

Harbour Improvements

Blandford

Lunenburg County, N.S.

Project No. R.075316.001

Geotechnical Investigation

APPENDIX A GEOTECHNICAL INVESTIGATION

Public Works Government Services Canada

Geotechnical Drilling / Sampling / Testing Blandford, Nova Scotia

Report

Date: May 1, 2015
Ref. N°: 20115



Public Works Government Services Canada

Geotechnical Drilling / Sampling / Testing Blandford, Nova Scotia

Report | 20115

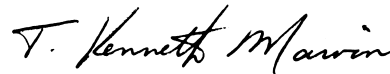
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0	2015-05-01	Report

1 INTRODUCTION

At the request of Public Works Government Services Canada (PWGSC), LVM - Maritime Testing (LVM-MTL), a division of EnGlobe Corp., has carried out a geotechnical drilling / sampling / testing program for a new wharf in Blandford, Nova Scotia. The purpose of the work was to assess the subsurface conditions at select areas of the site and to provide factual geotechnical report following completion of the work.

This report presents the engineering observations associated with the geotechnical drilling / sampling / testing program of the site. Included herein are the factual results of the field investigation including discussion of field procedures, subsurface conditions and laboratory analysis.

2 SITE AND PROJECT DESCRIPTION

The community of Blandford is located on the Aspotogan Peninsula situated between St Margaret's Bay and Mahone Bay. The site contains a marginal concrete wharf with an adjacent stone breakwater, a wood wharf and several buildings containing a fish processing plant. The existing wood wharf at Blandford will be replaced in the near future. To determine the existing subsurface conditions to input into the design and costing of the new wharf, a proposal for a geotechnical investigation has been requested.

3 INVESTIGATION PROCEDURE

The fieldwork for the investigation was carried out from April 24 to 26, 2015, when four (4) boreholes were drilled at the approximate locations shown on the enclosed Figure 1. The boreholes were drilled using a marine barge and auger drill rig supplied by Logan Geotech of Stewiacke, NS.

The site investigation was carried out by qualified geotechnical engineering personnel who located the boreholes in the field and logged the subsurface conditions. The test locations were predetermined by the client in advance of the investigation. The boreholes were advanced using HW-sized casing with field sampling and testing performed in the borehole. Standard Penetration Tests (SPT) were carried out at regular intervals in all boreholes to obtain soil blow counts (i.e. N-values) using a 50-mm O.D. split spoon sampler. Disturbed soil samples were obtained from the boreholes using conventional techniques. Bedrock was drilled and sampled at all boreholes using HQ-sized coring equipment.

Following field sampling and visual description, overburden samples were placed in waterproof sample bags and transported to our Dartmouth laboratory for further examination and scheduling for geotechnical index testing.

4 SUBSURFACE CONDITIONS

An explanation of terms and symbols used in the report is provided in Appendix 1. A summary of the encountered geologic conditions is provided on the Borehole and Test Pit Logs in Appendix 2. Laboratory Testing results are provided in Appendix 3.

It should be noted that the stratigraphic boundaries on the Borehole Logs typically represent a transition of one soil type to another and do not necessarily indicate an exact plane of geologic change. Subsurface conditions may vary between and beyond the Borehole locations.

In summary, the soil conditions encountered at the boreholes were similar and consisted of marine sediments overlying silt deposits, glacial till and slate bedrock. Bedrock was encountered at depths ranging from 4.9 metres to 6.4 metres below the harbour bottom. The following paragraphs and table further describe the subsurface conditions at the site. Coordinates are projected to UTM NAD 83, Zone 20 (CSRS).

Table 1 Summary of Subsurface Conditions

BOREHOLE NUMBER	SURFACE ELEVATION (METRES) ¹	NORTHING (METRES)	EASTING (METRES)	DEPTH TO TILL (METRES)	DEPTH TO BEDROCK (METRES)	ELEVATION OF BEDROCK (METRES)
BH 1	-2.478	4927421.11	411575.60	3.4	6.4	-8.878
BH 2	-2.097	4927405.76	411583.38	3.2	5.1	-7.197
BH 3	-3.240	4927409.46	411598.27	3.0	4.9	-8.140
BH 4	-2.478	4927405.77	411630.39	2.7	5.2	-7.678

1. Harbour Surface Elevations have been referenced to a local datum with an elevation of +3.467 metres provided by PWGSC (i.e. Top of Concrete Curb on Concrete Wharf).

4.1 Sediment

Marine sediments have been encountered at the surface of all boreholes. The sediment was generally a silty sand with some organics and peat. The sediment was typically black in colour and its moisture content can be described as saturated. Standard penetration N-values for the sediment at the boreholes ranged from 0 to 1 blow per 300 mm penetration, indicating a very loose / soft material. The sediment was proven for a total depth of 2.1 metres at borehole BH 2.

4.2 SILT

Silt deposits have been encountered in all boreholes below the marine sediments. The silt generally contained some organic fibres, trace sand and clay. The silt was blue-grey in colour and its moisture content can be described as saturated. Standard penetration N-values for the silt at the boreholes ranged from 2 to 20 blows per 300 mm penetration, indicating a soft to very stiff consistency. The silt was proven for a total depth of 3.4 metres at borehole BH 1.

Laboratory gradation testing of a select silt sample indicated a material with 3 percent gravel, 15 percent sand, and a fines (i.e. silt and clay sizes) content of 82 percent. Moisture content testing of a select silt sample indicated 28.7 percent. Atterberg limits on select samples of the silt indicated the material to be considered as non-plastic.

