FINAL

Public Works and Procurement Canada

Geotechnical Investigation in Support of the Mechanical Upgrade Project

Canadian Coast Guard College (CCGC), Sydney, Nova Scotia

Prepared by:

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Date: June, 2018

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Ms. Bernadette Landry, P.Eng.
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June 29, 2018

Project #
60563670

Dear Ms. Landry:

Subject: Geotechnical Investigation in Support of the Mechanical Upgrade Project
Canadian Coast Guard College (CCGC), Sydney, Nova Scotia

AECOM Canada Ltd. (AECOM) is pleased to submit this final report to Public Services and Procurement Canada (PSPC) providing the findings and recommendations of the geotechnical investigation in support of the mechanical upgrade project for the Canadian Coast Guard College (CCGC) located 1190 Westmount Rd, Sydney, Nova Scotia.

Should you have any questions, please do not hesitate to contact the undersigned.

Sincerely,
AECOM Canada Ltd.

Rob McCullough

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DM:mm
Encl.

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AECOM: 2015-04-13

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Executive Summary

This report provides the results of a geotechnical investigation in support of the proposed building addition of the DFO Office / Cabot Building, and a proposed seawater pump house for the Canadian Coast Guard College Campus, located at 1190 Westmont Road, Sydney, Nova Scotia. The mechanical upgrades addressed in this report include the construction of the piping trenches, approximately 170 m long, connecting the pump house to the Cabot Building.

Field work was performed on February 6th, February 8th, and February 9th, 2018. The sub-surface investigation consisted of drilling and sampling two (2) boreholes, to depths of 7.5 m and 8.4 m below the existing ground surface (m bgs), as well as excavating and sampling thirteen (13) test pits to depths between 2.6 m and 4.8 m bgs.

The borehole drilling was completed using a truck mounted B-17 drill rig, supplied and operated by Nova Drilling Inc. The test pit excavation was completed using a CAT 320E excavator supplied and operated by B. Curry and Sons Construction Ltd. Subsurface utilities were located and cleared by the public utility owners, and Allnorth Consultants Ltd., retained by AECOM. The boreholes were advanced from the existing ground surface using 116 mm outside diameter, continuous flight, solid-stem augers. The test pits were advanced from existing ground surface using CAT 320E excavator bucket. Borehole and test pit details are summarized below in Table 1.

Table 1: Borehole and Test Pit Summary

ID	Date of Completion	Contractor	Depth (m)
BH-1	02/06/2018	Nova Drilling	8.4
BH-2	02/06/2018	Nova Drilling	7.5
TP-1	02/08/2018	B. Curry & Sons Construction	3.6
TP-2	02/08/2018	B. Curry & Sons Construction	2.6
TP-3	02/08/2018	B. Curry & Sons Construction	3.5
TP-4	02/08/2018	B. Curry & Sons Construction	3.0
TP-5	02/08/2018	B. Curry & Sons Construction	3.0
TP-6	02/09/2018	B. Curry & Sons Construction	3.0
TP-7	02/09/2018	B. Curry & Sons Construction	4.6
TP-8	02/09/2018	B. Curry & Sons Construction	4.0
TP-9	02/09/2018	B. Curry & Sons Construction	4.5
TP-10	02/09/2018	B. Curry & Sons Construction	4.8
TP-11	02/09/2018	B. Curry & Sons Construction	4.7
TP-12	02/08/2018	B. Curry & Sons Construction	3.2
TP-13	02/09/2018	B. Curry & Sons Construction	2.5

Soil samples were reviewed by a qualified engineer at AECOM's office in Sydney, NS. All samples were submitted for moisture content analysis and select samples were submitted for particle size analysis, and Atterberg limits testing.

In general, the subsurface conditions encountered at the proposed pump house location consisted of granular fill, underlain by silty sand till underlain by, underlain by clayey silt till.

Monitoring wells were not installed during the investigation. Groundwater conditions were observed in the open boreholes during and upon completion of drilling. These are summarized below and presented on the borehole logs (Appendix B). Free groundwater was observed in both boreholes, BH-1 and BH-2, at depths of 3.2 m and 2.2 m bgs, respectively.

The subsurface conditions encountered along the proposed pipe alignment consisted of topsoil, underlain by sandy silt to silty sand fill, underlain by silty sand till, underlain by clayey to sandy silt till. Cobbles and boulders were encountered in both till layers.

Groundwater conditions were observed in the open test pits during and upon completion of excavation. These are summarized in below sections of report and presented on the borehole logs (Appendix B). Along the piping alignment, groundwater was observed on the sides of six (6) test pits, TP-6, TP-7, TP-8, TP-9, TP-10, and TP-11.

The subsurface conditions encountered at the proposed Cabot Building addition consisted of topsoil, or fill, underlain by sandy silt, underlain by clayey to sandy silt.

Free groundwater was not observed during and upon completion of excavation for the proposed Cabot Building.

Excavator refusal was encountered within test pits TP-1, TP-2, TP-3, and TP-8 at depths of 3.6 m, 2.6 m, 3.0 m, and 4.0 m bgs, respectively. Refusal of the excavator can be an indication of bedrock or a dense cobbley layer. Cobbles were encountered within all test pit locations.

A total of four (4) recovered soil samples were tested for grain size distribution analyses (sieve, sieve and hydrometer), and six (6) atterberg limit tests were performed on selected soil samples.

In conclusion, shallow footings can be used to support both, seawater pump house and Cabot building addition. The footings should bear on native silty sand glacial till below the frost penetration depth of 1.2 m bgs.

The recommended factored geotechnical resistance at Ultimate Limit State (ULS) and the geotechnical reaction at Serviceability Limit State (SLS) for the seawater pump house and Cabot building are summarized below. Details such as founding depth, footing type and size are provided in Section 3.1 of the report

- Factored geotechnical resistance at Ultimate States (ULS):.....350 kPa
- Geotechnical resistance at Serviceability Limit States (SLS):.....250 kPa

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Appendix C. Soil Laboratory Testing Results
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1. Introduction

AECOM Canada Ltd. (AECOM) was retained by Public Services and Procurement Canada (PSPC) to carry out a geotechnical investigation in support of the Canadian Coast Guard College (CCGC) Mechanical Upgrade Project. The mechanical upgrades addressed in this report include:

1. Seawater Pump House and Piping to Cabot Building;
2. Simulator – Building Addition at the DFO Office/Cabot Building; and
3. Associated piping, approximately 170 m long, between the pump house and Cabot Building.

The purpose of the investigation was to obtain information about the subsurface conditions at the site by means of advancing boreholes and test pits, and to assess the geotechnical engineering characteristics of the subsurface soils by means of field and laboratory tests.

1.1 Site Description

The site is located at 1190 Westmont Road in Sydney, Nova Scotia. The existing facilities include residences, a sports complex, a waterfront training facility, and indoor marine simulators. The site is generally surrounded by commercial, residential, and industrial properties. The north, northeast and northwest ends of the site are surrounded by Crawleys Creek, which stems from Sydney Harbour and the Spanish Florence Bay. The topography where the residences are located is generally flat, becoming moderately steep near banks of the creek. The ground surface drops approximately 6.5 m from the Cabot Building to the seawater pump house along a distance of 280 m.

1.2 Scope of Work

The scope of work for this project included the following services:

- Prepare a geotechnical investigation plan, including borehole locations;
- Arrange for public and private underground utilities clearances;
- Arrange a drilling sub-contractor to advance two (2) boreholes and thirteen (13) test pits;
- Monitor the drilling and test pit excavation operations;
- Collect soil samples from the boreholes at regular intervals and perform Standard Penetration Tests (SPTs);
- Collect bulk soil samples from the test pits;
- Observe groundwater conditions in the open boreholes and test pits; and,
- Conduct geotechnical laboratory testing including moisture content on all retrieved samples, particle size distribution tests (sieve, and sieve and hydrometer analyses) and Atterberg Limits tests on selected soil samples.

This geotechnical engineering report presents the findings of the investigation and provides geotechnical recommendations related to the following:

- Soil types and stratigraphy as encountered at the borehole locations;
- Groundwater levels at the borehole locations during and upon completion of drilling;

- Shallow groundwater conditions as observed in test pits;
- Suitable foundation options and recommendations for geotechnical resistances at Serviceability Limit State (SLS) and Ultimate Limit State (ULS) for the pump house and building foundations; and
- Recommendations on the trench excavation slopes, backfill requirements and dewatering.

The Site Plan and Borehole Location Plan are presented in Appendix A. Borehole and Test Pit logs are included in Appendix B, and the results of the laboratory testing (Grain Size Distribution curves, and Atterberg Limits and Corrosivity testing results) are presented in Appendix C.

2. Geotechnical Investigation

2.1 Subsurface Plan and Investigation

The locations of the boreholes and test pits were established in the field by AECOM personnel in accordance with the project requirements. The initial scope of work was to include two (2) boreholes and nine (9) test pits, and this was expanded to two (2) boreholes and thirteen (13) test pits at PSPC's request, see Appendix A. Subsurface utilities were located and cleared by the public utility owners, and Allnorth Consultants Ltd., retained by AECOM. AECOM supervised the hydrovacuum-excavation of utilities in the general area of proposed test pit and borehole locations, and this work was performed and backfilled on January 26, 2018.

The sub-surface investigation was performed on February 6th, February 8th, and February 9th, 2018. The sub-surface investigation consisted of drilling and sampling two (2) boreholes, to depths of 7.5 m and 8.4 m below ground surface (bgs), as well as excavating and sampling thirteen (13) test pits to depths ranging between 2.6 m and 4.8 m bgs.

The borehole drilling was completed using a truck mounted B-17 drill rig, supplied and operated by Nova Drilling Inc. The test pit excavation was completed using a CAT 320E excavator supplied and operated by B. Curry and Sons Construction Ltd. The boreholes were advanced from the existing ground surface using 116 mm outside diameter, continuous flight, solid-stem augers. The test pits were advanced from existing ground surface using a CAT 320E excavator bucket.

Standard Penetration Tests (SPTs) were carried out at regular intervals to assess the soil strength and to obtain soil samples. SPTs were carried out in general accordance with ASTM D1586. The test consists of freely dropping a 63.6 kg hammer over a vertical distance of 760 mm to drive a 51 mm outside diameter (O.D) split spoon sampler into the ground. The number of blows of the hammer required to drive the sampler into the relatively undisturbed ground over a vertical distance of 300 mm was recorded as the Standard Penetration Resistance or the N-value of the soil, which is indicative of the compactness of cohesionless soils (gravels, sands, silts) or the consistency of cohesive soils (clays and clayey soils).

Borehole and test pit details are summarized below in Table 2.

Table 2: Borehole and Test Pit Summary

ID	Date of Completion	Contractor	Depth (m) bgs
BH-1	02/06/2018	Nova Drilling	8.4
BH-2	02/06/2018	Nova Drilling	7.5
TP-1	02/08/2018	B. Curry & Sons Construction	3.6
TP-2	02/08/2018	B. Curry & Sons Construction	2.6
TP-3	02/08/2018	B. Curry & Sons Construction	3.5
TP-4	02/08/2018	B. Curry & Sons Construction	3.0
TP-5	02/08/2018	B. Curry & Sons Construction	3.0
TP-6	02/09/2018	B. Curry & Sons Construction	3.0
TP-7	02/09/2018	B. Curry & Sons Construction	4.6
TP-8	02/09/2018	B. Curry & Sons Construction	4.0
TP-9	02/09/2018	B. Curry & Sons Construction	4.5
TP-10	02/09/2018	B. Curry & Sons Construction	4.8
TP-11	02/09/2018	B. Curry & Sons Construction	4.7
TP-12	02/08/2018	B. Curry & Sons Construction	3.2
TP-13	02/09/2018	B. Curry & Sons Construction	2.5

Soil samples were reviewed by a qualified engineer at AECOM's office in Sydney, NS. Selected samples were submitted for moisture content analysis, particle size analysis, and Atterberg Limits testing.

No monitoring wells were installed as part of this investigation.

2.2 Subsurface Conditions

Subsurface conditions are described below and generally consisted of topsoil, underlain by silty sand till, underlain by clayey silty sand till and sedimentary bedrock (sandstone). Cobbles and boulders were encountered within the glacial till layers.

2.2.1 Geological Review

The study area is located entirely within the Sydney Basin physiographic region (Boehner and Giles, 2008), and is located on the boundary of the Sydney Coalfield comprising rocks of the Morien Group of Westphalian C to D age (Calder, 1985).The Sydney Basin is a structural basin defined by a succession of carboniferous rocks. Coarse pebble conglomerate, sandstone and minor siltstone comprise the lower part with a major section of coal bearing strata including sandstone, siltstone. The onshore section of the basin has a projected maximum thickness of 3500 m of carboniferous sedimentary rocks.

The study area is located within an anticline bounded by the Sydney Harbour Syncline and the Dutch Brook Syncline which both trend northeast / southwest, to the northwest and southeast of the study area, respectively.

The George River Fault, and Coxheath Fault, which both trend northeast / southwest, are approximately 11.5 km northwest and southeast of the study area, respectively.

Geological mapping of the study area indicates the native overburden soils typically consists of a stony till plain, known as Richmond Till, deposited during the most recent Wisconsinan glaciation (Nova Scotia Department of Natural Resources, 1992). The till has been described as having a stony and sandy matrix with material derived from local bedrock sources. Siltier till material incorporated from older glaciation periods may also be found within the unit.

2.2.2 Seawater Pump House

The detail subsurface conditions described below are based on information found in the Borehole Logs, see Appendix B.

2.2.2.1 Fill

A surficial sand fill layer, containing gravel, was encountered in boreholes BH-1 and BH-2 extending to 1.75 m and 0.08 m bgs, respectively. SPT's yielded N-values of 2 to 8 blows/0.3 m, which indicates a loose state of compactness. The surficial sand layer encountered is possibly the material used to backfill hydro-excavation holes.

Underlying the possible backfill material were sand and sandy silt fill materials in boreholes BH-1 and BH-2, respectively.

The sand fill in BH-1 ranged in depth from 1.75 m to 2.29 m bgs and contained trace silt. The single SPT N value obtained for the sand fill was 23, indicating a compact condition.

The sandy silt fill encountered in BH-2 contained trace amounts of rootlets and gravel and extended to a depth of 0.76 m bgs. SPT N value obtained for the sand fill was 5, indicating a loose state of compactness.

The natural moisture content for the fill samples varied from 11% to 16%.

2.2.2.2 Silty Sand Till

A layer of silty sand till that extended to 6.10 m bgs was encountered below fill materials in boreholes BH-1 and BH-2. The till contained some gravel, trace to some clay in a silty sand matrix and was reddish brown. While drilling within the layer, auger grinding was noted between 3.0 m and 6.1 m, which could be an indication of the presence of cobbles or boulders.

Majority of SPT N values ranged from 15 to 47, indicating a compact to dense state of compactness, but the lowest N value was 8, in BH-2 at 0.76 m bgs. The moisture content of samples obtained within the sandy silt till varied from 7% to 19%.

A grain size analysis was conducted on one (1) representative sample, and the results are presented on the borehole logs in Appendix B, and are summarized as follows:

Gravel:..... 15%
Sand: 42%
Silt: 30%
Clay sized particles: 13%

Based on the gradation analysis, the till is classified as silty sand, with some clay, and some gravel.

Atterberg Limits test were conducted on two (2) representative samples, and the results are presented on the borehole logs in Appendix B, and are summarized as follows:

Liquid Limit: 20%
Plastic Limit:..... 15% – 16%
Plasticity Index:..... 4 – 5
Natural Moisture Content..... 7% – 19%

2.2.2.3 Clayey Silt Till

In boreholes BH-1 and BH-2 a clayey silt till was encountered from 6.1 m bgs to borehole completion depths of 8.41 m and 7.53 m, respectively. The clayey silt till layer contained some sand, trace to some gravel and was found to range in colour from grey to reddish brown.

SPT N values ranged from 35 to greater than 50 blows/0.3 m, indicating a hard state of consistency. The moisture content from a sample of the clayey silt till was 8%.

2.2.3 Pipe Alignment

The detail subsurface conditions described below are based on information found in the Test Pit Logs, see Appendix B.

2.2.3.1 Topsoil / Organics

A surficial layer of topsoil was encountered in all eight (8) test pits along the pipe alignment, TP-6 to TP-13, that were excavated along the piping alignment. The thickness of topsoil ranged from 50 mm to 600 mm and has been summarized in Table 3, below.

Table 3: Summary of Topsoil / Organics Depths

BH ID	Bottom of Organic Layer (mm bgs)
TP-6	100
TP-7	50
TP-8	50
TP-9	300
TP-10	600
TP-11	200
TP-12	100
TP-13	100

2.2.3.2 Fill

Fill varying from sandy silt to sand to gravely sand was encountered in test pits TP-6, TP-7, TP-8, TP-9, TP-10, and TP-13. The depth of fill varied from 0.61 m (TP-6 and TP-7) to 1.89 m (TP-9) bgs. The moisture content of samples obtained from the fill layer varied from 13% to 20%.

2.2.3.3 Silty Sand Till

Underlying the fill materials in all test pits were layers of till (sand, silty sand, sandy silt, and silt containing trace to some gravel and trace to some clay). The clay content of the till was observed to increase with the increasing depth of test pits.

