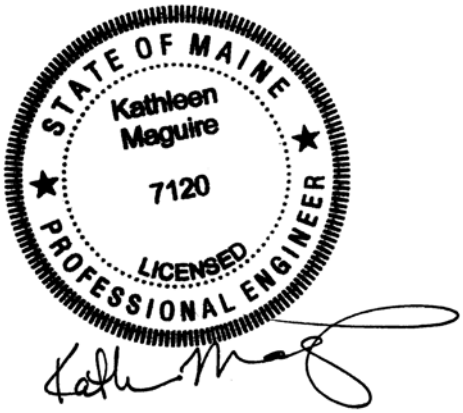
MAINE DEPARTMENT OF TRANSPORTATION
BRIDGE PROGRAM
GEOTECHNICAL SECTION
AUGUSTA, MAINE

GEOTECHNICAL DESIGN RECOMMENDATIONS

NAPLES BAY BRIDGE
RETAINING WALLS
NAPLES, MAINE

Prepared by:

Kathleen Maguire, P.E.
Geotechnical Engineer



Reviewed by:

Laura Krusinski, P.E.
Senior Geotechnical Engineer

Cumberland County
PIN 11060.00

Soils Report No. 2010-101
Bridge No. 2047

Fed No. BH-1106(000)X
February 21, 2010

TEDOCS NO. 1017007

INTRODUCTION

As a part of the replacement of the Naples Bay Bridge in Naples, Maine, US Route 302 will be widened to the north. This widened roadway section, which includes green space, will require filling at the edge of Long Lake which is adjacent to US Route 302 on the north. The fill will be constructed using an approximately 1200-foot long retaining wall installed in Long Lake to support the roadway and green space section. An interior retaining wall above the lake level will be utilized to allow for a walkway along the edge of the lake. A series of seven borings were conducted along a proposed retaining wall alignment in Long Lake in order to evaluate the subsurface conditions at the location of the proposed wall. Two previously drilled borings were used to evaluate the east end of the proposed retaining wall. The purpose of the borings was to identify soil conditions and to determine the depth to bedrock in order to develop geotechnical engineering recommendations for wall design and construction. This report provides the findings of the borings and makes geotechnical recommendations for the installation of a retaining wall along US Route 302 in Long Lake.

SUBSURFACE INVESTIGATION

Subsurface conditions were explored by drilling seven (7) test borings spaced approximately 200 feet apart along the proposed retaining wall alignment. Two borings drilled in 2006 (BB-NBB-302 and BB-NBB-303) have been used to evaluate the east end of the proposed retaining wall. The proposed retaining wall alignment and exploration locations are shown on Sheets 1, 2 and 3 - Boring Location Plans found at the end of this report. The 2006 borings were drilled on October 19 and 31, 2006 by the Maine Department of Transportation (MaineDOT) Materials and Testing Drill Crew. The 2009 borings were drilled between October 6 and 26, 2009 by the MaineDOT Materials and Testing Drill Crew. Details and sampling methods used, field data obtained, and soil conditions encountered are presented in the boring log provided at the end of this report.

The 2006 borings were drilled from a barge using standard rope and cathead drilling techniques. No soil samples were obtained in the 2006 borings. The 2009 borings were drilled from a barge mounted drill rig using solid stem auger and driven cased wash boring techniques. Soil samples in the 2009 borings were obtained where possible at 10-foot intervals using Standard Penetration Test (SPT) methods. During SPT sampling, the sampler is driven 24 inches and the hammer blows for each 6 inch interval of penetration are recorded. The standard penetration resistance, N-value, is the sum of the blows for the second and third intervals. The MaineDOT drill rig is equipped with an automatic hammer to drive the split spoon. The hammer was calibrated in February of 2009 and was found to deliver approximately 40 percent more energy during driving than the standard rope and cathead system. N-values for the 2009 borings discussed in this report are corrected values computed by applying an average energy transfer factor of 0.84 to the raw field N-values. This hammer efficiency factor (0.84) and both the raw field N-value and the corrected N-value are shown on the boring logs.

The bedrock was cored using a BX core barrel in the boring RWB-NBB-401 and using an NQ-2" core barrel in borings BB-NBB-302, BB-NBB-303, RWB-NBB-402A, RWB-NBB-403, and RWB-NBB-404. The MaineDOT geotechnical team member selected the boring locations and drilling methods, designated type and depth of sampling techniques and identified field and laboratory testing requirements. A Northeast Transportation Technician Certification Program (NETTCP) Certified Subsurface Inspector logged the subsurface conditions encountered. The borings were located in the field by a MaineDOT survey crew during drilling activities.

SUBSURFACE CONDITIONS

Subsurface conditions encountered at the borings generally consisted of a deep sand deposit overlying granite bedrock. Due to the presence of cobbles and boulders, two of the borings did not reach the bedrock surface. The boring logs are provided at the end of this report. The table below summarizes the depth to bedrock and bedrock elevation in each of the borings.

Boring Name	Station and Offset	Depth to Bedrock	Bedrock Elevation
BB-NBB-303	19+56.9, 58.4 feet RT	70.5 feet	191.5 feet
BB-NBB-302	20+64.9, 46.7 feet RT	79.3 feet	183.5 feet
RWB-NBB-401	22+65, 56.0 feet RT	79.1 feet	182.0 feet
RWB-NBB-402	24+58, 62.5 feet RT	N/A	N/A
RWB-NBB-402A	24+52, 62.5 feet RT	80.0 feet	180.6 feet
RWB-NBB-403	26+74, 70.0 feet RT	97.5 feet	165.2 feet
RWB-NBB-404	28+75, 63.0 feet RT	81.0 feet	182.3 feet
RWB-NBB-405	31+06, 71.0 feet RT	N/A	N/A
RWB-NBB-406	32+45, 52.0 feet RT	N/A	N/A

The subsurface conditions encountered are briefly summarized in the following paragraphs:

Sand. A deep layer of sand is present at all of the boring locations. The thickness of the layer ranged from approximately 70.5 feet in BB-NBB-303 at the east end of the proposed retaining wall to approximately 104.2 feet in RWB-NBB-406 at the west end of the proposed retaining wall. This layer is described as a light brown to golden brown in the upper portions changing to grey with depth. The layer was made up of wet, fine to medium sand with trace gravel and silt in the upper portions grading to wet, fine to coarse sand trace gravel with depth. SPT N-values in the layer indicate that the sand is very loose to loose in the upper approximately 35 feet of the layer and increasing in density to medium dense with depth. Cobbles and boulders were encountered in four (4) of the borings at depths of approximately 40 to 100 feet below ground surface and greater.

Bedrock. The bedrock was cored in six (6) of the borings. According to the Bedrock Geologic Map of Maine (1985) the bedrock in the vicinity of the site consists of igneous carboniferous muscovite-biotite granite commonly known as the Sebago pluton. The bedrock is pink in color and medium grained.

RETAINING WALL ALTERNATIVES

The following retaining wall alternatives were considered for the site:

- Sheet pile wall
- Soldier pile and lagging wall
- Cast-in-place concrete wall
- Prefabricated modular wall

For the retaining wall to be constructed within Long Lake, both the cast-in-place concrete retaining wall and the prefabricated modular retaining wall would require the use of a significant cofferdam to construct and are therefore eliminated from consideration. Both the driven sheet pile wall and the soldier pile and lagging wall are viable alternatives for this wall. Both of these wall types can be faced with a decorative facing to enhance the wall's appearance.

For the upper retaining wall above the lake level which will provide a walkway along the edge of the lake, all four of the alternatives are viable retaining walls for use. During the Preliminary Design phase of this project the team determined that the use of a Prefabricated Concrete Modular Gravity (PCMG) wall is recommended at this location.

RETAINING WALL RECOMMENDATIONS

Retaining Wall Within Long Lake - The proposed retaining wall along the shore of Long Lake will be approximately 1200 feet long. Based on the subsurface conditions encountered during the subsurface exploration program, the following recommendations are made:

The fill material behind proposed retaining wall should be Underdrain Backfill Material, Type C - MaineDOT Specification 703.22 and Stone Ditch Protection - MaineDOT Specification 703.29. The Designer may assume Soil Type 4 (MaineDOT Bridge Design Guide (BDG) Section 3.6.1) for backfill material soil properties. These backfill properties are: ϕ = 32 degrees, γ = 125 pcf.

The Naples project site is classified as Seismic Zone 2. Therefore, seismic analysis is required. Seismic design requirements for non-gravity cantilever retaining wall design are outlined in AASHTO LRFD Bridge Design Specifications (LRFD) Article 11.8.6.

The following values can be used in design for the existing soils at the site:

Soil Type	Internal Friction Angle ϕ	Cohesion (c)	Unit Weight (γ) of Soil Above Water Table	Unit Weight (γ) of Soil Below Water Table
Existing Fill	32 degrees	0 psf	120 pcf	58 pcf
Existing Sand	34 degrees	0 psf	125 pcf	63 pcf
New Backfill	32 degrees	0 psf	125 pcf	63 pcf

Design friction factors (Coulomb) for sheet piles against the existing site soils are as follows:

- Steel sheet pile against clean sand and gravel: coefficient of friction (tan δ) = 0.31; friction angle (δ) = 17 degrees
- Steel sheet pile against silty sand or sand: coefficient of friction (tan δ) = 0.25; friction angle (δ) = 14 degrees

The retaining walls shall be designed to withstand lateral earth pressures. Earth loads may be calculated using an active earth pressure coefficient, K_a, calculated using Rankine or Coulomb Theory. Where passive earth pressure in front of the wall can be considered, a passive earth pressure coefficient, K_p, calculated using Rankine or Coulomb Theory may be used. Refer to LRFD Equation 3.11.5.3-1 and Figures 3.11.5.4-1 and -2 for calculating Coulomb active and passive earth pressure coefficients. The following table presents the recommended Rankine earth pressure coefficients:

Internal Friction Angle ϕ	K_a Rankine	K_p Rankine
32 degrees	0.307	3.25
34 degrees	0.283	3.54

Lateral earth pressure distributions for design of non-gravity cantilevered walls are provided in LRFD Figure 3.11.5.6-3 with the design procedure described in LRFD C11.8.4.1.

Load combinations and load factors herein are based on LRFD Article 3.4.1. The load factors are presented in the table below:

	Load Factors			
Load Combination	EH, γ_p	ES, γ_p	EQ, γ_p	LS, γ
Strength I	1.5	1.5	-	1.75
Extreme Event I	1.0	1.0	1.0	-
Service I	1.0	1.0	-	1.0

A live load surcharge (LS) shall be applied where vehicular load is expected to act on the surface of the backfill within a distance equal to one-half the wall height behind the backface of the wall as required by Section 3.6.8 of the MaineDOT BDG and LRFD Article 3.11.6.4. The live load surcharge may be estimated as a uniform horizontal earth pressure due to an equivalent height (h_{eq}) taken from the table below:

Retaining Wall Height	h_{eq} Distance from Wall Backface to Edge of Traffic	
	0 feet	1.0 feet or Further
5 feet	5.0 feet	2.0 feet
10 feet	3.5 feet	2.0 feet
≥20 feet	2.0 feet	2.0 feet

Structural and geotechnical resistance factors herein are based on LRFD Article 11.5.6. The following table presents the resistance factors for use in non-gravity cantilever retaining wall design:

Condition	Resistance Factor, φ	
	Strength I Service I	Extreme Event I
Passive resistance of soil in front of the sheet pile wall	0.75	1.0
Flexural capacity of vertical elements	0.90	1.0

The selected sheet pile section should consider a sacrificial steel loss per the MaineDOT BDG that is consistent with the design life of the structure. As the pile will be installed within Long Lake, water induced corrosion of the steel is likely.