4.3 Till (Site-Native Glacial Soil)

Till deposits have been encountered at all boreholes below the silt deposits. The till consisted of silty sand, some gravel to gravelly, with occasional to some cobbles and boulders. The till was typically brown to grey in colour and its moisture content can be described as saturated. Standard penetration N-values for the till at the boreholes ranged from 21 to 53 blows per 300 mm penetration, indicating a compact to very dense material. The high N-values recorded in the fill deposit may be attributed to the gravel and cobble content and generally not representative of the *insitu* relative density. The till was proven for a total depth of 6.4 metres at borehole BH 1.

Laboratory gradation testing of select till samples indicated a material with 16 to 44 percent gravel, 37 to 39 percent sand, and a fines (i.e. silt and clay sizes) content of 17 to 47 percent. Moisture content testing of select till samples provided values ranging from 9.4 to 10.7 percent.

4.4 Bedrock

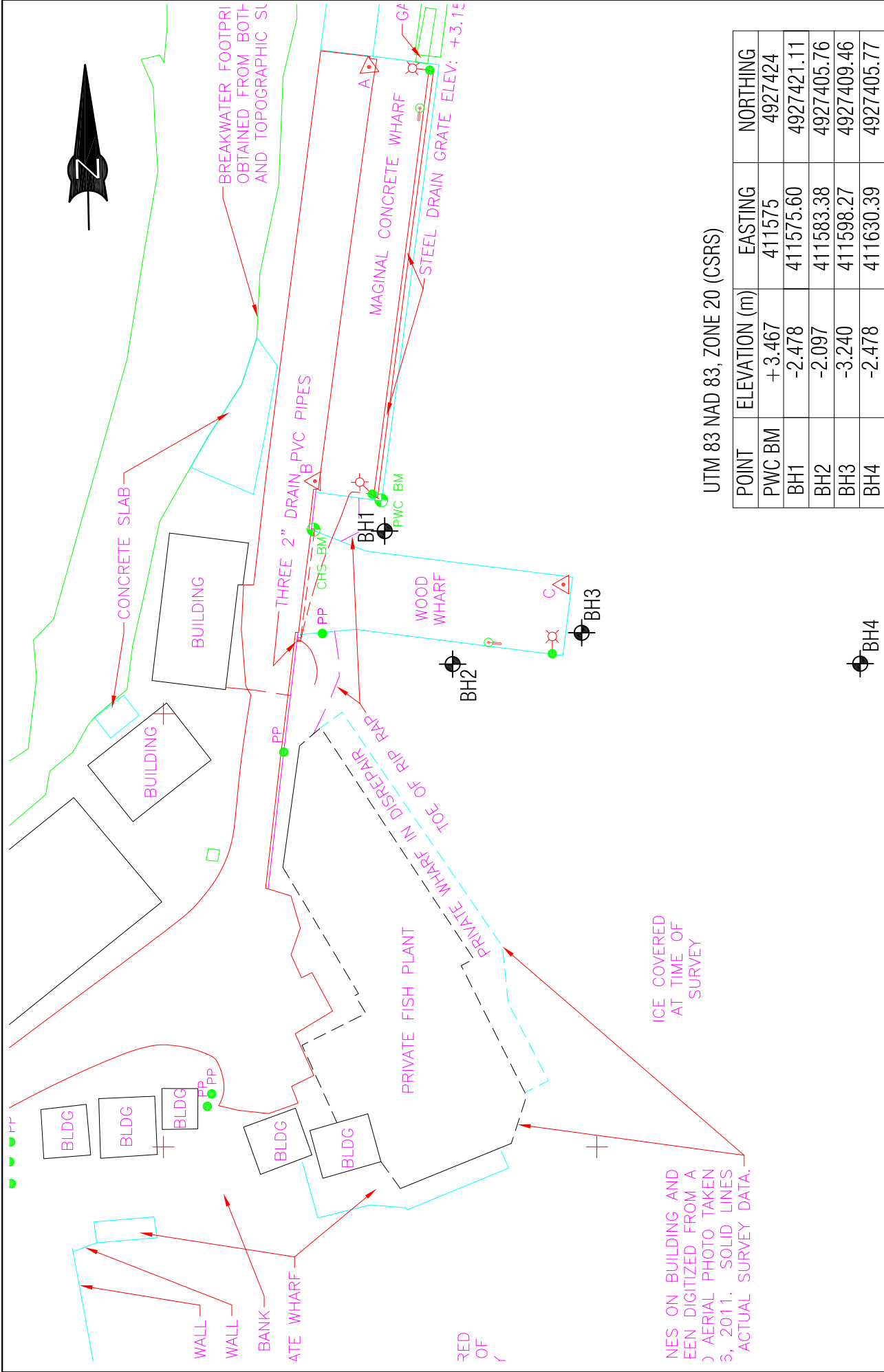
Geological mapping of the proposed development area indicates that the site is underlain by the Meguma Group of metasediments. These consolidated deposits are typically fine-grained, bluish grey in colour and fractured.

Bedrock was encountered in all boreholes at depths ranging from 4.9 metres to 6.4 metres. During the field investigation, bedrock was core-drilled at all locations. Examination of bedrock core samples obtained indicates that the site is underlain by slate bedrock.

The bedrock has been observed to be moderately to highly fractured, low to moderate strength, moderately weathered and dark bluish grey in colour. The Rock Quality Designation (RQD) values of core samples ranged from 0% to 45%, indicating a very poor to poor quality rock. Compressive Strength on "intact" cores indicated strengths of 25.8 MPa, 33.9 MPa, 54.7 MPa and 67.8 MPa.

5 CLOSURE

The geotechnical drilling / sampling / testing program undertaken has involved random sampling of site conditions. Should any conditions be encountered during constructions that are contrary to those reported herein, we request immediate notification so that reassessment can be undertaken.



