FINAL REPORT

FOUNDATION INVESTIGATION REPORT

Murky Creek Bridge Replacement, Highway 584, Site No. 48E-004, District of Thunder Bay, Ontario

Agreement No. 6014-E-0017
Assignment No. 10 & 11
GWP 6054-08-00
Geocres No. 42L-002

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December 12, 2016

Ministry of Transportation
Northwestern Region Geotechnical Section

Foundation Investigation Report
Agreement No. 6014-E-0017
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Type of Document:
Final

Project Name:
Foundation Investigation Report for Murky Creek Bridge Replacement
Highway 584, Site No. 48E-004, District of Thunder Bay, Ontario

Project Number:
ADM-00223648-J0 / K0

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1 FOUNDATION INVESTIGATION REPORT

1.1 Introduction

This foundation investigation report presents the results of two geotechnical investigations (combined as one) completed by **exp** Services Inc. for the replacement of the Murky Creek Bridge, located on Highway 584, about 44 km north of Geraldton, Ontario, in the District of Thunder Bay, the Ministry of Transportation (MTO) Northwestern Region. The work was undertaken under Agreement # 6014-E-0017, Assignment Nos. 10 and 11 (GWP 6054-08-00). The terms of reference (TOR) for Assignment 10 were as presented in the MTO letter dated February 16, 2016, requesting that a minimum of two boreholes be conducted at each proposed abutment and a minimum of one borehole be conducted at each approach. The additional/expanded scope for Assignment 11 was presented in an MTO letter dated March 14, 2016, for a minimum of one borehole at each proposed pier location, due to a change in proposed design from a single span bridge to a three span bridge.

Based on the information provided and our observations, the existing bridge consists of steel girders with a concrete deck resting on wooden piers. The bridge has five (5) spans of a total length of about 55 m and a width of about 9.2 m. It is understood that the existing bridge was constructed in 1972. The bridge was initially intended to be replaced with a new three (3) span bridge with span lengths of 10.5 m at the ends and 21.5 m in the center but according to the new GA drawing provided on September 22, 2016, it is understood that the existing bridge is proposed to be replaced with a single span bridge with span length of 36.5 m and a width of about 10.5 m. The new bridge will be constructed of precast concrete box girder located along the same alignment and staged construction will be carried out to replace the existing bridge. It is also understood that a grade raise of about 0.4 m with respect to original road surface is currently proposed at this site.

The purpose of the Assignment 10 investigation was to evaluate the subsurface conditions at the locations of the proposed abutments as well as the approaches of the new bridge, while the purpose of the Assignment 11 investigation was to investigate the conditions at the two proposed pier locations. Both assignments were undertaken to permit detailed design for the bridge 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 Murky Creek Bridge is located on Highway 584, about 44 km north of the Geraldton, in the District of Thunder Bay, Ontario. At the site, Hwy 584 is a two lane roadway, with a speed limit of 80 km/h and is about 9.2 m wide from edge to edge of the bridge, with steel guard rails along the bridge and extending to the approaches on both the north and south sides. Based on drawings provided, the roadway embankment is about 3.0 m high with slopes on the east and west sides of the roadway of about 3H:1V. The ground at the north and south abutments slopes down towards the creek at about 2H:1V and 3H:1V, respectively.

During the fieldwork on March 14 to 20, 2016, the general site conditions were assessed. Hwy 584 runs in a generally north and south direction and the water flows from northwest to southeast beneath the highway. At the time of this investigation, the approximate creek elevation (top of ice elevation) was about 321.04 m. Steel guard rails were present on both sides of the roadway along the bridge and the approaches.

The upstream and downstream sides of the bridge appeared to be free of vegetation and other obstructions apart from the ice. The shoreline in the vicinity of the bridge, both upstream and downstream was snow covered; as such only trees and larger bushes were observed, both of which were present only sporadically along the shoreline and more prevalent inland from the shoreline.

Select photographs of the site 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 5125, Scale 1:100,000, dated 1981, the underlying native soil at the site predominantly consists of bedrock knob , with subordinate landforms of sand glacial outwash plains or valley trains, peat organic terrain, or till ground moraine. The local relief is mainly low, undulating to rolling or knobby, with dry surface conditions in the bedrock knob and mixed in the subordinate landforms.