The excavator bucket met refusal in test pits TP-6 and TP-8 at 3.5 m and 3.7 m bgs. Heavy bucket grinding was noted within test pits TP-9 and TP-10 at 3.2 m and 4.5 m bgs. The excavator bucket refusal may be an indication of either inferred bedrock (sandstone) or a dense cobble layer.

The moisture content of the sand and silt till samples varied from 9% to 24%.

Grain size analyses were conducted on two (2) representative samples, and the results are presented on the borehole logs in Appendix B, and are summarized as follows:

Gravel:..... 13 – 14%
Sand: ..... 45% - 52%
Silt: 27%
Clay sized particles: 8%

Based on the gradation analyses, the cohesive glacial till is classified as silty sand, with some gravel and trace clay.

Atterberg Limits tests were conducted on four (4) representative samples of the till, and the results are presented on the borehole logs in Appendix B, and are summarized as follows:

Liquid Limit: ..... 18% - 21%
Plastic Limit:..... 16%
Plasticity Index:..... 2 – 5
Natural Moisture Content.....9% – 24%

Atterberg Limits tests were also conducted on samples selected from TP-7 and TP-10, at depths of 4.6 m and 2.4 bgs, and the test results indicated that the material was non-plastic.

2.2.4 Cabot Building Addition

2.2.4.1 Topsoil / Organics

A surficial layer of topsoil with trace to some organics was encountered in all five (5) test pits in the area of the Cabot building extension, TP-1 to TP-5, and it varied in thickness from 270 mm (TP-1) to 600 mm (TP-3, TP-4 and TP-5). The moisture content of samples obtained from this layer varied from 31% to 32%.

2.2.4.2 Fill

A sand fill layer containing trace gravel, trace silt, and trace organics was encountered in test pits TP-1 and TP-2 to depths of 1.0 m and 1.2 m bgs. The moisture content of the fill samples varied from 15% to 25%.

2.2.4.3 Gravely Silty Sand Till

Underlying the fill was a gravely silty sand till to sandy silt till with trace clay in test pits TP-1 to TP-5. The clay content was observed to increase with the increasing depth of the test pits.

The excavator bucket met refusal in test pits TP-1, TP-2, and TP-3 at depths of 3.6 m, 2.6 m, and 3.5 m bgs, respectively. The excavator bucket refusal may be an indication of either inferred bedrock or a dense cobble layer.

The moisture content of samples obtained from the gravelly silty sand till varied from 3% to 29%.

A grain size analysis was conducted on one (1) representative sample and the results are presented on the borehole logs in Appendix B, and are summarized as follows:

Gravel:..... 37%
Sand:..... 41%
Silt and clay sized particles: 22%

Based on the gradation analysis, the glacial till is classified as gravely sand with trace to some silt and clay.

2.2.5 Groundwater Conditions

Groundwater conditions were observed in the open boreholes during and upon completion of drilling and these are included on the borehole logs in Appendix B. No monitoring wells were installed for this investigation, as this is outside the scope of work presented within the RFP. As noted in Table 4 below, free groundwater was observed in both the boreholes at a depth of 2.2 m and 3.2 m bgs.

Table 4: Summary of Groundwater Conditions at the Completion of Drilling

BH ID	Date of Completion	Borehole Depth (m*)	Depth of Groundwater** (m*)
BH-1	02/06/2018	7.5	2.2
BH-2	02/06/2018	8.4	3.2

Notes: * *Refers to m below the existing ground surface.*
** *Un-stabilized groundwater levels.*

Groundwater was observed in seven (7) open test pits upon completion of excavation, and the details are included on the test pit logs in Appendix B. The depth at which groundwater was observed is summarized in Table 5, below.

Table 5: Summary of Groundwater Conditions at the Completion of Excavation

TP ID	Date of Completion	Test Pit Depth (m*)	Depth of Groundwater** (m*)
TP-1	02/08/2018	3.6	DRY
TP-2	02/08/2018	2.6	DRY
TP-3	02/08/2018	3.5	0.8
TP-4	02/08/2018	3.0	DRY
TP-5	02/08/2018	3.0	DRY
TP-6	02/09/2018	3.5	1.4
TP-7	02/09/2018	4.6	1.2
TP-8	02/09/2018	4.0	1.0
TP-9	02/09/2018	4.5	0.3
TP-10	02/09/2018	4.8	0.3
TP-11	02/09/2018	4.7	1.1
TP-12	02/08/2018	3.2	DRY
TP-13	02/09/2018	2.5	DRY

Notes: * *Refers to m below the existing ground surface.*
** *Un-stabilized groundwater levels.*

3. Engineering Recommendations

During the preparation of this report, the following drawings were provided to AECOM by PSPC:

- Drawing No. 5 of 7 “Topographic Plan” dated May 12, 2017, produced by Public Works and Government Services Canada
- Drawing No. C-100 “Proposed Seawater Heat Pump Pipe Routing and Building Location” dated 08/15/16, issued for 66% review, produced by M & R Engineering

3.1 Foundation Recommendations

It is understood that the proposed development will consist of (i) a single storey seawater pump house, and (ii) a single story simulator addition at the Cabot Building, with no basements.

Based on the sub-surface conditions, shallow footings are considered to be the most suitable foundation system for supporting the loads of the proposed structures.

3.1.1 Seawater Pump House

Shallow footings can be used to support the Seawater Pump House structure. The footings should be founded on the native silty sand glacial till below the frost penetration depth of 1.2 m bgs.

The proposed structure may be founded on spread footings. The recommended factored geotechnical resistance at Ultimate Limit State (ULS) and the geotechnical reaction at Serviceability Limit State (SLS) are given in the Table 6 below.

Table 6: Geotechnical Resistance – Spread Footings

Footing Type	Founding Stratum	Minimum Depth (m bgs)	SLS (kPa)	Factored ULS (kPa)
Strip (0.75 m wide)	Silty Sand Till	2.3	250	350
Square (1.5 m)	Silty Sand Till	2.3	250	360

The geotechnical bearing resistance values above are for vertical loads (no inclination) without load eccentricity. The ULS/SLS values will vary from those displayed above if inclined or eccentric loading conditions are applied. Additional analyses are required for providing ULS/SLS under inclined or eccentric loading conditions.

All loose, disturbed, remoulded or sloughed material should be removed from bearing surfaces of footing excavations. Footing surfaces should be shovel-cleaned to remove all disturbed, loose or wet material. The minimum width of footing that can be used should conform to specifications in the appropriate building code.

Footings should be founded on undisturbed, native, inorganic soil as described in the text of this report. It should be noted that weak or soft foundation soils may exist at the site which were not encountered in the test borings. Over-excavation below footing levels may be required to ensure that footings are founded on competent bearing strata. Any over excavated materials must be replaced by engineered fill, compacted in place, as directed by the site engineer. All footing excavations should be inspected by a qualified geotechnical engineer prior to forming and concreting.

Footing excavations should be protected from rain, snow, drying and ingress of free water at all times. Prolonged exposure of the foundation excavations should be avoided. Foundation soils beneath the footings must be protected from frost action during and after construction. Adequate soil cover should be provided to all footings.

Backfill against foundation walls and around grade beams should not be placed until the concrete foundation elements have developed sufficient strength and are laterally supported to resist earth pressures resulting from fill placement and compaction. The use of heavy equipment for compaction should be avoided. Backfill should be compacted in layers not exceeding 150 mm (6.0 inches) in compacted thickness, and should be compacted to a uniform dry density of at least 95% standard. The backfill material should be capped with a minimum 0.60 metres (2.0 feet) compacted thickness of selected fine grained soils to provide a relatively impermeable layer which will minimize surface water infiltration. The final site grading should also direct surface water to areas away from the proposed structure.

3.1.2 Cabot Building Addition

3.1.2.1 Shallow Footings

Shallow footings can be used to support the proposed structure. The footings should be founded on the native silty sand glacial till below the frost penetration depth of 1.2 m bgs.

The proposed structure may be founded on spread footings. The recommended factored geotechnical resistance at Ultimate Limit State (ULS) and the geotechnical reaction at Serviceability Limit State (SLS) are given in the Table 7 below.

Table 7: Geotechnical Resistance - Spread Footings

Footing Type	Founding Stratum	Minimum Depth (m bgs)	SLS (kPa)	Factored ULS (kPa)
Square (1.5 m)	Silty Sand Till	1.2	250	350

The additional recommendations for footing construction, as presented in Section 3.1.1, also apply for the Cabot Building addition.

3.1.3 Settlement Evaluation

The recommended design parameters presented in this section are for preliminary design purposes and compliance with the recommendations would produce tolerable settlement under normal structures.

It should be noted, however, that foundation settlements are a function of the foundation layout and the construction procedure. We recommend that AECOM should review the final design of the foundation system prior to construction.

3.2 Utility Trench Recommendations

The subsurface investigation indicated that the encountered silty sand till would be adequate to support the proposed utilities between the seawater pump house and the Cabot Building.

The excavation of the trench should be carried out in accordance with latest version of applicable Nova Scotia Provincial Standard Specifications.

3.2.1 Trench Backfilling

The trench should be backfilled with granular materials in accordance with latest version of applicable Provincial Standards. It is recommended that the backfill against the pipe walls comprise free draining granular material such as imported Type 1 Gravel.

With the approval of the geotechnical engineer at site, the excavated native material may be used as fill on the condition that it is free of any organics (such as topsoil, roots, peats, etc.) or other debris and inspected by a qualified engineer. Due to the nature of glacial tills, allowances should be made for the presence of cobbles and boulders in the sandy silt till.

Backfill should be placed in thin loose lifts not exceeding 200 mm and compacted to 95% standard Proctor maximum dry density. Over-compaction should be avoided since this may cause excessive lateral earth pressure against the structure walls. The backfill should be brought up evenly on both sides of the pipe to prevent unbalanced loads. It is recommended that the backfilling operation be reviewed by the site engineer in order to approve the backfill materials and degree of compaction

3.2.2 Backfilling Ditch Area

Following the backfilling of the trench, the ditch area should be backfilled with granular material or approved on-site/imported soil to the design level.

The following backfilling procedure is recommended:

a) After placing and compacting the trench backfill in accordance with the applicable Provincial Standards, the entire area should be inspected and approved by the geotechnical engineer. Spongy, wet or soft/loose spots should be sub-excavated to expose stable subgrade and these areas would be replaced with compactable approved soil, compatible with the subgrade conditions, as directed by the site engineer. Where required, the engineered fill should be benched into the native soils (as per applicable Provincial Standards).

b) The fill material must be a uniform, homogeneous material, and should be placed in thin layers not exceeding 200 mm loose thickness. Oversize particles (cobbles and boulders) larger than 120 mm should be removed. The material for backfilling the excavation and raising the grades should consist of select granular fill, or approved equivalent. For engineered fill below the structure foundations, each fill layer should be uniformly compacted with heavy compactors, suitable for the type of fill used, to at least 98% of its Standard Proctor Maximum Dry Density.

c) Full-time inspection and quality control by means of frequent field density and laboratory testing are necessary during the construction. The compaction procedure and efficiency should be approved by the site engineer.

d) The engineered fill should not be frozen, and the material should be placed at water contents within 2 % of the optimum value for compaction. The engineered fill should not be placed during winter months when freezing ambient temperatures occur persistently or intermittently.

3.3 Grade Supported Floor Slabs

Floor slabs supported on grade must be designed for the intended loads, including those resulting from materials storage and the operation of machinery. Any soft, organic and fill materials, as determined from inspection and proof-rolling, must be over-excavated and replaced by compacted engineered fill, as directed by the engineer.

Floor slabs should be supported on a well-compacted granular base to ensure uniform distribution of floor loadings over the subgrade. The required thickness of this base course is dependent upon the magnitude of the loadings, but should not be less than 100 mm (4.0 inches). The base course, and any other fill material used to replace soft subsoils, should be compacted to at least 98% of Standard Proctor maximum dry density.

It is recommended that the floor slabs should contain an adequate number of construction joints to ensure controlled cracking of concrete. Slabs supporting dynamic loadings, such as those resulting from the operation of machinery, should be specially designed.

3.4 Drainage

Final site grading should direct surface runoff away from the proposed structure to prevent surface water infiltration. The backfill around the building should be compacted to a minimum 95% of Standard Proctor maximum density and be graded with a positive slope away from the building to prevent surface ponding of water after settlement.

In view of the site conditions, a weeping tile drainage system connected to a positive drainage should be installed around the building foundations to enhance the drainage of subsurface water.

3.5 Frost Heave

The depth of frost penetration at the site is 1.2 m (Frost Design Practice in Canada, M. Amerstong, T. Csathy). The native sandy silt till within this depth is expected to be moderately susceptible to frost heaving.

3.6 Subgrade Protection

Subgrade soils beneath foundation elements must be protected from frost penetration during and after construction. Detrimental heaving may result due to soil freezing and/or settlement resulting from subsequent thawing of frozen soils. It is essential to ensure that footings and floor slabs are not poured on frozen subsoils, and that the foundation soils are protected from frost action at all times.

Similarly, all foundation excavations must be protected from rain, snow and the ingress of free water. Surface ponding should not be allowed on any excavated surfaces. Unnecessary prolonged exposure of bearing surfaces should be avoided, to limit effects of weathering and deterioration of the integrity of the subgrade soils

3.7 Temporary Excavation Side Slopes

Temporary excavations at the site should be sloped or shored for worker and foundation protection. Construction must conform to good practice and comply with regulations such as the Nova Scotia Occupational Health and Safety Regulations. For temporary excavations in the natural soil existing at the site, a construction side slope of 1.0 V: 1.5 H (1.0 Vertical to 1.5 Horizontal) may be used up to footing depth on the site.

Any construction side slope differing from the suggested one should be verified and approved by a qualified engineer.

Excavations must be protected from rain, snow and the ingress of free water. Prolonged exposure of excavated areas should be avoided to prevent deterioration of exposed soils with resultant slope instability. Similarly, excavated materials should be stockpiled away from the slope to avoid slope instability and to prevent materials falling into the excavation. The integrity of any adjacent structures should be protected by either underpinning or installing shoring prior to the excavation of the subject site.

3.8 Seismic Classification

A Site Classification 'D' should be used for earthquake load and effects in accordance with Table 4.1.8.4.A of the National Building Code of Canada, 2005.

3.9 Geo-Environmental Considerations

Based on visual observation during sub-surface exploration, no potential contaminants were observed at the site.

This report does not provide any recommendations with regard to the potential for environmental contamination of the soils at site. Any soil removed from the site should be handled and disposed of in accordance with the local applicable regulations and/or on recommendations provided by a qualified environmental engineer or scientist.

3.10 Soil Corrosivity and Cement Type

Two (2) soil samples were submitted for analysis for corrosivity and sulphate attack potential in the overburden soils. The results are summarized in Table 8, and the detailed results are presented in Appendix D.

Table 8: Summary of Corrosivity Testing Results

Borehole No.	Sample Depth (m)	Sulfide (u/g)	Chloride (mg/kg)	Sulphate (mg/kg)	pH	E.C. (µS/cm)	Resistivity (ohm.cm)	Redox Potential (mV)
BH-2	1.5 - 2.9	< 0.50	35	11	7.48	90	11000	170
TP-3	1.2	0.82	150	< 10	6.28	140	7200	150

Based on the results of the testing, the following conclusions are provided:

- There is minimal potential for sulphate attack on concrete (Sulphates <150 µg/g). Therefore, in accordance with Canadian Standard Association (CSA) document A23.1-14, normal Type 10 Portland Cement may be used.
- As the total points of soils is less than 10 as per AWWA C-105 Standard, no corrosion protective measures is recommended for cast iron alloys, if any, used at the site.

3.11 Dewatering and Excavations

Stockpiles of excavated materials should be kept at least 3.0 m from the edge of any excavation to avoid slope instability, subject to confirmation by the geotechnical engineer. Care should also be taken to avoid overloading of any underground services/structures by stockpiles.

The presence of cobbles and boulders may cause excavation difficulties and allowances should be made accordingly. The terms describing the relative density (loose, compact, dense, and very dense) or consistency (stiff, very stiff, hard) of soil strata give an indication of the effort needed for excavation. The trench side slopes should be regularly inspected for evidence of instability following periods of heavy rainfall, following periods of thawing, or when the trench has been left open for an extended period of time. Appropriate remedial action should be taken to ensure the continued stability of the slopes.

Perched groundwater inflow into the excavation should be expected from the fill and within the native glacial till deposits. Perched groundwater was encountered while excavating test pits TP-3, and TP-11 0.8 m and 1.1 m bgs,

respectively. The flow should be adequately controlled using conventional gravity dewatering techniques with filtered sump/pumps. Performing excavations during dry seasons will minimize pumping requirements.

Excavations for this site are not expected to require shoring. If required, all shoring systems must be designed by a qualified professional engineer, in accordance with the latest version of the Occupational Health and Safety Act for Construction Projects and the latest edition of the Canadian Foundation Engineering Manual. The design should take into consideration the effects of hydrostatic pressure and anticipated surcharge loading including the impact of construction activities.

4. References

Amerstong, M.D. and T.I. Csathy:
"Frost Design Practice in Canada, Ontario Department of Highways"

Boehner, R.C. and P.S. Giles:
"Geology of The Sydney Basin, Cape Breton and Victoria Counties, Cape Breton Island, Nova Scotia, Nova Scotia Department of Natural Resources", 2008.

