinates Virginia State Plane South (NAD 83, feet)		River Bottom Elevation (MLLW, feet)	Completion Depth (feet)	Terminal Elevation (MLLW, feet)	Test Depths (feet) "R" indicates remold test was performed
			Northing	Easting				
V-1		4/29/2008	3479104	12122073	-31.9	31.3	-63.2	10.6 **R,** 23.1 **R,** 31.3 **R**
V-2		4/29/2008	3479223	12122291	-48.4	9.8	-58.2	9.8 **R**
V-3		4/29/2008	3479672	12122464	-44.1	11.4	-55.5	6.5 **R,** 11.4 **R**
V-4		4/29/2008	3479817	12122822	-21.7	39.8	-61.5	10.3, 20.1, 29.9, 39.8

FIGURE D-1

SUMMARY OF VANE SHEAR TESTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

PROJECT NO: 3602.001	**COORDINATES:** E: 12,122,073 N: 3,479,104 Virginia State Plane, South Zone, NAD83, feet	**OPERATOR:** FAOL
COMPLETION DATE: 4/29/2008	**RIVER BOTTOM EL:** -31.9 ft +/- (rel. MLLW datum)	**EQUIPMENT:** Roson



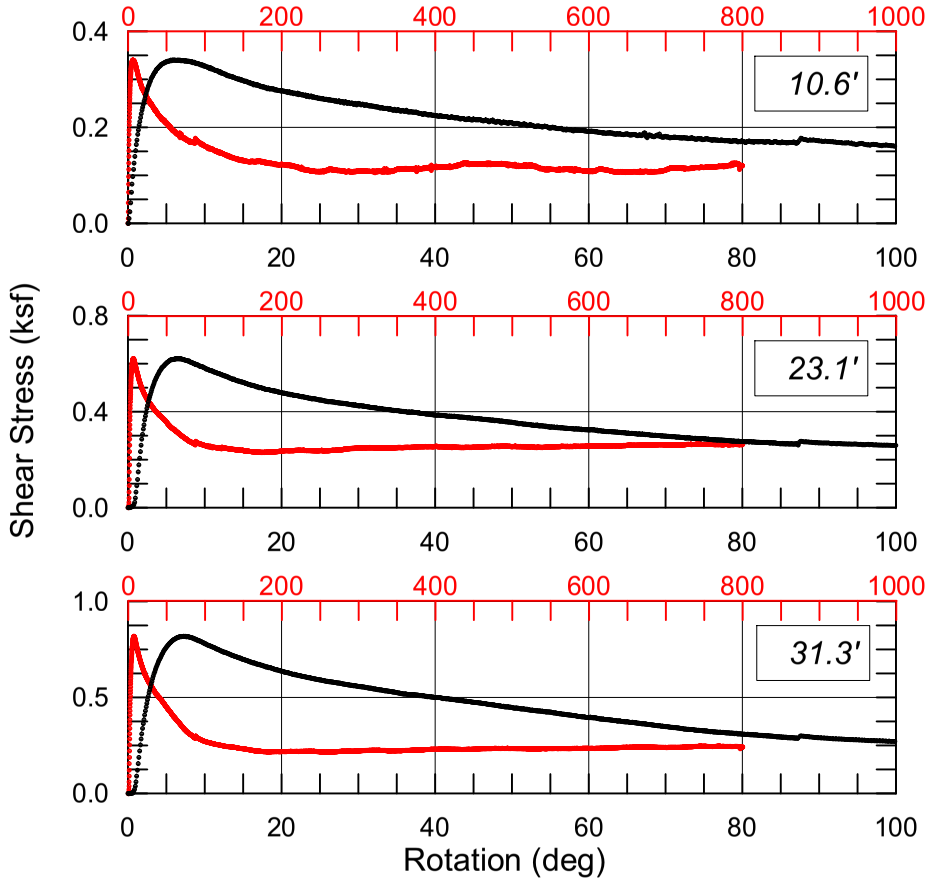


FIGURE D-2

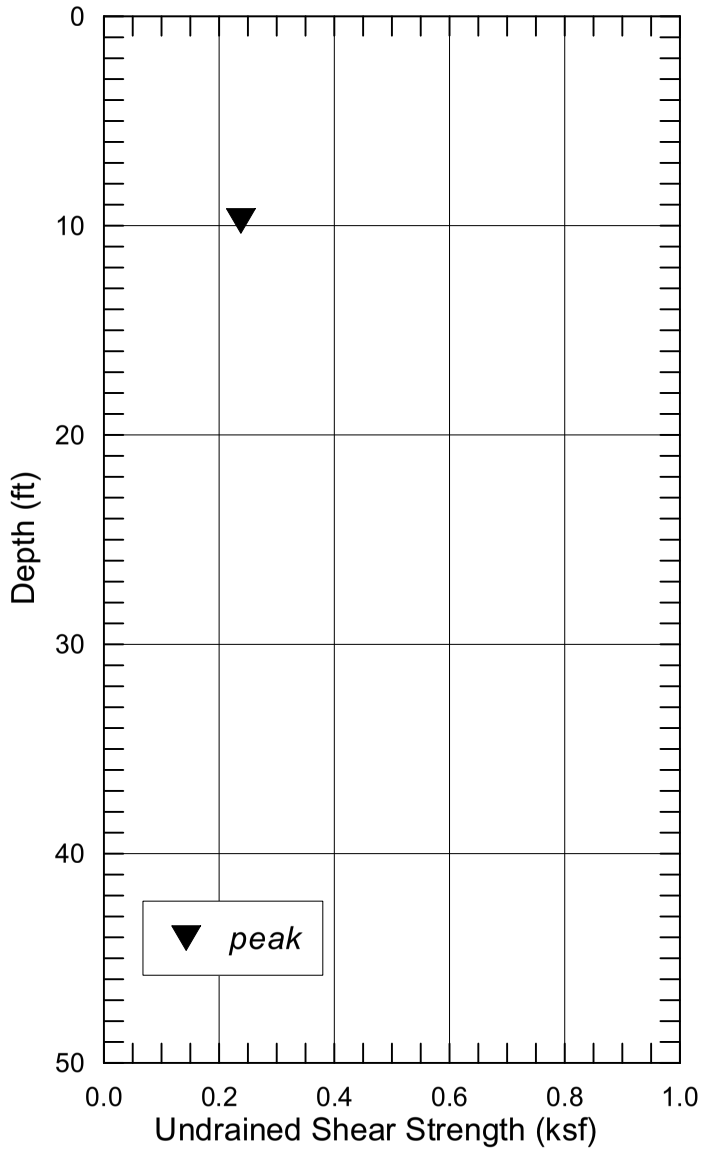
VANE SHEAR TEST RESULTS

EXPLORATION V-1

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\03-GDR\Grapher\V-1_landscape.grf

PROJECT NO: 3602.001	**COORDINATES:** E: 12,122,291 N: 3,479,223 Virginia State Plane, South Zone, NAD83, feet	**OPERATOR:** FAOL
COMPLETION DATE: 4/29/2008	**RIVER BOTTOM EL:** -48.4 ft +/- (rel. MLLW datum)	**EQUIPMENT:** Roson



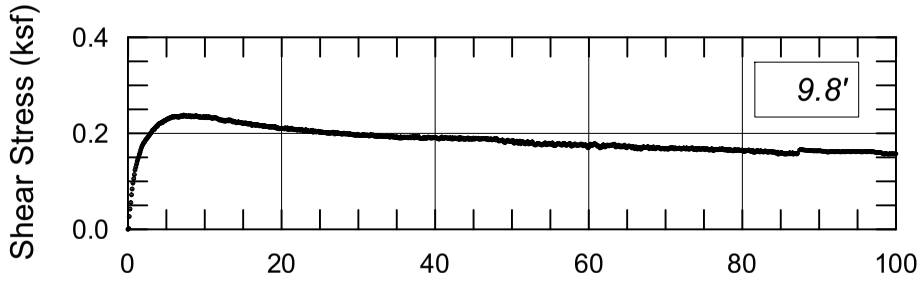


FIGURE D-3

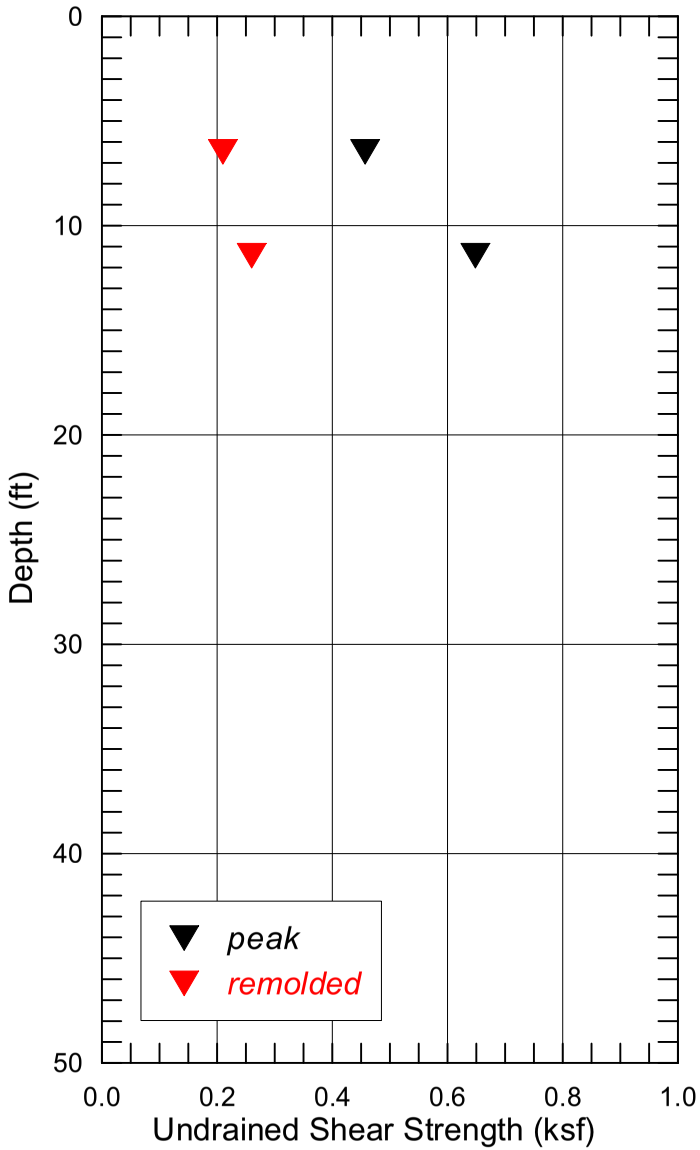
VANE SHEAR TEST RESULTS

EXPLORATION V-2

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\03-GDR\Grapher\V-2_landscape.grf

PROJECT NO: 3602.001	**COORDINATES:** E: 12,122,464 N: 3,479,672 Virginia State Plane, South Zone, NAD83, feet	**OPERATOR:** FAOL
COMPLETION DATE: 4/29/2008	**RIVER BOTTOM EL:** -44.1 ft +/- (rel. MLLW datum)	**EQUIPMENT:** Roson



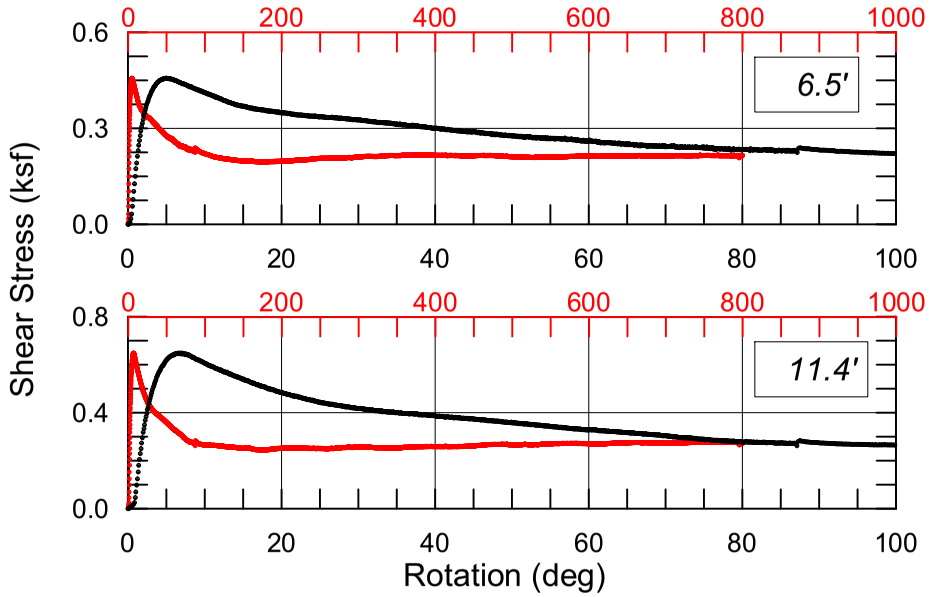


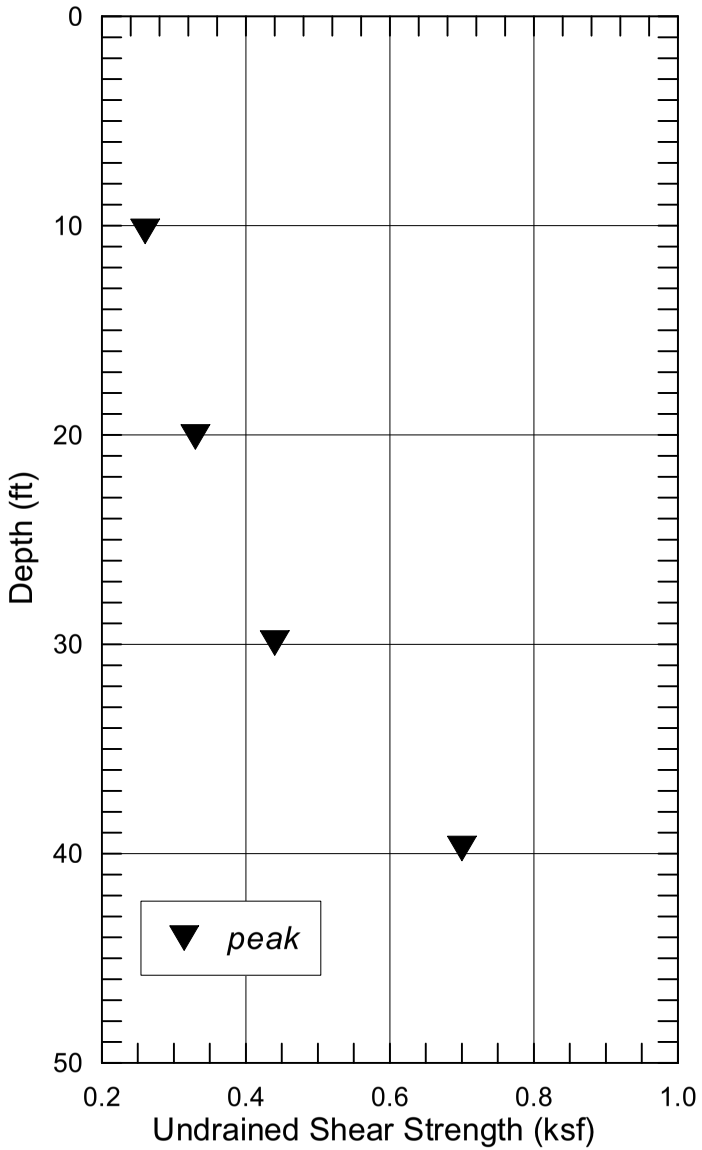
FIGURE D-4

VANE SHEAR TEST RESULTS
EXPLORATION V-3

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\03-GDR\Grapher\V-3_landscape.grf

PROJECT NO: 3602.001	**COORDINATES:** E: 12,122,822 N: 3,479,817 Virginia State Plane, South Zone, NAD83, feet	**OPERATOR:** FAOL
COMPLETION DATE: 4/29/2008	**RIVER BOTTOM EL:** -21.7 ft +/- (rel. MLLW datum)	**EQUIPMENT:** Roson



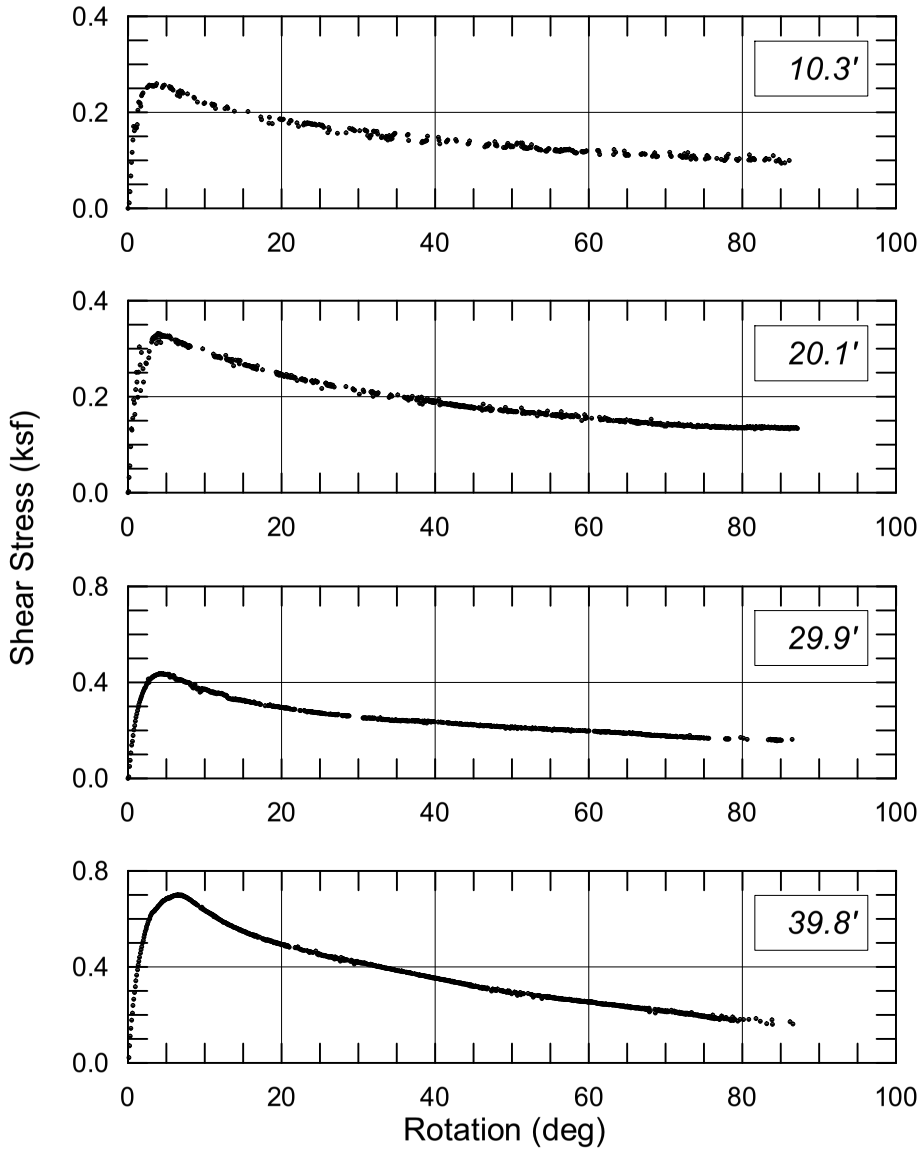


FIGURE D-5

VANE SHEAR TEST RESULTS
EXPLORATION V-4
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\03-GDR\Grapher\V-4_landscape.grf

APPENDIX E
LABORATORY TESTS

LOCATION	DEPTH, ft	MATERIAL DESCRIPTION	SAMPLE NUMBER	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	MOISTURE CONTENT (%)	FINES (%)	ATTERBERG LIMITS		DIRECT SHEAR		UU TRIAXIAL		MINIVANE		CORROSIVITY TESTS				ORGANIC CONTENT (%)	SPECIFIC GRAVITY
								LL	PI	C, ksf	ϕ, deg	S_u, ksf	Confining Stress, ksf	S_u, ksf	Residual S_u, ksf	R, $\Omega \cdot$cm	pH	Cl (mg/kg)	SO_4 (mg/kg)		
B-1	0.7	Fat CLAY (CH)	1A	88	40	120															
B-1	1.2	Fat CLAY (CH)	1B											0.07	0.05						
B-1	3.6	Fat CLAY (CH)	2A			144		113	81					0.02	0.02						
B-1	7.6	Fat CLAY (CH)	3A			85															
B-1	10.1	Sandy CLAY (CL)	4A																		
B-1	10.6	Sandy CLAY (CL)	4B	116	86	34						0.44	17.28								
B-1	11.1	Sandy CLAY (CL)	4C											0.52							
B-1	14.1	Sandy CLAY (CL)	5A			43															
B-1	16.4	Fat CLAY (CH)	6A				97														2.66
B-1	17.8	Fat CLAY (CH)	6B			79		87	59					0.59							
B-1	21.2	Fat CLAY (CH)	7A	95	54	75															
B-1	21.7	Fat CLAY (CH)	7B											0.39							
B-1	23.5	Fat CLAY (CH)	8A			80															
B-1	26.7	Fat CLAY (CH)	9A	92	51	79										55	5.0	5180	5250		
B-1	27.2	Fat CLAY (CH)	9B											0.51							
B-1	27.7	Fat CLAY (CH)	9C											1.00							
B-1	29.6	Organic CLAY (OH)	10A					97	61											6.9	
B-1	30.1	Organic CLAY (OH)	10B	89	49	82						0.50	17.28								
B-1	30.6	Organic CLAY (OH)	10C											0.66							
B-1	33.0	Organic CLAY (OH)	11A			86															
B-1	38.2	Silty Fine SAND (SM)	12A	118	97	22	23														
B-1	47.6	Silty Fine SAND (SM)	14A			20															
B-1	52.8	Fine to Medium SAND (SP)	15A	124	102	22	1														
B-1	57.9	Silty Fine SAND (SM)	16A	113	84	35	26														
B-1	62.8	Silty Fine SAND (SM)	17A			34															
B-1	67.3	Clayey Fine SAND (SC)	18A	117	86	36	46														
B-1	67.8	Clayey Fine SAND (SC)	18B				20	44	23												
B-1	72.2	Clayey Fine SAND (SC)	19A	118																	
B-1	72.7	Clayey Fine SAND (SC)	19B	117	86	35		50	32												
B-1	77.1	Clayey Fine SAND (SC)	20A	118																	

SUMMARY OF LABORATORY TEST RESULTS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-1a

LAB SUMMARY TABLE VIRGINIA REV _C:\DOCUMENTS AND SETTINGS\ABROIDESKTOP\MIDTOWN\MIDTOWN GINT FILES\FA08BOR.GPJ_ 7/8/08 01:00 PM

SUMMARY OF LABORATORY TEST RESULTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

LOCATION	DEPTH, ft	MATERIAL DESCRIPTION	SAMPLE NUMBER	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	MOISTURE CONTENT (%)	FINES (%)	ATTERBERG LIMITS		DIRECT SHEAR		UU TRIAXIAL		MINIVANE		CORROSIVITY TESTS				ORGANIC CONTENT (%)	SPECIFIC GRAVITY
								LL	PI	C, ksf	ϕ, deg	S_u, ksf	Confining Stress, ksf	S_u, ksf	Residual S_u, ksf	R, Ω·cm	pH	Cl (mg/kg)	SO_4 (mg/kg)		
B-1	77.6	Clayey Fine SAND (SC)	20B			34															

FIGURE E-1b

LOCATION	DEPTH, ft	MATERIAL DESCRIPTION	SAMPLE NUMBER	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	MOISTURE CONTENT (%)	FINES (%)	ATTERBERG LIMITS		DIRECT SHEAR		UU TRIAXIAL		MINIVANE		CORROSIVITY TESTS				ORGANIC CONTENT (%)	SPECIFIC GRAVITY
								LL	PI	C, ksf	ϕ, deg	S_u, ksf	Confining Stress, ksf	S_u, ksf	Residual S_u, ksf	R, $\Omega \cdot cm$	pH	Cl (mg/kg)	SO_4 (mg/kg)		
B-2	0.4	Fat CLAY (CH)	1A	79	31	153															
B-2	0.9	Fat CLAY (CH)	1B											0.07	0.04						
B-2	3.5	Fat CLAY (CH)	2A	78	30	159															
B-2	4.0	Fat CLAY (CH)	2B					120	90					0.06	0.03						
B-2	7.6	Fat CLAY (CH)	3A																		
B-2	8.1	Fat CLAY (CH)	3B	108	72	50						0.55	17.28								
B-2	8.6	Fat CLAY (CH)	3C											0.86							
B-2	10.3	Fat CLAY (CH)	4A			42		51	35												
B-2	14.1	Fat CLAY (CH)	5A	104	65	60															
B-2	14.6	Fat CLAY (CH)	5B											0.43							
B-2	17.2	Fat CLAY (CH)	6A	105	67	57															
B-2	17.7	Fat CLAY (CH)	6B					148	110					0.40							
B-2	20.7	Fat CLAY (CH)	7A			79															
B-2	23.5	Organic CLAY (OH)	8A	88	43	107		93	66			0.45	17.28							10.6	
B-2	24.0	Organic CLAY (OH)	8B											0.52							
B-2	26.6	Organic CLAY (OH)	9A	95	53	79						0.45	17.28								
B-2	27.1	Organic CLAY (OH)	9B											0.48							
B-2	27.6	Organic CLAY (OH)	9C											0.94							
B-2	29.5	Organic CLAY (OH)	10A			80															
B-2	33.3	Organic CLAY (OH)	11A																		
B-2	33.8	Organic CLAY (OH)	11B	89	48	88		117	86			0.30	17.28							9.5	
B-2	34.3	Organic CLAY (OH)	11C											0.67							
B-2	37.7	Silty Fine SAND (SM)	12			23	23														
B-2	42.7	Silty Fine SAND (SM)	13A			23															
B-2	44.0	Silty Fine SAND (SM)	13B																		
B-2	47.6	Fine to Medium SAND (SP)	14			25	3														
B-2	53.0	Fine to Medium SAND (SP)	15A	74																	
B-2	53.4	Fine to Medium SAND (SP)	15B			33															
B-2	57.4	Fine to Medium SAND (SP)	16A																		
B-2	58.2	Silty Fine SAND (SM)	16B			28															

SUMMARY OF LABORATORY TEST RESULTS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-1c

LAB SUMMARY TABLE VIRGINIA REV _C:\DOCUMENTS AND SETTINGS\ABROIDESKTOP\MIDTOWN\MIDTOWN GINT FILES\FA08BOR.GPJ_ 7/8/08 01:00 PM

LOCATION	DEPTH, ft	MATERIAL DESCRIPTION	SAMPLE NUMBER	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	MOISTURE CONTENT (%)	FINES (%)	ATTERBERG LIMITS		DIRECT SHEAR		UU TRIAXIAL		MINIVANE		CORROSIVITY TESTS				ORGANIC CONTENT (%)	SPECIFIC GRAVITY
								LL	PI	C, ksf	ϕ, deg	S_u, ksf	Confining Stress, ksf	S_u, ksf	Residual S_u, ksf	R, $\Omega \cdot$cm	pH	Cl (mg/kg)	SO_4 (mg/kg)		
B-2	62.5	Silty Fine SAND (SM)	17A	118	88	35															
B-2	62.9	Silty Fine SAND (SM)	17B													93	7.2	2199	3750		
B-2	63.2	Silty Fine SAND (SM)	17C	120	86	39															
B-2	67.3	Clayey Fine SAND (SC)	18A				36														
B-2	68.4	Clayey Fine SAND (SC)	18B	119	89	33	20			0.2	35										
B-2	73.2	Clayey Fine SAND (SC)	19			35															
B-2	77.1	Clayey Fine SAND (SC)	20			36															
B-2	84.2	Clayey Fine SAND (SC)	21																		
B-2	85.0	Clayey Fine SAND (SC)	22A	124	96	30															
B-2	85.3	Clayey Fine SAND (SC)	22B				37														
B-2	85.5	Clayey Fine SAND (SC)	22C	125	101	24															
B-2	86.9	Clayey Fine SAND (SC)	23A																		
B-2	87.6	Clayey Fine SAND (SC)	23B			29															
B-2	91.9	Clayey Fine SAND (SC)	24A	127	103	23															
B-2	92.3	Clayey Fine SAND (SC)	24B																		
B-2	92.9	Clayey Fine SAND (SC)	24C	122	94	30															
B-2	96.9	Clayey Fine SAND (SC)	25A	121	93	30															
B-2	97.3	Clayey Fine SAND (SC)	25B																		
B-2	97.8	Clayey Fine SAND (SC)	25C	123	96	28															

SUMMARY OF LABORATORY TEST RESULTS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-1d

LAB SUMMARY TABLE VIRGINIA REV _C:\DOCUMENTS AND SETTINGS\ABROIDESKTOP\MIDTOWN\MIDTOWN GINT FILES\FA08BOR.GPJ_ 7/8/08 01:00 PM

LOCATION	DEPTH, ft	MATERIAL DESCRIPTION	SAMPLE NUMBER	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	MOISTURE CONTENT (%)	FINES (%)	ATTERBERG LIMITS		DIRECT SHEAR		UU TRIAXIAL		MINIVANE		CORROSIVITY TESTS				ORGANIC CONTENT (%)	SPECIFIC GRAVITY
								LL	PI	C, ksf	ϕ, deg	S_u, ksf	Confining Stress, ksf	S_u, ksf	Residual S_u, ksf	R, $\Omega \cdot$cm	pH	Cl (mg/kg)	SO_4 (mg/kg)		
B-3	0.6	Fat CLAY (CH)	1A	87	42	105															
B-3	1.1	Fat CLAY (CH)	1B											0.40							
B-3	4.1	Fat CLAY (CH)	2A	88	43	105															
B-3	4.6	Fat CLAY (CH)	2B											0.32	0.11						
B-3	7.6	Fat CLAY (CH)	3A			114		111	83												
B-3	10.8	Fat CLAY (CH)	4A																		
B-3	11.3	Fat CLAY (CH)	4B	91	49	84															
B-3	11.8	Fat CLAY (CH)	4C											0.50		49	5.0	8397	4750		
B-3	13.6	Organic CLAY (OH)	5A																		
B-3	14.1	Organic CLAY (OH)	5B	88	44	99															
B-3	14.6	Organic CLAY (OH)	5C					110	81					0.30	0.10					7.8	
B-3	16.9	Organic CLAY (OH)	6A			82															
B-3	19.7	Fine SAND (SP)	7A			25															
B-3	20.6	Fine SAND (SP)	7B																		
B-3	23.0	Fine SAND (SP)	8A	107	83	29															
B-3	24.0	Fat CLAY (CH)	8B			58								0.28							
B-3	26.7	Fat CLAY (CH)	9A			62	81	60	37												
B-3	29.5	Fat CLAY (CH)	10A			59															
B-3	30.2	Fat CLAY (CH)	10B			36															
B-3	30.8	Fat CLAY (CH)	10C											0.12	0.07						
B-3	32.8	Fat CLAY (CH)	11A			45															
B-3	33.3	Fine SAND (SP)	11B			25	3														
B-3	37.7	Fine SAND (SP)	12A																		
B-3	38.2	Silty Fine SAND (SM)	12B			31	27	34	9												
B-3	43.2	Silty Fine SAND (SM)	13A																		
B-3	43.7	Silty Fine SAND (SM)	13B	117	88	34															
B-3	47.6	Silty Fine SAND (SM)	14			33															
B-3	52.5	Clayey Fine SAND (SC)	15A			29															
B-3	53.0	Clayey Fine SAND (SC)	15B			36	20	48	28												
B-3	57.6	Clayey Fine SAND (SC)	16A	121	88	37	51														

SUMMARY OF LABORATORY TEST RESULTS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-1e

LAB SUMMARY TABLE VIRGINIA REV _C:\DOCUMENTS AND SETTINGS\ABROIDESKTOP\MIDTOWN\MIDTOWN GINT FILES\FA08BOR.GPJ_ 7/8/08 01:00 PM

LOCATION	DEPTH, ft	MATERIAL DESCRIPTION	SAMPLE NUMBER	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	MOISTURE CONTENT (%)	FINES (%)	ATTERBERG LIMITS		DIRECT SHEAR		UU TRIAXIAL		MINIVANE		CORROSIVITY TESTS				ORGANIC CONTENT (%)	SPECIFIC GRAVITY
								LL	PI	C, ksf	ϕ, deg	S_u, ksf	Confining Stress, ksf	S_u, ksf	Residual S_u, ksf	R, $\Omega \cdot$cm	pH	Cl (mg/kg)	SO_4 (mg/kg)		
B-3	58.0	Clayey Fine SAND (SC)	16B																		
B-3	58.4	Clayey Fine SAND (SC)	16C	122	91	34															
B-3	62.8	Clayey Fine SAND (SC)	17A				41														
B-3	63.4	Clayey Fine SAND (SC)	17B	116	80	45															
B-3	67.3	Clayey Fine SAND (SC)	18			33															
B-3	72.2	Clayey Fine SAND (SC)	19A	124	92	34															
B-3	72.7	Clayey Fine SAND (SC)	19B																		
B-3	73.2	Clayey Fine SAND (SC)	19C	122	94	29															
B-3	77.1	Clayey Fine SAND (SC)	20A																		
B-3	78.1	Clayey Fine SAND (SC)	20B	125	96	30															
B-3	87.1	Clayey Fine SAND (SC)	21A																		
B-3	87.2	Clayey Fine SAND (SC)	21A				27														
B-3	87.6	Clayey Fine SAND (SC)	21B	120	90	34															
B-3	88.0	Clayey Fine SAND (SC)	21C	123																	
B-3	96.8	Clayey Fine SAND (SC)	22A																		
B-3	97.3	Fat CLAY (CH)	22B	108	74	46															
B-3	97.7	Fat CLAY (CH)	22C																		
B-3	106.6	Fat CLAY (CH)	23A																		2.74
B-3	108.6	Fat CLAY (CH)	23B			42	99	67	45					3.19							

SUMMARY OF LABORATORY TEST RESULTS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-1f

LAB SUMMARY TABLE VIRGINIA REV _C:\DOCUMENTS AND SETTINGS\ABROIDESKTOP\MIDTOWN\MIDTOWN GINT FILES\FA08BOR.GPJ_ 7/8/08 01:00 PM

LOCATION	DEPTH, ft	MATERIAL DESCRIPTION	SAMPLE NUMBER	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	MOISTURE CONTENT (%)	FINES (%)	ATTERBERG LIMITS		DIRECT SHEAR		UU TRIAXIAL		MINIVANE		CORROSIVITY TESTS				ORGANIC CONTENT (%)	SPECIFIC GRAVITY
								LL	PI	C, ksf	ϕ, deg	S_u, ksf	Confining Stress, ksf	S_u, ksf	Residual S_u, ksf	R, $\Omega \cdot$cm	pH	Cl (mg/kg)	SO_4 (mg/kg)		
B-4	1.5	Fat CLAY (CH)	1A	90	45	100															
B-4	2.0	Fat CLAY (CH)	1B											0.16							
B-4	5.0	Fat CLAY (CH)	2A	92	46	99															
B-4	5.5	Fat CLAY (CH)	2B					95	69					0.21							
B-4	8.1	Fat CLAY (CH)	3A	99	56	79															
B-4	8.6	Fat CLAY (CH)	3B	90										0.32							
B-4	11.0	Fat CLAY (CH)	4A	91				113	84												
B-4	11.5	Fat CLAY (CH)	4B	88	43	106								0.33							
B-4	13.6	Fat CLAY (CH)	5A			99															
B-4	14.5	Silty Fine SAND (SM)	5B																		
B-4	17.1	Silty Fine SAND (SM)	6A	111	80	38															
B-4	17.6	Fine SAND (SP)	6B																		
B-4	21.7	Fine SAND (SP)	7	113	92	22	2														
B-4	23.5	Fine SAND (SP)	8			21															
B-4	30.0	Silty Fine SAND (SM)	9A	114	87	31	14			0.2	25										
B-4	30.5	Silty Fine SAND (SM)	9B				30														
B-4	33.3	Silty Fine SAND (SM)	10			31															
B-4	38.2	Silty Fine SAND (SM)	11A	114	85	33															
B-4	38.7	Silty Fine SAND (SM)	11B																		
B-4	43.2	Silty Fine SAND (SM)	12A	117	83	42															
B-4	43.7	Silty Fine SAND (SM)	12B	118	82	44										104	7.0	1833	3500		
B-4	48.1	Clayey Fine SAND (SC)	13			34															
B-4	53.0	Clayey Fine SAND (SC)	14A																		
B-4	53.6	Clayey Fine SAND (SC)	14B	119	87	36															
B-4	57.4	Clayey Fine SAND (SC)	15A	107	78	38															
B-4	58.4	Clayey Fine SAND (SC)	15B				44														
B-4	62.8	Clayey Fine SAND (SC)	16			32															
B-4	67.3	Clayey Fine SAND (SC)	17A	113	80	41															
B-4	67.8	Clayey Fine SAND (SC)	17B	122	91	33															
B-4	68.3	Clayey Fine SAND (SC)	17C				20	38	20												

SUMMARY OF LABORATORY TEST RESULTS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-1g

LAB SUMMARY TABLE VIRGINIA REV NOT SEPARA C:\DOCUMENTS AND SETTINGS\ABROIDE\DESKTOP\MIDTOWN\MIDTOWN GINT FILES\FA088OR.GPJ 7/8/08 01:17 PM

LOCATION	DEPTH, ft	MATERIAL DESCRIPTION	SAMPLE NUMBER	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	MOISTURE CONTENT (%)	FINES (%)	ATTERBERG LIMITS		DIRECT SHEAR		UU TRIAXIAL		MINIVANE		CORROSIVITY TESTS				ORGANIC CONTENT (%)	SPECIFIC GRAVITY
								LL	PI	C, ksf	ϕ, deg	S_u, ksf	Confining Stress, ksf	S_u, ksf	Residual S_u, ksf	R, $\Omega \cdot$cm	pH	Cl (mg/kg)	SO_4 (mg/kg)		
B-4	72.2	Clayey Fine SAND (SC)	18A																		
B-4	73.0	Clayey Fine SAND (SC)	18B	124	93	33															
B-4	73.3	Clayey Fine SAND (SC)	18C	126																	
B-4	77.6	Clayey Fine SAND (SC)	19			28															
B-4	82.0	Clayey Fine SAND (SC)	20A	122	94	29															
B-4	82.5	Clayey Fine SAND (SC)	20B																		
B-4	86.9	Clayey Fine SAND (SC)	21A	121																	
B-4	87.4	Clayey Fine SAND (SC)	21B	121	92	31	22														
B-4	91.9	Fat CLAY (CH)	22A			22															
B-4	97.8	Fat CLAY (CH)	23A																		
B-4	98.3	Fat CLAY (CH)	23B	116	69	67	100	69	48			1.9	17.28								
B-4	98.8	Fat CLAY (CH)	23C											1.97							

SUMMARY OF LABORATORY TEST RESULTS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-1h

LAB SUMMARY TABLE VIRGINIA REV NOT SEPARA C:\DOCUMENTS AND SETTINGS\ABROIDE\DESKTOP\MIDTOWN\MIDTOWN GINT FILES\FA08BOR.GPJ 7/8/08 01:17 PM

LOCATION	DEPTH, ft	MATERIAL DESCRIPTION	SAMPLE NUMBER	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	MOISTURE CONTENT (%)	FINES (%)	ATTERBERG LIMITS		DIRECT SHEAR		UU TRIAXIAL		MINIVANE		CORROSIVITY TESTS				ORGANIC CONTENT (%)	SPECIFIC GRAVITY
								LL	PI	C, ksf	ϕ, deg	S_u, ksf	Confining Stress, ksf	S_u, ksf	Residual S_u, ksf	R, $\Omega \cdot$cm	pH	Cl (mg/kg)	SO_4 (mg/kg)		
B-5	1.0	Organic CLAY (OH)	1A																		
B-5	1.5	Organic CLAY (OH)	1B	94	51	84								0.42							
B-5	2.0	Organic CLAY (OH)	1C																		
B-5	4.3	Organic CLAY (OH)	2A																		
B-5	4.8	Organic CLAY (OH)	2B	91	46	96															
B-5	5.3	Organic CLAY (OH)	2C					99	72					0.42						7.5	
B-5	8.1	Fat CLAY (CH)	3A	97	52	87															
B-5	8.6	Fat CLAY (CH)	3B											0.48							
B-5	10.3	Fat CLAY (CH)	4A																		
B-5	10.8	Fat CLAY (CH)	4B			88	98														
B-5	13.8	Fat CLAY (CH)	5A	92	50	85															
B-5	14.3	Fat CLAY (CH)	5B					97	65					0.28							
B-5	16.9	Silty Fine SAND (SM)	6A	113	89	26															
B-5	17.4	Silty Fine SAND (SM)	6B																		
B-5	17.7	Silty Fine SAND (SM)	6C																		
B-5	20.2	Organic CLAY (OH)	7			83		96	67											6.2	
B-5	23.5	Organic CLAY (OH)	8A	94	51	86															
B-5	24.5	Organic CLAY (OH)	8B	100										0.41							
B-5	26.2	Organic CLAY (OH)	9B																		
B-5	27.7	Organic CLAY (OH)	9A	80	43	87															
B-5	28.2	Organic CLAY (OH)	9B					115	72					0.66						17.9	
B-5	30.0	Organic CLAY (OH)	10			53															
B-5	34.0	Organic CLAY (OH)	11A	106	62	70															
B-5	34.7	Fine SAND (SP)	11B	122	95	28										120	4.2	1462	1750		
B-5	38.2	Silty Fine SAND (SM)	12A	118	87	35															
B-5	38.7	Silty Fine SAND (SM)	12B				23														
B-5	39.7	Silty Fine SAND (SM)	12C	120	88	37															
B-5	42.7	Silty Fine SAND (SM)	13			31															
B-5	48.1	Clayey Fine SAND (SC)	14A	117	86	36															
B-5	48.5	Clayey Fine SAND (SC)	14B																		

SUMMARY OF LABORATORY TEST RESULTS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-1i

LAB SUMMARY TABLE VIRGINIA REV _C:\DOCUMENTS AND SETTINGS\ABROIDESKTOP\MIDTOWN\MIDTOWN GINT FILES\FA08BOR.GPJ_ 7/8/08 01:00 PM

LOCATION	DEPTH, ft	MATERIAL DESCRIPTION	SAMPLE NUMBER	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	MOISTURE CONTENT (%)	FINES (%)	ATTERBERG LIMITS		DIRECT SHEAR		UU TRIAXIAL		MINIVANE		CORROSIVITY TESTS				ORGANIC CONTENT (%)	SPECIFIC GRAVITY
								LL	PI	C, ksf	ϕ, deg	S_u, ksf	Confining Stress, ksf	S_u, ksf	Residual S_u, ksf	R, $\Omega \cdot$cm	pH	Cl (mg/kg)	SO_4 (mg/kg)		
B-5	49.1	Clayey Fine SAND (SC)	14C	121	90	35															
B-5	52.6	Clayey Fine SAND (SC)	15A	118																	
B-5	53.0	Clayey Fine SAND (SC)	15B																		
B-5	53.5	Clayey Fine SAND (SC)	15C	115	84	37	26			0.4	27										
B-5	57.4	Clayey Fine SAND (SC)	16			34	37														
B-5	62.8	Clayey Fine SAND (SC)	17A	114	84	35															
B-5	63.2	Clayey Fine SAND (SC)	17B																		
B-5	63.8	Clayey Fine SAND (SC)	17C	122	93	32															
B-5	67.8	Clayey Fine SAND (SC)	18A																		
B-5	68.4	Clayey Fine SAND (SC)	18B	120	90	34															
B-5	72.2	Clayey Fine SAND (SC)	19A																		
B-5	72.7	Clayey Fine SAND (SC)	19B			33	18														
B-5	77.3	Clayey Fine SAND (SC)	20A	123	91	35															
B-5	77.7	Clayey Fine SAND (SC)	20B																		
B-5	78.1	Clayey Fine SAND (SC)	20C	114	89	29															
B-5	82.2	Clayey Fine SAND (SC)	21A	122	94	30															
B-5	82.6	Clayey Fine SAND (SC)	21B				21														
B-5	83.1	Clayey Fine SAND (SC)	21C	126	97	29															
B-5	91.9	Clayey Fine SAND (SC)	22A	114	86	32															
B-5	92.3	Clayey Fine SAND (SC)	22B																		
B-5	102.5	Fat CLAY (CH)	23A	116	81	43															
B-5	102.8	Fat CLAY (CH)	23B					72	50					3.50+							
B-5	118.1	Fat CLAY (CH)	25A			45															
B-5	124.7	Fat CLAY (CH)	27A			42															

SUMMARY OF LABORATORY TEST RESULTS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-1j

LAB SUMMARY TABLE VIRGINIA REV _C:\DOCUMENTS AND SETTINGS\ABROIDESKTOP\MIDTOWN\MIDTOWN GINT FILES\FA08BOR.GPJ_ 7/8/08 01:00 PM

LOCATION	DEPTH, ft	MATERIAL DESCRIPTION	SAMPLE NUMBER	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	MOISTURE CONTENT (%)	FINES (%)	ATTERBERG LIMITS		DIRECT SHEAR		UU TRIAXIAL		MINIVANE		CORROSIVITY TESTS				ORGANIC CONTENT (%)	SPECIFIC GRAVITY
								LL	PI	C, ksf	ϕ, deg	S_u, ksf	Confining Stress, ksf	S_u, ksf	Residual S_u, ksf	R, $\Omega \cdot cm$	pH	Cl (mg/kg)	SO_4 (mg/kg)		
B-6	4.3	Fat CLAY (CH)	1A	94	49	92															
B-6	4.8	Fat CLAY (CH)	1B											0.23							
B-6	6.3	Fat CLAY (CH)	2					82	60												
B-6	10.3	Fat CLAY (CH)	3A	96	53	83															
B-6	10.8	Fat CLAY (CH)	3B											0.23							
B-6	14.6	Fat CLAY (CH)	4A	93	50	84		95	69												
B-6	15.1	Fat CLAY (CH)	4B											0.22	0.09						
B-6	17.9	Fat CLAY (CH)	5A			82															
B-6	20.7	Fat CLAY (CH)	6A																		
B-6	21.2	Fat CLAY (CH)	6B	95	51	86						0.40	5.76								
B-6	21.7	Fat CLAY (CH)	6C											0.52	0.15						
B-6	23.3	Organic CLAY (OH)	7A																		
B-6	23.8	Organic CLAY (OH)	7B	90	46	97		100	69			0.19	5.76								
B-6	24.3	Organic CLAY (OH)	7C											0.26	0.11						
B-6	27.7	Organic CLAY (OH)	8A			97															
B-6	30.2	Organic CLAY (OH)	9A	89	45	96						0.30	5.76								
B-6	30.7	Organic CLAY (OH)	9B																		
B-6	31.2	Organic CLAY (OH)	9C											0.50							
B-6	31.7	Organic CLAY (OH)	9D					84	55											13.2	
B-6	33.3	Organic CLAY (OH)	10A	93	50	88						0.32	5.76								
B-6	33.8	Silty Fine SAND (SM)	10B			47	33														
B-6	38.4	Silty Fine SAND (SM)	11A			21															
B-6	46.4	Silty Fine SAND (SM)	13A			31	13														
B-6	51.4	Silty Fine SAND (SM)	14A			30															
B-6	57.4	Silty Fine SAND (SM)	15			31															
B-6	62.3	Fine to Medium SAND (SP)	16A				3														
B-6	63.5	Clayey Fine SAND (SC)	16B			22															
B-6	68.8	Clayey Fine SAND (SC)	17			40															
B-6	73.7	Clayey Fine SAND (SC)	18A																		
B-6	74.2	Clayey Fine SAND (SC)	18B	110	80	38	43														

SUMMARY OF LABORATORY TEST RESULTS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-1k

LAB SUMMARY TABLE VIRGINIA REV _C:\DOCUMENTS AND SETTINGS\ABROIDESKTOP\MIDTOWN\MIDTOWN GINT FILES\FA08BOR.GPJ_ 7/8/08 01:00 PM

LOCATION	DEPTH, ft	MATERIAL DESCRIPTION	SAMPLE NUMBER	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	MOISTURE CONTENT (%)	FINES (%)	ATTERBERG LIMITS		DIRECT SHEAR		UU TRIAXIAL		MINIVANE		CORROSIVITY TESTS				ORGANIC CONTENT (%)	SPECIFIC GRAVITY
								LL	PI	C, ksf	ϕ, deg	S_u, ksf	Confining Stress, ksf	S_u, ksf	Residual S_u, ksf	R, $\Omega \cdot$cm	pH	Cl (mg/kg)	SO_4 (mg/kg)		
B-6	78.3	Clayey Fine SAND (SC)	19			34															
B-6	83.0	Clayey Fine SAND (SC)	20A	109	74	48															
B-6	84.0	Clayey Fine SAND (SC)	20B				23	47	27					0.59							
B-6	87.7	Clayey Fine SAND (SC)	21A	117	86	36															
B-6	88.3	Clayey Fine SAND (SC)	21B																		
B-6	88.9	Clayey Fine SAND (SC)	21C											0.91		120	6.4	1300	6000		
B-6	93.4	Clayey Fine SAND (SC)	22A				34														
B-6	93.9	Clayey Fine SAND (SC)	22B	110	71	56															
B-6	96.8	Clayey Fine SAND (SC)	23			29		34	14												
B-6	102.7	Clayey Fine SAND (SC)	24A	121	93	29															
B-6	103.2	Clayey Fine SAND (SC)	24B																		
B-6	103.7	Clayey Fine SAND (SC)	24C	123	95	29	19														
B-6	108.6	Clayey Fine SAND (SC)	25			32															

SUMMARY OF LABORATORY TEST RESULTS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-1I

LAB SUMMARY TABLE VIRGINIA REV _C:\DOCUMENTS AND SETTINGS\ABROIDESKTOP\MIDTOWN\MIDTOWN GINT FILES\FA08BOR.GPJ_ 7/8/08 01:00 PM

LOCATION	DEPTH, ft	MATERIAL DESCRIPTION	SAMPLE NUMBER	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	MOISTURE CONTENT (%)	FINES (%)	ATTERBERG LIMITS		DIRECT SHEAR		UU TRIAXIAL		MINIVANE		CORROSIVITY TESTS				ORGANIC CONTENT (%)	SPECIFIC GRAVITY
								LL	PI	C, ksf	ϕ, deg	S_u, ksf	Confining Stress, ksf	S_u, ksf	Residual S_u, ksf	R, $\Omega \cdot$cm	pH	Cl (mg/kg)	SO_4 (mg/kg)		
B-8	3.5	Silty Fine SAND (SM)	2A	114	90	26	14														
B-8	4.0	Fat CLAY (CH)	2B	93	51	81															
B-8	4.5	Fat CLAY (CH)	2C											0.16	0.12						
B-8	7.3	Fat CLAY (CH)	3A	93	50	86															
B-8	7.8	Fat CLAY (CH)	3B					94	69					0.29	0.10						
B-8	10.5	Fat CLAY (CH)	4A			79															
B-8	13.8	Fat CLAY (CH)	5A	95	51	84															
B-8	14.3	Fat CLAY (CH)	5B											0.39	0.17						
B-8	17.1	Fat CLAY (CH)	6A	97	55	77						0.32	5.76								
B-8	17.6	Fat CLAY (CH)	6B					96	73					0.36	0.14						
B-8	20.7	Fat CLAY (CH)	7A			82															
B-8	23.0	Fat CLAY (CH)	8A				99														2.67
B-8	24.5	Fat CLAY (CH)	8B			83		87	61					0.36	0.12						
B-8	27.2	Fat CLAY (CH)	9A																		
B-8	27.7	Fat CLAY (CH)	9B	93	50	88		92	66												
B-8	28.2	Fat CLAY (CH)	9C											0.20	0.02						
B-8	30.5	Fat CLAY (CH)	10A			90															
B-8	32.9	Fat CLAY (CH)	11A																		
B-8	33.4	Fat CLAY (CH)	11B	90	49	84						0.33	5.76								
B-8	33.9	Fat CLAY (CH)	11C											0.31	0.05						
B-8	38.7	Fat CLAY (CH)	12A	93	51	84															
B-8	39.2	Fat CLAY (CH)	12B	94								0.59	5.76								
B-8	39.7	Fat CLAY (CH)	12C	91										0.62							
B-8	42.7	Organic SILT (OH)	13			103											5.3	9097	6000		
B-8	48.7	Organic SILT (OH)	14A																		
B-8	49.1	Organic SILT (OH)	14B	78	36	116															
B-8	49.6	Organic SILT (OH)	14C					92	52											16.0	
B-8	53.5	Silty Fine SAND (SM)	15A	111			21														
B-8	54.0	Silty Fine SAND (SM)	15B																		
B-8	54.5	Silty Fine SAND (SM)	15C	103	72	43															

SUMMARY OF LABORATORY TEST RESULTS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-1m

LAB SUMMARY TABLE VIRGINIA REV _C:\DOCUMENTS AND SETTINGS\ABROIDESKTOP\MIDTOWN\MIDTOWN GINT FILES\FA08BOR.GPJ_ 7/8/08 01:00 PM

LOCATION	DEPTH, ft	MATERIAL DESCRIPTION	SAMPLE NUMBER	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	MOISTURE CONTENT (%)	FINES (%)	ATTERBERG LIMITS		DIRECT SHEAR		UU TRIAXIAL		MINIVANE		CORROSIVITY TESTS				ORGANIC CONTENT (%)	SPECIFIC GRAVITY
								LL	PI	C, ksf	ϕ, deg	S_u, ksf	Confining Stress, ksf	S_u, ksf	Residual S_u, ksf	R, $\Omega \cdot$cm	pH	Cl (mg/kg)	SO_4 (mg/kg)		
B-8	58.1	Silty Fine SAND (SM)	16			71	26														
B-8	64.3	Silty Fine SAND (SM)	17			66															
B-8	67.3	Clayey Fine SAND (SC)	18A	108			40														
B-8	68.8	Clayey Fine SAND (SC)	18B																		
B-8	69.3	Clayey Fine SAND (SC)	18C	118	86	37	19			0.3	29										
B-8	72.5	Clayey Fine SAND (SC)	19			35															
B-8	79.1	Clayey Fine SAND (SC)	20	109	79	38	50														
B-8	82.5	Clayey Fine SAND (SC)	21			35															
B-8	88.4	Clayey Fine SAND (SC)	22			35															
B-8	93.4	Clayey Fine SAND (SC)	23			39	42														
B-8	98.3	Clayey Fine SAND (SC)	24	110	83	34															

SUMMARY OF LABORATORY TEST RESULTS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-1n

LAB SUMMARY TABLE VIRGINIA REV _C:\DOCUMENTS AND SETTINGS\ABROIDESKTOP\MIDTOWN\MIDTOWN GINT FILES\FA08BOR.GPJ_ 7/8/08 01:00 PM

LOCATION	DEPTH, ft	MATERIAL DESCRIPTION	SAMPLE NUMBER	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	MOISTURE CONTENT (%)	FINES (%)	ATTERBERG LIMITS		DIRECT SHEAR		UU TRIAXIAL		MINIVANE		CORROSIVITY TESTS				ORGANIC CONTENT (%)	SPECIFIC GRAVITY
								LL	PI	C, ksf	ϕ, deg	S_u, ksf	Confining Stress, ksf	S_u, ksf	Residual S_u, ksf	R, $\Omega \cdot$cm	pH	Cl (mg/kg)	SO_4 (mg/kg)		
B-9	2.0	Poorly-graded SAND with silt (SP-SM)	1	117	92	28															
B-9	3.8	Poorly-graded SAND with silt (SP-SM)	2A				12														
B-9	5.3	Poorly-graded SAND with silt (SP-SM)	2B	112	84	33															
B-9	6.6	Poorly-graded SAND with silt (SP-SM)	3A																		
B-9	7.3	Fat CLAY (CH)	3B			52															
B-9	11.3	Fat CLAY (CH)	4A	94	52	81															
B-9	11.8	Fat CLAY (CH)	4B					85	62					0.34	0.10						
B-9	13.7	Fat CLAY (CH)	5A	97	53	83						0.23	5.76	0.19	0.13	55	6.4	7398	2875		
B-9	14.2	Fat CLAY (CH)	5B																		
B-9	17.4	Fat CLAY (CH)	6A			74															
B-9	20.5	Fat CLAY (CH)	7A	114	84	36	15	63	43												
B-9	21.0	Clayey Fine SAND (SC)	7B	120	93	30															
B-9	24.0	Clayey Fine SAND (SC)	8A	121	95	27		29	17												
B-9	27.2	Clayey Fine SAND (SC)	9A	118	91	30	14														
B-9	33.8	Clayey Fine SAND (SC)	11A	116	86	35															
B-9	38.7	Silty Fine SAND (SM)	12A			32															
B-9	43.7	Silty Fine SAND (SM)	13A	122	93	31															
B-9	48.6	Silty Fine SAND (SM)	14A	119	90	33	21	NP	NP												
B-9	53.5	Silty Fine SAND (SM)	15A			32															
B-9	58.4	Silty Fine SAND (SM)	16A	121	91	33										76	7.1	2899	4250		
B-9	63.3	Silty Fine SAND (SM)	17A	120	91	33															
B-9	67.5	Silty Fine SAND (SM)	18A			31															
B-9	73.2	Clayey Fine SAND (SC)	19A	117	87	34															
B-9	77.8	Clayey Fine SAND (SC)	20A	117	87	34	44														
B-9	82.5	Clayey Fine SAND (SC)	21A			34															
B-9	87.4	Clayey Fine SAND (SC)	22A				44														
B-9	87.9	Clayey Fine SAND (SC)	22B	118	88	34		44	24												
B-9	88.4	Clayey Fine SAND (SC)	22C																		

SUMMARY OF LABORATORY TEST RESULTS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-1o

LAB SUMMARY TABLE VIRGINIA REV _C:\DOCUMENTS AND SETTINGS\ABROIDESKTOP\MIDTOWN\MIDTOWN GINT FILES\FA08BOR.GPJ_ 7/8/08 01:00 PM

LOCATION	DEPTH, ft	MATERIAL DESCRIPTION	SAMPLE NUMBER	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	MOISTURE CONTENT (%)	FINES (%)	ATTERBERG LIMITS		DIRECT SHEAR		UU TRIAXIAL		MINIVANE		CORROSIVITY TESTS				ORGANIC CONTENT (%)	SPECIFIC GRAVITY
								LL	PI	C, ksf	ϕ, deg	S_u, ksf	Confining Stress, ksf	S_u, ksf	Residual S_u, ksf	R, $\Omega \cdot$cm	pH	Cl (mg/kg)	SO_4 (mg/kg)		
B-10	0.5	SAND (SP)	1A																		
B-10	2.0	Silty Fine SAND (SM)	1B	103	67	54								0.33							
B-10	4.3	Silty Fine SAND (SM)	2			47	33														
B-10	7.0	Sandy CLAY (CL)	3A																		
B-10	8.1	Sandy CLAY (CL)	3B					49	33												
B-10	8.6	Sandy CLAY (CL)	3C	113	71	59															
B-10	10.3	Sandy CLAY (CL)	4A																		
B-10	11.3	Silty Fine SAND (SM)	4B																		
B-10	11.8	Silty Fine SAND (SM)	4C	117	89	32															
B-10	13.6	Silty Fine SAND (SM)	5			20															
B-10	16.4	Medium SAND (SP)	6A																		
B-10	16.6	Medium SAND (SP)	6B			23	4														
B-10	20.2	Medium SAND (SP)	7	128	103	25										147	7.9	1699	310		
B-10	23.0	Medium SAND (SP)	8A																		
B-10	23.8	Medium SAND (SP)	8B			30															
B-10	26.7	Poorly-graded SAND with silt (SP-SM)	9	119	90	31	12														
B-10	30.1	Poorly-graded SAND with silt (SP-SM)	10	119	89	33															
B-10	39.4	Silty Fine SAND (SM)	13A																		
B-10	43.7	Silty Fine SAND (SM)	14A	120	91	32	20	NP	NP												
B-10	48.1	Silty Fine SAND (SM)	15A			30															
B-10	53.5	Silty Fine SAND (SM)	16A	120	90	33															
B-10	58.4	Silty Fine SAND (SM)	17A	119	90	32	23														
B-10	62.3	Silty Fine SAND (SM)	18A			34															
B-10	68.3	Clayey Fine SAND (SC)	19A	117	87	34	24														
B-10	73.2	Clayey Fine SAND (SC)	20A	117	87	36															
B-10	77.1	Clayey Fine SAND (SC)	21A			34															
B-10	87.9	Clayey Fine SAND (SC)	22A	118	86	37	37														

SUMMARY OF LABORATORY TEST RESULTS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-1p

LAB SUMMARY TABLE VIRGINIA REV _C:\DOCUMENTS AND SETTINGS\ABROIDESKTOP\MIDTOWN\MIDTOWN GINT FILES\FA08BOR.GPJ_ 7/8/08 01:00 PM

LOCATION	DEPTH, ft	MATERIAL DESCRIPTION	SAMPLE NUMBER	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	MOISTURE CONTENT (%)	FINES (%)	ATTERBERG LIMITS		DIRECT SHEAR		UU TRIAXIAL		MINIVANE		CORROSIVITY TESTS				ORGANIC CONTENT (%)	SPECIFIC GRAVITY
								LL	PI	C, ksf	ϕ, deg	S_u, ksf	Confining Stress, ksf	S_u, ksf	Residual S_u, ksf	R, $\Omega \cdot$cm	pH	Cl (mg/kg)	SO_4 (mg/kg)		
B-11	1.5	Silty SAND (SM)	1A	113	79	44															
B-11	2.0	Fine SAND (SP)	1B	104																	
B-11	5.3	Fine SAND (SP)	2	114	87	31	36														
B-11	8.6	Silty Fine SAND (SM)	3	116	84	38	34														
B-11	10.8	Silty Fine SAND (SM)	4			26															
B-11	14.1	Silty Fine SAND (SM)	5A																		
B-11	15.1	Silty Fine SAND (SM)	5B	121	98	23															
B-11	16.9	Silty Fine SAND (SM)	6A																		
B-11	17.9	Organic CLAY (OL)	6B	110				42	27											2.1	
B-11	18.4	Organic CLAY (OL)	6C	110	75	47															
B-11	20.2	Organic CLAY (OL)	7A			33															
B-11	20.9	Organic CLAY (OL)	7B			55															
B-11	23.9	Organic CLAY (OL)	8A																		
B-11	24.6	Organic CLAY (OL)	8B	80	43	88															
B-11	25.2	Silty Fine SAND (SM)	8C			18															
B-11	27.2	Silty Fine SAND (SM)	9A			25	21														
B-11	28.2	Silty Fine SAND (SM)	9B	123																	
B-11	30.5	Silty Fine SAND (SM)	10A																		
B-11	30.7	Silty Fine SAND (SM)	10B			25															
B-11	33.3	Silty Fine SAND (SM)	11A	118																	
B-11	34.3	Silty Fine SAND (SM)	11B	116	85	36															
B-11	37.8	Silty Fine SAND (SM)	12A				15														
B-11	38.6	Silty Fine SAND (SM)	12B	122																	
B-11	39.3	Silty Fine SAND (SM)	12C	128	96	33															
B-11	43.2	Silty Fine SAND (SM)	13			29															
B-11	48.1	Silty Fine SAND (SM)	14A	120	90	33	20														
B-11	53.5	Silty Fine SAND (SM)	15A	118	89	32										180	7.1	387	2500		
B-11	57.7	Silty Fine SAND (SM)	16A			34															
B-11	62.8	Silty Fine SAND (SM)	17A	121	91	33															
B-11	63.8	Silty Fine SAND (SM)	17B	119			23														

SUMMARY OF LABORATORY TEST RESULTS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-1q

LAB SUMMARY TABLE VIRGINIA REV NOT SEPARA C:\DOCUMENTS AND SETTINGS\ABROIDE\DESKTOP\MIDTOWN\MIDTOWN GINT FILES\FA08BOR.GPJ 7/8/08 01:45 PM

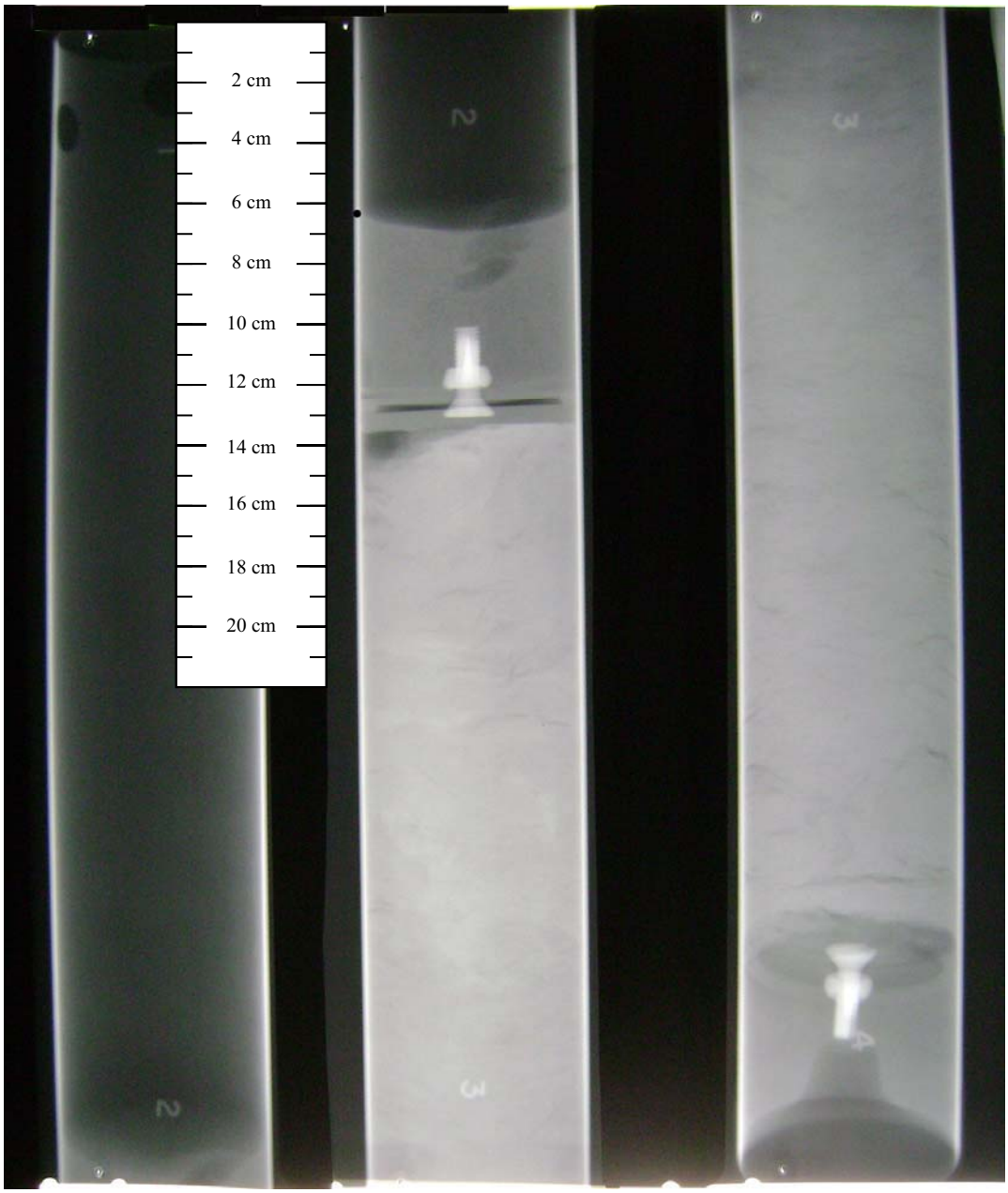
LOCATION	DEPTH, ft	MATERIAL DESCRIPTION	SAMPLE NUMBER	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	MOISTURE CONTENT (%)	FINES (%)	ATTERBERG LIMITS		DIRECT SHEAR		UU TRIAXIAL		MINIVANE		CORROSIVITY TESTS				ORGANIC CONTENT (%)	SPECIFIC GRAVITY
								LL	PI	C, ksf	ϕ, deg	S_u, ksf	Confining Stress, ksf	S_u, ksf	Residual S_u, ksf	R, $\Omega \cdot$cm	pH	Cl (mg/kg)	SO_4 (mg/kg)		
B-11	67.8	Clayey Fine SAND (SC)	18A	118	87	35	27														
B-11	68.8	Clayey Fine SAND (SC)	18B	118																	
B-11	72.7	Clayey Fine SAND (SC)	19A			36															
B-11	77.6	Clayey Fine SAND (SC)	20A	118	87	35		47	24												
B-11	78.6	Clayey Fine SAND (SC)	20B	117			15														

SUMMARY OF LABORATORY TEST RESULTS

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

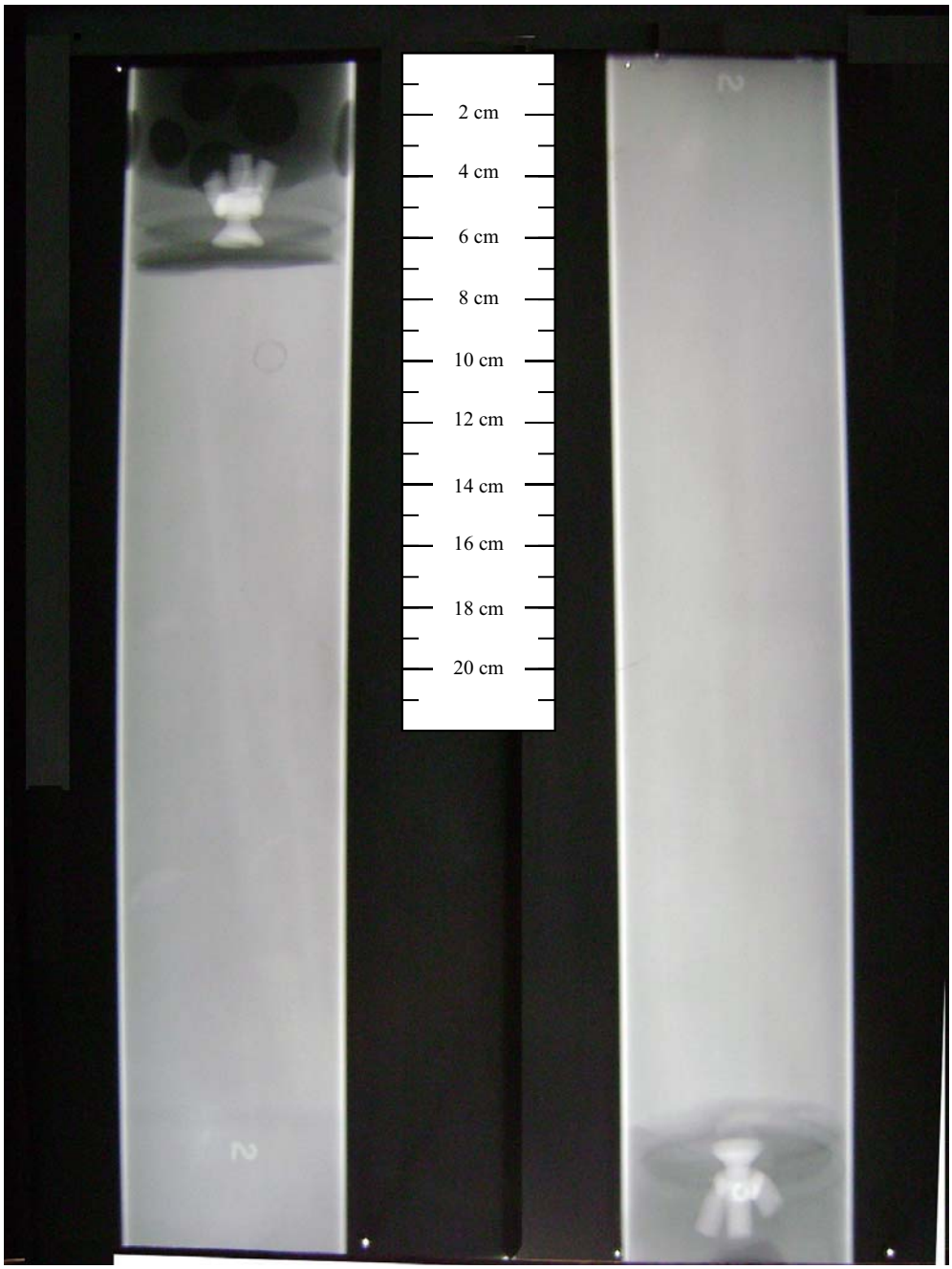
FIGURE E-1r

LAB SUMMARY TABLE VIRGINIA REV NOT SEPARA C:\DOCUMENTS AND SETTINGS\ABROIDE\DESKTOP\MIDTOWN\MIDTOWN GINT FILES\FA088OR.GPJ 7/8/08 01:45 PM



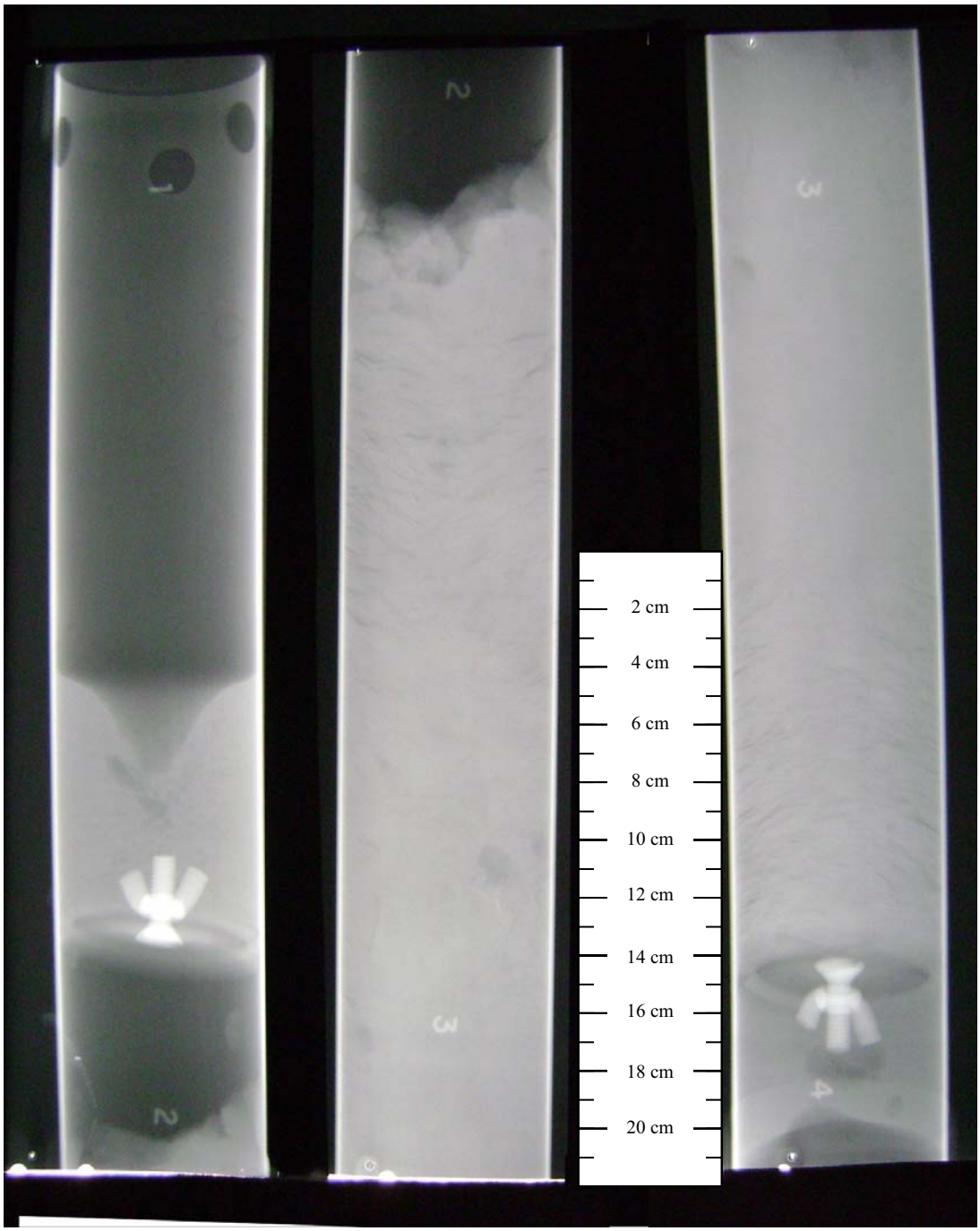
X-RAY RADIOGRAPH
Sample No. 6A, Depth: 16.4 ft.
Boring: 1

FIGURE E-2a



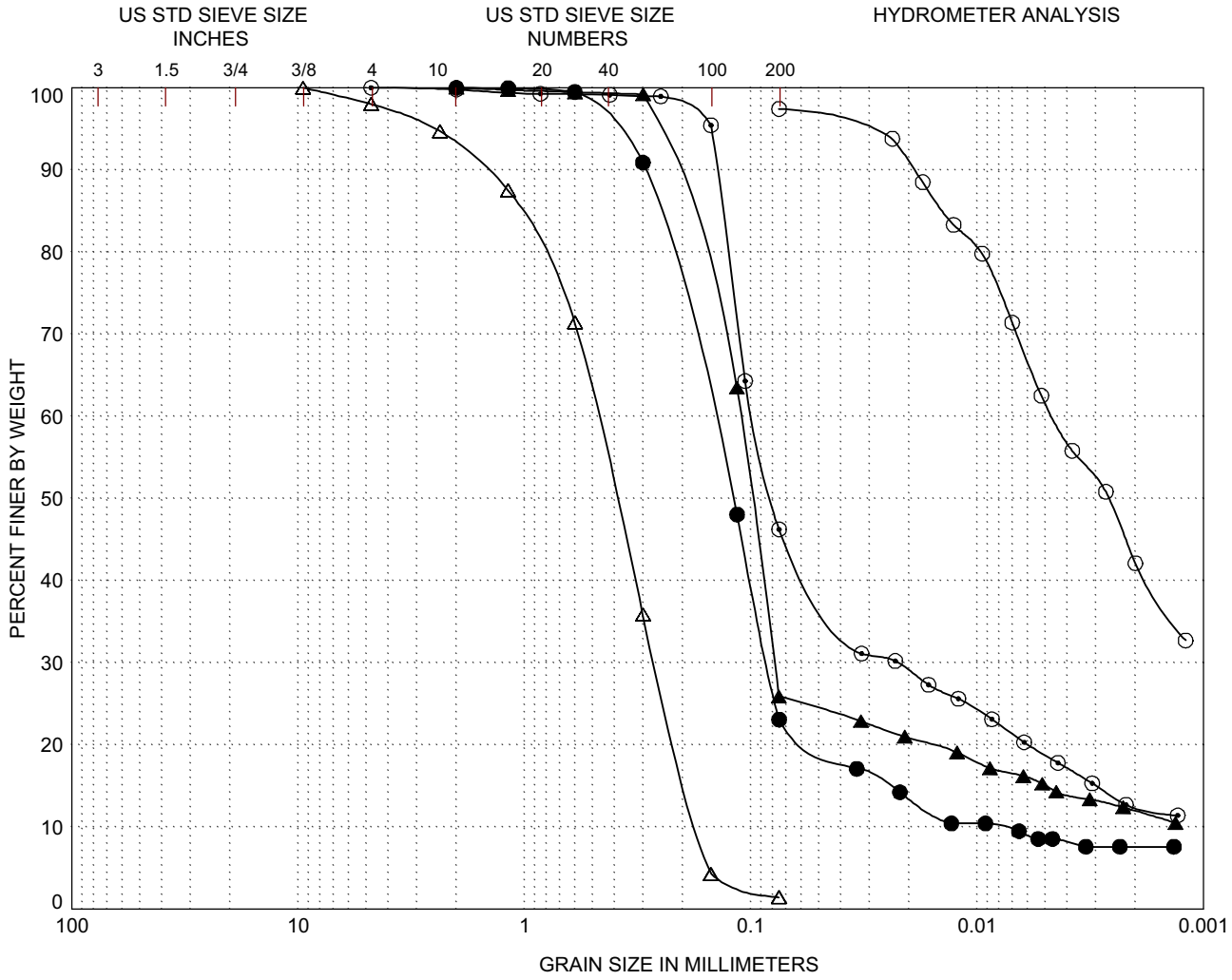
X-RAY RADIOGRAPH
Sample No. 23A, Depth: 106.6 ft.
Boring: 3

FIGURE E-2b



X-RAY RADIOGRAPH
Sample No. 8A, Depth: 23.0 ft.
Boring: 8

FIGURE E-2c

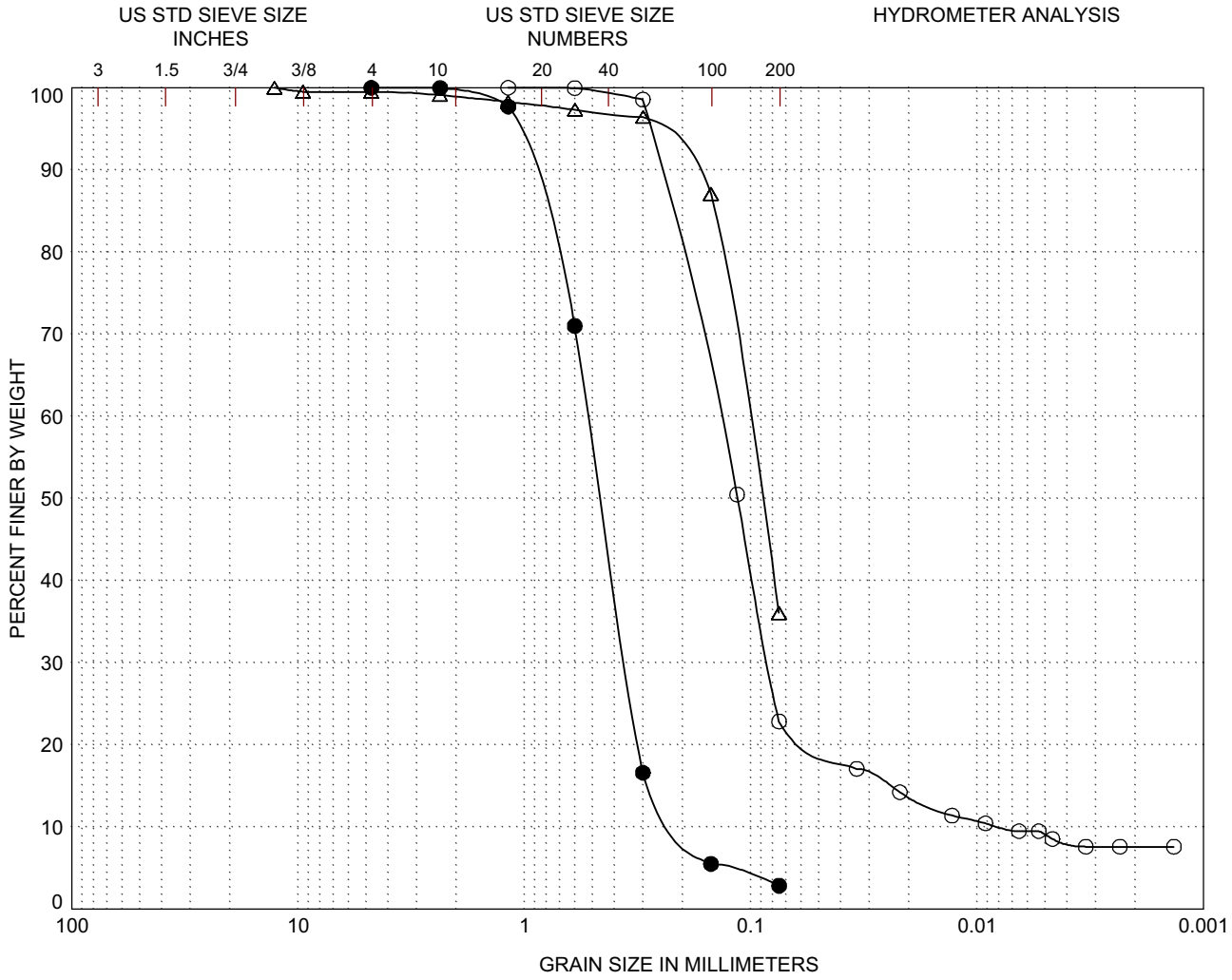


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND	(location)	(depth,ft)		Cc	Cu
○	B-1	16.4	Fat CLAY (CH)		
●	B-1	38.2	Silty Fine SAND (SM)	6.0	19.1
△	B-1	52.8	Fine to Medium SAND (SP)	0.9	2.8
▲	B-1	57.9	Silty Fine SAND (SM)		
⊙	B-1	67.3	Clayey Fine SAND (SC)		

GRAIN SIZE CURVES
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-3a

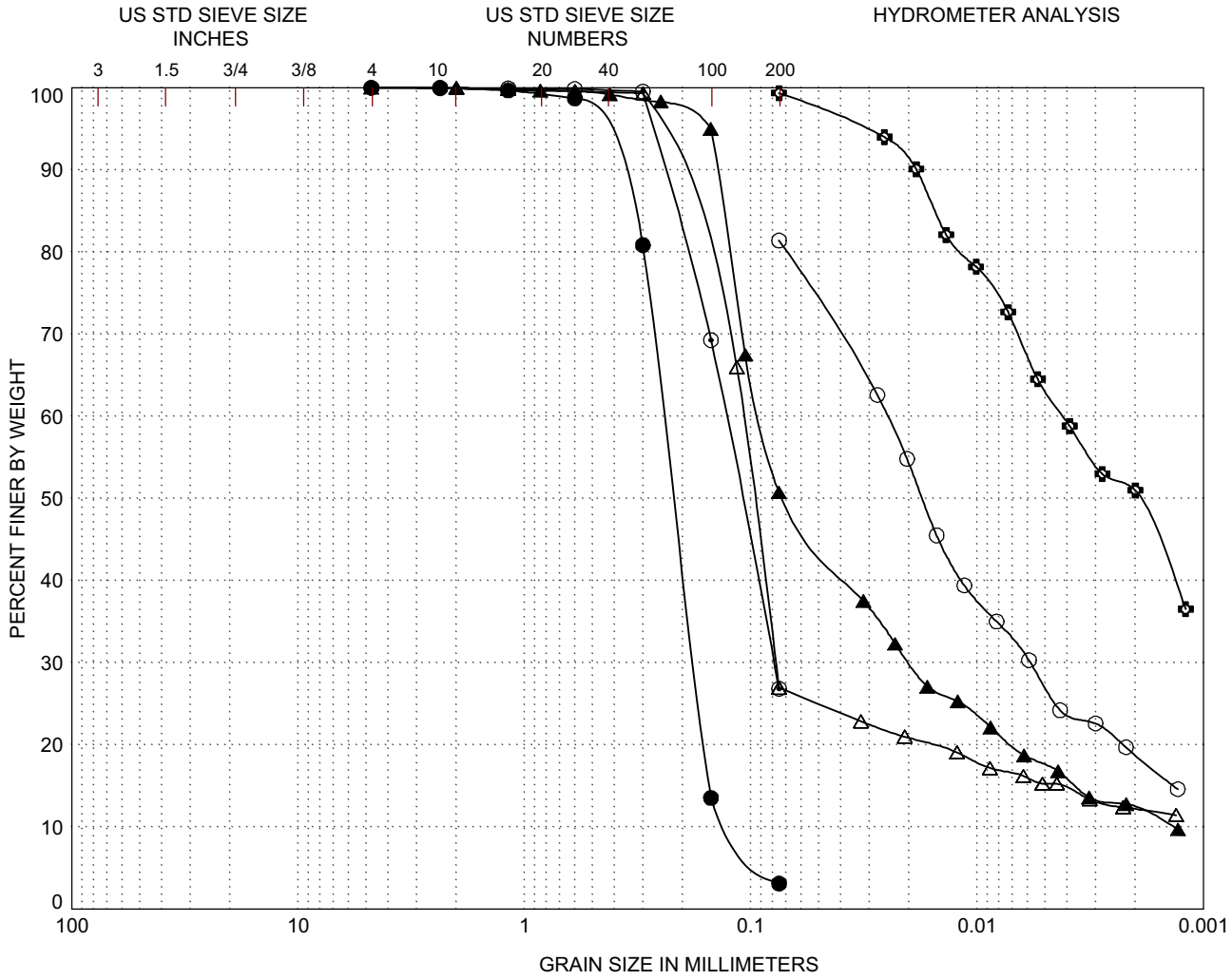


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND	(location)	(depth,ft)		Cc	Cu
○	B-2	37.7	Silty Fine SAND (SM)	6.4	17.7
●	B-2	47.6	Fine to Medium SAND (SP)	1.2	2.6
△	B-2	67.3	Clayey Fine SAND (SC)		

GRAIN SIZE CURVES
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-3b

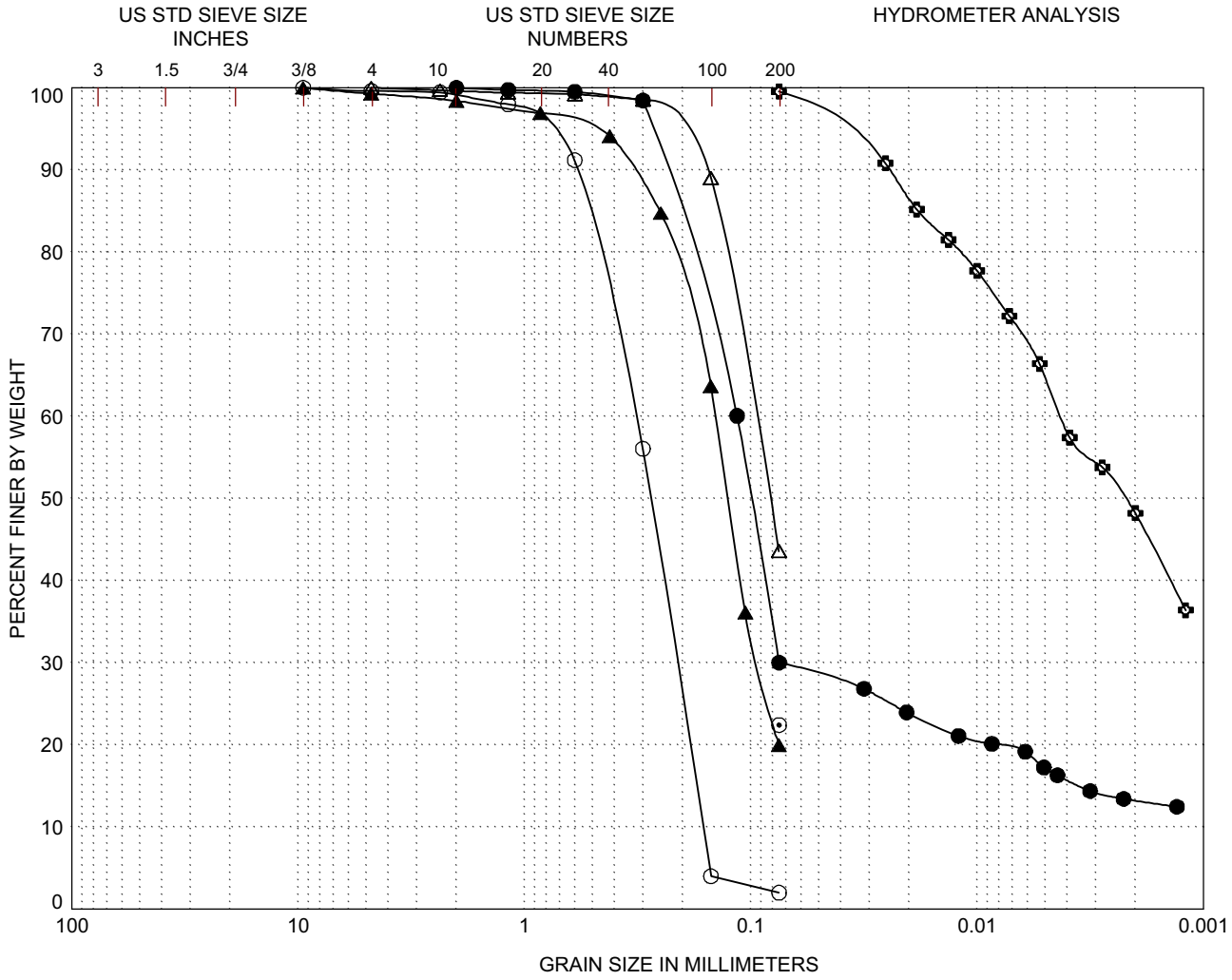


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND	(location)	(depth,ft)		Cc	Cu
○	B-3	26.7	Fat CLAY (CH)		
●	B-3	33.3	Fine SAND (SP)	1.1	2.0
△	B-3	38.2	Silty Fine SAND (SM)		
▲	B-3	57.6	Clayey Fine SAND (SC)	3.2	66.4
⊙	B-3	87.2	Clayey Fine SAND (SC)		
✿	B-3	108.6	Fat CLAY (CH)		

GRAIN SIZE CURVES
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-3c

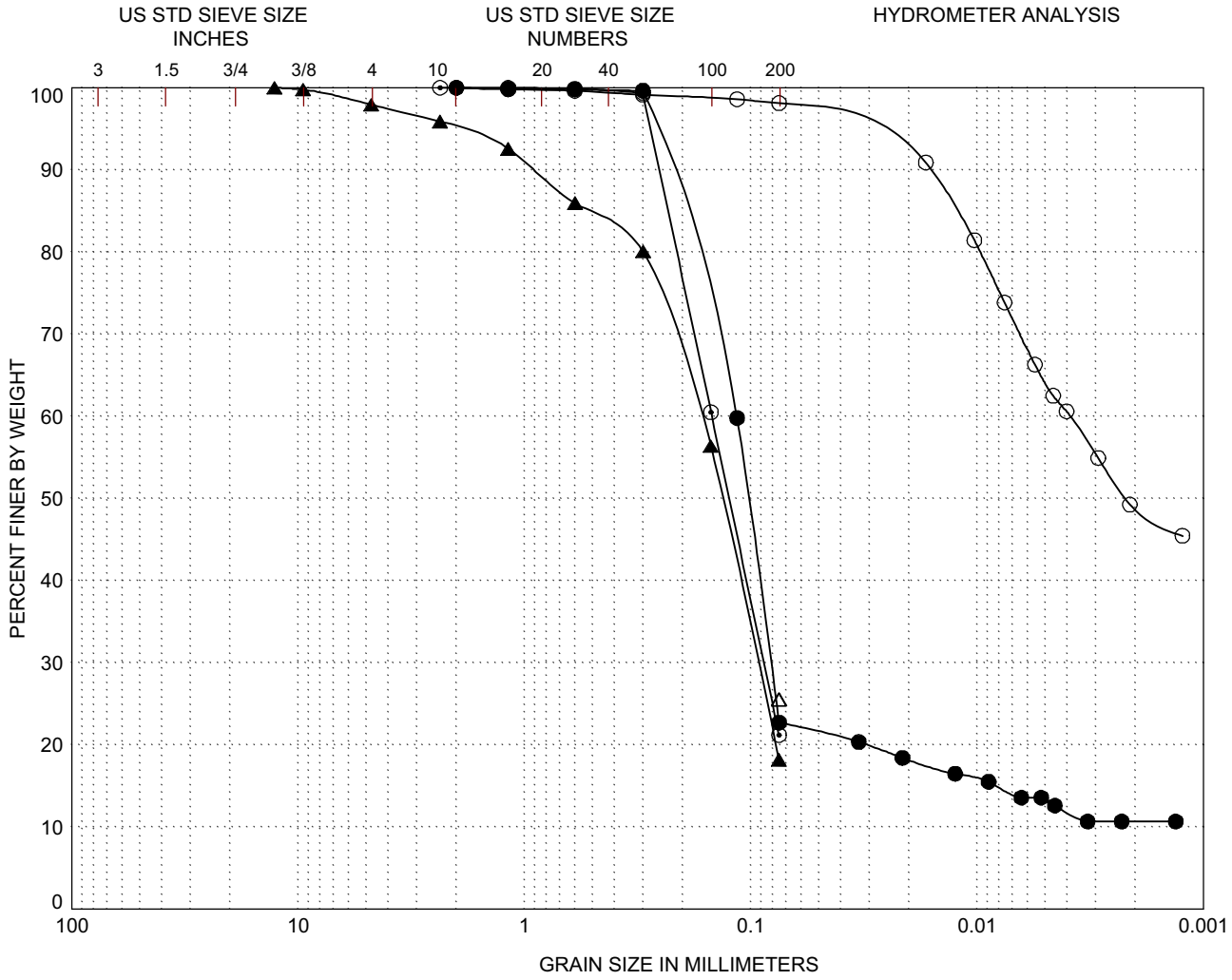


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND	(location)	(depth,ft)		Cc	Cu
○	B-4	21.7	Fine SAND (SP)	0.9	2.0
●	B-4	30.5	Silty Fine SAND (SM)		
△	B-4	58.4	Clayey Fine SAND (SC)		
▲	B-4	68.3	Clayey Fine SAND (SC)		
⊙	B-4	87.4	Clayey Fine SAND (SC)		
✿	B-4	98.3	Fat CLAY (CH)		

GRAIN SIZE CURVES
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-3d

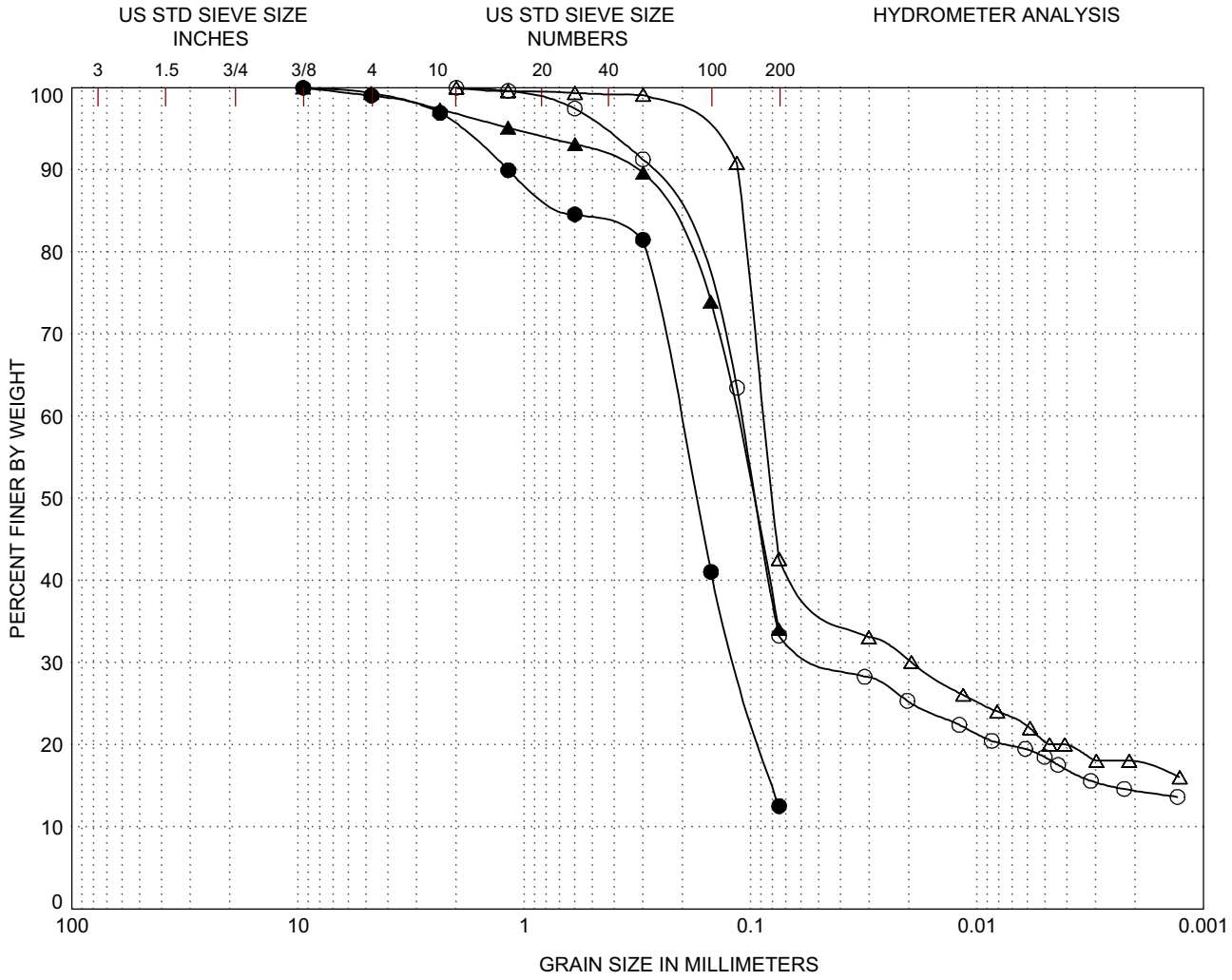


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND	(location)	(depth,ft)		Cc	Cu
○	B-5	10.8	Fat CLAY (CH)		
●	B-5	38.7	Silty Fine SAND (SM)		
△	B-5	53.5	Clayey Fine SAND (SC)		
▲	B-5	72.7	Clayey Fine SAND (SC)		
⊙	B-5	82.6	Clayey Fine SAND (SC)		

GRAIN SIZE CURVES
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-3e

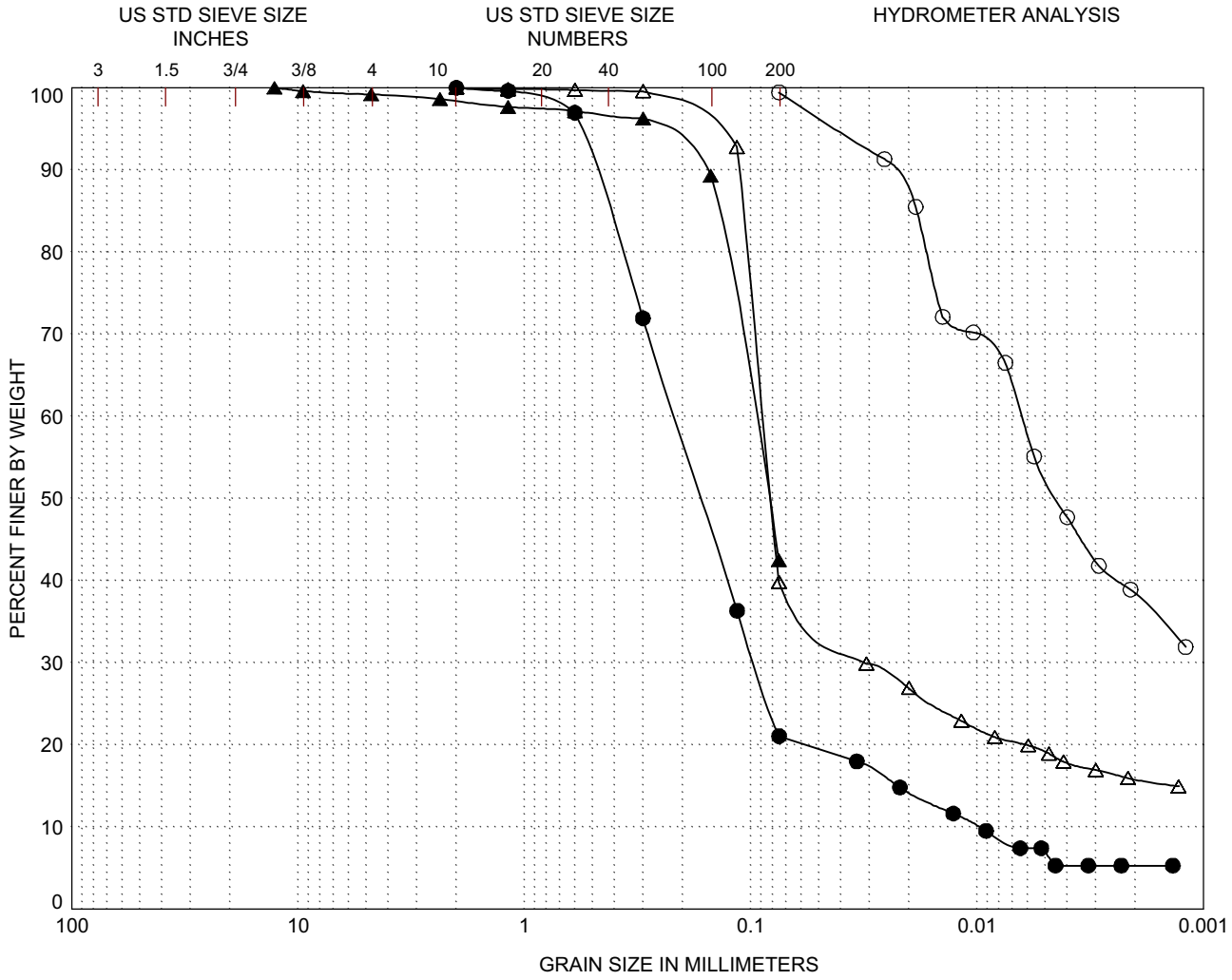


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND	(location)	(depth,ft)		Cc	Cu
○	B-6	33.8	Silty Fine SAND (SM)		
●	B-6	46.4	Silty Fine SAND (SM)		
△	B-6	74.2	Clayey Fine SAND (SC)		
▲	B-6	93.4	Clayey Fine SAND (SC)		

GRAIN SIZE CURVES
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-3f

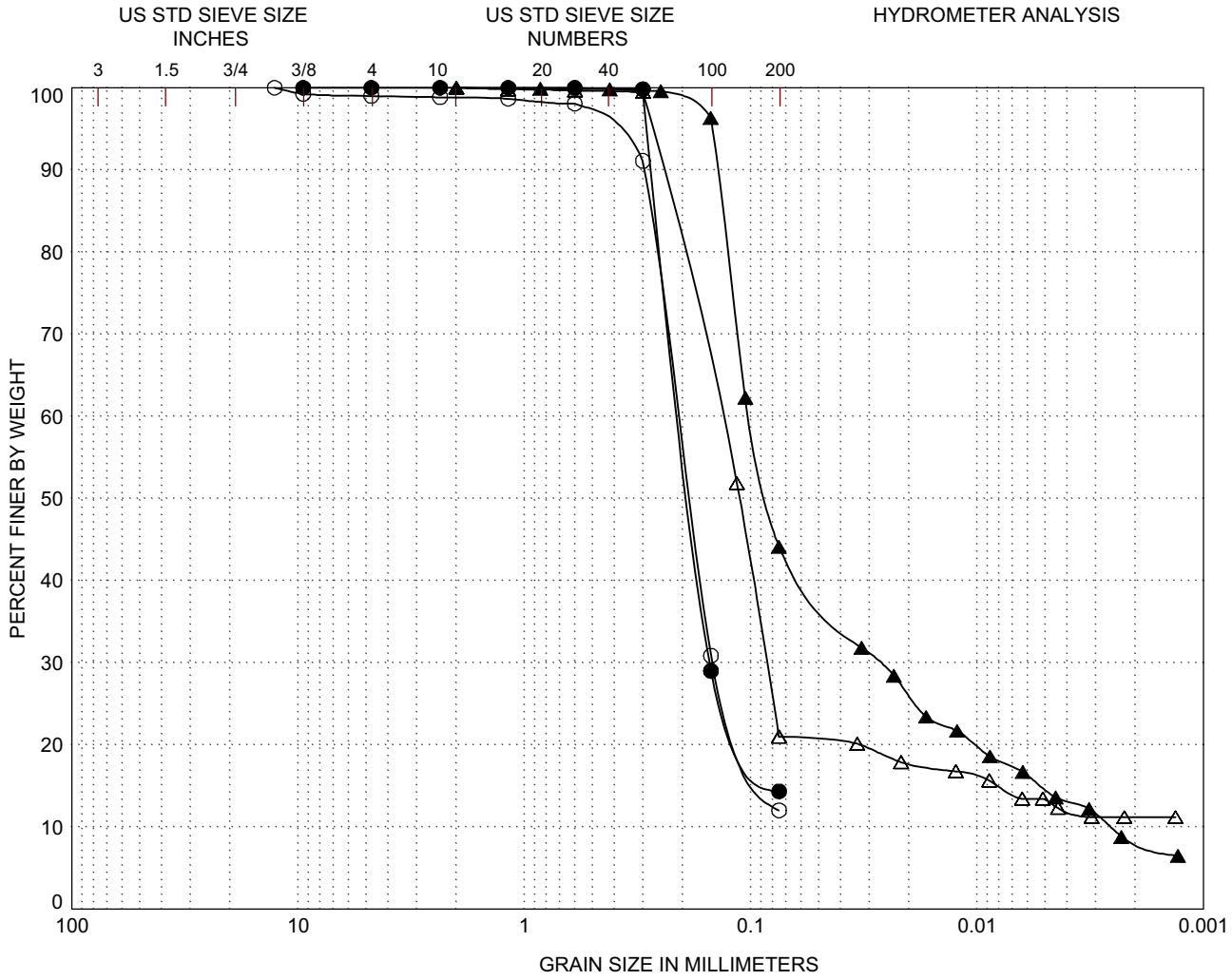


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND	(location)	(depth,ft)		Cc	Cu
○	B-8	23.0	Fat CLAY (CH)		
●	B-8	53.5	Silty Fine SAND (SM)	4.3	22.1
△	B-8	67.3	Clayey Fine SAND (SC)		
▲	B-8	93.4	Clayey Fine SAND (SC)		

GRAIN SIZE CURVES
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-3g

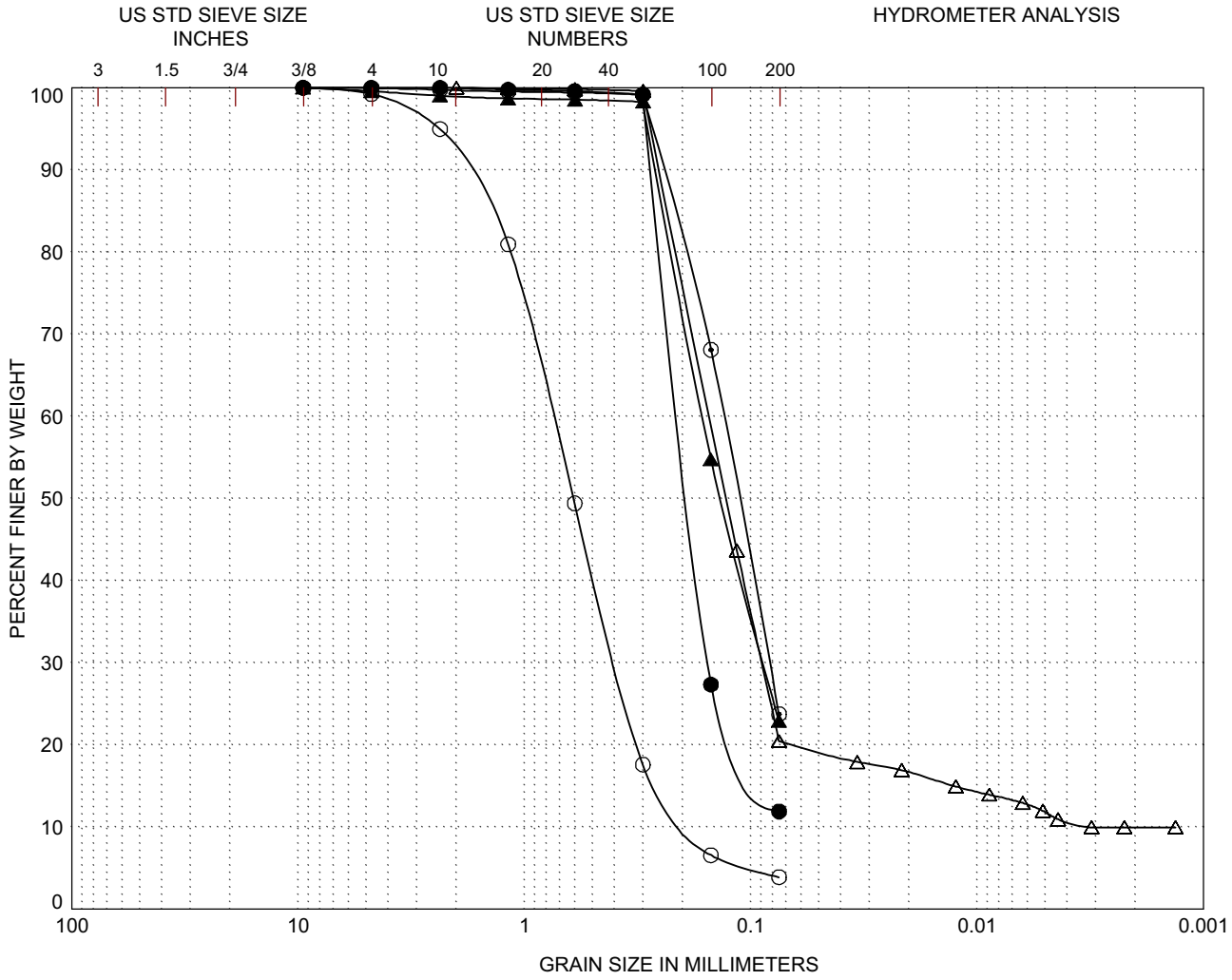


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND	(location)	(depth,ft)		Cc	Cu
○	B-9	3.8	Poorly-graded SAND with silt (SP-SM)	1.4	3.0
●	B-9	27.2	Clayey Fine SAND (SC)		
△	B-9	48.6	Silty Fine SAND (SM)		
▲	B-9	87.4	Clayey Fine SAND (SC)	2.8	39.3

GRAIN SIZE CURVES
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-3h

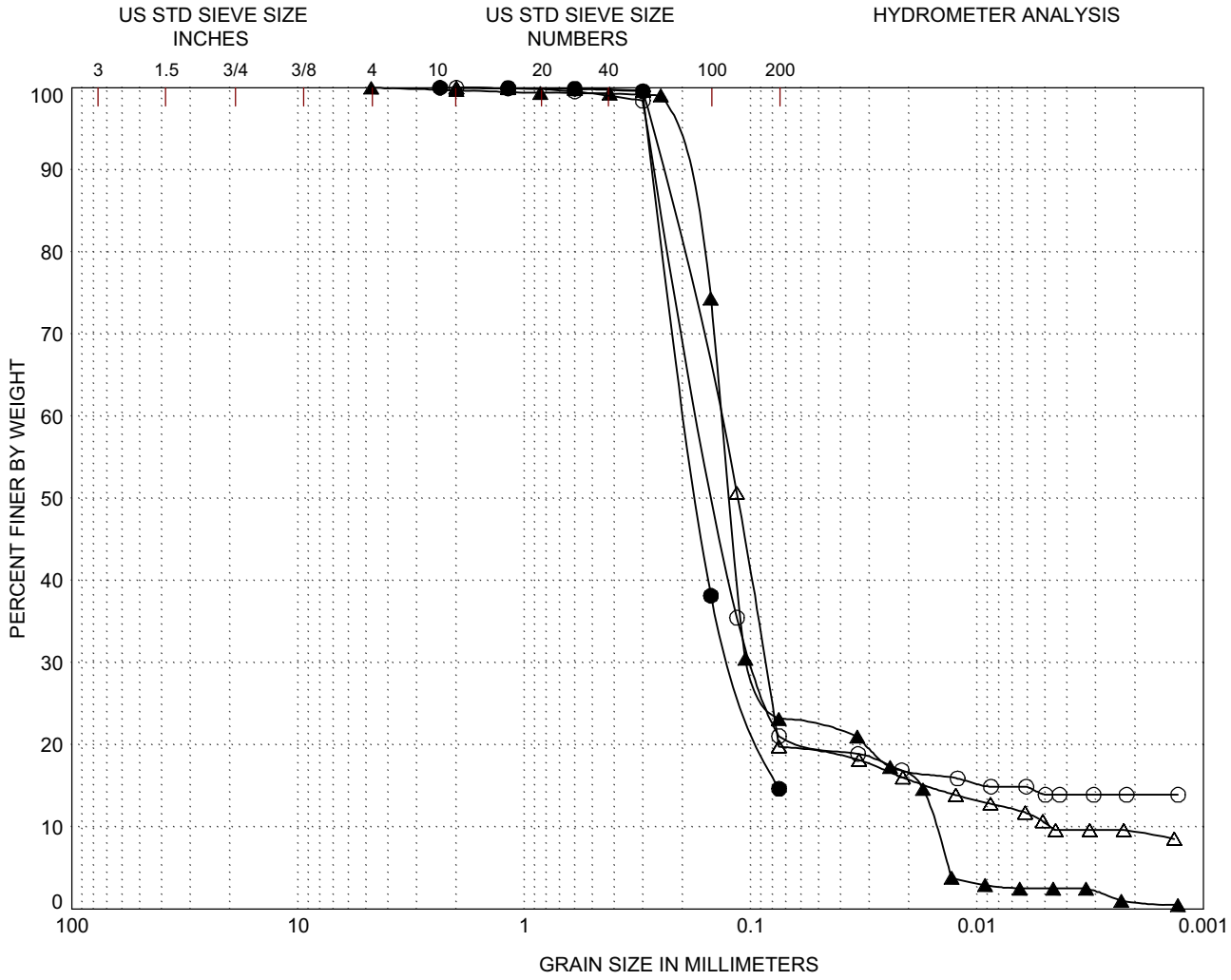


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND				Cc	Cu
	(location)	(depth,ft)			
○	B-10	16.6	Medium SAND (SP)	1.1	4.0
●	B-10	26.7	Poorly-graded SAND with silt (SP-SM)	1.7	3.0
△	B-10	43.7	Silty Fine SAND (SM)	16.5	47.7
▲	B-10	58.4	Silty Fine SAND (SM)		
⊙	B-10	68.3	Clayey Fine SAND (SC)		

GRAIN SIZE CURVES
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-3i

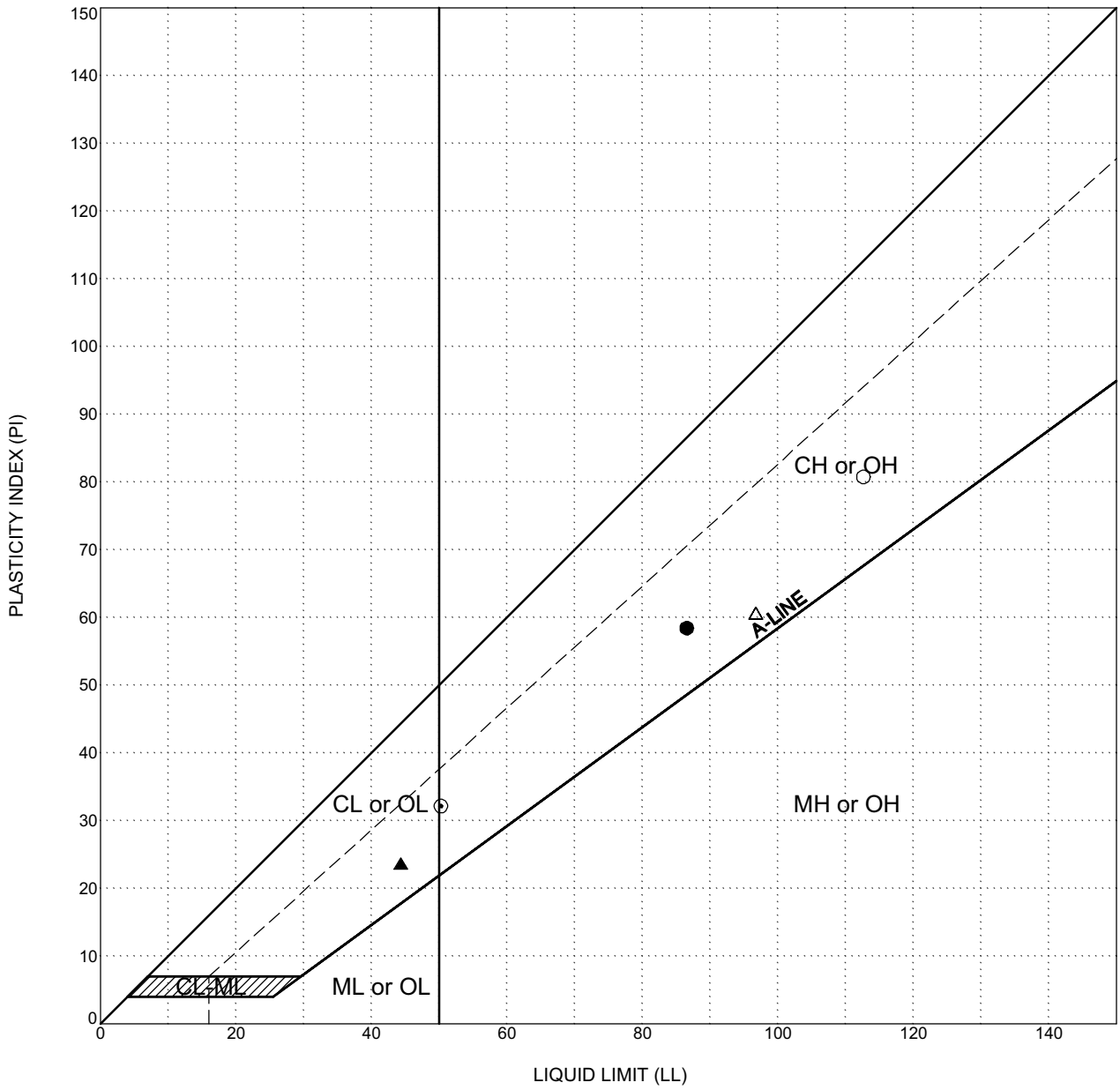


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND	(location)	(depth,ft)		Cc	Cu
○	B-11	27.2	Silty Fine SAND (SM)		
●	B-11	37.8	Silty Fine SAND (SM)		
△	B-11	48.1	Silty Fine SAND (SM)	11.5	29.2
▲	B-11	63.8	Silty Fine SAND (SM)	5.2	8.7

GRAIN SIZE CURVES
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-3j

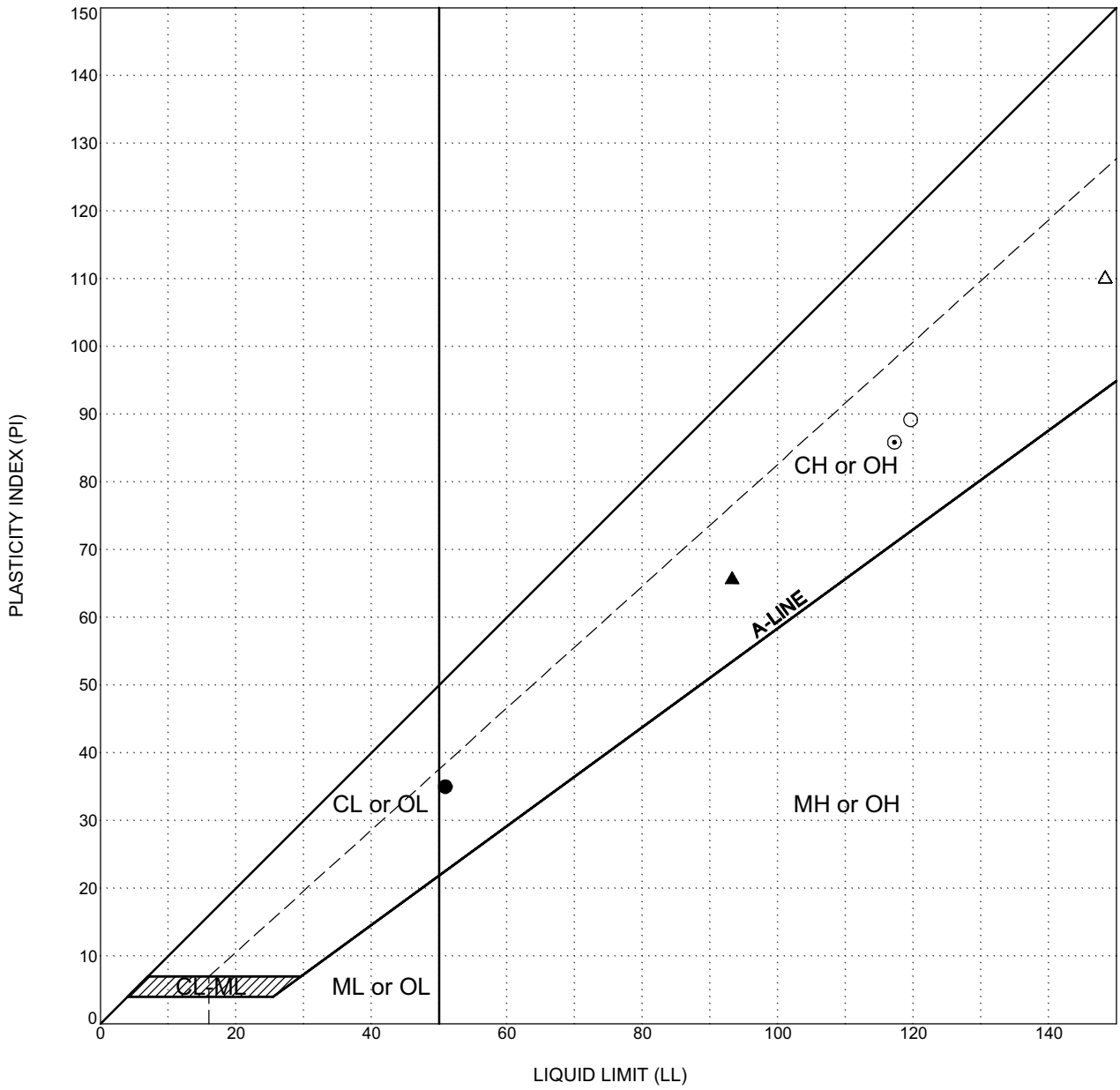


LEGEND			CLASSIFICATION	ATTERBERG LIMITS TEST RESULTS		
	location	depth, ft		LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)
○	B-1	3.6	Fat CLAY (CH)	113	32	81
●	B-1	17.8	Fat CLAY (CH)	87	28	59
△	B-1	29.6	Organic CLAY (OH)	97 (58)	36	61
▲	B-1	67.8	Clayey Fine SAND (SC)	44	21	23
⊙	B-1	72.7	Clayey Fine SAND (SC)	50	18	32

Note: Liquid Limit values in parentheses indicate second test performed on oven-dried specimen

PLASTICITY CHART
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-4a

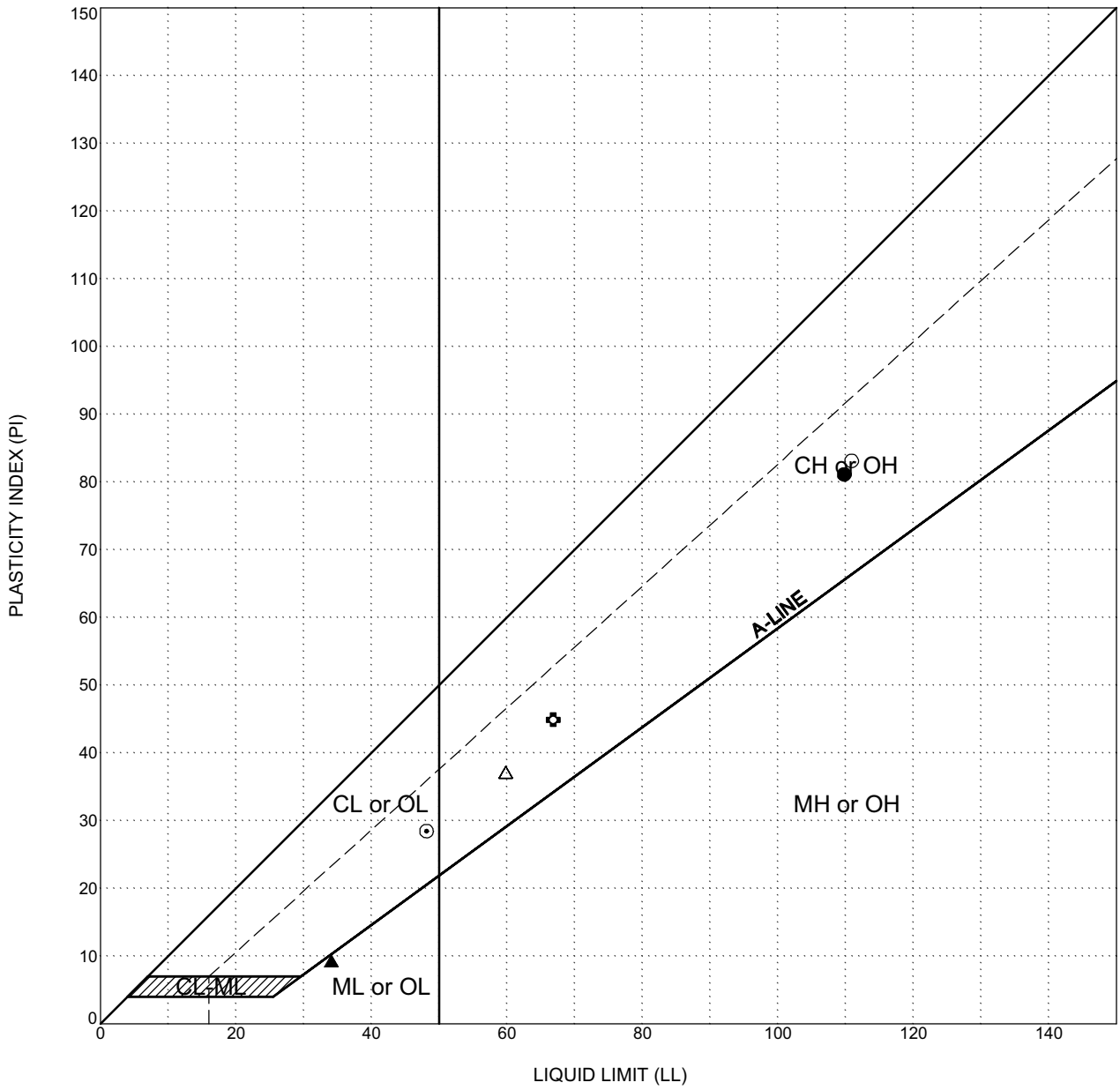


LEGEND			CLASSIFICATION	ATTERBERG LIMITS TEST RESULTS		
	location	depth, ft		LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)
○	B-2	4.0	Fat CLAY (CH)	120	30	90
●	B-2	10.3	Fat CLAY (CH)	51	16	35
△	B-2	17.7	Fat CLAY (CH)	148	38	110
▲	B-2	23.5	Organic CLAY (OH)	93 (57)	27	66
⊙	B-2	33.8	Organic CLAY (OH)	117 (63)	31	86

Note: Liquid Limit values in parentheses indicate second test performed on oven-dried specimen

PLASTICITY CHART
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-4b

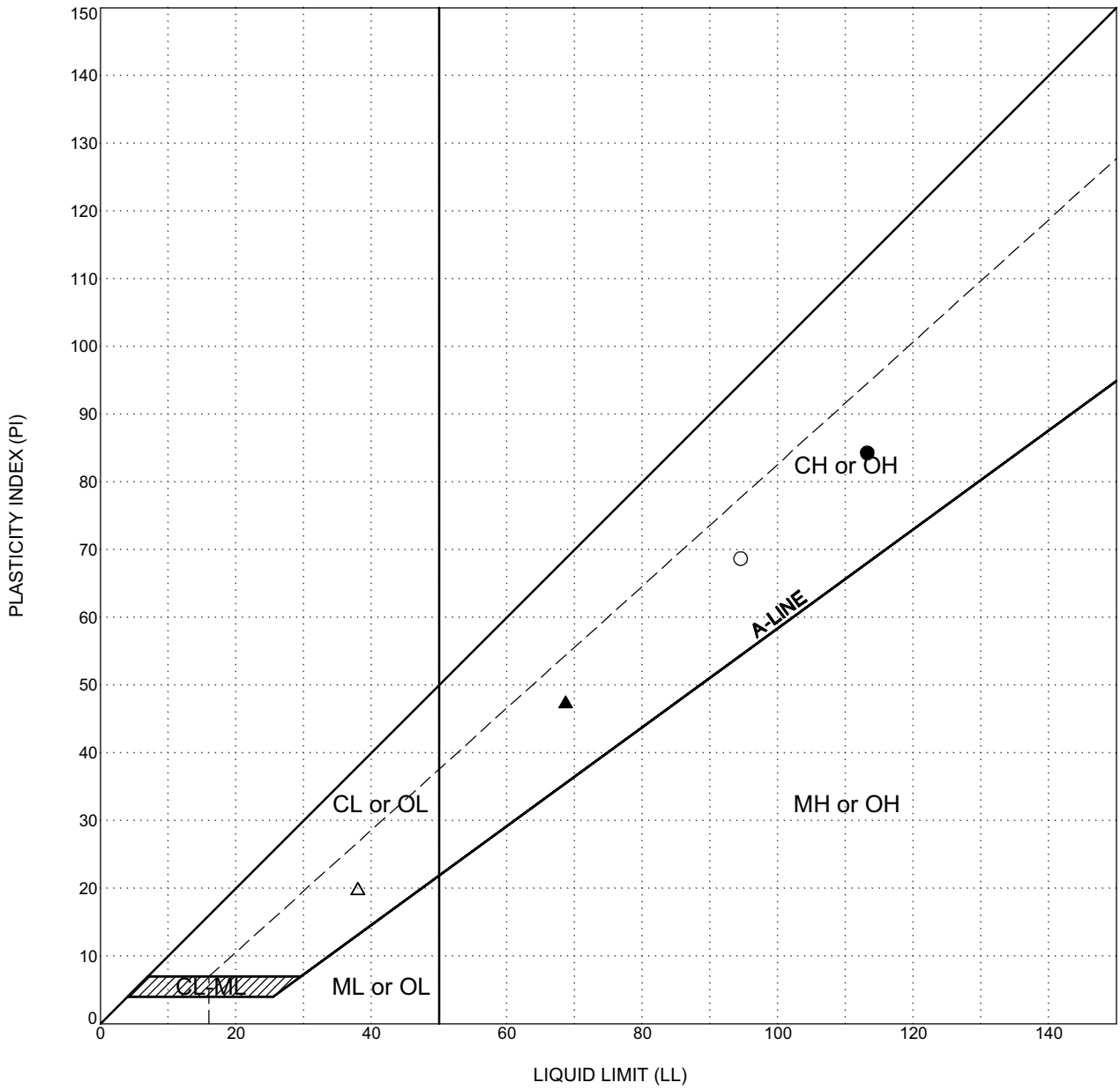


LEGEND			CLASSIFICATION	ATTERBERG LIMITS TEST RESULTS		
	location	depth, ft		LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)
○	B-3	7.6	Fat CLAY (CH)	111	28	83
●	B-3	14.6	Organic CLAY (OH)	110 (61)	29	81
△	B-3	26.7	Fat CLAY (CH)	60	23	37
▲	B-3	38.2	Silty Fine SAND (SM)	34	25	9
⊙	B-3	53.0	Clayey Fine SAND (SC)	48	20	28
✿	B-3	108.6	Fat CLAY (CH)	67	22	45

Note: Liquid Limit values in parentheses indicate second test performed on oven-dried specimen

PLASTICITY CHART
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-4c

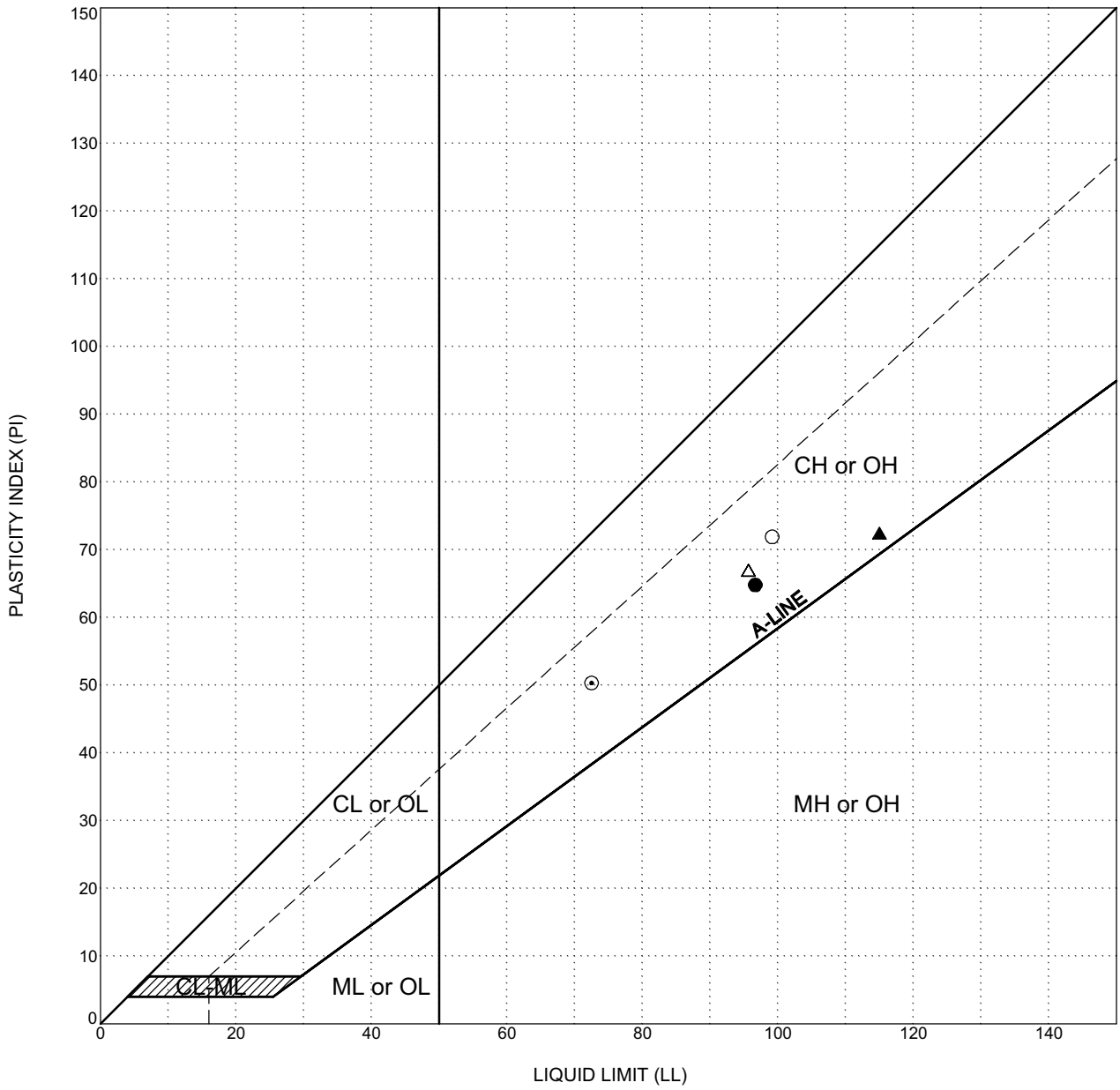


LEGEND	location	depth, ft	CLASSIFICATION	ATTERBERG LIMITS TEST RESULTS LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)
○	B-4	5.5	Fat CLAY (CH)	95	26	69
●	B-4	11.0	Fat CLAY (CH)	113	29	84
△	B-4	68.3	Clayey Fine SAND (SC)	38	18	20
▲	B-4	98.3	Fat CLAY (CH)	69	21	48

Note: Liquid Limit values in parentheses indicate second test performed on oven-dried specimen

PLASTICITY CHART
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-4d

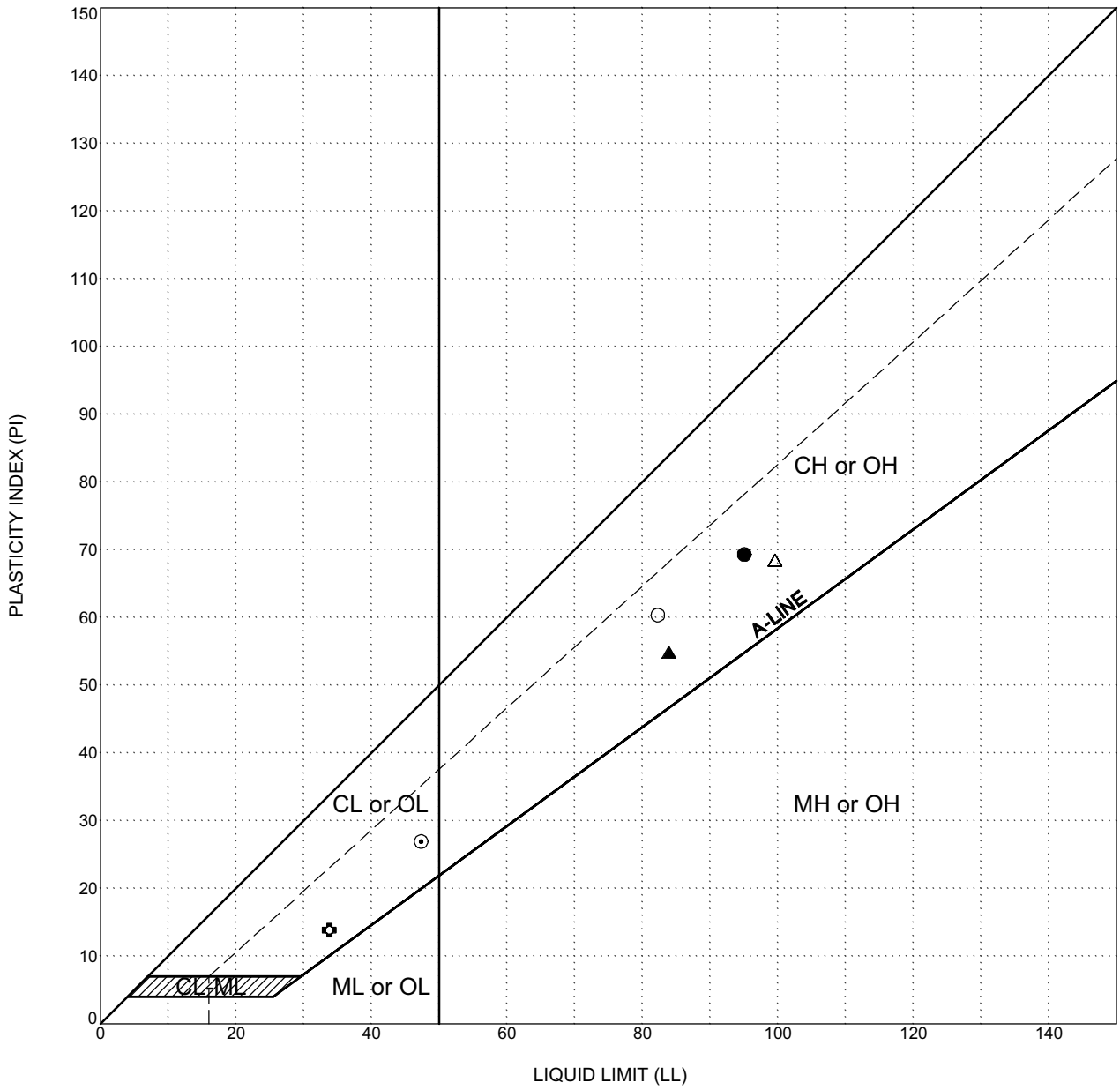


LEGEND			CLASSIFICATION	ATTERBERG LIMITS TEST RESULTS		
	location	depth, ft		LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)
○	B-5	5.3	Organic CLAY (OH)	99 (61)	27	72
●	B-5	14.3	Fat CLAY (CH)	97	32	65
△	B-5	20.2	Organic CLAY (OH)	96 (60)	29	67
▲	B-5	28.2	Organic CLAY (OH)	115 (58)	43	72
⊙	B-5	102.8	Fat CLAY (CH)	72	22	50

Note: Liquid Limit values in parentheses indicate second test performed on oven-dried specimen

PLASTICITY CHART
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-4e

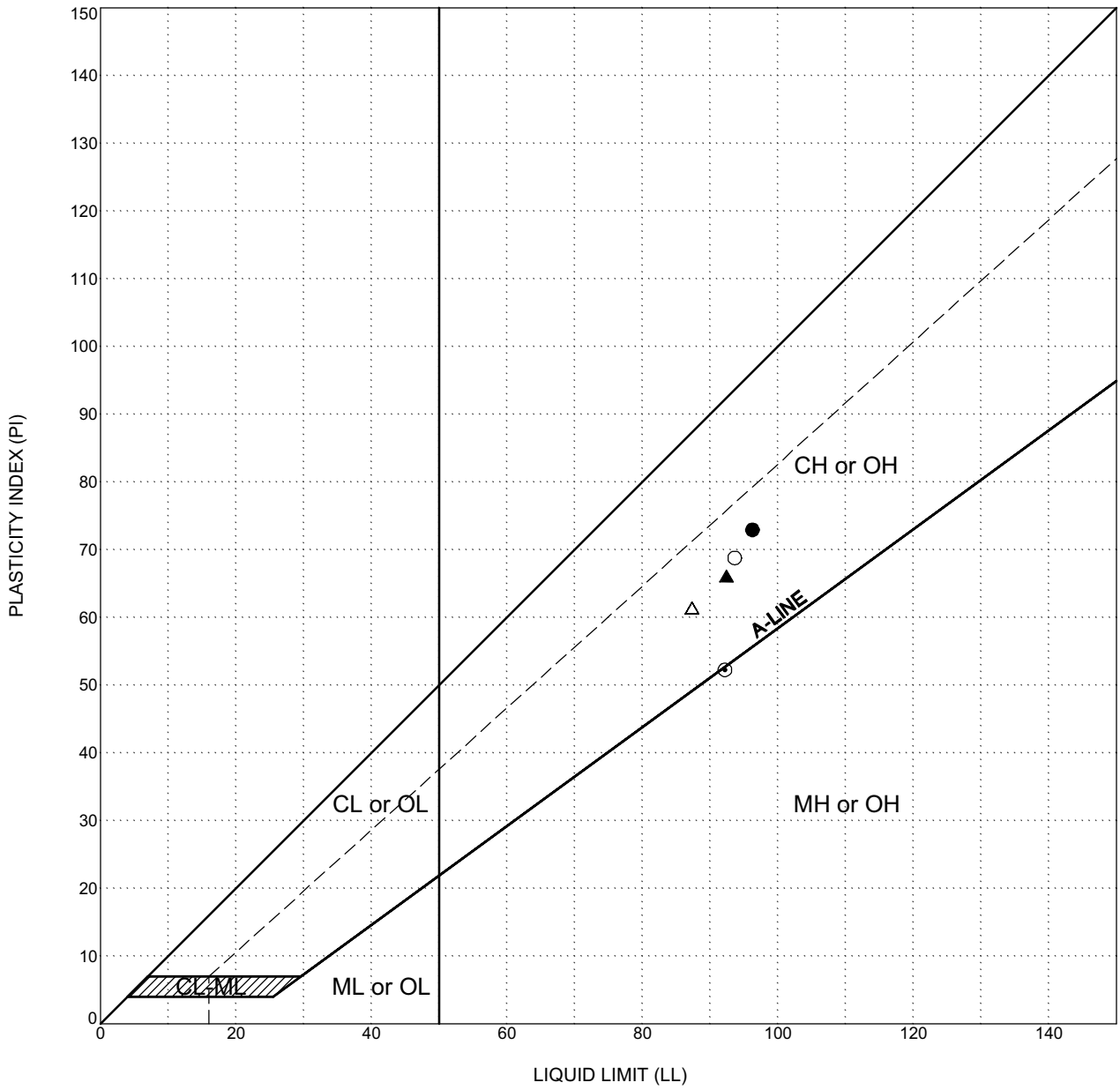


LEGEND			CLASSIFICATION	ATTERBERG LIMITS TEST RESULTS		
	location	depth, ft		LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)
○	B-6	6.3	Fat CLAY (CH)	82	22	60
●	B-6	14.6	Fat CLAY (CH)	95	26	69
△	B-6	23.8	Organic CLAY (OH)	100	31	69
▲	B-6	31.7	Organic CLAY (OH)	84 (49)	29	55
⊙	B-6	84.0	Clayey Fine SAND (SC)	47	20	27
✿	B-6	96.8	Clayey Fine SAND (SC)	34	20	14

Note: Liquid Limit values in parentheses indicate second test performed on oven-dried specimen

PLASTICITY CHART
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-4f

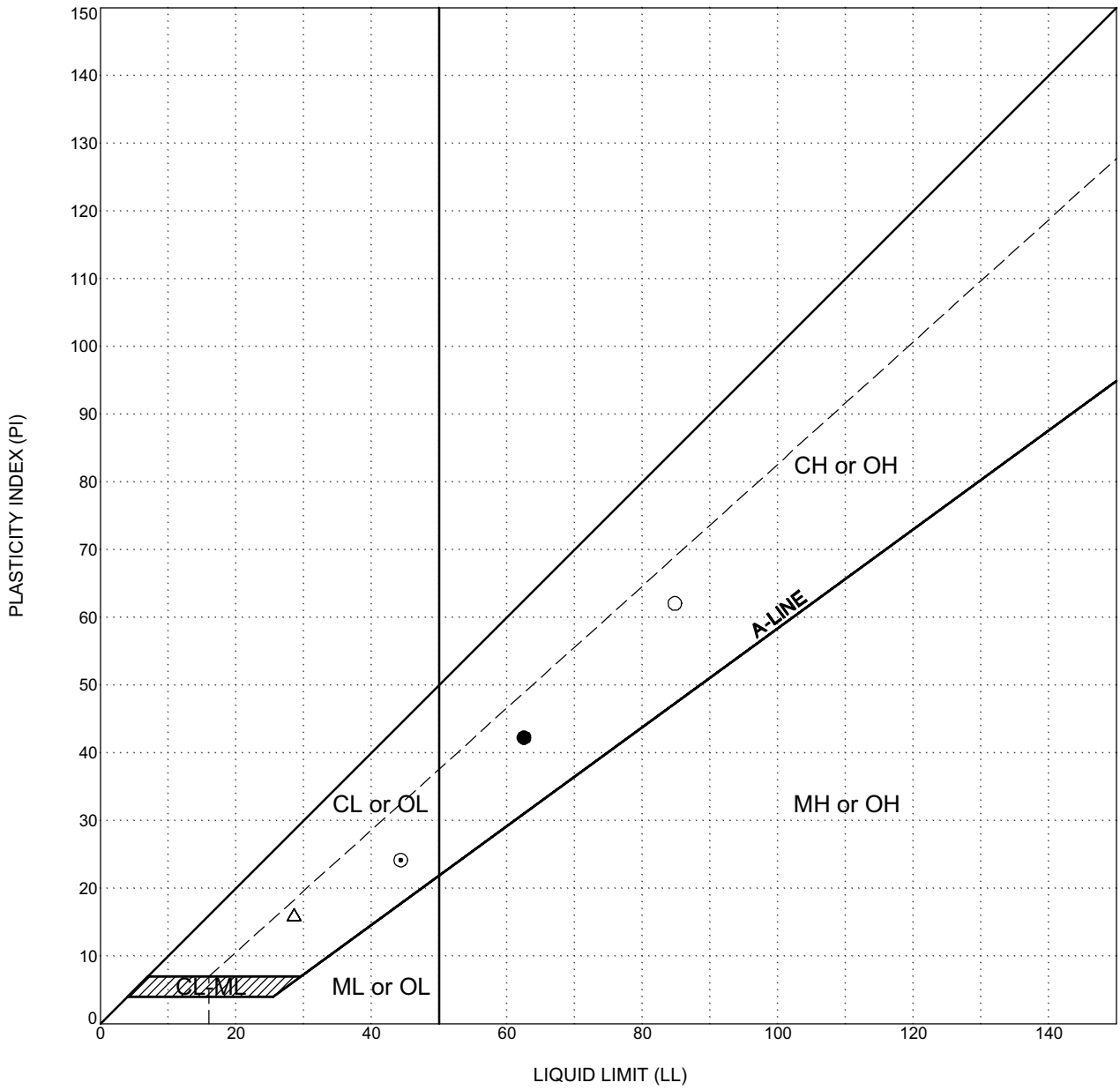


LEGEND			CLASSIFICATION	ATTERBERG LIMITS TEST RESULTS		
	location	depth, ft		LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)
○	B-8	7.8	Fat CLAY (CH)	94	25	69
●	B-8	17.6	Fat CLAY (CH)	96	23	73
△	B-8	24.5	Fat CLAY (CH)	87	26	61
▲	B-8	27.7	Fat CLAY (CH)	92	26	66
⊙	B-8	49.6	Organic SILT (OH)	92 (47)	40	52

Note: Liquid Limit values in parentheses indicate second test performed on oven-dried specimen

PLASTICITY CHART
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-4g

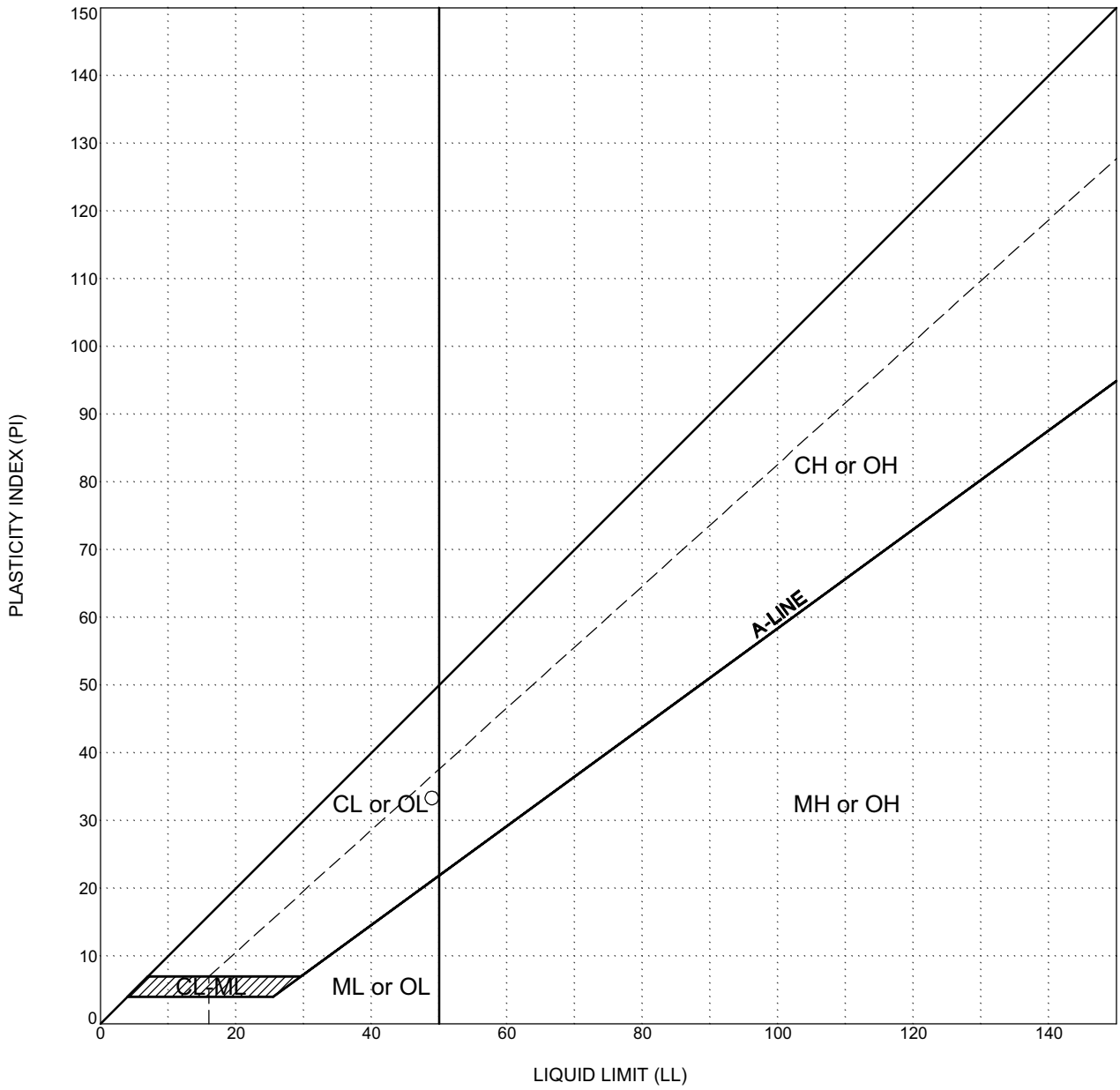


LEGEND			CLASSIFICATION	ATTERBERG LIMITS TEST RESULTS		
	location	depth, ft		LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)
○	B-9	11.8	Fat CLAY (CH)	85	23	62
●	B-9	20.5	Fat CLAY (CH)	63	20	43
△	B-9	24.0	Clayey Fine SAND (SC)	29	12	17
▲	B-9	48.6	Silty Fine SAND (SM)	NP	NP	NP
⊙	B-9	87.9	Clayey Fine SAND (SC)	44	20	24

Note: Liquid Limit values in parentheses indicate second test performed on oven-dried specimen

PLASTICITY CHART
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-4h



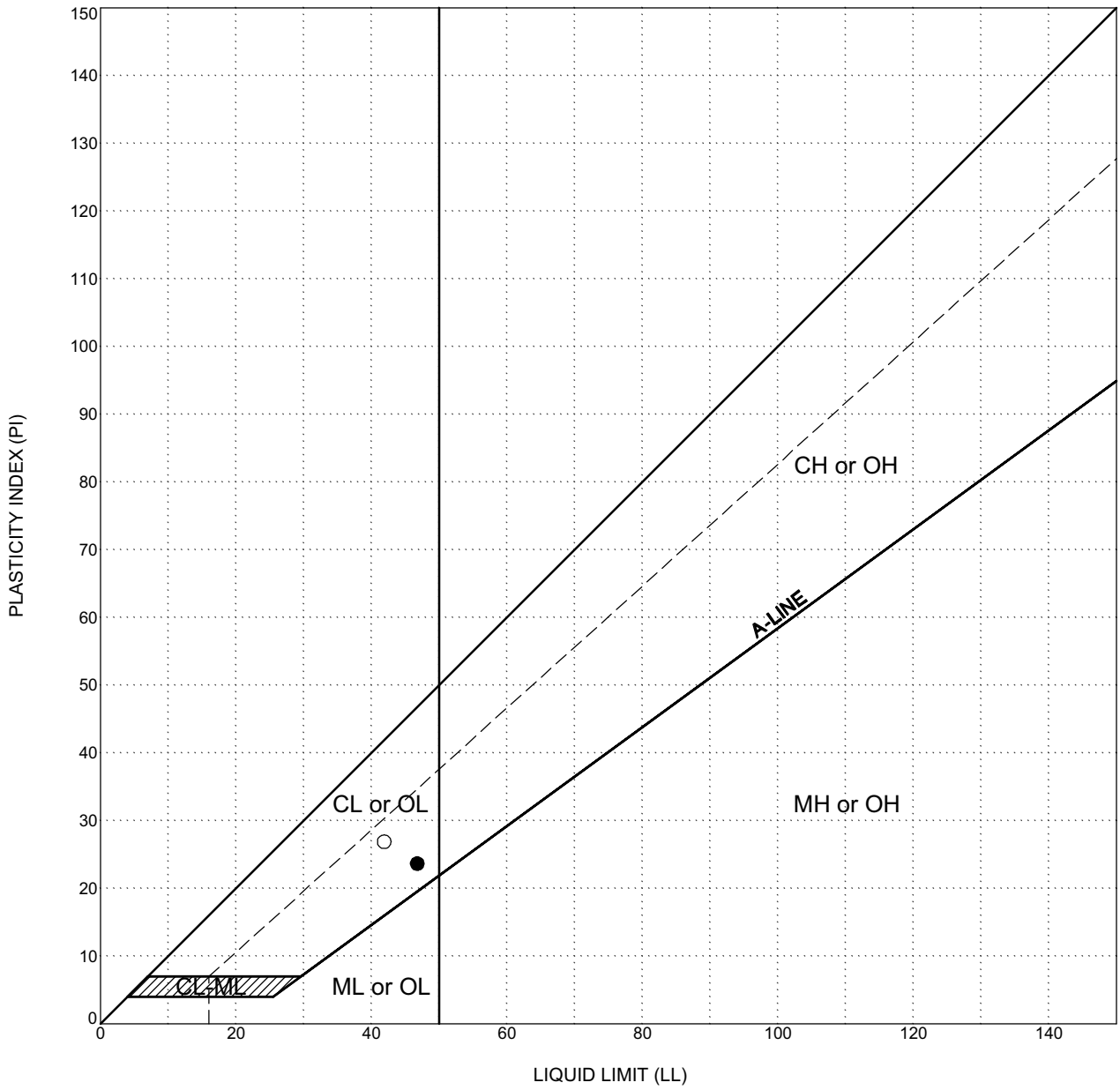
ATTERBERG LIMITS TEST RESULTS

LEGEND	location	depth, ft	CLASSIFICATION	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)
○	B-10	8.1	Sandy CLAY (CL)	49	16	33
●	B-10	43.7	Silty Fine SAND (SM)	NP	NP	NP

Note: Liquid Limit values in parentheses indicate second test performed on oven-dried specimen

PLASTICITY CHART
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-4i

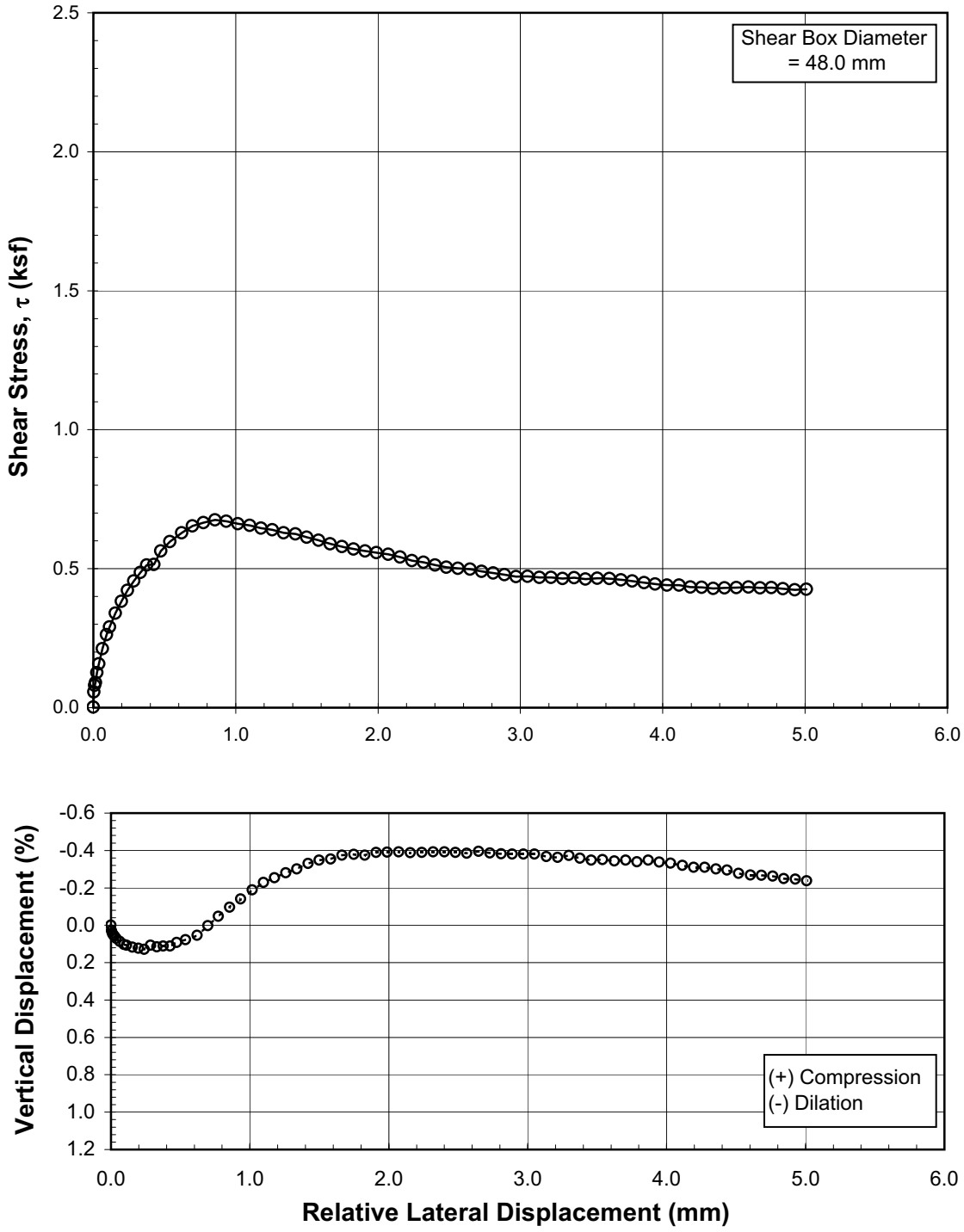


LEGEND			CLASSIFICATION	ATTERBERG LIMITS TEST RESULTS		
	location	depth, ft		LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)
○	B-11	17.9	Organic CLAY (OL)	42	15	27
●	B-11	77.6	Clayey Fine SAND (SC)	47	23	24

Note: Liquid Limit values in parentheses indicate second test performed on oven-dried specimen

PLASTICITY CHART
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE E-4j

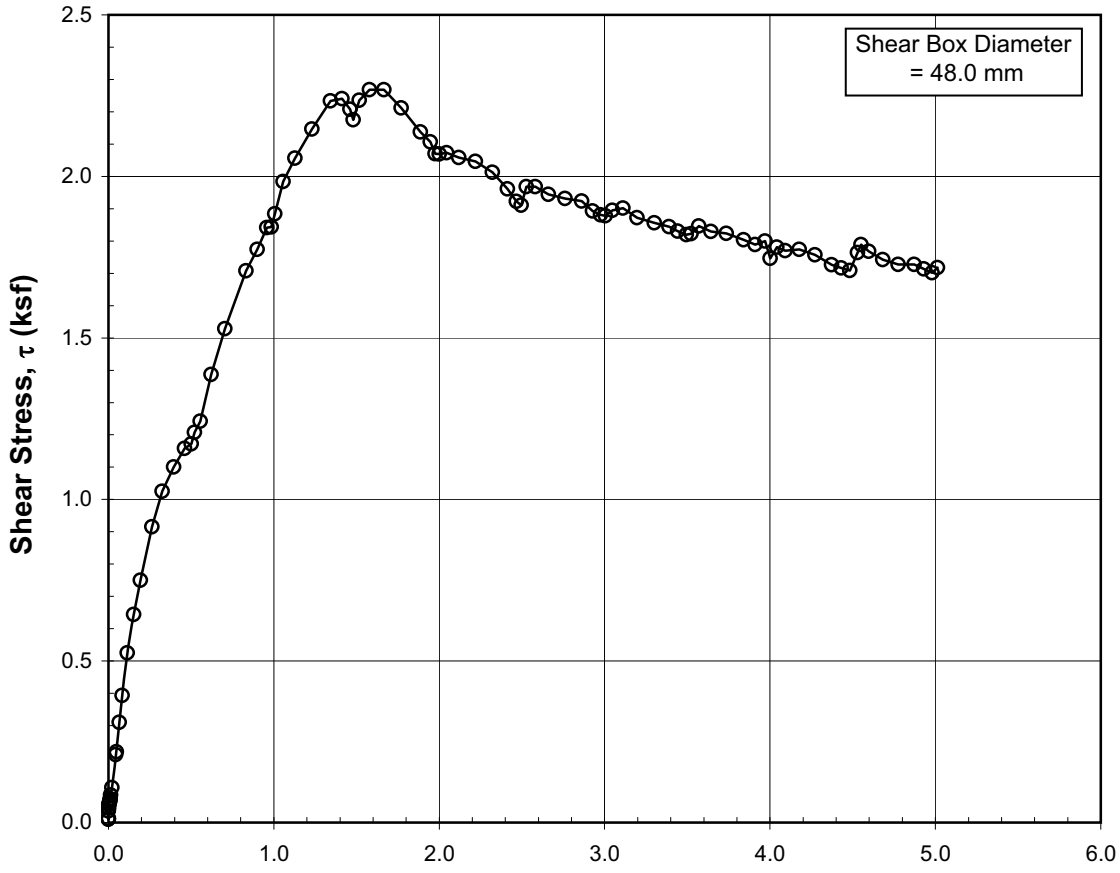


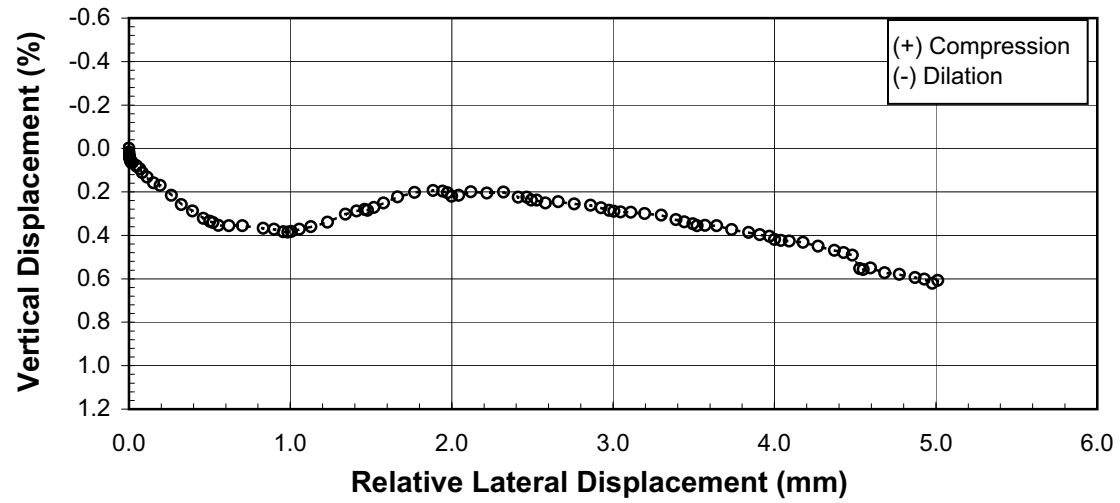
DRAINED DIRECT SHEAR TEST

Soil - Soil Interface $\sigma'_{v,c}$ = 0.68 ksf

Boring: B-2 - Sample: 18Ba - Depth: 68.4 ft

FIGURE E-5a



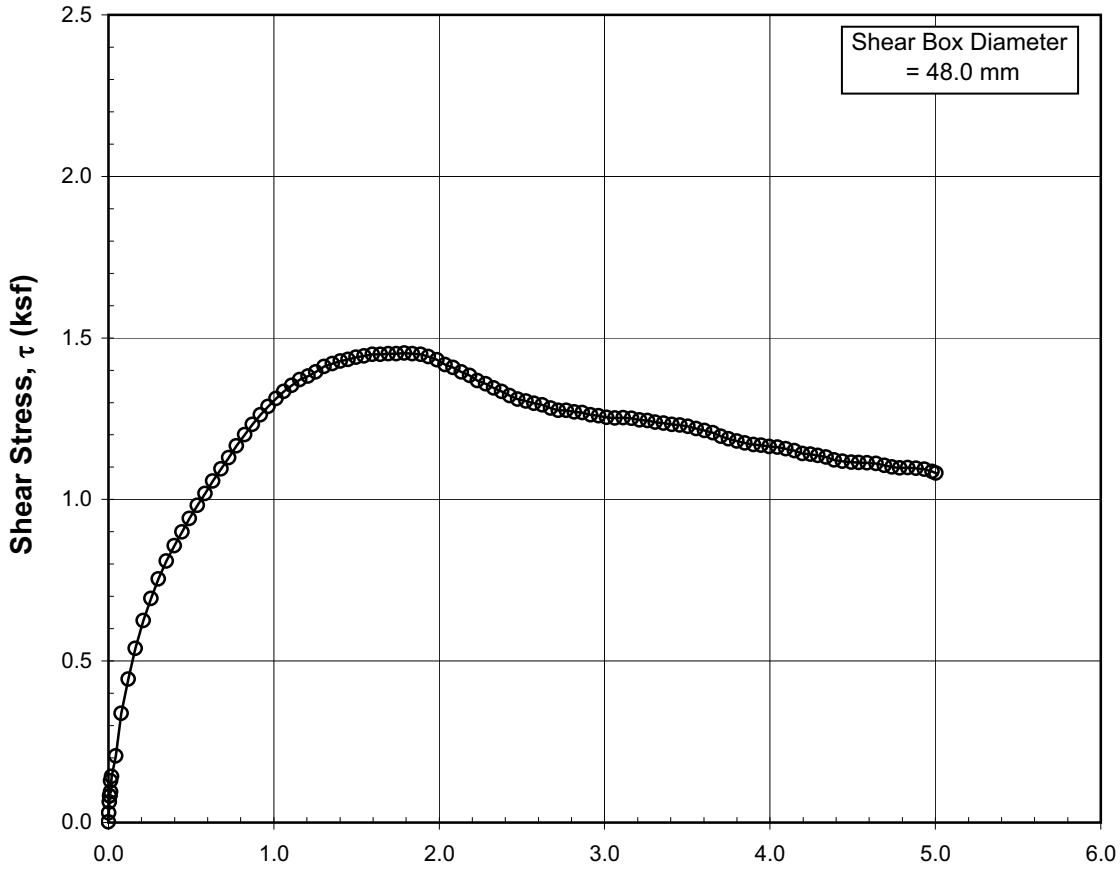


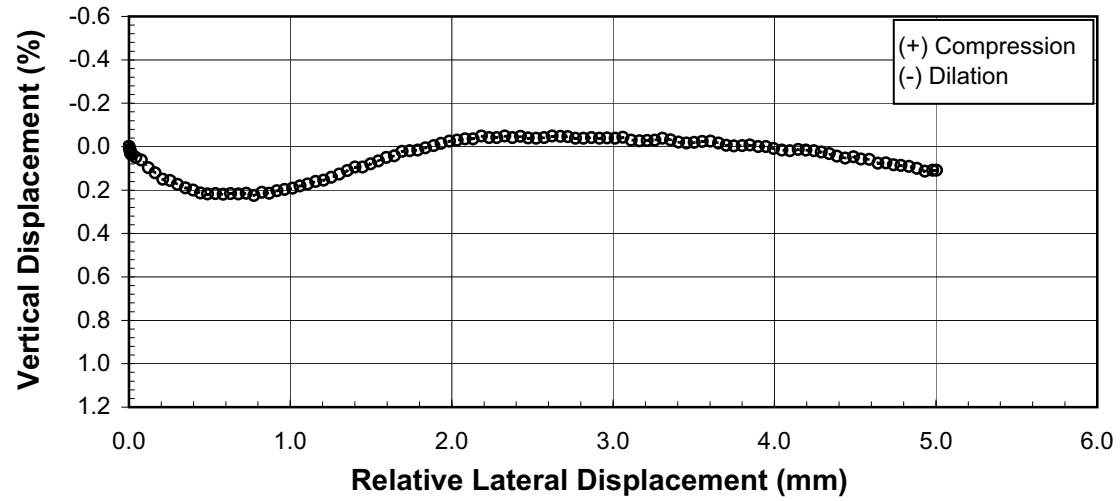
DRAINED DIRECT SHEAR TEST

Soil - Soil Interface $\sigma'_{v,c}$ = 3.00 ksf

Boring: B-2 - Sample: 18Bb - Depth: 68.4 ft

FIGURE E-5b



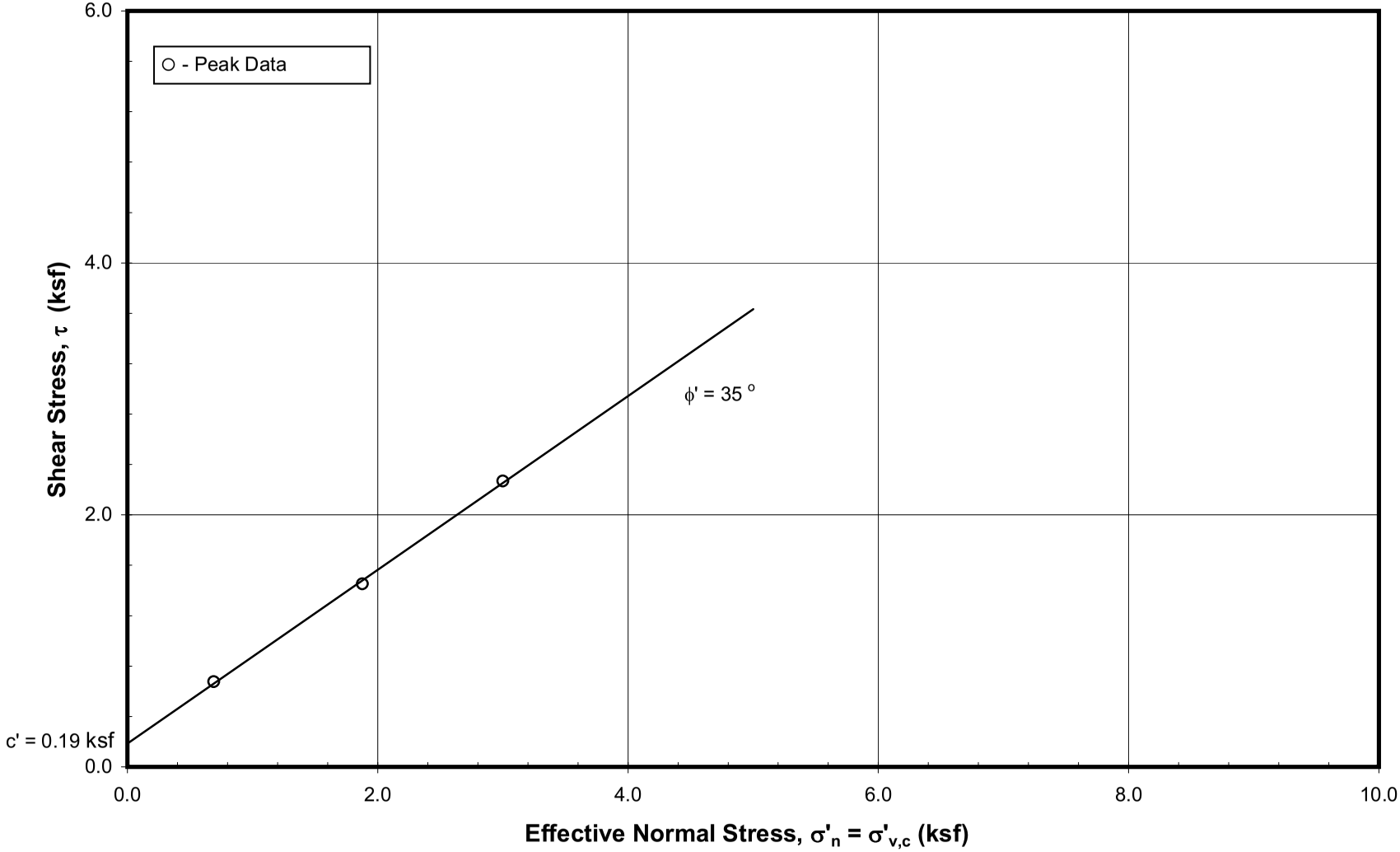


DRAINED DIRECT SHEAR TEST

Soil - Soil Interface $\sigma'_{v,c}$ = 1.88 ksf

Boring: B-2 - Sample: 18Bc - Depth: 68.4 ft

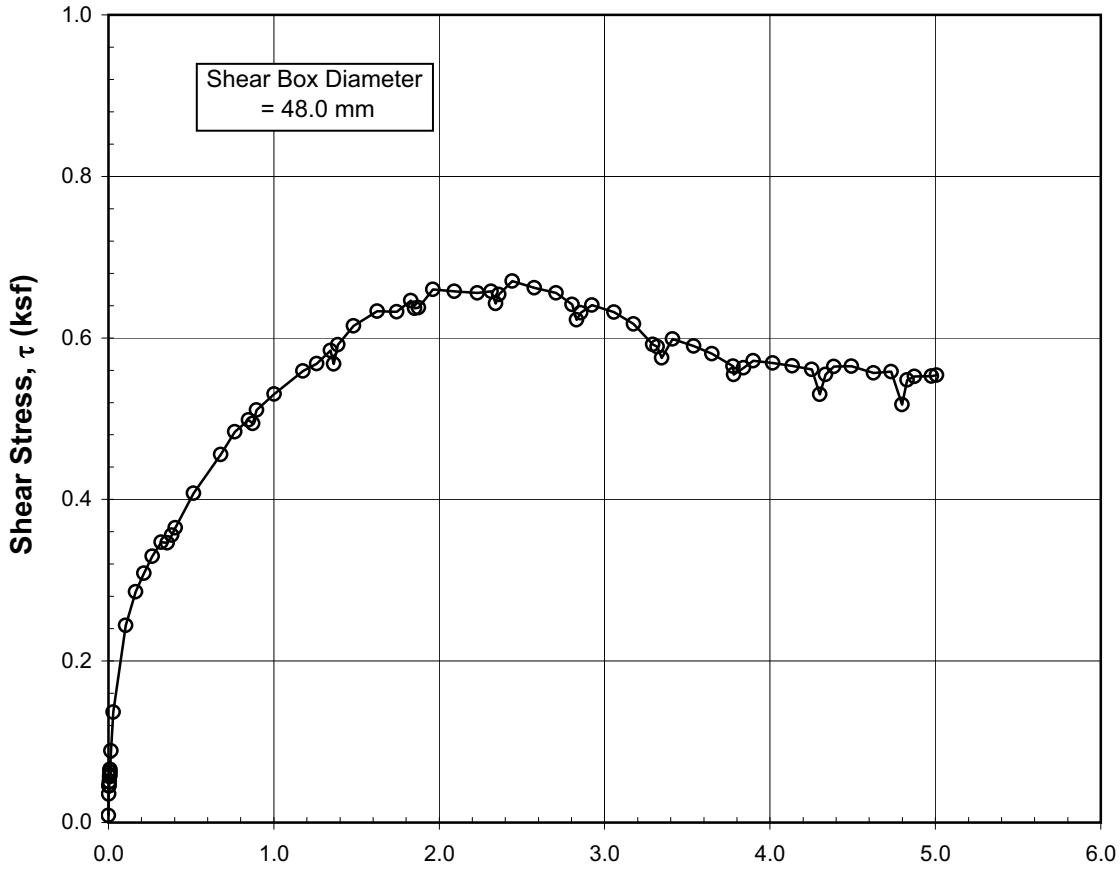
FIGURE E-5c

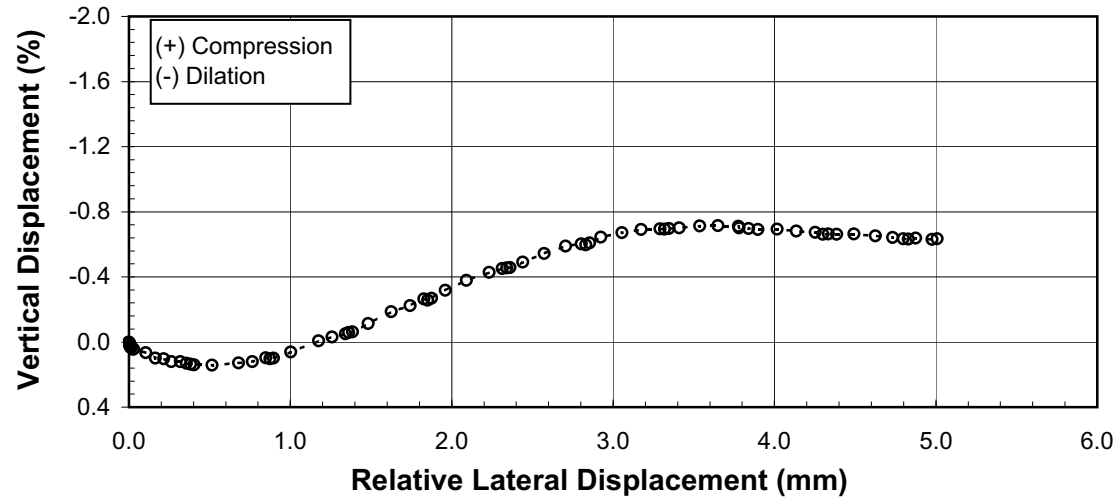


DRAINED DIRECT SHEAR TEST: Test Series - (Peak)

Soil - Soil Interface

Boring: B-2 - Sample: 18B (a,b&c) - Depth: 68.4 ft



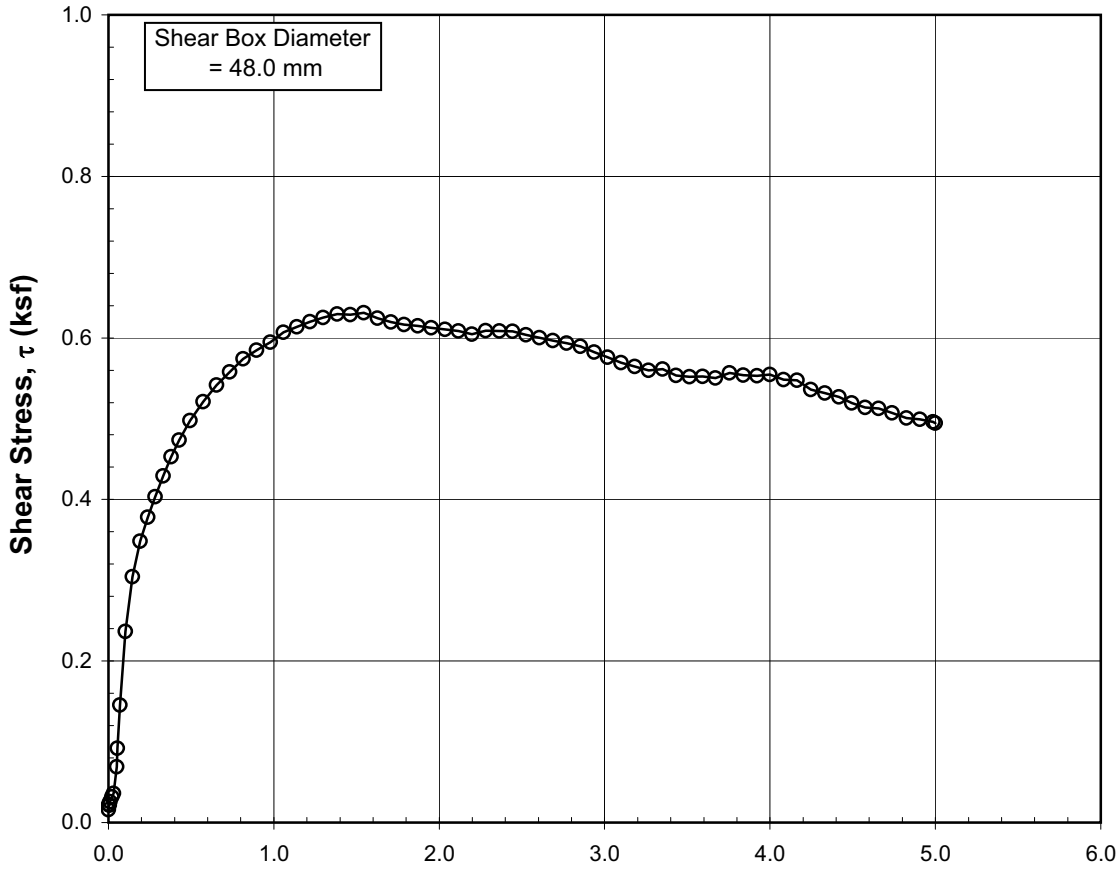


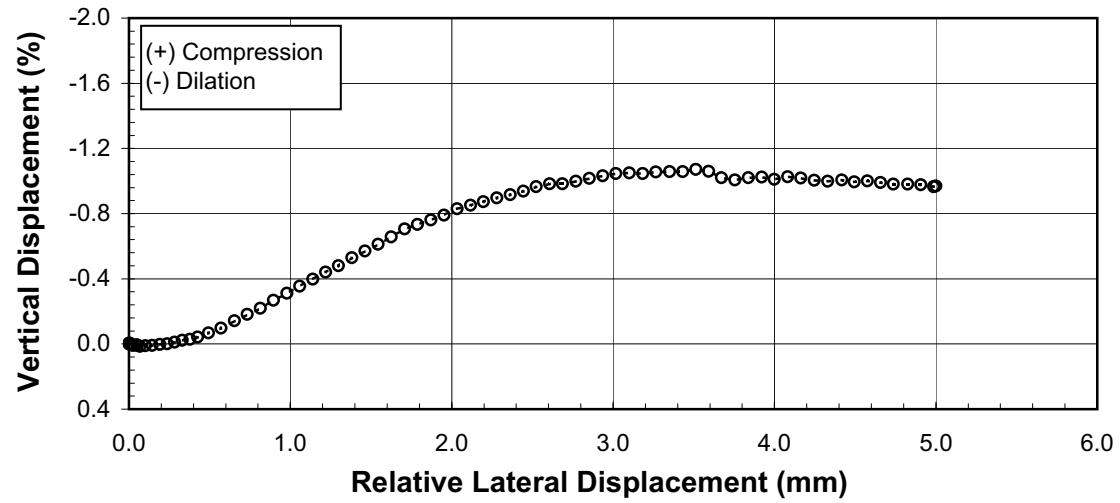
DRAINED DIRECT SHEAR TEST

Soil - Soil Interface $\sigma'_{v,c}$ = 1.05 ksf

Boring: B-4 - Sample: 9Aa - Depth: 30.0 ft

FIGURE E-5e



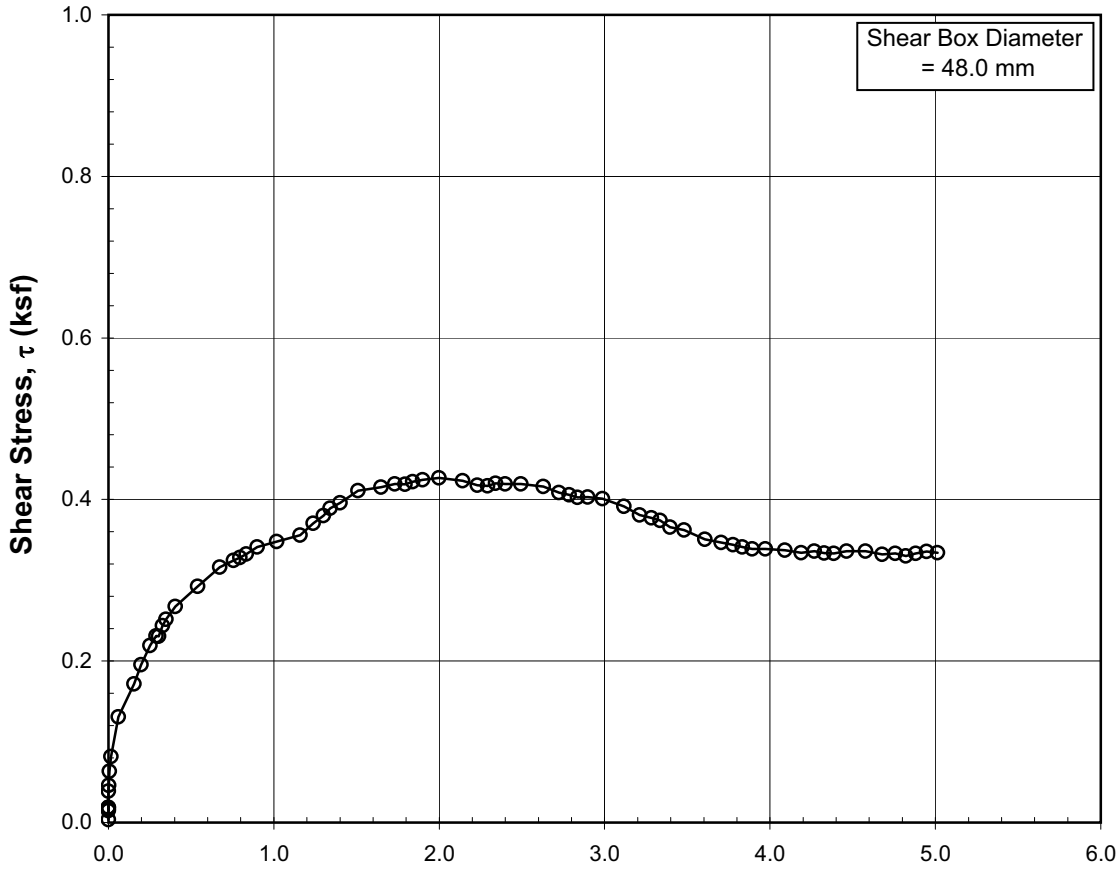


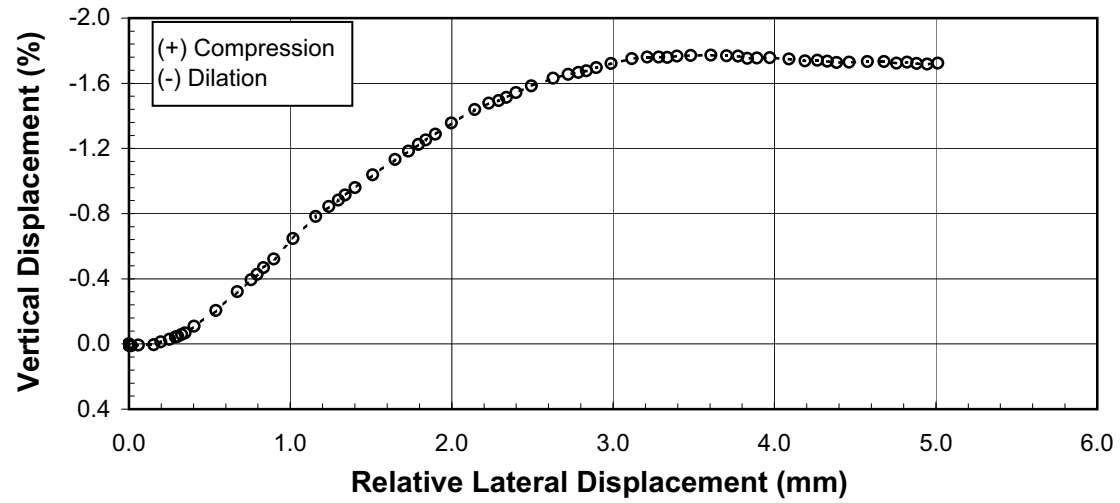
DRAINED DIRECT SHEAR TEST

Soil - Soil Interface $\sigma'_{v,c}$ = 0.90 ksf

Boring: B-4 - Sample: 9Ab - Depth: 30.0 ft

FIGURE E-5f



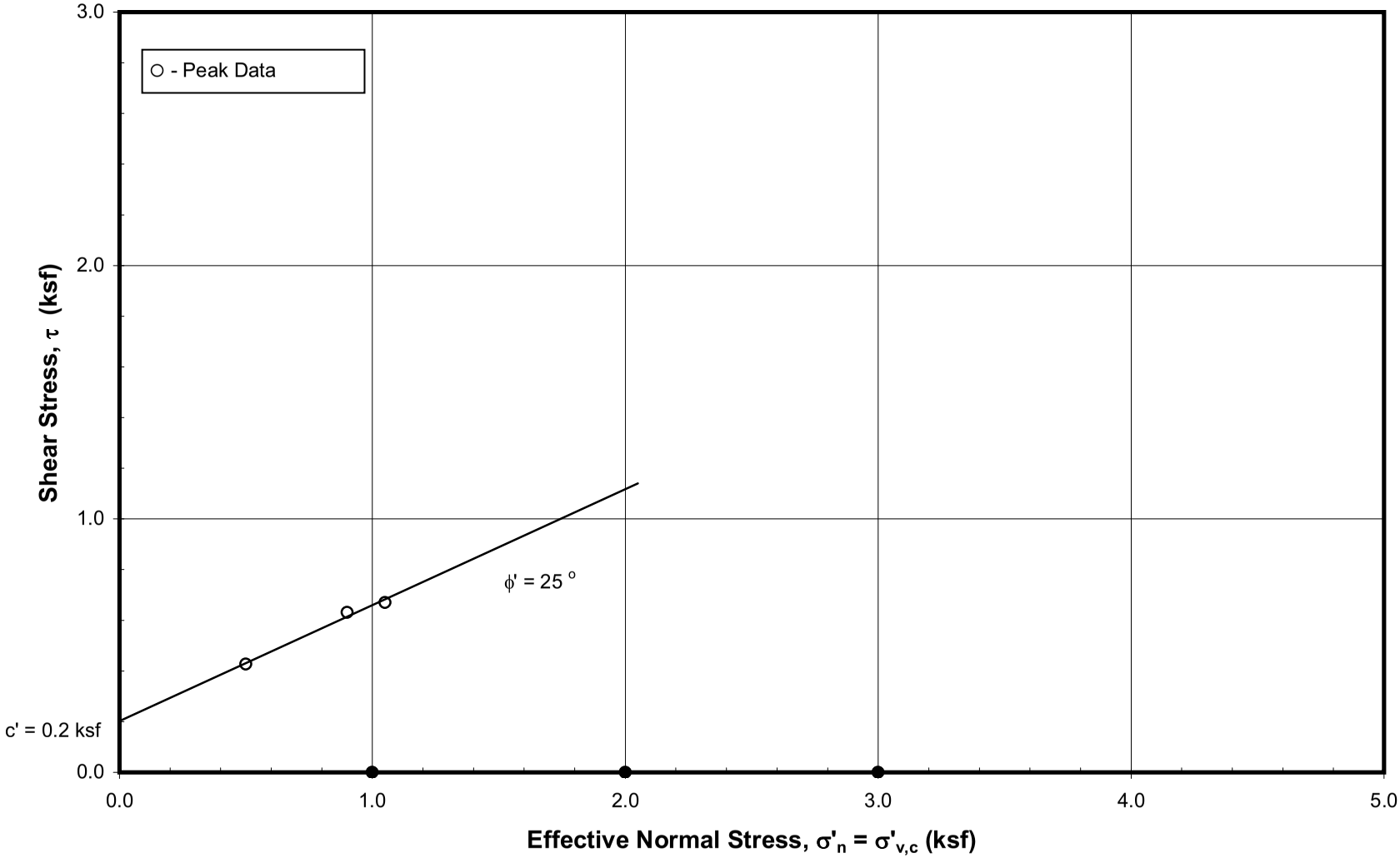


DRAINED DIRECT SHEAR TEST

Soil - Soil Interface $\sigma'_{v,c}$ = 0.50 ksf

Boring: B-4 - Sample: 9Ac - Depth: 30.0 ft

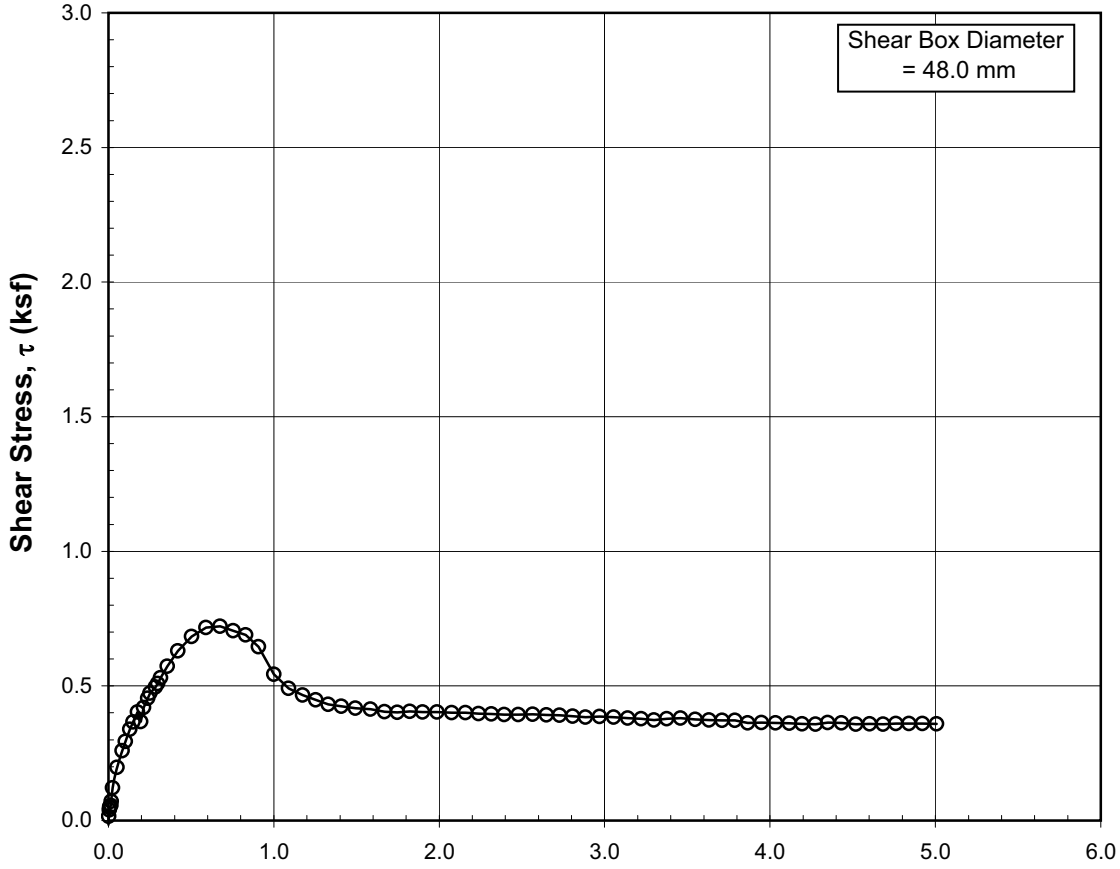
FIGURE E-5g

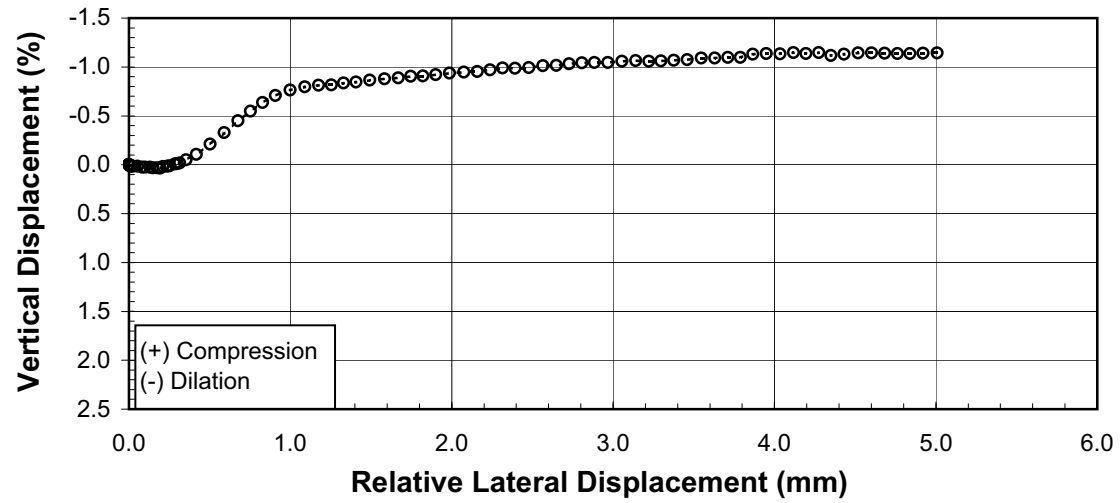


DRAINED DIRECT SHEAR TEST: Test Series - (Peak)

Soil - Soil Interface

Boring: B-4 - Sample: 9A (a,b&c) - Depth: 30.0 ft



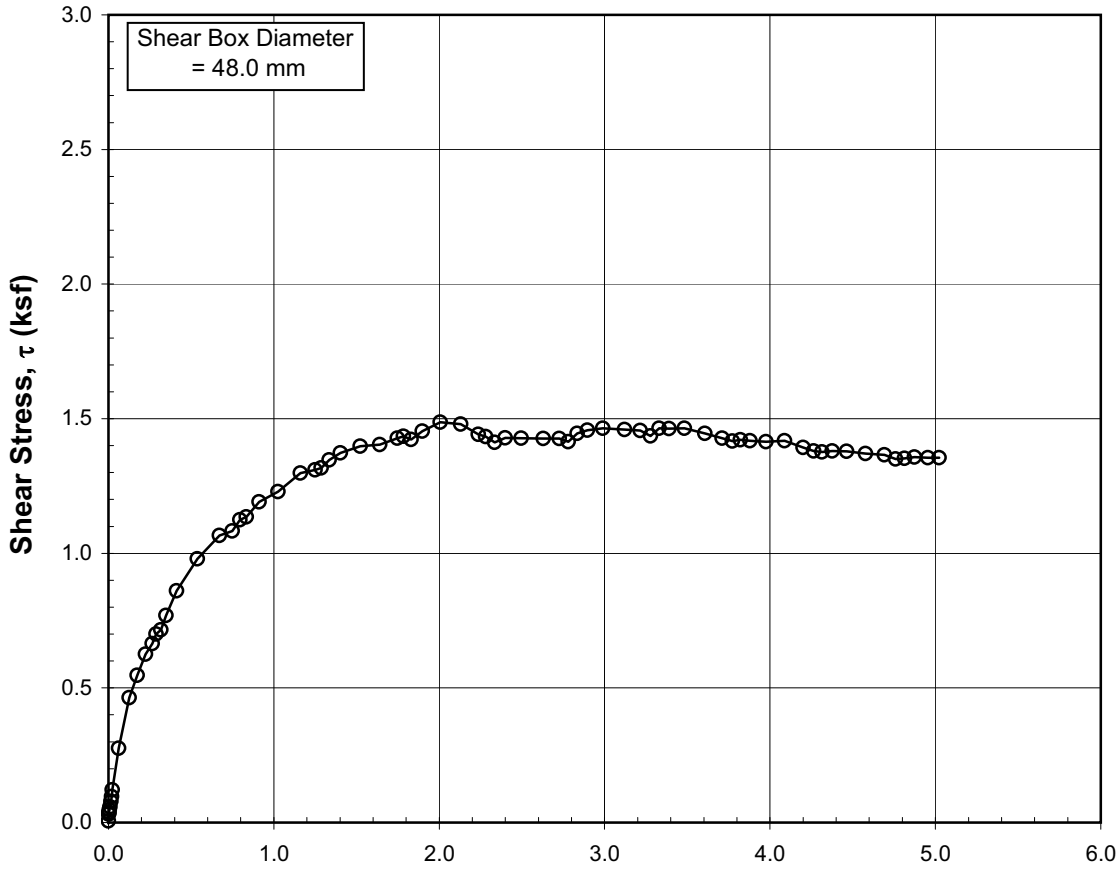


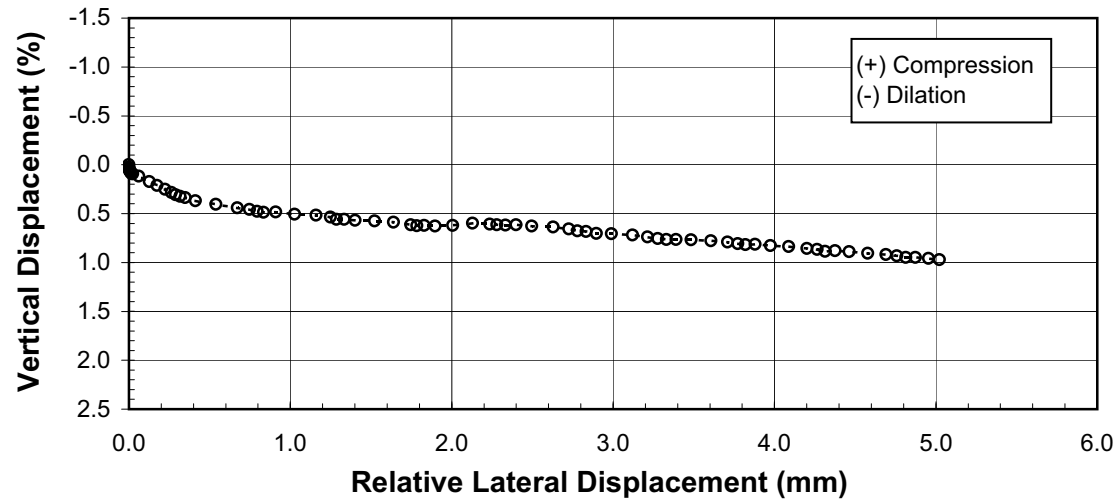
DRAINED DIRECT SHEAR TEST

Soil - Soil Interface $\sigma'_{v,c}$ = 0.59 ksf

Boring: B-5 - Sample: 15Ca - Depth: 53.5 ft

FIGURE E-5i



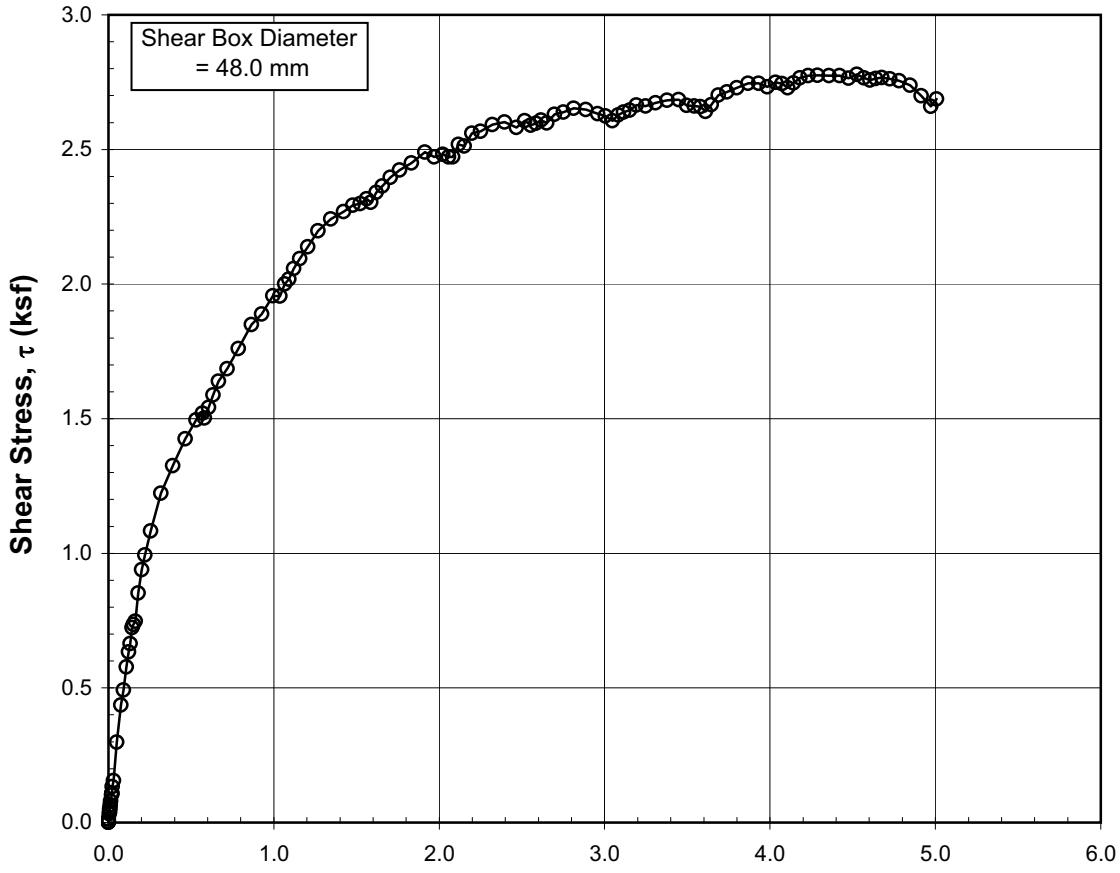


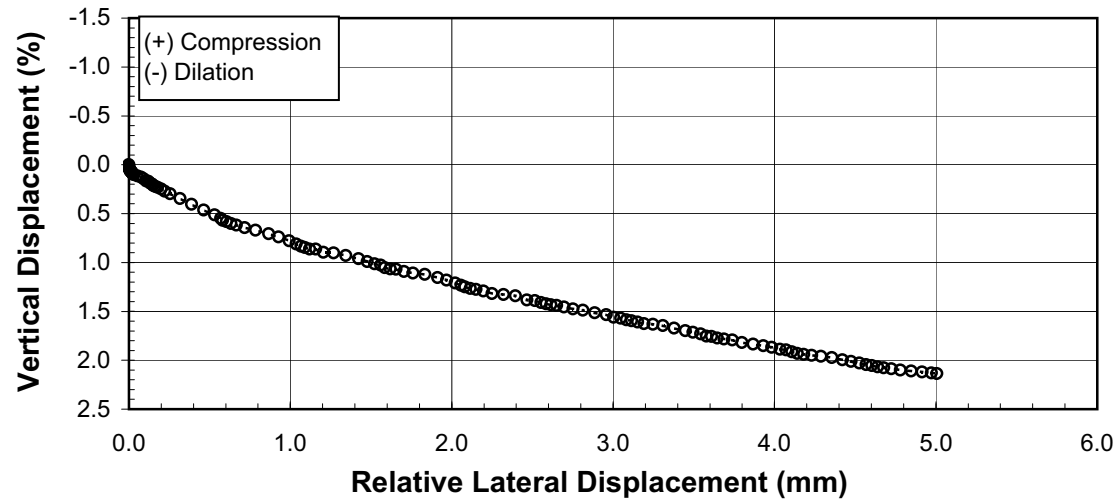
DRAINED DIRECT SHEAR TEST

Soil - Soil Interface $\sigma'_{v,c}$ = 2.30 ksf

Boring: B-5 - Sample: 15Cb - Depth: 53.5 ft

FIGURE E-5j



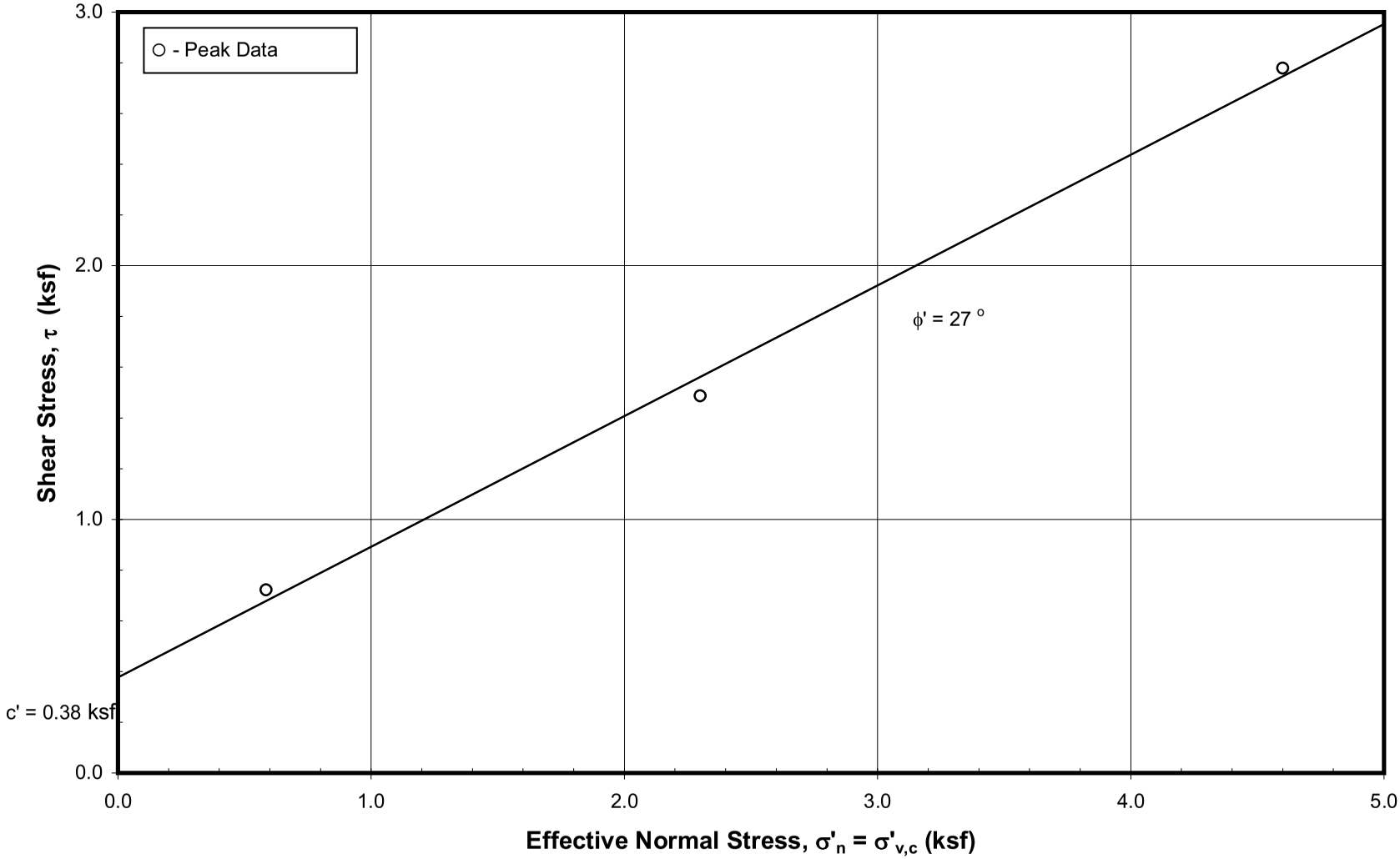


DRAINED DIRECT SHEAR TEST

Soil - Soil Interface $\sigma'_{v,c}$ = 4.60 ksf

Boring: B-5 - Sample: 15Cc - Depth: 53.5 ft

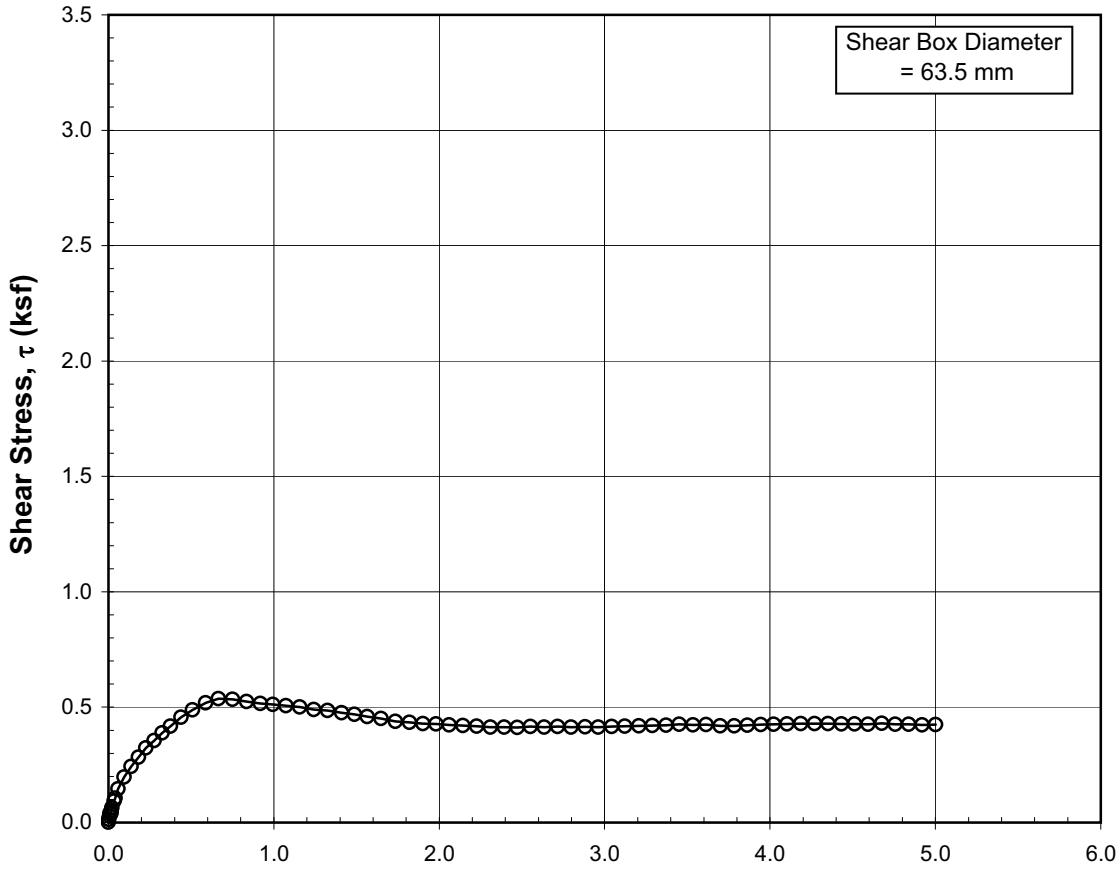
FIGURE E-5k

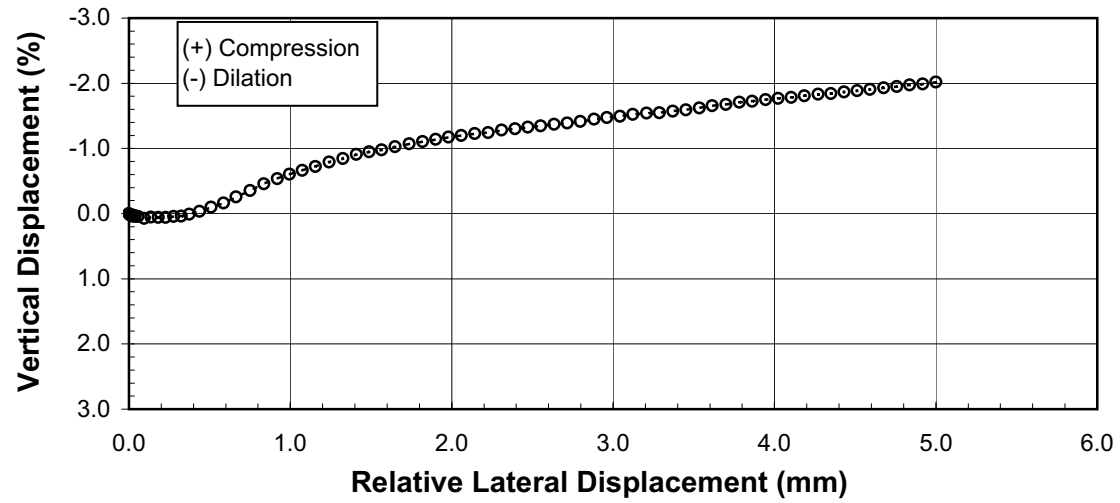


DRAINED DIRECT SHEAR TEST: Test Series - (Peak)

Soil - Soil Interface

Boring: B-5 - Sample: 15C (a,b&c) - Depth: 53.5 ft



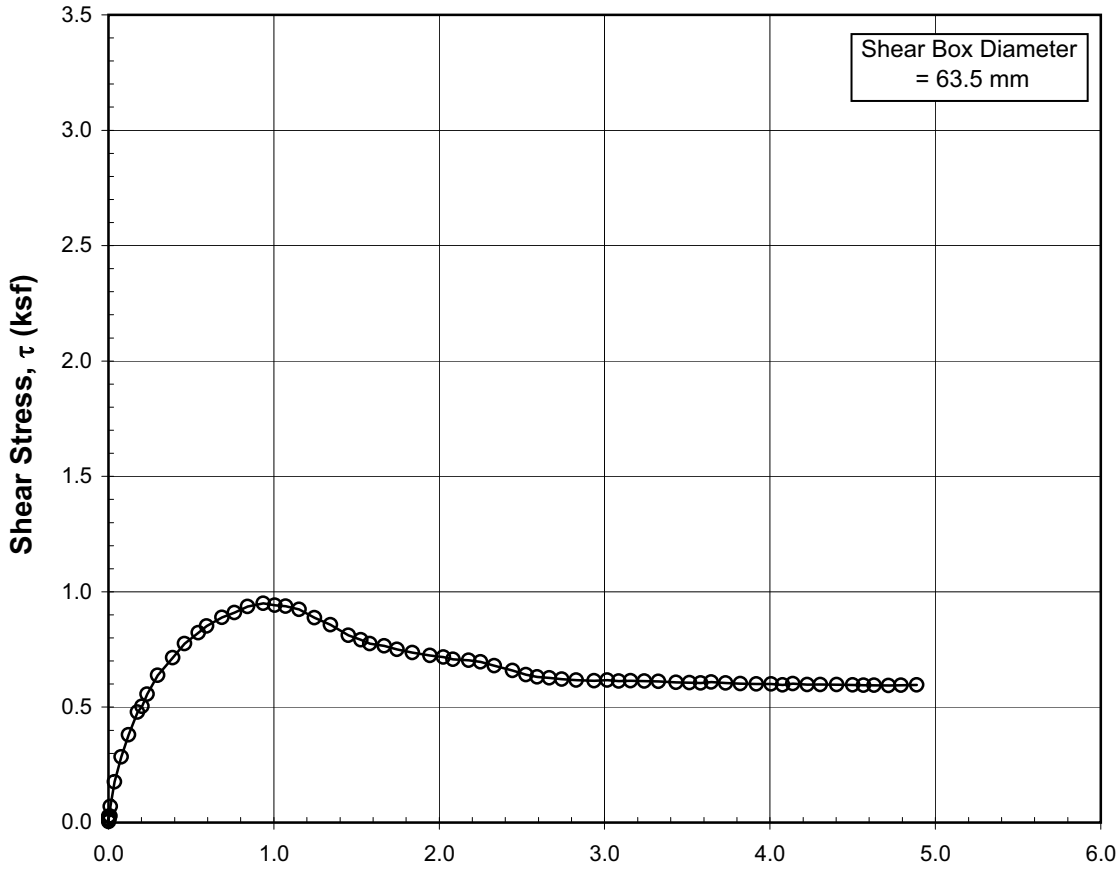


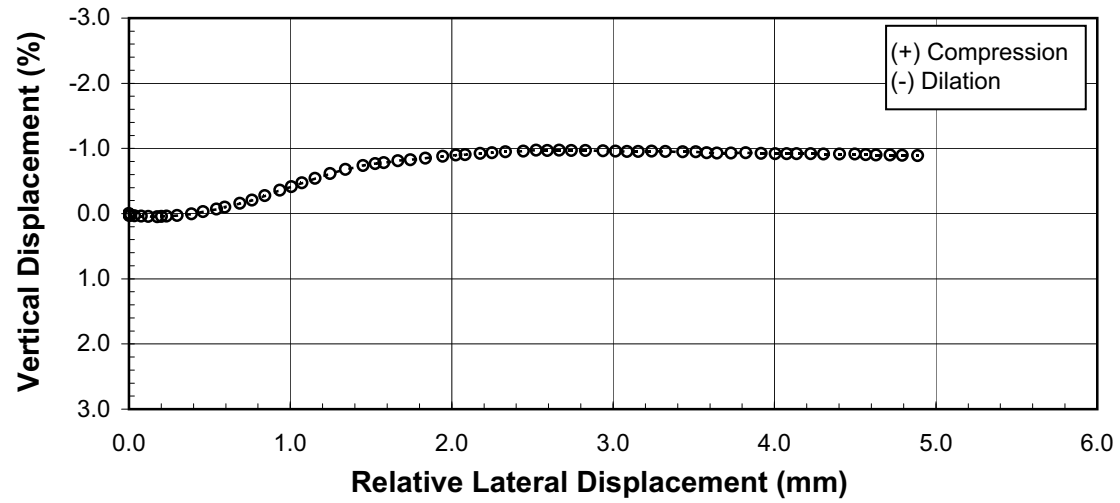
DRAINED DIRECT SHEAR TEST

Soil - Soil Interface $\sigma'_{v,c}$ = 0.49 ksf

Boring: B-8 - Sample: 18Ca - Depth: 69.3 ft

FIGURE E-5m



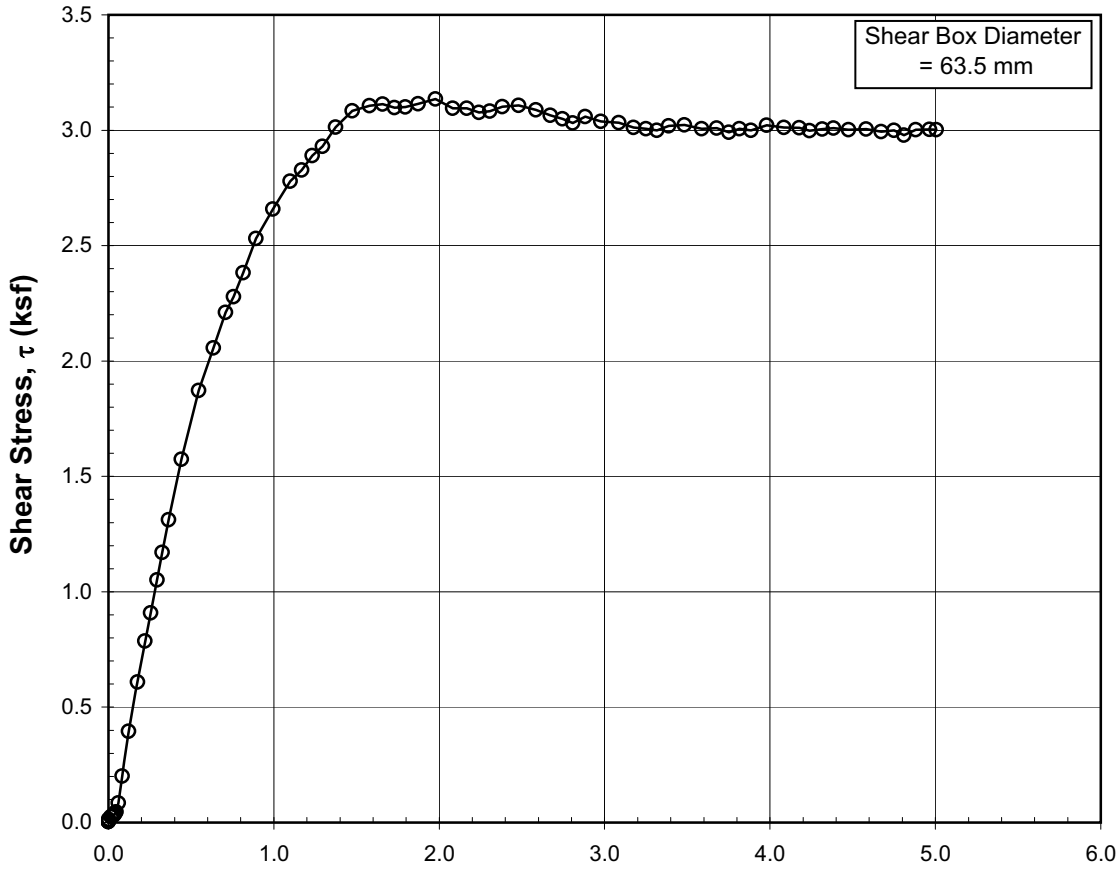


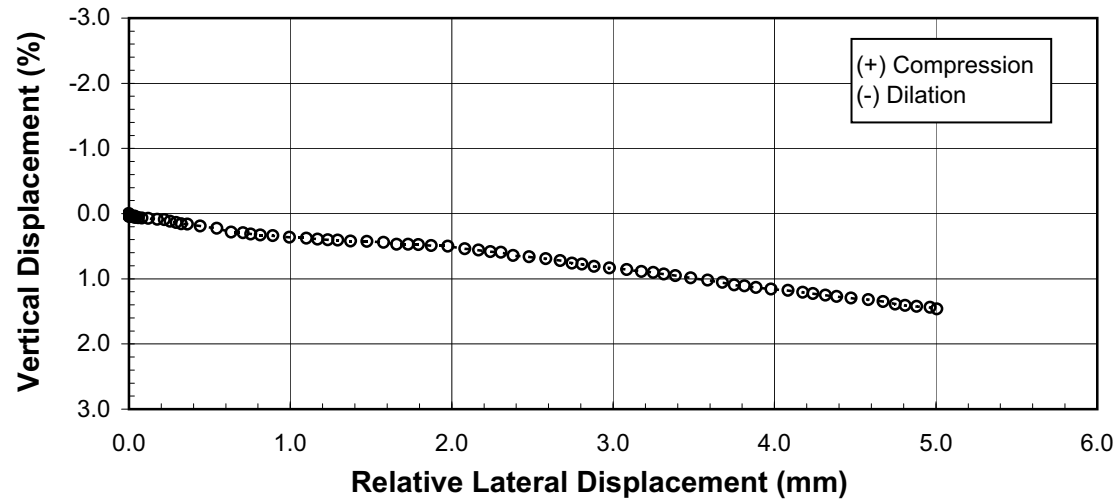
DRAINED DIRECT SHEAR TEST

Soil - Soil Interface $\sigma'_{v,c}$ = 0.98 ksf

Boring: B-8 - Sample: 18Cb - Depth: 69.3 ft

FIGURE E-5n



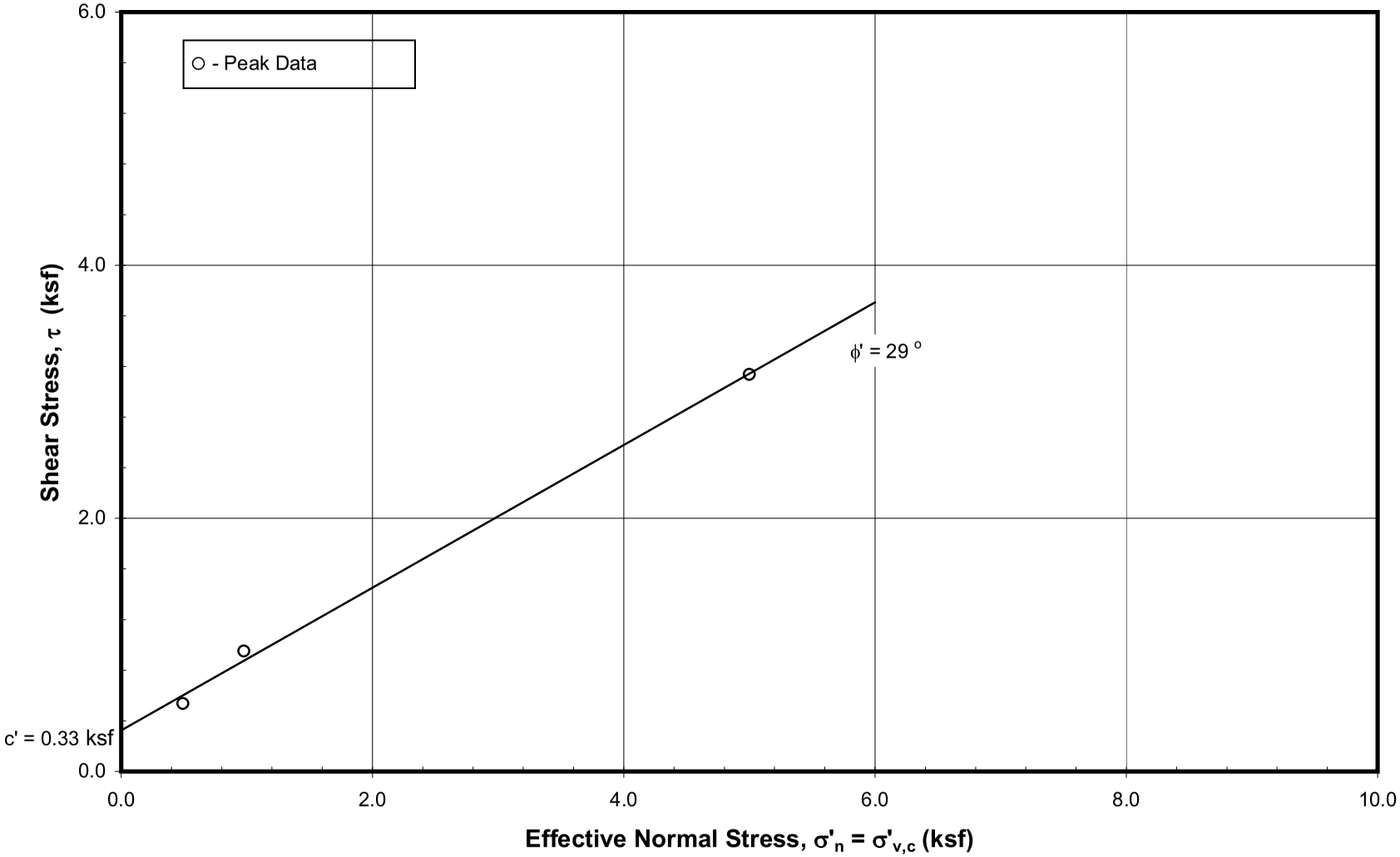


DRAINED DIRECT SHEAR TEST

Soil - Soil Interface $\sigma'_{v,c}$ = 5.00 ksf

Boring: B-8 - Sample: 18Cc - Depth: 69.3 ft

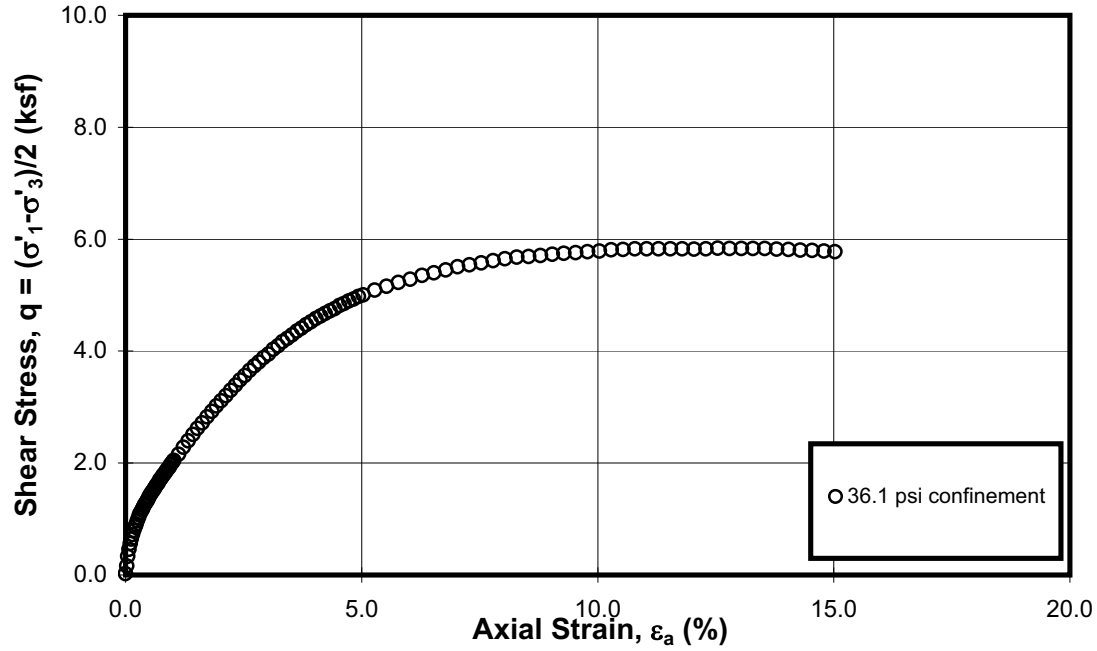
FIGURE E-5o

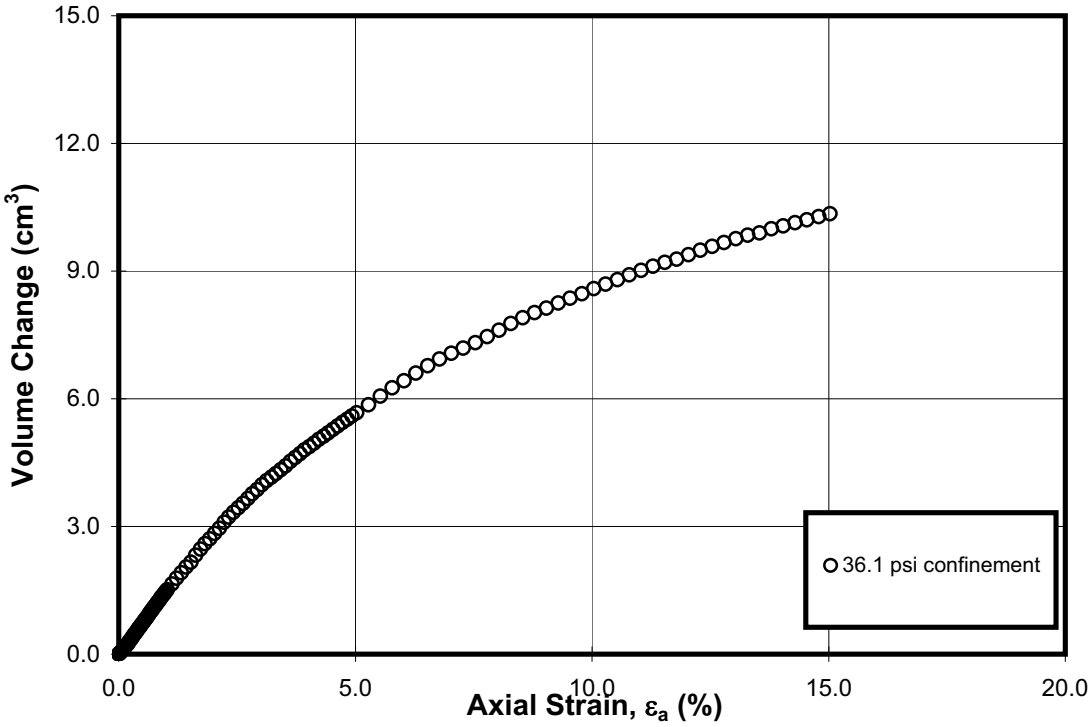


DRAINED DIRECT SHEAR TEST: Test Series - (Peak)

Soil - Soil Interface

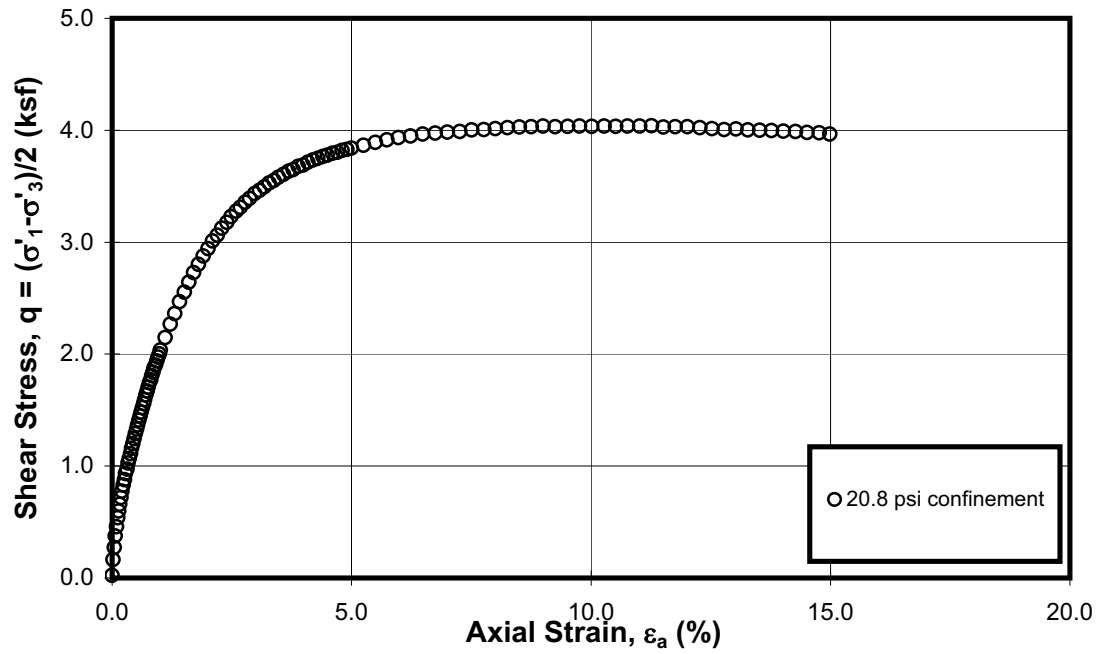
Boring: B-8 - Sample: 18C (a,b&c) - Depth: 69.3 ft

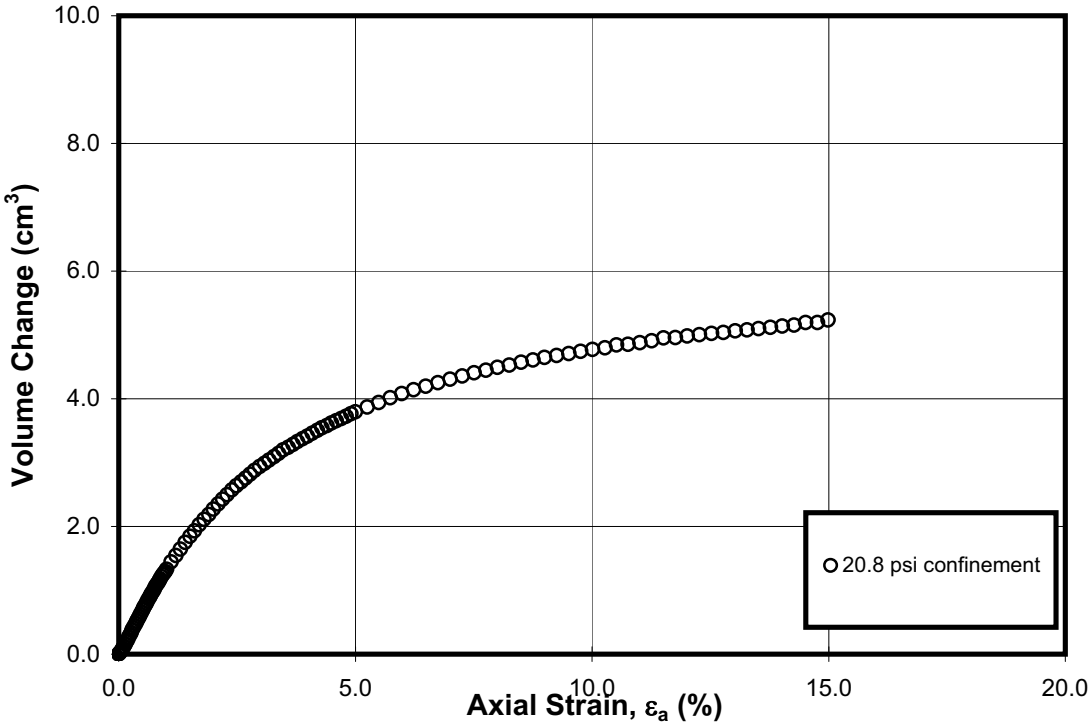




DRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: 16C - Depth: 58.4 ft
Boring B-3

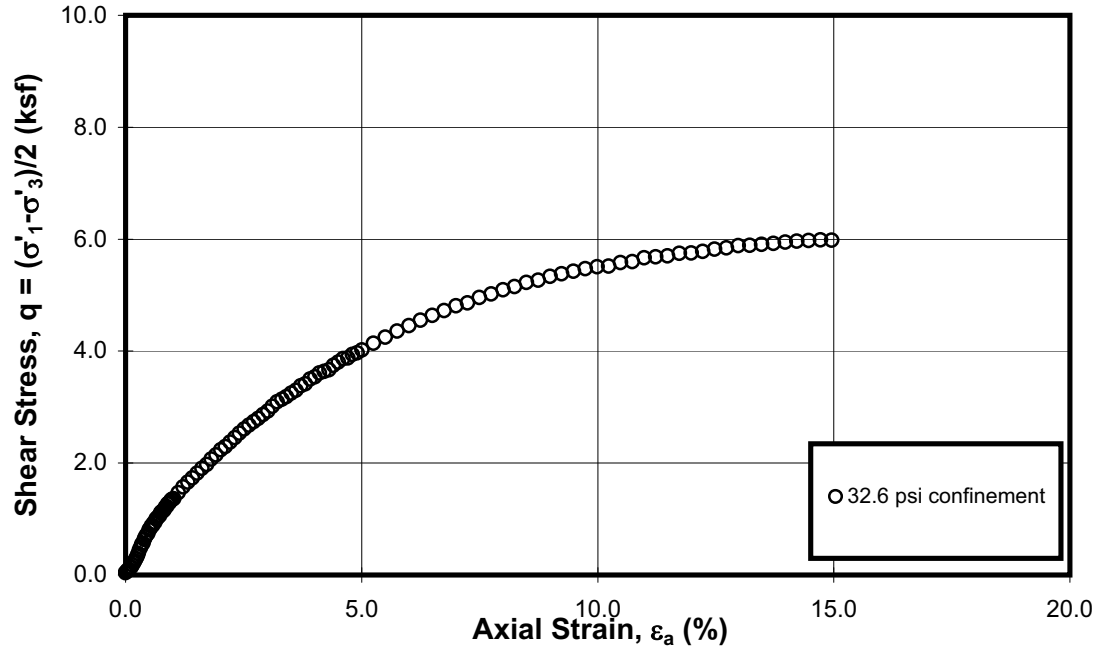
FIGURE E-6a

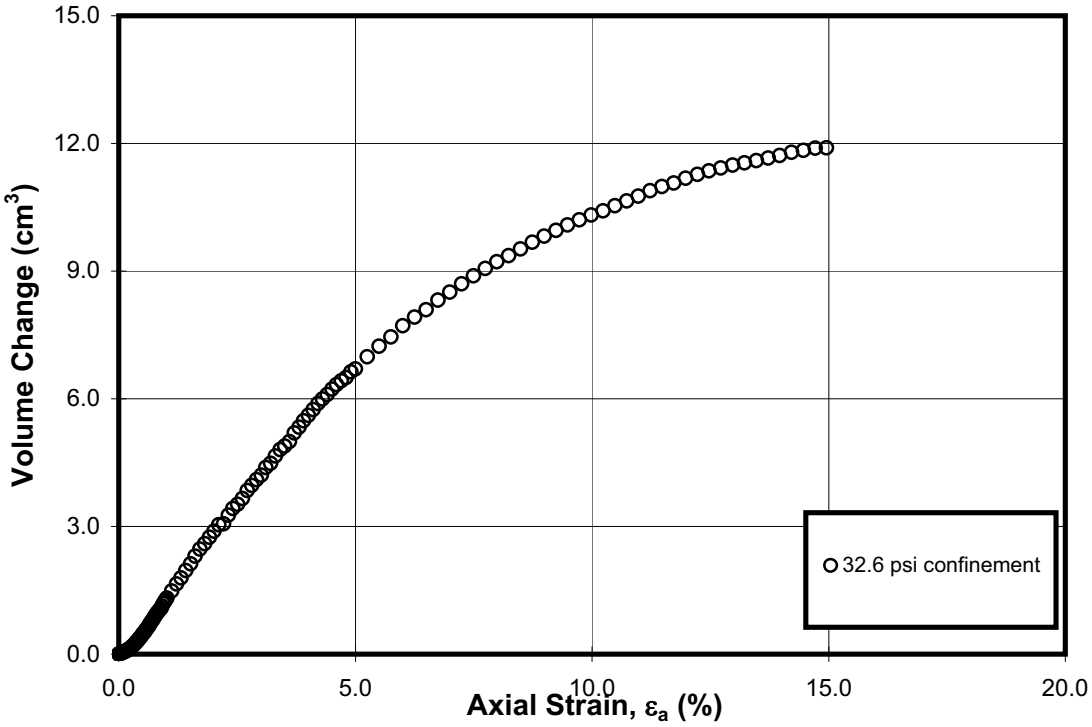




DRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: 18B - Depth: 74.2 ft
Boring B-6

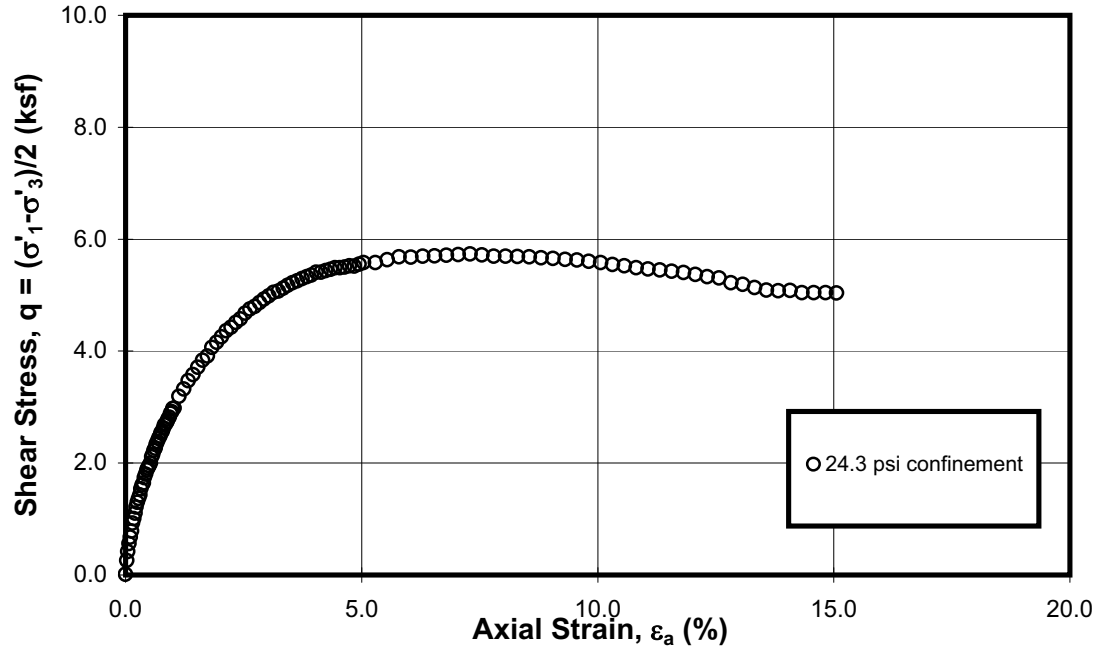
FIGURE E-6b

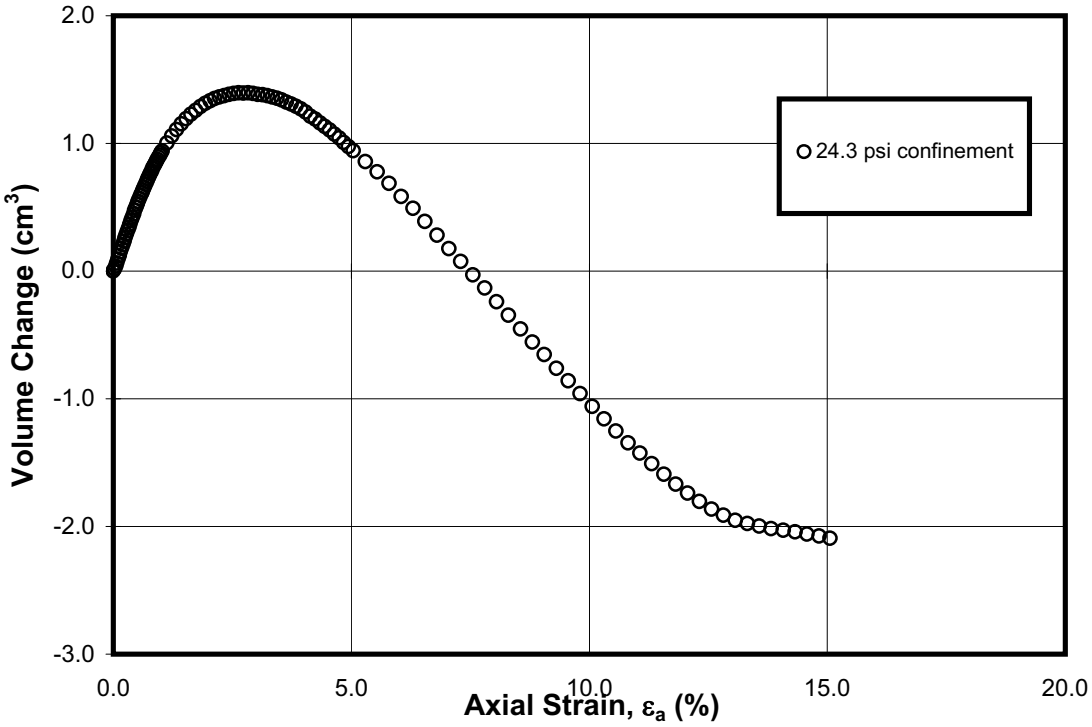




DRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: 22A - Depth: 87.4 ft
Boring B-9

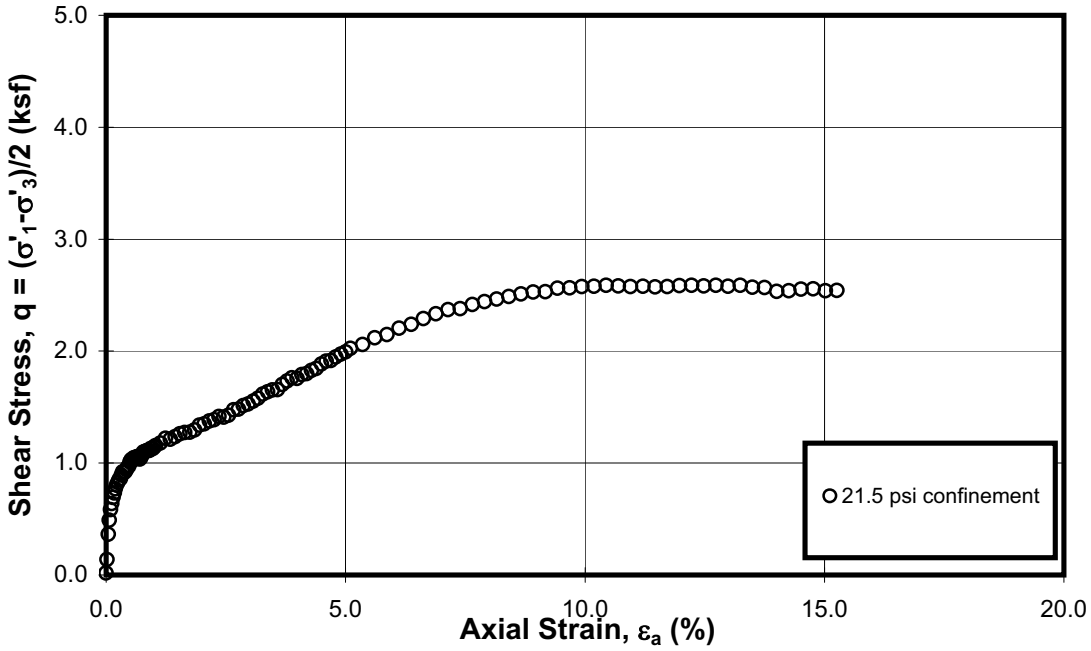
FIGURE E-6c

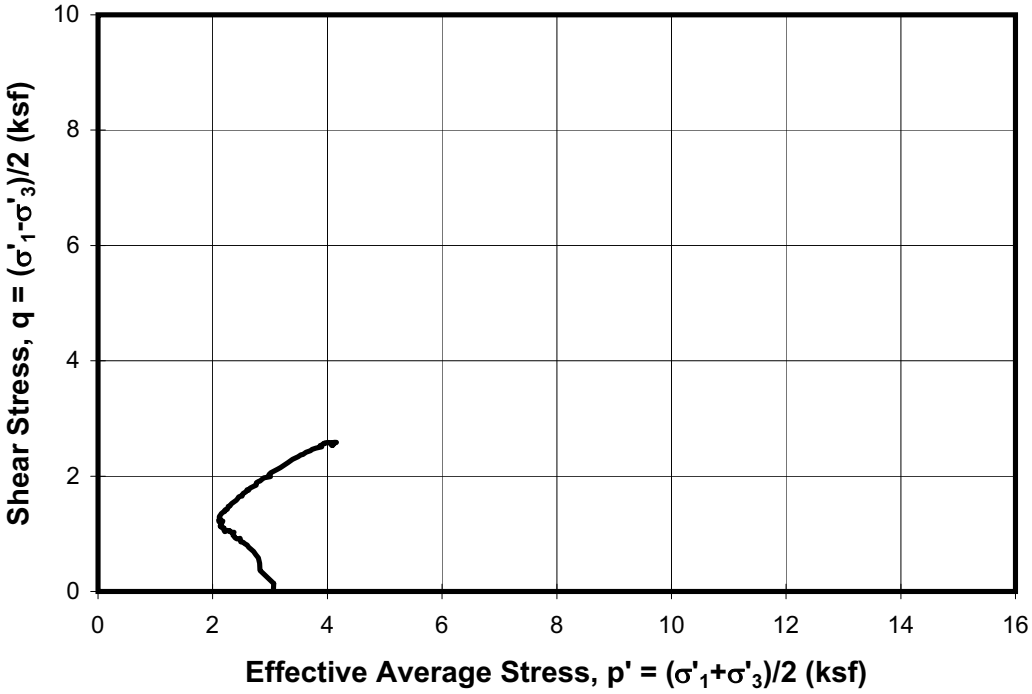




DRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: 17B - Depth: 63.8 ft
Boring B-11

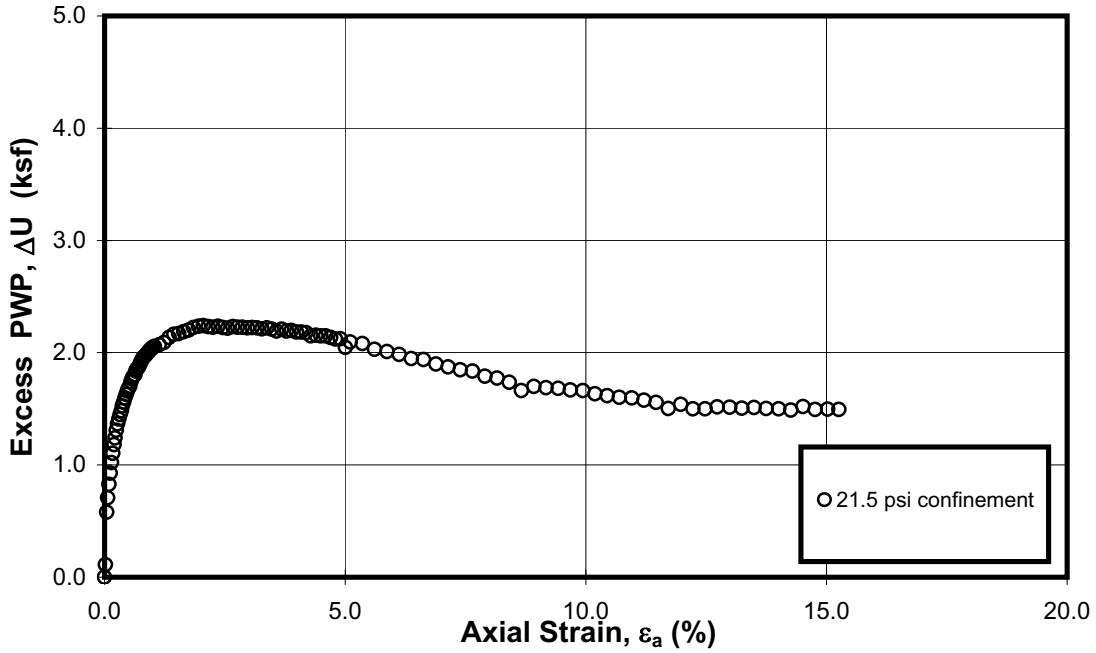
FIGURE E-6d

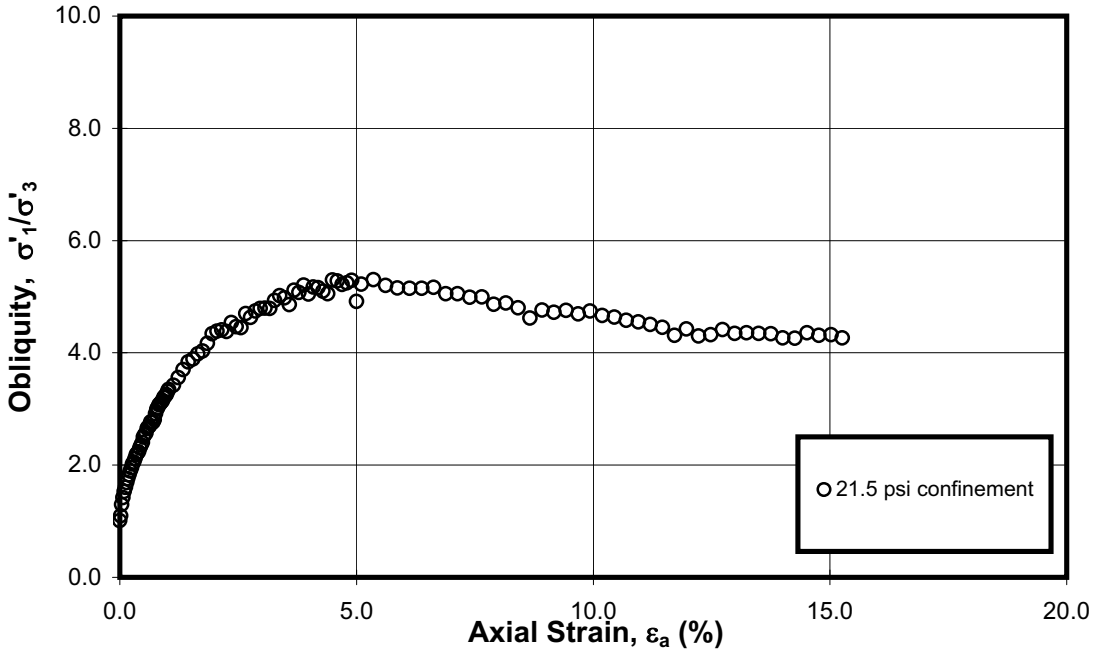




UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: 18A - Depth: 67.3 ft
Boring B-1

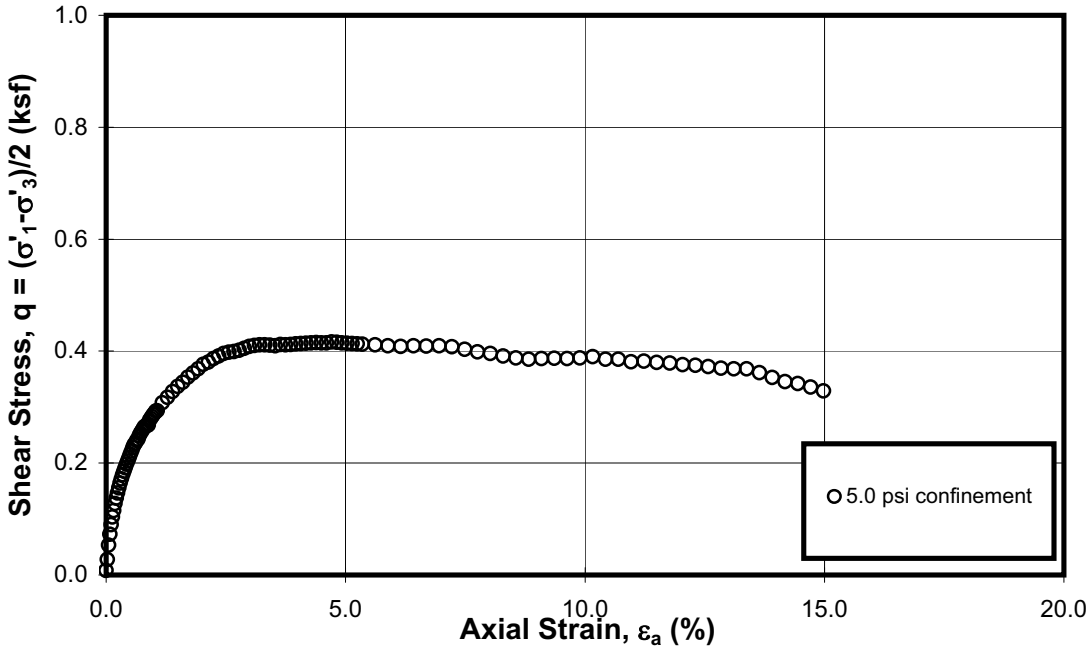
FIGURE E-7a

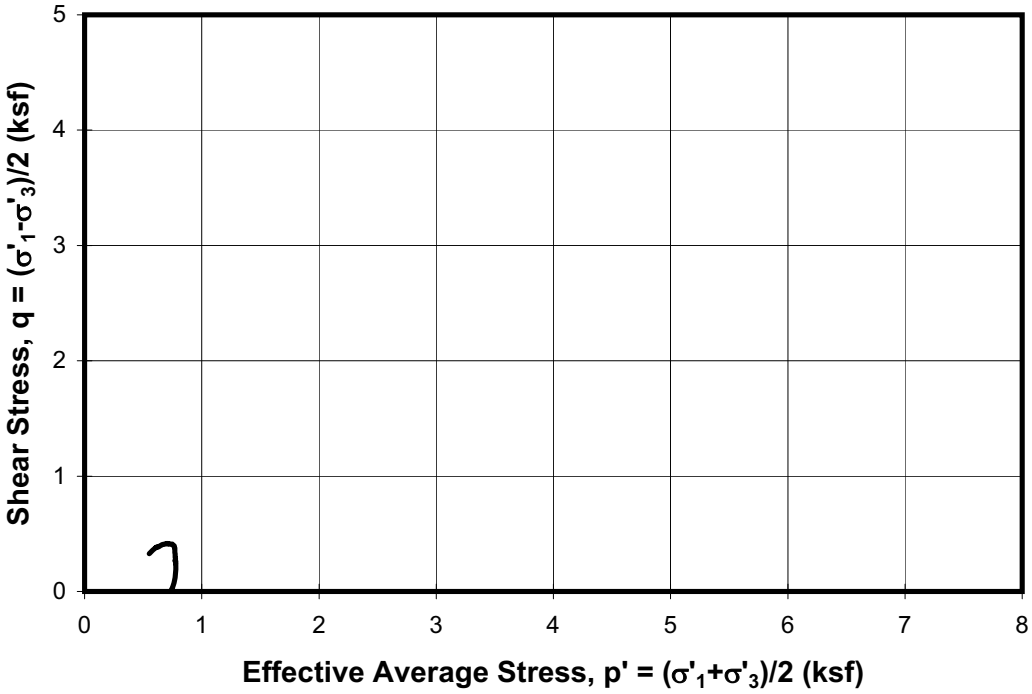




UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: 18A - Depth: 67.3 ft
Boring B-1

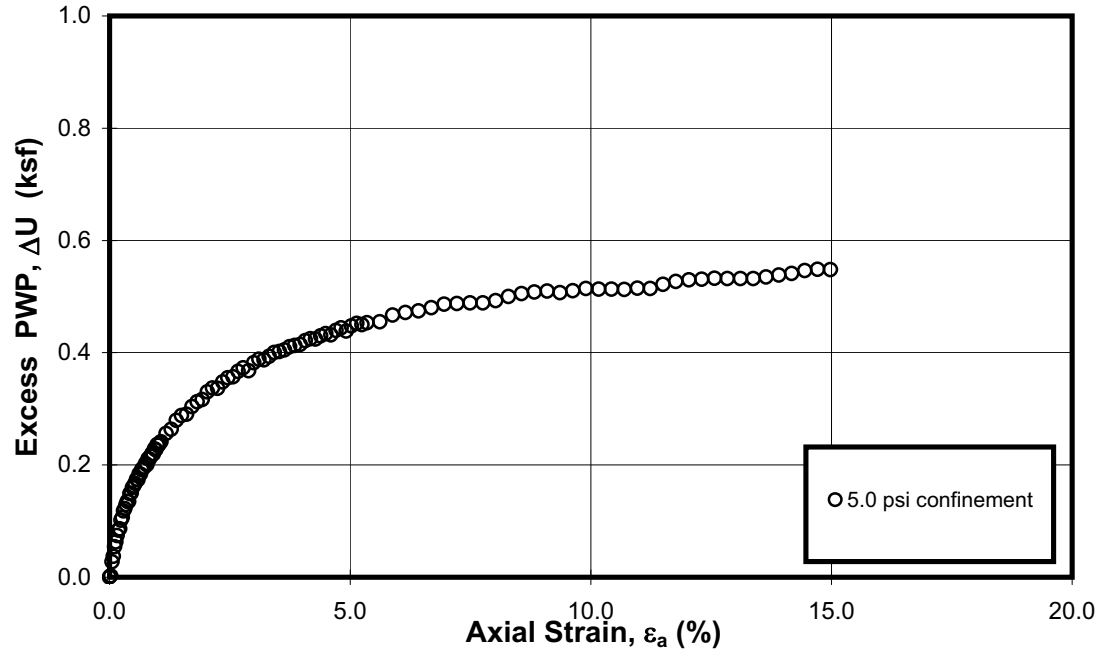
FIGURE E-7b

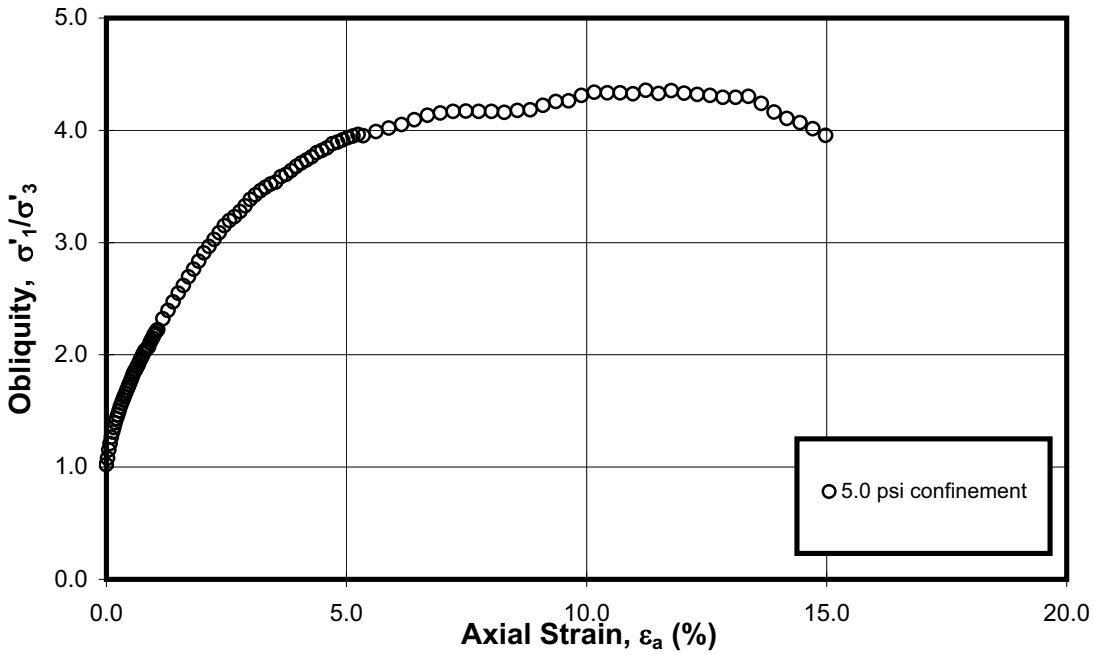




UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: 4B - Depth: 11.3 ft
Boring B-3

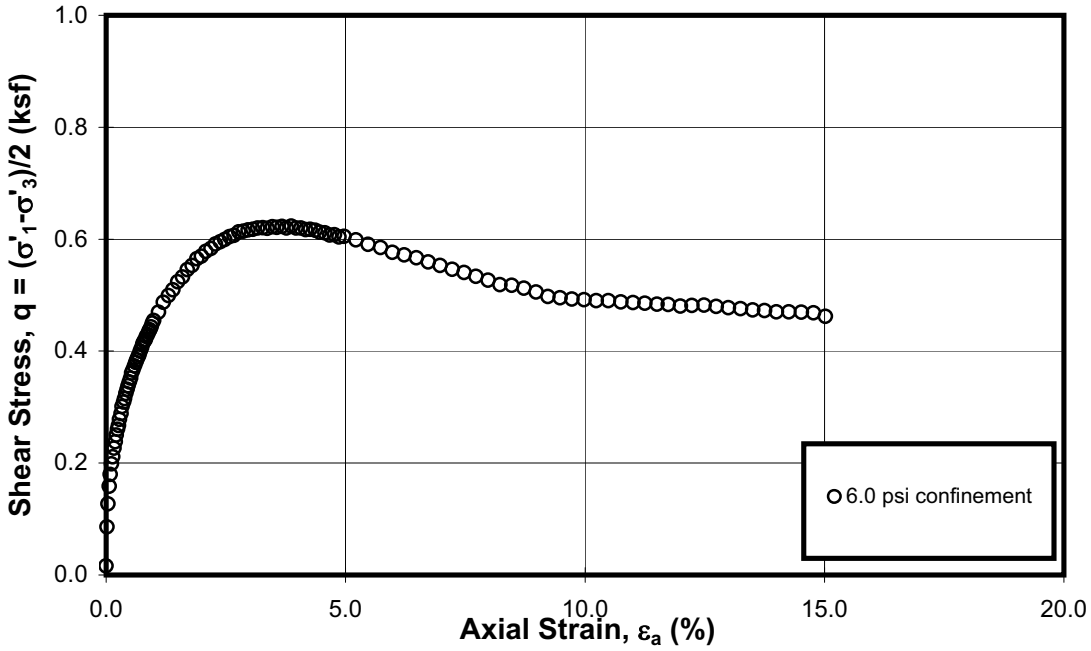
FIGURE E-7c

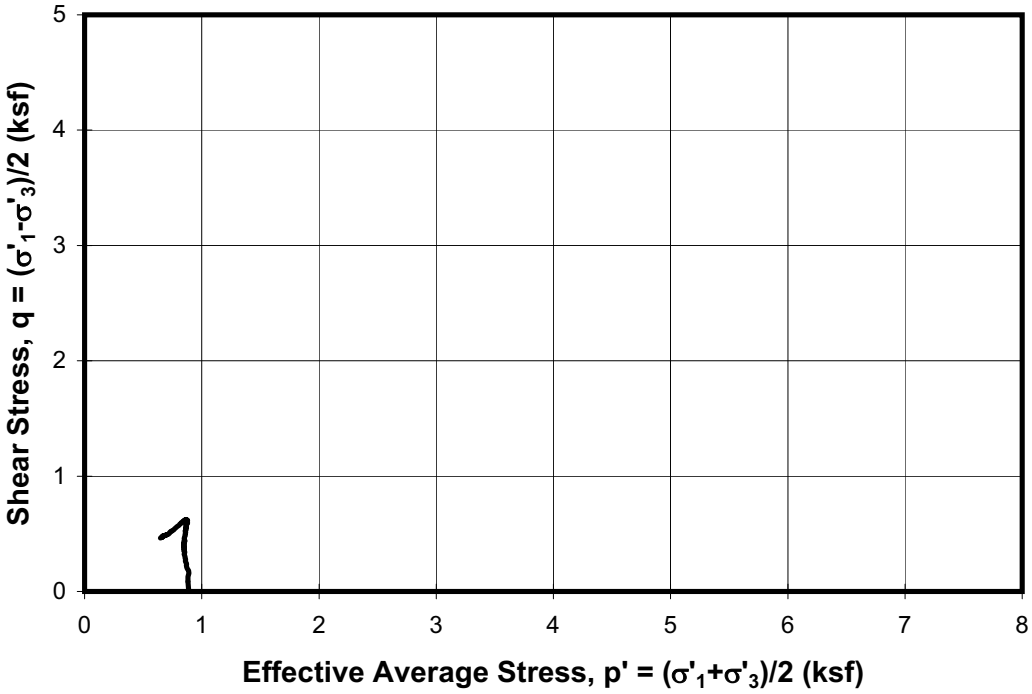




UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: 4B - Depth: 11.3 ft
Boring B-3

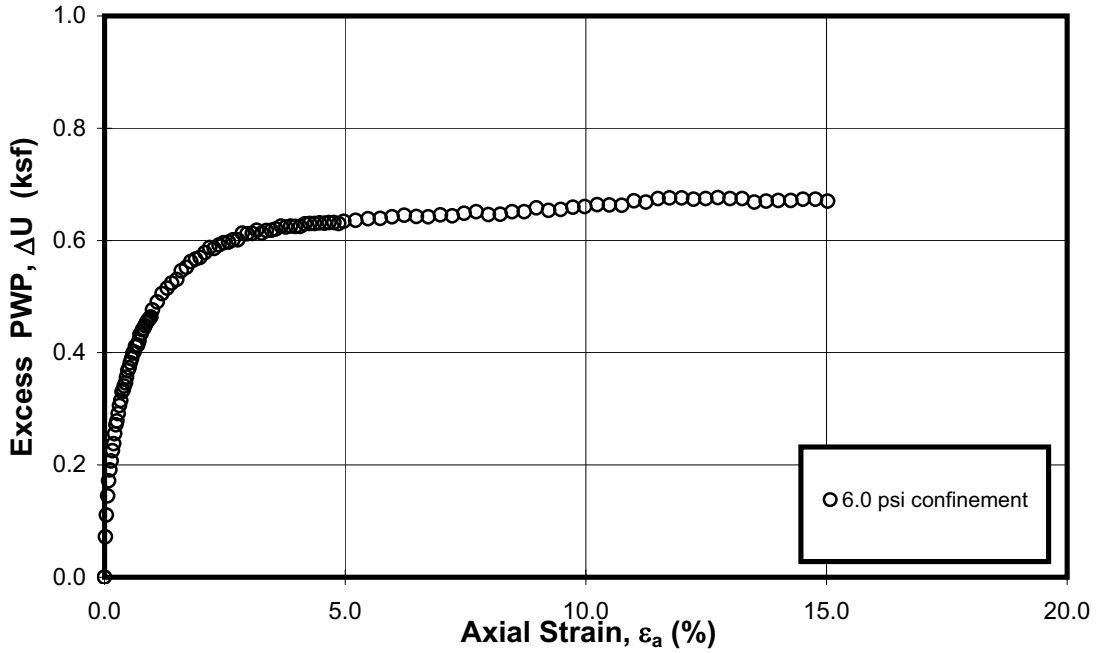
FIGURE E-7d

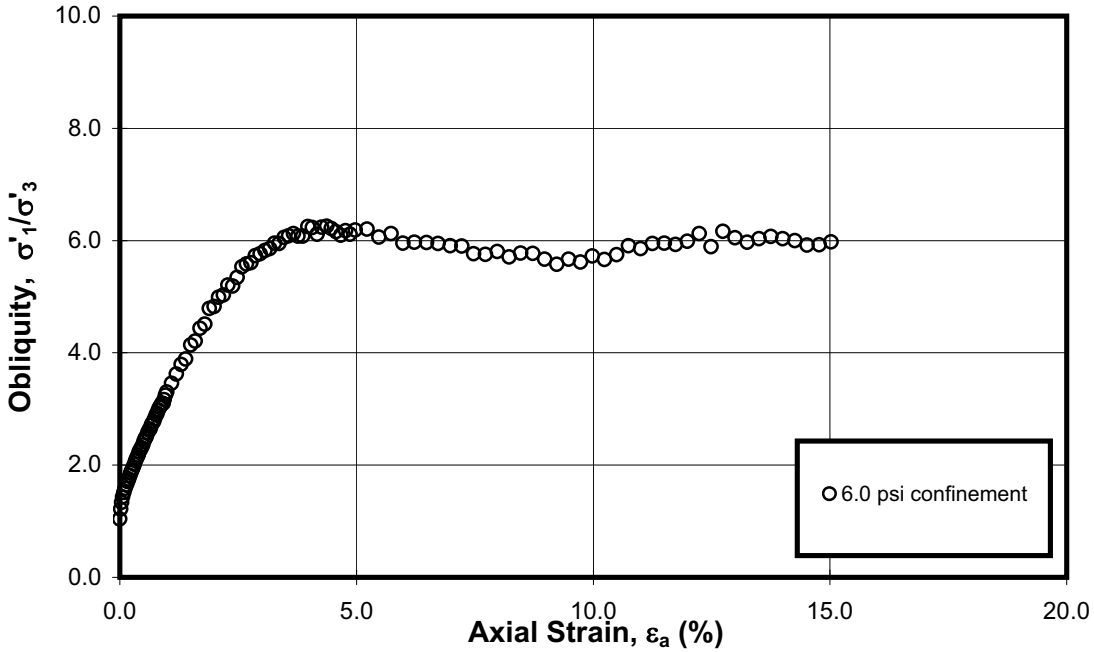




UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: 5A - Depth: 13.8 ft
Boring B-5

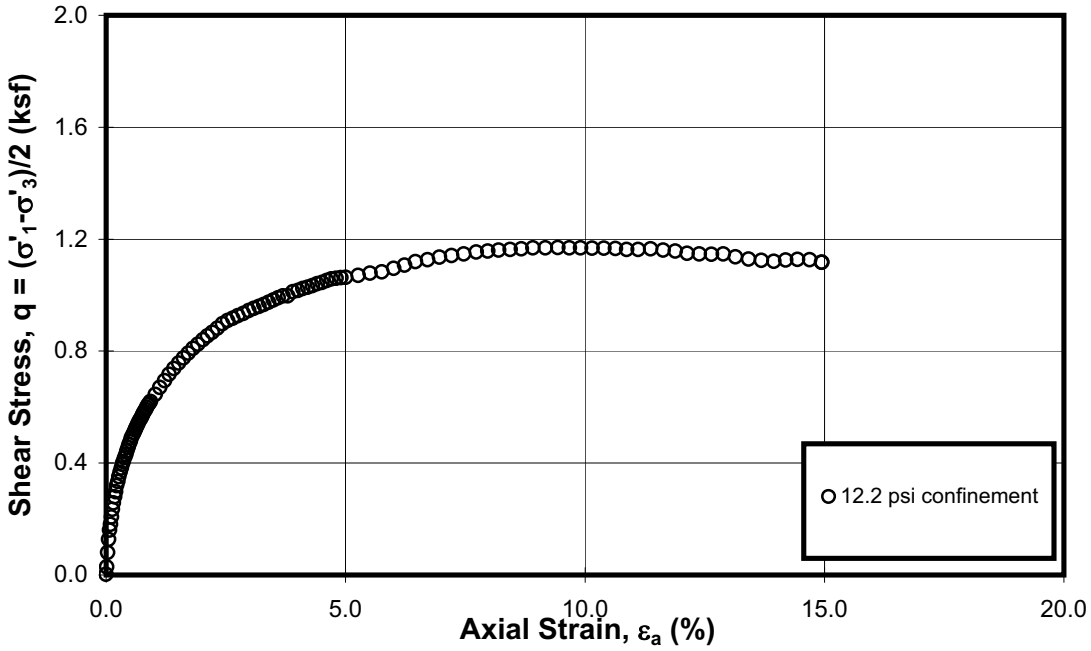
FIGURE E-7e

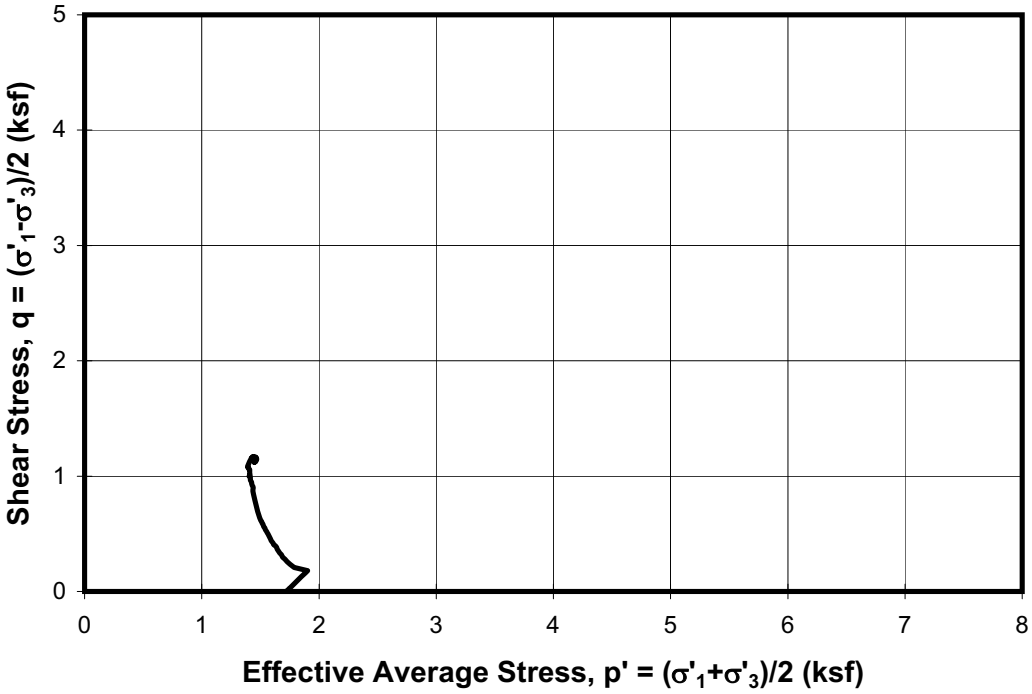




UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: 5A - Depth: 13.8 ft
Boring B-5

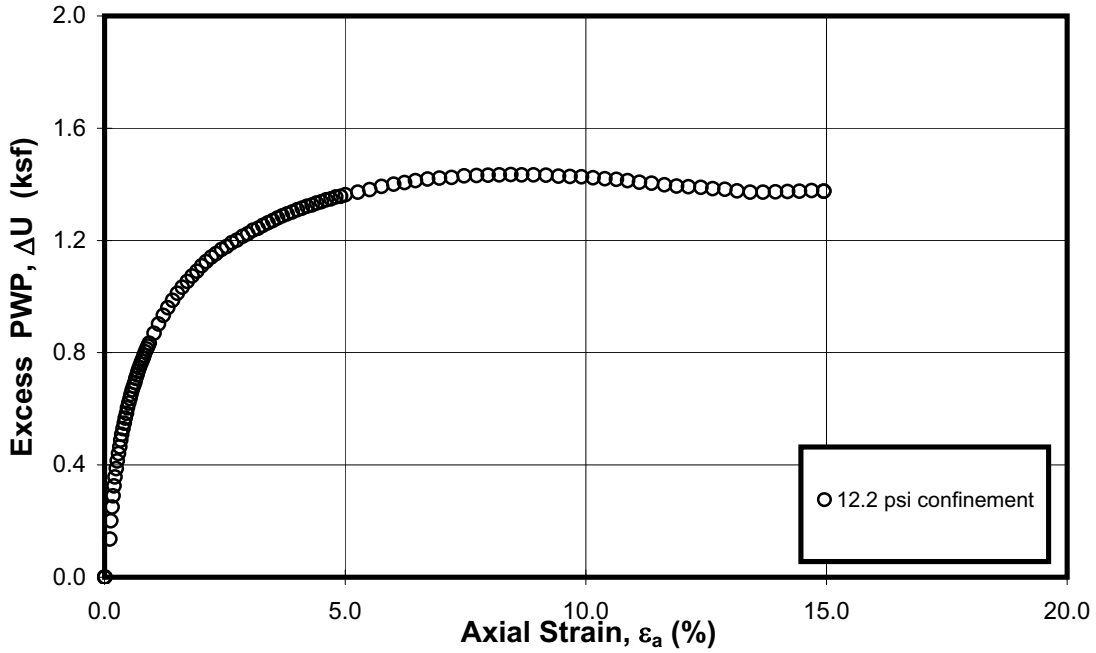
FIGURE E-7f

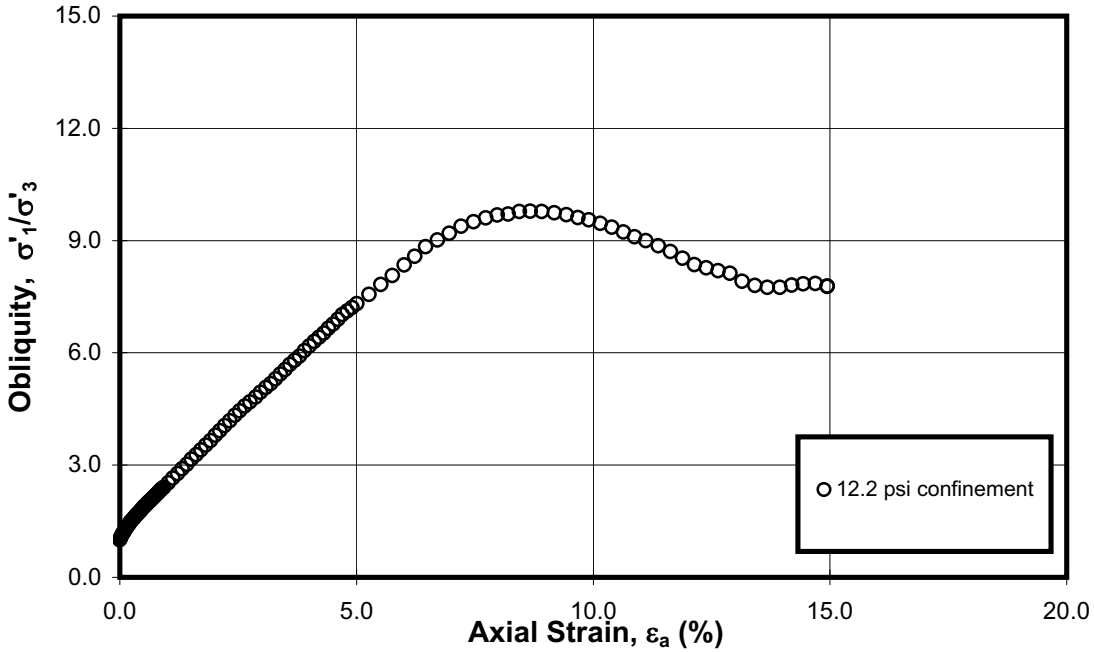




UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: 9A - Depth: 27.7 ft
Boring B-5

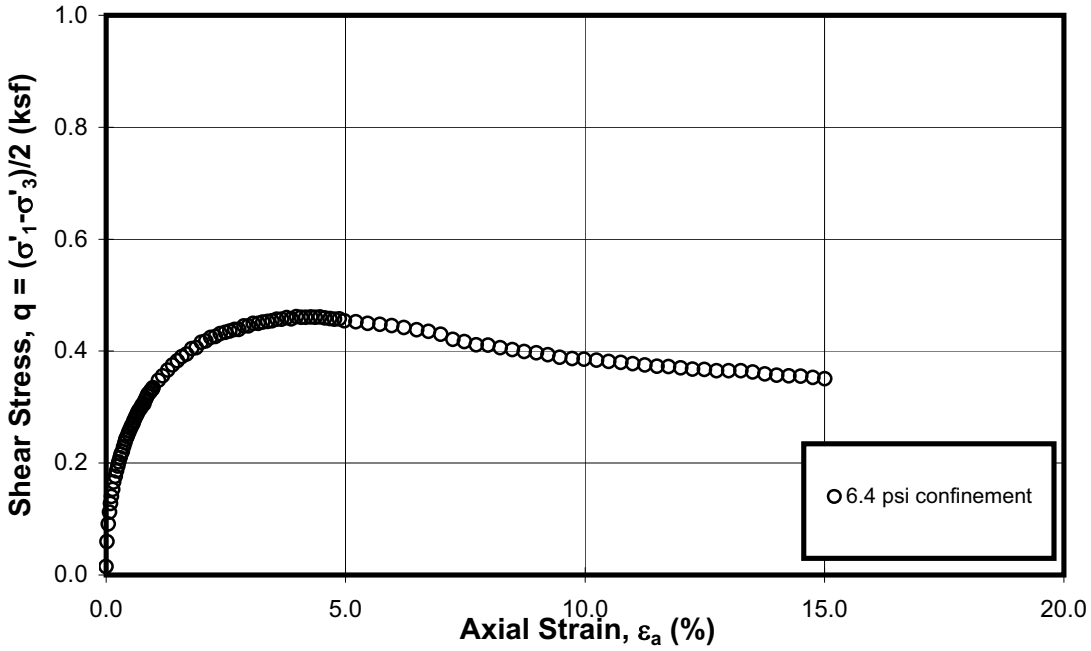
FIGURE E-7g

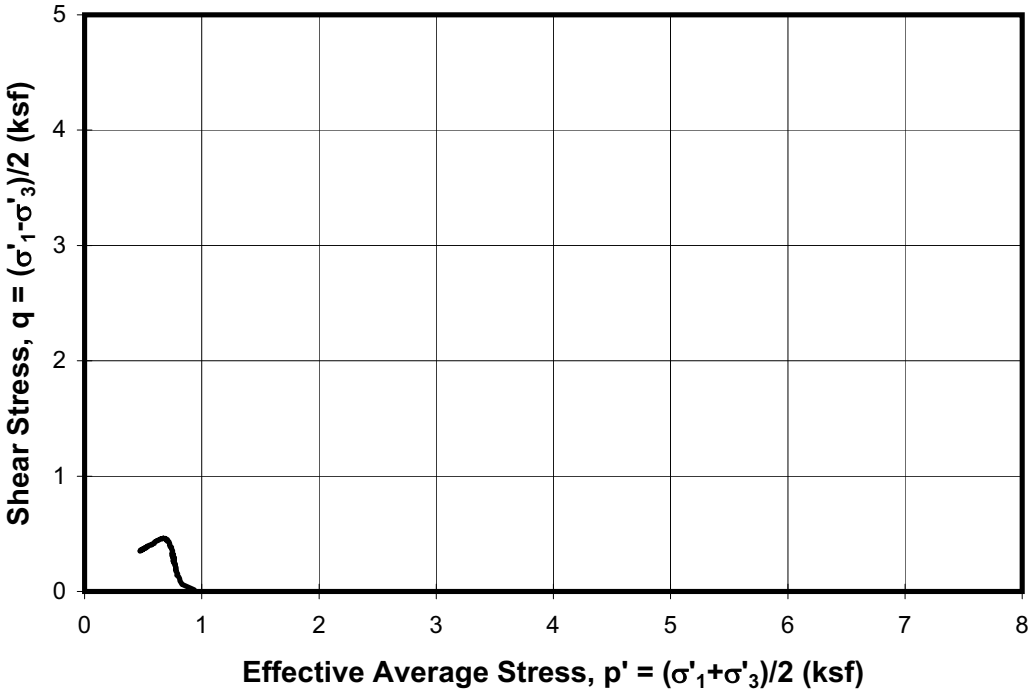




UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: 9A - Depth: 27.7 ft
Boring B-5

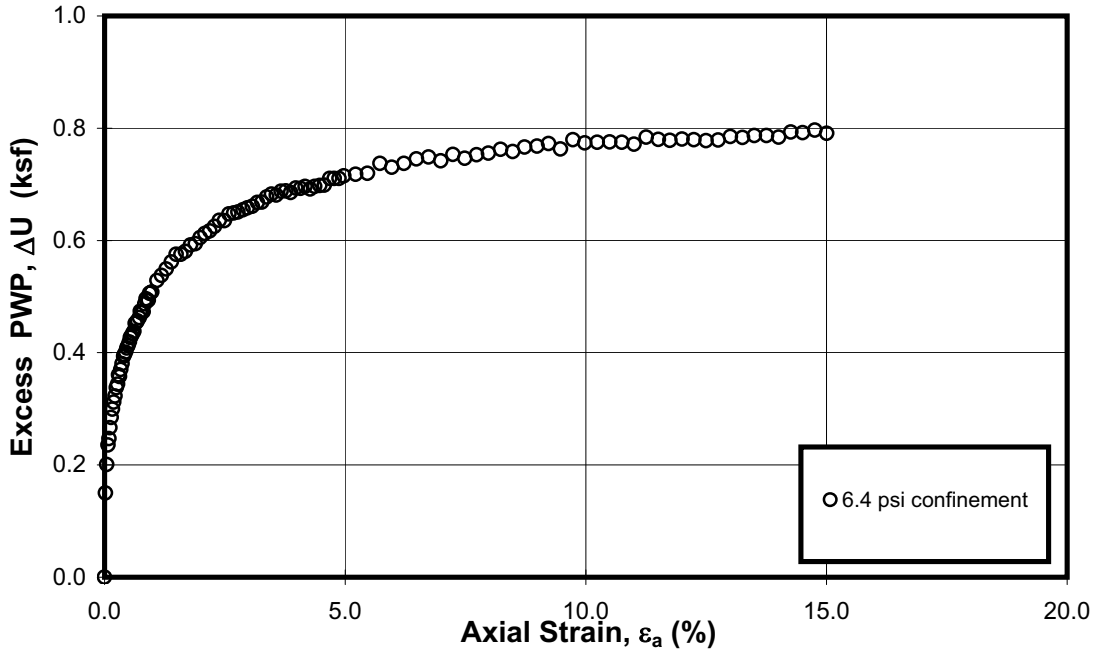
FIGURE E-7h

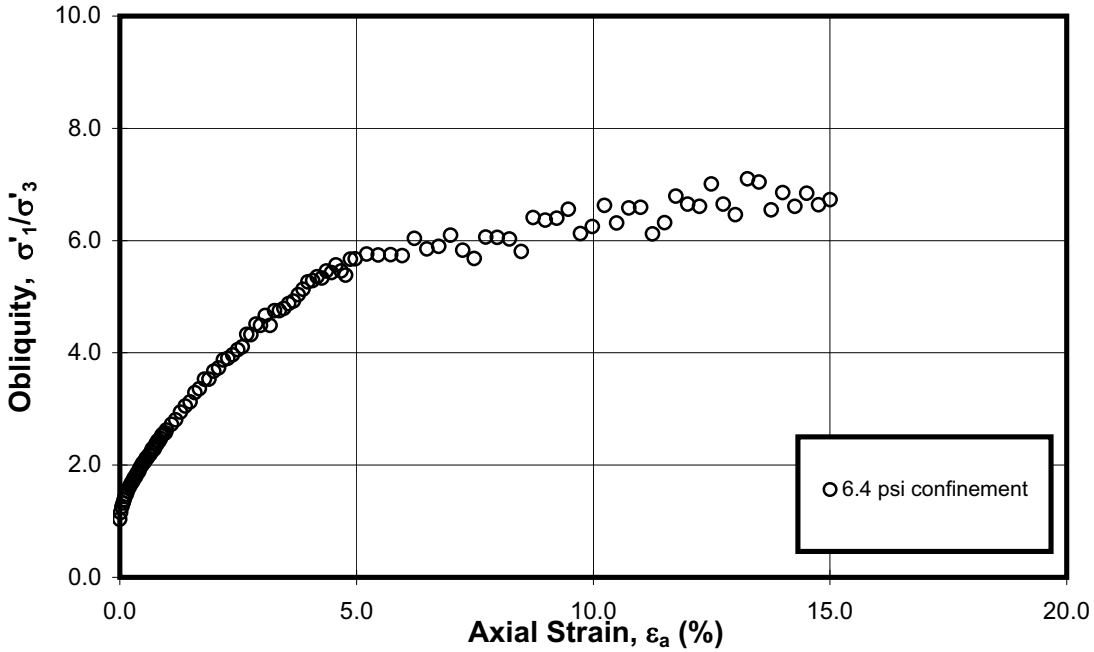




UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: 4A - Depth: 14.6 ft
Boring B-6

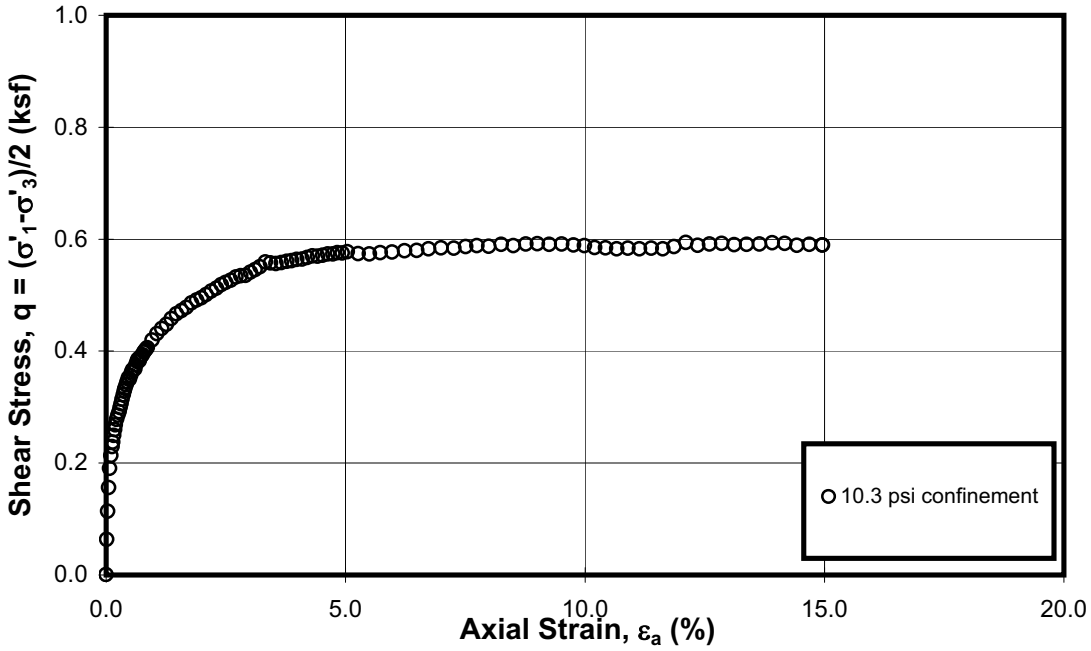
FIGURE E-7i

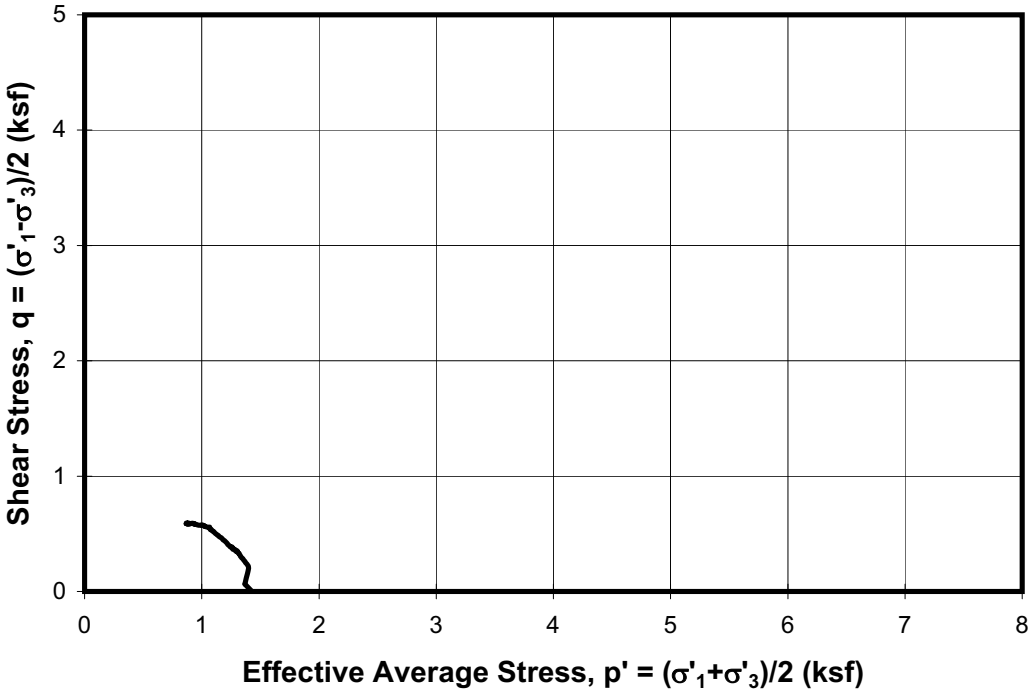




UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: 4A - Depth: 14.6 ft
Boring B-6

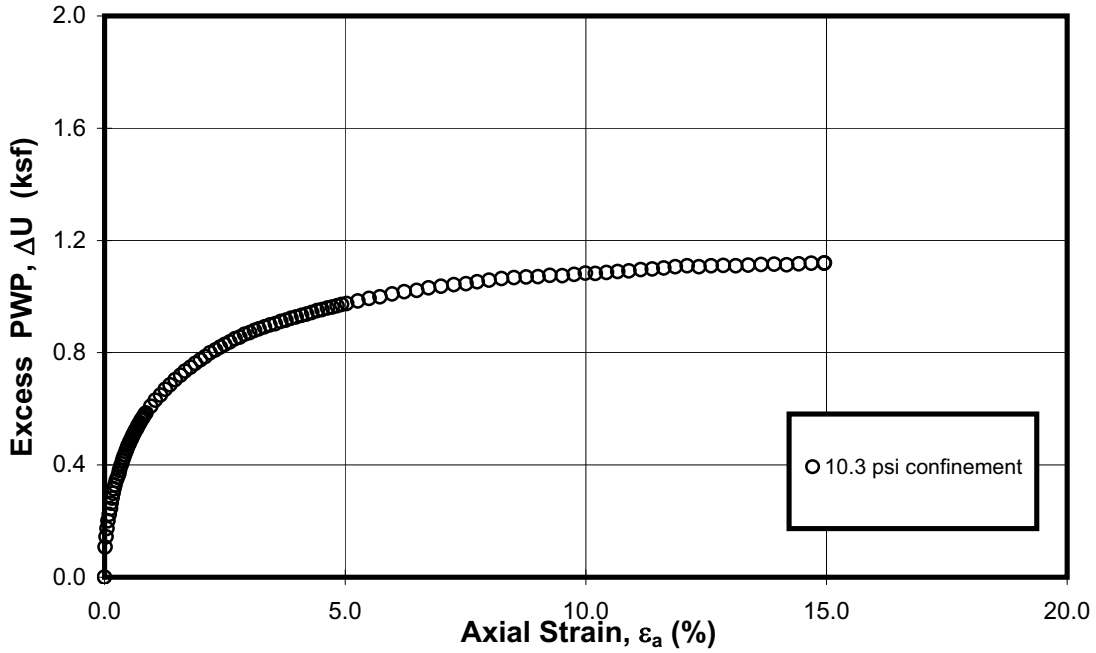
FIGURE E-7j

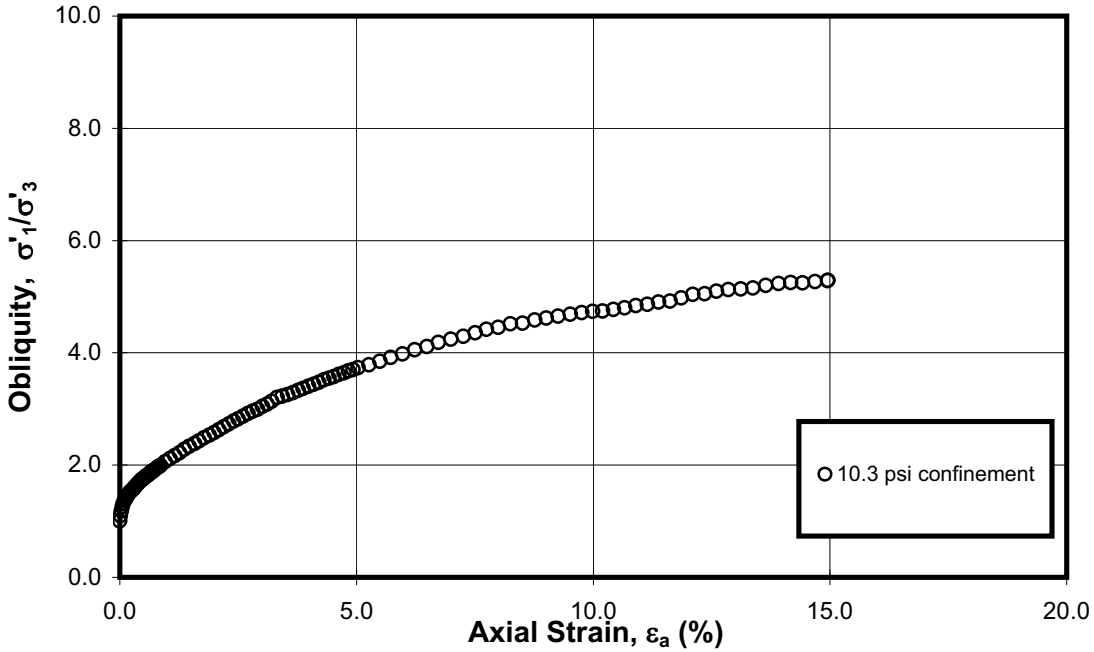




UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: 7A - Depth: 23.3 ft
Boring B-6

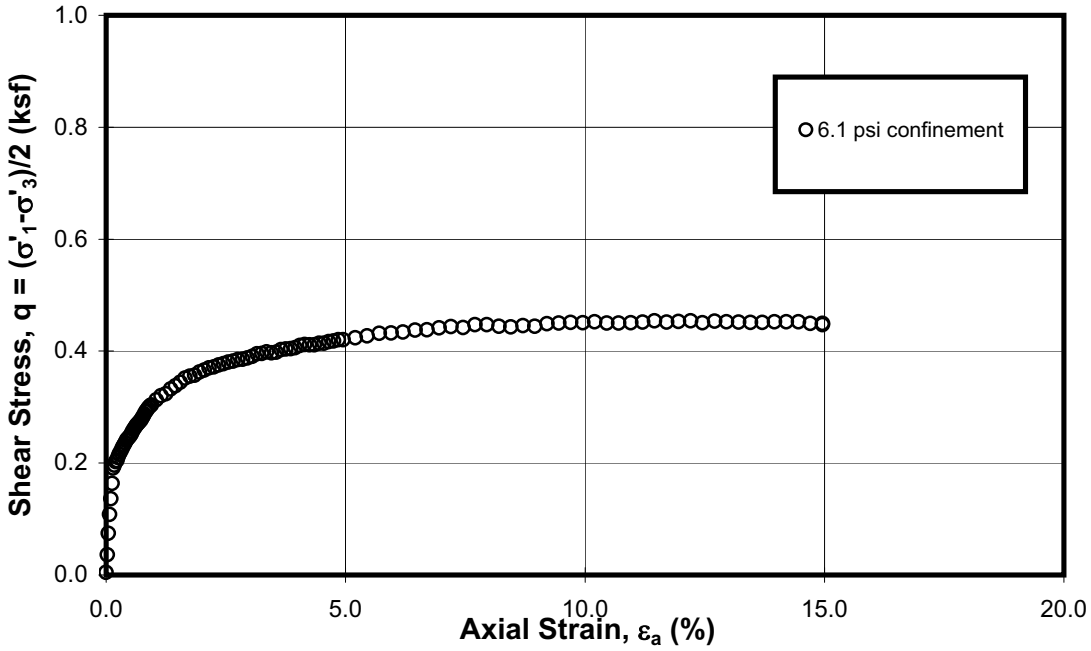
FIGURE E-7k

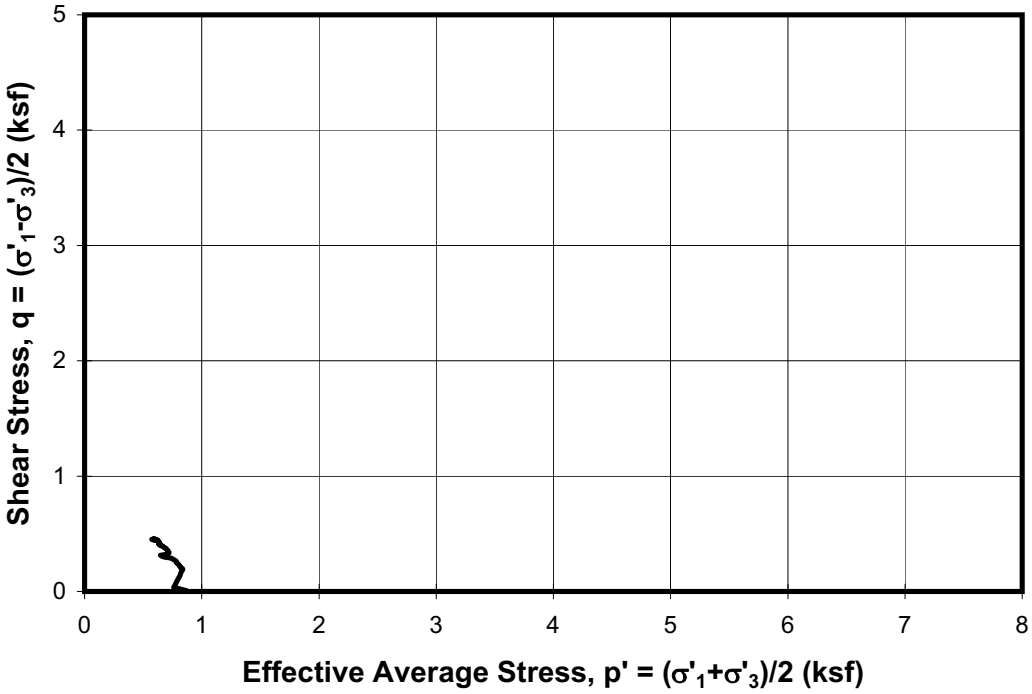




UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: 7A - Depth: 23.3 ft
Boring B-6

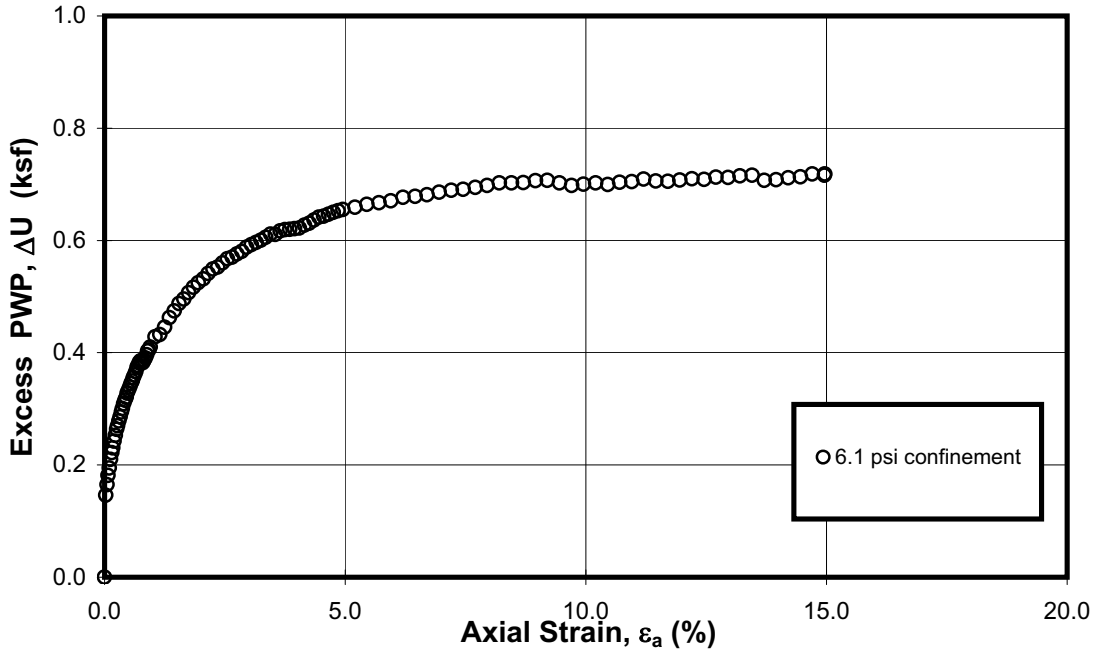
FIGURE E-7I

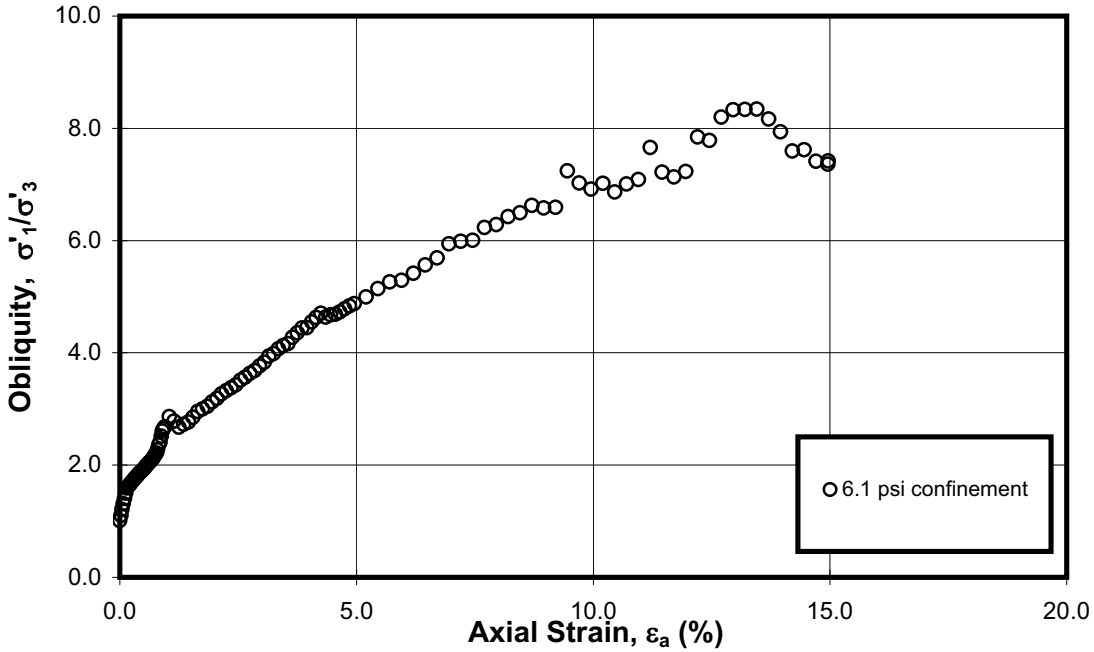




UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: 4A - Depth: 11.3 ft
Boring B-9

