FINAL REPORT

FOUNDATION INVESTIGATION REPORT

Gagne Lake Timber Culvert Replacement, Highway 11, Site No. 45-275/C,
Township of Farrington, District of Rainy River

Agreement No. 6014-E-0017
Assignment No. 6
GWP 6322-14-00
Geocres No. 52C-047

Prepared for:

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exp Services Inc.
December 15, 2015

Ministry of Transportation

Foundation Investigation Report
Agreement No. 6014-E-0017
Assignment No. 6
GWP 6322-14-00
Geocres No. 52C-047

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Project Name:
Foundation Investigation Report for Gagne Lake Timber Culvert Replacement
Highway 11, Site No. 45-275/C, Township of Farrington, District of Rainy River

Project Number:
ADM-00223648-E0

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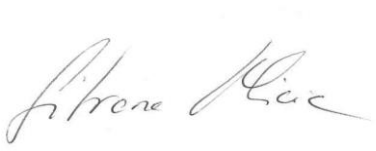

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Appendices

Part I: FOUNDATION INVESTIGATION REPORT

1.1 Introduction

This foundation investigation report presents the results of a geotechnical investigation completed by **exp** Services Inc. for the replacement of Gagne Lake Timber Culvert, located on Highway 11, about 20.6 km east of the junction of Hwy 11 and Hwy 502, in the Township of Farrington, District of Rainy River, the Ministry of Transportation (MTO) Northwestern Region. The work was undertaken under Agreement # 6014-E-0017, Assignment No. 6 (GWP 6322-14-00). The terms of reference (TOR) were as presented in the MTO letter dated May 27, 2015.

Based on preliminary information provided, it is understood that the existing culvert is a twin cell timber structure with a width of about 2.6 m (1.3 m for each cell of the twin culvert), length of about 22 m and a height of about 1.4 m. It is also understood that the existing culvert is intended to be replaced with a new culvert along the same alignment. The construction date of the existing culvert is unknown.

The purpose of the investigation was to evaluate the subsurface conditions along the alignment, to permit detailed design for the culvert replacement. The site specific geotechnical investigation consisted of borings, soil sampling, borehole logging, and field and laboratory testing.

This foundation investigation report has been prepared specifically and solely for the project described herein. It contains the factual results of the investigation and the laboratory testing completed for this project.

1.2 Site Description and Geological Setting

1.2.1 Site Description

As shown on Drawing 1 (Appendix B), the Gagne Lake Timber Culvert is located on Highway 11, about 20.6 km east of the junction of Hwy 11 and Hwy 502, in the District of Rainy River, east of Fort Frances, Ontario. At the site, Hwy 11 is a two lane roadway, with a speed limit of 90 km/h and is about 7.0 m wide from edge of pavement to edge of pavement, with relatively wide sand and gravel shoulders about 2.5 m and 4 m wide on the north and south sides of the highway, respectively. Based on drawings provided, the roadway embankment is about 3.0 m high with side slopes of about 1H:2V on the north side and about 1H:3.5V on the south side.

During the fieldwork on June 21, 22, 23, 25 and 26, 2015, the general site conditions were assessed. Hwy 11 generally runs in an east to west direction and Gagne Lake, flows from south to north beneath the highway. At the time of this investigation, the approximate lake elevations at the inlet and outlet were about 363.52 m and 363.35 m, respectively. The elevation of highway pavement centerline at the culvert centerline is about 366.0 m. Overhead wires were observed along the north side of the highway.

At the vicinity of the inlet and outlet of the culvert some tall grass was noted at both culvert ends. At the south side of the highway, low lying areas with tall grass and some immature trees were

observed on the south side of the highway. At the north side of the highway, tall grass and mature trees/forested area were noted. At the time of the investigation, some vegetation (e.g. tall grass, small logs/branches, etc.) appeared to be partially restricting the water flow at the inlet and outlet.

Select photographs are provided in Appendix A.

1.2.2 Geological Setting

According to the MNR Northern Ontario Engineering Geology Terrain Data Base Map, Ontario Geological Survey Map 5070, Scale 1:100,000, dated 1979, the underlying native soil at the site consists of peat organic terrain; mainly low local relief, plain, wet surface conditions. The site borders a landform consisting of bedrock knob with a subordinate landform consisting of silt till ground moraine; mainly moderate local relief, knobby, hummocky and dry surface conditions.

According the Ministry of Northern Development and Mines (MNDM) Bedrock Geology of Ontario, West-Central Sheet Map No. 2542, Scale 1:1,000,000, dated 1991, the bedrock geology of the site is of the Neo to Mesoarchean Era (2.5 to 3.4 Ga), Intrusive rocks, and generally consist of diorite, monzonite, granodiorite suite which includes, diorite, tonalite, monzonite, granodiorite, syenite, and hypabyssal equivalents complexes (saturated to oversaturated suite).

1.3 Investigation Procedures

1.3.1 Site Investigation and Field Testing

The field investigation was performed on June 21, 22, 23, 25 and 26, 2015. The field program consisted of drilling four (4) sampled boreholes (BH401 to BH404). Two (2) boreholes were located within the highway, BH401, and BH402. BH401 was located about 4.3 m west of the culvert centerline and about 3.7 m south of the highway centerline. BH402 was located about 4.3 m east of the culvert centerline and about 1.2 m north of the highway centerline. An additional two (2) boreholes (BH403 and BH404) were advanced off of the highway. BH403 was located about 6.7 m east of the culvert centerline and about 11.6 m north of the highway centerline (oulet/downstream side). BH404 was located about 9.1 m east of the culvert centerline and about 18.8 m south of the highway centerline (intlet/upstream side). The borehole locations are shown on Drawing 1 in Appendix B.

All the boreholes (BH401 to BH404) were advanced using a CME 850 track mounted drill rig. The drill rig was equipped with hollow stem continuous flight augers and standard soil sampling equipment (51 mm outside diameter split spoon samplers). In addition, the CME 850 drill rig was equipped with rock coring equipment (HQ size). The roadway boreholes BH401 and BH402 were advanced to depths of about 7.8 m and 8.4 m below ground surface, respectively. The off-road boreholes BH403 and BH404 were advanced to auger and SPT refusal, at depths of about 3.7 m and 6.4 m below ground surface, respectively. The off-road boreholes were terminated at the refusal depths.

At BH401 and BH402, at about 1.5 m and 1.1 m below ground surface, respectively, auger and SPT refusal was encountered and rock coring techniques were conducted to advance the boreholes to determine the nature of refusal (i.e. rock fill). Rock coring techniques at BH401 and

BH402 were continued through additional overburden soils and into the bedrock. Rock core samples were collected at both borehole locations. No rock coring techniques were conducted at the remaining borehole locations.

The borehole locations were referenced to the MTM ON-16 NAD83 coordinate system and their ground surface elevations were surveyed by **exp** personnel. The ground surface elevations, including top of water in the creek, were referenced to a geodetic benchmark (BM) provided (nail in rock) west of the site and north of the highway. The BM elevation is 367.214 m. The location of the BM is shown on Drawing 1, in Appendix B.

During the drilling of the boreholes (BH401 to BH404), soil samples were obtained using a 51 mm outside diameter (O.D.) split-spoon sampler in accordance with Standard Penetration Test (SPT) procedures (ASTM D1586), and were generally performed at intervals of about 0.75 m. The original field (uncorrected) SPT "N" values were recorded on the borehole logs as recommended in the Canadian Foundation Engineering Manual and used to provide an assessment of *in-situ* compactness (cohesionless) or consistency (cohesive) soils.

Upon completion of the boreholes, groundwater level measurements were carried out in boreholes in accordance with the Ministry of Transportation guidelines. The measured groundwater levels after completion of drilling boreholes were recorded on borehole log sheets in Appendix C. The boreholes were backfilled with a mixture of bentonite and auger cuttings. The borehole decommissioning was in general accordance with the Ministry of the Environment Regulation 903, as amended by Regulation 128/03 (the well regulation under the *Ontario Water Resources Act)*.

The fieldwork was supervised by a member of **exp**'s engineering staff who directed the drilling and sampling operation, logged borehole data in accordance with MTO and/or ASTM Standards for Soils Classification, and retrieved soil samples. All of the recovered soil samples were placed in labelled moisture-proof bags which, along with the rock cores, were brought to **exp**'s Thunder Bay laboratory for additional visual, textual and olfactory examination, and for subsequent examination by a geotechnical engineer and laboratory testing.

1.3.2 Laboratory Testing

All samples brought to the laboratory were subjected to visual examination and classification. The laboratory testing program included the determination of natural moisture content and particle size distribution for approximately 25% of the collected soil samples. Atterberg Limits tests were carried out on select cohesive soil samples. All of the laboratory tests were carried out in accordance with MTO and/or ASTM Standards, as appropriate, at the **exp** laboratory in Thunder Bay, Ontario.

The laboratory test results are provided on the attached borehole log sheets in Appendix C as well as graphically in Appendix D.

In addition, chemical testing of two select soil samples were conducted. The soil samples was sent via courier, in a secure cooler under chain of custody, to Maxxam Analytics Inc., a CALA-certified and accredited laboratory in Mississauga, Ontario. Details of the chemical testing are discussed below and the lab results are included in Appendix E.

1.4 Subsurface Conditions

The detailed subsurface conditions encountered in the boreholes advanced during this investigation are presented on the Borehole Records in Appendix C. Laboratory test results are provided in Appendix D. The "Explanation of Terms Used on Borehole Records" preceding the borehole logs in Appendix C forms an integral part of and should be read in conjunction with this report. In addition, photographs of the bedrock core obtained are included in Appendix C.

A borehole location plan and stratigraphic sections are provided in Appendix B. It should be noted that the stratigraphic boundaries indicated on the borehole log and stratigraphic sections are inferred from semi-continuous sampling, observations of drilling progress and results of Standard Penetration Tests. These boundaries typically represent transitions from one soil type to another and should not be interpreted as exact planes of geological change. Furthermore, subsurface conditions may vary between and beyond the borehole locations.