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 site lies near the border of two geologic formations of intrusive rock from the Neo to Mesoarchean Era (2.5 to 3.4 Ga). To the north is the foliated tonalite suite, consisting of tonalite to granodiorite, and to the south is granodiorite to granite. Both formations are massive to foliated in texture.

1.3 Investigation Procedures

1.3.1 Site Investigation and Field Testing

The field investigation was performed on March 14 to 20, 2016 based on the initially proposed three (3) span bridge replacement design. Since, due to the change in GA drawing (with a single span bridge) boreholes drilled at the piers locations may not be applicable for design purpose. However, these boreholes are also considered to describe the subsurface conditions encountered in this site in the section below.

The field program consisted of drilling eight (8) sampled boreholes (BH101 to BH108) within the traveled road way including six (6) through the bridge deck and into the ground below. Four (4) boreholes were located within proposed new bridge abutment locations. BH101 and BH104 were advanced at the proposed north abutment, and BH102 and BH103 at the proposed south abutment. Two (2) boreholes (BH107 and BH108) were advanced at the proposed north and south pier locations (based on initial three span bridge design), respectively. BH105 and BH106 were located within the roadway at the south and north approaches, respectively. The borehole locations are shown on Drawing 1 in Appendix B.

All the boreholes (BH101 to BH108) were advanced using a CME 55 rubber track mounted drill rig. The drill rig was equipped with hollow and solid 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 55 drill rig was equipped with rock coring equipment (NQ size). The boreholes BH101, BH102, BH103, BH104, BH107 and BH108 were advanced through the bridge deck after pre-coring through the concrete bridge deck using a dedicated concrete core drill equipped with a 10 inch (250 mm) concrete core bit, prior to advancing the augers or casing with the CME 55 drill rig.

At BH101, BH102 and BH104, rock coring techniques were initiated to advance the borehole beyond refusal at depths of about 1.4 m, 8.2 and 1.6 m, respectively. At BH103, rock coring techniques were conducted from ground surface in an attempt to expedite the drilling, rather than using hollow stem augers. BH107 and BH108 were also advanced using rock coring techniques from the surface of the boreholes, as these holes were advanced through ice and into, at the time, an unknown depth of flowing water (i.e. using casing was more stable/controlled to prevent loss of equipment). The same rock coring techniques were used to core and sample the bedrock at BH101, BH102, BH104, BH107 and BH108. No rock coring techniques were conducted at BH105 and BH106 (the approach boreholes).

The borehole locations were referenced to the MTM ON-14 NAD83 coordinate system and their ground surface elevations were surveyed by **exp** personnel. The ground surface elevations, including top of water at the creek (top of ice), were referenced to a geodetic benchmark (BM) provided (nail in tree root) south of the site and west of the highway. The BM elevation is 322.805 m. The location of the boreholes and the BM is shown on Drawing 1, in Appendix B.

During the drilling of the boreholes (BH101 to BH108), 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 directly from the field shear vane at BH105 (i.e. where sample was available).

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 concrete core holes advanced through the bridge deck were repaired after drilling was completed. At the abutment boreholes (BH101 – BH104), i.e. where the underside of the bridge deck was readily accessible, plywood forms were placed and quick setting high strength concrete was poured to repair the bridge deck with about 50 mm to 100 mm of cold patch asphalt surfacing the repaired holes. The forms were left in place on the underside of the bridge deck. At the holes (BH107 and BH108), i.e. where the underside of the bridge deck was not readily access about 50 mm of additional asphalt was removed from the perimeter of the concrete core holes and a plywood sheet was placed directly onto the concrete deck. On top of the plywood sheet 100 mm of quick setting high strength concrete was poured and about 50 mm to 100 mm of cold patch asphalt was placed surfacing the hole,

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.

1.3.3 Previous Investigations

The following previous/historical investigation report was provided by the client.