Calder, J.H., 1985:
"Coal in Nova Scotia, Nova Scotia Dept. of Mines and Energy", 1985 ISBN0-88871-072.

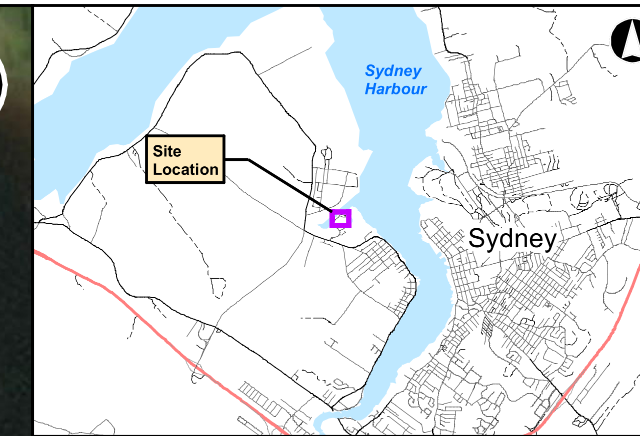
Canadian Geotechnical Society, 2006:
"Canadian Foundation Engineering Manual, 4th Edition"

Nova Scotia Department of Mines and Energy:
"Map 86-1, Sydney Basin", 1986.

Nova Scotia Department of Natural Resources:
"Map 92-3, Surficial Geology of The Province of Nova Scotia", 1992.

Appendix A

Site Location and Borehole Location Plan



Legend

- Approximate Borehole Locations
- Approximate Test Pit Locations
- Local Street
- Resource / Recreation

0 5 10 20 30 40
Metres

CANADIAN COAST GUARD COLLEGE, NOVA SCOTIA

SITE AND BOREHOLE LOCATION PLAN

Mar 08, 2018	1:1,000 * when printed 11"x17"	Datum: NAD 1983 UTM Zone 20N Source: Open Government Licence – Nova Scotia Image: © 2018 Microsoft Corporation © 2018 DigitalGlobe ©CNES (2018) Distribution Airbus DS
P#: 60563670		**Figure 1**

AECOM

Map location: X:\AECOM\60563670\920-929 (GIS-Graphics)\Design\01_Reports\Reporting\60563670_Fig1_SiteLocation.mxd
Date Saved: 3/8/2018 2:03:45 PM User Name: levesquei

AECOM Imagine it. Delivered.

Appendix B

Borehole Logs

PROJECT: Canadian Coast Guard College
LOCATION: 1190 Westmount Rd. Sydney, NS
AECOM PROJECT No.: 60563670
CLIENT: Public Services and Procurement Canada

RECORD OF BOREHOLE: BH-1

START DATE: 02/06/2018
END DATE: 02/06/2018
BORING METHOD: 116 mm Solid Stem Auger
CONTRACTOR: Nova Drilling Inc.
PENETRATION TEST HAMMER, 64kg; DROP, 760mm
SAMPLER HAMMER, 64kg; DROP, 760mm

DEPTH SCALE (METRES)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	N VALUE	ORGANIC VAPOUR CONCENTRATIONS [ppm] (40 80 120 160) / COMBUSTIBLE VAPOUR CONCENTRATIONS [%LEL] (20 40 60 80)	SHEAR STRENGTH Cu, kPa (Field Vane nat. +, Field Vane rem. ⊕, Quick Triaxial ●, Unconfined - △) (20 40 60 80) / WATER CONTENT PERCENT (Wp, w, Wl) (10 20 30 40)	REMARKS & GRAIN SIZE DISTRIBUTION (%)	SPECIFIC GRAVITY	WELL INSTALLATION AND WATER LEVELS
		GROUND SURFACE								GR SA SI CL		
0	Power Auger Drilling 116 mm Solid Stem Auger	**FILL** Gravely Sand, grey, moist, loose		0.00	1	SS	2					
1					2	SS	8					
2		Sand, trace silt, blackish brown, moist, compact		1.75	3	SS	23					
3		**SILTY SAND TILL** some gravel, some clay, reddish brown, moist to wet, compact		2.29	4	SS	18					
4					5	SS	17			*Auger Grinding*		02/06/2018
5		dense		4.57	6	SS	17					
6					7	SS	37			*Wet Spoon Auger Grinding*		
7		**CLAYEY SILT TILL** some sand, trace to some gravel, grey, moist to wet, hard		6.10	8	SS	35					
8					9	SS	65 / 125 mm					
					10	SS	50 / 25 mm			*Auger Grinding*		
9		End of Borehole		8.41								
10		Notes: 1. Free water was observed at 3.2 m below existing ground surface at the completion of drilling. 2. Borehole was open to 4.1 m below existing ground surface at the completion of drilling. 3. Borehole location was daylighted to 1.5 m below existing ground surface and backfilled on 01/26/2018.										
11												

(LOG TO BE READ IN CONJUNCTION WITH REPORT)

DEPTH SCALE
1 : 55

AECOM

LOGGED BY: JL
CHECKED BY: SP

AECOM_BH_002_NO COORDINATES 60563670_CCGC.GPJ GAL-MISS.GDT 6/27/18

PROJECT: Canadian Coast Guard College
LOCATION: 1190 Westmount Rd. Sydney, NS
AECOM PROJECT No.: 60563670
CLIENT: Public Services and Procurement Canada

RECORD OF BOREHOLE: BH-2

START DATE: 02/06/2018
END DATE: 02/06/2018
BORING METHOD: 116 mm Solid Stem Auger
CONTRACTOR: Nova Drilling Inc.

PENETRATION TEST HAMMER, 64kg; DROP, 760mm
SAMPLER HAMMER, 64kg; DROP, 760mm

DEPTH SCALE (METRES)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	N VALUE	ORGANIC VAPOUR CONCENTRATIONS [ppm] (40 80 120 160) / COMBUSTIBLE VAPOUR CONCENTRATIONS [%LEL] (20 40 60 80)	SHEAR STRENGTH Cu, kPa (Field Vane nat. +, Field Vane rem. ⊕, Quick Triaxial ●, Unconfined - △) (20 40 60 80) / WATER CONTENT PERCENT (Wp, w, Wl) (10 20 30 40)	REMARKS & GRAIN SIZE DISTRIBUTION (%)	SPECIFIC GRAVITY	WELL INSTALLATION AND WATER LEVELS
		GROUND SURFACE								GR SA SI CL		
0	Power Auger Drilling; 116 mm Solid Stem Auger	**FILL** Gravely Sand, grey, moist, loose Sandy Silt, trace rootlets, trace gravel, reddish brown, moist, loose		0.08	1	SS	5					
1		**SILTY SAND TILL** some gravel, reddish brown, trace black stains, moist, loose		0.76	2	SS	8					
2		compact to dense		1.52	3	SS	15					
2					4	SS	22					▽ 02/06/2018
3					5	SS	47					
4												
5					6	SS	28			*Wet Spoon* *Auger Grinding* 15 42 30 13		
6		**GRAVELY SAND** reddish brown, wet, dense		6.10	7	SS	49			*Wet Spoon*		
6		**SANDY CLAYEY SILT TILL** trace gravel, trace rock fragments, reddish brown, moist, hard		6.46								
7					8	SS	100 / 50 mm					
7		End of Borehole		7.53								
8		Notes: 1. Free water was observed at 2.2 m below existing grade at the completion of drilling. 2. Borehole was open to 3.4 m below existing grade at the completion of drilling.										
9												
10												
11												

(LOG TO BE READ IN CONJUNCTION WITH REPORT)

DEPTH SCALE
1 : 55

AECOM

LOGGED BY: JL
CHECKED BY: SP

AECOM_BH_002_NO COORDINATES_60563670_CCGC.GPJ GAL-MISS.GDT 6/27/18

PROJECT: Canadian Coast Guard College
LOCATION: 1190 Westmount Rd. Sydney, NS
AECOM PROJECT No.: 60563670
CLIENT: Public Services and Procurement Canada

RECORD OF BOREHOLE: TP-1

START DATE: 02/08/2018
END DATE: 02/08/2018
BORING METHOD:
CONTRACTOR: B. Curry & Sons Construction Ltd.

DEPTH SCALE (METRES)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	N VALUE	ORGANIC VAPOUR CONCENTRATIONS [ppm] (40 80 120 160) / COMBUSTIBLE VAPOUR CONCENTRATIONS [%LEL] (20 40 60 80)	SHEAR STRENGTH Cu, kPa (Field Vane nat. +, Field Vane rem. ⊕, Quick Triaxial ●, Unconfined - △) (20 40 60 80) / WATER CONTENT PERCENT (Wp, w, Wl) (10 20 30 40)	REMARKS & GRAIN SIZE DISTRIBUTION (%)	SPECIFIC GRAVITY	WELL INSTALLATION AND WATER LEVELS
		GROUND SURFACE								GR SA SI CL		
0		**TOPSOIL / ORGANICS** 270 mm thick, black		0.00								
		FILL Sand, trace gravel, trace organics, trace rootlets, brown, moist		0.25	1	GRAB			○			
1		**SAND** trace gravel, trace silt, reddish brown, moist		1.01	2	GRAB			○			
		SANDSTONE very thinly bedded, extremely weak, brown		1.65	3	GRAB			○			
2												
3					4	GRAB						
		End of Test Pit		3.63								
4		Notes: 1. Excavator refusal occured at 3.6 m below existing ground surface. 2. Freewater was not observed at the completion of excavation.										
5												
6												
7												
8												
9												
10												

(LOG TO BE READ IN CONJUNCTION WITH REPORT)

DEPTH SCALE
1 : 50

AECOM

LOGGED BY: JL
CHECKED BY: SP

AECOM_BH_002_NO COORDINATES_60563670_CCGC.GPJ GAL-MISS.GDT 6/27/18

PROJECT: Canadian Coast Guard College
LOCATION: 1190 Westmount Rd. Sydney, NS
AECOM PROJECT No.: 60563670
CLIENT: Public Services and Procurement Canada

RECORD OF BOREHOLE: TP-10

START DATE: 02/09/2018
END DATE: 02/09/2018
BORING METHOD:
CONTRACTOR: B. Curry & Sons Construction Ltd.

DEPTH SCALE (METRES)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	N VALUE	ORGANIC VAPOUR CONCENTRATIONS [ppm] (40 80 120 160) / COMBUSTIBLE VAPOUR CONCENTRATIONS [%LEL] (20 40 60 80)	SHEAR STRENGTH Cu, kPa (Field Vane nat. +, Field Vane rem. ⊕, Quick Triaxial ●, Unconfined - △) (20 40 60 80) / WATER CONTENT PERCENT (Wp, w, Wl) (10 20 30 40)	REMARKS & GRAIN SIZE DISTRIBUTION (%)	SPECIFIC GRAVITY	WELL INSTALLATION AND WATER LEVELS
		GROUND SURFACE								GR SA SI CL		
0		**TOPSOIL / ORGANICS** 600 mm thick, black		0.00								
		FILL Sand, trace gravel, trace silt, reddish brown, moist		0.60								
1		**SILTY SAND TILL** trace gravel, reddish brown, moist		0.76	1	GRAB			○			
					2	GRAB			○			
2												
					3	GRAB						
3												
					4	GRAB			○			
4												
		some gravel, trace clay		4.30	5	GRAB			○			
					6	GRAB			○			
5		End of Test Pit		4.79								
		Notes: 1. Excavator bucket grinding occured at 4.5 m below existing ground surface. 2. Freewater was not observed at the completion of excavation.										
6												
7												
8												
9												
10												

(LOG TO BE READ IN CONJUNCTION WITH REPORT)

DEPTH SCALE
1 : 50

AECOM

LOGGED BY: JL
CHECKED BY: SP

AECOM_BH_002_NO COORDINATES_60563670_CCGC.GPJ GAL-MISS.GDT 6/27/18

PROJECT: Canadian Coast Guard College
LOCATION: 1190 Westmount Rd. Sydney, NS
AECOM PROJECT No.: 60563670
CLIENT: Public Services and Procurement Canada

RECORD OF BOREHOLE: TP-11

START DATE: 02/09/2018
END DATE: 02/09/2018
BORING METHOD:
CONTRACTOR: B. Curry & Sons Construction Ltd.

DEPTH SCALE (METRES)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: N VALUE	ORGANIC VAPOUR CONCENTRATIONS [ppm] (40 80 120 160) / COMBUSTIBLE VAPOUR CONCENTRATIONS [%LEL] (20 40 60 80)	SHEAR STRENGTH Cu, kPa (Field Vane nat. +, Field Vane rem. ⊕, Quick Triaxial ●, Unconfined - △) (20 40 60 80) / WATER CONTENT PERCENT (Wp, w, Wl) (10 20 30 40)	REMARKS & GRAIN SIZE DISTRIBUTION (%)	SPECIFIC GRAVITY	WELL INSTALLATION AND WATER LEVELS
		GROUND SURFACE								GR SA SI CL		
0		**TOPSOIL / ORGANICS** 200 mm thick, black		0.00								
		SILTY SAND trace gravel, reddish brown, moist		0.20								
1		**SILTY SAND TILL** some gravel, some clay, reddish brown, moist		0.61	1	GRAB			w			
					2	GRAB						
2												
3		moist to wet		2.80	3	GRAB			Wp — w — Wl	13 45 [42]		
					4	GRAB						
4												
					5	GRAB						
5		End of Test Pit Note: 1. Wet pit walls were observed at 1.1 m below existing ground surface at the completion of excavation.		4.69								
6												
7												
8												
9												
10												

(LOG TO BE READ IN CONJUNCTION WITH REPORT)

DEPTH SCALE
1 : 50

AECOM

LOGGED BY: JL
CHECKED BY: SP

AECOM_BH_002_NO COORDINATES_60563670_CCGC.GPJ GAL-MISS.GDT 6/27/18

PROJECT: Canadian Coast Guard College
LOCATION: 1190 Westmount Rd. Sydney, NS
AECOM PROJECT No.: 60563670
CLIENT: Public Services and Procurement Canada

RECORD OF BOREHOLE: TP-12

START DATE: 02/08/2018
END DATE: 02/08/2018
BORING METHOD:
CONTRACTOR: B. Curry & Sons Construction Ltd.

DEPTH SCALE (METRES)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	N VALUE	ORGANIC VAPOUR CONCENTRATIONS [ppm] (40 80 120 160) / COMBUSTIBLE VAPOUR CONCENTRATIONS [%LEL] (20 40 60 80)	SHEAR STRENGTH Cu, kPa (Field Vane nat. +, Field Vane rem. ⊕, Quick Triaxial ●, Unconfined - △) (20 40 60 80) / WATER CONTENT PERCENT (Wp, w, Wl) (10 20 30 40)	REMARKS & GRAIN SIZE DISTRIBUTION (%)	SPECIFIC GRAVITY	WELL INSTALLATION AND WATER LEVELS
		GROUND SURFACE								GR SA SI CL		
0		**TOPSOIL / ORGANICS** 100 mm thick, black		0.00 0.10								
		SILTY SAND TILL trace organics, trace gravel, brown, moist			1	GRAB						
1												
		trace black staining		1.40	2	GRAB						
2					3	GRAB						
3					4	GRAB						
		End of Test Pit Note: 1. Freewater was not observed at the completion of excavation.		3.20								
4												
5												
6												
7												
8												
9												
10												

(LOG TO BE READ IN CONJUNCTION WITH REPORT)

DEPTH SCALE
1 : 50

AECOM

LOGGED BY: JL
CHECKED BY: SP

AECOM_BH_002_NO COORDINATES_60563670_CCGC.GPJ GAL-MISS.GDT 6/27/18

PROJECT: Canadian Coast Guard College
LOCATION: 1190 Westmount Rd. Sydney, NS
AECOM PROJECT No.: 60563670
CLIENT: Public Services and Procurement Canada

RECORD OF BOREHOLE: TP-13

START DATE: 02/09/2018
END DATE: 02/09/2018
BORING METHOD:
CONTRACTOR: B. Curry & Sons Construction Ltd.

DEPTH SCALE (METRES)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	N VALUE	ORGANIC VAPOUR CONCENTRATIONS [ppm] (40 80 120 160) / COMBUSTIBLE VAPOUR CONCENTRATIONS [%LEL] (20 40 60 80)	SHEAR STRENGTH Cu, kPa (Field Vane nat. +, Field Vane rem. ⊕, Quick Triaxial ●, Unconfined - △) (20 40 60 80) / WATER CONTENT PERCENT (Wp, w, WI) (10 20 30 40)	REMARKS & GRAIN SIZE DISTRIBUTION (%)	SPECIFIC GRAVITY	WELL INSTALLATION AND WATER LEVELS
		GROUND SURFACE								GR SA SI CL		
0		**TOPSOIL / ORGANICS** 100 mm thick, black		0.00 0.10								
		FILL Sand, some gravel, trace silt, reddish brown, moist			1	GRAB			○			
1												
		SILTY SAND TILL some clay, trace gravel, brown, moist		1.19	2	GRAB			○			
2												
					3	GRAB						
3		End of Test Pit Note: 1. At 2.9 m below existing ground surface, the pit walls continued to cave in.		2.90								
4												
5												
6												
7												
8												
9												
10												

(LOG TO BE READ IN CONJUNCTION WITH REPORT)

DEPTH SCALE
1 : 50

AECOM

LOGGED BY: JL
CHECKED BY: SP

AECOM_BH_002_NO COORDINATES_60563670_CCGC.GPJ GAL-MISS.GDT 6/27/18

PROJECT: Canadian Coast Guard College
LOCATION: 1190 Westmount Rd. Sydney, NS
AECOM PROJECT No.: 60563670
CLIENT: Public Services and Procurement Canada

RECORD OF BOREHOLE: TP-2

SHEET 1 OF 1

START DATE: 02/08/2018
END DATE: 02/08/2018
BORING METHOD:
CONTRACTOR: B. Curry & Sons Construction Ltd.