In general, the subsurface conditions along the proposed culvert alignment consist of a layer of fill material composed of sand, clayey silt, peat and rock fill. In general, the fill was overlying clayey silt to clay, silty sand with gravel to cobbles and boulders and overlying bedrock. A more detailed summary of the subsurface conditions encountered in the boreholes is provided in the following sections.

1.4.1 Sand Fill

Well graded sand with silt and gravel fill was encountered beneath the asphalt at BH401 and BH402, and silty sand with gravel fill was encountered surfacing BH403. The asphalt thickness at BH401 and BH402 was about 60 mm. The sand fill was generally described as dense to very dense, brown, and damp to moist. Trace asphalt was noted in the upper 0.2 m and upper 0.3 m at BH401 and BH402, respectively, and at BH403, some rock fill and trace roots and rootlets were observed. The SPT "N" values ranged between 40 and 100 (i.e. SPT refusal) blows per 300 mm penetration, with an average "N" value of about 70. The sand fill extended to depths ranging between about 0.9 m and 1.5 m below ground surface and at elevations ranging between about 363.3 m and 364.8 m.

Laboratory testing performed on selected samples consisted of moisture content and grain size distribution tests. The test results are as follows:

Moisture content:

- 2.3% to 22.4%

Grain size distribution:

- 17% gravel;
- 75% sand; and
- 8% silt and clay sizes.

The results of the moisture content and grain size distribution tests are provided on the record of borehole sheets in Appendix C. The results of the grain size distribution tests are also provided on Figure 1, in Appendix D.

1.4.2 Rock Fill

Rock fill was encountered beneath the sand fill at BH401 and BH402. The rock fill was described as angular. At BH402, plastic debris was noted at about 2.1 m depth and some coarse grained gravel was encountered at about 2.4 m depth. One SPT was conducted and the "N" value was 37 blows per 300 mm penetration. The rock fill at BH401 and BH402 extended to depths of about 2.9 m (363.0 m elevation) and 2.8 m (363.1 m elevation) below ground surface, respectively.

Laboratory testing performed on selected samples consisted of moisture content. The test results are as follows:

Moisture content:

- 3.8%

The results of the moisture content tests are provided on the record of borehole sheets in Appendix C.

1.4.3 Peat Fill and Clayey Silt Fill

Alternating layers of peat fill and clayey silt fill were encountered at BH404. The peat fill was generally described very soft, dark brown and wet, and the clayey silt fill was generally described as very soft, grey and wet. The SPT "N" values were all 0 blows per 300 mm penetration (i.e. advanced by weight of hammer and rods alone). The alternating fill layers of peat and clayey silt extended to about 2.0 m (361.9 m elevation) below ground surface.

Laboratory testing performed on selected samples consisted of moisture content. The test results are as follows:

Moisture content:

- 36.5% to 251%

The results of the moisture content tests are provided on the record of borehole sheets in Appendix C.

1.4.4 Peat

Peat was encountered beneath the fill at BH404. The peat was described as very soft, dark brown, and wet. One SPT was conducted and the "N" value was 0 blows per 300 mm penetration (i.e. advanced by weight of hammer and rods alone). The peat thickness was about 0.2 m and extended to about 2.2 m below ground surface (361.6 m elevation).

Laboratory testing performed on selected samples consisted of moisture content. The test results are as follows:

Moisture content:

- 101%

The results of the moisture content test are provided on the record of borehole sheets in Appendix C.

1.4.5 Clayey Silt to Clay

Clayey silt to clay was encountered underlying the fill and peat. The clayey silt to clay was generally described as very soft to hard, grey, and moist to wet. The SPT "N" values ranged between 1 and 32 blows per 300 mm penetration, with an average "N" value of about 8. The clayey silt to clay extended to depths ranging between about 3.1 m and 6.4 m below ground surface, and elevations ranging between 357.5 m and 361.3 m.

Laboratory testing performed on selected samples consisted of moisture content, grain size distribution and Atterberg Limit tests. The test results are as follows:

Moisture content:

- 27.1% to 51.6%

Grain size distribution:

- 0% to 1% gravel;
- 4% to 39% sand;
- 26% to <87% silt; and
- 20% to <87% clay size.

Total saturated unit weights have been calculated based on the moisture contents and are estimated to range from about 16.8 to 19.5 kN/m^3. Three (3) Atterberg Limits tests were performed on representative samples of the clayey silt to clay (BH403-S4, BH404-S6 and BH404-S9). The results indicated that the soil is of low to high plasticity. The data is shown on the plasticity charts, Figures 4 and 5. The liquid limit, plastic limit and plasticity index ranged between about 25 and 56, 16 and 22, and 9 and 38 respectively.

The results of the moisture content, grain size distribution and Atterberg Limits tests are provided on the record of borehole sheets in Appendix C. The results of the grain size distribution are also provided on Figure 2 in Appendix D, and Atterberg Limits tests are provided on Figures 4 and 5 in Appendix D.

1.4.6 Silty Sand with Gravel to Cobbles and Boulders

Silty sand with gravel, silty gravel with sand, and cobbles and boulders were encountered underlying the clayey silt to clay at BH401, BH402 and BH403. The sand and gravel was generally described as dense to very dense, grey and wet. Two SPT sampling tests were conducted and the "N" values were 38 and 100 (i.e. SPT refusal) blows per 300 mm penetration. The silty sand with gravel, silty gravel with sand, and cobbles and boulders extended to about 3.7 m to 5.8 m below ground surface and at elevations ranging between about 360.1 m and 360.9 m.

Laboratory testing performed on selected samples consisted of moisture content, and grain size distribution. The test results are as follows:

Moisture content:

- 9.5% to 15.2%

Grain size distribution:

- 18% to 52% gravel;
- 18% to 56% sand;
- <26% to 26% silt; and
- 4% to <26%clay size.

Total saturated unit weights have been calculated based on the moisture contents and are estimated to range from about 21.7 to 23.0 kN/m^3.

The results of the moisture content, and grain size distribution tests are provided on the record of borehole sheets in Appendix C. The results of the grain size distribution are also provided on Figures 1 and 3 in Appendix D.

1.4.7 Bedrock

Bedrock was encountered underlying the silty gravel with sand at BH401, and beneath the cobbles and boulders at BH402, at depths of about 5.0 m (360.9 m elevation) and 5.8 m (360.1 m elevation), respectively. The bedrock was generally described as a medium strong (25 MPa to 50 MPa compressive strength), sound to very sound, grey to white, and coarse grained granite. The boreholes were extended by rock coring about 2.6 m to 2.8 m into bedrock, and to depths ranging about 7.8 m and 8.4 m below ground surface. The boreholes were terminated at elevations ranging between about 357.5 m and 358.1 m. Photographs of the bedrock core samples are presented in Appendix C, after the Borehole Logs.

Gross recoveries ranged between about 98% and 100%. The Rock Quality Designation (RQD), which is a modified core recovery, ranged from 78% to 100% (sound to very sound).

1.5 Groundwater and Surface Water Conditions

Information on groundwater levels at the site was obtained by measuring the water levels in the open boreholes after completion of drilling. The groundwater levels encountered in the boreholes are shown on the borehole logs and presented below in Table 1.1.

Seasonal variations in the water table should be expected, with higher levels occurring during wetter periods of the year and lower levels during drier periods.

Table 1.1. Groundwater data

Borehole	Date Completed	Date Measured	Ground Surface Elevation[2]	Depth to Water[3]	Groundwater Elevation
BH401	Jun. 23/15	Jun. 23/15	365.87	1.92	363.95
BH402	Jun. 22/15	Jun. 22/15	365.91	2.46	363.45
BH403	Jun. 26/15	Jun. 26/15	364.24	1.17	363.07
BH404	Jun. 25/15	Jun. 26/15	363.88	0.0	363.88
Gagne Lake WL Upstream (South) Side	--	Jun. 26/15			363.52[4]
Gagne Lake WL Downstream (North) Side	--	Jun. 26/15	--	--	363.35[4]

Notes:
1) All units in metres.
2) Elevations surveyed are referenced to a geodetic benchmark (BM) provided (nail in rock) west of the site and north of highway. The BM elevation is 367.214 m.
3) Depths are relative to ground surface.
4) Indicates top of surface water elevation at Gagne Lake.

1.6 Chemical Analyses

Two soil sample were selected for chemical analyses and were sent via courier, in a secure cooler under chain of custody, to Maxxam Analytics Inc., a CALA-certified and accredited laboratory in Mississauga, Ontario. The analytical laboratory results are presented in Appendix E, and are summarized in Table 1.2, below.

Table 1.2. Corrosivity Chemical Analysis

Borehole	pH (unitless)	Chloride (ppm)	Soluble Sulphate (ppm)	Resistivity (ohm-cm)	Conductivity (µS/cm)
BH403-S3	6.59	81	<20	4,800	209
BH404-S5B	6.72	<20	27	8,400	119

1.7 Closure

A subsurface investigation is a limited sampling of a site; the subsurface conditions have been established only at the test hole locations. Should conditions at the site be encountered which differ from those reported at the test locations, we require that we be notified immediately in order to assess this additional information and our recommendations, as appropriate. It may then be necessary to perform additional investigation and analysis.

Contractors bidding on or undertaking any proposed work at this site should, relative to the subsurface conditions, decide on their own investigations, if deemed necessary, as well as their own interpretations of the factual results provided herein, so they may draw their own conclusions as to how the subsurface conditions may affect them.

This Foundation Investigation and Design Report has been prepared by Ahileas Mitsopoulos, P.Eng., Nimesh Tamrakar, M.Eng, EIT., Demetri N. Georgiou, MASc. P.Eng., and Silvana Micic, Ph.D., P.Eng. It was reviewed by TaeChul Kim, P.Eng. and by Stan E. Gonsalves, M.Eng., P.Eng., Designated MTO Foundation Contact. The field investigation was supervised by Elwin Farkas.

Yours truly,

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Encl.

