

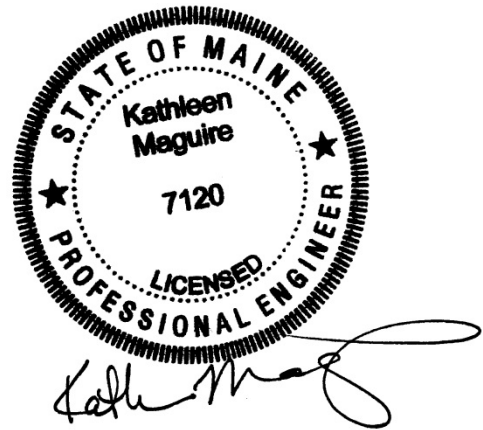
**MAINE DEPARTMENT OF TRANSPORTATION
HIGHWAY PROGRAM
GEOTECHNICAL SECTION
AUGUSTA, MAINE**

GEOTECHNICAL DESIGN REPORT

For the Replacement of:

**LARGE CULVERT #46804
ROUTE 9
CUMBERLAND, MAINE**

Prepared by:
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Reviewed by:
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Senior Geotechnical Engineer.

Cumberland County

WIN 21777.00
February 28, 2019

Soils Report 2019-04

PROJECT DETAILS

The purpose of this Geotechnical Design Report is to present subsurface information and make geotechnical design and construction recommendations for the replacement of an existing 98-foot long, 60-inch diameter corrugated metal pipe (large culvert #46804) on Route 9 in Cumberland. The existing culvert is in poor condition and a section of the inlet end has severed and lifted approximately 2 feet. The culvert is located approximately 0.01 of a mile northerly of Turkey Lane as shown in the attached Location Map. Route 9 is a Highway Corridor Priority 3 road.

The proposed replacement structure will be a 112-foot long, 60-inch diameter Reinforced Concrete Pipe (RCP) Class IV culvert on a skew of approximately 10 degrees to the roadway centerline. The invert of the proposed culvert is approximately 19 feet below the existing road grade at the roadway centerline. The invert of the proposed culvert will be lined with approximately 1 foot (at the culvert centerline) of Special Fill to facilitate fish passage. The roadway embankment slopes at the proposed culvert inlet and outlet shall be no steeper than 2H:1V to protect against erosion.

SUBSURFACE INVESTIGATION

One (1) probe and one (1) boring were drilled for this project between April 3 and 5, 2018 by the MaineDOT drill crew using a trailer mounted drill rig. Exploration locations are shown on the attached Boring Location Plan. Details and sampling methods used, field data obtained, and soil and groundwater conditions encountered are shown on the attached boring logs.

Probe HB-CUMB-101 was drilled using solid stem auger techniques. No soils samples were obtained in the probe. Boring HB-CUMB-102 was drilled using solid stem auger, cased wash boring, and open hole drilling techniques. Soil samples were obtained in boring HB-CUMB-102 at 5-foot intervals using Standard Penetration Test (SPT) methods. The MaineDOT drill rig is equipped with an automatic hammer to drive the split spoon. The MaineDOT calibrated automatic hammer delivers approximately 42 percent more energy during driving than the standard rope and cathead system. All N-values discussed in this report are corrected values (N_{60}) computed by applying an average energy transfer factor of 0.854 to the raw field N-values. In-situ vane shear tests were conducted in boring HB-CUMB-102 at 5-foot intervals in the soft soil deposits to determine the shear strength of the soft strata.

The MaineDOT Geotechnical Team member selected the boring and probe 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 (NETTCP) certified Subsurface Investigator logged the subsurface conditions encountered in both borings. 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 to assist in soil classification, evaluation of engineering properties of the soils and geologic assessment of the project site. Laboratory testing consisted of five (5) standard grain size analyses with natural water content, nine (9) grain size

analyses with hydrometer and natural water content and seven (7) Atterberg Limits tests. The results of the laboratory testing program are discussed in the following section and are shown on the attached boring logs, Laboratory Testing Summary Sheet, Grain Size Distribution Curves and Atterberg Limits Plots.

SUBSURFACE CONDITIONS

Subsurface conditions encountered at the test boring generally consisted of fill underlain by native sand underlain by native, clayey silt, silty clay, and silt, underlain by native sand. An interpretive subsurface profile depicting the generalized soil stratigraphy at the boring location is shown on the attached Interpretive Subsurface Profile.

Probe HB-CUMB-101 was drilled to a depth of approximately 30.5 feet below ground surface (bgs) and did not encounter a refusal surface. Boring HB-CUMB-102 was drilled to a depth of approximately 67.0 feet bgs and did not encounter a refusal surface.

The table below summarizes the field and laboratory information obtained in boring HB-CUMB-102:

Approx. Depth BGS ¹ (feet)	Soil Description	AASHTO ² Classification	USCS ³	WC% ⁴
0.0 – 17.5	Fill: Light brown, brown, and dark grey, dry to wet, fine to coarse sand, trace to some gravel, trace to some silt, trace organics. Cobbles were noted at a depth of approximately 16.8 to 17.5 feet bgs.	A-1-b	SP-SM or SM	5.4 to 12.3
17.5 – 24.5	Grey, wet, fine to coarse sand, some silt, little gravel.	A-2-4	SM	22.1
24.5 – 61.0	Grey, wet, silty clay, trace fine sand. Grey, wet, clayey silt, trace gravel, trace fine sand. Grey, wet, silt, some clay, trace fine to medium sand, trace gravel.	A-4 or A-6	CL	20.0 to 46.3
61.0 – 65.0	Grey, wet, silt, trace clay, trace fine to coarse sand, trace gravel.	A-4	ML	24.1
65.0 – 67.0	Grey, wet, fine to coarse sand, little silt, trace clay, trace gravel. No Refusal	A-2-4	SC-SM	19.9

¹BGS = below ground surface

²AASHTO = American Association of State Highway and Transportation Officials

³USCS = Unified Soil Classification System

⁴WC% = Water content in percent

Vane shear testing conducted within the clayey silt, silty clay, and silt layers showed measured undrained shear strengths ranging from approximately 379 to 723 pounds per square foot (psf) while the remolded shear strength ranged from approximately 31 to 366 psf. Based on the ratio of undrained to remolded shear strength from the vane shear tests, the clayey silt, silty clay, and silt were determined to have a sensitivity of approximately 2.0 to 14.4 and are classified as moderately sensitive to very sensitive.

The following table summarizes the results of Atterberg Limits tests done on seven (7) samples of the native clayey silt, silty clay, and silt:

Boring No. and Sample No.	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index
HB-CUMB-102 6D	42.2	35	22	13	1.55
HB-CUMB-102 7D	46.3	36	23	13	1.79
HB-CUMB-102 8D	36.1	31	21	10	1.51
HB-CUMB-102 9D	42.3	34	22	12	1.69
HB-CUMB-102 10D	39.8	29	20	9	2.20
HB-CUMB-102 11D	28.1	25	18	7	1.44
HB-CUMB-102 12D	20.0	24	16	8	0.5

Interpretation of these results indicate that the clayey silt, silty clay, and silt range from having low plasticity to medium plasticity with plasticity decreasing with depth. The soils in samples 6D through 11D are on the verge of being a viscous liquid if disturbed. Overburden pressure and interparticle cementation is providing stability to keep the soil in its current state, but the slightest disturbance causing remolding could convert the soil into a viscous fluid. The silt in sample 12D is overconsolidated, meaning it has experienced higher stresses in the past.

Four (4) corrected N-values obtained in the fill ranged from 11 to 40 blows per foot (bpf), indicating that the fill is medium dense to dense in consistency. One (1) corrected N-value obtained in the native sand underlying the fill was 7 bpf, indicating that the sand is loose in consistency. Eight (8) corrected N-values obtained in the clayey silt, silty clay, and silt were ranged from WOR (weight of rods) to 1 bpf, indicating that the soil is very soft in consistency. However, undrained shear strengths from the vane shear testing indicate that these soils are soft to medium stiff in consistency. One (1) corrected N-value obtained in the native sand underlying the clayey silt, silty clay, and silt was 14 bpf indicating that the sand is medium dense in consistency.

Groundwater was not recorded in the boring. Groundwater levels can be expected to fluctuate subject to seasonal variations, local soil conditions, topography, precipitation, and construction activity.

GEOTECHNICAL DESIGN AND CONSTRUCTION RECOMMENDATIONS

RCP Class IV Culvert Construction – The proposed replacement structure will be a 112-foot long, 60-inch diameter Reinforced Concrete Pipe (RCP) Class IV on a skew of approximately 10 degrees to the roadway centerline. The proposed pipe culvert shall be furnished and installed in accordance with MaineDOT Standard Specification 603.

The invert of the proposed culvert pipe ranges from approximately 57.14 feet at the inlet end to approximately 56.02 feet at the outlet end with a 1.0% slope. The culvert will be lined with approximately 1 foot of Special Fill to facilitate fish passage.

The full nature of the proposed culvert bearing surface will not become evident until the culvert excavation is made. Any cobbles or boulders encountered in excess of 6 inches shall be removed and replaced with compacted Granular Borrow Material for Underwater Backfill or Crushed Stone $\frac{3}{4}$ -Inch. The prepared subgrade shall be proof-rolled using a static roller to visually confirm the prepared subgrade is firm and stable. The exposed subgrade shall be free of ponded water so that bedding material placement and compaction can be completed in the dry.

The proposed structure shall be bedded on a 2-foot thick, geotextile wrapped, geogrid reinforced, crushed stone mat (Underdrain Backfill Material, Type C; Pay Item 203.55, see Special Provision 203, attached). The geogrid reinforcement shall meet the requirements of Special Provision 620, attached. The Reinforcement Geotextile shall meet the requirements of MaineDOT Standard Specification 722.01. The soils at the bedding elevation shall be excavated using a smooth-edged backhoe bucket to limit disturbance. Any disturbed soils at the bedding elevation resulting from excavation activities shall be removed by hand prior to placement of the geotextile wrapped, geogrid reinforced, crushed stone mat. All subgrade surfaces should be protected from construction traffic in order to limit disturbance. Groundwater and surface water levels shall be depressed sufficiently to allow work in the dry.

The soil backfill shall consist of Granular Borrow (703.19) with a maximum particle size of 4 inches. The Granular Borrow backfill shall be placed in lifts of 6 to 8 inches loose measure and compacted to the manufacturer's specifications or, in the absence of manufacturer's specifications, to at least 92 percent of the AASHTO T-180 maximum dry density. In no case shall the backfill soil be compacted less than 92 percent of the AASHTO T-180 maximum dry density.

Settlement – No settlement issues are anticipated at the site. No changes to the existing vertical or horizontal alignment are currently planned for this project. The proposed RCP Class IV culvert is the same nominal diameter as the existing culvert and will result in no additional net loading of the site soils at the structure location. Any settlement due to elastic compression of the bedding material will be immediate and negligible.

Scour and Riprap – Both the inlet and outlet of the RCP Class IV culvert pipe shall be protected against scour with riprap conforming to MaineDOT Standard Specification Section 703.26 Plain and Hand Laid Riprap. Slopes shall be no steeper than 2H:1V. No specific scour protection recommendations are needed other than armoring with riprap. The riprap on the slopes shall be underlain by a non-woven, Class 1 Erosion Control Geotextile meeting the requirements of MaineDOT Standard Specification 722.03 that is underlain by a 1-foot layer of protective aggregate cushion consisting of Granular Borrow Material for Underwater Backfill (703.19). The toe of the riprap sections shall be keyed into the existing soils 1 foot below the streambed elevation.

Construction Considerations – Construction activities will include construction of cofferdams and earth support systems to control stream flow during construction. Construction activities will

also include common earth excavation. Construction of the proposed RCP Class IV culvert will require deep soil excavation. Earth support systems shall be implemented if laying back slopes is not feasible. It is likely that the use of complex (four-sided) braced excavations with dewatering will be necessary due to the depth of the excavation. If this is the case, adequate embedment into firm soils underlying the native clayey silt, silty clay and silt will be necessary to allow for the excavation and maintenance of a stable excavation bottom. All earth support systems shall be designed by a Professional Engineer licensed in the State of Maine. Regardless of the method of excavation, all excavations and earth support systems shall meet all applicable OSHA regulations.

