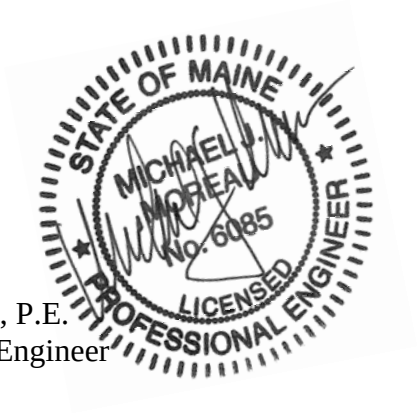
Maine Department of Transportation

Bridge Program
Geotechnical Section

GEOTECHNICAL DESIGN REPORT
for
HARWARD'S CROSSING BRIDGE REMOVAL AND ROUTE 24 RECONSTRUCTION BOWDOINHAM, SAGADAHOC COUNTY, MAINE



Prepared by:

Michael J. Moreau, P.E.
Geotechnical Design Engineer

Reviewed by:

Karen Gross
Geotechnical Engineer

Sagadahoc County
PIN 15091.00

Soils Report 2009-112
Bridge No. 3273

Fed No. BH – 1509(100) X
April 21, 2009

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MAINEDOT

Bridge Program
Geotechnical Division
16 State House Station
Augusta, Maine 04333

Phone: 207.624.3365
FAX: 207.624.3481
Email: michael.moreau@maine.gov

Memorandum

To: *Joel Kittredge*
From: *Mike Moreau, PE*
cc:
Date: *21 April 2009*
Subject: *Harward's Crossing Bridge Removal and Route 24 Reconstruction Bowdoinham, Maine PIN 15091*

Joel,

MaineDOT plans to remove Harward's Crossing Bridge construct an at-grade railroad crossing in its place, and reconstructing Route 24 at-grade alignment where the approach embankments presently exist. This memo report summarizes the geotechnical considerations and our recommendations for the project.

Bridge Removal

Current plans are to remove the bridge and construct an at-grade crossing. The bridge abutment and pier foundations should be removed below the depth of frost to prevent heaving of the highway pavement. Frost depth in this region is approximately 6 feet so bridge foundations should be removed at least 6 feet below the lowest point of the highway shoulder in each abutment and pier location. In addition at the pier locations, the excavation should be extended an additional 2 feet if wood piles are encountered. This will account for potential rotting and soil subsidence beneath the highway embankment.

Highway Construction

Native surficial soils along the alignment are alluvial sediments comprised primarily of silty fine to medium sand. Bridge embankment loads have consolidated most of the native soils under the embankments along the proposed alignment. Consequently, settlement will be negligible at those locations and will occur as the highway embankment is constructed. However, the native soil between the approach embankments has a loose consistency. Once the subgrade is exposed in these locations, the contractor should sample, test, and compact the subgrade soil in accordance with our standard specifications.

Current plans are to construct eleven foot wide travel lanes and 3 foot wide shoulders. Based on projected traffic data and DARWin analysis, 3 inches of new Hot Mix Asphalt (HMA) and 24 inches of 703.06, Type D, Aggregate Subbase Course Gravel would satisfy design needs. However, this is a major collector and the minimum pavement thickness for any highway section is 4 inches. Thus, the pavement structural section will include 4 inches of new HMA and 24 inches of subbase gravel.

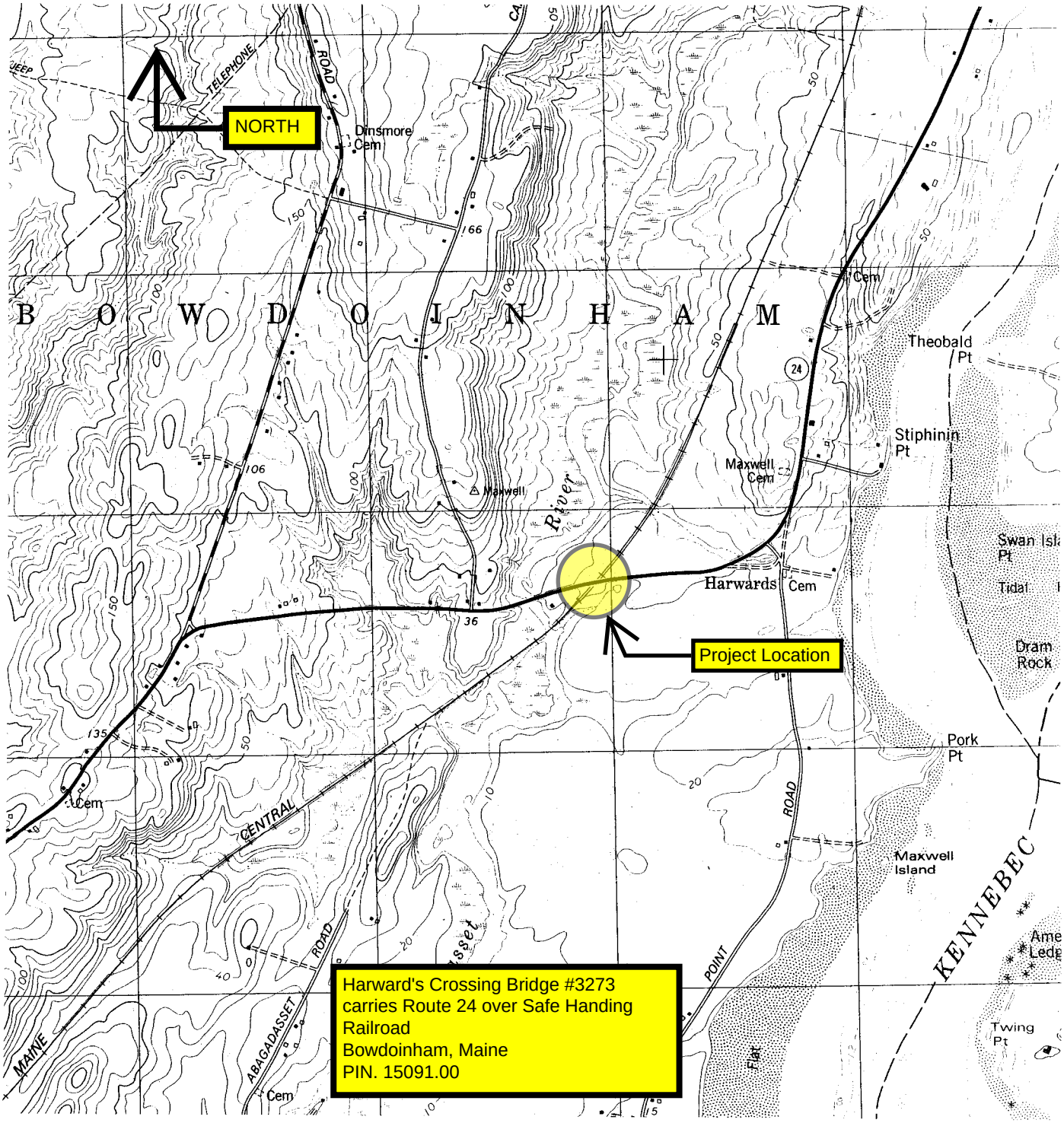
We recommend providing pavement structure drainage using Type B or C underdrains as appropriate in any curb or box section, if needed, and full ditches elsewhere. The underdrains should be connected to nearby culverts or have daylighted outlets. The native alluvial soils within the project area are both poorly drained and moderately to highly frost susceptible.

In some locations, these soil units may be saturated and significant water seepage may be encountered during excavation for ditches or the pavement structure, or during underdrain construction. The contractor should control groundwater and surface water infiltration to permit construction in-the-dry. We recommend that the contractor use temporary ditches, sumps, granular drainage blankets, stone ditch protection, or hand-laid riprap with geotextile underlayment to divert groundwater if significant seepage is encountered during ditch excavation.

APPENDIX - A

Figures

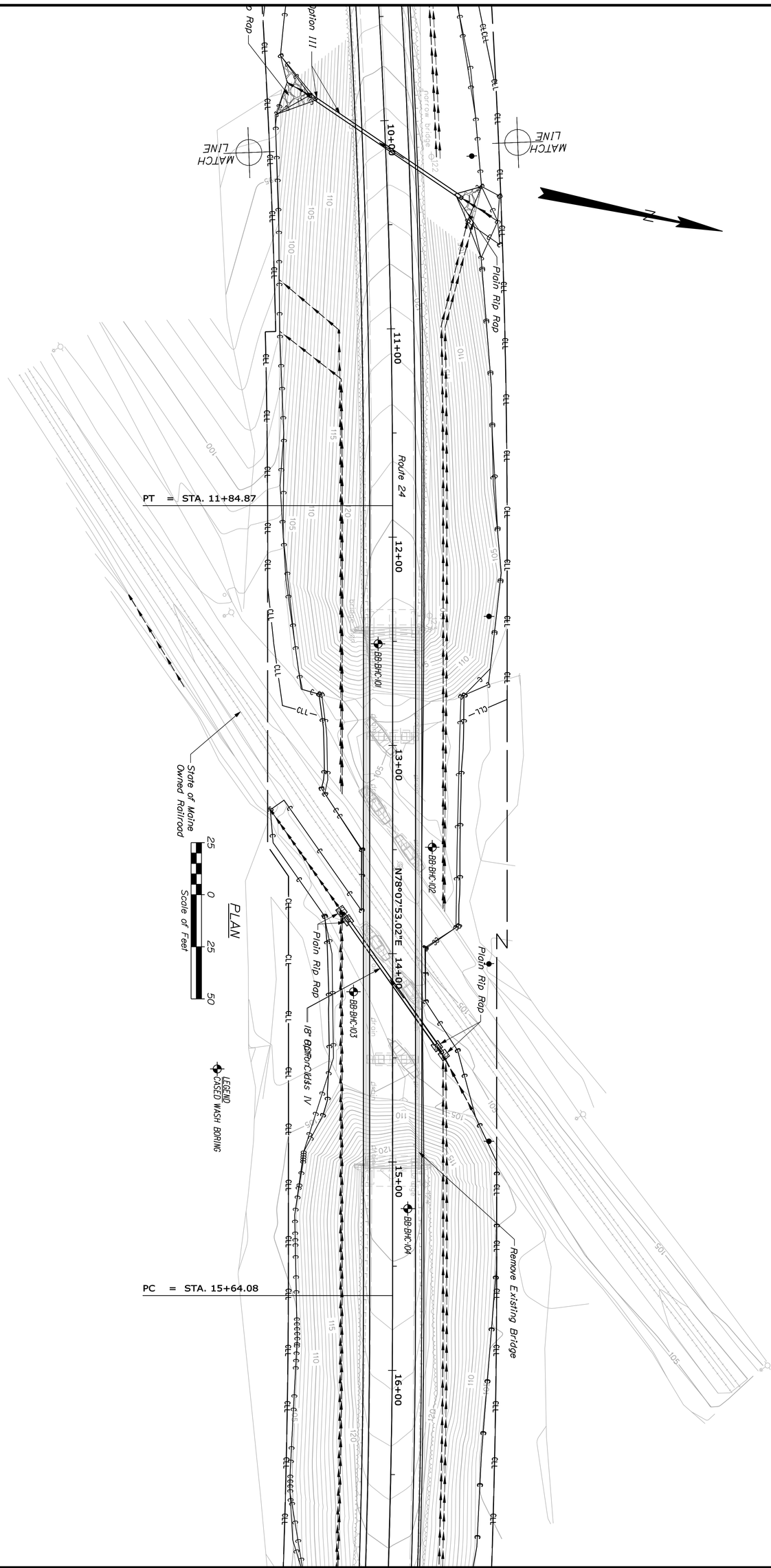
Site Location Map
Boring Location Plan
Boring Log Sheets



RICHMOND QUADRANGLE
MAINE
7.5 MINUTE SERIES (TOPOGRAPHIC)
SE/4 GARDINER 15' QUADRANGLE

SCALE 1:24 000

1 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER



SHEET NUMBER 2 OF 6

HARWARD'S CROSSING BRIDGE
SAFE HANDLING RAILROAD
BOWDOINHAM SAGADAHOC COUNTY

BORING LOCATION PLAN

		BY	DATE
PROJ. MANAGER			
DESIGN-DETAILED	M. MOREAU	T. WHITE	JAN 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-1509(100)X

BRIDGE NO. 3273 PIN 15091.00 BRIDGE PLANS

Filename: ...\003_BORING LOG BB-BHC-101.dgn Division: GEOTECH Username: terry.white Date:5/7/2009

Maine Department of Transportation
Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine

Boring No.: BB-BHC-101
PIN: 15091.00

Driller:	MaineDOT	Elevation (ft.)	121.5	Auger ID/OD:	N/A
Operator:	E. Giguere/C. Giles	Datum:	NAVD 88	Sampler:	Standard Split Spoon
Logged By:	M. Moreau	Rig Type:	CME 45C	Hammer Wt./Fall:	140#/30"
Date Start/Finish:	9/23/08, 9/30/08	Drilling Method:	Cased Wash Boring	Core Barrel:	NQ-2"
Boring Location:	12+51.2, 7.0 Rt.	Casing ID/OD:	HW & NW	Water Level*:	17.5' bgs.
Hammer Efficiency Factor: 0.77		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							1			Brown, very soft, wet, fine to medium sandy SILT, dilatant, (Fill).	
							7				
							6				
							5				
	1D	24/6	4.00 - 6.00	WOH/WOH/WOH/WOH	---		4				G#211462 A-4, ML WC=30.4%
5							4				
							7				
							10				
							13				
	2D	24/10	9.00 - 11.00	2/1/1/2	2	3	6			One silt seam 5 mm thick at 9.2' bgs.	
10							12				
							39				
							39				
							25				
	3D	24/3	14.00 - 16.00	3/1/1/1	2	3	14			Same as above.	
15							14				
							14				
							15	104.00		17.50 Brown and occasional black and orange layers between 19.0-20.0' bgs, mottled, stratified, brown, wet, loose, silty fine to medium SAND, trace gravel and numerous silt layers 1-3 mm thick, (Alluvium). One silty fine to coarse sand layer at 19.5- 19.7', silty sand is dilatant. Water at top of alluvium at 17.5' bgs.	
							17				
	4D	24/15	19.00 - 21.00	2/2/3/5	5	6	15				G#211463 A-4, SM WC=24.6%
20							38				
							45				
							47				
							43				
25	5D	24/10	24.00 - 26.00	3/2/4/2	6	8	53			Same as above.	

Remarks:

1.0 ft thick concrete Bridge Deck.
Bridge Deck to Ground Surface 10.4 ft.
Total NW Casing 155.5 ft from deck, 145.5 ft from soil.
Total HW Casing 105.5 ft from deck.

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.

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Maine Department of Transportation
Soil/Rock Exploration Log
US CUSTOMARY UNITS
Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine
Boring No.: BB-BHC-101
PIN: 15091.00
Driller: MaineDOT | Elevation (ft.) 121.5 | Auger ID/OD: N/A
Operator: E. Giguere/C. Giles | Datum: NAVD 88 | Sampler: Standard Split Spoon
Logged By: M. Moreau | Rig Type: CME 45C | Hammer Wt./Fall: 140#/30"
Date Start/Finish: 9/23/08, 9/30/08 | Drilling Method: Cased Wash Boring | Core Barrel: NQ-2"
Boring Location: 12+51.2, 7.0 Rt. | Casing ID/OD: HW & NW | Water Level*: 17.5' bgs.
Hammer Efficiency Factor: 0.77 | 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; Su = Insitu Field Vane Shear Strength (psf); Tv = Pocket Torvane Shear Strength (psf); qp = Unconfined Compressive Strength (ksf); N-uncorrected = Raw field SPT N-value; Hammer Efficiency Factor = Annual Calibration Value; N60 = SPT N-uncorrected corrected for hammer efficiency; N60 = (Hammer Efficiency Factor/60%)*N-uncorrected; Su(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							47				
							50				
							49				
							59			Few silt layers and medium dense between 28.0-44.0' bgs.	
	6D	24/17	29.00 - 31.00	5/7/6/11	13	17	86	92.50		29.00 Brown, wet, medium dense, fine to medium SAND, little silt (Alluvium).	G#211464 A-2-4, SM WC=26.0%
30							118				
							152				
							161				
							156				
	7D	24/14	34.00 - 36.00	5/5/6/5	11	14	66			One silt layer 0.1' thick between 34.6- 34.7' bgs, sand layers are alternating orange and brown color.	
35							86				
							95				
							101				
							122				
	8D	24/10	39.00 - 41.00	6/8/7/6	15	19	96			Similar to above, but trace gravel.	G#211465 A-2-4, SM WC=29.8%
40							127				
							141				
							138				
							132				
	9D	24/20	44.00 - 46.00	6/5/2/2	7	9	87			More numerous silt layers after 44.0' bgs. One silt layer 0.2' thick between 50.7' and 50.9' bgs.	
45							91				
							99				
							109				
							117	73.50		48.00 Stratified, grey, wet, medium dense to very loose, silty fine to medium SAND and numerous silt layers 1-3 mm thick, occasionally 1 cm thick, sand is dilatant, (Glaciomarine).	
50	10D	24/15	49.00 - 51.00	7/8/6/6	14	18	106				G#211466 A-4, SM

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Operator: E. Giguere/C. Giles | Datum: NAVD 88 | Sampler: Standard Split Spoon
Logged By: M. Moreau | Rig Type: CME 45C | Hammer Wt./Fall: 140#/30"
Date Start/Finish: 9/23/08, 9/30/08 | Drilling Method: Cased Wash Boring | Core Barrel: NQ-2"
Boring Location: 12+51.2, 7.0 Rt. | Casing ID/OD: HW & NW | Water Level*: 17.5' bgs.
Hammer Efficiency Factor: 0.77 | 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; Su = Insitu Field Vane Shear Strength (psf); Tv = Pocket Torvane Shear Strength (psf); qp = Unconfined Compressive Strength (ksf); N-uncorrected = Raw field SPT N-value; Hammer Efficiency Factor = Annual Calibration Value; N60 = SPT N-uncorrected corrected for hammer efficiency; N60 = (Hammer Efficiency Factor/60%)*N-uncorrected; Su(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

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50							123			Stratified, grey, wet, medium dense to very loose, silty fine to medium SAND and numerous silt layers 1-3 mm thick, (Glaciomarine).	WC=25.8%
							109				
							112				
							91				
	11D	24/20	54.00 - 56.00	WOH/WOH/WOH/WOH	---		83			One grey clay-silt layer from 54.7-55.0' bgs.	G#211467 A-4, CL-ML WC=24.2%
55							85				
							67				
							72			Silt layers predominant after 57.0' bgs.	
							56				
	12D	24/20	59.00 - 61.00	WOH/WOH/WOH/WOH	---		59				
60							71				
							71				
							62				
							61	57.40		64.10 Grey, wet, very soft to stiff, clayey-SILT to silty CLAY with trace fine sand in seams and partings. (Glaciomarine)	
	13D	24/17	64.00 - 66.00	WOR/WOR/WOR/WOR	---		66				#211468 WC=30.1%
65							62				
							66				
							65				
							58				
							58				
70	14D	24/24	70.50 - 72.50	WOR/WOR/WOR/WOR	---		66			Drove casing to 70.5' bgs, end of day. 37 blows to 70.5', 29 blows from 70.5-71.0' bgs. Spoon through vane interval.	G#211469 A-4, CL WC=30.6% LL=28 PL=20 PI=8
	V1		71.47 - 71.90	Su=665/137 psf			66			65x130 mm vane raw torque readings: V1: 24.2/5.0 ft-lbs	
	V2		72.47 - 72.90	Su=643/132 psf			55			passed several silty fine sand layers advancing vane. V2: 23.4/4.8 ft-lbs	
							56				
75	1U	24/24	74.00 - 76.00	Hydraulic Push			45				

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Operator: E. Giguere/C. Giles | Datum: NAVD 88 | Sampler: Standard Split Spoon
Logged By: M. Moreau | Rig Type: CME 45C | Hammer Wt./Fall: 140#/30"
Date Start/Finish: 9/23/08, 9/30/08 | Drilling Method: Cased Wash Boring | Core Barrel: NQ-2"
Boring Location: 12+51.2, 7.0 Rt. | Casing ID/OD: HW & NW | Water Level*: 17.5' bgs.
Hammer Efficiency Factor: 0.77 | 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; Su = Insitu Field Vane Shear Strength (psf); Tv = Pocket Torvane Shear Strength (psf); qp = Unconfined Compressive Strength (ksf); N-uncorrected = Raw field SPT N-value; Hammer Efficiency Factor = Annual Calibration Value; N60 = SPT N-uncorrected corrected for hammer efficiency; N60 = (Hammer Efficiency Factor/60%)*N-uncorrected; Su(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
75							30			Grey, wet, very soft to stiff, clayey-SILT to silty CLAY with trace fine sand in seams and partings. (Glaciomarine)	
							26				
	V3		77.00 - 77.43	Su=634/129 psf			24			65x130 mm vane raw torque readings: V3: 23.1/4.7 ft-lbs	
	V4		78.00 - 78.43	Su=656/137 psf			21			V4: 23.9/5.0 ft-lbs occasional silty fine sand seams apparent on vane advance.	
							33				
80							41				
							39				
							38				
							38				
	15D	24/24	84.00 - 86.00	WOR/WOR/WOR/WOR	---		43			Spoon through vane interval. occasional fine sand seams in spoon and black manganese stains after 84.0' bgs. 65x130 mm vane raw torque readings:	#211470 WC=40.2%
85	V5		85.00 - 85.43	Su=665/99 psf			52			V5: 24.2/3.6, ft-lbs	
	V6		86.00 - 86.43	Su=720/85 psf			50			V6: 26.2/3.1 ft-lbs	
							42				
							37				
	MU 16D	24/0 24/24	89.00 - 91.00 89.00 - 91.00	WOR/WOR/WOR/WOR	---		61			Missed tube sample. Spoon through tube interval.	#211471 WC=38.0%
90							53				
							48				
							37				
							39				
							35				
95							47				
							50				
							49				
							54				
100	17D	24/24	99.00 - 101.00	WOR/WOR/WOR/WOR	---		72			Spoon through vane interval, no silty fine sand layers advancing vane or in spoon.	#211472 WC=36.9%

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100	V7		100.00 - 100.43	Su=887/85 psf			87			65x130 mm vane raw torque readings: V7: 32.3/3.1 ft-lbs	
	V8		101.00 - 101.43	Su=843/135 psf			125			Grey, wet, very soft to stiff, clayey-SILT to silty CLAY with trace fine sand in seams and partings. (Glaciomarine) V7: 30.7/4.9 ft-lbs	
							103				
							91				
	2U	24/24	104.00 - 106.00	Hydraulic Push			85				G,V#211473 A-4, CL WC=34.7% LL=29 PL=21 PI=8
105							a32			a32 blows for 6", then changed to NW Casing with hydraulic push for remanding 6".	
							bHP			bHP=Hydraulic Push	
	V9		107.00 - 107.43	Su=901/168 psf			HP			65x130 mm vane raw torque readings: V9: 32.8/6.1 ft-lbs	
	V10		108.00 - 108.43	Su=860/170 psf			HP			V10: 31.3/6.2 ft-lbs	
							HP				
110							23				
							23				
							26				
							28			Spoon through vane interval.	
	18D	24/24	114.00 - 116.00	WOR/WOR/WOR/WOR	---		9				#211474 WC=31.7%
115	V11		115.00 - 115.43	Su=915/179 psf			19			65x130 mm vane raw torque readings: V11: 33.3/6.5 ft-lbs	
	V12		116.00 - 116.43	Su=1008/200 psf			24			V12: 36.7/7.3 ft-lbs	
							27				
							32				
							30				
120							35				
							39				
							39				
							44				
125	19D	24/24	124.00 - 126.00	WOR/WOR/WOR/WOR	---		18			Grey, wet, very soft to stiff, silty CLAY, with trace fine sand in seams and partings.	G#211475 A-6, CL

Remarks:
1.0 ft thick concrete Bridge Deck.
Bridge Deck to Ground Surface 10.4 ft.
Total NW Casing 155.5 ft from deck, 145.5 ft from soil.
Total HW Casing 105.5 ft from deck.
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 5 of 7

Boring No.: BB-BHC-101

Maine Department of Transportation
Soil/Rock Exploration Log
US CUSTOMARY UNITS
Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine
Boring No.: BB-BHC-101
PIN: 15091.00
Driller: MaineDOT | Elevation (ft.) 121.5 | Auger ID/OD: N/A
Operator: E. Giguere/C. Giles | Datum: NAVD 88 | Sampler: Standard Split Spoon
Logged By: M. Moreau | Rig Type: CME 45C | Hammer Wt./Fall: 140#/30"
Date Start/Finish: 9/23/08, 9/30/08 | Drilling Method: Cased Wash Boring | Core Barrel: NQ-2"
Boring Location: 12+51.2, 7.0 Rt. | Casing ID/OD: HW & NW | Water Level*: 17.5' bgs.
Hammer Efficiency Factor: 0.77 | 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; Su = Insitu Field Vane Shear Strength (psf); Tv = Pocket Torvane Shear Strength (psf); qp = Unconfined Compressive Strength (ksf); N-uncorrected = Raw field SPT N-value; Hammer Efficiency Factor = Annual Calibration Value; N60 = SPT N-uncorrected corrected for hammer efficiency; N60 = (Hammer Efficiency Factor/60%)*N-uncorrected; Su(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
125							25			Grey, wet, very soft to stiff, clayey-SILT to silty CLAY with trace fine sand in seams and partings. (Glaciomarine)	WC=35.2% LL=32 PL=22 PI=10
							27				
							33				
							34				
							36				
130							40				
							42				
							38				
							39				
	20D	24/24	134.00 - 136.00	WOR/WOR/WOR/WOR	---		HYD			NW Casing broke at 20.0 ft below surface after sample 20D. Retrieved casing flushed hole and readvanced casing to 144.0 ft with hydraulic push.	G#212201 A-6, CL WC=31.5% LL=30 PL=20 PI=10
135							PUSH				
140											
							13				
							14				
							34			Drive casing to 145.5 ft bgs - End of Day	
145	21D	24/24	145.50 - 147.50	WOR/WOR/WOR/WOR	---		33			Grey, wet, very soft, clay-SILT, with trace fine sand, trace gravel.	
							46				
							40				
							24				
150							24				

Remarks:
1.0 ft thick concrete Bridge Deck.
Bridge Deck to Ground Surface 10.4 ft.
Total NW Casing 155.5 ft from deck, 145.5 ft from soil.
Total HW Casing 105.5 ft from deck.
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 6 of 7

Boring No.: BB-BHC-101

Maine Department of Transportation
Soil/Rock Exploration Log
US CUSTOMARY UNITS
Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine
Boring No.: BB-BHC-101
PIN: 15091.00
Driller: MaineDOT | Elevation (ft.) 121.5 | Auger ID/OD: N/A
Operator: E. Giguere/C. Giles | Datum: NAVD 88 | Sampler: Standard Split Spoon
Logged By: M. Moreau | Rig Type: CME 45C | Hammer Wt./Fall: 140#/30"
Date Start/Finish: 9/23/08, 9/30/08 | Drilling Method: Cased Wash Boring | Core Barrel: NQ-2"
Boring Location: 12+51.2, 7.0 Rt. | Casing ID/OD: HW & NW | Water Level*: 17.5' bgs.
Hammer Efficiency Factor: 0.77 | 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; Su = Insitu Field Vane Shear Strength (psf); Tv = Pocket Torvane Shear Strength (psf); qp = Unconfined Compressive Strength (ksf); N-uncorrected = Raw field SPT N-value; Hammer Efficiency Factor = Annual Calibration Value; N60 = SPT N-uncorrected corrected for hammer efficiency; N60 = (Hammer Efficiency Factor/60%)*N-uncorrected; Su(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
150							WOC				
							WOC			5" of running sand, rewashed, kept full column of water pressure in casing on sand.	
							WOC				
							WOC				
	22D	24/13	154.00 - 156.00	2/2/3/2	5	6	29	-32.50		154.00 Grey, wet, loose, fine to medium SAND, trace gravel and silt (Glaciomarine).	G#212202 A-3, SP WC=20.6%
155							22				
							87				
							125	-35.50		157.00 Changed to Till at 157 ft bgs.	
							196				
							191				
160							244				
							257				
							313			Grey, wet, very dense, fine to coarse SAND, trace gravel, little silt. (Till)	
							272			a250 blows for 0.8'.	
	23D R1	9.6/9.6 60/60	164.00 - 164.80 164.80 - 169.80	17/60(3.6") RQD = 80%	---		a250 NQ-2	-43.30		164.80 Top of Bedrock at Elev. -43.3'. Bedrock: White to reddish grey, fine to coarse-grained biotite, feldspar, quartz, banded GNEISS, slightly weathered, moderately hard, fractures are horizontal to 30 degrees, tight to open, very close to close, with very minor silt in-filling. [Cushing Formation] R1:Core Times (min:sec) 164.8-165.8' (2:45) 165.8-166.8' (2:23) 166.8-167.8' (2:10) 167.8-168.8' (2:09) 168.8-169.8' (2:11) 100% Recovery	G#212203 A-2-4, SM WC=13.8%
165											
								-48.30		169.80 Bottom of Exploration at 169.80 feet below ground surface.	
170											
175											

Remarks:
1.0 ft thick concrete Bridge Deck.
Bridge Deck to Ground Surface 10.4 ft.
Total NW Casing 155.5 ft from deck, 145.5 ft from soil.
Total HW Casing 105.5 ft from deck.
Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
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Page 7 of 7

Boring No.: BB-BHC-101

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

BH-1509(100)X

PIN 15091.00

BRIDGE NO. 3273

BRIDGE PLANS

	BY	DATE
PROJ. MANAGER		
DESIGN-DETAILED	M. MOREAU	
CHECKED-REVIEWED	T. WHITE	JAN 2009
DESIGN2-DETAILED2		
DESIGN3-DETAILED3		
REVISIONS 1		
REVISIONS 2		
REVISIONS 3		
REVISIONS 4		
FIELD CHANGES		

SIGNATURE

P.E. NUMBER

DATE

HARWARD'S CROSSING BRIDGE
SAFE HANDLING RAILROAD
BOWDOINHAM SAGADAHOC COUNTY

BORING LOG BB-BHC-101

SHEET NUMBER
3
OF 6

Filename: ...\004_BORING LOG BB-BHC-102.dgn   Division: GEOTECH   Username: terry.white   Date:5/7/2009

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine

Boring No.: BB-BHC-102
PIN: 15091.00

Driller:	Northern Test Boring	Elevation (ft.)	104.5	Auger ID/OD:	5" Solid Stem
Operator:	Mike/Nick	Datum:	NAVD 88	Sampler:	Standard Split Spoon
Logged By:	B. Wilder	Rig Type:	Diedrich D-50	Hammer Wt./Fall:	140#/30"
Date Start/Finish:	9/22-25/08	Drilling Method:	Cased Wash Boring	Core Barrel:	NQ-2"
Boring Location:	13+48.8, 19.0 Lt.	Casing ID/OD:	HW	Water Level*:	8.0' bgs.
Hammer Efficiency Factor: 0.633		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

Page 1 of 7

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.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class
0	1D	24/16	0.00 - 2.00	3/2/2/2	4	4	SSA	104.20	TOPSOIL, (Sod). —0.30— Brown, damp, loose, fine to medium SAND, little gravel, some silt.	G#212204 A-2-4, SM WC=14.6%
								101.50	—3.00—	
5	2D	24/24	5.00 - 7.00	4/5/7/8	12	13			Brown, damp to wet, very loose to medium dense, fine SAND, trace gravel, trace to some silt. (Alluvium)	
10	3D	24/20	10.00 - 12.00	3/1/2/1	3	3	aHP		aHP=Hrdraulic Push	G#212205 A-2-4, SM WC=22.4%
15	4D	24/18	15.00 - 17.00	2/2/2/1	4	4				
							74			
							72			
20	5D	24/14	20.00 - 22.00	4/8/10/8	18	19	aHP			G#212206 A-3, SP-SM WC=25.5%
								81.50	—23.00— Brown, wet, stiff, SILT, some fine sand. (Glaciomarine)	
	6D	24/14	24.00 - 26.00	3/3/6/6	9	9				

Remarks:
Auto Hammer #283

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 7

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.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class
25							aHP		Brown, wet, stiff, SILT, some fine sand. (Glaciomarine)	
	7D	24/18	29.00 - 31.00	4/3/3/3	6	6				G#212207 A-4, ML WC=27.1%
30										
	8D	24/19	34.00 - 36.00	3/2/2/4	4	4		70.50	—34.00— Grey, wet, soft, SILT, some fine sand, trace clay. (Glaciomarine)	
35										
	9D	24/24	39.00 - 41.00	2/2/2/2	4	4			Similar to above but trace organics.	G#212208 A-4, CL-ML WC=28.1%
40										
	10D	24/24	44.00 - 46.00	WOR/WOR/WOR/WOR	---			60.00	—44.50— Grey, wet, very soft to medium stiff, clayey-SILT, trace fine sand in partings and seams. (Glaciomarine)	#212209 WC=25.0%
45										
	b1U	24/21	49.00 - 51.00	Hydraulic Push					bGus Piston Sample. Similar to above.	G,V#212210 A-4, CL-ML

Remarks:
Auto Hammer #283

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Page 3 of 7

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.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class
50							aHP		Grey, wet, very soft to medium stiff, clayey-SILT, trace fine sand in partings and seams. (Glaciomarine)	WC=28.3% LL=27 PL=22 PI=5
	11D	24/24	54.00 - 56.00	WOR/WOR/WOR/WOR	---					#212211 32.7%
55										
	V1		56.57 - 57.00	Su=288/55 psf					65x130 mm vane raw torque readings: V1: 10.5/2.0 ft-lbs	
	V2		57.57 - 58.00	Su=494/110 pdf					V2: 18.0/4.0 ft-lbs	
	2U	24/24	59.00 - 61.00	Hydraulic Push					Similar to above.	G,V,C#211458 A-4, CL WC=34.2% LL=28 PL=19 PI=9
60										
	V3		61.57 - 62.00	Su=275/55 psf					65x130 mm vane raw torque readings: V3: 10.0/2.0 ft-lbs	
	V4		62.57 - 63.00	Su=577/124 psf					V4: 21.0/4.5 ft-lbs	
	12D	24/24	64.00 - 66.00	WOR/WOR/WOR/WOR	---				Similar to above.	#212212 WC=40.1%
65										
	3U	24/24	69.00 - 71.00	Hydraulic Push					Similar to above.	G,V,C#211459 A-4, ML WC=38.6% LL=32 PL=24 PI=8
70										
	V5		71.57 - 72.00	Su=769/82 psf					65x130 mm vane raw torque readings: V5: 28.0/3.0 ft-lbs	
	V6		72.57 - 73.00	Su=604/55 psf					V6: 22.2/2.0 ft-lbs	
	13D	24/24	74.00 - 76.00	WOR/WOR/WOR/WOR	---					#212213 WC=36.1%

Remarks:
Auto Hammer #283

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Page 4 of 7

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.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class
75							aHP		Grey, wet, very soft to medium stiff, clayey-SILT, trace fine sand in partings and seams. (Glaciomarine)	
	4U	24/24	79.00 - 81.00	Hydraulic Push					Similar to above but dark grey.	
80										
	V7		81.57 - 82.00	Su=851/69 psf					65x130 mm vane raw torque readings: V7: 31.0/2.5 ft-lbs	
	V8		82.57 - 83.00	Su=934/69 psf					V8: 34.0/2.5 ft-lbs	
	14D	24/24	84.00 - 86.00	WOR/WOR/WOR/WOR	---				Similar to above but grey.	#212214 WC=33.9%
85										
	5U	24/24	89.00 - 91.00	Hydraulic Push						G,V#212215 WC=33.0% LL=27 PL=20 PI=7
90										
	V9		91.57 - 92.00	Su=906/192 psf					65x130 mm vane raw torque readings: V9: 33.0/7.0 ft-lbs	
	V10		92.57 - 93.00	Su=742/151 psf					V10: 27.0/5.5 ft-lbs	
	15D	24/24	94.00 - 96.00	WOR/WOR/WOR/HP	---					#212216 WC=30.8%
95									Similar to above but trace gravel and more silty sand layers after 94' bgs.	

Remarks:
Auto Hammer #283

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Page 5 of 7

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.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class
100	16D MV11	24/24	100.00 - 102.00 100.00 - 100.10	WOR/WOR/WOR/WOH Could not Push	---		aHP		Similar to above but dark grey. Failed 65x130 mm Vane attempt.	#212217 WC=34.5%
105	MU	24/0	105.00 - 107.00	Hydraulic Push					Failed Tube attempt.	
	17D	24/24	107.00 - 109.00	WOR/WOR/WOR/HP	---				Similar to above.	G#212218 A-6, CL WC=29.7% LL=30 PL=20 PI=10
110	V12		110.57 - 111.00	Su=1167/137 psf					65x130 mm vane raw torque readings: V12: 42.5/5.0 ft-lbs	
	V13		111.57 - 112.00	Su=1181/110 psf					V13: 43.0/4.0 ft-lbs	
							75	-8.70	—113.20—	
							101			
115	18D	24/3	115.00 - 117.00	7/9/14/11	23	24	156		Grey, wet, medium dense, fine to coarse SAND, some gravel to gravelly, some silt, (Till). Roller Coned ahead of casing from 115.0-125.0' bgs.	
							104			
							101			
							106			
120							105			
							115			
							117			
							253			
							263			
							207			

Remarks:
Auto Hammer #283

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
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Page 6 of 7

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.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class
125	19D	24/12	125.00 - 127.00	56/18/11/8	29	31	104		Grey, wet, medium dense, fine to coarse SAND, some gravel to gravelly, some silt, (Till). Roller Coned ahead of casing from 135.0-151.6' bgs.	G#212219 A-1-b, SM WC=9.0%
							110			
							105			
							77			
							101			
130							102			
							122			
							199			
							213			
							251			
135	20D	24/3	135.00 - 137.00	17/7/9/10	16	17	156		Similar to above.	
							205			
							213			
							300			
							336			
140							480			
							480			
							592			
							637			
							600			
145	21D	24/13	145.00 - 147.00	3/2/8/17	10	11	343	-40.50	—145.00— Grey, wet, loose, fine to medium SAND, little gravel, trace silt.	G#212220 A-1-b, SP WC=18.8%
							592			
							792			
							1015			
							152		Cobbles.	

Remarks:
Auto Hammer #283

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Page 7 of 7

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.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class
150							RC	-45.50	—150.00— Weathered ROCK. Roller-coned ahead to 151.6' bgs.	
	R1	50.4/50.4	151.60 - 155.80	RQD = 32%			NQ-2	-47.10	—151.60— Top of Intact Bedrock at Elev. -47.1'. Bedrock: Top half greenish to brownish tan, bottom half dark grey, fine to coarse-grained biotite, feldspar, quartz, banded GNEISS, green due to feldpar Amazonite, brown due to iron oxide, slight to moderate weathering, moderately hard, fractures are horizontal to 45 degrees, open, very close to close, with minor silt in-filling, jointing is largely healed. [Cushing Formation] R1:Core Times (min:sec) 151.6-152.6' (3:54) 152.6-153.6' (3:02) 153.6-154.6' (2:05) 154.6-155.6' (1:41) 155.6-155.8' (1:50) 100% Recovery Core Blocked, roller coned ahead to 155.8' bgs to clean out casing.	
155	R2	33.6/20	155.80 - 158.60	RQD = 0%				-51.30	—155.80— R2:Core Times (min:sec) 155.8-156.8' (5:00) 156.8-157.8' (5:15) 157.8-158.6' (9:00) 60% Recovery Core Blocked	
							↓	-54.10	—158.60— Bottom of Exploration at 158.60 feet below ground surface. Could not get back down hole, too much sand in casing, plugged up core barrel, pulled casing per M.Moreau.	

Remarks:
Auto Hammer #283

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
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STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
BH-1509(100)X
BRIDGE NO. 3273 PIN 15091.00 BRIDGE PLANS

		BY	DATE
PROJ. MANAGER			
DESIGN-DETAILED	M. MOREAU	T. WHITE	JAN 2009
CHECKED-REVIEWED			
DESIGN2-DETAILED2			
DESIGN3-DETAILED3			
REVISIONS 1			
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			

SIGNATURE
P.E. NUMBER
DATE

HARWARD'S CROSSING BRIDGE
SAFE HANDLING RAILROAD
BOWDOINHAM SAGADAHOC COUNTY

BORING LOG BB-BHC-102

SHEET NUMBER 4 OF 6

Filename: ...\005_BORING LOG BB-BHC-103.dgn   Division: GEOTECH   Username: terry.white   Date:5/7/2009

Maine Department of Transportation
Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine

Boring No.: BB-BHC-103
PIN: 15091.00

Driller:	MaineDOT	Elevation (ft.)	104.3	Auger ID/OD:	N/A
Operator:	E. Giguere/C. Giles	Datum:	NAVD 88	Sampler:	Standard Split Spoon
Logged By:	B. Wilder	Rig Type:	CME 45C	Hammer Wt./Fall:	140#/30"
Date Start/Finish:	10/20-27/08	Drilling Method:	Cased Wash Boring	Core Barrel:	NQ-2"
Boring Location:	14+18.2, 18.8 Rt.	Casing ID/OD:	HW & NW	Water Level*:	15.0' bgs.
Hammer Efficiency Factor: 0.77		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

Page 1 of 7

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.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class
0	1D	24/15	0.00 - 2.00	3/3/5/6	8	10	SSA	104.10 / 103.50	TOPSOIL, (Sod). —0.20 Brown, damp, loose, fine to coarse sandy GRAVEL, (Fill). —0.80 Olive, damp, stiff, fine to coarse sandy SILT, trace gravel, (Fill).	G#212221 A-4, ML WC=17.5%
								100.30	—4.00	
5	2D	24/18	5.00 - 7.00	4/4/4/5	8	10	33		Olive, wet, stiff, SILT, some fine sand, trace gravel, (Alluvium).	
							42			
							46			
							42			
10	3D	24/20	9.00 - 11.00	3/3/3/3	6	8	11		Similar to above, but saturated.	G#212222 A-4, ML WC=26.1%
							19			
							21			
							16			
							23			
15	4D	24/16	14.00 - 16.00	4/3/4/6	7	9	35	90.30	—14.00 Olive-brown, wet, loose to medium dense, fine SAND, trace gravel, some silt, (Alluvium).	
							51			
							61			
							73			
							84			
20	5D	24/14	19.00 - 21.00	3/3/5/7	8	10	45		Similar to above.	G#212223 A-2-4, SM WC=28.0%
							61			
							87			
							105			
							116			
25	6D	24/14	24.00 - 26.00	4/6/5/6	11	14	79		Similar to above.	