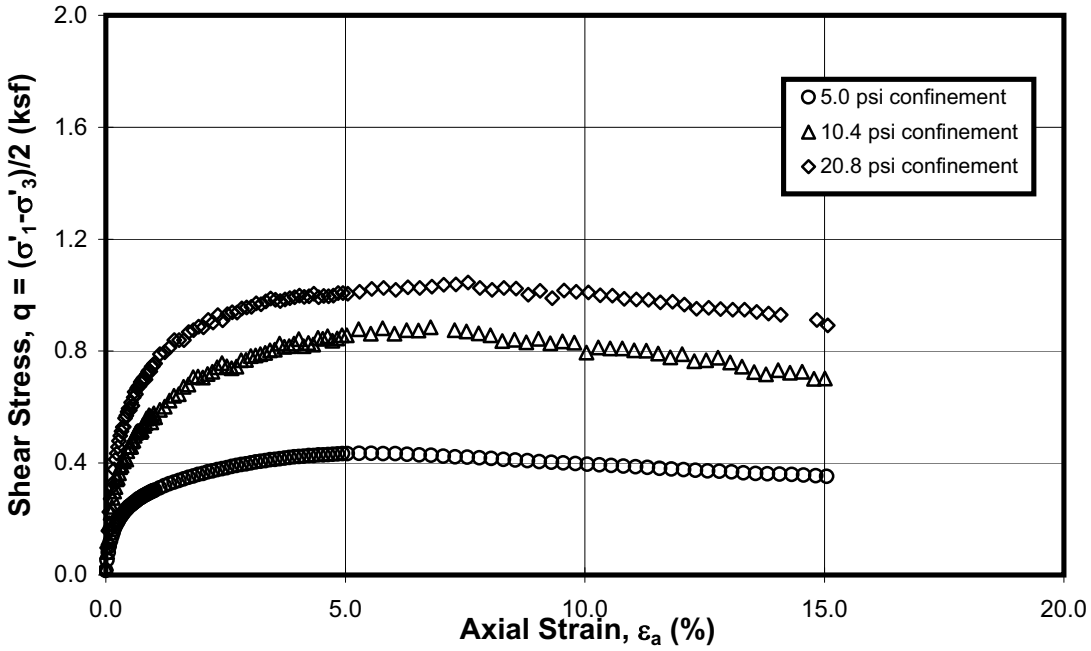
FIGURE E-7m

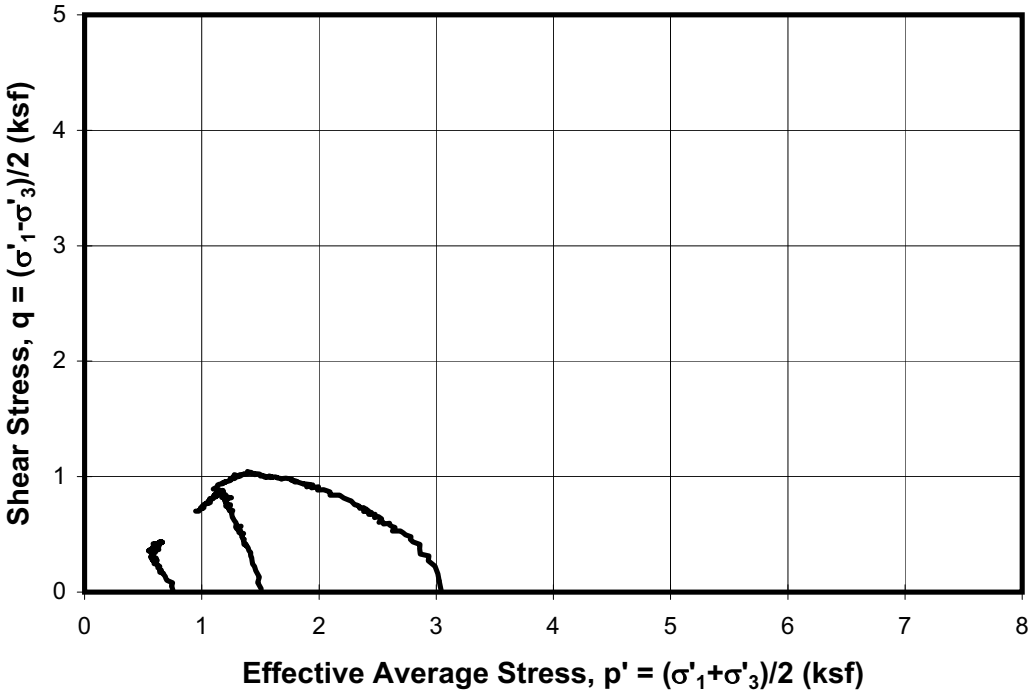




UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: 4A - Depth: 11.3 ft
Boring B-9

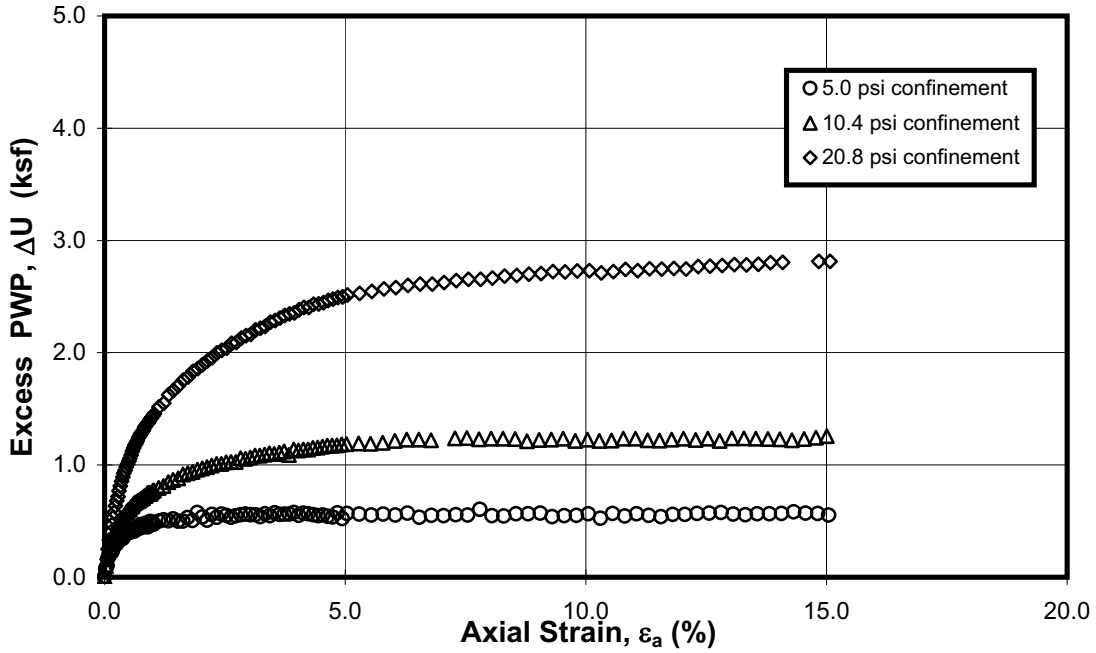
FIGURE E-7n

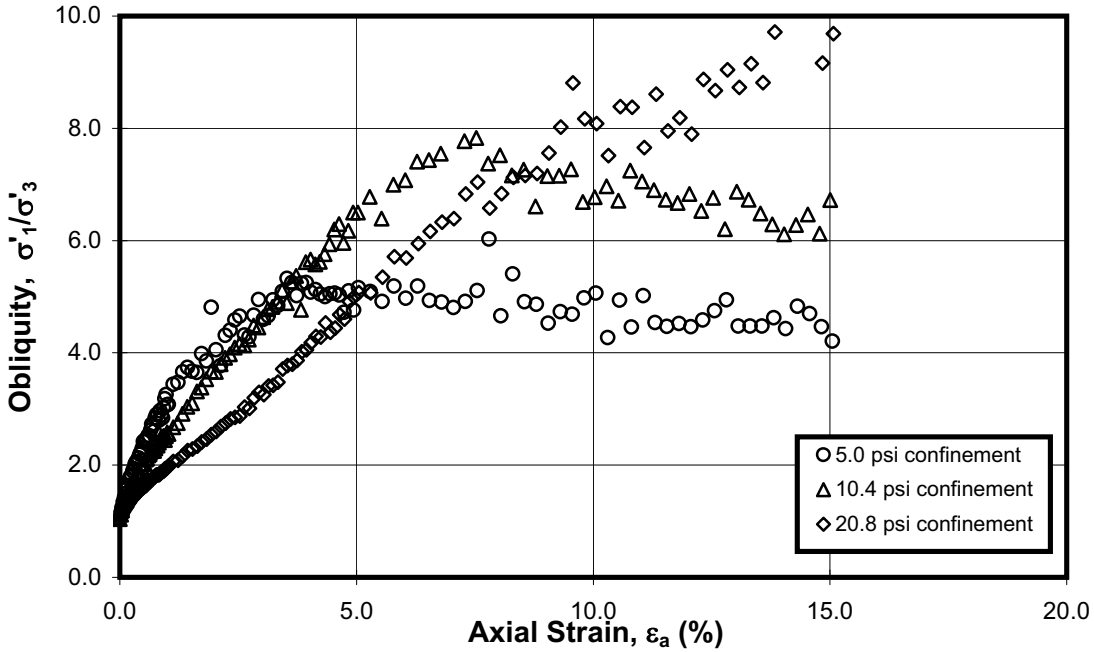




MULTI-SPECIMEN UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: 6A - Depth: 16.4 ft
Boring B-1

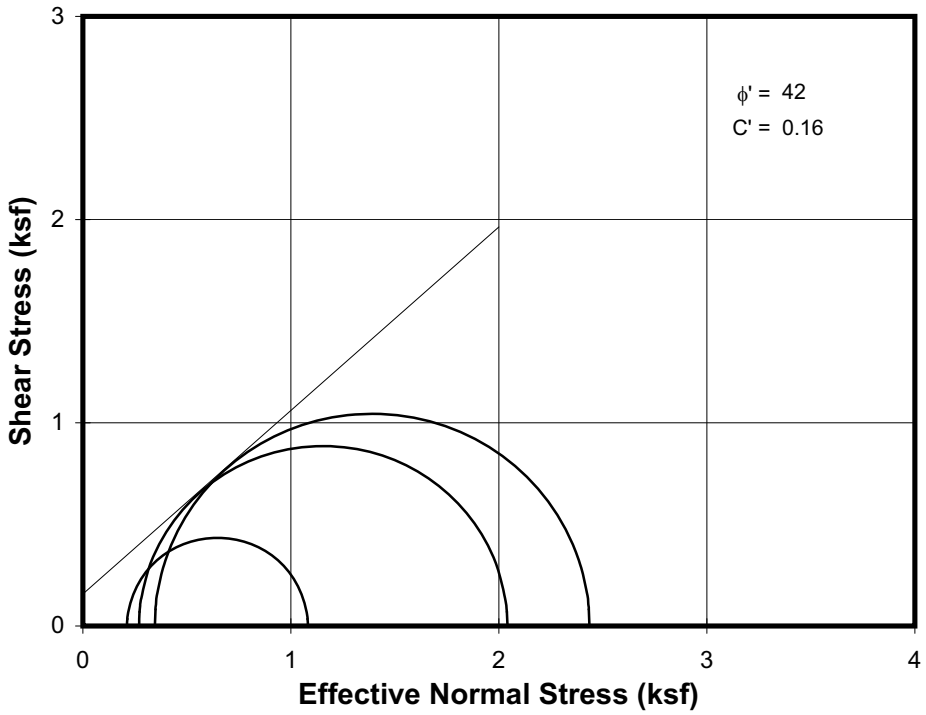
FIGURE E-7o

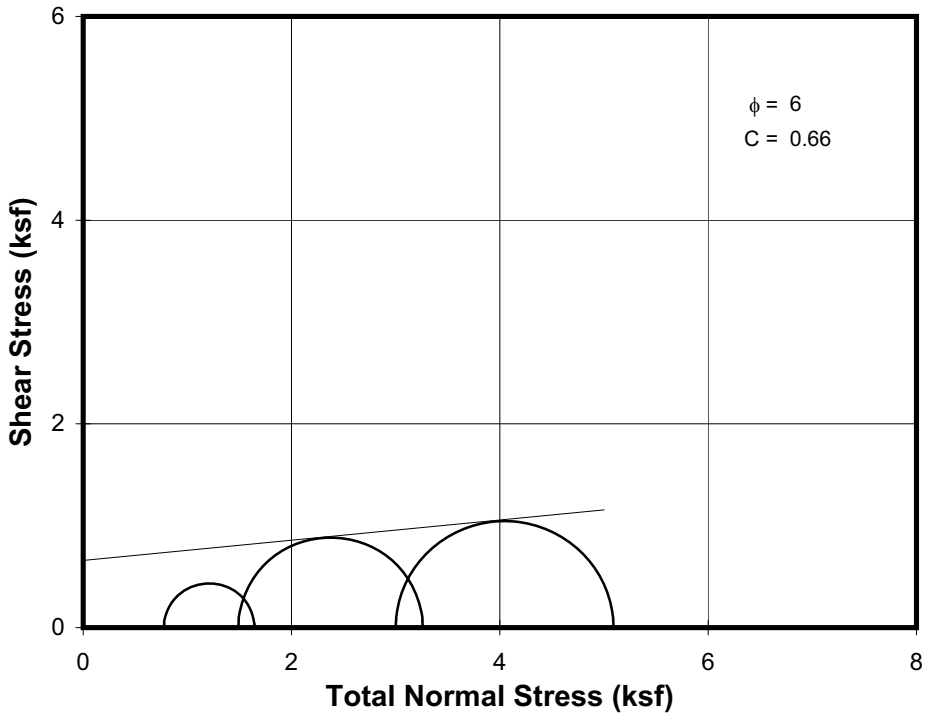




MULTI-SPECIMEN UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: 6A - Depth: 16.4 ft
Boring B-1

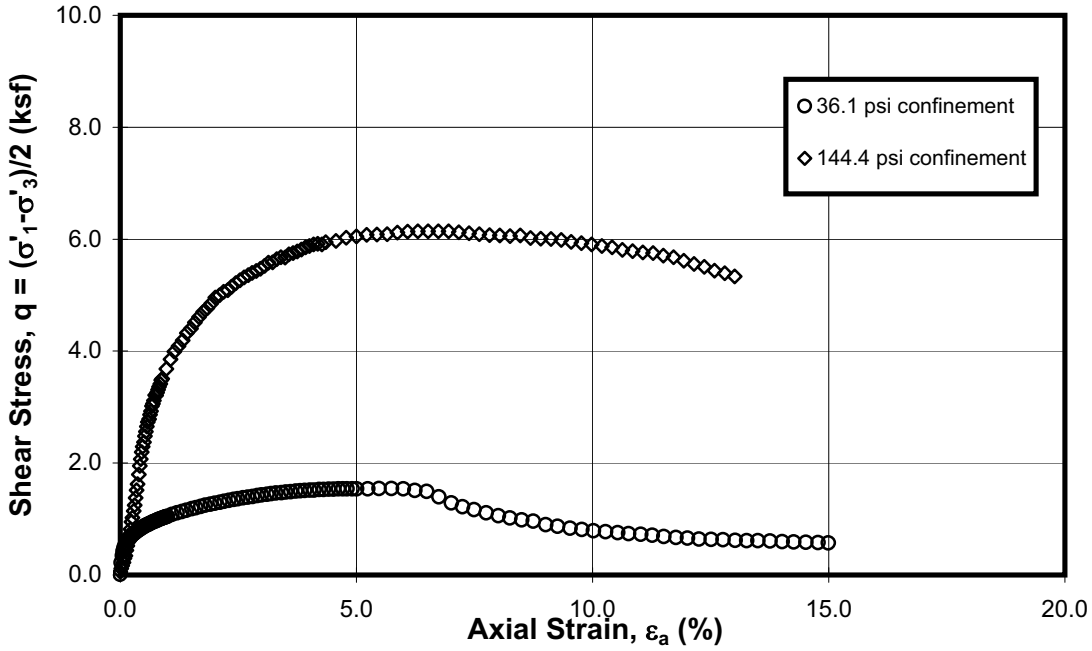
FIGURE E-7p

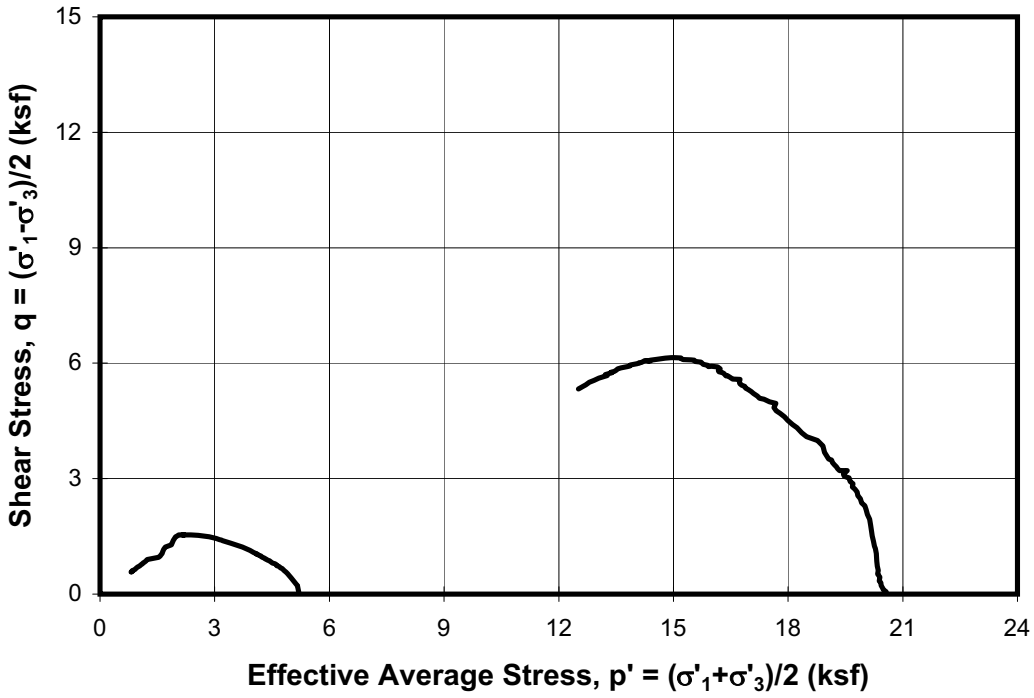




MULTI-SPECIMEN UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: 6A - Depth: 16.4 ft
Boring B-1

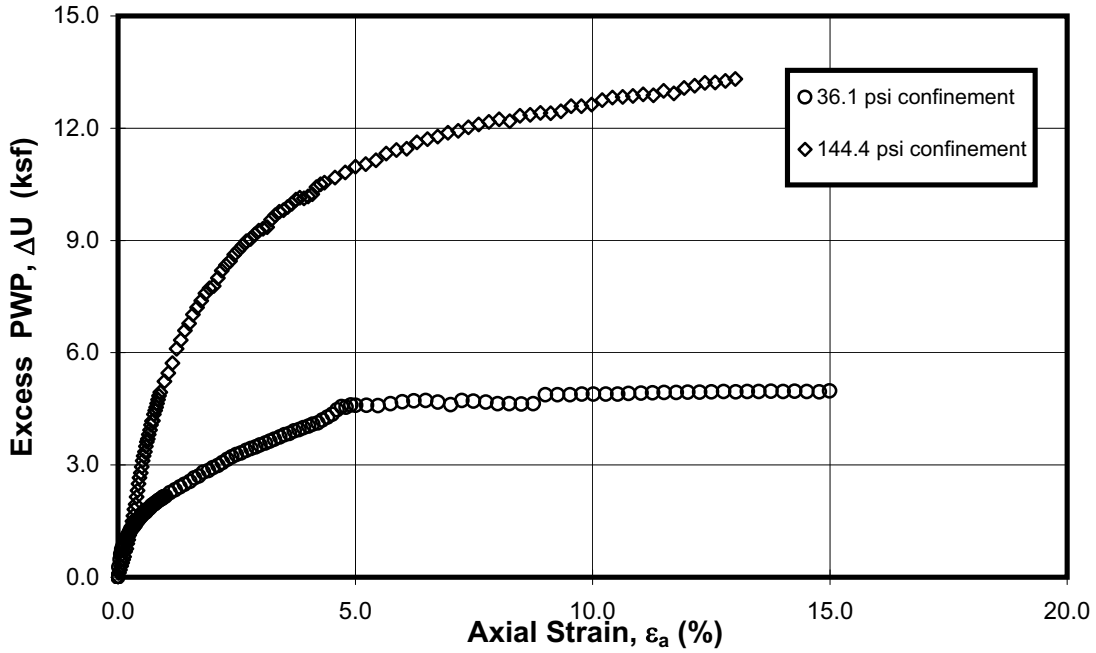
FIGURE E-7q

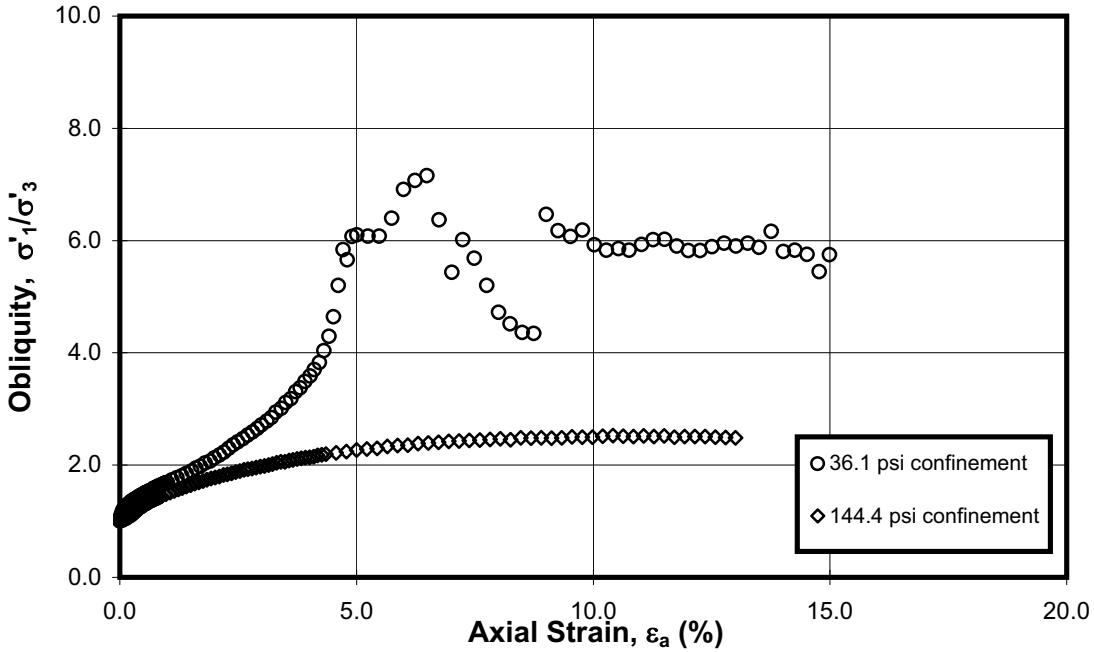




MULTI-SPECIMEN UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: 23A - Depth: 106.6 ft
Boring B-3

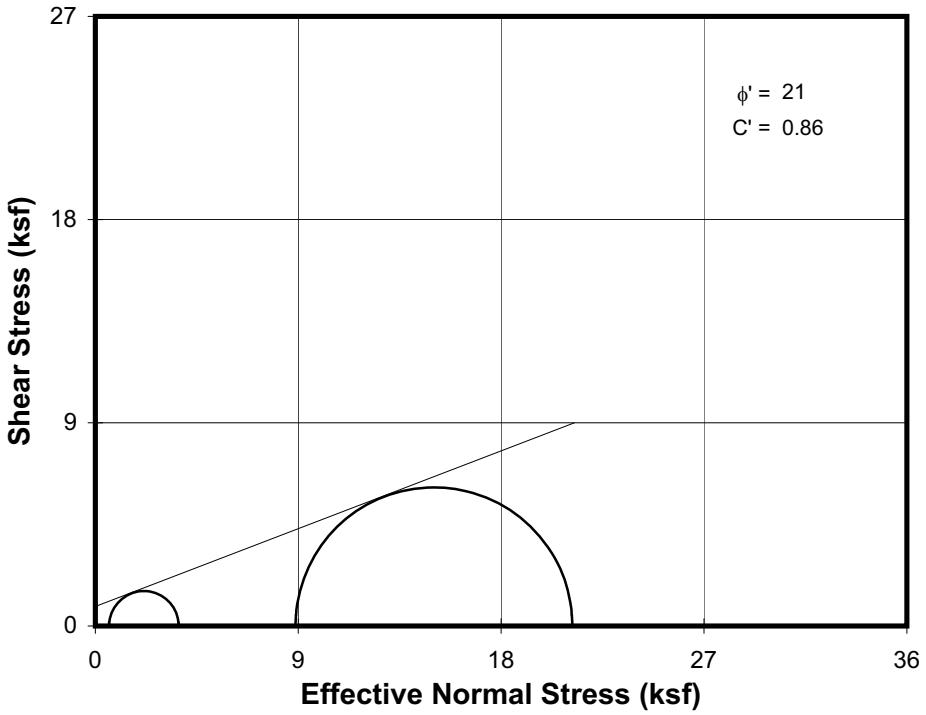
FIGURE E-7r

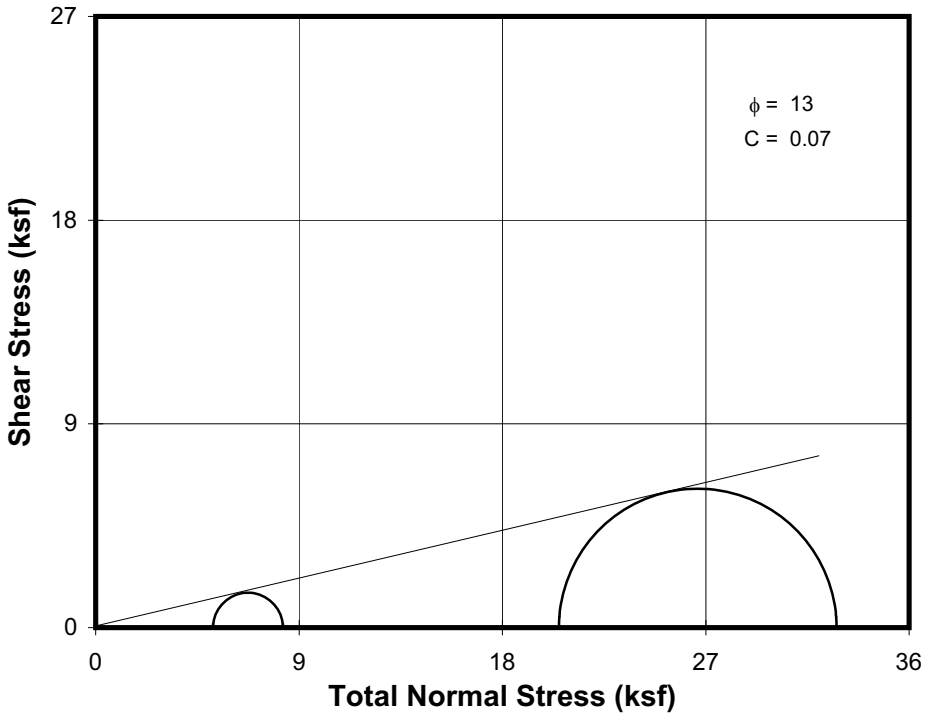




MULTI-SPECIMEN UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: 23A - Depth: 106.6 ft
Boring B-3

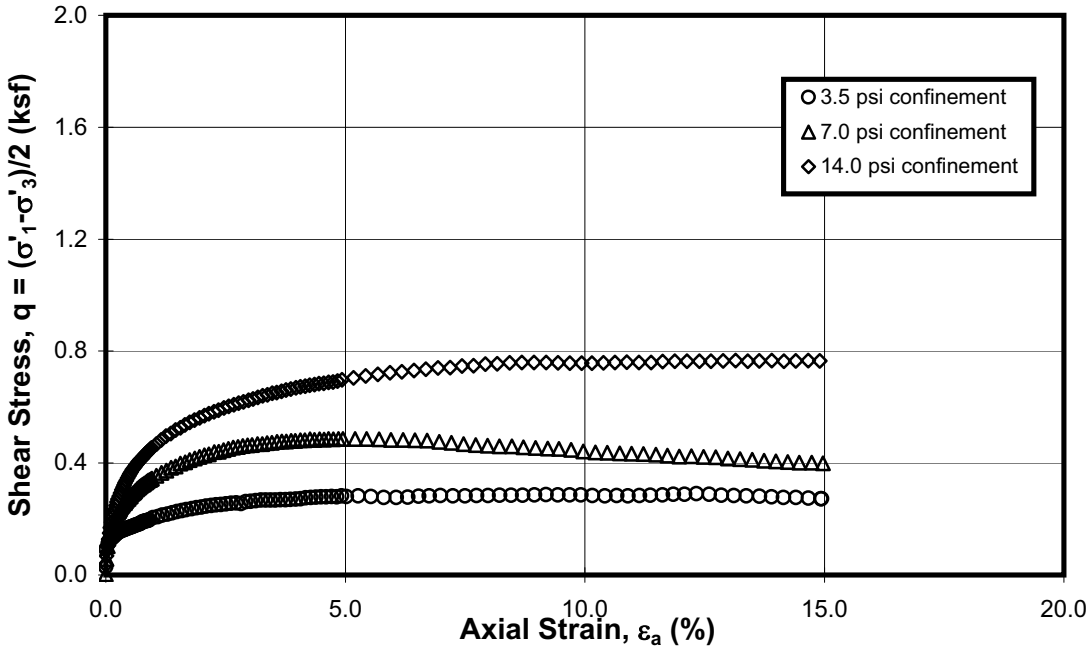
FIGURE E-7s

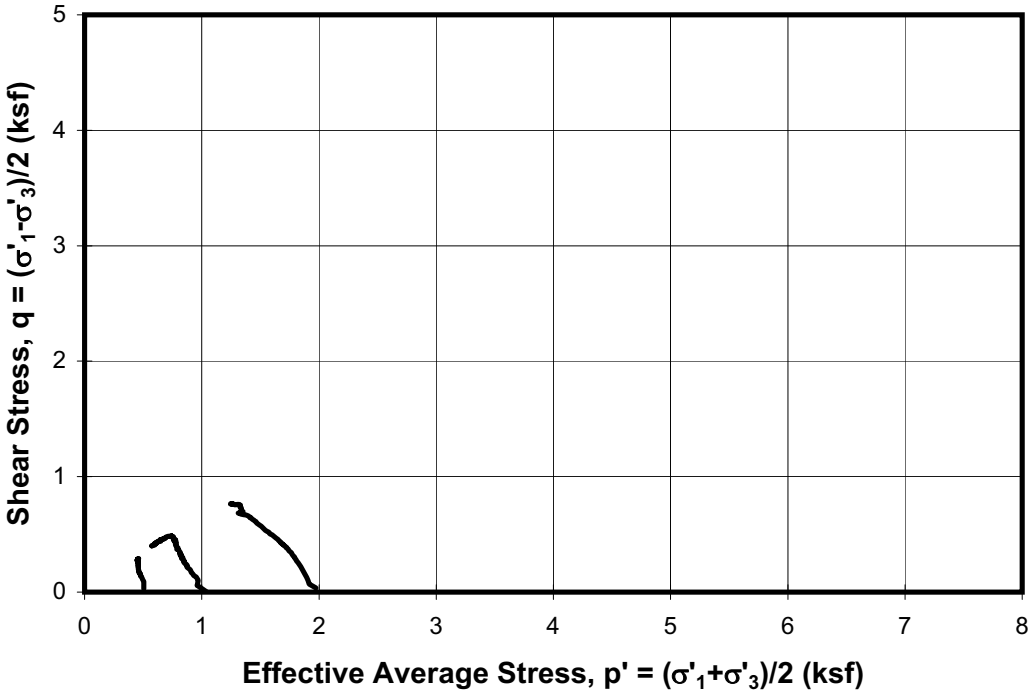




MULTI-SPECIMEN UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: 23A - Depth: 106.6 ft
Boring B-3

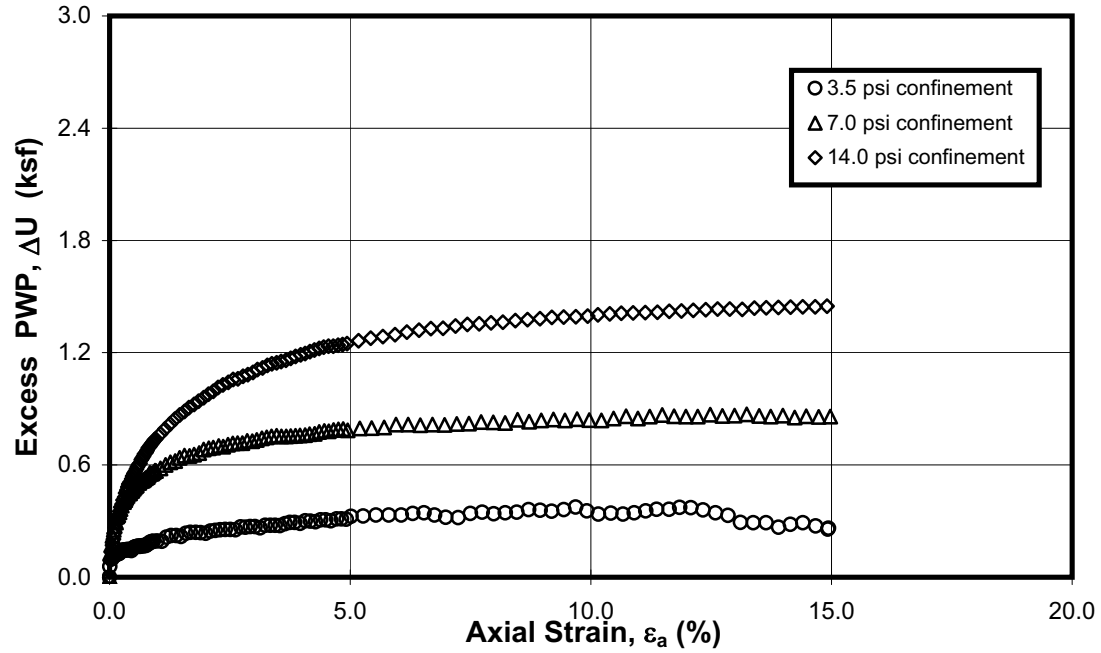
FIGURE E-7t

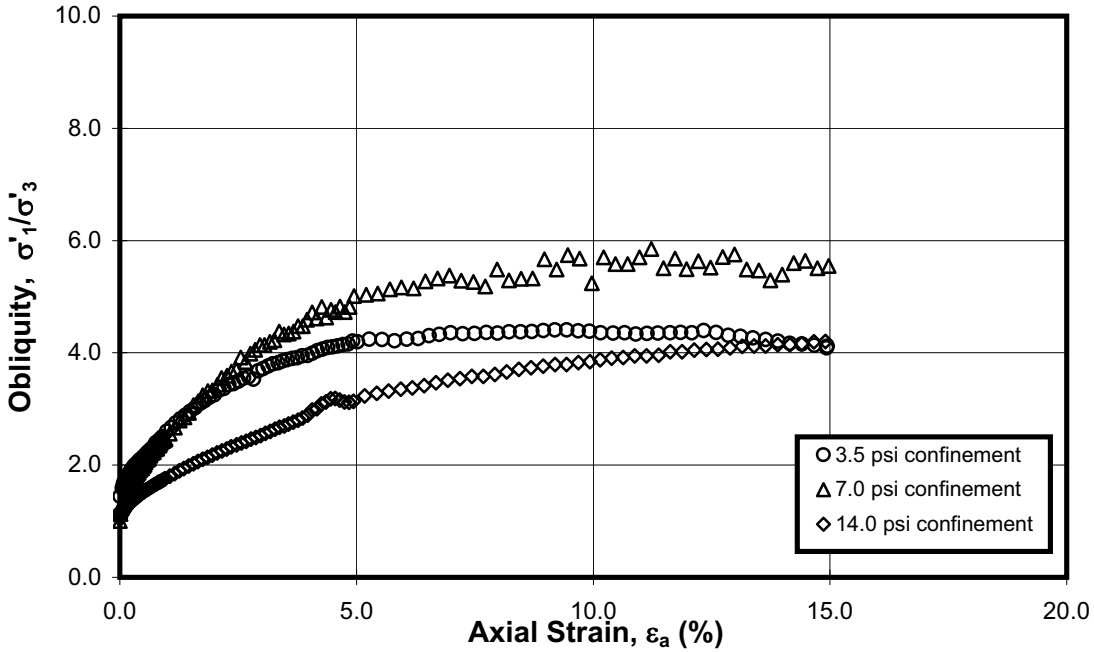




MULTI-SPECIMEN UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: 8A - Depth: 23.0 ft
Boring B-8

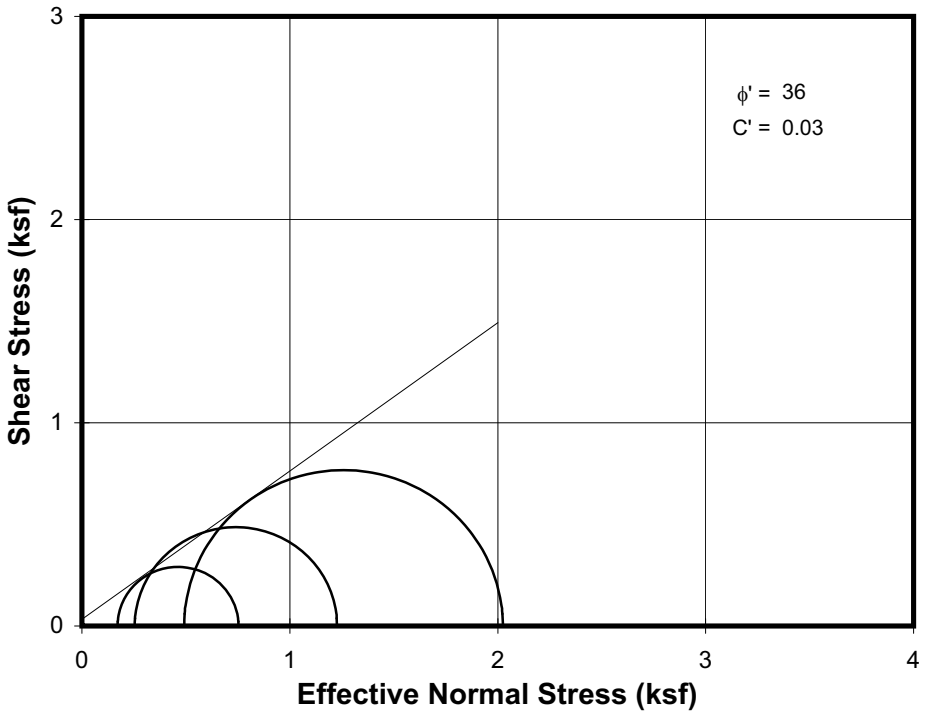
FIGURE E-7u

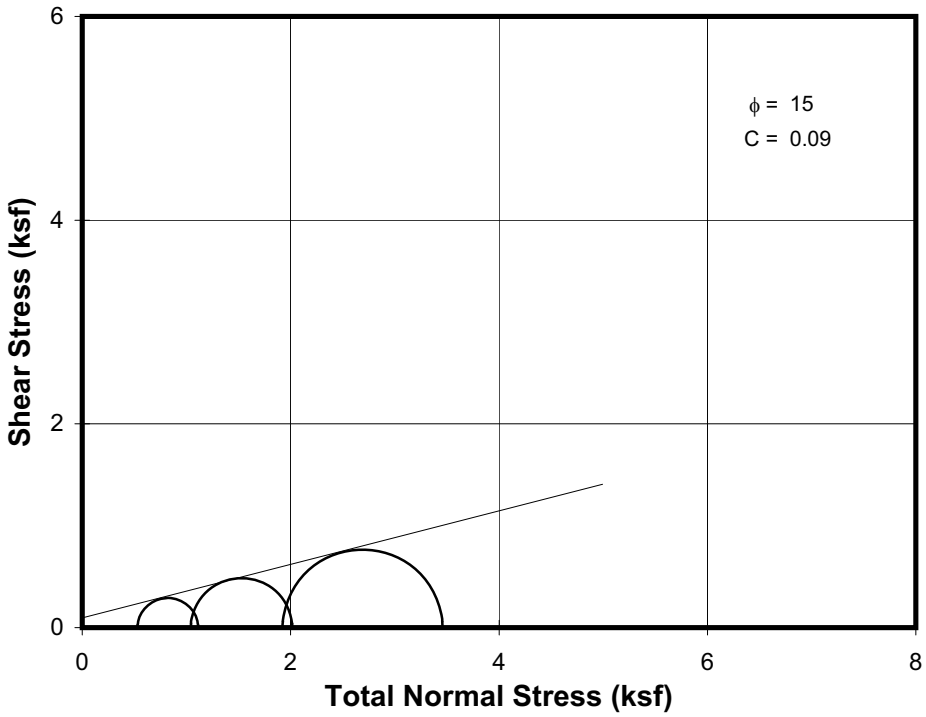




MULTI-SPECIMEN UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: 8A - Depth: 23.0 ft
Boring B-8

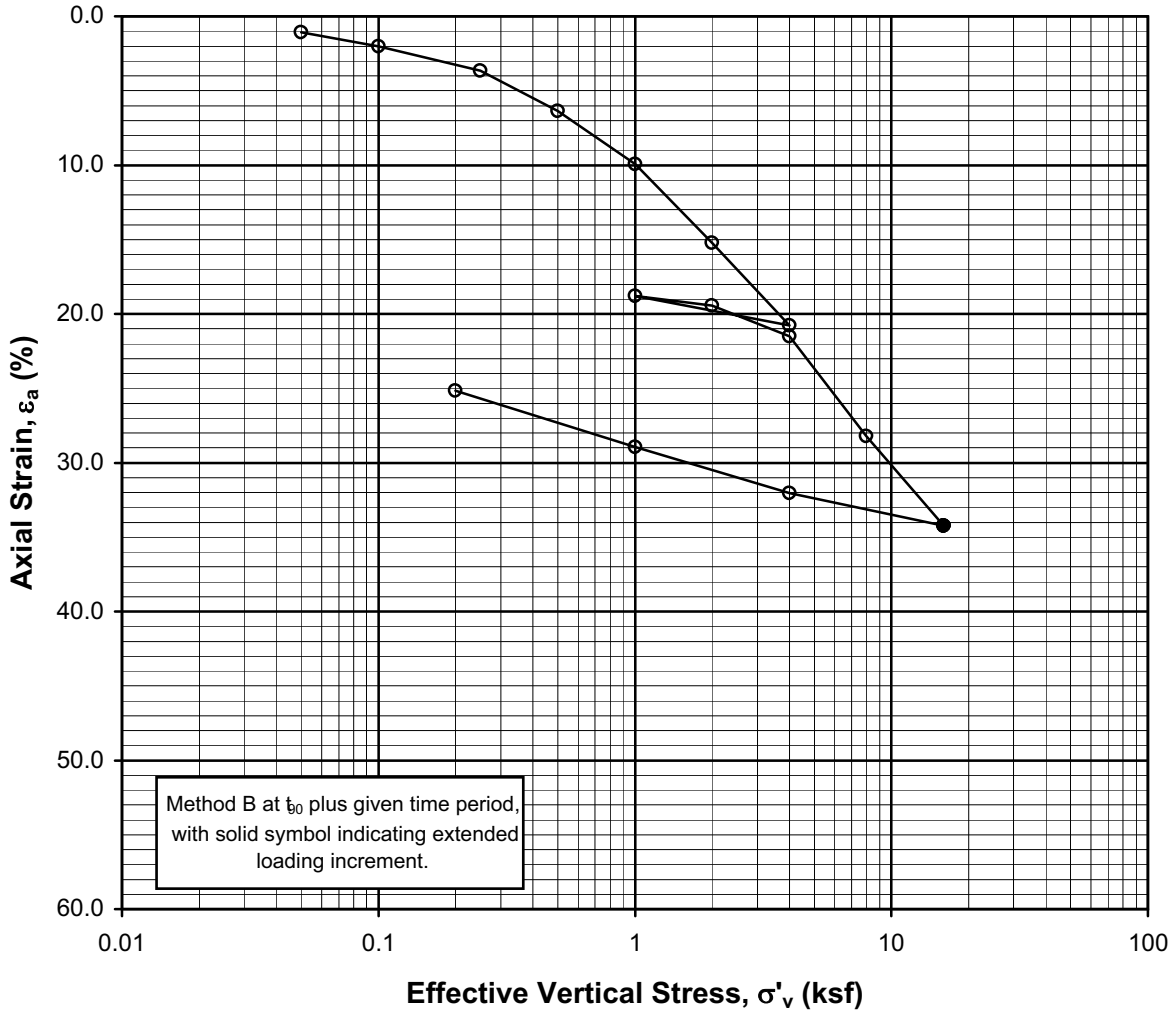
FIGURE E-7v



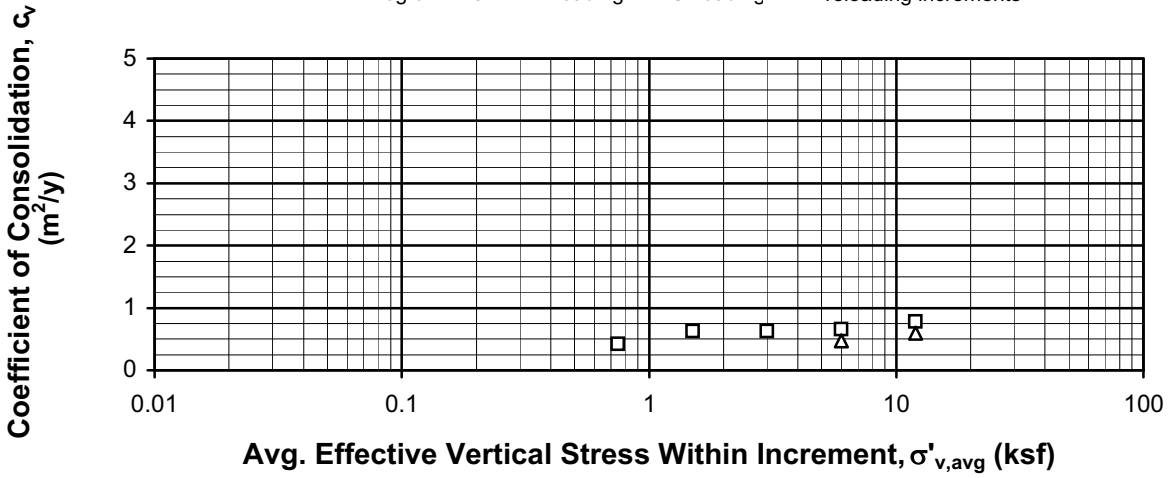


MULTI-SPECIMEN UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: 8A - Depth: 23.0 ft
Boring B-8

FIGURE E-7w



Fitting Methods: - Sqr. Rt. Time: □ - Loading ○ - Unloading
- Log of Time: Δ - Loading ◊- Unloading
with solid symbols indicating reloading increments

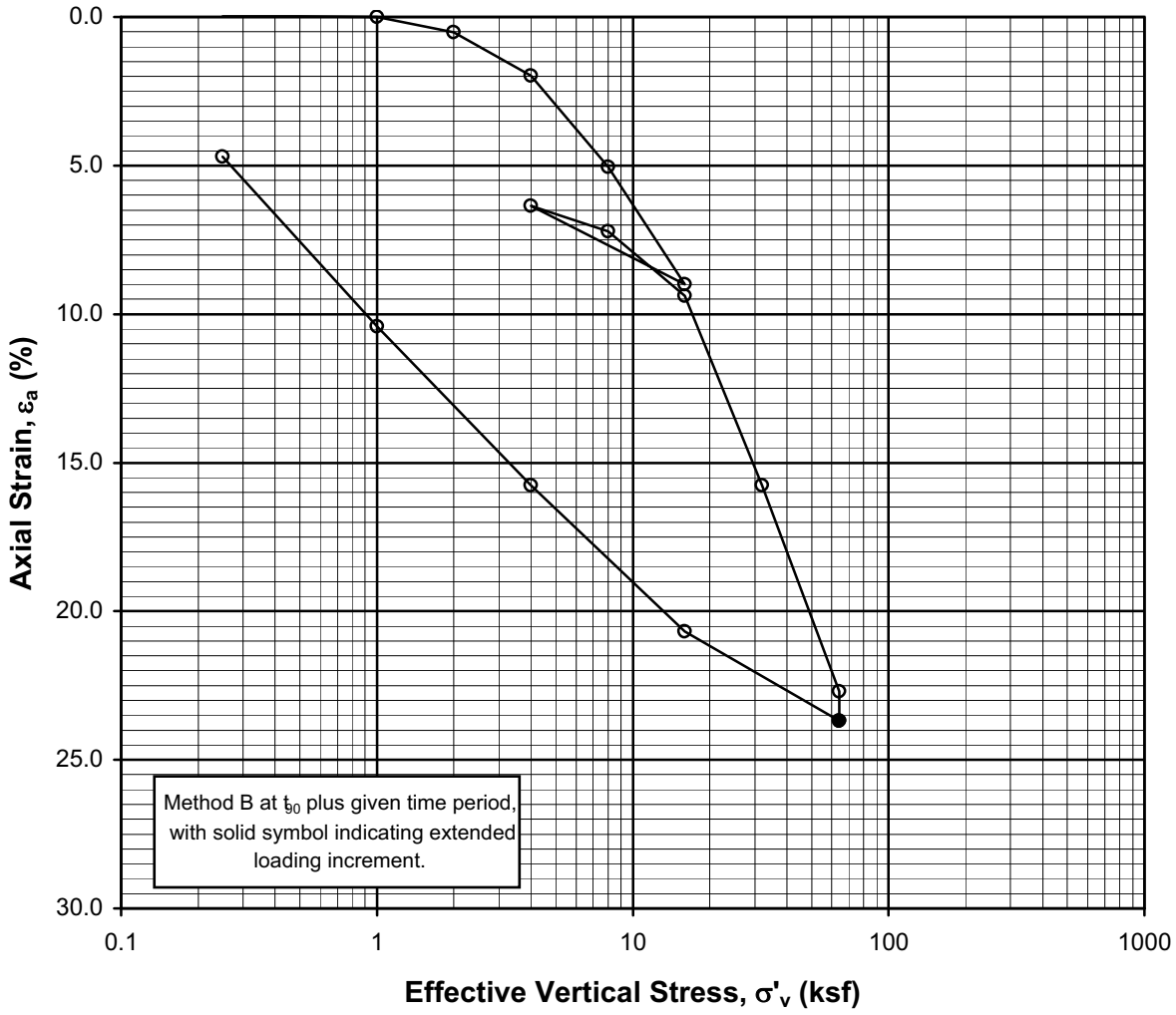


1-D CONSOLIDATION TEST: Incremental

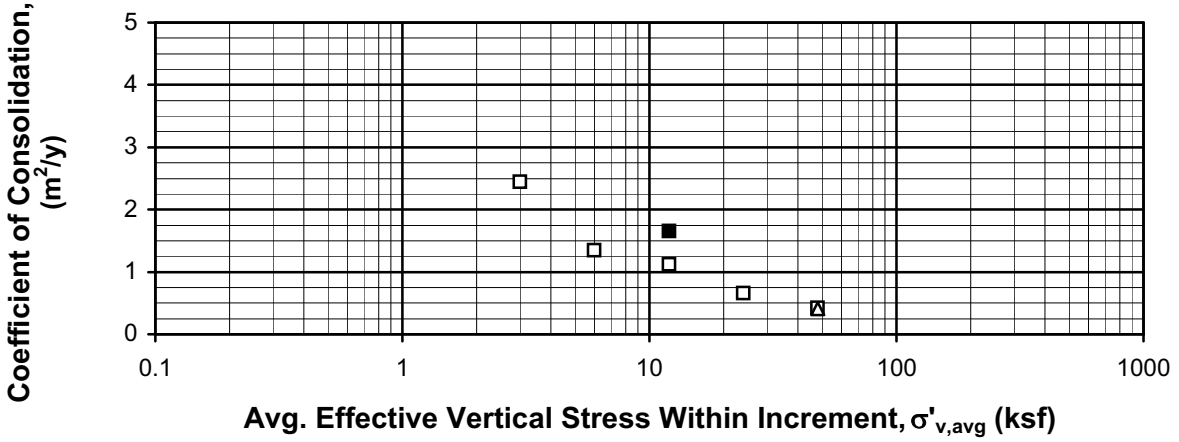
Sample No. 6A - Depth 16.4 ft

Boring B-1

FIGURE E-8a



Fitting Methods: - Sqr. Rt. Time: □ - Loading ○ - Unloading
- Log of Time: Δ - Loading ◊- Unloading
with solid symbols indicating reloading increments

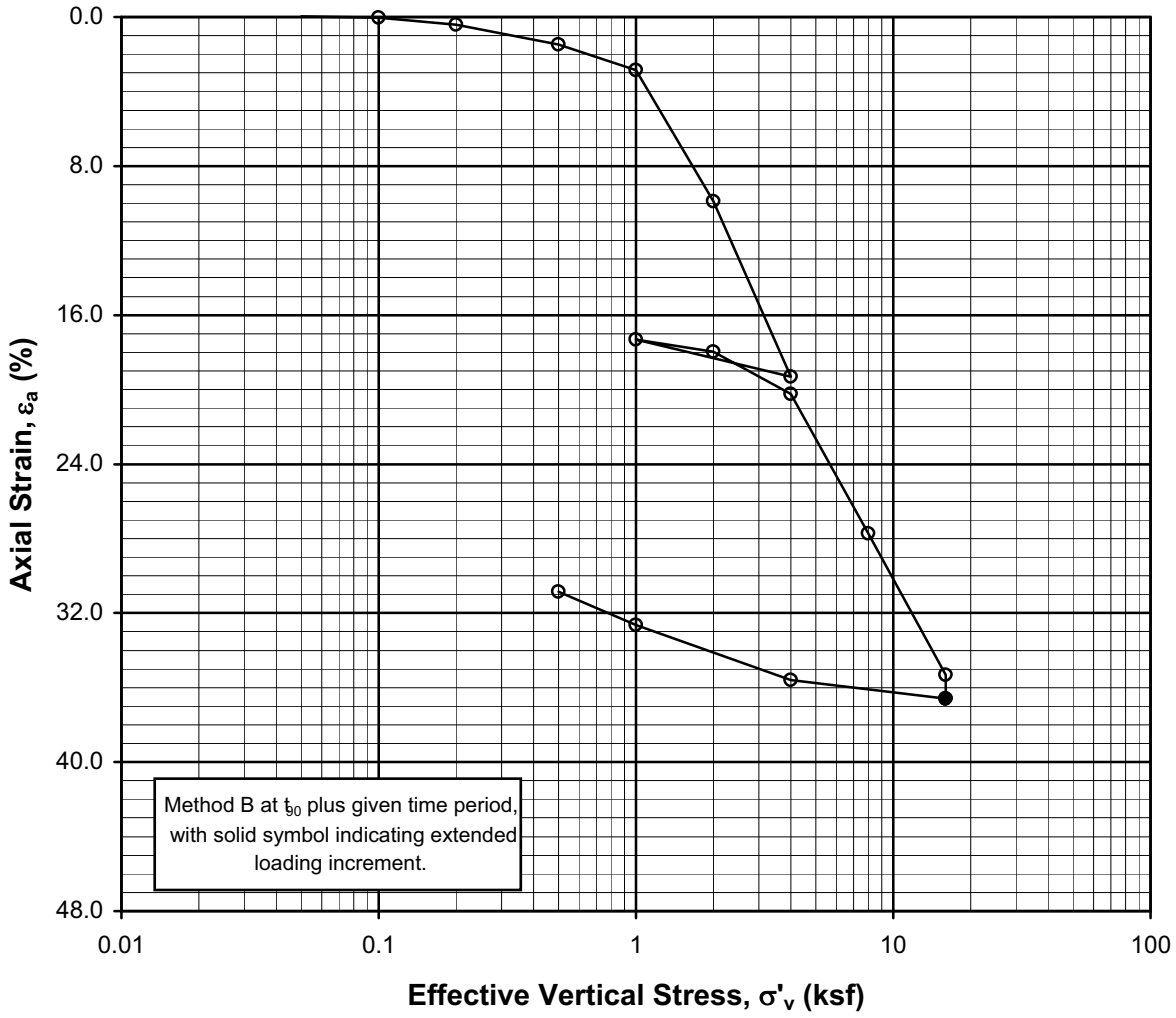


1-D CONSOLIDATION TEST: Incremental

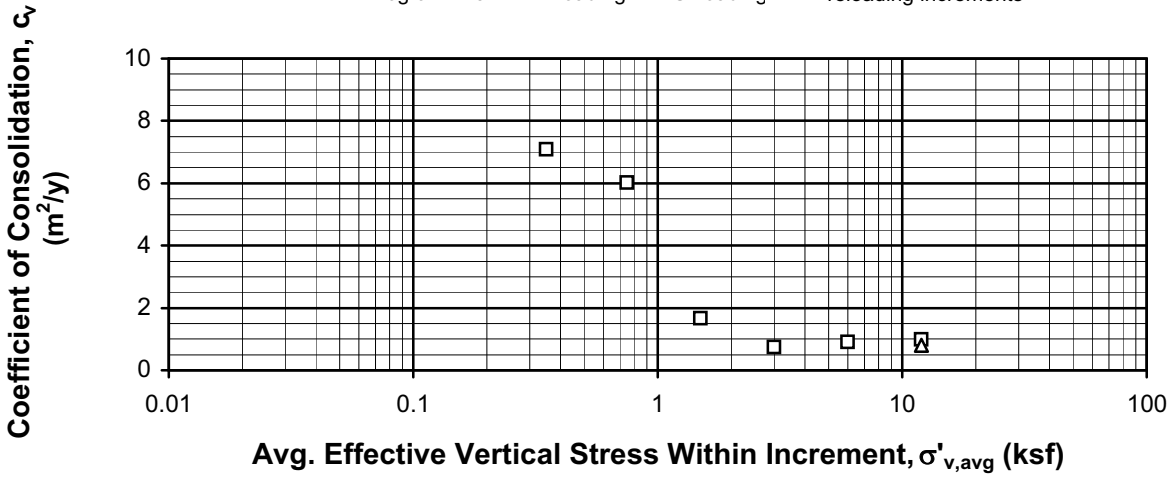
Sample No. 23A - Depth 106.6 ft

Boring B-3

FIGURE E-8b



Fitting Methods: - Sqr. Rt. Time: □ - Loading ○ - Unloading
- Log of Time: Δ - Loading ◊- Unloading
with solid symbols indicating reloading increments

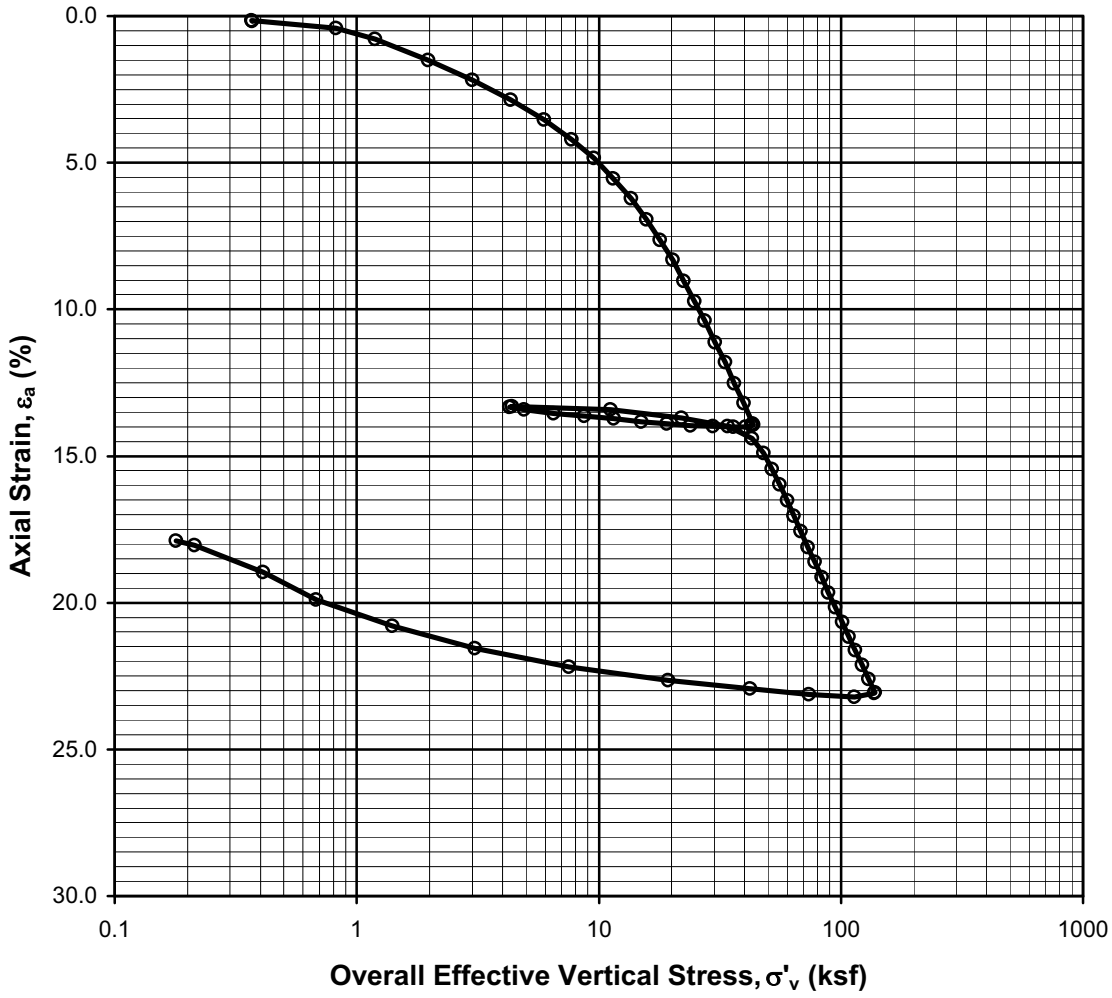


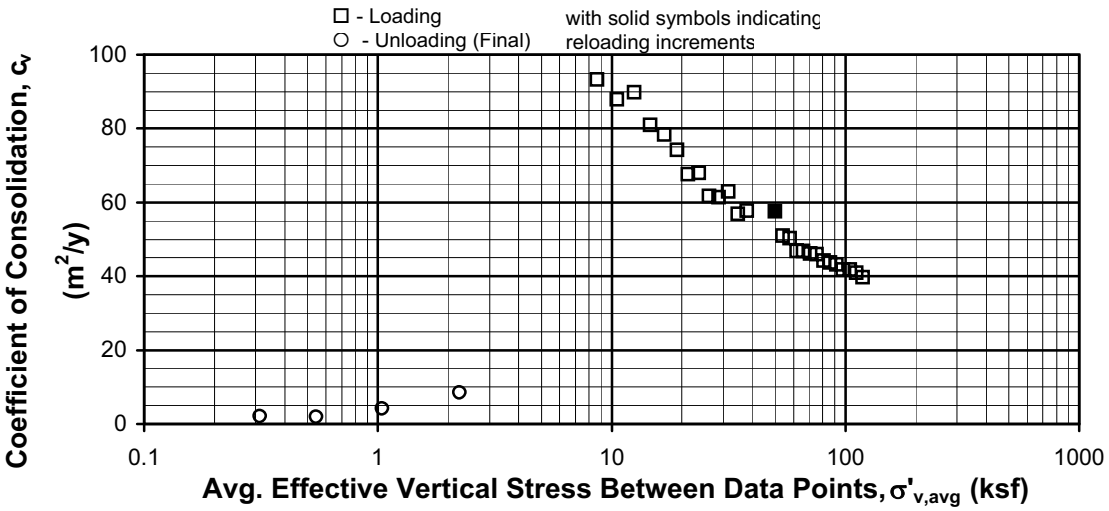
1-D CONSOLIDATION TEST: Incremental

Sample No. 8A - Depth 23.0 ft

Boring B-8

FIGURE E-8c



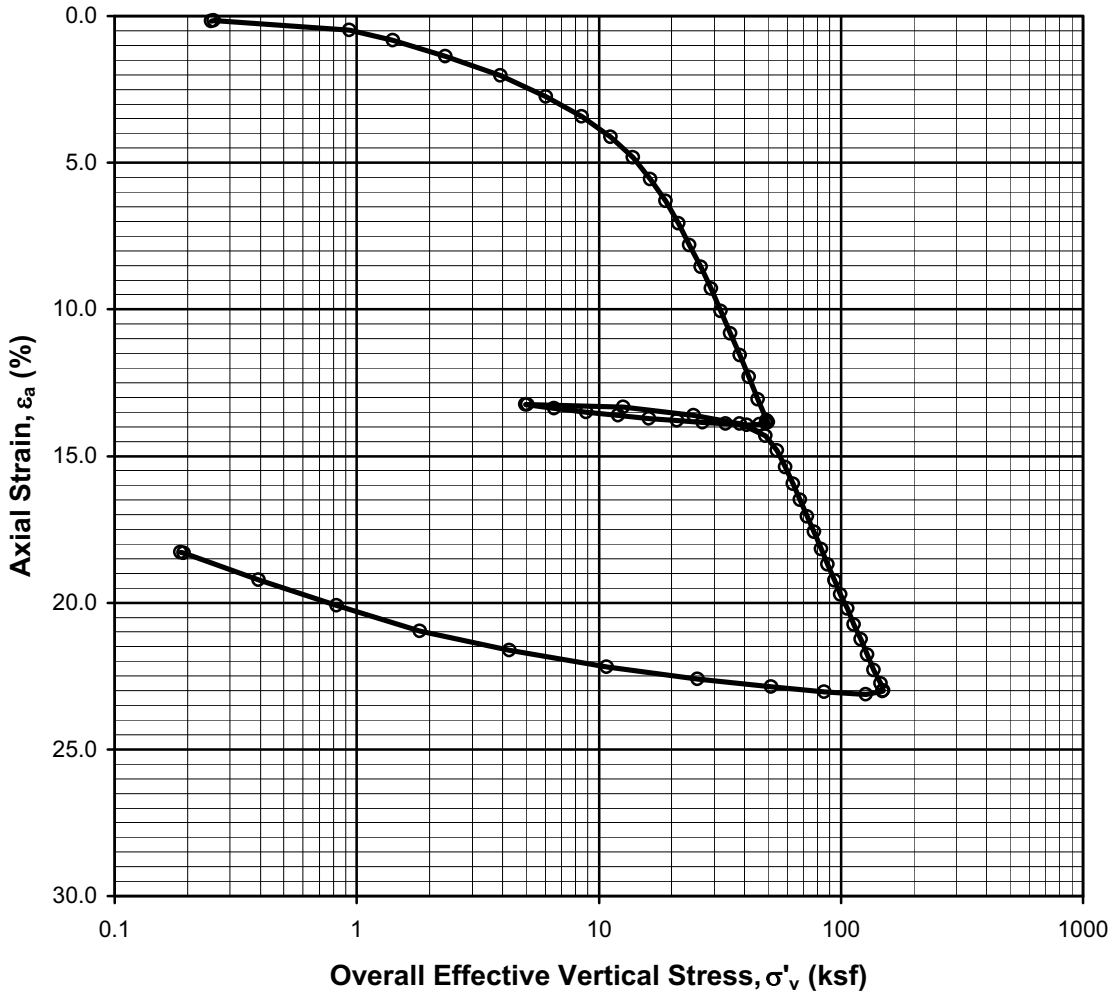


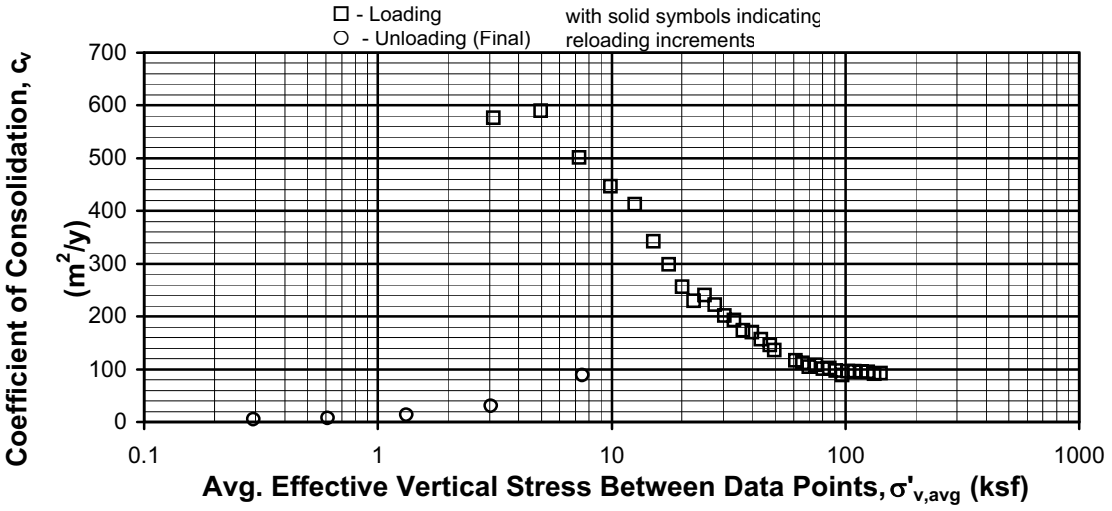
1-D CONSOLIDATION TEST: CRS

Sample No. 19A - Depth 72.2 ft

Boring B-1

FIGURE E-9a



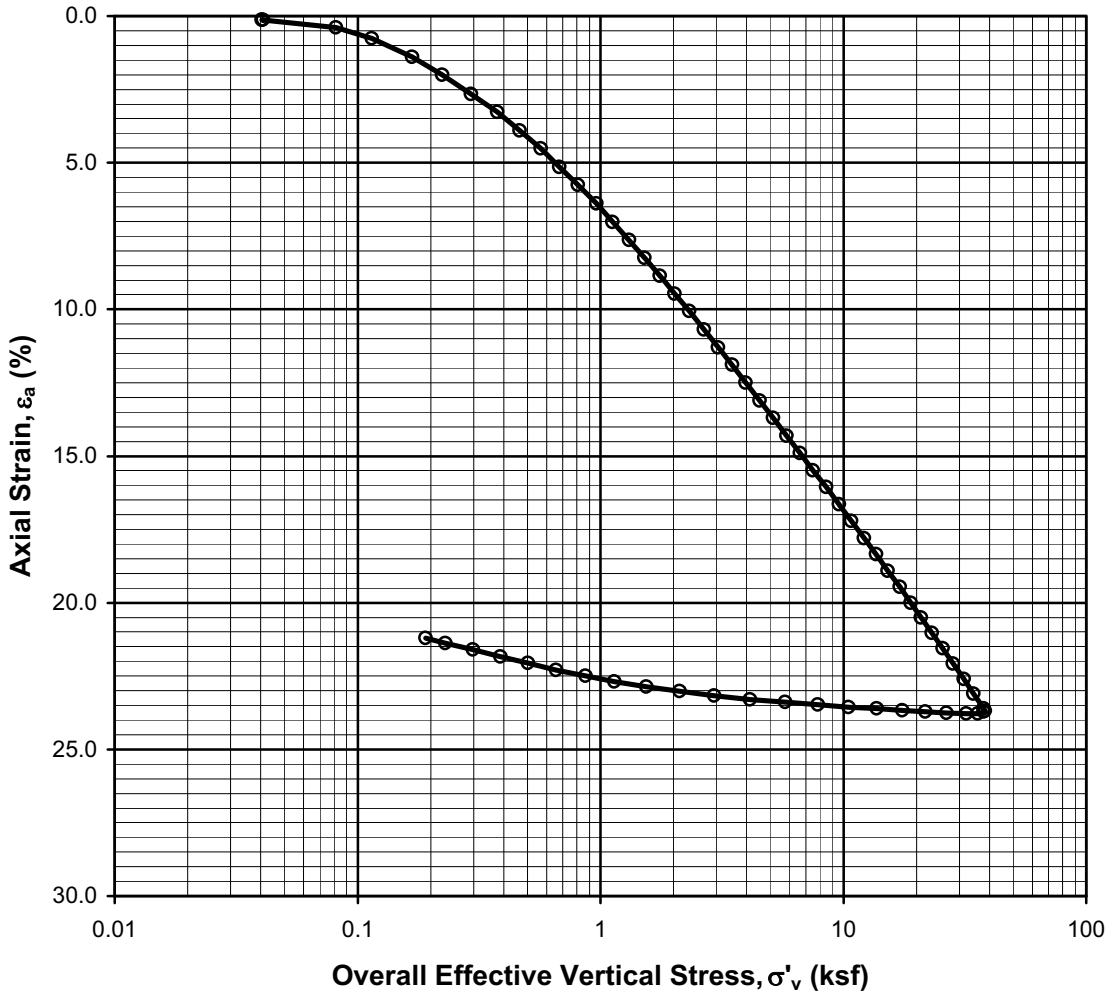


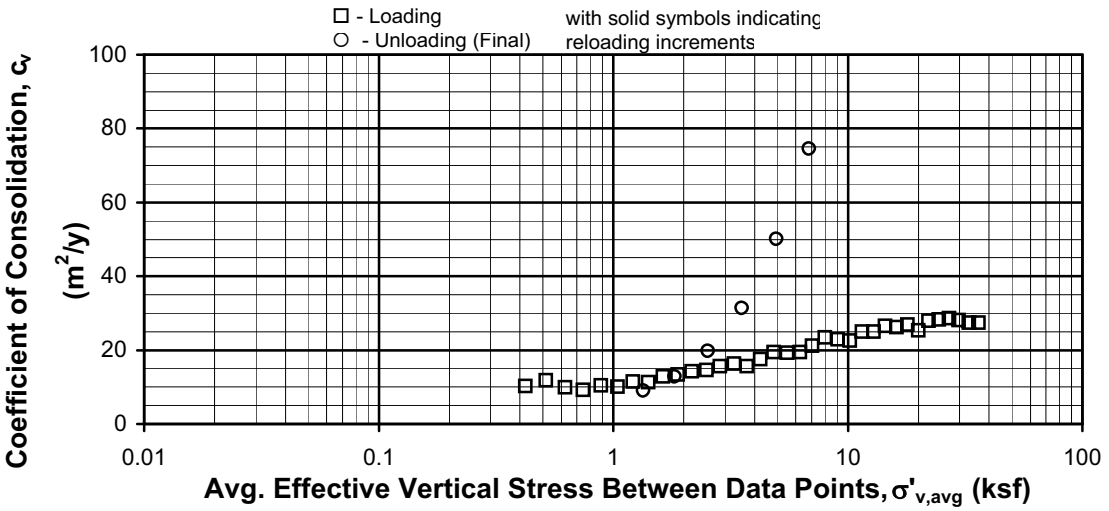
1-D CONSOLIDATION TEST: CRS

Sample No. 14B - Depth 53.6 ft

Boring B-4

FIGURE E-9b



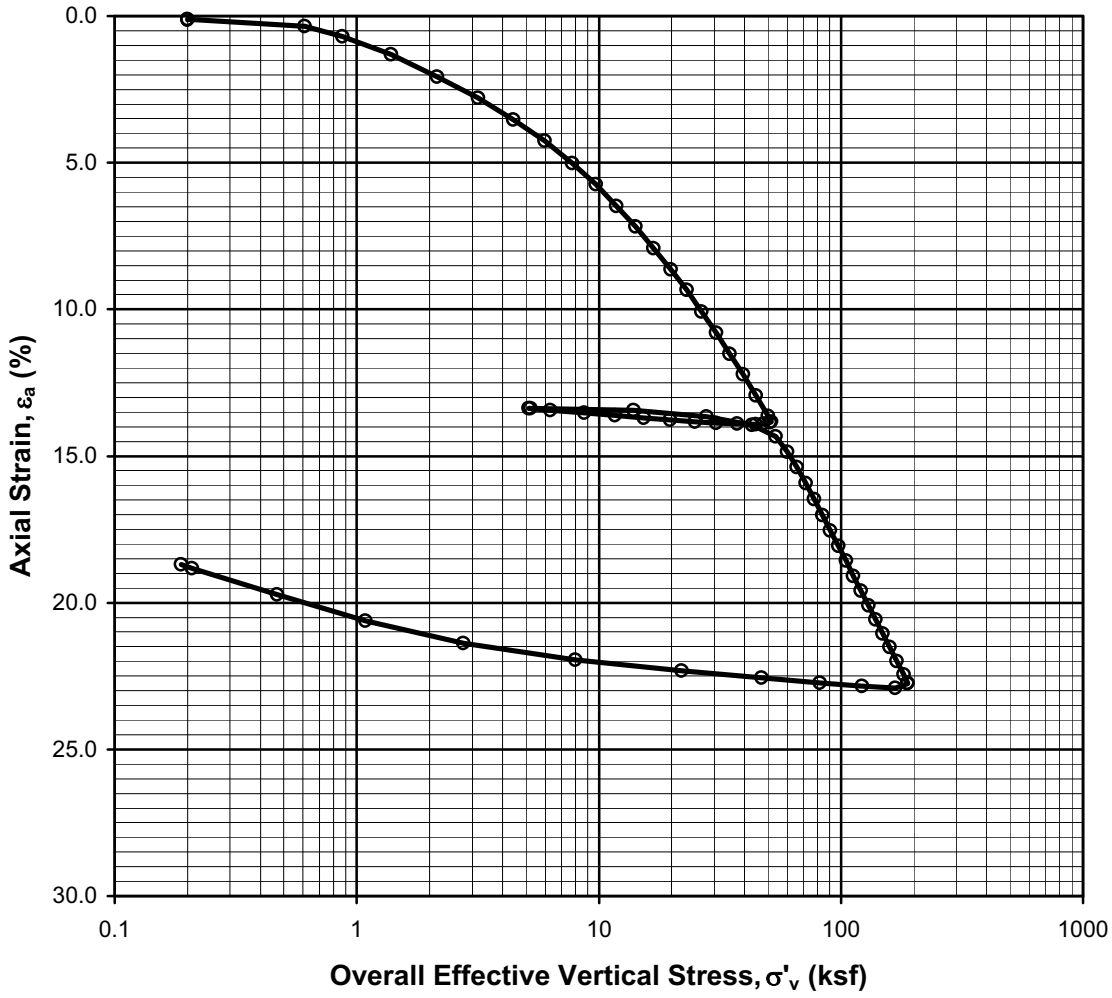


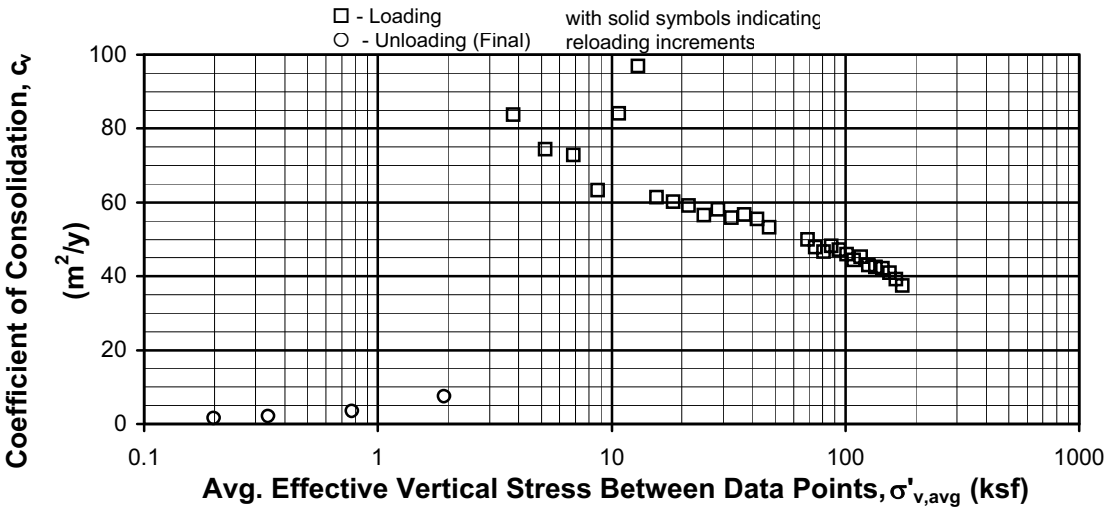
1-D CONSOLIDATION TEST: CRS

Sample No. 20A - Depth 83.0 ft

Boring B-6

FIGURE E-9c





1-D CONSOLIDATION TEST: CRS

Sample No. 22B - Depth 87.9 ft

Boring B-9

FIGURE E-9d

FUGRO ATLANTIC

-VOLUME 6-
BOTTOM CHARTING DATA REPORT
PROPOSED MIDTOWN SECOND PARALLEL TUNNEL

Prepared for:
VIRGINIA DEPARTMENT OF TRANSPORTATION

August 2008
Fugro Job No. 3602.001



FUGRO ATLANTIC

World Trade Center
101 West Main Street, Suite 350
Norfolk, Virginia 23510
Tel: (757) 625-3350

August 25, 2008
Project No. 3602.001

Virginia Department of Transportation
1221 E. Broad Street
Richmond, Virginia 23219

Attention: Mr. Raymond Partridge, Project Manager, Innovative Project Delivery

Subject: Volume 6, River Bottom Charting Data Report, Proposed Midtown Parallel Second Tunnel

Dear Mr. Partridge:

Fugro Atlantic (Fugro) has completed a river bottom charting marine survey program in support of the Virginia Department of Transportation's (VDOT) proposed Midtown Second Parallel Tunnel. This report summarizes the results of the bottom charting survey that included: 1) bathymetry, 2) side scan sonar, and 3) magnetometer data collection. The data obtained during the survey are presented in charts included in this report.

This report, which documents the river-bottom charting survey, is one of a series of reports documenting and presenting the results of Fugro's marine survey and geotechnical exploration program for the Midtown Second Parallel Tunnel Project. Fugro's marine survey and geotechnical exploration program for the project was completed in general accordance with our proposal, dated January 7, 2008, and was authorized by an Interagency Agreement between the Virginia Port Authority (VPA) and VDOT.

It has been a pleasure working with you through this phase of the project. We look forward to the opportunity to provide continued support as the project progresses.

Sincerely,

FUGRO ATLANTIC

COMMONWEALTH OF VIRGINIA
THOMAS WILLIAM MCNEILAN
Lic. No. 44962
PROFESSIONAL ENGINEER

Kevin Smith
Senior Engineering Geologist

Thomas W. McNeilan, P.E.
Vice President

Copies Submitted: (4) Addressee and PDF provided on CD

(1) Mr. John Daoulas, P.E., Senior Geotechnical Engineer for Special Projects, VDOT

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1.0 INTRODUCTION

1.1 PROJECT OVERVIEW

The proposed Midtown Second Parallel Tunnel is a main component of the major infrastructure improvement project aimed at providing increased capacity for east-west travel across the Elizabeth River. The Second Parallel Tunnel will extend between: 1) U.S. Route 58 and Interstate 264 in Portsmouth, and 2) Brambleton Avenue/Hampton Boulevard in Norfolk. The existing Midtown Tunnel provides one lane of travel in each direction. The second tunnel will provide two westbound travel lanes, allowing the existing tunnel to accommodate two lanes of eastbound traffic. Additionally, the second tunnel will provide increased flexibility for redirecting traffic during maintenance operations and emergency situations.

Preliminary information provided by the Virginia Department of Transportation (VDOT) indicates that the second tunnel is to be located northwest (downstream) of, and parallel to, the existing tunnel. In addition, VDOT anticipates that the second tunnel will follow a similar vertical alignment as the existing first tunnel. VDOT has defined the project area to extend 300 feet northwest (downstream) of the northern edge of the existing tunnel. The project vicinity is shown on Figure 1.

The current report and river bottom charting survey are part of a series of geotechnical exploration and survey activities for the Second Parallel Tunnel. Figure 2 shows the organization of the various reports that are being prepared for the geotechnical exploration and surveys for the project.

1.2 SCOPE OF WORK

1.2.1 River Bottom Survey

A marine survey investigation consisting of two separate phases was conducted from February 14 through 27, 2008. The first phase, a river bottom charting survey, was conducted from February 14 through 21, 2008. The second phase, a seismic reflection survey, was conducted from February 21 through 27, 2008. This report describes the river bottom charting survey and includes charts that display the survey results. Figure 3 shows the extents of the respective surveys. The seismic reflection survey and seismic data processing methods are documented in a separate report (Fugro, 2008a).

The river bottom charting survey was conducted in advance of the seismic reflection survey and geotechnical investigation to document water depths, map the river bottom, and identify obstructions within the project area. For this phase of work, McKim & Creed under subcontract to Fugro collected a suite of bathymetric, side scan sonar, and magnetometer data from their survey vessels *S/V Clock* and *S/V Philly II* (Figure 4). Bathymetric data were collected using a multibeam echosounder for about 75 percent of the area, while the balance of the survey was performed using a single beam echosounder in shallow water areas near the Norfolk shoreline.

1.2.2 Limited Shoreline Land Survey

To support the marine survey program, a limited conventional land survey was conducted along the Norfolk and Portsmouth shorelines. The survey was conducted on February 21 and 29, 2008, by NXL, Inc., under subcontract to Fugro. The purpose of the land survey was to locate (relative to the project's horizontal datum) various existing Midtown Tunnel structures and the shore crossings of the City of Norfolk's 30-inch water pipeline and Hampton Roads Sanitation District's 42-inch-diameter sewer pipeline. The land survey information was used to assist locating the respective features during the marine survey program and identify safe locations for the geotechnical subsurface explorations.

1.3 AUTHORIZATION

Fugro marine survey and geotechnical site exploration program in support of the VDOT proposed Midtown Second Parallel Tunnel Project was authorized by an Interagency Agreement between the Virginia Port Authority (VPA) and VDOT. Fugro's services for the Second Parallel Tunnel were completed in general accordance with our proposal dated January 7, 2008. The execution of that scope of work was authorized by amendment of the contract between the VPA and the Craney Island Design Partners (CIDP), LLC, and the associated subcontract between the CIDP and Fugro Atlantic (Fugro).

2.0 RIVER-BOTTOM SURVEY AND EQUIPMENT SYSTEMS

2.1 OVERVIEW OF THE SURVEY

The river bottom survey was initiated by conducting equipment initialization, system checks and calibrations at dockside and at the project site. The vessels transited to the project site early each day, commenced survey operations, and continued throughout the day before returning to one of the downtown Norfolk marinas each evening.

Survey operations consisted of boat passes over the site to provide 100 percent multibeam and side scan sonar data coverage in areas with sufficient water depth for the collection of those data. The multibeam bathymetry data was supplemented with single-beam bathymetry data at about 50-foot spacing in the shallow bottom area adjacent to the Norfolk shoreline. Magnetometer data were collected separately along survey lines up and down river (perpendicular to tunnel and two known utility pipelines) at about 25-foot spacing. One approximately 9,800-sq ft-area on the Norfolk side of the Navigation Channel was obstructed by a construction barge during the survey. That area is delineated on the figures and charts as a red-hatched area.

The coverage area for respective data collection activities are shown on Figure 3 and summarized in Table 1.

Table 1. Bottom Charting Survey Summary

Survey Type	Coverage Area (acres)	Survey Vessel
Multibeam	55.9	S/V Clock
Single Beam Sonar	17.1	S/V Philly II
Side Scan Sonar	66.0	S/V Philly II
Magnetometer	27.1	S/V Philly II

2.2 PROJECT DATUMS

Positioning information during all survey operations were output from a Real Time Kinematic (RTK) global positioning system (GPS), and logged as State Plane (Virginia South, feet) grid coordinates with the following spheroidal projection and projection parameters:

Datum	NAD83
Spheroid	GRS80
Semi-major Axis	6,378,137.000 m
Semi-minor Axis	6,356,752.314 m
Inverse Flattening	298.2572235630
Eccentricity^2	0.006694379990141

Projection	Lambert Conformal Conic
Grid	Lambert Conformal Conic (NAD83)
Zone	Virginia South (feet)
Latitude of Origin	36° 19'59.998"
Longitude of Origin	-78° 50' 00.000" W
False Easting	11,482,916.667 ft
False Northing	3,280,833333 ft
Scale Factor	0.3048
Convergence	World Standard

The vertical datum used during data acquisition of the field survey was North American Vertical Datum of 1988. Units used during the field survey were as follows:

- Linear units were feet,
- Angular units were degrees (°), and
- Time was recorded as local time in the field logs.

For reporting and charting, vertical units were converted to reference the vertical datum Mean Lower Low Water (MLLW). Measured water depths were corrected to MLLW based upon tidal data obtained from the National Oceanic and Atmospheric Administration (NOAA) tide gauge Station No. 8638610 (1983-2001 tidal epoch) located at Sewells Point, Hampton Road.

2.3 SURVEY VESSELS

McKim & Creed's *S/V Philly II* was employed as the operational platform for single beam bathymetry, side scan sonar, and the magnetometer surveys. She is a shallow draught welded-aluminum hydrographic survey boat measuring 24-feet long. The *S/V Philly II* is a MonArk survey vessel with twin 115 horsepower motors. Navigation and other topside survey instrumentation are enclosed in the vessel's wheelhouse. The side scan sonar and magnetometer sensors were towed from the stern while the single-beam sonar was mounted to the side of the vessel on a sturdy pole mount.

McKim & Creed's *S/V Clock* (Figure 4) was employed as the operational platform for the multibeam survey. She is a shallow draught welded-aluminum hydrographic survey boat measuring 28 feet long. The *S/V Clock* is a Thomas Marine survey vessel with twin 150 horsepower motors. The navigation and other topside survey instrumentation are enclosed in the vessel's wheelhouse. The sonar head was mounted to the side of the vessel on a sturdy pole mount.

2.4 NAVIGATION SYSTEM

Navigation survey control was provided by the McKim & Creed surveyors who also piloted the survey vessel. Prior to the survey, McKim & Creed Survey recovered and checked control monuments for accuracy using RTK GPS.

Survey control for the project was referenced to the State Plane Coordinate System, Virginia South, relative to North American Datum of 1983 for horizontal, and North American

Vertical Datum of 1988 for Vertical. Tidal variations were accounted for through the RTK GPS corrections with corrections updated at 10 Hz (10 updates per second). Other I/O interfaces with the navigation system included connections to the seismic systems, the echosounder, and the side scan sonar.

For this survey, Fugro's Starfix.Seis navigation system was interfaced to McKim & Creed's onboard Trimble 12-channel GPS receiver with an integrated Starfix Differential receiver. The Trimble unit receives ranging information from the same satellites as the Starfix differential reference stations. These corrections are applied to the DGPS receiver's satellite data to produce an accurate position of the vessel in real-time. The differentially-corrected position from the Trimble receiver is then passed to the navigation computer.

The Starfix.Seis navigation system continually recorded and transmitted tow-fish positions as well as vessel speed and position. An ethernet link to the data logging computers transmitted the positioning data and record event markings on the paper seismic and sub-bottom records.

Vessel offsets were measured on a level concrete floor at the shop. The vessel was leveled fore and aft using bubble and water levels. Benchmarks were installed at the reference point (RP; center transition to cabin), starboard and port draft measuring points, bow, stern, forward cabin top, and at aft quarter tow points. A drill mark was used as the RP reference point on the antenna mast. Bubble levels were installed on the cabin top and the deck for future leveling.

All reference points were measured to approximately 0.1 inch accuracy or better using level lines and a steel tape. The reference frame of the vessel is defined by the bow/stern RP (fore/aft), the starboard/port draft measurement benchmarks (athwart) and vertically by plumb line.

2.5 BATHYMETRY SURVEY

Bathymetry data for the project site were collected by both multibeam and single beam bathymetric systems. Where adequate water depth was present, the principal sounding data were acquired with the multibeam system. A single beam survey was conducted in the near shore area along the Norfolk side of the river where the water depth was too shallow to safely operate the multibeam system. The coverage areas for the multibeam and single-beam data collection are shown on Figure 3.

In addition to the project area bathymetric data, the bathymetric data from two recent surveys performed for projects unrelated to the Midtown Tunnel Second Parallel Tunnel project were obtained (by Fugro) to supplement as regional data. Both bathymetric systems employed on this survey and the data obtained from the two project areas are described below.

2.5.1 Multibeam Survey

The multibeam sonar system used was an Odom ES-3 with the sonar head mounted to the side of the vessel on a sturdy pole mount. Principle details of the system are provided in Table 2. The system configuration is shown on Figure 5.

Table 2. Multibeam Echosounder Instrumentation Summary

Parameter	Specification
Echosounder	ODOM ES3 Multibeam
Frequency	240 kHz - 120° swath
Power	approximately 100 watts
Velocity Check	Bar Check Method

A laptop computer was used to interface and control the system, running Odom's proprietary software.

The position data, multibeam data, and heave, pitch, and roll (HPR) data were simultaneously sent to another laptop computer running Hypack hydrographic survey software. A "patch test" was performed in order to calibrate the systems and account for inaccuracies in mounting for roll, pitch, timing latency and yaw. During data collection simultaneous with positioning, a serial link between the Odom Echotrak Dual Frequency echo sounder and the Hypack system resulted in an exchange of information between the systems. The echo sounder transmitted digital depth soundings to the navigation system for logging of depth soundings while the navigation system transmitted a closure at each fix position for marking the paper echo sounder record.

HPR corrections were supplied by a TSS DMS-05 sensor mounted near the center axis of the vessel. Horizontal and vertical offsets were measured and entered into the software. Speed of sound through the water column was measured with an Odom Digabar velocity profiler.

A bar-check calibration for speed of sound was conducted prior to commencing operations and each day thereafter. In the bar check calibration, a flat plate is suspended by a precisely marked line to a known depth below the transducer. Variations between the true bar depth and the observed depth are used to correct observed depths by adjusting the sound velocity on the echosounder until it reads correctly.

The project area was surveyed to attain 100-percent coverage with about 30-percent overlap for all areas that were accessible at the time of the survey. The resulting data were processed using Hypack's "Hysweep" software to remove erroneous data as needed. The processed data were merged into single file after analyzing the data and reducing excessive soundings.

2.5.2 Single Beam Survey

Single beam bathymetry data were acquired with an ODOM dual-frequency survey-grade echosounder operating at 200 kHz frequency. Principle details of the system are provided in Table 3.

Table 3. Single Beam Echosounder Instrumentation Summary

Parameter	Specification
Echosounder	ODOM Echotrak Dual Frequency
Frequency	200 kHz
Power	approximately 100 watts
Velocity Check	Bar Check Method

Bathymetric data were collected both continuously and simultaneously with the side scan sonar and magnetometer systems over the entire survey grid. Additional single beam data were collected at approximately 50-foot spaced track-lines in the shallow water area near the Norfolk shoreline to augment the multibeam survey data. The echosounder was calibrated prior to commencing the survey each day using the bar check method.

An Odom Echotrak Dual Frequency echo sounder was used to acquire single beam bathymetric data during survey operations. The Odom Echotrak Dual Frequency echo sounder collects analog paper records as well as digitized depth information for output to the navigational computer. Digital depth data were logged direct to the navigation computer along with date, time, and RTK position for post processing and mapping. Corrections to MLLW were applied in post processing based on the RTK measurements collected during the survey.

Single beam bathymetric data recorded by the navigation computer during data collection were sorted and thinned to a data density of 10-foot intervals, then edited to remove outliers. An exception to this is the shallow water survey area. In that area, the data point spacing was thinned to 0.5-foot-interval to allow those data to be used to locate a surface-laid pipeline. The edited soundings were then cross-referenced against the echosounder strip-chart recordings. The soundings were reduced to MLLW using the RTK vertical measurements recorded during data acquisition. Data was used to determine reasonable boundaries for multibeam and seismic survey collection.

During data collection simultaneous with positioning, a serial link between the Odom Echotrak Dual Frequency echo sounder and the Hypack system resulted in an exchange of information between the systems. The echo sounder transmitted digital depth soundings to the navigation system for logging of depth soundings while the navigation system transmitted a closure at each fix position for marking the paper echo sounder record.

Prior to operations a bar-check calibration for speed of sound was carried out. These calibration tests were conducted prior to commencing operations and obtained each day. In the

bar check calibration a flat plate is suspended by a precisely marked line to a known depth below the transducer. Variations between the true bar depth and the observed depth are used to correct observed depths by adjusting the sound velocity on the echosounder until it reads correctly.

2.5.3 Other Area Surveys

Bathymetric data from two other recent area surveys were acquired to supplement the project's multibeam and single beam surveys. One data set was surveyed by the United States Army Corps of Engineers (USACE) on March 26, 2007, and used a multibeam system to survey the navigation channel and flanks of the channel. The other data set was surveyed by Waterway Survey and Engineering, Ltd. On February 6 and 7, 2008, for the berth area at the Marine Hydraulics International, Inc. (MHI) facility. This survey is presumed to have been completed using a single beam system. Both data sets are referenced to MLLW and were incorporated by Fugro with the project data acquired by McKim & Creed to provide regional bathymetric data used for charting. The extents of the surveys are shown on Figure 3 and Chart 1.

2.5.4 Bathymetry Charts

Three types of bathymetry charts were generated to present water depths, and illuminate river bottom bathymetric features and conditions. A discussion that describes the river bottom conditions and features observed in these charts will be provided in the Elizabeth River Site Characterization Report (Figure 2). The charts (and figure and chart numbers) and how they were created are as follows:

- **Bathymetry (Figure 6 and Chart 2):** The bathymetric data from the project area multibeam and single beam surveys, and the two other area surveys were integrated to create one bathymetric data set. Bathymetric data for overlapping survey areas were not averaged. Instead, where data sets overlapped, the following hierarchy was used for data selection in descending priority: 1) project area multibeam data, 2) project area single beam data, 3) MHI area survey data, and 4) USACE Elizabeth River Navigation Channel survey data. Overall, the data sets matched very well and appear nearly seamless.
- **Sun-Illuminated Shaded Relief (Figure 7 and Chart 3):** A sun-illuminated shaded relief of the bathymetry was created using a sun azimuth of 315 degrees and an altitude of 45 degrees. The purpose of this chart is to illuminate bathymetric features of the river bottom.
- **River Bottom Slope Gradient (Figure 8 and Chart 4):** A river bottom slope gradient chart was created by calculating the slope from the bathymetric data. A key is provided which indicates the slope depicted on the map in units of: 1) degrees, 2) percent grade, and 3) horizontal to vertical ratio (h:v). The map presents the bottom conditions, illuminates various features, and documents existing dredge cut slopes.

2.6 SIDE SCAN SONAR SURVEY

A Marine Sonic Technology, Ltd. Sea Scan digital 600 kHz side scan sonar system was used to provide near photographic sonic images of the project area. The sonar towfish was towed across the area at various depths, depending on water depth. Due to the nature of towed equipment, access to very shallow water was limited. Principle details of the system are provided in Table 4.

Table 4. Side Scan Sonar Instrumentation Summary

Parameter	Specification
Side Scan Sonar	Marine Sonics Technology, Ltd. Side Scan Sonar
Frequency	600 kHz
Acquisition Software	SonarWiz Map
Sensor Height Above Seafloor	Variable

The resulting images were reviewed for possible obstructions and a list of these targets with position, description, and their approximate dimensions is provided as Table 5. The locations of the targets are shown on Chart 5.

Figures 9a and 9b show selected images of side scan sonar targets. Chart 5 shows the side scan sonar mosaic of the site and includes several larger scale inset images of targets.

Table 5. Summary of Side Scan Sonar Targets

Target	Northing	Easting	Approximate Target Dimensions (feet)	Interpreted Target
ST-1	12121321	3479961	Height: 5.9	Unknown
ST-2	12121539	3478397	Height: 1.0	Edge of pilings
ST-3	12121540	3478394	Height: 1.1 Width: 30.9	Edge of numerous pilings, extend to shore side and ahead
ST-4	12121556	3478313	Height: 1.1 Length: 86.4 Width: 54.7	Center of group of pilings and debris, height varies, extends to shore
ST-5	12121684	3478534	Height: 4.6 Length: 79.2 Width: 30.9	Group of scattered pilings, some may be upright, leaning or lying flat
ST-6	12121684	3478532	Height: 1.6	Fallen pilings
ST-7	12121688	3479545	Height: 1.8	Debris
ST-8	12121730	3478561	Height: 0.6 Length: 12.5 Width: 1.0	Unknown object on seafloor
ST-9	12121732	3478487	Height: 0.6 Length: 132.9 Width: 60.6	Field of fallen pilings
ST-10	12121782	3478675	Height: 0.8 Width: 49.2	Edge of numerous pilings, extends to shore and both directions parallel to shore
ST-11	12121783	3478676	Height: 0.8	Edge of pilings
ST-12	12121890	3478786	Height: 0.6	Edge of pilings
ST-13	12121901	3478795	Height: 0.6 Width: 36.5	Edge of numerous pilings, extends to shore and both directions parallel to shore
ST-14	12121904	3478743	Height: 6.4 Length: 1.7 Width: 0.6	Appears to be a piling at or near the surface
ST-15	12122058	3478934	Height: 0.0 Length: 14.2 Width: 0.8	Unknown object on seafloor
ST-16	12122070	3480142	Unknown	Unknown
ST-17	12122101	3480175	Height: 0.4 Length: 7.1 Width: 1.8	Unknown item on seafloor
ST-18	12122101	3480175	Height: 0.8 Length: 4.5 Width: 1.6	Unknown
ST-19	12122106	3479050	Height: 0.1 Length: 2.2 Width: 6.0	Unknown object on seafloor
ST-20	12122125	3479627	Height: 1.7 Length: 12.8	Unknown
ST-21	12122212	3480007	Height: 0.4 Length: 14.9 Width: 0.5	Unknown
ST-22	12122228	3480031	Height: 0.4 Length: 28.2 Width: 0.7	Item on seafloor, perhaps piling or log
ST-23	12122228	3480030	Height: 0.9 Length: 25.1 Width: 0.5	Unknown
ST-24	12122232	3479909	Height: 1.0	Tire(?)

Table 5. Continued

Target	Northing	Easting	Approximate Target Dimensions (feet)	Interpreted Target
ST-25	12122274	3478785	Height: 3.6 Length: 4.4 Width: 14.1	Tall piling
ST-26	12122430	3479816	Height: 1.5 Length: 70.5 Width: 35.1	Debris field
ST-27	12122451	3479813	Height: 1.1 Length: 79.2 Width: 60.9	Center of several unknown objects on seafloor, appear to be lying flat, misc. debris
ST-28	12122454	3479000	Height: 1.4 Length: 10.7 Width: 1.9	Debris
ST-29	12122481	3478602	Height: 1.4	Corner of pilings
ST-30	12122601	3478512	Height: 0.4	Corner of pilings
ST-31	12122639	3478429	Height: 0.5	Corner of pilings
ST-32	12122669	3478505	Height: 0.5	Piling
ST-33	12122715	3478473	Height: 0.5	Piling
ST-34	12122733	3479936	Height: 3.6	Possible tall piling
ST-35	12122856	3479848	Height: 0.8 Length: 46.8 Width: 35.6	Difficult to identify, probable scour or gouging
ST-36	12122863	3479848	Height: 0.8	Unknown - smeared by turning
ST-37	12122910	3478374	Height: 1.1 Length: 21.6 Width: 18.8	Debris
ST-38	12122927	3479784	Height: 0.8	Unknown
ST-39	12122928	3478355	Height: 0.9 Length: 7.9	Unknown
ST-40	12122958	3479745	Height: 1.6	Scour features(?)
ST-41	12122960	3479738	Height: 0.7 Length: 0.8 Width: 8.5	Item on seafloor, piling or log
ST-42	12122961	3479747	Height: 0.2 Length: 67.9 Width: 7.3	Looks like scouring
ST-43	12123011	3479817	Height: 0.3 Length: 32.1 Width: 0.7	Looks like scouring
ST-44	12123015	3479568	Height: 0.7 Length: 48.0 Width: 12.2	Several items on seafloor, unknown debris
ST-45	12123018	3479725	Height: 0.5 Length: 24.7 Width: 3.1	Unknown item on seafloor
ST-46	12123018	3479725	Height: 1.2	Unknown
ST-47	12123020	3479834	Height: 1.0	Unknown
ST-48	12123029	3479651	Height: 1.0 Length: 18.2 Width: 1.0	Unknown
ST-49	12123030	3479616	Height: 2.3 Length: 29.1 Width: 17.1	Debris

Table 5. Continued

Target	Northing	Easting	Approximate Target Dimensions (feet)	Interpreted Target
ST-50	12123079	3479681	Height: 0.4 Length: 16.1 Width: 3.8	Unknown debris
ST-51	12123091	3478212	Height: 0.6	Debris area
ST-52	12123141	3479839	Height: 0.7	Unknown
ST-53	12123155	3479724	Height: 0.1	Piling(?)
ST-54	12123185	3478275	Height: 0.6	Debris and pilings area
ST-55	12123191	3479708	Height: 1.2	Unknown
ST-56	12123217	3479773	Height: 1.1	Unknown
ST-57	12123222	3478112	Height: 0.7	Edge
ST-58	12123275	3478162	Height: 7.8	Corner debris / pilings field
ST-59	12123283	3478069	Height: 0.7	Edge
ST-60	12123331	3478120	Height: 4.0	Corner debris / pilings field
ST-61	12123518	3477883	Height: 1.9 Width: 28.7	Unknown
ST-62	12121930	3477883	Width:≤2.0	Abandoned pile
ST-63	12121956	3477883	Width:≤2.0	Abandoned pile
ST-64	12121991	3477883	Width:≤2.0	Abandoned pile
ST-65	12122663	3479972	Length: 92 Width: 23	Water pipeline and piles

Although attempt was made to identify any potential obstructions, it is possible (and indeed probable) that some obstructions were not identifiable and therefore, this can not be considered an absolute account of all items in the project area.

2.7 MAGNETOMETER SURVEY

The objective of the magnetometer survey is to identify metallic obstructions on or immediately below the river bottom. Locations of ferrous debris and pipelines may be identified in magnetometer surveys by the presence of magnetic anomalies. Ideally, to locate linear objects, survey lines are run perpendicular to the linear bodies. Taking into consideration that the tunnel and two known pipelines traverse the river parallel to each other, magnetometer survey lines were oriented perpendicular to those structures, or parallel to the axis of the river, and spaced about 25-feet apart.

A Marine Magnetics SeaSPY magnetometer was used to measure the ambient magnetic field across the project area from the stern of the *S/V Clock* via a tow cable. A Marine Magnetics' magnetometer measures the ambient magnetic field using a specialized branch of nuclear magnetic resonance technology applied specifically to hydrogen nuclei producing very high sensitivity and accuracy. The sensor is reported to have an absolute accuracy of 0.2 ηT and a counter sensitivity of 0.001 ηT. Principle details of the system are provided in Table 6.

Table 6. Magnetometer Instrumentation Summary

Parameter	Specification
Magnetometer:	Marine Magnetics Corp., SeaSPY Overhauser Total Field Magnetometer
Absolute Accuracy	0.2 ηT
Counter Sensitivity	0.001 ηT
Sensor Height Above Seafloor	Variable

The magnetometer was interfaced to the navigation computer through the SeaSPY communications transceiver. The total magnetic field values, tow senor altitude, and depth were logged together with time tagged navigation information at a rate of 2 HzData collected during the magnetometer survey were gridded and contoured to identify anomalies. Figure 10 and Chart 6 present the magnetic anomaly chart.

Two of the anomalies correspond well with known locations of subsurface obstructions. The upstream (southeastern) edge of the tunnel correlates well with the peak values of the anomaly that extends across the survey area. Another anomaly correlates well to the approximate location of the water pipeline. When reviewing individual magnetometer survey track-lines, the water pipeline appears as a strong peak that is readily identifiable in the data (Figure 11). Based on the width of the signature of the magnetic anomaly, an uncertainty was applied to the peak values of each ascertained water pipeline location (Figure 11). This uncertainty is displayed Figure 10 and Chart 6.

The tunnel magnetic anomaly appears as an even larger signature than the water pipeline. The anomaly is larger in intensity (higher nanoTesla values) and width (Figure 11). The peak values correlate well with the upstream edge of the tunnel. However, due to the character of the magnetic anomaly it is difficult to discern the center or downstream edge of the tunnel in the data. This magnetometer anomaly character is common for ferrous bodies of sufficient size and therefore, the magnetometer data collected in this survey should only be used to identify the general location of the existing tunnel.

The magnetometer data do not identify the location of the deeper sewer pipeline on the downstream side of the water pipeline.

Other magnetic anomalies are present within the area, but it is unknown what they are related to. Magnetic anomalies are affected by a variety of factors. For example, depth of burial or distance between the ferrous object and magnetometer will affect the size and intensity of the anomaly. Shape of the objects (e.g. spherical or circular point-like object versus long, linear object) will also affect the shape and character of the anomaly. Direction that the sensor is towed relative to the orientation of the object (e.g. survey track-line perpendicular to pipeline versus parallel or subparallel) will also affect the anomaly character and the level of precision and accuracy with which the feature may be located.

To use magnetometer data to locate objects with a high level of confidence, the exercise must be corroborated and calibrated by other investigative methods (e.g. side scan sonar data, subbottom geophysics, review of engineering as-built drawings, jet probing, potholing, etc.). Based on a review of engineering drawings and other data collected as part of this study, it appears that the magnetometer survey was able locate the water pipeline and the edge of the tunnel within +/ 20 feet. Additional discussion of the accuracy and precision with which the utilities may be located using the information collected during the marine surveys will be included in the Elizabeth River Site Characterization Report (Figure 2).

2.8 LAND SURVEY

A conventional land survey was conducted on February 21 and 29, 2008. The objective of the survey was to assist in documenting the locations of the existing Midtown Tunnel, City of Norfolk's water pipeline, and Hampton Roads Sanitation District's (HRSD) sewer pipeline. The survey was conducted by NXL, Inc. and employed RTK GPS survey equipment that collected survey grade data. Local benchmark information provided by VDOT were used as control for the survey. The survey area and features are shown on Figures 12 and 13. Photographs of selected features are shown on Figures 14 through 20.

Prior to the survey, VDOT representatives procured right-of-entry permissions for the private property areas of the survey. Additionally, Fugro representatives met with utility locators from HRSD and the City of Norfolk to coordinate the marking of their utilities on the Norfolk and Portsmouth sides. The following features were surveyed.

2.8.1 Midtown Tunnel Existing Structures

The objective of surveying the existing structures was to assist in establishing the tunnel location and approximate centerline to plan safe locations for the geotechnical borings and soundings. Our objective (and the scope of the survey) was not to provide design level and construction planning level information of the existing tunnel structures.

The existing structures that were surveyed included:

- Portsmouth and Norfolk vent structures and control buildings; and
- Inner and outer wall of the Portsmouth and Norfolk tunnel entry structures.

To establish an approximate tunnel centerline beneath the Elizabeth River, we extrapolated straight lines between the surveyed, straight sections of the inner and outer retaining walls on the Norfolk and Portsmouth shorelines. We found that the extrapolated lines of the inner and outer walls nearly matched (within 2 or 3 feet in most cases and within five feet in the worse case) those on the opposite sides of the tunnel. We then used the average midway point the four lines drawn and created one, linear, best fit line to approximate the tunnel centerline. According to the design drawings, the existing tunnel is 40 feet in diameter. Based on that information we define our tunnel extent, as shown in orange lines on our figures, as a 40-foot diameter tube on center from this centerline.

We also georeferenced the 1960 design drawings using the survey information (e.g. vent structures) and found the inferred tunnel location to be in good agreement with the design drawings. Additionally, our geophysical data further supports this inferred tunnel location. A discussion of the usage and limitations of the geophysical data are included herein this report, the Seismic Reflection Survey Report (Fugro, 2008a), and the Elizabeth River Site Characterization Report (Fugro, 2008b) as listed in the Figure 2.

2.8.2 City of Norfolk Water Pipeline

The City of Norfolk's 30-inch-diameter, concrete incased water pipeline is located approximately 400 feet downstream (northwest) of the existing tunnel and constrains the downstream side of the proposed project. The pipeline is exposed at the Norfolk and Portsmouth shore crossings (Figures 14 and 17). Where the pipeline is exposed, the approximate center of the pipelines was surveyed. Elsewhere, the surveyors relied on markings provided by the City of Norfolk's utility locator (Figures 14 and 18).

2.8.3 Hampton Road Sanitation District Sewer Pipeline

The HRSD 42-inch-diameter, steel sewer pipeline lies approximately 50 to 100-feet downstream (northwest) of the water pipeline. The Elizabeth River crossing sewer pipeline was constructed using a horizontally directional drilled (HDD) method. Nowhere is the pipeline exposed at the surface. Therefore, the survey relied entirely on the markings provided by the HRSD utility locator (Figures 15, 16, 19, and 20).

3.0 LIMITATIONS

3.1 LOCATION OF EXISTING TUNNEL AND WATER PIPELINE

The depicted location of the tunnel and centerline are not for usage in construction planning or design. Prior to our site investigation, we recognized that high quality as-built drawings or electronic files documenting the locations of the existing tunnel and water pipeline were not available. Therefore, we carried out a marine and land survey as described herein and other reports listed in Figure 2 to ground-truth historical drawings and assist us in defining a safe work area for the geotechnical boring and sounding exploration.

Limitations of precision and accuracy for respective methods used to infer and interpret the tunnel and pipeline locations are described where applicable. In general, methodologies using geophysical technology may not provide adequate precision and accuracy for the design and construction planning of the second parallel tunnel. An understanding of the capability and limitation of the geophysical technology employed is required to optimize the data they provide and reduce the chance of misusing their data. We note that additional surveys or investigations may be required to document the locations of the water pipeline and existing tunnel to support design and construction planning. Several examples of options for additional ground truthing follow:

- Survey the inner diameter of the existing tunnel to aid in establishing survey-grade data of the centerline and tunnel location;
- Use a diver to jet probe and locate the water pipeline and tunnel;
- Additional, denser spacing of geophysical (subbottom and magnetometer) surveys; or
- Contact the City of Norfolk to inquire and obtain any as-built or construction and maintenance related surveys. We note that during our initial inquiry to City of Norfolk staff through the MISS Utility notification process, the City of Norfolk representative we met indicated that they were not aware of survey data which documented as-built conditions of the pipeline. However, during our survey, a construction barge with divers appeared to be conducting work on the pipeline.

3.2 POTENTIAL VARIATIONS IN SURFACE AND SUBSURFACE CONDITIONS

Earth materials can vary in type, strength, and other geotechnical properties between points of observation and exploration. Therefore, we do not and cannot have a complete knowledge of the surface and subsurface conditions underlying the site. The conclusions and recommendations presented in this report are based on the findings at the points of exploration, interpolation, and extrapolation of information between and beyond the points of observation, and are subject to confirmation (to the extent possible) based on the conditions revealed during construction.

3.3 REPORT USE

This report has been prepared for the exclusive use of the VDOT and its agents for the specific application to the Midtown Second Parallel Tunnel Project, located in Portsmouth and Norfolk, Virginia. In our opinion, the data, findings, conclusions, professional opinions, and recommendations presented herein were prepared in accordance with generally accepted geotechnical engineering practices of the project region.

Although information contained in this report may be of some use for other purposes, it may not contain sufficient information for other parties or uses. If any changes are made to the project as described in this report, the conclusions and recommendations in this report shall not be considered valid unless the changes are reviewed and the conclusions and recommendations of this report are modified or validated in writing by Fugro. This report and the figures contained in this report are intended for input to project design; they are not intended to act as construction drawings or specifications.

3.4 LOCAL PRACTICE

In performing our professional services, in our opinion, we have used generally accepted geologic and geotechnical engineering principles and have applied that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers currently practicing in this or similar localities. No other warranty, express or implied, is made as to the professional advice included in this report.

4.0 REFERENCES

Fugro Atlantic (Fugro) (2008a), Seismic Reflection Survey Report, prepared for Virginia Department of Transportation, Fugro Atlantic Project No. 3602.001.

_____ (2008b - in preparation), Elizabeth River Site Characterization Report, prepared for Virginia Department of Transportation, Fugro Atlantic Project No. 3602.001.

FIGURES

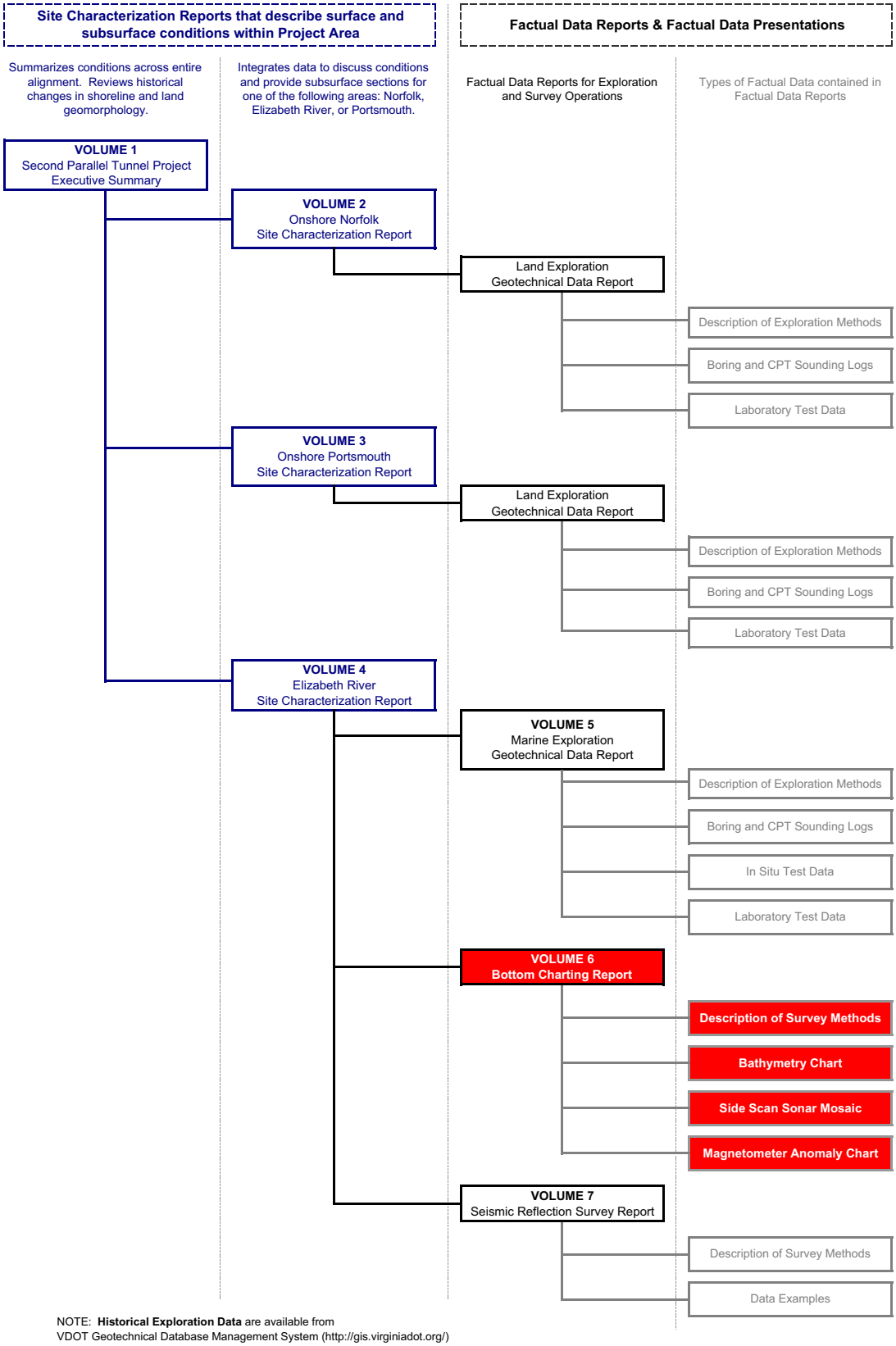


Aerial Photo Source: Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <<http://datagateway.nrcs.usda.gov/>>

PROJECT VICINITY MAP
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 1

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\02-BotChart_Rpt\MXD\Fig-01_Project_Vicinity_Map.mxd, 08/04/08, ksmith

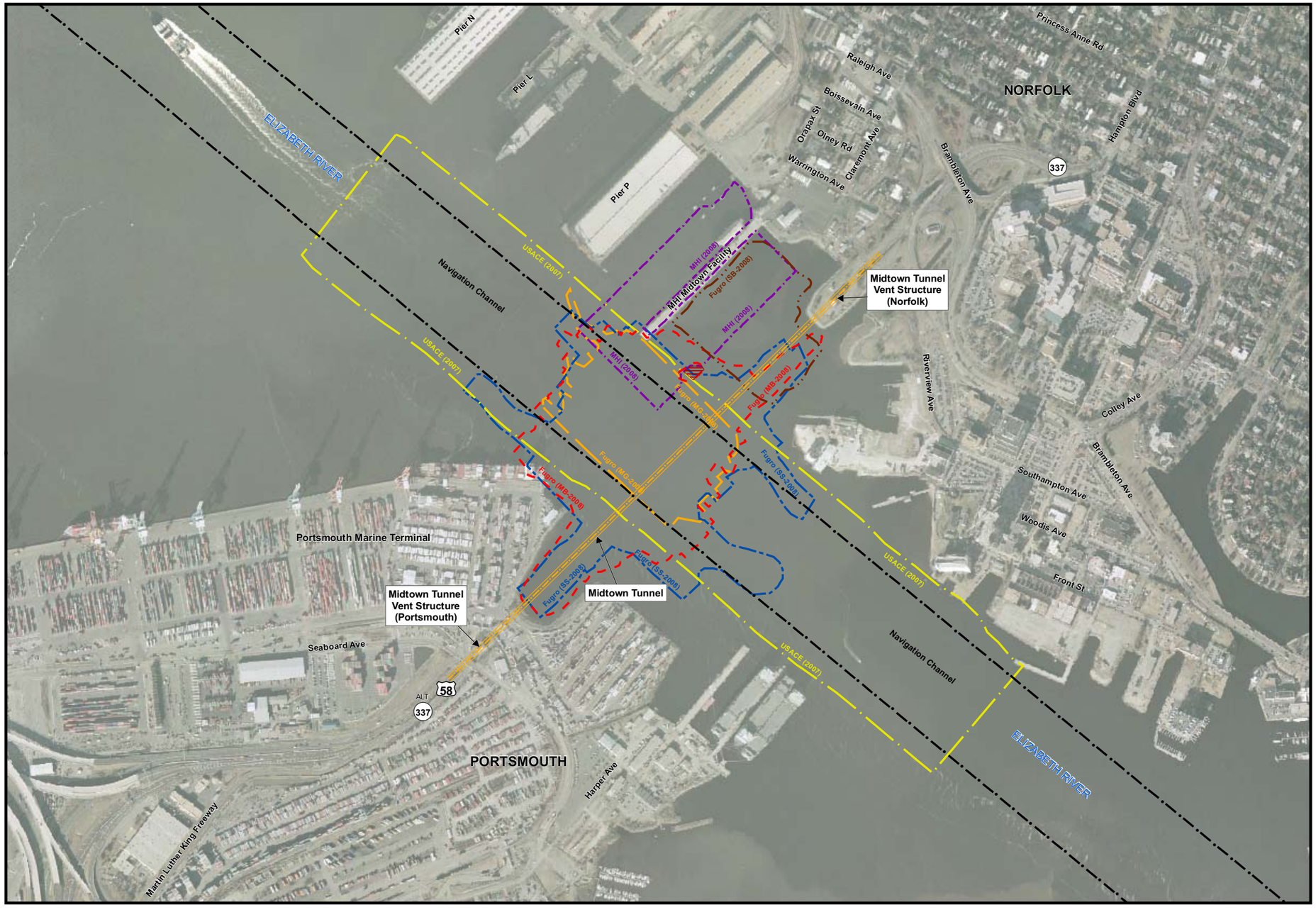


NOTE: **Historical Exploration Data** are available from
VDOT Geotechnical Database Management System (http://gis.virginiadot.org/)

GEOTECHNICAL REPORT ORGANIZATION

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 2



LEGEND

Approximate Location of Midtown Tunnel
Not for design or construction planning
(Refer to Section 3.1 in text)

Survey Boundaries and Data Sources

Data From Midtown Second Parallel Tunnel Project

Fugro (MB-2008): Multibeam Bathymetry Data
Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM ES3 Multibeam echosounder (240 Khz - 120 degree swath).

Fugro (SB-2008): Single Beam Bathymetry Data
Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM Echotrak Dual Frequency echosounder (200/28 kHz)

Fugro (SS-2008): Side Scan Sonar Data
Surveyed by McKim & Creed between February 13th and 22nd, 2008, using a Marine Sonics Side Scan Sonar system (600 kHz).

Fugro (MG-2008): Magnetometer Data
Surveyed by McKim & Creed between February 13th and 22nd, 2008, using a Marine Magnetics Sea SPY magnetometer.

Data From Other Area Projects

MHI (2008): Marine Hydraulics International, Inc. Single Beam Bathymetry Data
Surveyed by Waterway Surveys & Engineering, Ltd. at Lamberts Point between February 6th and 7th, 2008.

USACE (2007): U.S. Army Corps of Engineers Multibeam Bathymetry Data
Surveyed by United States Army Corps of Engineers- Norfolk District on March 26, 2007.

Area Obstructed During Fugro 2008 Survey

NOTES

1) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

0 400 800 Feet

N W E S

MARINE SURVEY EXTENTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

SEE CHART 1 FOR LARGE-SCALE PLOT

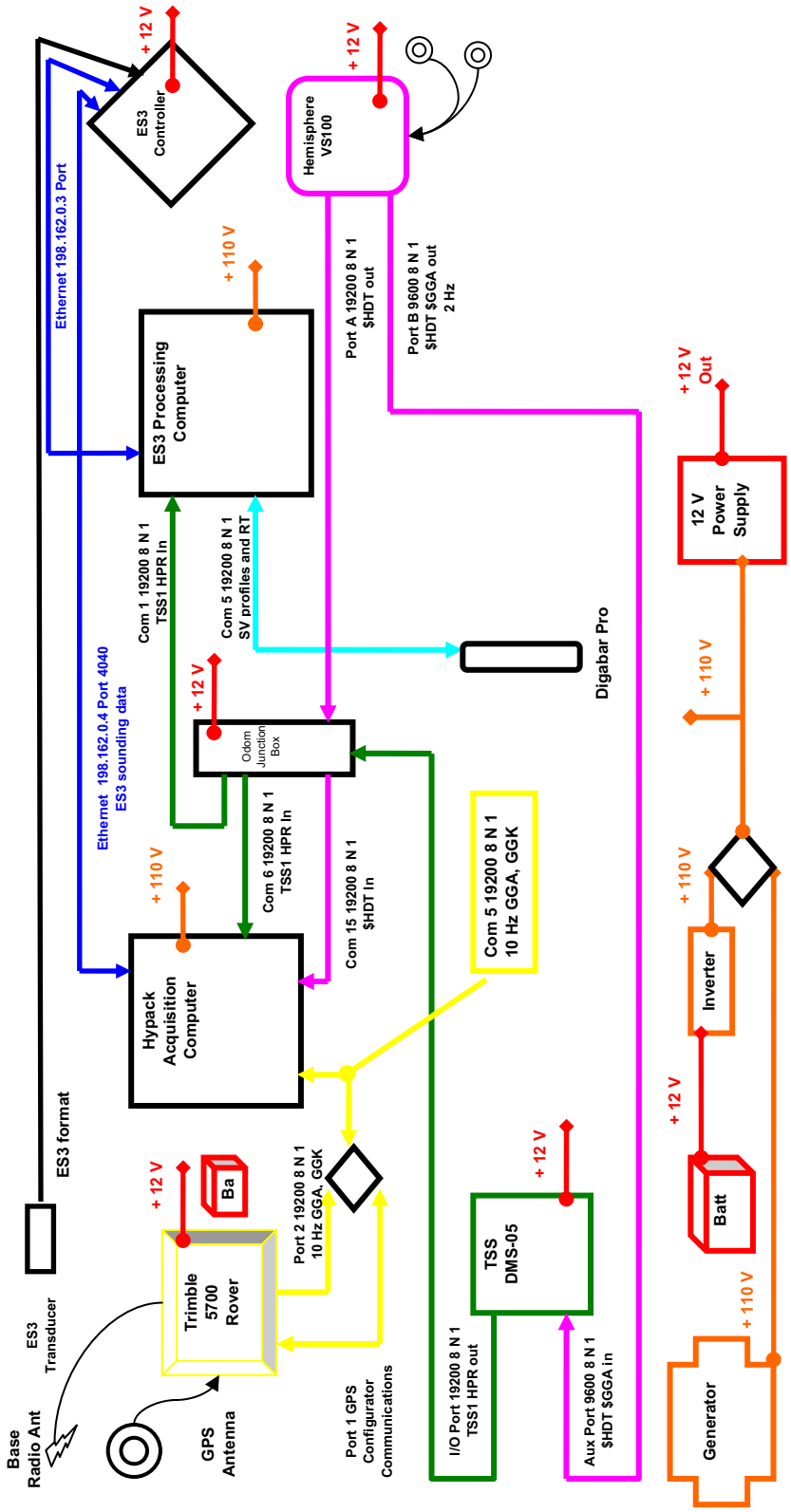
FIGURE 3

C:\Documents and Settings\KStevens\Desktop\MidTown_Tunnel\Bottom_Cht_Rpt\Fig-3_Survey_Extents_11x17.mxd, 07/31/08, kstevens



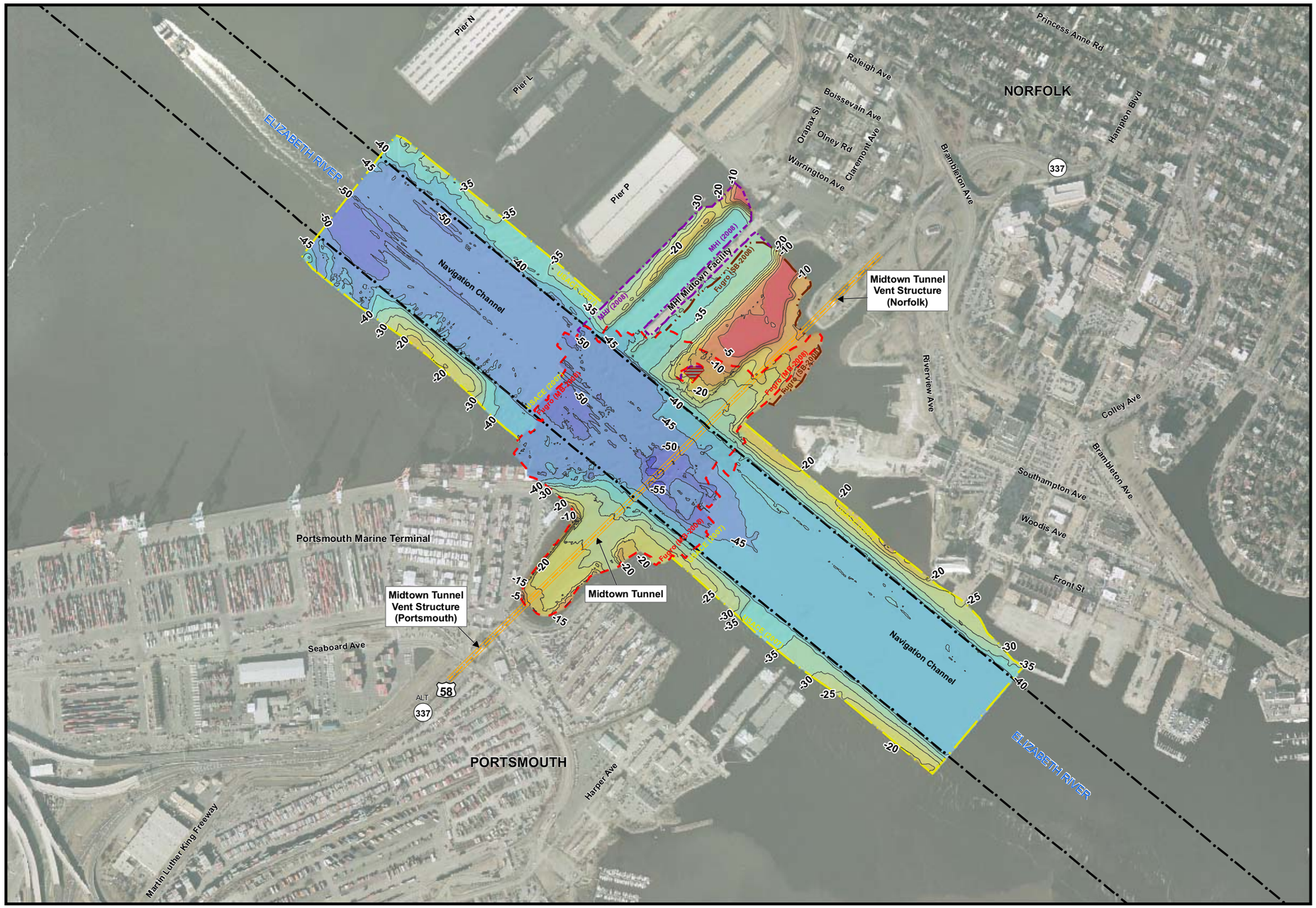
Photograph of S/V *Clock* at marina.

SURVEY VESSEL (S/V) Clock
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia



MULTIBEAM SYSTEM CONFIGURATION
S/V Clock
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 5



LEGEND

Approximate Location of Midtown Tunnel
Not for design or construction planning
(Refer to Section 3.1 in text)

Bathymetry (MLLW, feet)
Refer to notes for vertical datum.

- 0 to -5
- -5 to -10
- -10 to -15
- -15 to -20
- -20 to -25
- -25 to -30
- -30 to -35
- -35 to -40
- -40 to -45
- -45 to -50
- -50 to -55
- Deeper than -55

Bathymetric Contour in Feet (MLLW)
Contour interval is 5 ft.

Bathymetric Data Boundaries and Sources

Fugro (MB-2008): Multibeam Bathymetry Data Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM ES3 Multibeam echosounder (240 Khz - 120 degree swath).

Fugro (SB-2008): Single Beam Bathymetry Data Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM Echotrak Dual Frequency echosounder (200/28 kHz)

MHI (2008): Marine Hydraulics International, Inc. Single Beam Bathymetry Data Surveyed by Waterway Surveys & Engineering, Ltd. at Lamberts Point between February 6th and 7th, 2008.

USACE (2007): U.S. Army Corps of Engineers Multibeam Bathymetry Data Surveyed by United States Army Corps of Engineers- Norfolk District on March 26, 2007.

Area Obstructed During Fugro 2008 Survey

NOTES

1) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>
2) Reference to Mean Lower Low Water (MLLW), 1983-2001 Tidal Epoch, is based on observations performed and published by the National Oceanic and Atmospheric Administration, National Ocean Service (NOAA/NOS). Tidal Bench Mark 8638610 at Sewells Point, Hampton Roads, was used as the MLLW constraint for this project.

0 400 800 Feet

N W E S

BATHYMETRY
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

SEE CHART 2 FOR LARGE-SCALE PLOT

FIGURE 6

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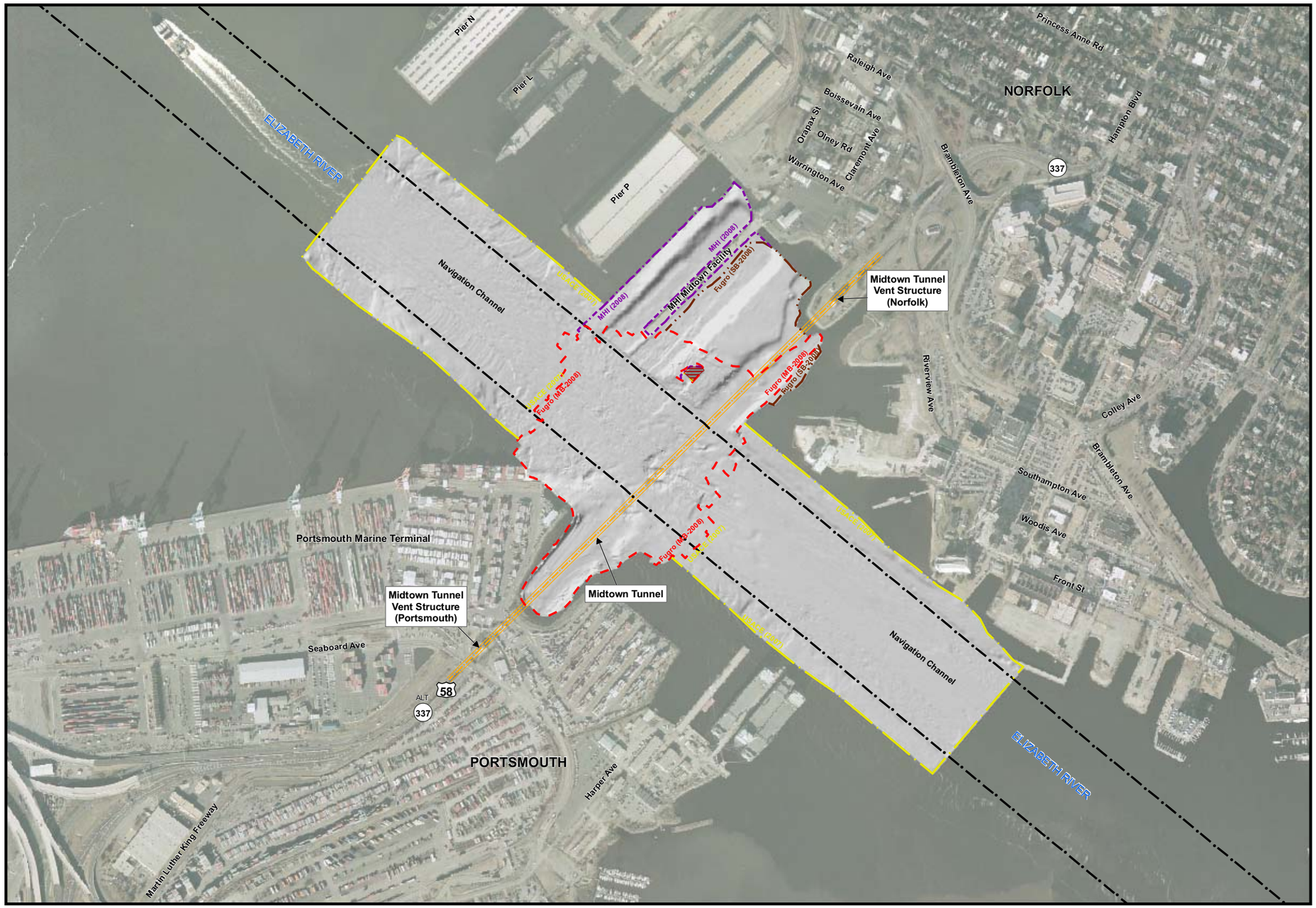

LEGEND

Sun-Illuminated Shaded Relief
Calculated from Bathymetric Data using
Sun Azimuth of 315 Degrees
and Altitude of 45 Degrees

Approximate Location of Midtown Tunnel
Not for design or construction planning
(Refer to Section 3.1 in text)

Bathymetric Data Boundaries and Sources

Fugro (MB-2008): Multibeam Bathymetry Data Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM ES3 Multibeam echosounder (240 Khz - 120 degree swath).

Fugro (SB-2008): Single Beam Bathymetry Data Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM Echotrak Dual Frequency echosounder (200/28 kHz)

MHI (2008): Marine Hydraulics International, Inc. Single Beam Bathymetry Data
Surveyed by Waterway Surveys & Engineering, Ltd. at Lamberts Point between February 6th and 7th, 2008.

USACE (2007): U.S. Army Corps of Engineers Multibeam Bathymetry Data
Surveyed by United States Army Corps of Engineers- Norfolk District on March 26, 2007.

Area Obstructed During Fugro 2008 Survey

NOTES

1) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>
2) Reference to Mean Lower Low Water (MLLW), 1983-2001 Tidal Epoch, is based on observations performed and published by the National Oceanic and Atmospheric Administration, National Ocean Service (NOAA/NOS). Tidal Bench Mark 8638610 at Sewells Point, Hampton Roads, was used as the MLLW constraint for this project.

0 400 800 Feet

N
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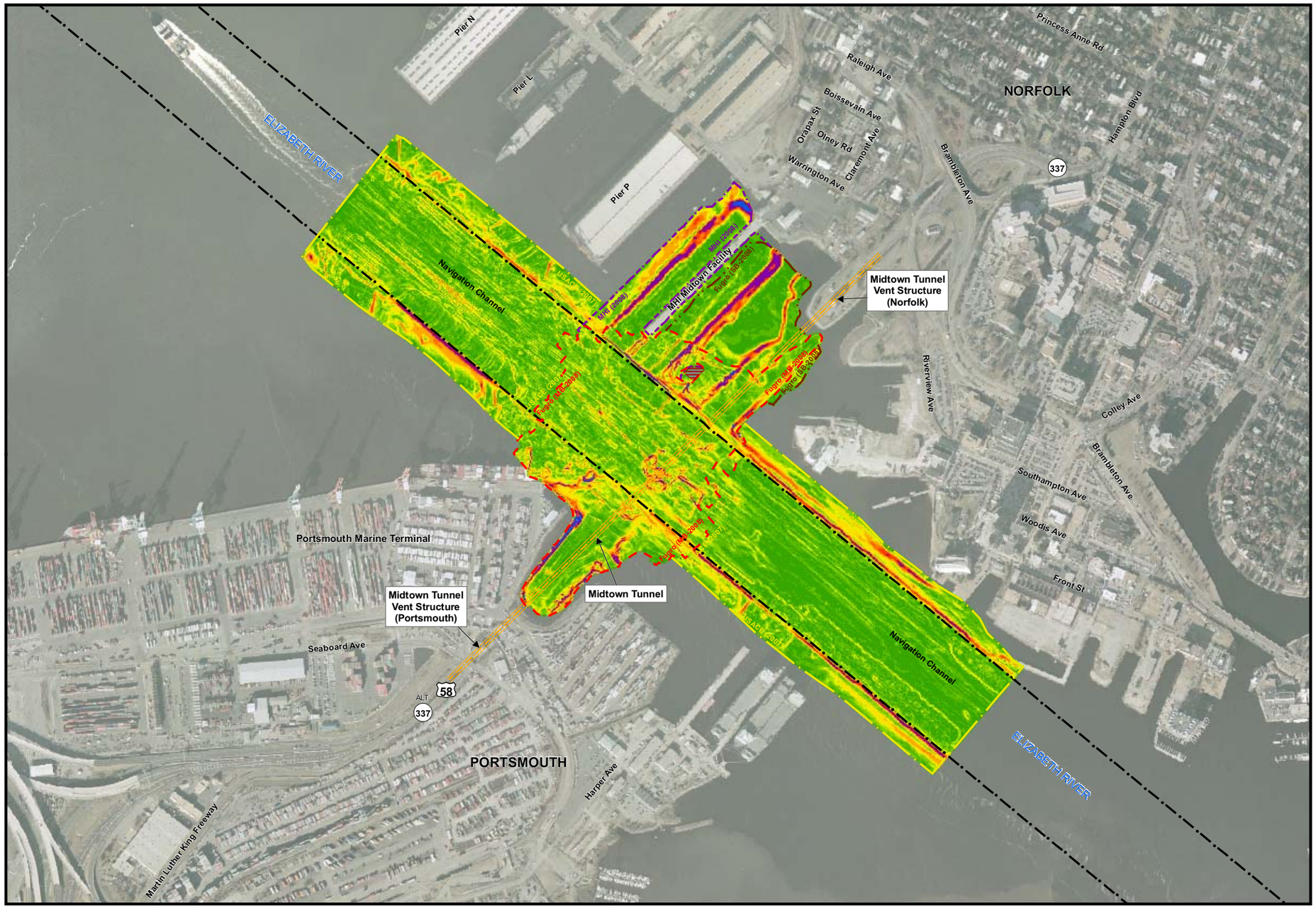
SUN-ILLUMINATED SHADED RELIEF
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

SEE CHART 3 FOR LARGE-SCALE PLOT

FIGURE 7

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\02-BotChart_Rpt\MXD\Fig-7_Hillshade_11x17.mxd, 08/04/08, kstevens



LEGEND

Approximate Location of Midtown Tunnel
Not for design or construction planning
(Refer to Section 3.1 in text)

Slope Gradient of River Bottom
Calculated from Bathymetric Data

Percent	Degrees	Horizontal to Vertical Ratio (H:V)
0 - 2	0 - 1.1	
2 - 4	1.1 - 2.3	
4 - 6	2.3 - 3.4	20:1
6 - 8	3.4 - 4.6	
8 - 10	4.6 - 5.7	
10 - 15	5.7 - 8.5	10:1
15 - 25	8.5 - 14.0	
25 - 30	14.0 - 16.7	4:1
30 - 35	16.7 - 19.3	3:1
48 - 52	25.6 - 27.5	2:1

Bathymetric Data Boundaries and Sources

Fugro (MB-2008): Multibeam Bathymetry Data
Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM ES3 Multibeam echosounder (240 Khz - 120 degree swath).

Fugro (SB-2008): Single Beam Bathymetry Data
Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM Echotrak Dual Frequency echosounder (200/28 kHz)

MHI (2008): Marine Hydraulics International, Inc.
Single Beam Bathymetry Data
Surveyed by Waterway Surveys & Engineering, Ltd. at Lamberts Point between February 6th and 7th, 2008.

USACE (2007): U.S. Army Corps of Engineers
Multibeam Bathymetry Data
Surveyed by United States Army Corps of Engineers- Norfolk District on March 26, 2007.

Area Obstructed During Fugro 2008 Survey

NOTES

1) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>
2) Reference to Mean Lower Low Water (MLLW), 1983-2001 Tidal Epoch, is based on observations performed and published by the National Oceanic and Atmospheric Administration, National Ocean Service (NOAA/NOS). Tidal Bench Mark 8638610 at Sewells Point, Hampton Roads, was used as the MLLW constraint for this project.

0 400 800 Feet

N
W E
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RIVER BOTTOM SLOPE GRADIENT
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

SEE CHART 4 FOR LARGE-SCALE PLOT

FIGURE 8

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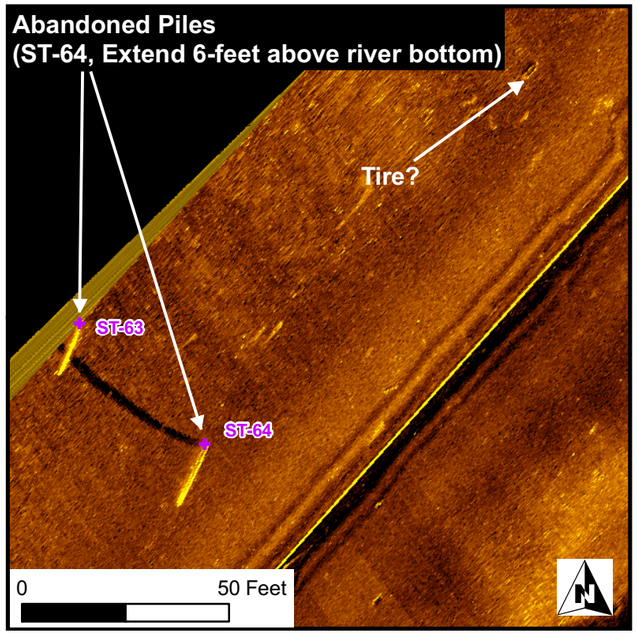

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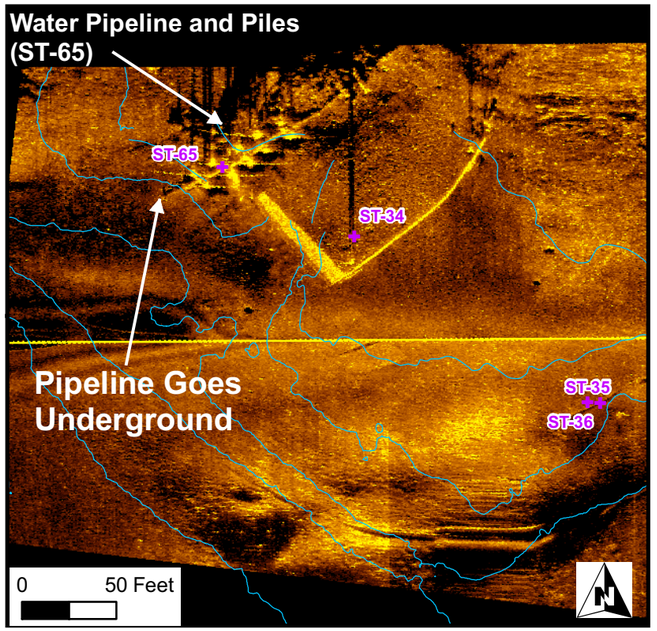
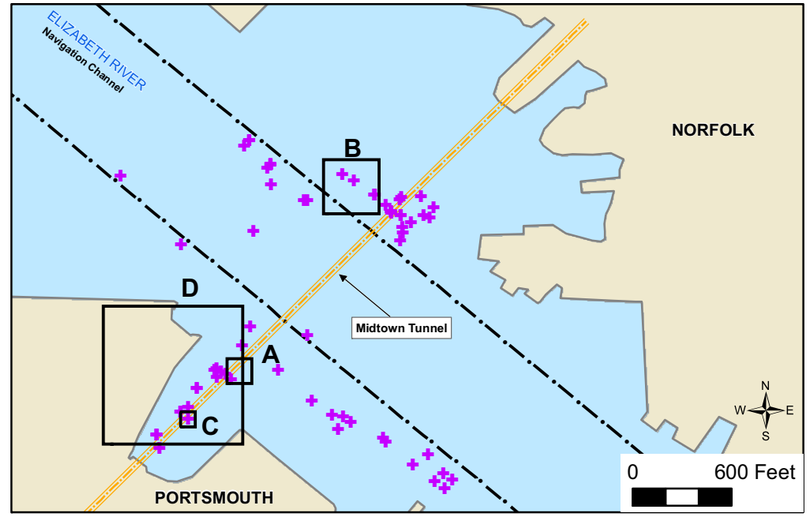


KEY MAP



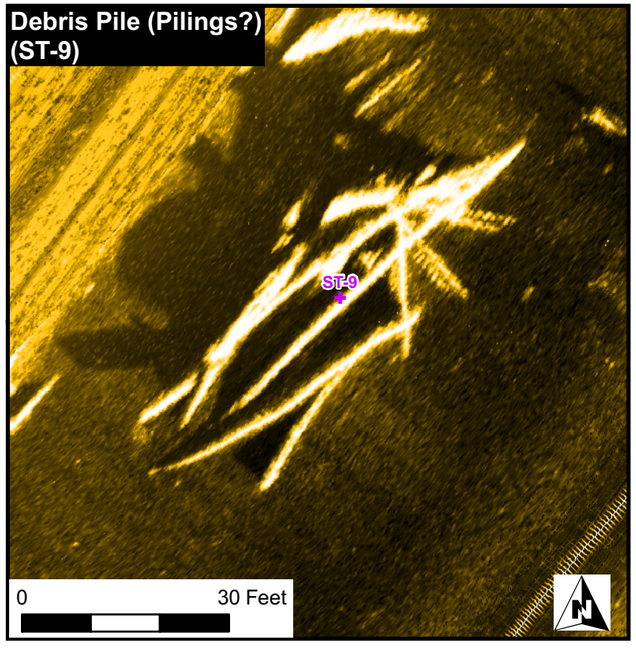
LEGEND

ST-2 — Sonar Target (refer to text for descriptions)

Approximate Location of Midtown Tunnel
Not for design or construction planning
(Refer to Section 3.1 in text)

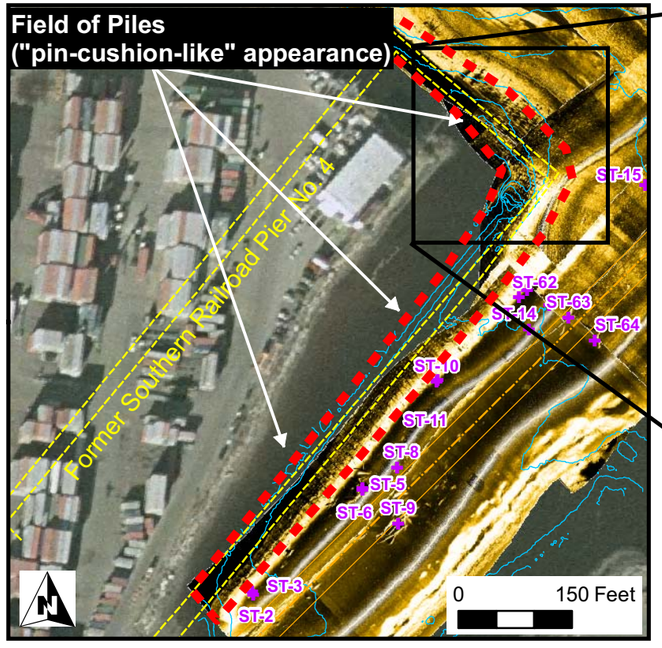
Bathymetric Contour in Feet (MLLW)
Contour interval is 5 ft.
Refer to Figure 6 and Chart 2 for bathymetric survey extents.
Refer to Notes 3 and 4 below for survey references and notes.

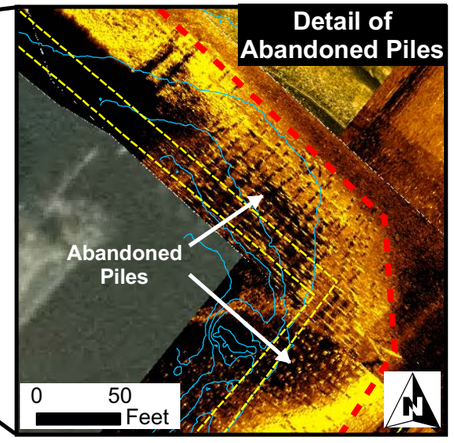
Inset C



SEE CHART 5 FOR SIDE SCAN MOSAIC

Inset D





Refer to Figure 9b for detail of Portsmouth tunnel approach

NOTES

1) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>
2) Side scan sonar survey conducted by McKim & Creed between February 13th and 22nd, 2008, using a Marine Sonics Side Scan Sonar system (600 kHz).
3) Bathymetric Data Sources:
   a) Fugro (MB-2008): Multibeam Bathymetry Data
   b) Fugro (SB-2008): Single Beam Bathymetry Data
   c) MHI (2008): Marine Hydraulics International, Inc. Single Beam Bathymetry Data
   d) USACE (2007): U.S. Army Corps of Engineers Multibeam Bathymetry Data
4) Reference to Mean Lower Low Water (MLLW), 1983-2001 Tidal Epoch, (NOAA/NOS). Tidal Bench Mark 8638610 at Sewells Point, Hampton Roads

SELECTED SIDE SCAN SONAR TARGETS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 9a

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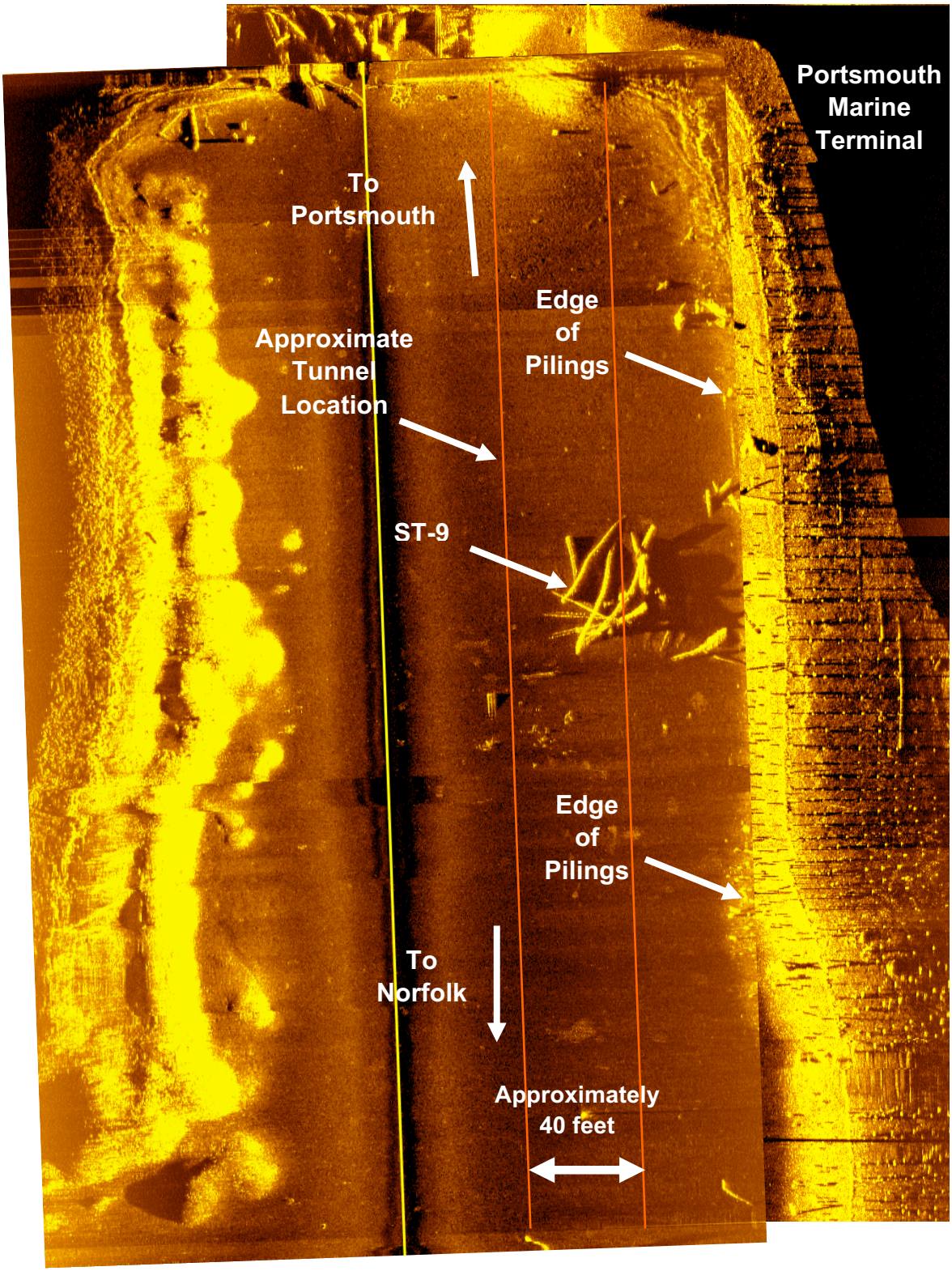
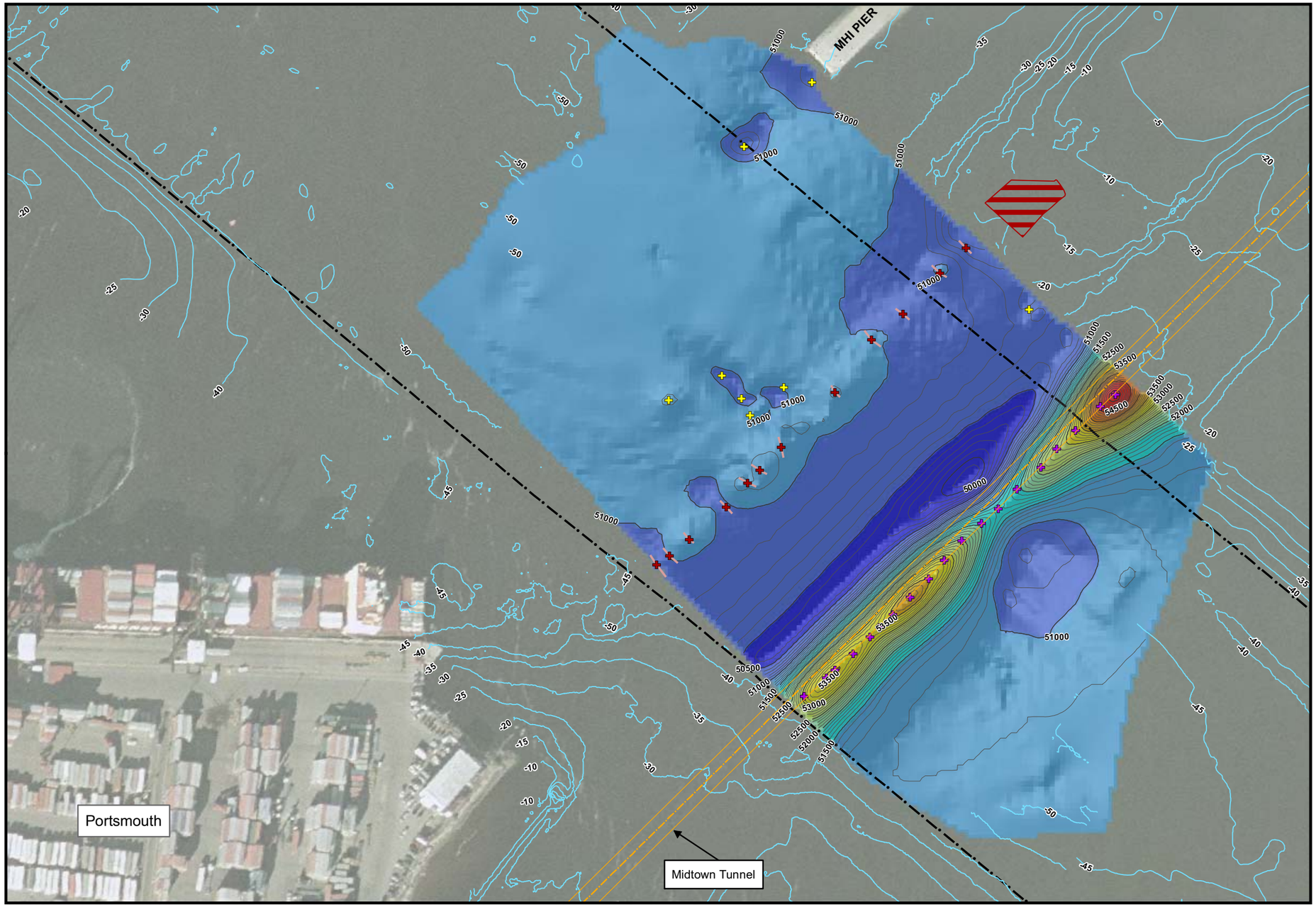


SELECTED SIDE SCAN SONAR TARGETS
Portsmouth Nearshore Area
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia



LEGEND

Magnetic Anomalies

- Inferred Midtown Tunnel Location
- Inferred Water Pipeline Location
- Unknown
- Magnetometer Contour
  Major contour interval is 500 nT.
  Minor contour interval is 100 nT.
- Width of Anomaly (Uncertainty of pipeline location)

Magnetometer Data (nT)

- Less than 50,500
- 50,500 - 51,000
- 51,000 - 51,500
- 51,500 - 52,000
- 52,000 - 52,500
- 52,500 - 53,000
- 53,000 - 53,500
- 53,500 - 54,000
- 54,000 - 54,500
- 54,500 - 55,200

- Approximate Location of Midtown Tunnel
  Not for design or construction planning
  (Refer to Section 3.1 in text)
- Bathymetric Contour in Feet (MLLW)
  Contour interval is 5 ft.
  Refer to Figure 6 and Chart 2 for bathymetric survey extents.
  Refer to Notes 3 and 4 below for survey references and notes.
- Area Obstructed During Fugro 2008 Survey

NOTES

1) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>
2) Magnetometer Survey Instrumentation: Marine Magnetics Corp., SeaSPY Overhauser Total Field Magnetometer
3) Bathymetric Data Sources:
   a) Fugro (MB-2008): Multibeam Bathymetry Data
   b) Fugro (SB-2008): Single Beam Bathymetry Data
   c) MHI (2008): Marine Hydraulics International, Inc. Single Beam Bathymetry Data
   d) USACE (2007): U.S. Army Corps of Engineers Multibeam Bathymetry Data
4) Reference to Mean Lower Low Water (MLLW), 1983-2001 Tidal Epoch, (NOAA/NOS). Tidal Bench Mark 8638610 at Sewells Point, Hampton Roads

0 100 200 Feet

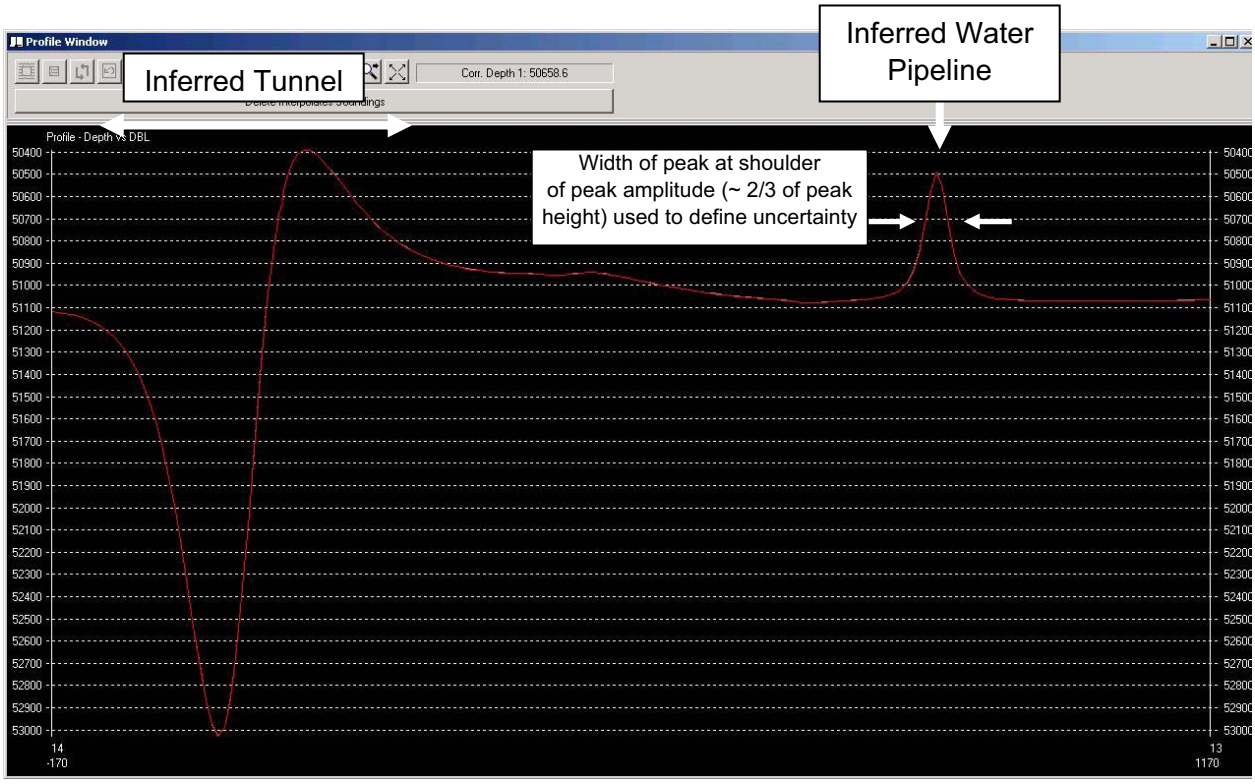
N W E S

MAGNETOMETER SURVEY
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

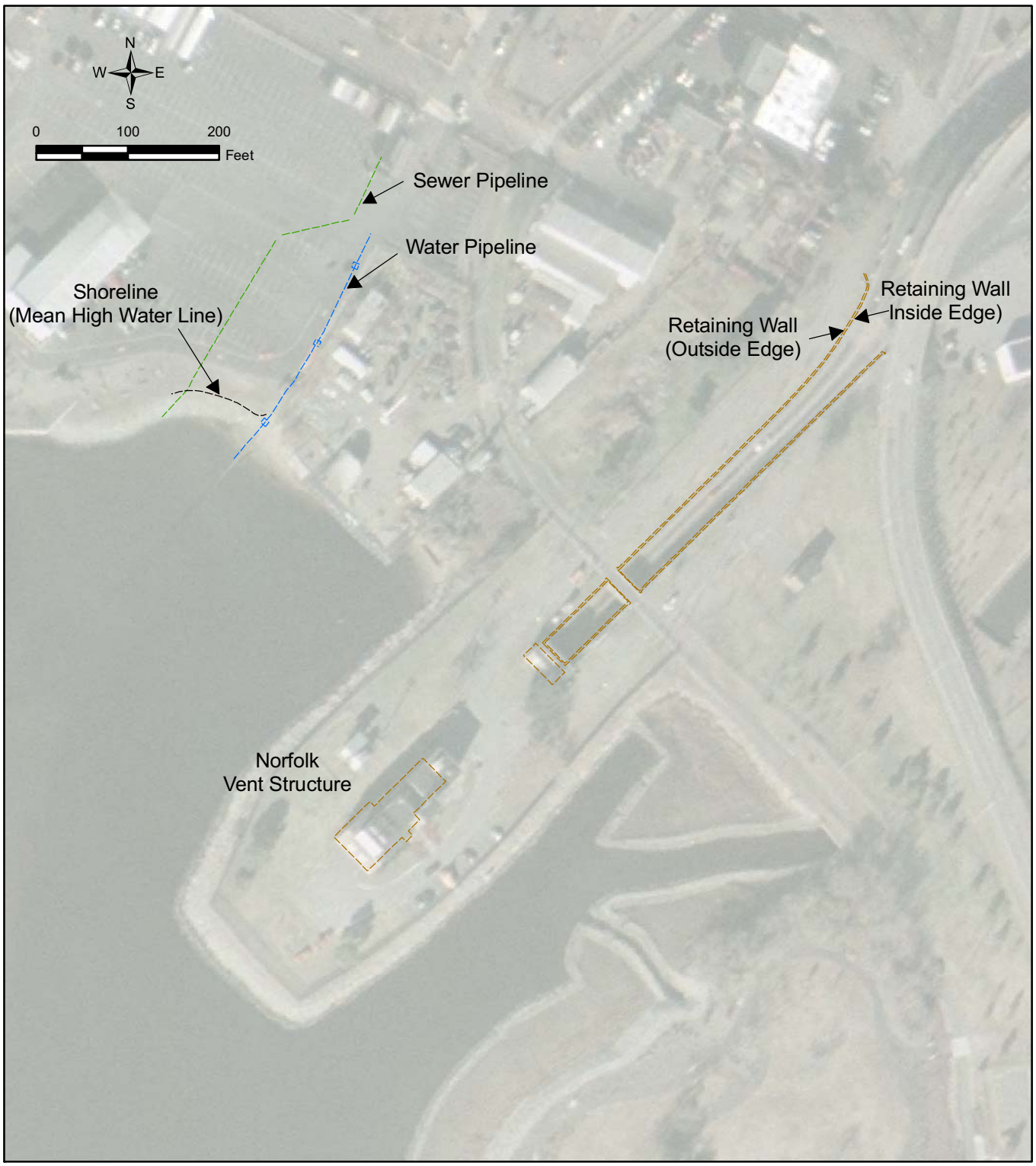
SEE CHART 6 FOR LARGE-SCALE PLOT

FIGURE 10

C:\Documents and Settings\KStevens\Desktop\MidTown_Tunnel\Bottom_Cht_Rpt\Fig-9_Magnetometer_11x17.mxd, 08/01/08, kstevens



MAGNETOMETER DATA EXAMPLE
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

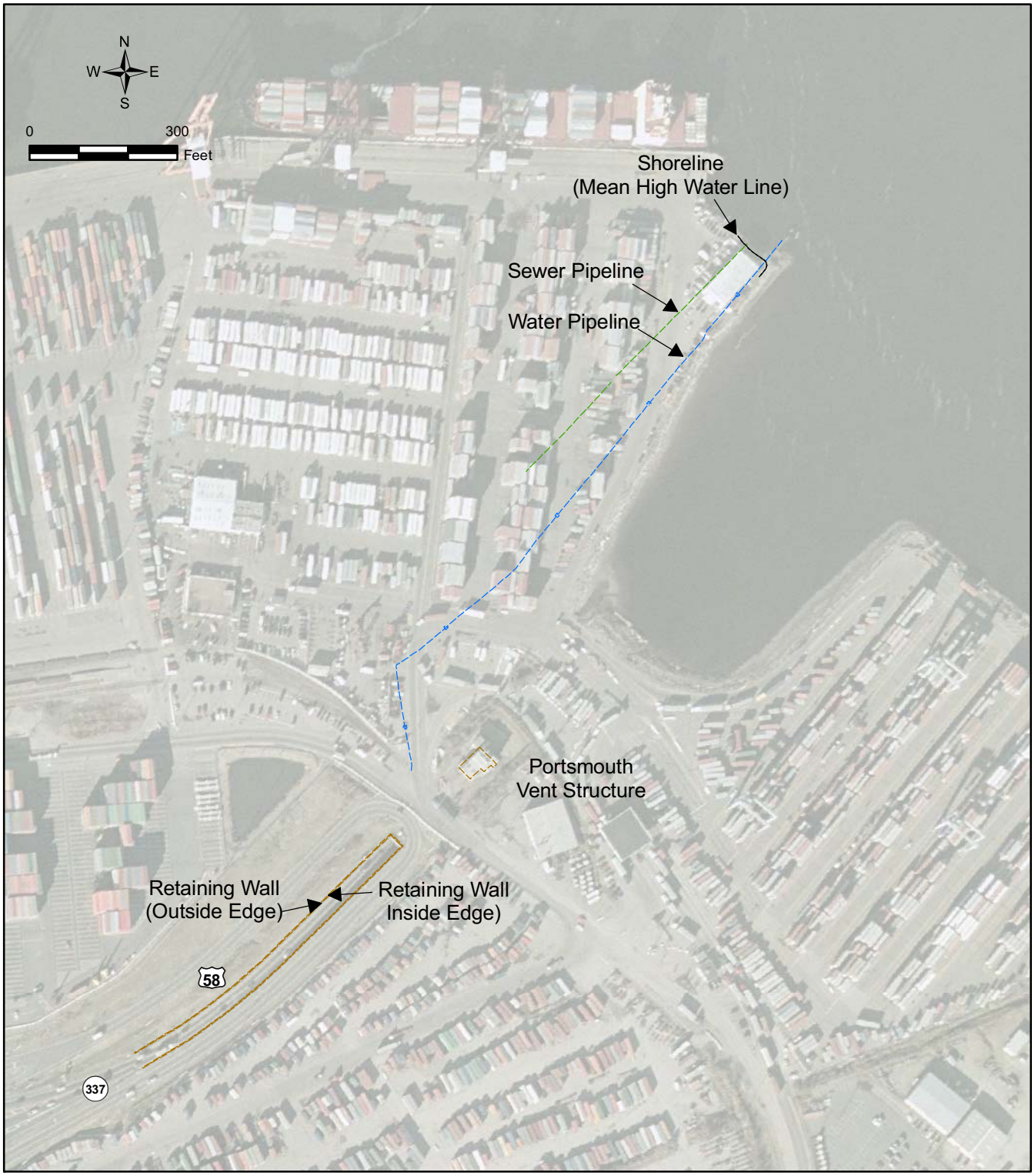


Aerial Photo Source: Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000)
<<http://datagateway.nrcs.usda.gov/>>

NORFOLK LAND SURVEY
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 12

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\02-BotChart_Rpt\MXD\Fig-12_LandSurvey.mxd, 08/04/08, ksmith



Aerial Photo Source: Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <<http://datagateway.nrcs.usda.gov/>>

PORTSMOUTH LAND SURVEY
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 13

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\02-BotChart_Rpt\MXD\Fig-12_LandSurvey.mxd, 08/04/08, ksmith



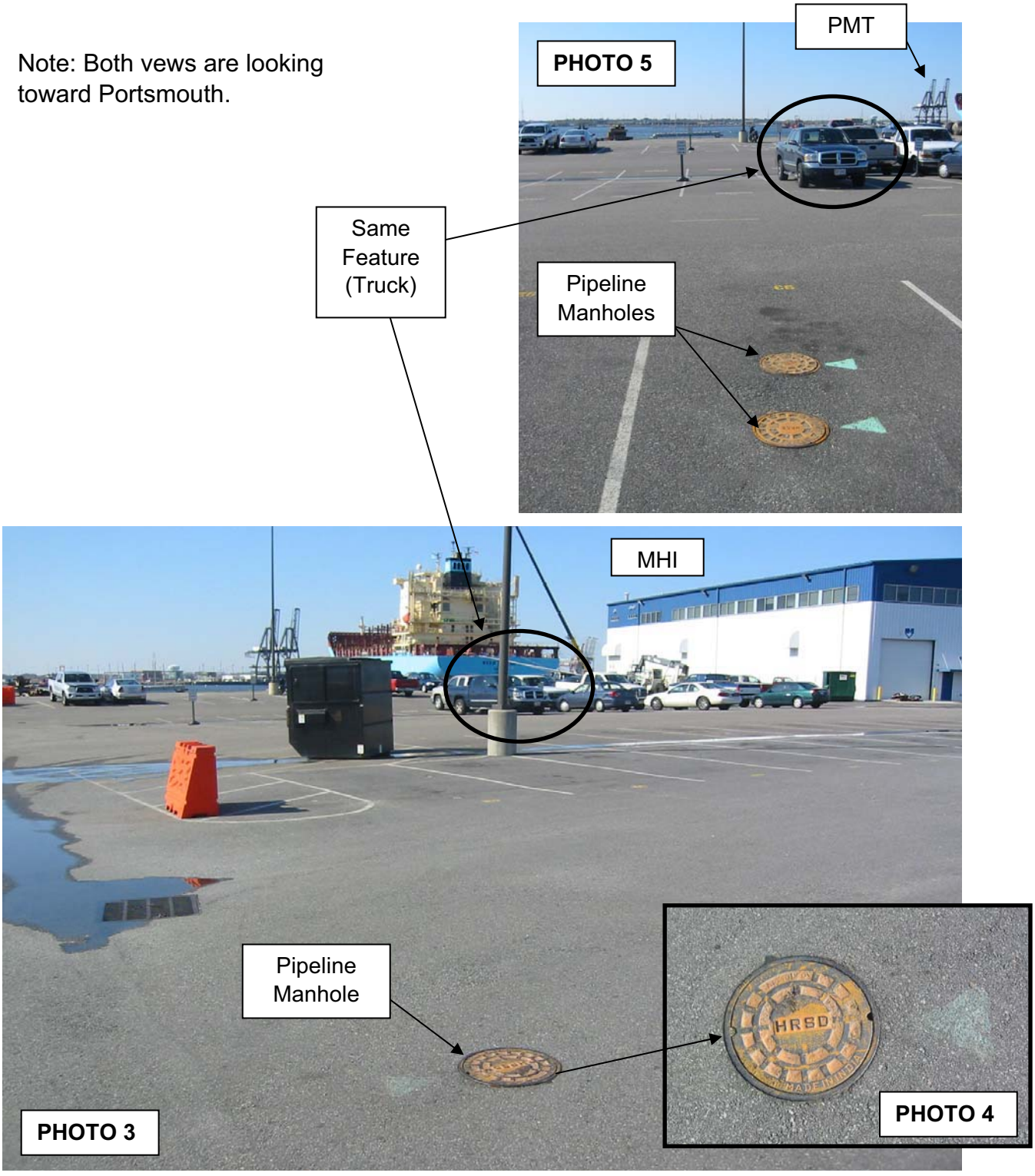
PHOTO 2: Pipeline and markings. Looking toward Portsmouth (southwest).



PHOTO 1: Pipeline markings looking toward Portsmouth (southwest).

PHOTOGRAPHS OF WATER PIPELINE AND LOCATION MARKINGS
Norfolk Land Survey
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

Note: Both vews are looking toward Portsmouth.



PHOTOGRAPHS OF SEWER PIPELINE LOCATION MARKINGS
Norfolk Land Survey
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

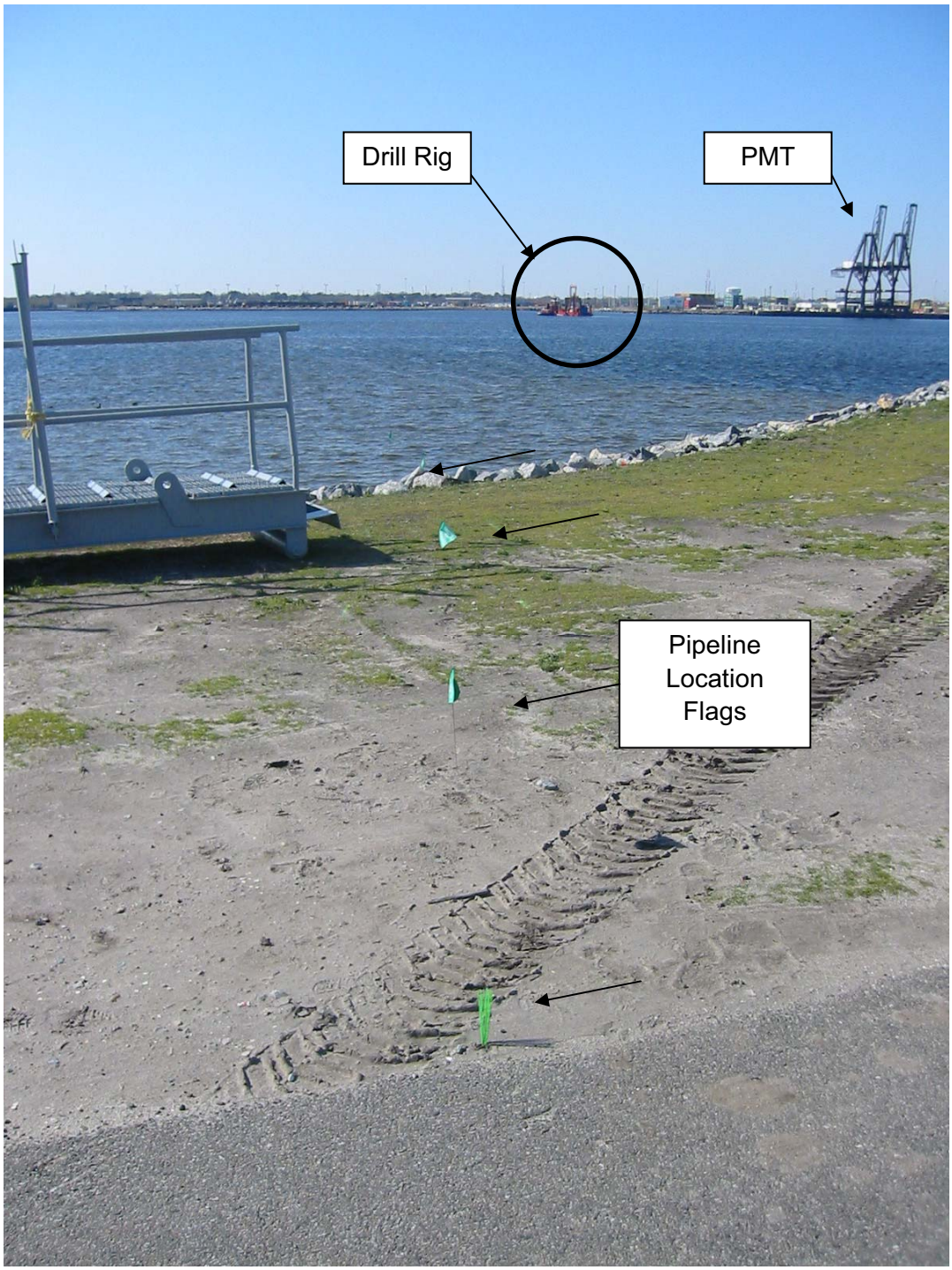


PHOTO 6: View is looking toward Portsmouth (southeast) from MHI facility.

PHOTOGRAPH OF SEWER PIPELINE LOCATION MARKINGS
Norfolk Land Survey
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

PHOTO 7: 30-inch diameter water pipeline landfall on Portsmouth shore. View is looking downstream (northwest).

PHOTOGRAPHS OF WATER PIPELINE LANDFALL
Portsmouth Land Survey
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

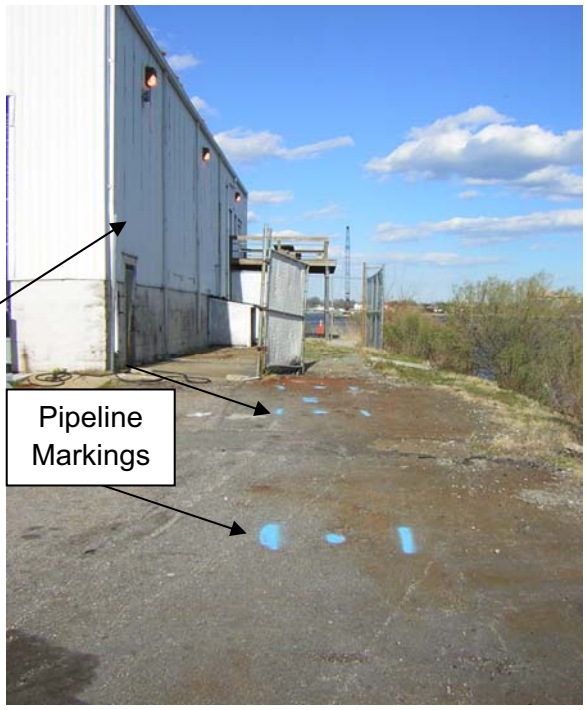


PHOTO 9: View looking toward Norfolk (northeast).

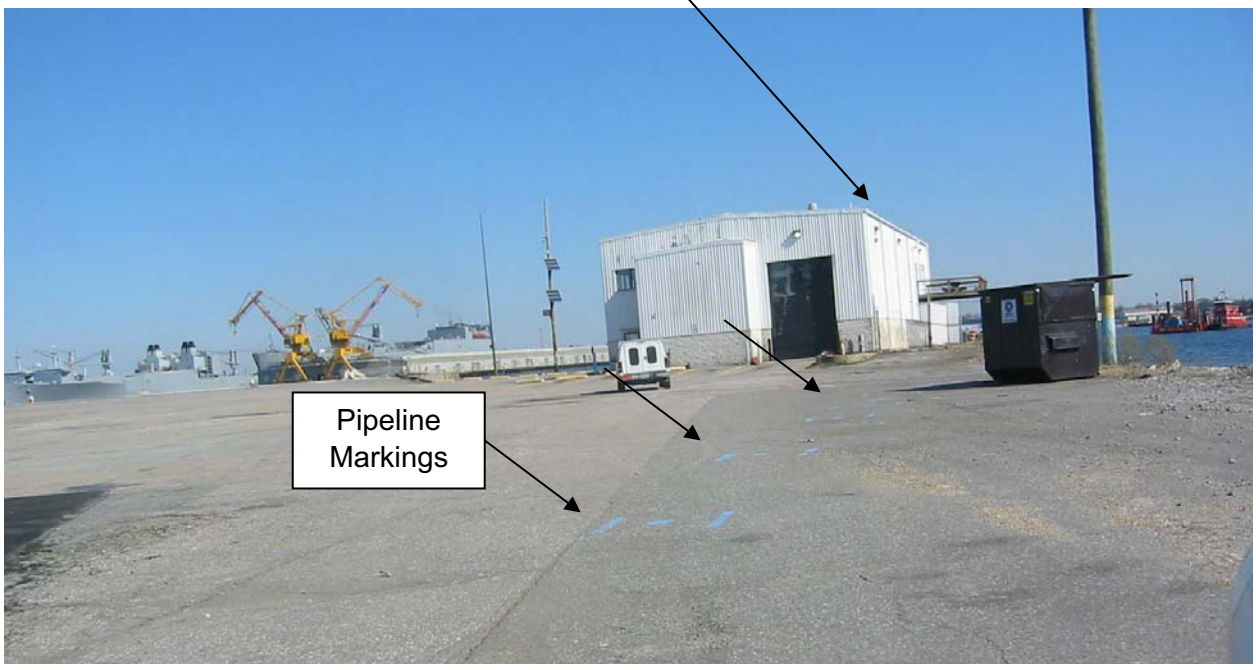


PHOTO 8: View looking toward Norfolk (northeast) across PMT parking lot.

PHOTOGRAPHS OF WATER PIPELINE LOCATION MARKINGS
Portsmouth Land Survey
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

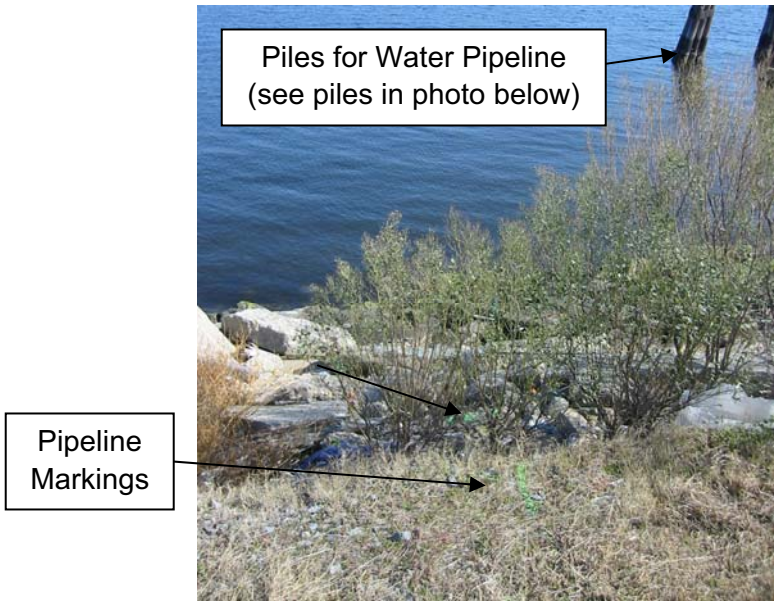


PHOTO 11: View looking toward Norfolk (northeast)

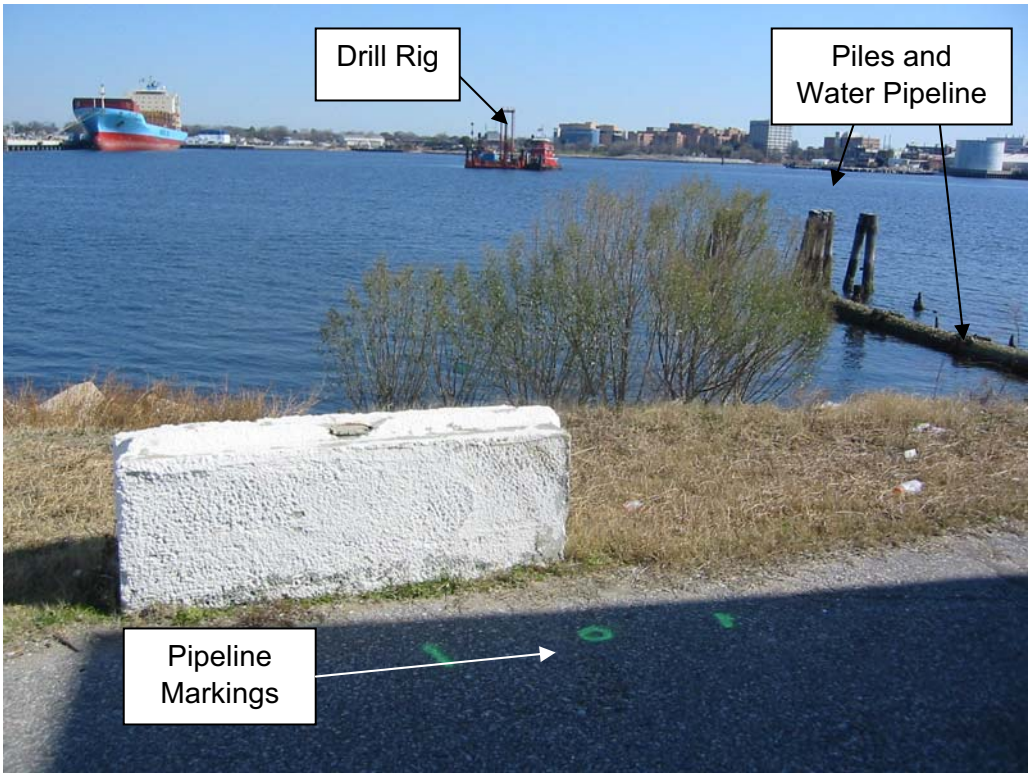


PHOTO 10: View looking toward Norfolk (northeast) across Elizabeth River

PHOTOGRAPHS OF SEWER PIPELINE LOCATION MARKINGS
Portsmouth Land Survey
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

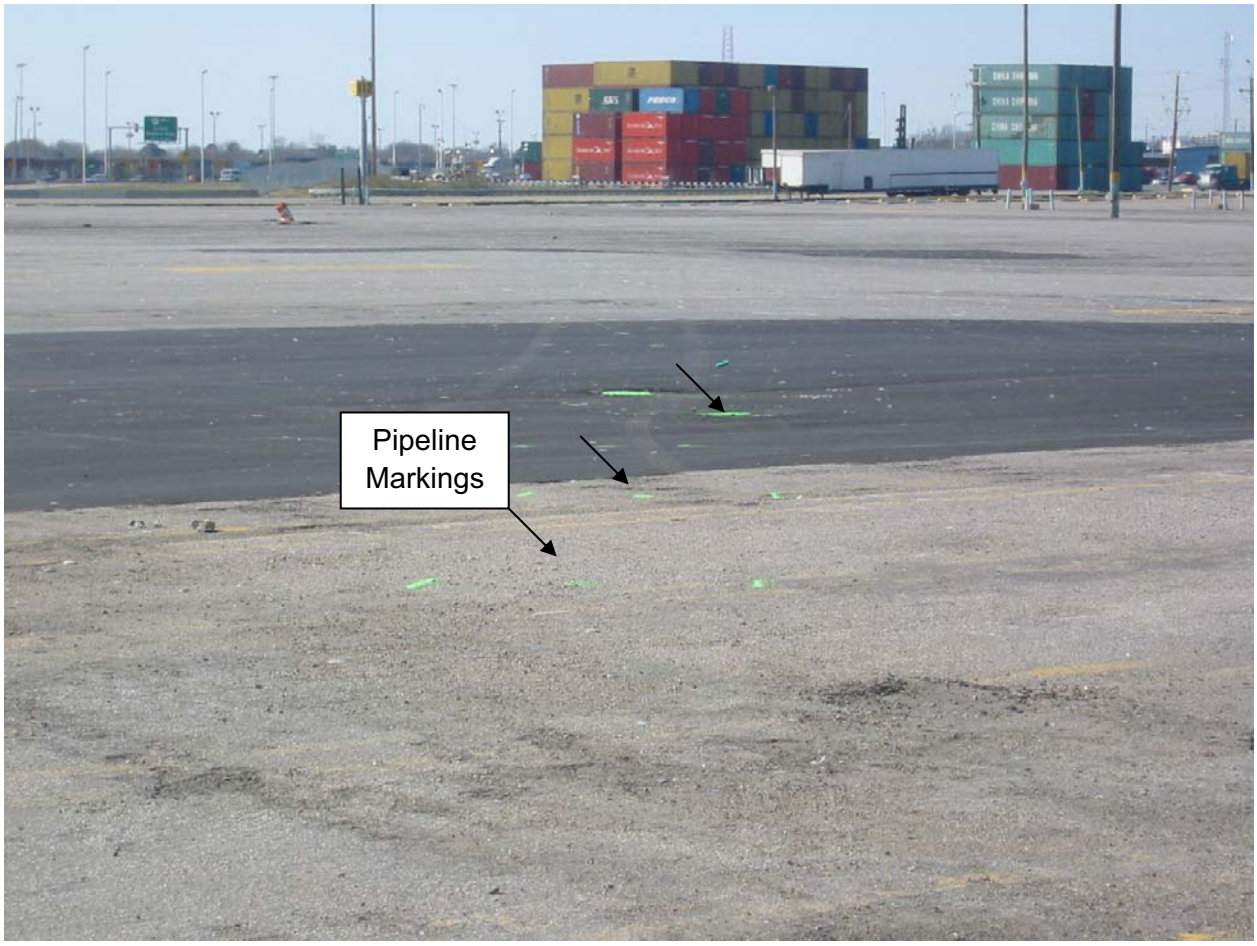


PHOTO 12: View looking toward Portsmouth (southwest) across the PMT parking lot from the approximate pipeline shore crossing location.

PHOTOGRAPHS OF SEWER PIPELINE LOCATION MARKINGS
Portsmouth Land Survey
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

CHARTS

12119000 12120000 12121000 12122000 12123000 12124000 12125000 12126000

3437000 3436000 3435000 3434000 3433000 3432000 3431000



LEGEND

Approximate Location of Midtown Tunnel
Not for design or construction planning
(Refer to Section 3.1 in text)

Survey Boundaries and Data Sources
Data From Midtown Second Parallel Tunnel Project

Fugro (MB-2008): Multibeam Bathymetry Data
Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM ES3 Multibeam echosounder (240 Khz - 120 degree swath).

Fugro (SB-2008): Single Beam Bathymetry Data
Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM Echotrak Dual Frequency echosounder (200/28 kHz).

Fugro (SS-2008): Side Scan Sonar Data
Surveyed by McKim & Creed between February 13th and 22nd, 2008, using a Marine Sonics Side Scan Sonar system (600 kHz).

Fugro (MG-2008): Magnetometer Data
Surveyed by McKim & Creed between February 13th and 22nd, 2008, using a Marine Magnetics Sea SPY magnetometer.

Data From Other Area Projects

MHI (2008): Marine Hydraulics International, Inc.
Single Beam Bathymetry Data
Surveyed by Waterway Surveys & Engineering, Ltd. at Lamberts Point between February 6th and 7th, 2008.

USACE (2007): U.S. Army Corps of Engineers
Multibeam Bathymetry Data
Surveyed by United States Army Corps of Engineers-Norfolk District on March 26, 2007

Area Obstructed During Fugro 2008 Survey

Notes:

1) Coordinate Grid: Virginia State Plane, South Zone, NAD 83, Feet

2) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

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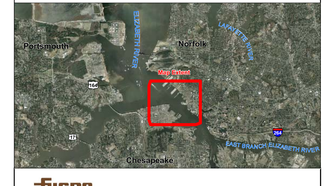
GEODETIC INFORMATION

SPHEROID:	GRS 1980
SEMI-MAJOR AXIS:	6,378,137.000
SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.257222101
ECCENTRICITY²:	0.006694380
PROJECTION:	LAMBERT CONFORMAL CONIC
ZONE:	VIRGINIA SOUTH
LONGITUDE OF ORIGIN:	36.3°
FALSE EASTING:	11,482,916
FALSE NORTHING:	3,280,833

N W E S



FUGRO ATLANTIC
Fugro Atlantic, Inc.
101 West Main Street, Suite 300
Norfolk, Virginia 23510
Tel: (757) 625-3000
Fax: (757) 625-3392
www.fugroatlantic.com

MARINE SURVEY EXTENTS
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

SCALE= 1:2,400
0 100 200 400 Feet

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	July 9, 2008	For Report Submittal	KCS	ADB	KRS
2					
3					

JOB NUMBER: 3602.001 CHART NO.: 1

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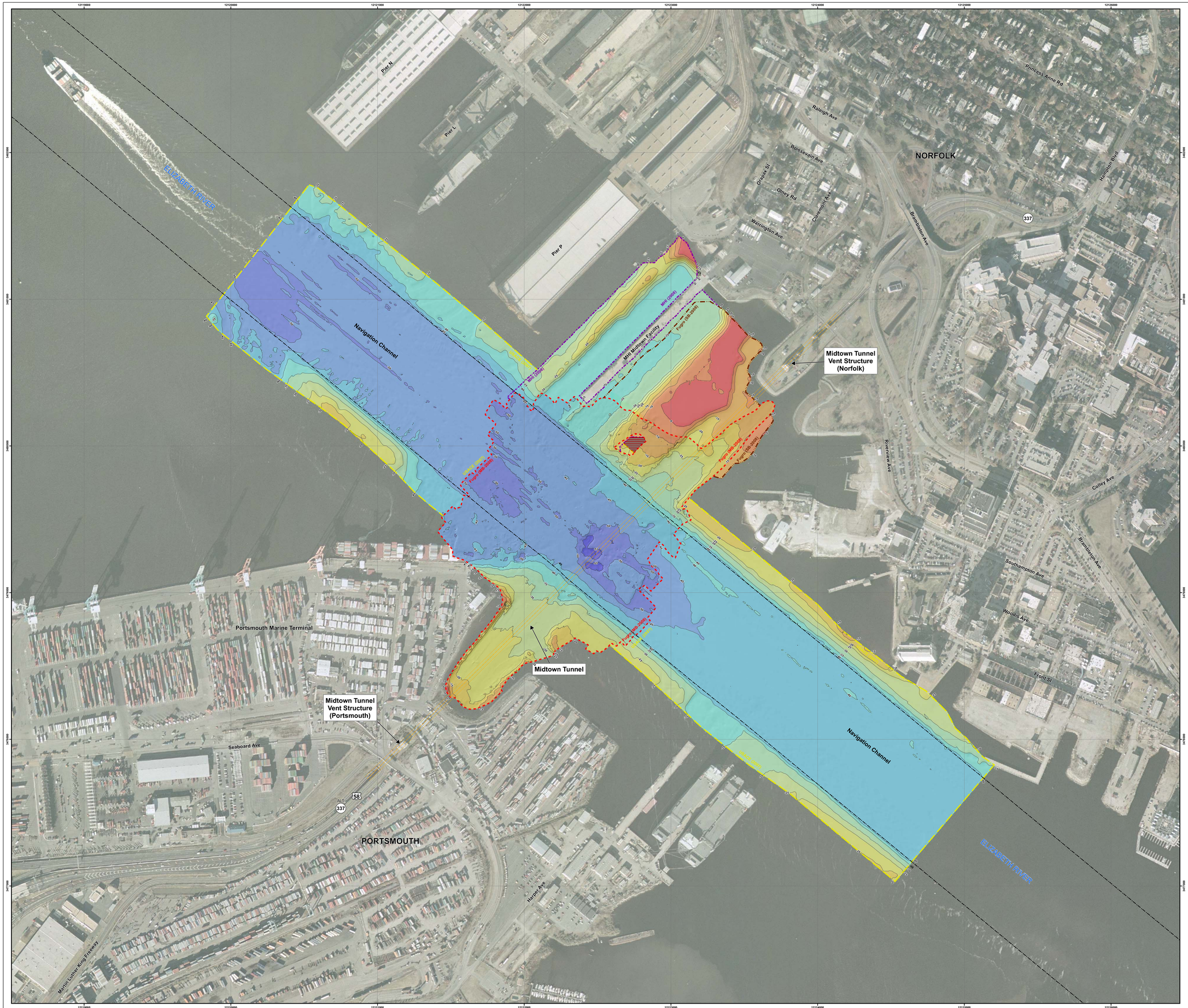

LEGEND

Bathymetry (MLLW, feet)
Refer to notes for vertical datum.

- 0 to -5
- -5 to -10
- -10 to -15
- -15 to -20
- -20 to -25
- -25 to -30
- -30 to -35
- -35 to -40
- -40 to -45
- -45 to -50
- -50 to -55
- Deeper than -55

Bathymetric Contour in Feet (MLLW)
Contour interval is 5 ft.

Approximate Location of Midtown Tunnel
Not for design or construction planning
(Refer to Section 3.1 in text)

Bathymetric Data Boundaries and Sources

Fugro (MB-2008): Multibeam Bathymetry Data
Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM ES3 Multibeam echosounder (240 Khz - 120 degree swath).

Fugro (SB-2008): Single Beam Bathymetry Data
Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM Echotrak Dual Frequency echosounder (200/28 kHz)

MHI (2008): Marine Hydraulics International, Inc.
Single Beam Bathymetry Data
Surveyed by Waterway Surveys & Engineering, Ltd. at Lamberts Point between February 6th and 7th, 2008.

USACE (2007): U.S. Army Corps of Engineers
Multibeam Bathymetry Data
Surveyed by United States Army Corps of Engineers-Norfolk District on March 26, 2007.

Area Obstructed During Fugro 2008 Survey

Notes:

1) Coordinate Grid: Virginia State Plane, South Zone, NAD 83, Feet

2) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

3) Reference to Mean Lower Low Water (MLLW), 1983-2001 Tidal Epoch, is based on observations performed and published by the National Oceanic and Atmospheric Administration, National Ocean Service (NOAA/NOS). Tidal Bench Mark 8638610 at Sewells Point, Hampton Roads, was used as the MLLW constraint for this project.

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GEODETIC INFORMATION

SPHEROID:	GRS 1980
SEMI-MAJOR AXIS:	6,378,137.000
SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.25722101
ECCENTRICITY^2:	0.006694380
PROJECTION:	LAMBERT CONFORMAL CONIC
ZONE:	VIRGINIA SOUTH
LONGITUDE OF ORIGIN:	36.3°
FALSE EASTING:	11,482,916
FALSE NORTHING:	3,280,833

N
W E
S



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www.fugroatlantic.com

BATHYMETRY
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

SCALE= 1:2,400

0 100 200 400 Feet

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	July 9, 2008	For Report Submittal	KCS	ADB	KRS
2					
3					

JOB NUMBER: 3602.001 CHART NO.: 2



LEGEND

Sun-Illuminated Shaded Relief
Calculated from Bathymetric Data using Sun Azimuth of 315 Degrees and Altitude of 45 Degrees

Approximate Location of Midtown Tunnel
Not for design or construction planning
(Refer to Section 3.1 in text)

Bathymetric Data Boundaries and Sources

Fugro (MB-2008): Multibeam Bathymetry Data
Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM ES3 Multibeam echosounder (240 Khz - 120 degree swath).

Fugro (SB-2008): Single Beam Bathymetry Data
Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM Echotrak Dual Frequency echosounder (200/28 kHz)

MHI (2008): Marine Hydraulics International, Inc. Single Beam Bathymetry Data
Surveyed by Waterway Surveys & Engineering, Ltd. at Lamberts Point between February 6th and 7th, 2008.

USACE (2007): U.S. Army Corps of Engineers Multibeam Bathymetry Data
Surveyed by United States Army Corps of Engineers-Norfolk District on March 26, 2007.

Area Obstructed During Fugro 2008 Survey

Notes:

1) Coordinate Grid: Virginia State Plane, South Zone, NAD 83, Feet

2) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

3) Reference to Mean Lower Low Water (MLLW), 1983-2001 Tidal Epoch, is based on observations performed and published by the National Oceanic and Atmospheric Administration, National Ocean Service (NOAA/NOS). Tidal Bench Mark 8638610 at Sewells Point, Hampton Roads, was used as the MLLW constraint for this project.

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GEODETIC INFORMATION

SPHEROID:	GRS 1980
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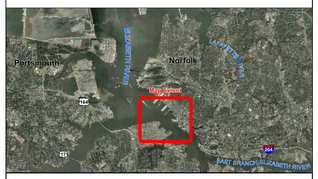
SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.257222101
ECCENTRICITY^2:	0.006694380
PROJECTION:	LAMBERT CONFORMAL CONIC
ZONE:	VIRGINIA SOUTH
LONGITUDE OF ORIGIN:	36.3°
FALSE EASTING:	11,482,916
FALSE NORTHING:	3,280,833

N W E S



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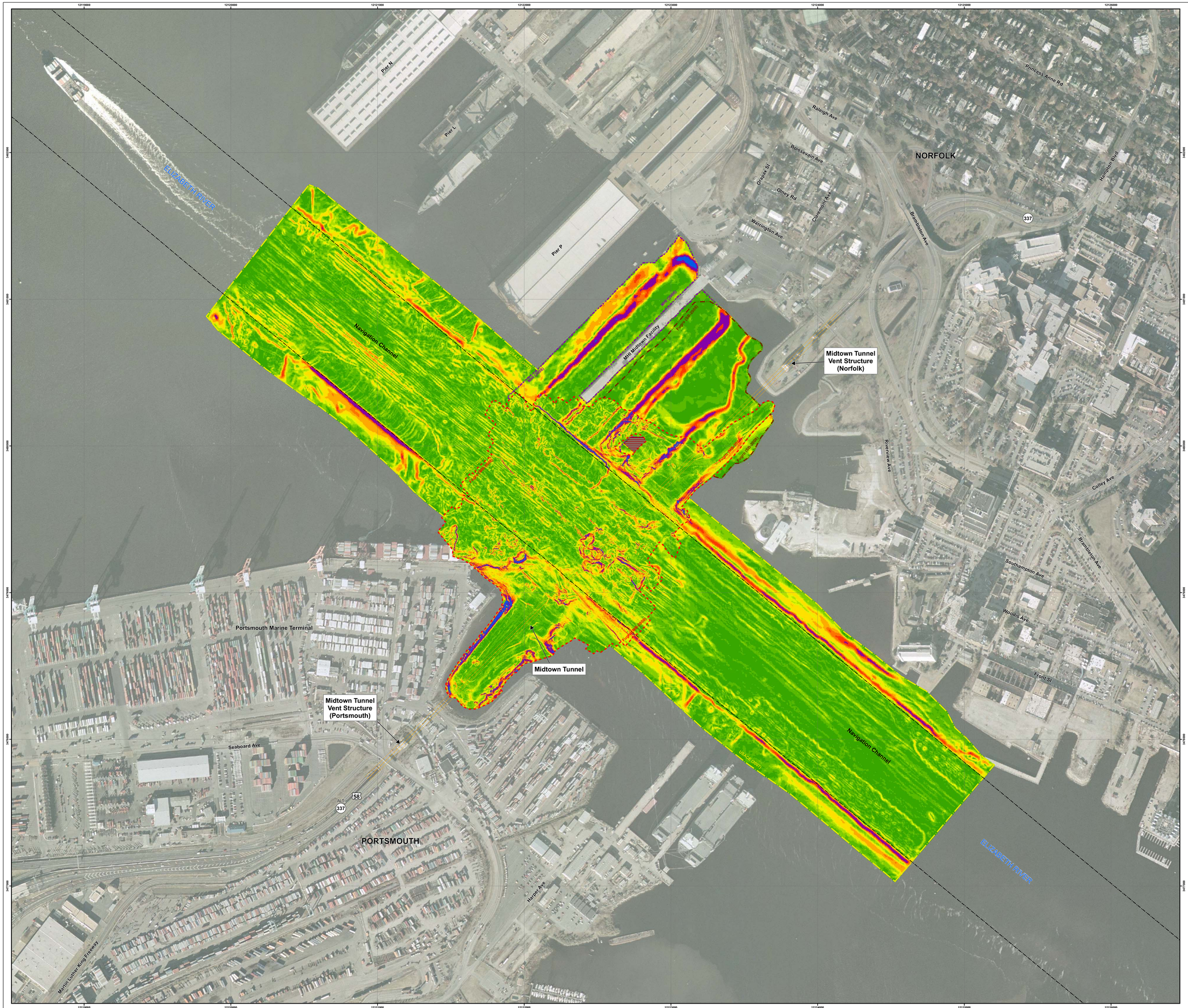
SUN-ILLUMINATED SHADED RELIEF
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

SCALE= 1:2,400

0 100 200 400 Feet

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	July 9, 2008	For Report Submittal	KCS	KRS	KRS
2					
3					

JOB NUMBER: 3602.001 CHART NO.: 3



LEGEND

Slope Gradient of River Bottom
Calculated from Bathymetric Data

Percent	Degrees	Horizontal to Vertical Ratio (H:V)
0 - 2	0 - 1.1	
2 - 4	1.1 - 2.3	
4 - 6	2.3 - 3.4	20:1
6 - 8	3.4 - 4.6	
8 - 10	4.6 - 5.7	10:1
10 - 15	5.7 - 8.5	
15 - 25	8.5 - 14.0	4:1
25 - 30	14.0 - 16.7	
30 - 35	16.7 - 19.3	3:1
48 - 52	25.6 - 27.5	2:1

Approximate Location of Midtown Tunnel
Not for design or construction planning
(Refer to Section 3.1 in text)

Bathymetric Data Boundaries and Sources

Fugro (MB-2008): Multibeam Bathymetry Data
Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM ES3 Multibeam echosounder (240 Khz - 120 degree swath).

Fugro (SB-2008): Single Beam Bathymetry Data
Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM Echotrak Dual Frequency echosounder (200/28 KHz)

MHI (2008): Marine Hydraulics International, Inc. Single Beam Bathymetry Data
Surveyed by Waterway Surveys & Engineering, Ltd. at Lamberts Point between February 6th and 7th, 2008.

USACE (2007): U.S. Army Corps of Engineers Multibeam Bathymetry Data
Surveyed by United States Army Corps of Engineers-Norfolk District on March 26, 2007.

Area Obstructed During Fugro 2008 Survey

Notes:

1) Coordinate Grid: Virginia State Plane, South Zone, NAD 83, Feet

2) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

3) Reference to Mean Lower Low Water (MLLW), 1983-2001 Tidal Epoch, is based on observations performed and published by the National Oceanic and Atmospheric Administration, National Ocean Service (NOAA/NOS). Tidal Bench Mark 8638610 at Sewells Point, Hampton Roads, was used as the MLLW constraint for this project.

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GEODETIC INFORMATION

SPHEROID:	GRS 1980
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SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.257222101
ECCENTRICITY^2:	0.006694380
PROJECTION:	LAMBERT CONFORMAL CONIC
ZONE:	VIRGINIA SOUTH
LONGITUDE OF ORIGIN:	36.3°
FALSE EASTING:	11,482,916
FALSE NORTHING:	3,280,833



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RIVER BOTTOM SLOPE GRADIENT
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

SCALE= 1:2,400
0 100 200 400 Feet

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	July 9, 2008	For Report Submittal	KCS	KRS	KRS
2					
3					

JOB NUMBER: 3602.001 CHART NO.: 4

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LEGEND

- ST-2 — Sonar Target (refer to text for descriptions)
- Approximate Location of Midtown Tunnel
  Not for design or construction planning
  (Refer to Section 3.1 in text)
- Bathymetric Contour in Feet (MLLW)
  Contour interval is 5 ft.
  Refer to Figure 6 and Chart 2 for bathymetric survey extents.
  Refer to Notes 4 and 5 below for survey references and notes.
- Area Obstructed During Fugro 2008 Survey

Notes:

1) Coordinate Grid: Virginia State Plane, South Zone, NAD 83, Feet.

2) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

3) Side scan sonar survey conducted by McKim & Creed between February 13th and 22nd, 2008, using a Marine Sonics Side Scan Sonar system (600 kHz).

4) Bathymetry data compiled from several sources:

   a) Fugro (2008), Multibeam survey conducted by McKim & Creed between February 13th and 22nd, 2008, using an ODOM ES3 Multibeam echosounder (240 Khz - 120 degree swath). The multibeam survey was supplemented between February 13th and 22nd, 2008, using an ODOM Echotrak Dual Frequency echosounder (200/28 kHz).

   b) Fugro (SB-2008), Single Beam Bathymetry Data
   Surveyed by McKim & Creed between February 13th and 22nd, 2008, using an ODOM Echotrak Dual Frequency echosounder (200/28 kHz)

   c) Marine Hydraulics International, Inc. (2008), Surveyed by Waterway Surveys & Engineering, Ltd at Lamberts Point between February 6th and 7th, 2008. using a single beam system.

   d) U.S. Army Corps of Engineers (2007), Surveyed by the USACE -Norfolk District on March 26, 2007 using a multibeam system.

5) Reference to Mean Lower Low Water (MLLW), 1983-2001 Tidal Epoch, is based on observations performed and published by the National Oceanic and Atmospheric Administration, National Ocean Service (NOAA/NOS). Tidal Bench Mark 8638610 at Sewells Point, Hampton Roads, was used as the MLLW constraint for this project.

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GEODETIC INFORMATION

SPHEROID:	GRS 1980
SEMI-MAJOR AXIS:	6,378,137.000
SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.257222101
PRIME MERIDIAN:	GREENWICH
PROJECTION:	LAMBERT CONFORMAL CONIC
ZONE:	VIRGINIA SOUTH
LONGITUDE OF ORIGIN:	36.3'
FALSE EASTING:	11,482,916
FALSE NORTHING:	3,280,833



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www.fugroatlantic.com

SIDE SCAN SONAR SURVEY
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

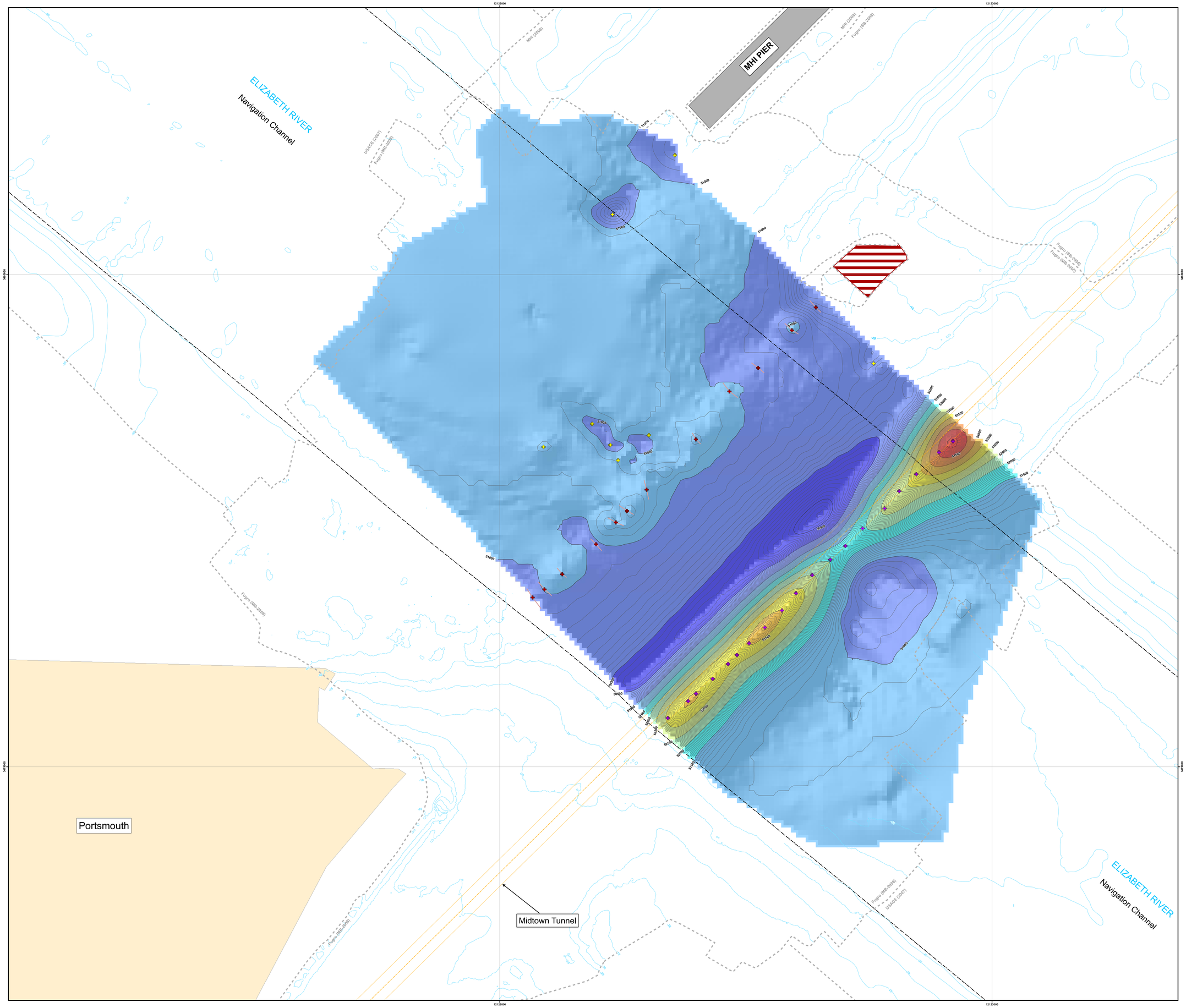
SCALE= 1:1,200

0 100 200 400 Feet

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	July 9, 2008	For Report Submittal	KCS	ADB	KRS
2					
3					

JOB NUMBER: 3602.001 CHART NO.: 5

N:\Projects\602_VDOT\3602-041 - Midtown - Tunnel\Dwg\plot\Working\Reporting\FinalReport_08_23\3602fDrChart 5_MidtownSecondParallel.mxd 5/22/08, kstevens



LEGEND

Magnetic Anomalies

- Inferred Midtown Tunnel Location
- Inferred Water Pipeline Location
- Unknown
- Width of Anomaly (Uncertainty of pipeline location)
- Magnetometer Contour
  Major contour interval is 500 nT.
  Minor contour interval is 50 nT.

Magnetometer Data (nT)

- Less than 50,500
- 50,500 - 51,000
- 51,000 - 51,500
- 51,500 - 52,000
- 52,000 - 52,500
- 52,500 - 53,000
- 53,000 - 53,500
- 53,500 - 54,000
- 54,000 - 54,500
- 54,500 - 55,200

- Approximate Location of Midtown Tunnel
  Not for design or construction planning
  (Refer to Section 3.1 in text)
- Bathymetric Contour in Feet (MLLW)
  Contour interval is 5 ft.
- Bathymetric survey extents: Refer to Figure 6 and Chart 2
  Refer to Notes 4 and 5 below for survey references and notes.
- Area Obstructed During Fugro 2008 Survey

Notes:

1) Coordinate Grid: Virginia State Plane, South Zone, NAD 83, Feet

2) Digital Ortho Quarter Quadrangle Mosaic for Cheasepeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

3) Magnetometer Survey Instrumentation: Marine Magnetics Corp., SeaSPY Overhauser Total Field Magnetometer

4) Bathymetric Data Sources:
   a) Fugro (MB-2008): Multibeam Bathymetry Data
      Surveyed by McKim & Creed between February 13th and 22nd, 2008,
      using an ODOM ES3 Multibeam echosounder (240 Khz - 120 degree swath).
   b) Fugro (SB-2008): Single Beam Bathymetry Data
      Surveyed by McKim & Creed between February 13th and 22nd, 2008,
      using an ODOM Echotrak Dual Frequency echosounder (200/28 kHz)
   c) MHI (2008): Marine Hydraulics International, Inc.
      Single Beam Bathymetry Data
      Surveyed by Waterway Surveys & Engineering, Ltd. at Lamberts
      Point between February 6th and 7th, 2008.
   d) USACE (2007): U.S. Army Corps of Engineers
      Multibeam Bathymetry Data
      Surveyed by United States Army Corps of Engineers- Norfolk District on March 26, 2007.

5) Reference to Mean Lower Low Water (MLLW), 1983-2001 Tidal Epoch, (NOAA/NOS).
   Tidal Bench Mark 8638610 at Sewells Point, Hampton Roads

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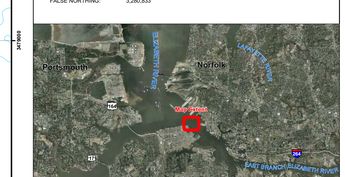
SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.257221101
ECCENTRICITY^2:	0.006694380
PROJECTION:	LAMBERT CONFORMAL CONIC
ZONE:	VIRGINIA SOUTH
LONGITUDE OF ORIGIN:	36.3°
FALSE EASTING:	11,482,916
FALSE NORTHING:	3,280,833

N W E S



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Fax: (757) 625-3352
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MAGNETOMETER SURVEY
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

SCALE= 1:720

0 30 60 120 Feet

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	July 9, 2008	For Report Submittal	KCS	KRS	KRS
2					
3					

JOB NUMBER: 3602.001

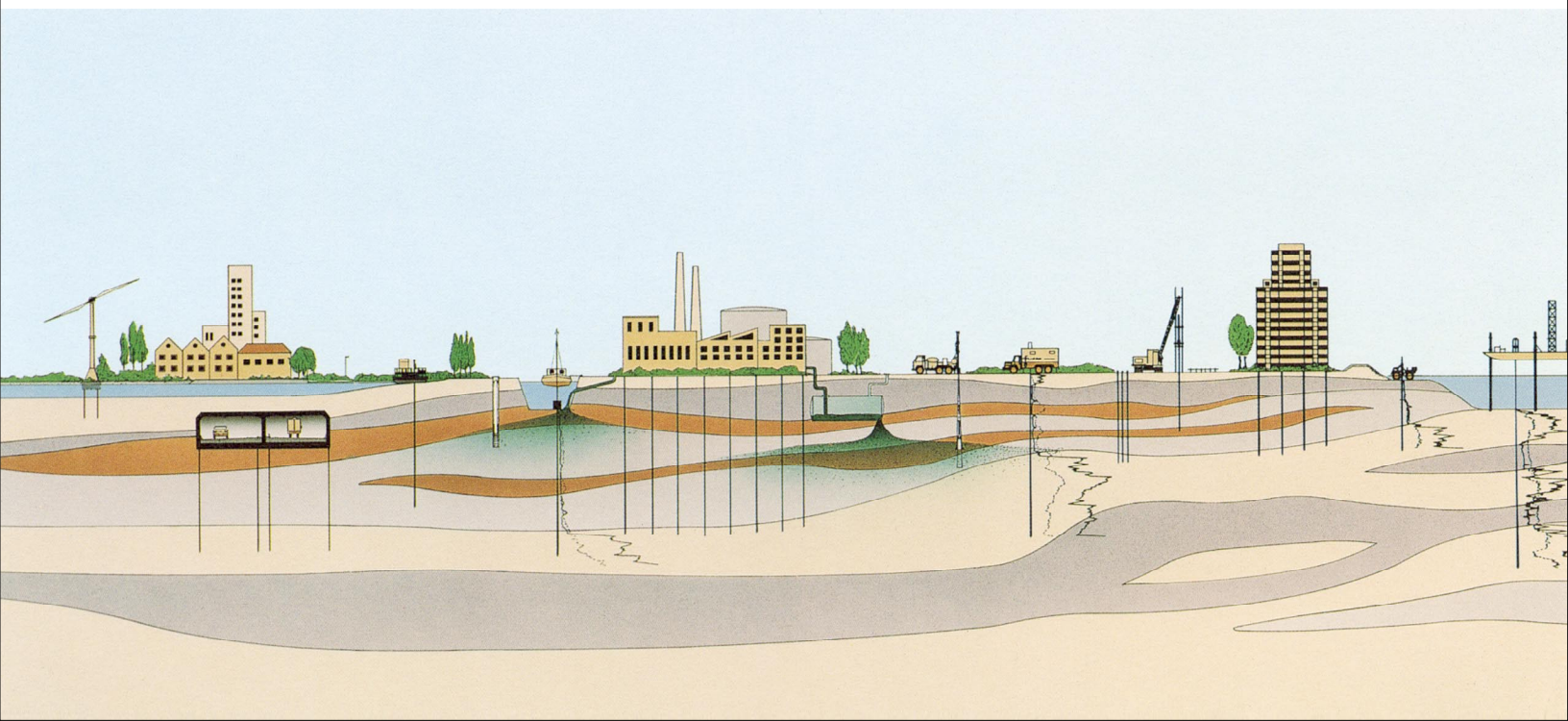
CHART NO.: 6

FUGRO ATLANTIC

-VOLUME 7-
SEISMIC REFLECTION DATA REPORT
PROPOSED MIDTOWN SECOND PARALLEL TUNNEL

Prepared for:
VIRGINIA DEPARTMENT OF TRANSPORTATION

August 2008
Fugro Job No. 3602.001



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101 West Main Street, Suite 350
Norfolk, Virginia 23510
Tel: (757) 625-3350
Fax: (757) 628-8244

August 29, 2008
Project No. 3602.001

Virginia Department of Transportation
1221 E. Broad Street
Richmond, Virginia 23219

Attention: Mr. Raymond Partridge, Project Manager, Innovative Project Delivery

Subject: Volume 7, Seismic Reflection Data Report, Proposed Midtown Second Parallel Tunnel

Dear Mr. Partridge:

Fugro Atlantic (Fugro) has completed a high resolution seismic reflection survey program in support of the Virginia Department of Transportation's (VDOT) proposed Midtown Second Parallel Tunnel. This report summarizes the seismic reflection field survey and seismic data processing procedures. Locations of seismic reflection survey tracklines and representative data examples obtained during the survey are presented in this report.

This report, which documents the seismic reflection survey, is one of a series of reports documenting and presenting the results of Fugro's marine survey and geotechnical exploration program for the Midtown Second Parallel Tunnel Project. Fugro's marine survey and geotechnical exploration program for the project was completed in general accordance with our proposal, dated January 7, 2008, and was authorized by an Interagency Agreement between the Virginia Port Authority and VDOT.

It has been a pleasure working with you through this phase of the project. We look forward to the opportunity to provide continued support as the project progresses.

Sincerely,

FUGRO ATLANTIC

Kevin Smith
Senior Engineering Geologist

Thomas W. McNeilan, P.E.
Vice President

COMMONWEALTH OF VIRGINIA
THOMAS WILLIAM MCNEILAN
Lic. No. 44082
PROFESSIONAL ENGINEER

Copies Submitted: (4) Addressee and PDF provided on CD
(1) Mr. John Daoulas, P.E., Senior Geotechnical Engineer for Special Projects, VDOT

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1.2 Scope of Work 1
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CHART

Chart

Ship Trackline Chart 1

APPENDIX

APPENDIX A EQUIPMENT SPECIFICATIONS

1.0 INTRODUCTION

1.1 PROJECT OVERVIEW

The proposed Midtown Second Parallel Tunnel is a main component of the major infrastructure improvement project aimed at providing increased capacity for east-west travel across the Elizabeth River. The Second Parallel Tunnel will extend between: 1) U.S. Route 58 and Interstate 264 in Portsmouth, and 2) Brambleton Avenue/Hampton Boulevard in Norfolk. The existing Midtown Tunnel provides one lane of travel in each direction. The second tunnel will provide two westbound travel lanes, allowing the existing tunnel to accommodate two lanes of eastbound traffic. Additionally, the second tunnel will provide increased flexibility for redirecting traffic during maintenance operations and emergency situations.

Preliminary information provided by the Virginia Department of Transportation (VDOT) indicates that the second tunnel is to be located northwest (downstream) of, and parallel to, the existing tunnel. In addition, VDOT anticipates that the second tunnel will follow a similar vertical alignment as the existing first tunnel. VDOT has defined the project area to extend 300 feet northwest (downstream) of the northern edge of the existing tunnel. The project vicinity is shown on Figure 1.

The current report and river bottom charting survey are part of a series of geotechnical exploration and survey activities for the Second Parallel Tunnel. Figure 2 shows the organization of the various reports that are being prepared for the geotechnical exploration and surveys for the project.

1.2 SCOPE OF WORK

A marine geophysical investigation, consisting of two separate phases (a river bottom charting survey followed by a seismic reflection survey) throughout the project area was conducted from February 14 through February 27, 2008. This report describes the seismic reflection survey conducted by Fugro aboard McKim & Creed's survey vessel and subsequent seismic data processing methods. Ship tracklines from the seismic survey are shown on Figure 3 and Chart 1.

In advance of the seismic reflection survey, the river bottom mapping survey was completed from February 14 to February 21, 2008, to document water depths and identify any riverbed obstructions within the project area. The river bottom charting survey is described in a separate report (Fugro, 2008a).

Seismic reflection records are produced when an acoustic energy source generates a pulse of sound that travels through the water column and penetrates into the seabed. The media (water, sediment, rock) through which the sound passes affects the acoustic signal in various ways. The more dense a medium, the faster the speed of sound, and thus as the wave front passes through materials with different densities, its rate of progress varies. At the interface between layers of different velocities (velocity contrasts or reflectors), some of the energy is reflected. These reflections are detected by the hydrophone array.

The seismic reflection survey for the Midtown Second Parallel Tunnel was conducted between February 21 and 27, 2008, using: 1) a subbottom Chirp profiler, and 2) a single-plate boomer source with multichannel hydrophone array. The smaller Chirp system was used to image the upper few tens of feet of sediment, while the larger boomer system was used to image the sediment sequence down to more than a200-foot-depth.

The survey was conducted along a predefined grid of track-lines that totaled 18 nautical miles. Two sets of survey track-lines traverse the survey area. One set is a grid of densely-spaced track-lines run normal to each other, which encompass the existing tunnel and proposed tunnel area (approximately 1,000 feet in the upstream and downstream direction). Those track-lines include the 100 series of track-lines, oriented parallel to the existing tunnel and the 200 series of track-lines oriented parallel to the river. The objective of those track-lines is to provide data coverage and subsurface information for the proposed second parallel tunnel alignment.

The other 300 series track-lines extend beyond the immediate proposed second parallel tunnel area and, when possible, were run normal to each other. Due to the narrow width of the river and other obstructions, some of the regional 300 series track-lines were run at oblique angles to each other. The purpose of the regional track-lines is to provide a framework that allows a correlation between regional conditions and the proposed future alignment.

Following the field survey, the seismic data were processed and output as SEG-Y files. The processed data were then loaded into Seismic Micro-Technology, Inc.'s Kingdom Suite software program for review. Available geotechnical data, cultural (e.g. pipeline, tunnel, and shoreline) features, and bathymetric data were also integrated into the software program to assist in review of the seismic data. This report describes the field survey and data processing procedures. A summary of our data review is provided in the Elizabeth River Site Characterization Report (Figure 2; Fugro, 2008b).

1.3 AUTHORIZATION

The Fugro marine survey and geotechnical site exploration program in support of the VDOT proposed Midtown Second Parallel Tunnel project was authorized by an Interagency Agreement between the Virginia Port Authority (VPA) and VDOT. Fugro's services for the Second Parallel Tunnel were completed in general accordance with our proposal, dated January 7, 2008. The execution of that scope of work was authorized by amendment of the contract between the VPA and the Craney Island Design Partners (CIDP), LLC, and the associated subcontract between the CIDP and Fugro Atlantic.

2.0 GEOPHYSICAL SURVEY AND SYSTEMS

2.1 OVERVIEW OF THE SURVEY

The seismic reflection survey was initiated by mobilizing Fugro's geophysical systems onto McKim & Creed's survey vessel *S/V Philly II* at Waterside and Nauticus Marinas in downtown Norfolk. Following the mobilization, a series of equipment initialization, system checks, and calibrations were performed. The vessel transited to the project site early each day, commenced survey operations, and continued throughout the day before returning to one of the downtown Norfolk marinas each evening. Fugro collected 18 nautical miles of data to correlate with existing boring and cone penetrometer test data and further characterize the subbottom conditions within the project area. The seismic reflection survey track-plot is shown on Figure 3.

2.2 PROJECT DATUMS

Positioning information during all survey operations were output from a real time kinematic (RTK) global positioning system (GPS) and logged as State Plane (Virginia South, feet) grid coordinates with the following spheroidal projection parameters:

Datum	NAD83
Spheroid	GRS80
Semi-major Axis	6,378,137.000 m
Semi-minor Axis	6,356,752.314 m
Inverse Flattening	298.2572235630
Eccentricity^2	0.006694379990141
Projection	Lambert Conformal Conic
Grid	Lambert Conformal Conic (NAD83)
Zone	Virginia South (feet)
Latitude of Origin	36° 19' 59.998" N
Longitude of Origin	-78° 50' 00.000" W
False Easting	11,482,916.667 ft
False Northing	3,280,833333 ft
Scale Factor	0.3048
Convergence	World Standard

The vertical datum reference for the field survey was Mean Lower Low Water (MLLW). Depths were corrected for tide variations during field activities based upon tidal data obtained from the National Oceanic and Atmospheric Administration (NOAA) tide gauge Station No. 8638610 (1983-2001 tidal epoch) located at Sewells Point, Hampton Road.

Units used during the field survey were as follows:

- Linear units were feet,
- Angular units were degrees (°), and
- Time was recorded as local time in the field logs.

For reporting and charting, vertical units were converted to reference the vertical datum MLLW. Measured water depths were corrected to MLLW based upon tidal data obtained from the NOAA tide gauge Station No. 8638610 (1983-2001 tidal epoch) located at Sewells Point, Hampton Road.

2.3 SURVEY VESSEL

McKim & Creed's *S/V Clock* (Figure 4) was employed as the operational platform for the multibeam survey. She is a shallow draught welded-aluminum hydrographic survey boat measuring 28-feet long. The *S/V Clock* is a Thomas Marine survey vessel with twin 150 horsepower motors.

2.4 NAVIGATION SYSTEM

Navigation survey control was provided by the McKim & Creed surveyors who also piloted the survey vessel. Prior to the survey, McKim & Creed Survey recovered and checked control monuments for accuracy using RTK GPS.

Survey control for the project is referenced to the State Plane Coordinate System, Virginia South, relative to North American Datum of 1983 for horizontal, and North American Vertical Datum of 1988 for vertical. Positioning of the vessel was supplied via RTK for real time horizontal and vertical positions. Tidal variations were accounted for through the RTK GPS corrections at an update rate of 10 Hz (ten updates per second). Other input/output interfaces with the navigation system included connections to the seismic systems, the echosounder, and the side scan sonar.

For this survey, Fugro's Starfix.Seis navigation system was interfaced to McKim & Creed's onboard Trimble 12-channel GPS receiver with an integrated Starfix differential receiver. The Trimble unit receives ranging information from the same satellites as the Starfix differential reference stations. These corrections are applied to the DGPS receiver's satellite data to produce an accurate position of the vessel in real-time. The differentially-corrected position from the Trimble receiver is then passed to the navigation computer.

The Starfix.Seis navigation system continually recorded and transmitted tow-fish positions as well as vessel speed and position. An ethernet link to the data logging computers transmitted the positioning data and record event markings on the paper seismic and subbottom records.

Vessel offsets were measured on a level concrete floor at the shop. The vessel was leveled fore and aft using bubble and water levels. Benchmarks were installed at the reference point (RP; center transition to cabin), starboard and port draft measuring points, bow, stern, forward cabin top, and at aft quarter tow points. A drill mark was used as the reference point (RP) on the antenna mast. Bubble levels were installed on the cabin top and the deck for future leveling.

All reference points were measured to approximately 0.1 inch accuracy or better using level lines and a steel tape. The reference frame of the vessel is defined by the bow/stern RP (fore/aft), the starboard/port draft measurement benchmarks (athwart) and vertically by plumb line.

2.5 BATHYMETRY SURVEY

A bathymetric survey was performed as part of the river bottom mapping phase of the survey. A multibeam sonar system was used to survey most of the area. A single beam sonar system was used to survey the shallow water area near the shoreline along the Norfolk side of the river. The water depths were tide corrected and referenced to MLLW. A description of the field survey, data processing methods, and the bathymetric chart are provided in the Bottom Charting Survey Report (Fugro, 2008a).

2.6 MULTICHANNEL "BOOMER" SYSTEM

The major components of the seismic reflection data acquisition systems are the seismic energy source, the hydrophone streamer and the digital recording system. The seismic reflection system used for the Second Parallel Tunnel geophysical survey included a mechanical "boomer" energy source and a multichannel, Geo-Eel hydrophone array.

2.6.1 Energy Source

An Applied Acoustics Engineering AA300J portable seismic energy source was used to power the AA300 boomer plate towed from a catamaran configuration. The boomer plate is an electro-mechanical transducer made of an insulated metal plate and a rubber diaphragm adjacent to a flat wound electrical coil. A short duration high-energy pulse is discharged from the AA300J energy source into the coil and the resulting magnetic field repels the metal plate in the transducer. The plate motion is transferred to the water by the rubber diaphragm, generating a broad-band acoustic pulse that does not have strong cavitations or ringing.

The Applied Acoustics Model AA300 subbottom towfish was deployed and towed from the starboard side stern of the vessel. Sufficient tow cable was deployed such that the towfish was clear of and beneath the vessel's wake. The system was triggered at an 8 to 10 Hz pulse rate and swept a frequency range between 2 to 10 kHz. The recorded seismic record length was dependent on water depth. Navigation fix marks were sent to the systems' printer every 100 meters (328 feet) down the survey line. All navigation information and subbottom data were time tagged and logged to a hard drive. All data were backed up and copied to DVD at the end of each survey day.

2.6.2 Multichannel Hydrophone Array

The reflected acoustic pulse, generated by the boomer source, was received by a multichannel Geo-Eel hydrophone array. The Geo-Eel includes hydrophones enclosed in a silica gel at specified intervals. The Geo-Eel transmits the recorded signal via ethernet connection.

The Midtown Second Parallel Tunnel project used both 8-channel and 24-channel (location dependant) hydrophone arrays. Both hydrophone arrays included 1.56 meter group spacing of the channels. For most of the series 100 and 200 project area tracklines, the data were collected with the 8-channel array, while the data for the 300 series regional tracklines were recorded with the longer 24-channel array. The raw data recorded by the hydrophone channels was logged to a Geometrics CNT recording system in a SEG-Y format for later post-processing.

2.6.3 Control and Recording Systems

On board the vessel, the hydrophone signal is applied to a time-varied gain amplifier. This unit allows the gain to increase linearly from the instant the source is fired to the end of the record length. This technique compensates for acoustic spreading losses in the water column and for attenuation of the seismic signal in the subsurface strata. This signal is then applied to an electronic bandpass filter that is tuned to eliminate signals outside of the bandwidth of the sound source, such as noise generated by the vessel's propulsion system or by the sea state.

The graphic recorder provides a visual means of depicting geologic features in two axes. One axis is two-way travel time of the acoustic signal through the water column and the seafloor. The other is the track-line of the vessel as measured in distance (or in some cases, time). Event marks supplied by the navigation system are also applied so that the graphic data may be referenced to the survey coordinate system.

A summary of the multichannel system employed on this survey are listed in Table 1. Equipment specifications are provided in Appendix A.

Table 1. Multichannel "Boomer" System Summary

Parameter	Specification
Boomer	Applied Acoustics Engineering
Source	Applied Acoustics Engineering Model AA300 plate/catamaran
Power Supply	AA300J Power Supply
Hydrophones	Geometrics GeoEel, 8-channel or 24-channel Digital Streamer
Channel Spacing	1.56 meter group spacing
Recording System	Geometrics CNT-1
Firing Rate	~ 2.5 Hz (0.75m)
Recording Parameters	1/4-msec sample rate, 200-msec record length

2.7 SUBBOTTOM PROFILER SYSTEM

A subbottom profiler was employed to obtain shallow seismic reflection data on the sediment layers immediately beneath the riverbed. These shallow data provide information on the spatial distribution and thickness of the unconsolidated surficial sediments.

An EdgeTech Geostar (Chirp) full-spectrum, digital subbottom profiler with an SB-216S towfish was used to collect subbottom data for the project. The Geostar is a wide band FM high resolution subbottom profiler. It generates cross sectional images of the seabed and collects digital normal incidence reflection data over many frequency ranges. For example, the system transmits a FM pulse that is linearly swept over a spectrum frequency range (also called a "chirp pulse") 2-16 kHz over 20 milliseconds. The acoustic return received at the hydrophone is match filtered with the outgoing FM pulse, generating a high resolution image of the subbottom stratigraphy.

Full Spectrum™ technology has several advantages over conventional systems including increased penetration with high resolution through use of the matched filter correlation and waveform weighting techniques. The Geostar combines a precision wide band, low noise, low distortion analog sonar front end with a powerful RISC workstation and a digital signal processing pipeline array coprocessor. The system provides subbottom penetration of up to 100 meters in clays with vertical resolution of 6 to 10 centimeters depending on operating frequency. The system is integrated with the navigation computer, which provides real-time towfish positions, speed, and event/fix marks, which are also recorded at the appropriate time on the recorder for subsequent post processing of the seismic data.

The subbottom signals are transmitted, received, amplified, and filtered before being printed on the graphic recorder. The system's tow vehicle is deployed from a tow cable over the vessel's stern at a depth of approximately 5 feet (1.5 meters) below the waterline. Subbottom and positioning data are both logged to the system's computer hard drive and the back-up data storage computer.

The subbottom profiler was deployed and operated simultaneously with the boomer-source Geo-Eel hydrophone array seismic reflection system. The survey vessel's position was referenced to the RTK GPS antenna position and used for all the analog systems while the seismic offsets were referenced to the navigation antenna position.

A summary of the system parameters employed during this survey are listed in Table 2. Equipment specifications are provided in Appendix A.

Table 2. Subbottom Profiler System Summary

Parameter	Specification
Subbottom Profiler	Edgetech Geostar Full Spectrum Profiler
Topside Processor	Model 3200 Towfish Edgetech, Model SB-216S
Acquisition Software	Edgetech Discover
Frequency Sweep	2-16 kHz
Firing rate	3 Hz
Display	Variable - dependent on water depth

3.0 DATA PROCESSING

Immediately following the completion of each day's field survey, a preliminary evaluation of the data was performed dockside. All data were reviewed for data quality and completeness. Digitally recorded data were checked and backed-up to a dedicated hard drive and copied to DVD media prior to leaving the field.

Subsequently, the data from the various survey systems were forwarded to Fugro's Ventura, California office for further evaluation, analysis, and processing. Once in Ventura, copies of the various data sets were distributed for processing.

3.1 MULTICHANNEL SEISMIC DATA PROCESSING

Data processing of the multichannel seismic reflection data acquired in the Elizabeth River followed the basic premise of the wavelet processing method used in the petroleum exploration industry. A single-plate boomer source type was used and combined with two different hydrophone streamer configurations. The objective for the 24-channel streamer was to provide deeper penetration, while the 8-channel mini-streamer provided higher resolution at lesser penetration.

Basic seismic data processing consists of: 1) filtering in time and space, 2) deconvolution to provide a sharper and more consistent seismic wavelet for interpretation, 3) correction of normal moveout due to varying subsurface velocity structure, 4) stacking of data traces to increase the signal-to-noise ratio, and 5) migration to put the reflecting horizons back into their proper lateral positions. All data were deconvolved to zero phase and to American polarity.

In general, the data quality is considered to be fair to good. The seismic data contain information about, but are not limited to, shallow to deep geologic structure, presence and location of utilities, features related to past construction activities (e.g. construction cut from placement of the tunnel and water pipeline), and presence of biogenic gas. Usefulness of the seismic data in some cases may be constrained due to the presence of biogenic gas and interference from the water bottom multiple. In some areas, the water bottom multiple interferes with prominent reflectors that are located within the depth of interest for the future tunnel design and may make it challenging to interpret the top of the key geologic units (e.g. top of the

Yorktown Formation). Integrating the seismic and geotechnical data will be essential to derive interpretations of subsurface structure with confidence. A Boomer seismic data example from Line 108 is shown on Figure 5.

3.2 SUBBOTTOM PROFILER DATA PROCESSING

Processing for the Chirp subbottom data included checking and de-spiking all navigation points using Starfix Proc. Starfix Proc is the application for automated (batch) processing of Starfix logged data. After the data are cleaned, verification was made that the corrected navigation files were referenced from the towed position (where the subbottom unit was located in the water). The corrected navigation and shot points were then inserted into a raw JSF file (Edgetech's Proprietary format) using Starfix Gplot (Addxyz). Gplot is the application for real time post processing of both sonar and seismic acoustic signals. The JSF files were then converted to SEG-Y using the utility JSF-to-SEG-Y inside Gplot. The SEG-Y data were then loaded into Kingdom Suite for interpretation.

The data quality generally is considered to be good. The seismic data contain information about, but are not limited to, shallow geologic structure, presence and location of utilities, features related to past construction activities (e.g. construction cut from placement of the tunnel and water pipeline), and presence of biogenic gas. A Chirp seismic data example from Line 305 is shown on Figure 6.

3.3 LIMITATIONS OF SEISMIC DATA

The characteristics of the seismic data place limitations on its use to assess seafloor and sub-seafloor geologic conditions. The dominant frequency of the entire data volume provided is judged to range between 300 Hz and 1,000 Hz in the upper 1 second (two way travel time) below the river bottom. The estimated limit of separability ($\lambda/4$) ranges between 5 and 50 feet, assuming an average sediment column velocity of 5,000 ft/sec for the sediments. The limit of separability is a measure of the vertical resolution of the data and is defined as acoustic wavelength (λ) divided by 4, and indicates the minimum bed thickness required to resolve the top and base of the bed as separate reflectors. Beds thinner than the local limit of separability may be detected in the seismic record, but may not be resolved in true thickness or lateral extent. Given these resolution limitations, thin stratigraphic bedding and man-made features and obstructions cannot be detected with the Boomer seismic reflection data set.

3.4 REPORT USE

This Seismic Reflection Data Report has been prepared for the Virginia Department of Transportation, solely for the preliminary, feasibility-level planning and design of the proposed Midtown Second Parallel Tunnel project. In performing our professional services, we have used the degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers and geologists currently practicing in this or similar localities. No other warranty, express or implied, is made as to the content of this report. Fugro Atlantic makes no claim or representation concerning any activity or conditions falling outside its specified purposes to which this report is directed.

4.0 REFERENCES

Fugro Atlantic (Fugro) (2008a), Bottom Charting Data Report, Proposed Midtown Second Parallel Tunnel, prepared for Virginia Department of Transportation, Fugro Atlantic Project No. 3602.001.

_____ (2008b - in preparation), Elizabeth River Site Characterization Report, Proposed Midtown Second Parallel Tunnel, prepared for Virginia Department of Transportation, Fugro Atlantic Project No. 3602.001.

FIGURES



Aerial Photo Source: Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <<http://datagateway.nrcs.usda.gov/>>

PROJECT VICINITY MAP
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 1

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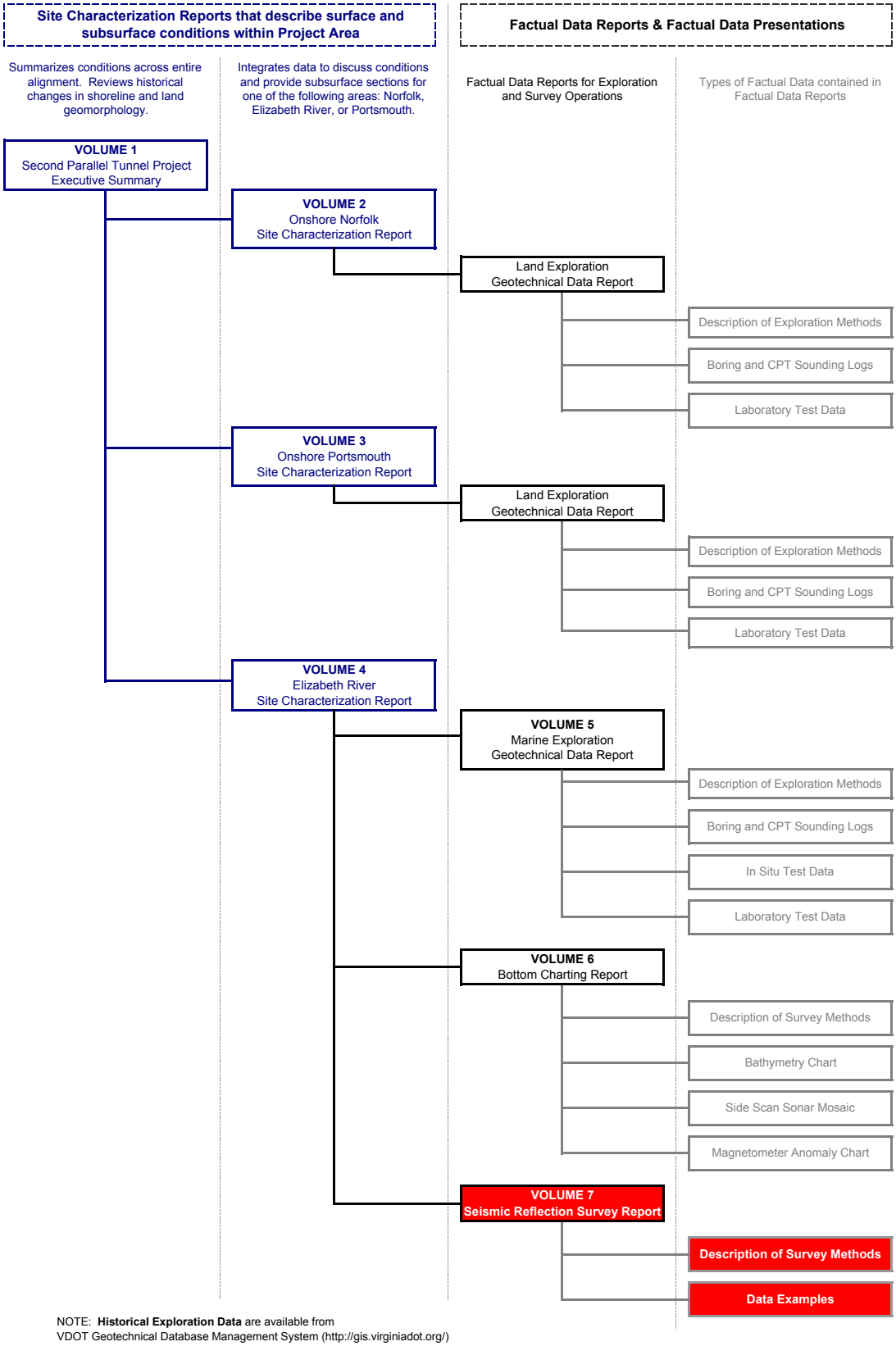
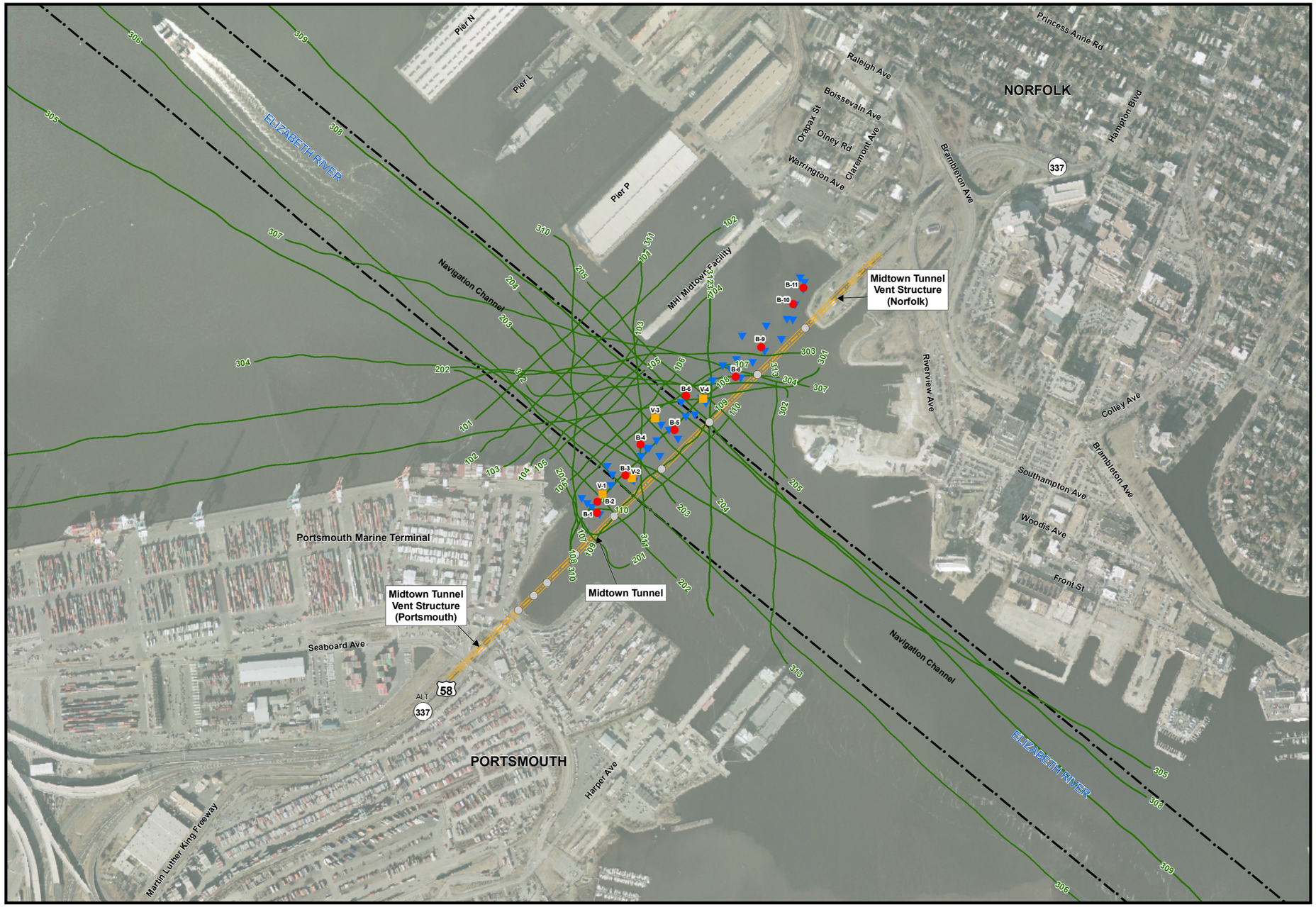


NOTE: **Historical Exploration Data** are available from
VDOT Geotechnical Database Management System (http://gis.virginiadot.org/)

GEOTECHNICAL REPORT ORGANIZATION

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 2



LEGEND

Approximate Location of Midtown Tunnel
Not for design or construction planning.
Refer to Fugro (2008a) for discussion.

2008 Exploration Locations

- C-38 — CPT
- B-11 — Boring
- T-4 — T-bar
- V-4 — Vane Shear
- 313 — Midtown Tunnel Geophysical Survey Lines

1960 Exploration Locations

- 60-11 — Boring

NOTES

1) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>

2) Geophysical survey utilized 1) a 3.5 kHz high-resolution subbottom profiler and 2) a boomer source with multi-channel hydrophone array seismic reflection system.

0 400 800 Feet

N
W E
S

SHIP TRACKLINE MAP

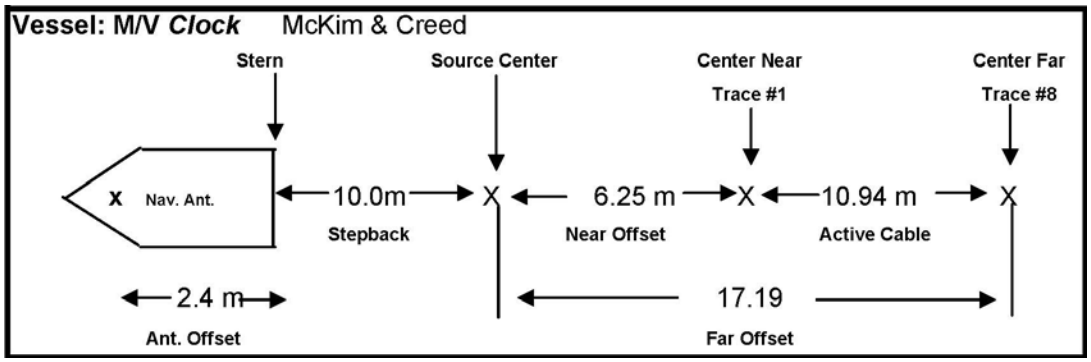
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 3

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\05-Seis_Reflcn_Rpt\MXD\Ship_Trackline_Map_11x17.mxd, 08/15/08, kstevens



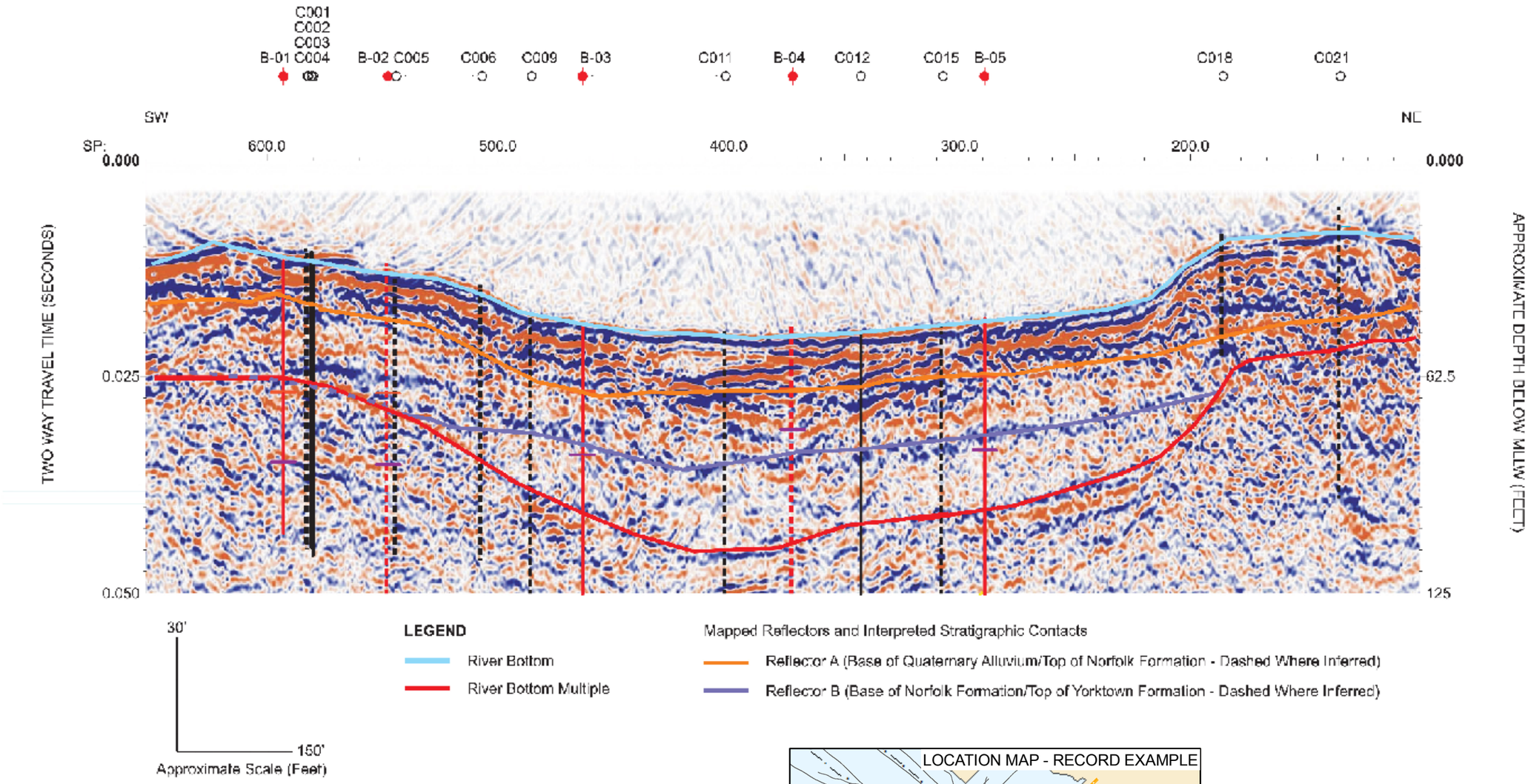
Photograph of S/V *Clock* at marina.

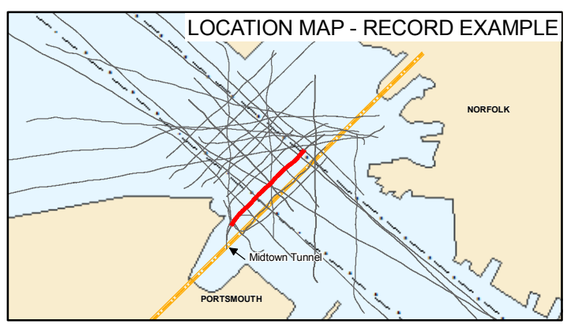


Schematic drawing of the multichannel boomer equipment configuration.
Note: geophone spacing (distance between traces) is 1.5 meters (5 feet).

SYSTEMS DIAGRAM, S/V *CLOCK*
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 4





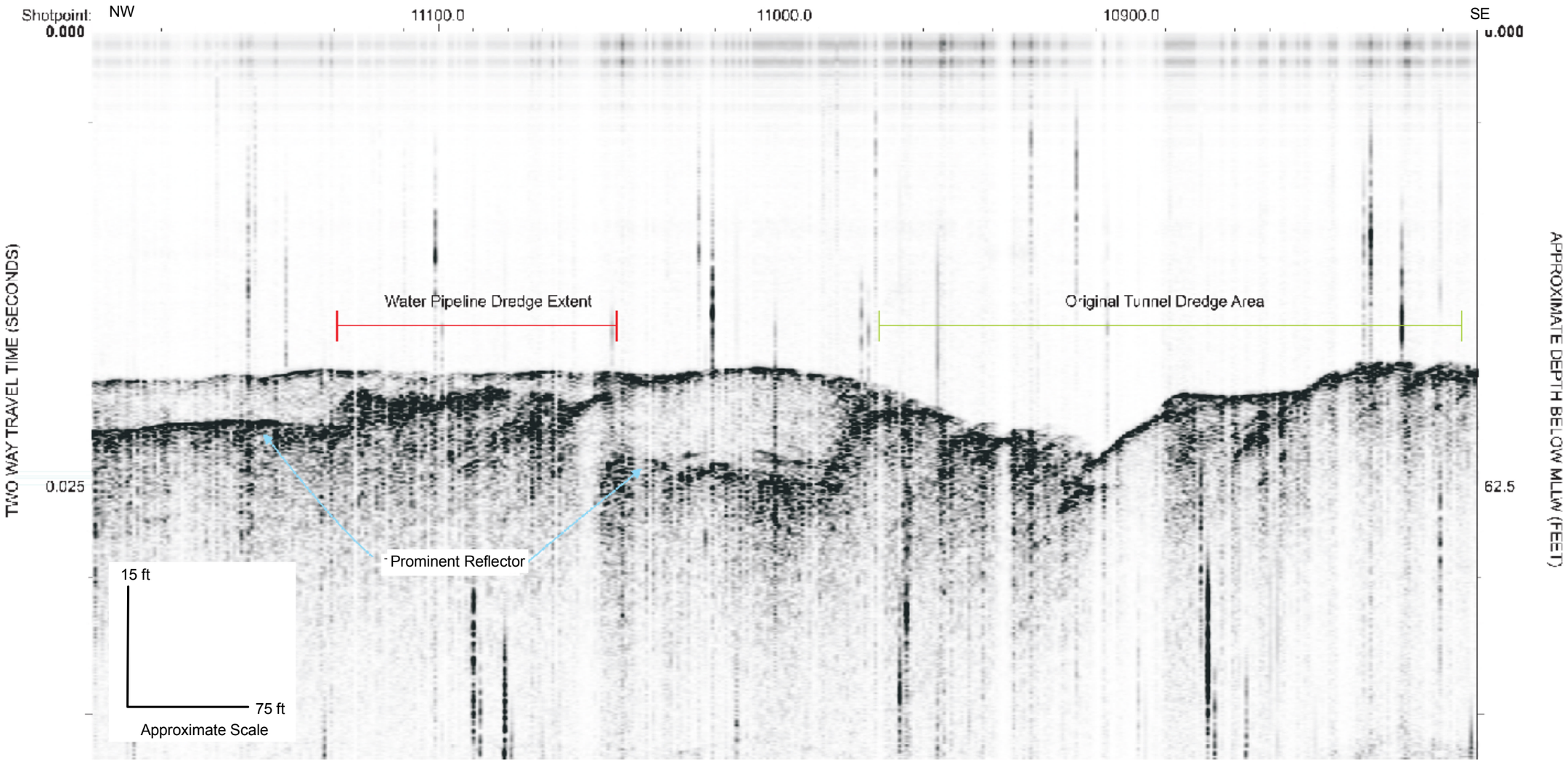
Notes:

1) Vertical exaggeration is 5x.
2) Approximate depth below mean lower low water is based on P-wave velocity of 5,000 ft/sec.
3) Horizontal scale varies slightly due to survey vessel speed.

BOOMER RECORD, LINE 108
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

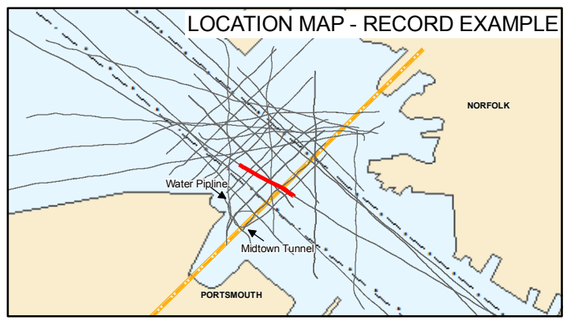
FIGURE 5

N:\Projects\3602_VDOT\3602-001_Midtown_Tunnel\Outputs\3602-001_Site_Char\05-Seis_Reflcn_Rpt\MXD\Line305.mxd, 08/05/08, kstevens



Notes:

1) Vertical exaggeration is 5x.
2) Approximate depth below mean lower low water is based on P-wave velocity of 5000 ft/sec.
3) Horizontal scale varies slightly due to survey vessel speed.
4) Note disturbance in both dredge areas.



CHIRP SEISMIC RECORD EXAMPLE OF LINE 305
Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

FIGURE 6

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CHART

12119000 12120000 12121000 12122000 12123000 12124000 12125000 12126000

3482000 3481000 3480000 3479000 3478000 3477000



LEGEND

- Approximate Location of Midtown Tunnel
  Not for design or construction planning.
  Refer to Fugro (2008a) for discussion.

2008 Exploration Locations

- C-38 — CPT
- B-11 — Boring
- T-4 — T-bar
- V-4 — Vane Shear
- 313 — Midtown Tunnel Geophysical Survey Lines

1960 Exploration Locations

- 60-11 — Boring

Notes:

1) Coordinate Grid: Virginia State Plane, South Zone, NAD 83, Feet
2) Digital Ortho Quarter Quadrangle Mosaic for Chesapeake, Virginia, United States Department of Agriculture, 2005 (Scale = 1:12,000) <http://datagateway.nrcs.usda.gov/>
3) Geophysical survey utilized 1) a 3.5 kHz high-resolution subbottom profiler and 2) a boomer source with multi-channel hydrophone array seismic reflection system.

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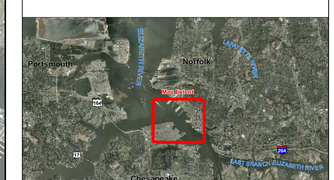
GEODETIC INFORMATION

SPHEROID:	GRS 1980
SEMI-MAJOR AXIS:	6,378,137.000
SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.257222101
ECCENTRICITY²:	0.006694380
PROJECTION:	LAMBERT CONFORMAL CONIC
ZONE:	VIRGINIA SOUTH
LONGITUDE OF ORIGIN:	-36
FALSE EASTING:	11,482,916
FALSE NORTHING:	3,280,833



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Fax: (757) 623-3152
www.fugroatlantic.com

SHIP TRACKLINE CHART

Midtown Second Parallel Tunnel
Portsmouth to Norfolk, Virginia

SCALE= 1:2,400

0 100 200 400 Feet

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Aug. 19, 2008	For Report Submittal	KWS	KCS	TWM
2					
3					

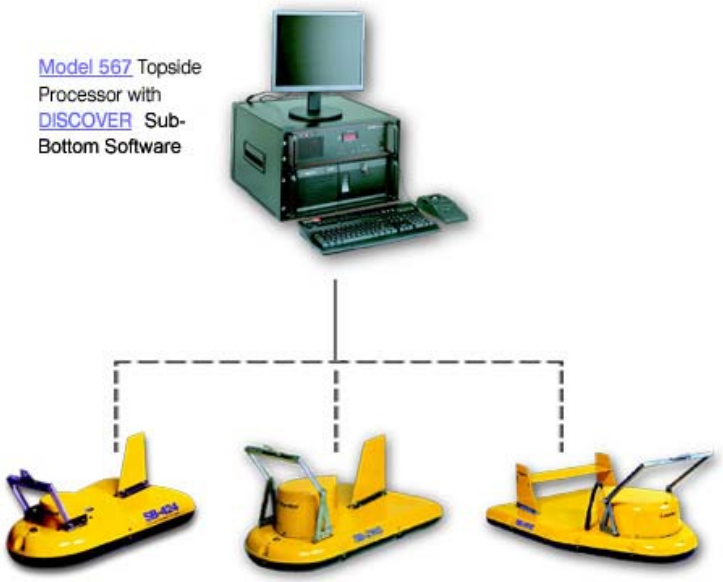
JOB NUMBER: 3602.001 CHART NO.: 1

N:\Projects\3602_VDOT\3602-001_Midtow_Tunnel\Activities\3602-001_Strv_Chart\Strv-Base_ArcMxd\Midtown1_Strv_Trackline_Proj.mxd, 08/19/08, kskeene

APPENDIX A
EQUIPMENT SPECIFICATIONS

Edgetech X-Star Full Spectrum Chirp
Sub-bottom Profiler System

Fugro provided an EdgeTech X-Star full spectrum digital sub-bottom profiler with an SB-216S towfish to collect seismic reflection data for the project. The X-Star is a wide band FM high resolution sub-bottom profiler. It generates cross sectional images of the seabed and collects digital normal incidence reflection data over many frequency ranges. The system transmits and FM pulse that is linearly swept over a spectrum frequency range (also called a "chrip pulse"). For example 2-16 kHz over 20 milliseconds. The acoustic return received at the hydrophone is matched filtered with the outgoing FM pulse, generating a high resolution image of the sub-bottom stratigraphy.



SB-424, SB-216S, or SB-0512i Tow Vehicle

Full Spectrum™ technology has several advantages over conventional systems including increased penetration with high resolution through use of the matched filter correlation and waveform weighting techniques. The X-Star combines a precision wide band, low noise, low distortion analog sonar front end with a powerful RISC workstation and a Digital Signal Processing pipeline array co-processor. The system provides sub-bottom penetration of up to 100 meters in clays with vertical resolution of 6-10 centimeters depending on operating frequency.

The system is integrated with the navigation computer which provides real-time towfish positions, speed, and event/fix marks.which are also recorded at the appropriate time on the recorder for subsquent post processing of the seismic data.

SPECIFICATIONS

SUB-BOTTOM PROFILER SYSTEM

Equipment Type	EdgeTech X-STAR
Operating Frequency	2-16 kHz
Power Level	3,000 Watts
Pulse Type	FM with amplitude and phase weighting
Pulse Length	20, 100 milliseconds
Pulse Repetition Rate	0.5 to 8 pulses/sec for full data acquistion window of 120 ms
Main Processor	Sparc Workstation
Vertical Resolution	From 6 to 10 cm depending on pulse frequency Vertical resolution remains nearly constant up to the full penetration depth.
Penetration	From 10 meters in course calcerous sands to 100 meters in silt clays

GeoEel Digital Marine Streamer System



- **Digital Streamer Means Better Quality Data, Less Time Deploying System**
- **Comparable In Price To Analog Systems**
- **Light Weight, Easy To Deploy On Small Boats**
- **4 ms to 1/16 ms Sampling Means Suitability For More Kinds of Surveys**
- **24-Bit, 110 dB Dynamic Range**
- **Automatic Configuration and Fully Self-Testing**
- **Small Diameter (38 mm, 1.5") Means Easy Deployment by Hand or With Small Winches**
- **Easily Shippable, No Special Environmental Requirements, Filled with Inert Silicon Oil**
- **Rugged, 1/8" Wall Thickness, Can Be Used As Bay Cable, Transition Zones**
- **Multiple Streamer Configuration**
- **Works with Standard Birds**
- **Uses Geometrics CNT-1 PC Controller**
  - Separate Windows Display Shots, Gathers, Trigger Timing, Noise, Gun Energy, Tape Status, Alarms
  - Real-Time Brute Stack
  - Multiple Storage Devices
  - Integrates Data from Sources, Nav, Birds
  - Drives Multiple Printers

The GEOEEL series of digital towed hydrophone streamers are the first small diameter arrays with the performance of larger systems. With a diameter of only 38mm, the GEOEEL is easy to deploy, easy to transport and largely immune from the noise, leakage and ground loops that plague the installation of analog streamers in a marine environment.

The GEOEEL is filled with inert silicon oil which makes it environmentally safe. Thick 1/8" abrasion resistant polyurethane keeps the streamer extremely rugged but still flexible enough to deploy by hand or mount on small winches. And the GEOEEL is easy to repair – no fragile fiber optics to break or go bad.

Sampling intervals of 4 ms to 1/16 ms make the GEOEEL suitable for deep petroleum, high-resolution engineering surveys or even sub-bottom profiling. Near-zero dead time makes surveys fast and efficient. A built-in digitally controlled oscillator provides calibration test signals for each channel. Other tests include noise, offset, pulse test, timing, leakage and capacitance of hydrophone elements.

The GEOEEL transmits data via fast Ethernet to Geometrics CNT-1 controller, running field-proven software that is used on over 40 vessels today. And the GEOEEL is entirely built by Geometrics, known for over 30 years as an industry leader in rugged, reliable and well-supported instrumentation.



Specifications:

GeoEel Digital Marine Streamer System

A-D Converter Module (ADCM):

Number of channels per active section: 8 (plus 1 optional depth sensor channel)
Sample Rates: 1/16 ms, 1/8 ms, 1/4 ms, 1/2 ms, 1 ms, 2 ms, 4 ms
Bandwidth: 5 Hz to 8kHz
Programmable Gain: 0 dB, 12dB, 24 dB, 36 dB, 42 dB
Maximum Input Range: ±2.25V
Resolution: 24 Bits including sign
Dynamic Range: 120db Typical @ 1ms, 70db Typical @ 1/16 ms
QC Tests: Leakage and capacitance of hydrophone elements, pulse, oscillator, timing.
Power Consumption: Approximately 100 mA at 48 VDC
Calibration Oscillator: 10 Hz to 2 kHz, 1 µvolt to 100 mv AC RMS
Dimensions: 38 mm diameter x 22cm long (1.75" diameter by 8.5")
Weight: 900 grams (2.0 lbs)
Packaging Material: 304 Stainless Steel Body
Connectors: Waterproof high density stainless steel, 41 pin

Hydrophone Array:

Active Section:
Number of Channels: 8 maximum per section
Number of Sections: Array dependent, 12 for 96 channels
Hydrophones per group: User option, 10 typical at 12.5m
Hydrophone Type: Benthos RDA Geopoint
Depth sensor (optional): ± 2.5 % accuracy, 0-50 meters
Jacket Material: Clear polyurethane, 70 Duro, 3.18mm (1/8") wall thickness
Outer Diameter: 38 mm (1.5 inches)
Ballast Fluid: Inert, non-polluting silicon oil, 100 cSt
Weight: ~135 kg (300 lbs) / 8 channels @12.5 meter group
Break Strength: over 1250 kg (2750 lbs), Vectran strain members
Maximum Tow Speed: ~8 knots recording, ~10 knots steaming, depending on configuration and sea state
Maximum Bend Radius: 60 cm

Stretch Section:
Length: 10, 25 or 50 meters standard
Outer Diameter: 35mm, 1.375".
Compass/Bird Coil: IO Model 587, mounted at start of section
Jacket Material: Clear polyurethane, 70 Duro, 3.18mm (1/8") wall
Ballast Fluid: Inert, non-polluting silicon oil, 100 cSt
Weight: ~ 67 Kg for 50 meter section
Break strength: over 1250 kg (2750 lbs), Vectran

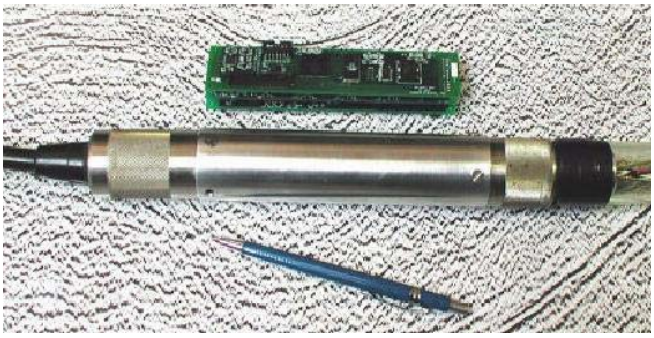
Tow Cable:

Electrical conductors: 10 twisted pair shielded
Weight: Dependent on length, ~ 25 kg (55 lbs) for 50 meters
Strain member: Vectran,
Break strength over 1250 kg (2750 lbs)
Maximum Diameter: 2.5 cm

Deck Interface and Power Supply (DIPS):

Power Requirements: 115/230 VAC, 3/1.5 Amp max, 50/60 Hz
Voltage to Streamer: 36 – 72 VDC
I/O Communications: 100Base TX Fast Ethernet, IEEE 802.3 compliant
Trigger Requirements: Isolated Input, Positive or Negative TTL, software selectable
Testing:
- Continuous monitoring of cable condition for leakage
- Continuous monitoring of Ethernet for faults and collisions

Optional Auxiliary Inputs: 8 analog channels with 24 bit resolution
Ethernet Connection: RJ-45
Trigger Connection: BNC



Controller: PC based running Geometrics CNT-1 software. Multiple shot and gather windows, waterfall and bar graph noise displays, windows for shot timing, gun energy, brute stack, tape status, spectral analysis. Sure-save software protects data loss even with total storage device failure. Files automatically kept in sequential order. Auto-switching between storage device, dual tape writing. Supports multiple printers. Full log kept of all parameter changes. Integrates navigation, gun, bird parameters into SEG-D, SEG-Y or SEG-2 header.

GEOMETRICS, INC. 2190 Fortune Drive, San Jose, CA 95131, USA.
(408) 954-0522 - Fax (408) 954-0902 - Email: sales@mail.geometrics.com

GEOMETRICS Europe Manor Farm Cottage, Galley Lane, Great Brickhill, Bucks, England MK17 9AB
44-1525-261874 - Fax 44-1525-261867 - Email:chris-leech@geometrics-europe.swinternet.co.uk

GEOMETRICS, China Laurel Industrial Company Inc., Beijing Office, Room 2509-2511 Full Link Plaza
#18 Chaoyangmenwai Dajie, Chaoyang District, Beijing, China 100020
10-6588-1126 (1127...1130) - 10-6588-1132 - Fax 10-6588-1162

GEOMETRICS

APPLIED ACOUSTICS
Underwater Technology



: Technical Specification

AA200 and AA300 Seismic Sound Source, Boomer Plates

The two boomer plates, the AA200 and AA300, produce a sharp, repeatable "industry standard" single pulse. Both models are field proven and differ in detail specification.

The Model AA200 is the 'small format' transducer which can be towed on either the CAT100 or CAT200 surface tow vehicles. It is ideal for inshore surveys for high resolution sediment analysis with the CSP-L energy source or as a higher penetration device with the CSP300-P and CSP-D models.

The Model AA300 is designed for higher power applications and has the extra advantage of use as a variable frequency boomer when used with the CSP-D range of energy sources. This allows wide ranging pulse widths not formerly available. The lengthening of the pulse width ensures even greater penetration whilst maintaining a high quality single pulse.



AA200

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F +44(0)1493 440720
E general@appliedacoustics.com
W www.appliedacoustics.com

MODEL TYPES - PHYSICAL SPECIFICATION

	Size	Weight air/water	Fixing Centres
Model AA200	38cm x 38cm	18kg/10kg	31.5cm^2
Model AA300	62cm x 52cm	25kg/14kg	40.6cm^2

ELECTRICAL INPUT

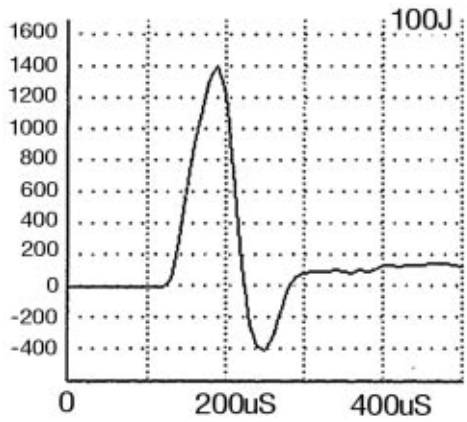
Recommended Power	AA200, 50 – 200J/shot AA300, 100 – 300J/shot
Maximum Energy Input	AA200, 300J/shot AA300, 350J/shot
Maximum power Input	AA200, 600J/second AA300, 1000J/shot

SOUND OUTPUT

Source level	AA200, 215 dB re 1 µPa at 1 metre with 200J AA300, 218 dB re 1 µPa at 1 metre with 300J
Pulse Length	AA200, 120/150/180 mS at 50/100/200J AA300, 150 – 400 mS depending on energy setting of CSP-D
Reverberation	AA200, <1/10 x initial pulse AA300, < 1/10 x initial pulse
Connector type	Enhanced Joy Plugs. Models AA201 and AA301 fitted with RMK type

COMPATIBILITY*

Energy Source	AA200, CSP-L; CSP300P;CSP-D AA300, CSP300P;CSP-D
Catamaran	AA200, CAT100; CAT200 AA300, CAT200



AA200 PULSE SHAPE

* Also compatible with older model CSP units.

Certificate No. 6447
BS: EN: ISO9001 : 2000

APPLIED ACOUSTICS
Underwater Technology

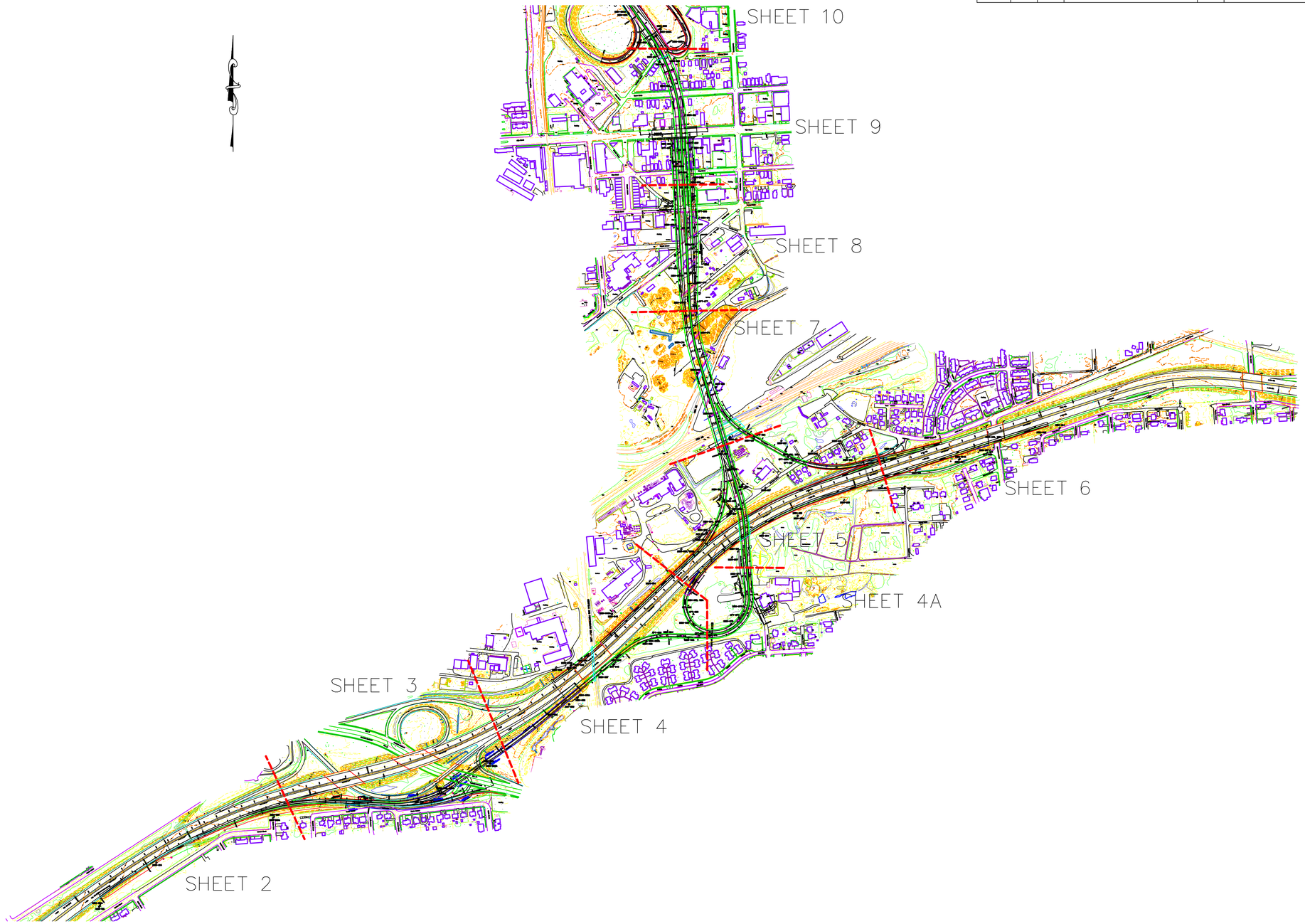
Due to continual product improvement, specification information may be subject to change without notice.

© Applied Acoustic Engineering Limited/Boomer Plates/June 2007

1.2 Geotechnical Conditions - MLK Extension

1.2.1 Geotechnical Conditions - MLK Extension - Boring and CPT Location Diagrams

FHWA REGION	STATE	FEDERAL AID ROUTE	FEDERAL AID PROJECT	STATE ROUTE	STATE PROJECT	SHEET NO.
3	VA.	—				1



LEGEND

- SPT BORING LOCATION
- DILATOMETER SOUNDING LOCATION
- CONE PENETROMETER SOUNDING LOCATION

GRAPHIC SCALE
0 250 500
1 inch = 500 ft.

Schnabel Engineering
Richmond, Virginia
GEOTECHNICAL ENGINEERS

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COMMONWEALTH OF VIRGINIA
DEPARTMENT OF TRANSPORTATION

STRUCTURE AND BRIDGE DIVISION

MARTIN LUTHER KING EXPRESSWAY
INTERIM PHASE
SUBSURFACE EXPLORATION LOCATION PLAN

No.	Description	Date
	Revisions	

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Drawn: .....
Checked: .....

Date	Plan No.	Sheet No.
OCT. 2010		1

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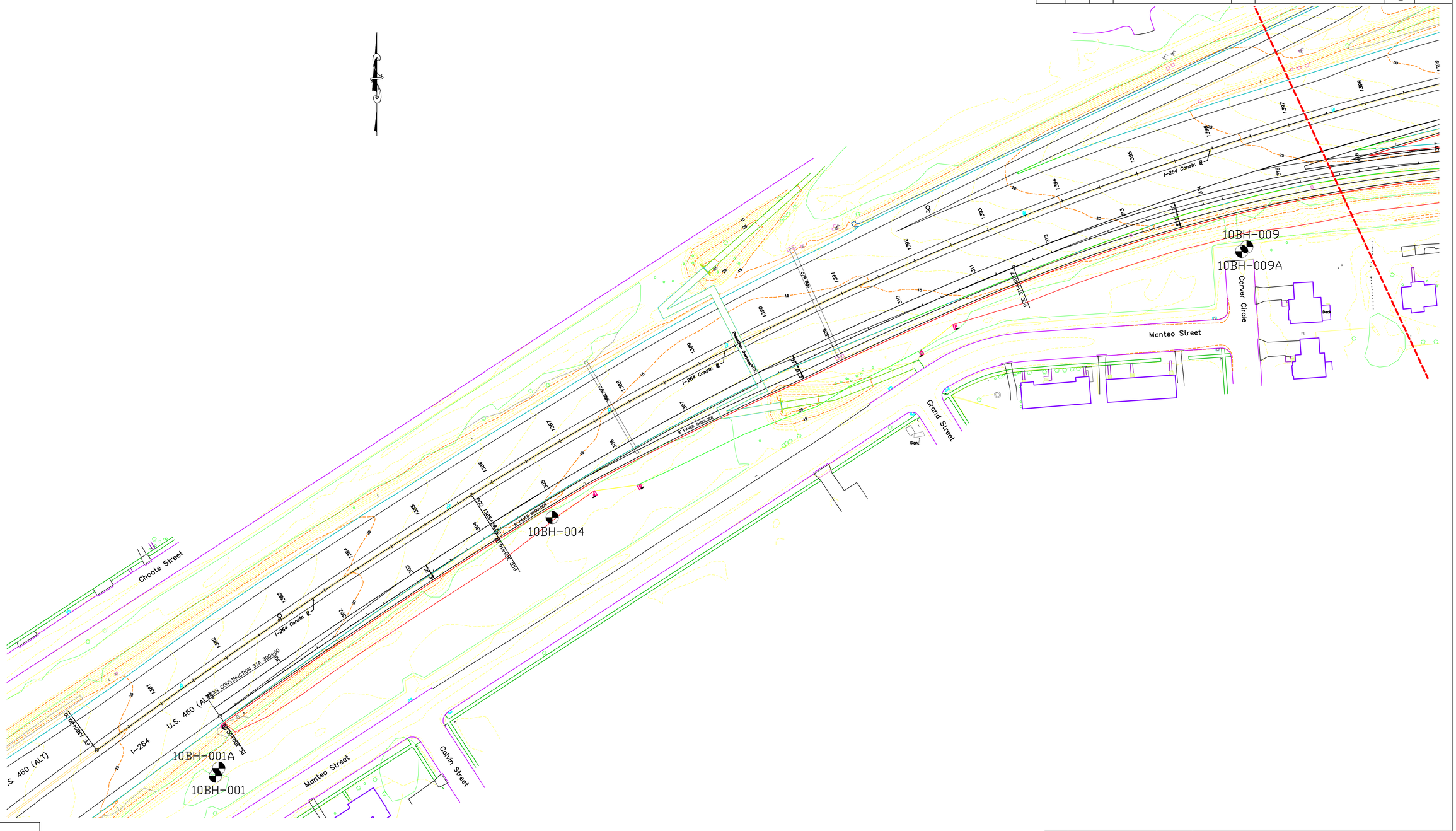

LEGEND

- SPT BORING LOCATION
- DILATOMETER SOUNDING LOCATION
- CONE PENETROMETER SOUNDING LOCATION

GRAPHIC SCALE
0 30 60
1 inch = 60 ft.

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STRUCTURE AND BRIDGE DIVISION

MARTIN LUTHER KING EXPRESSWAY
INTERIM PHASE
SUBSURFACE EXPLORATION LOCATION PLAN

No.	Description	Date
	Revisions	

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Date	Plan No.	Sheet No.
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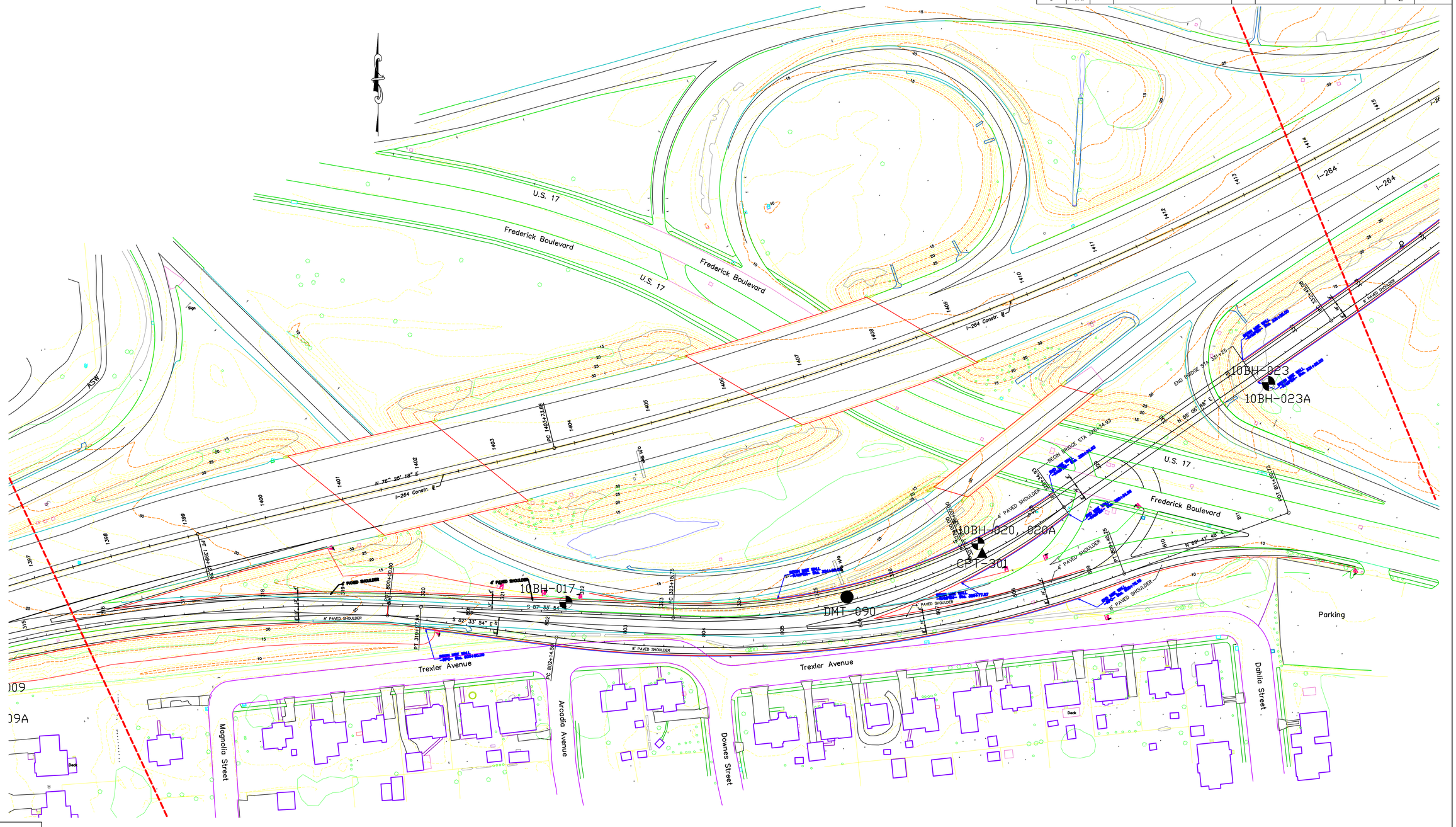

LEGEND

- SPT BORING LOCATION
- DILATOMETER SOUNDING LOCATION
- CONE PENETROMETER SOUNDING LOCATION

GRAPHIC SCALE
0 30 60
1 inch = 60 ft.

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MARTIN LUTHER KING EXPRESSWAY
INTERIM PHASE
SUBSURFACE EXPLORATION LOCATION PLAN

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Date	Plan No.	Sheet No.
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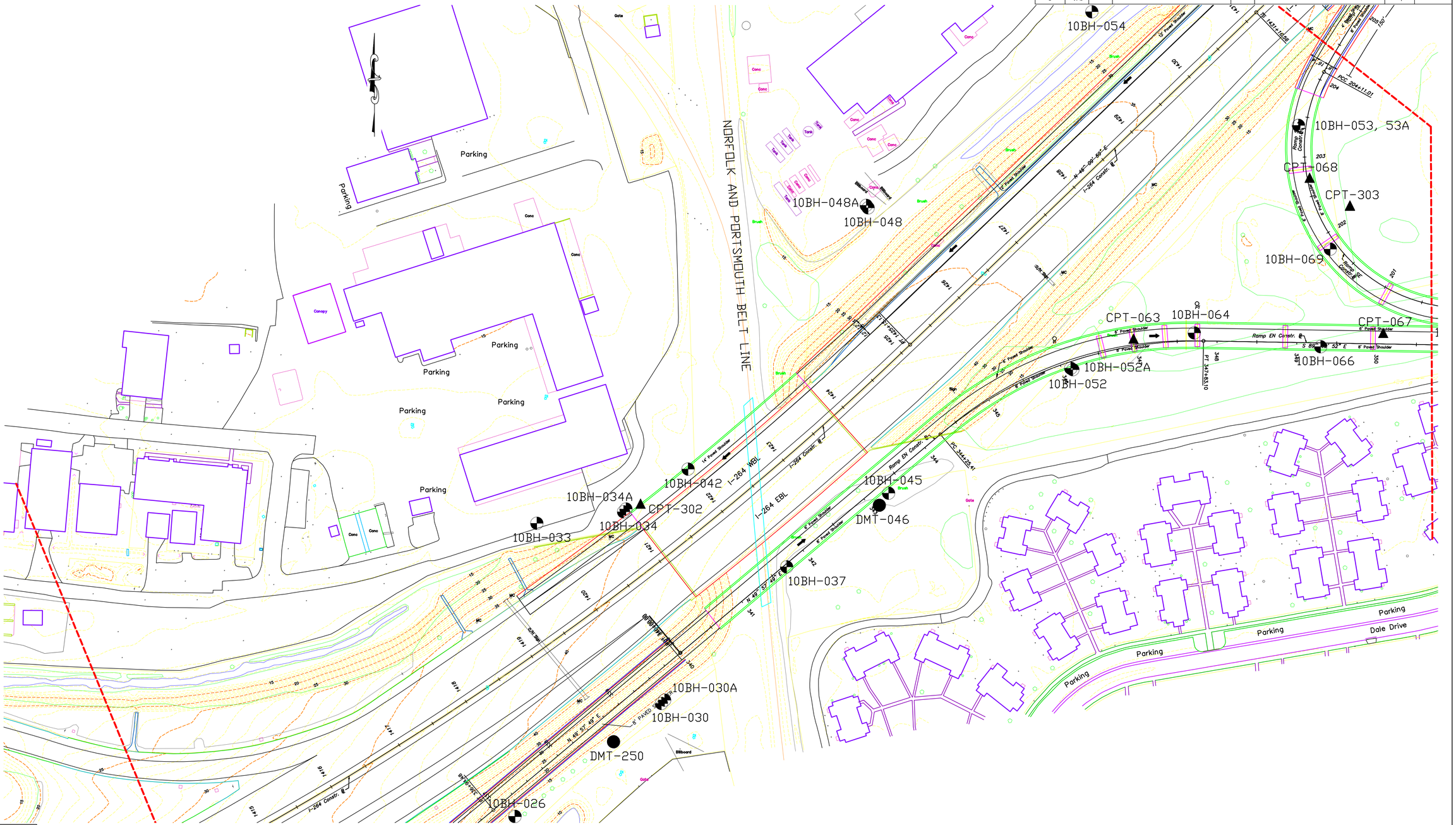

LEGEND

SPT BORING LOCATION

DILATOMETER SOUNDING LOCATION

CONE PENETROMETER SOUNDING LOCATION

GRAPHIC SCALE
0 30 60
1 inch = 60 ft.

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MARTIN LUTHER KING EXPRESSWAY
INTERIM PHASE
SUBSURFACE EXPLORATION LOCATION PLAN

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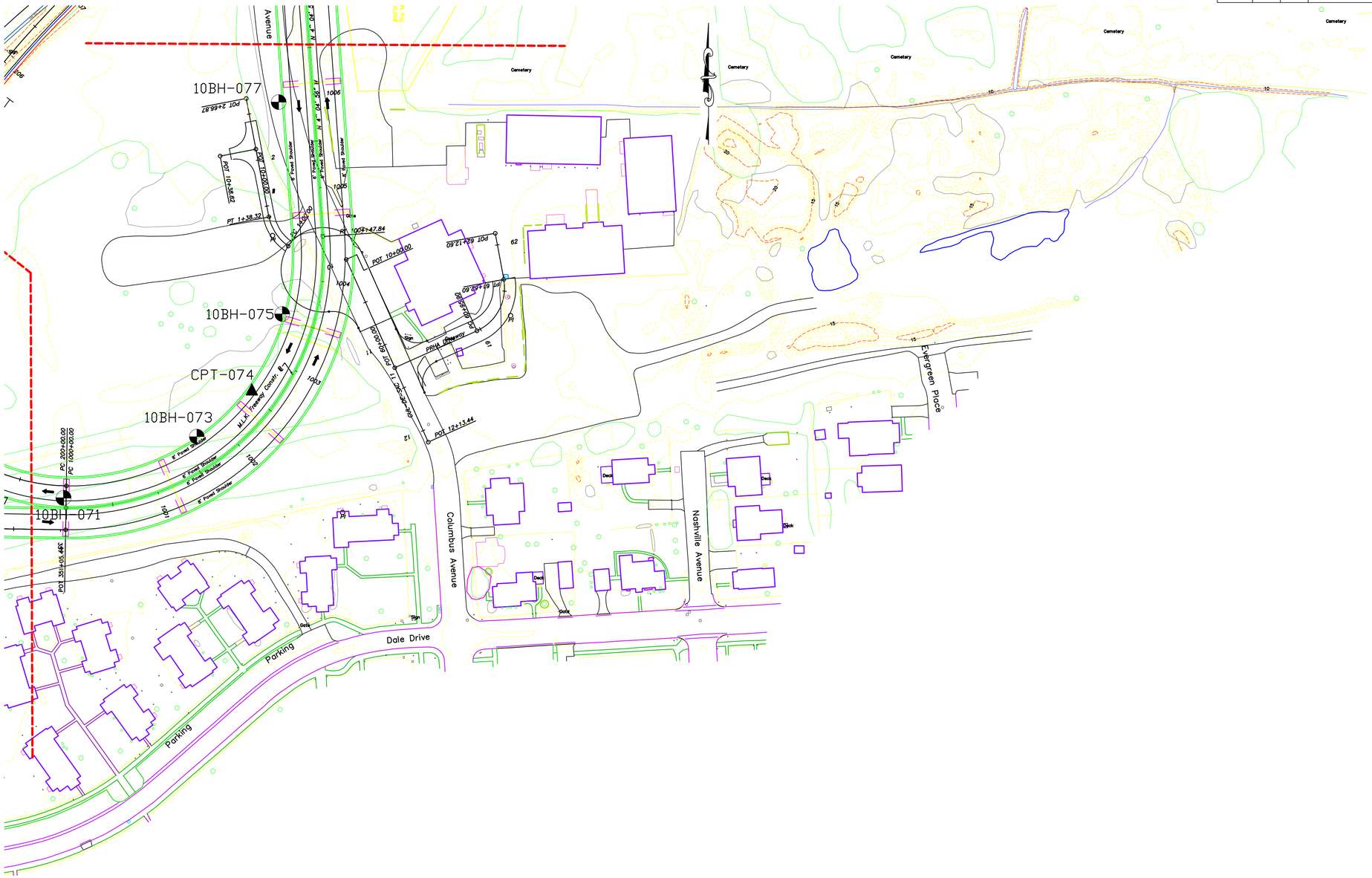
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10BH-075
CPT-074
10BH-073
10BH-071
Columbus Avenue
Nashville Avenue
Evergreen Place
Dale Drive
Parking
Parking
Cemetery
Cemetery
Cemetery
Cemetery
Deck
Deck
Deck
Deck
Gate
Gate
Gate

FHWA REGION	STATE	FEDERAL AID		STATE		SHEET NO.	
		ROUTE	PROJECT	ROUTE	PROJECT		
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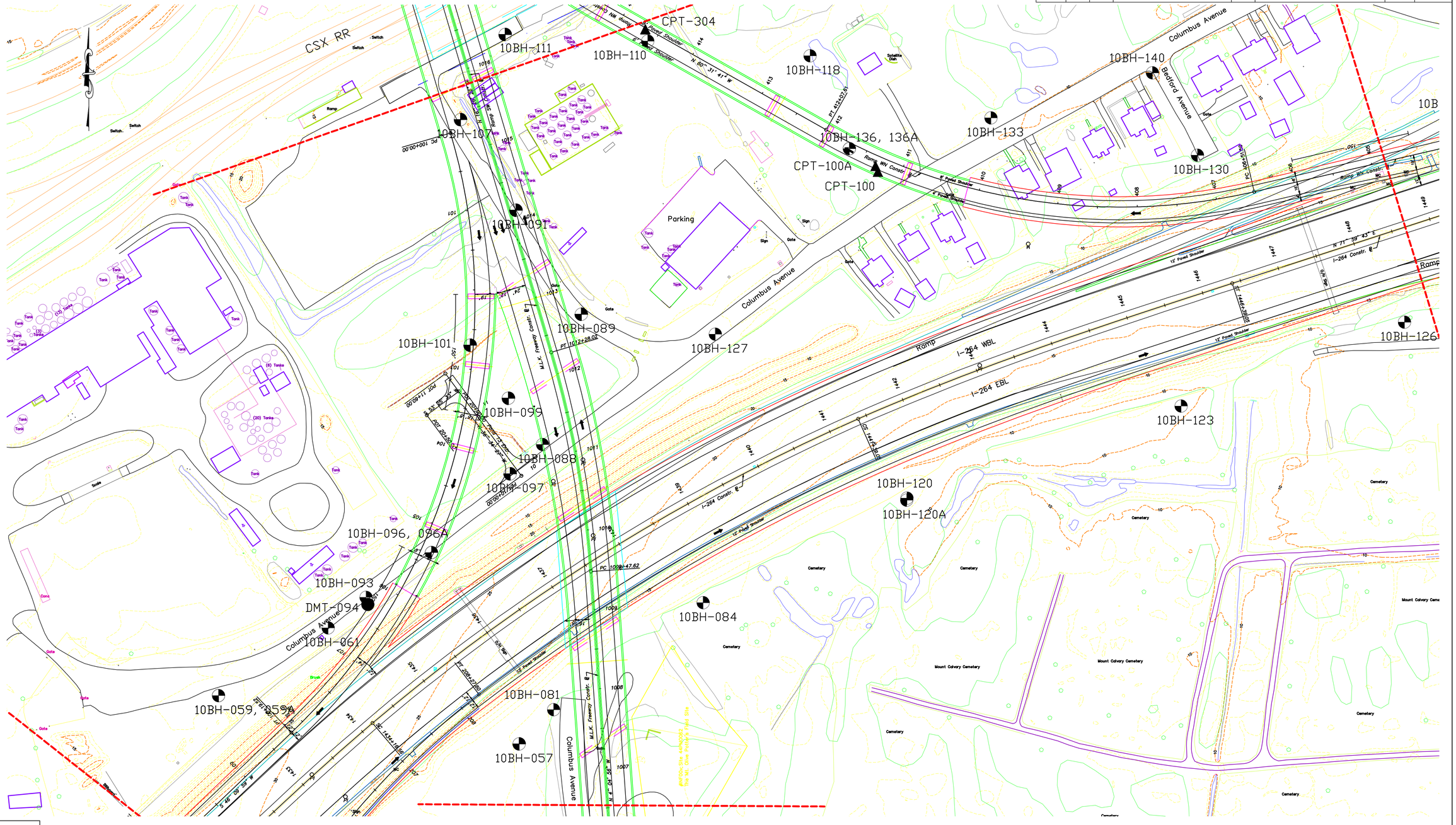

LEGEND

- SPT BORING LOCATION
- DILATOMETER SOUNDING LOCATION
- CONE PENETROMETER SOUNDING LOCATION

GRAPHIC SCALE
0 30 60
1 inch = 60 ft.

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No.	Description	Date
Revisions		

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MARTIN LUTHER KING EXPRESSWAY
INTERIM PHASE
SUBSURFACE EXPLORATION LOCATION PLAN

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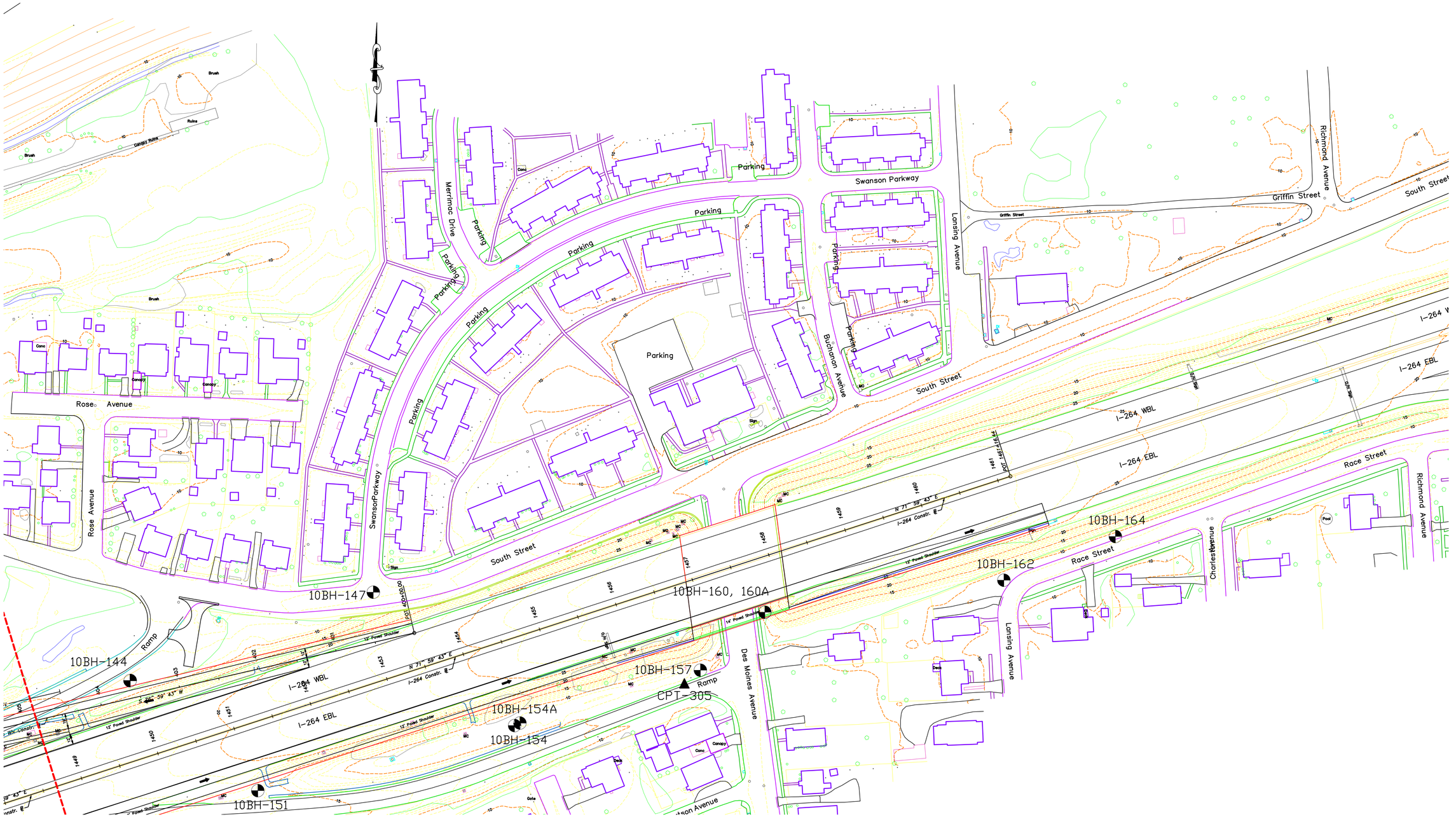

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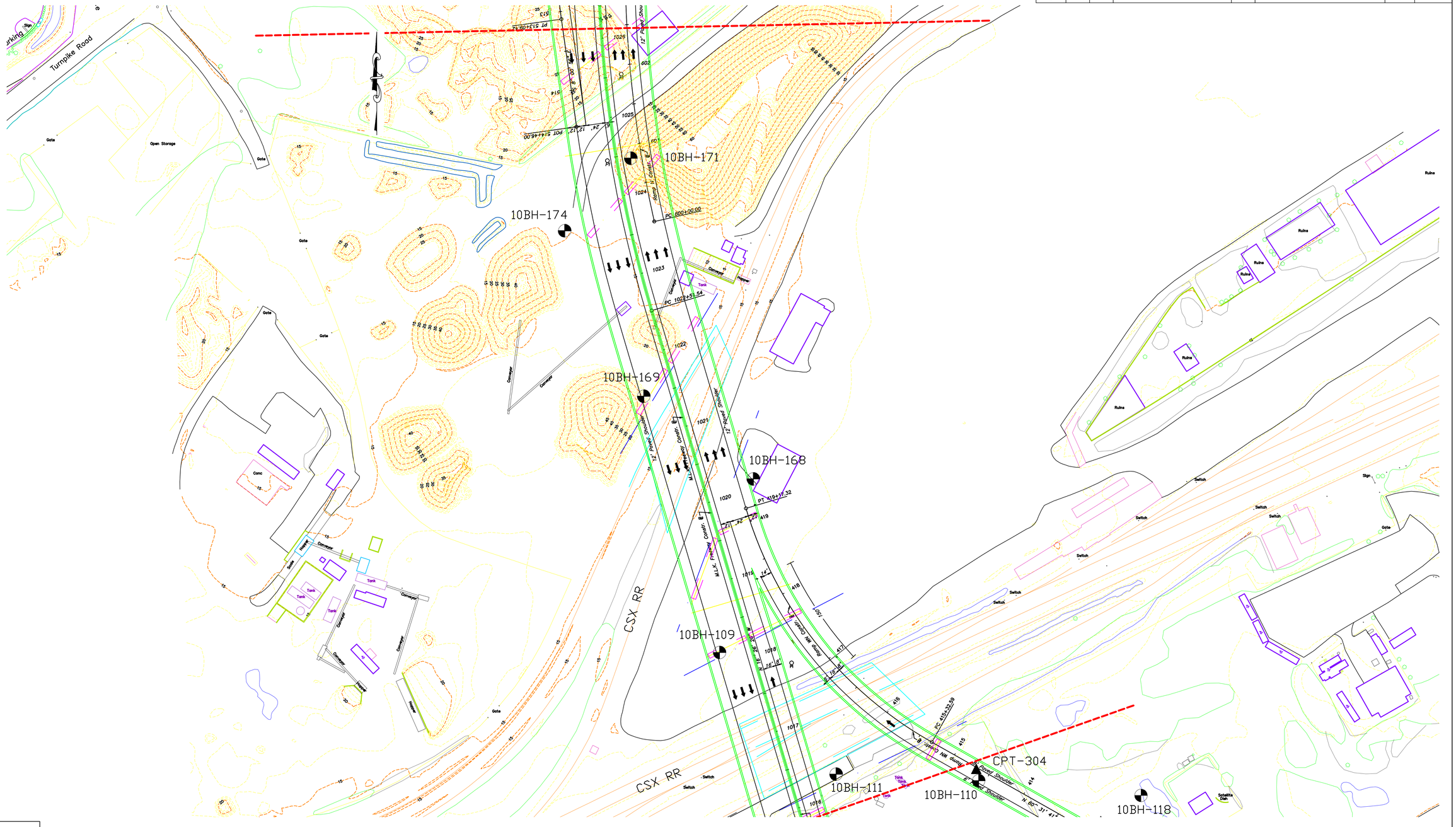

LEGEND

- SPT BORING LOCATION
- DILATOMETER SOUNDING LOCATION
- CONE PENETROMETER SOUNDING LOCATION

GRAPHIC SCALE
0 30 60
1 inch = 60 ft.

