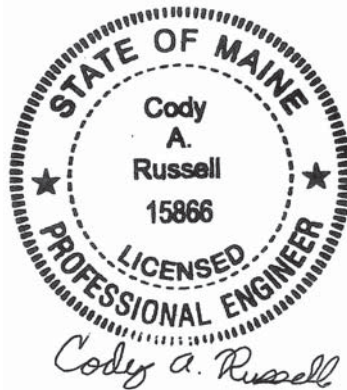


**MAINE DEPARTMENT OF TRANSPORTATION
HIGHWAY PROGRAM
GEOTECHNICAL SECTION
AUGUSTA, MAINE**

GEOTECHNICAL DATA REPORT

For the Replacement of a Retaining Wall on:
**ROUTE 24
RICHMOND, MAINE**

Prepared by:
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Geotechnical Engineer



Reviewed by:
Kathleen Maguire, P.E.
Senior Geotechnical Engineer

Sagadahoc County
WIN 23741.00

Soils Report 2021-05
February 1, 2021

INTRODUCTION

The purpose of this data report is to document subsurface information collected and make geotechnical and construction recommendations for the design and construction of a retaining wall on Route 24 in Richmond. This report presents the results of a limited geotechnical investigation performed near the existing retaining wall and the results of a limited laboratory testing program conducted on soils recovered during the geotechnical investigation. Route 24 is a Highway Corridor Priority 3 road.

SUBSURFACE INVESTIGATION

Three (3) borings (HB-RIC-101 through HB-RIC-103) were drilled along the existing retaining wall by the MaineDOT drill crew using a trailer mounted drill rig. Exploration locations are shown on Sheet 2 – Boring Location Plan. Details and sampling methods used, field data obtained, and soil and groundwater conditions encountered are presented in the attached Boring Logs.

The MaineDOT Geotechnical Team member selected the boring locations, drilling methods, designated type and depth of sampling, reviewed field logs for accuracy and identified field and laboratory testing requirements. A Northeast Transportation Training and Certification Program (NETTCP) certified subsurface inspector logged the subsurface conditions encountered. The borings were located in the field by taping to surveyed site features after completion of the drilling program.

LABORATORY TESTING

A laboratory testing program was conducted on select soil samples obtained in the borings to assist in soil classification. Laboratory testing consisted of six (6) standard grain size analyses with natural water content. The results of the laboratory tests are summarized in the attached Laboratory Testing Summary Sheet and Grain Size Distribution Curves. Laboratory test results for the samples obtained in the borings are also summarized on the attached boring logs.

GEOTECHNICAL RECOMMENDATIONS

The existing granite slab retaining wall will be replaced with a wet cast small landscape block wall. Both sets of existing steps will be replaced with concrete steps. The existing sidewalk in front of the retaining wall will be maintained.

Wet Cast Small Landscape Block Wall – The proposed replacement retaining wall shall be constructed as shown on the Contract Plans and shall meet the requirements of Standard Specification 673 Wet Cast Small Landscape Block Wall. The proposed wall shall be supplier designed in accordance with AASHTO LRFD Bridge Design Specifications (LRFD) 9th Edition 2020 and Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Slopes (FHWA-NHI-10-024 and FHWA-NHI-10-025, March 2012).

The proposed retaining wall 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. Refer to LRFD Article 3.11.5.3 and Equations 3.11.5.3-1 and -2 for calculating Coulomb active earth pressure coefficient. Lateral earth pressure distributions for design of MSE walls are provided in LRFD Figures 3.11.5.8.1-1, -2 and -3. Passive earth pressure in front of the wall should be neglected in the design.

The factored bearing resistances for the retaining wall bearing on a concrete leveling pad on native soils at the service and strength limit states are presented in the table below. In no instance shall the bearing stress exceed the nominal resistance of the structural concrete which may be taken as $0.3f'_c$.

Limit State	Resistance Factor ϕ_b	AASHTO LRFD Reference	Factored Bearing Resistance (ksf)
Service	1.0	Article 10.5.5.1	5.0
Strength	0.45	Table 10.5.5.2.2-1	3.5

The following additional considerations should be addressed in the wall design:

- No traffic load will be required in the design of the wall.
- Piped drainage shall be included in the design of the wall.
- A minimum embedment of 2.0 feet is required for the wall design.
- The retaining wall design shall include a drainage system (swale) at the top of the wall to carry surface water runoff away from the face of the wall.