Appendix A –
Site Photographs

Photo 1. Existing culvert inlet on south side of highway

Photo 2. Existing culvert outlet on north side of highway

Photo 3. Facing west on Highway 11 before the existing culvert

Photo 4. Facing east on Highway 11 before the existing culvert

Photo 5. Embankment slope on north side facing west

Photo 6. Embankment slope on south side facing east

Appendix B – Drawings

Agreement No. 6014-E-0017
Assignment No. 6
GWP 6322-14-00

GAGNE LAKE TIMBER CULVERT

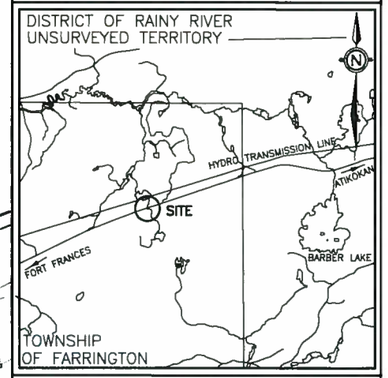
(Highway 11, Township of Farrington, ON)

PLAN

DWG 1

exp. **exp** Services Inc.

KEY PLAN



LEGEND

- BH401 365.87 — BOREHOLE LOCATION GROUND SURFACE ELEVATION IN METRES
- BM 367.214 — BENCHMARK LOCATION GEODETIC ELEVATION IN METRES

BH No.	APPROX. ELEV. (m)	MTM COORDINATES	
		NORTH	EAST
BH401	365.87	5,399,447	315,641
BH402	365.91	5,399,455	315,648
BH403	364.24	5,399,466	315,647
BH404	363.88	5,399,437	315,656

NOTES

1. ALL DIMENSIONS ARE IN METRES.
2. BASE MAP PROVIDED BY CLIENT.
3. MTM COORDINATES BASE ON MTM ZONE ON-16 PROJECTION, AS PER PROVIDED FIGURE.
4. THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. THE PROPOSED STRUCTURE DETAILS/WORKS ARE SHOWN FOR ILLUSTRATION PURPOSES ONLY.

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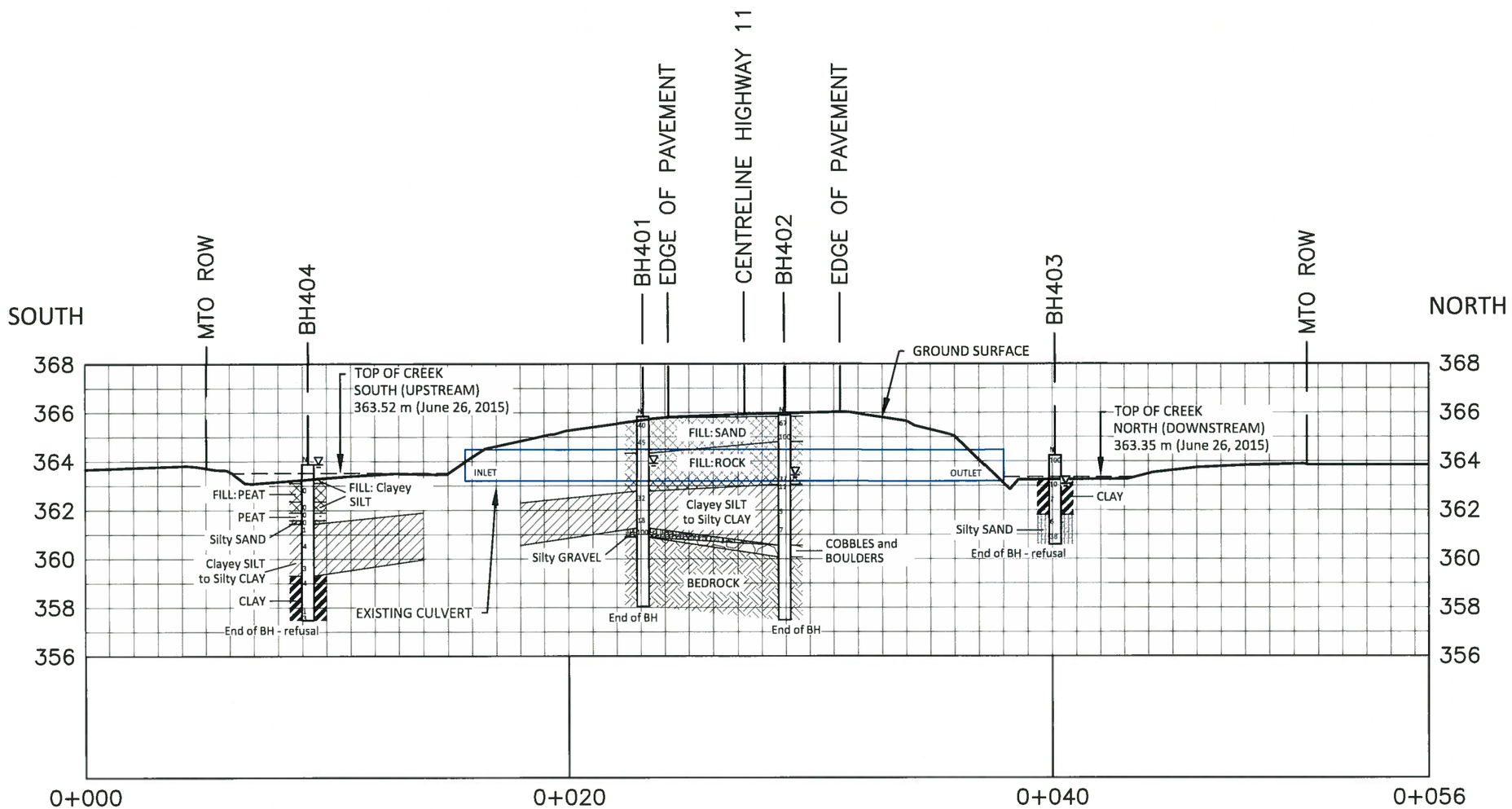
REVISIONS		
DATE	BY	DESCRIPTION

GEOCRES No. 52C-047	Project No. ADM-00223648-E0
Date: December 11, 2015	Scale : 1:250
Drawn By: RM	Checked By: AM
	Checked By: DG



A - A'
PROFILE OF GAGNE LAKE CULVERT

2 0 2 4
IN METRES

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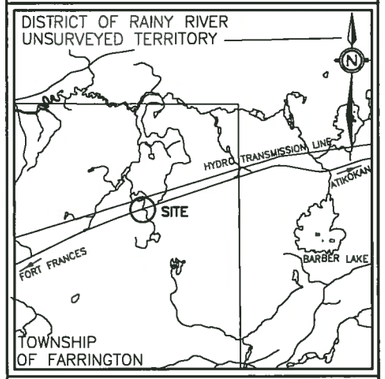
Agreement No. 6014-E-0017
Assignment No. 6
GWP 6322-14-00

GAGNE LAKE TIMBER CULVERT
(Highway 11, Township of Farrington, ON)
SECTION A-A'

DWG 2

*exp. **exp** Services Inc.

KEY PLAN



LEGEND

N STANDARD PENETRATION TEST (BLOWS/0.3 m)

▽ MEASURED WATER LEVEL

BH No.	APPROX. ELEV. (m)	MTM COORDINATES	
		NORTH	EAST
BH401	365.87	5,399,447	315,641
BH402	365.91	5,399,455	315,648
BH403	364.24	5,399,466	315,647
BH404	363.88	5,399,437	315,656

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REVISIONS

DATE	BY	DESCRIPTION

GEOCRES No. 52C-047	Project No. ADM-00223648-E0
Date: December 11, 2015	Horizontal Scale : 1:200
Drawn By: RM	Vertical Scale : 1:200
Checked By: AM	Checked By: DG

Appendix C –
Borehole Logs and Bedrock Core Photos

Explanation of Terms Used on Borehole Records

SOIL DESCRIPTION

Terminology describing common soil genesis:

Topsoil: mixture of soil and humus capable of supporting good vegetative growth.

Peat: fibrous fragments of visible and invisible decayed organic matter.

Fill: where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc.; none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional geotechnical site investigation.

Till: the term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

Terminology describing soil structure:

Desiccated: having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.

Stratified: alternating layers of varying material or color with the layers greater than 6 mm thick.

Laminated: alternating layers of varying material or color with the layers less than 6 mm thick.

Fissured: material breaks along plane of fracture.

Varved: composed of regular alternating layers of silt and clay.

Slickensided: fracture planes appear polished or glossy, sometimes striated.

Blocky: cohesive soil that can be broken down into small angular lumps which resist further breakdown.

Lensed: inclusion of small pockets of different soil, such as small lenses of sand scattered through a mass of clay; not thickness.

Seam: a thin, confined layer of soil having different particle size, texture, or color from materials above and below.

Homogeneous: same color and appearance throughout.

Well Graded: having wide range in grain sized and substantial amounts of all predominantly on grain size.

Uniformly Graded: predominantly on grain size.

All soil sample descriptions included in this report follow generally the ASTM D2487-11 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) with some modification to reflect current MTO practices. The system divides soils into three major categories: (1) coarse grained, (2) fine-grained, and (3) highly organic. The soil is then subdivided based on either gradation or plasticity characteristics. The system provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification. The classification excludes particles larger than 76 mm. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually in accordance with ASTM D2488-09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems. Others may use different classification systems; one such system is the ISSMFE Soil Classification.