DEPTH SCALE (METRES)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	N VALUE	ORGANIC VAPOUR CONCENTRATIONS [ppm] (40 80 120 160) / COMBUSTIBLE VAPOUR CONCENTRATIONS [%LEL] (20 40 60 80)	SHEAR STRENGTH Cu, kPa (Field Vane nat. +, Field Vane rem. ⊕, Quick Triaxial ●, Unconfined - △) (20 40 60 80) / WATER CONTENT PERCENT (Wp, w, Wl) (10 20 30 40)	REMARKS & GRAIN SIZE DISTRIBUTION (%)	SPECIFIC GRAVITY	WELL INSTALLATION AND WATER LEVELS
		GROUND SURFACE								GR SA SI CL		
0		**TOPSOIL / ORGANICS** 300 mm thick, black		0.00								
		FILL Sand, trace silt, trace gravel, trace organics, trace rootlets, reddish brown, moist		0.30	1	GRAB						
1		**SILTY SAND TILL** trace gravel, trace clay, reddish brown, moist		1.22	2	GRAB						
2				2.10	3	GRAB						
					4	GRAB						
		End of Test Pit		2.59								
3		Notes: 1. Excavator refusal occured at 2.6 m below existing ground surface. 2. Freewater was not observed at the completion of excavation.										
4												
5												
6												
7												
8												
9												
10												

(LOG TO BE READ IN CONJUNCTION WITH REPORT)

DEPTH SCALE
1 : 50

AECOM

LOGGED BY: JL
CHECKED BY: SP

AECOM_BH_002_NO COORDINATES_60563670_CCGC.GPJ GAL-MISS.GDT 6/27/18

PROJECT: Canadian Coast Guard College
LOCATION: 1190 Westmount Rd. Sydney, NS
AECOM PROJECT No.: 60563670
CLIENT: Public Services and Procurement Canada

RECORD OF BOREHOLE: TP-3

START DATE: 02/08/2018
END DATE: 02/08/2018
BORING METHOD:
CONTRACTOR: B. Curry & Sons Construction Ltd.

DEPTH SCALE (METRES)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	N VALUE	ORGANIC VAPOUR CONCENTRATIONS [ppm] (40 80 120 160) / COMBUSTIBLE VAPOUR CONCENTRATIONS [%LEL] (20 40 60 80)	SHEAR STRENGTH Cu, kPa (Field Vane nat. +, Field Vane rem. ⊕, Quick Triaxial ●, Unconfined - △) (20 40 60 80) / WATER CONTENT PERCENT (Wp, w, Wl) (10 20 30 40)	REMARKS & GRAIN SIZE DISTRIBUTION (%)	SPECIFIC GRAVITY	WELL INSTALLATION AND WATER LEVELS
		GROUND SURFACE								GR SA SI CL		
0		**TOPSOIL / ORGANICS** 300 mm thick, black		0.00	1	GRAB						
		GRAVELY SILTY SAND TILL trace clay, reddish brown, moist		0.61	2	GRAB						▽ 02/08/2018
1					3	GRAB						
2					4	GRAB				37 41 [22]		
					5	GRAB						
3					6	GRAB						
					7	GRAB						
		End of Test Pit		3.51								
4		Notes: 1. Excavator refusal occured at 3.5 m below existing ground surface. 2. Freewater was observed at 0.8 m below existing ground surface at the completion of excavation.										
5												
6												
7												
8												
9												
10												

(LOG TO BE READ IN CONJUNCTION WITH REPORT)

DEPTH SCALE
1 : 50

AECOM

LOGGED BY: JL
CHECKED BY: SP

AECOM_BH_002_NO COORDINATES_60563670_CCGC.GPJ GAL-MISS.GDT 6/27/18

PROJECT: Canadian Coast Guard College
LOCATION: 1190 Westmount Rd. Sydney, NS
AECOM PROJECT No.: 60563670
CLIENT: Public Services and Procurement Canada

RECORD OF BOREHOLE: TP-4

START DATE: 02/08/2018
END DATE: 02/08/2018
BORING METHOD:
CONTRACTOR: B. Curry & Sons Construction Ltd.

DEPTH SCALE (METRES)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	N VALUE	ORGANIC VAPOUR CONCENTRATIONS [ppm] (40 80 120 160) / COMBUSTIBLE VAPOUR CONCENTRATIONS [%LEL] (20 40 60 80)	SHEAR STRENGTH Cu, kPa (Field Vane nat. +, Field Vane rem. ⊕, Quick Triaxial ●, Unconfined - △) (20 40 60 80) / WATER CONTENT PERCENT (Wp, w, Wl) (10 20 30 40)	REMARKS & GRAIN SIZE DISTRIBUTION (%)	SPECIFIC GRAVITY	WELL INSTALLATION AND WATER LEVELS
		GROUND SURFACE								GR SA SI CL		
0		**TOPSOIL / ORGANICS** 600 mm thick, black		0.00								
		SILTY SAND TILL reddish brown, moist		0.60	1	GRAB						
1												
					2	GRAB						
2					3	GRAB						
		some clay, trace gravel		2.44	4	GRAB						
					5	GRAB						
3		End of Test Pit Note: 1. Freewater was not observed at the completion of excavation.		2.99								
4												
5												
6												
7												
8												
9												
10												

(LOG TO BE READ IN CONJUNCTION WITH REPORT)

DEPTH SCALE
1 : 50

AECOM

LOGGED BY: JL
CHECKED BY: SP

AECOM_BH_002_NO COORDINATES_60563670_CCGC.GPJ GAL-MISS.GDT 6/27/18

PROJECT: Canadian Coast Guard College
LOCATION: 1190 Westmount Rd. Sydney, NS
AECOM PROJECT No.: 60563670
CLIENT: Public Services and Procurement Canada

RECORD OF BOREHOLE: TP-5

START DATE: 02/08/2018
END DATE: 02/08/2018
BORING METHOD:
CONTRACTOR: B. Curry & Sons Construction Ltd.

DEPTH SCALE (METRES)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	N VALUE	ORGANIC VAPOUR CONCENTRATIONS [ppm] (40 80 120 160) / COMBUSTIBLE VAPOUR CONCENTRATIONS [%LEL] (20 40 60 80)	SHEAR STRENGTH Cu, kPa (Field Vane nat. +, Field Vane rem. ⊕, Quick Triaxial ●, Unconfined - △) (20 40 60 80) / WATER CONTENT PERCENT (Wp, w, Wl) (10 20 30 40)	REMARKS & GRAIN SIZE DISTRIBUTION (%)	SPECIFIC GRAVITY	WELL INSTALLATION AND WATER LEVELS
		GROUND SURFACE								GR SA SI CL		
0		**TOPSOIL / ORGANICS** 600 mm thick, black		0.00	1	GRAB						
		SILTY SAND TILL trace gravel, trace rootlets, brown, moist		0.60	2	GRAB						
1		reddish brown		1.22	3	GRAB						
2					4	GRAB						
					5	GRAB						
3		trace clay End of Test Pit		2.90 2.99								
4		Note: 1. Freewater was not observed at the completion of excavation.										
5												
6												
7												
8												
9												
10												

(LOG TO BE READ IN CONJUNCTION WITH REPORT)

DEPTH SCALE
1 : 50

AECOM

LOGGED BY: JL
CHECKED BY: SP

AECOM_BH_002_NO COORDINATES_60563670_CCGC.GPJ GAL-MISS.GDT 6/27/18

PROJECT: Canadian Coast Guard College
LOCATION: 1190 Westmount Rd. Sydney, NS
AECOM PROJECT No.: 60563670
CLIENT: Public Services and Procurement Canada

RECORD OF BOREHOLE: TP-6

START DATE: 02/09/2018
END DATE: 02/09/2018
BORING METHOD:
CONTRACTOR: B. Curry & Sons Construction Ltd.

DEPTH SCALE (METRES)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: N VALUE	ORGANIC VAPOUR CONCENTRATIONS [ppm] (40 80 120 160) / COMBUSTIBLE VAPOUR CONCENTRATIONS [%LEL] (20 40 60 80)	SHEAR STRENGTH Cu, kPa (Field Vane nat. +, Field Vane rem. ⊕, Quick Triaxial ●, Unconfined - △) (20 40 60 80) / WATER CONTENT PERCENT (Wp, w, Wl) (10 20 30 40)	REMARKS & GRAIN SIZE DISTRIBUTION (%)	SPECIFIC GRAVITY	WELL INSTALLATION AND WATER LEVELS
		GROUND SURFACE								GR SA SI CL		
0		**TOPSOIL / ORGANICS** 100 mm thick, black		0.00 0.10								
		FILL Sandy Silt, trace organics, trace rootlets, trace gravel, reddish brown, moist										
		SILTY SAND TILL trace to some clay, trace gravel, reddish brown, moist		0.61	1	GRAB						
1					2	GRAB						
2												
		Clayey, some gravel, some rock fragments		2.41	3	GRAB						
					4	GRAB						
3		End of Test Pit Notes: 1. Excavator refusal occured at 3.5 m below existing ground surface. 2. Wet pit walls were observed at 1.4 m below existing ground surface at the completion of excavation.		2.99								
4												
5												
6												
7												
8												
9												
10												

(LOG TO BE READ IN CONJUNCTION WITH REPORT)

DEPTH SCALE
1 : 50

AECOM

LOGGED BY: JL
CHECKED BY: SP

AECOM_BH_002_NO COORDINATES_60563670_CCGC.GPJ GAL-MISS.GDT 6/27/18

PROJECT: Canadian Coast Guard College
LOCATION: 1190 Westmount Rd. Sydney, NS
AECOM PROJECT No.: 60563670
CLIENT: Public Services and Procurement Canada

RECORD OF BOREHOLE: TP-7

SHEET 1 OF 1

START DATE: 02/09/2018
END DATE: 02/09/2018
BORING METHOD:
CONTRACTOR: B. Curry & Sons Construction Ltd.

DEPTH SCALE (METRES)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	N VALUE	ORGANIC VAPOUR CONCENTRATIONS [ppm] / COMBUSTIBLE VAPOUR CONCENTRATIONS [%LEL]	SHEAR STRENGTH Cu, kPa (Field Vane nat. +, Field Vane rem. ⊕, Quick Triaxial ●, Unconfined - △) / WATER CONTENT PERCENT (Wp, w, Wl)	REMARKS & GRAIN SIZE DISTRIBUTION (%)	SPECIFIC GRAVITY	WELL INSTALLATION AND WATER LEVELS
		GROUND SURFACE								GR SA SI CL		
0		**TOPSOIL / ORGANICS** 50 mm thick, black		0.05								
		FILL Sand, trace gravel, trace organics, trace rootlets, brown, moist										
		SILTY SAND TILL some clay, some gravel, reddish brown, moist		0.61	1	GRAB						
1					2	GRAB						
2												
3					3	GRAB						
4					4	GRAB						
					5	GRAB						
5		End of Test Pit		4.60								
		Note:										
		1. Wet pit walls were observed at 1.2 m below existing ground surface at the completion of excavation.										
6												
7												
8												
9												
10												

(LOG TO BE READ IN CONJUNCTION WITH REPORT)

DEPTH SCALE
1 : 50

AECOM

LOGGED BY: JL
CHECKED BY: SP

AECOM_BH_002_NO COORDINATES_60563670_CCGC.GPJ GAL-MISS.GDT 6/27/18

PROJECT: Canadian Coast Guard College
LOCATION: 1190 Westmount Rd. Sydney, NS
AECOM PROJECT No.: 60563670
CLIENT: Public Services and Procurement Canada

RECORD OF BOREHOLE: TP-8

START DATE: 02/09/2018
END DATE: 02/09/2018
BORING METHOD:
CONTRACTOR: B. Curry & Sons Construction Ltd.

DEPTH SCALE (METRES)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	N VALUE	ORGANIC VAPOUR CONCENTRATIONS [ppm] (40 80 120 160) / COMBUSTIBLE VAPOUR CONCENTRATIONS [%LEL] (20 40 60 80)	SHEAR STRENGTH Cu, kPa (Field Vane nat. +, Field Vane rem. ⊕, Quick Triaxial ●, Unconfined - △) (20 40 60 80) / WATER CONTENT PERCENT (Wp, w, Wl) (10 20 30 40)	REMARKS & GRAIN SIZE DISTRIBUTION (%)	SPECIFIC GRAVITY	WELL INSTALLATION AND WATER LEVELS
		GROUND SURFACE								GR SA SI CL		
0		**TOPSOIL / ORGANICS** 50 mm thick, black		0.05								
		SILTY SAND TILL some clay, trace gravel, trace oxidation, reddish brown, moist			1	GRAB						
1												
					2	GRAB						
2												
3		no oxidation, some gravel		2.99	3	GRAB				14 52 27 7		
					4	GRAB						
4		End of Test Pit		3.99								
		Notes: 1. Wet pit walls were observed at 1.0 m below existing ground surface at the completion of excavation. 2. At 4.0 m below existing ground surface the pit walls caved in.										
5												
6												
7												
8												
9												
10												

(LOG TO BE READ IN CONJUNCTION WITH REPORT)

DEPTH SCALE
1 : 50

AECOM

LOGGED BY: JL
CHECKED BY: SP

AECOM_BH_002_NO COORDINATES_60563670_CCGC.GPJ GAL-MISS.GDT 6/27/18

PROJECT: Canadian Coast Guard College
LOCATION: 1190 Westmount Rd. Sydney, NS
AECOM PROJECT No.: 60563670
CLIENT: Public Services and Procurement Canada

RECORD OF BOREHOLE: TP-9

START DATE: 02/09/2018
END DATE: 02/09/2018
BORING METHOD:
CONTRACTOR: B. Curry & Sons Construction Ltd.

DEPTH SCALE (METRES)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	N VALUE	ORGANIC VAPOUR CONCENTRATIONS [ppm] (40 80 120 160) / COMBUSTIBLE VAPOUR CONCENTRATIONS [%LEL] (20 40 60 80)	SHEAR STRENGTH Cu, kPa (Field Vane nat. +, Field Vane rem. ⊕, Quick Triaxial ●, Unconfined - △) (20 40 60 80) / WATER CONTENT PERCENT (Wp, w, Wl) (10 20 30 40)	REMARKS & GRAIN SIZE DISTRIBUTION (%)	SPECIFIC GRAVITY	WELL INSTALLATION AND WATER LEVELS
		GROUND SURFACE								GR SA SI CL		
0		**TOPSOIL / ORGANICS** 300 mm thick, black		0.00								
		FILL Sand, some silt, trace gravel, trace organics, trace rootlets, reddish brown		0.30	1	GRAB						
1												
					2	GRAB						
2		**SILTY SAND TILL** some clay, trace gravel, reddish brown, moist		1.89								
3					3	GRAB						
		some clay to clayey, cobbles			4	GRAB						
4												
					5	GRAB						
		End of Test Pit Note: 1. Wet pit walls were observed at 0.3 m below existing ground surface at the completion of excavation.		4.51								
5												
6												
7												
8												
9												
10												

(LOG TO BE READ IN CONJUNCTION WITH REPORT)