Ref: Investigation Survey Topographic Data, Blandford, NS, DWG#R.070454.024, Dated Jan. 28, 2015, Provided by Client.

LEGEND:

BH1

- Approximate Borehole Location

BM

- PWC Bench Mark

Site Plan Showing Approximate Borehole Locations
Blandford, Nova Scotia

DATE: April 2015

SCALE: 1:500

DRAWN BY: JU

CKD BY: RH

JOB No. 20115

FIGURE 1

Appendix 1 Explanation of Terms and Symbols

SYMBOLS AND TERMS USED ON THE BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Behavioural properties (i.e. plasticity, permeability) take precedence over particle gradation in describing soils.

Terminology describing soil structure:

Desiccated	- having visible signs of weathering by oxidation of clay minerals, shrinkage cracks etc.
Fissured	- having cracks, and hence a blocky structure
Varved	- composed of regular alternating layers of silt and clay
Stratified	- composed of alternating layers of different soil types, e.g. silt and sand or silt and clay
Well Graded	- having wide range in grain sizes and substantial amounts of all intermediate particle sizes
Uniformly Graded	- predominantly of one grain size.

Terminology used for describing soil strata based upon the proportion of individual particle size present:

Trace, or occasional	Less than 10%
Some	10-20%
Adjective (e.g. silty or sandy)	20-35%
And (e.g. silt and sand)	35-50%

The standard terminology to describe cohesionless soils includes the relative density, as determined by laboratory test or by the Standard Penetration Test 'N' - value: the number of blows of 140 pound (64 kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (305 mm) into the soil.

Relative Density	'N' Value	Relative Density %
Very loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by insitu vane tests, penetrometer tests, unconfined compression test, or occasionally by standard penetration tests.

Consistency	Undrained Shear Strength		'N' Value
	Kips/sq.ft.	kPa	
Very Soft	<0.25	<12.5	<2
Soft	0.25-0.5	12.5-25	2-4
Firm	0.5-1.0	25-50	4-8
Stiff	1.0-2.0	50-100	8-15
Very Stiff	2.0-4.0	100-200	15-30
Hard	>4.0	>200	>30

SOIL CLASSIFICATION SYSTEM (MODIFIED U.S.C.)

MAJOR DIVISION			GROUP SYMBOL	GRAPHIC SYMBOL	COLOR CODE	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA	
HIGHLY ORGANIC SOILS			Pt		ORANGE	PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOR OR ODOR, AND OFTEN FIBROUS TEXTURE	
COARSE-GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN NO. 200 SIEVE SIZE)	GRAVELS MORE THAN HALF COARSE FRACTION LARGER THAN NO. 4 SIEVE SIZE	CLEAN GRAVELS	GW		RED	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, <5% FINES	$C_u = \frac{D_{60}}{D_{10}} > 4$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$	
			GP		RED	POORLY-GRADED GRAVELS, AND GRAVEL-SAND MIXTURES, <5% FINES	NOT MEETING ALL ABOVE REQUIREMENTS	
		DIRTY GRAVELS	GM		YELLOW	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES >12% FINES	ATTERBERG LIMITS BELOW "A" LINE OR $I_p < 4$	
			GC		YELLOW	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES >12% FINES	ATTERBERG LIMITS ABOVE "A" LINE OR $I_p > 7$	
	SANDS MORE THAN HALF COARSE FRACTION SMALLER THAN NO. 4 SIEVE SIZE	CLEAN SANDS	SW		RED	WELL-GRADED SANDS, GRAVELLY SANDS, <5% FINES	$C_u = \frac{D_{60}}{D_{10}} > 6$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$	
			SP		RED	POORLY-GRADED SANDS, OR GRAVELLY SANDS, <5% FINES	NOT MEETING ALL ABOVE REQUIREMENTS	
		DIRTY SANDS	SM		YELLOW	SILTY SANDS, SAND-SILT MIXTURES >12% FINES	ATTERBERG LIMITS BELOW "A" LINE OR $I_p < 4$	
			SC		YELLOW	CLAYEY SANDS, SAND-CLAY MIXTURES >12% FINES	ATTERBERG LIMITS ABOVE "A" LINE OR $I_p > 7$	
FINE - GRAINED SOILS (MORE THAN HALF BY WEIGHT PASSES NO.200 SIEVE SIZE)	SILTS BELOW "A" LINE ON PLASTICITY CHART; NEGLEGIBLE ORGANIC CONTENT		ML		GREEN	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	$W_L < 50$	SEE CHART BELOW
			MH		BLUE	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS	$W_L > 50$	
	CLAYS ABOVE "A" LINE ON PLASTICITY CHART; NEGLEGIBLE ORGANIC CONTENT		CL		GREEN	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY, OR SILTY CLAYS, LEAN CLAYS	$W_L < 30$	
			CI		GREEN-BLUE	INORGANIC CLAYS OF MEDIUM PLASTICITY SILTY CLAYS	$W_L > 30, < 50$	
			CH		BLUE	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	$W_L > 50$	
	ORGANIC SILTS & ORGANIC CLAYS BELOW "A" LINE ON PLASTICITY CHART		OL		GREEN	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	$W_L < 50$	
			OH		BLUE	ORGANIC CLAYS OF HIGH PLASTICITY	$W_L > 50$	