Remarks:
Used new fixed hydraulic Piston on Tubes.
Casing sheared after boring completed. Left 40 ft of HW casing in borehole.

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
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Page 1 of 7 — Boring No.: BB-BHC-103

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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.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class
25							91		Olive-brown, wet, loose to medium dense, fine SAND, trace gravel, some silt, (Alluvium).	
							95			
							94			
							107	76.30	—28.00	
30	7D	24/18	29.00 - 31.00	5/5/5/4	10	13	77		Olive, brown, saturated, medium dense, fine SAND, some silt.	G#212224 A-2-4, SM WC=28.9%
							91			
							102			
							102			
							78	70.30	—34.00	
35	8D	24/20	34.00 - 36.00	2/1/WOH/1	1	1	86		Grey, saturated, very loose, fine SAND, some silt.	
							79			
							65			
							64	66.80	—37.50	
							61			
40	9D	24/12	39.00 - 41.00	WOR/WOR/WOR/WOR	---		43		Stratified, grey, wet, medium stiff, clay-SILT, with 1" sand layers.	G#212225 A-4, CL-ML WC=34.1%
	V1		40.57 - 41.00	Su=796/55 psf			45		65x130 mm vane raw touque readings: V1: 29.0/2.0 ft-lbs.	
	MV2		41.00 - 41.00	Could not push			47		Failed 65x130 mm vane attempt. Sand layer at 42' bgs.	
							35			
							28	61.30	—43.00	
45	1U	24/24	44.00 - 46.00	Hydraulic Push			37		Grey, wet, very soft to medium stiff, clayey-SILT to silty-CLAY, with trace fine sand in partings and seams. (Glaciomarine)	G.V#211433 A-4, CL WC=32.7% LL=28 PL=21 PI=7
							31			
	V3		46.57 - 47.00	Su=783/110 psf			30		65x130 mm vane raw touque readings: V3: 28.5/4.0 ft-lbs.	
	V4		47.57 - 48.00	Su=632/82 psf			29		V4: 23.0/3.0 ft-lbs.	
							29			
50	10D	24/24	49.00 - 51.00	WOR/WOR/WOR/WOR	---		29		Similar to above.	#211434 WC=31.5%

Remarks:
Used new fixed hydraulic Piston on Tubes.
Casing sheared after boring completed. Left 40 ft of HW casing in borehole.

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Page 2 of 7 — Boring No.: BB-BHC-103

Page 3 of 7

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.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class
50							31		Grey, wet, very soft to medium stiff, clayey-SILT to silty-CLAY, with trace fine sand in partings and seams. (Glaciomarine)	
	V5		51.57 - 52.00	Su=714/124 psf			32		65x130 mm vane raw touque readings: V5: 26.0/4.5 ft-lbs.	
	V6		52.57 - 53.00	Su=879/165 psf			26		V6: 32.0/6.0 ft-lbs.	
							26			
55	2U	24/24	54.00 - 56.00	Hydraulic Push			25		Similar to above.	G.V.C#211460 A-4, CL WC=36.2% LL=29 PL=22 PI=7
							25			
	V7		56.57 - 57.00	Su=687/82 psf			24		65x130 mm vane raw touque readings: V7: 25.0/3.0 ft-lbs.	
	V8		57.57 - 58.00	Su=687/82 psf			22		V8: 25.0/3.0 ft-lbs.	
							22			
60	11D	24/24	59.00 - 61.00	WOR/WOR/WOR/WOR	---		20			#211435 WC=36.1%
							22			
	V9		61.57 - 62.00	Su=618/82 psf			22		65x130 mm vane raw touque readings: V9: 22.5/3.0 ft-lbs.	
	V10		62.57 - 63.00	Su=659/137 psf			15		V10: 24.0/5.0 ft-lbs.	
							15			
65	MU 12D	24/0 24/24	64.00 - 66.00 64.00 - 66.00	WOR/WOR/WOR/WOR	---		19		Similar to above. Missed tube, sucking sand in from washtub. Take spoon through tube interval.	#211436 WC=41.1%
							19			
							11	37.30	—67.00	
							11		Similar to above but dark grey.	
							11			
70	13D	24/24	69.00 - 71.00	WOR/WOR/WOR/WOR	---		23		Missed tube, sucking sand in from washtub. Washed out to 71.0' bgs.	#211437 WC=39.3%
							12			
	V11		71.57 - 72.00	Su=714/82 psf			10		65x130 mm vane raw touque readings: V11: 26.0/3.0 ft-lbs.	
	V12		72.57 - 73.00	Su=769/82 psf			12		V12: 28.0/3.0 ft-lbs.	
							14			
75	3U	24/24	74.00 - 76.00	Hydraulic Push			35			G.V.C#211461 A-6, CL

Remarks:
Used new fixed hydraulic Piston on Tubes.
Casing sheared after boring completed. Left 40 ft of HW casing in borehole.

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Page 3 of 7 — Boring No.: BB-BHC-103

Page 4 of 7

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.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class
75							37		Dark grey, wet, very soft to medium stiff, clayey-SILT to silty-CLAY, with trace fine sand in partings and seams. (Glaciomarine)	WC=38.8% LL=33 PL=21 PI=12
	V13		76.57 - 77.00	Su=769/82 psf			27		65x130 mm vane raw touque readings: V13: 28.0/3.0 ft-lbs.	
	V14		77.57 - 78.00	Su=728/69 psf			21		V14: 26.5/2.5 ft-lbs.	
							21			
80	14D	24/24	79.00 - 81.00	WOR/WOR/WOR/WOR	---		21		Similar to above.	#211438 WC=34.0%
							15			
							16			
							14			
							14			
85	4U	24/24	84.00 - 86.00	Hydraulic Push			27		Similar to above.	G.V#211439 A-4, CL WC=27.2% LL=29 PL=20 PI=9
							20			
	V15		86.57 - 87.00	Su=893/110 psf			22		65x130 mm vane raw touque readings: V15: 32.5/4.0 ft-lbs.	
	V16		87.57 - 88.00	Su=742/110 psf			16		V16: 27.0/4.0 ft-lbs.	
							19			
90	15D	24/24	89.00 - 91.00	WOR/WOR/WOR/WOR	---		31		Similar to above but grey.	#211440 WC=35.7%
							25			
							22			
							23			
							22			
95	5U	24/24	94.00 - 96.00	Hydraulic Push			40		Similar to above.	
							33			
	V17		96.57 - 97.00	Su=838/220 psf			29		65x130 mm vane raw touque readings: V17: 30.5/8.0 ft-lbs.	
	V18		97.57 - 98.00	Su=934/247 psf			27		V18: 34.0/9.0 ft-lbs.	
							29			
100	16D	24/24	99.00 - 101.00	WOR/WOR/WOR/WOR	---		25		Similar to above.	#211441 WC=28.4%

Remarks:
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Page 4 of 7 — Boring No.: BB-BHC-103

Page 5 of 7

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.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class
100							aHP		Grey, wet, very soft to medium stiff, clayey-SILT to silty-CLAY, with trace fine sand in partings and seams. (Glaciomarine) Changed to NW Casing at 100' bgs.. aHP=Hydraulic Push	
105										
110	17D	24/24	109.00 - 111.00	WOR/WOR/WOR/WOR	---				Similar to above.	G#211442 A-6, CL WC=32.2% LL=32 PL=20 PI=12
	V19		111.57 - 112.00	Su=₵1317 psf					65x130 mm vane raw touque readings: V19: ₵48.0 ft-lbs.	
	V20		112.00 - 112.17	Could not push					Failed 65x130 mm vane attempt.	
115							1	-10.70	—115.00	
							7			
							10			
							9			
							7			
120	18D	24/8	119.00 - 121.00	WOH/8/4/4	12	15	11		Grey, saturated, medium dense, fine SAND, some silt (Glaciomarine).	
							2			
							3			
							3			
							3			
125							2			

Remarks:
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Page 5 of 7 — Boring No.: BB-BHC-103

Page 6 of 7

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.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class
125							12		Grey, saturated, medium dense, fine SAND, some silt.	
							26			
							25			
							38			
130	19D	24/15	129.00 - 131.00	25/14/8/7	22	28	9	-25.70	—130.00	G#211443 A-4, ML WC=19.2%
							27		Grey, wet, medium dense, fine to coarse SAND, little gravel, trace silt. (Glaciomarine)	
							57			
							75			
							108			
135							73			
							69			
							119			
	R1	60/24	137.80 - 142.80	RQD = N/A%			187 NQ-2	-33.50	—137.80 R1:COBBLES, BOULDERS and GRAVEL. R1:Core Times (min:sec) 137.8-138.8' (2:25) 138.8-139.8' (2:09) 139.8-140.8' (0:50) 140.8-141.8' (0:31) 141.8-142.8' (0:50) 40% Recovery	
							609			
140							325			
							234			
							347			
							943 RC		Roller Coned ahead to 145.1' bgs.	
145	R2	60/60	145.10 - 150.10	RQD = 42%			NQ-2	-40.80	—145.10 Top of Bedrock at Elev. -40.8'. Bedrock: Grey to greenish grey, fine to coarse-grained biotite, feldspar, quartz, banded GNEISS, with significant Pyrite/Arseno-Pyrite and 1/8 to 1/4-inch pink Garnet crytals, very slight weathering, moderately hard, fractures are horizontal to 45 degrees, some vertical between 147.6' and 148.6', tight to open, very close to close, with minor silt in-filling. [Cushing Formation] R2:Core Times (min:sec) 145.1-146.1' (1:09)	
150										

Remarks:
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Page 6 of 7 — Boring No.: BB-BHC-103

Page 7 of 7

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.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class
150								-45.80	146.1-147.1' (2:25) 147.1-148.1' (2:45) 148.1-149.1' (2:43) 149.1-150.1' (3:44) 100% Recovery —150.10 Bottom of Exploration at 150.10 feet below ground surface.	
155										
160										
165										
170										
175										

Remarks:
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Page 7 of 7 — Boring No.: BB-BHC-103

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
BH-1509(100)X
BRIDGE NO. 3273
PIN 15091.00
BRIDGE PLANS

PROJ. MANAGER		BY	DATE
DESIGN-DETAILED	M. MOREAU	T. WHITE	JAN 2009
CHECKED-REVIEWED			
DESIGN2-DETAILED2			
DESIGN3-DETAILED3			
REVISIONS 1			
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			

SIGNATURE
P.E. NUMBER
DATE

HARWARD'S CROSSING BRIDGE
SAFE HANDLING RAILROAD
BOWDOINHAM SAGADAHOC COUNTY

BORING LOG BB-BHC-103

SHEET NUMBER
5
OF 6

Filename: ...\006_BORING LOG BB-BHC-104.dgn   Division: GEOTECH   Username: terry.white   Date:5/7/2009

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine

Boring No.: BB-BHC-104
PIN: 15091.00

Driller:	MaineDOT	Elevation (ft.)	126.7	Auger ID/OD:	5" Solid Stem
Operator:	E. Giguere/C. Giles	Datum:	NAVD 88	Sampler:	Standard Split Spoon
Logged By:	M. Moreau	Rig Type:	CME 45C	Hammer Wt./Fall:	140#/30"
Date Start/Finish:	9/15-22/08	Drilling Method:	Cased Wash Boring	Core Barrel:	NQ-2"
Boring Location:	15+22.4, 7.3 Lt.	Casing ID/OD:	HW & NW	Water Level*:	13.6' bgs.
Hammer Efficiency Factor: 0.77		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.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class
0	1D/AB	24/17	0.80 - 2.80	6/4/4/3	8	10	SSA	125.90 125.30	PAVEMENT. ——0.80 (1D/A) 0.8-1.4' bgs. Brown, damp, loose, fine to coarse SAND, some gravel, trace silt, (Fill). ——1.40 (1D/B) 1.4-2.8' bgs. Brown, damp, loose, fine to medium silty SAND, trace gravel, mottled, (Fill).	G#211445 A-1-b, SW-SM WC=4.1% G#211446 A-4, SM WC=16.3%
5	2D	24/22	5.00 - 7.00	2/2/3/2	5	6	11			
							17			
							27			
							23			
	3D	24/14	9.00 - 11.00	2/2/2/6	4	5	9		Similar to above, but moist.	G#211447 A-4, SM WC=21.3%
10							18			
							37			
							12			
							28	113.10	——13.60	
	4D	24/6	14.00 - 16.00	2/1/2/1	3	4	9		Stratified, brown, wet, very loose, silty fine to medium SAND, with numerous thin seams of brown, sandy silt 1-2 mm thick, mottled, (Alluvium).	
15							15			
							18			
							19			
							21			
	5D	24/12	19.00 - 21.00	3/1/2/2	3	4	18		Similar to above, but less frequent silt seams.	G#211448 A-4, SM WC=26.8%
20							22			
							29			
							44			
							62			
	6D	24/15	24.00 - 26.00	4/2/5/9	7	9	33		Similar to above, but loose.	
25										

Remarks:

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Maine Department of Transportation
Soil/Rock Exploration Log
US CUSTOMARY UNITS
Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine
Boring No.: BB-BHC-104
PIN: 15091.00
Driller: MaineDOT | Elevation (ft.) 126.7 | Auger ID/OD: 5" Solid Stem
Operator: E. Giguere/C. Giles | Datum: NAVD 88 | Sampler: Standard Split Spoon
Logged By: M. Moreau | Rig Type: CME 45C | Hammer Wt./Fall: 140#/30"
Date Start/Finish: 9/15-22/08 | Drilling Method: Cased Wash Boring | Core Barrel: NQ-2"
Boring Location: 15+22.4, 7.3 Lt. | Casing ID/OD: HW & NW | Water Level*: 13.6' bgs.
Hammer Efficiency Factor: 0.77 | Hammer Type: Automatic ☒ Hydraulic ☐ Rope & Cathead ☐

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.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class
25							67		Stratified, brown, wet, very loose, silty fine to medium SAND, with numerous thin seams of brown, sandy silt 1-2 mm thick, mottled, (Alluvium). Predominantly SILT layers with little sand after 26.0' bgs.	
							118			
							114			
							106			
	7D	24/20	29.00 - 31.00	7/7/3/6	10	13	56		More numerous silt seams, stiff, silty sand layers dilatant.	G#211449 A-4, ML WC=28.2%
30							50			
							60			
							52			
							54			
	8D	24/17	34.00 - 36.00	3/2/2/1	4	5	48		Numerous silt seams, medium stiff, silty sand is dilatant.	
35							51			
							54			
							56			
							47			
	9D	24/15	39.00 - 41.00	5/5/5/7	10	13	48		Fewer silt seams after 37.5' bgs. One silt seam at 39.0- 39.1' bgs and one black and orange silty fine to medium sand layer at 39.5- 39.8' bgs.	
40							54			
							62			
							70			
							72			
	10D	24/17	44.00 - 46.00	4/4/4/6	8	10	61		No silt seams.	G#211450 A-2-4, SM WC=26.3%
45							91			
							88			
							79			
							86			
	11D	24/20	49.00 - 51.00	7/2/1/2	3	4	52	77.20	Similar to above to 49.5' bgs. ——49.50 Grey, wet, soft to medium stiff, fine sandy SILT, with	
50										

Remarks:

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: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine
Boring No.: BB-BHC-104
PIN: 15091.00

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.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class
50							66		few silt seams 2-4 mm thick, (Glacoimarine).	
							69			
							67			
							64			
	12D	24/14	54.00 - 56.00	6/3/1/1	4	5	89		Similar to above.	G#212226 A-4, ML WC=28.0%
55							81			
							74	69.70	——57.00	
							75			
							66			
	13D	24/20	59.00 - 61.00	WOR/WOR/WOR/WOR	---		63		Stratified, grey, wet, very soft, clay-SILT with silty fine sand seams 2-5 mm thick, (Glaciomarine).	
60							51	66.30	——60.40 Grey, wet, very soft to stiff, clayey-SILT with trace fine sand in partings and occasional silty fine sand seams less than 1 mm thick, (Glaciomarine).	
							42			
							38			
							43			
							38			
65	V1		65.00 - 65.43	Su=687/104 psf			52		65x130 mm raw torque readings: 25.0/3.8 ft-lbs	
	V2		66.00 - 66.43	Su=599/102 psf			82		21.8/3.7 ft-lbs	
							77			
							67			
	MU 14D	24/0 24/24	69.00 - 71.00 69.00 - 71.00	Hydraulic Push WOR/WOR/WOR/WOR	---		79		Failed tube attempt, no recovery. Took spoon sample through tube interval.	G#212227 A-4, CL-ML WC=32.8% LL=26 PL=20 PI=6
70							63			
							49			
							48			
							45			
	1U	24/6	74.00 - 76.00	Hydraulic Push			59			
75										

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Maine Department of Transportation
Soil/Rock Exploration Log
US CUSTOMARY UNITS
Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine
Boring No.: BB-BHC-104
PIN: 15091.00

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.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class
75							59		Grey, wet, very soft to stiff, clayey-SILT with trace fine sand in partings and occasional silty fine sand seams less than 1 mm thick, (Glaciomarine).	
	V3		76.00 - 76.43	Su=508/74 psf			46		Washed ahead to 76.0' bgs. 65x130 mm raw torque readings:	
	V4		77.00 - 77.43	Su=514/82 psf			34		18.5/2.7 ft-lbs 18.7/3.0 ft-lbs	
							26			
	2U	24/24	79.00 - 81.00	Hydraulic Push			52		Similar to above but CLAY with some silt.	G,C,V#212228 A-6, CL WC=41.8% LL=31 PL=20 PI=11
80							49			
							44			
	V5		82.00 - 82.43	Su=582/71 psf			36		65x130 mm raw torque readings: 21.2/2.6 ft-lbs	
	V6		83.00 - 83.43	Su=530/77 psf			36		19.3/2.8 ft-lbs After 83.0' bgs, casing advance indicates numerous silty fine sand seams.	
	15D	24/24	84.00 - 86.00	WOR/WOR/WOR/WOR	---		53		Washed ahead to 89.0' bgs, after taking spoon sample at 84'-86' bgs. Changed to NW Casing at 85.0' bgs. Bottom section of casing spun off column, telescped NW Casing through separated section and continued hole.	#212229 WC=37.3%
85							26			
							WOC			
90	16D V7	24/24	90.50 - 92.50 90.50 - 90.93	WOR/WOR/WOR/WOR Su=233/63 psf	---				Few silty fine sand seams and numerous black manganese stains after 90.0' bgs. Spoon through vane interval. 65x130 mm raw torque readings:	G#212230 A-6, CL WC=33.9% LL=34 PL=21 PI=13
	V8		91.50 - 91.93	Su=239/58 psf					8.5/2.3 ft-lbs 8.7/2.1 ft-lbs	
	17D	24/24	94.00 - 96.00	WOR/WOR/WOR/WOR	---					#212231 WC=36.2%
95										
	18D V9	24/24	99.00 - 101.00	WOR/WOR/WOR/WOR Su=931/27 psf	---				Spoon through vane interval. 65x130 mm raw torque readings: 33.9/1.0 ft-lbs	G#212232 A-4, CL
100										

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Maine Department of Transportation
Soil/Rock Exploration Log
US CUSTOMARY UNITS
Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine
Boring No.: BB-BHC-104
PIN: 15091.00

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.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class
100	V10		99.00 - 99.43 100.00 - 100.43	Su=862/27 psf			WOC		31.4/1.0 ft-lbs Grey, wet, very soft to stiff, clayey-SILT with trace fine sand in partings and occasional silty fine sand seams less than 1 mm thick, (Glaciomarine).	WC=36.4%
105										
	MD	24/0	109.00 - 111.00				aHYD		Failed sample attempt. aHydraulic Push Casing at 100 psi.	
110										
115										
							34			
120	V11		120.00 - 120.43	Su=860/74 psf			16		65x130 mm raw torque readings: 31.3/2.7 ft-lbs	
	V12		121.00 - 121.43	Su=920/74 psf			14		33.5/2.7 ft-lbs	
							12			
							12			
							10			
125										

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Maine Department of Transportation
Soil/Rock Exploration Log
US CUSTOMARY UNITS
Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine
Boring No.: BB-BHC-104
PIN: 15091.00

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.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class
125							10		Grey, wet, very soft to stiff, clayey-SILT with trace fine sand in partings and occasional silty fine sand seams less than 1 mm thick, (Glaciomarine).	
							10			
							8			
							8			
	19D	24/17	129.00 - 131.00	WOR/WOR/WOR/WOR	---		32		Similar to above but with little sand and trace gravel.	G#212233 A-4, CL WC=26.1% LL=23 PL=16 PI=7
130	V13 V14		130.00 - 130.43 130.90 - 131.33	Su=785/49 psf 1162/93 psf			10		More numerous silty fine sand seams after 130.0' bgs, some 3-5 mm thick. 65x130 mm raw torque readings: 28.6/1.8 ft-lbs 42.3/3.4 ft-lbs Refusal on vane advance at 131.3' bgs.	
							60			
							30			
							31			
							30			
135							54	-8.60	——135.30	
							91			
							70			
							109			
	20D	24/10	139.00 - 141.00	11/22/39/14	61	78	81		Grey, wet, very dense, fine to coarse sandy SILT, little gravel, occasional cobbles, well graded, (Till).	G#212234 A-4, SM WC=11.6%
140							99			
	R1	58/58	141.50 - 146.33	RQD = 16%			b67 NQ-2	-14.80	b67 blows for 0.5'. Casing bounce at 141.5' bgs, used roller cone to determine cobble or bedrock. ——141.50 Top of Bedrock at Elev. -14.8'. Bedrock: Greenish grey and white, fine to coarse-grained, biotite, feldspar, quartz GNEISS, moderately hard, slight weathering, fractures from horizontal to vertical, open, very close, with minor silt in-filling, some healed. [Cushing Formation] R1:Core Times (min:sec) 141.5-142.5' (4:55) 142.5-143.5' (4:35) 143.5-144.5' (4:42) 144.5-145.5' (2:56) 145.5-146.3' (2:13) 100% Recovery	
145								-19.60	——146.30 Bottom of Exploration at 146.30 feet below ground surface.	
150										

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STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
BH-1509(100)X
PIN 15091.00
BRIDGE NO. 3273
BRIDGE PLANS

		BY	DATE
PROJ. MANAGER			
DESIGN-DETAILED	M. MOREAU	T. WHITE	JAN 2009
CHECKED-REVIEWED			
DESIGN2-DETAILED2			
DESIGN3-DETAILED3			
REVISIONS 1			
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			

SIGNATURE
P.E. NUMBER
DATE

HARWARD'S CROSSING BRIDGE
SAFE HANDLING RAILROAD
BOWDOINHAM SAGADAHOC COUNTY

BORING LOG BB-BHC-104

SHEET NUMBER
6
OF 6

APPENDIX - B

Field Exploration and Test Data

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine

Boring No.: BB-BHC-101
PIN: 15091.00

Driller:	MaineDOT	**Elevation (ft.)**	121.5	**Auger ID/OD:**	N/A
Operator:	E. Giguere/C. Giles	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	M. Moreau	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	9/23/08, 9/30/08	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	12+51.2, 7.0 Rt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	17.5' bgs.
Hammer Efficiency Factor:	0.77	**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							1			Brown, very soft, wet, fine to medium sandy SILT, dilatant, (Fill).	
							7				
							6				
							5				
	1D	24/6	4.00 - 6.00	WOH/WOH/WOH/ WOH	---		4				G#211462 A-4, ML WC=30.4%
5							4				
							7				
							10				
							13				
	2D	24/10	9.00 - 11.00	2/1/1/2	2	3	6			One silt seam 5 mm thick at 9.2' bgs.	
10							12				
							39				
							39				
							25				
	3D	24/3	14.00 - 16.00	3/1/1/1	2	3	14			Same as above.	
15							14				
							14				
							15	104.00		17.50	
							17			Brown and occasional black and orange layers between 19.0-20.0' bgs, mottled, stratified, brown, wet, loose, silty fine to medium SAND, trace gravel and numerous silt layers 1-3 mm thick, (Alluvium). One silty fine to coarse sand layer at 19.5- 19.7', silty sand is dilatant. Water at top of alluvium at 17.5' bgs.	
	4D	24/15	19.00 - 21.00	2/2/3/5	5	6	15				G#211463 A-4, SM WC=24.6%
20							38				
							45				
							47				
							43				
25	5D	24/10	24.00 - 26.00	3/2/4/2	6	8	53			Same as above.	

Remarks:

1.0 ft thick concrete Bridge Deck.
Bridge Deck to Ground Surface 10.4 ft.
Total NW Casing 155.5 ft from deck, 145.5 ft from soil.
Total HW Casing 105.5 ft from deck.

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: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine

Boring No.: BB-BHC-101
PIN: 15091.00

Driller:	MaineDOT	**Elevation (ft.)**	121.5	**Auger ID/OD:**	N/A
Operator:	E. Giguere/C. Giles	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	M. Moreau	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	9/23/08, 9/30/08	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	12+51.2, 7.0 Rt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	17.5' bgs.
Hammer Efficiency Factor:	0.77	**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
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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							47				
							50				
							49				
							59			Few silt layers and medium dense between 28.0-44.0' bgs.	
								92.50		29.00	
	6D	24/17	29.00 - 31.00	5/7/6/11	13	17	86			Brown, wet, medium dense, fine to medium SAND, little silt (Alluvium).	G#211464 A-2-4, SM WC=26.0%
30							118				
							152				
							161				
							156				
	7D	24/14	34.00 - 36.00	5/5/6/5	11	14	66			One silt layer 0.1' thick between 34.6- 34.7' bgs, sand layers are alternating orange and brown color.	
35							86				
							95				
							101				
							122				
	8D	24/10	39.00 - 41.00	6/8/7/6	15	19	96			Similar to above, but trace gravel.	G#211465 A-2-4, SM WC=29.8%
40							127				
							141				
							138				
							132				
	9D	24/20	44.00 - 46.00	6/5/2/2	7	9	87			More numerous silt layers after 44.0' bgs. One silt layer 0.2' thick between 50.7' and 50.9' bgs.	
45							91				
							99				
							109				
							117	73.50		48.00	
	10D	24/15	49.00 - 51.00	7/8/6/6	14	18	106			Stratified, grey, wet, medium dense to very loose, silty fine to medium SAND and numerous silt layers 1-3 mm thick, occasionally 1 cm thick, sand is dilatant, (Glaciomarine).	G#211466 A-4, SM
50											

Remarks:

1.0 ft thick concrete Bridge Deck.
Bridge Deck to Ground Surface 10.4 ft.
Total NW Casing 155.5 ft from deck, 145.5 ft from soil.
Total HW Casing 105.5 ft from deck.

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: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine

Boring No.: BB-BHC-101
PIN: 15091.00

Driller:	MaineDOT	**Elevation (ft.)**	121.5	**Auger ID/OD:**	N/A
Operator:	E. Giguere/C. Giles	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	M. Moreau	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	9/23/08, 9/30/08	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	12+51.2, 7.0 Rt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	17.5' bgs.
Hammer Efficiency Factor:	0.77	**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.
50							123			Stratified, grey, wet, medium dense to very loose, silty fine to medium SAND and numerous silt layers 1-3 mm thick, (Glaciomarine).	WC=25.8%
							109				
							112				
							91				
	11D	24/20	54.00 - 56.00	WOH/WOH/WOH/ WOH	---		83			One grey clay-silt layer from 54.7-55.0' bgs.	G#211467 A-4, CL-ML WC=24.2%
55							85				
							67				
							72			Silt layers predominant after 57.0' bgs.	
							56				
	12D	24/20	59.00 - 61.00	WOH/WOH/WOH/ WOH	---		59				
60							71				
							71				
							62				
							61				
	13D	24/17	64.00 - 66.00	WOR/WOR/WOR/ WOR	---		66	57.40		64.10	#211468 WC=30.1%
65							62			Grey, wet, very soft to stiff, clayey-SILT to silty CLAY with trace fine sand in seams and partings, (Glaciomarine)	
							66				
							65				
							58				
							58				
70	14D	24/24	70.50 - 72.50	WOR/WOR/WOR/ WOR	---		66			Drove casing to 70.5' bgs, end of day. 37 blows to 70.5', 29 blows from 70.5-71.0' bgs. Spoon through vane interval.	G#211469 A-4, CL WC=30.6% LL=28 PL=20 PI=8
	V1		71.47 - 71.90	Su=665/137 psf			66			65x130 mm vane raw torque readings: V1: 24.2/5.0 ft-lbs	
	V2		72.47 - 72.90	Su=643/132 psf			55			passed several silty fine sand layers advancing vane. V2: 23.4/4.8 ft-lbs	
							56				
75	1U	24/24	74.00 - 76.00	Hydraulic Push			45				

Remarks:

1.0 ft thick concrete Bridge Deck.
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Total HW Casing 105.5 ft from deck.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine

Boring No.: BB-BHC-101
PIN: 15091.00

Driller:	MaineDOT	**Elevation (ft.)**	121.5	**Auger ID/OD:**	N/A
Operator:	E. Giguere/C. Giles	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	M. Moreau	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	9/23/08, 9/30/08	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	12+51.2, 7.0 Rt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	17.5' bgs.
Hammer Efficiency Factor:	0.77	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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SSA = Solid Stem Auger
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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							30			Grey, wet, very soft to stiff, clayey-SILT to silty CLAY with trace fine sand in seams and partings, (Glaciomarine)	
							26				
	V3		77.00 - 77.43	Su=634/129 psf			24			65x130 mm vane raw torque readings: V3: 23.1/4.7 ft-lbs	
	V4		78.00 - 78.43	Su=656/137 psf			21			V4: 23.9/5.0 ft-lbs occasional silty fine sand seams apparent on vane advance.	
							33				
80							41				
							39				
							38				
							38				
	15D	24/24	84.00 - 86.00	WOR/WOR/WOR/ WOR	---		43			Spoon through vane interval. occasional fine sand seams in spoon and black manganese stains after 84.0' bgs.	#211470 WC=40.2%
85	V5		85.00 - 85.43	Su=665/99 psf			52			65x130 mm vane raw torque readings: V5: 24.2/3.6, ft-lbs	
	V6		86.00 - 86.43	Su=720/85 psf			50			V6: 26.2/3.1 ft-lbs	
							42				
							37				
	MU ~~16D~~	24/0 ~~24/24~~	89.00 - 91.00 ~~89.00 - 91.00~~	WOR/WOR/WOR/ WOR	---		61			Missed tube sample. Spoon through tube interval.	#211471 WC=38.0%
90							53				
							48				
							37				
							39				
							35				
95							47				
							50				
							49				
							54				
100	17D	24/24	99.00 - 101.00	WOR/WOR/WOR/ WOR	---		72			Spoon through vane interval, no silty fine sand layers advancing vane or in spoon.	#211472 WC=36.9%

Remarks:

1.0 ft thick concrete Bridge Deck.
Bridge Deck to Ground Surface 10.4 ft.
Total NW Casing 155.5 ft from deck, 145.5 ft from soil.
Total HW Casing 105.5 ft from deck.

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: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine

Boring No.: BB-BHC-101
PIN: 15091.00

Driller:	MaineDOT	**Elevation (ft.)**	121.5	**Auger ID/OD:**	N/A
Operator:	E. Giguere/C. Giles	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	M. Moreau	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	9/23/08, 9/30/08	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	12+51.2, 7.0 Rt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	17.5' bgs.
Hammer Efficiency Factor:	0.77	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
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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
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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	V7		100.00 - 100.43	Su=887/85 psf			87			65x130 mm vane raw torque readings: V7: 32.3/3.1 ft-lbs	
	V8		101.00 - 101.43	Su=843/135 psf			125			Grey, wet, very soft to stiff, clayey-SILT to silty CLAY with trace fine sand in seams and partings, (Glaciomarine) V7: 30.7/4.9 ft-lbs	
							103				
							91				
	2U	24/24	104.00 - 106.00	Hydraulic Push			85				G,V#211473 A-4, CL WC=34.7% LL=29 PL=21 PI=8
105							[a]32			[a]32 blows for 6", then changed to NW Casing with hydraulic push for remanding 6". [b]HP=Hydraulic Push	
							[b]HP				
	V9		107.00 - 107.43	Su=901/168 psf			HP			65x130 mm vane raw torque readings: V9: 32.8/6.1 ft-lbs	
	V10		108.00 - 108.43	Su=860/170 psf			HP			V10: 31.3/6.2 ft-lbs	
							HP				
110							23				
							23				
							26				
							28				
	18D	24/24	114.00 - 116.00	WOR/WOR/WOR/ WOR	---		9			Spoon through vane interval.	#211474 WC=31.7%
115	V11		115.00 - 115.43	Su=915/179 psf			19			65x130 mm vane raw torque readings: V11: 33.3/6.5 ft-lbs	
	V12		116.00 - 116.43	Su=1008/200 psf			24			V12: 36.7/7.3 ft-lbs	
							27				
							32				
							30				
120							35				
							39				
							39				
							44				
125	19D	24/24	124.00 - 126.00	WOR/WOR/WOR/ WOR	---		18			Grey, wet, very soft to stiff, silty CLAY, with trace fine sand in seams and partings.	G#211475 A-6, CL

Remarks:

1.0 ft thick concrete Bridge Deck.
Bridge Deck to Ground Surface 10.4 ft.
Total NW Casing 155.5 ft from deck, 145.5 ft from soil.
Total HW Casing 105.5 ft from deck.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine

Boring No.: BB-BHC-101
PIN: 15091.00

Driller:	MaineDOT	**Elevation (ft.)**	121.5	**Auger ID/OD:**	N/A
Operator:	E. Giguere/C. Giles	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	M. Moreau	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	9/23/08, 9/30/08	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	12+51.2, 7.0 Rt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	17.5' bgs.
Hammer Efficiency Factor:	0.77	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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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
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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.
125							25			Grey, wet, very soft to stiff, clayey-SILT to silty CLAY with trace fine sand in seams and partings, (Glaciomarine)	WC=35.2% LL=32 PL=22 PI=10
							27				
							33				
							34				
							36				
130							40				
							42				
							38				
							39				
	20D	24/24	134.00 - 136.00	WOR/WOR/WOR/ WOR	---		HYD			NW Casing broke at 20.0 ft below surface after sample 20D. Retrieved casing flushed hole and readvanced casing to 144.0 ft with hydraulic push.	G#212201 A-6, CL WC=31.5% LL=30 PL=20 PI=10
135							PUSH				
140											
							13				
							14				
							34			Drive casing to 145.5 ft bgs - End of Day	
145	21D	24/24	145.50 - 147.50	WOR/WOR/WOR/ WOR	---		33			Grey, wet, very soft, clay-SILT, with trace fine sand, trace gravel.	
							46				
							40				
							24				
150							24				

Remarks:

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US CUSTOMARY UNITS

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Location: Bowdoinham, Maine

Boring No.: BB-BHC-101
PIN: 15091.00

Driller:	MaineDOT	**Elevation (ft.)**	121.5	**Auger ID/OD:**	N/A
Operator:	E. Giguere/C. Giles	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	M. Moreau	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	9/23/08, 9/30/08	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	12+51.2, 7.0 Rt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	17.5' bgs.
Hammer Efficiency Factor:	0.77	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
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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.
150							WOC				
							WOC				
							WOC			5" of running sand, rewashed, kept full column of water pressure in casing on sand.	
							WOC				
								-32.50		154.00	
	22D	24/13	154.00 - 156.00	2/2/3/2	5	6	29			Grey, wet, loose, fine to medium SAND, trace gravel and silt (Glaciomarine).	G#212202 A-3, SP WC=20.6%
155							22				
							87				
							125	-35.50		157.00	
							196			Changed to Till at 157 ft bgs.	
							191				
160							244				
							257				
							313			Grey, wet, very dense, fine to coarse SAND, trace gravel, little silt. (Till)	
							272				
	23D R1	9.6/9.6 60/60	164.00 - 164.80	17/60(3.6") RQD = 80%	---		[a]250 NQ-2			[a]250 blows for 0.8'.	G#212203 A-2-4, SM WC=13.8%
165			164.80 - 169.80					-43.30		164.80 Top of Bedrock at Elev. -43.3'. Bedrock: White to reddish grey, fine to coarse-grained biotite, feldspar, quartz, banded GNEISS, slightly weathered, moderately hard, fractures are horizontal to 30 degrees, tight to open, very close to close, with very minor silt in-filling. [Cushing Formation] R1:Core Times (min:sec) 164.8-165.8' (2:45) 165.8-166.8' (2:23) 166.8-167.8' (2:10) 167.8-168.8' (2:09) 168.8-169.8' (2:11) 100% Recovery	
170								-48.30		169.80	
										Bottom of Exploration at 169.80 feet below ground surface.	
175											

Remarks:

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Total NW Casing 155.5 ft from deck, 145.5 ft from soil.
Total HW Casing 105.5 ft from deck.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine

Boring No.: BB-BHC-102
PIN: 15091.00

Driller:	Northern Test Boring	**Elevation (ft.)**	104.5	**Auger ID/OD:**	5" Solid Stem
Operator:	Mike/Nick	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	Diedrich D-50	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	9/22-25/08	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	13+48.8, 19.0 Lt.	**Casing ID/OD:**	HW	**Water Level*:**	8.0' bgs.
Hammer Efficiency Factor:	0.633	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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SSA = Solid Stem Auger
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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
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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	24/16	0.00 - 2.00	3/2/2/2	4	4	SSA	104.20		TOPSOIL, (Sod). 0.30	G#212204 A-2-4, SM WC=14.6%
										Brown, damp, loose, fine to medium SAND, little gravel, some silt.	
								101.50		3.00	
5	2D	24/24	5.00 - 7.00	4/5/7/8	12	13				Brown, damp to wet, very loose to medium dense, fine SAND, trace gravel, trace to some silt. (Alluvium)	
10	3D	24/20	10.00 - 12.00	3/1/2/1	3	3	[a]HP			[a]HP=Hrdraulic Push	G#212205 A-2-4, SM WC=22.4%
15	4D	24/18	15.00 - 17.00	2/2/2/1	4	4					
							74				
							72				
20	5D	24/14	20.00 - 22.00	4/8/10/8	18	19	[a]HP				G#212206 A-3, SP-SM WC=25.5%
								81.50		23.00	
25	6D	24/14	24.00 - 26.00	3/3/6/6	9	9				Brown, wet, stiff, SILT, some fine sand. (Glaciomarine)	

Remarks:

Auto Hammer #283

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine

Boring No.: BB-BHC-102
PIN: 15091.00

Driller:	Northern Test Boring	**Elevation (ft.)**	104.5	**Auger ID/OD:**	5" Solid Stem
Operator:	Mike/Nick	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	Diedrich D-50	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	9/22-25/08	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	13+48.8, 19.0 Lt.	**Casing ID/OD:**	HW	**Water Level*:**	8.0' bgs.
Hammer Efficiency Factor:	0.633	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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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							[a]HP			Brown, wet, stiff, SILT, some fine sand. (Glaciomarine)	
	7D	24/18	29.00 - 31.00	4/3/3/3	6	6					G#212207 A-4, ML WC=27.1%
30											
	8D	24/19	34.00 - 36.00	3/2/2/4	4	4		70.50		34.00 Grey, wet, soft, SILT, some fine sand, trace clay. (Glaciomarine)	
35											
	9D	24/24	39.00 - 41.00	2/2/2/2	4	4				Similar to above but trace organics.	G#212208 A-4, CL-ML WC=28.1%
40											
	10D	24/24	44.00 - 46.00	WOR/WOR/WOR/ WOR	---			60.00		44.50 Grey, wet, very soft to medium stiff, clayey-SILT, trace fine sand in partings and seams. (Glaciomarine)	#212209 WC=25.0%
45											
	[b]1U	24/21	49.00 - 51.00	Hydraulic Push						[b]Gus Piston Sample. Similar to above.	G,V#212210 A-4, CL-ML
50											

Remarks:

Auto Hammer #283

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Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine

Boring No.: BB-BHC-102
PIN: 15091.00

Driller:	Northern Test Boring	**Elevation (ft.)**	104.5	**Auger ID/OD:**	5" Solid Stem
Operator:	Mike/Nick	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	Diedrich D-50	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	9/22-25/08	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	13+48.8, 19.0 Lt.	**Casing ID/OD:**	HW	**Water Level*:**	8.0' bgs.
Hammer Efficiency Factor:	0.633	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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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							[a]HP			Grey, wet, very soft to medium stiff, clayey-SILT, trace fine sand in partings and seams. (Glaciomarine)	WC=28.3% LL=27 PL=22 PI=5
	11D	24/24	54.00 - 56.00	WOR/WOR/WOR/ WOR	---						#212211 32.7%
55	V1		56.57 - 57.00	Su=288/55 psf						65x130 mm vane raw torque readings: V1: 10.5/2.0 ft-lbs V2: 18.0/4.0 ft-lbs	
	V2		57.57 - 58.00	Su=494/110 pdf							
	2U	24/24	59.00 - 61.00	Hydraulic Push						Similar to above.	G,V,C#211458 A-4, CL WC=34.2% LL=28 PL=19 PI=9
60	V3		61.57 - 62.00	Su=275/55 psf						65x130 mm vane raw torque readings: V3: 10.0/2.0 ft-lbs V4: 21.0/4.5 ft-lbs	
	V4		62.57 - 63.00	Su=577/124 psf							
	12D	24/24	64.00 - 66.00	WOR/WOR/WOR/ WOR	---					Similar to above.	#212212 WC=40.1%
65	3U	24/24	69.00 - 71.00	Hydraulic Push						Similar to above.	G,V,C#211459 A-4, ML WC=38.6% LL=32 PL=24 PI=8
70	V5		71.57 - 72.00	Su=769/82 psf						65x130 mm vane raw torque readings: V5: 28.0/3.0 ft-lbs V6: 22.2/2.0 ft-lbs	
	V6		72.57 - 73.00	Su=604/55 psf							
	13D	24/24	74.00 - 76.00	WOR/WOR/WOR/ WOR	---						#212213 WC=36.1%
75											

Remarks:

Auto Hammer #283

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine

Boring No.: BB-BHC-102
PIN: 15091.00

Driller:	Northern Test Boring	**Elevation (ft.)**	104.5	**Auger ID/OD:**	5" Solid Stem
Operator:	Mike/Nick	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	Diedrich D-50	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	9/22-25/08	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	13+48.8, 19.0 Lt.	**Casing ID/OD:**	HW	**Water Level*:**	8.0' bgs.
Hammer Efficiency Factor:	0.633	**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.
75							[a]HP			Grey, wet, very soft to medium stiff, clayey-SILT, trace fine sand in partings and seams. (Glaciomarine)	
	4U	24/24	79.00 - 81.00	Hydraulic Push						Similar to above but dark grey.	
80	V7		81.57 - 82.00	Su=851/69 psf						65x130 mm vane raw torque readings: V7: 31.0/2.5 ft-lbs V8: 34.0/2.5 ft-lbs	
	V8		82.57 - 83.00	Su=934/69 psf							
	14D	24/24	84.00 - 86.00	WOR/WOR/WOR/ WOR	---					Similar to above but grey.	#212214 WC=33.9%
85											
	5U	24/24	89.00 - 91.00	Hydraulic Push							G,V#212215 WC=33.0% LL=27 PL=20 PI=7
90	V9		91.57 - 92.00	Su=906/192 psf						65x130 mm vane raw torque readings: V9: 33.0/7.0 ft-lbs V10: 27.0/5.5 ft-lbs	
	V10		92.57 - 93.00	Su=742/151 psf							
	15D	24/24	94.00 - 96.00	WOR/WOR/WOR/HP	---						#212216 WC=30.8%
95										Similar to above but trace gravel and more silty sand layers after 94' bgs.	
100											

Remarks:

Auto Hammer #283

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine

Boring No.: BB-BHC-102
PIN: 15091.00

Driller:	Northern Test Boring	**Elevation (ft.)**	104.5	**Auger ID/OD:**	5" Solid Stem
Operator:	Mike/Nick	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	Diedrich D-50	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	9/22-25/08	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	13+48.8, 19.0 Lt.	**Casing ID/OD:**	HW	**Water Level*:**	8.0' bgs.
Hammer Efficiency Factor:	0.633	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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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 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	16D MV11	24/24	100.00 - 102.00	WOR/WOR/WOR/ WOH	---		[a]HP			Similar to above but dark grey. Failed 65x130 mm Vane attempt.	#212217 WC=34.5%
			100.00 - 100.10	Could not Push							
105	MU	24/0	105.00 - 107.00	Hydraulic Push						Failed Tube attempt.	
	17D	24/24	107.00 - 109.00	WOR/WOR/WOR/HP	---					Similar to above.	G#212218 A-6, CL WC=29.7% LL=30 PL=20 PI=10
110	V12		110.57 - 111.00	Su=1167/137 psf						65x130 mm vane raw torque readings: V12: 42.5/5.0 ft-lbs	
	V13		111.57 - 112.00	Su=1181/110 psf						V13: 43.0/4.0 ft-lbs	
							75	-8.70		113.20	
							101				
115	18D	24/3	115.00 - 117.00	7/9/14/11	23	24	156			Grey, wet, medium dense, fine to coarse SAND, some gravel to gravelly, some silt, (Till). Roller Coned ahead of casing from 115.0-125.0' bgs.	
							104				
							101				
							106				
							105				
120							115				
							117				
							253				
							263				
125							207				

Remarks:

Auto Hammer #283

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine

Boring No.: BB-BHC-102
PIN: 15091.00

Driller:	Northern Test Boring	**Elevation (ft.)**	104.5	**Auger ID/OD:**	5" Solid Stem
Operator:	Mike/Nick	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	Diedrich D-50	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	9/22-25/08	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	13+48.8, 19.0 Lt.	**Casing ID/OD:**	HW	**Water Level*:**	8.0' bgs.
Hammer Efficiency Factor:	0.633	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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SSA = Solid Stem Auger
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WOH = weight of 140lb. hammer
WOR/C = weight of rods or casing
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S_u = Insitu Field Vane 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
$S_{u(lab)}$ = 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.
125	19D	24/12	125.00 - 127.00	56/18/11/8	29	31	104			Grey, wet, medium dense, fine to coarse SAND, some gravel to gravelly, some silt, (Till).	G#212219 A-1-b, SM WC=9.0%
							110			Roller Coned ahead of casing from 135.0-151.6' bgs.	
							105				
							77				
							101				
130							102				
							122				
							199				
							213				
							251				
135	20D	24/3	135.00 - 137.00	17/7/9/10	16	17	156			Similar to above.	
							205				
							213				
							300				
							336				
140							480				
							480				
							592				
							637				
							600				
145	21D	24/13	145.00 - 147.00	3/2/8/17	10	11	343	-40.50		145.00 Grey, wet, loose, fine to medium SAND, little gravel, trace silt.	G#212220 A-1-b, SP WC=18.8%
							592				
							792				
							1015				
150							152			Cobbles.	