Any cobbles or boulders encountered in excess of 6 inches shall be removed and replaced with compacted Granular Borrow Material for Underwater Backfill (MaineDOT 703.19) or Crushed Stone ¾-Inch (MaineDOT 703.13). All subgrade surfaces shall be proof-rolled using a static roller to provide a firm and stable surface and protected from any unnecessary construction equipment or traffic. If disturbance and rutting occur, the Contractor shall remove and replace disturbed areas with compacted Granular Borrow for Underwater Backfill (703.19) or Crushed Stone ¾-Inch (703.13).

The Contractor shall control groundwater and surface water infiltration using temporary ditches, sumps, granular drainage blankets, stone ditch protection or hand-laid riprap with geotextile underlayment to divert groundwater and surface water as needed to maintain a stable excavation and allow work in the dry.

Using the excavated native soils as backfill around the culvert shall not be permitted. The native soils may only be used as Common Borrow in accordance with MaineDOT Standard Specifications 203 and 703.

The Contractor will have to excavate the existing subbase and subgrade fill soils in the vicinity of the culvert. These materials should not be used to re-base the roadway. Excavated subbase sand and gravel may be used as fill below roadway subgrade level in fill areas provided all other requirements of MaineDOT Standard Specifications 203 and 703 are met.

CLOSURE

This report has been prepared for the use of the MaineDOT Highway Program for specific application to the proposed replacement of large culvert #46804 under Route 9 in Cumberland, Maine in accordance with generally accepted geotechnical and foundation engineering practices. No other intended use or warranty is expressed or implied.

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 location 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

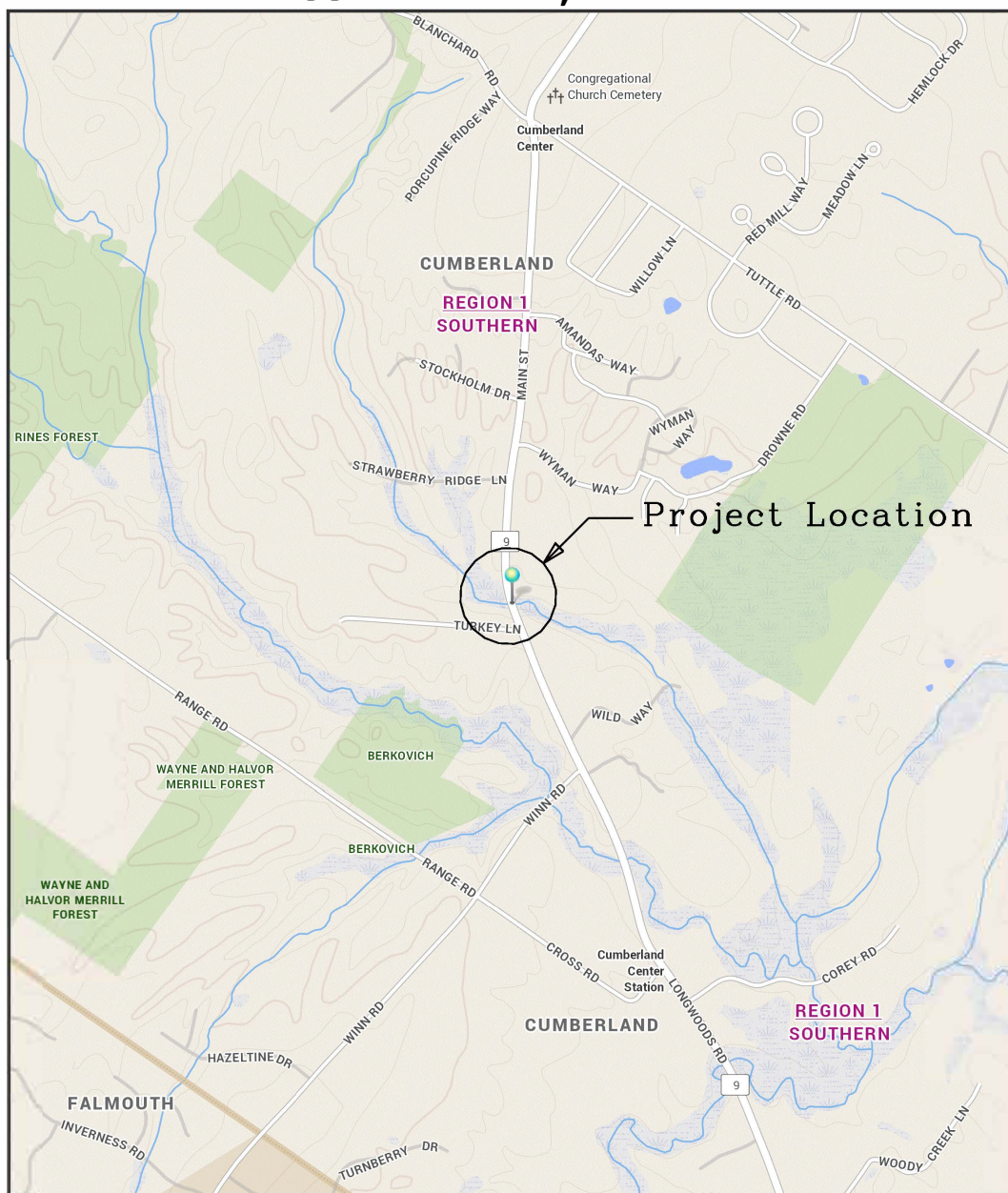
design and specifications in order that the earthwork and foundation recommendations and construction considerations presented in this report are properly interpreted and implemented in the design and specifications.

Attachments:

Location Map
Boring Location Plan
Interpretive Subsurface Profile
Key to Soil and Rock Descriptions and Terms
Boring Logs
Laboratory Testing Summary Sheet
Grain Size Distribution Curve Sheets
Atterberg Limits Plots
Special Provision 620 – Reinforcement Geogrid
Special Provision 203 – Culvert Bedding Stone



CUMBERLAND, MAINE



The Maine Department of Transportation provides this publication for information only. Reliance upon this information is at user risk. It is subject to revision and may be incomplete depending upon changing conditions. The Department assumes no liability if injuries or damages result from this information. This map is not intended to support emergency dispatch.

0.25 Miles
1 inch = 0.28 miles

Date: 2/15/2019
Time: 7:28:37 AM

SHEET NUMBER

1

OF 3

CUMBERLAND
ROUTE 9

LOCATION MAP

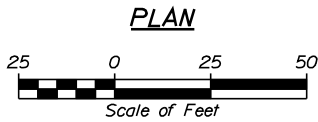
STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

021777.00

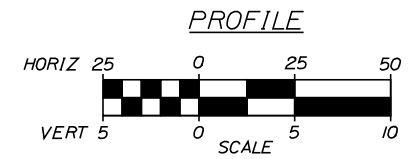
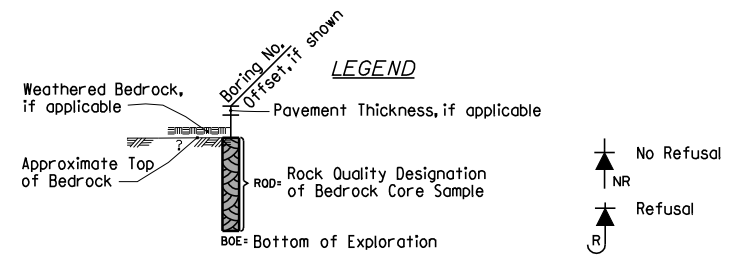
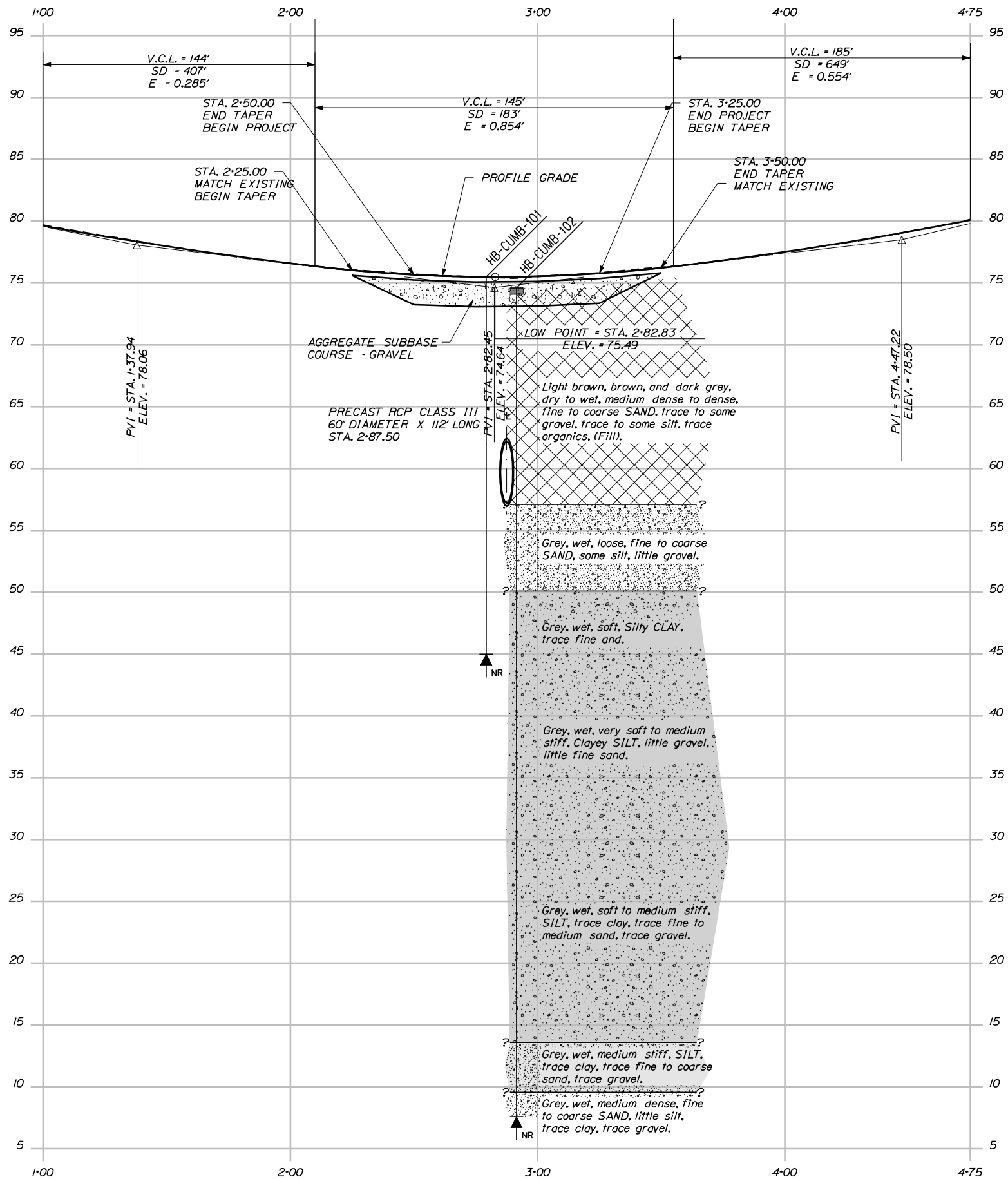
WIN

021777.00

HIGHWAY PLANS



2 OF 3	SHEET NUMBER	CUMBERLAND ROUTE 9	PROJ. MANAGER L. HAMILTON	BY M. YOUNG 5/14/05	DATE	STATE OF MAINE DEPARTMENT OF TRANSPORTATION 021777.00 WIN WIN 21777.00 HIGHWAY PLANS
			CHECKED-REVIEWED		SIGNATURE	
			DESIGNED DET. TAILED	C. RUSSELL T. WHITE	FEB. 2019	
			DESIGNS DET. TAILED		P.E. NUMBER	
			REVISIONS 1			
	BORING LOCATION PLAN		REVISIONS 2			
			REVISIONS 3			
			REVISIONS 4			
			FIELD CHANGES			
					DATE	



Note: This generalized interpretive soil profile is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized, and have been developed by interpretations of widely spaced explorations and samples. Actual soil and bedrock transitions may vary and are probably more erratic. For more specific information refer to the exploration logs.