ISSMFE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE		

0.002	0.006	0.02	0.06	0.2	0.6	2.0	6.0	20	60	200

EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

CLAY (PLASTIC) TO	FINE	MEDIUM	CRS.	FINE	COARSE
SILT (NONPLASTIC)	SAND			GRAVEL	

UNIFIED SOIL CLASSIFICATION

Terminology describing materials outside the USCS, (e.g. particles larger than 76 mm, visible organic matter, construction debris) is based upon the proportion of these materials present and as described below in accordance with Note 16 in ASTM D2488-09a:

Table a: Percent or Proportion of Soil, Pp

	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5≤Pp≤10%
Little	15≤Pp≤25%
Some	30≤Pp≤45%
Mostly	50≤Pp≤100%

The standard terminology to describe cohesionless soils includes the compactness as determined by the Standard Penetration Test 'N' value:

Table b: Apparent Density of Cohesionless Soil

	'N' Value (blows/0.3 m)
Very Loose	N<5
Loose	5≤N<10
Compact	10≤N<30
Dense	30≤N<50
Very Dense	50≤N

The standard terminology to describe cohesive soils includes consistency, which is based on undrained shear strength as measured by insitu vane tests, penetrometer tests, unconfined compression tests or similar field and laboratory analysis, Standard Penetration Test 'N' values can also be used to provide an approximate indication of the consistency and shear strength of fine grained, cohesive soils:

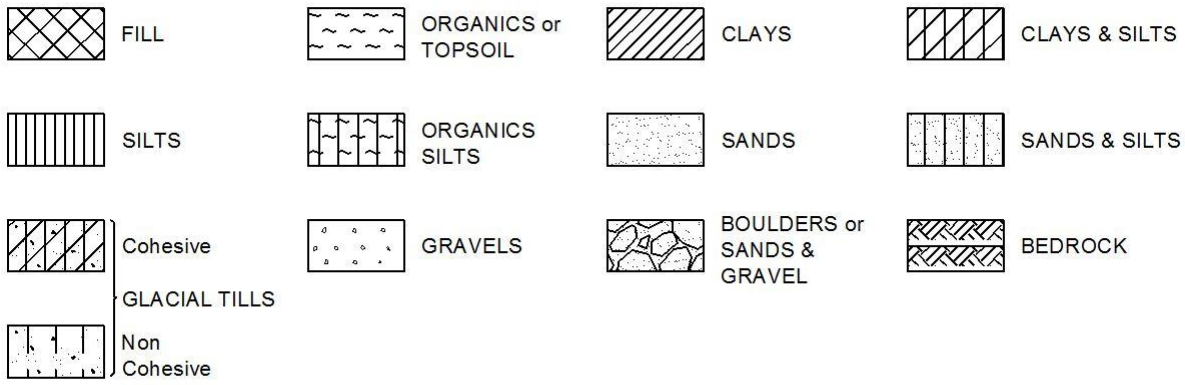
Table c: Consistency of Cohesive Soil

Consistency	Vane Shear Measurement (kPa)	'N' Value
Very Soft	<12.5	<2
Soft	12.5-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

Note: 'N' Value - The Standard Penetration Test records the number of blows of a 140 pound (64kg) hammer falling 30 inches (760mm), required to drive a 2 inch (50.8mm) O.D. split spoon sampler 1 foot (305mm). For split spoon samples where full penetration is not achieved, the number of blows is reported over the sampler penetration in meters (e.g. 50/0.15).

STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols:



WATER LEVEL MEASUREMENT

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

SS	Split spoon sample (obtained from the Standard Penetration Test)
WS	Wash sample
BS	Bulk sample
TW	Thin wall sample or Shelby tube
PS	Piston sample
AS	Auger sample
VT	Vane test
GS	Grab sample
HQ, NQ, etc.	Rock core samples obtained with the use of standard size diamond drilling bits

STRESS AND STRAIN

u_w	kPa	Pore water pressure
r_u	1	Pore pressure ratio
σ	kPa	Total normal stress
σ'	kPa	Effective normal stress
τ	kPa	Shear stress
$\sigma_1, \sigma_2, \sigma_3$	kPa	Principal stresses
ε	%	Linear strain
$\varepsilon_1, \varepsilon_2, \varepsilon_3$	%	Principal strains
E	kPa	Modulus of linear deformation
G	kPa	Modulus of shear deformation
μ	1	Coefficient of friction

MECHANICALL PROPERIES OF SOIL

m_v	kPa^{-1}	Coefficient of volume change
c_c	1	Compression index
c_s	1	Swelling index
c_r	1	Recompression index
c_v	m^2/s	Coefficient of consolidation
H	m	Drainage path
T_V	1	Time factor
U	%	Degree of consolidation
σ'_{v0}	kPa	Effective overburden pressure
σ'_P	kPa	Preconsolidation pressure
τ_f	kPa	Shear strength
c'	kPa	Effective cohesion intercept
ϕ'	$-°$	Effective angle of internal friction
c_u	kPa	Apparent cohesion intercept
ϕ_u	$-°$	Apparent angle of internal friction
τ_R	kPa	Residual shear strength
τ_r	kPa	Remoulded shear strength
S_t	1	Sensitivity = c_u/τ_r

PHYSICAL PROPERTIES OF SOIL

P_s	kg/m^3	Density of solid particles
γ_s	kN/m^3	Unit weight of solid particles
ρ_w	kg/m^3	Density of water
γ_w	kN/m^3	Unit weight of water
ρ	kg/m^3	Density of soil
γ	kN/m^3	Unit weight of soil
ρ_d	kg/m^3	Density of dry soil
γ_d	kN/m^3	Unit weight of dry soil
ρ_{sat}	kg/m^3	Density of saturated soil
γ_{sat}	kN/m^3	Unit weight of saturated soil
ρ'	kg/m^3	Density of submerged soil
γ'	kN/m^3	Unit weight of submerged soil
e	1, %	Void ratio
n	1, %	Porosity
w	1, %	Water content
S_r	%	Degree of saturation
W_L	%	Liquid limit
W_P	%	Plastic limit
W_s	%	Shrinkage limit
I_P	%	Plasticity index = $(W_L - W_P)$
I_L	%	Liquidity index = $(W - W_P)/I_P$
I_C	%	Consistency index = $(W_L - W)/I_P$
e_{max}	1, %	Void ratio in loosest state
e_{min}	1, %	Void ratio in densest state
I_D	1	Density index = $(e_{max} - e)/(e_{max} - e_{min})$
D	mm	Grain diameter
D_n	mm	N percent - diameter
C_u	1	Uniformity coefficient
h	m	Hydraulic head or potential
q	m^3/s	Rate of discharge
v	m/s	Discharge velocity
i	1	Hydraulic gradient
k	m/s	Hydraulic conductivity
j	kN/m^3	Seepage force

RECORD OF BOREHOLE No BH401

1 OF 1

METRIC

W.P. GWP No. 6322-14-00 LOCATION **Gagne Lake Culvert (Site No. 45-275/C) MTM ON-16 5,399,447N 315,641E** ORIGINATED BY EF

DIST 61 HWY Hwy 11 BOREHOLE TYPE CME 850 Track Carrier / HSA / HQ COMPILED BY RM

DATUM **Geodetic** DATE 6.22.15 - 6.23.15 CHECKED BY DG/AM

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
365.9	Asphalt										
365.8	**ASPHALT** - about 60 mm										
0.1	**Well Graded SAND with Silt and Gravel** - dense, brown, damp to moist, trace asphalt in upper 0.2 m		S1A	SS							
			S1B	SS	40						
			S1C	SS							
			S2	SS	45		365				
364.3											
1.5	**ROCK FILL** - angular - advanced HQ casing from about 1.5 m to 2.9 m depth					▽	364				No sample recovery
363.0							363				
2.9	**Clayey SILT to Silty CLAY** - very stiff to hard, grey, wet		S3	SS	32						gravel blocking SPT tip
							362				
			S4	SS	18						gravel blocking SPT tip
361.3											
4.6	**Silty GRAVEL with Sand** - very dense, grey, wet		S5	SS	100		361				52 18 26 4
360.9											
5.0	**BEDROCK** - medium strong, grey to white, sound to very sound, coarse grained, granite		S6	CORE							Recovery = 99%, RQD = 84%
	- becoming very sound at about 5.6 m depth		S7	CORE			360				Recovery = 98%, RQD = 98%
							359				
			S8	CORE							Recovery=100%, RQD = 100%
358.1											
7.8	**End of Borehole**										

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No BH402 1 OF 1 METRIC

W.P. GWP No. 6322-14-00 LOCATION **Gagne Lake Culvert (Site No. 45-275/C) MTM ON-16 5,399,455N 315,648E** ORIGINATED BY EF

DIST 61 HWY Hwy 11 BOREHOLE TYPE CME 850 Track Carrier / HSA / HQ COMPILED BY RM

DATUM **Geodetic** DATE 6.21.15 - 6.22.15 CHECKED BY DG/AM

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
365.9	Asphalt										
365.8	**ASPHALT** - about 60 mm										
0.1	**Well Graded SAND with Silt and Gravel** - very dense, brown, damp to moist, trace asphalt in upper 0.3 m		S1A	SS							
			S1B	SS	67						
			S1C	SS							
364.8			S2	SS	100		365				17 75 (8)
1.1	**ROCK FILL** - angular		S3	CORE			364				
	- plastic debris at about 2.1 m depth										
	- some coarse grained gravel at about 2.4 m depth		S4A	SS	37	▽					
363.1											
2.8	**Clayey SILT to Silty CLAY** - firm to hard, grey, moist to wet		S4B	SS	11		363				0 39 26 35
			S5	SS	5						1 12 (87)
			S6	VANE			362	>> 2			Field Vane = 310 kPa
				SS	7						No recovery
360.6			S7	VANE			361	>> 3			Field Vane = 155 kPa
5.3	**COBBLES AND BOULDERS**		S8	CORE							
360.1											
5.8	**BEDROCK** - medium strong, grey to white, very sound to sound, coarse grained, granite		S9	CORE			360				Recovery=99%, RQD=97%
			S10	CORE			359				Recovery=100%, RQD=78%
357.5							358				
8.4	**End of Borehole**										

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No BH403 1 OF 1 METRIC

W.P. GWP No. 6322-14-00 LOCATION **Gagne Lake Culvert (Site No. 45-275/C) MTM ON-16 5,399,466N 315,647E** ORIGINATED BY EF