Remarks:

Auto Hammer #283

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine

Boring No.: BB-BHC-102
PIN: 15091.00

Driller:	Northern Test Boring	**Elevation (ft.)**	104.5	**Auger ID/OD:**	5" Solid Stem
Operator:	Mike/Nick	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	Diedrich D-50	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	9/22-25/08	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	13+48.8, 19.0 Lt.	**Casing ID/OD:**	HW	**Water Level*:**	8.0' bgs.
Hammer Efficiency Factor:	0.633	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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RC = Roller Cone
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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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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.
150							RC	-45.50		150.00 Weathered ROCK. Roller-coned ahead to 151.6' bgs.	
	R1	50.4/50.4	151.60 - 155.80	RQD = 32%			NQ-2	-47.10		151.60 Top of Intact Bedrock at Elev. -47.1'. Bedrock: Top half greenish to brownish tan, bottom half dark grey, fine to coarse-grained biotite, feldspar, quartz, banded GNEISS, green due to feldpar Amazonite, brown due to iron oxide, slight to moderate weathering, moderately hard, fractures are horizontal to 45 degrees, open, very close to close, with minor silt in-filling, jointing is largely healed. [Cushing Formation] R1:Core Times (min:sec) 151.6-152.6' (3:54) 152.6-153.6' (3:02) 153.6-154.6' (2:05) 154.6-155.6' (1:41) 155.6-155.8' (1:50) 100% Recovery Core Blocked, roller coned ahead to 155.8' bgs to clean out casing.	
155	R2	33.6/20	155.80 - 158.60	RQD = 0%				-51.30			
								-54.10		155.80 R2:Core Times (min:sec) 155.8-156.8' (5:00) 156.8-157.8' (5:15) 157.8-158.6' (9:00) 60% Recovery Core Blocked 158.60 **Bottom of Exploration at 158.60 feet below ground surface.** Could not get back down hole, too much sand in casing, plugged up core barrel, pulled casing per M.Moreau.	
160											
165											
170											
175											

Remarks:

Auto Hammer #283

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine

Boring No.: BB-BHC-103
PIN: 15091.00

Driller:	MaineDOT	**Elevation (ft.)**	104.3	**Auger ID/OD:**	N/A
Operator:	E. Giguere/C. Giles	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/20-27/08	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	14+18.2, 18.8 Rt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	15.0' bgs.
Hammer Efficiency Factor:	0.77	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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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	1D	24/15	0.00 - 2.00	3/3/5/6	8	10	SSA	104.10		TOPSOIL, (Sod).	G#212221 A-4, ML WC=17.5%
								103.50		0.20	
										Brown, damp, loose, fine to coarse sandy GRAVEL, (Fill).	
										0.80	
										Olive, damp, stiff, fine to coarse sandy SILT, trace gravel, (Fill).	
								100.30		4.00	
5	2D	24/18	5.00 - 7.00	4/4/4/5	8	10	33			Olive, wet, stiff, SILT, some fine sand, trace gravel, (Alluvium).	
							42				
							46				
							42				
	3D	24/20	9.00 - 11.00	3/3/3/3	6	8	11			Similar to above, but saturated.	G#212222 A-4, ML WC=26.1%
10							19				
							21				
							16				
							23				
								90.30		14.00	
	4D	24/16	14.00 - 16.00	4/3/4/6	7	9	35			Olive-brown, wet, loose to medium dense, fine SAND, trace gravel, some silt, (Alluvium).	
15							51				
							61				
							73				
							84				
	5D	24/14	19.00 - 21.00	3/3/5/7	8	10	45			Similar to above.	G#212223 A-2-4, SM WC=28.0%
20							61				
							87				
							105				
							116				
	6D	24/14	24.00 - 26.00	4/6/5/6	11	14	79			Similar to above.	
25											

Remarks:

Used new fixed hydraulic Piston on Tubes.
Casing sheared after boring completed. Left 40 ft of HW casing in borehole.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine

Boring No.: BB-BHC-103
PIN: 15091.00

Driller:	MaineDOT	**Elevation (ft.)**	104.3	**Auger ID/OD:**	N/A
Operator:	E. Giguere/C. Giles	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/20-27/08	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	14+18.2, 18.8 Rt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	15.0' bgs.
Hammer Efficiency Factor:	0.77	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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WOH = weight of 140lb. hammer
WOR/C = weight of rods or casing
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T_v = Pocket Torvane Shear Strength (psf)
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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							91			Olive-brown, wet, loose to medium dense, fine SAND, trace gravel, some silt, (Alluvium).	
							95				
							94				
							107	76.30		28.00	
	7D	24/18	29.00 - 31.00	5/5/5/4	10	13	77			Olive, brown, saturated, medium dense, fine SAND, some silt.	G#212224 A-2-4, SM WC=28.9%
30							91				
							102				
							102				
							78				
	8D	24/20	34.00 - 36.00	2/1/WOH/1	1	1	86	70.30		34.00	
35							79			Grey, saturated, very loose, fine SAND, some silt.	
							65				
							64	66.80		37.50	
							61				
	9D	24/12	39.00 - 41.00	WOR/WOR/WOR/ WOR	---		43			Stratified, grey, wet, medium stiff, clay-SILT, with 1" sand layers.	G#212225 A-4, CL-ML WC=34.1%
40	V1		40.57 - 41.00	Su=796/55 psf			45			65x130 mm vane raw touque readings: V1: 29.0/2.0 ft-lbs.	
	MV2		41.00 - 41.00	Could not push			47			Failed 65x130 mm vane attempt. Sand layer at 42' bgs.	
							35				
							28	61.30		43.00	
	1U	24/24	44.00 - 46.00	Hydraulic Push			37			Grey, wet, very soft to medium stiff, clayey-SILT to silty-CLAY, with trace fine sand in partings and seams. (Glaciomarine)	G,V#211433 A-4, CL WC=32.7% LL=28 PL=21 PI=7
45							31				
	V3		46.57 - 47.00	Su=783/110 psf			30			65x130 mm vane raw touque readings: V3: 28.5/4.0 ft-lbs.	
	V4		47.57 - 48.00	Su=632/82 psf			29			V4: 23.0/3.0 ft-lbs.	
							29				
50	10D	24/24	49.00 - 51.00	WOR/WOR/WOR/ WOR	---		29			Similar to above.	#211434 WC=31.5%

Remarks:

Used new fixed hydraulic Piston on Tubes.
Casing sheared after boring completed. Left 40 ft of HW casing in borehole.

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: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine

Boring No.: BB-BHC-103
PIN: 15091.00

Driller:	MaineDOT	**Elevation (ft.)**	104.3	**Auger ID/OD:**	N/A
Operator:	E. Giguere/C. Giles	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/20-27/08	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	14+18.2, 18.8 Rt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	15.0' bgs.
Hammer Efficiency Factor:	0.77	**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							31			Grey, wet, very soft to medium stiff, clayey-SILT to silty-CLAY, with trace fine sand in partings and seams. (Glaciomarine)	
	V5		51.57 - 52.00	Su=714/124 psf			32			65x130 mm vane raw touque readings: V5: 26.0/4.5 ft-lbs.	
	V6		52.57 - 53.00	Su=879/165 psf			26			V6: 32.0/6.0 ft-lbs.	
							26				
	2U	24/24	54.00 - 56.00	Hydraulic Push			25			Similar to above.	G,V,C#211460 A-4, CL WC=36.2% LL=29 PL=22 PI=7
55							25				
	V7		56.57 - 57.00	Su=687/82 psf			24			65x130 mm vane raw touque readings:	
	V8		57.57 - 58.00	Su=687/82 psf			22			V7: 25.0/3.0 ft-lbs. V8: 25.0/3.0 ft-lbs.	
							22				
	11D	24/24	59.00 - 61.00	WOR/WOR/WOR/ WOR	---		20				#211435 WC=36.1%
60							22				
	V9		61.57 - 62.00	Su=618/82 psf			22			65x130 mm vane raw touque readings:	
	V10		62.57 - 63.00	Su=659/137 psf			15			V9: 22.5/3.0 ft-lbs. V10: 24.0/5.0 ft-lbs.	
							15				
	MU 12D	24/0 24/24	64.00 - 66.00 64.00 - 66.00	WOR/WOR/WOR/ WOR	---		19			Similar to above. Missed tube, sucking sand in from washtub. Take spoon through tube interval.	#211436 WC=41.1%
65							19				
							11				
							11	37.30		67.00 Similar to above but dark grey.	
							11				
	13D	24/24	69.00 - 71.00	WOR/WOR/WOR/ WOR	---		23			Missed tube, sucking sand in from washtub. Washed out to 71.0' bgs.	#211437 WC=39.3%
70							12				
	V11		71.57 - 72.00	Su=714/82 psf			10			65x130 mm vane raw touque readings:	
	V12		72.57 - 73.00	Su=769/82 psf			12			V11: 26.0/3.0 ft-lbs. V12: 28.0/3.0 ft-lbs.	
							14				
75	3U	24/24	74.00 - 76.00	Hydraulic Push			35				G,V,C#211461 A-6, CL

Remarks:

Used new fixed hydraulic Piston on Tubes.
Casing sheared after boring completed. Left 40 ft of HW casing in borehole.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine

Boring No.: BB-BHC-103
PIN: 15091.00

Driller:	MaineDOT	**Elevation (ft.)**	104.3	**Auger ID/OD:**	N/A
Operator:	E. Giguere/C. Giles	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/20-27/08	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	14+18.2, 18.8 Rt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	15.0' bgs.
Hammer Efficiency Factor:	0.77	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
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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							37			Dark grey, wet, very soft to medium stiff, clayey-SILT to silty-CLAY, with trace fine sand in partings and seams. (Glaciomarine)	WC=38.8% LL=33 PL=21 PI=12
	V13		76.57 - 77.00	Su=769/82 psf			27			65x130 mm vane raw touque readings: V13: 28.0/3.0 ft-lbs.	
	V14		77.57 - 78.00	Su=728/69 psf			21			V14: 26.5/2.5 ft-lbs.	
							21				
	14D	24/24	79.00 - 81.00	WOR/WOR/WOR/ WOR	---		21			Similar to above.	#211438 WC=34.0%
80							15				
							16				
							14				
							14				
	4U	24/24	84.00 - 86.00	Hydraulic Push			27			Similar to above.	G,V#211439 A-4, CL WC=27.2% LL=29 PL=20 PI=9
85							20				
	V15		86.57 - 87.00	Su=893/110 psf			22			65x130 mm vane raw touque readings: V15: 32.5/4.0 ft-lbs.	
	V16		87.57 - 88.00	Su=742/110 psf			16			V16: 27.0/4.0 ft-lbs.	
							19				
	15D	24/24	89.00 - 91.00	WOR/WOR/WOR/ WOR	---		31			Similar to above but grey.	#211440 WC=35.7%
90							25				
							22				
							23				
							22				
	5U	24/24	94.00 - 96.00	Hydraulic Push			40			Similar to above.	
95							33				
	V17		96.57 - 97.00	Su=838/220 psf			29			65x130 mm vane raw touque readings: V17: 30.5/8.0 ft-lbs.	
	V18		97.57 - 98.00	Su=934/247 psf			27			V18: 34.0/9.0 ft-lbs.	
							29				
100	16D	24/24	99.00 - 101.00	WOR/WOR/WOR/ WOR	---		25			Similar to above.	#211441 WC=28.4%

Remarks:

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine

Boring No.: BB-BHC-103
PIN: 15091.00

Driller:	MaineDOT	**Elevation (ft.)**	104.3	**Auger ID/OD:**	N/A
Operator:	E. Giguere/C. Giles	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/20-27/08	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	14+18.2, 18.8 Rt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	15.0' bgs.
Hammer Efficiency Factor:	0.77	**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.
100							[a]HP			Grey, wet, very soft to medium stiff, clayey-SILT to silty-CLAY, with trace fine sand in partings and seams. (Glaciomarine)	
										Changed to NW Casing at 100' bgs.. [a]HP=Hydraulic Push	
105											
	17D	24/24	109.00 - 111.00	WOR/WOR/WOR/ WOR	---					Similar to above.	G#211442 A-6, CL WC=32.2% LL=32 PL=20 PI=12
110	V19		111.57 - 112.00	Su=>1317 psf						65x130 mm vane raw touque readings: V19: >48.0 ft-lbs.	
	V20		112.00 - 112.17	Could not push						Failed 65x130 mm vane attempt.	
							1				
115							7	-10.70		115.00	
							10				
							9				
							7				
	18D	24/8	119.00 - 121.00	WOH/8/4/4	12	15	11			Grey, saturated, medium dense, fine SAND, some silt (Glaciomarine).	
120							2				
							3				
							3				
							3				
125							2				

Remarks:

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine

Boring No.: BB-BHC-103
PIN: 15091.00

Driller:	MaineDOT	**Elevation (ft.)**	104.3	**Auger ID/OD:**	N/A
Operator:	E. Giguere/C. Giles	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/20-27/08	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	14+18.2, 18.8 Rt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	15.0' bgs.
Hammer Efficiency Factor:	0.77	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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N-uncorrected = Raw field SPT N-value
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N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
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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.
125							12			Grey, saturated, medium dense, fine SAND, some silt.	
							26				
							25				
							38				
	19D	24/15	129.00 - 131.00	25/14/8/7	22	28	9				G#211443 A-4, ML WC=19.2%
130								-25.70		130.00	
							27			Grey, wet, medium dense, fine to coarse SAND, little gravel, trace silt. (Glaciomarine)	
							57				
							75				
							108				
							73				
135							69				
							119				
	R1	60/24	137.80 - 142.80	RQD = N/A%			187				
							NQ-2	-33.50		137.80	
							609			R1:COBBLES, BOULDERS and GRAVEL.	
										R1:Core Times (min:sec)	
							325			137.8-138.8' (2:25)	
140										138.8-139.8' (2:09)	
							234			139.8-140.8' (0:50)	
							347			140.8-141.8' (0:31)	
							943			141.8-142.8' (0:50) 40% Recovery	
							RC				
										Roller Coned ahead to 145.1' bgs.	
145								-40.80		145.10	
	R2	60/60	145.10 - 150.10	RQD = 42%			NQ-2			Top of Bedrock at Elev. -40.8'.	
										Bedrock: Grey to greenish grey, fine to coarse-grained biotite, feldspar, quartz, banded GNEISS, with significant Pyrite/Arseno-Pyrite and 1/8 to 1/4-inch pink Garnet crytals, very slight weathering, moderately hard, fractures are horizontal to 45 degrees, some vertical between 147.6' and 148.6', tight to open, very close to close, with minor silt in-filling. [Cushing Formation]	
										R2:Core Times (min:sec)	
										145.1-146.1' (1:09)	
150										146.1-147.1' (2:25)	

Remarks:

Used new fixed hydraulic Piston on Tubes.
Casing sheared after boring completed. Left 40 ft of HW casing in borehole.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine

Boring No.: BB-BHC-103
PIN: 15091.00

Driller:	MaineDOT	**Elevation (ft.)**	104.3	**Auger ID/OD:**	N/A
Operator:	E. Giguere/C. Giles	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/20-27/08	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	14+18.2, 18.8 Rt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	15.0' bgs.
Hammer Efficiency Factor:	0.77	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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SSA = Solid Stem Auger
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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
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WC = water content, percent
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.
150								-45.80		147.1-148.1' (2:45) 148.1-149.1' (2:43) 149.1-150.1' (3:44) 100% Recovery 150.10 **Bottom of Exploration at 150.10 feet below ground surface.**	
155											
160											
165											
170											
175											

Remarks:

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine

Boring No.: BB-BHC-104
PIN: 15091.00

Driller:	MaineDOT	**Elevation (ft.)**	126.7	**Auger ID/OD:**	5" Solid Stem
Operator:	E. Giguere/C. Giles	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	M. Moreau	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	9/15-22/08	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	15+22.4, 7.3 Lt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	13.6' bgs.
Hammer Efficiency Factor:	0.77	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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SSA = Solid Stem Auger
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WO1P = Weight of one person
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N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
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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/AB	24/17	0.80 - 2.80	6/4/4/3	8	10	SSA	125.90		PAVEMENT. 0.80	
								125.30		(1D/A) 0.8-1.4' bgs. Brown, damp, loose, fine to coarse SAND, some gravel, trace silt, (Fill). 1.40	G#211445 A-1-b, SW-SM WC=4.1%
										(1D/B) 1.4-2.8' bgs. Brown, damp, loose, fine to medium silty SAND, trace gravel, mottled, (Fill).	G#211446 A-4, SM WC=16.3%
5	2D	24/22	5.00 - 7.00	2/2/3/2	5	6	11				
							17				
							27				
							23				
	3D	24/14	9.00 - 11.00	2/2/2/6	4	5	9			Similar to above, but moist.	G#211447 A-4, SM WC=21.3%
10							18				
							37				
							12				
							28	113.10		13.60	
	4D	24/6	14.00 - 16.00	2/1/2/1	3	4	9			Stratified, brown, wet, very loose, silty fine to medium SAND, with numerous thin seams of brown, sandy silt 1-2 mm thick, mottled, (Alluvium).	
15							15				
							18				
							19				
							21				
	5D	24/12	19.00 - 21.00	3/1/2/2	3	4	18			Similar to above, but less frequent silt seams.	G#211448 A-4, SM WC=26.8%
20							22				
							29				
							44				
							62				
25	6D	24/15	24.00 - 26.00	4/2/5/9	7	9	33			Similar to above, but loose.	

Remarks:

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine

Boring No.: BB-BHC-104
PIN: 15091.00

Driller:	MaineDOT	**Elevation (ft.)**	126.7	**Auger ID/OD:**	5" Solid Stem
Operator:	E. Giguere/C. Giles	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	M. Moreau	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	9/15-22/08	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	15+22.4, 7.3 Lt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	13.6' bgs.
Hammer Efficiency Factor:	0.77	**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.
25							67			Stratified, brown, wet, very loose, silty fine to medium SAND, with numerous thin seams of brown, sandy silt 1-2 mm thick, mottled, (Alluvium).	
							118			Predominantly SILT layers with little sand after 26.0' bgs.	
							114				
							106				
	7D	24/20	29.00 - 31.00	7/7/3/6	10	13	56			More numerous silt seams, stiff, silty sand layers dilatant.	G#211449 A-4, ML WC=28.2%
30							50				
							60				
							52				
							54				
	8D	24/17	34.00 - 36.00	3/2/2/1	4	5	48			Numerous silt seams, medium stiff, silty sand is dilatant.	
35							51				
							54				
							56				
							47				
	9D	24/15	39.00 - 41.00	5/5/5/7	10	13	48			Fewer silt seams after 37.5' bgs. One silt seam at 39.0- 39.1' bgs and one black and orange silty fine to medium sand layer at 39.5- 39.8' bgs.	
40							54				
							62				
							70				
							72				
	10D	24/17	44.00 - 46.00	4/4/4/6	8	10	61			No silt seams.	G#211450 A-2-4, SM WC=26.3%
45							91				
							88				
							79				
							86				
	11D	24/20	49.00 - 51.00	7/2/1/2	3	4	52	77.20		Similar to above to 49.5' bgs.	
50										49.50	

Remarks:

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine

Boring No.: BB-BHC-104
PIN: 15091.00

Driller:	MaineDOT	**Elevation (ft.)**	126.7	**Auger ID/OD:**	5" Solid Stem
Operator:	E. Giguere/C. Giles	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	M. Moreau	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	9/15-22/08	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	15+22.4, 7.3 Lt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	13.6' bgs.
Hammer Efficiency Factor:	0.77	**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.
50							66			Grey, wet, soft to medium stiff, fine sandy SILT, with few silt seams 2-4 mm thick, (Glacoimarine).	
							69				
							67				
							64				
	12D	24/14	54.00 - 56.00	6/3/1/1	4	5	89			Similar to above.	G#212226 A-4, ML WC=28.0%
55							81				
							74				
							75	69.70		57.00	
							66				
	13D	24/20	59.00 - 61.00	WOR/WOR/WOR/ WOR	---		63			Stratified, grey, wet, very soft, clay-SILT with silty fine sand seams 2-5 mm thick, (Glaciomarine).	
60							51	66.30		60.40	
							42			Grey, wet, very soft to stiff, clayey-SILT with trace fine sand in partings and occasional silty fine sand seams less than 1 mm thick, (Glaciomarine).	
							38				
							43				
							38				
65	V1		65.00 - 65.43	Su=687/104 psf			52			65x130 mm raw torque readings: 25.0/3.8 ft-lbs 21.8/3.7 ft-lbs	
	V2		66.00 - 66.43	Su=599/102 psf			82				
							77				
							67				
	MU	24/0	69.00 - 71.00	Hydraulic Push	---		79			Failed tube attempt, no recovery. Took spoon sample through tube interval.	G#212227 A-4, CL-ML WC=32.8% LL=26 PL=20 PI=6
70	14D	24/24	69.00 - 71.00	WOR/WOR/WOR/ WOR			63				
							49				
							48				
							45				
75	1U	24/6	74.00 - 76.00	Hydraulic Push			59				

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Harward's Crossing Bridge #3273 Removal and Route 24 Reconstruction
Location: Bowdoinham, Maine

Boring No.: BB-BHC-104
PIN: 15091.00

Driller:	MaineDOT	**Elevation (ft.)**	126.7	**Auger ID/OD:**	5" Solid Stem
Operator:	E. Giguere/C. Giles	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	M. Moreau	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	9/15-22/08	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	15+22.4, 7.3 Lt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	13.6' bgs.
Hammer Efficiency Factor:	0.77	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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N-uncorrected = Raw field SPT N-value
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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							59			Grey, wet, very soft to stiff, clayey-SILT with trace fine sand in partings and occasional silty fine sand seams less than 1 mm thick, (Glaciomarine).	
	V3		76.00 - 76.43	Su=508/74 psf			46				
	V4		77.00 - 77.43	Su=514/82 psf			34			Washed ahead to 76.0' bgs. 65x130 mm raw torque readings: 18.5/2.7 ft-lbs 18.7/3.0 ft-lbs	
							26				
	2U	24/24	79.00 - 81.00	Hydraulic Push			52			Similar to above but CLAY with some silt.	G,C,V#212228 A-6, CL WC=41.8% LL=31 PL=20 PI=11
80							49				
							44				
	V5		82.00 - 82.43	Su=582/71 psf			36			65x130 mm raw torque readings: 21.2/2.6 ft-lbs 19.3/2.8 ft-lbs	
	V6		83.00 - 83.43	Su=530/77 psf			36			After 83.0' bgs, casing advance indicates numerous silty fine sand seams.	
	15D	24/24	84.00 - 86.00	WOR/WOR/WOR/ WOR	---		53			Washed ahead to 89.0' bgs, after taking spoon sample at 84'-86' bgs.	#212229 WC=37.3%
85							26			Changed to NW Casing at 85.0' bgs. Bottom section of casing spun off column, telescped NW Casing through separated section and continued hole.	
							WOC				
90	16D	24/24	90.50 - 92.50	WOR/WOR/WOR/ WOR	---					Few silty fine sand seams and numerous black manganese stains after 90.0' bgs.	G#212230
	V7		90.50 - 90.93	Su=233/63 psf						Spoon through vane interval.	A-6, CL
	V8		91.50 - 91.93	Su=239/58 psf						65x130 mm raw torque readings: 8.5/2.3 ft-lbs 8.7/2.1 ft-lbs	WC=33.9% LL=34 PL=21 PI=13
	17D	24/24	94.00 - 96.00	WOR/WOR/WOR/ WOR	---						#212231 WC=36.2%
95											
	18D	24/24	99.00 - 101.00	WOR/WOR/WOR/ WOR	---					Spoon through vane interval. 65x130 mm raw torque readings:	G#212232 A-4, CL
100											

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Maine Department of Transportation

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US CUSTOMARY UNITS

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Boring No.: BB-BHC-104
PIN: 15091.00

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Operator:	E. Giguere/C. Giles	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	M. Moreau	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	9/15-22/08	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	15+22.4, 7.3 Lt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	13.6' bgs.
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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.
100	V9		99.00 - 99.43	Su=931/27 psf			WOC			33.9/1.0 ft-lbs	WC=36.4%
	V10		100.00 - 100.43	Su=862/27 psf						31.4/1.0 ft-lbs	
										Grey, wet, very soft to stiff, clayey-SILT with trace fine sand in partings and occasional silty fine sand seams less than 1 mm thick, (Glaciomarine).	
105											
	MD	24/0	109.00 - 111.00				[a]HYD			Failed sample attempt. [a]Hydraulic Push Casing at 100 psi.	
110											
115											
							34				
120	V11		120.00 - 120.43	Su=860/74 psf			16			65x130 mm raw torque readings: 31.3/2.7 ft-lbs	
	V12		121.00 - 121.43	Su=920/74 psf			14			33.5/2.7 ft-lbs	
							12				
							12				
125							10				

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Logged By:	M. Moreau	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
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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.
125							10			Grey, wet, very soft to stiff, clayey-SILT with trace fine sand in partings and occasional silty fine sand seams less than 1 mm thick, (Glaciomarine).	
							10				
							8				
							8				
	19D	24/17	129.00 - 131.00	WOR/WOR/WOR/ WOR	---		32			Similar to above but with little sand and trace gravel.	G#212233 A-4, CL WC=26.1% LL=23 PL=16 PI=7
130	V13 V14		130.00 - 130.43 130.90 - 131.33	Su=785/49 psf ~~1162/93 psf~~			10 60			More numerous silty fine sand seams after 130.0' bgs, some 3-5 mm thick. 65x130 mm raw torque readings: 28.6/1.8 ft-lbs 42.3/3.4 ft-lbs Refusal on vane advance at 131.3' bgs.	
							30				
							31				
							30				
135							54	-8.60		135.30	
							91				
							70				
							109				
	20D	24/10	139.00 - 141.00	11/22/39/14	61	78	81			Grey, wet, very dense, fine to coarse sandy SILT, little gravel, occasional cobbles, well graded, (Till).	G#212234 A-4, SM WC=11.6%
140							99				
	R1	58/58	141.50 - 146.33	RQD = 16%			b67 NQ-2	-14.80		b67 blows for 0.5'. Casing bounce at 141.5' bgs, used roller cone to determine cobble or bedrock. 141.50 Top of Bedrock at Elev. -14.8'. Bedrock: Greenish grey and white, fine to coarse-grained, biotite, feldspar, quartz GNEISS, moderately hard, slight weathering, fractures from horizontal to vertical, open, very close, with minor silt in-filling, some healed. [Cushing Formation] R1:Core Times (min:sec) 141.5-142.5' (4:55) 142.5-143.5' (4:35) 143.5-144.5' (4:42) 144.5-145.5' (2:56) 145.5-146.3' (2:13) 100% Recovery 146.30	
145								-19.60		**Bottom of Exploration at 146.30 feet below ground surface.**	
150											

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APPENDIX - C

Laboratory Test Data

State of Maine - Department of Transportation

Laboratory Testing Summary Sheet

Town(s): Bowdoinham Project Number: 15091.00

Boring & Sample Identification Number	Station (Feet)	Offset (Feet)	Depth (Feet)	Reference Number	G.S.D.C. Sheet	W.C. %	L.L.	P.I.	Classification		
									Unified	AASHTO	Frost
BB-BHC-101, 1D	12+51.2	7.0 Rt.	4.0-6.0	211462	1	30.4			ML	A-4	IV
BB-BHC-101, 4D	12+51.2	7.0 Rt.	19.0-21.0	211463	1	24.6			SM	A-4	III
BB-BHC-101, 6D	12+51.2	7.0 Rt.	29.0-31.0	211464	1	26.0			SM	A-2-4	II
BB-BHC-101, 8D	12+51.2	7.0 Rt.	39.0-41.0	211465	1	29.8			SM	A-2-4	II
BB-BHC-101, 10D	12+51.2	7.0 Rt.	49.0-51.0	211466	1	25.8			SM	A-4	III
BB-BHC-101, 11D	12+51.2	7.0 Rt.	54.0-56.0	211467	1	24.2			CL-ML	A-4	IV
BB-BHC-101, 13D	12+51.2	7.0 Rt.	64.0-66.0	211468	---	30.1	No Sieve Analysis				
BB-BHC-101, 14D	12+51.2	7.0 Rt.	70.5-72.5	211469	2	30.6	28	8	CL	A-4	IV
BB-BHC-101, 15D	12+51.2	7.0 Rt.	84.0-86.0	211470	---	40.2	No Sieve Analysis				
BB-BHC-101, 16D	12+51.2	7.0 Rt.	89.0-91.0	211471	---	38.0	No Sieve Analysis				
BB-BHC-101, 17D	12+51.2	7.0 Rt.	99.0-101.0	211472	---	36.9	No Sieve Analysis				
BB-BHC-101, 2U	12+51.2	7.0 Rt.	104.0-106.0	211473	2	34.7	29	8	CL	A-4	IV
BB-BHC-101, 18D	12+51.2	7.0 Rt.	114.0-116.0	211474	---	31.7	No Sieve Analysis				
BB-BHC-101, 19D	12+51.2	7.0 Rt.	124.0-126.0	211475	2	35.2	32	10	CL	A-6	IV
BB-BHC-101, 20D	12+51.2	7.0 Rt.	134.0-136.0	212201	3	31.5	30	10	CL	A-6	IV
BB-BHC-101, 22D	12+51.2	7.0 Rt.	154.0-156.0	212202	3	20.6			SP	A-3	0
BB-BHC-101, 23D	12+51.2	7.0 Rt.	164.0-164.8	212203	3	13.8			SM	A-2-4	II
BB-BHC-102, 1D	13+48.8	19.0 Lt.	0.0-2.0	212204	4	14.6			SM	A-2-4	II
BB-BHC-102, 3D	13+48.8	19.0 Lt.	10.0-12.0	212205	4	22.4			SM	A-2-4	II
BB-BHC-102, 5D	13+48.8	19.0 Lt.	20.0-22.0	212206	4	25.5			SP-SM	A-3	0
BB-BHC-102, 7D	13+48.8	19.0 Lt.	29.0-31.0	212207	4	27.1			ML	A-4	IV
BB-BHC-102, 9D	13+48.8	19.0 Lt.	39.0-41.0	212208	4	28.1			CL-ML	A-4	IV
BB-BHC-102, 10D	13+48.8	19.0 Lt.	44.0-46.0	212209	---	25.0	No Sieve Analysis				
BB-BHC-102, 1U	13+48.8	19.0 Lt.	49.0-51.0	212210	4	28.3	27	5	CL-ML	A-4	IV
BB-BHC-102, 11D	13+48.8	19.0 Lt.	54.0-56.0	212211	---	32.7	No Sieve Analysis				
BB-BHC-102, 2U	13+48.8	19.0 Lt.	59.0-61.0	211458	5	34.2	28	9	CL	A-4	IV
BB-BHC-102, 12D	13+48.8	19.0 Lt.	64.0-66.0	212212	---	40.1	No Sieve Analysis				
BB-BHC-102, 3U	13+48.8	19.0 Lt.	69.0-71.0	211459	5	38.6	32	8	ML	A-4	IV
BB-BHC-102, 13D	13+48.8	19.0 Lt.	74.0-76.0	212213	---	36.1	No Sieve Analysis				
BB-BHC-102, 14D	13+48.8	19.0 Lt.	84.0-86.0	212214	---	33.9	No Sieve Analysis				
BB-BHC-102, 5U	13+48.8	19.0 Lt.	89.0-91.0	212215	5	33.0	27	7	CL	A-4	IV
BB-BHC-102, 15D	13+48.8	19.0 Lt.	94.0-96.0	212216	---	30.8	No Sieve Analysis				
BB-BHC-102, 16D	13+48.8	19.0 Lt.	100.0-102.0	212217	---	34.5	No Sieve Analysis				
BB-BHC-102, 17D	13+48.8	19.0 Lt.	107.0-109.0	212218	5	29.7	30	10	CL	A-6	IV
BB-BHC-102, 19D	13+48.8	19.0 Lt.	125.0-127.0	212219	5	9.0			SM	A-1-b	II
BB-BHC-102, 21D	13+48.8	19.0 Lt.	145.0-147.0	212220	5	18.8			SP	A-1-b	0
BB-BHC-103, 1D	14+18.2	18.8 Rt.	0.0-2.0	212221	6	17.5			ML	A-4	IV
BB-BHC-103, 3D	14+18.2	18.8 Rt.	9.0-11.0	212222	6	26.1			ML	A-4	IV
BB-BHC-103, 5D	14+18.2	18.8 Rt.	19.0-21.0	212223	6	28.0			SM	A-2-4	II
BB-BHC-103, 7D	14+18.2	18.8 Rt.	29.0-31.0	212224	6	28.9			SM	A-2-4	II
BB-BHC-103, 9D	14+18.2	18.8 Rt.	39.0-41.0	212225	6	34.1			CL-ML	A-4	IV

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.

GSDC = Grain Size Distribution Curve as determined by AASHTO T 88-93 (1996) and/or ASTM D 422-63 (Reapproved 1998)

WC = water content as determined by AASHTO T 265-93 and/or ASTM D 2216-98

LL = Liquid limit as determined by AASHTO T 89-96 and/or ASTM D 4318-98

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

State of Maine - Department of Transportation

Laboratory Testing Summary Sheet

Town(s): Bowdoinham Project Number: 15091.00

Boring & Sample Identification Number	Station (Feet)	Offset (Feet)	Depth (Feet)	Reference Number	G.S.D.C. Sheet	W.C. %	L.L.	P.I.	Classification		
									Unified	AASHTO	Frost
BB-BHC-103, 1U	14+18.2	18.8 Rt.	44.0-46.0	211433	6	32.7	28	7	CL	A-4	IV
BB-BHC-103, 10D	14+18.2	18.8 Rt.	49.0-51.0	211434	---	31.5	No Sieve Analysis				
BB-BHC-103, 2U	14+18.2	18.8 Rt.	54.0-56.0	211460	7	36.2	29	7	CL	A-4	IV
BB-BHC-103, 11D	14+18.2	18.8 Rt.	59.0-61.0	211435	---	36.1	No Sieve Analysis				
BB-BHC-103, 12D	14+18.2	18.8 Rt.	64.0-66.0	211436	---	41.1	No Sieve Analysis				
BB-BHC-103, 13D	14+18.2	18.8 Rt.	69.0-71.0	211437	---	39.3	No Sieve Analysis				
BB-BHC-103, 3U	14+18.2	18.8 Rt.	74.0-76.0	211461	7	38.8	33	12	CL	A-6	III
BB-BHC-103, 14D	14+18.2	18.8 Rt.	79.0-81.0	211438	---	34.0	No Sieve Analysis				
BB-BHC-103, 4U	14+18.2	18.8 Rt.	84.0-86.0	211439	7	27.2	29	9	CL	A-4	IV
BB-BHC-103, 15D	14+18.2	18.8 Rt.	89.0.-91.0	211440	---	35.7	No Sieve Analysis				
BB-BHC-103, 16D	14+18.2	18.8 Rt.	99.0-101.0	211441	---	28.4	No Sieve Analysis				
BB-BHC-103, 17D	14+18.2	18.8 Rt.	109.0-111.0	211442	7	32.2	32	12	CL	A-6	III
BB-BHC-103, 19D	14+18.2	18.8 Rt.	129.0-131.0	211443	7	19.2			ML	A-4	IV
BB-BHC-104, 1D/A	15+22.4	7.3 Lt.	0.8-1.4	211445	8	4.1			SW-SM	A-1-b	0
BB-BHC-104, 1D/B	15+22.4	7.3 Lt.	1.4-2.8	211446	8	16.3			SM	A-4	III
BB-BHC-104, 3D	15+22.4	7.3 Lt.	9.0-11.0	211447	8	21.3			SM	A-4	III
BB-BHC-104, 5D	15+22.4	7.3 Lt.	19.0-21.0	211448	8	26.8			SM	A-4	III
BB-BHC-104, 7D	15+22.4	7.3 Lt.	29.0-31.0	211449	9	28.2			ML	A-4	IV
BB-BHC-104, 10D	15+22.4	7.3 Lt.	44.0-46.0	211450	9	26.3			SM	A-2-4	II
BB-BHC-104, 12D	15+22.4	7.3 Lt.	54.0-56.0	212226	9	28.0			ML	A-4	IV
BB-BHC-104, 14D	15+22.4	7.3 Lt.	69.0-71.0	212227	9	32.8	26	6	CL-ML	A-4	IV
BB-BHC-103, 3U	14+18.2	18.8 Rt.	74.0-76.0	211461	7	38.8	33	12	CL	A-6	III
BB-BHC-104, 15D	15+22.4	7.3 Lt.	84.0-86.0	212229	---	37.3	No Sieve Analysis				
BB-BHC-104, 16D	15+22.4	7.3 Lt.	90.5-92.5	212230	10	33.9	34	13	CL	A-6	III
BB-BHC-104, 17D	15+22.4	7.3 Lt.	94.0-96.0	212231	---	36.2	No Sieve Analysis				
BB-BHC-104, 18D	15+22.4	7.3 Lt.	99.0-101.0	212232	10	36.4			CL	A-4	IV
BB-BHC-104, 19D	15+22.4	7.3 Lt.	129.0-131.0	212233	10	26.1	23	7	CL	A-4	IV
BB-BHC-104, 20D	15+22.4	7.3 Lt.	139.0-141.0	212234	10	11.6			SM	A-4	III
BB-BHC-102, 2U	13+48.8	19.0 Lt.	59.0-61.0	211458	5	34.2	Consolidation Test (T 216)				
BB-BHC-102, 3U	13+48.8	19.0 Lt.	69.0-71.0	211459	5	38.6	Consolidation Test (T 216)				
BB-BHC-103, 2U	14+18.2	18.8 Rt.	54.0-56.0	211460	7	36.2	Consolidation Test (T 216)				
BB-BHC-103, 3U	14+18.2	18.8 Rt.	74.0-76.0	211461	7	38.8	Consolidation Test (T 216)				
BB-BHC-103, 3U	14+18.2	18.8 Rt.	74.0-76.0	211461	7	38.8	Consolidation Test (T 216)				

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.