1. Foundation Investigation Report for Proposed Crossing at Murky Creek and Hwy# 584 Unsurveyed Territory, District No. 19, Thunder Bay; W.O. 70-11058; W.P. 29-68-02; Geocres No. 42L-001; Department of Highways Ontario; November 1970.

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 logs and stratigraphic section 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.

At the proposed abutments and existing approaches, the subsurface conditions generally consist of a layer of fill material composed of sand, gravel, cobbles and boulders, overlying native sand or clayey silt to silt, overlying cobbles and boulders, and overlying bedrock. The subsurface conditions at the BH107 and BH108 lie within the stream bed, and generally consist of native sand and gravel overlying the silty sand to silt, overlying the cobbles and boulders, and overlying bedrock. A more detailed summary of the subsurface conditions encountered in the boreholes is provided in the following sections.

The ground surface at the proposed abutments (BH101, BH102, BH103 and BH104) was encountered at depths ranging between about 2.1 m and 2.6 m below the top of the bridge deck. The top of ice/water at the bore holes (BH107 and BH108) was about 3.4 m below the top of the bridge deck at both boreholes, and the ground surface was encountered at about 7.1 m and 6.1 m below the top of the bridge deck at BH107 and BH108, respectively. At all boreholes advanced through the bridge deck, the thickness of the asphalt and concrete were about 90 mm and 250 mm, respectively.

1.4.1 Sand with Gravel with Sand Fill

Well graded sand with gravel fill was generally encountered surfacing the boreholes and beneath the asphalt at BH105 and BH106. The asphalt thickness was about 200 mm and 230 mm at BH105 and BH106, respectively. The fill was generally described as frozen in the upper zones and brown, becoming loose to compact, and damp to wet. Sand blow up of about 150 mm was noted at 1.7 m depth below ground surface at BH102. The SPT "N" values ranged between 4 and 48 blows per 300 mm penetration, with an average "N" value of about 17. The sand fill extended to depths ranging between about 0.8 m and 3.8 m below ground surface, with elevations ranging between about 319.9 m and 321.4 m.

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

Moisture content:

- 2.3% to 13.0%

Grain size distribution:

- 26% to 85% gravel;
- 15% to 69% sand; and
- 0% to 5% silt and 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 underlying the sand fill at BH101 and BH104. The cobbles and boulders fill extended to depths of 4.7 m (317.4 m elevation), and 4.6 m (317.6 m elevation) below ground surface at BH101and BH104, respectively.

1.4.3 Peat

Peat was encountered underlying the sand fill at BH106. The peat was described as soft, dark brown, and wet. One SPT was conducted within the peat layer and the "N" value was 6 blows per 300 mm penetration. The peat layer was about 0.4 m in thickness and extended to a depth of about 3.8 m (320.9 m elevation) below ground surface.

Laboratory testing performed on the peat sample consisted of moisture content. The test results are as follows:

Moisture content:

- 52.5%

1.4.4 Poorly Graded Sand to Silty Sand

Poorly graded sand to silty sand was generally encountered underlying the fill. The poorly graded sand was also described as either with silt or with gravel. The poorly graded sand to silty sand was generally described as very loose to compact, brown to grey, and wet. At BH102, occasional cobbles and boulders were noted in the upper 2.4 m. In addition, at BH102, sand blow up of about 300 mm and 900 mm at about 2.4 m and 5.5 m below ground surface, respectively. The SPT "N" values ranged between 0 (i.e. advance by the weight of the rods and hammer) and 26 blows per 300 mm penetration, with an average "N" value of about 10. The poorly graded sand to silty sand extended to depths ranging between about 3.4 m and 8.2 m below ground surface, with elevations ranging between about 313.4 m and 319.4 m.

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

Moisture content:

- 7.9% to 38.0%

Grain size distribution:

- 0% to 43% gravel;
- 38% to 99% sand; and
- 1% to 31% silt and clay size.

Total saturated unit weights have been calculated based on the moisture contents and are estimated to range from about 18.0 to 23.6 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 tests are also provided on Figures 2 and 3, in Appendix D.