DIST 61 HWY Hwy 11 BOREHOLE TYPE CME 850 Track Carrier / HSA COMPILED BY RM

DATUM **Geodetic** DATE 6.26.15 - 6.26.15 CHECKED BY DG/AM

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
364.2	Sand and Gravel										
0.0	**Silty SAND with Gravel (FILL)** - very dense, brown, moist to wet, some rock fill, trace roots and rootlets		S1	SS	100		364				
363.3			S2	AS							
0.9	**CLAY** - firm to very stiff, grey, moist to wet		S3	SS	10	▽	363				
			S4	SS	7						
			S5	VANE			362	>>1			Field Vane = 266 kPa
361.2			S6	SS	6						
3.1	**Silty SAND with Gravel** - dense, grey, wet		S7	SS	38		361				18 56 (26)
360.6											
3.7	**End of Borehole** - refusal to SPT and auger										

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No BH404 1 OF 1 METRIC

W.P. GWP No. 6322-14-00 LOCATION **Gagne Lake Culvert (Site No. 45-275/C) MTM ON-16 5,399,437N 315,656E** ORIGINATED BY EF

DIST 61 HWY Hwy 11 BOREHOLE TYPE CME 850 Track Carrier / HSA COMPILED BY RM

DATUM **Geodetic** DATE 6.25.15 - 6.26.15 CHECKED BY DG/AM

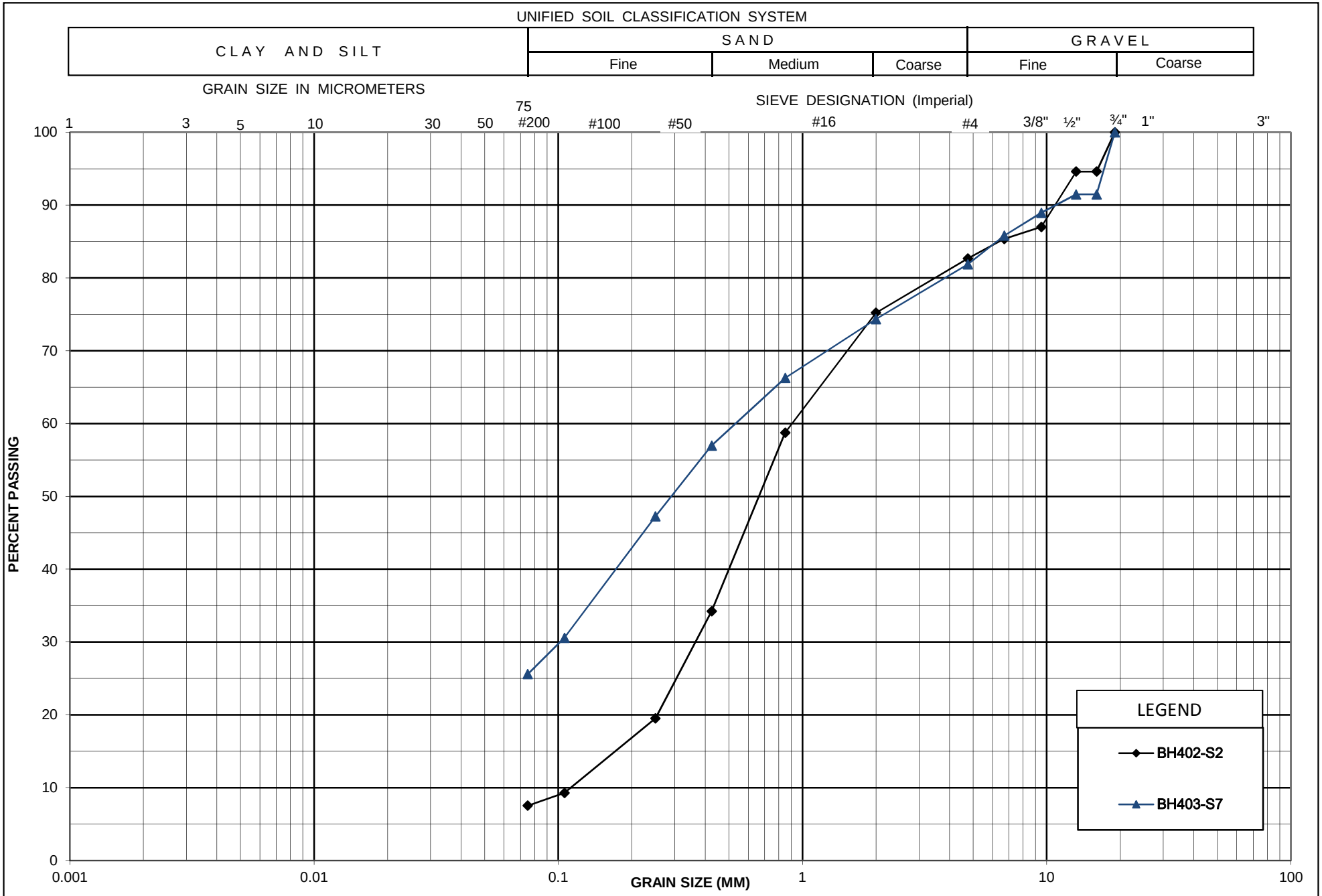
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
363.9	Peat										
0.0 / 363.6	**PEAT (FILL)** - very soft, dark brown, wet, trace roots and rootlets		S1	SS	0				160.7		
0.3 / 363.1	**Clayey SILT (FILL)** - very soft, grey, wet, some peat, trace roots and rootlets		S2	SS	0						No recovery
0.8 / 362.4	**PEAT (FILL)** - very soft, dark brown, wet		S3	SS	0		363		251		
1.5 / 361.9	**Clayey SILT (FILL)** - very soft, grey, wet		S4A	SS	0				94.3		
2.0 / 361.6	**PEAT** - very soft, dark brown, wet		S4B	SS	0		362		101		
2.2 / 361.4	**Silty SAND** - very loose, grey, wet, fine grained		S5A	SS	0						
2.4	**Clayey SILT to Silty CLAY** - very soft to hard, grey, moist to wet		S5B	SS	1						
			S6	SS	4		361				0 4 76 20
			S7	VANE				>> 2			Field Vane = 200 kPa
359.3			S8	SS	3		360				
4.6	**CLAY** - very soft to hard, grey, moist to wet		S9	SS	4		359				
			S10	VANE				>> 2			Field Vane = 200 kPa
357.6			S11A	SS	1		358				
357.3	**Clayey SILT to Silty CLAY** - soft, grey, moist to wet		S11B	SS	3						
6.4	**End of Borehole** - refusal to SPT and auger										

