Public Services & Procurement Canada

PROPOSED MCI HEAVY EQUIPMENT BUILDING, BEDFORD INSTITUTE OF OCEANOGRAPHY, DARTMOUTH, NOVA SCOTIA

October 30, 2020

Geotechnical Investigation

2004260

FINAL VERSION

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1 Introduction

Englobe Corp., at your request, has carried out a geotechnical investigation at the site of a proposed development at the Bedford Institute of Oceanography (BIO) in Dartmouth, Nova Scotia. The purpose of the work was to identify the subsurface soil and bedrock conditions at the site and make geotechnical recommendations regarding earthworks and foundation design.

This report presents our observations and preliminary engineering recommendations associated with the geotechnical investigation of the site. Included herein are the factual results of the field investigation including discussion of field procedures, subsurface conditions, laboratory analysis and recommendations for site development.

2 Site and Project Description

It is understood that an MCI heavy equipment building is proposed for construction at the BIO in Dartmouth, Nova Scotia. Detailed design of the structure has not been undertaken to date, however, preliminary indication is that the structure will be of conventional design and supported by a shallow foundation system.

3 Investigation Procedure

Fieldwork for the current investigation was carried out on October 16, 2020, when two (2) boreholes were drilled and three (3) test pits were excavated at the locations shown on the enclosed Figure 1. The borehole investigation was carried out using a truck mounted drill rig supplied by Nova Drilling from Mount Uniacke, NS. The test pits were excavated by a local earthworks contractor.

The investigation was carried out by qualified field engineering personnel who logged the subsurface conditions. The boreholes were advanced using continuous flight augers and casing with field sampling and testing performed in the open boreholes. Standard Penetration Tests (SPT) were carried out at regular intervals in select 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. Grab samples were obtained from the test pit locations.

4 Subsurface Conditions

An explanation of terms and symbols used in the report is provided in Appendix A. A summary of the encountered geologic conditions is provided in the Borehole Logs and Test Pit Logs in Appendix B.

It should be noted that the stratigraphic boundaries on the Borehole and Test Pit 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 test locations.

In summary, asphalt pavement or gravels were encountered overlying fill materials, undisturbed glacial till and inferred bedrock. Bedrock was inferred by excavator bucket refusal and split spoon refusal. The following table (Table 1) summarizes the subsurface conditions.

Table 1: Summary of Subsurface Conditions

LOCATION	DEPTH TO GROUNDWATER (METRES)	DEPTH TO TILL (METRES)	DEPTH TO INFERRED BEDROCK (METRES) [2.]
BH 1	-- [1.]	4.4	6.3
BH 2	-- [1.]	1.8	3.4
TP 1	--	3.5	4.0
TP 2	--	2.4	3.4
TP 3	--	1.8	2.7

1. Groundwater depth not observed due to water injection for coring process
2. Bedrock inferred by excavator bucket refusal or split spoon refusal

4.1 Asphalt Pavement

A layer of asphalt pavement was encountered at the surface of boreholes BH 1 and B2. The asphalt pavement was approximately 100 mm in thickness on average.

4.2 Fill

Fill was encountered in all boreholes and test pits either at the surface or beneath the asphalt pavement. The fill generally varied from sand and gravel to gravelly silty sand with occasional to some cobbles and boulders. Organics were encountered within the lower portions of the fill at test pit TP 1. Observations of the in situ deposits indicated that the material was grey to brown in colour and its moisture content was described as moist. Representative standard penetration N values recorded for the fill material ranged from 24 to greater than 50 blows per 300 mm, indicating a compact to dense material. The higher N-values recorded are due mainly to cobble and boulder content in the fill interfering with the test and not necessarily representative of *insitu* relative density. Observations of the test pits indicate the fill is in a losoe condition. The fill was proven to a total depth of 4.4 metres at borehole BH 1.

4.3 Glacial Till

Site-native glacial till deposits were encountered below the fill deposits at all boreholes and test pits. These typically compact soils ranged from gravelly silty sand, trace clay to silty sand, some gravel with trace clay. The till contained occasional to some cobbles and boulders.