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DEPARTMENT OF TRANSPORTATION

STRUCTURE AND BRIDGE DIVISION

MARTIN LUTHER KING EXPRESSWAY
INTERIM PHASE
SUBSURFACE EXPLORATION LOCATION PLAN

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Date	Plan No.	Sheet No.
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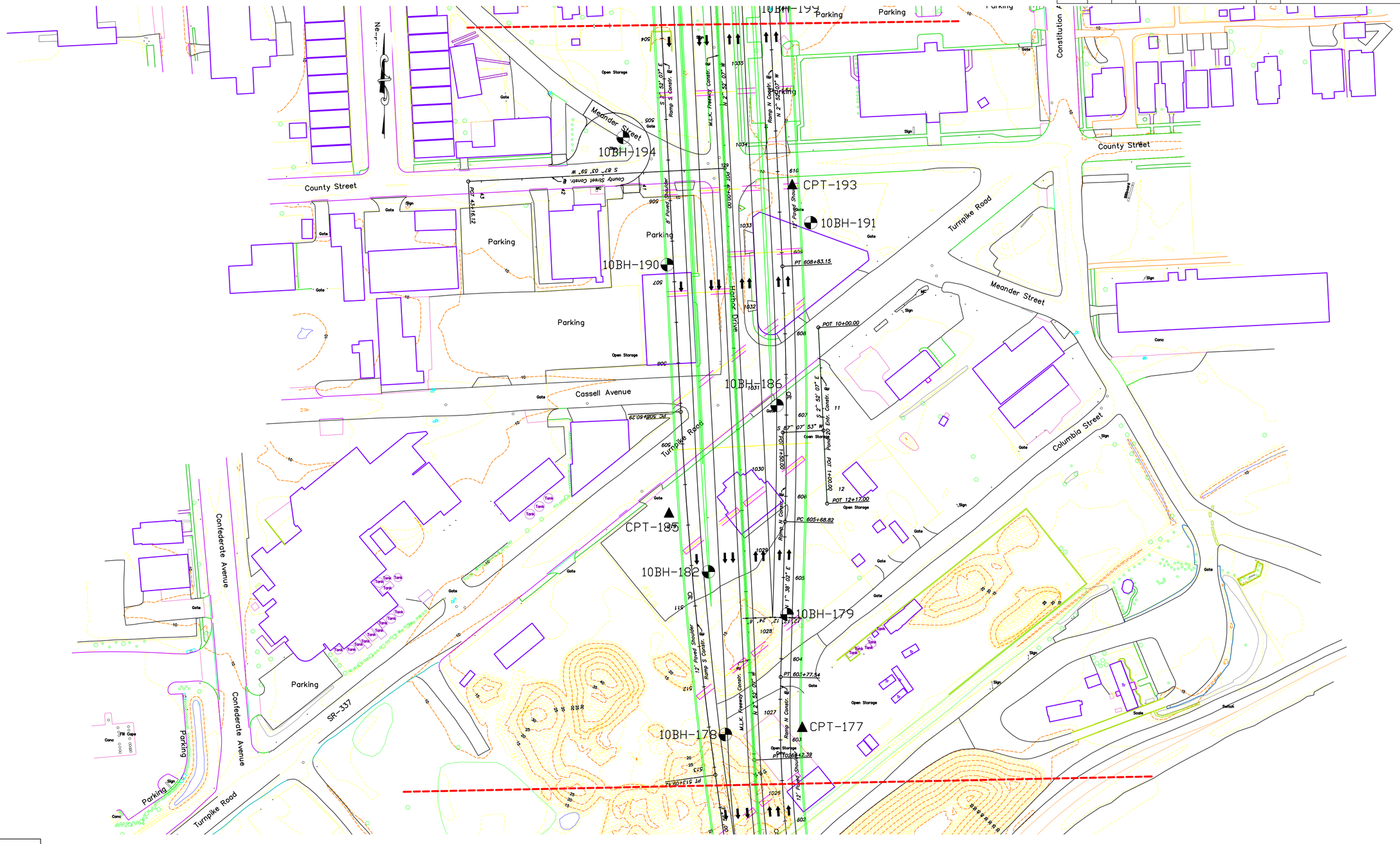
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10BH-191
10BH-190
10BH-186
10BH-185
10BH-182
10BH-179
10BH-178
CPT-193
CPT-185
CPT-177
Meander Street
County Street
Turnpike Road
Harbor Drive
Cassell Avenue
Confederate Avenue
SR-337
Columbia Street
Parking
Open Storage
Gate
Sign
Tank
Conc
Scale
Switch
POT 10+00.00
PT 608+83.15
PC 605+68.82
POT 12+17.00
PT 601+77.54
PT 602+42.39
PC 601+60.29
PT 601+15.00
PC 600+15.00
POT 43+16.12
S 87° 03' 59" W
S 2° 52' 07" E
N 2° 52' 07" W
S 87° 07' 53" W
N 1° 39' 02" E
N 2° 52' 07" W
S 2° 52' 07" E
Ramp S Constr. ℄
Ramp N Constr. ℄
M.L.K. Freeway Constr. ℄
Ramp H Constr. ℄
Ramp H Entr. Constr. ℄
County Street Constr. ℄
8' Paved Shoulder
12' Paved Shoulder
10' Paved Shoulder
POT 4+00.00
POT 1+00.00
POT 1+50.00
POT 1+00.00
POT 1+00.00
POT 1+00

FHWA REGION	STATE	FEDERAL AID ROUTE	FEDERAL AID PROJECT	STATE ROUTE	STATE PROJECT	SHEET NO.	
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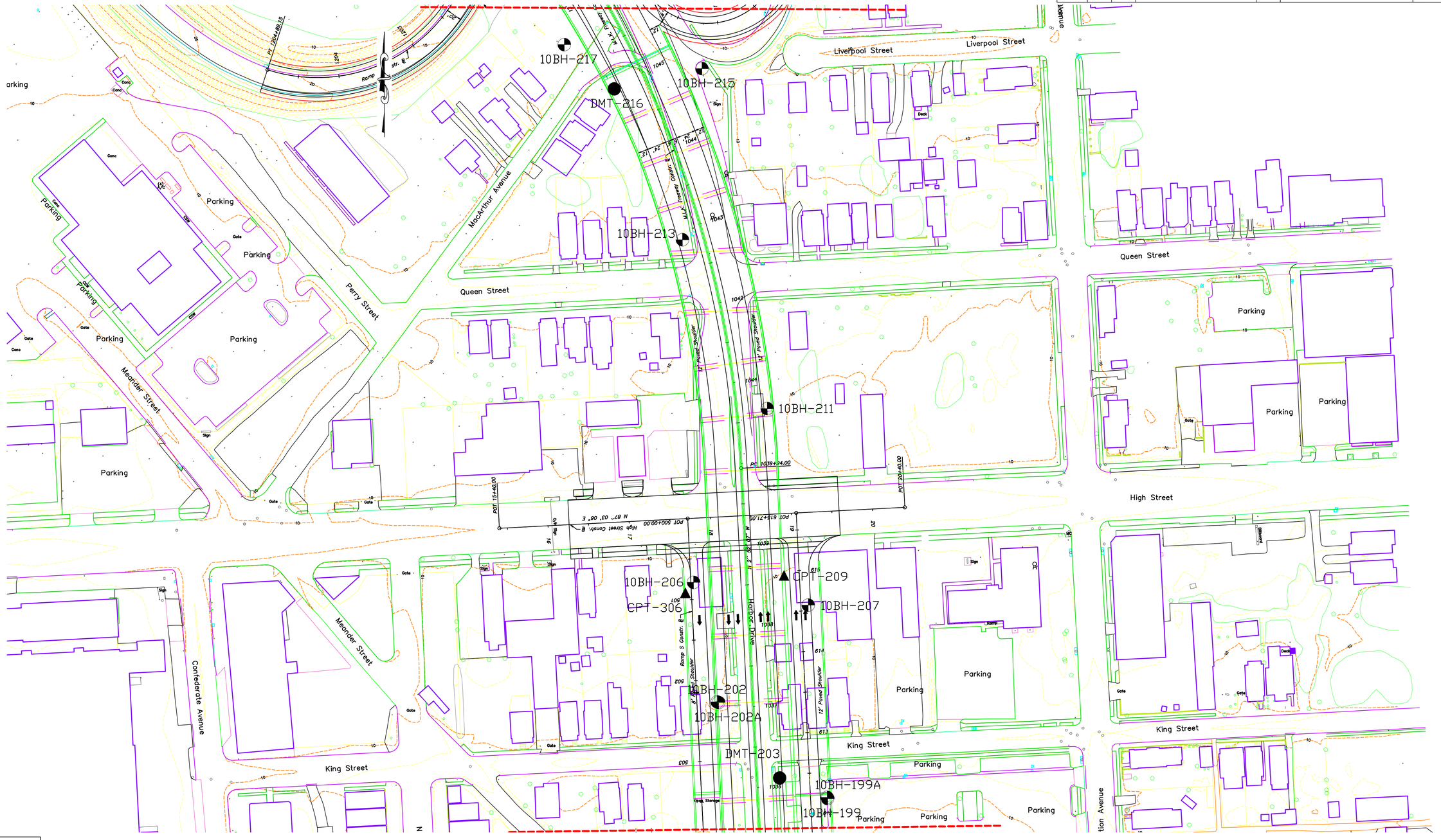

LEGEND

- SPT BORING LOCATION
- DILATOMETER SOUNDING LOCATION
- CONE PENETROMETER SOUNDING LOCATION

GRAPHIC SCALE
0 30 60
1 inch = 60 ft.

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GEOTECHNICAL ENGINEERS

No.	Description	Date
	Revisions	

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF TRANSPORTATION

STRUCTURE AND BRIDGE DIVISION

MARTIN LUTHER KING EXPRESSWAY
INTERIM PHASE
SUBSURFACE EXPLORATION LOCATION PLAN

Designed: ..... Drawn: ..... Checked:	Date	Plan No.	Sheet No.
	OCT. 2010		9

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FHWA REGION	STATE	FEDERAL AID		STATE		SHEET NO.	
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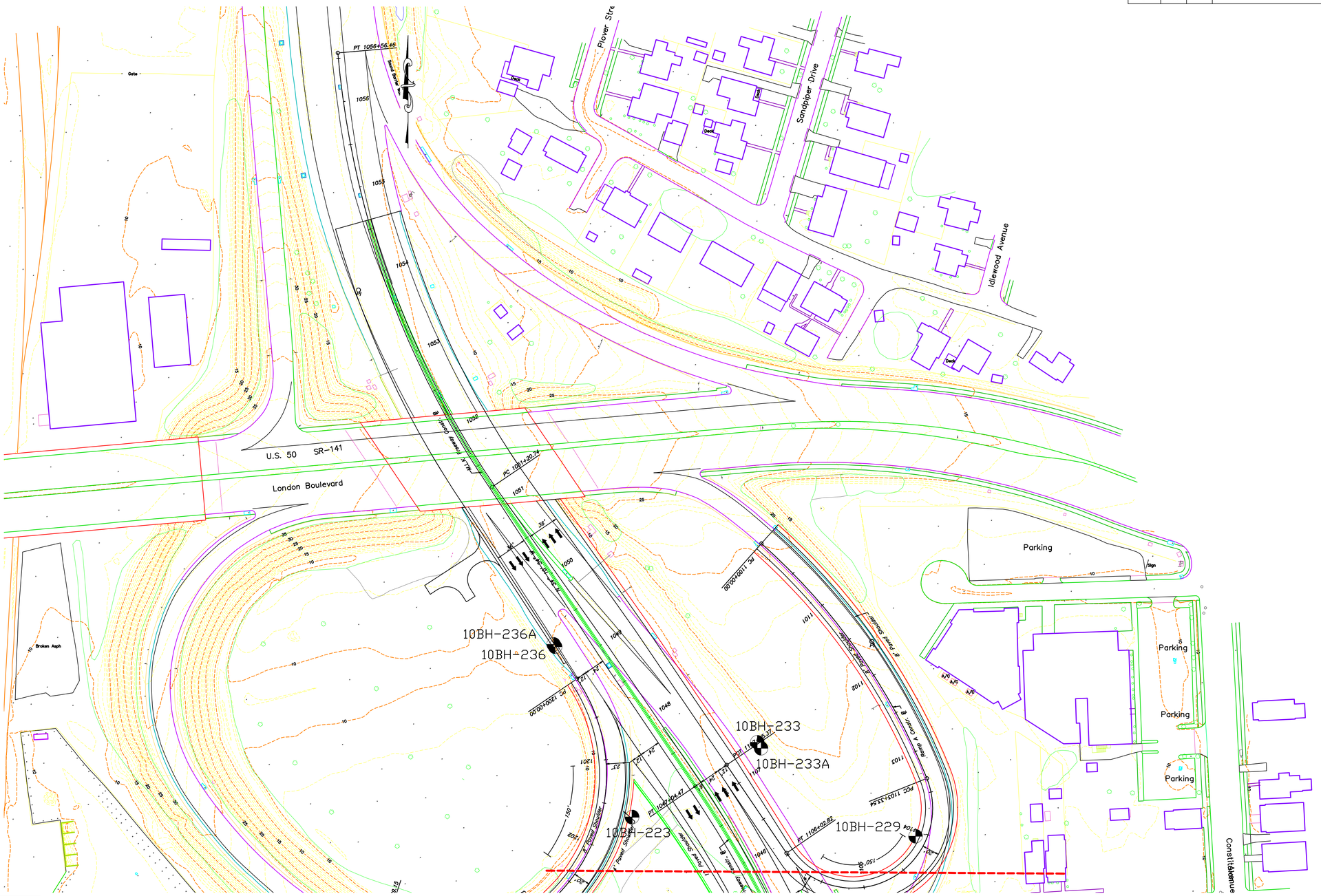

1.2.2 Geotechnical Conditions - MLK Extension - Boring Logs

VDOT Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-001
PAGE 1 OF 2

STATION: 1381+00 OFFSET: 107 ft RT
LATITUDE: 36.819234° N LONGITUDE: 76.342161° W
SURFACE ELEVATION: 11.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/11/2010 - 08/11/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
1.25	2	10	4 4 5	100		2						0.0 / 11.5 4-inches FOREST LITTER, ROOTMAT AND TOPSOIL **TOPS**			16.5	
	4 ▽		3 4 4 5	100		4						0.3 / 11.2 Dark brown, sandy lean CLAY, contains root fragments, stiff, moist [C2] [LYNNHAVEN MEMBER (TABB FORMATION)] **CL**			9.9	
	6	5	2 3 4 7	100		6						2.0 / 9.5 Light brown, fine to medium poorly graded SAND, trace silt, medium dense, moist [C1] **SP**			17.3	
	8		4 7 8 11	100		8						SAME, wet below 4 ft			20.9	
	10		6 7 10 11	100		10						5.2 / 6.3 Gray, fine to medium poorly graded SAND with silt, loose, wet [C1] **SP-SM**			25.2	
	12	0				13						SAME, light gray, medium dense below 8 ft				
	14		4 4 3 2	100		15						SAME, gray, loose below 13 ft			26.5	
	16	-5														
0.25	18		WOH WOH 1 0	100		18						16.5 / -5.0 Gray, ORGANIC SILT, trace sand, very soft, wet [D3] [SEDGEFIELD MEMBER (TABB FORMATION)] **OH**	126	91	94.3	98.8
	20					20										
	22	-10														
0.25	24		WOH WOH 1 2	100		23						24.0 / -12.5 Brown gray, sandy ORGANIC SILT, very soft, wet [D3] **OH**			81.8	
	26	-15				25										
0.5	28		1 1 2 1	100		28						SAME, dark brown below 28 ft	133	59	119.6	58.9
	30					30										
	32	-20														
	34		WOH WOH WOH 1	100		33						31.5 / -20.0 Light gray, clayey SAND, contains organic matter, very loose, wet [D1] **SC**	20	18	21.2	39.6

REMARKS: Rig Type: CME-45C (Track).

PAGE 1 OF 2
10BH-001

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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VDOT Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-001
PAGE 2 OF 2

STATION: 1381+00 OFFSET: 107 ft RT
LATITUDE: 36.819234° N LONGITUDE: 76.342161° W
SURFACE ELEVATION: 11.5 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/11/2010 - 08/11/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

FIELD DATA														LAB DATA			
PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	35					35										
	36	-25										36.5 / -25.0 Light gray, fine to medium poorly graded SAND, trace silt and gravel, medium dense, wet [D1] **SP**				
	38		7 9 8 3	35		38									23.6	
	40					40										
	42	-30										41.5 / -30.0 Light green gray, fine to coarse silty SAND, contains heavy concentrations of shell fragments and coquina, medium dense, wet [E1] [YORKTOWN FORMATION] **SM**				
	43		4 5 7 5	100		43									23.4	
	44					45										
	46	-35														
	48		6 4 5 6	100		48									24.6	
	50					50										
	52	-40														
	53		5 5 5 7	100		53									26.5	
	54					55										
	56	-45														
	58		10 10 11 14	100		58						SAME, green gray below 58 ft			25.1	
	60					60						Bottom of Boring at 60 ft.				

REMARKS: Rig Type: CME-45C (Track).

PAGE 2 OF 2
10BH-001

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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VDOT Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-001A
PAGE 1 OF 1

STATION: 1381+12 OFFSET: 112 ft RT
LATITUDE: 36.819261° N LONGITUDE: 76.342146° W
SURFACE ELEVATION: 11.3 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/11/2010 - 08/11/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)
	0	11.3										0.0 / 11.3 Rotary probe to 18 ft; see Boring 10BH-001 for strata descriptions.			
	2	10													
	4														
	6	5													
	8														
	10	0													
	12														
	14														
	16	-5													
0.25	18			100		18						18.0 / -6.7 Gray, ORGANIC SILT, moist [D3] [SEDGEFIELD MEMBER (TABB FORMATION)] **OH**			
	20					20						Bottom of Boring at 20 ft.			

REMARKS: Rig Type: CME-45C (Track).

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10BH-001A

SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-004
PAGE 1 OF 2

STATION: 304+87 OFFSET: 21 ft RT
LATITUDE: 36.820099° N LONGITUDE: 76.340691° W
SURFACE ELEVATION: 12.0 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/11/2010 - 08/11/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

FIELD DATA | **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)
			3 4 5	90		5						0.0 / 12.0 5-inches FOREST LITTER, ROOTMAT AND TOPSOIL **TOPS**			10.2
3	2	10	3 4 5	85		2						0.4 / 11.6 Dark brown, fine to medium silty SAND, contains root fragments, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SM**			20.8
	4 ▽		1 3 4	85		4						1.4 / 10.6 Gray, sandy lean CLAY, contains root fragments, stiff, moist [C2] **CL**			23.0
	6		1 1 1	100		6 7						2.0 / 10.0 Brown, fine to medium silty SAND, medium dense, moist [C1] **SM**			33.9
	8	5	1 2 4	85		8						3.8 / 8.2 Light brown, fine to medium poorly graded SAND, trace silt, medium dense, moist [C1] **SP** SAME, wet below 4 ft			21.3
	10					10						6.3 / 5.7 Gray, fine to medium clayey SAND, very loose, wet [C1] **SC**			
	12	0	2 1 1	100		13						8.0 / 4.0 Gray, fine to medium poorly graded SAND with silt, loose, wet [C1] **SP-SM**			28.3
	14					15									
	16														
	18	-5	4 4 2	65		18						SAME, fine to coarse below 18 ft			16.7
	20					20									
	22	-10	3 2 2	100		23						21.5 / -9.5 Gray, fine to medium clayey SAND, contains organic matter, loose, wet [C1] **SC**			
	24					25						24.2 / -12.2 Dark brown, PEAT, wet [D3] [SEDGEFIELD MEMBER (TABB FORMATION)] **PT**			189.9
	26	-15													
	28		1 1 1	100		28									169.4
0.25	30					30						29.5 / -17.5 Gray, sandy ORGANIC SILT, soft, wet [D3] **OH**			
	32	-20										31.5 / -19.5 Gray, fine to coarse poorly graded SAND, trace silt, dense, wet [D1] **SP**			
	34		6 14 17 21	75		33									16.2

REMARKS: Rig Type: CME-45C (Track).

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10BH-004

SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 2 OF 2

STATION: 304+87 OFFSET: 21 ft RT
LATITUDE: 36.820099° N LONGITUDE: 76.340691° W
SURFACE ELEVATION: 12.0 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/11/2010 - 08/11/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	36	-25				35									
	38		4 10 12 11	85		38						36.5 / -24.5 Light gray, fine to medium poorly graded SAND with silt, medium dense, wet [D1] **SP-SM**			20.5
	40					40									
	42	-30	7 8 9 14	100		43						41.5 / -29.5 Light green gray, fine to coarse silty SAND, contains heavy concentrations of shell fragments, medium dense, wet [E1] [YORKTOWN FORMATION] **SM**			26.7
	44					45									
	46	-35													
	48		11 18 23 25	100		48									21.6
	50					50									
	52	-40													
	54		18 22 28 34	100		53						SAME, green gray below 53 ft			18.8
						55						Bottom of Boring at 55 ft.			

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-009
PAGE 1 OF 2

STATION: 314+31 OFFSET: 68 ft RT
LATITUDE: 36.820977° N LONGITUDE: 76.337684° W
SURFACE ELEVATION: 11.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/20/2010 - 07/20/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: K. Megginson

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

DEPTH (ft)	ELEVATION (ft)	STANDARD PENETRATION TEST HAMMER BLOWS	SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	CORE RECOVERY (%)	ROCK QUALITY DESIGNATION	DIP ° STRATA	DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
2	10	3 6 13	50		2						0.0 / 11.6 6-inches ROOTMAT AND TOPSOIL **TOPS**			15.2	
4 ▽		4 2 1	35		4						0.5 / 11.1 Dark gray brown, fine to medium silty sand FILL, contains root fragments, organic matter and rock fragments, medium dense, moist [A1] [FILL] **FL**			20.5	
6	5	4 3 4	50		6						SAME, loose below 2 ft			26.5	
8		5 5 6	60		8						4.0 / 7.6 Light gray, fine to medium poorly graded SAND with silt, loose, wet [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP-SM**			27.1	
10		2 3 4	50		10						SAME, contains mica, medium dense below 6 ft			29.2	
12	0										SAME, loose below 8 ft				
14		2 2 4	65		13 15									23.3	
16	-5														
18		4 2 2	40		18						17.0 / -5.4 Brown and dark brown, PEAT, wet [D3] [SEDGEFIELD MEMBER (TABB FORMATION)] **PT**			428.3	
20					20										
22	-10	1 2 2	100		23						22.0 / -10.4 Light gray, fine to medium silty clayey SAND, contains organic matter and mica, loose, wet [D1] **SC-SM**	24	5	23.4	44.1
24					25										
26	-15														
28		2 2 2	80		28									27.8	
30					30										
32	-20										32.0 / -20.4 Gray brown and green gray, fine to medium poorly graded SAND, trace silt, contains mica, very loose, wet [D1] **SP**				
34		1 1 1	85		33									39.8	

REMARKS: Rig Type: CME-55 (Track).

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SPT_LOGB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 2 OF 2

STATION: 314+31 OFFSET: 68 ft RT
LATITUDE: 36.820977° N LONGITUDE: 76.337684° W
SURFACE ELEVATION: 11.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/20/2010 - 07/20/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: K. Megginson

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
35											SAME, light orange brown and gray below 35 ft				
36	-25														
38		2 1 2 2	85		38						SAME, gray, loose below 38 ft			22.8	
40					40										
42	-30														
43		5 6 9 10	100		43						42.0 / -30.4 Gray brown, fine to coarse silty SAND, contains heavy concentrations of shell fragments, medium dense, wet [E1] [YORKTOWN FORMATION] **SM**			32.3	
44															
45					45										
46															
48	-35	10 12 13 16	100		48						SAME, gray, dense below 48 ft			28.2	
50					50										
52	-40														
53		13 15 16 22	100		53									30.3	
54															
55					55										
56	-45														
58		10 11 16 18	100		58									32.1	
60					60						Bottom of Boring at 60 ft.				

REMARKS: Rig Type: CME-55 (Track).

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SPT_LOGB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-009A
PAGE 1 OF 1

STATION: 314+38 OFFSET: 65 ft RT
LATITUDE: 36.820962° N LONGITUDE: 76.337706° W
SURFACE ELEVATION: 11.2 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/20/2010 - 07/20/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: K. Megginson

GROUND WATER

▼ STABILIZED AT 4.8 ft AFTER 48 HOURS

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
0	11.2										0.0 / 11.2 Rotary probe to 14 ft; see Boring 10BH-009 for strata descriptions.				
16	-5	3 6 7 6	55		15 17						15.0 / -3.8 Gray, fine to medium poorly graded SAND with silt, medium dense, wet [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP-SM**			24.4	
18		3 1 1 0	65		19						17.5 / -6.3 Brown and dark brown, fine to medium clayey SAND, contains organic matter and mica, very loose, wet [D1] [SEDGEFIELD MEMBER (TABB FORMATION)] **SC**			24.2	
20			35		21						19.6 / -8.4 Dark brown, PEAT, wet [D3] **PT**				
22	-10	2 1 1 2	5		23						22.0 / -10.8 Light gray, fine to coarse silty clayey SAND, contains wood fragments and mica, loose, wet [D1] **SC-SM**			27.9	
24		WOH WOH 4 1	100		25							26	7	24.0	37.2
26	-15		40		27						Bottom of Boring at 27 ft.				

REMARKS: Rig Type: CME-55 (Track).

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10BH-009A

SPT_LOGB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-017
PAGE 1 OF 2

STATION: 321+31 OFFSET: 14 ft LT
LATITUDE: 36.821269° N LONGITUDE: 76.335213° W
SURFACE ELEVATION: 13.3 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/11/2010 - 08/11/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT #200 (%)
	0	13.3	7 10 12 13	90		2						0.0 / 13.3 5-inches ROOTMAT AND TOPSOIL **TOPS**			6.9	
	2	11.3	6 6 7 7	95		4						0.4 / 12.9 Dark brown gray, fine to medium silty sand FILL, medium dense, moist [A1] **FL**			14.1	
	4	9.3	6 5 9 9	95		6						2.0 / 11.3 Brown gray, fine to medium clayey sand FILL, medium dense, moist [A1] **FL**			14.9	
	6 ▽	7.3	5 5 3 3	85		8						4.0 / 9.3 Brown, fine to medium poorly graded SAND, trace silt, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP**			22.7	
	8	5.3	4 3 4 8	90		10						6.0 / 7.3 Brown, fine to medium poorly graded SAND with silt, medium dense, wet [C1] **SP-SM**			21.5	
	10											SAME, brown, loose below 8 ft				
	12											SAME, gray, contains shell fragments below 9 ft				
	14	0.3	3 2 2 3	45		13 15									30.9	
	16															
	18	-4.7	4 5 6 8	55		18 20						SAME, medium dense below 18 ft			15.0	
	20															
	22											21.5 / -8.2 Gray, fat CLAY, trace sand, contains organic matter and mica, very soft, moist [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CH**				
0.75	24	-10.3	WOH WOH 1 1	100		23 25									67.7	
	26															
	28	-15.3	1 1 1 1	100		28 30						SAME, soft below 28 ft				
1	30												82	52	62.3	88.2
	32															
1.25	34	-20.3	WOH 1 1 1	100		33									58.4	

REMARKS: Rig Type: CME-550X (ATV).

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10BH-017

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 2 OF 2

STATION: 321+31 OFFSET: 14 ft LT
LATITUDE: 36.821269° N LONGITUDE: 76.335213° W
SURFACE ELEVATION: 13.3 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/11/2010 - 08/11/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND / SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
0.75	36				35										
	38	-25	WOH 1 1 2	100	38						36.5 / -23.2 Gray, fat CLAY with sand, contains organic matter, soft, moist [D2] **CH**	66	37	49.3	81.5
	40				40										
	42	-30	4 7 7 6	85	43						41.5 / -28.2 Gray, fine to medium poorly graded SAND, trace silt, medium dense, moist [D1] **SP**			28.2	
	44				45										
	46														
	48	-35	5 5 6 9	100	48						46.5 / -33.2 Green gray, fine to coarse silty SAND, contains shell fragments, medium dense, moist [E1] [YORKTOWN FORMATION] **SM**			34.5	15.2
	50				50										
	52														
	54	-40	6 10 15 15	100	53 55						SAME, dense below 53 ft			32.9	
	56														
	58	-45	6 9 8 9	100	58						SAME, medium dense below 58 ft			36.8	
	60				60						Bottom of Boring at 60 ft.				

REMARKS: Rig Type: CME-550X (ATV).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-020
PAGE 1 OF 3

STATION: 327+18 OFFSET: 16 ft LT
LATITUDE: 36.821438° N LONGITUDE: 76.333441° W
SURFACE ELEVATION: 11.2 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/20/2010 - 07/20/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: K. Megginson

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 4.7 ft AFTER 55 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	0	10	6 11 11 10	100		2						0.0 / 11.2 6-inches ROOTMAT AND TOPSOIL **TOPS**			11.1
	2		5 4 6 5	60		4						0.5 / 10.7 Dark brown and dark gray, fine to medium silty sand FILL, contains root fragments and organic matter, medium dense, moist [A1] [FILL] **FL**			14.7
	4		2 4 2 3	65		6						2.0 / 9.2 Light brown, fine to medium poorly graded sand FILL, trace silt, medium dense, moist [A1] **FL**			23.7
	6	5	4 4 7 7	60		8						4.0 / 7.2 Light gray brown, fine to medium clayey SAND, contains root fragments, loose, wet [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SC**			23.7
	8		4 4 6 7	65		10									24.9
	10											5.0 / 6.2 Gray, fine to medium poorly graded SAND with silt, contains mica, loose, wet [C1] **SP-SM** SAME, medium dense below 6 ft			
	12	0				13									
	14		2 1 6 9	75		15						SAME, gray, loose below 13 ft			25.8
	16	-5													
	18		6 7 9 7	40		18						SAME, medium dense below 18 ft			28.8
	20					20									
	22	-10										22.0 / -10.8 Brown and gray, elastic SILT, trace sand, contains organic matter and mica, soft, moist [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **MH**			
0.25	24		WOH 1 1 1	100		23									50.4
	26	-15				25									
0.25	28		WOH 1 1 1	100		28									53.3
	30					30									
	32	-20										32.0 / -20.8 Brown and dark gray brown, sandy elastic SILT, trace gravel, contains mica, soft, moist [D2] **MH** SAME, dark yellow gray and gray brown, soft below 34 ft			
0.25	34		1 1 1 1	100		33									47.5

REMARKS: Rig Type: CME-55 (Track).

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10BH-020

SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-020
PAGE 2 OF 3

STATION: 327+18 OFFSET: 16 ft LT
LATITUDE: 36.821438° N LONGITUDE: 76.333441° W
SURFACE ELEVATION: 11.2 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/20/2010 - 07/20/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: K. Megginson

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 4.7 ft AFTER 55 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)
	36	-25				35									
	38		1 0 1 1	100		38						37.0 / -25.8 Brown and gray brown, fine to medium silty SAND, contains mica, wood fragments, and organic matter, very loose, wet [D1] **SM**			60.0
	40					40									
	42	-30	1 2 1 2	100		43						SAME, loose below 43 ft			52.7
	44					45									
	46	-35													
	48		1 1 4 4	100		48						SAME, gray brown below 48 ft			56.9
	50					50									
	52	-40										52.0 / -40.8 Brown and gray brown, fine to medium poorly graded SAND with silt, contains heavy concentrations of organic matter and wood fragments, medium dense, wet [D1] **SP-SM**			72.8
	54		5 4 6 13	100		53									
	56	-45				55									
	58		13 16 19 18	65		58						57.0 / -45.8 Gray, fine to coarse poorly graded SAND, trace silt, dense, wet [D1] **SP**			17.9
	60					60									
	62	-50										62.0 / -50.8 Light gray, fine to coarse silty SAND, contains heavy concentrations of shell fragments, medium dense, wet [E1] [YORKTOWN FORMATION] **SM**			42.7
	64		4 4 8 14	100		63									
	66	-55				65									
	68		3 5 6 17	100		68									33.7
	70														

REMARKS: Rig Type: CME-55 (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 3 OF 3

STATION: 327+18 OFFSET: 16 ft LT
LATITUDE: 36.821438° N LONGITUDE: 76.333441° W
SURFACE ELEVATION: 11.2 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/20/2010 - 07/20/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: K. Megginson

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH
▼ STABILIZED AT 4.7 ft AFTER 55 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	70														
	72	-60	2 4 7 15	100		73									37.0
	74					75									
	76	-65													
	78		3 5 7 16	100		78						SAME, gray, contains shell fragments below 78 ft			34.5
	80					80									
	82	-70													
	84		3 3 6 15	100		83						SAME, green gray and gray below 83 ft			28.8
	86	-75				85									
	88		4 3 7 8	100		88						SAME, contains cemented sand layers below 88 ft			31.0
	90					90									
	92	-80													
	94		3 3 4 9	100		93						SAME, loose below 93 ft			32.4
	96	-85				95									
	98		3 2 3 6	100		98									30.4
	100					100						Bottom of Boring at 100 ft.			

REMARKS: Rig Type: CME-55 (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 1 OF 1

STATION: 327+20 OFFSET: 16 ft LT
LATITUDE: 36.821439° N LONGITUDE: 76.333436° W
SURFACE ELEVATION: 11.2 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/21/2010 - 07/21/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
STABILIZED AT 4.7 ft AFTER 55 HOURS

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT -#200 (%)
												0.0 / 11.2 Rotary probe to 24 ft; See Boring 10BH-20 for strata descriptions.				
0.75	24			95		24						24.0 / -12.8 Brown and gray, elastic SILT, trace sand, contains organic matter and mica, moist [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **MH**	64	25	51.3	95.0
0.75	28			95		28							55	25	53.8	86.1
	30					30						Bottom of Boring at 30 ft.				

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 331+36 OFFSET: 19 ft RT
LATITUDE: 36.821972° N LONGITUDE: 76.332173° W
SURFACE ELEVATION: 11.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/20/2010 - 07/20/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 2.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
		10	3 8 8 6	50		2						0.0 / 11.4 7-inches ROOTMAT AND TOPSOIL **TOPS**			12.3	
	2 ▽		4 5 7 6	90		4						0.6 / 10.8 Dark gray, fine to medium silty sand FILL, contains brick and root fragments, medium dense, moist [A1] [FILL] **FL**			19.4	
	4		2 2 3 6	100		6						2.0 / 9.4 Light brown, fine to medium poorly graded SAND, trace silt, medium dense, wet [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP**			22.6	
	6	5	5 5 7 8	100		8									20.7	
	8		4 5 8 11	100		10						4.0 / 7.4 Brown, fine to medium poorly graded SAND with silt, loose, wet [C1] **SP-SM** SAME, gray below 5 ft SAME, medium dense below 6 ft			22.1	
	10															
	12	0				13										
	14		2 3 2 3	100		15						SAME, loose below 13 ft			33.2	
	16	-5														
	18		3 3 5 8	100		18						SAME, fine to coarse, medium dense below 18 ft			18.9	
	20					20										
	22	-10														
0.25	24		WOH WOH WOH WOH	100		23 25						21.5 / -10.1 Brown and gray, elastic SILT, trace sand, contains organic matter and mica, very soft, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **MH**			48.4	
	26	-15														
0.25	28		1 1 1 2	100		28 30									50.3	
	30															
	32	-20										31.5 / -20.1 Brown and gray fat CLAY, trace sand, contains organic matter and mica, very soft, wet [D2] **CH**				
0.5	34		1 0 1 1	100		33							74	43	51.0	90.8

REMARKS: Rig Type: CME-550X (ATV).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 331+36 OFFSET: 19 ft RT
LATITUDE: 36.821972° N LONGITUDE: 76.332173° W
SURFACE ELEVATION: 11.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/20/2010 - 07/20/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 2.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
	35															
	36	-25	WOH 1 1 2	100		38						36.5 / -25.1 Brown gray, fine to medium silty SAND, contains mica, very loose, wet [D1] **SM**			32.9	
	40					40										
	42	-30	4 5 3 2	100		43						41.5 / -30.1 Gray, fine to medium poorly graded SAND with silt, contains organic matter, medium dense, wet [D1] **SP-SM**			61.6	
	44					45						43.5 / -32.1 Gray, lean CLAY with sand, contains organic matter and mica, stiff, wet [D2] **CL**				
	46	-35														
	48		2 4 4 5	100		48						47.0 / -35.6 Gray, fine to medium clayey SAND, contains organic matter and mica, medium dense, wet [D1] **SC**			52.7	
	50					50										
	52	-40														
	54		3 3 6 12	100		53 55						52.0 / -40.6 Gray, fine to medium poorly graded SAND with silt, contains organic matter, medium dense, wet [D1] **SP-SM**			22.2	
	56	-45														
	58		9 9 11 20	100		58						57.0 / -45.6 Light gray, fine to medium poorly graded SAND, trace silt, medium dense, wet [D1] **SP**			20.6	
	60					60										
	62	-50										SAME, trace gravel below 62 ft				
	64		10 8 5 3	100		63 65						63.5 / -52.1 Green gray, fine to coarse clayey SAND, contains shell fragments, medium dense, wet [E1] [YORKTOWN FORMATION] **SC**			36.2	
	66	-55														
	68		2 2 2 4	100		68						SAME, loose below 68 ft	42	20	34.4	34.9
	70															

REMARKS: Rig Type: CME-550X (ATV).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 331+36 OFFSET: 19 ft RT
LATITUDE: 36.821972° N LONGITUDE: 76.332173° W
SURFACE ELEVATION: 11.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/20/2010 - 07/20/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 2.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	70															
	72	-60														
	73		2 3 4 10	100											33.4	
	74															
	75															
	76	-65														
	78		2 3 4 7	100											32.7	
	80															
	82	-70														
	83		2 3 4 9	100											29.7	
	84															
	85															
	86	-75														
	88		2 3 3 7	100											32.4	
	90															
	92	-80														
1	93		2 2 3 5	100								92.0 / -80.6 Green gray, sandy fat CLAY, contains shell fragments, firm, wet [E2] **CH**	52	27	34.6	57.1
	94															
	95															
	96	-85														
	98		3 2 3 5	100								97.0 / -85.6 Green gray, clayey SAND, contains shell fragments, loose, wet [E1] **SC**			31.4	
	100											Bottom of Boring at 100 ft.				

REMARKS: Rig Type: CME-550X (ATV).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 1 OF 1

STATION: 331+36 OFFSET: 21 ft RT
LATITUDE: 36.821965° N LONGITUDE: 76.332171° W
SURFACE ELEVATION: 11.3 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/20/2010 - 07/20/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▼ STABILIZED AT 4.0 ft AFTER 48 HOURS

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT #200 (%)
	0	10										0.0 / 11.3 Rotary probe to 28 ft; see Boring 10BH-023 for strata descriptions.				
	2															
	4 ▼															
	6	5														
	8															
	10															
	12	0														
	14															
	16	-5														
	18															
	20															
	22	-10														
0.5	24			95		23						23.0 / -11.7 Brown and gray, elastic SILT, trace sand, contains organic matter and mica, moist [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **MH**	56	25	49.4	90.4
	26	-15				25										
	28					28										
0.75	30			100		30							62	28	50.4	96.4
												Bottom of Boring at 30 ft.				

REMARKS: Rig Type: CME-550X (ATV).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-026
PAGE 1 OF 3

STATION: 337+10 OFFSET: 24 ft RT
LATITUDE: 36.822885° N LONGITUDE: 76.330565° W
SURFACE ELEVATION: 13.1 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/21/2010 - 07/21/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 5.4 ft AFTER 20 HOURS

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT #200 (%)
	0	13	8 15 17 12	100		2						0.0 / 13.1 5-inches ROOTMAT AND TOPSOIL **TOPS**			5.0	
	2	10	3 4 4 4	100		4						0.4 / 12.7 Orange brown, fine to medium poorly graded sand with silt FILL, dense, moist [A1] [FILL] **FL**			17.7	
	4 ▽		4 5 5 4	100		6						2.0 / 11.1 Gray, fine to medium silty SAND, contains root fragments, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SM**			22.2	
	6 ▼		4 2 3 4	100		8									20.3	
	8	5	3 2 1 5	100		10						4.0 / 9.1 Light brown, fine to medium poorly graded SAND, trace silt, medium dense, wet [C1] **SP**			25.9	
	10											7.7 / 5.4 Gray, fine to medium poorly graded SAND with silt, loose, wet [C1] **SP-SM**				
	12															
	14	0	2 2 2 3	100		13 15									28.4	
	16															
	18	-5	3 3 4 3	100		18 20						SAME, fine to coarse below 18 ft			18.4	
	20															
	22											21.5 / -8.4 Gray, fat CLAY, trace sand, contains organic matter and mica, very soft, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CH**				
0.25	24	-10	WOH WOH 1 1	100		23 25									65.4	
	26															
	28	-15	1 1 1 1	100		28 30						26.5 / -13.4 Gray, sandy SILT, contains organic matter and mica, soft, wet [D2] **ML**				
0.5	30												36	9	38.9	55.4
	32															
	34	-20	3 6 7 4	100		33						31.5 / -18.4 Gray, fine to medium silty SAND, contains organic matter and mica, medium dense, wet [D1] **SM**			31.2	

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-026

STATION: 337+10 OFFSET: 24 ft RT
LATITUDE: 36.822885° N LONGITUDE: 76.330565° W
SURFACE ELEVATION: 13.1 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/21/2010 - 07/21/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 5.4 ft AFTER 20 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	36					35										
	38	-25	WOH 1 1 1	100		38						36.5 / -23.4 Brown, fat CLAY, trace sand, contains organic matter, soft, moist [D2] **CH**				
0.5	40					40									63.6	
	42															
	44	-30	3 6 10 6	100		43 45						41.54 / -28.44 Gray, fine to medium poorly graded SAND, trace silt, contains organic matter and mica, medium dense, wet [D1] **SP**			26.1	
	46															
	48	-35	1 1 1 2	100		48						46.5 / -33.4 Brown gray, lean CLAY with sand, contains organic matter and mica, soft, wet [D2] **CL**				
0.5	50					50									59.7	
	52															
	54	-40	1 1 2 2	100		53 55						51.5 / -38.4 Brown and gray, fat CLAY, trace sand, contains mica, soft, moist [D2] **CH**	64	34		
0.75	56														46.0	96.6
	58	-45	1 1 2 3	100		58									57.7	
0.75	60					60										
	62															
	64	-50	1 1 2 3	100		63 65						SAME, gray below 63 ft			32.2	
0.5	66															
	68	-55	4 1 4 16	100		68 69						66.5 / -53.4 Gray, fine to medium silty SAND, loose, wet [D1] **SM**			27.1	
0.5	70											69.0 / -55.9				

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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STATION: 337+10 OFFSET: 24 ft RT
LATITUDE: 36.822885° N LONGITUDE: 76.330565° W
SURFACE ELEVATION: 13.1 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/21/2010 - 07/21/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
- FIRST ENCOUNTERED AT 4.0 ft DEPTH
- STABILIZED AT 5.4 ft AFTER 20 HOURS

FIELD DATA													LAB DATA			
PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
						70						Gray, fat CLAY, trace sand, contains silty sand pockets, firm, wet [D2] **CH**				
	72											69.5 / -56.4 Gray, fine to medium poorly graded SAND with silt, loose, wet [D1] **SP-SM**				
		-60	3			73										
			3													
	74		4	100											34.9	
			8			75						71.5 / -58.4 Green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SC**				
												Bottom of Boring at 75 ft.				

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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STATION: 339+40 OFFSET: 33 ft RT
LATITUDE: 36.823273° N LONGITUDE: 76.329913° W
SURFACE ELEVATION: 12.9 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/20/2010 - 07/20/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 5.1 ft AFTER 54 HOURS

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
			7 12 12 13	100		2						0.0 / 12.9 5-inches ROOTMAT AND TOPSOIL **TOPS**			7.3	
4.5	2	10	9 6 5 5	100		4						0.4 / 12.5 Orange brown, fine to medium poorly graded sand with silt FILL, contains crushed stone, dense, moist [A1] [FILL] **FL**			20.6	
	4 ▽ ▼		4 7 7 5	100		6						2.0 / 10.9 Gray, sandy fat CLAY, contains root fragments, stiff, moist [C2] [LYNNHAVEN MEMBER (TABB FORMATION)] **CH**			21.3	
	6		3 3 4 3	100		8									22.8	
	8	5	2 2 2 2	100		10						4.0 / 8.9 Light gray, fine to medium poorly graded SAND, trace silt, medium dense, wet [C1] **SP** SAME, loose below 6 ft			24.2	
	10											9.0 / 3.9 Gray, fine to medium poorly graded SAND with silt, loose, wet [C1] **SP-SM**				
	12															
		0	3 2 3 2	100		13									30.6	
	14					15										
	16															
	18	-5	2 1 1 1	100		18						16.5 / -3.6 Gray, fine to coarse silty SAND, contains lean clay lenses, very loose, wet [C1] **SM**			26.3	
	20					20										
	22															
		-10	2 1 3 2	100		23						21.5 / -8.6 Gray, sandy lean CLAY, contains organic matter, firm, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CL**				
0.25	24					25							37	18	30.7	57.1
	26															
	28	-15	2 3 2 1	100		28						26.5 / -13.6 Gray, fine to coarse poorly graded SAND with silt, contains lean clay layers, loose, wet [D1] **SP-SM**			22.8	
	30					30										
	32															
		-20	WOH WOH 1 12	100		33						31.5 / -18.6 Gray, sandy lean CLAY, contains organic matter, very soft, wet [D2] **CL**				
0.25	34														26.4	

REMARKS: Rig Type: CME-550X (ATV).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-030
PAGE 2 OF 3

STATION: 339+40 OFFSET: 33 ft RT
LATITUDE: 36.823273° N LONGITUDE: 76.329913° W
SURFACE ELEVATION: 12.9 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/20/2010 - 07/20/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 5.1 ft AFTER 54 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	35											34.5 / -21.6 Gray, fine to medium silty SAND, contains mica, very loose, wet [D1] **SM**				
	36											36.5 / -23.6 Gray, fat CLAY with sand, contains organic matter and mica, very soft, moist [D2] **CH**				
0.25	38	-25	WOH WOH 1 0	100		38									60.4	
	40					40										
	42															
	43	-30	3 2 3 3	100		43						SAME, contains silty sand layers below 43 ft				
0.25	44					45									50.2	
	46															
	48	-35	4 3 7 7	100		48						46.5 / -33.6 Gray, fine to medium poorly graded SAND, trace silt, contains organic matter, medium dense, wet [D1] **SP**			25.6	
	50					50										
	52															
	53	-40	2 1 2 3	100		53						51.5 / -38.6 Gray, fine to medium clayey SAND, contains organic matter and mica, loose, wet [D1] **SC**			46.7	
	54					55										
	56															
	58	-45	WOH WOH 1 1	100		58									52.4	
	60					60										
	62															
	63	-50	8 14 21 18	100		63						61.5 / -48.6 Brown gray, fine to medium poorly graded SAND, trace silt, contains organic matter, dense, wet [D1] **SP**			21.1	
	65					65										
	66															
	68	-55	10 12 17 15	65		68									15.1	
	70															

REMARKS: Rig Type: CME-550X (ATV).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-030
PAGE 3 OF 3

STATION: 339+40 OFFSET: 33 ft RT
LATITUDE: 36.823273° N LONGITUDE: 76.329913° W
SURFACE ELEVATION: 12.9 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/20/2010 - 07/20/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
- FIRST ENCOUNTERED AT 4.0 ft DEPTH
- STABILIZED AT 5.1 ft AFTER 54 HOURS

FIELD DATA													LAB DATA			
PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
						70										
	72											71.5 / -58.6 Brown gray, fine to coarse poorly graded SAND with silt, medium dense, wet [D1] **SP-SM**				
		-60	7 7 5 4	100		73										
	74					75						74.0 / -61.1 Green gray, fine to coarse clayey SAND, contains shell fragments, medium dense, wet [E1] [YORKTOWN FORMATION] **SC**			34.7	
												Bottom of Boring at 75 ft.				

REMARKS: Rig Type: CME-550X (ATV).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-030A

STATION: 339+46 OFFSET: 33 ft RT
LATITUDE: 36.823262° N LONGITUDE: 76.329927° W
SURFACE ELEVATION: 12.9 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/21/2010 - 07/21/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▼ STABILIZED AT 5.1 ft AFTER 54 HOURS

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT #200 (%)
	0	12.9										0.0 / 12.9 Rotary probe to 28 ft; see Boring 10BH-030 for strata descriptions.				
	2	10														
	4															
	6															
	8	5														
	10															
	12															
	14	0														
	16															
	18	-5														
	20															
	22															
	24	-10														
	26															
	28	-15	2	100		28						28.0 / -15.1 Gray, fine to medium poorly graded SAND with silt, loose, wet [D1] [SEDGEFIELD MEMBER (TABB FORMATION)] **SP-SM**			34.2	
	30		3 3 2			30						29.7 / -16.8 Gray, sandy lean CLAY, firm, wet [D2] **CL**				
0.5	32	-20		100		32						32.0 / -19.1 Rotary probe to 38 ft; see Boring 10BH-030 for strata descriptions.				
	34															

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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STATION: 339+46 OFFSET: 33 ft RT
LATITUDE: 36.823262° N LONGITUDE: 76.329927° W
SURFACE ELEVATION: 12.9 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/21/2010 - 07/21/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER

STABILIZED AT 5.1 ft AFTER 54 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
	36															
	38	-25				38						38.0 / -25.1				
0.75				95								Brown and gray, fat CLAY with sand, contains silty sand pockets, contains organic matter and mica, wet [D2] **CH**	68	36	53.5	84.6
	40					40						Bottom of Boring at 40 ft.				

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: RETAINING WALL

10BH-033
PAGE 1 OF 3

STATION: 1420+00 OFFSET: 133 ft LT
LATITUDE: 36.823892° N LONGITUDE: 76.330443° W
SURFACE ELEVATION: 13.7 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/22/2010 - 07/22/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 2.0 ft DEPTH
STABILIZED AT 5.7 ft AFTER 2 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
						0.5						0.0 / 13.7 2-inches ASPHALT **ASPH**			
	2		5 6 3	100		2						0.2 / 13.5 Dark gray, fine to coarse silty sand FILL, contains concrete fragments and crushed stone, medium dense, moist [A1] [FILL] **FL**			25.3
0.25	4	10	2 2 1 1	100		4									19.6
	6		2 3 10 12	100		6						2.0 / 11.7 Gray, sandy lean CLAY, contains root fragments, soft, wet [C2] [LYNNHAVEN MEMBER (TABB FORMATION)] **CL**			23.3
	8	5	5 4 9 8 4 4 3 4	100		8						4.0 / 9.7 Brown, fine to medium poorly graded SAND, trace silt, medium dense, wet [C1] **SP** SAME, light brown below 6 ft			20.8 25.9
	10					10						7.0 / 6.7 Orange brown, fine to medium poorly graded SAND with silt, medium dense, wet [C1] **SP-SM** SAME, gray, loose below 8 ft			
	12					13									
	14	0	2 3 3 3	100		15									29.5
	16														
	18		1 1 0 1			18						16.5 / -2.8 Brown, fat CLAY, trace sand, contains organic matter and silty sand pockets, very soft, moist, [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CH**			
0.25	20	-5		100		20									66.6
	22														
	23		WOH 1 1 1			23									
0.25	24	-10		100		25									56.4
	26														
	28		1 1 2 2			28						26.5 / -12.8 Dark gray, fine to medium silty SAND, contains mica, loose, wet [D1] **SM**			
	30	-15		100		30									66.5
	32														
	33		1 1 1 1			33						31.5 / -17.8 Brown, fat CLAY, trace sand, contains mica and organic matter, soft, moist [D2] **CH**			
0.25	34	-20		100											65.5

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: RETAINING WALL

10BH-033
PAGE 2 OF 3

STATION: 1420+00 OFFSET: 133 ft LT
LATITUDE: 36.823892° N LONGITUDE: 76.330443° W
SURFACE ELEVATION: 13.7 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/22/2010 - 07/22/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 2.0 ft DEPTH
STABILIZED AT 5.7 ft AFTER 2 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)
	35														
	36											36.5 / -22.8 Brown, fine to coarse poorly graded SAND, trace silt, medium dense, wet [D1] **SP**			22.8
	38	-25	2 5 6 7	100		38									
	40					40									
	42											41.5 / -27.8 Gray, fine to coarse clayey SAND, trace gravel, contains organic matter and mica, loose, wet [D1] **SC**			32.6
	43	-30	3 2 3 3	100		43									
	45					45									
	46											46.5 / -32.8 Light green gray, fine to coarse silty SAND, contains heavy concentrations of shell fragments and coquina, medium dense, wet [E1] [YORKTOWN FORMATION] **SM**			28.7
	48	-35	10 10 10 10	100		48									
	50					50									
	52											SAME, green gray, contains shell fragments, dense below 53 ft			32.7
	53	-40	11 13 14 13	100		53									
	55					55									
	56														
	58	-45	6 10 15 12	100		58									34.1
	60					60									
	62											61.5 / -47.8 Green gray, fine to coarse clayey SAND, contains shell fragments, medium dense, wet [E1] **SC**			
	63	-50	3 4 7 8	100		63									30.5
	65					65									
	66														
	68	-55	2 3 5 9	100		68						SAME, fine to medium below 68 ft			31.8
	70														

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: RETAINING WALL

10BH-033
PAGE 3 OF 3

STATION: 1420+00 OFFSET: 133 ft LT
LATITUDE: 36.823892° N LONGITUDE: 76.330443° W
SURFACE ELEVATION: 13.7 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/22/2010 - 07/22/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
- FIRST ENCOUNTERED AT 2.0 ft DEPTH
- STABILIZED AT 5.7 ft AFTER 2 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)
	70														
	72											71.5 / -57.8 Green gray, fine to coarse silty SAND, contains shell fragments, medium dense, wet [E1] **SM**			
	74	-60	2 4 7 13	100		73 75									33.4
												Bottom of Boring at 75 ft.			

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: RETAINING WALL

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PAGE 1 OF 2

STATION: 1421+00 OFFSET: 77 ft LT
LATITUDE: 36.823925° N LONGITUDE: 76.330070° W
SURFACE ELEVATION: 13.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/21/2010 - 07/22/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 4.8 ft AFTER 18 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
												0.0 / 13.4 12-inches CRUSHED STONE **CRA**			10.8
	2	10	4 4 4 4	100		2						1.0 / 12.4 Brown gray, fine to medium poorly graded sand with silt FILL, trace gravel, contains lean clay lenses, medium dense, moist [A1] [FILL] **FL**			14.5
	4		4 2 3 2	100		4						1.3 / 12.1 Gray, fine to medium poorly graded SAND with silt, contains lean clay lenses and root fragments, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP-SM**			18.7
	6		3 2 4 7	100		6						SAME, brown, loose, wet below 4 ft			17.0
	8	5	5 6 4 5	100		8						SAME, gray, contains organic matter below 6 ft SAME, medium dense below 8 ft			22.5
	10					10									
	12														
	14	0	5 7 10 8	100		13 15									29.2
	16														
	18	-5	4 4 3 2	100		18						SAME, loose below 18 ft			32.2
	20					20									
	22											21.5 / -8.1 Gray, fat CLAY, trace sand, soft, moist [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CH**			
0.5	24	-10	1 1 2 3	100		23 25									71.3
	26														
	28	-15	12 14 15 16	100		28 30						26.5 / -13.1 Gray, fine to medium silty SAND, contains mica and organic matter, dense, wet [D1] **SM**			25.4
	30														
	32											31.5 / -18.1 Gray, fine to coarse poorly graded SAND, trace silt and gravel, dense, wet [D1] **SP**			
	34	-20	13 17 20 19	100		33									16.0

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: RETAINING WALL

10BH-034
PAGE 2 OF 2

STATION: 1421+00 OFFSET: 77 ft LT
LATITUDE: 36.823925° N LONGITUDE: 76.330070° W
SURFACE ELEVATION: 13.4 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/21/2010 - 07/22/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
- FIRST ENCOUNTERED AT 4.0 ft DEPTH
- STABILIZED AT 4.8 ft AFTER 18 HOURS

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)
	36					35									
	38	-25	4 3 2 3	100		38						36.5 / -23.1 Gray, fine to medium silty SAND, contains fat clay layers, organic matter and mica, loose, wet [D1] **SM**			36.7
	40					40									
	42					43						41.5 / -28.1 Brown gray, lean CLAY with sand, contains organic matter and mica, stiff, wet [D2] **CL**			
0.5	44	-30	3 6 3 5	100		45									41.0
	46														
	48	-35	10 17 14 22	100		48						46.5 / -33.1 Gray, fine to medium silty SAND, contains organic matter, dense, wet [D1] **SM**			28.1
	50					50						Bottom of Boring at 50 ft.			

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: RETAINING WALL

10BH-034A

STATION: 1421+06 OFFSET: 78 ft LT
LATITUDE: 36.823934° N LONGITUDE: 76.330060° W
SURFACE ELEVATION: 13.4 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/22/2010 - 07/22/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER

FIELD DATA														LAB DATA			
			SOIL				ROCK										
PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	STANDARD PENETRATION TEST HAMMER BLOWS	SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	CORE RECOVERY (%)	ROCK QUALITY DESIGNATION	DIP ° STRATA	DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	0	10										0.0 / 13.4 Rotary probe to 20 ft; see Boring 10BH-034 for strata descriptions.				
	2															
	4															
	6															
	8	5														
	10															
	12															
	14	0														
	16															
	18	-5														
0.5	20		WOH 1 1 1	100		20						20.0 / -6.6 Gray, fat CLAY, trace sand, soft, moist [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CH**			78.8	
0.75	22			100		22							100	66	73.4	96.6
	24	-10				24						24.0 / -10.6 Rotary probe to 40 ft; see Boring 10BH-034 for strata descriptions.				
	26															
	28	-15														
	30															
	32															
	34	-20														

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: RETAINING WALL

10BH-034A
PAGE 2 OF 3

STATION: 1421+06 OFFSET: 78 ft LT
LATITUDE: 36.823934° N LONGITUDE: 76.330060° W
SURFACE ELEVATION: 13.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/22/2010 - 07/22/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	36															
	38	-25														
	40		1 1 6 6	100		40 42						40.0 / -26.6 Gray, fine to medium silty SAND, contains organic matter and lean clay pockets, loose, wet [D1] **SM**			38.6	
	42															
0.75	44	-30		100		43 45						42.5 / -29.1 Gray, lean CLAY with sand, contains organic matter and mica, wet [D2] **CL**				
	46											44.5 / -31.1 Gray, fine to medium silty SAND, wet [D1] **SM**				
	48	-35										45.0 / -31.6 Rotary probe to 53 ft; see Boring 10BH-034 for strata descriptions.				
	50															
	52															
	54	-40	2 3 4 4	100		53 55						53.0 / -39.6 Gray, fine to medium clayey SAND, contains organic matter and mica, loose, wet [D1] **SC**			43.4	
	56															
0.75	58	-45	3 2 2 2	100		58 60						56.5 / -43.1 Brown, elastic SILT, trace sand, firm, moist [D2] **MH**			54.4	
	60															
	62											61.5 / -48.1 Brown, fine to medium poorly graded SAND, trace silt, medium dense, wet [D1] **SP**				
	64	-50	3 6 15 23	100		63 65									20.1	
	66															
	68	-55	3 4 4 6	90		68						SAME, gray brown, contains organic matter below 68 ft			82.1	
	70															

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: RETAINING WALL

10BH-034A
PAGE 3 OF 3

STATION: 1421+06 OFFSET: 78 ft LT
LATITUDE: 36.823934° N LONGITUDE: 76.330060° W
SURFACE ELEVATION: 13.4 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/22/2010 - 07/22/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT #200 (%)
	70					70										
	72															
	73	-60	6 9 6 6	100		73						SAME, gray, trace gravel below 73 ft			35.5	
	74															
	75					75						74.8 / -61.4 Green gray, fine to coarse clayey SAND, contains shell fragments, medium dense, wet [E1] [YORKTOWN FORMATION] **SC**				
	76															
	78	-65	2 2 5 11	100		78									36.1	
	80					80										
	82															
	83	-70	2 4 6 15	100		83									31.9	
	84															
	85					85										
	86															
	88	-75	2 3 4 11	100		88									32.3	
	90					90										
	92															
	93	-80	3 3 4 8	100		93									31.9	
	94															
	95					95										
	96															
	98	-85	3 3 4 6	100		98						97.0 / -83.6 Green gray, sandy lean CLAY, contains shell fragments, stiff, wet [E2] **CL**			34.4	
1.25	100					100						Bottom of Boring at 100 ft.				

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-037
PAGE 1 OF 3

STATION: 341+71 OFFSET: 3 ft RT
LATITUDE: 36.823722° N LONGITUDE: 76.329378° W
SURFACE ELEVATION: 13.0 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/26/2010 - 07/26/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH
▼ STABILIZED AT 7.7 ft AFTER 3 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	0	13	5 5 4 3	100		2						0.0 / 13.0 2-inches ROOTMAT AND TOPSOIL **TOPS**			21.6	
	2	10	2 2 3 4	100		4						0.2 / 12.8 Dark brown, fine to medium silty sand FILL, contains organic matter, medium dense, moist [A1] [FILL] **FL**			16.6	
	4 ▽		4 4 4 2	100		6						2.0 / 11.0 Brown, fine to medium poorly graded SAND with silt, loose, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP-SM**			20.5	
	6		3 2 2 3	100		8						SAME, light brown, medium dense, wet below 4 ft			25.9	
	8 ▼	5	1 2 2 2	85		10						SAME, gray, loose below 6 ft			24.8	7.5
	10															
	12															
	14	0	3 3 4 3	90		15									24.4	
	16															
	18	-5	1 2 3 4	90		20						SAME, fine to coarse below 18 ft			25.1	
	22															
	24	-10	WOH 1 2 1	100		25						SAME, contains mica below 23 ft			31.1	
	26															
	28	-15	3 8 11 13	85		30						26.5 / -13.5 Fine to coarse poorly graded SAND with silt, contains mica and organic matter, medium dense, wet [D1] [SEDGEFIELD MEMBER (TABB FORMATION)] **SP-SM**			27.4	
	32															
	34	-20	5 5 5 9	100		33									26.4	

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

STATION: 341+71 OFFSET: 3 ft RT
LATITUDE: 36.823722° N LONGITUDE: 76.329378° W
SURFACE ELEVATION: 13.0 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/26/2010 - 07/26/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 7.7 ft AFTER 3 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
	35															
	36															
	38	-25	6 9 8 10	100		38									23.7	
	40					40										
	42											41.5 / -28.5 Gray, fine to medium poorly graded SAND, trace silt, medium dense, wet [D1] **SP**				
	43	-30	10 11 11 13	100		43									25.4	
	45					45										
	46															
	48	-35	13 11 14 21	90		48						SAME, dense below 48.5 ft			15.9	
	50					50										
	52															
	53	-40	12 15 15 12	100		53									16.8	
	55					55										
	56															
	58	-45	7 6 7 9	100		58						SAME, contains organic matter and mica, medium dense below 58 ft			29.7	
	60					60										
	62											61.5 / -48.5 Gray, fine to medium poorly graded SAND with silt and gravel, medium dense, wet [D1] **SP-SM**				
	63	-50	6 8 4 3	100		63										
	65					65						63.5 / -50.5 Gray, fine to medium clayey SAND, medium dense, wet [D1] **SC**			23.7	
	66															
	68	-55	5 8 10 13	100		68						66.5 / -53.5 Gray, fine to medium silty SAND, medium dense, wet [D1] **SM**			20.6	
	70															

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 341+71 OFFSET: 3 ft RT
LATITUDE: 36.823722° N LONGITUDE: 76.329378° W
SURFACE ELEVATION: 13.0 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/26/2010 - 07/26/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH
▼ STABILIZED AT 7.7 ft AFTER 3 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	70															
	72											71.5 / -58.5 Green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SC**				
	74	-60	2 2 2 9	100		73 75									33.4	
	76															
	78	-65	2 4 7 17	100		78 80						SAME, medium dense below 78 ft			32.7	
	82															
	84	-70	3 4 6 17	100		83 85									32.5	
	86															
	88	-75	4 3 5 13	100		88 90									30.9	
	92															
	94	-80	4 3 7 17	100		93 95									33.1	
	96															
2	98	-85	2 3 4 7	100		98 100						96.5 / -83.5 Green gray, sandy lean CLAY, contains shell fragments, stiff, moist [E2] **CL**			30.6	
	100											Bottom of Boring at 100 ft.				

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-042

STATION: 1422+00
LATITUDE: 36.824067° N
SURFACE ELEVATION: 12.9 ft
OFFSET: 70 ft LT
LONGITUDE: 76.329790° W
COORD. DATUM: NAD 83

Date(s) Drilled: 08/10/2010 - 08/10/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 2.0 ft DEPTH

FIELD DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP °: STRATA	ROCK: DIP °: JOINTS	STRATA LEGEND
		2 2 1 1	90							
2		1 1 1 1	90		2					
4	10	WOH WOH 2 2	35		4					
6		3 7 6 5	100		6					
8	5	3 4 4 4	85		8					
10					10					
12										
14	0	2 3 4 4	65		13					
					15					
16										
18	-5	2 1 2 3	90		18					
20					20					
22										
24	-10	5 6 7 8	85		23					
					25					
26										
28	-15	4 8 8 9	75		28					
30					30					
32										
34	-20	5 4 7 10	90		33					

FIELD DESCRIPTION OF STRATA

0.0 / 12.9
1-inch ROOTMAT AND TOPSOIL **TOPS**

0.1 / 12.8
Dark gray, fine to medium silty sand FILL, contains root fragments, crushed stone and brick fragments, loose, moist [A1] [FILL] **FL**
SAME, contains sandy lean clay lenses below 1.4 ft

2.0 / 10.9
Dark brown, fine to medium clayey SAND, very loose, wet [B1] [ALLUVIUM] **SC**

4.0 / 8.9
Brown, fine to medium poorly graded SAND, trace silt, very loose, wet [B1] **SP**
SAME, light brown below 5 ft

6.0 / 6.9
Gray, fine to medium poorly graded SAND with silt, medium dense, wet [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP-SM**

SAME, contains organic matter and mica below 18 ft

SAME, trace gravel below 28 ft

31.5 / -18.6
Gray, fine to medium poorly graded SAND with silt, contains organic matter and mica, medium dense, wet [D1] [SEDGEFIELD MEMBER (TABB FORMATION)] **SP-SM**

LAB DATA

LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
		14.0	
		41.1	
		24.0	
		20.4	
		21.9	
		25.0	
		22.9	
		20.8	
		20.3	
		26.7	

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 1422+00 OFFSET: 70 ft LT
LATITUDE: 36.824067° N LONGITUDE: 76.329790° W
SURFACE ELEVATION: 12.9 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/10/2010 - 08/10/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 2.0 ft DEPTH

FIELD DATA / **LAB DATA**

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
36					35										
38	-25	6 8 6 7	75		38						36.5 / -23.6 Gray, fine to medium poorly graded SAND, trace silt, contains mica, medium dense, wet [D1] **SP**			22.7	
40					40										
42															
44	-30	5 8 9 12	85		43 45						SAME, contains organic matter below 43 ft			23.8	
46															
48	-35	11 12 14 14	75		48						SAME, trace gravel below 48 ft			16.2	
50					50										
52															
54	-40	5 5 6 9	90		53 55						51.5 / -38.6 Gray, fine to medium poorly graded SAND with silt, contains organic matter and mica, medium dense, wet [D1] **SP-SM**			32.8	
56															
58	-45	5 7 13 14	100		58									26.5	
60					60										
62															
64	-50	15 23 25 25	100		63 65						61.5 / -48.6 Brown gray, fine to medium poorly graded SAND, trace silt, contains organic matter, very dense, wet [D1] **SP**			16.2	
66															
68	-55	13 14 14 14	75		68									19.8	
70															

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 1422+00 OFFSET: 70 ft LT
LATITUDE: 36.824067° N LONGITUDE: 76.329790° W
SURFACE ELEVATION: 12.9 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/10/2010 - 08/10/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 2.0 ft DEPTH

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
70															
72	-60	11 14 15 20	75		73										
74					75									15.5	
76															
78	-65	3 6 12 17	100		78						76.5 / -63.6 Green gray, fine to coarse clayey SAND, contains shell fragments, medium dense, wet [E1] [YORKTOWN FORMATION] **SC**			31.8	
80					80										
82															
84	-70	2 5 8 17	100		83									31.5	
86					85										
88	-75	2 3 6 16	100		88									32.9	
90					90										
92															
94	-80	5 4 7 14	100		93							38	15	32.4	40.1
96					95										
98	-85	2 2 4 7	100		98									33.8	
100					100						Bottom of Boring at 100 ft.				

REMARKS: Rig Type: CME-45C (Track).

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VDOT Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-045
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STATION: 343+28 OFFSET: 15 ft RT
LATITUDE: 36.823968° N LONGITUDE: 76.328934° W
SURFACE ELEVATION: 12.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/22/2010 - 07/22/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	0	12.6										0.0 / 12.6 4-inches ROOTMAT AND TOPSOIL **TOPS**			7.5
												0.3 / 12.3 Gray brown, fine to medium silty SAND, contains root fragments, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SM**			19.1
												2.0 / 10.6 Gray brown, fine to medium clayey SAND, loose, moist [C1] **SC**			20.5
												4.0 / 8.6 Light brown, fine to medium poorly graded SAND, medium dense, wet [C1] **SP**			24.9
												6.0 / 6.6 Gray, fine to medium poorly graded SAND with silt, contains root fragments, loose, wet [C1] **SP-SM**			25.0
												16.5 / -3.9 Gray, fine to medium poorly graded SAND, trace silt, very loose, wet [C1] **SP**			24.8
												SAME, contains mica, loose below 23 ft			26.5
												SAME, medium dense below 28 ft			33.5
												SAME, loose below 33 ft			32.1

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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STATION: 343+28 OFFSET: 15 ft RT
LATITUDE: 36.823968° N LONGITUDE: 76.328934° W
SURFACE ELEVATION: 12.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/22/2010 - 07/22/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	36					35									
	38	-25	9 10 10 12	50		38						36.5 / -23.9 Green gray, fine to medium poorly graded SAND, trace silt, medium dense, wet [D1] [SEDGEFIELD MEMBER (TABB FORMATION)] **SP**			28.7
	40					40									
	42	-30	5 8 11 12	65		43 45									27.1
	44														
	46														
	48	-35	8 12 15 15	85		48 50						SAME, dense below 48 ft			23.8
	50														
	52	-40	9 11 14 11	90		53 55									25.0
	54														
	56														
	58	-45	8 10 11 12	90		58 60						SAME, medium dense below 58 ft			29.2
	60														
	62	-50	1 0 1 1	95		63 65						61.5 / -48.9 Gray, fine to medium clayey SAND, very loose, wet [D1] **SC**			22.0
	64														
	66														
	68	-55	10 14 15 12	90		68						66.5 / -53.9 Light green gray, fine to medium poorly graded SAND, trace silt, dense, wet [D1] **SP**			20.1
	70														

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-045
PAGE 3 OF 3

STATION: 343+28 OFFSET: 15 ft RT
LATITUDE: 36.823968° N LONGITUDE: 76.328934° W
SURFACE ELEVATION: 12.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/22/2010 - 07/22/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	70					70									
	72	-60	3 2 3 6	100		73						71.5 / -58.9 Gray, fine to coarse clayey SAND, loose, wet [E1] [YORKTOWN FORMATION] **SC**			33.4
	74					75									
	76														
	78	-65	1 2 3 12	100		78						SAME, contains shell fragments below 78 ft			35.2
	80					80									
	82														
	84	-70	2 3 3 7	100		83 85									30.5
	86														
	88	-75	2 3 7 16	100		88						SAME, medium dense below 88 ft			32.8
	90					90									
	92														
	94	-80	2 2 4 10	100		93 95						SAME, loose below 93 ft			29.7
	96														
	98	-85	3 4 7 7	100		98						96.5 / -83.9 Gray, sandy lean CLAY, contains shell fragments, stiff, wet [E2] **CL**			30.4
1	100					100						Bottom of Boring at 100 ft.			

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-048

STATION: 1426+00 OFFSET: 160 ft LT
LATITUDE: 36.824951° N LONGITUDE: 76.328993° W
SURFACE ELEVATION: 14.1 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/09/2010 - 08/09/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 2.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	0		2 19 12 5	85		2						0.0 / 14.1 4-inches ROOTMAT AND TOPSOIL **TOPS**			14.3	
	2 ▽		2 1 2 2	100		4						0.3 / 13.8 Dark brown, fine to medium silty sand FILL, contains crushed stone and brick fragments, dense, moist [A1] [FILL] **FL**			33.3	
	4	10	WOH 1 0 1	100		6						2.0 / 12.1 Dark gray, sandy lean CLAY, contains organic matter, soft, wet [B2] [ALLUVIUM] **CL**			33.4	
	6		WOH WOH 3 4	100		8						5.0 / 9.1 Dark gray, fine to medium clayey SAND, contains organic matter, very loose, wet [B1] **SC**			29.0	
	8	5	3 3 4 3	90		10						6.0 / 8.1 Dark gray, sandy fat CLAY, soft, wet [B2] **CH**			22.5	
	10											7.0 / 7.1 Light brown, fine to medium poorly graded SAND with silt, loose, wet [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP-SM** SAME, gray below 8 ft				
	12					13										
	14	0	2 3 3 2	85		15									29.3	
	16															
	18		2 0 1 0	75		18						16.5 / -2.4 Gray, fine to medium silty SAND, contains mica and organic matter, very loose, wet [C1] **SM**				
	20	-5				20									24.1	
	22															
	24	-10	1 0 1 0	100		23 25									35.7	
	26															
	28		3 1 2 2	100		28						SAME, loose below 28 ft			36.0	
	30	-15				30										
	32															
0.25	34	-20	1 5 3 4	100		33						31.5 / -17.4 Gray, lean CLAY with sand, contains mica and silty sand pockets, stiff, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CL**	43	20	46.1	73.7

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-048
PAGE 2 OF 3

STATION: 1426+00 OFFSET: 160 ft LT
LATITUDE: 36.824951° N LONGITUDE: 76.328993° W
SURFACE ELEVATION: 14.1 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/09/2010 - 08/09/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 2.0 ft DEPTH

FIELD DATA														LAB DATA			
			SOIL				ROCK										
PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	STANDARD PENETRATION TEST HAMMER BLOWS	SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	CORE RECOVERY (%)	ROCK QUALITY DESIGNATION	DIP ° STRATA	DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
	35					35										
	36											36.5 / -22.4 Gray, fine to medium silty SAND, contains organic matter and mica, loose, wet [D1] **SM**				
	38	-25	2 1 3 5	90		38									47.4	
	40					40										
	42															
	43					43										
	44	-30	11 5 9 8	100		45						SAME, contains elastic silt pockets, medium dense below 43 ft			27.7	
	46															
	48					48						46.5 / -32.4 Green gray, fine to medium poorly graded SAND, trace silt, contains mica, medium dense, wet [D1] **SP**				
	50	-35	8 11 9 10	100		50									28.9	
	52															
	53					53										
	54	-40	6 8 14 23	100		55						SAME, gray below 53 ft			29.6	
	56															
	58					58						56.5 / -42.4 Gray, fine to medium silty SAND, contains organic matter and mica, loose, wet [D1] **SM**				
	60	-45	WOH 1 3 7	100		60									41.0	
	62															
	63					63						61.5 / -47.4 Green gray, fine to medium poorly graded SAND, trace silt, contains mica, medium dense, wet [D1] **SP**				
	64	-50	9 9 8 5	100		64.6									43.5	
0.5	65					65						64.6 / -50.5 Dark gray, lean CLAY with sand, contains organic matter and mica, very stiff, moist [D2] **CL**				
	66															
	68					68						66.5 / -52.4 Brown, fine to medium poorly graded SAND, trace silt, very dense, wet [D1] **SP**				
	70	-55	7 19 26 27	100											18.6	

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-048

STATION: 1426+00 OFFSET: 160 ft LT
LATITUDE: 36.824951° N LONGITUDE: 76.328993° W
SURFACE ELEVATION: 14.1 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/09/2010 - 08/09/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 2.0 ft DEPTH

FIELD DATA													LAB DATA			
PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	70															
	72															
	73											SAME, fine to coarse below 73 ft				
	74	-60	12 14 22 20	65											20.5	
	75															
	76															
	78											76.5 / -62.4 Green gray, fine to coarse clayey SAND, contains shell fragments, medium dense, wet [E1] [YORKTOWN FORMATION] **SC**				
	78		2 3 6 13	100											30.8	
	80	-65										Bottom of Boring at 80 ft.				

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-048A

STATION: 1426+00 OFFSET: 164 ft LT
LATITUDE: 36.824960° N LONGITUDE: 76.329001° W
SURFACE ELEVATION: 14.1 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/09/2010 - 08/09/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER

FIELD DATA														LAB DATA		
			SOIL				ROCK									
PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	STANDARD PENETRATION TEST HAMMER BLOWS	SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	CORE RECOVERY (%)	ROCK QUALITY DESIGNATION	DIP ° STRATA	DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA		LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
	0	10										0.0 / 14.1 Rotary probe to 33 ft; see Boring 10BH-048 for strata descriptions.				
	2															
	4															
	6															
	8	5														
	10															
	12															
	14	0														
	16															
	18	-5														
	20															
	22															
	24	-10														
	26															
	28															
	30	-15														
	32															
0.25	34	-20		90		33 35						33.0 / -18.9 Gray, lean CLAY with sand, contains mica, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CL** Bottom of Boring at 35 ft.				

REMARKS: Rig Type: CME-45C (Track).

10BH-048A

SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-052

STATION: 346+14 OFFSET: 10 ft RT
LATITUDE: 36.824378° N LONGITUDE: 76.328133° W
SURFACE ELEVATION: 13.1 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/27/2010 - 07/28/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 4.4 ft AFTER 19 HOURS

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT #200 (%)
	0	13.1	5 6 5 4	90		2						0.0 / 13.1 4-inches ROOTMAT AND TOPSOIL **TOPS**			17.4	
	2	10	2 4 5 7	100		4						0.3 / 12.8 Brown, fine to medium silty SAND, contains root fragments, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SM**			20.4	
	4		8 8 6 8	100		6						SAME, dark brown, medium dense below 0.9 ft			21.2	
	6		2 4 3 4	100		8						2.0 / 11.1 Dark brown, fine to medium clayey SAND, contains organic matter, medium dense, moist [C1] **SC**			25.6	
	8	5	3 4 4 3	100		10						3.4 / 9.7 Light brown, fine to medium poorly graded SAND, moist [C1] **SP**			21.4	
	10											SAME, wet below 4 ft				
	12											8.0 / 5.1 Gray, fine to medium poorly graded SAND with silt, loose, wet [C1] **SP-SM**				
	14	0	2 2 2 2	100		13 15									25.1	
	16															
	18	-5	1 1 1 0	100		18 20						16.5 / -3.4 Gray, fine to medium silty SAND, very loose, wet [D1] [SEDGEFIELD MEMBER (TABB FORMATION)] **SM**			24.4	
	20															
	22															
0.25	24	-10	WOH 1 1 1	100		23 25						21.5 / -8.4 Gray, elastic SILT, trace sand, contains mica and organic matter, soft, wet [D2] **MH**			98.8	
	26															
0.25	28	-15	1 1 1 1	100		28 30									84.0	
	30															
	32															
0.25	34	-20	1 1 0 1	100		33						31.5 / -18.4 Gray, elastic SILT with sand, contains organic matter and mica, very soft, wet [D2] **MH**	51	18	44.4	77.9

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 346+14 OFFSET: 10 ft RT
LATITUDE: 36.824378° N LONGITUDE: 76.328133° W
SURFACE ELEVATION: 13.1 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/27/2010 - 07/28/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 4.4 ft AFTER 19 HOURS

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT -#200 (%)
	36					35										
	38	-25	WOH WOH 1 1	100		38						36.5 / -23.4 Gray, fine to medium clayey SAND, contains organic matter and mica, very loose, wet [D1] **SC**			87.8	
	40					40										
	42															
0.25	44	-30	WOH 1 1 1	100		43 45						41.5 / -28.4 Gray, elastic SILT, contains organic matter and mica, trace sand, soft, moist [D2] **MH**			96.9	
	46															
0.25	48 50	-35	1 0 0 1	100		48 50							86	38	85.3	89.4
	52											51.5 / -38.4 Gray, fine to coarse poorly graded SAND with silt, trace gravel, contains organic matter, dense, wet [D1] **SP-SM**				
	54	-40	8 15 19 8	100		53 55									16.1	
	56															
	58	-45	4 4 2 3	100		58						58.5 / -45.4 Gray, lean CLAY with sand, contains mica, firm, moist [D2] **CL**			36.4	
0.5	60					60										
	62											61.5 / -48.4 Gray, fat CLAY with sand, soft, moist [D2] **CH**				
0.5	64	-50	WOH 1 1 3	100		63 65									24.4	
	66															
	68	-55	4 8 12 7	85		68						66.5 / -53.4 Gray, fine to coarse poorly graded SAND, trace silt and gravel, medium dense, wet [D1] **SP**			13.5	
	70															

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 346+14 OFFSET: 10 ft RT
LATITUDE: 36.824378° N LONGITUDE: 76.328133° W
SURFACE ELEVATION: 13.1 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/27/2010 - 07/28/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 4.4 ft AFTER 19 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	70															
	72											71.5 / -58.4 Green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SC**				
	74	-60	1 2 3 6	100		73 75									32.2	
	76															
	78	-65	1 2 3 9	100		78 80									34.7	
	82															
	84	-70	1 3 5 17	100		83 85						SAME, medium dense below 83 ft			29.3	
	86															
	88	-75	3 2 3 12	100		88 90						SAME, loose below 88 ft			33.8	
	92															
	94	-80	3 3 4 10	100		93 95									30.4	
	96															
	98	-85	1 2 3 6	100		98 100									32.8	
	100											Bottom of Boring at 100 ft.				

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-052A

STATION: 346+12 OFFSET: 8 ft RT
LATITUDE: 36.824383° N LONGITUDE: 76.328142° W
SURFACE ELEVATION: 13.1 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/28/2010 - 07/28/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
STABILIZED AT 4.4 ft AFTER 19 HOURS

FIELD DATA														LAB DATA			
			SOIL				ROCK										
PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	STANDARD PENETRATION TEST HAMMER BLOWS	SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	CORE RECOVERY (%)	ROCK QUALITY DESIGNATION	DIP ° STRATA	DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA		LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
														LL	PI		
	2	10										0.0 / 13.1 Rotary probe to 25 ft; see Boring 10BH-052 for strata descriptions.					
	4																
	6																
	8	5															
	10																
	12	0															
	14																
	16																
	18	-5															
	20																
	22																
	24	-10															
0.25	26			90		25 27						25.0 / -11.9 Gray, elastic SILT, trace sand, contains mica and organic matter, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **MH**		84	41	68.2	93.8
	28	-15										27.0 / -13.9 Rotary probe to 40 ft; see Boring 10BH-052 for strata descriptions.					
	30																
	32																
	34	-20															

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 346+12 OFFSET: 8 ft RT
LATITUDE: 36.824383° N LONGITUDE: 76.328142° W
SURFACE ELEVATION: 13.1 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/28/2010 - 07/28/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER

STABILIZED AT 4.4 ft AFTER 19 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
	36															
	38	-25														
0.5	40			100		40						40.0 / -26.9 Gray, fine to medium clayey SAND, contains organic matter and mica, wet [D1] **SC**				
	42					42						41.0 / -27.9 Gray, elastic SILT, contains mica, organic matter and silty sand lenses, wet [D2] **MH** Bottom of Boring at 42 ft.				

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-053
PAGE 1 OF 3

STATION: 203+40 OFFSET: 10 ft LT
LATITUDE: 36.825201° N LONGITUDE: 76.327142° W
SURFACE ELEVATION: 12.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/26/2010 - 07/26/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 5.0 ft AFTER 218 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	0	12.6	3 14 18 5	90		2						0.0 / 12.6 4-inches FOREST LITTER, ROOTMAT AND TOPSOIL **TOPS**			8.1	
	2	10	4 4 3 5	100		4						0.3 / 12.3 Dark brown, fine to medium silty sand FILL, contains crushed stone and root fragments, dense, moist [A1] [FILL] **FL**			13.1	
	4		4 7 7 6	100		6						2.0 / 10.6 Dark brown, fine to medium poorly graded SAND with silt, loose, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP-SM**			20.3	
	6		4 5 4 1	100		8						SAME, light orange brown, medium dense, wet below 4 ft			28.2	
	8	5	2 3 2 1	100		10						SAME, contains organic matter, loose below 7 ft			28.9	
	10															
	12											SAME, gray, contains shell fragments below 11.5 ft				
	14	0	4 3 4 4	100		13 15									26.2	
	16															
	18	-5	1 1 1 1	100		18						SAME, very loose below 18 ft			24.0	
	20					20										
	22	-10										21.5 / -8.9 Gray, fat CLAY, trace sand, contains organic matter and mica, soft, moist [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CH**				
0.5	24		2 1 1 2	100		23 25							62	35	64.9	91.3
	26															
	28	-15	WOH WOH WOH WOH	100		28 30						26.5 / -13.9 Gray, SILT with sand, trace gravel, contains mica, very soft, wet [D2] **ML**			44.4	
	30															
	32	-20										31.5 / -18.9 Brown, PEAT, wet [D3] **PT**				
	34		3 3 4 5	100		33									295.0	

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

STATION: 203+40 OFFSET: 10 ft LT
LATITUDE: 36.825201° N LONGITUDE: 76.327142° W
SURFACE ELEVATION: 12.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/26/2010 - 07/26/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 5.0 ft AFTER 218 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	35															
	36											36.5 / -23.9 Gray, elastic SILT, trace sand, contains organic matter and mica, firm, wet [D2] **MH**				
0.25	38	-25	1 2 2 2	100		38							67	34	60.2	97.0
	40					40										
	42	-30	WOH 1 2 2	100		43						SAME, contains heavy concentrations of organic matter below 43 ft				
0.25	44					45									114.0	
	46															
	48	-35	WOH WOH 1 1	100		48						46.5 / -33.9 Gray, elastic SILT with sand, contains organic matter and mica, very soft, wet [D2] **MH**				
	50					50							52	16	50.9	72.8
	52	-40	3 2 1 2	90		53						SAME, soft below 53 ft				
	54					55									51.0	
	56															
	58	-45	1 0 1 1	100		58						56.5 / -43.9 Gray, sandy lean CLAY, contains organic matter and mica, very soft, wet [D2] **CL**				
0.75	60					60									46.1	
	62	-50	2 2 2 2	100		63										
0.75	64					65									49.0	
	66															
	68	-55	8 9 16 12	85		68						66.5 / -53.9 Gray, fine to medium poorly graded SAND, trace silt, contains organic matter, dense, wet [D1] **SP**				
0.5	70														23.8	

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 203+40 OFFSET: 10 ft LT
LATITUDE: 36.825201° N LONGITUDE: 76.327142° W
SURFACE ELEVATION: 12.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/26/2010 - 07/26/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 5.0 ft AFTER 218 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	70															
	72	-60	11 11 14 20	100		73						SAME, brown gray below 73 ft			22.9	
	74					75										
	76															
	78	-65	1 3 4 7	100		78						76.5 / -63.9 Green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SC**			31.5	
	80					80										
	82	-70	1 3 4 12	100		83							38	20	32.0	36.4
	84					85										
	86															
	88	-75	2 2 3 9	100		88									32.8	
	90					90										
	92															
	94	-80	2 2 3 8	100		93									31.6	
	96					95										
	98	-85	2 2 3 6	100		98									30.8	
	100					100						Bottom of Boring at 100 ft.				

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 1 OF 1

STATION: 203+41 OFFSET: 11 ft LT
LATITUDE: 36.825201° N LONGITUDE: 76.327142° W
SURFACE ELEVATION: 12.6 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/27/2010 - 07/27/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▼ STABILIZED AT 5.5 ft AFTER 218 HOURS

FIELD DATA | **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT -#200 (%)
	0	12.6										0.0 / 12.6 Rotary probe to 25 ft; see Boring 10BH-053 for strata descriptions.				
0.5	26	-13.4		95		25 27						25.0 / -12.4 Gray, SILT with sand, trace gravel, contains mica, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **ML**			45.7	82.7
												27.0 / -14.4 Rotary probe to 33 ft; see Boring 10BH-053 for strata descriptions.				
4.5	34	-21.4		95		33 35						33.0 / -20.4 Brown, PEAT, wet [D3] **PT**			403.5	
												Bottom of Boring at 35 ft.				

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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STATION: 1429+70 OFFSET: 143 ft LT
LATITUDE: 36.825609° N LONGITUDE: 76.328016° W
SURFACE ELEVATION: 13.0 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/09/2010 - 08/09/2010
Drilling Method(s): Hollow Stem Auger
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 2.0 ft DEPTH

FIELD DATA | **LABORATORY DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)	ORGANIC CONTENT (%)
0.25	2	10	2 3 2	85		2						0.0 / 13.0 4-inches ROOTMAT AND TOPSOIL **TOPS**			37.5		
			1 2 2	100		2						0.3 / 12.7 Dark gray, sandy lean CLAY, contains root fragments, firm, moist [C2] [LYNNHAVEN MEMBER (TABB FORMATION)] **CL**			24.4		
	4		1 1 4	85		4						2.0 / 11.0 Brown, fine to medium silty SAND, contains root fragments, loose, wet [C1] **SM**			23.1		
	6		3 4 2	90		6						4.0 / 9.0 Light brown, fine to medium poorly graded SAND, trace silt, loose, wet [C1] **SP**			25.0		
	8	5	4 4 5	75		8						SAME, gray below 6 ft SAME, contains mica, medium dense below 8 ft			21.3		
	10					10											
	12					12											
		0	4 3 2	85		13						SAME, loose below 13 ft			26.6		
	14					15											
	16					16											
	18	-5	1 1 1	100		18						SAME, very loose below 18 ft					
	20					20						19.6 / -6.6 Gray, fine to medium clayey SAND, very loose, wet [D1] [SEDGEFIELD MEMBER (TABB FORMATION)] **SC**			39.4		
	22					22											
		-10	WOH WOH 1	100		23						21.5 / -8.5 Gray, elastic SILT with sand, contains organic matter and mica, very soft, wet [D2] **MH**			61.9		
0.25	24					24											
0.25						25						24.6 / -11.6 Gray and brown, ORGANIC SILT, trace sand, soft, wet [D3] **OH**					
	26					26											
	28	-15	1 1 1	100		28											
0.25	30					30									145.0		54.9
	32					32											
		-20	WOH 1 1	100		33						31.5 / -18.5 Gray, elastic SILT with sand, contains organic matter and mica, soft, wet [D2] **MH**					
0.25	34												66	26	71.5	84.0	

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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STATION: 1429+70 OFFSET: 143 ft LT
LATITUDE: 36.825609° N LONGITUDE: 76.328016° W
SURFACE ELEVATION: 13.0 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/09/2010 - 08/09/2010
Drilling Method(s): Hollow Stem Auger
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 2.0 ft DEPTH

LABORATORY DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)	ORGANIC CONTENT (%)
	35																
	36											36.5 / -23.5 Gray, fine to medium silty SAND, contains organic matter and mica, very loose, wet **SM**					
	38	-25	WOH 1 1 2	100		38							46	13	59.0	45.1	
	40					40											
	42											41.5 / -28.5 Gray, fine to medium poorly graded SAND with silt, contains mica, medium dense, wet [D1] **SP-SM**			31.0		
	43	-30	3 7 6 3	100		43											
	44					45											
	46																
0.25	48	-35	3 2 2 2	100		48						46.5 / -33.5 Gray, elastic SILT with sand, contains mica and silty sand lenses, firm, wet [D2] **MH**			90.5		
	50					50											
	52																
	53	-40	4 3 6 8	100		53						51.5 / -38.5 Gray, fine to coarse silty SAND, medium dense, wet [D1] **SM**	27	3	37.6	24.3	
	55					55											
	56																
0.25	58	-45	8 3 3 3	100		58						56.5 / -43.5 Gray, elastic SILT with sand, contains mica, firm, wet [D2] **MH** SAME, contains peat layers below 59.4 ft			62.2		
	60					60											
	62																
	63	-50	14 32 39 14	75		63						61.5 / -48.5 Gray, fine to coarse poorly graded SAND with silt and gravel, very dense, wet [D1] **SP-SM**			7.7		
	65					65											
	66																
	68	-55	4 4 6 13	100		68						66.5 / -53.5 Green gray, fine to coarse clayey SAND, contains shell fragments, medium dense, wet [E1] [YORKTOWN FORMATION] **SC**			31.1		
	70																

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGABC:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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STATION: 1429+70 OFFSET: 143 ft LT
LATITUDE: 36.825609° N LONGITUDE: 76.328016° W
SURFACE ELEVATION: 13.0 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/09/2010 - 08/09/2010
Drilling Method(s): Hollow Stem Auger
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 2.0 ft DEPTH

FIELD DATA													LABORATORY DATA				
			SOIL			ROCK											
PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	STANDARD PENETRATION TEST HAMMER BLOWS	SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	CORE RECOVERY (%)	ROCK QUALITY DESIGNATION	DIP ° STRATA	DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)	ORGANIC CONTENT (%)
	70																
	72	-60	2 2 4 11	100		73						SAME, loose below 73 ft			31.8		
	74					75						Bottom of Boring at 75 ft.					

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGABC:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-057

STATION: 208+28 OFFSET: 80 ft RT
LATITUDE: 36.826054° N LONGITUDE: 76.325916° W
SURFACE ELEVATION: 12.1 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/10/2010 - 08/10/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	2	10	3 4 4	85		2						0.0 / 12.1 4-inches FOREST LITTER, ROOTMAT AND TOPSOIL **TOPS**			10.1	
	4 ▽		2 4 4	100		4						0.3 / 11.8 Brown, fine to medium silty sand, PROBABLE FILL, contains root fragments and crushed stone, medium dense, moist [A1] [FILL] **FL**			13.9	
	6	5	3 5 6	100		6						2.0 / 10.1 Brown, fine to medium silty SAND, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SM**			20.9	
	8		2 4 1	100		8						4.0 / 8.1 Light brown, fine to medium poorly graded SAND, trace silt, medium dense, wet [C1] **SP**			27.3	
	10		1 1 1	100		10						7.0 / 5.1 Gray, fine to medium poorly graded SAND with silt, loose, wet [C1] **SP-SM**			23.7	
	12	0										SAME, contains mica below 8 ft				
	14		4 3 4	65		13						SAME, contains shell fragments below 13 ft			25.5	
	16					15										
	18	-5	1 1 1	100		18						16.5 / -4.4 Gray, fine to medium silty SAND, very loose, wet [D1] [SEDGEFIELD MEMBER (TABB FORMATION)] **SM**			25.1	
	20					20										
	22	-10	WOH 1 1	100		23						21.5 / -9.4 Gray, fat CLAY, trace sand, contains shell fragments and mica, soft, moist [D2] **CH**				
0.25	24					25							98	69	60.9	96.6
	26															
	28	-15	WOH 1 1	100		28									43.5	
0.25	30					30										
	32	-20										31.5 / -19.4 Light brown, PEAT, wet [D3] **PT**				
	34		2 3 5	65		33									541.5	

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 2 OF 3

STATION: 208+28 OFFSET: 80 ft RT
LATITUDE: 36.826054° N LONGITUDE: 76.325916° W
SURFACE ELEVATION: 12.1 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/10/2010 - 08/10/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

FIELD DATA | **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT #200 (%)
	36	-25	14 14 18 20	100		35 38									289.2	
	38															
	40															
	42	-30	4 3 3 4	15		43 45						41.5 / -29.4 Gray, fine to medium silty SAND, contains organic matter and mica, loose, wet [D1] **SM**			37.0	
	44															
	46															
	48	-35	1 1 2 2	100		48 50									57.6	
	50															
	52	-40	3 8 5 9	100		53 55						51.5 / -39.4 Gray, fine to medium poorly graded SAND, trace silt, contains mica, medium dense, wet [D1] **SP**			25.0	
	54															
	56															
	58	-45	5 6 10 12	50		58 60						56.5 / -44.4 Gray, fine to medium silty SAND, contains organic matter and mica, medium dense, wet [D1] **SM**			32.1	
	60															
	62	-50	8 8 11 16	100		63 65						61.5 / -49.4 Green gray, fine to coarse silty SAND, contains shell fragments, medium dense, wet [E1] [YORKTOWN FORMATION] **SM**			34.9	
	64															
	66															
	68	-55	3 4 6 13	100		68 70						66.5 / -54.4 Green gray, fine to coarse clayey SAND, contains shell fragments, medium dense, wet [E1] **SC**			32.9	
	70															

REMARKS: Rig Type: CME-45C (Track).

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10BH-057

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-057
PAGE 3 OF 3

STATION: 208+28 OFFSET: 80 ft RT
LATITUDE: 36.826054° N LONGITUDE: 76.325916° W
SURFACE ELEVATION: 12.1 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/10/2010 - 08/10/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

FIELD DATA													LAB DATA			
PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	70															
	72	-60	3													
			3			73										
	74		5	100											26.5	
			5			75						Bottom of Boring at 75 ft.				

REMARKS: Rig Type: CME-45C (Track).

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10BH-057

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-059
PAGE 1 OF 3

STATION: 108+59 OFFSET: 97 ft RT
LATITUDE: 36.826245° N LONGITUDE: 76.327201° W
SURFACE ELEVATION: 11.8 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/22/2010 - 07/22/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	0	10	5 6 8 8	55		2						0.0 / 11.8 4-inches ROOTMAT AND TOPSOIL **TOPS**			14.1	
	2		8 8 7 7	0		4						0.3 / 11.5 Gray and brown, fine to medium silty SAND, contains root fragments, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SM**				
	4 ▽		7 7 6 6	65		6									20.2	13.7
	6	5	7 4 4 4	100		8						SAME, wet below 4 ft			23.0	
	8		10 7 6 6	40		10									25.2	
	10															
	12	0	5 3 3 4	100		13						11.5 / 0.3 Gray, fine to medium poorly graded SAND with silt, contains shell fragments, loose, wet [C1] **SP-SM**			31.1	
	14					15										
	16	-5														
	18		1 1 1 1	100		18						SAME, very loose below 18 ft				
0.75	20					20						19.5 / -7.7 Gray, fat CLAY, soft, moist [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CH**			59.8	
	22	-10				23										
1	24		WOH WOH 1 1	100		25						SAME, contains organic matter, very soft below 23 ft			62.7	
	26															
	28	-15	1 0 1 0	100		28						26.5 / -14.7 Gray brown, fine to medium clayey SAND, contains organic matter, very loose, wet [D1] **SC**			39.4	
	30					30										
	32	-20										31.5 / -19.7 Dark brown, PEAT, wet [D3] **PT**				
	34		1 2 4 8	100		33									242.2	

REMARKS: Rig Type: CME-45C (Track).

PAGE 1 OF 3
10BH-059

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-059

STATION: 108+59 OFFSET: 97 ft RT
LATITUDE: 36.826245° N LONGITUDE: 76.327201° W
SURFACE ELEVATION: 11.8 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/22/2010 - 07/22/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH

FIELD DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP °: STRATA	ROCK: DIP °: JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
						35										
	36															
		-25										36.5 / -24.7 Dark gray, ORGANIC SILT, trace sand, contains shell fragments, soft, wet [D3] **OH**				
	38		1 1 1 1			38										
0.75				100											74.9	
	40					40										
	42	-30														
			3 2 2 2			43						SAME, firm below 43 ft				
	44			100											142.8	
						45										
	46															
		-35										46.5 / -34.7 Dark gray brown, ORGANIC SILT with sand, contains mica, soft, wet [D3] **OH**				
	48		1 1 1 1			48										
1.5				100									89	35	89.3	72.5
	50					50										
	52	-40										51.5 / -39.7 Light gray, fat CLAY with sand, contains organic matter, soft, moist [D2] **CH**				
			1 1 1 2			53										
1.25	54			100											29.3	
						55										
	56															
		-45										56.5 / -44.7 Green gray, fine to medium poorly graded SAND, trace silt, medium dense, wet [D1] **SP**				
	58		6 9 11 12			58										
				100											22.6	
	60					60										
	62	-50										61.5 / -49.7 Green gray, fine to coarse silty SAND, contains heavy concentrations of shell fragments, medium dense, wet [E1] [YORKTOWN FORMATION] **SM**				
			3 5 10 10			63										
	64			100											38.0	
						65										
	66															
		-55										66.5 / -54.7 Gray, fine to coarse clayey SAND, medium dense, wet [E1] **SC**				
	68		3 4 4 9			68										
				100											31.3	
	70															

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-059
PAGE 3 OF 3

STATION: 108+59 OFFSET: 97 ft RT
LATITUDE: 36.826245° N LONGITUDE: 76.327201° W
SURFACE ELEVATION: 11.8 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/22/2010 - 07/22/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	70															
	72	-60	2 2 3 7	100		73						SAME, contains coquina, loose below 73 ft			31.5	
	74					75										
	76	-65														
	78		2 2 2 4	100		78									33.2	
	80					80										
	82	-70														
	84		2 5 10 10	100		83						SAME, medium dense below 83 ft			38.0	
	86					85										
	88	-75	5 5 10 10	100		88									27.9	
	90					90										
	92	-80														
	94		6 6 6 8	100		93									31.2	
	96					95										
	98	-85														
	98		2 5 6 9	100		98									31.3	
	100					100						Bottom of Boring at 100 ft.				

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-059A

STATION: 108+59 OFFSET: 99 ft RT
LATITUDE: 36.826245° N LONGITUDE: 76.327201° W
SURFACE ELEVATION: 11.8 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/23/2010 - 07/23/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT -#200 (%)
												0.0 / 11.8 Rotary probe to 22 ft; see Boring 10BH-059 for strata descriptions.				
1	22	-10	1	100		22						22.0 / -10.2 Gray, fat CLAY, contains organic matter and mica, moist [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CH**	53	27	86.1	92.6
1	24		1 1 1			24						SAME, soft below 24 ft			57.8	
	26	-15	1 1 1 1	100		26						26.0 / -14.2 Gray brown, fine to medium clayey SAND, contains organic matter and mica, very loose, wet [D1] **SC**			45.1	
	28					28										
0.25	30		WOH 1	100		30						29.0 / -17.2 Gray brown, elastic SILT with sand, contains organic matter and mica, very soft, wet [D2] **MH**			53.5	
	32	-20	1 2 WOH 1 2 2	100		32						32.0 / -20.2 Gray brown, fine to medium silty SAND, contains organic matter and mica, wet [D1] **SM**			40.4	
	34					34										

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-059A
PAGE 2 OF 2

STATION: 108+59 OFFSET: 99 ft RT
LATITUDE: 36.826245° N LONGITUDE: 76.327201° W
SURFACE ELEVATION: 11.8 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/23/2010 - 07/23/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT -#200 (%)
	36	-25	2			36						36.0 / -24.2 Dark brown, ORGANIC SILT, trace sand, contains wood fragments, firm, wet [D3] **OH**			204.7	
			2 3 4	100												
0.5	38			85		38										
	40					40						Bottom of Boring at 40 ft.				

REMARKS: Rig Type: CME-45C (Track).

PAGE 2 OF 2
10BH-059A

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-061
PAGE 1 OF 3

STATION: 106+76 OFFSET: 52 ft RT
LATITUDE: 36.826470° N LONGITUDE: 76.326724° W
SURFACE ELEVATION: 12.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/24/2010 - 08/24/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 4.3 ft AFTER 43 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
												0.0 / 12.5 4-inches ROOTMAT AND TOPSOIL **TOPS**			3.8	
												0.3 / 12.2 Orange brown, fine to coarse silty sand FILL, contains crushed stone, medium dense, moist [A1] [FILL] **FL**	22	10	13.4	29.6
												2.0 / 10.5 Light orange brown, fine to medium poorly graded SAND, trace silt, medium dense, moist [A1] [FILL] **FL**			23.5	
												3.0 / 9.5 Dark gray, fine to medium clayey SAND, contains mica, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SC**			20.1	
												4.0 / 8.5 Light brown gray, fine to medium poorly graded SAND with silt, medium dense, wet [C1] **SP-SM**			19.6	
												SAME, gray, contains organic matter below 6 ft				
												SAME, loose below 8 ft				
												SAME, green gray, contains shell fragments below 13 ft			27.9	
												SAME, trace gravel, very loose below 18 ft			24.2	
												21.5 / -9.0 Gray, fat CLAY, trace sand, very soft, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CH**	120	89	82.5	92.9
												26.5 / -14.0 Gray, fat CLAY with sand, contains mica and organic matter, soft, wet [D2] **CH**			47.9	
												29.2 / -16.7 Dark brown, PEAT, wet [D3] **PT**				
												31.5 / -19.0 Dark brown, sandy ORGANIC SILT, firm, wet [D3] **OH**	162	94	109.7	56.6

REMARKS: Rig Type: CME-45C (Track).

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10BH-061

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:12/4/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-061

STATION: 106+76 OFFSET: 52 ft RT
LATITUDE: 36.826470° N LONGITUDE: 76.326724° W
SURFACE ELEVATION: 12.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/24/2010 - 08/24/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 4.3 ft AFTER 43 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
0.25	36	-25	2 1 2 2	40		35 38 40									121.6	
	38															
	40															
	42	-30	1 1 1 1	25		43 45						41.5 / -29.0 Brown gray, fine to medium clayey SAND, contains organic matter and mica, very loose, wet [D1] **SC**			59.1	
	44															
	46															
	48	-35	WOH WOH 2 1	100		48 50						46.5 / -34.0 Brown and gray, fine to medium silty SAND, contains organic matter and mica, very loose, wet [D1] **SM**	30	7	33.8	40.2
	50															
	52	-40	4 4 4 9	10		53 55						51.5 / -39.0 Green gray, fine to medium poorly graded SAND with silt, contains mica, medium dense, wet [D1] **SP-SM**			27.5	
	54															
	56															
	58	-45	8 7 12 17	40		58 60									21.5	
	60															
	62	-50	4 4 4 6	100		63 65						61.5 / -49.0 Green gray, fine to coarse silty SAND, contains heavy concentrations of shell fragments, medium dense, wet [E1] [YORKTOWN FORMATION] **SM**			39.3	
	64															
	66															
	68	-55	2 3 3 7	100		68						66.5 / -54.0 Green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] **SC**			30.4	
	70															

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:12/4/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-061
PAGE 3 OF 3

STATION: 106+76 OFFSET: 52 ft RT
LATITUDE: 36.826470° N LONGITUDE: 76.326724° W
SURFACE ELEVATION: 12.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/24/2010 - 08/24/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 4.3 ft AFTER 43 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	70															
	72	-60	2 2 3 6	100		73						71.5 / -59.0 Green gray, fine to coarse silty SAND, contains shell fragments, loose, wet [E1] **SM**			32.8	
	74					75										
	76															
	78	-65	1 3 3 6	100		78									32.9	
	80					80										
	82	-70														
1.25	84			50		83										
	86					85										
	88	-75	1 2 3 9	100		88									32.7	
0.75	90					90										
	92															
	92	-80				93						SAME, fine to medium below 93 ft				
2	94			50									39	13	31.6	47.6
	96					95										
	98	-85	2 3 4 11	100		98									33.5	
1	100					100						Bottom of Boring at 100 ft.				

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:12/4/10

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VDOT Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-064

STATION: 347+77 OFFSET: 10 ft LT
LATITUDE: 36.824495° N LONGITUDE: 76.327609° W
SURFACE ELEVATION: 12.7 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/28/2010 - 07/28/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
- FIRST ENCOUNTERED AT 4.0 ft DEPTH
- STABILIZED AT 3.4 ft AFTER 171 HOURS

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)
			9 7 8 6	35		2						0.0 / 12.7 4-inches FOREST LITTER, ROOTMAT AND TOPSOIL **TOPS**			12.1
	2	10	4 100/3	100		2.8						0.3 / 12.4 Dark brown gray, fine to medium silty sand FILL, contains root and concrete fragments, medium dense, moist [A1] [FILL] **FL**			10.4
	4		4 7 9 10	100		4						4.0 / 8.7 Dark brown, fine to medium silty SAND, medium dense, wet [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SM**			22.4
	6		8 6 10 4	100		6									13.9
	8	5	3 4 4 4	65		8						6.0 / 6.7 Orange brown, fine to medium poorly graded SAND, trace silt, medium dense, wet [C1] **SP** SAME, gray, trace silt below 8 ft			25.5
	10					10									
	12	0	8 5 5 6	100		13						11.5 / 1.2 Gray, fine to medium poorly graded SAND with silt, contains shell fragments, medium dense, wet [C1] **SP-SM**			24.2
	14					15									
	16														
0.25	18	-5	1 1 1 0	100		18						16.5 / -3.8 Gray, elastic SILT with sand, contains silty sand pockets, soft, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **MH**			44.0
	20					20									
	22	-10	WOH WOH 1 1	100		23						SAME, gray brown, contains organic matter and mica, very soft below 23 ft			52.9
0.5	24					25						24.0 / -11.3 Brown, PEAT, wet [D3] **PT**			
	26											26.5 / -13.8 Gray, ORGANIC SILT with sand, contains mica, firm, wet [D3] **OH**			
	28	-15	WOH 2 3 3	100		28									97.5
0.75	30					30									
	32	-20	WOH WOH 1 1	100		33						31.5 / -18.8 Gray, elastic SILT with sand, contains organic matter and mica, very soft, wet [D2] **MH**			63.1
0.5	34														

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-064
PAGE 2 OF 3

STATION: 347+77 OFFSET: 10 ft LT
LATITUDE: 36.824495° N LONGITUDE: 76.327609° W
SURFACE ELEVATION: 12.7 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/28/2010 - 07/28/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 3.4 ft AFTER 171 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)
0.25	36–38	-25	WOH WOH WOH 1	100		35–38									70.8
	40–42					40									
	42–44	-30	3 4 3 2	100		43–45						41.5 / -28.8 Gray, fine to medium silty SAND, contains mica, loose, wet [D1] **SM**			32.7
	46–48	-35	WOH 1 1 2	100		48–50						46.5 / -33.8 Gray, fine to medium clayey SAND, contains organic matter and mica, very loose, wet [D1] **SC**			43.1
0.5	52–54	-40	WOH WOH 1 1	100		53–55						51.5 / -38.8 Gray, sandy lean CLAY, contains organic matter and mica, very soft, wet [D2] **CL**			46.0
	56–58	-45	WOH 1 3 2	100		58–60						56.5 / -43.8 Gray, fine to medium clayey SAND, contains organic matter and mica, wet [D1] **SC**			49.3
	60–62	-50	1 1 1 2	100		63–65						61.5 / -48.8 Gray, elastic SILT with sand, contains organic matter and mica, soft, wet [D2] **MH** SAME, light gray below 64 ft			31.0
	66–68	-55	WOH 1 3 2	90		68						66.5 / -53.8 Gray, fine to coarse poorly graded SAND, trace silt, loose, wet [D1] **SP**			18.3
	70														

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 3 OF 3

STATION: 347+77 OFFSET: 10 ft LT
LATITUDE: 36.824495° N LONGITUDE: 76.327609° W
SURFACE ELEVATION: 12.7 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/28/2010 - 07/28/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 3.4 ft AFTER 171 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)
	70														
	72	-60	1 2 3 3	100		73						71.5 / -58.8 Green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SC**			35.7
	74					75									
	76														
	78	-65	4 5 6 7	100		78						SAME, medium dense below 78 ft			27.8
	80					80									
	82														
	84	-70	6 6 6 7	100		83									27.6
	86					85									
	88	-75	2 3 5 13	100		88						86.5 / -73.8 Green gray, sandy lean CLAY, contains shell fragments, stiff, wet [E2] **CL**			
0.75	90					90									31.1
	92														
	94	-80	3 2 6 12	100		93						91.5 / -78.8 Green gray, fine to medium clayey SAND, contains shell fragments, medium dense, wet [E1] **SC**			
	96					95									29.9
	98	-85	3 2 4 9	100		98						96.5 / -83.8 Green gray, sandy lean CLAY, contains shell fragments, firm, wet [E2] **CL**			
1	100					100									32.4
												Bottom of Boring at 100 ft.			

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-066

STATION: 349+30 OFFSET: 5 ft RT
LATITUDE: 36.824438° N LONGITUDE: 76.327069° W
SURFACE ELEVATION: 12.5 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/29/2010 - 07/29/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 4.7 ft AFTER 151 HOURS

FIELD DATA | **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)
												0.0 / 12.5 4-inches FOREST LITTER, ROOTMAT AND TOPSOIL **TOPS**			
0.25	2	10	6 8 7 6	90		2						0.3 / 12.2 Brown, fine to coarse silty sand FILL, trace gravel, contains root fragments, medium dense, moist [A1] [FILL] **FL**			12.4
	4		4 5 5 7	100		4						0.5 / 12.0 Gray, sandy lean CLAY, contains organic matter, very stiff, moist [C2] [LYNNHAVEN MEMBER (TABB FORMATION)] **CL**			10.4
	6		3 6 8 7	100		6						2.0 / 10.5 Brown, fine to medium silty SAND, medium dense, moist [C1] **SM**			22.7
	8	5	4 4 3 2	100		8						4.0 / 8.5 Brown, fine to medium poorly graded SAND with silt, medium dense, wet [C1] **SP-SM** SAME, loose below 6 ft SAME, gray below 7 ft SAME, contains shell fragments, medium dense below 13 ft			24.1
	10		2 2 1 2	100		10									23.6
	12	0	7 6 7 7	100		13									24.1
	14					15									
	16														
	18	-5	1 1 1 1	100		18						16.5 / -4.0 Gray, fine to medium silty SAND, contains organic matter, very loose, wet [D1] [SEDGEFIELD MEMBER (TABB FORMATION)] **SM**			35.4
	20					20									
	22	-10	WOH 1 1 1	100		23						21.5 / -9.0 Gray, sandy lean CLAY, contains organic matter and mica, soft, wet [D2] **CL**			
0.5	24					25									38.0
	26														
	28	-15	2 2 3 3	100		28						26.5 / -14.0 Brown, PEAT, wet [D3] **PT**			201.1
	30					30									
	32	-20	WOH 1 1 1	100		33						31.5 / -19.0 Gray, lean CLAY with sand, contains organic matter and mica, soft, wet [D2] **CL**			
0.25	34														61.2

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-066

STATION: 349+30 OFFSET: 5 ft RT
LATITUDE: 36.824438° N LONGITUDE: 76.327069° W
SURFACE ELEVATION: 12.5 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/29/2010 - 07/29/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 4.7 ft AFTER 151 HOURS

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP °: STRATA	ROCK: DIP °: JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
						35									
	36														
	38	-25	WOH WOH WOH WOH	100		38						SAME, very soft below 38 ft			
0.25															53.2
	40					40									
	42	-30										41.5 / -29.0 Gray, elastic SILT, trace sand, contains organic matter and mica, very soft, wet [D2] **MH**			
0.5	44		WOH WOH WOH 1	100		43									75.6
						45									
	46											46.5 / -34.0 Gray, lean CLAY with sand, contains organic matter and mica, very soft, wet [D2] **CL**			
	48	-35	WOH WOH WOH 1	100		48									
0.25															50.7
	50					50									
	52	-40													
0.25	54		WOH 1 0 1	100		53									48.5
						55									
	56														
	58	-45	WOH 1 1 2	100		58						SAME, soft below 58 ft			
0.25															45.1
	60					60									
	62	-50										61.5 / -49.0 Gray, fat CLAY with sand, soft, moist [D2] **CH**			
1	64		WOH 1 2 3	100		63									24.2
						65									
	66											66.5 / -54.0 Gray brown, ORGANIC CLAY, contains mica, firm, wet [D3] **OH**			
	68	-55	5 3 14 15	100		68									
1												69.0 / -56.5			59.5
	70														

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

STATION: 349+30 OFFSET: 5 ft RT
LATITUDE: 36.824438° N LONGITUDE: 76.327069° W
SURFACE ELEVATION: 12.5 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/29/2010 - 07/29/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
- FIRST ENCOUNTERED AT 4.0 ft DEPTH
- STABILIZED AT 4.7 ft AFTER 151 HOURS

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)
	70											Gray, fine to coarse poorly graded SAND, trace silt, dense, wet [D1] **SP**			
	72	-60	2 2 3 6	100		73						71.5 / -59.0 Green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SC**			32.2
	74					75									
	76														
	78	-65	2 2 4 8	100		78									29.9
	80					80									
	82	-70	2 3 7 16	100		83						SAME, medium dense below 83 ft			29.8
	84					85									
	86														
	88	-75	2 2 5 14	100		88						SAME, loose below 88 ft			34.5
	90					90									
	92														
	94	-80	3 4 5 9	100		93						SAME, medium dense below 93 ft			30.1
	96					95									
	98	-85	2 4 5 7	100		98									31.0
	100					100						Bottom of Boring at 100 ft.			

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 1 OF 3

STATION: 201+82 OFFSET: 10 ft LT
LATITUDE: 36.824773° N LONGITUDE: 76.327019° W
SURFACE ELEVATION: 13.7 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/27/2010 - 07/27/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 6.0 ft DEPTH
STABILIZED AT 6.5 ft AFTER 197 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
			4 5 4 6	50		2						0.0 / 13.7 4-inches FOREST LITTER, ROOTMAT AND TOPSOIL **TOPS**			10.1
	2		5 5 6 8	90		4						0.3 / 13.4 Brown, fine to coarse silty sand FILL, contains crushed stone and concrete fragments, medium dense, moist [A1] [FILL] **FL**			6.9
	4	10	8 8 8 8	15		6						4.0 / 9.7 Light brown, fine to medium poorly graded SAND with silt, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP-SM**			3.0
	6 ▽		11 9 10 7	90		8									24.2
	8	5	4 3 2 1	100		10						SAME, wet below 6 ft SAME, gray, loose below 8 ft			22.6
	10														
	12					13									
	14	0	3 3 3 5	100		15						SAME, contains shell fragments below 13 ft			25.2
	16														
	18	-5	2 1 0 1	100		18						16.5 / -2.8 Gray, fine to medium silty SAND, contains organic matter, very loose, wet [D1] [SEDGEFIELD MEMBER (TABB FORMATION)] **SM**			25.3
	20					20									
	22														
0.5	24	-10	1 1 1 1	100		23 25						21.5 / -7.8 Gray, elastic SILT with sand, contains organic matter and mica, soft, wet [D2] **MH**			59.5
	26														
	28	-15	2 1 2 2	100		28 30						26.5 / -12.8 Brown, PEAT, wet [D3] **PT**			256.4
	30														
	32														
0.25	34	-20	2 3 2 4	10		33						31.5 / -17.8 Gray, ORGANIC SILT, trace sand, firm, wet [D3] **OH**			227.2

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-069

STATION: 201+82 OFFSET: 10 ft LT
LATITUDE: 36.824773° N LONGITUDE: 76.327019° W
SURFACE ELEVATION: 13.7 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/27/2010 - 07/27/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 6.0 ft DEPTH
STABILIZED AT 6.5 ft AFTER 197 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)
	36					35									
	38	-25	2 1 0 1	100		38						36.5 / -22.8 Brown gray, lean CLAY with sand, contains organic matter, very soft, wet [D2] **CL**			
0.25	40					40									98.2
	42														
	44	-30	WOH WOH 1 1	100		43 45						41.5 / -27.8 Gray, fine to medium clayey SAND, contains organic matter and mica, very loose, wet [D1] **SC**			48.3
	46														
	48	-35	1 1 1 1	100		48						46.5 / -32.8 Gray, lean CLAY with sand, contains mica, soft, wet [D2] **CL**			
0.25	50					50									56.6
	52														
	54	-40	WOH WOH 1 2	100		53 55						SAME, very soft below 53 ft			35.7
	56														
	58	-45	WOH 1 1 0	100		58						56.5 / -42.8 Gray, elastic SILT, soft, wet [D2] **MH**			
0.25	60					60									43.6
	62														
	64	-50	WOH 1 2 2	100		63 65						SAME, contains organic matter below 63 ft			38.6
	66														
	68	-55	1 4 1 2	100		68						66.5 / -52.8 Gray, sandy lean CLAY, firm, wet [D2] **CL**			
0.25	70														23.2

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 3 OF 3

STATION: 201+82 OFFSET: 10 ft LT
LATITUDE: 36.824773° N LONGITUDE: 76.327019° W
SURFACE ELEVATION: 13.7 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/27/2010 - 07/27/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 6.0 ft DEPTH
STABILIZED AT 6.5 ft AFTER 197 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	70														
	72											71.5 / -57.8 Green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SC**			
	74	-60	1 2 4 4	100		73 75									33.4
	76														
	78	-65	2 2 5 8	100		78 80									30.2
	80														
	82														
	84	-70	3 3 6 11	100		83 85						SAME, contains organic matter, medium dense below 83 ft			30.8
	86														
	88	-75	3 3 6 15	100		88 90									33.0
	90														
	92														
	94	-80	3 3 7 17	100		93 95									32.3
	96														
	98	-85	2 2 3 8	100		98 100						SAME, loose below 98 ft			34.2
	100											Bottom of Boring at 100 ft.			

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-071

STATION: 351+03 OFFSET: 34 ft LT
LATITUDE: 36.824525° N LONGITUDE: 76.326475° W
SURFACE ELEVATION: 12.2 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/29/2010 - 07/29/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 4.7 ft AFTER 147 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)
			6 7 9 10	85		2						0.0 / 12.2 2-inches FOREST LITTER, ROOTMAT AND TOPSOIL **TOPS**			8.1
	2	10	9 9 6 7	100		4						0.2 / 12.0 Dark brown, fine to coarse silty sand FILL, trace gravel, contains plastic fragments, medium dense, moist [A1] [FILL] **FL**			7.2
	4		5 8 8 6	100		6						2.0 / 10.2 Gray, fine to medium silty SAND, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SM**			23.1
	6	5	2 1 2 1	100		8						3.7 / 8.5 Brown, fine to medium poorly graded SAND with silt, medium dense, moist [C1] **SP-SM**			28.7
	8		2 1 1 2	100		10						SAME, light brown, wet below 4 ft SAME, gray, loose below 7 ft			24.6
	10														
	12	0													
			5 5 5 5	100		13						SAME, contains shell fragments, medium dense below 13 ft			24.8
	14					15									
	16														
		-5													
	18		1 1 1 1	100		18						16.5 / -4.3 Gray, fine to medium silty SAND, very loose, wet [D1] [SEDGEFIELD MEMBER (TABB FORMATION)] **SM**			24.0
	20					20									
	22	-10													
0.25	24		WOH WOH WOH 1	100		23 25						21.5 / -9.3 Gray, elastic SILT, trace sand, very soft, wet [D2] **MH**			72.7
	26														
		-15													
0.25	28		WOH WOH WOH 1	100		28 30						26.5 / -14.3 Gray, lean CLAY with sand, contains organic matter and mica, very soft, wet [D2] **CL**			56.5
	30														
	32	-20													
			7 5 7 7	100		33						31.5 / -19.3 Brown, PEAT, wet [D3] **PT**			194.1
	34														

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-071
PAGE 2 OF 3

STATION: 351+03 OFFSET: 34 ft LT
LATITUDE: 36.824525° N LONGITUDE: 76.326475° W
SURFACE ELEVATION: 12.2 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/29/2010 - 07/29/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 4.7 ft AFTER 147 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	35														
	36														
		-25	2 1 1 1	0											
	38					38									
	40					40									
	42	-30	3 3 3 3	100		43						41.5 / -29.3 Gray, lean CLAY with sand, contains organic matter, firm, wet [D2] **CL**			
0.25	44					45									86.0
	46														
	48	-35	WOH 2 2 1	100		48									
0.25	50					50									50.5
	52	-40	WOH 1 1 1	100		53						SAME, contains heavy concentrations of organic matter, soft below 53 ft			
0.25	54					55									94.7
	56														
	58	-45	WOH WOH 1 1	100		58						56.5 / -44.3 Gray, fat CLAY, trace sand, contains mica, very soft, wet [D2] **CH**			
0.25	60					60									45.0
	62	-50	WOH WOH 1 1	15		63									
0.25	64					65									46.5
	66														
	68	-55	4 9 12 10	100		68						66.5 / -54.3 Gray, fine to medium poorly graded SAND with silt, medium dense, wet [D1] **SP-SM**			
	70														19.0

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 3 OF 3

STATION: 351+03 OFFSET: 34 ft LT
LATITUDE: 36.824525° N LONGITUDE: 76.326475° W
SURFACE ELEVATION: 12.2 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/29/2010 - 07/29/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 4.7 ft AFTER 147 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)
	70														
	72	-60	2 2 3 6	100		73						71.5 / -59.3 Green gray, fine to coarse silty SAND, contains shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SM**			28.6
	74					75									
	76														
	78	-65	2 2 2 7	100		78						76.5 / -64.3 Green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] **SC**			31.9
	80					80									
	82	-70	2 2 6 18	100		83						SAME, medium dense below 83 ft			31.5
	84					85									
	86														
	88	-75	2 3 7 18	100		88									31.0
	90					90									
	92	-80	3 3 5 14	100		93									33.7
	94					95									
	96														
	98	-85	2 2 3 9	100		98						97.5 / -85.3 Green gray, sandy lean CLAY, contains shell fragments, stiff, wet [E2] **CL**			34.0
1.25	100					100						Bottom of Boring at 100 ft.			

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-073

STATION: 1001+67 OFFSET: 34 ft LT
LATITUDE: 36.824695° N LONGITUDE: 76.325984° W
SURFACE ELEVATION: 12.0 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/30/2010 - 07/30/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
- FIRST ENCOUNTERED AT 4.0 ft DEPTH
- STABILIZED AT 5.1 ft AFTER 126 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)
4.5	0	12	3 3 4	100		0.7						0.0 / 12.0 5-inches FOREST LITTER, ROOTMAT AND TOPSOIL **TOPS**			11.4
	2	10	3 4 4			2						0.4 / 11.6 Dark brown, fine to medium silty sand FILL, contains crushed stone and root fragments, loose, moist [A1] [FILL] **FL**			
1.25			4 5 9	100											15.9
	4 ▽		5 6 6	100		4						0.7 / 11.3 Gray, sandy lean CLAY, contains root fragments, stiff, moist [C2] [LYNNHAVEN MEMBER (TABB FORMATION)] **CL**			23.0
	▼														
	6		WOH 1 2	100		6									21.8
		5													
	8		2 2 2 3	100		8						3.5 / 8.5 Light brown, fine to medium poorly graded SAND, trace silt, medium dense, moist [C1] **SP** SAME, wet below 4 ft			21.7
	10					10									
		0										6.0 / 6.0 Gray, fine to medium poorly graded SAND with silt, loose, wet [C1] **SP-SM**			
	12		1 2 1	65		13						11.5 / 0.5 Green gray, fine to medium silty SAND, contains shell fragments, loose, wet [C1] **SM**			
	14														35.3
						15									
	16														
		-5													
	18		WOH WOH 1	100		18									
0.5	20					20						19.0 / -7.0 Green gray, fat CLAY, trace sand, contains organic matter, very soft, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CH**			49.4
	22	-10													
			WOH WOH 1	100		23									
0.5	24					25									74.4
	26														
		-15													
	28		WOH WOH 1	100		28						SAME, gray below 28 ft			
0.25	30					30									58.3
	32	-20										31.5 / -19.5 Brown, PEAT, wet [D3] **PT**			
			WOH 2 2 3	100		33									
	34														255.7

REMARKS:

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 1001+67 OFFSET: 34 ft LT
LATITUDE: 36.824695° N LONGITUDE: 76.325984° W
SURFACE ELEVATION: 12.0 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/30/2010 - 07/30/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 5.1 ft AFTER 126 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	35														
	36														
		-25													
	38		5 6 5 4	100		38									236.1
	40					40									
	42	-30													
	43		2 2 3 2	100		43									
	44					45									221.3
	46														
		-35													
	48		WOH 1 2 1	100		48						46.5 / -34.5 Gray, fine to medium clayey SAND, contains organic matter and mica, loose, wet [D1] **SC**			55.0
	50					50									
	52	-40													
	53		5 3 3 3	100		53						51.5 / -39.5 Gray, fine to medium silty SAND, contains organic matter and mica, loose, wet [D1] **SM**			34.5
	54					55									
	56														
		-45													
	58		1 1 2 2	100		58						56.5 / -44.5 Gray, fine to medium clayey SAND, contains organic matter and mica, loose, wet [D1] **SC**			51.4
	60					60									
	62	-50													
	63		WOH WOH WOH WOH	100		63						61.5 / -49.5 Gray, elastic SILT, trace sand, contains organic matter, very soft, wet [D2] **MH**			
0.25	64					65									39.1
	66														
		-55													
	68		WOH WOH 1 2	100		68									34.1
	70														

REMARKS:

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 1001+67 OFFSET: 34 ft LT
LATITUDE: 36.824695° N LONGITUDE: 76.325984° W
SURFACE ELEVATION: 12.0 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/30/2010 - 07/30/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 5.1 ft AFTER 126 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)
	70														
	72	-60	WOH 1 1 2	100		73 75						71.5 / -59.5 Gray, fine to medium silty SAND, very loose, wet [D1] **SM**			33.9
	74														
	76	-65	1 2 2 3	50		78 80						76.5 / -64.5 Green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SC**			32.8
	78														
	80														
	82	-70	2 3 2 5	100		83 85									32.5
	84														
	86	-75	2 2 3 7	100		88 90									32.0
	88														
	90														
	92	-80	2 3 2 5	100		93 95						91.5 / -79.5 Green gray, sandy lean CLAY, contains shell fragments, firm, wet [E2] **CL**			33.1
1	94														
	96	-85													
	98		2 2 3 5	100		98 100									36.3
0.25	100											Bottom of Boring at 100 ft.			

REMARKS:

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-075

STATION: 1003+56 OFFSET: 35 ft LT
LATITUDE: 36.825049° N LONGITUDE: 76.325663° W
SURFACE ELEVATION: 12.5 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/10/2010 - 08/11/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
FIRST ENCOUNTERED AT 6.0 ft DEPTH
STABILIZED AT 6.0 ft AFTER 20 HOURS

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT -#200 (%)
	0	12.5	12 9 7 7	15		2						0.0 / 12.5 2-inches CRUSHED STONE **CRA**			18.6	
	2	10	4 5 4 4	100		4						0.2 / 12.3 Brown, fine to coarse silty sand FILL, trace gravel, contains root fragments, medium dense, moist [A1] [FILL] **FL**			12.4	
	4		5 7 10 8	90		6						2.0 / 10.5 Gray, fine to medium clayey sand FILL, medium dense, moist [A1] **FL**			13.5	
	6	5	7 5 5 4	95		8						4.0 / 8.5 Light gray, fine to medium poorly graded SAND, trace silt, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP**			24.3	
	8		2 2 1 2	100		10						SAME, wet below 6 ft			24.4	
	10											SAME, loose below 8 ft				
	12	0				13										
	14		4 5 5 4	100		15						SAME, medium dense below 13 ft			27.6	
	16															
	18	-5	1 1 0 1	100		18						16.5 / -4.0 Gray, fine to medium clayey SAND, very loose, wet [D1] [SEDGEFIELD MEMBER (TABB FORMATION)] **SC**			27.4	
	20					20										
	22	-10										21.5 / -9.0 Gray, fat CLAY, trace sand, soft, moist [D2] **CH**				
0.5	24		1 1 1 1	100		23									65.4	
	26					25										
	28	-15	1 1 1 1	100		28							69	43	49.8	97.1
0.5	30					30										
	32	-20										31.5 / -19.0 Brown, PEAT, contains heavy concentrations of wood fragments, wet [D3] **PT**				
	34		4 6 8 9	15		33									418.9	

REMARKS: Rig Type: CME-550X (ATV).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-075

STATION: 1003+56 OFFSET: 35 ft LT
LATITUDE: 36.825049° N LONGITUDE: 76.325663° W
SURFACE ELEVATION: 12.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/10/2010 - 08/11/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
FIRST ENCOUNTERED AT 6.0 ft DEPTH
STABILIZED AT 6.0 ft AFTER 20 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	35															
	36															
	38	-25	8 7 4 4	20		38									337.8	
	40					40										
	42															
	43	-30	14 16 11 10	25		43									268.2	
	44															
	45					45										
	46															
	48	-35	1 0 1 2	65		48						46.5 / -34.0 Gray brown, sandy elastic SILT, contains organic matter and mica, very soft, moist [D2] **MH**				
0.25	50					50									49.6	
	52															
	53	-40	2 1 3 2	25		53						SAME, contains wood fragments, firm below 53 ft				
0.25	54					55									74.6	
	56															
	58	-45	WOH WOH 1 1	50		58						SAME, soft below 58 ft				
0.25	60					60									63.2	
	62															
	63	-50	WOH 1 1 2	55		63						61.5 / -49.0 Gray, fine to medium clayey SAND, very loose, wet [D1] **SC**				
	64					65							50	20	50.5	42.7
	66															
	68	-55	3 5 8 9	50		68						SAME, medium dense below 68			28.2	
	70															

REMARKS: Rig Type: CME-550X (ATV).

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-075

STATION: 1003+56 OFFSET: 35 ft LT
LATITUDE: 36.825049° N LONGITUDE: 76.325663° W
SURFACE ELEVATION: 12.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/10/2010 - 08/11/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
FIRST ENCOUNTERED AT 6.0 ft DEPTH
STABILIZED AT 6.0 ft AFTER 20 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	70															
	72	-60	9 10 7 9	75		73 75						71.5 / -59.0 Gray, fine to coarse poorly graded SAND with silt, contains organic matter, medium dense, wet [D1] **SP-SM**			14.6	
	74															
	76															
	78	-65	2 3 2 5	100		78 80						76.5 / -64.0 Green gray, fine to coarse clayey SAND, loose, wet [E1] [YORKTOWN FORMATION] **SC**			35.4	
	80															
	82	-70	3 2 2 7	100		83 85									32.9	
	84															
	86															
	88	-75	3 3 3 6	100		88 90									30.1	
	90															
	92	-80	2 2 3 5	100		93 95									33.7	
	94															
	96															
	98	-85	3 3 4 6	100		98 100									34.7	
	100											Bottom of Boring at 100 ft.				

REMARKS: Rig Type: CME-550X (ATV).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 1005+94 OFFSET: 37 ft LT
LATITUDE: 36.825669° N LONGITUDE: 76.325658° W
SURFACE ELEVATION: 11.1 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/10/2010 - 08/10/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 2.0 ft DEPTH

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	2	10	50 7 3 2	50		2						0.0 / 11.1 2-inches ASPHALT **ASPH**			11.7	
			5 5 10 6	50								0.2 / 10.9 4-inches CONCRETE **CONC**			22.7	
	4		7 5 4 4	95		4 5						0.5 / 10.6 Gray brown, fine to medium clayey sand FILL, medium dense, moist [A1] [FILL] **FL**			22.6	
	6	5	3 2 1 2	100		6						2.0 / 9.1 Light brown gray, fine poorly graded SAND, trace silt, medium dense, wet [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP**			33.0	
	8		3 5 4 5	100		8						5.0 / 6.1 Gray, fine to medium clayey SAND, contains mica, medium dense, wet [C1] **SC**			20.6	
	10					10						SAME, loose below 6 ft				
		0										SAME, medium dense below 8 ft				
	12					13						11.5 / -0.4 Gray, fine poorly graded SAND with silt, contains shell fragments, medium dense, wet [C1] **SP-SM**				
	14		6 5 4 4	100		15									21.3	
	16	-5														
0.5	18		WOH WOH WOH 1	100		18						16.5 / -5.4 Gray, fat CLAY, trace sand, very soft, moist [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CH**			66.6	
	20					20										
		-10														
	22					23										
0.5	24		WOH WOH WOH 2	100		25							94	66	70.7	96.4
	26	-15														
	28		1 0 1 0	100		28						SAME, contains organic matter below 28 ft			54.6	
0.5	30					30										
		-20														
	32											31.5 / -20.4 Brown and brown, PEAT, wet [D3] **PT**				
	34		3 2 2 5	100		33									280.5	

REMARKS: Rig Type: CME-550X (ATV).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 2 OF 3

STATION: 1005+94 OFFSET: 37 ft LT
LATITUDE: 36.825669° N LONGITUDE: 76.325658° W
SURFACE ELEVATION: 11.1 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/10/2010 - 08/10/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 2.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	36	-25	1 1 1 2	100		35 38						36.5 / -25.4 Dark brown, ORGANIC SILT, trace sand, soft, wet [D3] **OH**			165.3	
	40	-30				40										
	42		1 1 1 1	100		43 45						41.5 / -30.4 Brown gray, fine to medium clayey SAND, contains organic matter and mica, very loose, wet [D1] **SC**			41.8	
	44															
	46	-35														
0.5	48		1 1 2 3	100		48 50						46.5 / -35.4 Brown gray, elastic SILT, trace sand, contains mica, soft, moist [D2] **MH**			70.1	
	50	-40														
	52		1 1 1 3	100		53 55						51.5 / -40.4 Brown gray, fine to medium clayey SAND, very loose, moist [D1] **SC**			53.2	
	54															
	56	-45														
	58		1 1 2 3	100		58 60						56.5 / -45.4 Brown gray, sandy SILT, contains organic matter, soft, wet [D2] **ML**	42	5	43.3	51.2
	60	-50														
	62															
	64		3 2 2 3	100		63 65						61.5 / -50.4 Gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SC**			29.2	
	66	-55														
	68		2 1 2 4	100		68									34.5	
	70															

REMARKS: Rig Type: CME-550X (ATV).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 1005+94 OFFSET: 37 ft LT
LATITUDE: 36.825669° N LONGITUDE: 76.325658° W
SURFACE ELEVATION: 11.1 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/10/2010 - 08/10/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 2.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	70															
	72	-60														
	73		2 2 3 5	100											29.9	
	74															
	75															
	76	-65														
	78		2 2 3 8	60											32.1	
	80															
	82	-70														
	83		2 2 3 6	100											31.1	
	84															
	85															
	86	-75														
	88		2 2 4 6	100											32.4	
	90															
	92	-80														
	93		2 1 4 6	100											31.3	
	94															
	95															
	96	-85														
	98		3 2 5 9	100											31.0	
	100											Bottom of Boring at 100 ft.				

REMARKS: Rig Type: CME-550X (ATV).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-081
PAGE 1 OF 3

STATION: 1007+77 OFFSET: 59 ft LT
LATITUDE: 36.826170° N LONGITUDE: 76.325765° W
SURFACE ELEVATION: 11.9 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/30/2010 - 07/30/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 4.5 ft AFTER 124 HOURS

LABORATORY DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)	ORGANIC CONTENT (%)
	0	11.9	14 7 3 3	25		2						0.0 / 11.9 2-inches FOREST LITTER, ROOTMAT AND TOPSOIL **TOPS**			8.4		
	2	10	3 3 3 4	90		4						0.2 / 11.7 Orange brown, fine to coarse silty sand FILL, contains gravel, medium dense, moist [A1] [FILL] **FL**			6.8		
	4		3 3 2 1	100		6						2.0 / 9.9 Light brown, fine to medium poorly graded SAND, trace silt, loose, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP**			22.1		
	6		2 2 2 1	100		8									26.0		
	8	5	1 1 2 3	100		10						SAME, wet below 4 ft SAME, gray below 6 ft			22.5		
	10											8.0 / 3.9 Gray, fine to medium poorly graded SAND with silt, loose, wet [C1] **SP-SM**					
	12	0	3 3 3 4	100		13 15									31.0		
	14																
	16																
	18	-5	1 1 0 1	100		18 20						16.5 / -4.6 Gray, fat CLAY, trace sand, contains mica and silty sand pockets, very soft, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CH**					
0.25	20												78	54	65.1	88.5	
	22	-10	WOH WOH 1 1	100		23 25									73.6		
0.25	24																
	26																
	28	-15	WOH 1 1 1	100		28 30									63.2		
0.25	30																
	32	-20	1 2 4 4	100		33						31.5 / -19.6 Dark brown, PEAT, wet [D3] **PT**					
	34												322	62	253.8	5.8	

REMARKS:

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SPT_LOGABC:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 2 OF 3

STATION: 1007+77 OFFSET: 59 ft LT
LATITUDE: 36.826170° N LONGITUDE: 76.325765° W
SURFACE ELEVATION: 11.9 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/30/2010 - 07/30/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 4.5 ft AFTER 124 HOURS

FIELD DATA / **LABORATORY DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)	ORGANIC CONTENT (%)
	35					35											
	36	-25										36.5 / -24.6 Black, ORGANIC SILT, trace sand, soft, wet [D3] **OH**					
0.5	38		1 2 1 3	100		38									99.7		47.1
	40					40											
	42	-30										41.5 / -29.6 Gray, fine to medium silty SAND, contains organic matter and mica, loose, wet [D1] **SM**					
	43		2 3 2 3	100		43									40.2		
	44					45											
	46	-35										46.5 / -34.6 Gray, fine to medium clayey SAND, contains organic matter and mica, loose, wet [D1] **SC**					
	48		WOH 1 5 4	100		48									54.1		
	50					50						49.0 / -37.1 Gray, fine to medium poorly graded SAND with silt, medium dense, wet [D1] **SP-SM**					
	52	-40															
	53		6 7 5 6	100		53									23.4		
	54					55											
	56	-45										56.5 / -44.6 Gray, fine to medium clayey SAND, contains organic matter and mica, very loose, wet [D1] **SC**					
	58		WOH WOH WOH 1	100		58									49.3		
	60					60											
	62	-50										61.5 / -49.6 Green gray, fine to coarse silty SAND, contains shell fragments and coquina, very loose, wet [E1] [YORKTOWN FORMATION] **SM**					
	63		WOH WOH 2 2	90		63									36.8		
	64					65											
	66	-55										66.5 / -54.6 Green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] **SC**					
	68		2 1 2 4	100		68							35	13	34.4	39.1	
	70																

REMARKS:

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SPT_LOGABC:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 3 OF 3

STATION: 1007+77 OFFSET: 59 ft LT
LATITUDE: 36.826170° N LONGITUDE: 76.325765° W
SURFACE ELEVATION: 11.9 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/30/2010 - 07/30/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 4.5 ft AFTER 124 HOURS

LABORATORY DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)	ORGANIC CONTENT (%)
	70																
	72	-60	3 2 3 6	100		73						SAME, fine to medium below 73 ft	30	11	31.7	36.3	
	74					75											
	76	-65															
	78		2 1 2 5	100		78									33.9		
	80					80											
	82	-70															
	84		1 2 3 5	100		83									34.3		
	86					85											
	88	-75															
	90		2 3 3 7	100		88									35.6		
	92	-80				90											
	94		2 1 3 6	100		93									34.5		
	96					95											
	98	-85															
	100		3 3 3 5	100		98									32.3		
						100						Bottom of Boring at 100 ft.					

REMARKS:

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SPT_LOGABC:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 1 OF 3

STATION: 1438+53 OFFSET: 117 ft RT
LATITUDE: 36.826527° N LONGITUDE: 76.325113° W
SURFACE ELEVATION: 11.9 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/04/2010 - 08/04/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.5 ft DEPTH
▼ STABILIZED AT 4.8 ft AFTER 269 HOURS

FIELD DATA / **LABORATORY DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)	ORGANIC CONTENT (%)
3	2	10	3 2 3	85		2						0.0 / 11.9 2-inches ROOTMAT AND TOPSOIL **TOPS**			10.7		
2.5	4		2 2 3	100		4						0.2 / 11.7 Dark gray, sandy lean clay FILL, contains burnt wood and root fragments, firm, moist [A2] [FILL] **FL**			13.2		
	6	5	4 5 4	100		6						2.0 / 9.9 Gray, sandy lean CLAY, contains root fragments, firm, moist [C2] [LYNNHAVEN MEMBER (TABB FORMATION)] **CL**			25.3		
	8		2 2 1	100		8						3.3 / 8.6 Brown, fine to medium poorly graded SAND, trace silt, loose, moist [C1] **SP**			26.0		
	10		1 1 2	85		10						SAME, light brown, medium dense, wet below 4 ft SAME, gray, loose below 6 ft			24.4		
	12	0										8.0 / 3.9 Gray, fine to medium poorly graded SAND with silt, contains organic matter, loose, wet [C1] **SP-SM**					
	14		2 2 3	100		13									21.7		
	16					15											
	18	-5	1 1 1	100		18						16.5 / -4.6 Gray, fine to medium silty SAND, contains shell fragments, very loose, wet [D1] [SEDGEFIELD MEMBER (TABB FORMATION)] **SM**					
0.25	20					19.5 20									37.6		
	22	-10										19.5 / -7.6 Gray, lean CLAY with sand, soft, wet [D2] **CL**					
			WOH 1 0	100		23						21.5 / -9.6 Gray, fat CLAY, trace sand, contains mica, very soft, moist [D2] **CH**					
0.25	24					25							95	65	69.3	99.2	
	26	-15															
	28		WOH WOH 1	100		28						SAME, contains organic matter below 28 ft					
0.25	30					30									50.0		
	32	-20										31.5 / -19.6 Brown, PEAT, wet [D3] **PT**					
	34		2 2 3 4	100		33							386	103	297.4	5.3	62.7

REMARKS: Rig Type: CME-550X (ATV).

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SPT_LOGABC:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 2 OF 3

STATION: 1438+53 OFFSET: 117 ft RT
LATITUDE: 36.826527° N LONGITUDE: 76.325113° W
SURFACE ELEVATION: 11.9 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/04/2010 - 08/04/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 6.5 ft DEPTH
STABILIZED AT 4.8 ft AFTER 269 HOURS

LABORATORY DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)	ORGANIC CONTENT (%)
	35																
	36	-25															
	38		2 2 3 3	100		38									154.6		
	40					40											
	42	-30										41.5 / -29.6 Gray, fine to medium silty SAND, contains organic matter and mica, loose, wet [D1] **SM**					
	43					43											
	44		WOH 1 2 1	100		45									38.5		
	46																
	48	-35				48						46.5 / -34.6 Brown and gray, elastic SILT, contains organic matter and mica, trace sand, very soft, wet [D2] **MH**					
0.25	50		WOH WOH WOH 1	100		50							62	19	67.8	85.4	
	52	-40															
	53					53											
0.25	54		WOH WOH WOH WOH	100		55									42.9		
	56																
	58	-45				58											
0.25	60		WOH WOH 1 2	100		60									55.9		
	62	-50										61.5 / -49.6 Gray, sandy lean CLAY, contains organic matter and mica, soft, moist [D2] **CL**					
	63					63											
1	64		WOH 1 2 3	100		65							35	19	24.1	68.6	
	66																
	68	-55				68											
0.5	70		1 3 13 16	100											24.3		

REMARKS: Rig Type: CME-550X (ATV).

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SPT_LOGABC:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 3 OF 3

STATION: 1438+53 OFFSET: 117 ft RT
LATITUDE: 36.826527° N LONGITUDE: 76.325113° W
SURFACE ELEVATION: 11.9 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/04/2010 - 08/04/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 6.5 ft DEPTH
STABILIZED AT 4.8 ft AFTER 269 HOURS

LABORATORY DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)	ORGANIC CONTENT (%)
	70															
	72	-60	3 4 3 4	100		73 75										
	74													25.9		
	76															
	78	-65	2 2 2 4	100		78 80								33.5		
	80															
	82	-70	2 2 2 5	100		83 85								32.0		
	84															
	86	-75	1 2 2 5	100		88 90								34.4		
	88															
	90															
	92	-80	2 3 3 5	100		93 95								32.2		
	94															
	96	-85	2 3 3 5	100		98 100								31.7		
	98															
	100															

FIELD DESCRIPTION OF STRATA

69.6 / -57.7
Green gray, fine to coarse poorly graded SAND with silt, medium dense, wet [D1] **SP-SM**

71.5 / -59.6
Green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SC**

Bottom of Boring at 100 ft.

REMARKS: Rig Type: CME-550X (ATV).

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SPT_LOGABC:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 1011+17 OFFSET: 39 ft LT
LATITUDE: 36.827086° N LONGITUDE: 76.325786° W
SURFACE ELEVATION: 12.3 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/25/2010 - 08/25/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 5.0 ft AFTER 47 HOURS

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT -#200 (%)
			3 5 5	85		2						0.0 / 12.3 4-inches ROOTMAT AND TOPSOIL **TOPS**			4.9	
	2	10	5 6 5	90		4						0.3 / 12.0 Orange brown, fine to coarse silty sand FILL, contains root fragments and crushed stone, medium dense, moist [A1] [FILL] **FL**			9.7	
	4		5 7 6	85		6						1.0 / 11.3 Light brown, fine to medium poorly graded sand FILL, trace silt, medium dense, moist [A1] **FL**			21.6	
	6	5	3 3 3	90		8						2.0 / 10.3 Brown gray, fine to medium clayey SAND, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SC**			24.8	
	8		2 1 2	100		10						4.0 / 8.3 Gray brown, fine to medium poorly graded SAND, trace silt, medium dense, wet [C1] **SP**			23.1	
	10		2									6.0 / 6.3 Gray brown, fine to medium poorly graded SAND with silt, loose, wet [C1] **SP-SM**				
	12	0	3 3 5	75		13						11.5 / 0.8 Green gray, fine to medium silty SAND, contains shell fragments, loose, wet [C1] **SM**			26.0	
	14					15										
	16															
	18	-5	WOH 1 1	85		18										
0.25	20					20						19.5 / -7.2 Gray, fat CLAY, trace sand, soft, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CH**			66.5	
	22	-10	WOH WOH 1	100		23						SAME, green gray, contains mica below 23 ft				
0.5	24		1			25									73.2	
	26															
	28	-15	WOH WOH WOH 1	100		28						SAME, gray below 28 ft	86	59	66.4	95.4
0.25	30					30										
	32	-20										31.5 / -19.2 Brown, PEAT, wet [D3] **PT**				
	34		1 2 2 5	100		33									207.5	

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 1011+17 OFFSET: 39 ft LT
LATITUDE: 36.827086° N LONGITUDE: 76.325786° W
SURFACE ELEVATION: 12.3 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/25/2010 - 08/25/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 5.0 ft AFTER 47 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	35															
	36	-25										36.5 / -24.2 Brown, ORGANIC CLAY, soft, wet [D3] **OH**				
0.5	38		3 1 2 2	100		38							55	33	81.3	91.4
	40					40										
	42	-30										41.5 / -29.2 Gray, fine to medium silty SAND, contains organic matter and mica, loose, wet [D1] **SM**				
	44		2 2 3 4	100		43 45									39.6	
	46															
	48	-35	WOH WOH 2 1	100		48 50						46.5 / -34.2 Green gray, fine to medium clayey SAND, contains organic matter and mica, very loose, wet [D1] **SC**			64.2	
	52	-40										51.5 / -39.2 Green gray, fine to medium poorly graded SAND, trace silt, contains organic matter and mica, medium dense, wet [D1] **SP**				
	54		2 5 8 10	75		53 55									30.4	
	56															
	58	-45	WOH WOH 2 1	100		58 60						56.5 / -44.2 Green gray, fine to medium silty SAND, contains organic matter and mica, very loose, wet [D1] **SM**			46.6	
	60															
	62	-50										61.5 / -49.2 Green gray, fat CLAY, trace sand, contains organic matter and mica, stiff, moist [D2] **CH**				
2	64		1 3 4 6	100		63 65									30.7	
	66															
	68	-55	4 4 5 12	100		68						66.5 / -54.2 Green gray, fine to medium silty SAND, contains organic matter, mica and shell fragments, medium dense, wet [D1] **SM**			25.3	
	70															

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 1011+17 OFFSET: 39 ft LT
LATITUDE: 36.827086° N LONGITUDE: 76.325786° W
SURFACE ELEVATION: 12.3 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/25/2010 - 08/25/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 5.0 ft AFTER 47 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT #200 (%)
	70															
	72	-60	2 3 5 8	100		73						71.5 / -59.2 Green gray, fine to coarse silty SAND, contains shell fragments, medium dense, wet [E1] [YORKTOWN FORMATION] **SM**			30.8	
	74					75										
	76															
	78	-65	2 3 5 16	100		78						76.5 / -64.2 Green gray, fine to coarse clayey SAND, contains shell fragments, medium dense, wet [E1] **SC**			33.3	
	80					80										
	82	-70	2 3 4 16	100		83						SAME, loose below 81.5 ft			33.4	
	84					85										
	86															
	88	-75	3 3 5 15	100		88						SAME, medium dense below 88 ft			34.3	
	90					90										
	92	-80	2 3 4 9	100		93						SAME, trace gravel, loose below 93 ft			33.4	
	94					95										
	96															
	98	-85	3 3 8 17	100		98						SAME, medium dense below 98 ft			32.0	
	100					100						Bottom of Boring at 100 ft.				

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 12

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PAGE 1 OF 3

STATION: 1012+70.55 OFFSET: 7.00 RT
LATITUDE: 36.827532° N LONGITUDE: 76.325607° W
SURFACE ELEVATION: 12.8 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/12/2010 - 4/12/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 5.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
2	10	NR NR 2 / 1 1 3	50		2						0.0 / 12.8 Dark gray, fine clayey SAND, loose, moist. **SC**			17.0	
4			75		4									15.0	
6		5 8 8 / 4 4 7	90		6						4.0 / 8.8 Light gray, fine to medium SAND, medium dense, wet. **SP**			22.0	
8	5	9 4 5 6	100		8									21.0	
10			100		10						8.0 / 4.8 Light gray, fine to medium SAND, loose, wet. **SP**			22.0	
12	0	4 4 2 3	75		13						11.5 / 1.3 Gray, silty SAND, trace shell fragments, loose, wet. **SM**			28.0	
14					15										
16															
18	-5	2 1 1 1	80		18									26.0	
20					20										
22	-10	2 1 1 1	100		23						21.5 / -8.7 Dark green to gray, CLAY, soft, wet. **CH**			65.0	
24					25										
26															
28	-15	WOH WOH 1 1	100		28							52	31	53.0	74.0
30					30										
32	-20	1 1 2 2	0		33						31.5 / -18.7 NO RECOVERY				
34					35										
36															
38	-25	2 2 3 4	85		38						36.5 / -23.7 Brown, ORGANIC SILT, medium stiff, wet. **OH**	204	95	165.0	70.0
40															

REMARKS: Rig Type: CME-550. Top of Yortown Formation estimated at 73.5 feet in depth, elevation -60.7 feet. This borehole was offset 20' west of its original staked position (along the pier alignment) due to an overhead power line conflict.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 12

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STATION: 1012+70.55 OFFSET: 7.00 RT
LATITUDE: 36.827532° N LONGITUDE: 76.325607° W
SURFACE ELEVATION: 12.8 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/12/2010 - 4/12/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 5.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
40															
42	-30	1 1 2 1	60		43						41.5 / -28.7 Brown, ORGANIC SILT, soft, wet. **OH**			111.0	
44					45										
46											46.5 / -33.7 Dark brown to gray, silty fine SAND, loose, wet. **SM**				
48	-35	2 3 4 4	80		48									43.0	
50					50										
52											51.5 / -38.7 Dark gray, SILT, soft, wet. **ML**				
54	-40	WOH 1 1 1	75		53							46	17	46.0	67.0
56					55										
58	-45	WOH 1 1 1	0		58										
60					60										
62											61.5 / -48.7 Green gray, clayey SAND, micaceous, loose, moist. **SC**				
64	-50	WOH 2 2 1	100		63							27	10	23.0	49.0
66					65										
68	-55	WOH WOH WOH 2	100		68									32.0	
70					70										
72											71.5 / -58.7 Brown to gray, sandy GRAVEL , medium dense, wet. **GW**				
74	-60	4 5 6 6	100		73						73.5 / -60.7 Brown to gray, silty SAND, medium dense, wet. **SM**	23	5	25.0	34.0
76					75										
78	-65	2 2 3 10	100		78						76.5 / -63.7 Gray, fine to coarse silty SAND, loose, moist. **SM**			34.0	
80															

REMARKS: Rig Type: CME-550. Top of Yortown Formation estimated at 73.5 feet in depth, elevation -60.7 feet. This borehole was offset 20' west of its original staked position (along the pier alignment) due to an overhead power line conflict.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 12

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STATION: 1012+70.55 OFFSET: 7.00 RT
LATITUDE: 36.827532° N LONGITUDE: 76.325607° W
SURFACE ELEVATION: 12.8 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/12/2010 - 4/12/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 5.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
80															
82	-70	2 1 2 5	100		83						81.5 / -68.7 Gray, fine to medium clayey SAND, loose, moist. **SC**	35	13	35.0	41.0
84					85										
86															
88	-75	4 2 5 10	100		88									34.0	
90					90										
92											91.5 / -78.7 Green to gray, sandy CLAY, micaceous, medium stiff, moist. **CL**				
94	-80	2 2 3 8	100		93									34.0	
96					95										
98											96.5 / -83.7 Green to gray, sandy CLAY, micaceous, stiff, moist. **CL**				
100	-85	3 4 5 11	100		98									31.0	
					100						End of Boring.				

REMARKS: Rig Type: CME-550. Top of Yortown Formation estimated at 73.5 feet in depth, elevation -60.7 feet. This borehole was offset 20' west of its original staked position (along the pier alignment) due to an overhead power line conflict.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 13

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PAGE 1 OF 3

STATION: 1014+20.99 OFFSET: 27.69 LT
LATITUDE: 36.827896° N LONGITUDE: 76.325877° W
SURFACE ELEVATION: 13.1 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/12/2010 - 4/12/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
0		NR NR NR NR	50		2						0.0 / 13.1 Gray, sandy CLAY, moist. **CL**			20.0	
2	10	NR NR NR NR	100		4						2.0 / 11.1 Gray, silty SAND, moist. **SM**			23.0	
4		3 5 3 2	100		6						4.0 / 9.1 Light gray, medium SAND, loose, wet. **SW**			23.0	
6 ▽		1 4 3 2	85		8						6.0 / 7.1 Gray, fine to medium SAND, loose, wet. **SP**			22.0	
8	5	3 2 1 2	100		10									23.0	
10															
12											11.5 / 1.6 Gray, fine silty SAND, trace shell fragments, loose, wet. **SM**				
14	0	6 4 3 2	80		13 15									28.0	
16															
18	-5	2 1 1 1	95		18 20						16.5 / -3.4 Gray, fine silty SAND, little shell fragments, loose, wet. **SM**			27.0	
20															
22											21.5 / -8.4 Blue to gray, CLAY, soft, wet. **CH**				
24	-10	1 1 1 1	100		23 25							78	50	65.0	98.0
26															
28	-15	WOH WOH 1 1	100		28 30									66.0	
30															
32											31.5 / -18.4 Brown, ORGANICS, medium stiff, moist. **OL**				
34	-20	2 1 3 4	100		33 35									262.0	
36															
38	-25	2 1 2 2	78		38						36.5 / -23.4 Brown, ORGANIC SILT, soft, moist. **OH**	107	43	178.0	65.0
40															

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 70 feet in depth, elevation -56.9 feet. This borehole was offset 70' west of its original staked position, along the pier alignment. The original location was outside the CSXT property.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 13

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STATION: 1014+20.99 OFFSET: 27.69 LT
LATITUDE: 36.827896° N LONGITUDE: 76.325877° W
SURFACE ELEVATION: 13.1 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/12/2010 - 4/12/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
40															
42											41.5 / -28.4 Brown, silty SAND, micaceous & trace of organics, loose, moist. **SM**				
43	-30	2 1 1 2	95									47	17	42.0	43.0
44															
45															
46															
48	-35	1 1 1 1	100											54.0	
50															
52											51.5 / -38.4 Brown to gray, silty SAND, micaceous, medium dense, wet. **SM**				
53	-40	3 5 5 8	90											36.0	
55															
58	-45	4 4 7 9	75											35.0	
60															
62											61.5 / -48.4 Blue to gray, CLAY, medium stiff, wet. **CL**				
63	-50	WOH 1 3 3	100									46	22	30.0	96.0
65															
66															
68	-55	4 3 3 4	100									42	23	28.0	70.0
70															
72											71.5 / -58.4 Gray, fine to coarse silty SAND, trace shells, loose, wet. **SM**				
73	-60	2 2 3 6	100											34.0	
75															
76											76.5 / -63.4 NO RECOVERY				
78	-65	2 2 3 5	0												
80															

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 70 feet in depth, elevation -56.9 feet. This borehole was offset 70' west of its original staked position, along the pier alignment. The original location was outside the CSXT property.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 13

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PAGE 3 OF 3

STATION: 1014+20.99 OFFSET: 27.69 LT
LATITUDE: 36.827896° N LONGITUDE: 76.325877° W
SURFACE ELEVATION: 13.1 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/12/2010 - 4/12/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
80					80										
82															
	-70	3 2 3 10	100		83										
84														35.0	
85					85										
86															
88	-75	3 2 2 8	100		88									34.0	
90					90										
92															
	-80	2 2 4 8	100		93										
94												44	26	31.0	52.0
95					95										
96															
98	-85	3 2 4 7	100		98									33.0	
100					100										

81.5 / -68.4
Green to gray, clayey SAND, trace shell fragments, loose, moist. **SC**

91.5 / -78.4
Green to gray, sandy CLAY, trace shell fragments, stiff, moist. **CL**

End of Boring.

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 70 feet in depth, elevation -56.9 feet. This borehole was offset 70' west of its original staked position, along the pier alignment. The original location was outside the CSXT property.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-093
PAGE 1 OF 3

STATION: 106+20 OFFSET: 34 ft RT
LATITUDE: 36.826572° N LONGITUDE: 76.326559° W
SURFACE ELEVATION: 12.5 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/24/2010 - 08/24/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 4.2 ft AFTER 27 HOURS

FIELD DATA | **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)
												0.0 / 12.5 4-inches ROOTMAT AND TOPSOIL **TOPS**			4.8
	2	10	5 7 3	75		3 2						0.3 / 12.2 Orange brown, fine to coarse silty sand FILL, contains crushed stone, medium dense, moist [A1] [FILL] **FL**			13.8
	4		2 1 0	15		1						2.0 / 10.5 Light brown, fine to medium poorly graded sand FILL, trace silt, contains silty sand pockets, very loose, moist [A1] **FL**			22.4
	6		1 5 8	85		4 6						4.0 / 8.5 Light brown gray, fine to medium poorly graded SAND, trace silt, medium dense, wet [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP**			20.7
	8	5	5 6 9	100		9 8						SAME, contains lean clay pockets below 6 ft			
	10		4 5 8	100		9 10						SAME, contains organic matter below 8 ft			21.7
	12	0	3 3 5	100		6 13						11.5 / 1.0 Gray, fine to medium poorly graded SAND with silt, medium dense, wet [D1] **SP-SM**			25.9
	14					15									
	16														
	18	-5	1 1 1	100		18									
0.25	20					20						19.6 / -7.1 Gray, elastic SILT, trace sand, soft, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **MH**			63.9
	22														
	24	-10	WOH 1 0	100		23 25									
0.25	26														61.3
	28	-15	WOH 1 1	100		28						26.5 / -14.0 Gray, elastic SILT with sand, contains organic matter and mica, soft, wet [D2] **MH**			
0.25	30					30									63.6
	32	-20	3 3 5	100		33						31.5 / -19.0 Brown, PEAT, wet [D3] **PT**			
	34														260.4

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 2 OF 3

STATION: 106+20 OFFSET: 34 ft RT
LATITUDE: 36.826572° N LONGITUDE: 76.326559° W
SURFACE ELEVATION: 12.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/24/2010 - 08/24/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH
▼ STABILIZED AT 4.2 ft AFTER 27 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT LL	LAB: PLASTICITY INDEX PI	LAB: MOISTURE CONTENT (%)
	35														
	36														
		-25										36.5 / -24.0 Gray brown, ORGANIC SILT, trace sand, soft, wet [D3] **OH**			
0.5	38		1 1 1 3	100		38									115.2
	40					40									
	42														
		-30										41.5 / -29.0 Gray, fine to medium silty SAND, contains organic matter and mica, medium dense, wet [D1] **SM**			
	43		3 9 6 4	100		43									35.9
	44					45									
	46														
		-35													
	48		WOH 1 1 1	100		48									46.5
	50					50									
	52											51.5 / -39.0 Green gray, fine to medium poorly graded SAND, trace silt, contains mica, medium dense, wet [D1] **SP**			
		-40													
	53		8 9 10 10	85		53									23.8
	54					55									
	56														
		-45													
	58		16 18 20 15	65		58									23.1
	60					60									
	62											61.5 / -49.0 Green gray, fine to coarse silty SAND, contains heavy concentrations of shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SM**			
		-50													
	63		4 3 3 5	100		63									39.4
	64					65									
	66														
		-55										66.5 / -54.0 Green gray, fine to coarse clayey SAND, contains shell fragments, medium dense, wet [E1] **SC**			
	68		3 4 4 12	100		68									32.1
	70														

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 3 OF 3

STATION: 106+20 OFFSET: 34 ft RT
LATITUDE: 36.826572° N LONGITUDE: 76.326559° W
SURFACE ELEVATION: 12.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/24/2010 - 08/24/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 4.2 ft AFTER 27 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)
	70														
	72	-60	3 2 4 10	100		73						71.5 / -59.0 Green gray, fine to coarse silty SAND, contains shell fragments and coquina, loose, wet [E1] **SM**			29.4
	74					75									
	76														
	78	-65	3 3 4 12	100		78						76.5 / -64.0 Green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] **SC**			30.5
	80					80									
	82	-70	3 4 6 10	100		83						SAME, medium dense below 83 ft			29.3
	84					85									
	86														
	88	-75	4 5 6 14	100		88									31.9
	90					90									
	92														
	94	-80	3 4 5 11	100		93									32.7
	96					95									
	98	-85	2 3 6 10	100		98									32.8
	100					100						Bottom of Boring at 100 ft.			

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 1 OF 3

STATION: 105+36 OFFSET: 13 ft LT
LATITUDE: 36.826722° N LONGITUDE: 76.326273° W
SURFACE ELEVATION: 12.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/23/2010 - 07/23/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
			14 8 5 5	65		2						0.0 / 12.5 2-inches ASPHALT **ASPH**			14.8
	2	10	5 6 5 6	100		4						0.2 / 12.3 5-inches CRUSHED STONE **CRA**			9.1
	4 ▽		4 4 4 4	100		6						0.6 / 11.9 Brown, fine to coarse silty sand FILL, contains gravel, medium dense, moist [A1] [FILL] **FL**			19.6
	6	5	4 6 7 6	100		8						2.0 / 10.5 Gray, fine to medium poorly graded SAND, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP**			22.3
	8		5 4 5 6	100		10						4.0 / 8.5 Gray, fine to medium poorly graded SAND with silt, medium dense, wet [C1] **SP-SM**			21.9
	10														
	12	0	3 3 2 2	100		13 15						SAME, loose below 13 ft			26.5
	14														
	16														
	18	-5	1 1 1 1	100		18 20						16.5 / -4.0 Gray, fine to medium clayey SAND, very loose, wet [D1] [SEDGEFIELD MEMBER (TABB FORMATION)] **SC**			25.7
	20														
	22	-10	1 0 0 0	100		23 25						21.5 / -9.0 Gray, fat CLAY, trace sand, very soft, moist [D2] **CH**			76.6
0.5	24														
	26														
	28	-15	1 0 1 1	100		28 30						SAME, contains organic matter below 28 ft			55.5
0.5	30														
	32	-20	3 4 4 6	100		33						31.5 / -19.0 Dark brown, ORGANIC SILT, trace sand, stiff, moist [D3] **OH**			247.4
	34														

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 2 OF 3

STATION: 105+36 OFFSET: 13 ft LT
LATITUDE: 36.826722° N LONGITUDE: 76.326273° W
SURFACE ELEVATION: 12.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/23/2010 - 07/23/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	36					35									
	38	-25	2 2 2 3	100		38						SAME, firm below 38 ft			
1.25	40					40									146.4
	42	-30	4 5 5 6	100		43						41.5 / -29.0 Brown gray, fine poorly graded SAND with silt, contains organic matter and mica, medium dense, wet [D1] **SP-SM**			
	44					45									33.9
	46	-35	1 0 1 1	75		48						46.5 / -34.0 Brown gray, sandy SILT, contains heavy concentrations of organic matter, very soft, wet [D2] **ML**			
1.5	48					48									50.9
	50					50									
	52	-40	4 4 5 5	100		53						51.5 / -39.0 Brown gray, fine to medium clayey SAND, contains organic matter, medium dense, wet [D1] **SC**			
	54					55									23.2
	56	-45	6 6 8 10	100		58						56.5 / -44.0 Green gray, fine poorly graded SAND with silt, medium dense, wet [D1] **SP-SM**			
	58					58									23.4
	60					60									
	62	-50	6 5 6 7	100		63						61.5 / -49.0 Light green gray, fine to coarse clayey SAND, contains heavy concentrations of shell fragments, medium dense, wet [E1] [YORKTOWN FORMATION] **SC**			
	64					65									32.4
	66														
	68	-55	4 2 4 11	100		68									31.1
	70														

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

STATION: 105+36 OFFSET: 13 ft LT
LATITUDE: 36.826722° N LONGITUDE: 76.326273° W
SURFACE ELEVATION: 12.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/23/2010 - 07/23/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	70														
	72	-60	3 3 3 4	100		73									31.4
	74					75									
	76														
	78	-65	4 4 6 11	100		78						SAME, fine to medium, medium dense below 78 ft			32.8
	80					80									
	82	-70	5 5 6 7	100		83									30.0
	84					85									
	86														
	88	-75	2 3 3 12	100		88						SAME, loose below 88 ft			33.0
	90					90									
	92	-80	3 3 7 12	100		93						SAME, medium dense below 93 ft			34.1
	94					95									
	96														
	98	-85	2 2 4 9	100		98						SAME, loose below 98 ft			32.9
	100					100						Bottom of Boring at 100 ft.			

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 1 OF 1

STATION: 105+36 OFFSET: 15 ft LT
LATITUDE: 36.826722° N LONGITUDE: 76.326273° W
SURFACE ELEVATION: 12.5 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/23/2010 - 07/23/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER

FIELD DATA / LABORATORY DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LABORATORY DATA: LIQUID LIMIT (LL)	LABORATORY DATA: PLASTICITY INDEX (PI)	LABORATORY DATA: MOISTURE CONTENT (%)	LABORATORY DATA: FINES CONTENT #200 (%)	LABORATORY DATA: ORGANIC CONTENT (%)
	2	10										0.0 / 12.5 Rotary probe to 22 ft; see Boring 10BH-096 for strata descriptions.					
	4																
	6																
	8	5															
	10																
	12	0															
	14																
	16																
	18	-5															
	20																
1	22	-10		100		22						22.0 / -9.5 Gray, fat CLAY, trace sand, moist [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CH**	100	77	74.0	99.8	
	24					24						24.0 / -11.5 Rotary probe to 32 ft; see Boring 10BH-096 for strata descriptions.					
	26																
	28	-15															
	30																
	32	-20				32						32.0 / -19.5 Dark brown, PEAT, wet [D3] **PT**					
1	34			90		34						Bottom of Boring at 34 ft.	332	82	285.3	1.4	54.7

REMARKS: Rig Type: CME-45C (Track).

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10BH-096A

SPT_LOGABC:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: RAMP PIER

10BH-097
PAGE 1 OF 3

STATION: 104+23.70 OFFSET: 32.60 RT
LATITUDE: 36.826987° N LONGITUDE: 76.325928° W
SURFACE ELEVATION: 13.9 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/14/2010 - 4/14/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: James Martin

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA / **LAB DATA**

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
2		1 2 4 3	75		2						0.0 / 13.9 Brown to tan, fine SAND, loose, dry. **SP**			14.0	
4	10	2 1 2 1	50		4						3.0 / 10.9 Tan, lean CLAY, soft, moist. **CL**			20.0	
6 ▽		1 1 2 4	67		6						4.0 / 9.9 Gray to tan, clayey SAND, loose, wet. **SC**			23.0	
8	5	3 4 6 7	92		8						5.0 / 8.9 Gray, fine SAND, loose, wet. **SW**			23.0	
10		3 6 6 8	100		10						8.0 / 5.9 Tan to gray, fine SAND, medium dense, wet. **SW**			19.0	
12					13						11.5 / 2.4 Gray, fine SAND, trace of silt, loose, wet. **SW**				
14	0	4 3 3 3	67		15									30.0	
16															
18					18						16.5 / -2.6 Gray, fine SAND, trace of silt and clay, loose, wet. **SW**				
20	-5	2 2 1 1	100		20									26.0	
22											21.5 / -7.6 Gray, CLAY, soft, wet. **CH**				
24	-10	WOH 1 1 1	100		25							74	46	70.0	98.0
26											26.5 / -12.6 Same, very soft, wet. **CH**				
28		WOH 1			28										
30	-15	WOH 1	100		30									66.0	
32											31.5 / -17.6 NO RECOVERY				
34	-20	1 1 2 3	0		33 35										
36															
38		2 2 2 1	96		38						36.5 / -22.6 Brown, ORGANIC SILT, soft, wet. **OH**				
40	-25											329	138	290.0	62.0

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 65 feet in depth, elevation -51.1 feet. This hole was drilled on the original surveyed and staked location.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: RAMP PIER

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PAGE 2 OF 3

STATION: 104+23.70 OFFSET: 32.60 RT
LATITUDE: 36.826987° N LONGITUDE: 76.325928° W
SURFACE ELEVATION: 13.9 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/14/2010 - 4/14/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: James Martin

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
40															
42															
44	-30	1 1 1 2	96		43 45						44.75 / -30.85 Gray, SILT and fine sands, soft, wet. **ML**			156.0	
46											46.5 / -32.6 Gray, SILT, some organics, very soft, moist. **MH**				
48	-35	WOH WOH 1 1	92		48 50							54	18	49.0	64.0
50															
52															
54	-40	WOH WOH WOH 1	96		53 55									53.0	
56															
58	-45	2 4 6 5	63		58 60						56.5 / -42.6 Gray, fine silty SAND, loose, moist. **SM**			29.0	
60															
62											61.5 / -47.6 Gray, medium SAND, and gravel, very dense, moist. **SP**				
64	-50	34 61 22 9	75		63 65									11.0	
66															
68	-55	2 4 3 6	100		68 70						66.5 / -52.6 Green gray, silty SAND, trace shell fragments, loose, moist. **SM**			28.0	
70															
72															
74	-60	2 1 2 3	92		73 75									32.0	
76											76.5 / -62.6 Green to gray, clayey SAND, trace shell fragments, loose, moist. **SC**				
78	-65	2 1 4 9	92		78							26	9	35.0	31.0
80															

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 65 feet in depth, elevation -51.1 feet. This hole was drilled on the original surveyed and staked location.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: CIty of Portsmouth
STRUCTURE: RAMP PIER

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PAGE 3 OF 3

STATION: 104+23.70 OFFSET: 32.60 RT
LATITUDE: 36.826987° N LONGITUDE: 76.325928° W
SURFACE ELEVATION: 13.9 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/14/2010 - 4/14/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: James Martin

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
80															
82											81.5 / -67.6 Green to gray, clayey SAND, loose, moist. **SC**				
83		3 3 3 6	100												
84	-70													32.0	
85															
86											86.5 / -72.6 Gray, clayey SAND, trace of shells, loose, moist. **SC**				
88		1 2 2 3	92									33	13	33.0	42.0
88	-75														
90															
92															
93		2 2 4 8	96											32.0	
94	-80														
95															
96															
98															
98		2 2 2 6	96											34.0	
100	-85														
100											End of Boring.				

FIELD DESCRIPTION OF STRATA

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 65 feet in depth, elevation -51.1 feet. This hole was drilled on the original surveyed and staked location.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: RAMP PIER

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PAGE 1 OF 3

STATION: 103+06.44 OFFSET: 10.72 LT
LATITUDE: 36.827248° N LONGITUDE: 76.325928° W
SURFACE ELEVATION: 13.3 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/13/2010 - 4/13/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
2	10	2 1 2 2	60		2						0.0 / 13.3 Brown, sandy CLAY, soft, dry. **CL**			17.0	
4		1 3 3 3	70		4						2.0 / 11.3 Light gray, silty SAND, loose, dry. **SM**			18.0	
6 ▽		4 6 4 3	100		6						4.0 / 9.3 Yellow, fine to medium SAND, loose, moist. **SP**			22.0	
8	5	1 1 2 2	100		8						6.0 / 7.3 Gray, fine to medium SAND, loose, wet. **SP**			23.0	
10		2 1 3 4	100		10						8.0 / 5.3 Dark gray, fine to medium SAND, loose, wet. **SP**			22.0	
12															
14	0	2 2 3 3	60		13 15						11.5 / 1.8 Dark gray, fine silty SAND, trace shell fragments, loose, wet. **SM**			32.0	
16															
18	-5	1 1 1 1	90		18						16.5 / -3.2 Dark gray, medium silty SAND, loose, wet. **SM**			27.0	
20					20										
22											21.5 / -8.2 Gray, CLAY, very soft, wet. **CH**				
24	-10	WOH WOH WOH 1	95		23 25							75	47	68.0	98.0
26															
28	-15	WOH WOH WOH 1	100		28									64.0	
30					30										
32											31.5 / -18.2 Brown, ORGANIC SILT, soft, moist. **OH**				
34	-20	1 1 2 2	100		33 35							250	103	197.0	58.0
36															
38	-25	2 2 4 3	85		38						36.5 / -23.2 Same, medium stiff, moist. **OH**			239.0	
40															

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 75 feet in depth, elevation -61.7 feet. This borehole was offset 10' east of its originally staked location to avoid a heavily wooded area.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: RAMP PIER

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PAGE 2 OF 3

STATION: 103+06.44 OFFSET: 10.72 LT
LATITUDE: 36.827248° N LONGITUDE: 76.325928° W
SURFACE ELEVATION: 13.3 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/13/2010 - 4/13/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
40															
42															
43	-30	2 2 2 3	100								41.5 / -28.2 Same, soft, moist. **OH**			183.0	
45															
46															
48	-35	1 1 WOH WOH	100								46.5 / -33.2 Gray to brown, SILT, micaceous & trace organics, very soft, wet. **ML**	44	12	52.0	69.0
50															
52															
53	-40	WOH 1 1 2	100								51.5 / -38.2 Gray to brown, SILT, micaceous & trace organics, soft, wet. **ML**			61.0	
55															
56															
58	-45	3 3 4 7	68								56.5 / -43.2 Brown to gray, fine to medium silty SAND, micaceous, loose, moist. **SM**			42.0	
60															
62															
63	-50	1 1 3 3	100								63.7 / -50.4 Blue to gray, CLAY, soft, moist. **CL**			43.0	
65															
66															
68	-55	1 1 1 2	100									31	11	33.0	63.0
70															
72											71.5 / -58.2 Gray, fine to coarse silty SAND, loose, wet. **SM**				
73	-60	1 2 2 4	100											29.0	
75															
76															
78	-65	2 2 3 9	100								76.5 / -63.2 Green to gray, fine to medium clayey SAND, trace shell fragments, loose, wet. **SC**			33.0	
80															

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 75 feet in depth, elevation -61.7 feet. This borehole was offset 10' east of its originally staked location to avoid a heavily wooded area.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: RAMP PIER

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PAGE 3 OF 3

STATION: 103+06.44 OFFSET: 10.72 LT
LATITUDE: 36.827248° N LONGITUDE: 76.325928° W
SURFACE ELEVATION: 13.3 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/13/2010 - 4/13/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
80					80										
82															
84	-70	3 1 3 9	100		83 85									33.0	
86															
88	-75	2 1 3 8	100		88 90									34.0	
90															
92											91.5 / -78.2				
94	-80	2 1 3 5	90		93 95						Green to gray, clayey SAND, trace of very fine shell fragments, loose, wet. **SC**	40	16	36.0	48.0
96															
98	-85	1 2 5 7	100		98									32.0	
100					100						End of Boring.				

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 75 feet in depth, elevation -61.7 feet. This borehole was offset 10' east of its originally staked location to avoid a heavily wooded area.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: RAMP ABUT

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PAGE 1 OF 3

STATION: 102+45.48 OFFSET: 46.65 RT
LATITUDE: 36.827434° N LONGITUDE: 76.326087° W
SURFACE ELEVATION: 13.2 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/16/2010 - 4/16/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): Shelby Tubes
Driller: Fishburne
Logger: James Martin

GROUND WATER
FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
0	13.2	3 2 2 2	13		2						0.0 / 13.2 Brown, top soil silty clay and gravel FILL, soft, dry. **FL**			20.0	
2	10	3 2 3 2	54		4						2.0 / 11.2 Tan to gray, clayey SAND, loose, moist. **SC**			19.0	
4		3 2 6 10	71		6						4.0 / 9.2 Gray, clayey SAND, loose, moist. **SC**			24.0	
6 ▽		6 7 8 10	96		8						4.25 / 8.95 Gray, fine to medium SAND, loose, wet. **SP**			22.0	
8	5	6 5 6 8	96		10						6.0 / 7.2 Gray, fine to medium SAND, medium dense, wet. **SP**			24.0	
10															
12	0	5 6 6 5	71		13 15						11.5 / 1.7 Gray, fine to medium SAND, trace shell fragments, medium dense, wet. **SP**			27.0	
16															
18	-5	1 1 1 1	83		18						16.5 / -3.3 Gray, fine to medium silty SAND, loose, wet. **SM**			26.0	
20		WOH WOH WOH WOH	92		20						20.0 / -6.8 Blue to gray, CLAY, very soft, wet. **CH**	74	46	62.0	97.0
22					22										
24	-10	1 1 1 1	92 100		24 26						24.0 / -10.8 Same, soft, wet. **CH**			73.0	
26															
28	-15	WOH WOH WOH WOH	96		28 30						27.0 / -13.8 Same, very soft, wet. **CH**			65.0	
30															
32	-20	3 3 4 5	92		33						31.5 / -18.3 Brown, ORGANIC SILT, medium stiff, wet. **OH**	244	109	275.0	64.0
34					35										
36			54		37										
38	-25	3 3 4 3	75		38									243.0	
40															

REMARKS: Rig Type: CME-550. Shelby tubes at 22'-24', 35'-37' and 90'-92' tested by others. Top of Yorktown Formation estimated at 70 feet in depth, elevation -56.8 feet. This borehole was offset 15' northeast of its originally staked location to avoid a deep drainage ditch.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: RAMP ABUT

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PAGE 2 OF 3

STATION: 102+45.48 OFFSET: 46.65 RT
LATITUDE: 36.827434° N LONGITUDE: 76.326087° W
SURFACE ELEVATION: 13.2 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/16/2010 - 4/16/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): Shelby Tubes
Driller: Fishburne
Logger: James Martin

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
40															
42											41.5 / -28.3 Brown, ORGANIC SILT, soft, wet. **OL**				
43	-30	1 WOH 1 1	100											107.0	
44															
45															
46											46.5 / -33.3 Brown, ORGANIC SILT, very soft, wet. **OL**				
48	-35	WOH WOH WOH WOH	100											47.0	
50															
52											51.5 / -38.3 Brown, SILT with organics, soft, wet. **MH**				
53	-40	1 1 1 1	79									58	24	69.0	73.0
54															
55															
56															
58	-45	WOH 1 1 1	100											54.0	
60															
62											61.5 / -48.3 Green to gray, silty SAND, and shells, loose, wet. **SM**				
63	-50	1 WOH WOH WOH	96											50.0	
64															
65															
66											66.5 / -53.3 Green to gray, silty SAND, trace shells, loose, wet. **SM**				
68	-55	1 2 3 4	100											30.0	
70															
72											71.5 / -58.3 Green to gray, clayey SAND, loose, wet. **SC**				
73	-60	1 2 2 7	88									22	4	30.0	30.0
74															
75															
76											76.5 / -63.3 Green to gray, silty SAND, trace shells, loose, moist. **SM**				
78	-65	1 2 5 12	100											35.0	
80															

REMARKS: Rig Type: CME-550. Shelby tubes at 22'-24', 35'-37' and 90'-92' tested by others. Top of Yorktown Formation estimated at 70 feet in depth, elevation -56.8 feet. This borehole was offset 15' northeast of its originally staked location to avoid a deep drainage ditch.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: RAMP ABUT

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PAGE 3 OF 3

STATION: 102+45.48 OFFSET: 46.65 RT
LATITUDE: 36.827434° N LONGITUDE: 76.326087° W
SURFACE ELEVATION: 13.2 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/16/2010 - 4/16/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): Shelby Tubes
Driller: Fishburne
Logger: James Martin

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
80					80										
82															
83	-70	1 2 2 9	100		83						81.5 / -68.3 Green to gray, clayey SAND, trace shells, loose, moist. **SC**			34.0	
84															
85					85										
86															
88	-75	2 2 4 8	100		88									34.0	
90					90										
92			38		92										
93	-80	8 6 10 12	96		93						92.5 / -79.3 Green to gray clayey SAND, trace shells, medium dense, moist. **SC**	36	14	32.0	44.0
94															
95					95										
96															
98	-85	4 5 6 7	100		98									32.0	
100					100						End of Boring.				

REMARKS: Rig Type: CME-550. Shelby tubes at 22'-24', 35'-37' and 90'-92' tested by others. Top of Yorktown Formation estimated at 70 feet in depth, elevation -56.8 feet. This borehole was offset 15' northeast of its originally staked location to avoid a deep drainage ditch.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 14

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PAGE 1 OF 3

STATION: 1015+51.46 OFFSET: 55.87 LT
LATITUDE: 36.828213° N LONGITUDE: 76.326106° W
SURFACE ELEVATION: 13.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/13/2010 - 4/13/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
2		NR NR NR 6	100		1.5						0.0 / 13.6 Undifferentiated FILL. Poor recovery limits description. **FL**			13.0	
4	10	2 2 3 4	50		2						2.0 / 11.6 Gray, clayey sand with gravel FILL, loose, moist. **FL**			18.0	
6 ▽		6 7 7 7	100		4						4.0 / 9.6 Yellow brown to gray, fine to medium SAND, medium dense, wet. **SP**			23.0	
8	5	6 3 3 3	95		6						6.0 / 7.6 Yellow brown to gray, fine to medium SAND, loose, wet. **SP**			22.0	
10		1 1 1 1	100		8									22.0	
12	0	3 3 3 4	75		10						11.5 / 2.1 Gray, fine to coarse silty SAND, trace shell fragments, loose, wet. **SM**			32.0	
14					13										
16					15										
18	-5	1 2 1 1	83		18									26.0	
20					20										
22					23						21.5 / -7.9 Blue gray, CLAY, very soft, moist. **CL**				
24	-10	WOH WOH WOH 1	100		25									47.0	
26											26.5 / -12.9 Blue gray, CLAY, with shells, very soft, moist. **CH**				
28	-15	WOH WOH WOH 1	100		28										
30					30							81	50	74.0	99.0
32											31.5 / -17.9 Gray, SILT, micaceous, soft, wet. **ML**				
34	-20	1 2 2 4	100		33									45.0	
36					35										
38	-25	1 2 2 2	100		38						36.5 / -22.9 Brown, ORGANIC SILT, soft, wet. **OH**				
40												135	70	108.0	81.0

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at a depth of 70 feet, elevation -56.4 feet. This hole was drilled on the original surveyed and staked location.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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VDOT Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 14

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PAGE 2 OF 3

STATION: 1015+51.46 OFFSET: 55.87 LT
LATITUDE: 36.828213° N LONGITUDE: 76.326106° W
SURFACE ELEVATION: 13.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/13/2010 - 4/13/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
40															
42															
44	-30	2 1 2 2	100		43 45									77.0	
46											46.5 / -32.9 Gray, silty SAND, micaceous, loose, moist. **SM**				
48	-35	4 3 2 1	80		48 50							24	2	45.0	24.0
52											51.5 / -37.9 No recovery.				
54	-40	1 1 1 1	0		53 55										
56															
58	-45	1 1 1 2	100		58 60						56.5 / -42.9 Gray, silty SAND, micaceous, loose, moist. **SM**			53.0	
62															
64	-50	WOH WOH WOH 3	100		63 65						63.3 / -49.7 Blue gray, CLAY, soft, moist. **CL**	47	23	33.0	89.0
66															
68	-55	1 2 2 3	100		68 70						66.5 / -52.9 Blue gray, sandy CLAY, trace shell fragments, soft, moist. **CL**	29	10	26.0	54.0
72											71.5 / -57.9 Blue gray, clayey SAND, trace shell fragments, loose, moist. **SC**				
74	-60	1 1 2 3	100		73 75									36.0	
76															
78	-65	2 2 2 5	100		78									35.0	
80															

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at a depth of 70 feet, elevation -56.4 feet. This hole was drilled on the original surveyed and staked location.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 14

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STATION: 1015+51.46 OFFSET: 55.87 LT
LATITUDE: 36.828213° N LONGITUDE: 76.326106° W
SURFACE ELEVATION: 13.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/13/2010 - 4/13/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
80															
82															
84	-70	2 1 4 10	100		83 85									35.0	
86															
88	-75	2 2 2 7	100		88 90									32.0	
92															
94	-80	3 3 2 6	100		93 95							41	19	32.0	43.0
96															
98	-85	3 2 3 10	100		98									31.0	
100					100						End of Boring.				

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at a depth of 70 feet, elevation -56.4 feet. This hole was drilled on the original surveyed and staked location.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 16

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STATION: 1018+26.38 OFFSET: 56.21 LT
LATITUDE: 36.828932° N LONGITUDE: 76.326394° W
SURFACE ELEVATION: 14.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/7/2010 - 4/7/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
0		10 15 12 9	50		2						0.0 / 14.4 Sandy gravel, FILL, medium dense, dry. **FL**			10.0	
2		4 5 4 14	75		4						2.0 / 12.4 Dark gray, clayey sand with gravel, FILL, loose, moist. **FL**			17.0	
4	10	3 3 4 4	50		6						4.0 / 10.4 Dark gray, fine to medium SAND, loose, moist. **SP**			16.0	
6 ▽		3 4 6 11	68		8						6.0 / 8.4 Dark gray, fine SAND, medium dense, wet **SW**			19.0	
8	5	4 4 4 6	55		10						8.0 / 6.4 Dark gray, medium SAND, loose, wet **SW**			23.0	
10															
12					13										
14	0	4 4 4 4	70		15									28.0	
16															
18		2 1 1 2	100		18										
20	-5				20									26.0	
22											21.5 / -7.1 Dark gray, CLAY, very soft, moist. **CH**				
24	-10	WOH WOH WOH 1	100		25							81	52	71.0	95.0
26															
28		WOH 1 1 1	100		28									45.0	
30	-15				30						29.3 / -14.9 Brown, woody ORGANICS, soft, wet. **OL**				
32											31.5 / -17.1 Brown, ORGANIC SILT, medium, wet. **OH**				
34	-20	1 2 3 4	100		33 35							159	68	166.0	58.0
36															
38		WOH WOH WOH 1	100		38						36.5 / -22.1 Dark gray to brown, SILT, very soft, wet. **MH**				
40	-25													70.0	

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 65 feet in depth, elevation -50.6 feet. This hole was drilled on the original surveyed and staked location.

SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 16

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PAGE 2 OF 3

STATION: 1018+26.38 OFFSET: 56.21 LT
LATITUDE: 36.828932° N LONGITUDE: 76.326394° W
SURFACE ELEVATION: 14.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/7/2010 - 4/7/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
40															
42															
44	-30	WOH WOH WOH 1	100		43 45									69.0	
46															
48					48										
50	-35	WOH WOH WOH 1	100		50							88	38	98.0	94.0
52											51.5 / -37.1 Gray, fine to medium SAND, loose, wet. **SP**				
54	-40	2 1 6 4	85		53 55						53.9 / -39.5 Brown, ORGANIC SILT, medium stiff, moist. **OL**			34.0	
56															
58											56.5 / -42.1 Brown, ORGANIC SILT, micaceous, soft, moist **OL**				
60	-45	WOH 1 1 1	100		58 60									47.0	
62											61.5 / -47.1 Gray, CLAY with trace sand & mica, stiff, moist **CL**				
64	-50	1 2 3 6	95		63 65							34	17	28.0	70.0
66											66.5 / -52.1 Green gray, fine SAND, trace of silt & gravel, loose, moist. **SP**				
68					68										
70	-55	3 3 6 7	65		70									24.0	
72											71.5 / -57.1 Gray, silty fine to medium SAND with trace shells, loose, moist **SM**				
74	-60	1 1 2 3	100		73 75									35.0	
76															
78					78										
80	-65	2 4 3 5	100											34.0	

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 65 feet in depth, elevation -50.6 feet. This hole was drilled on the original surveyed and staked location.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 16

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STATION: 1018+26.38 OFFSET: 56.21 LT
LATITUDE: 36.828932° N LONGITUDE: 76.326394° W
SURFACE ELEVATION: 14.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/7/2010 - 4/7/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
80					80										
82											81.5 / -67.1 Gray, silty fine to medium SAND, with trace shells, medium dense, wet. **SM**				
84	-70	5 5 6 6	55		83 85									35.0	
86															
88					88						86.5 / -72.1 Gray, silty fine SAND, medium dense, wet. **SM**				
90	-75	4 7 7 8	70		90									31.0	
92											91.5 / -77.1 Green gray, fine clayey SAND, loose, moist. **SC**				
94	-80	3 3 3 5	100		93 95							33	14	32.0	42.0
96															
98					98						96.5 / -82.1 Gray, fine sandy CLAY, medium stiff, moist. **CL**				
100	-85	3 3 3 6	100		100									32.0	
											End of Boring.				

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 65 feet in depth, elevation -50.6 feet. This hole was drilled on the original surveyed and staked location.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 1 OF 3

STATION: 414+57 OFFSET: 13 ft LT
LATITUDE: 36.828469° N LONGITUDE: 76.325295° W
SURFACE ELEVATION: 12.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/26/2010 - 08/27/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 4.1 ft AFTER 20 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
												0.0 / 12.4 2-inches ROOTMAT AND TOPSOIL **TOPS**			9.4
0.25	2	10	4 6 7 5	85		2						0.2 / 12.2 Dark brown, sandy lean clay FILL, contains asphalt fragments, very stiff, moist [A2] [FILL] **FL**			17.5
	4		3 5 3 3	100		4						2.0 / 10.4 Brown, fine to medium poorly graded SAND, trace silt, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP**			24.9
	6	5	1 2 2 1	100		6						SAME, wet, loose below 4 ft			
			1 2 3 4	100								SAME, gray below 7 ft			22.1
	8		4 4 7 8	100		8						8.0 / 4.4 Gray, fine to medium poorly graded SAND with silt, medium dense, wet [C1] **SP-SM**			22.5
	10					10									
	12	0	2 2 2 2	75		13						11.5 / 0.9 Green gray, fine to medium silty SAND, contains mica, loose, wet [C1] **SM**			26.8
	14					15									
	16														
	18	-5	1 1 1 0	100		18									
0.25	20					20						19.8 / -7.4 Gray, elastic SILT, trace sand, contains mica, soft, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **MH**			69.6
	22	-10				23						SAME, contains shell fragments below 23 ft			
0.25	24		WOH WOH 1 1	100		25									75.6
	26														
	28	-15	WOH WOH 1 0	100		28						26.5 / -14.1 Gray, lean CLAY with sand, contains shell fragments, organic matter and mica, very soft, wet [D2] **CL**			
0.25	30					30									48.3
	32	-20										31.5 / -19.1 Dark brown, PEAT, wet [D3] **PT**			
	34		2 2 5 5	100		33									283.5

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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STATION: 414+57 OFFSET: 13 ft LT
LATITUDE: 36.828469° N LONGITUDE: 76.325295° W
SURFACE ELEVATION: 12.4 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/26/2010 - 08/27/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 4.1 ft AFTER 20 HOURS

FIELD DATA | **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)
	35														
	36														
	38	-25	3 5 4 4	100		38									625.9
	40					40									
	42	-30				43						41.5 / -29.1 Brown, lean CLAY, trace sand, contains organic matter and mica, soft, wet [D2] **CL**			
0.25	44		WOH 1 1 1	100		45									63.9
	46														
	48	-35	6 6 7 7	75		48						46.5 / -34.1 Green gray, fine to medium silty SAND, contains organic matter and mica, medium dense, wet [D1] **SM**			25.4
	50					50									
	52	-40				53						51.5 / -39.1 Green gray, fine to medium poorly graded SAND with silt, contains organic matter and mica, dense, wet [D1] **SP-SM**			
	54		8 12 14 16	60		55									23.3
	56														
	58	-45	10 8 11 8	50		58									23.2
	60					60									
	62	-50				63						61.5 / -49.1 Green gray, fat CLAY, trace sand, contains organic matter and mica, soft, wet [D2] **CH**			
0.25	64		1 1 1 2	100		65									43.5
	66														
	68	-55	WOH WOH WOH 1	100		68						66.5 / -54.1 Green gray, fat CLAY with sand, contains organic matter and mica, soft, wet [D2] **CH**			
0.5	70														33.1

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 3 OF 3

STATION: 414+57 OFFSET: 13 ft LT
LATITUDE: 36.828469° N LONGITUDE: 76.325295° W
SURFACE ELEVATION: 12.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/26/2010 - 08/27/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 4.1 ft AFTER 20 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	70														
	72	-60	3 3 2 5	100		73						71.5 / -59.1 Green gray, fine to coarse silty SAND, contains shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SM**			32.1
	74					75									
	76														
	78	-65	3 2 2 10	100		78						76.5 / -64.1 Green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] **SC**			32.1
	80					80									
	82	-70	2 2 2 9	100		83									34.2
	84					85									
	86														
	88	-75	2 2 5 9	100		88									35.1
	90					90									
	92	-80	2 2 3 7	100		93									36.1
	94					95									
	96														
	98	-85	2 3 4 13	100		98									30.5
	100					100						Bottom of Boring at 100 ft.			

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 15

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PAGE 1 OF 3

STATION: 1016+34.12 OFFSET: 32.06 RT
LATITUDE: 36.828503° N LONGITUDE: 76.325906° W
SURFACE ELEVATION: 13.4 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/14/2010 - 4/14/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: James Martin

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA | **LAB DATA**

DEPTH (ft)	ELEVATION (ft)	STANDARD PENETRATION TEST HAMMER BLOWS (SOIL)	SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	CORE RECOVERY (%) (ROCK)	ROCK QUALITY DESIGNATION	DIP ° STRATA	DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
0	13.4	NR NR 5	8		2						0.0 / 13.4 Dark gray, sand FILL, loose, dry. **FL**			27.0	
2		3 4 6	50		4						2.0 / 11.4 Dark to light gray, sand and gravel FILL, medium dense, wet. **FL**			17.0	
4	10	9 9 9 10	71		6						4.0 / 9.4 Dark gray, clayey SAND, medium dense, wet. **SC**			21.0	
6 ▽		4 3 3 3	92		8						4.75 / 8.65 Light gray, fine to medium SAND, medium dense, wet. **SP**			19.0	
8	5	2 2 1 2	92		10						6.0 / 7.4 Light to dark gray, fine to medium SAND, loose, wet. **SP**			23.0	
10											8.0 / 5.4 Light to dark gray, fine to medium SAND, little silt, loose, wet. **SP**				
12	0	3 2 3 3	75		13 15						11.5 / 1.9 Gray, fine silty SAND, trace of shell fragments, loose, wet. **SM**			29.0	
16											16.5 / -3.1 Gray, fine silty SAND, trace of shell fragments and organics, loose, wet. **SM**			27.0	
18	-5	2 1 1 2	100		18 20										
20											21.5 / -8.1 Gray, CLAY, soft, moist. **CH**				
22	-10	WOH 1 1 1	100		23 25							83	57	86.0	97.0
24															
26	-15	WOH 1 1 1	100		28 30									78.0	
28															
30	-20	1 2 1 3	100		33 35						31.5 / -18.1 Brown, ORGANIC SILT, soft, wet. **OH**	296	138	261.0	63.0
32															
34											36.5 / -23.1 Gray, ORGANIC CLAY, very soft, wet. **OH**				
36	-25	WOH WOH WOH 1	96		38							101	53	118.0	94.0
38															
40															

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 73.7 feet in depth, elevation -60.35 feet. This borehole was offset 75' south of its original staked location to comply safety requirements per work adjacent to active rail lines.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 15

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PAGE 2 OF 3

STATION: 1016+34.12 OFFSET: 32.06 RT
LATITUDE: 36.828503° N LONGITUDE: 76.325906° W
SURFACE ELEVATION: 13.4 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/14/2010 - 4/14/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: James Martin

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB DATA: LIQUID LIMIT (LL)	LAB DATA: PLASTICITY INDEX (PI)	LAB DATA: MOISTURE CONTENT (%)	LAB DATA: FINES CONTENT -#200 (%)
40															
42											41.5 / -28.1 Brown, ORGANIC CLAY, soft, wet. **OH**				
44	-30	WOH 1 1 2	96		43 45							97	50	106.0	98.0
46															
48	-35	1 1 1 1	100		48 50						46.5 / -33.1 Gray, silty SAND, trace of organics, loose, wet. **SM**	26	2	38.0	26.0
50															
52											51.5 / -38.1 Gray, fine to medium silty SAND, micaceous, medium dense, moist. **SM**				
54	-40	2 7 6 6	67		53 55									36.0	
56															
58	-45	1 2 3 6	96		58 60						56.5 / -43.1 Gray, SILT with some fine sand, little organics, medium stiff, moist. **ML**			45.0	
60															
62															
64	-50	2 2 2 4	100		63 65							49	26	37.0	88.0
66											64.5 / -51.1 Blue to gray, CLAY, soft, moist. **CL**				
68	-55	WOH 1 1 2	96		68 70									27.0	
70															
72											71.5 / -58.1 Dark gray, medium SAND, little organics, loose, moist. **SP**				
74	-60	6 7 4 5	96		73 75						73.75 / -60.35 Green to gray, clayey SAND, with organics, loose, wet. **SC**			29.0	
76															
78	-65	2 2 4 14	63		78						76.5 / -63.1 Green to gray, clayey SAND, trace shell fragments, loose, moist. **SC**			31.0	
80															

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 73.7 feet in depth, elevation -60.35 feet. This borehole was offset 75' south of its original staked location to comply safety requirements per work adjacent to active rail lines.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 15

10BH-111
PAGE 3 OF 3

STATION: 1016+34.12 OFFSET: 32.06 RT
LATITUDE: 36.828503° N LONGITUDE: 76.325906° W
SURFACE ELEVATION: 13.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/14/2010 - 4/14/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: James Martin

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
80															
82															
84	-70	2 2 3 9	100		83 85									36.0	
86															
88	-75	2 2 2 7	88		88 90									34.0	
92															
94	-80	2 4 4 9	100		93 95							39	17	29.0	38.0
96															
98	-85	3 3 4 10	100		98 100									33.0	
100											End of Boring.				

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 73.7 feet in depth, elevation -60.35 feet. This borehole was offset 75' south of its original staked location to comply safety requirements per work adjacent to active rail lines.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: PAVEMENT

10BH-118

STATION: 412+70 OFFSET: 70 ft RT
LATITUDE: 36.828405° N LONGITUDE: 76.324600° W
SURFACE ELEVATION: 11.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/26/2010 - 08/26/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
- FIRST ENCOUNTERED AT 4.0 ft DEPTH
- STABILIZED AT 4.9 ft AFTER 32 HOURS

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
0	11.5	3 7 8 6	75		2						0.0 / 11.5 2-inches ROOTMAT AND TOPSOIL **TOPS**	23	10	13.5	44.7
2	10	5 6 6 7	85		4						0.2 / 11.3 Brown, fine to medium silty SAND, medium dense, moist [A1] [FILL] **FL**			18.5	
4	8	3 5 6 5	90		6						0.5 / 11.0 Gray and brown, fine to medium clayey SAND, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SC**			23.0	
6	6	2 1 1 1	100		8						2.0 / 9.5 Brown, fine to medium poorly graded SAND, trace silt, medium dense, moist [C1] **SP**			26.1	
8	4	1 2 2 4	100		10						SAME, wet below 4 ft SAME, very loose below 6 ft SAME, gray below 7.5 ft SAME, contains organic matter, loose below 8 ft			20.0	
10	2										Bottom of Boring at 10 ft.				

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-120
PAGE 1 OF 3

STATION: 1441+60 OFFSET: 118 ft RT
LATITUDE: 36.826872° N LONGITUDE: 76.324228° W
SURFACE ELEVATION: 11.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/04/2010 - 08/04/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 4.9 ft AFTER 14 HOURS

LABORATORY DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)	ORGANIC CONTENT (%)
	0	10	4 4 5 7	85		2						0.0 / 11.4 2-inches ROOTMAT AND TOPSOIL **TOPS**			13.0		
	2		5 4 4 5	90		4						0.2 / 11.2 Dark brown, fine to medium silty sand FILL, contains root fragments and crushed stone, medium dense, moist [A1] [FILL] **FL**			9.1		
	4		6 7 9 9	100		6						2.0 / 9.4 Brown, fine to medium poorly graded SAND, trace silt, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP**			21.9		
	6	5	5 1 2 2	100		8						SAME, light brown, wet below 4 ft			28.8		
	8		2 1 2 2	90		10						6.0 / 5.4 Gray, fine to medium poorly graded SAND with silt, loose, wet [C1] **SP-SM**			27.5		
	10																
	12	0				13											
	14		2 3 5 4	90		15									29.1		
	16	-5															
0.25	18		WOH 1 0 0	100		18						16.5 / -5.1 Gray, fat CLAY, trace sand, very soft, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CH**	83	58	73.3	97.1	
	20					20											
	22	-10				23											
0.25	24		WOH WOH 1 1	100		25									74.4		
	26	-15															
	28		WOH WOH 1 1	100		28						SAME, contains mica and silty sand lenses below 28 ft					
0.25	30					30									72.8		
	32	-20															
	34		2 3 4 3	100		33						31.5 / -20.1 Brown, PEAT, wet [D3] **PT**			317.6		

REMARKS: Rig Type: CME-550X (ATV).

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SPT_LOGABC:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-120
PAGE 2 OF 3

STATION: 1441+60 OFFSET: 118 ft RT
LATITUDE: 36.826872° N LONGITUDE: 76.324228° W
SURFACE ELEVATION: 11.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/04/2010 - 08/04/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH
▼ STABILIZED AT 4.9 ft AFTER 14 HOURS

LABORATORY DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)	ORGANIC CONTENT (%)
	35																
	36	-25										36.5 / -25.1 Black, ORGANIC SILT, trace sand, soft, wet [D3] **OH**					
	38		WOH 1 2 1	100		38									138.9		24
	40					40											
	42	-30										41.5 / -30.1 Brown, ORGANIC SILT with sand, firm, wet [D3] **OH**					
0.5	44		1 2 2 2	100		43 45							100	43	105.8	82.2	
	46	-35															
0.5	48		WOH 1 1 1	100		48 50									64.6		
	50																
	52	-40										51.5 / -40.1 Gray, fine to medium poorly graded SAND, trace silt, contains organic matter and mica, medium dense, wet [D1] **SP**					
	54		4 4 4 5	100		53 55									25.9		
	56	-45										56.5 / -45.1 Gray, sandy SILT, contains organic matter and mica, very soft, wet [D2] **ML**					
0.25	58		WOH WOH 1 0	100		58 60									39.3		
	60																
	62	-50										61.5 / -50.1 Brown gray, elastic SILT, trace sand, contains organic matter and mica, very soft, moist [D2] **MH**					
0.5	64		WOH WOH 1 1	100		63 65									56.9		
	66																
	68	-55										66.5 / -55.1 Gray, fat CLAY with sand, contains organic matter and mica, soft, moist [D2] **CH**					
1.5	70		WOH WOH 3 4	100		68									31.4		

REMARKS: Rig Type: CME-550X (ATV).

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SPT_LOGABC:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-120
PAGE 3 OF 3

STATION: 1441+60 OFFSET: 118 ft RT
LATITUDE: 36.826872° N LONGITUDE: 76.324228° W
SURFACE ELEVATION: 11.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/04/2010 - 08/04/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
- FIRST ENCOUNTERED AT 4.0 ft DEPTH
- STABILIZED AT 4.9 ft AFTER 14 HOURS

LABORATORY DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)	ORGANIC CONTENT (%)
	70																
	72	-60	4 3 3 5	100		73						71.5 / -60.1 Green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SC**			31.9		
	74					75											
	76	-65															
	78		2 2 2 4	100		78									33.3		
	80					80											
	82	-70															
	84		WOH 2 2 2	100		83									32.3		
	86					85											
	88	-75	3 3 3 6	100		88									31.3		
	90					90											
	92	-80															
	94		1 2 3 5	100		93									32.9		
	96	-85				95											
	98		WOH 3 3 2	100		98									30.8		
	100					100						Bottom of Boring at 100 ft.					

REMARKS: Rig Type: CME-550X (ATV).

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SPT_LOGABC:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-120A
PAGE 1 OF 2

STATION: 1441+58 OFFSET: 119 ft RT
LATITUDE: 36.826865° N LONGITUDE: 76.324229° W
SURFACE ELEVATION: 11.4 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/05/2010 - 08/05/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER

FIELD DATA													LABORATORY DATA				
PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)	ORGANIC CONTENT (%)
	0	10										0.0 / 11.4 Rotary probe to 25 ft; see Boring 10BH-120 for strata descriptions.					
	2																
	4																
	6	5															
	8																
	10																
	12	0															
	14																
	16	-5															
	18																
	20																
	22	-10															
	24																
0.5	26	-15		95		25 27						25.0 / -13.6 Gray, fat CLAY, trace sand, moist [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CH** 27.0 / -15.6 Rotary probe to 35 ft; see Boring 10BH-120 for strata descriptions.	86	58	73.5	99.3	
	28																
	30																
	32	-20															
	34																

REMARKS: Rig Type: CME-550X (ATV).

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10BH-120A

SPT_LOGABC:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-120A

STATION: 1441+58 OFFSET: 119 ft RT
LATITUDE: 36.826865° N LONGITUDE: 76.324229° W
SURFACE ELEVATION: 11.4 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/05/2010 - 08/05/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER

FIELD DATA													LABORATORY DATA				
			SOIL				ROCK										
PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	STANDARD PENETRATION TEST HAMMER BLOWS	SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	CORE RECOVERY (%)	ROCK QUALITY DESIGNATION	DIP ° STRATA	DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)	ORGANIC CONTENT (%)
2.75	36	-25		65		35						35.0 / -23.6 Brown, PEAT, wet [D3] **PT**	363	94	277.0	5.7	54.1
						37						37.0 / -25.6 Rotary probe to 58 ft; see Boring 10BH-120 for strata descriptions.					
	38																
	40																
	42	-30															
	44																
	46																
	48	-35															
	50																
	52																
	54	-40															
	56																
	58	-45				58						58.0 / -46.6 Gray, sandy SILT, contains organic matter and mica, wet [D2] **ML**	40	8	38.0	67.4	
0.25	60			100		60						Bottom of Boring at 60 ft.					

REMARKS: Rig Type: CME-550X (ATV).

SPT_LOGABC:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 1 OF 3

STATION: 1445+34 OFFSET: 127 ft RT
LATITUDE: 36.827168° N LONGITUDE: 76.323042° W
SURFACE ELEVATION: 10.3 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/05/2010 - 08/05/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 4.4 ft AFTER 27 HOURS

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
		10	4 8 18 14	75		2						0.0 / 10.3 4-inches ROOTMAT AND TOPSOIL **TOPS**			5.3	
	2		12 8 7 7	90		4						0.3 / 10.0 Light brown, fine to medium silty sand FILL, dense, moist [A1] [FILL] **FL**			8.2	
	4	5	4 5 6 3	100		6						2.0 / 8.3 Brown, fine to medium poorly graded SAND, trace silt, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP**			21.4	
	6		2 2 3 2	100		8						4.0 / 6.3 Orange brown, fine to medium poorly graded SAND with silt, medium dense, wet [C1] **SP-SM**			27.3	
	8		4 3 3 4	100		10						SAME, loose below 6 ft			29.0	
	10	0														
	12					13						SAME, gray, below 13 ft			28.1	
	14		2 2 2 2	85		15										
	16	-5														
	18		WOH WOH 1 0	100		18						16.5 / -6.2 Gray, fat CLAY, trace sand, very soft, moist [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CH**				
0.25	20	-10				20							83	58	72.9	94.8
	22															
	24		WOH WOH 1 1	100		23						SAME, contains mica below 23 ft			74.2	
0.25	26	-15				25										
	28		WOH 1 1 2	100		28									64.2	
0.25	30	-20				30						29.0 / -18.7 Brown, PEAT, wet [D3] **PT**				
	32															
	34		2 2 3 4	100		33									73.0	

REMARKS: Rig Type: CME-550X (ATV).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 2 OF 3

STATION: 1445+34 OFFSET: 127 ft RT
LATITUDE: 36.827168° N LONGITUDE: 76.323042° W
SURFACE ELEVATION: 10.3 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/05/2010 - 08/05/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 4.4 ft AFTER 27 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
1	36	-25				35						34.5 / -24.2 Brown, ORGANIC SILT, trace sand, soft, wet [D3] **OH**				
	38		1 1 2 3	100		38										
0.25												SAME, contains peat layers below 38.6 ft			192.2	
0.25	40	-30				40						39.0 / -28.7 Gray, SILT, contains organic matter and mica, trace sand, soft, wet [D2] **ML**				
	42															
			3 1 1 1	100		43										
0.25	44					45							48	15	47.0	85.8
	46	-35														
	48		8 5 7 6	100		48						46.5 / -36.2 Gray, fine to medium silty SAND, contains organic matter and mica, medium dense, wet [D1] **SM**			33.6	
	50	-40				50										
	52											51.5 / -41.2 Gray, sandy lean CLAY, contains organic matter and mica, very soft, wet [D2] **CL**				
			WOH WOH 1 2	100		53										
0.5	54					55									50.8	
	56	-45														
	58		1 1 1 1	100		58						56.5 / -46.2 Gray, fine to medium clayey SAND, contains organic matter and mica, very loose, wet [D1] **SC**				
															54.9	
	60	-50				60										
	62											61.5 / -51.2 Gray, elastic SILT, trace sand, soft, moist [D2] **MH**				
			1 1 2 2	100		63										
1	64					65									38.7	
	66	-55														
	68		2 2 3 3	100		68						66.5 / -56.2 Green gray, fine to coarse silty SAND, contains shell fragments and coquina, loose, wet [E1] [YORKTOWN FORMATION] **SM**				
	70														30.5	

REMARKS: Rig Type: CME-550X (ATV).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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STATION: 1445+34 OFFSET: 127 ft RT
LATITUDE: 36.827168° N LONGITUDE: 76.323042° W
SURFACE ELEVATION: 10.3 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/05/2010 - 08/05/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 4.4 ft AFTER 27 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	70	-60														
	72		2 2 2 3	100		73						71.5 / -61.2 Green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] **SC**				
	74					75									34.7	
	76	-65														
	78		1 1 3 3	100		78						SAME, fine to medium below 78 ft	42	20	38.7	39.8
	80	-70				80										
	82		2 2 3 4	100		83									32.3	
	84					85										
	86	-75														
	88		2 3 3 4	100		88									32.0	
	90					90										
	92	-80														
	94		3 3 4 5	100		93									28.7	
	96	-85				95										
	98		2 3 4 5	100		98									28.1	
	100					100						Bottom of Boring at 100 ft.				

REMARKS: Rig Type: CME-550X (ATV).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 1 OF 3

STATION: 1448+30 OFFSET: 114 ft RT
LATITUDE: 36.827439° N LONGITUDE: 76.322075° W
SURFACE ELEVATION: 11.2 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/06/2010 - 08/06/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 6.9 ft AFTER 4 HOURS

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	0	11.2	2 2 3 5	85		2						0.0 / 11.2 5-inches ROOTMAT AND TOPSOIL **TOPS**			8.0	
	2	10	6 6 6 4	90		4						0.4 / 10.8 Brown, fine to medium silty sand FILL, contains root fragments, loose, moist [A1] [FILL] **FL**			7.9	
	4 ▽		3 3 2 3	100		6						SAME, orange brown below 2 ft				
	6 ▼	5	2 3 3 3	100		8						4.0 / 7.2 Light gray, fine to medium poorly graded SAND with silt, contains root fragments, loose, wet [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP-SM**			20.2	
	8		2 1 2 2	100		10						SAME, light orange brown below 7 ft			27.5	
	10	0													26.9	
	12		4 5 4 4	75		13						11.5 / -0.3 Gray, fine to medium poorly graded SAND, trace silt, medium dense, wet [C1] **SP**			32.0	
	14					15										
	16	-5														
0.25	18		WOH WOH WOH WOH	100		18						16.5 / -5.3 Gray, fat CLAY, trace sand, contains mica, very soft, moist [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CH**	69	45	64.2	87.6
	20					20										
	22	-10														
0.25	24		WOH 1 0 1	100		23						21.5 / -10.3 Brown gray, lean CLAY with sand, contains organic matter and mica, very soft, wet [D2] **CL**			42.7	
	26	-15				25										
0.75	28		1 2 2 3	100		28						26.5 / -15.3 Dark brown, PEAT, wet [D3] **PT**	193	95	171.9	5.0
	30					30										
	32	-20														
0.25	34		2 1 2 3	100		33									127.7	

REMARKS: Rig Type: CME-550X (ATV).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 2 OF 3

STATION: 1448+30 OFFSET: 114 ft RT
LATITUDE: 36.827439° N LONGITUDE: 76.322075° W
SURFACE ELEVATION: 11.2 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/06/2010 - 08/06/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 6.9 ft AFTER 4 HOURS

FIELD DATA | **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT #200 (%)
	35															
	36	-25										36.5 / -25.3 Brown gray, elastic SILT, trace sand, contains organic matter and mica, soft, wet [D2] **MH**				
0.25	38		1 1 1 1	100		38									84.6	
	40					40										
	42	-30										41.5 / -30.3 Brown gray, lean CLAY with sand, contains organic matter and mica, soft, wet [D2] **CL**				
0.25	44		WOH 1 1 3	100		43 45									36.2	
	46	-35										46.5 / -35.3 Green gray, fine to medium poorly graded SAND, trace silt, contains mica, medium dense, wet [D1] **SP**				
	48		7 8 10 10	100		48									29.7	
	50					50										
	52	-40										51.5 / -40.3 Gray, fine to medium clayey SAND, contains organic matter and mica, very loose, wet [D1] **SC**				
	54		WOH WOH 1 0	100		53 55									39.8	
	56	-45										56.5 / -45.3 Green gray, fine to medium poorly graded SAND with silt, contains mica, loose, wet [D1] **SP-SM**				
	58		2 2 4 4	100		58									30.2	
	60					60										
	62	-50										61.5 / -50.3 Green gray, fine to medium poorly graded SAND, trace silt, contains mica, dense, wet [D1] **SP**				
	64		7 10 14 12	100		63 65									22.8	
	66	-55										66.5 / -55.3 Green gray, fine to coarse silty SAND, contains shell fragments, medium dense, wet [E1] [YORKTOWN FORMATION] **SM**				
	68		19 4 6 10	100		68									35.3	
	70															

REMARKS: Rig Type: CME-550X (ATV).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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STATION: 1448+30 OFFSET: 114 ft RT
LATITUDE: 36.827439° N LONGITUDE: 76.322075° W
SURFACE ELEVATION: 11.2 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/06/2010 - 08/06/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 6.9 ft AFTER 4 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	70															
												71.5 / -60.3 Green gray, fine to coarse clayey SAND, contains shell fragments, medium dense, wet [E1] **SC**				
	72	-60	3 4 5 6	100		73									33.4	
	74					75										
	76	-65														
	78		1 2 2 4	100		78						SAME, loose below 78 ft			30.5	
	80					80										
		-70														
	82					83										
	84		2 2 3 6	100		85									32.4	
	86	-75														
	88		2 3 3 5	100		88									31.3	
	90					90										
		-80														
	92					93										
	94		2 3 3 7	100		95									27.8	
	96	-85														
	98		5 7 7 13	100		98						SAME, medium dense below 98 ft			24.6	
	100					100						Bottom of Boring at 100 ft.				

REMARKS: Rig Type: CME-550X (ATV).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 1 OF 3

STATION: 1440+20 OFFSET: 172 ft LT
LATITUDE: 36.827452° N LONGITUDE: 76.325034° W
SURFACE ELEVATION: 11.1 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/25/2010 - 08/25/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT LL	LAB: PLASTICITY INDEX PI	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT #200 (%)
		10	14 5 6	27		0.5						0.0 / 11.1 4-inches ASPHALT **ASPH**			6.9	
	2		5 12 15 14	85		2						0.3 / 10.8 Brown, fine to coarse poorly graded sand with silt FILL, contains gravel and crushed stone, medium dense, moist [A1] [FILL] **FL**			11.4	
2.25	4 ▽		7 10 9 6	100		4						2.0 / 9.1 Dark brown gray, sandy lean clay FILL, contains crushed stone, very stiff, moist [A2] **FL**			19.1	
	6	5	2 2 2 2	100		6						3.7 / 7.4 Light brown, fine to medium poorly graded SAND, trace silt, dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP**			23.3	
	8		2 2 3 5	100		8						SAME, wet below 4 ft			21.4	
	10	0				10						7.0 / 4.1 Gray, fine to medium poorly graded SAND with silt, contains organic matter, loose, wet [C1] **SP-SM**				
	12					12										
	14		5 7 7 9	90		13						SAME, contains shell fragments, medium dense below 13 ft			22.7	
	16	-5				15										
	18		1 0 1 0	100		18						16.5 / -5.4 Gray, fat CLAY, trace sand, contains mica, very soft, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CH**				
0.25	20					20							91	67	79.0	95.7
	22	-10														
			WOH WOH WOH 1	100		23										
0.25	24					25									71.7	
	26	-15														
	28		WOH WOH 1 1	100		28										
0.25															74.8	
	30					30										
		-20														
	32											31.5 / -20.4 Brown, PEAT, wet [D3] **PT**				
			3 2 4 4	100		33										
	34														307.7	

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

STATION: 1440+20 OFFSET: 172 ft LT
LATITUDE: 36.827452° N LONGITUDE: 76.325034° W
SURFACE ELEVATION: 11.1 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/25/2010 - 08/25/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT -#200 (%)
	35															
	36	-25										36.5 / -25.4 Brown, ORGANIC SILT, trace sand, soft, wet [D3] **OH**				
	38		1 2 1 2	100		38										
0.25	40														102.8	
	42	-30														
	43		WOH WOH 1 1	100		43						SAME, gray brown, contains mica, very soft below 43 ft				
0.25	44					45									94.0	
	46	-35														
	48		2 1 7 8	100		48						46.5 / -35.4 Gray, fat CLAY with sand, contains mica and organic matter, stiff, wet [D2] **CH**				
0.25	50					50						49.7 / -38.6 Gray, fine to medium silty SAND, contains organic matter and mica, medium dense, wet [D1] **SM**	53	28	53.7	75.7
	52	-40										51.5 / -40.4 Gray, sandy SILT, contains organic matter and mica, firm, wet [D2] **ML**				
	53		2 2 2 2	100		53										
0.25	54					55									43.0	
	56	-45														
	58		WOH WOH 1 1	100		58						SAME, very soft below 58 ft				
0.25	60					60									44.4	
	62	-50														
	63		WOH 1 1 2	100		63						61.5 / -50.4 Brown, ORGANIC CLAY, soft, wet [D3] **OH**				
0.25	64					65							113	74	72.9	93.2
	66	-55														
	68		1 1 6 31	100		68						66.5 / -55.4 Green gray, fat CLAY, trace sand, stiff, moist [D2] **CH**				
0.75	70											SAME, brown, contains organic matter, trace gravel			40.9	

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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STATION: 1440+20 OFFSET: 172 ft LT
LATITUDE: 36.827452° N LONGITUDE: 76.325034° W
SURFACE ELEVATION: 11.1 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/25/2010 - 08/25/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

FIELD DATA														LAB DATA			
			SOIL				ROCK										
PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	STANDARD PENETRATION TEST HAMMER BLOWS	SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	CORE RECOVERY (%)	ROCK QUALITY DESIGNATION	DIP ° STRATA	DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA		LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
						70						below 69 ft					
	72	-60										69.6 / -58.5 Gray, fine to coarse poorly graded SAND with silt, trace gravel, loose, wet [D1] **SP-SM**					
			3			73											
	74		3 6 11	100								71.5 / -60.4 Green gray, fine to coarse clayey SAND, contains shell fragments, medium dense, wet [E1] [YORKTOWN FORMATION] **SC**				31.7	
						75						Bottom of Boring at 75 ft.					

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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STATION: 407+23 OFFSET: 59 ft RT
LATITUDE: 36.828032° N LONGITUDE: 76.322947° W
SURFACE ELEVATION: 10.4 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/26/2010 - 08/26/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

FIELD DATA / **LABORATORY DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)	ORGANIC CONTENT (%)
		10	7 8 7	90		1						0.0 / 10.4 2-inches ROOTMAT AND TOPSOIL **TOPS**			11.1		
4.5	2		7 6 5	90		2						0.2 / 10.2 Dark brown, fine to medium silty sand FILL, contains concrete fragments, medium dense, moist [A1] [FILL] **FL**			7.0		
	4 ▽	5	4 2 3	100		4						1.0 / 9.4 Gray brown, sandy fat CLAY, very stiff, moist [C2] [LYNNHAVEN MEMBER (TABB FORMATION)] **CH**			23.1		
	6		2 1 2	100		6						1.8 / 8.6 Brown, fine to medium clayey SAND, contains root fragments, medium dense, moist [C1] **SC**			25.7		
	8		2 3 4	100		8						2.0 / 8.4 Light brown, fine to medium poorly graded SAND, trace silt, medium dense, moist [C1] **SP** SAME, loose, wet below 4 ft			27.0		
	10	0				10											
	12																
	14		3 4 5	85		13						6.0 / 4.4 Orange brown, fine to medium poorly graded SAND with silt, loose, wet [C1] **SP-SM** SAME, brown below 8 ft SAME, gray, medium dense below 13 ft			27.9		
	16	-5				15											
	18		WOH WOH	100		18						16.5 / -6.1 Gray, fat CLAY, trace sand, contains mica, very soft, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CH**					
0.25	20		1			20									57.9		
	22	-10															
	23		WOH	100		23											
0.25	24		1 0			25							59	39	79.0	90.9	
	26	-15															
	28		1 1 1	100		28											
	30	-20	2			30									215.2		
	32																
	34		1 3 2	100		33						26.5 / -16.1 Brown, PEAT, wet [D3] **PT**			412.3		24.1
	36		3														

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGABC:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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STATION: 407+23 OFFSET: 59 ft RT
LATITUDE: 36.828032° N LONGITUDE: 76.322947° W
SURFACE ELEVATION: 10.4 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/26/2010 - 08/26/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

FIELD DATA | **LABORATORY DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)	ORGANIC CONTENT (%)
	36	-25				35											
	38		1 2 3 2	100		38									223.2		
	40	-30				40											
	42											41.5 / -31.1 Gray, fine to medium clayey SAND, contains organic matter and mica, loose, wet [D1] **SC**					
	44		2 2 2 2	100		43 45									40.3		
	46	-35															
	48		10 12 12 14	75		48						46.5 / -36.1 Green gray, fine to medium poorly graded SAND with silt, contains organic matter and mica, dense, wet [D1] **SP-SM**			28.3		
	50	-40				50											
	52																
	54		2 2 4 2	15		53 55						51.5 / -41.1 Green gray, fine to medium silty SAND, contains organic matter and mica, loose, wet [D1] **SM**			32.5		
	56	-45															
0.25	58		WOH WOH 1 0	100		58						56.5 / -46.1 Brown gray, lean CLAY with sand, contains organic matter and mica, very soft, wet [D2] **CL**			43.4		
	60	-50				60											
	62											61.5 / -51.1 Gray, elastic SILT with sand, contains mica, soft, moist [D2] **MH**					
0.25	64		WOH WOH 2 2	100		63 65							111	65	33.7	78.9	
	66	-55															
	68		2 2 3 8	50		68						66.5 / -56.1 Green gray, fine to medium silty SAND, contains shell fragments and coquina, loose, wet [E1] [YORKTOWN FORMATION] **SM**			27.7		
	70																

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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STATION: 407+23 OFFSET: 59 ft RT
LATITUDE: 36.828032° N LONGITUDE: 76.322947° W
SURFACE ELEVATION: 10.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/26/2010 - 08/26/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LABORATORY DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)	ORGANIC CONTENT (%)
	70	-60															
	72		2 3 3 4	100		73 75						71.5 / -61.1 Green gray, fine to medium clayey SAND, contains shell fragments, loose, wet [E1] **SC**			32.7		
	74	-65															
	76																
	78		2 2 3 8	100		78 80									35.0		
	80	-70															
	82																
	84		2 3 5 8	100		83 85						SAME, medium dense below 83 ft			31.0		
	86	-75															
	88			0		88											
	90					90											
	92	-80		40		92											
	94		2 2 3 5	100		93 95						SAME, loose below 93 ft			30.3		
	96	-85															
	98		5 7 8 15	0		98						SAME, contains coquina, medium dense below 98 ft			26.7		
	100					100						Bottom of Boring at 100 ft.					

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGABC:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-133
PAGE 1 OF 3

STATION: 410+07 OFFSET: 91 ft RT
LATITUDE: 36.828177° N LONGITUDE: 76.323830° W
SURFACE ELEVATION: 11.0 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/27/2010 - 07/27/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
		10	4 10 13 11	65		2						0.0 / 11.0 4-inches ROOTMAT AND TOPSOIL **TOPS**			4.1	
	2		7 4 3 4	65		4						0.3 / 10.7 Light brown, fine to coarse silty sand FILL, contains root fragments and crushed stone, dense, moist [A1] [FILL] **FL**			12.8	
	4 ▽		4 4 2 3	75		6						2.0 / 9.0 Gray brown, fine to medium poorly graded SAND with silt, loose, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP-SM**			23.0	
	6	5	1 2 1 3	85		8						SAME, gray and orange brown, wet below 4 ft			26.3	
	8		3 4 4 5	90		10						SAME, gray, medium dense below 8 ft			26.1	
	10	0														
	12					13										
	14		3 2 2 2	95		15						SAME, gray, loose below 13 ft			29.0	
	16	-5														
0.25	18		WOH WOH WOH WOH	100		18						16.5 / -5.5 Gray, fat CLAY, trace sand, contains mica, very soft, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CH**	66	47	70.4	94.9
	20					20										
	22	-10														
0.75	24		WOH WOH 1 1	100		23 25									82.3	
	26	-15														
0.75	28		1 0 1 0	100		28 30									69.6	
	30															
	32	-20				33						31.5 / -20.5 Dark brown, PEAT, moist [D3] **PT**				
	34		2 2 5 5	100									229	69	7.4	7.4

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-133
PAGE 2 OF 3

STATION: 410+07 OFFSET: 91 ft RT
LATITUDE: 36.828177° N LONGITUDE: 76.323830° W
SURFACE ELEVATION: 11.0 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/27/2010 - 07/27/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT #200 (%)
	35															
	36	-25										36.5 / -25.5 Dark brown, ORGANIC SILT with sand, firm, wet [D3] **OH**	216	81	178.1	83.4
	38		2 2 2 3	100		38										
	40	-30				40						41.5 / -30.5 Gray brown, fine to medium silty SAND, contains organic matter, very loose, wet [D1] **SM**			39.9	
	42		2 1 1 2	100		43										
	44					45										
	46	-35										46.5 / -35.5 Gray, sandy fat CLAY, contains heavy concentrations of organic matter, soft, wet [D2] **CH**			63.5	
	48		WOH 1 1 2	100		48										
	50					50										
	52	-40										51.5 / -40.5 Gray, fine to medium poorly graded SAND with silt, contains organic matter and mica, loose, wet [D1] **SP-SM**			36.7	
	54		3 2 3 4	100		53										
	56	-45				55										
0.25	58		WOH WOH 1 1	100		58						56.5 / -45.5 Gray, sandy SILT, contains mica, very soft, wet [D2] **ML**			46.1	
	60					60										
	62	-50										61.5 / -50.5 Gray, fat CLAY, trace sand, contains organic matter, soft, wet [D2] **CH**				
1	64		1 1 1 2	100		63							82	49	58.5	97.4
	66	-55				65										
	68		4 6 8 7	100		68						66.5 / -55.5 Gray, fine to medium poorly graded SAND with silt, medium dense, wet [D1] **SP-SM**			18.0	
	70															

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 3 OF 3

STATION: 410+07 OFFSET: 91 ft RT
LATITUDE: 36.828177° N LONGITUDE: 76.323830° W
SURFACE ELEVATION: 11.0 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/27/2010 - 07/27/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	70															
	72	-60	2 3 2 4	90		73						71.5 / -60.5 Gray, fine to coarse clayey SAND, contains heavy concentrations of shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SC**			37.1	
	74					75										
	76	-65														
	78		2 2 3 4	100		78									33.5	
	80					80										
	82	-70														
	84		2 2 3 5	100		83									33.3	
	86	-75				85										
	88		3 4 3 5	100		88									32.3	
	90					90										
	92	-80														
	94		2 2 4 7	100		93									31.8	
	96	-85				95										
	98		3 4 6 8	100		98						SAME, medium dense below 98 ft			28.6	
	100					100						Bottom of Boring at 100 ft.				

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 1 OF 3

STATION: 411+71 OFFSET: 7 ft LT
LATITUDE: 36.828082° N LONGITUDE: 76.324440° W
SURFACE ELEVATION: 11.7 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/27/2010 - 07/27/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	ORGANIC CONTENT (%)
	2	10	5 5 5	85		2						0.0 / 11.7 4-inches ROOTMAT AND TOPSOIL **TOPS**			11.2	
	4 ▽		3 2 2	90		4						0.3 / 11.4 Gray brown, fine to medium silty SAND, contains root fragments, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SM**			11.4	
	6	5	2 1 5	75		6						2.0 / 9.7 Brown, fine to medium poorly graded SAND with silt, loose, moist [C1] **SP-SM**			22.7	
	8		1 1 2	85		8						SAME, light gray brown, wet below 4 ft			24.3	
	10		2 2 3	90		10						SAME, gray below 7 ft			21.4	
	12	0				13										
	14		3 5 3	90		15						SAME, medium dense below 13 ft			28.1	
	16	-5				18						16.5 / -4.8 Gray, fat CLAY, trace sand, contains organic matter and mica, soft, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CH**				
0.25	18		1 1 1	95		18									66.5	
	20					20										
	22	-10				23						SAME, very soft below 23 ft				
0.5	24		WOH WOH 1	95		25									67.6	
	26	-15				28										
0.5	28		WOH 1 0	100		30									66.2	
	30															
	32	-20				33						31.5 / -19.8 Dark brown, PEAT, wet [D3] **PT**				
	34		1 2 3	100											277.7	

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAC:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-136
PAGE 2 OF 3

STATION: 411+71 OFFSET: 7 ft LT
LATITUDE: 36.828082° N LONGITUDE: 76.324440° W
SURFACE ELEVATION: 11.7 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/27/2010 - 07/27/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	ORGANIC CONTENT (%)
	35															
	36	-25	1 2 1 2	100		38									249.5	57.6
	38															
	40					40										
	42	-30	3 4 4 4	90		43						41.5 / -29.8 Gray, fine to medium poorly graded SAND, trace silt, contains organic matter and mica, medium dense, wet [D1] **SP**			29.8	
	44					45										
	46	-35	4 6 8 10	100		48									31.0	
	48															
	50					50										
	52	-40	3 3 7 6	100		53									30.0	
	54															
	56					55										
0.75	58	-45	5 2 2 2	100		58						56.5 / -44.8 Dark gray, elastic SILT with sand, contains organic matter and mica, firm, moist [D2] **MH**			44.4	
	60					60										
	62	-50	1 1 1 1	100		63						61.5 / -49.8 Gray, fat CLAY, trace sand, contains mica, soft, moist [D2] **CH**			88.8	
1	64					65										
	66	-55														
	68		2 2 6 19	100		68										
1.25	70											69.0 / -57.3			39.2	

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAC:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 3 OF 3

STATION: 411+71 OFFSET: 7 ft LT
LATITUDE: 36.828082° N LONGITUDE: 76.324440° W
SURFACE ELEVATION: 11.7 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/27/2010 - 07/27/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	ORGANIC CONTENT (%)
	70											Gray, fine to medium poorly graded SAND, trace silt, contains organic matter, medium dense, wet [D1] **SP**				
	71.5	-59.8										Light green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SC**			31.8	
	72	-60	1 2 2 3	100		73										
	74					75										
	76	-65														
	78		2 3 6 6	100		78						SAME, medium dense below 78 ft			33.1	
	80					80										
	82	-70														
	84		2 3 6 7	100		83									32.1	
	86					85										
	88	-75	2 2 3 7	100		88						SAME, gray, loose below 88 ft			33.0	
	90					90										
	92	-80														
	94		1 3 3 7	100		93									34.3	
	96	-85				95										
	98		2 3 4 12	100		98									31.3	
	100					100						Bottom of Boring at 100 ft.				

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAC:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-136A
PAGE 1 OF 1

STATION: 411+71 OFFSET: 9 ft LT
LATITUDE: 36.828082° N LONGITUDE: 76.324440° W
SURFACE ELEVATION: 11.7 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/28/2010 - 07/28/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER

FIELD DATA / **LABORATORY DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)	ORGANIC CONTENT (%)
	0.0 / 11.7											Rotary probe to 20 ft; see Boring 10BH-136 for strata descriptions.					
0.5	20	-10		100		20 22						20.0 / -8.3 Gray, fat CLAY, moist [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CH**	98	68	77.8	99.6	
	22.0 / -10.3											Rotary probe to 32 ft; see Boring 10BH-136 for strata descriptions.					
	32	-20		85		32 34						32.0 / -20.3 Dark brown, PEAT, wet [D3] **PT**	223	76	215.7	4.2	39.5
	34											Bottom of Boring at 34 ft.					

REMARKS: Rig Type: CME-45C (Track).

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10BH-136A

SPT_LOGABC:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: PAVEMENT

10BH-140
PAGE 1 OF 1

STATION: 407+77 OFFSET: 167 ft RT
LATITUDE: 36.828319° N LONGITUDE: 76.323132° W
SURFACE ELEVATION: 9.8 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/26/2010 - 08/26/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
		7 7 4	65		2						0.0 / 9.8 No ground cover			11.9	25.4
2	8	5 4 5	100		4						0.1 / 9.7 Orange brown and brown, fine to coarse silty sand FILL, contains crushed stone and metal fragments, medium dense, moist [A1] [FILL] **FL**			18.5	
4 ▽	6	2 3 2	100		6						1.8 / 8.0 Light brown, fine to medium poorly graded SAND with silt, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP-SM**			24.1	
6	4	1 1 2	100		8						SAME, loose, wet below 4 ft			21.3	
8	2	2 3 4	100		10									27.9	
10	0										SAME, gray below 9.7 ft Bottom of Boring at 10 ft.				

REMARKS: Rig Type: CME-45C (Track).

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10BH-140

SPT_LOGB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-144
PAGE 1 OF 3

STATION: 403+58 OFFSET: 22 ft RT
LATITUDE: 36.828123° N LONGITUDE: 76.321740° W
SURFACE ELEVATION: 8.8 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/06/2010 - 08/06/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 3.0 ft DEPTH
STABILIZED AT 3.4 ft AFTER 79 HOURS

FIELD DATA | **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	ORGANIC CONTENT (%)
												0.0 / 8.8 2-inches ROOTMAT AND TOPSOIL **TOPS**			8.9	
	2		4 7 6	90		2						0.2 / 8.6 Brown, fine to medium silty SAND, medium dense, moist [A1] [FILL] **FL**			16.8	
	4	5	5 4 4	100		4						1.7 / 7.1 Light orange brown, fine to medium poorly graded SAND, trace silt, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP**			24.9	
	6		3 3 3	100		6						SAME, brown, wet below 3 ft			31.4	
	8	0	2 2 3	100		8						SAME, loose below 4 ft			25.1	
	10		3 3 4	100		10										
	12					13						11.5 / -2.7 Gray, fine to medium silty SAND, loose, wet [C1] **SM**				
	14	-5	1 2 1	65		15									29.7	
	16															
0.25	18		WOH WOH 1	100		18						16.5 / -7.7 Brown gray, elastic SILT, trace sand, contains organic matter and mica, very soft, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **MH**			68.3	
	20	-10	0			20										
	22					23										
0.25	24	-15	WOH WOH 1	100		25									65.4	
	26		0													
	28		4 2 2	100		28						26.5 / -17.7 Dark gray brown, ORGANIC SILT, trace sand, firm, wet [D3] **OH**				
0.75	30	-20	2			30									106.5	18.4
	32					33						31.5 / -22.7 Brown gray, lean CLAY with sand, contains organic matter and mica, very soft, wet [D2] **CL**				
0.25	34	-25	WOH 1 0	100		1									72.7	

REMARKS: Rig Type: CME-550X (ATV).

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SPT_LOGAC:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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STATION: 403+58 OFFSET: 22 ft RT
LATITUDE: 36.828123° N LONGITUDE: 76.321740° W
SURFACE ELEVATION: 8.8 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/06/2010 - 08/06/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 3.0 ft DEPTH
STABILIZED AT 3.4 ft AFTER 79 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	ORGANIC CONTENT (%)
	36					35										
	38	-30	WOH 1 1 0	100		38						36.5 / -27.7 Brown gray, elastic SILT, trace sand, contains organic matter and mica, soft, wet [D2] **MH**				
0.25	40					40									92.6	
	42															
	44	-35	WOH 1 1 1	100		43 45						41.5 / -32.7 Brown gray, lean CLAY with sand, contains organic matter and mica, soft, wet [D2] **CL**				
0.25	46														41.6	
	48	-40	6 10 13 13	100		48 50						46.5 / -37.7 Gray, fine to medium silty SAND, contains organic matter and mica, dense, wet [D1] **SM**				
	50														27.2	
	52															
	54	-45	2 1 1 0	100		53 55						51.5 / -42.7 Gray, lean CLAY with sand, contains organic matter and mica, soft, wet [D2] **CL**				
0.25	56														44.7	
	58	-50	WOH 1 2 2	100		58 60									77.6	
0.5	60															
	62											61.5 / -52.7 Gray, elastic SILT, trace sand, contains organic matter and mica, soft, moist [D2] **MH**				
	64	-55	WOH 1 1 2	100		63 65									45.3	
0.75	66															
	68	-60	3 3 4 5	90		68						66.5 / -57.7 Gray, fine to coarse poorly graded SAND, trace silt and gravel, contains shell fragments, loose, wet [D1] **SP**				
	70														17.0	

REMARKS: Rig Type: CME-550X (ATV).

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SPT_LOGAC:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-144

STATION: 403+58 OFFSET: 22 ft RT
LATITUDE: 36.828123° N LONGITUDE: 76.321740° W
SURFACE ELEVATION: 8.8 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/06/2010 - 08/06/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 3.0 ft DEPTH
STABILIZED AT 3.4 ft AFTER 79 HOURS

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: ORGANIC CONTENT (%)
	70															
	72											71.5 / -62.7 Green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SC**				
	74	-65	2 2 3 4	100		73 75									33.3	
	76															
	78	-70	2 3 3 3	100		78 80									32.1	
	80															
	82											81.5 / -72.7 Green gray, sandy lean CLAY, contains shell fragments, firm, wet [E2] **CL**				
1.25	84	-75	2 3 3 6	100		83 85									30.8	
	86															
	88	-80	3 3 5 12	100		88 90						86.5 / -77.7 Green gray, fine to coarse clayey SAND, contains shell fragments, medium dense, wet [E1] **SC**			31.4	
	90															
	92											91.5 / -82.7 Green gray, sandy lean CLAY, contains shell fragments, stiff, wet [E2] **CL**				
1	94	-85	4 5 7 8	100		93 95									24.5	
	96															
	98	-90	2 4 6 9	100		98 100						96.5 / -87.7 Green gray, fine to coarse clayey SAND, contains shell fragments, medium dense, wet [E1] **SC**			29.7	
	100											Bottom of Boring at 100 ft.				

REMARKS: Rig Type: CME-550X (ATV).

SPT_LOGAC:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-147

STATION: 400+39 OFFSET: 61 ft RT
LATITUDE: 36.828406° N LONGITUDE: 76.320697° W
SURFACE ELEVATION: 7.3 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/27/2010 - 08/27/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
	2	5	8 14 9	87		0.5 2						0.0 / 7.3 2-inches ASPHALT **ASPH**			12.3	
			8 17 17 18	85								0.2 / 7.1 Dark gray, fine to coarse silty sand FILL, contains brick fragments, dense, moist [A1] [FILL] **FL**			10.7	
	4 ▽		23 20 11 12	100		4						SAME, gray, contains crushed stone and shell fragments below 2 ft			20.7	
	6		9 8 6 4	100		6						SAME, light brown gray, fine to medium, dense, wet below 4 ft				
	8	0	4 4 4 7	100		8						6.0 / 1.3 Orange brown, fine to medium poorly graded SAND with silt, medium dense, wet [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP-SM**			28.7	
	10					10						SAME, light orange gray below 8 ft			24.7	
	12	-5														
0.25	14		WOH WOH 1 1	100		13 15						11.5 / -4.2 Brown and gray, ORGANIC CLAY with sand, contains mica, very soft, wet [D3] [SEDGEFIELD MEMBER (TABB FORMATION)] **OH**	83	47	62.2	78.4
	16															
	18	-10	WOH WOH 1 0	100		18 20									73.9	
0.25	20															
	22	-15										21.5 / -14.2 Dark brown and gray, ORGANIC SILT with sand, contains mica, soft, wet [D3] **OH**				
0.25	24		WOH 1 1 1	100		23 25							87	32	75.7	78.8
	26															
	28	-20	2 6 5 9	85		28 30						26.5 / -19.2 Green gray, fine to medium silty SAND, contains organic matter and mica, medium dense, wet [D1] **SM**			30.0	
	30															
	32	-25										31.5 / -24.2 Green gray, fine to medium poorly graded SAND with silt, contains organic matter and mica, medium dense, wet [D1] **SP-SM**				
	34		5 6 6 7	75		33									27.1	

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 2 OF 3

STATION: 400+39 OFFSET: 61 ft RT
LATITUDE: 36.828406° N LONGITUDE: 76.320697° W
SURFACE ELEVATION: 7.3 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/27/2010 - 08/27/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	35															
	36															
		-30	7 8 11 10	65		38									28.4	
	40					40										
	42	-35	9 10 12 12	75		43									28.9	
	44					45										
	46															
		-40	11 11 8 7	65		48									36.2	
	48															
	50					50										
	52	-45	5 6 10 9	60		53						51.5 / -44.2 Green gray, fine to medium poorly graded SAND, trace silt, contains organic matter and mica, medium dense, wet [D1] **SP**			26.5	
	54					55										
	56															
		-50	9 10 6 9	60		58									27.2	
	58															
	60					60										
	62	-55	10 10 10 12	85		63						SAME, contains shell fragments below 63 ft			32.8	
	64					65										
	66															
		-60	1 2 5 5	100		68						66.5 / -59.2 Green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SC**			29.9	
	68															
	70															

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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STATION: 400+39 OFFSET: 61 ft RT
LATITUDE: 36.828406° N LONGITUDE: 76.320697° W
SURFACE ELEVATION: 7.3 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/27/2010 - 08/27/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
	70															
	72	-65	2 2 4 13	100		73 75									31.3	
	74															
	76															
	78	-70	2 4 7 10	100		78 80						SAME, medium dense below 78 ft			33.3	
	80															
	82	-75	2 2 6 20	100		83 85									28.8	
	84															
	86															
	88	-80	6 6 11 25	100		88 90						SAME, contains coquina below 88 ft			21.8	
	90															
	92	-85	15 14 12 32	100		93 95						SAME, dense below 93 ft			20.0	
	94															
	96															
	98	-90	8 9 10 17	100		98 100						SAME, medium dense below 98 ft			28.4	
	100											Bottom of Boring at 100 ft.				

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 1 OF 3

STATION: 1451+04 OFFSET: 83 ft RT
LATITUDE: 36.827737° N LONGITUDE: 76.321208° W
SURFACE ELEVATION: 16.8 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/03/2010 - 08/03/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

FIELD DATA | **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT -#200 (%)
	0	16.8	3 3 3	80		2						0.0 / 16.8 5-inches ROOTMAT AND TOPSOIL **TOPS**			9.9	
	2	15	4 5 4	95		4						0.4 / 16.4 Brown gray, fine to medium poorly graded sand FILL, trace silt, loose, moist [A1] [FILL] **FL**			8.3	
	4		7 5 7	90		6						SAME, light brown, medium dense below 2 ft			7.5	
	6 ▽	10	10 10 7	90		8						SAME, gray brown, contains root fragments, wet below 6 ft			17.2	
	8		7 7 8	90		10						8.0 / 8.8 Gray brown, fine poorly graded SAND with silt, medium dense, wet [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP-SM**			7.3	
	10		8 6													
	12	5	2 2 2	45		13						SAME, light brown, loose below 13 ft			28.7	
	14		2			15										
	16	0	4 4 4	55		18						SAME, gray, medium dense below 18 ft			26.3	
	18		3			20										
	20															
	22	-5	WOH WOH WOH WOH	90		23						21.5 / -4.7 Dark gray and dark brown, elastic SILT with sand, contains organic matter and mica, very soft, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **MH**				
0.25	24					25							70	25	57.3	77.7
	26	-10														
	28		1 0 1 1	100		28									71.4	
0.75	30					30										
	32	-15										31.5 / -14.7 Dark brown gray, elastic SILT, trace sand, contains organic matter, very soft, moist [D2] **MH**				
	33		1 0 1 1	100		33										
0.75	34												80	36	67.1	95.3

REMARKS: Rig Type: CME-550X (ATV).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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STATION: 1451+04 OFFSET: 83 ft RT
LATITUDE: 36.827737° N LONGITUDE: 76.321208° W
SURFACE ELEVATION: 16.8 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/03/2010 - 08/03/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT #200 (%)
	35															
	36	-20														
	38		WOH 1 1 1	100		38						SAME, soft below 38 ft			70.0	
0.25	40					40										
	42	-25										41.5 / -24.7 Gray, fine poorly graded SAND, trace silt, dense, wet [D1] **SP**				
	43		3 9 16 17	100		43									26.3	
	44					45										
	46															
	48	-30	4 3 6 6	95		48						46.5 / -29.7 Gray, fine poorly graded SAND with silt, contains mica, medium dense, wet [D1] **SP-SM**			37.8	
	50					50										
	52	-35														
	53		2 2 2 3	65		53						SAME, contains organic matter, loose below 53 ft			50.6	
	54					55										
	56															
	58	-40	3 4 2 1	100		58						56.5 / -39.7 Dark gray brown, elastic SILT with sand, contains mica, firm, moist [D2] **MH**			46.1	
0.5	60					60										
	62	-45										61.5 / -44.7 Gray, fat CLAY, trace sand, soft, moist [D2] **CH**				
	63		WOH 1 1 2	75		63							51	28	44.2	94.3
0.5	64					65										
	66															
	68	-50	1 2 2 3	85		68						SAME, firm below 68 ft			30.6	
	70															

REMARKS: Rig Type: CME-550X (ATV).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 3 OF 3

STATION: 1451+04 OFFSET: 83 ft RT
LATITUDE: 36.827737° N LONGITUDE: 76.321208° W
SURFACE ELEVATION: 16.8 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/03/2010 - 08/03/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	70															
	72	-55	2 3 4 11	65		73 75						71.5 / -54.7 Gray, fine to medium clayey SAND, loose, wet [D1] **SC**			30.1	
	74															
	76															
	78	-60	WOH 2 1 2	100		78 80						76.5 / -59.7 Gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SC**			30.5	
	80															
	82	-65	1 1 2 4	100		83 85									33.6	
	84															
	86															
	88	-70	2 2 4 6	100		88 90									31.5	
	90															
	92	-75	1 3 3 4	100		93 95									30.0	
	94															
	96															
	98	-80	WOR 2 3 4	100		98 100						Bottom of Boring at 100 ft.			30.7	
	100															

REMARKS: Rig Type: CME-550X (ATV).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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STATION: 1454+32 OFFSET: 104 ft RT
LATITUDE: 36.827939° N LONGITUDE: 76.320109° W
SURFACE ELEVATION: 9.2 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/29/2010 - 07/29/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
												0.0 / 9.2 4-inches ROOTMAT AND TOPSOIL **TOPS**			2.8
	2		6 16 19 15	85		2						0.3 / 8.9 Brown, fine to coarse silty sand FILL, contains root fragments and contains crushed stone, dense, moist [A1] [FILL] **FL**			9.1
	4	5	6 6 4 3	40		4						2.0 / 7.2 Gray brown, fine to coarse clayey sand FILL, medium dense, moist [A1] **FL**			8.5
	6 ▽		2 3 5 5	15		6						SAME, contains organic matter and crushed stone, medium dense below 4 ft			22.1
	8	0	2 2 2 2	90		8						6.0 / 3.2 Brown, fine to medium poorly graded SAND with silt, loose, wet [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP-SM**			30.4
	10		2 1 1	90		10									
	12														
	14	-5	2 2 1 1	100		13 15						SAME, gray, trace gravel below 13 ft			25.9
	16														
0.5	18	-10	1 1 1 1	100		18 20						16.5 / -7.3 Brown gray, elastic SILT, trace sand, contains organic matter and mica, soft, moist [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **MH**			67.6
	22					23									
0.75	24	-15	1 1 1 1	100		25									78.1
	26														
	28					28									
1	30	-20	1 1 2 2	100		30									63.3
	32														
	34	-25	1 2 1 2	100		33						31.5 / -22.3 Gray brown, fine to medium clayey SAND, contains organic matter and mica, loose, wet [D1] **SC**			68.7

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 2 OF 3

STATION: 1454+32 OFFSET: 104 ft RT
LATITUDE: 36.827939° N LONGITUDE: 76.320109° W
SURFACE ELEVATION: 9.2 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/29/2010 - 07/29/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	36					35									
	38	-30	2 2 3 5	100		38						36.5 / -27.3 Gray, fine to medium poorly graded SAND with silt, contains organic matter and mica, loose, wet [D1] **SP-SM**			38.3
	40					40									
	42					43						41.5 / -32.3 Gray, fine poorly graded SAND, trace silt, contains organic matter and mica, loose, wet [D1] **SP**			
	44	-35	4 3 4 5	100		45									31.3
	46														
	48					48									
	50	-40	3 4 5 11	100		50						SAME, medium dense below 48 ft			38.4
	52														
	54	-45	5 5 8 10	85		53 55									31.5
	56														
	58					58									
	60	-50	6 8 13 15	100		60									24.5
	62														
	64	-55	4 6 6 8	100		63 65									39.9
	66														
	68					68									
	70	-60	5 7 8 11	100											39.7

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 3 OF 3

STATION: 1454+32 OFFSET: 104 ft RT
LATITUDE: 36.827939° N LONGITUDE: 76.320109° W
SURFACE ELEVATION: 9.2 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/29/2010 - 07/29/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	70														
	72											71.5 / -62.3 Gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SC**			
	74	-65	2 2 2 3	100		73 75									33.6
	76														
	78		2 2 3 4	100		78 80									27.8
	80	-70													
	82														
	84	-75	2 3 2 7	100		83 85									30.7
	86														
	88		3 4 5 10	100		88 90						SAME, medium dense below 88 ft			26.7
	90	-80													
	92														
	94	-85	4 5 10 10	100		93 95						SAME, contains heavy concentrations of shell fragments and coquina below 93 ft			21.0
	96														
	98		3 3 8 9	100		98 100									24.7
	100	-90										Bottom of Boring at 100 ft.			

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 1 OF 1

STATION: 1454+39 OFFSET: 103 ft RT
LATITUDE: 36.827947° N LONGITUDE: 76.320086° W
SURFACE ELEVATION: 9.0 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/02/2010 - 08/02/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER

FIELD DATA													LAB DATA			
			SOIL				ROCK									
PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	STANDARD PENETRATION TEST HAMMER BLOWS	SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	CORE RECOVERY (%)	ROCK QUALITY DESIGNATION	DIP ° STRATA	DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
												0.0 / 9.0 Rotary probe to 18 ft; see Boring 10BH-154 for strata descriptions.				
0.25	18	-10		100		18						18.0 / -9.0 Brown and gray, elastic SILT, moist [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **MH**	59	28	57.7	93.0
0.5	26	-15		95		25 27						Bottom of Boring at 27 ft.				

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-157
PAGE 1 OF 3

STATION: 1456+77 OFFSET: 111 ft RT
LATITUDE: 36.828113° N LONGITUDE: 76.319313° W
SURFACE ELEVATION: 9.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/29/2010 - 07/29/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
												0.0 / 9.6 2-inches ROOTMAT AND TOPSOIL **TOPS**			6.7
	2		6 9 11 7	85		2						0.2 / 9.4 Gray brown, fine to medium silty sand FILL, medium dense, moist [A1] [FILL] **FL**			9.6
	4	5	7 7 6 5	90		4						2.0 / 7.6 Brown, poorly graded SAND, trace silt, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP**			15.7
	6 ▽		3 4 9 6	90		6						4.0 / 5.6 Light gray brown, fine to medium clayey SAND, medium dense, moist [C1] **SC**			23.2
	8		6 8 7 7	90		8						5.0 / 4.6 Light gray, fine to medium poorly graded SAND with silt, medium dense, moist [C1] **SP-SM** SAME, light brown, wet below 6 ft SAME, gray below 9 ft			22.8
	10	0	6 4 5 5	90		10									
	12														
	14	-5	2 2 1 2	85		13 15						11.5 / -1.9 Gray, fine to medium clayey SAND, loose, wet [D1] [SEDGEFIELD MEMBER (TABB FORMATION)] **SC**			30.2
	16														
	18		1 1 2 1	80		18						16.5 / -6.9 Dark gray brown, ORGANIC SILT, trace sand, soft, wet [D3] **OH**			212.4
	20	-10				20									
	22														
	24		1 1 1 1	90		23 25									112.9
	26	-15													
	28		WOH 1 2 1	90		28									
0.25	30	-20				30									48.9
	32														
	34		3 2 1 2	100		33						31.5 / -21.9 Brown gray, fine to medium silty SAND, contains organic matter, loose, wet [D1] **SM**			41.6
		-25													

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 2 OF 3

STATION: 1456+77 OFFSET: 111 ft RT
LATITUDE: 36.828113° N LONGITUDE: 76.319313° W
SURFACE ELEVATION: 9.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/29/2010 - 07/29/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
	35														
	36														
	38		6 3 3 4	15		38									34.2
	40	-30				40									
	42											41.5 / -31.9 Green gray, poorly graded SAND with silt, contains organic matter, medium dense, moist [D1] **SP-SM**			
	43		7 7 7 6	95		43									27.1
	44	-35				45									
	46														
	48		7 6 8 9	60		48									34.0
	50	-40				50									
	52											51.5 / -41.9 Gray, fine to medium poorly graded SAND, trace silt, contains organic matter and mica, medium dense, moist [D1] **SP**			
	53		3 3 7 8	70		53									34.5
	54	-45				55									
	56														
	58		6 8 12 12	75		58									28.1
	60	-50				60									
	62														
	63		6 8 8 8	50		63									26.4
	64	-55				65									
	66														
	68		6 9 9 8	50		68									27.2
	70	-60													

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 1456+77 OFFSET: 111 ft RT
LATITUDE: 36.828113° N LONGITUDE: 76.319313° W
SURFACE ELEVATION: 9.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/29/2010 - 07/29/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
	70														
	72											71.5 / -61.9 Gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SC**			
	74	-65	5 3 2 2	95		73 75									32.7
	76														
	78		2 2 2 3	100		78 80									31.1
	80	-70													
	82														
	84	-75	2 2 2 5	100		83 85									30.3
	86														
	88		5 7 6 11	100		88 90						86.5 / -76.9 Green gray, fine to coarse silty SAND, contains shell fragments and coquina, medium dense, wet [E1] **SM**			24.5
	90	-80													
	92														
	94	-85	5 5 6 11	100		93 95						SAME, gray, contains heavy concentrations of shell fragments, coquina and fat clay pockets below 93 ft			19.1
	96														
	98		6 4 5 7	100		98 100									30.3
	100	-90										Bottom of Boring at 100 ft.			

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 1 OF 3

STATION: 1457+73 OFFSET: 67 ft RT
LATITUDE: 36.828306° N LONGITUDE: 76.319033° W
SURFACE ELEVATION: 11.8 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/02/2010 - 08/02/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: F. Ramano

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	0	10	3 3 3 8	50		2						0.0 / 11.8 4-inches ROOTMAT AND TOPSOIL **TOPS**			12.4	
	2		8 8 14 15	60		4						0.3 / 11.5 Dark brown, fine to medium silty SAND, contains root fragments, loose, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SM**			7.7	
	4 ▽		12 7 8 6	85		6						SAME, medium dense below 2 ft			11.2	
	6	5	2 3 5 4	85		8						4.0 / 7.8 Light brown, fine to medium clayey SAND, medium dense, wet [C1] **SC**			20.3	
	8		4 2 2 2	90		10						6.0 / 5.8 Light brown, fine to medium poorly graded SAND with silt, medium dense, wet [C1] **SP-SM** SAME, loose below 8 ft			25.7	
	10															
	12	0														
	14		4 2 2 2	15		13 15						SAME, gray, fine to coarse, loose below 13 ft			35.2	
	16	-5														
	18		5 5 4 5	60		18						SAME, medium dense below 18 ft			18.4	
	20					20										
	22	-10														
0.5	24		1 1 2 2	100		23 25						21.5 / -9.7 Dark brown, ORGANIC SILT, trace sand, soft, wet [D3] [SEDGEFIELD MEMBER (TABB FORMATION)] **OH**			209.2	
	26	-15														
0.25	28		WOH WOH 1 1	100		28						26.5 / -14.7 Dark brown gray, elastic SILT with sand, contains organic matter and mica, very soft, wet [D2] **MH**			51.9	
	30					30										
	32	-20														
	34		1 4 4 7	50		33						31.5 / -19.7 Gray, fine to coarse poorly graded SAND with silt, contains mica, medium dense, wet [D1] **SP-SM**			26.6	11.3

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 2 OF 3

STATION: 1457+73 OFFSET: 67 ft RT
LATITUDE: 36.828306° N LONGITUDE: 76.319033° W
SURFACE ELEVATION: 11.8 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/02/2010 - 08/02/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: F. Ramano

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	36	-25	5 3 5 7	65		35 38 40						SAME, contains organic matter below 38 ft			34.5	
	42	-30	5 5 11 10	65		43 45									30.2	
	48	-35	6 7 8 12	65		48 50									33.1	
	52	-40	6 7 9 7	65		53 55									27.3	
	58	-45	7 6 5 6	75		58 60						56.5 / -44.7 Gray, fine to medium poorly graded SAND, trace silt, medium dense, wet [D1] **SP**			26.8	
	64	-50	3 4 9 10	50		63 65									29.9	
	68	-55	7 12 11 12	40		68						SAME, dense below 68 ft			25.4	
	70															

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 3 OF 3

STATION: 1457+73 OFFSET: 67 ft RT
LATITUDE: 36.828306° N LONGITUDE: 76.319033° W
SURFACE ELEVATION: 11.8 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/02/2010 - 08/02/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: F. Ramano

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	70															
	72	-60	WOH 1 1 2	100		73 75						71.5 / -59.7 Gray, fine to coarse clayey SAND, contains shell fragments, very loose, wet [E1] [YORKTOWN FORMATION] **SC**			30.4	
	74															
	76	-65	2 2 4 5	100		78 80						SAME, loose below 78 ft			28.3	
	78															
	80															
	82	-70	2 2 2 3	75		83 85									29.7	
	84															
	86	-75														
	88		4 4 10 12	100		88 90						SAME, contains coquina, medium dense below 88 ft			24.8	
	90															
	92	-80	2 3 5 8	100		93 95									25.8	
	94															
	96	-85														
	98		4 5 5 7	100		98 100									25.8	
	100											Bottom of Boring at 100 ft.				

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 1 OF 1

STATION: 1457+73 OFFSET: 69 ft RT
LATITUDE: 36.828306° N LONGITUDE: 76.319033° W
SURFACE ELEVATION: 11.8 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/03/2010 - 08/03/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	LAB: LIQUID LIMIT	LAB: PLASTICITY INDEX	LAB: MOISTURE CONTENT (%)
	2	10												
	4													
	6	5												
	8													
	10													
	12	0												
	14													
	16	-5												
	18													
	20													
	22	-10												
2.75	24			75		23								
	26					25								
	28	-15				28								
0.25	30			95		30								

FIELD DESCRIPTION OF STRATA

0.0 / 11.8
Rotary probe to 23 ft; see Boring 10BH-160 for strata descriptions.

23.0 / -11.2
Dark brown, ORGANIC SILT, trace sand, wet [D3] [SEDGEFIELD MEMBER (TABB FORMATION)] **OH**

25.0 / -13.2
Rotary probe to 28 ft; see Boring 10BH-160 for strata descriptions.

28.0 / -16.2
Dark brown gray, elastic SILT with sand, contains organic matter and mica, wet [D2] **MH**

Bottom of Boring at 30 ft.

REMARKS: Rig Type: CME-550X (ATV).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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STATION: 1460+71 OFFSET: 120 ft RT
LATITUDE: 36.828397° N LONGITUDE: 76.318014° W
SURFACE ELEVATION: 9.8 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/12/2010 - 08/12/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: F. Ramano

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

FIELD DATA | **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
												0.0 / 9.8 No ground cover			8.6	
	2		24 14 7 8	100		2						0.1 / 9.7 Dark brown, fine to medium silty sand FILL, contains crushed stone, organic matter and root fragments, medium dense, moist [A1] [FILL] **FL**			6.3	
	4	5	6 7 7 5	100		4						2.0 / 7.8 Light brown and light yellow brown, fine to medium poorly graded SAND with silt, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP-SM**			8.5	
	6 ▽		3 4 4 5	100		6						SAME, light brown, wet below 6 ft			22.7	
	8		3 5 5 7	100		8						SAME, loose below 8 ft			26.2	
	10	0	4 2 3 2	100		10										
	12															
	14	-5	3 2 1 1	100		13 15						SAME, dark gray, contains mica, trace gravel, loose below 13 ft			26.6	
	16															
0.25	18		WOH WOH WOH WOH	100		18						16.5 / -6.7 Dark gray, elastic SILT, trace sand, contains mica, very soft, moist [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **MH**			79.9	
	20	-10				20										
	22											21.5 / -11.7 Gray, fine to medium silty SAND, contains mica and organic matter, loose, wet [D1] **SM**				
	24		WOH 1 2 2	100		23 25							28	1	33.4	18.4
	26	-15														
	28		2 2 1 2	100		28									43.1	
	30	-20				30										
	32															
	34		3 4 3 4	100		33									38.4	
		-25														

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 2 OF 3

STATION: 1460+71 OFFSET: 120 ft RT
LATITUDE: 36.828397° N LONGITUDE: 76.318014° W
SURFACE ELEVATION: 9.8 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/12/2010 - 08/12/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: F. Ramano

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
	36					35										
	38		6 10 8 10	100		38						SAME, medium dense below 38 ft			27.4	
	40	-30				40										
	42											41.5 / -31.7 Gray, fine to medium poorly graded SAND, trace silt, contains organic matter and mica, medium dense, wet [D1] **SP**				
	44	-35	3 5 6 10	100		43 45									31.2	
	46															
	48		9 6 7 8	100		48									28.8	
	50	-40				50										
	52															
	54	-45	13 14 12 14	100		53 55						SAME, dense below 53 ft			21.8	
	56															
	58		9 12 14 14	100		58									36.2	
	60	-50				60										
	62															
	64	-55	11 12 14 15	100		63 65									23.9	
	66															
	68		14 14 15 14	100		68									21.8	
	70	-60														

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 3 OF 3

STATION: 1460+71 OFFSET: 120 ft RT
LATITUDE: 36.828397° N LONGITUDE: 76.318014° W
SURFACE ELEVATION: 9.8 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/12/2010 - 08/12/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: F. Ramano

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	70															
	72											71.5 / -61.7 Gray, fine to coarse clayey SAND, contains shell fragments, medium dense, wet [E1] [YORKTOWN FORMATION] **SC**				
	74	-65	14 6 6 5	100		73 75									32.3	
	76															
	78		2 2 3 6	100		78 80						SAME, loose below 78 ft			28.9	
	80	-70														
	82															
	84	-75	6 9 7 22	100		83 85						SAME, medium dense below 83 ft			28.9	
	86															
	88		8 7 11 27	100		88 90									22.9	
	90	-80														
	92															
	94	-85	4 4 8 17	100		93 95						SAME, contains heavy concentrations of shell fragments below 93 ft			16.7	
	96															
	98		6 8 9 24	100		98 100									26.8	
	100	-90										Bottom of Boring at 100 ft.				

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 1 OF 3

STATION: 1462+17 OFFSET: 112 ft RT
LATITUDE: 36.828538° N LONGITUDE: 76.317535° W
SURFACE ELEVATION: 9.5 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/12/2010 - 08/12/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: F. Ramano

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

FIELD DATA | **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT LL	LAB: PLASTICITY INDEX PI	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT #200 (%)
	0	5	4 18 11 11	100		2						0.0 / 9.5 No ground cover			7.2	
	2		7 9 8 8	100		4						0.1 / 9.4 Dark brown, fine to medium clayey sand FILL, trace gravel, contains root fragments and rock fragments, dense, moist [A1] [FILL] **FL**			4.7	
	4		6 5 4 5	100		6						2.0 / 7.5 Light brown and yellow brown, fine to medium poorly graded SAND with silt, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP-SM**			4.9	
	6 ▽		3 3 3 5	100		8									22.3	
	8		3 2 4 4	100		10						SAME, loose, wet below 6 ft			23.9	
	10	0														
	12					13										
	14		3 3 2 2	100		15						SAME, dark gray below 13 ft			29.3	
	16	-5														
	18		WOH 1 2 1	100		18						16.5 / -7.0 Gray, fine to medium clayey SAND, contains mica, loose, wet [C1] **SC**			23.2	
	20	-10				20										
	22					23						21.5 / -12.0 Dark gray, fine to medium poorly graded SAND with silt, contains mica, loose, wet [D1] [SEDGEFIELD MEMBER (TABB FORMATION)] **SP-SM**			25.9	
	24		4 1 2 4	100		25										
	26	-15														
	28		WOH WOH 1 0	100		28						26.5 / -17.0 Dark gray, elastic SILT, trace sand, contains mica and organic matter, very soft, moist [D2] **MH**			57.9	
0.5	30	-20				30										
	32					33						31.5 / -22.0 Dark gray, fine to medium silty SAND, contains mica, loose, wet [D1] **SM**			42.2	
	34	-25	1 1 2 3	100												

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 2 OF 3

STATION: 1462+17 OFFSET: 112 ft RT
LATITUDE: 36.828538° N LONGITUDE: 76.317535° W
SURFACE ELEVATION: 9.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/12/2010 - 08/12/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: F. Ramano

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	36					35										
	38		5 7 7 6	100		38						36.5 / -27.0 Gray, fine to medium poorly graded SAND, trace silt, contains mica and organic matter, medium dense, wet [D1] **SP**			25.5	
	40	-30				40										
	42															
	44	-35	8 5 5 5	100		43 45									27.8	
	46															
	48	-40	8 9 9 11	100		48 50									28.4	
	50															
	52											51.5 / -42.0 Dark gray, fine to medium poorly graded SAND with silt, contains mica and organic matter, dense, wet [D1] **SP-SM**				
	54	-45	8 12 17 19	100		53 55									21.7	10.2
	56															
0.75	58		WOH 1 1 2	100		58						56.5 / -47.0 Gray, fat CLAY with sand, contains mica, soft, moist [D2] **CH**			38.1	
	60	-50				60										
	62															
	64	-55	1 3 4 7	100		63 65						61.5 / -52.0 Dark gray, fine to medium clayey SAND, contains organic matter, loose, wet [D1] **SC**			32.5	
	66															
	68	-60	7 9 17 15	100		68						67.5 / -58.0 Dark gray, fine to medium silty SAND, dense, wet [D1] **SM**			37.2	
	70															

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 3 OF 3

STATION: 1462+17 OFFSET: 112 ft RT
LATITUDE: 36.828538° N LONGITUDE: 76.317535° W
SURFACE ELEVATION: 9.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/12/2010 - 08/12/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: F. Ramano

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	70															
	72											71.5 / -62.0 Dark gray, fine to medium poorly graded SAND with silt, dense, wet [D1] **SP-SM**				
	74	-65	23 20 17 18	100		73 75									20.7	
	76															
	78		5 5 8 19	100		78 80						77.5 / -68.0 Dark green gray, fine to coarse silty SAND, contains shell fragments, medium dense, wet [E1] [YORKTOWN FORMATION] **SM**			30.5	
	80	-70														
	82											SAME, contains heavy concentrations of shell fragments, dense below 83 ft				
	84	-75	13 14 16 14	100		83 85									19.3	
	86															
	88		10 11 12 16	100		88 90									25.9	
	90	-80														
	92															
	94	-85	6 4 5 10	100		93 95						SAME, medium dense below 93 ft			29.7	
	96															
	98		5 5 7 17	100		98 100						98.0 / -88.5 Dark gray, fine to coarse clayey SAND, contains shell fragments, medium dense, wet [E1] **SC**			31.4	
	100	-90										Bottom of Boring at 100 ft.				

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: CIty of Portsmouth
STRUCTURE: BRDIGE PIER 17

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PAGE 1 OF 3

STATION: 1020+18.32 OFFSET: 55.38 RT
LATITUDE: 36.829528° N LONGITUDE: 76.326232° W
SURFACE ELEVATION: 15.0 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/7/2010 - 4/7/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 5.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
0		6 7 9 14	60		2						0.0 / 15.0 Asphalt and gravel FILL, medium dense, dry. **FL**			8.0	
2		4 9 7 2	75		4						2.0 / 13.0 Black, sand with gravel FILL, medium dense, dry. **FL**			22.0	
4	10	2 2 1 1	100		6						4.0 / 11.0 Dark gray to black, SILT, soft, wet. **ML**			18.0	
6		WOH 5 5 5	100		8						6.0 / 9.0 Dark gray, fine to medium SAND, loose, wet. **SP**			21.0	
8		5 5 4 4	100		10						7.5 / 7.5 Dark gray, fine SAND, loose, wet. **SW**			23.0	
10	5										8.0 / 7.0 Dark gray, medium SAND, loose, wet. **SW**				
12											11.5 / 3.5 Dark gray, medium SAND, loose, wet. **SW**				
14	0	2 3 2 2	50		15									28.0	
16															
18		4 2 2 2	85		18									26.0	
20	-5				20										
22											21.5 / -6.5 Gray, CLAY, trace shells, very soft, wet. **CH**				
24		WOH WOH WOH 1	100		23							75	50	70.0	98.0
26	-10				25										
28		WOH 1 1 2	100		28						26.5 / -11.5 Gray, ORGANIC SILT, soft, wet. **OH**			43.0	
30	-15				30						29.0 / -14.0 Brown, ORGANIC SILT, soft, wet. **OH**				
32															
34		2 2 2 2	100		33							166	75	221.0	70.0
36	-20				35										
38		WOH WOH WOH WOH	100		38						36.5 / -21.5 Dark brown, silty fine SAND, trace of clay and organics, very loose, wet. **SM**	39	13	43.0	41.0
40	-25														

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 75 feet in depth, elevation -60 feet. This hole was drilled on the original surveyed and staked location.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRDIGE PIER 17

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PAGE 2 OF 3

STATION: 1020+18.32 OFFSET: 55.38 RT
LATITUDE: 36.829528° N LONGITUDE: 76.326232° W
SURFACE ELEVATION: 15.0 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/7/2010 - 4/7/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 5.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA | **LAB DATA**

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
40															
42											41.5 / -26.5 Dark brown, SILT, trace of sand lenses, very soft, wet. **ML**				
43															
44		WOH WOH WOH WOH	100											61.0	
45	-30														
46															
48		1 1 2 2	100								46.5 / -31.5 Dark brown, SILT, trace of sand, soft, wet. **ML**			77.0	
50	-35														
52											51.5 / -36.5 Gray to brown, SILT, trace of sand, very soft, wet. **MH**				
53															
54		WOH WOH WOH WOH	100									94	51	88.0	89.0
55	-40														
56															
58		WOH WOH WOH WOH	100											82.0	
60	-45														
62											61.5 / -46.5 Dark gray, SILT, trace of organics, soft, wet. **ML**				
63															
64		WOH 1 1 2	100											61.0	
65	-50														
66															
68		WOH 1 1 1	100											88.0	
70	-55														
72											71.5 / -56.5 Gray, sandy GRAVEL, dense, wet. **GW**				
73															
74		2 12 21 16	80											10.0	
75	-60										74.3 / -59.3 Gray, silty fine SAND, trace of shells, loose, moist. **SM**				
76															
78		1 2 3 6	100											33.0	
80	-65														

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 75 feet in depth, elevation -60 feet. This hole was drilled on the original surveyed and staked location.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRDIGE PIER 17

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PAGE 3 OF 3

STATION: 1020+18.32 OFFSET: 55.38 RT
LATITUDE: 36.829528° N LONGITUDE: 76.326232° W
SURFACE ELEVATION: 15.0 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/7/2010 - 4/7/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 5.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA / **LAB DATA**

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT -#200 (%)
80															
82															
83		2 2 3 6	100		83									34.0	
84	-70				85										
86											86.5 / -71.5 Green to gray, clayey SAND, trace of shells, loose, moist. **SC**				
88		2 2 4 6	100		88							34	14	33.0	43.0
90	-75				90										
92															
93		3 2 3 6	100		93									33.0	
94					95										
96	-80														
98					98						96.5 / -81.5 Green gray, clayey SAND, trace of shells and quartz pebbles, medium dense, wet. **SC**				
100	-85	4 6 6 6	100		100						End of Boring.			31.0	

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 75 feet in depth, elevation -60 feet. This hole was drilled on the original surveyed and staked location.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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VDOT Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 18

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PAGE 1 OF 3

STATION: 1021+61.64 OFFSET: 40.54 LT
LATITUDE: 36.829822° N LONGITUDE: 76.326694° W
SURFACE ELEVATION: 15.9 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/9/2010 - 4/9/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
0	15	35 50 45 43	85		2						0.0 / 15.9 Gray, crusher run gravel FILL, very dense, dry. **FL**			3.0	
2		46 21 19 22	90		4									20.0	
4		13 3 1 1	85		6						3.0 / 12.9 Black, silt FILL, dense, dry. **FL**			25.0	
6 ▽	10	2 3 6 8	55		8						4.0 / 11.9 Gray, gravel FILL, loose, dry. **FL**			21.0	
8		3 3 1 1	70		10						5.0 / 10.9 Dark black, silt FILL, soft, dry. **FL**			23.0	
10	5										6.0 / 9.9 Light brown to gray, fine SAND, loose, wet. **SW**				
12											8.0 / 7.9 Gray, silty SAND, loose, wet. **SM**				
14		3 2 3 2	75		15									35.0	
16	0										16.5 / -0.6 Gray, silty SAND, medium dense, wet. **SM**				
18		5 9 9 8	65		18									23.0	
20	-5				20										
22											21.5 / -5.6 Gray, CLAY, trace of shells, soft, wet. **CH**				
24		3 1 1 1	80		25							80	51	61.0	93.0
26	-10										26.5 / -10.6 Brown, ORGANIC SILT, soft, moist. **OH**				
28		1 1 1 2	100		28							241	101	231.0	60.0
30					30										
32	-15										31.5 / -15.6 Dark gray to brown, SILT, little organics & shell fragments, very soft, moist. **MH**				
34		WOH 1 WOH 1	100		35							70	34	87.0	83.0
36	-20										36.5 / -20.6 Brown to gray, fine silty SAND, micaceous, medium dense, wet. **SM**				
38		WOH 5 7 8	90		38									23.0	
40															

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 75 feet in depth, elevation -59.1 feet. This borehole was offset 23' east of its original staked position to avoid Vulcan aggregate stockpile.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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VDOT Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 18

10BH-169
PAGE 2 OF 3

STATION: 1021+61.64 OFFSET: 40.54 LT
LATITUDE: 36.829822° N LONGITUDE: 76.326694° W
SURFACE ELEVATION: 15.9 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/9/2010 - 4/9/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
42	-25	6 7 9 11	65		43 45									28.0	
46	-30										46.5 / -30.6 Green gray, fine silty SAND, medium dense, wet. **SM**				
48		6 6 10 12	65		48 50									29.0	
50	-35														
52		5 3 6 11	65		53 55									40.0	
54															
56	-40														
58		9 9 9 10	65		58 60									31.0	
60															
62	-45														
64		10 10 8 12	70		63 65									32.0	
66	-50														
68		6 5 5 5	85		68 70						68.65 / -52.75 Blue to gray, CLAY, trace silt, stiff, moist. **CL**			26.0	
70	-55														
72															
74		WOH 2 10 9	100		73 75						73.8 / -57.9 Dark brown, silty SAND, medium dense, wet. **SM**	26	5	26.0	24.0
76	-60														
78		3 5 4 5	100		78						76.5 / -60.6 Green gray, clayey SAND, trace of shell fragments, loose, moist. **SC**	27	10	28.0	40.0
80															

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 75 feet in depth, elevation -59.1 feet. This borehole was offset 23' east of its original staked position to avoid Vulcan aggregate stockpile.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 18

10BH-169
PAGE 3 OF 3

STATION: 1021+61.64 OFFSET: 40.54 LT
LATITUDE: 36.829822° N LONGITUDE: 76.326694° W
SURFACE ELEVATION: 15.9 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/9/2010 - 4/9/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
80	-65				80										
82		1 2 5 10	100		83						81.5 / -65.6 Green gray, fine to medium silty SAND, trace of shell fragments, loose, moist. **SM**				
84					85									34.0	
86	-70										86.5 / -70.6 Green gray, fine clayey SAND, loose, moist. **SC**				
88		2 2 5 10	100		88									33.0	
90					90										
92	-75				93										
94		1 2 3 6	100		95									33.0	
96	-80														
98		2 2 3 7	100		98									33.0	
100					100						End of Boring.				

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 75 feet in depth, elevation -59.1 feet. This borehole was offset 23' east of its original staked position to avoid Vulcan aggregate stockpile.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 19

10BH-171
PAGE 1 OF 3

STATION: 1024+53.98 OFFSET: 20.02 RT
LATITUDE: 36.830644° N LONGITUDE: 76.326726° W
SURFACE ELEVATION: 15.2 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/8/2010 - 4/8/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA | **LAB DATA**

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
0											0.0 / 15.2 Gray, crusher run gravel FILL, very dense, dry. **FL**			3.0	
2		14 34 50 39	80		2										
4		35 100/5"	46		4									7.0	
6	10	15 10 9 6	90		6						4.0 / 11.2 Gray, fine gravel FILL, medium dense, dry. **FL**			21.0	
8		6 5 6 7	65		8						4.8 / 10.4 Black, silty sand and gravel FILL, oily appearance, medium dense, moist. **FL**			18.0	
10	5	7 7 5 3	85		10						6.0 / 9.2 Dark gray to black, fine sand FILL, oily, medium dense, wet. **FL**			23.0	
12											8.0 / 7.2 Gray, gravel FILL, metal debris, medium dense, wet. **FL**				
14	0	3 1 3 2	83		13 15						8.5 / 6.7 Gray, fine to medium SAND, medium dense, wet. **SP** 11.5 / 3.7 Gray, fine silty SAND, loose, wet. **SM**			25.0	
16															
18		5 5 4 4	75		18									22.0	
20	-5				20										
22															
24		7 3 3 2	70		23 25						23.8 / -8.6 Dark gray, CLAY, micaceous, trace of shells, medium stiff, moist. **CH**	74	43	59.0	92.0
26	-10														
28		2 2 3 4	95		28						26.5 / -11.3 Dark gray to brown, ORGANIC SILT, medium stiff, moist. **OH**	221	107	165.0	73.0
30	-15				30										
32					33						31.5 / -16.3 Dark brown, SILT, trace of organics, soft, wet. **ML**				
34		1 1 1 2	85		35							49	18	49.0	75.0
36	-20														
38		4 5 9 8	83		38						36.5 / -21.3 Dark gray, fine silty SAND, medium dense, wet. **SM**			28.0	
40															

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 73.6 feet in depth, elevation -58.4 feet. This borehole was offset 45' west of its original staked position to avoid Vulcan aggregate stockpile.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 19

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PAGE 2 OF 3

STATION: 1024+53.98 OFFSET: 20.02 RT
LATITUDE: 36.830644° N LONGITUDE: 76.326726° W
SURFACE ELEVATION: 15.2 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/8/2010 - 4/8/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
40					40										
42											41.5 / -26.3 Gray, fine SAND, micaceous with trace of organics, medium dense, wet. **SP**				
44	-30	7 6 8 12	75		43 45									28.0	
46															
48		10 6 7 8	70		48 50									33.0	
50	-35														
52															
54		7 9 8 6	65		53 55									31.0	
56	-40														
58		6 7 7 8	75		58 60									36.0	
60	-45														
62											61.5 / -46.3 Dark brown to gray, CLAY, soft, moist. **CH**				
64		WOH 1 2 2	100		63 65							73	41	50.0	98.0
66	-50														
68		WOH 1 2 2	100		68 70									68.0	
70	-55														
72															
74		WOH 3 4 5	90		73 75						73.6 / -58.4 Gray, silty SAND, loose, moist. **SM**			29.0	
76	-60														
78		2 2 3 7	100		78						76.5 / -61.3 Green to gray, clayey medium SAND, trace of shells & gravel, loose, moist. **SC**	27	9	31.0	38.0
80															

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 73.6 feet in depth, elevation -58.4 feet. This borehole was offset 45' west of its original staked position to avoid Vulcan aggregate stockpile.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 19

10BH-171
PAGE 3 OF 3

STATION: 1024+53.98 OFFSET: 20.02 RT
LATITUDE: 36.830644° N LONGITUDE: 76.326726° W
SURFACE ELEVATION: 15.2 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/8/2010 - 4/8/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
80															
82															
84	-70	2 1 2 12	55		83 85									31.0	
86															
88		2 2 6 10	100		88 90									31.0	
90	-75														
92					93										
94		1 2 3 6	100		95									32.0	
96	-80														
98		2 1 3 6	100		98									32.0	
100					100						End of Boring.				

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 73.6 feet in depth, elevation -58.4 feet. This borehole was offset 45' west of its original staked position to avoid Vulcan aggregate stockpile.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 19

10BH-174
PAGE 1 OF 3

STATION: 1023+81.78 OFFSET: 78.75 LT
LATITUDE: 36.830399° N LONGITUDE: 76.327017° W
SURFACE ELEVATION: 15.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/9/2010 - 4/9/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
0	15.4	51	42		1						0.0 / 15.4 Gray, crusher run gravel FILL, very dense, dry. **FL**				
2		100/4"													
		83													
4		17/2"	33		3									10.0	
		9									4.0 / 11.4 Gray, gravel FILL, loose, dry **FL**				
6	10	4 2 3	95		5									15.0	
		1 3 6	45		7						4.75 / 10.65 Black, fine sandy CLAY, medium stiff, dry. **CL**			17.0	
8		3 2 2	100		9						6.0 / 9.4 Light gray, fine SAND, loose, wet. **SW**			23.0	
10	5	1			11						8.0 / 7.4 Dark gray, fine SAND, loose, wet. **SW**				
12		4 3 3	60		13						11.5 / 3.9 Gray, fine slity SAND, loose, wet. **SM**			30.0	
14	0	4			15										
16															
18		4 4 2	60		18									25.0	
20	-5	2			20										
22		2 1 1	100		23						21.5 / -6.1 Gray, clayey SAND, loose, wet. **SC**				
24		2			25							60	31	41.0	45.0
26	-10										26.5 / -11.1 Brown, ORGANIC SILT, medium stiff, moist. **OL**				
28		2 2 4	100		28									216.0	
30	-15	4			30										
32		1 1 1	100		33						31.5 / -16.1 Brown, SILT, trace of organics, soft, moist. **ML**				
34	-20	1			35							47	14	60.0	74.0
36											36.5 / -21.1 Dark gray to brown, silty SAND, micaceous, loose, moist. **SM**				
38		2 2 4	100		38									38.0	
40		7													

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 70 feet in depth, elevation -54.6 feet. This borehole was offset 32' north of its original staked position to avoid a Vulcan aggregate stockpile.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 19

10BH-174
PAGE 2 OF 3

STATION: 1023+81.78 OFFSET: 78.75 LT
LATITUDE: 36.830399° N LONGITUDE: 76.327017° W
SURFACE ELEVATION: 15.4 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/9/2010 - 4/9/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA | **LAB DATA**

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
40	-25														
42		6 10 11 14	70		43						41.5 / -26.1 Dark gray to brown, fine SAND, micaceous, medium dense, wet. **SW**			25.0	
44					45										
46	-30														
48		9 8 8 8	75		48									29.0	
50	-35				50										
52															
54		10 10 9 7	75		53									28.0	
56	-40				55										
58		5 6 7 9	75		58									34.0	
60	-45				60										
62											61.5 / -46.1 Dark gray to brown, SILT with little clay, soft, moist. **MH**				
64		WOH 1 1 1	100		63							87	47	60.0	90.0
66	-50				65										
68		WOH 2 3 5	5		68						66.5 / -51.1 Gray to green, SILT, micaceous, medium stiff, wet. **ML**			40.0	
70	-55				70										
72											71.5 / -56.1 Green to gray, fine clayey SAND, loose, moist. **SC**				
74		2 1 2 6	100		73									33.0	
76	-60				75										
78		3 2 2 8	100		78						76.5 / -61.1 Green to gray, fine clayey SAND, trace of shell fragments, loose, moist. **SC**			31.0	
80															

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 70 feet in depth, elevation -54.6 feet. This borehole was offset 32' north of its original staked position to avoid a Vulcan aggregate stockpile.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 19

10BH-174
PAGE 3 OF 3

STATION: 1023+81.78 OFFSET: 78.75 LT
LATITUDE: 36.830399° N LONGITUDE: 76.327017° W
SURFACE ELEVATION: 15.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/9/2010 - 4/9/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
80	-65				80										
82		2 2 1 9	100		83						81.5 / -66.1 Green to gray, fine clayey SAND, loose, moist. **SC**			35.0	
84					85										
86	-70										86.5 / -71.1 Gray, fine to medium clayey SAND, loose, moist. **SC**				
88		WOH 2 2 4	100		88							34	12	48.0	41.0
90	-75				90										
92					93						91.5 / -76.1 Gray, fine to medium clayey SAND, trace shell fragments, loose, moist. **SC**				
94		WOR WOR WOR 5	100		95									32.0	
96	-80														
98		2 2 2 6	100		98						96.5 / -81.1 Gray, fine to medium clayey SAND, loose, wet. **SC**			32.0	
100					100						End of Boring.				

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 70 feet in depth, elevation -54.6 feet. This borehole was offset 32' north of its original staked position to avoid a Vulcan aggregate stockpile.

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SPT_LOGB:0058-965-108_CSX_SPT_STATE PLANE.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 1 OF 3

STATION: 1026+75 OFFSET: 34 ft LT
LATITUDE: 36.831265° N LONGITUDE: 76.326965° W
SURFACE ELEVATION: 15.7 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/23/2010 - 08/23/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
		15	3 20 44 19	85		2						0.0 / 15.7 No ground cover			16.0
1	2		6 6 5 6	90								0.1 / 15.6 Brown, fine to coarse silty sand FILL, contains brick and concrete fragments, very dense, moist [A1] [FILL] **FL**			12.6
	4 ▽		3 6 7 9	85		4						2.0 / 13.7 Brown gray, sandy lean CLAY, stiff, moist [C2] [LYNNHAVEN MEMBER (TABB FORMATION)] **CL**			16.6
	6	10	5 8 5 6	90		6						4.0 / 11.7 Brown gray, fine to medium silty SAND, medium dense, wet [C1] **SM**			19.1
	8		3 2 2 2	75		8						SAME, gray, loose below 8 ft			21.3
	10					10									
	12	5													
	14		3 2 5 6	75		13									26.4
	16	0				15									
	18		3 8 9 5	65		18						16.5 / -0.8 Gray, fine to medium poorly graded SAND with silt, contains organic matter, medium dense, wet [C1] **SP-SM**			20.5
	20	-5				20									
	22											21.5 / -5.8 Brown, PEAT, wet [D3] [SEDGEFIELD MEMBER (TABB FORMATION)] **PT**			
	24		3 2 5 5	100		23 25									221.2
	26	-10													
	28		2 4 3 3	100		28						26.5 / -10.8 Gray, fine to medium silty SAND, contains organic matter and mica, loose, wet [D1] **SM**			36.7
0.25	30	-15				30						29.6 / -13.9 Dark gray, sandy elastic SILT, contains organic matter and mica, firm, wet [D2] **MH**			
	32											31.5 / -15.8 Green gray, fine to medium poorly graded SAND with silt, contains organic matter and mica, loose, wet [D1] **SP-SM**			
	34		2 3 3 2	85		33									31.3

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:12/4/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-178
PAGE 2 OF 3

STATION: 1026+75 OFFSET: 34 ft LT
LATITUDE: 36.831265° N LONGITUDE: 76.326965° W
SURFACE ELEVATION: 15.7 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/23/2010 - 08/23/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
	36	-20				35									
	38		8 7 8 7	75		38						36.5 / -20.8 Green gray, fine to medium silty SAND, contains organic matter and mica, medium dense, wet [D1] **SM**			28.2
	40	-25				40									
	42		7 9 10 11	65		43						41.5 / -25.8 Green gray, fine to medium poorly graded SAND with silt, contains organic matter and mica, medium dense, wet [D1] **SP-SM**			23.0
	44					45									
	46	-30													
	48		8 9 8 5	75		48									26.9
	50					50									
	52	-35													
	54		9 8 8 12	65		53						51.5 / -35.8 Green gray, fine to medium silty SAND, contains organic matter and mica, medium dense, wet [D1] **SM**			27.1
	56	-40				55									
	58		WOH 1 2 2	100		58						56.5 / -40.8 Brown gray, elastic SILT, trace sand, contains organic matter and mica, soft, moist [D2] **MH**			54.9
0.75	60					60									
	62	-45										61.5 / -45.8 Green gray, fat CLAY, trace sand, firm, moist [D2] **CH**			
	64		1 2 2 5	100		63									31.9
1	66	-50				65									
	68		4 4 4 5	75		68						SAME, stiff, wet below 68 ft			33.8
0.5	70														

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:12/4/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 3 OF 3

STATION: 1026+75 OFFSET: 34 ft LT
LATITUDE: 36.831265° N LONGITUDE: 76.326965° W
SURFACE ELEVATION: 15.7 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/23/2010 - 08/23/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	70	-55													
	72		9 7 7 8	100		73						71.5 / -55.8 Gray, fine to coarse poorly graded SAND, medium dense, wet [D1] **SP**			
	74					75						73.4 / -57.7 Green gray, fine to coarse clayey SAND, contains shell fragments, medium dense, wet [E1] [YORKTOWN FORMATION] **SC**			27.1
	76	-60													
	78		1 3 4 10	5		78						SAME, loose below 78 ft			31.1
	80					80									
	82	-65													
	84		2 2 6 15	100		83 85						SAME, medium dense below 83 ft			35.0
	86	-70													
	88		2 3 5 14	100		88									33.0
	90					90									
	92	-75													
	94		2 2 5 9	100		93 95						SAME, loose below 93 ft			33.6
	96	-80													
	98		3 4 8 19	100		98						SAME, medium dense below 98 ft			28.7
	100					100						Bottom of Boring at 100 ft.			

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:12/4/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 1 OF 3

STATION: 604+55 OFFSET: 6 ft RT
LATITUDE: 36.831666° N LONGITUDE: 76.326693° W
SURFACE ELEVATION: 11.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/20/2010 - 08/20/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
		10	21 12 9 7	15		2						0.0 / 11.4 No Ground Cover			6.6	
	2		4 5 3 5	100		4						0.1 / 11.3 Brown gray, fine to coarse silty sand FILL, contains crushed stone, medium dense, moist [A1] [FILL] **FL**			12.7	16.2
	4 ▽		2 5 4 1	90		6						2.0 / 9.4 Yellow brown, fine to coarse silty SAND, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SM**			22.4	
	6	5	1 1 0 0	100		8						SAME, light brown gray, wet below 4 ft			22.1	
	8		1 2 5 4	85		10						SAME, gray brown, very loose below 6 ft				
	10											8.0 / 3.4 Gray, fine to medium poorly graded SAND with silt, loose, wet [C1] **SP-SM**			20.3	
	12	0				13										
	14		4 3 3 3	85		15									23.7	
	16	-5														
	18		1 1 1 1	90		18						16.5 / -5.1 Gray, fine to coarse clayey SAND, contains shell fragments, mica, very loose, wet [D1] [SEDGEFIELD MEMBER (TABB FORMATION)] **SC**				
0.25	20					20							32	10	43.2	44.2
	22	-10														
			1 1 2 3	100		23						21.5 / -10.1 Brown, ORGANIC SILT, trace sand, soft, wet [D3] **OH**				
0.75	24					25									177.8	
	26	-15														
	28		1 1 1 1	85		28						26.5 / -15.1 Gray, fine to medium silty SAND, contains organic matter and mica, very loose, wet [D1] **SM**				
	30					30									32.8	
	32	-20														
			WOH WOH WOH 2	100		33						31.5 / -20.1 Gray, lean CLAY with sand, contains organic matter and mica, very soft, wet [D2] **CL**				
0.25	34														66.8	

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 604+55 OFFSET: 6 ft RT
LATITUDE: 36.831666° N LONGITUDE: 76.326693° W
SURFACE ELEVATION: 11.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/20/2010 - 08/20/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	35											34.6 / -23.2 Gray, fine to medium silty SAND, contains organic matter and mica, very loose, wet [D1] **SM**				
	36	-25										36.5 / -25.1 Green gray, fine to medium poorly graded SAND with silt, contains organic matter and mica, medium dense, wet [D1] **SP-SM**			25.1	
	38		8 8 11 13	75		38										
	40					40										
	42	-30														
	43		12 13 8 10	65		43						SAME, gray, contains mica below 43 ft			24.9	
	44					45										
	46															
	48	-35	5 7 10 10	50		48						SAME, green gray below 48 ft			33.9	
	50					50										
	52	-40														
	53		10 10 9 7	60		53									23.5	
	54					55										
	56	-45														
0.75	58		1 1 2 4	100		58						56.5 / -45.1 Brown gray, elastic SILT, trace sand, contains shell fragments, mica, soft, moist [D2] **MH**			59.4	
	60					60										
	62	-50														
1	63		1 3 4 4	100		63						61.5 / -50.1 Gray, fat CLAY, trace sand, contains mica, stiff, moist [D2] **CH**			30.4	
	64					65										
	66	-55														
	68		2 2 5 7	85		68						66.5 / -55.1 Green gray, fine to medium silty SAND, contains mica, loose, wet [D1] **SM**			35.3	
	70															

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-179

STATION: 604+55 OFFSET: 6 ft RT
LATITUDE: 36.831666° N LONGITUDE: 76.326693° W
SURFACE ELEVATION: 11.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/20/2010 - 08/20/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	70															
												71.5 / -60.1 Green gray, fine to coarse silty SAND, contains shell fragments and coquina, loose, wet [E1] [YORKTOWN FORMATION] **SM**			34.9	
	72	-60	2 4 3 4	100		73										
	74					75										
	76	-65										76.5 / -65.1 Green gray, fine to coarse clayey SAND, contains shell fragments, medium dense, wet [E1] **SC**			31.6	
	78		2 4 4 13	100		78										
	80					80										
	82	-70														
	84		2 4 7 16	100		83									32.3	
	86	-75				85										
	88		3 4 7 10	100		88									31.8	
	90					90										
	92	-80														
	94		3 3 4 9	100		93						SAME, loose below 93 ft			29.9	
	96	-85				95										
	98		2 3 5 12	100		98						SAME, medium dense below 98 ft			30.0	
	100					100						Bottom of Boring at 100 ft.				

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 1 OF 3

STATION: 1028+75 OFFSET: 44 ft LT
LATITUDE: 36.831816° N LONGITUDE: 76.327020° W
SURFACE ELEVATION: 12.2 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/20/2010 - 08/23/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 5.1 ft AFTER 68 HOURS

FIELD DATA | **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
			7 11 17	40		2						0.0 / 12.2 No ground cover			7.5	
0.75	2	10	2 2 2 5	90		4						0.1 / 12.1 Brown gray, fine to coarse silty sand FILL, contains crushed stone and asphalt, dense, moist [A1] [FILL] **FL**	21	9	14.7	35.1
	4		2 3 3	85		6						2.0 / 10.2 Brown and gray, fine to coarse clayey SAND, loose, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SC**			21.0	
	6	5	1 1 1 0	100		8						4.0 / 8.2 Gray, fine to medium poorly graded SAND with silt, loose, wet [C1] **SP-SM**			26.3	
	8		WOH WOH 1 3	85		10						SAME, brown gray below 6 ft			21.0	
	10											7.0 / 5.2 Gray, fine to medium clayey SAND, very loose, wet [C1] **SC**				
	12	0	6 5 7 3	75		13						8.0 / 4.2 Gray, fine to medium poorly graded SAND with silt, very loose, wet [C1] **SP-SM**			22.8	
	14					15						SAME, medium dense below 13 ft				
	16															
	18	-5	6 5 1 2	85		18						SAME, loose below 18 ft			21.9	
0.25	20					19.5 20						19.5 / -7.3 Gray brown, ORGANIC SILT, trace sand, soft, wet [D3] [SEDGEFIELD MEMBER (TABB FORMATION)] **OH**				
	22	-10	WOH 1 1 2	100		23										
0.75	24					25									206.6	
	26															
	28	-15	WOH 1 2 3	100		28						26.5 / -14.3 Gray, fine to medium silty SAND, contains organic matter and mica, loose, wet [D1] **SM**			29.5	
	30					30										
	32	-20										31.5 / -19.3 Gray, fine to medium poorly graded SAND with silt, contains organic matter and mica, very loose, wet [D1] **SP-SM**				
	34		WOH WOH 1 0	100		33									44.4	
0.25						34.7										

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-182

STATION: 1028+75 OFFSET: 44 ft LT
LATITUDE: 36.831816° N LONGITUDE: 76.327020° W
SURFACE ELEVATION: 12.2 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/20/2010 - 08/23/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
- FIRST ENCOUNTERED AT 4.0 ft DEPTH
- STABILIZED AT 5.1 ft AFTER 68 HOURS

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT #200 (%)
	35															
	36											SAME, contains sandy lean clay layers below 34.7 ft				
	38	-25	3 6 7 8	65		38						SAME, green gray, medium dense below 38 ft			30.2	
	40					40										
	42	-30	4 4 8 15	40		43						41.5 / -29.3 Green gray, fine to medium poorly graded SAND, contains organic matter and mica, medium dense, wet [D1] **SP**			30.8	
	44					45										
	46	-35	5 7 9 10	50		48						46.5 / -34.3 Green gray, fine to medium poorly graded SAND with silt, contains organic matter and mica, medium dense, wet [D1] **SP-SM**			31.7	
	48					50										
	50					53										
	52	-40	8 9 9 10	65		55									25.2	
	54															
	56					58						56.5 / -44.3 Brown gray, elastic SILT, trace sand, contains organic matter and mica, soft, moist [D2] **MH**			57.9	
0.5	58	-45	1 1 2 3	100		60										
	60															
	62	-50	2 1 1 0	100		63						61.5 / -49.3 Green gray, lean CLAY with sand, contains mica, soft, wet [D2] **CL**			28.1	
0.25	64					65										
	66	-55	6 5 4 10	100		68						66.5 / -54.3 Green gray, fine to medium poorly graded SAND with silt, contains mica, medium dense, wet [D1] **SP-SM**			30.6	
	70															

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 3 OF 3

STATION: 1028+75 OFFSET: 44 ft LT
LATITUDE: 36.831816° N LONGITUDE: 76.327020° W
SURFACE ELEVATION: 12.2 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/20/2010 - 08/23/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 5.1 ft AFTER 68 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	70															
	72	-60	24 8 9 11	100		73 75						71.5 / -59.3 Green gray, fine to coarse silty SAND, contains shell fragments, medium dense, wet [E1] [YORKTOWN FORMATION] **SM**			34.3	
	74															
	76	-65	2 1 3 10	100		78						76.5 / -64.3 Green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] **SC**			33.6	
	78															
	80					80										
	82	-70	3 3 3 11	100		83 85									33.4	
	84															
	86															
	88	-75	2 3 5 8	100		88 90						SAME, medium dense below 88 ft			31.3	
	90															
	92	-80	2 3 5 10	100		93 95									31.2	
	94															
	96															
	98	-85	3 4 7 17	100		98 100									30.3	
	100											Bottom of Boring at 100 ft.				

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 607+12 OFFSET: 12 ft LT
LATITUDE: 36.832374° N LONGITUDE: 76.326715° W
SURFACE ELEVATION: 11.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/19/2010 - 08/20/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 6.0 ft DEPTH
STABILIZED AT 7.6 ft AFTER 20 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
			5 2 2	20		0.5						0.0 / 11.5 4-inches ASPHALT **ASPH**			18.0	
	2	10	2 3 4			2						0.3 / 11.2 2-inches DENSE GRADED AGGREGATE **CRA**				
0.25			6	100								0.5 / 11.0 Dark gray, fine to medium clayey sand FILL, contains crushed stone and brick fragments, loose, moist [A1] [FILL] **FL**			14.0	
	4		2 4 5	90		4									17.4	
	6 ▽	5	3 1 2			6						2.0 / 9.5 Brown gray, sandy lean CLAY, stiff, moist [C2] [LYNNHAVEN MEMBER (TABB FORMATION)] **CL**			26.0	
	8 ▼		1 1	100		8						3.0 / 8.5 Yellow brown, fine to medium poorly graded SAND with silt, loose, moist [C1] **SP-SM**			26.1	
	10		2 2			10						SAME, light gray, medium dense below 4 ft SAME, brown gray, loose, wet below 6 ft				
	12	0														
	14		4 4 5	65		13						SAME, gray, medium dense below 13 ft			23.0	
	16	-5	8			15										
	18					18										
0.25			4 2 2	100		18.5						18.5 / -7.0 Dark brown, ORGANIC SILT with sand, firm, wet [D3] [SEDGEFIELD MEMBER (TABB FORMATION)] **OH**				
	20		3			20									104.6	
	22	-10														
			1 0 1			23						SAME, very soft below 23 ft				
0.25	24		2	100									205	89	158.5	75.9
	26	-15				25										
	28		WOH WOH 1	100		28						26.5 / -15.0 Gray, fine to medium clayey SAND, contains organic matter and mica, very loose, wet [D1] **SC**			54.2	
	30		1			30										
	32	-20										31.5 / -20.0 Green gray, fine to medium poorly graded SAND with silt, contains organic matter and mica, medium dense, wet [D1] **SP-SM**				
			2 8 13 16	65		33									22.8	
	34															

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 2 OF 3

STATION: 607+12 OFFSET: 12 ft LT
LATITUDE: 36.832374° N LONGITUDE: 76.326715° W
SURFACE ELEVATION: 11.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/19/2010 - 08/20/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 6.0 ft DEPTH
STABILIZED AT 7.6 ft AFTER 20 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
	35															
	36	-25	5 9 5 9	75		38									27.9	
	38					40										
	40															
	42	-30	5 7 4 8	85		43						41.5 / -30.0 Green gray, fine to medium silty SAND, contains organic matter and mica, medium dense, wet [D1] **SM**			29.2	
	44					45										
	46															
	48	-35	10 9 7 12	75		48						46.5 / -35.0 Green gray, fine to medium poorly graded SAND with silt, contains organic matter and mica, medium dense, wet [D1] **SP-SM**			21.5	
	50					50										
	52	-40	7 7 8 7	60		53									27.6	
	54					55										
	56															
0.5	58	-45	1 1 2 3	100		58						56.5 / -45.0 Brown gray, elastic SILT, trace sand, contains organic matter and mica, soft, moist [D2] **MH**			60.0	
	60					60										
	62	-50	2 2 4 5	100		63						61.5 / -50.0 Gray, fat CLAY with sand, contains organic matter, firm, moist [D2] **CH**			27.3	
1	64					65										
	66	-55	15 28 36 53	85		68						66.5 / -55.0 Light gray, fine to coarse poorly graded SAND, trace silt, very dense, wet [D1] **SP**			13.3	
	68															
	70															

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 607+12 OFFSET: 12 ft LT
LATITUDE: 36.832374° N LONGITUDE: 76.326715° W
SURFACE ELEVATION: 11.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/19/2010 - 08/20/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 6.0 ft DEPTH
STABILIZED AT 7.6 ft AFTER 20 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	70															
	72	-60	2 3 4 7	100		73						71.5 / -60.0 Green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SC**			28.0	
	74					75										
	76	-65														
	78		2 2 5 16	100		78									34.6	
	80					80										
	82	-70														
	84		2 3 4 11	100		83									32.6	
	86					85										
	88	-75	3 3 4 11	100		88									30.8	
	90					90										
	92	-80														
	94		3 3 4 8	100		93									30.1	
	96	-85				95										
	98		4 4 7 15	100		98						SAME, medium dense below 98 ft			25.7	
	100					100						Bottom of Boring at 100 ft.				

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-190

STATION: 506+78 OFFSET: 8 ft RT
LATITUDE: 36.832858° N LONGITUDE: 76.327163° W
SURFACE ELEVATION: 11.1 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/17/2010 - 08/17/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
0.75	0	10	5 3 2	87		0.5						0.0 / 11.1 5-inches ASPHALT **ASPH**			13.1
	2		3 6 12 14	75		2						0.4 / 10.7 Brown, sandy lean CLAY, contains brick fragments, firm, moist [A2] [FILL] **FL**			7.8
	4		6 8 7 6	85		4						2.0 / 9.1 Brown, fine to medium poorly graded SAND with silt, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP-SM**			9.7
	6 ▽	5	2 2 2 3	100		6						SAME, orange brown below 4 ft SAME, wet, loose below 6 ft			20.5
	8		3 4 3 3	100		8									30.5
	10					10									
	12	0				13									
	14		4 3 3 6	85		15						SAME, gray, below 13 ft			22.3
	16	-5													
	18		WOH WOH WOH 1	100		18						16.5 / -5.4 Gray, sandy lean CLAY, contains organic matter and mica, very soft, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CL**			
0.25															
0.25	20					20						19.0 / -7.9 Gray brown, ORGANIC SILT, trace sand, very soft, wet [D3] **OH**			124.4
	22	-10													
						23						SAME, firm below 23 ft			
0.25	24		2 2 3 4	100		25									138.2
	26	-15													
	28		WOH WOH 1 0	100		28						26.5 / -15.4 Gray, fine to medium clayey SAND, contains organic matter and mica, very loose, wet [D1] **SC**			39.0
	30					30									
		-20													
	32					33						31.5 / -20.4 Brown gray, fine to medium silty SAND, contains organic matter and mica, loose, wet [D1] **SM**			
	34		1 2 3 6	85											36.5

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 506+78 OFFSET: 8 ft RT
LATITUDE: 36.832858° N LONGITUDE: 76.327163° W
SURFACE ELEVATION: 11.1 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/17/2010 - 08/17/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
	36	-25				35									
	38		4 6 8 8	75		38						36.5 / -25.4 Green gray, fine to medium poorly graded SAND with silt, contains organic matter and mica, medium dense, wet [D1] **SP-SM**			33.0
	40					40									
		-30										41.5 / -30.4 Green gray, fine to medium silty SAND, contains organic matter and mica, medium dense, wet [D1] **SM**			
	42		3 3 5 10	65		43									41.8
	44					45									
	46	-35										46.5 / -35.4 Green gray, fine to medium poorly graded SAND with silt, contains organic matter and mica, medium dense, wet [D1] **SP-SM**			
	48		7 8 10 10	65		48									30.7
	50					50									
		-40													
	52														
	54		9 9 9 10	75		53									25.7
						55									
	56	-45													
0.5	58		1 1 1 3	100		58						56.5 / -45.4 Gray, elastic SILT, trace sand, contains organic matter and mica, soft, moist [D2] **MH**			60.2
	60					60									
		-50													
	62					63						61.5 / -50.4 Gray, fat CLAY with sand, contains organic matter and mica, soft, wet [D2] **CH**			
0.25	64		1 1 1 2	100		65									37.8
	66	-55													
	68		2 2 2 4	100		68						SAME, contains silty sand pockets, firm below 68 ft			
0.5	70														31.6
												69.4 / -58.3			

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:12/4/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 506+78 OFFSET: 8 ft RT
LATITUDE: 36.832858° N LONGITUDE: 76.327163° W
SURFACE ELEVATION: 11.1 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/17/2010 - 08/17/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	70	-60										Green gray, fine to medium silty SAND, contains mica, loose, wet [D1] **SM**			
	71.5	-60.4										71.5 / -60.4 Green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SC**			
	72														
	73		4 2 3 6	100											26.5
	74														
	75	-65													
	76														
	78		2 2 4 10	100											34.6
	80														
	82	-70													
	83		2 2 4 11	100											34.5
	84														
	85														
	86	-75													
	88		3 2 3 8	100											32.2
	90														
	92	-80													
	93		2 3 5 12	100								SAME, medium dense below 93 ft			30.7
	94														
	95														
	96	-85													
	98		2 3 5 12	100											25.2
	100											Bottom of Boring at 100 ft.			

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:12/4/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-191

STATION: 609+34 OFFSET: 38 ft RT
LATITUDE: 36.832988° N LONGITUDE: 76.326555° W
SURFACE ELEVATION: 10.9 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/18/2010 - 08/18/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
		10	22 14 9 9	15		2						0.0 / 10.9 Crushed stone **OTHER - CRUSHED STONE**			6.0
	2		8 10 12 11	85		4						0.5 / 10.4 Brown, fine to coarse silty sand FILL, contains crushed stone and brick fragments, dense, moist [A1] [FILL] **FL**			4.5
	4		6 6 5 4	90		6						2.0 / 8.9 Brown, fine to medium poorly graded SAND, trace silt, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP**			19.4
	6 ▽	5	3 2 4 2	75		8						4.0 / 6.9 Orange brown, fine to medium poorly graded SAND with silt, medium dense, moist [C1] **SP-SM**			29.0
	8		3 3 4 5	100		10						SAME, loose, wet below 6 ft SAME, light brown below 8 ft			25.7
	10	0													
	12														
	14		3 4 6 9	65		13 15						SAME, gray, medium dense below 13 ft			22.1
	16	-5													
	18		WOH WOH 1 2	100		18						16.5 / -5.6 Gray, fine to medium clayey SAND, contains organic matter and mica, very loose, wet [D1] [SEDGEFIELD MEMBER (TABB FORMATION)] **SC**			42.2
	20					20						19.0 / -8.1 Brown, PEAT, wet [D3] **PT**			
	22	-10				23									
0.25	24		3 2 3 5	75		23.6 25						23.6 / -12.7 Brown, sandy lean CLAY, contains organic matter and mica, firm, wet [D2] **CL**			45.8
	26	-15										24.9 / -14.0 Gray, fine to medium poorly graded SAND with silt, contains organic matter, loose, wet [D1] **SP-SM**			
	28		1 1 1 2	100		28						26.5 / -15.6 Brown gray, lean CLAY with sand, contains organic matter and mica, soft, wet [D2] **CL**			
0.25	30					30									58.3
		-20													
	32											31.5 / -20.6 Green gray, fine to medium poorly graded SAND with silt, contains organic matter and mica, medium dense, wet [D1] **SP-SM**			
	34		4 5 8 12	75		33									26.4

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-191
PAGE 2 OF 3

STATION: 609+34 OFFSET: 38 ft RT
LATITUDE: 36.832988° N LONGITUDE: 76.326555° W
SURFACE ELEVATION: 10.9 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/18/2010 - 08/18/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	36	-25				35									
	38		12 20 15 13	65		38						SAME, trace gravel, dense below 38 ft			27.2
	40	-30				40									
	42														
	44		9 10 10 12	75		43 45						SAME, medium dense below 43 ft			28.3
	46	-35													
	48		7 3 2 1	35		48 50						SAME, loose below 48 ft			26.1
	50	-40													
	52														
	54		4 8 8 12	65		53 55						SAME, medium dense below 53 ft			30.0
	56	-45													
	58		WOH 1 2 2	100		58 60						56.5 / -45.6 Brown gray, elastic SILT, trace sand, contains organic matter and mica, soft, moist [D2] **MH**			56.3
0.25	60	-50													
	62											61.5 / -50.6 Gray, fat CLAY with sand, contains mica, firm, moist [D2] **CH**			
0.75	64		1 2 3 4	100		63 65									31.6
	66	-55													
	68		1 3 13 21	85		68						66.5 / -55.6 Green gray, fine to medium silty SAND, trace gravel, loose, wet [D1] **SM** SAME, dense below 69 ft			25.3
	70														

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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VDOT Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 3 OF 3

STATION: 609+34 OFFSET: 38 ft RT
LATITUDE: 36.832988° N LONGITUDE: 76.326555° W
SURFACE ELEVATION: 10.9 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/18/2010 - 08/18/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)
	70														
												71.5 / -60.6 Green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SC**			30.7
	72	-60	3 3 3 10	100		73									
	74					75									
	76	-65													
	78		2 2 4 12	100		78									32.6
	80					80									
		-70													
	82					83						SAME, medium dense below 83 ft			
	84		3 3 5 4	100		85									32.9
	86	-75													
	88		3 3 4 10	100		88						SAME, loose below 88 ft			31.6
	90					90									
		-80													
	92					93						SAME, medium dense below 93 ft			
	94		3 3 7 15	100		95									28.6
	96	-85													
	98		6 6 15 34	100		98						SAME, contains coquina below 98 ft			25.0
	100					100						Bottom of Boring at 100 ft.			

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 505+20 OFFSET: 54 ft RT
LATITUDE: 36.833291° N LONGITUDE: 76.327337° W
SURFACE ELEVATION: 7.3 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/19/2010 - 08/19/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
			5 7 7 6	85		2						0.0 / 7.3 4-inches ROOTMAT AND TOPSOIL **TOPS**			7.7	
	2	5	5 5 5 5	75		4						0.3 / 7.0 Brown, fine to medium silty sand FILL, contains root fragments and crushed stone, medium dense, moist [A1] [FILL] **FL**			7.5	
	4		2 1 2 3	85		6						1.0 / 6.3 Yellow brown, fine to medium poorly graded sand with silt FILL, contains crushed stone, medium dense, moist [A1] **FL**			10.7	
	6 ▽	0	1 1 2 3	50		8						SAME, contains root fragments below 2 ft			26.6	
	8		3 4 5 3	90		10						4.0 / 3.3 Brown, fine to medium silty sand FILL, contains root fragments, crushed stone and brick fragments, loose, moist [A1] **FL**			30.8	
	10											6.0 / 1.3 Orange brown, fine to coarse poorly graded SAND with silt, loose, wet [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP-SM**				
	12	-5				13						SAME, gray, medium dense below 8 ft				
	14		5 4 4 2	75		15										
0.25	16											14.6 / -7.3 Gray, elastic SILT, trace sand, stiff, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **MH**			59.9	
		-10				18						16.5 / -9.2 Brown gray, ORGANIC SILT, trace sand, soft, wet [D3] **OH**				
0.25	18 20		2 1 2 2	100		20									166.7	
	22	-15				23						21.5 / -14.2 Brown and gray, sandy SILT, contains organic matter and mica, soft, wet [D2] **ML**				
0.25	24		1 1 1 2	100		25							41	11	38.8	59.4
	26											26.5 / -19.2 Gray, fine to medium silty SAND, contains organic matter and mica, very loose, wet [D1] **SM**				
	28	-20	WOH WOH 1 2	85		28 30									41.0	
	30 32	-25				33						31.5 / -24.2 Green gray, fine to medium poorly graded SAND with silt, contains organic matter and mica, medium dense, wet [D1] **SP-SM**				
	34		4 8 9 9	75											28.5	

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 505+20 OFFSET: 54 ft RT
LATITUDE: 36.833291° N LONGITUDE: 76.327337° W
SURFACE ELEVATION: 7.3 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/19/2010 - 08/19/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
	36	-30	5 6 8 9	65		38									40.5	
	38															
	40					40										
	42	-35	4 5 6 8	65		43									26.3	
	44					45										
	46															
	48	-40	5 6 9 11	65		48									30.6	
	50					50										
	52	-45	1 1 2 3	100		53						51.5 / -44.2 Brown, elastic SILT, trace sand, contains organic matter and mica, soft, moist [D2] **MH**				
0.5	54					55									57.4	
	56															
	58	-50	2 4 4 5	100		58						56.5 / -49.2 Gray, sandy fat CLAY, contains mica, stiff, moist [D2] **CH**				
1.75	60					60									21.6	
	62	-55	4 6 4 4	100		63						61.5 / -54.2 Gray, fine to medium poorly graded SAND with silt, contains mica, medium dense, wet [D1] **SP-SM**				
0.25	64					65						64.5 / -57.2 Gray, fat CLAY with sand, contains mica, stiff, wet [D2] **CH**			30.4	
	66															
	68	-60	4 13 9 7	80		68						66.5 / -59.2 Gray, fine to coarse poorly graded SAND, trace silt, contains gravel, medium dense, wet [D1] **SP**			12.2	
	70															

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 505+20 OFFSET: 54 ft RT
LATITUDE: 36.833291° N LONGITUDE: 76.327337° W
SURFACE ELEVATION: 7.3 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/19/2010 - 08/19/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	70											69.7 / -62.4 Green gray, fine to coarse clayey SAND, contains shell fragments, medium dense, wet [E1] [YORKTOWN FORMATION] **SC**				
	72	-65	2 5 10 13	100		73										
	74					75									32.5	
	76															
	78	-70	2 3 7 15	100		78									33.0	
	80					80										
	82	-75	2 2 5 8	100		83						SAME, loose below 83 ft			32.7	
	84					85										
	86															
	88	-80	2 3 8 11	100		88						SAME, medium dense below 88 ft			31.1	
	90					90										
	92	-85	7 10 17 26	100		93						SAME, dense below 93 ft			26.2	
	94					95										
	96															
	98	-90	7 12 21 25	100		98									17.5	
	100					100						Bottom of Boring at 100 ft.				

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 612+17 OFFSET: 21 ft RT
LATITUDE: 36.833763° N LONGITUDE: 76.326638° W
SURFACE ELEVATION: 7.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/02/2010 - 08/02/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 6.4 ft AFTER 3 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
4.5	2	5	6 9 5	100		0.5 1.2						0.0 / 7.4 2-inches ASPHALT **ASPH**			12.2
			7 6 2 3	100		2						0.2 / 7.2 Brown, fine to medium poorly graded sand FILL, trace silt, contains brick fragments, medium dense, moist, contains lean clay layers [A1] [FILL] **FL**			11.2
	4		2 2 2 1	100		4						1.2 / 6.2 Dark gray, sandy lean clay FILL, contains glass fragments, stiff, moist [A2] **FL**			13.2
	6		1 1 1 1	100		6						SAME, contains root and asphalt fragments below 2 ft			
0.25		0													88.9
	8		1 1 1 1	100		8						4.0 / 3.4 Gray, fine to medium clayey SAND, loose, wet [B1] [ALLUVIUM] **SC**			146.3
	10					10						6.0 / 1.4 Brown, lean CLAY, trace sand, contains heavy concentrations of organic matter, soft, wet [B2] **CL**			
	12	-5										9.0 / -1.6 Dark brown, fine to medium silty SAND, contains heavy concentrations of organic matter, very loose, wet [B1] **SM**			
			4 4 1 1	85		13									
0.25	14					14									45.2
						15						14.0 / -6.6 Dark gray, sandy lean CLAY, contains organic matter and mica, firm, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CL**			
	16														
		-10										16.5 / -9.1 Brown, PEAT, wet [D3] **PT**			
	18		2 2 2 4	100		18									215.5
	20					20									
	22	-15										21.5 / -14.1 Gray, fine to medium silty SAND, contains organic matter and mica, loose, wet [D1] **SM**			
			2 2 2 2	100		23									
	24					25									34.1
	26														
		-20										26.5 / -19.1 Gray, fine to medium poorly graded SAND with silt, contains organic matter and mica, medium dense, wet [D1] **SP-SM**			
	28		4 8 6 11	85		28									24.8
	30					30									
	32	-25													
			4 5 9 10	90		33									31.6
	34														

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 612+17 OFFSET: 21 ft RT
LATITUDE: 36.833763° N LONGITUDE: 76.326638° W
SURFACE ELEVATION: 7.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/02/2010 - 08/02/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 6.4 ft AFTER 3 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)
	36	-30	7 9 8 12	100		35 38									
	38														
	40					40									27.5
	42	-35	6 5 5 8	100		43 45									
	44														35.0
	46														
	48	-40	4 7 10 10	100		48 50									32.3
	50														
	52	-45	3 3 5 6	100		53 54 55						54.0 / -46.6 Brown, elastic SILT, trace sand, contains organic matter and mica, stiff, moist [D2] **MH** SAME, gray below 54.7 ft			54.4
1	54														
	56											56.5 / -49.1 Gray, fine to medium silty SAND, loose, wet [D1] **SM**			
	58	-50	1 2 2 4	100		58 60									25.8
	60														
	62	-55	3 4 11 18	100		63 65						SAME, medium dense below 63 ft			25.4
	66														
	68	-60	2 3 4 11	100		68 70						66.5 / -59.1 Gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SC**			29.9

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 612+17 OFFSET: 21 ft RT
LATITUDE: 36.833763° N LONGITUDE: 76.326638° W
SURFACE ELEVATION: 7.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/02/2010 - 08/02/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 6.4 ft AFTER 3 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)
	70														
	72	-65	2 4 5 10	100		73						SAME, medium dense below 73 ft			33.0
	74					75									
	76														
	78	-70	2 3 5 11	100		78									32.4
	80					80									
	82	-75	3 2 5 9	100		83						81.5 / -74.1 Gray, sandy lean CLAY, contains shell fragments, stiff, wet [E2] **CL**			31.8
1	84					85									
	86														
	88	-80	3 3 7 14	100		88						86.5 / -79.1 Gray, fine to coarse clayey SAND, contains shell fragments, medium dense, wet [E1] **SC**			29.7
	90					90									
	92	-85	6 6 8 20	100		93									24.4
	94					95									
	96														
	98	-90	30 12 37 54	100		98						96.5 / -89.1 Gray, fine to coarse silty SAND, contains shell fragments, coquina, very dense, wet [E1] **SM**			17.3
	100					100						Bottom of Boring at 100 ft.			