The use of hot-rolled sheets is recommended. Cold rolled sheet piles are not recommended for permanent applications. Cold rolled piles are typically thinner for the same section modulus. Section loss from corrosion could have a greater effect on cold rolled steel. The use of a ball and socket interlock system is recommended over the hook-type interlock system as the ball and socket system is less likely to unhook and separate underground due to driving pressure or obstructions. The use of ASTM A 572 Grade 50 steel is recommended.

The retaining wall design shall include a drainage system at the top to allow movement of any surface water behind the wall. Drainage behind the wall shall be in accordance with Section 5.4.1.4 Drainage of the MaineDOT BDG. The roadway should utilize curbing to direct any surface water runoff away from the wall.

Upper Retaining Wall Along Walkway - The proposed upper retaining wall along the proposed walkway along Long Lake will be approximately 250 feet long. Based on the subsurface conditions encountered during the subsurface exploration programs, the following recommendations are made:

Precast Concrete Modular Gravity (PCMG) walls may be used to retain the roadway section and create access to a walkway along Long Lake. In general, PCMG wingwalls should be used only where the flow velocities are low, and the potential for severe ice or wave action is low. PCMG walls should also only be used above the ordinary mean high water elevation (Q1.1). These walls shall be designed by a Professional Engineer subcontracted by the Contractor as a design-build item in accordance with Special Provision 635 which is attached to this report. PCMG walls shall be designed considering a live load surcharge equal to a uniform horizontal earth pressure due to an equivalent height of soil (h_{eq}) per LRFD Table 3.11.6.4-2.

Bearing resistance for PCMG walls founded on a leveling slab on fill sand shall be investigated at the strength limit state using factored loads and a factored bearing resistance of 10 ksf for wall system bases less than 6 feet wide and 12 ksf for bases from

8 to 12 feet wide. The bearing resistance factor, $\varphi_{b,}$ for spread footings on soil is 0.45. The stress distribution may be assumed to be a uniform distribution over the effective footing base as shown in LRFD Figure 11.6.3.2-1. Based on presumptive bearing resistance values a factored bearing resistance of 3 ksf may be used to control settlement when analyzing the service limit state and for preliminary footing sizing assuming a resistance factor of 1.0.

Any foundation placed on granular subgrade soils should be designed with an appropriate embedment for frost protection. According to the MaineDOT BDG Design Freezing Index map (MaineDOT BDG Figure 5-1) the site has a design freezing index of approximately 1370 F-degree days. A laboratory water content of 20% was used for granular soils above the water table. This correlates to a frost depth of 5.5 feet. It is recommended that any foundations placed on granular soils should be founded a minimum of 5.5 feet below finished exterior grade for frost protection.

The bearing resistance for PCMG bottom unit of the PCMG wall shall be checked for the extreme limit state with a resistance factor of 1.0. The PCMG units shall be designed so that the nominal bearing resistance after the design scour event provides adequate resistance to support the factored strength limit state loads with strength limit state resistance factors. In general, spread footings at stream crossings should be founded a minimum of 2 feet below the calculated design scour depth. The overall stability of the wall system should be investigated at the Service I Load Combination with a resistance factor φ, of 0.65.

Failure by sliding shall be investigated by the wall designer-supplier. A sliding resistance factor, $\varphi_{\tau,}$ of 0.90 shall be applied to the nominal sliding resistance of precast concrete wall segments founded on bedrock, concrete fill or granular borrow. For the lowest PCMG wall unit on bedding material the eccentricity of loading at the strength limit state, based on factored loads, shall not exceed one-fourth (1/4) of the footing dimensions in either direction (LRFD Article 10.6.3.3). Sliding computations for resistance to lateral loads shall assume a maximum frictional coefficient of tan 30º at the foundation soil to soil infill interface and a maximum frictional coefficient of 0.8x(tan 30º) at the foundation soil to concrete module interface. Recommended values of sliding frictional coefficients are based on LRFD Articles 11.11.4.2 and 10.6.3.4, and Table 10.5.5.2.2-1.

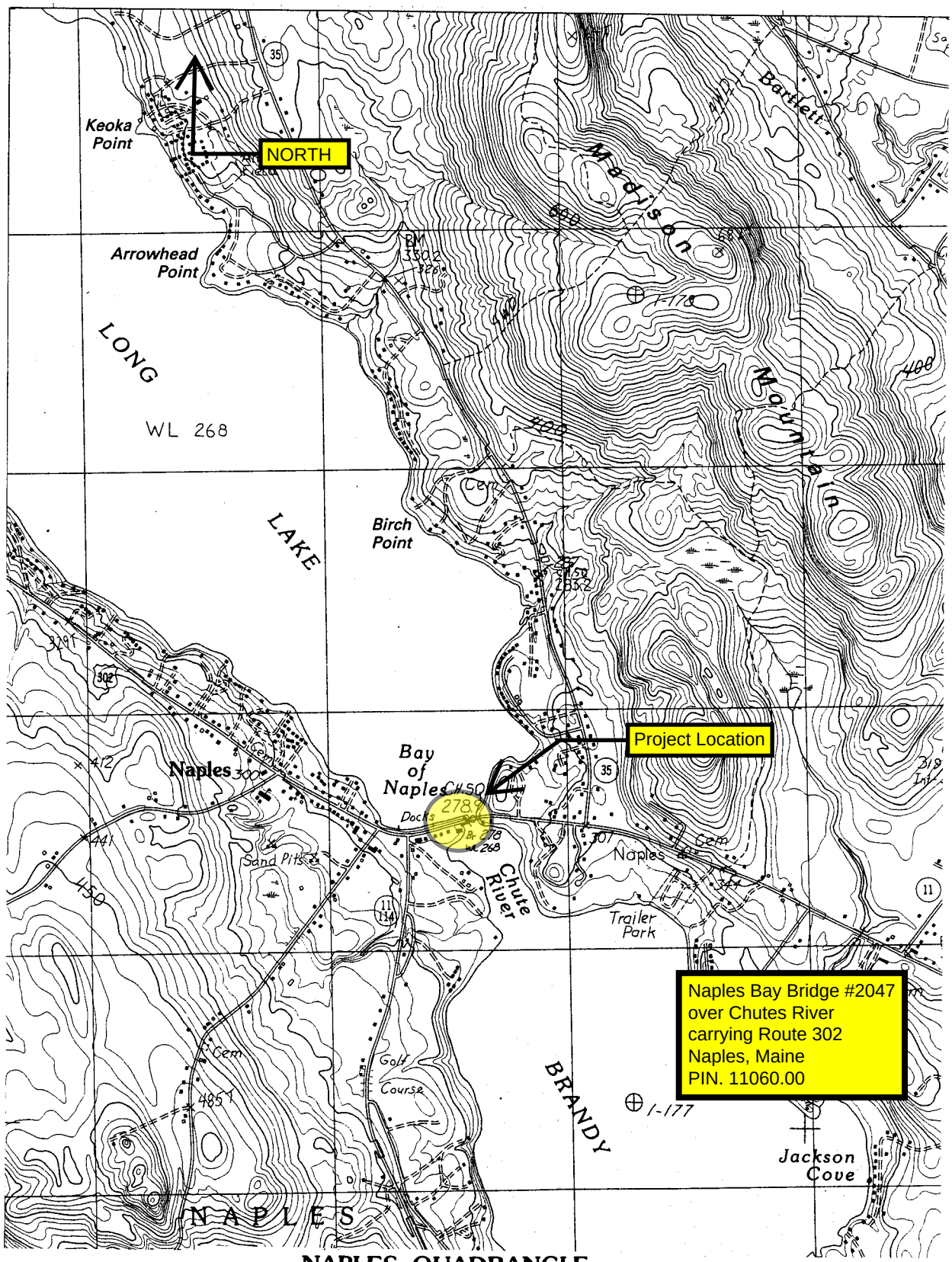
The ordinary mean high water elevation shall be indicated on the retaining wall plans per the design requirements for hydrostatic conditions in Special Provision 635.

CLOSURE

This report presents geotechnical recommendations for the purpose selecting and designing retaining walls along US Route 302 and Long Lake in Naples, Maine as a part of the Naples Bay Bridge replacement. These recommendations are based upon data obtained from nine (9) test borings conducted along a proposed alignment. The subsurface conditions presented from the borings are only relevant at the boring locations. Soil conditions along the wall will vary and are probably erratic. The nature and extent of variations to the subsurface

conditions may not be apparent until construction. If variations appear during construction, it may be necessary to re-evaluate these recommendations.

Attachments:
Sheet 1 – Location Map
Sheet 2 – Boring Location Plan
Sheet 3 – Boring Location Plan
Sheet 4 – Boring Location Plan
Boring Logs
Specials Provision 635



NAPLES QUADRANGLE
MAINE – CUMBERLAND CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

SCALE 1:24 000

INTERIOR—GEOLOGICAL SURVEY, RESTO

1 .5 0 KILOMETERS 1 2

1000 0 METERS 1000 2000

1 .5 0 1

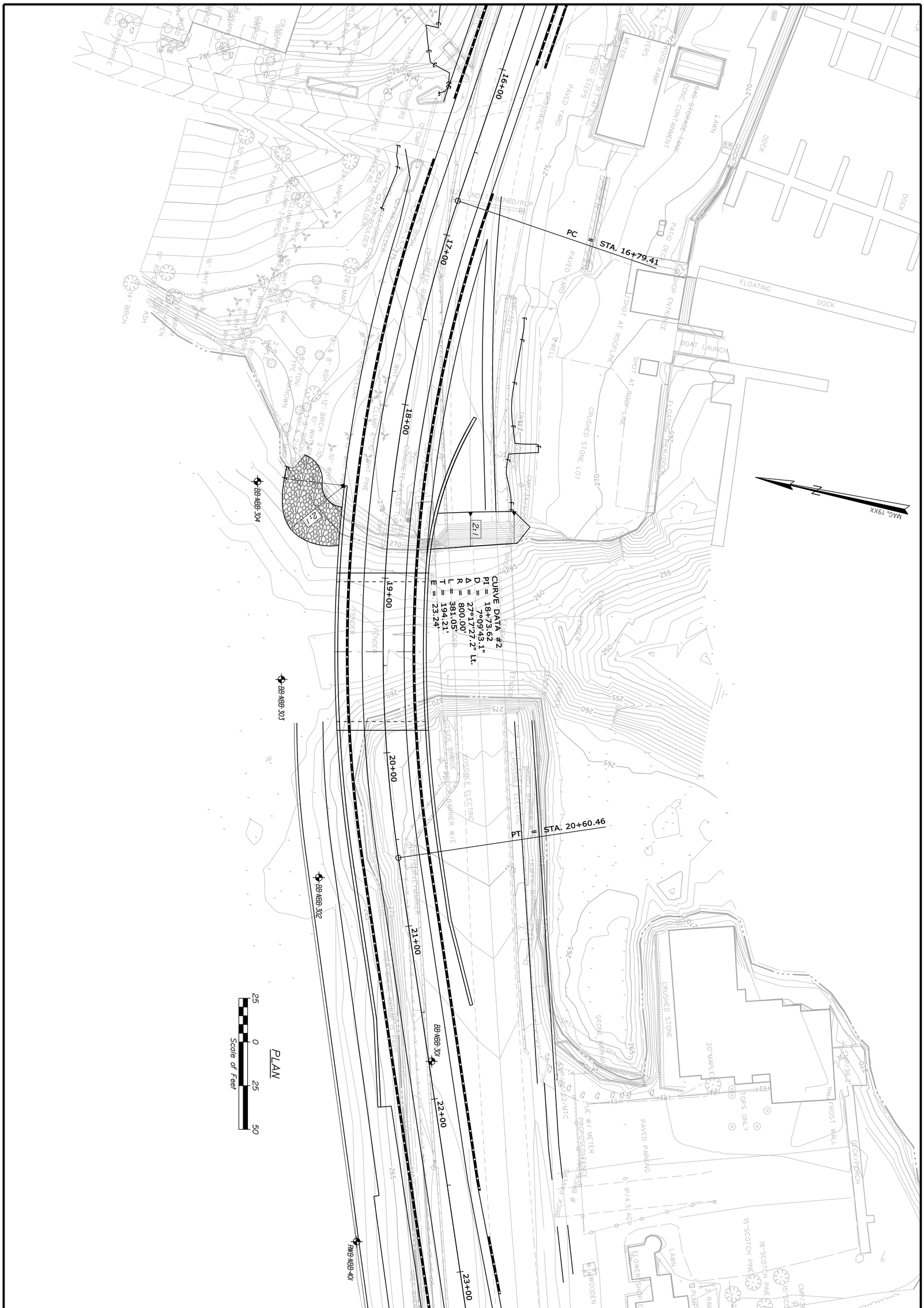
MILES

1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10 000

FEET

CONTOUR INTERVAL 10 FEET

Filename: ...\00\GEOTECH\MSTA\006_BLP1.dgn Division: GEOTECH Username: terry.white Date:2/12/2010