Observations of the in situ deposits indicated that the material was light brown to grey in colour and its moisture content was described as moist. Representative standard penetration N values recorded for the till material ranged from 26 to in excess of 50 blows per 300 mm, indicating a compact to very dense material. The higher N-values recorded are due mainly to cobble and boulder content in the fill interfering with the test and not necessarily representative of insitu relative density. The till was proven to a total depth of 6.3 metres below the existing ground surface at borehole BH 1.

4.4 Bedrock

Bedrock geology mapping of the area indicates that the site is underlain by the Meguma Group of metasediments. Specifically, the Goldenville Formation which consists of greywacke, quartzite, slate, schist and gneiss underlies the area.

Inferred bedrock was encountered in all boreholes and test pits. Bedrock was inferred by excavator bucket refusal and split spoon refusal.

4.5 Groundwater

Groundwater observations were made during the field investigation through open-hole measurement at the test locations. A summary of the accumulated groundwater information is provided on the Borehole and Test Pit Logs in Appendix B.

During the current site investigation, groundwater was not observed during the drilling process in the boreholes due to water injection for the coring process. Groundwater was not encountered in the test pits. Perched groundwater should be expected during construction. Seasonal variations in groundwater levels can be expected.

5 Discussion and Recommendations for Design

5.1 Site Development - General

In the following paragraphs, a discussion of site development is presented in light of the observed subsurface conditions. The recommendations outlined in the following sections assume that the structure will be located generally in the area(s) investigated, as shown in Figure 1. Currently, it is understood that the new structure will be of conventional design and will be carried by a foundation system of spread and strip footings. Current recommendations are based on preliminary information currently available for the project. Once final design drawings are available for the site, a review of our report should be conducted.

The subsurface conditions encountered throughout the development area are relatively uniform and consist of either asphalt pavement or gravels overlying fill deposits, "undisturbed" glacial soils and bedrock. The presence of competent bearing stratum at shallow depth will allow for the use of a conventional shallow foundation system for the proposed structure.

5.2 Site Preparation, Excavation and Earthworks

To prepare the immediate building areas to receive foundations/slabs, it will be necessary to remove all fill materials, wet/loose soils and organics from beneath foundation and slab bearing areas. This material should be subexcavated to the level of competent soil (i.e. material noted on the Borehole and Test Pit Logs as Inferred Bedrock or Glacial Till).

Following this initial subexcavation, geotechnical evaluation of the exposed subgrade is recommended to identify any loose or soft areas. Any such areas identified should be subexcavated and replaced with an approved structural fill.

Contingent upon final design grades, a filling program to reach desired floor and foundation subgrade levels may be necessary. This would likely include reuse of select on-site fill materials. Processing of site materials to remove organics and oversized particles will be required to create a suitable product for reuse as structural fill. Depending on final design grades, filling may require importation of an approved structural fill to compensate for deficient quantities. The reuse of on-site materials will be contingent to a large extent on the condition of the materials after excavation, handling and stockpiling. Re-use of the on-site soils would be subject to their condition at time of earthworks.

Imported structural fill should consist of well-graded sand and gravel, or rockfill with a maximum particle size of 200 mm diameter. The fill is to be free of organics, debris, and slate and should have a fines (i.e. silt and clay sized) content not greater than 15 percent. Structural fill should be placed in lifts not exceeding 300 mm in thickness compacted to 100 percent of the material's standard Proctor maximum dry density or equivalent for rockfill. Water and loose/soft soils should be removed from excavations, and bearing stratum approved prior to fill placement. Quality control inspection and testing of engineered fill is recommended.

Temporary excavations in soil extending in depth greater than 1.2 m should be sloped at a minimum one horizontal to one vertical (1H:1V). Flatter side slopes may be required for stability of the excavation due to surface or groundwater infiltration, or soil condition.

5.3 Re-use of On-site Materials and Backfilling

Select portions of the fill deposits and glacial till would be considered suitable for reuse at the site as common material or, in some applications, as engineered fill. The reuse of on-site materials will be contingent on the condition of the materials after excavation, handling and stockpiling. Organic soils and wet soils are not suitable for structural fill; these soils should only be used in non-settlement sensitive areas of the site.