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-199A
PAGE 1 OF 1

STATION: 612+18 OFFSET: 20 ft RT
LATITUDE: 36.833767° N LONGITUDE: 76.326640° W
SURFACE ELEVATION: 7.4 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/02/2010 - 08/02/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER

FIELD DATA | **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)
												0.0 / 7.4 Rotary probe to 6 ft; see Boring 10BH-199 for strata descriptions.			
0.75	6	0		65		6						6.0 / 1.4 Brown, lean CLAY, trace sand, contains heavy concentrations of organic matter, wet [B2] [ALLUVIUM] **CL**			
	8					8						8.0 / -0.6 Rotary probe to 16 ft; see Boring 10BH-199 for strata descriptions.			
	12	-5													
0.25	16	-10		90		16						16.0 / -8.6 Dark gray, sandy lean CLAY, contains heavy concentrations of organic matter, mica, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **CL**			
	18					18						17.0 / -9.6 Brown, PEAT, wet [D3] **PT** Bottom of Boring at 18 ft.			

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 1037+08 OFFSET: 44 ft LT
LATITUDE: 36.834099° N LONGITUDE: 76.327093° W
SURFACE ELEVATION: 10.1 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/02/2010 - 08/03/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
▼ STABILIZED AT 7.8 ft AFTER 19 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
2	0	10	2 2 2	85		1						0.0 / 10.1 4-inches ROOTMAT AND TOPSOIL **TOPS**			15.0
	2	5	3 3 3	75		2						0.3 / 9.8 Brown, fine to medium silty sand FILL, contains root and brick fragments, loose, moist [A1] [FILL] **FL**			2.5
	4		4 3 3	100		4						1.0 / 9.1 Brown, sandy lean clay FILL, contains root fragments and burnt wood, firm, moist [A2] **FL**			15.1
	6 ▽		3 3 3	100		6						2.0 / 8.1 Light brown, fine to medium poorly graded sand FILL, trace silt, contains root fragments, loose, moist [A1] **FL**			23.7
	8 ▼	0	4 3 5	100		8						4.0 / 6.1 Brown, fine to medium poorly graded SAND with silt, contains lean clay lenses, loose, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP-SM**			25.4
	10		4 3 2			10						SAME, medium dense, wet below 6 ft SAME, loose below 8 ft			
	12														
	14	-5	8 6 4	90		13						SAME, gray, medium dense below 13 ft			23.7
	16		4			15									
	18		2 2 3	75		18						16.5 / -6.4 Brown, PEAT, wet [D3] [SEDGEFIELD MEMBER (TABB FORMATION)] **PT**			209.7
	20	-10	4			20									
	22		7 6 6	100		23						21.5 / -11.4 Gray, fine to medium poorly graded SAND with silt, contains organic matter and mica, medium dense, wet [D1] **SP-SM**			31.4
	24		5			25									
	26	-15													
	28		2 1 2	90		28						SAME, loose below 28 ft			29.0
	30	-20	9			30									
	32														
	34		8 5 9	85		33						SAME, medium dense below 33 ft			33.5
			8												

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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STATION: 1037+08 OFFSET: 44 ft LT
LATITUDE: 36.834099° N LONGITUDE: 76.327093° W
SURFACE ELEVATION: 10.1 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/02/2010 - 08/03/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 6.0 ft DEPTH
STABILIZED AT 7.8 ft AFTER 19 HOURS

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)
	36					35									
	38		10 12 12 14	90		38						SAME, dense below 38 ft			23.8
	40	-30				40									
	42					43									
	44		4 5 6 8	90		45						SAME, medium dense below 43 ft			30.5
	46	-35													
	48		4 4 5 8	100		48									35.8
	50	-40				50									
	52					53									
	54		8 7 7 9	100		55									29.5
	56	-45													
	58		1 2 3 4	100		58						56.5 / -46.4 Gray, elastic SILT, trace sand, firm, moist [D2] **MH**			
0.75	60	-50				60									31.1
	62					63									
1.25	64		2 2 3 4	100		65						SAME, contains organic matter below 63 ft			26.2
	66	-55													
	68		5 6 6 5	100		68						66.5 / -56.4 Gray, fine to coarse clayey SAND, contains shell fragments, medium dense, wet [E1] [YORKTOWN FORMATION] **SC**			32.0
	70														

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-202
PAGE 3 OF 3

STATION: 1037+08 OFFSET: 44 ft LT
LATITUDE: 36.834099° N LONGITUDE: 76.327093° W
SURFACE ELEVATION: 10.1 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/02/2010 - 08/03/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 6.0 ft DEPTH
STABILIZED AT 7.8 ft AFTER 19 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	70														
	72														
	73		2 3 4 11	100								SAME, loose below 73 ft			31.2
	74	-65													
	75														
	76														
	78		3 5 8 11	100								SAME, medium dense below 78 ft			34.0
	80	-70													
	82														
1.25	83		3 2 3 9	100								81.5 / -71.4 Green gray, sandy lean CLAY, contains shell fragments, firm, wet [E2] **CL**			30.9
	84														
	85	-75													
	86														
	88		2 2 4 8	100								87.5 / -77.4 Green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] **SC**			30.5
	90	-80													
	92														
	93		4 4 5 16	100								SAME, medium dense below 93 ft			27.4
	94														
	95	-85													
	96														
	98		6 8 10 18	100								SAME, dense below 99 ft			21.2
	100											Bottom of Boring at 100 ft.			

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-202A
PAGE 1 OF 2

STATION: 1037+07 OFFSET: 42 ft LT
LATITUDE: 36.834096° N LONGITUDE: 76.327087° W
SURFACE ELEVATION: 10.1 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/03/2010 - 08/03/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT (%)
	2	5												
	4													
	6													
	8													
	10	0												
	12													
	14	-5												
	16													
	18													
	20	-10												
	22													
	24													
	26	-15												
	28													
	30	-20												
	32													
	34													

FIELD DESCRIPTION OF STRATA

0.0 / 10.1
Rotary probe to 58 ft; see Boring 10BH-202 for strata descriptions.

REMARKS: Rig Type: CME-45C (Track).

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10BH-202A

SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

STATION: 1037+07 OFFSET: 42 ft LT
LATITUDE: 36.834096° N LONGITUDE: 76.327087° W
SURFACE ELEVATION: 10.1 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/03/2010 - 08/03/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER

FIELD DATA														LAB DATA		
			SOIL				ROCK									
PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	STANDARD PENETRATION TEST HAMMER BLOWS	SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	CORE RECOVERY (%)	ROCK QUALITY DESIGNATION	DIP ° STRATA	DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA		LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT (%)
														LL	PI	
	36															
	38															
	40	-30														
	42															
	44															
		-35														
	46															
	48															
	50	-40														
	52															
	54															
		-45														
	56															
	58					58							58.0 / -47.9 Gray, elastic SILT, trace sand, moist [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **MH**			
1.25				100												
	60					60							Bottom of Boring at 60 ft.			

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-206
PAGE 1 OF 3

STATION: 1038+56 OFFSET: 66 ft LT
LATITUDE: 36.834514° N LONGITUDE: 76.327193° W
SURFACE ELEVATION: 11.2 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/17/2010 - 08/18/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 6.0 ft DEPTH
STABILIZED AT 6.4 ft AFTER 21 HOURS

FIELD DATA | **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
		10	3 3 3 3	10		2						0.0 / 11.2 2-inches ROOTMAT AND TOPSOIL **TOPS**			7.6	
	2		3 3 3 3	100		4						0.2 / 11.0 Brown, fine to medium silty sand FILL, contains root fragments and crushed stone, loose, moist [A1] [FILL] **FL**			2.2	2.9
	4		3 2 3 2	100		6						2.0 / 9.2 Light brown, fine to medium poorly graded SAND, trace silt, loose, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP**			10.5	
	6	5	2 2 1 2	100		8						6.0 / 5.2 Orange brown, fine to medium silty SAND, loose, wet [C1] **SM**			21.8	
	8		4 4 4 3	100		10						8.0 / 3.2 Orange brown, fine to medium poorly graded SAND with silt, medium dense, wet [C1] **SP-SM**			27.2	
	10	0														
	12					13						SAME, gray below 13 ft				
	14		5 3 5 6	85		15									21.8	
	16	-5														
	18		4 4 5 11	75		18						SAME, fine to coarse, contains organic matter below 18 ft			15.3	
	20					20										
	22	-10										21.5 / -10.3 Brown, PEAT, wet [D3] [SEDGEFIELD MEMBER (TABB FORMATION)] **PT**				
	24		1 2 2 2	100		23										
0.25	26	-15				25						24.5 / -13.3 Gray, lean CLAY, trace sand, contains organic matter, firm, wet [D2] **CL**			69.9	
	28		2 1 2 2	100		28						26.5 / -15.3 Dark gray, fine to coarse silty SAND, contains organic matter and mica, loose, wet [D1] **SM**	49	19	61.0	39.9
	30	-20				30										
	32											31.5 / -20.3 Green gray, fine to medium poorly graded SAND with silt, contains organic matter and mica, medium dense, wet [D1] **SP-SM**				
	34		5 5 5 10	75		33									36.6	

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 1038+56 OFFSET: 66 ft LT
LATITUDE: 36.834514° N LONGITUDE: 76.327193° W
SURFACE ELEVATION: 11.2 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/17/2010 - 08/18/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 6.0 ft DEPTH
STABILIZED AT 6.4 ft AFTER 21 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	35															
	36	-25	7 10 11 13	85		38									27.8	
	40					40										
	42	-30	10 9 9 8	75		43									26.7	
	44					45										
	46	-35	6 6 8 8	85		48									37.8	
	48					50										
	50	-40														
	52		5 8 9 10	85		53									36.0	
	54					55										
	56	-45														
0.5	58		1 1 2 2	100		58						56.5 / -45.3 Brown gray, elastic SILT, trace sand, contains organic matter and mica, soft, moist [D2] **MH**			60.2	
	60					60										
	62	-50										61.5 / -50.3 Green gray, sandy fat CLAY, contains organic matter and mica, stiff, moist [D2] **CH**				
1	64		1 3 5 5	100		63									23.4	
	66	-55				65										
	68					68						SAME, contains silty sand lenses, firm below 68 ft				
0.25	70		1 1 3 2	100											41.9	

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 1038+56 OFFSET: 66 ft LT
LATITUDE: 36.834514° N LONGITUDE: 76.327193° W
SURFACE ELEVATION: 11.2 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/17/2010 - 08/18/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 6.0 ft DEPTH
STABILIZED AT 6.4 ft AFTER 21 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	70															
	72	-60	2 2 4 6	100		73						71.5 / -60.3 Green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SC**			34.5	
	74					75										
	76	-65														
	78		2 2 5 11	100		78									32.2	
	80					80										
	82	-70														
	84		3 3 5 11	100		83						SAME, medium dense below 83 ft			31.9	
	86	-75				85										
	88		2 3 4 10	100		88						SAME, loose below 88 ft			32.2	
	90					90										
	92	-80														
	94		5 4 6 16	100		93						SAME, medium dense below 93 ft			29.1	
	96	-85				95										
	98		5 11 11 14	100		98						SAME, contains coquina below 98 ft			20.2	
	100					100						Bottom of Boring at 100 ft.				

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 1 OF 3

STATION: 614+57 OFFSET: 9 ft RT
LATITUDE: 36.834419° N LONGITUDE: 76.326701° W
SURFACE ELEVATION: 10.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/03/2010 - 08/03/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH
No Long Term Measurements Taken

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
		10	3 3 3 4	90		2						0.0 / 10.5 2-inches ROOTMAT AND TOPSOIL **TOPS**			16.0
	2		4 5 5 4	90		4						0.2 / 10.3 Dark brown, fine to coarse silty sand FILL, contains root and brick fragments, loose, moist [A1] [FILL] **FL**			4.8
	4 ▽		3 3 4 3	100		6						0.8 / 9.7 Brown, fine to medium poorly graded sand with silt FILL, contains lean clay lenses, loose, moist [A1] **FL**			17.2
	6	5	2 4 2 4	100		8						2.0 / 8.5 Light brown, fine to medium poorly graded SAND with silt, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP-SM**			23.0
	8		4 4 5 4	100		10						SAME, orange brown, loose, wet below 4 ft			25.3
	10	0										SAME, light brown, medium dense below 8 ft			
	12					13									
	14		4 4 5 4	100		15						SAME, orange brown below 13 ft			23.2
	16	-5													
	18		2 4 7 7	90		18						SAME, gray, trace gravel below 18 ft			18.5
	20	-10				20						19.0 / -8.5 Brown, PEAT, wet [D3] [SEDGEFIELD MEMBER (TABB FORMATION)] **PT**			
	22											21.5 / -11.0 Gray, sandy lean CLAY, contains organic matter and mica, soft, wet [D2] **CL**			
0.25	24		1 1 1 2	100		23 25									47.0
	26	-15													
	28		4 7 11 12	85		28 30						26.5 / -16.0 Gray, fine to medium poorly graded SAND, trace silt, contains organic matter and mica, medium dense, wet [D1] **SP**			22.9
	30	-20													
	32														
	34		6 9 13 12	90		33									22.6

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 2 OF 3

STATION: 614+57 OFFSET: 9 ft RT
LATITUDE: 36.834419° N LONGITUDE: 76.326701° W
SURFACE ELEVATION: 10.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/03/2010 - 08/03/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH
No Long Term Measurements Taken

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	35	-25													
	36														
	38		6 4 6 7	90		38									24.0
	40	-30				40									
	42														
	43					43									
	44		7 8 5 7	85											24.2
	45	-35				45									
	46														
	48		5 6 9 11	90		48						46.5 / -36.0 Gray, fine to medium poorly graded SAND with silt, contains mica, medium dense, wet [D1] **SP-SM**			31.1
	50	-40				50									
	52														
	53					53									
	54		4 6 7 8	90											26.7
	55	-45				55									
	56														
1	58		1 2 2 3	100		58						56.5 / -46.0 Gray, elastic SILT with sand, contains organic matter, firm, wet [D2] **MH**			28.0
	60	-50				60									
	62											61.5 / -51.0 Green gray, fine to medium silty SAND, contains mica, loose, wet [D1] **SM**			
	63		1 1 3 5	100		63									26.8
	65	-55				65									
	66														
	68		1 6 4 5	100		68						66.5 / -56.0 Green gray, fine to coarse clayey SAND, contains shell fragments, medium dense, wet [E1] [YORKTOWN FORMATION] **SC**			32.0
	70														

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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PAGE 3 OF 3

STATION: 614+57 OFFSET: 9 ft RT
LATITUDE: 36.834419° N LONGITUDE: 76.326701° W
SURFACE ELEVATION: 10.5 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/03/2010 - 08/03/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH
No Long Term Measurements Taken

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	70	-60													
	72		2 4 3 11	100		73						SAME, loose below 73 ft			30.8
	74					75									
	76	-65													
	78		1 2 3 10	100		78									33.6
	80					80									
	82	-70													
	84		2 3 4 10	100		83									32.1
	86	-75				85									
	88		2 2 4 9	100		88									30.8
	90					90									
	92	-80													
	94		5 6 10 21	100		93									25.0
	96	-85				95						SAME, medium dense below 93 ft			
	98		3 5 7 12	100		98						96.5 / -86.0 Green gray, sandy lean CLAY, contains shell fragments, stiff, wet [E2] **CL**			22.7
1.25	100					100						Bottom of Boring at 100 ft.			

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 1040+64 OFFSET: 38 ft RT
LATITUDE: 36.835085° N LONGITUDE: 76.326854° W
SURFACE ELEVATION: 9.0 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/26/2010 - 07/26/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 6.0 ft AFTER 223 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
												0.0 / 9.0 2-inches ROOTMAT AND TOPSOIL **TOPS**			3.3
	2		9 7 7 6	100		2						0.2 / 8.8 Gray brown, fine to medium silty sand FILL, medium dense, moist [A1] [FILL] **FL**			11.2
	4	5	4 4 4 3	100		4						2.0 / 7.0 Light brown, fine to medium poorly graded SAND with silt, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP-SM**			19.3
	6		3 2 2 2	100		6									
	8	0	2 1 3 4	90		8						SAME, loose, wet below 4 ft			24.5
	10		2 2 2 4	100		10									24.1
	12					13						11.5 / -2.5 Gray, fine to medium silty SAND, loose, wet [D1] [SEDGEFIELD MEMBER (TABB FORMATION)] **SM**			
	14	-5	3 2 2 2	100		15									34.6
	16														
	18					18						16.5 / -7.5 Brown gray, elastic SILT with sand, contains organic matter and mica, soft, moist [D2] **MH**			
0.75	20	-10	1 1 1 1	100		20									49.6
	22					23						21.5 / -12.5 Gray, fine to medium poorly graded SAND with silt, contains mica, medium dense, wet [D1] **SP-SM**			
	24	-15	3 4 7 8	90		25									33.7
	26														
	28					28						SAME, contains organic matter below 28 ft			
	30	-20	3 4 10 9	95		30									30.4
	32														
	34	-25	2 2 2 2	100		33						SAME, loose below 33 ft			43.5

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 1040+64 OFFSET: 38 ft RT
LATITUDE: 36.835085° N LONGITUDE: 76.326854° W
SURFACE ELEVATION: 9.0 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/26/2010 - 07/26/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
▽ FIRST ENCOUNTERED AT 4.0 ft DEPTH
▼ STABILIZED AT 6.0 ft AFTER 223 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)
	36					35									
	38	-30	3 5 10 9	90		38						SAME, medium dense below 38 ft			31.4
	40					40									
	42														
	44	-35	7 9 10 10	85		43 45									32.1
	46														
	48	-40	6 5 7 7	80		48 50									33.3
	50														
	52														
	54	-45	3 3 3 4	90		53 55						SAME, loose below 53 ft			45.9
	56														
1.25	58	-50	2 2 2 2	100		58 60						56.5 / -47.5 Gray, fat CLAY with sand, firm, moist [D2] **CH**			26.4
	60														
	62											61.5 / -52.5 Gray, fine to medium clayey SAND, contains mica, loose, wet [D1] **SC**			
	64	-55	2 2 1 2	95		63 65									33.3
	66														
	68	-60	2 2 4 4	100		68						66.5 / -57.5 Gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] [YORKTOWN] **SC**			32.7
	70														

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

10BH-211

STATION: 1040+64 OFFSET: 38 ft RT
LATITUDE: 36.835085° N LONGITUDE: 76.326854° W
SURFACE ELEVATION: 9.0 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/26/2010 - 07/26/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 6.0 ft AFTER 223 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	70														
	72														
	74	-65	1 2 2 4	100		73 75									33.0
	76														
	78	-70	1 2 2 4	100		78 80									32.9
	82														
	84	-75	3 3 3 3	95		83 85									32.3
	86														
	88	-80	3 3 3 4	95		88 90									30.2
	92														
	94	-85	5 5 8 13	95		93 95						SAME, contains heavy concentrations of shell fragments and coquina, medium dense below 93 ft			20.8
	96														
	98	-90	2 3 11 27	100		98 100						SAME, very dense below 99 ft			20.4
	100											Bottom of Boring at 100 ft.			

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 1042+86 OFFSET: 26 ft LT
LATITUDE: 36.835665° N LONGITUDE: 76.327195° W
SURFACE ELEVATION: 9.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/26/2010 - 07/26/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 6.0 ft AFTER 209 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
												0.0 / 9.4 4-inches ROOTMAT AND TOPSOIL **TOPS**			1.7
												0.3 / 9.1 Light brown, fine to medium silty SAND, contains root fragments, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SM**			4.7
												2.0 / 7.4 Gray brown, fine to medium poorly graded SAND with silt, medium dense, moist [C1] **SP-SM**			19.6
												SAME, orange brown, loose, wet below 4 ft			28.9
												SAME, gray below 6 ft			24.7
												SAME, medium dense below 18 ft			31.1
												21.5 / -12.1 Gray, fine poorly graded SAND with silt, contains organic matter, medium dense, wet [D1] [SEDGEFIELD MEMBER (TABB FORMATION)] **SP-SM**			33.3
												SAME, green gray, medium dense below 28 ft			32.9
												31.5 / -22.1 Brown gray, fine to medium silty SAND, contains organic matter and mica, loose, wet [D1] **SM**			29.6
															42.5

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 1042+86 OFFSET: 26 ft LT
LATITUDE: 36.835665° N LONGITUDE: 76.327195° W
SURFACE ELEVATION: 9.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/26/2010 - 07/26/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
FIRST ENCOUNTERED AT 4.0 ft DEPTH
STABILIZED AT 6.0 ft AFTER 209 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	36					35									
	38		4 6 4 9	95		38						36.5 / -27.1 Gray, fine poorly graded SAND, trace silt, contains organic matter and mica, medium dense, wet [D1] **SP**			31.7
	40	-30				40									
	42														
	44	-35	7 5 4 4	100		43 45									41.8
	46														
	48		5 5 7 8	100		48									
	50	-40				50									34.6
	52														
	54	-45	4 4 7 9	100		53 55									31.2
	56														
0.75	58		1 1 1 2	95		58						56.5 / -47.1 Gray fat CLAY, trace sand, soft, wet [D2] **CH**			30.1
	60	-50				60									
	62											61.5 / -52.1 Gray, fine to medium clayey SAND, loose, wet [D1] **SC**			
	64	-55	3 2 3 3	100		63 65									27.6
	66														
	68		2 2 4 5	100		68						66.5 / -57.1 Gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SC**			28.9
	70	-60													

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 1042+86 OFFSET: 26 ft LT
LATITUDE: 36.835665° N LONGITUDE: 76.327195° W
SURFACE ELEVATION: 9.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/26/2010 - 07/26/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: B. Azumah

GROUND WATER
- FIRST ENCOUNTERED AT 4.0 ft DEPTH
- STABILIZED AT 6.0 ft AFTER 209 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	70														
	72														
	73											SAME, contains coquina below 73 ft			
	74	-65	3 2 3 6	100											32.6
	75														
	76														
	78														
	78		2 2 3 5	100											31.2
	80	-70													
	80														
	82														
	83														
	84	-75	3 3 4 4	100											33.0
	85														
	86														
	88														
	88		2 2 4 7	95											29.8
	90	-80													
	90														
	92														
	93														
	94	-85	3 4 6 10	100								SAME, medium dense below 93 ft			22.5
	95														
	96														
	98														
	98		54 33 30 20	100								SAME, very dense below 98 ft			26.6
	100	-90													
	100											Bottom of Boring at 100 ft.			

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 1044+79 OFFSET: 69 ft RT
LATITUDE: 36.836242° N LONGITUDE: 76.327096° W
SURFACE ELEVATION: 11.2 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/13/2010 - 08/13/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

FIELD DATA | **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
		10	3 4 3 3	25		2						0.0 / 11.2 1-inch ROOTMAT AND TOPSOIL **TOPS**			6.3	
	2		7 9 9 8	90		4						0.1 / 11.1 Brown, fine to medium silty sand FILL, contains root fragments, loose, moist [A1] [FILL] **FL**			4.6	
	4		3 5 4 4	90		6						2.0 / 9.2 Brown, fine to medium poorly graded sand with silt FILL, contains glass fragments, medium dense, moist [A1] **FL**			11.6	
	6 ▽	5	2 2 1 2	100		8						4.0 / 7.2 Orange brown, fine to medium poorly graded SAND with silt, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP-SM**			24.4	
	8		2 4 5 6	85		10									26.1	
	10											SAME, loose, wet below 6 ft SAME, medium dense below 8 ft				
	12	0														
	14		6 4 5 6	75		13 15						SAME, gray below 13 ft			21.9	
	16	-5														
	18		1 1 1 2	40		18 20						16.5 / -5.3 Gray, fine to medium silty SAND, contains organic matter and mica, very loose, wet [D1] [SEDGEFIELD MEMBER (TABB FORMATION)] **SM**			44.1	
	20	-10														
	22											21.5 / -10.3 Gray, elastic SILT, trace sand, contains organic matter and mica, soft, wet [D2] **MH**				
0.25	24		1 1 1 1	100		23 25							73	37	59.7	96.7
	26	-15														
	28		1 1 0 1	100		28 30						26.5 / -15.3 Gray, fine to medium clayey SAND, contains organic matter and mica, very loose, wet [D1] **SC**			41.6	
	30	-20														
	32											31.5 / -20.3 Gray, fine to medium silty SAND, contains heavy concentrations of organic matter and mica, loose, wet [D1] **SM**				
	34		WOH 1 2 4	100		33									89.4	

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 1044+79 OFFSET: 69 ft RT
LATITUDE: 36.836242° N LONGITUDE: 76.327096° W
SURFACE ELEVATION: 11.2 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/13/2010 - 08/13/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	36	-25				35										
	38		6 8 9 12	50		38						36.5 / -25.3 Gray, fine to medium poorly graded SAND with silt, contains organic matter and mica, medium dense, wet [D1] **SP-SM**			26.1	
	40					40										
	42	-30	7 8 10 10	60		43									27.8	
	44					45										
	46	-35														
	48		7 8 11 10	50		48									27.6	
	50					50										
	52	-40														
	54		6 9 9 9	50		53									25.3	
	56	-45				55										
	58		6 10 8 10	90		58						56.5 / -45.3 Green gray, fine to medium silty SAND, medium dense, wet [D1] **SM**			24.3	
	60					60										
	62	-50														
	64		4 4 5 9	85		63									25.9	
	66	-55				65										
	68		24 25 20 10	100		68						66.5 / -55.3 Gray, fine to coarse poorly graded SAND, trace gravel, very dense, wet [D1] **SP**			15.3	
	70															

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

STATION: 1044+79 OFFSET: 69 ft RT
LATITUDE: 36.836242° N LONGITUDE: 76.327096° W
SURFACE ELEVATION: 11.2 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/13/2010 - 08/13/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT LL	LAB: PLASTICITY INDEX PI	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT #200 (%)
	70															
	72	-60														
	73		3 4 4 9	100											29.5	
	74															
	75															
	76	-65														
	78		3 4 7 12	100											29.9	
	80															
	82	-70														
	83		2 3 4 8	100								SAME, loose below 83 ft			32.8	
	84															
	85															
	86	-75														
	88		3 3 7 12	100								SAME, medium dense below 88 ft			27.9	
	90															
	92	-80														
	93		9 10 10 33	100								SAME, contains coquina below 93 ft			21.5	
	94															
	95															
	96	-85														
	98		11 27 29 15	100								96.5 / -85.3 Green gray, fine to medium silty SAND, contains coquina and heavy concentrations of shell fragments, very dense, wet [E1] **SM**				
	98															
1.5	100					100						99.5 / -88.3 Green gray, sandy lean CLAY, contains shell fragments, very hard, wet [E2] **CL** Bottom of Boring at 100 ft.			22.8	

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 1045+75 OFFSET: 70 ft LT
LATITUDE: 36.836334° N LONGITUDE: 76.327673° W
SURFACE ELEVATION: 10.8 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/16/2010 - 08/16/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 7.0 ft DEPTH

FIELD DATA														LAB DATA			
			SOIL				ROCK										
PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	STANDARD PENETRATION TEST HAMMER BLOWS	SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	CORE RECOVERY (%)	ROCK QUALITY DESIGNATION	DIP ° STRATA	DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	0	10	8 7 8 10	30		2						0.0 / 10.8 2-inches ROOTMAT AND TOPSOIL **TOPS**			7.7	
	2		15 17 16 13	65		4						0.2 / 10.6 Gray brown, fine to medium silty sand FILL, contains root fragments, medium dense, moist [A1] [FILL] **FL**			6.8	
	4		7 7 6 4	100		6						SAME, dense below 2 ft			10.5	
	6	5	2 3 3 4	100		8						4.0 / 6.8 Orange brown, fine to medium poorly graded SAND, trace silt, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP**			19.0	
	8		3 3 3 3	100		10						SAME, loose, wet below 6 ft			28.9	
	10	0														
	12		2 2 1 1	90		13						11.5 / -0.7 Gray, fine to medium silty SAND, loose, wet [D1] [SEDGEFIELD MEMBER (TABB FORMATION)] **SM**			25.5	
	14					15										
	16	-5														
0.25	18		1 0 1 0	100		18						16.5 / -5.7 Gray, elastic SILT, trace sand, contains organic matter and mica, very soft, wet [D2] **MH**			79.3	
	20	-10				20										
	22											21.5 / -10.7 Brown gray, ORGANIC SILT, trace sand, contains peat layers, soft, wet, [D3] **OH**				
0.25	24		1 1 1 2	100		23									118.2	
	26	-15				25										
	28		WOH WOH WOH 1	100		28						26.5 / -15.7 Dark gray, fat CLAY with sand, contains organic matter and mica, very soft, wet [D2] **CH**				
0.25	30					30							58	28	49.1	82.9
	32	-20														
	34		5 4 6 7	85		33						31.5 / -20.7 Green gray, fine to medium silty SAND, contains organic matter and mica, medium dense, wet [D1] **SM**			38.3	

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 1045+75 OFFSET: 70 ft LT
LATITUDE: 36.836334° N LONGITUDE: 76.327673° W
SURFACE ELEVATION: 10.8 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/16/2010 - 08/16/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 7.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	36	-25	5 6 7	75		35 38						36.5 / -25.7 Gray, fine to medium poorly graded SAND with silt, contains organic matter and mica, medium dense, wet [D1] **SP-SM**			30.1	
	40		5			40										
	42	-30	4 5 4 6	75		43 45						41.5 / -30.7 Green gray, fine to medium silty SAND, contains organic matter and mica, medium dense, wet [D1] **SM**			37.5	
	44															
	46	-35														
	48		5 4 4 7	75		48 50									38.6	
	50															
	52	-40														
	54		6 8 10 9	35		53 55									44.9	
	56	-45														
	58		4 4 4 4	0		58 60										
	60															
	62	-50														
0.5	64		1 1 2 4	100		63 65						61.5 / -50.7 Gray, sandy fat CLAY, soft, wet [D2] **CH**			26.3	
	66	-55														
	68		1 1 4 6	100		68						SAME, firm below 68 ft			42.6	
0.25	70															

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE

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STATION: 1045+75 OFFSET: 70 ft LT
LATITUDE: 36.836334° N LONGITUDE: 76.327673° W
SURFACE ELEVATION: 10.8 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/16/2010 - 08/16/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 7.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	70											69.5 / -58.7 Gray, fine to medium silty SAND, contains mica, loose, wet [D1] **SM**				
	72	-60										71.5 / -60.7 Green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SC**				
	74		2 2 2 7	100		73 75									33.0	
	76	-65														
	78		2 2 3 5	100		78 80									31.4	
	80															
	82	-70														
	84		2 2 3 7	100		83 85									33.7	
	86	-75														
	88		3 3 4 10	100		88 90									30.2	
	90	-80														
	92															
	94		6 5 7 19	100		93 95						SAME, medium dense below 93 ft			26.4	
	96	-85														
	98		3 2 8 98	100		98 100						SAME, very dense below 99.5 ft Bottom of Boring at 100 ft.			26.0	
	100															

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 1 OF 3

STATION: 1201+62 OFFSET: 35 ft LT
LATITUDE: 36.836635° N LONGITUDE: 76.327931° W
SURFACE ELEVATION: 11.6 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/16/2010 - 08/16/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 8.0 ft DEPTH
STABILIZED AT 8.5 ft AFTER 28 HOURS

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
		10	5 9 18 12	75		2						0.0 / 11.6 1-inch ROOTMAT AND TOPSOIL **TOPS**			10.1	
	2		7 7 10 8	100		4						0.1 / 11.5 Brown, fine to medium silty sand FILL, contains burnt wood fragments, dense, moist [A1] [FILL] **FL**			9.5	
	4		6 6 7 5	100		6						SAME, medium dense below 2 ft				
	6	5	2 2 3 2	100		8						3.6 / 8.0 Light brown, fine to medium poorly graded SAND with silt, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP-SM**			8.8	
	8 ▽		2 3 3 4	100		10						SAME, loose below 6 ft SAME, wet below 8 ft			24.3	
	10															
	12	0				13										
	14		3 4 3 3	85		15						SAME, gray, below 13 ft			24.1	
	16	-5														
	18		2 1 1 2	100		18						18.4 / -6.8 Gray, elastic SILT with sand, contains heavy concentrations of organic matter, mica, soft, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **MH**			76.7	
0.25	20					20										
	22	-10										21.5 / -9.9 Dark gray, sandy ORGANIC SILT, soft, wet [D3] **OH**				
0.25	24		1 1 1 1	100		23							139	70	170.0	64.6
	26					25										
	28	-15	WOH WOH 1 2	100		28						26.5 / -14.9 Gray, fine to medium clayey SAND, contains organic matter and mica, very loose, wet [D1] **SC**			36.3	
	30					30										
	32	-20										31.5 / -19.9 Gray, fine to medium poorly graded SAND with silt, contains organic matter and mica, medium dense, wet [D1] **SP-SM**				
	34		4 6 7 8	85		33									31.8	

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 2 OF 3

STATION: 1201+62 OFFSET: 35 ft LT
LATITUDE: 36.836635° N LONGITUDE: 76.327931° W
SURFACE ELEVATION: 11.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/16/2010 - 08/16/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
FIRST ENCOUNTERED AT 8.0 ft DEPTH
STABILIZED AT 8.5 ft AFTER 28 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	36	-25				35										
	38		5 5 5 9	75		38						SAME, green gray below 38 ft			23.9	
	40					40										
	42	-30				43										
	44		5 5 6 3	65		45									32.0	
	46															
	48	-35				48										
	50		7 8 8 8	85		50									30.1	
	52	-40				53						51.5 / -39.9 Green gray, fine to medium silty SAND, contains organic matter and mica, medium dense, wet [D1] **SM**				
	54		6 7 8 10	90		55									34.7	
	56	-45														
1	58		2 3 3 4	100		58						56.5 / -44.9 Gray, lean CLAY with sand, trace gravel, contains mica, firm, moist [D2] **CL**	38	20	26.0	78.7
	60					60										
	62	-50														
0.75	64		WOH 1 2 4	100		63						SAME, soft below 63 ft			27.1	
	66					65										
	68	-55	19 24 26 27	85		68						66.5 / -54.9 Light gray, fine to coarse poorly graded SAND, trace silt, very dense, wet [D1] **SP**			11.8	
	70															

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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STATION: 1201+62 OFFSET: 35 ft LT
LATITUDE: 36.836635° N LONGITUDE: 76.327931° W
SURFACE ELEVATION: 11.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/16/2010 - 08/16/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
- FIRST ENCOUNTERED AT 8.0 ft DEPTH
- STABILIZED AT 8.5 ft AFTER 28 HOURS

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT -#200 (%)
	70															
	72	-60	3 2 4 11	100		73						71.5 / -59.9 Green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SC**			34.1	
	74					75										
	76	-65														
	78		2 2 2 6	100		78									34.8	
	80					80						Bottom of Boring at 80 ft.				

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 1 OF 3

STATION: 1104+09 OFFSET: 13 ft RT
LATITUDE: 36.836554° N LONGITUDE: 76.326819° W
SURFACE ELEVATION: 10.8 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/13/2010 - 08/13/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT LL	LAB: PLASTICITY INDEX PI	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT #200 (%)
	0	10	3 5 5 4	75		2						0.0 / 10.8 1-inch ROOTMAT AND TOPSOIL **TOPS**			9.2	
	2		3 4 5 4	90		4						0.1 / 10.7 Brown, fine to medium silty sand FILL, contains root and brick fragments, medium dense, moist [A1] [FILL] **FL**			4.3	
	4		2 2 3 2	100		6						2.0 / 8.8 Brown, fine to medium poorly graded SAND with silt, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP-SM**			8.4	
	6 ▽	5	1 2 2 2	100		8						SAME, loose below 4 ft			29.6	
	8		3 2 2 3	100		10						SAME, wet below 6 ft			26.0	
	10	0				12										
	12					13										
	14		3 4 5 4	65		15						SAME, gray, medium dense below 13 ft			22.5	
	16	-5				18						16.5 / -5.7 Gray, elastic SILT with sand, contains organic matter and mica, very soft, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **MH**				
0.25	18		WOH WOH WOH WOH	100		20									53.5	
	20	-10				22										
0.25	22		WOH WOH 1 1	100		23									59.4	
	24					25										
	26	-15				28										
0.5	28		WOH 1 0 1	100		30									59.0	
	30	-20				32										
	32					33										
0.25	34		WOH WOH 1 1	100											50.2	

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 2 OF 3

STATION: 1104+09 OFFSET: 13 ft RT
LATITUDE: 36.836554° N LONGITUDE: 76.326819° W
SURFACE ELEVATION: 10.8 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 08/13/2010 - 08/13/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
	36	-25				35										
	38		WOH WOH 2 2	100		38										
0.25	40	-30				40						39.0 / -28.2 Gray, fine to medium silty SAND, contains organic matter and mica, very loose, wet [D1] **SM**			57.7	
	42															
	44		3 4 5 10	100		43 45						SAME, medium dense below 43 ft			41.2	
	46	-35														
	48		9 9 9 10	100		48						46.5 / -35.7 Gray, fine to medium poorly graded SAND with silt, contains organic matter, medium dense, wet [D1] **SP-SM**			32.6	
	50	-40				50										
	52											51.5 / -40.7 Gray, fat CLAY, trace sand, contains organic matter and mica, soft, wet [D2] **CH**				
0.5	54		WOH 1 1 2	100		53 55							77	45	51.9	96.0
	56	-45														
	58		6 6 4 5	75		58						56.5 / -45.7 Green gray, fine to medium silty SAND, medium dense, wet [D1] **SM**			24.2	
	60					60										
	62	-50														
	64		3 5 7 7	65		63 65						SAME, contains mica below 63 ft			30.4	
	66	-55														
	68		21 10 5 6	100		68 69						66.5 / -55.7 Gray, fine to medium poorly graded SAND, trace silt and gravel, medium dense, wet [D1] **SP**			30.3	
0.25	70											69.0 / -58.2				

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 3 OF 3

STATION: 1104+09 OFFSET: 13 ft RT
LATITUDE: 36.836554° N LONGITUDE: 76.326819° W
SURFACE ELEVATION: 10.8 ft COORD. DATUM: NAD 83

Date(s) Drilled: 08/13/2010 - 08/13/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

FIELD DATA														LAB DATA			
			SOIL				ROCK										
PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	STANDARD PENETRATION TEST HAMMER BLOWS	SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	CORE RECOVERY (%)	ROCK QUALITY DESIGNATION	DIP ° STRATA	DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA		LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
		-60				70						Green gray, sandy lean CLAY, contains shell fragments, very stiff, wet [E2] [YORKTOWN FORMATION] **CL**					
	72		2 3	100		73						71.5 / -60.7 Green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] **SC**				30.6	
	74		3 7			75						Bottom of Boring at 75 ft.					

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-233

STATION: 1107+27 OFFSET: 44 ft RT
LATITUDE: 36.836863° N LONGITUDE: 76.327432° W
SURFACE ELEVATION: 11.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/22/2010 - 07/22/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
		10	21 18 9 8	90		2						0.0 / 11.6 2-inches ROOTMAT AND TOPSOIL **TOPS**			8.8
	2		5 6 5 6	100		4						0.2 / 11.4 Brown, fine to medium silty sand FILL, contains concrete and asphalt fragments, dense, moist [A1] [FILL] **FL**			6.8
	4		4 3 3 3	100		6						2.0 / 9.6 Brown, fine to medium poorly graded SAND with silt, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP-SM**			13.0
	6 ▽	5	3 2 2 2	100		8						4.0 / 7.6 Light orange brown, fine to medium clayey SAND, loose, moist [C1] **SC**			21.2
	8		2 2 3 3	100		10						5.0 / 6.6 Orange brown, fine to medium poorly graded SAND with silt, contains clayey sand pockets, loose, moist [C1] **SP-SM** SAME, light brown, wet below 6 ft SAME, brown below 8 ft			26.4
	10														
	12	0				13						SAME, gray, medium dense below 13 ft			
	14		2 5 5 6	100		15									22.4
	16	-5													
0.25	18		WOH WOH WOH 1	100		18						16.5 / -4.9 Gray, elastic SILT, trace sand, contains mica and organic matter, very soft, moist [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **MH**			61.7
	20					20									
	22	-10				23									
0.25	24		WOH WOH 1 1	100		25									66.9
	26	-15													
	28		WOH 1 1 1	100		28						26.5 / -14.9 Gray, lean CLAY with sand, contains organic matter and mica, soft, wet [D2] **CL**			
0.5	30					30									48.5
	32	-20													
	34		1 3 5 5	100		33						31.5 / -19.9 Gray, fine to medium clayey SAND, contains organic matter and mica, medium dense, wet [D1] **SC**			56.1

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:12/8/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

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PAGE 2 OF 3

STATION: 1107+27 OFFSET: 44 ft RT
LATITUDE: 36.836863° N LONGITUDE: 76.327432° W
SURFACE ELEVATION: 11.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/22/2010 - 07/22/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	36	-25				35									
	38		2 5 9 9	100		38						36.5 / -24.9 Gray, fine to medium poorly graded SAND, trace silt, medium dense, wet [D1] **SP**			26.6
	40					40									
	42	-30	3 4 7 7	100		43						41.5 / -29.9 Gray, fine to medium poorly graded SAND with silt, contains organic matter and mica, medium dense, wet [D1] **SP-SM**			33.3
	44					45									
	46	-35													
	48		5 6 10 9	100		48									31.2
	50					50									
	52	-40													
	54		6 8 9 8	100		53 55						51.5 / -39.9 Gray, fine to medium silty SAND, contains mica and organic matter, medium dense, wet [D1] **SM**			35.4
	56	-45													
	58		5 4 6 7	100		58									37.7
	60					60									
	62	-50													
1	64		1 1 3 5	100		63 65						61.5 / -49.9 Gray, elastic SILT, trace sand, contains organic matter and mica, firm, moist [D2] **MH**			33.2
	66	-55													
	68		4 10 16 19	100		68						66.5 / -54.9 Gray, fine to medium poorly graded SAND with silt, contains organic matter and mica, dense, wet [D1] **SP-SM**			25.8
	70														

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:12/8/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-233
PAGE 3 OF 3

STATION: 1107+27 OFFSET: 44 ft RT
LATITUDE: 36.836863° N LONGITUDE: 76.327432° W
SURFACE ELEVATION: 11.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/22/2010 - 07/22/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	72	-60	2			70						71.5 / -59.9 Green gray, fine to coarse clayey SAND, contains shell fragments, loose, wet [E1] [YORKTOWN FORMATION] **SC**			
	74		3 4 7	100		73 75						Bottom of Boring at 75 ft.			32.4

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:12/8/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-233A
PAGE 1 OF 2

STATION: 1107+21 OFFSET: 44 ft RT
LATITUDE: 36.836843° N LONGITUDE: 76.327418° W
SURFACE ELEVATION: 11.7 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/23/2010 - 07/23/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT -#200 (%)
												0.0 / 11.7 Rotary probe to 16 ft; see Boring 10BH-233 for strata descriptions.				
	16	-5	2 6 5 2	85		16						16.0 / -4.3 Gray, fine to medium poorly graded SAND with silt, medium dense, wet [D1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP-SM**			22.9	
0.25	18		WOH WOH 1 2	100		18										
	20			90		20						18.0 / -6.3 Dark gray, elastic SILT, trace sand, contains organic matter and mica, very soft, moist [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **MH**			58.7	
0.75	22	-10	WOH WOH 2 1	100		22						SAME, soft below 22 ft	57	25	62.6	94.0
0.5	24			80		24									66.5	
1	26	-15	WOH 1 1 1	100		26									64.6	
0.25	28		WOH 1 1 2	100		28						28.0 / -16.3 Gray, lean CLAY with sand, contains organic matter and mica, soft, wet [D2] **CL**			50.4	
0.5	30		2 2 2 1	100		30						SAME, contains silty sand pockets, firm below 30 ft			57.3	
0.25	32	-20	2 2 2 2	100		32									50.4	
	34		2 3			34						34.0 / -22.3				

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-233A

STATION: 1107+21 OFFSET: 44 ft RT
LATITUDE: 36.836843° N LONGITUDE: 76.327418° W
SURFACE ELEVATION: 11.7 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/23/2010 - 07/23/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER

FIELD DATA													LAB DATA			
			SOIL				ROCK									
PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	STANDARD PENETRATION TEST HAMMER BLOWS	SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	CORE RECOVERY (%)	ROCK QUALITY DESIGNATION	DIP ° STRATA	DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
	36	-25	5 5	90		36						Gray, fine to medium clayey SAND, contains mica and organic matter, medium dense, wet [D1] **SC** Bottom of Boring at 36 ft.			35.8	

REMARKS: Rig Type: CME-45C (Track).

SPT_LOGAB:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-236
PAGE 1 OF 3

STATION: 1049+25 OFFSET: 43 ft LT
LATITUDE: 36.837179° N LONGITUDE: 76.328218° W
SURFACE ELEVATION: 10.0 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/23/2010 - 07/23/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 8.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
			12 12 10	87		0.5						0.0 / 10.0 6-inches ASPHALT **ASPH**			
	2		8 7 7 8	85		2						0.5 / 9.5 Dark gray, fine to coarse silty sand FILL, contains crushed stone, medium dense, moist [A1] [FILL] **FL**			9.8
	4	5	5 5 5 4	90		4						2.0 / 8.0 Orange brown, fine to medium poorly graded SAND with silt, contains lean clay lenses, medium dense, moist [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP-SM**			12.2
	6		4 5 6 4	0		6						SAME, light brown below 4 ft			11.7
	8 ▽		4 3 2 2	65		8						SAME, gray, loose, wet below 8 ft			29.3
	10	0				10									
	12					13						SAME, medium dense below 13 ft			
	14		5 8 7 4	100		15									24.2
	16	-5													
	18		1 2 2 3	100		18						16.5 / -6.5 Gray, elastic SILT, trace sand, contains mica and organic matter, firm, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **MH**			
0.25	20	-10				20						SAME, contains heavy concentrations of organic matter below 19.5 ft			96.8
	22					23						21.5 / -11.5 Gray, lean CLAY with sand, contains organic matter and mica, firm, wet [D2] **CL**			
0.25	24	-15	1 2 2 1	100		25									55.2
	26											26.5 / -16.5 Gray, fine to medium silty SAND, contains organic matter and mica, loose, wet [D1] **SM**			
	28		1 2 1 4	100		28									
	30	-20				30									37.3
	32					33						31.5 / -21.5 Gray, fine to medium poorly graded SAND with silt, contains mica, medium dense, wet [D1] **SP-SM**			
	34		4 8 7 8	100											39.0
		-25													

REMARKS: Rig Type: CME-45C (Track).

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-236
PAGE 2 OF 3

STATION: 1049+25 OFFSET: 43 ft LT
LATITUDE: 36.837179° N LONGITUDE: 76.328218° W
SURFACE ELEVATION: 10.0 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/23/2010 - 07/23/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 8.0 ft DEPTH

LAB DATA

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	35														
	36														
	38		4 6 7 7	100		38						SAME, contains organic matter below 38 ft			37.4
	40	-30				40									
	42														
	43		4 8 8 6	100		43									27.0
	44					45									
	46	-35													
	48		4 5 7 7	100		48									39.1
	50	-40				50									
	52														
	53		7 10 10 9	100		53									36.6
	54					55									
	56	-45													
	58		1 2 3 2	100		58						56.5 / -46.5 Light gray, elastic SILT with sand, firm, moist [D2] **MH**			32.2
1.5	60	-50				60									
	62														
	63		1 2 2 3	100		63						SAME, contains organic matter and mica below 63 ft			28.7
1.25	64					65									
	66	-55													
	68		7 16 14 8	90		68						66.5 / -56.5 Gray, fine to coarse poorly graded SAND with silt, dense, wet [D1] **SP-SM**			11.5
	70	-60													

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-236
PAGE 3 OF 3

STATION: 1049+25 OFFSET: 43 ft LT
LATITUDE: 36.837179° N LONGITUDE: 76.328218° W
SURFACE ELEVATION: 10.0 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/23/2010 - 07/23/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER
▽ FIRST ENCOUNTERED AT 8.0 ft DEPTH

FIELD DATA													LAB DATA		
PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	70														
	72											71.5 / -61.5 Green gray, fine to coarse clayey SAND, contains shell fragments, medium dense, wet [E1] [YORKTOWN] **SC**			
			3			73									
	74		5												
			10	100											33.6
		-65	9			75						Bottom of Boring at 75 ft.			

REMARKS: Rig Type: CME-45C (Track).

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SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: EMBANKMENT

10BH-236A

STATION: 1049+29 OFFSET: 43 ft LT
LATITUDE: 36.837187° N LONGITUDE: 76.328224° W
SURFACE ELEVATION: 10.0 ft COORD. DATUM: NAD 83

Date(s) Drilled: 07/23/2010 - 07/23/2010
Drilling Method(s): Tricone Roller Bit
SPT Method: Auto Hammer (140 lb)
Other Test(s): Not Applicable
Driller: Fishburne - Chesapeake
Logger: R. Rountree

GROUND WATER

FIELD DATA / **LAB DATA**

PKT. PENETROMETER (tsf)	DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)
	0	10										0.0 / 10.0 Rotary probe to 16 ft; see Boring 10BH-236 for strata descriptions.			
	16	-6	1 1 1 1	100		16						16.0 / -6.0 Gray, fine to medium poorly graded SAND with silt, very loose, wet [C1] [LYNNHAVEN MEMBER (TABB FORMATION)] **SP-SM**			50.9
0.25	20	-10	1 1 1 1	100		20						16.2 / -6.2 Gray, elastic SILT, contains mica and organic matter, soft, wet [D2] [SEDGEFIELD MEMBER (TABB FORMATION)] **MH**			122.0
1.75	22			80		22									
0.75	24		1 2 2 3	100		24						22.0 / -12.0 Dark brown, lean CLAY with sand, contains heavy concentrations of organic matter, firm, moist [D2] **CL**			154.5
0.25	26	-16	2 2 2 1	100		26						26.0 / -16.0 Gray, fine to medium silty SAND, contains organic matter and mica, loose, wet [D1] **SM**			55.7
	28		2 1 2 2			28						Bottom of Boring at 28 ft.			32.7

REMARKS: Rig Type: CME-45C (Track).

10BH-236A

SPT_LOGA:10613051_VDOT LOGS MASTER.GPJ:8.2.006:092710:11/29/10

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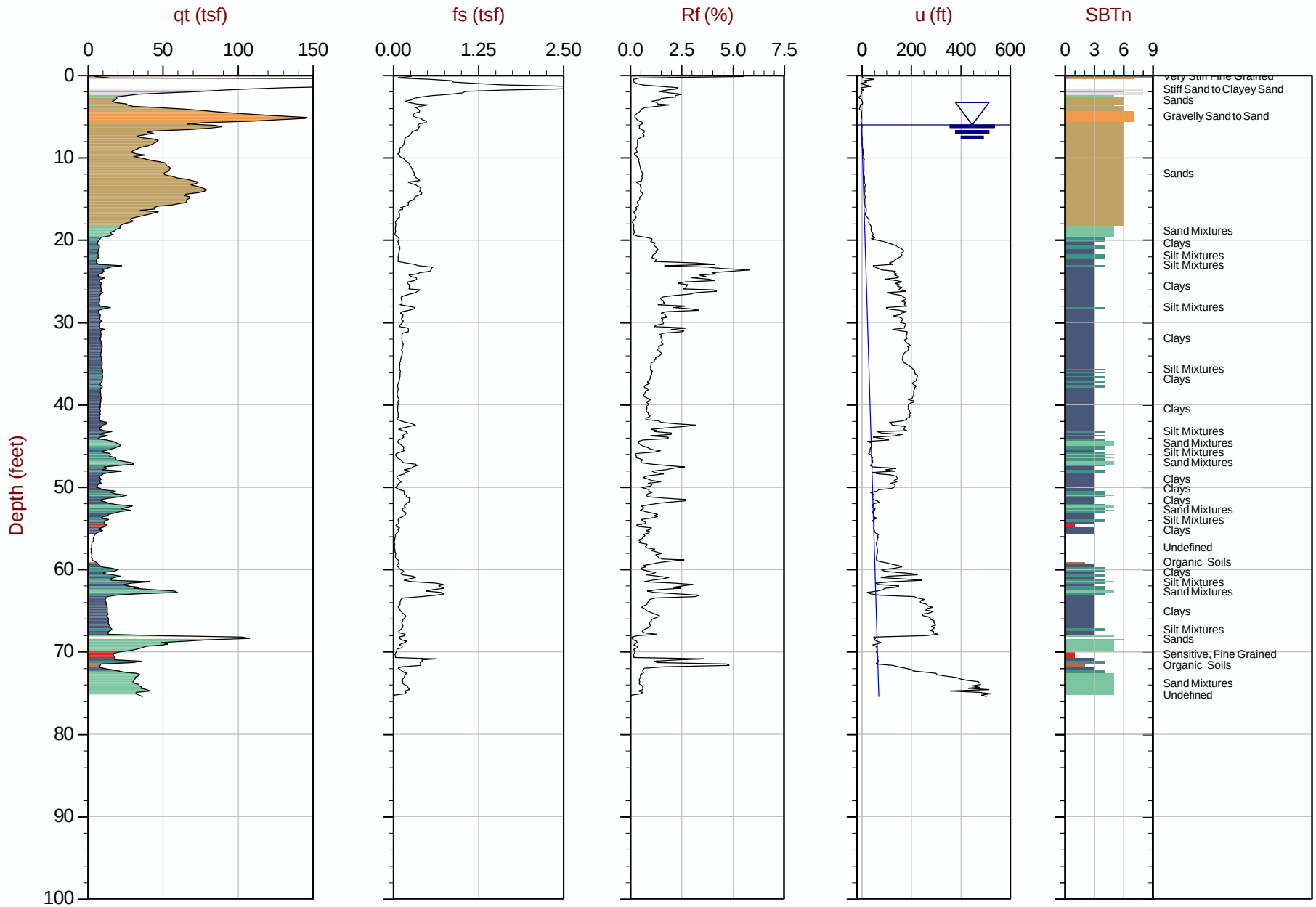
1.2.3 Geotechnical Conditions - MLK Extension - CPT and DMT Soundings

CONETEC

Schnabel

Job No: 10-951
Date: 07:21:10 13:02
Site: MLK Freeway

Sounding: CPT-063
Cone: 214:T1500F15U500



Max Depth: 23.000 m / 75.46 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 951CP63.COR
Unit Wt: SBT Chart Soil Zones

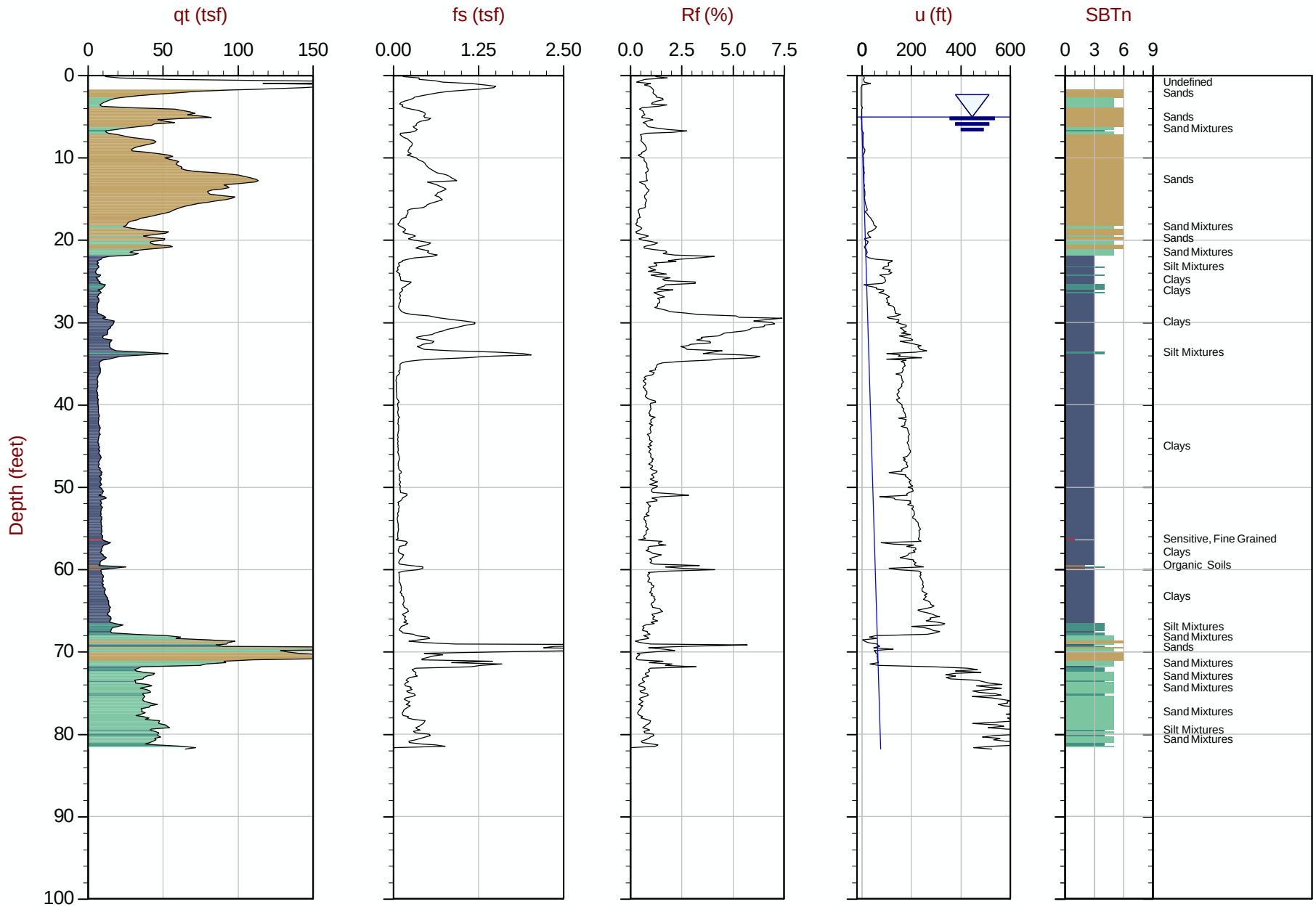
SBT: Lunne, Robertson and Powell, 1997
Page No: 1 of 1

CONETEC

Schnabel

Job No: 10-951
Date: 07:21:10 10:15
Site: MLK Freeway

Sounding: CPT-067
Cone: 214:T1500F15U500



Max Depth: 24.950 m / 81.86 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 951CP67.COR
Unit Wt: SBT Chart Soil Zones

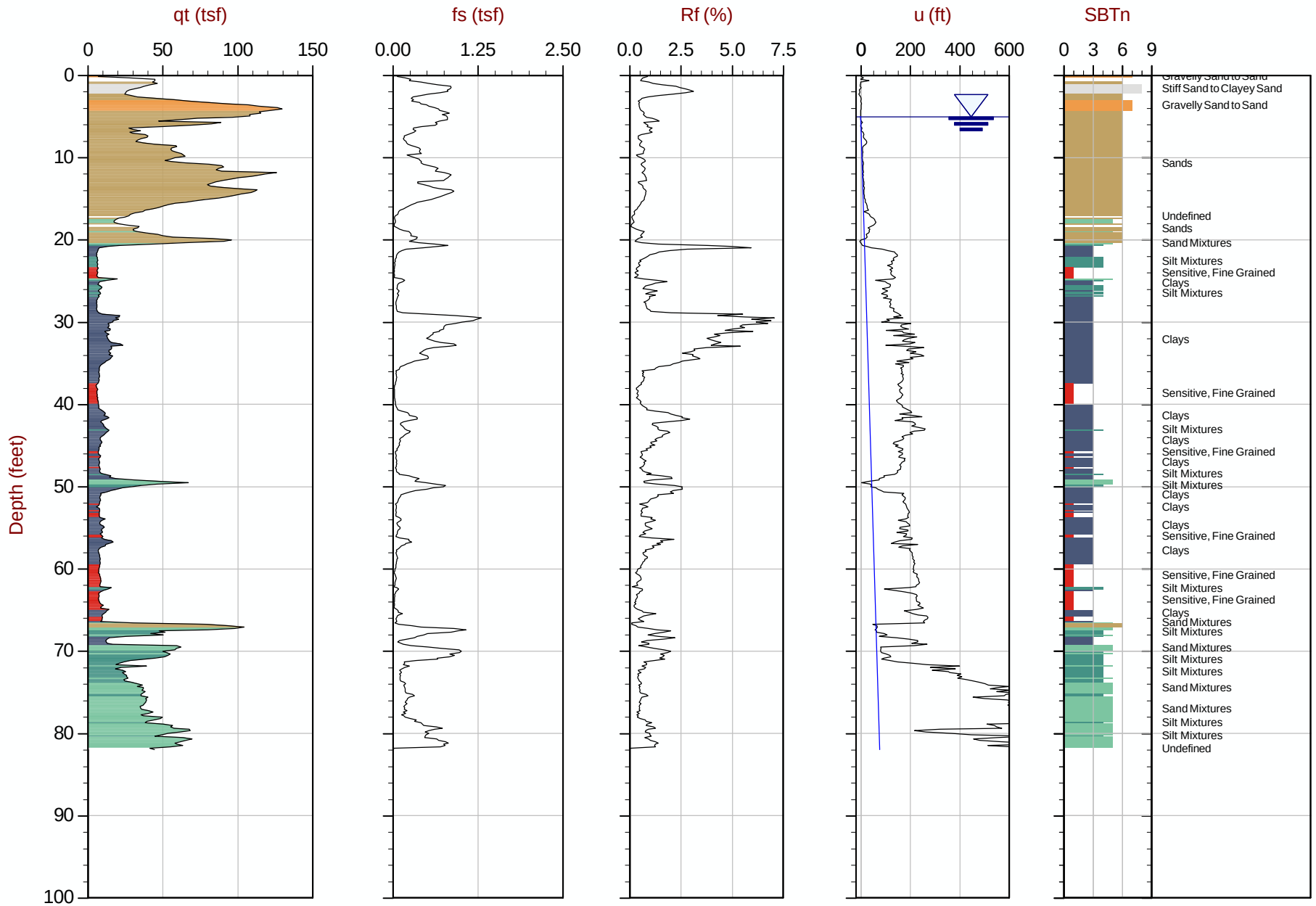
SBT: Lunne, Robertson and Powell, 1997

CONETEC

Schnabel

Job No: 10-951
Date: 07:21:10 14:08
Site: MLK Freeway

Sounding: CPT-068
Cone: 214:T1500F15U500



Max Depth: 25.000 m / 82.02 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 951CP68.COR
Unit Wt: SBT Chart Soil Zones

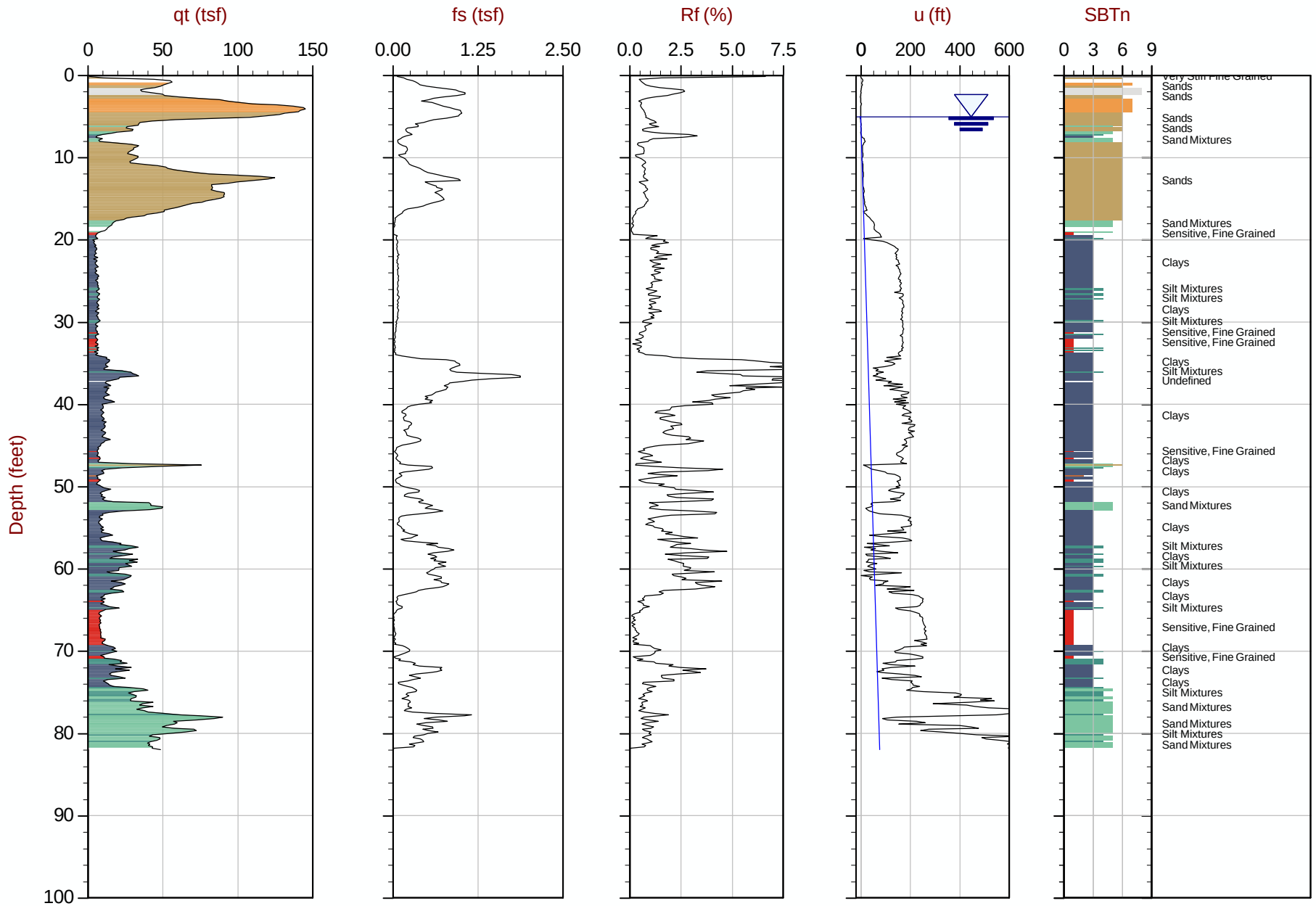
SBT: Lunne, Robertson and Powell, 1997

CONETEC

Schnabel

Job No: 10-951
Date: 07:21:10 10:15
Site: MLK Freeway

Sounding: CPT-074
Cone: 214:T1500F15U500



Max Depth: 25.000 m / 82.02 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 951CP74.COR
Unit Wt: SBT Chart Soil Zones

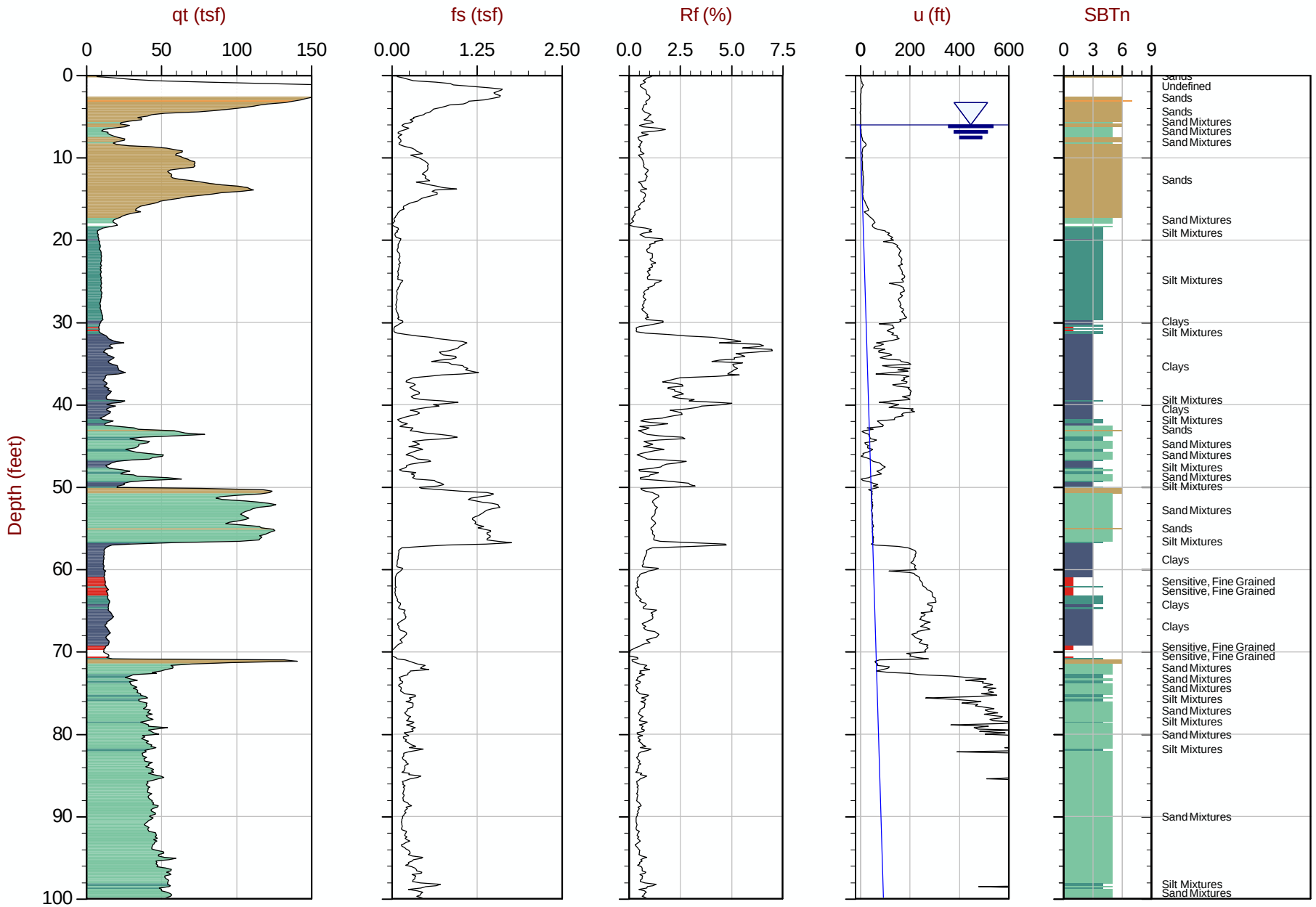
SBT: Lunne, Robertson and Powell, 1997

CONETEC

Schnabel

Job No: 10-951
Date: 08:02:10 09:26
Site: MLK Freeway

Sounding: CPT-100
Cone: 195:T1500F15U500



Max Depth: 31.000 m / 101.70 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 951CP100.COR
Unit Wt: SBT Chart Soil Zones

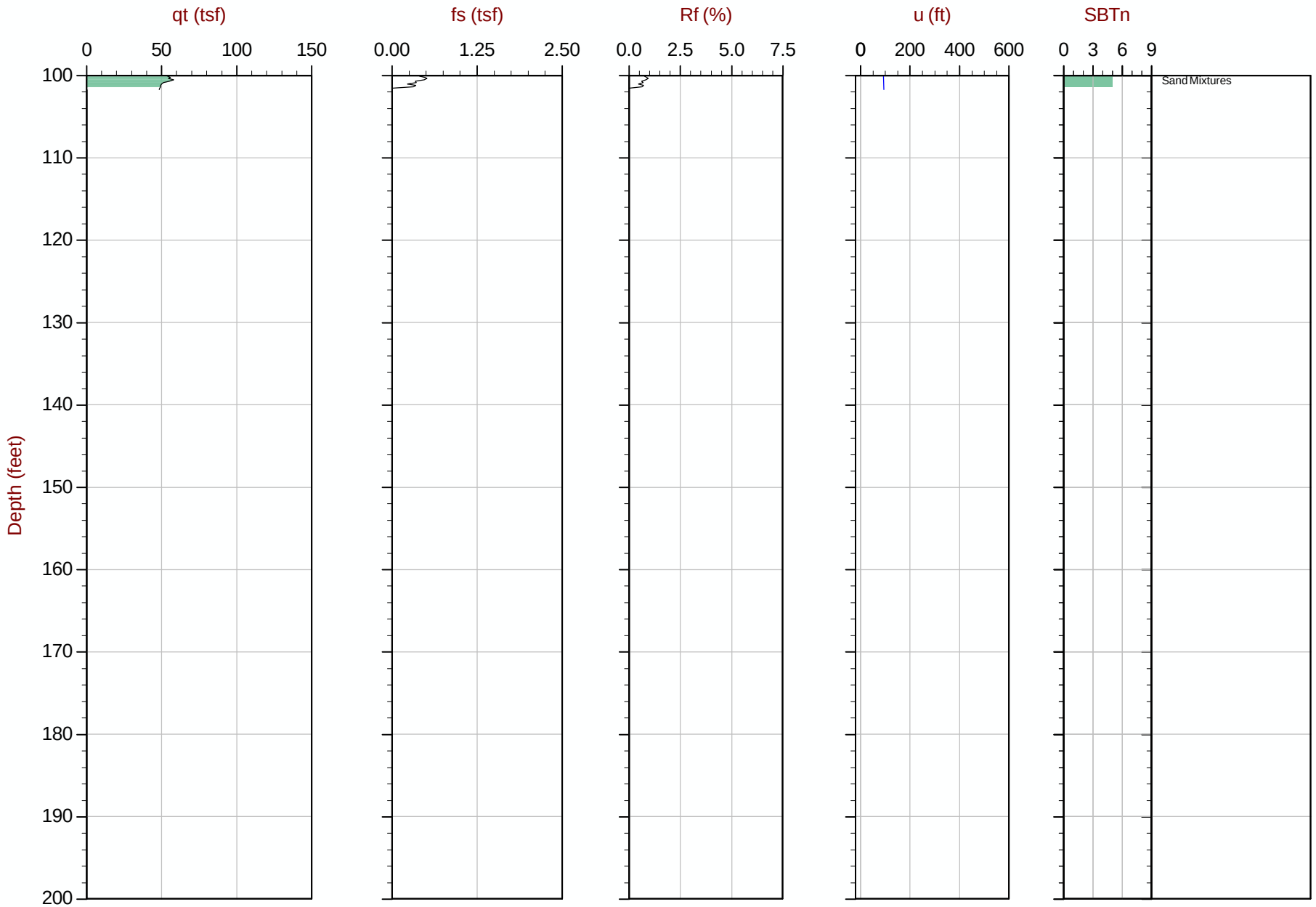
SBT: Lunne, Robertson and Powell, 1997

CONETEC

Schnabel

Job No: 10-951
Date: 08:02:10 09:26
Site: MLK Freeway

Sounding: CPT-100
Cone: 195:T1500F15U500



Max Depth: 31.000 m / 101.70 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 951CP100.COR
Unit Wt: SBT Chart Soil Zones

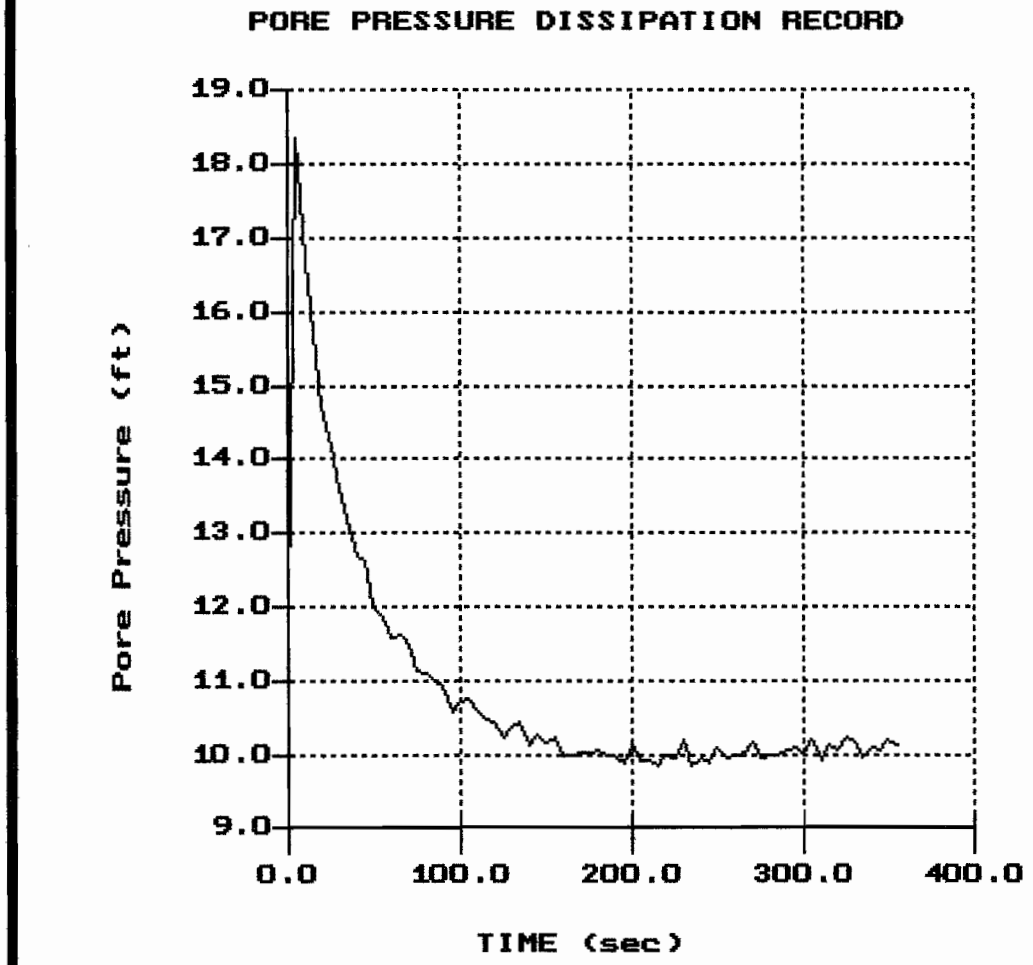
SBT: Lunne, Robertson and Powell, 1997

Schnabel

Hole:CPT-100
Location:MLK Freeway

Cone:195:T1500F15U500
Date:08:02:10 09:26

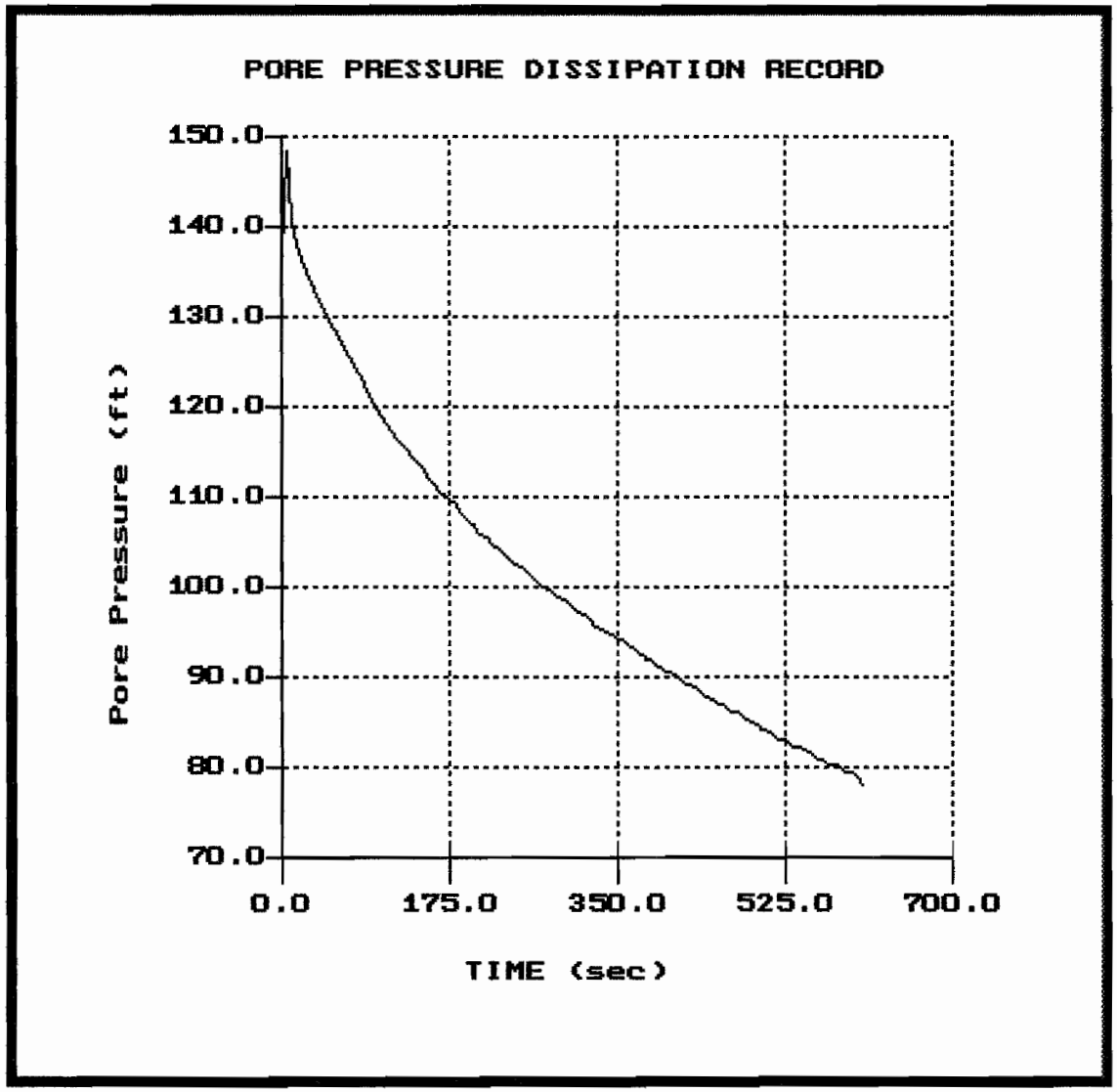
File: 951CP100.PPD
Depth (m): 4.30
(ft): 14.11
Duration : 355.0s
U-min: 9.82 235.0s
U-max: 18.33 5.0s



Schnabel

Hole:CPT-100
Location:MLK Freeway

Cone:195:T1500F15U500
Date:08:02:10 09:26

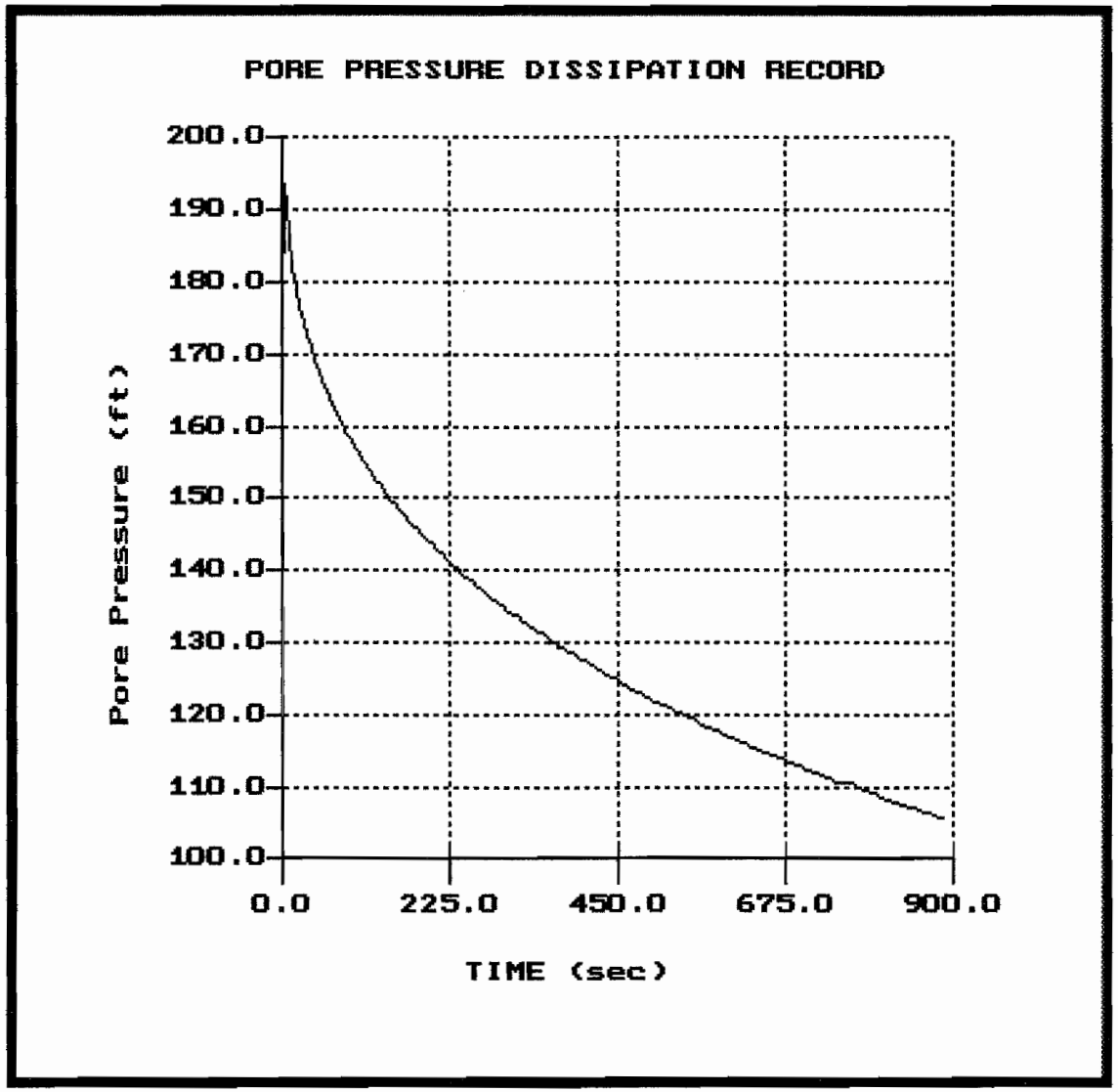


File: 951CP100.PPD
Depth (m): 6.10
(ft): 20.01
Duration : 605.0s
U-min: 77.96 605.0s
U-max: 148.35 5.0s

Schnabel

Hole:CPT-100
Location:MLK Freeway

Cone:195:T1500F15U500
Date:08:02:10 09:26

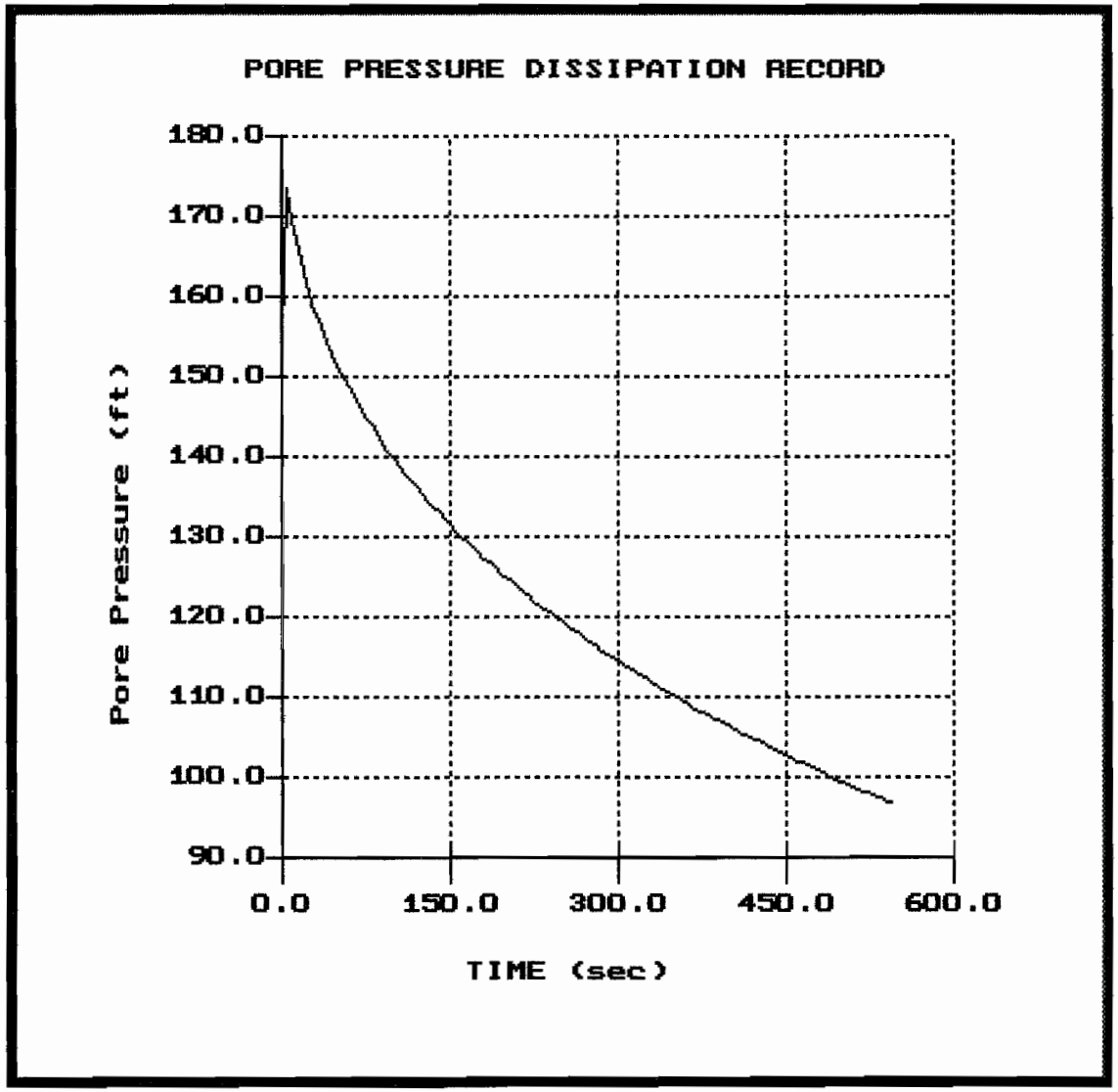


File: 951CP100.PPD
Depth (m): 7.65
(ft): 25.10
Duration : 885.0s
U-min: 105.52 885.0s
U-max: 193.47 5.0s

Schnabel

Hole:CPT-100
Location:MLK Freeway

Cone:195:T1500F15U500
Date:08:02:10 09:26



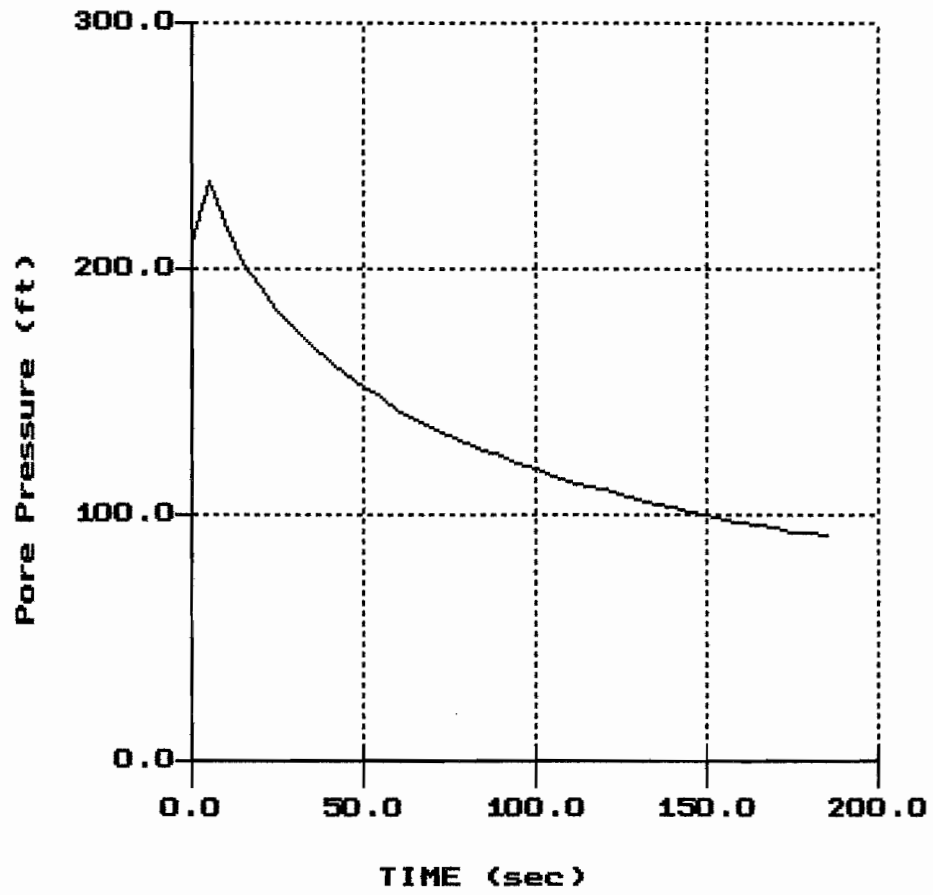
File: 951CP100.PPD
Depth (m): 9.15
(ft): 30.02
Duration : 545.0s
U-min: 96.87 545.0s
U-max: 173.56 5.0s

Schnabel

Hole:CPT-100
Location:MLK Freeway

Cone:195:T1500F15U500
Date:08:02:10 09:26

PORE PRESSURE DISSIPATION RECORD

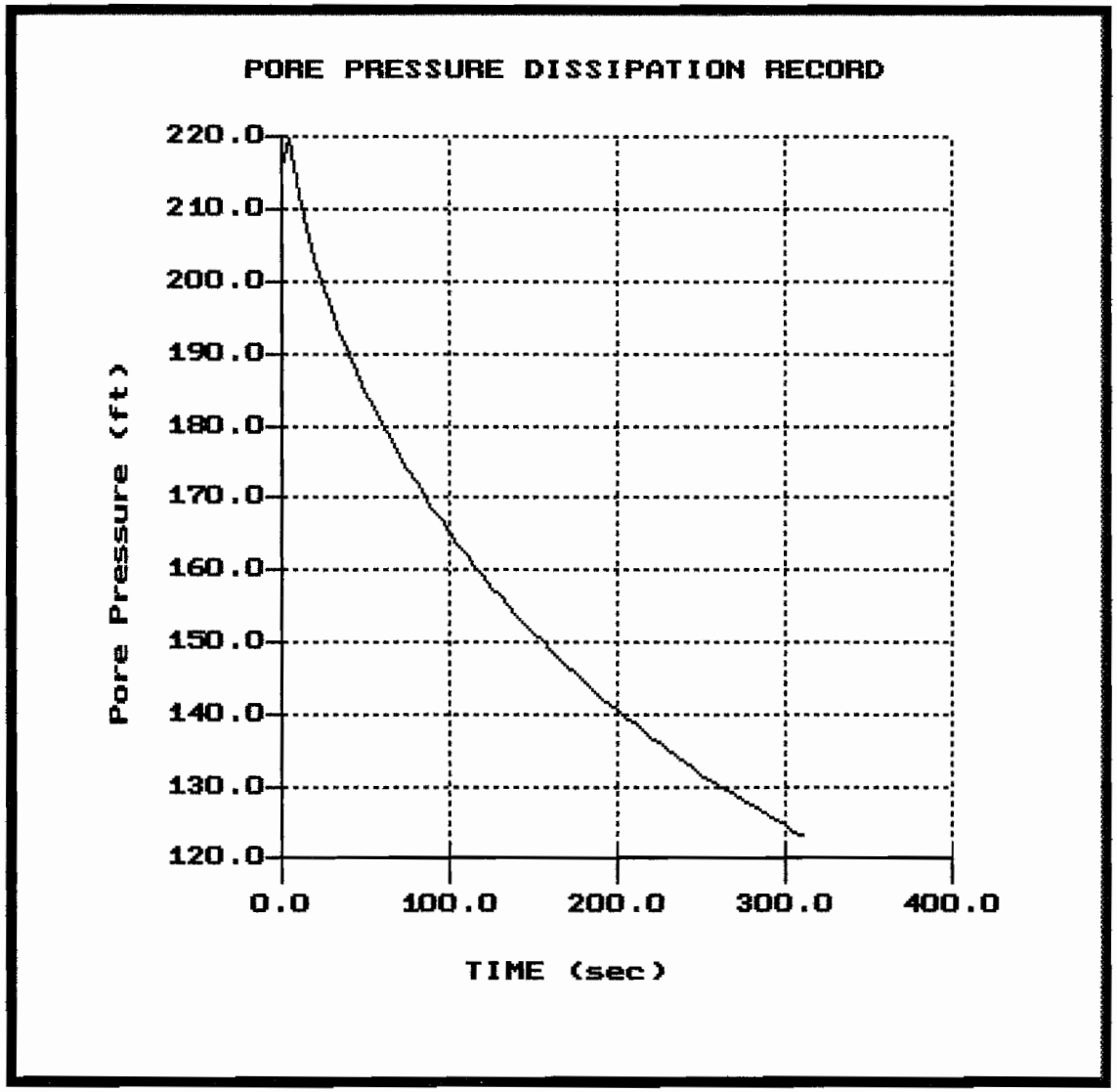


File: 951CP100.PPD
Depth (m): 10.70
(ft): 35.10
Duration : 185.0s
U-min: 91.21 185.0s
U-max: 235.19 5.0s

Schnabel

Hole:CPT-100
Location:MLK Freeway

Cone:195:T1500F15U500
Date:08:02:10 09:26

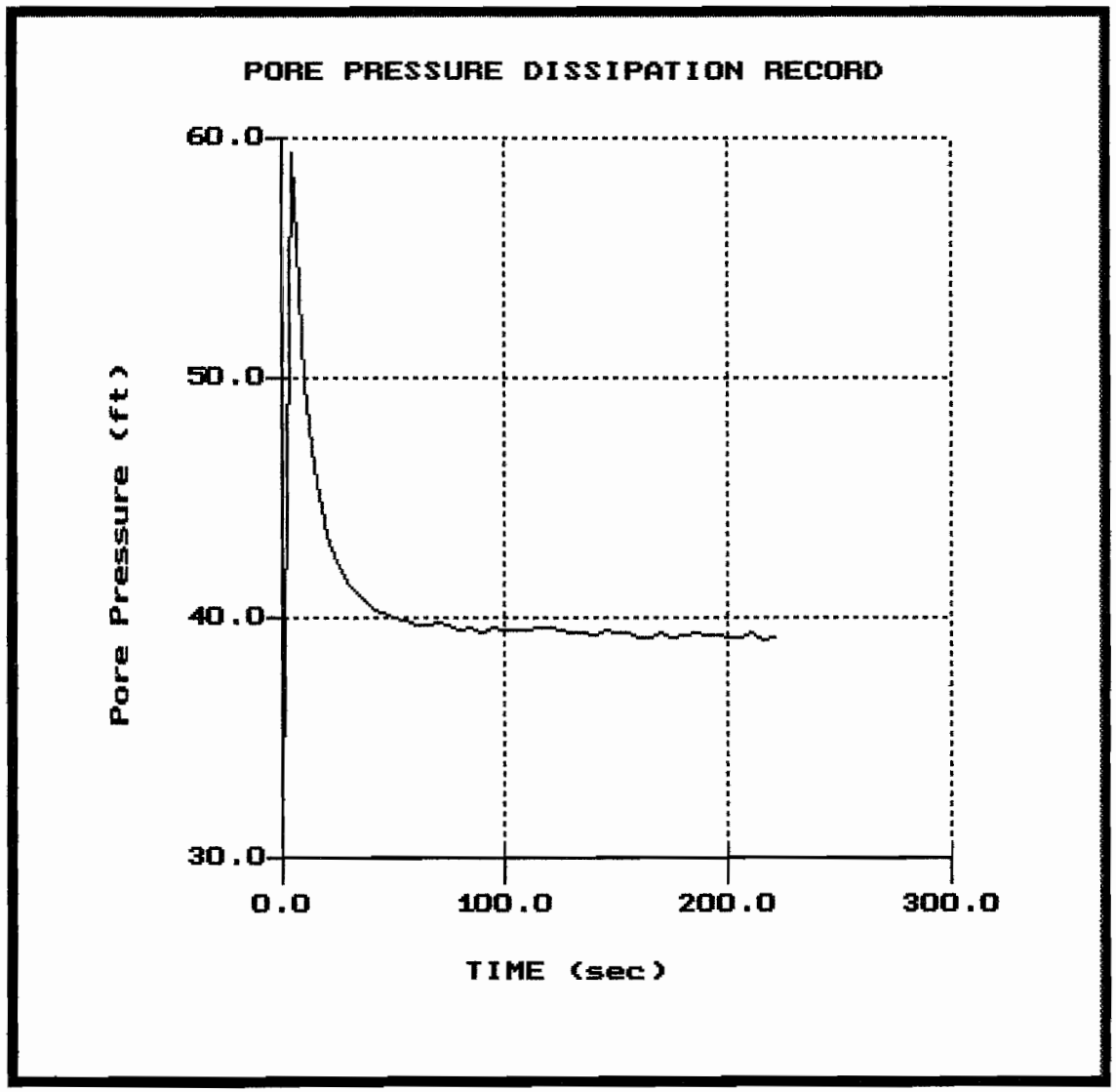


File: 951CP100.PPD
Depth (m): 12.20
(ft): 40.03
Duration : 310.0s
U-min: 123.10 310.0s
U-max: 219.50 5.0s

Schnabel

Hole:CPT-100
Location:MLK Freeway

Cone:195:T1500F15U500
Date:08:02:10 09:26

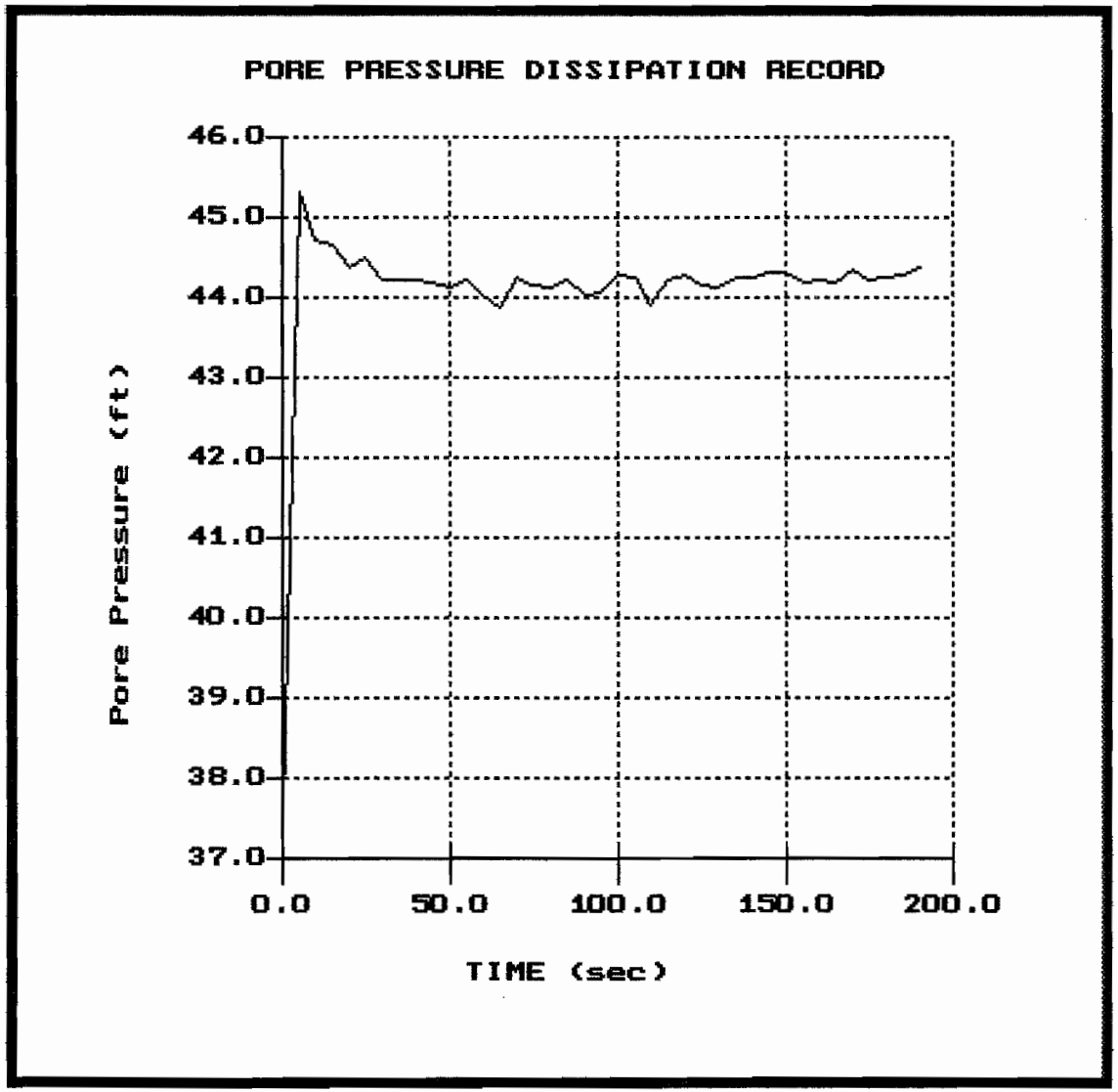


File: 951CP100.PPD
Depth (m): 13.75
(ft): 45.11
Duration : 220.0s
U-min: 31.59 0.0s
U-max: 59.43 5.0s

Schnabel

Hole:CPT-100
Location:MLK Freeway

Cone:195:T1500F15U500
Date:08:02:10 09:26



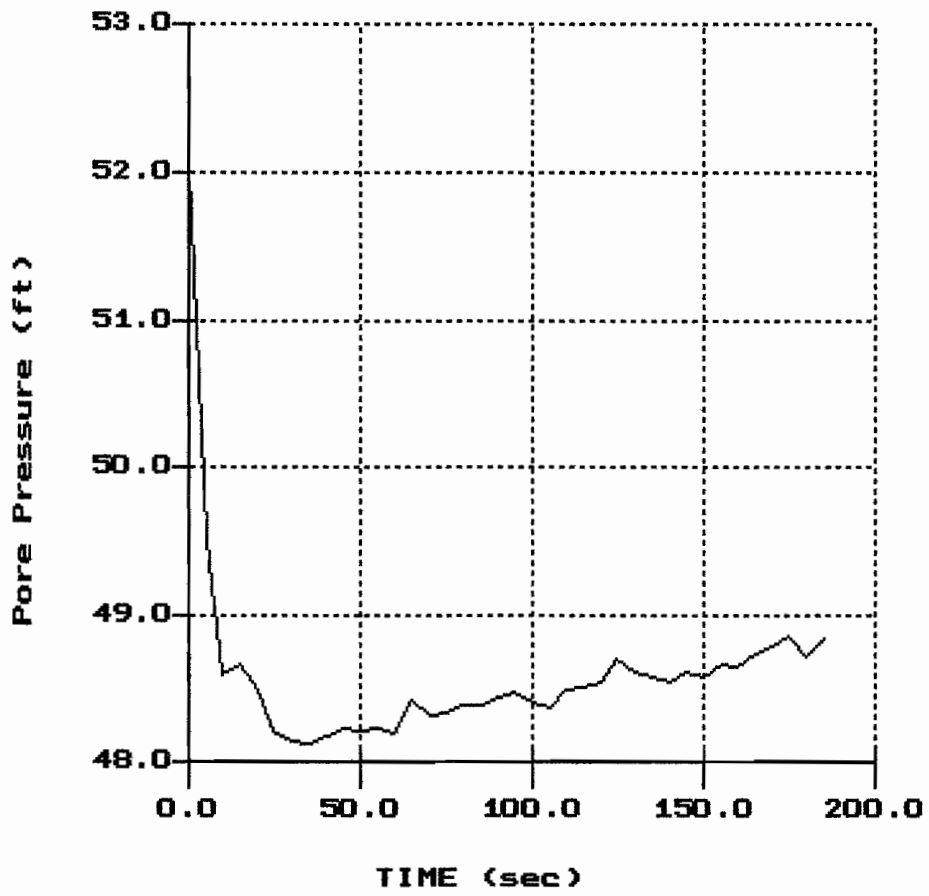
File: 951CP100.PPD
Depth (m): 15.35
(ft): 50.36
Duration : 190.0s
U-min: 37.50 0.0s
U-max: 45.31 5.0s

Schnabel

Hole:CPT-100
Location:MLK Freeway

Cone:195:T1500F15U500
Date:08:02:10 09:26

PORE PRESSURE DISSIPATION RECORD

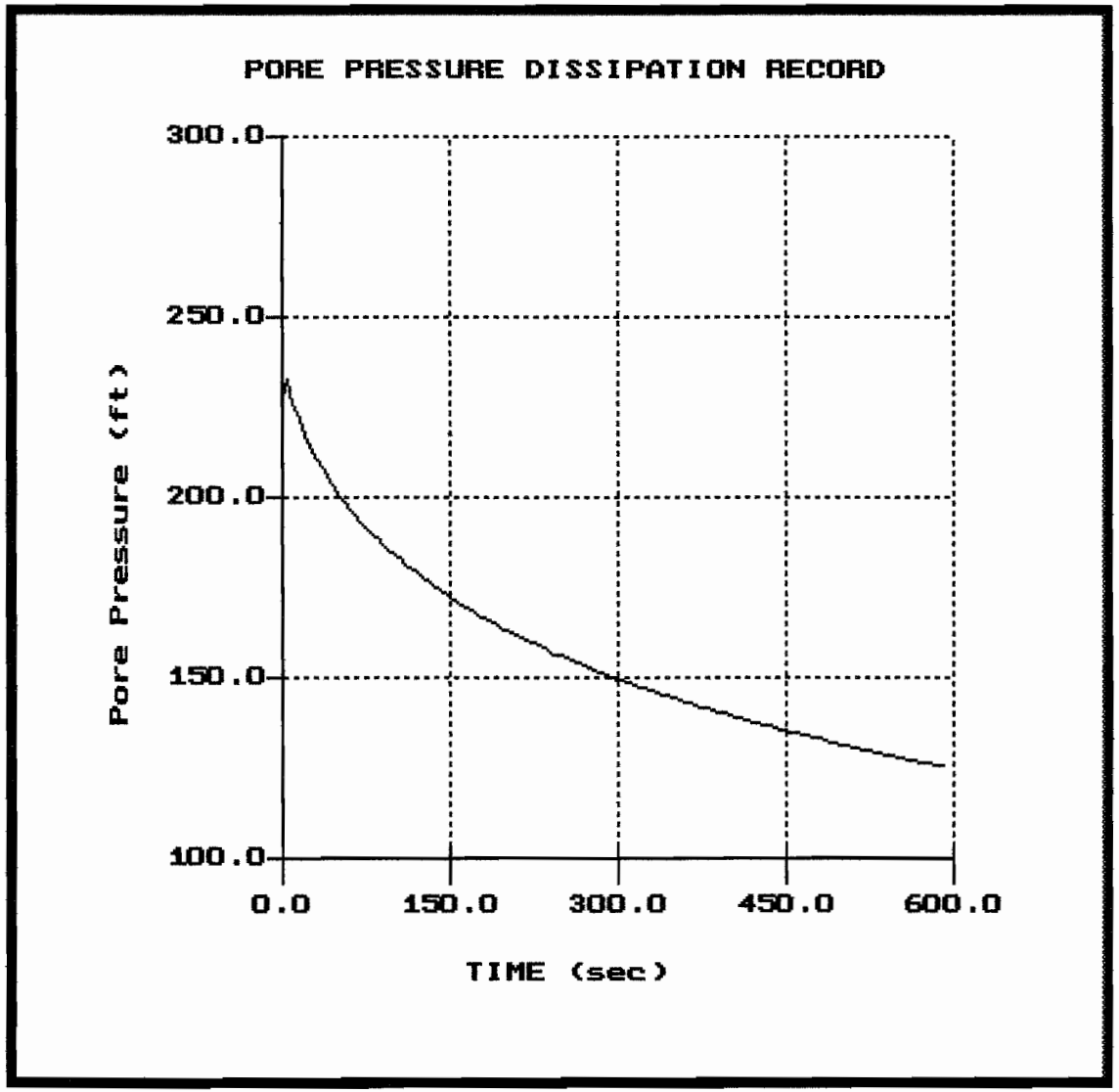


File: 951CP100.PPD
Depth (m): 16.80
(ft): 55.12
Duration : 185.0s
U-min: 48.12 35.0s
U-max: 52.05 0.0s

Schnabel

Hole:CPT-100
Location:MLK Freeway

Cone:195:T1500F15U500
Date:08:02:10 09:26



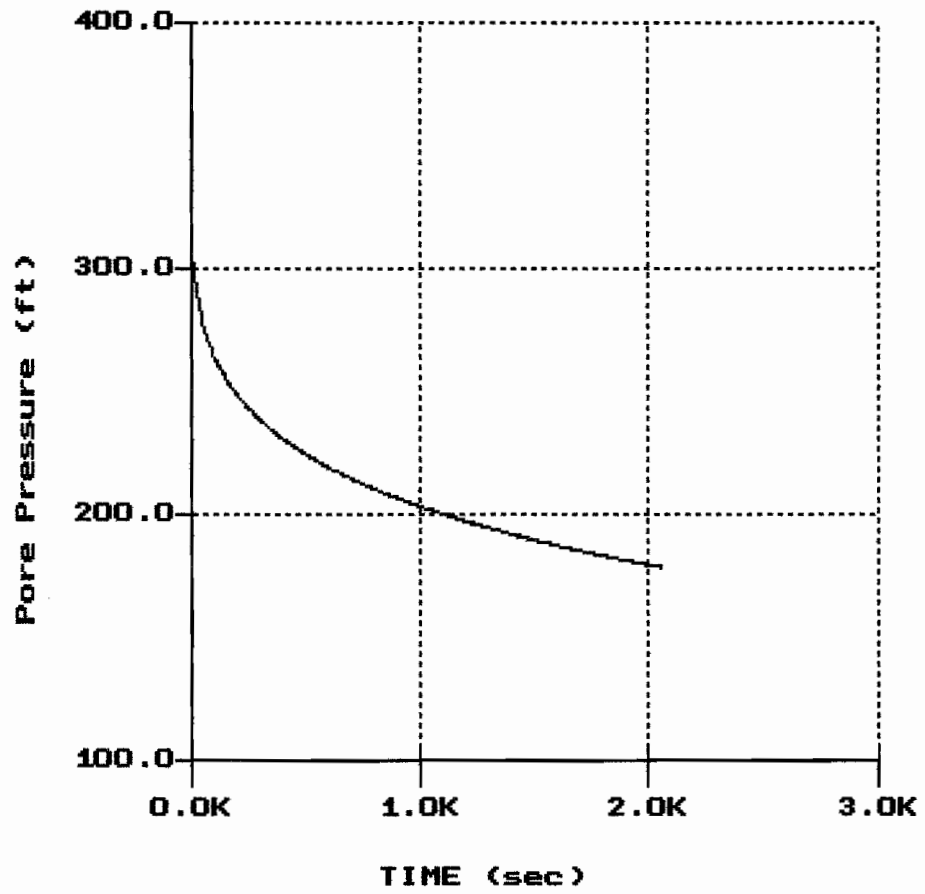
File: 951CP100.PPD
Depth (m): 18.30
(ft): 60.04
Duration : 590.0s
U-min: 125.61 590.0s
U-max: 232.57 5.0s

Schnabel

Hole:CPT-100
Location:MLK Freeway

Cone:195:T1500F15U500
Date:08:02:10 09:26

PORE PRESSURE DISSIPATION RECORD

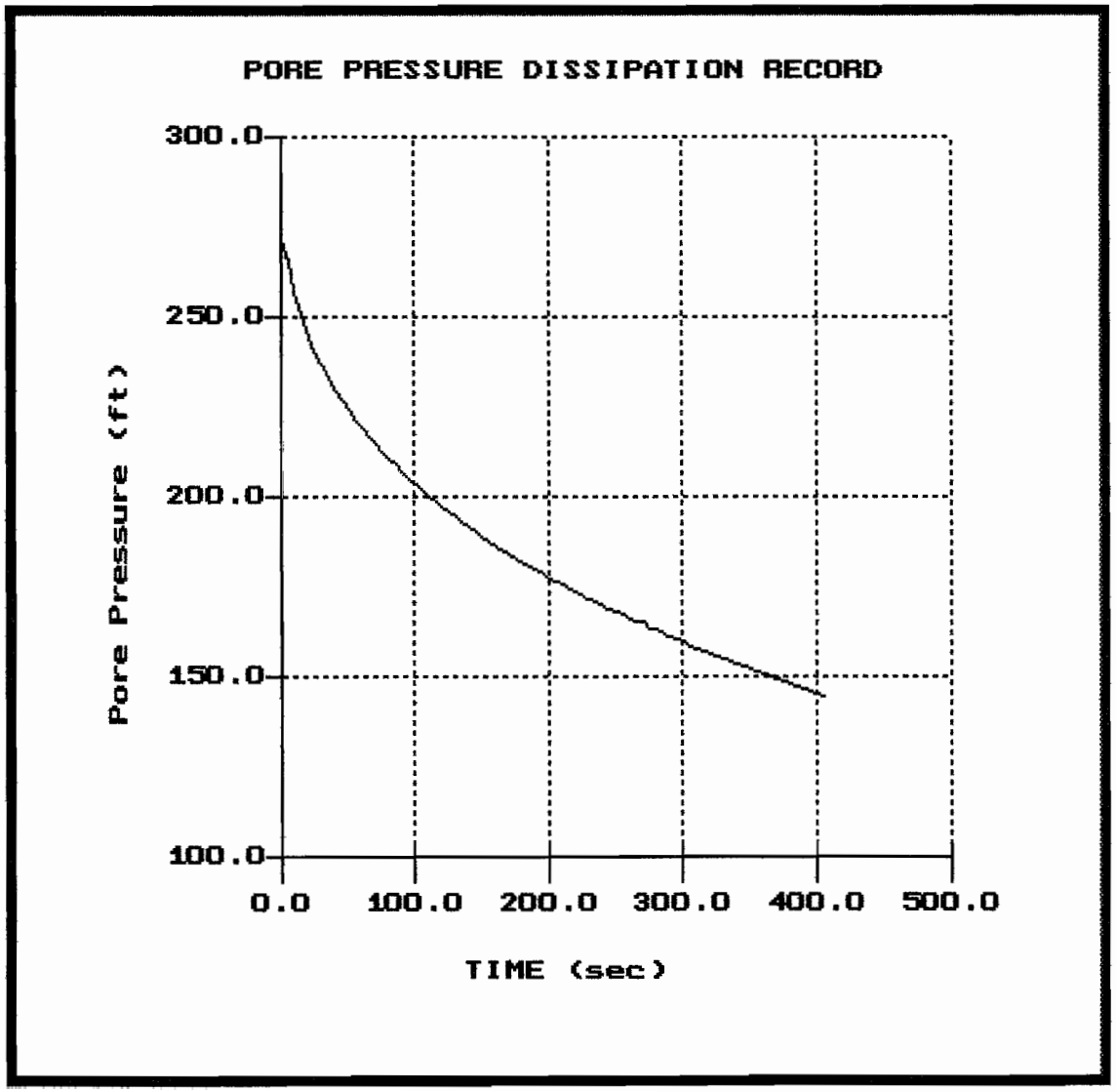


File: 951CP100.PPD
Depth (m): 19.85
(ft): 65.12
Duration : 2050.0s
U-min: 178.43 2050.0s
U-max: 304.16 5.0s

Schnabel

Hole:CPT-100
Location:MLK Freeway

Cone:195:T1500F15U500
Date:08:02:10 09:26



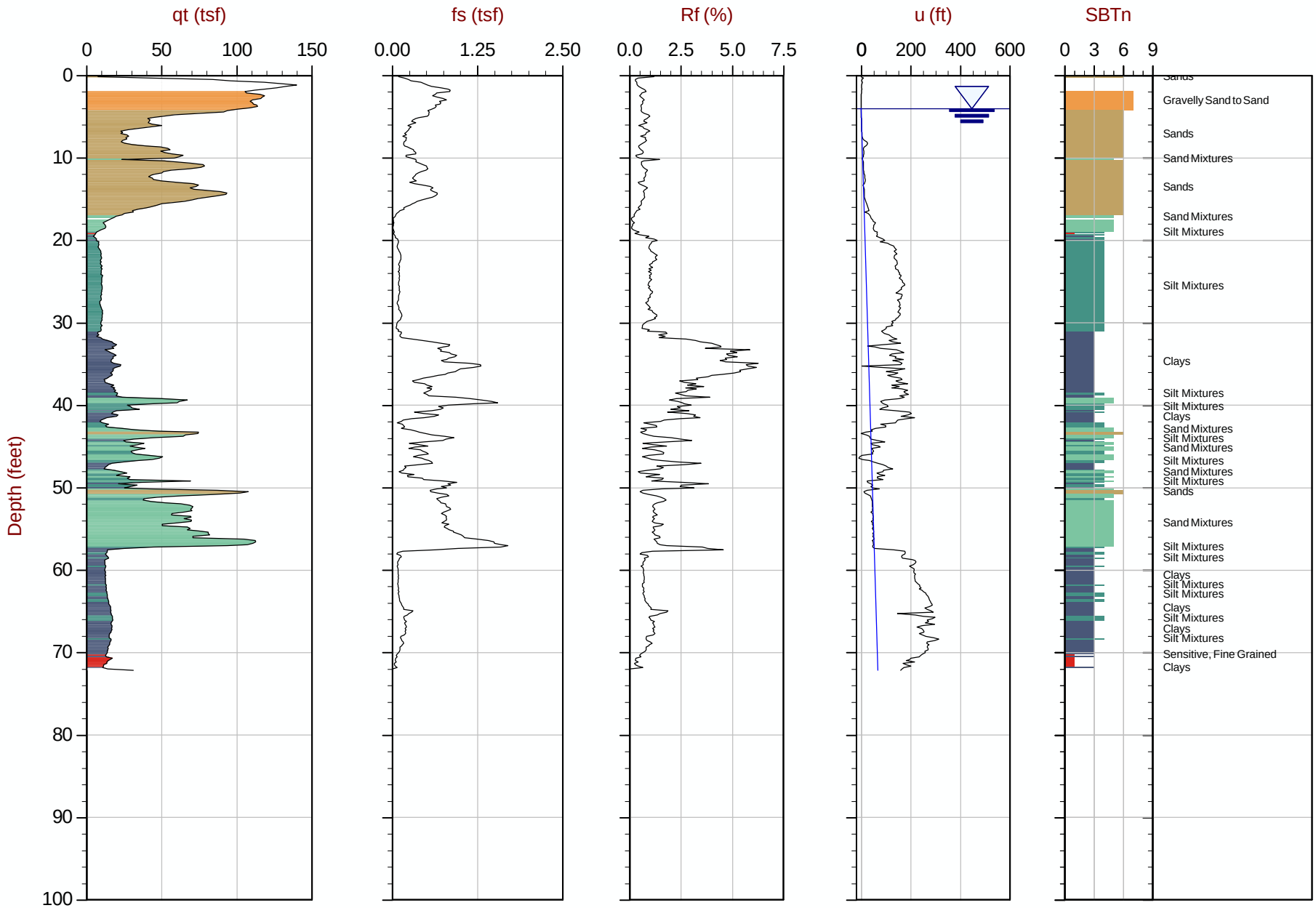
File: 951CP100.PPD
Depth (m): 21.35
(ft): 70.05
Duration : 405.0s
U-min: 144.56 405.0s
U-max: 271.46 0.0s

CONETEC

Schnabel

Job No: 10-951
Date: 08:02:10 12:14
Site: MLK Freeway

Sounding: CPT-100a
Cone: 195:T1500F15U500



Max Depth: 22.000 m / 72.18 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

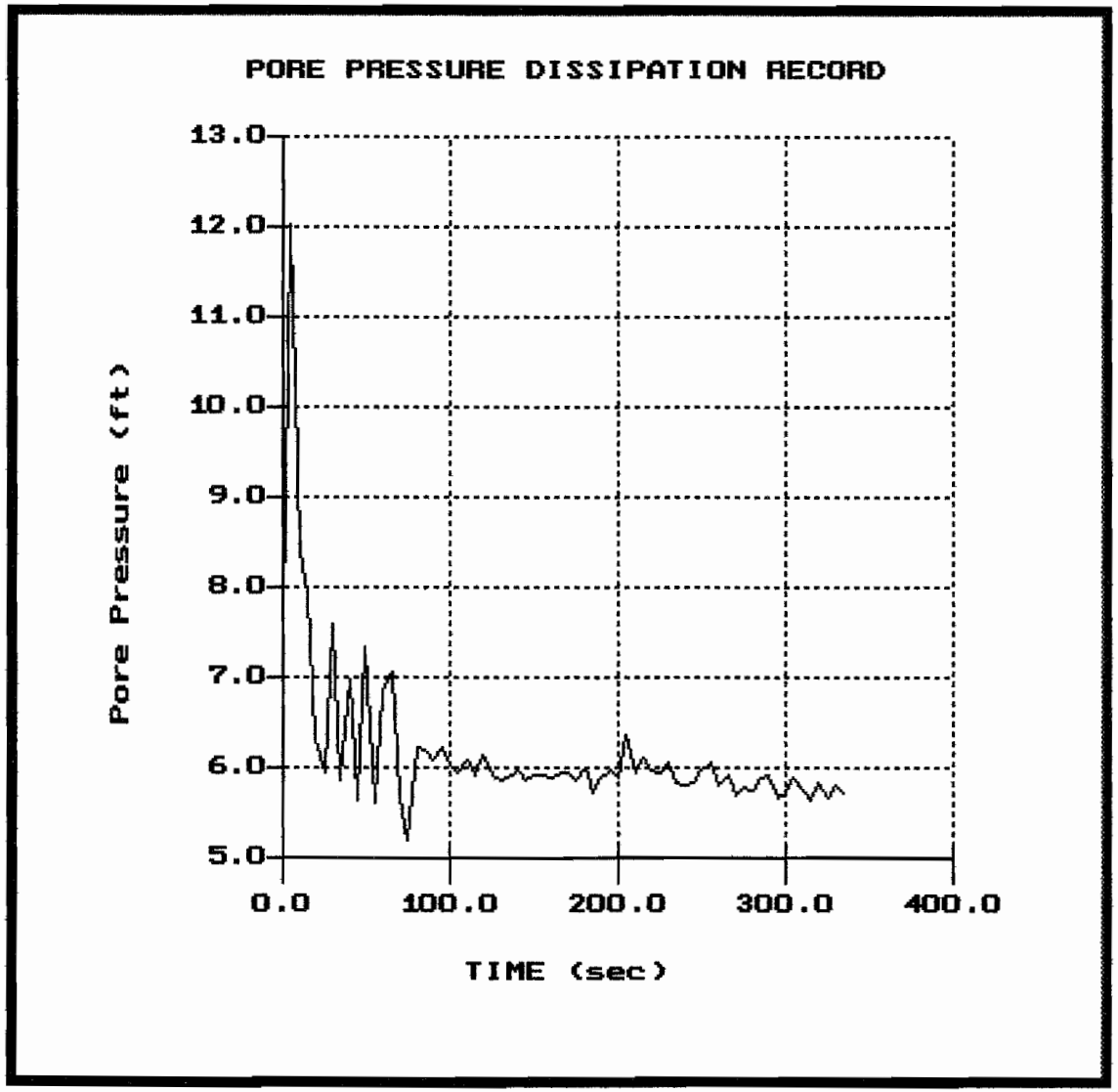
File: 951CP100A.COR
Unit Wt: SBT Chart Soil Zones

SBT: Lunne, Robertson and Powell, 1997

Schnabel

Hole:CPT-100a
Location:MLK Freeway

Cone:195:T150OF15U500
Date:08:02:10 12:14



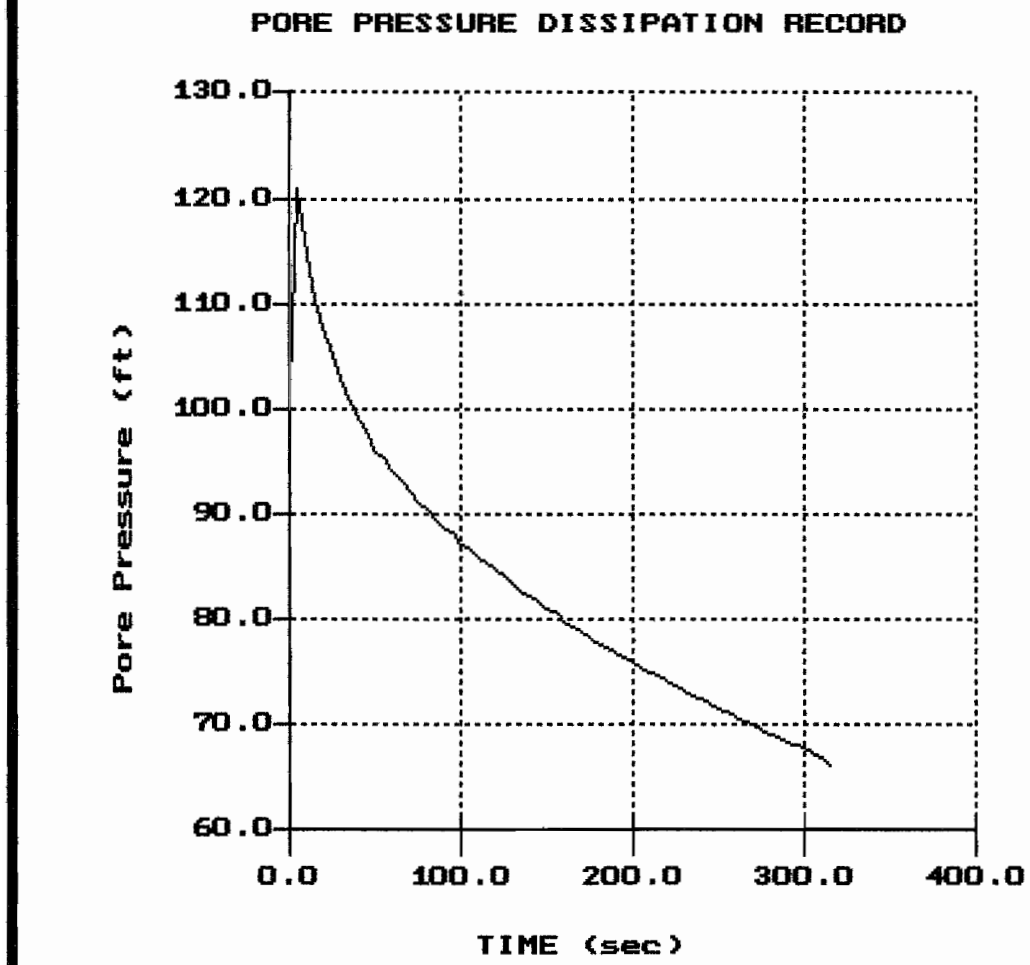
File: 51CP100A.PPD
Depth (m): 3.05
(ft): 10.01
Duration : 335.0s
U-min: 5.19 75.0s
U-max: 12.04 5.0s

Schnabel

Hole:CPT-100a
Location:MLK Freeway

Cone:195:T1500F15U500
Date:08:02:10 12:14

File: 51CP100A.PPD
Depth (m): 6.10
(ft): 20.01
Duration : 315.0s
U-min: 66.07 315.0s
U-max: 120.87 5.0s

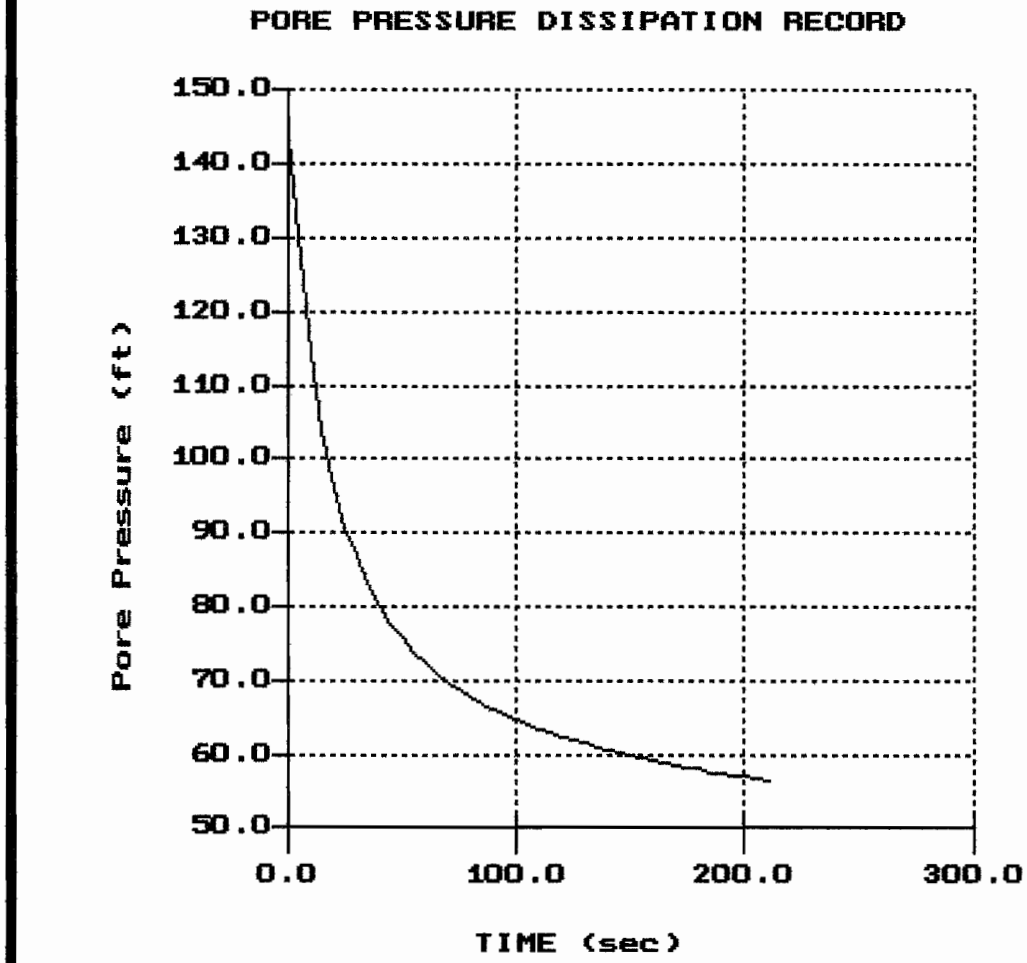


Schnabel

Hole:CPT-100a
Location:MLK Freeway

Cone:195:T1500F15U500
Date:08:02:10 12:14

File: 51CP100A.PPD
Depth (m): 10.70
(ft): 35.10
Duration : 210.0s
U-min: 56.36 210.0s
U-max: 143.42 0.0s

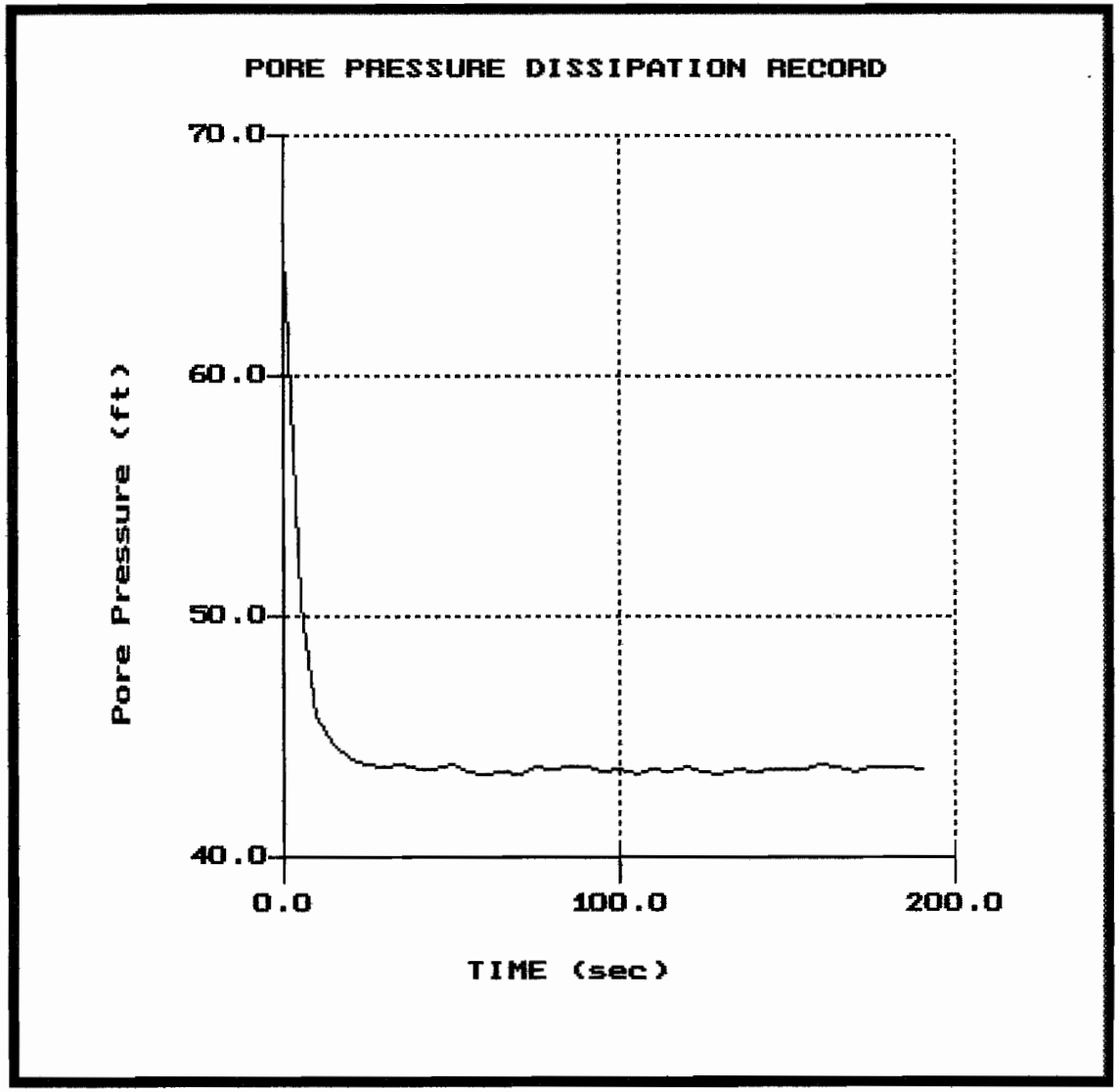


Schnabel

Hole:CPT-100a
Location:MLK Freeway

Cone:195:T1500F15U500
Date:08:02:10 12:14

File: 51CP100A.PPD
Depth (m): 15.25
(ft): 50.03
Duration : 190.0s
U-min: 43.41 130.0s
U-max: 65.39 0.0s

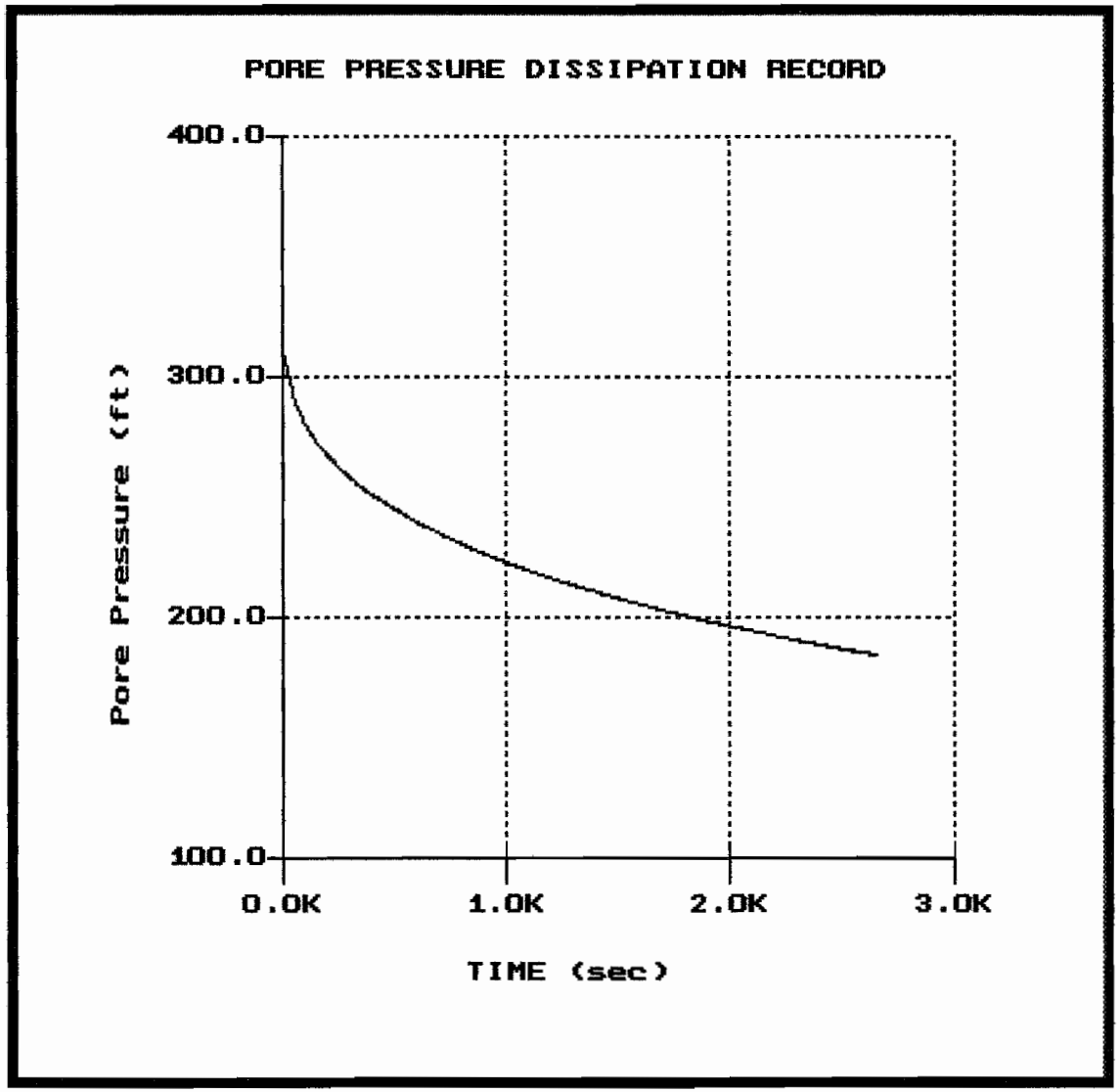


Schnabel

Hole:CPT-100a
Location:MLK Freeway

Cone:195:T1500F15U500
Date:08:02:10 12:14

File: 51CP100A.PPD
Depth (m): 19.85
(ft): 65.12
Duration : 2650.0s
U-min: 184.17 2650.0s
U-max: 309.09 5.0s

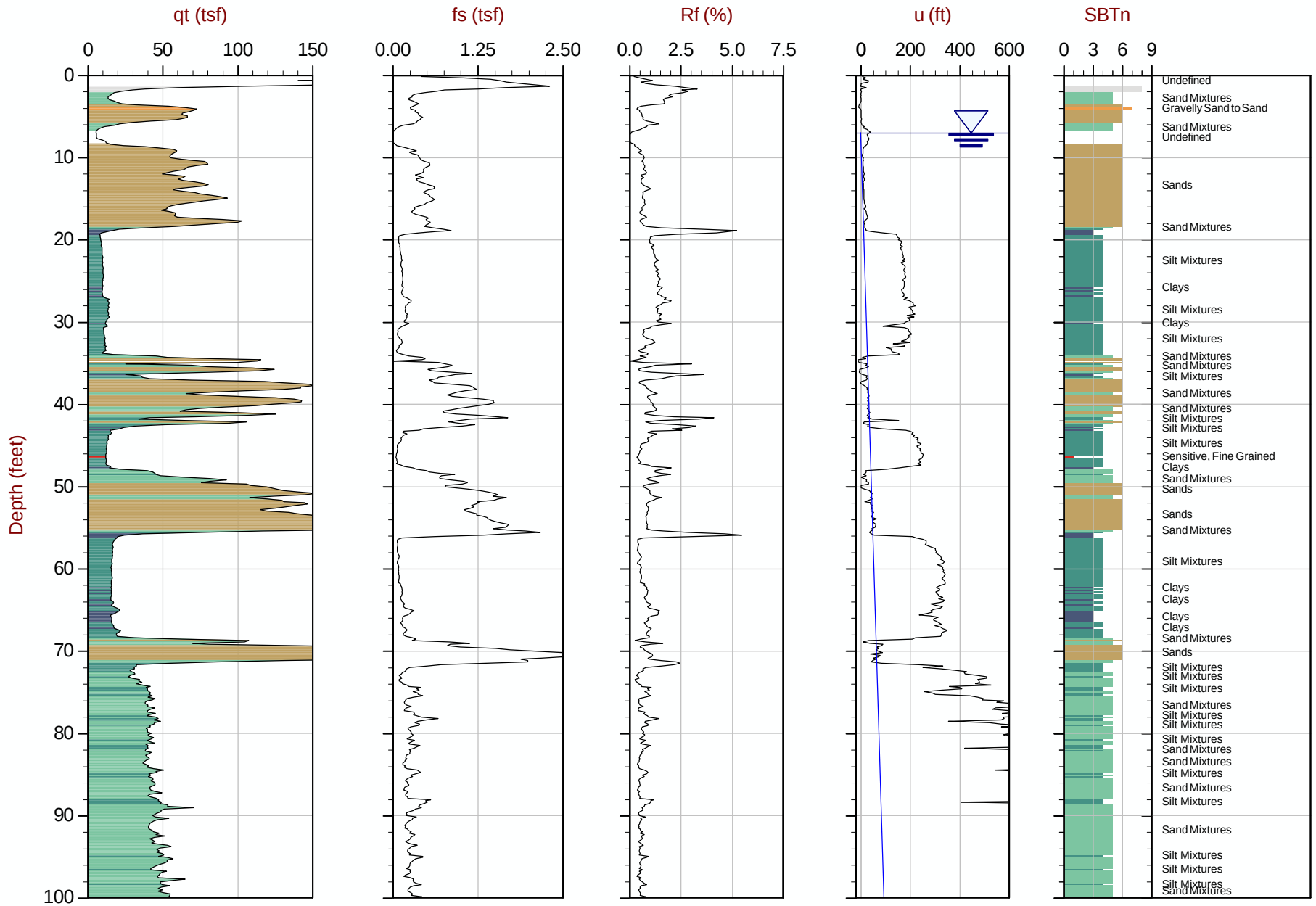


CONETEC

Schnabel

Job No: 10-951
Date: 08:02:10 15:44
Site: MLK Freeway

Sounding: CPT-177
Cone: 195:T1500F15U500



Max Depth: 31.000 m / 101.70 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 951CP177.COR
Unit Wt: SBT Chart Soil Zones

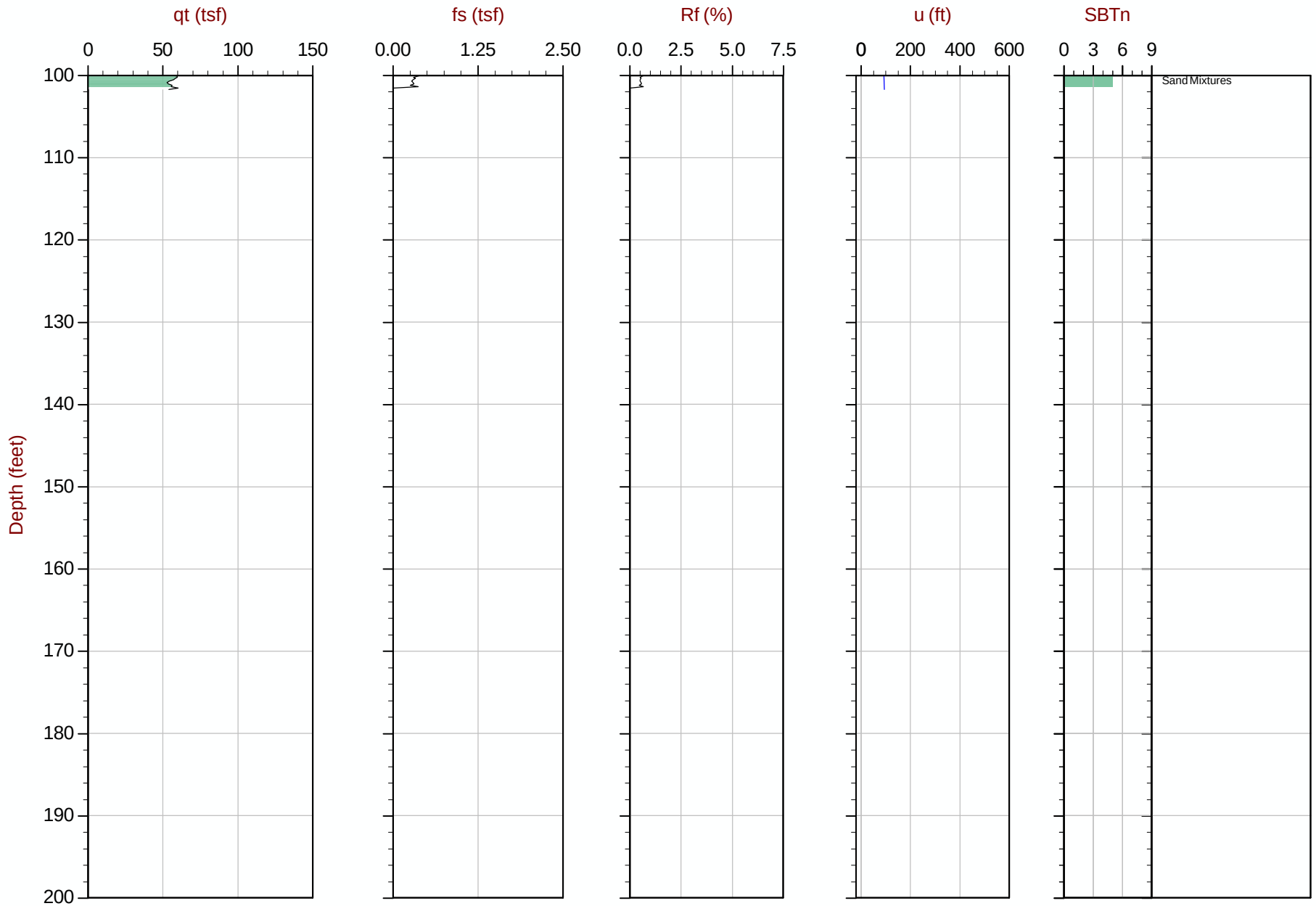
SBT: Lunne, Robertson and Powell, 1997

CONETEC

Schnabel

Job No: 10-951
Date: 08:02:10 15:44
Site: MLK Freeway

Sounding: CPT-177
Cone: 195:T1500F15U500



Max Depth: 31.000 m / 101.70 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 951CP177.COR
Unit Wt: SBT Chart Soil Zones

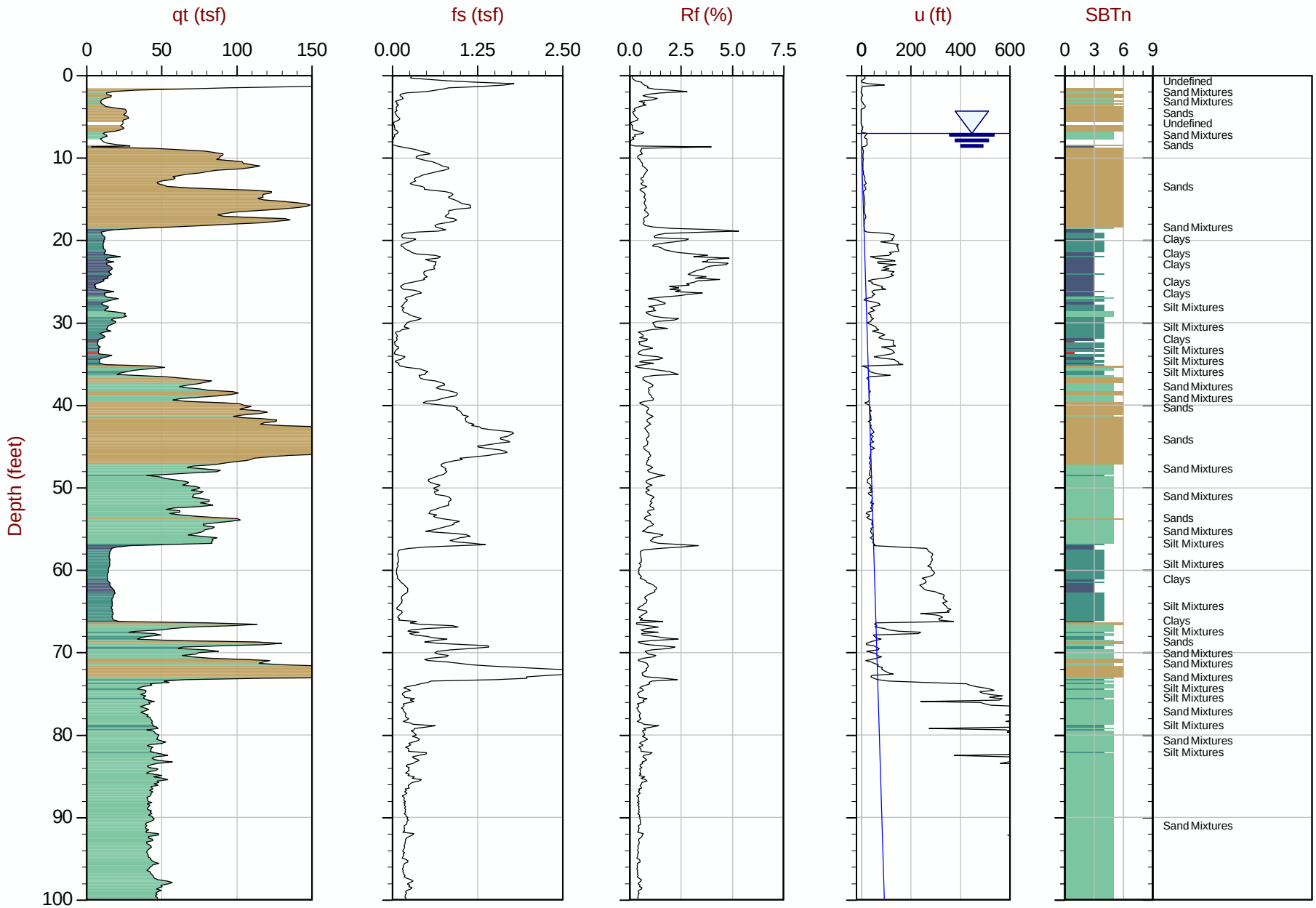
SBT: Lunne, Robertson and Powell, 1997

CONETEC

Schnabel

Job No: 10-951
Date: 08:03:10 09:11
Site: MLK Freeway

Sounding: CPT-185
Cone: 195:T1500F15U500



Max Depth: 31.100 m / 102.03 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 951CP185.COR
Unit Wt: SBT Chart Soil Zones

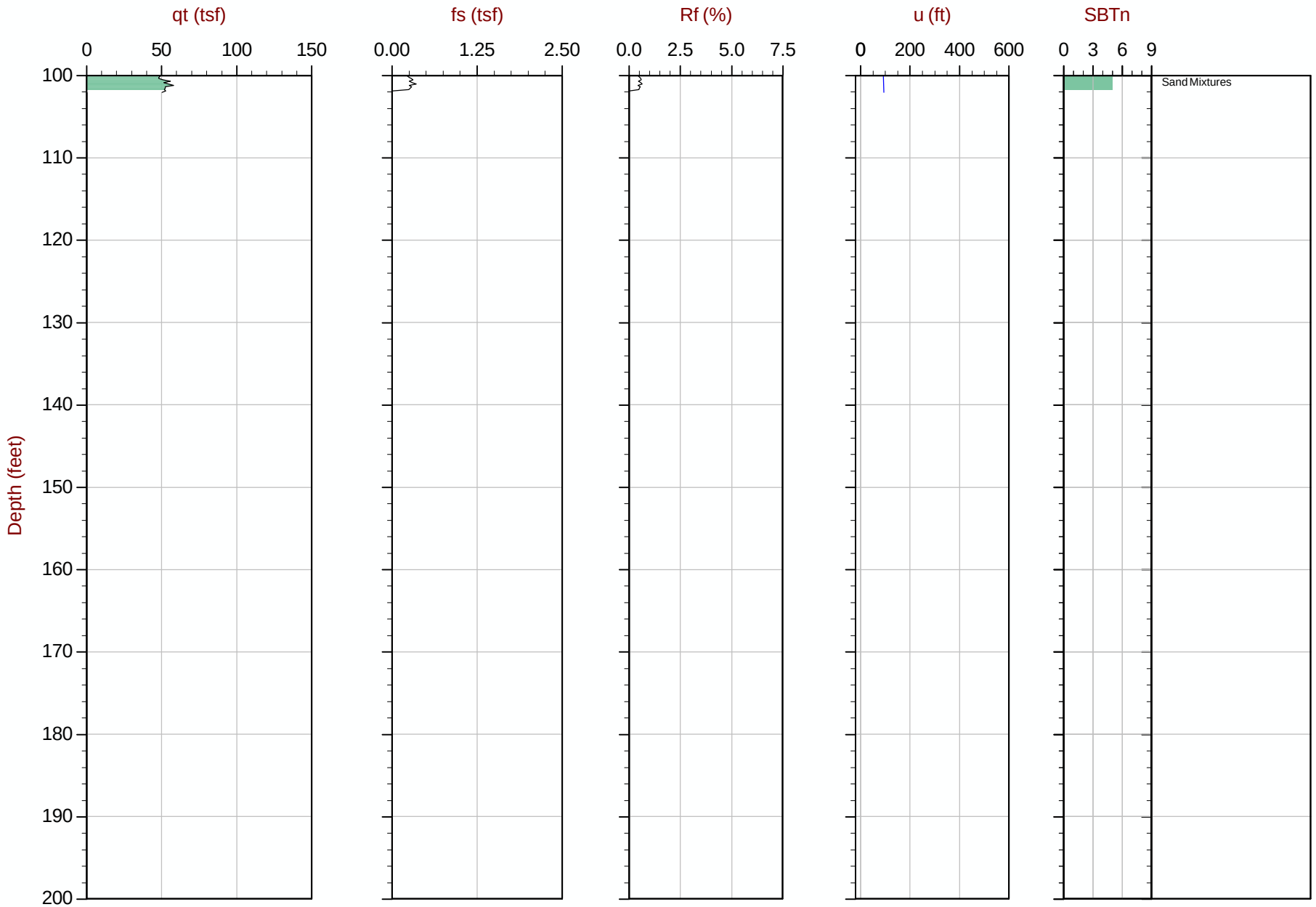
SBT: Lunne, Robertson and Powell, 1997

CONETEC

Schnabel

Job No: 10-951
Date: 08:03:10 09:11
Site: MLK Freeway

Sounding: CPT-185
Cone: 195:T1500F15U500



Max Depth: 31.100 m / 102.03 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 951CP185.COR
Unit Wt: SBT Chart Soil Zones

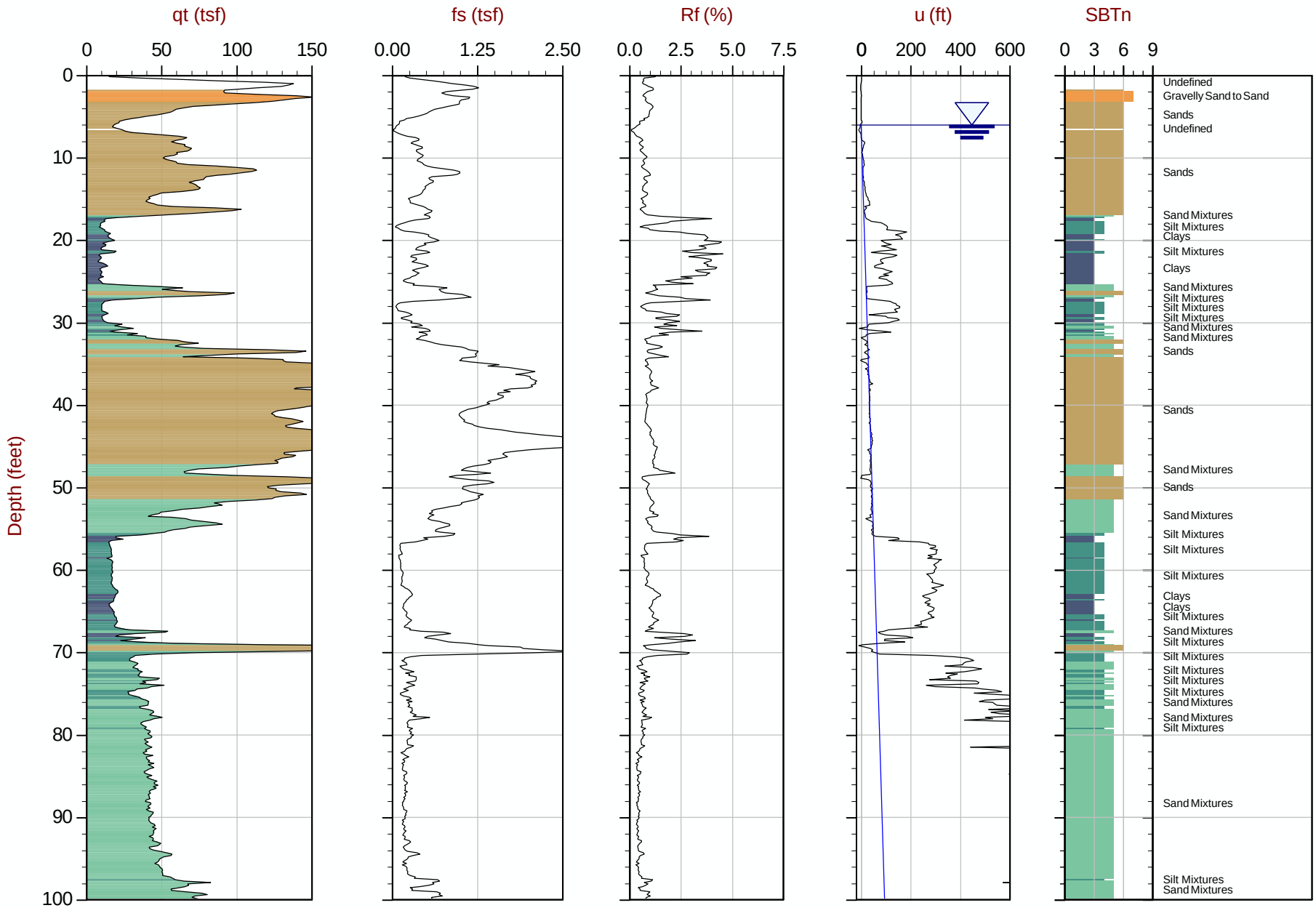
SBT: Lunne, Robertson and Powell, 1997

CONETEC

Schnabel

Job No: 10-951
Date: 08:02:10 14:32
Site: MLK Freeway

Sounding: CPT-193
Cone: 195:T1500F15U500



Max Depth: 30.800 m / 101.05 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 951CP193.COR
Unit Wt: SBT Chart Soil Zones

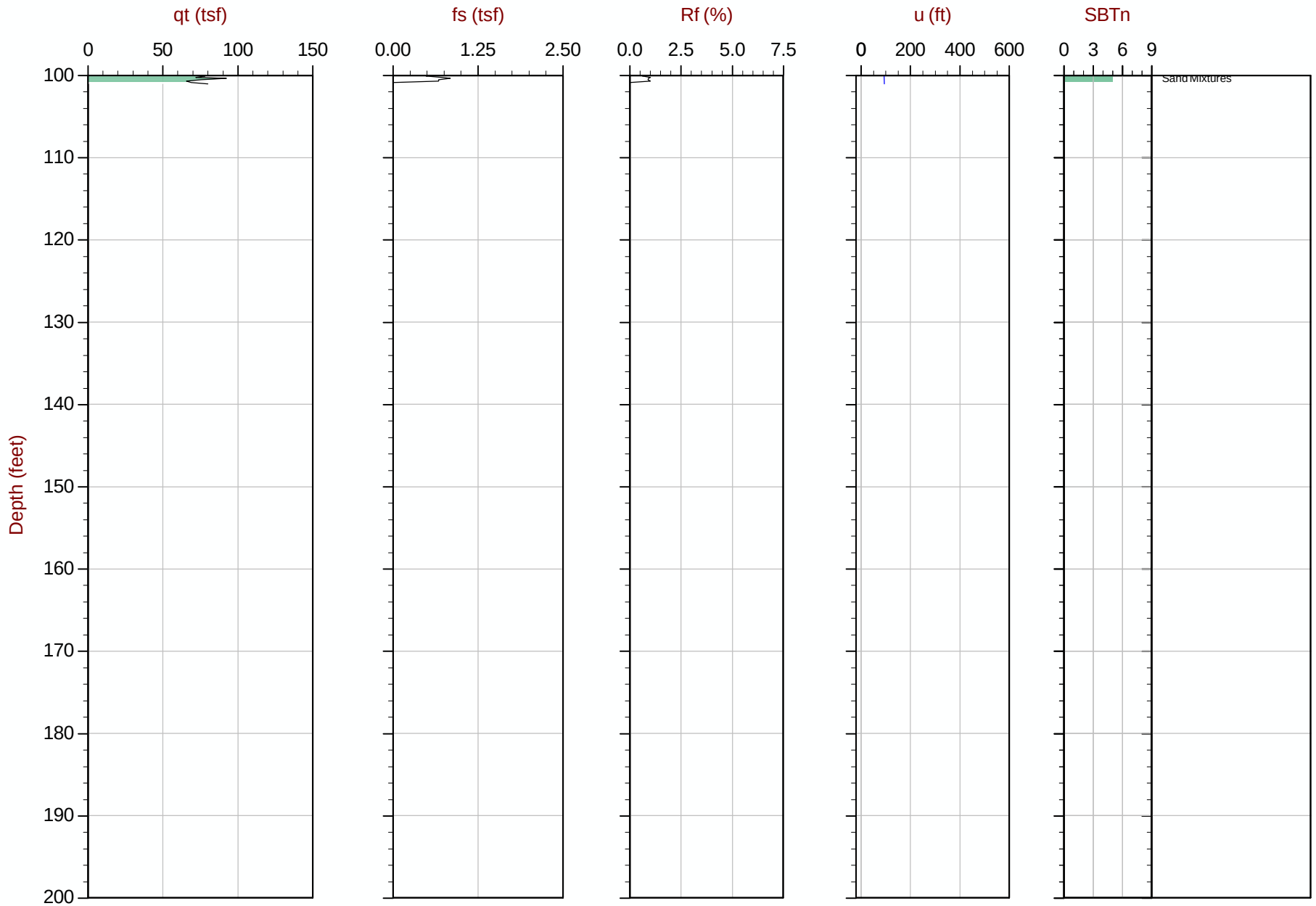
SBT: Lunne, Robertson and Powell, 1997

CONETEC

Schnabel

Job No: 10-951
Date: 08:02:10 14:32
Site: MLK Freeway

Sounding: CPT-193
Cone: 195:T1500F15U500



Max Depth: 30.800 m / 101.05 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 951CP193.COR
Unit Wt: SBT Chart Soil Zones

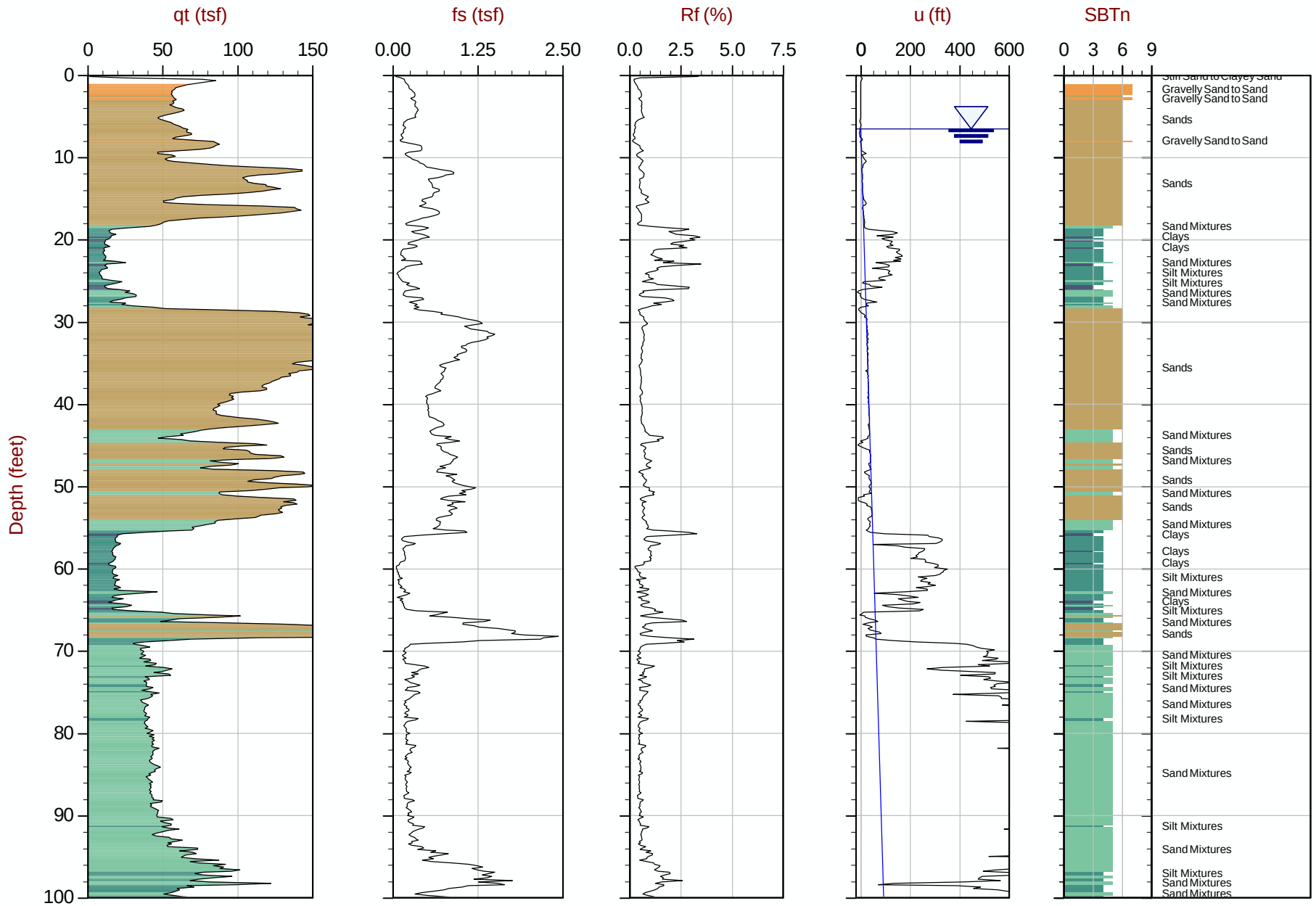
SBT: Lunne, Robertson and Powell, 1997

CONETEC

Schnabel

Job No: 10-951
Date: 08:03:10 11:10
Site: MLK Freeway

Sounding: CPT-209
Cone: 195:T1500F15U500



Max Depth: 30.750 m / 100.88 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 951CP209.COR
Unit Wt: SBT Chart Soil Zones

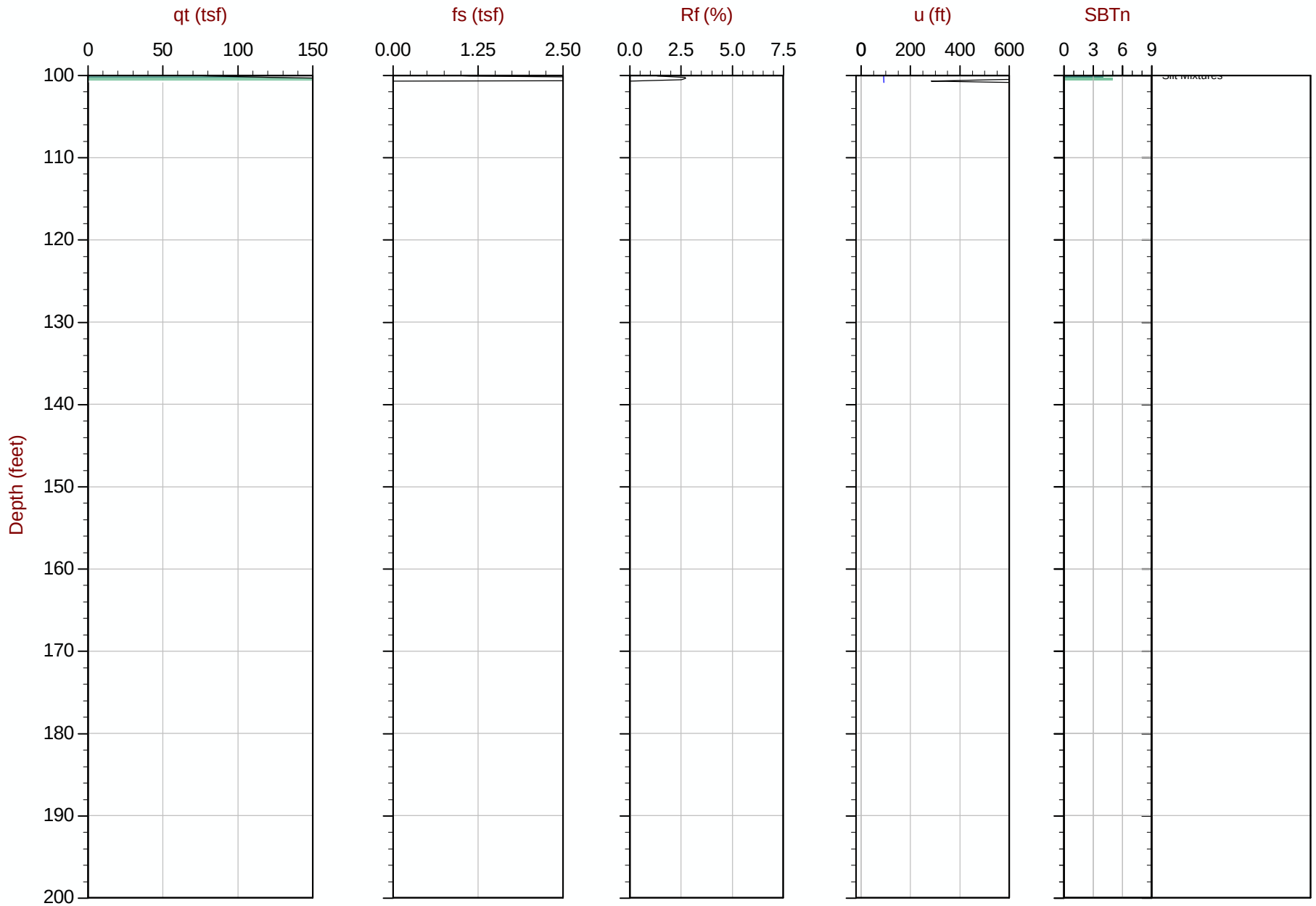
SBT: Lunne, Robertson and Powell, 1997

CONETEC

Schnabel

Job No: 10-951
Date: 08:03:10 11:10
Site: MLK Freeway

Sounding: CPT-209
Cone: 195:T1500F15U500



Max Depth: 30.750 m / 100.88 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 951CP209.COR
Unit Wt: SBT Chart Soil Zones

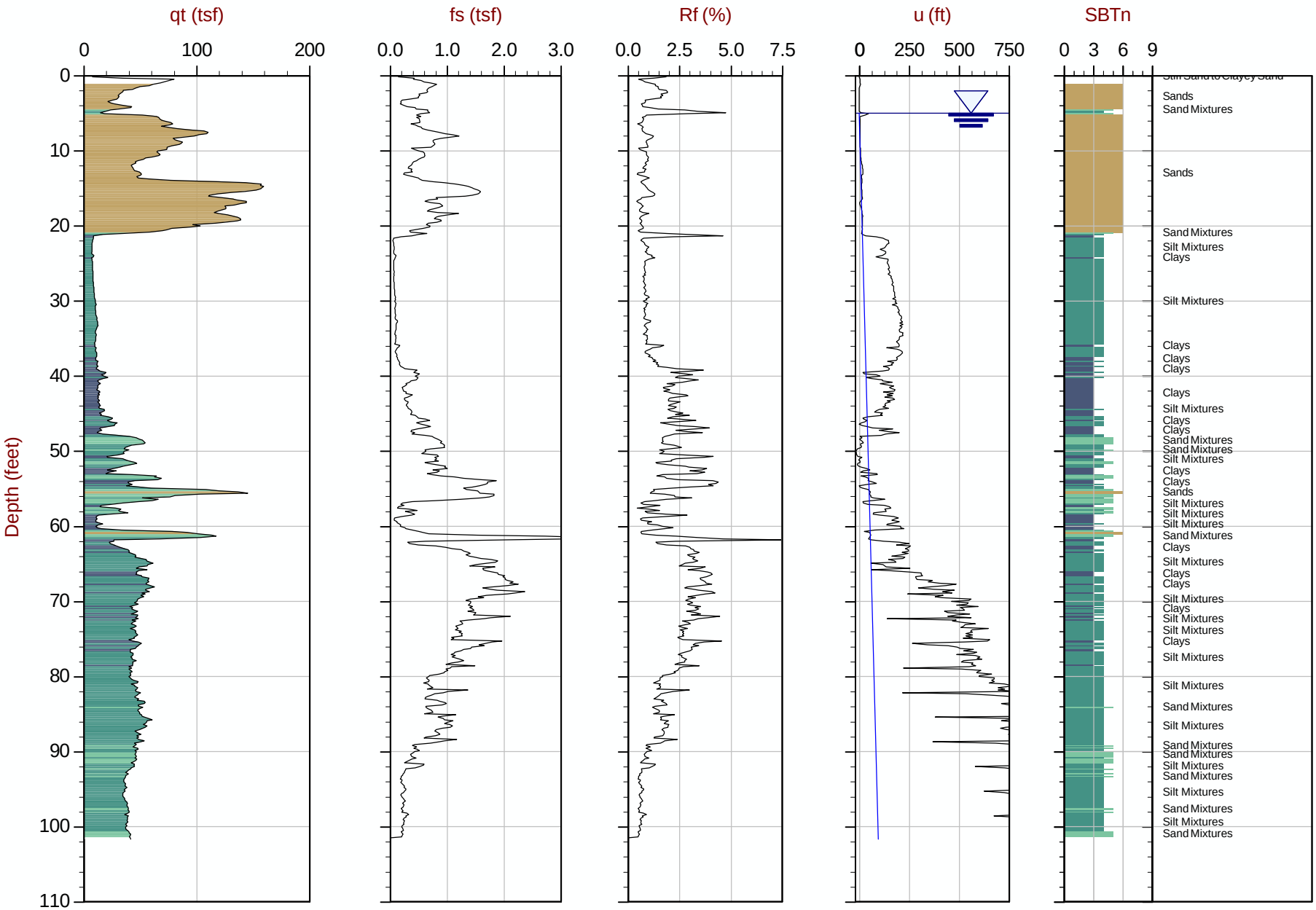
SBT: Lunne, Robertson and Powell, 1997

CONETEC

Schnabel

Job No: 10-965
Date: 09:03:10 08:46
Site: MLK Freeway

Sounding: CPT-301
Cone: 214:T1500F15U500



Max Depth: 31.000 m / 101.70 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 965CP301.COR
Unit Wt: SBT Chart Soil Zones

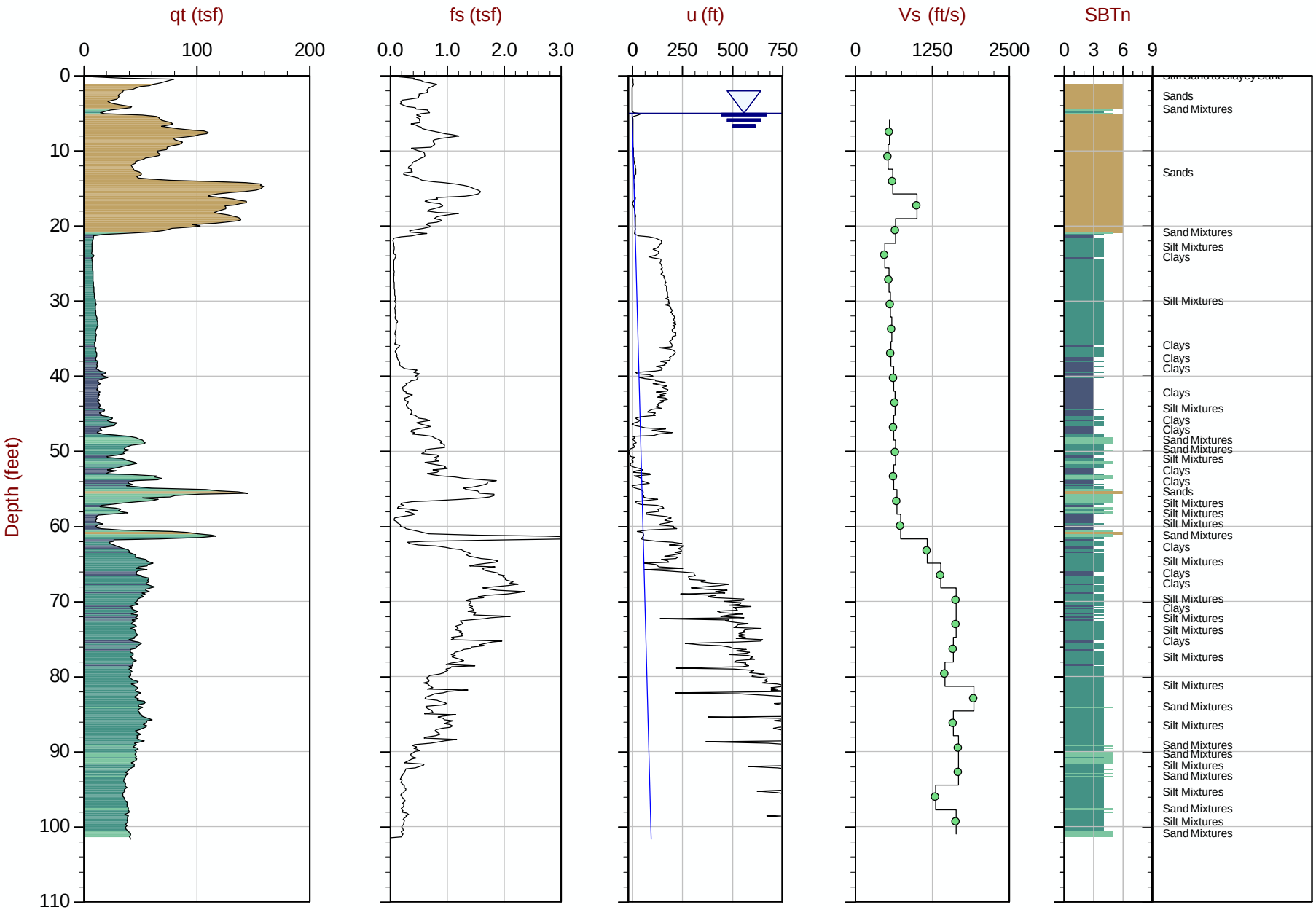
SBT: Lunne, Robertson and Powell, 1997

CONETEC

Schnabel

Job No: 10-965
Date: 09:03:10 08:46
Site: MLK Freeway

Sounding: CPT-301
Cone: 214:T1500F15U500

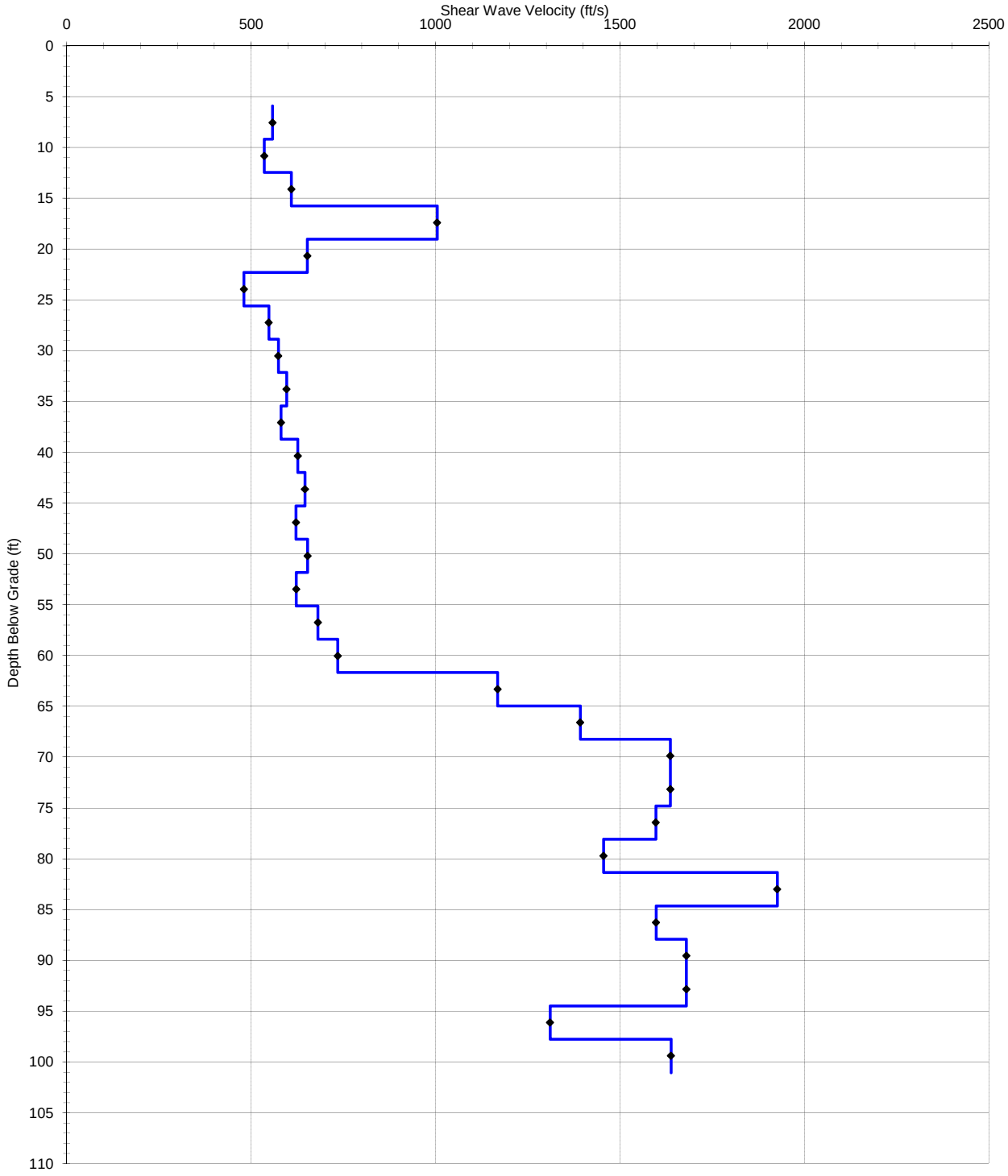


Max Depth: 31.000 m / 101.70 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 965CP301.COR
Unit Wt: SBT Chart Soil Zones

SBT: Lunne, Robertson and Powell, 1997
Page No: 1 of 1

Shear Wave Velocity- CPT-301
MLK Freeway
10-965
September 3, 2010

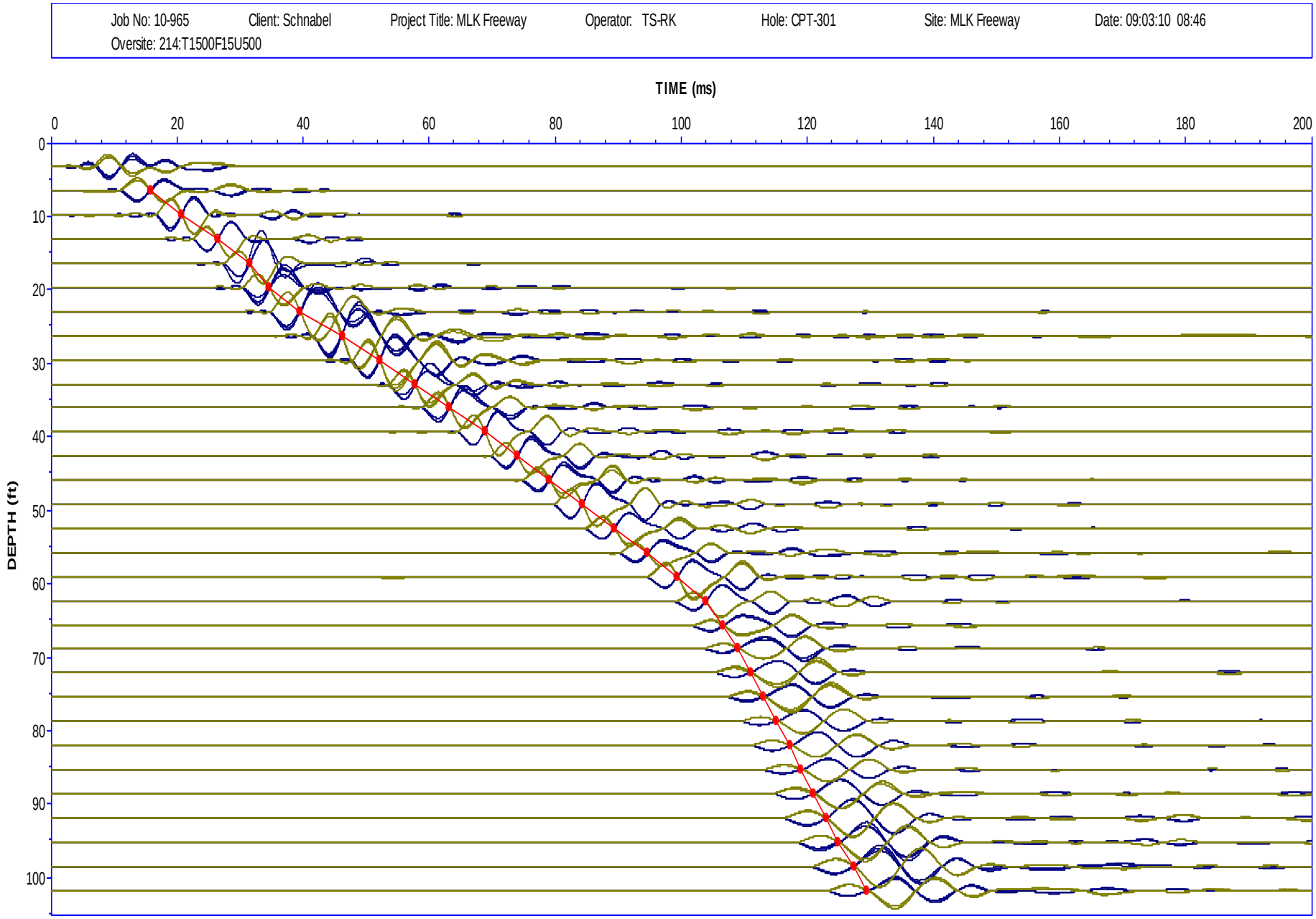


ConeTec Shear Wave Velocity Data Reduction Sheet

Hole: CPT-301
Location: MLK Freeway
Cone: AD214
Date: 3-Sep-10
Source: Beam

Source Depth	0.00 m
Source Offset	1.45 m

Tip Depth (m)	Geophone Depth(m)	Travel Path (m)	Interval time (ms)	Velocity (m/s)	Velocity (ft/s)	Interval Depth (m)	Interval Depth (ft)
0.00							
2.00	1.80	2.31					
3.00	2.80	3.15	4.95	170.1	557.9	2.30	7.55
4.00	3.80	4.07	5.60	163.2	535.5	3.30	10.83
5.00	4.80	5.01	5.10	185.7	609.2	4.30	14.11
6.00	5.80	5.98	3.15	306.1	1004.3	5.30	17.39
7.00	6.80	6.95	4.90	198.9	652.4	6.30	20.67
8.00	7.80	7.93	6.70	146.4	480.3	7.30	23.95
9.00	8.80	8.92	5.90	167.0	547.8	8.30	27.23
10.00	9.80	9.91	5.65	174.9	573.7	9.30	30.51
11.00	10.80	10.90	5.45	181.7	596.1	10.30	33.79
12.00	11.80	11.89	5.60	177.1	581.1	11.30	37.07
13.00	12.80	12.88	5.20	191.0	626.5	12.30	40.35
14.00	13.80	13.88	5.05	196.8	645.8	13.30	43.63
15.00	14.80	14.87	5.25	189.5	621.7	14.30	46.92
16.00	15.80	15.87	5.00	199.1	653.2	15.30	50.20
17.00	16.80	16.86	5.25	189.7	622.4	16.30	53.48
18.00	17.80	17.86	4.80	207.6	681.1	17.30	56.76
19.00	18.80	18.86	4.45	224.0	734.9	18.30	60.04
20.00	19.80	19.85	2.80	356.1	1168.3	19.30	63.32
21.00	20.80	20.85	2.35	424.4	1392.4	20.30	66.60
22.00	21.80	21.85	2.00	498.8	1636.5	21.30	69.88
23.00	22.80	22.85	2.00	498.9	1636.8	22.30	73.16
24.00	23.80	23.84	2.05	486.8	1597.2	23.30	76.44
25.00	24.80	24.84	2.25	443.6	1455.5	24.30	79.72
26.00	25.80	25.84	1.70	587.2	1926.6	25.30	83.00
27.00	26.80	26.84	2.05	487.0	1597.9	26.30	86.29
28.00	27.80	27.84	1.95	512.1	1680.0	27.30	89.57
29.00	28.80	28.84	1.95	512.1	1680.2	28.30	92.85
30.00	29.80	29.84	2.50	399.5	1310.6	29.30	96.13
31.00	30.80	30.83	2.00	499.4	1638.4	30.30	99.41

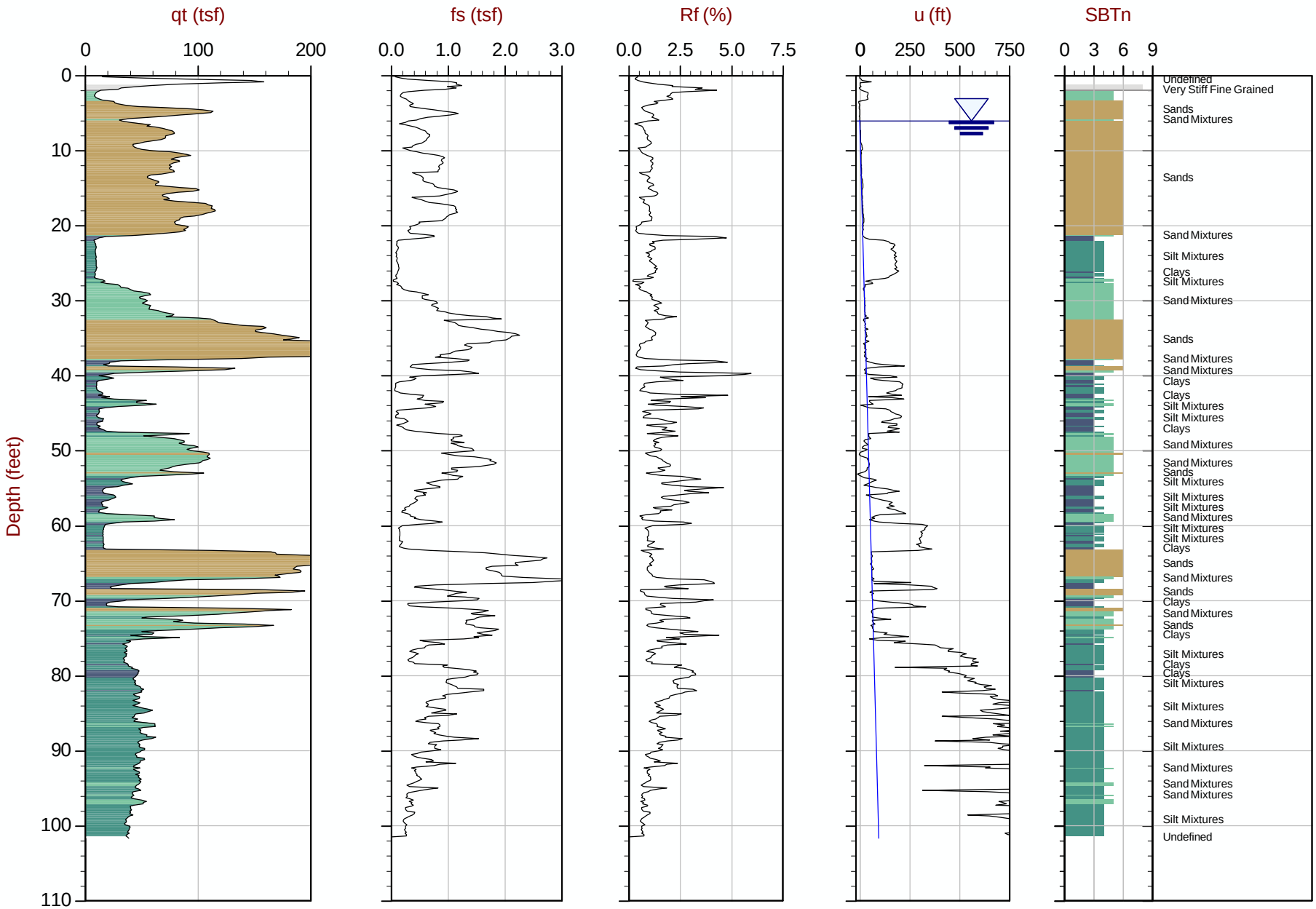

Job No: 10-965
Client: Schnabel
Project Title: MLK Freeway
Operator: TS-RK
Hole: CPT-301
Site: MLK Freeway
Date: 09:03:10 08:46
Oversite: 214:T1500F15U500
TIME (ms)
0
20
40
60
80
100
120
140
160
180
200
DEPTH (ft)
0
10
20
30
40
50
60
70
80
90
100

CONETEC

Schnabel

Job No: 10-965
Date: 09:02:10 14:37
Site: MLK Freeway

Sounding: CPT-302
Cone: 214:T1500F15U500



Max Depth: 31.000 m / 101.70 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 965CP302.COR
Unit Wt: SBT Chart Soil Zones

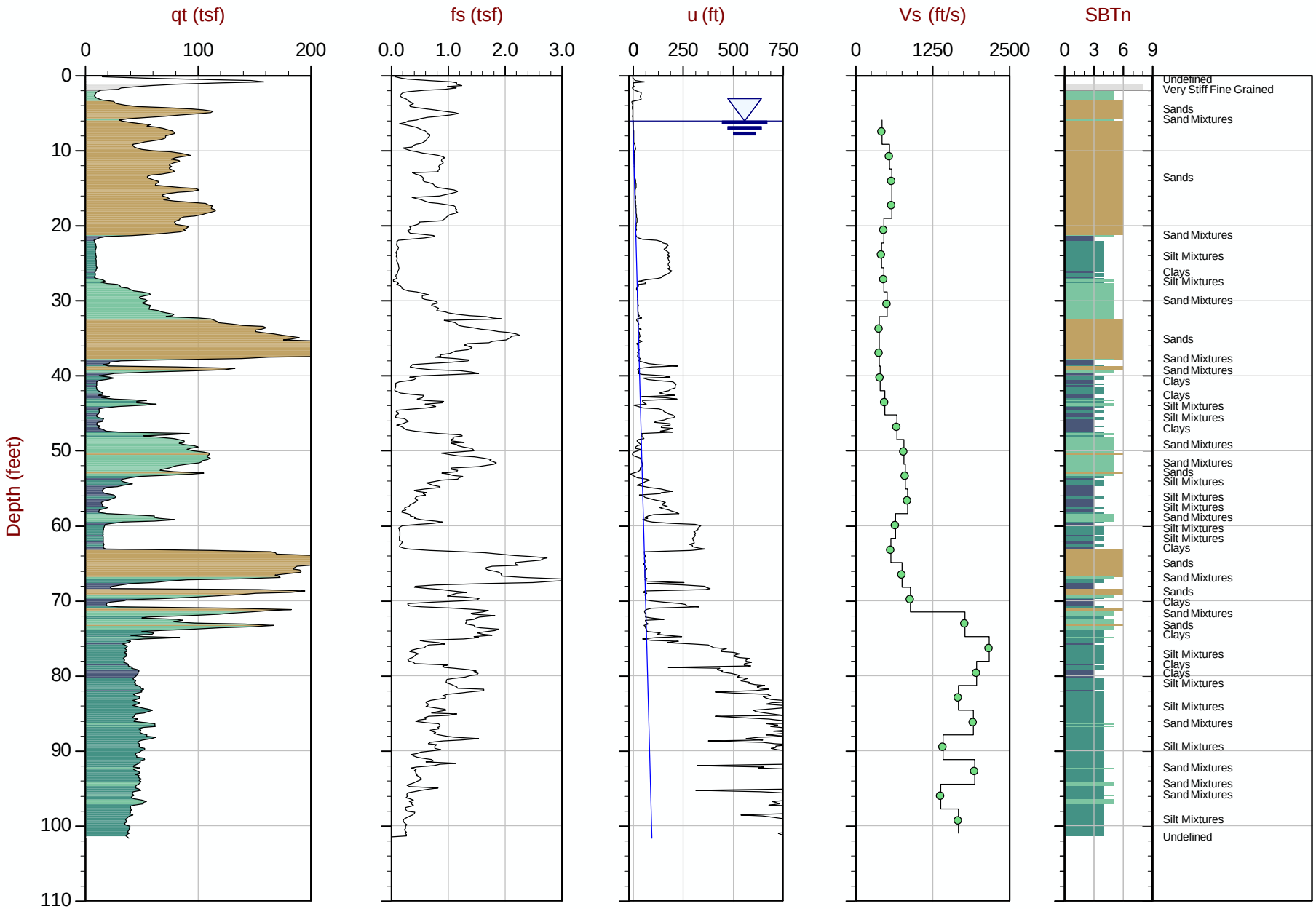
SBT: Lunne, Robertson and Powell, 1997
Page No: 1 of 1

CONETEC

Schnabel

Job No: 10-965
Date: 09:02:10 14:37
Site: MLK Freeway

Sounding: CPT-302
Cone: 214:T1500F15U500

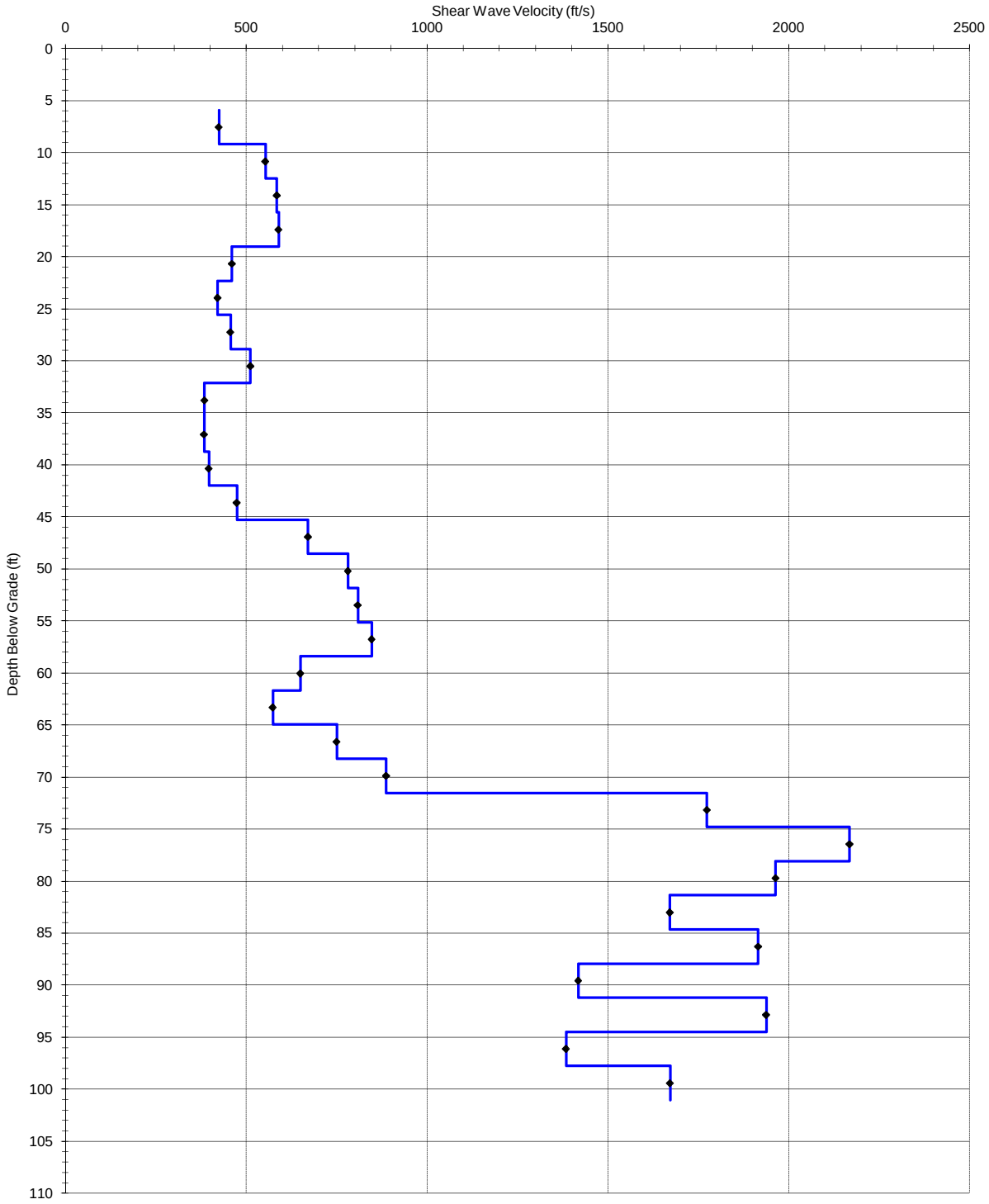


Max Depth: 31.000 m / 101.70 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 965CP302.COR
Unit Wt: SBT Chart Soil Zones

SBT: Lunne, Robertson and Powell, 1997

Shear Wave Velocity- CPT-302
MLK Freeway
10-965
September 2, 2010

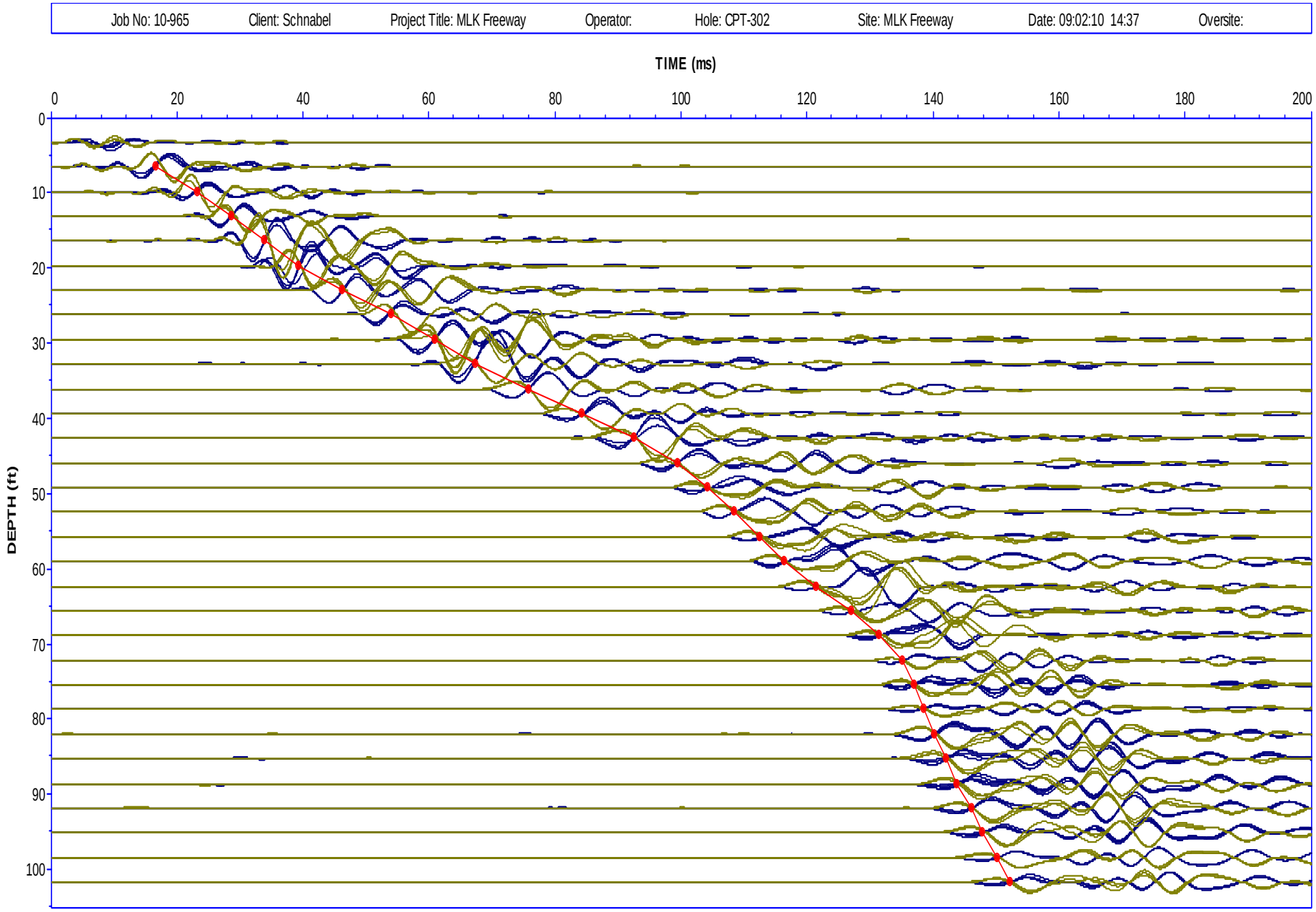


ConeTec Shear Wave Velocity Data Reduction Sheet

Hole: CPT-302
Location: MLK Freeway
Cone: AD214
Date: 2-Sep-10
Source: Beam

Source Depth	0.00 m
Source Offset	1.45 m

Tip Depth (m)	Geophone Depth(m)	Travel Path (m)	Interval time (ms)	Velocity (m/s)	Velocity (ft/s)	Interval Depth (m)	Interval Depth (ft)
0.00							
2.00	1.80	2.31					
3.00	2.80	3.15	6.51	129.3	424.4	2.30	7.55
4.00	3.80	4.07	5.42	168.6	553.0	3.30	10.83
5.00	4.80	5.01	5.32	178.1	584.5	4.30	14.11
6.00	5.80	5.98	5.37	179.6	589.2	5.30	17.39
7.00	6.80	6.95	6.95	140.3	460.2	6.30	20.67
8.00	7.80	7.93	7.65	128.2	420.6	7.30	23.95
9.00	8.80	8.92	7.08	139.1	456.3	8.30	27.23
10.00	9.80	9.91	6.34	155.8	511.3	9.30	30.51
11.00	10.80	10.90	8.46	117.1	384.1	10.30	33.79
12.00	11.80	11.89	8.49	116.8	383.3	11.30	37.07
13.00	12.80	12.88	8.22	120.8	396.3	12.30	40.35
14.00	13.80	13.88	6.88	144.5	474.1	13.30	43.63
15.00	14.80	14.87	4.87	204.5	670.8	14.30	46.92
16.00	15.80	15.87	4.18	238.2	781.3	15.30	50.20
17.00	16.80	16.86	4.04	246.5	808.6	16.30	53.48
18.00	17.80	17.86	3.86	258.2	847.2	17.30	56.76
19.00	18.80	18.86	5.03	198.0	649.7	18.30	60.04
20.00	19.80	19.85	5.70	174.8	573.5	19.30	63.32
21.00	20.80	20.85	4.36	228.6	750.1	20.30	66.60
22.00	21.80	21.85	3.69	270.3	886.7	21.30	69.88
23.00	22.80	22.85	1.85	540.7	1773.9	22.30	73.16
24.00	23.80	23.84	1.51	660.9	2168.4	23.30	76.44
25.00	24.80	24.84	1.67	598.7	1964.1	24.30	79.72
26.00	25.80	25.84	1.96	509.4	1671.4	25.30	83.00
27.00	26.80	26.84	1.71	584.0	1916.1	26.30	86.29
28.00	27.80	27.84	2.31	432.3	1418.4	27.30	89.57
29.00	28.80	28.84	1.69	590.7	1938.0	28.30	92.85
30.00	29.80	29.84	2.37	422.0	1384.4	29.30	96.13
31.00	30.80	30.83	1.96	509.7	1672.2	30.30	99.41

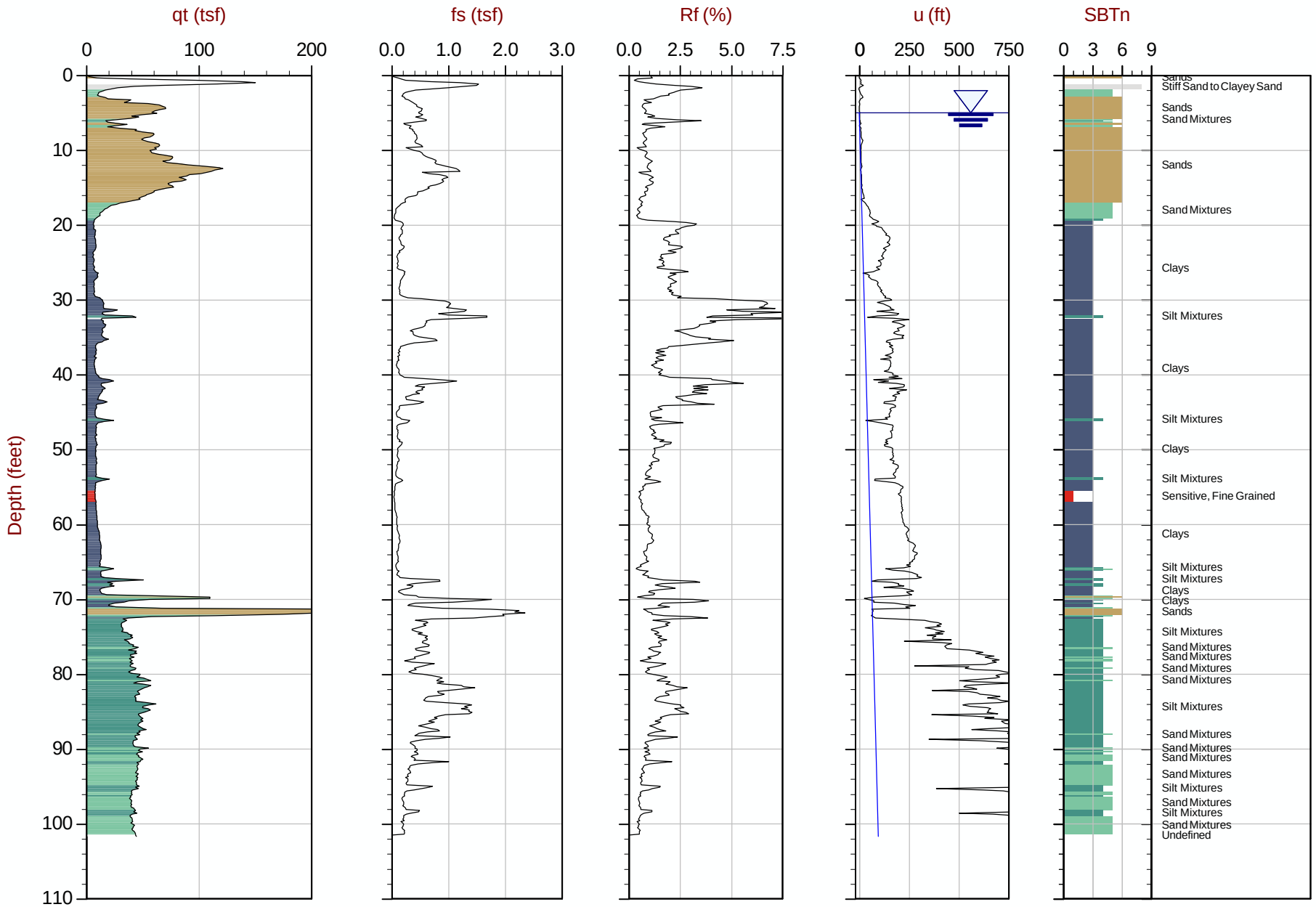

Job No: 10-965
Client: Schnabel
Project Title: MLK Freeway
Operator:
Hole: CPT-302
Site: MLK Freeway
Date: 09:02:10 14:37
Oversite:
TIME (ms)
0
20
40
60
80
100
120
140
160
180
200
DEPTH (ft)
0
10
20
30
40
50
60
70
80
90
100

CONETEC

Schnabel

Job No: 10-965
Date: 09:02:10 12:37
Site: MLK Freeway

Sounding: CPT-303
Cone: 214:T1500F15U500



Max Depth: 31.000 m / 101.70 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 965CP303.COR
Unit Wt: SBT Chart Soil Zones

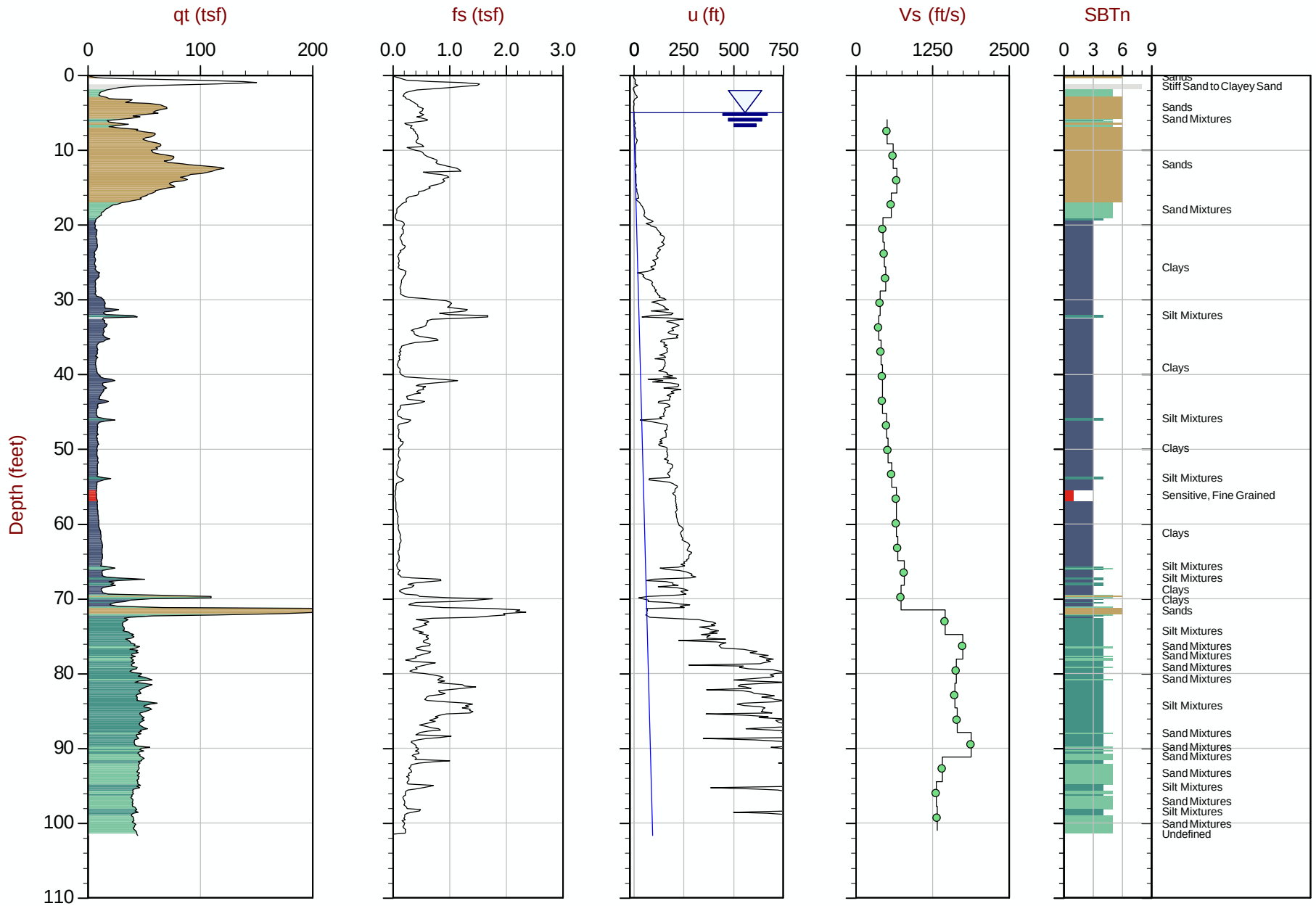
SBT: Lunne, Robertson and Powell, 1997
Page No: 1 of 1

CONETEC

Schnabel

Job No: 10-965
Date: 09:02:10 12:37
Site: MLK Freeway

Sounding: CPT-303
Cone: 214:T1500F15U500

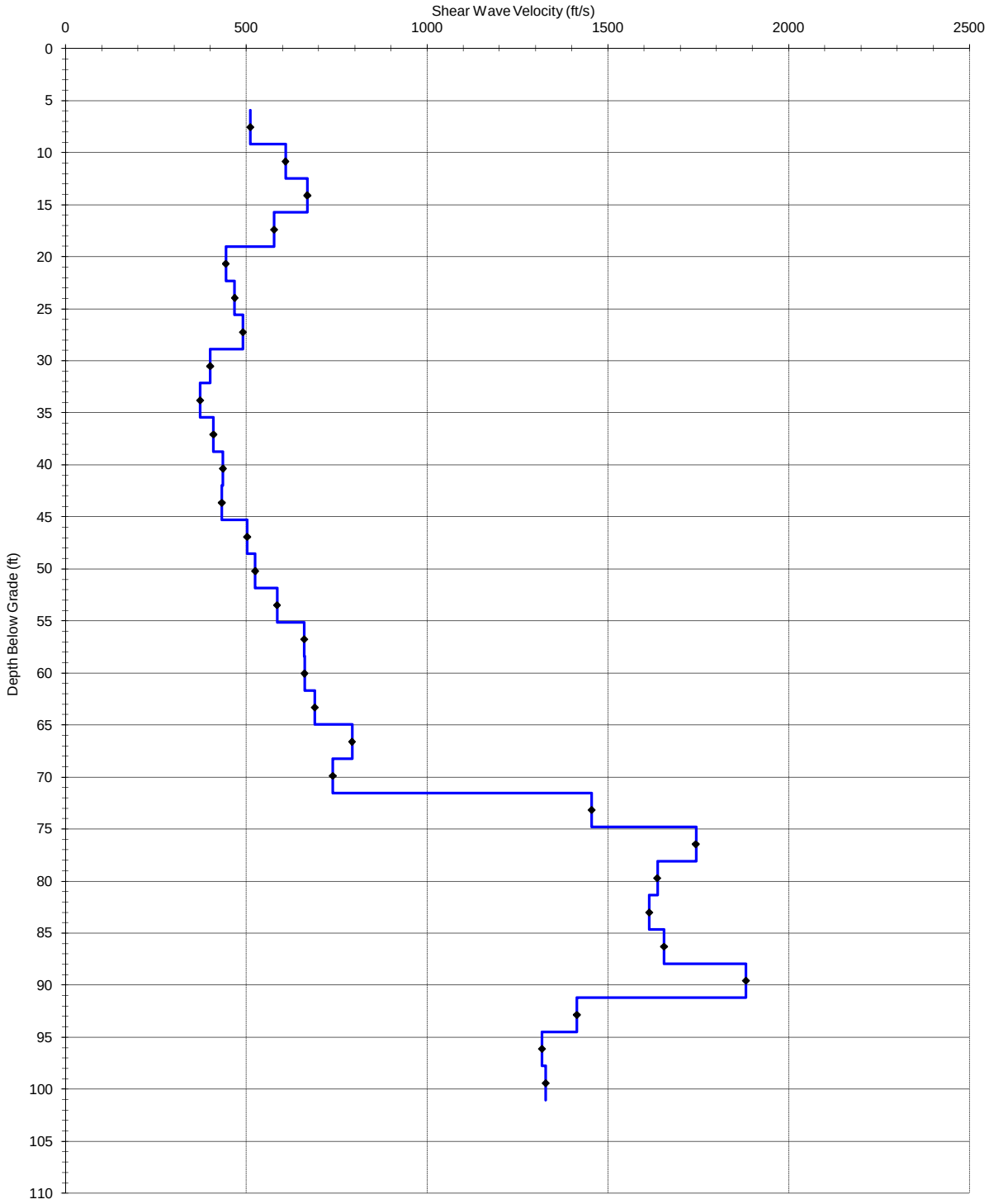


Max Depth: 31.000 m / 101.70 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 965CP303.COR
Unit Wt: SBT Chart Soil Zones

SBT: Lunne, Robertson and Powell, 1997
Page No: 1 of 1

Shear Wave Velocity- CPT-303
MLK Freeway
10-965
September 2, 2010

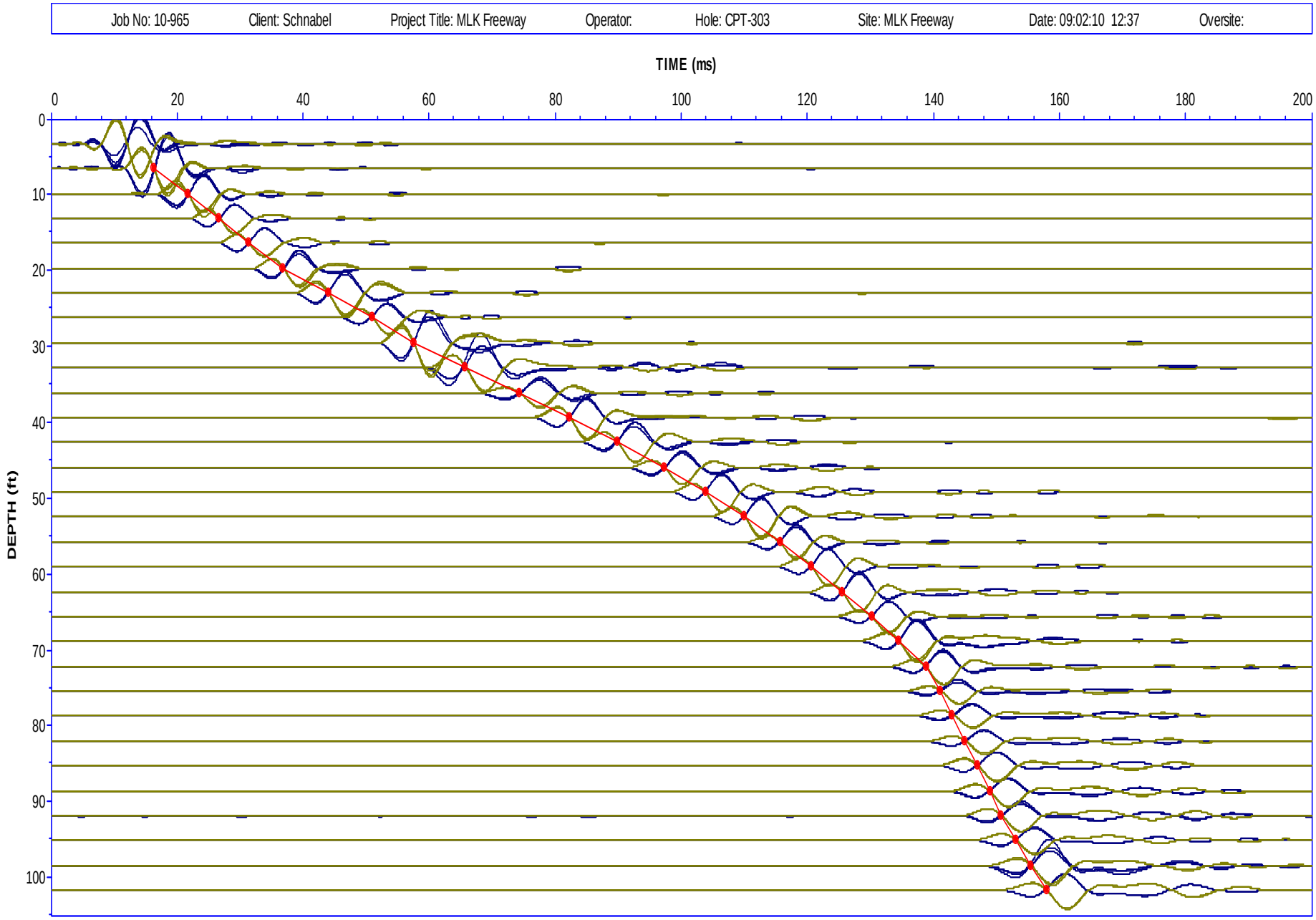


ConeTec Shear Wave Velocity Data Reduction Sheet

Hole: CPT-303
Location: MLK Freeway
Cone: AD214
Date: 2-Sep-10
Source: Beam

Source Depth	0.00 m
Source Offset	1.45 m

Tip Depth (m)	Geophone Depth(m)	Travel Path (m)	Interval time (ms)	Velocity (m/s)	Velocity (ft/s)	Interval Depth (m)	Interval Depth (ft)
0.00							
2.00	1.80	2.31					
3.00	2.80	3.15	5.40	155.8	511.0	2.30	7.55
4.00	3.80	4.07	4.93	185.4	608.3	3.30	10.83
5.00	4.80	5.01	4.65	203.7	668.4	4.30	14.11
6.00	5.80	5.98	5.49	175.7	576.6	5.30	17.39
7.00	6.80	6.95	7.21	135.1	443.1	6.30	20.67
8.00	7.80	7.93	6.88	142.6	467.7	7.30	23.95
9.00	8.80	8.92	6.59	149.4	490.1	8.30	27.23
10.00	9.80	9.91	8.10	121.9	400.0	9.30	30.51
11.00	10.80	10.90	8.72	113.5	372.4	10.30	33.79
12.00	11.80	11.89	7.95	124.7	409.1	11.30	37.07
13.00	12.80	12.88	7.48	132.7	435.4	12.30	40.35
14.00	13.80	13.88	7.55	131.7	432.0	13.30	43.63
15.00	14.80	14.87	6.49	153.2	502.7	14.30	46.92
16.00	15.80	15.87	6.23	159.9	524.6	15.30	50.20
17.00	16.80	16.86	5.59	178.3	584.9	16.30	53.48
18.00	17.80	17.86	4.95	201.3	660.3	17.30	56.76
19.00	18.80	18.86	4.95	201.5	661.0	18.30	60.04
20.00	19.80	19.85	4.75	210.0	689.0	19.30	63.32
21.00	20.80	20.85	4.13	241.5	792.3	20.30	66.60
22.00	21.80	21.85	4.43	225.4	739.4	21.30	69.88
23.00	22.80	22.85	2.25	443.7	1455.7	22.30	73.16
24.00	23.80	23.84	1.88	531.5	1743.7	23.30	76.44
25.00	24.80	24.84	2.00	499.0	1637.0	24.30	79.72
26.00	25.80	25.84	2.03	492.1	1614.5	25.30	83.00
27.00	26.80	26.84	1.98	504.6	1655.5	26.30	86.29
28.00	27.80	27.84	1.74	573.7	1882.2	27.30	89.57
29.00	28.80	28.84	2.32	431.1	1414.2	28.30	92.85
30.00	29.80	29.84	2.49	401.8	1318.1	29.30	96.13
31.00	30.80	30.83	2.47	404.9	1328.4	30.30	99.41

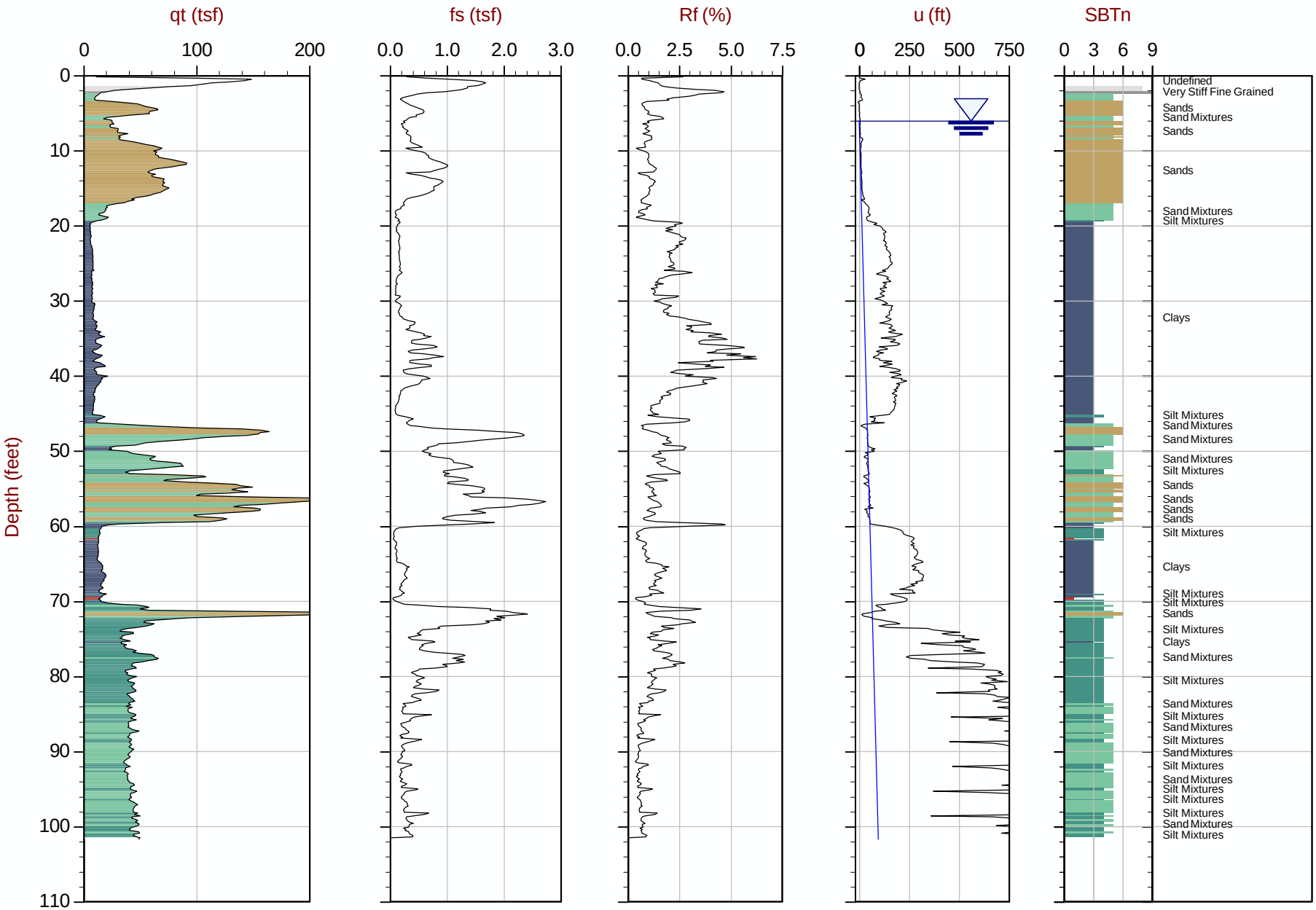

Job No: 10-965
Client: Schnabel
Project Title: MLK Freeway
Operator:
Hole: CPT-303
Site: MLK Freeway
Date: 09:02:10 12:37
Oversite:
TIME (ms)
0
20
40
60
80
100
120
140
160
180
200
DEPTH (ft)
0
10
20
30
40
50
60
70
80
90
100

CONETEC

Schnabel

Job No: 10-965
Date: 09:02:10 10:05
Site: MLK Freeway

Sounding: CPT-304
Cone: 214:T1500F15U500



Max Depth: 31.000 m / 101.70 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 965CP304.COR
Unit Wt: SBT Chart Soil Zones

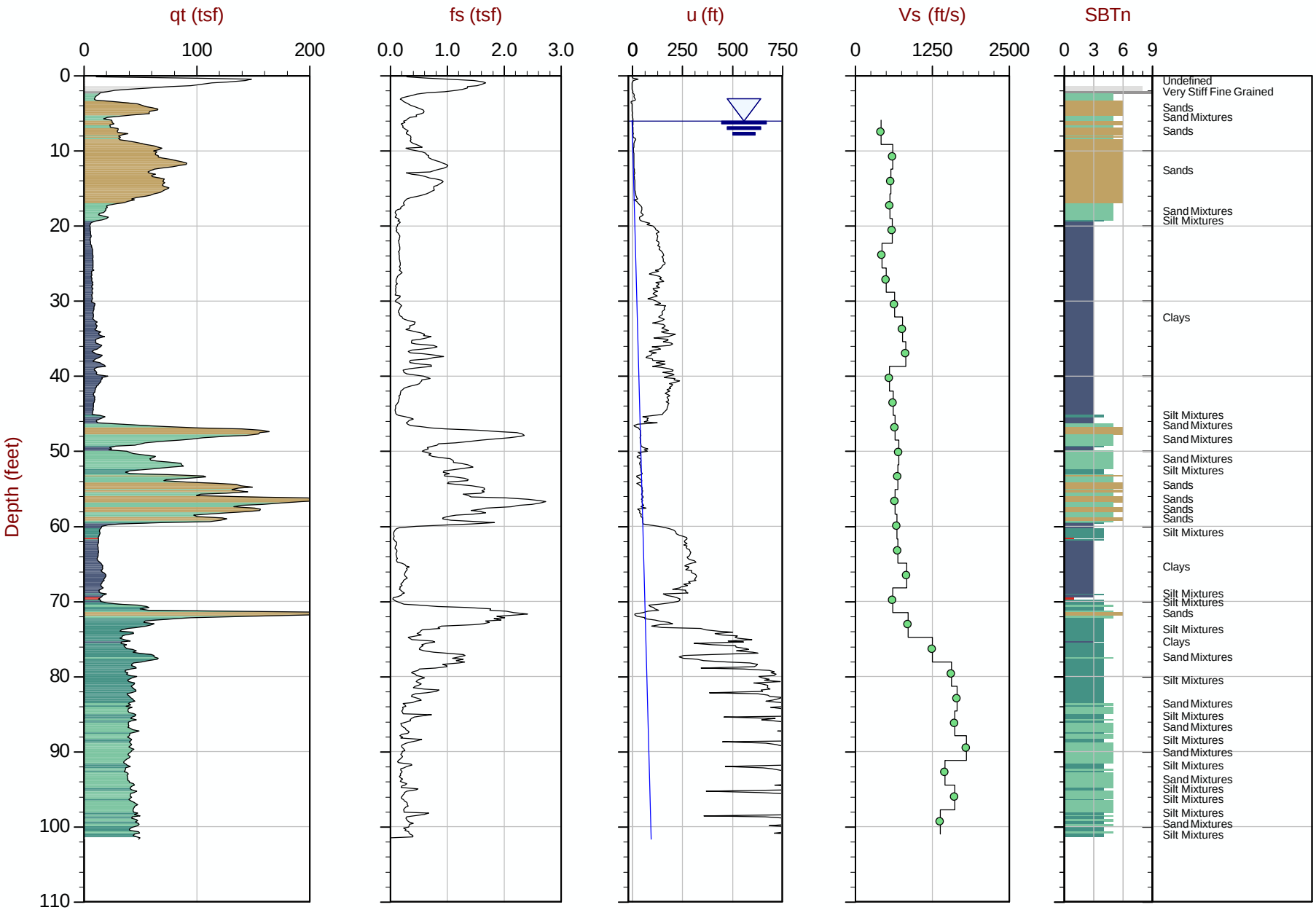
SBT: Lunne, Robertson and Powell, 1997
Page No: 1 of 1

CONETEC

Schnabel

Job No: 10-965
Date: 09:02:10 10:05
Site: MLK Freeway

Sounding: CPT-304
Cone: 214:T1500F15U500

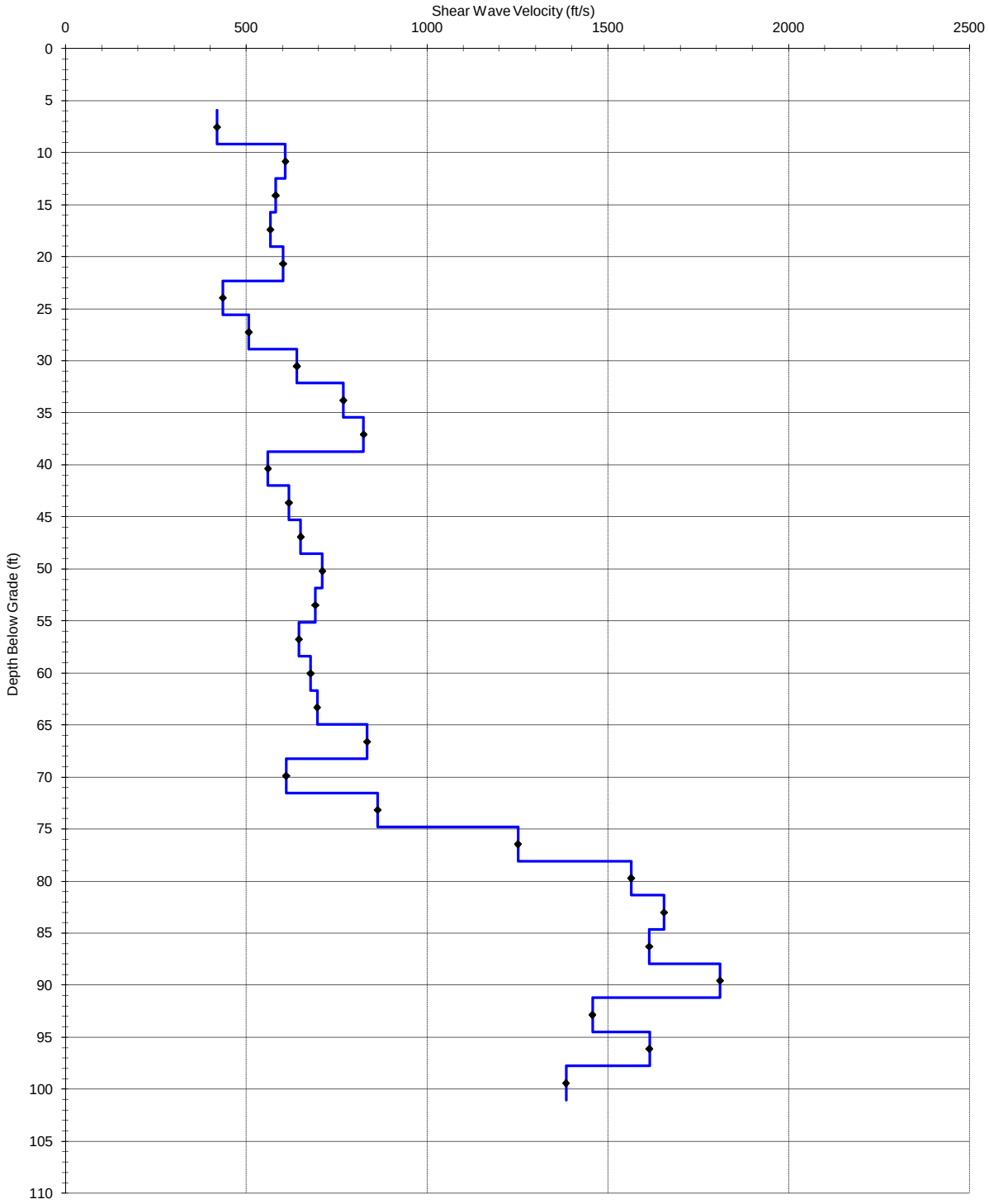


Max Depth: 31.000 m / 101.70 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 965CP304.COR
Unit Wt: SBT Chart Soil Zones

SBT: Lunne, Robertson and Powell, 1997

Shear Wave Velocity- CPT-304
MLK Freeway
10-965
September 2, 2010

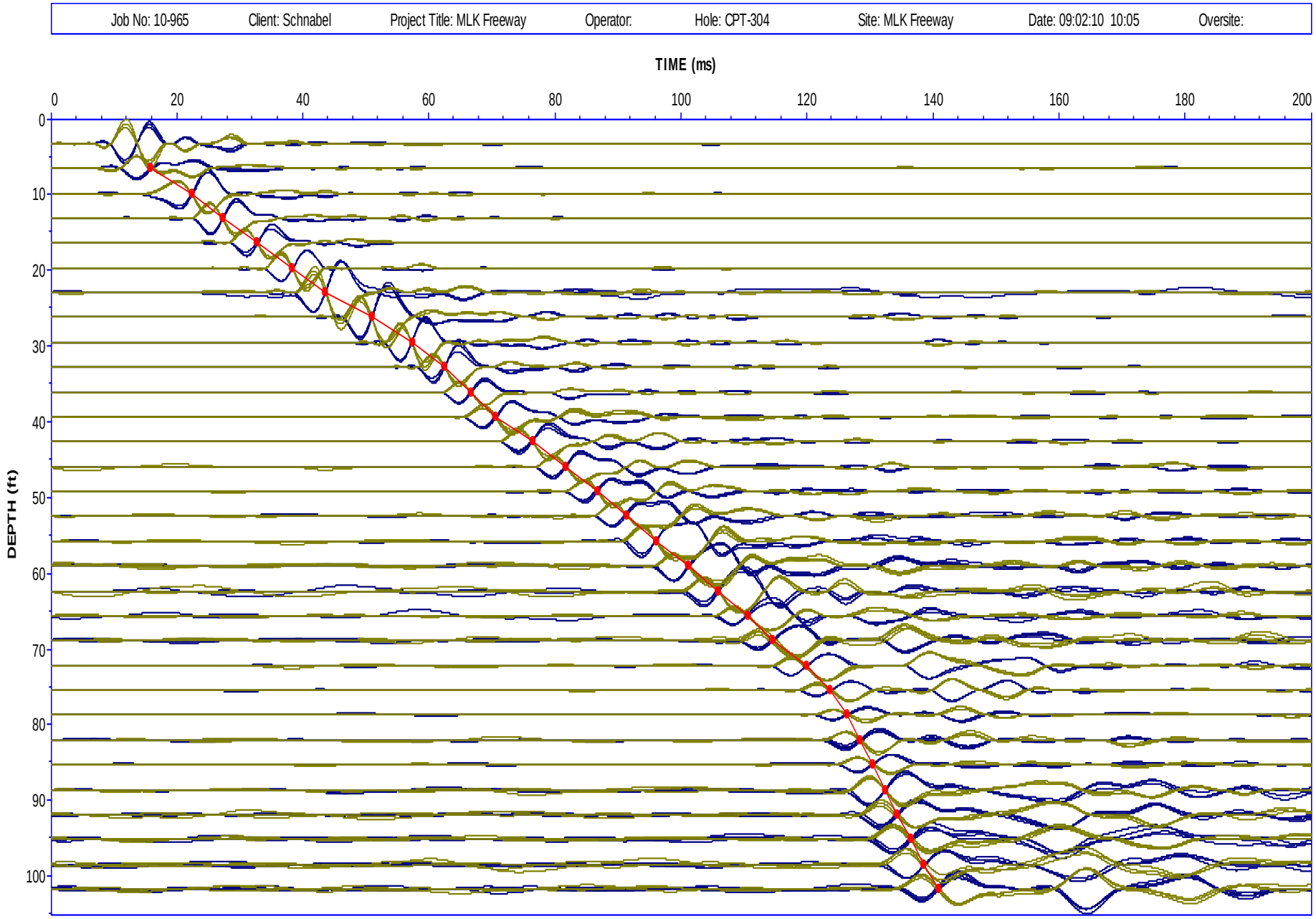


ConeTec Shear Wave Velocity Data Reduction Sheet

Hole: CPT-304
Location: MLK Freeway
Cone: AD214
Date: 2-Sep-10
Source: Beam

Source Depth	0.00 m
Source Offset	1.45 m

Tip Depth (m)	Geophone Depth(m)	Travel Path (m)	Interval time (ms)	Velocity (m/s)	Velocity (ft/s)	Interval Depth (m)	Interval Depth (ft)
0.00							
2.00	1.80	2.31					
3.00	2.80	3.15	6.59	127.7	418.8	2.30	7.55
4.00	3.80	4.07	4.93	185.3	607.9	3.30	10.83
5.00	4.80	5.01	5.35	177.0	580.6	4.30	14.11
6.00	5.80	5.98	5.59	172.6	566.2	5.30	17.39
7.00	6.80	6.95	5.32	183.2	601.0	6.30	20.67
8.00	7.80	7.93	7.40	132.5	434.8	7.30	23.95
9.00	8.80	8.92	6.38	154.5	506.9	8.30	27.23
10.00	9.80	9.91	5.07	195.0	639.9	9.30	30.51
11.00	10.80	10.90	4.23	234.3	768.6	10.30	33.79
12.00	11.80	11.89	3.95	251.2	824.2	11.30	37.07
13.00	12.80	12.88	5.82	170.7	559.9	12.30	40.35
14.00	13.80	13.88	5.28	188.1	617.3	13.30	43.63
15.00	14.80	14.87	5.02	198.2	650.3	14.30	46.92
16.00	15.80	15.87	4.60	216.5	710.3	15.30	50.20
17.00	16.80	16.86	4.73	210.6	690.9	16.30	53.48
18.00	17.80	17.86	5.07	196.6	644.9	17.30	56.76
19.00	18.80	18.86	4.83	206.4	677.1	18.30	60.04
20.00	19.80	19.85	4.70	212.1	695.9	19.30	63.32
21.00	20.80	20.85	3.92	254.2	834.1	20.30	66.60
22.00	21.80	21.85	5.37	185.8	609.6	21.30	69.88
23.00	22.80	22.85	3.79	263.2	863.5	22.30	73.16
24.00	23.80	23.84	2.62	381.4	1251.3	23.30	76.44
25.00	24.80	24.84	2.09	476.9	1564.5	24.30	79.72
26.00	25.80	25.84	1.98	504.5	1655.3	25.30	83.00
27.00	26.80	26.84	2.03	492.2	1614.7	26.30	86.29
28.00	27.80	27.84	1.81	551.8	1810.4	27.30	89.57
29.00	28.80	28.84	2.25	444.3	1457.6	28.30	92.85
30.00	29.80	29.84	2.03	492.3	1615.2	29.30	96.13
31.00	30.80	30.83	2.37	422.0	1384.6	30.30	99.41

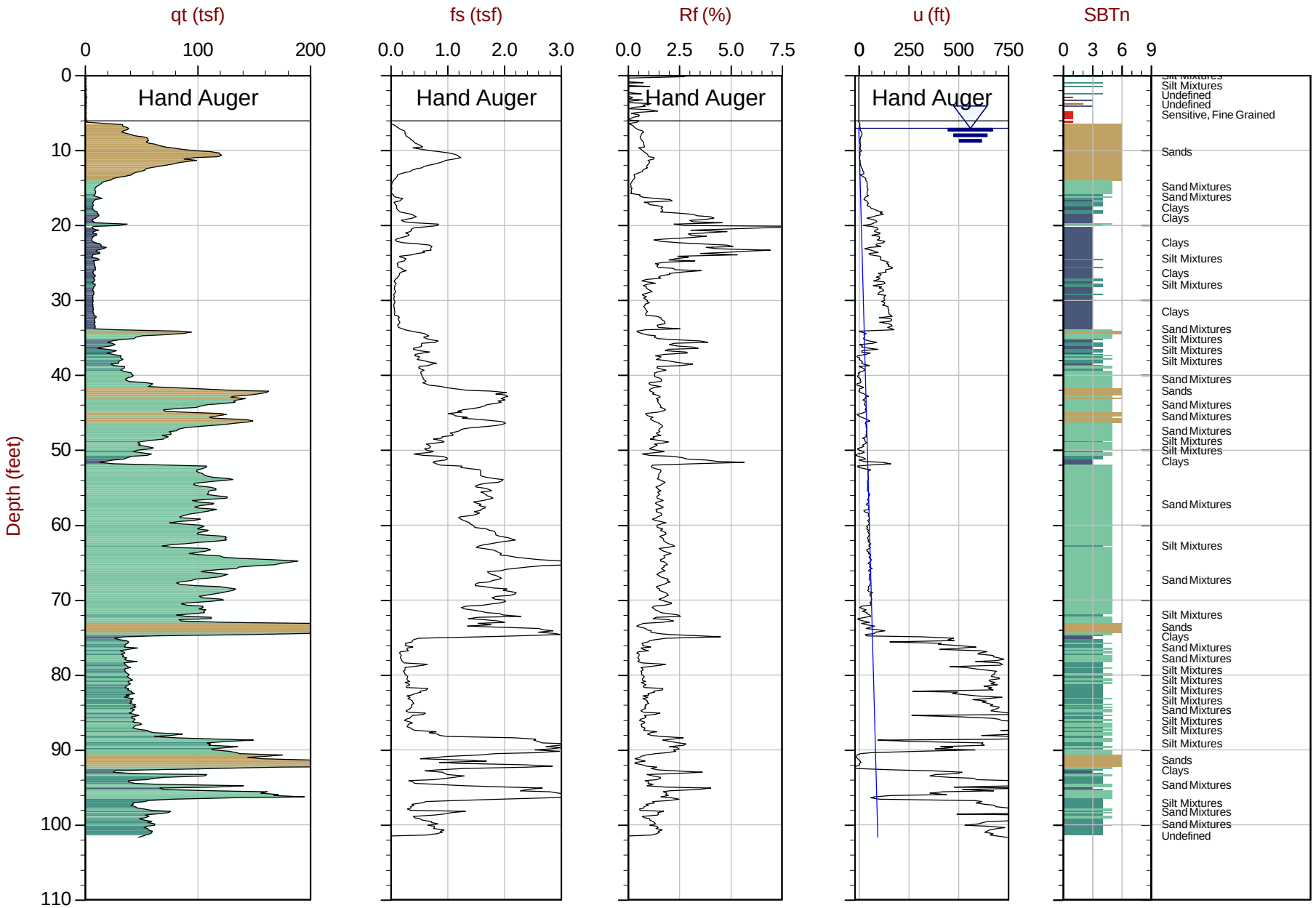

Job No: 10-965
Client: Schnabel
Project Title: MLK Freeway
Operator:
Hole: CPT-304
Site: MLK Freeway
Date: 09:02:10 10:05
Oversite:
TIME (ms)
0
20
40
60
80
100
120
140
160
180
200
DEPTH (ft)
0
10
20
30
40
50
60
70
80
90
100

CONETEC

Schnabel

Job No: 10-965
Date: 09:07:10 09:47
Site: MLK Freeway

Sounding: CPT-305
Cone: 214:T1500F15U500



Max Depth: 31.000 m / 101.70 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 965CP305.COR
Unit Wt: SBT Chart Soil Zones

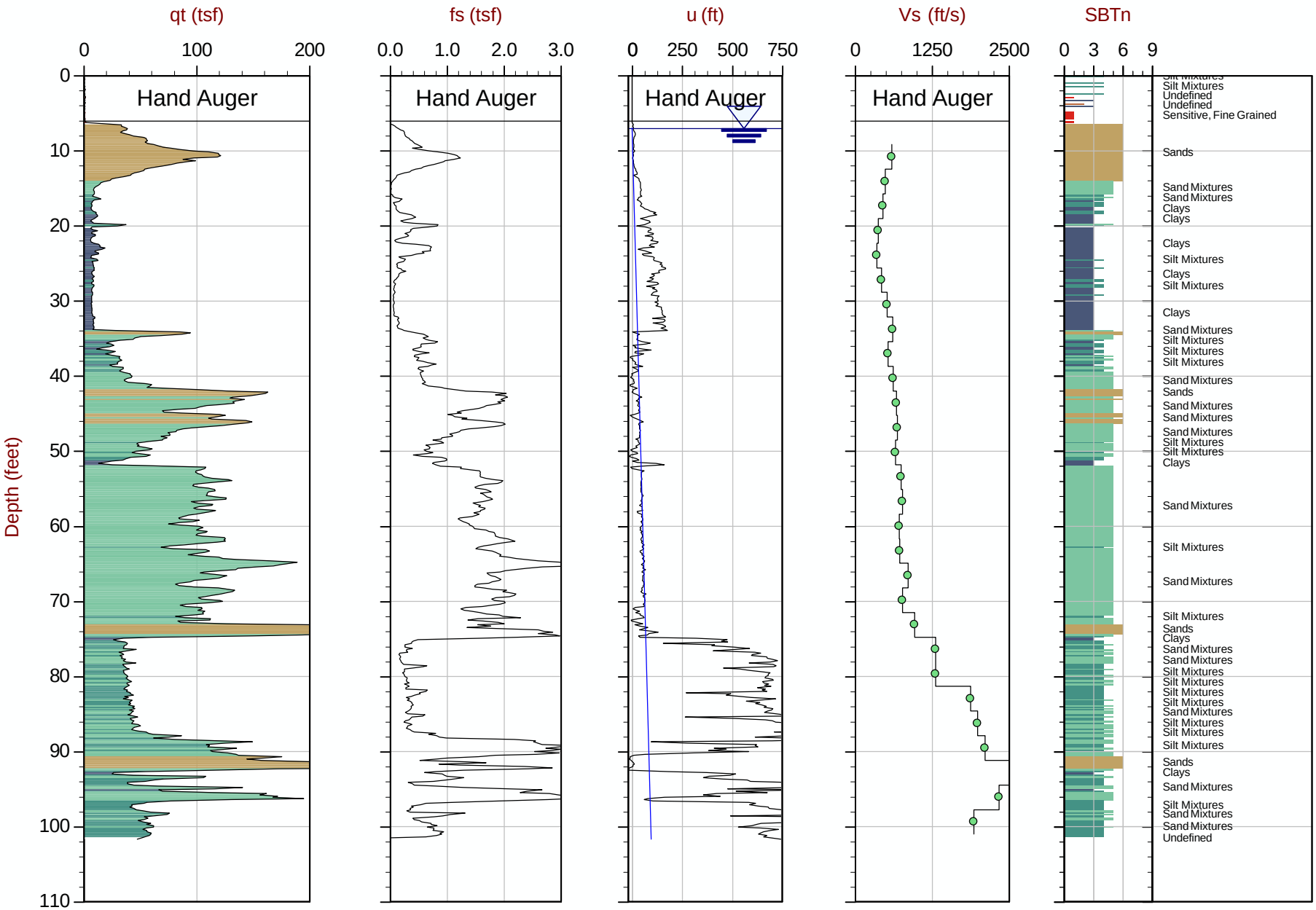
SBT: Lunne, Robertson and Powell, 1997
Page No: 1 of 1

CONETEC

Schnabel

Job No: 10-965
Date: 09:07:10 09:47
Site: MLK Freeway

Sounding: CPT-305
Cone: 214:T1500F15U500

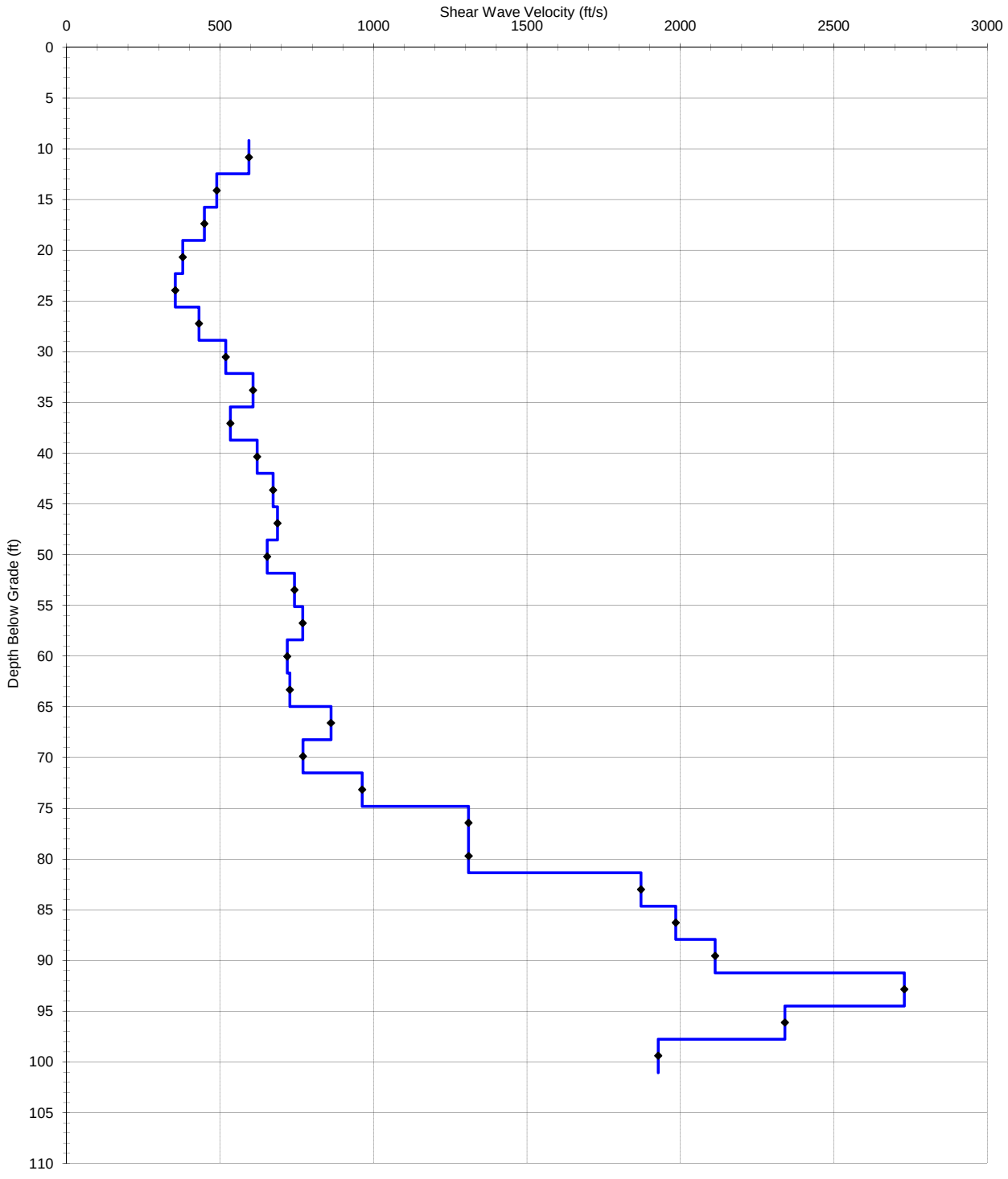


Max Depth: 31.000 m / 101.70 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 965CP305.COR
Unit Wt: SBT Chart Soil Zones

SBT: Lunne, Robertson and Powell, 1997
Page No: 1 of 1

Shear Wave Velocity- CPT-305
MLK Freeway
10-965
September 7, 2010

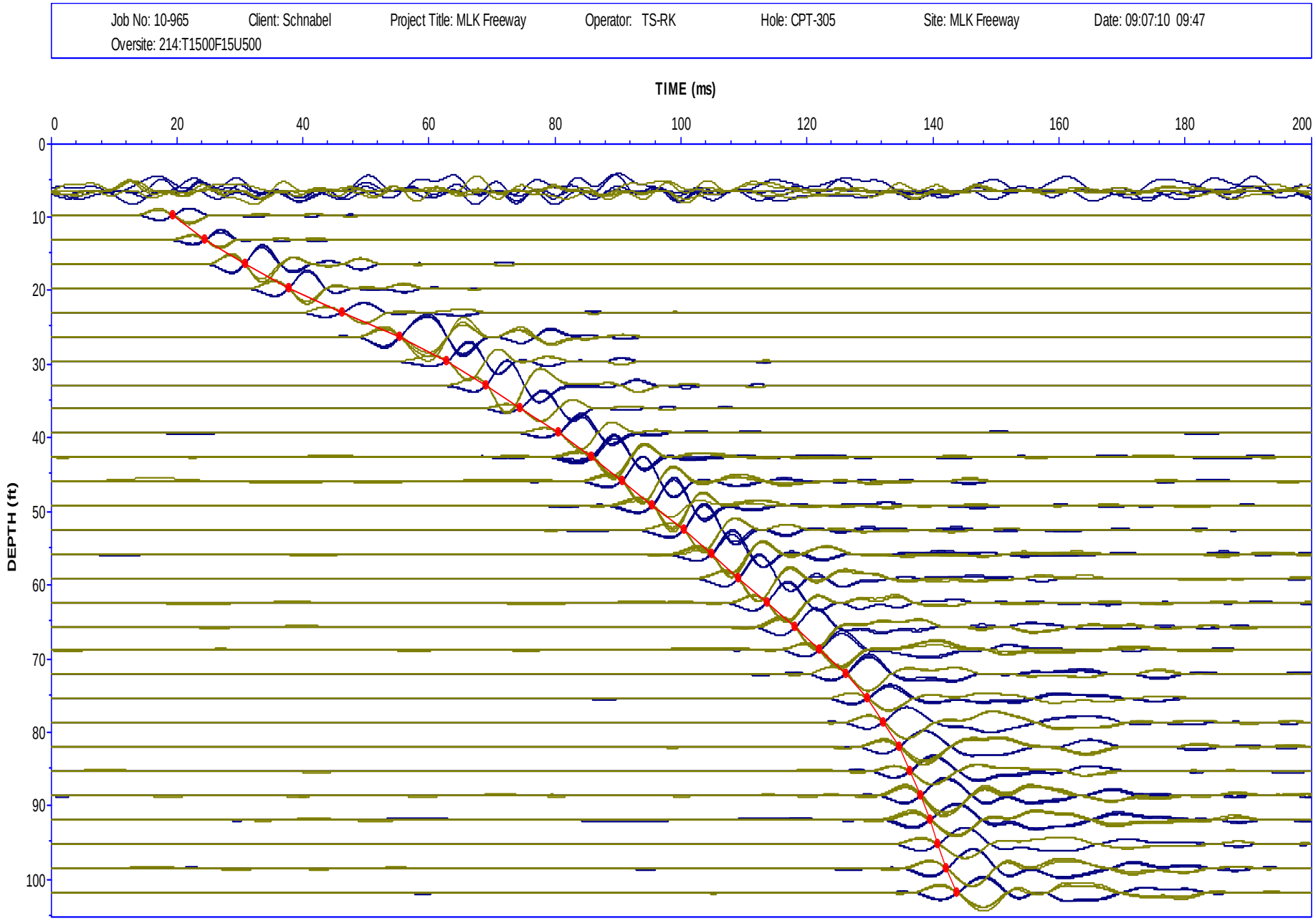


ConeTec Shear Wave Velocity Data Reduction Sheet

Hole: CPT-305
Location: MLK Freeway
Cone: AD214
Date: 7-Sep-10
Source: Beam

Source Depth	0.00 m
Source Offset	1.45 m

Tip Depth (m)	Geophone Depth(m)	Travel Path (m)	Interval time (ms)	Velocity (m/s)	Velocity (ft/s)	Interval Depth (m)	Interval Depth (ft)
0.00							
3.00	2.80	3.15					
4.00	3.80	4.07	5.05	181.0	593.8	3.30	10.83
5.00	4.80	5.01	6.35	149.1	489.3	4.30	14.11
6.00	5.80	5.98	7.05	136.8	448.7	5.30	17.39
7.00	6.80	6.95	8.45	115.3	378.3	6.30	20.67
8.00	7.80	7.93	9.10	107.8	353.6	7.30	23.95
9.00	8.80	8.92	7.50	131.3	430.9	8.30	27.23
10.00	9.80	9.91	6.25	158.1	518.6	9.30	30.51
11.00	10.80	10.90	5.35	185.1	607.2	10.30	33.79
12.00	11.80	11.89	6.10	162.6	533.4	11.30	37.07
13.00	12.80	12.88	5.25	189.2	620.6	12.30	40.35
14.00	13.80	13.88	4.85	205.0	672.4	13.30	43.63
15.00	14.80	14.87	4.75	209.4	687.1	14.30	46.92
16.00	15.80	15.87	5.00	199.1	653.2	15.30	50.20
17.00	16.80	16.86	4.40	226.4	742.7	16.30	53.48
18.00	17.80	17.86	4.25	234.5	769.2	17.30	56.76
19.00	18.80	18.86	4.55	219.1	718.8	18.30	60.04
20.00	19.80	19.85	4.50	221.6	727.0	19.30	63.32
21.00	20.80	20.85	3.80	262.5	861.1	20.30	66.60
22.00	21.80	21.85	4.25	234.7	770.1	21.30	69.88
23.00	22.80	22.85	3.40	293.5	962.8	22.30	73.16
24.00	23.80	23.84	2.50	399.2	1309.7	23.30	76.44
25.00	24.80	24.84	2.50	399.3	1309.9	24.30	79.72
26.00	25.80	25.84	1.75	570.5	1871.6	25.30	83.00
27.00	26.80	26.84	1.65	605.1	1985.2	26.30	86.29
28.00	27.80	27.84	1.55	644.2	2113.5	27.30	89.57
29.00	28.80	28.84	1.20	832.2	2730.3	28.30	92.85
30.00	29.80	29.84	1.40	713.4	2340.4	29.30	96.13
31.00	30.80	30.83	1.70	587.5	1927.6	30.30	99.41

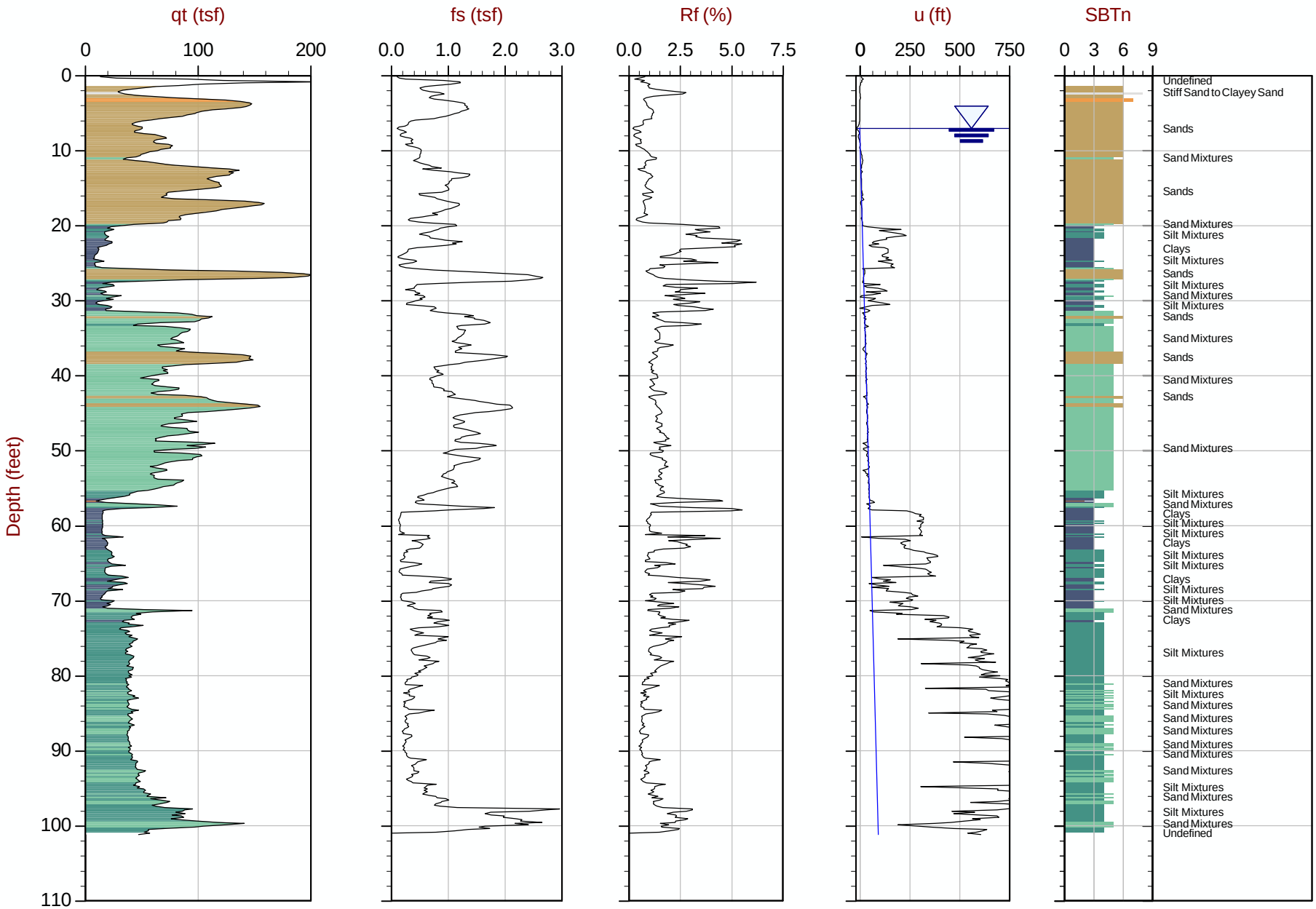

Job No: 10-965
Client: Schnabel
Project Title: MLK Freeway
Operator: TS-RK
Hole: CPT-305
Site: MLK Freeway
Date: 09:07:10 09:47
Oversite: 214:T1500F15U500
TIME (ms)
0
20
40
60
80
100
120
140
160
180
200
DEPTH (ft)
0
10
20
30
40
50
60
70
80
90
100

CONETEC

Schnabel

Job No: 10-965
Date: 09:03:10 12:58
Site: MLK Freeway

Sounding: CPT-306
Cone: 214:T1500F15U500



Max Depth: 30.850 m / 101.21 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 965CP306.COR
Unit Wt: SBT Chart Soil Zones

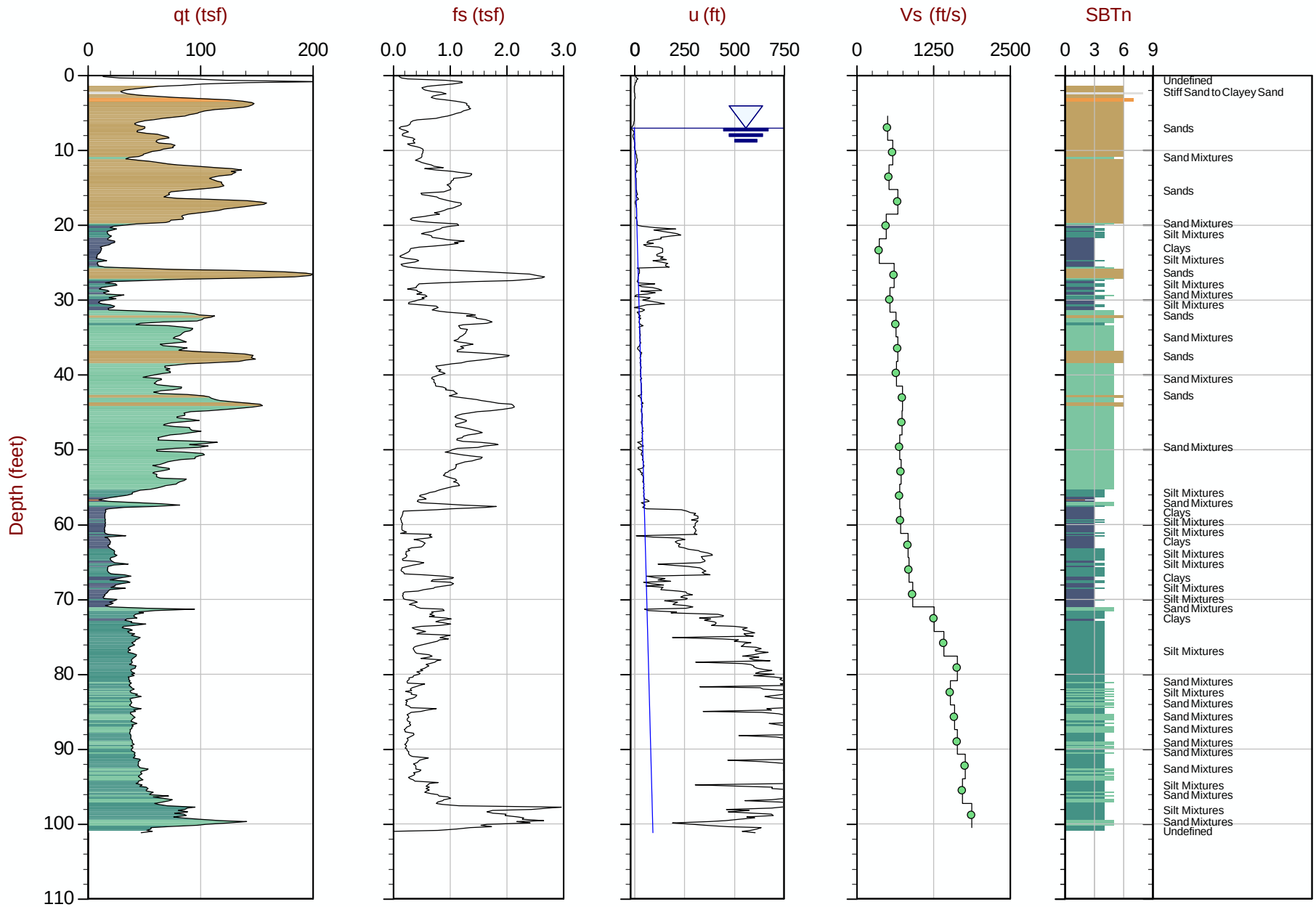
SBT: Lunne, Robertson and Powell, 1997
Page No: 1 of 1

CONETEC

Schnabel

Job No: 10-965
Date: 09:03:10 12:58
Site: MLK Freeway

Sounding: CPT-306
Cone: 214:T1500F15U500

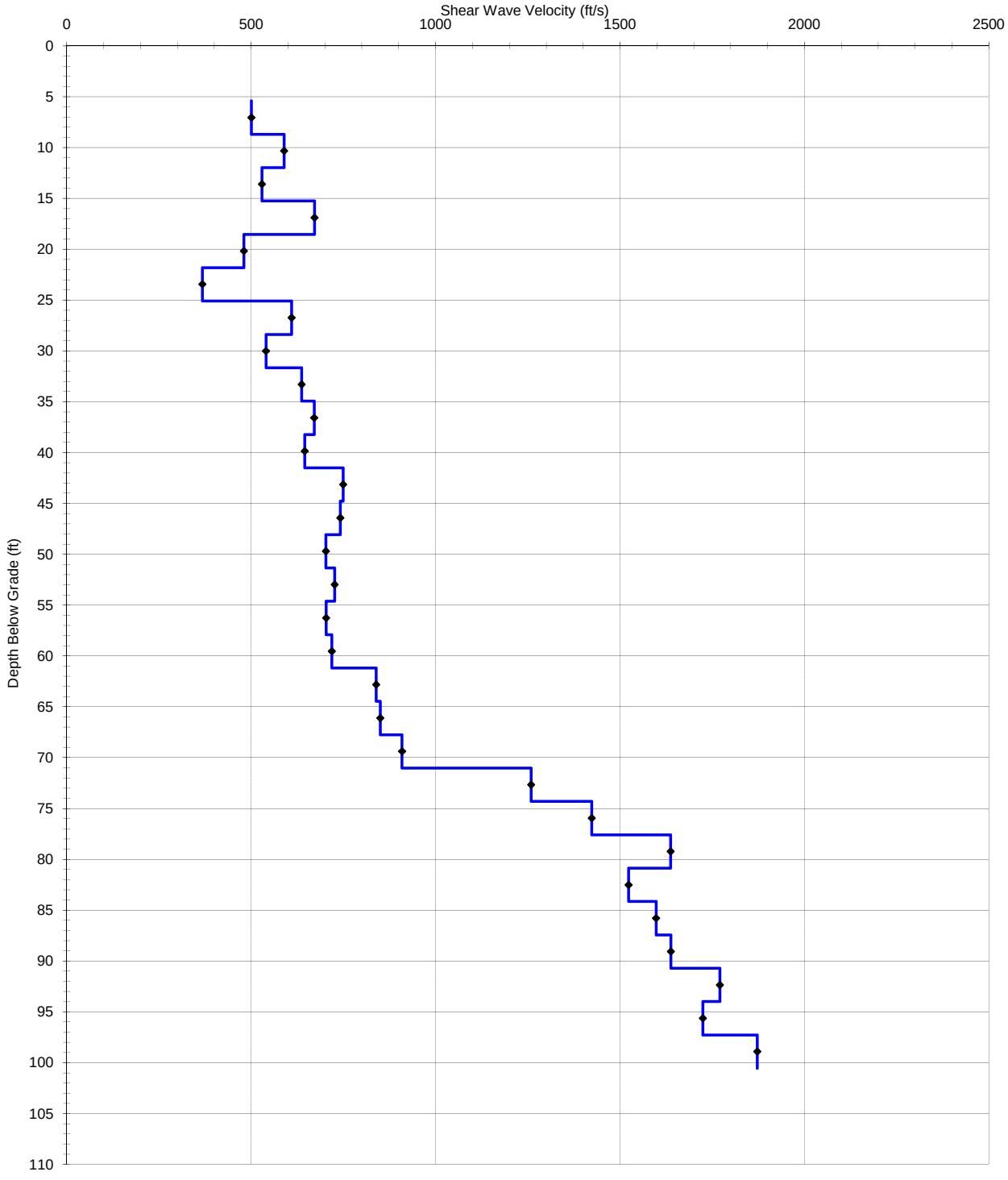


Max Depth: 30.850 m / 101.21 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 965CP306.COR
Unit Wt: SBT Chart Soil Zones

SBT: Lunne, Robertson and Powell, 1997
Page No: 1 of 1

Shear Wave Velocity- CPT-306
MLK Freeway
10-965
September 3, 2010



ConeTec Shear Wave Velocity Data Reduction Sheet

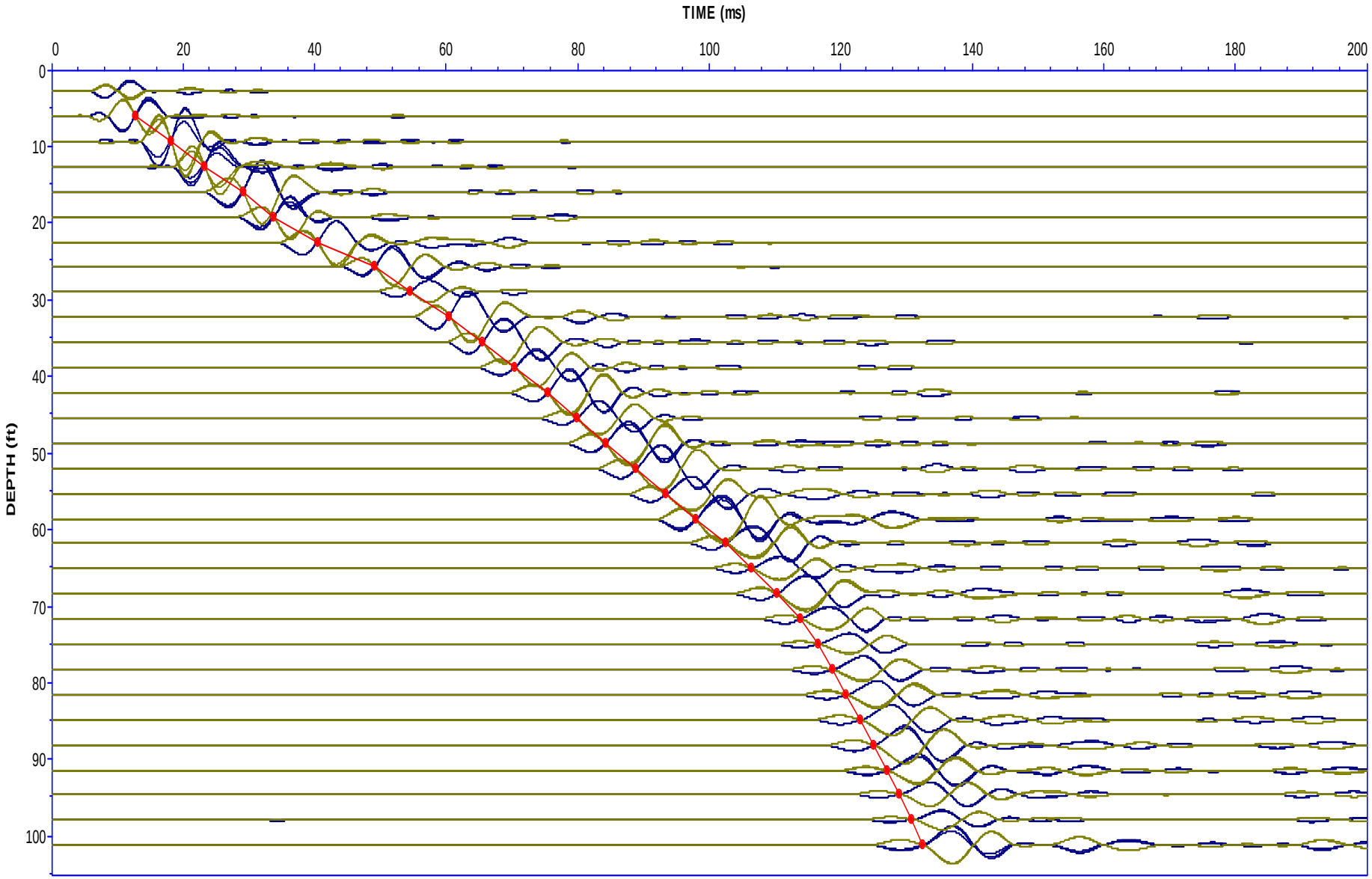
Hole: CPT-306
Location: MLK Freeway
Cone: AD214
Date: 3-Sep-10
Source: Beam

Source Depth	0.00 m
Source Offset	1.45 m

Tip Depth (m)	Geophone Depth(m)	Travel Path (m)	Interval time (ms)	Velocity (m/s)	Velocity (ft/s)	Interval Depth (m)	Interval Depth (ft)
0.00							
1.85	1.65	2.20					
2.85	2.65	3.02	5.40	152.6	500.7	2.15	7.05
3.85	3.65	3.93	5.05	179.5	589.1	3.15	10.33
4.85	4.65	4.87	5.85	161.3	529.1	4.15	13.61
5.85	5.65	5.83	4.70	204.7	671.7	5.15	16.90
6.85	6.65	6.81	6.65	146.3	480.1	6.15	20.18
7.85	7.65	7.79	8.75	112.0	367.4	7.15	23.46
8.85	8.65	8.77	5.30	185.8	609.5	8.15	26.74
9.85	9.65	9.76	6.00	164.6	540.1	9.15	30.02
10.85	10.65	10.75	5.10	194.1	636.8	10.15	33.30
11.85	11.65	11.74	4.85	204.4	670.8	11.15	36.58
12.85	12.65	12.73	5.05	196.6	645.0	12.15	39.86
13.85	13.65	13.73	4.35	228.5	749.6	13.15	43.14
14.85	14.65	14.72	4.40	226.1	741.7	14.15	46.42
15.85	15.65	15.72	4.65	214.1	702.3	15.15	49.70
16.85	16.65	16.71	4.50	221.3	726.1	16.15	52.98
17.85	17.65	17.71	4.65	214.3	703.0	17.15	56.27
18.85	18.65	18.71	4.55	219.1	718.7	18.15	59.55
19.85	19.65	19.70	3.90	255.7	838.8	19.15	62.83
20.85	20.65	20.70	3.85	259.1	849.9	20.15	66.11
21.85	21.65	21.70	3.60	277.1	909.1	21.15	69.39
22.85	22.65	22.70	2.60	383.8	1259.1	22.15	72.67
23.85	23.65	23.69	2.30	433.9	1423.6	23.15	75.95
24.85	24.65	24.69	2.00	499.1	1637.4	24.15	79.23
25.85	25.65	25.69	2.15	464.3	1523.3	25.15	82.51
26.85	26.65	26.69	2.05	487.0	1597.8	26.15	85.79
27.85	27.65	27.69	2.00	499.3	1638.0	27.15	89.07
28.85	28.65	28.69	1.85	539.8	1770.9	28.15	92.35
29.85	29.65	29.69	1.90	525.6	1724.5	29.15	95.64
30.85	30.65	30.68	1.75	570.7	1872.5	30.15	98.92

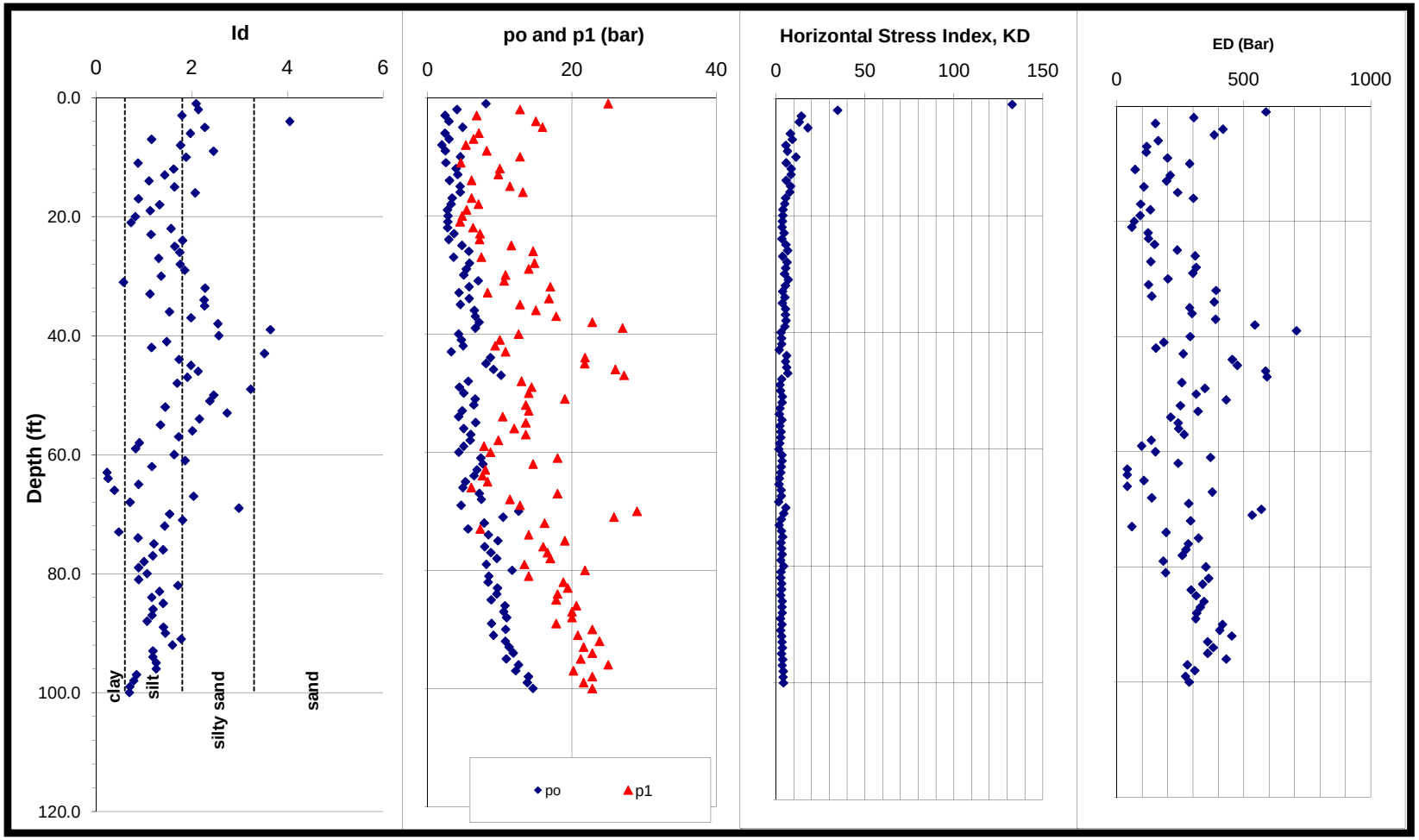
Job No: 10-965 Client: Schnabel Project Title: MLK Freeway Operator: TS-RK Hole: CPT-306 Site: MLK Freeway Date: 09:03:10 12:58

Oversite: 214:T1500F15U500



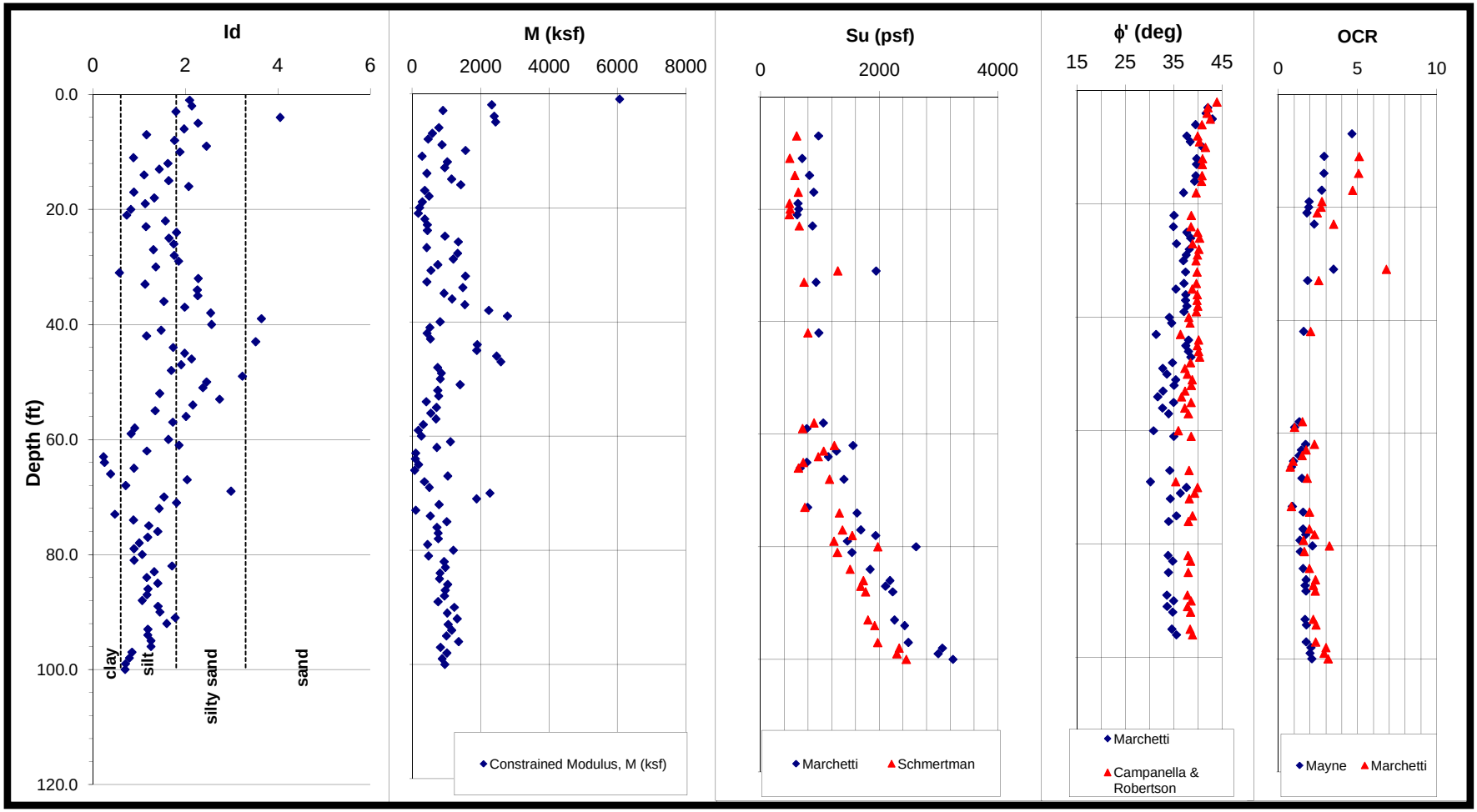
DILATOMETER TEST RESULTS

Test ID: DMT-046
Site: MLK Freeway
Location: Portsmouth, VA
Project No.: 10-951



DILATOMETER TEST RESULTS

Test ID: DMT-046
Site: MLK Freeway
Location: Portsmouth, VA
Project No.: 10-951



Job No: 10-951
Job Name: MLK Freeway
Job Location: Portsmouth, VA
Date: 7/28/10
Sounding No: DMT-046
Ground Water Depth (ft): 4.5

ΔA = 0.2 bar
ΔB = 0.175 bar
Zm= 0 bar

[1] Depth Below Existing Ground Surface
[2] Mayne, 1995
[3] Marchetti,1980
[4] Marchetti, 1997
[5] Campanella and Robertson, 1991
[6] Marchetti,1980
[7] Schmertman, 1981

CONETEC

Depth[1]	A	B	C	po	p1	p2	u_o	σ_{vo}	σ_{vo}'			E_D				ϕ'[4]	ϕ'[5]		E_D	s_u[6]	s_u[7]	M
(ft)	(bar)	(bar)	(bar)	(bar)	(bar)	(bar)	(psf)	(psf)	(psf)	Id	K_D	(bar)	K_o	OCR[2]	OCR[3]	(deg)	(deg)	R_M	(ksf)	(psf)	(psf)	(ksf)
1.0	8.7	25.2	0	8.1	25.025		0	127	127	2.09	132.8	588	7.6			49.5	46.7	4.95	1227			6072
2.0	4.3	13	0	4.1	12.825		0	246	246	2.14	34.6	303	3.8			45.5	44.0	3.68	633			2329
3.0	2.45	7	0	2.4	6.825		0	358	358	1.80	14.2	152	2.3			42.0	42.1	2.83	318			900
4.0	3.35	15.2	0	3.0	15.025		0	477	477	4.05	13.0	418	2.2			41.7	41.9	2.75	873			2401
5.0	5.2	16.1	0	4.9	15.925		31	599	568	2.27	17.9	383	2.6			43.0	42.6	3.05	801			2443
6.0	2.45	7.3	0	2.4	7.125		94	711	617	1.97	8.1	163	1.6			39.5	40.8	2.30	341			782
7.0	2.95	6.55	0	3.0	6.375		156	823	667	1.16	9.1	118	1.7	4.6	10.7			2.41	245	979	609	591
8.0	1.95	5.5	0	2.0	5.325		218	932	713	1.77	5.5	116	1.2			37.7	40.0	1.94	242			468
9.0	2.55	8.4	0	2.5	8.225		281	1045	764	2.45	6.4	199	1.4			38.4	40.3	2.10	417			873
10.0	4.75	13	0	4.6	12.825		343	1164	821	1.88	11.2	287	2.0			41.0	41.6	2.61	599			1561
11.0	2.45	4.8	0	2.6	4.625		406	1272	866	0.88	5.7	72	1.3	2.9	5.1			1.93	150	703	492	290
12.0	4.05	10.2	0	4.0	10.025		468	1388	920	1.62	8.5	210	1.7			39.7	41.0	2.34	439			1029
13.0	4.25	10	0	4.2	9.825		530	1504	974	1.44	8.4	196	1.6			39.7	40.9	2.33	409			954
14.0	3	6.3	0	3.1	6.125		593	1615	1022	1.11	5.7	107	1.3	2.9	5.1			1.94	223	825	579	431
15.0	4.65	11.6	0	4.5	11.425		655	1733	1078	1.64	8.2	240	1.6			39.6	40.9	2.30	500			1153
16.0	4.75	13.4	0	4.5	13.225		718	1852	1134	2.07	7.7	301	1.6			39.3	40.7	2.26	630			1423
17.0	3.35	6.3	0	3.4	6.125		780	1963	1183	0.89	5.4	94	1.2	2.7	4.7			1.88	196	897	637	368
18.0	3.25	7.25	0	3.3	7.075		842	2075	1232	1.33	4.9	132	1.1			37.0	39.6	1.79	276			495
19.0	2.7	5.6	0	2.8	5.425		905	2184	1279	1.13	3.8	92	1.0	1.9	2.7			1.55	192	632	489	297
20.0	2.75	5	0	2.9	4.825		967	2291	1324	0.82	3.8	68	0.9	1.9	2.7			1.52	143	644	500	216
21.0	2.7	4.7	0	2.8	4.525		1030	2398	1368	0.73	3.6	59	0.9	1.8	2.4			1.45	124	617	486	179
22.0	2.75	6.5	0	2.8	6.325		1092	2508	1416	1.57	3.3	123	0.9			35.1	38.6	1.44	257			370
23.0	3.65	7.45	0	3.7	7.275		1154	2621	1466	1.15	4.5	125	1.1	2.3	3.5			1.70	261	877	653	443
24.0	2.95	7.4	0	2.9	7.225		1217	2732	1516	1.81	3.3	148	0.8			34.9	38.6	1.44	310			446
25.0	4.9	11.8	0	4.8	11.625		1279	2850	1571	1.65	5.5	238	1.2			37.7	40.0	1.93	497			960
26.0	5.95	14.8	0	5.7	14.625		1342	2970	1629	1.75	6.5	309	1.4			38.5	40.3	2.09	645			1350
27.0	3.6	7.65	0	3.6	7.475		1404	3083	1679	1.31	3.7	134	0.9			35.6	38.9	1.52	280			424
28.0	6.05	15	0	5.8	14.825		1466	3203	1737	1.76	6.2	312	1.3			38.2	40.2	2.04	653			1331
29.0	5.6	14.2	0	5.4	14.025		1529	3323	1794	1.85	5.4	300	1.2			37.6	39.9	1.92	626			1203
30.0	5.1	11	0	5.0	10.825		1591	3440	1849	1.36	4.8	201	1.1			37.0	39.6	1.79	420			751
31.0	7	10.8	0	7.0	10.625		1654	3556	1902	0.58	6.8	125	1.4	3.5	6.8			2.11	261	1949	1303	550
32.0	6.1	17.2	0	5.8	17.025		1716	3678	1962	2.28	5.3	391	1.2			37.4	39.8	1.91	816			1560
33.0	4.35	8.5	0.2	4.4	8.325	0.40	1778	3791	2013	1.13	3.6	138	0.9	1.9	2.5			1.50	287	937	733	431
34.0	6.1	17	0.05	5.8	16.825	0.25	1841	3913	2072	2.26	4.9	383	1.1			37.1	39.7	1.85	801			1483
35.0	4.75	13	0.1	4.6	12.825	0.30	1903	4031	2127	2.27	3.6	287	0.9			35.4	38.8	1.56	599			934
36.0	6.7	15.2	0	6.5	15.025		1966	4151	2186	1.54	5.3	296	1.2			37.5	39.9	1.89	618			1168
37.0	6.95	18	0	6.6	17.825		2028	4274	2246	1.99	5.2	389	1.2			37.4	39.8	1.90	812			1542
38.0	7.7	23	0.2	7.2	22.825	0.40	2090	4399	2308	2.55	5.6	544	1.3			37.7	40.0	1.97	1136			2242
39.0	7.4	27.2	0	6.6	27.025		2153	4525	2372	3.64	4.9	708	1.1			37.1	39.7	1.89	1478			2787
40.0	4.5	12.8	0.2	4.3	12.625	0.40	2215	4642	2427	2.57	2.8	289	0.7			34.1	38.1	1.36	603			817
41.0	4.75	10.2	0.4	4.7	10.025	0.60	2278	4758	2480	1.48	3.0	185	0.8			34.6	38.4	1.35	386			520
42.0	4.95	9.55	0.2	4.9	9.375	0.40	2340	4872	2532	1.16	3.1	154	0.8	1.6	2.0			1.36	322	983	797	437
43.0	3.45	11	0.1	3.3	10.825	0.30	2402	4987	2584	3.52	1.7	261	0.5			31.4	36.4	0.98	546			533
44.0	9.15	22	0.1	8.7	21.825	0.30	2465	5112	2647	1.74	6.0	455	1.3			38.1	40.1	2.01	949			1905
45.0	8.55	21.95	0.1	8.1	21.775	0.30	2527	5237	2710	1.99	5.3	475	1.2			37.5	39.9	1.91	991			1891
46.0	9.75	26.2	0.1	9.1	26.025	0.30	2590	5364	2774	2.13	6.0	586	1.3			38.0	40.1	2.02	1223			2471
47.0	10.8	27.4	0.15	10.2	27.225	0.35	2652	5492	2840	1.91	6.6	591	1.4			38.5	40.4	2.10	1235			2597
48.0	5.8	13.2	0.3	5.6	13.025	0.50	2714	5610	2896	1.70	3.1	256	0.8			34.7	38.4	1.39	535			745
49.0	4.7	14.6	0.25	4.4	14.425	0.45	2777	5728	2952	3.23	2.2	347	0.6			32.7	37.3	1.18	725			856
50.0	5.25	14.2	0.2	5.0	14.025	0.40	2839	5847	3008	2.46	2.5	312	0.7			33.6	37.8	1.26	653			824
51.0	7	19.2	0	6.6	19.025		2902	5969	3068	2.38	3.6	431	0.9			35.4	38.8	1.56	900			1403
52.0	6.55	13.8	0.45	6.4	13.625	0.65	2964	6088	3124	1.45	3.3	250	0.9			35.1	38.6	1.43	523			751
53.0	5.05	14.2	0.3	4.8	14.025	0.50	3026	6207	3180	2.74	2.2	320	0.6			32.8	37.3	1.16	668			776
54.0	4.4	10.6	0	4.3	10.425		3089	6321	3233	2.16	1.8	212	0.5			31.7	36.6	0.93	443			413
55.0	6.8	13.8	0.4	6.7	13.625	0.60	3151	6440	3289	1.35	3.3	241	0.8			35.0	38.6	1.41	504			711
56.0	5.15	12.2	0.6	5.0	12.025	0.80	3214	6557	3344	2.02	2.2	243	0.6			32.7	37.3	1.08	508			546

Job No: 10-951
Job Name: MLK Freeway
Job Location: Portsmouth, VA
Date: 7/28/10
Sounding No: DMT-046
Ground Water Depth (ft): 4.5

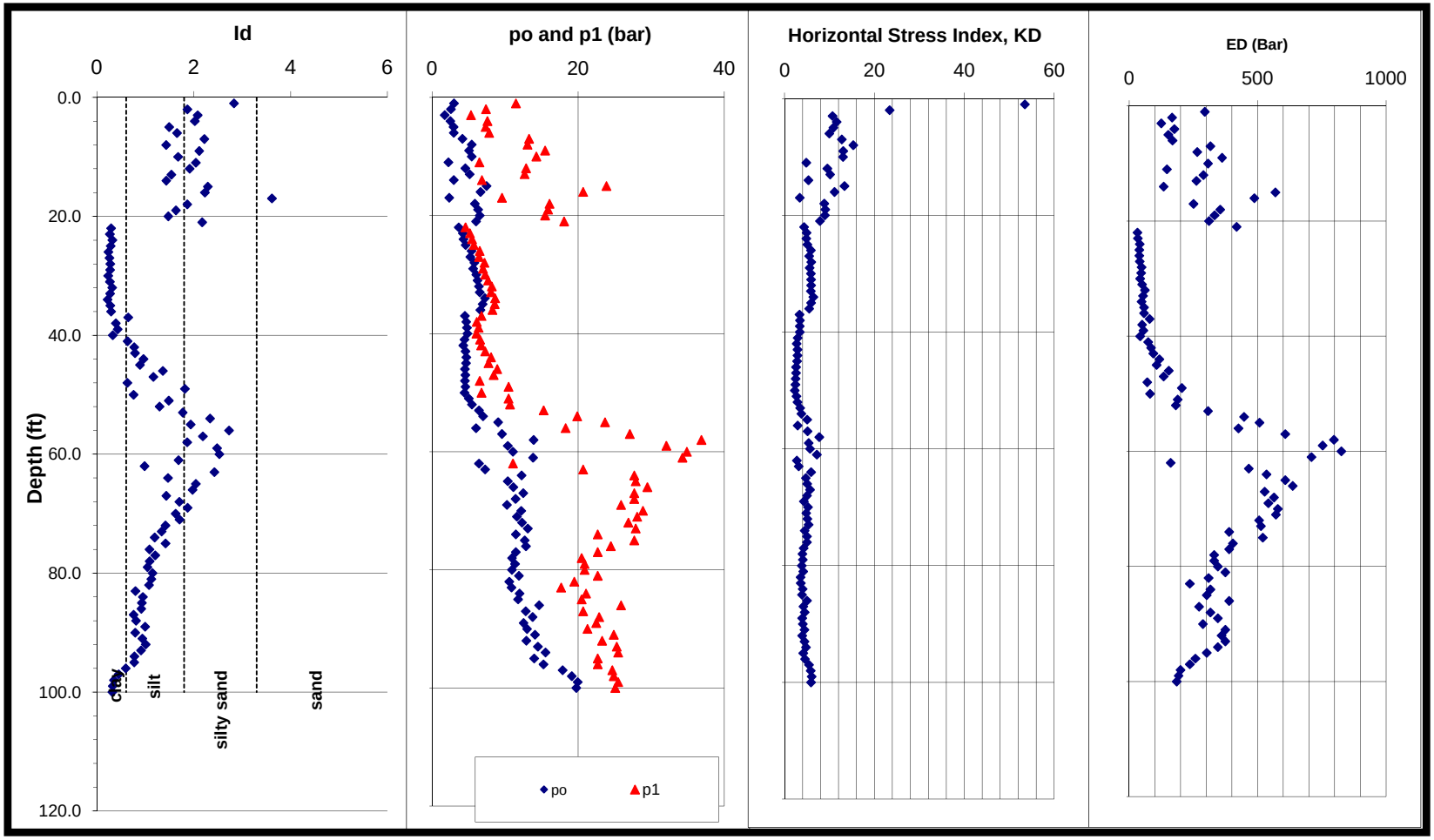
ΔA = 0.2 bar
ΔB = 0.175 bar
Zm= 0 bar

[1] Depth Below Existing Ground Surface
[2] Mayne, 1995
[3] Marchetti,1980
[4] Marchetti, 1997
[5] Campanella and Robertson, 1991
[6] Marchetti,1980
[7] Schmertman, 1981

Depth[1]	A	B	C	po	p1	p2	u_o	σ_{vo}	σ_{vo}'			E_D				ϕ'[4]	ϕ'[5]		E_D	s_u[6]	s_u[7]	M
(ft)	(bar)	(bar)	(bar)	(bar)	(bar)	(bar)	(psf)	(psf)	(psf)	Id	K_D	(bar)	K_o	OCR[2]	OCR[3]	(deg)	(deg)	R_M	(ksf)	(psf)	(psf)	(ksf)
57.0	6.15	13.8	0.5	6.0	13.625	0.70	3276	6676	3400	1.73	2.7	265	0.7			33.9	38.0	1.26	554			697
58.0	5.9	10	0.5	5.9	9.825	0.70	3338	6790	3452	0.91	2.6	136	0.7	1.3	1.5			1.15	283	1060	901	326
59.0	4.95	8	0.45	5.0	7.825	0.65	3401	6902	3501	0.83	2.0	97	0.6	1.0	1.0			0.89	204	780	708	180
60.0	4.35	8.9	0.8	4.3	8.725	1.00	3463	7014	3551	1.63	1.6	152	0.4			30.8	35.9	0.85	318			270
61.0	7.7	18.2	0.4	7.4	18.025	0.60	3526	7137	3611	1.86	3.3	369	0.8			35.0	38.6	1.45	770			1121
62.0	7.8	14.8	1.5	7.7	14.625	1.70	3588	7256	3668	1.17	3.4	241	0.9	1.7	2.3			1.43	504	1560	1243	721
63.0	6.7	8.2	3.5	6.8	8.025	3.70	3650	7365	3715	0.23	2.9	41	0.8	1.5	1.8			1.22	86	1281	1064	104
64.0	6.3	7.8	2.5	6.4	7.625	2.70	3713	7474	3761	0.25	2.6	41	0.7	1.3	1.5			1.12	86	1144	975	96
65.0	5.2	8.5	1.2	5.3	8.325	1.40	3775	7586	3810	0.89	1.9	107	0.5	1.0	0.9			0.85	223	780	720	189
66.0	4.75	6.25	2.3	4.9	6.075	2.50	3838	7692	3854	0.39	1.7	41	0.4	0.8	0.7			0.85	86	670	638	73
67.0	7.5	18.2	0.2	7.2	18.025	0.40	3900	7814	3914	2.04	2.8	376	0.7			34.2	38.1	1.33	786			1043
68.0	7.45	11.6	1.1	7.5	11.425	1.30	3962	7930	3967	0.71	2.9	138	0.8	1.5	1.8			1.25	287	1406	1162	359
69.0	4.85	13	0.4	4.7	12.825	0.60	4025	8046	4021	2.99	1.4	283	0.4			30.2	35.4	0.85	592			503
70.0	13.2	29.2	0.55	12.6	29.025	0.75	4087	8175	4088	1.54	5.4	569	1.2			37.6	39.9	1.91	1189			2276
71.0	11	26	0.7	10.5	25.825	0.90	4150	8302	4152	1.81	4.3	533	1.0			36.4	39.3	1.69	1113			1885
72.0	8.05	16.4	0.8	7.9	16.225	1.00	4212	8423	4211	1.44	2.9	291	0.8			34.3	38.2	1.30	607			787
73.0	5.5	7.5	1.4	5.6	7.325	1.60	4274	8532	4257	0.48	1.8	59	0.5	0.9	0.8			0.85	124	794	746	105
74.0	8.5	14.2	0.3	8.4	14.025	0.50	4337	8650	4314	0.88	3.1	194	0.8	1.6	2.0			1.31	405	1627	1328	532
75.0	10	19.2	0	9.8	19.025		4399	8774	4374	1.21	3.7	322	0.9			35.6	38.9	1.51	672			1013
76.0	8.1	16.2	0	7.9	16.025		4462	8894	4433	1.40	2.7	281	0.7			34.0	38.0	1.23	588			726
77.0	8.95	16.8	0	8.8	16.625		4524	9015	4491	1.19	3.1	272	0.8	1.6	2.0			1.34	569	1691	1381	760
78.0	9.75	17.2	0.3	9.6	17.025	0.50	4586	9137	4551	1.00	3.4	258	0.9	1.7	2.3			1.42	538	1941	1546	765
79.0	8.2	13.6	0	8.1	13.425		4649	9255	4606	0.89	2.7	183	0.7	1.4	1.6			1.18	382	1465	1237	450
80.0	12	22	0	11.7	21.825		4711	9380	4669	1.07	4.2	351	1.0	2.2	3.2			1.65	732	2622	1976	1205
81.0	8.55	14.2	0.15	8.5	14.025	0.35	4774	9499	4725	0.89	2.7	192	0.7	1.4	1.6			1.20	401	1541	1295	481
82.0	8.7	19	0	8.4	18.825		4836	9621	4785	1.71	2.7	362	0.7			33.8	37.9	1.24	755			935
83.0	9.95	19.6	0.2	9.7	19.425	0.40	4898	9745	4846	1.33	3.2	338	0.8			34.8	38.5	1.37	706			970
84.0	9.8	18.2	0	9.6	18.025		4961	9867	4906	1.17	3.1	292	0.8	1.6	2.0			1.33	611	1848	1509	815
85.0	9.05	18	0	8.8	17.825		5023	9989	4966	1.40	2.7	312	0.7			33.9	38.0	1.23	653			800
86.0	11	20.8	0.5	10.7	20.625	0.70	5086	10113	5027	1.19	3.4	343	0.9	1.8	2.3			1.45	717	2183	1732	1039
87.0	10.8	20.2	0	10.5	20.025		5148	10236	5088	1.17	3.3	329	0.9	1.7	2.2			1.41	687	2108	1688	969
88.0	11.2	20.2	0	11.0	20.025		5210	10360	5150	1.07	3.4	314	0.9	1.7	2.3			1.44	656	2229	1770	944
89.0	9.1	18	0.3	8.9	17.825	0.50	5273	10482	5209	1.41	2.5	311	0.7			33.6	37.8	1.17	649			759
90.0	11.2	23	0	10.8	22.825		5335	10607	5272	1.45	3.3	416	0.8			35.0	38.6	1.42	869			1233
91.0	9.5	21	0	9.1	20.825		5398	10731	5333	1.78	2.6	405	0.7			33.6	37.8	1.21	847			1026
92.0	11.2	24	0.45	10.8	23.825	0.65	5460	10856	5396	1.60	3.2	453	0.8			34.8	38.5	1.39	945			1318
93.0	11.6	21.8	0	11.3	21.625		5522	10981	5459	1.19	3.3	358	0.9	1.7	2.2			1.41	748	2259	1810	1055
94.0	12.2	23	0.3	11.9	22.825	0.50	5585	11106	5521	1.19	3.5	380	0.9	1.8	2.4			1.46	793	2429	1922	1158
95.0	11.2	21.4	0.2	10.9	21.225	0.40	5647	11231	5583	1.26	3.1	358	0.8			34.6	38.4	1.34	748			1002
96.0	13	25.2	0	12.6	25.025		5710	11357	5647	1.26	3.7	431	0.9			35.5	38.9	1.51	900			1359
97.0	12.4	20.4	0	12.2	20.225		5772	11481	5709	0.85	3.5	278	0.9	1.8	2.4			1.43	580	2491	1975	829
98.0	14.2	23	0	14.0	22.825		5834	11606	5771	0.79	4.0	307	1.0	2.1	3.0			1.58	641	3065	2336	1016
99.0	14	21.8	0	13.8	21.625		5897	11730	5833	0.71	3.9	271	1.0	2.0	2.9			1.55	565	2995	2299	877
100.0	14.8	23	0.8	14.6	22.825	1.00	5959	11855	5896	0.70	4.2	285	1.0	2.1	3.1			1.61	595	3244	2455	957

DILATOMETER TEST RESULTS

Test ID: DMT-090
Site: MLK Freeway
Location: Portsmouth, VA
Project No.: 10-951



DILATOMETER TEST RESULTS

Test ID: DMT-090
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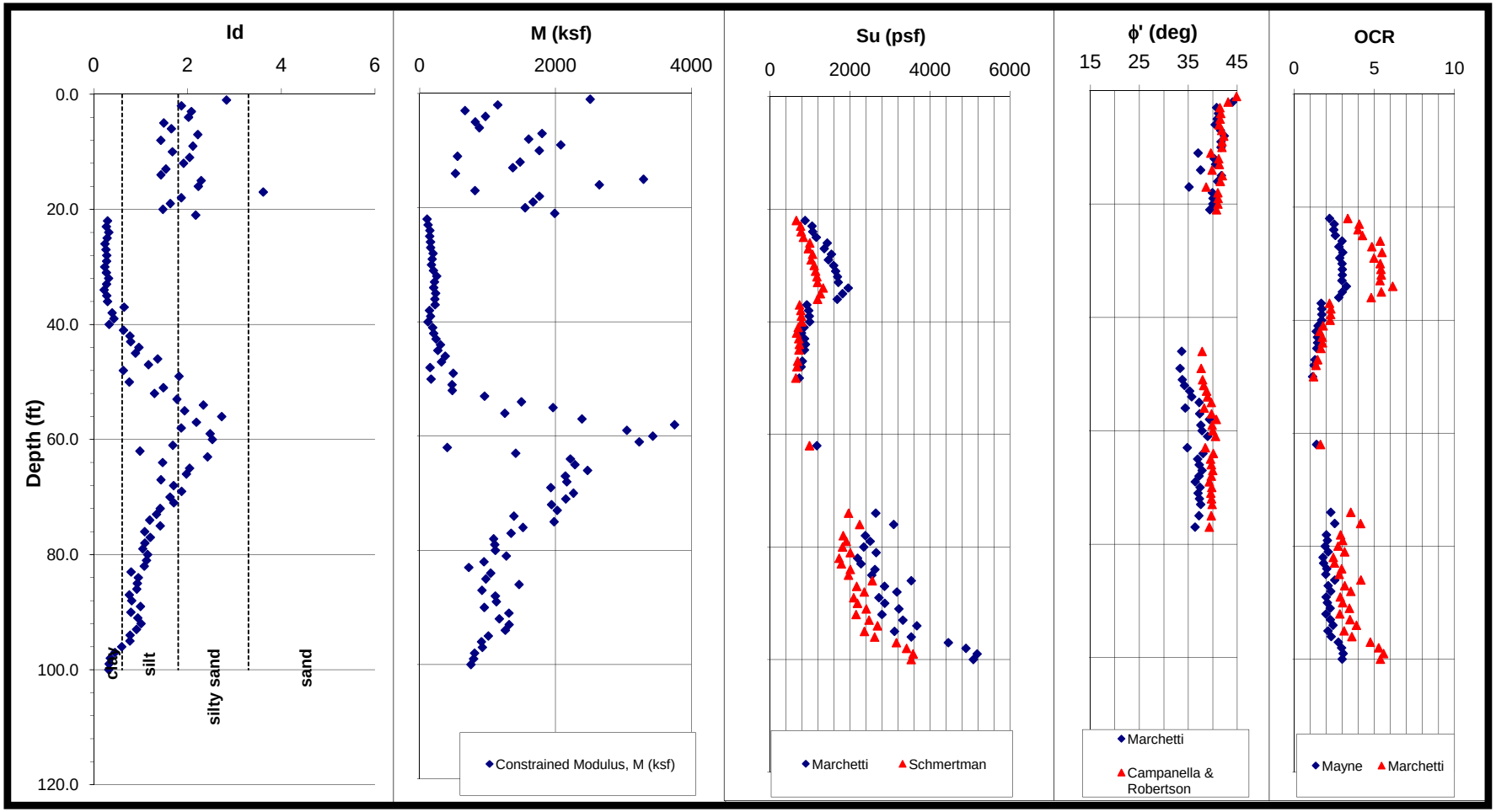


