FINAL REPORT

FOUNDATION INVESTIGATION REPORT

Caribus Lake Tributary Timber Culvert Replacement, Highway 11, Site No. 45-269/C, District of Rainy River

Agreement No. 6014-E-0017
Assignment No. 6
GWP 6320-14-00
Geocres No. 52B-024

Prepared for:

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exp Services Inc.
December 15, 2015

Ministry of Transportation

Foundation Investigation Report
Agreement No. 6014-E-0017
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Project Name:
Foundation Investigation Report Caribus Lake Tributary Timber Culvert Replacement
Highway 11, Site No. 45-269/C, District of Rainy River

Project Number:
ADM-00223648-E0

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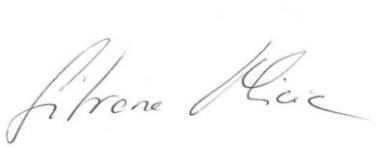

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Date Submitted:
December 15, 2015

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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 Caribus Lake Tributary Timber Culvert, located on Highway 11, about 3.1 km west of the junction of Hwy 11 and Hwy 11B, in the District of Rainy River, the Ministry of Transportation (MTO) Northwestern Region. The work was undertaken under Agreement # 6014-E-0017, Assignment No. 6 (GWP 6320-14-00). The terms of reference (TOR) were as presented in the MTO letter dated May 27, 2015.

Based on preliminary information provided, it is understood the existing culvert is a twin cell timber structure with a width of about 4.2 m (2.1 m for each cell of the twin culvert), length of about 20 m and a height of about 1.8 m. It is also understood that the existing culvert construction date was unknown, and is intended to be replaced with a new culvert along the same alignment.

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 Caribus Lake Tributary Timber Culvert is located on Highway 11, about 3.1 km west of the junction of Hwy 11 and Hwy 11B, in the District of Rainy River, south of Atikokan, Ontario. At the site, Hwy 11 is a two lane roadway, with a speed limit of 90 km/h and is about 7.1 m wide from edge of pavement to edge of pavement, with sand and gravel shoulders about 2 m wide. Based on drawings provided, the roadway embankment is about 3.5 m high with side slopes of about 2H:1V.

During the fieldwork on June 19 to 21, and 26 to 28, 2015, the general site conditions were assessed. Hwy 11 runs in an east to west direction and Caribus Creek, flows from north to south beneath the highway, ultimately towards Steep Rock Lake which is about 5 km north of the site (note that Caribus Creek flows north to south beneath the highway, then west and then north). At the time of this investigation, the approximate creek elevations at the inlet and outlet were about 427.39 m and 427.38 m, respectively. The elevation of highway pavement centerline at the culvert centerline is about 430.5 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. The surrounding area of the culvert also contained tall grass. The inlet and outlet appeared to be

generally clear of debris and excess vegetation, and as such the flow does not appear to be restricted.

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 5073, Scale 1:100,000, dated 1979, the underlying native soil at the site consists of peat organic terrain with a subordinate landform consisting of bedrock plain; mainly low local relief, plain, wet 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), Supracrustal rocks, and generally consist of metasedimentary rocks. The metasedimentary rocks include wacke, arkose, argillite, slate, marble, chert, iron formation, and minor metavolcanic rock complexes.

1.3 Investigation Procedures

1.3.1 Site Investigation and Field Testing

The field investigation was performed on June 19 to 21, and 26 to 28, 2015. The field program consisted of drilling four (4) sampled boreholes (BH301 to BH304). Two (2) boreholes were located within the highway, BH301, and BH302. BH301 was located about 5 m west of the culvert centerline and about 3 m north of the highway centerline. BH302 was located about 5 m east of the culvert centerline and about 1.2 m south of the highway centerline. An additional two (2) boreholes (BH303 and BH304) were advanced off of the highway. BH303 was located about 5.5 m west of the culvert centerline and about 13 m north of the highway centerline (inlet/upstream side). BH304 was located about 3.2 m west of the culvert centerline and about 15 m south of the highway centerline (outlet/downstream side). The borehole locations are shown on Drawing 1 in Appendix B.

All the boreholes (BH301 to BH304) 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 (includes 51 mm outside diameter split spoon samplers and *in situ* shear vane testing equipment). In addition, the CME 850 drill rig was equipped with rock coring equipment (HQ size). The roadway boreholes BH301 and BH302 were advanced to depths of about 8.5 m, 8.3 m below ground surface, respectively. The off-road boreholes BH303 and BH304 were advanced to auger and SPT refusal, at depths of about 2.3 m and 3.5 m below ground surface, respectively. The off-road boreholes were terminated at the refusal depths.

At BH301, initial refusal to SPT was encountered at about 3.4 m depth; however, using augering techniques, the borehole was advanced beyond the SPT refusal. At BH302, SPT and auger refusal were encountered at about 2.7 m depth, and rock coring techniques were used to advance the borehole. Rock coring techniques at BH302 were continued through additional overburden soils and into the bedrock. At BH301, rock coring techniques were initiated at about 5.4 m depth to

advance the borehole 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 (regular iron bar [RIB] in rock) east of the site and south of the highway. The BM elevation is 431.009 m. The location of the BM is shown on Drawing 1, in Appendix B.

During the drilling of the boreholes (BH301 to BH304), 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. In addition, samples were collected from the auger flighting in the upper 0.3 m at BH301 and BH302.

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 silty gravel with sand, and cobbles and boulders. In general, the fill was overlying peat, overlying clayey silt and overlying bedrock. A more detailed summary of the subsurface conditions encountered in the boreholes is provided in the following sections.

1.4.1 Silty Gravel with Sand Fill

Silty gravel with sand fill was encountered beneath the asphalt at BH301 and BH302. The asphalt thickness at BH301 and BH302 was about 75 mm and 60 mm, respectively. The silty gravel with sand fill was generally described as very dense to compact at depth, brown, damp to moist, containing occasional cobbles. Trace asphalt was noted in the upper 0.3 m at BH301. The SPT "N" values ranged between 13 and 100 (i.e. SPT refusal) blows per 300 mm penetration, with an average "N" value of about 47. The silty gravel with sand fill extended to depths ranging between about 2.3 m (428.2 m elevation) and 3.8 m (426.6 m elevation) below ground surface.