FILL



TILL

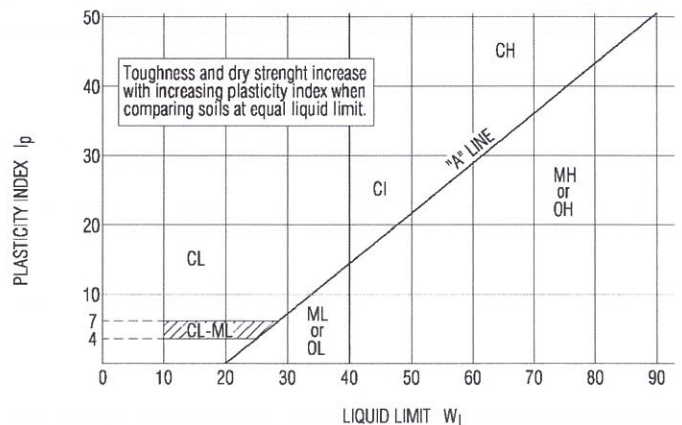


BEDROCK

- All sieve sizes mentioned on this chart are U.S. Standard, ASTM E11.
- Boundary classifications possessing characteristics of two groups are given combined group symbols eg GW-GC is a well-graded gravel-sand mixture with clay binder between 5% and 12%.
- Soil fractions and limiting textural boundaries are in accordance with the Unified Soil Classification System, except that an inorganic clay of medium plasticity (CI) is recognized.
- The following adjectives may be employed to define percentage ranges by weight of minor components:

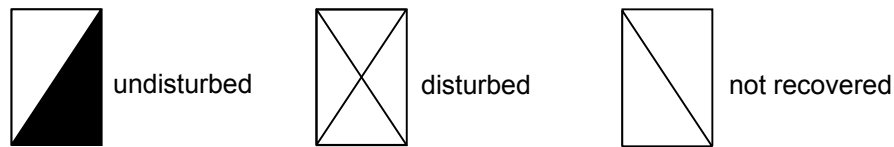
and	50 - 36%
gravelly, sandy, silty, clayey, ect.	35 - 21%
some	20 - 11%
trace	10 - 1%

PLASTICITY CHART



SOIL SAMPLES

CONDITION – This column graphically indicates the depth and condition of the sample:



TYPE – The type of sample is indicated in this column as follows:

- A auger sample
- B block sample
- C rock core, or frozen soil core
- D drive sample
- G grab sample
- SS split spoon
- P Pitcher tube sample
- U tube sample (usually thin-walled)
- W wash or air return sample
- O other (see report text)

PENETRATION RESISTANCE – Unless otherwise noted this column refers to the number of blows (N) of a 140 pound (63.5 kg) hammer freely dropping 30 inches (0.76 m) required to drive a 2 inch (50.8 mm) O.D. open-end sampler 0.5 feet (0.15 m) to 1.5 feet (0.45 m) into the soil, or until 100 blows have been applied, in which case, the penetration is stated. This is the standard penetration test referred to in ASTM D 1586.

OTHER TESTS

In this column are tabulated results of other laboratory tests as indicated by the following symbols:

*C	Consolidation test
Fines	Percentage by weight smaller than #200 sieve
D _R	Relative density (formerly specific gravity)
k	Permeability coefficient
*MA	Mechanical grain size analysis and hydrometer test (if appropriate)
pp	Pocket penetrometer strength
*q	Triaxial compression test
q _U	Unconfined compressive strength
*SB	Shearbox test
SO ₄	Concentration of water-soluble sulphate
*ST	Swelling test
TV	Torvane shear strength
VS	Vane Shear Strength (undisturbed-remolded)
ε _f	Unit strain at failure
γ	Unit weight of soil or rock
γ _d	Dry unit weight of soil or rock
ρ	Density of soil or rock
ρ _d	Dry density of soil or rock

* The results of these tests usually are reported separately

Appendix 2

Borehole Logs

LOGGED/DWN. RH				CKD. KM		DATE OF INVEST.4/24/15				JOB NO. 20115		HOLE NO.BH 1	
CASING RESISTANCE blows/300mm				DEPTH		MODIFIED USCS	SOIL SYMBOL	SOIL DESCRIPTION		SOIL SAMPLE		DRILL TYPE	
<div><div></div><div></div><div></div><div></div><div></div></div>								DATUM	Top of concrete curb on concrete wharf. Elevation provided by PWGSC. Elev. = +3.467 m	COND.	TYPE	PENE. RESIST.	Drill Rig
WC % wp- □ w- ● wl- △ 10 20 30 40 50				ft	m			SURFACE ELEVATION-2.48 meters					OTHER TESTS
<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><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<div>LVM MARITIME TESTING</div>				<div>BOREHOLE LOG</div>						
				<div>PROJECT</div> <div>Geotechnical Drilling / Sampling / Testing - Blandford, Nova Scotia</div>						
LOGGED/DWN. RH		CKD. KM		DATE OF INVEST.4/24/15			JOB NO. 20115		HOLE NO.BH 1	
<div>CASING RESISTANCE</div> <div>blows/300mm</div> <div>↓</div>		<div>DEPTH</div>		<div>MODIFIED</div> <div>USCS</div>	<div>SOIL</div> <div>SYMBOL</div>	<div>SOIL DESCRIPTION</div>		<div>SOIL SAMPLE</div>		<div>DRILL TYPE</div>
<div>WC %</div> <div>wp- □ w- ● wl- △</div> <div>10 20 30 40 50</div>		<div>ft</div> <div>m</div>	<div>DATUM</div> <div>Top of concrete curb on concrete wharf. Elevation provided by PWGSC. Elev. = +3.467 m</div>			<div>COND.</div>	<div>TYPE</div>	<div>PENE.</div> <div>RESIST.</div>	<div>Drill Rig</div>	
			<div>SURFACE ELEVATION-2.48 meters</div>						<div>OTHER TESTS</div>	
				<div>End of Borehole at 10.7 metres in Bedrock.</div> <div>Northing (metres): 4927421.11</div> <div>Easting (metres): 411575.60</div>						
		36 11								
		38								
		12								
		40								
		42								
		13								
		44								
		46 14								
		48								
		15								
		50								
		52								
		16								
		54								
		56 17								
		58								
		18								
		60								
		62 19								
		64								
		20								
		66								
										PLATE 2