Job No: 10-951
Job Name: MLK Freeway
Job Location: Portsmouth, VA
Date: 7/28/10
Sounding No: DMT-090
Ground Water Depth (ft): 5

ΔA = 0.2 bar
ΔB = 0.325 bar
Zm= 0 bar

[1] Depth Below Existing Ground Surface
[2] Mayne, 1995
[3] Marchetti,1980
[4] Marchetti, 1997
[5] Campanella and Robertson, 1991
[6] Marchetti,1980
[7] Schmertman, 1981

Depth[1] (ft)	A (bar)	B (bar)	C (bar)	po (bar)	p1 (bar)	p2 (bar)	u_o (psf)	σ_{vo} (psf)	σ_{vo}' (psf)	Id	K_D	E_D (bar)	K_o	OCR[2]	OCR[3]	ϕ'[4] (deg)	ϕ'[5] (deg)	R_M	E_D (ksf)	s_u[6] (psf)	s_u[7] (psf)	M (ksf)
1.0	3.2	11.8	0	3.0	11.475		0	117	117	2.83	53.5	294	4.8			47.0	44.9	4.09	614			2512
2.0	2.6	7.7	0	2.6	7.375		0	230	230	1.87	23.4	167	3.0			44.0	43.1	3.30	348			1150
3.0	1.7	5.65	0	1.7	5.325		0	339	339	2.08	10.7	125	1.9			40.8	41.5	2.56	261			667
4.0	2.55	7.9	0	2.5	7.575		0	452	452	2.02	11.6	176	2.0			41.2	41.6	2.64	367			969
5.0	2.95	7.65	0	2.9	7.325		0	565	565	1.49	10.9	152	1.9			40.9	41.5	2.58	318			819
6.0	3	8.15	0	3.0	7.825		62	679	616	1.65	10.0	169	1.8			40.5	41.3	2.50	352			879
7.0	4.4	13.6	0	4.2	13.275		125	798	673	2.22	12.7	316	2.1			41.6	41.9	2.73	660			1802
8.0	5.6	13.4	0	5.4	13.075		187	918	730	1.43	15.3	265	2.4			42.3	42.2	2.90	554			1606
9.0	5.35	15.8	0	5.1	15.475		250	1039	789	2.11	13.1	362	2.2			41.7	41.9	2.75	755			2079
10.0	5.65	14.6	0	5.4	14.275		312	1159	847	1.68	13.0	307	2.2			41.7	41.9	2.75	641			1763
11.0	2.25	6.8	0	2.2	6.475		374	1270	896	2.04	4.8	147	1.1			37.0	39.6	1.82	306			558
12.0	4.75	13.2	0	4.6	12.875		437	1389	953	1.92	9.5	289	1.8			40.3	41.2	2.45	603			1480
13.0	5.3	13	0	5.1	12.675		499	1509	1009	1.54	10.1	261	1.9			40.6	41.4	2.51	546			1372
14.0	2.95	7.15	0	3.0	6.825		562	1620	1059	1.43	5.3	134	1.2			37.5	39.9	1.89	280			528
15.0	8.05	24.2	0	7.5	23.875		624	1747	1123	2.29	13.3	569	2.2			41.8	41.9	2.77	1189			3297
16.0	7.1	21	0	6.6	20.675		686	1871	1185	2.23	11.1	487	2.0			41.0	41.6	2.60	1018			2646
17.0	2.5	9.9	0	2.4	9.575		749	1985	1236	3.61	3.4	250	0.9			35.1	38.7	1.56	523			814
18.0	6.15	16.4	0	5.9	16.075		811	2107	1295	1.86	8.8	354	1.7			39.9	41.0	2.38	740			1763
19.0	6.55	16.2	0	6.3	15.875		874	2228	1355	1.63	9.1	332	1.7			40.0	41.1	2.41	694			1670
20.0	6.75	15.8	0	6.5	15.475		936	2350	1414	1.47	9.0	311	1.7			40.0	41.1	2.40	649			1554
21.0	6.4	18.4	0	6.0	18.075		998	2473	1474	2.17	7.9	418	1.6			39.4	40.8	2.28	873			1989
22.0	3.5	4.9	1.45	3.7	4.575	1.65	1061	2578	1517	0.29	4.3	32	1.0	2.2	3.3			1.64	67	878	658	109
23.0	4.05	5.5	2.5	4.2	5.175	2.70	1123	2684	1561	0.26	4.9	34	1.1	2.5	4.1			1.77	70	1054	766	125
24.0	4.15	5.8	2.3	4.3	5.475	2.50	1186	2791	1605	0.32	4.8	41	1.1	2.5	4.0			1.76	86	1068	778	150
25.0	4.45	6.05	2.5	4.6	5.725	2.70	1248	2898	1650	0.28	5.1	39	1.2	2.6	4.3			1.80	82	1159	835	147
26.0	5.25	6.85	3.05	5.4	6.525	3.25	1310	3006	1696	0.24	5.9	39	1.3	3.0	5.4			1.95	82	1434	996	160
27.0	5.1	6.75	3.15	5.2	6.425	3.35	1373	3115	1742	0.26	5.5	41	1.2	2.8	4.8			1.89	86	1357	958	162
28.0	5.65	7.5	3.5	5.8	7.175	3.70	1435	3224	1789	0.27	5.9	48	1.3	3.0	5.5			1.97	101	1538	1064	198
29.0	5.5	7.3	3.5	5.6	6.975	3.70	1498	3334	1836	0.27	5.6	46	1.3	2.8	5.0			1.90	97	1462	1027	185
30.0	5.9	7.6	3.7	6.0	7.275	3.90	1560	3443	1883	0.23	5.9	43	1.3	3.0	5.4			1.95	89	1592	1106	175
31.0	6.1	8	3.9	6.2	7.675	4.10	1622	3553	1931	0.26	5.9	50	1.3	3.0	5.4			1.96	105	1642	1139	205
32.0	6.3	8.5	4.1	6.4	8.175	4.30	1685	3665	1980	0.31	5.9	61	1.3	3.0	5.4			1.96	127	1690	1172	250
33.0	6.4	8.4	4.5	6.5	8.075	4.70	1747	3776	2029	0.27	5.9	54	1.3	3.0	5.3			1.95	112	1710	1188	219
34.0	7.1	8.95	4.5	7.2	8.625	4.70	1810	3887	2077	0.22	6.4	48	1.4	3.3	6.1			2.04	101	1957	1330	206
35.0	6.8	8.9	4.6	6.9	8.575	4.80	1872	3999	2127	0.27	5.9	57	1.3	3.0	5.4			1.96	120	1815	1258	235
36.0	6.5	8.6	3.9	6.6	8.275	4.10	1934	4110	2175	0.29	5.5	57	1.2	2.8	4.8			1.88	120	1682	1189	225
37.0	4.4	7.1	0.7	4.5	6.775	0.90	1997	4220	2224	0.65	3.3	79	0.9	1.7	2.2			1.37	166	922	738	227
38.0	4.55	6.45	1.05	4.7	6.125	1.25	2059	4329	2269	0.39	3.4	50	0.9	1.7	2.3			1.39	105	969	772	146
39.0	4.65	6.7	0.95	4.8	6.375	1.15	2122	4437	2316	0.43	3.4	56	0.9	1.7	2.3			1.39	116	985	785	161
40.0	4.7	6.4	0.75	4.8	6.075	0.95	2184	4545	2361	0.33	3.4	43	0.9	1.7	2.2			1.38	89	993	793	124
41.0	4.35	6.9	0.6	4.4	6.575	0.80	2246	4655	2408	0.63	2.9	74	0.8	1.5	1.8			1.24	154	852	704	191
42.0	4.2	7.05	0.3	4.3	6.725	0.50	2309	4765	2456	0.77	2.7	85	0.7	1.4	1.6			1.17	177	787	664	208
43.0	4.5	7.6	0.5	4.6	7.275	0.70	2371	4876	2505	0.79	2.9	94	0.8	1.5	1.8			1.23	196	864	718	242
44.0	4.65	8.4	0.4	4.7	8.075	0.60	2434	4989	2555	0.96	2.9	118	0.8	1.5	1.8			1.25	245	887	736	308
45.0	4.6	8.05	0.5	4.7	7.725	0.70	2496	5101	2605	0.89	2.8	107	0.7	1.4	1.7			1.21	223	862	722	269
46.0	4.5	9.25	0.7	4.5	8.925	0.90	2558	5215	2656	1.36	2.6	154	0.7			33.6	37.8	1.17	322			377
47.0	4.55	8.75	0.55	4.6	8.425	0.75	2621	5328	2707	1.17	2.6	134	0.7	1.3	1.5			1.15	280	809	692	322
48.0	4.4	6.85	0.5	4.5	6.525	0.70	2683	5437	2754	0.63	2.4	70	0.7	1.2	1.4			1.06	146	777	672	155
49.0	4.65	10.8	0.75	4.6	10.475	0.95	2746	5552	2807	1.81	2.4	205	0.7			33.3	37.6	1.16	428			496
50.0	4.35	7.1	0.65	4.4	6.775	0.85	2808	5662	2854	0.76	2.3	81	0.6	1.2	1.2			0.99	169	733	646	168
51.0	5.1	10.8	0.85	5.0	10.475	1.05	2870	5778	2907	1.48	2.6	189	0.7			33.8	37.9	1.21	394			476

Job No: 10-951
Job Name: MLK Freeway
Job Location: Portsmouth, VA
Date: 7/28/10
Sounding No: DMT-090
Ground Water Depth (ft): 5

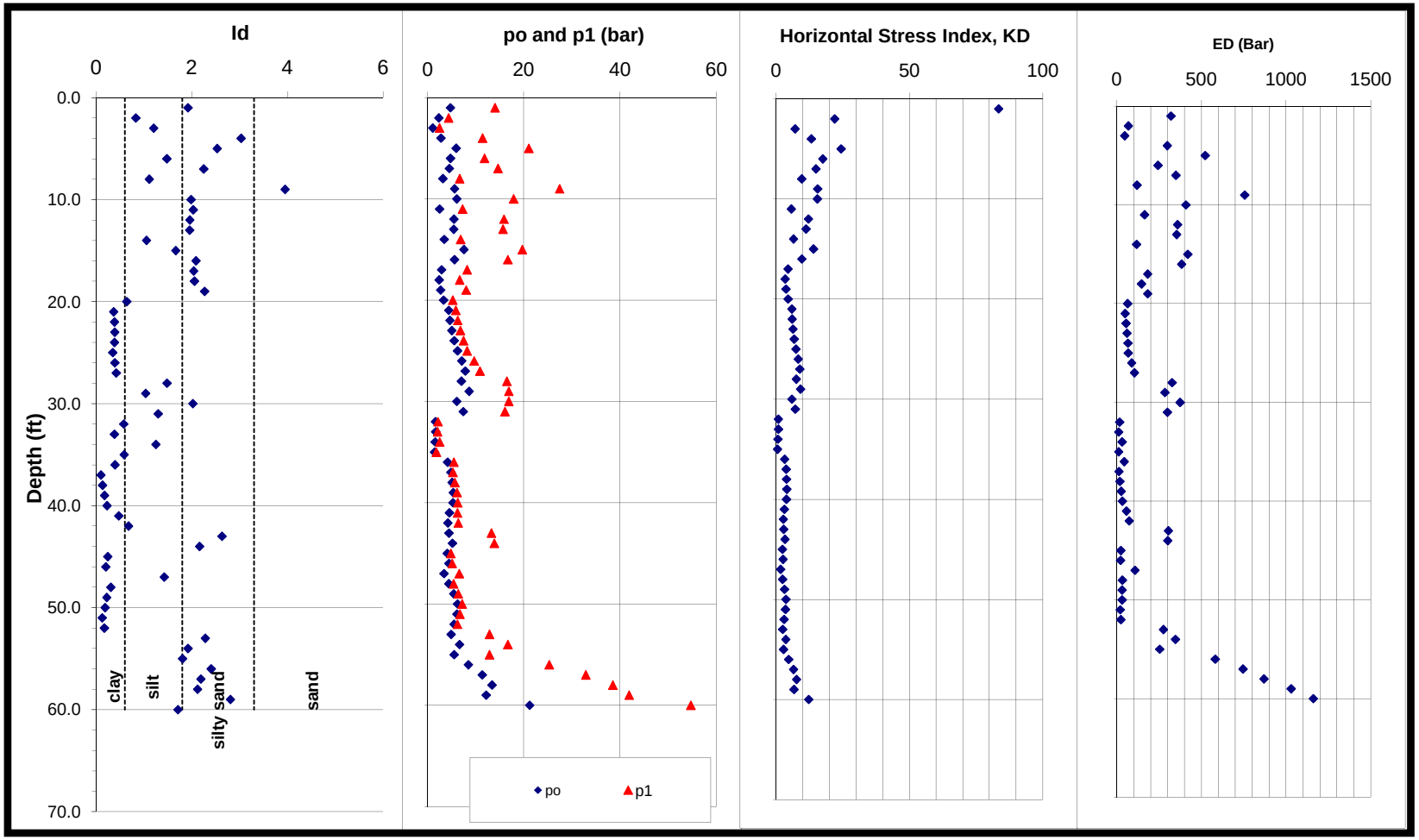
ΔA = 0.2 bar
ΔB = 0.325 bar
Zm= 0 bar

[1] Depth Below Existing Ground Surface
[2] Mayne, 1995
[3] Marchetti,1980
[4] Marchetti, 1997
[5] Campanella and Robertson, 1991
[6] Marchetti,1980
[7] Schmertman, 1981

Depth[1] (ft)	A (bar)	B (bar)	C (bar)	po (bar)	p1 (bar)	p2 (bar)	u_o (psf)	σ_{vo} (psf)	σ_{vo}' (psf)	Id	K_D	E_D (bar)	K_o	OCR[2]	OCR[3]	ϕ'[4] (deg)	ϕ'[5] (deg)	R_M	E_D (ksf)	s_u[6] (psf)	s_u[7] (psf)	M (ksf)
52.0	5.5	11	0.7	5.5	10.675	0.90	2933	5894	2961	1.29	2.9	181	0.8			34.2	38.2	1.27	379			481
53.0	6.65	15.6	0.5	6.4	15.275	0.70	2995	6014	3019	1.77	3.5	307	0.9			35.3	38.7	1.49	641			957
54.0	7.4	20.2	0.95	7.0	19.875	1.15	3058	6137	3079	2.33	3.7	447	0.9			35.7	38.9	1.60	934			1499
55.0	9.55	24	0.8	9.1	23.675	1.00	3120	6263	3143	1.93	5.0	507	1.2			37.2	39.7	1.85	1060			1965
56.0	6.4	18.6	0.4	6.0	18.275	0.60	3182	6385	3202	2.73	2.9	425	0.8			34.4	38.2	1.41	888			1255
57.0	10.2	27.4	0.75	9.6	27.075	0.95	3245	6512	3267	2.19	5.1	608	1.2			37.3	39.8	1.88	1269			2390
58.0	14.8	37.2	0.9	13.9	36.875	1.10	3307	6644	3337	1.86	7.7	797	1.6			39.3	40.7	2.26	1665			3754
59.0	11.2	32.4	1	10.4	32.075	1.20	3370	6773	3404	2.48	5.4	753	1.2			37.5	39.9	1.94	1573			3051
60.0	12	35.2	0.65	11.1	34.875	0.85	3432	6904	3472	2.53	5.7	826	1.3			37.8	40.0	1.99	1725			3433
61.0	14.6	34.6	0.9	13.8	34.275	1.10	3494	7035	3540	1.68	7.2	710	1.5			39.0	40.6	2.18	1482			3234
62.0	6.45	11.4	0.55	6.4	11.075	0.75	3557	7151	3594	0.98	2.7	161	0.7	1.4	1.6			1.21	337	1175	987	407
63.0	7.7	21	0.4	7.3	20.675	0.60	3619	7274	3655	2.43	3.2	465	0.8			34.8	38.5	1.46	972			1415
64.0	12.8	28	0.05	12.3	27.675	0.25	3682	7403	3721	1.47	5.9	535	1.3			38.0	40.1	1.99	1117			2220
65.0	11	28.2	0	10.4	27.875		3744	7531	3787	2.04	4.7	608	1.1			36.9	39.6	1.80	1269			2288
66.0	11.8	29.8	0.1	11.1	29.475	0.30	3806	7659	3853	1.97	5.0	637	1.2			37.2	39.7	1.86	1330			2473
67.0	13	28	0	12.5	27.675		3869	7788	3919	1.43	5.7	527	1.3			37.8	40.0	1.95	1101			2145
68.0	12	28	0.35	11.4	27.675	0.55	3931	7916	3984	1.70	5.0	564	1.2			37.2	39.7	1.84	1178			2167
69.0	10.8	26.2	0.3	10.3	25.875	0.50	3994	8043	4049	1.87	4.3	542	1.0			36.4	39.3	1.71	1132			1931
70.0	12.8	29.2	0.3	12.2	28.875	0.50	4056	8171	4115	1.62	5.2	578	1.2			37.4	39.8	1.88	1208			2265
71.0	12.2	28.4	0.3	11.6	28.075	0.50	4118	8299	4181	1.71	4.8	571	1.1			37.0	39.6	1.80	1193			2152
72.0	12.8	27.2	0.25	12.3	26.875	0.45	4181	8427	4247	1.41	5.1	506	1.2			37.2	39.7	1.84	1056			1942
73.0	13.6	28.2	0.2	13.1	27.875	0.40	4243	8556	4312	1.34	5.4	513	1.2			37.5	39.9	1.89	1071			2025
74.0	11.8	23	0.2	11.5	22.675	0.40	4306	8681	4376	1.19	4.5	389	1.1	2.3	3.5			1.71	812	2645	1964	1389
75.0	13.2	28	0	12.7	27.675		4368	8810	4442	1.41	5.0	520	1.2			37.2	39.7	1.82	1086			1980
76.0	13.2	24.8	1	12.8	24.475	1.20	4430	8936	4506	1.08	5.0	404	1.2	2.5	4.1			1.81	843	3094	2240	1522
77.0	11.8	23	0.3	11.5	22.675	0.50	4493	9062	4569	1.20	4.3	389	1.0			36.4	39.3	1.66	812			1347
78.0	11.2	20.8	0.4	10.9	20.475	0.60	4555	9186	4631	1.09	4.0	331	1.0	2.0	2.9			1.58	691	2388	1831	1090
79.0	11.6	21.2	0.4	11.3	20.875	0.60	4618	9310	4693	1.04	4.1	331	1.0	2.1	3.0			1.60	691	2506	1908	1107
80.0	11.2	21.2	0.55	10.9	20.875	0.75	4680	9435	4755	1.15	3.8	345	1.0	1.9	2.7			1.55	721	2345	1814	1115
81.0	12.2	23	0.75	11.9	22.675	0.95	4742	9560	4818	1.12	4.2	374	1.0	2.1	3.1			1.63	782	2654	2008	1277
82.0	10.8	19.8	0.9	10.6	19.475	1.10	4805	9684	4879	1.08	3.5	309	0.9	1.8	2.4			1.47	645	2193	1728	947
83.0	11	18	0.4	10.9	17.675	0.60	4867	9805	4938	0.80	3.6	236	0.9	1.8	2.5			1.47	493	2276	1785	724
84.0	12.2	21.4	0.9	12.0	21.075	1.10	4930	9930	5000	0.95	4.0	316	1.0	2.0	3.0			1.58	660	2626	2006	1046
85.0	12	20.8	0.55	11.8	20.475	0.75	4992	10054	5062	0.92	3.9	301	1.0	2.0	2.8			1.55	630	2547	1962	975
86.0	15	26.2	0.65	14.7	25.875	0.85	5054	10181	5127	0.92	5.0	389	1.2	2.5	4.2			1.80	812	3536	2558	1463
87.0	13	21	0.2	12.8	20.675	0.40	5117	10305	5188	0.76	4.2	272	1.0	2.1	3.2			1.61	569	2866	2167	918
88.0	14	23.2	1	13.8	22.875	1.20	5179	10431	5251	0.81	4.5	316	1.1	2.3	3.5			1.69	660	3174	2357	1115
89.0	12.8	22.8	1	12.5	22.475	1.20	5242	10556	5314	0.99	3.9	345	1.0	2.0	2.9			1.57	721	2726	2092	1131
90.0	13.2	21.6	0	13.0	21.275		5304	10680	5376	0.79	4.1	287	1.0	2.1	3.0			1.59	599	2871	2186	952
91.0	14.4	25.2	1.5	14.1	24.875	1.70	5366	10807	5441	0.94	4.4	374	1.1	2.3	3.4			1.68	782	3226	2405	1315
92.0	13.2	23.6	0.3	12.9	23.275	0.50	5429	10933	5504	1.01	3.9	360	1.0	2.0	2.8			1.56	751	2800	2153	1174
93.0	14.8	25.6	0.5	14.5	25.275	0.70	5491	11059	5568	0.91	4.4	374	1.1	2.3	3.5			1.69	782	3326	2476	1318
94.0	15.8	25.8	0.5	15.5	25.475	0.70	5554	11186	5633	0.77	4.8	345	1.1	2.4	3.9			1.75	721	3674	2687	1262
95.0	14.2	23	1.1	14.0	22.675	1.30	5616	11311	5695	0.77	4.1	301	1.0	2.1	3.1			1.61	630	3114	2359	1012
96.0	15.4	23	3.5	15.2	22.675	3.70	5678	11436	5758	0.59	4.5	258	1.1	2.3	3.6			1.69	538	3533	2616	911
97.0	18	25	7.5	17.9	24.675	7.70	5741	11562	5821	0.45	5.4	236	1.2	2.8	4.7			1.87	493	4461	3159	923
98.0	19.2	25.2	10	19.1	24.875	10.20	5803	11687	5883	0.35	5.8	199	1.3	3.0	5.3			1.94	417	4902	3414	809
99.0	20	25.8	12	19.9	25.475	12.20	5866	11812	5946	0.32	6.0	192	1.3	3.1	5.6			1.98	401	5182	3577	794
100.0	19.8	25.4	11.2	19.7	25.075	11.40	5928	11936	6008	0.32	5.9	185	1.3	3.0	5.4			1.96	386	5086	3531	755

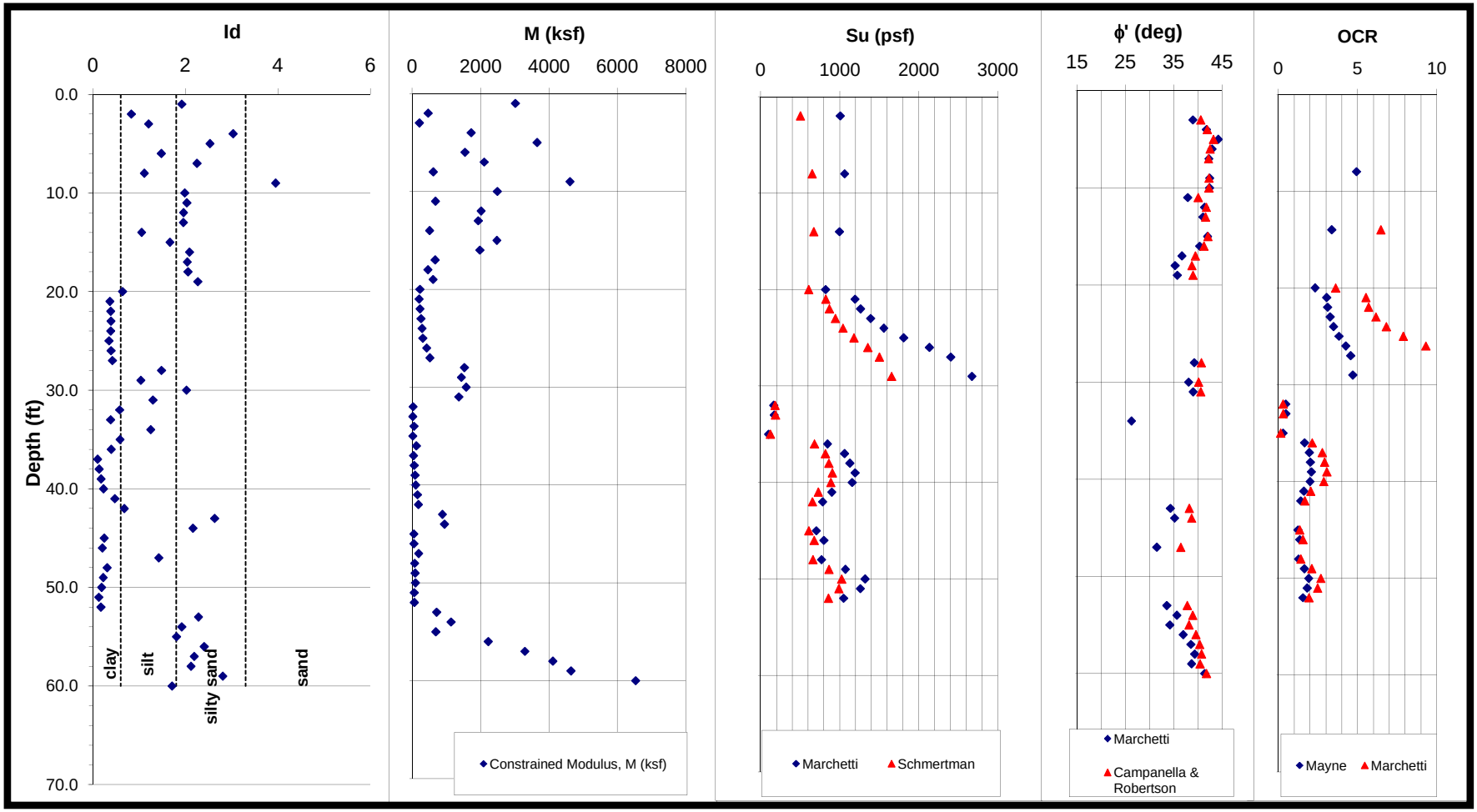
DILATOMETER TEST RESULTS

Test ID: DMT-094
Site: MLK Freeway
Location: Portsmouth, VA
Project No.: 10-951



DILATOMETER TEST RESULTS

Test ID: DMT-094
Site: MLK Freeway
Location: Portsmouth, VA
Project No.: 10-951



Job No: 10-951
Job Name: MLK Freeway
Job Location: Portsmouth, VA
Date: 7/29/10
Sounding No: DMT-094
Ground Water Depth (ft): 4

	Membrane 1		Membrane 2	
ΔA =	0.2	bar	ΔA =	0.225
ΔB =	0.15	bar	ΔB =	0.3
Zm=	0	bar	Zm=	0

[1] Depth Below Existing Ground Surface
[2] Mayne, 1995
[3] Marchetti,1980
[4] Marchetti, 1997
[5] Campanella and Robertson, 1991
[6] Marchetti,1980
[7] Schmertman, 1981

Depth[1] (ft)	A (bar)	B (bar)	C (bar)	po (bar)	p1 (bar)	p2 (bar)	u_o (psf)	σ_{vo} (psf)	σ_{vo}' (psf)	Id	K_D	E_D (bar)	K_o	OCR[2]	OCR[3]	ϕ'[4] (deg)	ϕ'[5] (deg)	R_M	E_D (ksf)	s_u[6] (psf)	s_u[7] (psf)	M (ksf)	
1.0	5.05	14.2	0	4.8	14.05		0	120	120	1.92	83.5	321	6.0			48.3	45.8	4.51	670			3020	
2.0	2.3	4.55	0	2.4	4.4		0	228	228	0.83	22.0	69	2.9	11.2	42.2			3.25	145	1007	502	470	
3.0	1	2.65	0	1.1	2.5		0	330	330	1.20	7.2	47	1.5			39.0	40.6	2.17	99			215	
4.0	3.05	11.6	0	2.8	11.45		0	446	446	3.03	13.3	299	2.2			41.8	41.9	2.77	624			1728	
5.0	6.5	21.2	0	6.0	21.05		62	571	509	2.53	24.4	523	3.1			44.2	43.2	3.35	1092			3654	
6.0	4.95	12	0	4.8	11.85		125	690	565	1.48	17.6	244	2.6			42.9	42.5	3.03	510			1547	
7.0	4.85	14.8	0	4.6	14.65		187	810	623	2.25	15.0	350	2.4			42.3	42.2	2.89	731			2108	
8.0	3.2	6.85	0	3.2	6.7		250	922	672	1.11	9.7	120	1.8	4.9	11.7			2.47	251	1062	651	620	
9.0	6.5	27.6	0	5.7	27.45		312	1049	737	3.95	15.6	756	2.4			42.4	42.3	2.92	1579			4615	M1
10.0	6.45	18.2	0	6.1	17.9		374	1172	797	1.99	15.5	409	2.4			42.4	42.3	2.92	854			2492	M2
11.0	2.55	7.6	0	2.5	7.3		437	1284	847	2.03	5.8	165	1.3			37.9	40.1	1.99	344			684	
12.0	5.8	16.2	0	5.5	15.9		499	1405	906	1.96	12.2	360	2.1			41.4	41.8	2.69	751			2020	
13.0	5.75	16	0	5.5	15.7		562	1527	965	1.96	11.3	354	2.0			41.0	41.6	2.62	740			1935	
14.0	3.45	7.2	0	3.5	6.9		624	1639	1015	1.05	6.6	118	1.4	3.4	6.5			2.09	245	996	671	513	
15.0	7.95	20	0	7.6	19.7		686	1763	1077	1.66	14.1	420	2.3			42.0	42.1	2.83	877			2478	
16.0	5.95	17	0	5.6	16.7		749	1885	1137	2.09	9.7	383	1.8			40.4	41.3	2.47	801			1981	
17.0	3	8.55	0	3.0	8.25		811	1999	1188	2.04	4.5	183	1.1			36.7	39.5	1.77	382			675	
18.0	2.45	7	0	2.5	6.7		874	2110	1236	2.06	3.5	147	0.9			35.3	38.7	1.52	306			464	
19.0	2.8	8.35	0	2.8	8.05		936	2222	1286	2.27	3.8	183	0.9			35.7	39.0	1.61	382			615	
20.0	3.25	5.55	0	3.4	5.25		998	2331	1332	0.64	4.6	65	1.1	2.3	3.6			1.70	135	821	607	229	
21.0	4.3	6.2	1.8	4.5	5.9	2.00	1061	2439	1378	0.37	6.0	50	1.3	3.0	5.5			1.97	105	1193	825	206	
22.0	4.55	6.6	2.1	4.7	6.3	2.30	1123	2549	1425	0.38	6.1	56	1.3	3.1	5.7			1.99	116	1263	869	231	
23.0	4.95	7.15	2.5	5.1	6.85	2.70	1186	2659	1473	0.39	6.4	61	1.4	3.3	6.2			2.04	127	1391	945	261	
24.0	5.45	7.8	2.45	5.6	7.5	2.65	1248	2770	1522	0.38	6.8	66	1.4	3.5	6.8			2.11	139	1558	1041	293	
25.0	6.15	8.55	2.95	6.3	8.25	3.15	1310	2883	1572	0.35	7.5	68	1.5	3.8	7.9			2.21	143	1808	1181	315	
26.0	7.05	10	3.95	7.2	9.7	4.15	1373	2997	1624	0.39	8.4	88	1.6	4.3	9.3			2.32	185	2134	1357	427	
27.0	7.8	11.2	4.5	7.9	10.9	4.70	1435	3113	1678	0.42	9.0	105	1.7	4.6	10.4			2.39	219	2404	1503	522	
28.0	7.3	16.8	0.1	7.1	16.5	0.30	1498	3235	1738	1.48	7.6	327	1.5			39.3	40.7	2.24	683			1530	
29.0	8.85	17.2	2.3	8.7	16.9	2.50	1560	3358	1798	1.04	9.2	285	1.7	4.7	10.8			2.42	595	2672	1658	1440	
30.0	6.4	17.2	0.2	6.1	16.9	0.40	1622	3480	1858	2.02	6.0	374	1.3			38.1	40.1	2.02	782			1582	
31.0	7.65	16.4	0	7.5	16.1		1685	3602	1917	1.30	7.3	300	1.5			39.0	40.6	2.19	626			1368	
32.0	1.5	2.5	0.2	1.7	2.2	0.40	1747	3697	1950	0.58	0.9	17	0.2	0.5	0.3			0.85	36	164	181	31	
33.0	1.55	2.4	0.5	1.8	2.1	0.70	1810	3791	1981	0.38	0.9	12	0.2	0.5	0.3			0.85	25	170	186	21	
34.0	1.45	2.85	0.2	1.6	2.55	0.40	1872	3889	2017	1.25	0.8	32	0.1			26.2	#NUM!	0.85	67			57	
35.0	1.3	2.15	0.5	1.5	1.85	0.70	1934	3980	2046	0.59	0.6	12	0.0	0.3	0.2			0.85	25	99	122	21	
36.0	4.05	5.8	2.6	4.2	5.5	2.80	1997	4087	2090	0.39	3.3	45	0.8	1.7	2.1			1.35	93	845	680	126	
37.0	4.7	5.6	3.4	4.9	5.3	3.60	2059	4189	2130	0.10	3.8	14	1.0	2.0	2.8			1.52	29	1060	819	43	
38.0	4.95	6	3.45	5.1	5.7	3.65	2122	4293	2171	0.13	4.0	19	1.0	2.0	2.9			1.55	40	1127	863	62	
39.0	5.2	6.45	0	5.4	6.15		2184	4398	2214	0.18	4.1	26	1.0	2.1	3.1			1.59	55	1194	907	87	
40.0	5.15	6.6	3.2	5.3	6.3	3.40	2246	4505	2259	0.23	3.9	34	1.0	2.0	2.9			1.54	70	1157	888	109	
41.0	4.45	6.55	2.5	4.6	6.25	2.70	2309	4614	2305	0.47	3.2	57	0.8	1.6	2.0			1.32	120	899	729	158	
42.0	4.15	6.7	0.3	4.3	6.4	0.50	2371	4723	2352	0.68	2.8	74	0.7	1.4	1.7			1.20	154	783	655	184	
43.0	4.7	13.6	0.45	4.5	13.3	0.65	2434	4841	2407	2.63	2.9	305	0.8			34.3	38.2	1.39	637			889	
44.0	5.4	14.2	0.5	5.2	13.9	0.70	2496	4960	2464	2.16	3.4	301	0.9			35.2	38.7	1.51	630			948	
45.0	3.95	5.15	2	4.1	4.85	2.20	2558	5063	2505	0.24	2.4	25	0.7	1.2	1.4			1.05	51	704	609	54	
46.0	4.3	5.45	2.55	4.5	5.15	2.75	2621	5166	2546	0.20	2.7	23	0.7	1.4	1.6			1.14	48	799	676	54	
47.0	3.4	6.9	0.9	3.5	6.6	1.10	2683	5276	2593	1.43	1.8	108	0.5			31.5	36.4	0.85	226			192	
48.0	4.3	5.75	1.7	4.5	5.45	1.90	2746	5381	2636	0.31	2.5	34	0.7	1.3	1.4			1.08	70	769	661	76	
49.0	5.3	6.7	2.7	5.5	6.4	2.90	2808	5488	2680	0.22	3.2	32	0.8	1.6	2.1			1.34	67	1071	864	89	
50.0	6.1	7.5	3	6.3	7.2	3.20	2870	5595	2724	0.19	3.8	32	0.9	1.9	2.7			1.50	67	1320	1025	100	
51.0	5.95	7.05	2.7	6.1	6.75	2.90	2933	5700	2767	0.13	3.6	21	0.9	1.8	2.5			1.45	44	1260	990	63	
52.0	5.35	6.55	3.35	5.5	6.25	3.55	2995	5805	2809	0.17	3.1	25	0.8	1.6	1.9			1.28	51	1049	858	66	
53.0	5.1	13.2	0.5	4.9	12.9	0.70	3058	5922	2865	2.28	2.5	276	0.7			33.6	37.8	1.25	576			718	
54.0	6.95	17	0.2	6.7	16.7	0.40	3120	6043	2923	1.92	3.7	347	0.9			35.6	38.9	1.57	725			1139	
55.0	5.7	13.2	0.6	5.6	12.9	0.80	3182	6161	2979	1.81	2.8	254	0.8			34.2	38.2	1.31	531			695	

Job No: 10-951
Job Name: MLK Freeway
Job Location: Portsmouth, VA
Date: 7/29/10
Sounding No: DMT-094
Ground Water Depth (ft): 4

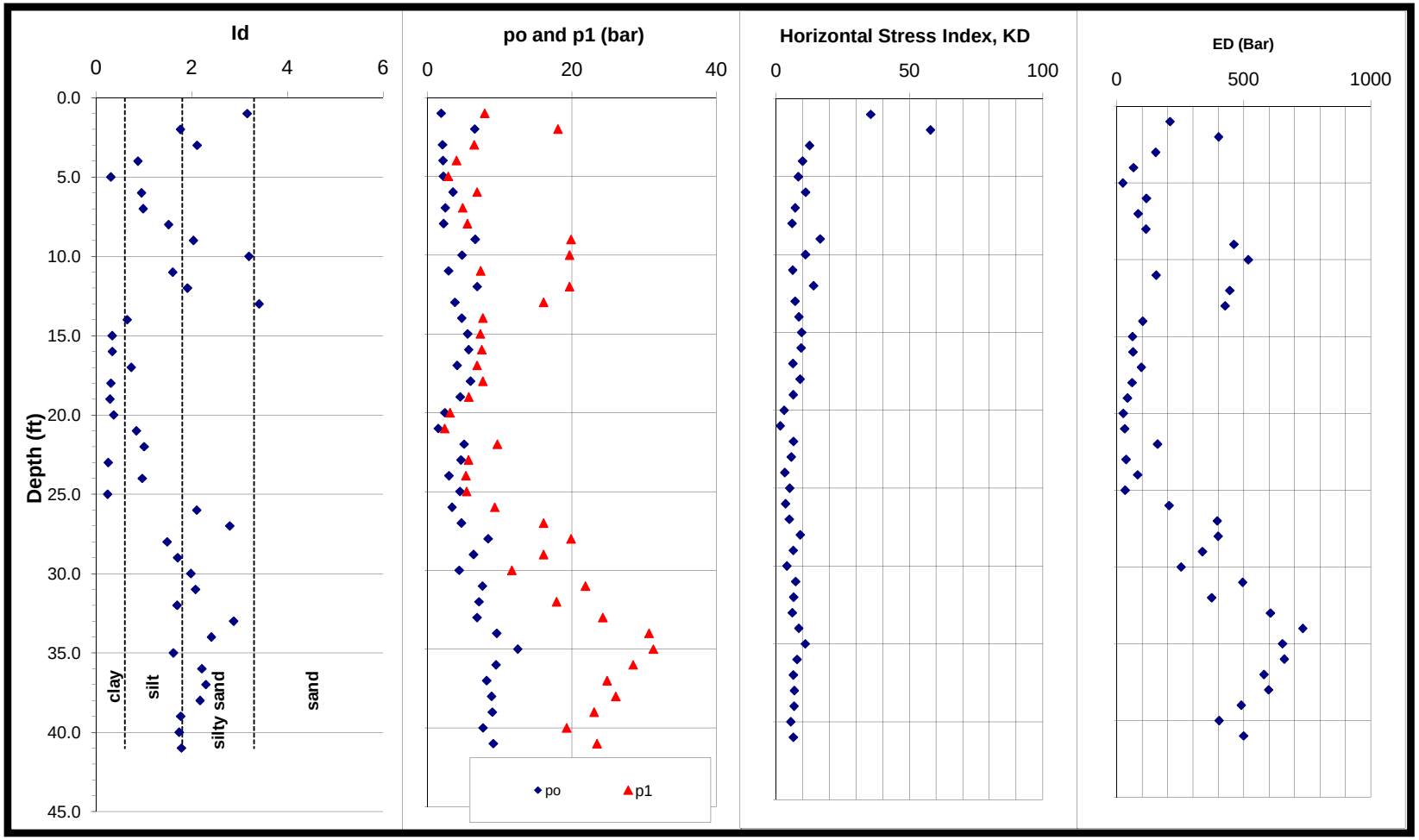
	Membrane 1		Membrane 2	
ΔA =	0.2	bar	ΔA =	0.225
ΔB =	0.15	bar	ΔB =	0.3
Zm=	0	bar	Zm=	0

[1] Depth Below Existing Ground Surface
[2] Mayne, 1995
[3] Marchetti,1980
[4] Marchetti, 1997
[5] Campanella and Robertson, 1991
[6] Marchetti,1980
[7] Schmertman, 1981

Depth[1]	A	B	C	po	p1	p2	u_o	σ_{vo}	σ_{vo}'			E_D				ϕ'[4]	ϕ'[5]		E_D	s_u[6]	s_u[7]	M
(ft)	(bar)	(bar)	(bar)	(bar)	(bar)	(bar)	(psf)	(psf)	(psf)	Id	K_D	(bar)	K_o	OCR[2]	OCR[3]	(deg)	(deg)	R_M	(ksf)	(psf)	(psf)	(ksf)
56.0	9.1	25.6	0.3	8.5	25.3	0.50	3245	6288	3043	2.41	4.8	582	1.1			37.0	39.6	1.83	1216			2226
57.0	12.2	33.2	0.2	11.4	32.9	0.40	3307	6418	3110	2.19	6.6	746	1.4			38.5	40.4	2.12	1558			3297
58.0	14.4	38.8	0.85	13.4	38.5	1.05	3370	6550	3180	2.12	7.8	870	1.6			39.3	40.8	2.27	1817			4116
59.0	13.4	42.2	0.2	12.2	41.9	0.40	3432	6683	3251	2.81	6.8	1030	1.4			38.7	40.4	2.16	2152			4645
60.0	22.6	55	0.5	21.2	54.7	0.70	3494	6820	3326	1.71	12.3	1161	2.1			41.4	41.8	2.69	2426			6536

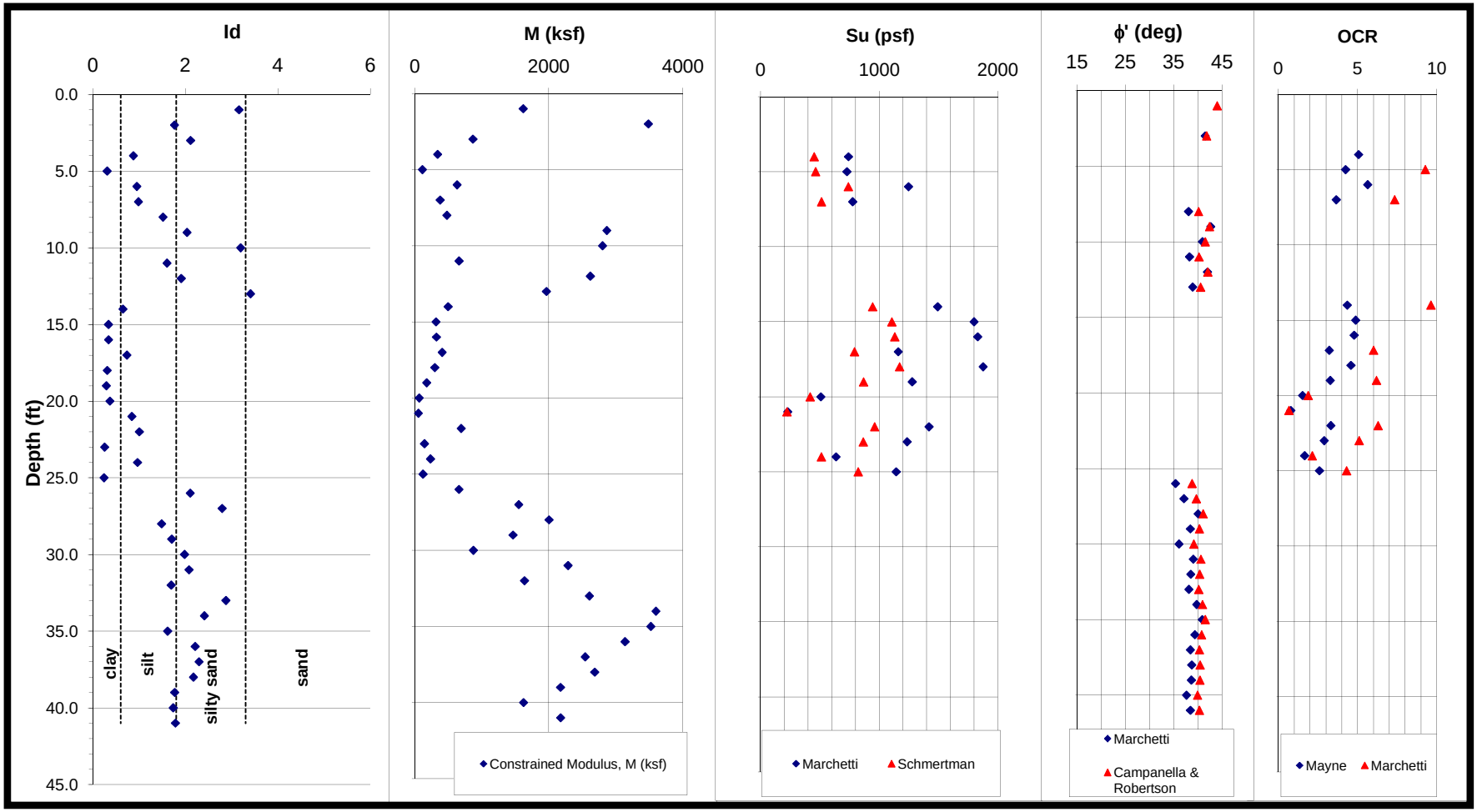
DILATOMETER TEST RESULTS

Test ID: DMT-203
Site: MLK Freeway
Location: Portsmouth, VA
Project No.: 10-951



DILATOMETER TEST RESULTS

Test ID: DMT-203
Site: MLK Freeway
Location: Portsmouth, VA
Project No.: 10-951



Job No: 10-951
Job Name: MLK Freeway
Job Location: Portsmouth, VA
Date: 7/30/10
Sounding No: DMT-203
Ground Water Depth (ft): 6

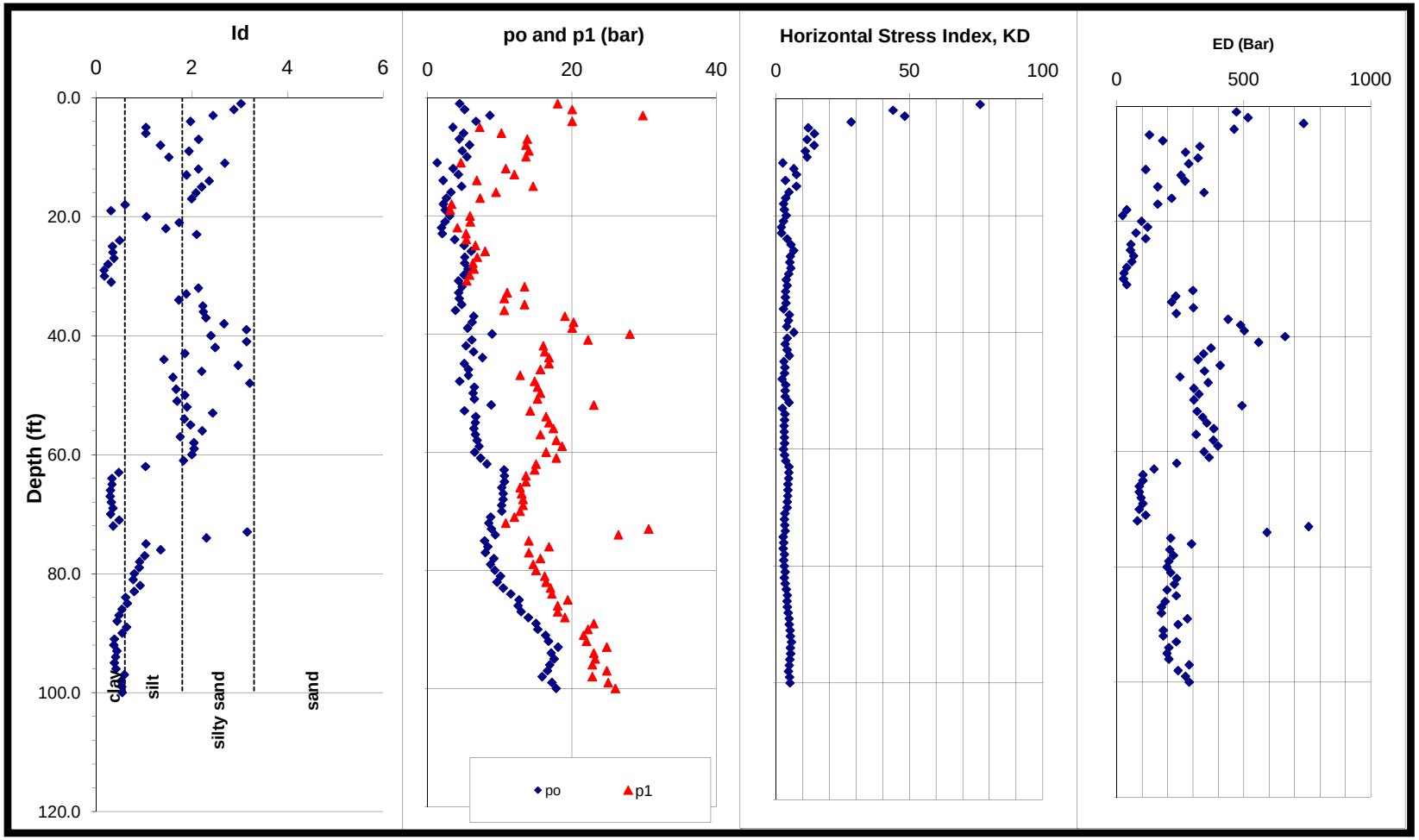
ΔA = 0.2 bar
ΔB = 0.1 bar
Zm= 0 bar

[1] Depth Below Existing Ground Surface
[2] Mayne, 1995
[3] Marchetti,1980
[4] Marchetti, 1997
[5] Campanella and Robertson, 1991
[6] Marchetti,1980
[7] Schmertman, 1981

Depth[1] (ft)	A (bar)	B (bar)	C (bar)	po (bar)	p1 (bar)	p2 (bar)	u_o (psf)	σ_{vo} (psf)	σ_{vo}' (psf)	Id	K_D	E_D (bar)	K_o	OCR[2]	OCR[3]	ϕ'[4] (deg)	ϕ'[5] (deg)	R_M	E_D (ksf)	s_u[6] (psf)	s_u[7] (psf)	M (ksf)
1.0	2	8.05	0	1.9	7.95		0	112	112	3.16	35.5	210	3.8			45.6	44.0	3.70	438			1619
2.0	6.9	18.2	0	6.6	18.1		0	236	236	1.76	58.0	401	5.0			47.2	45.0	4.16	837			3485
3.0	2.1	6.6	0	2.1	6.5		0	347	347	2.11	12.6	153	2.1			41.5	41.8	2.72	320			868
4.0	2.05	4.15	0	2.2	4.05		0	454	454	0.88	9.9	66	1.8	5.1	12.2			2.49	137	741	451	342
5.0	2.05	3	0	2.2	2.9		0	556	556	0.31	8.3	24	1.6	4.2	9.3			2.31	49	728	463	114
6.0	3.5	7	0	3.5	6.9		0	668	668	0.95	11.1	117	2.0	5.6	14.4			2.60	244	1247	739	632
7.0	2.4	5	0	2.5	4.9		62	777	715	0.98	7.2	84	1.5	3.7	7.3			2.17	175	776	513	379
8.0	2.2	5.65	0	2.2	5.55		125	887	762	1.52	6.0	115	1.3			38.1	40.1	2.00	240			480
9.0	7.05	20	0	6.6	19.9		187	1011	824	2.03	16.5	461	2.5			42.7	42.4	2.98	963			2865
10.0	5.3	19.8	0	4.8	19.7		250	1134	885	3.19	11.0	517	2.0			40.9	41.5	2.59	1081			2801
11.0	2.95	7.5	0	2.9	7.4		312	1247	935	1.60	6.2	155	1.4			38.3	40.2	2.05	323			661
12.0	7.3	19.8	0	6.9	19.7		374	1371	997	1.91	14.1	445	2.3			42.0	42.1	2.82	928			2620
13.0	4.2	16.2	0	3.8	16.1		437	1492	1055	3.41	7.1	426	1.5			38.9	40.6	2.21	890			1965
14.0	4.7	7.8	0	4.8	7.7		499	1605	1106	0.65	8.5	102	1.7	4.3	9.6			2.34	213	1493	944	498
15.0	5.45	7.45	0.8	5.6	7.35	1.00	562	1716	1155	0.34	9.6	62	1.8	4.9	11.5			2.46	129	1800	1106	318
16.0	5.6	7.65	0.5	5.7	7.55	0.70	624	1828	1204	0.34	9.4	64	1.8	4.8	11.2			2.44	133	1831	1131	324
17.0	4.05	7	0.5	4.1	6.9	0.70	686	1940	1253	0.73	6.3	97	1.4	3.2	6.0			2.03	202	1160	791	410
18.0	5.85	7.8	1.2	6.0	7.7	1.40	749	2051	1303	0.31	9.0	60	1.7	4.6	10.4			2.39	126	1876	1171	300
19.0	4.4	5.85	0.5	4.5	5.75	0.70	811	2159	1348	0.29	6.4	42	1.4	3.3	6.2			2.05	88	1278	868	179
20.0	2.25	3.25	0	2.4	3.15		874	2261	1387	0.37	3.0	26	0.8	1.5	1.9			1.27	53	508	417	68
21.0	1.35	2.5	0	1.5	2.4		936	2360	1424	0.84	1.6	31	0.4	0.8	0.7			0.85	65	228	221	55
22.0	5.1	9.8	0	5.1	9.7		998	2476	1477	1.00	6.5	160	1.4	3.3	6.3			2.07	335	1420	961	693
23.0	4.5	5.8	1.5	4.7	5.7	1.70	1061	2583	1522	0.25	5.7	36	1.3	2.9	5.1			1.92	76	1236	865	146
24.0	2.9	5.45	0.35	3.0	5.35	0.55	1123	2692	1568	0.96	3.3	82	0.8	1.7	2.1			1.38	171	636	512	236
25.0	4.35	5.55	2.05	4.5	5.45	2.25	1186	2798	1612	0.24	5.1	33	1.2	2.6	4.3			1.81	68	1143	822	124
26.0	3.5	9.45	0	3.4	9.35		1248	2912	1664	2.10	3.5	206	0.9			35.4	38.8	1.54	430			661
27.0	5.05	16.2	0	4.7	16.1		1310	3033	1723	2.79	4.9	395	1.2			37.1	39.7	1.88	826			1551
28.0	8.75	20	0	8.4	19.9		1373	3158	1785	1.48	9.1	399	1.7			40.1	41.1	2.40	833			2004
29.0	6.65	16.2	0	6.4	16.1		1435	3279	1844	1.70	6.5	337	1.4			38.4	40.3	2.08	704			1466
30.0	4.55	11.8	0	4.4	11.7		1498	3397	1899	1.98	4.1	253	1.0			36.1	39.2	1.66	529			876
31.0	8.1	22	0	7.6	21.9		1560	3522	1962	2.08	7.3	496	1.5			39.1	40.6	2.21	1035			2287
32.0	7.45	18	0	7.1	17.9		1622	3645	2022	1.69	6.6	373	1.4			38.5	40.4	2.10	780			1637
33.0	7.5	24.4	0	6.9	24.3		1685	3770	2085	2.87	6.1	605	1.3			38.1	40.2	2.06	1263			2606
34.0	10.4	30.8	0	9.6	30.7		1747	3899	2152	2.41	8.5	732	1.7			39.8	41.0	2.35	1530			3598
35.0	13.2	31.4	0	12.5	31.3		1810	4030	2220	1.61	10.9	652	1.9			40.9	41.5	2.59	1362			3522
36.0	10.2	28.6	0	9.5	28.5		1872	4158	2286	2.21	7.9	659	1.6			39.4	40.8	2.28	1377			3137
37.0	8.8	25	0	8.2	24.9		1934	4285	2350	2.29	6.5	579	1.4			38.5	40.3	2.10	1210			2543
38.0	9.5	26.2	0	8.9	26.1		1997	4412	2415	2.17	6.9	598	1.4			38.7	40.5	2.15	1248			2685
39.0	9.45	23.2	0	9.0	23.1		2059	4538	2479	1.77	6.7	490	1.4			38.7	40.4	2.12	1023			2175
40.0	8.05	19.4	0	7.7	19.3		2122	4662	2540	1.74	5.5	403	1.2			37.7	39.9	1.93	841			1623
41.0	9.6	23.6	0	9.1	23.5		2184	4788	2604	1.78	6.5	499	1.4			38.5	40.3	2.09	1043			2176

DILATOMETER TEST RESULTS

Test ID: DMT-216
Site: MLK Freeway
Location: Portsmouth, VA
Project No.: 10-951



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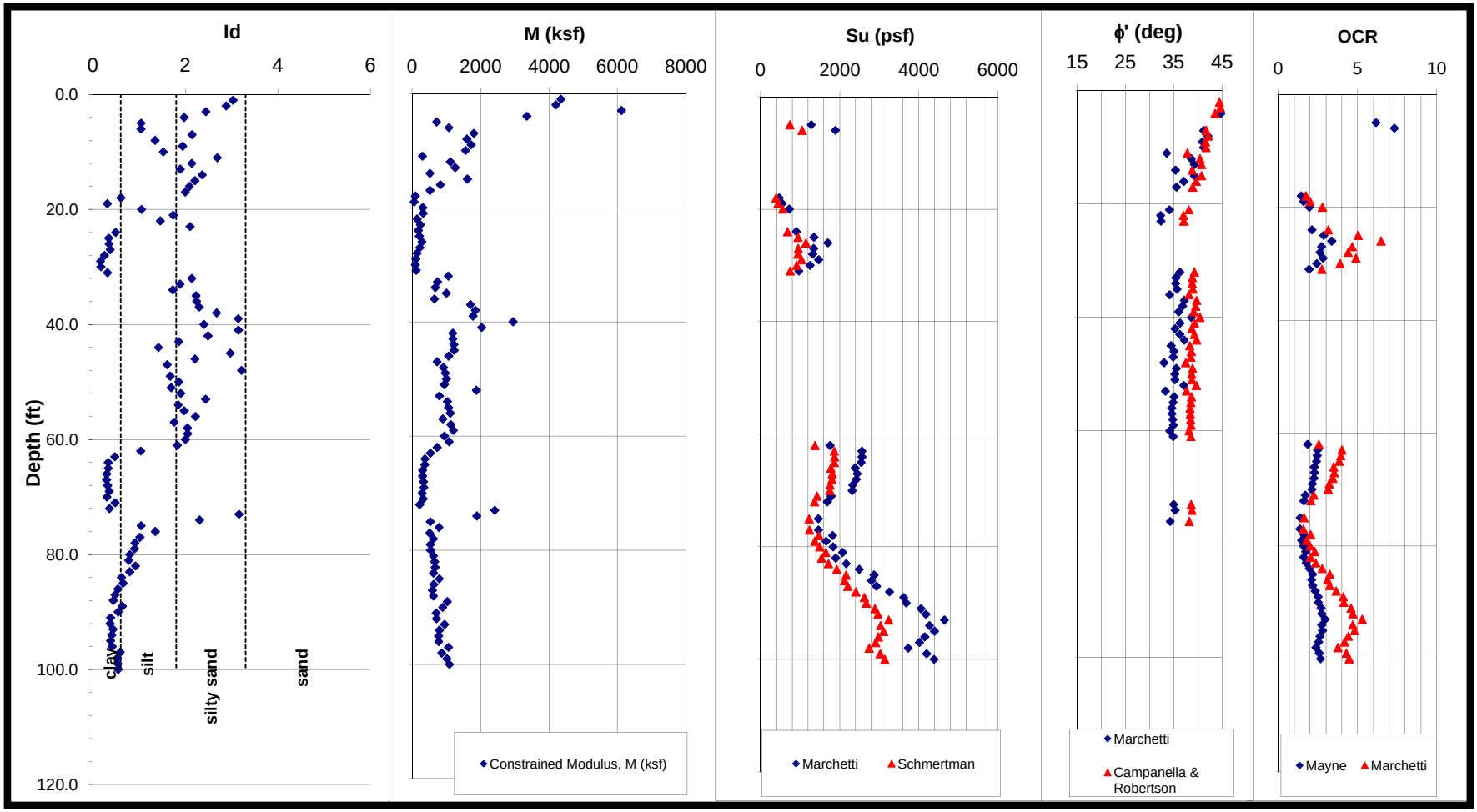

Job No: 10-951
Job Name: MLK Freeway
Job Location: Portsmouth, VA
Date: 7/30/10
Sounding No: DMT-216
Ground Water Depth (ft): 6

ΔA = 0.225 bar
ΔB = 0.15 bar
Zm= 0 bar

[1] Depth Below Existing Ground Surface
[2] Mayne, 1995
[3] Marchetti,1980
[4] Marchetti, 1997
[5] Campanella and Robertson, 1991
[6] Marchetti,1980
[7] Schmertman, 1981

Depth[1] (ft)	A (bar)	B (bar)	C (bar)	po (bar)	p1 (bar)	p2 (bar)	u_o (psf)	σ_{vo} (psf)	σ_{vo}' (psf)	Id	K_D	E_D (bar)	K_o	OCR[2]	OCR[3]	ϕ'[4] (deg)	ϕ'[5] (deg)	R_M	E_D (ksf)	s_u[6] (psf)	s_u[7] (psf)	M (ksf)
1.0	4.9	18.2	0	4.5	18.05		0	122	122	3.03	76.5	471	5.7			48.1	45.6	4.43	984			4354
2.0	5.65	20.2	0	5.2	20.05		0	246	246	2.88	43.9	516	4.3			46.3	44.4	3.90	1079			4207
3.0	9.45	30	0	8.7	29.85		0	375	375	2.44	48.3	735	4.5			46.6	44.6	3.99	1535			6126
4.0	7.15	20.2	0	6.7	20.05		0	500	500	1.97	28.2	462	3.4			44.8	43.5	3.48	965			3357
5.0	3.5	7.4	0	3.5	7.25		0	613	613	1.04	12.1	128	2.1	6.2	16.6			2.68	268	1279	741	719
6.0	5.05	10.4	0	5.0	10.25		0	730	730	1.04	14.4	181	2.3	7.3	21.7			2.84	379	1891	1050	1077
7.0	4.65	14	0	4.4	13.85		62	850	787	2.14	11.7	327	2.0			41.2	41.7	2.65	683			1807
8.0	6	13.8	0	5.9	13.65		125	970	845	1.35	14.3	271	2.3			42.1	42.1	2.84	565			1604
9.0	5.05	14.2	0	4.8	14.05		187	1090	903	1.94	11.0	320	1.9			40.9	41.5	2.59	668			1728
10.0	5.65	13.8	0	5.5	13.65		250	1211	961	1.52	11.7	283	2.0			41.2	41.7	2.65	592			1565
11.0	1.3	4.8	0	1.4	4.65		312	1317	1005	2.69	2.5	114	0.7			33.6	37.8	1.28	238			304
12.0	3.7	11	0	3.6	10.85		374	1434	1060	2.14	6.7	252	1.4			38.6	40.4	2.13	527			1122
13.0	4.45	12.2	0	4.3	12.05		437	1552	1116	1.89	7.7	269	1.6			39.3	40.7	2.25	561			1263
14.0	2.2	7	0	2.2	6.85		499	1664	1164	2.36	3.5	161	0.9			35.4	38.8	1.55	337			522
15.0	5	14.8	0	4.8	14.65		562	1784	1222	2.21	7.7	343	1.6			39.3	40.7	2.26	717			1617
16.0	3.35	9.65	0	3.3	9.5		624	1899	1275	2.09	4.9	216	1.1			37.1	39.6	1.83	451			827
17.0	2.65	7.45	0	2.7	7.3		686	2011	1325	2.00	3.7	161	0.9			35.6	38.9	1.56	337			526
18.0	2.05	3.5	0	2.2	3.35		749	2114	1366	0.61	2.8	39	0.8	1.5	1.7			1.21	82	468	389	99
19.0	2.3	3.3	0.7	2.5	3.15	0.93	811	2215	1404	0.31	3.1	23	0.8	1.6	2.0			1.31	48	541	440	62
20.0	3	6.05	0.1	3.1	5.9	0.33	874	2326	1452	1.05	3.8	97	1.0	2.0	2.8			1.55	204	723	558	315
21.0	2.4	6.1	0	2.5	5.95		936	2435	1499	1.74	2.8	121	0.7			34.1	38.1	1.29	253			326
22.0	1.85	4.3	0	2.0	4.15		998	2541	1542	1.46	2.0	76	0.6			32.3	37.0	0.95	158			150
23.0	2	5.5	0.1	2.1	5.35	0.33	1061	2649	1588	2.10	2.1	114	0.6			32.4	37.1	1.03	238			245
24.0	3.65	5.55	1	3.8	5.4	1.23	1123	2757	1634	0.49	4.2	56	1.0	2.1	3.1			1.60	116	900	681	186
25.0	4.95	6.8	2.9	5.1	6.65	3.13	1186	2867	1681	0.34	5.6	54	1.3	2.9	5.0			1.91	112	1349	947	215
26.0	5.95	8.15	3.45	6.1	8	3.68	1248	2979	1731	0.35	6.6	66	1.4	3.4	6.5			2.08	139	1700	1146	289
27.0	5.05	7.05	2.3	5.2	6.9	2.53	1310	3089	1778	0.37	5.4	59	1.2	2.7	4.7			1.86	124	1342	954	230
28.0	5	6.45	2.6	5.2	6.3	2.83	1373	3197	1824	0.25	5.2	39	1.2	2.6	4.4			1.82	82	1315	943	149
29.0	5.45	6.6	2.8	5.6	6.45	3.03	1435	3303	1868	0.16	5.5	28	1.2	2.8	4.9			1.89	59	1466	1034	112
30.0	4.9	6	2.75	5.1	5.85	2.98	1498	3409	1911	0.17	4.8	26	1.1	2.4	3.9			1.74	55	1249	913	96
31.0	4.15	5.6	0.6	4.3	5.45	0.83	1560	3516	1956	0.32	3.8	39	1.0	1.9	2.7			1.51	82	965	747	124
32.0	5	13.6	0.15	4.8	13.45	0.38	1622	3635	2012	2.14	4.2	300	1.0			36.3	39.3	1.70	626			1061
33.0	4.45	11.2	0	4.4	11.05		1685	3751	2066	1.89	3.6	232	0.9			35.5	38.8	1.54	485			745
34.0	4.5	10.8	0	4.4	10.65		1747	3867	2120	1.73	3.5	216	0.9			35.4	38.8	1.51	451			682
35.0	4.95	13.6	0.3	4.8	13.45	0.53	1810	3986	2177	2.23	3.7	301	0.9			35.7	38.9	1.60	630			1005
36.0	4	10.8	0.4	3.9	10.65	0.63	1872	4102	2230	2.24	2.8	234	0.7			34.1	38.1	1.34	489			654
37.0	6.8	19.2	0.2	6.4	19.05	0.43	1934	4225	2290	2.30	5.0	438	1.2			37.2	39.7	1.87	915			1710
38.0	6.65	20.4	0.25	6.2	20.25	0.48	1997	4348	2351	2.67	4.7	487	1.1			36.8	39.5	1.82	1018			1854
39.0	6.05	20.2	0.4	5.6	20.05	0.63	2059	4471	2412	3.14	4.0	502	1.0			36.0	39.1	1.70	1048			1783
40.0	9.65	28.2	0.2	9.0	28.05	0.43	2122	4599	2477	2.40	6.7	662	1.4			38.6	40.4	2.14	1383			2955
41.0	6.7	22.4	0	6.2	22.25		2184	4723	2539	3.15	4.2	558	1.0			36.3	39.3	1.75	1166			2038
42.0	5.65	16.2	0.5	5.4	16.05	0.73	2246	4843	2597	2.49	3.5	371	0.9			35.2	38.7	1.54	774			1193
43.0	6.65	16.4	0.3	6.4	16.25	0.53	2309	4965	2656	1.86	4.2	342	1.0			36.2	39.2	1.67	713			1195
44.0	7.85	17	0.5	7.6	16.85	0.73	2371	5087	2716	1.42	5.0	320	1.2			37.2	39.7	1.83	668			1220
45.0	5.45	17	0.5	5.1	16.85	0.73	2434	5207	2774	2.97	3.0	407	0.8			34.4	38.3	1.44	850			1228
46.0	5.95	15.8	0.45	5.7	15.65	0.68	2496	5328	2832	2.21	3.3	345	0.9			35.0	38.6	1.49	721			1072
47.0	5.8	13	0.7	5.7	12.85	0.93	2558	5446	2888	1.61	3.2	249	0.8			34.9	38.5	1.41	519			735
48.0	4.75	15	0.5	4.5	14.85	0.73	2621	5565	2944	3.21	2.3	360	0.6			33.0	37.4	1.22	751			916
49.0	6.7	15.4	0.5	6.5	15.25	0.73	2683	5685	3002	1.67	3.6	303	0.9			35.5	38.9	1.53	633			971
50.0	6.55	15.8	0	6.3	15.65		2746	5806	3060	1.86	3.4	323	0.9			35.2	38.7	1.49	675			1006
51.0	6.7	15.4	0.7	6.5	15.25	0.93	2808	5926	3118	1.69	3.5	303	0.9			35.3	38.7	1.49	633			942
52.0	9.3	23.2	0.6	8.8	23.05	0.83	2870	6052	3181	1.90	4.9	493	1.1			37.1	39.7	1.83	1029			1884
53.0	5.35	14.4	0.9	5.1	14.25	1.13	2933	6170	3238	2.44	2.4	316	0.6			33.3	37.6	1.21	660			800
54.0	6.95	16.6	0.95	6.7	16.45	1.18	2995	6292	3296	1.85	3.3	338	0.9			35.1	38.6	1.47	706			1035
55.0	6.9	17	0.75	6.6	16.85	0.98	3058	6413	3355	1.97	3.2	354	0.8			34.9	38.5	1.44	740			1066

Job No: 10-951
Job Name: MLK Freeway
Job Location: Portsmouth, VA
Date: 7/30/10
Sounding No: DMT-216
Ground Water Depth (ft): 6

ΔA = 0.225 bar
ΔB = 0.15 bar
Zm= 0 bar

[1] Depth Below Existing Ground Surface
[2] Mayne, 1995
[3] Marchetti,1980
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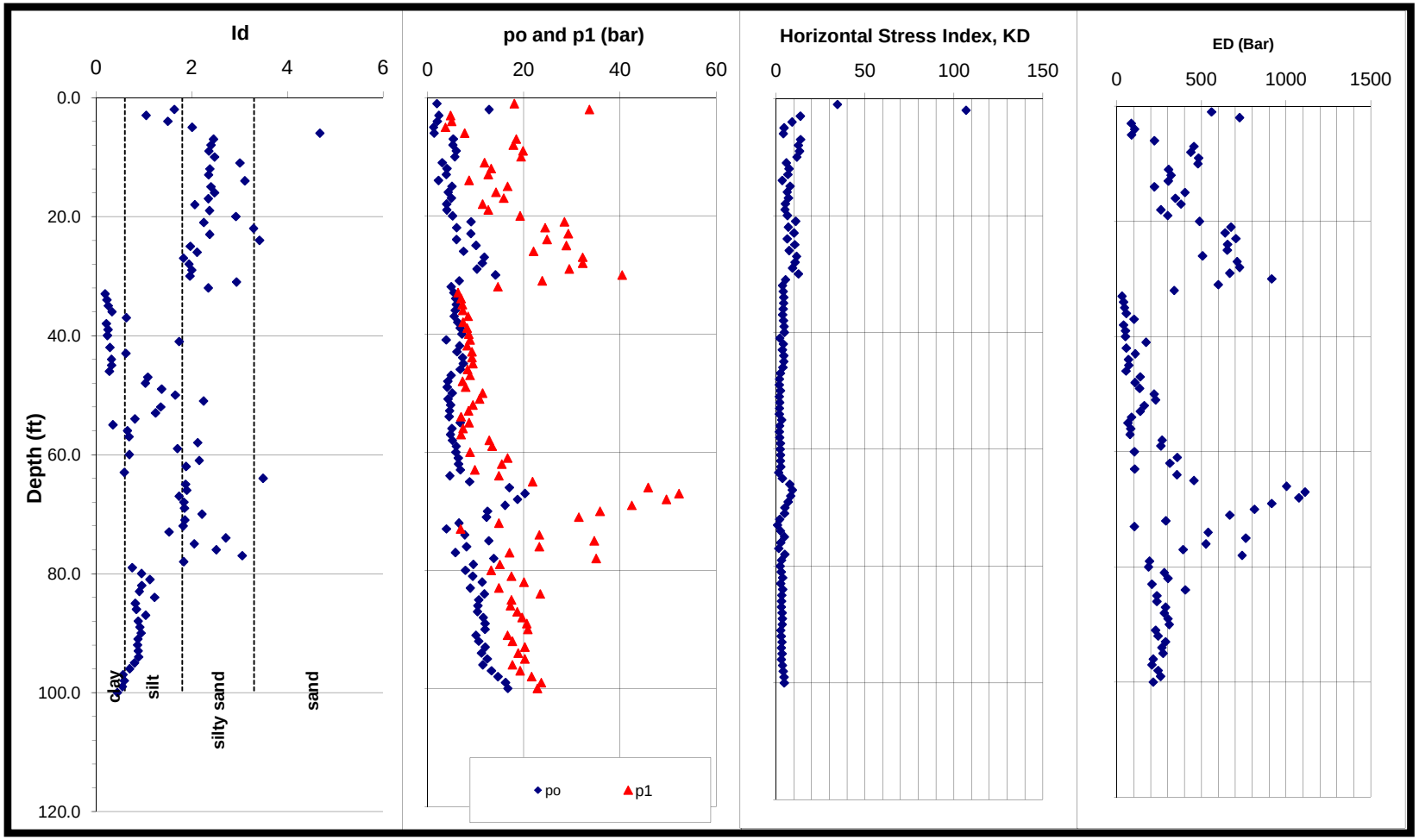
[7] Schmertman, 1981

Depth[1] (ft)	A (bar)	B (bar)	C (bar)	po (bar)	p1 (bar)	p2 (bar)	u_o (psf)	σ_{vo} (psf)	σ_{vo}' (psf)	Id	K_D	E_D (bar)	K_o	OCR[2]	OCR[3]	ϕ'[4] (deg)	ϕ'[5] (deg)	R_M	E_D (ksf)	s_u[6] (psf)	s_u[7] (psf)	M (ksf)
56.0	6.75	17.6	0.7	6.5	17.45	0.93	3120	6535	3415	2.22	3.0	382	0.8			34.5	38.3	1.40	797			1118
57.0	6.85	15.8	0.6	6.6	15.65	0.83	3182	6655	3473	1.76	3.1	312	0.8			34.6	38.4	1.38	653			902
58.0	7.2	18	0.6	6.9	17.85	0.83	3245	6777	3532	2.05	3.2	380	0.8			34.8	38.5	1.43	793			1133
59.0	7.5	18.8	1.35	7.2	18.65	1.58	3307	6900	3592	2.05	3.3	398	0.8			34.9	38.6	1.46	831			1210
60.0	6.8	16.6	1	6.6	16.45	1.23	3370	7020	3651	2.00	2.8	343	0.7			34.2	38.1	1.32	717			947
61.0	7.65	18	0.5	7.4	17.85	0.73	3432	7143	3711	1.83	3.2	363	0.8			34.9	38.5	1.43	759			1086
62.0	8.35	15.2	3.4	8.3	15.05	3.63	3494	7263	3768	1.03	3.6	236	0.9	1.9	2.6			1.49	493	1756	1374	736
63.0	10.6	15	7.3	10.6	14.85	7.53	3557	7382	3825	0.47	4.9	147	1.1	2.5	4.0			1.76	306	2560	1863	540
64.0	10.6	13.8	7.5	10.7	13.65	7.73	3619	7499	3880	0.33	4.8	103	1.1	2.5	3.9			1.75	215	2562	1869	377
65.0	10.6	13.8	7.8	10.7	13.65	8.03	3682	7617	3935	0.33	4.7	103	1.1	2.4	3.8			1.73	215	2542	1863	373
66.0	10.2	13	7.3	10.3	12.85	7.53	3744	7733	3989	0.30	4.5	88	1.1	2.3	3.5			1.67	185	2389	1778	308
67.0	10.4	13.2	7.2	10.5	13.05	7.43	3806	7849	4042	0.29	4.5	88	1.1	2.3	3.5			1.68	185	2441	1813	310
68.0	10.4	13.4	7.4	10.5	13.25	7.63	3869	7965	4097	0.32	4.4	96	1.1	2.2	3.4			1.66	200	2419	1805	332
69.0	10.2	13.4	7	10.3	13.25	7.23	3931	8082	4151	0.35	4.2	103	1.0	2.2	3.2			1.62	215	2327	1755	348
70.0	10.2	13	7.35	10.3	12.85	7.58	3994	8198	4205	0.30	4.2	88	1.0	2.1	3.1			1.60	185	2316	1753	296
71.0	8.7	12.2		8.8	12.05		4056	8315	4259	0.48	3.3	114	0.9	1.7	2.2			1.38	238	1784	1426	328
72.0	8.4	11	5.3	8.5	10.85	5.53	4118	8429	4310	0.36	3.2	81	0.8	1.6	2.1			1.32	169	1686	1366	224
73.0	9.7	30.8	1	8.9	30.65	1.23	4181	8556	4376	3.16	3.3	755	0.8			35.0	38.6	1.53	1577			2419
74.0	10	26.6	1.45	9.4	26.45	1.68	4243	8683	4440	2.31	3.5	591	0.9			35.3	38.7	1.53	1235			1893
75.0	8	14.2	0	7.9	14.05		4306	8802	4497	1.04	2.7	212	0.7	1.4	1.6			1.21	443	1458	1226	534
76.0	8.55	17	0	8.4	16.85		4368	8924	4556	1.35	2.9	294	0.8			34.3	38.2	1.28	614			789
77.0	8.1	14.2	0.25	8.0	14.05	0.48	4430	9043	4612	1.02	2.7	209	0.7	1.4	1.6			1.19	436	1463	1236	517
78.0	9.3	15.8	0	9.2	15.65		4493	9163	4670	0.91	3.2	223	0.8	1.6	2.0			1.34	466	1821	1476	626
79.0	8.8	14.8	0.9	8.7	14.65	1.13	4555	9282	4727	0.90	2.9	205	0.8	1.5	1.8			1.26	428	1654	1371	537
80.0	9.4	15.2	0.5	9.4	15.05	0.73	4618	9402	4785	0.80	3.1	198	0.8	1.6	2.0			1.32	413	1834	1492	545
81.0	10.2	16.4	0.6	10.1	16.25	0.83	4680	9523	4843	0.77	3.4	212	0.9	1.7	2.3			1.41	443	2071	1648	624
82.0	9.75	16.6	0.9	9.7	16.45	1.13	4742	9644	4902	0.92	3.1	236	0.8	1.6	2.0			1.34	493	1899	1541	660
83.0	10.6	17.2	1.5	10.5	17.05	1.73	4805	9766	4961	0.80	3.5	227	0.9	1.8	2.3			1.43	474	2164	1715	675
84.0	11.6	17.4	2.2	11.6	17.25	2.43	4867	9887	5020	0.62	3.8	198	1.0	2.0	2.8			1.52	413	2494	1926	627
85.0	12.8	19.6	3.5	12.7	19.45	3.73	4930	10010	5080	0.65	4.3	234	1.0	2.2	3.2			1.63	489	2869	2160	795
86.0	12.6	18.2	3.9	12.6	18.05	4.13	4992	10132	5140	0.54	4.1	190	1.0	2.1	3.1			1.59	398	2803	2125	634
87.0	13	18.2	4.6	13.0	18.05	4.83	5054	10253	5199	0.48	4.2	176	1.0	2.2	3.2			1.62	367	2929	2206	595
88.0	14	19.2	4.7	14.0	19.05	4.93	5117	10375	5258	0.44	4.6	176	1.1	2.3	3.6			1.70	367	3260	2409	624
89.0	15.2	23.2	5.3	15.0	23.05	5.53	5179	10500	5321	0.64	4.9	278	1.1	2.5	4.1			1.78	580	3617	2624	1031
90.0	15.4	22.4	6.7	15.3	22.25	6.93	5242	10625	5383	0.54	5.0	241	1.2	2.5	4.1			1.78	504	3686	2670	898
91.0	16.4	21.8	7.9	16.4	21.65	8.13	5304	10748	5444	0.38	5.3	183	1.2	2.7	4.6			1.85	382	4056	2889	708
92.0	16.8	22.2	8.5	16.8	22.05	8.73	5366	10872	5505	0.37	5.4	183	1.2	2.7	4.7			1.87	382	4181	2967	714
93.0	18.2	25	9.5	18.1	24.85	9.73	5429	10997	5568	0.44	5.8	234	1.3	3.0	5.3			1.94	489	4651	3238	951
94.0	17.2	23.2	8.3	17.1	23.05	8.53	5491	11121	5630	0.41	5.4	205	1.2	2.7	4.7			1.87	428	4271	3031	798
95.0	17.6	23.4	8.5	17.6	23.25	8.73	5554	11246	5692	0.38	5.5	198	1.2	2.8	4.8			1.88	413	4400	3111	776
96.0	17	23	7.7	16.9	22.85	7.93	5616	11370	5754	0.41	5.2	205	1.2	2.6	4.4			1.82	428	4153	2977	781
97.0	16.8	25	5.8	16.6	24.85	6.03	5678	11496	5818	0.59	5.0	285	1.2	2.5	4.2			1.79	595	4019	2906	1065
98.0	16	23	6.5	15.9	22.85	6.73	5741	11621	5880	0.53	4.7	241	1.1	2.4	3.8			1.72	504	3733	2745	867
99.0	17.4	25.2	5.6	17.3	25.05	5.83	5803	11747	5944	0.54	5.1	271	1.2	2.6	4.3			1.81	565	4200	3023	1021
100.0	18	26.2	4.6	17.8	26.05	4.83	5866	11873	6008	0.55	5.2	285	1.2	2.7	4.5			1.83	595	4388	3138	1092

DILATOMETER TEST RESULTS

Test ID: DMT-250
Site: MLK Freeway
Location: Portsmouth, VA
Project No.: 10-951



DILATOMETER TEST RESULTS

Test ID: DMT-250
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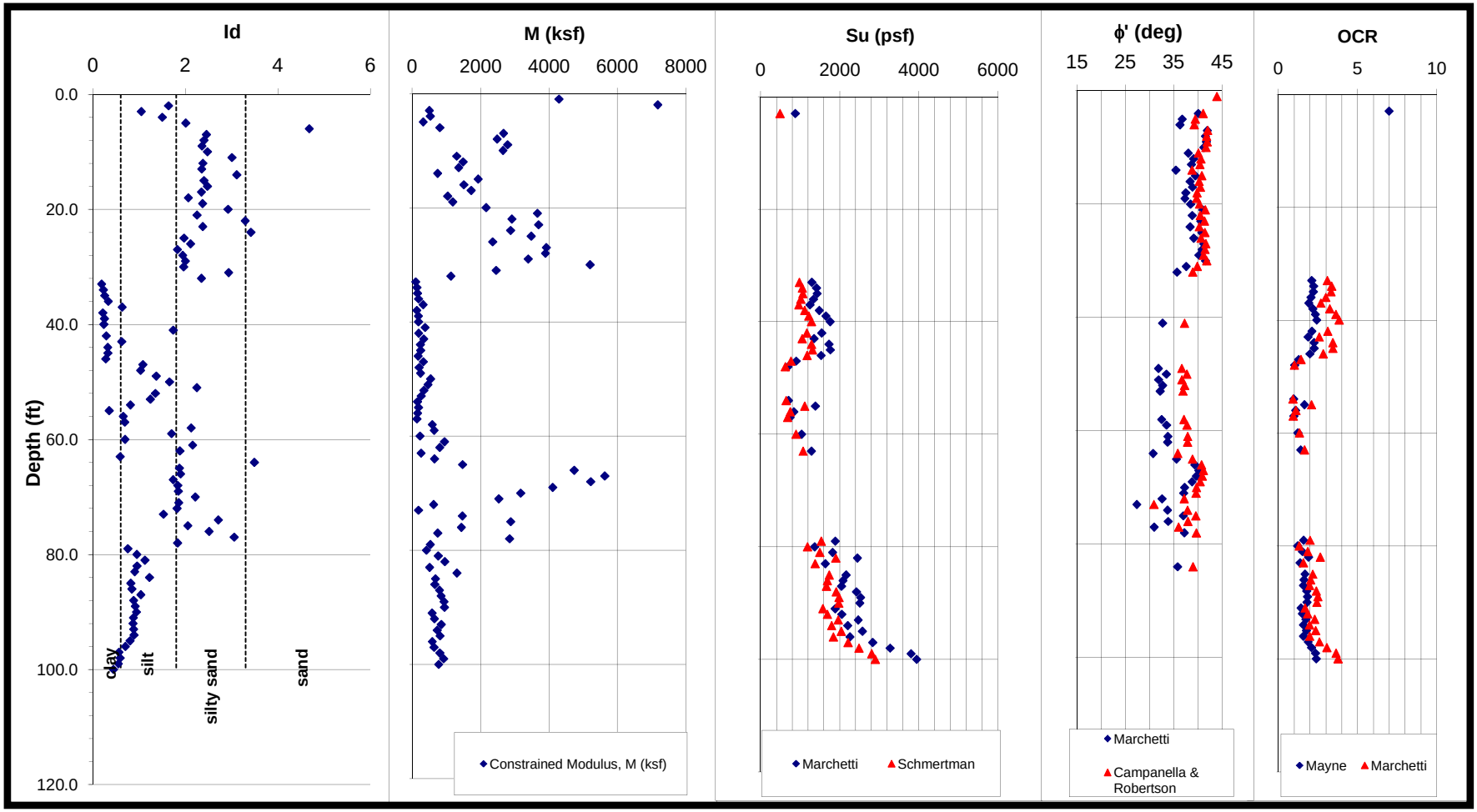

Job No: 10-951
Job Name: MLK Freeway
Job Location: Portsmouth, VA
Date: 8/5/10
Sounding No: DMT-250
Ground Water Depth (ft): 7

ΔA = 0.175 bar
ΔB = 0.325 bar
Zm= 0 bar

[1] Depth Below Existing Ground Surface
[2] Mayne, 1995
[3] Marchetti,1980
[4] Marchetti, 1997
[5] Campanella and Robertson, 1991
[6] Marchetti,1980
[7] Schmertman, 1981

Depth[1] (ft)	A (bar)	B (bar)	C (bar)	po (bar)	p1 (bar)	p2 (bar)	u_o (psf)	σ_{vo} (psf)	σ_{vo}' (psf)	Id	K_D	E_D (bar)	K_o	OCR[2]	OCR[3]	ϕ'[4] (deg)	ϕ'[5] (deg)	R_M	E_D (ksf)	s_u[6] (psf)	s_u[7] (psf)	M (ksf)
1.0	2.55	18.4	0	2.0	18.075		0	118	118	8.23	34.6	559	3.8			45.5	43.9	3.67	1168			4292
2.0	13.6	34	0	12.8	33.675		0	250	250	1.63	106.8	725	6.8			49.0	46.3	4.74	1514			7182
3.0	2.3	5.15	0	2.4	4.825		0	359	359	1.05	13.7	86	2.2	7.0	20.2			2.80	179	877	492	501
4.0	2	5.4	0	2.0	5.075		0	468	468	1.50	9.1	106	1.7			40.1	41.1	2.41	221			531
5.0	1.2	4.1	0	1.3	3.775		0	573	573	2.01	4.6	87	1.1			36.7	39.5	1.77	183			323
6.0	1.5	8.1	0	1.4	7.775		0	684	684	4.68	4.2	222	1.0			36.3	39.2	1.74	464			809
7.0	5.8	18.8	0	5.4	18.475		0	807	807	2.45	13.8	455	2.2			41.9	42.0	2.81	951			2671
8.0	5.7	18.2	0	5.3	17.875		62	930	867	2.40	12.6	437	2.1			41.5	41.8	2.72	913			2485
9.0	6.45	20.2	0	6.0	19.875		125	1054	929	2.36	13.3	483	2.2			41.7	41.9	2.77	1008			2791
10.0	6.15	19.8	0	5.7	19.475		187	1177	990	2.48	11.8	479	2.0			41.2	41.7	2.65	1001			2656
11.0	3.3	12.2	0	3.1	11.875		250	1294	1045	3.00	5.9	306	1.3			38.0	40.1	2.04	639			1302
12.0	4.3	13.6	0	4.0	13.275		312	1413	1101	2.38	7.4	321	1.5			39.1	40.6	2.22	670			1488
13.0	4.15	13	0	3.9	12.675		374	1532	1158	2.35	6.7	304	1.4			38.6	40.4	2.14	635			1359
14.0	2.4	9	0	2.3	8.675		437	1645	1208	3.11	3.6	222	0.9			35.4	38.8	1.60	464			744
15.0	5.45	17	0	5.1	16.675		499	1767	1268	2.40	8.0	403	1.6			39.5	40.8	2.29	841			1928
16.0	4.6	14.6	0	4.3	14.275		562	1887	1325	2.47	6.4	346	1.4			38.4	40.3	2.09	723			1511
17.0	5.3	16.2	0	5.0	15.875		624	2008	1384	2.35	7.0	379	1.5			38.9	40.5	2.18	791			1724
18.0	4.15	11.8	0	4.0	11.475		686	2125	1439	2.06	5.3	261	1.2			37.5	39.8	1.91	544			1037
19.0	4.25	13	0	4.0	12.675		749	2243	1495	2.37	5.1	301	1.2			37.3	39.8	1.89	628			1186
20.0	5.7	19.6	0.05	5.2	19.275	0.23	811	2366	1555	2.92	6.5	488	1.4			38.5	40.3	2.12	1020			2161
21.0	9.8	28.8	0.15	9.1	28.475	0.33	874	2495	1621	2.25	11.1	674	2.0			41.0	41.6	2.60	1408			3661
22.0	6.75	24.8	0.15	6.0	24.475	0.33	936	2620	1684	3.29	6.9	639	1.5			38.8	40.5	2.18	1335			2916
23.0	9.8	29.6	0.25	9.0	29.275	0.43	998	2749	1751	2.38	10.2	703	1.9			40.6	41.4	2.52	1469			3696
24.0	6.75	25.2	0.2	6.0	24.875	0.38	1061	2875	1814	3.41	6.4	654	1.4			38.4	40.3	2.11	1366			2877
25.0	10.8	29.2	0.25	10.1	28.875	0.43	1123	3004	1880	1.97	10.6	652	1.9			40.8	41.5	2.56	1362			3480
26.0	8	22.4	0.25	7.5	22.075	0.43	1186	3129	1943	2.11	7.4	506	1.5			39.1	40.7	2.22	1058			2353
27.0	12.6	32.6	0.35	11.8	32.275	0.53	1248	3259	2011	1.83	11.6	710	2.0			41.2	41.7	2.64	1484			3922
28.0	12.2	32.6	0.2	11.4	32.275	0.38	1310	3390	2079	1.94	10.8	725	1.9			40.8	41.5	2.57	1514			3896
29.0	11	29.8	0.4	10.3	29.475	0.58	1373	3519	2146	2.00	9.3	667	1.8			40.2	41.2	2.44	1393			3393
30.0	15.2	40.8	0.35	14.1	40.475	0.53	1435	3653	2217	1.96	12.7	915	2.1			41.5	41.8	2.72	1910			5200
31.0	7.25	24.2	0.35	6.6	23.875	0.53	1498	3778	2280	2.93	5.4	599	1.2			37.6	39.9	1.96	1252			2454
32.0	5.2	15	0.25	4.9	14.675	0.43	1560	3898	2338	2.35	3.7	339	0.9			35.6	38.9	1.60	708			1131
33.0	5.35	6.7	2.9	5.5	6.375	3.08	1622	4005	2382	0.19	4.1	31	1.0	2.1	3.1			1.59	65	1296	983	103
34.0	5.75	7.35	3.2	5.9	7.025	3.38	1685	4113	2428	0.23	4.4	40	1.1	2.2	3.4			1.65	84	1413	1057	138
35.0	5.85	7.6	3.55	6.0	7.275	3.73	1747	4223	2476	0.26	4.3	46	1.0	2.2	3.3			1.64	95	1428	1071	156
36.0	5.65	7.7	3.45	5.7	7.375	3.63	1810	4333	2524	0.33	4.0	56	1.0	2.1	3.0			1.57	118	1337	1019	185
37.0	5.5	8.8	2.85	5.5	8.475	3.03	1872	4447	2575	0.63	3.8	102	0.9	1.9	2.7			1.50	213	1248	969	320
38.0	6.15	7.75	3.95	6.3	7.425	4.13	1934	4556	2621	0.22	4.3	40	1.0	2.2	3.3			1.62	84	1483	1116	136
39.0	6.7	8.6	4.4	6.8	8.275	4.58	1997	4666	2670	0.25	4.6	51	1.1	2.3	3.6			1.70	107	1653	1222	181
40.0	7.05	8.95	4.9	7.2	8.625	5.08	2059	4777	2718	0.24	4.7	51	1.1	2.4	3.8			1.73	107	1758	1288	185
41.0	3.95	9.2	0.9	3.9	8.875	1.08	2122	4891	2770	1.74	2.2	173	0.6			32.7	37.2	1.05	361			378
42.0	6.55	8.6	2.45	6.6	8.275	2.63	2184	5002	2818	0.29	4.2	56	1.0	2.1	3.1			1.60	118	1545	1170	189
43.0	6.1	9.6	1.3	6.1	9.275	1.48	2246	5117	2870	0.62	3.7	109	0.9	1.9	2.6			1.48	228	1351	1055	337
44.0	7.2	9.6	4.75	7.3	9.275	4.93	2309	5229	2921	0.32	4.4	69	1.1	2.2	3.4			1.66	145	1729	1290	240
45.0	7.35	9.8	3.95	7.4	9.475	4.13	2371	5342	2971	0.33	4.4	71	1.1	2.3	3.4			1.66	148	1763	1314	247
46.0	6.7	8.7	3.2	6.8	8.375	3.38	2434	5453	3020	0.28	3.9	55	1.0	2.0	2.8			1.53	114	1529	1177	175
47.0	4.9	9.2	0.9	4.9	8.875	1.08	2496	5567	3071	1.08	2.5	138	0.7	1.3	1.4			1.13	289	897	771	326
48.0	4.2	7.65	0.75	4.2	7.325	0.93	2558	5678	3120	1.03	2.0	107	0.5	1.0	1.0			0.90	224	691	627	202
49.0	4.1	8.3	0.6	4.1	7.975	0.78	2621	5791	3170	1.37	1.9	135	0.5			31.8	36.7	0.86	282			243
50.0	5.25	11.8	1	5.1	11.475	1.18	2683	5907	3224	1.66	2.5	220	0.7			33.4	37.7	1.17	460			538

Job No: 10-951
Job Name: MLK Freeway
Job Location: Portsmouth, VA
Date: 8/5/10
Sounding No: DMT-250
Ground Water Depth (ft): 7

ΔA = 0.175 bar
ΔB = 0.325 bar
Zm= 0 bar

[1] Depth Below Existing Ground Surface
[2] Mayne, 1995
[3] Marchetti,1980
[4] Marchetti, 1997
[5] Campanella and Robertson, 1991
[6] Marchetti,1980
[7] Schmertman, 1981

CONETEC

Depth[1] (ft)	A (bar)	B (bar)	C (bar)	po (bar)	p1 (bar)	p2 (bar)	u_o (psf)	σ_{vo} (psf)	σ_{vo}' (psf)	Id	K_D	E_D (bar)	K_o	OCR[2]	OCR[3]	ϕ'[4] (deg)	ϕ'[5] (deg)	R_M	E_D (ksf)	s_u[6] (psf)	s_u[7] (psf)	M (ksf)
51.0	4.4	11.2	0.9	4.3	10.875	1.08	2746	6023	3277	2.25	1.9	230	0.5			31.8	36.7	0.96	479			463
52.0	4.85	9.8	0.75	4.8	9.475	0.93	2808	6137	3329	1.35	2.2	162	0.6			32.7	37.3	1.01	339			342
53.0	4.6	8.9	0.9	4.6	8.575	1.08	2870	6250	3380	1.24	2.0	138	0.5			32.2	36.9	0.91	289			263
54.0	4.45	7.35	0.75	4.5	7.025	0.93	2933	6361	3428	0.81	1.9	87	0.5	1.0	0.9			0.85	183	702	648	155
55.0	6.7	9	2.85	6.8	8.675	3.03	2995	6472	3477	0.35	3.2	66	0.8	1.6	2.1			1.34	137	1384	1118	183
56.0	5	7.75	0.95	5.1	7.425	1.13	3058	6583	3525	0.66	2.1	82	0.6	1.1	1.1			0.92	171	840	752	158
57.0	4.7	7.35	0.95	4.8	7.025	1.13	3120	6693	3573	0.69	1.9	78	0.5	1.0	0.9			0.85	164	744	684	139
58.0	5.35	13.2	1.05	5.2	12.875	1.23	3182	6811	3628	2.12	2.1	268	0.6			32.5	37.1	1.05	559			588
59.0	6.15	13.8	1.45	6.0	13.475	1.63	3245	6929	3684	1.70	2.5	261	0.7			33.5	37.7	1.18	544			642
60.0	5.85	9.2	1	5.9	8.875	1.18	3307	7042	3735	0.70	2.4	104	0.6	1.2	1.3			1.05	217	1034	898	227
61.0	6.7	17	1.2	6.4	16.675	1.38	3370	7163	3793	2.16	2.6	357	0.7			33.8	37.9	1.27	746			944
62.0	6.7	15.8	1.25	6.4	15.475	1.43	3432	7283	3851	1.88	2.6	313	0.7			33.7	37.9	1.23	654			807
63.0	6.8	10.2	1.8	6.8	9.875	1.98	3494	7397	3903	0.59	2.8	106	0.7	1.4	1.7			1.18	221	1284	1077	260
64.0	4.95	15.2	1.35	4.6	14.875	1.53	3557	7515	3959	3.49	1.5	355	0.4			30.7	35.8	0.88	742			653
65.0	9.2	22.2	1.45	8.8	21.875	1.63	3619	7640	4021	1.87	3.6	455	0.9			35.5	38.9	1.55	951			1473
66.0	18.2	46.2	1.55	17.0	45.875	1.73	3682	7775	4093	1.90	7.8	1002	1.6			39.3	40.8	2.26	2093			4736
67.0	21.6	52.6	1.65	20.3	52.275	1.83	3744	7912	4168	1.74	9.2	1111	1.8			40.1	41.1	2.43	2321			5630
68.0	20	50	1.4	18.7	49.675	1.58	3806	8048	4242	1.84	8.3	1075	1.6			39.7	40.9	2.33	2245			5220
69.0	17.2	42.8	1.45	16.1	42.475	1.63	3869	8182	4313	1.85	6.9	915	1.5			38.8	40.5	2.15	1910			4108
70.0	13.4	36.2	1.5	12.5	35.875	1.68	3931	8313	4382	2.21	5.0	813	1.2			37.2	39.7	1.87	1697			3173
71.0	13	31.8	1.6	12.3	31.475	1.78	3994	8443	4449	1.86	4.9	667	1.1			37.0	39.6	1.82	1393			2533
72.0	6.75	15.2	1.3	6.5	14.875	1.48	4056	8562	4506	1.82	2.1	290	0.6			32.6	37.2	1.04	605			627
73.0	3.9	7.25	1.4	3.9	6.925	1.58	4118	8671	4552	1.53	0.9	104	0.2			27.3	30.9	0.85	217			184
74.0	8.3	23.6	1.65	7.7	23.275	1.83	4181	8795	4615	2.71	2.6	539	0.7			33.7	37.9	1.30	1126			1467
75.0	13.6	35	1.55	12.7	34.675	1.73	4243	8926	4683	2.05	4.8	761	1.1			36.9	39.6	1.81	1590			2881
76.0	8.65	23.6	0.15	8.1	23.275	0.33	4306	9051	4745	2.51	2.7	526	0.7			33.8	37.9	1.31	1100			1437
77.0	6.15	17.4	1	5.8	17.075	1.18	4368	9171	4803	3.05	1.6	392	0.4			30.9	36.0	0.91	818			746
78.0	14.6	35.4	1.7	13.8	35.075	1.88	4430	9302	4871	1.83	5.0	740	1.2			37.2	39.7	1.84	1545			2847
79.0	9.6	15.4	1.2	9.5	15.075	1.38	4493	9422	4929	0.76	3.1	193	0.8	1.6	2.0			1.32	403	1889	1537	531
80.0	7.95	13.6	1.3	7.9	13.275	1.48	4555	9540	4985	0.95	2.4	188	0.6	1.2	1.3			1.06	392	1365	1188	416
81.0	9.6	17.8	0.9	9.4	17.475	1.08	4618	9662	5044	1.13	3.0	281	0.8	1.5	1.9			1.30	586	1821	1499	761
82.0	11.6	20.4	0.55	11.4	20.075	0.73	4680	9786	5106	0.96	3.7	302	0.9	1.9	2.6			1.51	632	2448	1905	955
83.0	9	15.2	1	8.9	14.875	1.18	4742	9905	5163	0.90	2.7	208	0.7	1.4	1.6			1.18	434	1636	1382	510
84.0	12.2	23.8	1	11.8	23.475	1.18	4805	10031	5226	1.22	3.8	404	0.9			35.8	39.0	1.55	845			1308
85.0	10.8	17.8	1.1	10.7	17.475	1.28	4867	10153	5286	0.82	3.3	237	0.8	1.7	2.2			1.38	495	2164	1738	680
86.0	10.6	17.6	1.15	10.5	17.275	1.33	4930	10274	5345	0.84	3.2	237	0.8	1.6	2.0			1.34	495	2084	1690	662
87.0	10.6	19	1.4	10.4	18.675	1.58	4992	10397	5405	1.04	3.1	288	0.8	1.6	2.0			1.33	601	2046	1669	799
88.0	11.8	20	1.25	11.6	19.675	1.43	5054	10521	5466	0.88	3.5	281	0.9	1.8	2.4			1.44	586	2424	1915	846
89.0	12.2	21	1.45	12.0	20.675	1.63	5117	10645	5528	0.92	3.6	302	0.9	1.8	2.5			1.47	632	2529	1986	930
90.0	12.2	21.2	1.6	12.0	20.875	1.78	5179	10769	5590	0.94	3.5	310	0.9	1.8	2.4			1.46	647	2509	1978	943
91.0	10.2	17	1.1	10.1	16.675	1.28	5242	10890	5648	0.88	2.8	230	0.7	1.4	1.7			1.22	479	1885	1577	583
92.0	10.8	18	1.55	10.6	17.675	1.73	5304	11012	5708	0.87	3.0	244	0.8	1.5	1.8			1.27	510	2053	1692	650
93.0	12.2	20.6	1.7	12.0	20.275	1.88	5366	11135	5769	0.88	3.4	288	0.9	1.7	2.3			1.42	601	2470	1965	851
94.0	11.4	19.2	1.1	11.2	18.875	1.28	5429	11258	5829	0.89	3.1	266	0.8	1.6	2.0			1.32	556	2205	1798	732
95.0	12.6	20.6	1.65	12.4	20.275	1.83	5491	11382	5891	0.81	3.5	273	0.9	1.8	2.4			1.43	571	2575	2041	815
96.0	11.6	18	1.8	11.5	17.675	1.98	5554	11503	5950	0.70	3.1	215	0.8	1.6	2.0			1.31	449	2261	1842	586
97.0	13.4	19.6	2.6	13.3	19.275	2.78	5616	11626	6010	0.56	3.7	208	0.9	1.9	2.6			1.48	434	2837	2214	640
98.0	14.8	22	2.9	14.6	21.675	3.08	5678	11750	6072	0.59	4.1	244	1.0	2.1	3.1			1.59	510	3277	2490	809
99.0	16.4	24	5.45	16.2	23.675	5.63	5741	11875	6135	0.55	4.6	259	1.1	2.3	3.6			1.70	540	3809	2814	919
100.0	16.8	23.2	6.5	16.7	22.875	6.68	5803	12000	6196	0.45	4.7	215	1.1	2.4	3.8			1.72	449	3951	2903	774

1.2.4 Geotechnical Conditions - MLK Extension - Laboratory Testing

Summary Of Laboratory Tests

Project Number: 10613051

Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Stratum	Natural Moisture (%)	Wet Natural Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index	Oven Dry Liquid Limit	Organic Content (%)	% Passing No. 200 Sieve	% Passing No. 40 Sieve
10BH-001	18.0 - 20.0 / -6.5 - -8.5	Jar	Gray, ORGANIC SILT, OH	D3	94.3	--	126	35	91	61	--	98.8	99.5
10BH-001	28.0 - 30.0 / -16.5 - -18.5	Jar	Dark brown, sandy ORGANIC SILT, OH	D3	119.6	--	133	74	59	67	--	58.9	75.1
10BH-001	33.0 - 35.0 / -21.5 - -23.5	Jar	Light gray, fine to coarse clayey SAND, SC	D1	21.2	--	20	2	18	--	--	39.6	96.1
10BH-009	23.0 - 25.0 / -11.4 - -13.4	Jar	Light gray, fine to medium silty, clayey SAND, SC-SM	D1	23.4	--	24	19	5	--	--	44.1	99.6
10BH-009A	23.0 - 25.0 / -11.8 - -13.8	Jar	Light gray, fine to medium silty, clayey SAND, SC-SM	D1	24.0	--	26	19	7	--	--	37.2	99.4
10BH-017	28.0 - 30.0 / -14.7 - -16.7	Jar	Gray, fat CLAY, contains mica and organic matter, CH	D2	62.3	--	82	30	52	--	--	88.2	99.5
10BH-017	38.0 - 40.0 / -24.7 - -26.7	Jar	Gray, fat CLAY with sand, contains organic matter, CH	D2	49.3	--	66	29	37	--	--	81.5	99.9

Notes:
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Schnabel ENGINEERING

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Portsmouth, VA

DYNAMIC LAB SUMMARY 10613051 SCHNABEL LOGS MASTER.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 10/26/10

Summary Of Laboratory Tests

Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Stratum	Natural Moisture (%)	Wet Natural Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index	Oven Dry Liquid Limit	Organic Content (%)	% Passing No. 200 Sieve	% Passing No. 40 Sieve
10BH-017	48.0 - 50.0 -34.7 - -36.7	Jar	Green gray, fine to coarse silty SAND, contains shell fragments, SM	E1	34.5	--	NP	NP	NP	--	--	15.2	94.6
10BH-020A	24.0 - 26.0 -12.8 - -14.8	Tube	Gray, elastic SILT, contains mica, MH	D2	51.3	105.5	64	39	25	--	--	95.0	99.8
10BH-020A	28.0 - 30.0 -16.8 - -18.8	Tube	Gray, elastic SILT, contains mica, MH	D2	53.8	103.3	55	30	25	--	--	86.1	99.3
10BH-023	33.0 - 35.0 -21.6 - -23.6	Jar	Brown and gray, fat CLAY, contains mica, CH	D2	51.0	--	74	31	43	--	--	90.8	99.7
10BH-023	68.0 - 70.0 -56.6 - -58.6	Jar	Green gray, fine to coarse clayey SAND, contains shell fragments, SC	E1	34.4	--	42	22	20	--	--	34.9	95.5
10BH-023	93.0 - 95.0 -81.6 - -83.6	Jar	Green gray, sandy fat CLAY, CH	E2	34.6	--	52	25	27	--	--	57.1	99.7
10BH-023A	23.0 - 25.0 -11.7 - -13.7	Tube	Gray, elastic SILT, contains mica, MH	D2	49.4	105.5	56	31	25	--	--	90.4	99.5

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Summary Of Laboratory Tests

Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Stratum	Natural Moisture (%)	Wet Natural Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index	Oven Dry Liquid Limit	Organic Content (%)	% Passing No. 200 Sieve	% Passing No. 40 Sieve
10BH-023A	28.0 - 30.0 -16.7 - -18.7	Tube	Gray, elastic SILT, contains mica, MH	D2	50.4	105.9	62	34	28	--	--	96.4	99.7
10BH-026	28.0 - 30.0 -14.9 - -16.9	Jar	Gray, sandy SILT, contains mica, ML	D2	38.9	--	36	27	9	--	--	55.4	99.6
10BH-026	53.0 - 55.0 -39.9 - -41.9	Jar	Gray, fat CLAY, CH	D2	46.0	--	64	30	34	--	--	96.6	99.7
10BH-030	23.0 - 25.0 -10.1 - -12.1	Jar	Gray, sandy lean CLAY, CL	D2	30.7	--	37	19	18	--	--	57.1	97.1
10BH-030A	38.0 - 40.0 -25.1 - -27.1	Tube	Gray, fat CLAY with sand, CH	D2	53.5	105.5	68	32	36	--	--	84.6	99.7
10BH-034A	22.0 - 24.0 -8.6 - -10.6	Tube	Gray, fat CLAY, CH	D2	73.4	95.7	100	34	66	--	--	96.6	99.6
10BH-037	8.0 - 10.0 5.0 - 3.0	Jar	Gray, fine to medium poorly graded SAND with silt, SP-SM	C1	24.8	--	NP	NP	NP	--	--	7.5	95.7

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Summary Of Laboratory Tests

Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Stratum	Natural Moisture (%)	Wet Natural Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index	Oven Dry Liquid Limit	Organic Content (%)	% Passing No. 200 Sieve	% Passing No. 40 Sieve
10BH-042	93.0 - 95.0 -80.1 - -82.1	Jar	Green gray, fine to coarse clayey SAND, SC	E1	32.4	--	38	23	15	--	--	40.1	97.0
10BH-048	33.0 - 35.0 -18.9 - -20.9	Jar	Gray, lean CLAY with sand, CL	D2	46.1	--	43	23	20	--	--	73.7	99.3
10BH-052	33.0 - 35.0 -19.9 - -21.9	Jar	Gray, elastic SILT with sand, contains organic matter, MH	D2	44.4	--	51	33	18	--	--	77.9	99.8
10BH-052	48.0 - 50.0 -34.9 - -36.9	Jar	Gray, elastic SILT, contains organic matter, MH	D2	85.3	--	86	48	38	--	--	89.4	99.8
10BH-052A	25.0 - 27.0 -11.9 - -13.9	Tube	Gray, elastic SILT, contains organic matter, MH	D2	68.2	92.6	84	43	41	--	--	93.8	96.8
10BH-053	23.0 - 25.0 -10.4 - -12.4	Jar	Gray, fat CLAY, contains organic matter, CH	D2	64.9	--	62	27	35	--	--	91.3	98.2
10BH-053	38.0 - 40.0 -25.4 - -27.4	Jar	Gray, elastic SILT, contains organic matter, MH	D2	60.2	--	67	33	34	--	--	97.0	99.7

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10BH-053	48.0 - 50.0 -35.4 - -37.4	Jar	Gray, elastic SILT with sand, contains organic matter, MH	D2	50.9	--	52	36	16	--	--	72.8	99.4
10BH-053	83.0 - 85.0 -70.4 - -72.4	Jar	Green gray, fine to coarse clayey SAND, SC	D2	32.0	--	38	18	20	--	--	36.4	95.0
10BH-053A	25.0 - 27.0 -12.4 - -14.4	Tube	Gray, SILT with sand, contains mica and gravel, ML	D2	45.7	110.7	NP	NP	NP	--	--	82.7	99.5
10BH-053A	33.0 - 35.0 -20.4 - -22.4	Tube	Brown, PEAT, PT	D3	403.5	65.4	--	--	--	--	--	--	--
10BH-054	28.0 - 30.0 -15.0 - -17.0	Jar	Black, ORGANIC SILT, OH (VISUAL)	D3	145.0	--	--	--	--	--	54.9	--	--
10BH-054	33.0 - 35.0 -20.0 - -22.0	Jar	Gray, elastic SILT with sand, contains mica and organic matter, MH	D2	71.5	--	66	40	26	--	--	84.0	99.4
10BH-054	38.0 - 40.0 -25.0 - -27.0	Jar	Gray, fine to medium silty SAND, contains mica and organic matter, SM	D1	59.0	--	46	33	13	--	--	45.1	99.5

Notes:
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10BH-054	53.0 - 55.0 -40.0 - -42.0	Jar	Gray, fine to coarse silty SAND, SM	D1	37.6	--	27	24	3	--	--	24.3	98.8
10BH-057	23.0 - 25.0 -10.9 - -12.9	Jar	Gray, fat CLAY, CH	D2	60.9	--	98	29	69	--	--	96.6	99.2
10BH-059	4.0 - 6.0 7.8 - 5.8	Jar	Gray, fine to medium silty SAND, SM	C1	20.2	--	NP	NP	NP	--	--	13.7	96.2
10BH-059	48.0 - 50.0 -36.2 - -38.2	Jar	Dark gray, ORGANIC SILT with sand, contains mica, OH	D3	89.3	--	89	54	35	53	--	72.5	89.6
10BH-059A	22.0 - 24.0 -10.2 - -12.2	Tube	Gray, fat CLAY, CH	D2	86.1	99.7	53	27	26	--	--	92.6	97.4
10BH-061	3.0 - 4.0 9.5 - 8.5	Jar	Dark gray, fine to medium clayey SAND, SC	C1	13.4	--	22	12	10	--	--	29.6	95.0
10BH-061	23.0 - 25.0 -10.5 - -12.5	Jar	Gray, fat CLAY, CH	D2	82.5	--	120	31	89	--	--	92.9	97.0

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Summary Of Laboratory Tests

Project Number: 10613051

Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Stratum	Natural Moisture (%)	Wet Natural Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index	Oven Dry Liquid Limit	Organic Content (%)	% Passing No. 200 Sieve	% Passing No. 40 Sieve
10BH-061	33.0 - 35.0 -20.5 - -22.5	Jar	Dark brown, sandy ORGANIC SILT, OH	D3	109.7	--	162	68	94	60	--	56.6	78.3
10BH-061	48.0 - 50.0 -35.5 - -37.5	Jar	Gray, fine to medium silty SAND, contains organic matter, SM	D1	33.8	--	30	23	7	--	--	40.2	98.4
10BH-061	93.0 - 95.0 -80.5 - -82.5	Tube	Gray, fine to medium silty SAND, SM	E1	31.6	120.5	39	26	13	--	--	47.6	99.0
10BH-075	28.0 - 30.0 -15.5 - -17.5	Jar	Gray, fat CLAY, CH	D2	49.8	--	69	26	43	--	--	97.1	99.7
10BH-075	63.0 - 65.0 -50.5 - -52.5	Jar	Gray, fine to medium clayey SAND, SC	D1	50.5	--	50	30	20	--	--	42.7	97.5
10BH-077	23.0 - 25.0 -11.9 - -13.9	Jar	Gray, fat CLAY, CH	D2	70.7	--	94	28	66	--	--	96.4	99.7
10BH-077	58.0 - 60.0 -46.9 - -48.9	Jar	Gray, sandy SILT, contains organic matter, ML	D2	43.3	--	42	37	5	--	--	51.2	99.5

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10BH-081	18.0 - 20.0 / -6.1 - -8.1	Jar	Gray, fat CLAY, CH	D2	65.1	--	78	24	54	--	--	88.5	97.2
10BH-081	33.0 - 35.0 / -21.1 - -23.1	Jar	Dark brown, PEAT, PT	D3	253.8	--	322	260	62	75	--	5.8	32.7
10BH-081	38.0 - 40.0 / -26.1 - -28.1	Jar	Black, ORGANIC SILT, OH (VISUAL)	D3	99.7	--	--	--	--	--	47.1	--	--
10BH-081	68.0 - 70.0 / -56.1 - -58.1	Jar	Green gray, fine to coarse clayey SAND, SC	E1	34.4	--	35	22	13	--	--	39.1	95.9
10BH-081	73.0 - 75.0 / -61.1 - -63.1	Jar	Green gray, fine to medium clayey SAND, SC	E1	31.7	--	30	19	11	--	--	36.3	86.1
10BH-084	23.0 - 25.0 / -11.1 - -13.1	Jar	Gray, fat CLAY, CH	D2	69.3	--	95	30	65	--	--	99.2	99.8
10BH-084	33.0 - 35.0 / -21.1 - -23.1	Jar	Dark brown, PEAT, PT	D3	297.4	--	386	283	103	--	62.7	5.3	34.2

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Summary Of Laboratory Tests

Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Stratum	Natural Moisture (%)	Wet Natural Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index	Oven Dry Liquid Limit	Organic Content (%)	% Passing No. 200 Sieve	% Passing No. 40 Sieve
10BH-084	48.0 - 50.0 -36.1 - -38.1	Jar	Brown and gray, elastic SILT, contains organic matter, MH	D2	67.8	--	62	43	19	--	--	85.4	97.8
10BH-084	63.0 - 65.0 -51.1 - -53.1	Jar	Gray, sandy lean CLAY, CL	D2	24.1	--	35	16	19	--	--	68.6	99.9
10BH-088	28.0 - 30.0 -15.7 - -17.7	Jar	Gray, fat CLAY, CH	D2	66.4	--	86	27	59	--	--	95.4	99.0
10BH-088	38.0 - 40.0 -25.7 - -27.7	Jar	Brown, ORGANIC CLAY, OH	D3	81.3	--	55	22	33	36	--	91.4	96.5
10BH-096A	22.0 - 24.0 -9.5 - -11.5	Tube	Gray, fat CLAY, CH	D2	74.0	96.3	100	23	77	--	--	99.8	100.0
10BH-096A	32.0 - 34.0 -19.5 - -21.5	Tube	Dark brown, PEAT, PT	D3	285.3	73.5	332	250	82	68	54.7	1.4	16.7
10BH-118	1.0 - 2.0 10.5 - 9.5	Jar	Brown and gray, fine to medium clayey SAND, SC	C1	13.5	--	23	13	10	--	--	44.7	95.3

Notes:
1. Soil tests in general accordance with ASTM standards.
2. Soil classifications are in general accordance with ASTM D2487(as applicable), based on testing indicated and visual classification.
3. Key to abbreviations: NP=Non-Plastic; -- indicates no test performed

Schnabel ENGINEERING

Project: Martin Luther King Expressway
Route 58 and Interstate 264
Portsmouth, VA

DYNAMIC LAB SUMMARY 10613051 SCHNABEL LOGS MASTER.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 10/26/10

Summary Of Laboratory Tests

Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Stratum	Natural Moisture (%)	Wet Natural Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index	Oven Dry Liquid Limit	Organic Content (%)	% Passing No. 200 Sieve	% Passing No. 40 Sieve
10BH-120	18.0 - 20.0 / -6.6 - -8.6	Jar	Gray, fat CLAY, CH	D2	73.3	--	83	25	58	--	--	97.1	99.6
10BH-120	38.0 - 40.0 / -26.6 - -28.6	Jar	Black, ORGANIC SILT, OH	D3	138.9	--	--	--	--	--	24	--	--
10BH-120	43.0 - 45.0 / -31.6 - -33.6	Jar	Brown, ORGANIC SILT with sand, OH	D3	105.8	--	100	57	43	51	--	82.2	92.3
10BH-120A	25.0 - 27.0 / -13.6 - -15.6	Tube	Gray, fat CLAY, CH	D2	73.5	97.1	86	28	58	--	--	99.3	100.0
10BH-120A	35.0 - 37.0 / -23.6 - -25.6	Tube	Brown, PEAT, PT	D3	277.0	68.3	363	269	94	70	54.1	5.7	29.3
10BH-120A	58.0 - 60.0 / -46.6 - -48.6	Tube	Gray, sandy SILT, contains mica and organic matter, ML	D2	38.0	111.3	40	32	8	--	--	67.4	100.0
10BH-123	18.0 - 20.0 / -7.7 - -9.7	Jar	Gray, fat CLAY, CH	D2	72.9	--	83	25	58	--	--	94.8	98.6

Notes:
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Schnabel ENGINEERING

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Route 58 and Interstate 264
Portsmouth, VA

DYNAMIC LAB SUMMARY 10613051 SCHNABEL LOGS MASTER.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 10/26/10

Summary Of Laboratory Tests

Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Stratum	Natural Moisture (%)	Wet Natural Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index	Oven Dry Liquid Limit	Organic Content (%)	% Passing No. 200 Sieve	% Passing No. 40 Sieve
10BH-123	43.0 - 45.0 / -32.7 - -34.7	Jar	Gray, SILT, contains organic matter, ML	D2	47.0	--	48	33	15	--	--	85.8	99.3
10BH-123	78.0 - 80.0 / -67.7 - -69.7	Jar	Green gray, fine to medium clayey SAND, SC	E1	38.7	--	42	22	20	--	--	39.8	97.5
10BH-126	18.0 - 20.0 / -6.8 - -8.8	Jar	Gray, fat CLAY, CH	D2	64.2	--	69	24	45	--	--	87.6	96.2
10BH-126	28.0 - 30.0 / -16.8 - -18.8	Jar	Dark brown, PEAT, PT	D3	171.9	--	193	98	95	70	--	5.0	24.1
10BH-127	18.0 - 20.0 / -6.9 - -8.9	Jar	Gray, fat CLAY, CH	D2	79.0	--	91	24	67	--	--	95.7	99.6
10BH-127	48.0 - 50.0 / -36.9 - -38.9	Jar	Gray, fat CLAY with sand, contains organic matter, CH	D2	53.7	--	53	25	28	--	--	75.7	90.3
10BH-127	63.0 - 65.0 / -51.9 - -53.9	Jar	Brown, ORGANIC CLAY, OH	D3	72.9	--	113	39	74	51	--	93.2	98.4

Notes:
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Schnabel ENGINEERING

Project: Martin Luther King Expressway
Route 58 and Interstate 264
Portsmouth, VA

DYNAMIC LAB SUMMARY 10613051 SCHNABEL LOGS MASTER.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 10/26/10

Summary Of Laboratory Tests

Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Stratum	Natural Moisture (%)	Wet Natural Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index	Oven Dry Liquid Limit	Organic Content (%)	% Passing No. 200 Sieve	% Passing No. 40 Sieve
10BH-130	23.0 - 25.0 -12.6 - -14.6	Jar	Gray, fat CLAY, CH	D2	79.0	--	59	20	39	--	--	90.9	98.1
10BH-130	33.0 - 35.0 -22.6 - -24.6	Jar	Brown, PEAT, PT	D3	412.3	--	--	--	--	--	24.1	--	--
10BH-130	63.0 - 65.0 -52.6 - -54.6	Jar	Gray, elastic SILT with sand, MH	D2	33.7	--	111	46	65	--	--	78.9	98.9
10BH-133	18.0 - 20.0 -7.0 - -9.0	Jar	Gray, fat CLAY, CH	D2	70.4	--	66	19	47	--	--	94.9	99.5
10BH-133	33.0 - 35.0 -22.0 - -24.0	Jar	Dark brown, PEAT, PT	D3	7.4	--	229	160	69	66	--	7.4	22.1
10BH-133	38.0 - 40.0 -27.0 - -29.0	Jar	Dark brown, ORGANIC SILT with sand, OH	D3	178.1	--	216	135	81	74	--	83.4	89.8
10BH-133	63.0 - 65.0 -52.0 - -54.0	Jar	Gray, fat CLAY, CH	D2	58.5	--	82	33	49	--	--	97.4	99.7

Notes:
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Schnabel ENGINEERING

Project: Martin Luther King Expressway
Route 58 and Interstate 264
Portsmouth, VA

DYNAMIC LAB SUMMARY 10613051 SCHNABEL LOGS MASTER.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 10/26/10

Summary Of Laboratory Tests

Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Stratum	Natural Moisture (%)	Wet Natural Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index	Oven Dry Liquid Limit	Organic Content (%)	% Passing No. 200 Sieve	% Passing No. 40 Sieve
10BH-136	38.0 - 40.0 / -26.3 - -28.3	Jar	Dark brown, PEAT, PT	D3	249.5	--	--	--	--	--	57.6	--	--
10BH-136A	20.0 - 22.0 / -8.3 - -10.3	Tube	Gray, fat CLAY, CH	D2	77.8	94.2	98	30	68	--	--	99.6	99.9
10BH-136A	32.0 - 34.0 / -20.3 - -22.3	Tube	Dark brown, PEAT, PT	D3	215.7	78.9	223	147	76	75	39.5	4.2	19.6
10BH-140	0.0 - 2.0 / 9.8 - 7.8	Jar	Brown, fine to coarse silty SAND, contains crushed stone, SM	A1	11.9	--	NP	NP	NP	--	--	25.4	93.4
10BH-144	28.0 - 30.0 / -19.2 - -21.2	Jar	Dark brown, ORGANIC SILT, OH (VISUAL)	D3	106.5	--	--	--	--	--	18.4	--	--
10BH-147	13.0 - 15.0 / -5.7 - -7.7	Jar	Brown and gray, ORGANIC CLAY with sand, OH	D3	62.2	--	83	36	47	45	--	78.4	91.6
10BH-147	23.0 - 25.0 / -15.7 - -17.7	Jar	Gray, ORGANIC SILT with sand, OH	D3	75.7	--	87	55	32	52	--	78.8	95.1

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Schnabel ENGINEERING

Project: Martin Luther King Expressway
Route 58 and Interstate 264
Portsmouth, VA

DYNAMIC LAB SUMMARY 10613051 SCHNABEL LOGS MASTER.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 10/26/10

Summary Of Laboratory Tests

Project Number: 10613051

Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Stratum	Natural Moisture (%)	Wet Natural Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index	Oven Dry Liquid Limit	Organic Content (%)	% Passing No. 200 Sieve	% Passing No. 40 Sieve
10BH-151	23.0 - 25.0 / -6.2 - -8.2	Jar	Dark brown, elastic SILT with sand, MH	D2	57.3	--	70	45	25	--	--	77.7	97.4
10BH-151	33.0 - 35.0 / -16.2 - -18.2	Jar	Dark brown, elastic SILT, contains organic matter, MH	D2	67.1	--	80	44	36	--	--	95.3	99.0
10BH-151	63.0 - 65.0 / -46.2 - -48.2	Jar	Gray, fat CLAY, CH	D2	44.2	--	51	23	28	--	--	94.3	99.7
10BH-154A	18.0 - 20.0 / -9.0 - -11.0	Tube	Dark gray, elastic SILT, MH	D2	57.7	99.6	59	31	28	--	--	93.0	99.3
10BH-160	33.0 - 35.0 / -21.2 - -23.2	Jar	Gray, fine to coarse poorly graded SAND with silt, SP-SM	D1	26.6	--	NP	NP	NP	--	--	11.3	92.0
10BH-162	23.0 - 25.0 / -13.2 - -15.2	Jar	Gray, fine to medium silty SAND, contains mica, SM	D1	33.4	--	28	27	1	--	--	18.4	99.8
10BH-164	53.0 - 55.0 / -43.5 - -45.5	Jar	Dark gray, fine to coarse poorly graded SAND with silt, contains mica, SP-SM	D1	21.7	--	NP	NP	NP	--	--	10.2	89.8

Notes:
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Schnabel ENGINEERING

Project: Martin Luther King Expressway
Route 58 and Interstate 264
Portsmouth, VA

DYNAMIC LAB SUMMARY 10613051 SCHNABEL LOGS MASTER.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 10/26/10

Summary Of Laboratory Tests

Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Stratum	Natural Moisture (%)	Wet Natural Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index	Oven Dry Liquid Limit	Organic Content (%)	% Passing No. 200 Sieve	% Passing No. 40 Sieve
10BH-179	2.0 - 4.0 9.4 - 7.4	Jar	Yellow brown, fine to coarse silty SAND, SM	C1	12.7	--	NP	NP	NP	--	--	16.2	84.1
10BH-179	18.0 - 20.0 -6.6 - -8.6	Jar	Gray, fine to coarse clayey SAND, contains shell fragments, SC	D1	43.2	--	32	22	10	--	--	44.2	94.3
10BH-182	2.0 - 4.0 10.2 - 8.2	Jar	Brown and gray, fine to coarse clayey SAND, SC	C1	14.7	--	21	12	9	--	--	35.1	94.9
10BH-186	23.0 - 25.0 -11.5 - -13.5	Jar	Dark brown, ORGANIC SILT with sand, OH	D3	158.5	--	205	116	89	91	--	75.9	91.5
10BH-194	23.0 - 25.0 -15.7 - -17.7	Jar	Gray, sandy SILT, contains organic matter, ML	D2	38.8	--	41	30	11	--	--	59.4	99.0
10BH-206	2.0 - 4.0 9.2 - 7.2	Jar	Light brown, fine to medium poorly graded SAND, SP	C1	2.2	--	NP	NP	NP	--	--	2.9	89.5
10BH-206	28.0 - 30.0 -16.8 - -18.8	Jar	Dark gray, fine to coarse silty SAND, contains organic matter, SM	C1	61.0	--	49	30	19	--	--	39.9	95.9

Notes:
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Schnabel ENGINEERING

Project: Martin Luther King Expressway
Route 58 and Interstate 264
Portsmouth, VA

DYNAMIC LAB SUMMARY 10613051 SCHNABEL LOGS MASTER.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 10/26/10

Summary Of Laboratory Tests

Project Number: 10613051

Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Stratum	Natural Moisture (%)	Wet Natural Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index	Oven Dry Liquid Limit	Organic Content (%)	% Passing No. 200 Sieve	% Passing No. 40 Sieve
10BH-215	23.0 - 25.0 -11.8 - -13.8	Jar	Gray, elastic SILT, MH	D2	59.7	--	73	36	37	--	--	96.7	99.6
10BH-217	28.0 - 30.0 -17.2 - -19.2	Jar	Dark gray, fat CLAY with sand, contains organic matter, CH	D2	49.1	--	58	30	28	--	--	82.9	96.9
10BH-223	23.0 - 25.0 -11.4 - -13.4	Jar	Dark gray, sandy ORGANIC SILT, OH	D3	170.0	--	139	69	70	--	--	64.6	79.2
10BH-223	58.0 - 60.0 -46.4 - -48.4	Jar	Gray, lean CLAY with sand, CL	D2	26.0	--	38	18	20	--	--	78.7	99.3
10BH-229	53.0 - 55.0 -42.2 - -44.2	Jar	Gray, fat CLAY, contains organic matter, CH	D2	51.9	--	77	32	45	--	--	96.0	99.6
10BH-233A	20.0 - 22.0 -8.3 - -10.3	Tube	Dark gray, elastic SILT, MH	D2	62.6	100.2	57	32	25	--	--	94.0	99.0

Notes:
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Schnabel ENGINEERING

Project: Martin Luther King Expressway
Route 58 and Interstate 264
Portsmouth, VA

DYNAMIC LAB SUMMARY 10613051 SCHNABEL LOGS MASTER.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 10/26/10

Summary Of Laboratory Tests

Project Number: 10613051

Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Stratum	pH	Resistivity (ohm-cm)
10BH-004	4.0 - 10.0 / 8.0 - 2.0	Jar	Light brown and gray, fine to medium silty SAND, SM (VISUAL)	C1	3.9	1800
10BH-017	4.0 - 10.0 / 9.3 - 3.3	Jar	Light brown and gray, fine to medium, silty SAND, SM (VISUAL)	C1	5.8	2400
10BH-023	4.0 - 10.0 / 7.4 - 1.4	Jar	Brown and gray, fine to medium silty SAND, SM (VISUAL)	C1	3.1	890
10BH-096	33.0 - 40.0 / -20.5 - -27.5	Jar	Black, PEAT, PT	D3	5.9	1100
10BH-126	4.0 - 10.0 / 7.2 - 1.2	Jar	Light brown and gray, silty SAND, SM (VISUAL)	C1	5.2	8500
10BH-144	4.0 - 10.0 / 4.8 - -1.2	Jar	Light brown, silty SAND, SM (VISUAL)	C1	4.4	3800
10BH-157	18.0 - 25.0 / -8.4 - -15.4	Jar	Black, PEAT, PT	D3	4.1	700

Notes:
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Schnabel ENGINEERING

Project: Martin Luther King Expressway
Route 58 and Interstate 264
Portsmouth, VA

DYNAMIC LAB SUMMARY 10613051 SCHNABEL LOGS MASTER.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 10/7/10

Summary Of Laboratory Tests

Project Number: 10613051

Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Stratum	pH	Resistivity (ohm-cm)
10BH-215	4.0 - 10.0 / 7.2 - 1.2	Jar	Brown, fine to medium silty SAND, SM (VISUAL)	C1	6.1	6500

Notes:
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Schnabel ENGINEERING

Project: Martin Luther King Expressway
Route 58 and Interstate 264
Portsmouth, VA

DYNAMIC LAB SUMMARY 10613051 SCHNABEL LOGS MASTER.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 10/7/10

Summary Of Laboratory Tests

Project Number: P8330138

Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Stratum	Natural Moisture (%)	Wet Natural Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index	Oven Dry Liquid Limit	% Passing No. 200 Sieve
10BH-101	22.0 - 24.0 / -8.8 - -10.8	Tube	Gray, fat CLAY, trace sand, CH	D2	65.9	99.2	86	29	57	--	98.7
10BH-101	35.0 - 37.0 / -21.8 - -23.8	Tube	Dark brown, sandy ORGANIC SILT, OH	D3	217.6	67.4	220	156	64	63	51.4

Notes:
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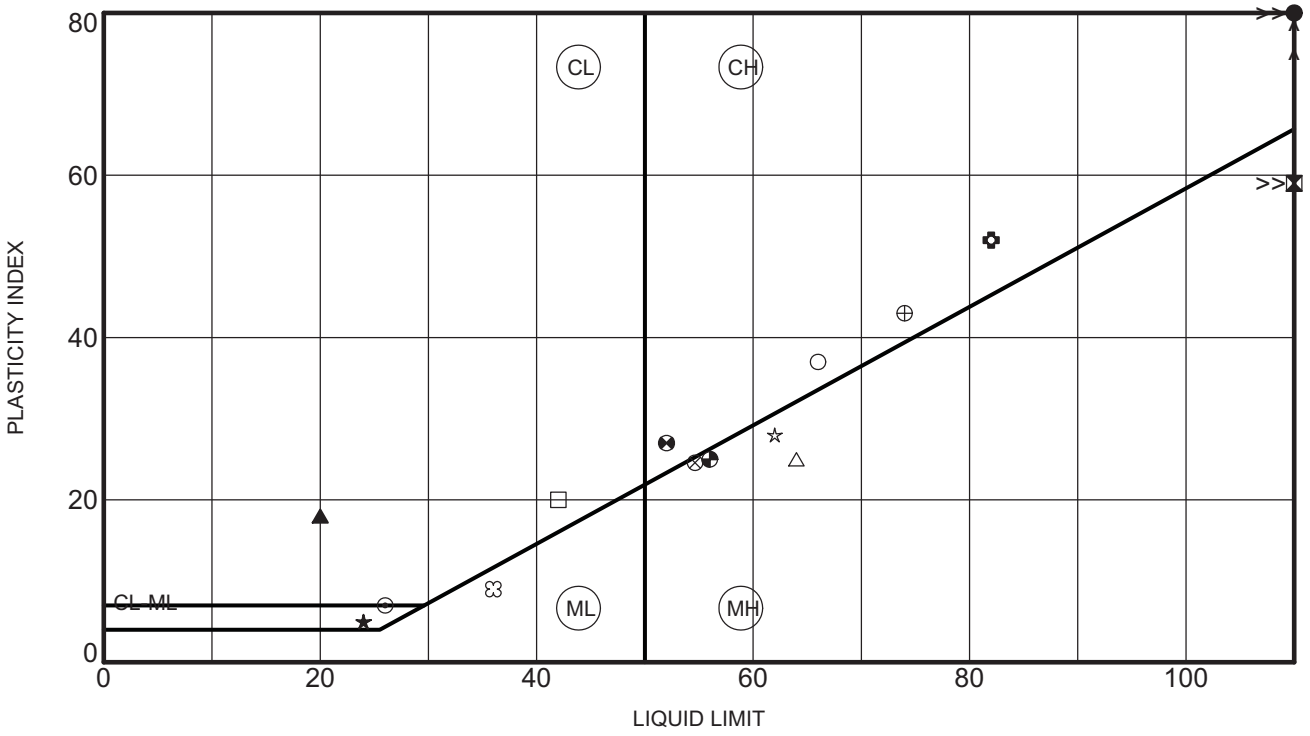
3. Key to abbreviations: NP=Non-Plastic; -- indicates no test performed

Schnabel ENGINEERING

Project: MLK Freeway Extension
MARSHALL MILLER BORING
Portsmouth, VA

DYNAMIC LAB SUMMARY P8330138 LAB DATA.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 10/22/10



PLOTTED DATA REPRESENTS SOIL PASSING NO. 40 SIEVE

	Specimen		LL	PL	PI	Fines	Oven Dry Liquid Limit	Description
●	10BH-001	18.0 ft	126	35	91	99	61.0	Gray, ORGANIC SILT, OH
⊠	10BH-001	28.0 ft	133	74	59	59	67.0	Dark brown, sandy ORGANIC SILT, OH
▲	10BH-001	33.0 ft	20	2	18	40		Light gray, fine to coarse clayey SAND, SC
★	10BH-009	23.0 ft	24	19	5	44		Light gray, fine to medium silty, clayey SAND, SC-SM
⊙	10BH-009A	23.0 ft	26	19	7	37		Light gray, fine to medium silty, clayey SAND, SC-SM
✿	10BH-017	28.0 ft	82	30	52	88		Gray, fat CLAY, contains mica and organic matter, CH
○	10BH-017	38.0 ft	66	29	37	82		Gray, fat CLAY with sand, contains organic matter, CH
△	10BH-020A	24.0 ft	64	39	25	95		Gray, elastic SILT, contains mica, MH
⊗	10BH-020A	28.0 ft	55	30	25	86		Gray, elastic SILT, contains mica, MH
⊕	10BH-023	33.0 ft	74	31	43	91		Brown and gray, fat CLAY, contains mica, CH
□	10BH-023	68.0 ft	42	22	20	35		Green gray, fine to coarse clayey SAND, contains shell fragments, SC
⊠	10BH-023	93.0 ft	52	25	27	57		Green gray, sandy fat CLAY, CH
◒	10BH-023A	23.0 ft	56	31	25	90		Gray, elastic SILT, contains mica, MH
☆	10BH-023A	28.0 ft	62	34	28	96		Gray, elastic SILT, contains mica, MH
⊠	10BH-026	28.0 ft	36	27	9	55		Gray, sandy SILT, contains mica, ML

NOTE: An organic clay or silt is a soil that would be classified as a clay or silt, respectively, except that its oven dried liquid limit is less than 75% of its liquid limit value.

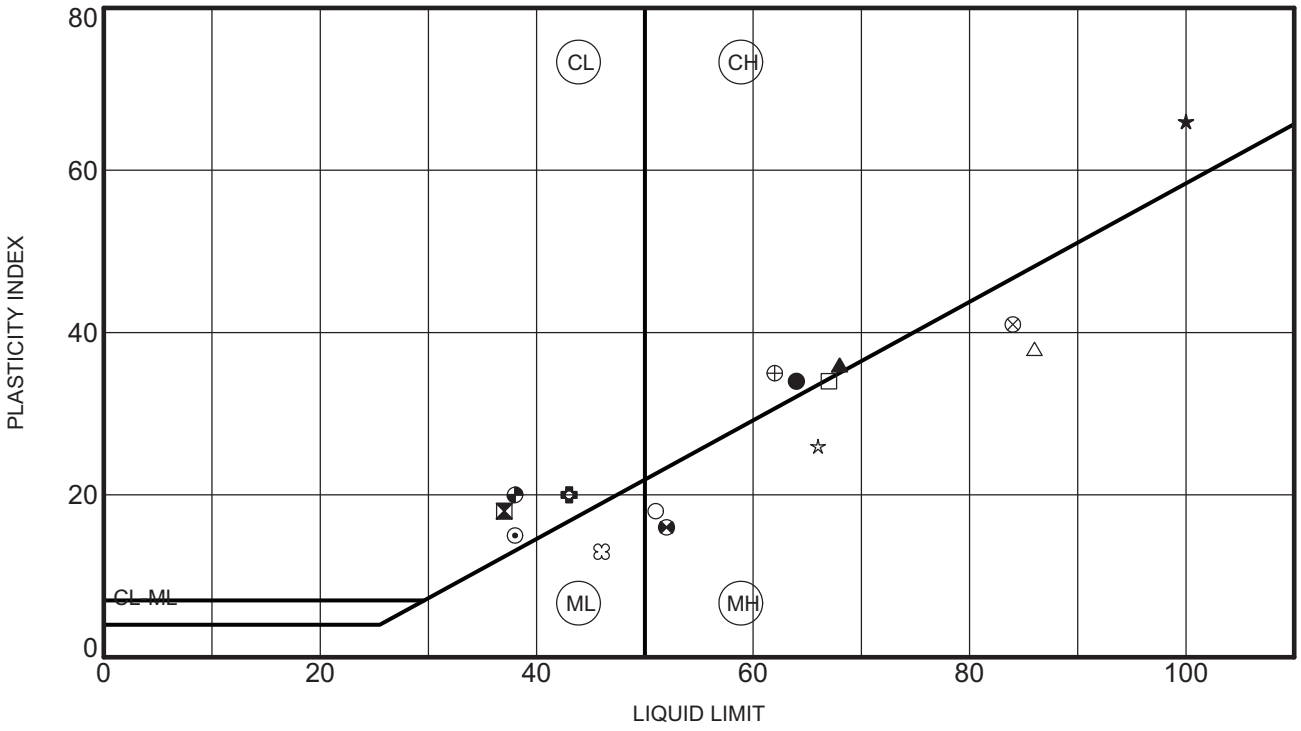
Schnabel ENGINEERING

ATTERBERG LIMITS

Project: Martin Luther King Expressway
Route 58 and Interstate 264
Portsmouth, VA

Contract: 10613051

ATTERBERG_LIMITS 10613051 SCHNABEL LOGS MASTER.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 10/15/10



PLOTTED DATA REPRESENTS SOIL PASSING NO. 40 SIEVE

	Specimen		LL	PL	PI	Fines	Oven Dry Liquid Limit	Description
●	10BH-026	53.0 ft	64	30	34	97		Gray, fat CLAY, CH
⊠	10BH-030	23.0 ft	37	19	18	57		Gray, sandy lean CLAY, CL
▲	10BH-030A	38.0 ft	68	32	36	85		Gray, fat CLAY with sand, CH
★	10BH-034A	22.0 ft	100	34	66	97		Gray, fat CLAY, CH
⊙	10BH-042	93.0 ft	38	23	15	40		Green gray, fine to coarse clayey SAND, SC
✿	10BH-048	33.0 ft	43	23	20	74		Gray, lean CLAY with sand, CL
○	10BH-052	33.0 ft	51	33	18	78		Gray, elastic SILT with sand, contains organic matter, MH
△	10BH-052	48.0 ft	86	48	38	89		Gray, elastic SILT, contains organic matter, MH
⊗	10BH-052A	25.0 ft	84	43	41	94		Gray, elastic SILT, contains organic matter, MH
⊕	10BH-053	23.0 ft	62	27	35	91		Gray, fat CLAY, contains organic matter, CH
□	10BH-053	38.0 ft	67	33	34	97		Gray, elastic SILT, contains organic matter, MH
⊠	10BH-053	48.0 ft	52	36	16	73		Gray, elastic SILT with sand, contains organic matter, MH
◔	10BH-053	83.0 ft	38	18	20	36		Green gray, fine to coarse clayey SAND, SC
☆	10BH-054	33.0 ft	66	40	26	84		Gray, elastic SILT with sand, contains mica and organic matter, MH
⊠	10BH-054	38.0 ft	46	33	13	45		Gray, fine to medium silty SAND, contains mica and organic matter, SM

NOTE: An organic clay or silt is a soil that would be classified as a clay or silt, respectively, except that its oven dried liquid limit is less than 75% of its liquid limit value.

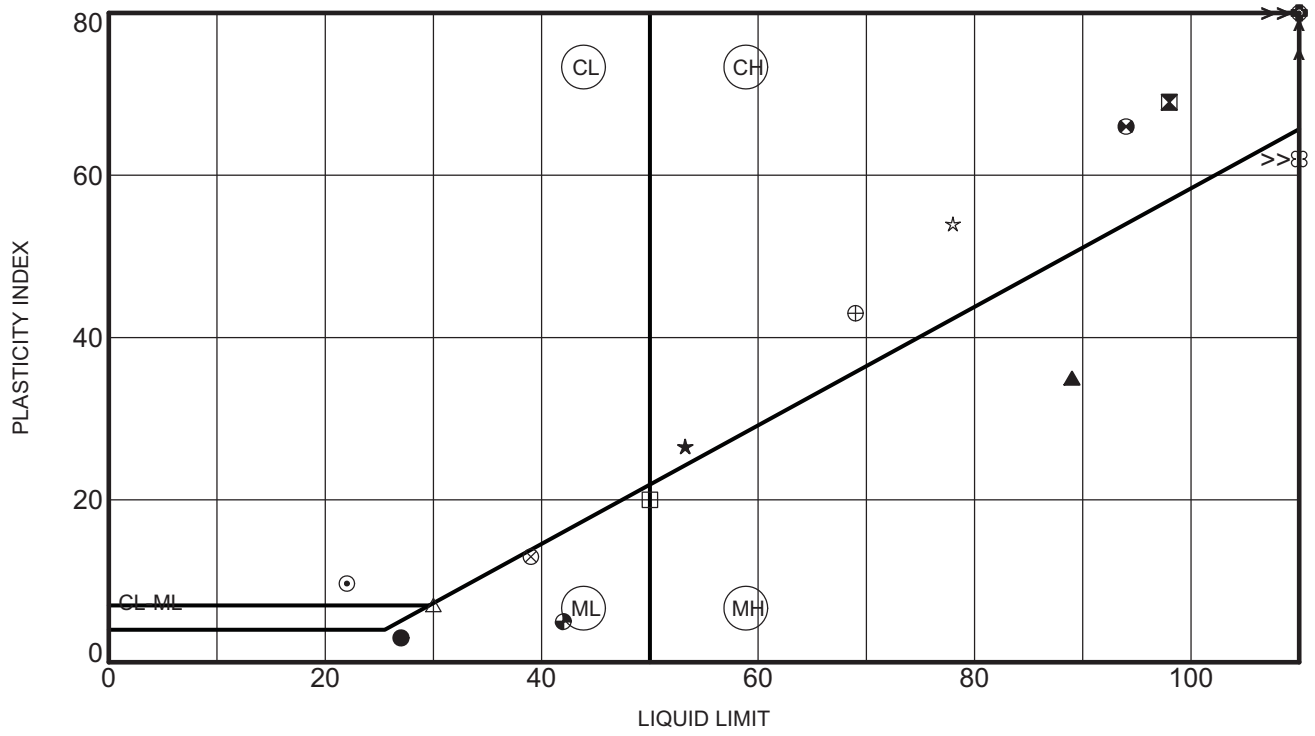
Schnabel ENGINEERING

ATTERBERG LIMITS

Project: Martin Luther King Expressway
Route 58 and Interstate 264
Portsmouth, VA

Contract: 10613051

ATTERBERG_LIMITS 10613051 SCHNABEL LOGS MASTER.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 10/15/10



PLOTTED DATA REPRESENTS SOIL PASSING NO. 40 SIEVE

	Specimen		LL	PL	PI	Fines	Oven Dry Liquid Limit	Description
●	10BH-054	53.0 ft	27	24	3	24		Gray, fine to coarse silty SAND, SM
⊠	10BH-057	23.0 ft	98	29	69	97		Gray, fat CLAY, CH
▲	10BH-059	48.0 ft	89	54	35	73	53.0	Dark gray, ORGANIC SILT with sand, contains mica, OH
★	10BH-059A	22.0 ft	53	27	26	93		Gray, fat CLAY, CH
⊙	10BH-061	3.0 ft	22	12	10	30		Dark gray, fine to medium clayey SAND, SC
✿	10BH-061	23.0 ft	120	31	89	93		Gray, fat CLAY, CH
○	10BH-061	33.0 ft	162	68	94	57	60.0	Dark brown, sandy ORGANIC SILT, OH
△	10BH-061	48.0 ft	30	23	7	40		Gray, fine to medium silty SAND, contains organic matter, SM
⊗	10BH-061	93.0 ft	39	26	13	48		Gray, fine to medium silty SAND, SM
⊕	10BH-075	28.0 ft	69	26	43	97		Gray, fat CLAY, CH
□	10BH-075	63.0 ft	50	30	20	43		Gray, fine to medium clayey SAND, SC
⊠	10BH-077	23.0 ft	94	28	66	96		Gray, fat CLAY, CH
◒	10BH-077	58.0 ft	42	37	5	51		Gray, sandy SILT, contains organic matter, ML
☆	10BH-081	18.0 ft	78	24	54	89		Gray, fat CLAY, CH
⊠	10BH-081	33.0 ft	322	260	62	6	75.0	Dark brown, PEAT, PT

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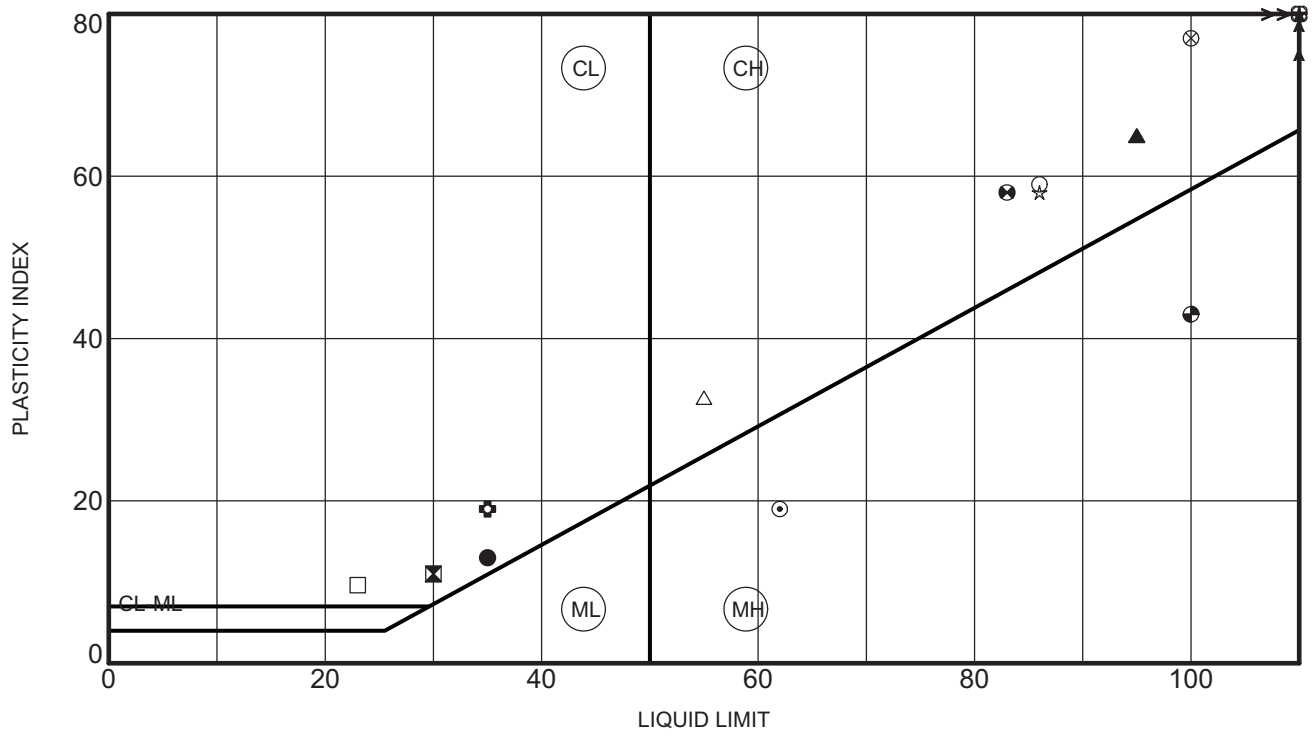
Schnabel ENGINEERING

ATTERBERG LIMITS

Project: Martin Luther King Expressway
Route 58 and Interstate 264
Portsmouth, VA

Contract: 10613051

ATTERBERG_LIMITS 10613051 SCHNABEL LOGS MASTER.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 10/15/10



PLOTTED DATA REPRESENTS SOIL PASSING NO. 40 SIEVE

	Specimen		LL	PL	PI	Fines	Oven Dry Liquid Limit	Description
●	10BH-081	68.0 ft	35	22	13	39		Green gray, fine to coarse clayey SAND, SC
⊠	10BH-081	73.0 ft	30	19	11	36		Green gray, fine to medium clayey SAND, SC
▲	10BH-084	23.0 ft	95	30	65	99		Gray, fat CLAY, CH
★	10BH-084	33.0 ft	386	283	103	5		Dark brown, PEAT, PT
⊙	10BH-084	48.0 ft	62	43	19	85		Brown and gray, elastic SILT, contains organic matter, MH
✿	10BH-084	63.0 ft	35	16	19	69		Gray, sandy lean CLAY, CL
○	10BH-088	28.0 ft	86	27	59	95		Gray, fat CLAY, CH
△	10BH-088	38.0 ft	55	22	33	91	36.0	Brown, ORGANIC CLAY, OH
⊗	10BH-096A	22.0 ft	100	23	77	100		Gray, fat CLAY, CH
⊕	10BH-096A	32.0 ft	332	250	82	1	68.0	Dark brown, PEAT, PT
□	10BH-118	1.0 ft	23	13	10	45		Brown and gray, fine to medium clayey SAND, SC
⊠	10BH-120	18.0 ft	83	25	58	97		Gray, fat CLAY, CH
◒	10BH-120	43.0 ft	100	57	43	82	51.0	Brown, ORGANIC SILT with sand, OH
☆	10BH-120A	25.0 ft	86	28	58	99		Gray, fat CLAY, CH
⊠	10BH-120A	35.0 ft	363	269	94	6	70.0	Brown, PEAT, PT

NOTE: An organic clay or silt is a soil that would be classified as a clay or silt, respectively, except that its oven dried liquid limit is less than 75% of its liquid limit value.

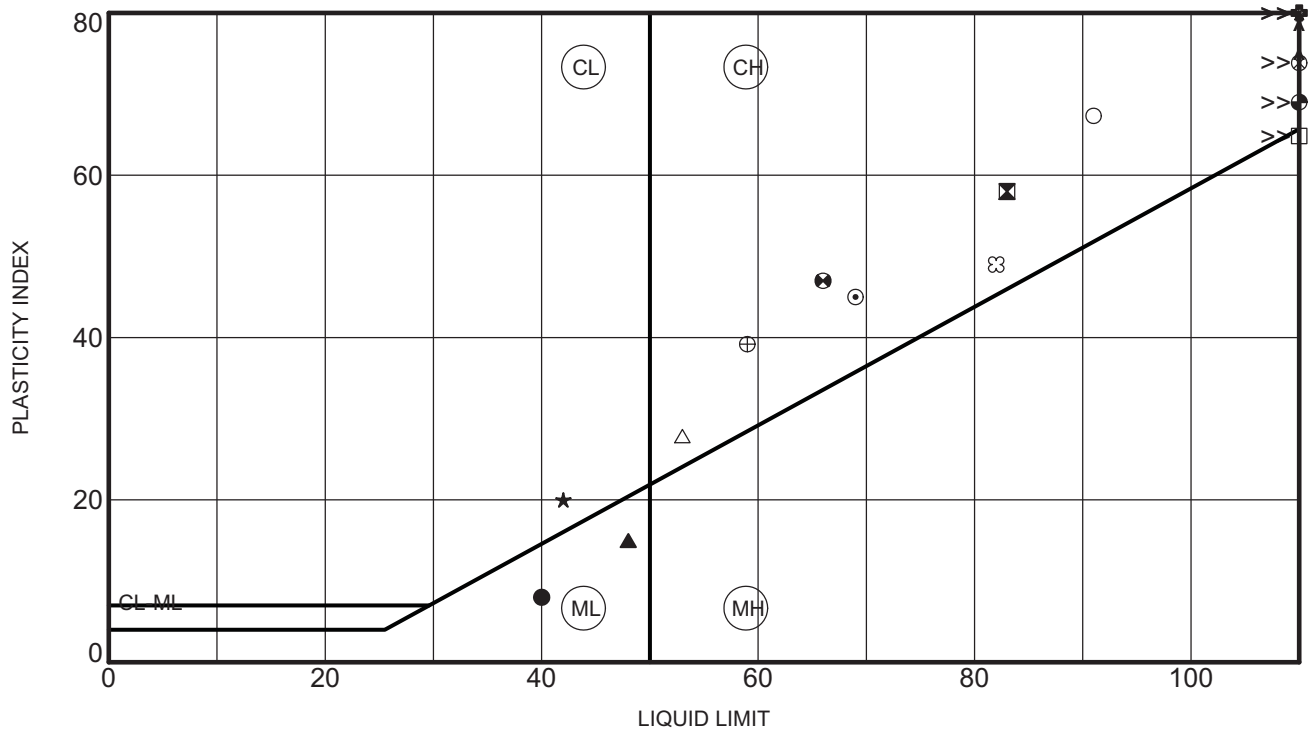
Schnabel ENGINEERING

ATTERBERG LIMITS

Project: Martin Luther King Expressway
Route 58 and Interstate 264
Portsmouth, VA

Contract: 10613051

ATTERBERG_LIMITS 10613051 SCHNABEL LOGS MASTER.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 10/15/10



PLOTTED DATA REPRESENTS SOIL PASSING NO. 40 SIEVE

	Specimen		LL	PL	PI	Fines	Oven Dry Liquid Limit	Description
●	10BH-120A	58.0 ft	40	32	8	67		Gray, sandy SILT, contains mica and organic matter, ML
⊠	10BH-123	18.0 ft	83	25	58	95		Gray, fat CLAY, CH
▲	10BH-123	43.0 ft	48	33	15	86		Gray, SILT, contains organic matter, ML
★	10BH-123	78.0 ft	42	22	20	40		Green gray, fine to medium clayey SAND, SC
⊙	10BH-126	18.0 ft	69	24	45	88		Gray, fat CLAY, CH
✿	10BH-126	28.0 ft	193	98	95	5	70.0	Dark brown, PEAT, PT
○	10BH-127	18.0 ft	91	24	67	96		Gray, fat CLAY, CH
△	10BH-127	48.0 ft	53	25	28	76		Gray, fat CLAY with sand, contains organic matter, CH
⊗	10BH-127	63.0 ft	113	39	74	93	51.0	Brown, ORGANIC CLAY, OH
⊕	10BH-130	23.0 ft	59	20	39	91		Gray, fat CLAY, CH
□	10BH-130	63.0 ft	111	46	65	79		Gray, elastic SILT with sand, MH
⊠	10BH-133	18.0 ft	66	19	47	95		Gray, fat CLAY, CH
◒	10BH-133	33.0 ft	229	160	69	7	66.0	Dark brown, PEAT, PT
☆	10BH-133	38.0 ft	216	135	81	83	74.0	Dark brown, ORGANIC SILT with sand, OH
⊠	10BH-133	63.0 ft	82	33	49	97		Gray, fat CLAY, CH

NOTE: An organic clay or silt is a soil that would be classified as a clay or silt, respectively, except that its oven dried liquid limit is less than 75% of its liquid limit value.

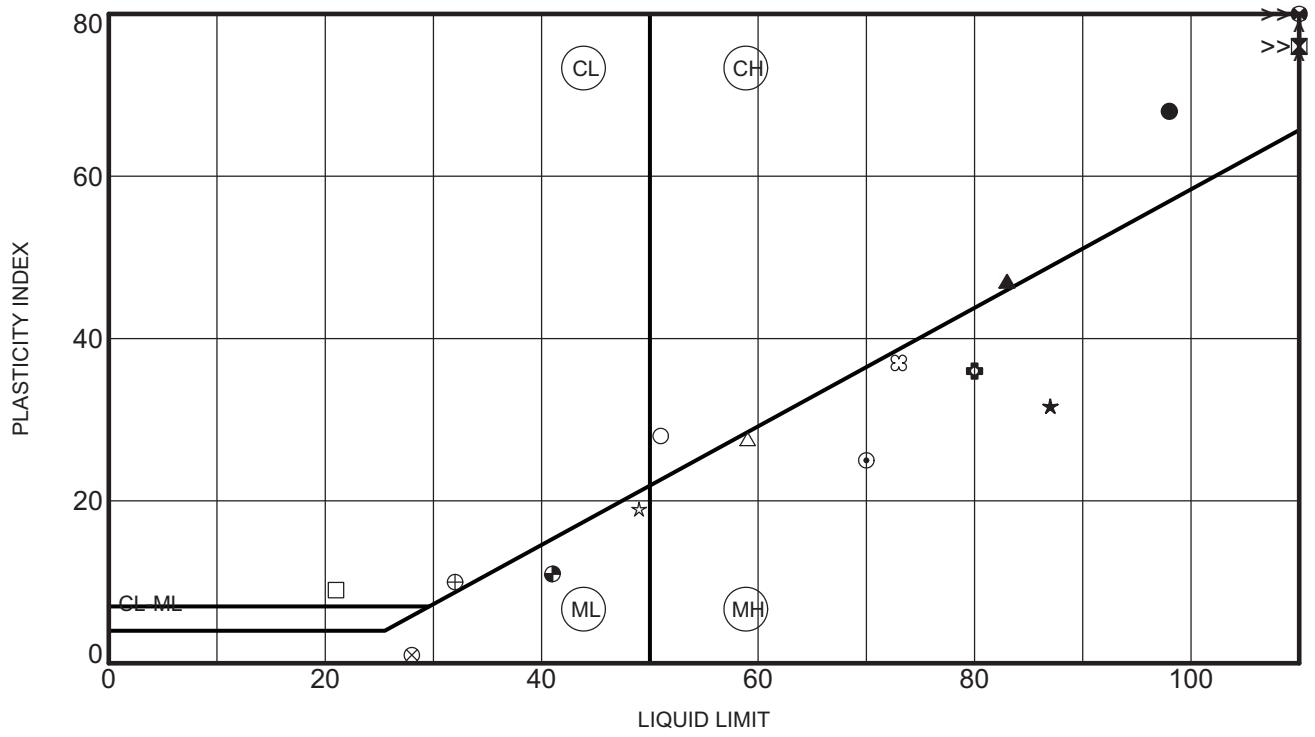
Schnabel ENGINEERING

ATTERBERG LIMITS

Project: Martin Luther King Expressway
Route 58 and Interstate 264
Portsmouth, VA

Contract: 10613051

ATTERBERG_LIMITS 10613051 SCHNABEL LOGS MASTER.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 10/15/10



PLOTTED DATA REPRESENTS SOIL PASSING NO. 40 SIEVE

	Specimen		LL	PL	PI	Fines	Oven Dry Liquid Limit	Description
●	10BH-136A	20.0 ft	98	30	68	100		Gray, fat CLAY, CH
⧓	10BH-136A	32.0 ft	223	147	76	4	75.0	Dark brown, PEAT, PT
▲	10BH-147	13.0 ft	83	36	47	78	45.0	Brown and gray, ORGANIC CLAY with sand, OH
★	10BH-147	23.0 ft	87	55	32	79	52.0	Gray, ORGANIC SILT with sand, OH
⊙	10BH-151	23.0 ft	70	45	25	78		Dark brown, elastic SILT with sand, MH
✿	10BH-151	33.0 ft	80	44	36	95		Dark brown, elastic SILT, contains organic matter, MH
○	10BH-151	63.0 ft	51	23	28	94		Gray, fat CLAY, CH
△	10BH-154A	18.0 ft	59	31	28	93		Dark gray, elastic SILT, MH
⊗	10BH-162	23.0 ft	28	27	1	18		Gray, fine to medium silty SAND, contains mica, SM
⊕	10BH-179	18.0 ft	32	22	10	44		Gray, fine to coarse clayey SAND, contains shell fragments, SC
□	10BH-182	2.0 ft	21	12	9	35		Brown and gray, fine to coarse clayey SAND, SC
◍	10BH-186	23.0 ft	205	116	89	76	91.0	Dark brown, ORGANIC SILT with sand, OH
◒	10BH-194	23.0 ft	41	30	11	59		Gray, sandy SILT, contains organic matter, ML
☆	10BH-206	28.0 ft	49	30	19	40		Dark gray, fine to coarse silty SAND, contains organic matter, SM
⧆	10BH-215	23.0 ft	73	36	37	97		Gray, elastic SILT, MH

NOTE: An organic clay or silt is a soil that would be classified as a clay or silt, respectively, except that its oven dried liquid limit is less than 75% of its liquid limit value.

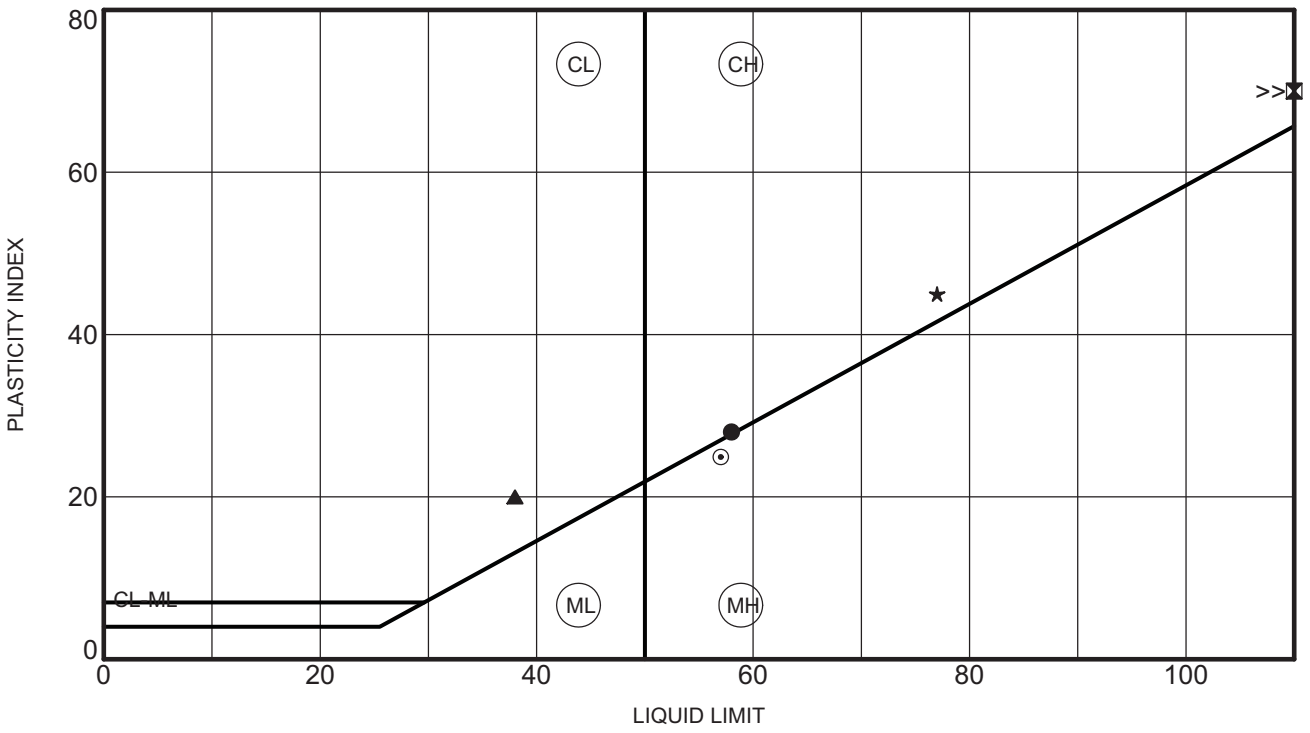
Schnabel ENGINEERING

ATTERBERG LIMITS

Project: Martin Luther King Expressway
Route 58 and Interstate 264
Portsmouth, VA

Contract: 10613051

ATTERBERG_LIMITS 10613051 SCHNABEL LOGS MASTER.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 10/15/10



PLOTTED DATA REPRESENTS SOIL PASSING NO. 40 SIEVE

	Specimen		LL	PL	PI	Fines	Oven Dry Liquid Limit	Description
●	10BH-217	28.0 ft	58	30	28	83		Dark gray, fat CLAY with sand, contains organic matter, CH
⊠	10BH-223	23.0 ft	139	69	70	65		Dark gray, sandy ORGANIC SILT, OH
▲	10BH-223	58.0 ft	38	18	20	79		Gray, lean CLAY with sand, CL
★	10BH-229	53.0 ft	77	32	45	96		Gray, fat CLAY, contains organic matter, CH
⊙	10BH-233A	20.0 ft	57	32	25	94		Dark gray, elastic SILT, MH

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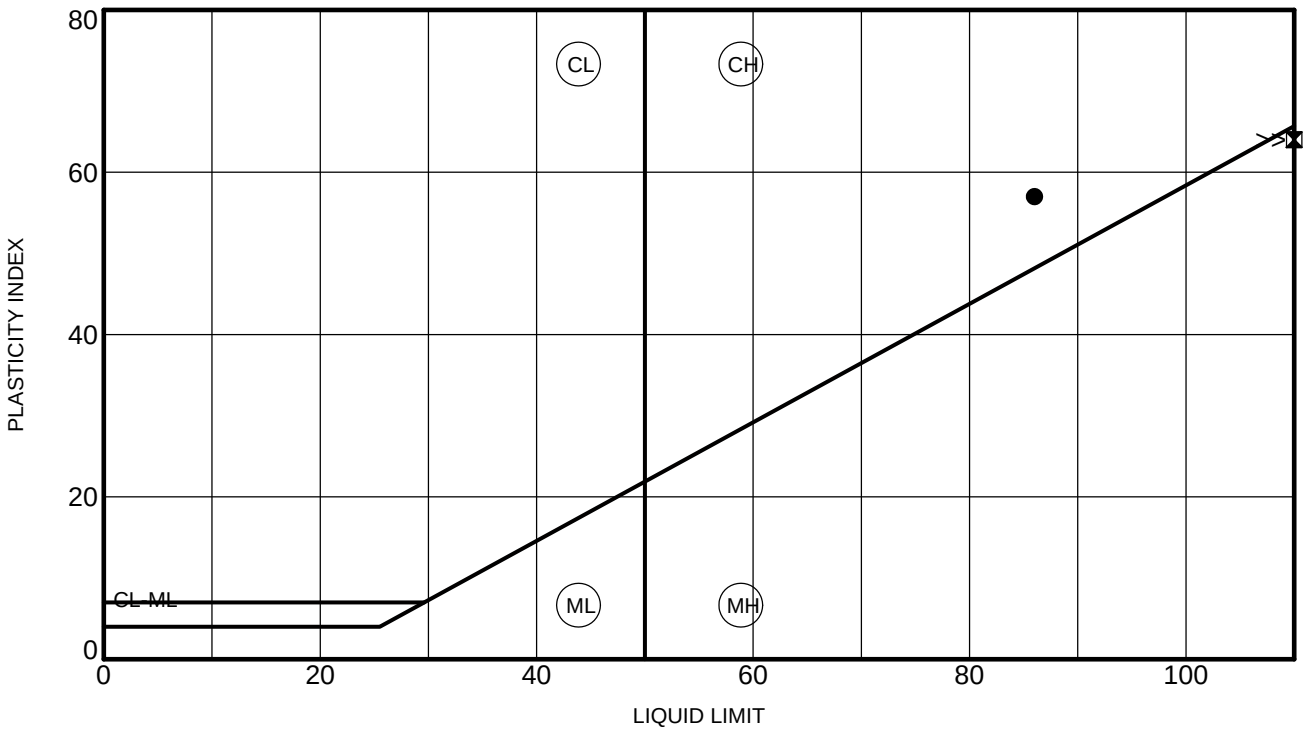
Schnabel ENGINEERING

ATTERBERG LIMITS

Project: Martin Luther King Expressway
Route 58 and Interstate 264
Portsmouth, VA

Contract: 10613051

ATTERBERG_LIMITS 10613051 SCHNABEL LOGS MASTER.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 10/15/10



PLOTTED DATA REPRESENTS SOIL PASSING NO. 40 SIEVE

	Specimen		LL	PL	PI	Fines	Oven Dry Liquid Limit	Description
●	**10BH-101**	**22.0 ft**	**86**	**29**	**57**	**99**		**Gray, fat CLAY, trace sand, CH**
⧓	**10BH-101**	**35.0 ft**	**220**	**156**	**64**	**51**	**63.0**	**Dark brown, sandy ORGANIC SILT, OH**

NOTE: An organic clay or silt is a soil that would be classified as a clay or silt, respectively, except that its oven dried liquid limit is less than 75% of its liquid limit value.

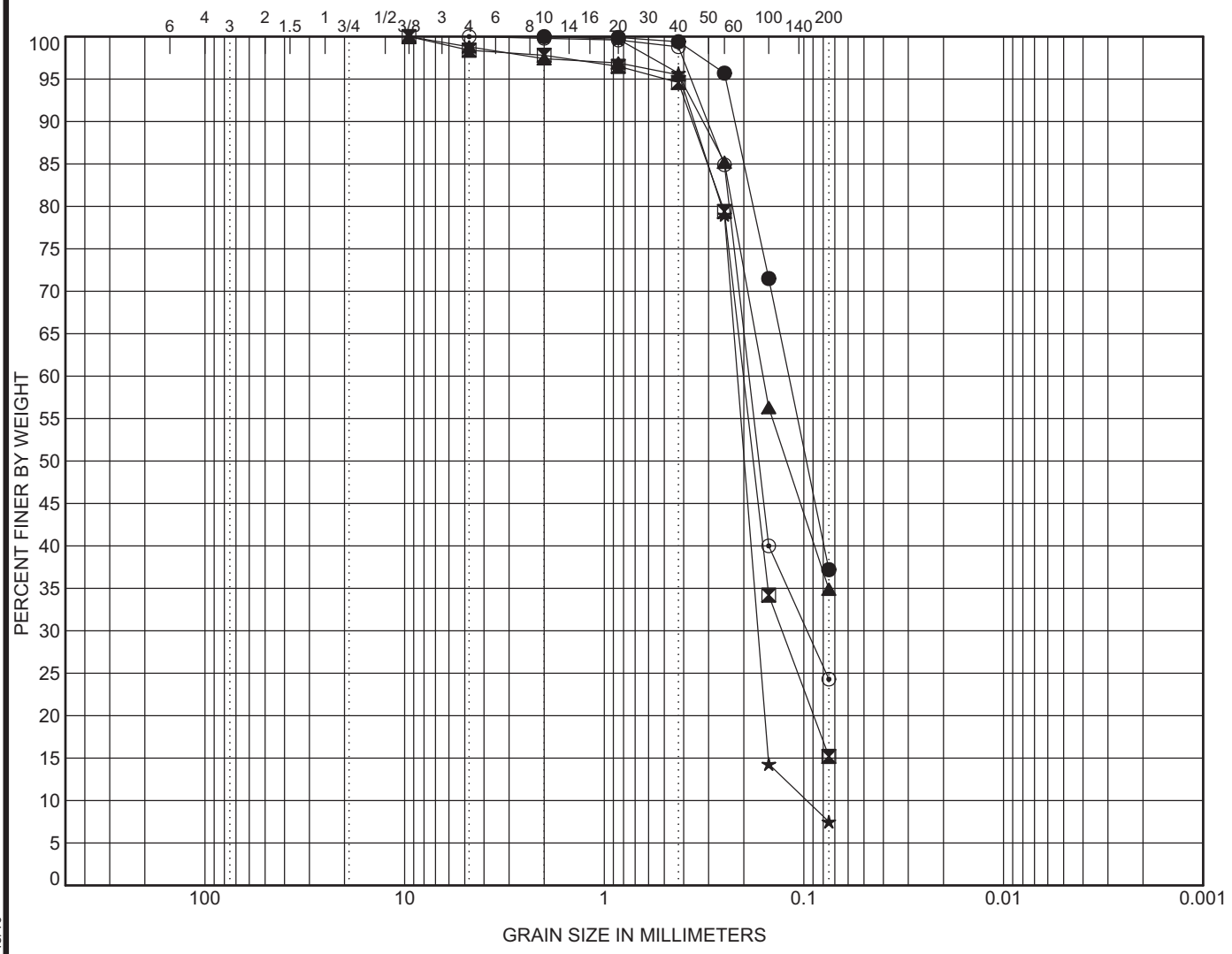
Schnabel ENGINEERING

ATTERBERG LIMITS

Project: MLK Freeway Extension
MARSHALL MILLER BORING
Portsmouth, VA

Contract: P8330138

ATTERBERG_LIMITS P8330138 LAB DATA.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 10/22/10



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen		Sample Description	LL	PL	PI
●	10BH-009A	23.0 ft	Light gray, fine to medium silty, clayey SAND, SC-SM	26	19	7
⊠	10BH-017	48.0 ft	Green gray, fine to coarse silty SAND, contains shell fragments, SM	NP	NP	NP
▲	10BH-023	68.0 ft	Green gray, fine to coarse clayey SAND, contains shell fragments, SC	42	22	20
★	10BH-037	8.0 ft	Gray, fine to medium poorly graded SAND with silt, SP-SM	NP	NP	NP
⊙	10BH-054	53.0 ft	Gray, fine to coarse silty SAND, SM	27	24	3

	Specimen		Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	10BH-009A	23.0 ft	ASTM D422	2	0.119					37.2	
⊠	10BH-017	48.0 ft	ASTM D422	9.5	0.201	0.129		1.6	83.2	15.2	
▲	10BH-023	68.0 ft	ASTM D422	9.5	0.16			1.2	63.9	34.9	
★	10BH-037	8.0 ft	ASTM D422	2	0.215	0.17	0.097			7.5	
⊙	10BH-054	53.0 ft	ASTM D422	4.75	0.188	0.096		0.0	75.7	24.3	

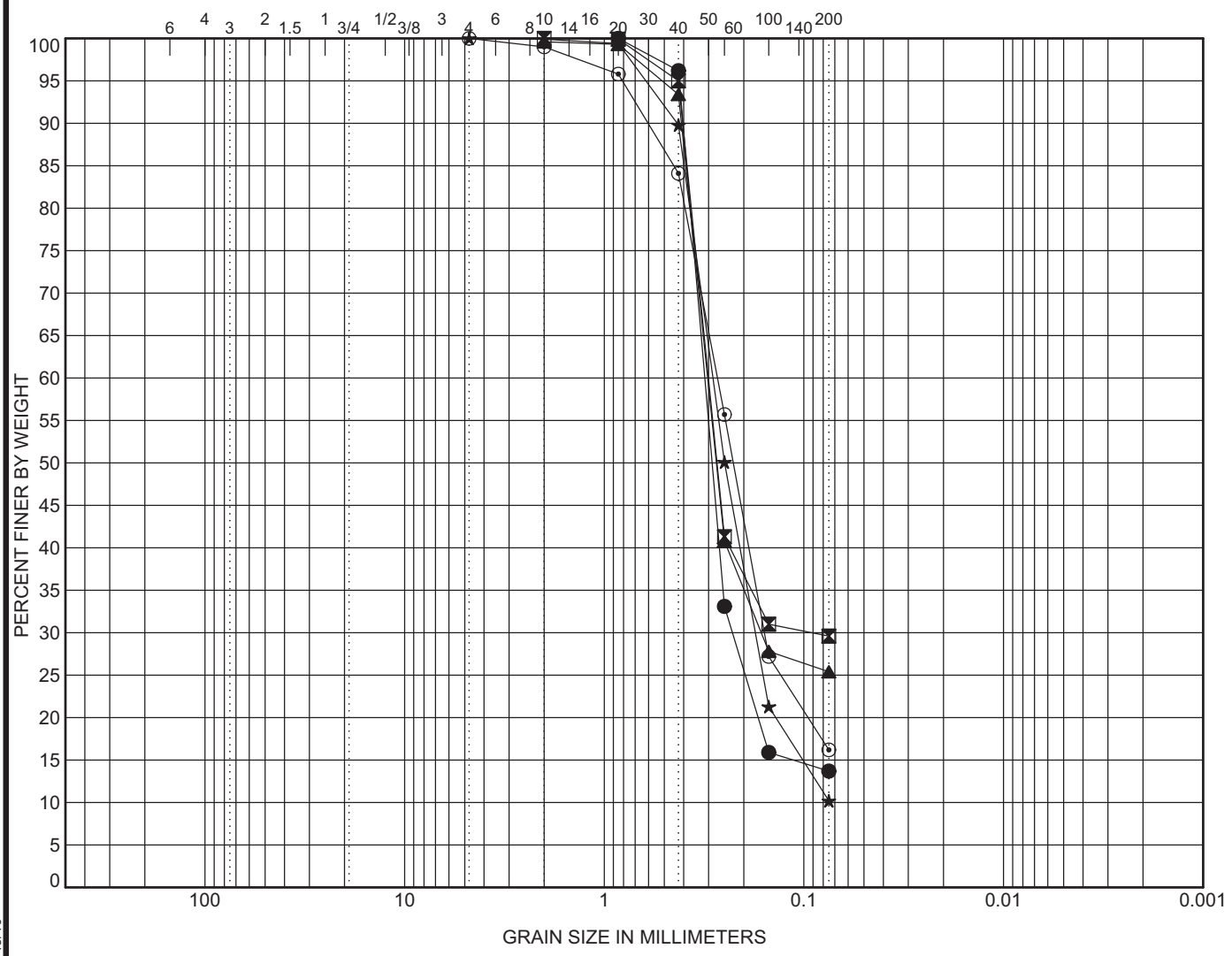
Schnabel ENGINEERING

GRADATION CURVES

Project: Martin Luther King Expressway
Route 58 and Interstate 264
Portsmouth, VA

Contract: 10613051

SIEVE 5 SHEET 10613051 SCHNABEL LOGS MASTER.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 10/15/10



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen		Sample Description	LL	PL	PI
● 10BH-059	4.0 ft	**Gray, fine to medium silty SAND, SM**	**NP**	**NP**	**NP**
⊠ 10BH-061	3.0 ft	**Dark gray, fine to medium clayey SAND, SC**	**22**	**12**	**10**
▲ 10BH-140	0.0 ft	**Brown, fine to coarse silty SAND, contains crushed stone, SM**	**NP**	**NP**	**NP**
★ 10BH-164	53.0 ft	**Dark gray, fine to coarse poorly graded SAND with silt, contains mica, SP-SM**	**NP**	**NP**	**NP**
⊙ 10BH-179	2.0 ft	**Yellow brown, fine to coarse silty SAND, SM**	**NP**	**NP**	**NP**

Specimen		Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● 10BH-059	4.0 ft	**ASTM D422**	**0.85**	**0.313**	**0.228**				**13.7**	
⊠ 10BH-061	3.0 ft	**ASTM D422**	**2**	**0.301**	**0.091**				**29.6**	
▲ 10BH-140	0.0 ft	**ASTM D422**	**2**	**0.303**	**0.164**				**25.4**	
★ 10BH-164	53.0 ft	**ASTM D422**	**4.75**	**0.285**	**0.175**		**0.0**	**89.8**	**10.2**	
⊙ 10BH-179	2.0 ft	**ASTM D422**	**4.75**	**0.271**	**0.158**		**0.0**	**83.8**	**16.2**	

Schnabel ENGINEERING

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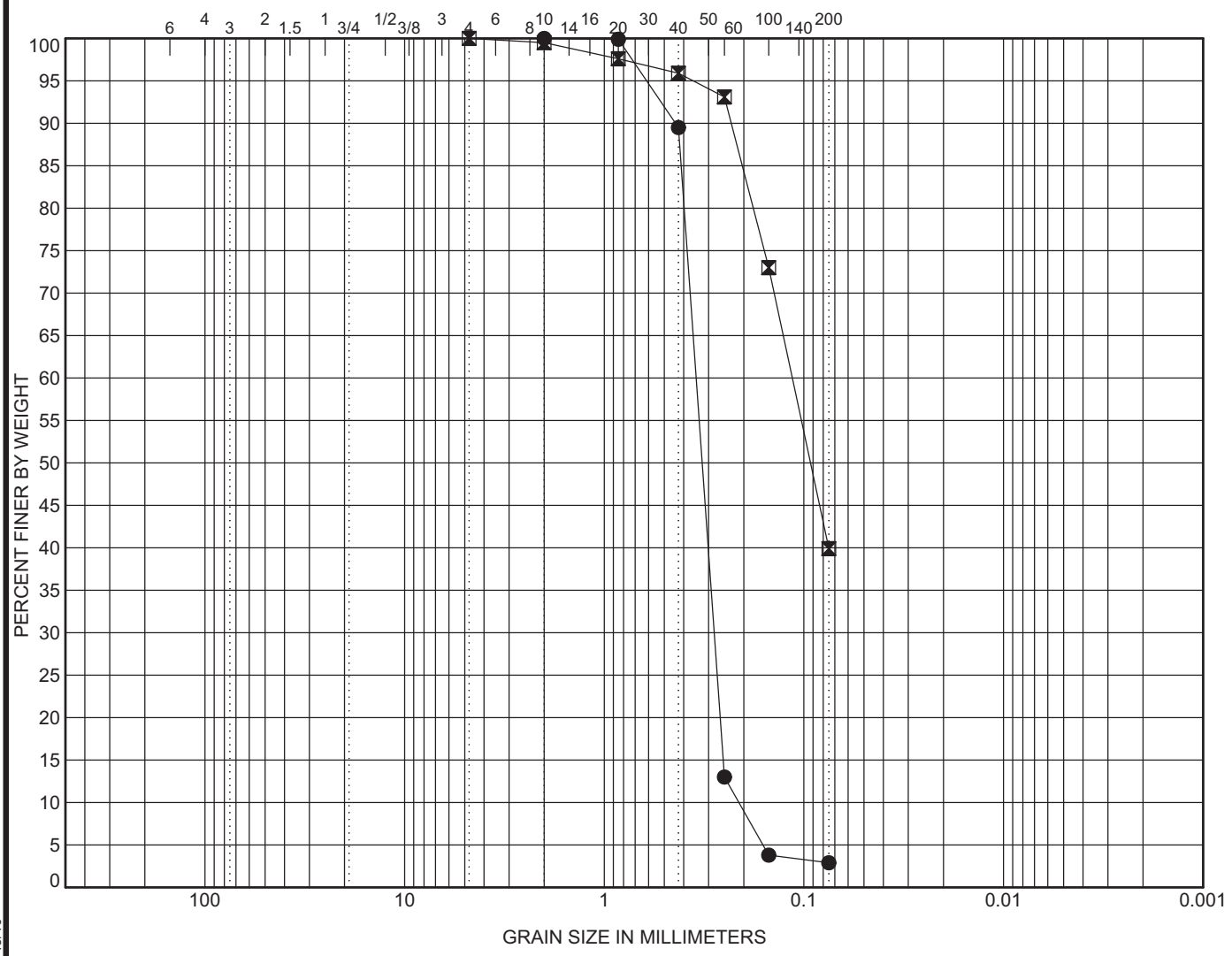


COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen		Sample Description	LL	PL	PI		
●	10BH-206	2.0 ft	Light brown, fine to medium poorly graded SAND, SP	NP	NP	NP		
⊠	10BH-206	28.0 ft	Dark gray, fine to coarse silty SAND, contains organic matter, SM	49	30	19		

	Specimen		Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	10BH-206	2.0 ft	ASTM D422	2	0.346	0.281	0.212			2.9	
⊠	10BH-206	28.0 ft	ASTM D422	4.75	0.114			0.0	60.1	39.9	

Schnabel ENGINEERING

GRADATION CURVES

Project: Martin Luther King Expressway
Route 58 and Interstate 264
Portsmouth, VA

Contract: 10613051

SIEVE 5 SHEET 10613051 SCHNABEL LOGS MASTER.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 10/15/10

Schnabel ENGINEERING

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST REPORT

Project: *MLK Expressway* SEI Contract: *10613051*

Location: *Portsmouth, VA* Boring No.: *10BH-020A*
Date: *9/15/2010* Depth: *24'-26'*

Test Specimen Data	
Initial Diameter, in:	*2.86*
Initial Area. in^2:	*6.43*
Initial Height, in:	*6.00*
Height/Diameter Ratio:	*2.10*
Natural Moisture, %	*50.6*
Moist Unit Weight, pcf:	*105.5*
Dry Unit Weight, pcf:	*70.1*

Testing Information	
Test Procedure:	*ASTM D2850*
Type of Specimen:	*Tube Sample*
Confining Stress (psi) :	*11.00*

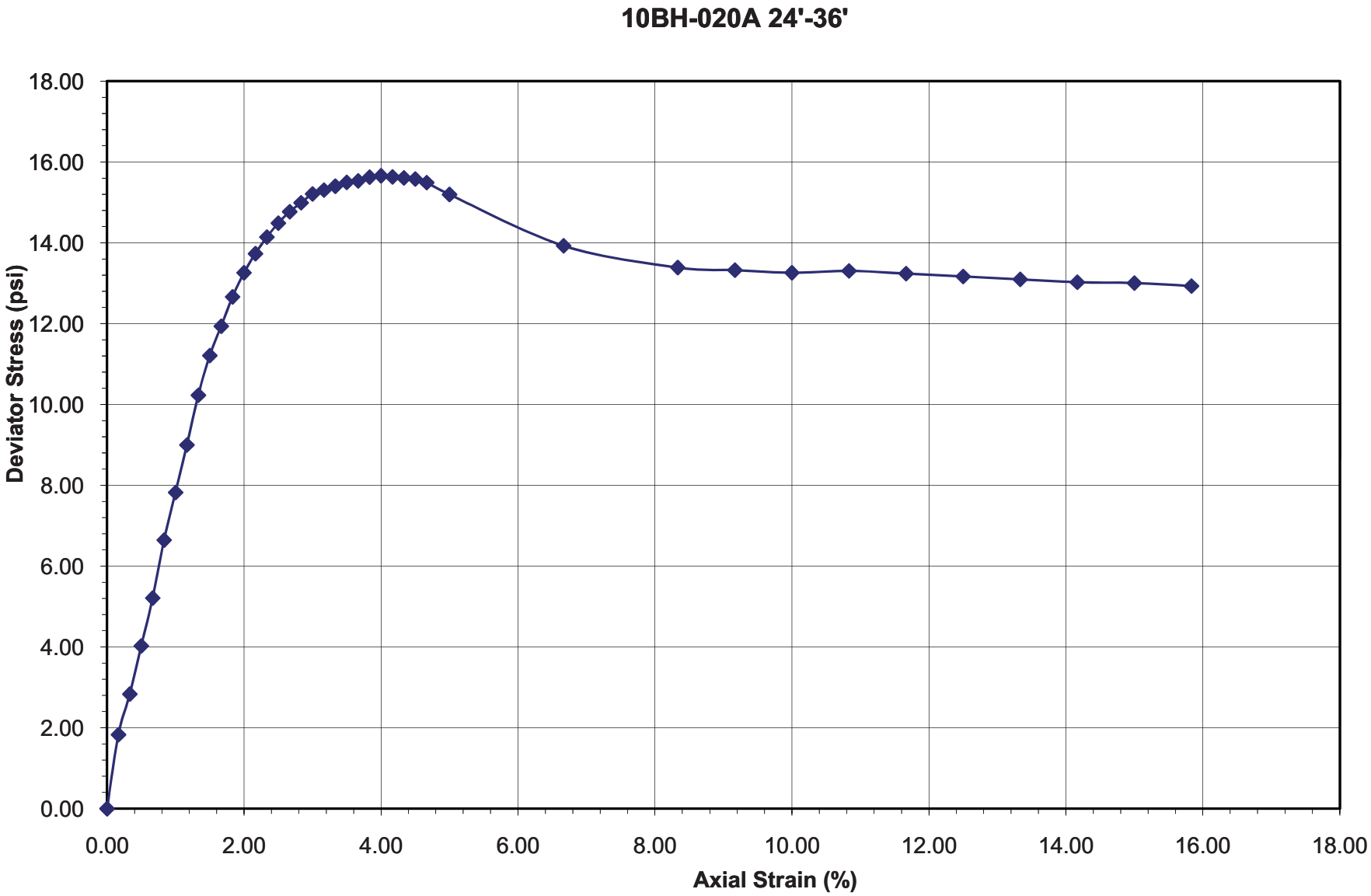
Strength Data	
Strain at Failure %:	*4.00*
Deviator Stress at failure, psi:	*15.66*
Shear Strength (Su), psi:	*7.8*

Soil Description.:	*Gray, elastic SILT, contains mica, MH*

LL, %:	*64*	%<200	86.1
PL, %:	*39*	Gs:	-

Proving Ring Factor 0.4062

Axial Deflection (0.001 in)	Proving Ring Dial	Axial Load (lbs)	Axial Strain. (%)	Dev. Stress (psi)	σ 1 (psi)	σ 3 (psi)	Corrected Area (In^2)	S_U (psi)
0	0	0.00	0.00	0.00	11.00	11.00	6.425	0.0
10	29	11.78	0.17	1.83	12.83	11.00	6.436	0.9
20	45	18.28	0.33	2.84	13.84	11.00	6.447	1.4
30	64	26.00	0.50	4.03	15.03	11.00	6.457	2.0
40	83	33.71	0.67	5.21	16.21	11.00	6.468	2.6
50	106	43.06	0.83	6.65	17.65	11.00	6.479	3.3
60	125	50.78	1.00	7.82	18.82	11.00	6.490	3.9
70	144	58.49	1.17	9.00	20.00	11.00	6.501	4.5
80	164	66.62	1.33	10.23	21.23	11.00	6.512	5.1
90	180	73.12	1.50	11.21	22.21	11.00	6.523	5.6
100	192	77.99	1.67	11.94	22.94	11.00	6.534	6.0
110	204	82.86	1.83	12.66	23.66	11.00	6.545	6.3
120	214	86.93	2.00	13.26	24.26	11.00	6.556	6.6
130	222	90.18	2.17	13.73	24.73	11.00	6.567	6.9
140	229	93.02	2.33	14.14	25.14	11.00	6.579	7.1
150	235	95.46	2.50	14.49	25.49	11.00	6.590	7.2
160	240	97.49	2.67	14.77	25.77	11.00	6.601	7.4
170	244	99.11	2.83	14.99	25.99	11.00	6.612	7.5
180	248	100.74	3.00	15.21	26.21	11.00	6.624	7.6
190	250	101.55	3.17	15.30	26.30	11.00	6.635	7.7
200	252	102.36	3.33	15.40	26.40	11.00	6.647	7.7
210	254	103.17	3.50	15.50	26.50	11.00	6.658	7.7
220	255	103.58	3.67	15.53	26.53	11.00	6.670	7.8
230	257	104.39	3.83	15.62	26.62	11.00	6.681	7.8
240	258	104.80	4.00	15.66	26.66	11.00	6.693	7.8
250	258	104.80	4.17	15.63	26.63	11.00	6.704	7.8
260	258	104.80	4.33	15.60	26.60	11.00	6.716	7.8
270	258	104.80	4.50	15.58	26.58	11.00	6.728	7.8
280	257	104.39	4.67	15.49	26.49	11.00	6.740	7.7
300	253	102.77	5.00	15.20	26.20	11.00	6.763	7.6
400	236	95.86	6.67	13.93	24.93	11.00	6.884	7.0
500	231	93.83	8.33	13.39	24.39	11.00	7.009	6.7
550	232	94.24	9.17	13.32	24.32	11.00	7.073	6.7
600	233	94.64	10.00	13.26	24.26	11.00	7.139	6.6
650	236	95.86	10.83	13.30	24.30	11.00	7.206	6.7
700	237	96.27	11.67	13.24	24.24	11.00	7.274	6.6
750	238	96.68	12.50	13.17	24.17	11.00	7.343	6.6
800	239	97.08	13.33	13.10	24.10	11.00	7.414	6.5
850	240	97.49	14.17	13.02	24.02	11.00	7.486	6.5
900	242	98.30	15.00	13.00	24.00	11.00	7.559	6.5
950	243	98.71	15.83	12.93	23.93	11.00	7.634	6.5
1000	244	99.11	16.67	12.85	23.85	11.00	7.710	6.4


10BH-020A 24'-36'
Deviator Stress (psi)
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
Axial Strain (%)

Schnabel ENGINEERING

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST REPORT

Project: *MLK Expressway* SEI Contract: *10613051*

Location: *Portsmouth, VA* Boring No.: *10BH-023A*
Date: *9/14/2010* Depth: *23'-25'*

Test Specimen Data	
Initial Diameter, in:	*2.86*
Initial Area, in^2:	*6.43*
Initial Height, in:	*6.00*
Height/Diameter Ratio:	*2.10*
Natural Moisture, %	*46.8*
Moist Unit Weight, pcf:	*107.2*
Dry Unit Weight, pcf:	*73.0*

Testing Information	
Test Procedure:	*ASTM D2850*
Type of Specimen:	*Tube Sample*
Confining Stress (psi) :	*10.50*

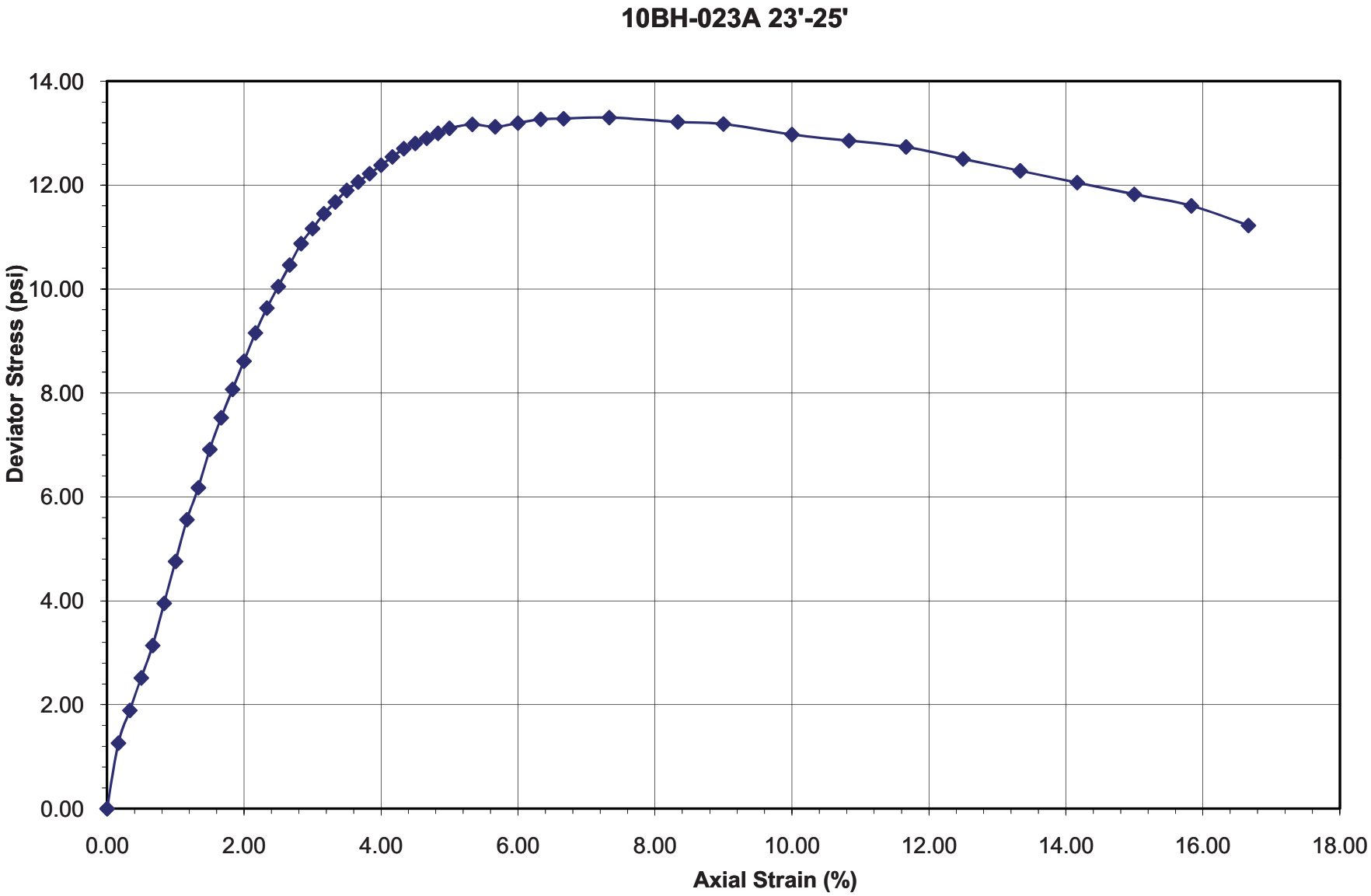
Strength Data	
Strain at Failure %:	*7.33*
Deviator Stress at failure, psi:	*13.30*
Shear Strength (Su), psi:	*6.6*

Soil Desc.:	*Gray, elastic SILT, contains mica, MH*

LL, %:	*56*	%<200	90.4
PL, %:	*31*	Gs:	-

Proving Ring Factor 0.4062

Axial Deflection (0.001 in)	Proving Ring Dial	Axial Load (lbs)	Axial Strain. (%)	Dev. Stress (psi)	σ 1 (psi)	σ 3 (psi)	Corrected Area (In^2)	S_U (psi)
0	0	0.00	0.00	0.00	10.20	10.20	6.425	0.0
10	20	8.12	0.17	1.26	11.76	10.50	6.436	0.6
20	30	12.19	0.33	1.89	12.39	10.50	6.447	0.9
30	40	16.25	0.50	2.52	13.02	10.50	6.457	1.3
40	50	20.31	0.67	3.14	13.64	10.50	6.468	1.6
50	63	25.59	0.83	3.95	14.45	10.50	6.479	2.0
60	76	30.87	1.00	4.76	15.26	10.50	6.490	2.4
70	89	36.15	1.17	5.56	16.06	10.50	6.501	2.8
80	99	40.21	1.33	6.18	16.68	10.50	6.512	3.1
90	111	45.09	1.50	6.91	17.41	10.50	6.523	3.5
100	121	49.15	1.67	7.52	18.02	10.50	6.534	3.8
110	130	52.81	1.83	8.07	18.57	10.50	6.545	4.0
120	139	56.46	2.00	8.61	19.11	10.50	6.556	4.3
130	148	60.12	2.17	9.15	19.65	10.50	6.567	4.6
140	156	63.37	2.33	9.63	20.13	10.50	6.579	4.8
150	163	66.21	2.50	10.05	20.55	10.50	6.590	5.0
160	170	69.05	2.67	10.46	20.96	10.50	6.601	5.2
170	177	71.90	2.83	10.87	21.37	10.50	6.612	5.4
180	182	73.93	3.00	11.16	21.66	10.50	6.624	5.6
190	187	75.96	3.17	11.45	21.95	10.50	6.635	5.7
200	191	77.58	3.33	11.67	22.17	10.50	6.647	5.8
210	195	79.21	3.50	11.90	22.40	10.50	6.658	5.9
220	198	80.43	3.67	12.06	22.56	10.50	6.670	6.0
230	201	81.65	3.83	12.22	22.72	10.50	6.681	6.1
240	204	82.86	4.00	12.38	22.88	10.50	6.693	6.2
250	207	84.08	4.17	12.54	23.04	10.50	6.704	6.3
260	210	85.30	4.33	12.70	23.20	10.50	6.716	6.4
270	212	86.11	4.50	12.80	23.30	10.50	6.728	6.4
280	214	86.93	4.67	12.90	23.40	10.50	6.740	6.4
290	216	87.74	4.83	13.00	23.50	10.50	6.751	6.5
300	218	88.55	5.00	13.09	23.59	10.50	6.763	6.5
320	220	89.36	5.33	13.17	23.67	10.50	6.787	6.6
340	220	89.36	5.67	13.12	23.62	10.50	6.811	6.6
360	222	90.18	6.00	13.19	23.69	10.50	6.835	6.6
380	224	90.99	6.33	13.26	23.76	10.50	6.860	6.6
400	225	91.40	6.67	13.28	23.78	10.50	6.884	6.6
440	227	92.21	7.33	13.30	23.80	10.50	6.934	6.6 ←
500	228	92.61	8.33	13.21	23.71	10.50	7.009	6.6
540	229	93.02	9.00	13.17	23.67	10.50	7.061	6.6
600	228	92.61	10.00	12.97	23.47	10.50	7.139	6.5
650	228	92.61	10.83	12.85	23.35	10.50	7.206	6.4
700	228	92.61	11.67	12.73	23.23	10.50	7.274	6.4
750	226	91.80	12.50	12.50	23.00	10.50	7.343	6.3
800	224	90.99	13.33	12.27	22.77	10.50	7.414	6.1
850	222	90.18	14.17	12.05	22.55	10.50	7.486	6.0
900	220	89.36	15.00	11.82	22.32	10.50	7.559	5.9
950	218	88.55	15.83	11.60	22.10	10.50	7.634	5.8
1000	213	86.52	16.67	11.22	21.72	10.50	7.710	5.6


10BH-023A 23'-25'
Deviator Stress (psi)
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
Axial Strain (%)

Schnabel ENGINEERING

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST REPORT

Project: *MLK Expressway* SEI Contract: *10613051*

Location: *Portsmouth, VA* Boring No.: *10BH-023A*
Date: *9/14/2010* Depth: *28'-30'*

Test Specimen Data	
Initial Diameter, in:	*2.86*
Initial Area. in^2:	*6.43*
Initial Height, in:	*6.00*
Height/Diameter Ratio:	*2.10*
Natural Moisture, %	*50.5*
Moist Unit Weight, pcf:	*106.1*
Dry Unit Weight, pcf:	*70.5*

Testing Information	
Test Procedure:	*ASTM D2850*
Type of Specimen:	*Tube Sample*
Confining Stress (psi) :	*12.00*

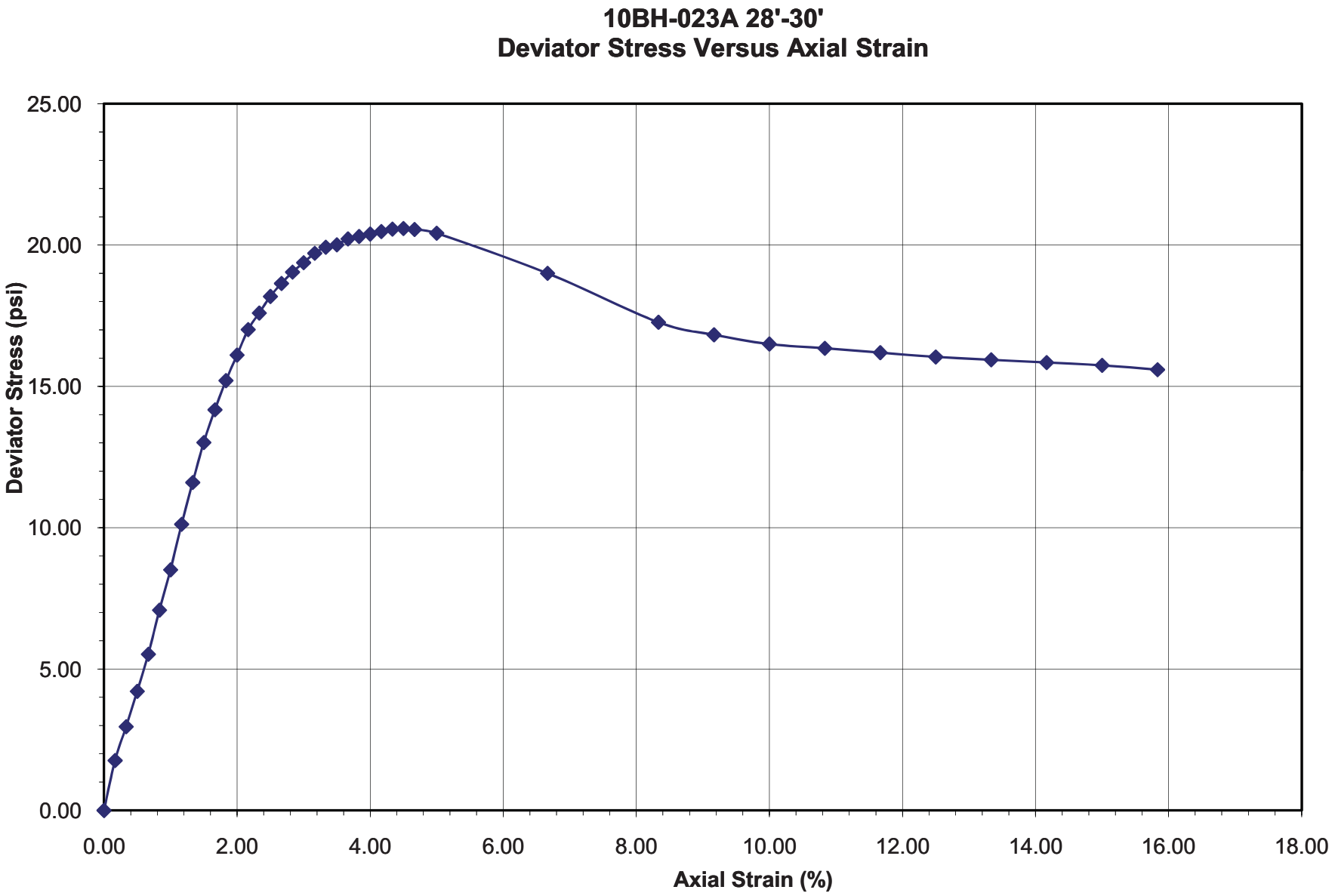
Strength Data	
Strain at Failure %:	*4.50*
Deviator Stress at failure, psi:	*20.59*
Shear Strength (Su), psi:	*10.3*

Soil Description.:	*Gray, elastic SILT, contains mica, MH*

LL, %:	*62*	%<200	96.4
PL, %:	*34*	Gs:	-

Proving Ring Factor 0.4062

Axial Deflection (0.001 in)	Proving Ring Dial	Axial Load (lbs)	Axial Strain. (%)	Dev. Stress (psi)	σ 1 (psi)	σ 3 (psi)	Corrected Area (In^2)	S_U (psi)
0	0	0.00	0.00	0.00	12.00	12.00	6.425	0.0
10	28	11.37	0.17	1.77	13.77	12.00	6.436	0.9
20	47	19.09	0.33	2.96	14.96	12.00	6.447	1.5
30	67	27.22	0.50	4.21	16.21	12.00	6.457	2.1
40	88	35.75	0.67	5.53	17.53	12.00	6.468	2.8
50	113	45.90	0.83	7.08	19.08	12.00	6.479	3.5
60	136	55.24	1.00	8.51	20.51	12.00	6.490	4.3
70	162	65.80	1.17	10.12	22.12	12.00	6.501	5.1
80	186	75.55	1.33	11.60	23.60	12.00	6.512	5.8
90	209	84.90	1.50	13.02	25.02	12.00	6.523	6.5
100	228	92.61	1.67	14.17	26.17	12.00	6.534	7.1
110	245	99.52	1.83	15.21	27.21	12.00	6.545	7.6
120	260	105.61	2.00	16.11	28.11	12.00	6.556	8.1
130	275	111.71	2.17	17.01	29.01	12.00	6.567	8.5
140	285	115.77	2.33	17.60	29.60	12.00	6.579	8.8
150	295	119.83	2.50	18.18	30.18	12.00	6.590	9.1
160	303	123.08	2.67	18.65	30.65	12.00	6.601	9.3
170	310	125.92	2.83	19.04	31.04	12.00	6.612	9.5
180	316	128.36	3.00	19.38	31.38	12.00	6.624	9.7
190	322	130.80	3.17	19.71	31.71	12.00	6.635	9.9
200	326	132.42	3.33	19.92	31.92	12.00	6.647	10.0
210	328	133.23	3.50	20.01	32.01	12.00	6.658	10.0
220	332	134.86	3.67	20.22	32.22	12.00	6.670	10.1
230	334	135.67	3.83	20.31	32.31	12.00	6.681	10.2
240	336	136.48	4.00	20.39	32.39	12.00	6.693	10.2
250	338	137.30	4.17	20.48	32.48	12.00	6.704	10.2
260	340	138.11	4.33	20.56	32.56	12.00	6.716	10.3
270	341	138.51	4.50	20.59	32.59	12.00	6.728	10.3
280	341	138.51	4.67	20.55	32.55	12.00	6.740	10.3
300	340	138.11	5.00	20.42	32.42	12.00	6.763	10.2
400	322	130.80	6.67	19.00	31.00	12.00	6.884	9.5
500	298	121.05	8.33	17.27	29.27	12.00	7.009	8.6
550	293	119.02	9.17	16.83	28.83	12.00	7.073	8.4
600	290	117.80	10.00	16.50	28.50	12.00	7.139	8.3
650	290	117.80	10.83	16.35	28.35	12.00	7.206	8.2
700	290	117.80	11.67	16.20	28.20	12.00	7.274	8.1
750	290	117.80	12.50	16.04	28.04	12.00	7.343	8.0
800	291	118.20	13.33	15.94	27.94	12.00	7.414	8.0
850	292	118.61	14.17	15.85	27.85	12.00	7.486	7.9
900	293	119.02	15.00	15.75	27.75	12.00	7.559	7.9
950	293	119.02	15.83	15.59	27.59	12.00	7.634	7.8
1000	293	119.02	16.67	15.44	27.44	12.00	7.710	7.7


10BH-023A 28'-30'
Deviator Stress Versus Axial Strain
Deviator Stress (psi)
25.00
20.00
15.00
10.00
5.00
0.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
Axial Strain (%)

Schnabel ENGINEERING

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST REPORT

Project: *MLK Expressway* SEI Contract: *10613051*

Location: *Portsmouth, VA* Boring No.: *10BH-030A*
Date: *9/15/2010* Depth: *38'-40'*

Test Specimen Data	
Initial Diameter, in:	*2.86*
Initial Area. in^2:	*6.43*
Initial Height, in:	*6.00*
Height/Diameter Ratio:	*2.10*
Natural Moisture, %	*44.8*
Moist Unit Weight, pcf:	*104.1*
Dry Unit Weight, pcf:	*71.9*

Testing Information	
Test Procedure:	*ASTM D2850*
Type of Specimen:	*Tube Sample*
Confining Stress (psi) :	*15.00*

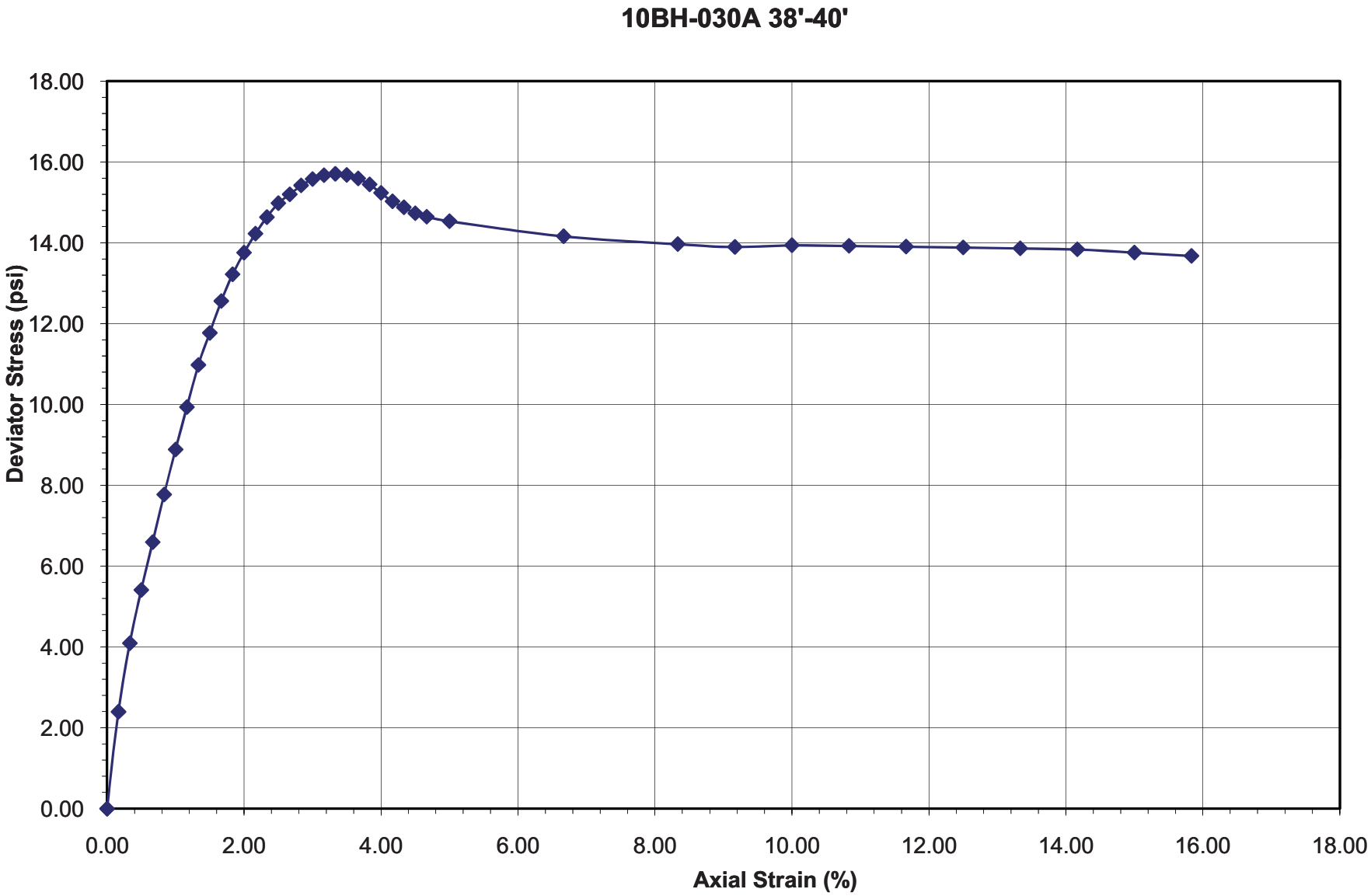
Strength Data	
Strain at Failure %:	*3.33*
Deviator Stress at failure, psi:	*15.71*
Shear Strength (Su), psi:	*7.9*

Soil Description.:	*Gray, fat CLAY with sand, CH*

LL, %:	*68*	%<200	84.6
PL, %:	*32*	Gs:	-

Proving Ring Factor 0.4062

Axial Deflection (0.001 in)	Proving Ring Dial	Axial Load (lbs)	Axial Strain. (%)	Dev. Stress (psi)	σ 1 (psi)	σ 3 (psi)	Corrected Area (In^2)	S_U (psi)
0	0	0.00	0.00	0.00	15.00	15.00	6.425	0.0
10	38	15.44	0.17	2.40	17.40	15.00	6.436	1.2
20	65	26.40	0.33	4.10	19.10	15.00	6.447	2.0
30	86	34.93	0.50	5.41	20.41	15.00	6.457	2.7
40	105	42.65	0.67	6.59	21.59	15.00	6.468	3.3
50	124	50.37	0.83	7.77	22.77	15.00	6.479	3.9
60	142	57.68	1.00	8.89	23.89	15.00	6.490	4.4
70	159	64.59	1.17	9.93	24.93	15.00	6.501	5.0
80	176	71.49	1.33	10.98	25.98	15.00	6.512	5.5
90	189	76.77	1.50	11.77	26.77	15.00	6.523	5.9
100	202	82.05	1.67	12.56	27.56	15.00	6.534	6.3
110	213	86.52	1.83	13.22	28.22	15.00	6.545	6.6
120	222	90.18	2.00	13.75	28.75	15.00	6.556	6.9
130	230	93.43	2.17	14.23	29.23	15.00	6.567	7.1
140	237	96.27	2.33	14.63	29.63	15.00	6.579	7.3
150	243	98.71	2.50	14.98	29.98	15.00	6.590	7.5
160	247	100.33	2.67	15.20	30.20	15.00	6.601	7.6
170	251	101.96	2.83	15.42	30.42	15.00	6.612	7.7
180	254	103.17	3.00	15.58	30.58	15.00	6.624	7.8
190	256	103.99	3.17	15.67	30.67	15.00	6.635	7.8
200	257	104.39	3.33	15.71	30.71	15.00	6.647	7.9
210	257	104.39	3.50	15.68	30.68	15.00	6.658	7.8
220	256	103.99	3.67	15.59	30.59	15.00	6.670	7.8
230	254	103.17	3.83	15.44	30.44	15.00	6.681	7.7
240	251	101.96	4.00	15.23	30.23	15.00	6.693	7.6
250	248	100.74	4.17	15.03	30.03	15.00	6.704	7.5
260	246	99.93	4.33	14.88	29.88	15.00	6.716	7.4
270	244	99.11	4.50	14.73	29.73	15.00	6.728	7.4
280	243	98.71	4.67	14.65	29.65	15.00	6.740	7.3
300	242	98.30	5.00	14.53	29.53	15.00	6.763	7.3
400	240	97.49	6.67	14.16	29.16	15.00	6.884	7.1
500	241	97.89	8.33	13.97	28.97	15.00	7.009	7.0
550	242	98.30	9.17	13.90	28.90	15.00	7.073	6.9
600	245	99.52	10.00	13.94	28.94	15.00	7.139	7.0
650	247	100.33	10.83	13.92	28.92	15.00	7.206	7.0
700	249	101.14	11.67	13.91	28.91	15.00	7.274	7.0
750	251	101.96	12.50	13.88	28.88	15.00	7.343	6.9
800	253	102.77	13.33	13.86	28.86	15.00	7.414	6.9
850	255	103.58	14.17	13.84	28.84	15.00	7.486	6.9
900	256	103.99	15.00	13.76	28.76	15.00	7.559	6.9
950	257	104.39	15.83	13.68	28.68	15.00	7.634	6.8
1000	258	104.80	16.67	13.59	28.59	15.00	7.710	6.8


10BH-030A 38'-40'
Deviator Stress (psi)
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
Axial Strain (%)

Schnabel ENGINEERING

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST REPORT

Project: *MLK Expressway* SEI Contract: *10613051*

Location: *Portsmouth, VA* Boring No.: *10BH-034A*
Date: *9/17/2010* Depth: *22'-24'*

Test Specimen Data	
Initial Diameter, in:	*2.86*
Initial Area. in^2:	*6.43*
Initial Height, in:	*6.00*
Height/Diameter Ratio:	*2.10*
Natural Moisture, %	*73.4*
Moist Unit Weight, pcf:	*96.7*
Dry Unit Weight, pcf:	*55.8*

Testing Information	
Test Procedure:	*ASTM D2850*
Type of Specimen:	*Tube Sample*
Confining Stress (psi) :	*10.50*

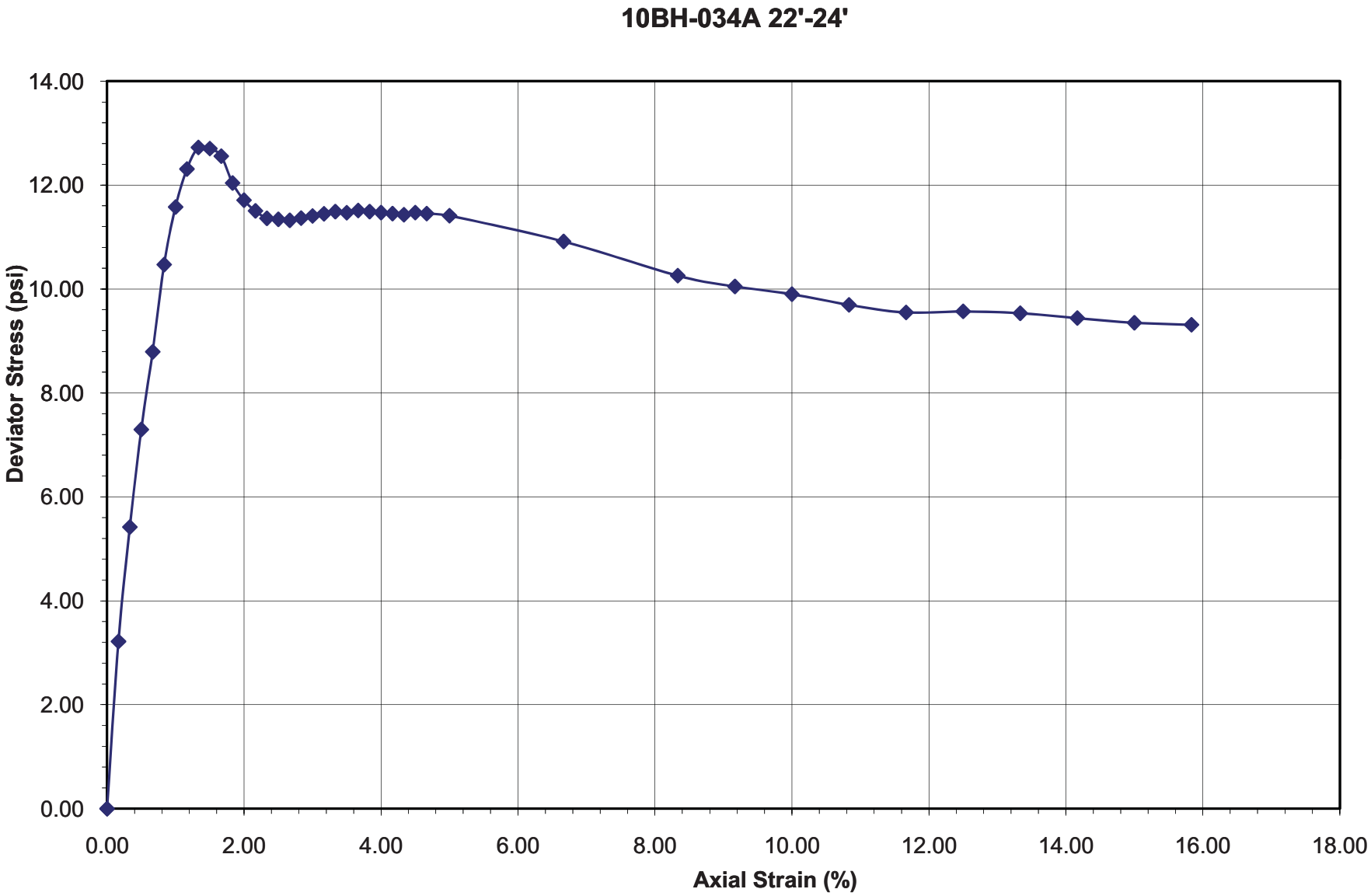
Strength Data	
Strain at Failure %:	*1.33*
Deviator Stress at failure, psi:	*12.73*
Shear Strength (Su), psi:	*6.4*

Soil Description.:	*Gray, fat CLAY, CH*

LL, %:	*100*	%<200	96.6
PL, %:	*34*	Gs:	-

Proving Ring Factor 0.4062

Axial Deflection (0.001 in)	Proving Ring Dial	Axial Load (lbs)	Axial Strain. (%)	Dev. Stress (psi)	σ 1 (psi)	σ 3 (psi)	Corrected Area (In^2)	S_U (psi)
0	0	0.00	0.00	0.00	10.50	10.50	6.425	0.0
10	51	20.72	0.17	3.22	13.72	10.50	6.436	1.6
20	86	34.93	0.33	5.42	15.92	10.50	6.447	2.7
30	116	47.12	0.50	7.30	17.80	10.50	6.457	3.6
40	140	56.87	0.67	8.79	19.29	10.50	6.468	4.4
50	167	67.84	0.83	10.47	20.97	10.50	6.479	5.2
60	185	75.15	1.00	11.58	22.08	10.50	6.490	5.8
70	197	80.02	1.17	12.31	22.81	10.50	6.501	6.2
80	204	82.86	1.33	12.73	23.23	10.50	6.512	6.4
90	204	82.86	1.50	12.70	23.20	10.50	6.523	6.4
100	202	82.05	1.67	12.56	23.06	10.50	6.534	6.3
110	194	78.80	1.83	12.04	22.54	10.50	6.545	6.0
120	189	76.77	2.00	11.71	22.21	10.50	6.556	5.9
130	186	75.55	2.17	11.50	22.00	10.50	6.567	5.8
140	184	74.74	2.33	11.36	21.86	10.50	6.579	5.7
150	184	74.74	2.50	11.34	21.84	10.50	6.590	5.7
160	184	74.74	2.67	11.32	21.82	10.50	6.601	5.7
170	185	75.15	2.83	11.36	21.86	10.50	6.612	5.7
180	186	75.55	3.00	11.41	21.91	10.50	6.624	5.7
190	187	75.96	3.17	11.45	21.95	10.50	6.635	5.7
200	188	76.37	3.33	11.49	21.99	10.50	6.647	5.7
210	188	76.37	3.50	11.47	21.97	10.50	6.658	5.7
220	189	76.77	3.67	11.51	22.01	10.50	6.670	5.8
230	189	76.77	3.83	11.49	21.99	10.50	6.681	5.7
240	189	76.77	4.00	11.47	21.97	10.50	6.693	5.7
250	189	76.77	4.17	11.45	21.95	10.50	6.704	5.7
260	189	76.77	4.33	11.43	21.93	10.50	6.716	5.7
270	190	77.18	4.50	11.47	21.97	10.50	6.728	5.7
280	190	77.18	4.67	11.45	21.95	10.50	6.740	5.7
300	190	77.18	5.00	11.41	21.91	10.50	6.763	5.7
400	185	75.15	6.67	10.92	21.42	10.50	6.884	5.5
500	177	71.90	8.33	10.26	20.76	10.50	7.009	5.1
550	175	71.09	9.17	10.05	20.55	10.50	7.073	5.0
600	174	70.68	10.00	9.90	20.40	10.50	7.139	5.0
650	172	69.87	10.83	9.70	20.20	10.50	7.206	4.8
700	171	69.46	11.67	9.55	20.05	10.50	7.274	4.8
750	173	70.27	12.50	9.57	20.07	10.50	7.343	4.8
800	174	70.68	13.33	9.53	20.03	10.50	7.414	4.8
850	174	70.68	14.17	9.44	19.94	10.50	7.486	4.7
900	174	70.68	15.00	9.35	19.85	10.50	7.559	4.7
950	175	71.09	15.83	9.31	19.81	10.50	7.634	4.7
1000	174	70.68	16.67	9.17	19.67	10.50	7.710	4.6


10BH-034A 22'-24'
Deviator Stress (psi)
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
Axial Strain (%)

Schnabel ENGINEERING

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST REPORT

Project: *MLK Expressway* SEI Contract: *10613051*

Location: *Portsmouth, VA* Boring No.: *10BH-052A*
Date: *9/22/2010* Depth: *25'-27'*

Test Specimen Data	
Initial Diameter, in:	*2.86*
Initial Area. in^2:	*6.43*
Initial Height, in:	*6.06*
Height/Diameter Ratio:	*2.12*
Natural Moisture, %	*73.8*
Moist Unit Weight, pcf:	*92.6*
Dry Unit Weight, pcf:	*53.3*

Testing Information	
Test Procedure:	*ASTM D2850*
Type of Specimen:	*Tube Sample*
Confining Stress (psi) :	*11.50*

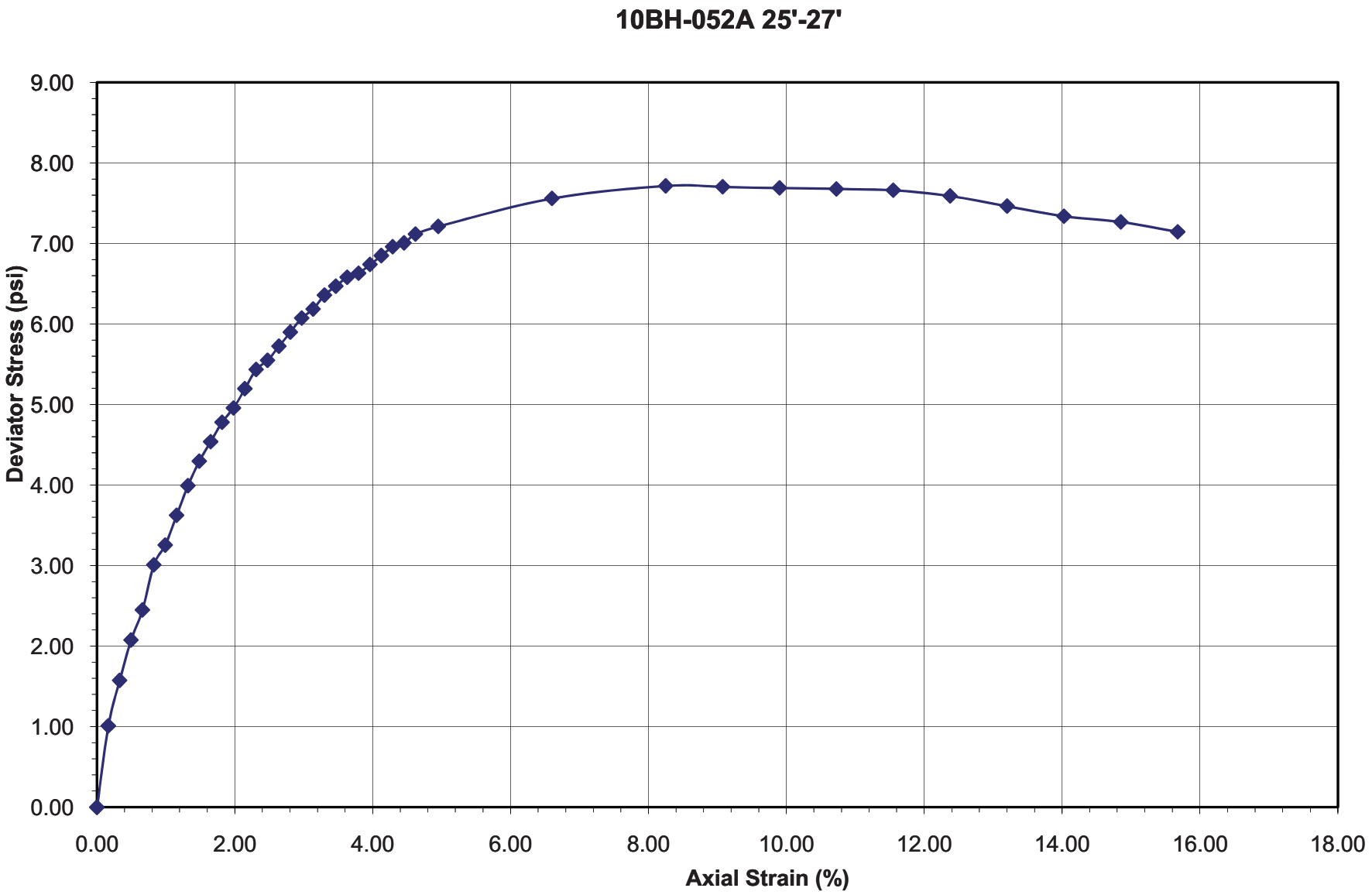
Strength Data	
Strain at Failure %:	*8.25*
Deviator Stress at failure, psi:	*7.71*
Shear Strength (Su), psi:	*3.9*

Soil Description.:	*Gray, elastic SILT, contains organic matter, MH*

LL, %:	*84*	%<200	93.8
PL, %:	*43*	Gs:	-

Proving Ring Factor 0.4062

Axial Deflection (0.001 in)	Proving Ring Dial	Axial Load (lbs)	Axial Strain. (%)	Dev. Stress (psi)	σ 1 (psi)	σ 3 (psi)	Corrected Area (In^2)	S_U (psi)
0	0	0.00	0.00	0.00	11.50	11.50	6.425	0.0
10	16	6.50	0.17	1.01	12.51	11.50	6.436	0.5
20	25	10.16	0.33	1.58	13.08	11.50	6.446	0.8
30	33	13.40	0.50	2.08	13.58	11.50	6.457	1.0
40	39	15.84	0.66	2.45	13.95	11.50	6.468	1.2
50	48	19.50	0.83	3.01	14.51	11.50	6.479	1.5
60	52	21.12	0.99	3.25	14.75	11.50	6.489	1.6
70	58	23.56	1.16	3.62	15.12	11.50	6.500	1.8
80	64	26.00	1.32	3.99	15.49	11.50	6.511	2.0
90	69	28.03	1.49	4.30	15.80	11.50	6.522	2.1
100	73	29.65	1.65	4.54	16.04	11.50	6.533	2.3
110	77	31.28	1.82	4.78	16.28	11.50	6.544	2.4
120	80	32.50	1.98	4.96	16.46	11.50	6.555	2.5
130	84	34.12	2.15	5.20	16.70	11.50	6.566	2.6
140	88	35.75	2.31	5.43	16.93	11.50	6.577	2.7
150	90	36.56	2.48	5.55	17.05	11.50	6.588	2.8
160	93	37.78	2.64	5.72	17.22	11.50	6.599	2.9
170	96	39.00	2.81	5.90	17.40	11.50	6.611	2.9
180	99	40.21	2.97	6.07	17.57	11.50	6.622	3.0
190	101	41.03	3.14	6.19	17.69	11.50	6.633	3.1
200	104	42.24	3.30	6.36	17.86	11.50	6.644	3.2
210	106	43.06	3.47	6.47	17.97	11.50	6.656	3.2
220	108	43.87	3.63	6.58	18.08	11.50	6.667	3.3
230	109	44.28	3.80	6.63	18.13	11.50	6.679	3.3
240	111	45.09	3.96	6.74	18.24	11.50	6.690	3.4
250	113	45.90	4.13	6.85	18.35	11.50	6.702	3.4
260	115	46.71	4.29	6.96	18.46	11.50	6.713	3.5
270	116	47.12	4.46	7.01	18.51	11.50	6.725	3.5
280	118	47.93	4.62	7.12	18.62	11.50	6.736	3.6
300	120	48.74	4.95	7.21	18.71	11.50	6.760	3.6
400	128	51.99	6.60	7.56	19.06	11.50	6.879	3.8
500	133	54.02	8.25	7.71	19.21	11.50	7.003	3.9
550	134	54.43	9.08	7.70	19.20	11.50	7.066	3.9
600	135	54.84	9.90	7.69	19.19	11.50	7.131	3.8
650	136	55.24	10.73	7.68	19.18	11.50	7.197	3.8
700	137	55.65	11.55	7.66	19.16	11.50	7.264	3.8
750	137	55.65	12.38	7.59	19.09	11.50	7.333	3.8
800	136	55.24	13.20	7.46	18.96	11.50	7.402	3.7
850	135	54.84	14.03	7.34	18.84	11.50	7.473	3.7
900	135	54.84	14.85	7.27	18.77	11.50	7.546	3.6
950	134	54.43	15.68	7.14	18.64	11.50	7.620	3.6
1000	134	54.43	16.50	7.07	18.57	11.50	7.695	3.5


10BH-052A 25'-27'
Deviator Stress (psi)
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
Axial Strain (%)

Schnabel ENGINEERING

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST REPORT

Project: *MLK Expressway* SEI Contract: *10613051*

Location: *Portsmouth, VA* Boring No.: *10BH-61*
Date: *9/29/2010* Depth: *93'-95'*

Test Specimen Data	
Initial Diameter, in:	*2.86*
Initial Area, in^2:	*6.43*
Initial Height, in:	*6.00*
Height/Diameter Ratio:	*2.10*
Natural Moisture, %	*32.2*
Moist Unit Weight, pcf:	*119.4*
Dry Unit Weight, pcf:	*90.3*

Testing Information	
Test Procedure:	*ASTM D2850*
Type of Specimen:	*Tube Sample*
Confining Stress (psi) :	*30.00*

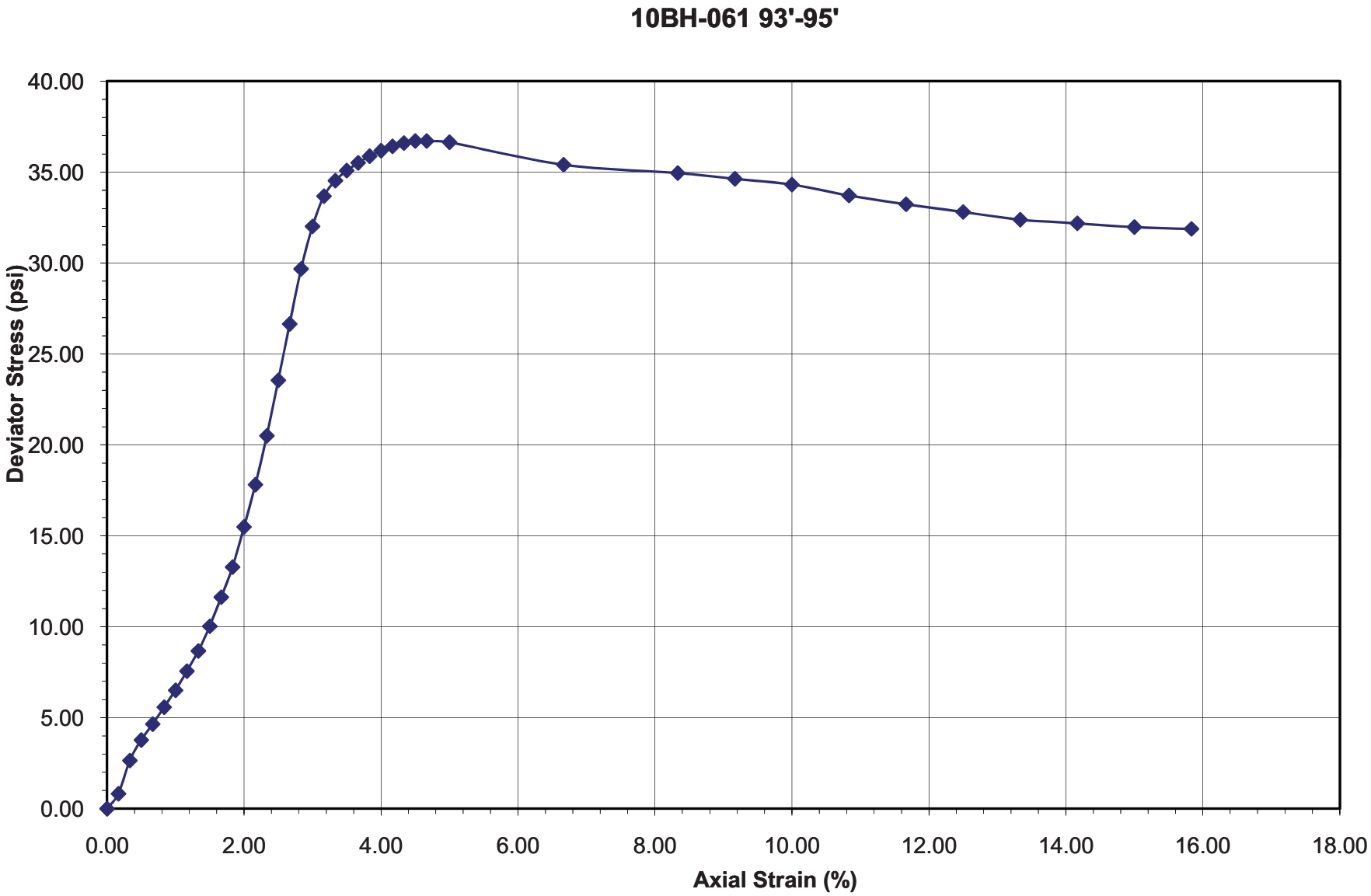
Strength Data	
Strain at Failure %:	*4.50*
Deviator Stress at failure, psi:	*36.71*
Shear Strength (Su), psi:	*18.4*

Soil Description.:	*Gray, fine to medium silty SAND, SM*

LL, %:	*39*	%<200	47.6
PI, %:	*26*	Gs:	-

Proving Ring Factor 0.4062

Axial Deflection (0.001 in)	Proving Ring Dial	Axial Load (lbs)	Axial Strain. (%)	Dev. Stress (psi)	σ 1 (psi)	σ 3 (psi)	Corrected Area (In^2)	S_U (psi)
0	0	0.00	0.00	0.00	30.00	30.00	6.425	0.0
10	13	5.28	0.17	0.82	30.82	30.00	6.436	0.4
20	42	17.06	0.33	2.65	32.65	30.00	6.447	1.3
30	60	24.37	0.50	3.77	33.77	30.00	6.457	1.9
40	74	30.06	0.67	4.65	34.65	30.00	6.468	2.3
50	89	36.15	0.83	5.58	35.58	30.00	6.479	2.8
60	104	42.24	1.00	6.51	36.51	30.00	6.490	3.3
70	121	49.15	1.17	7.56	37.56	30.00	6.501	3.8
80	139	56.46	1.33	8.67	38.67	30.00	6.512	4.3
90	161	65.40	1.50	10.03	40.03	30.00	6.523	5.0
100	187	75.96	1.67	11.63	41.63	30.00	6.534	5.8
110	214	86.93	1.83	13.28	43.28	30.00	6.545	6.6
120	250	101.55	2.00	15.49	45.49	30.00	6.556	7.7
130	288	116.99	2.17	17.81	47.81	30.00	6.567	8.9
140	332	134.86	2.33	20.50	50.50	30.00	6.579	10.2
150	382	155.17	2.50	23.55	53.55	30.00	6.590	11.8
160	433	175.88	2.67	26.64	56.64	30.00	6.601	13.3
170	483	196.19	2.83	29.67	59.67	30.00	6.612	14.8
180	522	212.04	3.00	32.01	62.01	30.00	6.624	16.0
190	550	223.41	3.17	33.67	63.67	30.00	6.635	16.8
200	565	229.50	3.33	34.53	64.53	30.00	6.647	17.3
210	575	233.57	3.50	35.08	65.08	30.00	6.658	17.5
220	583	236.81	3.67	35.51	65.51	30.00	6.670	17.8
230	590	239.66	3.83	35.87	65.87	30.00	6.681	17.9
240	596	242.10	4.00	36.17	66.17	30.00	6.693	18.1
250	601	244.13	4.17	36.41	66.41	30.00	6.704	18.2
260	605	245.75	4.33	36.59	66.59	30.00	6.716	18.3
270	608	246.97	4.50	36.71	66.71	30.00	6.728	18.4
280	609	247.38	4.67	36.70	66.70	30.00	6.740	18.4
300	610	247.78	5.00	36.64	66.64	30.00	6.763	18.3
400	600	243.72	6.67	35.40	65.40	30.00	6.884	17.7
500	603	244.94	8.33	34.95	64.95	30.00	7.009	17.5
550	603	244.94	9.17	34.63	64.63	30.00	7.073	17.3
600	603	244.94	10.00	34.31	64.31	30.00	7.139	17.2
650	598	242.91	10.83	33.71	63.71	30.00	7.206	16.9
700	595	241.69	11.67	33.23	63.23	30.00	7.274	16.6
750	593	240.88	12.50	32.80	62.80	30.00	7.343	16.4
800	591	240.06	13.33	32.38	62.38	30.00	7.414	16.2
850	593	240.88	14.17	32.18	62.18	30.00	7.486	16.1
900	595	241.69	15.00	31.97	61.97	30.00	7.559	16.0
950	599	243.31	15.83	31.87	61.87	30.00	7.634	15.9
1000	604	245.34	16.67	31.82	61.82	30.00	7.710	15.9


10BH-061 93'-95'
Deviator Stress (psi)
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
Axial Strain (%)

Schnabel ENGINEERING

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST REPORT

Project: *MLK Expressway* SEI Contract: *10613051*

Location: *Portsmouth, VA* Boring No.: *10BH-096A*
Date: *9/24/2010* Depth: *22'-24'*

Test Specimen Data	
Initial Diameter, in:	*2.86*
Initial Area, in^2:	*6.43*
Initial Height, in:	*6.04*
Height/Diameter Ratio:	*2.11*
Natural Moisture, %	*71.6*
Moist Unit Weight, pcf:	*97.4*
Dry Unit Weight, pcf:	*56.8*

Testing Information	
Test Procedure:	*ASTM D2850*
Type of Specimen:	*Tube Sample*
Confining Stress (psi) :	*10.50*

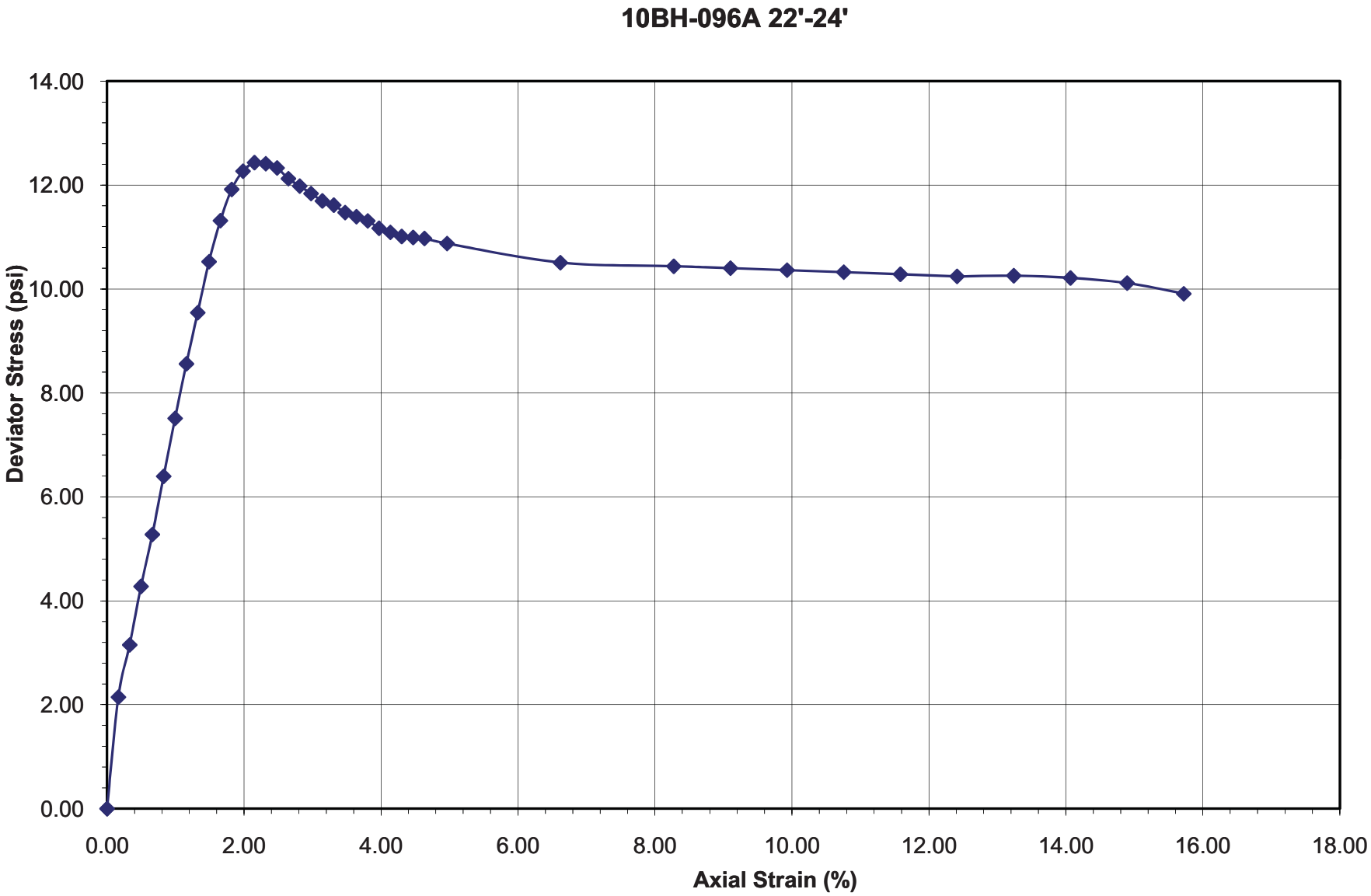
Strength Data	
Strain at Failure %:	*2.15*
Deviator Stress at failure, psi:	*12.43*
Shear Strength (Su), psi:	*6.2*

Soil Description.:	*Gray, fat CLAY, CH*

LL, %:	*100*	%<200	99.8
PL, %:	*23*	Gs:	-

Proving Ring Factor 0.4062

Axial Deflection (0.001 in)	Proving Ring Dial	Axial Load (lbs)	Axial Strain. (%)	Dev. Stress (psi)	σ 1 (psi)	σ 3 (psi)	Corrected Area (In^2)	S_U (psi)
0	0	0.00	0.00	0.00	10.50	10.50	6.425	0.0
10	34	13.81	0.17	2.15	12.65	10.50	6.436	1.1
20	50	20.31	0.33	3.15	13.65	10.50	6.446	1.6
30	68	27.62	0.50	4.28	14.78	10.50	6.457	2.1
40	84	34.12	0.66	5.28	15.78	10.50	6.468	2.6
50	102	41.43	0.83	6.40	16.90	10.50	6.479	3.2
60	120	48.74	0.99	7.51	18.01	10.50	6.490	3.8
70	137	55.65	1.16	8.56	19.06	10.50	6.500	4.3
80	153	62.15	1.32	9.54	20.04	10.50	6.511	4.8
90	169	68.65	1.49	10.53	21.03	10.50	6.522	5.3
100	182	73.93	1.66	11.32	21.82	10.50	6.533	5.7
110	192	77.99	1.82	11.92	22.42	10.50	6.544	6.0
120	198	80.43	1.99	12.27	22.77	10.50	6.555	6.1
130	201	81.65	2.15	12.43	22.93	10.50	6.566	6.2
140	201	81.65	2.32	12.41	22.91	10.50	6.577	6.2
150	200	81.24	2.48	12.33	22.83	10.50	6.589	6.2
160	197	80.02	2.65	12.12	22.62	10.50	6.600	6.1
170	195	79.21	2.81	11.98	22.48	10.50	6.611	6.0
180	193	78.40	2.98	11.84	22.34	10.50	6.622	5.9
190	191	77.58	3.14	11.70	22.20	10.50	6.634	5.8
200	190	77.18	3.31	11.61	22.11	10.50	6.645	5.8
210	188	76.37	3.48	11.47	21.97	10.50	6.656	5.7
220	187	75.96	3.64	11.39	21.89	10.50	6.668	5.7
230	186	75.55	3.81	11.31	21.81	10.50	6.679	5.7
240	184	74.74	3.97	11.17	21.67	10.50	6.691	5.6
250	183	74.33	4.14	11.09	21.59	10.50	6.702	5.5
260	182	73.93	4.30	11.01	21.51	10.50	6.714	5.5
270	182	73.93	4.47	10.99	21.49	10.50	6.726	5.5
280	182	73.93	4.63	10.97	21.47	10.50	6.737	5.5
300	181	73.52	4.97	10.87	21.37	10.50	6.761	5.4
400	178	72.30	6.62	10.51	21.01	10.50	6.881	5.3
500	180	73.12	8.28	10.44	20.94	10.50	7.005	5.2
550	181	73.52	9.10	10.40	20.90	10.50	7.069	5.2
600	182	73.93	9.93	10.36	20.86	10.50	7.133	5.2
650	183	74.33	10.76	10.32	20.82	10.50	7.200	5.2
700	184	74.74	11.59	10.28	20.78	10.50	7.267	5.1
750	185	75.15	12.41	10.24	20.74	10.50	7.336	5.1
800	187	75.96	13.24	10.26	20.76	10.50	7.406	5.1
850	188	76.37	14.07	10.21	20.71	10.50	7.477	5.1
900	188	76.37	14.90	10.12	20.62	10.50	7.550	5.1
950	186	75.55	15.72	9.91	20.41	10.50	7.624	5.0
1000	183	74.33	16.55	9.65	20.15	10.50	7.699	4.8


10BH-096A 22'-24'
Deviator Stress (psi)
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
Axial Strain (%)

Schnabel ENGINEERING

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST REPORT

Project: *MLK Expressway* SEI Contract: *10613051*

Location: *Portsmouth, VA* Boring No.: *10BH-120A*
Date: *9/24/2010* Depth: *25'-27'*

Test Specimen Data	
Initial Diameter, in:	*2.86*
Initial Area. in^2:	*6.43*
Initial Height, in:	*6.00*
Height/Diameter Ratio:	*2.10*
Natural Moisture, %	*74.1*
Moist Unit Weight, pcf:	*97.7*
Dry Unit Weight, pcf:	*56.1*

Testing Information	
Test Procedure:	*ASTM D2850*
Type of Specimen:	*Tube Sample*
Confining Stress (psi) :	*11.50*

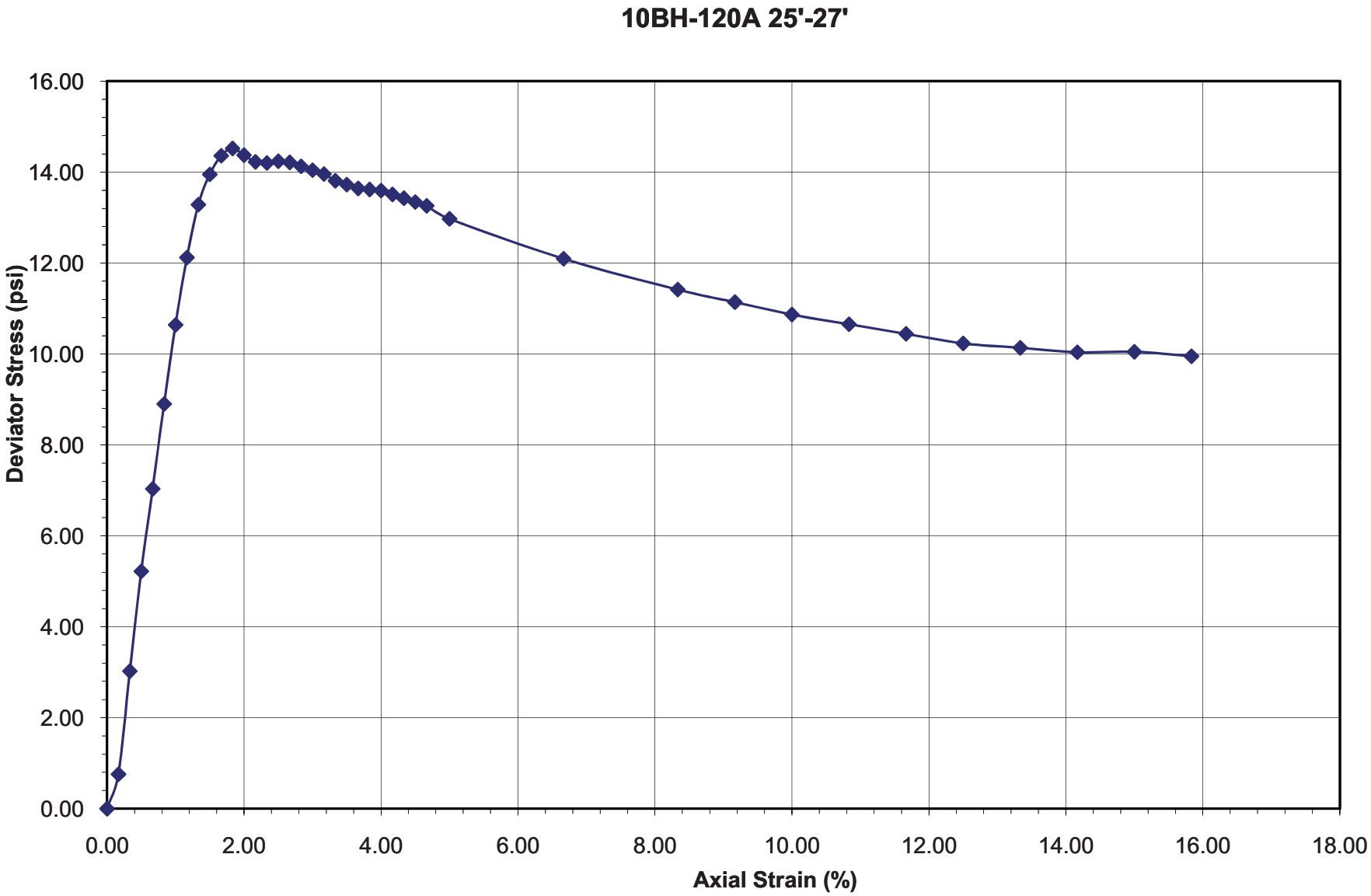
Strength Data	
Strain at Failure %:	*1.83*
Deviator Stress at failure, psi:	*14.52*
Shear Strength (Su), psi:	*7.3*

Soil Description.:	*Gray, fat CLAY, CH*

LL, %:	*86*	%<200	99.3
PL, %:	*22*	Gs:	-

Proving Ring Factor 0.4062

Axial Deflection (0.001 in)	Proving Ring Dial	Axial Load (lbs)	Axial Strain. (%)	Dev. Stress (psi)	σ 1 (psi)	σ 3 (psi)	Corrected Area (In^2)	S_U (psi)
0	0	0.00	0.00	0.00	11.50	11.50	6.425	0.0
10	12	4.87	0.17	0.76	12.26	11.50	6.436	0.4
20	48	19.50	0.33	3.02	14.52	11.50	6.447	1.5
30	83	33.71	0.50	5.22	16.72	11.50	6.457	2.6
40	112	45.49	0.67	7.03	18.53	11.50	6.468	3.5
50	142	57.68	0.83	8.90	20.40	11.50	6.479	4.5
60	170	69.05	1.00	10.64	22.14	11.50	6.490	5.3
70	194	78.80	1.17	12.12	23.62	11.50	6.501	6.1
80	213	86.52	1.33	13.29	24.79	11.50	6.512	6.6
90	224	90.99	1.50	13.95	25.45	11.50	6.523	7.0
100	231	93.83	1.67	14.36	25.86	11.50	6.534	7.2
110	234	95.05	1.83	14.52	26.02	11.50	6.545	7.3
120	232	94.24	2.00	14.37	25.87	11.50	6.556	7.2
130	230	93.43	2.17	14.23	25.73	11.50	6.567	7.1
140	230	93.43	2.33	14.20	25.70	11.50	6.579	7.1
150	231	93.83	2.50	14.24	25.74	11.50	6.590	7.1
160	231	93.83	2.67	14.21	25.71	11.50	6.601	7.1
170	230	93.43	2.83	14.13	25.63	11.50	6.612	7.1
180	229	93.02	3.00	14.04	25.54	11.50	6.624	7.0
190	228	92.61	3.17	13.96	25.46	11.50	6.635	7.0
200	226	91.80	3.33	13.81	25.31	11.50	6.647	6.9
210	225	91.40	3.50	13.73	25.23	11.50	6.658	6.9
220	224	90.99	3.67	13.64	25.14	11.50	6.670	6.8
230	224	90.99	3.83	13.62	25.12	11.50	6.681	6.8
240	224	90.99	4.00	13.60	25.10	11.50	6.693	6.8
250	223	90.58	4.17	13.51	25.01	11.50	6.704	6.8
260	222	90.18	4.33	13.43	24.93	11.50	6.716	6.7
270	221	89.77	4.50	13.34	24.84	11.50	6.728	6.7
280	220	89.36	4.67	13.26	24.76	11.50	6.740	6.6
300	216	87.74	5.00	12.97	24.47	11.50	6.763	6.5
400	205	83.27	6.67	12.10	23.60	11.50	6.884	6.0
500	197	80.02	8.33	11.42	22.92	11.50	7.009	5.7
550	194	78.80	9.17	11.14	22.64	11.50	7.073	5.6
600	191	77.58	10.00	10.87	22.37	11.50	7.139	5.4
650	189	76.77	10.83	10.65	22.15	11.50	7.206	5.3
700	187	75.96	11.67	10.44	21.94	11.50	7.274	5.2
750	185	75.15	12.50	10.23	21.73	11.50	7.343	5.1
800	185	75.15	13.33	10.14	21.64	11.50	7.414	5.1
850	185	75.15	14.17	10.04	21.54	11.50	7.486	5.0
900	187	75.96	15.00	10.05	21.55	11.50	7.559	5.0
950	187	75.96	15.83	9.95	21.45	11.50	7.634	5.0
1000	188	76.37	16.67	9.90	21.40	11.50	7.710	5.0


10BH-120A 25'-27'
Deviator Stress (psi)
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
Axial Strain (%)

Schnabel ENGINEERING

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST REPORT

Project: *MLK Expressway* SEI Contract: *10613051*

Location: *Portsmouth, VA* Boring No.: *10BH-120A*
Date: *9/24/2010* Depth: *58'-60'*

Test Specimen Data	
Initial Diameter, in:	*2.85*
Initial Area. in^2:	*6.38*
Initial Height, in:	*6.00*
Height/Diameter Ratio:	*2.11*
Natural Moisture, %	*42.1*
Moist Unit Weight, pcf:	*109.6*
Dry Unit Weight, pcf:	*77.1*

Testing Information	
Test Procedure:	*ASTM D2850*
Type of Specimen:	*Tube Sample*
Confining Stress (psi) :	*18.00*

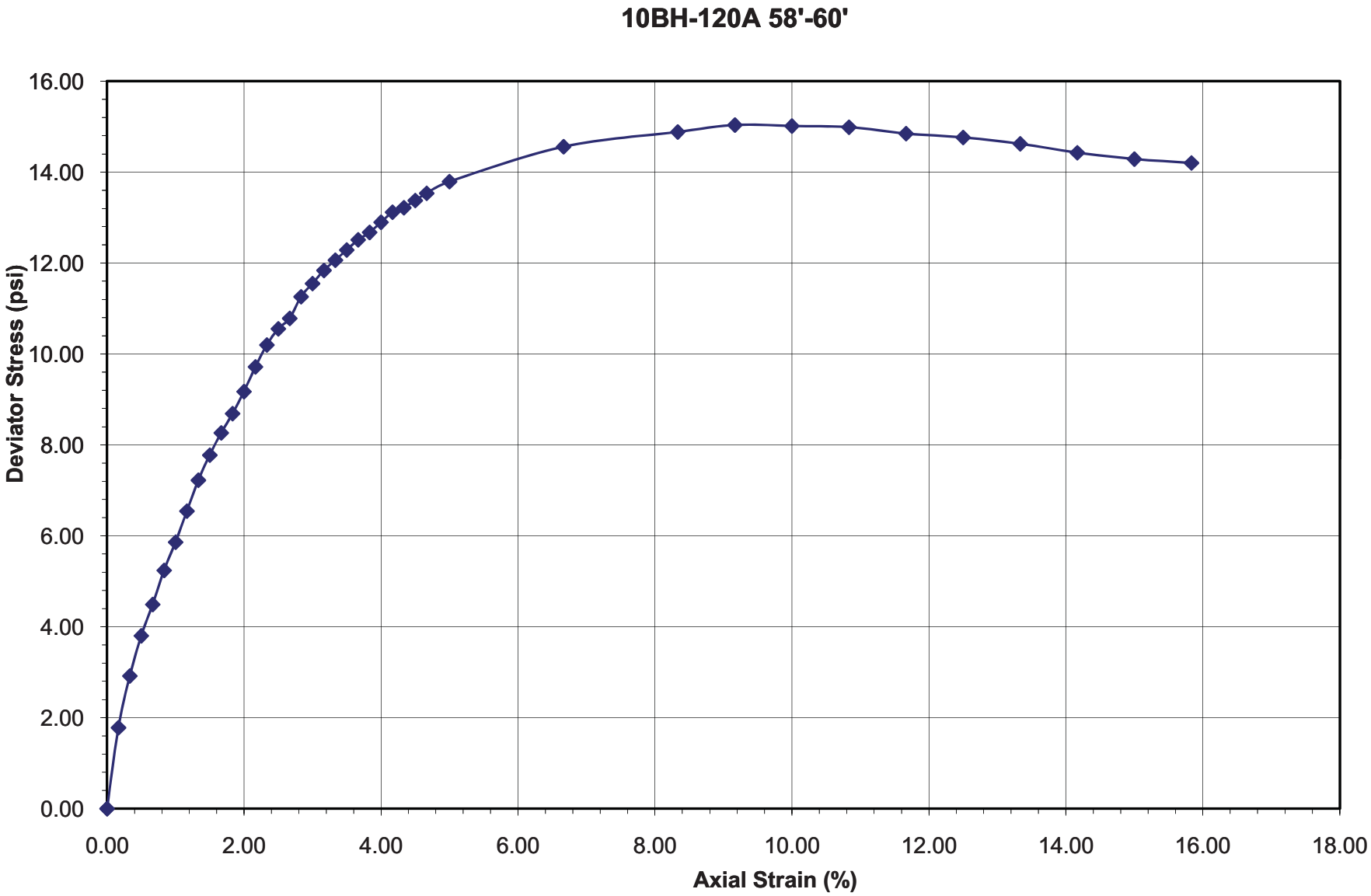
Strength Data	
Strain at Failure %:	*9.17*
Deviator Stress at failure, psi:	*15.04*
Shear Strength (Su), psi:	*7.5*

Soil Description.:	*Gray, sandy SILT, contains mica and organic matter, ML*

LL, %:	*40*	%<200	67.4
PL, %:	*32*	Gs:	-

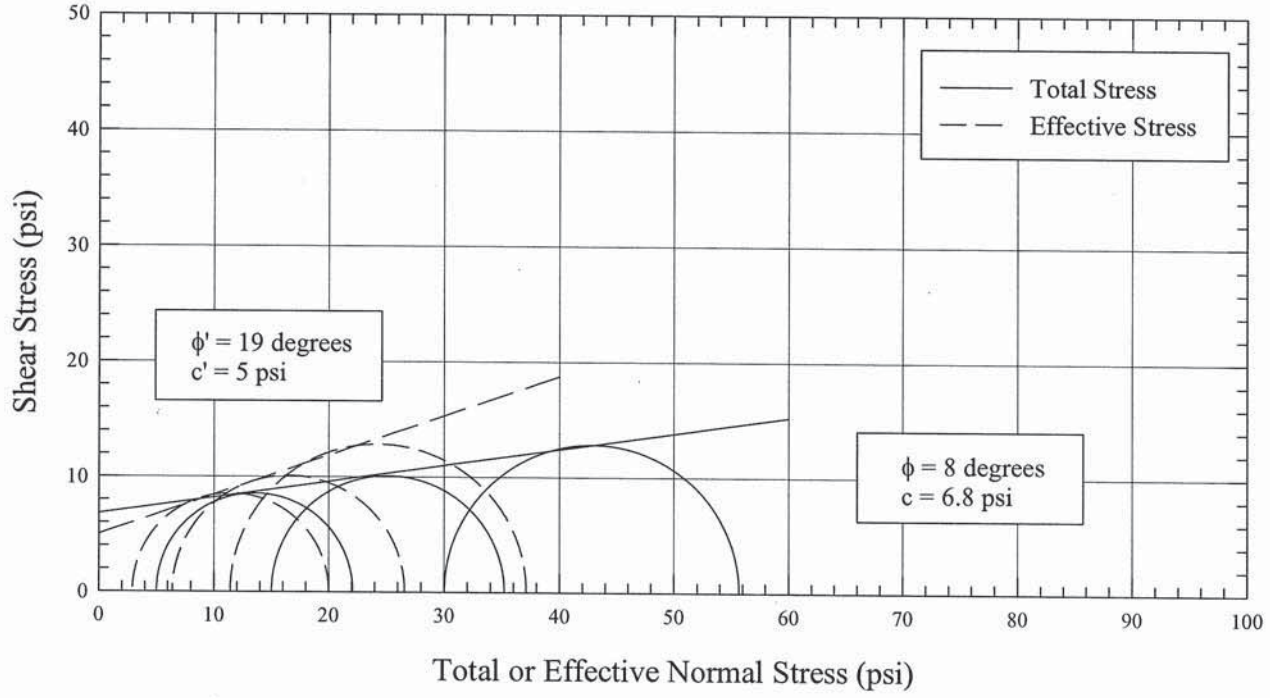
Proving Ring Factor 0.4062

Axial Deflection (0.001 in)	Proving Ring Dial	Axial Load (lbs)	Axial Strain. (%)	Dev. Stress (psi)	σ 1 (psi)	σ 3 (psi)	Corrected Area (In^2)	S_U (psi)
0	0	0.00	0.00	0.00	18.00	18.00	6.380	0.0
10	28	11.37	0.17	1.78	19.78	18.00	6.391	0.9
20	46	18.69	0.33	2.92	20.92	18.00	6.402	1.5
30	60	24.37	0.50	3.80	21.80	18.00	6.412	1.9
40	71	28.84	0.67	4.49	22.49	18.00	6.423	2.2
50	83	33.71	0.83	5.24	23.24	18.00	6.434	2.6
60	93	37.78	1.00	5.86	23.86	18.00	6.445	2.9
70	104	42.24	1.17	6.54	24.54	18.00	6.456	3.3
80	115	46.71	1.33	7.22	25.22	18.00	6.466	3.6
90	124	50.37	1.50	7.78	25.78	18.00	6.477	3.9
100	132	53.62	1.67	8.26	26.26	18.00	6.488	4.1
110	139	56.46	1.83	8.69	26.69	18.00	6.499	4.3
120	147	59.71	2.00	9.17	27.17	18.00	6.510	4.6
130	156	63.37	2.17	9.72	27.72	18.00	6.522	4.9
140	164	66.62	2.33	10.20	28.20	18.00	6.533	5.1
150	170	69.05	2.50	10.55	28.55	18.00	6.544	5.3
160	174	70.68	2.67	10.78	28.78	18.00	6.555	5.4
170	182	73.93	2.83	11.26	29.26	18.00	6.566	5.6
180	187	75.96	3.00	11.55	29.55	18.00	6.578	5.8
190	192	77.99	3.17	11.84	29.84	18.00	6.589	5.9
200	196	79.62	3.33	12.06	30.06	18.00	6.600	6.0
210	200	81.24	3.50	12.29	30.29	18.00	6.612	6.1
220	204	82.86	3.67	12.51	30.51	18.00	6.623	6.3
230	207	84.08	3.83	12.67	30.67	18.00	6.635	6.3
240	211	85.71	4.00	12.90	30.90	18.00	6.646	6.4
250	215	87.33	4.17	13.12	31.12	18.00	6.658	6.6
260	217	88.15	4.33	13.22	31.22	18.00	6.669	6.6
270	220	89.36	4.50	13.38	31.38	18.00	6.681	6.7
280	223	90.58	4.67	13.53	31.53	18.00	6.693	6.8
300	228	92.61	5.00	13.79	31.79	18.00	6.716	6.9
400	245	99.52	6.67	14.56	32.56	18.00	6.836	7.3
500	255	103.58	8.33	14.88	32.88	18.00	6.960	7.4
550	260	105.61	9.17	15.04	33.04	18.00	7.024	7.5 ←
600	262	106.42	10.00	15.01	33.01	18.00	7.089	7.5
650	264	107.24	10.83	14.99	32.99	18.00	7.155	7.5
700	264	107.24	11.67	14.85	32.85	18.00	7.223	7.4
750	265	107.64	12.50	14.76	32.76	18.00	7.292	7.4
800	265	107.64	13.33	14.62	32.62	18.00	7.362	7.3
850	264	107.24	14.17	14.43	32.43	18.00	7.433	7.2
900	264	107.24	15.00	14.29	32.29	18.00	7.506	7.1
950	265	107.64	15.83	14.20	32.20	18.00	7.580	7.1
1000	265	107.64	16.67	14.06	32.06	18.00	7.656	7.0

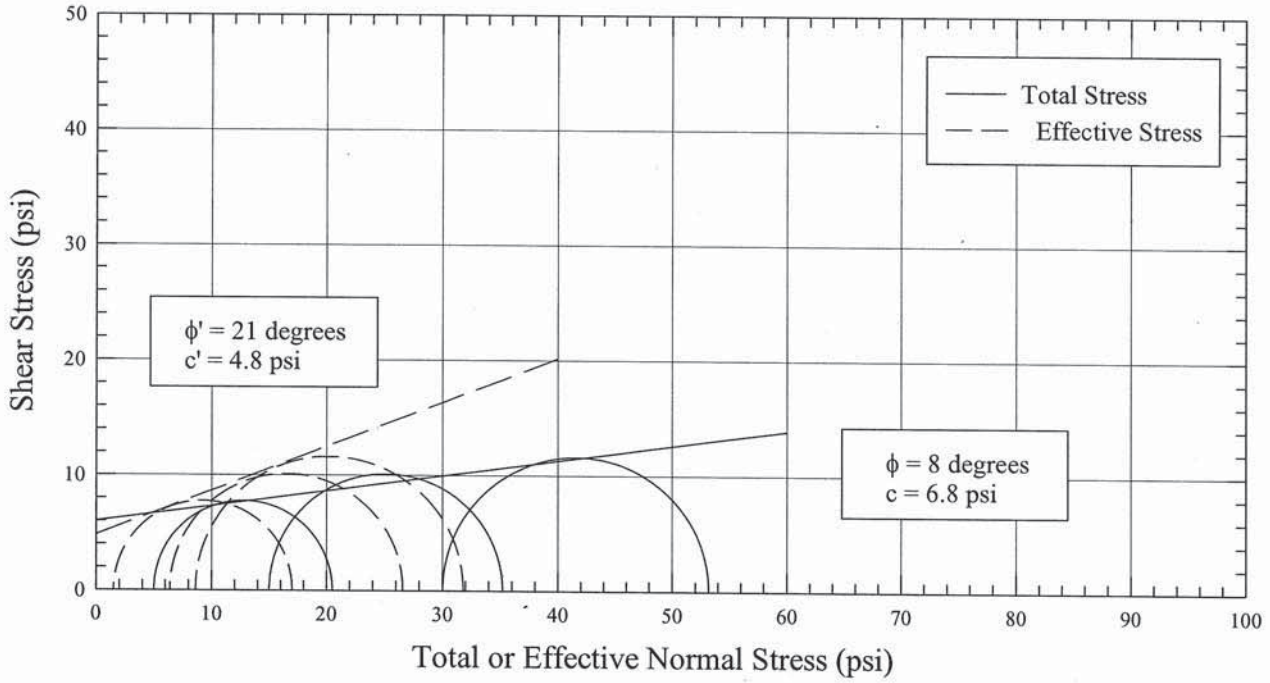

10BH-120A 58'-60'
Deviator Stress (psi)
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
Axial Strain (%)

Consolidated Undrained (CU) Triaxial Shear (ASTM D4767)

Mohr Stress Circles at Maximum Deviator Stress Criterion



Mohr Stress Circles at Maximum Principal Stress Ratio Criterion



Boring No.: *10BH-020A* Depth: *28-30 ft* SEC Contract: *10613051* Date: *9/16/10*

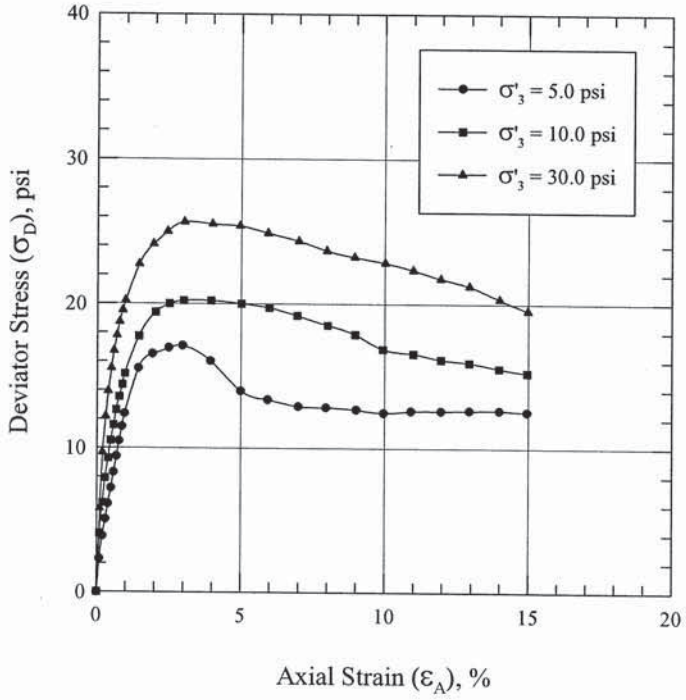
Sample Description: *ELASTIC SILT (MH), contains mica - gray* Reviewed By: *CJS*

Specimen Type: *Tube Sample* Gs: *2.64* LL: *55* PI: *25* %<200: *86.1*

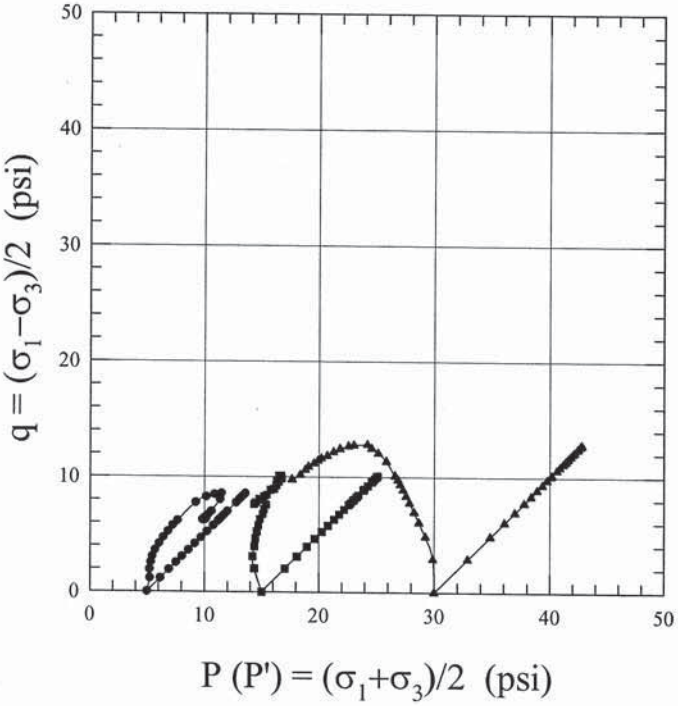
Schnabel ENGINEERING

MLK Expressway Extension
Portsmouth, VA

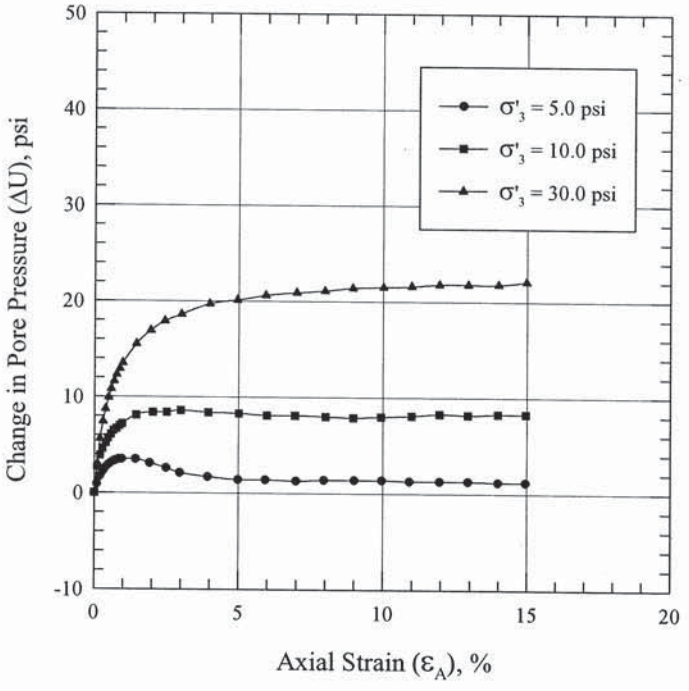
Deviator Stress vs. Axial Strain



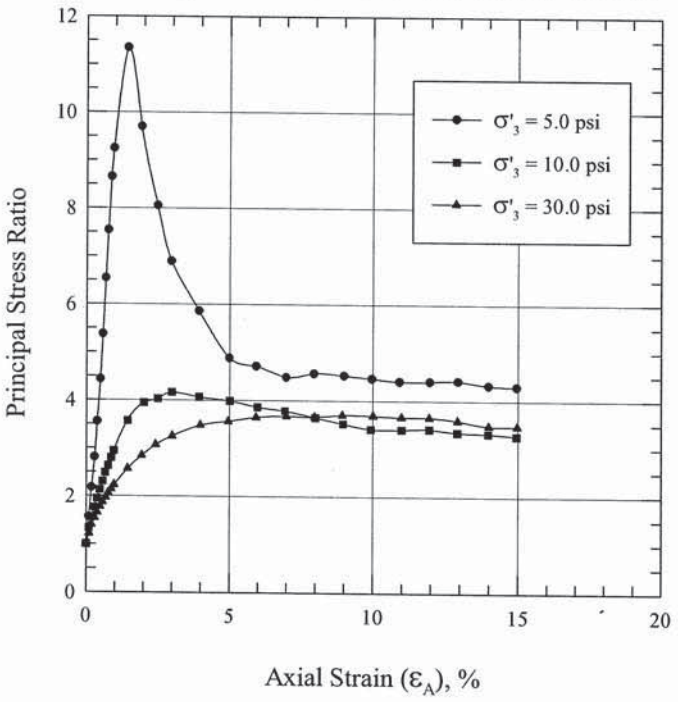
Stress Paths



Change in Pore Pressure vs. Axial Strain



Principal Stress Ratio vs. Axial Strain



Boring No.: *10BH-020A* Depth: *28-30 ft* SEC Contract: *10613051* Date: *9/03/10*

Sample Description: *ELASTIC SILT (MH), contains mica - gray* Reviewed By: *CJS*

Specimen Type: *Tube Sample* Specific Gravity: 2.64 LL: *55* PI: *25* %<200: *86.1*

Schnabel ENGINEERING

MLK Expressway Extension
Portsmouth, VA

Schnabel ENGINEERING

Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *MLK Expressway Extension*

Location: *Portsmouth, VA*

Schnabel Contract: *10613051*
Boring No.: *10BH-020A*
Depth: *28-30 ft.*
Elevation: *-16.8 to -18.8 ft.*
Confining Stress (psi): *5.0*

Date: *9/16/2010*

Reviewed by: *CJS*

	Specimen Conditions	
	Initial	Consolidated
Diameter (in)	2.853	2.85
Height (in)	5.810	5.80
Area (in^2)	6.40	6.37
Moisture (%)	55.6	
W_{solids} (lbs)	1.44	
ρ_{wet} (pcf)	104.3	
ρ_{dry} (pcf)	67.0	67.4
Void Ratio	1.46	1.44
Saturation, %	100	98

Shear Testing Conditions	
Cell Pressure (psi):	20.0
Back Pressure (psi):	15.0
Eff. Confining Stress (psi):	5.0
Final B check	0.98
t_{50} (min.):	5.7
Rate of Strain (%/min):	0.0337

Filter strips used? *YES*

Specimen Type: *Tube Sample*

Soil Description: *ELASTIC SILT (MH), contains mica - gray*

Liquid Limit: *55*
Plasticity Index: *25*
% finer that No. 200: *86.1*
Specific Gravity: *2.64*

Remarks:

Failure Sketch



Reading No.	Deviator Load (lbs)	Corrected[1] Dev. Load (lbs.)	Axial Deformation (in.)	Axial Strain (%)	Pore Pressure (psi)	Change in Pore Press. (psi)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	Deviator Stress (psi)	Principal Stress Ratio	A_{bar}	P (psi)	P' (psi)	q (psi)
Zero	0.0	0.0	0.000	0.00	15.0	0.0	6.37	5.0	5.0	5.0	5.0	0.0	1.00	0.00	5.0	5.0	0.0
1	14.8	14.7	0.005	0.09	15.9	0.9	6.38	7.3	5.0	6.4	4.1	2.3	1.56	0.39	6.2	5.3	1.2
2	24.9	24.7	0.011	0.19	16.7	1.7	6.39	8.9	5.0	7.2	3.3	3.9	2.17	0.44	6.9	5.2	1.9
3	32.6	32.3	0.017	0.29	17.2	2.2	6.39	10.0	5.0	7.8	2.8	5.0	2.80	0.44	7.5	5.3	2.5
4	39.6	39.1	0.022	0.38	17.6	2.6	6.40	11.1	5.0	8.5	2.4	6.1	3.55	0.42	8.1	5.5	3.1
5	46.7	46.1	0.028	0.48	17.9	2.9	6.40	12.2	5.0	9.3	2.1	7.2	4.43	0.40	8.6	5.7	3.6
6	53.9	53.2	0.033	0.57	18.1	3.1	6.41	13.3	5.0	10.2	1.9	8.3	5.37	0.37	9.2	6.1	4.2
7	61.2	60.4	0.039	0.67	18.3	3.3	6.42	14.4	5.0	11.1	1.7	9.4	6.54	0.35	9.7	6.4	4.7
8	68.1	67.2	0.044	0.76	18.4	3.4	6.42	15.5	5.0	12.1	1.6	10.5	7.54	0.32	10.2	6.8	5.2
9	74.8	73.8	0.050	0.86	18.5	3.5	6.43	16.5	5.0	13.0	1.5	11.5	8.65	0.31	10.7	7.2	5.7
10	80.7	79.6	0.055	0.95	18.5	3.5	6.43	17.4	5.0	13.9	1.5	12.4	9.24	0.28	11.2	7.7	6.2
11	102.0	100.3	0.083	1.43	18.5	3.5	6.47	20.5	5.0	17.0	1.5	15.5	11.34	0.23	12.8	9.3	7.8
12	109.6	107.3	0.111	1.91	18.1	3.1	6.50	21.5	5.0	18.4	1.9	16.5	9.69	0.19	13.3	10.2	8.3
13	113.1	110.6	0.144	2.48	17.6	2.6	6.54	21.9	5.0	19.3	2.4	16.9	8.05	0.15	13.5	10.9	8.5
14	114.8	112.2	0.172	2.97	17.1	2.1	6.57	22.1	5.0	20.0	2.9	17.1	6.89	0.12	13.5	11.4	8.5
15	109.2	106.4	0.228	3.93	16.7	1.7	6.63	21.0	5.0	19.3	3.3	16.0	5.86	0.11	13.0	11.3	8.0
16	96.6	93.6	0.289	4.98	16.4	1.4	6.71	19.0	5.0	17.6	3.6	14.0	4.88	0.10	12.0	10.6	7.0
17	93.7	90.5	0.344	5.93	16.4	1.4	6.78	18.4	5.0	17.0	3.6	13.4	4.71	0.10	11.7	10.3	6.7
18	91.8	88.3	0.405	6.98	16.3	1.3	6.85	17.9	5.0	16.6	3.7	12.9	4.48	0.10	11.4	10.1	6.4
19	92.5	88.8	0.461	7.95	16.4	1.4	6.92	17.8	5.0	16.4	3.6	12.8	4.56	0.11	11.4	10.0	6.4
20	92.7	88.8	0.522	9.00	16.4	1.4	7.00	17.7	5.0	16.3	3.6	12.7	4.52	0.11	11.3	9.9	6.3
21	92.4	88.3	0.578	9.97	16.4	1.4	7.08	17.5	5.0	16.1	3.6	12.5	4.47	0.11	11.2	9.8	6.2
22	94.4	90.1	0.633	10.91	16.3	1.3	7.15	17.6	5.0	16.3	3.7	12.6	4.40	0.10	11.3	10.0	6.3
23	95.8	91.3	0.694	11.97	16.3	1.3	7.24	17.6	5.0	16.3	3.7	12.6	4.41	0.10	11.3	10.0	6.3
24	97.2	92.5	0.750	12.93	16.3	1.3	7.32	17.6	5.0	16.3	3.7	12.6	4.41	0.10	11.3	10.0	6.3
25	98.6	93.6	0.811	13.98	16.2	1.2	7.41	17.6	5.0	16.4	3.8	12.6	4.33	0.09	11.3	10.1	6.3
26	99.1	93.9	0.867	14.95	16.2	1.2	7.49	17.5	5.0	16.3	3.8	12.5	4.30	0.10	11.3	10.1	6.3

Notes: 1. Deviator load corrected for membrane and filter cage (if applicable) effects.
2. Right Cylinder Correction Method

Schnabel ENGINEERING

Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *MLK Expressway Extension*

Location: *Portsmouth, VA*

Schnabel Contract: *10613051*
Boring No.: *10BH-020A*
Depth: *28-30 ft.*
Elevation: *-16.8 to 18.8 ft.*
Confining Stress (psi): *15.0*

Date: *9/16/2010*

Reviewed by: *CJS*

	Specimen Conditions	
	Initial	Consolidated
Diameter (in)	2.857	2.83
Height (in)	5.798	5.76
Area (in^2)	6.41	6.31
Moisture (%)	51.0	
W_{solids} (lbs)	1.52	
ρ_{wet} (pcf)	106.4	
ρ_{dry} (pcf)	70.5	72.1
Void Ratio	1.34	1.28
Saturation, %	100	100

Shear Testing Conditions	
Cell Pressure (psi):	25.0
Back Pressure (psi):	10.0
Eff. Confining Stress (psi):	15.0
Final B check	0.98
t_{50} (min.):	6.5
Rate of Strain (%/min):	0.0337

Filter strips used? *YES*

Specimen Type: *Tube Sample*

Soil Description: *ELASTIC SILT (MH), contains mica - gray*

Liquid Limit: *55*
Plasticity Index: *25*
% finer that No. 200: *86.1*
Specific Gravity: *2.64*

Remarks:

Failure Sketch



Reading No.	Deviator Load (lbs)	Corrected[1] Dev. Load (lbs.)	Axial Deformation (in.)	Axial Strain (%)	Pore Pressure (psi)	Change in Pore Press. (psi)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	Deviator Stress (psi)	Principal Stress Ratio	A_{bar}	P (psi)	P' (psi)	q (psi)
Zero	0.0	0.0	0.000	0.00	10.0	0.0	6.31	15.0	15.0	15.0	15.0	0.0	1.00	0.00	15.0	15.0	0.0
1	25.8	25.7	0.005	0.09	12.7	2.7	6.32	19.1	15.0	16.4	12.3	4.1	1.33	0.66	17.0	14.3	2.0
2	39.4	39.2	0.011	0.19	13.9	3.9	6.32	21.2	15.0	17.3	11.1	6.2	1.56	0.63	18.1	14.2	3.1
3	50.4	50.1	0.016	0.28	14.6	4.6	6.33	22.9	15.0	18.3	10.4	7.9	1.76	0.58	19.0	14.4	4.0
4	59.3	58.8	0.022	0.38	15.2	5.2	6.34	24.3	15.0	19.1	9.8	9.3	1.95	0.56	19.6	14.4	4.6
5	67.2	66.6	0.027	0.47	15.7	5.7	6.34	25.5	15.0	19.8	9.3	10.5	2.13	0.54	20.3	14.6	5.3
6	74.2	73.5	0.033	0.57	16.1	6.1	6.35	26.6	15.0	20.5	8.9	11.6	2.30	0.53	20.8	14.7	5.8
7	81.1	80.3	0.038	0.66	16.5	6.5	6.35	27.6	15.0	21.1	8.5	12.6	2.49	0.51	21.3	14.8	6.3
8	87.1	86.2	0.044	0.76	16.7	6.7	6.36	28.5	15.0	21.8	8.3	13.5	2.63	0.49	21.8	15.1	6.8
9	92.6	91.6	0.050	0.87	17.0	7.0	6.37	29.4	15.0	22.4	8.0	14.4	2.80	0.49	22.2	15.2	7.2
10	97.7	96.6	0.055	0.96	17.2	7.2	6.37	30.2	15.0	23.0	7.8	15.2	2.94	0.48	22.6	15.4	7.6
11	115.3	113.6	0.083	1.44	18.1	8.1	6.40	32.7	15.0	24.6	6.9	17.7	3.57	0.46	23.9	15.8	8.9
12	127.4	125.0	0.116	2.01	18.4	8.4	6.44	34.4	15.0	26.0	6.6	19.4	3.94	0.43	24.7	16.3	9.7
13	132.0	129.5	0.144	2.50	18.4	8.4	6.47	35.0	15.0	26.6	6.6	20.0	4.03	0.42	25.0	16.6	10.0
14	134.2	131.6	0.172	2.99	18.6	8.6	6.51	35.2	15.0	26.6	6.4	20.2	4.16	0.43	25.1	16.5	10.1
15	135.7	132.9	0.227	3.94	18.4	8.4	6.57	35.2	15.0	26.8	6.6	20.2	4.06	0.42	25.1	16.7	10.1
16	136.0	133.0	0.288	5.00	18.3	8.3	6.64	35.0	15.0	26.7	6.7	20.0	3.99	0.41	25.0	16.7	10.0
17	135.7	132.5	0.344	5.97	18.1	8.1	6.71	34.7	15.0	26.6	6.9	19.7	3.86	0.41	24.9	16.8	9.9
18	133.6	130.2	0.400	6.95	18.1	8.1	6.78	34.2	15.0	26.1	6.9	19.2	3.78	0.42	24.6	16.5	9.6
19	130.8	127.1	0.461	8.01	18.0	8.0	6.86	33.5	15.0	25.5	7.0	18.5	3.65	0.43	24.3	16.3	9.3
20	128.0	124.1	0.516	8.96	17.9	7.9	6.93	32.9	15.0	25.0	7.1	17.9	3.52	0.44	24.0	16.1	9.0
21	122.4	118.3	0.572	9.93	18.0	8.0	7.01	31.9	15.0	23.9	7.0	16.9	3.41	0.47	23.4	15.4	8.4
22	121.8	117.5	0.633	10.99	18.1	8.1	7.09	31.6	15.0	23.5	6.9	16.6	3.40	0.49	23.3	15.2	8.3
23	120.4	115.9	0.688	11.95	18.3	8.3	7.17	31.2	15.0	22.9	6.7	16.2	3.41	0.51	23.1	14.8	8.1
24	120.4	115.7	0.744	12.92	18.2	8.2	7.25	31.0	15.0	22.8	6.8	16.0	3.35	0.51	23.0	14.8	8.0
25	119.1	114.2	0.805	13.98	18.3	8.3	7.34	30.6	15.0	22.3	6.7	15.6	3.32	0.53	22.8	14.5	7.8
26	118.3	113.2	0.861	14.95	18.3	8.3	7.42	30.2	15.0	21.9	6.7	15.2	3.28	0.54	22.6	14.3	7.6

Notes: 1. Deviator load corrected for membrane and filter cage (if applicable) effects.
2. Right Cylinder Correction Method

Schnabel ENGINEERING

Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *MLK Expressway Extension*

Location: *Portsmouth, VA*

Schnabel Contract: *10613051*
Boring No.: *10BH-020A*
Depth: *28-30 ft.*
Elevation: *-16.8 to -18.8 ft.*
Confining Stress (psi): *30.0*

Date: *9/16/2010*

Reviewed by: *CJS*

	Specimen Conditions	
	Initial	Consolidated
Diameter (in)	2.850	2.80
Height (in)	5.807	5.72
Area (in^2)	6.38	6.16
Moisture (%)	53.8	
W_{solids} (lbs)	1.46	
ρ_{wet} (pcf)	104.9	
ρ_{dry} (pcf)	68.2	71.8
Void Ratio	1.42	1.29
Saturation, %	100	99

Shear Testing Conditions	
Cell Pressure (psi):	45.0
Back Pressure (psi):	15.0
Eff. Confining Stress (psi):	30.0
Final B check	0.96
t_{50} (min.):	11.9
Rate of Strain (%/min):	0.0337

Filter strips used? *YES*

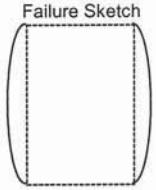
Specimen Type: *Tube Sample*

Soil Description: *ELASTIC SILT (MH), contains mica - gray*

Liquid Limit: *55*
Plasticity Index: *25*
% finer that No. 200: *86.1*
Specific Gravity: *2.64*

Remarks:

Failure Sketch

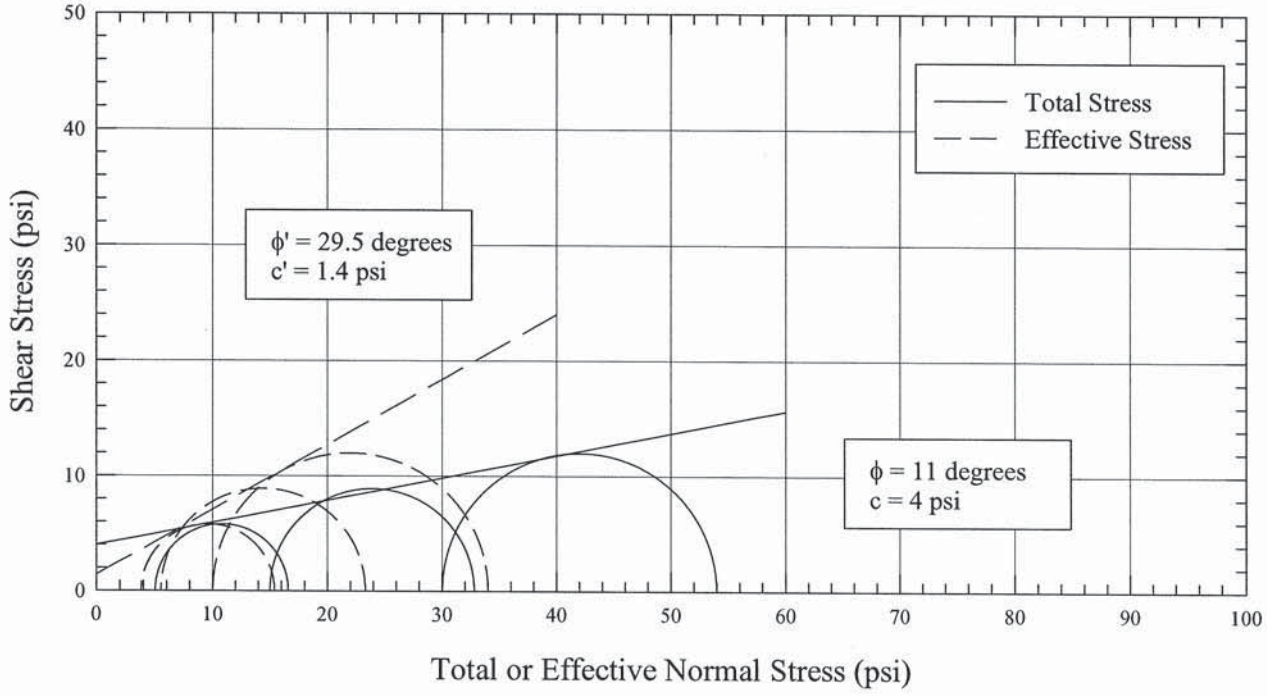


Reading No.	Deviator Load (lbs)	Corrected[1] Dev. Load (lbs.)	Axial Deformation (in.)	Axial Strain (%)	Pore Pressure (psi)	Change in Pore Press. (psi)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	Deviator Stress (psi)	Principal Stress Ratio	A_{bar}	P (psi)	P' (psi)	q (psi)
Zero	0.0	0.0	0.000	0.00	15.0	0.0	6.16	30.0	30.0	30.0	30.0	0.0	1.00	0.00	30.0	30.0	0.0
1	35.8	35.7	0.006	0.10	18.0	3.0	6.16	35.8	30.0	32.8	27.0	5.8	1.21	0.52	32.9	29.9	2.9
2	59.9	59.7	0.011	0.19	20.6	5.6	6.17	39.7	30.0	34.1	24.4	9.7	1.40	0.58	34.8	29.2	4.8
3	75.4	75.0	0.017	0.30	22.4	7.4	6.18	42.2	30.0	34.8	22.6	12.2	1.54	0.61	36.1	28.7	6.1
4	86.5	86.0	0.022	0.38	23.7	8.7	6.18	43.9	30.0	35.2	21.3	13.9	1.65	0.62	37.0	28.3	7.0
5	96.6	96.0	0.028	0.49	24.9	9.9	6.19	45.5	30.0	35.6	20.1	15.5	1.77	0.64	37.8	27.9	7.8
6	104.2	103.5	0.033	0.58	25.8	10.8	6.19	46.7	30.0	35.9	19.2	16.7	1.87	0.65	38.4	27.6	8.4
7	111.1	110.3	0.039	0.68	26.6	11.6	6.20	47.8	30.0	36.2	18.4	17.8	1.97	0.65	38.9	27.3	8.9
8	117.0	116.1	0.044	0.77	27.3	12.3	6.20	48.7	30.0	36.4	17.7	18.7	2.06	0.66	39.4	27.1	9.4
9	122.3	121.3	0.050	0.87	27.9	12.9	6.21	49.5	30.0	36.6	17.1	19.5	2.14	0.66	39.8	26.9	9.8
10	126.8	125.6	0.056	0.98	28.5	13.5	6.22	50.2	30.0	36.7	16.5	20.2	2.22	0.67	40.1	26.6	10.1
11	143.7	142.0	0.083	1.45	30.5	15.5	6.25	52.7	30.0	37.2	14.5	22.7	2.57	0.68	41.4	25.9	11.4
12	153.7	151.4	0.111	1.94	31.9	16.9	6.28	54.1	30.0	37.2	13.1	24.1	2.84	0.70	42.1	25.2	12.1
13	160.2	157.7	0.139	2.43	32.9	17.9	6.31	55.0	30.0	37.1	12.1	25.0	3.07	0.72	42.5	24.6	12.5
14	165.5	162.9	0.172	3.01	33.6	18.6	6.35	55.7	30.0	37.1	11.4	25.7	3.25	0.72	42.8	24.2	12.8
15	166.4	163.6	0.228	3.99	34.7	19.7	6.41	55.5	30.0	35.8	10.3	25.5	3.48	0.77	42.8	23.1	12.8
16	167.4	164.4	0.283	4.95	35.1	20.1	6.48	55.4	30.0	35.3	9.9	25.4	3.56	0.79	42.7	22.6	12.7
17	166.1	162.9	0.339	5.93	35.6	20.6	6.55	54.9	30.0	34.3	9.4	24.9	3.65	0.83	42.4	21.8	12.4
18	164.6	161.2	0.400	7.00	35.9	20.9	6.62	54.3	30.0	33.4	9.1	24.3	3.68	0.86	42.2	21.3	12.2
19	162.1	158.5	0.456	7.98	36.1	21.1	6.69	53.7	30.0	32.6	8.9	23.7	3.66	0.89	41.8	20.7	11.8
20	161.0	157.2	0.511	8.94	36.4	21.4	6.76	53.2	30.0	31.8	8.6	23.2	3.70	0.92	41.6	20.2	11.6
21	160.4	156.3	0.572	10.01	36.5	21.5	6.84	52.9	30.0	31.4	8.5	22.9	3.69	0.94	41.4	19.9	11.4
22	158.9	154.6	0.628	10.99	36.6	21.6	6.92	52.4	30.0	30.8	8.4	22.4	3.66	0.97	41.2	19.6	11.2
23	156.7	152.2	0.683	11.95	36.8	21.8	6.99	51.8	30.0	30.0	8.2	21.8	3.65	1.00	40.9	19.1	10.9
24	154.9	150.2	0.739	12.93	36.8	21.8	7.07	51.2	30.0	29.4	8.2	21.2	3.59	1.03	40.6	18.8	10.6
25	150.5	145.6	0.800	14.00	36.8	21.8	7.16	50.3	30.0	28.5	8.2	20.3	3.48	1.07	40.2	18.4	10.2
26	146.7	141.6	0.856	14.98	37.1	22.1	7.24	49.6	30.0	27.5	7.9	19.6	3.47	1.13	39.8	17.7	9.8

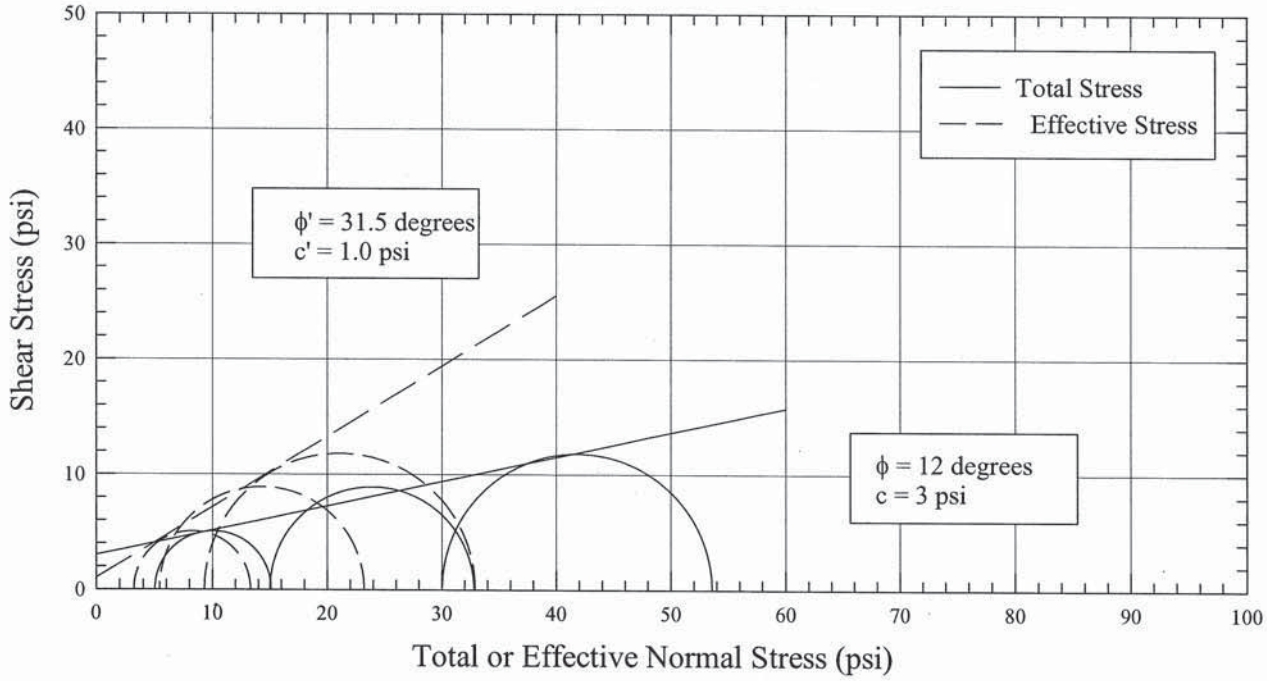
Notes: 1. Deviator load corrected for membrane and filter cage (if applicable) effects.
2. Right Cylinder Correction Method

Consolidated Undrained (CU) Triaxial Shear (ASTM D4767)

Mohr Stress Circles at Maximum Deviator Stress Criterion



Mohr Stress Circles at Maximum Principal Stress Ratio Criterion



Boring No.: *10BH-053A* Depth: *25-27 ft* SEC Contract: *10613051* Date: *9/16/10*

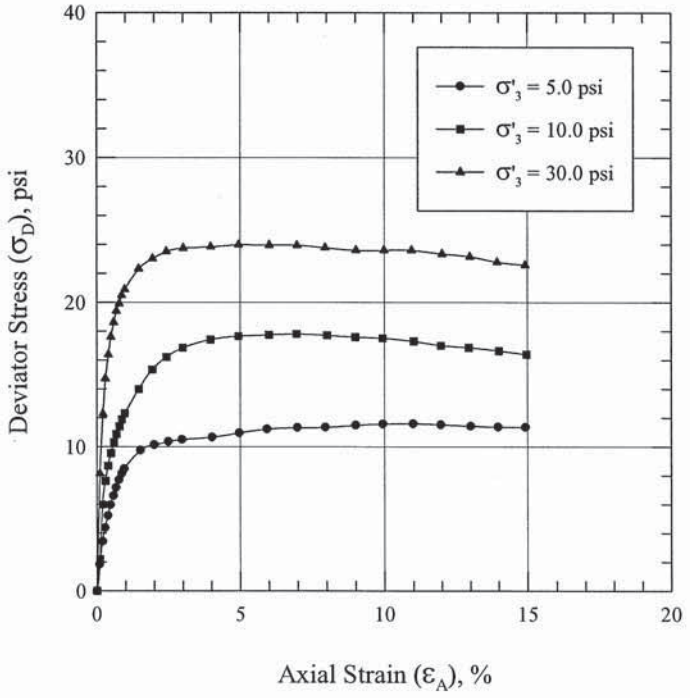
Sample Description: *SILT WITH SAND (ML), contains mica and gravel - gray* Reviewed By: *CJS*

Specimen Type: *Tube Sample* Gs: *2.66* LL: *NP* PI: *NP* %<200: *82.7*

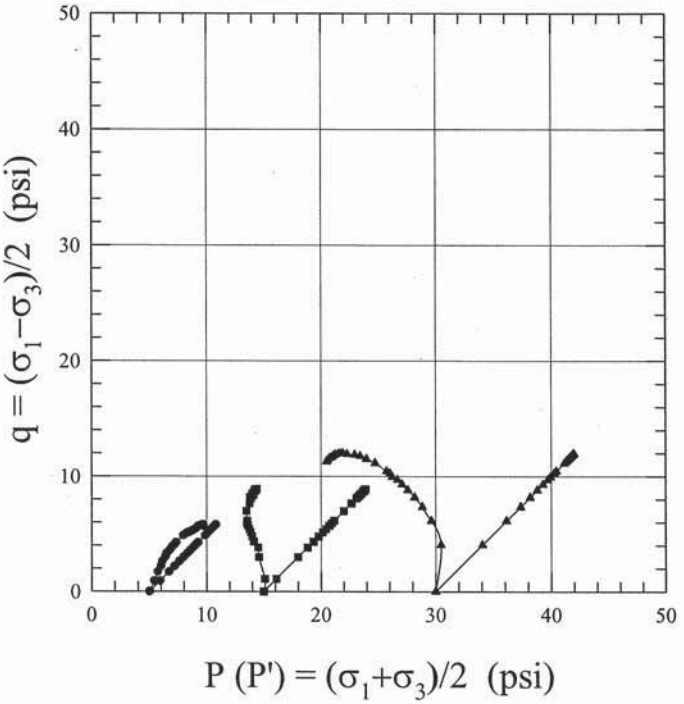
Schnabel ENGINEERING

MLK Expressway Extension
Portsmouth, VA

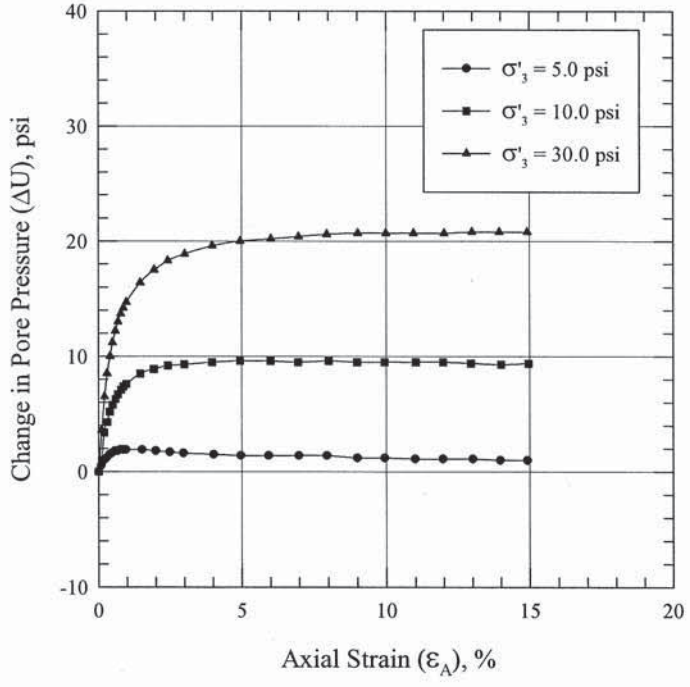
Deviator Stress vs. Axial Strain



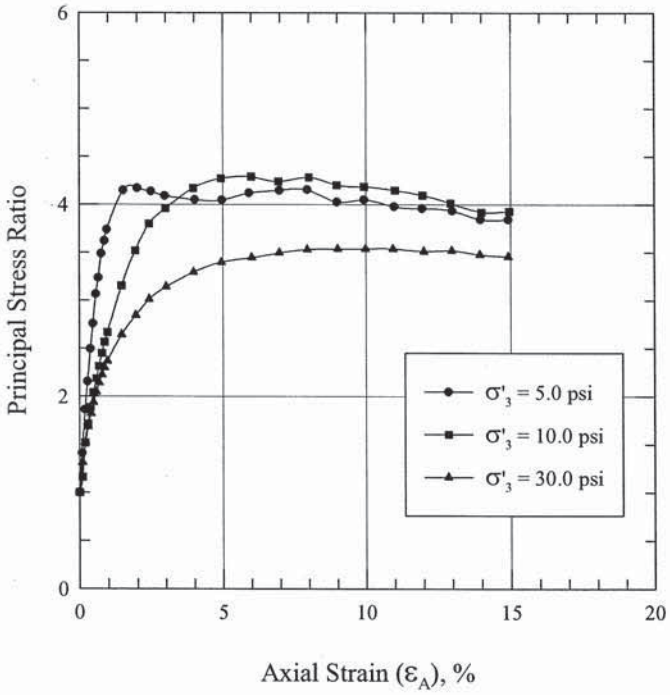
Stress Paths



Change in Pore Pressure vs. Axial Strain



Principal Stress Ratio vs. Axial Strain



Boring No.: *10BH-053A* Depth: *25-27 ft* SEC Contract: *10613051* Date: *9/16/10*

Sample Description: *SILT WITH SAND (ML), contains mica and gravel - gray* Reviewed By: *CJS*

Specimen Type: *Tube Sample* Specific Gravity: 2.66 LL: *NP* PI: *NP* %<200: *82.7*

Schnabel ENGINEERING

MLK Expressway Extension
Portsmouth, VA

Schnabel ENGINEERING

Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *MLK Expressway Extension*

Location: *Portsmouth, VA*

Schnabel Contract: *10613051*
Boring No.: *10BH-053A*
Depth: *25-27 ft.*
Elevation: *-12.4 to -14.4 ft.*
Confining Stress (psi): *5.0*

Date: *9/16/2010*

Reviewed by: *CJS*

	Specimen Conditions	
	Initial	Consolidated
Diameter (in)	2.878	2.87
Height (in)	5.812	5.80
Area (in^2)	6.51	6.47
Moisture (%)	42.9	
W_{solids} (lbs)	1.67	
ρ_{wet} (pcf)	109.3	
ρ_{dry} (pcf)	76.5	77.0
Void Ratio	1.17	1.16
Saturation, %	98	100

Shear Testing Conditions	
Cell Pressure (psi):	10.0
Back Pressure (psi):	5.0
Eff. Confining Stress (psi):	5.0
Final B check	0.96
t_{50} (min.):	2.0
Rate of Strain (%/min):	0.1023

Filter strips used? *YES*

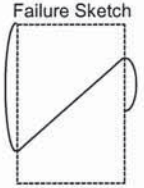
Specimen Type: *Tube Sample*

Soil Description: *SILT WITH SAND (ML), contains mica and gravel - gray*

Liquid Limit: *NP*
Plasticity Index: *NP*
% finer that No. 200: *82.7*
Specific Gravity: *2.66*

Remarks:

Failure Sketch



Reading No.	Deviator Load (lbs)	Corrected[1] Dev. Load (lbs.)	Axial Deformation (in.)	Axial Strain (%)	Pore Pressure (psi)	Change in Pore Press. (psi)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	Deviator Stress (psi)	Principal Stress Ratio	A_{bar}	P (psi)	P' (psi)	q (psi)
Zero	0.0	0.0	0.000	0.00	5.0	0.0	6.47	5.0	5.0	5.0	5.0	0.0	1.00	0.00	5.0	5.0	0.0
1	11.9	11.9	0.005	0.09	5.5	0.5	6.48	6.8	5.0	6.3	4.5	1.8	1.41	0.27	5.9	5.4	0.9
2	22.3	22.3	0.011	0.19	6.0	1.0	6.48	8.4	5.0	7.4	4.0	3.4	1.86	0.29	6.7	5.7	1.7
3	28.5	28.4	0.016	0.28	6.2	1.2	6.49	9.4	5.0	8.2	3.8	4.4	2.15	0.27	7.2	6.0	2.2
4	34.0	33.9	0.022	0.38	6.5	1.5	6.50	10.2	5.0	8.7	3.5	5.2	2.49	0.29	7.6	6.1	2.6
5	38.9	38.8	0.027	0.47	6.6	1.6	6.50	11.0	5.0	9.4	3.4	6.0	2.76	0.27	8.0	6.4	3.0
6	43.1	43.0	0.033	0.57	6.8	1.8	6.51	11.6	5.0	9.8	3.2	6.6	3.06	0.27	8.3	6.5	3.3
7	46.7	46.6	0.038	0.65	6.8	1.8	6.51	12.1	5.0	10.3	3.2	7.1	3.23	0.25	8.6	6.8	3.6
8	50.4	50.2	0.044	0.76	6.9	1.9	6.52	12.7	5.0	10.8	3.1	7.7	3.49	0.25	8.9	7.0	3.9
9	53.2	53.0	0.050	0.86	6.9	1.9	6.53	13.1	5.0	11.2	3.1	8.1	3.62	0.23	9.1	7.2	4.1
10	55.6	55.4	0.055	0.95	6.9	1.9	6.53	13.5	5.0	11.6	3.1	8.5	3.74	0.22	9.2	7.3	4.2
11	64.4	64.1	0.088	1.52	6.9	1.9	6.57	14.8	5.0	12.9	3.1	9.8	4.15	0.19	9.9	8.0	4.9
12	67.4	67.0	0.116	2.00	6.8	1.8	6.60	15.1	5.0	13.3	3.2	10.1	4.17	0.18	10.1	8.3	5.1
13	69.2	68.7	0.144	2.48	6.7	1.7	6.64	15.3	5.0	13.6	3.3	10.3	4.14	0.16	10.2	8.5	5.2
14	70.7	70.1	0.172	2.96	6.6	1.6	6.67	15.5	5.0	13.9	3.4	10.5	4.09	0.15	10.3	8.7	5.3
15	72.8	71.9	0.233	4.01	6.5	1.5	6.74	15.7	5.0	14.2	3.5	10.7	4.05	0.14	10.3	8.8	5.3
16	75.7	74.6	0.288	4.96	6.4	1.4	6.81	16.0	5.0	14.6	3.6	11.0	4.04	0.13	10.5	9.1	5.5
17	78.5	77.2	0.344	5.93	6.4	1.4	6.88	16.2	5.0	14.8	3.6	11.2	4.12	0.12	10.6	9.2	5.6
18	80.3	78.8	0.405	6.98	6.4	1.4	6.96	16.3	5.0	14.9	3.6	11.3	4.15	0.12	10.7	9.3	5.7
19	81.5	79.8	0.461	7.94	6.4	1.4	7.03	16.3	5.0	14.9	3.6	11.3	4.15	0.12	10.7	9.3	5.7
20	83.7	81.8	0.522	8.99	6.2	1.2	7.11	16.5	5.0	15.3	3.8	11.5	4.03	0.10	10.7	9.5	5.7
21	85.4	83.2	0.577	9.94	6.2	1.2	7.19	16.6	5.0	15.4	3.8	11.6	4.05	0.10	10.8	9.6	5.8
22	86.8	84.4	0.638	10.99	6.1	1.1	7.27	16.6	5.0	15.5	3.9	11.6	3.98	0.09	10.8	9.7	5.8
23	87.4	84.8	0.694	11.96	6.1	1.1	7.35	16.5	5.0	15.4	3.9	11.5	3.96	0.10	10.8	9.7	5.8
24	87.9	85.1	0.755	13.01	6.1	1.1	7.44	16.4	5.0	15.3	3.9	11.4	3.93	0.10	10.7	9.6	5.7
25	88.6	85.6	0.811	13.97	6.0	1.0	7.52	16.4	5.0	15.4	4.0	11.4	3.84	0.09	10.7	9.7	5.7
26	89.7	86.5	0.866	14.92	6.0	1.0	7.61	16.4	5.0	15.4	4.0	11.4	3.84	0.09	10.7	9.7	5.7