PROJ. MANAGER	J. FERGUSON	BY	DATE
DESIGN-DETAILED	K. MAGUIRE	T. WHITE	8\2009
CHECKED-REVIEWED	_____	_____	_____
DESIGN2-DETAILED2	_____	__	_____
DESIGN3-DETAILED3	_____	_____	_____
REVISIONS 1	_____		_____
REVISIONS 2	_____		_____
REVISIONS 3	_____		_____
REVISIONS 4	_____		_____
FIELD CHANGES	_____		_____

SIGNATURE

P.E. NUMBER

DATE

SHEET NUMBER 2 OF 4

NAPLES BAY BRIDGE
CHUTES RIVER
NAPLES CUMBERLAND COUNTY

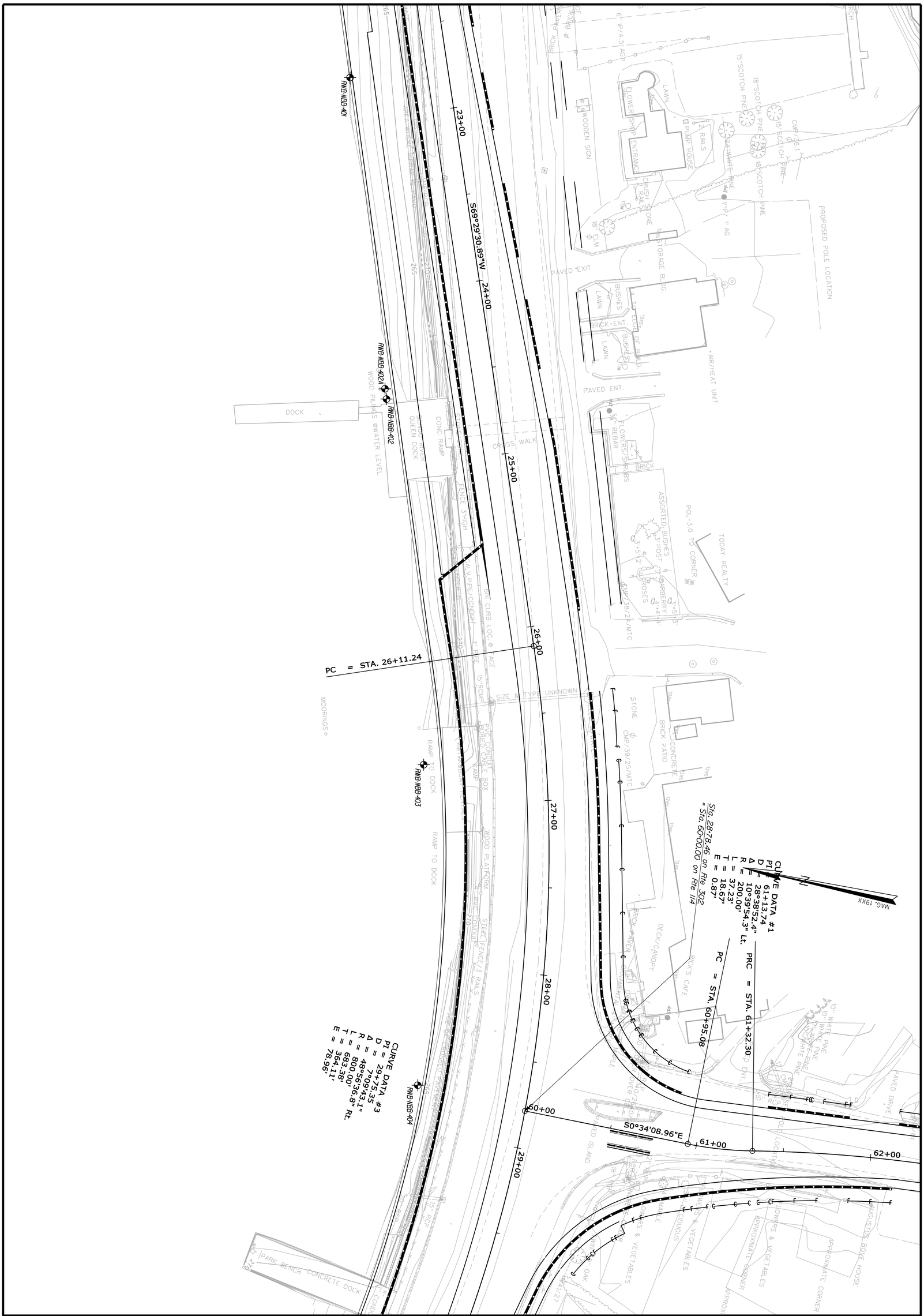
BORING LOCATION PLAN

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

BH-A106(000)X

BRIDGE NO. 2047 PIN 11060.00 BRIDGE PLANS

Filename: ...\00\geotech\msta\007_BLP2.dgn Division: GEOTECH Username: terry.white Date:2/12/2010



PROJ. MANAGER	J. FERGUSON	BY	DATE
DESIGN-DETAILED	K. MAGUIRE	T. WHITE	8\2009
CHECKED-REVIEWED	_____	_____	_____
DESIGN2-DETAILED2	_____	__	_____
DESIGN3-DETAILED3	_____	_____	_____
REVISIONS 1	_____		_____
REVISIONS 2	_____		_____
REVISIONS 3	_____		_____
REVISIONS 4	_____		_____
FIELD CHANGES	_____		_____

SIGNATURE

P.E. NUMBER

DATE

SHEET NUMBER 3 OF 4

NAPLES BAY BRIDGE
CHUTES RIVER
NAPLES CUMBERLAND COUNTY

BORING LOCATION PLAN

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

BH-A106(000)X

BRIDGE NO. 2047 PIN 11060.00 BRIDGE PLANS

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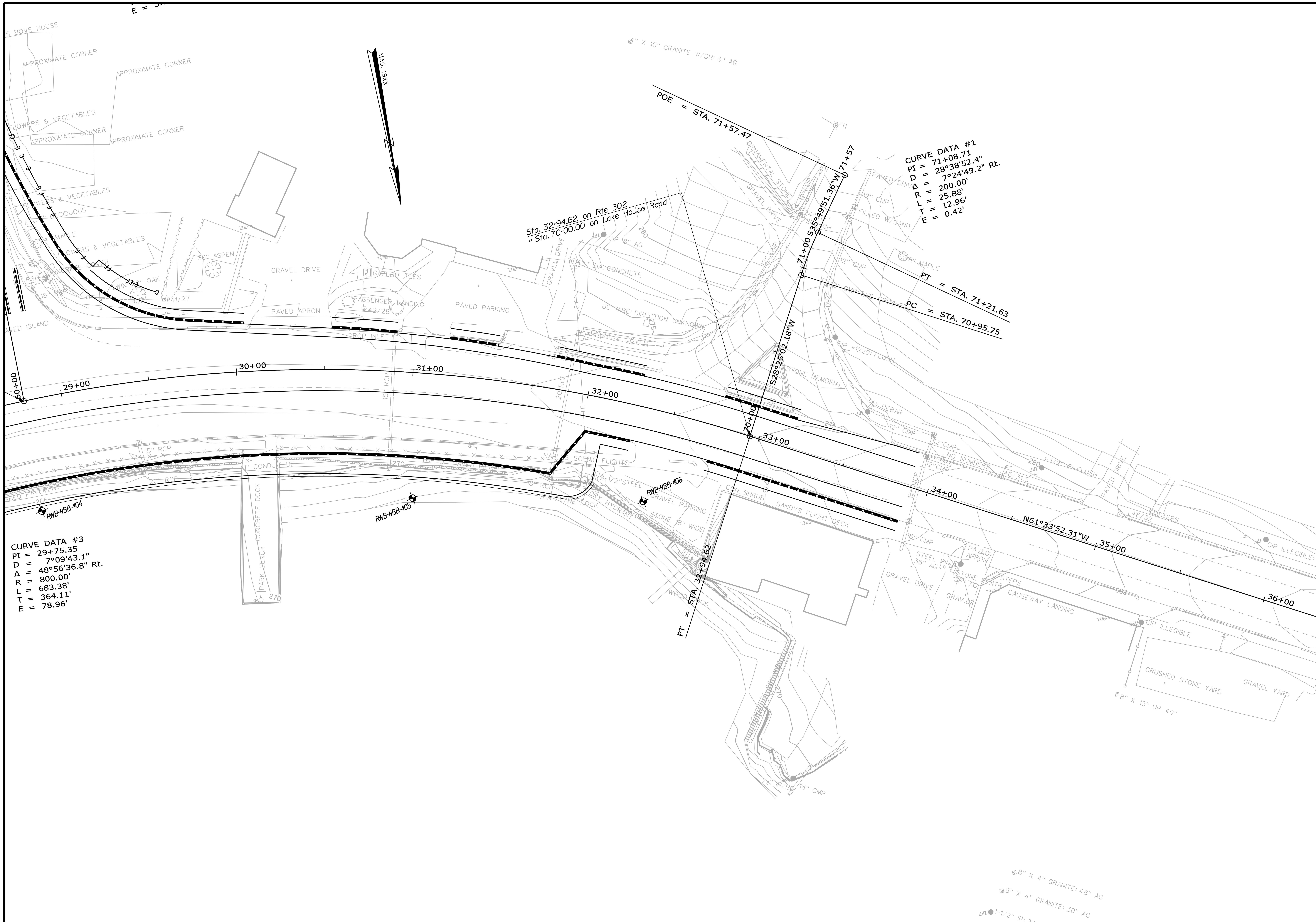

PROJ. MANAGER	J. FERGUSON	BY	DATE
DESIGN-DETAILED	K. MAGUIRE	T. WHITE	8/2009
CHECKED-REVIEWED			
DESIGN2-DETAILED2			
DESIGN3-DETAILED3			
REVISIONS 1			
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			

SIGNATURE

P.E. NUMBER

DATE

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

BH-A106(000)X

PIN
11060.00

BRIDGE NO. 2047

BRIDGE PLANS

NAPLES BAY BRIDGE
CHUTES RIVER
NAPLES CUMBERLAND COUNTY

BORING LOCATION PLAN

SHEET NUMBER

4

OF 4

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE-GRAINED SOILS (more than half of material is larger than No. 200 sieve size)	GRAVELS (more than half of coarse fraction is larger than No. 4 sieve size)	CLEAN GRAVELS (little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
			GP	Poorly-graded gravels, gravel sand mixtures, little or no fines
		GRAVEL WITH FINES (Appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (more than half of coarse fraction is smaller than No. 4 sieve size)	CLEAN SANDS (little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines
			SP	Poorly-graded sands, gravelly sand, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures.
FINE-GRAINED SOILS (more than half of material is smaller than No. 200 sieve size)	SILTS AND CLAYS (liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts
	HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils.