BOREHOLE LOG

PROJECT

Geotechnical Drilling / Sampling / Testing -
Blandford, Nova Scotia

LOGGED/DWN. JC		CKD. KM		DATE OF INVEST.4/26/15		JOB NO. 20115		HOLE NO.BH 2				
CASING RESISTANCE blows/300mm		DEPTH		MODIFIED USCS	SOIL SYMBOL	SOIL DESCRIPTION		SOIL SAMPLE		DRILL TYPE		
WC % wp-□ w-● wl-△ 10 20 30 40 50						DATUM Top of concrete curb on concrete wharf. Elevation provided by PWGSC. Elev. = +3.467 m SURFACE ELEVATION-2.10 meters		COND.	TYPE	PENE. RESIST.	Drill Rig	
		ft	m							OTHER TESTS		
		2				SEDIMENT : silty sand, some organics and peat, loose, saturated, black.			SS	N=0	TCR - Total Core Recovered	
			1						SS	N=0		RQD - Rock Quality Designation
		4							SS	N=0		UCS - Unconfined Compressive Strength
		6	2		OL				SS	N=0	79 bolws per 200mm	
		8				SILT : some organic fibres, trace sand and clay, non-plastic, soft to firm, saturated, blue-grey.			SS	N=8		-Cobbles / Boulders
		10	3						SS	79/200		
		12				TILL : silty sand, some gravel to gravelly, occasional to some cobbles and boulders, compact, saturated, brown to grey.			RC		TCR: 50% RQD: 0%	
		14	4									
		16	5						SS	N=28		
		18				BEDROCK : Slate, highly fractured, moderately weathered, dark bluish grey.			RC		TCR: 83% RQD: 20%	
		20	6						RC			
		22	7						RC			
		24							RC		TCR: 88% RQD: 0%	
		26	8						RC			
		28										
		30	9			End of Borehole at 10.1 metres in Bedrock.					UCS: 67.8 MPa	
		32				Northing (metres): 4927405.76 Easting (metres): 411583.38			RC			
			10								TCR: 100% RQD: 22%	
											PLATE 3	

BOREHOLE LOG

PROJECT

Geotechnical Drilling / Sampling / Testing -
Blandford, Nova Scotia

LOGGED/DWN. JC				CKD. KM		DATE OF INVEST.4/26/15		JOB NO. 20115		HOLE NO.BH 4			
CASING RESISTANCE blows/300mm				DEPTH		MODIFIED USCS	SOIL SYMBOL	SOIL DESCRIPTION		SOIL SAMPLE		DRILL TYPE	
WC % wp- □ w- ● wl- △ 10 20 30 40 50								DATUM Top of concrete curb on concrete wharf. Elevation provided by PWGSC. Elev. = +3.467 m SURFACE ELEVATION-2.48 meters		COND. •	TYPE	PENE. RESIST. •	Drill Rig
													OTHER TESTS
				2	OL		SEDIMENT : silty sand, some organics and peat, loose, saturated, black.			SS	N=0	TCR - Total Core Recovered	
				4						SS	N=0	RQD - Rock Quality Designation	
				6			SILT : some organic fibres, trace sand and clay, non-plastic, stiff, saturated, blue-grey.			SS	N=17	UCS - Unconfined Compressive Strength	
				8						SS	N=14		
				10			TILL : silty sand, some gravel to gravelly, occasional to some cobbles and boulders, compact to very dense, saturated, brown to grey.						
				12						SS	N=28		
				14						SS	N=53		
				16			-Cobbles / Boulders			RC			
				18			BEDROCK : Slate, highly fractured, moderately weathered, dark bluish grey.			RC		TCR: 72% RQD: 0%	
				20								UCS: 54.7 MPa	
22				RC		TCR: 100% RQD: 17%							
24													
26				RC		TCR: 100% RQD: 29%							
28													
30													
32													
10													
End of Borehole at 8.5 metres in Bedrock.													
Northing (metres): 4927405.77 Easting (metres): 411630.39													
PLATE 5													

Appendix 3 Laboratory Test Results

TABLE 3-1: SUMMARY OF LABORATORY DATA
Geotechnical Drilling / Sampling / Testing
Blandford, Nova Scotia
Project No. 20115

Borehole No.	Sample No.	Depth (metres)	Description	Moisture Content (%)	Particle Size Distribution			Atterberg Limits wL, wP, IP	UCS (MPa)
					Gravel (%)	Sand (%)	Fines (silts and clays) (%)		
BH 1	4	1.8-2.4	Silt					Non Plastic	33.9
	9	5.2-5.8	Till	10.7	16	37	47		
		7.9-8.2	Rock Core						
BH 2	5	2.4-3.0	Silt					Non Plastic	67.8
		8.5-8.8	Rock Core						
BH 3	4	1.8-2.4	Silt					Non Plastic	25.8
	2	3.7-4.3	Till	9.5	33	38	29		
	7	7.0-7.3	Rock Core						
BH 4	4	2.1-2.7	Silt	28.7	3	15	82	Non Plastic	54.7
	6	4.0-4.6	Till	9.4	44	39	17		
		6.1-6.4	Rock Core						

97 TROOP AVE., DARTMOUTH, N.S. B3B 2A7 - TEL (902) 468-6486 FAX 468-4919

Client:

Public Works & Government Services Canada
1713 Bedford Row
Halifax, Nova Scotia
B3J 3C9