Notes: 1. Deviator load corrected for membrane and filter cage (if applicable) effects.
2. Right Cylinder Correction Method

Schnabel ENGINEERING

Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *MLK Expressway Extension*

Location: *Portsmouth, VA*

Schnabel Contract: *10613051*
Boring No.: *10BH-053A*
Depth: *25-27 ft.*
Elevation: *-12.4 to -14.4 ft.*
Confining Stress (psi): *15.0*

Date: *9/16/2010*

Reviewed by: *CJS*

	Specimen Conditions	
	Initial	Consolidated
Diameter (in)	2.871	2.83
Height (in)	5.814	5.76
Area (in^2)	6.48	6.31
Moisture (%)	45.6	
W_{solids} (lbs)	1.66	
ρ_{wet} (pcf)	111.1	
ρ_{dry} (pcf)	76.3	79.1
Void Ratio	1.17	1.10
Saturation, %	100	96

Shear Testing Conditions	
Cell Pressure (psi):	20.0
Back Pressure (psi):	5.0
Eff. Confining Stress (psi):	15.0
Final B check	1.00
t_{50} (min.):	4.9
Rate of Strain (%/min):	0.081

Filter strips used? *YES*

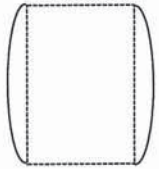
Specimen Type: *Tube Sample*

Soil Description: *SILT WITH SAND (ML), contains mica - gray*

Liquid Limit: *NP*
Plasticity Index: *NP*
% finer that No. 200: *82.7*
Specific Gravity: *2.66*

Remarks:

Failure Sketch



Reading No.	Deviator Load (lbs)	Corrected[1] Dev. Load (lbs.)	Axial Deformation (in.)	Axial Strain (%)	Pore Pressure (psi)	Change in Pore Press. (psi)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	Deviator Stress (psi)	Principal Stress Ratio	A_{bar}	P (psi)	P' (psi)	q (psi)
Zero	0.0	0.0	0.000	0.00	5.0	0.0	6.31	15.0	15.0	15.0	15.0	0.0	1.00	0.00	15.0	15.0	0.0
1	14.0	14.0	0.006	0.10	6.0	1.0	6.32	17.2	15.0	16.2	14.0	2.2	1.16	0.45	16.1	15.1	1.1
2	37.9	37.9	0.011	0.19	8.4	3.4	6.32	21.0	15.0	17.6	11.6	6.0	1.52	0.57	18.0	14.6	3.0
3	48.4	48.3	0.017	0.30	9.3	4.3	6.33	22.6	15.0	18.3	10.7	7.6	1.71	0.56	18.8	14.5	3.8
4	55.1	55.0	0.022	0.38	10.2	5.2	6.33	23.7	15.0	18.5	9.8	8.7	1.89	0.60	19.3	14.1	4.3
5	60.8	60.7	0.028	0.49	10.8	5.8	6.34	24.6	15.0	18.8	9.2	9.6	2.04	0.61	19.8	14.0	4.8
6	65.6	65.5	0.034	0.59	11.3	6.3	6.35	25.3	15.0	19.0	8.7	10.3	2.19	0.61	20.2	13.9	5.2
7	69.3	69.2	0.039	0.68	11.7	6.7	6.35	25.9	15.0	19.2	8.3	10.9	2.31	0.62	20.4	13.7	5.4
8	72.9	72.7	0.045	0.78	12.1	7.1	6.36	26.4	15.0	19.3	7.9	11.4	2.45	0.62	20.7	13.6	5.7
9	75.9	75.7	0.050	0.87	12.4	7.4	6.37	26.9	15.0	19.5	7.6	11.9	2.56	0.62	20.9	13.5	5.9
10	78.7	78.5	0.056	0.97	12.6	7.6	6.37	27.3	15.0	19.7	7.4	12.3	2.66	0.62	21.2	13.6	6.2
11	89.9	89.6	0.084	1.46	13.5	8.5	6.40	29.0	15.0	20.5	6.5	14.0	3.15	0.61	22.0	13.5	7.0
12	99.2	98.8	0.111	1.93	13.9	8.9	6.43	30.4	15.0	21.5	6.1	15.4	3.52	0.58	22.7	13.8	7.7
13	105.4	104.9	0.139	2.42	14.2	9.2	6.47	31.2	15.0	22.0	5.8	16.2	3.80	0.57	23.1	13.9	8.1
14	110.3	109.7	0.172	2.99	14.3	9.3	6.51	31.9	15.0	22.6	5.7	16.9	3.96	0.55	23.4	14.1	8.4
15	115.4	114.6	0.228	3.96	14.5	9.5	6.57	32.4	15.0	22.9	5.5	17.4	4.17	0.54	23.7	14.2	8.7
16	118.3	117.2	0.284	4.93	14.6	9.6	6.64	32.7	15.0	23.1	5.4	17.7	4.27	0.54	23.8	14.2	8.8
17	120.5	119.2	0.345	5.99	14.6	9.6	6.71	32.8	15.0	23.2	5.4	17.8	4.29	0.54	23.9	14.3	8.9
18	122.3	120.8	0.400	6.95	14.5	9.5	6.78	32.8	15.0	23.3	5.5	17.8	4.24	0.53	23.9	14.4	8.9
19	123.3	121.6	0.461	8.01	14.6	9.6	6.86	32.7	15.0	23.1	5.4	17.7	4.28	0.54	23.9	14.3	8.9
20	124.0	122.1	0.517	8.98	14.5	9.5	6.93	32.6	15.0	23.1	5.5	17.6	4.20	0.54	23.8	14.3	8.8
21	124.9	122.8	0.572	9.94	14.5	9.5	7.01	32.5	15.0	23.0	5.5	17.5	4.19	0.54	23.8	14.3	8.8
22	125.1	122.7	0.634	11.02	14.5	9.5	7.09	32.3	15.0	22.8	5.5	17.3	4.15	0.55	23.7	14.2	8.7
23	124.6	122.0	0.689	11.97	14.5	9.5	7.17	32.0	15.0	22.5	5.5	17.0	4.10	0.56	23.5	14.0	8.5
24	125.1	122.3	0.745	12.94	14.4	9.4	7.25	31.9	15.0	22.5	5.6	16.9	4.01	0.56	23.4	14.0	8.4
25	125.2	122.2	0.806	14.00	14.3	9.3	7.34	31.7	15.0	22.4	5.7	16.7	3.92	0.56	23.3	14.0	8.3
26	124.9	121.7	0.861	14.96	14.4	9.4	7.42	31.4	15.0	22.0	5.6	16.4	3.93	0.57	23.2	13.8	8.2

Notes: 1. Deviator load corrected for membrane and filter cage (if applicable) effects.
2. Right Cylinder Correction Method

Schnabel ENGINEERING

Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *MLK Expressway Extension*

Location: *Portsmouth, VA*

Schnabel Contract: *10613051*
Boring No.: *10BH-053A*
Depth: *25-27 ft.*
Elevation: *-12.4 to -14.4 ft.*
Confining Stress (psi): *30.0*

Date: *9/16/2010*

Reviewed by: *CJS*

	Specimen Conditions	
	Initial	Consolidated
Diameter (in)	2.876	2.84
Height (in)	5.804	5.73
Area (in^2)	6.50	6.33
Moisture (%)	40.9	
W_{solids} (lbs)	1.71	
ρ_{wet} (pcf)	110.3	
ρ_{dry} (pcf)	78.3	81.3
Void Ratio	1.12	1.04
Saturation, %	97	99

Shear Testing Conditions	
Cell Pressure (psi):	40.0
Back Pressure (psi):	10.0
Eff. Confining Stress (psi):	30.0
Final B check	0.98
t_{50} (min.):	2.1
Rate of Strain (%/min):	0.125

Filter strips used? *YES*

Specimen Type: *Tube Sample*

Soil Description: *SILT WITH SAND (ML), contains mica and gravel - gray*

Liquid Limit: *NP*
Plasticity Index: *NP*
% finer that No. 200: *82.7*
Specific Gravity: *2.66*

Remarks:

Failure Sketch

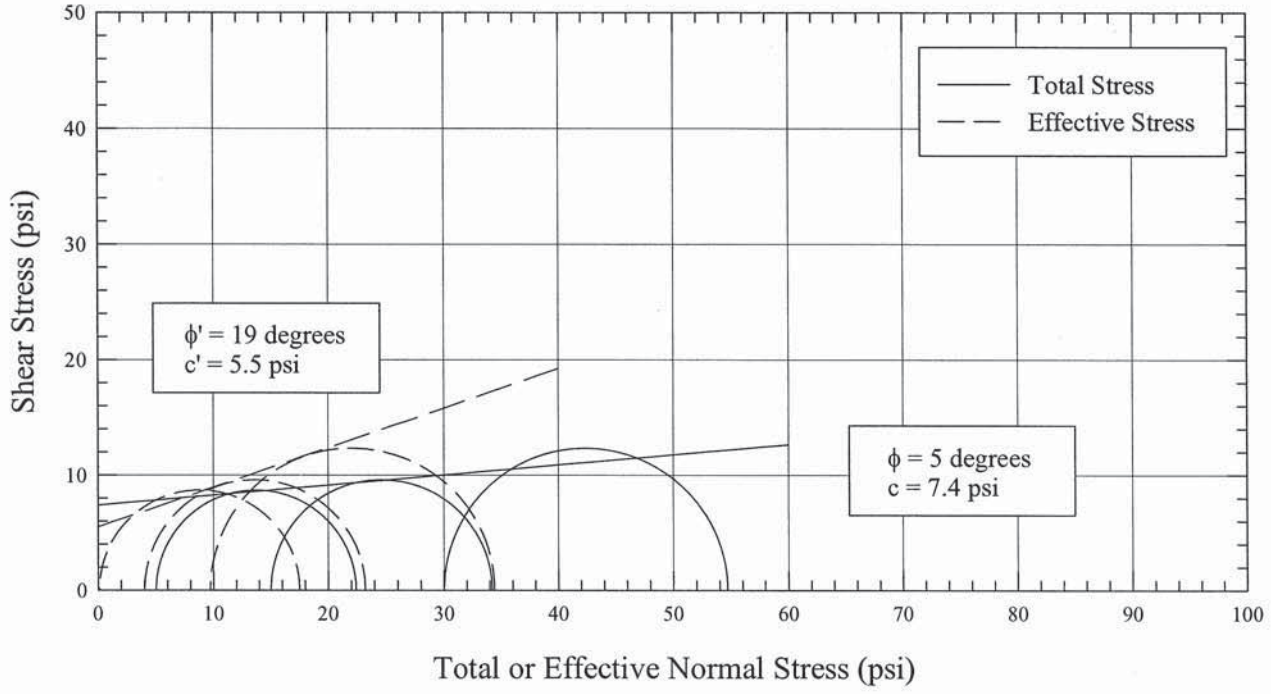


Reading No.	Deviator Load (lbs)	Corrected[1] Dev. Load (lbs.)	Axial Deformation (in.)	Axial Strain (%)	Pore Pressure (psi)	Change in Pore Press. (psi)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	Deviator Stress (psi)	Principal Stress Ratio	A_{bar}	P (psi)	P' (psi)	q (psi)
Zero	0.0	0.0	0.000	0.00	10.0	0.0	6.33	30.0	30.0	30.0	30.0	0.0	1.00	0.00	30.0	30.0	0.0
1	51.6	51.6	0.006	0.10	13.6	3.6	6.34	38.1	30.0	34.5	26.4	8.1	1.31	0.44	34.1	30.5	4.1
2	78.0	78.0	0.012	0.21	16.5	6.5	6.34	42.3	30.0	35.8	23.5	12.3	1.52	0.53	36.1	29.6	6.1
3	93.5	93.4	0.017	0.30	18.5	8.5	6.35	44.7	30.0	36.2	21.5	14.7	1.68	0.58	37.4	28.9	7.4
4	104.3	104.2	0.023	0.40	20.0	10.0	6.35	46.4	30.0	36.4	20.0	16.4	1.82	0.61	38.2	28.2	8.2
5	112.1	112.0	0.028	0.49	21.2	11.2	6.36	47.6	30.0	36.4	18.8	17.6	1.94	0.64	38.8	27.6	8.8
6	118.6	118.5	0.034	0.59	22.2	12.2	6.37	48.6	30.0	36.4	17.8	18.6	2.05	0.66	39.3	27.1	9.3
7	123.8	123.7	0.039	0.68	23.0	13.0	6.37	49.4	30.0	36.4	17.0	19.4	2.14	0.67	39.7	26.7	9.7
8	127.3	127.1	0.045	0.78	23.7	13.7	6.38	49.9	30.0	36.2	16.3	19.9	2.22	0.69	40.0	26.3	10.0
9	131.1	130.9	0.050	0.87	24.2	14.2	6.38	50.5	30.0	36.3	15.8	20.5	2.30	0.69	40.3	26.1	10.3
10	133.8	133.6	0.056	0.98	24.7	14.7	6.39	50.9	30.0	36.2	15.3	20.9	2.37	0.70	40.5	25.8	10.5
11	143.6	143.3	0.084	1.46	26.4	16.4	6.42	52.3	30.0	35.9	13.6	22.3	2.64	0.74	41.2	24.8	11.2
12	149.1	148.7	0.112	1.95	27.5	17.5	6.46	53.0	30.0	35.5	12.5	23.0	2.84	0.76	41.5	24.0	11.5
13	153.1	152.6	0.139	2.42	28.3	18.3	6.49	53.5	30.0	35.2	11.7	23.5	3.01	0.78	41.8	23.5	11.8
14	155.7	155.1	0.173	3.02	28.9	18.9	6.53	53.8	30.0	34.9	11.1	23.8	3.14	0.80	41.9	23.0	11.9
15	158.0	157.1	0.228	3.98	29.6	19.6	6.59	53.8	30.0	34.2	10.4	23.8	3.29	0.82	41.9	22.3	11.9
16	160.7	159.6	0.284	4.95	30.0	20.0	6.66	54.0	30.0	34.0	10.0	24.0	3.40	0.83	42.0	22.0	12.0
17	162.6	161.3	0.345	6.02	30.2	20.2	6.73	54.0	30.0	33.8	9.8	24.0	3.44	0.84	42.0	21.8	12.0
18	164.4	162.9	0.400	6.97	30.4	20.4	6.80	53.9	30.0	33.5	9.6	23.9	3.49	0.85	42.0	21.6	12.0
19	165.2	163.5	0.456	7.95	30.6	20.6	6.88	53.8	30.0	33.2	9.4	23.8	3.53	0.87	41.9	21.3	11.9
20	166.1	164.2	0.517	9.01	30.7	20.7	6.96	53.6	30.0	32.9	9.3	23.6	3.54	0.88	41.8	21.1	11.8
21	168.1	166.0	0.573	9.99	30.7	20.7	7.03	53.6	30.0	32.9	9.3	23.6	3.54	0.88	41.8	21.1	11.8
22	170.1	167.8	0.628	10.95	30.7	20.7	7.11	53.6	30.0	32.9	9.3	23.6	3.54	0.88	41.8	21.1	11.8
23	170.6	168.0	0.689	12.01	30.7	20.7	7.19	53.4	30.0	32.7	9.3	23.4	3.51	0.89	41.7	21.0	11.7
24	171.3	168.5	0.745	12.99	30.8	20.8	7.27	53.2	30.0	32.4	9.2	23.2	3.52	0.90	41.6	20.8	11.6
25	170.6	167.6	0.800	13.95	30.8	20.8	7.36	52.8	30.0	32.0	9.2	22.8	3.48	0.91	41.4	20.6	11.4
26	171.3	168.1	0.856	14.93	30.8	20.8	7.44	52.6	30.0	31.8	9.2	22.6	3.46	0.92	41.3	20.5	11.3

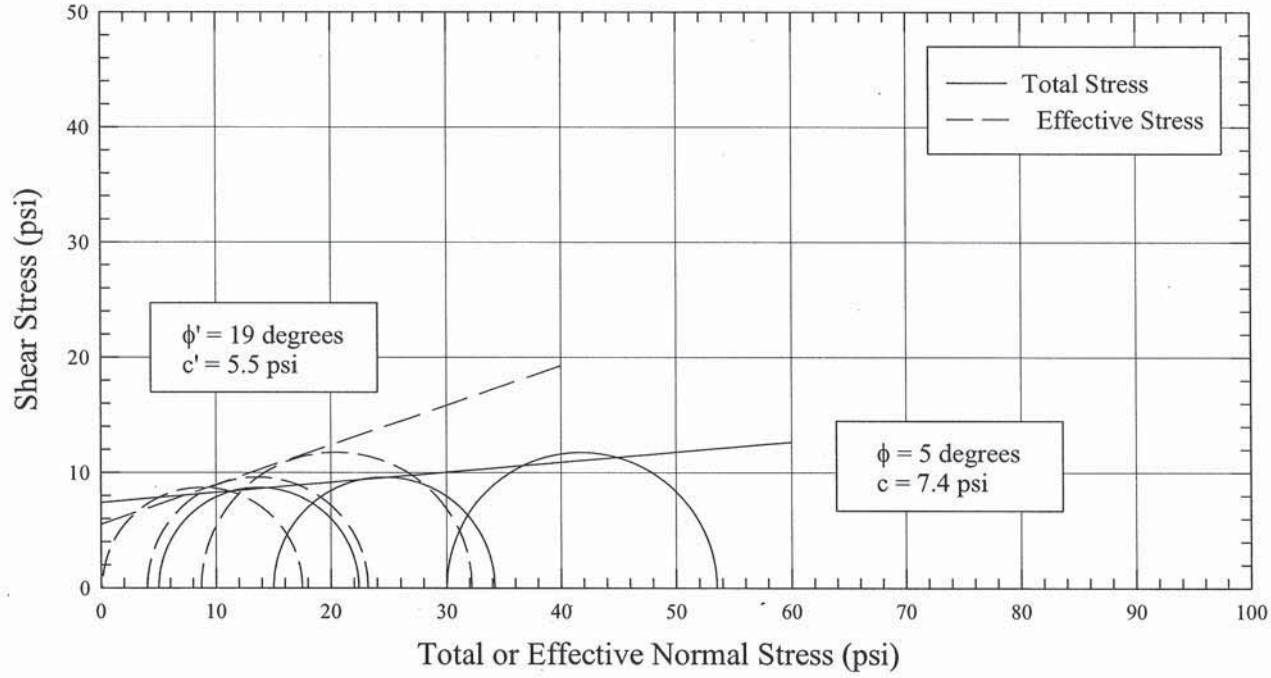
Notes: 1. Deviator load corrected for membrane and filter cage (if applicable) effects.
2. Right Cylinder Correction Method

Consolidated Undrained (CU) Triaxial Shear (ASTM D4767)

Mohr Stress Circles at Maximum Deviator Stress Criterion



Mohr Stress Circles at Maximum Principal Stress Ratio Criterion

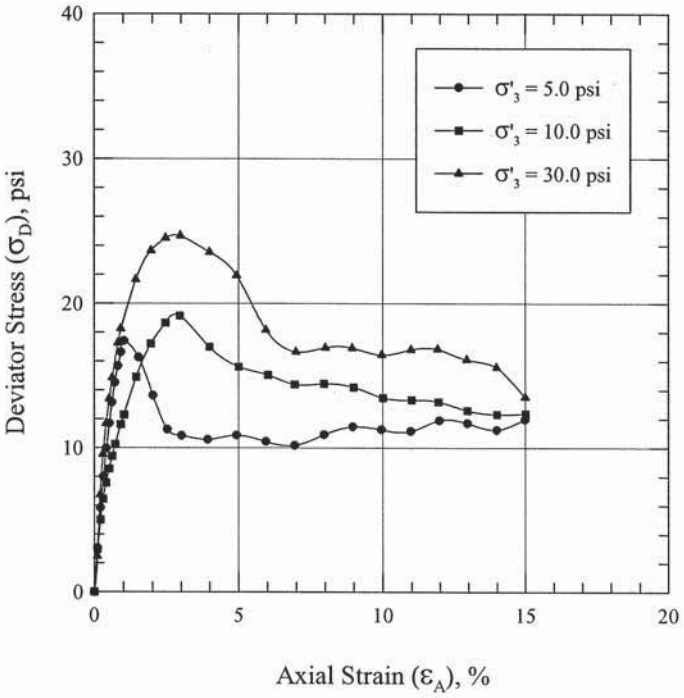


Boring No.: *10BH-059A* Depth: *22-24 ft* SEC Contract: *10613051* Date: *9/16/10*
Sample Description: *FAT CLAY (CH) - gray* Reviewed By: *CJS*
Specimen Type: *Tube Sample* Gs: *2.68* LL: *53* PI: *26* %<200: *92.6*

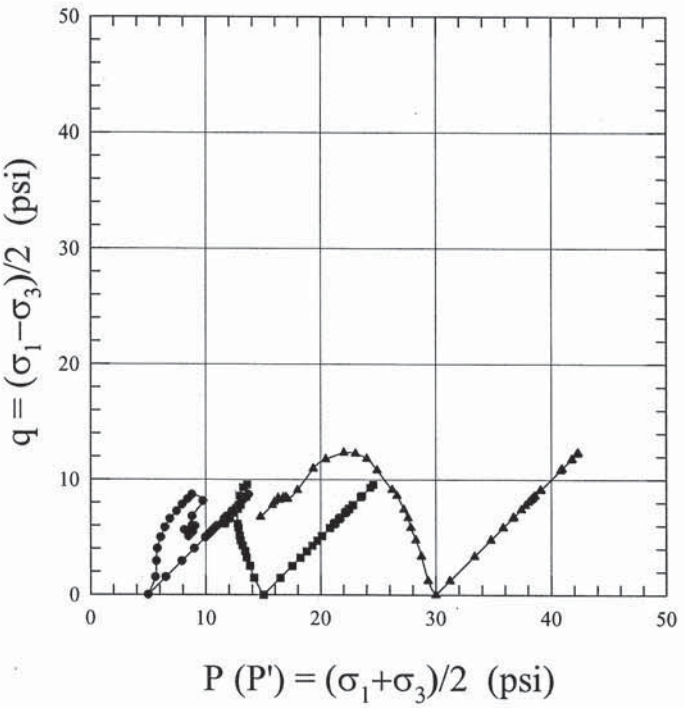
Schnabel ENGINEERING

MLK Expressway Extension
Portsmouth, VA

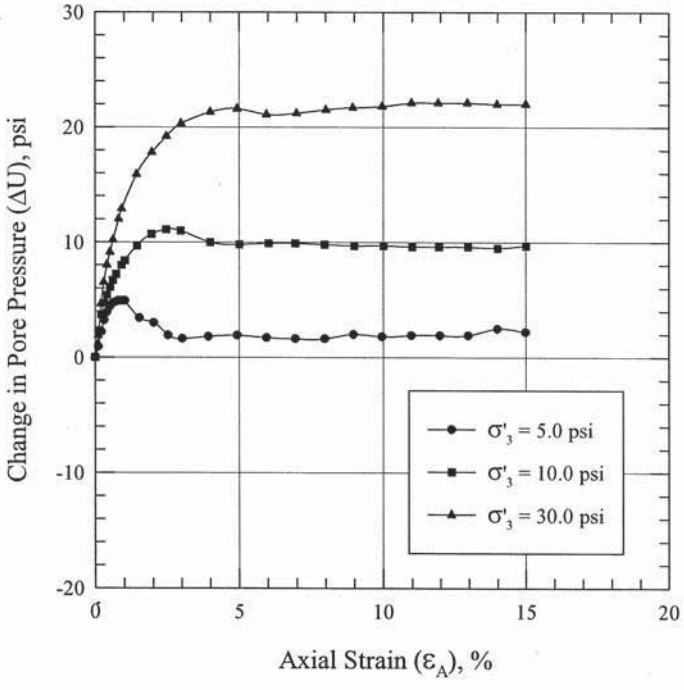
Deviator Stress vs. Axial Strain



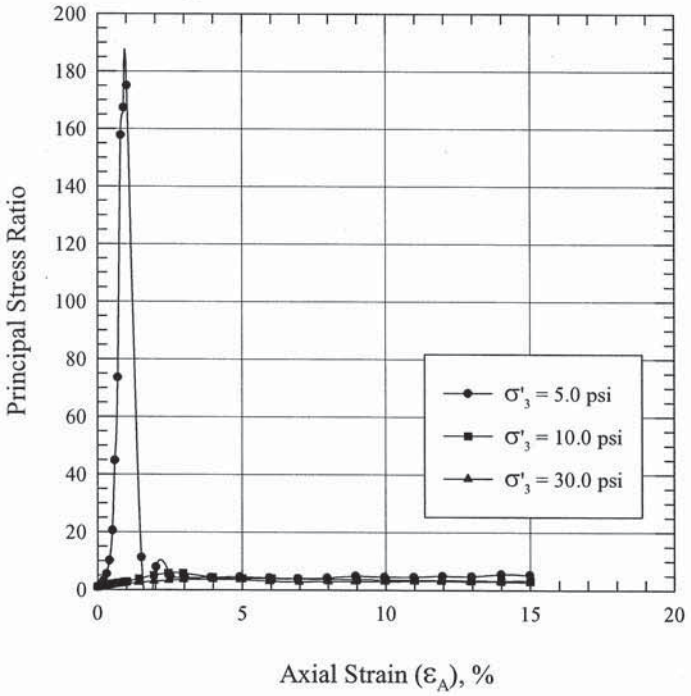
Stress Paths



Change in Pore Pressure vs. Axial Strain



Principal Stress Ratio vs. Axial Strain



Boring No.: *10BH-059A* Depth: *22-24 ft* SEC Contract: *10613051* Date: *9/16/10*

Sample Description: *FAT CLAY (CH) - gray* Reviewed By: *CJS*

Specimen Type: *Tube Sample* Specific Gravity: 2.68 LL: *53* PI: *26* %<200: *92.6*

Schnabel ENGINEERING

MLK Expressway Extension
Portsmouth, VA

Schnabel ENGINEERING

Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *MLK Expressway Extention*

Location: *Portsmouth, VA*

Schnabel Contract: *10613051*
Boring No.: *10BH-059A*
Depth: *22-24 ft.*
Elevation: *-10.2 to -12.2 ft.*
Confining Stress (psi): *5.0*

Date: *9/16/2010*

Reviewed by: *CJS*

	Specimen Conditions	
	Initial	Consolidated
Diameter (in)	2.879	2.87
Height (in)	5.819	5.81
Area (in^2)	6.51	6.49
Moisture (%)	74.7	
W_{solids} (lbs)	1.22	
ρ_{wet} (pcf)	97.1	
ρ_{dry} (pcf)	55.6	55.9
Void Ratio	2.01	1.99
Saturation, %	100	99

Shear Testing Conditions	
Cell Pressure (psi):	15.0
Back Pressure (psi):	10.0
Eff. Confining Stress (psi):	5.0
Final B check	1.00
t_{50} (min.):	4.0
Rate of Strain (%/min):	0.03025

Filter strips used? *YES*

Specimen Type: *Tube Sample*

Soil Description: *FAT CLAY (CH) - gray*

Liquid Limit: *53*
Plasticity Index: *26*
% finer that No. 200: *92.6*
Specific Gravity: *2.68*

Remarks:

Failure Sketch



Reading No.	Deviator Load (lbs)	Corrected[1] Dev. Load (lbs.)	Axial Deformation (in.)	Axial Strain (%)	Pore Pressure (psi)	Change in Pore Press. (psi)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	Deviator Stress (psi)	Principal Stress Ratio	A_{bar}	P (psi)	P' (psi)	q (psi)
Zero	0.0	0.0	0.000	0.00	10.0	0.0	6.49	5.0	5.0	5.0	5.0	0.0	1.00	0.00	5.0	5.0	0.0
1	19.9	19.8	0.006	0.10	10.9	0.9	6.50	8.0	5.0	7.1	4.1	3.0	1.74	0.30	6.5	5.6	1.5
2	38.1	37.9	0.012	0.21	12.2	2.2	6.50	10.8	5.0	8.6	2.8	5.8	3.08	0.38	7.9	5.7	2.9
3	52.4	52.0	0.018	0.31	13.2	3.2	6.51	13.0	5.0	9.8	1.8	8.0	5.44	0.40	9.0	5.8	4.0
4	65.4	64.9	0.024	0.41	13.9	3.9	6.52	15.0	5.0	11.1	1.1	10.0	10.05	0.39	10.0	6.1	5.0
5	76.9	76.3	0.030	0.52	14.4	4.4	6.52	16.7	5.0	12.3	0.6	11.7	20.49	0.38	10.8	6.4	5.8
6	86.5	85.8	0.035	0.60	14.7	4.7	6.53	18.1	5.0	13.4	0.3	13.1	44.78	0.36	11.6	6.9	6.6
7	95.7	94.9	0.041	0.71	14.8	4.8	6.54	19.5	5.0	14.7	0.2	14.5	73.55	0.33	12.3	7.5	7.3
8	103.5	102.5	0.047	0.81	14.9	4.9	6.54	20.7	5.0	15.8	0.1	15.7	157.68	0.31	12.8	7.9	7.8
9	110.0	108.9	0.053	0.91	14.9	4.9	6.55	21.6	5.0	16.7	0.1	16.6	167.25	0.29	13.3	8.4	8.3
10	115.3	114.1	0.059	1.02	14.9	4.9	6.56	22.4	5.0	17.5	0.1	17.4	174.97	0.28	13.7	8.8	8.7
11	109.1	107.3	0.088	1.52	13.4	3.4	6.59	21.3	5.0	17.9	1.6	16.3	11.17	0.21	13.1	9.7	8.1
12	92.6	90.2	0.117	2.01	13.0	3.0	6.62	18.6	5.0	15.6	2.0	13.6	7.81	0.22	11.8	8.8	6.8
13	77.5	75.0	0.146	2.51	11.9	1.9	6.66	16.3	5.0	14.4	3.1	11.3	4.63	0.17	10.6	8.7	5.6
14	75.2	72.6	0.175	3.01	11.6	1.6	6.69	15.8	5.0	14.2	3.4	10.8	4.19	0.15	10.4	8.8	5.4
15	74.2	71.4	0.228	3.93	11.8	1.8	6.76	15.6	5.0	13.8	3.2	10.6	4.30	0.17	10.3	8.5	5.3
16	77.2	74.2	0.286	4.92	11.9	1.9	6.83	15.9	5.0	14.0	3.1	10.9	4.50	0.17	10.4	8.5	5.4
17	75.2	72.0	0.345	5.94	11.7	1.7	6.90	15.4	5.0	13.7	3.3	10.4	4.16	0.16	10.2	8.5	5.2
18	74.4	70.9	0.403	6.94	11.6	1.6	6.98	15.2	5.0	13.6	3.4	10.2	3.99	0.16	10.1	8.5	5.1
19	80.6	76.9	0.462	7.96	11.6	1.6	7.05	15.9	5.0	14.3	3.4	10.9	4.21	0.15	10.5	8.9	5.5
20	85.6	81.7	0.520	8.95	12.0	2.0	7.13	16.5	5.0	14.5	3.0	11.5	4.82	0.17	10.7	8.7	5.7
21	85.3	81.2	0.578	9.95	11.8	1.8	7.21	16.3	5.0	14.5	3.2	11.3	4.52	0.16	10.6	8.8	5.6
22	85.6	81.3	0.637	10.97	11.9	1.9	7.29	16.1	5.0	14.2	3.1	11.1	4.60	0.17	10.6	8.7	5.6
23	92.3	87.8	0.695	11.97	11.9	1.9	7.37	16.9	5.0	15.0	3.1	11.9	4.84	0.16	11.0	9.1	6.0
24	92.1	87.3	0.753	12.97	11.9	1.9	7.46	16.7	5.0	14.8	3.1	11.7	4.78	0.16	10.9	9.0	5.9
25	89.9	84.9	0.812	13.98	12.5	2.5	7.55	16.3	5.0	13.8	2.5	11.3	5.50	0.22	10.6	8.1	5.6
26	96.6	91.4	0.870	14.98	12.2	2.2	7.63	17.0	5.0	14.8	2.8	12.0	5.28	0.18	11.0	8.8	6.0

Notes: 1. Deviator load corrected for membrane and filter cage (if applicable) effects.
2. Right Cylinder Correction Method

Schnabel ENGINEERING

Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *MLK Expressway Extention*

Location: *Portsmouth, VA*

Schnabel Contract: *10613051*
Boring No.: *10BH-059A*
Depth: *22-24 ft.*
Elevation: *-10.2 to -12.2 ft.*
Confining Stress (psi): *15.0*

Date: *9/16/2010*

Reviewed by: *CJS*

	Specimen Conditions	
	Initial	Consolidated
Diameter (in)	2.885	2.87
Height (in)	5.810	5.72
Area (in^2)	6.54	6.47
Moisture (%)	86.1	
W_{solids} (lbs)	1.17	
ρ_{wet} (pcf)	99.3	
ρ_{dry} (pcf)	53.3	54.8
Void Ratio	2.13	2.05
Saturation, %	100	87

Shear Testing Conditions	
Cell Pressure (psi):	40.0
Back Pressure (psi):	25.0
Eff. Confining Stress (psi):	15.0
Final B check	0.96
t_{50} (min.):	13.2
Rate of Strain (%/min):	0.03025

Filter strips used? *YES*

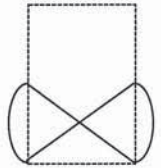
Specimen Type: *Tube Sample*

Soil Description: *FAT CLAY (CH) - gray*

Liquid Limit: *53*
Plasticity Index: *26*
% finer that No. 200: *92.6*
Specific Gravity: *2.68*

Remarks:

Failure Sketch



Reading No.	Deviator Load (lbs)	Corrected[1] Dev. Load (lbs.)	Axial Deformation (in.)	Axial Strain (%)	Pore Pressure (psi)	Change in Pore Press. (psi)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	Deviator Stress (psi)	Principal Stress Ratio	A_{bar}	P (psi)	P' (psi)	q (psi)
Zero	0.0	0.0	0.000	0.00	25.0	0.0	6.47	15.0	15.0	15.0	15.0	0.0	1.00	0.00	15.0	15.0	0.0
1	19.3	19.2	0.006	0.10	27.3	2.3	6.48	18.0	15.0	15.7	12.7	3.0	1.23	0.78	16.5	14.2	1.5
2	32.7	32.4	0.012	0.21	28.7	3.7	6.48	20.0	15.0	16.3	11.3	5.0	1.44	0.74	17.5	13.8	2.5
3	42.2	41.8	0.017	0.30	29.7	4.7	6.49	21.4	15.0	16.7	10.3	6.4	1.63	0.73	18.2	13.5	3.2
4	49.7	49.2	0.023	0.40	30.4	5.4	6.50	22.6	15.0	17.2	9.6	7.6	1.79	0.71	18.8	13.4	3.8
5	56.2	55.6	0.029	0.51	31.1	6.1	6.50	23.5	15.0	17.4	8.9	8.5	1.96	0.71	19.3	13.2	4.3
6	62.1	61.4	0.035	0.61	31.7	6.7	6.51	24.4	15.0	17.7	8.3	9.4	2.14	0.71	19.7	13.0	4.7
7	67.6	66.7	0.041	0.72	32.2	7.2	6.52	25.2	15.0	18.0	7.8	10.2	2.31	0.70	20.1	12.9	5.1
8	72.4	71.4	0.047	0.82	32.7	7.7	6.52	25.9	15.0	18.2	7.3	10.9	2.50	0.70	20.5	12.8	5.5
9	77.0	75.9	0.052	0.91	33.0	8.0	6.53	26.6	15.0	18.6	7.0	11.6	2.66	0.69	20.8	12.8	5.8
10	81.6	80.4	0.058	1.01	33.4	8.4	6.54	27.3	15.0	18.9	6.6	12.3	2.86	0.68	21.1	12.7	6.1
11	99.6	97.9	0.082	1.43	34.7	9.7	6.56	29.9	15.0	20.2	5.3	14.9	3.81	0.65	22.5	12.8	7.5
12	115.9	113.6	0.111	1.94	35.7	10.7	6.60	32.2	15.0	21.5	4.3	17.2	5.00	0.62	23.6	12.9	8.6
13	126.2	123.7	0.140	2.45	36.1	11.1	6.63	33.7	15.0	22.6	3.9	18.7	5.78	0.60	24.3	13.2	9.3
14	130.3	127.7	0.169	2.96	36.0	11.0	6.67	34.2	15.0	23.2	4.0	19.2	5.79	0.57	24.6	13.6	9.6
15	117.3	114.5	0.228	3.99	35.0	10.0	6.74	32.0	15.0	22.0	5.0	17.0	4.40	0.59	23.5	13.5	8.5
16	109.4	106.4	0.286	5.00	34.8	9.8	6.81	30.6	15.0	20.8	5.2	15.6	4.00	0.63	22.8	13.0	7.8
17	106.8	103.5	0.344	6.02	34.9	9.9	6.88	30.0	15.0	20.1	5.1	15.0	3.95	0.66	22.5	12.6	7.5
18	103.5	100.0	0.397	6.94	34.9	9.9	6.95	29.4	15.0	19.5	5.1	14.4	3.82	0.69	22.2	12.3	7.2
19	105.2	101.5	0.455	7.96	34.8	9.8	7.03	29.4	15.0	19.6	5.2	14.4	3.78	0.68	22.2	12.4	7.2
20	104.9	101.0	0.514	8.99	34.7	9.7	7.11	29.2	15.0	19.5	5.3	14.2	3.68	0.68	22.1	12.4	7.1
21	101.0	96.9	0.572	10.00	34.7	9.7	7.19	28.5	15.0	18.8	5.3	13.5	3.54	0.72	21.7	12.0	6.7
22	101.2	96.9	0.629	11.00	34.6	9.6	7.27	28.3	15.0	18.7	5.4	13.3	3.47	0.72	21.7	12.1	6.7
23	101.5	97.0	0.683	11.95	34.6	9.6	7.35	28.2	15.0	18.6	5.4	13.2	3.44	0.73	21.6	12.0	6.6
24	98.4	93.6	0.741	12.96	34.6	9.6	7.43	27.6	15.0	18.0	5.4	12.6	3.33	0.76	21.3	11.7	6.3
25	97.7	92.7	0.800	13.99	34.5	9.5	7.52	27.3	15.0	17.8	5.5	12.3	3.24	0.77	21.2	11.7	6.2
26	99.3	94.1	0.858	15.01	34.7	9.7	7.61	27.4	15.0	17.7	5.3	12.4	3.33	0.78	21.2	11.5	6.2

Notes: 1. Deviator load corrected for membrane and filter cage (if applicable) effects.
2. Right Cylinder Correction Method

Schnabel ENGINEERING

Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *MLK Expressway Extention*

Location: *Portsmouth, VA*

Schnabel Contract: *10613051*
Boring No.: *10BH-059A*
Depth: *22-24 ft.*
Elevation: *-10.2 to -12.2 ft.*
Confining Stress (psi): *30.0*

Date: *9/16/2010*

Reviewed by: *CJS*

	Specimen Conditions	
	Initial	Consolidated
Diameter (in)	2.879	2.83
Height (in)	5.793	5.68
Area (in^2)	6.51	6.28
Moisture (%)	70.1	
W_{solids} (lbs)	1.25	
ρ_{wet} (pcf)	97.5	
ρ_{dry} (pcf)	57.3	60.6
Void Ratio	1.92	1.76
Saturation, %	98	100

Shear Testing Conditions	
Cell Pressure (psi):	45.0
Back Pressure (psi):	15.0
Eff. Confining Stress (psi):	30.0
Final B check	0.98
t_{50} (min.):	13.2
Rate of Strain (%/min):	0.03025

Filter strips used? *YES*

Specimen Type: *Tube Sample*

Soil Description: *FAT CLAY(CH) - gray*

Liquid Limit: *53*
Plasticity Index: *26*
% finer that No. 200: *92.6*
Specific Gravity: *2.68*

Remarks:

Failure Sketch

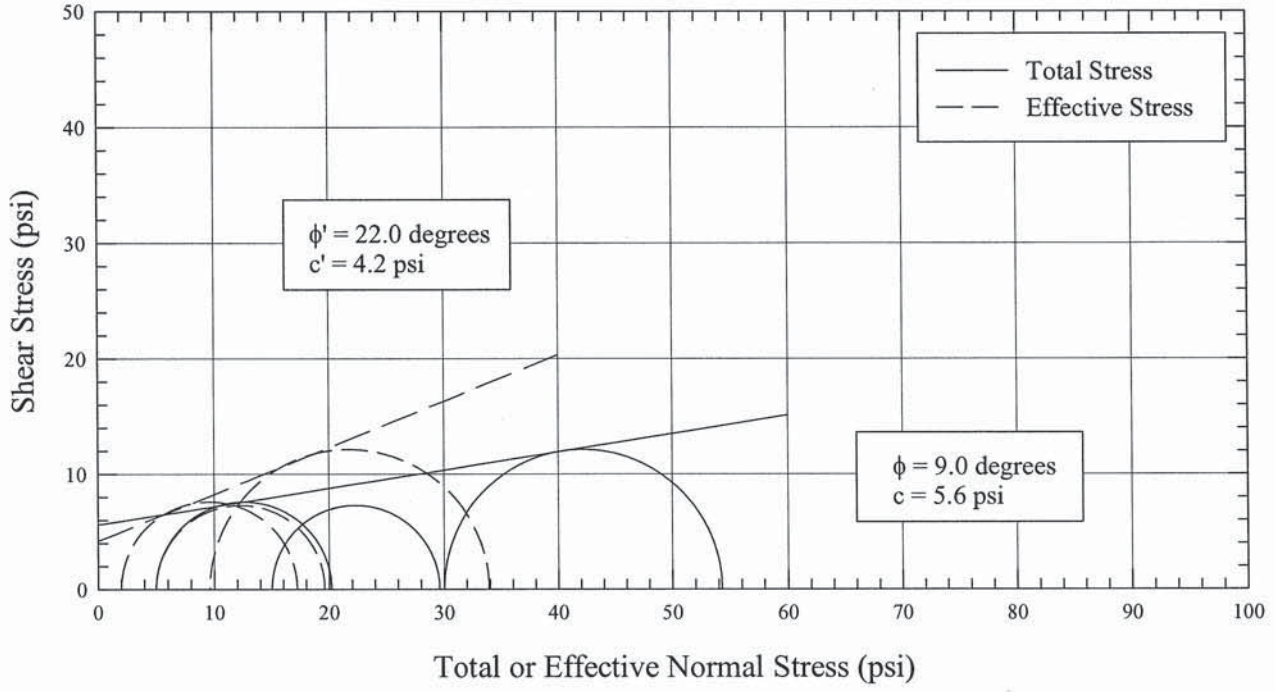


Reading No.	Deviator Load (lbs)	Corrected[1] Dev. Load (lbs.)	Axial Deformation (in.)	Axial Strain (%)	Pore Pressure (psi)	Change in Pore Press. (psi)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	Deviator Stress (psi)	Principal Stress Ratio	A_{bar}	P (psi)	P' (psi)	q (psi)
Zero	0.0	0.0	0.000	0.00	15.0	0.0	6.28	30.0	30.0	30.0	30.0	0.0	1.00	0.00	30.0	30.0	0.0
1	15.7	15.6	0.006	0.11	16.9	1.9	6.28	32.5	30.0	30.6	28.1	2.5	1.09	0.77	31.2	29.3	1.2
2	42.5	42.3	0.011	0.19	19.6	4.6	6.29	36.7	30.0	32.1	25.4	6.7	1.26	0.68	33.4	28.8	3.4
3	60.5	60.1	0.017	0.30	21.5	6.5	6.30	39.6	30.0	33.1	23.5	9.6	1.41	0.68	34.8	28.3	4.8
4	74.1	73.6	0.023	0.40	23.0	8.0	6.30	41.7	30.0	33.7	22.0	11.7	1.53	0.68	35.8	27.8	5.8
5	85.0	84.4	0.029	0.51	24.1	9.1	6.31	43.4	30.0	34.3	20.9	13.4	1.64	0.68	36.7	27.6	6.7
6	94.5	93.8	0.035	0.62	25.2	10.2	6.32	44.8	30.0	34.6	19.8	14.8	1.75	0.69	37.4	27.2	7.4
7	102.9	102.0	0.041	0.72	26.2	11.2	6.32	46.1	30.0	34.9	18.8	16.1	1.86	0.69	38.1	26.9	8.1
8	110.2	109.2	0.046	0.81	27.0	12.0	6.33	47.3	30.0	35.3	18.0	17.3	1.96	0.70	38.6	26.6	8.6
9	116.7	115.6	0.052	0.92	27.9	12.9	6.33	48.3	30.0	35.4	17.1	18.3	2.07	0.71	39.1	26.2	9.1
10	122.5	121.3	0.058	1.02	28.6	13.6	6.34	49.1	30.0	35.5	16.4	19.1	2.17	0.71	39.6	26.0	9.6
11	139.6	137.9	0.081	1.43	30.9	15.9	6.37	51.7	30.0	35.8	14.1	21.7	2.54	0.73	40.8	24.9	10.8
12	153.8	151.5	0.111	1.95	32.8	17.8	6.40	53.7	30.0	35.9	12.2	23.7	2.94	0.75	41.8	24.0	11.8
13	160.3	157.8	0.140	2.46	34.2	19.2	6.44	54.5	30.0	35.3	10.8	24.5	3.27	0.78	42.3	23.1	12.3
14	162.3	159.7	0.169	2.97	35.3	20.3	6.47	54.7	30.0	34.4	9.7	24.7	3.55	0.82	42.3	22.0	12.3
15	156.7	153.9	0.227	4.00	36.3	21.3	6.54	53.5	30.0	32.2	8.7	23.5	3.71	0.90	41.8	20.5	11.8
16	147.8	144.8	0.280	4.93	36.6	21.6	6.60	51.9	30.0	30.3	8.4	21.9	3.61	0.98	41.0	19.4	11.0
17	124.5	121.3	0.338	5.95	36.1	21.1	6.67	48.2	30.0	27.1	8.9	18.2	3.04	1.16	39.1	18.0	9.1
18	115.8	112.4	0.397	6.99	36.2	21.2	6.75	46.7	30.0	25.5	8.8	16.7	2.89	1.27	38.3	17.1	8.3
19	119.2	115.5	0.455	8.01	36.5	21.5	6.82	46.9	30.0	25.4	8.5	16.9	2.99	1.27	38.5	17.0	8.5
20	120.5	116.6	0.508	8.94	36.7	21.7	6.89	46.9	30.0	25.2	8.3	16.9	3.04	1.28	38.5	16.8	8.5
21	118.7	114.6	0.566	9.96	36.8	21.8	6.97	46.4	30.0	24.6	8.2	16.4	3.01	1.33	38.2	16.4	8.2
22	122.8	118.5	0.624	10.98	37.1	22.1	7.05	46.8	30.0	24.7	7.9	16.8	3.13	1.31	38.4	16.3	8.4
23	124.5	120.0	0.677	11.91	37.1	22.1	7.13	46.8	30.0	24.7	7.9	16.8	3.13	1.31	38.4	16.3	8.4
24	120.9	116.2	0.735	12.94	37.1	22.1	7.21	46.1	30.0	24.0	7.9	16.1	3.04	1.37	38.1	16.0	8.1
25	118.7	113.8	0.794	13.97	37.0	22.0	7.30	45.6	30.0	23.6	8.0	15.6	2.95	1.41	37.8	15.8	7.8
26	104.9	99.8	0.852	14.99	37.0	22.0	7.38	43.5	30.0	21.5	8.0	13.5	2.69	1.63	36.8	14.8	6.8

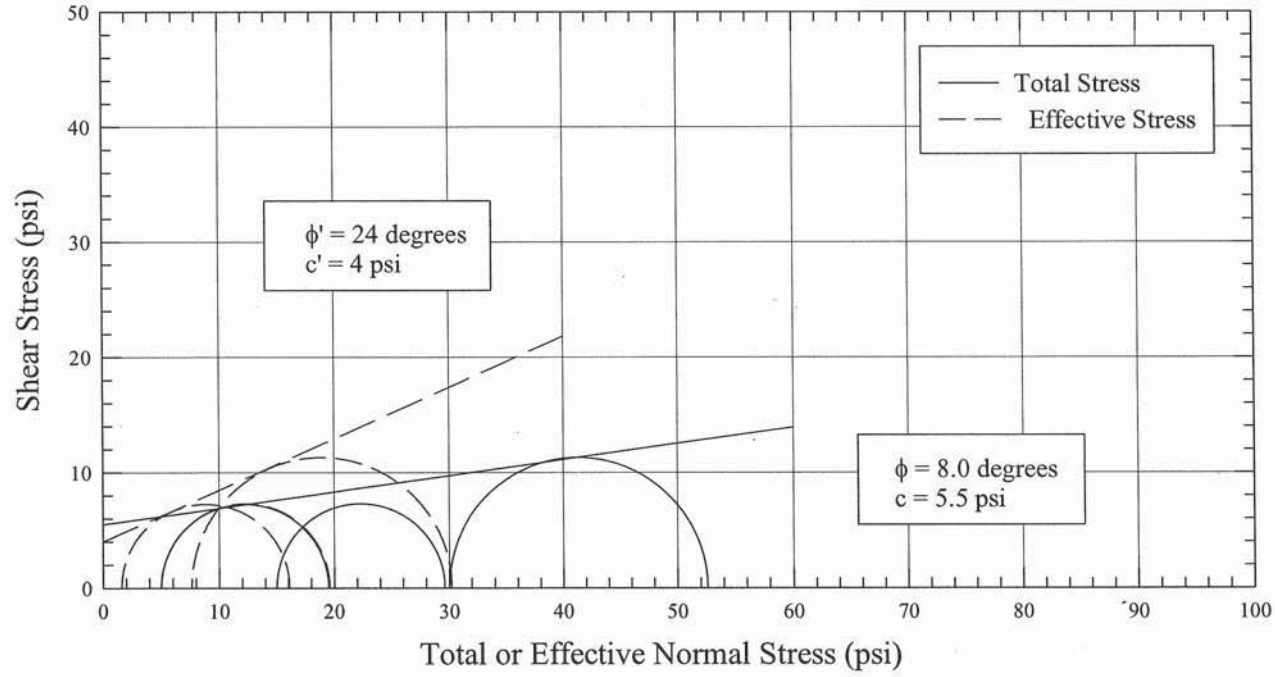
Notes: 1. Deviator load corrected for membrane and filter cage (if applicable) effects.
2. Right Cylinder Correction Method

Consolidated Undrained (CU) Triaxial Shear (ASTM D4767)

Mohr Stress Circles at Maximum Deviator Stress Criterion



Mohr Stress Circles at Maximum Principal Stress Ratio Criterion



Boring No.: *10BH-154A* Depth: *18-20 ft* SEC Contract: *10613051* Date: *09/16/10*

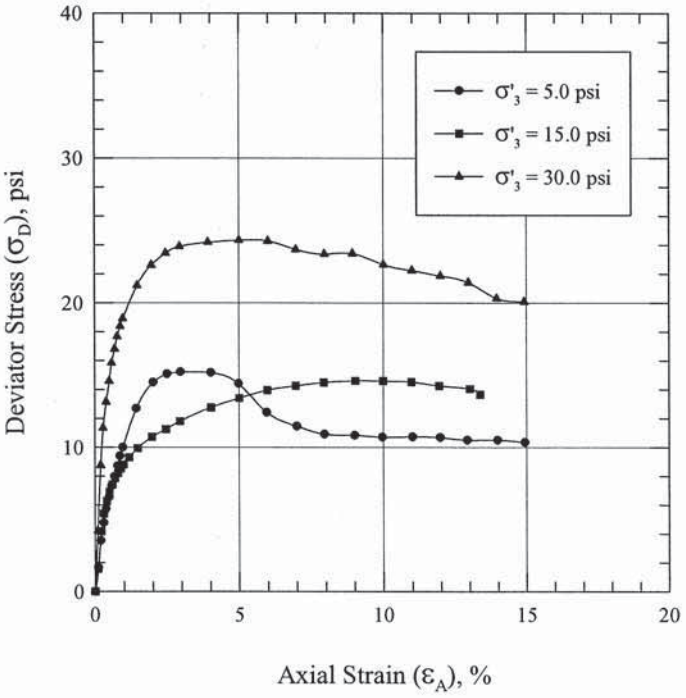
Sample Description: *ELASTIC SILT (MH) - dark gray* Reviewed By: *CJS*

Specimen Type: *Tube Sample* Gs: *2.60* LL: *59* PI: *28* %<200: *93.0*

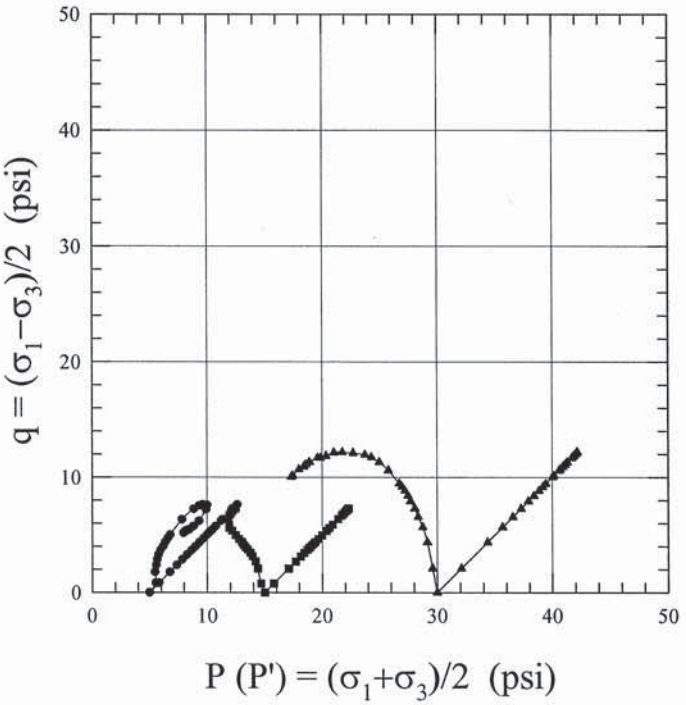
Schnabel ENGINEERING

MLK Expressway Extension
Portsmouth, VA

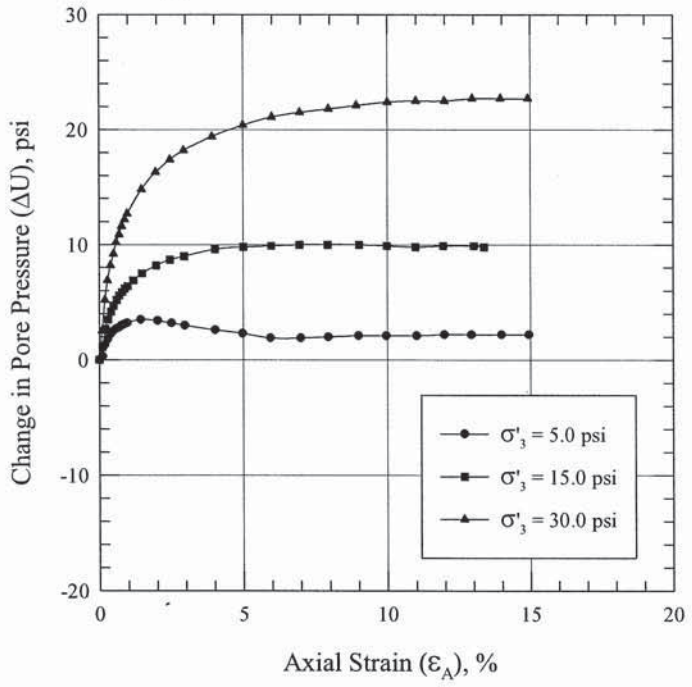
Deviator Stress vs. Axial Strain



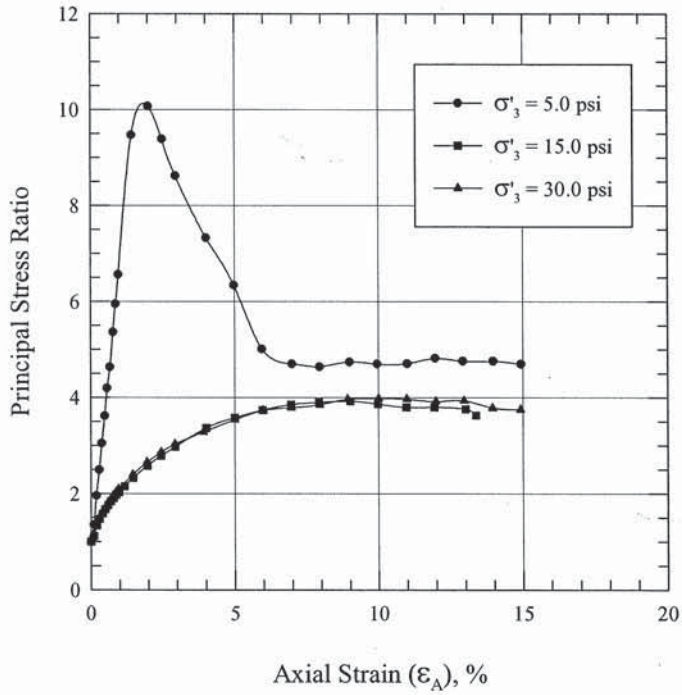
Stress Paths



Change in Pore Pressure vs. Axial Strain



Principal Stress Ratio vs. Axial Strain



Boring No.: *10BH-154A* Depth: *18-20 ft* SEC Contract: *10613051* Date: *9/16/10*

Sample Description: *ELASTIC SILT (MH) - dark gray* Reviewed By: *CJS*

Specimen Type: *Tube Sample* Specific Gravity: 2.60 LL: *59* PI: *28* %<200: *93.0*

Schnabel ENGINEERING

MLK Expressway Extension
Portsmouth, VA

Schnabel ENGINEERING

Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *MLK Expressway Extension*

Location: *Portsmouth, VA*

Schnabel Contract: *10613051*
Boring No.: *10BH-154A*
Depth: *18-20 ft.*
Elevation: *-8.8 to -10.8 ft.*
Confining Stress (psi): *5.0*

Date: *9/16/2010*

Reviewed by: *CJS*

	Specimen Conditions	
	Initial	Consolidated
Diameter (in)	2.873	2.87
Height (in)	5.817	5.81
Area (in^2)	6.48	6.46
Moisture (%)	59.9	
W_{solids} (lbs)	1.36	
ρ_{wet} (pcf)	99.5	
ρ_{dry} (pcf)	62.2	62.6
Void Ratio	1.61	1.59
Saturation, %	97	100

Shear Testing Conditions	
Cell Pressure (psi):	15.0
Back Pressure (psi):	10.0
Eff. Confining Stress (psi):	5.0
Final B check	0.98
t_{50} (min.):	2.4
Rate of Strain (%/min):	0.0669

Filter strips used? *YES*

Specimen Type: *Tube Sample*

Soil Description: *ELASTIC SILT (MH) - dark gray*

Liquid Limit: *59*
Plasticity Index: *28*
% finer that No. 200: *93.0*
Specific Gravity: *2.60*

Remarks:

Failure Sketch



Reading No.	Deviator Load (lbs)	Corrected[1] Dev. Load (lbs.)	Axial Deformation (in.)	Axial Strain (%)	Pore Pressure (psi)	Change in Pore Press. (psi)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	Deviator Stress (psi)	Principal Stress Ratio	A_{bar}	P (psi)	P' (psi)	q (psi)
Zero	0.0	0.0	0.000	0.00	10.0	0.0	6.46	5.0	5.0	5.0	5.0	0.0	1.00	0.00	5.0	5.0	0.0
1	10.9	10.8	0.006	0.10	10.3	0.3	6.46	6.7	5.0	6.4	4.7	1.7	1.35	0.18	5.8	5.5	0.8
2	23.1	22.9	0.011	0.19	11.3	1.3	6.47	8.5	5.0	7.2	3.7	3.5	1.96	0.37	6.8	5.5	1.8
3	31.2	30.9	0.017	0.29	11.8	1.8	6.48	9.8	5.0	8.0	3.2	4.8	2.49	0.38	7.4	5.6	2.4
4	37.6	37.1	0.022	0.38	12.2	2.2	6.48	10.7	5.0	8.5	2.8	5.7	3.05	0.38	7.9	5.7	2.9
5	43.0	42.4	0.028	0.48	12.5	2.5	6.49	11.5	5.0	9.0	2.5	6.5	3.62	0.38	8.3	5.8	3.3
6	48.3	47.6	0.033	0.57	12.7	2.7	6.49	12.3	5.0	9.6	2.3	7.3	4.19	0.37	8.7	6.0	3.7
7	52.7	51.9	0.039	0.67	12.8	2.8	6.50	13.0	5.0	10.2	2.2	8.0	4.63	0.35	9.0	6.2	4.0
8	57.6	56.7	0.045	0.78	13.0	3.0	6.51	13.7	5.0	10.7	2.0	8.7	5.35	0.34	9.4	6.4	4.4
9	62.2	61.2	0.050	0.86	13.1	3.1	6.51	14.4	5.0	11.3	1.9	9.4	5.94	0.33	9.7	6.6	4.7
10	66.4	65.3	0.056	0.96	13.2	3.2	6.52	15.0	5.0	11.8	1.8	10.0	6.56	0.32	10.0	6.8	5.0
11	84.9	83.2	0.083	1.43	13.5	3.5	6.55	17.7	5.0	14.2	1.5	12.7	9.47	0.28	11.3	7.8	6.3
12	98.0	95.6	0.117	2.02	13.4	3.4	6.59	19.5	5.0	16.1	1.6	14.5	10.07	0.23	12.3	8.9	7.3
13	102.4	99.9	0.145	2.50	13.2	3.2	6.62	20.1	5.0	16.9	1.8	15.1	9.38	0.21	12.5	9.3	7.5
14	104.0	101.4	0.172	2.96	13.0	3.0	6.65	20.2	5.0	17.2	2.0	15.2	8.62	0.20	12.6	9.6	7.6
15	104.9	102.1	0.233	4.01	12.6	2.6	6.73	20.2	5.0	17.6	2.4	15.2	7.32	0.17	12.6	10.0	7.6
16	101.0	98.0	0.289	4.98	12.3	2.3	6.80	19.4	5.0	17.1	2.7	14.4	6.34	0.16	12.2	9.9	7.2
17	88.5	85.3	0.345	5.94	11.9	1.9	6.87	17.4	5.0	15.5	3.1	12.4	5.01	0.15	11.2	9.3	6.2
18	83.1	79.6	0.406	6.99	11.9	1.9	6.94	16.5	5.0	14.6	3.1	11.5	4.70	0.17	10.7	8.8	5.7
19	80.2	76.5	0.461	7.94	12.0	2.0	7.01	15.9	5.0	13.9	3.0	10.9	4.64	0.18	10.5	8.5	5.5
20	80.8	76.9	0.522	8.99	12.1	2.1	7.10	15.8	5.0	13.7	2.9	10.8	4.74	0.19	10.4	8.3	5.4
21	80.9	76.8	0.578	9.96	12.1	2.1	7.17	15.7	5.0	13.6	2.9	10.7	4.69	0.20	10.4	8.3	5.4
22	82.3	78.0	0.639	11.01	12.1	2.1	7.26	15.7	5.0	13.6	2.9	10.7	4.71	0.20	10.4	8.3	5.4
23	82.9	78.4	0.695	11.97	12.2	2.2	7.34	15.7	5.0	13.5	2.8	10.7	4.81	0.21	10.3	8.1	5.3
24	82.7	78.0	0.750	12.92	12.2	2.2	7.42	15.5	5.0	13.3	2.8	10.5	4.75	0.21	10.3	8.1	5.3
25	83.9	78.9	0.811	13.97	12.2	2.2	7.51	15.5	5.0	13.3	2.8	10.5	4.76	0.21	10.3	8.1	5.3
26	83.8	78.6	0.867	14.93	12.2	2.2	7.59	15.4	5.0	13.2	2.8	10.4	4.70	0.21	10.2	8.0	5.2

Notes: 1. Deviator load corrected for membrane and filter cage (if applicable) effects.
2. Right Cylinder Correction Method

Schnabel ENGINEERING

Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *MLK Expressway Extension*

Location: *Portsmouth, VA*

Schnabel Contract: *10613051*
Boring No.: *10BH-154A*
Depth: *18-20 ft.*
Elevation: *-8.8 to -10.8 ft.*
Confining Stress (psi): *15.0*

Date: *9/16/2010*

Reviewed by: *CJS*

	Specimen Conditions	
	Initial	Consolidated
Diameter (in)	2.874	2.82
Height (in)	5.824	5.68
Area (in^2)	6.49	6.25
Moisture (%)	57.7	
W_{solids} (lbs)	1.38	
ρ_{wet} (pcf)	99.7	
ρ_{dry} (pcf)	63.2	67.3
Void Ratio	1.57	1.41
Saturation, %	96	100

Shear Testing Conditions	
Cell Pressure (psi):	25.0
Back Pressure (psi):	10.0
Eff. Confining Stress (psi):	15.0
Final B check	0.98
t_{50} (min.):	9.4
Rate of Strain (%/min):	0.0425

Filter strips used? *YES*

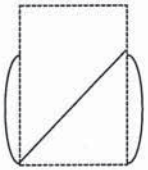
Specimen Type: *Tube Sample*

Soil Description: *ELASTIC SILT (MH) - dark gray*

Liquid Limit: *59*
Plasticity Index: *28*
% finer that No. 200: *93.0*
Specific Gravity: *2.60*

Remarks:

Failure Sketch



Reading No.	Deviator Load (lbs)	Corrected[1] Dev. Load (lbs.)	Axial Deformation (in.)	Axial Strain (%)	Pore Pressure (psi)	Change in Pore Press. (psi)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	Deviator Stress (psi)	Principal Stress Ratio	A_{bar}	P (psi)	P' (psi)	q (psi)
Zero	0.0	0.0	0.000	0.00	10.0	0.0	6.25	15.0	15.0	15.0	15.0	0.0	1.00	0.00	15.0	15.0	0.0
1	10.0	9.9	0.006	0.11	11.1	1.1	6.26	16.6	15.0	15.5	13.9	1.6	1.11	0.70	15.8	14.7	0.8
2	26.4	26.1	0.012	0.21	12.7	2.7	6.27	19.2	15.0	16.5	12.3	4.2	1.34	0.65	17.1	14.4	2.1
3	34.3	33.9	0.017	0.30	13.5	3.5	6.27	20.4	15.0	16.9	11.5	5.4	1.47	0.65	17.7	14.2	2.7
4	39.9	39.4	0.023	0.40	14.2	4.2	6.28	21.3	15.0	17.1	10.8	6.3	1.58	0.67	18.1	13.9	3.1
5	44.1	43.5	0.028	0.49	14.7	4.7	6.28	21.9	15.0	17.2	10.3	6.9	1.67	0.68	18.5	13.8	3.5
6	47.5	46.8	0.034	0.60	15.2	5.2	6.29	22.4	15.0	17.2	9.8	7.4	1.76	0.70	18.7	13.5	3.7
7	50.3	49.5	0.039	0.69	15.6	5.6	6.30	22.9	15.0	17.3	9.4	7.9	1.84	0.71	18.9	13.3	3.9
8	52.7	51.8	0.045	0.79	15.9	5.9	6.30	23.2	15.0	17.3	9.1	8.2	1.90	0.72	19.1	13.2	4.1
9	54.9	53.9	0.050	0.88	16.2	6.2	6.31	23.5	15.0	17.3	8.8	8.5	1.97	0.73	19.3	13.1	4.3
10	56.9	55.7	0.056	0.99	16.4	6.4	6.31	23.8	15.0	17.4	8.6	8.8	2.03	0.73	19.4	13.0	4.4
11	60.3	58.9	0.067	1.18	16.9	6.9	6.33	24.3	15.0	17.4	8.1	9.3	2.15	0.74	19.7	12.8	4.7
12	64.9	63.1	0.084	1.48	17.5	7.5	6.35	25.0	15.0	17.5	7.5	10.0	2.33	0.75	20.0	12.5	5.0
13	70.8	68.5	0.112	1.97	18.2	8.2	6.38	25.7	15.0	17.5	6.8	10.7	2.58	0.76	20.4	12.2	5.4
14	74.6	72.1	0.139	2.45	18.7	8.7	6.41	26.3	15.0	17.6	6.3	11.3	2.79	0.77	20.6	11.9	5.6
15	78.7	76.1	0.167	2.94	19.0	9.0	6.44	26.8	15.0	17.8	6.0	11.8	2.97	0.76	20.9	11.9	5.9
16	86.0	83.2	0.228	4.01	19.6	9.6	6.51	27.8	15.0	18.2	5.4	12.8	3.37	0.75	21.4	11.8	6.4
17	91.3	88.3	0.284	5.00	19.8	9.8	6.58	28.4	15.0	18.6	5.2	13.4	3.58	0.73	21.7	11.9	6.7
18	96.1	92.9	0.339	5.97	19.9	9.9	6.65	29.0	15.0	19.1	5.1	14.0	3.74	0.71	22.0	12.1	7.0
19	99.3	95.9	0.395	6.96	20.0	10.0	6.72	29.3	15.0	19.3	5.0	14.3	3.85	0.70	22.1	12.1	7.1
20	102.1	98.5	0.450	7.92	20.0	10.0	6.79	29.5	15.0	19.5	5.0	14.5	3.90	0.69	22.3	12.3	7.3
21	104.3	100.4	0.512	9.02	20.0	10.0	6.87	29.6	15.0	19.6	5.0	14.6	3.92	0.68	22.3	12.3	7.3
22	105.5	101.4	0.567	9.98	19.9	9.9	6.95	29.6	15.0	19.7	5.1	14.6	3.86	0.68	22.3	12.4	7.3
23	106.4	102.1	0.623	10.97	19.8	9.8	7.02	29.5	15.0	19.7	5.2	14.5	3.80	0.67	22.3	12.5	7.3
24	105.8	101.3	0.678	11.94	19.9	9.9	7.10	29.3	15.0	19.4	5.1	14.3	3.80	0.69	22.1	12.2	7.1
25	105.8	101.1	0.739	13.01	19.9	9.9	7.19	29.1	15.0	19.2	5.1	14.1	3.76	0.70	22.0	12.1	7.0
26	103.5	98.7	0.759	13.36	19.8	9.8	7.22	28.7	15.0	18.9	5.2	13.7	3.63	0.72	21.8	12.0	6.8

Notes: 1. Deviator load corrected for membrane and filter cage (if applicable) effects.
2. Right Cylinder Correction Method

Schnabel ENGINEERING

Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *MLK Expressway Extension*

Location: *Portsmouth, VA*

Schnabel Contract: *10613051*
Boring No.: *10BH-154A*
Depth: *18-20 ft.*
Elevation: *-8.8 to -10.8 ft.*
Confining Stress (psi): *30.0*

Date: *9/16/2010*

Reviewed by: *CJS*

	Specimen Conditions	
	Initial	Consolidated
Diameter (in)	2.870	2.80
Height (in)	5.788	5.65
Area (in^2)	6.47	6.15
Moisture (%)	60.1	
W_{solids} (lbs)	1.35	
ρ_{wet} (pcf)	99.9	
ρ_{dry} (pcf)	62.4	67.3
Void Ratio	1.60	1.41
Saturation, %	98	100

Shear Testing Conditions	
Cell Pressure (psi):	45.0
Back Pressure (psi):	15.0
Eff. Confining Stress (psi):	30.0
Final B check	0.96
t_{50} (min.):	6.0
Rate of Strain (%/min):	0.0669

Filter strips used? *YES*

Specimen Type: *Tube Sample*

Soil Description: *ELASTIC SILT (MH) - dark gray*

Liquid Limit: *59*
Plasticity Index: *28*
% finer that No. 200: *93.0*
Specific Gravity: *2.60*

Remarks:

Failure Sketch

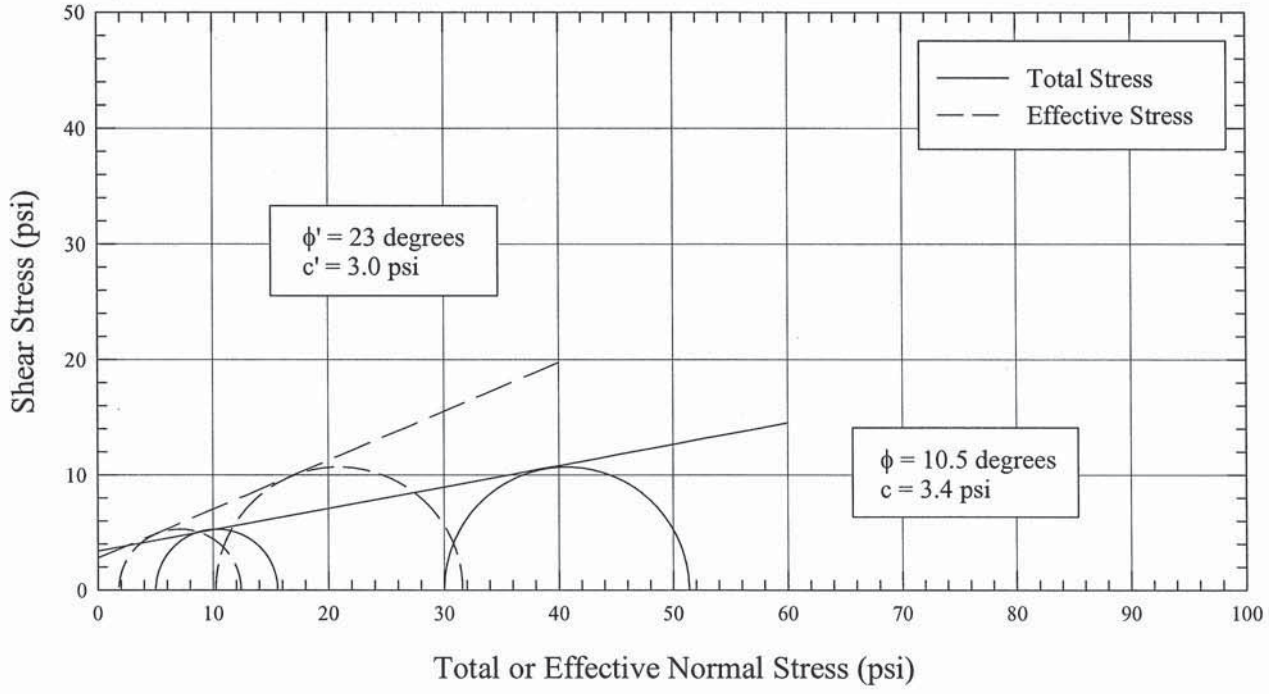


Reading No.	Deviator Load (lbs)	Corrected[1] Dev. Load (lbs.)	Axial Deformation (in.)	Axial Strain (%)	Pore Pressure (psi)	Change in Pore Press. (psi)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	Deviator Stress (psi)	Principal Stress Ratio	A_{bar}	P (psi)	P' (psi)	q (psi)
Zero	0.0	0.0	0.000	0.00	15.0	0.0	6.15	30.0	30.0	30.0	30.0	0.0	1.00	0.00	30.0	30.0	0.0
1	26.0	25.9	0.005	0.09	17.5	2.5	6.15	34.2	30.0	31.7	27.5	4.2	1.15	0.59	32.1	29.6	2.1
2	54.1	53.9	0.011	0.19	20.2	5.2	6.16	38.7	30.0	33.5	24.8	8.7	1.35	0.59	34.4	29.2	4.4
3	70.3	70.0	0.016	0.28	21.9	6.9	6.16	41.4	30.0	34.5	23.1	11.4	1.49	0.61	35.7	28.8	5.7
4	81.6	81.1	0.022	0.39	23.2	8.2	6.17	43.2	30.0	35.0	21.8	13.2	1.60	0.62	36.6	28.4	6.6
5	90.6	90.0	0.028	0.50	24.2	9.2	6.18	44.6	30.0	35.4	20.8	14.6	1.70	0.63	37.3	28.1	7.3
6	98.7	98.0	0.033	0.58	25.2	10.2	6.18	45.9	30.0	35.7	19.8	15.9	1.80	0.64	37.9	27.7	7.9
7	104.8	104.0	0.039	0.69	25.9	10.9	6.19	46.8	30.0	35.9	19.1	16.8	1.88	0.65	38.4	27.5	8.4
8	110.4	109.5	0.044	0.78	26.6	11.6	6.19	47.7	30.0	36.1	18.4	17.7	1.96	0.66	38.8	27.2	8.8
9	115.1	114.1	0.050	0.88	27.2	12.2	6.20	48.4	30.0	36.2	17.8	18.4	2.03	0.66	39.2	27.0	9.2
10	118.6	117.4	0.055	0.97	27.7	12.7	6.21	48.9	30.0	36.2	17.3	18.9	2.09	0.67	39.5	26.8	9.5
11	134.0	132.3	0.083	1.47	29.8	14.8	6.24	51.2	30.0	36.4	15.2	21.2	2.40	0.70	40.6	25.8	10.6
12	144.1	141.8	0.111	1.96	31.3	16.3	6.27	52.6	30.0	36.3	13.7	22.6	2.65	0.72	41.3	25.0	11.3
13	150.3	147.8	0.139	2.46	32.4	17.4	6.30	53.5	30.0	36.1	12.6	23.5	2.86	0.74	41.7	24.3	11.7
14	154.0	151.4	0.166	2.94	33.2	18.2	6.33	53.9	30.0	35.7	11.8	23.9	3.03	0.76	42.0	23.8	12.0
15	157.6	154.8	0.222	3.93	34.4	19.4	6.40	54.2	30.0	34.8	10.6	24.2	3.28	0.80	42.1	22.7	12.1
16	160.5	157.5	0.283	5.00	35.4	20.4	6.47	54.3	30.0	33.9	9.6	24.3	3.54	0.84	42.2	21.8	12.2
17	162.0	158.8	0.339	5.99	36.1	21.1	6.54	54.3	30.0	33.2	8.9	24.3	3.73	0.87	42.1	21.0	12.1
18	160.0	156.6	0.394	6.97	36.5	21.5	6.61	53.7	30.0	32.2	8.5	23.7	3.79	0.91	41.9	20.4	11.9
19	159.7	156.1	0.450	7.96	36.8	21.8	6.68	53.4	30.0	31.6	8.2	23.4	3.85	0.93	41.7	19.9	11.7
20	161.9	158.1	0.505	8.93	37.1	22.1	6.75	53.4	30.0	31.3	7.9	23.4	3.97	0.94	41.7	19.6	11.7
21	158.7	154.6	0.566	10.01	37.4	22.4	6.83	52.6	30.0	30.2	7.6	22.6	3.98	0.99	41.3	18.9	11.3
22	157.9	153.6	0.622	11.00	37.5	22.5	6.90	52.3	30.0	29.8	7.5	22.3	3.97	1.01	41.1	18.6	11.1
23	157.2	152.7	0.678	11.99	37.5	22.5	6.98	51.9	30.0	29.4	7.5	21.9	3.92	1.03	40.9	18.4	10.9
24	155.9	151.2	0.733	12.96	37.7	22.7	7.06	51.4	30.0	28.7	7.3	21.4	3.93	1.06	40.7	18.0	10.7
25	150.0	145.1	0.789	13.95	37.7	22.7	7.14	50.3	30.0	27.6	7.3	20.3	3.78	1.12	40.2	17.5	10.2
26	150.2	145.1	0.844	14.92	37.7	22.7	7.22	50.1	30.0	27.4	7.3	20.1	3.75	1.13	40.0	17.3	10.0

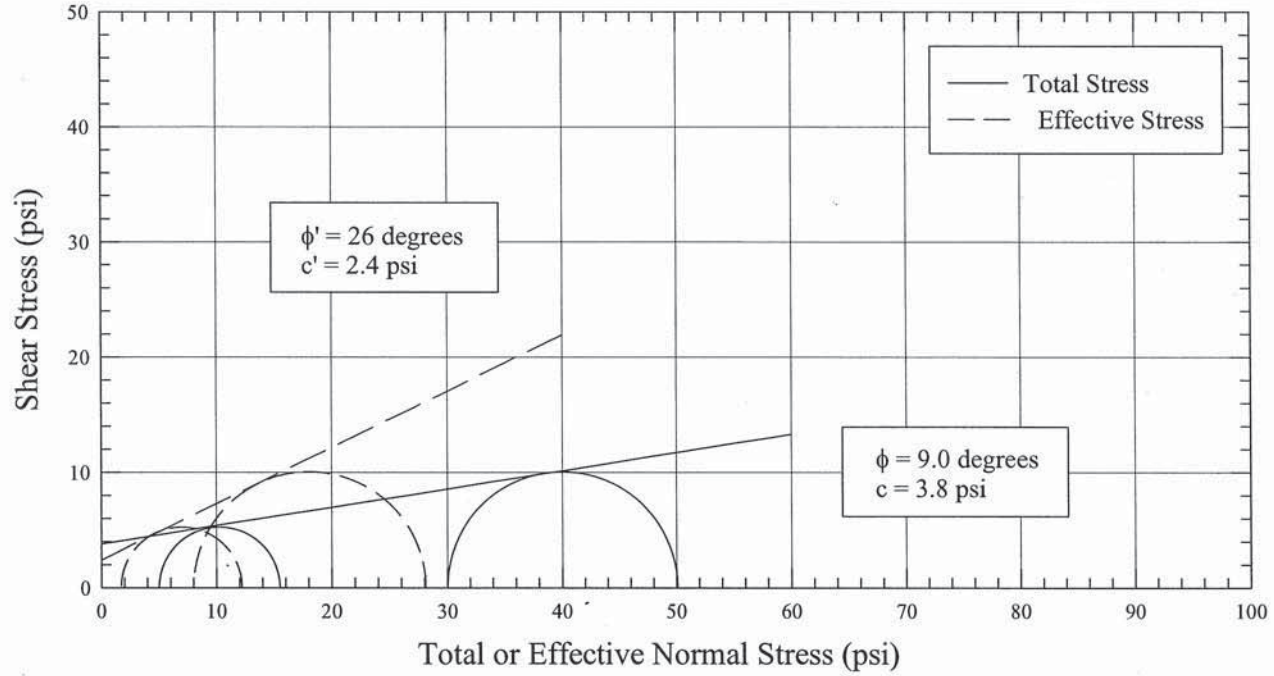
Notes: 1. Deviator load corrected for membrane and filter cage (if applicable) effects.
2. Right Cylinder Correction Method

Consolidated Undrained (CU) Triaxial Shear (ASTM D4767)

Mohr Stress Circles at Maximum Deviator Stress Criterion



Mohr Stress Circles at Maximum Principal Stress Ratio Criterion



Boring No.: *10BH-233A* Depth: *20-22 ft* SEC Contract: *10613051* Date: *9/16/10*

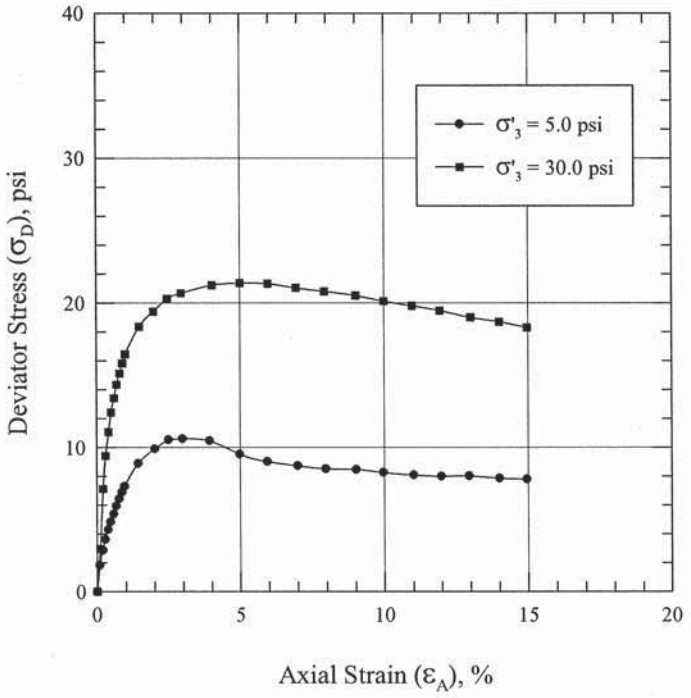
Sample Description: *ELASTIC SILT (MH) - dark gray* Reviewed By: *CJS*

Specimen Type: *Tube Sample* Gs: *2.62* LL: *57* PI: *25* %<200: *94.0*

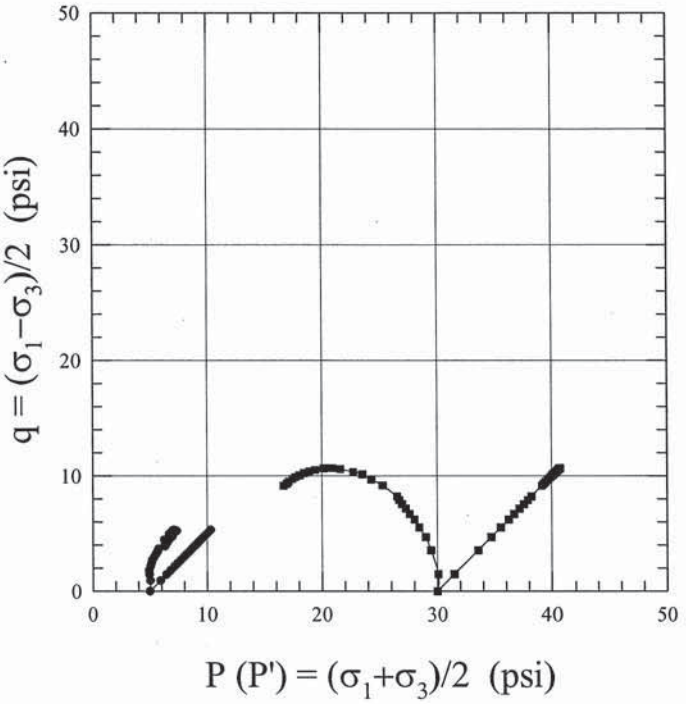
Schnabel ENGINEERING

MLK Expressway Extension
Portsmouth, VA

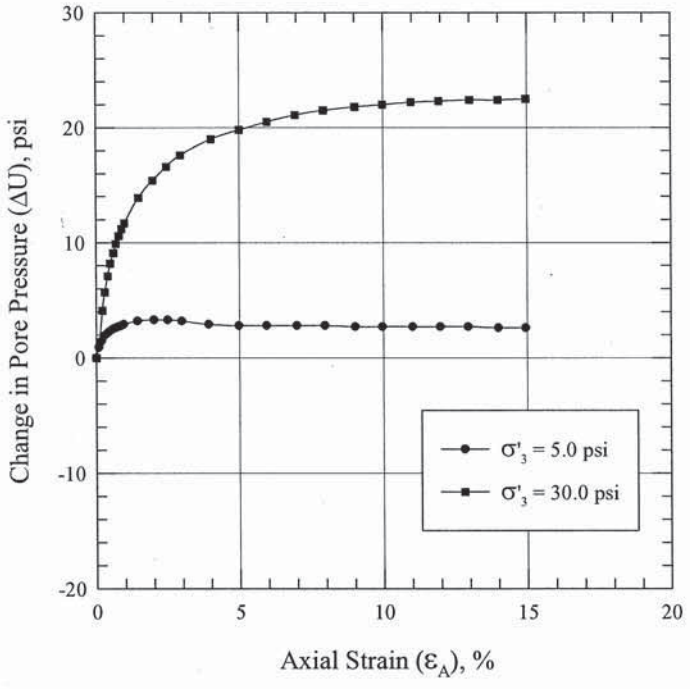
Deviator Stress vs. Axial Strain



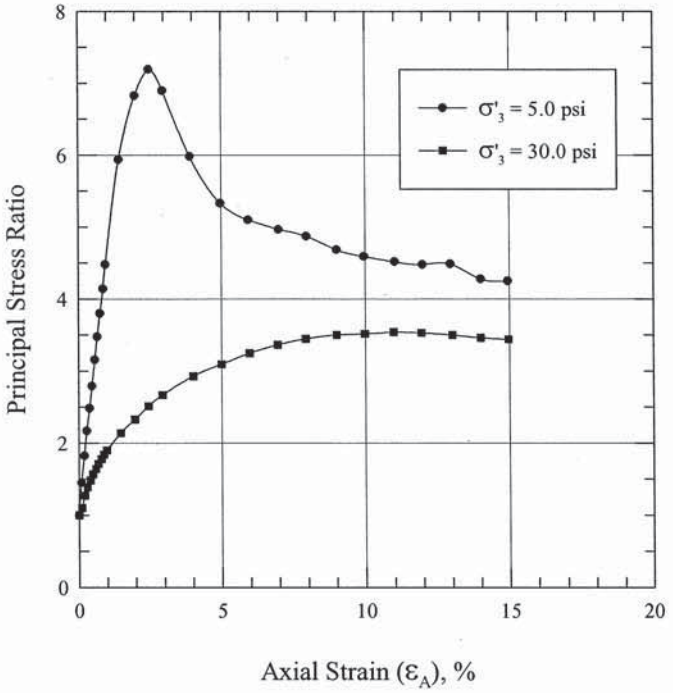
Stress Paths



Change in Pore Pressure vs. Axial Strain



Principal Stress Ratio vs. Axial Strain



Boring No.: *10BH-233A* Depth: *20-22 ft* SEC Contract: *10613051* Date: *9/16/10*

Sample Description: *ELASTIC SILT (MH) - dark gray* Reviewed By: *CJS*

Specimen Type: *Tube Sample* Specific Gravity: 2.62 LL: *57* PI: *25* %<200: *94.0*

Schnabel ENGINEERING

MLK Expressway Extension
Portsmouth, VA

Schnabel ENGINEERING

Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *MLK Expressway Extension*

Location: *Portsmouth, VA*

Schnabel Contract: *10613051*
Boring No.: *10BH-233A*
Depth: *20-22 ft.*
Elevation: *-8.3 to -10.3 ft.*
Confining Stress (psi): *5.0*

Date: *9/16/2010*

Reviewed by: *CJS*

	Specimen Conditions	
	Initial	Consolidated
Diameter (in)	2.867	2.86
Height (in)	5.808	5.79
Area (in^2)	6.46	6.41
Moisture (%)	62.6	
W_{solids} (lbs)	1.35	
ρ_{wet} (pcf)	100.9	
ρ_{dry} (pcf)	62.0	62.6
Void Ratio	1.64	1.61
Saturation, %	100	99

Shear Testing Conditions	
Cell Pressure (psi):	10.0
Back Pressure (psi):	5.0
Eff. Confining Stress (psi):	5.0
Final B check	0.96
t_{50} (min.):	4.7
Rate of Strain (%/min):	0.0276

Filter strips used? *YES*

Specimen Type: *Tube Sample*

Soil Description: *ELASTIC SILT (MH) - dark gray*

Liquid Limit: *57*
Plasticity Index: *25*
% finer that No. 200: *94.0*
Specific Gravity: *2.62*

Remarks:

Failure Sketch



Reading No.	Deviator Load (lbs)	Corrected[1] Dev. Load (lbs.)	Axial Deformation (in.)	Axial Strain (%)	Pore Pressure (psi)	Change in Pore Press. (psi)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	Deviator Stress (psi)	Principal Stress Ratio	A_{bar}	P (psi)	P' (psi)	q (psi)
Zero	0.0	0.0	0.000	0.00	5.0	0.0	6.41	5.0	5.0	5.0	5.0	0.0	1.00	0.00	5.0	5.0	0.0
1	11.9	11.8	0.005	0.09	5.9	0.9	6.42	6.8	5.0	5.9	4.1	1.8	1.45	0.49	5.9	5.0	0.9
2	18.7	18.5	0.011	0.19	6.5	1.5	6.43	7.9	5.0	6.4	3.5	2.9	1.82	0.52	6.4	4.9	1.4
3	23.6	23.3	0.016	0.28	6.9	1.9	6.43	8.6	5.0	6.7	3.1	3.6	2.17	0.53	6.8	4.9	1.8
4	28.1	27.6	0.022	0.38	7.1	2.1	6.44	9.3	5.0	7.2	2.9	4.3	2.48	0.49	7.1	5.0	2.1
5	31.7	31.1	0.027	0.47	7.3	2.3	6.44	9.8	5.0	7.5	2.7	4.8	2.79	0.48	7.4	5.1	2.4
6	35.4	34.7	0.033	0.57	7.5	2.5	6.45	10.4	5.0	7.9	2.5	5.4	3.15	0.46	7.7	5.2	2.7
7	39.1	38.3	0.038	0.66	7.6	2.6	6.46	10.9	5.0	8.3	2.4	5.9	3.47	0.44	8.0	5.4	3.0
8	42.5	41.6	0.044	0.76	7.7	2.7	6.46	11.4	5.0	8.7	2.3	6.4	3.80	0.42	8.2	5.5	3.2
9	45.7	44.7	0.050	0.86	7.8	2.8	6.47	11.9	5.0	9.1	2.2	6.9	4.14	0.41	8.5	5.7	3.5
10	48.4	47.3	0.055	0.95	7.9	2.9	6.47	12.3	5.0	9.4	2.1	7.3	4.48	0.40	8.7	5.8	3.7
11	59.5	57.8	0.083	1.43	8.2	3.2	6.51	13.9	5.0	10.7	1.8	8.9	5.94	0.36	9.4	6.2	4.4
12	67.2	64.8	0.116	2.00	8.3	3.3	6.54	14.9	5.0	11.6	1.7	9.9	6.83	0.33	10.0	6.7	5.0
13	71.7	69.2	0.144	2.48	8.3	3.3	6.58	15.5	5.0	12.2	1.7	10.5	7.19	0.31	10.3	7.0	5.3
14	72.7	70.1	0.172	2.97	8.2	3.2	6.61	15.6	5.0	12.4	1.8	10.6	6.89	0.30	10.3	7.1	5.3
15	72.6	69.8	0.227	3.92	7.9	2.9	6.67	15.5	5.0	12.6	2.1	10.5	5.98	0.28	10.2	7.3	5.2
16	67.3	64.3	0.288	4.97	7.8	2.8	6.75	14.5	5.0	11.7	2.2	9.5	5.33	0.29	9.8	7.0	4.8
17	64.7	61.5	0.344	5.94	7.8	2.8	6.82	14.0	5.0	11.2	2.2	9.0	5.10	0.31	9.5	6.7	4.5
18	63.6	60.1	0.405	6.99	7.8	2.8	6.89	13.7	5.0	10.9	2.2	8.7	4.97	0.32	9.4	6.6	4.4
19	63.0	59.3	0.461	7.96	7.8	2.8	6.97	13.5	5.0	10.7	2.2	8.5	4.87	0.33	9.3	6.5	4.3
20	63.6	59.7	0.522	9.01	7.7	2.7	7.05	13.5	5.0	10.8	2.3	8.5	4.68	0.32	9.2	6.5	4.2
21	62.9	58.8	0.577	9.96	7.7	2.7	7.12	13.3	5.0	10.6	2.3	8.3	4.59	0.33	9.1	6.4	4.1
22	62.6	58.3	0.638	11.01	7.7	2.7	7.21	13.1	5.0	10.4	2.3	8.1	4.52	0.33	9.0	6.3	4.0
23	62.8	58.3	0.694	11.98	7.7	2.7	7.29	13.0	5.0	10.3	2.3	8.0	4.48	0.34	9.0	6.3	4.0
24	63.8	59.1	0.750	12.94	7.7	2.7	7.37	13.0	5.0	10.3	2.3	8.0	4.49	0.34	9.0	6.3	4.0
25	63.6	58.6	0.811	13.99	7.6	2.6	7.46	12.9	5.0	10.3	2.4	7.9	4.28	0.33	8.9	6.3	3.9
26	64.0	58.8	0.866	14.94	7.6	2.6	7.54	12.8	5.0	10.2	2.4	7.8	4.25	0.33	8.9	6.3	3.9

Notes: 1. Deviator load corrected for membrane and filter cage (if applicable) effects.

2. Right Cylinder Correction Method

Schnabel ENGINEERING

Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *MLK Expressway Extension*

Location: *Portsmouth, VA*

Schnabel Contract: *10613051*
Boring No.: *10BH-233A*
Depth: *20-22 ft.*
Elevation: *-8.3 to -10.3 ft.*
Confining Stress (psi): *30.0*

Date: *9/16/2010*

Reviewed by: *CJS*

	Specimen Conditions	
	Initial	Consolidated
Diameter (in)	2.867	2.78
Height (in)	5.805	5.68
Area (in^2)	6.46	6.06
Moisture (%)	60.3	
W_{solids} (lbs)	1.38	
ρ_{wet} (pcf)	101.7	
ρ_{dry} (pcf)	63.4	69.1
Void Ratio	1.58	1.37
Saturation, %	100	98

Shear Testing Conditions	
Cell Pressure (psi):	35.0
Back Pressure (psi):	5.0
Eff. Confining Stress (psi):	30.0
Final B check	0.96
t_{50} (min.):	14.5
Rate of Strain (%/min):	0.0276

Filter strips used? *YES*

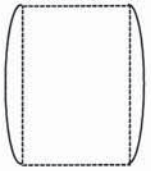
Specimen Type: *Tube Sample*

Soil Description: *ELASTIC SILT (MH) - dark gray*

Liquid Limit: *57*
Plasticity Index: *25*
% finer that No. 200: *94.0*
Specific Gravity: *2.62*

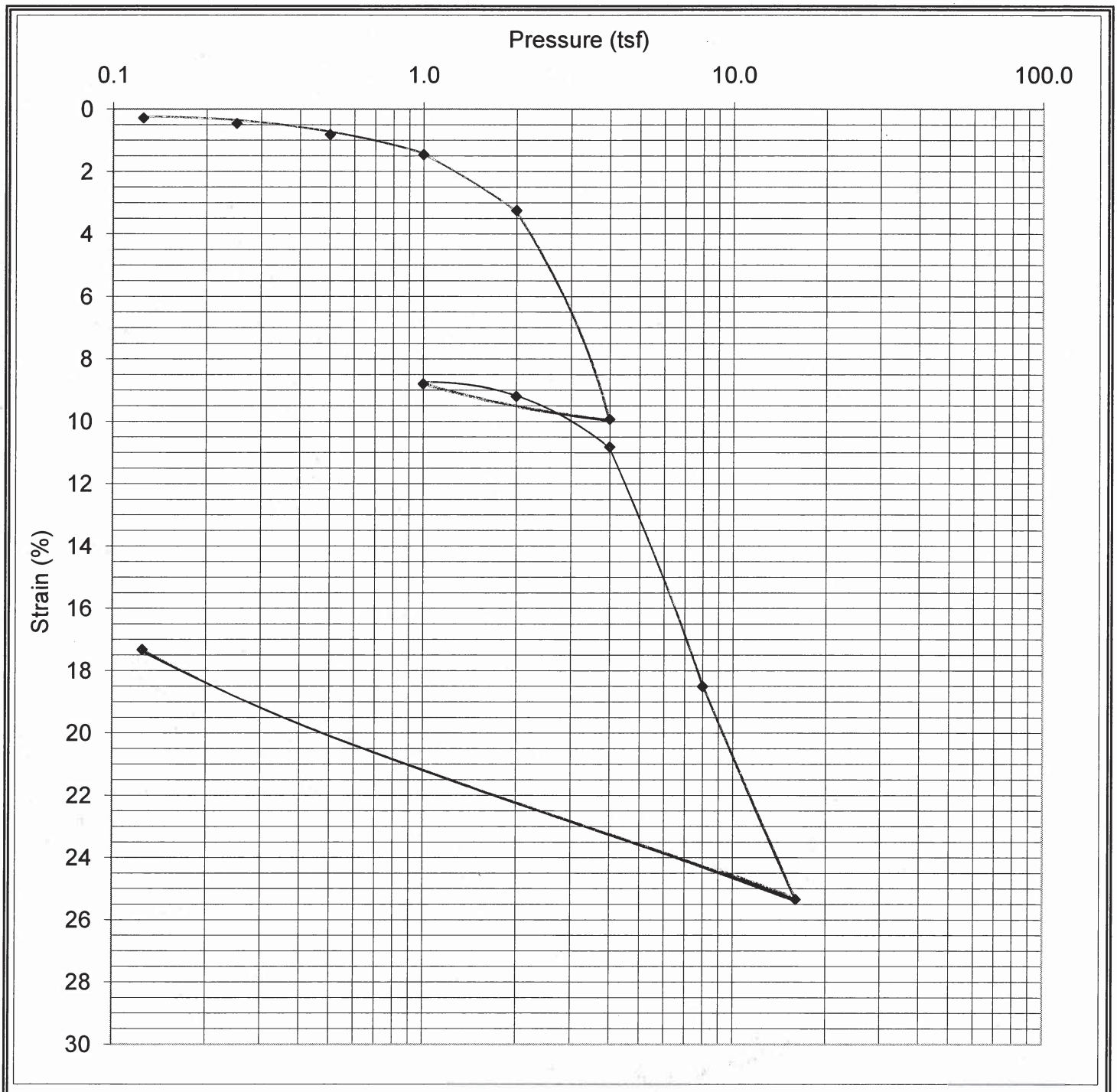
Remarks:

Failure Sketch



Reading No.	Deviator Load (lbs)	Corrected[1] Dev. Load (lbs.)	Axial Deformation (in.)	Axial Strain (%)	Pore Pressure (psi)	Change in Pore Press. (psi)	Corrected Area[2] (in^2)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	Deviator Stress (psi)	Principal Stress Ratio	A_{bar}	P (psi)	P' (psi)	q (psi)
Zero	0.0	0.0	0.000	0.00	5.0	0.0	6.06	30.0	30.0	30.0	30.0	0.0	1.00	0.00	30.0	30.0	0.0
1	18.1	18.0	0.006	0.11	6.4	1.4	6.06	33.0	30.0	31.6	28.6	3.0	1.10	0.47	31.5	30.1	1.5
2	43.5	43.2	0.012	0.21	9.1	4.1	6.07	37.1	30.0	33.0	25.9	7.1	1.28	0.58	33.6	29.5	3.6
3	57.6	57.2	0.017	0.30	10.7	5.7	6.08	39.4	30.0	33.7	24.3	9.4	1.39	0.61	34.7	29.0	4.7
4	67.8	67.3	0.023	0.40	12.1	7.1	6.08	41.1	30.0	34.0	22.9	11.1	1.48	0.64	35.5	28.4	5.5
5	76.3	75.7	0.028	0.49	13.2	8.2	6.09	42.4	30.0	34.2	21.8	12.4	1.57	0.66	36.2	28.0	6.2
6	82.5	81.8	0.034	0.60	14.1	9.1	6.09	43.4	30.0	34.3	20.9	13.4	1.64	0.68	36.7	27.6	6.7
7	88.4	87.6	0.039	0.69	14.9	9.9	6.10	44.4	30.0	34.5	20.1	14.4	1.71	0.69	37.2	27.3	7.2
8	93.3	92.4	0.045	0.79	15.6	10.6	6.11	45.1	30.0	34.5	19.4	15.1	1.78	0.70	37.6	27.0	7.6
9	97.8	96.8	0.050	0.88	16.2	11.2	6.11	45.8	30.0	34.6	18.8	15.8	1.84	0.71	37.9	26.7	7.9
10	101.8	100.6	0.056	0.99	16.7	11.7	6.12	46.4	30.0	34.7	18.3	16.4	1.90	0.71	38.2	26.5	8.2
11	114.7	112.9	0.084	1.48	18.9	13.9	6.15	48.4	30.0	34.5	16.1	18.4	2.14	0.76	39.2	25.3	9.2
12	122.3	120.0	0.112	1.97	20.4	15.4	6.18	49.4	30.0	34.0	14.6	19.4	2.33	0.79	39.7	24.3	9.7
13	128.5	126.0	0.139	2.45	21.6	16.6	6.21	50.3	30.0	33.7	13.4	20.3	2.51	0.82	40.1	23.5	10.1
14	131.7	129.1	0.167	2.94	22.6	17.6	6.24	50.7	30.0	33.1	12.4	20.7	2.67	0.85	40.3	22.7	10.3
15	136.8	134.0	0.228	4.01	24.0	19.0	6.31	51.2	30.0	32.2	11.0	21.2	2.93	0.89	40.6	21.6	10.6
16	139.3	136.3	0.284	5.00	24.8	19.8	6.38	51.4	30.0	31.6	10.2	21.4	3.10	0.93	40.7	20.9	10.7
17	140.7	137.5	0.339	5.97	25.5	20.5	6.44	51.3	30.0	30.8	9.5	21.3	3.25	0.96	40.7	20.2	10.7
18	140.4	137.0	0.395	6.95	26.1	21.1	6.51	51.0	30.0	29.9	8.9	21.0	3.36	1.00	40.5	19.4	10.5
19	140.5	136.9	0.450	7.92	26.5	21.5	6.58	50.8	30.0	29.3	8.5	20.8	3.45	1.03	40.4	18.9	10.4
20	140.4	136.6	0.512	9.01	26.8	21.8	6.66	50.5	30.0	28.7	8.2	20.5	3.50	1.06	40.3	18.5	10.3
21	139.5	135.5	0.567	9.98	27.0	22.0	6.73	50.1	30.0	28.1	8.0	20.1	3.52	1.09	40.1	18.1	10.1
22	139.0	134.8	0.623	10.97	27.2	22.2	6.80	49.8	30.0	27.6	7.8	19.8	3.54	1.12	39.9	17.7	9.9
23	138.4	133.9	0.678	11.93	27.3	22.3	6.88	49.5	30.0	27.2	7.7	19.5	3.53	1.15	39.7	17.4	9.7
24	137.0	132.3	0.739	13.01	27.4	22.4	6.96	49.0	30.0	26.6	7.6	19.0	3.50	1.18	39.5	17.1	9.5
25	136.6	131.7	0.795	13.99	27.4	22.4	7.04	48.7	30.0	26.3	7.6	18.7	3.46	1.20	39.3	16.9	9.3
26	135.5	130.4	0.850	14.96	27.5	22.5	7.12	48.3	30.0	25.8	7.5	18.3	3.44	1.23	39.2	16.7	9.2

Notes: 1. Deviator load corrected for membrane and filter cage (if applicable) effects.
2. Right Cylinder Correction Method



Description of Sample:	Gray, elastic SILT, trace sand, contains mica, MH				
Boring :	10BH-020A	Depth:	24'-26'	Stratum:	D2

Probable Preconsolidation Stress (tsf)	2.1
Approximate Overburden Stress (tsf):	0.8
Compression Ratio (from 4 to 16 tsf):	0.260
Recompression Ratio (from 1 to 2 tsf):	0.013

Schnabel ENGINEERING

CONSOLIDATION TEST

Project:	MLK Expressway Extension Portsmouth, Virginia
Contract Number:	10613051

Consolidation Test Results
(Sequence 3) Load 0.500 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-020A
Depth: 24'-26'
Sample Type: Undisturbed

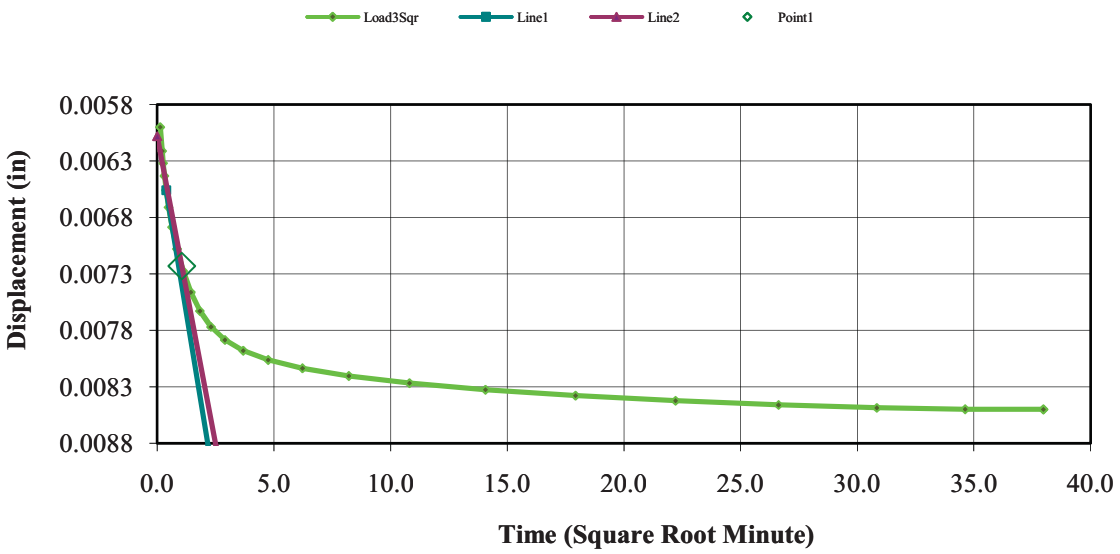
Soil Description: Gray, elastic SILT, trace sand, contains mica, MH
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0049	0.0045	0.4500	1.3002
1	00:00:01	0.0060	0.0056	0.5600	1.2977
2	00:00:02	0.0061	0.0057	0.5700	1.2974
3	00:00:03	0.0062	0.0058	0.5800	1.2972
4	00:00:04	0.0064	0.0060	0.6000	1.2967
5	00:00:05	0.0064	0.0060	0.6000	1.2967
6	00:00:06	0.0065	0.0061	0.6100	1.2965
7	00:00:12	0.0067	0.0063	0.6300	1.2960
8	00:00:15	0.0068	0.0064	0.6400	1.2958
9	00:00:30	0.0071	0.0067	0.6700	1.2951
10	00:01:00	0.0075	0.0071	0.7100	1.2942
11	00:02:00	0.0076	0.0072	0.7200	1.2940
12	00:04:00	0.0079	0.0075	0.7500	1.2933
13	00:05:00	0.0079	0.0075	0.7500	1.2933
14	00:08:01	0.0080	0.0076	0.7600	1.2930
15	00:10:01	0.0080	0.0076	0.7600	1.2930
16	00:15:01	0.0081	0.0077	0.7700	1.2928
17	00:30:02	0.0082	0.0078	0.7800	1.2926
18	01:00:04	0.0083	0.0079	0.7900	1.2923
19	02:00:09	0.0083	0.0079	0.7900	1.2923
20	04:00:17	0.0084	0.0080	0.8000	1.2921
21	08:00:34	0.0084	0.0080	0.8000	1.2921
22	12:00:51	0.0085	0.0081	0.8100	1.2919
23	16:01:08	0.0085	0.0081	0.8100	1.2919
24	20:01:24	0.0085	0.0081	0.8100	1.2919
25	24:01:41	0.0085	0.0081	0.8100	1.2919
26	24:01:41	0.0085	0.0081	0.8100	1.2919

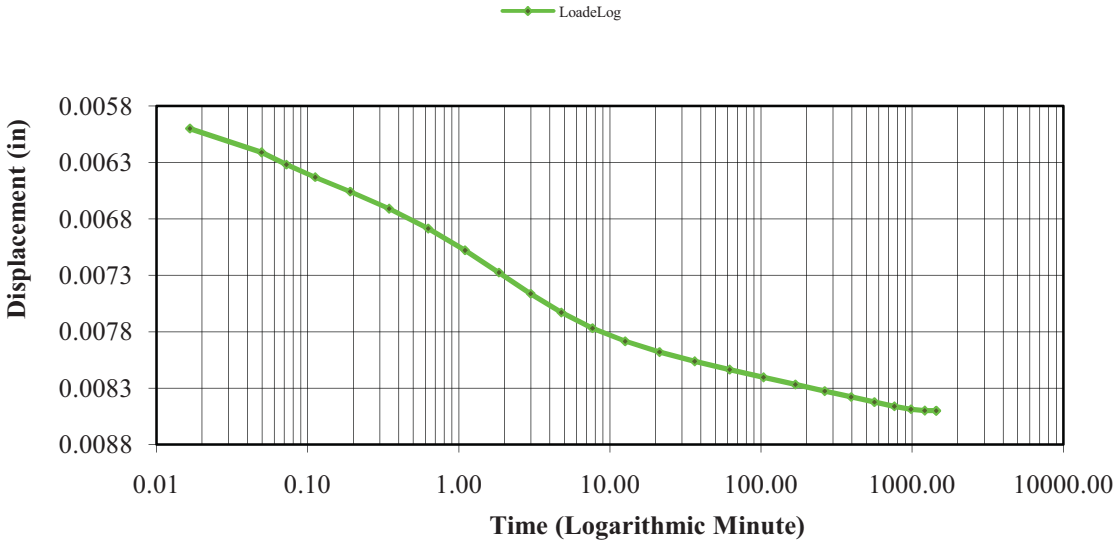
Tested By: **Checked By:**

Consolidation Test Results
(Sequence 3) Load 0.500 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)



Consolidation Test Results
(Sequence 5) Load 2.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-020A
Depth: 24'-26'
Sample Type: Undisturbed

Soil Description: Gray, elastic SILT, trace sand, contains mica, MH
Remarks:

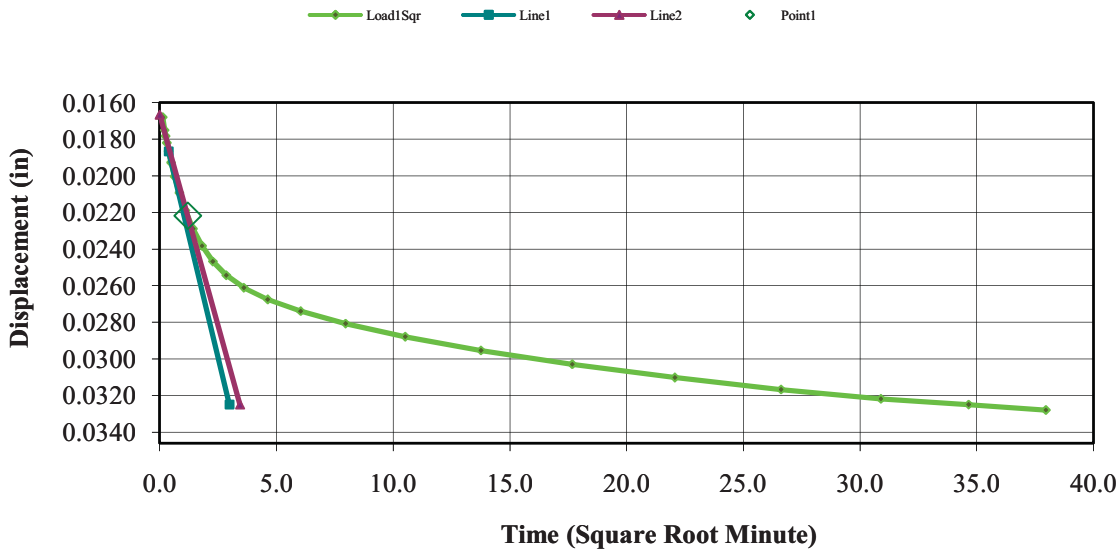
Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0149	0.0145	1.4500	1.2771
1	00:00:01	0.0168	0.0164	1.6400	1.2727
2	00:00:02	0.0172	0.0168	1.6800	1.2718
3	00:00:03	0.0176	0.0172	1.7200	1.2709
4	00:00:04	0.0179	0.0175	1.7500	1.2702
5	00:00:05	0.0181	0.0177	1.7700	1.2697
6	00:00:06	0.0183	0.0179	1.7900	1.2692
7	00:00:12	0.0192	0.0188	1.8800	1.2672
8	00:00:15	0.0196	0.0192	1.9200	1.2662
9	00:00:30	0.0208	0.0204	2.0400	1.2635
10	00:01:00	0.0223	0.0219	2.1900	1.2600
11	00:02:01	0.0238	0.0234	2.3400	1.2565
12	00:04:01	0.0251	0.0247	2.4700	1.2535
13	00:05:01	0.0254	0.0250	2.5000	1.2528
14	00:08:01	0.0261	0.0257	2.5700	1.2512
15	00:10:01	0.0264	0.0260	2.6000	1.2505
16	00:15:01	0.0268	0.0264	2.6400	1.2496
17	00:30:02	0.0277	0.0273	2.7300	1.2475
18	01:00:05	0.0286	0.0282	2.8200	1.2454
19	02:00:09	0.0293	0.0289	2.8900	1.2438
20	04:00:17	0.0302	0.0298	2.9800	1.2417
21	08:00:34	0.0311	0.0307	3.0700	1.2397
22	12:00:51	0.0318	0.0314	3.1400	1.2380
23	16:01:08	0.0323	0.0319	3.1900	1.2369
24	20:01:25	0.0325	0.0321	3.2100	1.2364
25	24:01:42	0.0328	0.0324	3.2400	1.2357

Tested By:

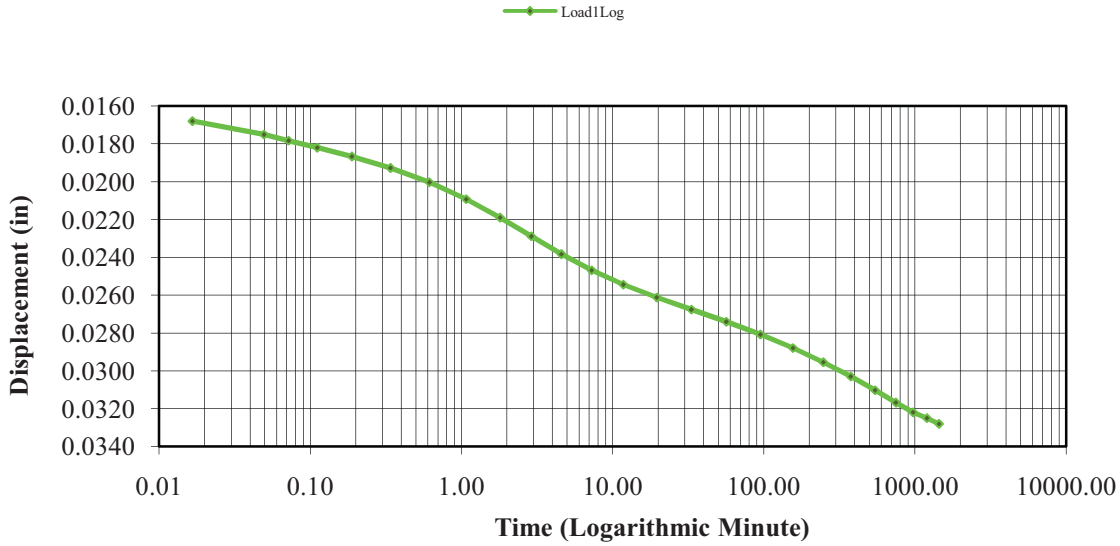
Checked By:

Consolidation Test Results
(Sequence 5) Load 2.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)



Consolidation Test Results
(Sequence 6) Load 4.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-020A
Depth: 24'-26'
Sample Type: Undisturbed

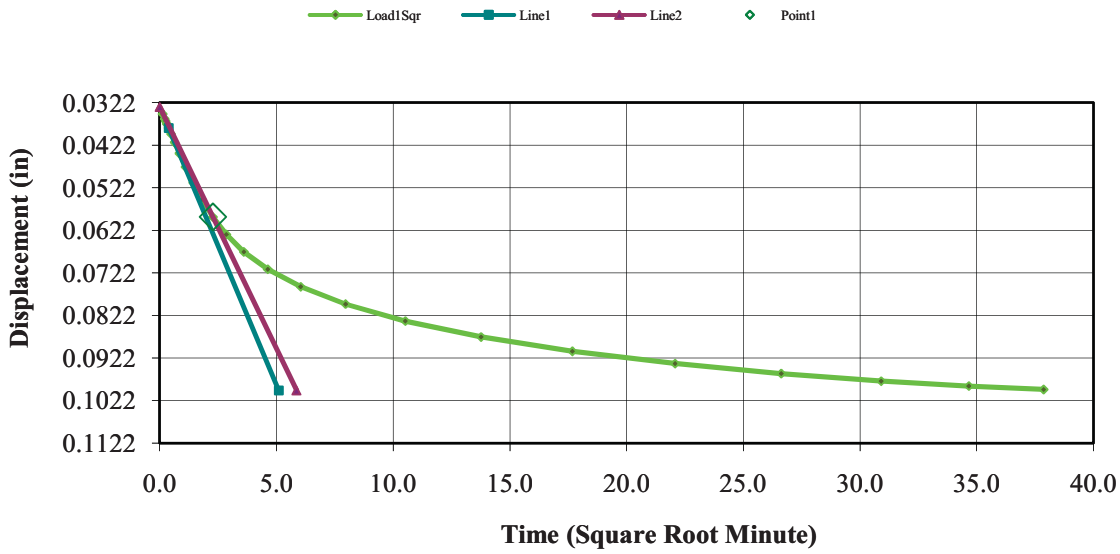
Soil Description: Gray, elastic SILT, trace sand, contains mica, MH
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0328	0.0324	3.2400	1.2357
1	00:00:01	0.0349	0.0345	3.4500	1.2309
2	00:00:02	0.0356	0.0352	3.5200	1.2293
3	00:00:03	0.0362	0.0358	3.5800	1.2279
4	00:00:04	0.0365	0.0361	3.6100	1.2272
5	00:00:05	0.0370	0.0366	3.6600	1.2260
6	00:00:06	0.0373	0.0369	3.6900	1.2253
7	00:00:12	0.0391	0.0387	3.8700	1.2212
8	00:00:15	0.0397	0.0393	3.9300	1.2198
9	00:00:30	0.0426	0.0422	4.2200	1.2131
10	00:01:00	0.0466	0.0462	4.6200	1.2038
11	00:02:00	0.0520	0.0516	5.1600	1.1914
12	00:04:01	0.0588	0.0584	5.8400	1.1757
13	00:05:01	0.0612	0.0608	6.0800	1.1701
14	00:08:01	0.0664	0.0660	6.6000	1.1581
15	00:10:01	0.0688	0.0684	6.8400	1.1526
16	00:15:01	0.0729	0.0725	7.2500	1.1431
17	00:30:02	0.0788	0.0784	7.8400	1.1294
18	01:00:05	0.0835	0.0831	8.3100	1.1186
19	02:00:09	0.0875	0.0871	8.7100	1.1093
20	04:00:17	0.0909	0.0905	9.0500	1.1015
21	08:00:34	0.0941	0.0937	9.3700	1.0941
22	12:00:51	0.0963	0.0959	9.5900	1.0890
23	16:01:08	0.0979	0.0975	9.7500	1.0853
24	20:01:25	0.0988	0.0984	9.8400	1.0832
25	23:53:45	0.0996	0.0992	9.9200	1.0814

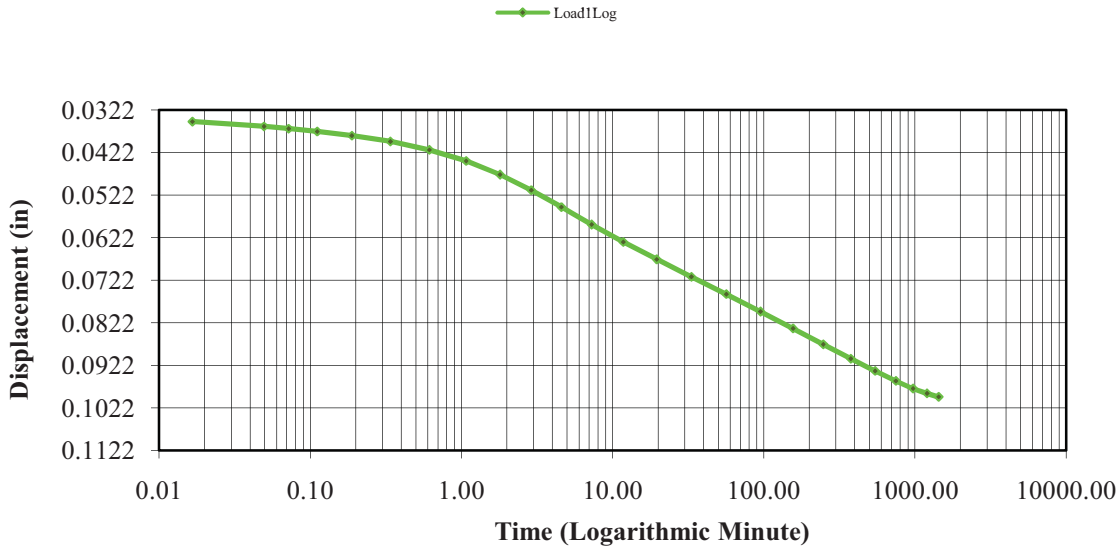
Tested By: **Checked By:**

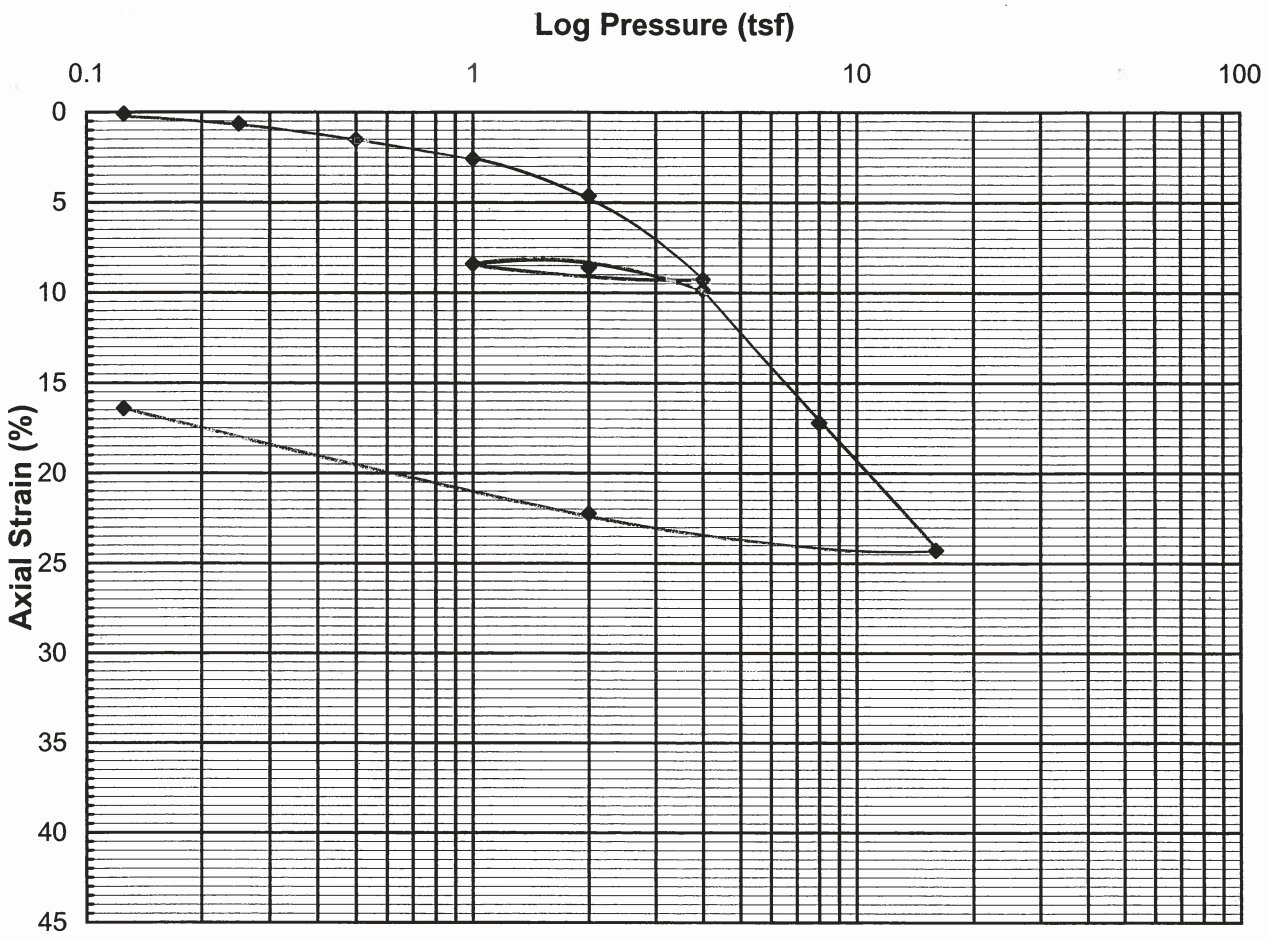
Consolidation Test Results
(Sequence 6) Load 4.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)





Probable Preconsolidation Pressure (Pp), tsf: *2.8*		**Recompression Ratio (Cer):**	*0.030*
Type of Specimen: *Tube Sample*		**Compression Ratio (Cec):**	*0.260*
Description: *ELASTIC SILT (MH), contains mica - gray*		**Initial**	**Final**
		Water Content, %	*50.1* / *38.1*
LL: *55* **PI:** *25* **Gs:** *2.64* **P_o' (tsf):** *0.90*		**Void Ratio**	*1.33* / *0.95*
% < No. 200: *86.1* **Test Method:** *ASTM D2435 Method A*		**Saturation, %**	*99* / *100*
Test Condition: *Inundated @ 0.05 tsf*		**Dry Unit Weight, pcf**	*70.6* / *84.4*
Remarks:	**Project:** MLK Expressway Extension		
Average Water Content of Trimmings, %: *47.5*	**Location** *Portsmouth, VA*		
Schnabel ENGINEERING	**Boring:** *10BH-020A*	**Schnabel No.** *10613051*	
	Depth: *28-30 ft.*	**Elevation:** *-16.8 to -18.8 ft.*	
	Date: *9/16/2010*	**Reviewed by:** *CJS*	
	Consolidation Test Report		

Schnabel ENGINEERING

Consolidation Time Curves

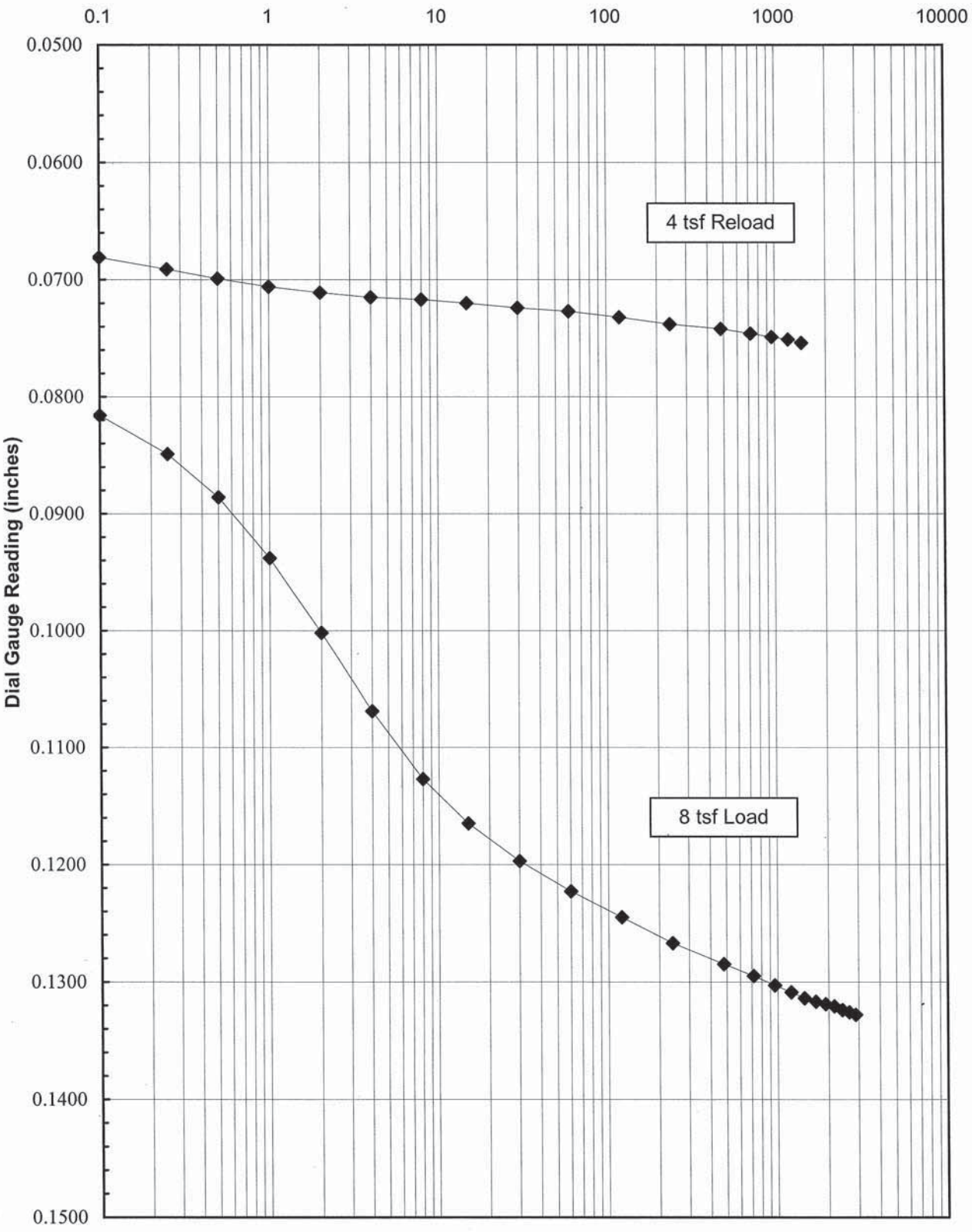
9/16/10

Project: MLK Expressway Extension

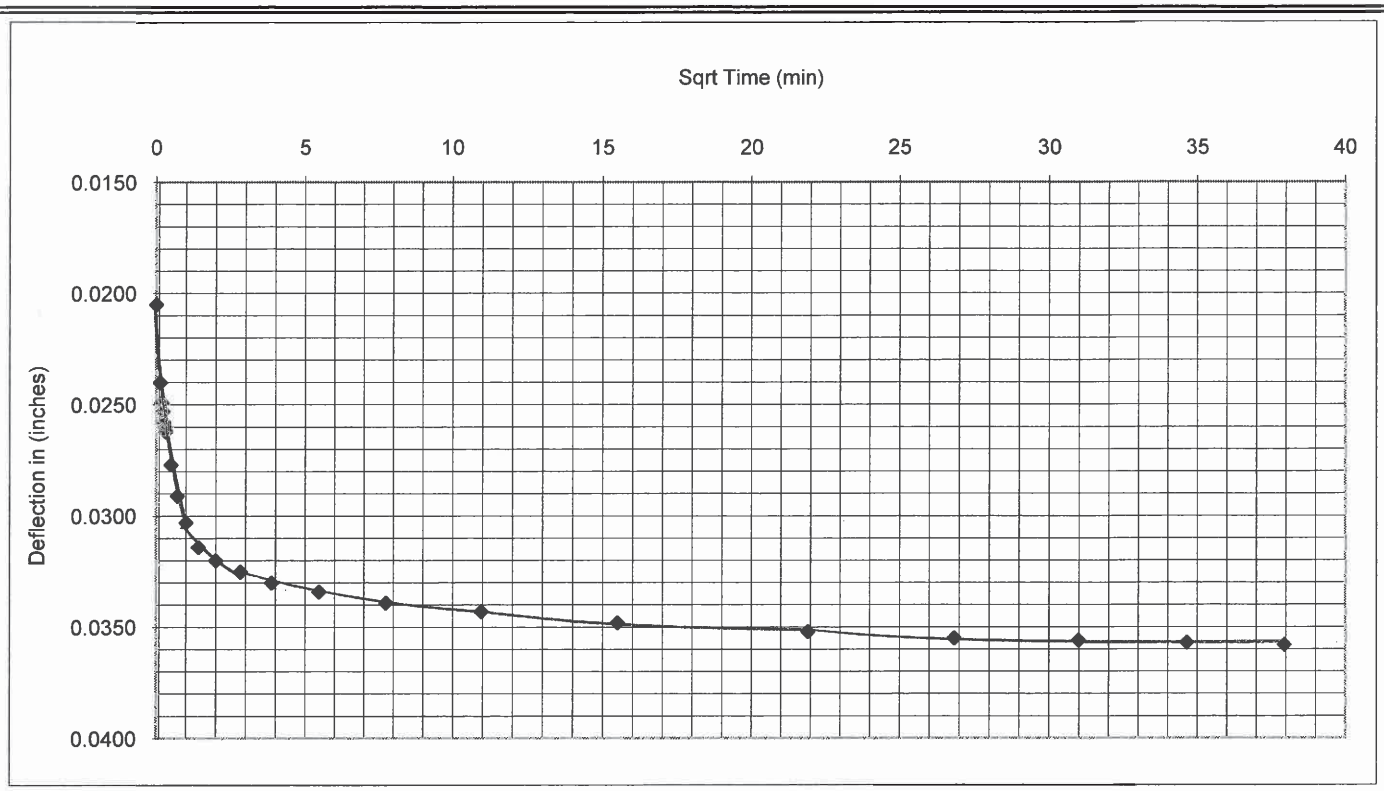
Schnabel Contract: 10613051

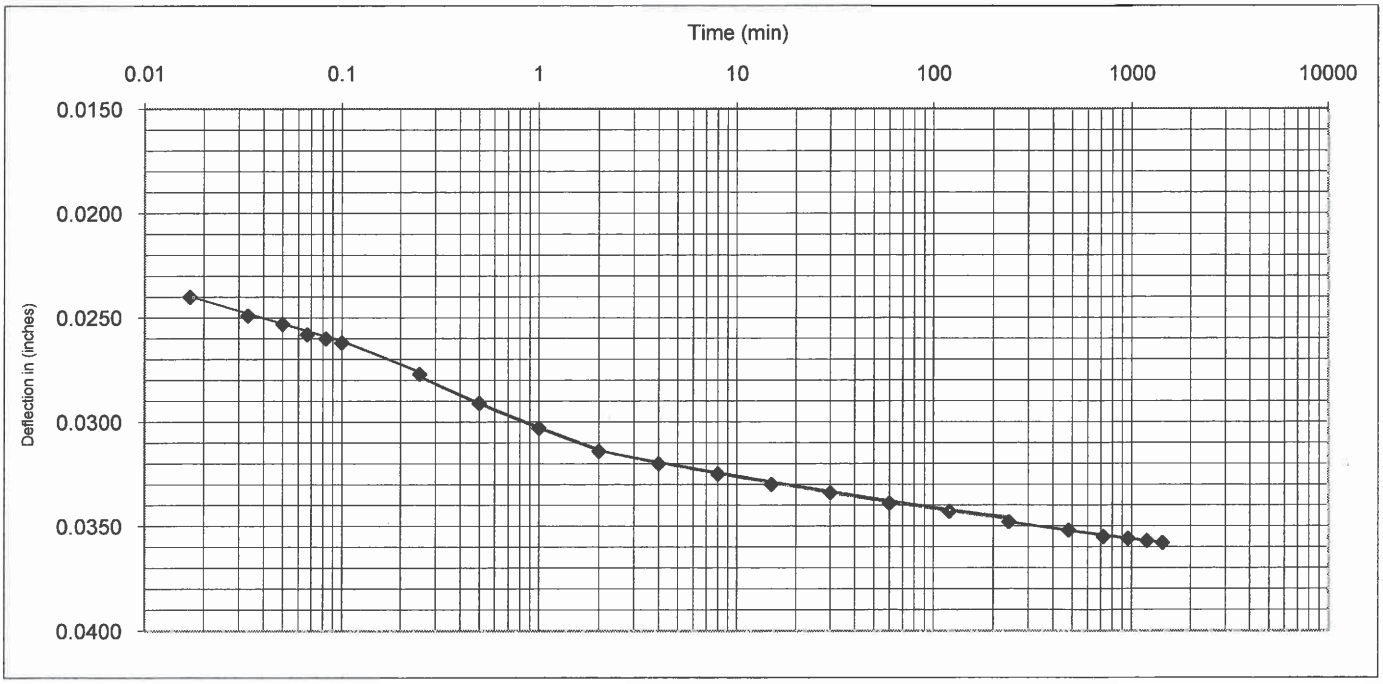
Boring No.: 10BH-020A Depth: 28-30 ft.

Reviewed by: CJS Test Drainage Conditions: Double



Consol 5/2007 Rev. 4





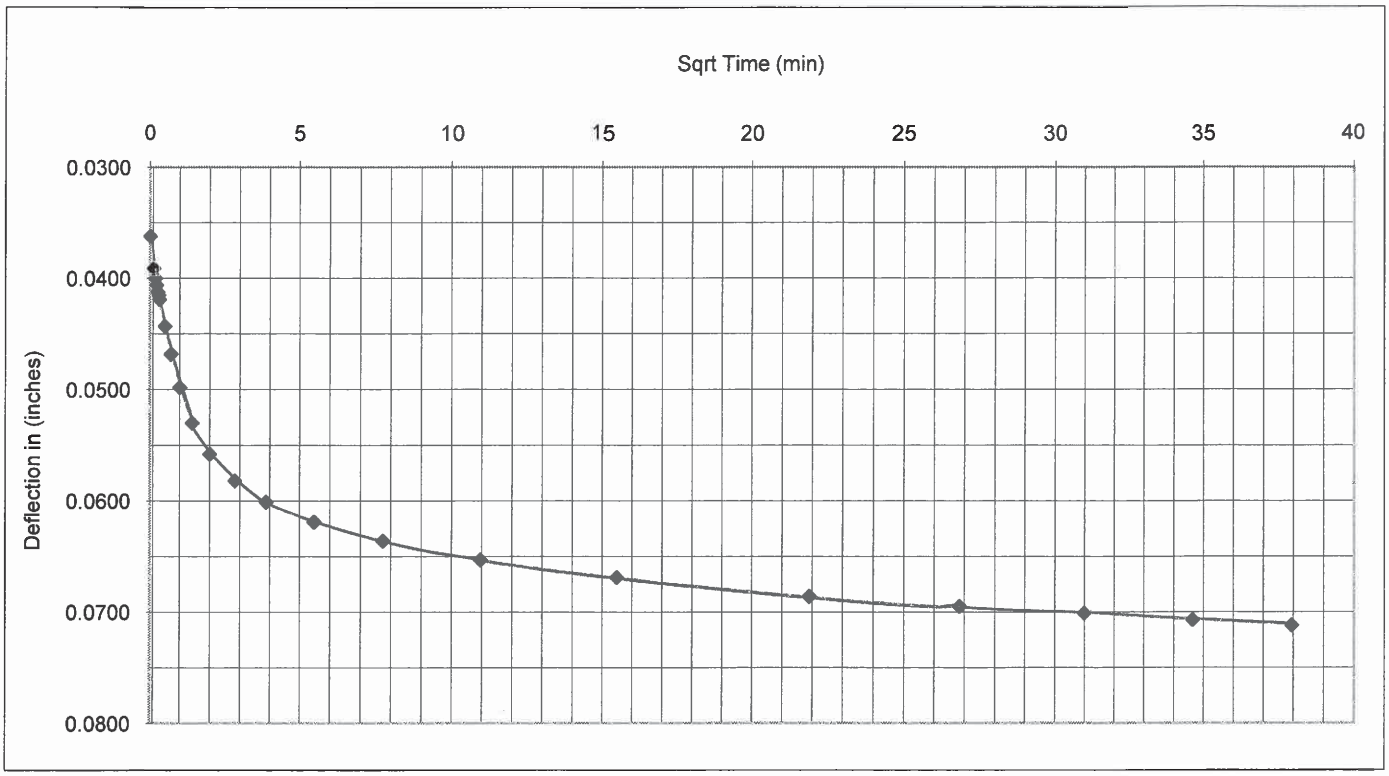
Description of Sample:	ELASTIC SILT (MH), contains mica - gray

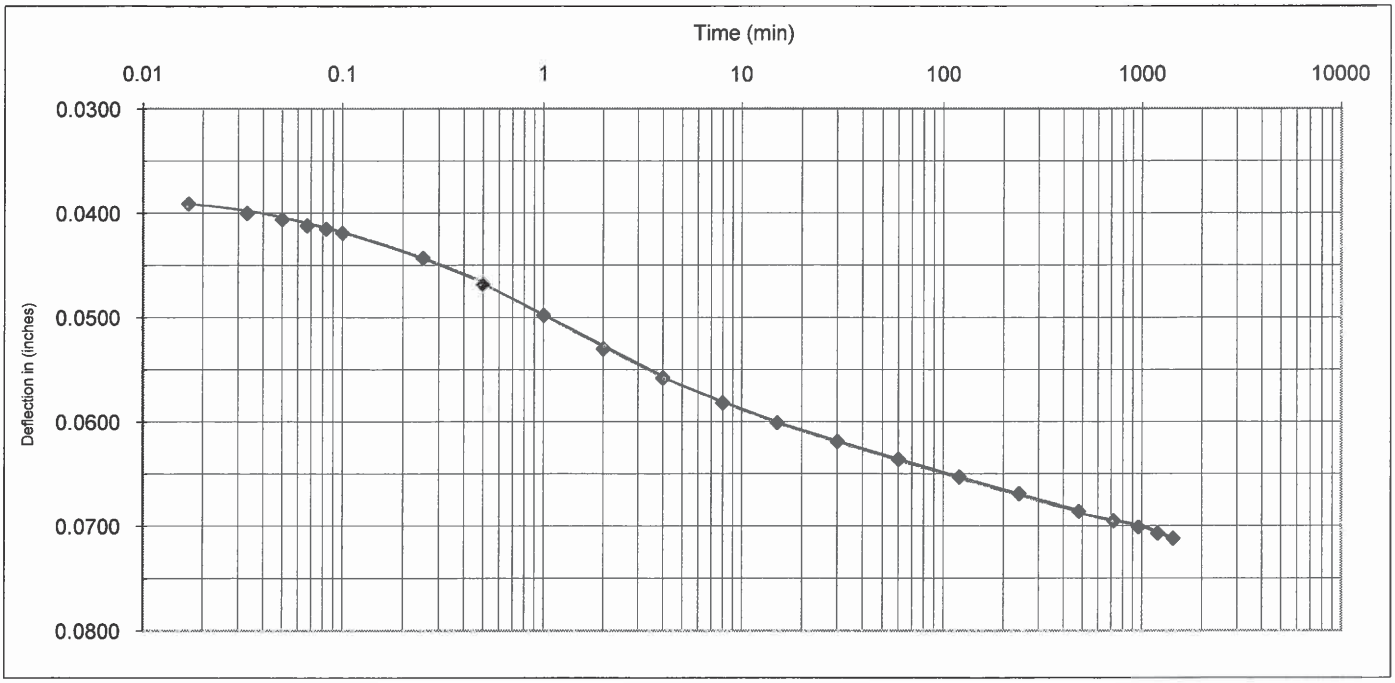
Schnabel ENGINEERING

TIME-COMPRESSION CURVE

Boring :	10BH-020A	Depth:	28'-30'	Stratum:	D2
Load (tsf)					2.0
Coefficient of Consolidation (sqrt t in^2/min)					
Coefficient of Consolidation (log t in^2/min)					
Coefficient of Secondary Compression					

Project:	MLK Expressway Portsmouth, Virginia
Contract Number:	10613051





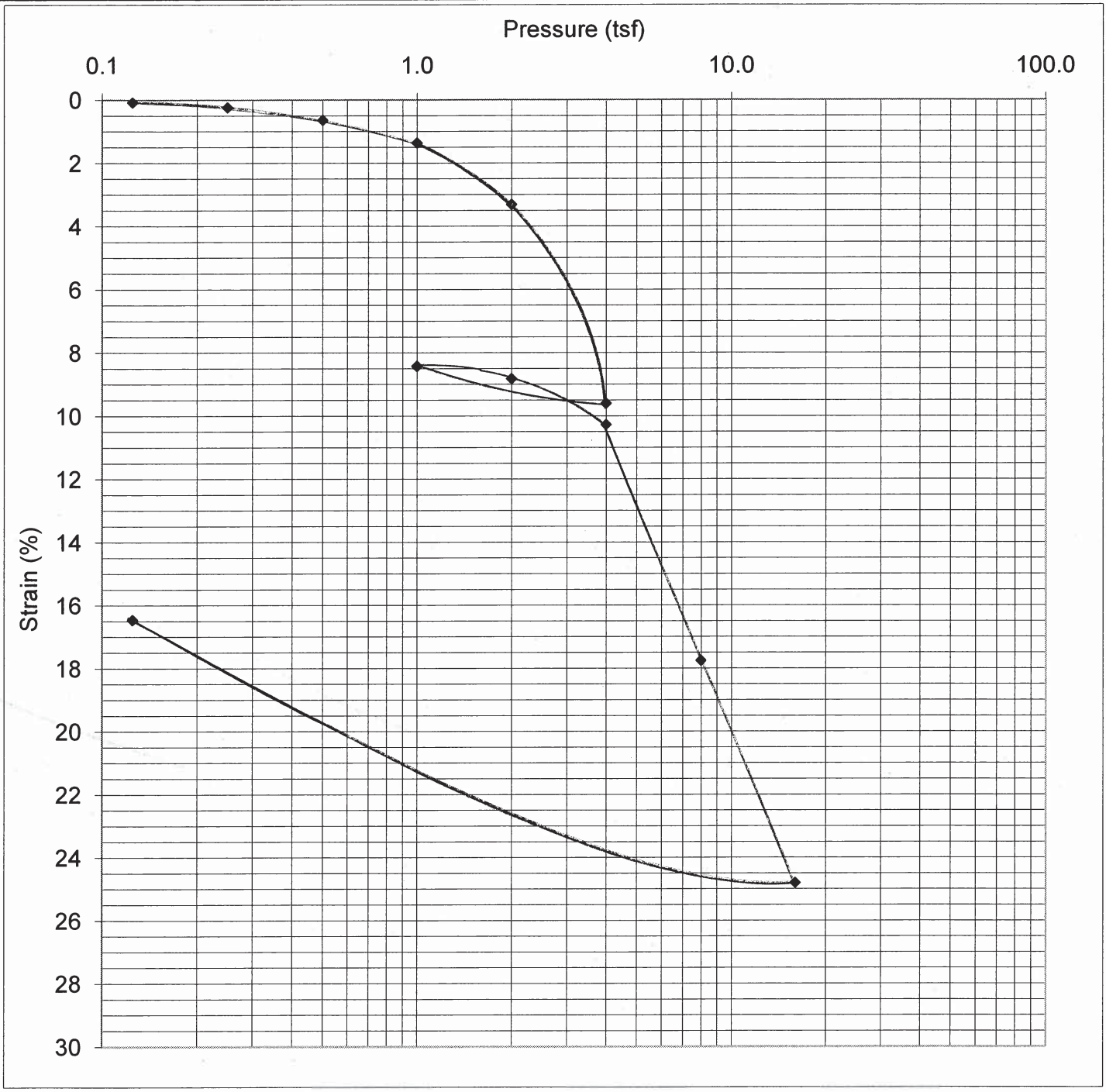
Description of Sample:	ELASTIC SILT (MH), contains mica gray

Schnabel ENGINEERING

TIME-COMPRESSION CURVE

Boring :	10BH-020A	Depth:	28'-30'	Stratum:	D2
Load (tsf)					4.0
Coefficient of Consolidation (sqrt t in^2/min)					
Coefficient of Consolidation (log t in^2/min)					
Coefficient of Secondary Compression					

Project:	MLK Expressway Portsmouth, Virginia
Contract Number:	10613051



Description of Sample:	Gray, elastic SILT, trace sand, MH				
Boring :	10BH-023A	Depth:	23'-25'	Stratum:	D2

Probable Preconsolidation Stress (tsf)	2.2
Approximate Overburden Stress (tsf):	0.7
Compression Ratio (from 4 to 16 tsf):	0.270
Recompression Ratio (from 1 to 2 tsf):	0.017

Schnabel ENGINEERING

CONSOLIDATION TEST

Project:	MLK Expressway Extension Portsmouth, Virginia
Contract Number:	10613051

Consolidation Test Results
(Sequence 3) Load 0.500 tsf

Project: MLK Expressway
Location: Portsmouth, VA
10613051

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-023A
Depth: 23'-25'
Sample Type: Undisturbed

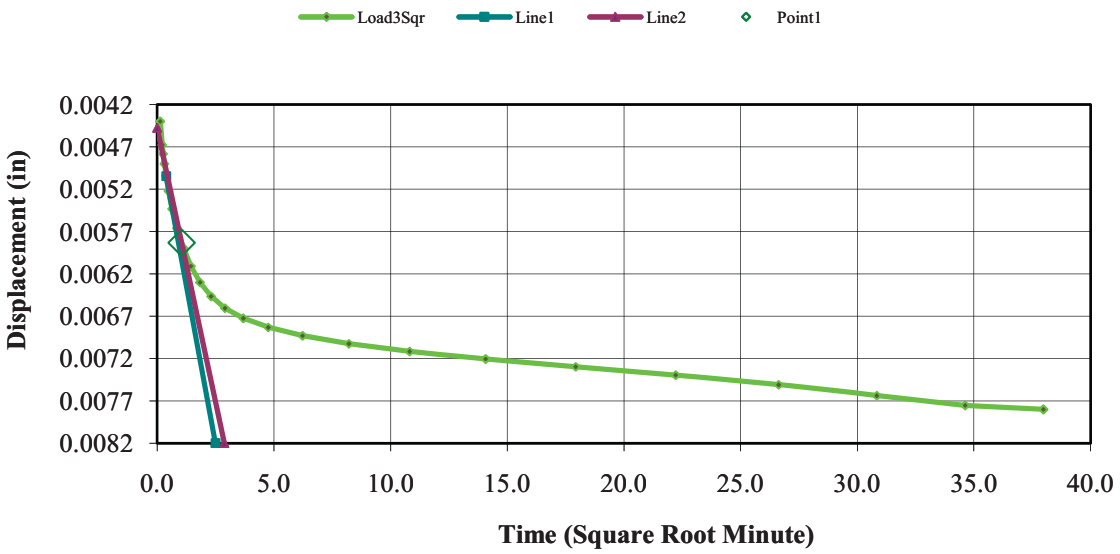
Soil Description:
Gray, elastic SILT, trace sand, MH
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0038	0.0024	0.2400	1.2828
1	00:00:01	0.0044	0.0030	0.3000	1.2814
2	00:00:02	0.0046	0.0032	0.3200	1.2809
3	00:00:03	0.0047	0.0033	0.3300	1.2807
4	00:00:04	0.0048	0.0034	0.3400	1.2805
5	00:00:05	0.0049	0.0035	0.3500	1.2802
6	00:00:06	0.0049	0.0035	0.3500	1.2802
7	00:00:12	0.0052	0.0038	0.3800	1.2796
8	00:00:15	0.0054	0.0040	0.4000	1.2791
9	00:00:30	0.0057	0.0043	0.4300	1.2784
10	00:01:00	0.0061	0.0047	0.4700	1.2775
11	00:02:01	0.0064	0.0050	0.5000	1.2768
12	00:04:01	0.0065	0.0051	0.5100	1.2766
13	00:05:01	0.0066	0.0052	0.5200	1.2763
14	00:08:02	0.0067	0.0053	0.5300	1.2761
15	00:10:02	0.0068	0.0054	0.5400	1.2759
16	00:15:03	0.0069	0.0055	0.5500	1.2757
17	00:30:05	0.0070	0.0056	0.5600	1.2754
18	01:00:11	0.0071	0.0057	0.5700	1.2752
19	02:00:21	0.0072	0.0058	0.5800	1.2750
20	04:00:42	0.0073	0.0059	0.5900	1.2747
21	08:01:02	0.0073	0.0059	0.5900	1.2747
22	12:01:19	0.0074	0.0060	0.6000	1.2745
23	16:01:36	0.0077	0.0063	0.6300	1.2738
24	20:01:53	0.0078	0.0064	0.6400	1.2736
25	24:02:09	0.0078	0.0064	0.6400	1.2736
26	24:02:09	0.0078	0.0064	0.6400	1.2736

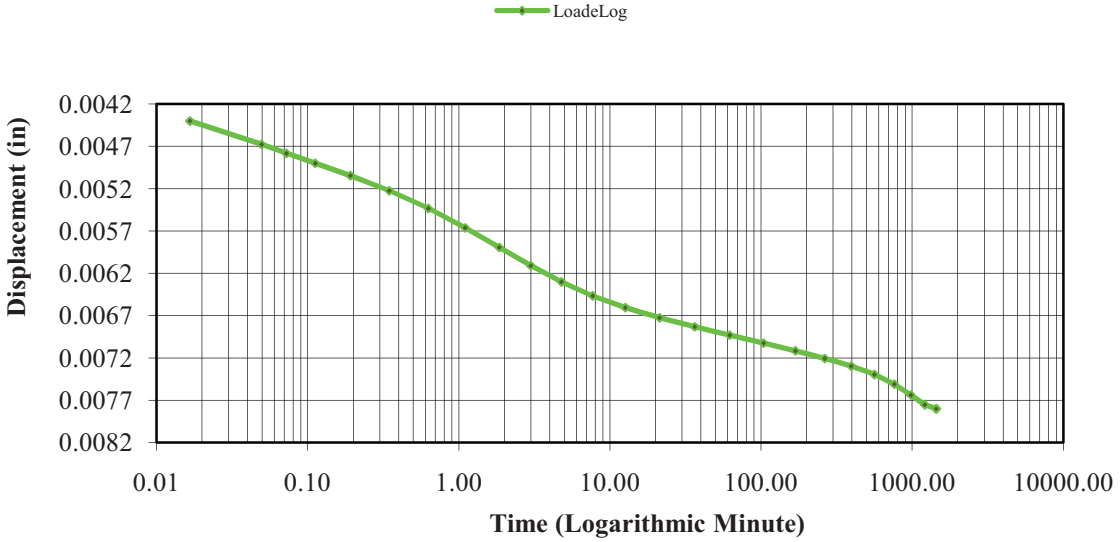
Tested By: **Checked By:**

Consolidation Test Results
(Sequence 3) Load 0.500 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)



Consolidation Test Results
(Sequence 5) Load 2.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-023A
Depth: 23'-25'
Sample Type: Undisturbed

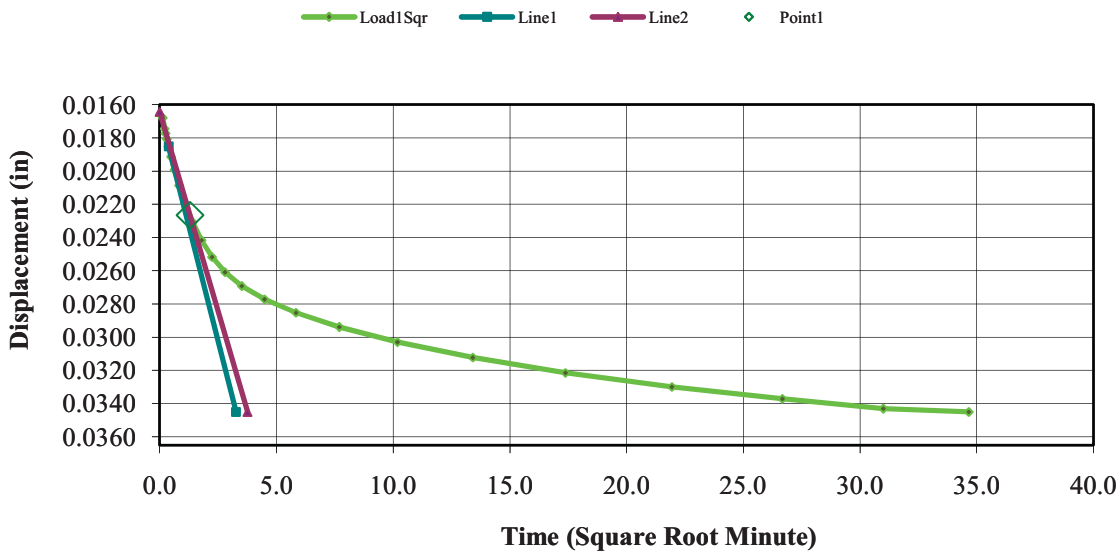
Soil Description: Gray, elastic SILT, trace sand, MH
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0150	0.0136	1.3600	1.2571
1	00:00:01	0.0168	0.0154	1.5400	1.2530
2	00:00:02	0.0172	0.0158	1.5800	1.2521
3	00:00:03	0.0176	0.0162	1.6200	1.2512
4	00:00:04	0.0177	0.0163	1.6300	1.2509
5	00:00:05	0.0179	0.0165	1.6500	1.2505
6	00:00:06	0.0182	0.0168	1.6800	1.2498
7	00:00:12	0.0191	0.0177	1.7700	1.2477
8	00:00:15	0.0193	0.0179	1.7900	1.2473
9	00:00:30	0.0207	0.0193	1.9300	1.2441
10	00:01:00	0.0223	0.0209	2.0900	1.2404
11	00:02:00	0.0240	0.0226	2.2600	1.2365
12	00:04:00	0.0256	0.0242	2.4200	1.2329
13	00:05:00	0.0260	0.0246	2.4600	1.2320
14	00:08:00	0.0269	0.0255	2.5500	1.2299
15	00:10:01	0.0272	0.0258	2.5800	1.2292
16	00:15:01	0.0279	0.0265	2.6500	1.2276
17	00:30:02	0.0289	0.0275	2.7500	1.2253
18	01:00:04	0.0301	0.0287	2.8700	1.2226
19	02:00:08	0.0311	0.0297	2.9700	1.2203
20	04:00:17	0.0321	0.0307	3.0700	1.2180
21	08:00:34	0.0332	0.0318	3.1800	1.2155
22	12:00:50	0.0337	0.0323	3.2300	1.2143
23	16:01:07	0.0343	0.0329	3.2900	1.2130
24	20:01:24	0.0345	0.0331	3.3100	1.2125

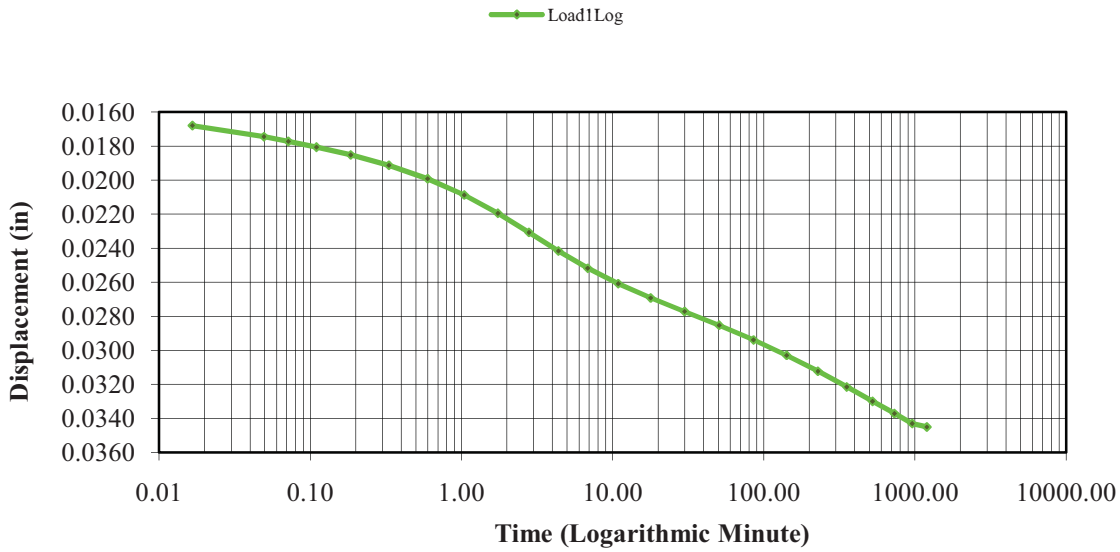
Tested By: **Checked By:**

Consolidation Test Results
(Sequence 5) Load 2.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)



Consolidation Test Results
(Sequence 6) Load 4.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-023A
Depth: 23'-25'
Sample Type: Undisturbed

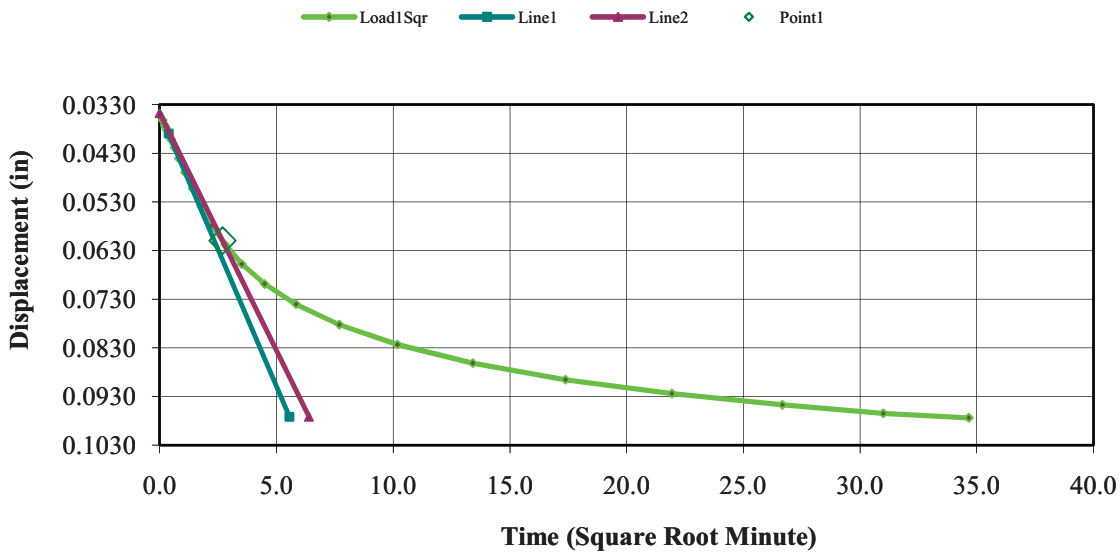
Soil Description:
Gray, elastic SILT, trace sand, MH
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0345	0.0331	3.3100	1.2125
1	00:00:01	0.0362	0.0348	3.4800	1.2086
2	00:00:02	0.0369	0.0355	3.5500	1.2070
3	00:00:03	0.0373	0.0359	3.5900	1.2061
4	00:00:04	0.0377	0.0363	3.6300	1.2052
5	00:00:05	0.0379	0.0365	3.6500	1.2047
6	00:00:06	0.0383	0.0369	3.6900	1.2038
7	00:00:12	0.0398	0.0384	3.8400	1.2004
8	00:00:15	0.0402	0.0388	3.8800	1.1995
9	00:00:30	0.0426	0.0412	4.1200	1.1940
10	00:01:00	0.0462	0.0448	4.4800	1.1857
11	00:02:00	0.0510	0.0496	4.9600	1.1748
12	00:04:00	0.0573	0.0559	5.5900	1.1603
13	00:05:00	0.0596	0.0582	5.8200	1.1551
14	00:08:00	0.0648	0.0634	6.3400	1.1432
15	00:10:00	0.0672	0.0658	6.5800	1.1377
16	00:15:01	0.0714	0.0700	7.0000	1.1281
17	00:30:02	0.0776	0.0762	7.6200	1.1139
18	01:00:04	0.0826	0.0812	8.1200	1.1024
19	02:00:08	0.0865	0.0851	8.5100	1.0935
20	04:00:17	0.0898	0.0884	8.8400	1.0860
21	08:00:34	0.0929	0.0915	9.1500	1.0789
22	12:00:50	0.0949	0.0935	9.3500	1.0743
23	16:01:07	0.0965	0.0951	9.5100	1.0706
24	20:01:24	0.0974	0.0960	9.6000	1.0686

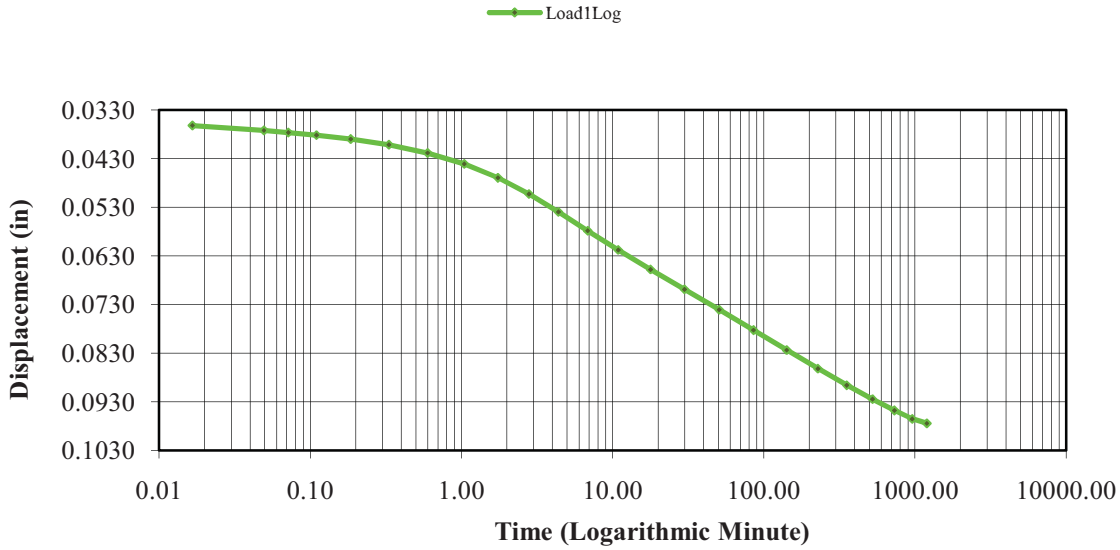
Tested By: **Checked By:**

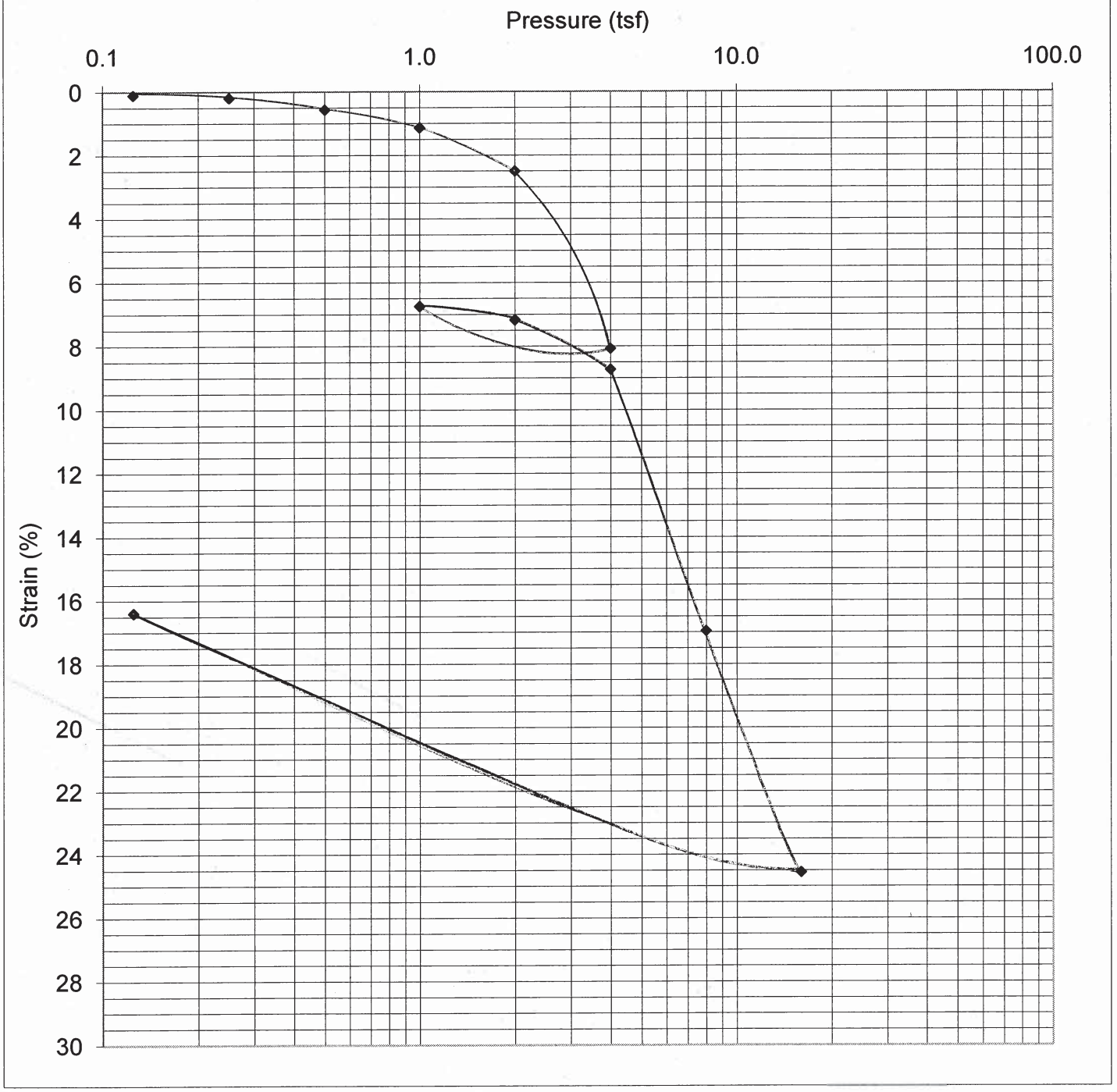
Consolidation Test Results
(Sequence 6) Load 4.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)





Description of Sample:	Gray, elastic Silt, trace sand, contains mica, MH

Boring :	10BH-023A	Depth:	28'-30'	Stratum:	D2

Probable Preconsolidation Stress (tsf)	2.5
Approximate Overburden Stress (tsf):	0.9
Compression Ratio (from 4 to 16 tsf):	0.280
Recompression Ratio (from 1 to 2 tsf):	0.012

Schnabel ENGINEERING

CONSOLIDATION TEST

Project:	MLK Expressway Extension Portsmouth, Virginia
Contract Number:	10613051

Consolidation Test Results
(Sequence 3) Load 0.500 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-023A
Depth: 28'-30'
Sample Type: Undisturbed

Soil Description:
Gray, elastic SILT, trace sand, contains mica, MH

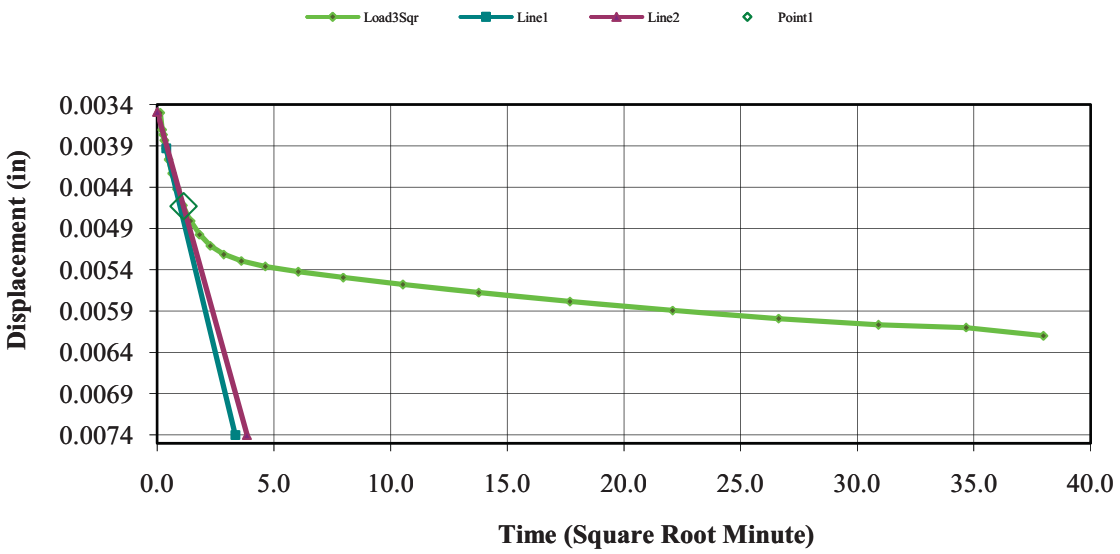
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0025	0.0019	0.1900	1.3062
1	00:00:01	0.0035	0.0029	0.2900	1.3039
2	00:00:02	0.0037	0.0031	0.3100	1.3034
3	00:00:03	0.0037	0.0031	0.3100	1.3034
4	00:00:04	0.0038	0.0032	0.3200	1.3032
5	00:00:05	0.0038	0.0032	0.3200	1.3032
6	00:00:06	0.0038	0.0032	0.3200	1.3032
7	00:00:12	0.0040	0.0034	0.3400	1.3027
8	00:00:15	0.0042	0.0036	0.3600	1.3023
9	00:00:30	0.0045	0.0039	0.3900	1.3016
10	00:01:00	0.0047	0.0041	0.4100	1.3011
11	00:02:00	0.0050	0.0044	0.4400	1.3004
12	00:04:01	0.0053	0.0047	0.4700	1.2997
13	00:05:01	0.0053	0.0047	0.4700	1.2997
14	00:08:01	0.0053	0.0047	0.4700	1.2997
15	00:10:02	0.0053	0.0047	0.4700	1.2997
16	00:15:03	0.0054	0.0048	0.4800	1.2995
17	00:30:05	0.0054	0.0048	0.4800	1.2995
18	01:00:11	0.0055	0.0049	0.4900	1.2993
19	02:00:21	0.0056	0.0050	0.5000	1.2990
20	04:00:42	0.0058	0.0052	0.5200	1.2986
21	08:01:01	0.0059	0.0053	0.5300	1.2984
22	12:01:18	0.0060	0.0054	0.5400	1.2981
23	16:01:35	0.0061	0.0055	0.5500	1.2979
24	20:01:52	0.0061	0.0055	0.5500	1.2979
25	24:02:09	0.0062	0.0056	0.5600	1.2977

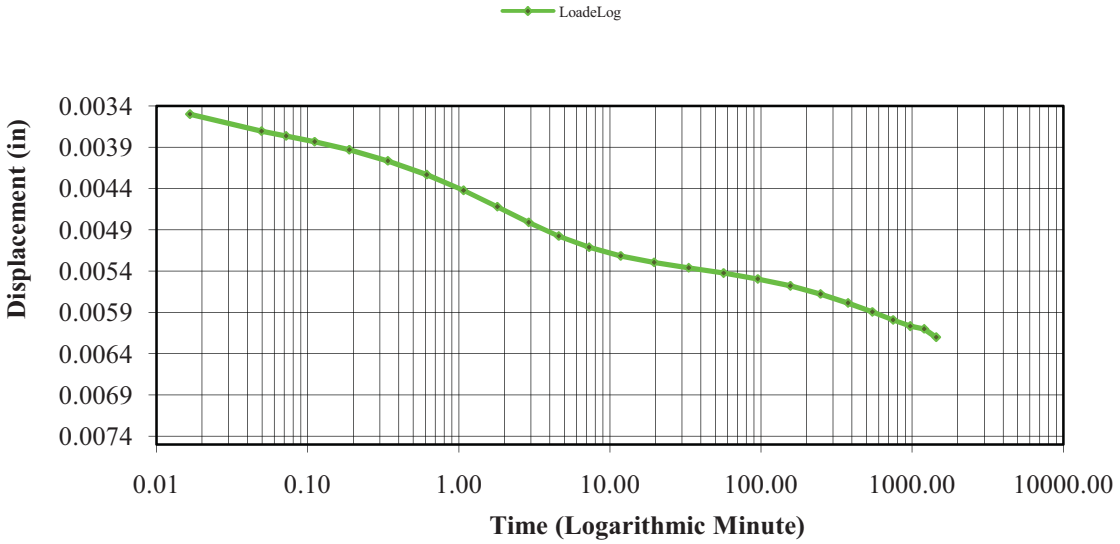
Tested By: **Checked By:**

Consolidation Test Results
(Sequence 3) Load 0.500 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)



Consolidation Test Results
(Sequence 5) Load 2.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-023A
Depth: 28'-30'
Sample Type: Undisturbed

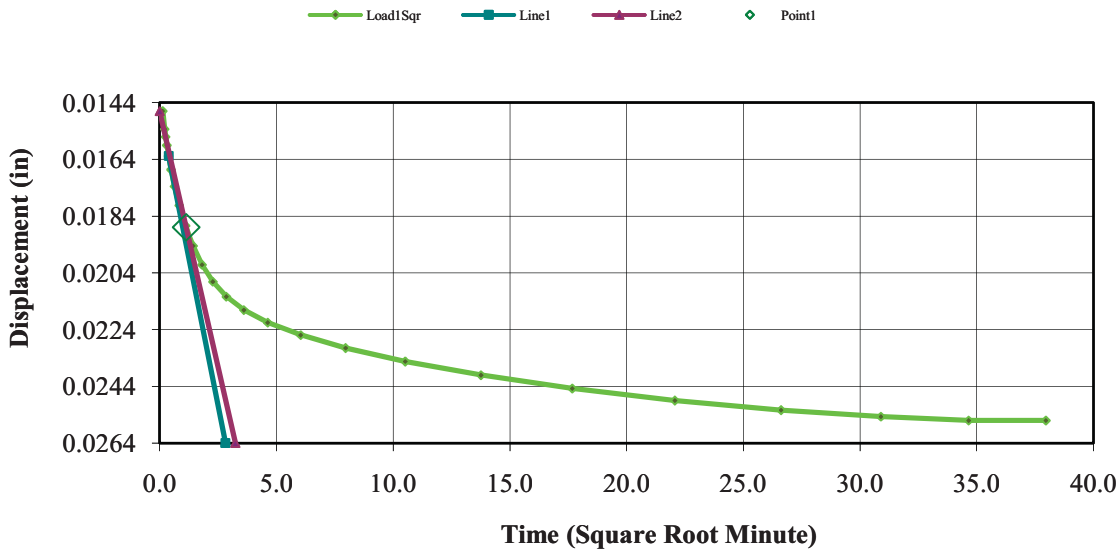
Soil Description:
Gray, elastic SILT, trace sand, contains mica, MH
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0119	0.0113	1.1300	1.2845
1	00:00:01	0.0147	0.0141	1.4100	1.2780
2	00:00:02	0.0150	0.0144	1.4400	1.2773
3	00:00:03	0.0155	0.0149	1.4900	1.2762
4	00:00:04	0.0157	0.0151	1.5100	1.2757
5	00:00:05	0.0158	0.0152	1.5200	1.2755
6	00:00:06	0.0159	0.0153	1.5300	1.2752
7	00:00:12	0.0167	0.0161	1.6100	1.2734
8	00:00:15	0.0172	0.0166	1.6600	1.2722
9	00:00:30	0.0181	0.0175	1.7500	1.2702
10	00:01:01	0.0190	0.0184	1.8400	1.2681
11	00:02:01	0.0201	0.0195	1.9500	1.2655
12	00:04:01	0.0210	0.0204	2.0400	1.2635
13	00:05:01	0.0213	0.0207	2.0700	1.2628
14	00:08:01	0.0216	0.0210	2.1000	1.2621
15	00:10:01	0.0219	0.0213	2.1300	1.2614
16	00:15:01	0.0222	0.0216	2.1600	1.2607
17	00:30:03	0.0229	0.0223	2.2300	1.2591
18	01:00:05	0.0234	0.0228	2.2800	1.2579
19	02:00:09	0.0238	0.0232	2.3200	1.2570
20	04:00:17	0.0245	0.0239	2.3900	1.2554
21	08:00:34	0.0251	0.0245	2.4500	1.2540
22	12:00:51	0.0253	0.0247	2.4700	1.2535
23	16:01:08	0.0255	0.0249	2.4900	1.2531
24	20:01:25	0.0256	0.0250	2.5000	1.2528
25	24:01:42	0.0256	0.0250	2.5000	1.2528

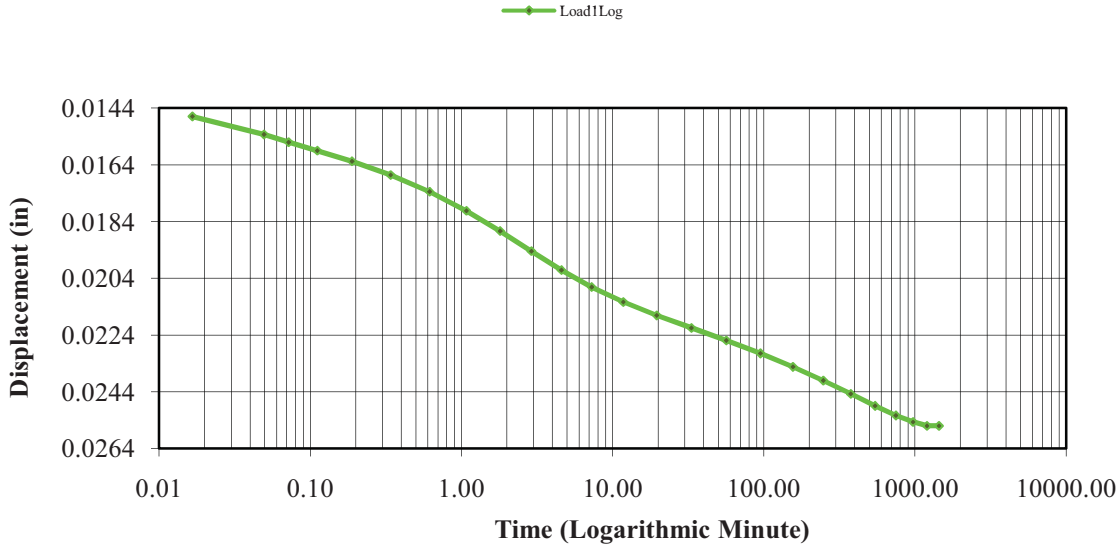
Tested By: **Checked By:**

Consolidation Test Results
(Sequence 5) Load 2.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)



Consolidation Test Results
(Sequence 6) Load 4.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-023A
Depth: 28'-30'
Sample Type: Undisturbed

Soil Description:
Gray, elastic SILT, trace sand, contains mica, MH

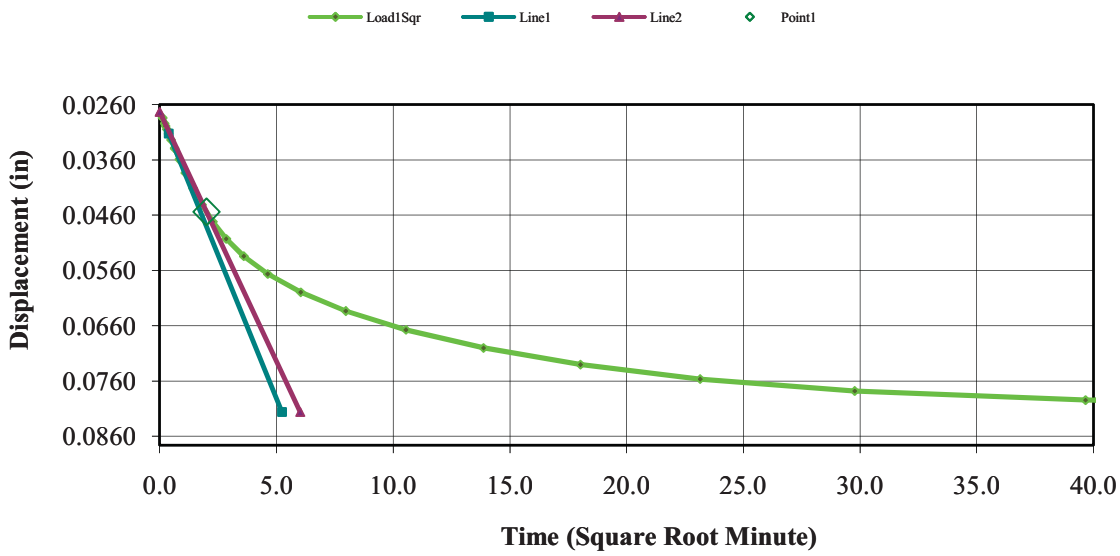
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0256	0.0250	2.5000	1.2528
1	00:00:01	0.0284	0.0278	2.7800	1.2464
2	00:00:02	0.0291	0.0285	2.8500	1.2447
3	00:00:03	0.0294	0.0288	2.8800	1.2441
4	00:00:04	0.0300	0.0294	2.9400	1.2427
5	00:00:05	0.0302	0.0296	2.9600	1.2422
6	00:00:06	0.0306	0.0300	3.0000	1.2413
7	00:00:12	0.0319	0.0313	3.1300	1.2383
8	00:00:15	0.0326	0.0320	3.2000	1.2367
9	00:00:30	0.0349	0.0343	3.4300	1.2313
10	00:01:00	0.0379	0.0373	3.7300	1.2244
11	00:02:00	0.0420	0.0414	4.1400	1.2149
12	00:04:00	0.0470	0.0464	4.6400	1.2034
13	00:05:00	0.0486	0.0480	4.8000	1.1997
14	00:08:00	0.0526	0.0520	5.2000	1.1904
15	00:10:01	0.0543	0.0537	5.3700	1.1865
16	00:15:01	0.0574	0.0568	5.6800	1.1794
17	00:30:02	0.0623	0.0617	6.1700	1.1680
18	01:00:04	0.0665	0.0659	6.5900	1.1583
19	02:00:08	0.0701	0.0695	6.9500	1.1500
20	04:00:17	0.0733	0.0727	7.2700	1.1426
21	08:00:34	0.0762	0.0756	7.5600	1.1359
22	12:00:51	0.0781	0.0775	7.7500	1.1315
23	16:01:08	0.0797	0.0791	7.9100	1.1278
24	20:01:25	0.0806	0.0800	8.0000	1.1257
25	24:01:41	0.0813	0.0807	8.0700	1.1241

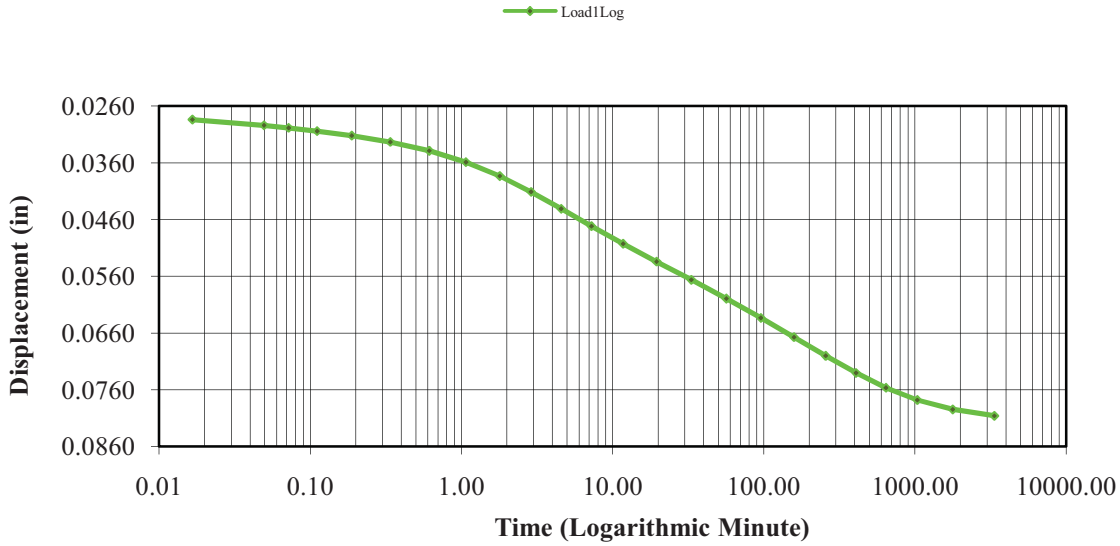
Tested By: **Checked By:**

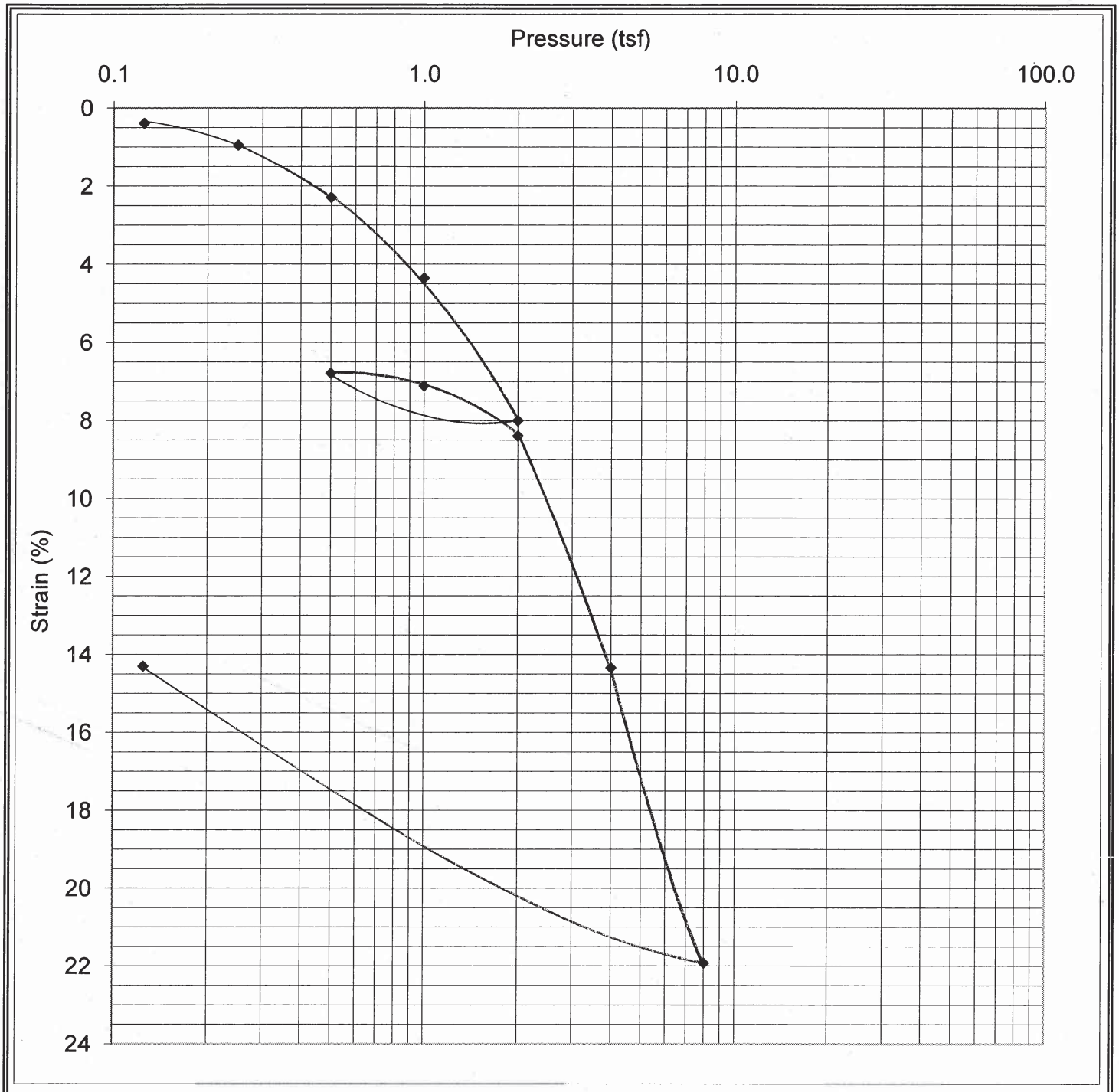
Consolidation Test Results
(Sequence 6) Load 4.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)





Description of Sample:	Gray, fat Clay with sand, CH				
Boring :	10BH-030A	Depth:	38'-40'	Stratum:	D2

Probable Preconsolidation Stress (tsf)	1.5
Approximate Overburden Stress (tsf):	1.2
Compression Ratio (from 2 to 8 tsf):	0.240
Recompression Ratio (from ½ to 1 tsf):	0.010

Schnabel ENGINEERING

CONSOLIDATION TEST

Project:	MLK Expressway Extension Portsmouth, Virginia
Contract Number:	10613051

Consolidation Test Results
(Sequence 3) Load 0.500 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-030A
Depth: 38'-40'
Sample Type: Undisturbed

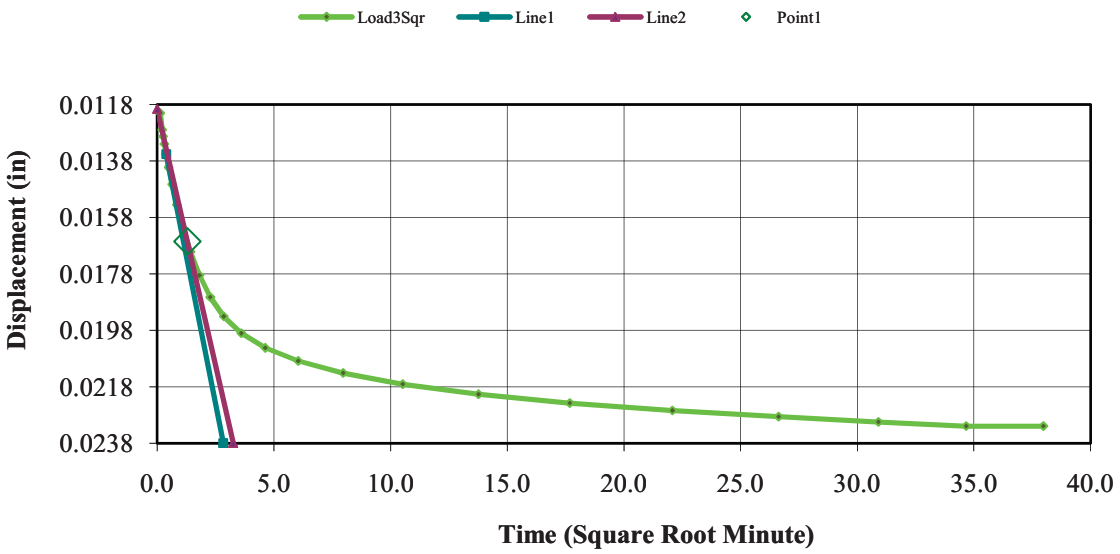
Soil Description: Gray, fat CLAY with sand, CH
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0098	0.0095	0.9500	1.4515
1	00:00:01	0.0121	0.0118	1.1800	1.4458
2	00:00:02	0.0125	0.0122	1.2200	1.4448
3	00:00:03	0.0128	0.0125	1.2500	1.4440
4	00:00:04	0.0129	0.0126	1.2600	1.4438
5	00:00:05	0.0131	0.0128	1.2800	1.4433
6	00:00:06	0.0133	0.0130	1.3000	1.4428
7	00:00:12	0.0139	0.0136	1.3600	1.4413
8	00:00:15	0.0143	0.0140	1.4000	1.4403
9	00:00:30	0.0152	0.0149	1.4900	1.4381
10	00:01:00	0.0163	0.0160	1.6000	1.4354
11	00:02:00	0.0176	0.0173	1.7300	1.4322
12	00:04:00	0.0190	0.0187	1.8700	1.4287
13	00:05:00	0.0193	0.0190	1.9000	1.4279
14	00:08:01	0.0200	0.0197	1.9700	1.4262
15	00:10:01	0.0203	0.0200	2.0000	1.4255
16	00:15:01	0.0208	0.0205	2.0500	1.4242
17	00:30:02	0.0212	0.0209	2.0900	1.4232
18	01:00:04	0.0217	0.0214	2.1400	1.4220
19	02:00:08	0.0221	0.0218	2.1800	1.4210
20	04:00:17	0.0225	0.0222	2.2200	1.4200
21	08:00:34	0.0227	0.0224	2.2400	1.4195
22	12:00:51	0.0228	0.0225	2.2500	1.4193
23	16:01:07	0.0231	0.0228	2.2800	1.4185
24	20:01:24	0.0232	0.0229	2.2900	1.4183
25	24:01:41	0.0232	0.0229	2.2900	1.4183

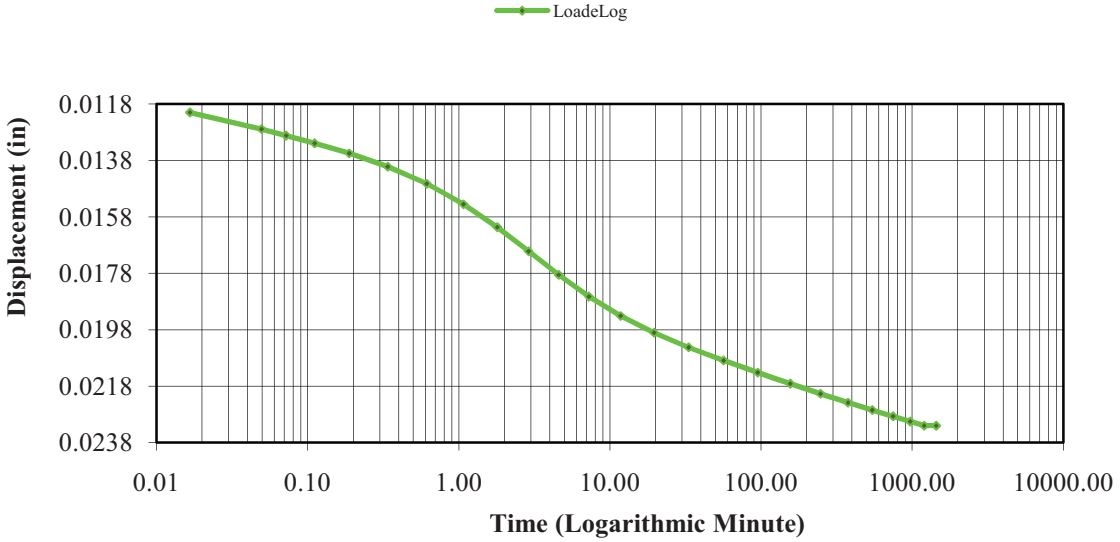
Tested By: **Checked By:**

Consolidation Test Results
(Sequence 3) Load 0.500 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)



Consolidation Test Results
(Sequence 5) Load 2.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-030A
Depth: 38'-40'
Sample Type: Undisturbed

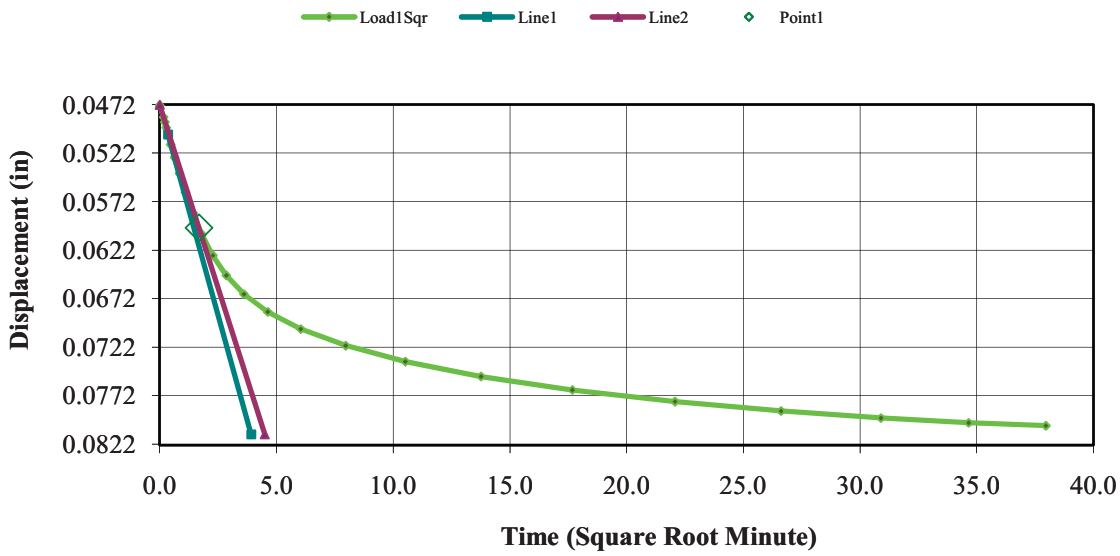
Soil Description: Gray, fat CLAY with sand, CH
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0438	0.0435	4.3500	1.3673
1	00:00:00	0.0473	0.0470	4.7000	1.3586
2	00:00:01	0.0481	0.0478	4.7800	1.3567
3	00:00:02	0.0487	0.0484	4.8400	1.3552
4	00:00:03	0.0490	0.0487	4.8700	1.3544
5	00:00:04	0.0495	0.0492	4.9200	1.3532
6	00:00:05	0.0497	0.0494	4.9400	1.3527
7	00:00:12	0.0512	0.0509	5.0900	1.3490
8	00:00:15	0.0517	0.0514	5.1400	1.3478
9	00:00:30	0.0536	0.0533	5.3300	1.3431
10	00:01:00	0.0561	0.0558	5.5800	1.3369
11	00:02:00	0.0594	0.0591	5.9100	1.3287
12	00:04:00	0.0632	0.0629	6.2900	1.3193
13	00:05:00	0.0643	0.0640	6.4000	1.3166
14	00:08:00	0.0666	0.0663	6.6300	1.3109
15	00:10:00	0.0677	0.0674	6.7400	1.3082
16	00:15:01	0.0694	0.0691	6.9100	1.3039
17	00:30:02	0.0718	0.0715	7.1500	1.2980
18	01:00:04	0.0736	0.0733	7.3300	1.2936
19	02:00:08	0.0753	0.0750	7.5000	1.2893
20	04:00:17	0.0768	0.0765	7.6500	1.2856
21	08:00:33	0.0780	0.0777	7.7700	1.2827
22	12:00:50	0.0790	0.0787	7.8700	1.2802
23	16:01:07	0.0796	0.0793	7.9300	1.2787
24	20:01:24	0.0800	0.0797	7.9700	1.2777
25	24:01:41	0.0803	0.0800	8.0000	1.2770

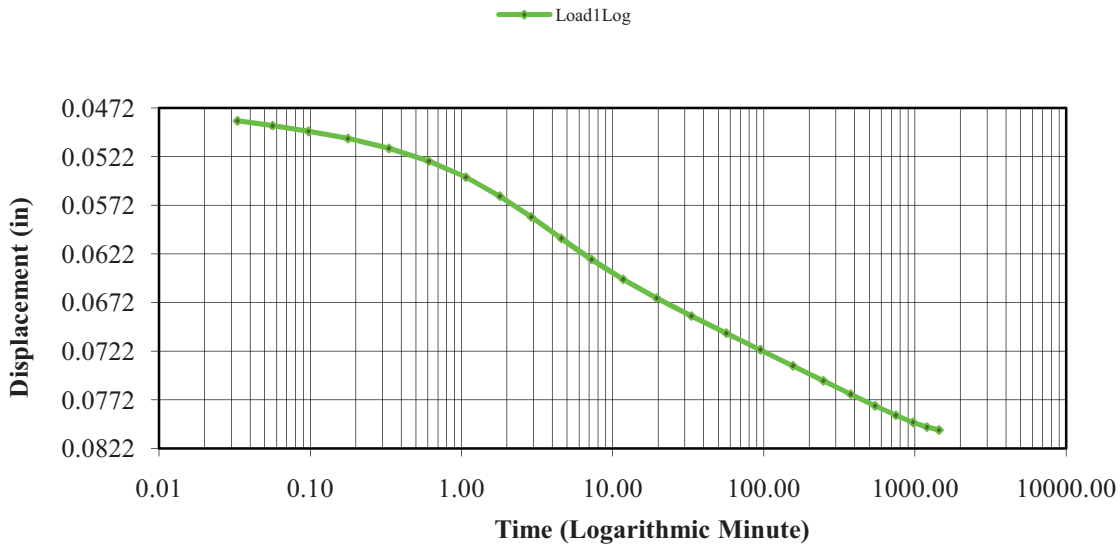
Tested By: **Checked By:**

Consolidation Test Results
(Sequence 5) Load 2.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)



Consolidation Test Results
(Sequence 9) Load 4.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-030A
Depth: 38'-40'
Sample Type: Undisturbed

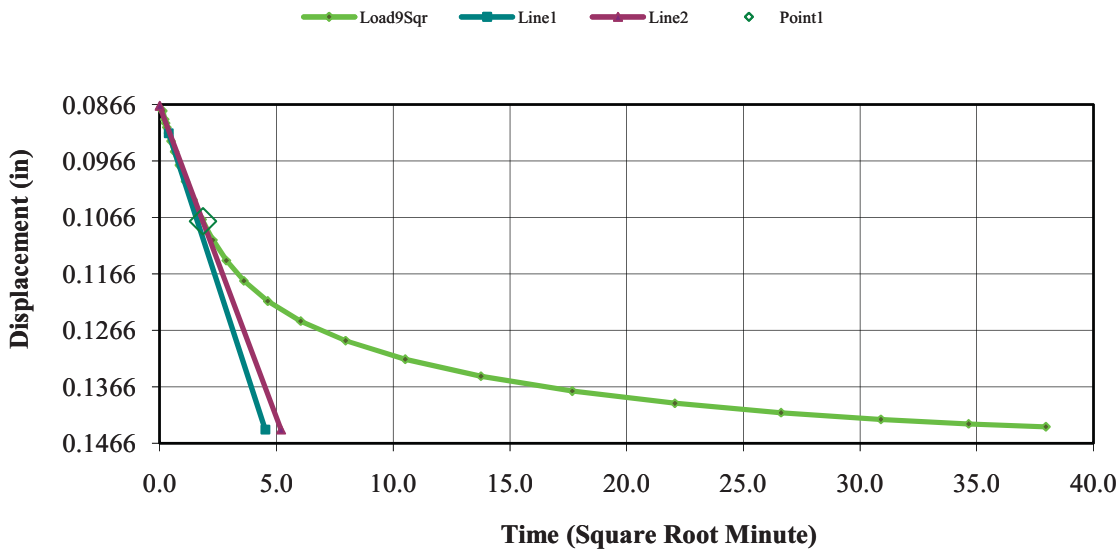
Soil Description: Gray, fat CLAY with sand, CH
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0842	0.0839	8.3900	1.2673
1	00:00:01	0.0877	0.0874	8.7400	1.2587
2	00:00:02	0.0887	0.0884	8.8400	1.2562
3	00:00:03	0.0894	0.0891	8.9100	1.2544
4	00:00:04	0.0899	0.0896	8.9600	1.2532
5	00:00:05	0.0904	0.0901	9.0100	1.2520
6	00:00:06	0.0908	0.0905	9.0500	1.2510
7	00:00:12	0.0928	0.0925	9.2500	1.2460
8	00:00:15	0.0936	0.0933	9.3300	1.2441
9	00:00:30	0.0961	0.0958	9.5800	1.2379
10	00:01:00	0.0997	0.0994	9.9400	1.2290
11	00:02:01	0.1043	0.1040	10.4000	1.2176
12	00:04:01	0.1103	0.1100	11.0000	1.2027
13	00:05:01	0.1123	0.1120	11.2000	1.1978
14	00:08:01	0.1171	0.1168	11.6800	1.1859
15	00:10:01	0.1193	0.1190	11.9000	1.1804
16	00:15:01	0.1230	0.1227	12.2700	1.1713
17	00:30:03	0.1281	0.1278	12.7800	1.1587
18	01:00:05	0.1321	0.1318	13.1800	1.1488
19	02:00:09	0.1351	0.1348	13.4800	1.1413
20	04:00:17	0.1377	0.1374	13.7400	1.1349
21	08:00:34	0.1402	0.1399	13.9900	1.1287
22	12:00:51	0.1416	0.1413	14.1300	1.1253
23	16:01:08	0.1425	0.1422	14.2200	1.1230
24	20:01:25	0.1432	0.1429	14.2900	1.1213
25	24:01:42	0.1437	0.1434	14.3400	1.1201

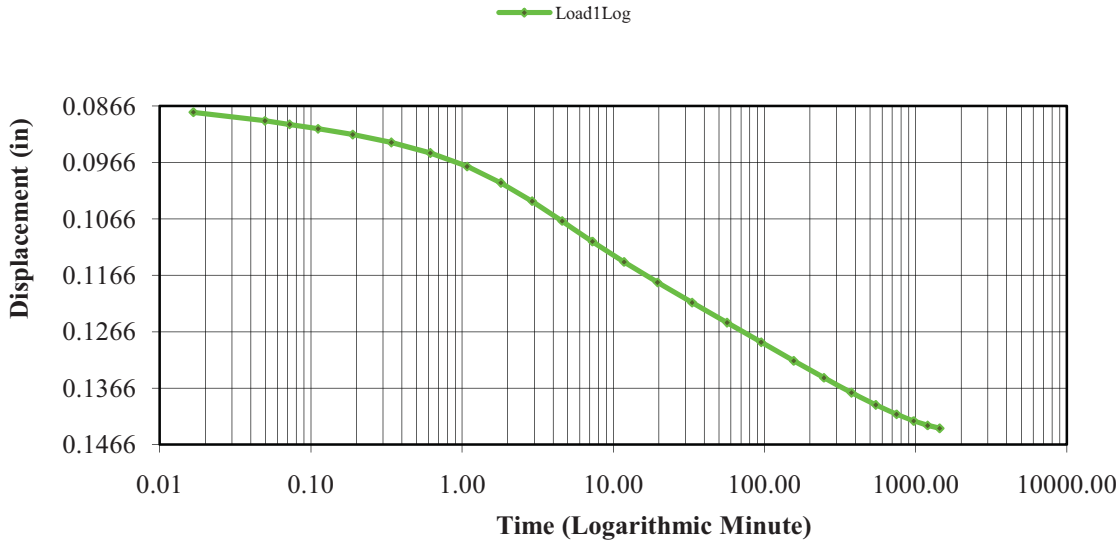
Tested By: **Checked By:**

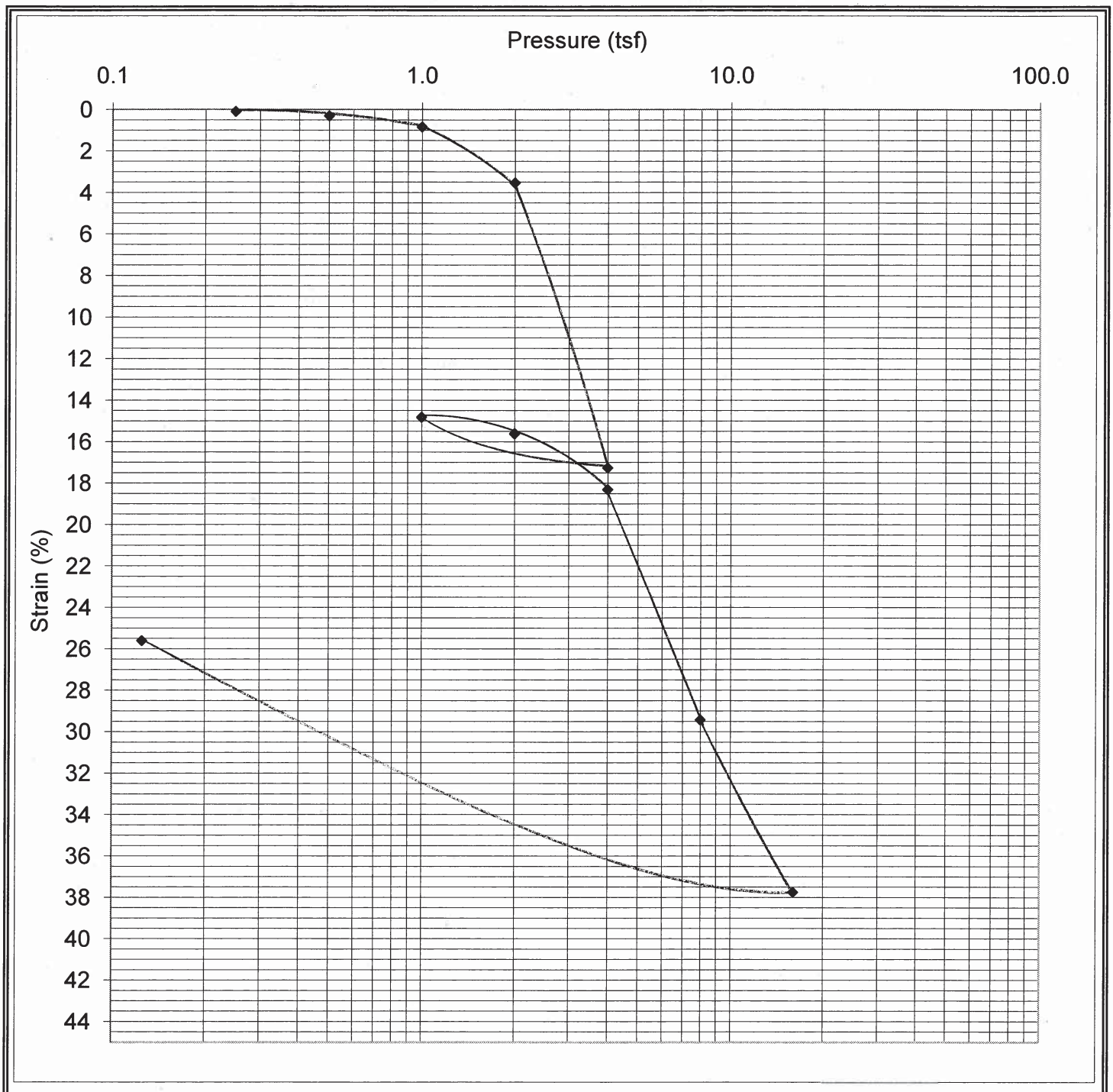
Consolidation Test Results
(Sequence 9) Load 4.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)





Description of Sample:	Gray, fat CLAY, trace sand, CH				
Boring :	10BH-034A	Depth:	22'-24'	Stratum:	D2

Probable Preconsolidation Stress (tsf)	1.9
Approximate Overburden Stress (tsf):	0.8
Compression Ratio (from 4 to 8 tsf):	0.430
Recompression Ratio (from 1 to 2 tsf):	0.025

Schnabel ENGINEERING

CONSOLIDATION TEST

Project:	MLK Expressway Extension Portsmouth, Virginia
Contract Number:	10613051

Consolidation Test Results
(Sequence 4) Load 1.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date: 8-2-10
Test Number:

Sample Number:
Boring Number: 10BH-034A
Depth: 22'-24'
Sample Type: Undisturbed

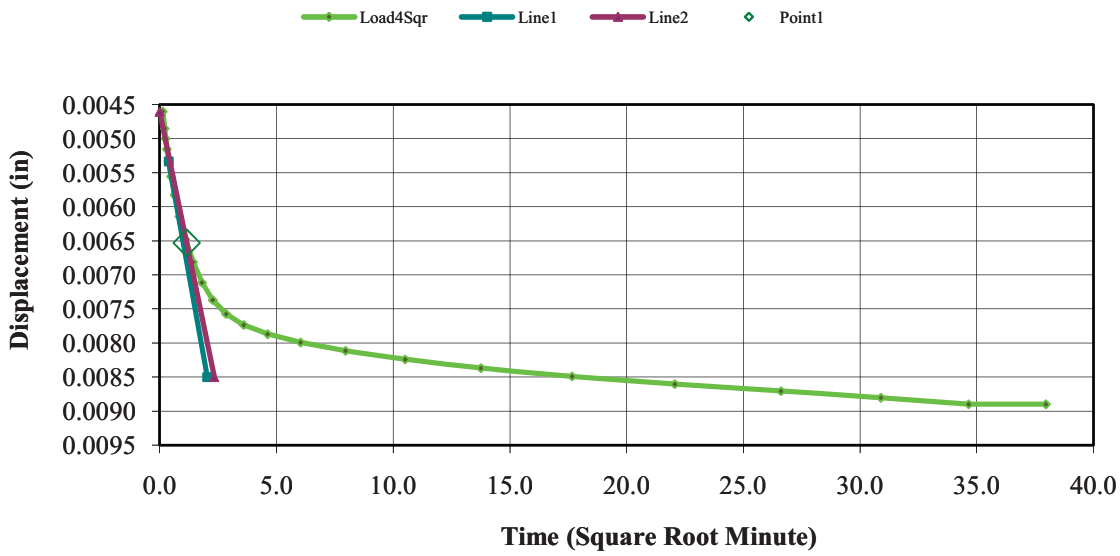
Soil Description: Gray, fat CLAY, trace sand, CH
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0036	0.0030	0.3000	1.9492
1	00:00:01	0.0046	0.0040	0.4000	1.9462
2	00:00:02	0.0047	0.0041	0.4100	1.9459
3	00:00:03	0.0048	0.0042	0.4200	1.9456
4	00:00:04	0.0051	0.0045	0.4500	1.9448
5	00:00:05	0.0052	0.0046	0.4600	1.9445
6	00:00:06	0.0052	0.0046	0.4600	1.9445
7	00:00:12	0.0055	0.0049	0.4900	1.9436
8	00:00:15	0.0056	0.0050	0.5000	1.9433
9	00:00:30	0.0062	0.0056	0.5600	1.9415
10	00:01:00	0.0067	0.0061	0.6100	1.9400
11	00:02:00	0.0071	0.0065	0.6500	1.9388
12	00:04:00	0.0076	0.0070	0.7000	1.9374
13	00:05:00	0.0077	0.0071	0.7100	1.9371
14	00:08:00	0.0078	0.0072	0.7200	1.9368
15	00:10:00	0.0078	0.0072	0.7200	1.9368
16	00:15:00	0.0079	0.0073	0.7300	1.9365
17	00:30:00	0.0080	0.0074	0.7400	1.9362
18	01:00:00	0.0082	0.0076	0.7600	1.9356
19	01:59:59	0.0084	0.0078	0.7800	1.9350
20	03:59:59	0.0085	0.0079	0.7900	1.9347
21	08:00:16	0.0086	0.0080	0.8000	1.9344
22	12:00:33	0.0087	0.0081	0.8100	1.9341
23	16:00:50	0.0088	0.0082	0.8200	1.9338
24	20:01:07	0.0089	0.0083	0.8300	1.9335
25	24:01:24	0.0089	0.0083	0.8300	1.9335

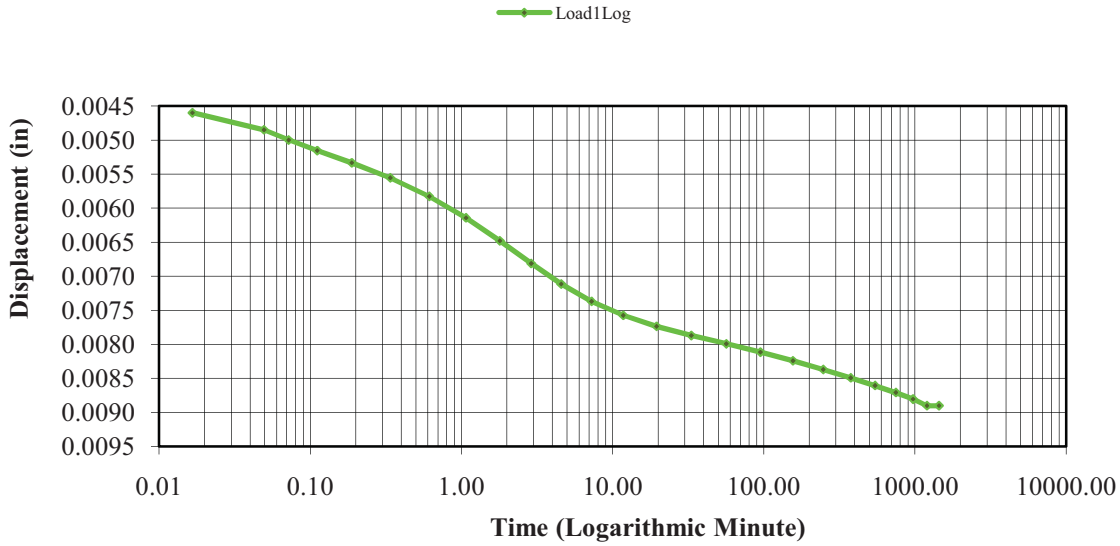
Tested By: **Checked By:**

Consolidation Test Results
(Sequence 4) Load 1.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)



Consolidation Test Results
(Sequence 5) Load 2.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date: 8-2-10
Test Number:

Sample Number:
Boring Number: 10BH-034A
Depth: 22'-24'
Sample Type: Undisturbed

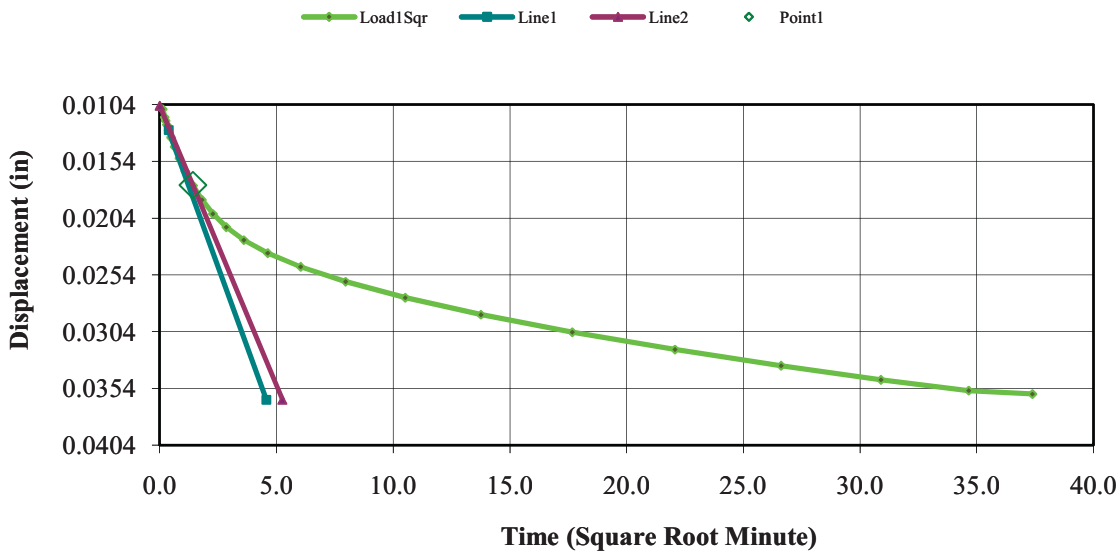
Soil Description: Gray, fat CLAY, trace sand, CH
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0089	0.0083	0.8300	1.9335
1	00:00:01	0.0108	0.0102	1.0200	1.9279
2	00:00:02	0.0112	0.0106	1.0600	1.9267
3	00:00:03	0.0116	0.0110	1.1000	1.9255
4	00:00:04	0.0119	0.0113	1.1300	1.9246
5	00:00:05	0.0120	0.0114	1.1400	1.9243
6	00:00:06	0.0123	0.0117	1.1700	1.9235
7	00:00:12	0.0132	0.0126	1.2600	1.9208
8	00:00:15	0.0135	0.0129	1.2900	1.9199
9	00:00:30	0.0148	0.0142	1.4200	1.9161
10	00:01:00	0.0164	0.0158	1.5800	1.9113
11	00:02:00	0.0183	0.0177	1.7700	1.9057
12	00:04:01	0.0203	0.0197	1.9700	1.8998
13	00:05:01	0.0208	0.0202	2.0200	1.8983
14	00:08:01	0.0221	0.0215	2.1500	1.8945
15	00:10:01	0.0227	0.0221	2.2100	1.8927
16	00:15:01	0.0236	0.0230	2.3000	1.8900
17	00:30:02	0.0252	0.0246	2.4600	1.8853
18	01:00:04	0.0268	0.0262	2.6200	1.8806
19	02:00:09	0.0285	0.0279	2.7900	1.8755
20	04:00:17	0.0302	0.0296	2.9600	1.8705
21	08:00:34	0.0320	0.0314	3.1400	1.8652
22	12:00:51	0.0335	0.0329	3.2900	1.8607
23	16:01:08	0.0348	0.0342	3.4200	1.8569
24	20:01:25	0.0356	0.0350	3.5000	1.8545
25	23:18:00	0.0359	0.0353	3.5300	1.8536

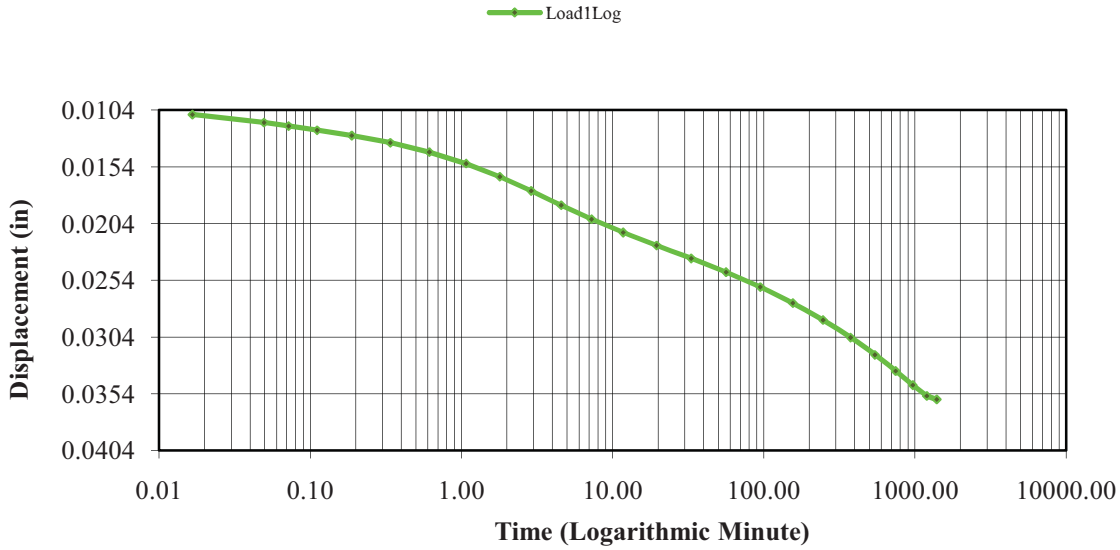
Tested By: **Checked By:**

Consolidation Test Results
(Sequence 5) Load 2.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)



Consolidation Test Results
(Sequence 6) Load 4.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date: 8-2-10
Test Number:

Sample Number:
Boring Number: 10BH-034A
Depth: 22'-24'
Sample Type: Undisturbed

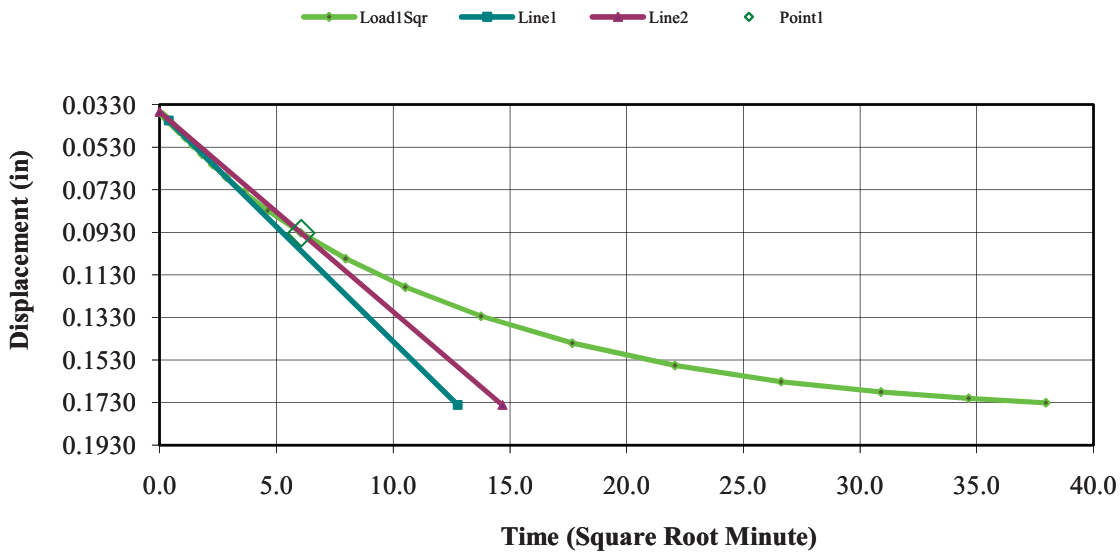
Soil Description: Gray, fat CLAY, trace sand, CH
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0359	0.0353	3.5300	1.8536
1	00:00:01	0.0379	0.0373	3.7300	1.8477
2	00:00:02	0.0384	0.0378	3.7800	1.8462
3	00:00:03	0.0389	0.0383	3.8300	1.8448
4	00:00:04	0.0392	0.0386	3.8600	1.8439
5	00:00:05	0.0396	0.0390	3.9000	1.8427
6	00:00:06	0.0399	0.0393	3.9300	1.8418
7	00:00:12	0.0412	0.0406	4.0600	1.8380
8	00:00:15	0.0417	0.0411	4.1100	1.8365
9	00:00:30	0.0439	0.0433	4.3300	1.8300
10	00:01:00	0.0472	0.0466	4.6600	1.8202
11	00:02:00	0.0519	0.0513	5.1300	1.8063
12	00:04:00	0.0586	0.0580	5.8000	1.7865
13	00:05:00	0.0614	0.0608	6.0800	1.7782
14	00:08:01	0.0679	0.0673	6.7300	1.7590
15	00:10:01	0.0716	0.0710	7.1000	1.7480
16	00:15:01	0.0792	0.0786	7.8600	1.7256
17	00:30:02	0.0952	0.0946	9.4600	1.6782
18	01:00:04	0.1144	0.1138	11.3800	1.6214
19	02:00:09	0.1336	0.1330	13.3000	1.5646
20	04:00:17	0.1492	0.1486	14.8600	1.5185
21	08:00:34	0.1599	0.1593	15.9300	1.4868
22	12:00:51	0.1652	0.1646	16.4600	1.4712
23	16:01:08	0.1685	0.1679	16.7900	1.4614
24	20:01:25	0.1710	0.1704	17.0400	1.4540
25	24:01:41	0.1731	0.1725	17.2500	1.4478

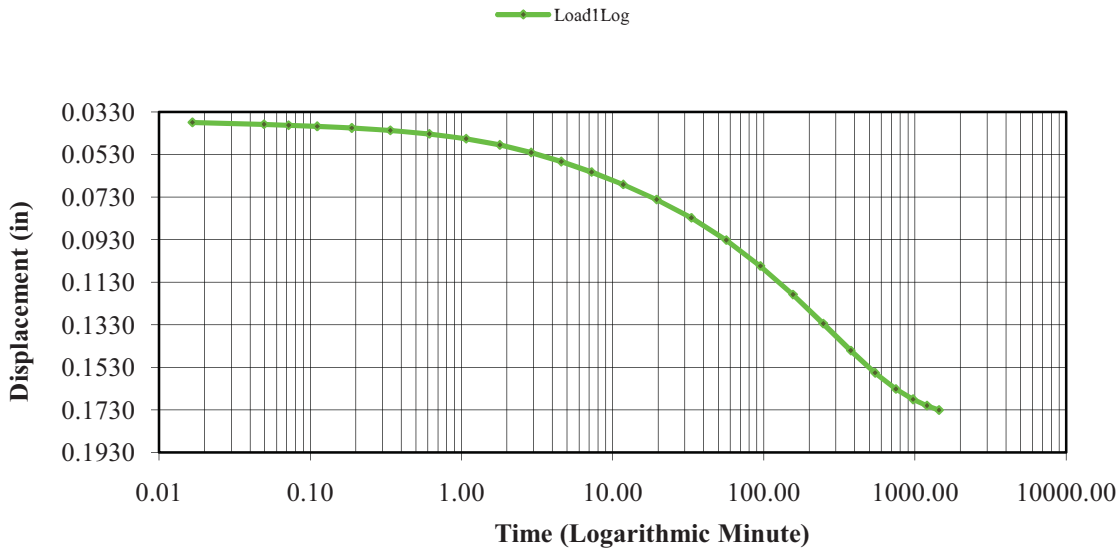
Tested By: **Checked By:**

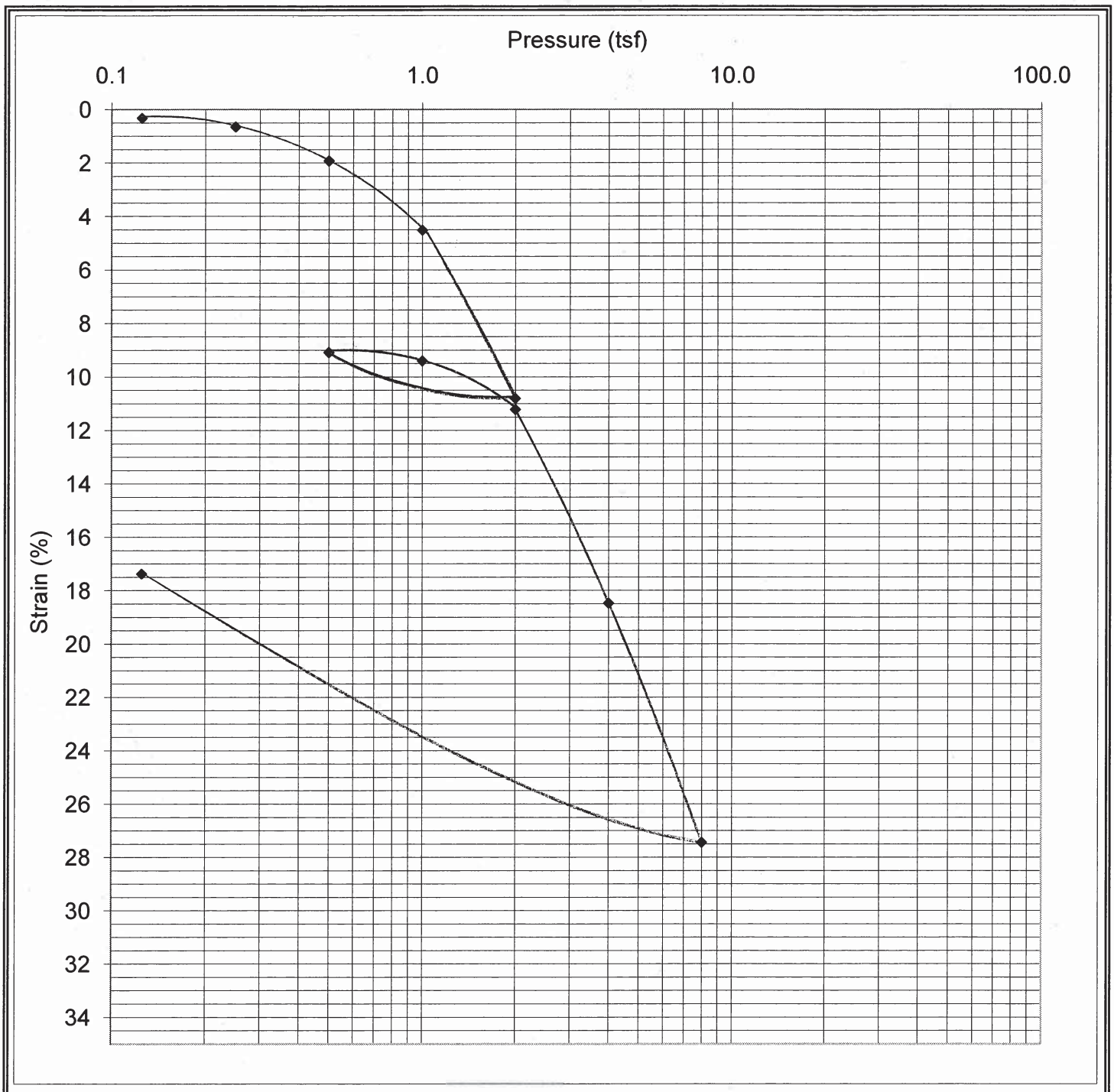
Consolidation Test Results
(Sequence 6) Load 4.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)





Description of Sample:	Gray, fat CLAY, trace sand, contains organics, CH				
Boring :	10BH-052A	Depth:	25'-27'	Stratum:	D2

Probable Preconsolidation Stress (tsf)	1.2
Approximate Overburden Stress (tsf):	0.8
Compression Ratio (from 2 to 8 tsf):	0.280
Recompression Ratio (from ½ to 1 tsf):	0.012

Schnabel ENGINEERING

CONSOLIDATION TEST

Project:	MLK Expressway Extension Portsmouth, Virginia
Contract Number:	10613051

Consolidation Test Results
(Sequence 3) Load 0.500 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-052A
Depth: 25'-27'
Sample Type: Undisturbed

Soil Description:
Gray, elastic SILT, trace sand, contains organics, MH
Remarks:

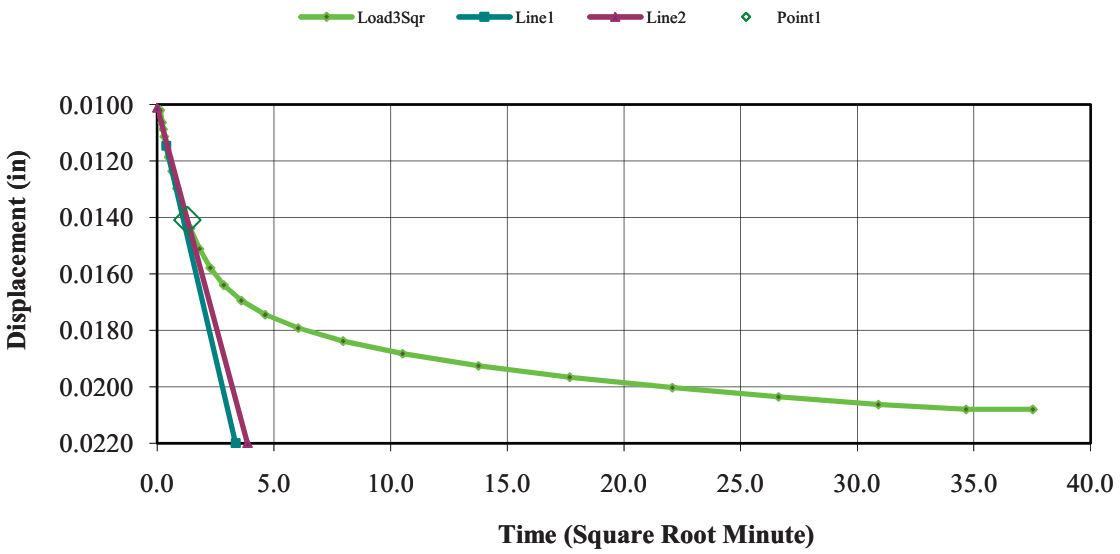
Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0081	0.0065	0.6500	1.9360
1	00:00:01	0.0102	0.0086	0.8600	1.9298
2	00:00:02	0.0104	0.0088	0.8800	1.9292
3	00:00:03	0.0106	0.0090	0.9000	1.9286
4	00:00:04	0.0110	0.0094	0.9400	1.9274
5	00:00:05	0.0111	0.0095	0.9500	1.9271
6	00:00:06	0.0112	0.0096	0.9600	1.9268
7	00:00:12	0.0119	0.0103	1.0300	1.9248
8	00:00:15	0.0120	0.0104	1.0400	1.9245
9	00:00:30	0.0128	0.0112	1.1200	1.9221
10	00:01:00	0.0137	0.0121	1.2100	1.9194
11	00:02:00	0.0150	0.0134	1.3400	1.9156
12	00:04:00	0.0160	0.0144	1.4400	1.9126
13	00:05:00	0.0164	0.0148	1.4800	1.9115
14	00:08:00	0.0169	0.0153	1.5300	1.9100
15	00:10:00	0.0173	0.0157	1.5700	1.9088
16	00:15:01	0.0176	0.0160	1.6000	1.9079
17	00:30:02	0.0183	0.0167	1.6700	1.9058
18	01:00:04	0.0188	0.0172	1.7200	1.9044
19	02:00:08	0.0192	0.0176	1.7600	1.9032
20	04:00:16	0.0197	0.0181	1.8100	1.9017
21	08:00:33	0.0200	0.0184	1.8400	1.9008
22	12:00:50	0.0204	0.0188	1.8800	1.8996
23	16:01:07	0.0207	0.0191	1.9100	1.8987
24	20:01:24	0.0208	0.0192	1.9200	1.8985
25	23:27:49	0.0208	0.0192	1.9200	1.8985

Tested By:

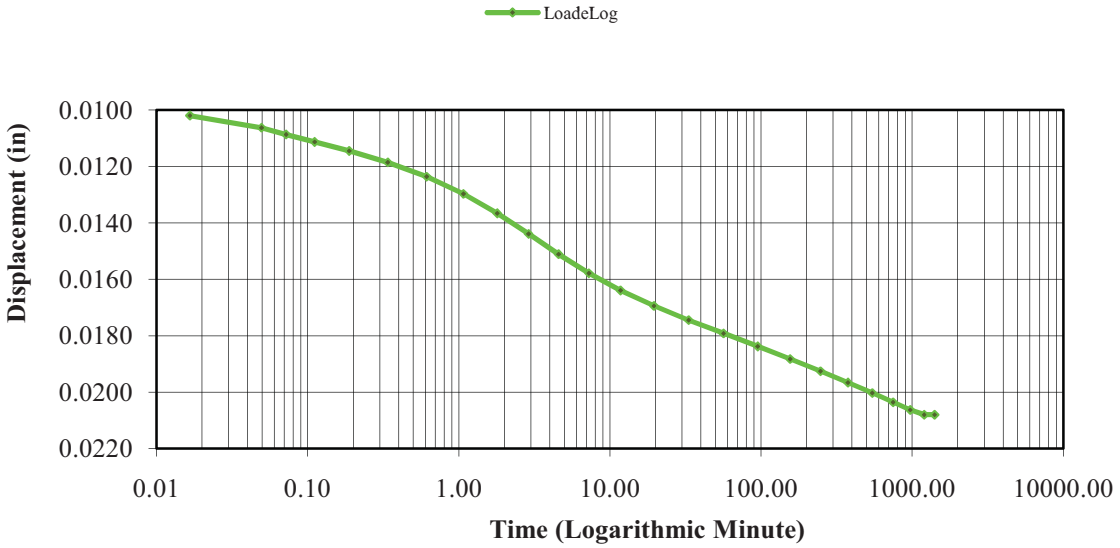
Checked By:

Consolidation Test Results
(Sequence 3) Load 0.500 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)



Consolidation Test Results
(Sequence 5) Load 2.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-052A
Depth: 25'-27'
Sample Type: Undisturbed

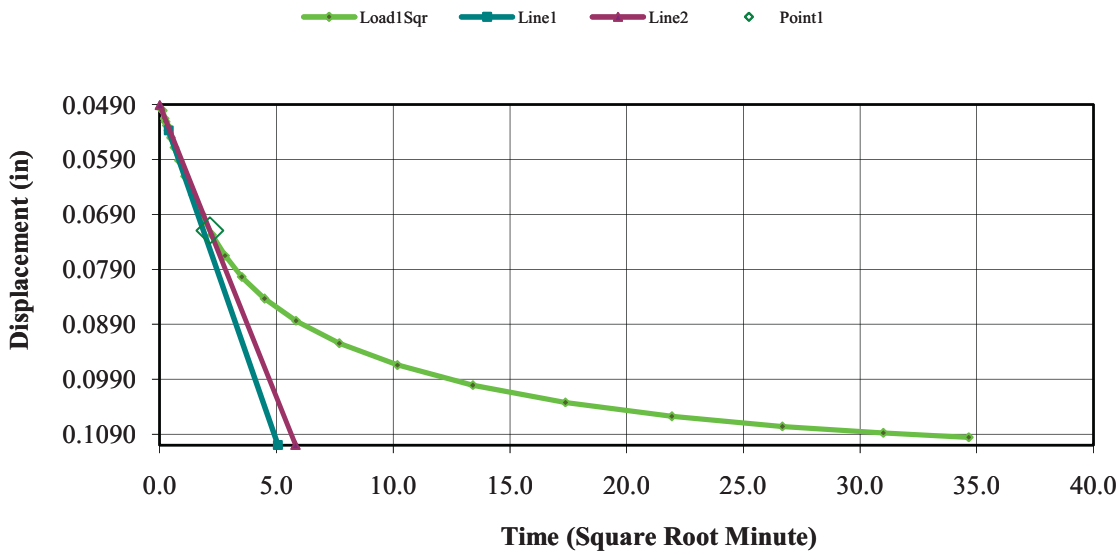
Soil Description:
Gray, elastic SILT, trace sand, contains organics, MH
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0467	0.0451	4.5100	1.8219
1	00:00:01	0.0501	0.0485	4.8500	1.8119
2	00:00:02	0.0511	0.0495	4.9500	1.8089
3	00:00:03	0.0518	0.0502	5.0200	1.8068
4	00:00:04	0.0521	0.0505	5.0500	1.8060
5	00:00:05	0.0527	0.0511	5.1100	1.8042
6	00:00:06	0.0529	0.0513	5.1300	1.8036
7	00:00:12	0.0546	0.0530	5.3000	1.7986
8	00:00:15	0.0552	0.0536	5.3600	1.7968
9	00:00:30	0.0581	0.0565	5.6500	1.7882
10	00:01:00	0.0616	0.0600	6.0000	1.7779
11	00:02:00	0.0663	0.0647	6.4700	1.7640
12	00:04:00	0.0725	0.0709	7.0900	1.7457
13	00:05:00	0.0745	0.0729	7.2900	1.7398
14	00:08:00	0.0792	0.0776	7.7600	1.7259
15	00:10:00	0.0816	0.0800	8.0000	1.7188
16	00:15:01	0.0856	0.0840	8.4000	1.7070
17	00:30:02	0.0920	0.0904	9.0400	1.6880
18	01:00:04	0.0968	0.0952	9.5200	1.6739
19	02:00:08	0.1007	0.0991	9.9100	1.6623
20	04:00:17	0.1037	0.1021	10.2100	1.6535
21	08:00:33	0.1064	0.1048	10.4800	1.6455
22	12:00:50	0.1079	0.1063	10.6300	1.6411
23	16:01:07	0.1088	0.1072	10.7200	1.6384
24	20:01:24	0.1096	0.1080	10.8000	1.6360

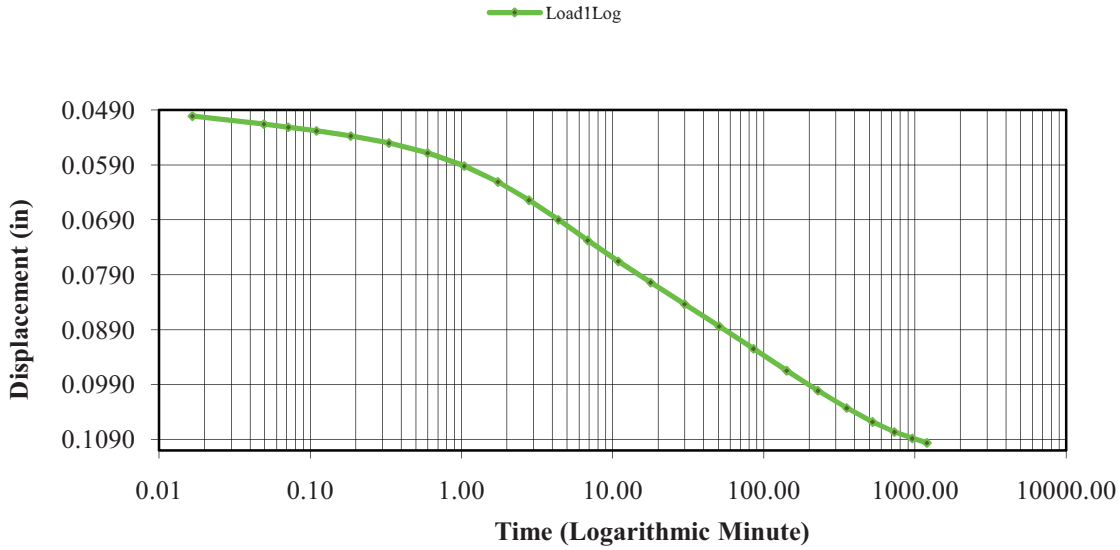
Tested By: **Checked By:**

Consolidation Test Results
(Sequence 5) Load 2.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)



Consolidation Test Results
(Sequence 9) Load 4.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-052A
Depth: 25'-27'
Sample Type: Undisturbed

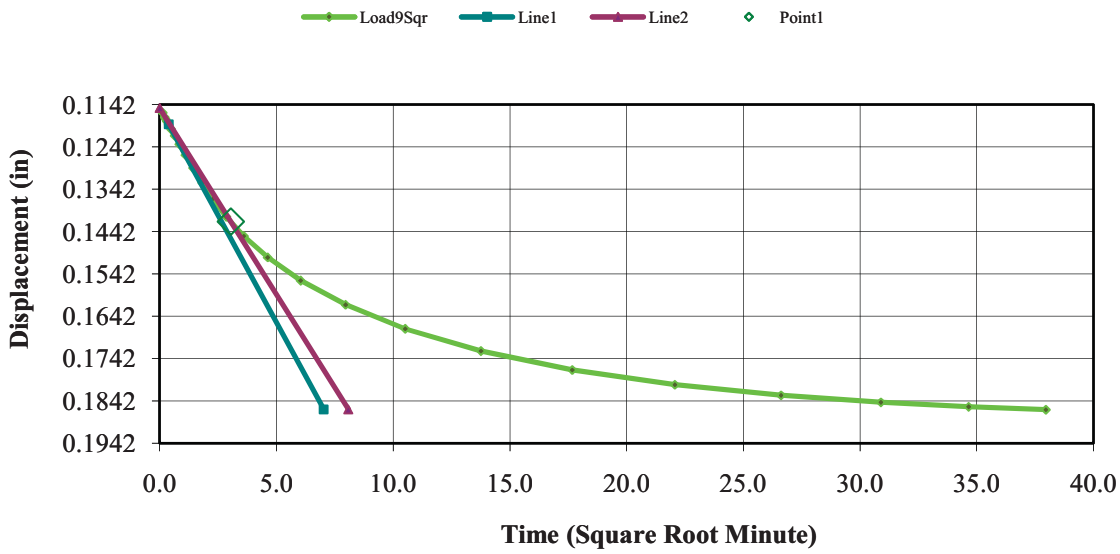
Soil Description: Gray, elastic SILT, trace sand, contains organics, MH
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.1137	0.1121	11.2100	1.6239
1	00:00:01	0.1161	0.1145	11.4500	1.6168
2	00:00:02	0.1168	0.1152	11.5200	1.6148
3	00:00:03	0.1173	0.1157	11.5700	1.6133
4	00:00:04	0.1176	0.1160	11.6000	1.6124
5	00:00:05	0.1179	0.1163	11.6300	1.6115
6	00:00:06	0.1183	0.1167	11.6700	1.6103
7	00:00:12	0.1196	0.1180	11.8000	1.6065
8	00:00:15	0.1200	0.1184	11.8400	1.6053
9	00:00:30	0.1223	0.1207	12.0700	1.5985
10	00:01:00	0.1252	0.1236	12.3600	1.5899
11	00:02:00	0.1294	0.1278	12.7800	1.5775
12	00:04:00	0.1351	0.1335	13.3500	1.5607
13	00:05:00	0.1373	0.1357	13.5700	1.5542
14	00:08:01	0.1424	0.1408	14.0800	1.5391
15	00:10:01	0.1453	0.1437	14.3700	1.5305
16	00:15:01	0.1506	0.1490	14.9000	1.5149
17	00:30:02	0.1600	0.1584	15.8400	1.4871
18	01:00:04	0.1680	0.1664	16.6400	1.4634
19	02:00:09	0.1737	0.1721	17.2100	1.4466
20	04:00:17	0.1782	0.1766	17.6600	1.4333
21	08:00:34	0.1816	0.1800	18.0000	1.4233
22	12:00:51	0.1835	0.1819	18.1900	1.4176
23	16:01:08	0.1847	0.1831	18.3100	1.4141
24	20:01:25	0.1856	0.1840	18.4000	1.4114
25	24:01:42	0.1863	0.1847	18.4700	1.4094

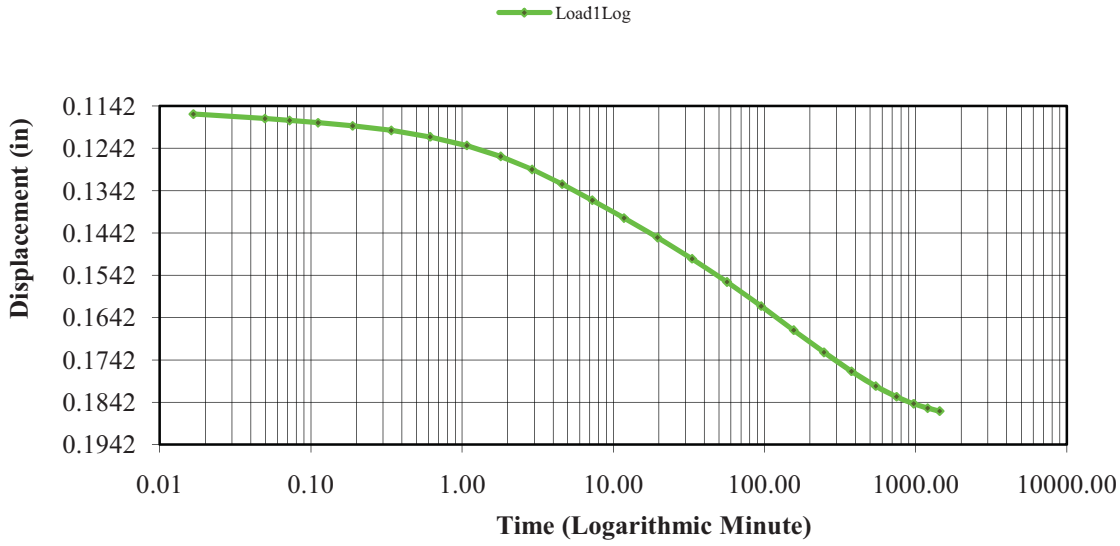
Tested By: **Checked By:**

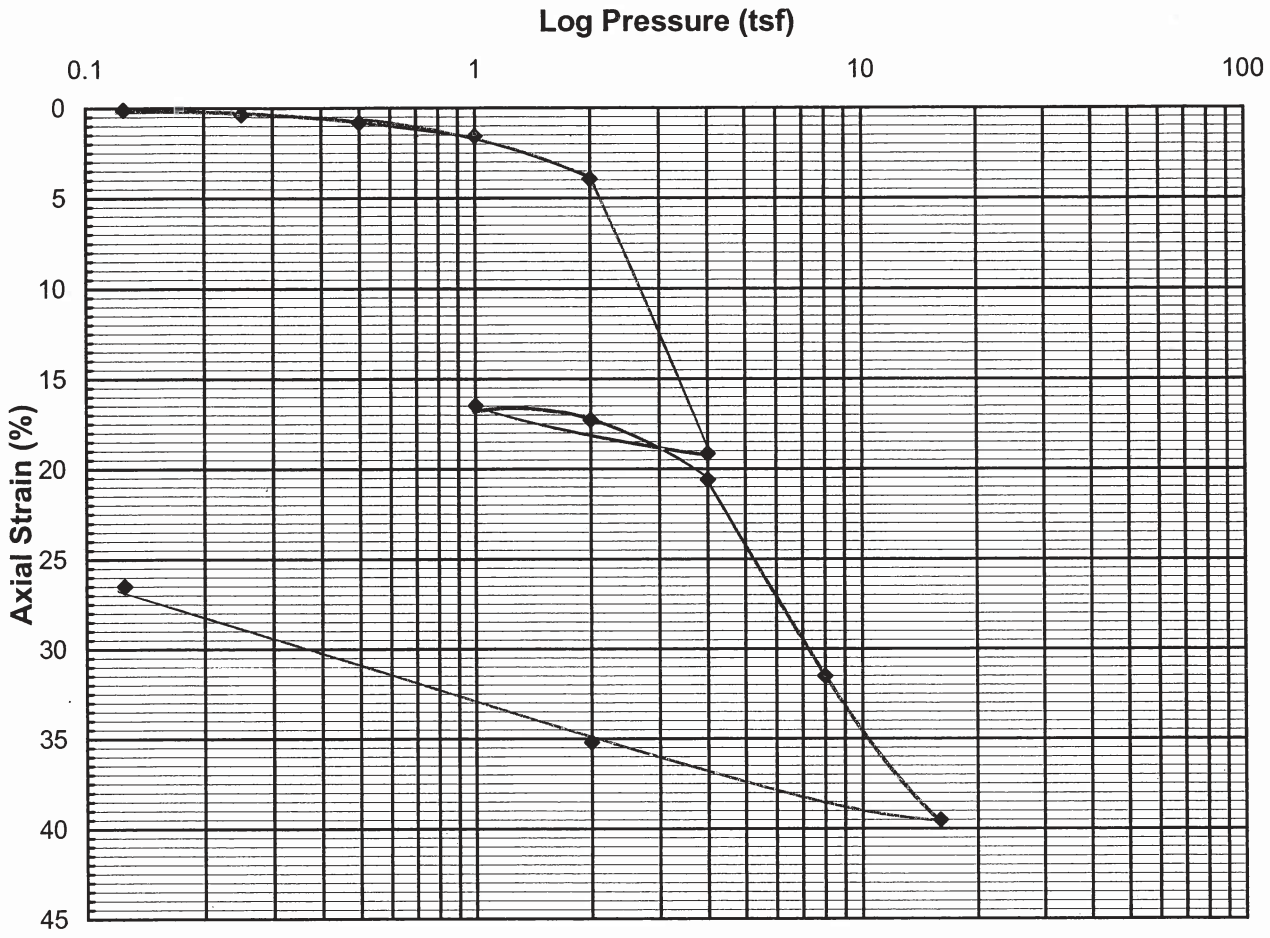
Consolidation Test Results
(Sequence 9) Load 4.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)





Probable Preconsolidation Pressure (Pp), tsf: *2.0*			**Recompression Ratio (Cer):** *0.025*
Type of Specimen: *Tube Sample*			**Compression Ratio (Cec):** *0.460*
Description: *FAT CLAY (CH) - gray*			**Initial** / **Final**
			Water Content, % *81.4* / *51.8*
LL: *53*	**PI:** *26*	**Gs:** *2.68*	**P_o' (tsf):** *0.80* — **Void Ratio** *2.21* / *1.36*
% < No. 200: *92.6*		**Test Method:** *ASTM D2435 Method A*	**Saturation, %** *99* / *100*
Test Condition: *Inundated @ 0.05 tsf*			**Dry Unit Weight, pcf** *52.1* / *70.8*
Remarks:			**Project:** MLK Expressway Extension
Average Water Content of Trimmings, %: *79.1*			**Location** *Portsmouth, VA*
Schnabel ENGINEERING			**Boring:** *10BH-059A* — **Schnabel No.** *10613051*
			Depth: *22-24 ft.* — **Elevation:** *-10.2 to -12.2 ft.*
			Date: *9/16/2010* — **Reviewed by:** *CJS*

Consolidation Test Report

Schnabel ENGINEERING

Consolidation Time Curves

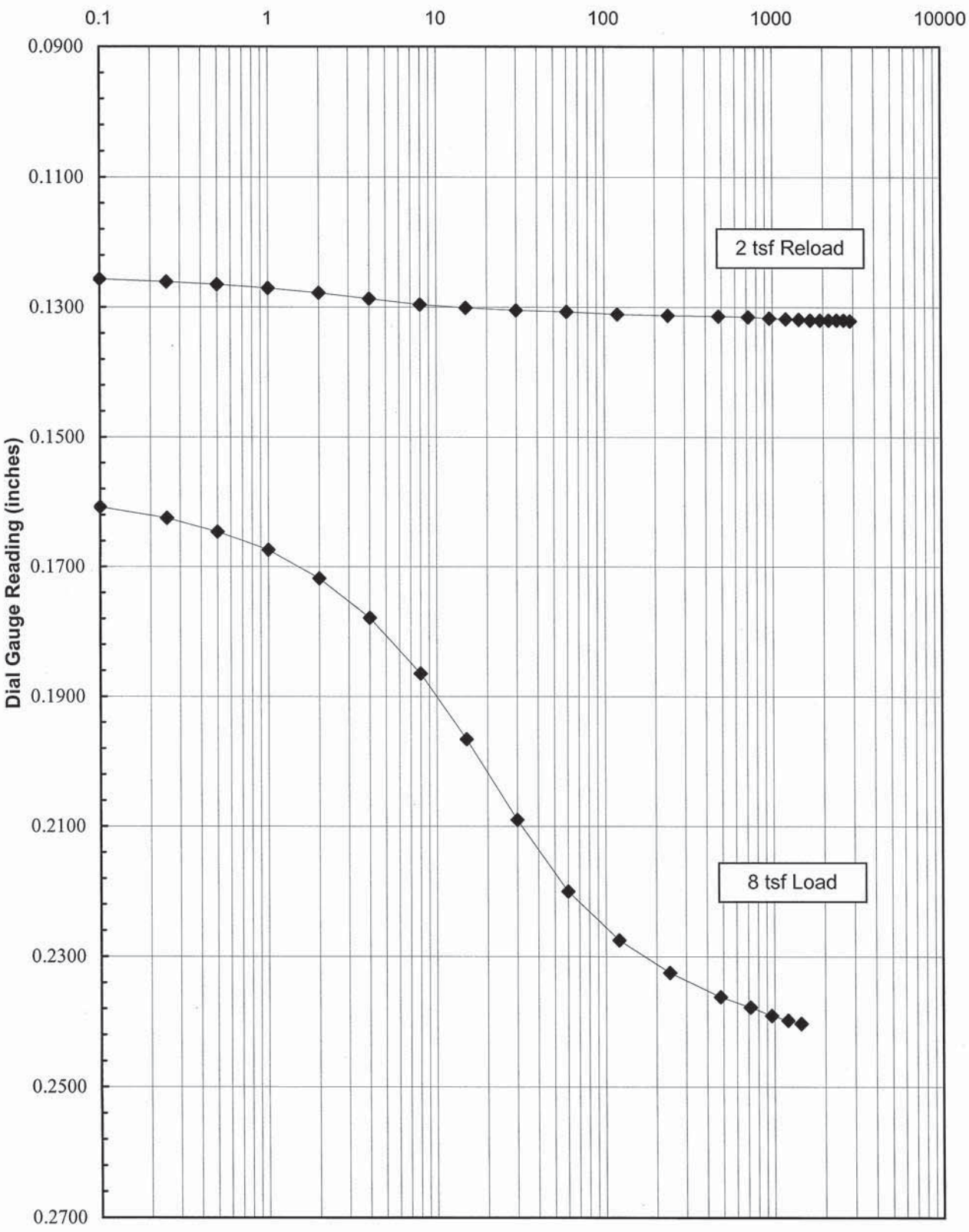
9/16/10

Project: MLK Expressway Extension

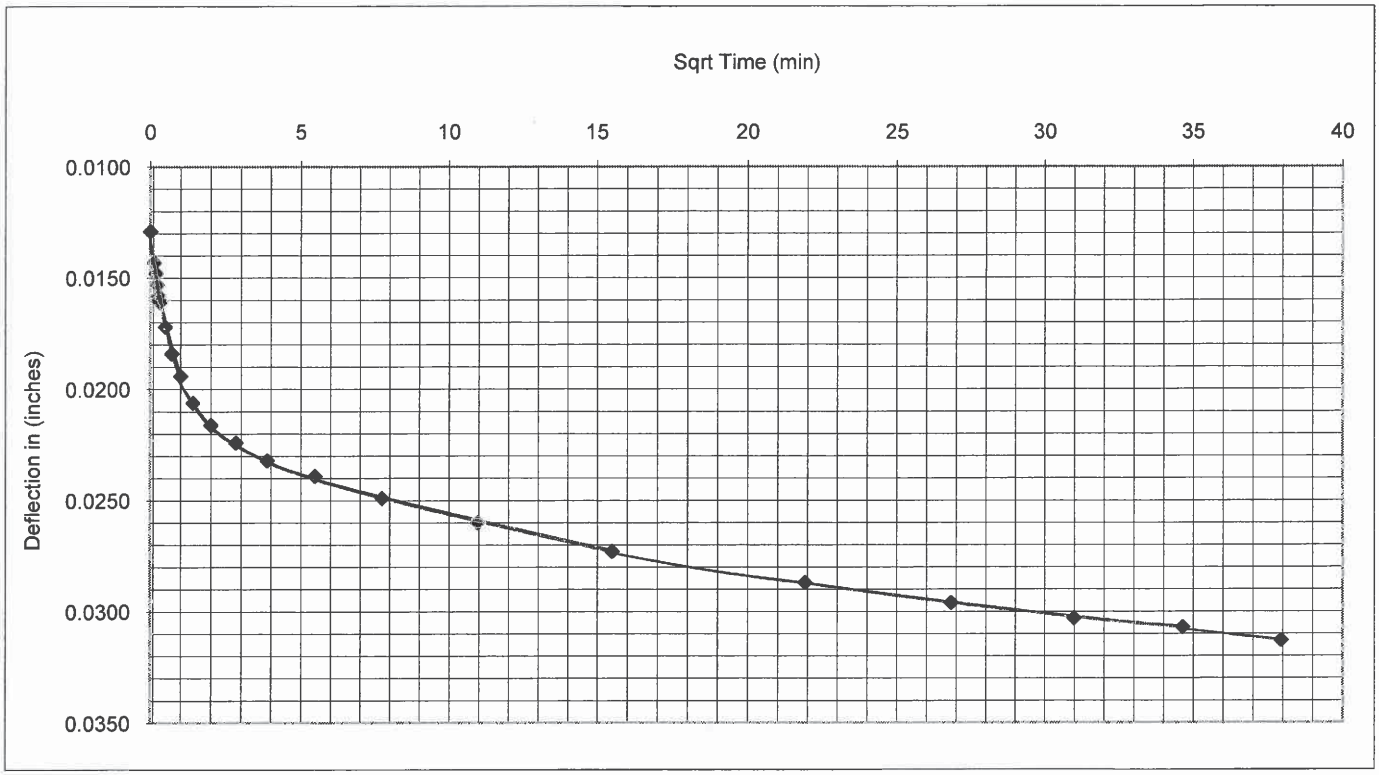
Schnabel Contract: 10613051

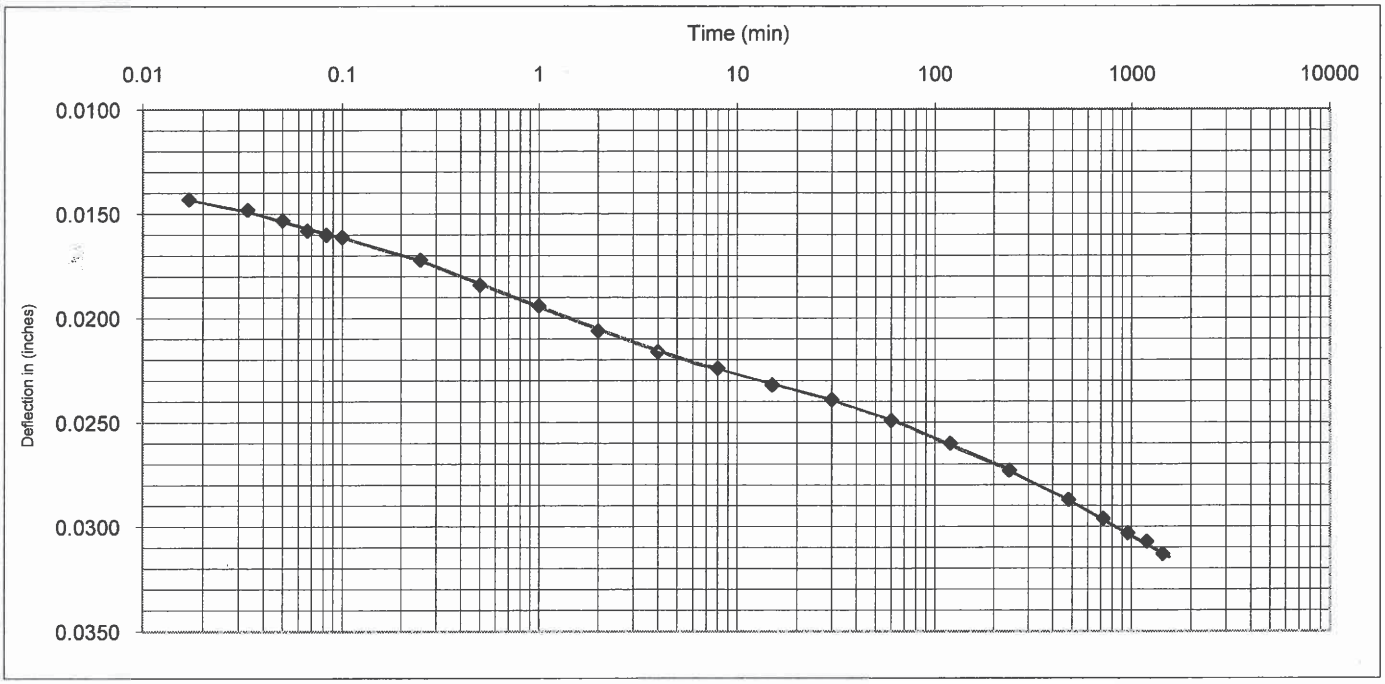
Boring No.: 10BH-059A Depth: 22-24 ft.