1.4.5 Clayey Silt

Clayey silt was encountered within the poorly graded sand to silty sand at BH102, BH103 and below silt with sand layer at BH105. The clayey silt was generally described as soft to stiff, grey, and wet. Blow up of about 600 mm was noted at 5.5 m below ground surface at BH102. The SPT

"N" values ranged between 0 (i.e. advanced by weight of hammer and rods) and 11 blows per 300 mm penetration; an SPT "N" value of 100 (i.e. SPT refusal) was noted in BH105, however, this is likely refusal on bedrock or cobbles and boulders. Three (3) *in situ* field vane tests were performed and the results ranged between about 17 kPa and 83 kPa. The clayey silt extended to depths ranging between about 4.9 m and about 7.9 m below ground surface, and elevations ranging between about 316.4 m and 317.4 m. The clayey silt was present at the termination depth of BH105 at about 7.9 m (316.4 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:

- 21.6% to 50.8%

Grain size distribution:

- 0% gravel;
- 0% to 4% sand;
- 40% to 66% silt; and
- 31% to 56% clay sizes.

Total saturated unit weights have been calculated based on the moisture contents and are estimated to range from about 16.8 to 20.3 kN/m^3. Three (3) Atterberg Limits tests were performed on representative samples of the silty clay to clayey silt (BH102-S6B, BH103-S6 and BH105-S10). The results indicated that the soil is of low to medium plasticity. The data is shown on the plasticity chart, Figure 5. The liquid limit, plastic limit and plasticity index ranged between about 28 and 35, 15 and 16, and 13 and 19, respectively.

The results of the moisture content, grain size distribution, *in-situ* field vanes 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 4 in Appendix D, and Atterberg Limits tests are provided on Figure 5 in Appendix D.

1.4.6 Silt

Silt was generally encountered underlying the poorly graded sand to silty sand. The silt was generally described as loose to very dense, grey, and wet. Silt and/or sand blow up of about 1,200 mm was noted at 7.0 m below ground surface at BH102. The SPT "N" values ranged between 7 and 100 (i.e. SPT refusal) blows per 300 mm penetration, with an average "N" value of about 28. Four (4) *in situ* field vane tests were performed, as some cohesive properties were noted, yielding results ranging between about 25 kPa and <122 kPa. The silt extended to depths ranging between

about 5.0 m and about 8.8 m below ground surface, and elevations ranging between 312.5 m and 318.1 m.

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

Moisture content:

- 20.8% to 26.2%

Grain size distribution:

- 0% gravel;
- 0% to 36% sand;
- 57% to 91% silt; and
- 7% to 14% clay sizes.

Total saturated unit weights have been calculated based on the moisture contents and are estimated to range from about 19.6 to 20.5 kN/m^3. Three (3) Atterberg Limits tests were performed on representative samples of the silt (BH106-S6, BH107-S4 and BH108-S6). The results indicated that the soil contains little cohesive properties. The data is shown on the plasticity chart, Figure 5. The liquid limit, plastic limit and plasticity index ranged between about 18 and 23, 16 and 17, and 3 and 6, 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 provided on Figure 4 in Appendix D, and Atterberg Limits tests are provided on Figure 5 in Appendix D.

1.4.7 Cobbles and Boulders

Cobbles and boulders were encountered underlying the silt at BH101, BH102, BH103 and BH108, as well as beneath the poorly graded sand at BH104. The cobbles and boulders extended to depths ranging between about 7.3 m and 12.5 m below ground surface, and elevations ranging between about 309.8 m and 312.3 m. Cobbles and boulders were present at the termination depth of BH103 at about 11.9 m (310.4 m elevation) below ground surface.

1.4.8 Bedrock

Bedrock was encountered underlying the cobbles and boulders at BH101, BH102, BH104 and BH108, and beneath the silt at BH107. The bedrock was encountered at depths ranging between about 5.0 m and 12.5 m below ground surface. The bedrock was encountered at elevations

ranging between 309.8 m and 312.5 m. The bedrock was generally described as medium strong (25 MPa to 50 MPa compressive strength), white, black and red to pink in colour, severely fractured to very sound and medium grained, granite. The boreholes were extended by rock coring to depths ranging between about 1.4 m to 3.4 m into bedrock, and to depths ranging between about 8.1 m and 15.5 m below ground surface. The boreholes were terminated at elevations ranging between about 306.8 m and 310.9 m. Photographs of the bedrock core samples are presented in Appendix C, after the Borehole Logs.