GSDC = Grain Size Distribution Curve as determined by AASHTO T 88-93 (1996) and/or ASTM D 422-63 (Reapproved 1998)

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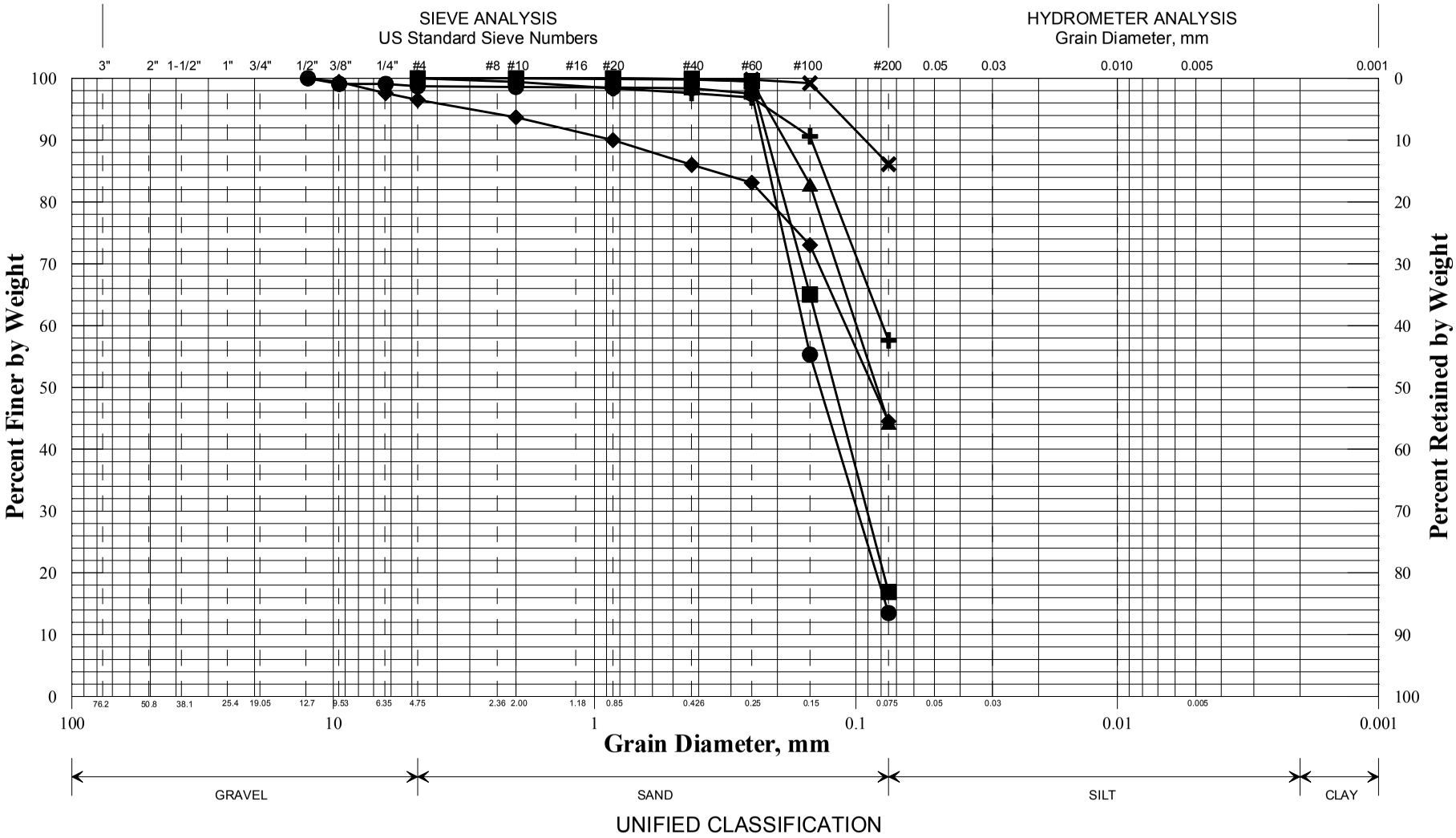
PI = Plasticity Index as determined by AASHTO 90-96 and/or ASTM D4318-98

State of Maine Department of Transportation

GRAIN SIZE DISTRIBUTION CURVE



	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
✚	BB-BHC-101/1D	12+51.2	7.0 RT	4.0-6.0	Sandy SILT.	30.4			
◆	BB-BHC-101/4D	12+51.2	7.0 RT	19.0-21.0	Silty SAND, trace gravel.	24.6			
■	BB-BHC-101/6D	12+51.2	7.0 RT	29.0-31.0	SAND, little silt.	26.0			
●	BB-BHC-101/8D	12+51.2	7.0 RT	39.0-41.0	SAND, little silt, trace gravel.	29.8			
▲	BB-BHC-101/10D	12+51.2	7.0 RT	49.0-51.0	Silty SAND.	25.8			
✕	BB-BHC-101/11D	12+51.2	7.0 RT	54.0-56.0	SILT, trace sand.	24.2			

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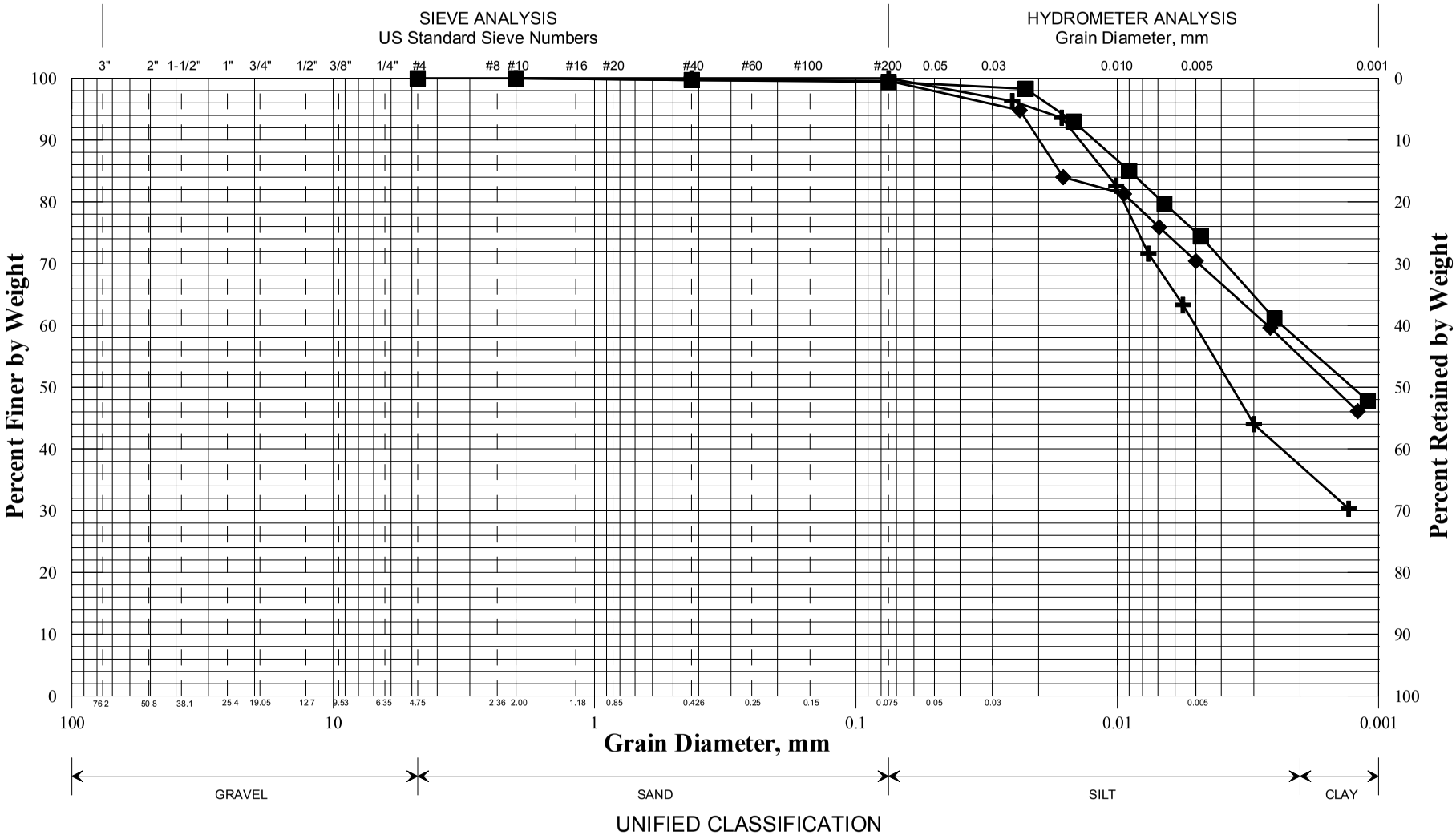
GRAIN SIZE DISTRIBUTION CURVE



	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
✚	BB-BHC-101/14D	12+51.2	7.0 RT	70.5-72.5	Clayey SILT.	30.6	28	20	8
◆	BB-BHC-101/2U	12+51.2	7.0 RT	104.0-106.0	Silty CLAY, trace sand.	34.7	29	21	8
■	BB-BHC-101/19D	12+51.2	7.0 RT	124.0-126.0	Silty CLAY, trace sand.	35.2	32	22	10
●									
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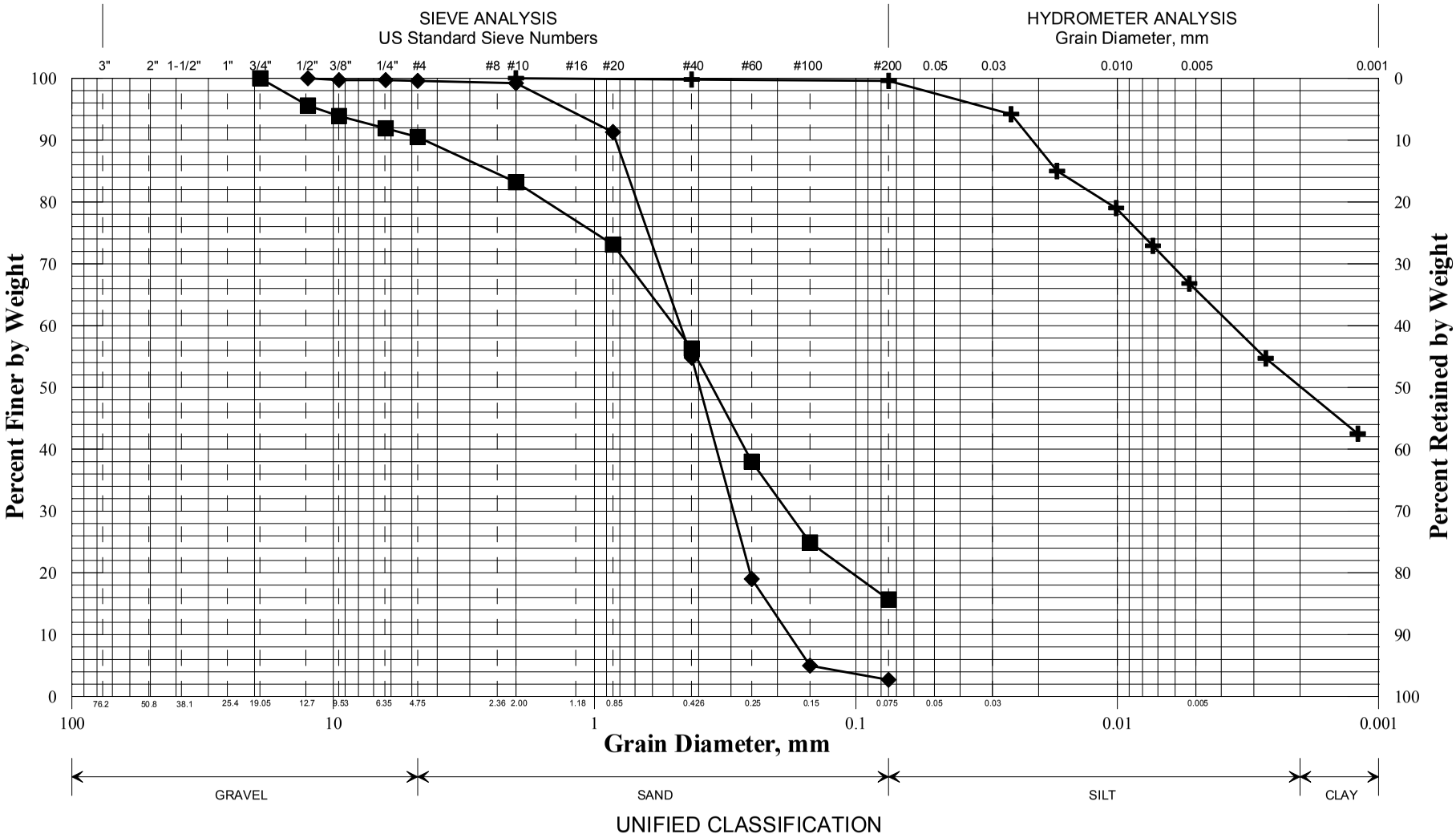

	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
✚	BB-BHC-101/20D	12+51.2	7.0 RT	134.0-135.0	Silty CLAY, trace sand.	31.5	30	20	10
◆	BB-BHC-101/22D	12+51.2	7.0 RT	154.0-156.0	SAND, trace silt, trace gravel.	20.6			
■	BB-BHC-101/23D	12+51.2	7.0 RT	164.0-164.8	SAND, little silt, trace gravel.	13.8			
●									
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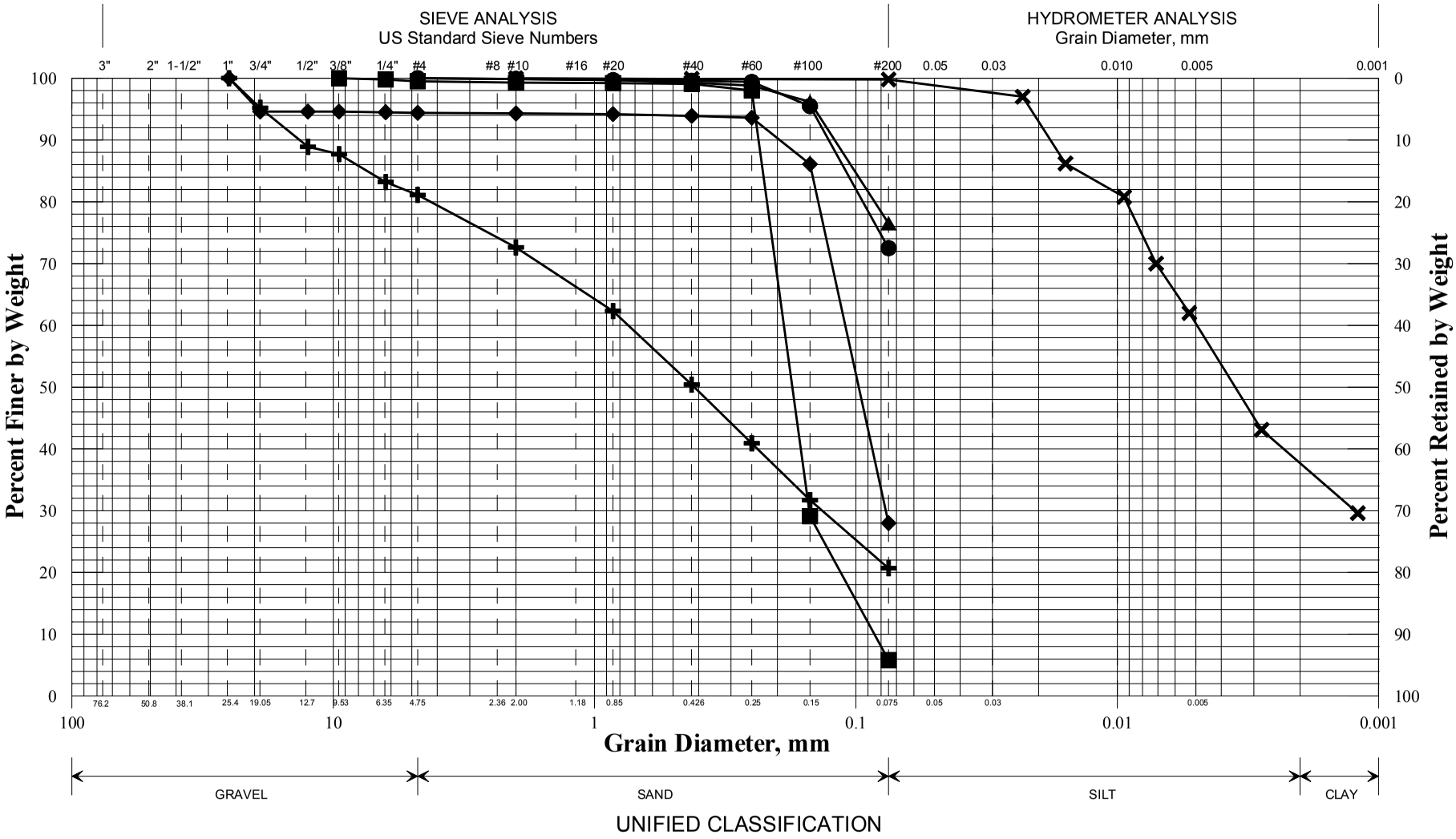
GRAIN SIZE DISTRIBUTION CURVE



	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
✚	BB-BHC-102/1D	13+48.8	19.0 LT	0.0-2.0	SAND, some silt, little gravel.	14.6			
◆	BB-BHC-102/3D	13+48.8	19.0 LT	10.0-12.0	SAND, some silt, trace gravel.	22.4			
■	BB-BHC-102/5D	13+48.8	19.0 LT	20.0-22.0	SAND, trace silt, trace gravel.	25.5			
●	BB-BHC-102/7D	13+48.8	19.0 LT	29.0-31.0	SILT, some sand.	27.1			
▲	BB-BHC-102/9D	13+48.8	19.0 LT	39.0-41.0	SILT, some sand.	28.1			
✕	BB-BHC-102/1U	13+48.8	19.0 LT	49.0-51.0	Clayey SILT, trace sand.	28.3	27	22	5

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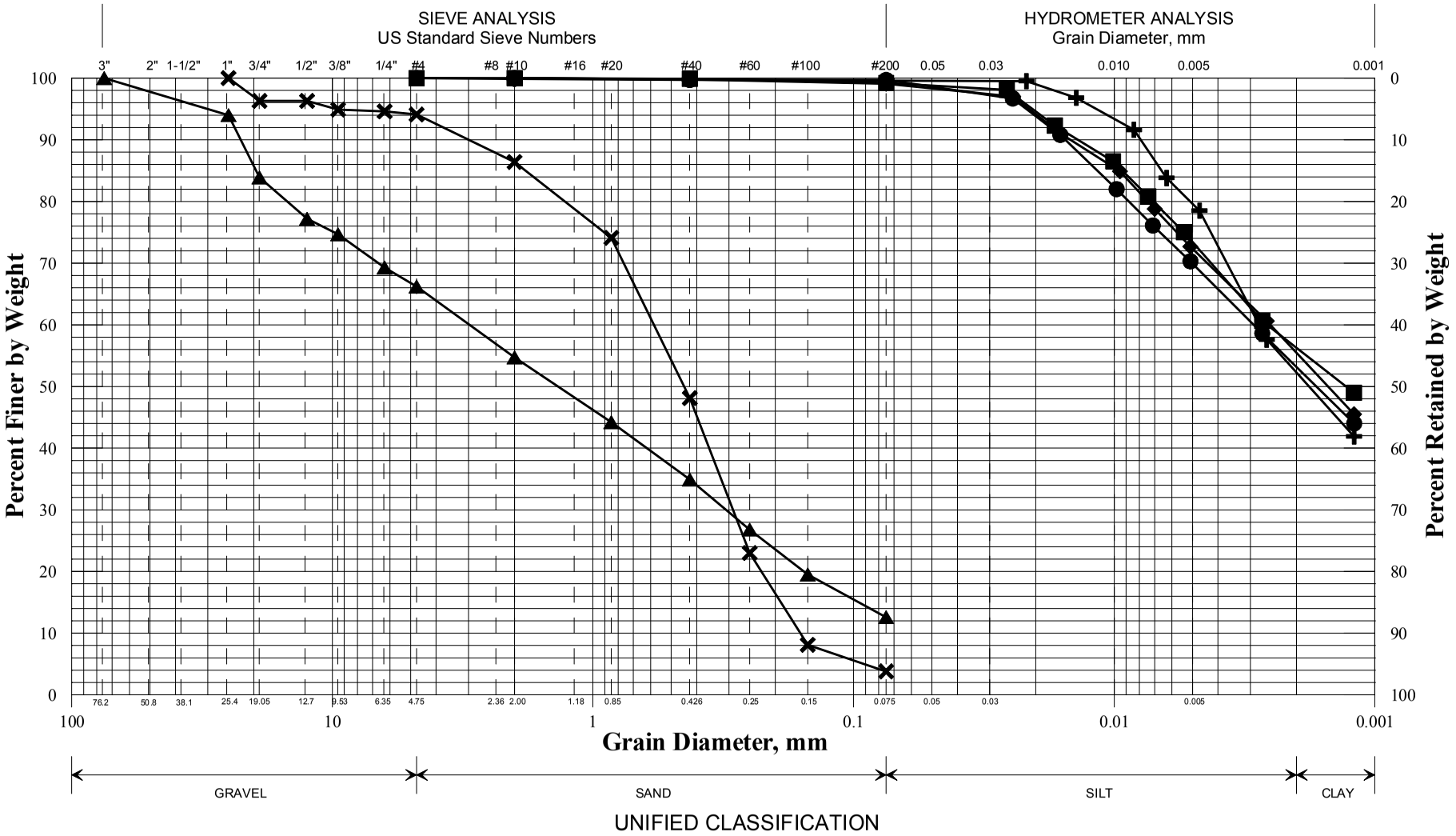
GRAIN SIZE DISTRIBUTION CURVE



	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
✚	BB-BHC-102/2U	13+48.8	19.0 LT	59.0-61.0	Silty CLAY, trace sand.	34.2	28	19	9
◆	BB-BHC-102/3U	13+48.8	19.0 LT	69.0-71.0	Silty CLAY, trace sand.	38.6	32	24	8
■	BB-BHC-102/5U	13+48.8	19.0 LT	89.0-91.0	Silty CLAY, trace sand.	33.0	27	20	7
●	BB-BHC-102/17D	13+48.8	19.0 LT	107.0-109.0	Silty CLAY, trace sand.	29.7	30	20	10
▲	BB-BHC-102/19D	13+48.8	19.0 LT	125.0-127.0	SAND, some gravel, little silt.	9.0			
✕	BB-BHC-102/21D	13+48.8	19.0 LT	145.0-147.0	SAND, trace gravel, trace silt.	18.8			

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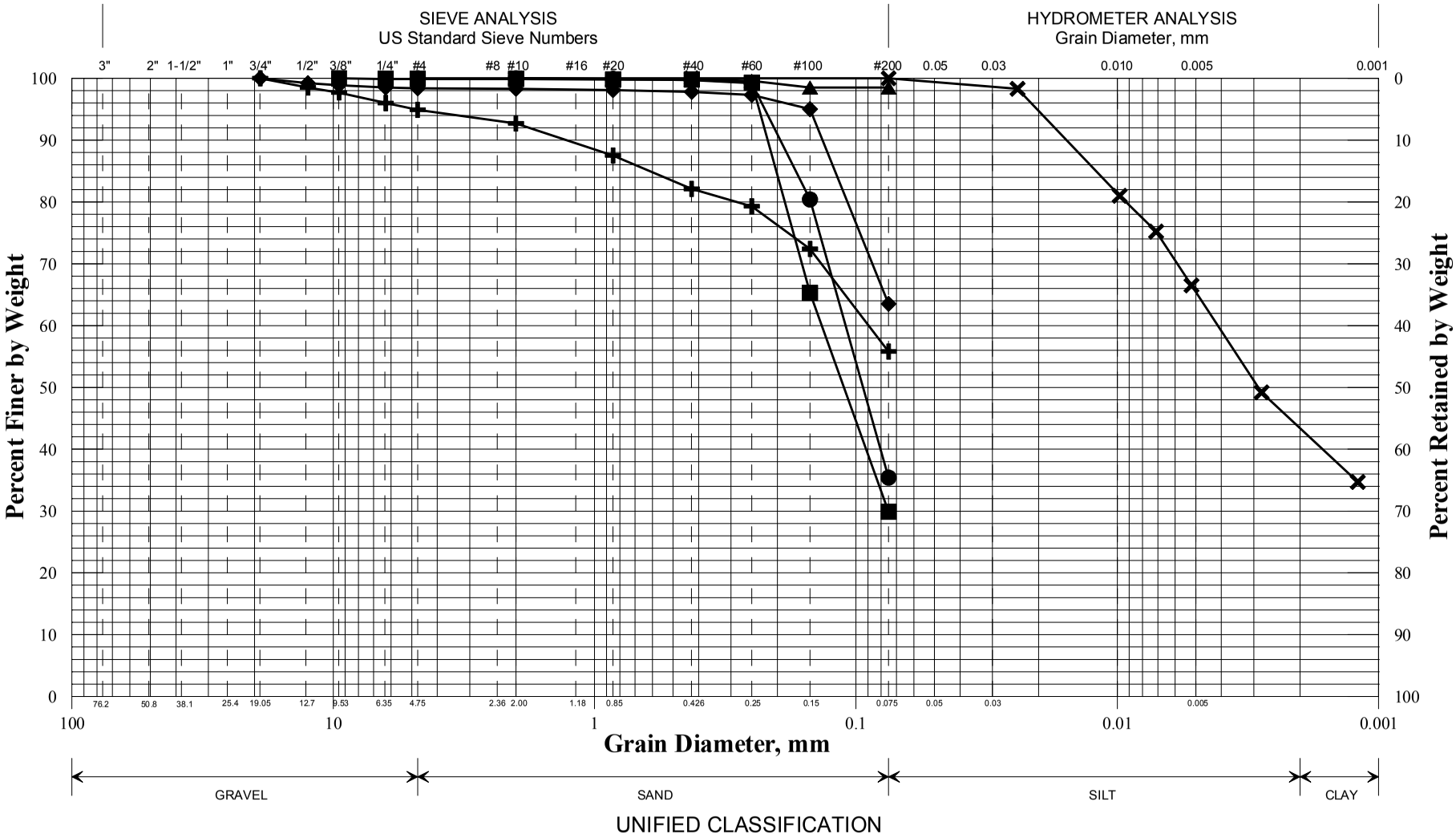

	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
✚	BB-BHC-103/1D	14+18.2	18.8 RT	0.0-2.0	Sandy SILT, trace gravel.	17.5			
◆	BB-BHC-103/3D	14+18.2	18.8 RT	9.0-11.0	SILT, some sand, trace gravel.	26.1			
■	BB-BHC-103/5D	14+18.2	18.8 RT	19.0-21.0	SAND, some silt, trace gravel.	28.0			
●	BB-BHC-103/7D	14+18.2	18.8 RT	29.0-31.0	SAND, some silt.	28.9			
▲	BB-BHC-103/9D	14+18.2	18.8 RT	39.0-41.0	SILT, trace sand.	34.1			
✕	BB-BHC-103/1U	14+18.2	18.8 RT	44.0-46.0	Clayey SILT.	32.7	28	21	7

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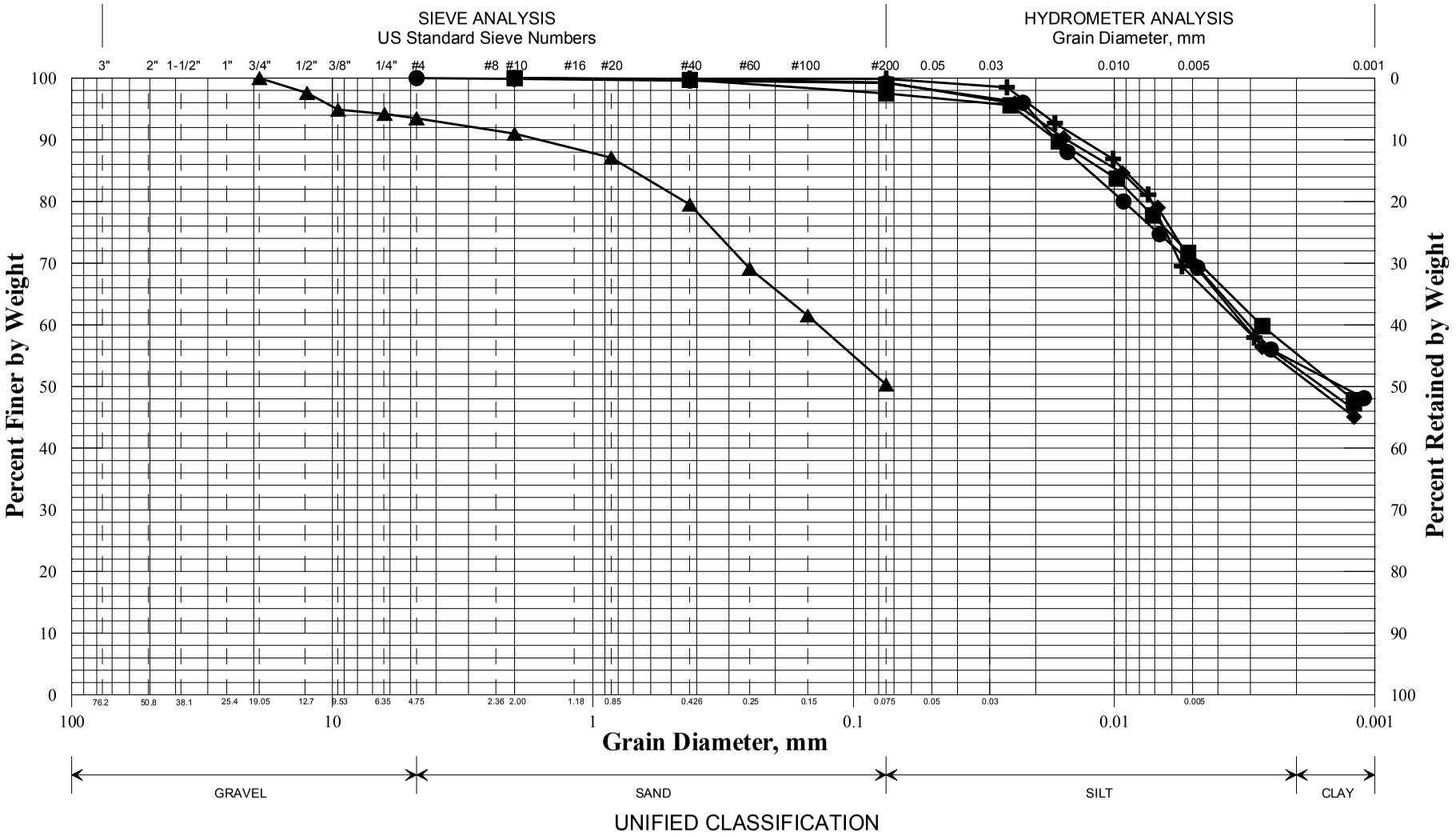

	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
✚	BB-BHC-103/2U	14+18.2	18.8 RT	54.0-56.0	Silty CLAY, trace sand.	36.2	29	22	7
◆	BB-BHC-103/3U	14+18.2	18.8 RT	74.0-76.0	Silty CLAY, trace sand.	38.8	33	21	12
■	BB-BHC-103/4U	14+18.2	18.8 RT	84.0-86.0	Silty CLAY, trace sand.	27.2	29	20	9
●	BB-BHC-103/17D	14+18.2	18.8 RT	109.0-111.0	Silty CLAY, trace sand.	32.2	32	20	12
▲	BB-BHC-103/19D	14+18.2	18.8 RT	129.0-131.0	Sandy SILT, trace gravel.	19.2			
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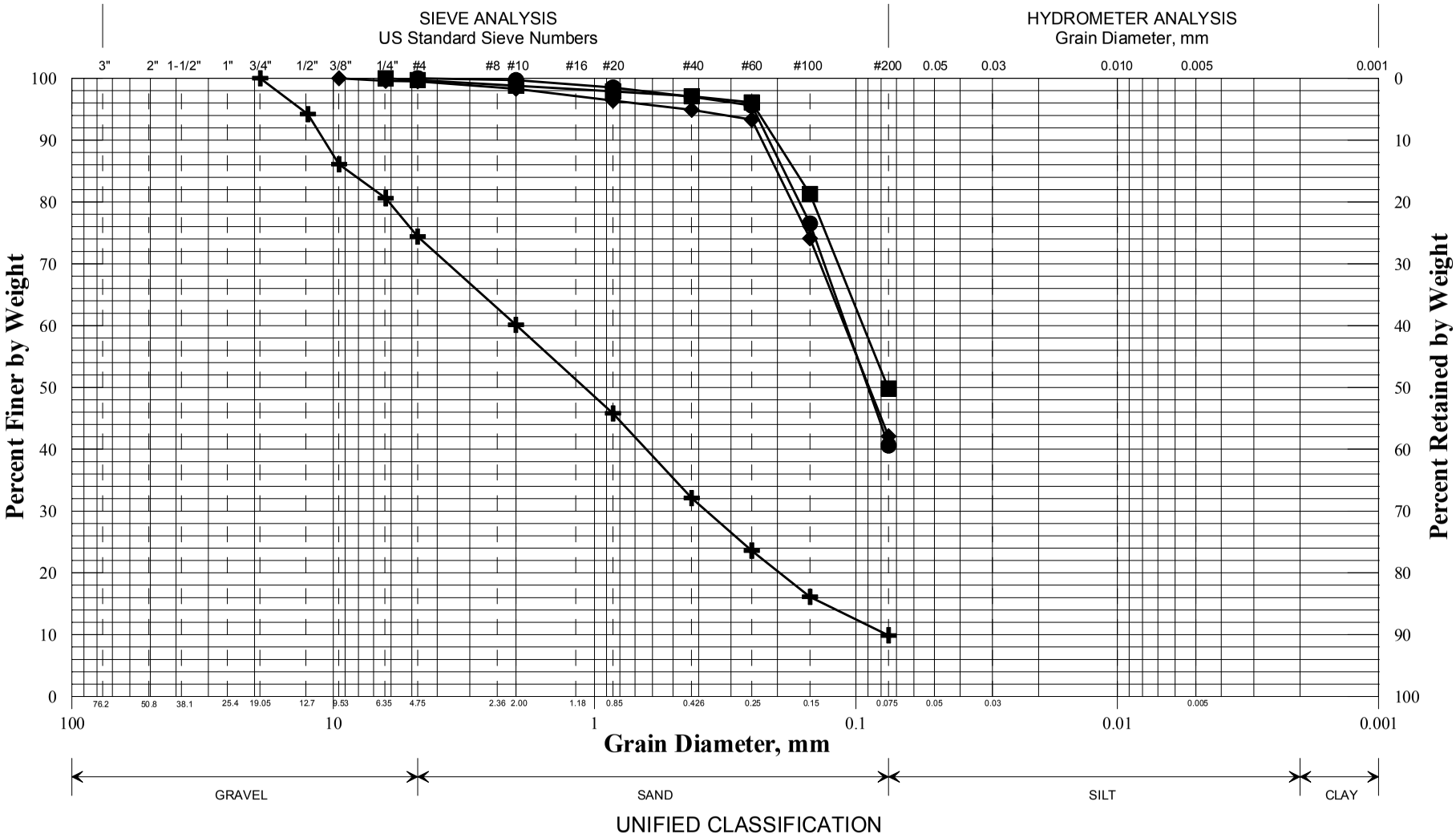

	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
✚	BB-BHC-104/1D/A	15+22.4	7.3 LT	0.8-1.4	SAND, some gravel, trace silt.	4.1			
◆	BB-BHC-104/1D/B	15+22.4	7.3 LT	1.4-2.8	Silty SAND, trace gravel.	16.3			
■	BB-BHC-104/3D	15+22.4	7.3 LT	9.0-11.0	Silty SAND, trace gravel.	21.3			
●	BB-BHC-104/5D	15+22.4	7.3 LT	19.0-21.0	Silty SAND.	26.8			
▲									
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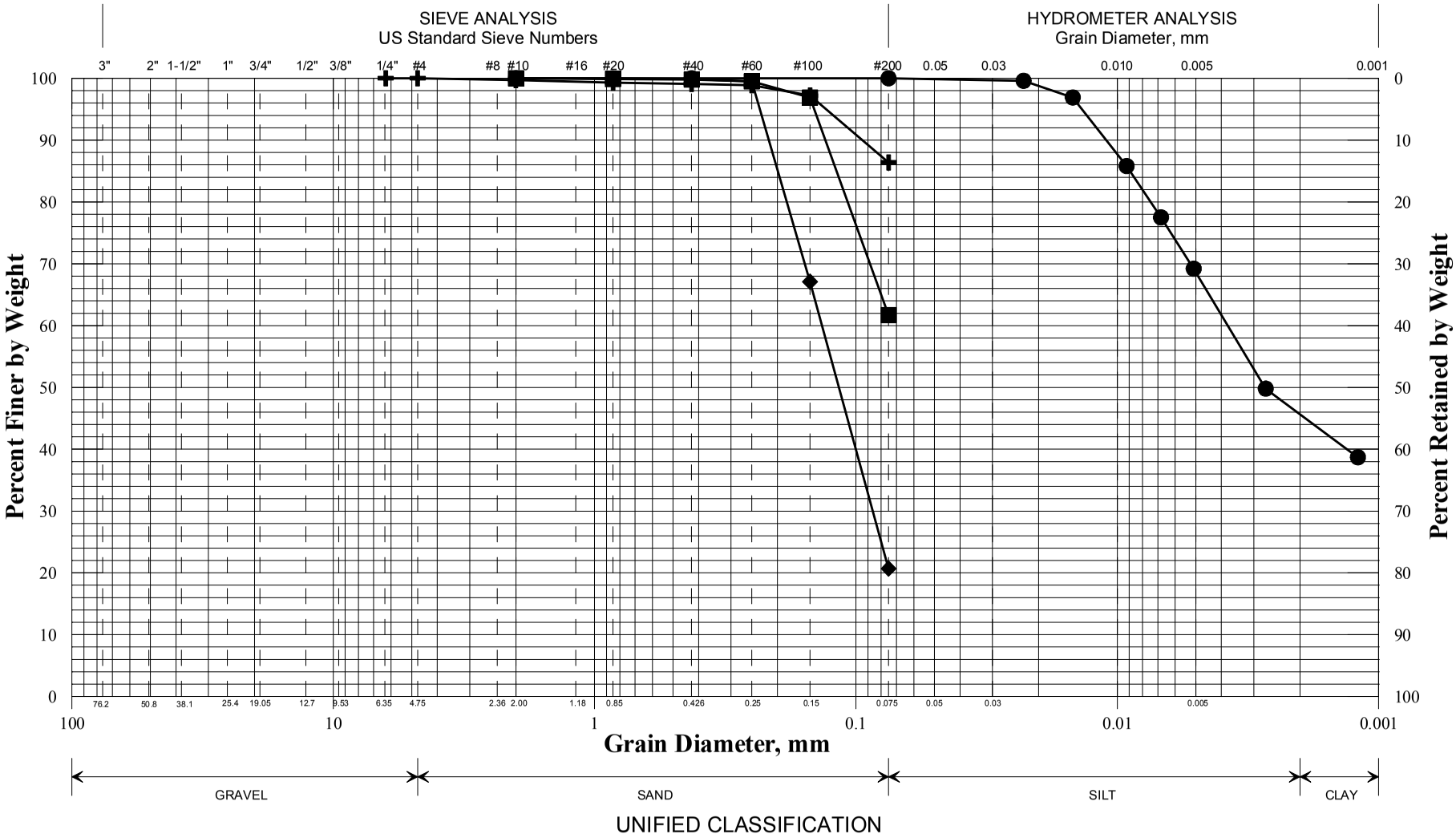
GRAIN SIZE DISTRIBUTION CURVE