Desired Soil Observations: (in this order)

Color (Munsell color chart)
Moisture (dry, damp, moist, wet, saturated)
Density/Consistency (from above right hand side)
Name (sand, silty sand, clay, etc., including portions - trace, little, etc.)
Gradation (well-graded, poorly-graded, uniform, etc.)
Plasticity (non-plastic, slightly plastic, moderately plastic, highly plastic)
Structure (layering, fractures, cracks, etc.)
Bonding (well, moderately, loosely, etc., if applicable)
Cementation (weak, moderate, or strong, if applicable, ASTM D 2488)
Geologic Origin (till, marine clay, alluvium, etc.)
Unified Soil Classification Designation
Groundwater level

Maine Department of Transportation
Geotechnical Section
Key to Soil and Rock Descriptions and Terms
Field Identification Information

TERMS DESCRIBING DENSITY/CONSISTENCY

Coarse-grained soils (more than half of material is larger than No. 200 sieve): Includes (1) clean gravels; (2) silty or clayey gravels; and (3) silty, clayey or gravelly sands. Consistency is rated according to standard penetration resistance.

Modified Burmister System

Descriptive Term	Portion of Total
trace	0% - 10%
little	11% - 20%
some	21% - 35%
adjective (e.g. sandy, clayey)	36% - 50%

Density of Cohesionless Soils	Standard Penetration Resistance N-Value (blows per foot)
Very loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

Fine-grained soils (more than half of material is smaller than No. 200 sieve): Includes (1) inorganic and organic silts and clays; (2) gravelly, sandy or silty clays; and (3) clayey silts. Consistency is rated according to shear strength as indicated.

Consistency of Cohesive soils	SPT N-Value blows per foot	Approximate Undrained Shear Strength (psf)	Field Guidelines
Very Soft	WOH, WOR, WOP, <2	0 - 250	Fist easily Penetrates
Soft	2 - 4	250 - 500	Thumb easily penetrates
Medium Stiff	5 - 8	500 - 1000	Thumb penetrates with moderate effort
Stiff	9 - 15	1000 - 2000	Indented by thumb with great effort
Very Stiff	16 - 30	2000 - 4000	Indented by thumbnail
Hard	>30	over 4000	Indented by thumbnail with difficulty

Rock Quality Designation (RQD):

$$RQD = \frac{\text{sum of the lengths of intact pieces of core* > 100 mm}}{\text{length of core advance}}$$

*Minimum NQ rock core (1.88 in. OD of core)

Correlation of RQD to Rock Mass Quality

Rock Mass Quality	RQD
Very Poor	<25%
Poor	26% - 50%
Fair	51% - 75%
Good	76% - 90%
Excellent	91% - 100%

Desired Rock Observations: (in this order)

Color (Munsell color chart)
Texture (aphanitic, fine-grained, etc.)
Lithology (igneous, sedimentary, metamorphic, etc.)
Hardness (very hard, hard, mod. hard, etc.)
Weathering (fresh, very slight, slight, moderate, mod. severe, severe, etc.)
Geologic discontinuities/jointing:
- -dip (horiz - 0-5, low angle - 5-35, mod. dipping - 35-55, steep - 55-85, vertical - 85-90)
- -spacing (very close - <5 cm, close - 5-30 cm, mod. close 30-100 cm, wide - 1-3 m, very wide >3 m)
- -tightness (tight, open or healed)
- -infilling (grain size, color, etc.)

Formation (Waterville, Ellsworth, Cape Elizabeth, etc.)
RQD and correlation to rock mass quality (very poor, poor, etc.)
ref: AASHTO Standard Specification for Highway Bridges 17th Ed. Table 4.4.8.1.2A
Recovery

Sample Container Labeling Requirements:

PIN
Bridge Name / Town
Boring Number
Sample Number
Sample Depth
Blow Counts
Sample Recovery
Date
Personnel Initials

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge Over Chutes River
Location: US Route 302 Naples, Maine

Boring No.: BB-NBB-302
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	262.8	**Auger ID/OD:**	N/A
Operator:	E. Giguere	**Datum:**	NAVD88	**Sampler:**	N/A
Logged By:	B. Wilder/G. Lidstone	**Rig Type:**	CME 45C on Barge	**Hammer Wt./Fall:**	300#/16"
Date Start/Finish:	10/19/06-10/19/06	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	20+64.9, 46.7 Rt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	Boring in Lake

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
R = Rock Core Sample
V = Insitu Vane Shear Test
SSA = Solid Stem Auger

Definitions:
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WOH = weight of 140lb. hammer
WOR = weight of rods WOC = weight of casing

Definitions:
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0						3			Brown, fine to medium SAND, (in wash).	
						17				
						29				
						33				
						34				
5						29				
						21				
						15				
						17				
						20				
10						25				
						28				
						20				
						18				
						20				
15						31				
						29				
						WOC			Washed out HW casing, switched to NW casing at 17.0' bgs.	
						2				
						7				
20						6				
						9				
						9				
						11				
25						14				

Remarks:

Donut hammer, cathead, rope to 41.0' bgs. Then switched to safety hammer.
8.1' from Barge Deck to Ground when surveyed on 10/19/06.
Water depth fluctuated due to rain. 10/23/06, casing sanded together, broke 140# safety hammer. 10/24/06; 07:30-17:00 , pulled HW casing, started at 41.0' bgs. 10/25/06; 07:30-14:00, had to stop work, waves too high.

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge Over Chutes River
Location: US Route 302 Naples, Maine

Boring No.: BB-NBB-302
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	262.8	**Auger ID/OD:**	N/A
Operator:	E. Giguere	**Datum:**	NAVD88	**Sampler:**	N/A
Logged By:	B. Wilder/G. Lidstone	**Rig Type:**	CME 45C on Barge	**Hammer Wt./Fall:**	300#/16"
Date Start/Finish:	10/19/06-10/19/06	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	20+64.9, 46.7 Rt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	Boring in Lake

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
R = Rock Core Sample
V = Insitu Vane Shear Test
SSA = Solid Stem Auger

Definitions:
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WOH = weight of 140lb. hammer
WOR = weight of rods WOC = weight of casing

Definitions:
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25						10				
						16				
						26				
						39				
						51				
30						45				
						56				
						68				
						100				
						107				
35						126				
						127			Washed out casing, fine to medium SAND, (in wash). Roller coned to 41.0' bgs.	
						200				
						305				
						680				
40						985				
						188				
						155				
						235				
						240				
45						270				
						210			Washed out casing.	
						248				
						407				
50						470				

Remarks:

Donut hammer, cathead, rope to 41.0' bgs. Then switched to safety hammer.
8.1' from Barge Deck to Ground when surveyed on 10/19/06.
Water depth fluctuated due to rain. 10/23/06, casing sanded together, broke 140# safety hammer. 10/24/06; 07:30-17:00 , pulled HW casing, started at 41.0' bgs. 10/25/06; 07:30-14:00, had to stop work, waves too high.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge Over Chutes River
Location: US Route 302 Naples, Maine

Boring No.: BB-NBB-302
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	262.8	**Auger ID/OD:**	N/A
Operator:	E. Giguere	**Datum:**	NAVD88	**Sampler:**	N/A
Logged By:	B. Wilder/G. Lidstone	**Rig Type:**	CME 45C on Barge	**Hammer Wt./Fall:**	300#/16"
Date Start/Finish:	10/19/06-10/19/06	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	20+64.9, 46.7 Rt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	Boring in Lake

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
R = Rock Core Sample
V = Insitu Vane Shear Test
SSA = Solid Stem Auger

Definitions:
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WOH = weight of 140lb. hammer
WOR = weight of rods WOC = weight of casing

Definitions:
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
50						420				
						205			Washed out casing at 51.0' bgs. Brown, fine SAND, trace medium sand.	
						415				
						610				
						725				
55						820				
						590			Washed out casing at 56.0' bgs. Washed ahead of casing to 61.0' bgs. Brown, fine SAND, trace medium sand, trace coarse sand.	
						760				
						740				
						707				
60						775				
						290			Washed out casing, some coarse sand, (in wash).	
						485				
						282				
						188				
65						210				
						312			Washed out casing at 66.0' bgs. Similar to above.	
						478				
						348				
						259				
70						218	192.20		70.60	
						340			Brown, coarse SAND, some gravel. Roller coned ahead of casing from 71.0- 74.7' bgs.	
						278				
						252				
75	R1	22.8/2	74.70 - 76.60			a151			a151 blows for 0.7'.	

Remarks:

Donut hammer, cathead, rope to 41.0' bgs. Then switched to safety hammer.
8.1' from Barge Deck to Ground when surveyed on 10/19/06.
Water depth fluctuated due to rain. 10/23/06, casing sanded together, broke 140# safety hammer. 10/24/06; 07:30-17:00 , pulled HW casing, started at 41.0' bgs. 10/25/06; 07:30-14:00, had to stop work, waves too high.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge Over Chutes River
Location: US Route 302 Naples, Maine

Boring No.: BB-NBB-302
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	262.8	**Auger ID/OD:**	N/A
Operator:	E. Giguere	**Datum:**	NAVD88	**Sampler:**	N/A
Logged By:	B. Wilder/G. Lidstone	**Rig Type:**	CME 45C on Barge	**Hammer Wt./Fall:**	300#/16"
Date Start/Finish:	10/19/06-10/19/06	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	20+64.9, 46.7 Rt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	Boring in Lake

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
R = Rock Core Sample
V = Insitu Vane Shear Test
SSA = Solid Stem Auger

Definitions:
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WOH = weight of 140lb. hammer
WOR = weight of rods WOC = weight of casing

Definitions:
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
75						NQ 305			R1:Cobbles	
						210			Roller coned ahead of casing from 76.5- 79.7' bgs.	
						392				
						389				
	R2	60/60	79.70 - 84.70			b200 RC NQ	183.50		b200 blows for 0.3'. 79.30 Top of Bedrock at Elev. 183.5'. Roller coned into bedrock from 79.3-79.7' bgs. Bedrock: R2:Core Times (min:sec) 79.7-80.7' (6:00) 80.7-81.7' (6:00) 81.7-82.7' (7:00) 82.7-83.7' (6:00) 83.7-84.7' (5:00) 100% Recovery	
80										
85							178.10		84.70 **Bottom of Exploration at 84.70 feet below ground surface.**	
90										
95										
100										

Remarks:

Donut hammer, cathead, rope to 41.0' bgs. Then switched to safety hammer.
8.1' from Barge Deck to Ground when surveyed on 10/19/06.
Water depth fluctuated due to rain. 10/23/06, casing sanded together, broke 140# safety hammer. 10/24/06; 07:30-17:00 , pulled HW casing, started at 41.0' bgs. 10/25/06; 07:30-14:00, had to stop work, waves too high.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge Over Chutes River
Location: US Route 302 Naples, Maine

Boring No.: BB-NBB-303
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	262.0 +/-	**Auger ID/OD:**	N/A
Operator:	E. Giguere	**Datum:**	NAVD88	**Sampler:**	N/A
Logged By:	B. Wilder	**Rig Type:**	CME 45C on Barge	**Hammer Wt./Fall:**	300#/16"
Date Start/Finish:	10/31/06-10/31/06	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	19+56.9, 58.4 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	Boring in Lake