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

Moisture content:

- 4.0% to 12.4%

Grain size distribution:

- 38% to 45% gravel;
- 25% to 35% sand;
- 26% to <27% silt ; and
- 4% to <27% clay size.

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 Cobbles and Boulders Fill

Cobbles and boulders fill was encountered beneath the silty gravel with sand fill at BH302 and within the silty gravel with sand fill at BH301. The cobbles and boulders fill was generally described as compact to very dense, greenish grey, wet, weathered, fractured, and containing some sand and some silt. The SPT "N" values ranged between 10 and 100 (i.e. SPT refusal) blows per 300 mm penetration, with an average "N" value of about 46. The cobbles and boulders fill extended to depths of about 3.1 m (427.4 m elevation) and 3.8 m (426.7 m elevation) below ground surface.

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

Moisture content:

- 3.6% to 5.4%

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

1.4.3 Peat

Peat was generally encountered beneath the fill and surfacing the off-road boreholes. The peat was generally described as soft, dark brown, wet and containing trace roots to roolets. The SPT "N" values ranged between 0 (i.e. advanced by weight of hammer and rods alone) and 5 blows per 300 mm penetration, with an average "N" value of about 2. The peat thickness ranged between about 0.3 m and 2.1 m and extended to depths ranging between about 1.5 m and 4.1 m below ground surface. The peat extended to elevations ranging between about 426.2 m and 426.3 m.

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

Moisture content:

- 41.9% to 317.3%

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

1.4.4 Clayey Silt

Clayey silt was encountered underlying the peat. The clayey silt was generally described as firm to hard, brown to grey, moist to wet, and varved. Some gravel and some sand was encountered at depth at BH301. The SPT "N" values ranged between 3 and 22 blows per 300 mm penetration, with an average "N" value of about 9. Note that at each borehole where clayey silt was encountered (BH301, BH303 and BH304), SPT "N" values of 100 blows (i.e. SPT refusal) was encountered at the clayey silt termination depths and is not considered representative of the clayey silt. Two *in situ* field vane test were performed and the results at BH301 and BH304 were 116 kPa and >330 kPa, respectively. The clayey silt extended to depths ranging between about 2.3 m and about 5.4 m below ground surface, and elevations ranging between 424.4 m and 426.0 m.

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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:

- 18.1% to 34.7%

Grain size distribution:

- 0% gravel;
- 2% to 3% sand;
- 70% to 75% silt; and
- 22% to 28% clay size.

Total saturated unit weights have been calculated based on the moisture contents and are estimated to range from about 18.4 to 21.0 kN/m^3. Two (2) Atterberg Limits tests were performed on representative samples of the clayey silt (BH301-S9B and BH304-S4). The results indicated that the soil is of low to medium plasticity. The data is shown on the plasticity chart, Figure 4. The liquid limit, plastic limit and plasticity index ranged between about 29 and 32, 19 and 20, and 9 and 13 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 3 in Appendix D, and Atterberg Limits tests are provided on Figure 4 in Appendix D.

1.4.5 Silty Sand to Gravel and Cobbles

At BH302 only, silty sand to gravel and cobbles was encountered beneath the fill. The silty sand was described as very dense, grey, and wet. One SPT sampling test was conducted the “N” value was 100 (i.e. SPT refusal) blows per 300 mm penetration. The silty sand extended to about 4.1 m below ground surface (elevation 426.4 m).

Gravel and cobbles were encountered underlying the silty sand at BH302. The gravel and cobbles were described as very dense and grey. No SPT sampling was conducted. The gravel and cobbles extended to about 5.3 m below ground surface (elevation 425.2 m).

Laboratory testing performed on selected samples consisted of moisture content, grain size distribution and Atterberg Limit tests. No laboratory testing was performed on the gravel and cobbles. The test results are as follows:

Moisture content:

- 12.7%

Grain size distribution:

- 0% gravel;

- 54% sand;
- 43% silt; and
- 3% clay size.

Total saturated unit weight has been calculated based on the moisture contents and is estimated to be about 22.3 kN/m^3. One (1) Atterberg Limits tests was performed on representative sample of the silty sand (BH302-S7), as some cohesive properties were noted. The results indicated that the soil is of low plasticity and the soil contained more cohesionless properties than cohesive properties. The data is shown on the plasticity chart, Figure 5. The liquid limit, plastic limit and plasticity results were 19, 12 and 7, 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 Figure 5 in Appendix D.

1.4.6 Bedrock

Bedrock was encountered underlying the clayey silt at BH301, and beneath the cobbles and boulders at BH302, at depths of about 5.4 m (425.0 m elevation) and 5.3 m (425.2 m elevation), respectively. The bedrock was generally described as a medium strong (25 MPa to 50 MPa compressive strength), fractured to very sound, green to grey, and fine grained. The boreholes were extended by rock coring about 3.0 m to 3.1 m into bedrock, and to depths ranging about 8.3 m and 8.5 m below ground surface. The boreholes were terminated at elevations ranging between about 422.0 m and 422.2 m. Photographs of the bedrock core samples are presented in Appendix C, after the Borehole Logs.

Gross recoveries ranged between about 93% and 100%. The Rock Quality Designation (RQD), which is a modified core recovery, ranged from 53% to 100% (fractured to very sound).

No laboratory testing was performed on the bedrock.

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
BH301	Jun. 20/15	Jun. 20/15	430.4	3.62	426.78
BH302	Jun. 21/15	Jun. 21/15	430.5	2.86	427.64
BH303	Jun. 27/15	Jun. 28/15	428.3	0.69	427.61
BH304	Jun. 26/15	Jun. 27/15	427.8	0.25	427.55
Caribus Creek WL Upstream (North) Side	--	Jun. 27/15			427.39[4]
Caribus Creek WL Downstream (South) Side	--	Jun. 27/15	--	--	427.38[4]

Notes:
1) All units in metres.
2) Elevations surveyed are referenced to a geodetic benchmark (BM) provided (regular iron bar [RIB] in rock) east of the site and south of the highway. The BM elevation is 431.009 m.
3) Depths are relative to ground surface.
4) Indicates top of surface water elevation at Caribus Creek.