DEPTH SCALE
1 : 50

AECOM

LOGGED BY: JL
CHECKED BY: SP

AECOM_BH_002_NO COORDINATES_60563670_CCGC.GPJ GAL-MISS.GDT 6/27/18

Appendix C

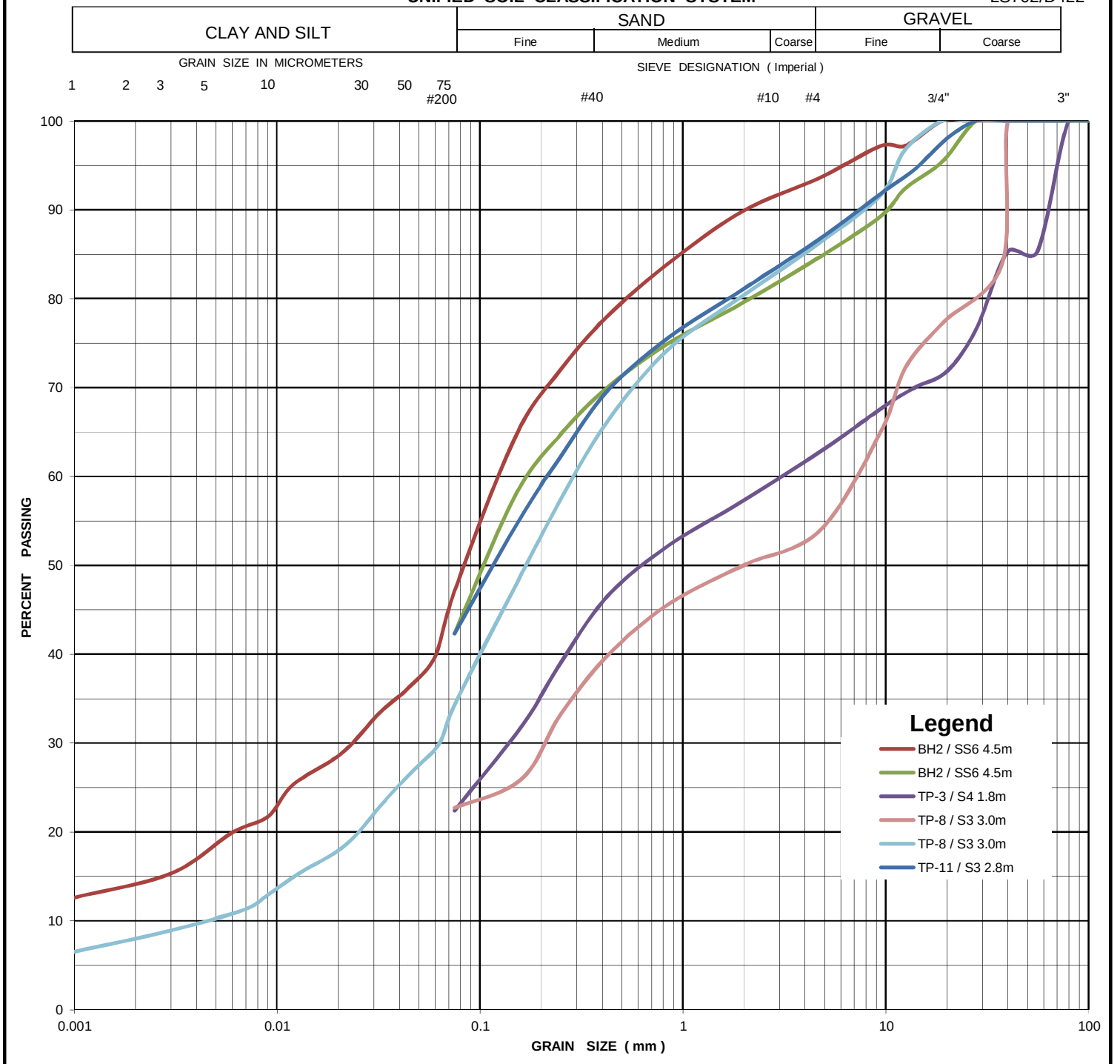
Soil Laboratory Testing Results

C1 – Geotechnical Laboratory Testing Results
C2 – Corrosivity Testing Results

C1 – Geotechnical Laboratory Testing Results

UNIFIED SOIL CLASSIFICATION SYSTEM

LS702/D422



AECOM

MECHANICAL UPGRADE PROJECT COAST GUARD COLLEGE

PROJECT No.	60563670
DRAWN BY	JL
CHECKED BY	SP
DATE	March 15, 2018

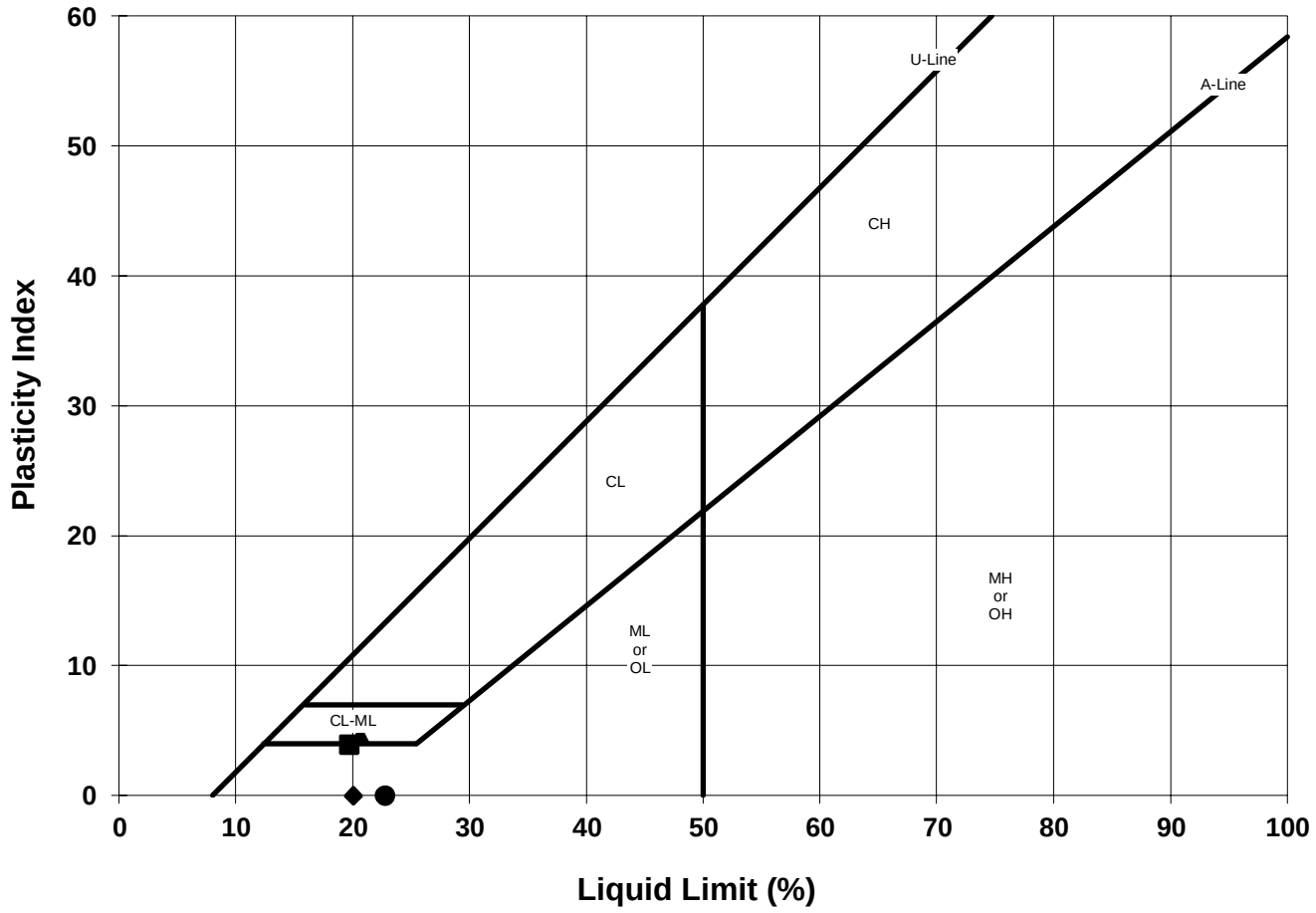
FIGURE No.

L-1

EXP Services Inc. - Plastic Limits
ASTM D4318

SYD-00245424-A0

6, 9 - Feb-18



Client: AECOM

Job No: SYD-00245424-A0

Project: Canadian Coast Guard College Lab Testing

Location: CCGC, Westmount NS

Sample Date: 6, 9 - Feb-18

Test Date: 14-Feb-18

Sample By: Client

Test By: KA

DATA SUMMARY

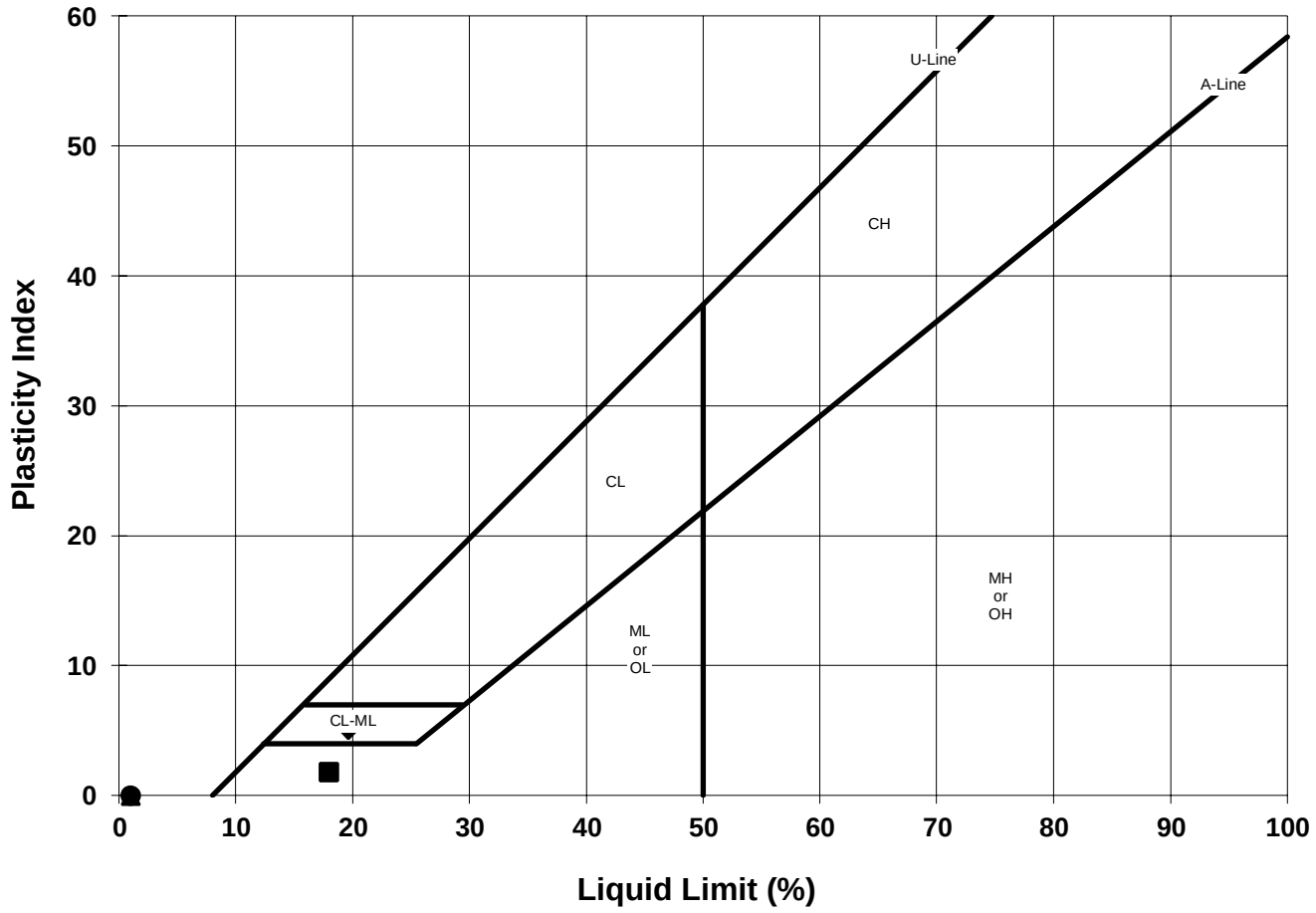
Sample #	Liquid Limit	Plastic Limit	Plastic Index	Soil Symbol	Soil Type	Legend
BH-1 SS7	20	16	4	CL-ML	Not reported to EXP	■
TP-10 S3	20			ML	Not reported to EXP	◆
TP-11 S3	21	16	5	CL-ML	Not reported to EXP	▲
TP-7 S5	23			ML	Not reported to EXP	●

Comment: TP-10 S3 and TP-7 S5 could not be rolled.

EXP Services Inc. - Plastic Limits
ASTM D4318

SYD-00245424-A0

Feb 6 & 9, 2018



Client: AECOM

Job No: SYD-00245424-A0

Project: Canadian Coast Guard College Lab Testing

Location: CCGC, Westmount NS

Sample Date: Feb 6 & 9, 2018

Test Date: 14-Feb-18

Sample By: Client

Test By: KA

DATA SUMMARY

Sample #	Liquid Limit	Plastic Limit	Plastic Index	Soil Symbol	Soil Type	Legend
TP-8 S3	18	16	2	ML	Not reported to EXP	■
BH-2 SS6	20	15	5	CL-ML	Not reported to EXP	◆
						▲
						●

Comment:

EXP Services Inc.
301 Alexandra Street, Suite A, Sydney, NS B1S 2E8
Tel: (902) 562 - 2394 Fax: (902) 564 - 5660

Moisture Density Relationship (Standard Proctor) - ASTM D698

Client: AECOM | File No.: SYD-00245424-A0

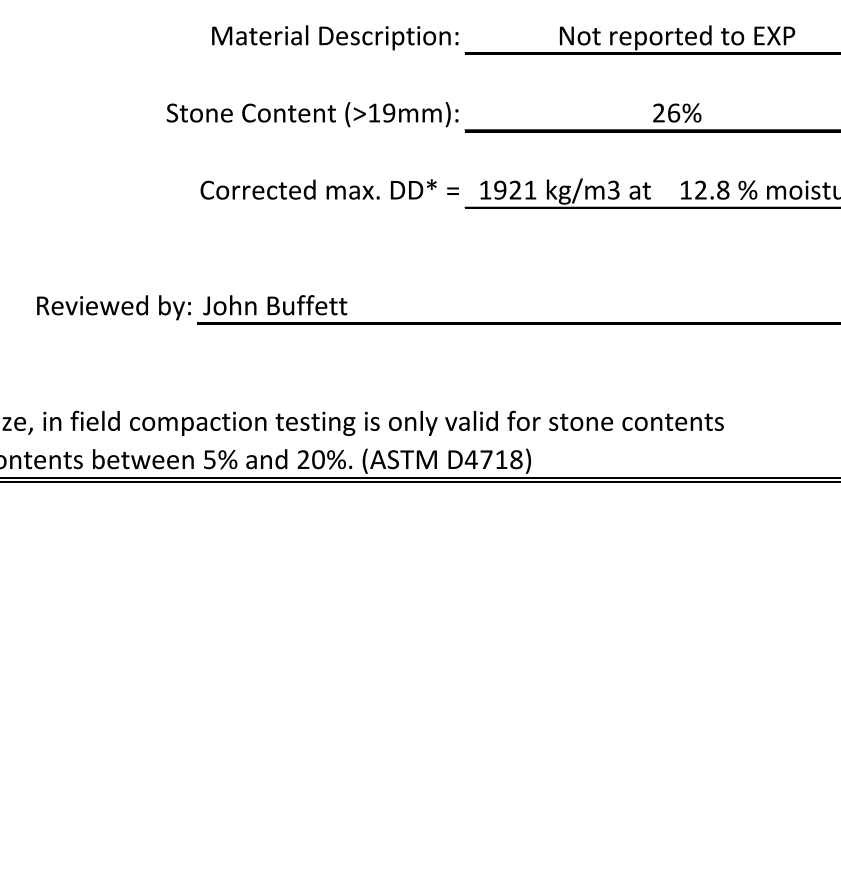
Project: CCGC | Sampled by: Client

Tested by: KA | Test Date: 16-Feb-18 | Sample Date: Various

Material Type: Not reported to EXP
TP-5 (S4), TP-4 (S3), TP-3 (S4)

Data Summary

	Water Content (%)	Dry Density (kg/m^3)
Point 1	16.6	1856
Point 2	8.2	1836
Point 3	10.4	1880
Point 4	13.5	1912
Point 5		
Point 6		
Point 7		