	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
✚	BB-BHC-104/7D	15+22.4	7.3 LT	29.0-31.0	SILT, little sand.	28.2			
◆	BB-BHC-104/10D	15+22.4	7.3 LT	44.0-46.0	SAND some silt.	26.3			
■	BB-BHC-104/12D	15+22.4	7.3 LT	54.0-56.0	Sandy SILT.	28.0			
●	BB-BHC-104/14D	15+22.4	7.3 LT	69.0-71.0	Clayey SILT.	32.8	26	20	6
▲									
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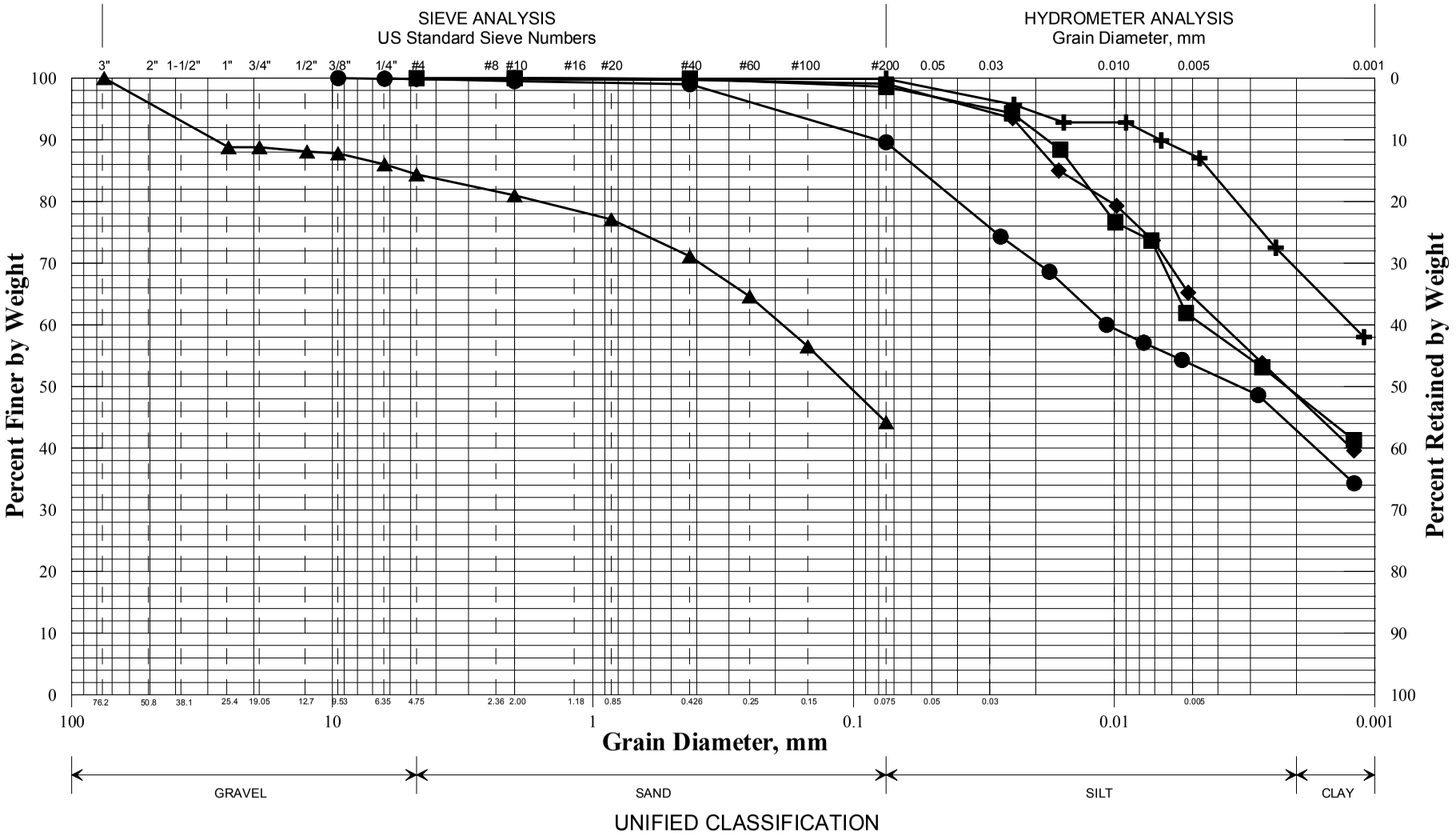
GRAIN SIZE DISTRIBUTION CURVE



	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
✚	BB-BHC-104/2U	15+22.4	7.3 LT	79.0-81.0	CLAY, some silt, trace sand.	41.8	31	20	11
◆	BB-BHC-104/16D	15+22.4	7.3 LT	90.5-92.5	Clayey SILT, trace sand.	33.9	34	21	13
■	BB-BHC-104/18D	15+22.4	7.3 LT	99.0-101.0	Clayey SILT, trace sand.	36.4			
●	BB-BHC-104/19D	15+22.4	7.3 LT	129.0-131.0	Clayey SILT, little sand, trace gravel.	26.1	23	16	7
▲	BB-BHC-104/20D	15+22.4	7.3 LT	139.0-141.0	Sandy SILT, little gravel.	11.6			
✖									

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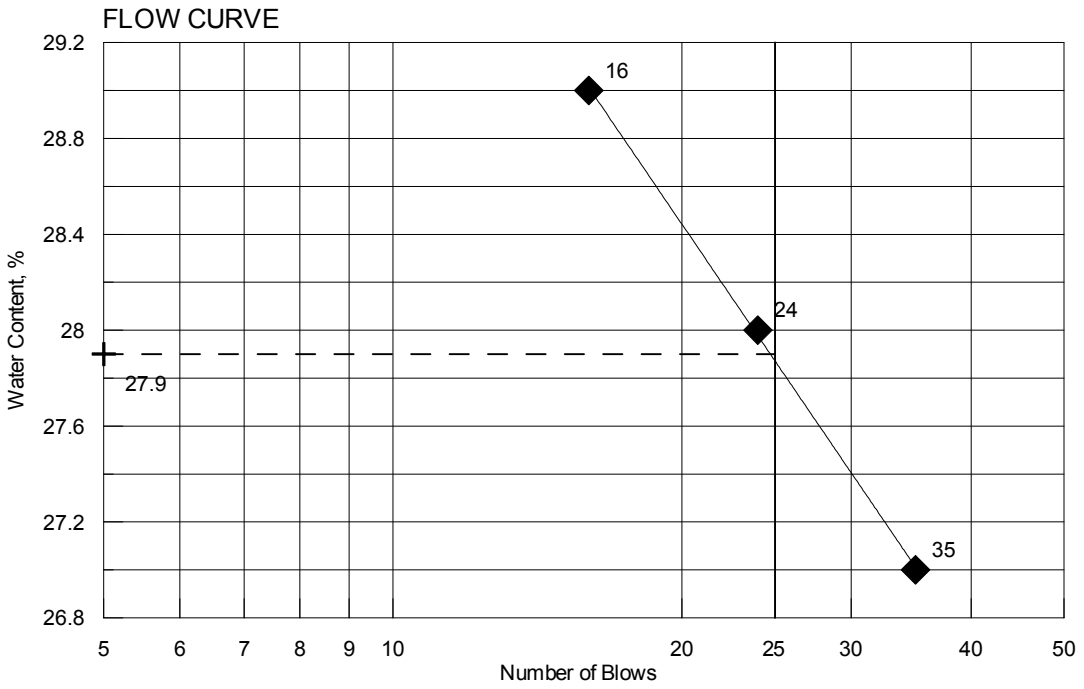
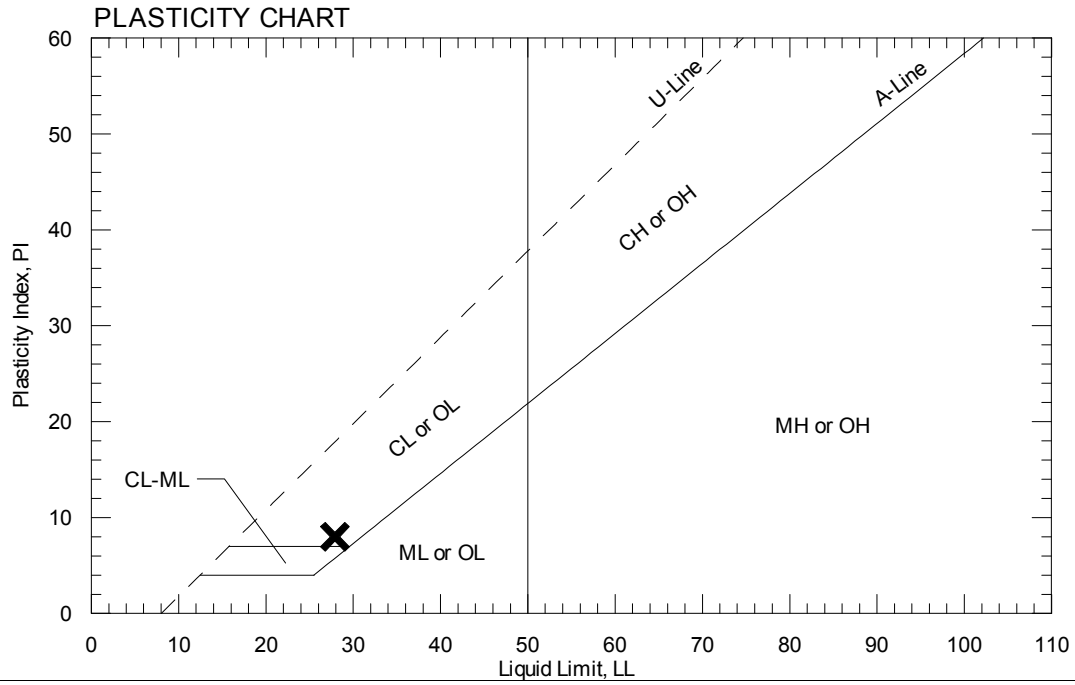
BB-BHC-101

ATTERBERG AND LAB VANE SHEAR TEST RESULTS

TOWN	Bowdoinham	Reference No.	211469
PIN	015091.00	Water Content, %	30.6
Sampled	9/25/2008	Plastic Limit	20
Boring No./Sample No.	BB-BHC-101/14D	Liquid Limit	28
Station	12+51.2	Plasticity Index	8
Depth	70.5-72.5	Tested By	BBURR





AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **11/18/2008**

Paper Copy: Lab File; Project File; Geotech File

Maine DOT, Materials Testing & Exploration, 219 Hogan Road, Bangor, Maine 04401

GEOTECHNICAL TEST REPORT
Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
211473	**BB-BHC-101/2U**	**GEOTECHNICAL (UNDISTURBED)**	**9/22/2008**	**10/28/2008**

Sample Type: **GEOTECHNICAL** Location: **OTHER** Station: **12+51.2** Offset, ft: **7.0** **RT** Dbfg, ft: **104.0-106.0**

PIN: **015091.00** Town: **Bowdoinham** Sampler: **WILDER, BRUCE H**

TEST RESULTS

Sieve Analysis (T-88)

SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	
¾ in. [19.0 mm]	
½ in. [12.5 mm]	
⅜ in. [9.5 mm]	
¼ in. [6.3 mm]	
No. 4 [4.75 mm]	
No. 10 [2.00 mm]	**100.0**
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	**99.7**
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	**99.6**
[0.0236 mm]	**94.8**
[0.0161 mm]	**84.0**
[0.0094 mm]	**81.3**
[0.0069 mm]	**75.9**
[0.0050 mm]	**70.4**
[0.0026 mm]	**59.6**
[0.0012 mm]	**46.1**

Wash Method

Direct Shear (T 236)

Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)

Trimmings, Water Content, %

	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %

29

Plastic Limit (T 90), %

21

Plasticity Index (T 90), %

8

Specific Gravity, Corrected to 20°C (T 100)

2.75

Loss on Ignition (T 267)

Loss, % H2O, %

Water Content (T 265), %

34.7

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In. U. Shear tons/ft²	3 In. Remold tons/ft²	6 In. U. Shear tons/ft²	6 In. Remold tons/ft²	Water Content, %	Description of Material Sampled at the Various Tube Depths
0-0.5	0.29	0.03	0.31	0.04	35.7	Mottled light gray clay.
0.5-1.0	0.31	0.04	0.36	0.05	35.3	Mottled light gray clay.
1.0-1.5	0.36	0.03	0.42	0.05	35.0	Mottled light gray clay.
1.5-2.0	0.22	0.04	0.23	0.04	36.0	Mottled light gray clay.

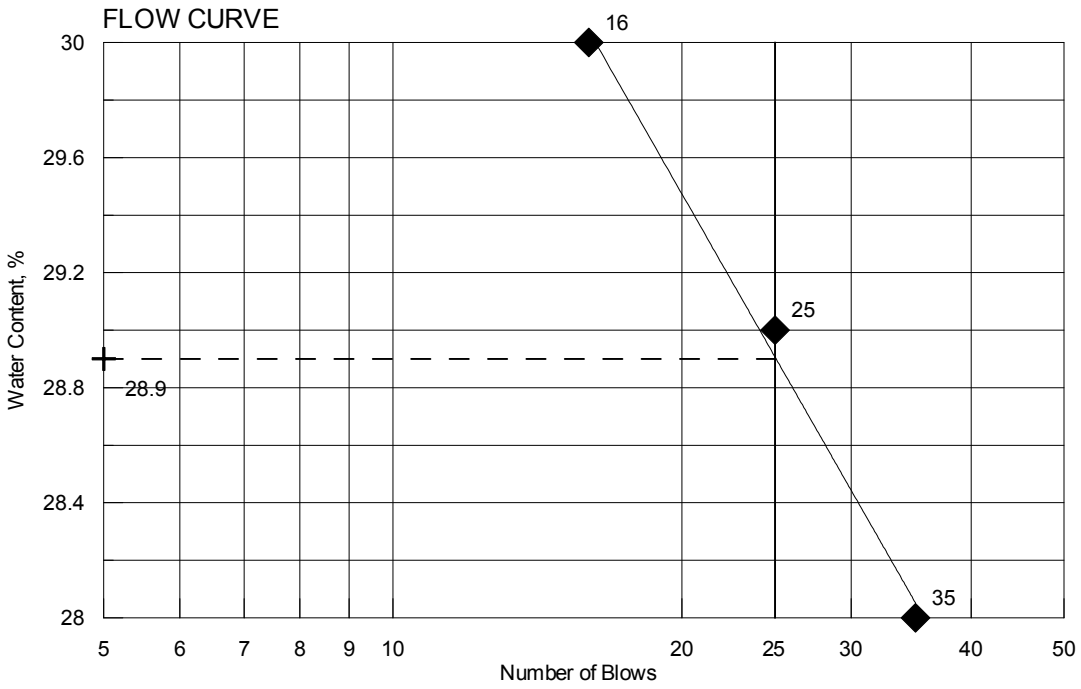
Comments:

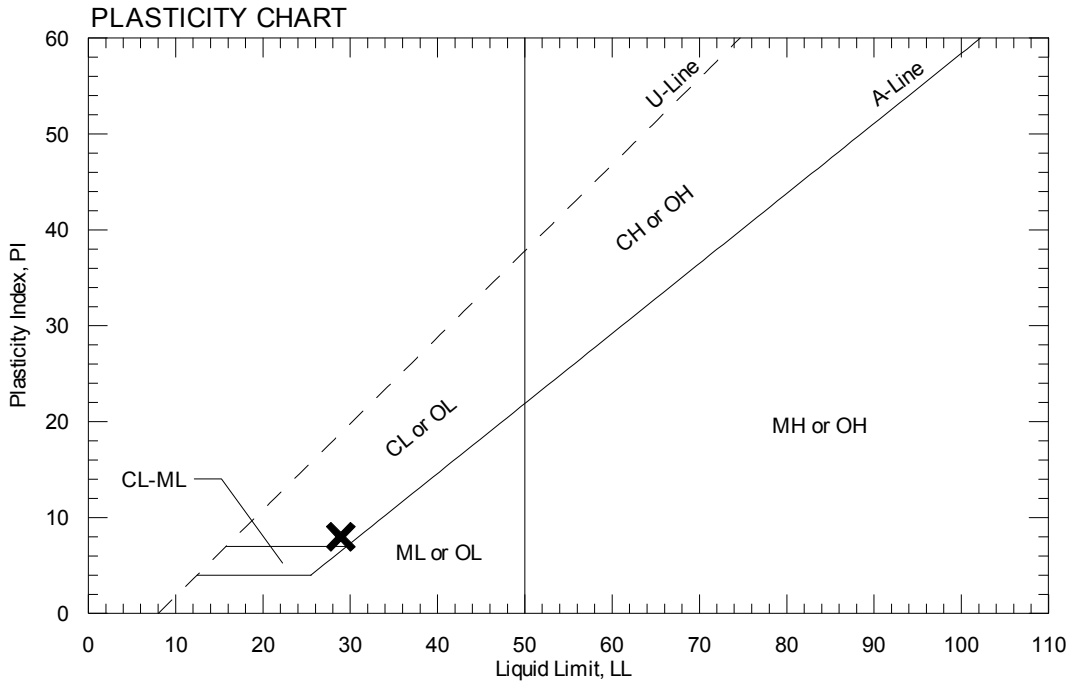
AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **12/3/2008**

Paper Copy: Lab File; Project File; Geotech File

TOWN	Bowdoinham	Reference No.	211473
PIN	015091.00	Water Content, %	34.7
Sampled	9/22/2008	Plastic Limit	21
Boring No./Sample No.	BB-BHC-101/2U	Liquid Limit	29
Station	12+51.2	Plasticity Index	8
Depth	104.0-106.0	Tested By	BBURR



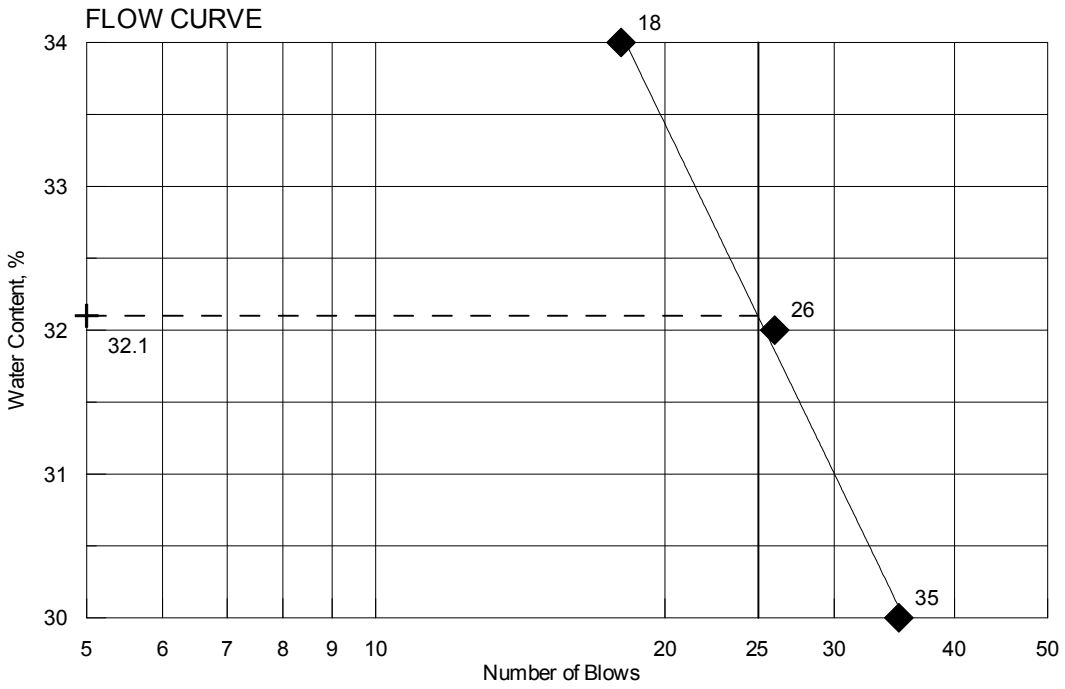


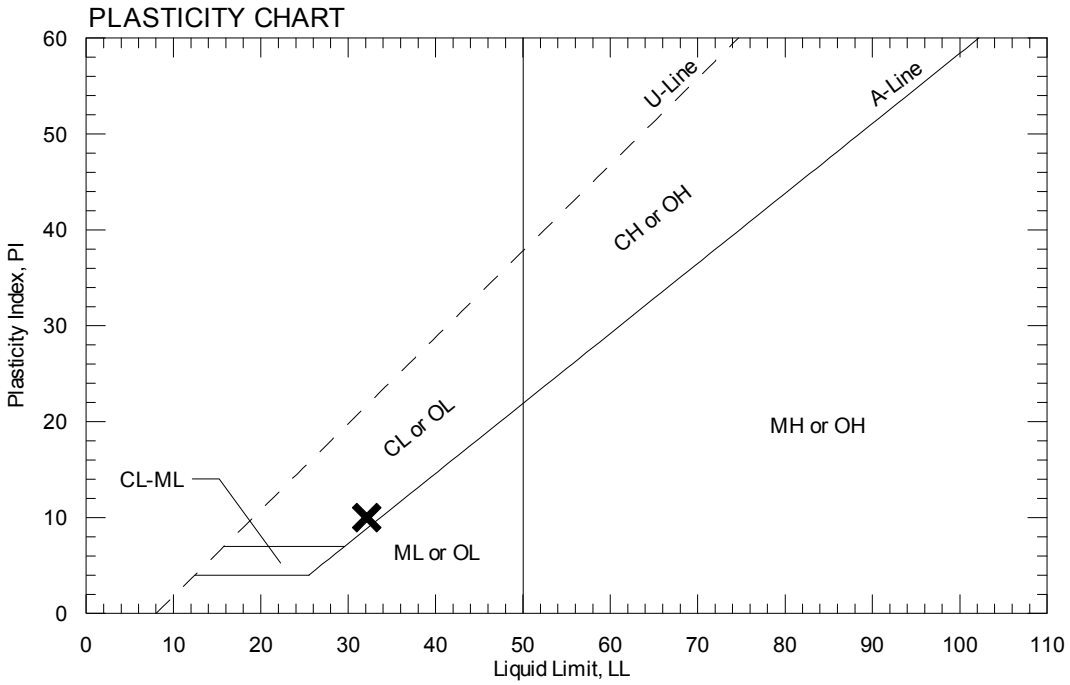
AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **12/3/2008**

Paper Copy: Lab File; Project File; Geotech File

TOWN	Bowdoinham	Reference No.	211475
PIN	015091.00	Water Content, %	35.2
Sampled	9/25/2008	Plastic Limit	22
Boring No./Sample No.	BB-BHC-101/19D	Liquid Limit	32
Station	12+51.2	Plasticity Index	10
Depth	124.0-126.0	Tested By	BBURR



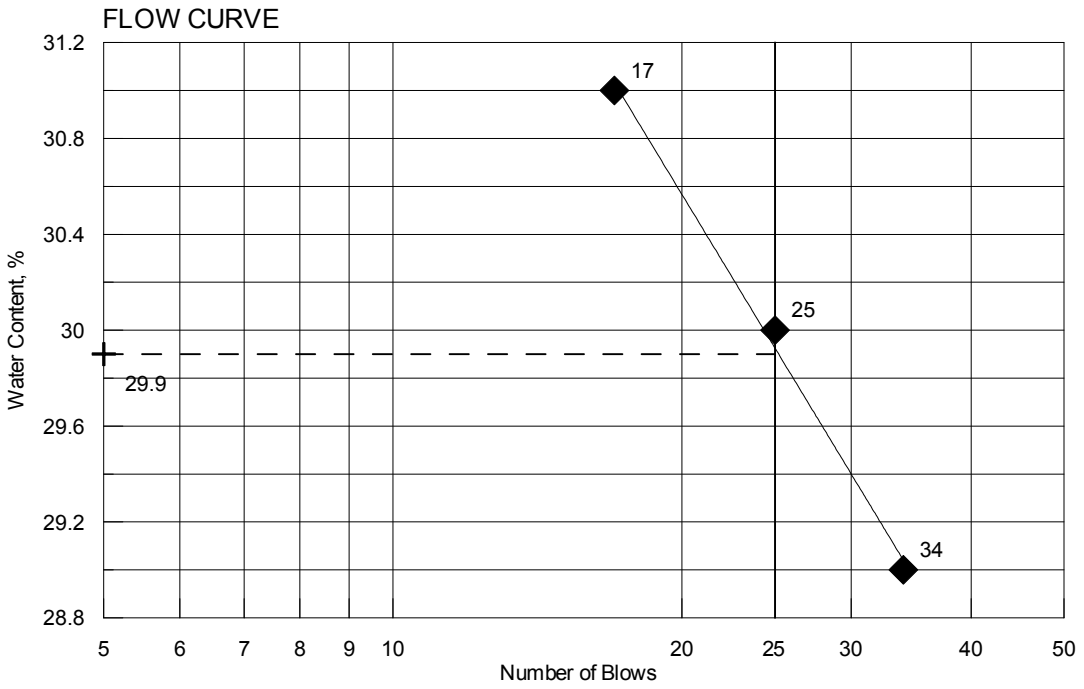


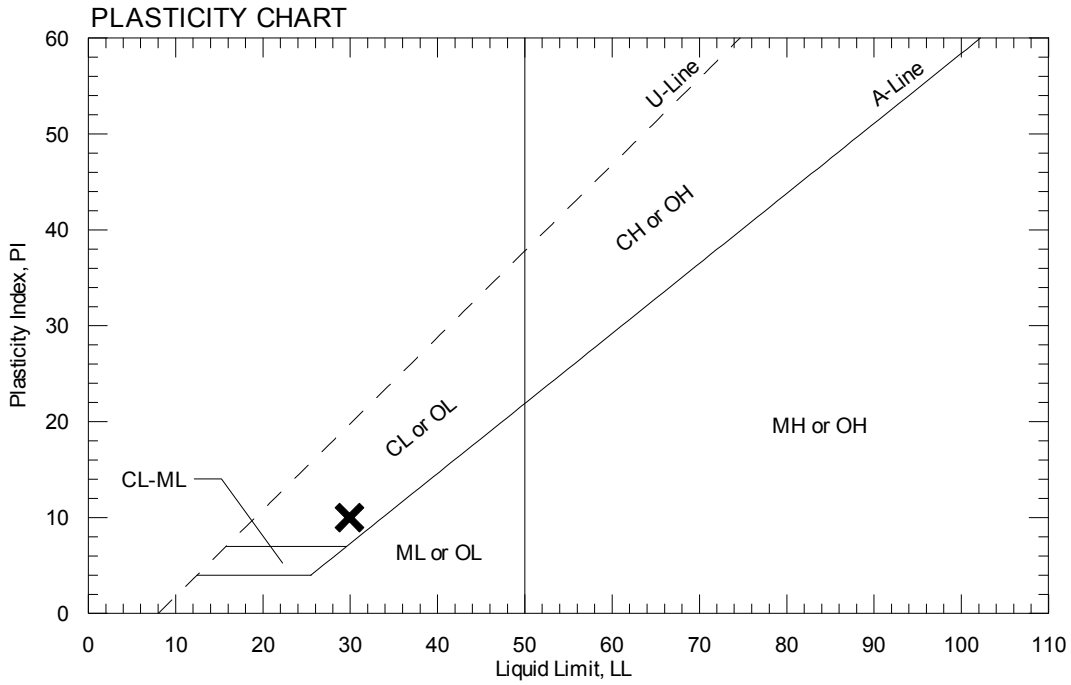
AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **11/18/2008**

Paper Copy: Lab File; Project File; Geotech File

TOWN	Bowdoinham	Reference No.	212201
PIN	015091.00	Water Content, %	31.5
Sampled	9/25/2008	Plastic Limit	20
Boring No./Sample No.	BB-BHC-101/20D	Liquid Limit	30
Station	12+51.2	Plasticity Index	10
Depth	134.0-135.0	Tested By	BBURR





AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **11/18/2008**

Paper Copy: Lab File; Project File; Geotech File

BB-BHC-102

ATTERBERG, LAB VANE SHEAR, AND CONSOLIDATION TEST RESULTS

Maine DOT, Materials Testing & Exploration, 219 Hogan Road, Bangor, Maine 04401

GEOTECHNICAL TEST REPORT
Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
212210	**BB-BHC-102/1U**	**GEOTECHNICAL (UNDISTURBED)**	**9/22/2008**	**10/28/2008**

Sample Type: **GEOTECHNICAL** Location: **OTHER** Station: **13+48.8** Offset, ft: **19.0 LT** Dbfg, ft: **49.0-51.0**

PIN: **015091.00** Town: **Bowdoinham** Sampler: **WILDER, BRUCE H**

TEST RESULTS

Sieve Analysis (T-88)

SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	
¾ in. [19.0 mm]	
½ in. [12.5 mm]	
⅜ in. [9.5 mm]	
¼ in. [6.3 mm]	
No. 4 [4.75 mm]	
No. 10 [2.00 mm]	**100.0**
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	**99.9**
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	**99.8**
[0.0230 mm]	**97.0**
[0.0158 mm]	**86.2**
[0.0094 mm]	**80.8**
[0.0071 mm]	**70.0**
[0.0053 mm]	**62.0**
[0.0028 mm]	**43.1**
[0.0012 mm]	**29.6**

Wash Method

Direct Shear (T 236)

Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)

Trimmings, Water Content, %	

	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %
27

Plastic Limit (T 90), %
22

Plasticity Index (T 90), %
5

Specific Gravity, Corrected to 20°C (T 100)
2.74

Loss on Ignition (T 267)
Loss, % H2O, %

Water Content (T 265), %
28.3

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In. U. Shear tons/ft²	3 In. Remold tons/ft²	6 In. U. Shear tons/ft²	6 In. Remold tons/ft²	Water Content, %	Description of Material Sampled at the Various Tube Depths
0-0.5	0.4	0.02	0.29	0.02	29.1	Mottled light gray clay.
0.5-1.0	0.23	0.02	0.37	0.04	30.4	Mottled light gray clay.
1.0-1.5	0.27	0	0.2	0	30.1	Mottled light gray clay.

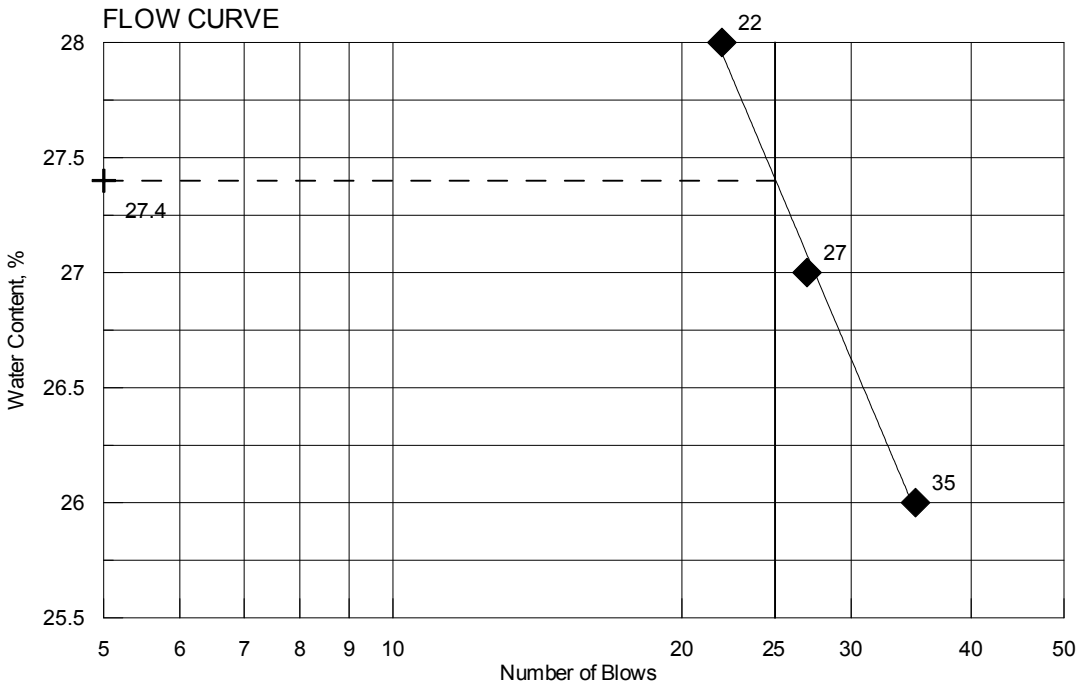
Comments:

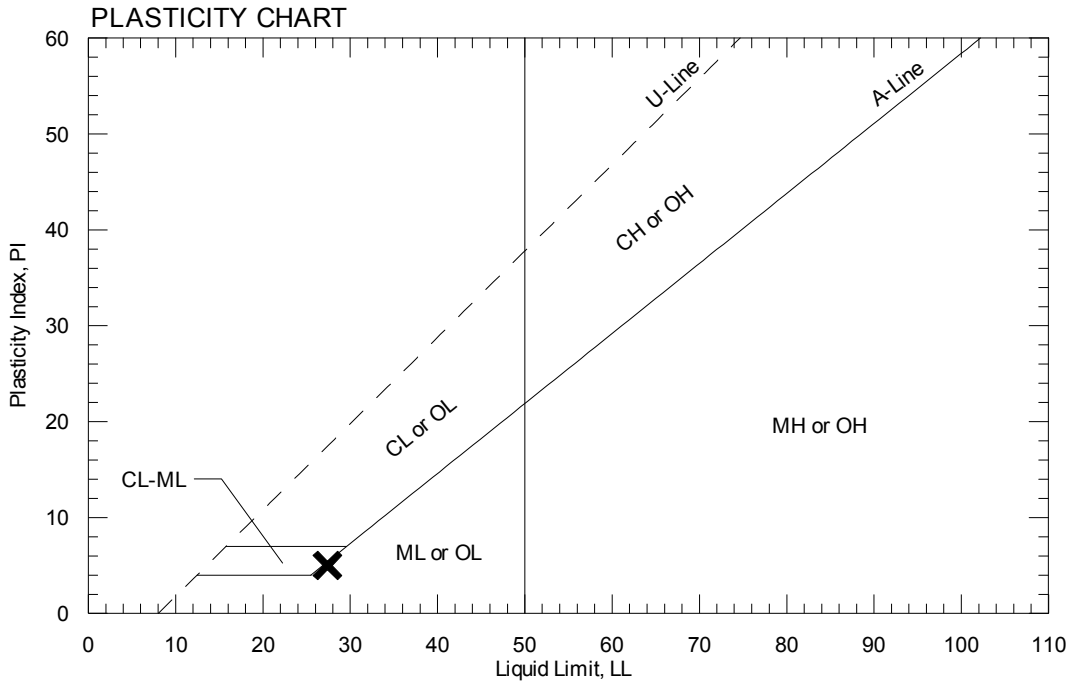
AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **12/5/2008**

Paper Copy: Lab File; Project File; Geotech File

TOWN	Bowdoinham	Reference No.	212210
PIN	015091.00	Water Content, %	28.3
Sampled	9/22/2008	Plastic Limit	22
Boring No./Sample No.	BB-BHC-102/1U	Liquid Limit	27
Station	13+48.8	Plasticity Index	5
Depth	49.0-51.0	Tested By	BBURR





AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **12/5/2008**

Paper Copy: Lab File; Project File; Geotech File

Maine DOT, Materials Testing & Exploration, 219 Hogan Road, Bangor, Maine 04401

GEOTECHNICAL TEST REPORT
Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
211458	**BB-BHC-102/2U**	**GEOTECHNICAL (UNDISTURBED)**	**9/25/2008**	**10/28/2008**

Sample Type: **GEOTECHNICAL** Location: **OTHER** Station: **13+48.8** Offset, ft: **19.0 LT** Dbfg, ft: **59.0-61.0**

PIN: **015091.00** Town: **Bowdoinham** Sampler: **WILDER, BRUCE H**

TEST RESULTS

Sieve Analysis (T-88)

SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	
¾ in. [19.0 mm]	
½ in. [12.5 mm]	
⅜ in. [9.5 mm]	
¼ in. [6.3 mm]	
No. 4 [4.75 mm]	
No. 10 [2.00 mm]	**100.0**
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	**99.8**
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	**99.6**
[0.0217 mm]	**99.5**
[0.0140 mm]	**96.8**
[0.0084 mm]	**91.6**
[0.0063 mm]	**83.8**
[0.0047 mm]	**78.5**
[0.0026 mm]	**57.6**
[0.0012 mm]	**41.9**

Wash Method

Direct Shear (T 236)

Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)

Trimmings, Water Content, %	**34.6**

	Initial	Final		Void Ratio	% Strain
Water Content, %	**35.4**	**24.4**	Pmin		
Dry Density, lbs/ft³	**86.8**	**104**	Pp		
Void Ratio	**1.01**	**0.68**	Pmax		
Saturation, %	**97.6**	**100.2**	Cc/C'c		

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %

28

Plastic Limit (T 90), %

19

Plasticity Index (T 90), %

9

Specific Gravity, Corrected to 20°C (T 100)

2.80

Loss on Ignition (T 267)

Loss, % H2O, %

Water Content (T 265), %

34.2

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In. U. Shear tons/ft²	3 In. Remold tons/ft²	6 In. U. Shear tons/ft²	6 In. Remold tons/ft²	Water Content, %	Description of Material Sampled at the Various Tube Depths
0-0.5	0.2	0.01	0.19	0.01	35.6	Alternating layers of light to dark gray clay.
0.625-1.0	0.18	0.01	0.2	0.01	35.5	Alternating layers of light to dark gray clay.
1.0-1.5	0.11	0	0.11	0	36.0	Alternating layers of light to dark gray clay.
1.5-1.83	0.1	0	0.18	0	34.9	Alternating layers of light to dark gray clay with a small portion appearing to be super saturated.