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

Sample	pH (unitless)	Chloride (ppm)	Soluble Sulphate (ppm)	Resistivity (ohm-cm)	Conductivity (µS/cm)
BH301-S9B/S10/S11	6.54	220	30	2,300	435
BH304-S3	6.72	36	<20	7,000	143

Note:
1) Due to insufficient sample volume, samples S9B, S10 and S11 from BH301 were combined for chemical analyses.

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,

exp Services Inc.

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Encl.

Appendix A –
Site Photographs

Photo 1. Existing culvert inlet on north side of highway

Photo 2. Existing culvert outlet on south side of highway

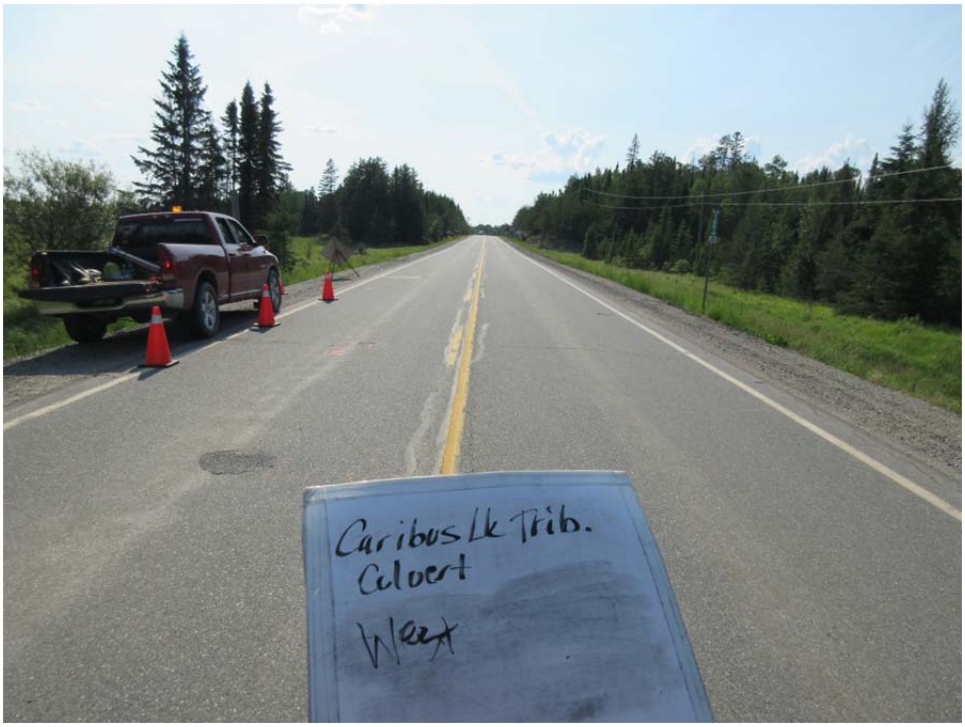

Photo 3. Facing west on Highway 11 before the existing culvert

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

Photo 5. Embankment slope on north side facing east

Photo 6. Embankment slope on south side facing west

Appendix B – Drawings

N 5 399 800

E 404 800

2 2130 x 1800 x 20.03 CTC Caribus Lake Flow

11+900

12+000

MTO ROW

MTO ROW

EDGE OF PAVEMENT

EDGE OF PAVEMENT

HIGHWAY 11

EXISTING CULVERT

Caribus Lake Flow

A

A'

BH303
428.30

BH301
430.41

BH302
430.52

BH304
427.85

SIB

BOB FOTS

SIB

P-3076-69

P-3076-22

SIB

NAIL

BO

SIB

BM
431.009

P—

N 5 399 700

10 0 10 20
IN METRES

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LICENSED PROFESSIONAL ENGINEER
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15/12/15
PROVINCE OF ONTARIO

Agreement No. 6014-E-0017
Assignment No. 6
GWP 6320-14-00

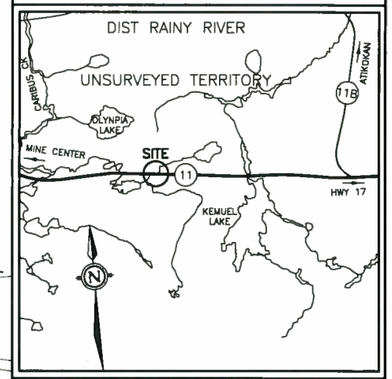
CARIBUS LAKE CULVERT

(Hwy 11, Rainy River District, Atikokan, ON)
PLAN

DWG 1

exp. **exp** Services Inc.

KEY PLAN



LEGEND

BH301 430.41 — BOREHOLE LOCATION GROUND SURFACE ELEVATION IN METRES

BM 431.009 — BENCHMARK LOCATION GEODETIC ELEVATION IN METRES

BH No.	APPROX. ELEV. (m)	MTM COORDINATES	
		NORTH	EAST
BH301	430.41	5,399,746	404,751
BH302	430.52	5,399,740	404,761
BH303	428.30	5,399,755	404,752
BH304	427.85	5,399,728	404,751

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.