CLOSURE

This Geotechnical Data Report has been prepared for the use of the MaineDOT Highway Program for specific application to the retaining wall replacement on Route 24 in Richmond, Maine in accordance with generally accepted geotechnical and foundation engineering practices. No other intended use or warranty is expressed or implied.

MaineDOT conducted a limited number of soil explorations at discrete locations along the project and a limited number of laboratory tests. MaineDOT shall not be responsible for the Bidder's or Contractor's interpretations, estimates, or conclusions derived from the geotechnical information. Data provided may not be representative of the subsurface conditions between boring locations.

In the event that any changes in the nature, design, or location of the proposed project are planned, this report should be reviewed by a geotechnical engineer to assess the appropriateness of the conclusions and recommendations and to modify the recommendations as appropriate to reflect the changes in design. These analyses and recommendations are based in part upon a limited subsurface investigation at discrete exploratory locations completed at the site. If variations from the conditions encountered during the investigation appear evident during construction, it may also become necessary to re-evaluate the recommendations made in this report.

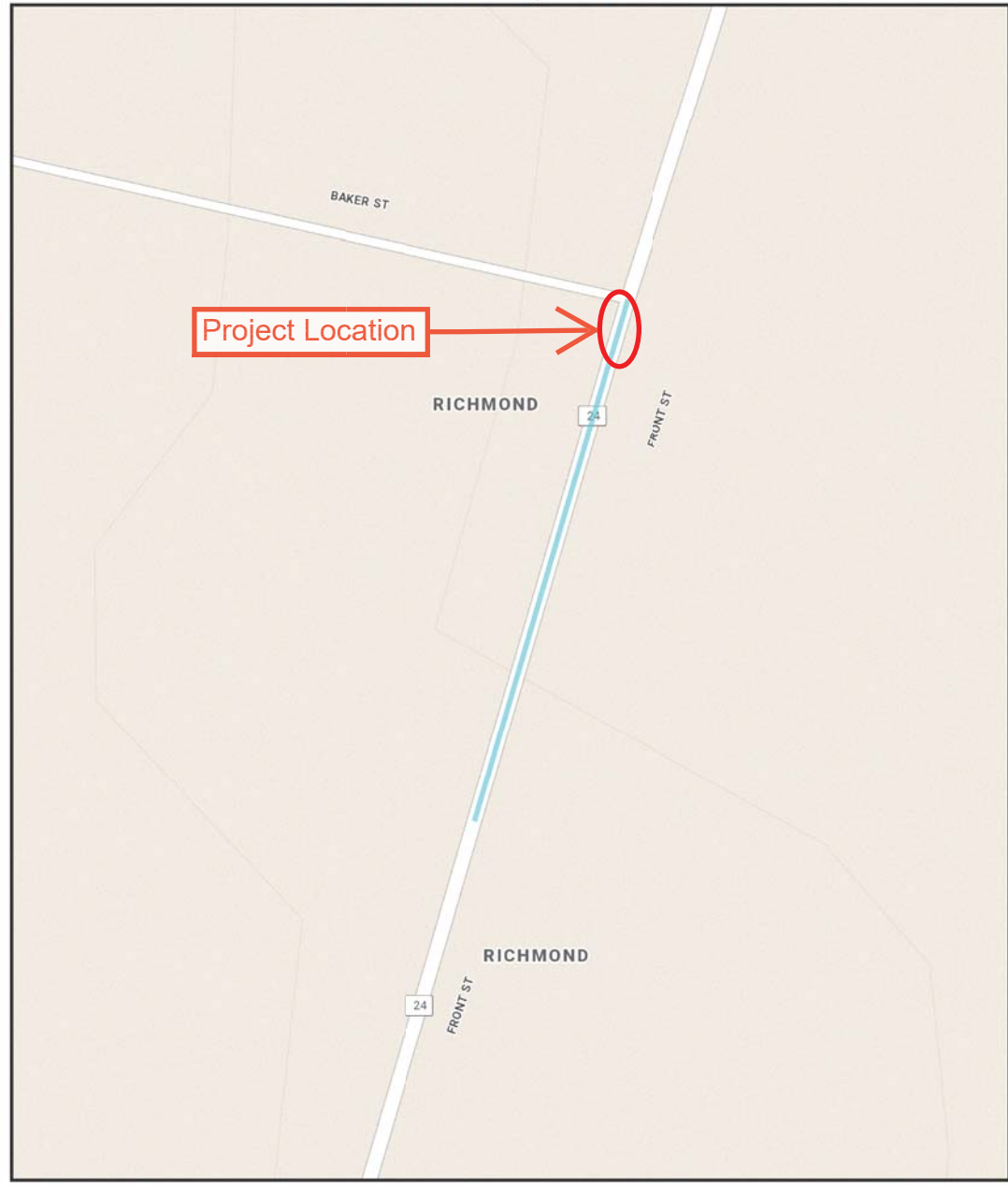
It is recommended that a geotechnical engineer be provided the opportunity for a review of the design and specifications in order that the earthwork and foundation recommendations and construction considerations presented in this report are properly interpreted and implemented in the design and specifications.