Our Project No:

20115

Client Contract No.:

Client PO.:

CC:

Attn: Kate McCarthy

PHONE (902) 496-5047

FAX: (902) 496-5422

Project: Geotechnical Drilling / Sampling / Testing - Blandford, Nova Scotia

Source: BH 1

Sample No: 9

Date Sampled: 24-Apr-15

Location: 5.2-5.8 m

Sampled by: RH/JC

Date Received: 27-Apr-15

Date Tested: 30-Apr-15

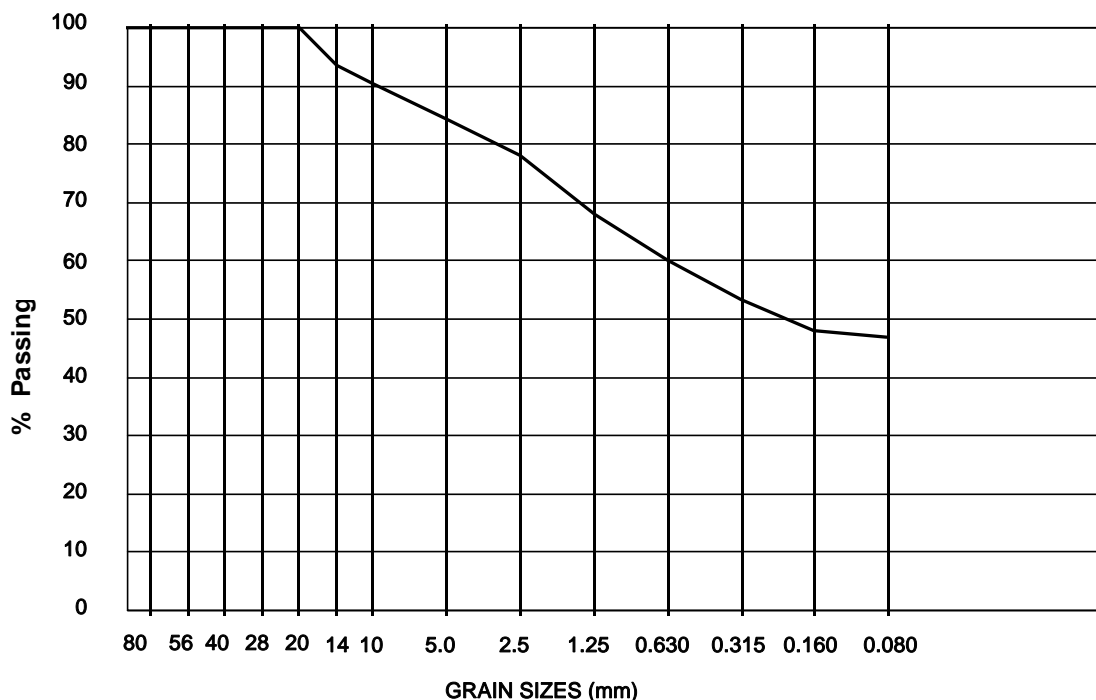
PHYSICAL PROPERTY TESTS

Soil Type	Till	Liquid Limit	Flat and Elongated Particles, %
Gravel, %	16	Plastic Limit	Coarse Spec. Gravity
Sand, %	37	Plasticity Index	Fractured Faces, %
Silt and Clay, %	47	Coarse Absorption, %	Petrographic No.
Moisture Cont., %	10.7	Fine Absorption, %	Max. Dry Density, (kg/m3)
Abrasion Loss, %		Micro Deval Loss, %	Optimum Moisture, %

Sieve Size (mm)	Percent Passing	Spec. Band
112		
80		
56		
40		
28		
20	100	
14	94	
10	91	
5.0	84	
2.5	78	
1.25	68	
0.630	60	
0.315	53	
0.160	48	
0.080	46.9	

GRAIN SIZE CURVE

Spec Band
NO SPEC



Comments:

Record No: 9051

MTL Tech: JA

PER



CERTIFIED LABORATORY
FOR TESTING CONCRETE

Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of test results is provided only on request.

pm KM

97 TROOP AVE., DARTMOUTH, N.S. B3B 2A7 - TEL (902) 468-6486 FAX 468-4919

Client:

Public Works & Government Services Canada
1713 Bedford Row
Halifax, Nova Scotia
B3J 3C9

Our Project No:

20115

Client Contract No.:

Client PO.:

CC:

Attn: Kate McCarthy

PHONE (902) 496-5047

FAX: (902) 496-5422

Project: Geotechnical Drilling / Sampling / Testing - Blandford, Nova Scotia

Source: BH 3

Sample No: 7

Date Sampled: 25-Apr-15

Location: 3.7-4.3 m

Sampled by: RH

Date Received: 27-Apr-15

Date Tested: 30-Apr-15

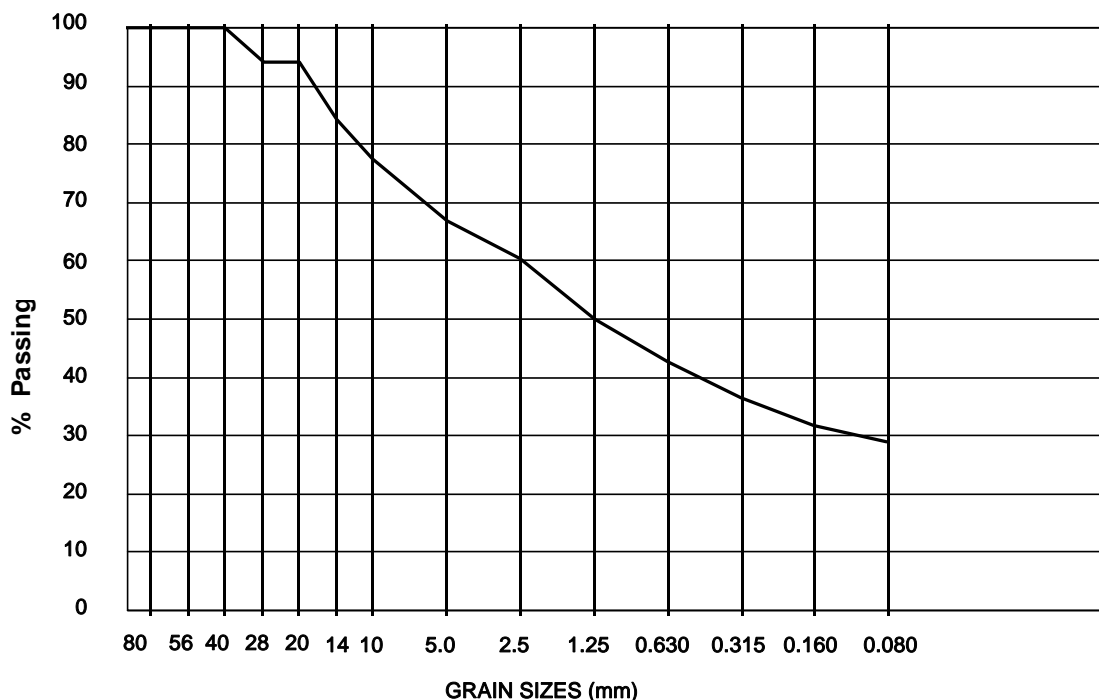
PHYSICAL PROPERTY TESTS

Soil Type	Till	Liquid Limit	Flat and Elongated Particles, %
Gravel, %	33	Plastic Limit	Coarse Spec. Gravity
Sand, %	38	Plasticity Index	Fractured Faces, %
Silt and Clay, %	29	Coarse Absorption, %	Petrographic No.
Moisture Cont., %	9.5	Fine Absorption, %	Max. Dry Density, (kg/m3)
Abrasion Loss, %		Micro Deval Loss, %	Optimum Moisture, %

Sieve Size (mm)	Percent Passing	Spec. Band
112		
80		
56		
40	100	
28	94	
20	94	
14	84	
10	77	
5.0	67	
2.5	60	
1.25	50	
0.630	43	
0.315	36	
0.160	32	
0.080	28.9	

GRAIN SIZE CURVE

Spec Band
NO SPEC



Comments:

Record No: 9052

MTL Tech: JA

PER



CERTIFIED LABORATORY
FOR TESTING CONCRETE

Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of test results is provided only on request.

pm KM

97 TROOP AVE., DARTMOUTH, N.S. B3B 2A7 - TEL (902) 468-6486 FAX 468-4919

Client:

Public Works & Government Services Canada
1713 Bedford Row
Halifax, Nova Scotia
B3J 3C9

Our Project No:

20115

Client Contract No.:

Client PO.:

CC:

Attn: Kate McCarthy

PHONE (902) 496-5047

FAX: (902) 496-5422

Project: Geotechnical Drilling / Sampling / Testing - Blandford, Nova Scotia

Source: BH 4

Sample No: 4

Date Sampled: 26-Apr-15

Location: 2.1-2.7 m

Sampled by: JC

Date Received: 27-Apr-15

Date Tested: 30-Apr-15

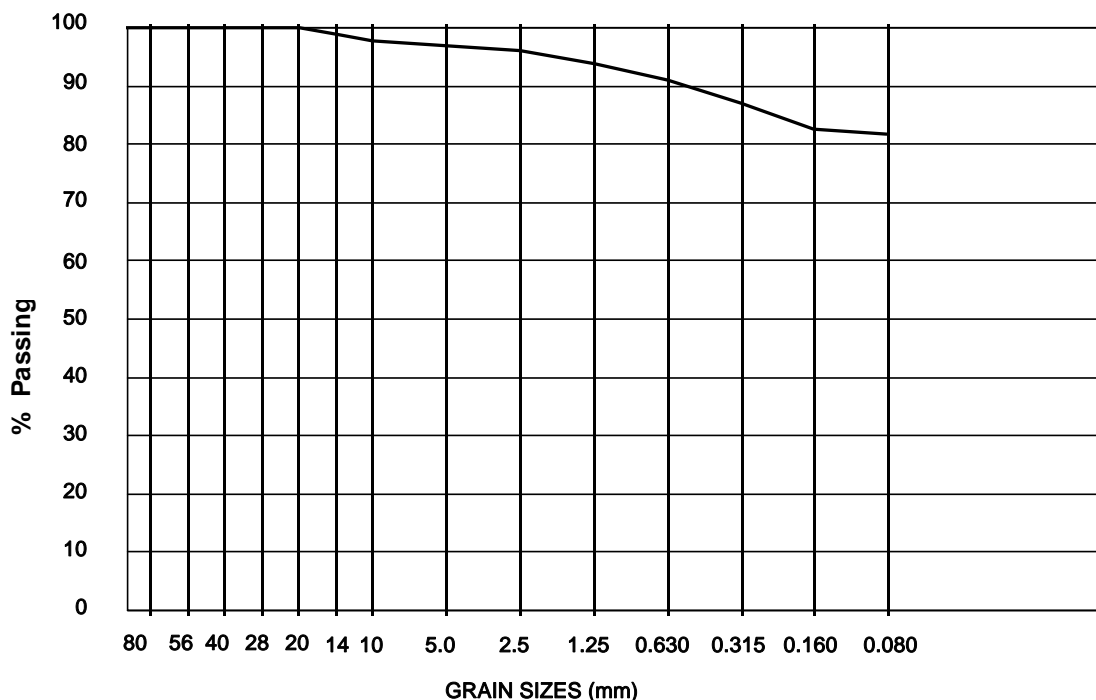
PHYSICAL PROPERTY TESTS

Soil Type	Silt	Liquid Limit	Flat and Elongated Particles, %
Gravel, %	3	Plastic Limit	Coarse Spec. Gravity
Sand, %	15	Plasticity Index	Fractured Faces, %
Silt and Clay, %	82	Coarse Absorption, %	Petrographic No.
Moisture Cont., %	28.7	Fine Absorption, %	Max. Dry Density, (kg/m3)
Abrasion Loss, %		Micro Deval Loss, %	Optimum Moisture, %