REVISIONS

DATE	BY	DESCRIPTION

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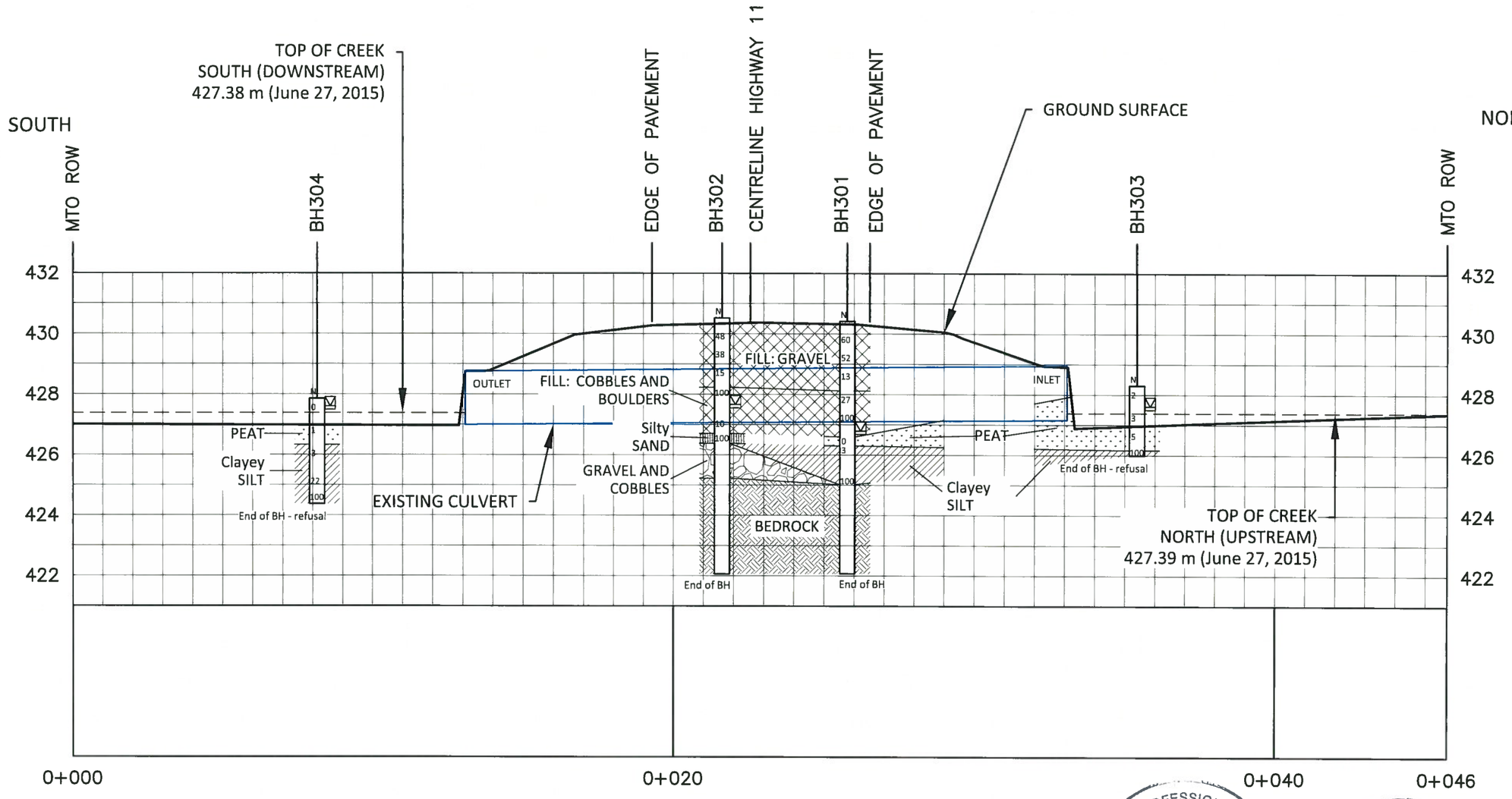
	Checked By: DG



A - A'
PROFILE OF CARIBUS LAKE CULVERT

3 0 3 6
IN METRES

LICENSED PROFESSIONAL ENGINEER
S. MICIC
100050187
15/12/15
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
S.E.M. GONSALVES
15/18/15
PROVINCE OF ONTARIO

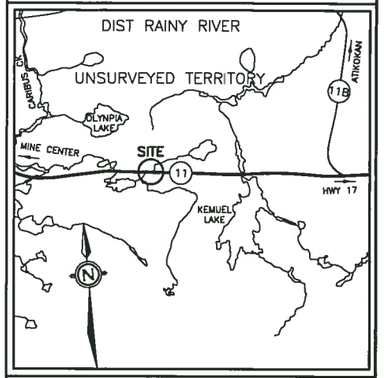
Agreement No. 6014-E-0017
Assignment No. 6
GWP 6320-14-00

CARIBUS LAKE CULVERT
(Hwy 11, Rainy River District, Atikokan, 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
BH301	430.41	5,399,746	404,751
BH302	430.52	5,399,740	404,761
BH303	428.30	5,399,755	404,752
BH304	427.85	5,399,728	404,751

NOTES

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REVISIONS

DATE	BY	DESCRIPTION

GEOCRES No. 52B-024	Project No. ADM-00223648-E0
Date: December 8, 2015	Horizontal Scale : 1:150
Drawn By: RM	Vertical Scale : 1:150
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:

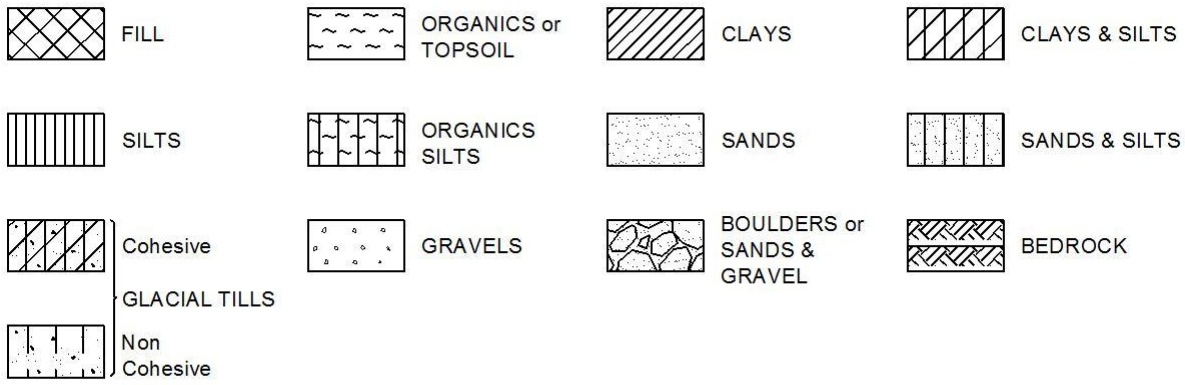
Table c: Consistency of Cohesive Soil

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 BH301 1 OF 1 METRIC

W.P. GWP No. 6320-14-00 LOCATION **Caribus Lake Culvert (Site No. 45-269/C) MTM ON-16 5,399,746N 404,751E** ORIGINATED BY EF