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

BH401 - Bedrock Core Samples with Depths and Elevations

BH402 - Bedrock Core Samples with Depths and Elevations

Appendix D – Laboratory Data



exp

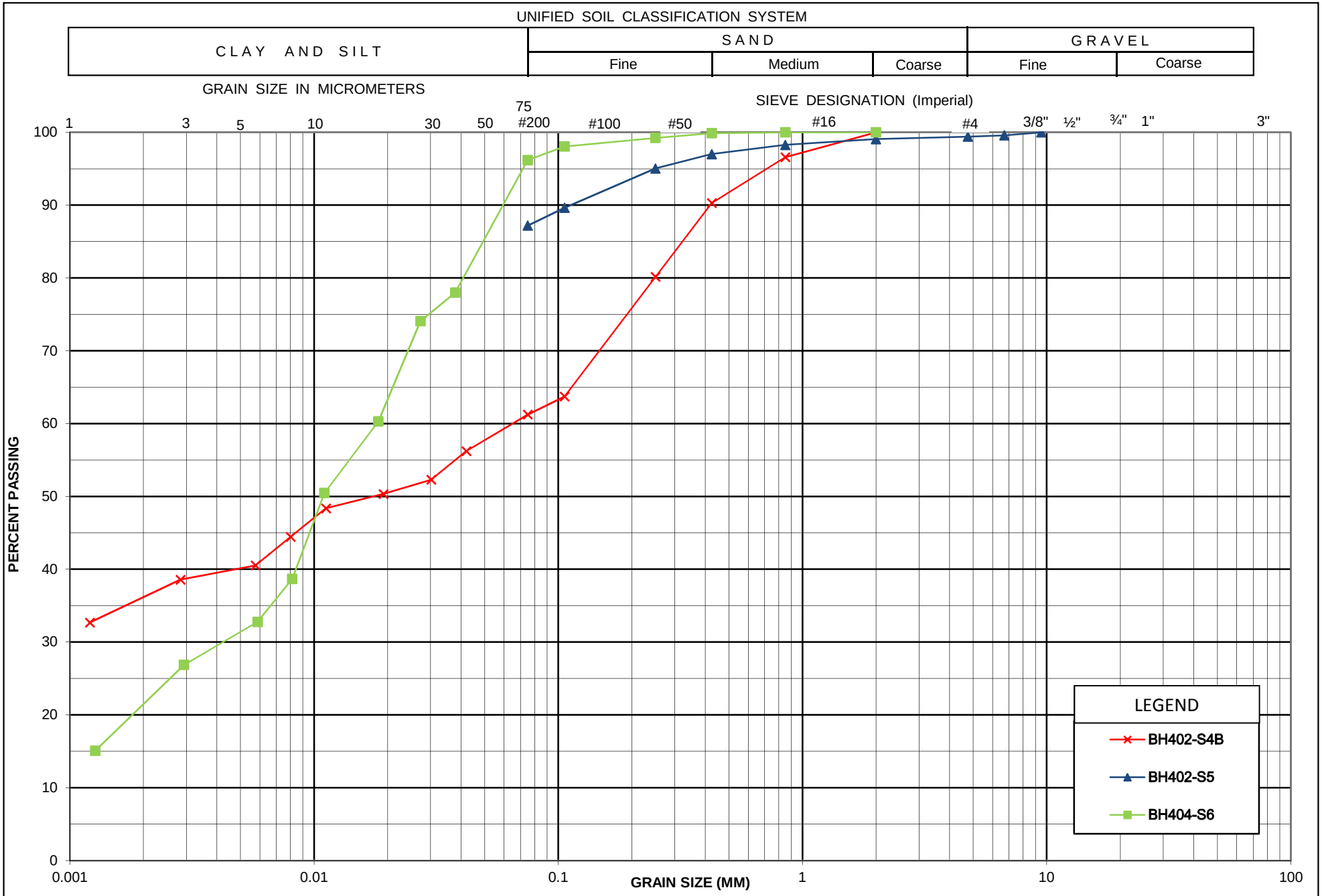
GRAIN SIZE DISTRIBUTION

SAND

FIGURE: No. 1

GWP: 6322-14-00

DATE : August 20, 2015



exp

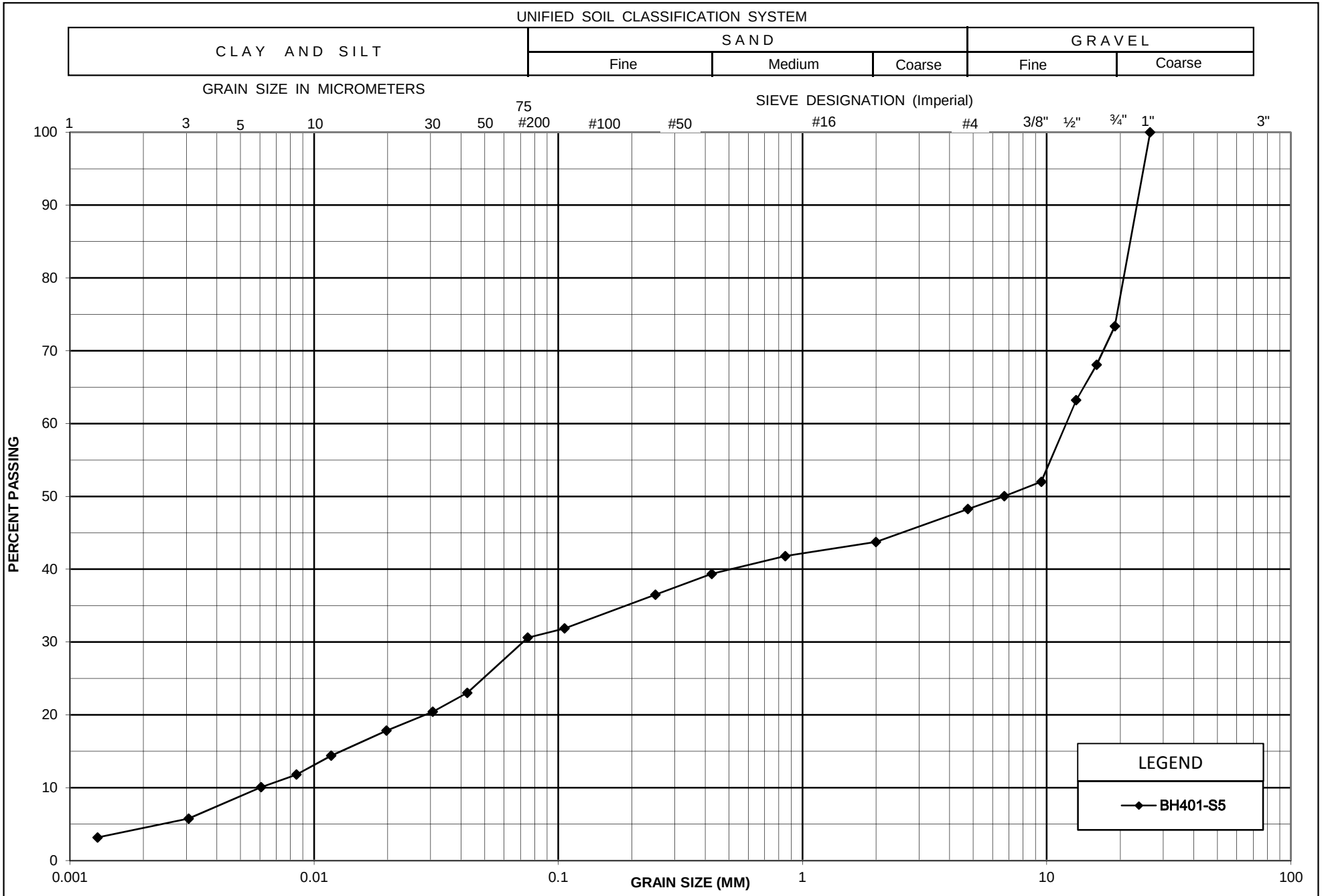
GRAIN SIZE DISTRIBUTION

Clayey SILT to Silty CLAY

FIGURE: No. 2

GWP: 6322-14-00

DATE : August 20, 2015



GRAIN SIZE DISTRIBUTION

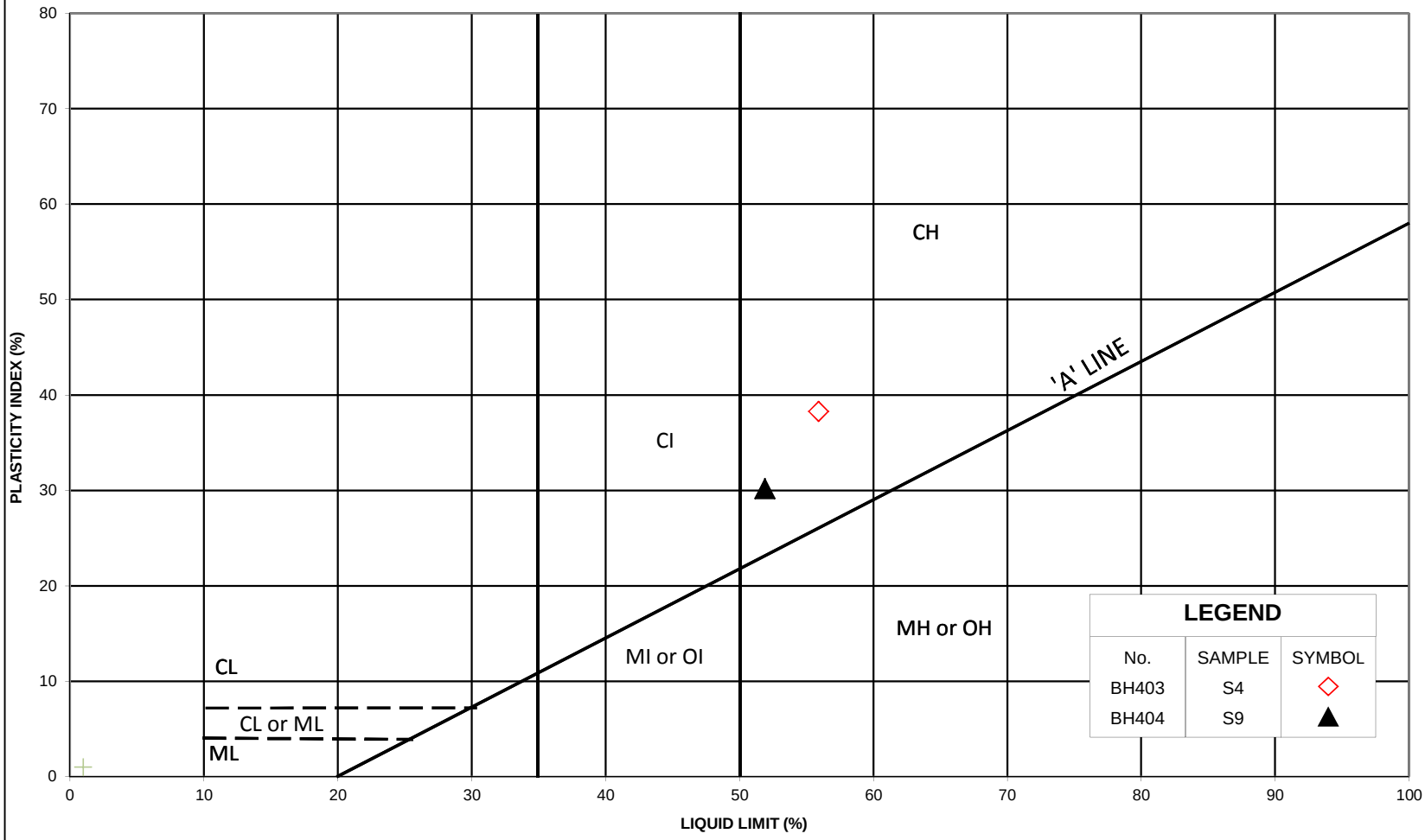
Silty GRAVEL with Sand

FIGURE: No. 3

GWP: 6322-14-00

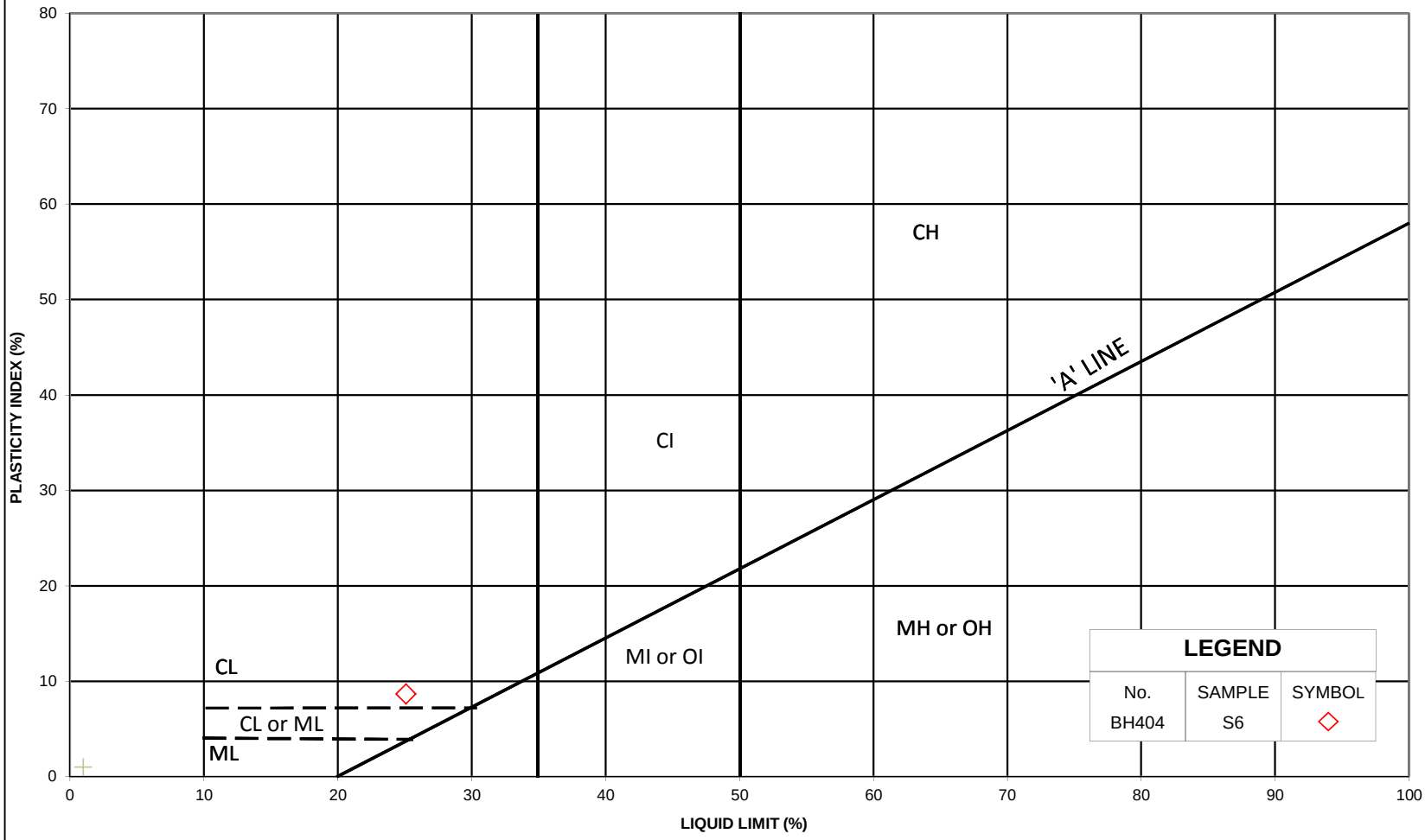
DATE : August 20, 2015

Gagne Lake Culvert (Site No. 45-275/C)
GWP No. 6322-14-00, Highway 11, District of Rainy River, Ontario



exp.	PLASTICITY CHART ***CLAY***	FIGURE No. 4 ADM-00223648-E0 August 20, 2015

Gagne Lake Culvert (Site No. 45-275/C)
GWP No. 6322-14-00, Highway 11, District of Rainy River, Ontario



exp.

PLASTICITY CHART

Clayey SILT

FIGURE No. 5

ADM-00223648-E0

August 20, 2015

Appendix E – Chemical Analyses

Your Project #: ADM-00223648-E0
Site Location: MTO ASSIGNMENT #6 - HWYS 11 & 502
Your C.O.C. #: na

Attention:Ahileas Mitsopoulos/Michael S

exp Services Inc
Thunder Bay Branch
1142 Roland St
Thunder Bay, ON
P7B 5M4

Report Date: 2015/07/09
Report #: R3568313
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B5C9097
Received: 2015/07/03, 10:55

Sample Matrix: Soil
Samples Received: 10

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Chloride (20:1 extract)	10	N/A	2015/07/09	CAM SOP-00463	EPA 325.2 m
Conductivity	10	N/A	2015/07/08	CAM SOP-00414	OMOE E3138 v2 m
pH CaCl2 EXTRACT	10	2015/07/08	2015/07/08	CAM SOP-00413	EPA 9045 D m
Resistivity of Soil	5	2015/07/03	2015/07/08	CAM SOP-00414	SM 22 2510 m
Resistivity of Soil	5	2015/07/03	2015/07/09	CAM SOP-00414	SM 22 2510 m
Sulphate (20:1 Extract)	10	N/A	2015/07/09	CAM SOP-00464	EPA 375.4 m

Remarks:

Maxxam Analytics has performed all analytical testing herein in accordance with ISO 17025 and the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act. All methodologies comply with this document and are validated for use in the laboratory. The methods and techniques employed in this analysis conform to the performance criteria (detection limits, accuracy and precision) as outlined in the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act.

The CWS PHC methods employed by Maxxam conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following the 'Alberta Environment Draft Addenda to the CWS-PHC, Appendix 6, Validation of Alternate Methods'. Documentation is available upon request. Maxxam has made the following improvements to the CWS-PHC reference benchmark method: (i) Headspace for F1; and, (ii) Mechanical extraction for F2-F4. Note: F4G cannot be added to the C6 to C50 hydrocarbons. The extraction date for samples field preserved with methanol for F1 and Volatile Organic Compounds is considered to be the date sampled.

Maxxam Analytics is accredited for all specific parameters as required by Ontario Regulation 153/04. Maxxam Analytics is limited in liability to the actual cost of analysis unless otherwise agreed in writing. There is no other warranty expressed or implied. Samples will be retained at Maxxam Analytics for three weeks from receipt of data or as per contract.

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.

Your Project #: ADM-00223648-E0
Site Location: MTO ASSIGNMENT #6 - HWYS 11 & 502
Your C.O.C. #: na