Reviewed by: CJS Test Drainage Conditions: Double



Consol 5/2007 Rev. 4





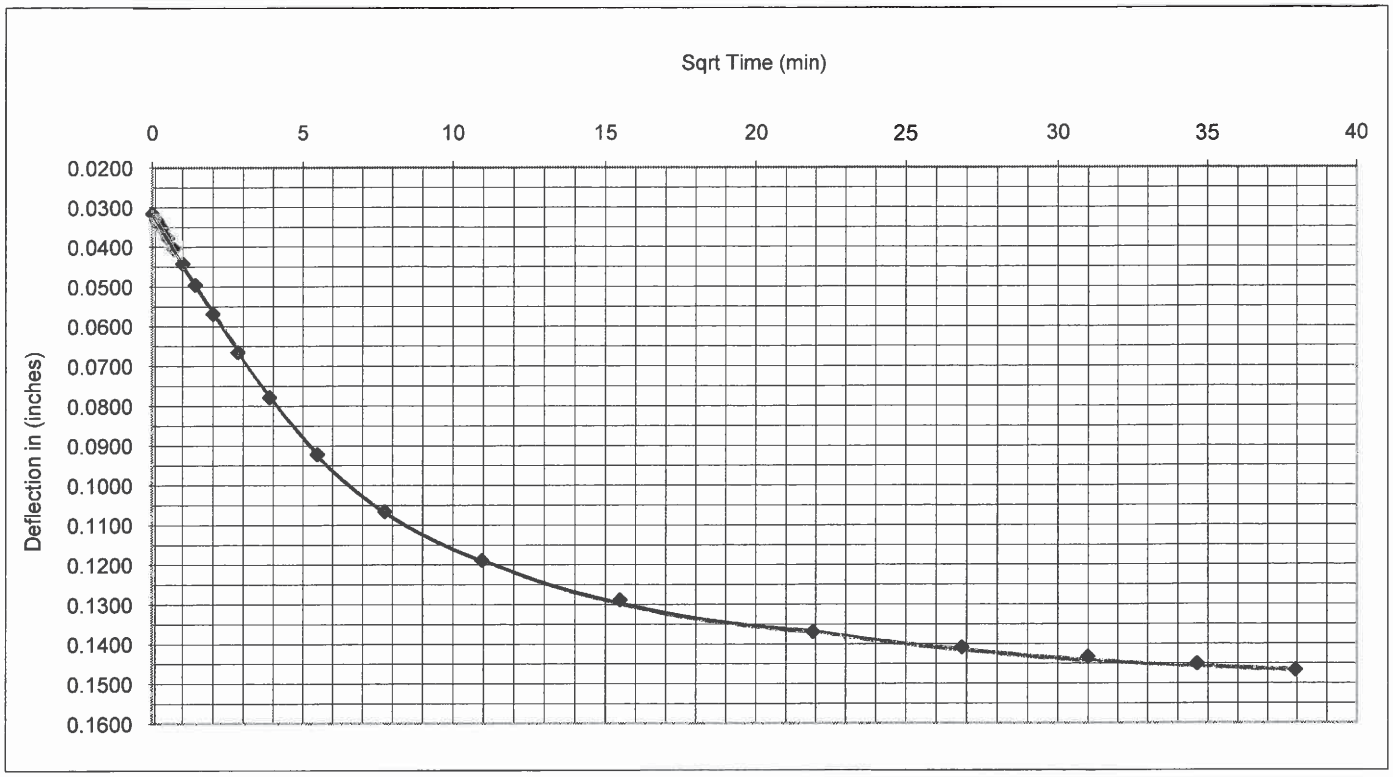
Description of Sample:	FAT CLAY (CH) - gray

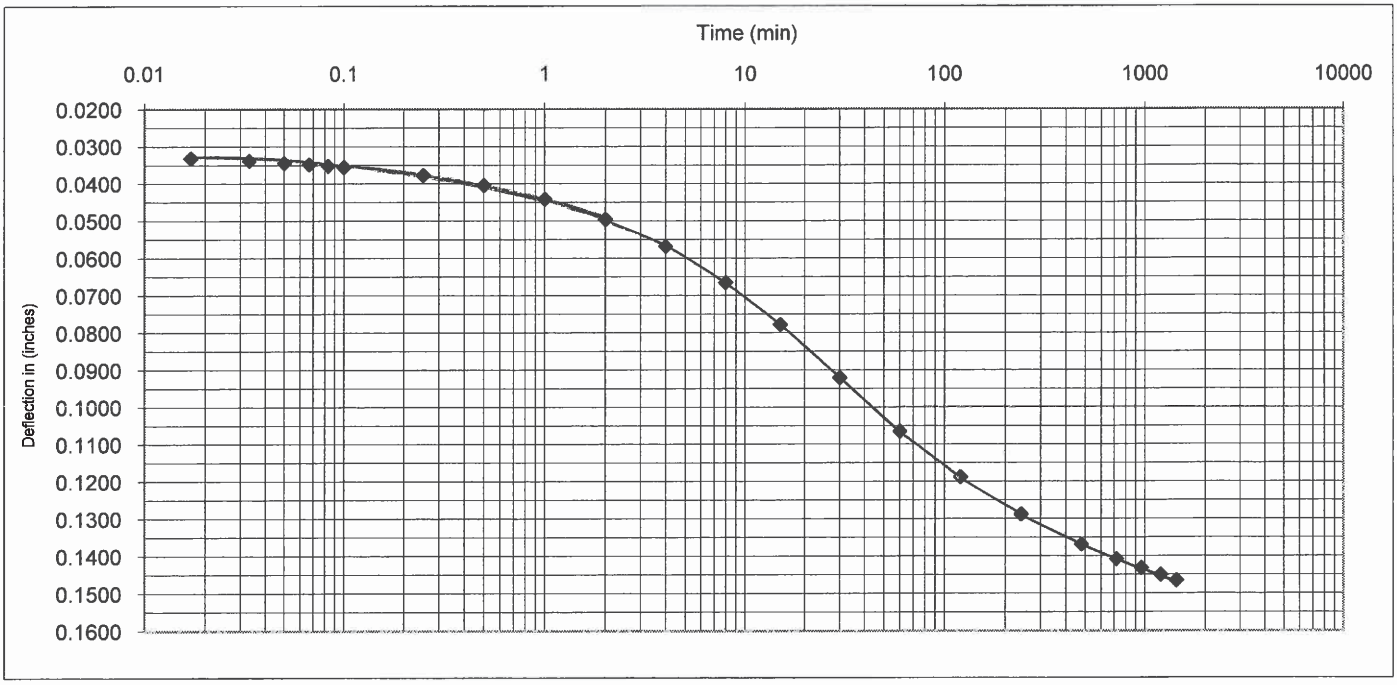
Schnabel ENGINEERING

TIME-COMPRESSION CURVE

Boring :	10BH-059A	Depth:	22'-24'	Stratum:	D2
Load (tsf)					2.0
Coefficient of Consolidation (sqrt t in^2/min)					
Coefficient of Consolidation (log t in^2/min)					
Coefficient of Secondary Compression					

Project:	MLK Expressway Portsmouth, Virginia
Contract Number:	10613051





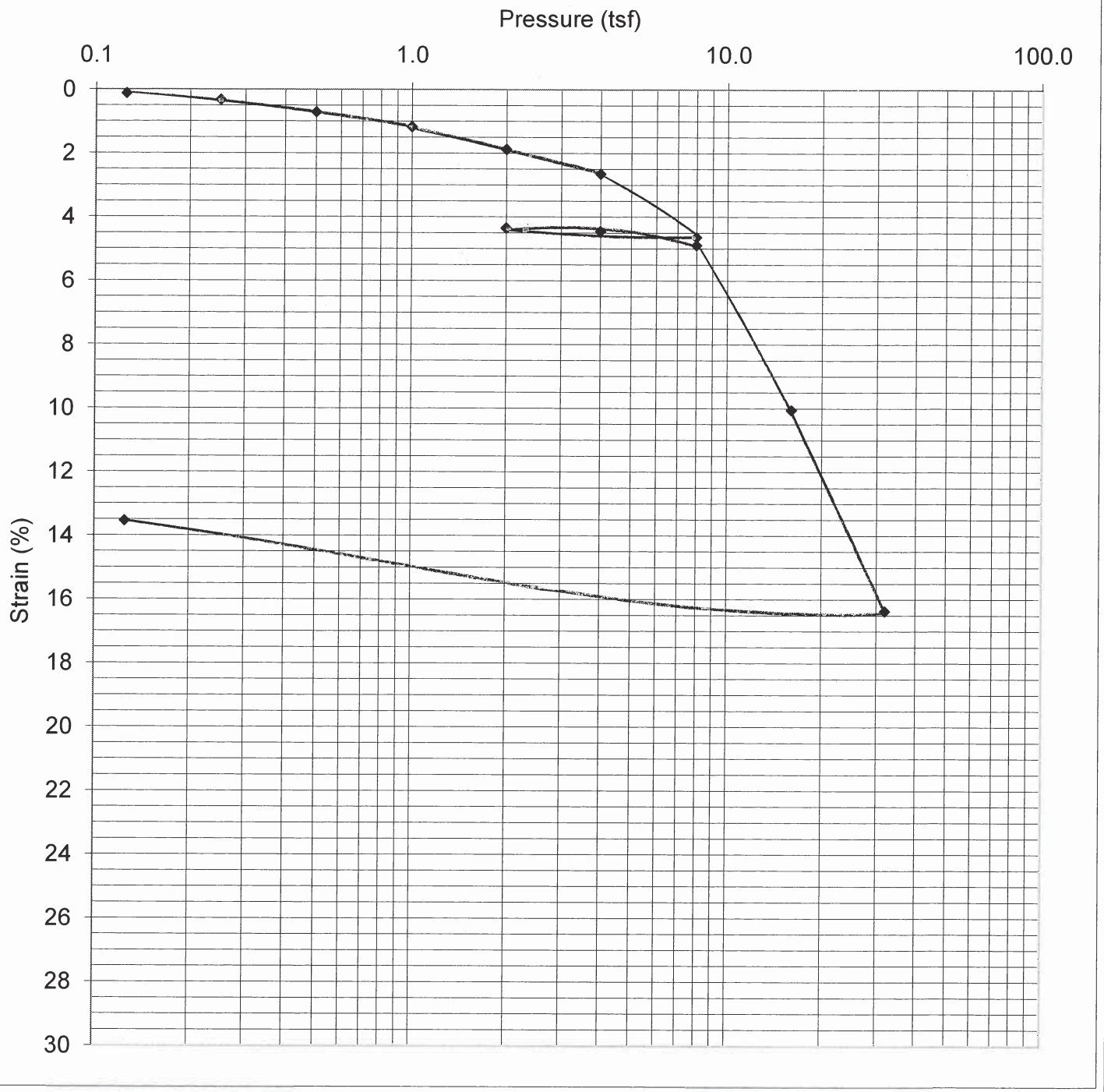
Description of Sample:	FAT CLAY (CH) - gray

Schnabel ENGINEERING

TIME-COMPRESSION CURVE

Boring :	10BH-059A	Depth:	22'-24'	Stratum:	D2
Load (tsf)					4.0
Coefficient of Consolidation (sqrt t in^2/min)					
Coefficient of Consolidation (log t in^2/min)					
Coefficient of Secondary Compression					

Project:	MLK Expressway Portsmouth, Virginia
Contract Number:	10613051



Description of Sample:	Gray, fine to coarse silty SAND, SM				
Boring :	10BH-061	Depth:	93'-95'	Stratum:	E1

Probable Preconsolidation Stress (tsf)	7.0
Approximate Overburden Stress (tsf):	2.3
Compression Ratio (from 16 to 32 tsf):	0.01
Recompression Ratio (from 2 to 4 tsf):	0.19

Schnabel ENGINEERING

CONSOLIDATION TEST

Project:	MLK Expressway Extension Portsmouth, VA
Contract Number:	10613051

Consolidation Test Results
(Sequence 4) Load 1.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-061A
Depth: 93'-95'
Sample Type: Undisturbed

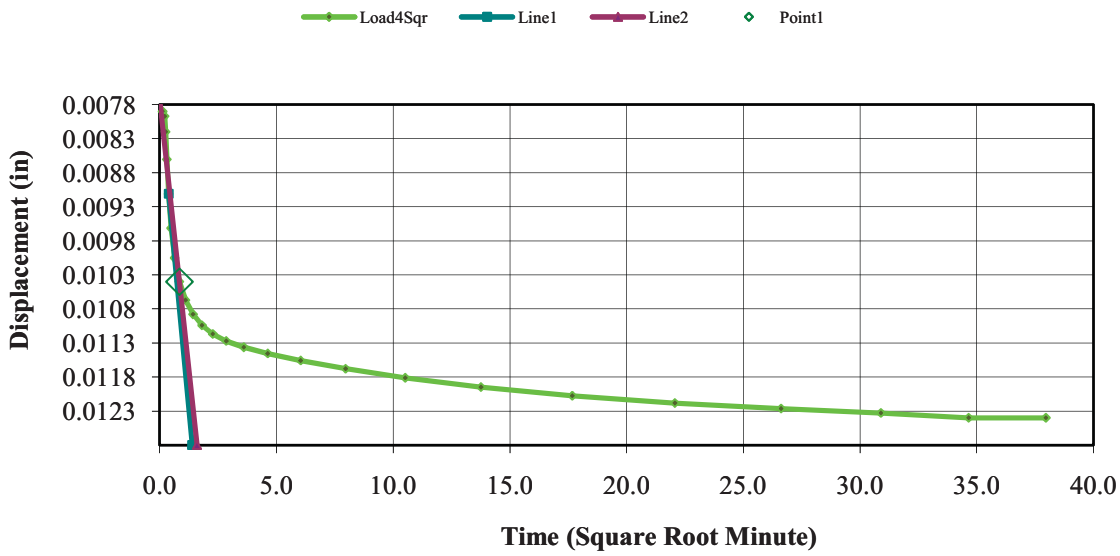
Soil Description: Gray, fine to medium silty SAND, SM
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0078	0.0071	0.7100	0.8449
1	00:00:01	0.0079	0.0072	0.7200	0.8447
2	00:00:02	0.0079	0.0072	0.7200	0.8447
3	00:00:03	0.0079	0.0072	0.7200	0.8447
4	00:00:04	0.0079	0.0072	0.7200	0.8447
5	00:00:05	0.0079	0.0072	0.7200	0.8447
6	00:00:06	0.0095	0.0088	0.8800	0.8418
7	00:00:12	0.0104	0.0097	0.9700	0.8401
8	00:00:15	0.0105	0.0098	0.9800	0.8399
9	00:00:30	0.0106	0.0099	0.9900	0.8397
10	00:01:00	0.0108	0.0101	1.0100	0.8393
11	00:02:00	0.0111	0.0104	1.0400	0.8388
12	00:04:00	0.0113	0.0106	1.0600	0.8384
13	00:05:00	0.0113	0.0106	1.0600	0.8384
14	00:08:01	0.0113	0.0106	1.0600	0.8384
15	00:10:01	0.0114	0.0107	1.0700	0.8382
16	00:15:01	0.0114	0.0107	1.0700	0.8382
17	00:30:02	0.0115	0.0108	1.0800	0.8380
18	01:00:04	0.0118	0.0111	1.1100	0.8375
19	02:00:09	0.0120	0.0113	1.1300	0.8371
20	04:00:17	0.0121	0.0114	1.1400	0.8369
21	08:00:34	0.0122	0.0115	1.1500	0.8367
22	12:00:51	0.0123	0.0116	1.1600	0.8366
23	16:01:07	0.0123	0.0116	1.1600	0.8366
24	20:01:24	0.0124	0.0117	1.1700	0.8364
25	24:01:41	0.0124	0.0117	1.1700	0.8364

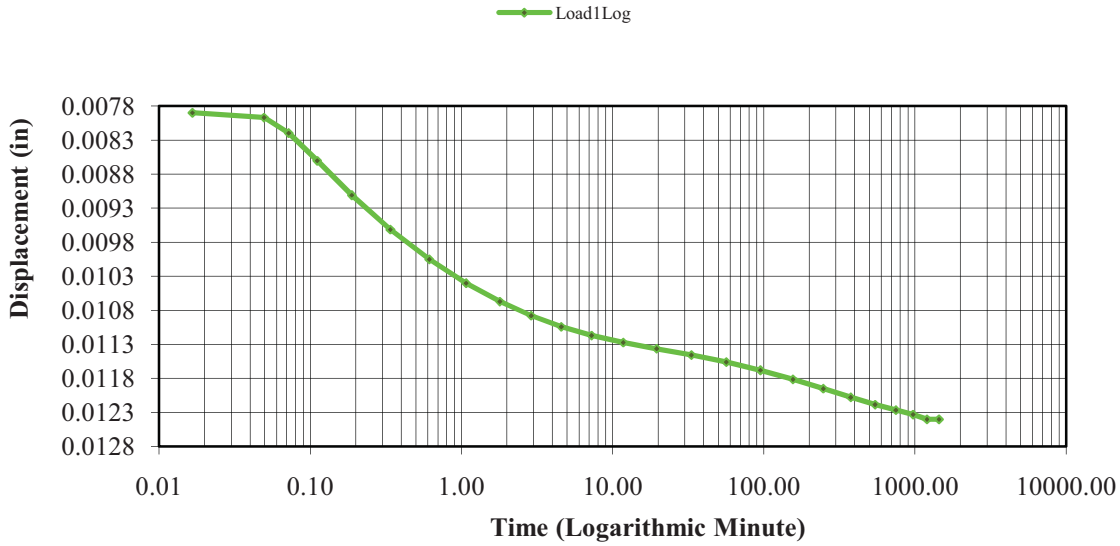
Tested By: **Checked By:**

Consolidation Test Results
(Sequence 4) Load 1.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)



Consolidation Test Results
(Sequence 7) Load 8.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-061A
Depth: 93'-95'
Sample Type: Undisturbed

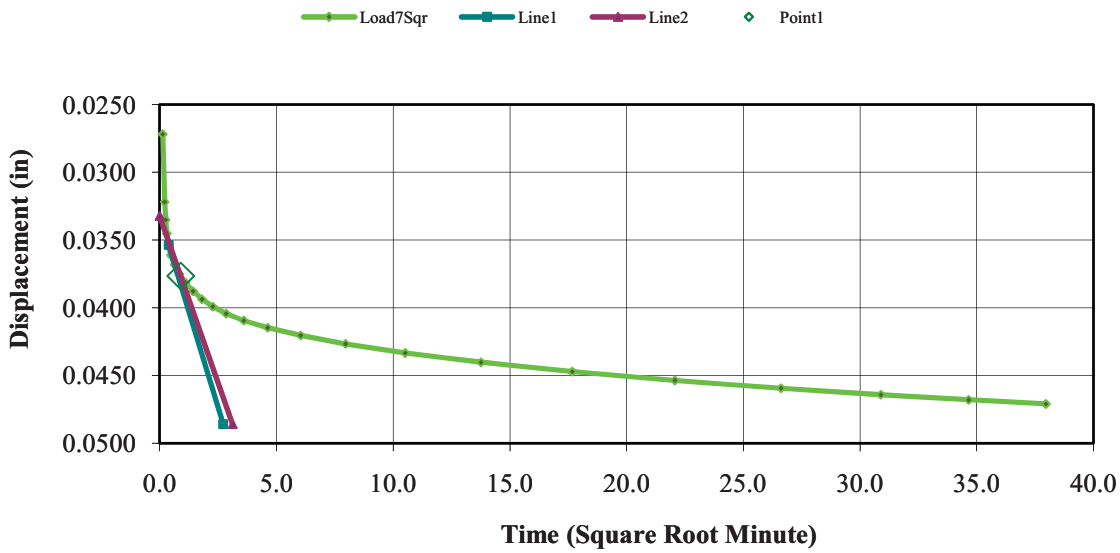
Soil Description: Gray, fine to medium silty SAND, SM
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0272	0.0265	2.6500	0.8089
1	00:00:01	0.0272	0.0265	2.6500	0.8089
2	00:00:02	0.0314	0.0307	3.0700	0.8011
3	00:00:03	0.0330	0.0323	3.2300	0.7981
4	00:00:04	0.0338	0.0331	3.3100	0.7966
5	00:00:05	0.0353	0.0346	3.4600	0.7938
6	00:00:06	0.0354	0.0347	3.4700	0.7936
7	00:00:12	0.0366	0.0359	3.5900	0.7914
8	00:00:15	0.0369	0.0362	3.6200	0.7909
9	00:00:30	0.0377	0.0370	3.7000	0.7894
10	00:01:00	0.0385	0.0378	3.7800	0.7879
11	00:02:00	0.0393	0.0386	3.8600	0.7864
12	00:04:00	0.0400	0.0393	3.9300	0.7851
13	00:05:00	0.0402	0.0395	3.9500	0.7847
14	00:08:00	0.0408	0.0401	4.0100	0.7836
15	00:10:00	0.0410	0.0403	4.0300	0.7832
16	00:15:01	0.0415	0.0408	4.0800	0.7823
17	00:30:02	0.0423	0.0416	4.1600	0.7808
18	01:00:04	0.0431	0.0424	4.2400	0.7793
19	02:00:08	0.0439	0.0432	4.3200	0.7778
20	04:00:17	0.0447	0.0440	4.4000	0.7764
21	08:00:34	0.0455	0.0448	4.4800	0.7749
22	12:00:51	0.0459	0.0452	4.5200	0.7741
23	16:01:08	0.0465	0.0458	4.5800	0.7730
24	20:01:24	0.0468	0.0461	4.6100	0.7725
25	24:01:41	0.0471	0.0464	4.6400	0.7719

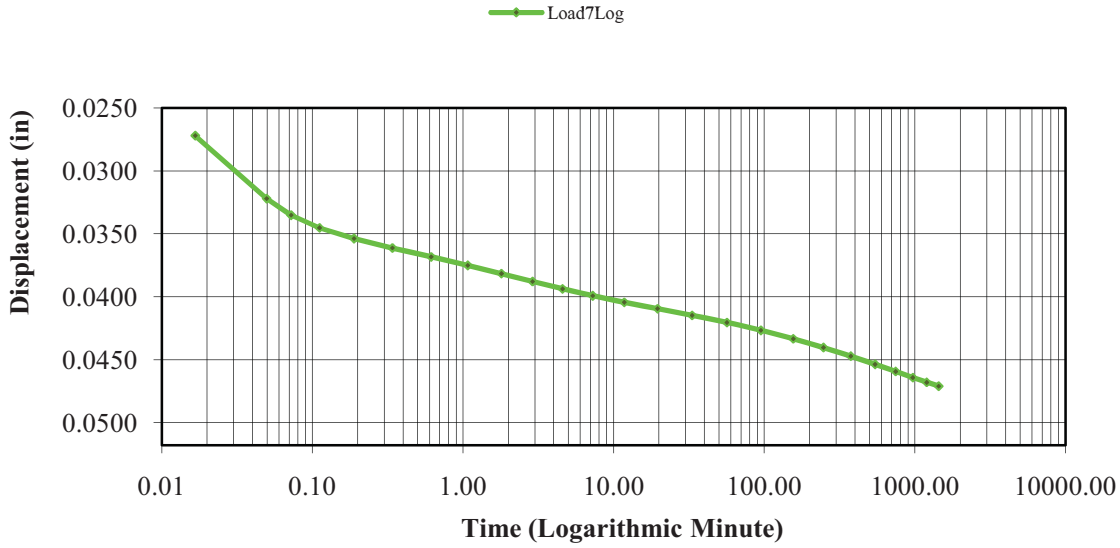
Tested By: **Checked By:**

Consolidation Test Results
(Sequence 7) Load 8.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)



Consolidation Test Results
(Sequence 11) Load 16.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-061A
Depth: 93'-95'
Sample Type: Undisturbed

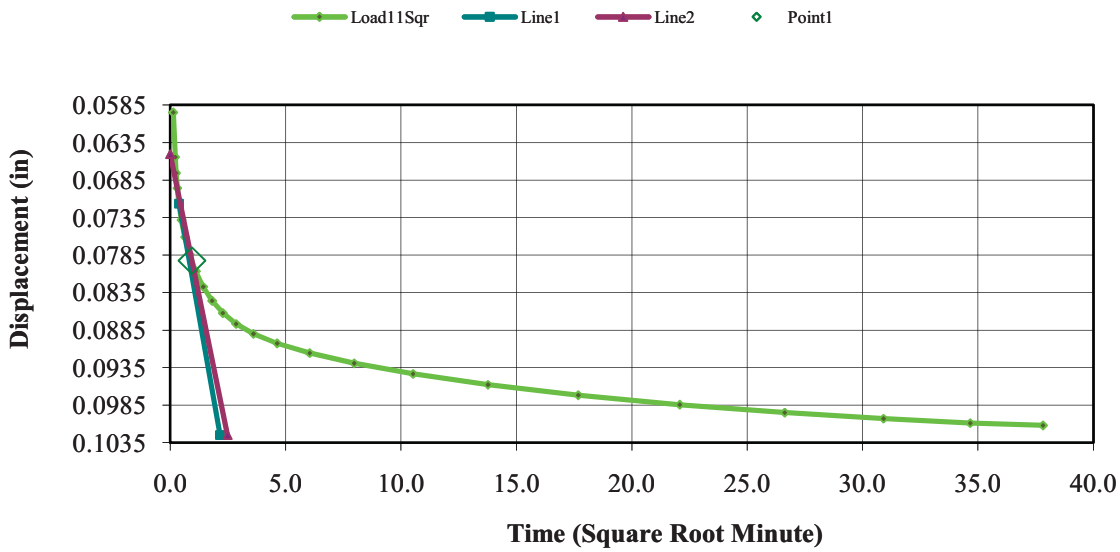
Soil Description: Gray, fine to medium silty SAND, SM
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0496	0.0489	4.8900	0.7673
1	00:00:01	0.0595	0.0588	5.8800	0.7489
2	00:00:02	0.0635	0.0628	6.2800	0.7414
3	00:00:03	0.0664	0.0657	6.5700	0.7360
4	00:00:04	0.0682	0.0675	6.7500	0.7327
5	00:00:05	0.0697	0.0690	6.9000	0.7299
6	00:00:06	0.0707	0.0700	7.0000	0.7280
7	00:00:12	0.0750	0.0743	7.4300	0.7201
8	00:00:15	0.0762	0.0755	7.5500	0.7178
9	00:00:30	0.0794	0.0787	7.8700	0.7119
10	00:01:00	0.0823	0.0816	8.1600	0.7065
11	00:02:00	0.0847	0.0840	8.4000	0.7020
12	00:04:01	0.0867	0.0860	8.6000	0.6983
13	00:05:01	0.0874	0.0867	8.6700	0.6970
14	00:08:01	0.0889	0.0882	8.8200	0.6942
15	00:10:01	0.0894	0.0887	8.8700	0.6933
16	00:15:01	0.0905	0.0898	8.9800	0.6913
17	00:30:02	0.0922	0.0915	9.1500	0.6881
18	01:00:05	0.0939	0.0932	9.3200	0.6849
19	02:00:09	0.0956	0.0949	9.4900	0.6818
20	04:00:17	0.0972	0.0965	9.6500	0.6788
21	08:00:34	0.0987	0.0980	9.8000	0.6760
22	12:00:51	0.0998	0.0991	9.9100	0.6740
23	16:01:08	0.1003	0.0996	9.9600	0.6730
24	20:01:25	0.1009	0.1002	10.0200	0.6719
25	23:49:46	0.1012	0.1005	10.0500	0.6714

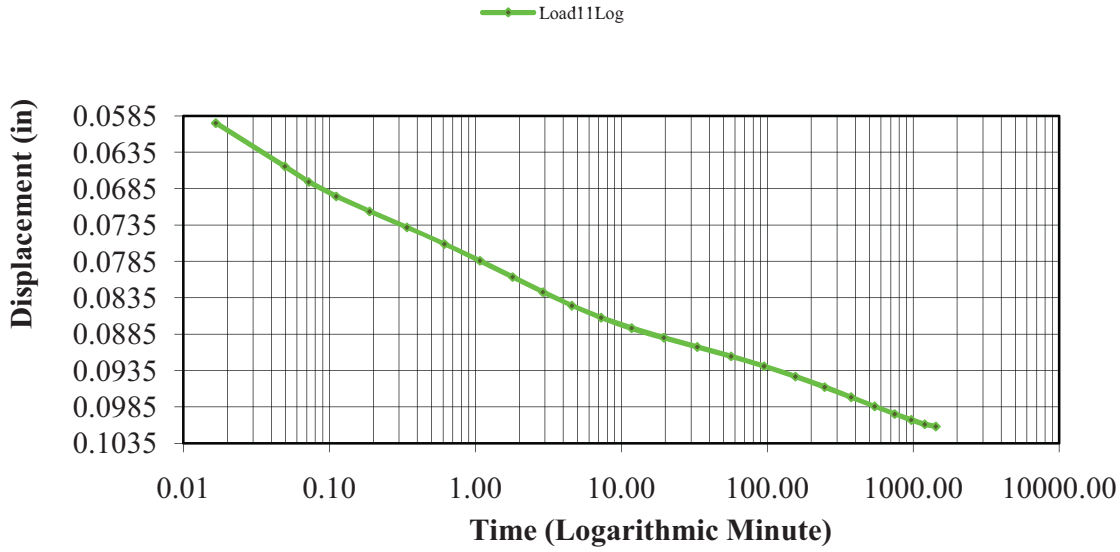
Tested By: **Checked By:**

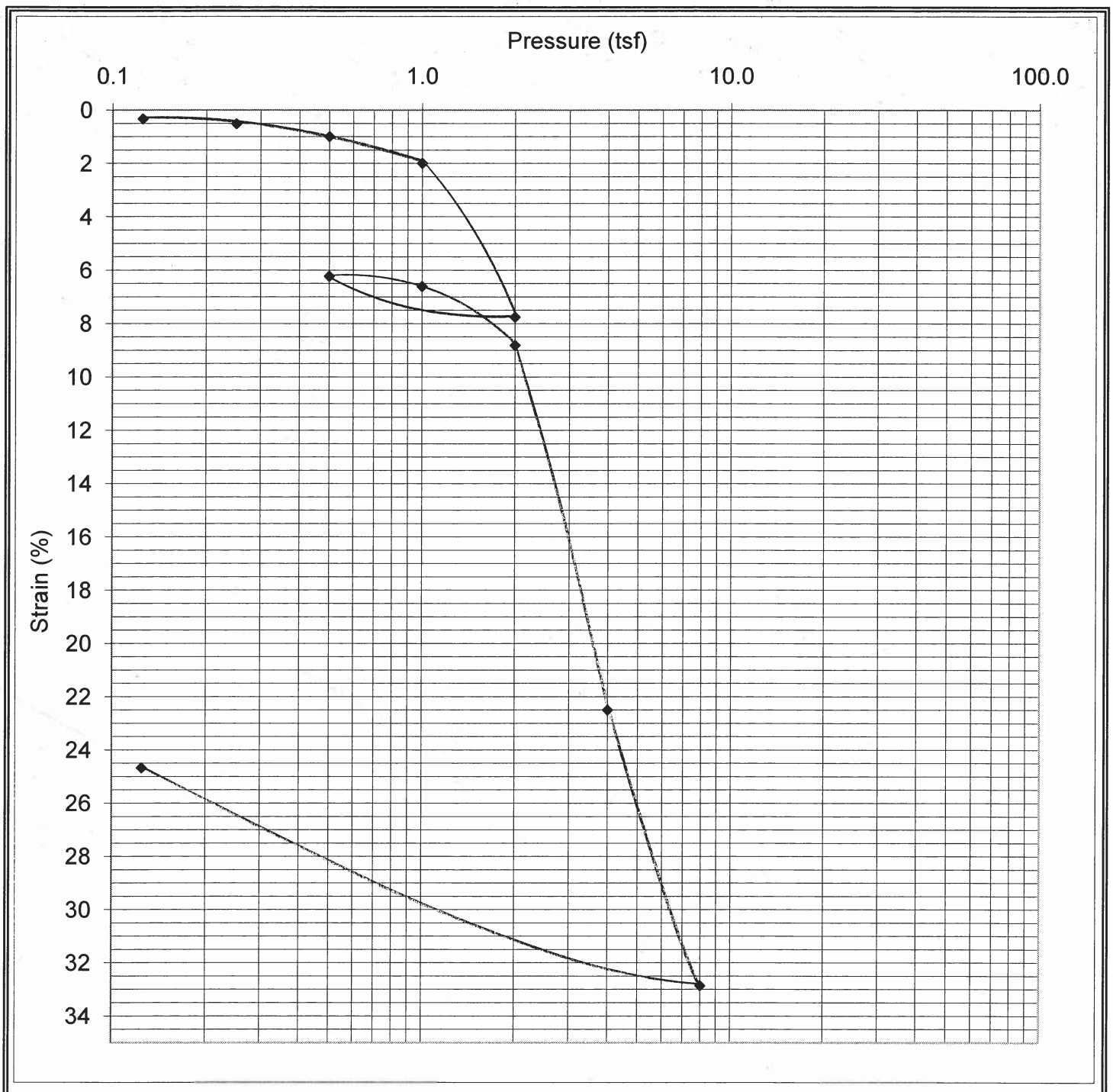
Consolidation Test Results
(Sequence 11) Load 16.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)





Description of Sample:	Gray, fat CLAY, trace sand, CH				
Boring :	10BH-096A	Depth:	22'-24'	Stratum:	D2

Probable Preconsolidation Stress (tsf)	1.6
Approximate Overburden Stress (tsf):	0.75
Compression Ratio (from 4 to 16 tsf):	0.550
Recompression Ratio (from 1 to 2 tsf):	0.014

Schnabel ENGINEERING

CONSOLIDATION TEST

Project:	MLK Expressway Extension Portsmouth, Virginia
Contract Number:	10613051

Consolidation Test Results
(Sequence 3) Load 0.500 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-096A
Depth: 22-24'
Sample Type: Undisturbed

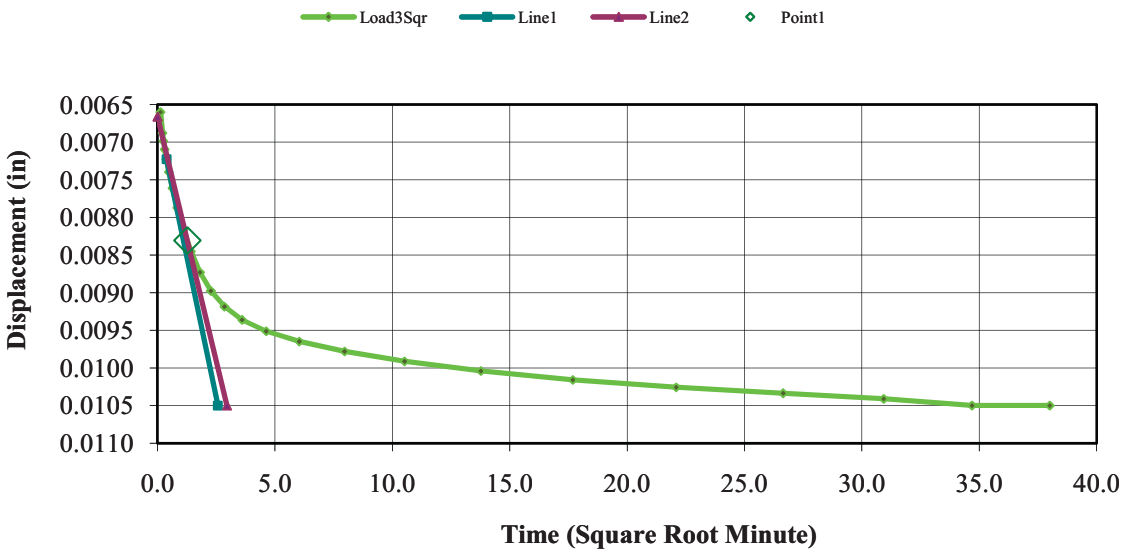
Soil Description: Gray, fat CLAY, trace sand, CH
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0057	0.0051	0.5100	1.8657
1	00:00:01	0.0066	0.0060	0.6000	1.8631
2	00:00:02	0.0068	0.0062	0.6200	1.8626
3	00:00:03	0.0069	0.0063	0.6300	1.8623
4	00:00:04	0.0070	0.0064	0.6400	1.8620
5	00:00:05	0.0071	0.0065	0.6500	1.8617
6	00:00:06	0.0072	0.0066	0.6600	1.8614
7	00:00:12	0.0073	0.0067	0.6700	1.8611
8	00:00:15	0.0074	0.0068	0.6800	1.8608
9	00:00:30	0.0079	0.0073	0.7300	1.8594
10	00:01:00	0.0082	0.0076	0.7600	1.8585
11	00:02:00	0.0088	0.0082	0.8200	1.8568
12	00:04:00	0.0091	0.0085	0.8500	1.8559
13	00:05:00	0.0092	0.0086	0.8600	1.8557
14	00:08:00	0.0094	0.0088	0.8800	1.8551
15	00:10:01	0.0095	0.0089	0.8900	1.8548
16	00:15:01	0.0096	0.0090	0.9000	1.8545
17	00:30:02	0.0097	0.0091	0.9100	1.8542
18	01:00:04	0.0098	0.0092	0.9200	1.8539
19	02:00:16	0.0101	0.0095	0.9500	1.8531
20	04:00:39	0.0102	0.0096	0.9600	1.8528
21	08:01:27	0.0103	0.0097	0.9700	1.8525
22	12:02:14	0.0103	0.0097	0.9700	1.8525
23	16:03:01	0.0104	0.0098	0.9800	1.8522
24	20:03:48	0.0105	0.0099	0.9900	1.8519
25	24:04:36	0.0105	0.0099	0.9900	1.8519

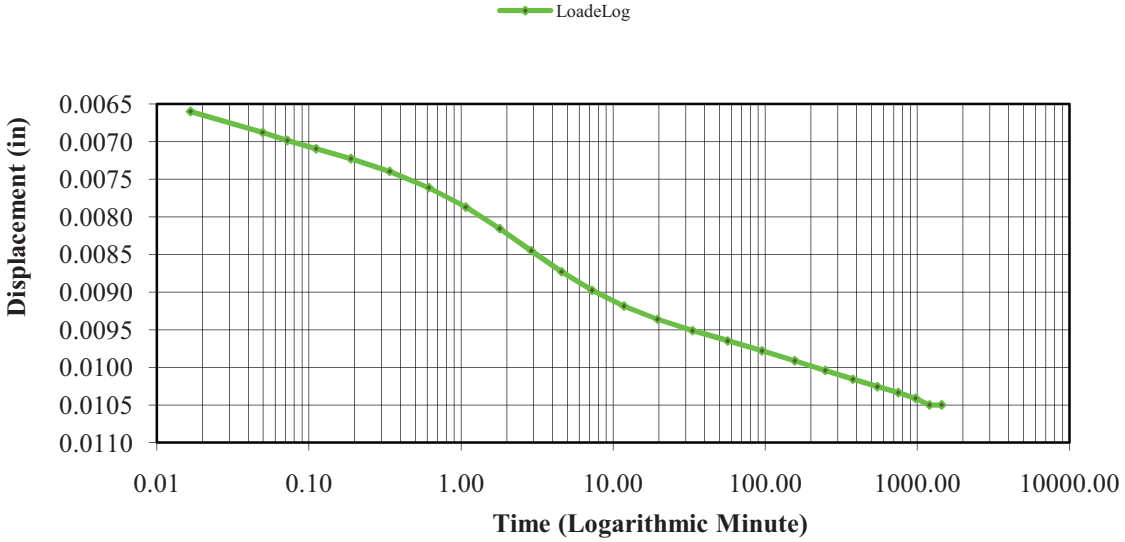
Tested By: **Checked By:**

Consolidation Test Results
(Sequence 3) Load 0.500 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)



Consolidation Test Results
(Sequence 5) Load 2.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-096A
Depth: 22-24'
Sample Type: Undisturbed

Soil Description: Gray, fat CLAY, trace sand, CH
Remarks:

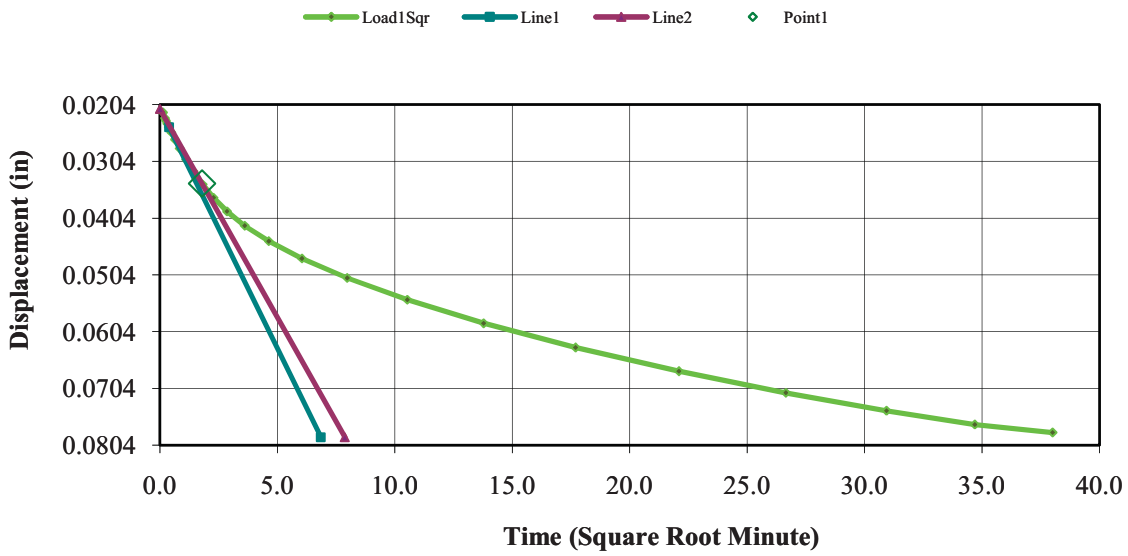
Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0205	0.0199	1.9900	1.8231
1	00:00:01	0.0218	0.0212	2.1200	1.8194
2	00:00:02	0.0225	0.0219	2.1900	1.8173
3	00:00:03	0.0229	0.0223	2.2300	1.8162
4	00:00:04	0.0233	0.0227	2.2700	1.8150
5	00:00:05	0.0235	0.0229	2.2900	1.8145
6	00:00:06	0.0239	0.0233	2.3300	1.8133
7	00:00:12	0.0250	0.0244	2.4400	1.8101
8	00:00:15	0.0256	0.0250	2.5000	1.8084
9	00:00:30	0.0274	0.0268	2.6800	1.8032
10	00:01:00	0.0299	0.0293	2.9300	1.7960
11	00:02:00	0.0330	0.0324	3.2400	1.7871
12	00:04:01	0.0367	0.0361	3.6100	1.7764
13	00:05:01	0.0379	0.0373	3.7300	1.7730
14	00:08:02	0.0407	0.0401	4.0100	1.7649
15	00:10:02	0.0420	0.0414	4.1400	1.7612
16	00:15:03	0.0444	0.0438	4.3800	1.7543
17	00:30:06	0.0486	0.0480	4.8000	1.7422
18	01:00:12	0.0529	0.0523	5.2300	1.7298
19	02:00:24	0.0576	0.0570	5.7000	1.7162
20	04:00:47	0.0625	0.0619	6.1900	1.7021
21	08:01:34	0.0680	0.0674	6.7400	1.6863
22	12:02:22	0.0717	0.0711	7.1100	1.6756
23	16:03:09	0.0746	0.0740	7.4000	1.6673
24	20:03:56	0.0768	0.0762	7.6200	1.6609
25	24:04:43	0.0782	0.0776	7.7600	1.6569

Tested By:

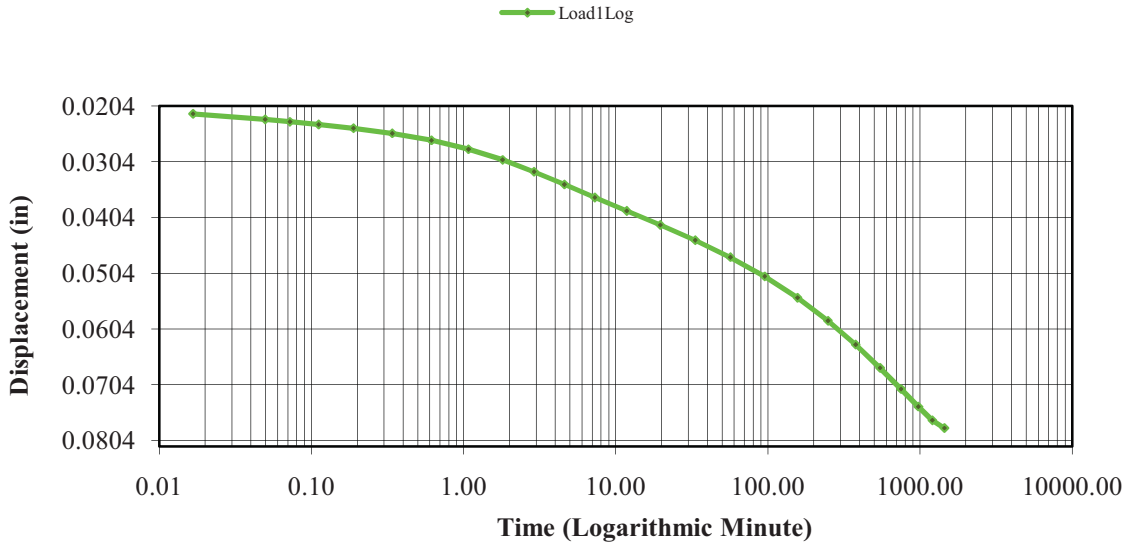
Checked By:

Consolidation Test Results
(Sequence 5) Load 2.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)



Consolidation Test Results
(Sequence 9) Load 4.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-096A
Depth: 22-24'
Sample Type: Undisturbed

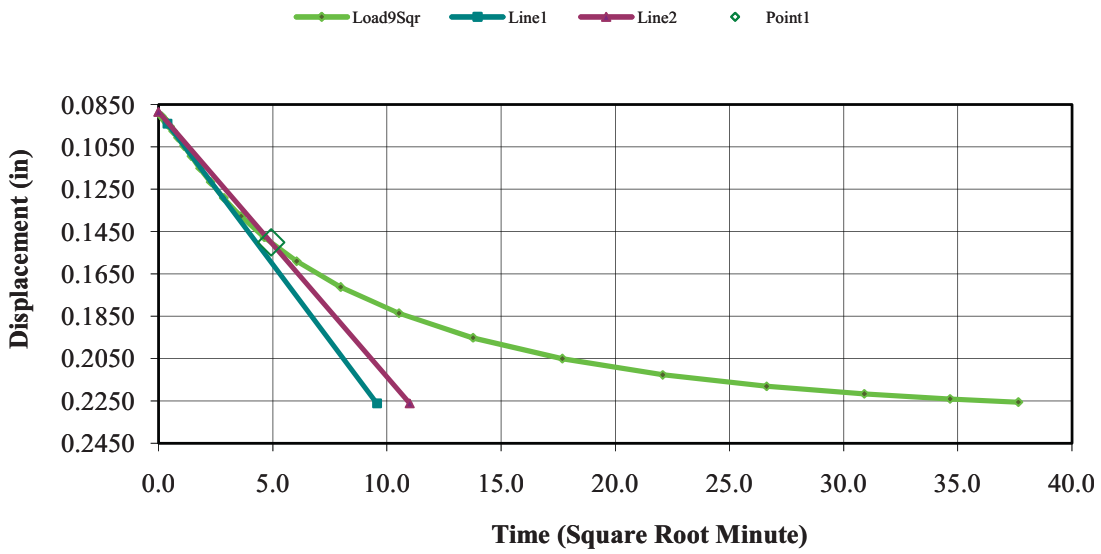
Soil Description: Gray, fat CLAY, trace sand, CH
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0887	0.0881	8.8100	1.6267
1	00:00:01	0.0906	0.0900	9.0000	1.6212
2	00:00:02	0.0913	0.0907	9.0700	1.6192
3	00:00:03	0.0919	0.0913	9.1300	1.6174
4	00:00:04	0.0922	0.0916	9.1600	1.6166
5	00:00:05	0.0927	0.0921	9.2100	1.6151
6	00:00:06	0.0930	0.0924	9.2400	1.6143
7	00:00:12	0.0948	0.0942	9.4200	1.6091
8	00:00:15	0.0955	0.0949	9.4900	1.6071
9	00:00:30	0.0985	0.0979	9.7900	1.5984
10	00:01:00	0.1028	0.1022	10.2200	1.5861
11	00:02:00	0.1091	0.1085	10.8500	1.5679
12	00:04:00	0.1183	0.1177	11.7700	1.5414
13	00:05:00	0.1219	0.1213	12.1300	1.5310
14	00:08:01	0.1311	0.1305	13.0500	1.5045
15	00:10:01	0.1361	0.1355	13.5500	1.4901
16	00:15:01	0.1464	0.1458	14.5800	1.4605
17	00:30:02	0.1662	0.1656	16.5600	1.4034
18	01:00:04	0.1850	0.1844	18.4400	1.3493
19	02:00:08	0.1990	0.1984	19.8400	1.3090
20	04:00:17	0.2083	0.2077	20.7700	1.2822
21	08:00:34	0.2153	0.2147	21.4700	1.2620
22	12:00:51	0.2193	0.2187	21.8700	1.2505
23	16:01:08	0.2220	0.2214	22.1400	1.2427
24	20:01:25	0.2241	0.2235	22.3500	1.2367
25	23:37:33	0.2256	0.2250	22.5000	1.2323

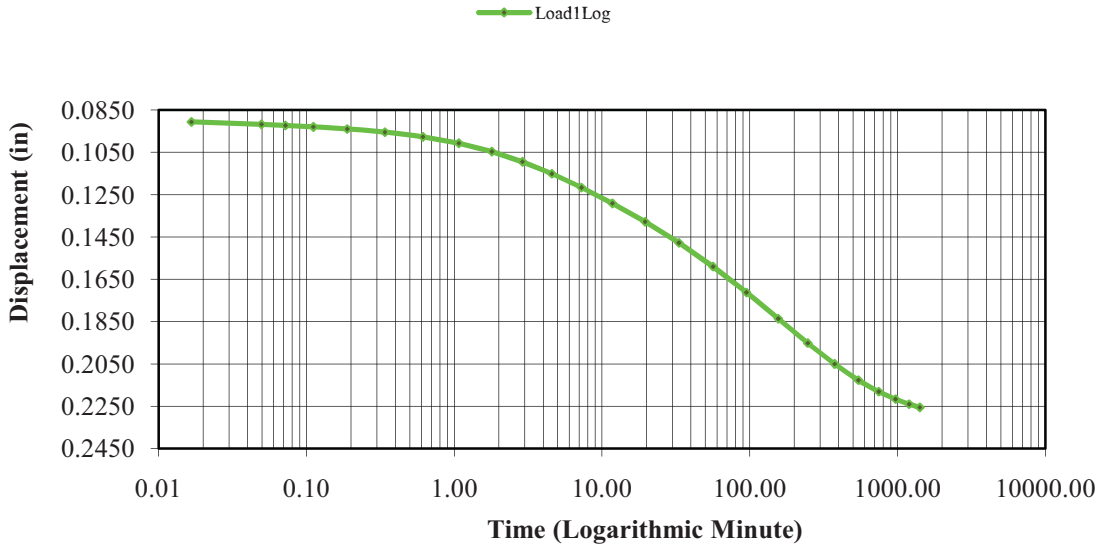
Tested By: **Checked By:**

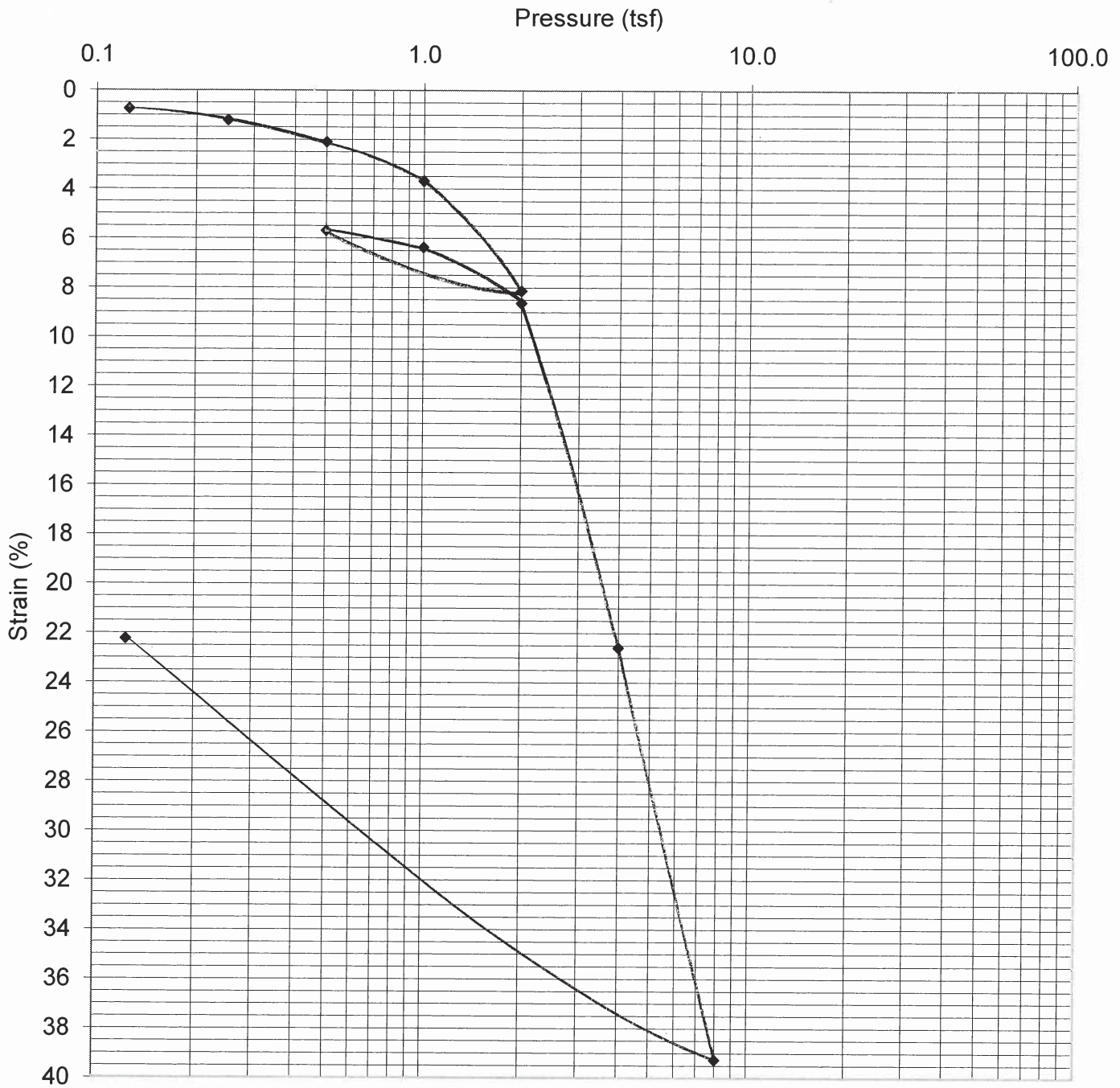
Consolidation Test Results
(Sequence 9) Load 4.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)





Description of Sample:	Dark brown, PEAT, PT				
Boring :	10BH-096A	Depth:	32'-34'	Stratum:	D3

Probable Preconsolidation Stress (tsf)	1.7
Approximate Overburden Stress (tsf):	0.95
Compression Ratio (from 2 to 8 tsf):	0.480
Recompression Ratio (from ½ to 1 tsf):	0.024

Schnabel ENGINEERING

CONSOLIDATION TEST

Project:	MLK Expressway Extension Portsmouth, VA
Contract Number:	10613051

Consolidation Test Results
(Sequence 3) Load 0.500 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date: 9-02-10
Test Number:

Sample Number:
Boring Number: 10BH-096A
Depth: 32'-34'
Sample Type: Undisturbed

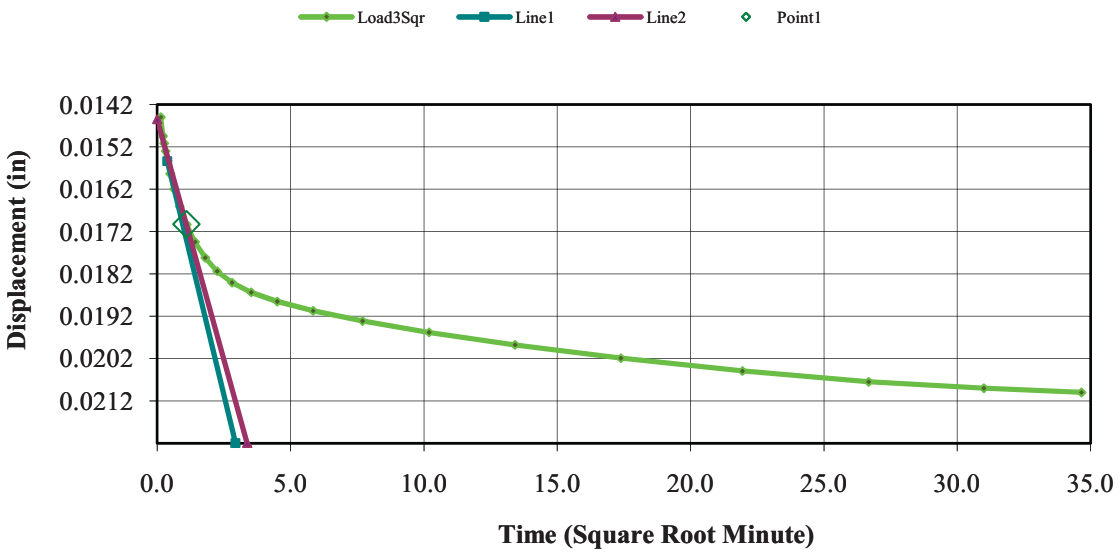
Soil Description: Dark brown, PEAT
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0122	0.0121	1.2100	7.5680
1	00:00:01	0.0145	0.0144	1.4400	7.5481
2	00:00:02	0.0148	0.0147	1.4700	7.5455
3	00:00:03	0.0150	0.0149	1.4900	7.5437
4	00:00:04	0.0152	0.0151	1.5100	7.5420
5	00:00:05	0.0152	0.0151	1.5100	7.5420
6	00:00:06	0.0153	0.0152	1.5200	7.5411
7	00:00:12	0.0159	0.0158	1.5800	7.5359
8	00:00:15	0.0160	0.0159	1.5900	7.5351
9	00:00:30	0.0167	0.0166	1.6600	7.5290
10	00:01:00	0.0173	0.0172	1.7200	7.5238
11	00:02:00	0.0179	0.0178	1.7800	7.5186
12	00:04:00	0.0184	0.0183	1.8300	7.5143
13	00:05:00	0.0184	0.0183	1.8300	7.5143
14	00:08:01	0.0186	0.0185	1.8500	7.5125
15	00:10:01	0.0187	0.0186	1.8600	7.5117
16	00:15:01	0.0189	0.0188	1.8800	7.5099
17	00:30:02	0.0192	0.0191	1.9100	7.5073
18	01:00:04	0.0194	0.0193	1.9300	7.5056
19	02:00:09	0.0198	0.0197	1.9700	7.5021
20	04:00:17	0.0201	0.0200	2.0000	7.4995
21	08:00:34	0.0206	0.0205	2.0500	7.4952
22	12:00:51	0.0208	0.0207	2.0700	7.4934
23	16:01:07	0.0209	0.0208	2.0800	7.4926
24	20:01:24	0.0210	0.0209	2.0900	7.4917

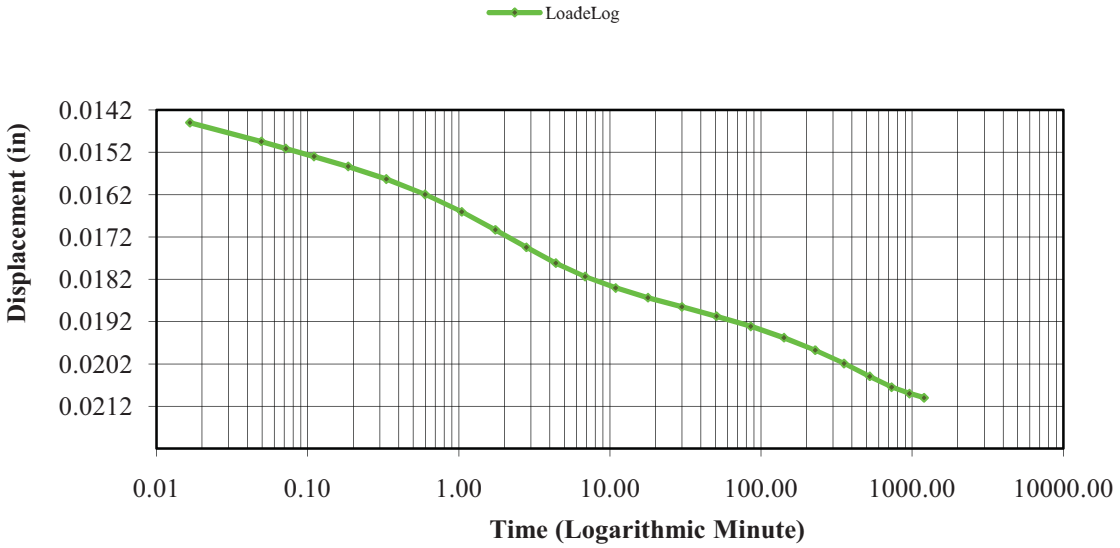
Tested By: **Checked By:**

Consolidation Test Results
(Sequence 3) Load 0.500 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)



Consolidation Test Results
(Sequence 5) Load 2.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date: 9-02-10
Test Number:

Sample Number:
Boring Number: 10BH-096A
Depth: 32'-34'
Sample Type: Undisturbed

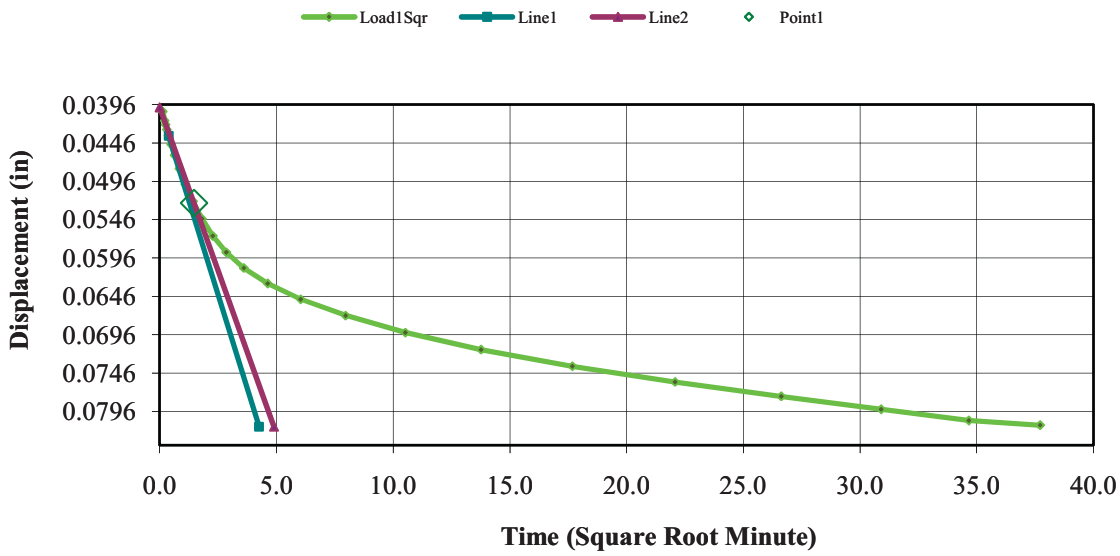
Soil Description: Dark brown, PEAT
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0369	0.0368	3.6800	7.3538
1	00:00:01	0.0405	0.0404	4.0400	7.3226
2	00:00:02	0.0412	0.0411	4.1100	7.3165
3	00:00:03	0.0418	0.0417	4.1700	7.3113
4	00:00:04	0.0423	0.0422	4.2200	7.3070
5	00:00:05	0.0426	0.0425	4.2500	7.3044
6	00:00:06	0.0431	0.0430	4.3000	7.3000
7	00:00:12	0.0446	0.0445	4.4500	7.2870
8	00:00:15	0.0452	0.0451	4.5100	7.2818
9	00:00:30	0.0473	0.0472	4.7200	7.2636
10	00:01:00	0.0500	0.0499	4.9900	7.2402
11	00:02:00	0.0534	0.0533	5.3300	7.2107
12	00:04:00	0.0570	0.0569	5.6900	7.1795
13	00:05:00	0.0583	0.0582	5.8200	7.1682
14	00:08:00	0.0607	0.0606	6.0600	7.1474
15	00:10:00	0.0617	0.0616	6.1600	7.1387
16	00:15:01	0.0633	0.0632	6.3200	7.1248
17	00:30:02	0.0661	0.0660	6.6000	7.1006
18	01:00:04	0.0688	0.0687	6.8700	7.0771
19	02:00:08	0.0714	0.0713	7.1300	7.0546
20	04:00:17	0.0736	0.0735	7.3500	7.0355
21	08:00:33	0.0758	0.0757	7.5700	7.0164
22	12:00:50	0.0777	0.0776	7.7600	6.9999
23	16:01:07	0.0794	0.0793	7.9300	6.9852
24	20:01:24	0.0808	0.0807	8.0700	6.9731
25	23:42:15	0.0814	0.0813	8.1300	6.9679

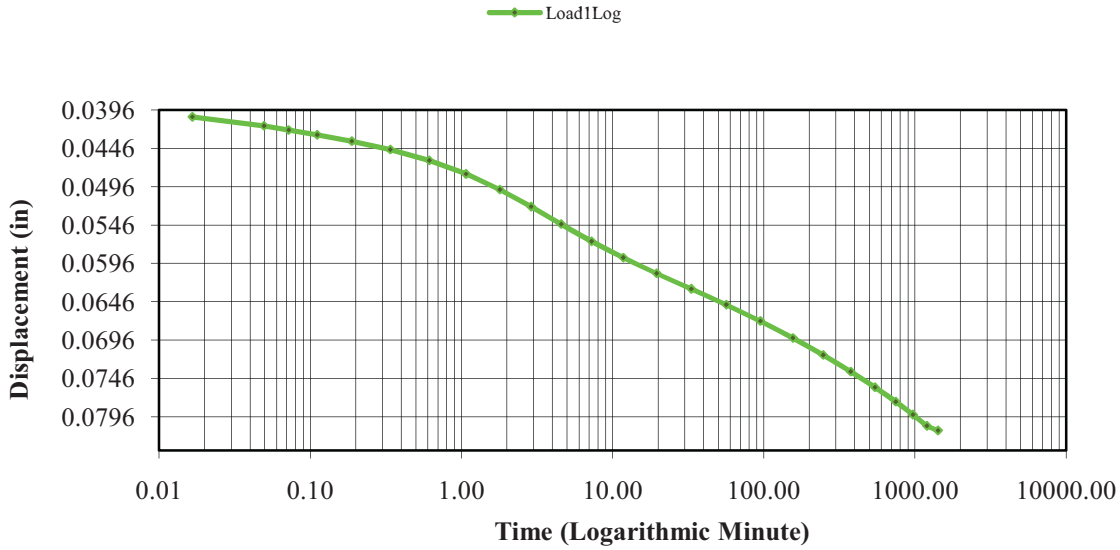
Tested By: **Checked By:**

Consolidation Test Results
(Sequence 5) Load 2.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)



Consolidation Test Results
(Sequence 9) Load 4.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date: 9-02-10
Test Number:

Sample Number:
Boring Number: 10BH-096A
Depth: 32'-34'
Sample Type: Undisturbed

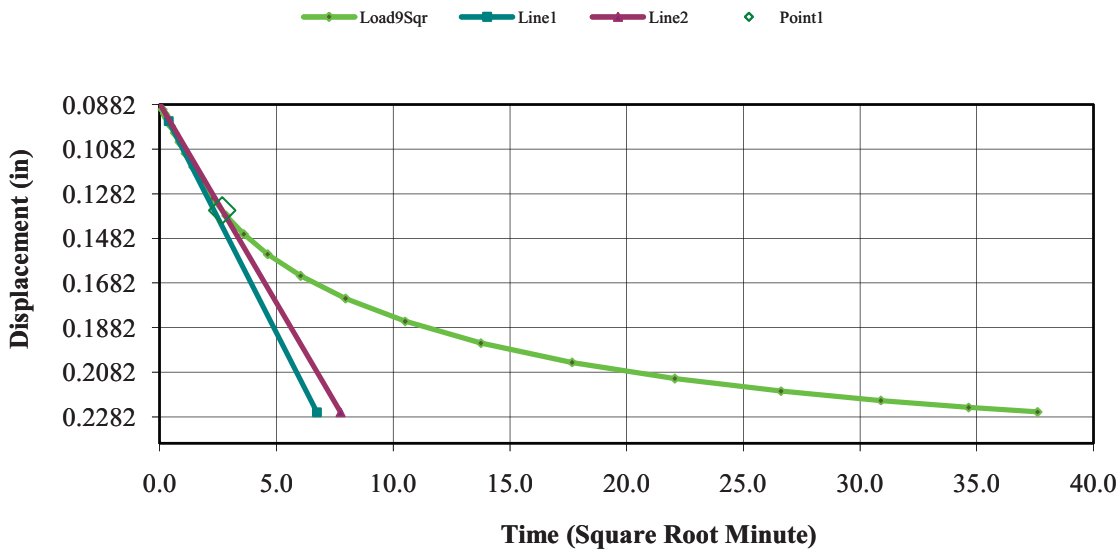
Soil Description: Dark brown, PEAT
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0863	0.0862	8.6200	6.9254
1	00:00:01	0.0905	0.0904	9.0400	6.8889
2	00:00:02	0.0916	0.0915	9.1500	6.8794
3	00:00:03	0.0924	0.0923	9.2300	6.8725
4	00:00:04	0.0931	0.0930	9.3000	6.8664
5	00:00:05	0.0937	0.0936	9.3600	6.8612
6	00:00:06	0.0944	0.0943	9.4300	6.8551
7	00:00:12	0.0970	0.0969	9.6900	6.8326
8	00:00:15	0.0981	0.0980	9.8000	6.8230
9	00:00:30	0.1025	0.1024	10.2400	6.7849
10	00:01:00	0.1088	0.1087	10.8700	6.7302
11	00:02:00	0.1171	0.1170	11.7000	6.6582
12	00:04:00	0.1280	0.1279	12.7900	6.5637
13	00:05:00	0.1323	0.1322	13.2200	6.5264
14	00:08:00	0.1422	0.1421	14.2100	6.4405
15	00:10:00	0.1471	0.1470	14.7000	6.3980
16	00:15:00	0.1564	0.1563	15.6300	6.3174
17	00:30:00	0.1713	0.1712	17.1200	6.1882
18	01:00:00	0.1857	0.1856	18.5600	6.0633
19	01:59:59	0.1966	0.1965	19.6500	5.9687
20	03:59:57	0.2053	0.2052	20.5200	5.8933
21	08:00:14	0.2129	0.2128	21.2800	5.8274
22	12:00:31	0.2176	0.2175	21.7500	5.7866
23	16:00:48	0.2211	0.2210	22.1000	5.7562
24	20:01:05	0.2240	0.2239	22.3900	5.7311
25	23:34:19	0.2260	0.2259	22.5900	5.7137

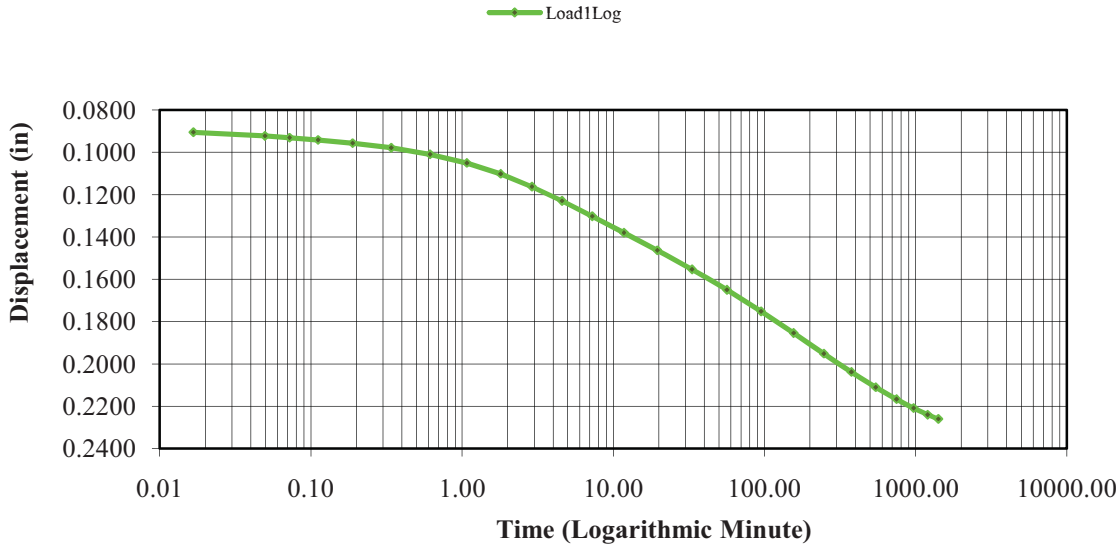
Tested By: **Checked By:**

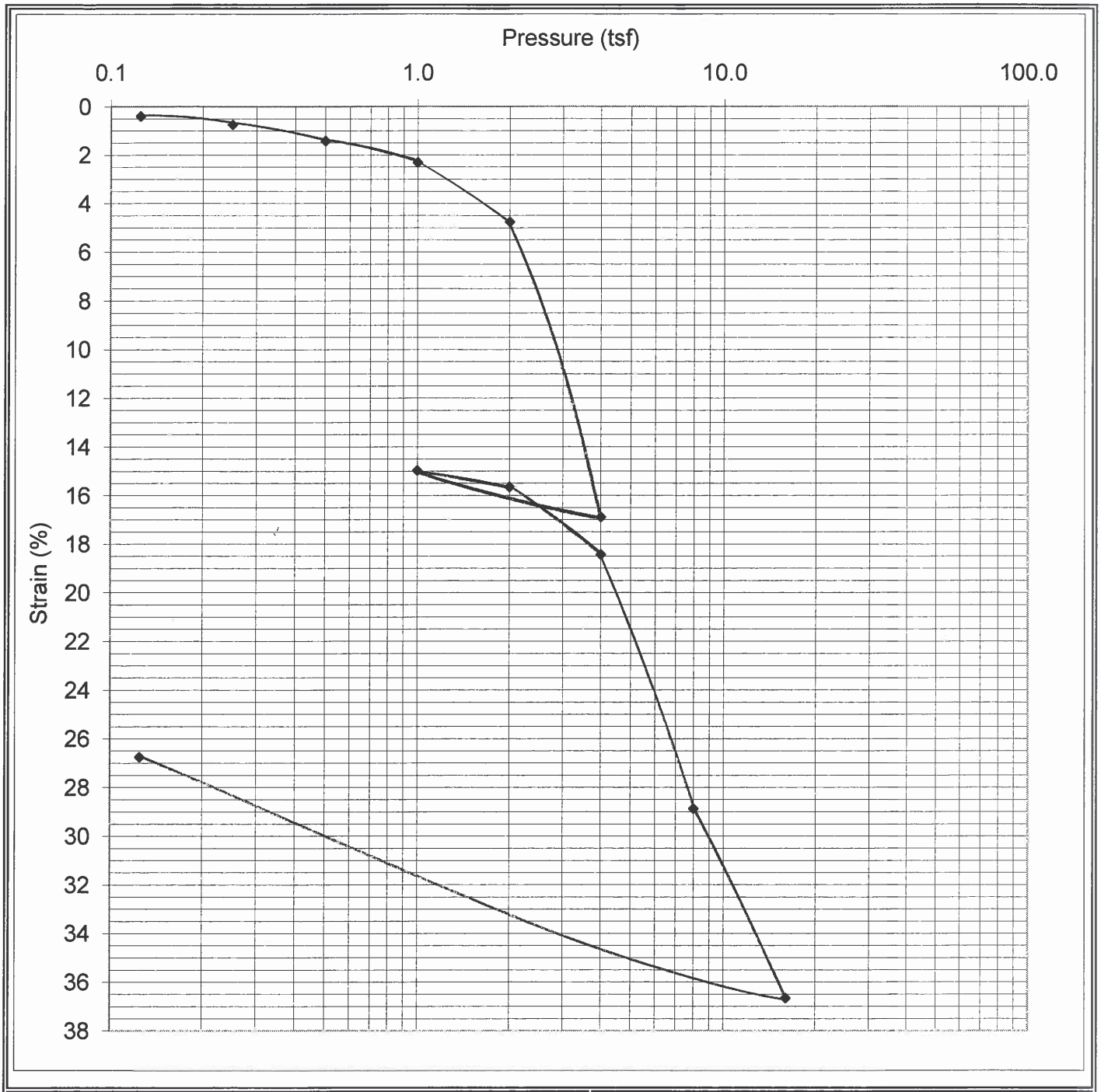
Consolidation Test Results
(Sequence 9) Load 4.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)





Description of Sample:	Gray, fat CLAY, CH				
Boring :	10BH-101	Depth:	22'-24'	Stratum:	D2

Probable Preconsolidation Stress (tsf)	1.9
Approximate Overburden Stress (tsf):	0.76
Compression Ratio (from 8 to 16 tsf):	0.390
Recompression Ratio (from 1 to 2 tsf):	0.024

Schnabel ENGINEERING

CONSOLIDATION TEST

Project:	MLK Expressway Portsmouth, VA
Contract Number:	10613051

Consolidation Test Results
(Sequence 3) Load 0.500 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: P8330138

Test Date: 4-30-10
Test Number:

Sample Number:
Boring Number: 10BH-101
Depth: 22'-24'
Sample Type: Undisturbed

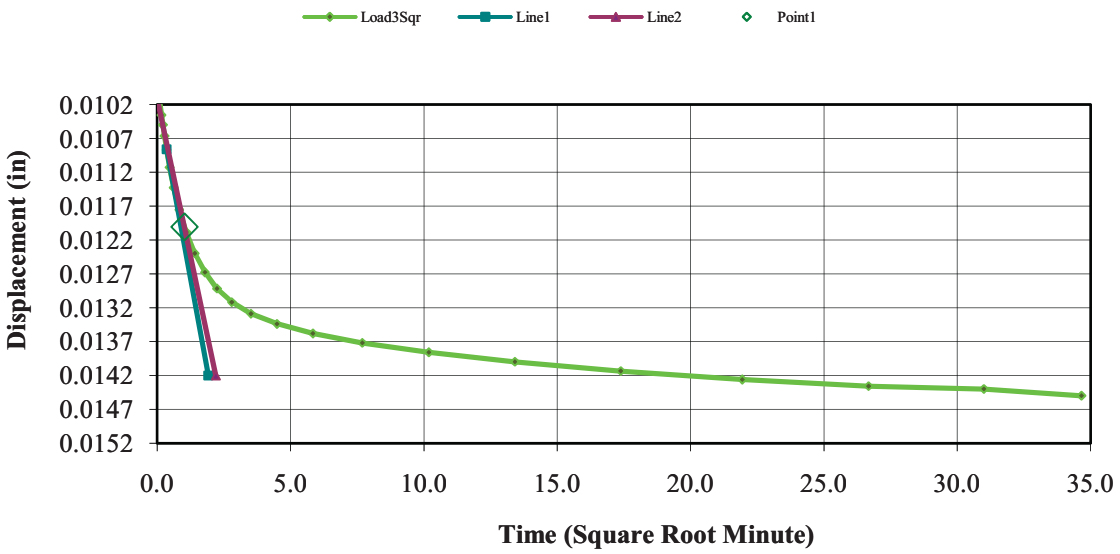
Soil Description: FAT CLAY (CH), gray
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0078	0.0075	0.7500	57.8030
1	00:00:00	0.0099	0.0096	0.9600	57.6786
2	00:00:01	0.0103	0.0100	1.0000	57.6549
3	00:00:02	0.0104	0.0101	1.0100	57.6490
4	00:00:03	0.0105	0.0102	1.0200	57.6430
5	00:00:04	0.0106	0.0103	1.0300	57.6371
6	00:00:05	0.0107	0.0104	1.0400	57.6312
7	00:00:12	0.0112	0.0109	1.0900	57.6016
8	00:00:15	0.0113	0.0110	1.1000	57.5956
9	00:00:30	0.0119	0.0116	1.1600	57.5601
10	00:01:00	0.0123	0.0120	1.2000	57.5364
11	00:02:00	0.0128	0.0125	1.2500	57.5068
12	00:04:00	0.0130	0.0127	1.2700	57.4949
13	00:05:00	0.0131	0.0128	1.2800	57.4890
14	00:08:00	0.0133	0.0130	1.3000	57.4771
15	00:10:00	0.0134	0.0131	1.3100	57.4712
16	00:15:01	0.0135	0.0132	1.3200	57.4653
17	00:30:02	0.0137	0.0134	1.3400	57.4534
18	01:00:04	0.0138	0.0135	1.3500	57.4475
19	02:00:08	0.0140	0.0137	1.3700	57.4357
20	04:00:17	0.0141	0.0138	1.3800	57.4297
21	08:00:35	0.0143	0.0140	1.4000	57.4179
22	12:00:53	0.0144	0.0141	1.4100	57.4120
23	16:01:11	0.0144	0.0141	1.4100	57.4120
24	20:01:29	0.0145	0.0142	1.4200	57.4060

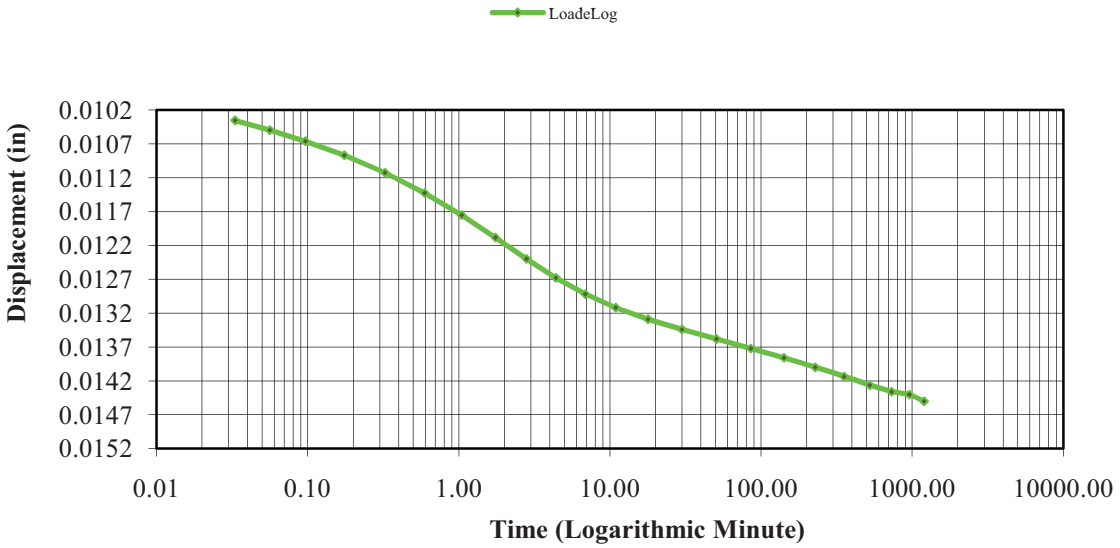
Tested By: **Checked By:**

Consolidation Test Results
(Sequence 3) Load 0.500 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)



Consolidation Test Results
(Sequence 5) Load 2.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: P8330138

Test Date: 4-30-10
Test Number:

Sample Number:
Boring Number: 10BH-101
Depth: 22'-24'
Sample Type: Undisturbed

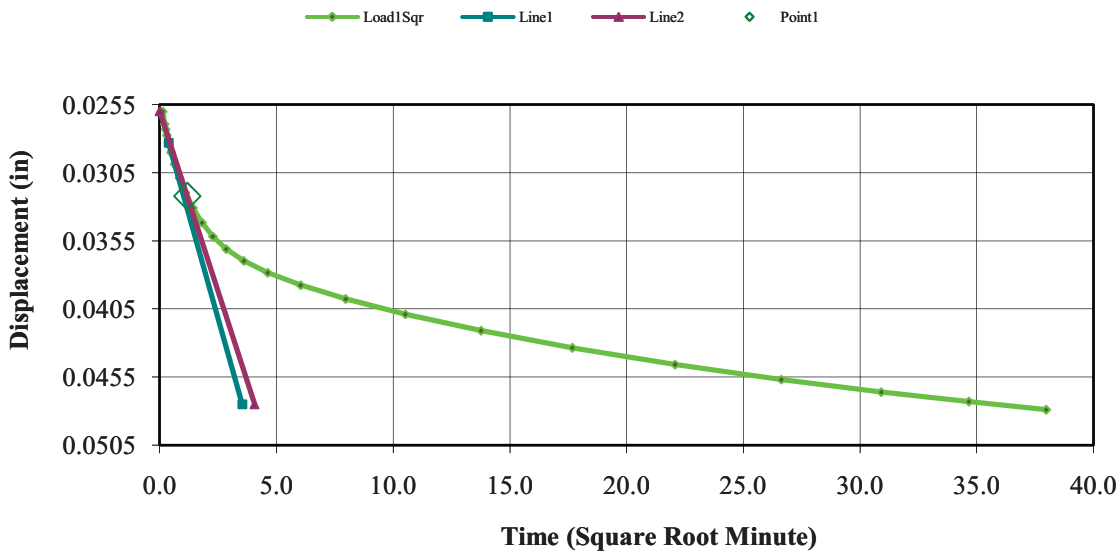
Soil Description: FAT CLAY (CH), gray
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0234	0.0231	2.3100	56.8787
1	00:00:01	0.0260	0.0257	2.5700	56.7247
2	00:00:02	0.0266	0.0263	2.6300	56.6891
3	00:00:03	0.0271	0.0268	2.6800	56.6595
4	00:00:04	0.0273	0.0270	2.7000	56.6477
5	00:00:05	0.0276	0.0273	2.7300	56.6299
6	00:00:06	0.0280	0.0277	2.7700	56.6062
7	00:00:12	0.0289	0.0286	2.8600	56.5529
8	00:00:15	0.0294	0.0291	2.9100	56.5233
9	00:00:30	0.0308	0.0305	3.0500	56.4403
10	00:01:00	0.0324	0.0321	3.2100	56.3455
11	00:02:00	0.0340	0.0337	3.3700	56.2507
12	00:04:00	0.0355	0.0352	3.5200	56.1618
13	00:05:00	0.0360	0.0357	3.5700	56.1322
14	00:08:01	0.0368	0.0365	3.6500	56.0848
15	00:10:01	0.0372	0.0369	3.6900	56.0611
16	00:15:01	0.0379	0.0376	3.7600	56.0196
17	00:30:02	0.0391	0.0388	3.8800	55.9486
18	01:00:04	0.0403	0.0400	4.0000	55.8775
19	02:00:09	0.0416	0.0413	4.1300	55.8004
20	04:00:18	0.0432	0.0429	4.2900	55.7056
21	08:00:36	0.0448	0.0445	4.4500	55.6108
22	12:00:54	0.0458	0.0455	4.5500	55.5516
23	16:01:12	0.0467	0.0464	4.6400	55.4983
24	20:01:30	0.0473	0.0470	4.7000	55.4627
25	24:01:48	0.0479	0.0476	4.7600	55.4272

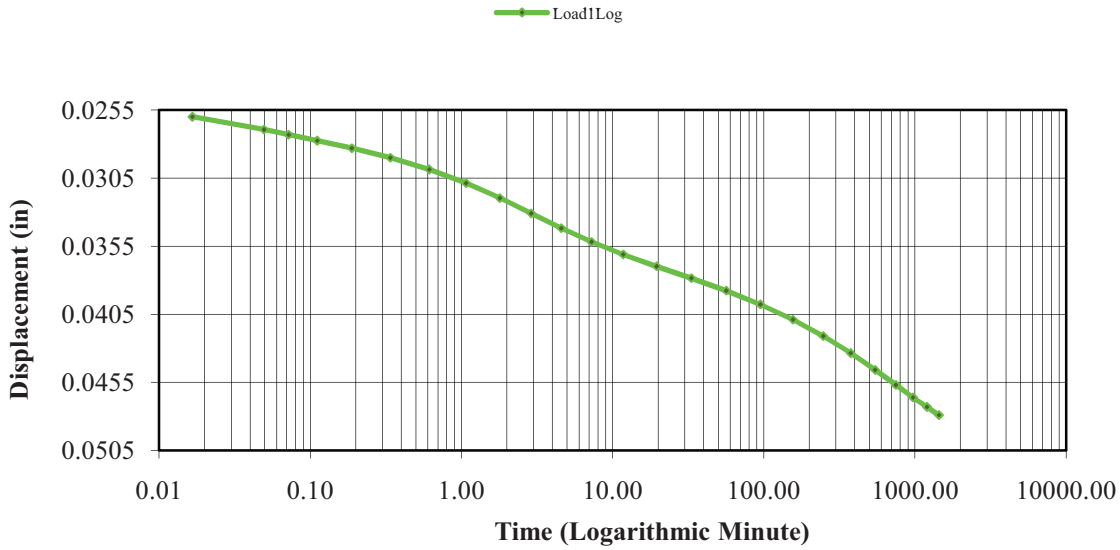
Tested By: **Checked By:**

Consolidation Test Results
(Sequence 5) Load 2.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)



Consolidation Test Results
(Sequence 6) Load 4.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: P8330138

Test Date: 4-30-10
Test Number:

Sample Number:
Boring Number: 10BH-101
Depth: 22'-24'
Sample Type: Undisturbed

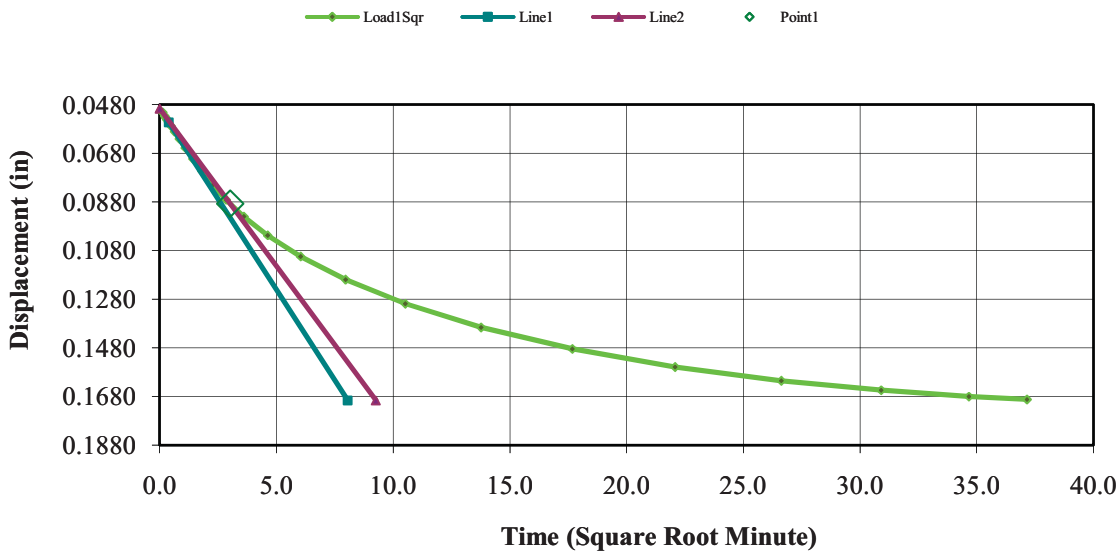
Soil Description: FAT CLAY (CH), gray
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0479	0.0476	4.7600	55.4272
1	00:00:01	0.0513	0.0510	5.1000	55.2257
2	00:00:02	0.0522	0.0519	5.1900	55.1724
3	00:00:03	0.0529	0.0526	5.2600	55.1309
4	00:00:04	0.0535	0.0532	5.3200	55.0954
5	00:00:05	0.0538	0.0535	5.3500	55.0776
6	00:00:06	0.0544	0.0541	5.4100	55.0421
7	00:00:12	0.0563	0.0560	5.6000	54.9295
8	00:00:15	0.0570	0.0567	5.6700	54.8880
9	00:00:30	0.0602	0.0599	5.9900	54.6984
10	00:01:00	0.0647	0.0644	6.4400	54.4318
11	00:02:00	0.0708	0.0705	7.0500	54.0704
12	00:04:00	0.0791	0.0788	7.8800	53.5787
13	00:05:00	0.0822	0.0819	8.1900	53.3950
14	00:08:01	0.0896	0.0893	8.9300	52.9566
15	00:10:00	0.0936	0.0933	9.3300	52.7196
16	00:15:01	0.1012	0.1009	10.0900	52.2693
17	00:30:02	0.1152	0.1149	11.4900	51.4398
18	01:00:04	0.1288	0.1285	12.8500	50.6341
19	02:00:09	0.1403	0.1400	14.0000	49.9527
20	04:00:18	0.1501	0.1498	14.9800	49.3721
21	08:00:36	0.1585	0.1582	15.8200	48.8744
22	12:00:53	0.1628	0.1625	16.2500	48.6197
23	16:01:12	0.1657	0.1654	16.5400	48.4478
24	20:01:30	0.1680	0.1677	16.7700	48.3116
25	23:00:06	0.1692	0.1689	16.8900	48.2405

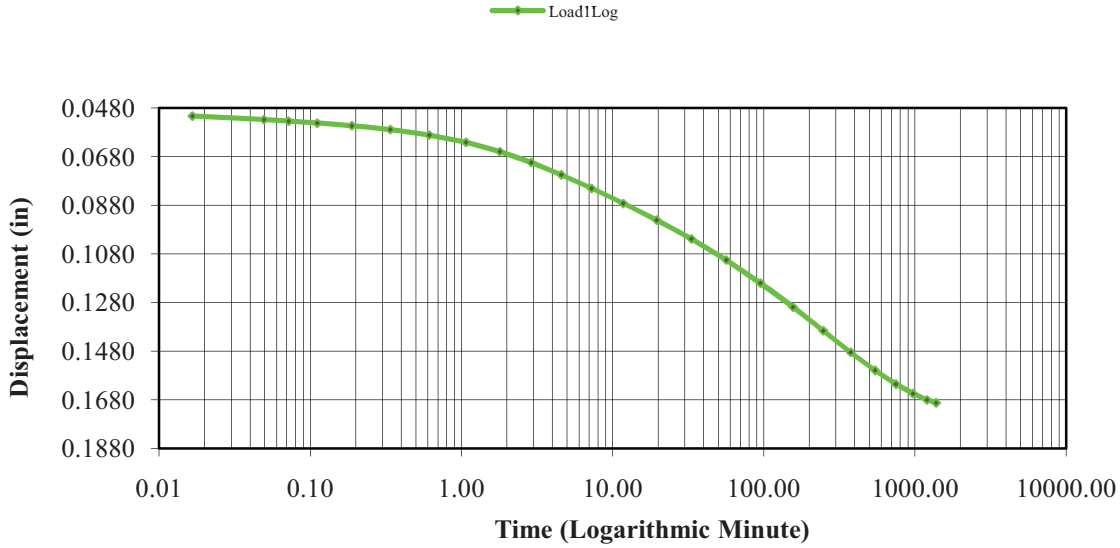
Tested By: **Checked By:**

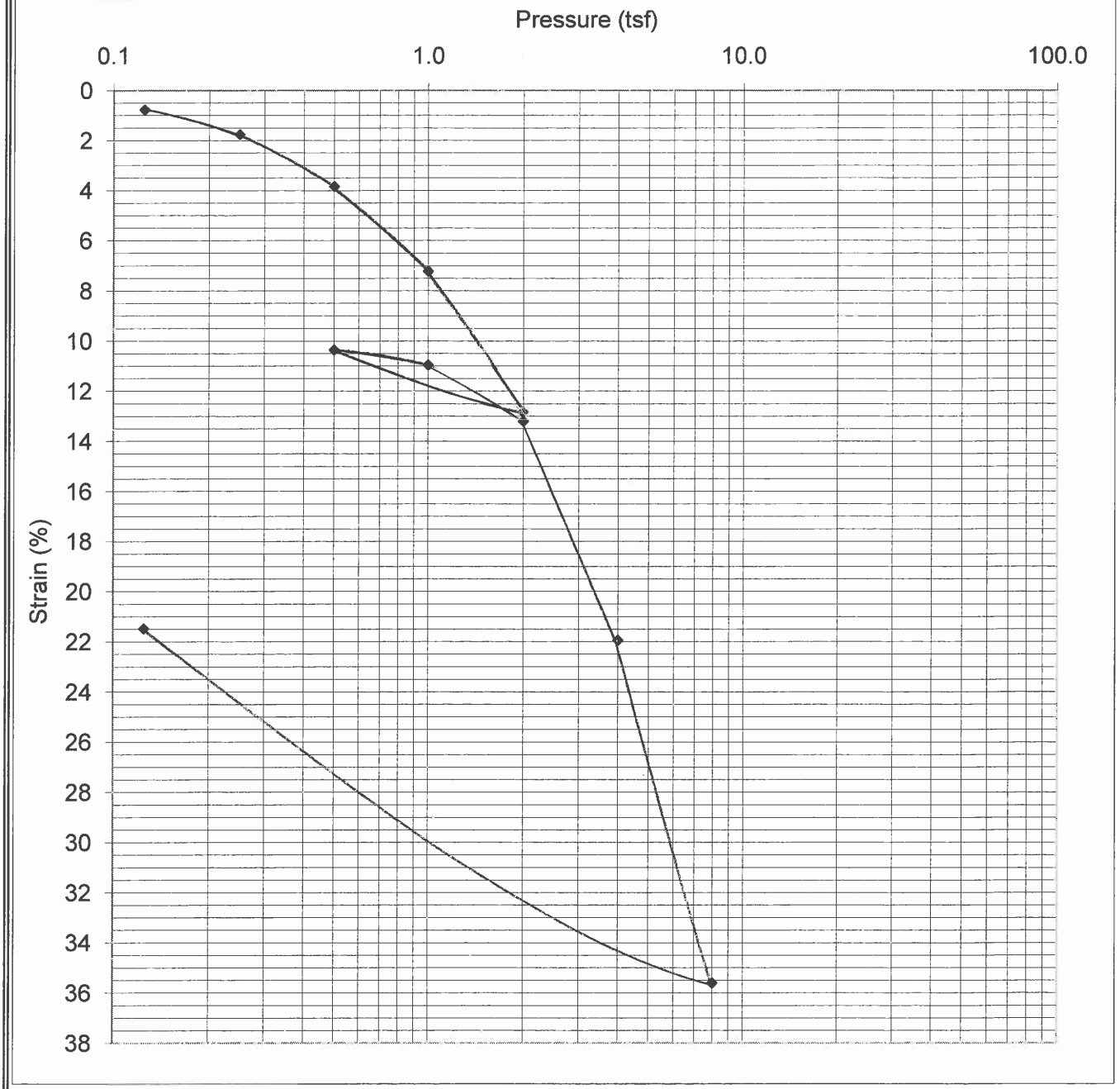
Consolidation Test Results
(Sequence 6) Load 4.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)





Description of Sample:	Dark brown, sandy organic Silt, OH				
Boring :	10BH-101	Depth:	35'-37'	Stratum:	D3

Probable Preconsolidation Stress (tsf)	1.8
Approximate Overburden Stress (tsf):	0.95
Compression Ratio (from 2 to 4 tsf):	0.450
Recompression Ratio (from ½ to 1 tsf):	0.023

Schnabel ENGINEERING

CONSOLIDATION TEST

Project:	MLK Expressway Portsmouth, VA
Contract Number:	10613051

Consolidation Test Results
(Sequence 3) Load 0.500 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: P8330138

Test Date: 5-11-10
Test Number:

Sample Number:
Boring Number: 10BH-101
Depth: 35-37'
Sample Type: Undisturbed

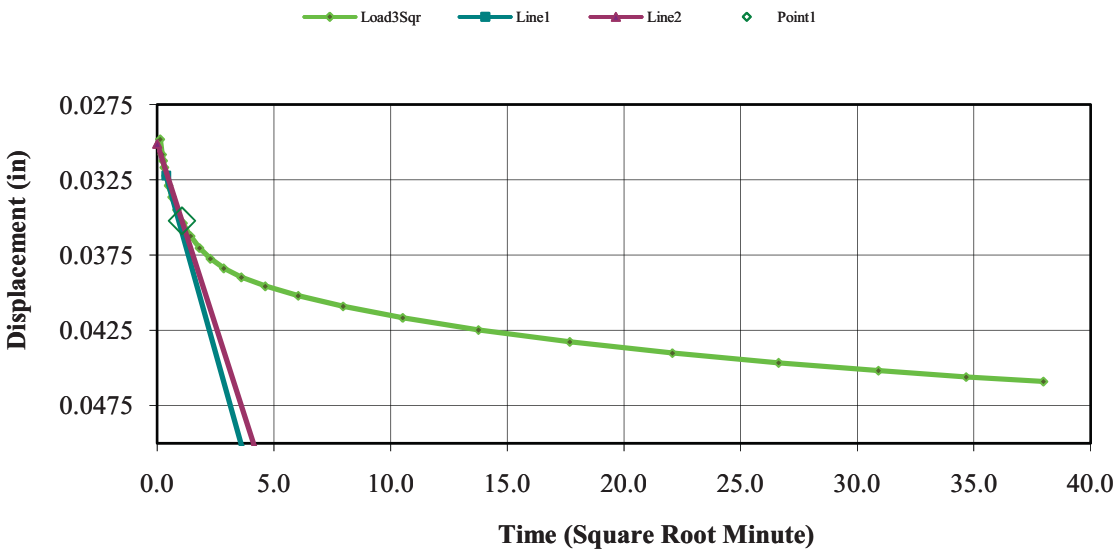
Soil Description: Dark brown, sandy organic silt, OH
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0251	0.0176	1.7600	6.6761
1	00:00:01	0.0298	0.0223	2.2300	6.6394
2	00:00:02	0.0305	0.0230	2.3000	6.6339
3	00:00:03	0.0309	0.0234	2.3400	6.6308
4	00:00:04	0.0313	0.0238	2.3800	6.6277
5	00:00:05	0.0316	0.0241	2.4100	6.6253
6	00:00:06	0.0318	0.0243	2.4300	6.6238
7	00:00:12	0.0330	0.0255	2.5500	6.6144
8	00:00:15	0.0333	0.0258	2.5800	6.6120
9	00:00:30	0.0347	0.0272	2.7200	6.6011
10	00:01:00	0.0359	0.0284	2.8400	6.5917
11	00:02:00	0.0371	0.0296	2.9600	6.5823
12	00:04:00	0.0380	0.0305	3.0500	6.5753
13	00:05:01	0.0383	0.0308	3.0800	6.5730
14	00:08:01	0.0388	0.0313	3.1300	6.5691
15	00:10:01	0.0391	0.0316	3.1600	6.5667
16	00:15:01	0.0396	0.0321	3.2100	6.5628
17	00:30:03	0.0404	0.0329	3.2900	6.5566
18	01:00:05	0.0413	0.0338	3.3800	6.5495
19	02:00:09	0.0423	0.0348	3.4800	6.5417
20	04:00:18	0.0433	0.0358	3.5800	6.5339
21	08:00:36	0.0442	0.0367	3.6700	6.5269
22	12:00:54	0.0447	0.0372	3.7200	6.5230
23	16:01:11	0.0452	0.0377	3.7700	6.5191
24	20:01:29	0.0456	0.0381	3.8100	6.5159
25	24:01:47	0.0459	0.0384	3.8400	6.5136

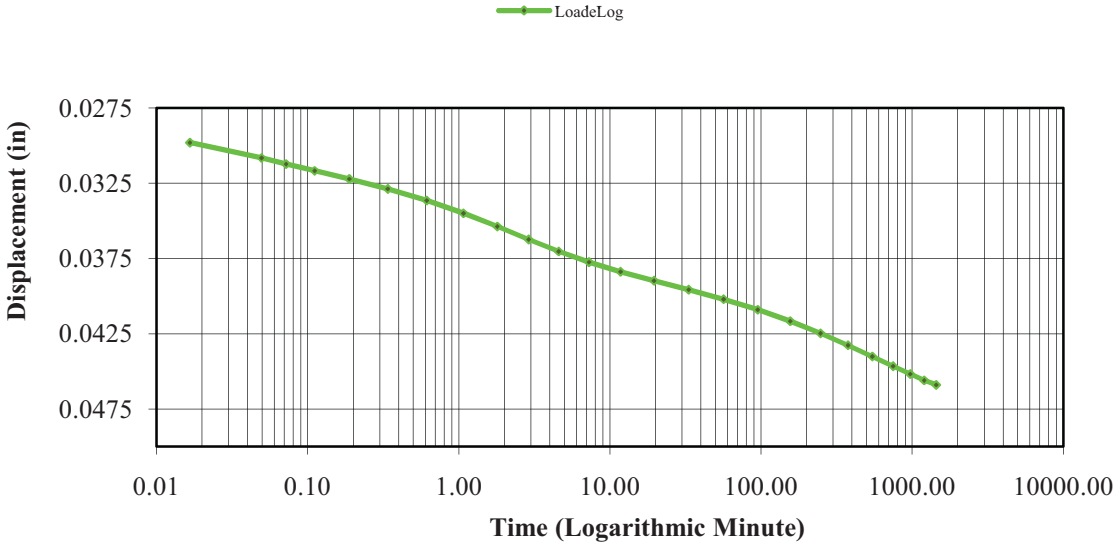
Tested By: **Checked By:**

Consolidation Test Results
(Sequence 3) Load 0.500 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)



Consolidation Test Results
(Sequence 5) Load 2.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: P8330138

Test Date: 5-11-10
Test Number:

Sample Number:
Boring Number: 10BH-101
Depth: 35-37'
Sample Type: Undisturbed

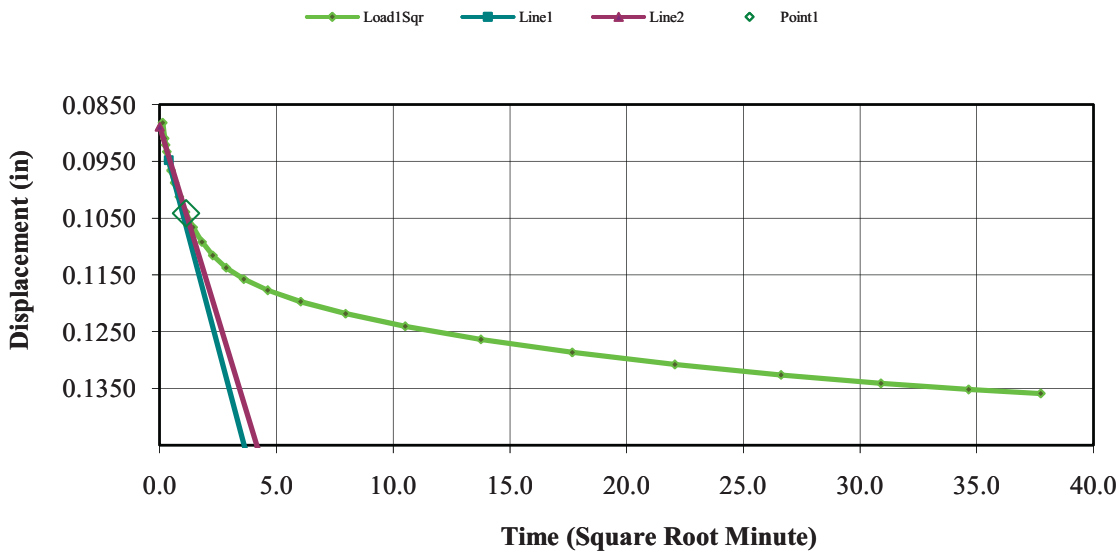
Soil Description: Dark brown, sandy organic silt, OH
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0797	0.0722	7.2200	6.2495
1	00:00:01	0.0882	0.0807	8.0700	6.1831
2	00:00:02	0.0900	0.0825	8.2500	6.1690
3	00:00:03	0.0913	0.0838	8.3800	6.1588
4	00:00:04	0.0923	0.0848	8.4800	6.1510
5	00:00:05	0.0931	0.0856	8.5600	6.1448
6	00:00:06	0.0938	0.0863	8.6300	6.1393
7	00:00:12	0.0967	0.0892	8.9200	6.1167
8	00:00:15	0.0978	0.0903	9.0300	6.1081
9	00:00:30	0.1012	0.0937	9.3700	6.0815
10	00:01:00	0.1051	0.0976	9.7600	6.0510
11	00:02:00	0.1089	0.1014	10.1400	6.0213
12	00:04:00	0.1124	0.1049	10.4900	5.9940
13	00:05:00	0.1134	0.1059	10.5900	5.9862
14	00:08:00	0.1155	0.1080	10.8000	5.9698
15	00:10:00	0.1164	0.1089	10.8900	5.9627
16	00:15:01	0.1180	0.1105	11.0500	5.9502
17	00:30:02	0.1207	0.1132	11.3200	5.9291
18	01:00:04	0.1233	0.1158	11.5800	5.9088
19	02:00:09	0.1260	0.1185	11.8500	5.8877
20	04:00:18	0.1285	0.1210	12.1000	5.8682
21	08:00:36	0.1312	0.1237	12.3700	5.8471
22	12:00:54	0.1329	0.1254	12.5400	5.8338
23	16:01:12	0.1343	0.1268	12.6800	5.8229
24	20:01:30	0.1352	0.1277	12.7700	5.8158
25	23:45:06	0.1359	0.1284	12.8400	5.8104

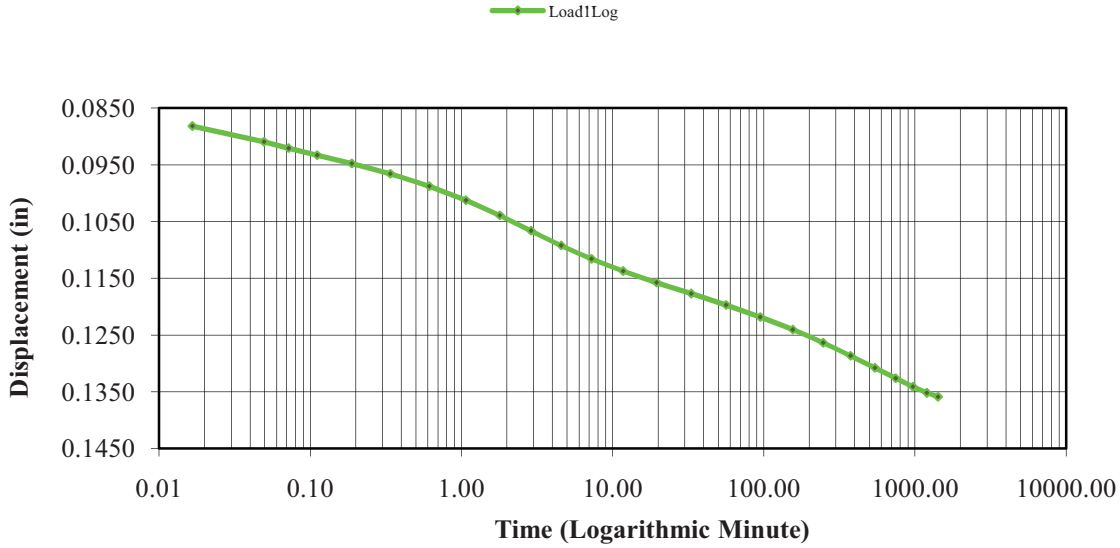
Tested By: **Checked By:**

Consolidation Test Results
(Sequence 5) Load 2.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)



Consolidation Test Results
(Sequence 9) Load 4.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: P8330138

Test Date: 5-11-10
Test Number:

Sample Number:
Boring Number: 10BH-101
Depth: 35-37'
Sample Type: Undisturbed

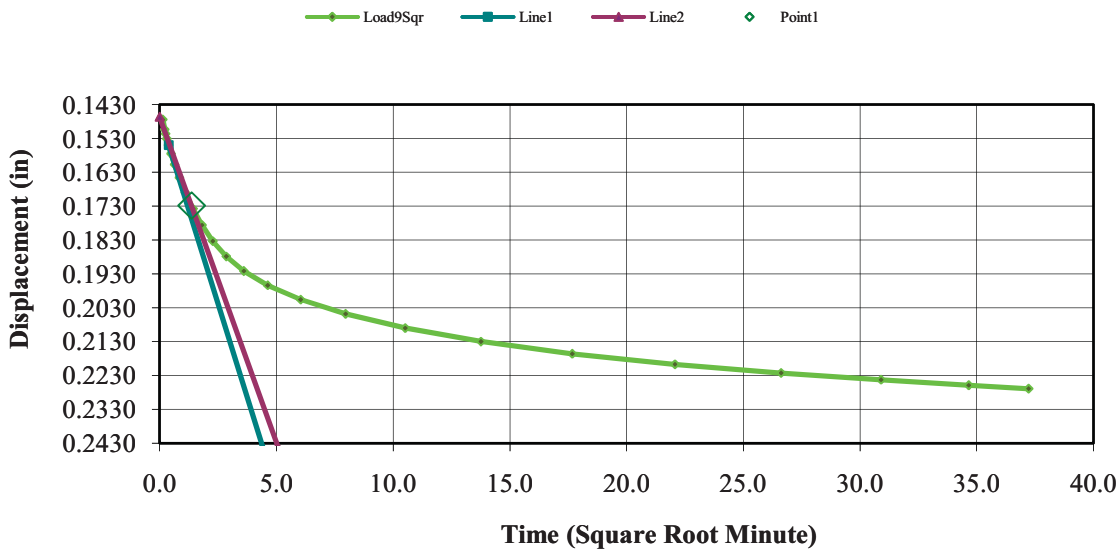
Soil Description: Dark brown, sandy organic silt, OH
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.1395	0.1320	13.2000	5.7822
1	00:00:01	0.1474	0.1399	13.9900	5.7205
2	00:00:02	0.1492	0.1417	14.1700	5.7064
3	00:00:03	0.1507	0.1432	14.3200	5.6947
4	00:00:04	0.1517	0.1442	14.4200	5.6869
5	00:00:05	0.1527	0.1452	14.5200	5.6791
6	00:00:06	0.1535	0.1460	14.6000	5.6728
7	00:00:12	0.1572	0.1497	14.9700	5.6439
8	00:00:15	0.1586	0.1511	15.1100	5.6330
9	00:00:30	0.1635	0.1560	15.6000	5.5947
10	00:01:00	0.1694	0.1619	16.1900	5.5486
11	00:02:00	0.1764	0.1689	16.8900	5.4939
12	00:04:01	0.1840	0.1765	17.6500	5.4345
13	00:05:00	0.1865	0.1790	17.9000	5.4150
14	00:08:01	0.1915	0.1840	18.4000	5.3759
15	00:10:01	0.1938	0.1863	18.6300	5.3580
16	00:15:01	0.1977	0.1902	19.0200	5.3275
17	00:30:02	0.2036	0.1961	19.6100	5.2814
18	01:00:05	0.2087	0.2012	20.1200	5.2415
19	02:00:09	0.2132	0.2057	20.5700	5.2064
20	04:00:18	0.2171	0.2096	20.9600	5.1759
21	08:00:36	0.2204	0.2129	21.2900	5.1501
22	12:00:54	0.2226	0.2151	21.5100	5.1329
23	16:01:12	0.2243	0.2168	21.6800	5.1196
24	20:01:30	0.2259	0.2184	21.8400	5.1071
25	23:05:45	0.2269	0.2194	21.9400	5.0993

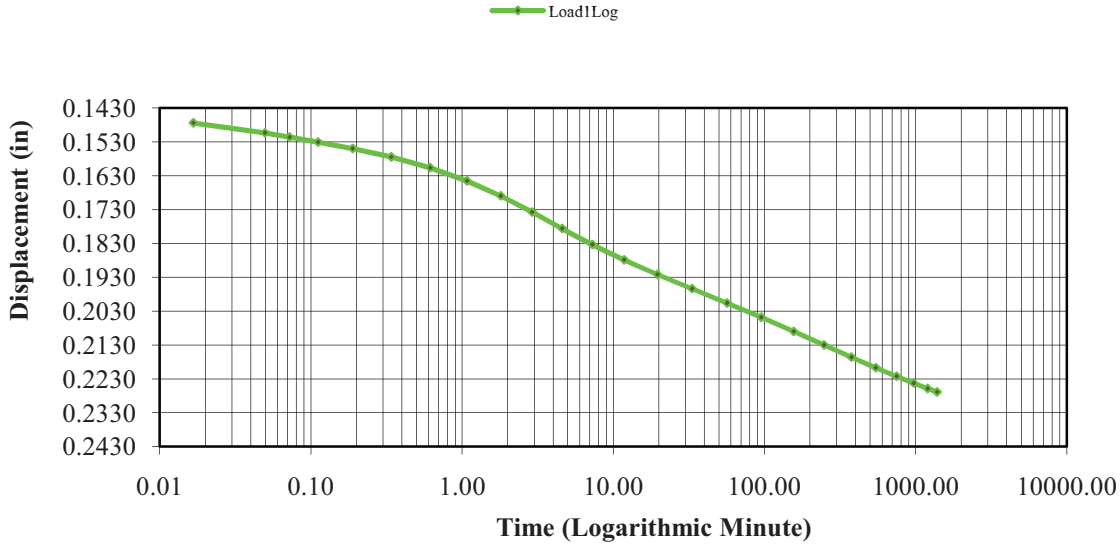
Tested By: **Checked By:**

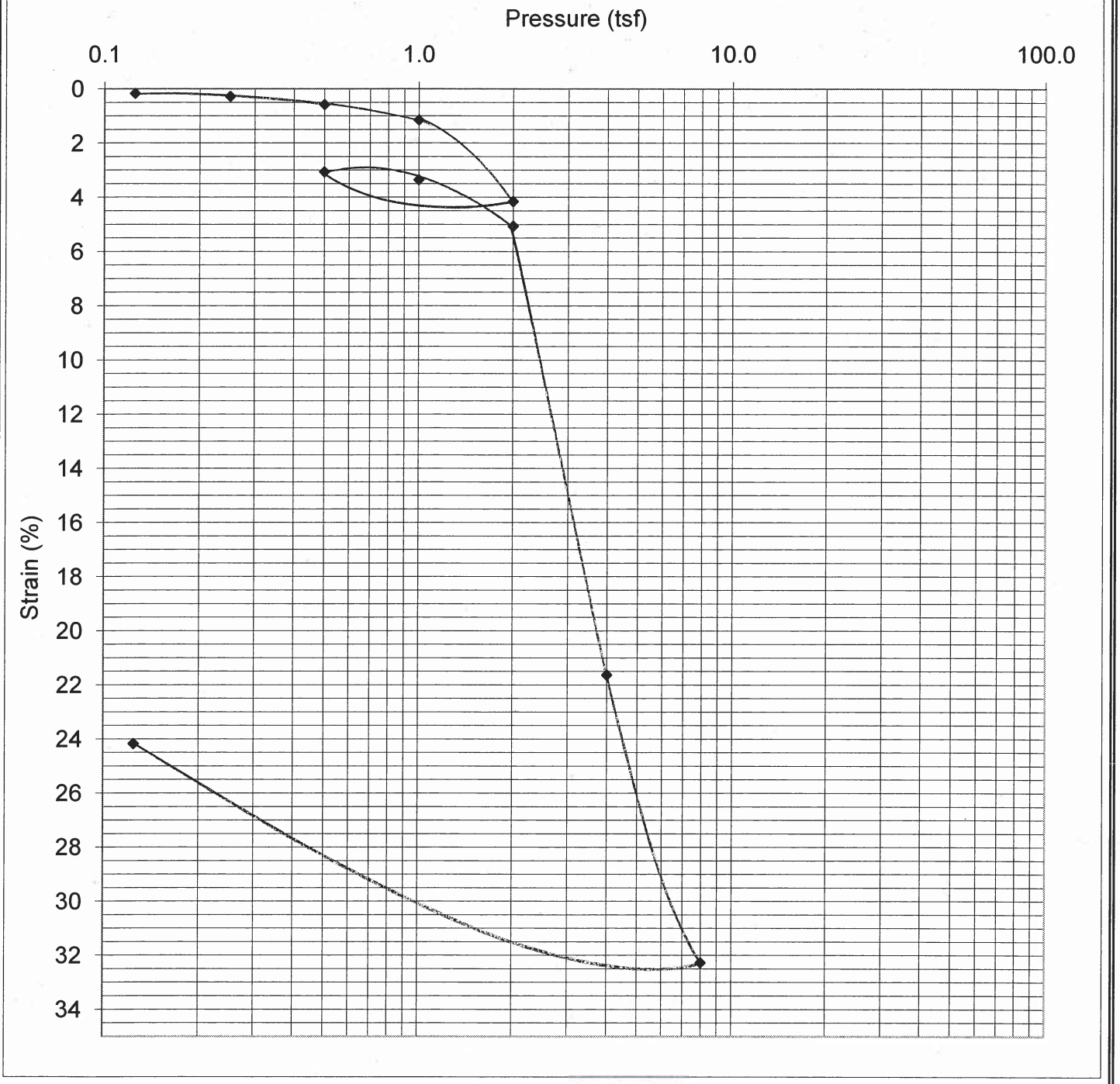
Consolidation Test Results
(Sequence 9) Load 4.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)





Description of Sample:	Gray, fat CLAY, trace sand, CH				
Boring :	10BH-120A	Depth:	25-27	Stratum:	D2

Probable Preconsolidation Stress (tsf)	1.9
Approximate Overburden Stress (tsf):	0.8
Compression Ratio (from 2 to 4 tsf):	0.540
Recompression Ratio (from ½ to 1 tsf):	0.010

Schnabel ENGINEERING

CONSOLIDATION TEST

Project:	MLK Expressway Extension Portsmouth, Virginia
Contract Number:	10613051

Consolidation Test Results
(Sequence 3) Load 0.500 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-120A
Depth: 25'-27'
Sample Type: Undisturbed

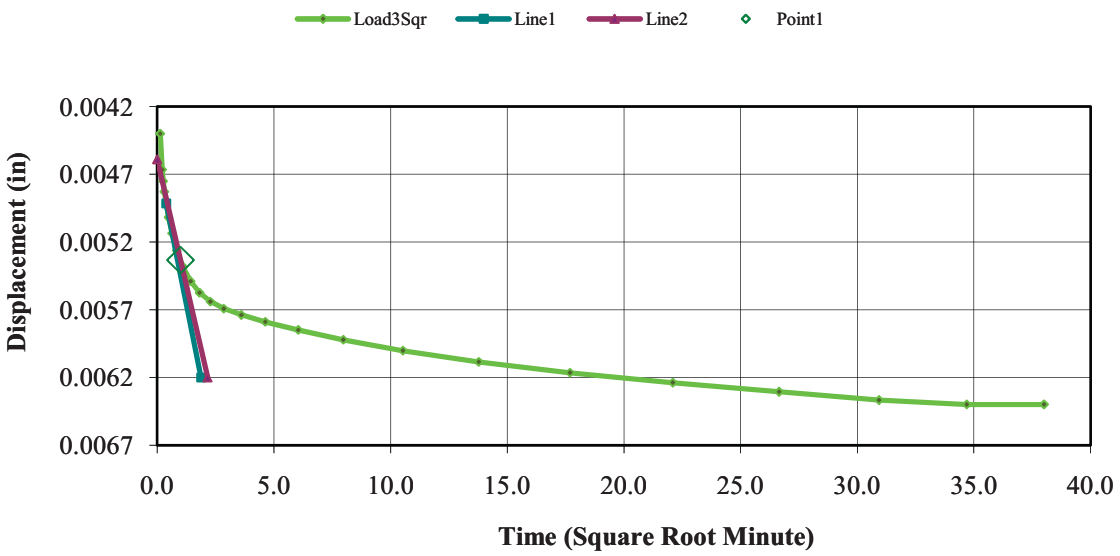
Soil Description: Gray, fat CLAY, CH
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0034	0.0027	0.2700	1.9591
1	00:00:01	0.0044	0.0037	0.3700	1.9562
2	00:00:02	0.0046	0.0039	0.3900	1.9556
3	00:00:03	0.0047	0.0040	0.4000	1.9553
4	00:00:04	0.0048	0.0041	0.4100	1.9550
5	00:00:05	0.0048	0.0041	0.4100	1.9550
6	00:00:06	0.0049	0.0042	0.4200	1.9547
7	00:00:12	0.0050	0.0043	0.4300	1.9544
8	00:00:15	0.0050	0.0043	0.4300	1.9544
9	00:00:30	0.0054	0.0047	0.4700	1.9532
10	00:01:01	0.0056	0.0049	0.4900	1.9526
11	00:02:01	0.0056	0.0049	0.4900	1.9526
12	00:04:01	0.0057	0.0050	0.5000	1.9523
13	00:05:01	0.0057	0.0050	0.5000	1.9523
14	00:08:02	0.0057	0.0050	0.5000	1.9523
15	00:10:02	0.0057	0.0050	0.5000	1.9523
16	00:15:03	0.0058	0.0051	0.5100	1.9520
17	00:30:06	0.0058	0.0051	0.5100	1.9520
18	01:00:12	0.0060	0.0053	0.5300	1.9514
19	02:00:24	0.0061	0.0054	0.5400	1.9511
20	04:00:47	0.0062	0.0055	0.5500	1.9508
21	08:01:34	0.0062	0.0055	0.5500	1.9508
22	12:02:21	0.0063	0.0056	0.5600	1.9505
23	16:03:09	0.0064	0.0057	0.5700	1.9502
24	20:03:56	0.0064	0.0057	0.5700	1.9502
25	24:04:43	0.0064	0.0057	0.5700	1.9502

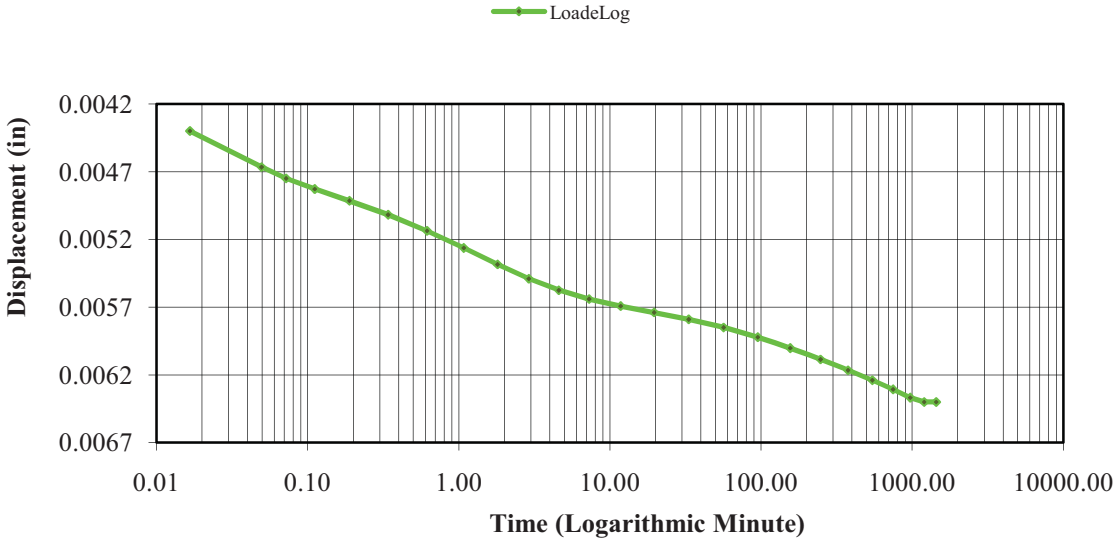
Tested By: **Checked By:**

Consolidation Test Results
(Sequence 3) Load 0.500 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)



Consolidation Test Results
(Sequence 5) Load 2.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-120A
Depth: 25'-27'
Sample Type: Undisturbed

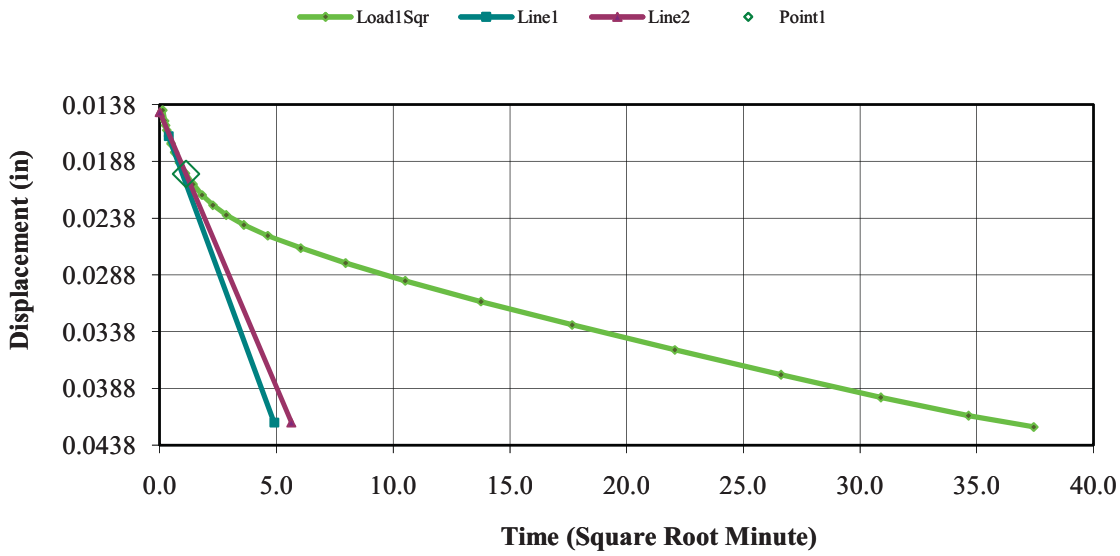
Soil Description: Gray, fat CLAY, CH
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0121	0.0114	1.1400	1.9333
1	00:00:01	0.0143	0.0136	1.3600	1.9268
2	00:00:02	0.0150	0.0143	1.4300	1.9247
3	00:00:03	0.0153	0.0146	1.4600	1.9238
4	00:00:04	0.0157	0.0150	1.5000	1.9226
5	00:00:05	0.0160	0.0153	1.5300	1.9217
6	00:00:06	0.0161	0.0154	1.5400	1.9214
7	00:00:12	0.0173	0.0166	1.6600	1.9179
8	00:00:15	0.0177	0.0170	1.7000	1.9167
9	00:00:30	0.0190	0.0183	1.8300	1.9128
10	00:01:00	0.0202	0.0195	1.9500	1.9093
11	00:02:01	0.0216	0.0209	2.0900	1.9051
12	00:04:01	0.0228	0.0221	2.2100	1.9016
13	00:05:01	0.0232	0.0225	2.2500	1.9004
14	00:08:02	0.0241	0.0234	2.3400	1.8977
15	00:10:02	0.0245	0.0238	2.3800	1.8965
16	00:15:03	0.0251	0.0244	2.4400	1.8947
17	00:30:03	0.0265	0.0258	2.5800	1.8906
18	01:00:05	0.0281	0.0274	2.7400	1.8858
19	02:00:08	0.0302	0.0295	2.9500	1.8796
20	04:00:13	0.0324	0.0317	3.1700	1.8731
21	08:00:24	0.0353	0.0346	3.4600	1.8645
22	12:00:36	0.0377	0.0370	3.7000	1.8573
23	16:00:47	0.0398	0.0391	3.9100	1.8511
24	20:00:58	0.0412	0.0405	4.0500	1.8470
25	23:22:15	0.0422	0.0415	4.1500	1.8440

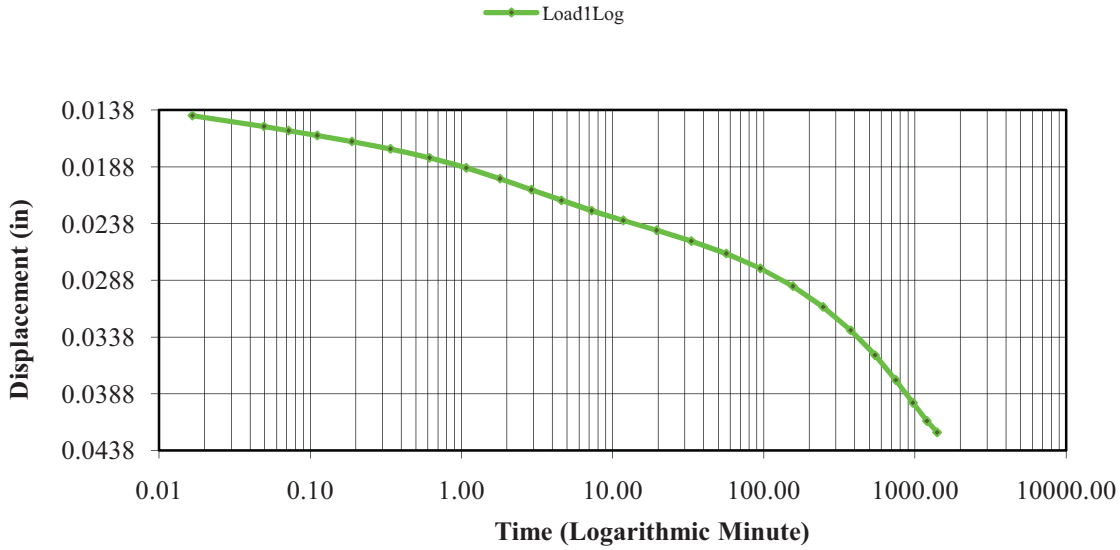
Tested By: **Checked By:**

Consolidation Test Results
(Sequence 5) Load 2.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)



Consolidation Test Results
(Sequence 9) Load 4.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-120A
Depth: 25'-27'
Sample Type: Undisturbed

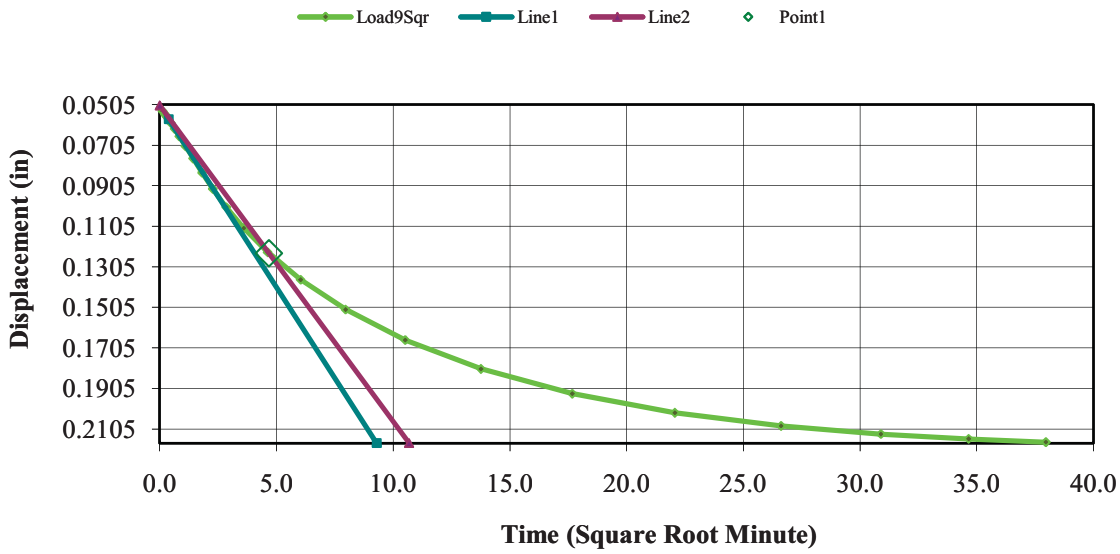
Soil Description: Gray, fat CLAY, CH
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0513	0.0506	5.0600	1.8170
1	00:00:01	0.0537	0.0530	5.3000	1.8099
2	00:00:02	0.0545	0.0538	5.3800	1.8075
3	00:00:03	0.0552	0.0545	5.4500	1.8054
4	00:00:04	0.0557	0.0550	5.5000	1.8039
5	00:00:05	0.0561	0.0554	5.5400	1.8028
6	00:00:06	0.0566	0.0559	5.5900	1.8013
7	00:00:12	0.0586	0.0579	5.7900	1.7953
8	00:00:15	0.0596	0.0589	5.8900	1.7924
9	00:00:30	0.0633	0.0626	6.2600	1.7814
10	00:01:00	0.0689	0.0682	6.8200	1.7648
11	00:02:00	0.0769	0.0762	7.6200	1.7410
12	00:04:00	0.0882	0.0875	8.7500	1.7075
13	00:05:00	0.0928	0.0921	9.2100	1.6939
14	00:08:00	0.1038	0.1031	10.3100	1.6612
15	00:10:00	0.1096	0.1089	10.8900	1.6440
16	00:15:01	0.1216	0.1209	12.0900	1.6084
17	00:30:02	0.1445	0.1438	14.3800	1.5405
18	01:00:04	0.1673	0.1666	16.6600	1.4728
19	02:00:08	0.1854	0.1847	18.4700	1.4191
20	04:00:16	0.1975	0.1968	19.6800	1.3832
21	08:00:33	0.2063	0.2056	20.5600	1.3571
22	12:00:50	0.2106	0.2099	20.9900	1.3443
23	16:01:07	0.2135	0.2128	21.2800	1.3357
24	20:01:24	0.2154	0.2147	21.4700	1.3301
25	24:01:41	0.2170	0.2163	21.6300	1.3253

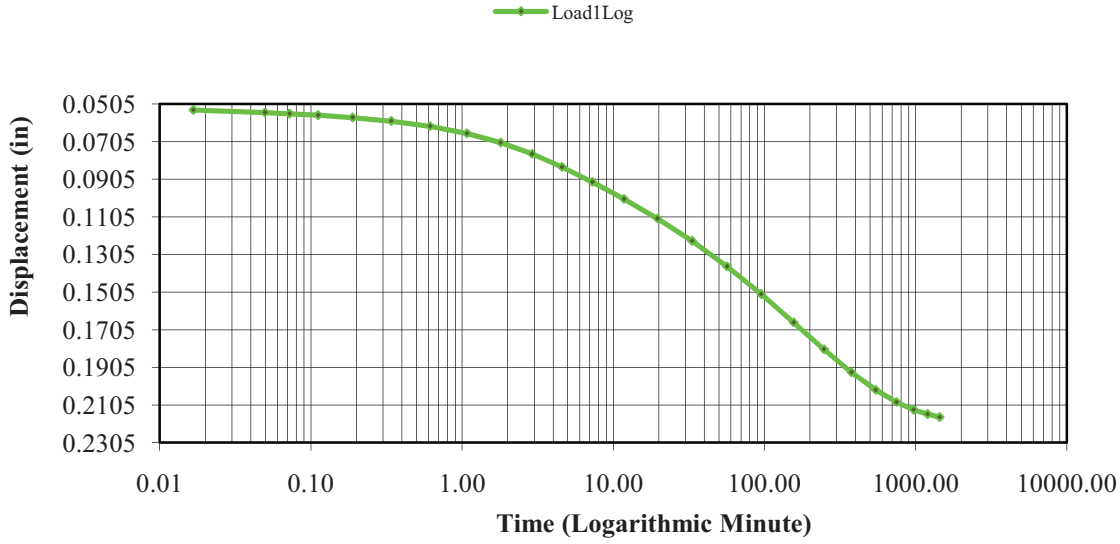
Tested By: **Checked By:**

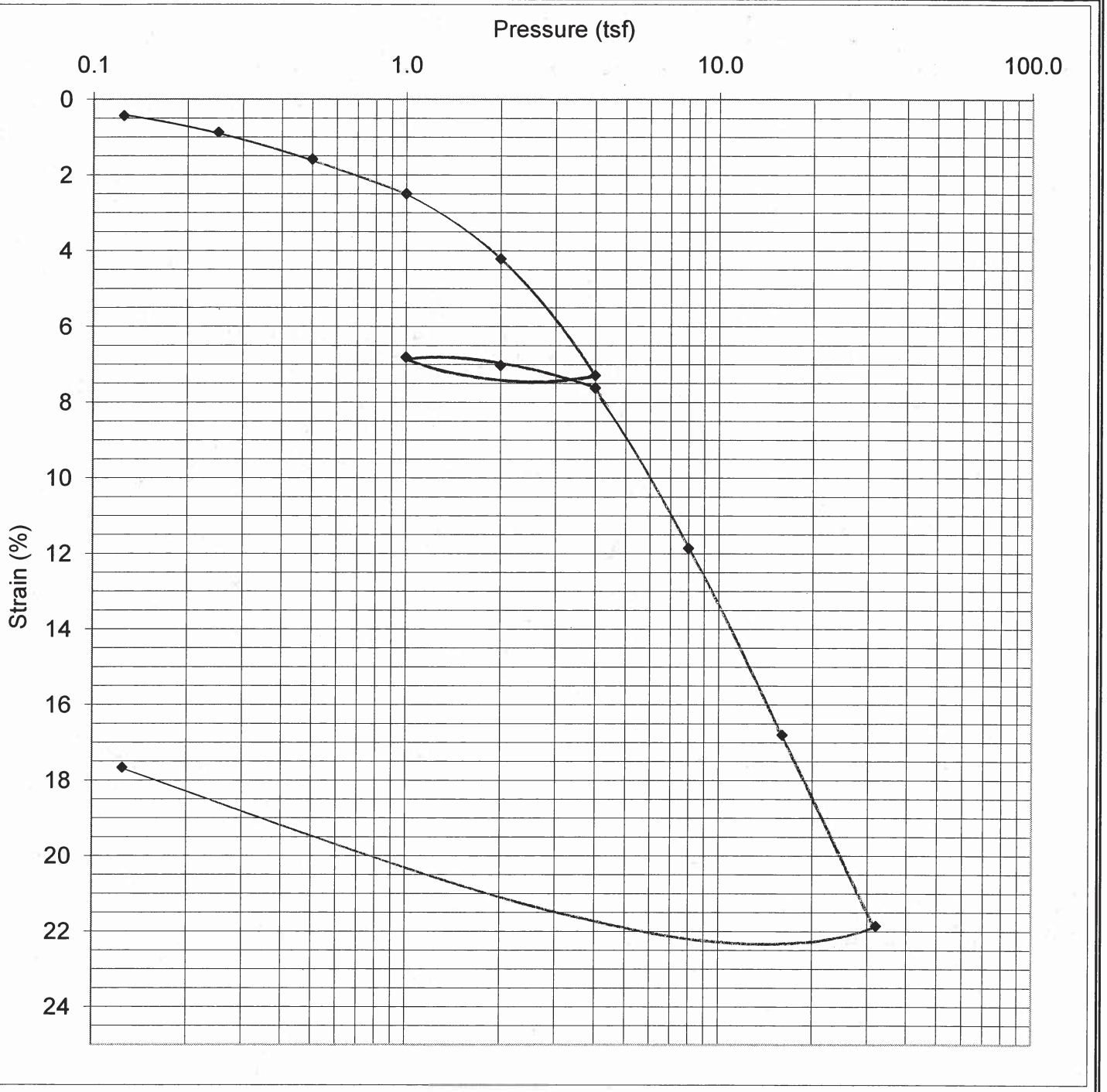
Consolidation Test Results
(Sequence 9) Load 4.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)





Description of Sample:	Gray, sandy SILT, contains mica and organics, ML				
Boring :	10BH-120A	Depth:	58'-60'	Stratum:	D2

Probable Preconsolidation Stress (tsf)	2.4
Approximate Overburden Stress (tsf):	1.3
Compression Ratio (from 4 to 16 tsf):	0.160
Recompression Ratio (from 1 to 2 tsf):	0.010

Schnabel ENGINEERING

CONSOLIDATION TEST

Project:	MLK Expressway Extension Portsmouth, VA
Contract Number:	10613051

Consolidation Test Results
(Sequence 3) Load 0.500 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-120A
Depth: 58'-60'
Sample Type: Undisturbed

Soil Description:

Remarks:

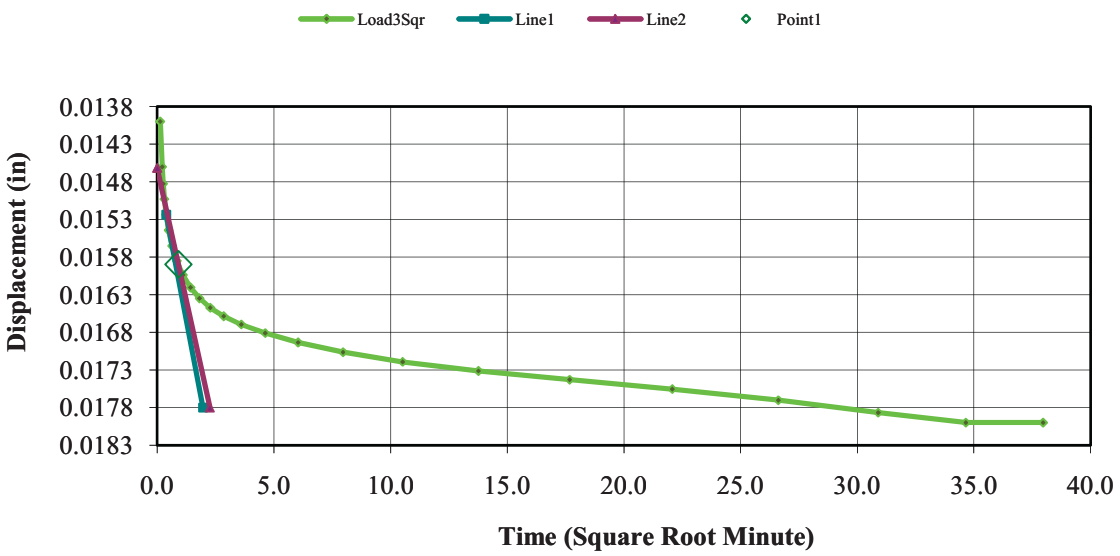
Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0109	0.0087	0.8700	1.0340
1	00:00:01	0.0140	0.0118	1.1800	1.0276
2	00:00:02	0.0143	0.0121	1.2100	1.0270
3	00:00:03	0.0148	0.0126	1.2600	1.0260
4	00:00:04	0.0149	0.0127	1.2700	1.0258
5	00:00:05	0.0150	0.0128	1.2800	1.0256
6	00:00:06	0.0151	0.0129	1.2900	1.0254
7	00:00:12	0.0157	0.0135	1.3500	1.0242
8	00:00:15	0.0157	0.0135	1.3500	1.0242
9	00:00:30	0.0159	0.0137	1.3700	1.0237
10	00:01:00	0.0162	0.0140	1.4000	1.0231
11	00:02:00	0.0164	0.0142	1.4200	1.0227
12	00:04:00	0.0165	0.0143	1.4300	1.0225
13	00:05:00	0.0166	0.0144	1.4400	1.0223
14	00:08:00	0.0166	0.0144	1.4400	1.0223
15	00:10:01	0.0167	0.0145	1.4500	1.0221
16	00:15:01	0.0167	0.0145	1.4500	1.0221
17	00:30:02	0.0171	0.0149	1.4900	1.0213
18	01:00:03	0.0173	0.0151	1.5100	1.0209
19	02:00:06	0.0173	0.0151	1.5100	1.0209
20	04:00:11	0.0174	0.0152	1.5200	1.0207
21	08:00:23	0.0174	0.0152	1.5200	1.0207
22	12:00:34	0.0177	0.0155	1.5500	1.0201
23	16:00:45	0.0179	0.0157	1.5700	1.0196
24	20:00:56	0.0180	0.0158	1.5800	1.0194
25	24:01:08	0.0180	0.0158	1.5800	1.0194

Tested By:

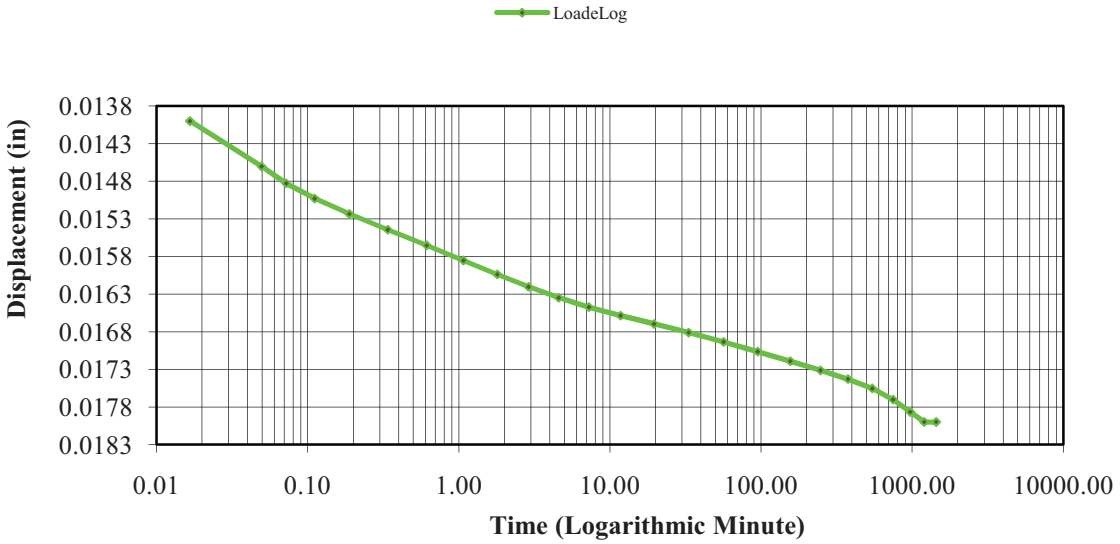
Checked By:

Consolidation Test Results
(Sequence 3) Load 0.500 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)



Consolidation Test Results
(Sequence 5) Load 2.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-120A
Depth: 58'-60'
Sample Type: Undisturbed

Soil Description:

Remarks:

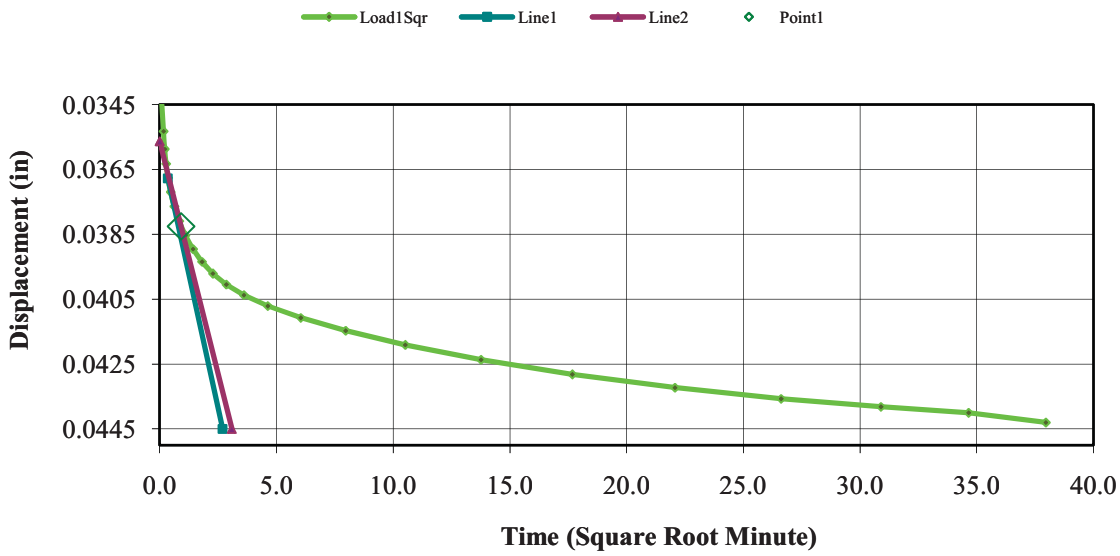
Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0271	0.0249	2.4900	1.0008
1	00:00:00	0.0334	0.0312	3.1200	0.9878
2	00:00:01	0.0349	0.0327	3.2700	0.9848
3	00:00:02	0.0357	0.0335	3.3500	0.9831
4	00:00:03	0.0360	0.0338	3.3800	0.9825
5	00:00:04	0.0365	0.0343	3.4300	0.9815
6	00:00:05	0.0366	0.0344	3.4400	0.9813
7	00:00:11	0.0374	0.0352	3.5200	0.9796
8	00:00:14	0.0377	0.0355	3.5500	0.9790
9	00:00:30	0.0382	0.0360	3.6000	0.9780
10	00:01:00	0.0389	0.0367	3.6700	0.9766
11	00:02:00	0.0392	0.0370	3.7000	0.9759
12	00:04:00	0.0398	0.0376	3.7600	0.9747
13	00:05:00	0.0399	0.0377	3.7700	0.9745
14	00:08:00	0.0403	0.0381	3.8100	0.9737
15	00:10:00	0.0405	0.0383	3.8300	0.9733
16	00:15:00	0.0406	0.0384	3.8400	0.9731
17	00:30:02	0.0413	0.0391	3.9100	0.9716
18	01:00:04	0.0417	0.0395	3.9500	0.9708
19	02:00:08	0.0422	0.0400	4.0000	0.9698
20	04:00:16	0.0429	0.0407	4.0700	0.9683
21	08:00:33	0.0433	0.0411	4.1100	0.9675
22	12:00:50	0.0437	0.0415	4.1500	0.9667
23	16:01:07	0.0438	0.0416	4.1600	0.9665
24	20:01:24	0.0440	0.0418	4.1800	0.9661
25	24:01:41	0.0443	0.0421	4.2100	0.9655

Tested By:

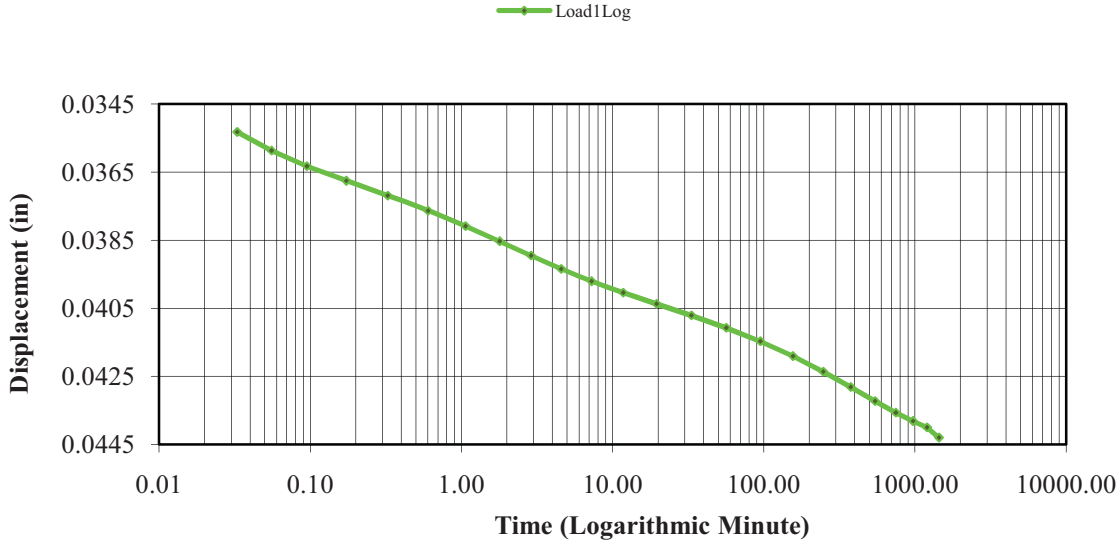
Checked By:

Consolidation Test Results
(Sequence 5) Load 2.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)



Consolidation Test Results
(Sequence 6) Load 4.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-120A
Depth: 58'-60'
Sample Type: Undisturbed

Soil Description:

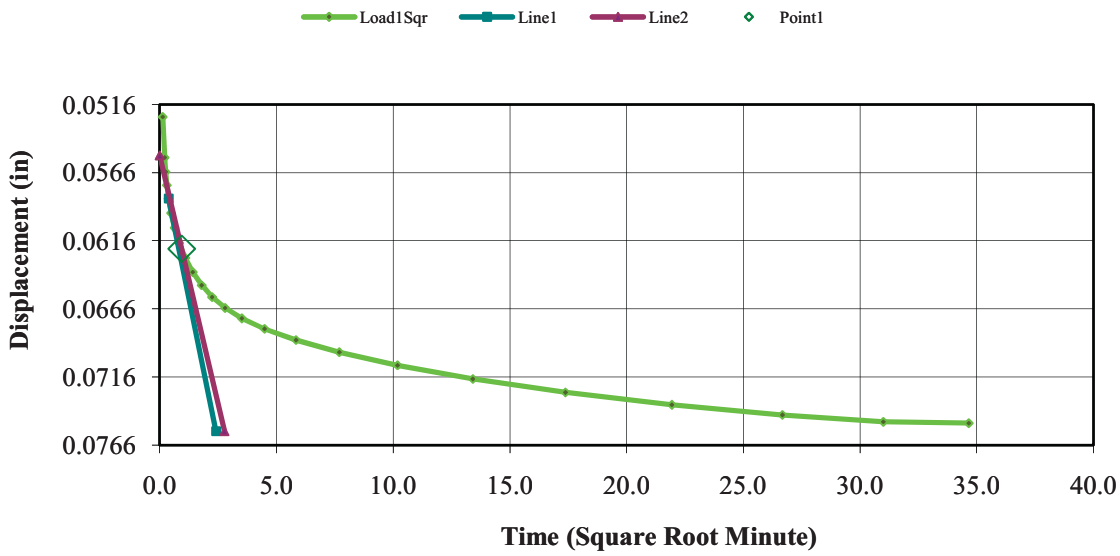
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0443	0.0421	4.2100	0.9655
1	00:00:01	0.0525	0.0503	5.0300	0.9487
2	00:00:02	0.0546	0.0524	5.2400	0.9443
3	00:00:03	0.0559	0.0537	5.3700	0.9417
4	00:00:04	0.0569	0.0547	5.4700	0.9396
5	00:00:05	0.0575	0.0553	5.5300	0.9384
6	00:00:06	0.0582	0.0560	5.6000	0.9370
7	00:00:12	0.0602	0.0580	5.8000	0.9329
8	00:00:15	0.0606	0.0584	5.8400	0.9320
9	00:00:30	0.0622	0.0600	6.0000	0.9287
10	00:01:01	0.0636	0.0614	6.1400	0.9259
11	00:02:01	0.0647	0.0625	6.2500	0.9236
12	00:04:01	0.0661	0.0639	6.3900	0.9207
13	00:05:01	0.0662	0.0640	6.4000	0.9205
14	00:08:01	0.0670	0.0648	6.4800	0.9189
15	00:10:01	0.0676	0.0654	6.5400	0.9177
16	00:15:02	0.0682	0.0660	6.6000	0.9164
17	00:30:03	0.0693	0.0671	6.7100	0.9142
18	01:00:05	0.0704	0.0682	6.8200	0.9119
19	02:00:09	0.0717	0.0695	6.9500	0.9093
20	04:00:17	0.0726	0.0704	7.0400	0.9074
21	08:00:34	0.0739	0.0717	7.1700	0.9047
22	12:00:51	0.0745	0.0723	7.2300	0.9035
23	16:01:08	0.0749	0.0727	7.2700	0.9027
24	20:01:25	0.0750	0.0728	7.2800	0.9025

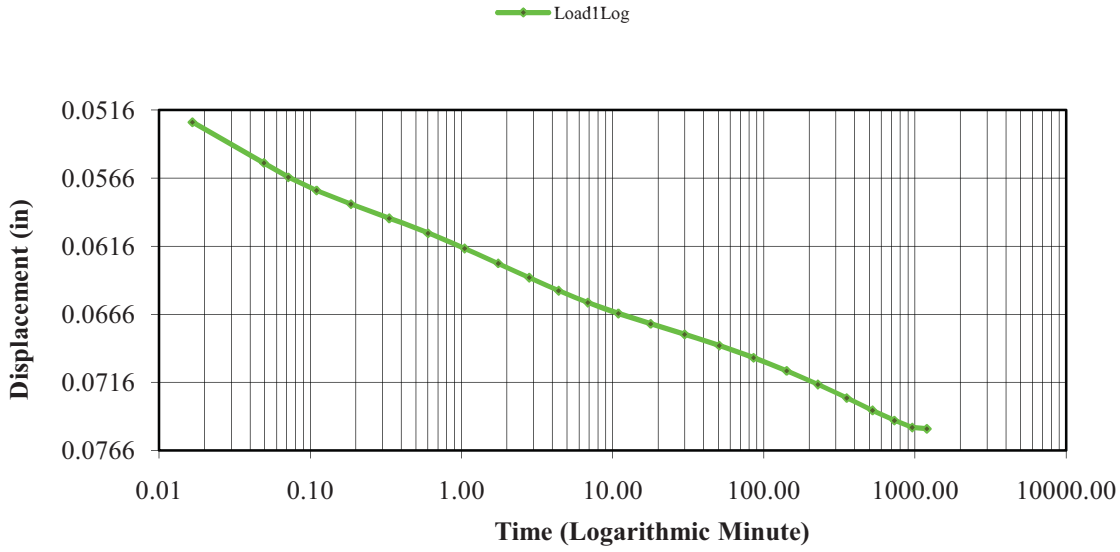
Tested By: **Checked By:**

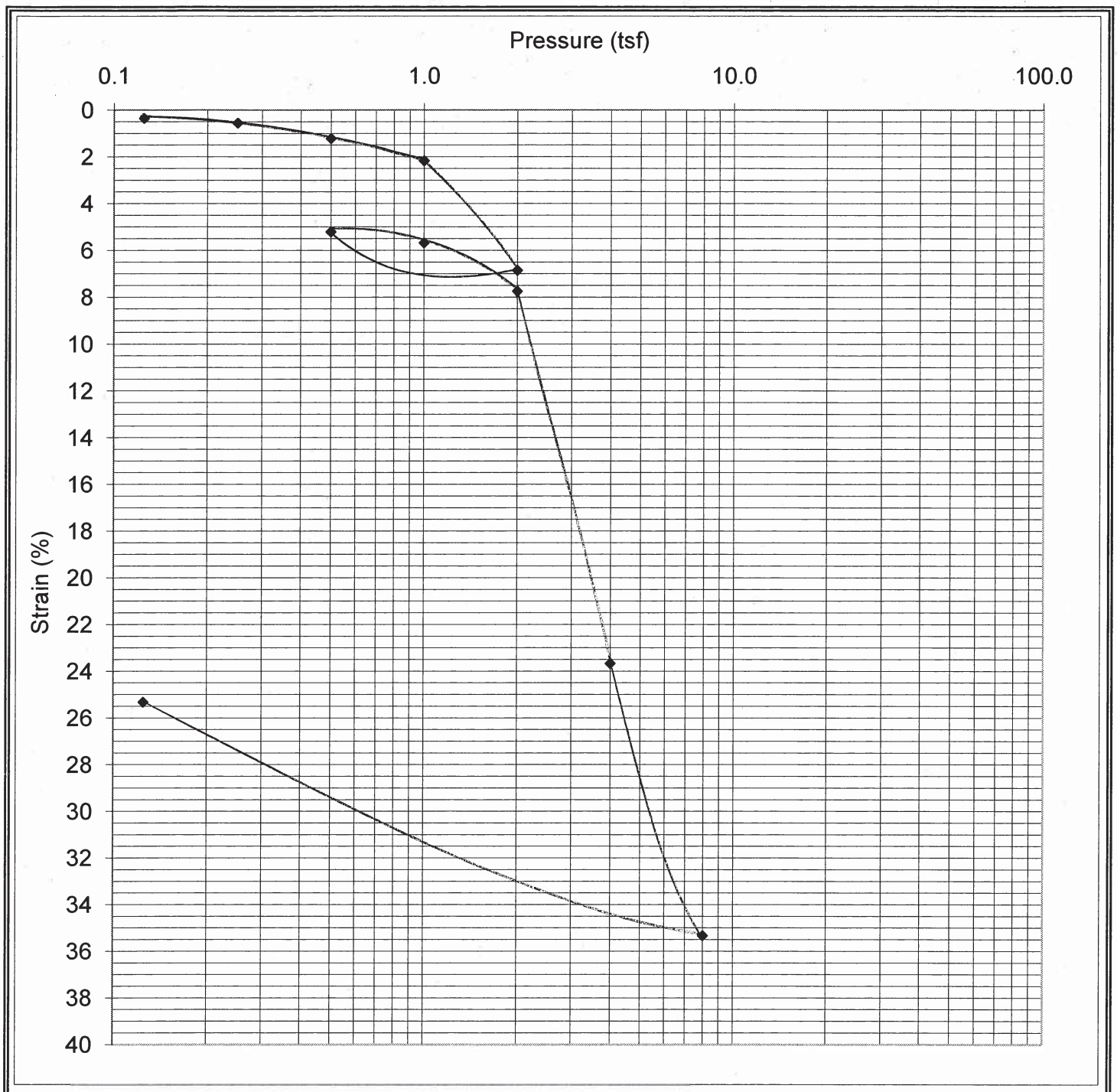
Consolidation Test Results
(Sequence 6) Load 4.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)





Description of Sample:	Gray, fat CLAY, trace sand, CH				
Boring :	10BH-136A	Depth:	20'-22'	Stratum:	D2

Probable Preconsolidation Stress (tsf)	1.7
Approximate Overburden Stress (tsf):	0.7
Compression Ratio (from 2 to 4 tsf):	0.490
Recompression Ratio (from ½ to 1 tsf):	0.016

Schnabel ENGINEERING

CONSOLIDATION TEST

Project:	MLK Expressway Extension Portsmouth, Virginia
Contract Number:	10613051

Consolidation Test Results
(Sequence 3) Load 0.500 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-136A
Depth: 20'-22'
Sample Type: Undisturbed

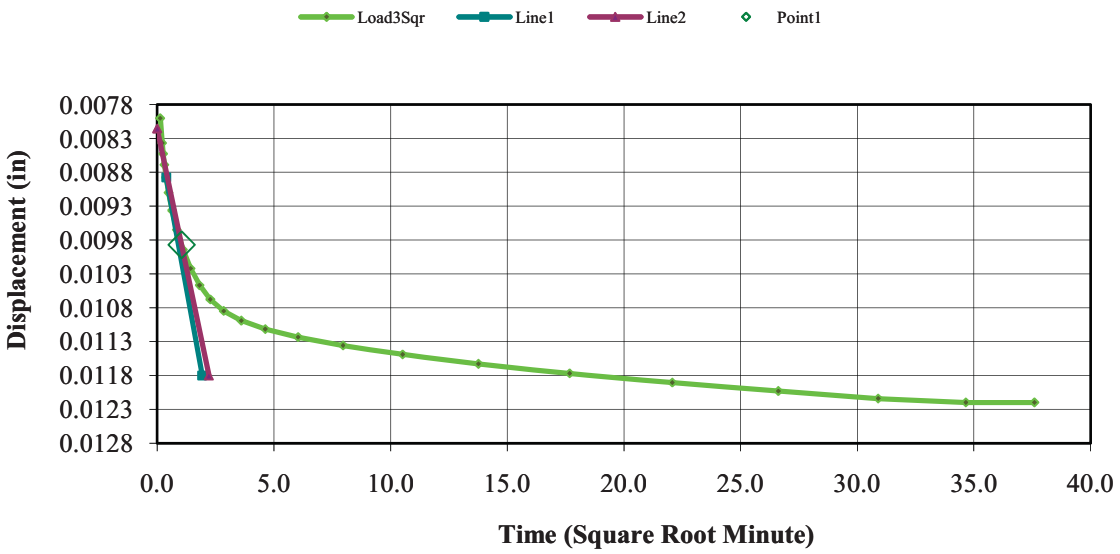
Soil Description: Gray, fat CLAY, trace sand, CH
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0056	0.0055	0.5500	1.1063
1	00:00:01	0.0080	0.0079	0.7900	1.1013
2	00:00:02	0.0082	0.0081	0.8100	1.1008
3	00:00:03	0.0084	0.0083	0.8300	1.1004
4	00:00:04	0.0086	0.0085	0.8500	1.1000
5	00:00:05	0.0087	0.0086	0.8600	1.0998
6	00:00:06	0.0087	0.0086	0.8600	1.0998
7	00:00:12	0.0091	0.0090	0.9000	1.0989
8	00:00:15	0.0093	0.0092	0.9200	1.0985
9	00:00:30	0.0097	0.0096	0.9600	1.0977
10	00:01:00	0.0102	0.0101	1.0100	1.0966
11	00:02:00	0.0105	0.0104	1.0400	1.0960
12	00:04:00	0.0108	0.0107	1.0700	1.0953
13	00:05:01	0.0109	0.0108	1.0800	1.0951
14	00:08:01	0.0110	0.0109	1.0900	1.0949
15	00:10:01	0.0111	0.0110	1.1000	1.0947
16	00:15:01	0.0111	0.0110	1.1000	1.0947
17	00:30:02	0.0113	0.0112	1.1200	1.0943
18	01:00:04	0.0114	0.0113	1.1300	1.0941
19	02:00:09	0.0116	0.0115	1.1500	1.0936
20	04:00:17	0.0118	0.0117	1.1700	1.0932
21	08:00:34	0.0119	0.0118	1.1800	1.0930
22	12:00:51	0.0120	0.0119	1.1900	1.0928
23	16:01:08	0.0122	0.0121	1.2100	1.0924
24	20:01:25	0.0122	0.0121	1.2100	1.0924
25	23:33:40	0.0122	0.0121	1.2100	1.0924

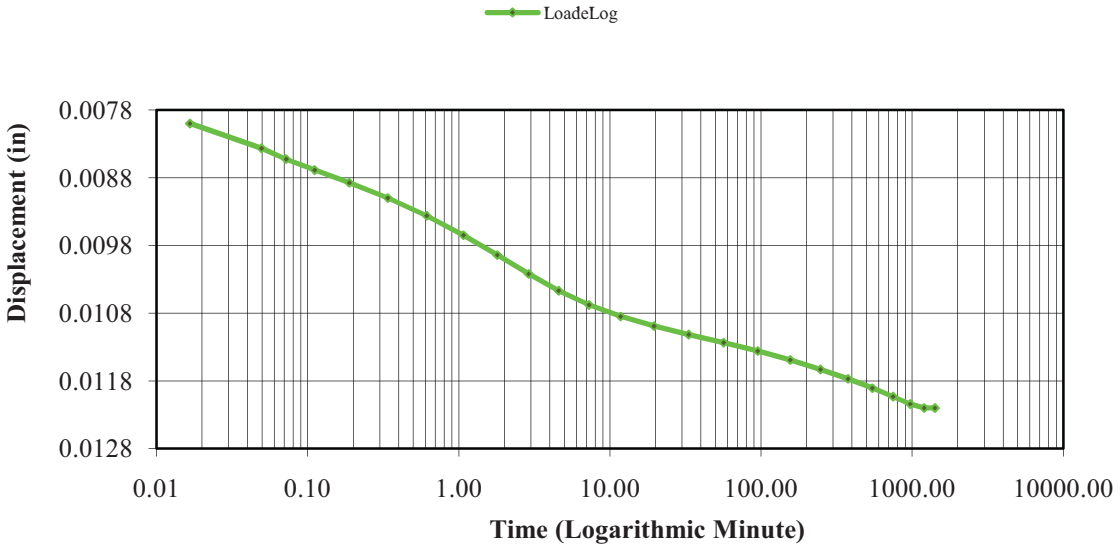
Tested By: **Checked By:**

Consolidation Test Results
(Sequence 3) Load 0.500 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)



Consolidation Test Results
(Sequence 5) Load 2.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-136A
Depth: 20'-22'
Sample Type: Undisturbed

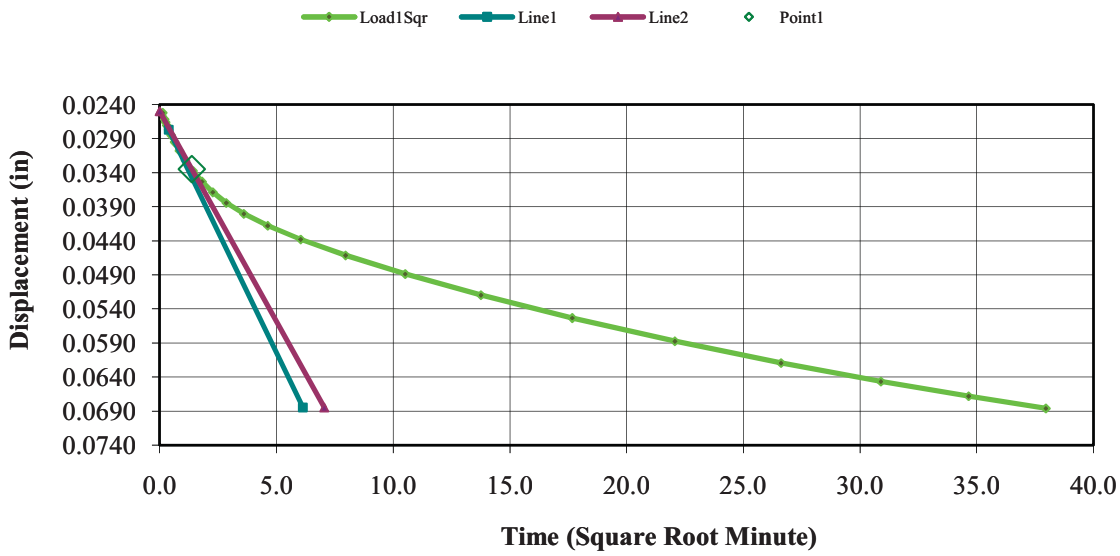
Soil Description: Gray, fat CLAY, trace sand, CH
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0217	0.0216	2.1600	1.0722
1	00:00:01	0.0252	0.0251	2.5100	1.0648
2	00:00:02	0.0258	0.0257	2.5700	1.0636
3	00:00:03	0.0263	0.0262	2.6200	1.0625
4	00:00:04	0.0266	0.0265	2.6500	1.0619
5	00:00:05	0.0270	0.0269	2.6900	1.0610
6	00:00:06	0.0272	0.0271	2.7100	1.0606
7	00:00:12	0.0284	0.0283	2.8300	1.0581
8	00:00:15	0.0288	0.0287	2.8700	1.0572
9	00:00:30	0.0304	0.0303	3.0300	1.0538
10	00:01:00	0.0324	0.0323	3.2300	1.0496
11	00:02:01	0.0346	0.0345	3.4500	1.0449
12	00:04:01	0.0370	0.0369	3.6900	1.0398
13	00:05:01	0.0378	0.0377	3.7700	1.0381
14	00:08:01	0.0394	0.0393	3.9300	1.0348
15	00:10:01	0.0401	0.0400	4.0000	1.0333
16	00:15:01	0.0416	0.0415	4.1500	1.0301
17	00:30:02	0.0441	0.0440	4.4000	1.0248
18	01:00:05	0.0470	0.0469	4.6900	1.0187
19	02:00:09	0.0504	0.0503	5.0300	1.0115
20	04:00:17	0.0544	0.0543	5.4300	1.0030
21	08:00:34	0.0592	0.0591	5.9100	0.9928
22	12:00:51	0.0624	0.0623	6.2300	0.9860
23	16:01:08	0.0648	0.0647	6.4700	0.9810
24	20:01:25	0.0668	0.0667	6.6700	0.9767
25	24:01:42	0.0686	0.0685	6.8500	0.9729

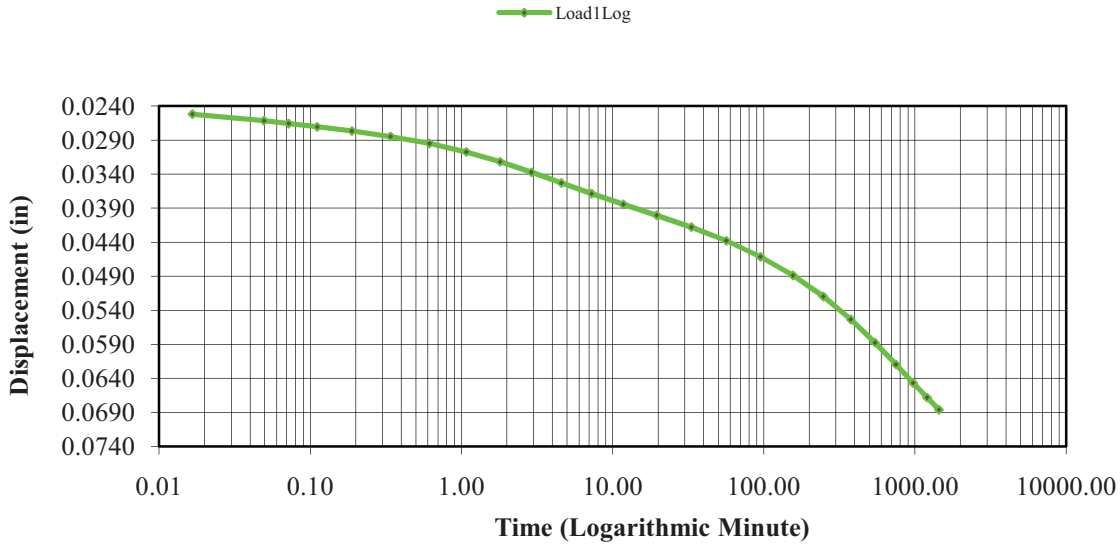
Tested By: **Checked By:**

Consolidation Test Results
(Sequence 5) Load 2.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)



Consolidation Test Results
(Sequence 9) Load 4.000 tsf

Project: MLK Expressway
Location: Portsmouth, VA

Project Number: 10613051

Test Date:
Test Number:

Sample Number:
Boring Number: 10BH-136A
Depth: 20'-22'
Sample Type: Undisturbed

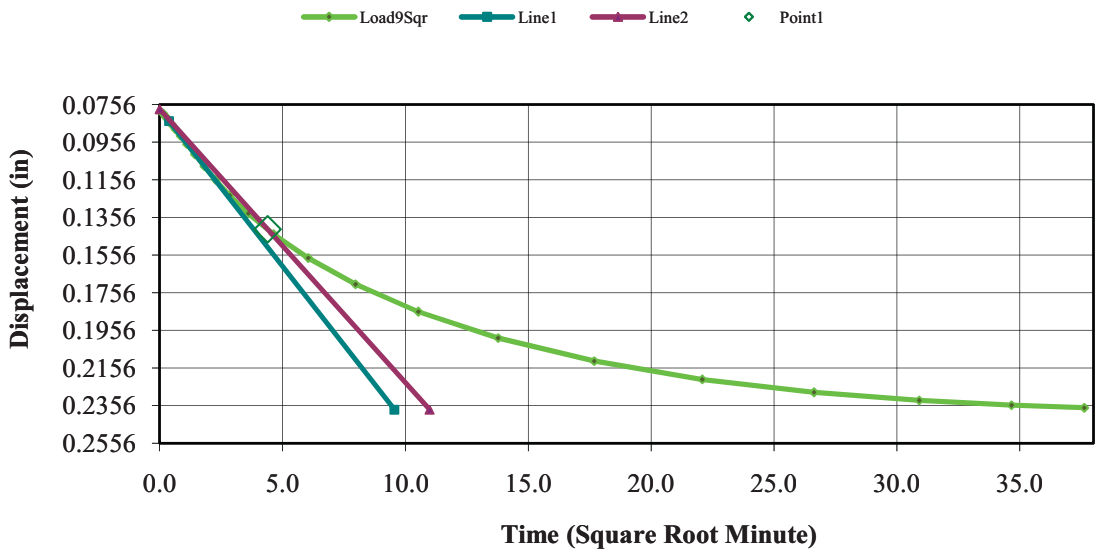
Soil Description: Gray, fat CLAY, trace sand, CH
Remarks:

Index	Time	Displacement (in)	Settlement (in)	Axial Strain (%)	Void Ratio
0	00:00:00	0.0775	0.0774	7.7400	0.9541
1	00:00:01	0.0803	0.0802	8.0200	0.9481
2	00:00:02	0.0812	0.0811	8.1100	0.9462
3	00:00:03	0.0818	0.0817	8.1700	0.9449
4	00:00:04	0.0824	0.0823	8.2300	0.9437
5	00:00:05	0.0830	0.0829	8.2900	0.9424
6	00:00:06	0.0833	0.0832	8.3200	0.9418
7	00:00:12	0.0855	0.0854	8.5400	0.9371
8	00:00:15	0.0863	0.0862	8.6200	0.9354
9	00:00:30	0.0897	0.0896	8.9600	0.9282
10	00:01:00	0.0948	0.0947	9.4700	0.9174
11	00:02:00	0.1020	0.1019	10.1900	0.9022
12	00:04:00	0.1121	0.1120	11.2000	0.8808
13	00:05:00	0.1162	0.1161	11.6100	0.8721
14	00:08:00	0.1262	0.1261	12.6100	0.8509
15	00:10:00	0.1315	0.1314	13.1400	0.8397
16	00:15:01	0.1424	0.1423	14.2300	0.8166
17	00:30:02	0.1635	0.1634	16.3400	0.7719
18	01:00:04	0.1851	0.1850	18.5000	0.7262
19	02:00:08	0.2030	0.2029	20.2900	0.6882
20	04:00:17	0.2160	0.2159	21.5900	0.6607
21	08:00:34	0.2256	0.2255	22.5500	0.6404
22	12:00:51	0.2303	0.2302	23.0200	0.6304
23	16:01:08	0.2333	0.2332	23.3200	0.6241
24	20:01:25	0.2354	0.2353	23.5300	0.6196
25	23:35:23	0.2368	0.2367	23.6700	0.6167

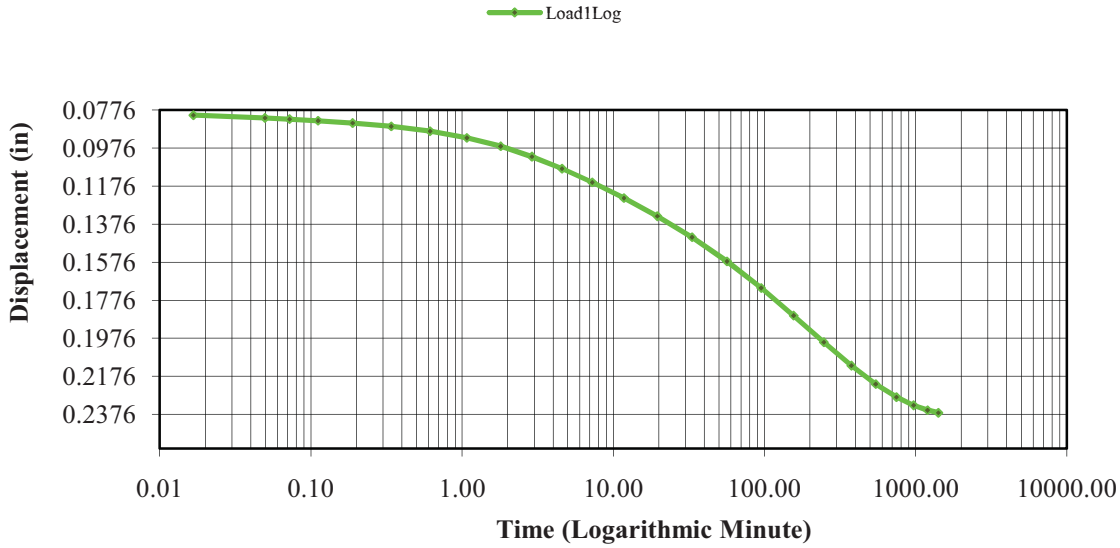
Tested By: **Checked By:**

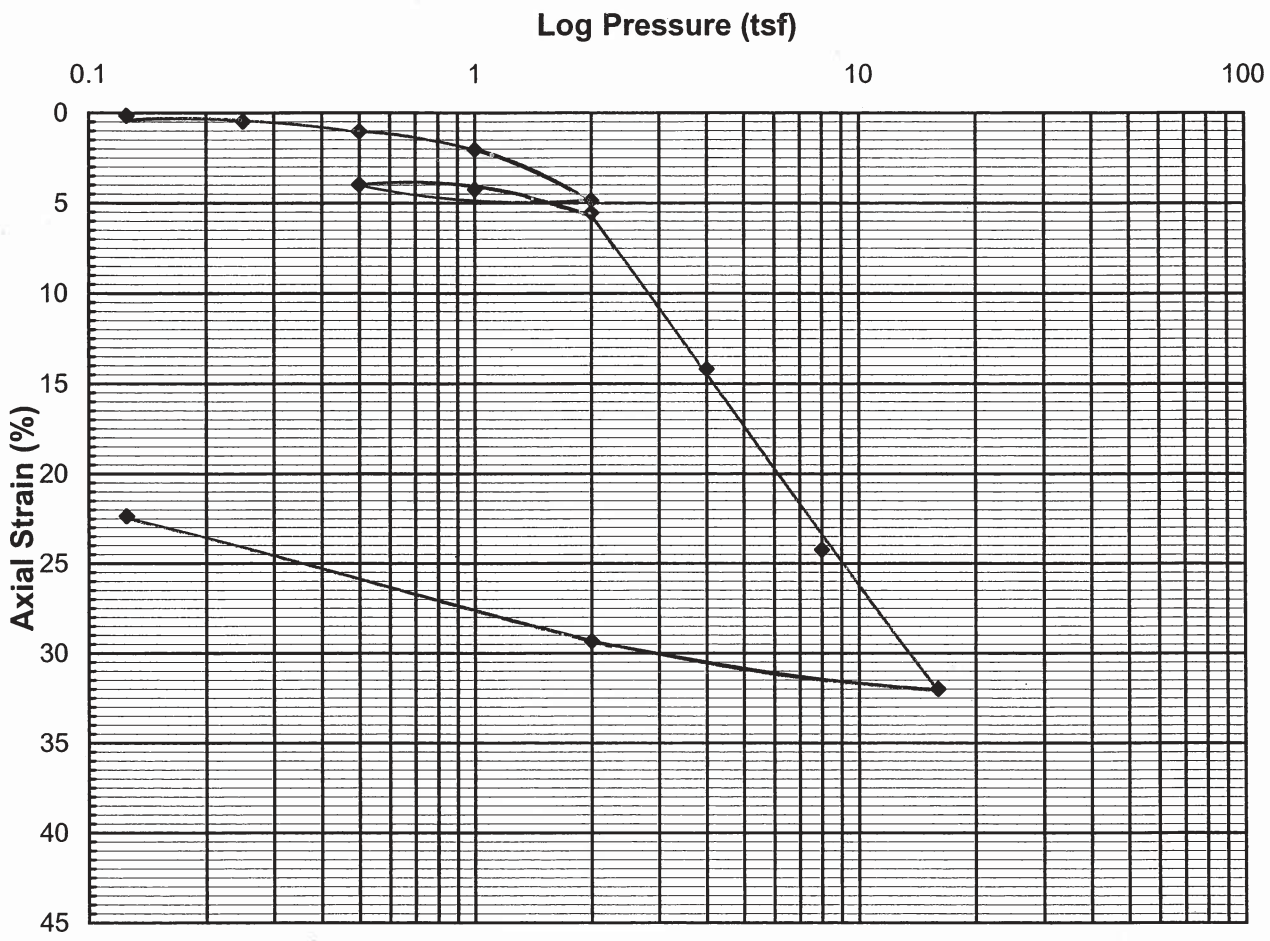
Consolidation Test Results
(Sequence 9) Load 4.000 tsf

Consolidation Graph (Squareroot Time)



Consolidation Graph (Logarithmic Time)





Probable Preconsolidation Pressure (Pp), tsf: *1.9*		**Recompression Ratio (Cer):**	*0.027*
Type of Specimen: *Tube Sample*		**Compression Ratio (Cec):**	*0.300*
Description: *ELASTIC SILT (MH) - dark gray*		**Initial**	**Final**
		Water Content, %	*67.0* / *44.8*
LL: *59* **PI:** *28* **Gs:** *2.60* **P_o' (tsf):** *0.71*		**Void Ratio**	*1.74* / *1.12*
% < No. 200: *93.0* **Test Method:** *ASTM D2435 Method A*		**Saturation, %**	*100* / *100*
Test Condition: *Inundated @ 0.05 tsf*		**Dry Unit Weight, pcf**	*59.3* / *76.3*
Remarks:		**Project:** MLK Expressway Extension	
Average Water Content of Trimmings, %: *65.6*		**Location** *Portsmouth, VA*	
Schnabel ENGINEERING		**Boring:** *10BH-154A*	**Schnabel No.** *10613051*
		Depth: *18-20 ft.*	**Elevation:** *-8.8 to -10.8 ft.*
		Date: *9/16/2010*	**Reviewed by:** *CJS*
		Consolidation Test Report	

Schnabel ENGINEERING

Consolidation Time Curves

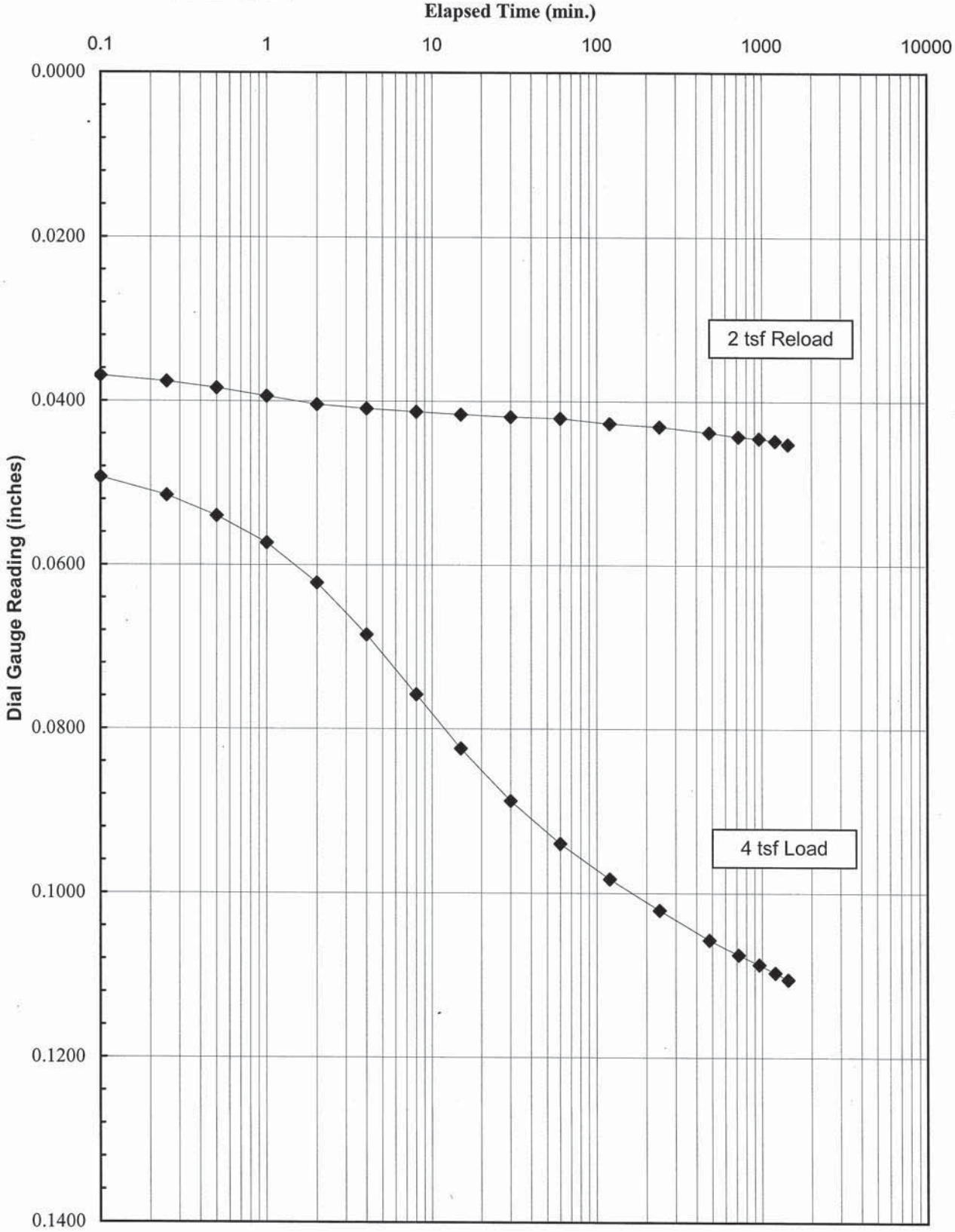
9/16/10

Project: MLK Expressway Extension

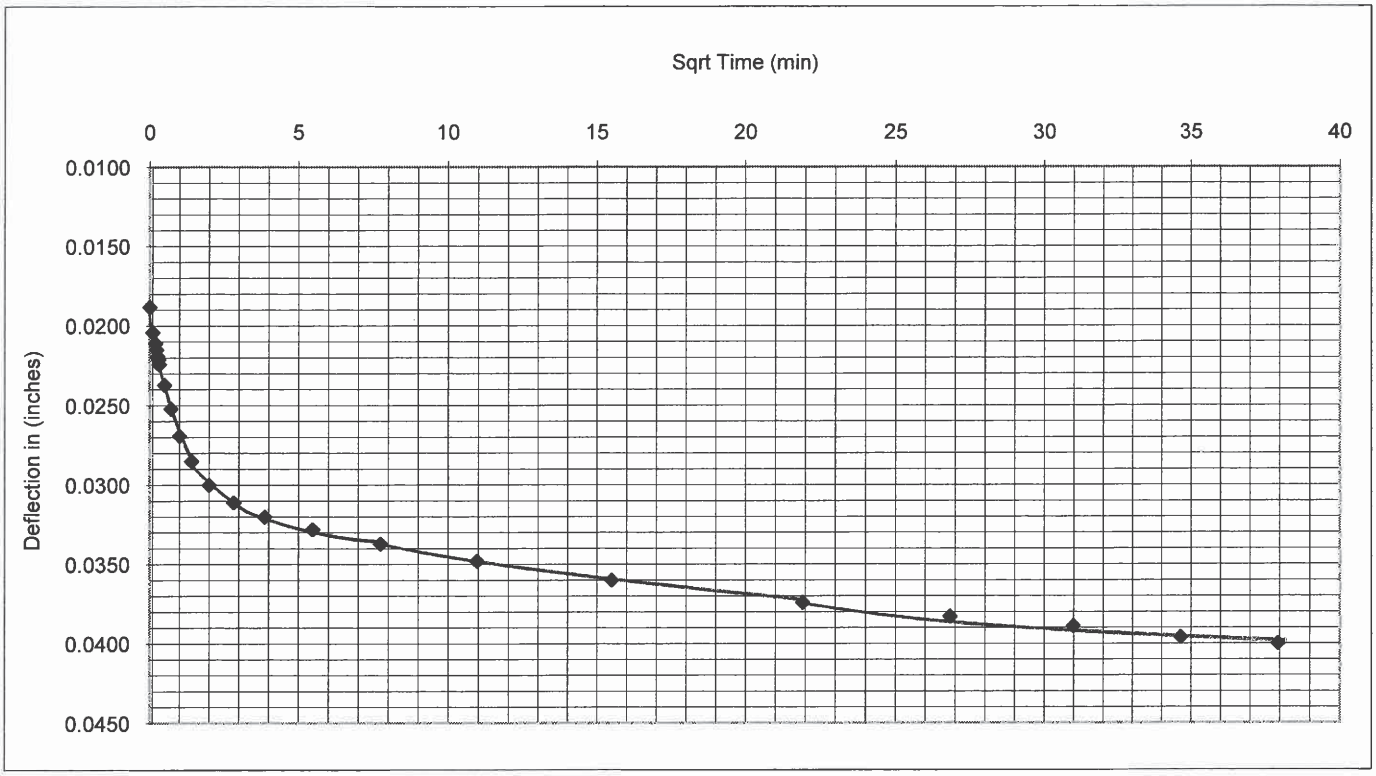
Schnabel Contract: 10613051

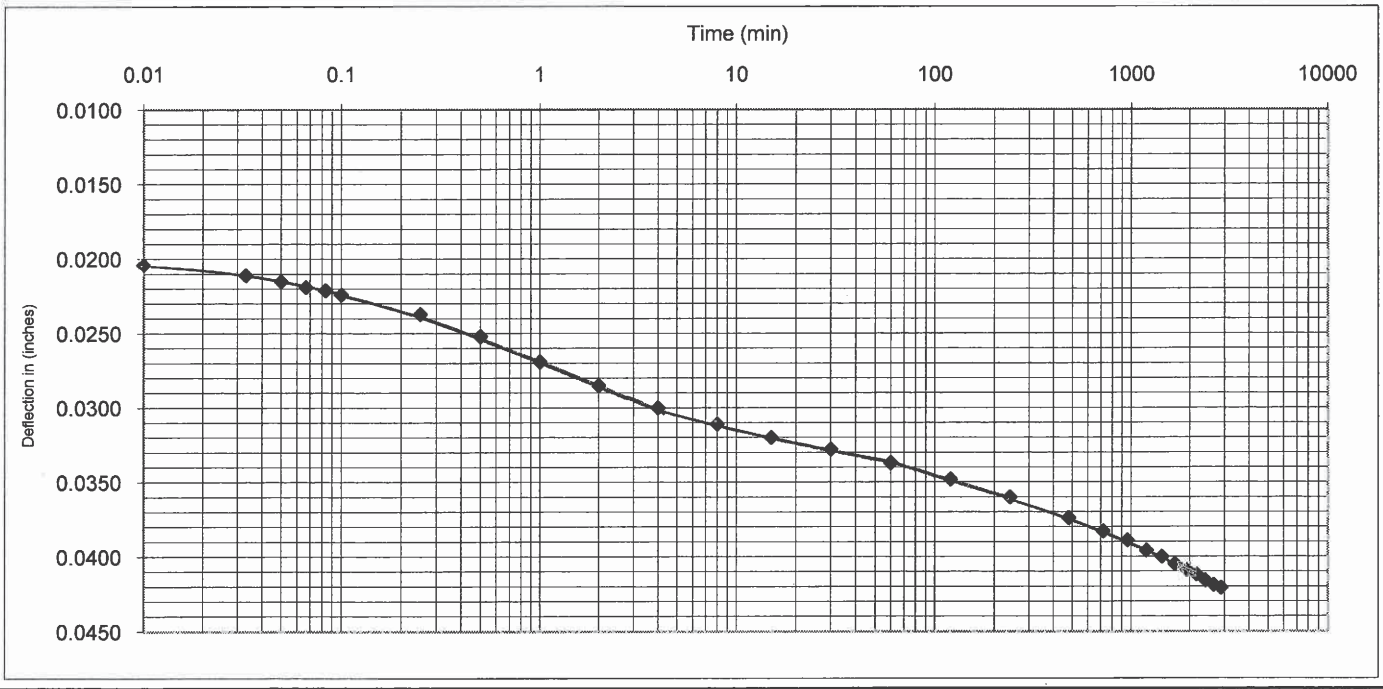
Boring No.: 10BH-154A Depth: 18-20 ft.

Reviewed by: CJS Test Drainage Conditions: Double



Consol 5/2007 Rev. 4





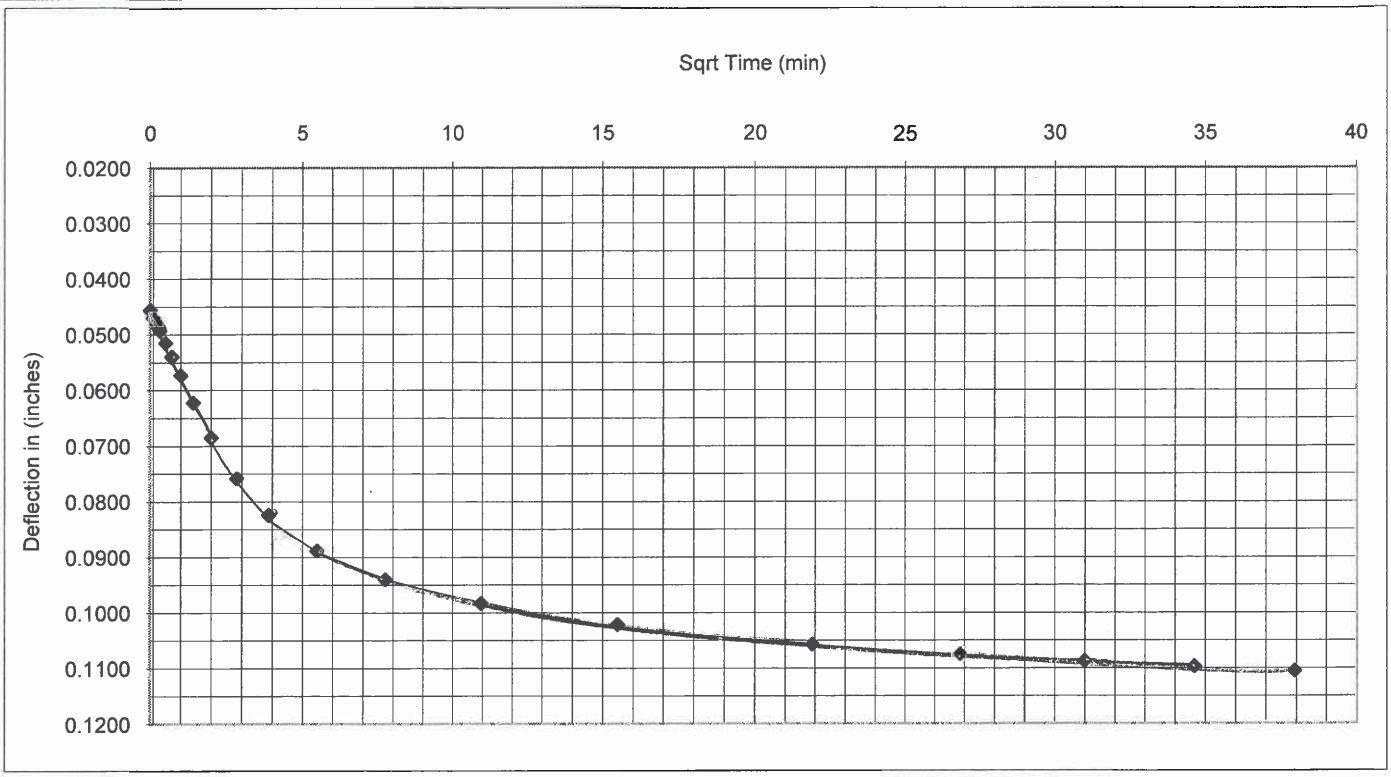
Description of Sample:	ELASTIC SILT (MH) - dark gray

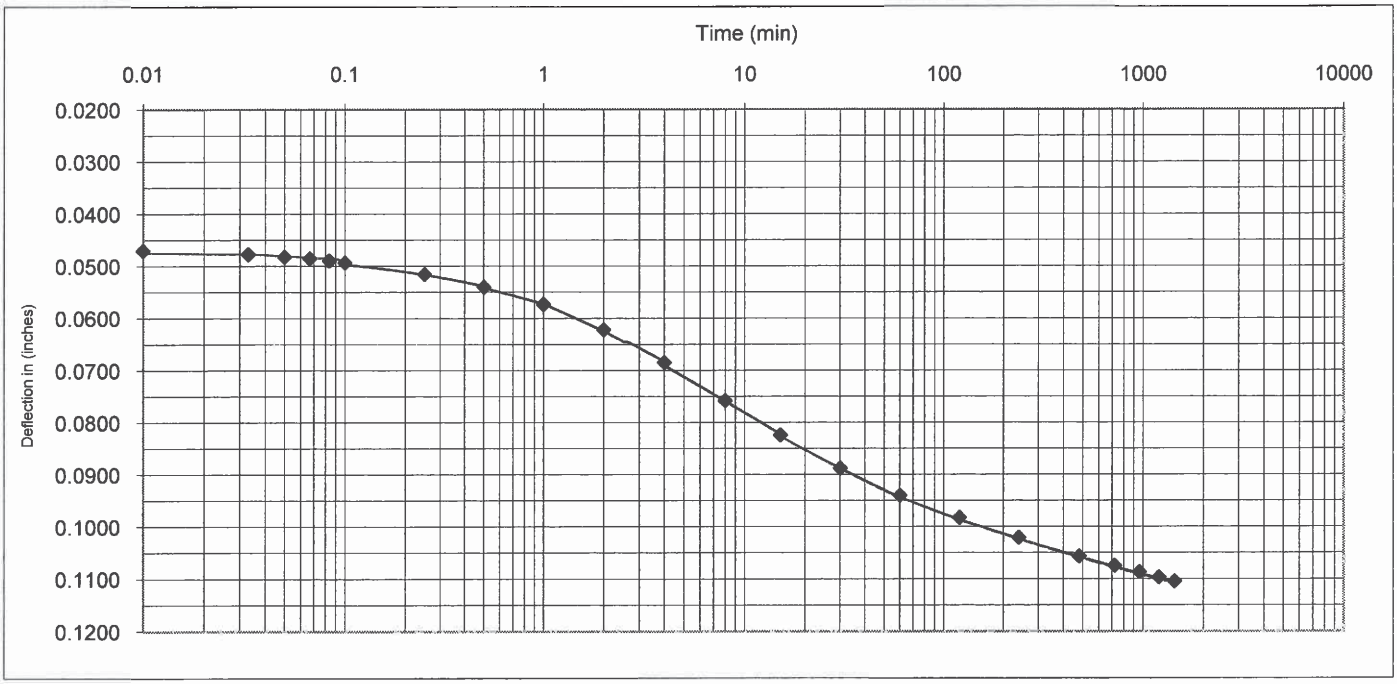
Schnabel ENGINEERING

TIME-COMPRESSION CURVE

Boring :	10BH-154A	Depth:	18'-20'	Stratum:	D2
Load (tsf)					2.0
Coefficient of Consolidation (sqrt t in^2/min)					
Coefficient of Consolidation (log t in^2/min)					
Coefficient of Secondary Compression					

Project:	MLK Expressway Portsmouth, Virginia
Contract Number:	10613051





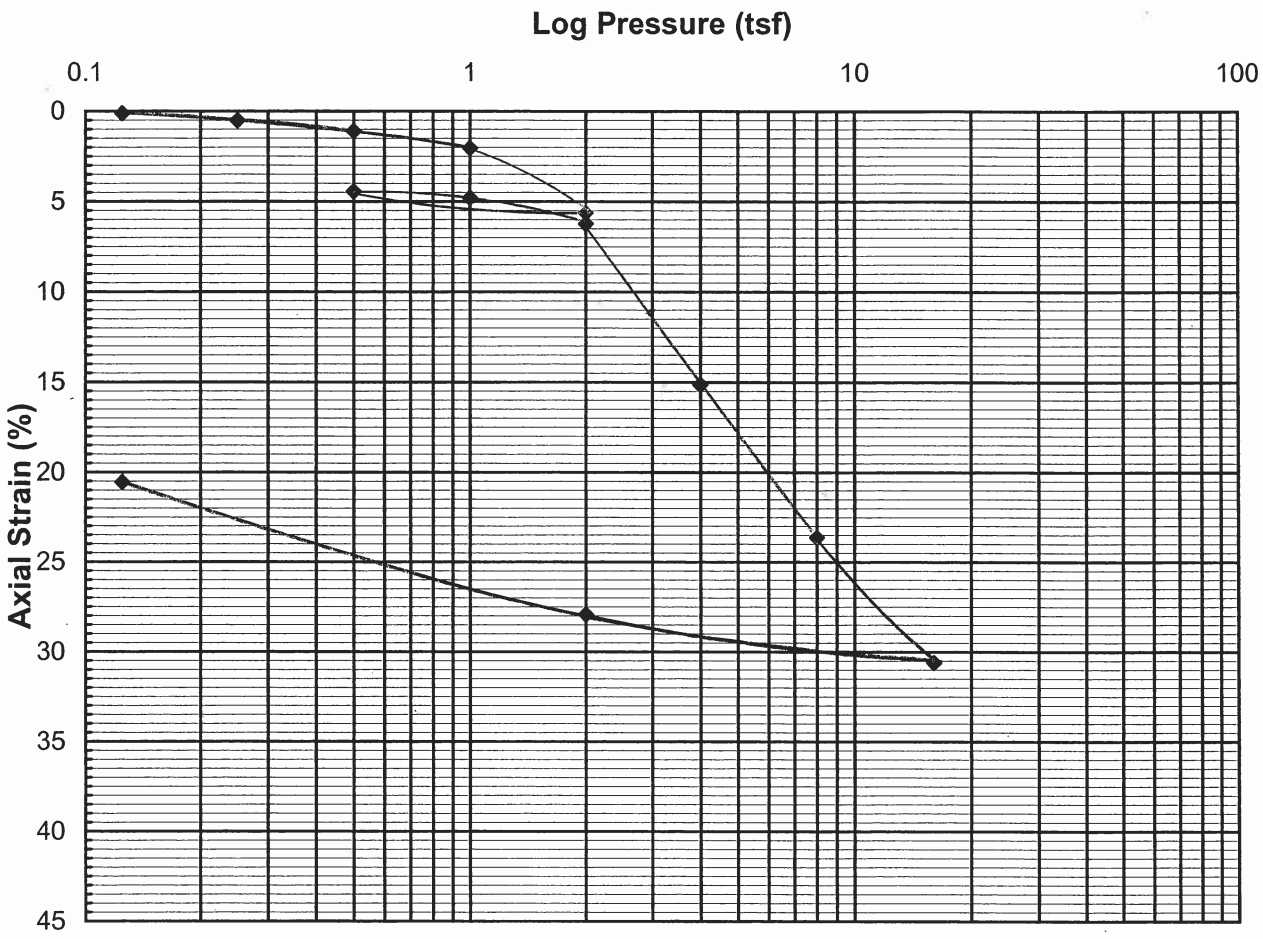
Description of Sample:	ELASTIC SILT (MH) - dark gray

Boring :	10BH-154A	Depth:	18'-20'	Stratum:	D2
Load (tsf)					4.0
Coefficient of Consolidation (sqrt t in^2/min)					
Coefficient of Consolidation (log t in^2/min)					
Coefficient of Secondary Compression					

Schnabel ENGINEERING

TIME-COMPRESSION CURVE

Project:	MLK Expressway Portsmouth, Virginia
Contract Number:	10613051



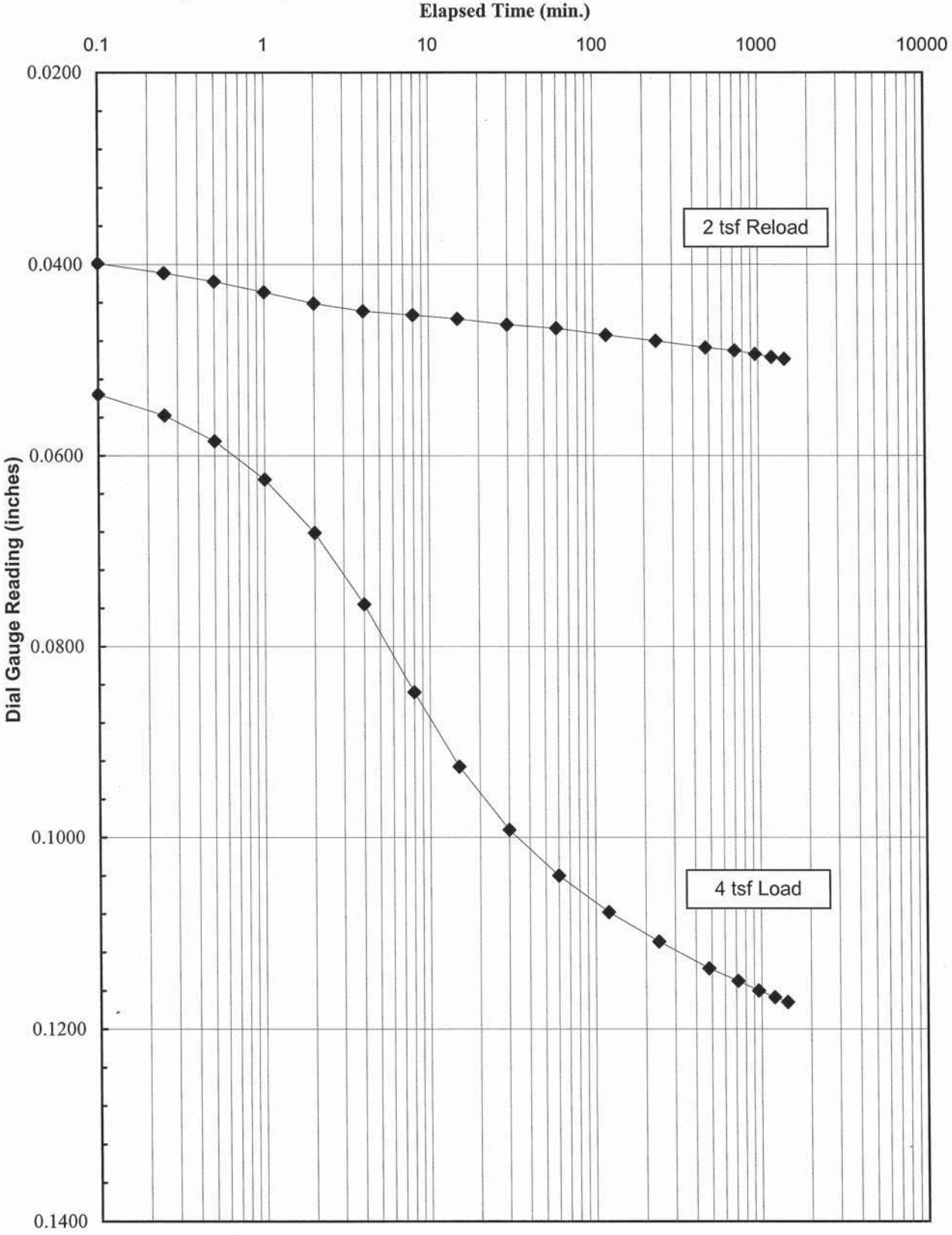
Probable Preconsolidation Pressure (Pp), tsf:	*1.8*				**Recompression Ratio (Cer):**		*0.023*
Type of Specimen:	*Tube Sample*				**Compression Ratio (Cec):**		*0.280*
Description:	*ELASTIC SILT (MH) - dark gray*					**Initial**	**Final**
					Water Content, %	*62.1*	*42.0*
LL: *57*	**PI:** *25*	**Gs:** *2.62*	**P_o' (tsf):** *0.75*		**Void Ratio**	*1.61*	*1.07*
% < No. 200: *94.0*		**Test Method:** *ASTM D2435 Method A*			**Saturation, %**	*100*	*100*
Test Condition: *Inundated @ 0.05 tsf*					**Dry Unit Weight, pcf**	*62.6*	*78.8*
Remarks:					**Project:**	MLK Expressway Extension	
Average Water Content of Trimmings, %:	*60.3*				**Location**	*Portsmouth, VA*	
Schnabel ENGINEERING					**Boring:** *10BH-233A*	**Schnabel No.**	*10613051*
					Depth: *20-22 ft.*	**Elevation:**	*-8.3 to -10.3 ft.*
					Date: *9/16/2010*	**Reviewed by:**	*CJS*
					Consolidation Test Report		

Schnabel ENGINEERING

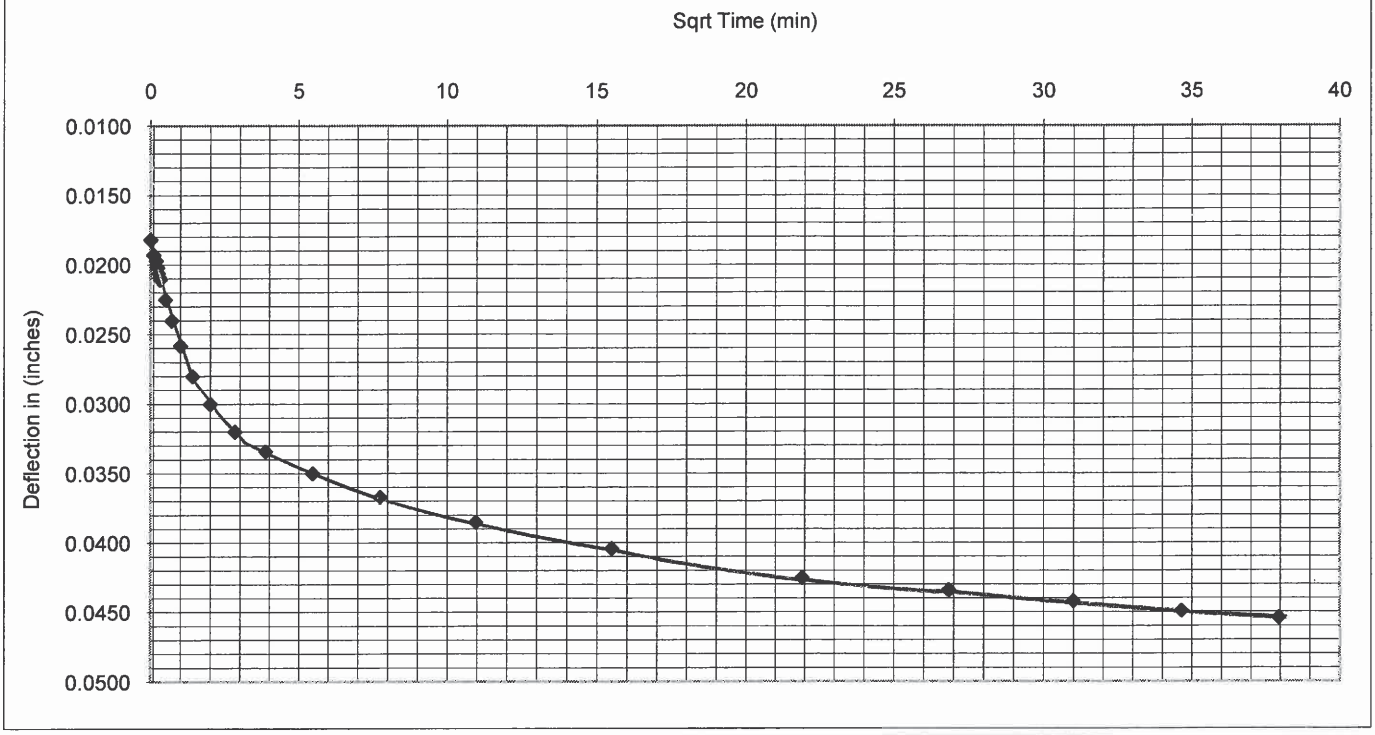
Consolidation Time Curves

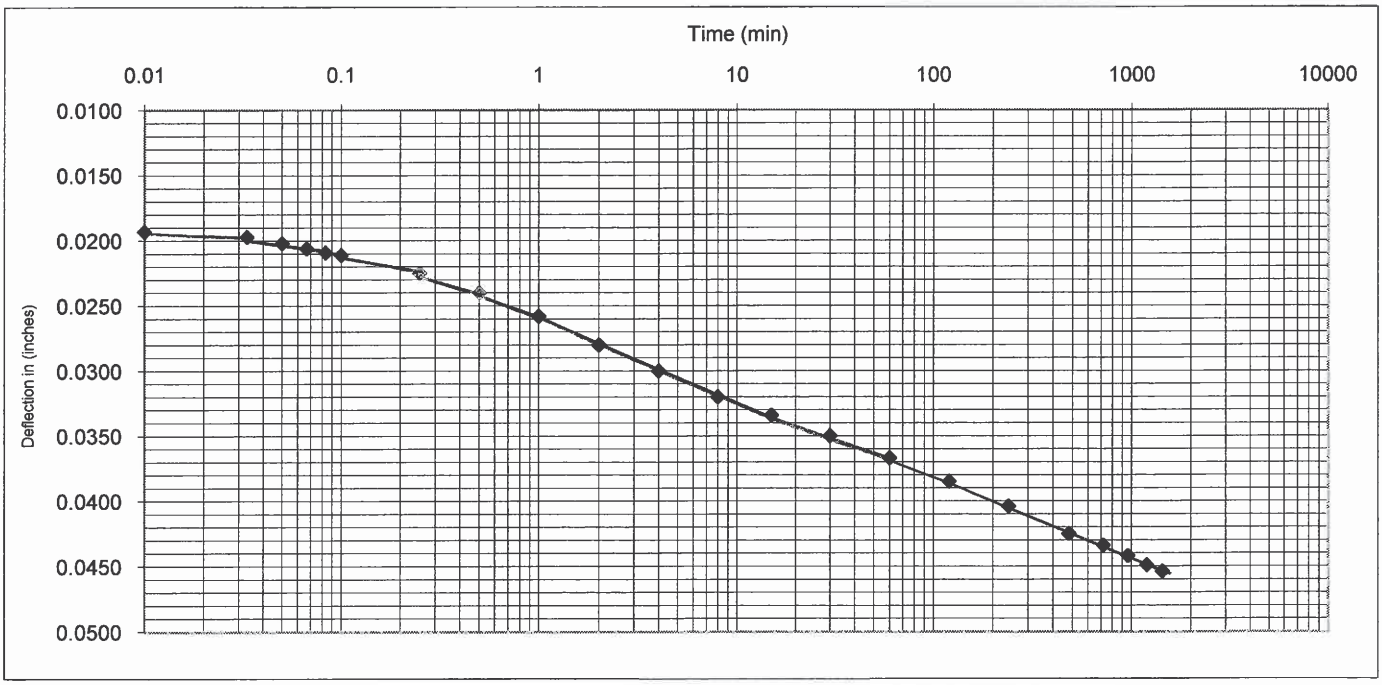
9/16/10

Project: MLK Expressway Extension
Schnabel Contract: 10613051
Boring No.: 10BH-233A Depth: 20-22 ft.
Reviewed by: CJS Test Drainage Conditions: Double



Consol 5/2007 Rev. 4





Description of Sample:	ELASTIC SILT (MH) - dark gray

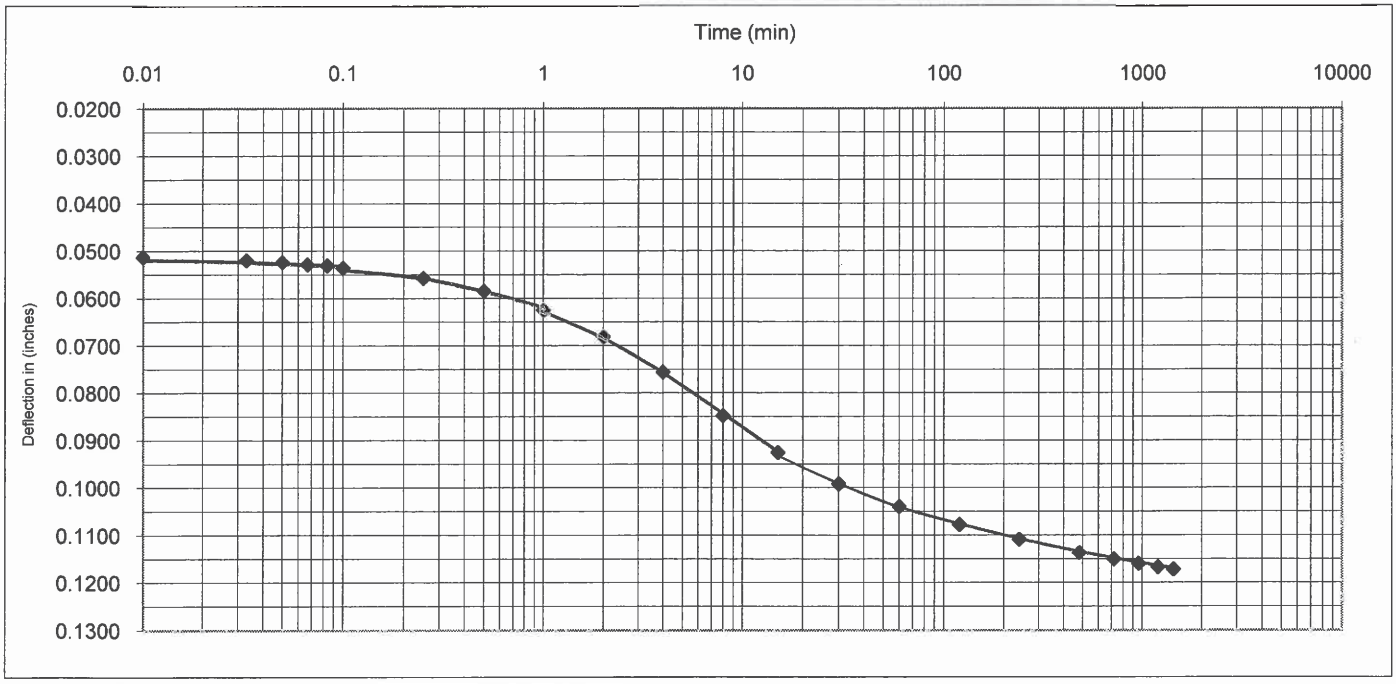
Schnabel ENGINEERING

TIME-COMPRESSION CURVE

Boring :	10BH-233A	Depth:	20'-22'	Stratum:	D2
Load (tsf)					2.0
Coefficient of Consolidation (sqrt t in2/min)					
Coefficient of Consolidation (log t in2/min)					
Coefficient of Secondary Compression					

Project:	MLK Expressway Portsmouth, Virginia
Contract Number:	10613051





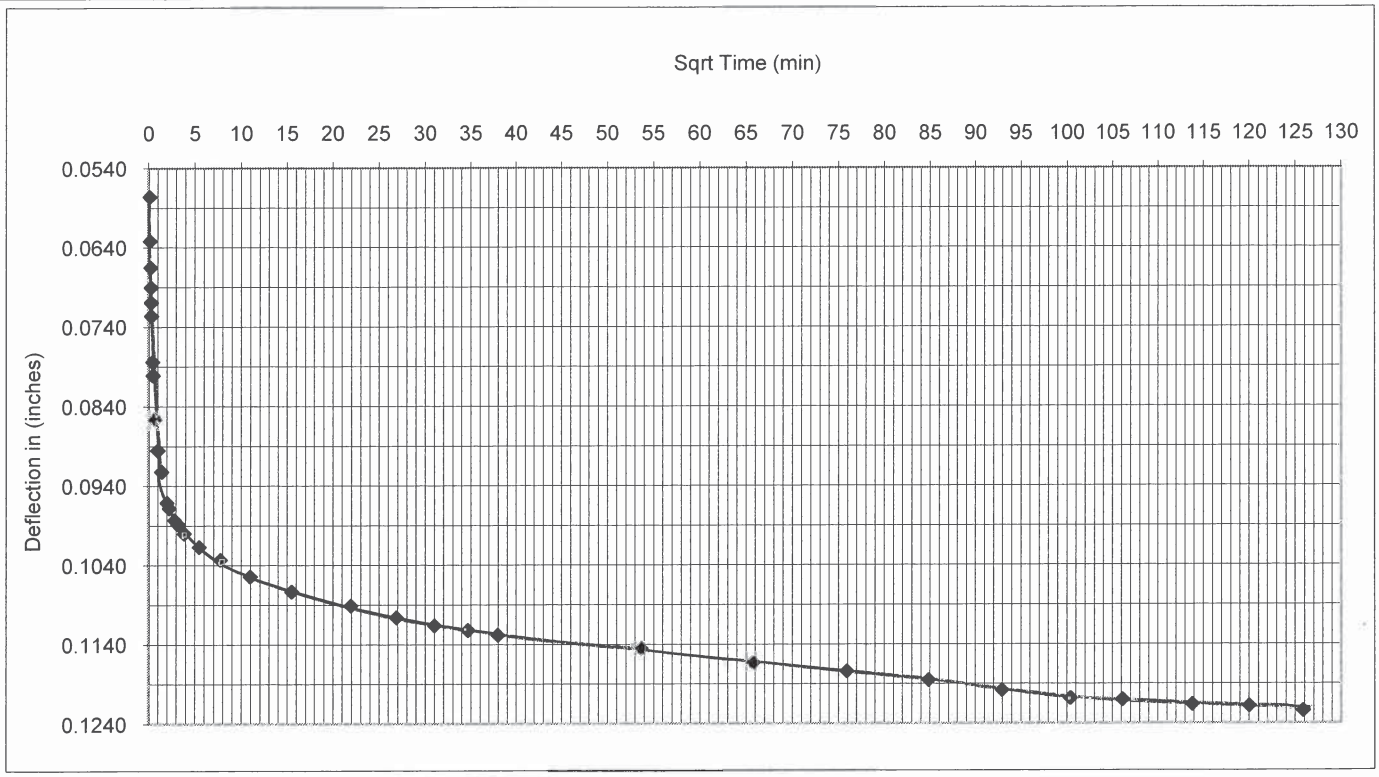
Description of Sample:	ELASTIC SILT (MH) - dark gray

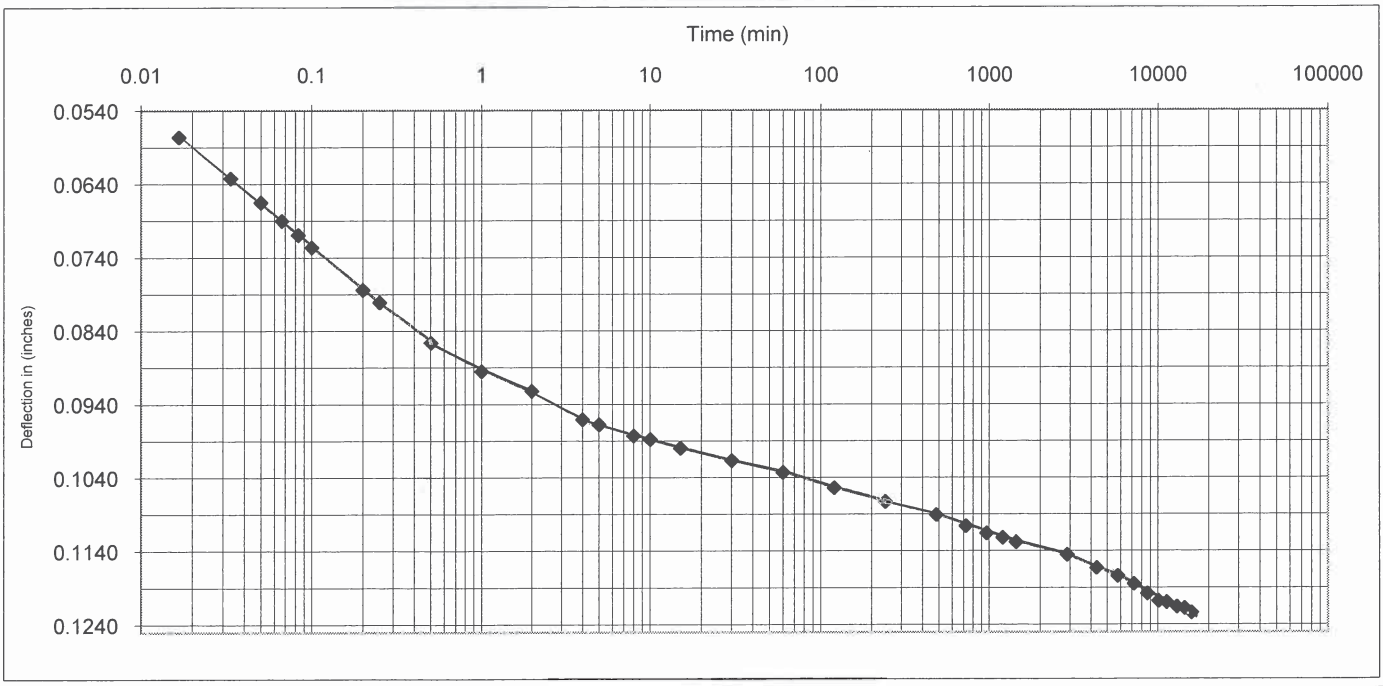
Boring :	10BH-233A	Depth:	20'-22'	Stratum:	D2
Load (tsf)					4.0
Coefficient of Consolidation (sqrt t in2/min)					
Coefficient of Consolidation (log t in2/min)					
Coefficient of Secondary Compression					

Schnabel ENGINEERING

TIME-COMPRESSION CURVE

Project:	MLK Expressway Portsmouth, Virginia
Contract Number:	10613051





Description of Sample:	Dark Brown, PEAT, PT

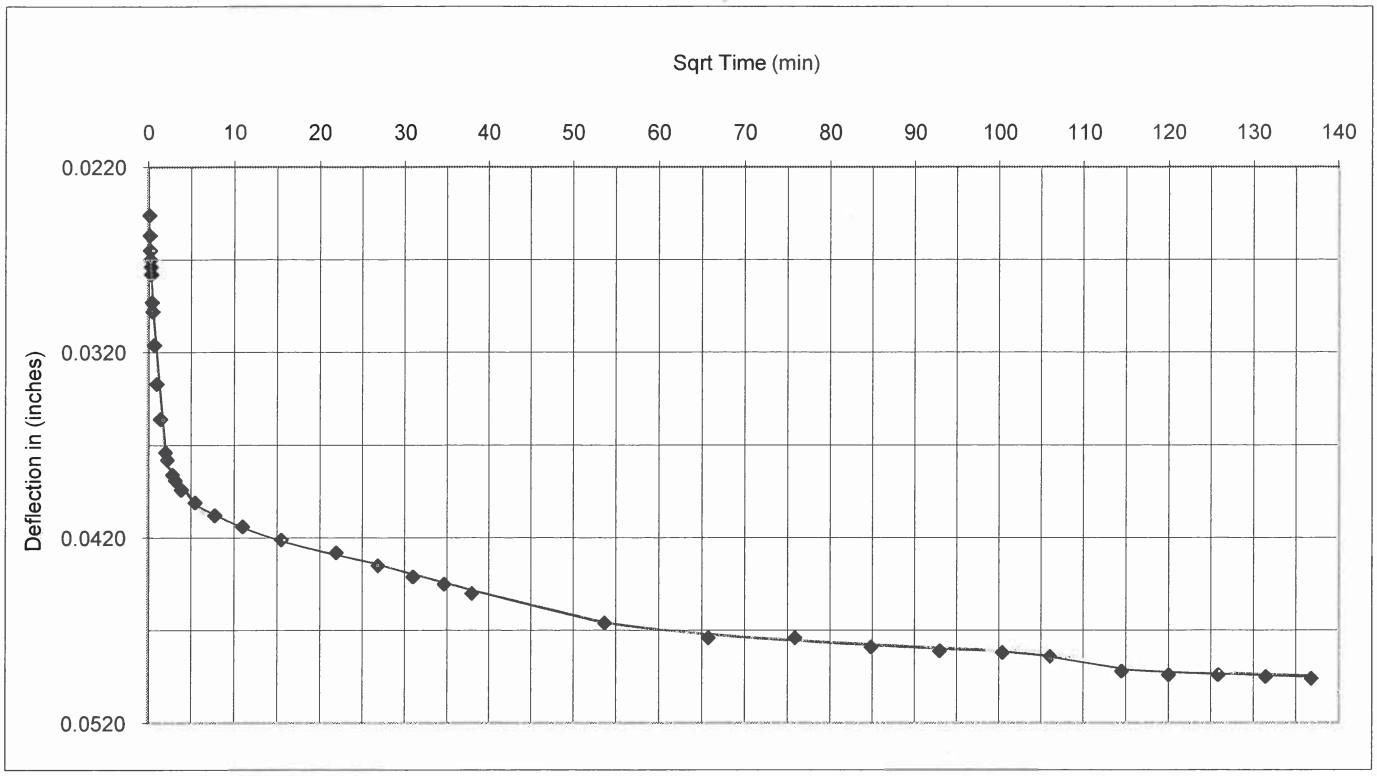
Schnabel ENGINEERING

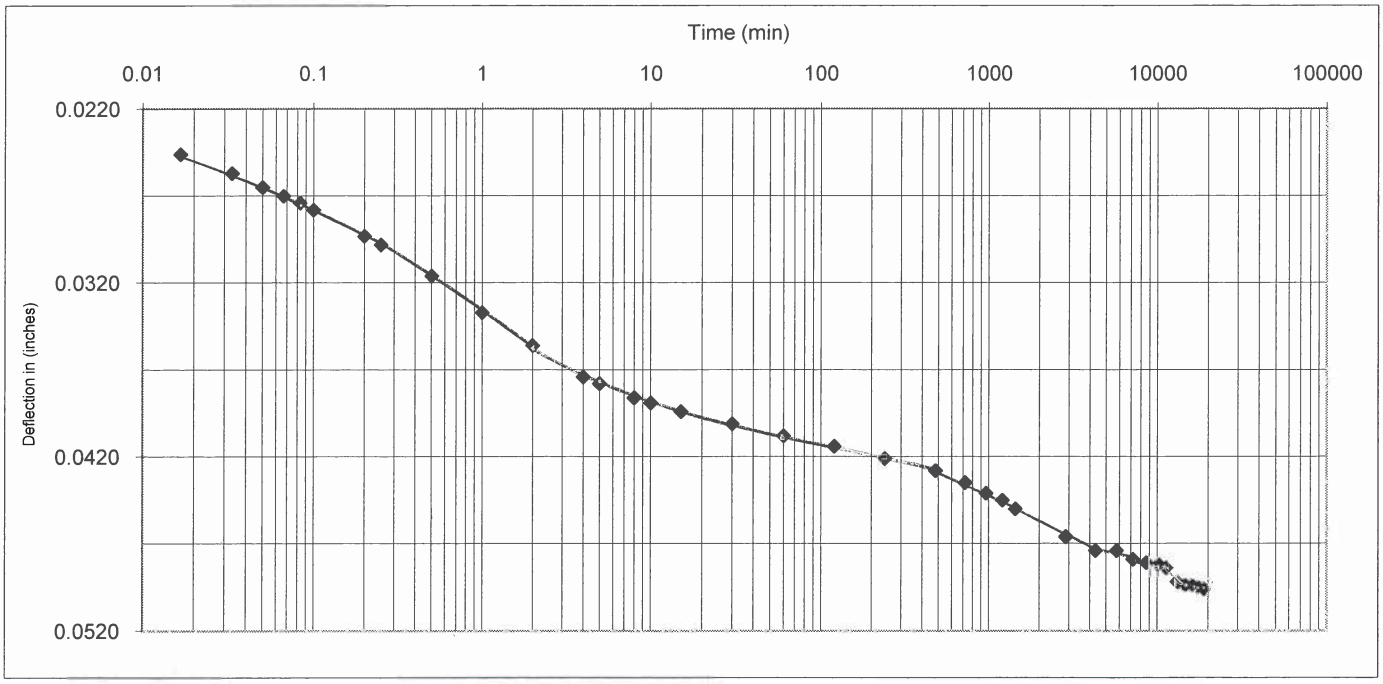
TIME-COMPRESSION CURVE

Boring :	10BH-096A	Depth:	33'-34'	Stratum:	D3

Load (tsf)	2.0
Coefficient of Consolidation (sqrt t in^2/min)	0.077
Coefficient of Consolidation (log t in^2/min)	0.577
Coefficient of Secondary Compression	0.011

Project:	MLK Expressway Portsmouth, VA
Contract Number:	10613051





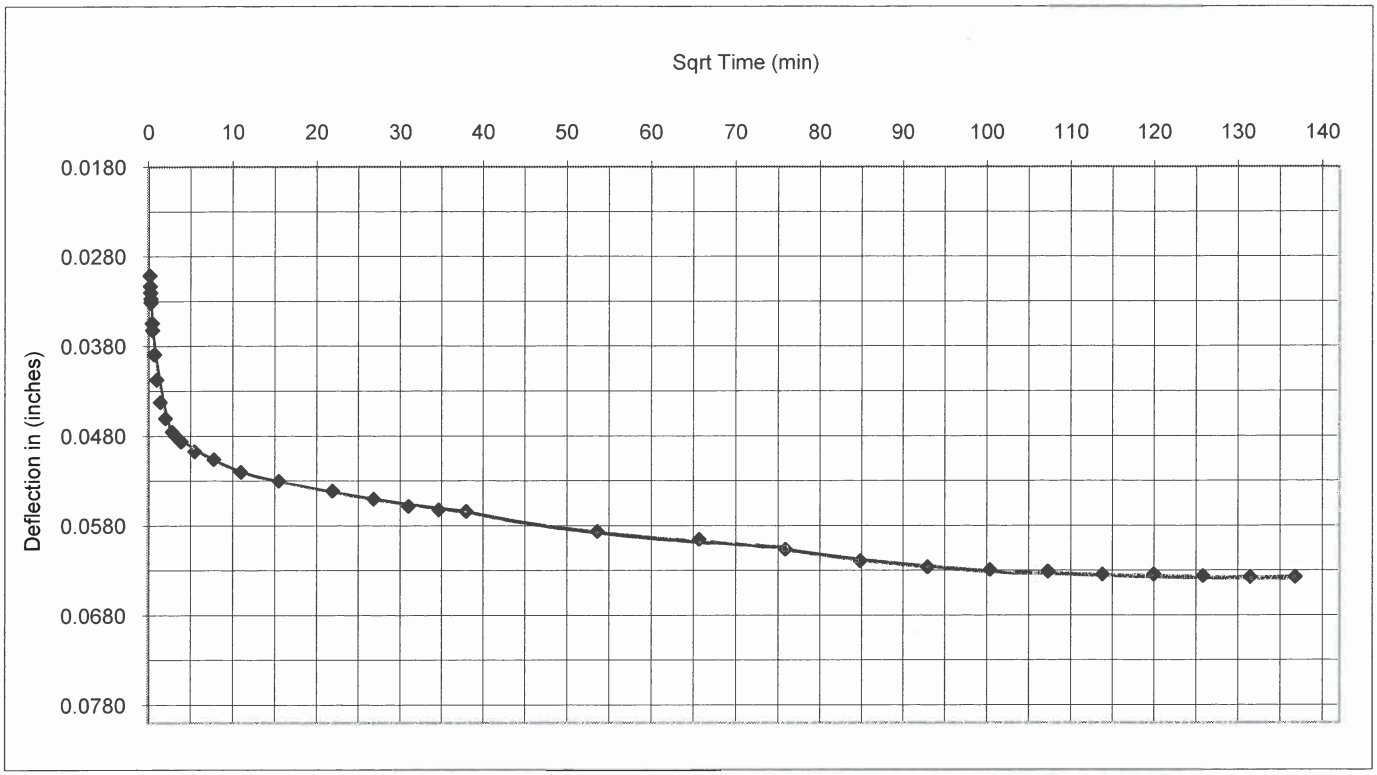
Description of Sample:	Brown, PEAT, contains wood fragments, PT

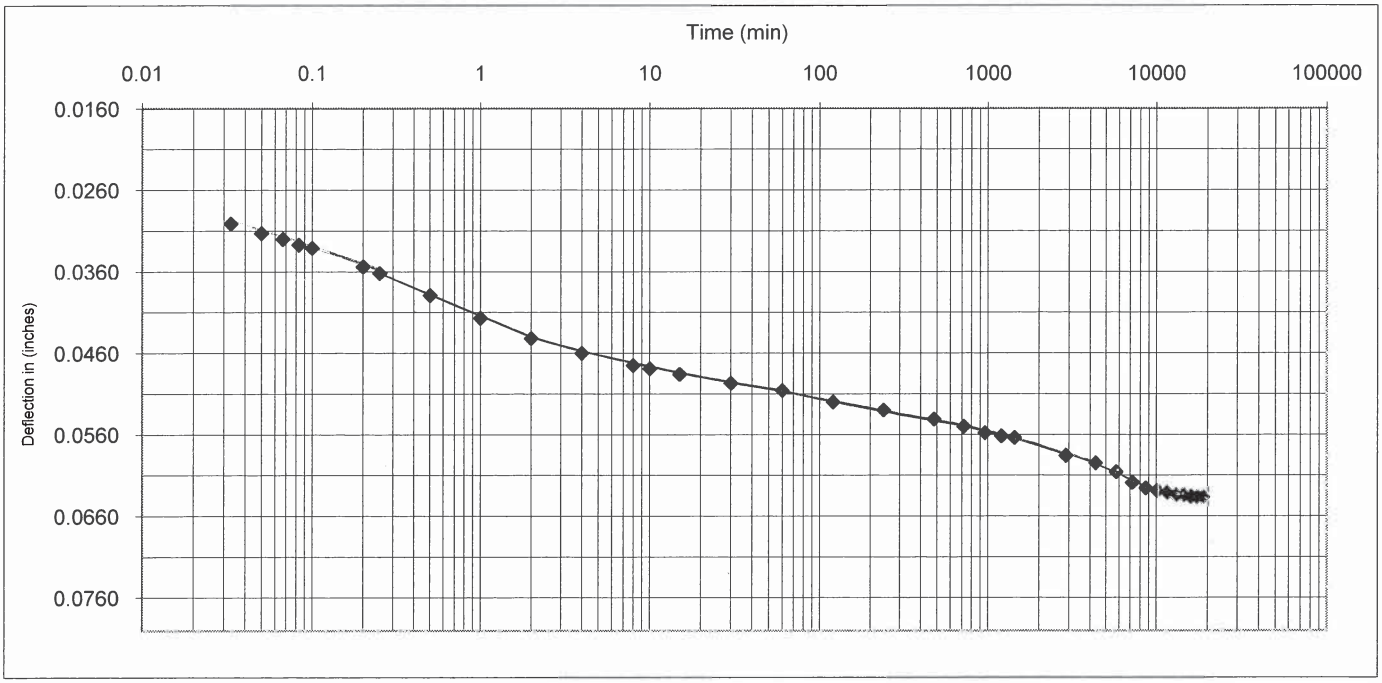
Boring :	10BH-120A	Depth:	35'-37'	Stratum:	D3
Load (tsf)					1.5
Coefficient of Consolidation (sqrt t in2/min)					0.031
Coefficient of Consolidation (log t in2/min)					0.150
Coefficient of Secondary Compression					0.008

Schnabel ENGINEERING

TIME-COMPRESSION CURVE

Project:	MLK Expressway Extension Portsmouth, VA
Contract Number:	10613051





Description of Sample:	Dark Brown, PEAT, contains wood fragments, PT

Schnabel ENGINEERING

TIME-COMPRESSION CURVE

Boring :	10BH-136A	Depth:	32'-34'	Stratum:	D3
Load (tsf)					2.0
Coefficient of Consolidation (sqrt t in^2/min)					0.037
Coefficient of Consolidation (log t in^2/min)					0.180
Coefficient of Secondary Compression					0.009

Project:	MLK Expressway Extension Portsmouth, VA
Contract Number:	10613051

1.2.5 Geotechnical Conditions - MLK Extension - Marshall Miller & Associates Geotechnical Data Report - CSXT Property - Non-PB

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July 8, 2010

Mr. Andy Winch
Virginia Department of Transportation
1700 N. Main Street
Suffolk, Virginia 23434

Re: Geotechnical Data Report
Proposed Martin Luther King Jr. Freeway Extension (CSXT Property)
Portsmouth, Virginia
VDOT Project # 0058-965-107 UPC76642, ACT 612
MM&A Project # VHAMP084

Dear Mr. Winch:

Marshall Miller & Associates, Incorporated (MM&A) submits this *Geotechnical Data Report* for the proposed Martin Luther King Jr. (MLK) Freeway extension project in Portsmouth, Virginia. The study area consisted of the CSX Transportation (CSXT) site as shown on the Vicinity Map in **Attachment I**.

PURPOSE

The purpose of the study was to obtain subsurface geotechnical data from the CSXT site where MM&A was already performing an environmental study with an approved access agreement. The Virginia Department of Transportation (VDOT) has proposed bridges over the rail tracks with bridged ramp connections to Interstate 264 for the proposed MLK extension. Previous test borings for the project area include a 1992 study by Haley & Aldrich, Inc. Those boreholes were established to maximum depths between 60.5 feet and 80.5 feet. Therefore, VDOT desired deeper boreholes to further assess the subsurface conditions at select locations in the area of proposed bridge foundations and approach abutments only located within the CSXT property.

SITE DESCRIPTION

The CSXT property is situated north of Interstate 264 and south of Turnpike Road (Route 337). The CSXT property is designated as Parcel 012 on VDOT's plan sheets and includes the Vulcan Sales Yard, an inactive rail container yard and a vacant lot. A brief description of each portion of the property is described as follows.

Vulcan Sales Yard

This site is situated south of Turnpike Road and is accessed through Meander Road. Vulcan leases the site for a gravel sales operation. Due to the numerous, large gravel stockpiles, the three geotechnical boreholes drilled here required off-sets (10BH-169, 171 and 174).

Container Yard

This site is situated south of the Vulcan Sales Yard and north of the main line rail tracks. This site contains inactive support buildings and was most recently used for rail container storage. The two geotechnical boreholes in this area (10BH-109 and 168) were accessible.

Vacant Lot

This site is situated south of the main line rail tracks and north of Columbus Avenue. The south portion is mainly wooded, which required clearing paths for three boreholes (10BH-097, 099 and 101). The north part is open with pavement and a spur connected to the mail rail line; however, no buildings are present. Off-sets were required on the following boreholes: 10BH-101 (drainage ditch), 10BH-099 (large tree), 10BH-089 and 10BH-091 (originally off CSXT property) and 10BH-111 (rail tracks).

GEOLOGIC SETTING

The project corridor is located within the Coastal Plain Province of Virginia (*Geologic Map of Virginia*, 1993). The area is underlain by sediments of the late Pleistocene Tabb Formation. The formation generally consists of clayey, silty, sandy soils and buried

swamp remains. Beneath this unit is the Yorktown Formation (lower-upper Pliocene to lower Pliocene). The formation generally consists of fine to coarse grained sand, commonly very shelly, interbedded with sandy and silty blue-gray clay.

SUBSURFACE INVESTIGATION AND LABORATORY TESTING PROGRAM

The subsurface investigation program included in this study was developed between VDOT and the Elizabeth River Crossing (ERC) group as part of the Public-Private Transportation Act (PPTA) project. The scope was finalized in a teleconference dated April 5, 2010 between all parties. The study included drilling 12 standard penetration test (SPT) borings at select locations determined from ERC's proposed Phase 1 and 2 boring location plans included in **Attachment I**. The study excluded the performance of any cone penetrometer soundings (CPT) or dilatometer soundings (DMT) denoted on these plans. The locations where the selected borings were drilled in coordination with ERC's boring location plans are 10BH-089, 091, 097, 099, 101, 107, 109, 111, 168, 169, 171 and 174. As discussed below, Boring No. 176 was also selected but later deleted from the subsurface exploration program once it was determined by survey that the location of this boring fell outside the CSXT property.

For this VDOT investigation, MM&A established 12 boreholes from April 7 – April 16, 2010. The subsurface data collection consisted of the following:

- standard penetration tests to a depth of 100 feet performed in general accordance with ASTM D 1586,
- soil descriptions with United Soil Classification System (USCS) designation,
- natural moisture content % for each sample, and
- Atterberg limits and % passing #200 sieve on select samples.

VDOT surveyed the proposed borehole positions prior to the drilling, which are depicted on the site maps provided to MM&A in **Attachment I**. Certain boreholes required off-sets due to site obstacles such as rail tracks (agreement stipulated no closer than 30 feet from rail tracks), gravel piles, utilities and staying on CSXT property. Boreholes that

required off-set are denoted on the boring logs included in **Attachment II**. The off-sets and elimination of 10BH-176 were communicated with VDOT and ERC during the drilling. Additionally, VDOT surveyed final borehole positions as referenced to the North American Datum of 1983 (NAD 83). The final coordinates and elevations are depicted on the boring logs in **Attachment II**.

The drilling was performed by Fishburne Drilling, Inc. of Chesapeake, Virginia using 4-inch diameter mud rotary drilling equipment. Split-spoons samples were obtained continuously to a depth of 10 feet, then every 5 feet thereafter. The standard penetration resistance (N) was determined by counting the number of blows required to drive a 24-inch long split spoon sampler under the impact from an automatic 140-pound hammer free falling 30 inches. Samples from each split spoon were placed into glass jars and submitted for laboratory testing by Atlantic Geotechnical Services, Inc. of Ashland, Virginia. All borings were drilled and logged under the direct supervision of MM&A. On behalf of ERC, a representative from Schnabel Engineering, LCC observed the drilling operations, samples collected via split-spoon sampler, and obtained Shelby Tubes from one borehole (10BH-101). The boring logs are included in **Attachment II**.

The boring logs were prepared and the soils described in general accordance with the guidelines included in Chapter 3 of the VDOT Materials Manual of Instructions (MOI). Soil descriptions on the boring logs are visual and are generally in accordance with the USCS as described in ASTM D 2488. Laboratory samples tested were classified in accordance with the USCS (ASTM D 2487). It should be noted that some variation can be expected between samples visually classified and samples classified in the laboratory.

Natural moisture content tests, Atterberg Limits and grain size analyses (percent passing No. 200 sieve) were performed on selected SPT samples in accordance with ASTM D 2216, ASTM D 4318 and ASTM D 1140, respectively. The results of the laboratory testing performed are included on the Summary of Laboratory Data Sheets in **Attachment III** and on the boring logs in **Attachment II**. Laboratory test results from

the two selected Shelby tube samples obtained from Boring 10BH-101 that were conducted by Schnabel Engineering, LCC are included in **Attachment IV**.

All untested soil samples with the exception of the Shelby tube samples collected and retained by Schnabel Engineering, LCC as part of this investigation are available for inspection at the office of the Hampton Roads District Materials Engineer, 1700 North Main Street, Suffolk, Virginia, 23434. Please contact Dr. Chung Wu, P.E., PhD at 757-925-2674 to obtain access to the samples.

SUBSURFACE CONDITIONS

The following characterizes the generalized subsurface soil stratigraphy and ground water conditions within the CSXT property based on the boring data included in **Attachment II**. The characterization below describes typical soil types and average depths and observed ground water conditions that were uncovered in the borings performed for this study. The reader should refer to the boring logs for the specific data for each borehole.

Fill and Possible Fill – Soils that contained evidence of disturbance and/or debris (topsoil, roots, remolded structure, crushed aggregate, asphalt fragment, etc.) were generally encountered in most of the borings on the vacant lot and in all the borings performed on the container yard and Vulcan Sales Yard. The fill soils generally consisted of very soft consistency lean clay with gravel FILL and very loose to medium dense silty and clayey sand with gravel FILL, poorly graded sand with gravel FILL and poorly graded gravel FILL. The depth of fill beneath the existing ground surface, where encountered, ranged from about 2 to 8.5 ft. Crusher run FILL that was generally dense to very dense was encountered in Borings 10BH-169, 10BH-171 and 10BH-174 to depths of about 3 ft, 4 ft and 4 ft, respectively, below the existing ground surface.

Tabb Formation – This stratum was encountered in all borings drilled within the CSXT property. The soils of the Tabb Formation generally consist of very soft to stiff consistency lean CLAY (CL), fat CLAY (CH), elastic SILT (MH) and SILT (ML) and very loose to medium dense clayey SAND (SC), silty SAND (SM), poorly graded SAND

(SP) and well graded SAND (SW). A layer of firm density well graded gravel (GW) was also encountered at the bottom of this formation in two of the borings (10BH-089 and 10BH-168). Samples representing the Tabb Formation were found to contain varying amounts of shell fragments, mica and organic matter. This stratum was encountered to depths ranging between about 65 and 75 ft below the existing ground surface.

An organic layer ranging between 5 and 20 ft in thickness was encountered within the Tabb Formation in each of the borings at depths generally ranging from 25 to 50 ft below the existing ground surface. In Boring 10BH-109, the organic layer extended about 60 ft below the existing ground surface. These organic materials encountered generally consisted of organic SILT (OH and OL). The moisture content values recorded for samples collected from within this organic layer varied from about 47 to 290 percent.

Yorktown Formation - This stratum which underlies the Tabb Formation represents the fine-grained and coarse-grained soils of the Yorktown Formation. The soils within this stratum generally consist of loose to medium dense silty SAND (SM) and clayey SAND (SC) and firm to stiff consistency lean CLAY (CL) that contains varying amounts of shell fragments. This stratum was encountered in all borings to the maximum depths of penetration of 100 ft. The estimated top of elevation of the Yorktown Formation at each of the borehole locations are indicated on the boring logs and range from about EL -51 to EL-62. The depths and corresponding elevations provided on the logs should be considered approximate.

Ground water - Ground water level readings were recorded during drilling. As indicated on the boring logs in **Attachment II**, ground water was observed during drilling in all the borings at depths from about 5 to 6 ft, El 7.1 to El 10. No long term ground water readings were taken since the boreholes were backfilled upon completion for safety. The water levels indicated on the boring logs represent an estimate of the ground water levels that existed at the time of drilling. Fluctuations of the ground water levels shown on the boring logs should be expected with changes in precipitation, surface run-off, evaporation and similar factors.

LIMITATIONS

The geotechnical data was collected as directed for use by others for the Martin Luther King Jr. (MLK) Freeway extension project in Portsmouth, Virginia. The information was collected to satisfy the requirements as specified by VDOT and included in our work plan/opinion of probable cost approved on March 1, 2010. The adequacy of the data for its intended use is to be determined by others.

The descriptions provided herein are based on the referenced subsurface explorations. The nature and extent of variations between boreholes may not become evident until revealed during construction. If variations then appear evident, it will be necessary to re-evaluate subsurface conditions.

The service provided for this assignment was performed with the skill and care ordinarily exercised by reputable members of the engineering profession practicing under similar conditions at the same time or similar locality. No expressed or implied warranty is made or intended by the rendition of these services or by furnishing oral or written reports of the findings made. In the event new information, documentation, or evidence becomes available, MM&A reserves the right to revise or amend this report.

If you have any questions or require further information, please contact the undersigned.

Sincerely,

Marshall Miller & Associates, Inc.

James L. Douglass, P.G., P.E.
Senior Scientist

James T. Martin, Jr., P.G.
Senior Scientist

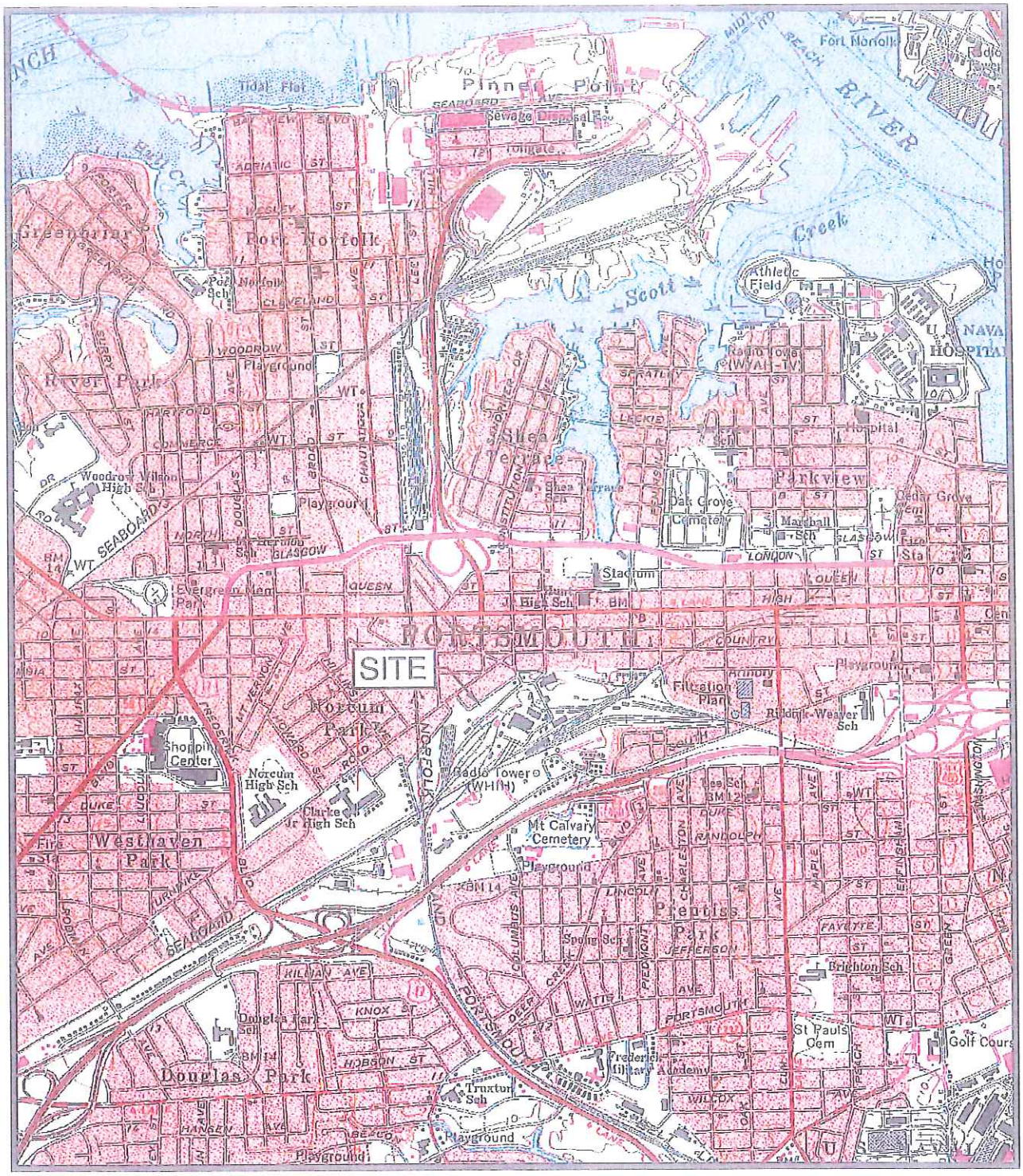
cc: Raymond Partridge, VDOT Innovative Project Delivery Division

MARSHALL MILLER & ASSOCIATES

Attachment I

Maps

MARSHALL MILLER & ASSOCIATES



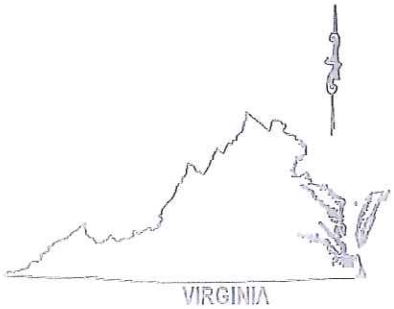
VDOT

MLK Phase II ESA
Portsmouth, Virginia

2,000' 0 2,000'

SCALE 1:24,000

Vicinity Map

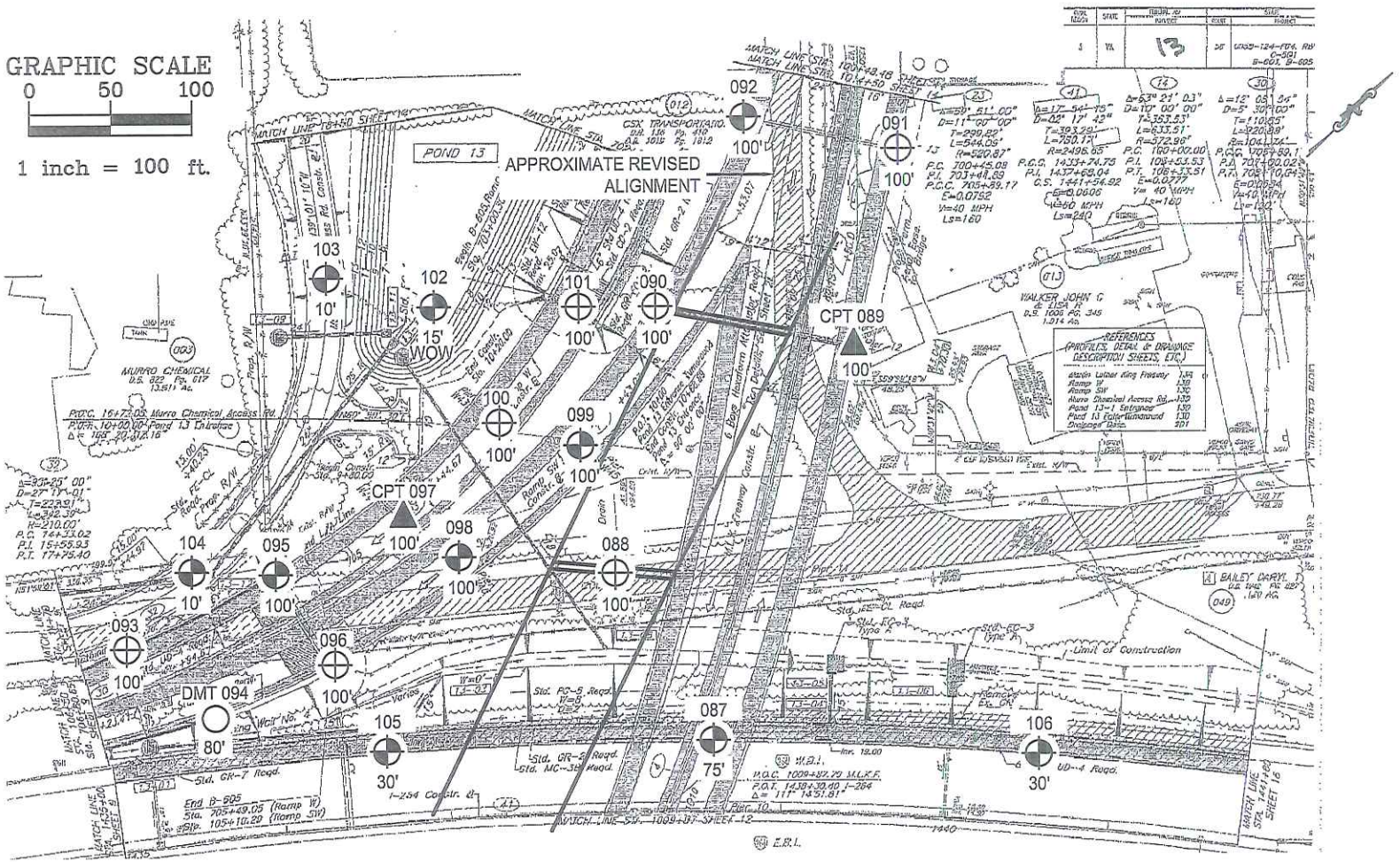


Prepared by:

MARSHALL MILLER & ASSOCIATES

VHAMP084 03/25/2010

USGS 7.5' NORFOLK SOUTH, VA QUADRANGLE - 1994
CONTOUR INTERVAL = 5'



LEGEND

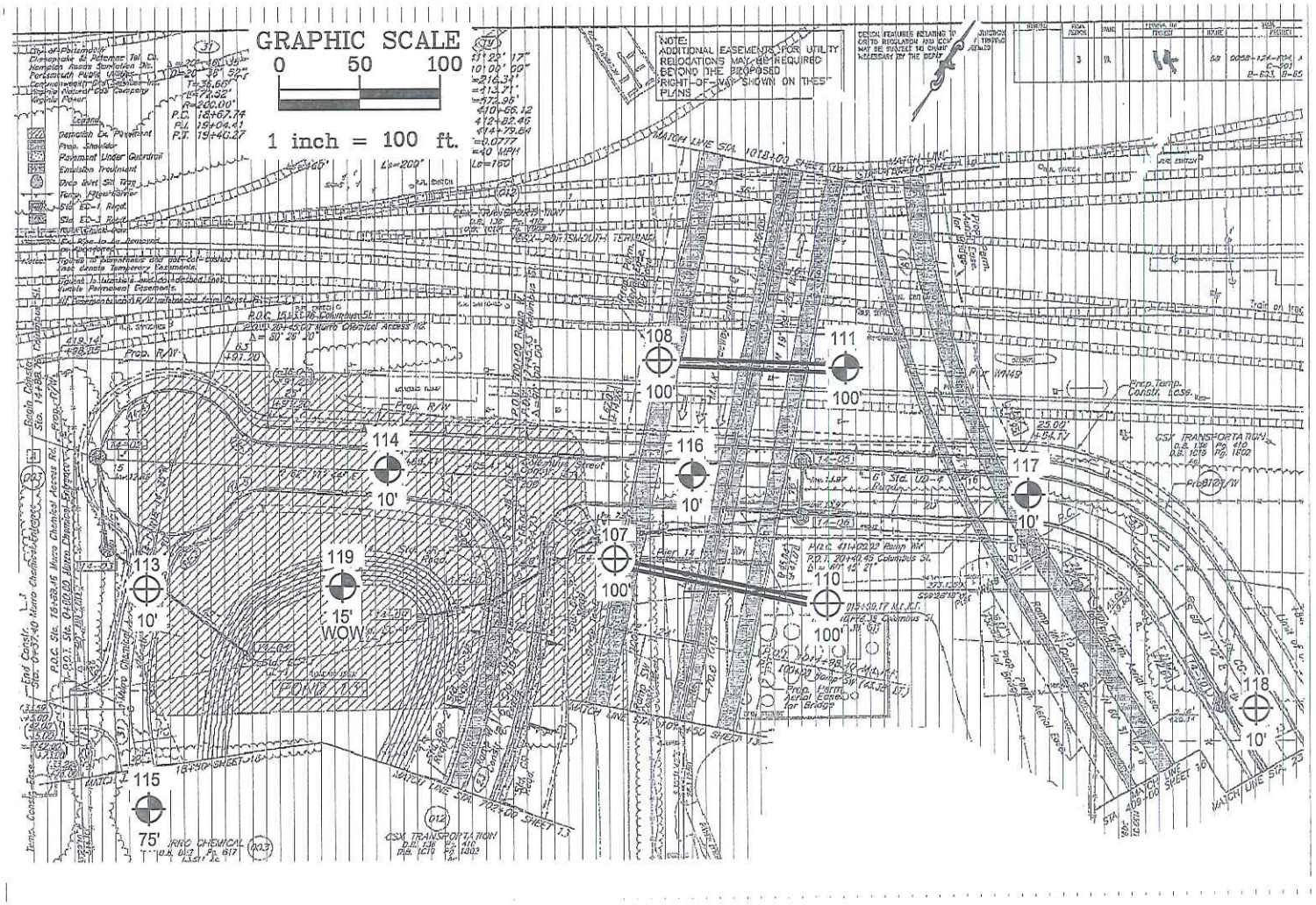
001	APPROXIMATE PHASE 1 TEST BORING LOCATION
001	APPROXIMATE PHASE 2 TEST BORING LOCATION
DMT 001	APPROXIMATE PHASE 1 DILATOMETER LOCATION
CPT 001	APPROXIMATE PHASE 2 CPT LOCATION

Schnabel Engineering

MIDTOWN TUNNEL AND MLK EXPRESSWAY
PORTSMOUTH, VIRGINIA

PROPOSED BORING LOCATION PLAN

PROJECT NO. P8330138
FIGURE 11



LEGEND

001 — APPROXIMATE PHASE 1 TEST BORING LOCATION

001 — APPROXIMATE PHASE 2 TEST BORING LOCATION

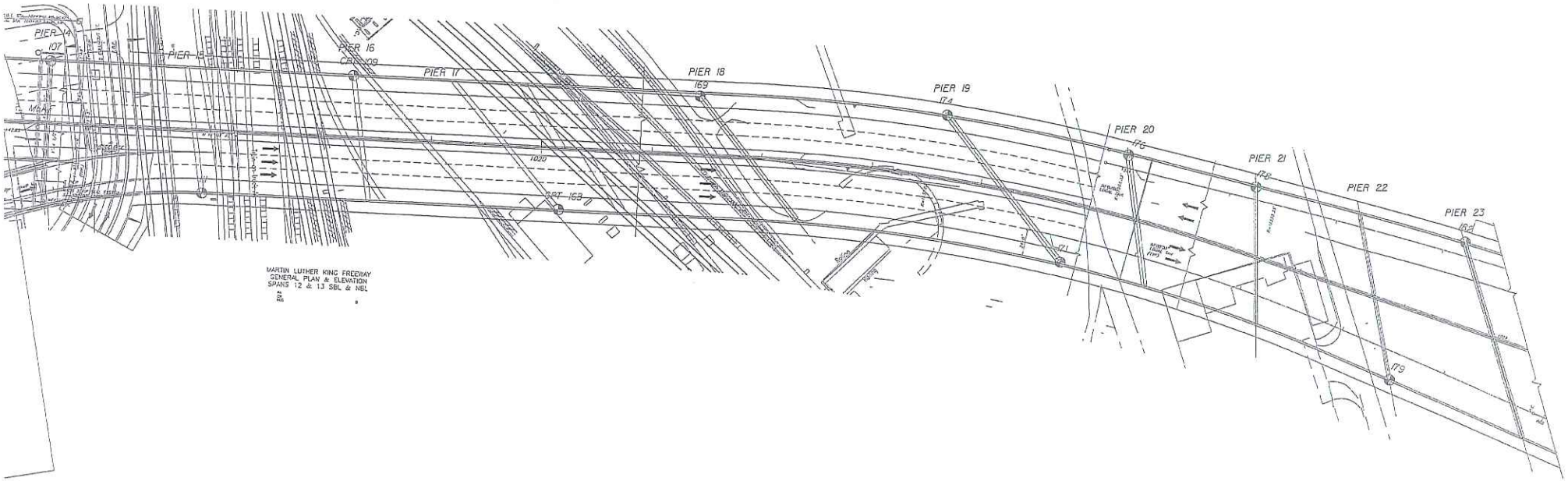
CPT 001 — APPROXIMATE PHASE 2 CPT LOCATION

Schnabel Engineering

MIDTOWN TUNNEL AND MLK EXPRESSWAY
PORTSMOUTH, VIRGINIA

PROPOSED BORING LOCATION PLAN

PROJECT NO. P8330138
FIGURE 12



MLK BORING LOCATIONS
VOLKERT, INC. 3/1/2010

Attachment II

Geotechnical Logs

MARSHALL MILLER & ASSOCIATES

VDOT Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 12

10BH-089
PAGE 1 OF 3

STATION: 1012+70.55 OFFSET: 7.00 RT
LATITUDE: 36.827532° N LONGITUDE: 76.325607° W
SURFACE ELEVATION: 12.8 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/12/2010 - 4/12/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 5.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA | **LAB DATA**

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
0		NR NR 2	50		2						0.0 / 12.8 Dark gray, fine clayey SAND, loose, moist. **SC**			17.0	
2	10	1 1 3	75		4									15.0	
4		5 8 8	90		6						4.0 / 8.8 Light gray, fine to medium SAND, medium dense, wet. **SP**			22.0	
6		4 4 7	100		8									21.0	
8	5	9 4 5	100		10						8.0 / 4.8 Light gray, fine to medium SAND, loose, wet. **SP**			22.0	
10															
12					13						11.5 / 1.3 Gray, silty SAND, trace shell fragments, loose, wet. **SM**				
14	0	4 4 2	75		15									28.0	
16															
18	-5	2 1 1	80		18									26.0	
20					20										
22					23						21.5 / -8.7 Dark green to gray, CLAY, soft, wet. **CH**				
24	-10	2 1 1	100		25									65.0	
26															
28	-15	WOH WOH 1	100		28							52	31	53.0	74.0
30					30										
32	-20	1 1 2	0		33						31.5 / -18.7 NO RECOVERY				
34					35										
36															
38	-25	2 2 3 4	85		38						36.5 / -23.7 Brown, ORGANIC SILT, medium stiff, wet. **OH**	204	95	165.0	70.0
40															

REMARKS: Rig Type: CME-550. Top of Yortown Formation estimated at 73.5 feet in depth, elevation -60.7 feet. This borehole was offset 20' west of its original staked position (along the pier alignment) due to an overhead power line conflict.

PAGE 1 OF 3
10BH-089

SPT_LOGB:0058-965-108_CSX_SPT.GPJ:8.1.025:032210:7/20/10

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VDOT Virginia Department of Transportation

PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 12

10BH-089
PAGE 2 OF 3

STATION: 1012+70.55 OFFSET: 7.00 RT
LATITUDE: 36.827532° N LONGITUDE: 76.325607° W
SURFACE ELEVATION: 12.8 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/12/2010 - 4/12/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 5.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA / **LAB DATA**

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT LL	LAB: PLASTICITY INDEX PI	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT -#200 (%)
40															
42	-30	1 1 2 1	60		43 45						41.5 / -28.7 Brown, ORGANIC SILT, soft, wet. **OH**			111.0	
46															
48	-35	2 3 4 4	80		48 50						46.5 / -33.7 Dark brown to gray, silty fine SAND, loose, wet. **SM**			43.0	
52	-40	WOH 1 1 1	75		53 55						51.5 / -38.7 Dark gray, SILT, soft, wet. **ML**	46	17	46.0	67.0
56															
58	-45	WOH 1 1 1	0		58 60										
62	-50	WOH 2 2 1	100		63 65						61.5 / -48.7 Green gray, clayey SAND, micaceous, loose, moist. **SC**	27	10	23.0	49.0
66															
68	-55	WOH WOH WOH 2	100		68 70									32.0	
72	-60	4 5 6 6	100		73 75						71.5 / -58.7 Brown to gray, sandy GRAVEL , medium dense, wet. **GW** 73.5 / -60.7 Brown to gray, silty SAND, medium dense, wet. **SM**	23	5	25.0	34.0
76											76.5 / -63.7 Gray, fine to coarse silty SAND, loose, moist. **SM**				
78	-65	2 2 3 10	100		78									34.0	
80															

REMARKS: Rig Type: CME-550. Top of Yortown Formation estimated at 73.5 feet in depth, elevation -60.7 feet. This borehole was offset 20' west of its original staked position (along the pier alignment) due to an overhead power line conflict.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 12

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STATION: 1012+70.55 OFFSET: 7.00 RT
LATITUDE: 36.827532° N LONGITUDE: 76.325607° W
SURFACE ELEVATION: 12.8 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/12/2010 - 4/12/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 5.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA												LAB DATA			
DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
80					80										
82	-70	2 1 2 5	100		83						81.5 / -68.7 Gray, fine to medium clayey SAND, loose, moist. **SC**	35	13	35.0	41.0
84					85										
86															
88	-75	4 2 5 10	100		88									34.0	
90					90										
92	-80	2 2 3 8	100		93						91.5 / -78.7 Green to gray, sandy CLAY, micaceous, medium stiff, moist. **CL**			34.0	
94					95										
96															
98	-85	3 4 5 11	100		98						96.5 / -83.7 Green to gray, sandy CLAY, micaceous, stiff, moist. **CL**			31.0	
100					100						End of Boring.				

REMARKS: Rig Type: CME-550. Top of Yortown Formation estimated at 73.5 feet in depth, elevation -60.7 feet. This borehole was offset 20' west of its original staked position (along the pier alignment) due to an overhead power line conflict.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 13

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STATION: 1014+20.99 OFFSET: 27.69 LT
LATITUDE: 36.827896° N LONGITUDE: 76.325877° W
SURFACE ELEVATION: 13.1 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/12/2010 - 4/12/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA / **LAB DATA**

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT -#200 (%)
0											0.0 / 13.1 Gray, sandy CLAY, moist. **CL**			20.0	
2	10	NR NR NR NR	50		2										
4		NR NR NR NR	100		4						2.0 / 11.1 Gray, silty SAND, moist. **SM**			23.0	
6		3 5 3 2	100		6						4.0 / 9.1 Light gray, medium SAND, loose, wet. **SW**			23.0	
8	5	1 4 3 2	85		8						6.0 / 7.1 Gray, fine to medium SAND, loose, wet. **SP**			22.0	
10		3 2 1 2	100		10									23.0	
12	0	6 4 3 2	80		13						11.5 / 1.6 Gray, fine silty SAND, trace shell fragments, loose, wet. **SM**			28.0	
14					15										
16															
18	-5	2 1 1 1	95		18						16.5 / -3.4 Gray, fine silty SAND, little shell fragments, loose, wet. **SM**			27.0	
20					20										
22					23						21.5 / -8.4 Blue to gray, CLAY, soft, wet. **CH**				
24	-10	1 1 1 1	100		25							78	50	65.0	98.0
26															
28	-15	WOH WOH 1 1	100		28									66.0	
30					30										
32											31.5 / -18.4 Brown, ORGANICS, medium stiff, moist. **OL**				
34	-20	2 1 3 4	100		33									262.0	
36					35										
38	-25	2 1 2 2	78		38						36.5 / -23.4 Brown, ORGANIC SILT, soft, moist. **OH**				
40												107	43	178.0	65.0

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 70 feet in depth, elevation -56.9 feet. This borehole was offset 70' west of its original staked position, along the pier alignment. The original location was outside the CSXT property.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 13

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STATION: 1014+20.99 OFFSET: 27.69 LT
LATITUDE: 36.827896° N LONGITUDE: 76.325877° W
SURFACE ELEVATION: 13.1 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/12/2010 - 4/12/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA / **LAB DATA**

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT -#200 (%)
40															
42											41.5 / -28.4 Brown, silty SAND, micaceous & trace of organics, loose, moist. **SM**				
43	-30	2 1 1 2	95									47	17	42.0	43.0
44															
45															
46															
48	-35	1 1 1 1	100											54.0	
50															
52											51.5 / -38.4 Brown to gray, silty SAND, micaceous, medium dense, wet. **SM**				
53	-40	3 5 5 8	90											36.0	
55															
56															
58	-45	4 4 7 9	75											35.0	
60															
62											61.5 / -48.4 Blue to gray, CLAY, medium stiff, wet. **CL**				
63	-50	WOH 1 3 3	100									46	22	30.0	96.0
65															
66															
68	-55	4 3 3 4	100									42	23	28.0	70.0
70															
72											71.5 / -58.4 Gray, fine to coarse silty SAND, trace shells, loose, wet. **SM**				
73	-60	2 2 3 6	100											34.0	
75															
76											76.5 / -63.4 NO RECOVERY				
78	-65	2 2 3 5	0												
80															

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 70 feet in depth, elevation -56.9 feet. This borehole was offset 70' west of its original staked position, along the pier alignment. The original location was outside the CSXT property.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 13

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STATION: 1014+20.99 OFFSET: 27.69 LT
LATITUDE: 36.827896° N LONGITUDE: 76.325877° W
SURFACE ELEVATION: 13.1 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/12/2010 - 4/12/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA / **LAB DATA**

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT -#200 (%)
80															
82															
83	-70	3 2 3 10	100												
84														35.0	
85															
86															
88	-75	3 2 2 8	100												
90														34.0	
92											81.5 / -68.4 Green to gray, clayey SAND, trace shell fragments, loose, moist. **SC**				
93	-80	2 2 4 8	100												
94												44	26	31.0	52.0
95															
96															
98	-85	3 2 4 7	100											33.0	
100											91.5 / -78.4 Green to gray, sandy CLAY, trace shell fragments, stiff, moist. **CL**				
											End of Boring.				

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 70 feet in depth, elevation -56.9 feet. This borehole was offset 70' west of its original staked position, along the pier alignment. The original location was outside the CSXT property.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: RAMP PIER

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STATION: 104+23.70 OFFSET: 32.60 RT
LATITUDE: 36.826987° N LONGITUDE: 76.325928° W
SURFACE ELEVATION: 13.9 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/14/2010 - 4/14/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: James Martin

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB DATA: LIQUID LIMIT (LL)	LAB DATA: PLASTICITY INDEX (PI)	LAB DATA: MOISTURE CONTENT (%)	LAB DATA: FINES CONTENT #200 (%)
0		1 2 4 3	75		2						0.0 / 13.9 Brown to tan, fine SAND, loose, dry. **SP**			14.0	
2		2 1 2 1	50		4						3.0 / 10.9 Tan, lean CLAY, soft, moist. **CL**			20.0	
4	10	1 1 2 4	67		6						4.0 / 9.9 Gray to tan, clayey SAND, loose, wet. **SC**			23.0	
6 ▽		3 4 6 7	92		8						5.0 / 8.9 Gray, fine SAND, loose, wet. **SW**			23.0	
8	5	3 6 6 8	100		10						8.0 / 5.9 Tan to gray, fine SAND, medium dense, wet. **SW**			19.0	
10															
12					13						11.5 / 2.4 Gray, fine SAND, trace of silt, loose, wet. **SW**				
14	0	4 3 3 3	67		15									30.0	
16															
18					18						16.5 / -2.6 Gray, fine SAND, trace of silt and clay, loose, wet. **SW**				
20	-5	2 2 1 1	100		20									26.0	
22					23						21.5 / -7.6 Gray, CLAY, soft, wet. **CH**				
24	-10	WOH 1 1 1	100		25							74	46	70.0	98.0
26															
28		WOH 1 WOH 1			28						26.5 / -12.6 Same, very soft, wet. **CH**				
30	-15		100		30									66.0	
32											31.5 / -17.6 NO RECOVERY				
34	-20	1 1 2 3	0		33 35										
36															
38					38						36.5 / -22.6 Brown, ORGANIC SILT, soft, wet. **OH**				
40	-25	2 2 2 1	96									329	138	290.0	62.0

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 65 feet in depth, elevation -51.1 feet. This hole was drilled on the original surveyed and staked location.

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SPT_LOGB:0058-965-108_CSX_SPT.GPJ:8.1.025:032210:7/19/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: RAMP PIER

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STATION: 104+23.70 OFFSET: 32.60 RT
LATITUDE: 36.826987° N LONGITUDE: 76.325928° W
SURFACE ELEVATION: 13.9 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/14/2010 - 4/14/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: James Martin

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB DATA: LIQUID LIMIT (LL)	LAB DATA: PLASTICITY INDEX (PI)	LAB DATA: MOISTURE CONTENT (%)	LAB DATA: FINES CONTENT -#200 (%)
40															
42															
43		1 1 1 2	96											156.0	
44	-30														
45											44.75 / -30.85 Gray, SILT and fine sands, soft, wet. **ML**				
46											46.5 / -32.6 Gray, SILT, some organics, very soft, moist. **MH**				
48		WOH WOH 1 1	92									54	18	49.0	64.0
50	-35														
52															
53		WOH WOH WOH 1	96											53.0	
54	-40														
55															
56															
58		2 4 6 5	63								56.5 / -42.6 Gray, fine silty SAND, loose, moist. **SM**			29.0	
60	-45														
62											61.5 / -47.6 Gray, medium SAND, and gravel, very dense, moist. **SP**				
63		34 61 22 9	75											11.0	
64	-50														
65															
66															
68		2 4 3 6	100								66.5 / -52.6 Green gray, silty SAND, trace shell fragments, loose, moist. **SM**			28.0	
70	-55														
72															
73		2 1 2 3	92											32.0	
74	-60														
75															
76															
78		2 1 4 9	92								76.5 / -62.6 Green to gray, clayey SAND, trace shell fragments, loose, moist. **SC**	26	9	35.0	31.0
80	-65														

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 65 feet in depth, elevation -51.1 feet. This hole was drilled on the original surveyed and staked location.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: RAMP PIER

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STATION: 104+23.70 OFFSET: 32.60 RT
LATITUDE: 36.826987° N LONGITUDE: 76.325928° W
SURFACE ELEVATION: 13.9 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/14/2010 - 4/14/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: James Martin

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA | **LAB DATA**

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
80															
82											81.5 / -67.6 Green to gray, clayey SAND, loose, moist. **SC**				
83		3 3 3 6	100											32.0	
84	-70														
85															
86															
88		1 2 2 3	92								86.5 / -72.6 Gray, clayey SAND, trace of shells, loose, moist. **SC**	33	13	33.0	42.0
88	-75														
90															
92															
93		2 2 4 8	96											32.0	
94	-80														
95															
96															
98		2 2 2 6	96											34.0	
98	-85														
100					100						End of Boring.				

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 65 feet in depth, elevation -51.1 feet. This hole was drilled on the original surveyed and staked location.

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SPT_LOGB:0058-965-108_CSX_SPT.GPJ:8.1.025:032210:7/19/10

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: RAMP PIER

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STATION: 103+06.44 OFFSET: 10.72 LT
LATITUDE: 36.827248° N LONGITUDE: 76.325928° W
SURFACE ELEVATION: 13.3 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/13/2010 - 4/13/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB DATA: LIQUID LIMIT (LL)	LAB DATA: PLASTICITY INDEX (PI)	LAB DATA: MOISTURE CONTENT (%)	LAB DATA: FINES CONTENT #200 (%)
0		2 1 2 2	60		2						0.0 / 13.3 Brown, sandy CLAY, soft, dry. **CL**			17.0	
2	10	1 3 3 3	70		4						2.0 / 11.3 Light gray, silty SAND, loose, dry. **SM**			18.0	
4		4 6 4 3	100		6						4.0 / 9.3 Yellow, fine to medium SAND, loose, moist. **SP**			22.0	
6 ▽		1 1 2 2	100		8						6.0 / 7.3 Gray, fine to medium SAND, loose, wet. **SP**			23.0	
8	5	2 1 3 4	100		10						8.0 / 5.3 Dark gray, fine to medium SAND, loose, wet. **SP**			22.0	
10															
12											11.5 / 1.8 Dark gray, fine silty SAND, trace shell fragments, loose, wet. **SM**				
14	0	2 2 3 3	60		13 15									32.0	
16															
18	-5	1 1 1 1	90		18 20						16.5 / -3.2 Dark gray, medium silty SAND, loose, wet. **SM**			27.0	
20															
22											21.5 / -8.2 Gray, CLAY, very soft, wet. **CH**				
24	-10	WOH WOH WOH 1	95		23 25							75	47	68.0	98.0
26															
28	-15	WOH WOH WOH 1	100		28 30									64.0	
30															
32											31.5 / -18.2 Brown, ORGANIC SILT, soft, moist. **OH**				
34	-20	1 1 2 2	100		33 35							250	103	197.0	58.0
36															
38	-25	2 2 4 3	85		38						36.5 / -23.2 Same, medium stiff, moist. **OH**			239.0	
40															

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 75 feet in depth, elevation -61.7 feet. This borehole was offset 10' east of its originally staked location to avoid a heavily wooded area.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: RAMP PIER

10BH-099

STATION: 103+06.44 OFFSET: 10.72 LT
LATITUDE: 36.827248° N LONGITUDE: 76.325928° W
SURFACE ELEVATION: 13.3 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/13/2010 - 4/13/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA | **LAB DATA**

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
40															
42											41.5 / -28.2 Same, soft, moist. **OH**				
43	-30	2 2 2 3	100		43									183.0	
44															
45					45										
46															
47											46.5 / -33.2 Gray to brown, SILT, micaceous & trace organics, very soft, wet. **ML**				
48	-35	1 1 WOH WOH	100		48							44	12	52.0	69.0
49															
50					50										
51															
52											51.5 / -38.2 Gray to brown, SILT, micaceous & trace organics, soft, wet. **ML**				
53	-40	WOH 1 1 2	100		53									61.0	
54															
55					55										
56															
57											56.5 / -43.2 Brown to gray, fine to medium silty SAND, micaceous, loose, moist. **SM**				
58	-45	3 3 4 7	68		58									42.0	
59															
60					60										
61															
62															
63	-50	1 1 3 3	100		63									43.0	
64															
65					65										
66															
67											63.7 / -50.4 Blue to gray, CLAY, soft, moist. **CL**				
68	-55	1 1 1 2	100		68							31	11	33.0	63.0
69															
70					70										
71															
72											71.5 / -58.2 Gray, fine to coarse silty SAND, loose, wet. **SM**				
73	-60	1 2 2 4	100		73									29.0	
74															
75					75										
76															
77											76.5 / -63.2 Green to gray, fine to medium clayey SAND, trace shell fragments, loose, wet. **SC**				
78	-65	2 2 3 9	100		78									33.0	
79															
80															

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 75 feet in depth, elevation -61.7 feet. This borehole was offset 10' east of its originally staked location to avoid a heavily wooded area.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: RAMP PIER

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STATION: 103+06.44 OFFSET: 10.72 LT
LATITUDE: 36.827248° N LONGITUDE: 76.325928° W
SURFACE ELEVATION: 13.3 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/13/2010 - 4/13/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA / **LAB DATA**

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT -#200 (%)
80															
82															
83	-70	3 1 3 9	100		83									33.0	
84															
85					85										
86															
88	-75	2 1 3 8	100		88									34.0	
90					90										
92											91.5 / -78.2 Green to gray, clayey SAND, trace of very fine shell fragments, loose, wet. **SC**	40	16	36.0	48.0
93	-80	2 1 3 5	90		93										
94															
95					95										
96															
98	-85	1 2 5 7	100		98									32.0	
100					100						End of Boring.				

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 75 feet in depth, elevation -61.7 feet. This borehole was offset 10' east of its originally staked location to avoid a heavily wooded area.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: RAMP ABUT

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STATION: 102+45.48 OFFSET: 46.65 RT
LATITUDE: 36.827434° N LONGITUDE: 76.326087° W
SURFACE ELEVATION: 13.2 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/16/2010 - 4/16/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): Shelby Tubes
Driller: Fishburne
Logger: James Martin

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA | LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
2	10	3 2 2 2	13		2						0.0 / 13.2 Brown, top soil silty clay and gravel FILL, soft, dry. **FL**			20.0	
4		3 2 3 2	54		4						2.0 / 11.2 Tan to gray, clayey SAND, loose, moist. **SC**			19.0	
6 ▽		3 2 6 10	71		6						4.0 / 9.2 Gray, clayey SAND, loose, moist. **SC**			24.0	
8	5	6 7 8 10	96		8						4.25 / 8.95 Gray, fine to medium SAND, loose, wet. **SP**			22.0	
10		6 5 6 8	96		10						6.0 / 7.2 Gray, fine to medium SAND, medium dense, wet. **SP**			24.0	
12	0	5 6 6 5	71		13 15						11.5 / 1.7 Gray, fine to medium SAND, trace shell fragments, medium dense, wet. **SP**			27.0	
16															
18	-5	1 1 1 1	83		18						16.5 / -3.3 Gray, fine to medium silty SAND, loose, wet. **SM**			26.0	
20		WOH WOH WOH WOH	92		20						20.0 / -6.8 Blue to gray, CLAY, very soft, wet. **CH**	74	46	62.0	97.0
22	-10		92		22										
24		1 1 1 1	100		24						24.0 / -10.8 Same, soft, wet. **CH**			73.0	
26					26										
28	-15	WOH WOH WOH WOH	96		28 30						27.0 / -13.8 Same, very soft, wet. **CH**			65.0	
32															
34	-20	3 3 4 5	92		33 35						31.5 / -18.3 Brown, ORGANIC SILT, medium stiff, wet. **OH**	244	109	275.0	64.0
36			54		37										
38	-25	3 3 4 3	75		38										
40														243.0	

REMARKS: Rig Type: CME-550. Shelby tubes at 22'-24', 35'-37' and 90'-92' tested by others. Top of Yorktown Formation estimated at 70 feet in depth, elevation -56.8 feet. This borehole was offset 15' northeast of its originally staked location to avoid a deep drainage ditch.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: RAMP ABUT

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STATION: 102+45.48 OFFSET: 46.65 RT
LATITUDE: 36.827434° N LONGITUDE: 76.326087° W
SURFACE ELEVATION: 13.2 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/16/2010 - 4/16/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): Shelby Tubes
Driller: Fishburne
Logger: James Martin

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA												LAB DATA			
DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
40					40										
42											41.5 / -28.3 Brown, ORGANIC SILT, soft, wet. **OL**				
44	-30	1 WOH 1 1	100		43 45									107.0	
46											46.5 / -33.3 Brown, ORGANIC SILT, very soft, wet. **OL**				
48	-35	WOH WOH WOH WOH	100		48									47.0	
50					50										
52											51.5 / -38.3 Brown, SILT with organics, soft, wet. **MH**				
54	-40	1 1 1 1	79		53 55							58	24	69.0	73.0
56															
58	-45	WOH 1 1 1	100		58									54.0	
60					60										
62											61.5 / -48.3 Green to gray, silty SAND, and shells, loose, wet. **SM**				
64	-50	1 WOH WOH WOH	96		63 65									50.0	
66											66.5 / -53.3 Green to gray, silty SAND, trace shells, loose, wet. **SM**				
68	-55	1 2 3 4	100		68									30.0	
70					70										
72											71.5 / -58.3 Green to gray, clayey SAND, loose, wet. **SC**				
74	-60	1 2 2 7	88		73 75							22	4	30.0	30.0
76															
78	-65	1 2 5 12	100		78						76.5 / -63.3 Green to gray, silty SAND, trace shells, loose, moist. **SM**			35.0	
80															

REMARKS: Rig Type: CME-550. Shelby tubes at 22'-24', 35'-37' and 90'-92' tested by others. Top of Yorktown Formation estimated at 70 feet in depth, elevation -56.8 feet. This borehole was offset 15' northeast of its originally staked location to avoid a deep drainage ditch.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: RAMP ABUT

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STATION: 102+45.48 OFFSET: 46.65 RT
LATITUDE: 36.827434° N LONGITUDE: 76.326087° W
SURFACE ELEVATION: 13.2 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/16/2010 - 4/16/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): Shelby Tubes
Driller: Fishburne
Logger: James Martin

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
80					80										
82											81.5 / -68.3 Green to gray, clayey SAND, trace shells, loose, moist. **SC**				
84	-70	1 2 2 9	100		83									34.0	
86					85										
88	-75	2 2 4 8	100		88									34.0	
90			38		90										
92					92										
94	-80	8 6 10 12	96		93 95						92.5 / -79.3 Green to gray clayey SAND, trace shells, medium dense, moist. **SC**	36	14	32.0	44.0
96															
98	-85	4 5 6 7	100		98									32.0	
100					100						End of Boring.				

REMARKS: Rig Type: CME-550. Shelby tubes at 22'-24', 35'-37' and 90'-92' tested by others. Top of Yorktown Formation estimated at 70 feet in depth, elevation -56.8 feet. This borehole was offset 15' northeast of its originally staked location to avoid a deep drainage ditch.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 14

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STATION: 1015+51.46 OFFSET: 55.87 LT
LATITUDE: 36.828213° N LONGITUDE: 76.326106° W
SURFACE ELEVATION: 13.6 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/13/2010 - 4/13/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA | **LAB DATA**

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
2		NR NR NR 6	100		1.5						0.0 / 13.6 Undifferentiated FILL. Poor recovery limits description. **FL**			13.0	
4	10	2 2 3 4	50		2						2.0 / 11.6 Gray, clayey sand with gravel FILL, loose, moist. **FL**			18.0	
6 ▽		6 7 7 7	100		4						4.0 / 9.6 Yellow brown to gray, fine to medium SAND, medium dense, wet. **SP**			23.0	
8	5	6 3 3 3	95		6						6.0 / 7.6 Yellow brown to gray, fine to medium SAND, loose, wet. **SP**			22.0	
10		1 1 1 1	100		8									22.0	
12					10						11.5 / 2.1 Gray, fine to coarse silty SAND, trace shell fragments, loose, wet. **SM**				
14	0	3 3 3 4	75		13									32.0	
16					15										
18	-5	1 2 1 1	83		18									26.0	
20					20										
22					23						21.5 / -7.9 Blue gray, CLAY, very soft, moist. **CL**				
24	-10	WOH WOH WOH 1	100		25									47.0	
26											26.5 / -12.9 Blue gray, CLAY, with shells, very soft, moist. **CH**				
28	-15	WOH WOH WOH 1	100		28							81	50	74.0	99.0
30					30										
32											31.5 / -17.9 Gray, SILT, micaceous, soft, wet. **ML**				
34	-20	1 2 2 4	100		33									45.0	
36					35										
38	-25	1 2 2 2	100		38						36.5 / -22.9 Brown, ORGANIC SILT, soft, wet. **OH**				
40												135	70	108.0	81.0

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at a depth of 70 feet, elevation -56.4 feet. This hole was drilled on the original surveyed and staked location.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 14

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PAGE 2 OF 3

STATION: 1015+51.46 OFFSET: 55.87 LT
LATITUDE: 36.828213° N LONGITUDE: 76.326106° W
SURFACE ELEVATION: 13.6 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/13/2010 - 4/13/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA / **LAB DATA**

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT #200 (%)
40															
42															
43	-30	2 1 2 2	100		43									77.0	
44															
45															
46															
48	-35	4 3 2 1	80		48						46.5 / -32.9 Gray, silty SAND, micaceous, loose, moist. **SM**	24	2	45.0	24.0
50					50										
52											51.5 / -37.9 No recovery.				
53	-40	1 1 1 1	0		53										
55					55										
56															
58	-45	1 1 1 2	100		58						56.5 / -42.9 Gray, silty SAND, micaceous, loose, moist. **SM**			53.0	
60					60										
62															
63	-50	WOH WOH WOH 3	100		63						63.3 / -49.7 Blue gray, CLAY, soft, moist. **CL**	47	23	33.0	89.0
65					65										
66															
68	-55	1 2 2 3	100		68						66.5 / -52.9 Blue gray, sandy CLAY, trace shell fragments, soft, moist. **CL**	29	10	26.0	54.0
70					70										
72															
73	-60	1 1 2 3	100		73						71.5 / -57.9 Blue gray, clayey SAND, trace shell fragments, loose, moist. **SC**			36.0	
75					75										
76															
78	-65	2 2 2 5	100		78									35.0	
80															

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at a depth of 70 feet, elevation -56.4 feet. This hole was drilled on the original surveyed and staked location.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 14

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STATION: 1015+51.46 OFFSET: 55.87 LT
LATITUDE: 36.828213° N LONGITUDE: 76.326106° W
SURFACE ELEVATION: 13.6 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/13/2010 - 4/13/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
80															
82															
84	-70	2 1 4 10	100		83 85									35.0	
86															
88	-75	2 2 2 7	100		88 90									32.0	
90															
92															
94	-80	3 3 2 6	100		93 95							41	19	32.0	43.0
96															
98	-85	3 2 3 10	100		98 100									31.0	
100											End of Boring.				

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at a depth of 70 feet, elevation -56.4 feet. This hole was drilled on the original surveyed and staked location.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 16

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STATION: 1018+26.38 OFFSET: 56.21 LT
LATITUDE: 36.828932° N LONGITUDE: 76.326394° W
SURFACE ELEVATION: 14.4 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/7/2010 - 4/7/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA / **LAB DATA**

DEPTH (ft)	ELEVATION (ft)	STANDARD PENETRATION TEST HAMMER BLOWS	SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	CORE RECOVERY (%)	ROCK QUALITY DESIGNATION	DIP ° STRATA	DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
0		10 15 12 9	50		2						0.0 / 14.4 Sandy gravel, FILL, medium dense, dry. **FL**			10.0	
2		4 5 4 14	75		4						2.0 / 12.4 Dark gray, clayey sand with gravel, FILL, loose, moist. **FL**			17.0	
4	10	3 3 4 4	50		6						4.0 / 10.4 Dark gray, fine to medium SAND, loose, moist. **SP**			16.0	
6 ▽		3 4 6 11	68		8						6.0 / 8.4 Dark gray, fine SAND, medium dense, wet **SW**			19.0	
8		4 4 4 6	55		10						8.0 / 6.4 Dark gray, medium SAND, loose, wet **SW**			23.0	
10	5														
12					13										
14	0	4 4 4 4	70		15									28.0	
16															
18		2 1 1 2	100		18									26.0	
20	-5				20										
22					23						21.5 / -7.1 Dark gray, CLAY, very soft, moist. **CH**				
24	-10	WOH WOH WOH 1	100		25							81	52	71.0	95.0
26															
28		WOH 1 1 1	100		28									45.0	
30	-15				30						29.3 / -14.9 Brown, woody ORGANICS, soft, wet. **OL**				
32											31.5 / -17.1 Brown, ORGANIC SILT, medium, wet. **OH**				
34	-20	1 2 3 4	100		33 35							159	68	166.0	58.0
36															
38		WOH WOH WOH 1	100		38						36.5 / -22.1 Dark gray to brown, SILT, very soft, wet. **MH**			70.0	
40	-25														

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 65 feet in depth, elevation -50.6 feet. This hole was drilled on the original surveyed and staked location.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 16

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STATION: 1018+26.38 OFFSET: 56.21 LT
LATITUDE: 36.828932° N LONGITUDE: 76.326394° W
SURFACE ELEVATION: 14.4 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/7/2010 - 4/7/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA / **LAB DATA**

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT -#200 (%)
40															
42															
43															
44	-30	WOH WOH WOH 1	100		45									69.0	
46															
48					48										
50	-35	WOH WOH WOH 1	100		50							88	38	98.0	94.0
52					53						51.5 / -37.1 Gray, fine to medium SAND, loose, wet. **SP**				
54	-40	2 1 6 4	85		55						53.9 / -39.5 Brown, ORGANIC SILT, medium stiff, moist. **OL**			34.0	
56															
58					58						56.5 / -42.1 Brown, ORGANIC SILT, micaceous, soft, moist **OL**				
60	-45	WOH 1 1 1	100		60									47.0	
62											61.5 / -47.1 Gray, CLAY with trace sand & mica, stiff, moist **CL**				
63					63										
64	-50	1 2 3 6	95		65							34	17	28.0	70.0
66															
68					68						66.5 / -52.1 Green gray, fine SAND, trace of silt & gravel, loose, moist. **SP**				
70	-55	3 3 6 7	65		70									24.0	
72											71.5 / -57.1 Gray, silty fine to medium SAND with trace shells, loose, moist **SM**				
73					73										
74	-60	1 1 2 3	100		75									35.0	
76															
78					78										
80	-65	2 4 3 5	100											34.0	

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 65 feet in depth, elevation -50.6 feet. This hole was drilled on the original surveyed and staked location.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 16

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STATION: 1018+26.38 OFFSET: 56.21 LT
LATITUDE: 36.828932° N LONGITUDE: 76.326394° W
SURFACE ELEVATION: 14.4 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/7/2010 - 4/7/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA / **LAB DATA**

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT -#200 (%)
80															
82											81.5 / -67.1 Gray, silty fine to medium SAND, with trace shells, medium dense, wet. **SM**				
83		5 5 6 6	55												
84	-70													35.0	
85															
86															
88		4 7 7 8	70								86.5 / -72.1 Gray, silty fine SAND, medium dense, wet. **SM**				
88														31.0	
90	-75														
90															
92											91.5 / -77.1 Green gray, fine clayey SAND, loose, moist. **SC**				
93		3 3 3 5	100									33	14	32.0	42.0
94	-80														
95															
96															
98											96.5 / -82.1 Gray, fine sandy CLAY, medium stiff, moist. **CL**				
98		3 3 3 6	100											32.0	
100	-85														
100											End of Boring.				

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 65 feet in depth, elevation -50.6 feet. This hole was drilled on the original surveyed and staked location.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 15

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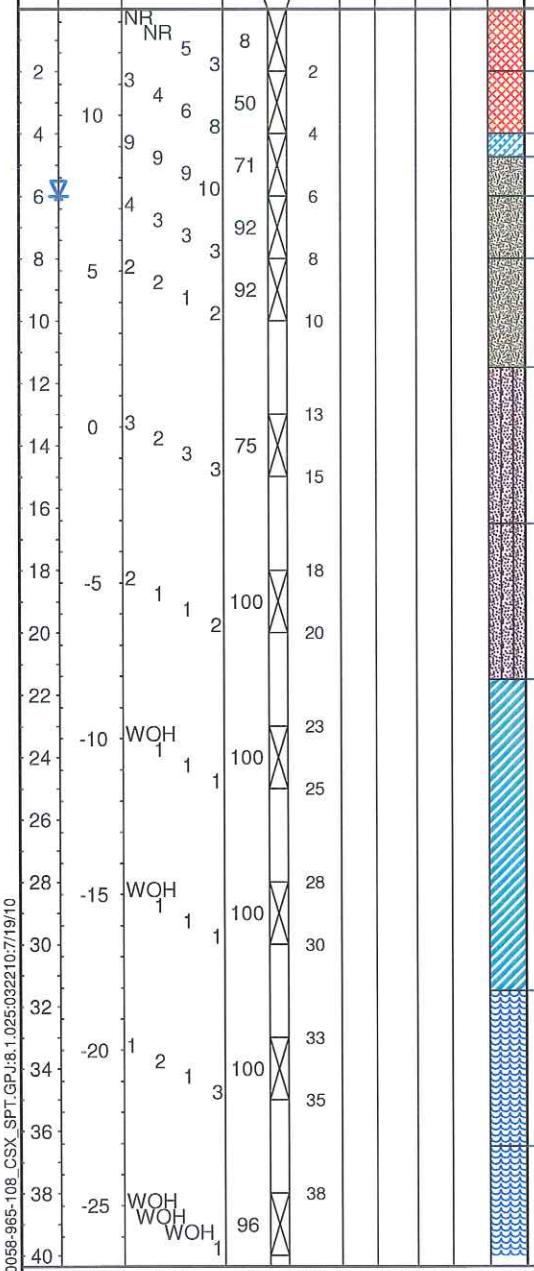
PAGE 1 OF 3

STATION: 1016+34.12 OFFSET: 32.06 RT
LATITUDE: 36.828503° N LONGITUDE: 76.325906° W
SURFACE ELEVATION: 13.4 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/14/2010 - 4/14/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: James Martin

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN



FIELD DESCRIPTION OF STRATA

0.0 / 13.4
Dark gray, sand FILL, loose, dry. **FL**

2.0 / 11.4
Dark to light gray, sand and gravel FILL, medium dense, wet. **FL**

4.0 / 9.4
Dark gray, clayey SAND, medium dense, wet. **SC**

4.75 / 8.65
Light gray, fine to medium SAND, medium dense, wet. **SP**

6.0 / 7.4
Light to dark gray, fine to medium SAND, loose, wet. **SP**

8.0 / 5.4
Light to dark gray, fine to medium SAND, little silt, loose, wet. **SP**

11.5 / 1.9
Gray, fine silty SAND, trace of shell fragments, loose, wet. **SM**

16.5 / -3.1
Gray, fine silty SAND, trace of shell fragments and organics, loose, wet. **SM**

21.5 / -8.1
Gray, CLAY, soft, moist. **CH**

31.5 / -18.1
Brown, ORGANIC SILT, soft, wet. **OH**

36.5 / -23.1
Gray, ORGANIC CLAY, very soft, wet. **OH**

LL	PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
		27.0	
		17.0	
		21.0	
		19.0	
		23.0	
		29.0	
		27.0	
83	57	86.0	97.0
		78.0	
296	138	261.0	63.0
101	53	118.0	94.0

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 73.7 feet in depth, elevation -60.35 feet. This borehole was offset 75' south of its original staked location to comply safety requirements per work adjacent to active rail lines.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 15

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PAGE 2 OF 3

STATION: 1016+34.12 OFFSET: 32.06 RT
LATITUDE: 36.828503° N LONGITUDE: 76.325906° W
SURFACE ELEVATION: 13.4 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/14/2010 - 4/14/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: James Martin

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA												LAB DATA			
DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
40															
42											41.5 / -28.1 Brown, ORGANIC CLAY, soft, wet. **OH**				
43															
44	-30	WOH 1 1 2	96									97	50	106.0	98.0
45															
46															
48	-35	1 1 1 1	100								46.5 / -33.1 Gray, silty SAND, trace of organics, loose, wet. **SM**	26	2	38.0	26.0
50															
52											51.5 / -38.1 Gray, fine to medium silty SAND, micaceous, medium dense, moist. **SM**				
53															
54	-40	2 7 6 6	67											36.0	
55															
56															
58	-45	1 2 3 6	96								56.5 / -43.1 Gray, SILT with some fine sand, little organics, medium stiff, moist. **ML**			45.0	
60															
62															
63															
64	-50	2 2 2 4	100									49	26	37.0	88.0
65															
66															
68	-55	WOH 1 1 2	96								64.5 / -51.1 Blue to gray, CLAY, soft, moist. **CL**			27.0	
70															
72											71.5 / -58.1 Dark gray, medium SAND, little organics, loose, moist. **SP**				
73															
74	-60	6 7 4 5	96								73.75 / -60.35 Green to gray, clayey SAND, with organics, loose, wet. **SC**			29.0	
75															
76											76.5 / -63.1 Green to gray, clayey SAND, trace shell fragments, loose, moist. **SC**				
78	-65	2 2 4 14	63											31.0	
80															

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 73.7 feet in depth, elevation -60.35 feet. This borehole was offset 75' south of its original staked location to comply safety requirements per work adjacent to active rail lines.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 15

10BH-111

STATION: 1016+34.12 OFFSET: 32.06 RT
LATITUDE: 36.828503° N LONGITUDE: 76.325906° W
SURFACE ELEVATION: 13.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/14/2010 - 4/14/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: James Martin

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
80															
82															
84	-70	2 2 3 9	100		83 85									36.0	
86															
88	-75	2 2 2 7	88		88 90									34.0	
92															
94	-80	2 4 4 9	100		93 95							39	17	29.0	38.0
96															
98	-85	3 3 4 10	100		98 100									33.0	
100											End of Boring.				

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 73.7 feet in depth, elevation -60.35 feet. This borehole was offset 75' south of its original staked location to comply safety requirements per work adjacent to active rail lines.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRDIGE PIER 17

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STATION: 1020+18.32 OFFSET: 55.38 RT
LATITUDE: 36.829528° N LONGITUDE: 76.326232° W
SURFACE ELEVATION: 15.0 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/7/2010 - 4/7/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 5.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT #200 (%)
0		6 7 9 14	60		2						0.0 / 15.0 Asphalt and gravel FILL, medium dense, dry. **FL**			8.0	
2		4 9 7 2	75		4						2.0 / 13.0 Black, sand with gravel FILL, medium dense, dry. **FL**			22.0	
4	10	2 2 1 1	100		6						4.0 / 11.0 Dark gray to black, SILT, soft, wet. **ML**			18.0	
6		WOH 5 5 5	100		8						6.0 / 9.0 Dark gray, fine to medium SAND, loose, wet. **SP**			21.0	
8		5 5 4 4	100		10						7.5 / 7.5 Dark gray, fine SAND, loose, wet. **SW** 8.0 / 7.0 Dark gray, medium SAND, loose, wet. **SW**			23.0	
10	5														
12		2 3 2 2	50		13						11.5 / 3.5 Dark gray, medium SAND, loose, wet. **SW**			28.0	
14	0				15										
16															
18		4 2 2 2	85		18									26.0	
20	-5				20										
22					23						21.5 / -6.5 Gray, CLAY, trace shells, very soft, wet. **CH**				
24		WOH WOH WOH 1	100		25							75	50	70.0	98.0
26	-10														
28		WOH 1 1 2	100		28						26.5 / -11.5 Gray, ORGANIC SILT, soft, wet. **OH**			43.0	
30	-15				30						29.0 / -14.0 Brown, ORGANIC SILT, soft, wet. **OH**				
32															
34		2 2 2 2	100		33							166	75	221.0	70.0
36	-20				35										
38		WOH WOH WOH WOH	100		38						36.5 / -21.5 Dark brown, silty fine SAND, trace of clay and organics, very loose, wet. **SM**	39	13	43.0	41.0
40	-25														

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 75 feet in depth, elevation -60 feet. This hole was drilled on the original surveyed and staked location.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRDIGE PIER 17

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STATION: 1020+18.32 OFFSET: 55.38 RT
LATITUDE: 36.829528° N LONGITUDE: 76.326232° W
SURFACE ELEVATION: 15.0 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/7/2010 - 4/7/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 5.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA / **LAB DATA**

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT -#200 (%)
40															
42					43						41.5 / -26.5 Dark brown, SILT, trace of sand lenses, very soft, wet. **ML**				
44	-30	WOH WOH WOH WOH	100		45									61.0	
46															
48		1 1 2 2	100		48						46.5 / -31.5 Dark brown, SILT, trace of sand, soft, wet. **ML**				
50	-35				50									77.0	
52											51.5 / -36.5 Gray to brown, SILT, trace of sand, very soft, wet. **MH**				
54		WOH WOH WOH WOH	100		53							94	51	88.0	89.0
56	-40				55										
58					58									82.0	
60	-45	WOH WOH WOH WOH	100		60										
62											61.5 / -46.5 Dark gray, SILT, trace of organics, soft, wet. **ML**				
64		WOH 1 1 2	100		63									61.0	
66	-50				65										
68		WOH 1 1 1	100		68									88.0	
70	-55				70										
72											71.5 / -56.5 Gray, sandy GRAVEL, dense, wet. **GW**				
74		2 12 21 16	80		73									10.0	
76	-60				75						74.3 / -59.3 Gray, silty fine SAND, trace of shells, loose, moist. **SM**				
78		1 2 3 6	100		78									33.0	
80	-65														

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 75 feet in depth, elevation -60 feet. This hole was drilled on the original surveyed and staked location.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRDIGE PIER 17

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PAGE 3 OF 3

STATION: 1020+18.32 OFFSET: 55.38 RT
LATITUDE: 36.829528° N LONGITUDE: 76.326232° W
SURFACE ELEVATION: 15.0 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/7/2010 - 4/7/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 5.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA / **LAB DATA**

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT #200 (%)
80															
82															
83		2 2 3 6	100											34.0	
84	-70														
85															
86											86.5 / -71.5 Green to gray, clayey SAND, trace of shells, loose, moist. **SC**				
88		2 2 4 6	100									34	14	33.0	43.0
90	-75														
92															
93		3 2 3 6	100											33.0	
94															
95	-80														
96															
98		4 6 6 6	100								96.5 / -81.5 Green gray, clayey SAND, trace of shells and quartz pebbles, medium dense, wet. **SC**			31.0	
100	-85										End of Boring.				

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 75 feet in depth, elevation -60 feet. This hole was drilled on the original surveyed and staked location.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 18

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PAGE 1 OF 3

STATION: 1021+61.64 OFFSET: 40.54 LT
LATITUDE: 36.829822° N LONGITUDE: 76.326694° W
SURFACE ELEVATION: 15.9 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/9/2010 - 4/9/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA | LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT -#200 (%)
0	15	35 50 45 43	85		2						0.0 / 15.9 Gray, crusher run gravel FILL, very dense, dry. **FL**			3.0	
2		46 21 19 22	90		4									20.0	
4		13 3 1 1	85		6						3.0 / 12.9 Black, silt FILL, dense, dry. **FL**			25.0	
6 ▽	10	2 3 6 8	55		8						4.0 / 11.9 Gray, gravel FILL, loose, dry. **FL**			21.0	
8		3 3 1 1	70		10						5.0 / 10.9 Dark black, silt FILL, soft, dry. **FL**			23.0	
10	5										6.0 / 9.9 Light brown to gray, fine SAND, loose, wet. **SW**				
12											8.0 / 7.9 Gray, silty SAND, loose, wet. **SM**				
14		3 2 3 2	75		15									35.0	
16	0														
18		5 9 9 8	65		18						16.5 / -0.6 Gray, silty SAND, medium dense, wet. **SM**			23.0	
20	-5				20										
22		3 1 1 1	80		23						21.5 / -5.6 Gray, CLAY, trace of shells, soft, wet. **CH**				
24					25							80	51	61.0	93.0
26	-10										26.5 / -10.6 Brown, ORGANIC SILT, soft, moist. **OH**				
28		1 1 1 2	100		28										
30					30							241	101	231.0	60.0
32	-15										31.5 / -15.6 Dark gray to brown, SILT, little organics & shell fragments, very soft, moist. **MH**				
34		WOH 1 WOH 1	100		33							70	34	87.0	83.0
36	-20				35										
38		WOH 5 7 8	90		38						36.5 / -20.6 Brown to gray, fine silty SAND, micaceous, medium dense, wet. **SM**			23.0	
40															

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 75 feet in depth, elevation -59.1 feet. This borehole was offset 23' east of its original staked position to avoid Vulcan aggregate stockpile.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 18

10BH-169

STATION: 1021+61.64 OFFSET: 40.54 LT
LATITUDE: 36.829822° N LONGITUDE: 76.326694° W
SURFACE ELEVATION: 15.9 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/9/2010 - 4/9/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA / **LAB DATA**

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT -#200 (%)
40	-25														
42		6 7 9 11	65		43										
44					45									28.0	
46	-30										46.5 / -30.6 Green gray, fine silty SAND, medium dense, wet. **SM**				
48		6 6 10 12	65		48									29.0	
50					50										
52	-35														
54		5 3 6 11	65		53									40.0	
56	-40				55										
58		9 9 9 10	65		58									31.0	
60					60										
62	-45														
64		10 10 8 12	70		63									32.0	
66	-50				65										
68		6 5 5 5	85		68						68.65 / -52.75 Blue to gray, CLAY, trace silt, stiff, moist. **CL**			26.0	
70					70										
72	-55														
74		WOH 2 10 9	100		73						73.8 / -57.9 Dark brown, silty SAND, medium dense, wet. **SM**	26	5	26.0	24.0
76	-60				75										
78		3 5 4 5	100		78						76.5 / -60.6 Green gray, clayey SAND, trace of shell fragments, loose, moist. **SC**	27	10	28.0	40.0
80															

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 75 feet in depth, elevation -59.1 feet. This borehole was offset 23' east of its original staked position to avoid Vulcan aggregate stockpile.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 18

10BH-169
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STATION: 1021+61.64 OFFSET: 40.54 LT
LATITUDE: 36.829822° N LONGITUDE: 76.326694° W
SURFACE ELEVATION: 15.9 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/9/2010 - 4/9/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND / SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
80	-65													
82		1 2 5 10	100	83 / 85						81.5 / -65.6 Green gray, fine to medium silty SAND, trace of shell fragments, loose, moist. **SM**			34.0	
84														
86	-70									86.5 / -70.6 Green gray, fine clayey SAND, loose, moist. **SC**				
88		2 2 5 10	100	88 / 90									33.0	
90														
92	-75													
93		1 2 3 6	100	93 / 95									33.0	
94														
96	-80													
98		2 2 3 7	100	98 / 100									33.0	
100										End of Boring.				

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 75 feet in depth, elevation -59.1 feet. This borehole was offset 23' east of its original staked position to avoid Vulcan aggregate stockpile.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 19

10BH-171
PAGE 1 OF 3

STATION: 1024+53.98 OFFSET: 20.02 RT
LATITUDE: 36.830644° N LONGITUDE: 76.326726° W
SURFACE ELEVATION: 15.2 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/8/2010 - 4/8/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA / **LAB DATA**

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
0		14 34 50 39	80		2						0.0 / 15.2 Gray, crusher run gravel FILL, very dense, dry. **FL**			3.0	
2		35 100/5"	46		4									7.0	
4	10	15 10 9 6	90		6						4.0 / 11.2 Gray, fine gravel FILL, medium dense, dry. **FL**			21.0	
6 ▽		6 5 6 7	65		8						4.8 / 10.4 Black, silty sand and gravel FILL, oily appearance, medium dense, moist. **FL**			18.0	
8		7 7 5 3	85		10						6.0 / 9.2 Dark gray to black, fine sand FILL, oily, medium dense, wet. **FL**			23.0	
10	5										8.0 / 7.2 Gray, gravel FILL, metal debris, medium dense, wet. **FL**				
12		3 1 3 2	83		13						8.5 / 6.7 Gray, fine to medium SAND, medium dense, wet. **SP**				
14	0				15						11.5 / 3.7 Gray, fine silty SAND, loose, wet. **SM**			25.0	
16															
18		5 5 4 4	75		18									22.0	
20	-5				20										
22															
24		7 3 3 2	70		23						23.8 / -8.6 Dark gray, CLAY, micaceous, trace of shells, medium stiff, moist. **CH**	74	43	59.0	92.0
26	-10				25										
28		2 2 3 4	95		28						26.5 / -11.3 Dark gray to brown, ORGANIC SILT, medium stiff, moist. **OH**	221	107	165.0	73.0
30	-15				30										
32											31.5 / -16.3 Dark brown, SILT, trace of organics, soft, wet. **ML**				
34		1 1 1 2	85		33							49	18	49.0	75.0
36	-20				35										
38		4 5 9 8	83		38						36.5 / -21.3 Dark gray, fine silty SAND, medium dense, wet. **SM**			28.0	
40															

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 73.6 feet in depth, elevation -58.4 feet. This borehole was offset 45' west of its original staked position to avoid Vulcan aggregate stockpile.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 19

10BH-171
PAGE 2 OF 3

STATION: 1024+53.98 OFFSET: 20.02 RT
LATITUDE: 36.830644° N LONGITUDE: 76.326726° W
SURFACE ELEVATION: 15.2 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/8/2010 - 4/8/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
40															
42											41.5 / -26.3 Gray, fine SAND, micaceous with trace of organics, medium dense, wet. **SP**				
43		7 6 8 12	75											28.0	
44	-30														
45															
46															
48		10 6 7 8	70											33.0	
50	-35														
52															
53		7 9 8 6	65											31.0	
54															
55	-40														
56															
58		6 7 7 8	75											36.0	
60	-45														
62											61.5 / -46.3 Dark brown to gray, CLAY, soft, moist. **CH**				
63		WOH 1 2 2	100											50.0	
64												73	41		98.0
65	-50														
66															
68		WOH 1 2 2	100											68.0	
70	-55														
72															
73		WOH 3 4 5	90											29.0	
74											73.6 / -58.4 Gray, silty SAND, loose, moist. **SM**				
75	-60														
76															
78		2 2 3 7	100								76.5 / -61.3 Green to gray, clayey medium SAND, trace of shells & gravel, loose, moist. **SC**				
80												27	9	31.0	38.0

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 73.6 feet in depth, elevation -58.4 feet. This borehole was offset 45' west of its original staked position to avoid Vulcan aggregate stockpile.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 19

10BH-171
PAGE 3 OF 3

STATION: 1024+53.98 OFFSET: 20.02 RT
LATITUDE: 36.830644° N LONGITUDE: 76.326726° W
SURFACE ELEVATION: 15.2 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/8/2010 - 4/8/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
80															
82															
83		2 1 2 12	55												
84	-70													31.0	
85															
86															
88		2 2 6 10	100											31.0	
90	-75														
92															
93		1 2 3 6	100											32.0	
94															
95	-80														
96															
98															
98		2 1 3 6	100											32.0	
100					100						End of Boring.				

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 73.6 feet in depth, elevation -58.4 feet. This borehole was offset 45' west of its original staked position to avoid Vulcan aggregate stockpile.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 19

10BH-174
PAGE 1 OF 3

STATION: 1023+81.78 OFFSET: 78.75 LT
LATITUDE: 36.830399° N LONGITUDE: 76.327017° W
SURFACE ELEVATION: 15.4 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/9/2010 - 4/9/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA												LAB DATA			
		SOIL				ROCK									
DEPTH (ft)	ELEVATION (ft)	STANDARD PENETRATION TEST HAMMER BLOWS	SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	CORE RECOVERY (%)	ROCK QUALITY DESIGNATION	DIP ° STRATA	DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
0	15	51 (100/4")	42		2						0.0 / 15.4 Gray, crusher run gravel FILL, very dense, dry. **FL**			10.0	
2		83 (17/2")	33		4										
4		9 4 2 3	95		6						4.0 / 11.4 Gray, gravel FILL, loose, dry **FL**			15.0	
6 ▽	10	1 3 6 6	45		8						4.75 / 10.65 Black, fine sandy CLAY, medium stiff, dry. **CL**			17.0	
8		3 2 2 1	100		10						6.0 / 9.4 Light gray, fine SAND, loose, wet. **SW**			23.0	
10	5										8.0 / 7.4 Dark gray, fine SAND, loose, wet. **SW**				
12		4 3 3 4	60		13						11.5 / 3.9 Gray, fine slity SAND, loose, wet. **SM**			30.0	
14					15										
16	0				18										
18		4 4 2 2	60		20									25.0	
20	-5														
22		2 1 1 2	100		23						21.5 / -6.1 Gray, clayey SAND, loose, wet. **SC**				
24					25							60	31	41.0	45.0
26	-10										26.5 / -11.1 Brown, ORGANIC SILT, medium stiff, moist. **OL**				
28		2 2 4 4	100		28									216.0	
30	-15				30										
32											31.5 / -16.1 Brown, SILT, trace of organics, soft, moist. **ML**				
34		1 1 1 1	100		33							47	14	60.0	74.0
36	-20				35										
38		2 2 4 7	100		38						36.5 / -21.1 Dark gray to brown, silty SAND, micaceous, loose, moist. **SM**			38.0	
40															

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 70 feet in depth, elevation -54.6 feet. This borehole was offset 32' north of its original staked position to avoid a Vulcan aggregate stockpile.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 19

10BH-174
PAGE 2 OF 3

STATION: 1023+81.78 OFFSET: 78.75 LT
LATITUDE: 36.830399° N LONGITUDE: 76.327017° W
SURFACE ELEVATION: 15.4 ft COORD. DATUM: NAD 83

Date(s) Drilled: 4/9/2010 - 4/9/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

FIELD DATA / **LAB DATA**

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LAB: LIQUID LIMIT (LL)	LAB: PLASTICITY INDEX (PI)	LAB: MOISTURE CONTENT (%)	LAB: FINES CONTENT #200 (%)
40	-25														
42		6 10 11 14	70		43						41.5 / -26.1 Dark gray to brown, fine SAND, micaceous, medium dense, wet. **SW**			25.0	
44					45										
46	-30														
48		9 8 8 8	75		48									29.0	
50	-35				50										
52															
54		10 10 9 7	75		53									28.0	
56	-40				55										
58		5 6 7 9	75		58									34.0	
60	-45				60										
62											61.5 / -46.1 Dark gray to brown, SILT with little clay, soft, moist. **MH**				
64		WOH 1 1 1	100		63							87	47	60.0	90.0
66	-50				65										
68		WOH 2 3 5	5		68						66.5 / -51.1 Gray to green, SILT, micaceous, medium stiff, wet. **ML**			40.0	
70	-55				70										
72											71.5 / -56.1 Green to gray, fine clayey SAND, loose, moist. **SC**				
74		2 1 2 6	100		73									33.0	
76	-60				75										
78		3 2 2 8	100		78						76.5 / -61.1 Green to gray, fine clayey SAND, trace of shell fragments, loose, moist. **SC**			31.0	
80															

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 70 feet in depth, elevation -54.6 feet. This borehole was offset 32' north of its original staked position to avoid a Vulcan aggregate stockpile.

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PROJECT #: 0058-965-108, PE 101
LOCATION: City of Portsmouth
STRUCTURE: BRIDGE PIER 19

10BH-174

STATION: 1023+81.78 OFFSET: 78.75 LT
LATITUDE: 36.830399° N LONGITUDE: 76.327017° W
SURFACE ELEVATION: 15.4 ft COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 4/9/2010 - 4/9/2010
Drilling Method(s): Mud Rotary
SPT Method: Automatic Hammer
Other Test(s): None
Driller: Fishburne
Logger: Jim Douglass

GROUND WATER
▽ FIRST ENCOUNTERED AT 6.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SOIL: SAMPLE LEGEND	SOIL: SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
80	-65														
82											81.5 / -66.1 Green to gray, fine clayey SAND, loose, moist. **SC**				
83		2 2 1 9	100											35.0	
84															
85	-70														
86															
88		WOH 2 2 4	100								86.5 / -71.1 Gray, fine to medium clayey SAND, loose, moist. **SC**	34	12	48.0	41.0
90	-75														
92											91.5 / -76.1 Gray, fine to medium clayey SAND, trace shell fragments, loose, moist. **SC**				
93		WOR WOR WOR 5	100											32.0	
94															
95	-80														
96															
98											96.5 / -81.1 Gray, fine to medium clayey SAND, loose, wet. **SC**				
98		2 2 2 6	100											32.0	
100											End of Boring.				

REMARKS: Rig Type: CME-550. Top of Yorktown Formation estimated at 70 feet in depth, elevation -54.6 feet. This borehole was offset 32' north of its original staked position to avoid a Vulcan aggregate stockpile.

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Attachment III

Laboratory Data

MARSHALL MILLER & ASSOCIATES

LABORATORY TEST RESULTS

MLK – CSX/VHAMP084
Portsmouth, Virginia
(AGS Project No. RC10-122)

Boring No.	Sample No.	Depth in feet	Classification, USCS	Natural Moisture Content, %	Atterberg Limits			% Passing #200 Sieve
					LL	PL	PI	
10BH-109	1	0 – 2		10				
	2	2 – 4		17				
	3	4 – 6		16				
	4	6 – 8		19				
	5	8 – 10		23				
	6	13 – 15		28				
	7	18 – 20		26				
	8	23 – 25	CH	71	81	29	52	95
	9	28 – 30		45				
	10	33 – 35	OH	166	159	91	68	58
	11	38 – 40		70				
	12	43 – 45		69				
	13	48 – 50	MH	98	88	50	38	94
	14	53 – 55		34				
	15	58 – 60		47				
	16	63 – 65	CL	28	34	17	17	70
	17	68 – 70		24				
	18	73 – 75		35				
	19	78 – 80		34				
	20	83 – 85		35				
	21	88 – 90		31				
	22	93 – 95	SC	32	33	19	14	42
	23	98 – 100		32				

Atlantic Geotechnical Services, Inc.
10971 Richardson Road, Ashland, VA 23005
Phone (804) 550-2203 Fax (804) 550-2204

May 5, 2010

MLK – CSX/VHAMP084
Portsmouth, Virginia
(AGS Project No. RC10-122)

Boring No.	Sample No.	Depth in feet	Classification, USCS	Natural Moisture Content, %	Atterberg Limits			% Passing #200 Sieve
					LL	PL	PI	
10BH-168	1	0 – 2		8				
	2	2 – 4		22				
	3	4 – 6		18				
	4	6 – 8		21				
	5	8 – 10		23				
	6	13 – 15		28				
	7	18 – 20		26				
	8	23 – 25	CH	70	75	25	50	98
	9	28 – 30		43				
	10	33 – 35	OH	221	166	91	75	70
	11	38 – 40	SM	43	39	26	13	41
	12	43 – 45		61				
	13	48 – 50		77				
	14	53 – 55	MH	88	94	43	51	89
	15	58 – 60		82				
	16	63 – 65		61				
	17	68 – 70		88				
	18	73 – 75		10				
	19	78 – 80		33				
	20	83 – 85		34				
	21	88 – 90	SC	33	34	20	14	43
	22	93 – 95		33				
	23	98 – 100		31				

MLK – CSX/VHAMP084
Portsmouth, Virginia
(AGS Project No. RC10-122)

Boring No.	Sample No.	Depth in feet	Classification, USCS	Natural Moisture Content, %	Atterberg Limits			% Passing #200 Sieve
					LL	PL	PI	
10BH-171	1	0 – 2		3				
	2	2 – 4		7				
	3	4 – 6		21				
	4	6 – 8		18				
	5	8 – 10		23				
	6	13 – 15		25				
	7	18 – 20		22				
	8	23 – 25	CH	59	74	31	43	92
	9	28 – 30	OH	165	221	114	107	73
	10	33 – 35	ML	49	49	31	18	75
	11	38 – 40		28				
	12	43 – 45		28				
	13	48 – 50		33				
	14	53 – 55		31				
	15	58 – 60		36				
	16	63 – 65	CH	50	73	32	41	98
	17	68 – 70		68				
	18	73 – 75		29				
	19	78 – 80	SC	31	27	18	9	38
	20	83 – 85		31				
	21	88 – 90		31				
	22	93 – 95		32				
	23	98 – 100		32				

MLK – CSX/VHAMP084
Portsmouth, Virginia
(AGS Project No. RC10-122)

Boring No.	Sample No.	Depth in feet	Classification, USCS	Natural Moisture Content, %	Atterberg Limits			% Passing #200 Sieve
					LL	PL	PI	
10BH-169	1	0 – 2		3				
	2	2 – 4		20				
	3	4 – 6		25				
	4	6 – 8		21				
	5	8 – 10		23				
	6	13 – 15		35				
	7	18 – 20		23				
	8	23 – 25	CH	61	80	29	51	93
	9	28 – 30	OH	231	241	140	101	60
	10	33 – 35	MH	87	70	36	34	83
	11	38 – 40		23				
	12	43 – 45		28				
	13	48 – 50		29				
	14	53 – 55		40				
	15	58 – 60		31				
	16	63 – 65		32				
	17	68 – 70		26				
	18	73 – 75	SC-SM	26	26	21	5	24
	19	78 – 80	SC	28	27	17	10	40
	20	83 – 85		34				
	21	88 – 90		33				
	22	93 – 95		33				
	23	98 – 100		33				

MLK – CSX/VHAMP084
Portsmouth, Virginia
(AGS Project No. RC10-122)

Boring No.	Sample No.	Depth in feet	Classification, USCS	Natural Moisture Content, %	Atterberg Limits			% Passing #200 Sieve
					LL	PL	PI	
10BH-174	1	2 – 4		10				
	2	4 – 6		15				
	3	6 – 8		17				
	4	8 – 10		23				
	5	13 – 15		30				
	6	18 – 20		25				
	7	23 – 25	SC	41	60	29	31	45
	8	28 – 30		216				
	9	33 – 35	ML	60	47	33	14	74
	10	38 – 40		38				
	11	43 – 45		25				
	12	48 – 50		29				
	13	53 – 55		28				
	14	58 – 60		34				
	15	63 – 65	MH	60	87	40	47	90
	16	68 – 70*		40				
	17	73 – 75		33				
	18	78 – 80		31				
	19	83 – 85		35				
	20	88 – 90	SC	48	34	22	12	41
	21	93 – 95		32				
	22	98 – 100		32				

*NOTE: **Partial Recovery of 68' – 70' Sample. Did not have enough material to conduct requested Atterberg Limits and #200 Wash. Tested 63' – 65' instead.**

MLK – CSX/VHAMP084
Portsmouth, Virginia
(AGS Project No. RC10-122)

Boring No.	Sample No.	Depth in feet	Classification, USCS	Natural Moisture Content, %	Atterberg Limits			% Passing #200 Sieve
					LL	PL	PI	
10BH-089	1	0 – 2		17				
	2	2 – 4		15				
	3	4 – 6		22				
	4	6 – 8		21				
	5	8 – 10		22				
	6	13 – 15		28				
	7	18 – 20		26				
	8	23 – 25		65				
	9	28 – 30	CH	53	52	21	31	74
	10	38 – 40	OH	165	204	109	95	70
	11	43 – 45		111				
	12	48 – 50		43				
	13	53 – 55	ML	46	46	29	17	67
	14	63 – 65	SC	23	27	17	10	49
	15	68 – 70		32				
	16	73 – 75	SC-SM	25	23	18	5	34
	17	78 – 80		34				
	18	83 – 85	SC	35	35	22	13	41
	19	88 – 90		34				
	20	93 – 95		34				
	21	98 – 100		31				

MLK – CSX/VHAMP084
Portsmouth, Virginia
(AGS Project No. RC10-122)

Boring No.	Sample No.	Depth in feet	Classification, USCS	Natural Moisture Content, %	Atterberg Limits			% Passing #200 Sieve
					LL	PL	PI	
10BH-091	1	0 – 2		20				
	2	2 – 4		23				
	3	4 – 6		23				
	4	6 – 8		22				
	5	8 – 10		23				
	6	13 – 15		28				
	7	18 – 20		27				
	8	23 – 25	CH	65	78	28	50	98
	9	28 – 30		66				
	10	33 – 35		262				
	11	38 – 40	OH	178	107	64	43	65
	12	43 – 45	SM	42	47	30	17	43
	13	48 – 50		54				
	14	53 – 55		36				
	15	58 – 60		35				
	16	63 – 65	CL	30	46	24	22	96
	17	68 – 70	CL	28	42	19	23	70
	18	73 – 75		34				
	19	83 – 85		35				
	20	88 – 90		34				
	21	93 – 95	CL	31	44	18	26	52
	22	98 – 100		33				

MLK – CSX/VHAMP084
Portsmouth, Virginia
(AGS Project No. RC10-122)

Boring No.	Sample No.	Depth in feet	Classification, USCS	Natural Moisture Content, %	Atterberg Limits			% Passing #200 Sieve
					LL	PL	PI	
10BH-099	1	0 – 2		17				
	2	2 – 4		18				
	3	4 – 6		22				
	4	6 – 8		23				
	5	8 – 10		22				
	6	13 – 15		32				
	7	18 – 20		27				
	8	23 – 25	CH	68	75	28	47	98
	9	28 – 30		64				
	10	33 – 35	OH	197	250	147	103	58
	11	38 – 40		239				
	12	43 – 45		183				
	13	48 – 50	ML	52	44	32	12	69
	14	53 – 55		61				
	15	58 – 60		42				
	16	63 – 65		43				
	17	68 – 70	CL	33	31	20	11	63
	18	73 – 75		29				
	19	78 – 80		33				
	20	83 – 85		33				
	21	88 – 90		34				
	22	93 – 95	SC	36	40	24	16	48
	23	98 – 100		32				

MLK – CSX/VHAMP084
Portsmouth, Virginia
(AGS Project No. RC10-122)

Boring No.	Sample No.	Depth in feet	Classification, USCS	Natural Moisture Content, %	Atterberg Limits			% Passing #200 Sieve
					LL	PL	PI	
10BH-107	1	1.5 – 2		13				
	2	2 – 4		18				
	3	4 – 6		23				
	4	6 – 8		22				
	5	8 – 10		22				
	6	13 – 15		32				
	7	18 – 20		26				
	8	23 – 25		47				
	9	28 – 30	CH	74	81	31	50	99
	10	33 – 35		45				
	11	38 – 40	OH	108	135	65	70	81
	12	43 – 45		77				
	13	48 – 50	SM	45	24	22	2	24
	14	58 – 60		53				
	15	63 – 65	CL	33	47	24	23	89
	16	68 – 70	CL	26	29	19	10	54
	17	73 – 75		36				
	18	78 – 80		35				
	19	83 – 85		35				
	20	88 – 90		32				
	21	93 – 95	SC	32	41	22	19	43
	22	98 – 100		31				

MLK – CSX/VHAMP084
Portsmouth, Virginia
(AGS Project No. RC10-122)

Boring No.	Sample No.	Depth in feet	Classification, USCS	Natural Moisture Content, %	Atterberg Limits			% Passing #200 Sieve
					LL	PL	PI	
10BH-097	1	0 – 2		14				
	2	2 – 4		20				
	3	4 – 6		23				
	4	6 – 8		23				
	5	8 – 10		19				
	6	13 – 15		30				
	7	18 – 20		26				
	8	23 – 25	CH	70	74	28	46	98
	9	28 – 30		66				
	10	38 – 40	OH	290	329	191	138	62
	11	43 – 45		156				
	12	48 – 50	MH	49	54	36	18	64
	13	53 – 55		53				
	14	58 – 60		29				
	15	63 – 65		11				
	16	68 – 70		28				
	17	73 – 75		32				
	18	78 – 80	SC	35	26	17	9	31
	19	83 – 85		32				
	20	88 – 90	SC	33	33	20	13	42
	21	93 – 95		32				
	22	98 – 100		34				

MLK – CSX/VHAMP084
Portsmouth, Virginia
(AGS Project No. RC10-122)

Boring No.	Sample No.	Depth in feet	Classification, USCS	Natural Moisture Content, %	Atterberg Limits			% Passing #200 Sieve
					LL	PL	PI	
10BH-111	1	0 – 2		27				
	2	2 – 4		17				
	3	4 – 6		21				
	4	6 – 8		19				
	5	8 – 10		23				
	6	13 – 15		29				
	7	18 – 20		27				
	8	23 – 25	CH	86	83	26	57	97
	9	28 – 30		78				
	10	33 – 35	OH	261	296	158	138	63
	11	38 – 40	OH	118	101	48	53	94
	12	43 – 45	OH	106	97	47	50	98
	13	48 – 50	SM	38	26	24	2	26
	14	53 – 55		36				
	15	58 – 60		45				
	16	63 – 64.5		60				
	17	64.5 – 65	CL	37	49	23	26	88
	18	68 – 70		27				
	19	73 – 73.75		25				
	20	73.75 - 75		29				
	21	78 – 80		31				
	22	83 – 85		36				
	23	88 – 90		34				
	24	93 – 95	SC	29	39	22	17	38
	25	98 – 100		33				

MLK – CSX/VHAMP084
Portsmouth, Virginia
(AGS Project No. RC10-122)

Boring No.	Sample No.	Depth in feet	Classification, USCS	Natural Moisture Content, %	Atterberg Limits			% Passing #200 Sieve
					LL	PL	PI	
10BH-101	1	0 – 2		20				
	2	2 – 4		19				
	3	4 – 6		24				
	4	6 – 8		22				
	5	8 – 10		24				
	6	13 – 15		27				
	7	18 – 20		26				
	8	20 – 22	CH	62	74	28	46	97
	9	24 – 26		73				
	10	28 – 30		65				
	11	33 – 35	OH	275	244	135	109	64
	12	38 – 40		243				
	13	43 – 45		107				
	14	48 – 50		47				
	15	53 – 55	MH	69	58	34	24	73
	16	58 – 60		54				
	17	63 – 65		50				
	18	68 – 70		30				
	19	73 – 75	SC-SM	30	22	18	4	30
	20	78 – 80		35				
	21	83 – 85		34				
	22	88 – 90		34				
	23	93 – 95	SC	32	36	22	14	44
	24	95 – 100		32				

Attachment IV

Schnabel Engineering Shelby Tube Laboratory Data

Schnabel ENGINEERING

One West Cary Street
Richmond, VA 23220
T/ 804-649-7035
F/ 804-783-8023

TRANSMITTAL

TO:	Fred Parkinson, P.E.	**DATE:**	May 21, 2010
COMPANY:	Parsons Brinkerhoff	**SUBJECT:**	Soil Laboratory Test Results
ADDRESS:	6161 Kempsville Circle, Suite 110 Norfolk, VA 23502	**PROJECT NAME/NO.:**	Martin Luther King Freeway P8330138
FROM:	Ed Drahos, P.E.	**CC:**	Ian Chaney, Jim Seli; Doug Alexander

COPIES	DATE	NO.	DESCRIPTION
1	May 21, 2010	2	Summary of Laboratory Tests and Atterberg Limits
1	May 21, 2010	1	Consolidation Test, 10BH-101, 22-24 ft
1	May 21, 2010	2	Time-Compression Curves, 10BH-101, 22-24 ft
1	May 21, 2010	1	Consolidation Test, 10BH-101, 35-37 ft
1	May 21, 2010	2	Time-Compression Curves, 10BH-101, 35-37 ft

X AS REQUESTED ☐ FOR APPROVAL ☐ PLEASE REPLY ☐ FOR YOUR USE

COMMENTS:

Our laboratory test results for the undisturbed tube samples from Boring 10BH-101 are attached. Please call if you have any questions.

SIGNED: Edward G. Drahos

Edward G. Drahos, P.E.

SENT VIA: ☐ First Class Mail ☐ Overnight Service X Email ☐ Other

Summary Of Laboratory Tests

Project Number: P8330138

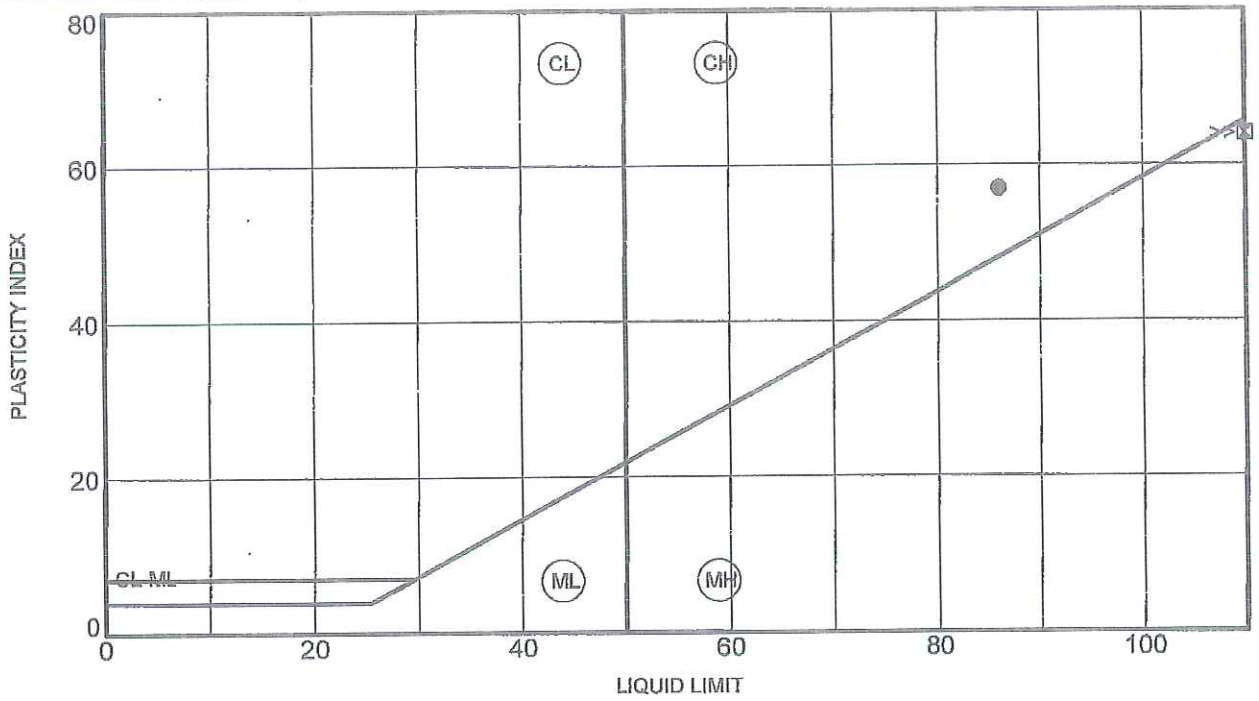
Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Stratum	Natural Moisture (%)	Wet Natural Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve
10BH-101	22.0 - 24.0	Tube	Gray, fat CLAY, trace sand, CH	--	65.9	99.2	86	29	57	98.7
10BH-101	35.0 - 37.0	Tube	Dark brown, sandy organic SILT, OH	--	217.6	67.4	220	156	64	51.4

Notes:
1. Soil tests in general accordance with ASTM standards.
2. Soil classifications are in general accordance with ASTM D2487(as applicable), based on testing indicated and visual classification.
3. Key to abbreviations: NP=Non-Plastic; -- indicates no test performed

Schnabel

Project: MLK Freeway Expansion
Portsmouth, VA

DYNAMIC LAB SUMMARY P8330138 LAB DATA.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 5/21/10



PLOTTED DATA REPRESENTS SOIL PASSING NO. 40 SIEVE

	Specimen		LL	PL	PI	Fines	Oven Dry Liquid Limit	Description
●	10BH-101	22.0 ft	86	29	57	99		Gray, fat CLAY, trace sand, CH
☒	10BH-101	35.0 ft	220	156	64	51	63.0	Dark brown, sandy organic SILT, OH

NOTE: An organic clay or silt is a soil that would be classified as a clay or silt, respectively, except that its oven dried liquid limit is less than 75% of its liquid limit value.

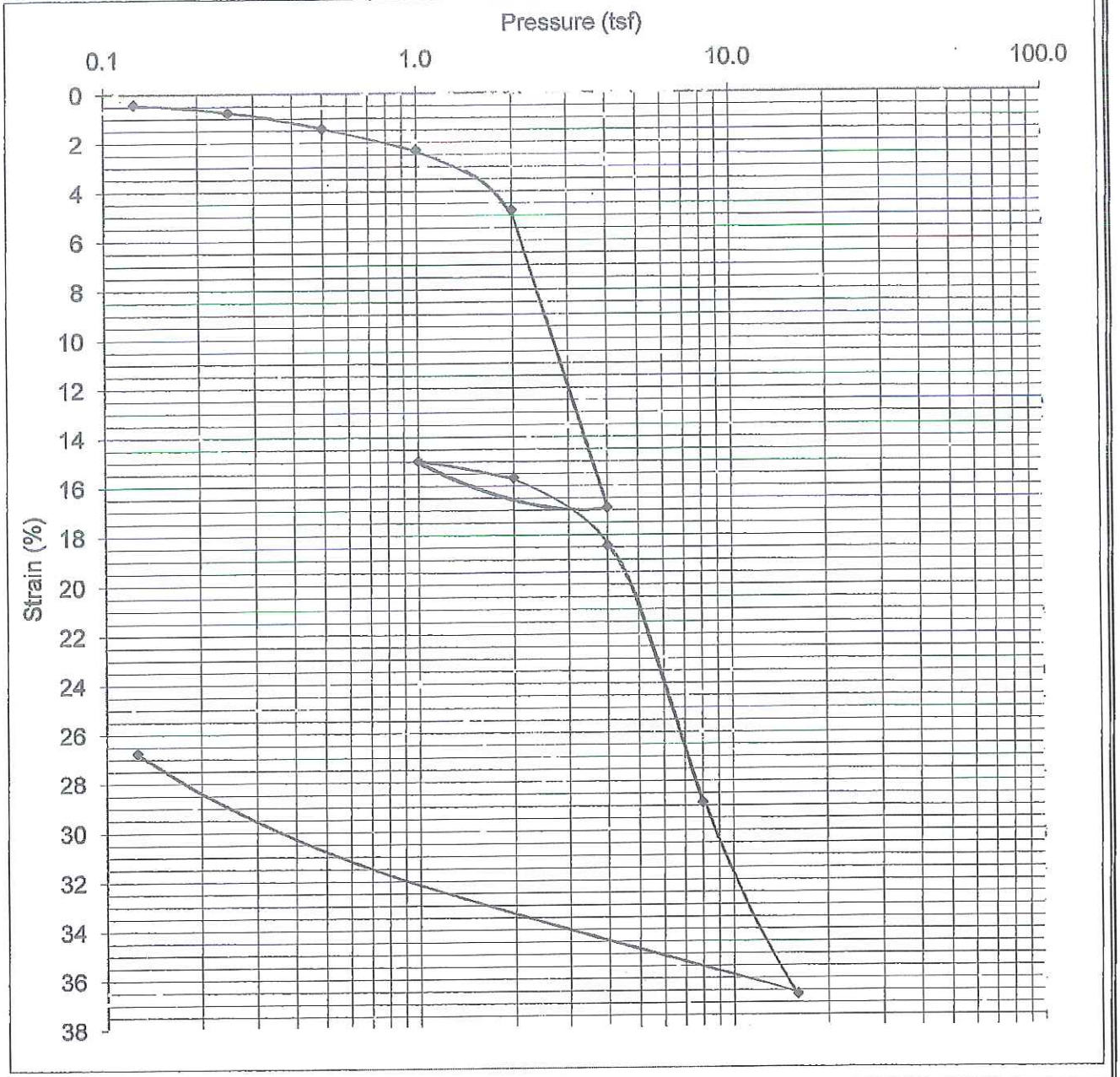
Schnabel

ATTERBERG LIMITS

Project: MLK Freeway Expansion
Portsmouth, VA

Contract: P8330138

ATTERBERG LIMITS P8330138 LAB DATA.GPJ SCHNABEL DATA TEMPLATE 2008 04_22.GDT 5/21/10



Description of Sample:	Gray, fat CLAY, CH				
Boring :	10BH-101	Depth:	22'-24'	Stratum:	

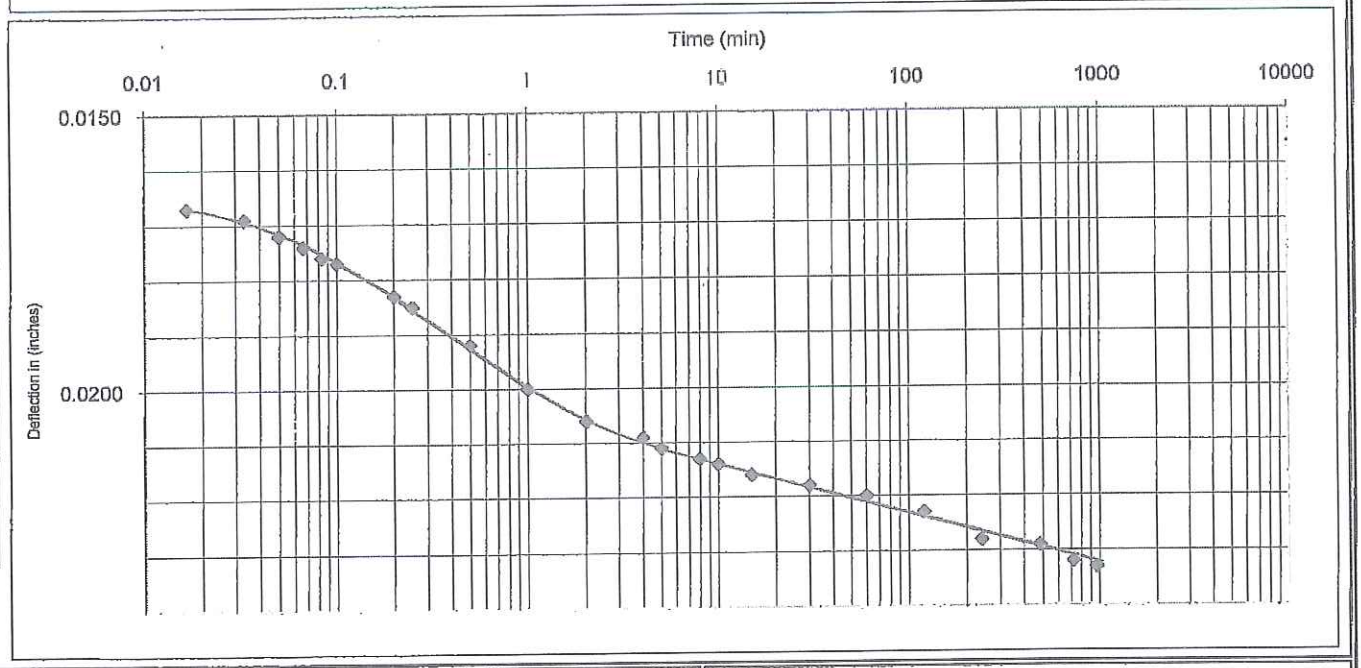
Probable Preconsolidation Stress (tsf)	
Approximate Overburden Stress (tsf):	
Compression Ratio (from 2 to 4 tsf):	
Recompression Ratio (from ½ to 1 tsf):	

Schnabel

CONSOLIDATION TEST

Project:	MLK Freeway Expansion Portsmouth, VA
Contract Number:	P8330138





Description of Sample:	Gray, fat CLAY, CH

Boring :	10BH-101	Depth:	22'-24'	Stratum:

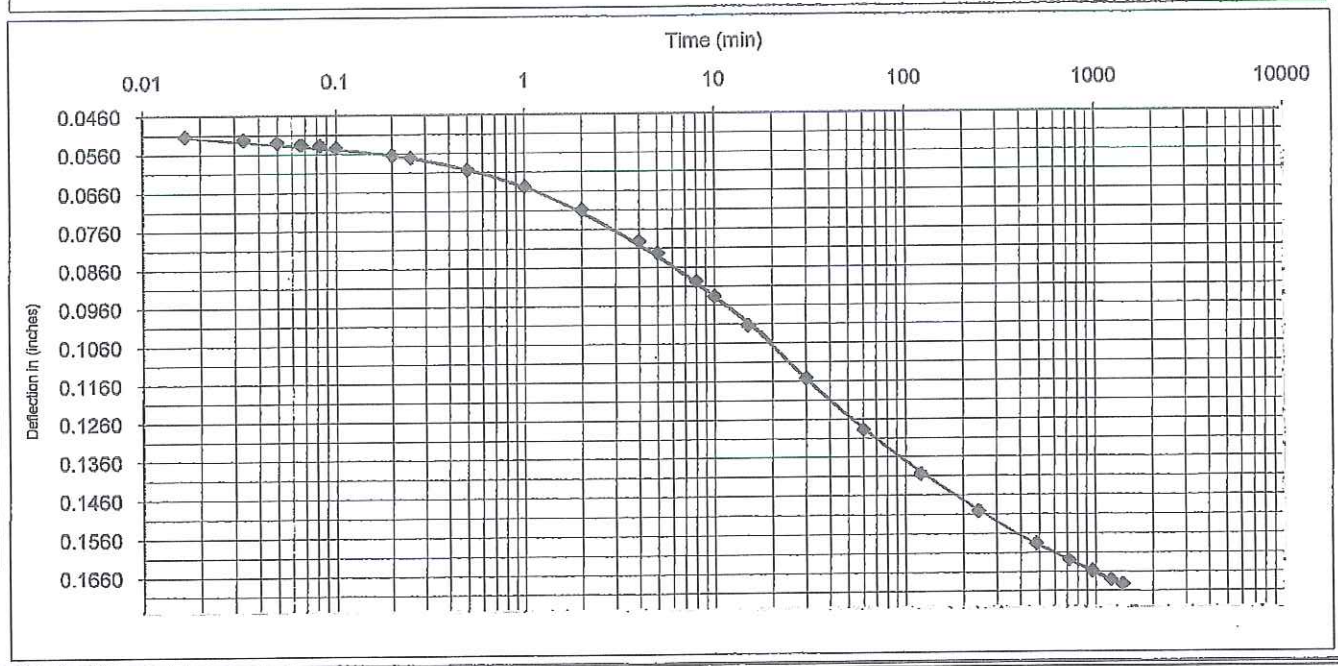
Load (tsf)	1.0
Coefficient of Consolidation (sqrt t in2/min)	
Coefficient of Consolidation (log t in2/min)	
Coefficient of Secondary Compression	

Schnabel Engineering

TIME-COMPRESSION CURVE

Project:	MLK Freeway Expansion Portsmouth, VA
Contract Number:	P8330138



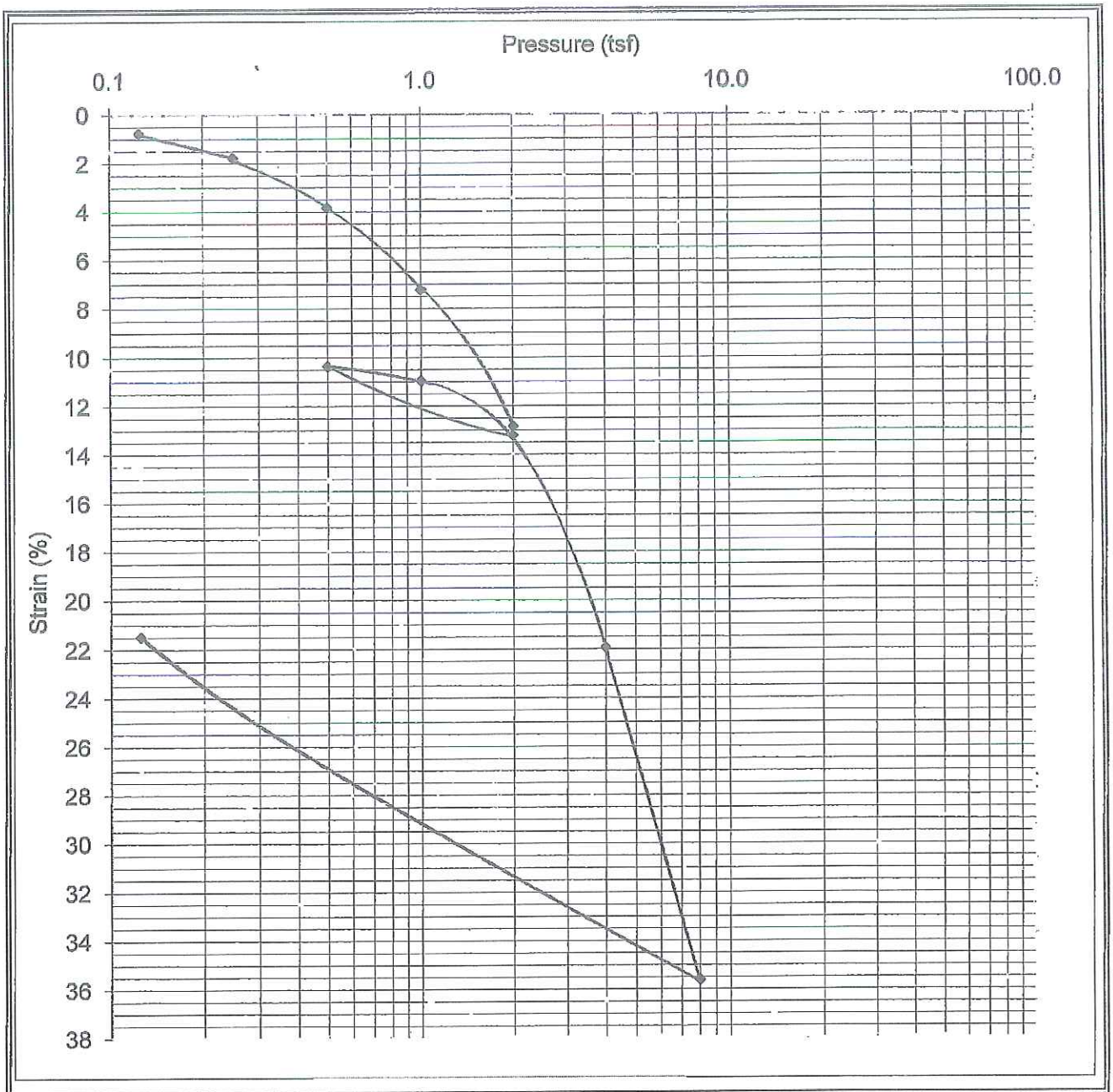


Description of Sample:	Gray, fat CLAY, CH				
Boring :	10BH-101	Depth:	22'-24'	Stratum:	
Load (tsf)					4.0
Coefficient of Consolidation (sqrt t in2/min)					
Coefficient of Consolidation (log t in2/min)					
Coefficient of Secondary Compression					

Schnabel ENGINEERING

TIME-COMPRESSION CURVE

Project:	MLK Freeway Expansion Portsmouth, VA
Contract Number:	P8330138

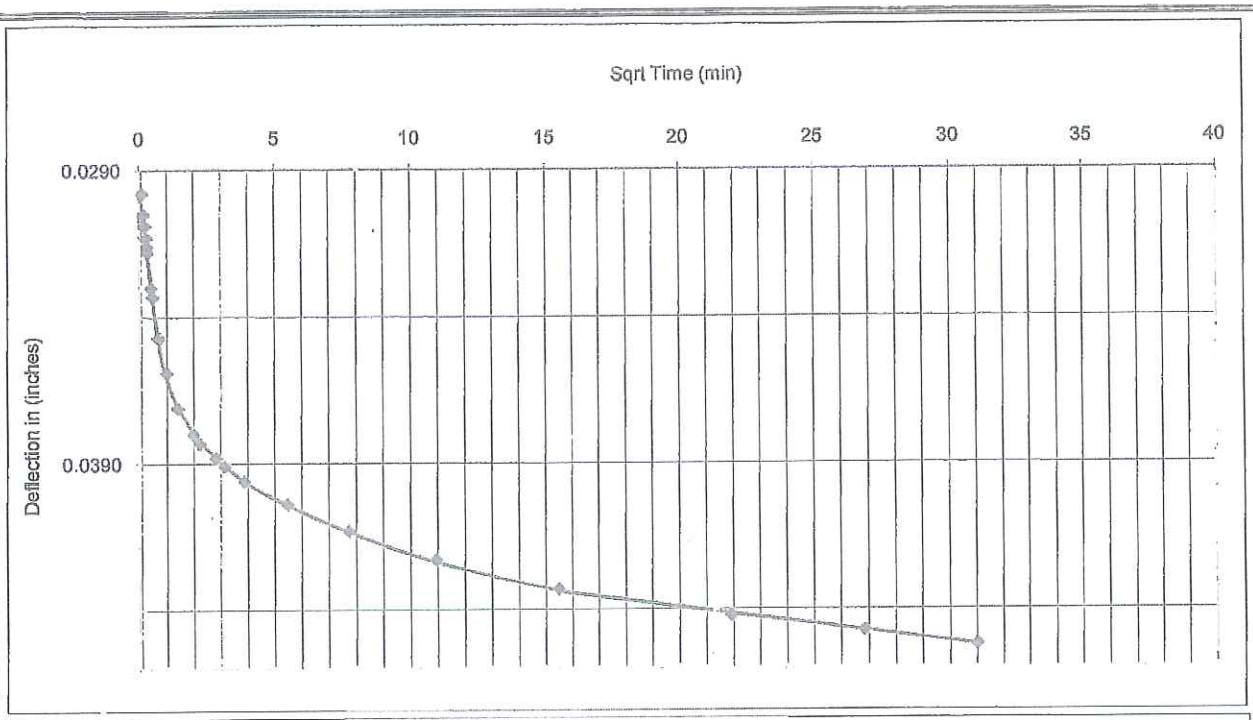


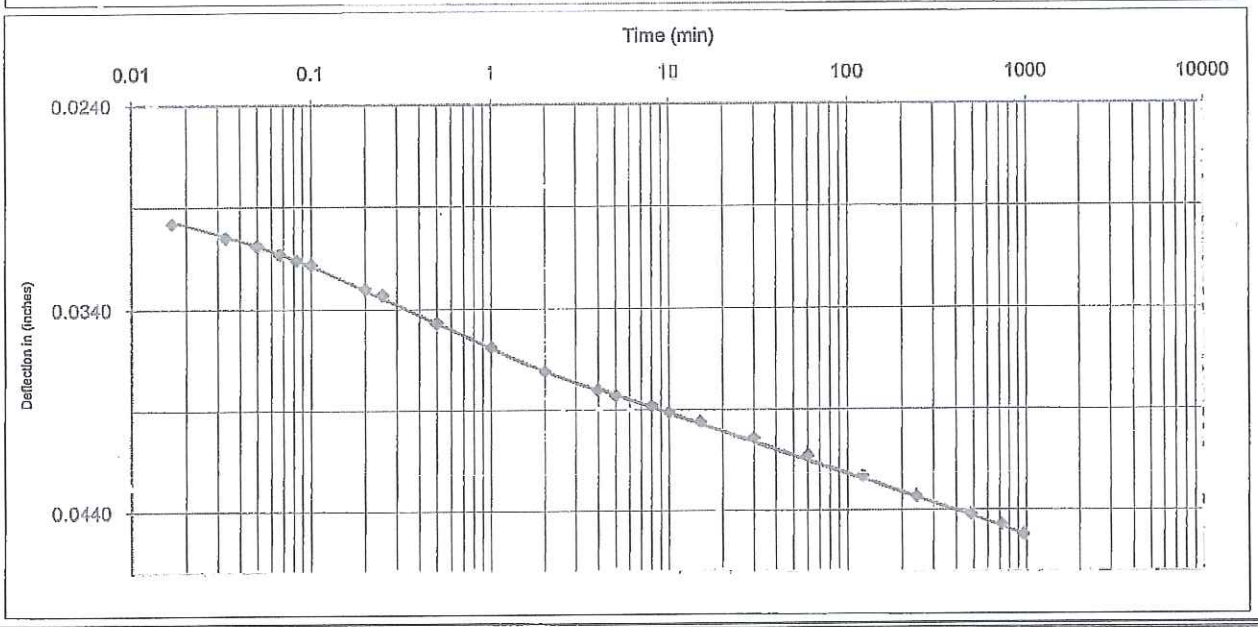
Description of Sample:	Dark brown, sandy organic Silt, OH				
Boring :	10BH-101	Depth:	35'-37'	Stratum:	
Probable Preconsolidation Stress (tsf)					
Approximate Overburden Stress (tsf):					
Compression Ratio (from 2 to 4 tsf):					
Recompression Ratio (from ½ to 1 tsf):					

Schnabel

CONSOLIDATION TEST

Project:	MLK Freeway Expansion Portsmouth, VA
Contract Number:	P8330138





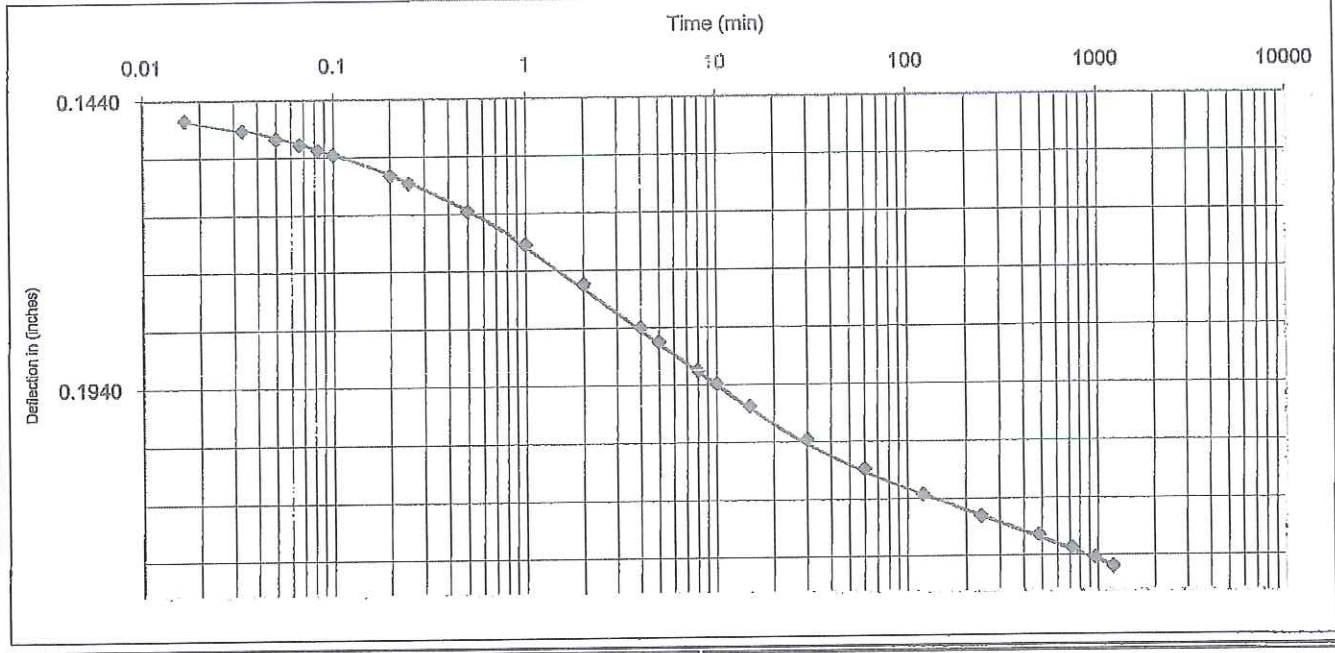
Description of Sample:	Dark brown, sandy organic Silt, OH				
Boring :	10BH-101	Depth:	35'-37'	Stratum:	
Load (tsf)					0.5
Coefficient of Consolidation (sqrt t in2/min)					
Coefficient of Consolidation (log t in2/min)					
Coefficient of Secondary Compression					

Schnabel

TIME-COMPRESSION CURVE

Project:	MLK Freeway Expansion Portsmouth, VA
Contract Number:	P8330138





Description of Sample:	Dark brown, sandy organic Silt, OH				
Boring :	10BH-101	Depth:	35'-37'	Stratum:	
Load (tsf)					4.0
Coefficient of Consolidation (sqrt t in2/min)					
Coefficient of Consolidation (log t in2/min)					
Coefficient of Secondary Compression					

Schnabel ENGINEERING

TIME-COMPRESSION CURVE

Project:	MLK Freeway Expansion Portsmouth, VA
Contract Number:	P8330138

2. Threatened or Endangered Species

2. Threatened or Endangered Species

As defined per the Environmental Assessment dated March, 2011 prepared by VDOT:
“No rare, threatened or endangered species are anticipated to be impacted by the project. No Critical Habitat areas or Wildlife and Waterfowl Refuges occur in the project vicinity.”