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

DATUM **Geodetic** DATE 6.20.15 - 6.20.15 CHECKED BY AM/DG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
430.4	Asphalt								
430.0	**ASPHALT** - about 75 mm		S1	AUGER					
0.1	**Silty GRAVEL with Sand (FILL)** - very dense to compact, brown, damp to moist, occasional cobbles, trace asphalt in upper 0.3 m		S2	AUGER					
			S3	SS	60		430		
			S4	SS	52				
	- becoming moist to wet at about 1.5 m depth		S5	SS	13		429		45 25 26 4
428.1									
2.3	**COBBLES AND BOULDERS (FILL)** - compact, greenish grey, wet, weathered, fractured		S6	SS	27		428		
427.4									
3.1	**Silty GRAVEL with Sand (FILL)** - very dense, brown, wet, occasional cobbles - cobbles and boulders at 3.4 m depth		S7	SS	100		427		
			S8	AUGER		▽			
426.6									
3.8	**PEAT** - soft, dark brown, wet, some silt to silty		S9A	SS	0			145.02	
426.3									
4.1	**Clayey SILT** - firm to very stiff, grey, wet, varved		S9B	SS	3				0 3 75 22
			S10	VANE			426		
425.0	- some gravel, some sand at about 5.3 m depth		S11	SS	100		425		
5.4	**BEDROCK** - medium strong, green to grey, fractured, fine grained		S12	CORE					Recovery=93%, RQD=53%
	- becoming very sound at about 6.9 m depth						424		
			S13	CORE			423		Recovery=100%, RQD=100%
422.0							422		
8.5	**End of Borehole**								

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

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

RECORD OF BOREHOLE No BH302 1 OF 1 METRIC

W.P. GWP No. 6320-14-00 LOCATION **Caribus Lake Culvert (Site No. 45-269/C) MTM ON-16 5,399,740N 404,761E** ORIGINATED BY EF

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

DATUM **Geodetic** DATE 6.19.15 - 6.21.15 CHECKED BY AM/DG

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
430.5	Asphalt										
430.0	**ASPHALT** - about 60 mm										
0.1	**Silty GRAVEL with Sand (FILL)** - dense to compact, brown, damp to moist, occasional cobbles		S1	AUGER							
			S2	SS	48		430				
			S3	SS	38				○		38 35 (27)
			S4	SS	15		429		○		
428.2											
2.3	**COBBLES AND BOULDERS (FILL)** - very dense to compact, greenish grey, wet, some sand, some silt, weathered, fractured - refusal to auger at about 2.7 m depth		S5	SS	100		428		○		
			S6	CORE		▽					
				SS	10		427				No recovery
426.7											
3.8	**Silty SAND** - very dense, grey, wet		S7	SS	100				⊢●		0 54 43 3
426.4											
4.1	**GRAVEL and COBBLES** - very dense, grey		S8	CORE			426				
425.2											
5.3	**BEDROCK** - medium strong, green to grey, fractured, fine grained		S9	CORE			425				Recovery=100%, RQD=60%
							424				
			S10	CORE			423				Recovery=100%, RQD=57%
422.2											
8.3	**End of Borehole**										

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

RECORD OF BOREHOLE No BH303 1 OF 1 METRIC

W.P. GWP No. 6320-14-00 LOCATION **Caribus Lake Culvert (Site No. 45-269/C) MTM ON-16 5,399,755N 404,752E** ORIGINATED BY EF

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

DATUM **Geodetic** DATE 6.27.15 - 6.28.15 CHECKED BY AM/DG

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
428.3	Peat										
0.0	**PEAT** - soft, dark brown, wet, trace gravel, trace sand, trace roots and rootlets		S1	SS	2	▽	428				
			S2	SS	3		427				
			S3	SS	5						
426.2											
2.1 426.0	**Clayey SILT** - very stiff, brown to grey, moist to wet		S4	SS	100		426				
2.3	**End of Borehole** - refusal to SPT and auger										

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

RECORD OF BOREHOLE No BH304 1 OF 1 METRIC

W.P. GWP No. 6320-14-00 LOCATION **Caribus Lake Culvert (Site No. 45-269/C) MTM ON-16 5,399,728N 404,751E** ORIGINATED BY EF

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

DATUM **Geodetic** DATE 6.26.15 - 6.27.15 CHECKED BY AM/DG

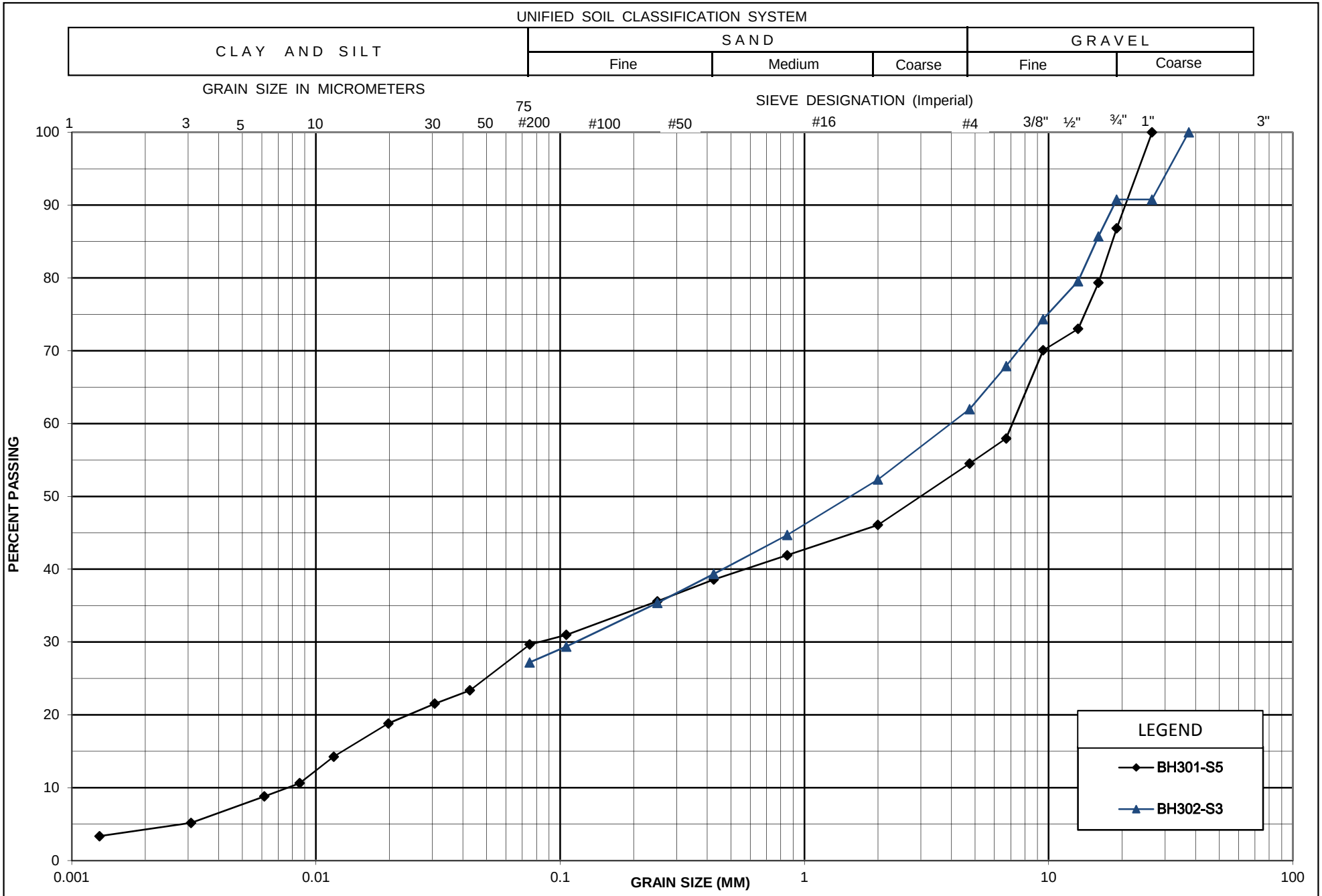
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
427.8	Peat										
0.0	**PEAT** - soft, dark brown, wet, trace roots and rootlets		S1	SS	0	▽			307.8		
			S2	SS	1		427		317.3		
426.3											
1.5	**Clayey SILT** - firm to hard, grey, wet		S3	SS	3		426	>>			
				VANE							Field Vane > 330 kPa
			S4	SS	22		425				0 2 70 28
424.4			S5	SS	100						
3.5	**End of Borehole** - refusal to SPT and auger										