Attachments:

Location Map
Boring Location Plan
Key to Soil and Rock Descriptions and Terms
Boring Logs
Laboratory Testing Summary Sheet
Grain Size Distribution Curves



RICHMOND, MAINE

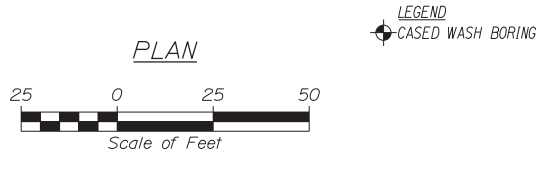
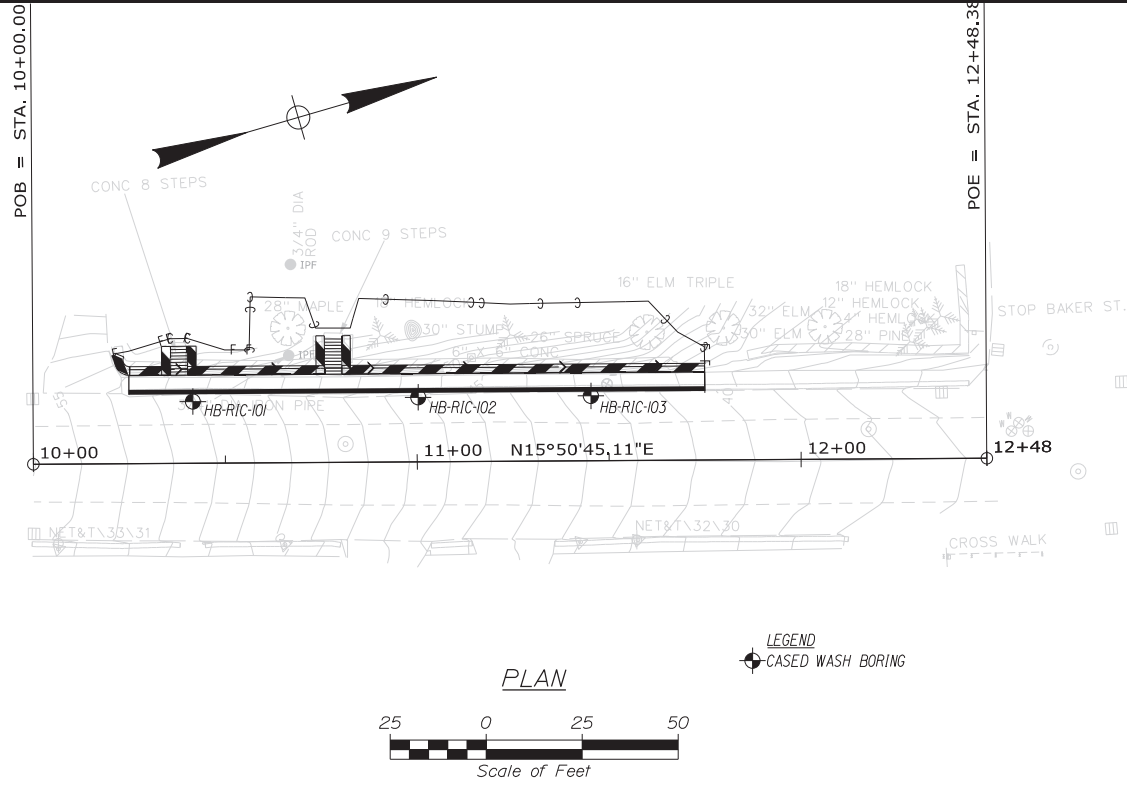