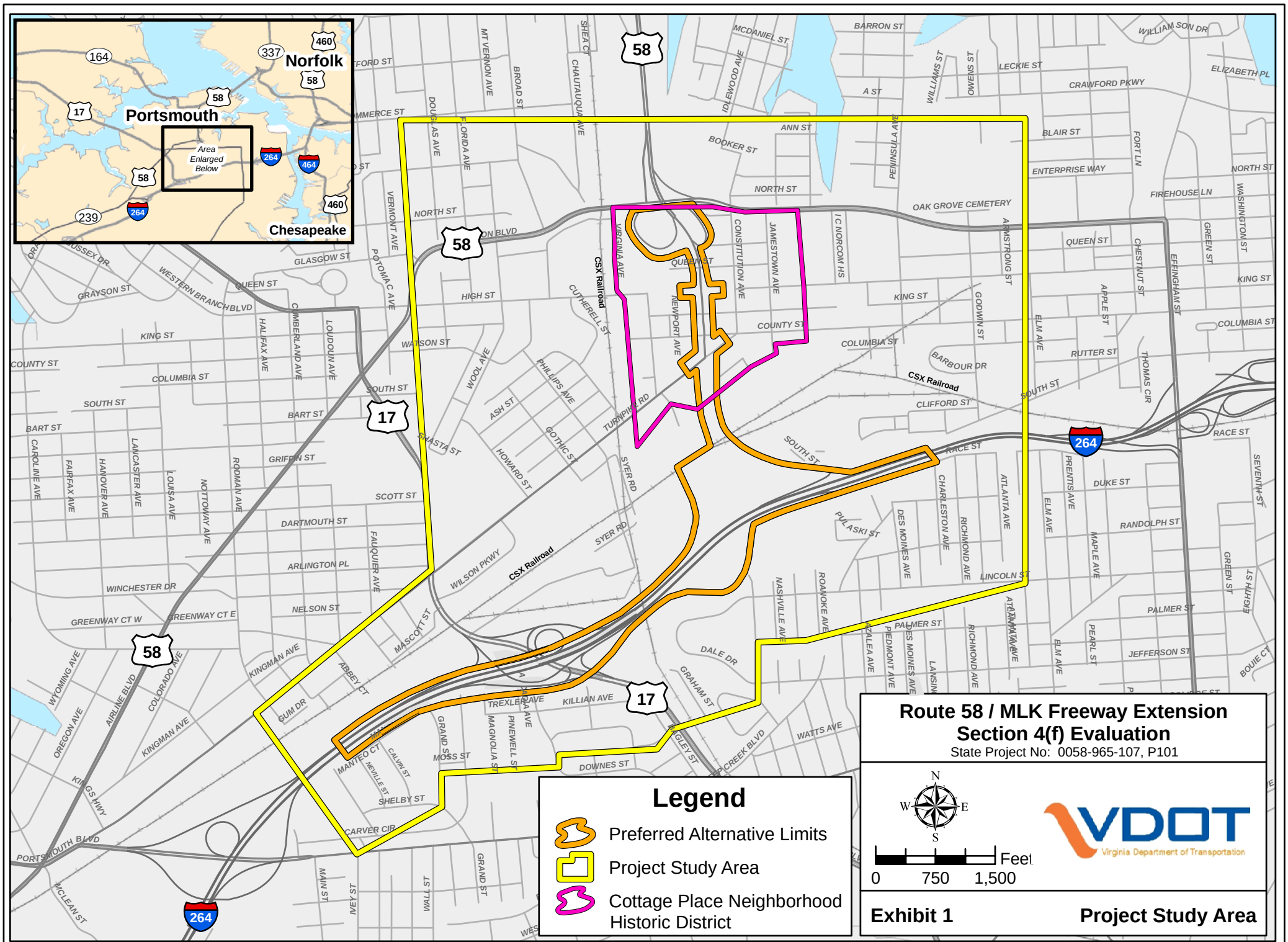
Accordingly, there are no known threatened or endangered species whose habitat is protected by Law on the Project Right of Way.

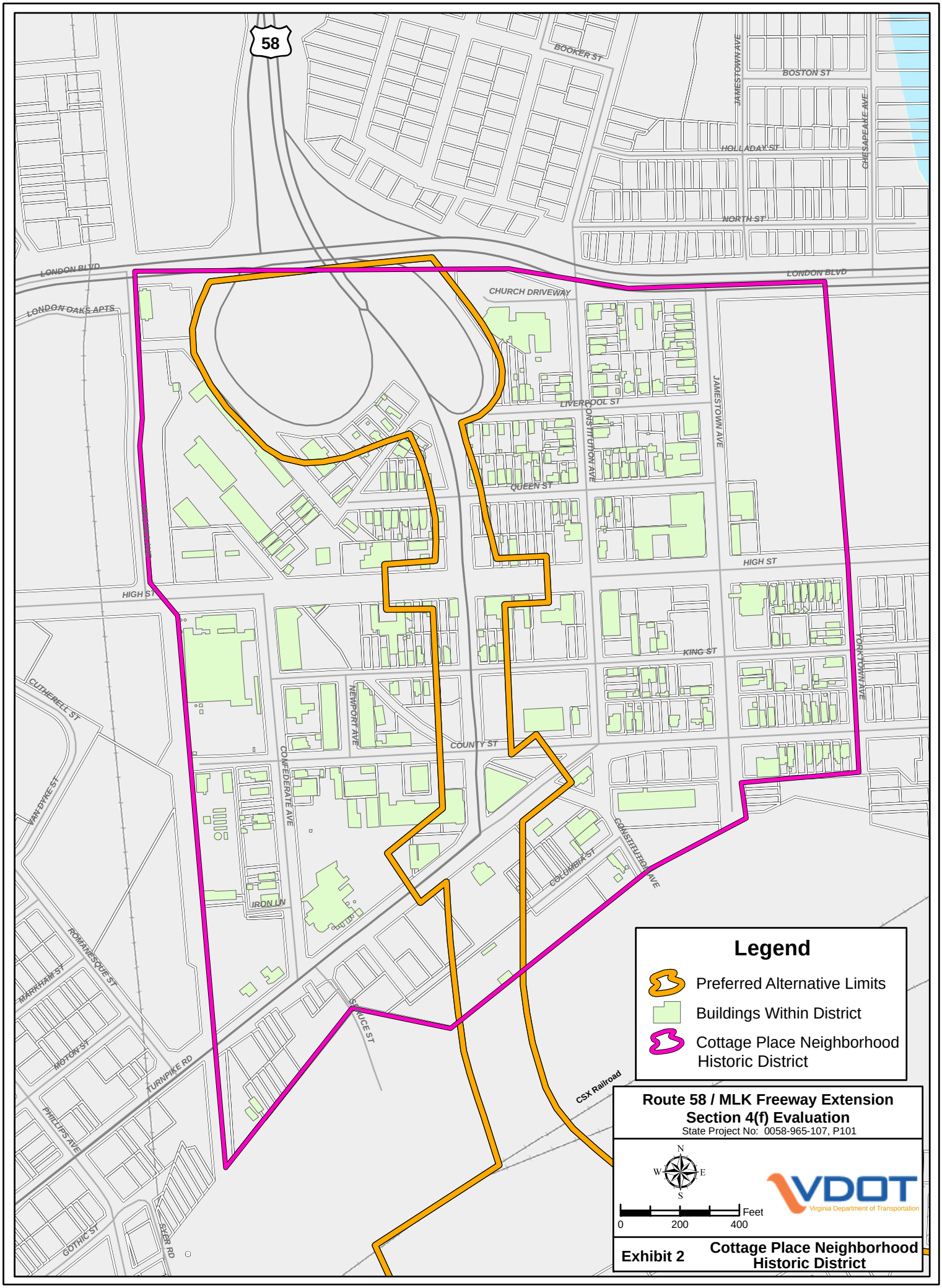
3. Archeological and Cultural Resources

3.1 Archeological and Cultural Resources - Cottage Place Historic District

3.1 Archeological and Cultural Resources - Cottage Place Historic District

The attached Cottage Place Historic District location maps were extracted from the February, 2009 Martin Luther King Extension Finding of No Significant Impact prepared by VDOT.


Portsmouth
Norfolk
Chesapeake
Area Enlarged Below
Legend
Preferred Alternative Limits
Project Study Area
Cottage Place Neighborhood Historic District
Route 58 / MLK Freeway Extension
Section 4(f) Evaluation
State Project No: 0058-965-107, P101
N
W
E
S
0
750
1,500
Feet
VDOT
Virginia Department of Transportation
Exhibit 1
Project Study Area


58
BOOKER ST
JAMESTOWN AVE
BOSTON ST
CHESAPEAKE AVE
HOLLADAY ST
NORTH ST
LONDON BLVD
LONDON OAKS APTS
CHURCH DRIVEWAY
LIVERPOOL ST
CONSTITUTION AVE
JAMESTOWN AVE
QUEEN ST
HIGH ST
KING ST
CUTHERELL ST
VAN DYKE ST
NEWPORT AVE
COUNTY ST
CONFEDERATE AVE
IRON LN
COLUMBIA ST
CONSTITUTION AVE
ROMANESQUE ST
MARKHAM ST
MOTON ST
TURNPIKE RD
PHILLIPS AVE
GOTHIC ST
SILVER RD
CSX Railroad
Legend
Preferred Alternative Limits
Buildings Within District
Cottage Place Neighborhood Historic District
Route 58 / MLK Freeway Extension
Section 4(f) Evaluation
State Project No: 0058-965-107, P101
N
W
E
S
0
200
400
Feet
VDOT
Virginia Department of Transportation
Exhibit 2
Cottage Place Neighborhood Historic District

3.2 Archeological and Cultural Resources - Potters Field Cemetery

3.2 Archeological and Cultural Resources - Potters Field Cemetery

The following State Plan Coordinates define the limits of the Potters Field Cemetery. These coordinates were provided by Kenneth E. Stuck of VDOT on September 17, 2010 as referenced in the attached email.

N 3467428.50
E 12119416.70

N 3467427.90
E 12119363.60

N 3467588.10
E 12119341.80

N 3467678.10
E 12119392.40

Jonna, Peter

From: Piper, Derek [Piper@pbworld.com]
Sent: Friday, April 15, 2011 4:47 PM
To: VanEssendelft, Stephen
Cc: Jonna, Peter; SKW Document Control; Parkinson, Fred H.; MTT@projectsolvemail.com
Subject: FW: MLK Potter's Field boundaries

Importance: High

Categories: Filed

Here you go. This is the information that we used to locate Potters Field.

d/

From: Stuck, Kenneth E. [mailto:Kenneth.Stuck@VDOT.Virginia.gov]
Sent: Friday, September 17, 2010 11:52 AM
To: Nies, Nick M.; Bartnik, Irene
Cc: Opperman, Antony F.; Hodges, Mary Ellen N.; Cromwell, Jackie H.; Bryan S. Ellis; Piper, Derek; Rick Palmer; Tyler, Stuart; Ken.Dierks@kimley-horn.com
Subject: RE: MLK Potter's Field boundaries

Renee,

Here is some additional information I have from a survey done by the City of Portsmouth surveyors at my direction in the field to survey in the boundaries of the potter's field. They are in State Plane coordinates and you could use these to plot on the plan from Volkert. Here are the four coordinates I have.

N 3467428.50

E 12119416.70

N 3467427.90

E 12119363.60

N 3467588.10

E 12119341.80

N 3467678.10

E 12119392.40

Let me know if you have any questions.

Ken

From: Nies, Nick M
Sent: Thursday, September 16, 2010 5:01 PM
To: 'Bartnik, Irene'
Cc: Opperman, Antony F.; Hodges, Mary Ellen N.; Cromwell, Jackie H.; 'Bryan S. Ellis'; 'Piper, Derek'; 'Rick Palmer'; 'Tyler, Stuart'; 'Ken.Dierks@kimley-horn.com'; Stuck, Kenneth E.
Subject: MLK Potter's Field boundaries

Good Afternoon Renee,

Based on discussions at yesterdays Cultural Resource meeting with DHR, we had Mr. Kenneth Stuck (see email below) review the map you provided. We concur with his initial findings and will provide you additional information in the next few days.

Thank you,

Nick

Nicholas M. Nies
Project Manager
VDOT – Environmental Division
(804)786-1092

From: Stuck, Kenneth E.

Sent: Thursday, September 16, 2010 9:03 AM
To: Opperman, Antony F.
Subject: MLK Potter's Field boundaries

Tony,

Attached is a scan of the boundaries I shot in with the help of the City of Portsmouth survey office. I can finally make a color scan and send it. As you can see, the boundaries do not match the locations of the concrete piles we saw yesterday. The boundaries drawn on the PB plan do not look to go far enough westward to match the boundaries from the survey. I will pull the reports and look at the detailed measured drawings for the potters field, but I think the boundaries PB is using will need to be adjusted.

Ken

<< File: MLKPottersField.pdf >>

Ken Stuck

VDOT Hampton Roads District Environmental

1700 North Main Street

Suffolk, Va 23434

Office (757) 925-2372

Fax (757) 925-3600

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4. Paleontological Resources

4. Paleontological Resources

There are no known paleontological resources on the Project Right of Way as defined per the Environmental Assessment dated March, 2011 prepared by VDOT.

5. Utilities

5.1 Utilities - New Midtown Tunnel

PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
DESIGNED BY Parsons Brinckerhoff (757) 466-1732

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
2-10-2011 3-17-2011	VA.	—	0058-965-102, C-501	22(1)

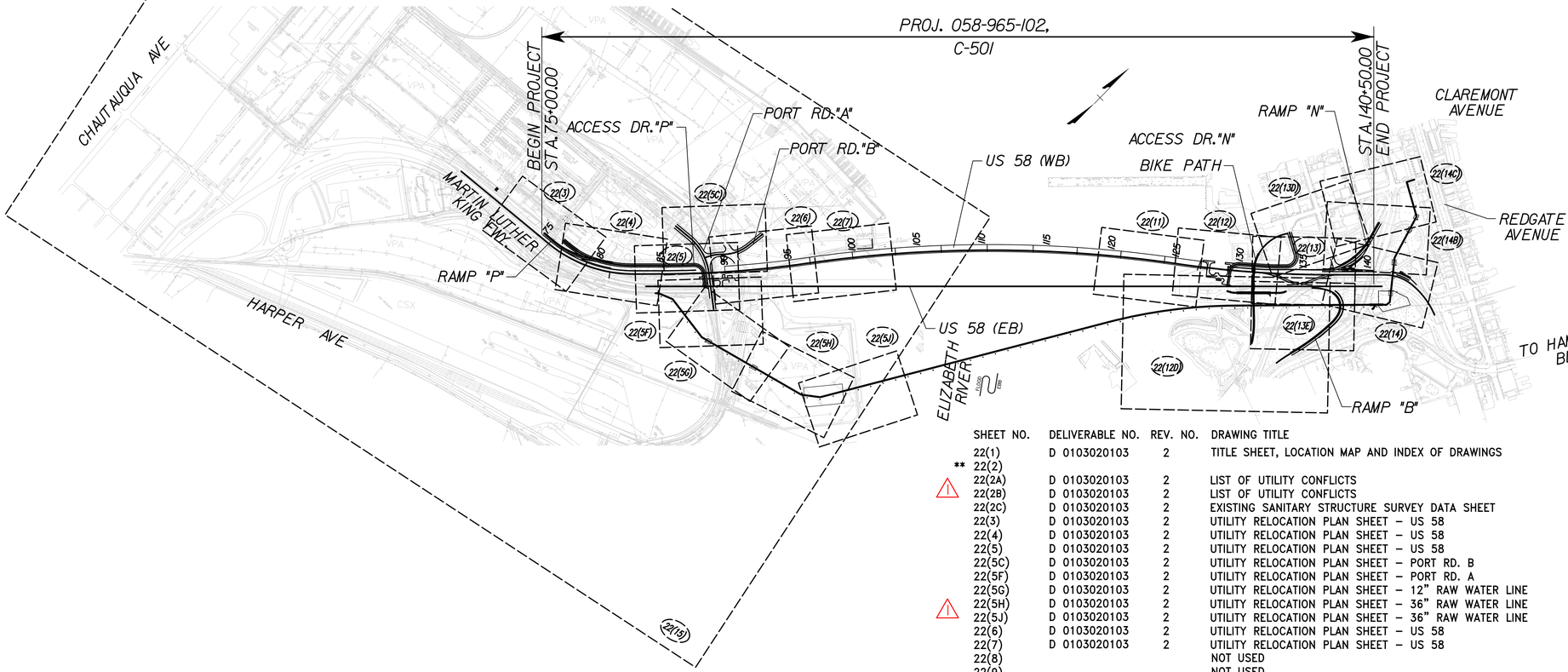
DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

COMMONWEALTH OF VIRGINIA

DEPARTMENT OF TRANSPORTATION

PLAN AND PROFILE OF PROPOSED STATE HIGHWAY

MIDTOWN TUNNEL PROJECT
MTT UTILITY RELOCATION PLANS - PRELIMINARY



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SHEET NO.	DELIVERABLE NO.	REV. NO.	DRAWING TITLE
22(1)	D 0103020103	2	TITLE SHEET, LOCATION MAP AND INDEX OF DRAWINGS
** 22(2)			
22(2A)	D 0103020103	2	LIST OF UTILITY CONFLICTS
22(2B)	D 0103020103	2	LIST OF UTILITY CONFLICTS
22(2C)	D 0103020103	2	EXISTING SANITARY STRUCTURE SURVEY DATA SHEET
22(3)	D 0103020103	2	UTILITY RELOCATION PLAN SHEET – US 58
22(4)	D 0103020103	2	UTILITY RELOCATION PLAN SHEET – US 58
22(5)	D 0103020103	2	UTILITY RELOCATION PLAN SHEET – US 58
22(5C)	D 0103020103	2	UTILITY RELOCATION PLAN SHEET – PORT RD. B
22(5F)	D 0103020103	2	UTILITY RELOCATION PLAN SHEET – PORT RD. A
22(5G)	D 0103020103	2	UTILITY RELOCATION PLAN SHEET – 12" RAW WATER LINE
22(5H)	D 0103020103	2	UTILITY RELOCATION PLAN SHEET – 36" RAW WATER LINE
22(5J)	D 0103020103	2	UTILITY RELOCATION PLAN SHEET – 36" RAW WATER LINE
22(6)	D 0103020103	2	UTILITY RELOCATION PLAN SHEET – US 58
22(7)	D 0103020103	2	UTILITY RELOCATION PLAN SHEET – US 58
22(8)			NOT USED
22(9)			NOT USED
22(10)			NOT USED
22(11)	D 0103020103	2	UTILITY RELOCATION PLAN SHEET – US 58
22(12)	D 0103020103	2	UTILITY RELOCATION PLAN SHEET – US 58
22(12D)	D 0103020103	2	UTILITY RELOCATION PLAN SHEET – 10" WATER LINE
22(13)	D 0103020103	2	UTILITY RELOCATION PLAN SHEET – US 58
22(13D)	D 0103020103	2	UTILITY RELOCATION PLAN SHEET – SERVICE RD. N
22(13E)	D 0103020103	2	UTILITY RELOCATION PLAN SHEET – CRASH HOUSE
22(14)	D 0103020103	2	UTILITY RELOCATION PLAN SHEET – US 58
22(14B)	D 0103020103	2	UTILITY RELOCATION PLAN SHEET – RAMP N
22(14C)	D 0103020103	2	UTILITY RELOCATION PLAN SHEET – CLAREMONT AVE
22(15)	D 0103020103	2	UTILITY RELOCATION PLAN SHEET – 12" WATER LINE

**NOT INCLUDED IN THIS SUBMISSION

Legend

(MW)	Monitoring Well
AATUR	Abandoned According to Utility Records
AATFV	Abandoned According to Field Verification
A/C	Air Conditioner
CA	Crab Apple
CAB	Cabinet
CLF	Chain Link Fence
CM	Crepe Myrtle
DI	Drainage Inlet
DIP	Ductile Iron Pipe
EM	Electric Meter
FES	Flaired End Section
FOM	Fiber Optic Marker
G/L	Gound Light
GM	Gas Meter
GW	Guy Wire
GV	Gas Valve
GMP	Gas Marker Post
HDPP	High Density Plastic Pipe
L/P	Light Pole
MP	Mile Post
Orn	Ornamental
P/P	Power Pole
SMH	Sanitary Manhole
SOE	Support of Excavation
SSMH	Storm Sewer Manhole
T/P	Telephone Pole
TMS	Traffic Management Systems
Tped	Telephone Pedistal
TRLP	Traffic Light Pole
TMP	Telephone Marker Post
WDF	Wood Fence
WMP	Water Marker Post

CONVENTIONAL SIGNS

STATE LINE
COUNTY LINE
CITY,TOWN OR VILLAGE
RIGHT OF WAY LINE
FENCE LINE
UNFENCED PROPERTY LINE
FENCED PROPERTY LINE
WATER LINE
SANITARY SEWER LINE
GAS LINE
ELECTRIC UNDERGROUND CABLE
TRAVELED WAY
GUARD RAIL
RETAINING WALL
RAILROADS
BASE OR SURVEY LINE

LEVEE OR EMBANKMENT
BRIDGES
CULVERTS
DROP INLET
POWER POLES
TELEPHONE OR TELEGRAPH POLES
TELEPHONE OR TELEGRAPH LINES
HEDGE
TREES
HEAVY WOODS
GROUND ELEVATION
GRADE ELEVATION

SCALE	PROJECT	SHEET NO.
0' 500' 1000'		22(1)

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DESIGNED BY Parsons Brinckerhoff (757) 466-1732

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REVISED	STATE	STATE		SHEET NO.
2-10-2011 3-17-2011	VA.	ROUTE	PROJECT	
		—	0058-965-107 C-501	22(2A)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

UTILITY IMPACTS TO THE MTT PORTION OF THE MTT-MLK PROJECT
SANITARY SEWER

No.	Plan Sheet No.	Approx. Stationing	Utility	Utility Owner	Location	Street	Utility Conflict	Disposition	Possible Solution Remarks
UTILITIES IMPACT PORTSMOUTH SIDE OF MTT									
S1	5, 5C	88+25	6" FM	Portsmouth PU	Portsmouth Portal	Harper Ave.	MTT Approach	Conflict	390 LF temporary relocation of 6" FM during construction of MTT approach. Relocate over support of excavation (SOE). Include (2) 6" disconnect valves, 55 LF 18" steel casing pipe under crane work area. Intent is to locate temporary line on contractor's utility bridge and walkway (per discussion with SKW)
S1B	5, 5C	88+25	6" FM	Portsmouth PU	Portsmouth Portal	Harper Ave.	MTT Approach	Conflict	Replace 225 LF 6" FM after construction of roadway over boat section is complete.
S2	5	88+75	4" FM	VPA	Portsmouth Portal	Harper Ave.	MTT Approach	Conflict	Temporary Pump & Haul for 4" Sanitary FM until the relocation of the 4" FM has been completed.
S2B	5, 5C, 5F	88+75	4" FM	VPA	Portsmouth Portal	Harper Ave.	MTT Approach	Conflict	Replace 750 LF 4" FM after construction of roadway over boat section is complete.
S2C	5C	90+50	4" FM	VPA	Portsmouth Portal	Service road behind existing ventilation building	Port road B and MTT	Conflict	Abandon 80 LF 4" FM. Cap and fill with flowable fill.
S2D	5C, 6	91+90	4" FM	VPA	Portsmouth Portal	Service road behind existing ventilation building	Port road B and MTT	Conflict	Remove 220 LF 4" FM
S3	6	92+00	8" SAN	VPA	Portsmouth Portal	Service road behind existing ventilation building			Abandon 170 LF 8" SAN. Cap and fill with flowable fill. Remove (1) MH (SMH#61-63). Plug down stream invert for this line at SMH#61-62).
S4	6, 7	92+00 to 100+10	4" FM	VPA	Portsmouth Portal				Remove 830 LF 4" FM
S5	6, 7	100+30	4" FM	VPA	Portsmouth Portal		New Construction		1600 LF 4" FM and 2 ARV, to relocated building at end of pier. Building to be demolished during construction of the MTT tunnel section. Then replaced after tunnel section is constructed. Final location not determined at this stage. Anticipate location/relocation will be determined during final design.
S6	7	100+50	4" FM	VPA	Portsmouth Portal		New Construction		Provide packaged duplex submersible grinder pump station ((2) 5-HP, 3-phase, 20gpm, 70 feet head, and remote control panel.)
S8	7	97+35 to 98+00	48" FM	VPA	Portsmouth Portal		SOE		48" FM 40' to 50' from proposed SOE
S8A	7	98+00 to 101+50	42" FM	VPA	Portsmouth Portal		SOE	Conflict	42" FM to be abandoned and filled with flowable fill, from STA 99_00 20 L east, under 42" FM Relocation project prior to start of this contract.
UTILITIES IMPACT NORFOLK SIDE OF MTT									
S100	12	127+00	Septic tank & drain field	VDOT	Norfolk Portal	Existing support facility	Support of Excavation (SOE)	Conflict	Remove septic tank and drain field
S101	12	127+50	6" SAN	VDOT	Norfolk Portal	Existing support facility	SOE	Conflict	From 6" service lateral, provide cleanout, 80 LF 6" PVC SAN to proposed packaged pump station.
S102	12	126+75	Duplex Submersible Grinder	VDOT	Norfolk Portal	Existing support facility	SOE	Conflict	Provide packaged duplex submersible grinder pump station ((2) 5-HP, 3-phase, 20gpm, 70 feet head, and remote control panel.)
S103	12	126+75	2" FM	VDOT	Norfolk Portal	Existing support facility	SOE	Conflict	360 LF 2" PVC FM from packaged pump station to connection at proposed 4" FM.
S104	12	129+50	4" FM	VDOT	Norfolk Portal	New Support facility	New Construction		285 LF 4" FM from proposed transfer station at new support facility, to connection point with proposed 2" FM.
S104B	12, 12D	129+50	4" FM	VDOT	Norfolk Portal	New Support facility	New Construction		2550 LF 4" FM from connection point with proposed 2" FM to HRSD manhole at Southampton and Colley Ave.
S104C	12D			VDOT	Norfolk Portal	New Support facility	New Construction		10 foot vertical offset under (3) 10'x3.5' box culverts, include 70 LF 12" steel casing (coated inside and out) for 4" FM.
S105	12, 13, 13E	131+25 to 136+50	2" FM	VDOT	Norfolk Portal	Crash House	MTT and proposed Ramp N	Conflict	630 LF 2" FM from packaged pump station at crash house to connection point at proposed 4" FM at bike trail.
S106	13E	136+50	Duplex Submersible Grinder	VDOT	Norfolk Portal	Crash House	MTT and proposed Ramp N	Conflict	Provide packaged duplex submersible grinder pump station ((2) 5-HP, 3-phase, 20gpm, 70 feet head, and remote control panel.)
S107	13, 13E	136+75	4" FM	VDOT	Norfolk Portal	Crash House	MTT and proposed Ramp N	Conflict	Abandon 240 LF 4" FM. Cap both ends and fill with flowable fill.
S107B	13	136+50	4" FM	VDOT	Norfolk Portal	Crash House	MTT and proposed Ramp N	Conflict	Remove 180 LF 4" FM. Plug invert at SMH# 71-12. (***Protect existing electrical duct***)

UTILITY IMPACTS TO THE MTT PORTION OF THE MTT-MLK PROJECT
WATER

No.	Plan Sheet No.	Approx. Stationing	Utility	Utility Owner	Location	Street	Utility Conflict	Disposition	Possible Solution Remarks
UTILITIES IMPACT PORTSMOUTH SIDE OF MTT									
W1	3	PROPOSED US 58 (WB) CONSTRUCTION BASELINE 75+25	8" W (AATUR)	VPA	Portsmouth Portal	Spencer St.	MTT Tie-In to MLK	Conflict	Remove 30 LF 8" Water and plug both ends
W2	3	75+50	4" W (AATUR)	VPA	Portsmouth Portal	Spencer St.	MTT Tie-In to MLK	Conflict	Remove 30 LF 4" Water and plug both ends
W3	3	75+75	6" W (AATUR)	VPA	Portsmouth Portal	Spencer St.	MTT Tie-In to MLK	Conflict	Remove 30 LF 6" Water and plug both ends
W4	3	77+00	8" W (AATUR)	Portsmouth PU	Portsmouth Portal	US 58 (WB)	MTT Tie-In to MLK	Conflict	Remove 130 LF 8" Water
W5	4, 5	79+50 TO 90+00	30" W (AATUR)	Norfolk DU	Portsmouth Portal	US 58 (WB)	MTT Tie-In to MLK	Conflict	Remove 1120 LF 30" Water
W6	5	88+25	36" W	Norfolk DU	Portsmouth Portal	Harper Ave.	Midtown Tunnel	Conflict	Remove 85 LF 36" Water
W7	5, 5F, 5G, 15		12" W	Portsmouth PU	Portsmouth Portal	Harper Ave.	New line for new support facility	New Construction	7000 LF 12" DIP Water from Chautauqua and Cleveland to PS at new support facility on Harper Ave. Includes (1) Jack & Bore under railroad (70 LF 24" steel casing pipe)
W8	5, 5C	88+25	8" W		Portsmouth Portal	Harper Ave.	MTT BOAT & cut & cover section	Conflict	265 LF temporary relocation of 8" DI Water during construction of MTT approach. Relocate over support of excavation (SOE). Include (2) 8" disconnect valves, 35 LF 18" steel casing pipe under crane work area. Intent is to locate temporary line on contractor's utility bridge and walkway (per discussion with SKW)
W8B	5, 5C	88+25	8" W		Portsmouth Portal	Harper Ave.	MTT BOAT & cut & cover section	Conflict	Replace 150 LF 8" DI Water after construction of roadway over boat section is complete.
W9	7	100+10	Water Service (2" ?)		Portsmouth Portal		MTT Tunnel section	Conflict	Restore water service to relocated building at end of pier. Building to be demolished during construction of the Midtown Tunnel. Then replaced after tunnel section constructed. It is anticipated that the location of building will be determined during the final design phase.
UTILITIES IMPACT NORFOLK SIDE OF MTT									
W100	12, 12D	131+25 to 129+50	10" W	VDOT	Norfolk Portal	Bike trail to proposed support building	New water and fire line to MTT	New Construction	2450 LF 10" DI Water from intersection of Brambleton & Riverview (routed to site along the bike path) to 10" tee for connection to proposed support building.
W100 B	12			VDOT	Norfolk Portal				(1) 10x8 reducer, 270 LF 8" DIP, (2) fire hydrants, (2) 8" valves
W100 C	12			VDOT	Norfolk Portal				(1) Jack & Bore, 50 LF 18" steel casing pipe (coated inside and out) for 8" DI water
W100 D	12D			VDOT	Norfolk Portal				12 foot vertical offset under (3) 10'x3.5' box culverts. Include 70 LF 24" steel casing pipe (coated inside and out) for 10" DI W
W101	12	129+50	10" W	VDOT	Norfolk Portal	Proposed support building	New water and fire line to MTT	New Construction	70 LF 10" DI Water for fire at 10" tee
W102	12	129+50	8" W	VDOT	Norfolk Portal	Proposed support building	New water and fire line to MTT	New Construction	50 LF 8" DI Water for fire, 10"x8" tee, (1) fire hydrant
W103	12, 13	130+00	4" W	VDOT	Norfolk Portal	Proposed support building	New water and fire line to MTT	New Construction	80 LF 6" DIP, one fire department connection
W104	12	129+50	6" W	VDOT	Norfolk Portal				160 LF 6" DI Water, from proposed 10" Water to existing support facility, include (1) 10"x6" tee.
W105	12		6" W	VDOT	Norfolk Portal				Abandon 6" Water from proposed 10" Water to existing support facility (after connection of proposed 6" Water)
W106	12	129+50	6" W	VDOT	Norfolk Portal				Connect existing 6" Water from West Olney Street to proposed 10" Water with 10"x6" tee.
W107	12, 13	131+75	6" W	VDOT	Norfolk Portal	US 58 (WB)	Support of Excavation (SOE)	Conflict	Provide 6" blind flange at tee for existing fire hydrant.
W108	12, 13	131+75 to 134+00	6" W	VDOT	Norfolk Portal	US 58 (WB)	SOE	Conflict	Abandon 220 LF 6" Water. Cap and fill with flowable fill.
W108 B	13	134+00 to 136+00	6" W	VDOT	Norfolk Portal	US 58 (WB)		Conflict	Remove 240 LF 6" Water
W108 C	13	136+00 to 137+25	6" W	VDOT	Norfolk Portal		Ramp N	Conflict	Abandon 110 LF 6" Water. Install 6" blind flange at West Olney.
W109	13	135+20	Water Service (size unk)	VDOT	Norfolk Portal		Ramp N	Conflict	Remove 60 LF Water (at service line (?). Size unknown)

	PROJECT	SHEET NO.
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Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
2-10-2011	VA.	—	0058-965-107 C-501	22(2B)

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UTILITY IMPACTS TO THE MTT PORTION OF THE MTT-MLK PROJECT
TELEPHONE / COMMUNICATIONS / FIBER OPTIC

No.	Plan Sheet No.	Test Hole No.	Approx. Stationing	Utility	Utility Owner	Location	Street	Utility Conflict	Disposition	Possible Solution Remarks
T1	3,4,5,5F,6,7		77+00 - 101+00/RT	Telephone/FO	Verizon	VPA	Service Road		Protect	
T2	3,4,5		77+00 - 87+00/RT	Telephone/FO	Verizon	MTT	Service Road		Protect	
T3	3,4,5	VDOT Permit #595-23	75+00 - 87+85/RT&LT	Telephone/FO	AT&T	MTT	Portsmouth Open Approach	Construction Open Approach	Conflict	Conflict - Sat 81+00 - 82+50 (Relocate/Offset) - Test Hole Required sat 79+50
T4	3,4,5		75+00 - 90+00/RT&LT	Telephone	Level3	MTT	Portsmouth Open Approach	Construction Open Approach	Conflict	Conflict - Sat 81+00 - 82+50 (Relocate/Offset) - Test Hole Required sat 79+50
T5	5		89+75/RT&LT	Telephone	Level3	MTT	Portsmouth Vent Building	Ventilation Build Construction	Conflict	Relocate
T6	3,4,5		75+00 - 90+00/RT	TC Duct	VDOT	MTT	Portsmouth Open Approach		Protect	
T7	3,4,5		75+00 - 90+00/RT&LT	TC Duct	VDOT	MTT	Portsmouth Open Approach	Construction Open Approach	Conflict	Relocate
T8	5		88+55	Telephone/FO	VPA	MTT	Access Road "P", Port Road "A"	Road Construction	Conflict	Relocate
T9	5		87+80 - 89+05/LT	Telephone	Level3	MTT	Portsmouth Open Approach	Construction Open Approach	Conflict	Relocate
T10	5		87+80 - 88+20/RT	TC Duct	VDOT	MTT	Access Road "P"	Road Construction	Protect	Test Hole Required
T11	5,5C		86+80 - 86+40LT	Telephone	VPA	MTT			Protect	
T12	5C,5F,6		91+40/RT&LT	Telephone/FO	VPA	MTT	Tunnel	Tunnel Const	Conflict	Relocate
T13	5F			Telephone	Verizon	MTT			Protect	
T14	5F		90+80/RT	Telephone/FO	VPA	MTT			Protect	
T15	5F		90+65/RT	Telephone	VPA	MTT			Protect	
T16	12,13		131+20 - 137+20	Telephone	Verizon/AT&T	MTT	Norfolk Open Approach	Construction Open Approach	Conflict	Relocate - Excavation 28' to 16' in Depth Station 131+00 - 135+50
T17	12,13		131+20 - 137+20	Telephone	Verizon/AT&T	MTT	Norfolk Open Approach	Construction Open Approach	Conflict	Relocate - Excavation 28' to 16' in Depth Station 131+00 - 135+50
T18	12,13		131+20 - 137+20	Telephone	Verizon/AT&T	MTT	Norfolk Open Approach	Construction Ventilation Building	Conflict	Relocate - Excavation 28' to 16' in Depth Station 131+00 - 135+50
T19	12,13		131+20 - 137+20	CATV	COX	MTT	Norfolk Open Approach	Construction Ventilation Building	Conflict	Relocate - Excavation 28' to 16' in Depth Station 131+00 - 135+50
T20	12,13		131+20 - 137+20	Telephone	Level3	MTT	Norfolk Open Approach	Construction Open Approach	Conflict	Relocate - Excavation 28' to 16' in Depth Station 131+00 - 135+50
T21	12,13		Right existing vent Building, Right Elizabeth River Trail	Telephone	AT&T	MTT			Protect	
T22	13E		Crash Bldg.	Telephone	Verizon	MTT	Crash Bldg.		Protect	
T23	12,13		Existing Vent Building - West Olney Rd.	Telephone	Level3	MTT	Norfolk Open Approach	Construction Open Approach	Conflict	Relocate - Excavation 28' to 16' in Depth Station 131+00 - 135+50
T24	12,13		Existing Vent Building - West Olney Rd.	Telephone	AT&T	MTT	Norfolk Open Approach	Construction Open Approach	Conflict	Relocate - Excavation 28' to 16' in Depth Station 131+00 - 135+50
T25	12,13		Right Existing Vent Building, Right Elizabeth Rive Trail	Telephone	AT&T	MTT			Protect	
T26	14C		Clairmont Street	CATV	Cox	MTT	Clairmont Street	Const. 36" Water Main	Relocate	Reroute Elec. Power Supply
T27	12,13		Right of Existing Vent Building	Cell Phone Service	Sprint, AT&T, Ntelos	MTT	Norfolk Open Approach		Protect	Maintain Existing Security Fence
T28	5		87+50	Cell Phone Service	Sprint, AT&T, Ntelos	Mtt	Portsmouth Open Approach		Protect	Maintain Existing Security Fence

UTILITY IMPACTS TO THE MTT PORTION OF THE MTT-MLK PROJECT
GAS

No.	Plan Sheet No.	Approx. Stationing	Utility	Utility Owner	Location	Street	Utility Conflict	Disposition	Possible Solution Remarks
G1	12,13	127+00 - 136+80	Gas 4"	VNG	MTT	Tunnel West Olney Rd.	Norfolk Open Approach Construction		Line Abandoned
G2	14C	Clairmont Street	Gas 2"	VNG	MTT	Clairmont Street	Const. 36" Water Main	Conflict	Relocate
G3	14C	Clairmont Street	Gas 4"	VNG	MTT	Clairmont Street	Const. 36" Water Main		Protect
G4	14C	Clairmont street	Gas 1 1/4"	VNG	MTT	Clairmont Street	Const. 36" Water Main	Conflict	Relocate

UTILITY IMPACTS TO THE MTT PORTION OF THE MTT-MLK PROJECT
ELECTRIC

No.	Plan Sheet No.	Approx. Stationing	Utility	Pole #	Utility Owner	Location	Street	Utility Conflict	Disposition	Possible Solution Remarks
E1	3,4,5	75+35 - 89+50	Electric		DVP	MTT	Portsmouth Open Approach	Construction Open Approach	Conflict	Relocate
E2	3,4,5	75+95 -87+10	Electric		DVP	MTT	Portsmouth Open Approach	Construction Open Approach	Conflict	Relocate
E3	5	85+10 - 87+20	Electric		DVP/VDOT	MTT	Portsmouth Open Approach	Construction Open Approach	Conflict	Relocate
E4	5	85+20 - 87+40	Electric		DVP/VDOT	MTT	Portsmouth Open Approach	Construction Open Approach	Conflict	Relocate
E5	5	87+05 - 87+50	Electric		DVP/VDOT	MTT	Portsmouth Open Approach	Construction Open Approach	Conflict	Relocate
E6	5	87+05 - 88+35	Electric		DVP/VDOT	MTT	Portsmouth Open Approach	Construction Open Approach	Conflict	Relocate
E7	5	86+65 - 89+45	Electric		VDOT	MTT	Access Drive "P", Port Road "A"	Road Construction	Conflict Potential	Test Hole Required
E8	5	89+25 - 89+90	Electric		Bldg. Service	MTT	Port Road "A"		Protect	
E9	5	86+25 - 87+10	Electric		VDOT	MTT	Service Existing Open Approach		Protect	
E10	5C	11+30 - 13+75	Electric		Port Authority	MTT	Port Road "A"	Road Construction	Protect	
E11	5C	12+00	Electric		Port Authority	MTT	Port Road "A"		Protect	
E12	5C,6	91+35/RT&LT	Electric		Port Authority	MTT	Port Road "B", Tunnel Construction	Tunnel Construction	Conflict	Relocate
E13	6	91+40/RT	Electric		Port Authority	MTT	Unknown		Protect	
E14	7	99+10 - 100+25/LT	Electric		Port Authority	MTT	Building	Tunnel Construction	Conflict	Relocate
E15	3,4,5	75+35 - 88+00/RT	Electric		VDOT	MTT	Portsmouth Open Approach	Construction Open Approach	Conflict	Remove
E16	13,14	137+60 - 141+30	Electric		VDOT	MTT	Ramp "N", West Olney	Road Construction	Potential Conflict	Test Hole Required
E17	13,13E	Existing Crossing EB & WB	Electric		VDOT	MTT	Exit Ramp Brambleton		Protect	
E18	14,14B	Existing Service	Electric		VDOT	MTT			Protect	
E19	14	Roadway Lighting	Electric		DVP/VDOT	MTT	Entrance Ramp Hampton Blvd.		Protect	
E20	14	Roadway Lighting	Electric		DVP/VDOT	MTT	Exit Ramp Hampton Blvd.		Protect	
E21	14	Roadway Lighting	Electric		DVP/VDOT	MTT	Exit ramp Hampton Blvd.		Protect	Test Hole Required
E23	13	Roadway Lighting	Electric		DVP/VDOT	MTT	135+70 - 137+50/RT&LT	Road Construction	Protect	Test Hole Required
E24	13	Roadway Lighting	Electric		DVP/VDOT	MTT	136+60 - 137+50/RT&LT	Road Construction	Protect	Test Hole Required
E25	12	Flood Gate House Power Service	Electric		VDOT	MTT	127+90 - 129+80	Norfolk Open Approach Construction	Protect	
E26	12	Tunnel Power Service	Electric	Transformer #OG50	DVP/VDOT	MTT	Elizabeth River Trail	Norfolk Open Approach Construction	Conflict	Relocate
E27	12	Tunnel Power Service	Electric		VDOT	MTT	Elizabeth River Trail	Norfolk Open Approach Construction	Conflict	Relocate
E28	12	Roadway Lighting	Electric		VDOT	MTT	VDOT Service Road		Protect	
E29	13	Roadway Lighting	Electric		VDOT	MTT	135+20 - 137+40/RT&LT	Norfolk Open Approach Construction	Conflict	Relocate
E30	14C	Distribution Service	Electric	P/P#PI16	DVP	MTT	Claremont Ave	36" Water Main	Conflict	Relocate
PP#1	12	131+10 LT	Electric	PP#OF47	DVP	MTT	Elizabeth River Trails	Norfolk Open Approach Construction	Conflict	Relocate
PP#2	12	130+60 LT	Electric	PP#OF36	VDOT	MTT		Norfolk Open Approach	Conflict	Relocate
PP#3	12	130+45 LT	Electric	PP#OG10	VDOT	MTT		Norfolk Open Approach	Conflict	Relocate
PP#4	12	129+10 LT	Electric	PP#NO90	VDOT	MTT		Norfolk Open Approach	Conflict	Relocate
PP#5	12	127+90 LT	Electric	PP#NF79	VDOT	MTT		Norfolk Open Approach Construction	Conflict	Relocate
PP#6	12	131+35 LT	Electric	PP#OF39	DVP	MTT	Elizabeth River Trails	Norfolk Open Approach Construction	Conflict	Relocate
PP#7	13		Electric	PP#OG98	DVP	MTT	West Olney Rd.		Protect	
TC1	14B	239+35	Electric		VDOT	MTT	Ramp "N"	Ramp Construction	Conflict	Relocate
TC2	14B	239+64	Electric		VDOT	MTT	Ramp "N"	Ramp Construction	Conflict	Relocate

PROJECT	SHEET NO.
____-___-___	22(2B)

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16-MAR-2011
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PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
DESIGNED BY Parsons Brinckerhoff (757) 466-1732

Existing Sanitary Structure Survey Data

In Pl SMH#54-50
Rim=9.75
Inv In=5.45(SW)
BOS=0.80
Surcharged

In Pl SMH#54-51
Rim=8.53
BOS=1.70
Surcharged

In Pl SMH#54-52
Rim=9.06
Inv In=2.17(E)
Inv In=2.11(W)
Inv Out=2.01(N)

In Pl SMH#54-55
Rim=8.90
Inv In=2.30(E)
Inv In=3.70(S)
Inv Out=2.37(W)

In Pl SMH#56-34
Rim=10.98
Inv In=6.99(E)
Inv Out=6.98(W)

In Pl SMH#56-35
Rim=13.38
Inv In=5.16(E)
Inv In=4.46(W)
Inv Out=4.42(N) 10"DIP

In Pl SMH#56-36
Rim=13.46
Inv In=4.36(S)
Inv In=4.46(E)
Inv Out=4.34(N)

In Pl SMH#56-37
Rim=14.04
Inv In=5.76(W)
Inv Out=5.76(E)

In Pl SMH#56-38
Rim=14.14
Inv In=5.96(W)
Inv In=7.44(S)
Inv Out=6.00(E)

In Pl SMH#56-39
Rim=14.30
Inv In=7.05(S)
Inv In=6.15(W)
Inv Out=6.14(E)

In Pl SMH#56-41
Rim=14.48
Inv In=6.45(W)
Inv In=6.44(S)
Inv Out=6.44(E)

In Pl SMH#56-52
Rim=12.89
Inv In=10.14(SW)
Inv Out=10.12(N)

In Pl SMH#57-23
Rim=7.75
BOS=4.01
No Pipes Found

In Pl SMH#57-50
Rim=9.01
Inaccessable

In Pl SMH#58-50
Rim=8.35
Inv In=5.85(E)
BOS=2.85
Surcharged

In Pl SMH#58-54
Rim=9.36
Inv In=3.18(W)
Inv Out=3.16(E)

In Pl SMH#60-51
Rim=7.70
Inv In=2.63(N)
Inv In=2.68(S)
Inv Out=2.59(SW)

In Pl SMH#60-52
Rim=8.12
Inv=Inaccessable

In Pl SMH#60-53
Rim=8.02
Inv In=3.95(E)
Inv In=4.09(N)
Inv Out=3.93(W)

In Pl SMH#61-60
Rim=3.96
BOS=-3.68
Surcharged

In Pl SMH#61-61
Rim=4.87
Inv In=2.59
BOS=-3.03
Surcharged

In Pl SMH#61-62
Rim=7.91
Inv In=3.51(NW)
Inv Out=3.49(SW)

In Pl SMH#61-63
Rim=6.97
Inv In=4.12(NW)
Inv In=4.12(NE)
Inv Out=4.12(SW)

In Pl SMH#62-60
Rim=6.95
Inv In=2.89(N)
Inv In=2.61(NW)
Inv Out=2.60(SE)

In Pl SMH#62-61
Rim=6.92
Inv In=2.52(N)
Inv In=1.57(NW)
Inv Out=1.47(SE)

In Pl SMH#70-2
Rim=7.77
Inv In=0.65(SE)
Inv Out=0.69(NW)

In Pl SMH#70-4
Rim=6.85
Inv In=0.05(SE)
Inv In=-0.23(SW)
Inv In=-0.21(NE)
Inv Out=-0.27(NW)

In Pl SMH#70-8
Rim=8.20
Inv In=0.72(SE)
Inv In=0.62(SW)
Inv In=0.61(NE)
Inv Out=0.59(NW)

In Pl SMH#70-9
Rim=7.33
Inv In=0.17(SE)
Inv In=0.05(SW)
Inv In=0.07(NE)
Inv Out=0.04(NW)

In Pl SMH#71-1
Rim=7.95
Inv In=1.52(NW)
Inv In=1.57(E)
Inv In=1.64(S)
Inv Out=1.50(SE)

In Pl SMH#71-2
Rim=6.99
Inv In=1.00(SE)
Inv Out=0.84(NW)

In Pl SMH#71-3
Rim=7.22
Inv In=1.07(NW)
Inv In=3.22(SW)
Inv Out=1.07(SE)

In Pl SMH#71-4
Rim=6.10
Inv In=2.17(SE)
Inv Out=2.14(NW)

In Pl SMH#71-5
Rim=6.35
Surcharged
Inv In=0.48(SE)
Inv Out=0.55(NW)

In Pl SMH#71-12
Rim=6.14
Inv In=3.14(NE)
Inv In=3.14(SW)
Inv Out=3.01(NW)

In Pl SMH#74-1
Rim=8.65
Inv In=0.27(NW)
Inv Out=0.26(SE)

In Pl SMH#74-2
Rim=8.43
Inv In=0.73(S)
Inv In=-0.01(NW)
Inv Out=-0.02(SE)

In Pl SMH#74-3
Rim=8.23
Inv In=0.01(SW)
Inv In=-0.51(NW)
Inv In=0.13(NE)
Inv Out=-0.52(SE)

In Pl SMH#74-5
Rim=9.85
Inv In=1.05(NW)
Inv In=2.78(NE)
Inv Out=0.95(SE)

In Pl SMH#74-6
Rim=8.97
Inv In=0.97(NW)
Inv In=0.88(NE)
Inv In=0.93(SE)
Inv Out=0.79(SW)

In Pl SMH#74-7
Rim=8.33
Inv In=0.21(NE)
Inv In=0.21(SW)
Inv Out=0.08(NW)

In Pl SMH#74-9
Rim=10.23
Inv In=4.19(SW)
Inv Out=4.18(NE)

In Pl SMH#74-10
Rim=9.26
Inv In=4.78(S)
Inv Out=4.77(NE)

In Pl SMH#74-11
Rim=9.53
Inv In=5.07(SE)
Inv Out=5.03(N)

In Pl SMH#75-6
Rim=7.65
Inv In=-1.16(NW)
Inv Out=-1.23(SE)

In Pl SMH#75-7
Rim=7.10
Inv In=-1.80(SW)
Inv In=1.70(W)
Inv In=-2.00(NW)
Inv Out=-2.10(SE)

In Pl SMH#75-8
Rim=7.32
Inv In=-0.09(SE)
Inv Out=-0.22(NE)

In Pl SMH#76-1
Rim=6.60
Inv In=0.85(SE)
Inv Out=0.80(NW)

In Pl SMH#76-2
Rim=5.84
Inv In=-2.96(NW)
Inv In=0.74(S)
Inv Out=-3.30(SE)

In Pl SMH#76-12
Rim=5.13
Inv In=-3.91(NW)
Inv In=-4.11(NE)
Inv Out=-4.13(SE)

In Pl SMH#76-13
Rim=5.05
Inv In=-4.23(NW)
Inv In=-4.18(NE)
Inv Out=-4.38(SE)

In Pl SMH#76-14
Rim=5.44
Inv In=-4.13(NW)
Inv In=1.77(SW)
Inv Out=-4.28(SE)

In Pl SMH#76-17
Rim=5.83
Inv In=-2.65(SE)
Inv In=-2.42(NW)
Inv Out=-2.76(SW)

In Pl SMH#76-18
Rim=5.28
Inv In=-3.11(NE)
Inv Out=-3.16(SW)

In Pl SMH#77-13
Rim=7.00
Inv In=-4.83(NW)
Inv Out=-4.92(SE)

In Pl SMH#77-14
Rim=7.02
Inv In=-4.89(NW)
Inv In=-0.58(NE)
Inv Out=-5.03(SE)

In Pl SMH#77-15
Rim=7.38
Inv In=1.08(NW)
Inv Out=1.00(SW)

In Pl SMH#77-18
Rim=7.26
Inv In=5.58(NW)
Inv Out=-5.78(SE)

In Pl DI#78-2
Rim=7.45
Inv In=1.80(NW)
Inv In=1.60(SW)
Inv Out=1.60(SE)

In Pl DI#78-5
Rim=8.17
Inv In=1.17(NW)
Inv In=1.22(SW)
Inv Out=1.17(SE)

In Pl SMH#78-6
Rim=8.36
Inv In=-5.64(NW)
Inv In=2.66(SW)
Inv Out=-5.75(SE)

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-107 C-501	22(2C)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

THESE PLANS ARE UNFINISHED AND UNAPPROVED AND ARE NOT TO BE USED FOR ANY TYPE OF CONSTRUCTION OR THE ACQUISITION OF RIGHT OF WAY.

	PROJECT	SHEET NO.
	____-___-___	22(2C)

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16-MAR-2011
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18:25

PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
DESIGNED BY Parsons Brinckerhoff (757) 466-1732

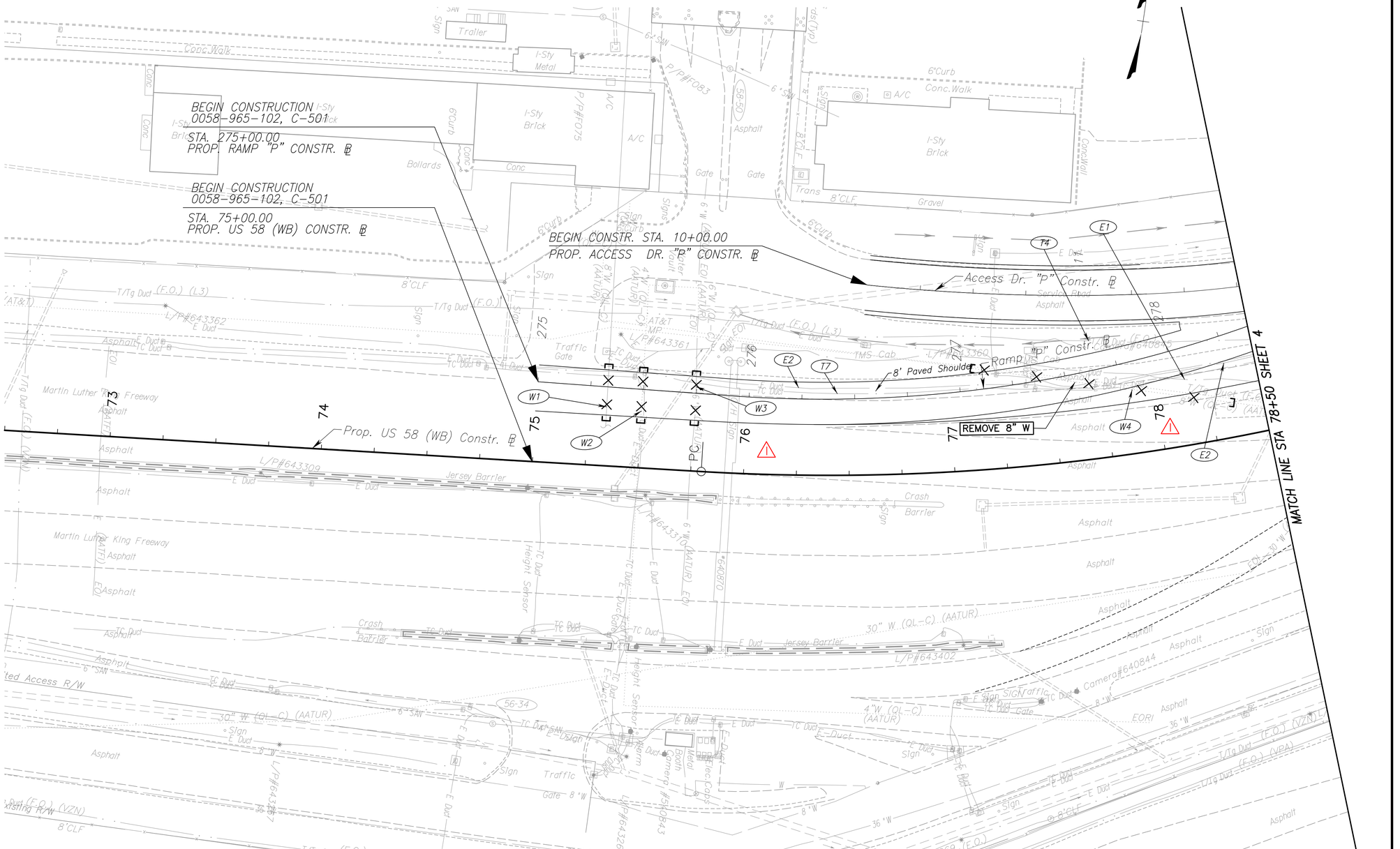
UTILITY OWNERS:
Electric: Dominion Virginia Power
Gas: Virginia Natural Gas
Columbia Gas Transmissions
Sanitary: Hampton Roads Sanitation District
City of Norfolk
City of Portsmouth
Telephone: Verizon Communications
Cox Communications
AT&T
Cavalier Telephone
Level3/KMC/Adelphia/Telcov
Traffic: Virginia Department of Transportation
T.V.: Cox Communications
Water: City of Norfolk
City of Portsmouth

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

REVISED	STATE	STATE ROUTE	STATE PROJECT	STATE SHEET NO.
2-10-2011	VA.	—	0058-965-102, C-501	22(3)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

US 58



UTILITY RELOCATION LEGEND

8 "SAN	Proposed Utility Size & Type
6 "W	Abandon
6 "W	Remove
6" W	Pipe Casing
6 "W	Coupling
○	San Manhole

Utility Conflict Designations
(# indicates unique designation number)

E#	Electrical Duct/Pole/Light
G#	Gas Line
PP#	Electric Power Pole
S#	Sanitary Sewer Line
T#	Telephone/Communications/ Fiber Optic
TT#	Electric Transmission Tower
W#	Water Line

THESE PLANS ARE UNFINISHED AND UNAPPROVED AND ARE NOT TO BE USED FOR ANY TYPE OF CONSTRUCTION OR THE ACQUISITION OF RIGHT OF WAY.

SCALE 0 25' 50'

PROJECT	SHEET NO.
___-___-___	22(3)

16-MAR-2011

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PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
DESIGNED BY Parsons Brinckerhoff (757) 466-1732

UTILITY OWNERS:
Electric: Dominion Virginia Power
Gas: Virginia Natural Gas
Columbia Gas Transmissions
Sanitary: Hampton Roads Sanitation District
City of Norfolk
City of Portsmouth
Telephone: Verizon Communications
Cox Communications
AT&T
Cavalier Telephone
Level3/KMC/Adelphia/Telcov
Traffic: Virginia Department of Transportation
T.V.: Cox Communications
Water: City of Norfolk
City of Portsmouth

UTILITY RELOCATION LEGEND

8 "SAN	Proposed Utility Size & Type
6 "W	Abandon
6 "W	Remove
6 "W	Pipe Casing
6 "W	Coupling
○	San Manhole

Utility Conflict Designations
(# indicates unique designation number)

- (E#) Electrical Duct/Pole/Light
- (G#) Gas Line
- (PP#) Electric Power Pole
- (S#) Sanitary Sewer Line
- (T#) Telephone/Communications/ Fiber Optic
- (TT#) Electric Transmission Tower
- (W#) Water Line

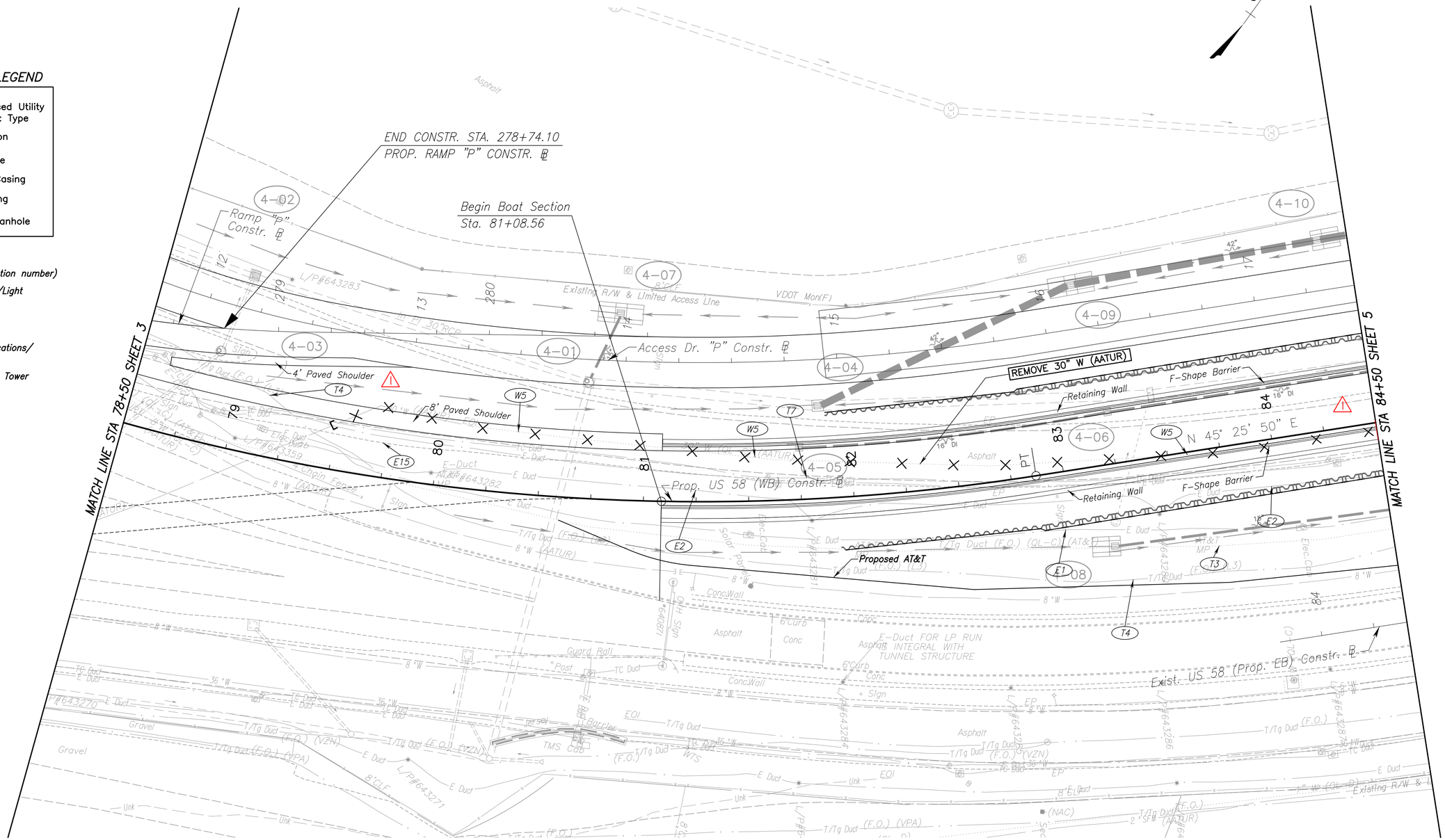
THESE PLANS ARE UNFINISHED AND UNAPPROVED AND ARE NOT TO BE USED FOR ANY TYPE OF CONSTRUCTION OR THE ACQUISITION OF RIGHT OF WAY.

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
2-10-2011	VA.	—	0058-965-102, C-501	22(4)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

US 58



SCALE 0 25' 50'

PROJECT	SHEET NO.
___-___-___	22(4)

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REVISED	STATE	STATE		SHEET NO.
		ROUTE	PROJECT	
2-10-2011	VA.	—	0058-965-102, C-501	22(5)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

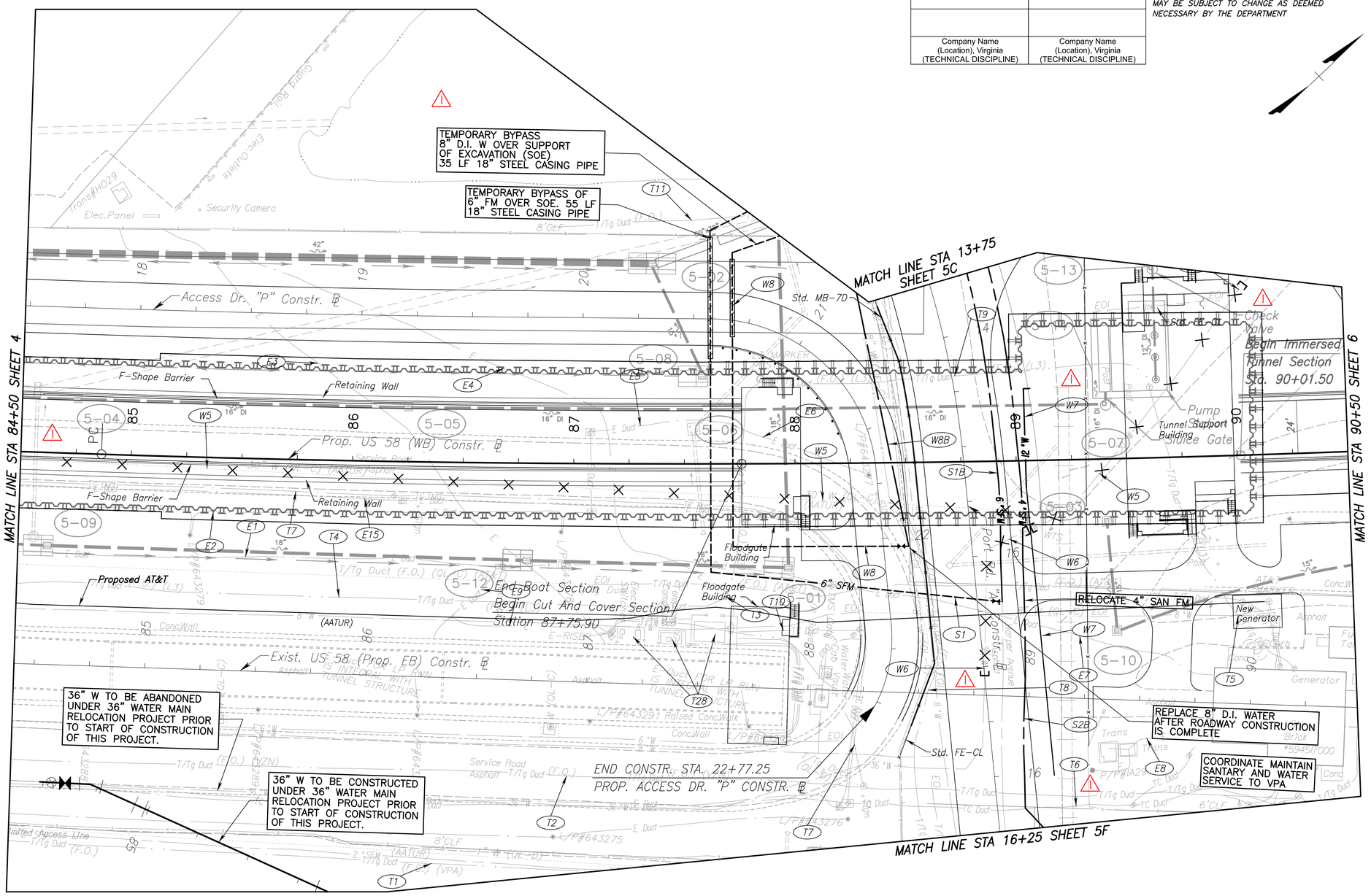
Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
DESIGNED BY Parsons Brinckerhoff (757) 466-1732

UTILITY OWNERS:
Electric: Dominion Virginia Power
Gas: Virginia Natural Gas
Columbia Gas Transmissions
Sanitary: Hampton Roads Sanitation District
City of Norfolk
City of Portsmouth
Telephone: Verizon Communications
Cox Communications
AT&T
Cavalier Telephone
Level3/KMC/Adelphia/Telcov
Traffic: Virginia Department of Transportation
T.V.: Cox Communications
Water: City of Norfolk
City of Portsmouth

Utility Conflict Designations
(# indicates unique designation number)

- E# Electrical Duct/Pole/Light
- G# Gas Line
- PP# Electric Power Pole
- S# Sanitary Sewer Line
- T# Telephone/Communications/ Fiber Optic
- TT# Electric Transmission Tower
- W# Water Line



UTILITY RELOCATION LEGEND

- 8 "SAW — Proposed Utility Size & Type
- 6 "W — Abandon
- 6 "W — Remove
- 6 "W — Pipe Casing
- 6 "W — Coupling
- San Manhole

THESE PLANS ARE UNFINISHED AND UNAPPROVED AND ARE NOT TO BE USED FOR ANY TYPE OF CONSTRUCTION OR THE ACQUISITION OF RIGHT OF WAY.

SCALE 0 25' 50'

	PROJECT	SHEET NO.
	___-___-___	22(5)

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16-MAR-2011
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16-MAR-2011
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PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
DESIGNED BY Parsons Brinckerhoff (757) 466-1732

UTILITY OWNERS:
Electric: Dominion Virginia Power
Gas: Virginia Natural Gas
Columbia Gas Transmissions
Sanitary: Hampton Roads Sanitation District
City of Norfolk
City of Portsmouth
Telephone: Verizon Communications
Cox Communications
AT&T
Cavalier Telephone
Level3/KMC/Adelphia/Telcov
Traffic: Virginia Department of Transportation
T.V.: Cox Communications
Water: City of Norfolk
City of Portsmouth

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
2-10-2011	VA.	—	0058-965-102, C-501	22(5C)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

Port Rd. "B"

BEGIN CONSTR. STA. 10+00.00
PROP. PORT RD. "A" CONSTR. ℄

Port Rd. "A" Constr. ℄

BEGIN CONSTR. STA. 10+00.00
PROP. PORT RD. "B" CONSTR. ℄
PROP. PORT RD. "A" STA. 13+36.64

END CONSTR. STA. 14+93.27
PROP. PORT RD. "B" CONSTR. ℄

Port Rd. "B" Constr. ℄

RELOCATE 4" FM AFTER ROADWAY CONSTRUCTION IS COMPLETE

TEMPORARY PUMP AND HAUL FACILITY 4" SAN FM UNTIL RELOCATION OF NEW 4" FM IS COMPLETE

30"W TO BE ABANDONED UNDER 36" WATER MAIN RELOCATION PROJECT PRIOR TO START OF CONSTRUCTION OF THIS PROJECT.

ABANDON 4" SAN FM

REPLACE 6" SAN FM DURING RESTORATION OF HARPER AVE

REPLACE 8" D.I. WATER AFTER ROADWAY CONSTRUCTION IS COMPLETE

REMOVE 4" SAN FM

MATCH LINE STA 13+75 SHEET 5

MATCH LINE SHEET 6

Utility Conflict Designations
(# indicates unique designation number)
E# Electrical Duct/Pole/Light
G# Gas Line
PP# Electric Power Pole
S# Sanitary Sewer Line
T# Telephone/Communications/ Fiber Optic
TT# Electric Transmission Tower
W# Water Line

UTILITY RELOCATION LEGEND

8 "SAW	Proposed Utility Size & Type
6 "W	Abandon
6 "W	Remove
6"W	Pipe Casing
6 "W	Coupling
○	San Manhole

THESE PLANS ARE UNFINISHED AND UNAPPROVED AND ARE NOT TO BE USED FOR ANY TYPE OF CONSTRUCTION OR THE ACQUISITION OF RIGHT OF WAY.

SCALE	PROJECT	SHEET NO.
0 25' 50'	—-—-—	22(5C)

PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
DESIGNED BY Parsons Brinckerhoff (757) 466-1732

UTILITY OWNERS:

Electric:	Dominion Virginia Power
Gas:	Virginia Natural Gas Columbia Gas Transmissions
Sanitary:	Hampton Roads Sanitation District City of Norfolk City of Portsmouth
Telephone:	Verizon Communications Cox Communications AT&T Cavalier Telephone Level3/KMC/Adelphia/Telcov
Traffic:	Virginia Department of Transportation
T.V.:	Cox Communications
Water:	City of Norfolk City of Portsmouth

Utility Conflict Designations
(# indicates unique designation number)

- (E#) Electrical Duct/Pole/Light
- (G#) Gas Line
- (PP#) Electric Power Pole
- (S#) Sanitary Sewer Line
- (T#) Telephone/Communications/ Fiber Optic
- (TT#) Electric Transmission Tower
- (W#) Water Line

UTILITY RELOCATION LEGEND

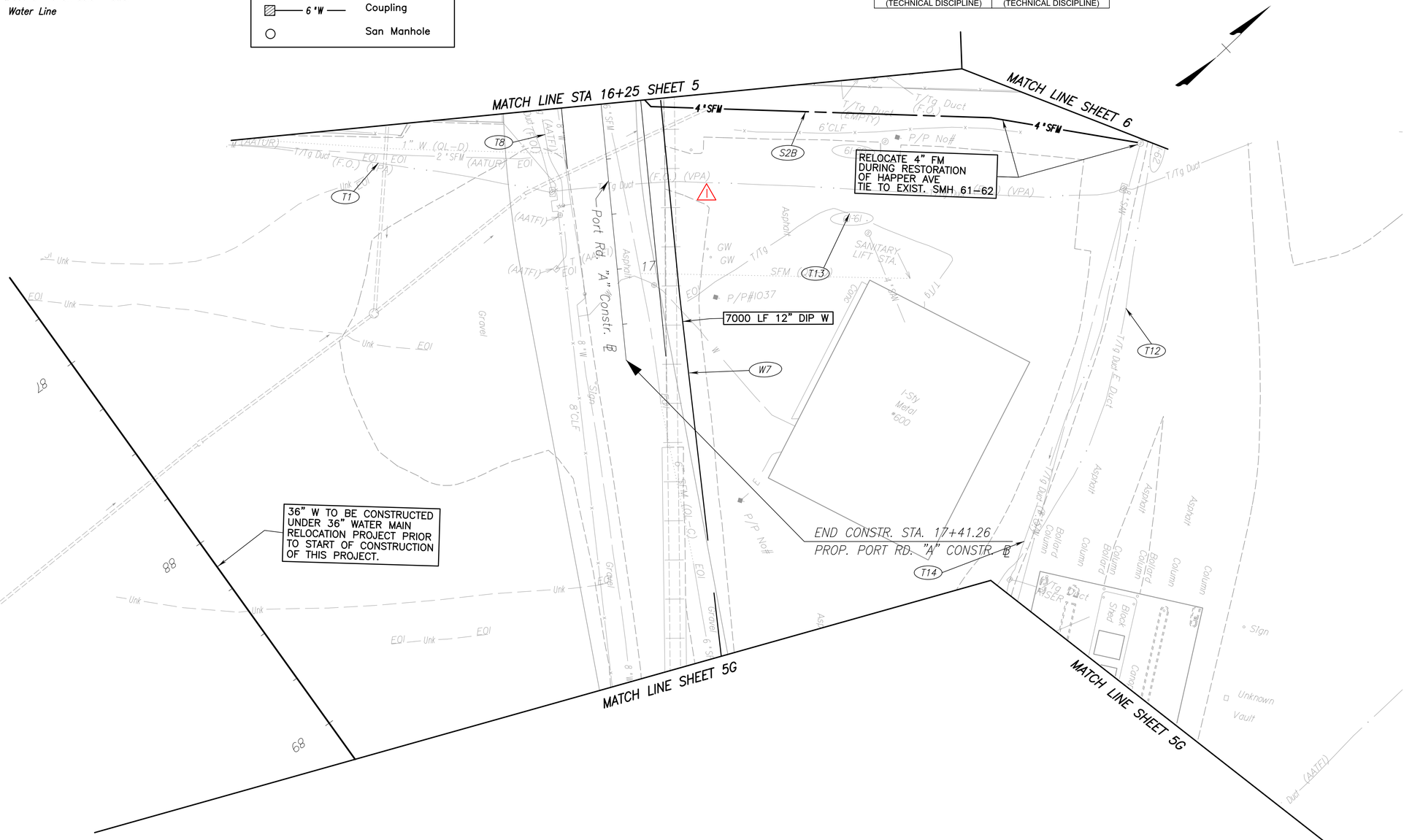
- 8 "SAN — Proposed Utility Size & Type
- 6 "W — Abandon
- 6 "W — Remove
- 6 "W — Pipe Casing
- 6 "W — Coupling
- San Manhole

THESE PLANS ARE UNFINISHED AND UNAPPROVED AND ARE NOT TO BE USED FOR ANY TYPE OF CONSTRUCTION OR THE ACQUISITION OF RIGHT OF WAY.

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

REVISED	STATE	ROUTE	PROJECT	SHEET NO.
2-10-2011 3-17-2011	VA.	—	0058-965-102, C-501 22(5F)	22(5F)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT



*NEW TOPOGRAPHIC SURVEY RECENTLY OBTAINED FOR AREAS DEPICTED ON PLAN SHEETS 22(5F), 22(5G), 22(5H), 22(5J). PRELIMINARY DESIGN OF UTILITY RELOCATIONS DEPICTED ON THESE PLAN SHEETS DID NOT ACCOUNT FOR POTENTIAL CONFLICTS INTRODUCED BY THE NEW SURVEY.

SCALE 0 25' 50'

PROJECT	SHEET NO.
- - - -	22(5F)

18:26

PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
DESIGNED BY Parsons Brinckerhoff (757) 466-1732

UTILITY OWNERS:

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Traffic:	Virginia Department of Transportation
T.V.:	Cox Communications
Water:	City of Norfolk City of Portsmouth

Utility Conflict Designations
(# indicates unique designation number)

- (E#) Electrical Duct/Pole/Light
- (G#) Gas Line
- (PP#) Electric Power Pole
- (S#) Sanitary Sewer Line
- (T#) Telephone/Communications/ Fiber Optic
- (TT#) Electric Transmission Tower
- (W#) Water Line

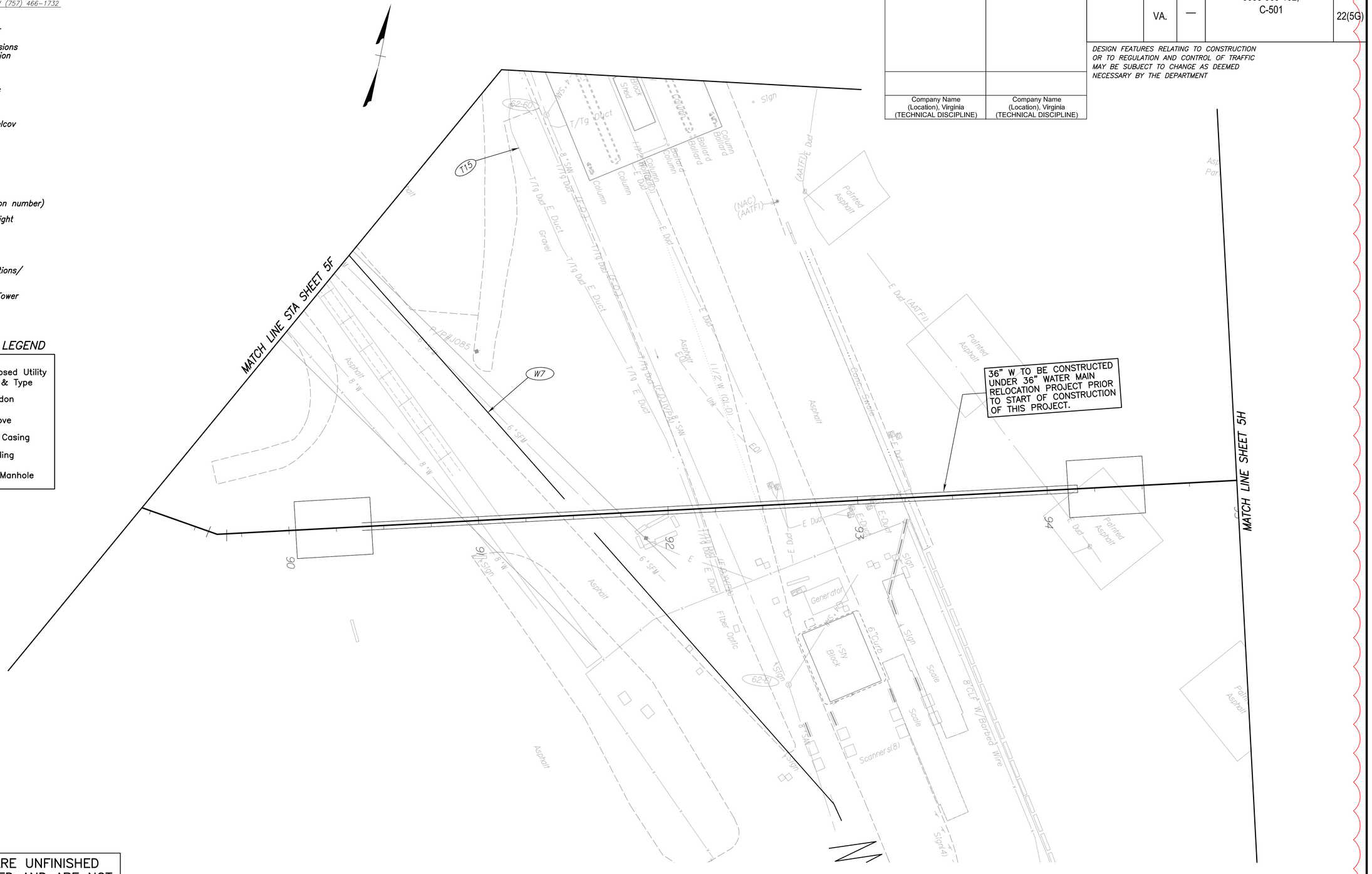
UTILITY RELOCATION LEGEND

- 8"SAN — Proposed Utility Size & Type
- 6"W — Abandon
- 6"W — Remove
- 6"W — Pipe Casing
- 6"W — Coupling
- San Manhole

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

REVISED	STATE	STATE ROUTE	PROJECT	SHEET NO.
2-10-2011 3-17-2011	VA.	—	0058-965-102, C-501	22(5G)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT



THESE PLANS ARE UNFINISHED AND UNAPPROVED AND ARE NOT TO BE USED FOR ANY TYPE OF CONSTRUCTION OR THE ACQUISITION OF RIGHT OF WAY.

*NEW TOPOGRAPHIC SURVEY RECENTLY OBTAINED FOR AREAS DEPICTED ON PLAN SHEETS 22(5F), 22(5G), 22(5H), 22(5J). PRELIMINARY DESIGN OF UTILITY RELOCATIONS DEPICTED ON THESE PLAN SHEETS DID NOT ACCOUNT FOR POTENTIAL CONFLICTS INTRODUCED BY THE NEW SURVEY.

2 1

SCALE	PROJECT	SHEET NO.
0 25' 50'	- - -	22(5G)

16-MAR-2011

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PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
DESIGNED BY Parsons Brinckerhoff (757) 466-1732

UTILITY OWNERS:

Electric:	Dominion Virginia Power
Gas:	Virginia Natural Gas
	Columbia Gas Transmissions
Sanitary:	Hampton Roads Sanitation District
	City of Norfolk
	City of Portsmouth
Telephone:	Verizon Communications
	Cox Communications
	AT&T
	Cavalier Telephone
	Level3/KMC/Adelphia/Telcov
Traffic:	Virginia Department of Transportation
T.V.:	Cox Communications
Water:	City of Norfolk
	City of Portsmouth

Utility Conflict Designations
(# indicates unique designation number)

- (E#) Electrical Duct/Pole/Light
- (G#) Gas Line
- (PP#) Electric Power Pole
- (S#) Sanitary Sewer Line
- (T#) Telephone/Communications/ Fiber Optic
- (TT#) Electric Transmission Tower
- (W#) Water Line

UTILITY RELOCATION LEGEND

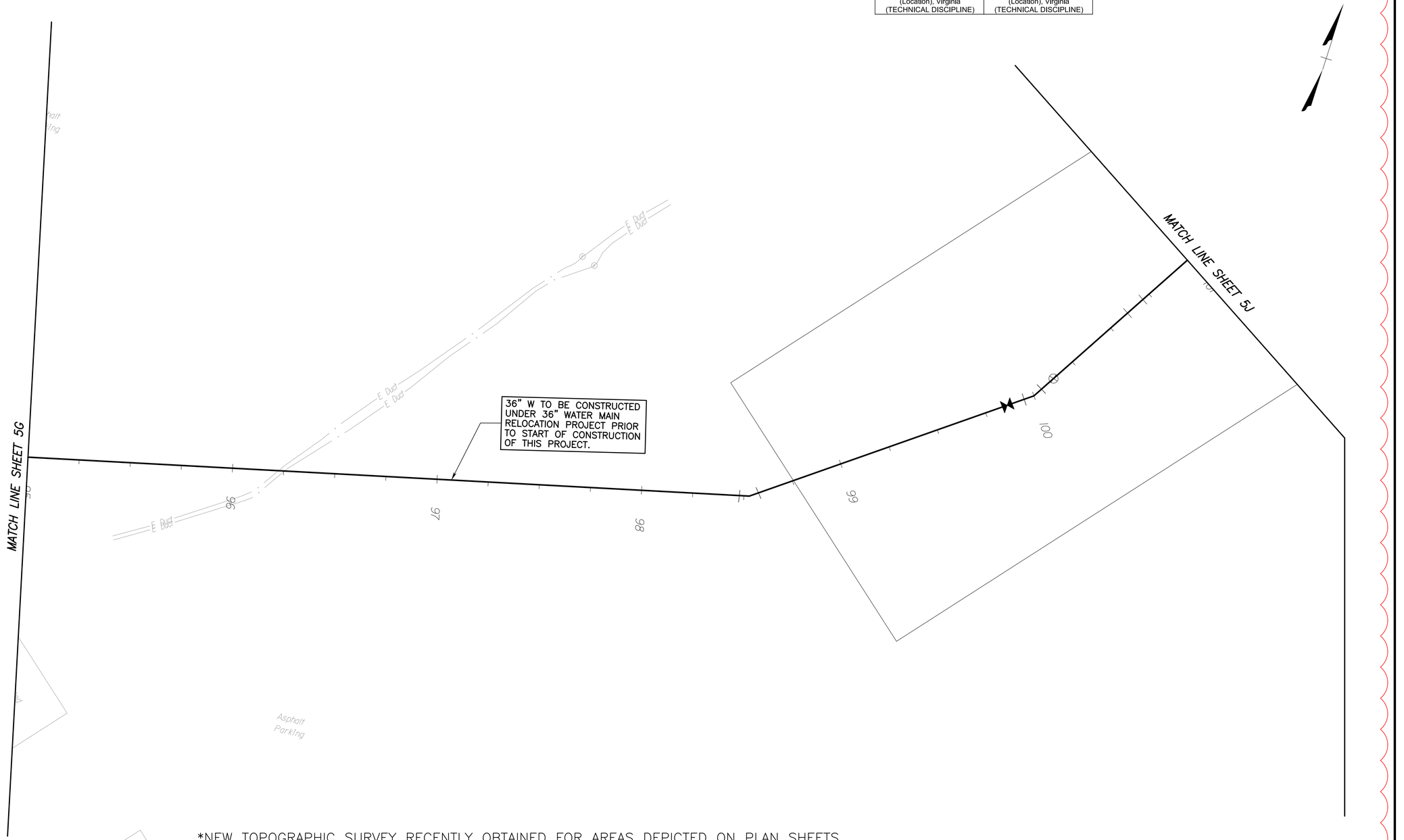
- 8 "SAN — Proposed Utility Size & Type
- 6 "W — Abandon
- 6 "W — Remove
- 6 "W — Pipe Casing
- 6 "W — Coupling
- San Manhole

THESE PLANS ARE UNFINISHED AND UNAPPROVED AND ARE NOT TO BE USED FOR ANY TYPE OF CONSTRUCTION OR THE ACQUISITION OF RIGHT OF WAY.

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

REVISED	STATE	STATE ROUTE	PROJECT	SHEET NO.
2-10-2011 3-17-2011	VA.	—	0058-965-102, C-501	22(5H)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT



*NEW TOPOGRAPHIC SURVEY RECENTLY OBTAINED FOR AREAS DEPICTED ON PLAN SHEETS 22(5F), 22(5G), 22(5H), 22(5J). PRELIMINARY DESIGN OF UTILITY RELOCATIONS DEPICTED ON THESE PLAN SHEETS DID NOT ACCOUNT FOR POTENTIAL CONFLICTS INTRODUCED BY THE NEW SURVEY.

SCALE	PROJECT	SHEET NO.
0 25' 50'		22(5H)

PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
DESIGNED BY Parsons Brinckerhoff (757) 466-1732

UTILITY OWNERS:
Electric: Dominion Virginia Power
Gas: Virginia Natural Gas
Columbia Gas Transmissions
Sanitary: Hampton Roads Sanitation District
City of Norfolk
City of Portsmouth
Telephone: Verizon Communications
Cox Communications
AT&T
Cavalier Telephone
Level3/KMC/Adelphia/Telcov
Traffic: Virginia Department of Transportation
T.V.: Cox Communications
Water: City of Norfolk
City of Portsmouth

Utility Conflict Designations
(# indicates unique designation number)

- (E#) Electrical Duct/Pole/Light
- (G#) Gas Line
- (PP#) Electric Power Pole
- (S#) Sanitary Sewer Line
- (T#) Telephone/Communications/ Fiber Optic
- (TT#) Electric Transmission Tower
- (W#) Water Line

UTILITY RELOCATION LEGEND

- 8 "SAN — Proposed Utility Size & Type
- 6 "W — Abandon
- 6 "W — Remove
- 6 "W — Pipe Casing
- 6 "W — Coupling
- San Manhole

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
2-10-2011 3-17-2011	VA.	—	0058-965-102, C-501	22(5J)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT



ELIZABETH RIVER

*NEW TOPOGRAPHIC SURVEY RECENTLY OBTAINED FOR AREAS DEPICTED ON PLAN SHEETS 22(5F), 22(5G), 22(5H), 22(5J). PRELIMINARY DESIGN OF UTILITY RELOCATIONS DEPICTED ON THESE PLAN SHEETS DID NOT ACCOUNT FOR POTENTIAL CONFLICTS INTRODUCED BY THE NEW SURVEY.

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2 1

SCALE	PROJECT	SHEET NO.
0 25' 50'	- - -	22(5J)

18:34
16-MAR-2011
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PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
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UTILITY OWNERS:
Electric: Dominion Virginia Power
Gas: Virginia Natural Gas
Columbia Gas Transmissions
Sanitary: Hampton Roads Sanitation District
City of Norfolk
City of Portsmouth
Telephone: Verizon Communications
Cox Communications
AT&T
Cavalier Telephone
Level3/KMC/Adelphia/Telcov
Traffic: Virginia Department of Transportation
T.V.: Cox Communications
Water: City of Norfolk
City of Portsmouth

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-102, C-501	22(6)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

US 58

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

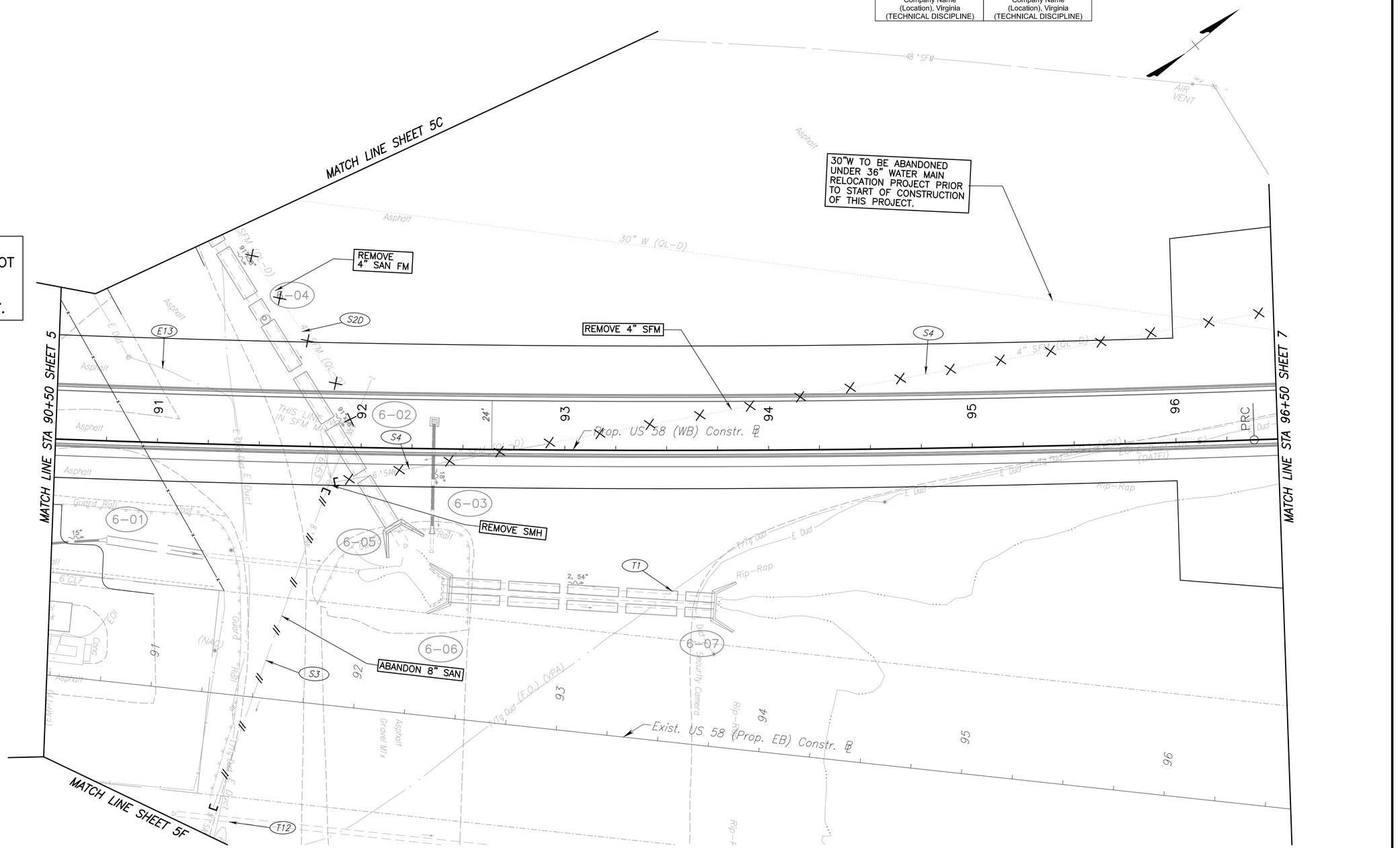
THESE PLANS ARE UNFINISHED AND UNAPPROVED AND ARE NOT TO BE USED FOR ANY TYPE OF CONSTRUCTION OR THE ACQUISITION OF RIGHT OF WAY.

UTILITY RELOCATION LEGEND

8 "SAN	Proposed Utility Size & Type
6 "W	Abandon
6 "W	Remove
6 "W	Pipe Casing
6 "W	Coupling
	San Manhole

Utility Conflict Designations
(# indicates unique designation number)

- E# Electrical Duct/Pole/Light
- G# Gas Line
- PP# Electric Power Pole
- S# Sanitary Sewer Line
- T# Telephone/Communications/ Fiber Optic
- TT# Electric Transmission Tower
- W# Water Line



SCALE 0 25' 50'

PROJECT	SHEET NO.
—-—-—	22(6)

16-MAR-2011
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18:26

18:26

PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
DESIGNED BY Parsons Brinckerhoff (757) 466-1732

UTILITY OWNERS:
Electric: Dominion Virginia Power
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City of Norfolk
City of Portsmouth
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AT&T
Cavalier Telephone
Level3/KMC/Adelphia/Telcov
Traffic: Virginia Department of Transportation
T.V.: Cox Communications
Water: City of Norfolk
City of Portsmouth

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UTILITY RELOCATION LEGEND

8 "SAN	Proposed Utility Size & Type
6 "W //	Abandon
6 "W X	Remove
6 "W	Pipe Casing
6 "W	Coupling
○	San Manhole

Utility Conflict Designations
(# indicates unique designation number)

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- (W#) Water Line

42" FM TO BE ABANDONED AND FILLED WITH FLOWABLE FILL UNDER 42" FM RELOCATION PROJECT PRIOR TO START OF THIS PROJECT.

REMOVE 4" SFM

30"W TO BE ABANDONED UNDER 36" WATER MAIN RELOCATION PROJECT PRIOR TO START OF CONSTRUCTION OF THIS PROJECT.

2 STORY BLOCK BUILDING TO BE DEMOLISHED DURING CONSTRUCTION OF MTT AND REPLACED AFTERWARDS.
PROVIDE DUPLEX SUBMERSIBLE GRINDER PUMP PACKAGE ((2) -5HP, 3-PHASE, 20GPM, 70 FEET HEAD REMOTE CONTROL PANEL)
PROVIDE APPROXIMATELY 1600 LF 4" FM, INCLUDE (2) ARV
EXACT LOCATION OF WATER AND SEWER TO BE DETERMINED AT SUBSEQUENT DESIGN PHASES.

MATCH LINE STA 96+50 SHEET 6

MATCH LINE STA 102+50 SHEET 8

Prop. US 58 (WB) Constr. ℄

Exist. US 58 (Prop. EB) Constr. ℄

REVISED	STATE	STATE		SHEET NO.
2-10-2011 3-17-2011		ROUTE	PROJECT	
	VA.	—	0058-965-102, C-501	22(7)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

US 58

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

SCALE 0 25' 50'

	PROJECT	SHEET NO.
	___-___-___	22(7)

16-MAR-2011

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PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
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UTILITY OWNERS:
Electric: Dominion Virginia Power
Gas: Virginia Natural Gas
Columbia Gas Transmissions
Sanitary: Hampton Roads Sanitation District
City of Norfolk
City of Portsmouth
Telephone: Verizon Communications
Cox Communications
AT&T
Cavalier Telephone
Level3/KMC/Adelphia/Telcov
Traffic: Virginia Department of Transportation
T.V.: Cox Communications
Water: City of Norfolk
City of Portsmouth

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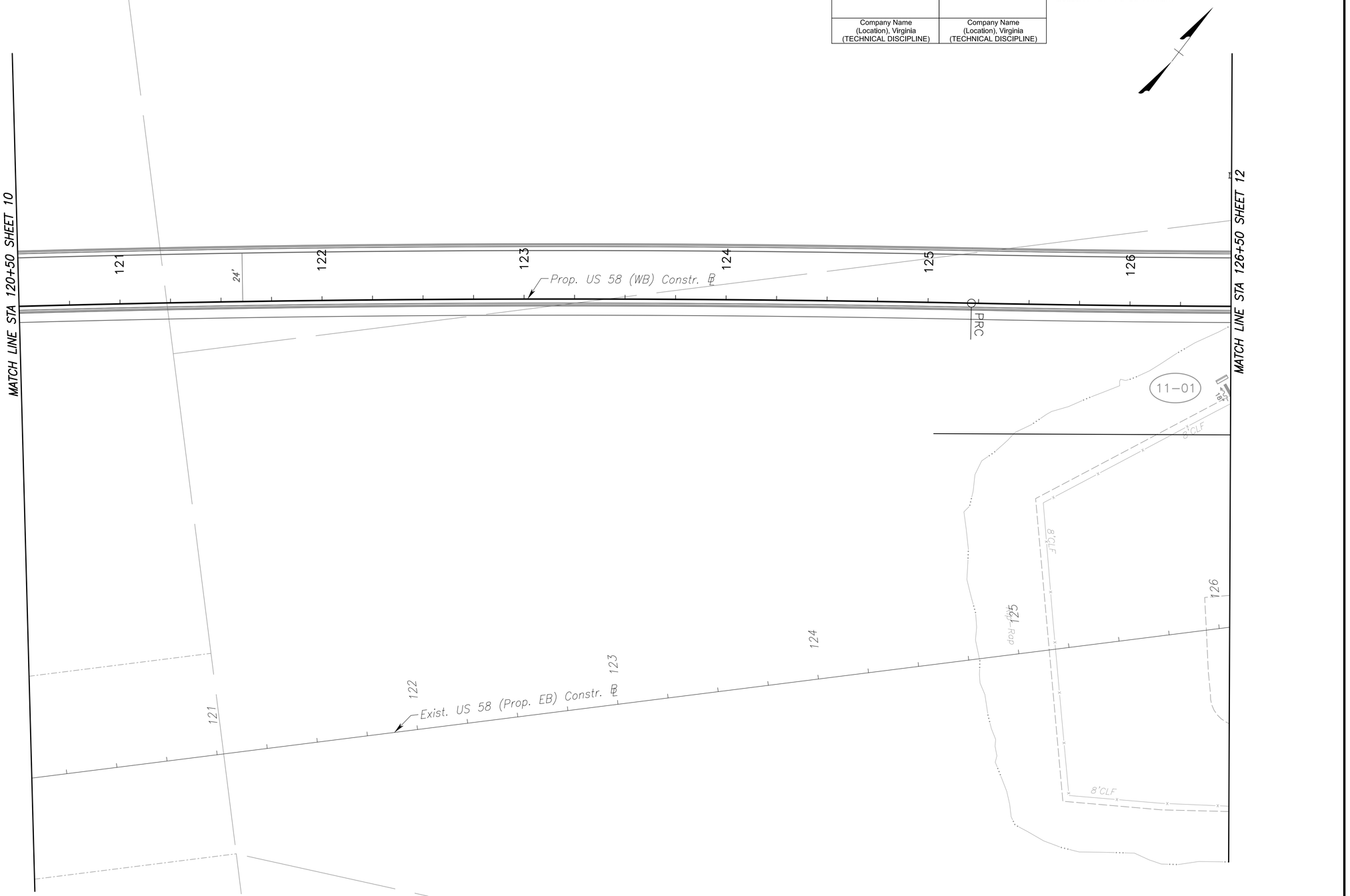
Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-102, C-501	22(11)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

US 58



UTILITY RELOCATION LEGEND

8 "SAN	Proposed Utility Size & Type
6 "W	Abandon
6 "W	Remove
6 "W	Pipe Casing
6 "W	Coupling
○	San Manhole

Utility Conflict Designations
(# indicates unique designation number)

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- (G#) Gas Line
- (PP#) Electric Power Pole
- (S#) Sanitary Sewer Line
- (T#) Telephone/Communications/ Fiber Optic
- (TT#) Electric Transmission Tower
- (W#) Water Line

SCALE
0 25' 50'

	PROJECT	SHEET NO.
	—-—-—	22(11)

16-MAR-2011

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PROJECT MANAGER Frank Fabian (757) 396-6800
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DESIGNED BY Parsons Brinckerhoff (757) 466-1732

UTILITY OWNERS:
Electric: Dominion Virginia Power
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Columbia Gas Transmissions
Sanitary: Hampton Roads Sanitation District
City of Norfolk
City of Portsmouth
Telephone: Verizon Communications
Cox Communications
AT&T
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Traffic: Virginia Department of Transportation
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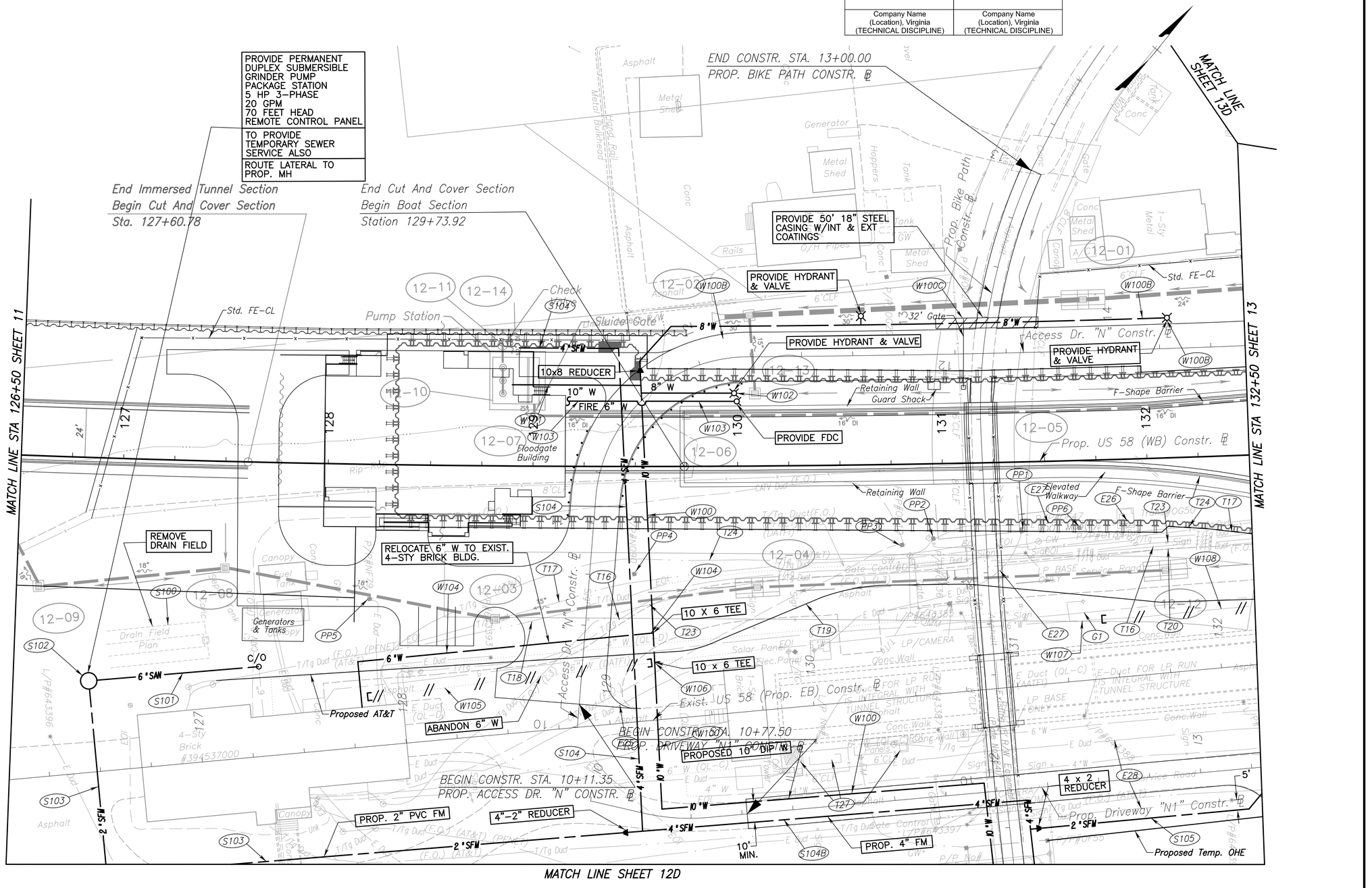
Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
2-10-2011	VA.	—	0058-965-102, C-501	22(12)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

US 58



UTILITY RELOCATION LEGEND

- 8 "SAN — Proposed Utility Size & Type
- 6 "W — Abandon
- 6 "W — Remove
- 6 "W — Pipe Casing
- 6 "W — Coupling
- San Manhole

SCALE 0 25' 50'

	PROJECT	SHEET NO.
	—-—-—	22(12)

18:27

PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
DESIGNED BY Parsons Brinckerhoff (757) 466-1732

UTILITY OWNERS:
Electric: Dominion Virginia Power
Gas: Virginia Natural Gas
Columbia Gas Transmissions
Sanitary: Hampton Roads Sanitation District
City of Norfolk
City of Portsmouth
Telephone: Verizon Communications
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AT&T
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Level3/KMC/Adelphia/Telcov
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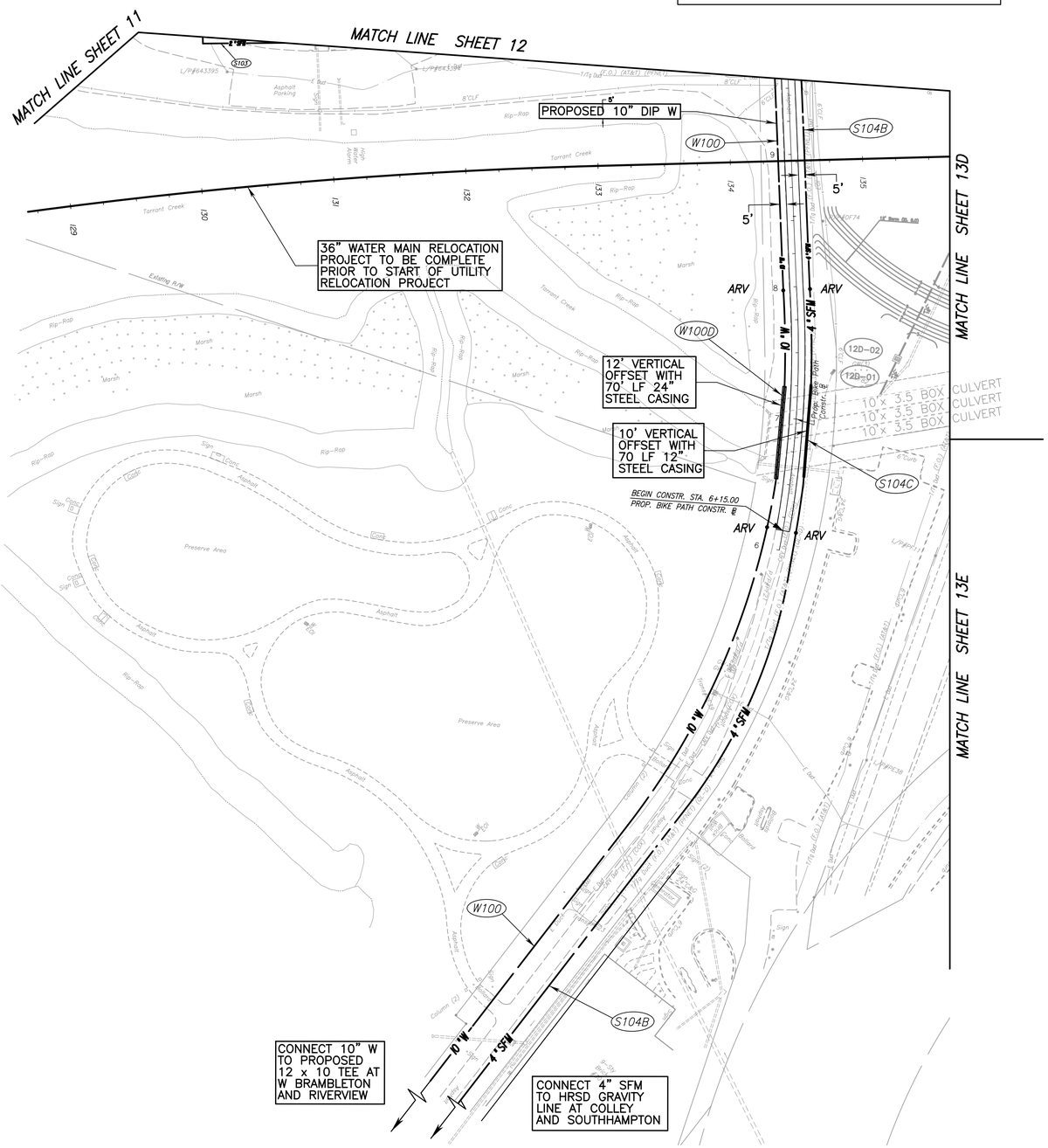

UTILITY RELOCATION LEGEND

- 8 "SAN — Proposed Utility Size & Type
- 6 "W — Abandon
- 6 "W — Remove
- 6 "W — Pipe Casing
- 6 "W — Coupling
- San Manhole

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
2-10-2011	VA.	—	0058-965-102, C-501	22(12D)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

SCALE	PROJECT	SHEET NO.
0 50' 100'	___-___-___	22(12D)

16-MAR-2011

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16-MAR-2011

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PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
DESIGNED BY Parsons Brinckerhoff (757) 466-1732

UTILITY OWNERS:
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Columbia Gas Transmissions
Sanitary: Hampton Roads Sanitation District
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City of Portsmouth
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AT&T
Cavalier Telephone
Level3/KMC/Adelphia/Telcov
Traffic: Virginia Department of Transportation
T.V.: Cox Communications
Water: City of Norfolk
City of Portsmouth

Utility Conflict Designations
(# indicates unique designation number)

- (E#) Electrical Duct/Pole/Light
- (G#) Gas Line
- (PP#) Electric Power Pole
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- (W#) Water Line

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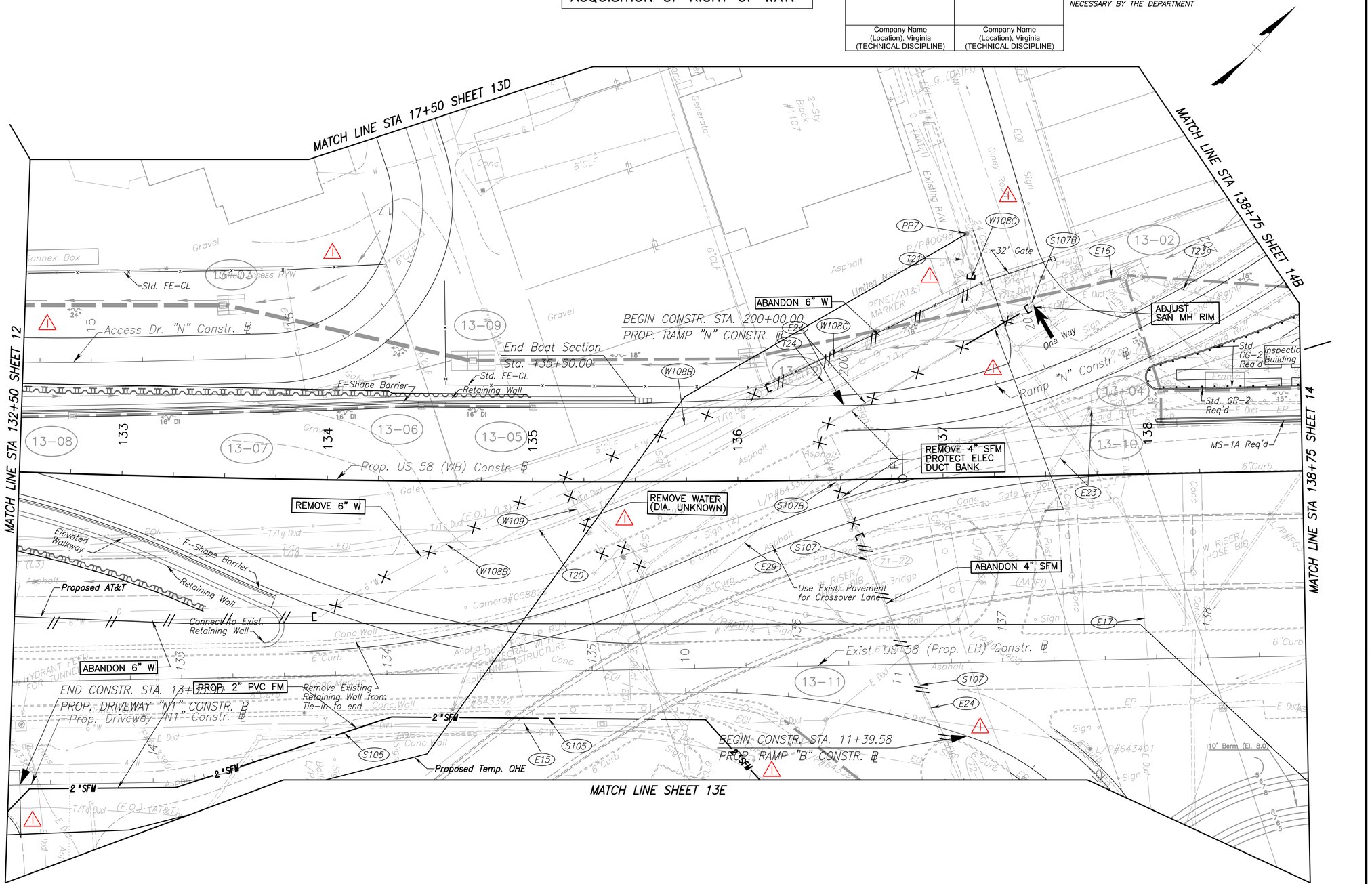
Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
2-10-2011	VA.	—	0058-965-102, C-501	22(13)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

US 58



UTILITY RELOCATION LEGEND

8 "SAN	Proposed Utility Size & Type
6 "W	Abandon
6 "W	Remove
6 "W	Pipe Casing
6 "W	Coupling
○	San Manhole

SCALE	PROJECT	SHEET NO.
0 25' 50'	—-—-—	22(13)

18:27

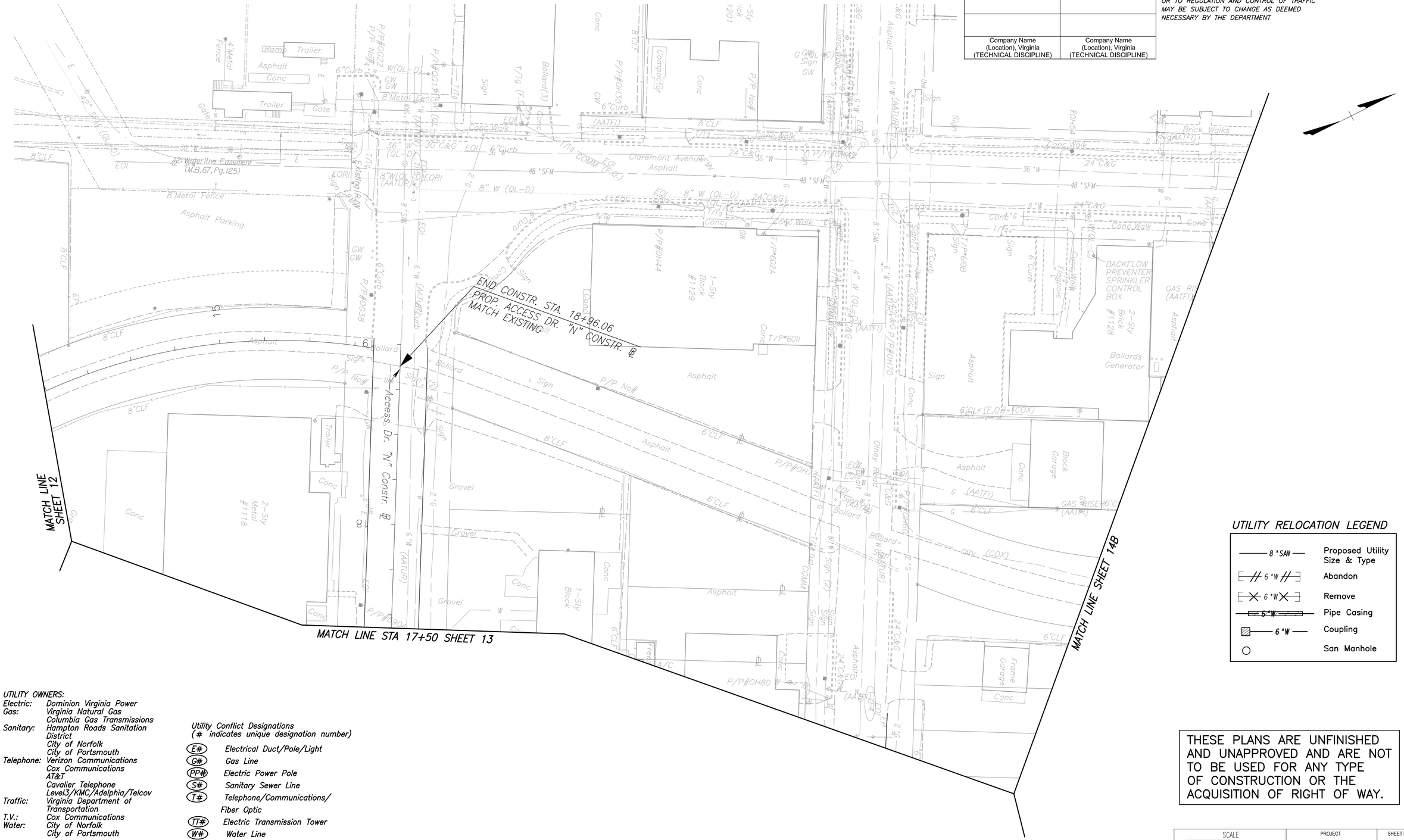
PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
DESIGNED BY Parsons Brinckerhoff (757) 466-1732

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-102, C-501	22(13D)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

Access Dr. "N"



UTILITY RELOCATION LEGEND

8 "SAN	Proposed Utility Size & Type
6 "W	Abandon
6 "W	Remove
6"W	Pipe Casing
6 "W	Coupling
○	San Manhole

UTILITY OWNERS:

Electric:	Dominion Virginia Power
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Sanitary:	Hampton Roads Sanitation District City of Norfolk City of Portsmouth
Telephone:	Verizon Communications Cox Communications AT&T Cavalier Telephone Level3/KMC/Adelphia/Telcov
Traffic:	Virginia Department of Transportation
T.V.:	Cox Communications
Water:	City of Norfolk City of Portsmouth

Utility Conflict Designations
(# indicates unique designation number)

E#	Electrical Duct/Pole/Light
G#	Gas Line
PP#	Electric Power Pole
S#	Sanitary Sewer Line
T#	Telephone/Communications/ Fiber Optic
TT#	Electric Transmission Tower
W#	Water Line

THESE PLANS ARE UNFINISHED AND UNAPPROVED AND ARE NOT TO BE USED FOR ANY TYPE OF CONSTRUCTION OR THE ACQUISITION OF RIGHT OF WAY.

SCALE	PROJECT	SHEET NO.
0 25' 50'	____-___-___	22(13D)

16-MAR-2011

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PROJECT MANAGER Frank Fabian (757) 396-6800
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REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
2-10-2011	VA.	—	0058-965-102, C-501	22(13E)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

Crash House

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

UTILITY OWNERS:
Electric: Dominion Virginia Power
Gas: Virginia Natural Gas
Columbia Gas Transmissions
Sanitary: Hampton Roads Sanitation District
City of Norfolk
City of Portsmouth
Telephone: Verizon Communications
Cox Communications
AT&T
Cavalier Telephone
Level3/KMC/Adelphia/Telcov
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T.V.: Cox Communications
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City of Portsmouth

Utility Conflict Designations
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- S# Sanitary Sewer Line
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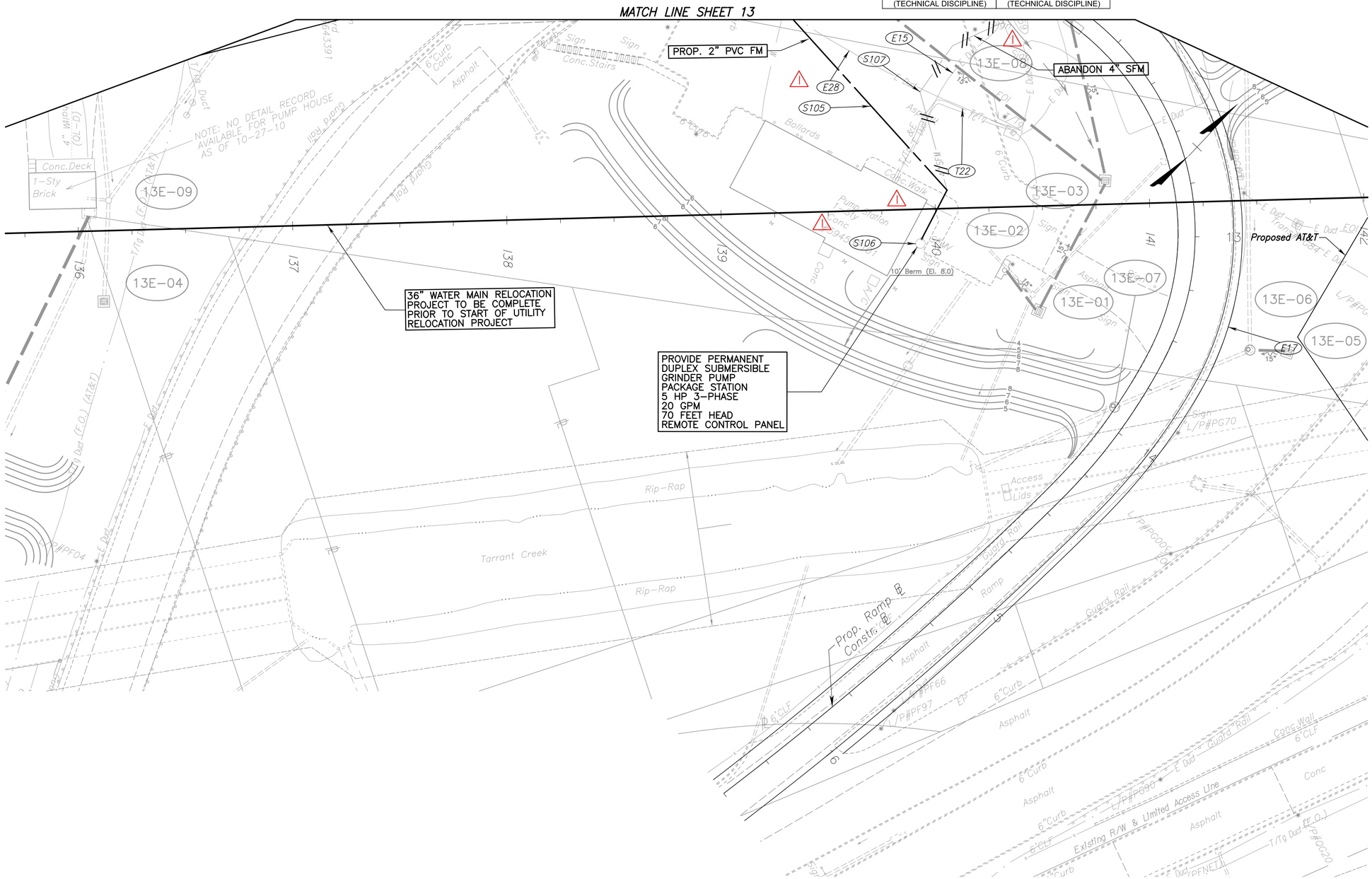
- TT# Electric Transmission Tower
- W# Water Line



UTILITY RELOCATION LEGEND

8" SAN	Proposed Utility Size & Type
6" W	Abandon
6" W	Remove
6" W	Pipe Casing
6" W	Coupling
	San Manhole

SCALE 0 25' 50'

PROJECT	SHEET NO.
___-___-___	22(13E)

18:27
16-MAR-2011
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T.V.:	Cox Communications
Water:	City of Norfolk City of Portsmouth

Utility Conflict Designations
(# indicates unique designation number)

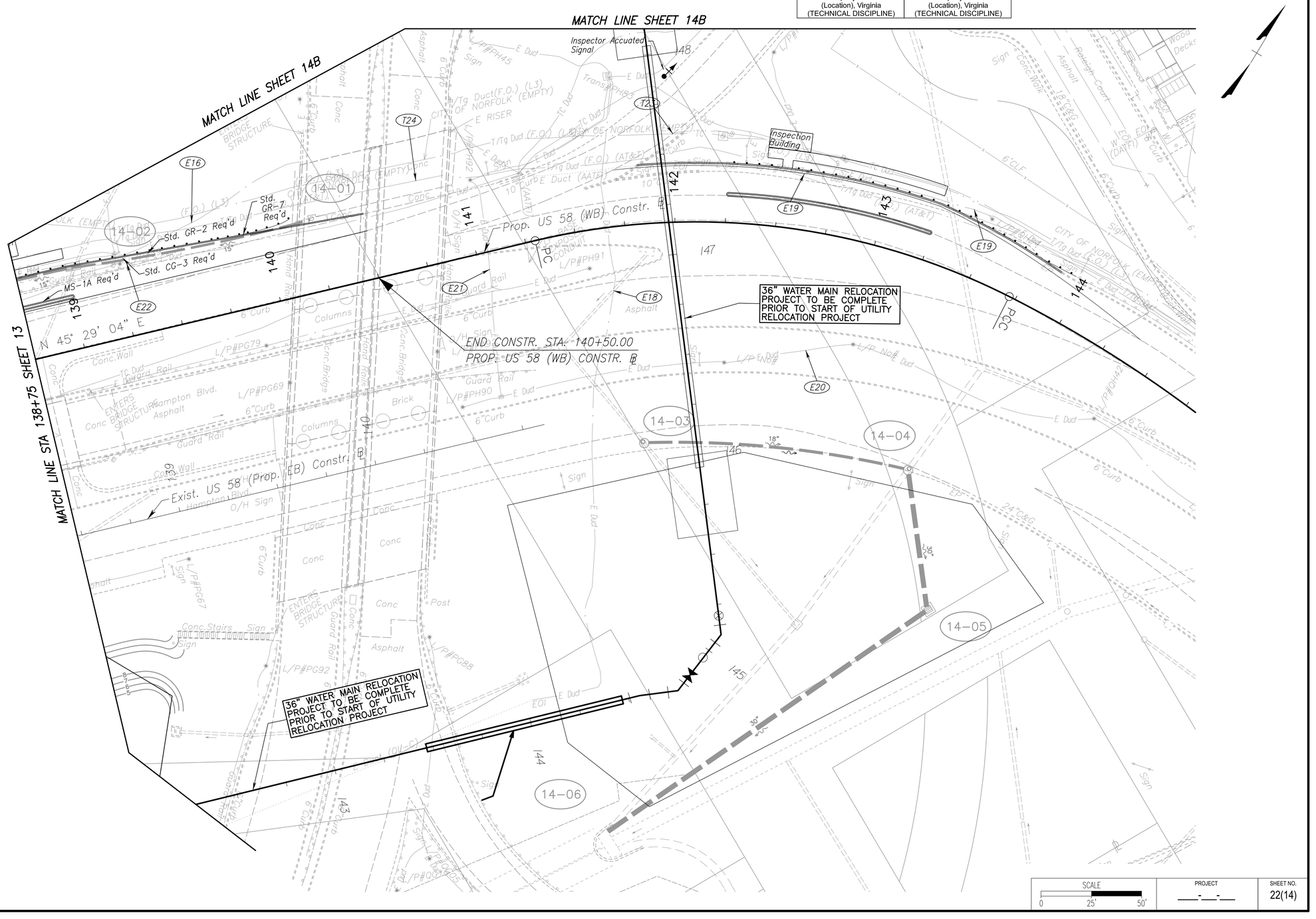
- (E#) Electrical Duct/Pole/Light
- (G#) Gas Line
- (PP#) Electric Power Pole
- (S#) Sanitary Sewer Line
- (T#) Telephone/Communications/ Fiber Optic
- (TT#) Electric Transmission Tower
- (W#) Water Line

THESE PLANS ARE UNFINISHED AND UNAPPROVED AND ARE NOT TO BE USED FOR ANY TYPE OF CONSTRUCTION OR THE ACQUISITION OF RIGHT OF WAY.

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-102, C-501	22(14)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT



8 "SAN	Proposed Utility Size & Type
6 "W	Abandon
6 "W	Remove
6 "W	Pipe Casing
6 "W	Coupling
	San Manhole

SCALE	PROJECT	SHEET NO.
0 25' 50'	—-—-—	22(14)

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16-MAR-2011
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18:27

16-MAR-2011

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PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
DESIGNED BY Parsons Brinckerhoff (757) 466-1732

UTILITY OWNERS:
Electric: Dominion Virginia Power
Gas: Virginia Natural Gas
Columbia Gas Transmissions
Sanitary: Hampton Roads Sanitation District
City of Norfolk
City of Portsmouth
Telephone: Verizon Communications
Cox Communications
AT&T
Cavalier Telephone
Level3/KMC/Adelphia/Telcov
Traffic: Virginia Department of Transportation
T.V.: Cox Communications
Water: City of Norfolk
City of Portsmouth

UTILITY RELOCATION LEGEND

8 "SAN	Proposed Utility Size & Type
6 "W	Abandon
6 "W	Remove
6 "W	Pipe Casing
6 "W	Coupling
	San Manhole

Utility Conflict Designations
(# indicates unique designation number)

- E# Electrical Duct/Pole/Light
- G# Gas Line
- PP# Electric Power Pole
- S# Sanitary Sewer Line
- T# Telephone/Communications/ Fiber Optic
- TT# Electric Transmission Tower
- W# Water Line

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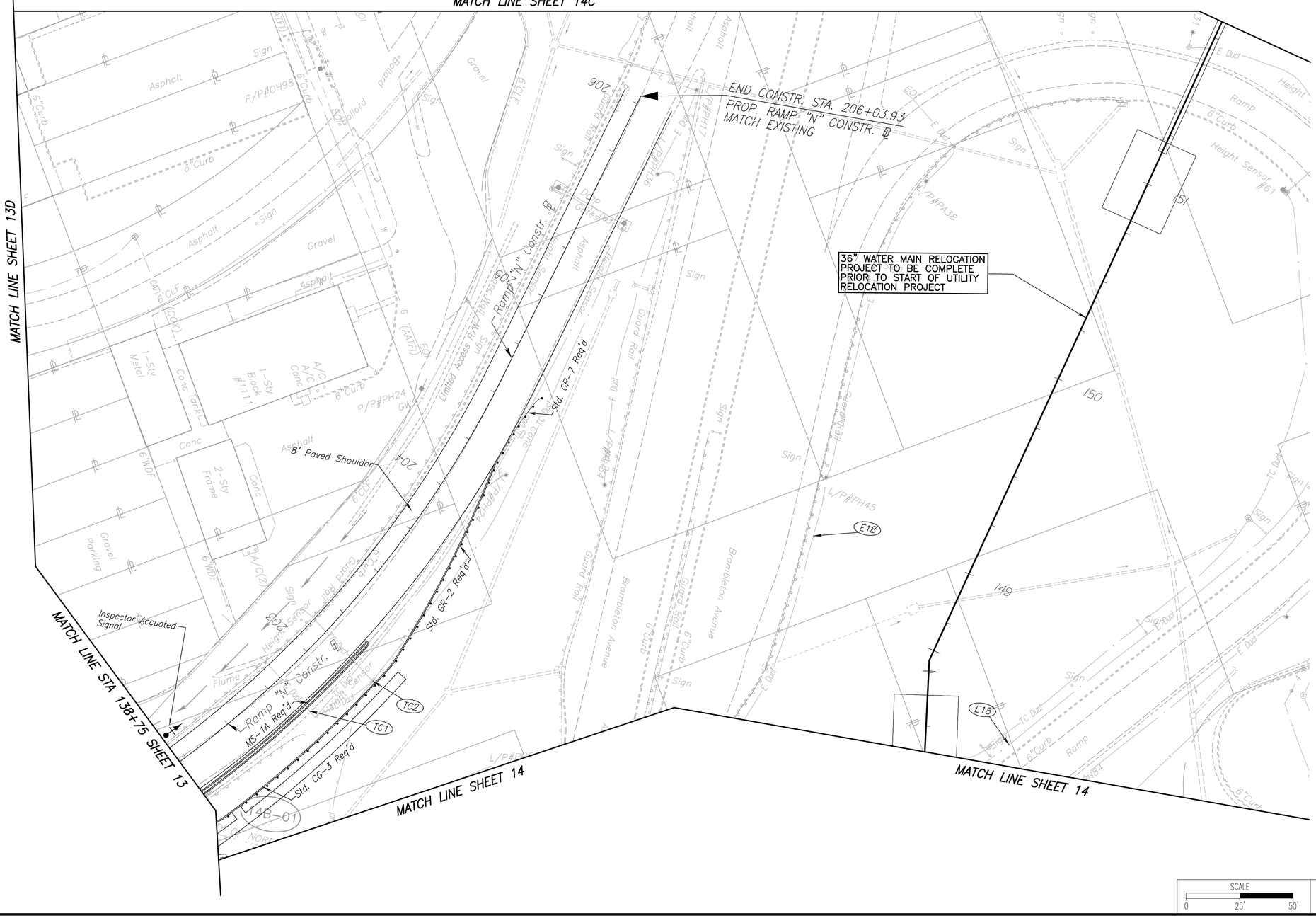
Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-102, C-501	22(14B)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

Ramp "N"



SCALE	PROJECT	SHEET NO.
0 25' 50'	___-___-___	22(14B)

18:27

16-MAR-2011

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PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
DESIGNED BY Parsons Brinckerhoff (757) 466-1732

UTILITY OWNERS:

Electric:	Dominion Virginia Power
Gas:	Virginia Natural Gas Columbia Gas Transmissions
Sanitary:	Hampton Roads Sanitation District City of Norfolk City of Portsmouth
Telephone:	Verizon Communications Cox Communications AT&T Cavalier Telephone Level3/KMC/Adelphia/Telcov
Traffic:	Virginia Department of Transportation
T.V.:	Cox Communications
Water:	City of Norfolk City of Portsmouth

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-102, C-501	22(14C)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

MATCH LINE SHEET 13D

MATCH LINE SHEET 14B

36" WATER MAIN RELOCATION PROJECT TO BE COMPLETE PRIOR TO START OF UTILITY RELOCATION PROJECT

Claremont Avenue

Boissevain Avenue

Asphalt Parking

Existing R/W

Limited Access R/W

Asphalt Walk

Conc Walk

Gravel

Metal Stairs

1-Sty Brick #1200

1-Sty Metal Warehouse

1-Sty Brick #1129

1-Sty Block #1130

2-Sty Frame #816

Compressor

Generator T/P#609B

Shed

Cable Power Conc.

4 Wire Fence

Post

Brick #1121

PVC Shed

6'WDF

3'CLF

6'CLF

A/C

Conc Wall

Guard Rail

Bollard

Mailbox

Sign

Conc Post

Manhole

Utility Conflict Designations (# indicates unique designation number)

- E# Electrical Duct/Pole/Light
- G# Gas Line
- PP# Electric Power Pole
- S# Sanitary Sewer Line
- T# Telephone/Communications/ Fiber Optic
- TT# Electric Transmission Tower
- W# Water Line

UTILITY RELOCATION LEGEND

- 8 "SAN — Proposed Utility Size & Type
- 6 "W — Abandon
- 6 "W — Remove
- 6 "W — Pipe Casing
- 6 "W — Coupling
- San Manhole

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SCALE	PROJECT	SHEET NO.
0 25' 50'	___-___-___	22(14C)

PROJECT MANAGER Frank Fabian (757) 396-6800
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UTILITY OWNERS:
Electric: Dominion Virginia Power
Gas: Virginia Natural Gas
Columbia Gas Transmissions
Sanitary: Hampton Roads Sanitation District
City of Norfolk
City of Portsmouth
Telephone: Verizon Communications
Cox Communications
AT&T
Cavalier Telephone
Level3/KMC/Adelphia/Telcov
Traffic: Virginia Department of Transportation
T.V.: Cox Communications
Water: City of Norfolk
City of Portsmouth

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-102, C-501	22(15)

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

PROPOSED TUNNEL
E. MIDTOWN TUNNEL
SUPPORT BUILDING
W7
12 "W
70 FEET 24" STEEL CASING PIPE
PROPOSED 7000' 12" D.I.P. W FROM CHAUTAUQUA & CLEVELAND TO PUMP STATION AT NEW SUPPORT BUILDING

THESE PLANS ARE UNFINISHED AND UNAPPROVED AND ARE NOT TO BE USED FOR ANY TYPE OF CONSTRUCTION OR THE ACQUISITION OF RIGHT OF WAY.

NOTES:

1. BASE MAPPING BY VIRGINIA INTERNATIONAL TERMINALS NORFOLK VIRGINIA ENGINEERING AND MAINTENANCE.
2. NO SURVEY OR SUBSURFACING UTILITY ENGINEERING FOR THE ROUTING OF THE PROPOSED 12" D.I.P. WATERLINE.
3. LAYOUT OF PROPOSED 12" D.I.P. WATER IS FOR ESTIMATINING PURPOSES.

SCALE	PROJECT	SHEET NO.
0 200' 400'		22(15)

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16-MAR-2011
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5.2 Utilities - MLK Extension

PROJECT MANAGER Frank Fabian (757) 396-6800
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REVISED	STATE	STATE		SHEET NO.
		ROUTE	PROJECT	
2-10-2011	VA.	—	0058-965-107 C-501	36(1)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

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COMMONWEALTH OF VIRGINIA

DEPARTMENT OF TRANSPORTATION

PLAN AND PROFILE OF PROPOSED STATE HIGHWAY

MIDTOWN TUNNEL PROJECT
MLK UTILITY RELOCATION PLANS - PRELIMINARY

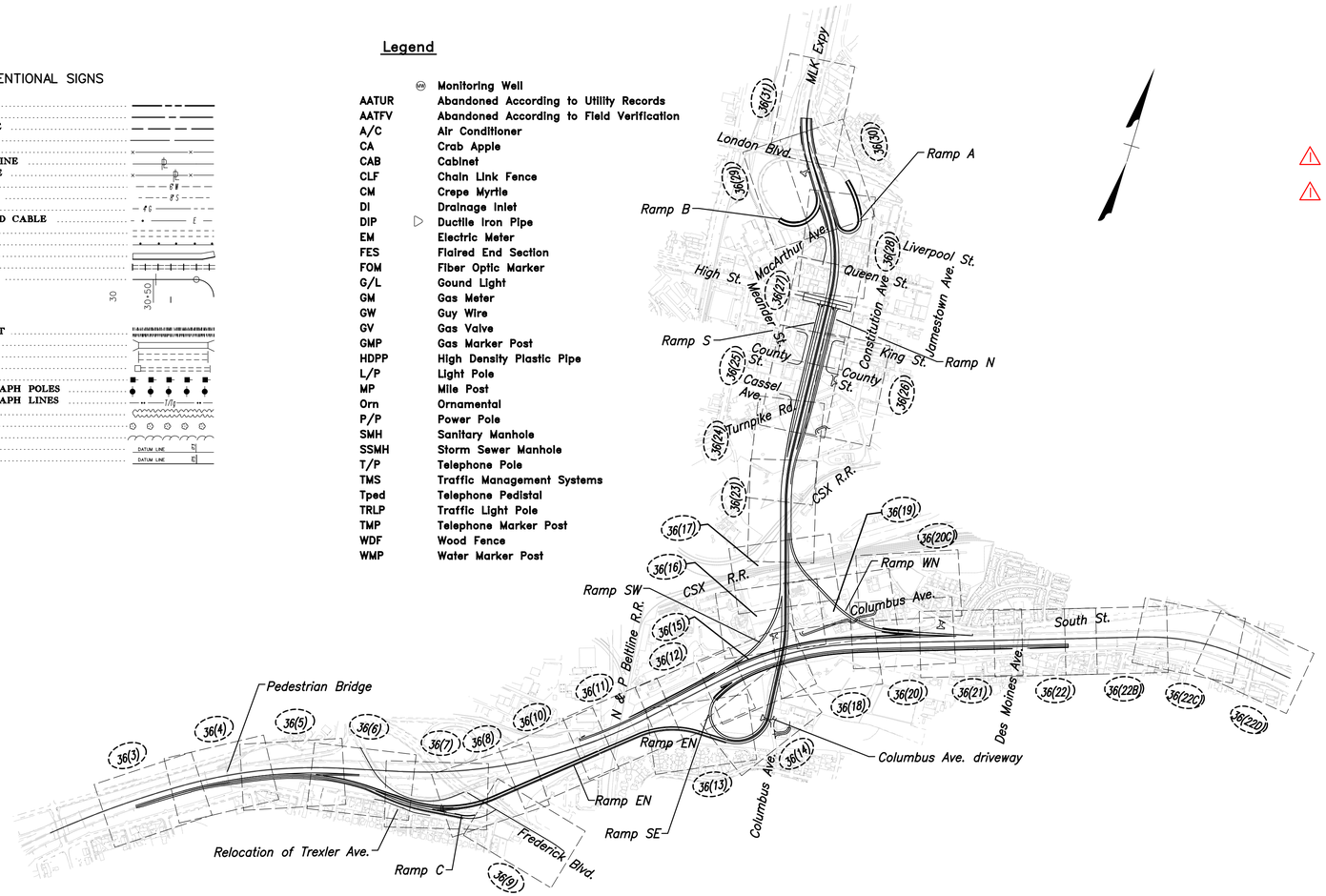
CONVENTIONAL SIGNS

STATE LINE
COUNTY LINE
CITY,TOWN OR VILLAGE
RIGHT OF WAY LINE
FENCE LINE
UNFENCED PROPERTY LINE
FENCED PROPERTY LINE
WATER LINE
SANITARY SEWER LINE
GAS LINE
ELECTRIC UNDERGROUND CABLE
TRAVELED WAY
GUARD RAIL
RETAINING WALL
RAILROADS
BASE OR SURVEY LINE

LEVEE OR EMBANKMENT
BRIDGES
CULVERTS
DROP INLET
POWER POLES
TELEPHONE OR TELEGRAPH POLES
TELEPHONE OR TELEGRAPH LINES
HEDGE
TREES
HEAVY WOODS
GROUND ELEVATION
GRADE ELEVATION

Legend

	(MW)	Monitoring Well
AATUR		Abandoned According to Utility Records
AATFV		Abandoned According to Field Verification
A/C		Air Conditioner
CA		Crab Apple
CAB		Cabinet
CLF		Chain Link Fence
CM		Crepe Myrtle
DI		Drainage Inlet
DIP	▷	Ductile Iron Pipe
EM		Electric Meter
FES		Flaired End Section
FOM		Fiber Optic Marker
G/L		Gound Light
GM		Gas Meter
GW		Guy Wire
GV		Gas Valve
GMP		Gas Marker Post
HDPP		High Density Plastic Pipe
L/P		Light Pole
MP		Mile Post
Orn		Ornamental
P/P		Power Pole
SMH		Sanitary Manhole
SSMH		Storm Sewer Manhole
T/P		Telephone Pole
TMS		Traffic Management Systems
Tped		Telephone Pedistal
TRLP		Traffic Light Pole
TMP		Telephone Marker Post
WDF		Wood Fence
WMP		Water Marker Post



SHEET NO.	DELIVERABLE NO.	REV. NO.	DRAWING TITLE
36(1)	D 0103020104	2	TITLE SHEET, LOCATION MAP AND INDEX OF DRAWINGS
36(2)**			
36(2A)	D 0103020104	2	LIST OF UTILITY CONFLICTS
36(2B)	D 0103020104	2	LIST OF UTILITY CONFLICTS
⚠ 36(2C)	D 0103020104	2	LIST OF UTILITY CONFLICTS
36(2D) to 36(2F)	D 0103020104	2	SANITARY STRUCTURE DATA SHEETS
⚠ 36(3)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - I-264
36(4)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - I-264
36(5)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - I-264
36(5C)			NOT USED
36(5F)			NOT USED
36(6)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - I-264
36(7)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - I-264
36(8)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - I-264
36(9)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - FREDRICK BLVD.
36(10)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - I-264
36(11)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - I-264
36(12)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - I-264
36(13)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - I-264
36(14)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - I-264
36(15)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - RAMP 'SW'
36(16)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - MLK
36(17)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - MLK
36(18)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - MLK
36(19)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - RAMP 'WN'
36(20)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - I-264
36(20C)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - I-264
36(21)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - I-264
36(22)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - I-264
36(22B)			NOT USED
36(22C)			NOT USED
36(22D)			NOT USED
36(23)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - TURNPIKE RD.
36(24)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - TURNPIKE RD.
36(25)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - COUNTY ST.
36(26)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - COUNTY ST.
36(27)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - MLK
36(28)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - MLK
36(29)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - LONDON BLVD.
36(30)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - LONDON BLVD
36(31)	D 0103020104	2	UTILITY RELOCATION PLAN SHEET - MLK

**NOT INCLUDED IN THIS SUBMISSION

SCALE	PROJECT	SHEET NO.
0 600' 1200'		36(1)

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17-MAR-2011
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PROJECT MANAGER Frank Fabian (757) 396-6800
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DESIGNED BY Parsons Brinckerhoff (757) 466-1732

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-107 C-501	36(2A)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

UTILITY IMPACTS TO THE MLK PORTION OF THE MTT-MLK PROJECT
WATER

No.	Plan Sheet No.	Approx. Stationing	Utility	Utility Owner	Location	Street	Utility Conflict	Disposition	Possible Solution Remarks
W1	30	1052+05	8"W	Portsmouth Public Utilities	MLK	London Blvd.		Conflict	Remove at proposed storm drain structure
W2	29&30	1049+15	3"W	Portsmouth Public Utilities	MLK			Conflict	Remove 3" in Pond. Abandon 3" under road.
W3	28&30	1045+75	12"W	Portsmouth Public Utilities	MLK	MacArthur Ave.		Conflict	Relocate with two crossings consisting of split steel casing. Trench crossings of MLK and Ramp required road/lane closures and/or detours. Will be daytime shutdown.
W4	28	1042+20	16"W	Portsmouth Public Utilities	MLK	Queen Street	Old lead joint ball and socket pipe under crane work area	Conflict	Replace & offset 16" W under MLK and connect to existing 6" water from the south. And connect to 2" water from the north.
W5	27	1039+55	10"W	Portsmouth Public Utilities	MLK	High Street		Conflict	Replace 10" W under MLK and connect to existing 6" water from the north.
W6	27	1036+45	2"W	Portsmouth Public Utilities	MLK	King Street		Conflict	Remove 2" W from 2211 King Street east to middle of MLK
W7	25, 27	1033+80	6"	Portsmouth Public Utilities	MLK	County Street		Conflict	Replace 6" W on County Street with 6" loop, Include new fire hydrant, and connect to existing 2" W near 2211 King Street
W7B	25	NOT USED							NOT USED
W7C	25	1034	2"W	Portsmouth Public Utilities	MLK	County Street		Conflict	Abandon 230 feet of 2" W on County Street under the MLK
W7D	26	NOT USED							NOT USED
W8	25	1030+60	8"W	Portsmouth Public Utilities	MLK	Turnpike Road		Protect	Protect existing. Coordinate with VDOT concerning Turnpike Road realignment project. The MTT/MLK project is expected to precedes the Turnpike Road realignment project. The intent of this note is to indicate the existence of the Turnpike Road Realignment project.
W9	24	1027+35	10"W	Portsmouth Public Utilities	MLK			Protect	
W10		NOT USED							NOT USED
W11	15, 16	1011+40	6"W	Portsmouth Public Utilities	MLK	Columbus Ave.		Conflict	horizontal/vertical offset along 6" W to avoid conflicts with proposed storm drain and pier under MLK find ramp SW. Abandon or replace sections of existing 6"W
W11B		NOT USED							NOT USED
W12	25 & 27	1030+70 to 1039+55	6"W	Portsmouth Public Utilities	MLK	M.L.K. Freeway Constr. BL		Conflict	Cap. 6" W at Turnpike Road in middle of MLK and abandon 6" W north under MLK to High Street. Remove sections at piers and POND 25.
W13	24 & 25	Along Turnpike Road	Service Connections	Portsmouth Public Utilities	MLK	Turnpike Road		Conflict	Abandon Service connections.
W14	27	1036+50	6"W	Portsmouth Public Utilities	MLK	King Street		Conflict	Abandon 6" W from east side where new 6" connection is made to middle of MLK
W14B	25, 27	1036+50	6"W	Portsmouth Public Utilities	MLK	King Street		Relocate	Proposed 6" W from County to King Street along proposed service/access road.
W21	17, 19	413+80 to 416+25	20"W	Portsmouth Public Utilities	MLK	Ramp " WN" Constr. BL			Abandoned according to City of Portsmouth Public Utilities. Remove under Ramp WN
W22	13, 14	1002+50	6"W	Portsmouth Public Utilities	MLK	MLK Freeway BL		Conflict	Abandon 6" W and remove sections at proposed piers and POND 14
W23	14, 15	1004+20	6"W	Portsmouth Public Utilities	MLK	MLK Freeway BL		Conflict	Remove 6" W from north edge of POND 14 (+/- 300' south of I 264) south to STA 1004+50 MLK Construction baseline. 6" W abandoned according to City Portsmouth Public Utilities
W24		NOT USED							NOT USED
				UTILITIES IMPACT INTERSTATE I-264 CORRIDOR					
W15	3 & 4	NOT USED							NOT USED
W16	5	314+50	6"W	Portsmouth Public Utilities	I-264	Ramp "EN" Constr. BL end of Carver Circle		Pending	City cannot confirm status as abandoned. Treat as ACTIVE. No construction record found. Assume extend existing casing under proposed ramp construction as shown.
W17		NOT USED							NOT USED
W17B	6, 7		6"W	Portsmouth Public Utilities	I-264	Trexler between Downes and Arcadia		Conflict	Remove 6" W from new tie in at Downes Street, west to proposed relocation at Arcadia.
W17C	6, 7		6"W	Portsmouth Public Utilities	I-264	Trexler between Downes and Arcadia		Conflict	Relocate 6" W from new tie in at Downes Street, west to proposed relocation at Arcadia.
W18	8	328+75	12"W	Portsmouth Public Utilities	I-264	Ramp "EN" Constr. BL		Conflict	Replace 12"W 40LF DI at Pier
W19	11		20"W	Portsmouth Public Utilities	I-264	Ramp "EN" Constr. BL & Ramp "SE" Constr. BL		Conflict	Approximate location according to VDHT plan Feb 1962
W19	11		20"W	Portsmouth Public Utilities	I-264	Ramp "EN" Constr. BL & Ramp "SE" Constr. BL	Conflict w/ Piers on Ramp "EN" several locations	Protect	Protect exist 20" CI water from construction activity including pre-augering piles
W19B	11, 13, 14		20"W	Portsmouth Public Utilities	I-264	Ramp "EN" Constr. BL & Ramp "SE" Constr. BL	Conflict w/ Piers on Ramp "EN" several locations	Conflict	Abandon existing 20" water after relocated 20" water connection is complete. Abandon from STA 345+00 to 348+50. Remove from 348+50 to Columbus Avenue.
W19C	11, 13, 14		20"W	Portsmouth Public Utilities	I-264	Ramp "EN" Constr. BL & Ramp "SE" Constr. BL		Conflict	Relocate 20"W between concrete wing wall (plan sheet 11) and Columbus Avenue (plan sheet 14).
W20	14		2"W, 4"W & Service Lines	Portsmouth Public Utilities	I 264	Ramp "WN" Constr. BL		Conflict	Remove 4"W within limits of POND 14.
W25	16, 17		24" W	Portsmouth Public Utilities	I 264	POND 16		Conflict	Remove 24"W within limits of POND 16.
W25B		NOT USED							NOT USED
W26	27, 28	1039+56 to 1042+12	6" W	Portsmouth Public Utilities	MLK	Harbor Dr	Conflict w/ Piers on MLK	Conflict	Remove 280 feet 6" W between Queen Street and High Street. According to Portsmouth Public Utilities there are no service connections on this line and it can be abandoned.
W27		NOT USED							NOT USED
W28		NOT USED							NOT USED
W29	30	1048+85	12"W	PPU	I 264	NE Loop on London		Conflict	Status of 12" W not clear on survey. Disposition pending response from City of Portsmouth Public Utilities

UTILITY IMPACTS TO THE MLK PORTION OF THE MTT-MLK PROJECT
SANITARY SEWER

No.	Plan Sheet No.	Approx. Stationing	Utility	Utility Owner	Location	Street	Utility Conflict	Disposition	Possible Solution Remarks
S1		NOT USED							NOT USED
S2	28	1042+30	8" TC Gravity	Portsmouth Public Utilities	MLK	Queen Street	Old terra cotta pipe under crane work area	Conflict	Abandon SAN 4" to 8" and abandon MH at MacArthur and Liverpool
S2B	28		8" TC Gravity	Portsmouth Public Utilities	MLK	Queen Street	Old terra cotta pipe under crane work area	Conflict	Replace 8" SAN under MLK with 8" D.I. SAN
S3	27	1038+95	8" TC Gravity	Portsmouth Public Utilities	MLK	High Street	Old terra cotta pipe under crane work area	Conflict	Replace 8" SAN under MLK with 8" HDPE SAN encased inside 14" steel casing carrier pipe. Casing to include protective coating inside and out. Include two new manholes.
S4	27	1036+45	8" TC Gravity	Portsmouth Public Utilities	MLK	King Street		Conflict	Replace 8" SAN under MLK with 8" HDPE SAN encased inside 14" steel casing carrier pipe. Casing to include protective coating inside and out. Include two new manholes.
S5	25	1033+60	8" TC Gravity	Portsmouth Public Utilities	MLK	County Street		Conflict	Abandon 8" sanitary and manhole under MLK
S5B								Conflict	Abandon 8" sanitary and manhole under MLK
S5C	25		8" Gravity	Portsmouth Public Utilities	MLK	King Street		Conflict	Install 8" DIP SAN from 2211 King Street to existing 8" SAN. Include 2 manhole and one service lateral to 2211 King Street
S6									no longer used
S7	25	1029+80 Left	6" TC Gravity	Portsmouth Public Utilities	MLK	MLK Freeway Constr. BL		Conflict	Abandon 6" SAN west to manhole and plug at manhole
S8	16, 19, 20	1011+05	8" PVC Gravity	Portsmouth Public Utilities	MLK	Columbus Ave.		Conflict	Abandon existing 8" TC SAN located at back of properties on Columbus (north of interstate 264.) Remove at POND 20
S8B	16, 19, 20, 20C		8" PVC Gravity	Portsmouth Public Utilities	MLK	Columbus Ave.		Conflict	Relocate 271 feet of 8" SAN, 775 feet of 10" SAN from 1240 Columbus to South Street (100' east of Columbus Street). Include five (5) manholes and four (4) private laterals
S9	13 & 14	200+50 Ramp SE to 1002+00 M.L.K.	4" SAN	Portsmouth Public Utilities	MLK	MLK Freeway Constr. BL & Ramp SE Constr. BL		Conflict	Abandon 4" SAN outside of construction limits. Remove 4" SAN within limits of construction to MH 7-14.
S9B		NOT USED							NOT USED
S10		NOT USED							NOT USED
S11		NOT USED							NOT USED
S12		NOT USED							NOT USED
S12B	6, 7	800+00 to 810+00 Right Ramp C Constr. BL	8" PVC Gravity	Portsmouth Public Utilities	MLK	Trexler Ave. between Downes Street and Arcadia	MSE Wall	Conflict	Remove 8" SAN between MH 01-1 and MH 01-2. Remove 8" SAN between MH 01-1 to MH 01-10
S12C	6, 7	800+00 to 810+00 Right Ramp C Constr. BL	8" PVC Gravity	Portsmouth Public Utilities	MLK	Trexler Ave. between Downes Street and Arcadia	MSE Wall	Conflict	Relocate 8" SAN between Arcadia Avenue and Downes Street. Include 3 new manholes.
S13	25 & 27	1031+45 to 1036+45	8" DIP Gravity	Portsmouth Public Utilities	MLK	MLK Freeway Constr. BL		Conflict	Remove 8" SAN under MLK from Turnpike Road to King Street.
S14		NOT USED							NOT USED
S15		NOT USED							NOT USED
S16		NOT USED							NOT USED
				UTILITIES IMPACT INTERSTATE I-264 CORRIDOR					
S17		NOT USED							NOT USED
S18		NOT USED							NOT USED
S20	27		8" SAN	PPU	MLK	High Street	12' from pier	Conflict	Line 8" sanitary (S20) and add two sanitary manholes close to pile driving and fiber optic duct banks above Include two new manholes.

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PROJECT	SHEET NO.
___-___-___	36(2A)

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PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
DESIGNED BY Parsons Brinckerhoff (757) 466-1732

REVISED	STATE	STATE		SHEET NO.
		ROUTE	PROJECT	
	VA.	—	0058-965-107 C-501	36(2B)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

UTILITY IMPACTS TO THE MLK PORTION OF THE MTT-MLK PROJECT
TELEPHONE / COMMUNICATIONS / FIBER OPTIC

No.	Plan Sheet No.	Approx. Stationing	Utility	Utility Owner	Location	Street	Utility Conflict	Disposition	Possible Solution Remarks
T1	30	1049+60 - 1050+70	Telephone/FO	Verizon/AT&T	MLK	London Blvd.	Drainage Structure 24-07 & Widening	Review	Adjust Drainage/Test Hole
T2	28	1105+30	Telephone	Verizon/AT&T	MLK	Ramp A	Manhole	Conflict	Relocate Verizon Manhole #261 Public Right-of-Way
T3	27,28	1039+84 - 1042+60	Telephone	Verizon/AT&T	MLK	Queen to High Street	Bridge Pier Footers	Conflict	Relocate Duct Bank to Preliminary Utility Easement #1
T4	27,28	1040+00 - 1042+00	Telephone	Verizon/AT&T	MLK	Queen to High Street	Bridge Footer/Drainage Structure Pipe	Conflict	Relocate
T5	27	18+65 - 20+00	Telephone	Verizon/AT&T	MLK	High Street		Protect	Underground Duct Bank
T6	27	18+65 - 18+10	Telephone	Verizon/AT&T	MLK	High Street		Protect	Underground Duct Bank
T7	27	18+10 - 16+00	Telephone	Verizon/AT&T	MLK	High Street		Protect	Test Hole Required
T8	27	18+10 - 16+00	Telephone	Verizon/AT&T	MLK	High Street	Potential Drainage Conflict	Review	Test Hole Required
T9	27	18+65	Telephone	Verizon/AT&T	MLK	High Street	Manhole (260) Size/Bridge Pier Footer	Review	Adjust Manhole to Accommodate T3 Adjustment
T10	27	18+10	Telephone	Verizon/AT&T	MLK	High Street	Manhole 57	Protect	
T11	27	1038+95	Telephone	Verizon/AT&T	MLK	High Street		Protect	Underground Duct Bank
T12	27	1036+00 - 1039+84	Telephone	Verizon/AT&T	MLK	Harbor Drive	Bridge Pier Footers	Conflict	Relocate Duct Bank to Preliminary Utility Easement #3
T13	25,27	1036+25 - 1037+85	Telephone	Verizon/AT&T	MLK	Harbor Drive	Bridge Pier Footers		Abandoned
T14	27	1036+25 - 1039+84	Telephone	Verizon/AT&T	MLK	Harbor Drive	Bridge Pier Footers	Conflict	Relocate Duct Bank to Preliminary Utility Easement #3
T15	27	1035+00 - 1036+00	Telephone/FO	Verizon/AT&T	MLK	Harbor Drive	Bridge Pier Footers	Conflict	Relocate Duct Bank to Preliminary Utility Easement #3
T16	25	1035+00 - 1033+95	Telephone	Verizon/AT&T	MLK	Harbor Drive - County Street	Bridge Pier Footers	Conflict	Relocate Duct Bank to Preliminary Utility Easement #3
T17	25	1035+00 - 1030+80	Telephone/FO	Verizon/AT&T	MLK	Harbor Drive - Turnpike Road	Bridge Pier Footers	Conflict	Relocate Duct Bank to Preliminary Utility Easement #3
T18	25	1035+00 -1032+55	CATV	Verizon	MLK	Harbor Drive	Bridge Pier Footers	Conflict	Relocate Duct Bank to Preliminary Utility Easement #3
T19	24	1027+25	Telephone	Verizon	MLK	Columbia Street		Protect	Underground Duct Bank
T20	24	1025+00	Telephone	Verizon	MLK	Private Drive		Protect	Underground Duct Bank
T21	11	1422+65	Telephone	Verizon	I-264	CSX		Protect	Underground Duct Bank
T22	22	1457+75 RT	Telephone	Verizon	I-264	Des Moines Ave	Bridge Widening	Protect	Underground Duct Bank

UTILITY IMPACTS TO THE MLK PORTION OF THE MTT-MLK PROJECT
GAS

No.	Plan Sheet No.	Approx. Stationing	Utility	Utility Owner	Location	Street	Utility Conflict	Disposition	Possible Solution Remarks
G1	28	1045+75	1 1/4" Gas	Columbia	MLK	MacArthur Ave.		Conflict	Cap & Abandon MLK Crossing
G2	28	1042+60	6" Gas	Columbia	MLK	Queen Street	Bridge Pier Footer	Conflict	Relocate
G3	27,28	1042+60 - 1036+30	6" Gas	Columbia	MLK	High Street & Harbor Drive	Bridge Pier Footers	Conflict	Relocate
G4	27	1039+84	1 1/4" Gas	Columbia	MLK	High Street	Bridge Pier Footer	Protect	
G5	27	1039+86	6" Gas	Columbia	MLK	High Street	Bridge Pier Footer	Conflict	Relocate
G6	27	1038+88	6" Gas	Columbia	MLK	High Street	Drainage Structures 23-01 & 23-14	Review	Adjust Structures or Relocate Gas Line
G7	27	1037+40 - 1038+88	1 1/4" Gas	Columbia	MLK	Harbor Drive	Bridge Pier Footers	Conflict	Abandon
G8	27	1036+30	6" Gas	Columbia	MLK	Harbor Drive & King Street	G3 Removal Cap Line	Obsolete	Cap & Abandon MLK Crossing
G9	25	1035+10 - 1036+15	2" Gas	Columbia	MLK	Harbor Drive	Bridge Pier Footer	Conflict	Cap & Abandon MLK Crossing
G10	25	1032+40 - 1035+10	2" Gas	Columbia	MLK	Harbor Drive	Bridge Pier Footers	Conflict	Abandon
G11	25	1033+95	2" Gas	Columbia	MLK	Harbor Drive & County Street	Drainage Structure 22-02, 22-04 & 22-11	Conflict	Abandon
G12	25	1033+35	1 1/4" Gas	Columbia	MLK	Harbor Drive & County Street	Bridge Pier Footer	Conflict	Cap & Abandon MLK Crossing
G13	25	509+00 - 510 +80	1 1/2" Gas	Columbia	MLK	Turnpike Road	Bridge Footer	Conflict	Cap & Abandon MLK Crossing
G14	24	509+00 - 510+50	1 1/2" Gas	Columbia	MLK	Turnpike Road	Bridge Footer	Conflict	Cap & Abandon MLK Crossing
G15	24	1027+80	1 1/4" Gas	Columbia	MLK	Columbia Street		Protect	
G16	16	1011+60	3" Gas	Columbia	MLK	Columbus Avenue		Protect	
G17	19	411+00	3" Gas	Columbia	MLK Ramp WN	Columbus Avenue	Bridge Pier Footer	Conflict	Adjust Alignment
G18	16	105+20	3" Gas	Columbia	MLK	Columbus Avenue	Drainage Structure	Protect	Adjust Drainage
G19	14	1004+50 - 1008+20	2" Gas	Columbia	MLK	Columbus Avenue	Bridge Pier Footers	Conflict	Cap & Abandon MLK Crossing
G20	19	410+15	2" Gas	Columbia	MLK Ramp WN	Columbus Avenue	Bridge Abutment	Conflict	Adjust Gas Line to Accommodate Pile Installation
G21	28	1042+40	4" Gas	Columbia	MLK	Queen Street		Protect	
G22	28	1041+95	1 1/4" Gas	Columbia	MLK	Queen Street		Protect	
G23	27	1036+50	1 1/4" Gas	Columbia	MLK	King Street	Relocate Street Closure	Conflict	Relocate/Adjust
G24	7	804+00	2" Gas	Columbia	I-264	Trexler Ave	Street Relocation	Conflict	Adjust Line Caps

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	PROJECT	SHEET NO.
	____-___-___	36(2B)

PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
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DESIGNED BY Parsons Brinckerhoff (757) 466-1732

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Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-107 C-501	36(2C)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

UTILITY IMPACTS TO THE MLK PORTION OF THE MTT-MLK PROJECT
ELECTRIC

No.	Plan Sheet No.	Approx. Stationing	Utility	Pole #	Utility Owner	Location	Street	Utility Conflict	Disposition	Possible Solution Remarks
E1	30,31	1053+42 RT	Electric/Duct		DVP/VDOT	MLK	MLK	Drainage Structure 24-07	Conflict	Adjust Drainage
E2	29, 30	1049+00 LT	Electric/Duct		DVP	MLK	MLK	Drainage Pond	Conflict	Relocate
E3	30	1051+00- Ramp "B" RT	Electric/Duct		DVP/VDOT	MLK		Construction	Conflict	Lighting to be Removed and Restored as Part of Const. Design
E4	30	Ramp "A" RT	Electric/Duct		DVP/VDOT	MLK		Construction	Conflict	Lighting to be Removed and Restored as Part of const.
E5	30	1051+00-1048+75 RT	Electric/Duct		DVP/VDOT	MLK	MLK	Construction	Conflict	Lighting to be Removed and Restored as Part of Const. Design
E6	30	1050+00 RT	Electric/Duct		DVP/VDOT	MLK	MLK	Construction	Protect	
E7	30	1045+50 - Ramp "B"	Electric/Duct		DVP/VDOT	MLK	MLK	Construction	Conflict	Relocate
E8	16	1011+00 RT	Electric/Duct		DVP	MLK	Columbus Avenue		Protect	
E9	15	107+80 LT	Electric/Duct		DVP	I-264	Columbus Avenue	Drainage Structure 9-02	Protect	Adjust Drainage/Design
E10	14	1004+50 RT	Electric/Duct		DVP	MLK	Columbus Avenue	Bridge	Conflict	Relocate Service
E11	15	1434+00 - 1435+90 RT	Electric/Duct		VDOT	I-264	I-264	Construction	Conflict	Adjust Roadway Lighting to Accommodate Road Widening RT and LT of CL
E12	20	405+90 LT	TC/FO Duct		VDOT	I-264	Ramp WN	Construction/Ramp	Conflict	Relocate
E13	20	405+60 LT	Electric/Duct		VDOT	I-264	Ramp WN	Construction/Pond 20	Conflict	Relocate
E14	20	405+60 LT	Electric/Duct		VDOT	I-264	Ramp WN	Construction/Ramp	Conflict	Relocate
E15	20,21	405+00 - 400+00	TC/FO Duct		VDOT	I-264	Ramp WN	Construction/Ramp	Conflict	Relocate
E16	21	405+00 -400+00	Electric/Duct		VDOT	I-264	Ramp WN	Construction/Ramp	Conflict	Relocate
E17	22	1461+00 - 1458+00 RT	Electric/Duct		VDOT	I-264	I-264	Construction/Road Widening	Conflict	Relocate
E18	21	1458+90 - 1450+65 RT	Electric/Duct		VDOT	I-264	I-264	Construction/Road Widening	Conflict	Relocate
E19	15,18,20	1449+00 - 1435+90 RT	Electric/Duct		VDOT	I-264	I-264	Construction/Road Widening	Conflict	Relocate
E20	),12,15,18,	1447+75 - 1434+75 LT	Electric/Duct		VDOT	I-264	I-264	Construction/Road Widening	Conflict	Relocate follows the alignment of E23
E21	15	1434+75 - 1431+60 RT	Electric/Duct		VDOT	I-264	I-264	Construction/Road Widening	Conflict	Relocate
E22	11,12,15,18	1435+90 - 1419+00 LT	Electric/Duct		VDOT	I-264	I-264	Construction/Road Widening	Conflict	Relocate
E23	12,15,18	1448+35 - 1424+00 LT	TC/FO duct		VDOT	I-264	I-264	Construction/Road Widening	Conflict	Relocate
E24	11	1423+30 LT	Electric/Pole	Pole See PP#67	DVP	I-264	CSX	Construction/Road Widening	Protect	
E25	11	1423+00 LT & RT	Electric/Duct		DVP	I-264	CSX	Construction/Road Widening	Conflict	Relocate
E26	11	1422+10 RT	Electric/Pole	Pole See PP#71	DVP	I-264	CSX	Construction/Road Widening	Conflict	Relocate
E27	11	1423+40 LT	Electric/Pole	Pole See PP#69	DVP	I-264	CSX	Construction/Road Widening	Conflict	Relocate
E28	11	1422+40 LT	Electric/Pole	Pole See PP#70	DVP	I-264	CSX	Construction/Road Widening	Conflict	Relocate
E29	11	1422+40 LT	Electric/Pole	Pole See PP#68	DVP	I-264	CSX	Construction/Road Widening	Conflict	Relocate
E30	11	1422+20 LT	Electric/Duct		DVP	I-264	CSX	Construction/Road Widening	Protect	
E31	11	1422+25 LT	Electric/Duct		DVP	I-264	CSX	Construction/Road	Protect	
E32	11	1422+35 RT	Electric/Duct		DVP	I-264	CSX	Construction/Road	Protect	
E33	11	1421+50 RT	Electric/Pole	Pole See PP#72	DVP	I-264	CSX	Construction/Road	Conflict	Relocate
E34	11	1421+40 RT	Electric/Pole	Pole See PP#73	DVP	I-264	CSX	Construction/Road Widening	Conflict	Relocate
E35	11	1421+30 RT	Electric/Pole	Pole See PP#74	DVP	I-264	CSX	Construction/Road Widening	Conflict	Relocate
E36	11	1421+25	Electric/Pole LT	PP#BH29	DVP	I-264	CSX	Construction/Road Widening	Conflict	Relocate
E37	10	1421+00 - 1419+00	Electric/Duct		VDOT	I-264	I-264	Construction/Road Widening	Conflict	Roadway Lighting to be Removed and Restored as Part of Const. Design
E38	10	1421+00 - 1419+00	TC/FO Duct		VDOT	I-264	I-264	Construction/Road Widening	Conflict	Roadway Lighting to be Removed and Restored as Part of Const. Design
E39	8	3000+00 - 3001+85	TC/FO Duct		City	Ramp EN	Frederick Blvd.	Median/Construction	Protect	
E40	3,4,5,6,7,8	328+00 - 300+00	Electric/Duct		VDOT	Ramp EN	I-264	Construction/Road Widening	Conflict	Roadway Lighting to be Removed and Restored as Part of Const. Design
E41	6	317+50	TC/FO Duct		VDOT	Ramp EN	I-264	Construction/Road Widening	Protect	
E42		NOT USED								NOT USED
E43	8	3000+00 -3185+00	Electric/Duct		City	Ramp EN	Frederick Blvd.	Median/Construction	Protect	
E44	22	1457+10	Electric/TC		VDOT	I-264	Des Moines Ave.	Bridge Widening	Conflict	Roadway Lighting & Power to be Removed & Relocated as Part of Const. Design
TT-1	11	1422+35 LT	Transmission Tower	#?	DVP	I-264	I-264	Construction/Road Widening	Review	Tower Approximately 60' from Bridge
TT-2	11	1421+60 RT	Transmission Tower	#?	DVP	I-264	I-264	Construction/Road Widening	Review	Tower Approximately 45' from Bridge
PP#1	28	1045+50	Electric/Pole	P/P #	DVP	MLK	MacArthur Ave.	Construction/Road Widening	Conflict	Remove
PP#2	28	1045+50 RT	Electric Pole	PP#DC1	DVP	MLK	MLK	Construction/Bridge	Conflict	Remove
PP#2	28	1044+55 CL	Electric/Pole	PP#DD13	DVP	MLK	MLK	Construction/Bridge	Conflict	Remove
PP#3	28	1042+58 LT	Electric/Pole	PP#GW	DVP	MLK	Queen Street	Construction/Bridge	Conflict	Remove
PP#4	28	1043+60 RT	Electric/Pole	PP#DB46	DVP	MLK	MLK	Construction/Bridge	Conflict	Remove
PP#5	28	1042+65 RT	Electric/Pole	PP#DB45	DVP	MLK	Queen Street	Construction/Bridge	Conflict	Remove/Relocate
PP#6	28	1041+80 LT	Electric/Pole	PP#DB	DVP	MLK	MLK	Construction/Bridge	Conflict	Remove
PP#7	28	1042+05 LT	Electric/Pole	PP#DB03	DVP	MLK	Queen Street	Construction/Bridge	Protect	
PP#8	28	1042+00 RT	Electric/Pole	PP#DB5	DVP	MLK	Queen Street	Construction/Bridge	Conflict	Relocate
PP#9	27	1040+85 LT	Electric/Pole	PP#DB30	DVP	MLK	MLK	Construction/Bridge	Conflict	Remove
PP#10	27	1039+90RT	Electric/Pole	PP#DA	DVP	MLK	High Street	Construction/Bridge	Conflict	Remove/Relocate
PP#11	27	1039+90 LT	Electric/Pole	PP#DA29	DVP	MLK	High Street	Drainage	Conflict	Relocate/Modify Drainage
PP#12	27	1039+00 LT	Electric/Pole	PP#DA18	DVP	MLK	High Street	Drainage	Conflict	Relocate/Modify Drainage
PP#13	27	1039+00 LT	Electric/Pole	PP#DA48	DVP	MLK	High Street	Construction/Bridge	Conflict	Remove/Relocate
PP#14	27	1039+00 RT	Electric/Pole	PP#DA48	DVP	MLK	High Street	Construction/Bridge	Conflict	Remove/Relocate
PP#15	27	1039+90 RT	Electric/Pole	PP#DA59	DVP	MLK	Harbor Drive	Construction/Bridge	Conflict	Remove

UTILITY IMPACTS TO THE MLK PORTION OF THE MTT-MLK PROJECT
ELECTRIC

No.	Plan Sheet No.	Approx. Stationing	Utility	Pole #	Utility Owner	Location	Street	Utility Conflict	Disposition	Possible Solution Remarks
PP#16	27	1039+00 RT	Electric/Pole	PP#	DVP	MLK	High Street	Construction/Ramp	Protect	
PP#17	27	1037+90 RT	Electric/Pole	PP#DA46	DVP	MLK	Harbor Drive	Construction/Bridge	Conflict	Remove
PP#18	27	1036+55 RT	Electric/Pole	PP#DA63	DVP	MLK	King Street	Construction/Bridge	Conflict	Remove & Relocate OHE Service UG
PP#19	27	1036+60 LT	Electric/Pole	PP#DA62	DVP	MLK	Harbor Drive	Construction/Bridge	Conflict	Remove & Relocate OHE Service UG
PP#20	27	1035+40 RT	Electric/Pole		Private	MLK	Church Property	Construction/Bridge	Conflict	Remove & Relocate as Part of Const. Design.
PP#21	25	1035+10 RT	Electric/Pole	PP#DA50	DVP	MLK	Harbor Drive	Construction/Bridge	Conflict	Remove
PP#22	25	1034+60 RT	Electric/Pole		Private	MLK	Church Property	Construction/Bridge	Conflict	Remove & Relocate as Part of Const Design
PP#23	25	1033+90 RT	Electric/Pole	PP#DO70	DVP	MLK	County Street	Construction Bridge	Conflict	Remove & Relocate
PP#24	25	1033+65 RT	Electric/Pole	PP#DO69	DVP	MLK	County Street	Construction/Bridge	Conflict	Remove
PP#25	25	1033+45 RT	Electric/Pole	PP#DO68	DVP	MLK	County Street	Construction/Bridge	Conflict	Remove
PP#26	25	1034+00 LT	Electric/Pole	PP#DP80	DVP	MLK	Harbor Drive	Construction/Bridge	Conflict	Remove
PP#27	25	1033+60 LT	Electric/Pole	PP#68OA	DVP	MLK	County Street	Construction/Bridge	Conflict	Remove
PP#28	25	1033+50 LT	Electric/Pole		Private	MLK	County Street	Construction/Bridge	Conflict	Remove
PP#29	25	1033+55 LT	Electric/Pole	PP#	DVP	MLK	Harbor Drive	Construction/Bridge	Conflict	Remove
PP#30	25	1032+60 LT	Electric/Pole	PP#DO49	DVP	MLK	Harbor Drive	Construction/Bridge	Conflict	Remove & Relocate OHE Service UG
PP#31	25	1031+50 LT	Electric/Pole	PP#DO47	DVP	MLK	Harbor Drive	Construction/Bridge	Conflict	Remove & Relocate OHE Service UG
PP#32	25	1031+45 RT	Electric/Pole	PP#	DVP	MLK	Turnpike Road	Construction/Bridge	Conflict	Remove & Relocate OHE Service UG
PP#33	25	1031+55 RT	Electric/Pole	PP#BO86	DVP	MLK	Turnpike Road	Drainage	Conflict	Relocate/Modify Drainage
PP#34	25	1030+80 RT	Electric/Pole	PP#DO75	DVP	MLK	Turnpike Road	Construction/Bridge	Conflict	Remove
PP#35	25	1030+45 LT	Electric/Pole	PP#	DVP	MLK	Turnpike Road	Construction/Bridge	Conflict	Remove
PP#36	25	1030+65 LT	Electric/Pole	PP#DO33	DVP	MLK	Turnpike Road	Construction/Bridge	Conflict	Remove
PP#37	25	1030+00 LT	Electric/Pole	PP#	DVP	MLK	Turnpike Road	Construction/Bridge	Conflict	Remove
PP#38	25	1031+00 RT	Electric/Pole	PP#		MLK	Turnpike Road	Construction/Bridge	Conflict	Remove
PP#39	25	1030+90 RT	Electric/Pole	PP#		MLK	Turnpike Road	Construction/Bridge	Conflict	Remove
PP#40	24	1029+50 LT	Electric/Pole	PP#		MLK	MLK	Construction/Bridge	Conflict	Remove
PP#41	24	1029+20 LT	Electric/Pole	PP#		MLK	MLK	Construction/Bridge	Conflict	Remove
PP#42	24	1029+10 LT	Electric/Pole	PP#DO64	DVP	MLK	MLK	Construction/Bridge	Conflict	Remove
PP#43	24	1028+70 LT	Electric/Pole	PP#DN49	DVP	MLK	MLK	Construction/Bridge	Conflict	Remove
PP#44	24	1027+60 RT	Electric/Pole	PP#LI56	DVP	MLK	Columbia Street	Construction/Bridge	Conflict	Remove
PP#45	24	1027+25 RT	Electric/Pole			MLK	Columbia Street	Construction/Bridge	Conflict	Remove
PP#46	24	1025+35 RT	Electric/Pole			MLK	Gravel Drive	Construction/Bridge	Conflict	Remove
PP#47	17	1015+35 LT	Electric/Pole			MLK	MLK	Construction/Bridge	Conflict	Relocate/Remove
PP#48	17	1015+30 LT	Electric/Pole			MLK	MLK	Construction/Bridge	Conflict	Relocate/Remove
PP#49	16	1014+00 LT	Electric/Pole			MLK	MLK		Protect	
PP#50	16	1014+10 LT	Electric/Pole			MLK	MLK	Construction/Bridge	Conflict	Remove
PP#51	16	1013+10 RT	Electric/Pole			MLK	MLK	Construction/Bridge	Conflict	Remove
PP#52	19	410+15 RT	Electric/Pole	PP#FL33	DVP	MLK	Columbus Street		Protect	
PP#53	19	410+15 LT	Electric/Pole	PP#FL02	DVP	MLK	Columbus Street		Protect	
PP#54	16	1011+00 CL	Electric/Pole	PP#DJ37	DVP	MLK	Columbus Street	Construction/Bridge	Conflict	Remove
PP#55	16	105+00 LT	Electric/Pole	PP#DJ06	DVP	I-264	Columbus Street	Construction/Bridge	Protect	
PP#56	15	106+60 RT	Electric/Pole	PP#	DVP	I-264	Columbus Street	Construction/Ramp	Protect	
PP#57	15	1432+95 RT	Electric/Pole	PP#CJ55	DVP	I-264	Columbus Street	Construction/Ramp	Protect	
PP#58	15	1036+05 LT	Electric/Pole	PP#EK21	DVP	I-264			Protect	
PP#59	15	1026+30 LT	Electric/Pole	PP#EJ38	DVP	MLK	Ramp SE	Construction/Bridge	Conflict	Remove
PP#60	14	1006+05 LT	Electric/Pole	PP#LJ26	DVP	MLK	Ramp SE	Construction/Bridge	Protect	
PP#61	15	1007+50 RT	Electric/Pole	PP#EK51	DVP	MLK	Ramp NE	Construction/Bridge	Conflict	Remove
PP#62	14	1006+30 CL	Electric/Pole	PP#EJ39	DVP	MLK	Ramp NE	Construction/Bridge	Conflict	Remove
PP#63	14	1005+80 CL	Electric/Pole	PP#EJ37	DVP	MLK	Ramp NE	Construction/Bridge	Conflict	Remove
PP#64	14	1005+05 LT	Electric/Pole	PP#EJ24	DVP	MLK	Ramp SE	Construction/Bridge	Conflict	Remove
PP#65	14	1004+35 RT	Electric/Pole	PP#EJ25	DVP	MLK	Ramp NE	Construction/Bridge	Protect	
PP#66	14	1004+50 LT	Electric/Pole	PP#EJ32	DVP	MLK	Ramp EN	Construction/Bridge	Conflict	Remove
PP#67	11	1423+30 LT	Electric/Pole	LP#641098	DVP	I-264	I-264	Construction/Bridge Widening	Conflict	Within 20' Structure - Relocate
PP#68	11	1422+40 LT	Electric/Pole	PP#B1 017	DVP	I-264	I-264	Construction/Bridge Widening	Conflict	Within 10' Structure - Relocate
PP#69	11	1422+40 LT	Electric/Pole	PP#B18478	DVP	I-264	I-264	Construction/Bridge Widening	Protect	Within 42' Structure
PP#70	11	1422+40 LT	Electric/Pole	PP#B18475	DVP	I-264	I-264	Construction/Bridge Widening	Conflict Potential	Within - 25' Structure - Review
PP#71	11	1422+10 RT	Electric/Pole	PP#CH73	DVP	I-264	I-264	Construction/Bridge Widening	Conflict	Relocate
PP#72	11	1421+50 RT	Electric/Pole	PP#BI090	DVP	I-264	I-264	Construction/Bridge Widening	Conflict	Relocate
PP#73	11	1421+40 RT	Electric/Pole	PP#BIG903	DVP	I-264	I-264		Conflict	Relocate
PP#74	11	1421+30 RT	Electric/Pole	PP#B49T690	DVP	I-264	I-264		Conflict	Relocate
PP#75	8	328+00 RT	Electric/Pole	PP#641032	DVP	I-264	Ramp "EN"	Ramp Construction	Conflict	Relocate
PP#76	7	804+40 RT	Electric/Pole	PP#XG41	DVP	I-264	Ramp "EN"	Ramp Construction	Conflict	Relocate
PP#77	7	803+30 RT	Electric/Pole	PP#9109	DVP	I-264	Ramp "EN"	Ramp Construction	Conflict	Relocate
PP#78	6	801+60 RT	Electric/Pole	PP#WG82	DVP	I-264	Ramp "EN"	Ramp Construction	Conflict	Relocate
PP#79	6	802+55 RT	Electric/Pole	PP#XG12	DVP	I-264	Ramp "EN"""	Ramp Construction	Conflict	Relocate

	PROJECT	SHEET NO.
	____-___-___	36(2C)

PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
DESIGNED BY Parsons Brinckerhoff (757) 466-1732

Existing Sanitary Structure Survey Data

In Pl SMH#01-1
Rim=11.51
Inv In=7.28(N)
Inv In=7.29(W)
Inv Out=7.23(S)

In Pl SMH#01-2
Rim=11.66
Inv In=7.52(E)
Inv In=7.94(S)
Inv Out=7.48(W)

In Pl SMH#01-3
Rim=11.04
Inv In=7.14(E)
Inv Out=7.14(W)

In Pl SMH#01-4
Rim=11.17
Inv In=8.28(N)
Inv In=8.20(E)
Inv Out=8.30(S)

In Pl SMH#01-10
Rim=12.00
Inv In=7.70(E)
Inv Out=7.69(NW)

In Pl SMH#01-11
Rim=13.08
Inv In=7.58(SE)
Inv Out=7.58(W)

In Pl SMH#02-3
Rim=11.37
Inv In=8.36(E)
Inv Out=8.30(W)

In Pl SMH#02-9
Rim=11.47
Inv In=7.54(N)
Inv In=7.27(W)
Inv In=7.86(S)
Inv Out=7.28(E)

In Pl SMH#03-4
Rim=11.49
Inv In=8.20(NE)
Inv In=8.21(W)
Inv Out=8.21(SE)

In Pl SMH#03-9
Rim=15.11
Inv In=11.20(N)
Inv Out=11.20(SE)

In Pl SMH#03-10
Rim=13.91
Inv In=10.67(NW)
Inv Out=10.46(S)

In Pl SMH#04-2
Rim=11.24
Inv In=6.90(W)
Inv In=6.26(N)
Inv Out=6.25(S)

In Pl SMH#05-1
Rim=11.26
Inv In=7.61(N)
Inv Out=6.55(S)

In Pl SMH#05-2
Rim=11.06
Inv In=7.28(N)
Inv Out=6.56(E)

In Pl SMH#05-3
Rim=10.64
Inv In=6.28(W)
Inv Out=6.14(S)

In Pl SMH#06-1
Rim=11.12
Inv In=7.25(N)
Inv Out=7.25(S)

In Pl SMH#06-4
Rim=10.60
Inv In=6.35(SW)
Inv Out=6.24(E)

In Pl SMH#06-5
Rim=10.38
Inv In=7.33(SE)
Inv In=7.46(W)
Inv In=7.51(N)
Inv Out=6.78(NE)

In Pl SMH#06-6
Rim=11.28
Inv In=5.78(W)
Inv Out=5.76(S)

In Pl SMH#07-4
Rim=12.74
Inv In=9.12(N)
Inv Out=9.10(W)

In Pl SMH#07-5
Rim=12.20
Inv In=9.23(E)
Inv Out=9.24(S)

In Pl SMH#07-6
No Rim
Debris Filled

In Pl SMH#07-7
Rim=11.56
Inv Out=6.36

In Pl SMH#07-8
Rim=10.74
Inv In=5.64(N)
Inv Out=5.53(S)

In Pl SMH#07-9
Rim=11.94
Inv In=8.03(W)
Inv In=8.57(E)
Inv Out=6.73(S)

In Pl SMH#07-10
Rim=10.30
Inv In=5.82(N)
Inv Out=5.80(S)

In Pl SMH#07-14
Rim=11.98
Inv In=7.94(W)
Inv In=7.38(N)
Inv In=7.38(E)
Inv Out=7.34(S)

In Pl SMH#09-1
Rim=11.03
Inv In=3.03(N)
Inv Out=3.03(E)

In Pl SMH#09-2
Rim=10.25
Inv Out=6.40

In Pl SMH#09-3
Rim=10.65
Inv In=3.83(N)
Inv In=4.65(E)
Inv Out=3.93(S)

In Pl SMH#09-4
Rim=10.66
Inv In=4.82(E)
Inv In=4.78(W)
Inv Out=4.66(S)

In Pl SMH#09-5
Abandoned

In Pl SMH#09-6
Rim=9.63
Inv In=6.48(W)
Inv Out=6.48(E)

In Pl SMH#10-1
Rim=8.86
Inv Out=5.76

In Pl SMH#10-4
Rim=8.71
Inv In=3.01(E)
Inv OUt=2.86(S)

In Pl SMH#10-7
Rim=8.88
Inv In=1.26(N)
Inv OUt=1.18(SE)

In Pl SMH#10-8
Rim=8.90
Inv In=-0.35(N)
Inv Out=-0.40(S)

In Pl SMH#10-13
Rim=8.97
Inv In=-0.68(N)
Inv In=-0.77(S)
Inv Out=-0.83(E)

In Pl SMH#11-1
Rim=11.57
Inv In=6.32(SE)
Inv In=6.65(SW)
Inv Out=6.15(NW)

In Pl SMH#11-4
Rim=11.48
Inv In=6.39(SE)
Inv In=7.45(SW)
Inv Out=6.36(NW)

In Pl SMH#11-5
Rim=12.42
Inv In=5.99(SE)
Inv Out=5.97(NE)

In Pl SMH#11-14
Rim=12.03
Inv In=4.20&-0.12(SW)
Inv In=0.00(NE)
Inv Out=-0.29(NW)

In Pl SMH#11-17
Rim=11.89
Inv In=3.09(SW)
Inv In=-0.76(E)
Inv In=-0.85(NE)
Inv Out=-0.81(N)

In Pl SMH#11-20
Rim=12.09
Inv In=-0.49(SE)
Inv Out=-0.53(W)

In Pl SMH#11-21
Rim=11.54
Inv In=-1.19(S)
Inv Out=-1.39(NW)

In Pl SMH#11-27
Rim=12.56
Inv In=4.26(SW)
Inv Out=4.07(NE)

In Pl SMH#12-1
Rim=12.54
Inv In=3.84(NW)
Inv Out=3.74(S)

In Pl SMH#12-2
Rim=12.76
Inv In=4.63(NW)
Inv In=5.39(NE)
Inv Out=4.78(SE)

In Pl SMH#12-3
Rim=11.87
Inv In=1.57(NE)
Inv In=7.84(NNE)
Inv Out=1.57(SW)

In Pl SMH#12-9
Rim=11.63
Inv In=3.62(SE)
Inv In=6.43(NE)
Inv Out=3.43(NW)

In Pl SMH#12-10
Rim=11.68
Inv In=0.23(NE)
Inv In=3.18(SE)
Inv Out=0.27(SW)

In Pl SMH#12-12
Rim=12.29
Inv In=4.41(SE)
Inv Out=4.39(NW)

In Pl SMH#12-13
Rim=12.02
Inv In=1.02(NE)
Inv Out=0.91(SW)

In Pl SMH#12-14
Rim=11.99
Inv In=8.19(NE)
Inv In=8.16(SE)
Inv Out=8.13(SW)

In Pl SMH#12-15
Rim=12.04
Inv In=9.04(SE)
Inv Out=9.03(NW)

In Pl SMH#11-26
Rim=12.32
Inv In=0.62(NE)
Inv In=1.48(N)
Inv Out=0.62(SW)

In Pl SMH#13-1
Rim=11.10
Inv In=2.64(NE)
Inv Out=2.51(SW)

In Pl SMH#13-4
Rim=11.70
Inv In=3.87(NE)
Inv Out=3.77(SW)

In Pl SMH#13-9
Rim=11.52
Inv In=1.66(NE)
Inv In=1.64(S)
Inv Out=1.20(NW)

In Pl SMH#13-11
Rim=12.44
Inv In=1.39(SE)
Inv In=1.34(SW)

In Pl SMH#13-12
Rim=11.49
Inv In=1.79(SE)
Inv Out=1.68(N)

In Pl SMH#13-13
Rim=11.90
Inv In=2.46(SE)
Inv Out=2.30(NW)

In Pl SMH#13-15
Rim=11.46
Inv In=4.14(NE)
Inv Out=4.05(SW)

In Pl SMH#14-2
Rim=11.00
Inv In=5.39(NE)
Inv In=6.48(SE)
Inv Out=5.35(SW)

In Pl SMH#14-7
Rim=11.12
Inv In=7.52(S)
Inv In=8.22(SW)
Inv Out=7.48(NW)

In Pl SMH#14-8
Rim=11.97
Inv In=4.93(NE)
Inv Out=4.88(SW)

In Pl SMH#14-11
Rim=10.48
Inv In=5.87(E)
Inv Out=5.85(SW)

In Pl SMH#15-1
Rim=11.53
Inv In=5.88(NE)
Inv Out=5.84(SW)

In Pl SMH#15-2
Rim=11.82
Inv In=6.63(E)
Inv Out=6.58(SW)

In Pl SMH#15-3
Rim=11.26
Inv In=7.14(NE)
Inv Out=7.10(W)

In Pl SMH#15-4
Rim=12.10
Inv In=7.53(NW)
Inv In=7.72(E)
Inv Out=7.45(SW)

In Pl SMH#15-5
Rim=10.50
Paved Over

In Pl SMH#15-6
Rim=10.72
Inv In=7.57(SE)
Inv In=6.67(N)
Inv Out=6.62(W)

In Pl SMH#15-7
Rim=10.66
Inv In=6.44(N)
Inv In=6.64(E)
Inv In=6.67(S)
Inv Out=6.66(W)

In Pl SMH#15-11
Rim=12.31
Inv In=8.49(NW)
Inv In=7.95(NE)
Inv Out=7.86(SE)

In Pl SMH#15-13
Rim=11.29
Inv In=8.05(S)
Inv Out=8.04(N)

In Pl SMH#15-17
Rim=11.95
Inv In=7.02(E)
Inv Out=7.01(W)

In Pl SMH#15-21
Rim=12.00
Inv In=8.39(W)
Inv In=8.37(N)
Inv Out=8.31(E)

In Pl SMH#15-34
Rim=14.00
Inv In=11.54(NE)
Inv Out=11.47(SW)

In Pl Stormceptor#19-11
Rim=13.12
BOS=9.07

In Pl Grinder Pump#19-12
Rim=13.07
Inv In=8.85
BOS=6.99

In Pl SMH#19-13
Rim=14.57
Inv In=11.35(N)
Inv Out=11.35(S)

In Pl SMH#19-14
Rim=13.98
Inv In=9.88(E)
Inv In=9.63(SE)
Inv In=9.56(SW)
Inv In=10.02(W)
Inv Out=9.35(N)

In Pl SMH#19-17
Rim=12.80
Inv In=8.50(S)
Inv Out=8.40(N)

In Pl SMH#20-5
Grinder Pump
Rim=13.85

In Pl SMH#20-6
Grease Trap
Rim=13.90
Inv In=11.73(E)
Inv Out=11.70(W)
BOS=8.01

In Pl SMH#21-2
Top=13.97
No Rim
BOS=9.27

In Pl SMH#21-3
Rim=12.51
Inv In=9.39(W)
Inv Out=9.39(E)

In Pl SMH#22-1
Rim=12.54
Inv In=8.89(W)
Inv Out=8.88(E)

In Pl SMH#22-2
Rim=12.14
Inv In=8.04(W)
Inv Out=7.99(NE)

In Pl SMH#22-3
Rim=12.12
Inv In=7.32(SW)
Inv Out=7.30(NE)

In Pl SMH#23-1
Rim=10.92
Inv In=7.29(NW)
Inv In=6.65(SW)
Inv Out=6.60(E)

In Pl SMH#23-2
Rim=11.30
Top Pipe=8.21

In Pl SMH#23-7
Rim=11.65
Inv In=5.90
Inv Out=5.15

In Pl SMH#23-11
Oil Seperator
Rim=12.14
Top Pipe=10.44

In Pl SMH#23-12
Rim=11.48
Inv In=7.30(SW)
Inv Out=6.58(NE)

In Pl SMH#24-1
Rim=9.86
Inv In=4.01(SW)
Inv Out=4.01(NE)

In Pl SMH#24-2
Rim=10.66
Inv In=4.46(NW)
Inv Out=4.46(SE)

In Pl SMH#24-3
Rim=11.19
Inv In=5.35(NW)
Inv In=5.29(SW)
Inv Out=5.29(SE)

In Pl SMH#24-5
Rim=10.32
Inv In=4.67(SW)
Inv Out=4.67(NE)

In Pl SMH#24-6
Rim=10.66
Inv In=4.81(SW)
Inv Out=4.81(NE)

In Pl SMH#24-7
Rim=7.05
Inv In=3.30(SW)
Inv Out=3.24(N)

THESE PLANS ARE UNFINISHED AND UNAPPROVED AND ARE NOT TO BE USED FOR ANY TYPE OF CONSTRUCTION OR THE ACQUISITION OF RIGHT OF WAY.

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-107 C-501	36(2D)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

	PROJECT	SHEET NO.
	____-___-___	36(2D)

10:45
17-MAR-2011
T:\173189-MidtownTunnel\MLK\Sheet\Utilities\4MK-CUTY-PLN-02D.dgn

PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
DESIGNED BY Parsons Brinckerhoff (757) 466-1732

Exiting Sanitary Structure Survey Data

In Pl SMH#25-2
Rim=8.01
Inv In=4.39(W)
Inv In=3.54(E)
Inv Out=3.43(S)

In Pl SMH#25-3
Rim=6.62
Inv In=3.04(N)
Inv In=2.77(E)
Inv Out=2.77(W)

In Pl SMH#25-4
Rim=7.27
Inv In=2.92(E)
Inv Out=2.72(SW)

In Pl SMH#25-6
Rim=7.70
Inv In=2.92(W)
Inv In=2.89(S)
Inv Out=2.85(NE)

In Pl SMH#25-8
Rim=5.97
Inv In=2.21(W)
Inv Out=1.96(E)

In Pl SMH#25-9
Rim=5.92
Abandoned
Inv In=2.27(S)
Inv Out=2.22(N)

In Pl SMH#25-17
Rim=7.00
Inv In=1.68(W)
Inv Out=1.65(E)

In Pl SMH#25-21
Rim=6.83
Inv In=1.37(W)
Inv Out=1.33(E)

In Pl SMH#25-24
Rim=7.52
Inv In=3.09(S)
Inv Out=3.07(N)

In Pl SMH#25-26
Rim=7.90
Inv In=5.21(E)
Inv Out=5.16(N)

In Pl SMH#25-27
Rim=7.60
Inv In=4.60(S)
Inv In=4.62(E)
Inv Out=4.50(N)

In Pl SMH#25-28
Rim=7.64
Inv In=4.14(S)
Inv In=4.14(N)
Inv Out=4.09(E)

In Pl SMH#25-30
Rim=7.98
Inv In=4.03(W)
Inv Out=3.98(E)

In Pl SMH#25-31
Rim=7.95
Inv In=5.60(W)
Inv Out=5.50(N)

In Pl SMH#25-32
Rim=8.53
Inv In=5.33(S)
Inv Out=5.16(NE)

In Pl SMH#26-2
Rim=7.72
Inv In=4.68(N)
Inv Out=4.58(S)

In Pl SMH#26-6
Rim=7.56
Inv In=5.45(E)
Inv Out=5.21(S)

In Pl SMH#27-1
Rim=9.15
Inv In=4.59&1.38(NW)
Inv Out=1.96(NE)

In Pl SMH#27-3
Rim=9.42
Inv In=1.51(N)
Inv Out=1.49(SW)

In Pl SMH#27-4
Rim=9.90
Inv In=1.51(NE)
Inv Out=1.50(W)

In Pl SMH#27-5
Rim=10.26
Inv In=1.49(N)
Inv Out=1.47(SW)

In Pl SMH#27-6
Rim=10.22
Inv In=1.59(NW)
Inv In=1.52(N)
Inv In=1.52(NE)
Inv Out=1.39(SW)

In Pl SMH#27-7
Rim=10.39
Inv In=0.22(NW)
Inv Out=0.01(S)

In Pl SMH#27-10
Rim=10.02
Inv In=1.39(NE)
Inv In=1.39(SW)
Inv Out=1.39(SE)

In Pl SMH#27-11
Rim=9.74
Inv In=0.68(SW)
Inv In=1.37(NW)
Inv In=0.69(NE)
Inv Out=0.52(SE)

In Pl SMH#27-12
Rim=7.95
Inv In=3.95(S)
Inv In=4.06(W)
Inv Out=3.89(N)

In Pl SMH#27-14
Rim=9.18
Inv In=4.98(E)
Inv In=4.98(SW)
Inv Out=4.93(SE)

In Pl SMH#27-15
Rim=8.47
Inv In=3.13(SW)
Inv In=3.30(W)
Inv Out=3.07(NE)

In Pl SMH#27-17
Rim=8.71
Inv In=3.08(SW)
Inv Out=3.05(NE)

In Pl SMH#27-20
Rim=8.50
Inv In=5.69(W)
Inv Out=5.47(N)

In Pl SMH#27-21
Rim=8.77
Inv In=4.87(S)
Inv Out=4.85(NE)

In Pl SMH#27-22
Rim=8.55
Inv In=4.96(S)
Inv Out=4.85(E)

In Pl SMH#27-23
Rim=8.59
Inv In=5.10(N)
Inv Out=5.01(W)

In Pl SMH#27-24
Rim=8.79
Inv In=4.49(N)
Inv In=4.45(W)
Inv Out=4.39(E)

In Pl SMH#27-26
Rim=9.63
Inv In=4.29(W)
Inv In=4.39(SW)
Inv Out=4.05(E)

In Pl SMH#27-27
Rim=9.77
Inv In=4.89(E)
Inv Out=4.67(S)

In Pl SMH#27-28
Rim=9.67
Inv In=3.68(N)
Inv In=3.46(W)
Inv Out=3.42(S)

In Pl SMH#27-29
Rim=9.47
Inv In=3.65(N)
Inv Out=3.37(S)

In Pl SMH#27-31
Rim=8.54
Inv In=2.50(N)
Inv In=5.14(E)
Inv Out=2.03(S)

In Pl SMH#27-36
Rim=8.62
Inv In=2.02(N)
Inv In=4.82(E)
Inv Out=2.02(S)

In Pl SMH#27-38
Rim=9.13
Inv In=1.60(N)
Inv In=1.61(E)
Inv Out=1.59(S)

In Pl SMH#27-39
Rim=10.08
Inv In=3.36(S)
Inv Out=3.31(W)

In Pl SMH#27-40
Rim=9.77
Inv In=5.77(N)
Inv In=5.72(S)
Inv Out=5.40(W)

In Pl SMH#27-42
Rim=9.69
Unable to Open

In Pl SMH#27-45
Rim=9.01
Inv In=2.98(N)
Inv Out=2.92(S)

In Pl SMH#27-49
Rim=9.86
Inv In=2.01(N)
Inv In=2.00(W)
Inv Out=1.88(S)

In Pl SMH#28-2
Rim=9.21
Inv In=1.98(N)
Inv In=5.88(E)
Inv Out=1.96(S)

In Pl SMH#28-3
Rim=8.69
Inv In=0.78(N)
Inv In=-1.76(W)
Inv In=0.74(S)
Inv Out=-1.79(E)

In Pl SMH#28-4
Rim=9.18
Inv In=5.44(NE)
Inv Out=2.95(S)

In Pl SMH#28-5
Rim=8.14
Inv In=1.21(N)
Inv In=-2.13(W)
Inv In=0.06(S)
Inv Out=-2.22(E)

In Pl SMH#28-7
Rim=9.85
Inv In=3.25(N)
Inv In=1.66(E)
Inv Out=1.63(W)

In Pl SMH#28-15
Rim=10.05
Inv In=3.33(N)
Inv In=4.96(E)
Inv Out=3.21(W)

In Pl SMH#28-16
Rim=9.99
Inv In=5.11(E)
Inv Out=5.06(W)

In Pl SMH#28-18
Rim=9.51
Inv In=2.16(NW)
Inv Out=2.13(S)

In Pl SMH#28-20
Rim=9.84
Inv In=3.44(N)
Inv Out=3.44(S)

In Pl SMH#28-22
Rim=9.86
Inv In=3.47(N)
Inv In=3.53(W)
Inv Out=3.45(S)

In Pl SMH#29-1
Rim=8.33
Inv In=-3.77(S)
Inv Out=-3.83(N)

In Pl SMH#29-2
Rim=8.90
Inv In=-4.42(S)
Inv Out=-4.50(E)
Surcharged

In Pl SMH#29-3
Rim=8.93
Inv In=-4.35(W)
Inv In=-0.47(N)
Inv Out=-4.46(E)

In Pl SMH#29-7
Rim=9.11
Inv In=5.18(NE)
Inv In=-4.79(W)
Inv In=-3.11(S)
Inv Out=-4.94(E)

In Pl SMH#29-8
Rim=8.11
Inv In=-1.03(S)
Inv Out=-1.12(N)

In Pl SMH#29-11
Rim=9.68
Inv In=4.70(N)
Inv Out=4.66(S)

In Pl SMH#29-16
Rim=9.03
BOS=4.18
Surcharged

In Pl SSMH#29-43
Rim=9.96
Inv In=6.61(N)
Inv Out=6.51(W)

In Pl SMH#29-44
Rim=12.11
Top Pipe=1.01

In Pl SMH#30-2
Rim=8.69
Inv In=-4.77(W)
Inv In=-3.08(S)
Inv Out=-4.86(E)

In Pl SMH#30-3
Rim=7.88
Inv In=-1.74(S)
Inv Out=-1.80(N)

In Pl SMH#30-4
Rim=5.93
Inv In=-5.44(E)
Inv In=-3.40(S)
Inv In=-5.42(W)
Inv Out=-5.47(NE) 21"Conc

In Pl SMH#30-18
Rim=5.63
Inv In=-2.07(S)
Inv Out=-2.17(N)

In Pl SMH#31-2
Rim=4.35
Inv In=-1.60(S)
Inv In=-4.26(E)
Inv Out=-4.31(W)

In Pl SMH#31-5
Rim=5.21
Inv In=-4.36(E)
Inv In=-3.21(S)
Inv Out=-4.33(W)

In Pl SMH#31-8
Rim=4.85
Inv In=-3.50(N)
Inv In=-3.93(E)
Inv In=-3.45(S)
Inv Out=-3.87(W)

In Pl SMH#31-12
Rim=4.88
Inv In=-3.95(E)
Inv Out=-4.02(W)

In Pl SMH#31-17
Rim=5.55
Inv In=-3.11(E)
Inv In=-1.27(S)
Inv Out=-3.24(W)

In Pl SMH#31-26
Rim=8.51
Inv In=2.57(N)
Inv In=2.91(E)
Inv Out=2.61(S)

In Pl SMH#31-29
Rim=8.48
Inv In=2.00(N)
Inv Out=1.66(W)

In Pl SMH#31-30
Rim=8.10
Inv In=0.78(E)
Inv Out=0.73(S)

In Pl SMH#31-32
Rim=5.50
Inv In=-1.69(S)
Inv In=-0.83(W)
Inv Out=-1.77(N)

In Pl SMH#37-1
Rim=11.49
Inv In=7.08(SW)
Inv In=6.82(SE)
Inv Out=6.98(NE)

In Pl SMH#37-2
Rim=10.43
Inv In=7.24(SE)
Inv In=7.14(SW)
Inv Out=7.14(NW)

In Pl SMH#37-3
Rim=11.59
Inv In=7.89(SW)
Inv Out=7.84(NE)

In Pl SMH#37-4
Rim=9.96
Inv In=6.30(SW)
Inv Out=6.36(NE)

In Pl SMH#37-12
Rim=8.91
Inv In=6.20(SE)
Inv Out=6.08(NW)

In Pl SMH#37-19
Rim=10.46
Inv In=5.14(S)
Inv In=5.12(E)
Inv Out=5.08(N)

In Pl SMH#37-20
Rim=10.10
Inv In=5.10(E)
Inv Out=5.10(SW)

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REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-107 C-501	36(2E)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

	PROJECT	SHEET NO.
	____-___-___	36(2E)

10:45
17-MAR-2011
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PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
DESIGNED BY Parsons Brinckerhoff (757) 466-1732

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-107 C-501	36(2F)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

Existing Sanitary Structure Survey Data

In Pl SMH#38-1
Rim=11.10
Inv In=5.56(SE)
Inv In=5.49(SW)
Inv In=5.56(NW)
Inv Out=5.51(NE)
Top Conflict=8.22

In Pl SMH#38-2
Rim=11.34
Inv In=4.95(SW)
Inv Out=4.95(NE)
Top Conflict=8.35

In Pl SMH#38-5
Rim=11.09
Inv In=4.04(SW)
Inv Out=3.99(SE)

In Pl SMH#38-11
Rim=9.49
Inv In=6.26(E)
Inv In=6.16(SE)
Inv In=6.36(SW)
Inv Out=6.16(NW)

In Pl SMH#39-3
Rim=11.19
Inv In=3.16(SE)
Inv In=5.32(SW)
Inv In=3.05(NW)
Inv Out=3.09(E)

In Pl SMH#39-6
Rim=9.51
Inv In=2.46(W)
Inv Out=2.44(N)

In Pl SMH#39-13
Rim=7.75
Inv In=0.42(W)
Inv Out=0.32(E)

In Pl SMH#39-19
Rim=7.74
Inv In=1.14(W)
Inv Out=0.99(E)

In Pl SMH#39-26
Rim=9.08
Inv In=4.39(N)
Inv In=1.39(W)
Inv Out=1.04(E)

In Pl SMH#40-5
Rim=10.78
Inv In=7.18(NW)
Inv In=7.12(SW)
Inv Out=7.08(SE)

In Pl SMH#40-6
Rim=10.99
Inv In=8.19(E)
Inv Out=6.09(W)

In Pl SMH#40-7
Rim=10.94
paved Over

In Pl SMH#40-14
Rim=11.13
Inv In=6.40(SW)
Inv In=6.57(W)
Inv Out=6.18(E)

In Pl SMH#40-51
Rim=11.45
Inv In=9.22(SW)
Inv In=9.11(E)
Inv Out=8.95(N)

In Pl SMH#41-53
Rim=10.60
Inv In=8.29(E)
Inv In=8.24(S)
Inv In=8.32(W)
Inv Out=8.24(N)

In Pl SMH#42-1
Rim=9.94
Inv In=5.64(W)
Inv Out=3.54(SE)

In Pl SMH#42-4
Rim=10.29
Inv In=6.08(W)
Inv Out=6.03(NE)

In Pl SMH#42-5
Rim=9.97
Inv In=3.02(NW)
Inv In=5.57(SW)
Inv Out=3.02(SE)

In Pl SMH#42-6
Rim=10.06
Inv In=2.93(NW)
Inv Out=2.92(NE)

In Pl SMH#42-10
Rim=10.62
Inv In=6.31(W)
Inv In=6.25(N)
Inv Out=6.21(E)

In Pl SMH#42-11
Rim=10.70
Inv In=3.47(S)
Inv In=3.47(W)
Inv In=3.80(N)
Inv Out=3.47(E)

In Pl SMH#42-13
Rim=8.52
Inv In=2.57(SE) Stub
Inv In=2.55(W)
Inv In=2.57(NW) Stub
Inv Out=2.47(E)

In Pl SMH#42-19
Rim=10.32
Inv In=4.37(E)
Inv In=4.43(S)
Inv In=4.38(W)
Inv Out=4.33(N)

In Pl SMH#43-9
Rim=7.75
Inv In=4.61(W)
Inv Out=4.60(E)

In Pl SMH#43-10
Rim=8.45
Inv In=4.32(W)
Inv Out=4.31(E)

In Pl SMH#43-11
Rim=7.53
Inv In=1.87(S)
Inv In=2.03(SW)
Inv In=1.79(W)
Inv In=1.73(N)
Inv Out=1.71(E)

In Pl SMH#43-13
Rim=6.86
Inv In=2.44(S)
Inv Out=1.48(N)

In Pl SMH#43-14
Rim=7.44
Inv In=2.30(S)
Inv Out=2.22(N)

In Pl SMH#43-17
Rim=8.81
Inv In=3.41(E)
Inv In=2.87(S)
Inv In=3.05(W)
Inv Out=2.87(N)

In Pl SMH#44-1
Rim=10.01
Inv In=0.21(W)
Inv Out=0.18(E)

In Pl SMH#44-2
Rim=9.85
Inv In=-1.26(W)
Inv In=-4.28(N)
Inv Out=-4.51(E)
Surcharged

In Pl SMH#44-3
Rim=6.63
Inv In=-3.42(N)
Inv In=1.63 &-3.39(W)
Inv Out=-3.49(S)

In Pl SMH#44-4
Rim=6.06
Inv In=-3.18(N)
Inv In=1.66 &-2.94(W)
Inv Out=-3.26(S)

In Pl SMH#44-8
Rim=9.01
Inv In=0.41(W)
Inv In=0.30(E)

In Pl SMH#44-12
Rim=7.36
Inv In=3.21(W)
Inv Out=3.11(E)

In Pl SMH#44-14
Rim=7.33
Inv In=3.65(N)
Inv In=3.71(W)
Inv Out=3.68(E)

In Pl SMH#45-9
Rim=10.90
Inv In=6.11(S)
Inv Out=6.04(N)

In Pl SMH#46-3
Rim=7.48
Inv In=2.03(SW)
Inv In=2.09(NW)
Inv Out=2.03(NE)

In Pl SMH#46-4
Rim=7.38
Inv In=2.05(SW)
Inv Out=2.03(E)

In Pl SMH#47-2
Rim=9.87
Inv In=3.84(SW)
Inv In=6.57(NW)
Inv Out=3.74(SE)

In Pl SMH#47-6
Rim=10.62
Inv In=3.44(NW)
Inv Out=3.42(E)

In Pl SMH#47-19
Rim=8.29
Inv In=0.94(W)
Inv Out=0.84(E)

In Pl SMH#48-2
Rim=9.49
Inv In=0.00(W)
Inv Out=0.06(NE)

In Pl SMH#48-3
Rim=9.51
Inv In=-0.25(SW)
Inv Out=-0.29(E)

In Pl SMH#48-7
Rim=8.50
Inv In=-0.82(W)
Inv Out=-0.88(E)

In Pl SMH#48-8
Rim=9.77
Inv Out=4.02

In Pl SMH#48-9
Rim=6.07
Inv In=-3.06(N)
Inv In=1.87 & -2.47(W)
Inv Out=-3.17(S)

In Pl SMH#48-11
Rim=9.60
Inv In=4.38(S)
Inv In=2.37(W)
Inv In=4.41(N)
Inv Out=2.30(E)

In Pl SMH#48-12
Rim=9.73
Inv In=4.48(S)
Inv In=2.51(W)
Inv In=4.48(N)
Inv Out=2.73(E)
Top Conflict=7.78

In Pl SMH#48-15
Rim=6.89
Inv In=1.87(W)
Inv In=2.92(SW)
Inv Out=1.82(E)

In Pl SMH#48-19
Rim=8.83
Inv In=5.77
BOS=-1.59
Surcharged

In Pl SMH#48-20
Rim=10.08
BOS=1.23
Surcharged

In Pl SMH#48-35
Rim=9.16
Inv In=0.04(W)
Inv Out=-0.52(E)
Surcharged

In Pl SMH#49-3
Rim=8.95
Inv In=5.23(S)
Inv Out=5.25(N)

In Pl SMH#49-4
Rim=8.44
Inv In=4.41(S)
Inv Out=4.36(N)

In Pl SMH#50-4
Rim=10.29
Inv In=6.79(SW)
Inv Out=6.77(SE)

In Pl SMH#51-2
Rim=10.32
Inv In=6.07(NE)
Inv In=7.30(SW)
Inv In=6.12(NW)
Inv Out=6.07(SE)

In Pl SMH#51-3
Rim=10.65
BOS=4.08
No Pipes Found

In Pl SMH#51-4
Rim=10.59
Inv In=5.61(SW)
Inv In=5.51(NW)
Inv Out=5.50(SE)

In Pl SMH#51-5
Rim=10.49
Inv In=5.24(NE)
Inv In=5.21(NW)
Inv Out=5.17(SE)

In Pl SMH#51-6
Rim=10.43
Inv In=6.21(NE)
Inv Out=6.09(SW)

In Pl SMH#51-7
Rim=9.21
Inv In=4.56(NW)
Inv Out=4.48(E)

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	PROJECT	SHEET NO.
	____-___-___	36(2F)

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17-MAR-2011
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10:46

PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
DESIGNED BY Parsons Brinckerhoff (757) 466-1732

UTILITY OWNERS:
Electric: Dominion Virginia Power
Gas: Virginia Natural Gas
Columbia Gas Transmissions
Sanitary: Hampton Roads Sanitation District
City of Portsmouth
Telephone: Verizon Communications
Cox Communications
AT&T
Level3/KMC/Adelphia/Telcov
Traffic: Virginia Department of Transportation
T.V.: Cox Communications
Water: City of Portsmouth

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Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-107 C-501	36(3)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

RAMP EN

BEGIN PROJECT
BEGIN CONSTRUCTION
_____, RW-201, C-501
Sta. 300+00.00
Prop. Ramp "EN" Constr. ℄
Sta. 1381+50.88 US 264 Constr. ℄
Off. 56.00' (Rt.)

SSMH Plans Not Found

MATCH LINE STA 304+50 SHEET 4

UTILITY RELOCATION LEGEND

8 "SAN	Proposed Utility Size & Type
6 "W	Abandon
6 "W	Remove
6 "W	Pipe Casing
6 "W	Coupling
	San Manhole

SCALE	PROJECT	SHEET NO.
0 25' 50'	___-___-___	36(3)

17-MAR-2011

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PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
DESIGNED BY Parsons Brinckerhoff (757) 466-1732

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Electric: Dominion Virginia Power
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Columbia Gas Transmissions
Sanitary: Hampton Roads Sanitation District
City of Portsmouth
Telephone: Verizon Communications
Cox Communications
AT&T
Level3/KMC/Adelphia/Telcov
Traffic: Virginia Department of Transportation
T.V.: Cox Communications
Water: City of Portsmouth

UTILITY RELOCATION LEGEND

8 "SAN	Proposed Utility Size & Type
6 "W	Abandon
6 "W	Remove
6 "W	Pipe Casing
6 "W	Coupling
	San Manhole

Utility Conflict Designations
(# indicates unique designation number)

- (E#) Electrical Duct/Pole/Light
- (G#) Gas Line
- (PP#) Electric Power Pole
- (S#) Sanitary Sewer Line
- (T#) Telephone/Communications/ Fiber Optic
- (TT#) Electric Transmission Tower
- (W#) Water Line

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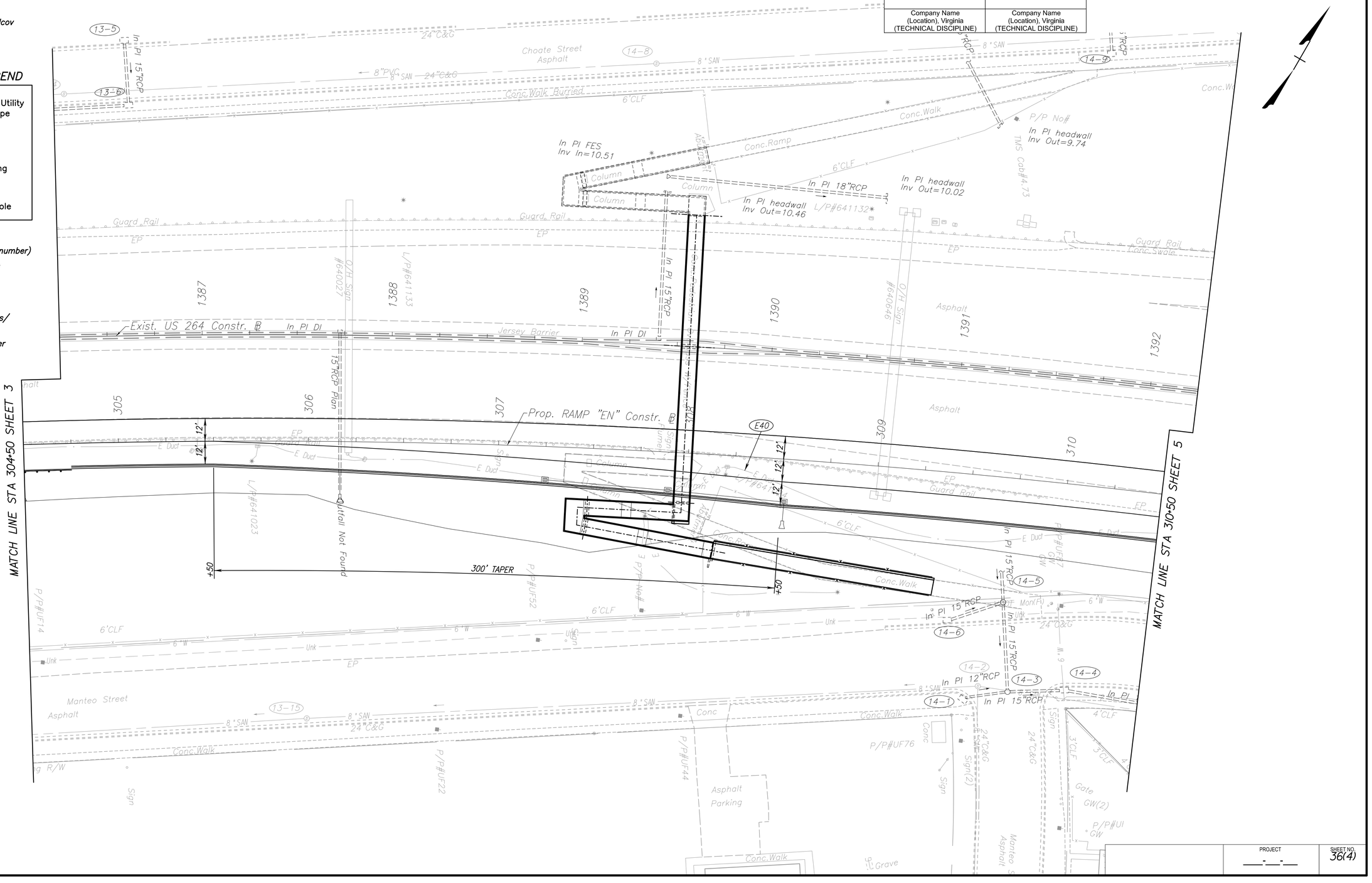
Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-107 C-501	36(4)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

RAMP EN



PROJECT	SHEET NO.
- -	36(4)

PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
DESIGNED BY Parsons Brinckerhoff (757) 466-1732

UTILITY OWNERS:
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Columbia Gas Transmissions
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Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
2-10-2011	VA.	—	0058-965-107 C-501	36(5)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

RAMP EN

Utility Conflict Designations
(# indicates unique designation number)

- (E#) Electrical Duct/Pole/Light
- (G#) Gas Line
- (PP#) Electric Power Pole
- (S#) Sanitary Sewer Line
- (T#) Telephone/Communications/ Fiber Optic
- (TT#) Electric Transmission Tower
- (W#) Water Line

MATCH LINE STA 310+50 SHEET 4

MATCH LINE STA 316+50 SHEET 6

Prop. RAMP "EN" Constr. ℄

Exist. US 264 Constr. ℄

I-264 (WBL)

I-264 (EBL)

Jersey Barrier

Guard Rail

Conc.Swale

Asphalt Ramp

Asphalt

Conc

EP

In Pl DI

In Pl 15"RCP

In Pl 18"RCP

In Pl 12"RCP

In Pl 36"RCP

Outlet Not Found

DI Not Found

EXTEND CASING ON EXIST. 6" W
18" STEEL SPLIT CASING
TEST HOLE TO VERIFY

TAPER

100' SHLD. TAPER

30"Stub

Manteo Street

Carver Circle

Existing R/W

Flag Pole

Wood Deck

Post

Metal Shed

1-Sty Brick

1-Sty Frame&Brick

2-Sty Frame

Conc Walk

Gate

Sign

Unk

6'CLF

4'CLF

5'CLF

6"W

8"SAN

8"TC

24"C&G

UTILITY RELOCATION LEGEND

- 8"SAN — Proposed Utility Size & Type
- 6"W — Abandon
- 6"W — Remove
- 6"W — Pipe Casing
- 6"W — Coupling
- San Manhole

SCALE 0 25' 50'

PROJECT

SHEET NO. 36(5)

17-MAR-2011

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10:46

PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
DESIGNED BY Parsons Brinckerhoff (757) 466-1732

UTILITY OWNERS:
Electric: Dominion Virginia Power
Gas: Virginia Natural Gas
Columbia Gas Transmissions
Sanitary: Hampton Roads Sanitation District
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Telephone: Verizon Communications
Cox Communications
AT&T
Level3/KMC/Adelphia/Telcov
Traffic: Virginia Department of Transportation
T.V.: Cox Communications
Water: City of Portsmouth

Utility Conflict Designations
(# indicates unique designation number)

- (E#) Electrical Duct/Pole/Light
- (G#) Gas Line
- (PP#) Electric Power Pole
- (S#) Sanitary Sewer Line
- (T#) Telephone/Communications/ Fiber Optic
- (TT#) Electric Transmission Tower
- (W#) Water Line

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Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-107 C-501	36(6)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

RAMP EN

MATCH LINE STA 316+50 SHEET 5

MATCH LINE STA 322+25 SHEET 7

Exist. US 264 Constr. ℄

Exist. EB I-264 On-Ramp ℄

Prop. RAMP "EN" Constr. ℄

Prop. RAMP "C" Constr. ℄

Prop. TREXLER Constr. ℄

Sta. 800+00.00
Prop. Ramp "C" Constr. ℄ =
Sta. 319+51.80
Prop. Ramp "EN" Constr. ℄
Off. 12.00" (Rt.)

Beg. Trexler MB-7F
Prop. Ramp "C"
Sta. 801+49.33

End Construction
POT 1400+84.00

BEGIN CONSTRUCTION
RW=201, C-501
Sta. 10+45.00
Prop. Trexler Constr. ℄

PROP. SAN MH
CONNECT TO EXIST. 8" SAN

PROP. SAN MH
CONNECT TO EXIST. 8" SAN

CUT & CAP 2"G

CONNECT TO EXIST. 6" W

REMOVE 6" W

REMOVE 8" PVC SAN AND MH

RELOCATE 6" D.I. WATER

Proposed OHE

Proposed Power Pole

In Pl FES
Inv Out=12.09

In Pl 15"RCP

In Pl 24"RCP

In Pl 15"RCP

In Pl DI

Pr. Pipe Headwall
Inv In=8.07

Jersey Barrier

Guard Rail

Conc.Bridge

Columns(9)

Asphalt

10' Paved Shoulder

8' Paved Shoulder

Asphalt Ramp

Trexler Avenue

Magnolia Street

Conc.Walk

Limited Access R/W

10' Utility Easement (M.B.2,Pg.38)

1-Sty Frame #3429

1-Sty Brick #3425

1-Sty Frame #3421

1-Sty Brick #3417

2-Sty Frame

Frame Garage

Metal Shed

Block Shed

Frame Shed

Conc Gate

Ramp

Arcadia Asphalt

Conc Flume

Valley Gutter

Sign

Post

Post(2)

Carport

Conc

A/C

E Duct

TC Duct

F Duct

24"C&G

6'CLF

3'CLF

4'CLF

5'WDF

OHE

GW(2)

P/P#WG42

P/P#WG43

P/P#WG39

P/P#WG73

P/P#WR78

L/P#641124

L/P#641038

L/P#641039

L/P#641029

L/P#641048

L/P#641040

1399 1400 1401 1402 1403 1404

800 801 802 902 903 904 905

319 320 321 322

SCALE 0 25' 50'

PROJECT ___-___-___

SHEET NO. 36(6)

UTILITY RELOCATION LEGEND

- 8"SAN — Proposed Utility Size & Type
- 6"W — Abandon
- 6"W — Remove
- 6"W — Pipe Casing
- 6"W — Coupling
- San Manhole

17-MAR-2011

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17-MAR-2011

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PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
DESIGNED BY Parsons Brinckerhoff (757) 466-1732

UTILITY OWNERS:
Electric: Dominion Virginia Power
Gas: Virginia Natural Gas
Columbia Gas Transmissions
Sanitary: Hampton Roads Sanitation District
City of Portsmouth
Telephone: Verizon Communications
Cox Communications
AT&T
Level3/KMC/Adelphia/Telcov
Traffic: Virginia Department of Transportation
T.V.: Cox Communications
Water: City of Portsmouth

Utility Conflict Designations
(# indicates unique designation number)
(E#) Electrical Duct/Pole/Light
(G#) Gas Line
(PP#) Electric Power Pole
(S#) Sanitary Sewer Line
(T#) Telephone/Communications/ Fiber Optic
(TT#) Electric Transmission Tower
(W#) Water Line

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

REVISED	STATE	STATE		SHEET NO.
		ROUTE	PROJECT	
2-10-2011	VA.	—	0058-965-107 C-501	36(7)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

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MATCH LINE STA 322+25 SHEET 6

MATCH LINE STA 327+50 SHEET 8

REMOVE 6" W

REMOVE 8" PVC SAN AND MH

MB-7E

6"x 6"x 8" TEE CONNECT TO EXIST. 8"

BEGIN BRIDGE STA. 326+20.00

6' Paved Shoulder

Prop. RAMP "EN" Constr. ℄

CONNECT TO EXIST. 6" W

Proposed OHE

Proposed Power Pole

RELOCATE 8" PVC SAN

RELOCATE 6" D.I. WATER

CUT & CAP 2"G

PROP. SAN MH

RELOCATE 8" PVC SAN

CONNECT TO EXIST. MH

TAPER

Prop. RAMP "C" Constr. ℄

Prop. TREXLER Constr. ℄

Exist. EB I-264 On-Ramp ℄

Exist. US 264 Constr. ℄

In Pl Headwall
In Pl 15"RCP
Inv Out=12.03

Inv Not Found

END CONSTRUCTION
Sta. 13+85.00
Prop. Trexler Constr. ℄

UTILITY RELOCATION LEGEND

8 "SAN	Proposed Utility Size & Type
6 "W	Abandon
6 "W	Remove
6 "W	Pipe Casing
6 "W	Coupling
○	San Manhole

SCALE	PROJECT	SHEET NO.
0 25' 50'	—-—-—	36(7)

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UTILITY RELOCATION LEGEND

8 "SAN	Proposed Utility Size & Type
6 "W	Abandon
6 "W	Remove
6 "W	Pipe Casing
6 "W	Coupling
	San Manhole

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Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
2-10-2011	VA.	—	0058-965-107 C-501	36(8)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

RAMP EN

MATCH LINE STA 327+50 SHEET 7

MATCH LINE STA 333+50 SHEET 10

MATCH LINE 3003+25 SHEET 9

I-264 (WBL)

I-264 (EBL)

Exist. US 264 Constr. EB

Exist. Frederick Blvd Constr. EB

Prop. RAMP "EN" Constr. EB

Prop. RAMP "C" Constr. EB

REPLACE 12" W W/40' 12" DIP CONNECT TO EXIST.

END CONSTRUCTION, _____-_____-_____, RW-201, C-501
Sta. 10+97.15
Prop. Ramp C Constr. EB

POND 8

PROJECT	SHEET NO.
—-—-—	36(8)

PROJECT MANAGER Frank Fabian (757) 396-6800
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UTILITY RELOCATION LEGEND

8 "SAN	Proposed Utility Size & Type
6 "W	Abandon
6 "W	Remove
6"W	Pipe Casing
6 "W	Coupling
○	San Manhole

Utility Conflict Designations
(# indicates unique designation number)

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	VA.	—	0058-965-107 C-501	36(9)

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MATCH LINE STA 3003+25 SHEET 8

POND 8

END CONSTRUCTION
Sta. 3004+34.11
Ex. Frederick Blvd. Constr. ℄

Exist. Frederick Blvd Constr. ℄
U.S. 17
Fredrick Boulevard

In Pl 30"RCP
In Pl 38"RCP
In Pl SSMH#03-3 Paved Over
15"Plans
36"Plans
In Pl 15"RCP

1-Sty Frame #3301
1-Sty Brick #3305
1-Sty Frame #3232
1-Sty Frame #2000
Canopy
Metal Shed
Frame Shed
Frame Shed
SMH By Plan Not Found
10' Utility Easement (M.B.2,Pg.38)
Asphalt Ramp
Asphalt Parking
Asphalt Parking
Conc Walk
Guard Rail
Existing R/W
Existing R/W
Sta. 4"C&G
Sta. 24"C&G
Sta. 24"C&G
Post
Gate
Bollard
Sign
Sign
Sign
Sign
VDOT Mon(F)
VDOT Mon(F)
VDOT Mon(F)
P/P#AG33
P/P#AG32
P/P#AF29
P/P Not #
L/P Base
L/P Base
GW
EP
Asphalt
Conc
Unk
TC Duct
E Duct
T/Tg
Curb
Rail
Sta.

3004 3005 3006 3007 3008 3009

W18

02-6 02-7 03-1 03-2 03-3 03-4

8 "SAN 12 "W 6 "W 2 "G 4"CLF 6"CLF 8'CLF 5'CLF 6"Curb 12"Conc 24"C&G

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REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-107 C-501	36(10)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

RAMP EN

UTILITY RELOCATION LEGEND

8"SAN	Proposed Utility Size & Type
6"W	Abandon
6"W	Remove
6"W	Pipe Casing
6"W	Coupling
	San Manhole

Utility Conflict Designations
(# indicates unique designation number)

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- (G#) Gas Line
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- (TT#) Electric Transmission Tower
- (W#) Water Line

MATCH LINE STA 333+50 SHEET 8

MATCH LINE STA 1420+50 SEE SHEETNo.II

MATCH LINE STA 340+00 SHEET II

Existing R/W & Limited Access Line
VDOT Mon(F)
Exist. US 264 Constr. ℄
Prop. RAMP "EN" Constr. ℄
Jersey Barrier
Asphalt
Asphalt Ramp
Guard Rail
6"Curb
6"CLF
Gravel
Sign
Inv Out=10.81
In Pl 15"RCP
In Pl FES
Inv Out=8.62
In Pl 21"RCP
In Pl 30"HDPP
Inv Buried
Pond
Control
Rip-Rap
Fountain
Gazebo
6-Sty Block Showroom
8'CLF
Gate
Billboard
Canopy
Conc
Bollard
Conc Flume
E Duct
Guard Rail
L/P#641102
L/P#641133
L/P#641101
L/P#641100
L/P#641059
E/P#641058
E/P#6400?9
1415
1416
1417
1418
1419
1420
334
335
336
337
338
339
340
16'
6.5
7.5
12.0
12.3
12.5
POND 8
E37
E38
03-1
03-5
SCALE 0 25' 50'

PROJECT —-—-—
SHEET NO. 36(10)

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PROJECT MANAGER Frank Fabian (757) 396-6800
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Telephone: Verizon Communications
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Traffic: Virginia Department of Transportation
T.V.: Cox Communications
Water: City of Portsmouth

UTILITY RELOCATION LEGEND

- 8 "SAN — Proposed Utility Size & Type
- 6 "W — Abandon
- 6 "W — Remove
- 6 "W — Pipe Casing
- 6 "W — Coupling
- San Manhole

Utility Conflict Designations
(# indicates unique designation number)

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- (G#) Gas Line
- (PP#) Electric Power Pole
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UTILITY RELOCATION DESIGN BY DOMINION VIRGINIA POWER TO BE COMPLETED BY ESTIMATED DATE OF FEB. 1 2011.

PRE-AUGER ALL BRIDGE PIER PILES TO NOT IMPACT EXIST. 20" C.I. WATER

20" W EXIST. LOCATION ACCORDING TO VDH PLAN FEBRUARY 1962
37' 36" RCP ENCASEMENT
105' 36" RCP ENCASEMENT

CONNECT TO EXIST. 20" WATER NIGHT TIME SHUTDOWN
PRE-AUGER ALL BRIDGE PIER PILES TO NOT IMPACT EXIST. C.I. WATER

REMOVE 20" W

RELOCATE 20" D.I. W

THESE PLANS ARE UNFINISHED AND UNAPPROVED AND ARE NOT TO BE USED FOR ANY TYPE OF CONSTRUCTION OR THE ACQUISITION OF RIGHT OF WAY.

Match Line Sta. 1420+50 See Sheet No. 10

Match Line Sta. 340+00 See Sheet No. 10

Match Line Sta. 1426+50 See Sheet No. 12

Match Line Sta. 345+50 See Sheet No. 13

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
2-10-2011	VA.	—	0058-965-107 C-501	36(11)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

SCALE 0 25' 50' | PROJECT ___-___-___ | SHEET NO. 36(11)

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PROJECT MANAGER Frank Fabian (757) 396-6800
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Traffic:	Virginia Department of Transportation
T.V.:	Cox Communications
Water:	City of Portsmouth

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-107 C-501	36(12)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

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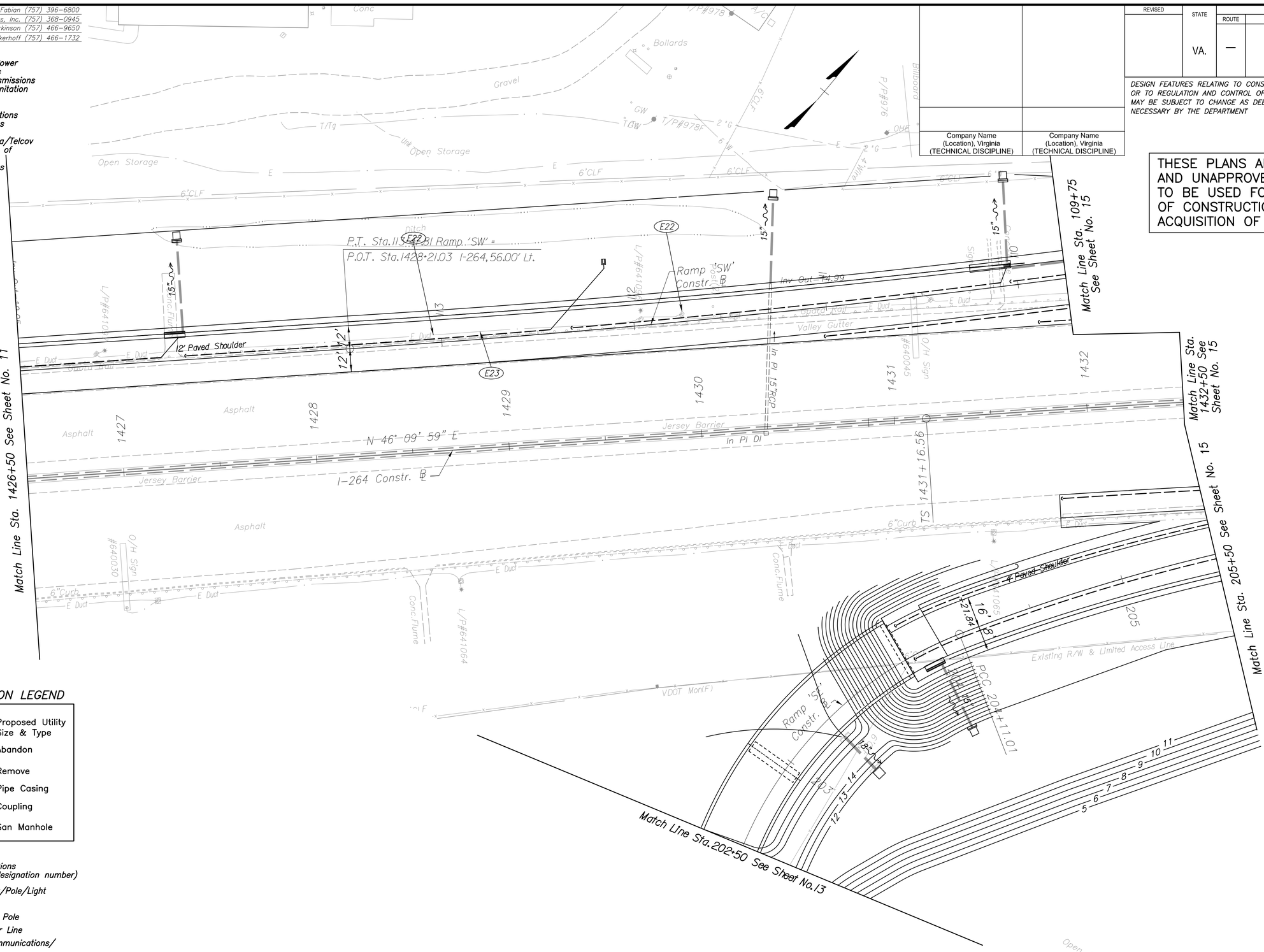

UTILITY RELOCATION LEGEND

8 "SAN	Proposed Utility Size & Type
6 "W	Abandon
6 "W	Remove
6 "W	Pipe Casing
6 "W	Coupling
	San Manhole

Utility Conflict Designations
(# indicates unique designation number)

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- (TT#) Electric Transmission Tower
- (W#) Water Line

SCALE	PROJECT	SHEET NO.
0 25' 50'	—-—-—	36(12)

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17-MAR-2011

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REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
2-10-2011	VA.	—	0058-965-107 C-501	36(13)

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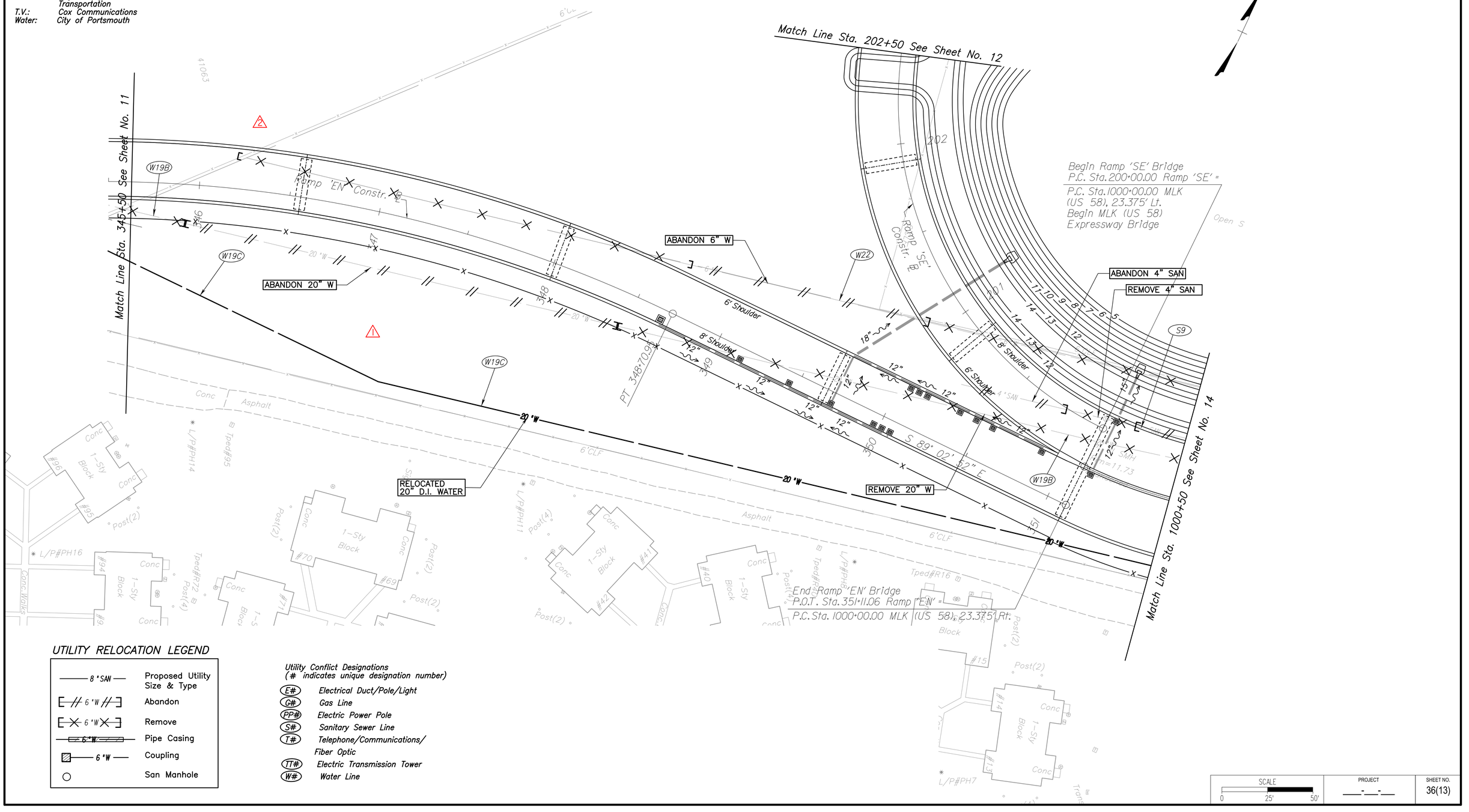

UTILITY RELOCATION LEGEND

8 "SAN	Proposed Utility Size & Type
6 "W	Abandon
6 "W	Remove
6 "W	Pipe Casing
6 "W	Coupling
	San Manhole

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(# indicates unique designation number)

E#	Electrical Duct/Pole/Light
G#	Gas Line
PP#	Electric Power Pole
S#	Sanitary Sewer Line
T#	Telephone/Communications/ Fiber Optic
TT#	Electric Transmission Tower
W#	Water Line

SCALE	PROJECT	SHEET NO.
0 25' 50'		36(13)

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6 "W	Abandon
6 "W	Remove
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2-10-2011	VA.	—	0058-965-107 C-501	36(14)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

POND 14

REMOVE WATER LINE (WATER LINE ABANDONED BY CITY ACCORDING TO PPU)

REMOVE WATER LINE (WATER LINE ABANDONED BY CITY ACCORDING TO PPU)

Match Line Sta. 1000+50 See Sheet No. 13

Match Line Sta. 1006+50 See Sheet No. 15

ABANDON 4" SAN

REMOVE 20" W

REMOVE 4" SAN

REMOVE 4" SAN

ABANDON 20" W

ABANDON 4" SAN

CONNECT TO EXIST. 20"W NIGHT TIME SHUTDOWN

ABANDON 6" W

CUT & CAP 2"G

ADJUST SAN MH RIM

MLK (US 58) Expressway Constr. B

PRHA Driveway

Columbus Avenue

SCALE 0 25' 50'

PROJECT

SHEET NO. 36(14)

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REVISED	STATE	STATE		SHEET NO.
		ROUTE	PROJECT	
2-10-2011	VA.	—	0058-965-107 C-501	36(15)

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Match Line Sta. 109+75 See Sheet No. 12

Match Line Sta. 1432+50 See Sheet No. 12

Match Line Sta. 205+50 See Sheet No. 12

Match Line Sta. 105+75 See Sheet No. 16

Match Line Sta. 1010+75 See Sheet No. 16

Match Line Sta. 1438+50 See Sheet No. 18

Match Line Sta. 1006+50 See Sheet No. 14

CONNECT TO EXIST. 6" W

ABANDON 6" W

VERTICAL & HORIZONTAL OFFSET 6" W

OHE TO UGE

REMOVE WATER LINE (WATER LINE ABANDONED BY CITY ACCORDING TO PPU)

REMOVE 6" W

P.T. Sta.208+27.60 Ramp 'SE' =
P.O.C. Sta.1435+44.68 I-264, 56.00' Rt.

Ramp 'SE' Constr. ℄

Ramp 'SW' Constr. ℄

I-264 Constr. ℄

I-264 (WBL)

I-264 (EBL)

MLK (US 58) Expressway Constr. ℄

Site 44PM0062
The Mt.Olive Potter's Field Site

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6 "W	Remove
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T#	Telephone/Communications/ Fiber Optic
TT#	Electric Transmission Tower
W#	Water Line

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SCALE	PROJECT	SHEET NO.
0 25' 50'	—-—-—	36(15)

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17-MAR-2011
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21-NOV-2011

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2-10-2011	VA.	—	0058-965-107 C-501	36(16)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

REMOVE 24" W
W25
24"W
Ditch
Gravel
Conc
Hoppers
O/H Pipes
Tanks
Metal Shed
Blower
Retaining Walls
Match Line Sta. 101+25 See Sheet No. 17
PP50
PP49
102
19'
6'
12'
+05.52
+45.02
~8"
6'CLF
Ramp 'SW' Constr. B
Ramp 'S' Constr. B
MLK (US 58) Expressway Constr. B
N 16° 26' 26" W
Match Line Sta. 1014+50 See Sheet No. 17
~10"
~12"
1014
Open Storage
Connex Box
OHE (Abandoned)
PP51
1013
OHE (Under) Gate
Elec.Outlet
24"C&G
Asphalt Parking
2-Sty Metal #1420
6"Curb
Conc
6"CLF
23-11
23-2
23-1
22-3
P/P #EK1016
Rest
Tank
Tanks
Metal Shed
Gravel
Asph
Conc
Conc Wall
Open
P/P No#
104
~8"
8' Shoulder
6' Shoulder
6"
16' 6"
+55.52
8'
24'
PT 1012+28.02
~12"
Existing R/W
1012
VDOT Mon(F)
G16
W11
3"G
RELOCATE 8" SAN
S8B
8"SAN
CONNECT TO EXIST. 6" W
CONNECT TO EXIST. SAN MH
G18
125
In Pl Headwall Inv Out=8.46
Inv Out=8.58
18"RCP
RF
E8
VERTICAL & HORIZONTAL OFFSET 6" W
ABANDON 6" W
W11
6"CLF
REMOVE 6" W
ABANDON 6" W
ABANDON 8" SAN
S8
W23
PP55
E8
OHE TO UGE
PP54
Columbus Avenue
In Pl Headwall Inv Out=6.87
Match Line Sta. 105+75 See Sheet No. 15
Match Line Sta. 1010+75 See Sheet No. 15
Match Line See Sheet No. 19

SCALE	PROJECT	SHEET NO.
0 25' 50'	___-___-___	36(16)

PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
DESIGNED BY Parsons Brinckerhoff (757) 466-1732

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-107 C-501	36(17)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

THESE PLANS ARE UNFINISHED AND UNAPPROVED AND ARE NOT TO BE USED FOR ANY TYPE OF CONSTRUCTION OR THE ACQUISITION OF RIGHT OF WAY.

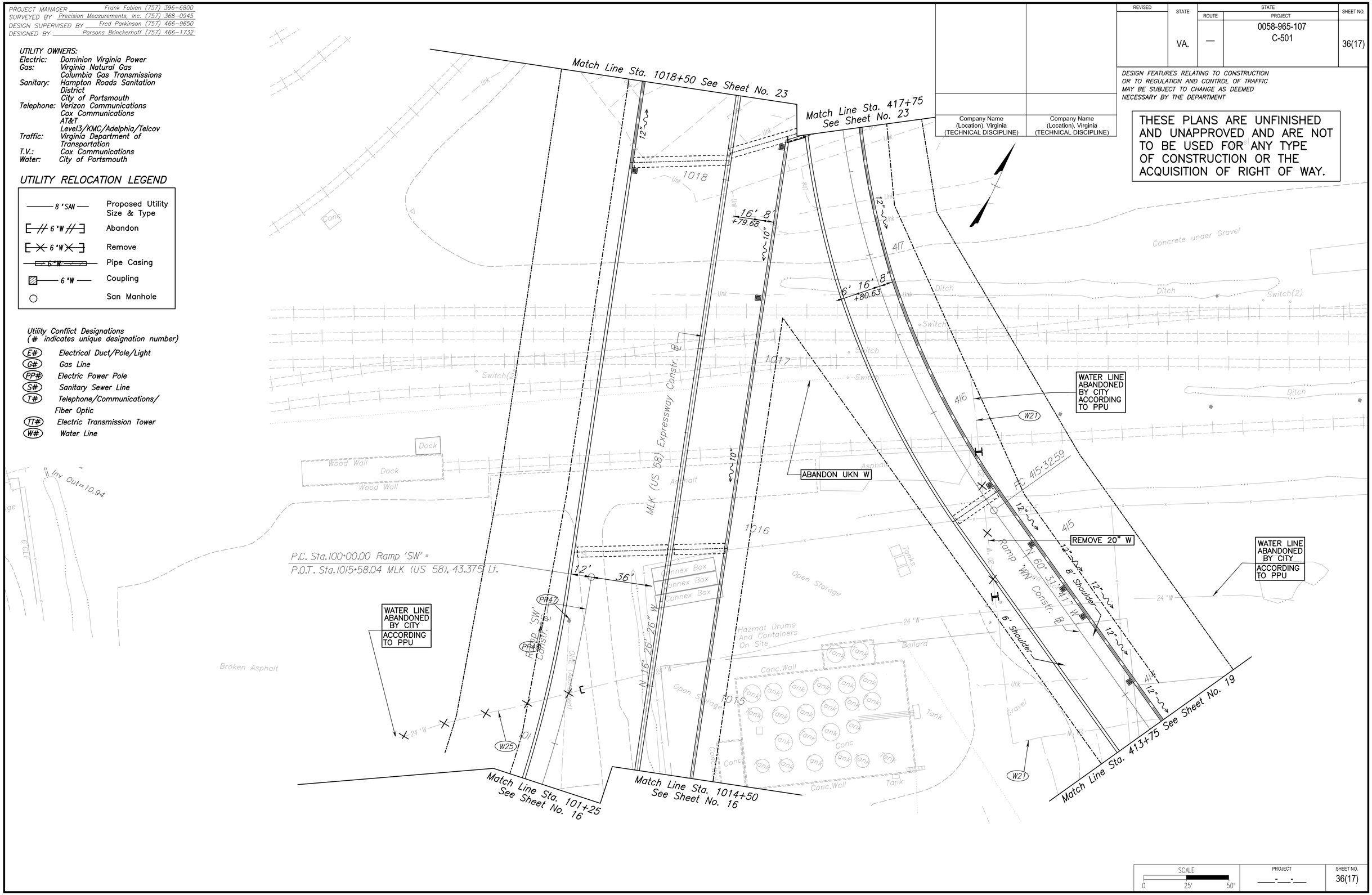
UTILITY OWNERS:
Electric: Dominion Virginia Power
Gas: Virginia Natural Gas
Columbia Gas Transmissions
Sanitary: Hampton Roads Sanitation District
City of Portsmouth
Telephone: Verizon Communications
Cox Communications
AT&T
Level3/KMC/Adelphia/Telcov
Traffic: Virginia Department of Transportation
T.V.: Cox Communications
Water: City of Portsmouth

UTILITY RELOCATION LEGEND

8 "SAN	Proposed Utility Size & Type
6 "W	Abandon
6 "W	Remove
6 "W	Pipe Casing
6 "W	Coupling
	San Manhole

Utility Conflict Designations
(# indicates unique designation number)

- E# Electrical Duct/Pole/Light
- G# Gas Line
- PP# Electric Power Pole
- S# Sanitary Sewer Line
- T# Telephone/Communications/ Fiber Optic
- TT# Electric Transmission Tower
- W# Water Line



SCALE 0 25' 50'
PROJECT
SHEET NO. 36(17)

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21-NOV-2011
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PROJECT MANAGER Frank Fabian (757) 396-6800
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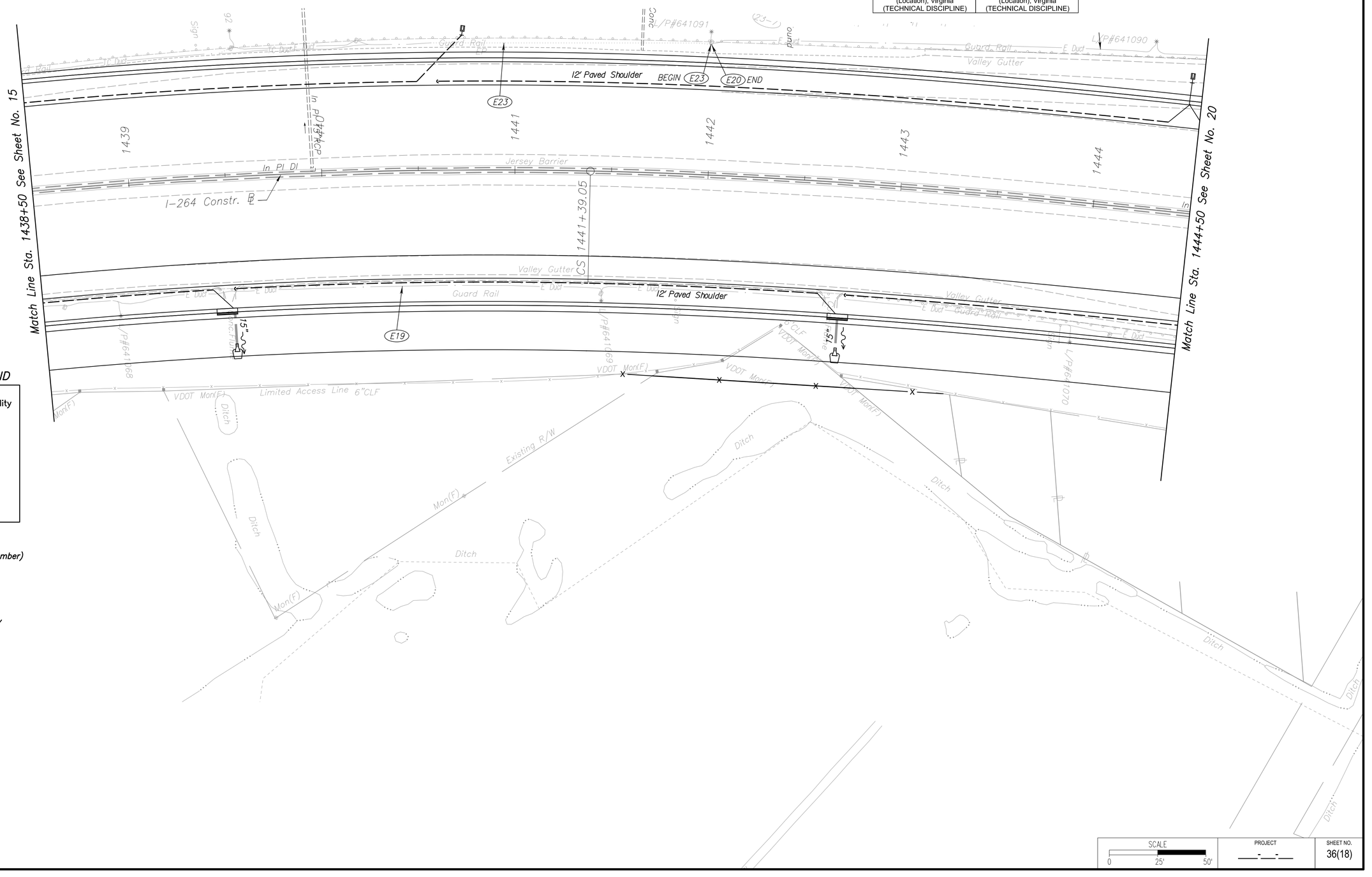
Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-107 C-501	36(18)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT



UTILITY RELOCATION LEGEND

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6 "W	Abandon
6 "W	Remove
6 "W	Pipe Casing
6 "W	Coupling
	San Manhole

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W#	Water Line

SCALE	PROJECT	SHEET NO.
0 25' 50'	—-—-—	36(18)

10:46
17-MAR-2011
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UTILITY RELOCATION LEGEND

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6 "W	Abandon
6 "W	Remove
6 "W	Pipe Casing
6 "W	Coupling
	San Manhole

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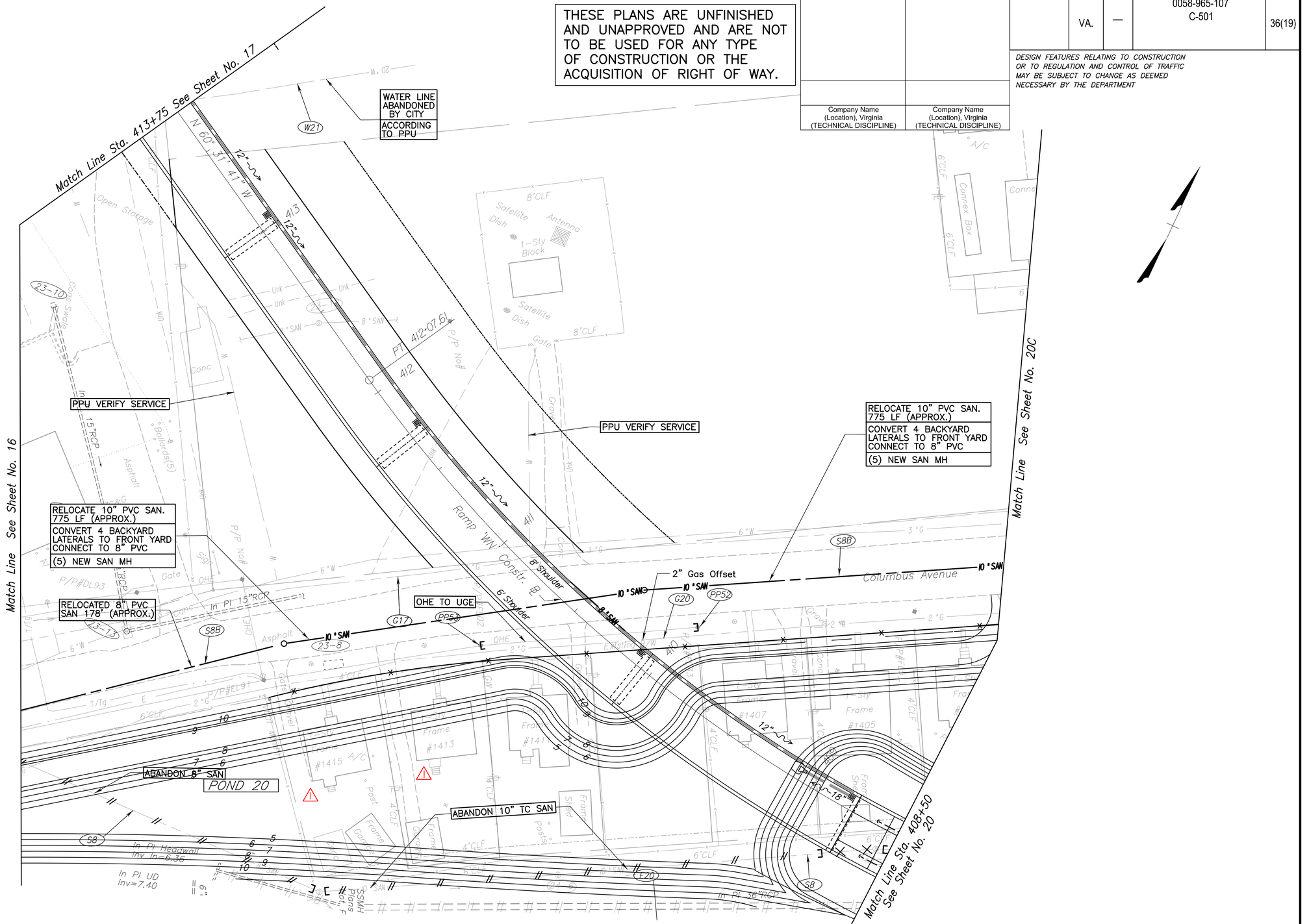
Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
2-10-2011	VA.	—	0058-965-107 C-501	36(19)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT



SCALE	PROJECT	SHEET NO.
0 25' 50'	___-___-___	36(19)

PROJECT MANAGER Frank Fabian (757) 396-6800
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REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-107 C-501	36(20)

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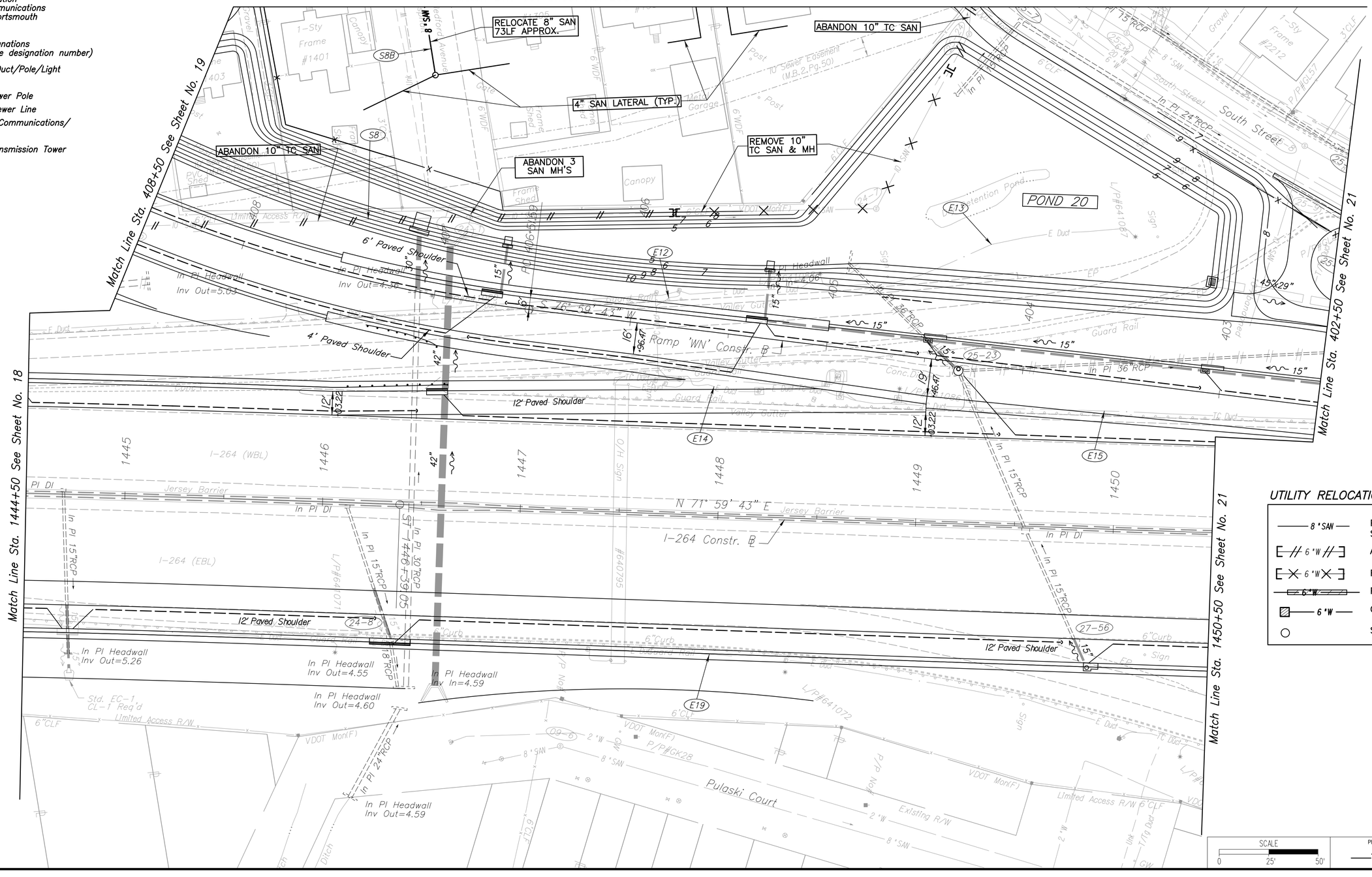
Match Line See Sheet No. 20C
Match Line Sta. 408+50 See Sheet No. 19
Match Line Sta. 1444+50 See Sheet No. 18
Match Line Sta. 402+50 See Sheet No. 21
Match Line Sta. 1450+50 See Sheet No. 21
RELOCATE 8" SAN 73LF APPROX.
ABANDON 10" TC SAN
4" SAN LATERAL (TYP.)
ABANDON 10" TC SAN
ABANDON 3 SAN MH'S
REMOVE 10" TC SAN & MH
POND 20
6' Paved Shoulder
4' Paved Shoulder
12' Paved Shoulder
S 16° 50' 43" W
N 71° 59' 43" E
Ramp 'WN' Constr. ℄
I-264 Constr. ℄
I-264 (WBL)
I-264 (EBL)
Jersey Barrier
Pulaski Court
South Street
In Pl Headwall Inv Out=5.63
In Pl Headwall Inv Out=4.56
In Pl Headwall Inv In=4.66
In Pl Headwall Inv Out=5.26
In Pl Headwall Inv Out=4.55
In Pl Headwall Inv In=4.59
In Pl Headwall Inv Out=4.60
In Pl Headwall Inv Out=4.59
In Pl 15"RCP
In Pl 24"RCP
In Pl 30"RCP
In Pl 36"RCP
In Pl 18"RCP
In Pl 24"RCP
Std. EC-1 CL-1 Req'd
Limited Access R/W
Existing R/W
VDOT Mon(F)
Guard Rail
Valley Gutter
Conc. Ditch
Sign
Gravel
Canopy
Shed
Garage
Post
Gate
Fence
Utility Access Rd
Detention Pond
Jersey Barrier
1-Sty Frame #1401
1-Sty Frame #2212
Metal Garage
Frame Shed
Frame Canopy
Frame Garage
Brick Garage
Brick Shed
Concrete Block Shed
Concrete Block Garage
Concrete Block Canopy
Brick Canopy
Frame Shed
Frame Garage
Frame Canopy

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Utility Conflict Designations
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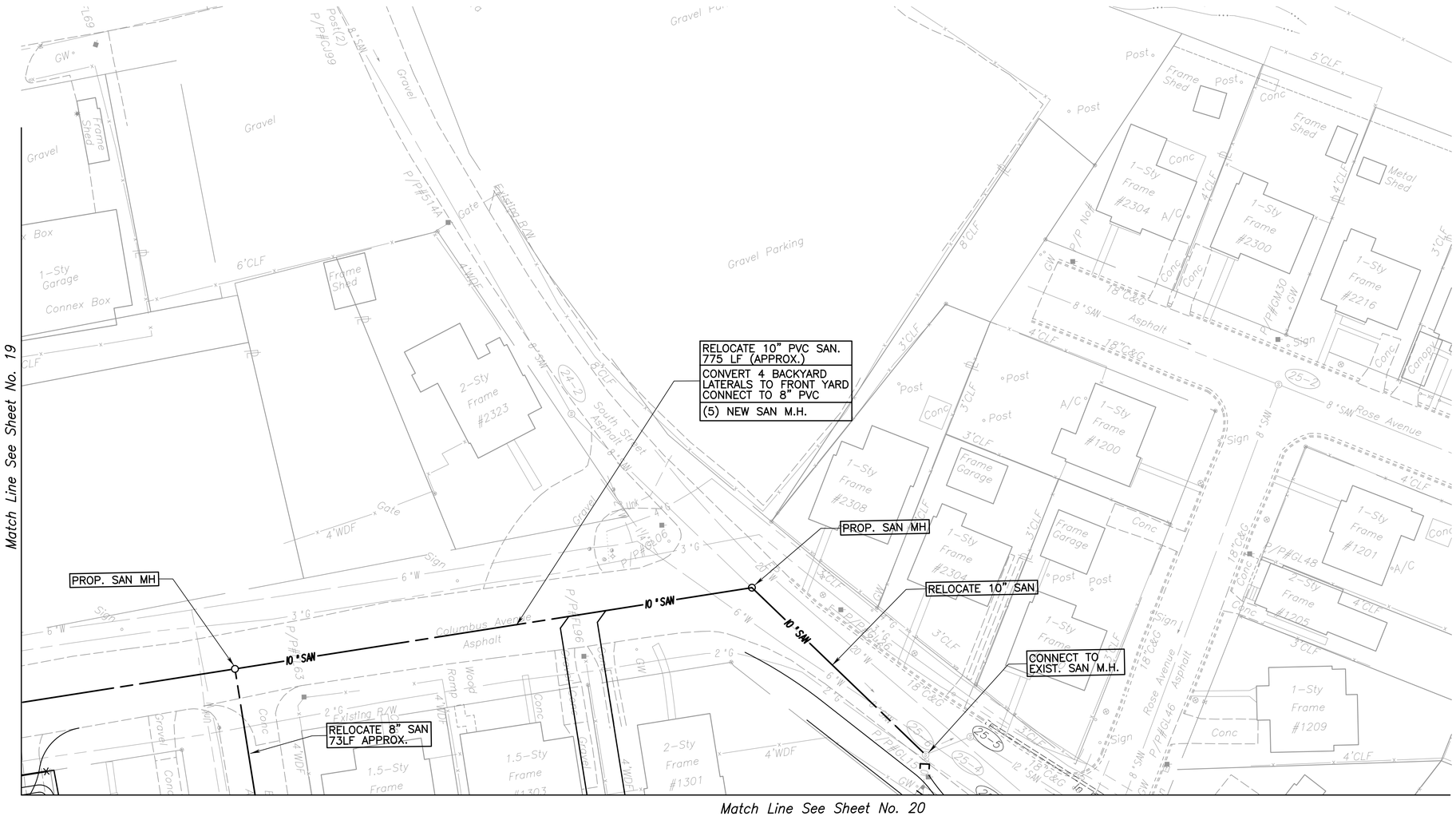
Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-107 C-501	36(20C)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT



UTILITY RELOCATION LEGEND

8 "SAN	Proposed Utility Size & Type
6 "W	Abandon
6 "W	Remove
6 "W	Pipe Casing
6 "W	Coupling
	San Manhole

SCALE	PROJECT	SHEET NO.
0 25' 50'	—-—-—	36(20C)

10:47 17-MAR-2011 T:\173189-MidtownTunnel\MLK\Sheet\Utilities\4MK-CUTY-PLN-020C.dgn

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UTILITY OWNERS:
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UTILITY RELOCATION LEGEND

8 "SAN	Proposed Utility Size & Type
6 "W	Abandon
6 "W	Remove
6 "W	Pipe Casing
6 "W	Coupling
	San Manhole

Utility Conflict Designations
(# indicates unique designation number)

E#	Electrical Duct/Pole/Light
G#	Gas Line
PP#	Electric Power Pole
S#	Sanitary Sewer Line
T#	Telephone/Communications/ Fiber Optic
TT#	Electric Transmission Tower
W#	Water Line

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-107 C-501	36(21)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

Match Line Sta. 402+50 See Sheet No. 20
Match Line Sta. 1450+50 See Sheet No. 20
Match Line Sta. 1456+50 See Sheet No. 22
Begin Construction
P.O.T. Sta.400+00.00 Ramp 'WN'
P.O.T. Sta.1453+50.00 I-264, 44.00' Lt.
Ramp 'WN' Constr. ℄
I-264 Constr. ℄
I-264 (WBL)
I-264 (EBL)
N 71° 59' 43" E
14' Paved Shoulder
12' Paved Shoulder
In Pl 18"RCP
In Pl 24"RCP
In Pl 36"RCP
In Pl 15"RCP
In Pl 12"RCP
In Pl DI
In Pl Headwall
Inv In=5.74
Jersey Barrier
Valley Gutter
Guard Rail
Flume 1
Gravel
Asphalt
Conc Walk
Conc Wall
Sign
Gate
Fence
Shed
Deck
Frame
Brick
Robertson Road
Portsmouth Avenue
South Street
Limited Access
Existing R/W
1451
1452
1453
1454
1455
1456

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SCALE	PROJECT	SHEET NO.
0 25' 50'	—-—-—	36(21)

PROJECT MANAGER Frank Fabian (757) 396-6800
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UTILITY OWNERS:

Electric:	Dominion Virginia Power
Gas:	Virginia Natural Gas Columbia Gas Transmissions
Sanitary:	Hampton Roads Sanitation District City of Portsmouth
Telephone:	Verizon Communications Cox Communications AT&T Level3/KMC/Adelphia/Telcov
Traffic:	Virginia Department of Transportation
T.V.:	Cox Communications
Water:	City of Portsmouth

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REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-107 C-501	36(22)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

Match Line Sta. 1456+50 See Sheet No. 21

N 71° 59' 43" E

I-264 Constr. ℄

I-264 (EBL)

I-264 (W

South Street

Race Street

Jersey Barrier

Guard Rail

Conc Bridge

Conc Slope

Column

Asphalt

Gravel

Conc Walk

Fence

6'CLF

6'WOF

6'PVC Fence

Dog Pen

Wood Deck

Metal Shed

Frame Shed

Garage Ruins

Elec.Panel

Tele.Cab

Sign

Canopy

Brick

Conc

Post(8)

Gas Vlv

Gas Mtr

Guy Wire

Utility Pole

Light

Tree

Bush

Existing R/W

Proposed R/W

Des Moines Avenue

Valley Gutter

Conc Walk P/P#JJ94

P/P#JK19

P/P#IL49

P/P#IL18

P/P#IL29

P/P#IM50

P/P#IL78

P/P#RF12

P/P#EK21

P/P#IL09

P/P#641083

P/P#641082

P/P#641081

P/P#P5086

P/P#P5072

P/P#P5184

Tped#1413

Tped#1414

1457 1458 1459 1460 1461 1462

#1802 #1804 #1708 #1704 #1220 #1413 #1324 #1325 #1327

#36 #40 #42 #44 #43

27-2 27-3 27-5 27-6 27-7 27-8 27-9 27-10 27-11 27-38 27-39 27-43 27-55

28-7 28-12 28-31 28-32 28-35 28-36 28-37

E17 E44 T22

18"RCP 15"RCP 24"C&G 30"C&G 6"Curb 6'CLF 8"PVC 8"SAN 8"WS, 8 In Pl 15"RCP In Pl 18"RCP In Pl DI

14' Shoulder 12' Paved Shoulder

UTILITY RELOCATION LEGEND

8 "SAN	Proposed Utility Size & Type
6 "W	Abandon
6 "W	Remove
6 "W	Pipe Casing
6 "W	Coupling
○	San Manhole

Utility Conflict Designations
(# indicates unique designation number)

- (E#) Electrical Duct/Pole/Light
- (G#) Gas Line
- (PP#) Electric Power Pole
- (S#) Sanitary Sewer Line
- (T#) Telephone/Communications/ Fiber Optic
- (TT#) Electric Transmission Tower
- (W#) Water Line

SCALE 0 25' 50'

PROJECT	SHEET NO.
—-—-—	36(22)

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REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-107 C-501	36(23)

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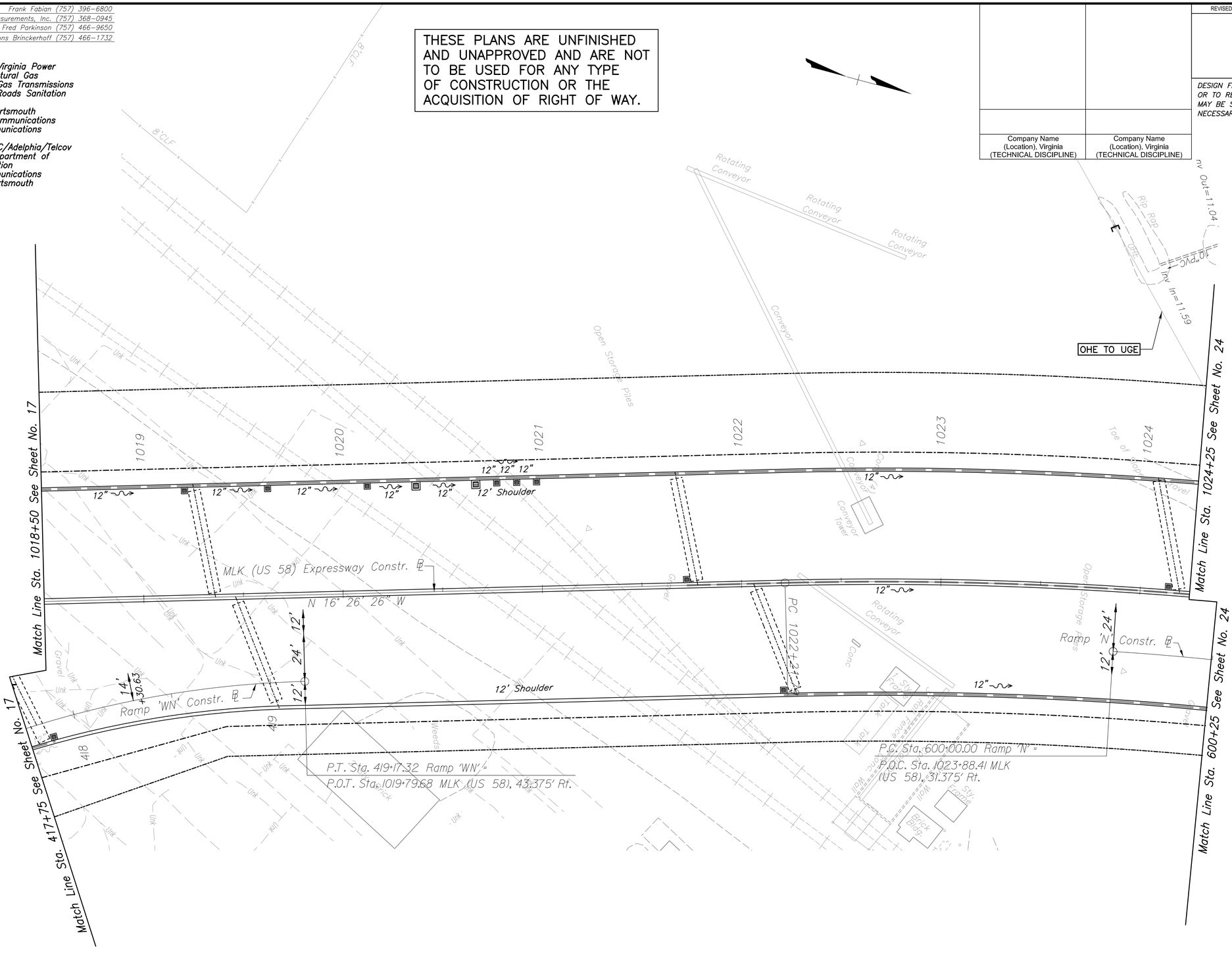

UTILITY RELOCATION LEGEND

8 "SAN	Proposed Utility Size & Type
6 "W //	Abandon
6 "W X	Remove
6 "W	Pipe Casing
6 "W	Coupling
○	San Manhole

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G#	Gas Line
PP#	Electric Power Pole
S#	Sanitary Sewer Line
T#	Telephone/Communications/ Fiber Optic
TT#	Electric Transmission Tower
W#	Water Line

SCALE	PROJECT	SHEET NO.
0 25' 50'		36(23)

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17-MAR-2011
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- (TT#) Electric Transmission Tower
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REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-107 C-501	36(24)

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

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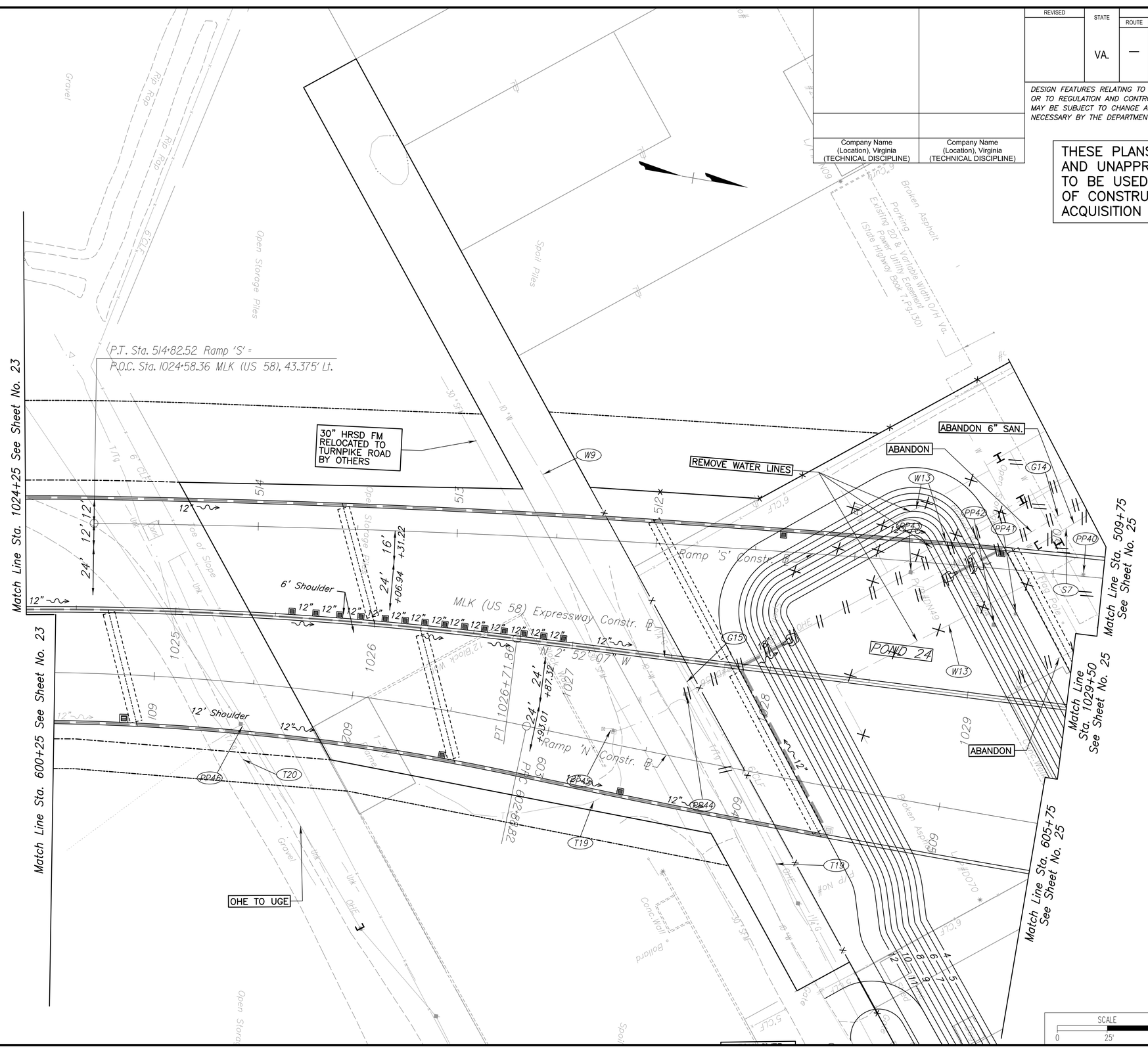

SCALE	PROJECT	SHEET NO.
0 25' 50'	—-—-—	36(24)

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Water: City of Portsmouth

UTILITY RELOCATION LEGEND

- 8"SAN — Proposed Utility Size & Type
- 6"W — Abandon
- 6"W — Remove
- 6"W — Pipe Casing
- 6"W — Coupling
- San Manhole

Utility Conflict Designations
(# indicates unique designation number)

- E# Electrical Duct/Pole/Light
- G# Gas Line
- PP# Electric Power Pole
- S# Sanitary Sewer Line
- T# Telephone/Communications/ Fiber Optic
- TT# Electric Transmission Tower
- W# Water Line

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REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
2-10-2011	VA.	—	0058-965-107 C-501	36(25)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

CUT & CAP 2"G
ABANDON 6" SAN PLUG AT MH
ABANDON 1 1/4"G
REMOVE 8" SAN
RELOCATE 6" W CONNECT TO EXIST.
PROP. SAN MH CONNECT TO EXIST.
8" D.I. SAN
RELOCATE 6" W
ABANDON 2" W
REMOVE 6" W
ABANDON 8" SAN.
REMOVE 8" SAN
ABANDON 6" W
ABANDON 2" W
ABANDON
6" W CONNECT TO EXIST. 2" W
ABANDON WATER LINES COORDINATE WITH PORTSMOUTH PUBLIC UTILITIES
OHE TO UGE
Proposed Verizon
POND 25
POND 24
MLK (US 58) Expressway Constr. B
County Street Constr. B
Ramp 'S' Constr. B
Ramp 'N' Constr. B
8" Shoulder
6' Shoulder
12' Shoulder
Tie-in to Existing
Match Line Sta.509+75 See Sheet No. 24
Match Line Sta. 1029+50 See Sheet No. 24
Match Line See Sheet No. 26
Match Line Sta. 503+75 See Sheet No. 27
Match Line Sta. 1035+50 See Sheet No. 27
Match Line Sta. 605+75 See Sheet No. 24
Match Line Sta. 611+75 See Sheet No. 27

SCALE	PROJECT	SHEET NO.
0 25' 50'	- - -	36(25)

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PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
DESIGNED BY Parsons Brinckerhoff (757) 466-1732

UTILITY OWNERS:
Electric: Dominion Virginia Power
Gas: Virginia Natural Gas
Columbia Gas Transmissions
Sanitary: Hampton Roads Sanitation District
City of Portsmouth
Telephone: Verizon Communications
Cox Communications
AT&T
Level3/KMC/Adelphia/Telcov
Traffic: Virginia Department of Transportation
T.V.: Cox Communications
Water: City of Portsmouth

Utility Conflict Designations
(# indicates unique designation number)
(E#) Electrical Duct/Pole/Light
(G#) Gas Line
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(T#) Telephone/Communications/ Fiber Optic
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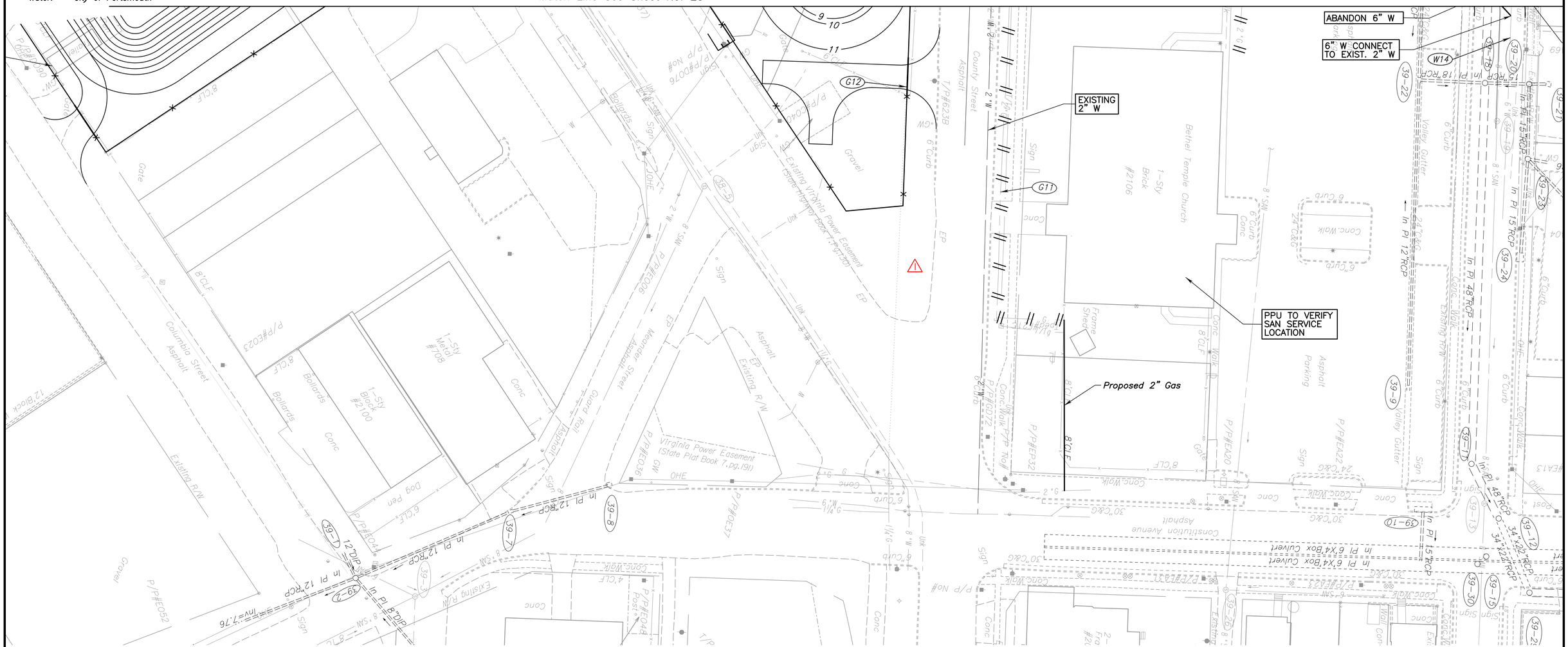
Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
2-10-2011	VA.	—	0058-965-107 C-501	36(26)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

Match Line See Sheet No. 25



UTILITY RELOCATION LEGEND

8 "SAN	Proposed Utility Size & Type
6 "W	Abandon
6 "W	Remove
6 "W	Pipe Casing
6 "W	Coupling
○	San Manhole

SCALE 0 25' 50'

PROJECT

SHEET NO. 36(26)

17-MAR-2011

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REVISED	STATE	STATE		SHEET NO.
2-10-2011		ROUTE	PROJECT	
	VA.	—	0058-965-107 C-501	36(27)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

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DESIGNED BY Parsons Brinckerhoff (757) 466-1732

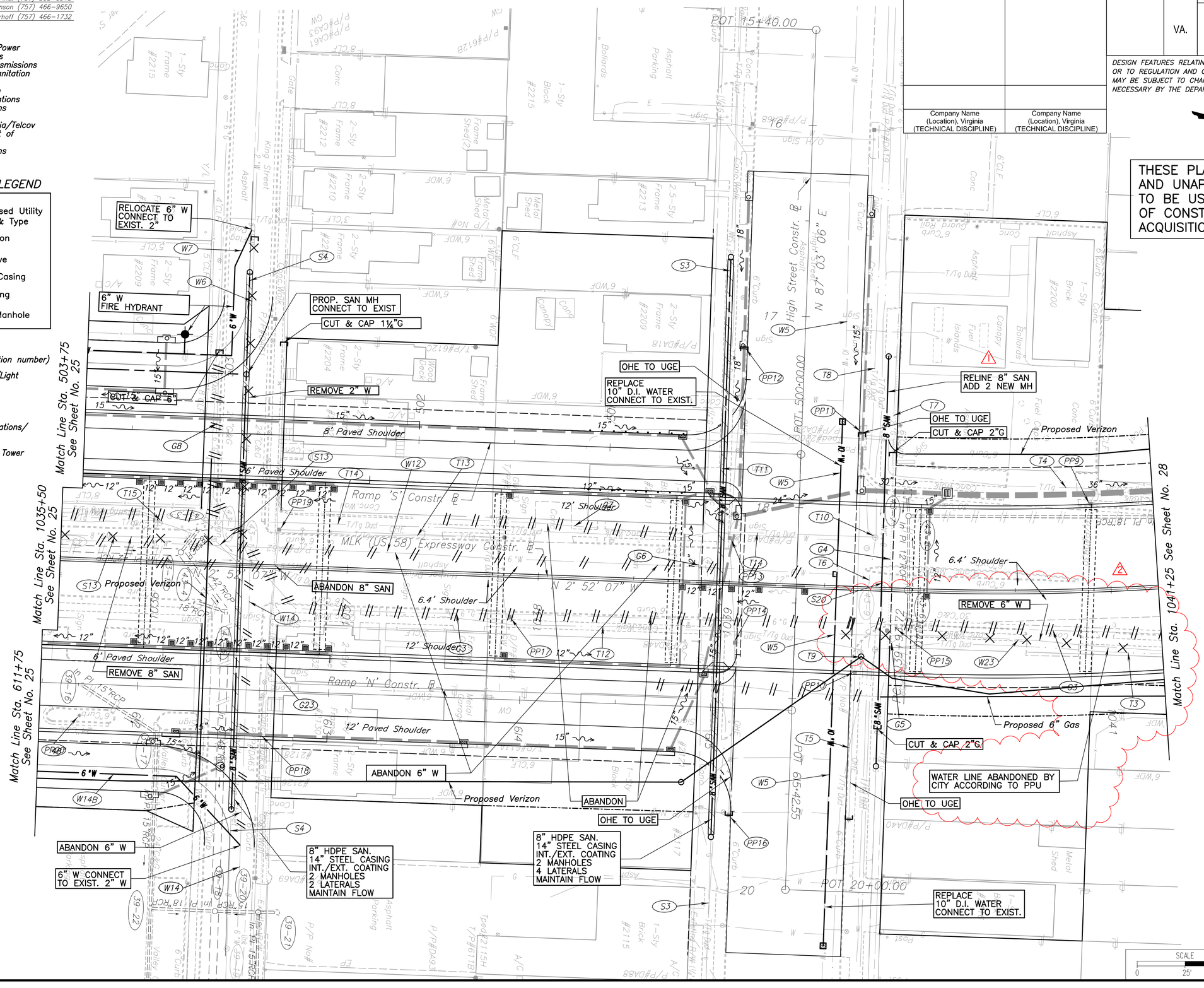
UTILITY OWNERS:
Electric: Dominion Virginia Power
Gas: Virginia Natural Gas
Columbia Gas Transmissions
Sanitary: Hampton Roads Sanitation District
City of Portsmouth
Telephone: Verizon Communications
Cox Communications
AT&T
Level3/KMC/Adelphia/Telcov
Traffic: Virginia Department of Transportation
T.V.: Cox Communications
Water: City of Portsmouth

UTILITY RELOCATION LEGEND

- 8 "SAN — Proposed Utility Size & Type
- 6 "W — Abandon
- 6 "W — Remove
- 6 "W — Pipe Casing
- 6 "W — Coupling
- San Manhole

Utility Conflict Designations
(# indicates unique designation number)

- (E#) Electrical Duct/Pole/Light
- (G#) Gas Line
- (PP#) Electric Power Pole
- (S#) Sanitary Sewer Line
- (T#) Telephone/Communications/ Fiber Optic
- (TT#) Electric Transmission Tower
- (W#) Water Line



SCALE	PROJECT	SHEET NO.
0 25' 50'	-__-__-	36(27)

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PROJECT MANAGER Frank Fabian (757) 396-6800
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DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
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Telephone: Verizon Communications
Cox Communications
AT&T
Level3/KMC/Adelphia/Telcov
Traffic: Virginia Department of Transportation
T.V.: Cox Communications
Water: City of Portsmouth

Utility Conflict Designations
(# indicates unique designation number)

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- G# Gas Line
- PP# Electric Power Pole
- S# Sanitary Sewer Line
- T# Telephone/Communications/ Fiber Optic
- TT# Electric Transmission Tower
- W# Water Line

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-107 C-501	36(28)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)

THESE PLANS ARE UNFINISHED AND UNAPPROVED AND ARE NOT TO BE USED FOR ANY TYPE OF CONSTRUCTION OR THE ACQUISITION OF RIGHT OF WAY.

UTILITY RELOCATION LEGEND

- 8 "SAN — Proposed Utility Size & Type
- 6 "W — Abandon
- 6 "W — Remove
- 6"W — Pipe Casing
- 6 "W — Coupling
- San Manhole

OHE TO UGE

RELOCATE 12" D.I. W FULLY RESTRAINED
CONNECT TO EXISTING 12" W
20" STEEL SPLIT CASING (145 LF) US 58
20" STEEL SPLIT CASING (67 LF) RAMP A
DAY TIME SHUTDOWN
PROVIDE DETOUR FOR TRENCHING OF US 58 AND EXISTING RAMP A (ONLY ONE AT A TIME)

CONNECT TO EXIST. 16" W

Proposed 6" Gas

6" JUMPER

REPLACE 8" D.I. SAN
CONNECT TO EXIST. W/ COUPLINGS
MAINTAIN FLOW

Proposed Verizon

RELOCATE 16" W

REMOVE 6" W

REMOVE 16" W

Proposed Verizon

Tie-in to Existing

OHE TO UGE

CONNECT PROP. 16" W TO EXIST. 12" W

CONNECT TO EXIST. 16" W

MLK (US 58) Expressway Constr. ℄

MacArthur Avenue

Queen Street

Liverpool Street

Ramp 'A' Constr. ℄

6.4' Shoulder

12' Shoulder

10' Paved Shoulder

6' Paved Shoulder

ABANDON SAN 4"–8" AND ABANDON MH

EXISTING SANITARY PLUGGED (BY OTHERS)

Match Line Sta. 1041+25 See Sheet No. 27

Match Line Sta. 1044+00 See Sheet No. 28

Match Line Sta. 1046+50 See Sheet No. 30

Match Line Sta. 1106+50 See Sheet No. 30

Match Line Sta. 1103+25 See Sheet No. 30

SCALE 0 25' 50'

PROJECT

SHEET NO. 36(28)

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17-MAR-2011

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PROJECT MANAGER Frank Fabian (757) 396-6800
SURVEYED BY Precision Measurements, Inc. (757) 368-0945
DESIGN SUPERVISED BY Fred Parkinson (757) 466-9650
DESIGNED BY Parsons Brinckerhoff (757) 466-1732

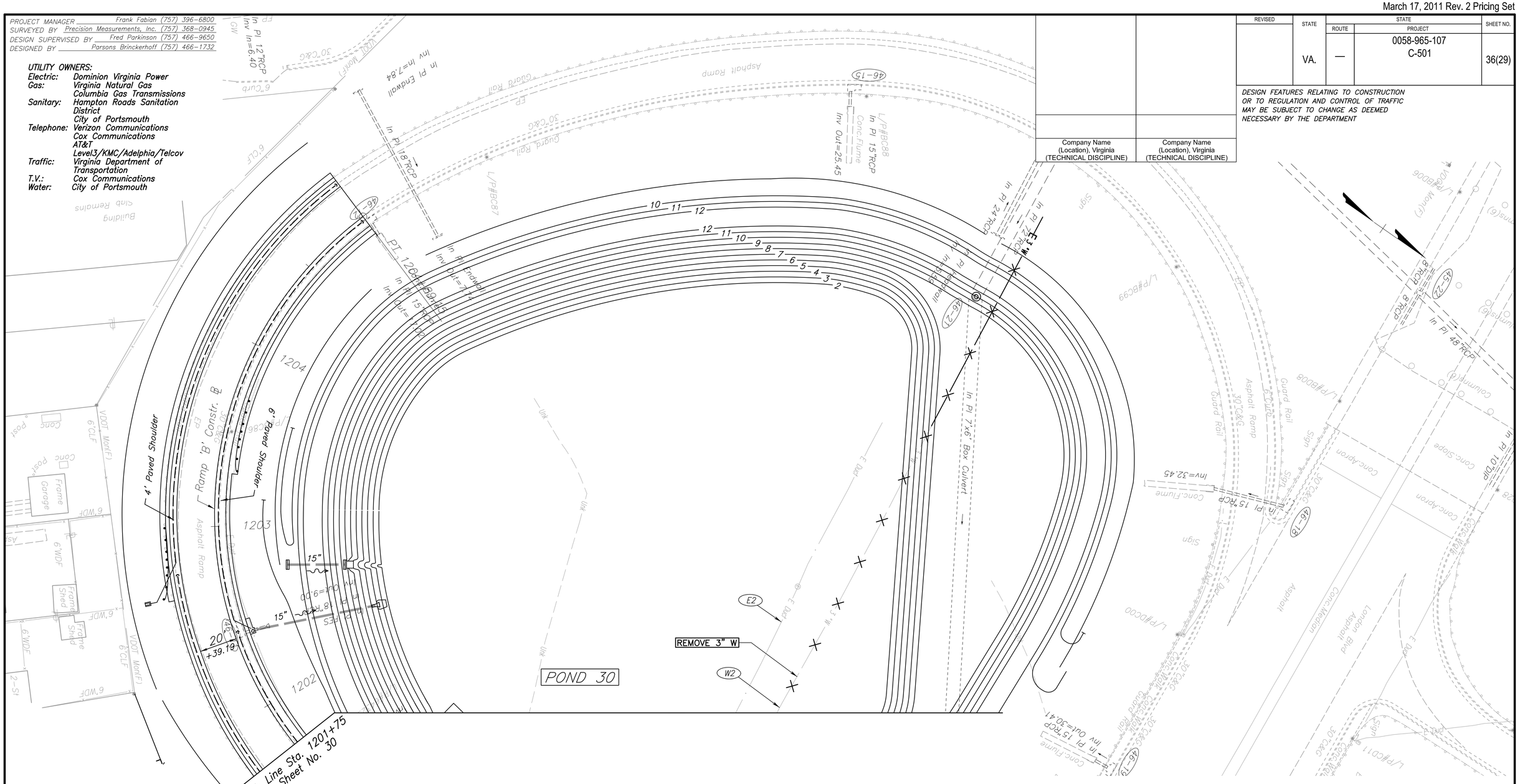
UTILITY OWNERS:

Electric:	Dominion Virginia Power
Gas:	Virginia Natural Gas Columbia Gas Transmissions
Sanitary:	Hampton Roads Sanitation District City of Portsmouth
Telephone:	Verizon Communications Cox Communications AT&T Level3/KMC/Adelphia/Telcov
Traffic:	Virginia Department of Transportation
T.V.:	Cox Communications
Water:	City of Portsmouth

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-107 C-501	36(29)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)



Utility Conflict Designations
(# indicates unique designation number)

- E# — Electrical Duct/Pole/Light
- G# — Gas Line
- PP# — Electric Power Pole
- S# — Sanitary Sewer Line
- T# — Telephone/Communications/ Fiber Optic
- TT# — Electric Transmission Tower
- W# — Water Line

UTILITY RELOCATION LEGEND

8 "SAN	Proposed Utility Size & Type
6 "W (abandon)	Abandon
6 "W (remove)	Remove
6"W	Pipe Casing
6 "W	Coupling
○	San Manhole

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SCALE	PROJECT	SHEET NO.
0 25' 50'	- - -	36(29)

PROJECT MANAGER	Frank Fabian (757) 396-6800
SURVEYED BY	Precision Measurements, Inc. (757) 368-0945
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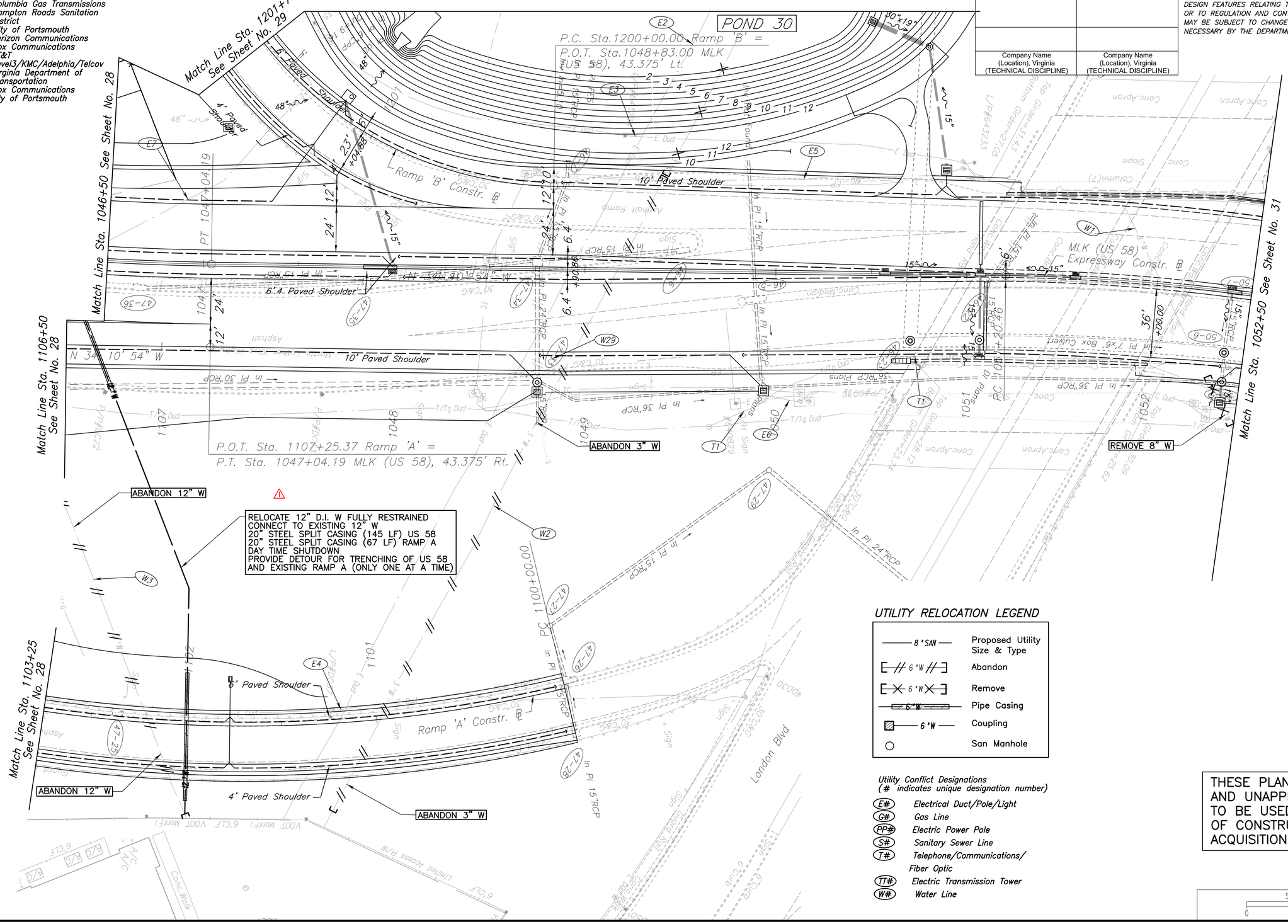
T.V.:	Cox Communications
Water:	City of Portsmouth

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-107 C-501	36(30)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

Company Name (Location), Virginia (TECHNICAL DISCIPLINE)	Company Name (Location), Virginia (TECHNICAL DISCIPLINE)



UTILITY RELOCATION LEGEND

8" SAN	Proposed Utility Size & Type
6" W	Abandon
6" W	Remove
6" W	Pipe Casing
6" W	Coupling
	San Manhole

Utility Conflict Designations
(# indicates unique designation number)

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SCALE	PROJECT	SHEET NO.
0 25' 50'		36(30)

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17-MAR-2011

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PROJECT MANAGER Frank Fabian (757) 396-6800
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REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	—	0058-965-107 C-501	36(31)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

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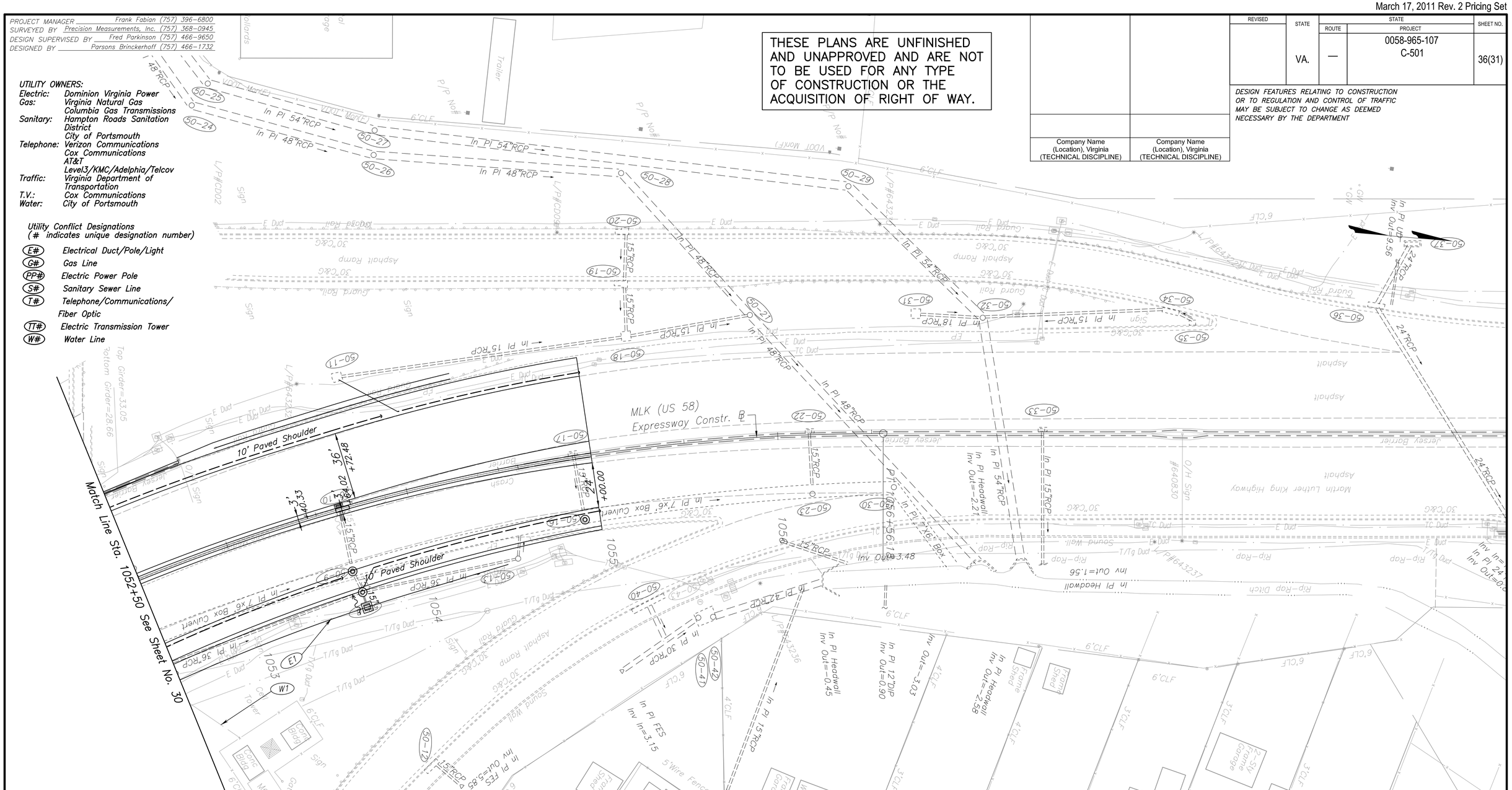
MLK (US 58)
Expressway Constr. ℄
10' Paved Shoulder
Match Line Sta. 1052+50 See Sheet No. 30
10' Paved Shoulder
In Pl 54"RCP
In Pl 48"RCP
In Pl 15"RCP
In Pl 7'x6' Box Culvert
In Pl 36"RCP
In Pl 42"RCP
In Pl 30"RCP
In Pl 18"RCP
In Pl 24"RCP
In Pl FES
Inv In=3.15
In Pl FES
Inv Out=3.85
In Pl Headwall
Inv Out=-0.45
In Pl 12"Dip
Inv Out=0.90
In Pl Headwall
Inv Out=-3.03
In Pl Headwall
Inv Out=-2.58
In Pl Headwall
Inv Out=1.56
Inv Out=3.48
Martin Luther King Highway
Asphalt
Asphalt Ramp
Jersey Barrier
Guard Rail
Sound Wall
Rip-Rap
Rip-Rap Ditch
Sign
Trailer
Frame Shed
Metal Shed
Metal Garage
2-Sty Frame Garage
1-Sty Frame #310
1.5-Sty Frame #312
Conc Bldg
Post
Conc. Walk
Top Girder=33.05
Bottom Girder=28.66
Station 1053+72.48
Station 1054+00.00
Station 1056+56.00
Station 1058+00.00
Station 1055+00.00
Station 1057+00.00
Station 1059+00.00
Station 1060+00.00
Station 1061+00.00
Station 1062+00.00
Station 1063+00.00
Station 1064+00.00
Station 1065+00.00
Station 1066+00.00
Station 1067+00.00
Station 1068+00.00
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Station 1070+00.00
Station 1071+00.00
Station 1072+00.00
Station 1073+00.00
Station 1074+00.00
Station 1075+00.00
Station 1076+00.00
Station 1077+00.00
Station 1078+00.00
Station