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
R = Rock Core Sample
V = Insitu Vane Shear Test
SSA = Solid Stem Auger

Definitions:
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WOH = weight of 140lb. hammer
WOR = weight of rods WOC = weight of casing

Definitions:
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0						1			Golden brown, fine to medium SAND, trace silt, (in wash).	
						1				
						3				
						17				
						26				
5						28				
						31				
						20				
						50				
						16				
10						16				
						17				
						17				
						18				
						20				
15						14				
						22				
						22				
						24				
						29				
20						30				
						36				
						30				
						26				
25						30				

Remarks:

9.3' from Barge Deck to Ground.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge Over Chutes River
Location: US Route 302 Naples, Maine

Boring No.: BB-NBB-303
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	262.0 +/-	**Auger ID/OD:**	N/A
Operator:	E. Giguere	**Datum:**	NAVD88	**Sampler:**	N/A
Logged By:	B. Wilder	**Rig Type:**	CME 45C on Barge	**Hammer Wt./Fall:**	300#/16"
Date Start/Finish:	10/31/06-10/31/06	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	19+56.9, 58.4 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	Boring in Lake

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
R = Rock Core Sample
V = Insitu Vane Shear Test
SSA = Solid Stem Auger

Definitions:
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WOH = weight of 140lb. hammer
WOR = weight of rods WOC = weight of casing

Definitions:
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25						35				
						47				
						46				
						63				
						69				
30						87				
						98				
						93				
						94				
						132				
35						124				
						133				
						97				
						93				
						121				
40						113				
						97				
						90				
						87				
						85				
45						109				
						132				
						135			Golden brown, very dense, fine to coarse SAND, (in wash).	
						184				
50						173				

Remarks:

9.3' from Barge Deck to Ground.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge Over Chutes River
Location: US Route 302 Naples, Maine

Boring No.: BB-NBB-303
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	262.0 +/-	**Auger ID/OD:**	N/A
Operator:	E. Giguere	**Datum:**	NAVD88	**Sampler:**	N/A
Logged By:	B. Wilder	**Rig Type:**	CME 45C on Barge	**Hammer Wt./Fall:**	300#/16"
Date Start/Finish:	10/31/06-10/31/06	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	19+56.9, 58.4 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	Boring in Lake

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
R = Rock Core Sample
V = Insitu Vane Shear Test
SSA = Solid Stem Auger

Definitions:
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WOH = weight of 140lb. hammer
WOR = weight of rods WOC = weight of casing

Definitions:
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
50						230				
						174				
						162				
						177				
						188				
55						207				
						108				
						130				
						138				
						144				
60						126				
						152				
						143				
						142				
						132				
65						129				
						103				
						105				
						129				
						153				
70	R1	12/12	70.70 - 71.70	RQD = 100%		[a]160 NQ	191.50		[a]160 blows for 0.5'.	
									70.50	
							190.30		Top of Bedrock at Elev. 191.5'. Roller coned into bedrock from 70.5-70.7' bgs. Bedrock: R1:Core Times (min:sec) 70.7-71.7' (6:14) 100% Recovery	
									71.70	
									Bottom of Exploration at 71.70 feet below ground surface. Core barrel blocked. Casing bent. Could not obtain any further rock core.	
75										

Remarks:

9.3' from Barge Deck to Ground.

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge #2047 over Chutes River carrying Route 302
Location: Naples, Maine

Boring No.: RWB-NBB-401
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	261.1	**Auger ID/OD:**	N/A
Operator:	Giguere/Giles/Wright	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/6/09-10/7/09	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	BX
Boring Location:	22+65, 56.0 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	Water Boring
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Insitu Vane Shear Test attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR/C = weight of rods or casing
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0							5				
							23				
							13				
							12				
							8				
5							6				
	1D	24/19	6.00 - 8.00	2/3/2/2	5	7	[a]HP			[a]HP = Hydraulic Push Grey, wet, loose, fine SAND, little silt.	
							HP				
							HP				
							HP				
10							HP				
							3				
							9				
							4				
							5				
15							5				
	2D	24/18	16.00 - 18.00	WOR/WOH/1/1	1	1	WOH			Similar to above, except very loose.	
							WOH				
							11				
							7				
20							14				
							17				
							18	239.10		22.00	
							21				
25							35				

Remarks:

Raft Boring, 8.8' from Deck to Ground.
400-500# down pressure on Core Barrel.

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge #2047 over Chutes River carrying Route 302
Location: Naples, Maine

Boring No.: RWB-NBB-401
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	261.1	**Auger ID/OD:**	N/A
Operator:	Giguere/Giles/Wright	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/6/09-10/7/09	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	BX
Boring Location:	22+65, 56.0 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	Water Boring
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Insitu Vane Shear Test attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR/C = weight of rods or casing
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25							27				
	3D	24/17	26.00 - 28.00	3/2/3/3	5	7	WOH			Grey-brown, wet, loose, fine SAND, trace silt.	
							21				
							50				
							69				
30							63				
							31				
							36				
							35				
							86	226.60		34.50	
35							174				
	4D	24/15	36.00 - 38.00	WOH/WOH/1/1	1	1	141			Light brown, wet, very loose, fine SAND, trace silt.	
							207				
							167				
							221				
40							324				
							325	220.10		41.00	
							324				
							297				
							297				
45							278				
	5D	18/18	46.00 - 47.50	19/29/34	63	88	113			Brown, wet, very dense, fine to medium SAND, trace silt. 3.0' running sand.	
							135				
							184				
50							230				

Remarks:

Raft Boring, 8.8' from Deck to Ground.
400-500# down pressure on Core Barrel.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge #2047 over Chutes River carrying Route 302
Location: Naples, Maine

Boring No.: RWB-NBB-401
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	261.1	**Auger ID/OD:**	N/A
Operator:	Giguere/Giles/Wright	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/6/09-10/7/09	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	BX
Boring Location:	22+65, 56.0 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	Water Boring
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Insitu Vane Shear Test attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR/C = weight of rods or casing
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
50							335				
							281				
							243				
							243				
							281				
55							284				
	6D	24/8	56.00 - 58.00	6/10/11/11	21	29	221			Similar to above, except medium dense. 5.0' running sand.	
							232				
							238				
							238				
60							284				
							232				
							286				
							300				
							300				
65							300				
	MD	24/0	66.00 - 68.00	3/10/10/12	20	28	270			Failed Sample attempt, similar to above in wash. 21.0' running sand.	
							278				
							235				
							243				
70							281				
	7D	24/17	71.00 - 73.00	2/2/3/5	5	7	135			Similar to above, except loose. Kept a head of water.	
							138				
							173				
75							173				

Remarks:

Raft Boring, 8.8' from Deck to Ground.
400-500# down pressure on Core Barrel.

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge #2047 over Chutes River carrying Route 302
Location: Naples, Maine

Boring No.: RWB-NBB-401
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	261.1	**Auger ID/OD:**	N/A
Operator:	Giguere/Giles/Wright	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/6/09-10/7/09	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	BX
Boring Location:	22+65, 56.0 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	Water Boring
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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V = Insitu Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Insitu Vane Shear Test attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR/C = weight of rods or casing
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
75							173				
							238				
							189				
							189				
	R1	21.6/5	79.10 - 80.90	RQD = N/A%			b150 BX	182.00		b150 blows for 0.1'. 79.10	
80								180.20		Bedrock: Pink, medium grained, muscovite-biotite GRANITE. R1:Core Times (min:sec) 79.1-80.9' (20:00) 23% Recovery Casing broke, could not get back down. 80.90	
										Bottom of Exploration at 80.90 feet below ground surface.	
85											
90											
95											
100											

Remarks:

Raft Boring, 8.8' from Deck to Ground.
400-500# down pressure on Core Barrel.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge #2047 over Chutes River carrying Route 302
Location: Naples, Maine

Boring No.: RWB-NBB-402
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	260.6	**Auger ID/OD:**	N/A
Operator:	Giguere/Giles/Wright	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/12/09-10/13/09	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	24+58, 62.5 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	Water Boring
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Insitu Vane Shear Test attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR/C = weight of rods or casing
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/14	0.00 - 2.00	6/6/7/6	13	18	2			Grey, wet, medium dense, fine to medium SAND, little silt.	
							10				
							11				
							14				
							18				
5							[a]HP			[a]HP = Hydraulic Push	
							16				
							18				
							21				
							22				
10	2D	24/16	10.00 - 12.00	1/1/WOH/WOH	1	1	21	250.60		10.00 — Grey, wet, very loose, silty fine SAND, little clay, slightly plastic.	
							4				
							20				
							16				
							22				
15							28				
							20				
							17				
							18	242.60		18.00	
							19				
20	3D	24/14	20.00 - 22.00	WOH/WOH/2/2	2	3	19			Grey-Brown, wet, very loose, fine SAND, trace silt.	
							9				
							16				
							20				
25							28				

Remarks:

Raft Boring, 9.0' from Deck to Ground.
400-500# down pressure on Core Barrel.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge #2047 over Chutes River carrying Route 302
Location: Naples, Maine

Boring No.: RWB-NBB-402
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	260.6	**Auger ID/OD:**	N/A
Operator:	Giguere/Giles/Wright	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/12/09-10/13/09	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	24+58, 62.5 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	Water Boring
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR/C = weight of rods or casing
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
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LL = Liquid Limit
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G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25							42				
							57				
							68				
							75				
							103				
30	4D	24/15	30.00 - 32.00	WOH/3/4/4	7	10	107			Similar to above, except loose.	
							54				
							54				
							81				
							70				
35							111				
							76	224.60		36.00	
							78				
							78				
							78				
40							116				
	5D	3.6/3.6	41.00 - 41.30	50(3.6")	---		NQ-2	219.30		Brown, wet, very dense, fine to medium SAND, trace silt.	
	R1	116.4/30	41.30 - 51.00							41.30 Granite BOULDER from 41.3-43.8' bgs.	
								216.80		43.80	
										Brown, wet, very dense fine to medium SAND, trace silt.	
45											
50											

Remarks:

Raft Boring, 9.0' from Deck to Ground.
400-500# down pressure on Core Barrel.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge #2047 over Chutes River carrying Route 302
Location: Naples, Maine

Boring No.: RWB-NBB-402
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	260.6	**Auger ID/OD:**	N/A
Operator:	Giguere/Giles/Wright	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/12/09-10/13/09	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	24+58, 62.5 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	Water Boring
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR/C = weight of rods or casing
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
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N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
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WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
50								209.60		51.00	
										Bottom of Exploration at 51.00 feet below ground surface. Could not get casing through Boulder, moved to RWB-NB-402A.	
55											
60											
65											
70											
75											

Remarks:

Raft Boring, 9.0' from Deck to Ground.
400-500# down pressure on Core Barrel.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge #2047 over Chutes River carrying Route 302
Location: Naples, Maine

Boring No.: RWB-NBB-402A
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	260.6	**Auger ID/OD:**	N/A
Operator:	Giguere/Giles/Wright	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/13/09-10/14/09	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	24+52, 62.5 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	Water Boring
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR/C = weight of rods or casing
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
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N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
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WC = water content, percent
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C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
40							102			Drove Casing to 40.0' bgs. started Bore Hole.	
							138				
							126				
							134				
							162				
45							180				
							164				
							136				
							128				
							166				
50	1D	24/17	50.00 - 52.00	5/5/5/5	10	14	112			Brown, wet, medium dense, fine to medium SAND, trace silt.	
							131				
							124				
							119				
							135				
55							138				
							138				
							173				
							170				
							173				
60	2D	24/18	60.00 - 62.00	5/6/5/5	11	15	75			Similar to above.	
							76				
							79				
							118				
65							126				

Remarks:

Raft Boring, 9.3' from Deck to Ground.
400-500# down pressure on Core Barrel.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge #2047 over Chutes River carrying Route 302
Location: Naples, Maine

Boring No.: RWB-NBB-402A
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	260.6	**Auger ID/OD:**	N/A
Operator:	Giguere/Giles/Wright	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/13/09-10/14/09	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	24+52, 62.5 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	Water Boring
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR/C = weight of rods or casing
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
65							131				
							137				
							139				
							163				
							169				
70	3D	24/17	70.00 - 72.00	WOH/WOH/2/4	2	3	86			Similar to above, except very loose.	
							120				
							130				
							152				
							175				
75							224				
							225			Grey in wash water from 77.0-80.0' bgs.	
							237				
							239				
							360				
80	R1	45.6/42	80.00 - 83.80	RQD = 0%			NQ-2	180.60		80.00 Top of Bedrock at Elev. 180.6'. Bedrock: Pink, medium grained, muscovite-biotite GRANITE. R1:Core Times (min:sec) 80.0-81.0' (3:00) 81.0-82.0' (2:40) 82.0-83.0' (4:40) 83.0-83.8' (8:43) 92% Recovery Core Blocked.	
								176.80		83.80 **Bottom of Exploration at 83.80 feet below ground surface.**	
85											
90											

Remarks:

Raft Boring, 9.3' from Deck to Ground.
400-500# down pressure on Core Barrel.