STATE OF MAINE DEPARTMENT OF TRANSPORTATION	021777.00		WIN	HIGHWAY PLANS
	WIN 21777.00			
	HIGHWAY PLANS			
CUMBERLAND ROUTE 9	PROJ. MANAGER	L. HAMILTON	BY	DATE
	CHECKED-REVIEWED	M. YOUNG-SHAGOS		
	DESIGNED-DETAILED	C. RUSSELL	T. WHITE	FEB 2019
	REVISIONS 1			
	REVISIONS 2			
INTERPRETIVE SUBSURFACE PROFILE	REVISIONS 3			
	REVISIONS 4			
	FIELD CHANGES			
	SHEET NUMBER			
	3			
OF 3				

UNIFIED SOIL CLASSIFICATION SYSTEM					MODIFIED BURMISTER 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	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.	Descriptive Term		Portion of Total (%)	
		(little or no fines)	GP	Poorly-graded gravels, gravel sand mixtures, little or no fines.	trace	0 - 10		
					little	11 - 20		
					some	21 - 35		
					adjective (e.g. sandy, clayey)	36 - 50		
	SANDS (more than half of coarse fraction is smaller than No. 4 sieve size)	CLEAN SANDS	SW	Well-graded sands, gravelly sands, little or no fines	TERMS DESCRIBING DENSITY/CONSISTENCY			
		(little or no fines)	SP	Poorly-graded sands, gravelly sand, little or no fines.				
		SANDS WITH FINES (Appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures.	<u>Coarse-grained soils</u> (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. Density is rated according to standard penetration resistance (N-value).			
			GC	Clayey gravels, gravel-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.	Density of Cohesionless Soils	
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.	Very loose			0 - 4			
OL	Organic silts and organic silty clays of low plasticity.	Loose			5 - 10			
SILTS AND CLAYS (liquid limit greater than 50)	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.	Medium Dense		11 - 30			
	CH	Inorganic clays of high plasticity, fat clays.	Dense		31 - 50			
	OH	Organic clays of medium to high plasticity, organic silts.	Very Dense	> 50				
HIGHLY ORGANIC SOILS	Pt	Peat and other highly organic soils.	<u>Fine-grained soils</u> (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 undrained shear strength as indicated.					
					<u>Approximate Undrained Shear Strength (psf)</u>			
					<u>Consistency of Cohesive soils</u>	<u>SPT N-Value (blows per foot)</u>	<u>Field Guidelines</u>	
					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
					<u>Rock Quality Designation (RQD):</u>			
					RQD (%) = $\frac{\text{sum of the lengths of intact pieces of core} * > 4 \text{ inches}}{\text{length of core advance}}$			
					*Minimum NQ rock core (1.88 in. OD of core)			
					Correlation of RQD to Rock Mass Quality			
					<u>Rock Mass Quality</u>		<u>RQD (%)</u>	
					Very Poor		≤25	
					Poor		26 - 50	
					Fair		51 - 75	
					Good		76 - 90	
					Excellent		91 - 100	
					<u>Desired Rock Observations (in this order, if applicable):</u>			
					Color (Munsell color chart)			
					Texture (aphanitic, fine-grained, etc.)			
					Rock Type (granite, schist, sandstone, 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 deg., low angle - 5-35 deg., mod. dipping - 35-55 deg., steep - 55-85 deg., vertical - 85-90 deg.)			
					-spacing (very close - <2 inch, close - 2-12 inch, mod. close - 1-3 feet, wide - 3-10 feet, very wide >10 feet)			
					-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: ASTM D6032 and AASHTO Standard Specification for Highway Bridges, 17th Ed. Table 4.4.8.1.2A			
					Recovery (inch/inch and percentage)			
					Rock Core Rate (X.X ft - Y.Y ft (min:sec))			
					<u>Sample Container Labeling Requirements:</u>			
					WIN	Blow Counts		
					Bridge Name / Town	Sample Recovery		
					Boring Number	Date		
					Sample Number	Personnel Initials		
					Sample Depth			
Maine Department of Transportation Geotechnical Section Key to Soil and Rock Descriptions and Terms Field Identification Information								

Maine Department of Transportation <u>Soil/Rock Exploration Log</u> <u>US CUSTOMARY UNITS</u>				Project: Large Culvert Replacement on Route 9 Location: Cumberland, Maine				Boring No.: HB-CUMB-101 WIN: 21777.00			
Drilling Contractor: MaineDOT				Elevation (ft.) 75.5				Auger ID/OD: 5" Dia.			
Operator: Daggett/Wilder				Datum: NAVD88				Sampler: N/A			
Logged By: C. Russell				Rig Type: CME 45C				Hammer Wt./Fall: N/A			
Date Start/Finish: 4/3/2018; 09:00-09:30				Drilling Method: Solid Stem Auger				Core Barrel: N/A			
Boring Location: 2+79.2, 12.0 ft Lt.				Casing ID/OD: N/A				Water Level*: None Observed			
Definitions: D = Spilt Spoon Sample S = Sample off Auger Flights B = Bucket Sample off Auger Flights MD = Unsuccessful Split Spoon Sample Attempt U = Thin Wall Tube Sample MV = Unsuccessful Field Vane Shear Test Attempt V = Field Vane Shear Test, PP= Pocket Penetrometer MU = Unsuccessful Thin Wall Tube Sample 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 1 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-value = Raw Field SPT N-value T_v = Pocket Torvane Shear Strength (psf) WC = Water Content, percent ≈ = Similar or Equal too LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test											
Depth (ft.)	Sample Information								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-value	Casing Blows	Elevation (ft.)	Graphic Log			
0						SSA			Probe, no material descriptions taken.		
5											
10											
15											
20											
25											
Remarks:											
Stratification lines represent approximate boundaries between soil types; transitions may be gradual.									Page 1 of 2		
* 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.									Boring No.: HB-CUMB-101		

[illegible]

Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS				Project: Large Culvert Replacement on Route 9 Location: Cumberland, Maine				Boring No.: HB-CUMB-102 WIN: 21777.00			
Driller: MaineDOT				Elevation (ft.): 74.6				Auger ID/OD: 5" Dia. Solid Stem			
Operator: Daggett/Wilder				Datum: NAVD88				Sampler: Standard Split Spoon			
Logged By: C. Russell				Rig Type: CME 45C				Hammer Wt./Fall: 140#/30"			
Date Start/Finish: 4/3/2018-4/5/2018				Drilling Method: Cased Wash Boring				Core Barrel: N/A			
Boring Location: 2+91.5, 9.7 ft Rt.				Casing ID/OD: NW-3"				Water Level*: None Observed			
Hammer Efficiency Factor: 0.854				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 = 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	74.1		6" HMA.	
	1D	24/10	1.00 - 3.00	6/8/7/11	15	21				Light brown, dry, medium dense, fine to coarse SAND, little gravel, trace silt, (Fill).	G#302623 A-1-b, SP-SM WC=5.4%
5	2D	24/24	5.00 - 7.00	20/18/10/14	28	40				Brown, damp, dense, fine to coarse SAND, little silt, trace gravel, (Fill).	G#302624 A-1-b, SM WC=9.5%
10	3D	24/8	10.00 - 12.00	5/6/5/7	11	16	7			Light brown, moist, medium dense, fine to coarse SAND, little gravel, little silt, trace organics, (Fill).	G#302625 A-1-b, SM WC=9.7%
15	4D	21.6/10	15.00 - 16.80	7/5/3/60(3.6")	8	11	9			Dark grey, wet, medium dense, fine to coarse SAND, some gravel, some silt, (Fill).	G#303172 A-1-b, SM WC=12.3%
										Roller Coned through cobbles from 16.8- 17.5 ft bgs., then to 20.0 ft bgs.	
20	5D	24/3	20.00 - 22.00	1/2/3/5	5	7	18			Grey, wet, loose, fine to coarse SAND, some silt, little gravel.	G#303173 A-2-4, SM WC=22.1%
25								50.1			
Remarks: Went open hole to 40.3 ft bgs on 4/3/2018, Hydraulic Push to 40.5 ft bgs on 4/5/2018.											
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.										Page 1 of 3 Boring No.: HB-CUMB-102	

Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS				Project: Large Culvert Replacement on Route 9 Location: Cumberland, Maine				Boring No.: HB-CUMB-102 WIN: 21777.00			
Driller: MaineDOT				Elevation (ft.): 74.6				Auger ID/OD: 5" Dia. Solid Stem			
Operator: Daggett/Wilder				Datum: NAVD88				Sampler: Standard Split Spoon			
Logged By: C. Russell				Rig Type: CME 45C				Hammer Wt./Fall: 140#/30"			
Date Start/Finish: 4/3/2018-4/5/2018				Drilling Method: Cased Wash Boring				Core Barrel: N/A			
Boring Location: 2+91.5, 9.7 ft Rt.				Casing ID/OD: NW-3"				Water Level*: None Observed			
Hammer Efficiency Factor: 0.854				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 = 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 140 lb. Hammer WOR/C = Weight of Rods or Casing WO1P = Weight of One Person S _p = Peak/Remolded Field Vane Undrained Shear Strength (psf) S _{u(lab)} = Lab Vane Undrained Shear Strength (psf) q _u = 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				
25	6D	24/24	25.00 - 27.00	WOR/WOH/WOH/	---					Grey, wet, soft, Silty CLAY, trace fine sand. 55x110 mm raw torque readings: V1: 10.5/1.3 ft-lbs V2: 11.0/2.0 ft-lbs	G#303174 A-6, CL WC=42.2% LL=35 PL=22 PI=13
	V1		25.63 - 26.00	Su=469/58 psf							
	V2		26.63 - 27.00	Su=491/89 psf							
30	7D	24/16	30.00 - 32.00	WOR/WOR/WOR/	---					Grey, wet, soft, Silty CLAY, trace fine sand. 55x110 mm raw torque readings: V3: 8.5/0.7 ft-lbs Failed 55x110 mm vane attempt. Small sand layer at 31.9 ft bgs.	G#303175 A-6, CL WC=46.3% LL=36 PL=23 PI=13
	V3		30.63 - 31.00	Su=379/31 psf							
	MV			Would not Push							
35	8D	24/12	35.00 - 37.00	WOR/WOR/WOR/	---					Grey, wet, very soft, Clayey SILT, trace gravel, trace fine sand. Roller Cone sunk to 40.3 ft bgs.	G#300876 A-4, CL WC=36.1% LL=31 PL=21 PI=10
40	9D	24/24	40.50 - 42.50	WOR/WOR/WOR/	---					Grey, wet, soft, Silty CLAY, trace fine sand. 55x110 mm raw torque readings: V4: 10.0/3.5 ft-lbs V5: 11.0/3.0 ft-lbs	G#300877 A-6, CL WC=42.3% LL=34 PL=22 PI=12
	V4		40.93 - 41.30	Su=446/156 psf							
	V5		41.93 - 42.30	Su=491/134 psf							
45	10D	24/24	45.00 - 47.00	WOR/WOR/WOR/	---					Grey, wet, medium stiff to soft, Clayey SILT, trace gravel, trace fine sand. 55x110 mm raw torque readings: V6: 16.0/4.0 ft-lbs V7: 11.0/2.5 ft-lbs	G#300878 A-4, CL WC=39.8% LL=29 PL=20 PI=9
	V6		45.63 - 46.00	Su=714/179 psf							
	V7		46.63 - 47.00	Su=491/112 psf							
50											
Remarks: Went open hole to 40.3 ft bgs on 4/3/2018, Hydraulic Push to 40.5 ft bgs on 4/5/2018.											
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.										Page 2 of 3 Boring No.: HB-CUMB-102	