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

BH301 - Bedrock Core Samples with Depths and Elevations

BH302 - Bedrock Core Samples with Depths and Elevations

Appendix D – Laboratory Data



exp.

GRAIN SIZE DISTRIBUTION

Silty GRAVEL with Sand

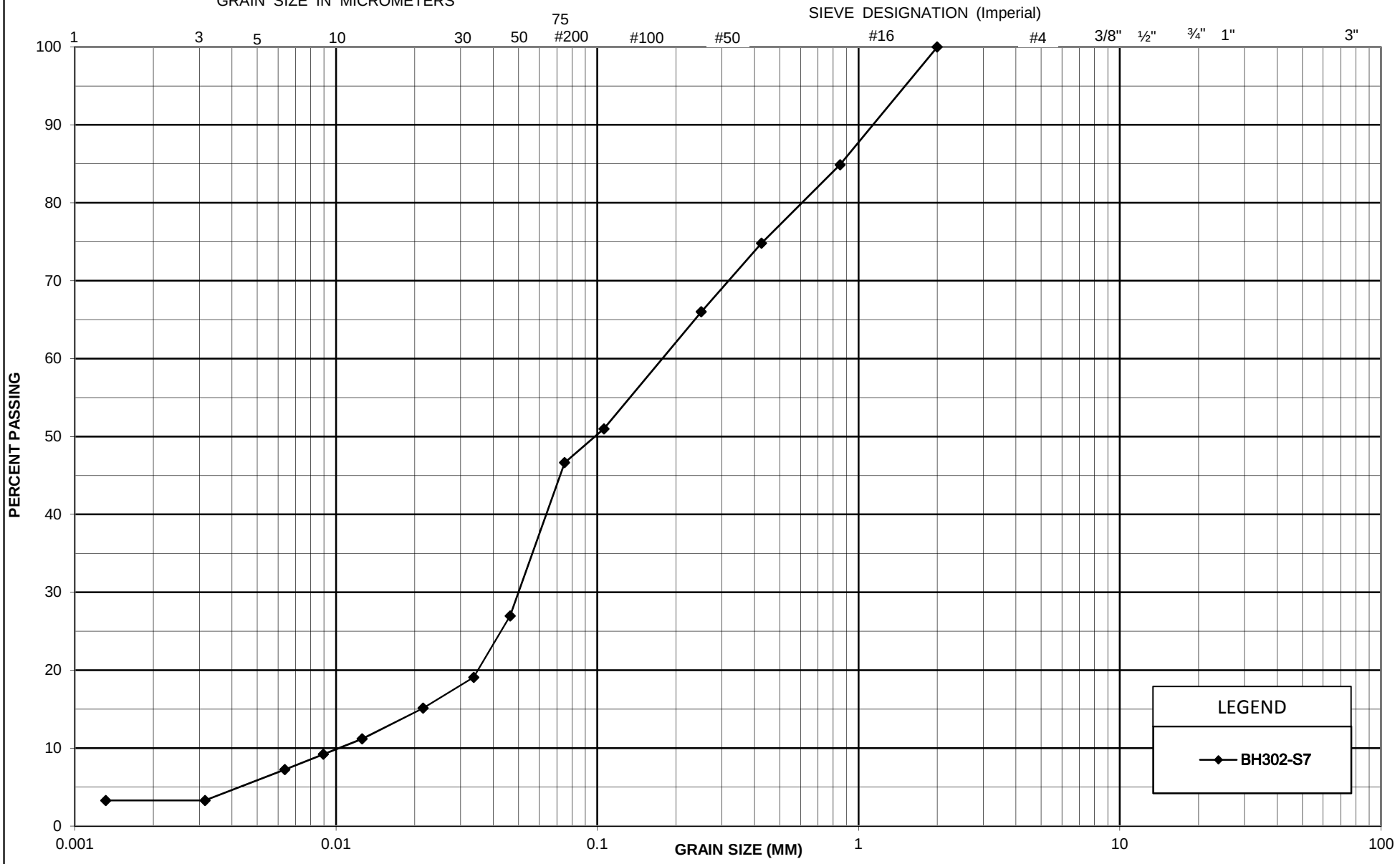
FIGURE: No. 1

GWP: 6320-14-00

DATE : July 16, 2015

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



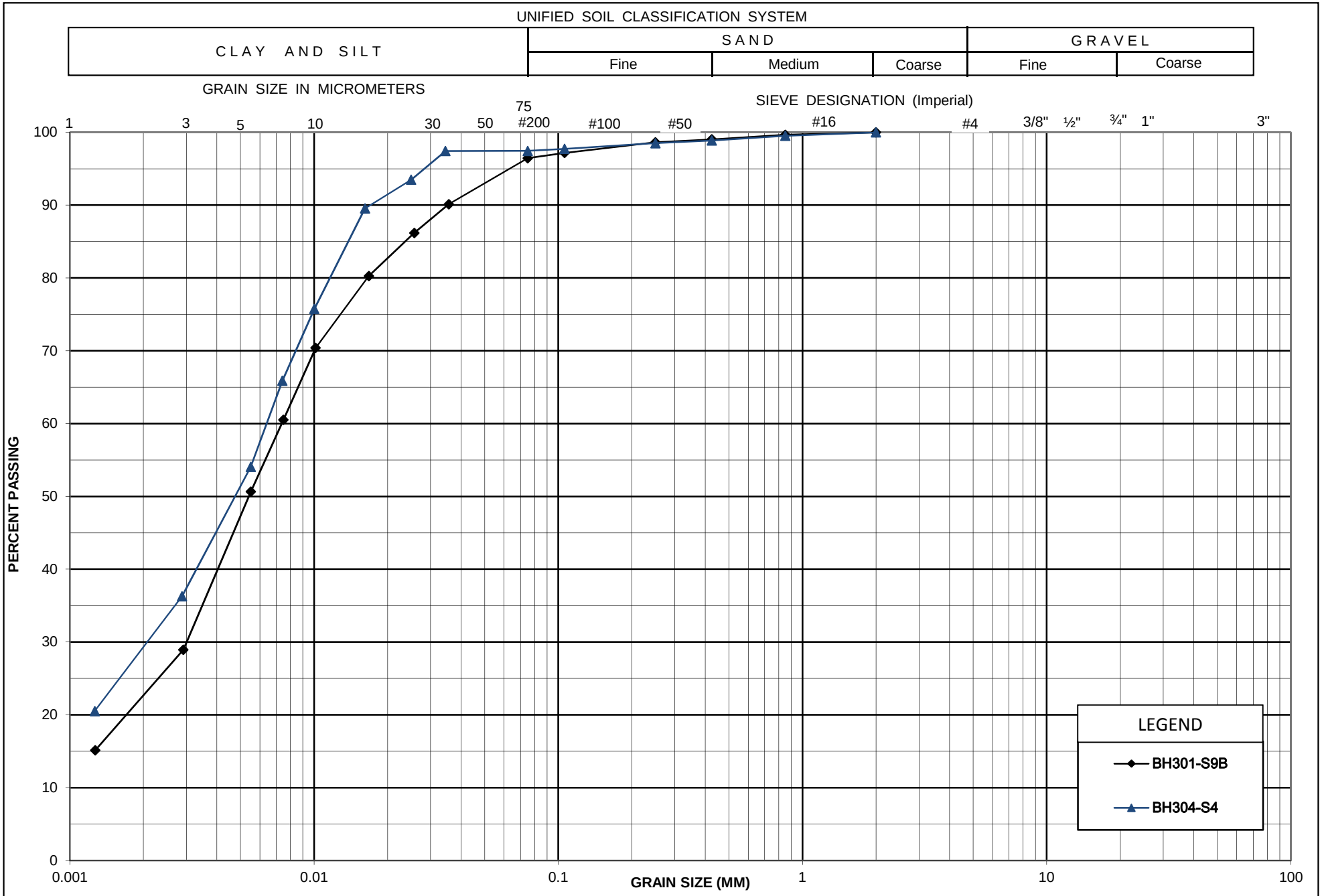
GRAIN SIZE DISTRIBUTION

Silty SAND

FIGURE: No. 2

GWP: 6320-14-00

DATE : July 16, 2015