Maximum Dry Density: 1920 kg/m^3

Optimum Water Content: 12.8 %

Method Used: C

Preparation Method: Dry

Assumed Gs Stone : 2.6

Assumed Wc Stone : 2.5 %

Water Content as received: 16.6 %

Rammer Type: Manual

Material Description: Not reported to EXP

Stone Content (>19mm): 26% %

Corrected max. DD* = 1921 kg/m3 at 12.8 % moisture

Reviewed by: John Buffett

A283

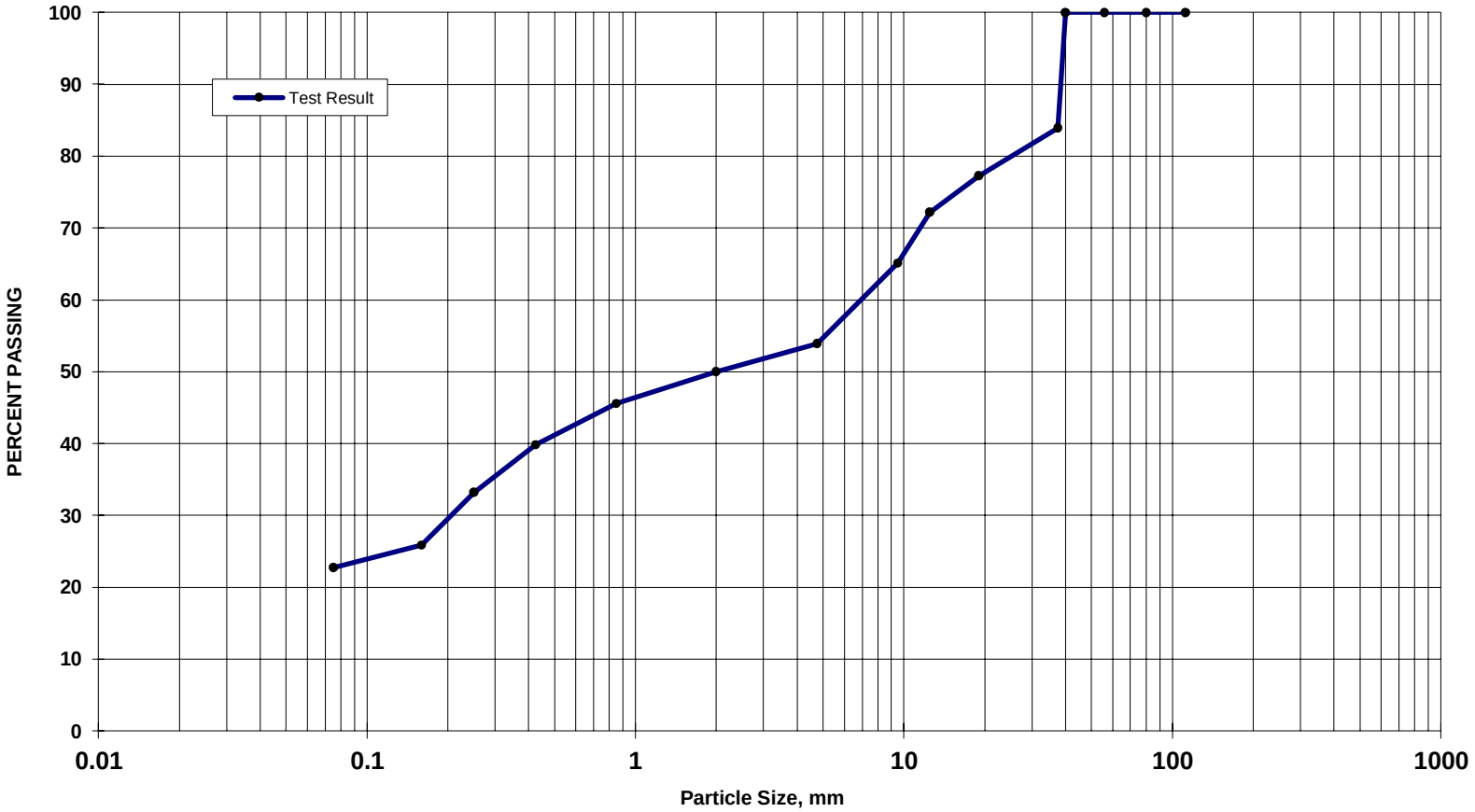
* Note that use of maximum dry density, corrected for oversize, in field compaction testing is only valid for stone contents between 5% and 30% and is only recommended for stone contents between 5% and 20%. (ASTM D4718)

ASTM/USCS Sieve Analysis

Canadian Coast Guard College Lab Testing

SYD-00245424-A0

21-Feb-18



TEST DATA	
Sieve Size (mm)	Percent Passing (%)
112	100.0
80	100.0
56	100.0
40	100.0
37.5	83.9
19	77.2
12.5	72.2
9.5	65.1
4.75	53.9
2	50.0
0.85	45.6
0.425	39.8
0.25	33.2
0.16	25.9
0.075	22.7

Client: AECOM

Sample: TP-8 S3

Soil Type: Not reported to EXP

USCS Soil Name: Silty gravel with sand

Gravel (%) 46.1

Sand (%) 31.1

Fines (%) 22.7

USCS Symbol: GM

C_u

C_c

$W_{content}$(%) 12.6

Test By: KA

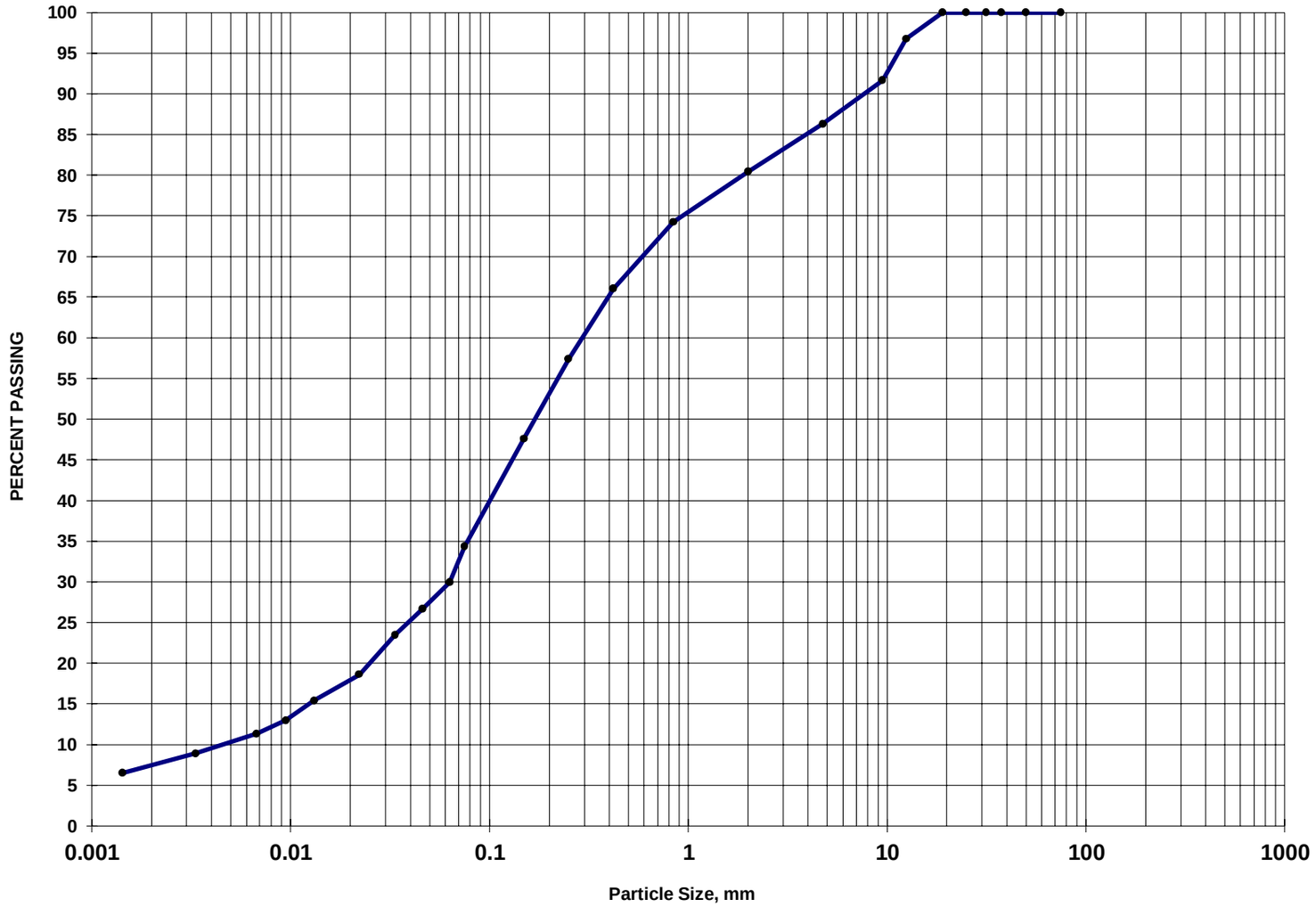
Comment: Client's PO number is 60563670. Fines are classified as ML.

Specified Gradational Limits		
Size (mm)	Low Limit % Passing	High Limit % Passing
80		
56		
28		
14		
5		
0.16		
0.08		

EXP Services Inc. ASTM D422 Hydrometer Analysis

SYD-00245424-A0
February 22, 2018

Canadian Coast Guard College Lab Testing



TEST DATA	
Size (mm)	Percent Passing (%)
Sieve Analysis	
75.000	100
50.000	100
37.500	100
31.500	100
25.000	100
19.000	100
12.500	96.8
9.500	91.7
4.750	86.3
2.000	80.4
0.841	74.2
0.420	66.0
0.250	57.4
0.149	47.6
0.075	34.3
Hydrometer Analysis	
0.063	29.9
0.046	26.7
0.034	23.5
0.022	18.6
0.013	15.4
0.009	12.9
0.007	11.3
0.003	8.9
0.001	6.5

Client: AECOM

Sample: TP8 S3

Soil Type: Not reported to EXP

USCS Soil Name:

Comment: Client's PO number 60563670.

Gravel (%) 13.7

Sand (%) 52.0

Fines (%) 34.3

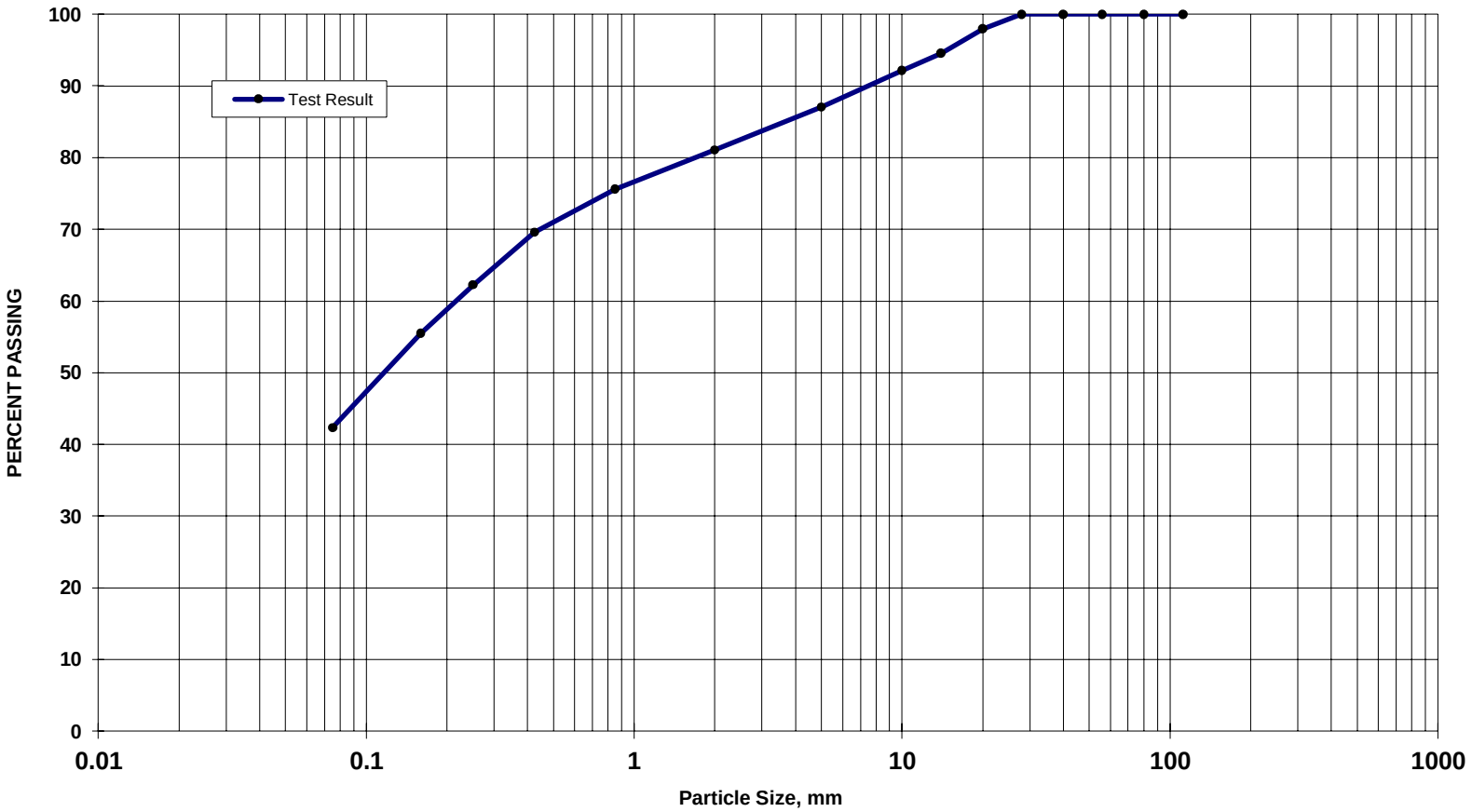
USCS Symbol:

ASTM/USCS Sieve Analysis

Canadian Coast Guard College Lab Testing

SYD-00245424-A0

14-Feb-18



TEST DATA	
Sieve Size (mm)	Percent Passing (%)
112	100.0
80	100.0
56	100.0
40	100.0
28	100.0
20	98.0
14	94.6
10	92.2
5	87.1
2	81.1
0.85	75.6
0.425	69.6
0.25	62.2
0.16	55.5
0.075	42.3

Client: AECOM

Sample: TP-11 S3

Soil Type: Not reported to EXP

USCS Soil Name: Silty, clayey sand

Gravel (%) 12.9

Sand (%) 44.8

Fines (%) 42.3

USCS Symbol: SC-SM

C_u

C_c

$W_{content}$(%) 13.0

Test By: KA

Comment: Client's PO number is 60563670. Fines are classified as CL-ML.

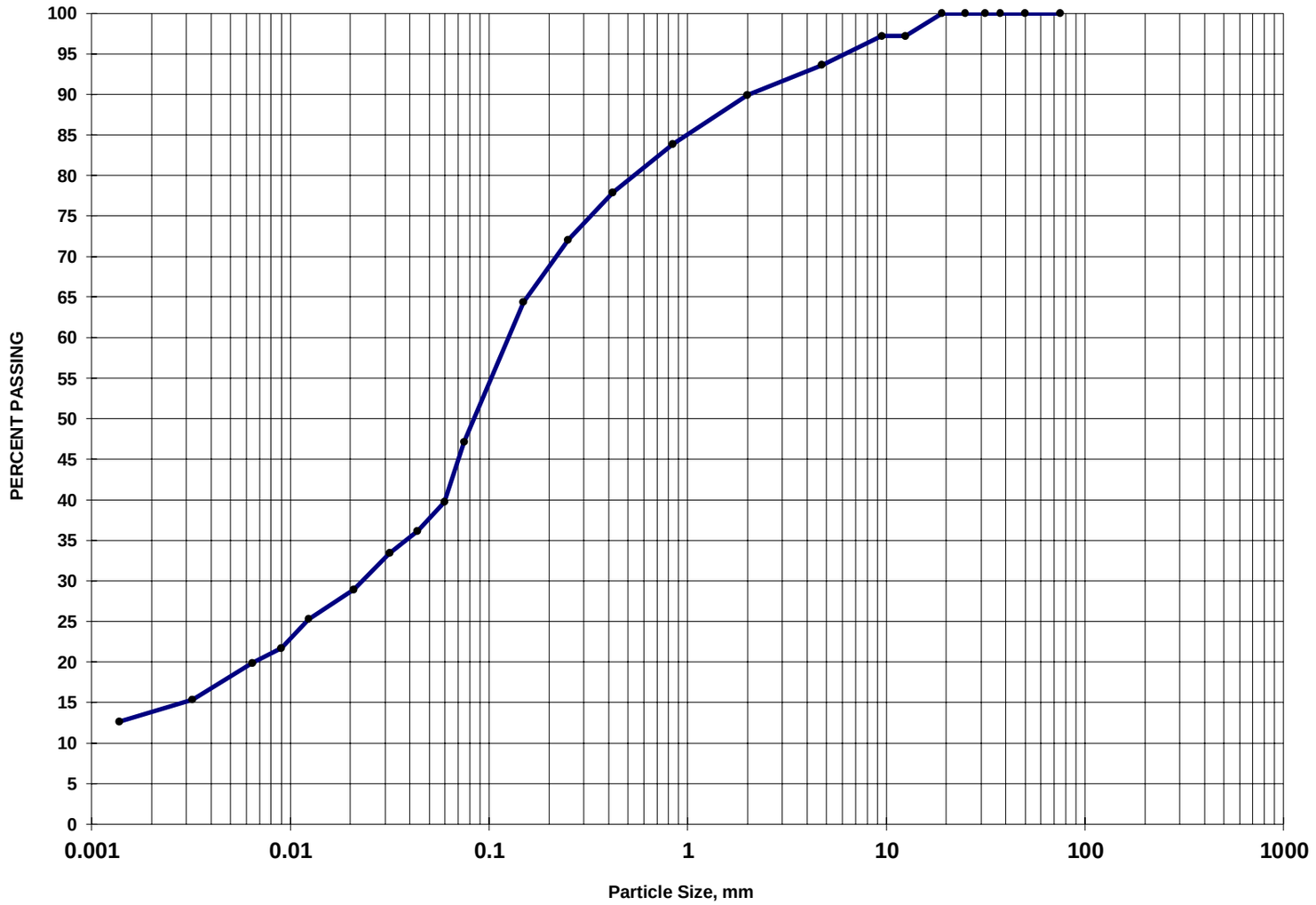
Specified Gradational Limits		
Size (mm)	Low Limit % Passing	High Limit % Passing
80		
56		
28		
14		
5		
0.16		
0.08		

EXP Services Inc. ASTM D422 Hydrometer Analysis

SYD-00245424-A0

February 22, 2018

Canadian Coast Guard College Lab Testing



TEST DATA	
Size (mm)	Percent Passing (%)
Sieve Analysis	
75.000	100.0
50.000	100.0
37.500	100.0
31.500	100.0
25.000	100.0
19.000	100.0
12.500	97.2
9.500	97.2
4.750	93.6
2.000	89.9
0.841	83.9
0.420	77.9
0.250	72.0
0.149	64.4
0.075	47.1
Hydrometer Analysis	
0.060	39.7
0.044	36.1
0.032	33.4
0.021	28.9
0.012	25.3
0.009	21.7
0.006	19.9
0.003	15.3
0.001	12.6

Client: AECOM

Sample: BH-2 SS6

Soil Type: Not reported to EXP

USCS Soil Name: Silty, clayey sand with gravel

Comment: Client's PO number 60563670.