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0.006 Miles
1 inch = 0.01 miles

Date: 1/8/2021
Time: 7:36:53 AM

SHEET NUMBER 1 OF 2	RICHMOND ROUTE 24	STATE OF MAINE DEPARTMENT OF TRANSPORTATION	
		23741.00	
	LOCATION MAP	WIN 23741.00	HIGHWAY PLANS



SHEET NUMBER
2
OF 2

**RICHMOND
ROUTE 24
BORING LOCATION PLAN**

PROJ. MANAGER	BY	DATE
DESIGN-DETAILED		
CHECKED-REVIEWED		
DESIGNS-DETAILED01	C. RUSSELL	T. WHITE
DESIGNS-DETAILED03		
REVISIONS 1		
REVISIONS 2		
REVISIONS 3		
REVISIONS 4		
FIELD CHANGES		

SIGNATURE
P.E. NUMBER
DATE

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
023741.00
WIN
23741.00
HIGHWAY PLANS

Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS		Project: Retaining Wall Replacement on Route 24	Boring No.: HB-RIC-101
		Location: Richmaond, Maine	WIN: 23741.00
Driller: MaineDOT	Elevation (ft.): 52.1	Auger ID/OD: 5" Solid Stem	
Operator: Daggett/Niles/Sullivan	Datum: NAVD88	Sampler: Standard Split Spoon	
Logged By: C. Russell	Rig Type: CME 45C	Hammer Wt./Fall: 140#/30"	
Date Start/Finish: 8/14/2018; 10:35-12:45	Drilling Method: Cased Wash Boring	Core Barrel: NQ-2"	
Boring Location: 10+41.6, 16.0 ft Lt.	Casing ID/OD: NW-3"	Water Level*: None Observed	

Hammer Efficiency Factor: 0.928	Hammer Type: Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/>
Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample Attempt U = Thin Wall Tube Sample MU = Unsuccessful Thin Wall Tube Sample Attempt V = Field Vane Shear Test, PP = Pocket Penetrometer MV = Unsuccessful Field 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 = Peak/Remolded Field Vane Undrained Shear Strength (psf) S _{u(lab)} = Lab Vane Undrained Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) N-uncorrected = Raw Field SPT N-value Hammer Efficiency Factor = Rig Specific Annual Calibration Value N ₆₀ = SPT N-uncorrected Corrected for Hammer Efficiency N ₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected
	T _v = Pocket Torvane 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								Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/AASHTO and Unified Class.
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N ₆₀	Casing Blows					
0												
	1D	24/10	1.00 - 3.00	7/14/15/12	29	45		SSA		Brown, damp, dense, Gravelly fine to coarse SAND, trace silt, (Fill).	G#296545 A-1-b, SW-SM WC=2.4%	
5	2D	24/9	5.00 - 7.00	3/4/11/23	15	23				Brown, damp, medium dense, Gravelly fine to coarse SAND, trace silt, (Fill).	G#296546 A-1-a, SW-SM WC=3.6%	
	R1	60/57	8.70 - 13.70	RQD = 56%				NQ-2	43.7	Top of Bedrock at Elev. 43.7 ft. Auger REFUSAL at 8.4 ft bgs. Roller Coned ahead to 8.7 ft bgs. R1: Bedrock: Mafic to Felsic VOLCANIC ROCKS [Cushing Formation]. Rock Quality = Fair. R1: Core Times (min:sec) 8.7-9.7 ft (1:15) 9.7-10.7 ft (2:17) 10.7-11.7 ft (3:19) 11.7-12.7 ft (3:27) 12.7-13.7 ft (3:58) 95% Recovery	8.4	
10												
15									38.4	Bottom of Exploration at 13.7 feet below ground surface.	13.7	
20												
25												

Remarks:
Augered to Bedrock then spun NW Casing to Bedrock.