Attention:Ahileas Mitsopoulos/Michael S

exp Services Inc
Thunder Bay Branch
1142 Roland St
Thunder Bay, ON
P7B 5M4

Report Date: 2015/07/09
Report #: R3568313
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B5C9097
Received: 2015/07/03, 10:55

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Hina Siddiqui, Project Manager –Environmental Customer Service
Email: HSiddiqui@maxxam.ca
Phone# (905) 817-5700
==========
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 Job #: B5C9097
Report Date: 2015/07/09

exp Services Inc
Client Project #: ADM-00223648-E0
Site Location: MTO ASSIGNMENT #6 - HWYS 11 & 502

RESULTS OF ANALYSES OF SOIL

Maxxam ID		AOD715	AOD716	AOD716	AOD717	AOD718		
Sampling Date		2015/06/19 14:10	2015/06/27 12:15	2015/06/27 12:15	2015/06/28 10:20	2015/06/28 17:00		
COC Number		na	na	na	na	na		
	Units	**BH101-S7**	**BH104-S3B/S4/S5**	**BH104-S3B/S4/S5 Lab-Dup**	**BH201-S7A**	**BH203-S3**	**RDL**	**QC Batch**
Calculated Parameters								
Resistivity	ohm-cm	1300	2500		3300	1800		4091370
Inorganics								
Soluble (20:1) Chloride (Cl)	ug/g	790	190	200	170	320	20	4094438
Conductivity	umho/cm	773	395	399	301	557	2	4096183
Available (CaCl2) pH	pH	6.34	6.65		5.49	5.43	N/A	4094481
Soluble (20:1) Sulphate (SO4)	ug/g	270	25	24	<20	<20	20	4094443

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

Maxxam ID		AOD719	AOD720	AOD721	AOD722	AOD723	AOD724		
Sampling Date		2015/06/20 07:25	2015/06/26 06:20	2015/06/26 16:15	2015/06/25 15:30	2015/06/25 10:30	2015/06/25 14:10		
COC Number		na	na	na	na	na	na		
	Units	**BH301-S9B/S10/S11**	**BH304-S3**	**BH403-S3**	**BH404-S5B**	**BH503-S4**	**BH504-S1B**	**RDL**	**QC Batch**
Calculated Parameters									
Resistivity	ohm-cm	2300	7000	4800	8400	5300	1500		4091370
Inorganics									
Soluble (20:1) Chloride (Cl)	ug/g	220	36	81	<20	89	370	20	4094438
Conductivity	umho/cm	435	143	209	119	190	646	2	4096183
Available (CaCl2) pH	pH	6.54	6.72	6.59	6.72	5.89	4.90	N/A	4094481
Soluble (20:1) Sulphate (SO4)	ug/g	30	<20	<20	27	<20	<20	20	4094443

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Maxxam Job #: B5C9097
Report Date: 2015/07/09

exp Services Inc
Client Project #: ADM-00223648-E0
Site Location: MTO ASSIGNMENT #6 - HWYS 11 & 502

TEST SUMMARY

Maxxam ID: AOD715
Sample ID: BH101-S7
Matrix: Soil

Collected: 2015/06/19
Shipped:
Received: 2015/07/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	4094438	N/A	2015/07/09	Deonarine Ramnarine
Conductivity	AT	4096183	N/A	2015/07/08	Lemeneh Addis
pH CaCl2 EXTRACT	AT	4094481	2015/07/08	2015/07/08	Surinder Rai
Resistivity of Soil		4091370	2015/07/08	2015/07/08	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	4094443	N/A	2015/07/09	Deonarine Ramnarine

Maxxam ID: AOD716
Sample ID: BH104-S3B/S4/S5
Matrix: Soil

Collected: 2015/06/27
Shipped:
Received: 2015/07/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	4094438	N/A	2015/07/09	Deonarine Ramnarine
Conductivity	AT	4096183	N/A	2015/07/08	Lemeneh Addis
pH CaCl2 EXTRACT	AT	4094481	2015/07/08	2015/07/08	Surinder Rai
Resistivity of Soil		4091370	2015/07/08	2015/07/08	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	4094443	N/A	2015/07/09	Deonarine Ramnarine

Maxxam ID: AOD716 Dup
Sample ID: BH104-S3B/S4/S5
Matrix: Soil

Collected: 2015/06/27
Shipped:
Received: 2015/07/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	4094438	N/A	2015/07/09	Deonarine Ramnarine
Conductivity	AT	4096183	N/A	2015/07/08	Lemeneh Addis
Sulphate (20:1 Extract)	KONE/EC	4094443	N/A	2015/07/09	Deonarine Ramnarine