Gravel (%) 6.4

Sand (%) 46.5

Fines (%) 47.1

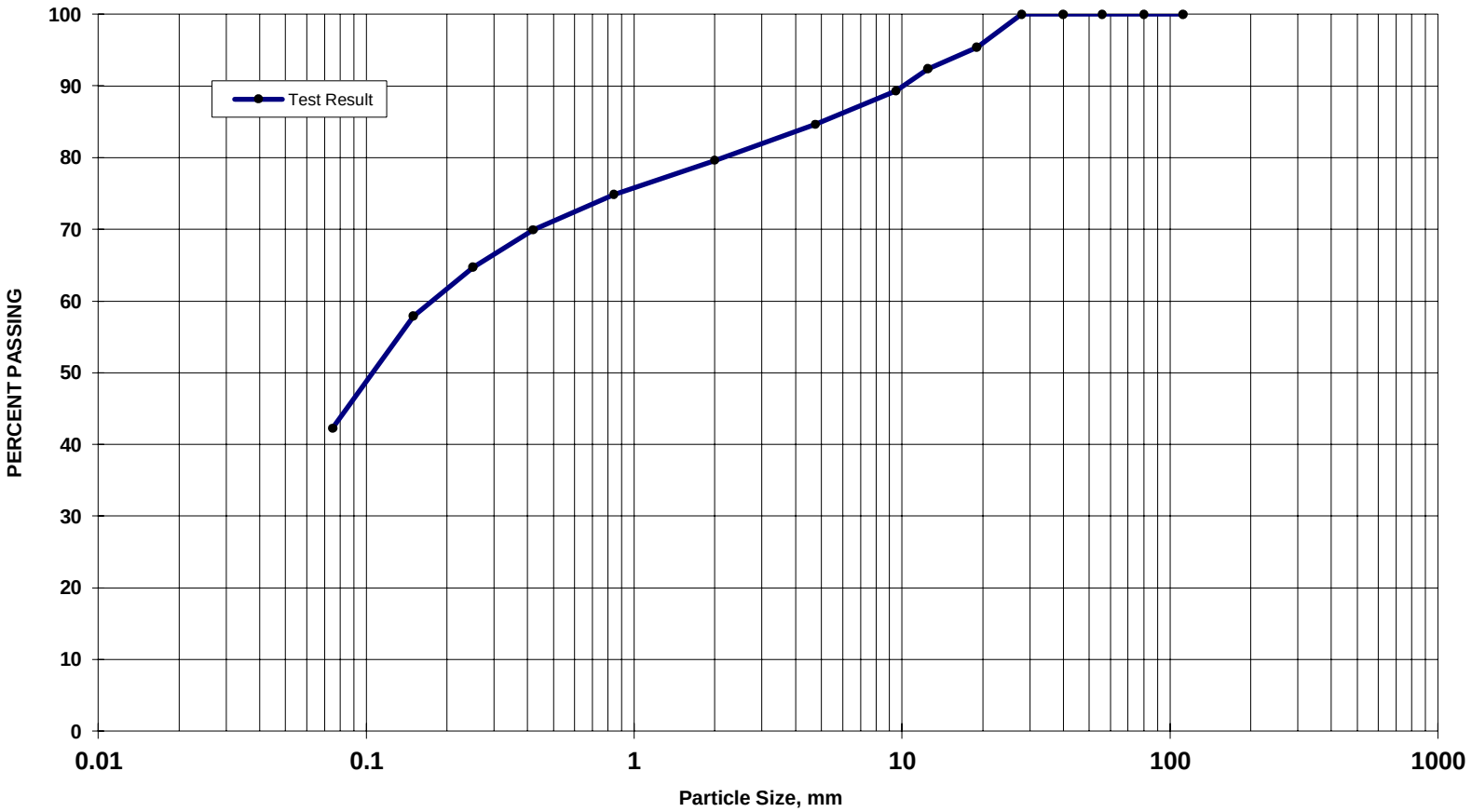
USCS Symbol: SC-SM

ASTM/USCS Sieve Analysis

Canadian Coast Guard College Lab Testing

SYD-00245424-A0

14-Feb-18



TEST DATA	
Sieve Size (mm)	Percent Passing (%)
112	100.0
80	100.0
56	100.0
40	100.0
28	100.0
19	95.4
12.5	92.4
9.5	89.3
4.75	84.7
2	79.6
0.841	74.9
0.42	69.9
0.25	64.7
0.15	57.9
0.075	42.3

Client: AECOM

Sample: BH-2 SS6

Soil Type: Not reported to EXP

USCS Soil Name: Silty, clayey sand with gravel

Gravel (%) 15.3

Sand (%) 42.4

Fines (%) 42.3

USCS Symbol: SC-SM

C_u

C_c

$W_{content}$(%) 13.4

Test By: KA

Comment: Client's PO number is 60563670. Fines are classified as CL-ML.

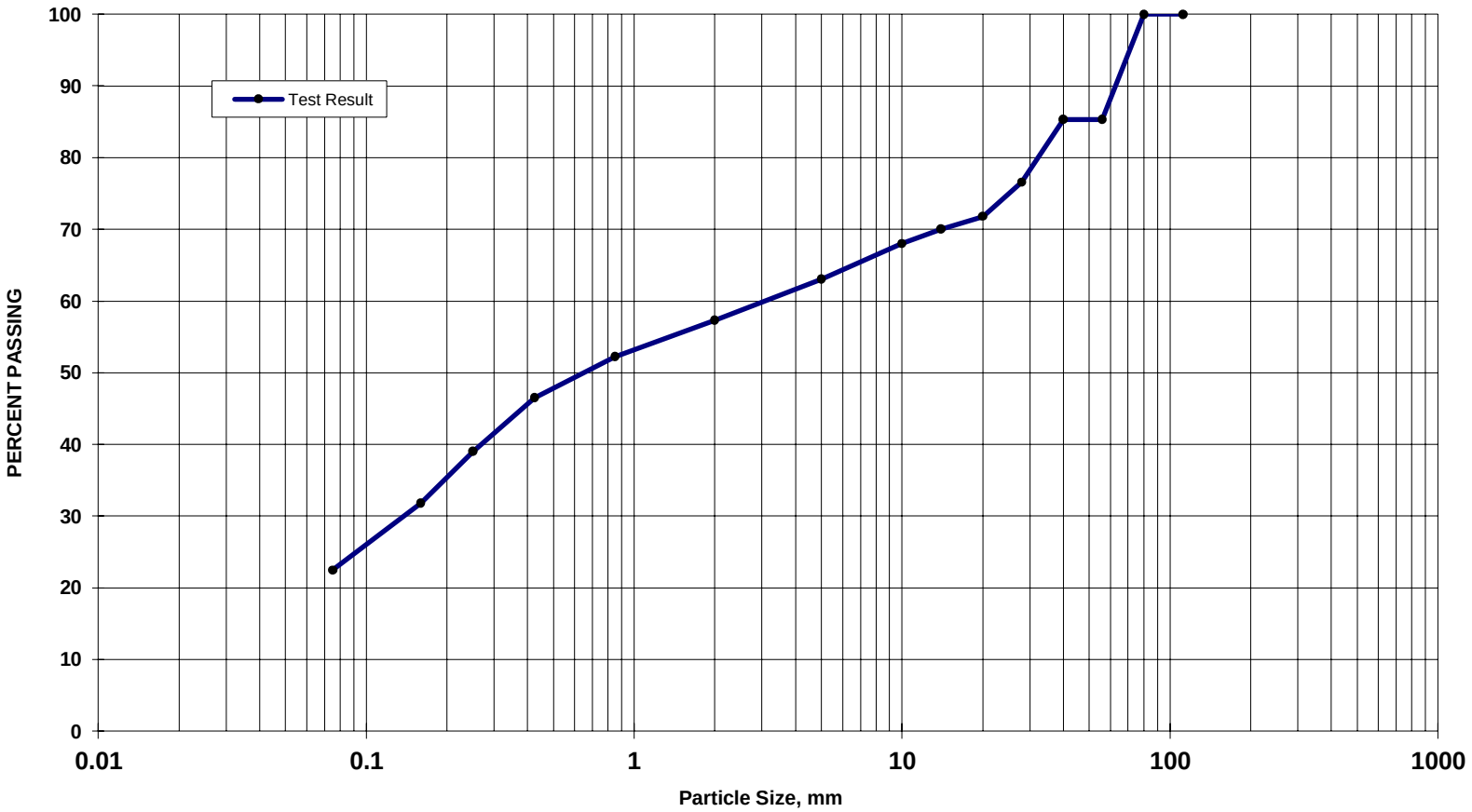
Specified Gradational Limits		
Size (mm)	Low Limit % Passing	High Limit % Passing
80		
56		
28		
14		
5		
0.16		
0.08		

ASTM/USCS Sieve Analysis

Canadian Coast Guard College Lab Testing

SYD-00245424-A0

14-Feb-18



TEST DATA	
Sieve Size (mm)	Percent Passing (%)
112	100.0
80	100.0
56	85.3
40	85.3
28	76.6
20	71.8
14	70.0
10	68.0
5	63.1
2	57.3
0.85	52.2
0.425	46.5
0.25	39.0
0.16	31.8
0.075	22.4

Client: AECOM

Sample: TP-3 S4

Soil Type: Not reported to EXP

USCS Soil Name:

Gravel (%) 36.9

Sand (%) 40.6

Fines (%) 22.4

USCS Symbol:

C_u

C_c

$W_{content}$(%) 11.9

Test By: KA

Comment: Client's PO number is 60563670

Specified Gradational Limits		
Size (mm)	Low Limit % Passing	High Limit % Passing
80		
56		
28		
14		
5		
0.16		
0.08		

C2 – Corrosivity Testing Results

Maxxam
A Bureau Veritas Group Company

Your Project #: 60563670 TASK
Site Location: 1190 WESTMOUNT RD, SYDNEY NS
Your C.O.C. #: D29243

Attention: Ray Rice

AECOM Canada Ltd
1701 Hollis St
SH400
Halifax , NS
CANADA B3J 3M8

Report Date: 2018/02/23
Report #: R5009768
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B831755
Received: 2018/02/09, 17:30

Sample Matrix: Soil
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Chloride in Soil by Auto. Colourimetry (1)	2	N/A	2018/02/22	ATL SOP 00014	SM 22 4500-Cl- E m
Conductance - soil (1)	2	2018/02/21	2018/02/21	ATL SOP 00004	SM 22 2510B m
pH (5:1 DI Water Extract) (1)	2	2018/02/21	2018/02/22	ATL SOP 00003	SM 22 4500-H+ B m
Redox Potential (Soil) (2)	2	N/A	2018/02/22		
Resistivity in Soil (1)	2	2018/02/13	2018/02/21	N/A	Auto Calc.
Sulphate in Soil by Auto Colourimetry (1)	2	2018/02/22	2018/02/22	ATL SOP 00023	ASTM D516-16 m
Sulphide in Soil (3)	2	2018/02/21	2018/02/21		

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) This test was performed by Maxxam Bedford
(2) This test was performed by Bedford to Maxxam LCQ
(3) This test was performed by Sydney to Burnaby Subcontract

Maxxam Analytics International Corporation o/a Maxxam Analytics 465 George St., Unit G, Sydney, NS, B1P 1K5 Tel:902 567 1255 Toll Free: 888 535 7770 Fax: 902 539 6504 www.maxxam.ca

Your Project #: 60563670 TASK
Site Location: 1190 WESTMOUNT RD, SYDNEY NS
Your C.O.C. #: D29243

Attention: Ray Rice

AECOM Canada Ltd
1701 Hollis St
SH400
Halifax , NS
CANADA B3J 3M8

Report Date: 2018/02/23
Report #: R5009768
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B831755
Received: 2018/02/09, 17:30

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Natalie MacAskill, Key Account Specialist
Email: NMacAskill@maxxam.ca
Phone# (902)567-1255 Ext:17
==========
This report has been generated and distributed using a secure automated process.
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Maxxam Job #: B831755
Report Date: 2018/02/23

AECOM Canada Ltd
Client Project #: 60563670 TASK
Site Location: 1190 WESTMOUNT RD, SYDNEY NS

RESULTS OF ANALYSES OF SOIL

Maxxam ID		GBO417			GBO417			GBO475		
Sampling Date		2018/02/08			2018/02/08			2018/02/06		
COC Number		D29243			D29243			D29243		
	UNITS	TP-3 SAMPLE 3	RDL	QC Batch	TP-3 SAMPLE 3 Lab-Dup	RDL	QC Batch	BH2 SS3+SS4	RDL	QC Batch
Calculated Parameters										
Resistivity	ohm-cm	7200		5397607				11000		5397607
Inorganics										
Chloride (Cl)	mg/kg	150	5.0	5410145	130	5.0	5410145	35	5.0	5410145
Conductivity	uS/cm	140	1.0	5408557	120	1.0	5408557	90	1.0	5408557
Soluble (5:1) pH	pH	6.28	N/A	5410103	6.33	N/A	5410103	7.48	N/A	5410103
Sulphate (SO4)	mg/kg	<10	10	5410147	<10	10	5410147	11	10	5410147
Subcontracted Analysis										
Subcontract Parameter	N/A	ATTACHED	N/A	5410175				ATTACHED		5410175

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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Maxxam Job #: B831755
Report Date: 2018/02/23

AECOM Canada Ltd
Client Project #: 60563670 TASK
Site Location: 1190 WESTMOUNT RD, SYDNEY NS

GENERAL COMMENTS

Results relate only to the items tested.

Maxxam Analytics International Corporation o/a Maxxam Analytics 465 George St., Unit G, Sydney, NS, B1P 1K5 Tel:902 567 1255 Toll Free: 888 535 7770 Fax: 902 539 6504 www.maxxam.ca

Maxxam Job #: B831755
Report Date: 2018/02/23

AECOM Canada Ltd
Client Project #: 60563670 TASK
Site Location: 1190 WESTMOUNT RD, SYDNEY NS

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
5408557	TPE	Leachate Blank	Conductivity	2018/02/21	<1.0		uS/cm	
5408557	TPE	Spiked Blank	Conductivity	2018/02/21		100	%	N/A
5408557	TPE	Method Blank	Conductivity	2018/02/21	<1.0		uS/cm	
5408557	TPE	RPD [GBO417-01]	Conductivity	2018/02/21	12		%	35
5410103	TPE	RPD [GBO417-01]	Soluble (5:1) pH	2018/02/22	0.79		%	N/A
5410145	MCN	Matrix Spike [GBO417-01]	Chloride (Cl)	2018/02/22		62	%	N/A
5410145	MCN	QC Standard	Chloride (Cl)	2018/02/22		106	%	80 - 120
5410145	MCN	Method Blank	Chloride (Cl)	2018/02/22	<5.0		mg/kg	
5410145	MCN	RPD [GBO417-01]	Chloride (Cl)	2018/02/22	15		%	35
5410147	MCN	Matrix Spike [GBO417-01]	Sulphate (SO4)	2018/02/22		132 (1)	%	N/A
5410147	MCN	Method Blank	Sulphate (SO4)	2018/02/22	<10		mg/kg	
5410147	MCN	RPD [GBO417-01]	Sulphate (SO4)	2018/02/22	NC		%	25

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Leachate Blank: A blank matrix containing all reagents used in the leaching procedure. Used to determine any process contamination.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Elevated spike recovery due to sample matrix, result confirmed by repeat analysis.