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge #2047 over Chutes River carrying Route 302
Location: Naples, Maine

Boring No.: RWB-NBB-403
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	262.7	**Auger ID/OD:**	N/A
Operator:	Giguere/Giles/Wright	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/15,16,19/09	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	26+74, 70.0 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	Water Boring
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Insitu Vane Shear Test attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR/C = weight of rods or casing
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0							6				
							15				
							18				
	1D	24/14	3.00 - 5.00	2/3/3/2	6	8	2			Grey, wet, loose, fine SAND, trace silt.	
							5				
5							6				
							8				
							8				
							13				
							9				
10							8				
							11	251.70		11.00	
							10				
	2D	24/12	13.00 - 15.00	WOR/WOR/1/WOR	1	1	2			Grey, wet, very loose, fine SAND, little silt.	
							7				
15							10				
							4				
							5				
							8				
							8				
20							9				
							12	241.70		21.00	
							13				
	3D	24/17	23.00 - 25.00	WOH/WOH/WOH/2	---		15			Grey, wet, very loose, silty fine SAND.	
25							12				

Remarks:

Raft Boring, 7.0' from Deck to Ground.
400-500# down pressure on Core Barrel.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge #2047 over Chutes River carrying Route 302
Location: Naples, Maine

Boring No.: RWB-NBB-403
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	262.7	**Auger ID/OD:**	N/A
Operator:	Giguere/Giles/Wright	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/15,16,19/09	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	26+74, 70.0 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	Water Boring
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Insitu Vane Shear Test attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR/C = weight of rods or casing
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25							15				
							17				
							17				
							12				
							17				
30							20				
							32				
							49	230.20		32.50	
	4D	24/18	33.00 - 35.00	3/4/3/4	7	10	44			Grey, wet, stiff, sandy-SILT, little clay, slightly plastic.	
							47				
35							48				
							47				
							42				
							36				
							38				
40							37				
							35	221.70		41.00	
							35				
	5D	24/20	43.00 - 45.00	WOH/WOH/2/3	2	3	45			Grey, wet, very loose, fine to medium SAND, trace silt.	
							40				
45							46				
							78				
							76				
							70				
							106	213.70		49.00	
50											

Remarks:

Raft Boring, 7.0' from Deck to Ground.
400-500# down pressure on Core Barrel.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge #2047 over Chutes River carrying Route 302
Location: Naples, Maine

Boring No.: RWB-NBB-403
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	262.7	**Auger ID/OD:**	N/A
Operator:	Giguere/Giles/Wright	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/15,16,19/09	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	26+74, 70.0 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	Water Boring
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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SSA = Solid Stem Auger
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RC = Roller Cone
WOH = weight of 140lb. hammer
WOR/C = weight of rods or casing
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
50							99				
							124				
							133				
	6D	24/18	53.00 - 55.00	WOR/1/2/4	3	4	84			Brown, wet, very loose, fine to medium SAND, trace silt.	
							77				
55							119				
							117				
							128				
							124				
							112				
60							117				
							118				
							134	200.70		62.00	
	7D	24/19	63.00 - 65.00	WOR/4/5/9	9	13	108			Brown, wet, medium dense, fine to coarse SAND, trace silt.	
							127				
65							132				
							137				
							129				
							110				
							128				
70							128				
							128				
							150				
	8D	24/18	73.00 - 75.00	4/5/10/17	15	21	146			Similar to above.	
75							122				

Remarks:

Raft Boring, 7.0' from Deck to Ground.
400-500# down pressure on Core Barrel.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge #2047 over Chutes River carrying Route 302
Location: Naples, Maine

Boring No.: RWB-NBB-403
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	262.7	**Auger ID/OD:**	N/A
Operator:	Giguere/Giles/Wright	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/15,16,19/09	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	26+74, 70.0 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	Water Boring
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR/C = weight of rods or casing
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
75							124				
							131				
							125				
							342	184.70		78.00	
							328				
80							173				
							170				
							184				
	9D	24/14	83.00 - 85.00	2/2/32/20	34	48	117			Light brown, wet, dense, fine to medium SAND, trace silt, trace gravel.	
							136				
85							166				
							240				
							334				
							242				
							221				
90							330				
	R1	93.6/60	91.70 - 99.50	RQD = 36%			[a]869 NQ-2	171.00		[a]869 blows for 0.7'. 91.70	
										R1: BOULDERS and COBBLES. R1:Core Times (min:sec) 91.7-92.7' (2:58) 92.7-93.7' (2:53) 93.7-94.7' (0:15) 94.7-95.7' (0:45) 95.7-96.7' (1:39) 96.7-97.7' (1:15)	
95											
								165.20		97.50	
										Top of Bedrock at Elev. 165.2'. Bedrock: Pink, medium grained, muscovite-biotite GRANITE. R1:Core Times (min:sec) cont. 97.7-98.7' (2:30) 98.7-99.5' (2:15) 64% Recovery	
100								163.20			

Remarks:

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400-500# down pressure on Core Barrel.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge #2047 over Chutes River carrying Route 302
Location: Naples, Maine

Boring No.: RWB-NBB-403
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	262.7	**Auger ID/OD:**	N/A
Operator:	Giguere/Giles/Wright	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/15,16,19/09	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	26+74, 70.0 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	Water Boring
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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SSA = Solid Stem Auger
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LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
100										Core Blocked	
										99.50	
										Bottom of Exploration at 99.50 feet below ground surface.	
105											
110											
115											
120											
125											

Remarks:

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400-500# down pressure on Core Barrel.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge #2047 over Chutes River carrying Route 302
Location: Naples, Maine

Boring No.: RWB-NBB-404
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	263.3	**Auger ID/OD:**	N/A
Operator:	Giguere/Giles/Wright	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/15,16,19/09	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	28+75, 63.0 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	Water Boring
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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WOH = weight of 140lb. hammer
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S_u = Insitu Field Vane Shear Strength (psf)
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PI = Plasticity Index
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C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0							16				
							11				
							14				
	1D	24/18	3.00 - 5.00	3/3/3/4	6	8	2			Grey-Brown, wet, loose, fine to medium SAND, little silt.	
							5				
5							6				
							7				
							7				
							9				
							7				
10							10	253.30		10.00	
							10				
							10				
	2D	24/14	13.00 - 15.00	WOH/WOH/2/2	2	3	3			Light grey, wet, very loose, fine SAND, trace silt.	
							7				
15							7				
							10				
							8				
							17				
							15				
20							12				
							21				
							23				
	3D	24/14	23.00 - 25.00	WOH/1/2/4	3	4	15			Grey, wet, very loose, fine SAND, trace silt.	
25							9				

Remarks:

Raft Boring, 6.8' from Deck to Ground.
400-500# down pressure on Core Barrel.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge #2047 over Chutes River carrying Route 302
Location: Naples, Maine

Boring No.: RWB-NBB-404
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	263.3	**Auger ID/OD:**	N/A
Operator:	Giguere/Giles/Wright	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/15,16,19/09	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	28+75, 63.0 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	Water Boring
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25							12				
							15				
							16				
							14				
							22				
30							22				
							36	232.30		31.00	
							45				
	4D	24/20	33.00 - 35.00	WOR/WOR/WOH/ WOH	---		24			Grey, wet, very soft, sandy SILT, little clay, slightly plastic.	
							20				
35							33				
							88				
							111	226.30		37.00	
							117				
							117				
40							120				
							108				
							107				
	5D	24/20	43.00 - 45.00	3/7/15/18	22	31	52			Brown, wet, dense, fine to medium SAND, trace silt.	
							58				
45							77				
							112				
							122				
							120				
50							128				

Remarks:

Raft Boring, 6.8' from Deck to Ground.
400-500# down pressure on Core Barrel.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge #2047 over Chutes River carrying Route 302
Location: Naples, Maine

Boring No.: RWB-NBB-404
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	263.3	**Auger ID/OD:**	N/A
Operator:	Giguere/Giles/Wright	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/15,16,19/09	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	28+75, 63.0 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	Water Boring
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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HSA = Hollow Stem Auger
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WOH = weight of 140lb. hammer
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WO1P = Weight of one person
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C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
50							131				
							123				
							128				
	6D	24/24	53.00 - 55.00	2/4/5/9	9	13	73			Light brown, wet, medium dense, fine to medium SAND, trace silt.	
							73				
55							116				
							115				
							124				
							124				
							134				
60							135				
							132				
							136				
	7D	24/22	63.00 - 65.00	WOR/WOR/3/5	3	4	69			Similar to above, except very loose.	
							73				
65							86				
							119				
							116				
							138				
							135				
70							138				
							167	192.30		71.00	
							171				
	8D	24/20	73.00 - 75.00	3/7/13/20	20	28	127			Brown, wet, medium dense, fine to coarse SAND, little gravel, trace silt.	
75							138				

Remarks:

Raft Boring, 6.8' from Deck to Ground.
400-500# down pressure on Core Barrel.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge #2047 over Chutes River carrying Route 302
Location: Naples, Maine

Boring No.: RWB-NBB-404
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	263.3	**Auger ID/OD:**	N/A
Operator:	Giguere/Giles/Wright	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/15,16,19/09	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	28+75, 63.0 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	Water Boring
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Insitu Vane Shear Test attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR/C = weight of rods or casing
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
75							127				
							127				
							133				
							176				
							187				
80							350				
	R1	60/51	81.00 - 86.00	RQD = 43%			NQ-2	182.30		81.00 Top of Bedrock at Elev. 182.3'. Bedrock: Pink, medium grained, muscovite-biotite GRANITE. R1:Core Times not given. 85% Recovery	
85								177.30		86.00 **Bottom of Exploration at 86.00 feet below ground surface.**	
90											
95											
100											

Remarks:

Raft Boring, 6.8' from Deck to Ground.
400-500# down pressure on Core Barrel.