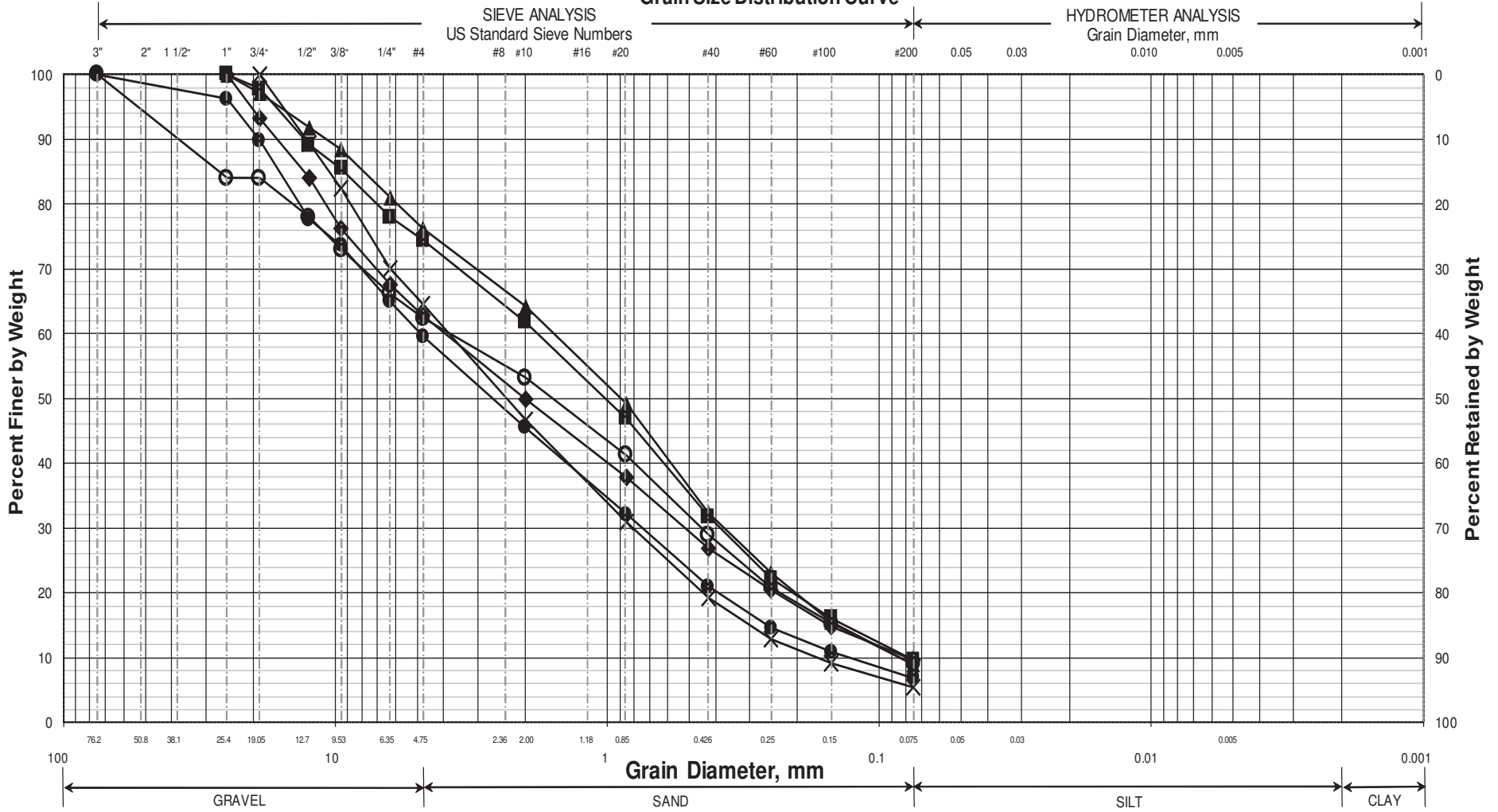
Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS		Project: Retaining Wall Replacement on Route 24	Boring No.: HB-RIC-102
		Location: Richmaond, Maine	WIN: 23741.00
Driller: MaineDOT	Elevation (ft.): 46.2	Auger ID/OD: 5" Solid Stem	
Operator: Daggett/Niles/Sullivan	Datum: NAVD88	Sampler: Standard Split Spoon	
Logged By: C. Russell	Rig Type: CME 45C	Hammer Wt./Fall: 140#/30"	
Date Start/Finish: 8/14/2018; 08:00-09:05	Drilling Method: Cased Wash Boring	Core Barrel: NQ-2"	
Boring Location: 11+00.4, 16.7 ft Lt.	Casing ID/OD: NW-3"	Water Level*: None Observed	