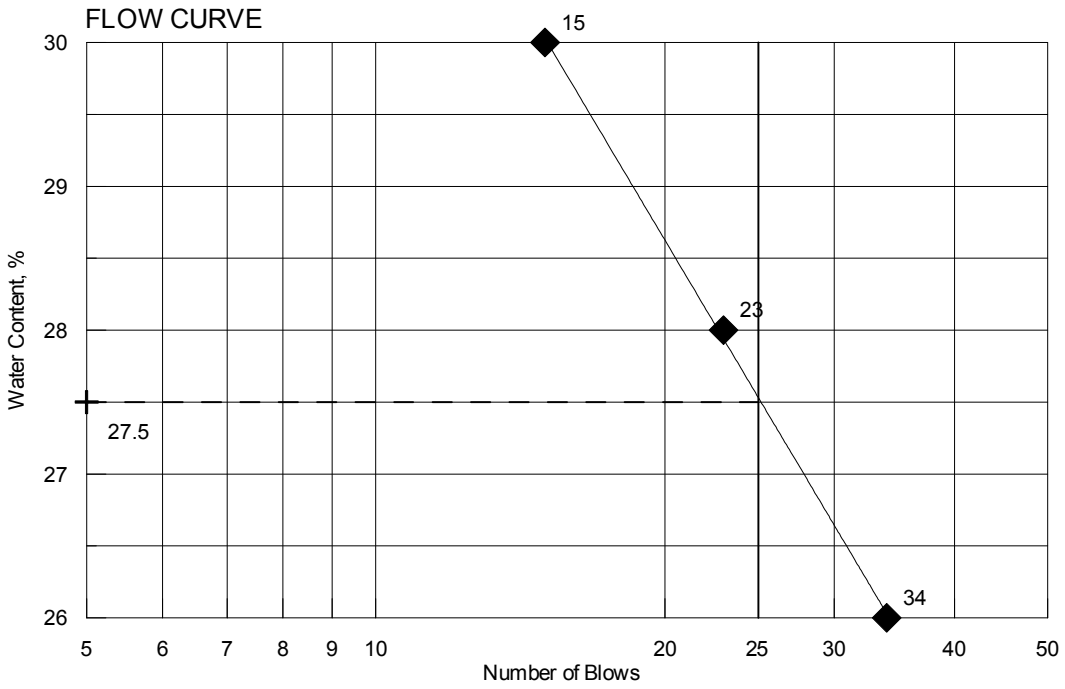
Comments:

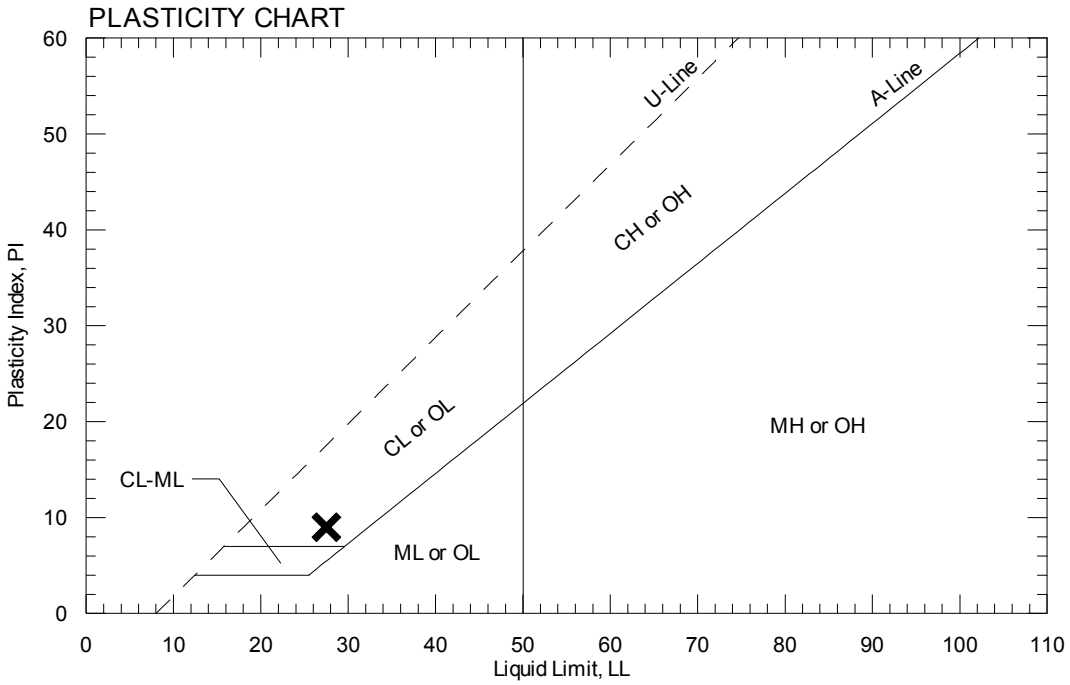
AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **12/3/2008**

Paper Copy: Lab File; Project File; Geotech File

TOWN	Bowdoinham	Reference No.	211458
PIN	015091.00	Water Content, %	34.2
Sampled	9/25/2008	Plastic Limit	19
Boring No./Sample No.	BB-BHC-102/2U	Liquid Limit	28
Station	13+48.8	Plasticity Index	9
Depth	59.0-61.0	Tested By	BBURR





AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **12/3/2008**

Paper Copy: Lab File; Project File; Geotech File

CONSOLIDATION TEST DATA

Project: BOWDINHAM
Boring No.: BB-BHC-102
Sample No.: 2U
Test No.: 211458

Location:
Tested By: Brian Fogg
Test Date: 11/14/08
Sample Type: TUBE

Project No.: 01509100
Checked By:
Depth: 59-61 FT
Elevation:

Soil Description: CLAY-SILT
Remarks:

Measured Specific Gravity: 2.80
Initial Void Ratio: 1.01
Final Void Ratio: 0.68

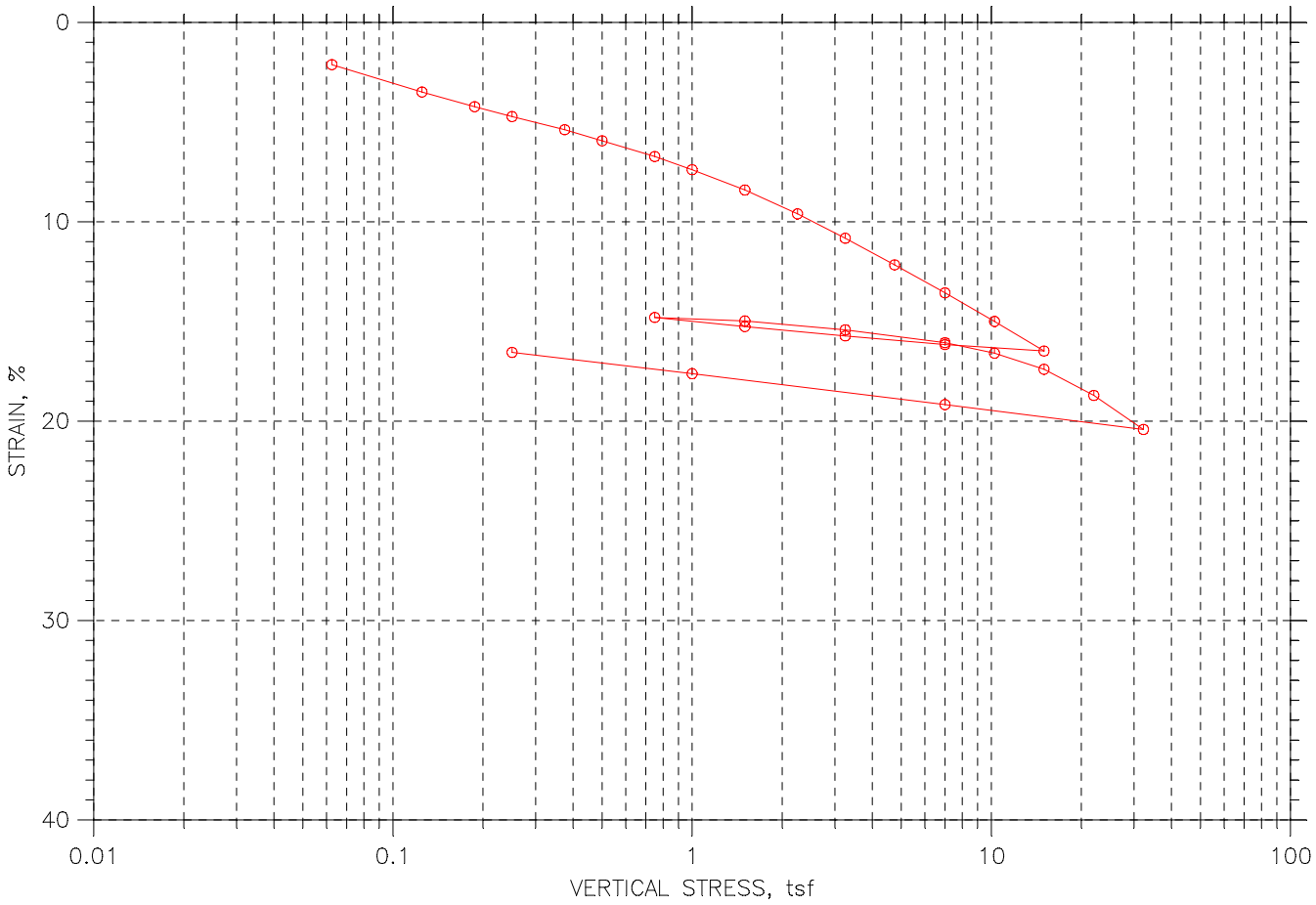
Liquid Limit: 28
Plastic Limit: 19
Plasticity Index: 9

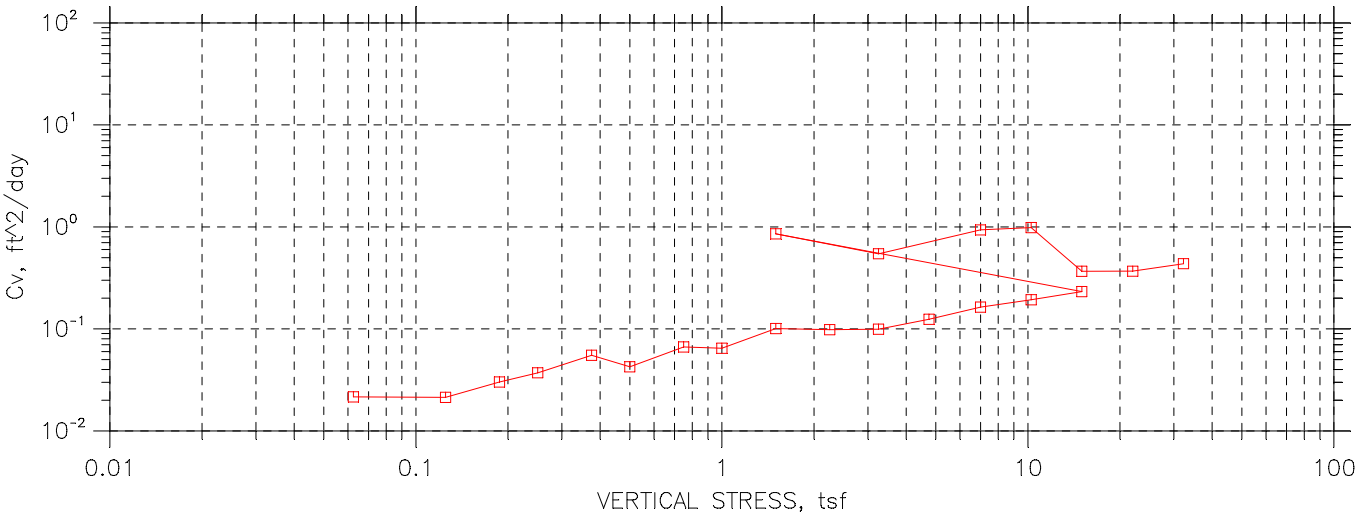
Initial Height: 1.02 in
Specimen Diameter: 2.48 in

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID	67	RING	RING	44
Wt. Container + Wet Soil, gm	302.41	414.75	402.35	193.68
Wt. Container + Dry Soil, gm	241.93	374.88	374.88	166.29
Wt. Container, gm	67.1	262.13	262.13	53.85
Wt. Dry Soil, gm	174.83	112.75	112.75	112.44
Water Content, %	34.59	35.36	24.36	24.36
Void Ratio	---	1.01	0.68	---
Degree of Saturation, %	---	97.62	100.19	---
Dry Unit Weight, pcf	---	86.787	104	---

CONSOLIDATION TEST DATA

SUMMARY REPORT





	Project: BOWDINHAM	Location:	Project No.: 01509100
	Boring No.: BB-BHC-102	Tested By: Brian Fogg	Checked By:
	Sample No.: 2U	Test Date: 11/14/08	Depth: 59-61 FT
	Test No.: 211458	Sample Type: TUBE	Elevation:
	Description: CLAY-SILT		
	Remarks:		

Wed, 22-APR-2009 13:45:10

Maine DOT, Materials Testing & Exploration, 219 Hogan Road, Bangor, Maine 04401

GEOTECHNICAL TEST REPORT
Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
211459	**BB-BHC-102/3U**	**GEOTECHNICAL (UNDISTURBED)**	**9/25/2008**	**10/28/2008**

Sample Type: **GEOTECHNICAL** Location: **OTHER** Station: **13+48.8** Offset, ft: **19.0 LT** Dbfg, ft: **69.0-71.0**

PIN: **015091.00** Town: **Bowdoinham** Sampler: **WILDER, BRUCE H**

TEST RESULTS

Sieve Analysis (T-88)

SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	
¾ in. [19.0 mm]	
½ in. [12.5 mm]	
⅜ in. [9.5 mm]	
¼ in. [6.3 mm]	
No. 4 [4.75 mm]	
No. 10 [2.00 mm]	**100.0**
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	**99.8**
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	**99.1**
[0.0244 mm]	**97.0**
[0.0159 mm]	**90.9**
[0.0095 mm]	**84.9**
[0.0070 mm]	**78.8**
[0.0051 mm]	**72.7**
[0.0026 mm]	**60.6**
[0.0012 mm]	**45.5**

Wash Method

Direct Shear (T 236)

Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)

Trimmings, Water Content, %	**40.8**

	Initial	Final		Void Ratio	% Strain
Water Content, %	**40.3**	**26.9**	Pmin		
Dry Density, lbs/ft³	**79.4**	**99.5**	Pp		
Void Ratio	**1.19**	**0.75**	Pmax		
Saturation, %	**94.2**	**100.1**	Cc/C'c		

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %

32

Plastic Limit (T 90), %

24

Plasticity Index (T 90), %

8

Specific Gravity, Corrected to 20°C (T 100)

2.79

Loss on Ignition (T 267)

Loss, % H2O, %

Water Content (T 265), %

38.6

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In. U. Shear tons/ft²	3 In. Remold tons/ft²	6 In. U. Shear tons/ft²	6 In. Remold tons/ft²	Water Content, %	Description of Material Sampled at the Various Tube Depths
0-0.5	0.2	0	0.22	0	40.8	Mottled light gray clay.
0.625-1.0	0.2	0.01	0.19	0	41.3	Mottled light gray clay.
1.0-1.5	0.18	0	0.21	0	41.0	Mottled light gray clay.
1.5-2.0	0.22	0	0.16	0	40.3	Mottled light gray clay with a fine sand line at 20 1/2".

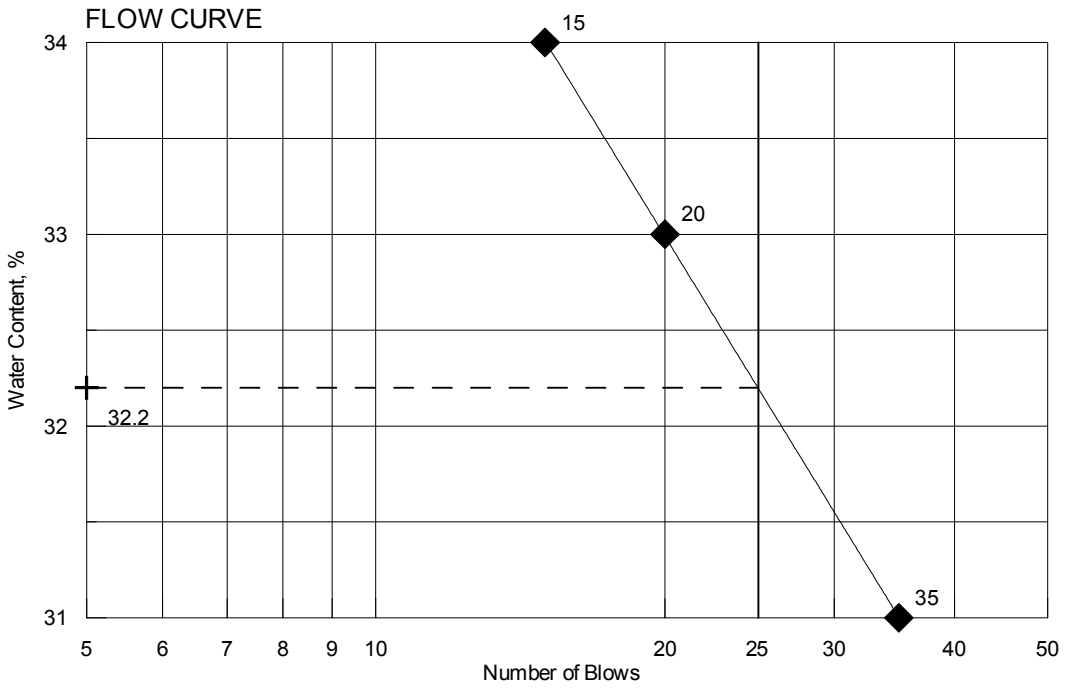
Comments:

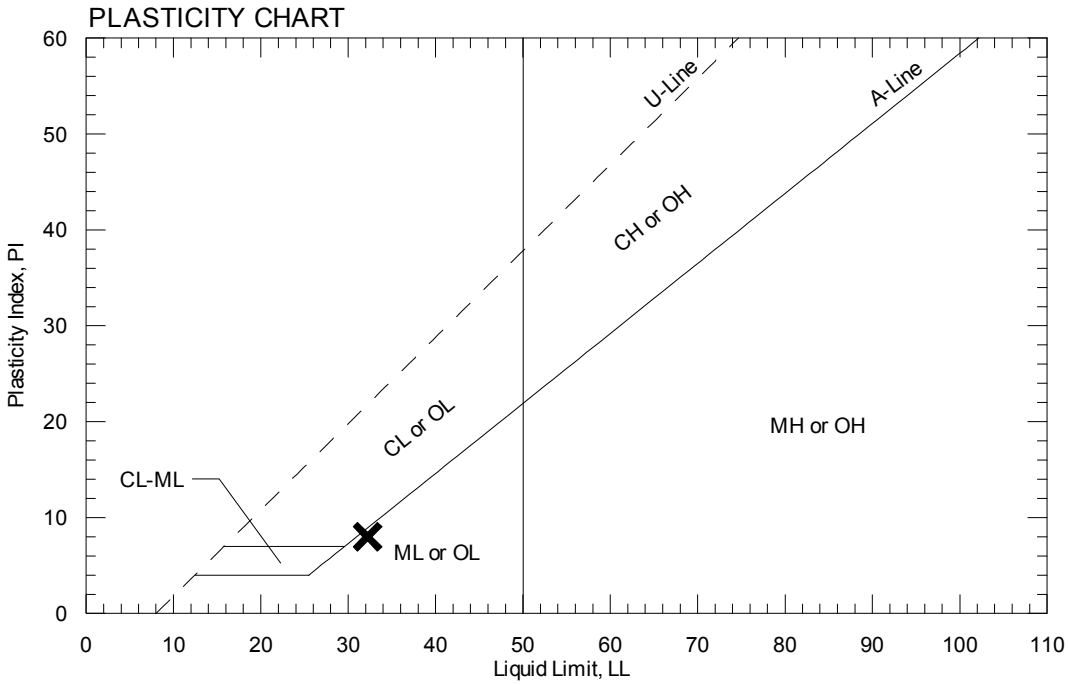
AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **12/5/2008**

Paper Copy: Lab File; Project File; Geotech File

TOWN	Bowdoinham	Reference No.	211459
PIN	015091.00	Water Content, %	38.6
Sampled	9/25/2008	Plastic Limit	24
Boring No./Sample No.	BB-BHC-102/3U	Liquid Limit	32
Station	13+48.8	Plasticity Index	8
Depth	69.0-71.0	Tested By	BBURR





AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **12/5/2008**

Paper Copy: Lab File; Project File; Geotech File

CONSOLIDATION TEST DATA

Project:
Boring No.: BB-BHC-102
Sample No.: 211459
Test No.: 3U

Location: BOWDINHAM
Tested By: Brian Fogg
Test Date: 11/17/08
Sample Type: TUBE

Project No.: 01509100
Checked By:
Depth: 69-71 FT
Elevation:

Soil Description: CLAY-SILT
Remarks:

Measured Specific Gravity: 2.79
Initial Void Ratio: 1.19
Final Void Ratio: 0.75

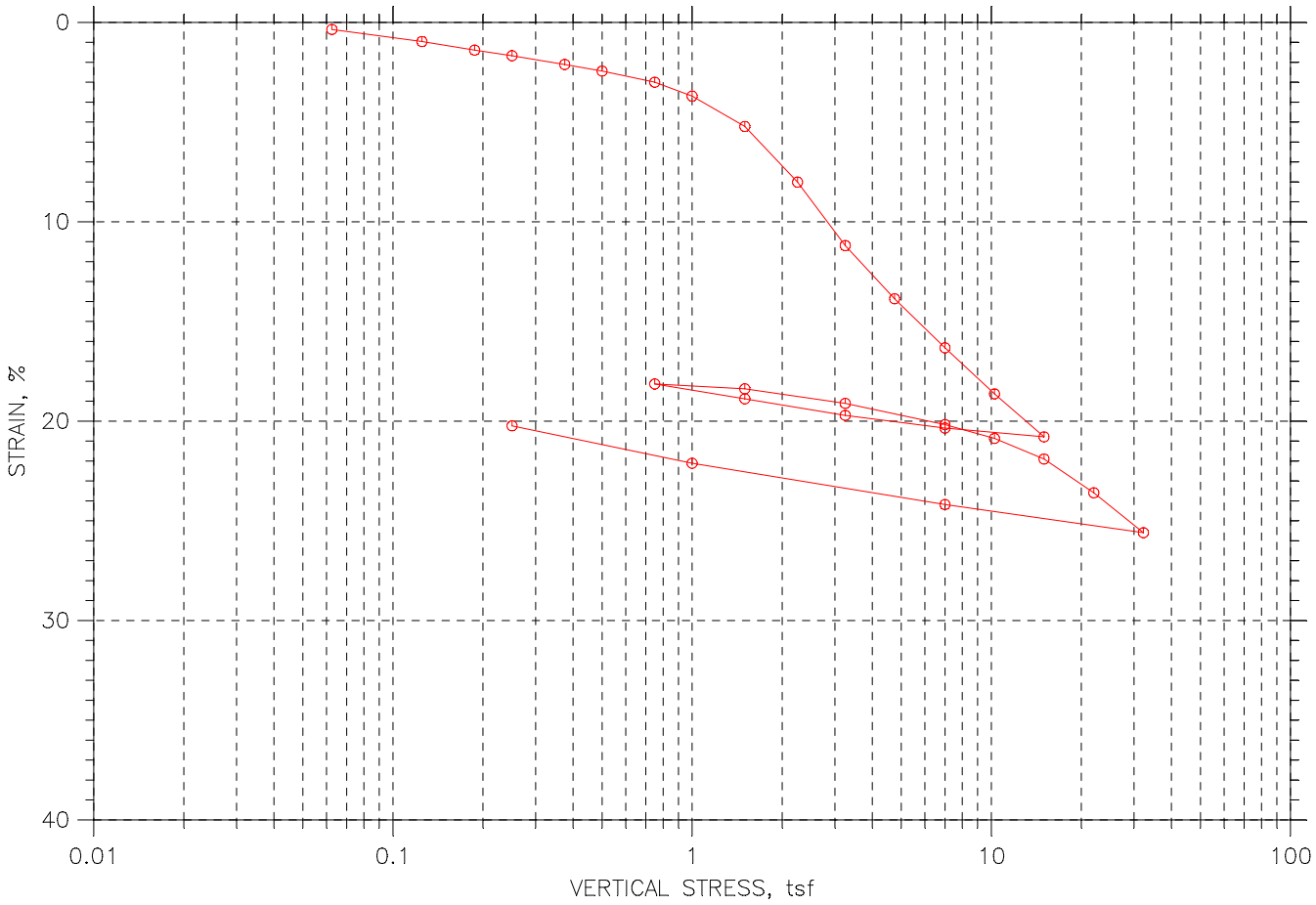
Liquid Limit: 32
Plastic Limit: 24
Plasticity Index: 8

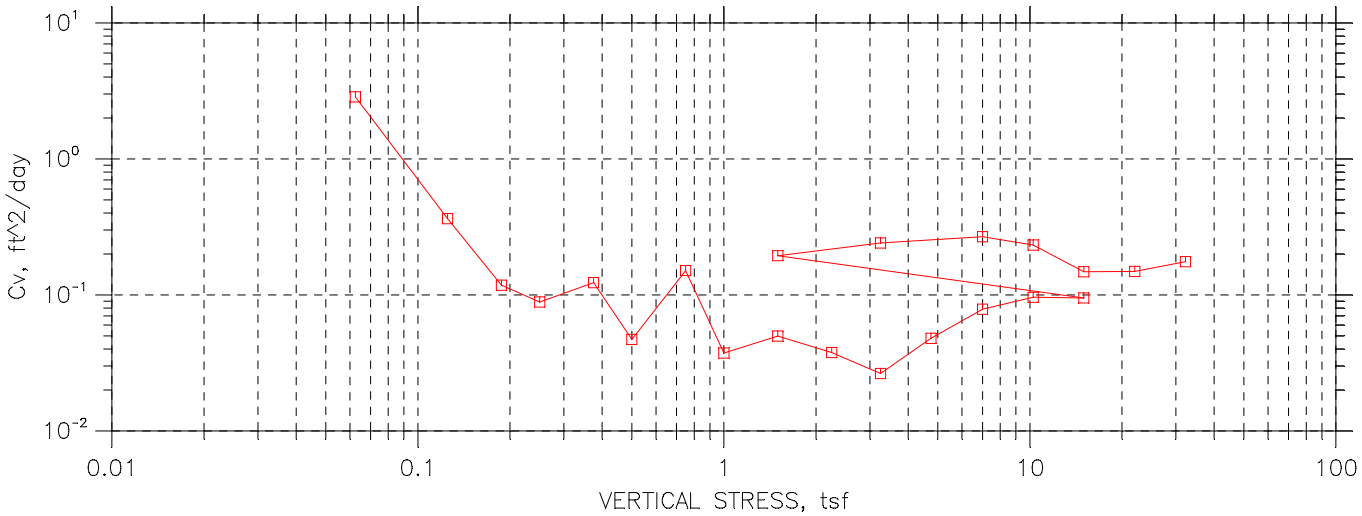
Initial Height: 1.01 in
Specimen Diameter: 2.48 in

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID	213	RING	RING	108
Wt. Container + Wet Soil, gm	143.43	405.8	392.08	192.73
Wt. Container + Dry Soil, gm	120.05	364.57	364.57	165.22
Wt. Container, gm	62.76	262.29	262.29	62.93
Wt. Dry Soil, gm	57.29	102.28	102.28	102.29
Water Content, %	40.81	40.31	26.89	26.89
Void Ratio	---	1.19	0.75	---
Degree of Saturation, %	---	94.22	100.09	---
Dry Unit Weight, pcf	---	79.404	99.546	---

CONSOLIDATION TEST DATA

SUMMARY REPORT





	Project:	Location: BOWDINHAM	Project No.: 01509100
	Boring No.: BB-BHC-102	Tested By: Brian Fogg	Checked By:
	Sample No.: 211459	Test Date: 11/17/08	Depth: 69-71 FT
	Test No.: 3U	Sample Type: TUBE	Elevation:
	Description: CLAY-SILT		
	Remarks:		

Wed, 22-APR-2009 13:54:25

Maine DOT, Materials Testing & Exploration, 219 Hogan Road, Bangor, Maine 04401

GEOTECHNICAL TEST REPORT
Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
212215	**BB-BHC-102/5U**	**GEOTECHNICAL (UNDISTURBED)**	**9/16/2008**	**10/28/2008**

Sample Type: **GEOTECHNICAL** Location: **OTHER** Station: **13+48.8** Offset, ft: **19.0 LT** Dbfg, ft: **89.0-91.0**

PIN: **015091.00** Town: **Bowdoinham** Sampler: **MOREAU, MICHAEL J**

TEST RESULTS

Sieve Analysis (T-88)

SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	
¾ in. [19.0 mm]	
½ in. [12.5 mm]	
⅜ in. [9.5 mm]	
¼ in. [6.3 mm]	
No. 4 [4.75 mm]	**100.0**
No. 10 [2.00 mm]	**100.0**
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	**99.9**
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	**99.2**
[0.0258 mm]	**98.1**
[0.0169 mm]	**92.3**
[0.0101 mm]	**86.5**
[0.0074 mm]	**80.8**
[0.0054 mm]	**75.0**
[0.0027 mm]	**60.6**
[0.0012 mm]	**49.0**

Wash Method

Direct Shear (T 236)

Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)

Trimmings, Water Content, %

	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %
27

Plastic Limit (T 90), %
20

Plasticity Index (T 90), %
7

Specific Gravity, Corrected to 20°C (T 100)
2.72

Loss on Ignition (T 267)

Loss, % H2O, %

Water Content (T 265), %
33.0

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In. U. Shear tons/ft²	3 In. Remold tons/ft²	6 In. U. Shear tons/ft²	6 In. Remold tons/ft²	Water Content, %	Description of Material Sampled at the Various Tube Depths
0-0.5	0.25	0.02	0.29	0.02	33.5	Mottled light gray clay.
0.5-1.0	0.33	0.01	0.33	0.02	32.6	Mottled light gray clay.
1.0-1.5	0.29	0.02	0.21	0.02	33.3	Mottled light gray clay.
1.5-1.7	0.19	0.01			33.8	Mottled light gray clay.

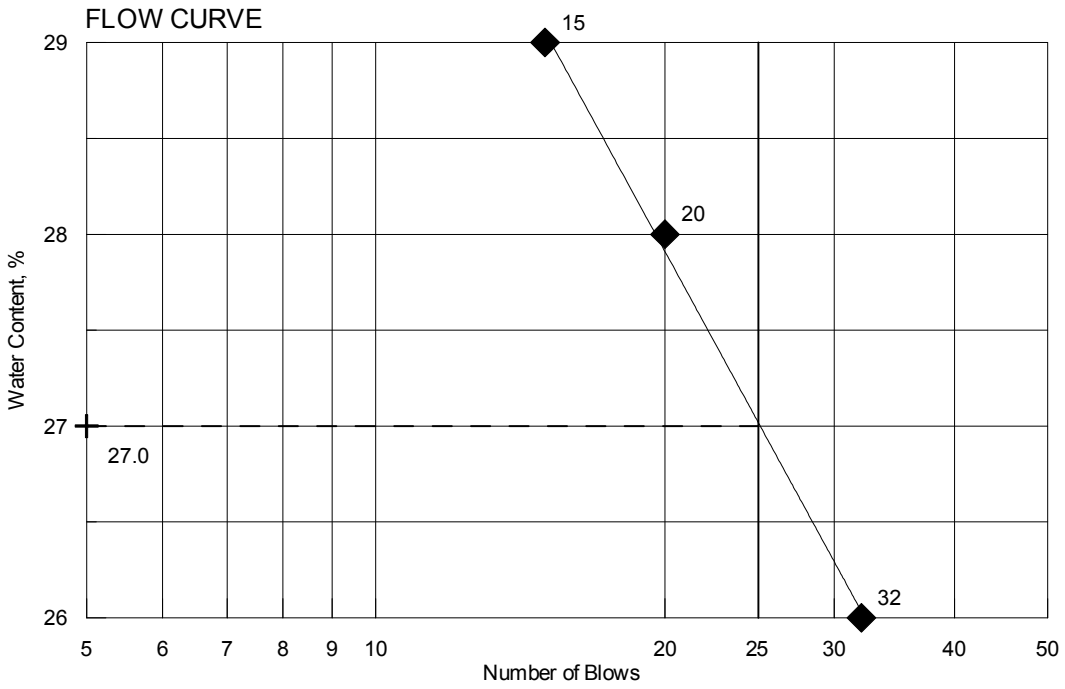
Comments:

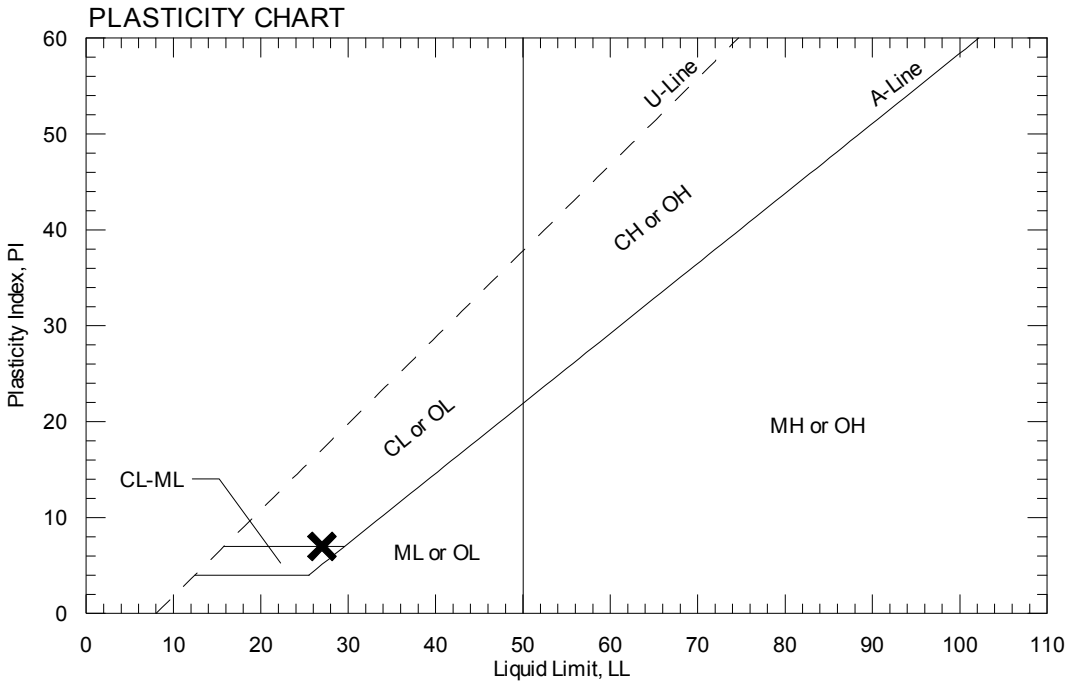
AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **12/5/2008**

Paper Copy: Lab File; Project File; Geotech File

TOWN	Bowdoinham	Reference No.	212215
PIN	015091.00	Water Content, %	33
Sampled	9/16/2008	Plastic Limit	20
Boring No./Sample No.	BB-BHC-102/5U	Liquid Limit	27
Station	13+48.8	Plasticity Index	7
Depth	89.0-91.0	Tested By	BBURR



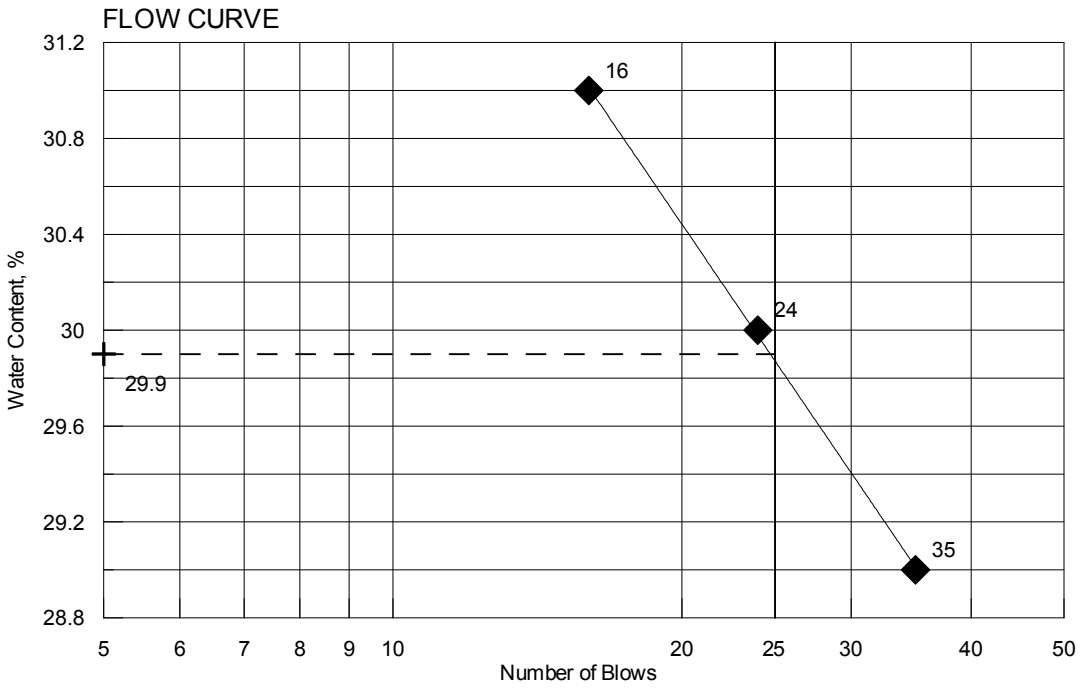


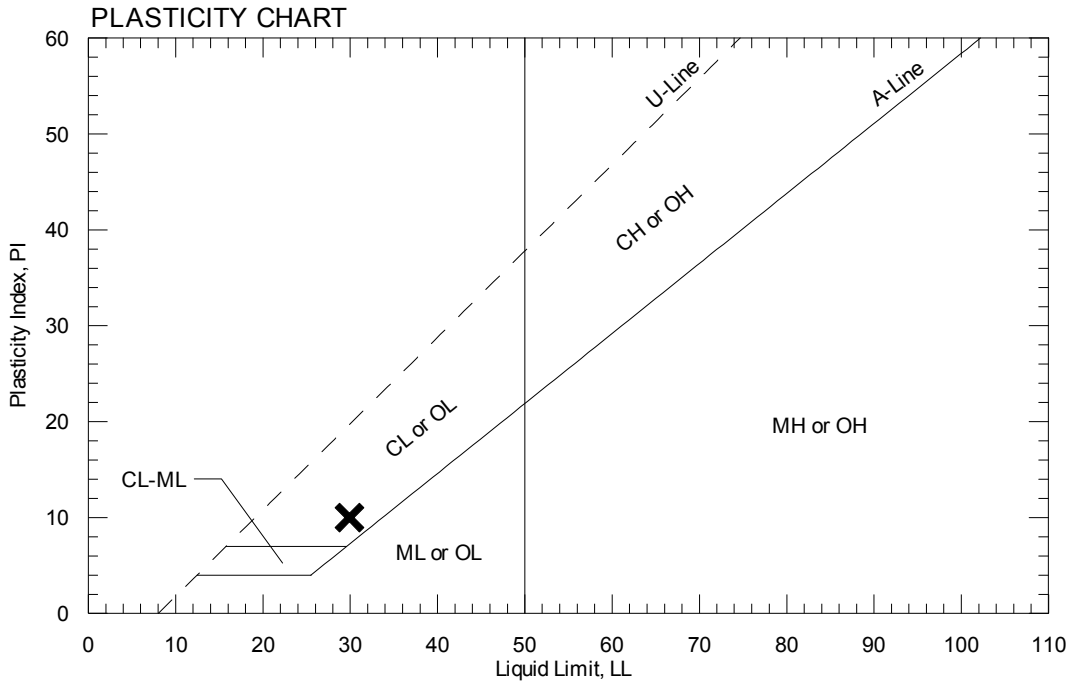
AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **12/5/2008**

Paper Copy: Lab File; Project File; Geotech File

TOWN	Bowdoinham	Reference No.	212218
PIN	015091.00	Water Content, %	29.7
Sampled	9/23/2008	Plastic Limit	20
Boring No./Sample No.	BB-BHC-102/17D	Liquid Limit	30
Station	13+48.8	Plasticity Index	10
Depth	107.0-109.0	Tested By	BBURR





AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **12/3/2008**

Paper Copy: Lab File; Project File; Geotech File

BB-BHC-103

ATTERBERG, LAB VANE SHEAR, AND CONSOLIDATION TEST RESULTS

Maine DOT, Materials Testing & Exploration, 219 Hogan Road, Bangor, Maine 04401

GEOTECHNICAL TEST REPORT
Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
211433	**BB-BHC-103/1U**	**GEOTECHNICAL (UNDISTURBED)**	**9/16/2008**	**10/28/2008**

Sample Type: **GEOTECHNICAL** Location: **OTHER** Station: **14+18.2** Offset, ft: **18.8** **RT** Dbfg, ft: **44.0-46.0**

PIN: **015091.00** Town: **Bowdoinham** Sampler: **MOREAU, MICHAEL J**

TEST RESULTS

Sieve Analysis (T-88)

SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	
¾ in. [19.0 mm]	
½ in. [12.5 mm]	
⅜ in. [9.5 mm]	
¼ in. [6.3 mm]	
No. 4 [4.75 mm]	
No. 10 [2.00 mm]	**100.0**
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	**100.0**
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	**100.0**
[0.0241 mm]	**98.3**
[0.0125 mm]	**92.6**
[0.0098 mm]	**81.0**
[0.0071 mm]	**75.2**
[0.0052 mm]	**66.5**
[0.0028 mm]	**49.2**
[0.0012 mm]	**34.7**

Wash Method

Direct Shear (T 236)

Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)

Trimmings, Water Content, %	

	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %

28

Plastic Limit (T 90), %

21

Plasticity Index (T 90), %

7

Specific Gravity, Corrected to 20°C (T 100)

2.73

Loss on Ignition (T 267)

Loss, % H2O, %

Water Content (T 265), %

32.7

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In. U. Shear tons/ft²	3 In. Remold tons/ft²	6 In. U. Shear tons/ft²	6 In. Remold tons/ft²	Water Content, %	Description of Material Sampled at the Various Tube Depths
0-0.5	0.26	0.01	0.23	0.02	33.4	Light to medium dark gray clay.
0.5-1.0	0.23	0	0.18	0	34.7	Light to medium dark gray clay.
1.0-1.5	0.25	0.02	0.19	0.02	31.5	Light to medium dark gray clay.