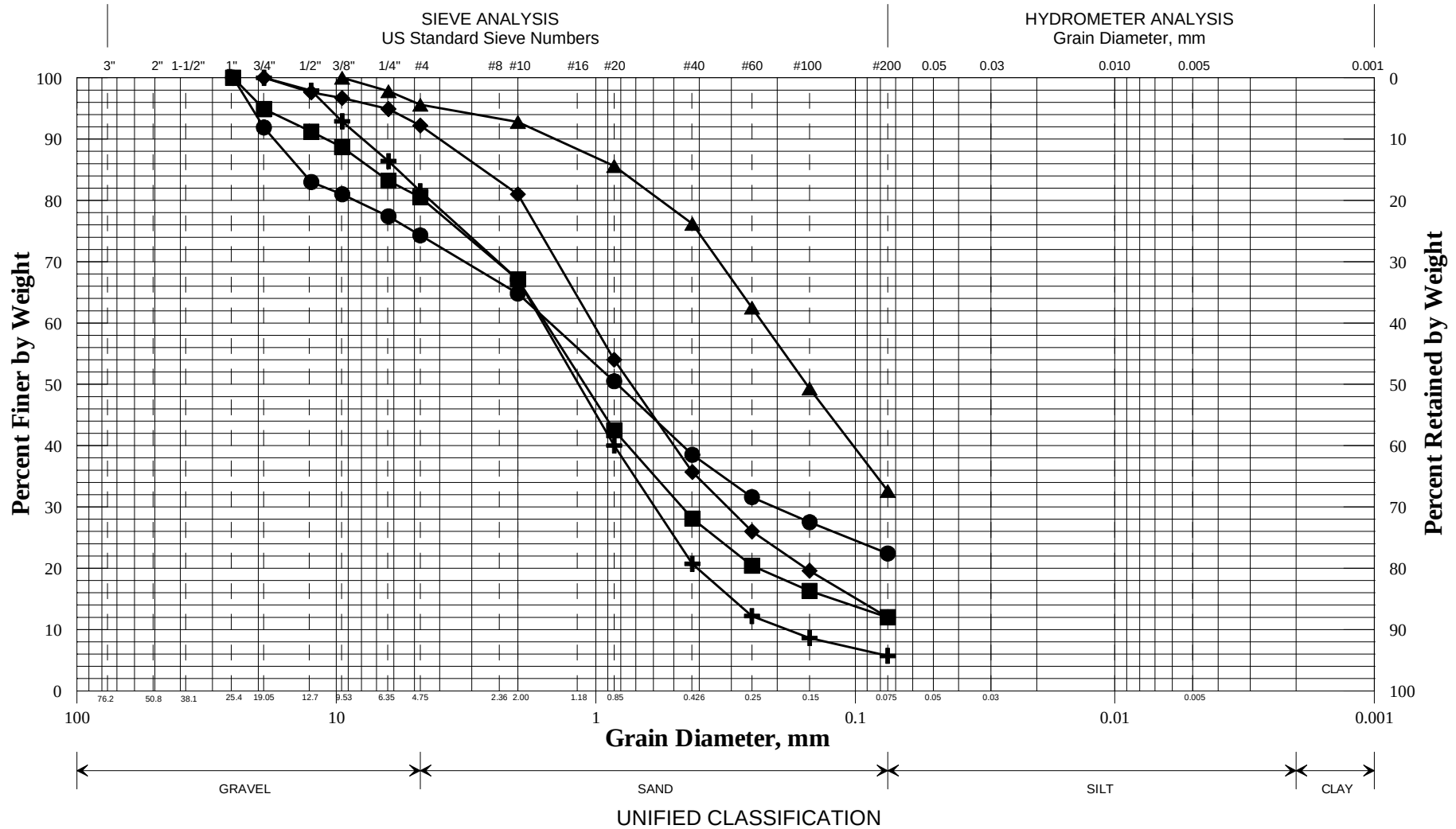
Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS				Project: Large Culvert Replacement on Route 9 Location: Cumberland, Maine				Boring No.: HB-CUMB-102 WIN: 21777.00			
Driller: MaineDOT				Elevation (ft.): 74.6				Auger ID/OD: 5" Dia. Solid Stem			
Operator: Daggett/Wilder				Datum: NAVD88				Sampler: Standard Split Spoon			
Logged By: C. Russell				Rig Type: CME 45C				Hammer Wt./Fall: 140#/30"			
Date Start/Finish: 4/3/2018-4/5/2018				Drilling Method: Cased Wash Boring				Core Barrel: N/A			
Boring Location: 2+91.5, 9.7 ft Rt.				Casing ID/OD: NW-3"				Water Level*: None Observed			
Hammer Efficiency Factor: 0.854				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 = 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 140 lb. 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 _u = 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				
50	11D V8 V9	24/10	50.00 - 52.00 50.63 - 51.00 51.63 - 52.00	WOR/WOR/WOR/ WOR Su=469/125 psf Su=491/125 psf	---					Grey, wet, soft, SILT, some clay, trace fine sand. 55x110 mm raw torque readings: V8: 10.5/2.8 ft-lbs V9: 11.0/2.8 ft-lbs	G#300879 A-4, CL WC=28.1% LL=25 PL=18 PI=7
55	12D V10 V11	24/24	55.00 - 57.00 55.63 - 56.00 56.63 - 57.00	WOR/WOR/WOR/ WOR Su=647/45 psf Su=379/67 psf	---					Grey, wet, medium stiff to soft, SILT, some clay, trace sand, trace gravel. 55x110 mm raw torque readings: V10: 14.5/1.0 lbs V11: 8.5/1.5 ft-lbs	G#300880 A-4, CL WC=20.0% LL=24 PL=16 PI=8
60	13D V12 MV	24/10	60.00 - 62.00 60.63 - 61.00 61.00 - 61.00	WOR/WOH/1/6 Su=723/366 psf Would not Push	1	1			13.6	55x110 mm raw torque readings: V12: 16.2/8.2 ft-lbs Failed 55x110 mm vane attempt. Grey, wet, medium stiff, SILT, trace clay, trace fine to coarse sand, trace gravel.	61.0 G#300881 A-4, ML WC=24.1%
65	14D	24/24	65.00 - 67.00	WOR/5/5/14	10	14			9.6	Grey, wet, medium dense, fine to coarse SAND, little silt, trace clay, trace gravel.	65.0 G#300882 A-2-4, SC-SM WC=19.9%
70									7.6	Bottom of Exploration at 67.0 feet below ground surface. NO REFUSAL	67.0
75											
Remarks: Went open hole to 40.3 ft bgs on 4/3/2018, Hydraulic Push to 40.5 ft bgs on 4/5/2018.											
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.										Page 3 of 3 Boring No.: HB-CUMB-102	

Town(s): Cumberland Work Number: 21777.00

Classification of these soil samples is in accordance with AASHTO Classification System M-145-40. This classification is followed by the "Frost Susceptibility Rating" from zero (non-frost susceptible) to Class IV (highly frost susceptible). The "Frost Susceptibility Rating" is based upon the MaineDOT and Corps of Engineers Classification Systems.

PI = Plasticity Index as determined by AASHTO 90-96 and/or ASTM D4318-98

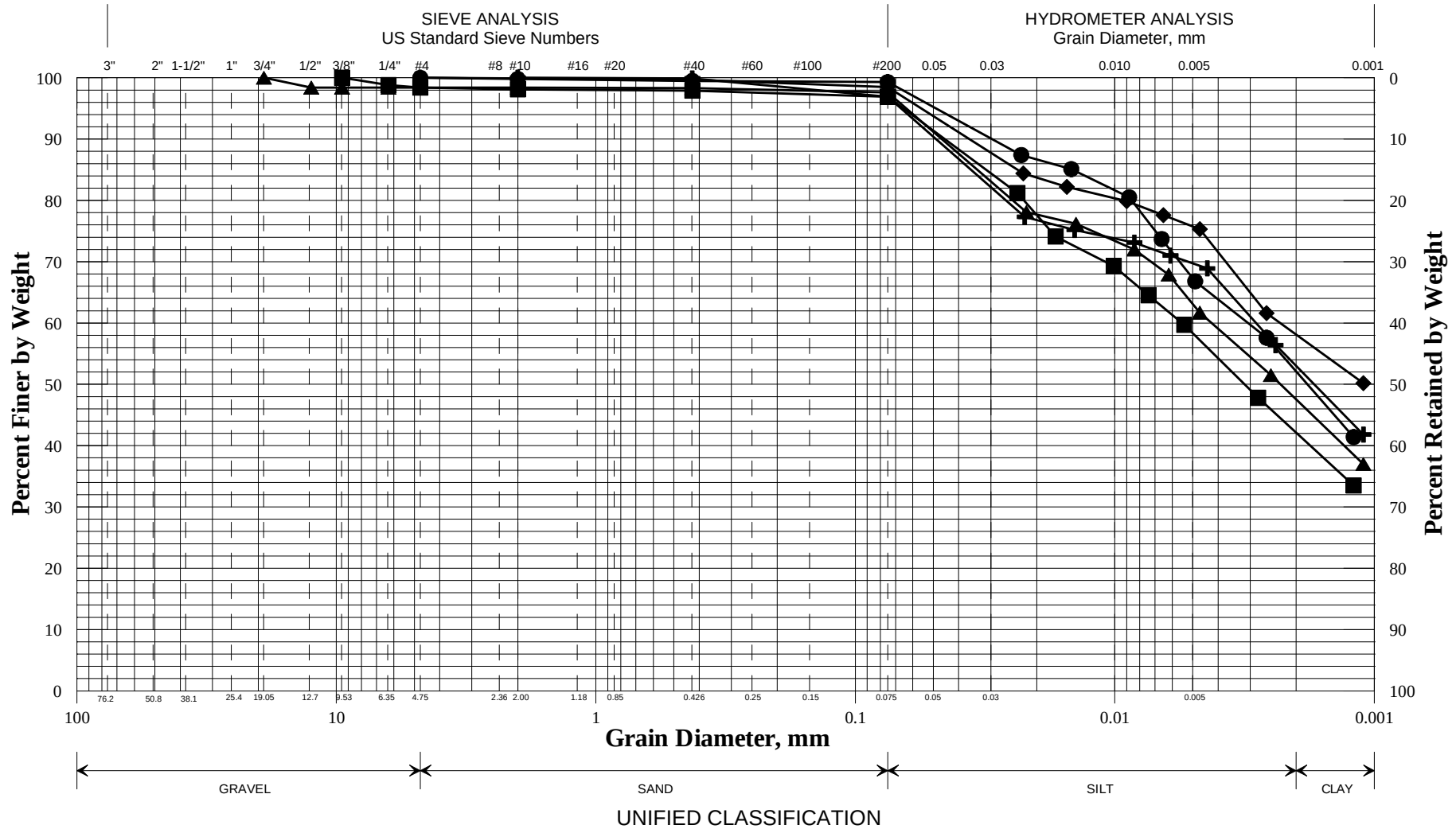
State of Maine Department of Transportation
GRAIN SIZE DISTRIBUTION CURVE



	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
+	HB-CUMB-102/1D	2+91.5	9.7 RT	1.0-3.0	SAND, little gravel, trace silt.	5.4			
◆	HB-CUMB-102/2D	2+91.5	9.7 RT	5.0-7.0	SAND, little silt, trace gravel.	9.5			
■	HB-CUMB-102/3D	2+91.5	9.7 RT	10.0-12.0	SAND, little gravel, little silt.	9.7			
●	HB-CUMB-102/4D	2+91.5	9.7 RT	15.0-16.8	SAND, some gravel, some silt.	12.3			
▲	HB-CUMB-102/5D	2+91.5	9.7 RT	20.0-22.0	SAND, some silt, trace gravel.	22.1			
×									