GRAIN SIZE DISTRIBUTION

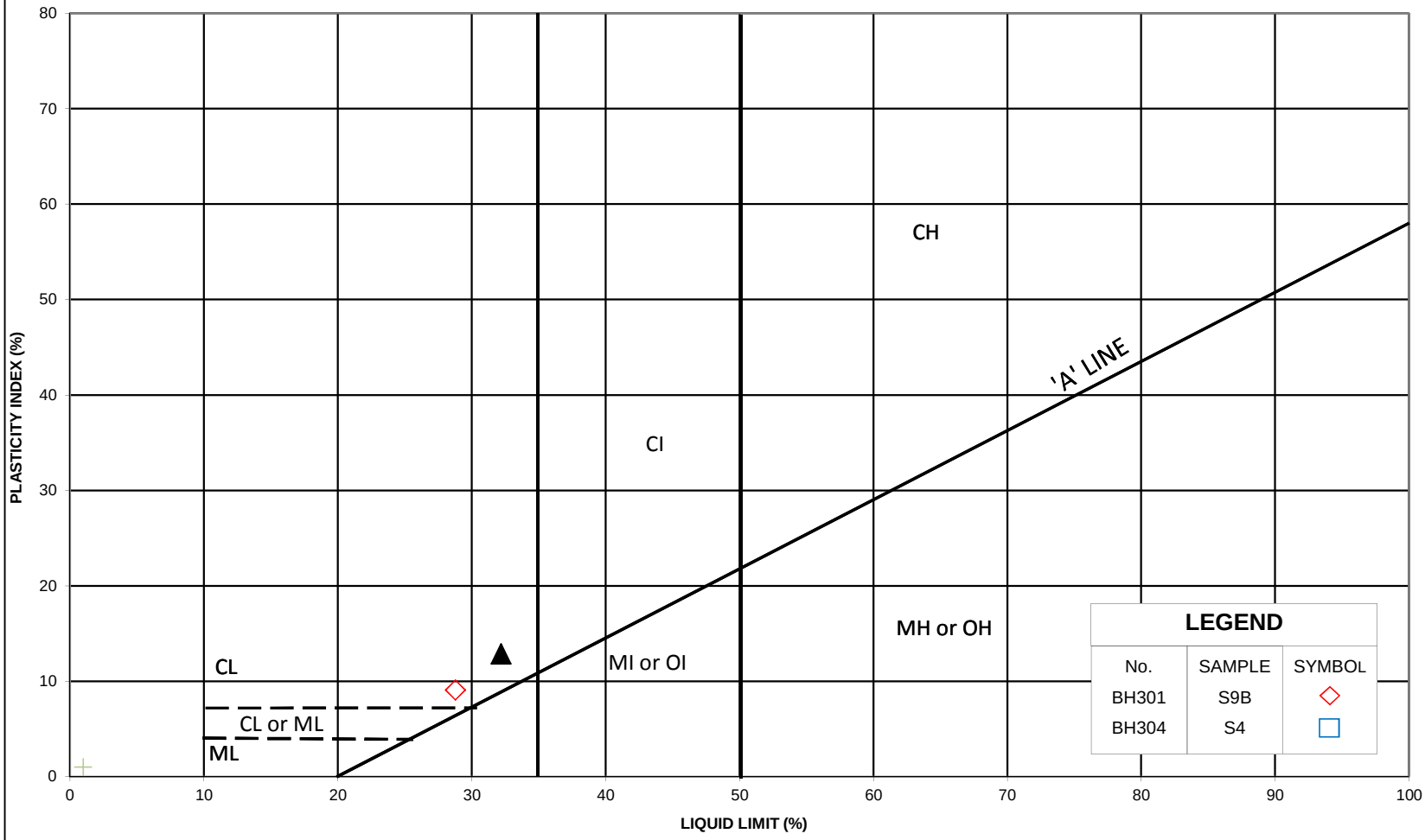
Clayey SILT

FIGURE: No. 3

GWP: 6320-14-00

DATE : July 16, 2015

Caribus Lake Culvert (Site No. 45-259/C)
GWP No. 6320-14-00, Highway 11, Atikokan, Ontario



PLASTICITY CHART

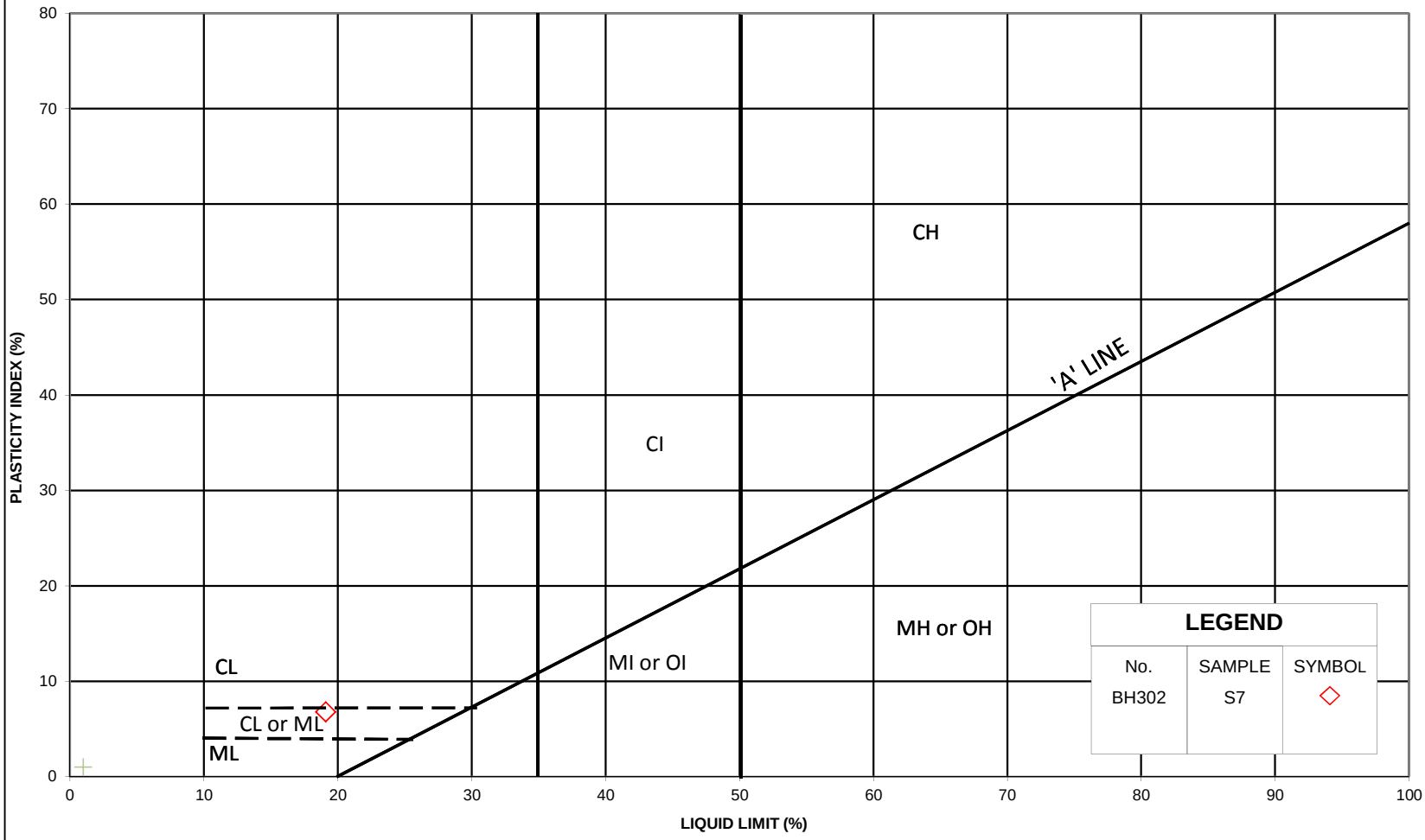
Clayey SILT

FIGURE No. 4

ADM-00223648-E0

July 22, 2015

Caribus Lake Culvert (Site No. 45-259/C)
GWP No. 6320-14-00, Highway 11, Atikokan, Ontario



exp.

PLASTICITY CHART

Silty SAND

FIGURE No. 5

ADM-00223648-E0

July 22, 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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Maxxam Job #: B5C9097
Report Date: 2015/07/09

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

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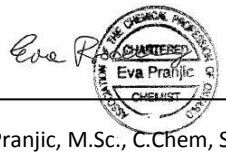
Site Location: MTO ASSIGNMENT #6 - HWYS 11 & 502

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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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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