To qualify as engineered backfill, all boulders, debris and deleterious inclusions should be removed. Backfill should be placed in lifts and compacted using appropriate compaction equipment. Lift thickness should be limited to 400 mm using large vibratory rollers, and 250 mm using hand equipment (e.g. diesel plate tampers). The maximum particle size should be limited to 2/3 of the lift thickness.

Backfill against structures should be compacted to 95% of Standard Proctor Density.

5.4 Foundation Design

For design of foundations by Limit States Design, the factored bearing resistance (using a bearing resistance factor of 0.5) of strip footings with a minimum width of 0.6 metres and spread footings with a minimum width of 1.2 metres are as follows:

Table 2: Limit States Design Parameters

LIMIT STATES DESIGN PARAMETER	GLACIAL TILL / STRUCTURAL FILL
Factored Geotechnical Resistance at Ultimate Limit States (ULS)	300 kPa
Geotechnical Resistance at Serviceability Limit States (SLS)	200 kPa

The effect of site conditions on seismic response should be considered in the design of foundations. Based on the subsurface soil conditions encountered in the test locations, the site may be considered as Class C for seismic site response (NBCC 2015 Table 4.1.8.4.A).

5.5 Interpreted Soil and Bedrock Design Parameters

Bedrock and soil parameters recommended for use in design are outlined in the following table. The parameters indicated have been summarized from known empirical correlations. The values indicated are provided as a guide and their specific use in design should be confirmed with the geotechnical engineer.

Table 3: Interpreted Soil and Bedrock Design Parameters

PARAMETER	GLACIAL TILL	IMPORTED STRUCTURAL FILL (I.E. CRUSHED GRAVEL OR ROCKFILL)
Total Unit Weight, kN/m3	21	21.5
Effective Unit Weight, kN/m^3	11	11.5
Effective Angle of Internal Friction	32°	36°
Active Earth Pressure Coeff.(K_a)	0.31	0.26
Passive Earth Pressure Coeff.(K_p)	3.3	3.85

5.6 Floor Slabs

Slab-on-grade floors for the proposed structure should be cast on a free-draining granular material (Nova Scotia Transportation and Infrastructure Renewal (NSTIR) Type 1 Gravel or equivalent) with a minimum thickness of 200 mm and compacted to 100 percent of the material's standard Proctor maximum dry density.

In heavily loaded areas (i.e. equipment storage, vehicle bay, etc.), the minimum thickness should be increased to 300 mm and may require the placement of rockfill to provide adequate subgrade strength.

To reach the level of the underslab base course, earthworks should be carried out in accordance with previous recommendations for foundation and subgrade preparation.

5.7 De-Watering and Foundation Drainage

During earthworks, water may be expected to enter excavations during precipitation events, as surface runoff or as seepage from within the soil and rock strata. The rate of infiltration into shallow excavations is expected to be minor to moderate and can be controlled by conventional dewatering techniques consisting of 50 to 75 mm diameter portable pumps and grading of excavations to sump locations.

Water pumped from excavations is expected to contain fines and will require care in disposal. Provision for proper site drainage in accordance with applicable municipal, provincial, and federal environmental requirements should be made at the construction stage. Consideration should be given to the environmental implications related to pumping and disposal of potentially environmentally impacted groundwater.

5.8 Erosion and Sediment Control Guidelines

Nova Scotia Environment has published a set of guidelines dealing with environmental protection, specifically, erosion and sedimentation control. The document is of a general nature, however, presents proven methods for lessening the impact of soil erosion on downstream receptors. The Guidelines should be adopted for construction.

5.9 Flexible Pavement Design

Reinstatement of asphalt paved areas will likely be required following building construction. It is expected that vehicle traffic will generally be large trucks, construction equipment, etc. A flexible pavement design recommended for the site is as follows:

Table 4: Flexible Pavement Design

ITEM	HEAVY DUTY PAVEMENT
Asphalt Top Course – C mix *	40 mm
Asphalt Base Course – B mix *	50 mm

NSTIR Type 1 Gravel **	150 mm
NSTIR Type 2 Gravel **	350 mm

* Minimum compaction (asphalt pavement) – 92 % Theoretical Maximum Density (ASTM D2041)
** Minimum compaction (granular(s)) – 100 % Standard Proctor Maximum Dry Density

The above pavement designs assume a prepared subgrade levelled and compacted to 98 percent standard Proctor maximum dry density. An assessment of the prepared subgrade at time of construction may warrant re-evaluation of design gravel thickness.