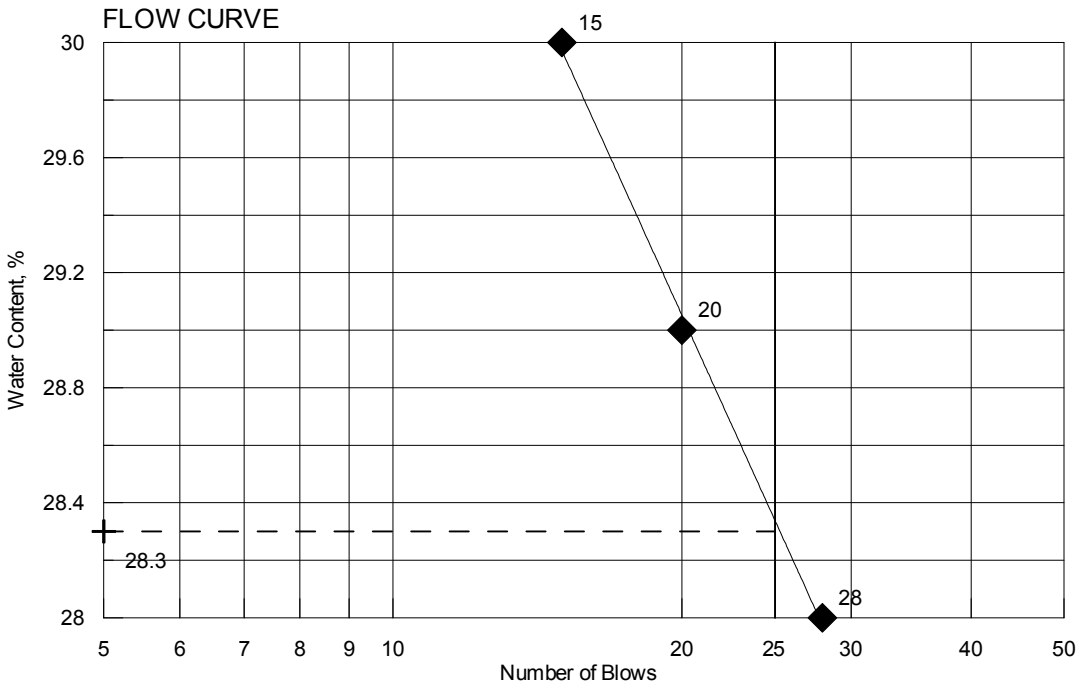
Comments:

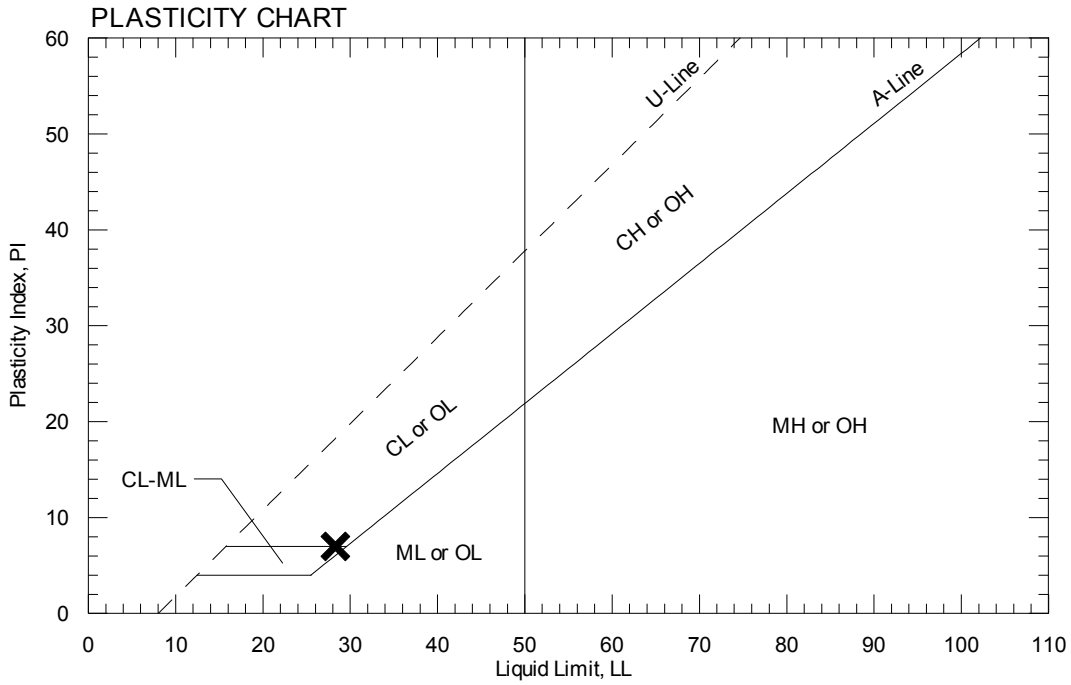
AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **12/3/2008**

Paper Copy: Lab File; Project File; Geotech File

TOWN	Bowdoinham	Reference No.	211433
PIN	015091.00	Water Content, %	32.7
Sampled	9/16/2008	Plastic Limit	21
Boring No./Sample No.	BB-BHC-103/1U	Liquid Limit	28
Station	14+18.2	Plasticity Index	7
Depth	44.0-46.0	Tested By	BBURR





AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **12/3/2008**

Paper Copy: Lab File; Project File; Geotech File

Maine DOT, Materials Testing & Exploration, 219 Hogan Road, Bangor, Maine 04401

GEOTECHNICAL TEST REPORT
Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
211460	**BB-BHC-103/2U**	**GEOTECHNICAL (UNDISTURBED)**	**9/25/2008**	**10/28/2008**

Sample Type: **GEOTECHNICAL** Location: **OTHER** Station: **14+18.2** Offset, ft: **18.8** **RT** Dbfg, ft: **54.0-56.0**

PIN: **015091.00** Town: **Bowdoinham** Sampler: **WILDER, BRUCE H**

TEST RESULTS

Sieve Analysis (T-88)

SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	
¾ in. [19.0 mm]	
½ in. [12.5 mm]	
⅜ in. [9.5 mm]	
¼ in. [6.3 mm]	
No. 4 [4.75 mm]	
No. 10 [2.00 mm]	**100.0**
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	**99.9**
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	**99.9**
[0.0258 mm]	**98.5**
[0.0169 mm]	**92.7**
[0.0101 mm]	**86.9**
[0.0074 mm]	**81.1**
[0.0055 mm]	**69.5**
[0.0029 mm]	**57.9**
[0.0012 mm]	**46.3**

Wash Method

Direct Shear (T 236)

Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)

Trimmings, Water Content, % **35.8**

	Initial	Final		Void Ratio	% Strain
Water Content, %	**33**	**23.9**	Pmin		
Dry Density, lbs/ft³	**85.8**	**102**	Pp		
Void Ratio	**0.95**	**0.64**	Pmax		
Saturation, %	**93.2**	**100.1**	Cc/C'c		

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %
29

Plastic Limit (T 90), %
22

Plasticity Index (T 90), %
7

Specific Gravity, Corrected to 20°C (T 100)
2.68

Loss on Ignition (T 267)

Loss, % H2O, %

Water Content (T 265), %
36.2

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In. U. Shear tons/ft²	3 In. Remold tons/ft²	6 In. U. Shear tons/ft²	6 In. Remold tons/ft²	Water Content, %	Description of Material Sampled at the Various Tube Depths
0-0.5	0.25	0.01	0.21	0.02	35.6	Alternating layers of light to dark gray clay.
0.625-1.0	0.19	0.01	0.19	0.01	35.5	Alternating layers of light to dark gray clay.
1.0-1.5	0.2	0.02	0.23	0.02	32.1	Alternating layers of light to dark gray clay.

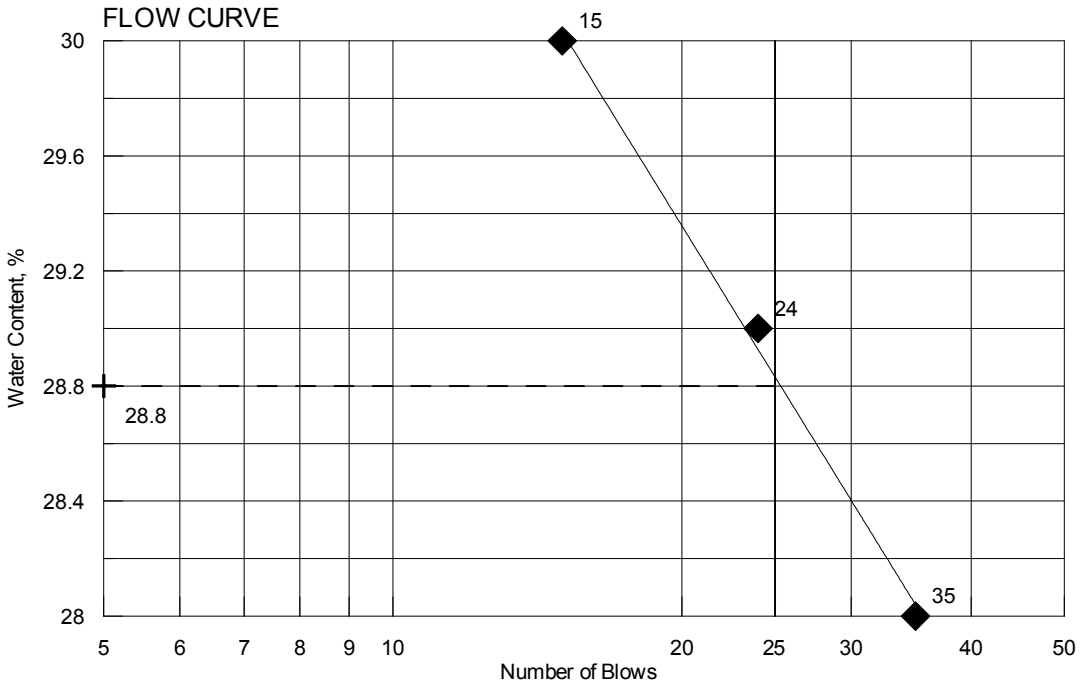
Comments:

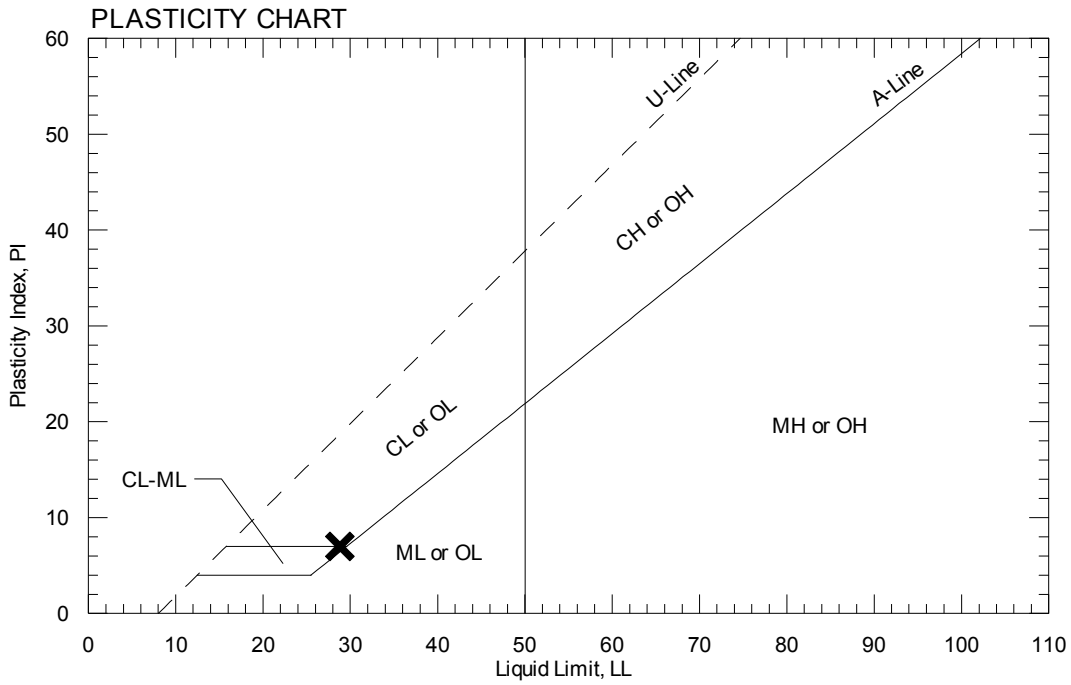
AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **12/5/2008**

Paper Copy: Lab File; Project File; Geotech File

TOWN	Bowdoinham	Reference No.	211460
PIN	015091.00	Water Content, %	36.2
Sampled	9/25/2008	Plastic Limit	22
Boring No./Sample No.	BB-BHC-103/2U	Liquid Limit	29
Station	14+18.2	Plasticity Index	7
Depth	54.0-56.0	Tested By	BBURR





AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **12/5/2008**

Paper Copy: Lab File; Project File; Geotech File

CONSOLIDATION TEST DATA

Project:
Boring No.: BB-BHC-103
Sample No.: 2U
Test No.: 211460

Location: BOWDINHAM
Tested By: Brian Fogg
Test Date: 10/14/08
Sample Type: SHELBY TUBE

Project No.: 015091.00
Checked By:
Depth: 54-56 FT
Elevation:

Soil Description: CLAY-SILT
Remarks:

Measured Specific Gravity: 2.68
Initial Void Ratio: 0.95
Final Void Ratio: 0.64

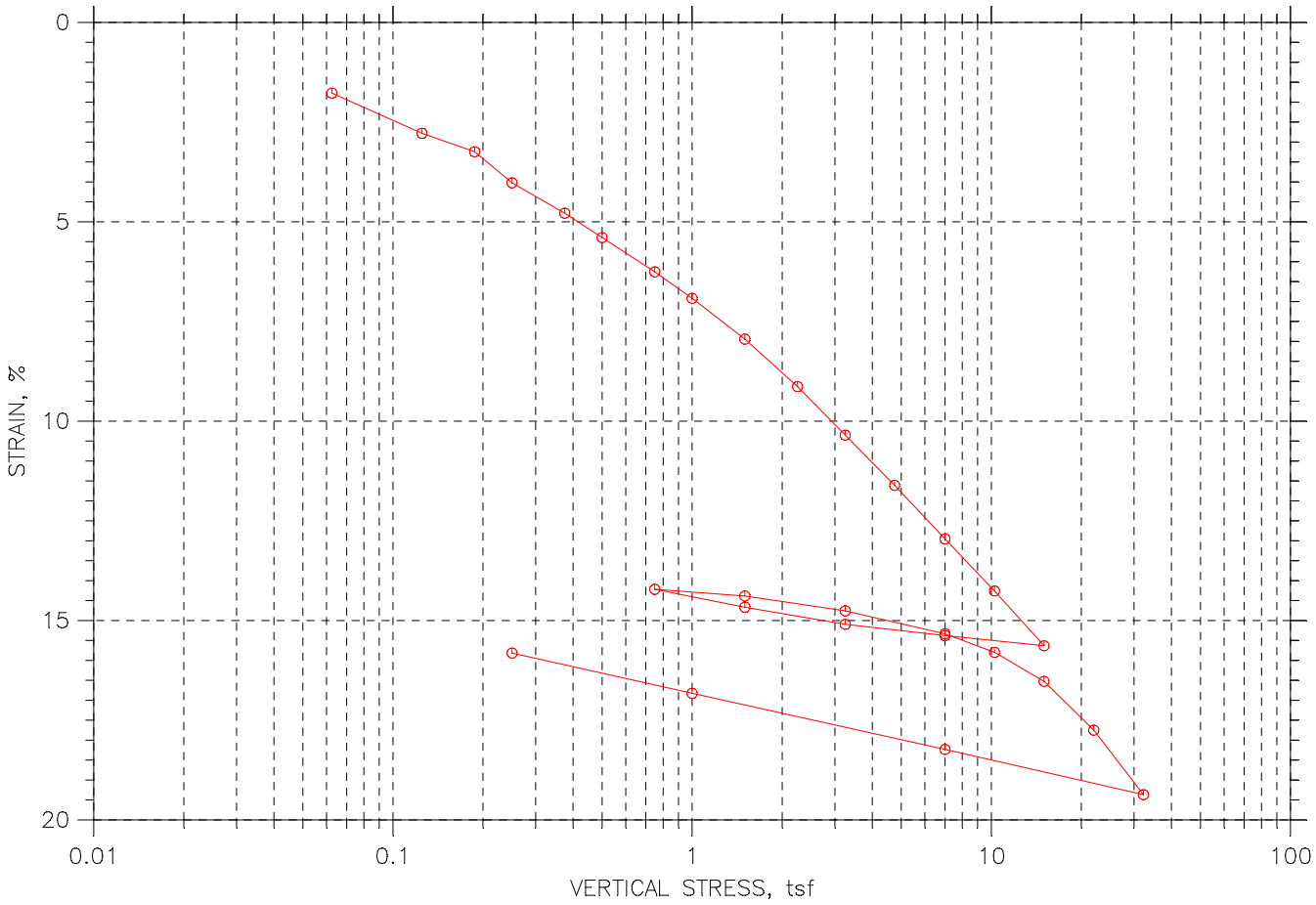
Liquid Limit: 29
Plastic Limit: 22
Plasticity Index: 7

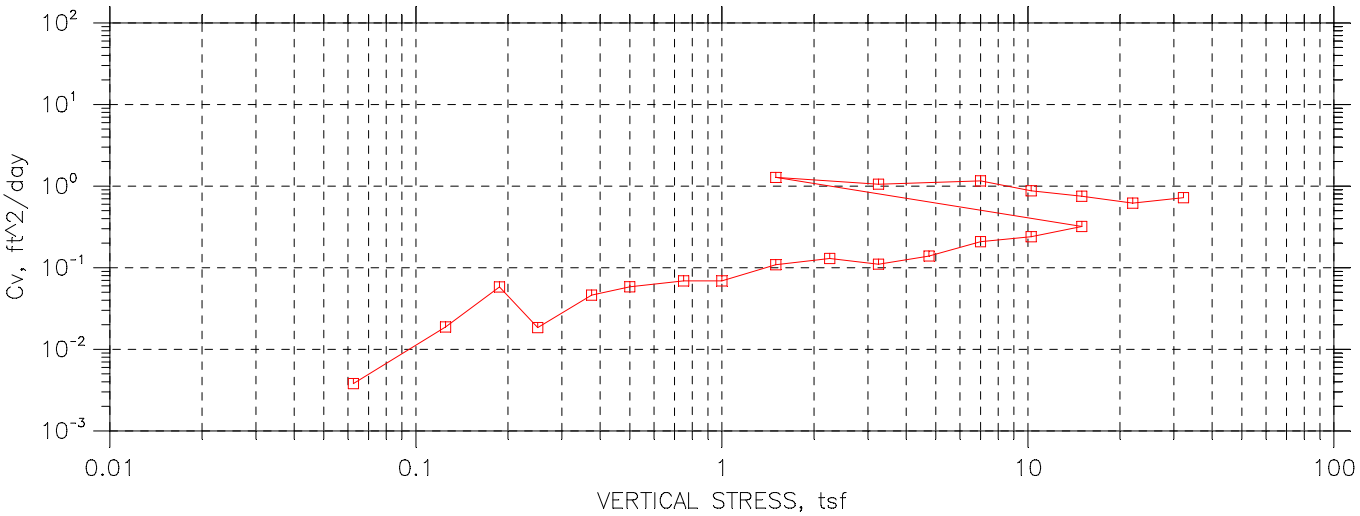
Initial Height: 1.05 in
Specimen Diameter: 2.48 in

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID	39	RING	RING	82
Wt. Container + Wet Soil, gm	212.59	415.03	404.58	204.13
Wt. Container + Dry Soil, gm	170.29	377.07	377.07	177.24
Wt. Container, gm	51.96	262.12	262.12	64.86
Wt. Dry Soil, gm	118.33	114.95	114.95	112.38
Water Content, %	35.75	33.02	23.93	23.93
Void Ratio	---	0.95	0.64	---
Degree of Saturation, %	---	93.22	100.05	---
Dry Unit Weight, pcf	---	85.831	101.96	---

CONSOLIDATION TEST DATA

SUMMARY REPORT





	Project:	Location: BOWDINHAM	Project No.: 015091.00
	Boring No.: BB-BHC-103	Tested By: Brian Fogg	Checked By:
	Sample No.: 2U	Test Date: 10/14/08	Depth: 54-56 FT
	Test No.: 211460	Sample Type: SHELBY TUBE	Elevation:
	Description: CLAY-SILT		
	Remarks:		

Wed, 22-APR-2009 13:59:47

Maine DOT, Materials Testing & Exploration, 219 Hogan Road, Bangor, Maine 04401

GEOTECHNICAL TEST REPORT
Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
211461	**BB-BHC-103/3U**	**GEOTECHNICAL (UNDISTURBED)**	**9/25/2008**	**10/28/2008**

Sample Type: **GEOTECHNICAL** Location: **OTHER** Station: **14+18.2** Offset, ft: **18.8** **RT** Dbfg, ft: **74.0-76.0**

PIN: **015091.00** Town: **Bowdoinham** Sampler: **WILDER, BRUCE H**

TEST RESULTS

Sieve Analysis (T-88)

SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	
¾ in. [19.0 mm]	
½ in. [12.5 mm]	
⅜ in. [9.5 mm]	
¼ in. [6.3 mm]	
No. 4 [4.75 mm]	
No. 10 [2.00 mm]	**100.0**
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	**99.8**
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	**99.3**
[0.0241 mm]	**95.9**
[0.0156 mm]	**90.3**
[0.0093 mm]	**84.6**
[0.0068 mm]	**79.0**
[0.0051 mm]	**70.5**
[0.0027 mm]	**56.4**
[0.0012 mm]	**45.1**

Wash Method

Direct Shear (T 236)

Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)

Trimmings, Water Content, % **37.5**

	Initial	Final		Void Ratio	% Strain
Water Content, %	**38.4**	**24.7**	Pmin		
Dry Density, lbs/ft³	**78.4**	**102.8**	Pp		
Void Ratio	**1.21**	**0.7**	Pmax		
Saturation, %	**88.1**	**102.8**	Cc/C'c		

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %

33

Plastic Limit (T 90), %

21

Plasticity Index (T 90), %

12

Specific Gravity, Corrected to 20°C (T 100)

2.77

Loss on Ignition (T 267)

Loss, % H2O, %

Water Content (T 265), %

38.8

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In. U. Shear tons/ft²	3 In. Remold tons/ft²	6 In. U. Shear tons/ft²	6 In. Remold tons/ft²	Water Content, %	Description of Material Sampled at the Various Tube Depths
0-0.5	0.25	0	0.25	0	39.0	Light gray clay.
0.625-1.0	0.21	0.01	0.1	0	38.8	Light gray clay.
1.0-1.5	0.15	0	0.15	0	38.8	Light gray clay.
1.5-2.0	0.1	0	0.01	0	37.3	super sensitive light gray clay.

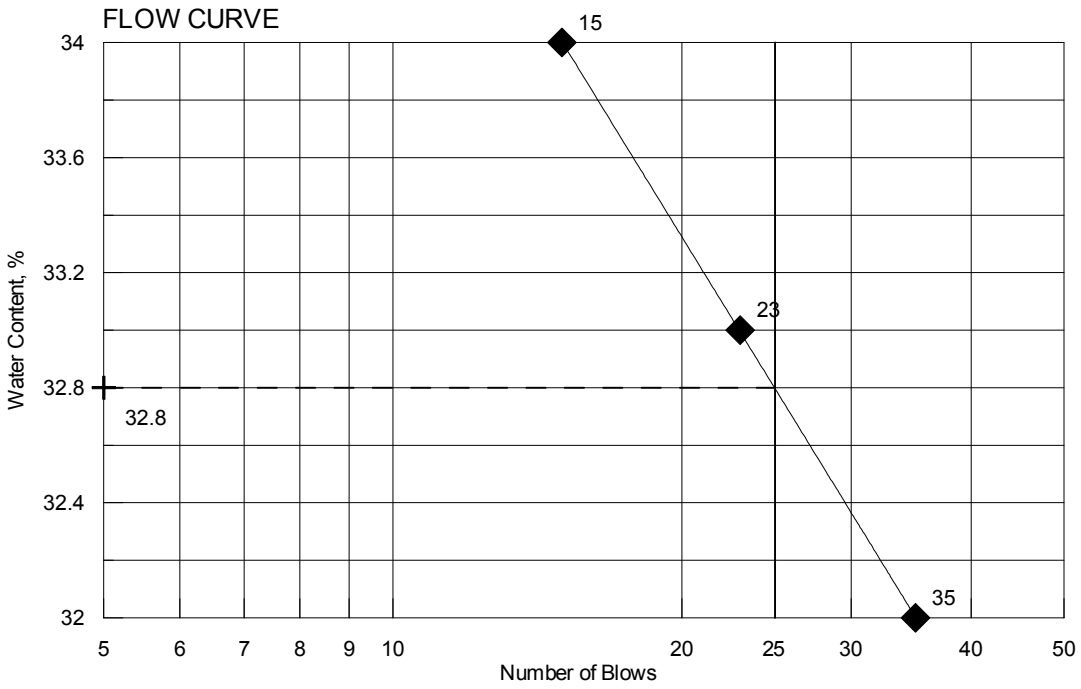
Comments:

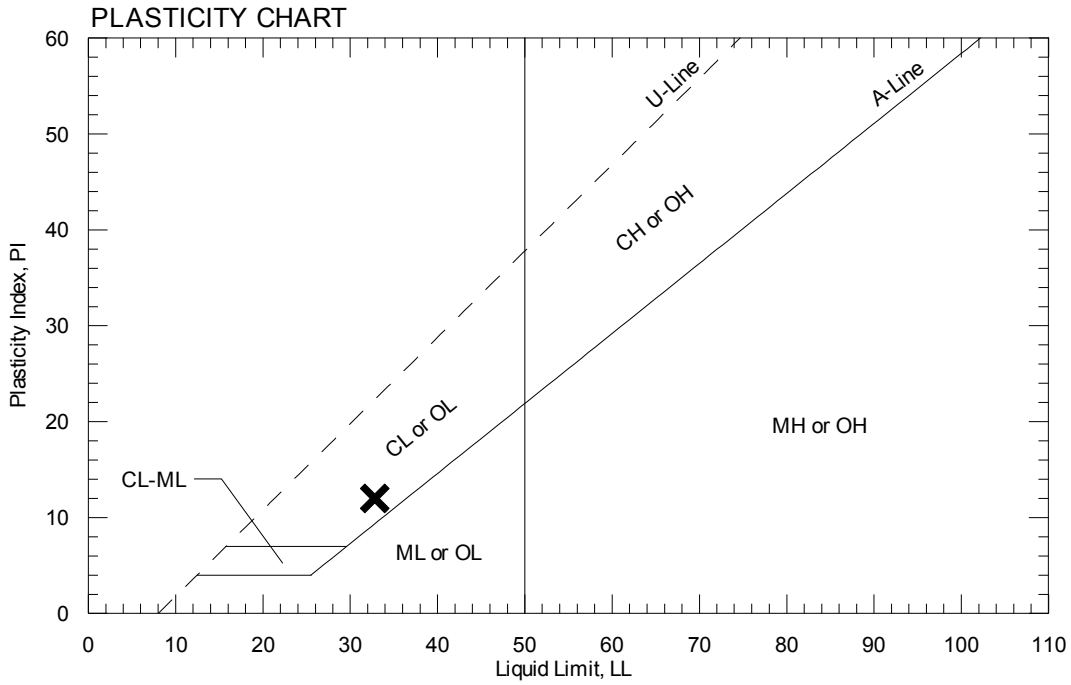
AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **12/3/2008**

Paper Copy: Lab File; Project File; Geotech File

TOWN	Bowdoinham	Reference No.	211461
PIN	015091.00	Water Content, %	38.8
Sampled	9/25/2008	Plastic Limit	21
Boring No./Sample No.	BB-BHC-103/3U	Liquid Limit	33
Station	14+18.2	Plasticity Index	12
Depth	74.0-76.0	Tested By	BBURR





AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **12/3/2008**

Paper Copy: Lab File; Project File; Geotech File

CONSOLIDATION TEST DATA

Project: BOWDINHAM
Boring No.: BB-BHC-103
Sample No.: 3U
Test No.: 211461

Location:
Tested By: Brian Fogg
Test Date: 11/12/08
Sample Type: TUBE

Project No.: 015091
Checked By:
Depth: 74-76 FT
Elevation:

Soil Description: CLAY-SILT
Remarks:

Measured Specific Gravity: 2.77
Initial Void Ratio: 1.21
Final Void Ratio: 0.68

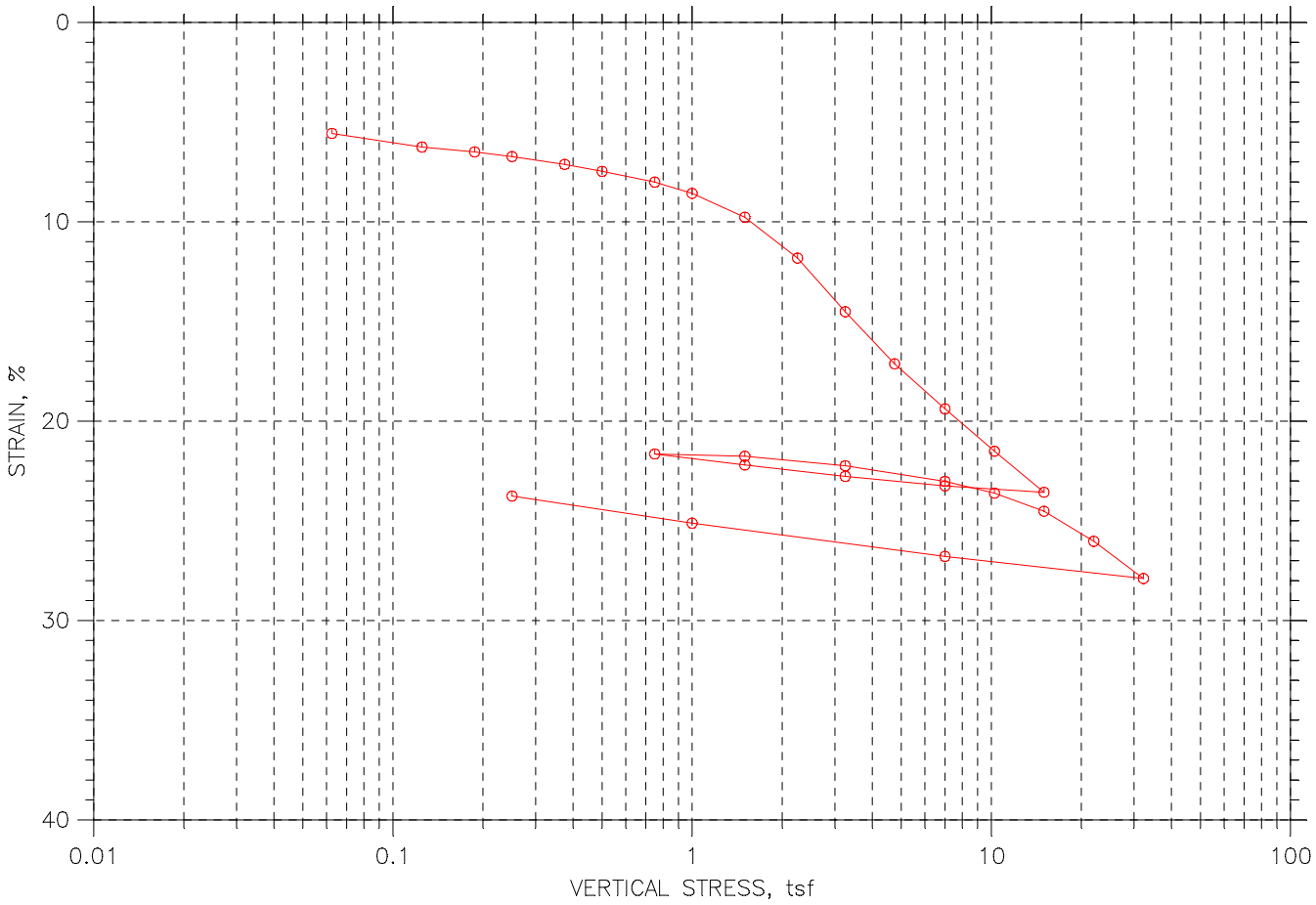
Liquid Limit: 33
Plastic Limit: 21
Plasticity Index: 12

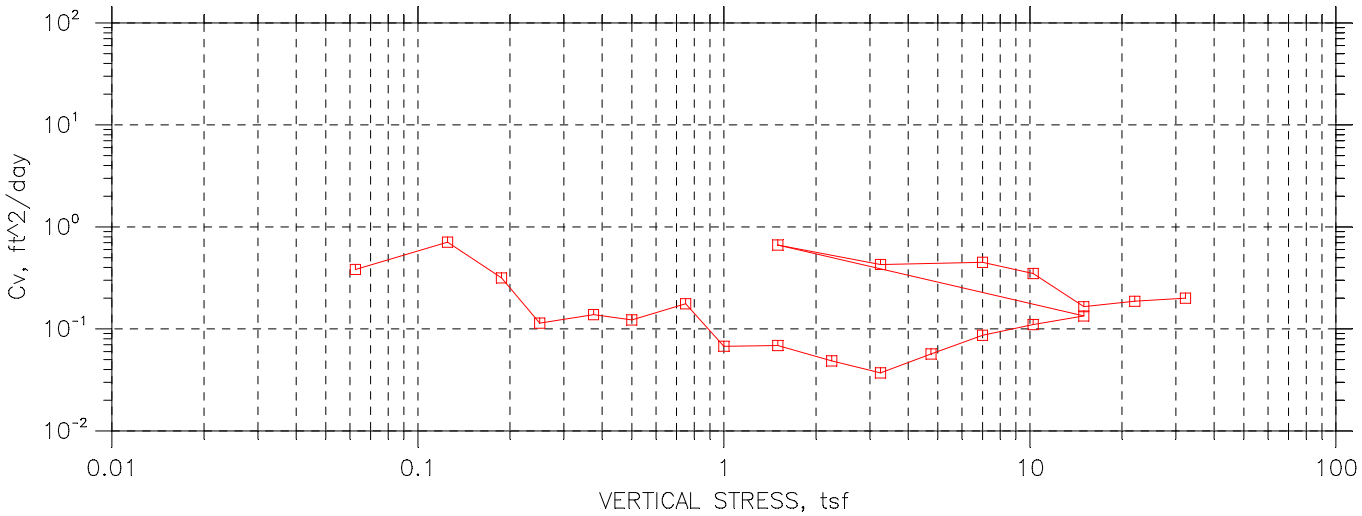
Initial Height: 1.07 in
Specimen Diameter: 2.48 in

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID	82	RING	RING	35
Wt. Container + Wet Soil, gm	124.93	410.1	395.48	198.08
Wt. Container + Dry Soil, gm	108.56	369.05	369.05	171.74
Wt. Container, gm	64.87	262.1	262.1	65.13
Wt. Dry Soil, gm	43.69	106.95	106.95	106.61
Water Content, %	37.47	38.38	24.71	24.71
Void Ratio	---	1.21	0.68	---
Degree of Saturation, %	---	88.10	100.29	---
Dry Unit Weight, pcf	---	78.368	102.79	---

CONSOLIDATION TEST DATA

SUMMARY REPORT





	Project: BOWDINHAM	Location:	Project No.: 015091
	Boring No.: BB-BHC-103	Tested By: Brian Fogg	Checked By:
	Sample No.: 3U	Test Date: 11/12/08	Depth: 74-76 FT
	Test No.: 211461	Sample Type: TUBE	Elevation:
	Description: CLAY-SILT		
	Remarks:		

Wed, 22-APR-2009 14:04:49

Maine DOT, Materials Testing & Exploration, 219 Hogan Road, Bangor, Maine 04401

GEOTECHNICAL TEST REPORT
Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
211439	**BB-BHC-103/4U**	**GEOTECHNICAL (UNDISTURBED)**	**9/16/2008**	**10/28/2008**

Sample Type: **GEOTECHNICAL** Location: **OTHER** Station: **14+18.2** Offset, ft: **18.8 RT** Dbfg, ft: **84.0-86.0**

PIN: **015091.00** Town: **Bowdoinham** Sampler: **MOREAU, MICHAEL J**

TEST RESULTS

Sieve Analysis (T-88)

SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	
¾ in. [19.0 mm]	
½ in. [12.5 mm]	
⅜ in. [9.5 mm]	
¼ in. [6.3 mm]	
No. 4 [4.75 mm]	
No. 10 [2.00 mm]	**100.0**
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	**99.7**
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	**97.5**
[0.0250 mm]	**95.6**
[0.0163 mm]	**89.7**
[0.0098 mm]	**83.7**
[0.0071 mm]	**77.7**
[0.0052 mm]	**71.7**
[0.0027 mm]	**59.8**
[0.0012 mm]	**47.8**

Wash Method

Direct Shear (T 236)

Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)

Trimmings, Water Content, %	

	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %

29

Plastic Limit (T 90), %

20

Plasticity Index (T 90), %

9

Specific Gravity, Corrected to 20°C (T 100)

2.75

Loss on Ignition (T 267)

Loss, % H2O, %

Water Content (T 265), %

27.2

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In. U. Shear tons/ft²	3 In. Remold tons/ft²	6 In. U. Shear tons/ft²	6 In. Remold tons/ft²	Water Content, %	Description of Material Sampled at the Various Tube Depths
0-0.5	0.31	0	0.33	0.02	34.0	Light gray clay.
0.5-1.0	0.27	0	0.33	0	40.4	Mottled light gray clay.
1.0-1.5	0.06	0	0.02	0	44.0	Supersaturated light gray clay.
1.5-2.0	0	0	0	0	43.4	Supersaturated light gray clay.

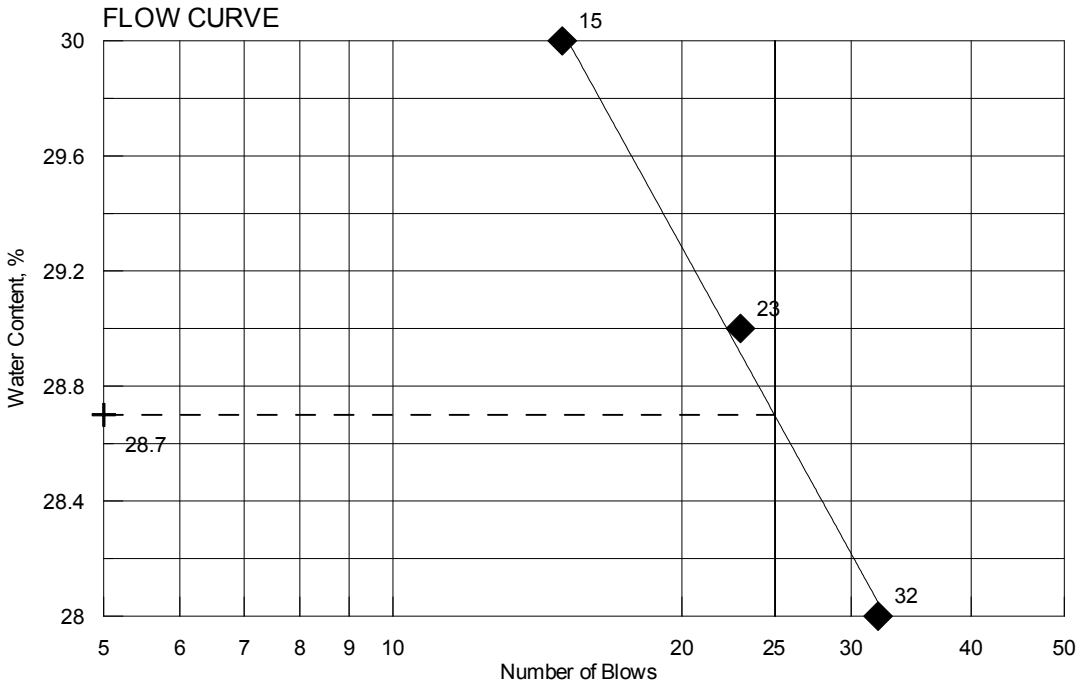
Comments:

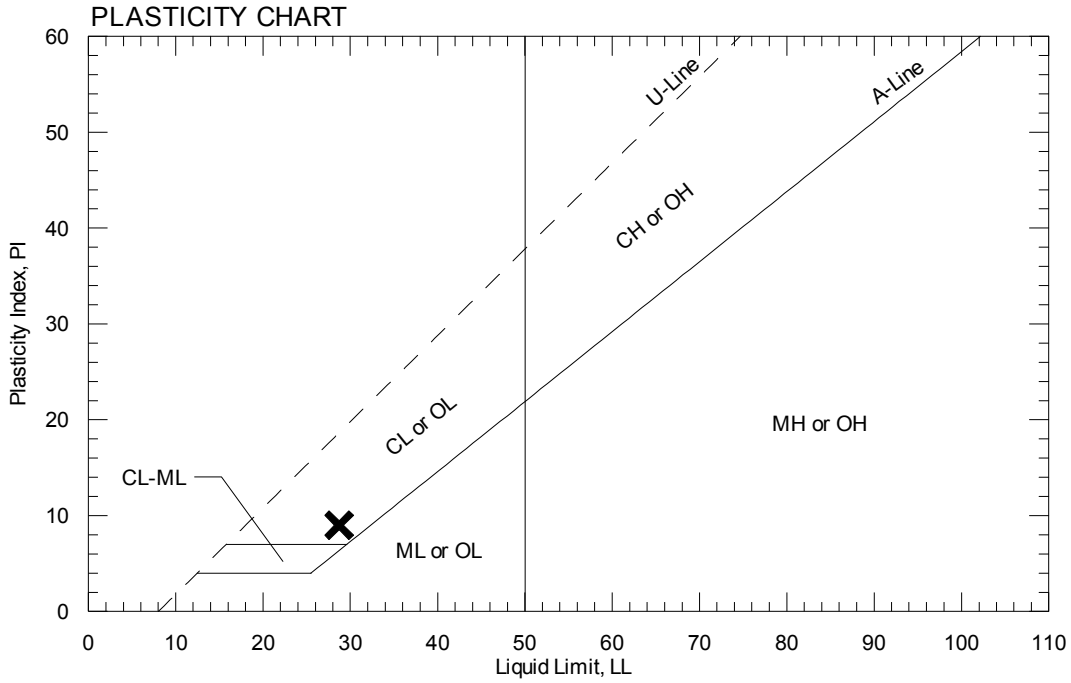
AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **12/3/2008**

Paper Copy: Lab File; Project File; Geotech File

TOWN	Bowdoinham	Reference No.	211439
PIN	015091.00	Water Content, %	27.2
Sampled	9/16/2008	Plastic Limit	20
Boring No./Sample No.	BB-BHC-103/4U	Liquid Limit	29
Station	14+18.2	Plasticity Index	9
Depth	84.0-86.0	Tested By	BBURR



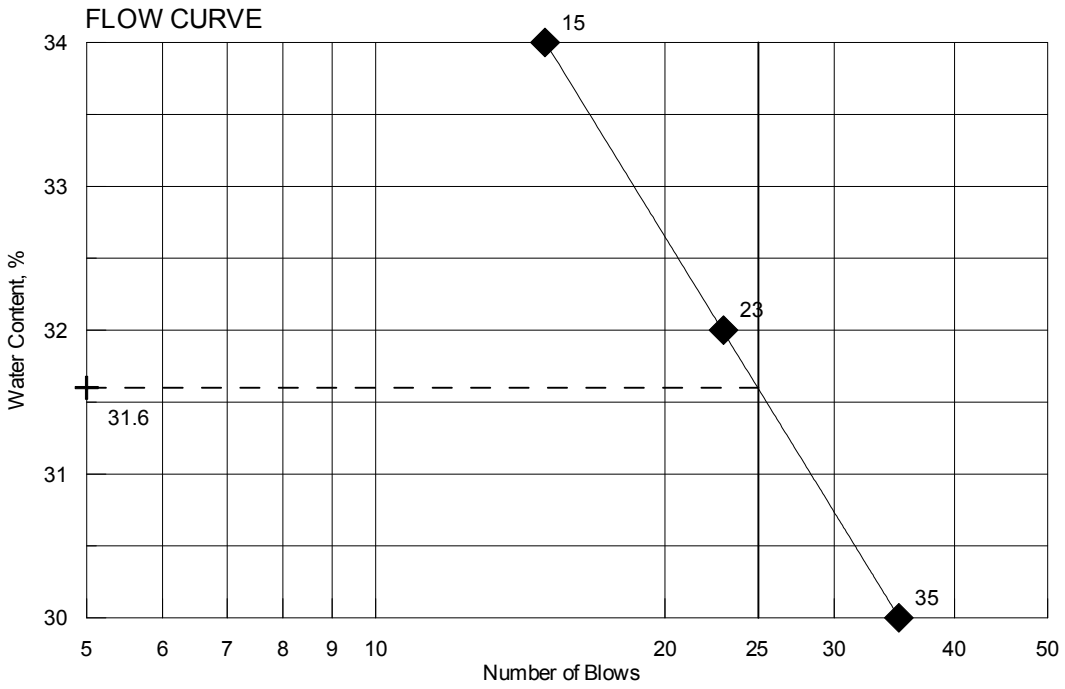


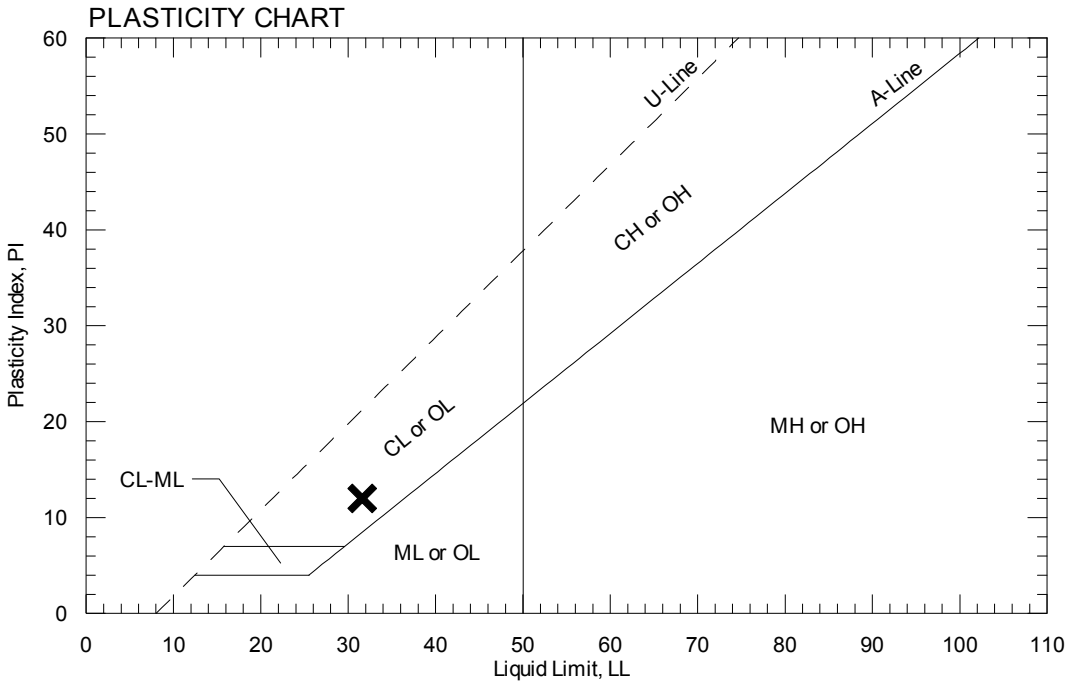
AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **12/3/2008**