Sieve Size (mm)	Percent Passing	Spec. Band
112		
80		
56		
40		
28		
20	100	
14	99	
10	98	
5.0	97	
2.5	96	
1.25	94	
0.630	91	
0.315	87	
0.160	83	
0.080	81.8	

GRAIN SIZE CURVE

Spec Band
NO SPEC



Comments:

Record No: 9053

MTL Tech: JA

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pm KM

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Client:

Public Works & Government Services Canada
1713 Bedford Row
Halifax, Nova Scotia
B3J 3C9

Our Project No:

20115

Client Contract No.:

Client PO.:

CC:

Attn: Kate McCarthy

PHONE (902) 496-5047

FAX: (902) 496-5422

Project: Geotechnical Drilling / Sampling / Testing - Blandford, Nova Scotia

Source: BH 4

Sample No: 6

Date Sampled: 26-Apr-15

Sampled by: JC

Date Received: 27-Apr-15

Location: 4.0 - 4.6 m

Date Tested: 30-Apr-15

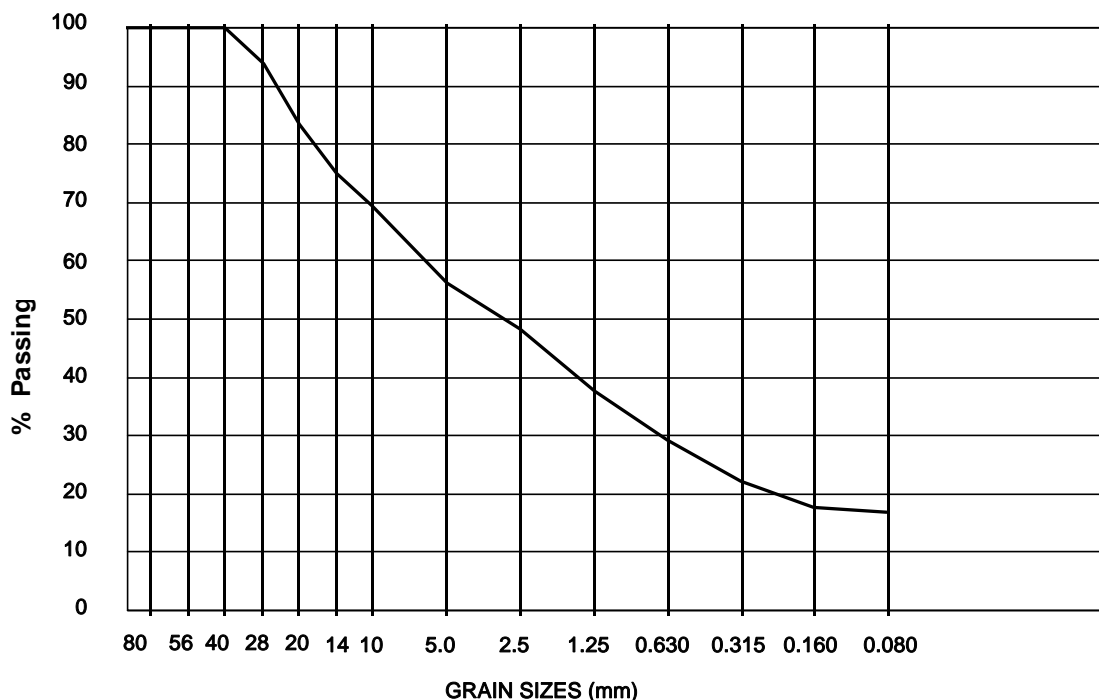
PHYSICAL PROPERTY TESTS

Soil Type	Till	Liquid Limit	Flat and Elongated Particles, %
Gravel, %	44	Plastic Limit	Coarse Spec. Gravity
Sand, %	39	Plasticity Index	Fractured Faces, %
Silt and Clay, %	17	Coarse Absorption, %	Petrographic No.
Moisture Cont., %	9.4	Fine Absorption, %	Max. Dry Density, (kg/m3)
Abrasion Loss, %		Micro Deval Loss, %	Optimum Moisture, %

Sieve Size (mm)	Percent Passing	Spec. Band
112		
80		
56		
40	100	
28	94	
20	83	
14	75	
10	69	
5.0	56	
2.5	48	
1.25	38	
0.630	29	
0.315	22	
0.160	18	
0.080	16.8	

GRAIN SIZE CURVE

Spec Band
NO SPEC



Comments:

Record No: 9054

MTL Tech: JA

PER



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FOR TESTING CONCRETE

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pm KM

TESTING OF ROCK CORE SPECIMENS

Client	PWGSC	MTL Number	20115
Job Location	Blandford, NS	Date Placed	
Location		Date Cored	
Coring Contractor	LVM/MTL	Cores Trimmed	Yes
Core Diameter	61	Capping Material	
Maximum Aggregate Size		Curing	

[illegible]

REMARKS:

Technician: TM Date Tested: April 29, 2015