Grading of parking and access areas should ensure positive drainage away from active site areas (i.e. to perimeter/adjacent ditches, catch basins, sheet flow off-site, etc.). At or near the proposed structure(s) a minimum of 2 percent positive grade should be maintained.

6 Comments on Construction

The following comments on specific construction aspects of the project are provided for the guidance of designers. The contractor undertaking the work should make their own interpretation of the factual information provided in this report as it affects their construction procedures and scheduling.

Portions of the in-situ soils are subject to loosening and softening in the presence of water. Construction methods and scheduling should reflect this. If construction takes place in the winter months care must be taken not to allow freezing of subsoil. Any fill or native soil that freezes must be sub excavated and replaced.

In periods of inclement weather or during extended work delays, foundation excavations within the site native soils should be protected by a granular pad (NSTIR Type 1 Gravel or equivalent), or working mat of lean concrete placed over the bearing soil immediately following excavation and preparation of the foundation contact area. It may be also necessary to insulate the founding strata during periods of sub-zero temperatures.

Geotechnical inspection and testing by qualified personnel is recommended during earthworks construction.

7 Closure

The geotechnical investigation 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.

LEGEND

- Approximate Test Pit Location
- Approximate Borehole Location

Client

Public Services & Procurement Canada

Projet

Geotechnical Investigation
Proposed MCI Heavy Equipment Building
Bedford Institute of Oceanography
Dartmouth, Nova Scotia

Titre

Test Location Plan

Englobe

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Discipline: Geotechnical	Prepared by: RH / Verified by: -
Scale: No Scale	Drawn by: JJ / Approved by: -
Date: October 2020	Figure No: 1
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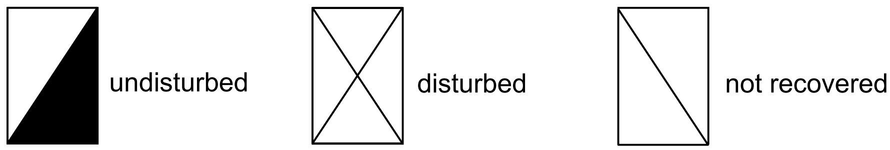
Appendix A Terms and Symbols

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 appropiate)
pp	Pocket pentrometer 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 (undistrubed-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

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 or 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	$Cu = \frac{D_{60}}{D_{10}} > 4$ $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1$ to 3	
			GP		RED	POORLY-GRADED GRAVELS, AND GRAVEL-SAND MIXTURES, <5% FINES	NOT MEETING ALL ABOVE REQUIRMENTS	
		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	$Cu = \frac{D_{60}}{D_{10}} > 6$ $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1$ to 3	
			SP		RED	POORLY-GRADED SANDS, OR GRAVELLY SANDS, <5% FINES	NOT MEETING ALL ABOVE REQUIRMENTS	
		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; NEGLIGIBLE ORGANIC CONTENT		ML		GREEN	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	$W_L < 50$	
			MH		BLUE	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS	$W_L > 50$	
	CLAYS ABOVE "A" LINE ON PLASTICITY CHART; NEGLIGIBLE 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	$W_L > 30, < 50$	SEE CHART BELOW
			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

1. All sieve sizes mentioned on this chart are U.S. Standard, ASTM E11.

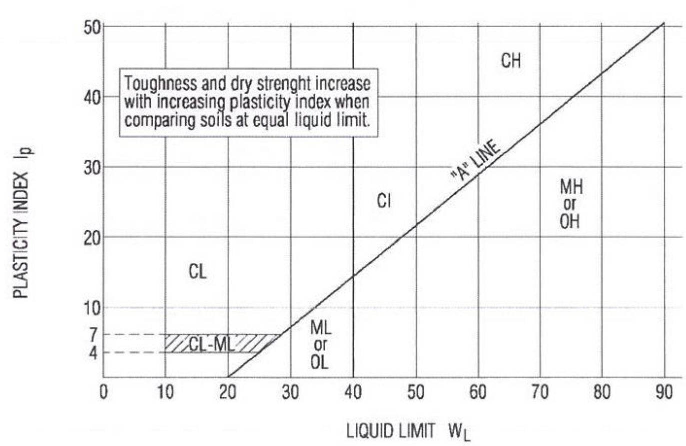
2. Boundary classifications possessing characteristics of two groups are given combined group symbols eg GW-GC is a well-graded gravel-sand mixture wtih clay binder between 5% and 12%.