Hammer Efficiency Factor: 0.928	Hammer Type: Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/>
Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample Attempt U = Thin Wall Tube Sample MU = Unsuccessful Thin Wall Tube Sample Attempt V = Field Vane Shear Test, PP = Pocket Penetrometer MV = Unsuccessful Field 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 = Peak/Remolded Field Vane Undrained Shear Strength (psf) S _u (lab) = Lab Vane Undrained Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) N-uncorrected = Raw Field SPT N-value Hammer Efficiency Factor = Rig Specific Annual Calibration Value N ₆₀ = SPT N-uncorrected Corrected for Hammer Efficiency N ₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected
	T _v = Pocket Torvane 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							Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/AASHTO and Unified Class.
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N ₆₀	Casing Blows				
0							SSA	45.8		5" HMA.	
	1D	24/12	1.00 - 3.00	8/12/9/10	21	32				Brown, damp, dense, fine to coarse SAND, some gravel, trace silt, (Fill).	G#296547 A-1-b, SW-SM WC=3.3%
5	2D	24/14	5.00 - 7.00	6/6/4/8	10	15				Brown, damp, medium dense, Gravelly fine to coarse SAND, trace silt, (Fill).	G#296548 A-1-a, SW-SM WC=3.4%
	R1	60/60	7.90 - 12.90	RQD = 68%			NQ-2	39.0		Weathered ROCK.	
								38.4		Top of Intact Bedrock at Elev. 38.4 ft. Auger REFUSAL at 7.8 ft bgs. Roller Coned ahead to 7.9 ft bgs. R1: Bedrock: Mafic to Felsic VOLCANIC ROCKS [Cushing Formation]. Rock Quality = Fair. R1: Core Times (min:sec) 7.9-8.9 ft (1:53) 8.9-9.9 ft (1:43) 9.9-10.9 ft (1:24) 10.9-11.9 ft (2:10) 11.9-12.9 ft (2:15) 100% Recovery	
15								33.3		Bottom of Exploration at 12.9 feet below ground surface.	

Remarks:
Augered to Bedrock then spun NW Casing to Bedrock.

Maine Department of Transportation Grain Size Distribution Curve



UNIFIED CLASSIFICATION

	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	WC, %	LL	PL	PI
○	HB-RIC-101/1D	10+41.6	16.0 LT	1.0-3.0	Gravelly SAND, trace silt.	2.4			
◆	HB-RIC-101/2D	10+41.6	16.0 LT	5.0-7.0	Gravelly SAND, trace silt.	3.6			
■	HB-RIC-102/1D	11+00.4	16.7 LT	1.0-3.0	SAND, some gravel, trace silt.	3.3			
●	HB-RIC-102/2D	11+00.4	16.7 LT	5.0-7.0	Gravelly SAND, trace silt.	3.4			
▲	HB-RIC-103/1D	11+45.3	16.9 LT	1.0-3.0	SAND, some gravel, trace silt.	2.8			
×	HB-RIC-103/2D	11+45.3	16.9 LT	5.0-7.0	SAND, some gravel, trace silt.	3.1			

WIN
023741.00
Town
Richmond
Reported by/Date
WHITE, TERRY A 1/26/2021