Paper Copy: Lab File; Project File; Geotech File

TOWN	Bowdoinham	Reference No.	211442
PIN	015091.00	Water Content, %	32.2
Sampled	10/23/2008	Plastic Limit	20
Boring No./Sample No.	BB-BHC-103/17D	Liquid Limit	32
Station	14+18.2	Plasticity Index	12
Depth	109.0-111.0	Tested By	BBURR





AUTHORIZATION AND DISTRIBUTION

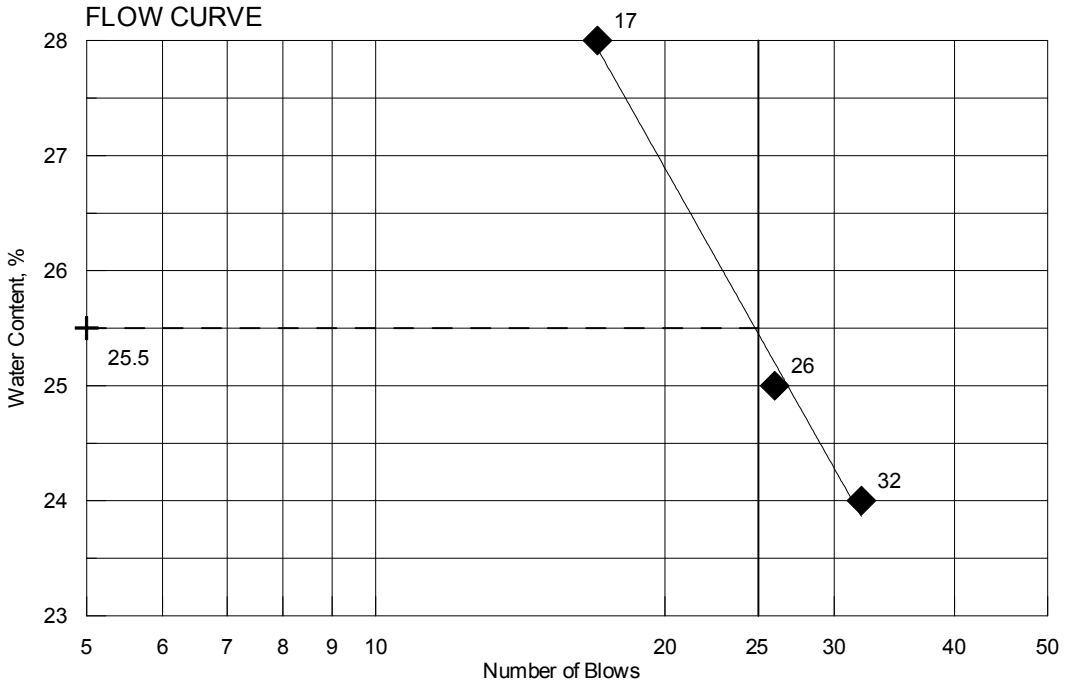
Reported by: **FOGG, BRIAN** Date Reported: **11/18/2008**

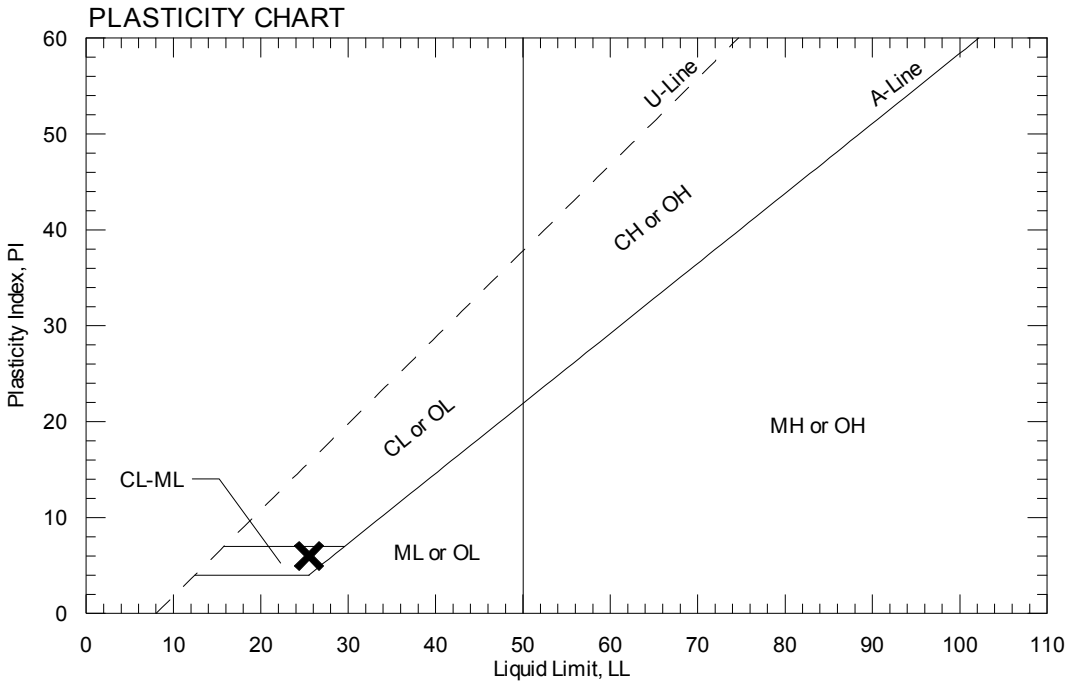
Paper Copy: Lab File; Project File; Geotech File

BB-BHC-104

ATTERBERG, LAB VANE SHEAR, AND CONSOLIDATION TEST RESULTS

TOWN	Bowdoinham	Reference No.	212227
PIN	015091.00	Water Content, %	32.8
Sampled	9/16/2008	Plastic Limit	20
Boring No./Sample No.	BB-BHC-104/14D	Liquid Limit	26
Station	15+22.4	Plasticity Index	6
Depth	69.0-71.0	Tested By	BBURR





AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **12/3/2008**

Paper Copy: Lab File; Project File; Geotech File

Maine DOT, Materials Testing & Exploration, 219 Hogan Road, Bangor, Maine 04401

GEOTECHNICAL TEST REPORT
Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
212228	**BB-BHC-104/2U**	**GEOTECHNICAL (UNDISTURBED)**	**9/16/2008**	**10/28/2008**

Sample Type: **GEOTECHNICAL** Location: **OTHER** Station: **15+22.4** Offset, ft: **7.3** **LT** Dbfg, ft: **79.0-81.0**

PIN: **015091.00** Town: **Bowdoinham** Sampler: **MOREAU, MICHAEL J**

TEST RESULTS

Sieve Analysis (T-88)

SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	
¾ in. [19.0 mm]	
½ in. [12.5 mm]	
⅜ in. [9.5 mm]	
¼ in. [6.3 mm]	
No. 4 [4.75 mm]	
No. 10 [2.00 mm]	**100.0**
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	**99.9**
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	**99.9**
[0.0242 mm]	**95.7**
[0.0156 mm]	**92.8**
[0.0090 mm]	**92.8**
[0.0066 mm]	**89.9**
[0.0047 mm]	**87.0**
[0.0024 mm]	**72.5**
[0.0011 mm]	**58.0**

Wash Method

Direct Shear (T 236)

Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)

Trimmings, Water Content, %	**44.0**

	Initial	Final		Void Ratio	% Strain
Water Content, %	**44.9**	**29.5**	Pmin		
Dry Density, lbs/ft³	**75.3**	**96**	Pp		
Void Ratio	**1.33**	**0.83**	Pmax		
Saturation, %	**94.9**	**100.1**	Cc/C'c		

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %

31

Plastic Limit (T 90), %

20

Plasticity Index (T 90), %

11

Specific Gravity, Corrected to 20°C (T 100)

2.81

Loss on Ignition (T 267)

Loss, % H2O, %

Water Content (T 265), %

41.8

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In. U. Shear tons/ft²	3 In. Remold tons/ft²	6 In. U. Shear tons/ft²	6 In. Remold tons/ft²	Water Content, %	Description of Material Sampled at the Various Tube Depths
0-0.5	0.22	0.02	0.21	0.02	43.0	Alternating layers of light to dark gray clay.
0.625-1.0	0.17	0	0.17	0	41.5	Alternating layers of light to dark gray clay.
1.0-1.5	0.17	0	0.15	0	38.6	Alternating layers of light to dark gray clay.
1.5-1.92	0.1	0	0.13	0	35.9	Alternating layers of light to dark gray clay.

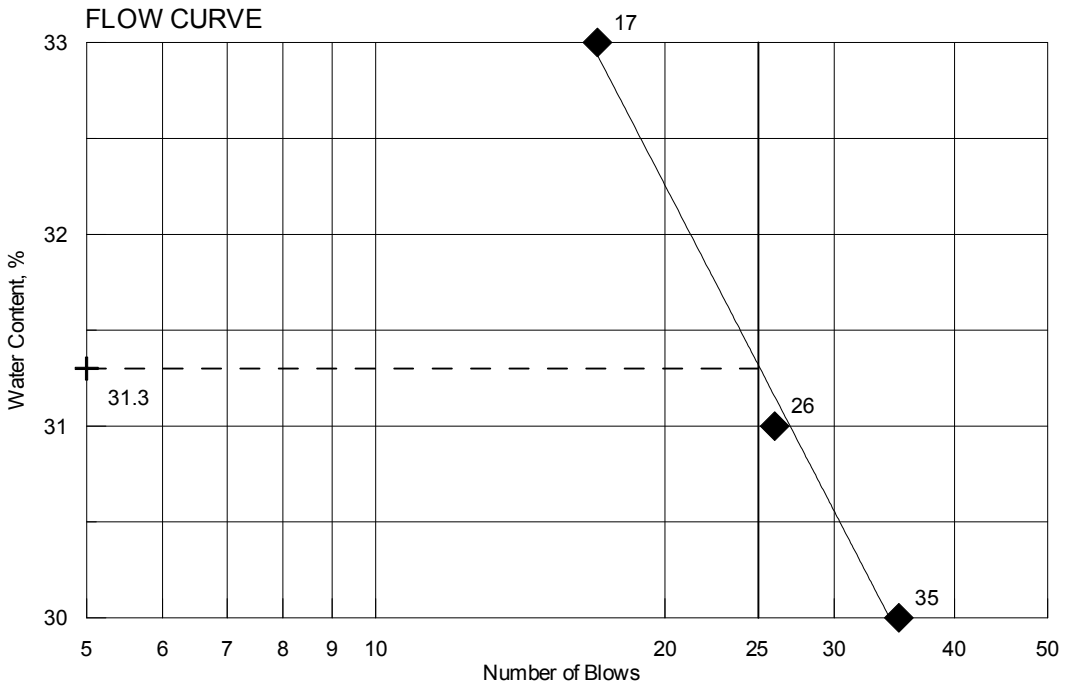
Comments:

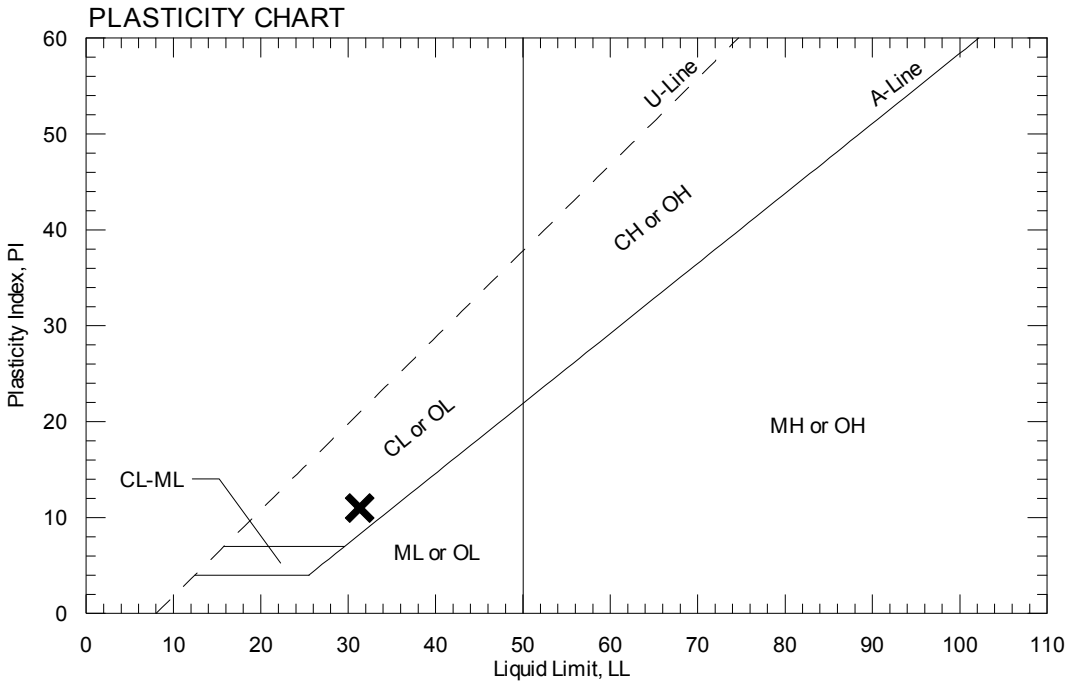
AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **11/4/2008**

Paper Copy: Lab File; Project File; Geotech File

TOWN	Bowdoinham	Reference No.	212228
PIN	015091.00	Water Content, %	41.8
Sampled	9/16/2008	Plastic Limit	20
Boring No./Sample No.	BB-BHC-104/2U	Liquid Limit	31
Station	15+22.4	Plasticity Index	11
Depth	79.0-81.0	Tested By	BBURR





AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **11/4/2008**

Paper Copy: Lab File; Project File; Geotech File

CONSOLIDATION TEST DATA

Project:
Boring No.: BB-BHC-104
Sample No.: 2U
Test No.: 212228

Location: BOWDINHAM
Tested By: B BURRILL
Test Date: 10/14/08
Sample Type: TUBE

Project No.: 015091
Checked By:
Depth: 79-81 FT
Elevation:

Soil Description: CLAY-SILT
Remarks:

Measured Specific Gravity: 2.81
Initial Void Ratio: 1.33
Final Void Ratio: 0.83

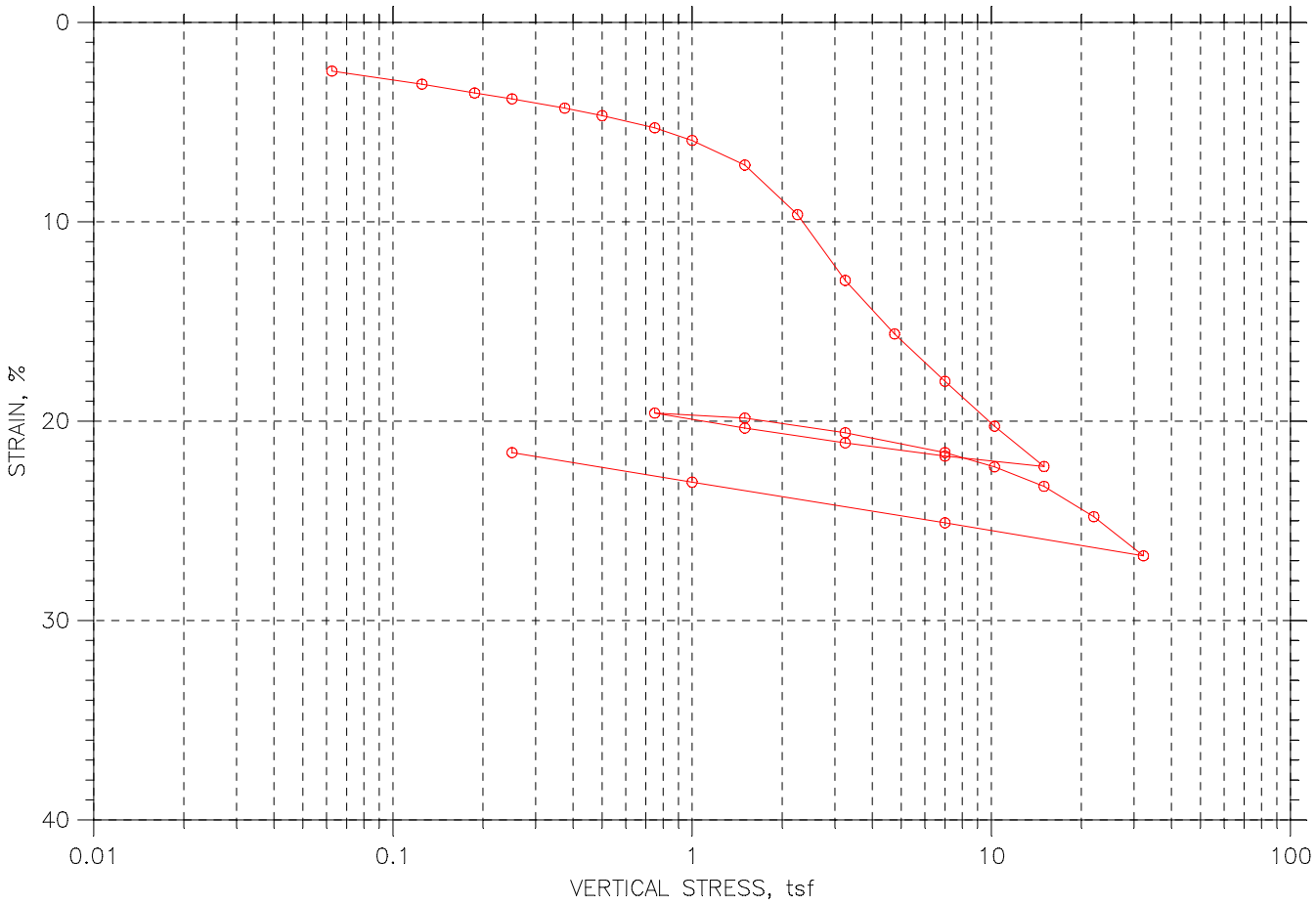
Liquid Limit: 31
Plastic Limit: 20
Plasticity Index: 11

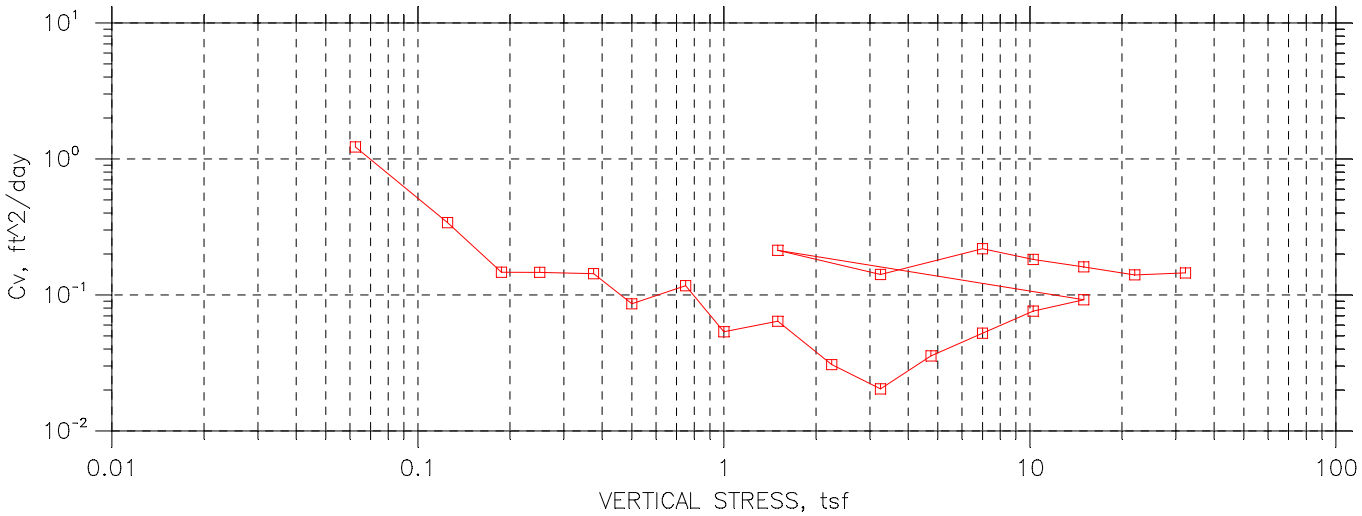
Initial Height: 1.02 in
Specimen Diameter: 2.48 in

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID	65	RING	RING	218
Wt. Container + Wet Soil, gm	148.21	404.28	389.13	192.53
Wt. Container + Dry Soil, gm	121.29	360.23	360.23	163.68
Wt. Container, gm	60.07	262.11	262.11	65.75
Wt. Dry Soil, gm	61.22	98.115	98.115	97.93
Water Content, %	43.97	44.90	29.46	29.46
Void Ratio	---	1.33	0.83	---
Degree of Saturation, %	---	94.90	100.13	---
Dry Unit Weight, pcf	---	75.306	96.028	---

CONSOLIDATION TEST DATA

SUMMARY REPORT

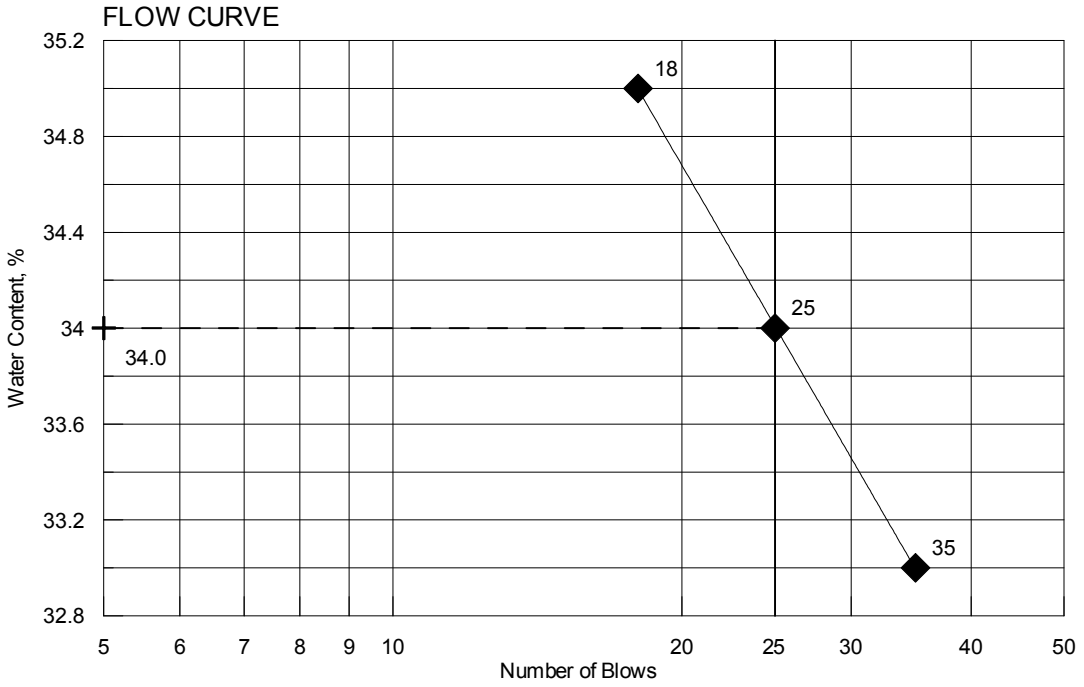


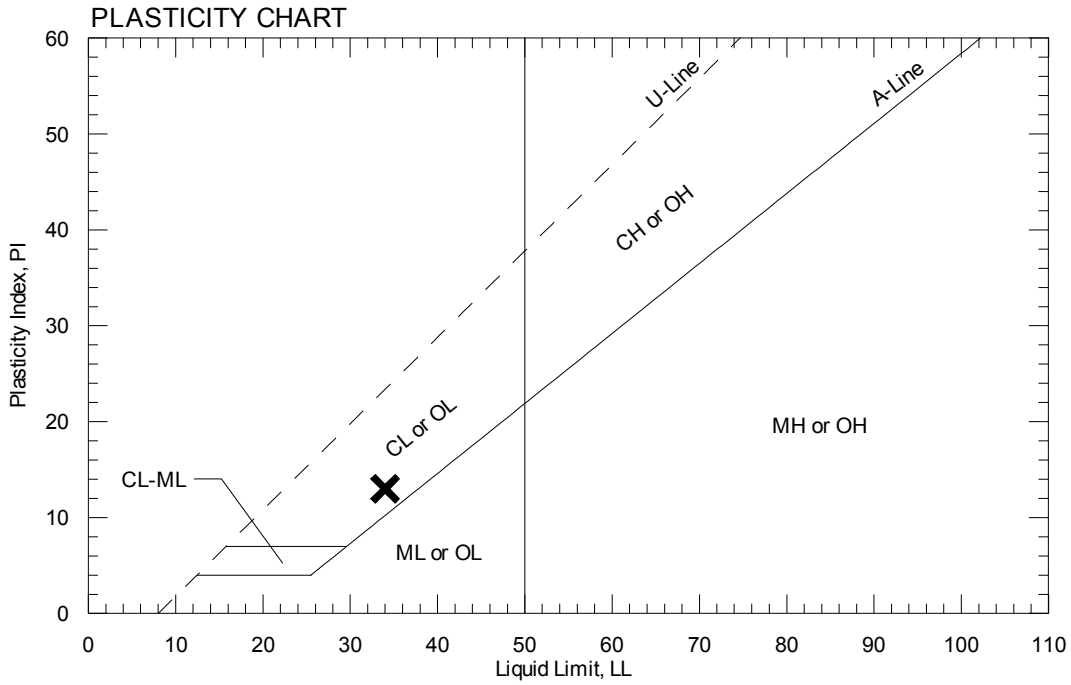


	Project:	Location: BOWDINHAM	Project No.: 015091
	Boring No.: BB-BHC-104	Tested By: B BURRILL	Checked By:
	Sample No.: 2U	Test Date: 10/14/08	Depth: 79-81 FT
	Test No.: 212228	Sample Type: TUBE	Elevation:
	Description: CLAY-SILT		
	Remarks:		

Wed, 22-APR-2009 14:20:26

TOWN	Bowdoinham	Reference No.	212230
PIN	015091.00	Water Content, %	33.9
Sampled	9/17/2008	Plastic Limit	21
Boring No./Sample No.	BB-BHC-104/16D	Liquid Limit	34
Station	15+22.4	Plasticity Index	13
Depth	90.5-92.5	Tested By	BBURR



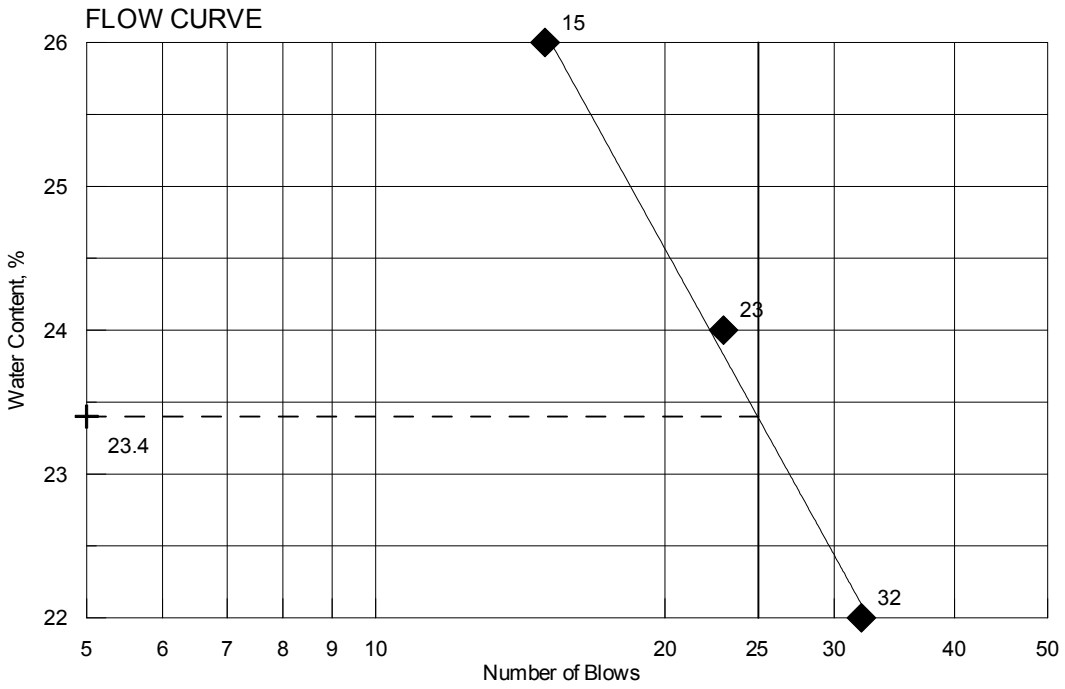


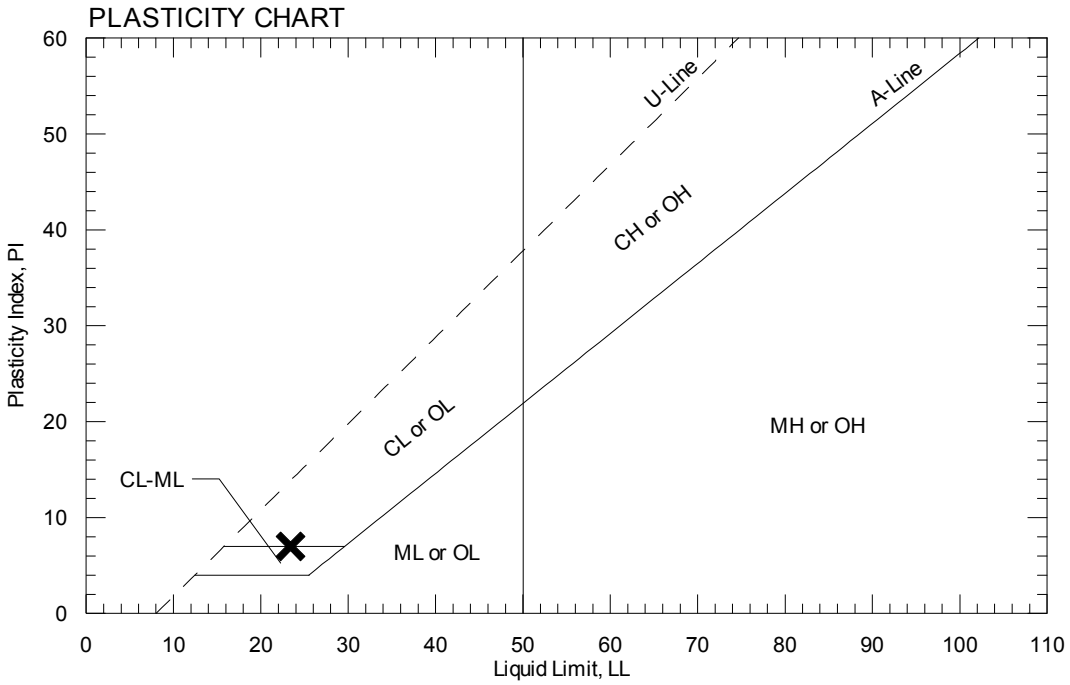
AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **12/3/2008**

Paper Copy: Lab File; Project File; Geotech File

TOWN	Bowdoinham	Reference No.	212233
PIN	015091.00	Water Content, %	26.1
Sampled	9/17/2008	Plastic Limit	16
Boring No./Sample No.	BB-BHC-104/19D	Liquid Limit	23
Station	15+22.4	Plasticity Index	7
Depth	129.0-131.0	Tested By	BBURR





AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **12/3/2008**

Paper Copy: Lab File; Project File; Geotech File

APPENDIX - D

Calculations

11/26/2008 Copy for
Joel Kittredge
Requested 11/25/2008

STATE OF MAINE

INTERDEPARTMENTAL MEMORANDUM

FILE: SR 24
COPY:

Date of Request: **05/16/08** Return: **07/28/08**
Latest Date Needed By: **ASAP**

To: **Ed Hanscom** Dept.: **MDOT, Bureau of Planning**

From: **Sue Murphy** Dept.: **MDOT, Bridge Program**

Subject: **Request for Traffic Information** Project Manager: **Wayne Frankhauser**

TOWN(S): **Bowdoinham** P.I.N. **015091.00** Consultant Proj

COUNTY: **Sagadahoc** ROUTE: **SR 24**

LOCATION/ DESCRIPTION: Improvement of Harward's Crossing Bridge (#3273) carrying SR 24 over the Maine Coast RR Line, 0.17 mi (0.27 km) NE/O Abagadasset River (Br. #5493) in Bowdoinham, ME.

	Roadway Changes or Relocation (Attach Sketch)	Turning Movement needed (Provide Locations under Comments)	Other Please Describe Under Comments
Please Check Box if Applicable:			

Prep By: JG

	Description of Sections	Sec. 1 SR 24 SW/O IR 322 (Pork Pt Rd) N Jct	Sec. 2	Sec. 3	Sec. 4	Sec. 5
1	Latest AADT (Year)	760 (2007)				
2	Current **2008** AADT	770				
3	Future **2028** AADT	890				
4	Future AADT	1000				
5	DHV - % of AADT	11%	%	%	%	%
6	Design Hourly Volume	113				
7	% Heavy Trucks (AADT)	8%	%	%	%	%
8	% Heavy Trucks (DHV)	5%	%	%	%	%
9	Direct.Dist. (DHV)	55%	%	%	%	%
10	18-KIP Equivalent P 2.0	34				
11	18-KIP Equivalent P 2.5	32				

Notes or Remarks: 18-Kip ESALs based on 20 year life.

PLEASE PROVIDE: (1) PIN NUMBER, (2) CURRENT & FUTURE YEARS FOR WHICH YOU WANT AADT CALCULATED AND SEND TO MIKE MORGAN. (A LOCATION MAP IS NO LONGER NEEDED.) **TRAFFIC REQUESTS WILL BE FILLED ON A FIRST COME / FIRST SERVED BASIS. PLEASE SEND WHEN PROJECT KICKS OFF!!!!**

Need Only Data Items Numbered

Comments: No proximal HT data available on SR 24. Used estimate based on surrounding class sites.

1993 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

A Proprietary AASHTOWare
Computer Software Product
State of Maine

Flexible Structural Design Module

Harward's Crosssing Bridge Replacement with At-Grade Crossing
Bowdoinham, Maine, PIN 15091
February 2009

Flexible Structural Design

18-kip ESALs Over Initial Performance Period	233,600
Initial Serviceability	4.5
Terminal Serviceability	2.5
Reliability Level	85 %
Overall Standard Deviation	0.45
Roadbed Soil Resilient Modulus	4,300 psi
Stage Construction	1
Calculated Design Structural Number	3.16 in

Specified Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di)(in)	Width (ft)	Calculated SN (in)
1	New HMA	1	0.44	4	-	1.76
2	ASCG Type D	1	0.09	24	-	2.16
Total	-	-	-	28.00	-	3.92

FROST PENETRATION:

Method 1

Reference: MaineDOT Bridge Design Guide, Design Freezing Index (DFI) Map and Depth of Frost Penetration Table 5-1.

DFI =1370 degree-days
Site has Coarse-Grained Soils.
Use Coarse-Grained for design With W_n = 15% to 20%. Use W_n = 20%

From the 2003 Bridge Design Guide Table 5-1:

$$Frost\_depth := [0.7 \cdot (65.5in - 63.0in) + 63.0in]$$

$$Frost\_depth = 64.75 \cdot in$$

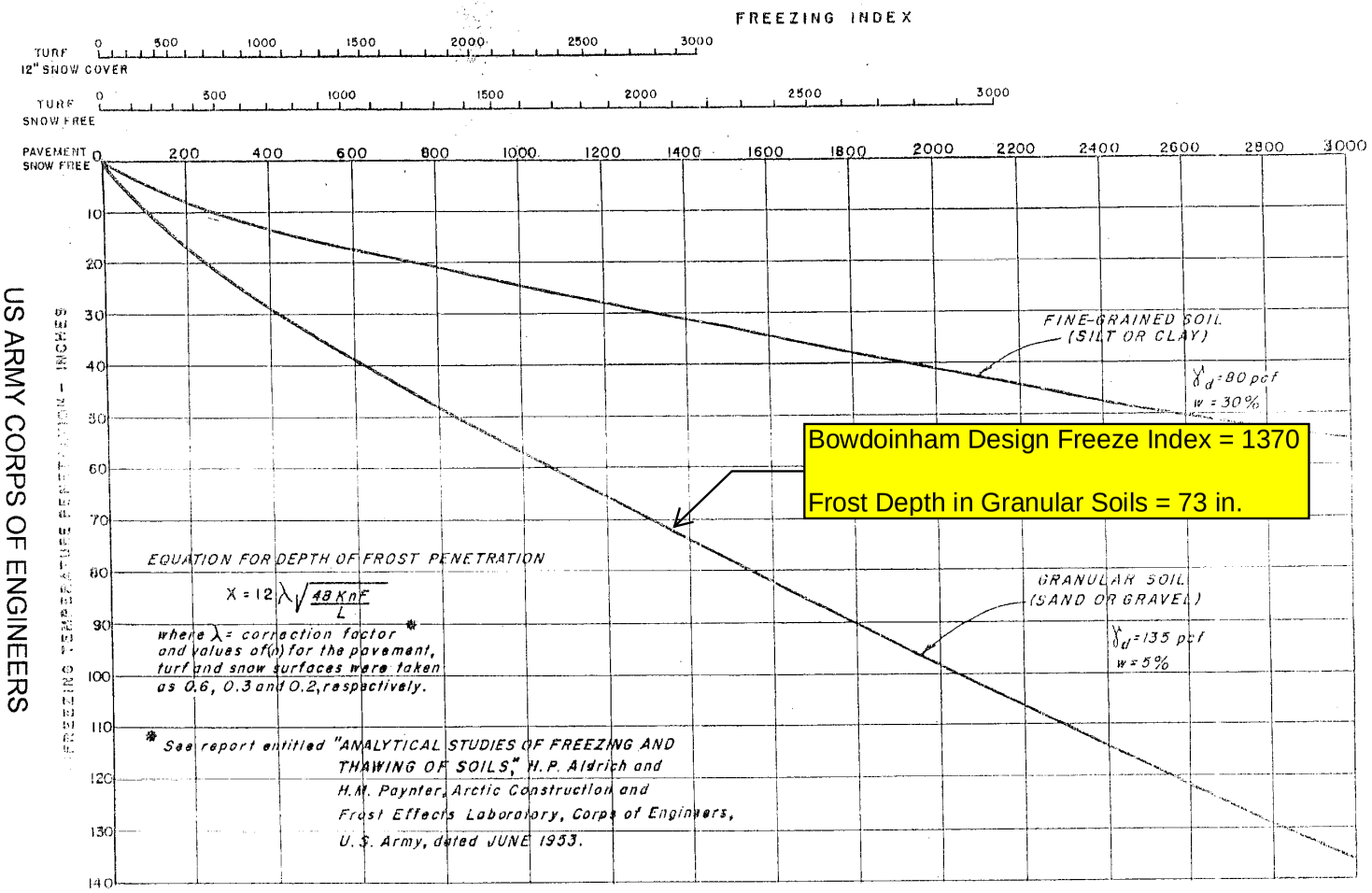
$$Frost\_depth = 5.4 \cdot ft$$

Method 2

Consider US Army Corps Charts That Look at Frost Beneath Snow-Free Pavements (See Attached Chart)

Using Freeze Index of 1370 degree-days, Frost Depth for Granular Soil is **73 in.**

Use 6 feet



RELATIONSHIP BETWEEN FREEZING INDEX AND FREEZING TEMPERATURE PENETRATION FOR VARIOUS SURFACE CONDITIONS FOR GRANULAR AND FINE-GRAINED SOILS

US ARMY CORPS OF ENGINEERS
Frost Investigations, Prediction of Freezing Temperature Penetration in New England
Miscellaneous Paper No. 11
June 1955

FIGURE 6