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge #2047 over Chutes River carrying Route 302
Location: Naples, Maine

Boring No.: RWB-NBB-405
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	265.5	**Auger ID/OD:**	N/A
Operator:	Giguere/Giles/Wright	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/20/09-10/21/09	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	31+06, 71.0 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	Water Boring
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR/C = weight of rods or casing
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0							5				
							10				
							24				
							32				
							40				
5							32				
							30				
							33				
							31				
							32				
10	1D	24/18	10.00 - 12.00	1/2/3/3	5	7	9			Grey brown, wet, loose, fine SAND, little silt.	
							13				
							11				
							14				
							11				
15							31				
							27				
							21				
							21				
							25				
20	2D	24/16	20.00 - 22.00	WOR/WOH/1/3	1	1	24			Similar to above, except very loose.	
							27				
							30				
							25				
25							25				

Remarks:

Raft Boring, 4.8' from Deck to Ground.
400-500# down pressure on Core Barrel.

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge #2047 over Chutes River carrying Route 302
Location: Naples, Maine

Boring No.: RWB-NBB-405
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	265.5	**Auger ID/OD:**	N/A
Operator:	Giguere/Giles/Wright	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/20/09-10/21/09	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	31+06, 71.0 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	Water Boring
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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SSA = Solid Stem Auger
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RC = Roller Cone
WOH = weight of 140lb. hammer
WOR/C = weight of rods or casing
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
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C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25							24				
							33				
							39				
							52				
							58				
30	3D	24/13	30.00 - 32.00	WOH/1/2/3	3	4	26			Similar to above.	
							28				
							39				
							56				
							60				
35							69				
							72				
							90	228.50		37.00	
							112				
							108				
40	4D	24/6	40.00 - 42.00	2/4/4/6	8	11	40			Brown, wet, medium dense, fine to coarse SAND, little gravel, trace silt.	
							56				
							62				
							60				
							63				
45							63				
							70				
							70				
							72				
50							84				

Remarks:

Raft Boring, 4.8' from Deck to Ground.
400-500# down pressure on Core Barrel.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge #2047 over Chutes River carrying Route 302
Location: Naples, Maine

Boring No.: RWB-NBB-405
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	265.5	**Auger ID/OD:**	N/A
Operator:	Giguere/Giles/Wright	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/20/09-10/21/09	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	31+06, 71.0 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	Water Boring
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
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MV = Unsuccessful Insitu Vane Shear Test attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR/C = weight of rods or casing
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
50	5D	24/8	50.00 - 52.00	1/3/6/12	9	13	88			Similar to above.	
							74				
							75				
							82				
							112				
55							138				
							181	209.50		56.00	
							190				
							226				
							227				
60	6D	10.8/10.8	60.00 - 60.90	4/50(4.8")	---		200			Grey, wet, very dense, gravelly fine to coarse SAND, trace silt.	
	R1	72/32	61.50 - 67.50				[a]200 NQ-2			[a]200 blows for 0.5'.	
								204.00		61.50	
										R1:BOULDERS and COBBLES.	
										R1:Core Times (min:sec)	
										61.5-62.5' (4:14)	
										62.5-63.5' (1:20)	
										63.5-64.5' (0:30)	
65										64.5-65.5' (2:00)	
										65.5-66.5' (3:43)	
										66.5-67.5' (3:50) 44% Recovery	
										Could not get back down.	
								198.00		67.50	
										Bottom of Exploration at 67.50 feet below ground surface.	
70											
75											

Remarks:

Raft Boring, 4.8' from Deck to Ground.
400-500# down pressure on Core Barrel.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge #2047 over Chutes River carrying Route 302
Location: Naples, Maine

Boring No.: RWB-NBB-406
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	273.1	**Auger ID/OD:**	5" Solid Stem1D
Operator:	Giguere/Giles/Wright	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/22,23,26/09	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	32+45, 52.0 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	None Observed
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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MV = Unsuccessful Insitu Vane Shear Test attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR/C = weight of rods or casing
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/20	0.00 - 2.00	3/6/3/3	9	13	SSA			Brown, damp, medium dense, fine to coarse SAND, trace silt, (Fill).	
5										Cobble from 5.0-5.8' bgs.	
								266.10		7.00	
10	2D	24/18	10.00 - 12.00	9/9/7/6	16	22	31			Light brown, wet, medium dense, fine SAND, little silt.	
							24				
							18				
							18				
15							18				
							40				
							33				
							32				
							36				
20							30				
	3D	24/1	20.00 - 22.00	4/4/3/4	7	10	14			Similar to above but loose.	
							14				
							23				
							29				
25							25				

Remarks:

100# down pressure on Core Barrel.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge #2047 over Chutes River carrying Route 302
Location: Naples, Maine

Boring No.: RWB-NBB-406
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	273.1	**Auger ID/OD:**	5" Solid Stem1D
Operator:	Giguere/Giles/Wright	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/22,23,26/09	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	32+45, 52.0 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	None Observed
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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R = Rock Core Sample
SSA = Solid Stem Auger
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WOH = weight of 140lb. hammer
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N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25							43				
							49				
							62				
							75				
							81				
30	4D	24/12	30.00 - 32.00	WOH/1/3/5	4	6	33			Similar to above.	
							46				
							67				
							78				
							92				
35							107				
							85				
							120				
							121				
							114				
40	5D	24/20	40.00 - 42.00	WOR/1/3/5	4	6	70			Similar to above.	
							70				
							81				
							122				
							117				
45							142				
							127				
							127				
							135				
50							126				

Remarks:

100# down pressure on Core Barrel.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge #2047 over Chutes River carrying Route 302
Location: Naples, Maine

Boring No.: RWB-NBB-406
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	273.1	**Auger ID/OD:**	5" Solid Stem1D
Operator:	Giguere/Giles/Wright	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/22,23,26/09	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	32+45, 52.0 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	None Observed
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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WOH = weight of 140lb. hammer
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WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
50	6D	24/18	50.00 - 52.00	4/6/6/12	12	17	85			Similar to above, except medium dense.	
							79				
							108				
							112				
							119	219.10		54.00	
55							117				
							124				
							124				
							127				
							134				
60	7D	24/8	60.00 - 62.00	3/4/3/6	7	10	116			Light brown, wet, loose, fine to coarse SAND, little gravel, trace silt.	
							117				
							130				
							119				
							139				
65							126				
							130				
							125				
							131			3.0' running sand up Casing.	
							164				
70	8D	24/18	70.00 - 72.00	5/5/6/18	11	15	135			Similar to above, except medium dense.	
							134				
							162				
							186				
75							191				

Remarks:

100# down pressure on Core Barrel.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge #2047 over Chutes River carrying Route 302
Location: Naples, Maine

Boring No.: RWB-NBB-406
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	273.1	**Auger ID/OD:**	5" Solid Stem1D
Operator:	Giguere/Giles/Wright	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/22,23,26/09	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	32+45, 52.0 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	None Observed
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR/C = weight of rods or casing
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
75							237				
							216				
							129				
							183				
							228				
80	9D	24/12	80.00 - 82.00	1/3/5/5	8	11	118			Similar to above.	
							126				
							125				
							120				
							162				
85							163				
							130				
							227				
							227				
							272				
90	10D	24/4	90.00 - 92.00	1/3/5/6	8	11	173			Similar to above.	
							170				
							177				
							217				
							225				
95							222				
							175				
							244				
							230				
100							294				

Remarks:

100# down pressure on Core Barrel.

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Naples Bay Bridge #2047 over Chutes River carrying Route 302
Location: Naples, Maine

Boring No.: RWB-NBB-406
PIN: 11060.00

Driller:	MaineDOT	**Elevation (ft.)**	273.1	**Auger ID/OD:**	5" Solid Stem1D
Operator:	Giguere/Giles/Wright	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/22,23,26/09	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	32+45, 52.0 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	None Observed
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Insitu Vane Shear Test attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR/C = weight of rods or casing
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
100	11D	24/1	100.00 - 102.00	3/3/8/19	11	15	131			Similar to above, except medium dense.	
							180				
							115				
							242				
	R1	40.8/28	104.20 - 107.60				a200 NQ-2	168.90		[a]200 blows for 0.2'.	
105										104.20 R1: BOULDERS and COBBLES. R1:Core Times (min:sec) 104.2-105.2' (1:39) 105.2-106.2' (3:05) 106.2-107.2' (2:20) 107.2-107.6' (1:08) 68% Recovery	
								165.50		Could not get back down. 107.60 **Bottom of Exploration at 107.60 feet below ground surface.**	
110											
115											
120											
125											

Remarks:

100# down pressure on Core Barrel.

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

SPECIAL PROVISION
SECTION 635
PREFABRICATED CONCRETE MODULAR GRAVITY WALL

The following replaces Section 635 in the Standard Specifications in its entirety:

635.01 Description. This work shall consist of the construction of a prefabricated modular reinforced concrete gravity wall in accordance with these specifications and in reasonably close conformance with the lines and grades shown on the plans, or established by the Resident.

Included in the scope of the Prefabricated Concrete Modular Gravity Wall construction are**:** all grading necessary for wall construction, excavation, compaction of the wall foundation, backfill, construction of leveling pads, placement of geotextile, segmental unit erection, and all incidentals necessity to complete the work.

The Prefabricated Concrete Modular Gravity Wall design shall follow the general dimensions of the wall envelope shown in the contract plans. The top of the leveling pad shall be located at or below the theoretical leveling pad elevation. The minimum wall embedment shall be at or below the elevation shown on the plans. The top of the face panels shall be at or above the top of the panel elevation shown on the plans.

The Contractor shall require the design-supplier to supply an on-site, qualified experienced technical representative to advise the Contractor concerning proper installation procedures. The technical representative shall be on-site during initial stages of installation and thereafter shall remain available for consultation as necessary for the Contractor or as required by the Resident. The work done by this representative is incidental.

635.02 Materials. Materials shall meet the requirements of the following subsections of Division 700 - Materials:

Gravel Borrow	703.20
Preformed Expansion Joint Material	705.01
Reinforcing Steel	709.01
Structural Pre-cast Concrete Units	712.061
Drainage Geotextile	722.02

The Contractor is cautioned that all of the materials listed are not required for every Prefabricated Concrete Modular Gravity Wall. The Contractor shall furnish the Resident a Certificate of Compliance certifying that the applicable materials comply with this section of the specifications. Materials shall meet the following additional requirements:

Concrete Units:

Tolerances. In addition to meeting the requirements of 712.061, all prefabricated units shall be manufactured with the following tolerances. All units not meeting the listed tolerances will be rejected.

1. All dimensions shall be within (edge to edge of concrete) ±3/16 inch.

2. Squareness. The length differences between the two diagonals shall not exceed 5/16 inch.
3. Surface Tolerances. For steel formed surfaces, and other formed surface, any surface defects in excess of 0.08 inch in 4 feet will be rejected. For textured surfaces, any surface defects in excess of 5/16 inch in 5 feet shall be rejected.

Joint Filler. (where applicable) Joints shall be filled with material approved by the Resident and supplied by the approved Prefabricated Concrete Modular Gravity Wall supplier. 4 inch wide, by 0.5 inch thick preformed expansion joint filler shall be placed in all horizontal joints between facing units. In all vertical joints, a space of 0.25 inch shall be provided. All Preformed Expansion Joint Material shall meet the requirements of subsection 502.03.

Woven Drainage Geotextile. Woven drainage geotextile 12 inches wide shall be bonded with an approved adhesive compound to the back face, covering all joints between units, including joints abutting concrete structures. Geotextile seam laps shall be 6 inches minimum. The fabric shall be secured to the concrete with an adhesive satisfactory to the Resident. Dimensions may be modified per the wall supplier's recommendations, with written approval of the Resident.

Concrete Shear Keys. (where applicable) Shear keys shall have a thickness at least equal to the pre-cast concrete stem.