Maxxam ID: AOD717
Sample ID: BH201-S7A
Matrix: Soil

Collected: 2015/06/28
Shipped:
Received: 2015/07/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	4094438	N/A	2015/07/09	Deonarine Ramnarine
Conductivity	AT	4096183	N/A	2015/07/08	Lemeneh Addis
pH CaCl2 EXTRACT	AT	4094481	2015/07/08	2015/07/08	Surinder Rai
Resistivity of Soil		4091370	2015/07/08	2015/07/08	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	4094443	N/A	2015/07/09	Deonarine Ramnarine

Maxxam ID: AOD718
Sample ID: BH203-S3
Matrix: Soil

Collected: 2015/06/28
Shipped:
Received: 2015/07/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	4094438	N/A	2015/07/09	Deonarine Ramnarine
Conductivity	AT	4096183	N/A	2015/07/08	Lemeneh Addis
pH CaCl2 EXTRACT	AT	4094481	2015/07/08	2015/07/08	Surinder Rai
Resistivity of Soil		4091370	2015/07/08	2015/07/08	Automated Statchk

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Maxxam Job #: B5C9097
Report Date: 2015/07/09

exp Services Inc
Client Project #: ADM-00223648-E0
Site Location: MTO ASSIGNMENT #6 - HWYS 11 & 502

TEST SUMMARY

Maxxam ID: AOD718
Sample ID: BH203-S3
Matrix: Soil

Collected: 2015/06/28
Shipped:
Received: 2015/07/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphate (20:1 Extract)	KONE/EC	4094443	N/A	2015/07/09	Deonarine Ramnarine

Maxxam ID: AOD719
Sample ID: BH301-S9B/S10/S11
Matrix: Soil

Collected: 2015/06/20
Shipped:
Received: 2015/07/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	4094438	N/A	2015/07/09	Deonarine Ramnarine
Conductivity	AT	4096183	N/A	2015/07/08	Lemeneh Addis
pH CaCl2 EXTRACT	AT	4094481	2015/07/08	2015/07/08	Surinder Rai
Resistivity of Soil		4091370	2015/07/08	2015/07/08	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	4094443	N/A	2015/07/09	Deonarine Ramnarine

Maxxam ID: AOD720
Sample ID: BH304-S3
Matrix: Soil

Collected: 2015/06/26
Shipped:
Received: 2015/07/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	4094438	N/A	2015/07/09	Deonarine Ramnarine
Conductivity	AT	4096183	N/A	2015/07/08	Lemeneh Addis
pH CaCl2 EXTRACT	AT	4094481	2015/07/08	2015/07/08	Surinder Rai
Resistivity of Soil		4091370	2015/07/09	2015/07/09	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	4094443	N/A	2015/07/09	Deonarine Ramnarine

Maxxam ID: AOD721
Sample ID: BH403-S3
Matrix: Soil

Collected: 2015/06/26
Shipped:
Received: 2015/07/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	4094438	N/A	2015/07/09	Deonarine Ramnarine
Conductivity	AT	4096183	N/A	2015/07/08	Lemeneh Addis
pH CaCl2 EXTRACT	AT	4094481	2015/07/08	2015/07/08	Surinder Rai
Resistivity of Soil		4091370	2015/07/09	2015/07/09	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	4094443	N/A	2015/07/09	Deonarine Ramnarine

Maxxam ID: AOD722
Sample ID: BH404-S5B
Matrix: Soil

Collected: 2015/06/25
Shipped:
Received: 2015/07/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	4094438	N/A	2015/07/09	Deonarine Ramnarine
Conductivity	AT	4096183	N/A	2015/07/08	Lemeneh Addis
pH CaCl2 EXTRACT	AT	4094481	2015/07/08	2015/07/08	Surinder Rai
Resistivity of Soil		4091370	2015/07/09	2015/07/09	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	4094443	N/A	2015/07/09	Deonarine Ramnarine

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Maxxam Job #: B5C9097
Report Date: 2015/07/09

exp Services Inc
Client Project #: ADM-00223648-E0
Site Location: MTO ASSIGNMENT #6 - HWYS 11 & 502

TEST SUMMARY

Maxxam ID: AOD723
Sample ID: BH503-S4
Matrix: Soil

Collected: 2015/06/25
Shipped:
Received: 2015/07/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	4094438	N/A	2015/07/09	Deonarine Ramnarine
Conductivity	AT	4096183	N/A	2015/07/08	Lemeneh Addis
pH CaCl2 EXTRACT	AT	4094481	2015/07/08	2015/07/08	Surinder Rai
Resistivity of Soil		4091370	2015/07/09	2015/07/09	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	4094443	N/A	2015/07/09	Deonarine Ramnarine

Maxxam ID: AOD724
Sample ID: BH504-S1B
Matrix: Soil

Collected: 2015/06/25
Shipped:
Received: 2015/07/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	4094438	N/A	2015/07/09	Deonarine Ramnarine
Conductivity	AT	4096183	N/A	2015/07/08	Lemeneh Addis
pH CaCl2 EXTRACT	AT	4094481	2015/07/08	2015/07/08	Surinder Rai
Resistivity of Soil		4091370	2015/07/09	2015/07/09	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	4094443	N/A	2015/07/09	Deonarine Ramnarine

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exp Services Inc
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GENERAL COMMENTS

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

Package 1	2.7°C

Results relate only to the items tested.

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Maxxam Job #: B5C9097
Report Date: 2015/07/09

QUALITY ASSURANCE REPORT

exp Services Inc
Client Project #: ADM-00223648-E0
Site Location: MTO ASSIGNMENT #6 - HWYS 11 & 502

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits
4094438	Soluble (20:1) Chloride (Cl)	2015/07/09	NC	70 - 130	107	70 - 130	<20	ug/g	6.5	35
4094443	Soluble (20:1) Sulphate (SO4)	2015/07/09	NC	70 - 130	109	70 - 130	<20	ug/g	NC	35
4094481	Available (CaCl2) pH	2015/07/08			100	97 - 103			0.51	N/A
4096183	Conductivity	2015/07/08			102	90 - 110	<2	umho/cm	1.0	10

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.

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 (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

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 (one or both samples < 5x RDL).

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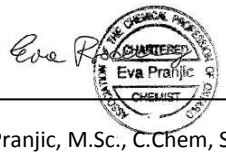
Site Location: MTO ASSIGNMENT #6 - HWYS 11 & 502

VALIDATION SIGNATURE PAGE

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



Ewa Pranjic, M.Sc., C.Chem, Scientific 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.

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Phone: 905-817-5700 Fax: 905-817-5779 Toll Free: 800-563-6266

IMMEDIATE TEST

CHAIN OF CUSTODY RECORD

Page 1 of 1

INVOICE INFORMATION	REPORT INFORMATION (if differs from invoice)	PROJECT INFORMATION	TURNAROUND TIME (TAT) REQUIRED
Company Name: exp Services Inc.	Company Name:	Quotation #:	[x] Regular TAT (5-7 days)
Contact Name: Michael Suslyk, Ahileas Mitsopoulos	Contact Name:	P.O. #:	PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address: 1142 Roland Street	Address:	Project #: ADM-00223648-E0	Rush TAT (Applicable Surcharge)
Thunder Bay, ON P7B 5M4		Site Location: MTO Assignment # 6 - Hwys 11 & 502	[ ] 1 Day (100%)
Phone: 807.623.9495 Fax: 807.623.8070	Phone: Fax:	Site #:	[ ] 2 Days (50%)
Email: michael.suslyk@exp.com, ahileas.mitsopoulos@exp.com	Email:	Sampled By: Elwin Farkas	[ ] 3-4 Days (25%)

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY

REGULATION 153 (2011)

[ ] Table 1 [ ] Res/Park [ ] Med/Fine
[ ] Table 2 [ ] Ind/Comm [ ] Coarse
[ ] Table 3 * [ ] Agri/Other
[ ] Table ___

FOR RSC (PLEASE CIRCLE) Yes / [No]

OTHER REGULATIONS

[ ] CCME [ ] Sanitary Sewer Bylaw
[ ] MISA [ ] Storm Sewer Bylaw
[ ] PWQO Municipality:
[ ] Other (Specify):

[ ] REG 558 (MINIMUM 3 DAY TAT REQUIRED)

Include Criteria on Certificate of Analysis (Y/N)? Y

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

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX	# OF CONT.	FIELD FILTERED (PLEASE CIRCLE) Metals / Hg / CrVI	pH	Water Soluble Sulphate	Resistivity	Conductivity	Chloride
1	BH101-S7	19-Jun-15	2:10	Soil	2		x	x	x	x	x
2	BH104-S3B/S4/S5	27-Jun-15	12:15	Soil	2		x	x	x	x	x
3	BH201-S7A	28-Jun-15	10:20	Soil	2		x	x	x	x	x
4	BH2013-S3	28/06/2015	5:00	Soil	2		x	x	x	x	x
5	BH301-S9B/S10/S11	20/06/2015	7:25	Soil	2		x	x	x	x	x
6	BH304-S3	26/06/2015	6:20	Soil	2		x	x	x	x	x
7	BH403-S3	26/06/2015	4:15	Soil	2		x	x	x	x	x
8	BH404-S5B	25/06/2015	3:30	Soil	2		x	x	x	x	x
9	BH503-S4	25/06/2015	10:30	Soil	2		x	x	x	x	x
10	BH504-S1B	25/06/2015	2:10	Soil	2		x	x	x	x	x

ANALYSIS REQUESTED

Rush Confirmation #:

Date Required:

LABORATORY USE ONLY

CUSTODY SEAL (Y/N)	Temperature (°C) on Receipt
Present N	2, 3, 3
Intact N	
COOLING MEDIA PRESENT (Y / N) Y	

COMMENTS / TAT COMMENTS

RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME:	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME:
Michael Suslyk	02-Jul-15	13:00	Alex Vahdati ALEX VAHDATI	2015/07/03	10:55

3-Jul-15 10:55
Hina Siddiqui
B5C9097
FW ENV-417

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