3. 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.

4. 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



Appendix B Borehole and Test Pit Logs

BOREHOLE LOG

Englobe

PROJECT
MCI Heavy Equipment Building
BIO, Dartmouth, Nova Scotia

LOGGED/DWN. NMD	CKD. RH	DATE OF INVEST. 20-10-16	JOB NO. 2004260.000	HOLE NO. BH 1

CASING RESISTANCE ▲ blows/300mm

WC % wp- w- ● wl- △ (10, 20, 30, 40, 50)

DEPTH (ft, m) | ELEVATION | SOIL SYMBOL

SOIL DESCRIPTION — DATUM: Existing Ground Surface — SURFACE ELEVATION

SOIL SAMPLE: COND. | TYPE | N-VALUE RQD/ RECOVERY

DRILL TYPE: Excavator

OTHER TESTS

Depth	Soil Description	Type	N-Value / RQD / Recovery
0 ft	Asphalt		
	FILL : sand and gravel, trace silt, compact, moist, grey.		
2 ft		SS	N=69
2 ft	FILL: gravelly silty sand, occasional to some cobbles and boulders, compact, moist, grey to brown.		
3 ft		SS	90/100
4.5 ft		SS	50/125
7 ft		SS	N=45
8.5 ft		SS	50/75
11 ft		SS	N=24
14.5 ft	TILL: silty sand, some gravel, occasional to some cobbles and boulders, trace clay, compact, moist, light brown to greyish brown.		
16 ft		SS	N=26
18.5 ft		SS	50/25
20 ft		SS	158/225

Depth scale: ft 1–20; m 1–6

BOREHOLE LOG

PROJECT
MCI Heavy Equipment Building
BIO, Dartmouth, Nova Scotia

LOGGED/DWN. NMD	CKD. RH	DATE OF INVEST. 20-10-16	JOB NO. 2004260.000	HOLE NO. BH 1

CASING RESISTANCE ▲ blows/300mm; WC % wp- w- ● wl- △ (10 20 30 40 50)	DEPTH ft	DEPTH m	ELEVATION	SOIL SYMBOL	SOIL DESCRIPTION (DATUM Existing Ground Surface; SURFACE ELEVATION)	COND.	TYPE	N-VALUE RQD/ RECOVERY	DRILL TYPE: Excavator; OTHER TESTS
					INFERRED BEDROCK				
	22				End of Borehole at 6.3 metres on inferred bedrock or large boulder. Bedrock inferred by split spoon refusal.				
	23	7							
	24				Groundwater depth not determined due to water injection for coring process.				
	25								
	26	8							
	27								
	28								
	29	9							
	30								
	31								
	32								
	33	10							
	34								
	35								
	36	11							
	37								
	38								
	39	12							
	40								
	41								

BOREHOLE LOG

PROJECT
MCI Heavy Equipment Building
BIO, Dartmouth, Nova Scotia

LOGGED/DWN. NMD	CKD. RH	DATE OF INVEST. 20-10-16	JOB NO. 2004260.000	HOLE NO. BH 2

CASING RESISTANCE ▲ blows/300mm
WC % wp- w- ● wl- △ (10, 20, 30, 40, 50)

DATUM: Existing Ground Surface
SURFACE ELEVATION:
DRILL TYPE: Excavator

DEPTH (ft)	SOIL DESCRIPTION	SOIL SAMPLE TYPE	N-VALUE RQD/ RECOVERY	OTHER TESTS
0	Asphalt			
0–1.2	FILL : sand and gravel, trace silt, compact, moist, grey.	SS	50/75	
1.2–6	FILL: gravelly silty sand, occasional to some cobbles and boulders, compact, moist, grey to brown.	SS	50/125	
		SS	50/125	
6–11.2	TILL: silty sand, some gravel, occasional to some cobbles and boulders, trace clay, compact to very dense, moist, grey to brown.	SS	N=102	
		SS	50/25	
		SS	50/50	
11.2	INFERRED BEDROCK			

End of Borehole at 3.4 metres on inferred bedrock or large boulder. Bedrock inferred by split spoon refusal.