WIN
021777.00
Town
Cumberland
Reported by/Date
WHITE, TERRY A 5/10/2018

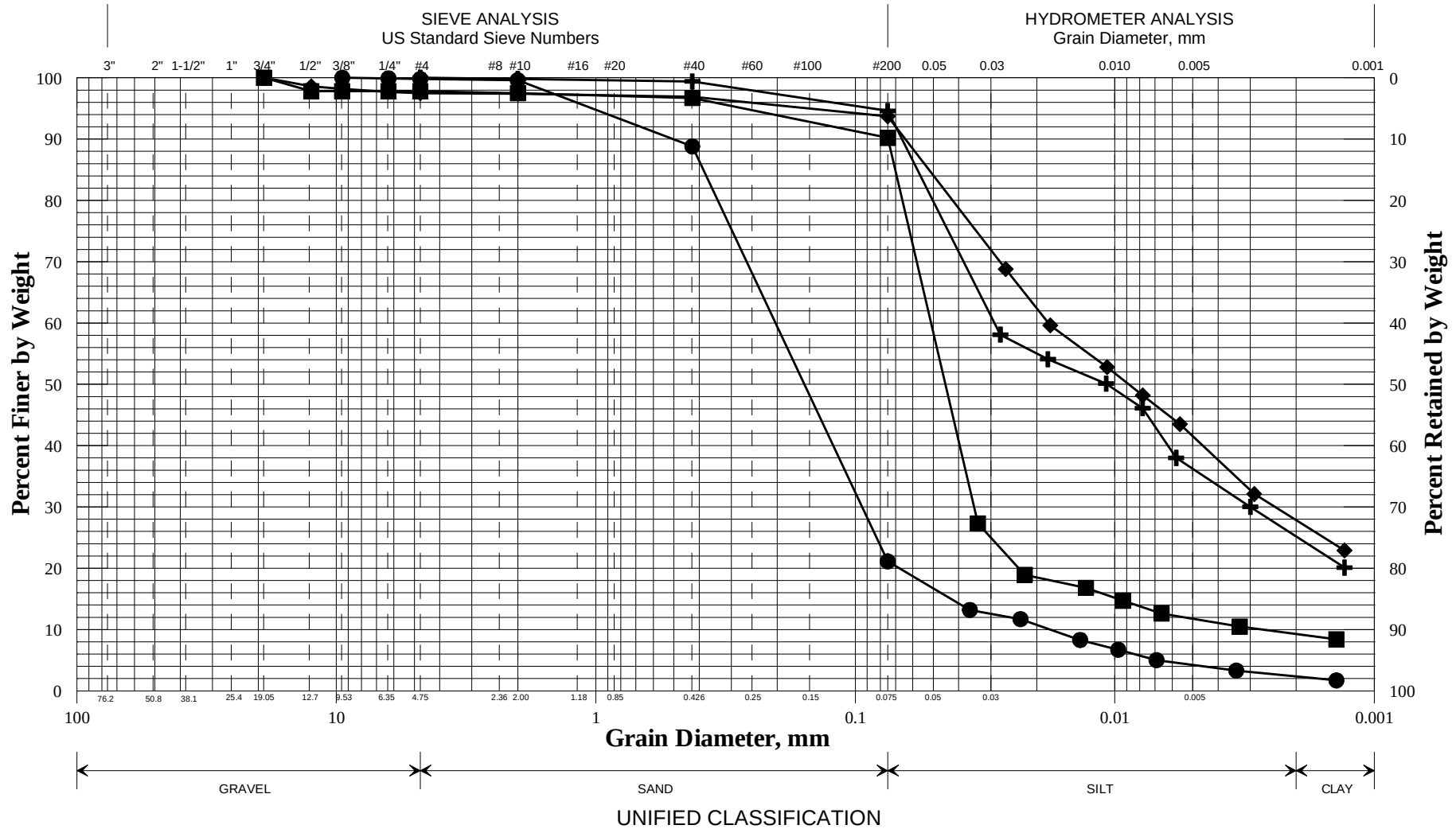
State of Maine Department of Transportation
GRAIN SIZE DISTRIBUTION CURVE



	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
+	HB-CUMB-102/6D	2+91.5	9.7 RT	25.0-27.0	Silty CLAY, trace sand.	42.2	35	22	13
◆	HB-CUMB-102/7D	2+91.5	9.7 RT	30.0-32.0	Silty CLAY, trace sand.	46.3	36	23	13
■	HB-CUMB-102/8D	2+91.5	9.7 RT	35.0-37.0	Clayey SILT, trace gravel, trace sand.	36.1	31	21	10
●	HB-CUMB-102/9D	2+91.5	9.7 RT	40.5-42.5	Silty CLAY, trace sand.	42.3	34	22	12
▲	HB-CUMB-102/10D	2+91.5	9.7 RT	45.0-47.0	Clayey SILT, trace gravel, trace sand.	39.8	29	20	9
×									

WIN
021777.00
Town
Cumberland
Reported by/Date
WHITE, TERRY A 5/10/2018

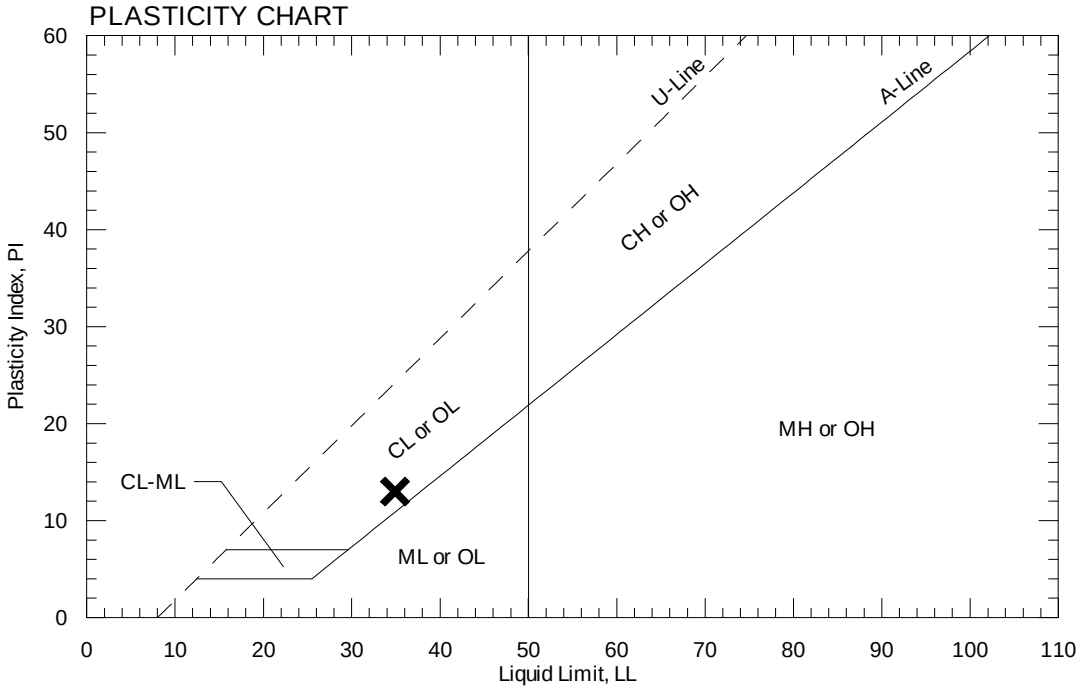
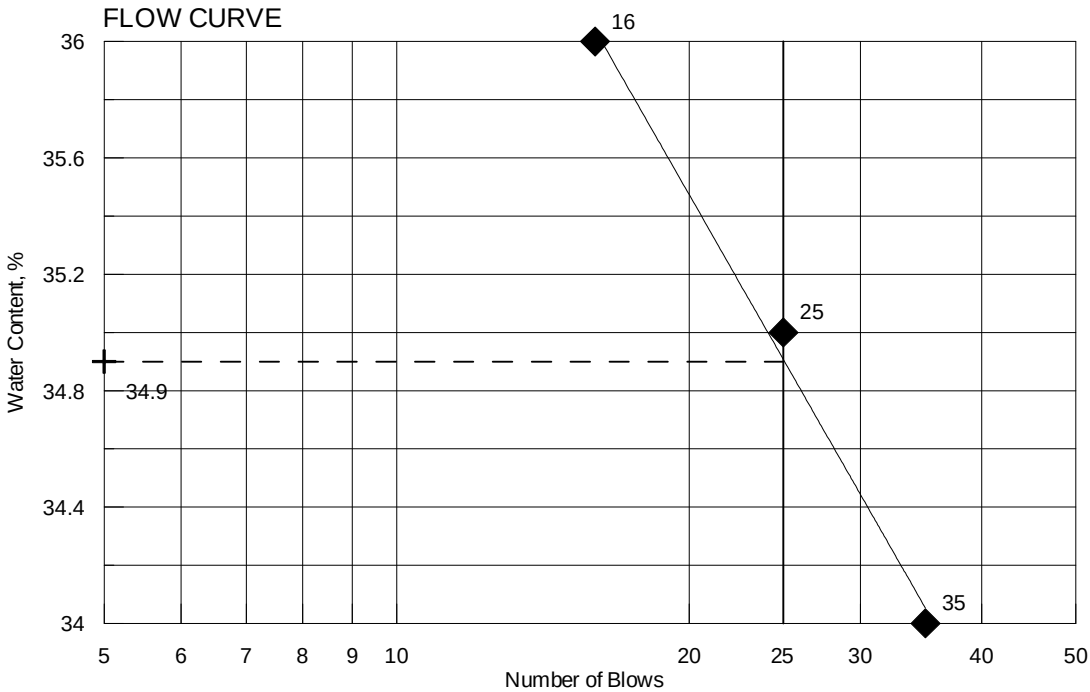
State of Maine Department of Transportation
GRAIN SIZE DISTRIBUTION CURVE



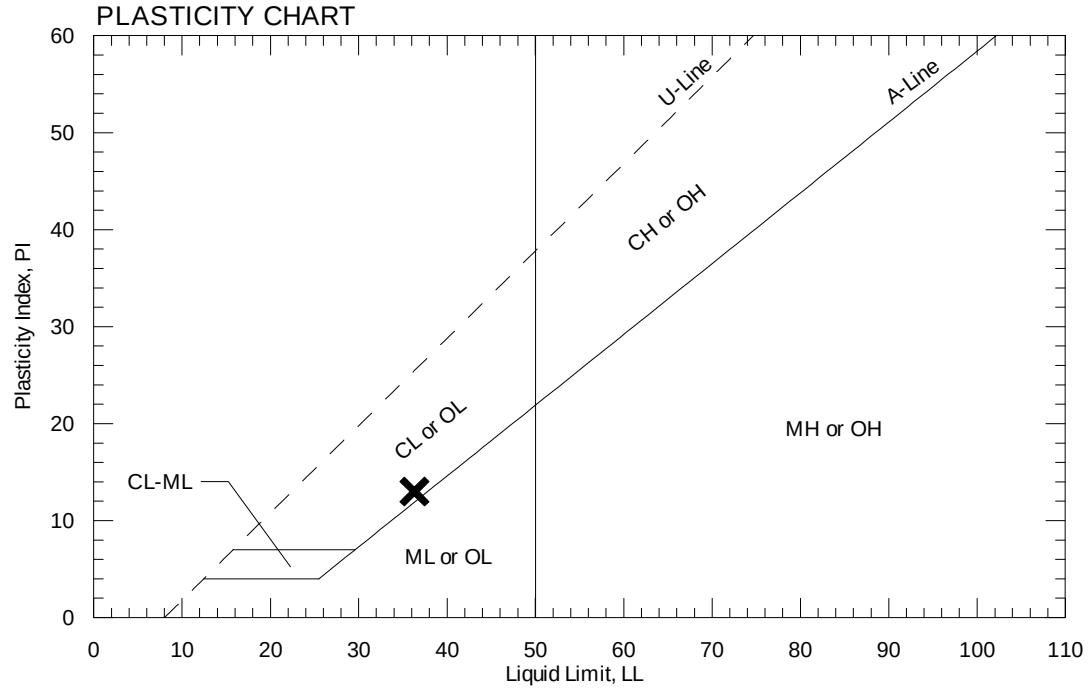
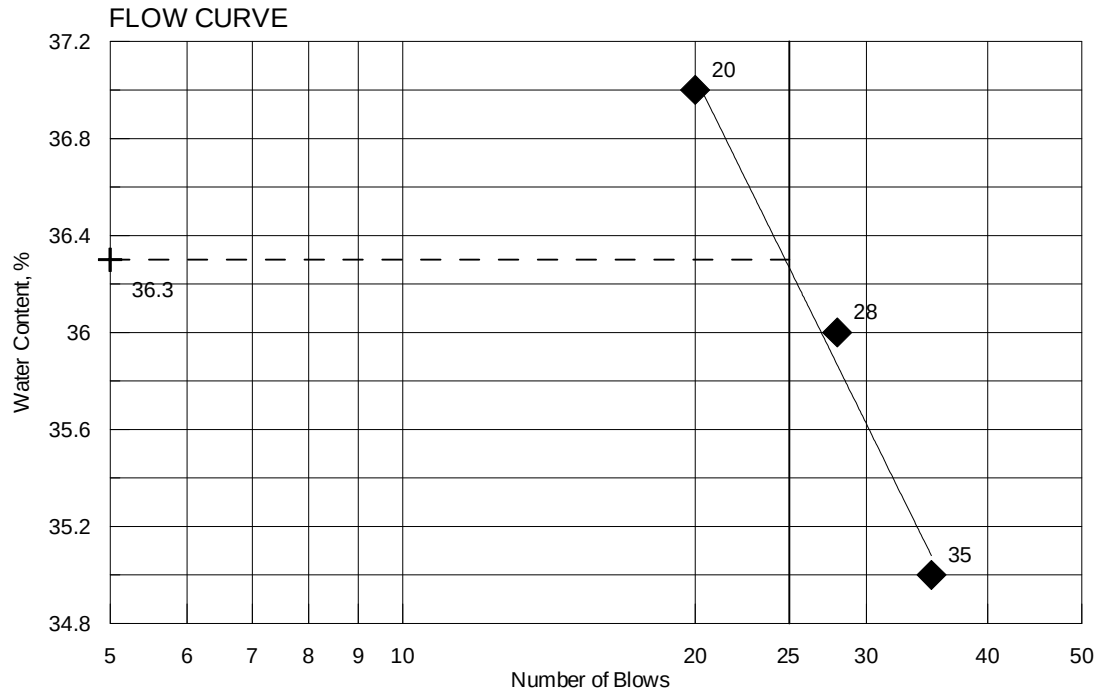
	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
+	HB-CUMB-102/11D	2+91.5	9.7 RT	50.0-52.0	SILT, some clay, trace sand.	28.1	25	18	7
◆	HB-CUMB-102/12D	2+91.5	9.7 RT	55.0-57.0	SILT, some clay, trace sand, trace gravel.	20.0	24	16	8
■	HB-CUMB-102/13D	2+91.5	9.7 RT	61.0-62.0	SILT, trace clay, trace sand, trace gravel.	24.1			
●	HB-CUMB-102/14D	2+91.5	9.7 RT	65.0-67.0	SAND, little silt, trace clay, trace gravel.	19.9			
▲									
×									