Maxxam Analytics International Corporation o/a Maxxam Analytics 465 George St., Unit G, Sydney, NS, B1P 1K5 Tel:902 567 1255 Toll Free: 888 535 7770 Fax: 902 539 6504 www.maxxam.ca

Maxxam Job #: B831755
Report Date: 2018/02/23

AECOM Canada Ltd
Client Project #: 60563670 TASK
Site Location: 1190 WESTMOUNT RD, SYDNEY NS

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Eric Dearman, Scientific Specialist

Natalie MacAskill, Key Account Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics 465 George St., Unit G, Sydney, NS, B1P 1K5 Tel:902 567 1255 Toll Free: 888 535 7770 Fax: 902 539 6504 www.maxxam.ca

Maxxam
A Bureau Veritas Group Company

200 Bluewater Road, Suite 105, Bedford, Nova Scotia B4B 1G9 Tel: 902-420-0203 Fax: 902-420-8612 Toll Free: 1-800-565-7227
49-55 Elizabeth Avenue, St John's, NL A1A 1W9 Tel: 709-754-0203 Fax: 709-754-8612 Toll Free: 1-888-492-7227
465 George Street,Unit G,Sydney, NS B1P 1K5 Tel: 902-567-1255 Fax: 902-539-6504 Toll Free: 1-888-535-7770
www.maxxam.ca E-mail: Customerservicebedford@maxxam.ca

CHAIN OF CUSTODY RECORD

COC #: D29243 Page ____ of ____

Invoice Information	Report Information (if differs from invoice)	Project Information (where applicable)	Turnaround Time (TAT) Required
Company Name: AECOM Canada Ltd	Company Name: AECOM	Quotation #:	☑ Regular TAT (5 business days) Most analyses
Contact Name: Ray RICE	Contact Name: CC: Jonathan	P.O. #:	PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address: 1701 Hollis St. Unit 400 Halifax, NS Postal Code: B3J 3M8	Address: 5080 Commerce Blvd (Lum) Mississauga, ON Postal Code:	Project #: 60563670 Task	IF RUSH please specify date (Surcharges will be applied)
Phone: 902-428-2022 Fax:	Phone: Fax:	Site Location: 1190 Westmount Rd Sydney, NS	DATE REQUIRED:
Email:	Email: jonathan.lum@aecom.com	Site #:	
		Sampled By: Jonathan Lum	

Laboratory Use Only

CUSTODY SEAL Present	CUSTODY SEAL Intact	COOLER TEMPERATURES	COOLER TEMPERATURES
N/A		6.5	

COOLING MEDIA PRESENT Y / N

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

Analysis Requested

	SAMPLE IDENTIFICATION	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED	FIELD FILTERED &PRESERVED	LAB FILTRATION REQUIRED	RCAP-MS (Total Metals) Well / Surface water	RCAP-MS (Dissolved Metals) Ground waters	Metals (Water): Total Digest (Default Method) for well water & surface water	Metals (Water): Dissolved for ground water	Metals (Water): Mercury (CIRCLE) TOTAL / DISSOLVED	Metals (Soil): Metals & Mercury Default Acid Extractable (Available) Digest	Metals (Soil): Metals Total Digest -for Ocean sediments (HNO3/HF/HClO4)	Metals (Soil): Mercury Low level by Cold Vapour AA	Metals (Soil): Hot Water Soluble Boron (required for CCME Agricultural/ Landfill)	RBCA Hydrocarbons (BTEX, C6-C32)	Hydrocarbons Soil (Potable), NS Fuel Oil Spill Policy Low Level BTEX ,C6-C32	CCME Hydrocarbons (CWS-PHC F1/BTEX, F2-F4)	NB Potable Water BTEX, VPH, Low level T.E.H	PAHs (Default for water/soil)	PAHs (FWAL /CCME Sediment)	PCBs	VOCs	Total Coliform/E.coli (Presence/Absence)	Total Coliform/E.Coli (Count)	Carbon/Salinity Suite	HOLD- DO NOT ANALYZE
1	TP-3 Sample 3	2018/02/05		Soil																						✓	
2	BH2 SS3 + SS4	2018/02/06		Soil																						✓	
3																											
4																											
5																											
6																											
7																											
8																											
9																											
10																											

Regulatory Requirements (Specify)

COMMENTS

Redox Potential
Sulfide / Sulphide
Chloride
Sulfate
pH
EC (5:1)

Only 1-250ml jar provided.

RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY:(Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	MAXXAM JOB #
Jonathan Lum	2018/02/09	5:30 PM	N MACABILLL	2018/02/09	530pm	B831755

White: Maxxam Pink: Client

Maxxam
A Bureau Veritas Group Company

Success Through Science®

Your Project #: KB831755
Site#: 1190 WESTMOUNT RD, SYDNEY, NS
Your C.O.C. #: B831755

Attention: NATALIE MACASKILL

MAXXAM ANALYTICS
200 BLUEWATER ROAD, SUITE 105
BEDFORD, NS
CANADA B4B 1G9

Report Date: 2018/02/21
Report #: R2518308
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B811715
Received: 2018/02/15, 08:40

Sample Matrix: Soil
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Moisture	2	2018/02/16	2018/02/16	BBY8SOP-00017	BCMOE BCLM Dec2000 m
Sulphide in Soil	2	2018/02/16	2018/02/19	BBY6SOP-00007,	EPA-821-R-91-100 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected.

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Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Maxxam Analytics International Corporation o/a Maxxam Analytics Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Your Project #: KB831755
Site#: 1190 WESTMOUNT RD, SYDNEY, NS
Your C.O.C. #: B831755

Attention: NATALIE MACASKILL

MAXXAM ANALYTICS
200 BLUEWATER ROAD, SUITE 105
BEDFORD, NS
CANADA B4B 1G9

Report Date: 2018/02/21
Report #: R2518308
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B811715
Received: 2018/02/15, 08:40

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Graham Rudkin, Project Manager, Environmental
Email: GRudkin@maxxam.ca
Phone# (604)638-5926 Ext:5926

==========

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Maxxam Job #: B811715
Report Date: 2018/02/21

MAXXAM ANALYTICS
Client Project #: KB831755
Sampler Initials: JL

RESULTS OF CHEMICAL ANALYSES OF SOIL

Maxxam ID		SY8672	SY8673		
Sampling Date		2018/02/08	2018/02/06		
COC Number		B831755	B831755		
	UNITS	TP-3 SAMPLE 3	BH2 SS3+SS4	RDL	QC Batch
MISCELLANEOUS					
Sulphide	ug/g	0.82 (1)	<0.50 (1)	0.50	8912691

RDL = Reportable Detection Limit
(1) Headspace in sample jar was noted at the time of extraction.

Maxxam Analytics International Corporation o/a Maxxam Analytics Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Maxxam Job #: B811715
Report Date: 2018/02/21

MAXXAM ANALYTICS
Client Project #: KB831755
Sampler Initials: JL

PHYSICAL TESTING (SOIL)

Maxxam ID		SY8672	SY8673		
Sampling Date		2018/02/08	2018/02/06		
COC Number		B831755	B831755		
	UNITS	TP-3 SAMPLE 3	BH2 SS3+SS4	RDL	QC Batch
Physical Properties					
Moisture	%	15	13	0.30	8912823
RDL = Reportable Detection Limit					

Maxxam Analytics International Corporation o/a Maxxam Analytics Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Maxxam Job #: B811715
Report Date: 2018/02/21

MAXXAM ANALYTICS
Client Project #: KB831755
Sampler Initials: JL

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	3.3°C

Sample SY8672 [TP-3 SAMPLE 3] : Sample analyzed past method specified hold time for Sulphide in Soil. {Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised.}

Sample SY8673 [BH2 SS3+SS4] : Sample analyzed past method specified hold time for Sulphide in Soil. {Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised.} Sample received past method specified hold time for Sulphide in Soil.

Results relate only to the items tested.

Maxxam Analytics International Corporation o/a Maxxam Analytics Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Maxxam Job #: B811715
Report Date: 2018/02/21

QUALITY ASSURANCE REPORT

MAXXAM ANALYTICS
Client Project #: KB831755
Sampler Initials: JL

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
8912691	Sulphide	2018/02/16	27 (1)	75 - 125	115	75 - 125	<0.50	ug/g	19	30
8912823	Moisture	2018/02/16					<0.30	%	1.1	20

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

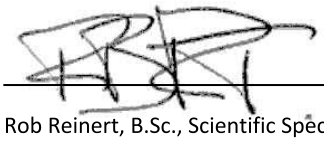
Maxxam Analytics International Corporation o/a Maxxam Analytics Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Maxxam Job #: B811715
Report Date: 2018/02/21

MAXXAM ANALYTICS
Client Project #: KB831755
Sampler Initials: JL

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Rob Reinert, B.Sc., Scientific Specialist

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Maxxam Analytics International Corporation o/a Maxxam Analytics Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Your Project #: B831755
Your C.O.C. #: N-A

Attention: Natalie MacAskill

Maxxam Analytics
200 Bluewater road
Bedford, NS
CANADA B4B 1G9

Report Date: 2018/02/16
Report #: R2353628
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B805492
Received: 2018/02/15, 11:30

Sample Matrix: SOIL
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Primary Reference
Redox Potential***	2	2018/02/16	2018/02/16	QUE SOP-00151	SM 2580 B

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
Note: RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

*** This analysis is not subject to MDDELCC accreditation.

Your Project #: B831755
Your C.O.C. #: N-A

Attention: Natalie MacAskill

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200 Bluewater road
Bedford, NS
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CERTIFICATE OF ANALYSIS

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Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Diane Goulet, Project Manager Assistant
Email: DGoulet@maxxam.ca
Phone# (418)658-5784 Ext:6442
==========
This report has been generated and distributed using a secure automated process.
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Maxxam Job #: B805492
Report Date: 2018/02/16

Maxxam Analytics
Client Project #: B831755

CONVENTIONAL PARAMETERS (SOIL)

Maxxam ID		FC1173	FC1176	
Sampling Date		2018/02/08	2018/02/06	
COC Number		N-A	N-A	
	Units	**GBO417-01R\TP-3 SAMPLE 3**	**GBO475-01R\BH2 SS3+SS4**	**QC Batch**
CONVENTIONALS				
Redox Potential	mV	150	170	1879717
QC Batch = Quality Control Batch				

Maxxam Analytics International Corporation o/a Maxxam Analytique 2690, Avenue Dalton, Sainte-Foy, Québec G1P 3S4 Tél.: (418) 658-5784 Télécopieur: (418) 658-6594

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Report Date: 2018/02/16

Maxxam Analytics
Client Project #: B831755

GENERAL COMMENTS

All results are calculated on a dry weight basis except where not applicable.

Results relate only to the items tested.

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Client Project #: B831755

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
1879717	GG1	Spiked Blank	Redox Potential	2018/02/16		103	%	80 - 120

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

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Client Project #: B831755

VALIDATION SIGNATURE PAGE

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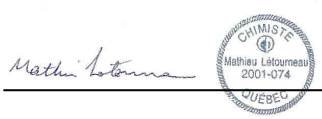

Mathieu Letourneau, B. Sc., Chemist, Scientific Service Specialist

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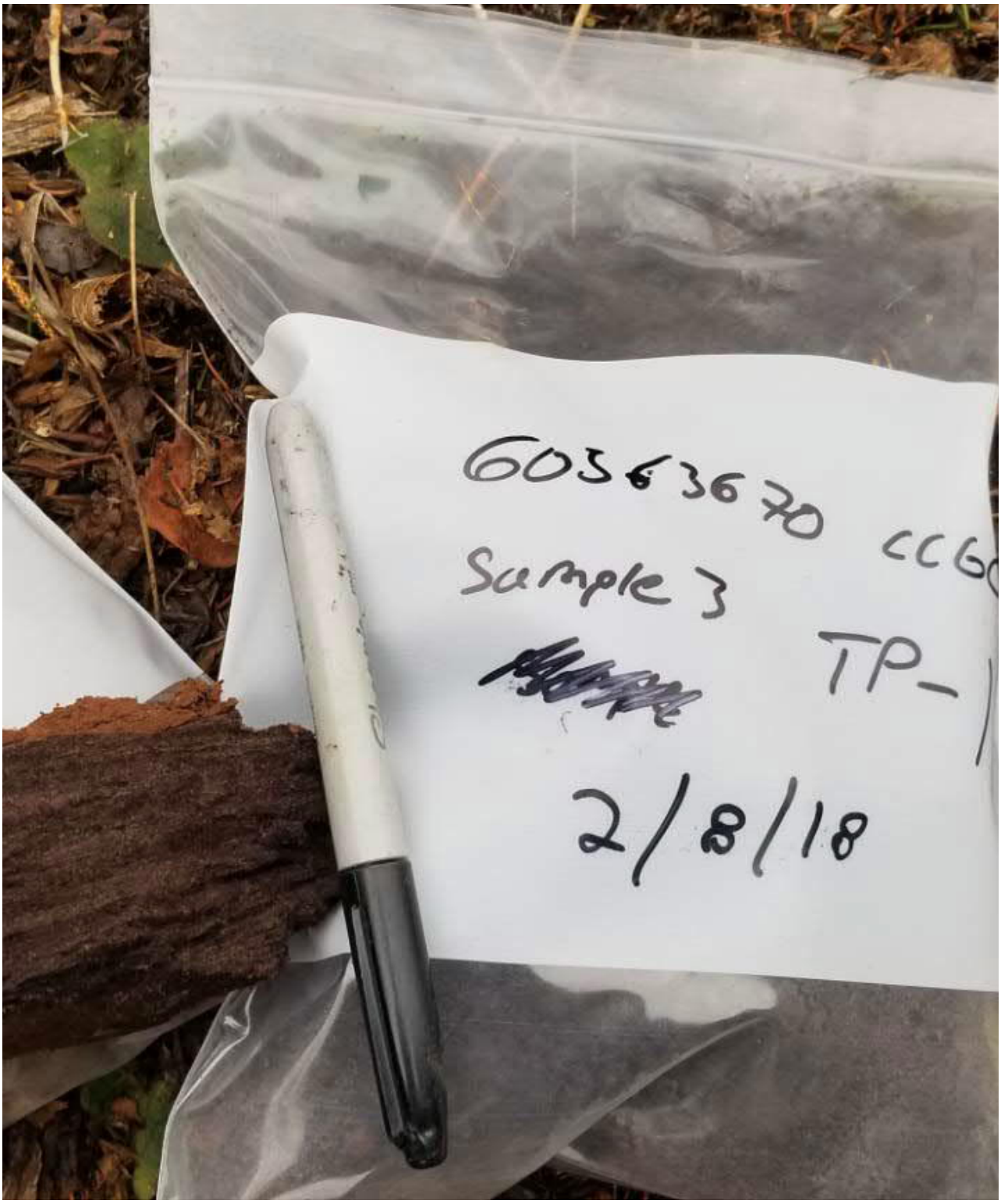
Appendix D

Site Photographs

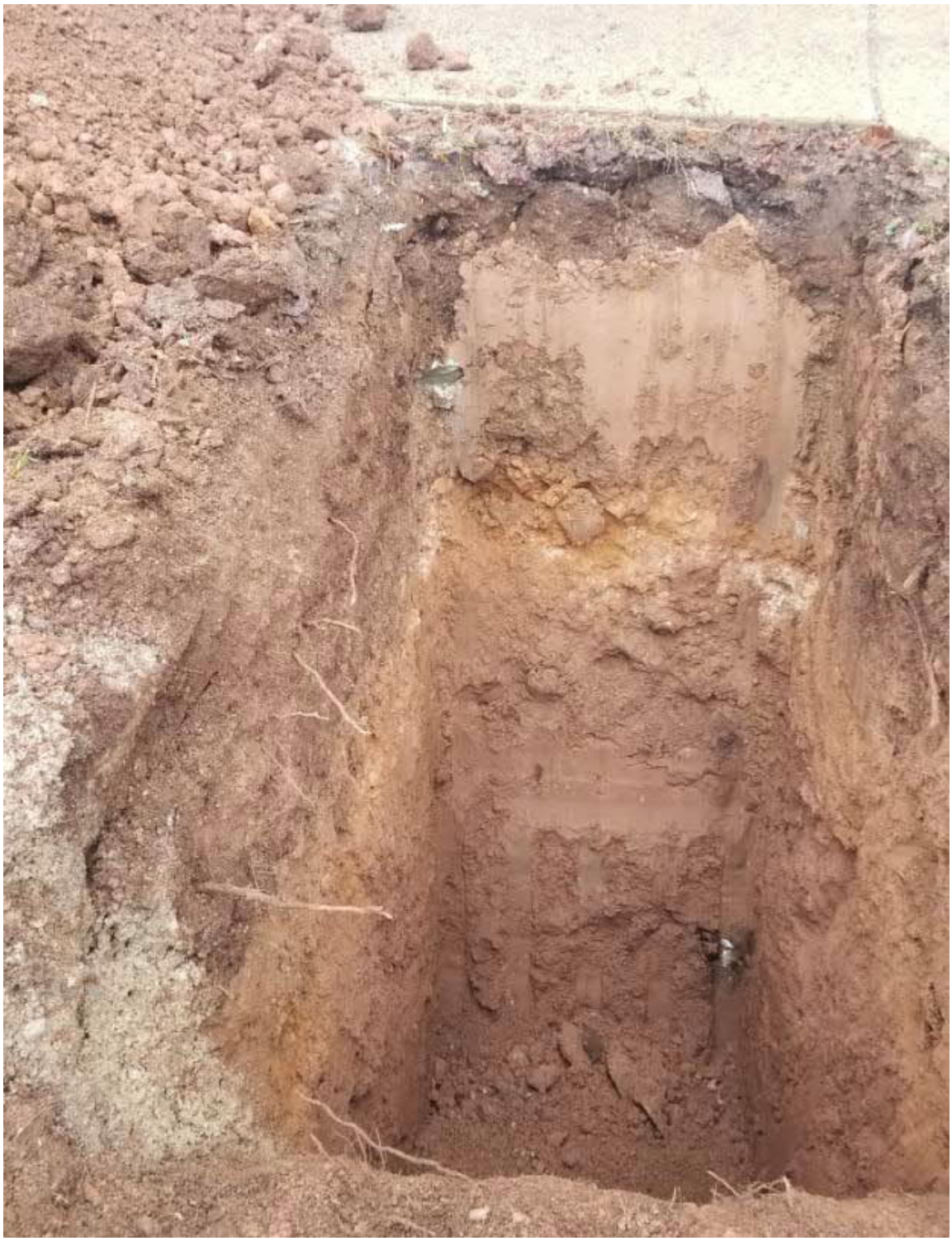


Test Pit 1 – Sample 3

Test Pit 2

Test Pit 3

Test Pit 4



Test Pit 5

Test Pit 6

Test Pit 8

Test Pit 8 – Excavated Soils

Test Pit 9

Test Pit 10

Test Pit 11

Test Pit 12

Test Pit 13