Groundwater depth not determined due to water injection for coring process.

Depth scale: ft 1–20; m 1–6

Englobe

TEST PIT LOG

PROJECT
MCI Heavy Equipment Building
BIO, Dartmouth, Nova Scotia

LOGGED/DWN. NMD	CKD. RH	DATE OF INVEST. 20-10-16	JOB NO. 2004260.000	TEST PIT TP 1

WC % wp- w- wl- (10 20 30 40 50)	DEPTH (ft / m)	ELEVATION	SOIL SYMBOL	SOIL DESCRIPTION (DATUM Existing Ground Surface; SURFACE ELEVATION)	SOIL SAMPLE: COND.	TYPE	POCKET PENE.	BACKHOE TYPE: Excavator / OTHER TESTS
	0–0.5 ft			FILL : sand and gravel, trace silt, compact, moist, grey.				
	0.5–3 ft			FILL : sandy gravel, some silt, some cobbles, compact, moist, grey.				
	3–11.5 ft			FILL: gravelly silty sand, trace organics (roots, grubbings), occasional to some cobbles and boulders, loose, moist, grey to black.				
	11.5–13 ft			TILL: silty sand, some gravel, trace clay, compact, moist, light brown to greyish brown.				
	13 ft (4.0 m)			INFERRED BEDROCK				
				End of Test Pit at 4.0 metres on inferred bedrock or large boulder. Bedrock inferred by excavator bucket refusal.				
				Test Pit dry upon completion.				

Depth scale: ft 1–20; m 1–6

TEST PIT LOG

PROJECT
MCI Heavy Equipment Building
BIO, Dartmouth, Nova Scotia

LOGGED/DWN. NMD	CKD. RH	DATE OF INVEST. 20-10-16	JOB NO. 2004260.000	TEST PIT TP 2

BACKHOE TYPE: Excavator

DATUM: Existing Ground Surface

SURFACE ELEVATION

WC % wp- ⅄ w- ● wl- △ (10 20 30 40 50)	DEPTH ft	DEPTH m	ELEVATION	SOIL SYMBOL	SOIL DESCRIPTION	COND.	TYPE	POCKET PENE.	OTHER TESTS
	0	0			FILL : sand and gravel, trace silt, compact, moist, grey.				
					FILL: gravelly silty sand, occasional to some cobbles and boulders, loose, moist, grey to brownish grey.				
	8				TILL: gravelly silty sand, occasional to some cobbles and boulders, trace clay, compact, moist, greyish brown.				
	11				INFERRED BEDROCK End of Test Pit at 3.4 metres on inferred bedrock or large boulder. Bedrock inferred by excavator bucket refusal. Test Pit dry upon completion.				

Depth scale: ft 1–20; m 1–6

TEST PIT LOG

PROJECT
MCI Heavy Equipment Building
BIO, Dartmouth, Nova Scotia

LOGGED/DWN. NMD	CKD. RH	DATE OF INVEST. 20-10-16	JOB NO. 2004260.000	TEST PIT TP 3

BACKHOE TYPE: Excavator

OTHER TESTS

DATUM: Existing Ground Surface

SURFACE ELEVATION

WC % wp- ⅄ w- ● wl- △
10 20 30 40 50

DEPTH (ft)	DEPTH (m)	ELEVATION	SOIL SYMBOL	SOIL DESCRIPTION	COND.	TYPE	POCKET PENE.
0–1			▩	FILL : sand and gravel, trace silt, compact, moist, grey.			
1–6			▩	FILL: gravelly silty sand, occasional to some cobbles and boulders, loose, moist, grey to brownish grey. - 600 mm thick concrete block			
6–9	2		▨	TILL: gravelly silty sand, occasional to some cobbles and boulders, trace clay, compact, moist, greyish brown.			
9				INFERRED BEDROCK End of Test Pit at 2.7 metres on inferred bedrock or large boulder. Bedrock inferred by excavator bucket refusal. Test Pit dry upon completion.			

Depth scale: ft 1–20; m 1–6