WIN	
021777.00	
Town	
Cumberland	
Reported by/Date	
WHITE, TERRY A	5/10/2018

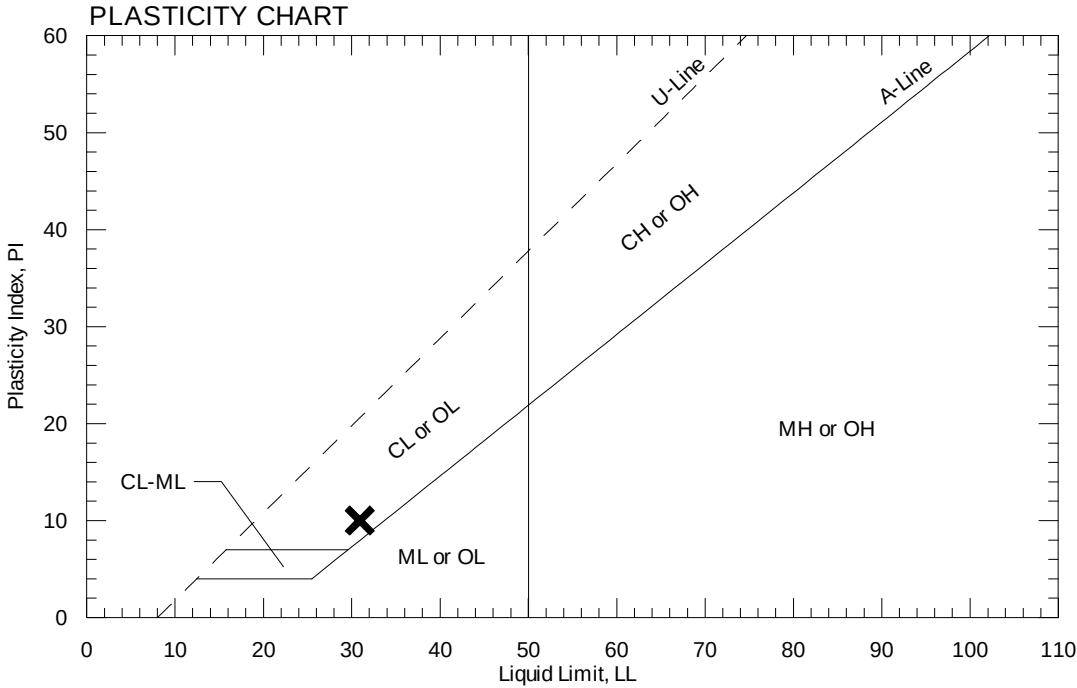
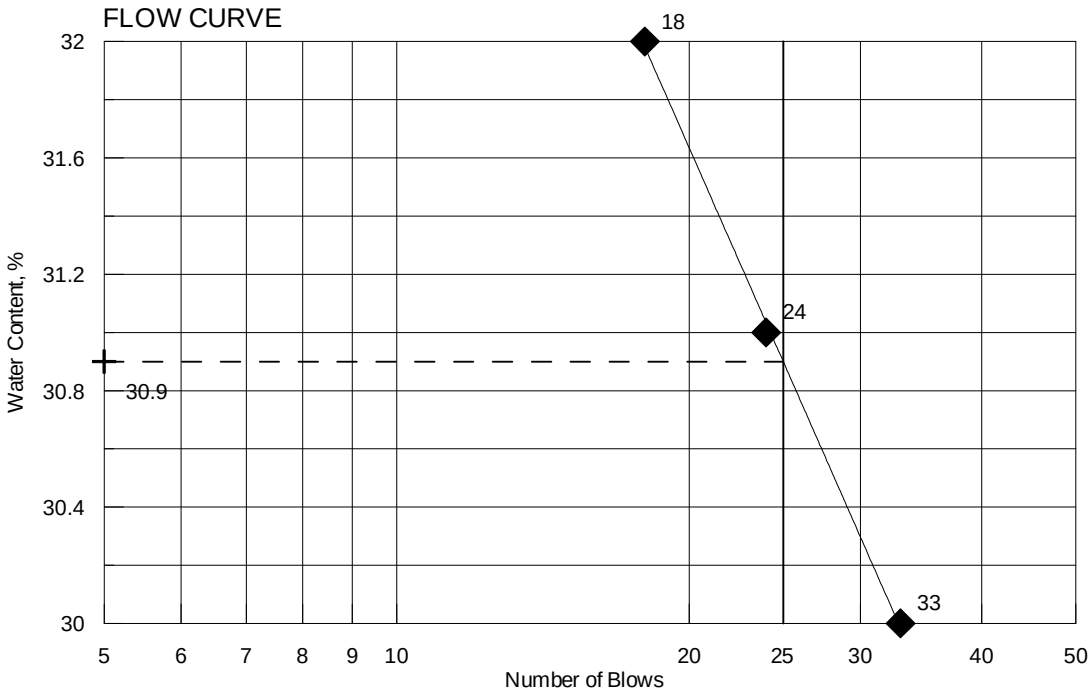
TOWN	Cumberland	Reference No.	303174
WIN	021777.00	Water Content, %	42.2
Sampled	4/3/2018	Liquid Limit @ 25 blows (T 89), %	35
Boring No./Sample No.	HB-CUMB-102/6D	Plastic Limit (T 90), %	22
Station	2+91.5	Plasticity Index (T 90), %	13
Depth	25.0-27.0	Tested By	BBURR



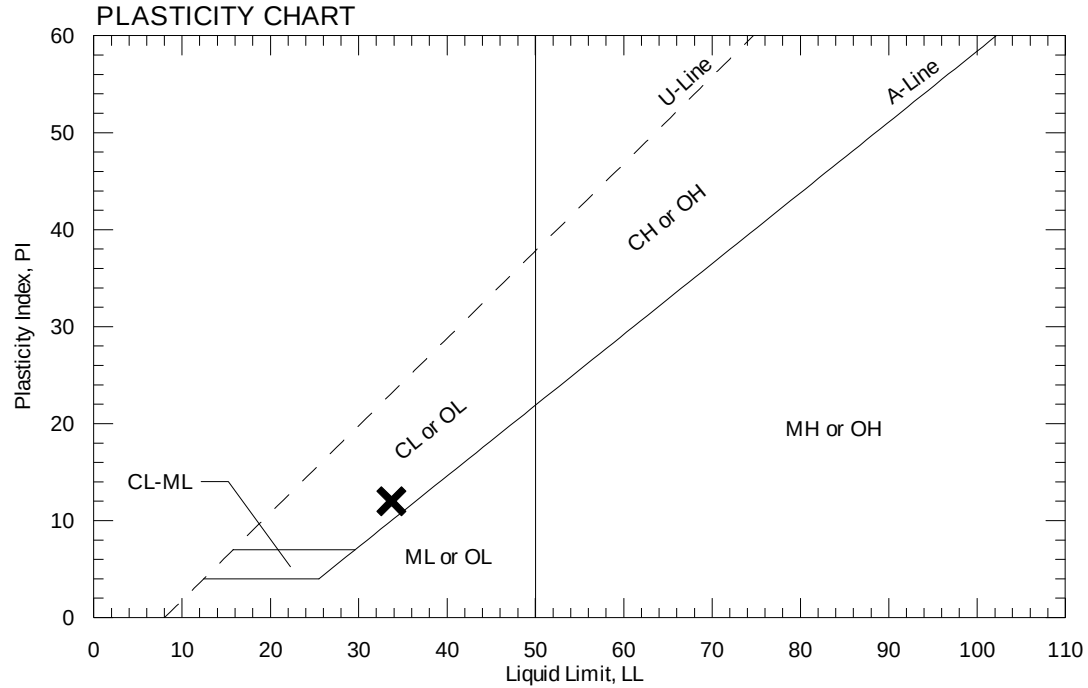
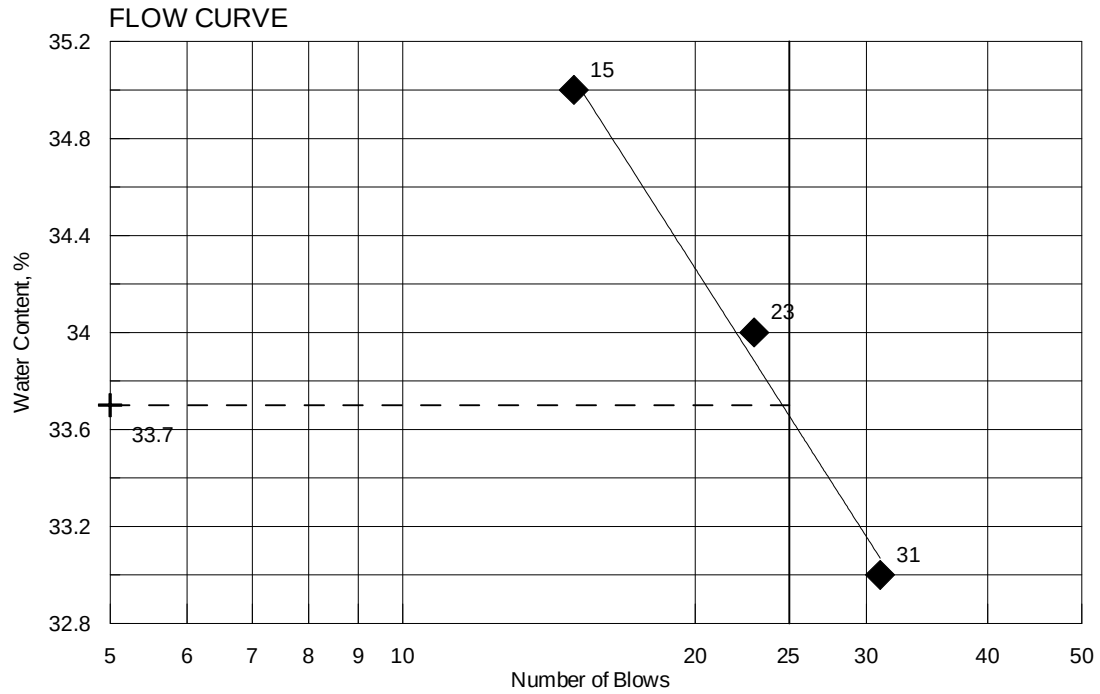
TOWN	Cumberland	Reference No.	303175
WIN	021777.00	Water Content, %	46.3
Sampled	4/3/2018	Liquid Limit @ 25 blows (T 89), %	36
Boring No./Sample No.	HB-CUMB-102/7D	Plastic Limit (T 90), %	23
Station	2+91.5	Plasticity Index (T 90), %	13
Depth	30.0-32.0	Tested By	BBURR