Concrete Leveling Pad. Cast-in-place concrete shall be Fill Concrete conforming to the requirements of Section 502 Structural Concrete. The horizontal tolerance on the surface of the pad shall be 0.25 inch in 10 feet. Dimensions may be modified per the wall supplier's recommendations, with written approval of the Resident.

Backfill and Bedding Material. Bedding and backfill material placed behind and within the reinforced concrete modules shall be gravel borrow conforming to the requirements of Subsection 703.20. The backfill materials shall conform to the following additional requirements: the plasticity index (PI) as determined by AASHTO T90 shall not exceed 6. Compliance with the gradation and plasticity requirements shall be the responsibility of the Contractor, who shall furnish a copy of the backfill test results prior to construction.

The backfilling of the interior of the wall units and behind the wall shall progress simultaneously. The material shall be placed in layers not over 8 inches in depth, loose measure, and thoroughly compacted by mechanical or vibratory compactors. Puddling for compaction will not be allowed.

Materials Certificate Letter. The Contractor, or the supplier as his agent, shall furnish the Resident a Materials Certificate Letter for the above materials, including the backfill material, in accordance with Section 700 of the Standard Specifications. A copy of all test results performed by the Contractor or his supplier necessary to assure contract compliance shall also be furnished to the Resident. Acceptance will be based upon the materials Certificate Letter, accompanying test reports, and visual inspection by the Resident.

635.03 Design Requirements. The Prefabricated Concrete Modular Gravity Wall shall be designed and sealed by a licensed Professional Engineer registered in accordance with the laws

of the State of Maine. The design to be performed by the wall system supplier shall be in accordance with AASHTO LRFD Bridge Design Specifications, current edition, except as required herein. Design shall consider Strength and Extreme Limit States. Thirty days prior to beginning construction of the wall, the design computations shall be submitted to the Resident for review by the Department. Design calculations that consist of computer generated output shall be supplemented with at least one hand calculation and graphic demonstrating the design methodology used. Design calculations shall provide thorough documentation of the sources of equations used and material properties. The design by the wall system supplier shall consider the stability of the wall as outlined below:

A. Stability Analysis:
   1. Overturning: Location of the resultant of the reaction forces shall be within the middle one-half of the base width.
   2. Sliding: $R_R \geq \gamma_{p(max)} \cdot (EH+ES)$
      Where: R_R = Factored Sliding Resistance
      $\gamma_{p(max)}$ = Maximum Load Factor
      EH = Horizontal Earth Pressure
      ES = Earth Surcharge (as applicable)
   4. Bearing Pressure: $q_R \geq$ Factored Bearing Pressure
      Where: q_R = Factored Bearing Resistance, as shown on the plans
      Factored Bearing Pressure = Determined considering the applicable loads and load factors which result in the maximum calculated bearing pressure.
   5. Pullout Resistance: Pullout resistance shall be determined using nominal resistances and forces. The ratio of the sum of the nominal resistances to the sum of the nominal forces shall be greater than, or equal to, 1.5.

   Live load surcharge on PCMG walls shall be estimated as a uniform horizontal earth pressure due to an equivalent height of soil (h_{eq}) taken form LRFD Table 3.11.6.4-2 with consideration for the distance from the wall pressure surface to the edge of traffic. Traffic impact loads transmitted to the wall through guardrail posts shall be calculated and applied in compliance with LRFD Section 11, where Article 11.10.10.2 is modified such that the upper 3.5 feet of concrete modular units shall be designed for an additional horizontal load of $\gamma P_{H1,}$ where γP_{H1}=300 lbs per linear foot of wall.

B. Backfill and Wall Unit Soil Parameters. For overturning and sliding stability calculations, earth pressure shall be assumed acting on a vertical plane rising from the back of the lowest wall stem. For overturning, the unit weight of the backfill within the wall units shall be limited to 96 pcf. For sliding analyses, the unit weight of the backfill within the wall units can be assumed to be 120 pcf. Both analyses may assume a friction angle of 34 degrees for backfill within the wall units.

   These unit weights and friction angles are based on a wall unit backfill meeting the requirements for select backfill in this specification. Backfill behind the wall units shall be assumed to have a unit weight of 120 pcf and a friction angle of 30 degrees. The friction angle of the foundation soils shall be assumed to be 30 degrees unless otherwise noted on the plans.

C. Internal Stability. Internal stability of the wall shall be demonstrated using accepted methods, such as Elias' Method, 1991. Shear keys shall not contribute to pullout resistance. Soil-to-soil frictional component along stem shall not contribute to pullout resistance. The failure plane used to determine pullout resistance shall be found by the Rankine theory only for vertical walls with level backfills. When walls are battered or with backslopes > 0 degrees are considered, the angle of the failure plane shall be per Jumikus Method. For computation of pullout force, the width of the backface of each unit shall be no greater than 4.5 feet. A unit weight of the soil inside the units shall be assumed no greater than 120 pcf when computing pullout. Coulomb theory may be used.

D. External loads which affect the internal stability such as those applied through piling, bridge footings, traffic, slope surcharge, hydrostatic and seismic loads shall be accounted for in the design.

E. The maximum calculated factored bearing pressure under the Prefabricated Concrete Modular Gravity block wall shall be clearly indicated on the design drawings.

F. Stability During Construction. Stability during construction shall be considered during design, and shall meet the requirements of the AASHTO LRFD Bridge Design Specifications, Extreme Limit State.

G. Hydrostatic forces. Unless specified otherwise, when a design high water surface is shown on the plans at the face of the wall, the design stresses calculated from that elevation to the bottom of wall must include a 3 feet minimum differential head of saturated backfill. In addition, the buoyant weight of saturated soil shall be used in the calculation of pullout resistance.

H. Design Life. The wall design life shall be a minimum of 75 years.

I. Not more than two vertically consecutive units shall have the same stem length, or the same unit depth. Walls with units with extended height curbs shall be designed for the added earth pressure. A separate computation for pullout of each unit with extended height curbs, or extended height coping, shall be prepared and submitted in the design package described above.

635.04 Submittals. The Contractor shall supply wall design computations, wall details, dimensions, quantities, and cross sections necessary to construct the wall. Thirty (30) days prior to beginning construction of the wall, the design computations and wall details shall be submitted to the Resident for review. The fully detailed plans shall be prepared in conformance with Subsection 105.7 of the Standard Specifications and shall include, but not be limited to the following items:

A. A plan and elevation sheet or sheets for each wall, containing the following: elevations at the top of leveling pads, the distance along the face of the wall to all steps in the leveling pads, the designation as to the type of prefabricated module, the distance along the face of the wall to where changes in length of the units occur, the location of the original and final ground line.

B. All details, including reinforcing bar bending details, shall be provided. Bar bending details shall be in accordance with Department standards.

C. All details for foundations and leveling pads, including details for steps in the leveling pads, as well as allowable and actual maximum bearing pressures shall be provided.

D. All prefabricated modules shall be detailed. The details shall show all dimensions necessary to construct the element, and all reinforcing steel in the element.

E. The wall plans shall be prepared and stamped by a Professional Engineer. Four sets of design drawings and detail design computations shall be submitted to the Resident.

F. Four weeks prior to the beginning of construction, the contractor shall supply the Resident with two copies of the design-supplier's Installation Manual. In addition, the Contractor shall have two copies of the Installation Manual on the project site.

635.05 Construction Requirements

Excavation. The excavation and use as fill disposal of all excavated material shall meet the requirements of Section 203 -- Excavation and Embankment, except as modified herein.

Foundation. The area upon which the modular gravity wall structure is to rest, and within the limits shown on the submitted plans, shall be graded for a width equal to, or exceeding, the length of the module. Prior to wall and leveling pad construction, this foundation material shall be compacted to at least 95 percent of maximum laboratory dry density, determined using AASHTO T180, Method C or D. Frozen soils and soils unsuitable or incapable of sustaining the required compaction, shall be removed and replaced.

A concrete leveling pad shall be constructed as indicated on the plans. The leveling pad shall be cast to the design elevations as shown on the plans, or as required by the wall supplier upon written approval of the Resident. Allowable elevation tolerances are +0.01 feet and -0.02 feet from the design elevations. Leveling pads which do not meet this requirement shall be repaired or replaced as directed by the Resident at no additional cost to the Department. Placement of wall units may begin after 24 hours curing time of the concrete leveling pad.

Method and Equipment. Prior to erection of the Prefabricated Concrete Modular Gravity Wall, the Contractor shall furnish the Resident with detailed information concerning the proposed construction method and equipment to be used. The erection procedure shall be in accordance with the manufacturer's instructions. Any pre-cast units that are damaged due to handling will be replaced at the Contractor's expense.

Installation of Wall Units. A field representative from the wall system being used shall be available, as needed, during the erection of the wall. The services of the representative shall be at no additional cost to the Department. Vertical and horizontal joint fillers shall be installed as shown on the plans.

The maximum offset in any unit joint shall be 3/4 inch. The overall vertical tolerance of the wall, plumb from top to bottom, shall not exceed 1/2 inch per 10 feet of wall height. The prefabricated wall units shall be installed to a tolerance of plus or minus 3/4 inch in 10 feet in vertical alignment and horizontal alignment.

Select Backfill Placement. Backfill placement shall closely follow the erection of each row of prefabricated wall units. The Contractor shall decrease the lift thickness if necessary to obtain the specified density. The maximum lift thickness shall be 8 inches (loose). Gravel borrow backfill shall be compacted in accordance with Subsection 203.12 except that the minimum required compaction shall be 92 percent of maximum density as determined by AASHTO T180 Method C or D. Backfill compaction shall be accomplished without disturbance or displacement of the wall units. Sheepsfoot rollers will not be allowed. Whenever a compaction test fails, no additional backfill shall be placed over the area until the lift is recompacted and a passing test achieved.

The moisture content of the backfill material prior to and during compaction shall be uniform throughout each layer. Backfill material shall have a placement moisture content less than or equal to the optimum moisture content. Backfill material with a placement moisture content in excess of the optimum moisture content shall be removed and reworked until the moisture content is uniform and acceptable throughout the entire lift. The optimum moisture content shall be determined in accordance with AASHTO T180, Method C or D. At the end of the day's operations, the Contractor shall shape the last level of backfill so as to direct runoff of rain water away from the wall face.

635.06 Method of Measurement. Prefabricated Concrete Modular Gravity Wall will be measured by the square meter of front surface not to exceed the dimensions shown on the contract plans or authorized by the Resident. Vertical and horizontal dimensions will be from the edges of the facing units. No field measurements for computations will be made unless the Resident specifies, in writing, a change in the limits indicated on the plans.

635.07 Basis of Payment. The accepted quantity of Prefabricated Concrete Modular Gravity Retaining Wall will be paid for at the contract unit price per square meter complete in place. Payment shall be full compensation for furnishing all labor, equipment and materials including excavation, foundation material, backfill material, pre-cast concrete units hardware, joint fillers, woven drainage geotextile, cast-in-place coping or traffic barrier and technical field representative. Cost of cast-in-place concrete for leveling pad will not be paid for separately, but will be considered incidental to the Prefabricated Concrete Modular Gravity Wall.

There will be no allowance for excavating and backfilling for the Prefabricated Concrete Modular Gravity Wall beyond the limits shown on the approved submitted plans, except for excavation required to remove unsuitable subsoil in preparation for the foundation, as approved by the Resident. Payment for excavating unsuitable material shall be full compensation for all costs of pumping, drainage, sheeting, bracing and incidentals for proper execution of the work.

Payment will be made under:

Pay Item	Pay Unit
635.14 Prefabricated Concrete Modular Gravity Wall	Square Foot