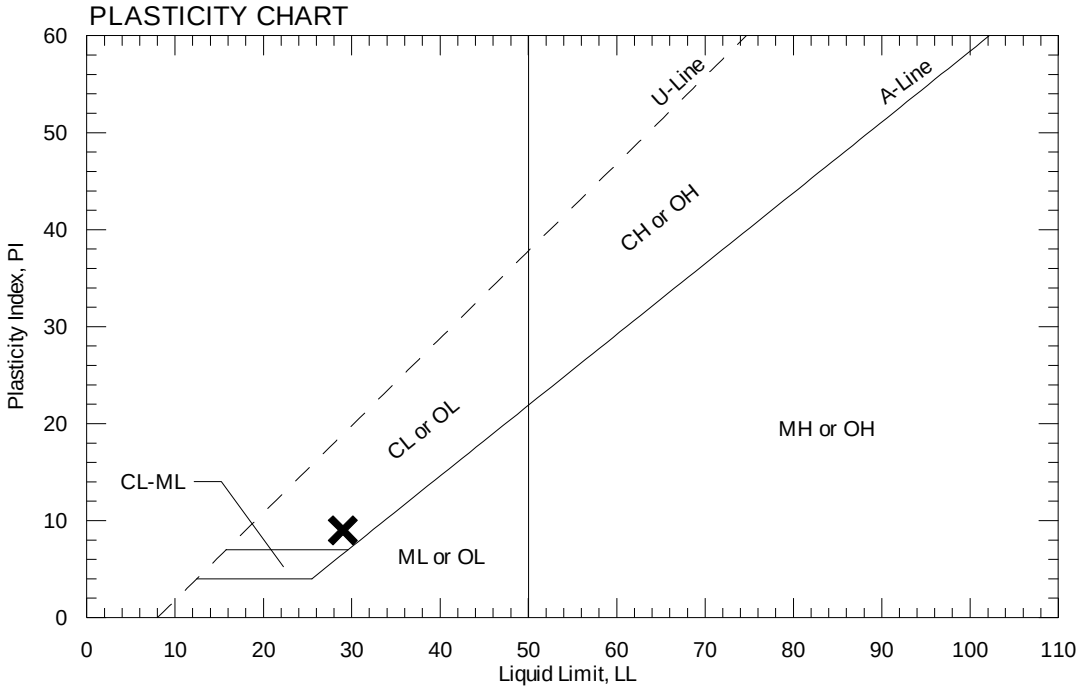
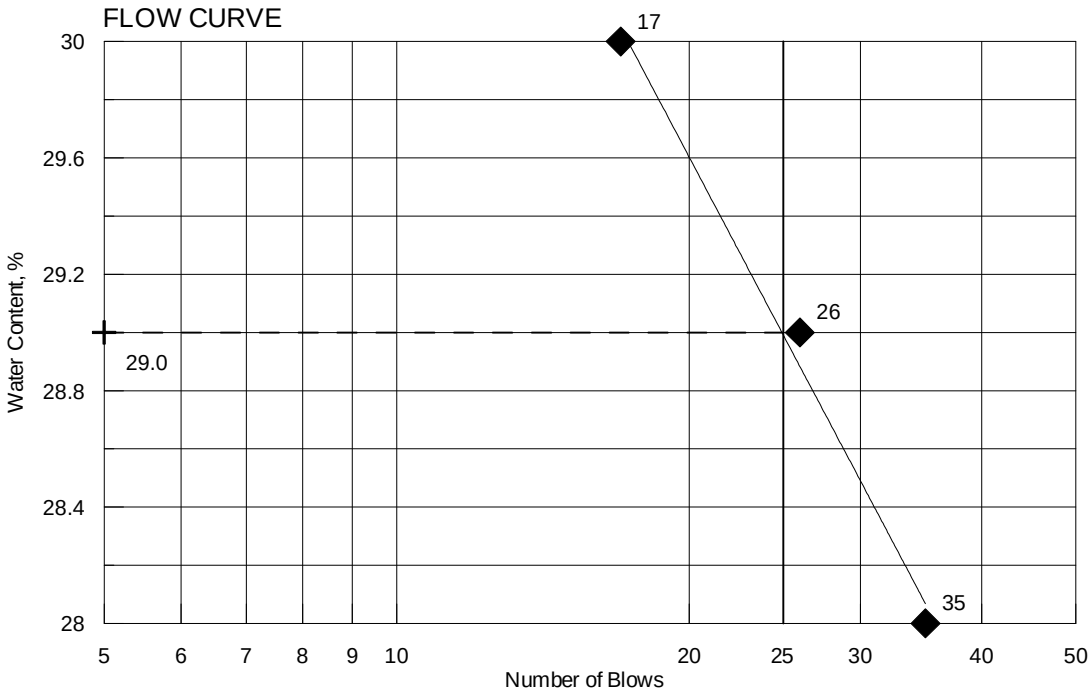
TOWN	Cumberland	Reference No.	300876
WIN	021777.00	Water Content, %	36.1
Sampled	4/3/2018	Liquid Limit @ 25 blows (T 89), %	31
Boring No./Sample No.	HB-CUMB-102/8D	Plastic Limit (T 90), %	21
Station	2+91.5	Plasticity Index (T 90), %	10
Depth	35.0-37.0	Tested By	BBURR



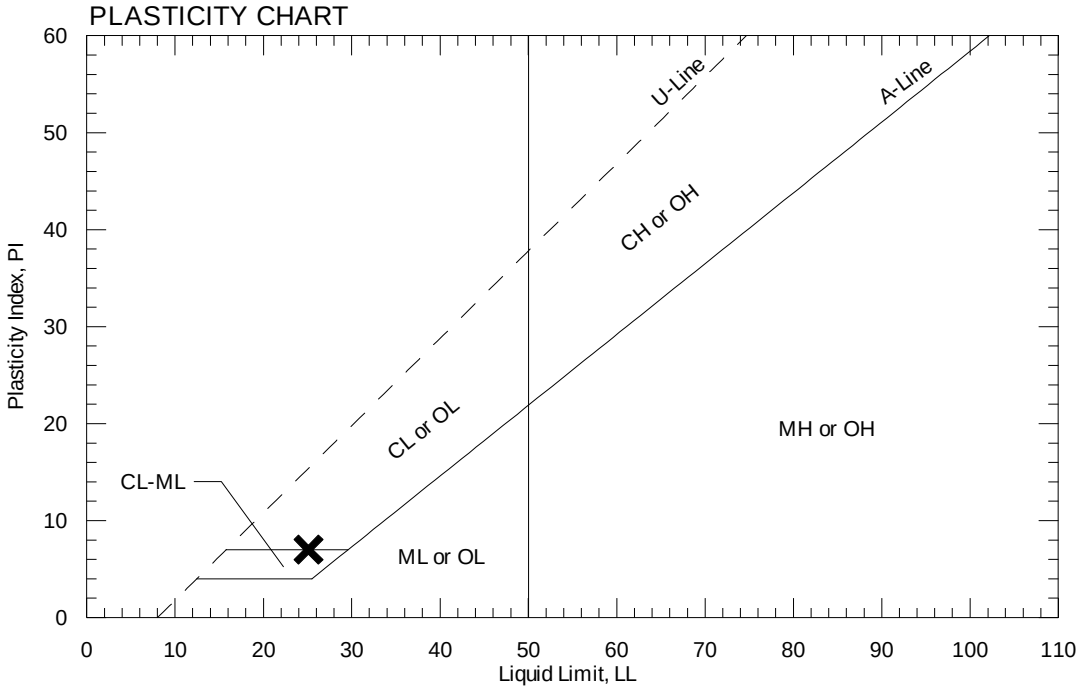
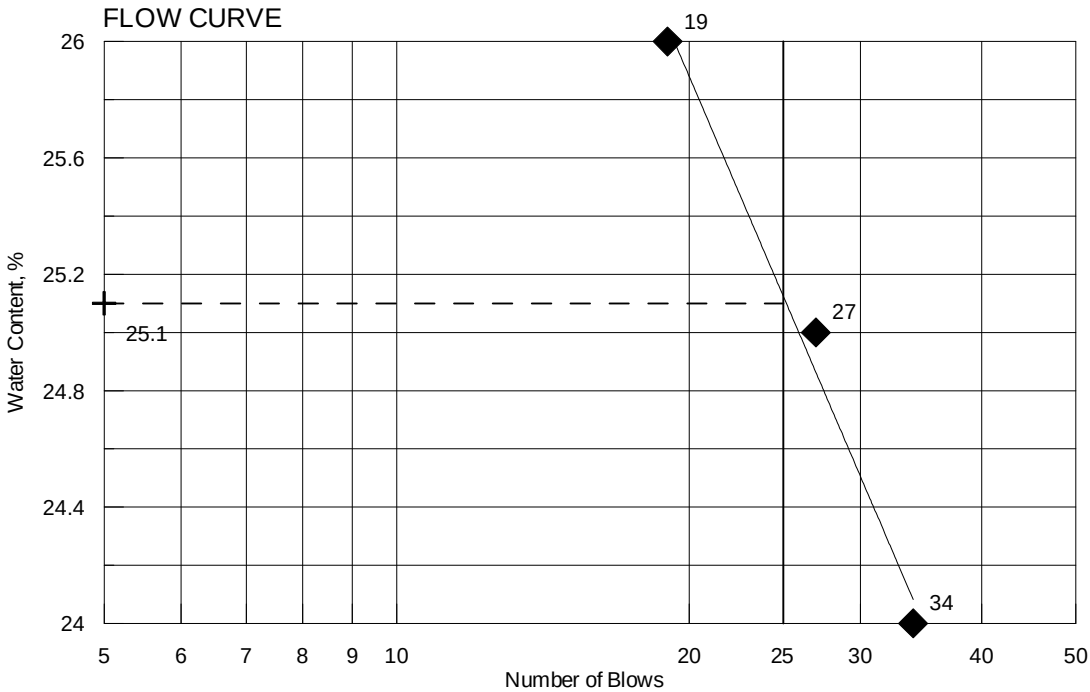
TOWN	Cumberland	Reference No.	300877
WIN	021777.00	Water Content, %	42.3
Sampled	4/3/2018	Liquid Limit @ 25 blows (T 89), %	34
Boring No./Sample No.	HB-CUMB-102/9D	Plastic Limit (T 90), %	22
Station	2+91.5	Plasticity Index (T 90), %	12
Depth	40.5-42.5	Tested By	BBURR



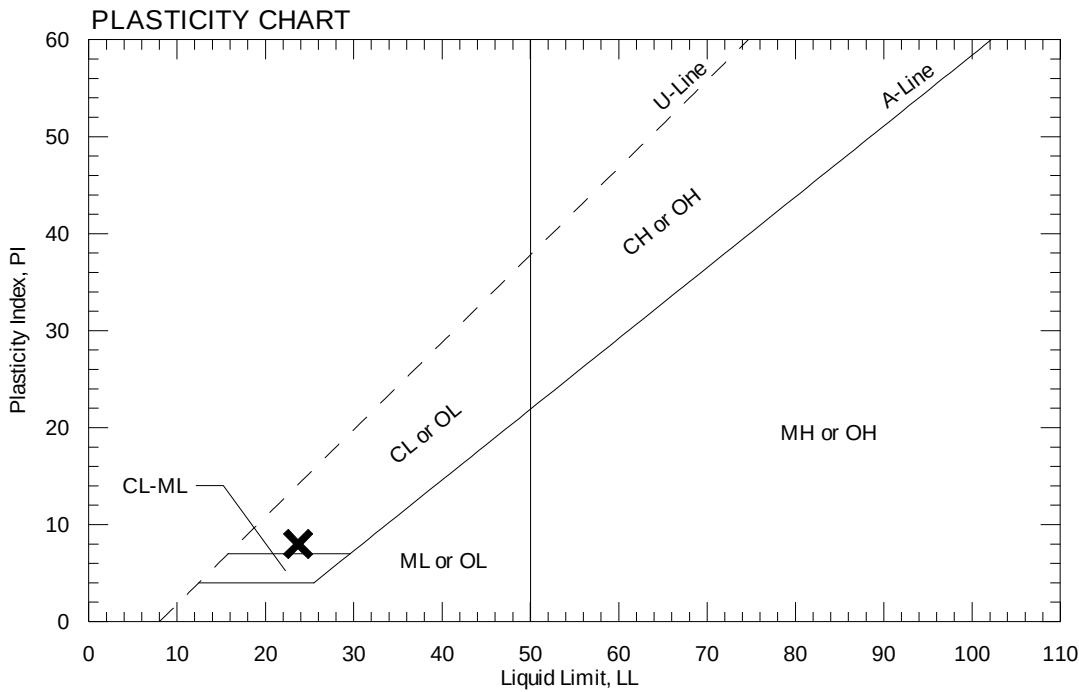
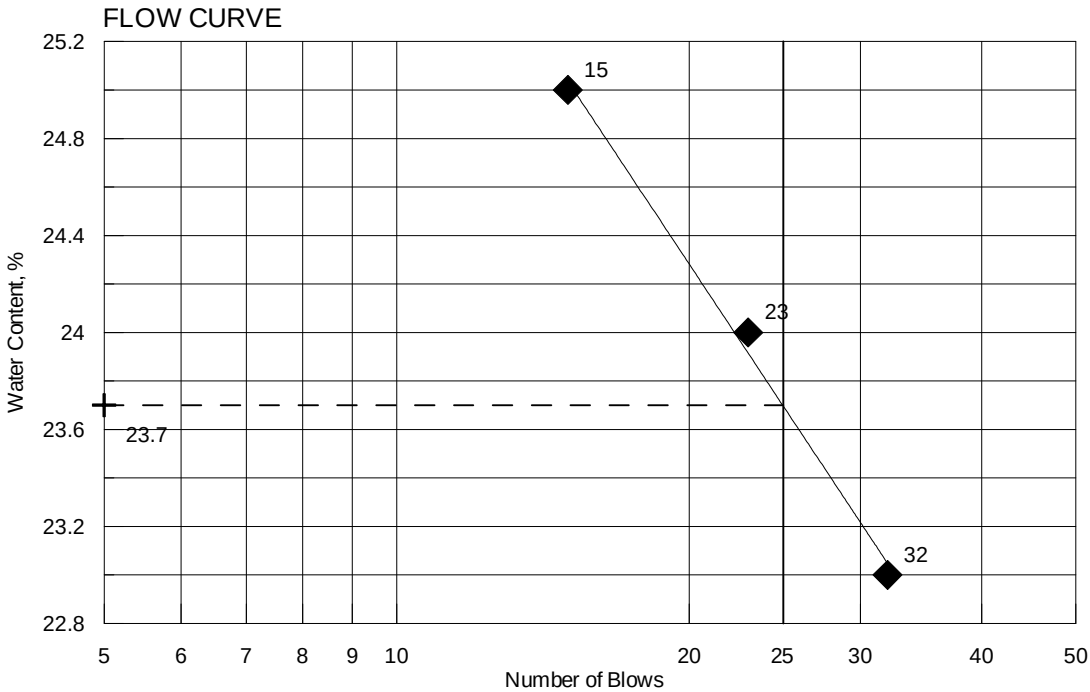
TOWN	Cumberland	Reference No.	300878
WIN	021777.00	Water Content, %	39.8
Sampled	4/5/2018	Liquid Limit @ 25 blows (T 89), %	29
Boring No./Sample No.	HB-CUMB-102/10D	Plastic Limit (T 90), %	20
Station	2+91.5	Plasticity Index (T 90), %	9
Depth	45.0-47.0	Tested By	BBURR



TOWN	Cumberland	Reference No.	300879
WIN	021777.00	Water Content, %	28.1
Sampled	4/5/2018	Liquid Limit @ 25 blows (T 89), %	25
Boring No./Sample No.	HB-CUMB-102/11D	Plastic Limit (T 90), %	18
Station	2+91.5	Plasticity Index (T 90), %	7
Depth	50.0-52.0	Tested By	BBURR



TOWN	Cumberland	Reference No.	300880
WIN	021777.00	Water Content, %	20
Sampled	4/5/2018	Liquid Limit @ 25 blows (T 89), %	24
Boring No./Sample No.	HB-CUMB-102/12D	Plastic Limit (T 90), %	16
Station	2+91.5	Plasticity Index (T 90), %	8
Depth	55.0-57.0	Tested By	BBURR



SPECIAL PROVISION
SECTION 203
EXCAVATION AND EMBANKMENT
(Culvert Bedding Stone)

Description This work shall consist of constructing a foundation pad of Culvert Bedding Stone in accordance with these specifications and in reasonably close conformity with the width, length, grade and thickness shown on the Plans or established by the Resident.

Materials Culvert Bedding Stone shall meet the requirements of Standard Specification Section 703.22, Underdrain Backfill Material, Type C.

Construction Requirements The Culvert Bedding Stone shall be placed and graded as shown on the Plans or as directed by the Resident, and shall be compacted as required to ensure that all voids in the stone are filled, as approved by the Resident.

Method of Measurement Culvert Bedding Stone will be measured by the cubic yard, complete, in place.

Basis of Payment The accepted quantity of Culvert Bedding Stone will be paid for at the Contract unit price per cubic yard, complete, in place.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
203.55 Culvert Bedding Stone	Cubic Yard

**SPECIAL PROVISION
SECTION 620 - GEOTEXTILES
(Reinforcement Geogrid)**

Amend Standard Specification 620 – GEOTEXTILES to include the following:

620.01 Description This work shall consist of furnishing and installing Reinforcement Geogrid within the Culvert Bedding Stone in accordance with these specifications and in reasonably close conformity with the lines, grades, and dimensions shown on the plans or as directed by the Resident.

620.02 Material Reinforcement Geogrid shall consist of a regular network of woven, integrally formed, polymeric tensile elements with aperture geometry sufficient to permit significant mechanical interlock with the surrounding soil, aggregate or other material. The Reinforcement Geogrid structure shall be dimensionally stable to retain its geometry under construction stresses and shall have high resistance to damage during construction, ultraviolet degradation, and all forms of chemical and biological degradation encountered in the soil being reinforced. Non-woven Reinforcement Geogrid are not acceptable for this application.

The Reinforcement Geogrid shall meet or exceed the Minimum Average Roll Values (MARV) of the properties in Table 1. Acceptable manufacturers for Reinforcement Geogrids must be approved by the Resident.

Table 1 - Physical Property Requirements
(Non-Woven Biaxial Reinforcement Geogrid)

Reinforcement Geogrid Mechanical Property	Test Method	Minimum Average Roll Value (MARV) ¹
Tensile strength at 5% Strain MD or XD	ASTM D 6637	1,200 lb/ft
Rib Junction Strength	GRI-GG2	1,000 lb/ft in both directions
Aperture Openings		Between 0.75 and 3 inches
Percent Open Area		50 to 80%

¹ Values are minimum average roll values determined in accordance with ASTM D 4759

A biaxial Reinforcement Geogrid shall be used in this application.

620.03 Placement Reinforcement Geogrid shall be installed, in accordance with the manufacturer's recommendations, unless otherwise modified by this Special Provision. The Reinforcement Geogrid shall be placed within the layers of Crushed Stone Bedding at the proper elevation and alignment as shown on the Plans or as directed by the Resident.

1. The Reinforcement Geogrid shall be placed in continuous longitudinal strips. Splicing along the length will not be allowed. Reinforcement Geogrid shall be oriented such that the roll length runs either parallel or perpendicular to the construction centerline. The Contractor shall verify correct orientation of the Reinforcement Geogrid.

2. Reinforcement Geogrid may be temporarily secured in-place with staples, pins, sand bags or backfill as required by fill properties, fill placement procedures, or weather conditions, or as directed by the Resident.
3. Coverage of less than 100 percent shall not be allowed.
4. The Reinforcement Geogrid shall be lightly anchored and pulled taut to reduce any slack as directed by the Resident.
5. Fill shall not be dumped directly onto the Reinforcement Geogrid. It shall be dumped at the edge of the Reinforcement Geogrid or on a previous course of fill with a minimum compacted depth of 8 inches.
6. The Reinforcement Geogrid shall be covered with fill materials within 7 days of placement to protect against unnecessary exposure.
7. Fill may then be pushed onto the Reinforcement Geogrid using a track mounted bulldozer. At no time shall construction equipment be allowed directly onto the Reinforcement Geogrid. Track mounted equipment shall be allowed on previous courses of fill with a minimum compacted depth of 8 inches. Smooth drum roller compaction equipment shall be allowed on previous courses of fill with a minimum compacted depth of 8 inches and spread fill with a minimum depth of 12 inches, loose measure. At no time shall rubber tired or sheeps-foot rollers be allowed onto the reinforced fill. Turning of vehicles should be kept to a minimum to prevent tracks from displacing the fill and damaging the Reinforcement Geogrid. Sudden breaking and sharp turning shall be avoided. Equipment speeds over 10 MPH shall not be allowed.
8. Placement, spreading, and compaction of soil on top of the Reinforcement Geogrid shall advance from one end of the Reinforcement Geogrid and move towards the other. Care shall be taken to minimize the development of wrinkles and to ensure that the Reinforcement Geogrid doesn't move from its position during fill placement. A spotter shall observe all fill placement operations to ensure the Reinforcement Geogrid does not slip, achieves the minimum coverage specified on the Plans, and is not damaged by the work.
9. Fill shall be compacted as specified in (1) the Standard Specifications or (2) to at least 90 percent of the maximum dry density determined in accordance with AASHTO T-180, whichever is greater. Density testing shall be made at a minimum frequency of one (1) test per lift or as otherwise specified in the Standard Specifications. Care shall be taken not to drive test apparatus through the Reinforcement Geogrid tensile elements.
10. All rutting formed during construction shall be filled with new Culvert Bedding Stone. In no case shall rutting be filled by blading down

620.04 Overlap Adjacent rolls of Reinforcement Geogrid shall be overlapped a minimum of 1 foot.

620.05 Seams Seams along adjacent lengths of Reinforcement Geogrid shall be tied together with hog rings or cable ties every 3 to 6 feet.

620.06 Certification Prior to construction the Contractor shall submit to the Resident the Manufacturer's certification that the Reinforcement Geogrid supplied has been evaluated in full compliance with this Specification and is fit for long-term, critical soil reinforcement applications. The Contractor's submittal package shall include, but not be limited to, actual tests for tension/creep, durability/aging, construction damage, and quality control tensile testing.

620.08 Shipment, Storage, Protection, and Repair of Fabric The Contractor shall check the Reinforcement Geogrid upon delivery to ensure that the proper material has been received. Each Reinforcement Geogrid roll shall be shipped in a protective bag and clearly marked with roll number, lot number, geogrid style and principle strength direction. During all periods of shipment and storage, the Reinforcement Geogrid shall be protected from temperatures greater than 140°F and all deleterious materials that might otherwise become affixed to the Reinforcement Geogrid and effect its performance. The manufacturer's recommendations shall be followed with regard to protection from direct sunlight. The Reinforcement Geogrid shall be stored off the ground in a clean, dry environment out of the pathway of construction equipment.

Any Reinforcement Geogrid damage shall be repaired or replaced in accordance with the manufacturer's recommendations. The Contractor shall replace any Reinforcement Geogrid damaged during installation at no additional cost to the Department.

620.09 Method of Measurement Reinforcement Geogrid will be measured by the number of Square Yards of surface area installed. Overlaps for connections, splices, patches, and repairs of damaged Reinforcement Geogrid, etc. are incidental to this Pay Item.

620.10 Basis of Payment Reinforcement Geogrid placement will be paid for per Square Yard in-place which shall be full compensation for all off-loading, inspection, storage, labor, materials, equipment, tools and any incidentals to complete the installation.

Payment will be made under:

Pay Item

620.65 Reinforcement Geogrid

Pay Unit

Square Yard