Gross recoveries ranged between about 80% and 100%. The Rock Quality Designation (RQD), which is a modified core recovery, ranged between 35% and 100% (severely fractured 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
BH101	Mar. 16/16	Mar. 16/16	322.01	0.97	321.04
BH102	Mar. 18/16	Mar. 18/16	322.29	0.91	321.38
BH103	Mar. 19/16	Mar. 19/16	322.30	0.69	321.61
BH104	Mar. 16/16	Mar. 16/16	322.20	0.57	321.63
BH105[4]	Mar. 16/16	--	324.73	--	--
BH106	Mar. 14/16	Mar. 14/16	324.31	4.40	319.91
BH107	Mar. 17/16	Mar. 17/16	317.49	-3.66	321.15
BH108	Mar. 20/16	Mar. 20/16	318.34	-2.74	321.08
Murky Creek (top of ice)	--	Mar. 18/16	--	--	321.04[5]

Borehole	Date Completed	Date Measured	Ground Surface Elevation[2]	Depth to Water[3]	Groundwater Elevation

Notes:

1) All units in metres.
2) Elevations surveyed are referenced to a geodetic benchmark (BM) provided (nail in tree) south of the site and west of the highway. The BM elevation is 322.805 m.
3) Depths are relative to ground surface. Negative value indicates water/ice encountered above ground surface.
4) BH105 collapsed at time of auger removal, depth to groundwater could not be measured.
5) Indicates top of ice elevation at approximately the centre of bridge.

1.6 Chemical Analyses

Two soil samples 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 Identification	pH (unitless)	Soluble Chloride (ppm)	Soluble Sulphate (ppm)	Resistivity (ohm-cm)	Conductivity (µS/cm)
BH101-S5 Sand with Silt	8.05	<20	30	11,000	89
BH104-S2 Sand with Gravel Fill	7.63	240	<20	1,700	575

2 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, M.E.Sc., 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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3 LIMITATIONS AND USE OF REPORT

BASIS OF REPORT

This report ("Report") is based on site conditions known or inferred by the geotechnical investigation undertaken as of the date of the Report. Should changes occur which potentially impact the geotechnical condition of the site, or if construction is implemented more than one year following the date of the Report, the recommendations of exp may require re-evaluation.

The Report is provided solely for the guidance of design engineers and on the assumption that the design will be in accordance with applicable codes and standards. Any changes in the design features which potentially impact the geotechnical analyses or issues concerning the geotechnical aspects of applicable codes and standards will necessitate a review of the design by exp. Additional field work and reporting may also be required.

Where applicable, recommended field services are the minimum necessary to ascertain that construction is being carried out in general conformity with building code guidelines, generally accepted practices and exp's recommendations. Any reduction in the level of services recommended will result in exp providing qualified opinions regarding the adequacy of the work. exp can assist design professionals or contractors retained by the Client to review applicable plans, drawings, and specifications as they relate to the Report or to conduct field reviews during construction.

Contractors contemplating work on the site are responsible for conducting an independent investigation and interpretation of the borehole results contained in the Report. The number of boreholes necessary to determine the localized underground conditions as they impact construction costs, techniques, sequencing, equipment and scheduling may be greater than those carried out for the purpose of the Report.

Classification and identification of soils, rocks, geological units, contaminant materials, building envelopment assessments, and engineering estimates are based on investigations performed in accordance with the standard of care set out below and require the exercise of judgment. As a result, even comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations or building envelope descriptions involve an inherent risk that some conditions will not be detected. All documents or records summarizing investigations are based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated. Some conditions are subject to change over time. The Report presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, these should be disclosed to exp to allow for additional or special investigations to be undertaken not otherwise within the scope of investigation conducted for the purpose of the Report.

RELIANCE ON INFORMATION PROVIDED

The evaluation and conclusions contained in the Report are based on conditions in evidence at the time of site inspections and information provided to exp by the Client and others. The Report has

been prepared for the specific site, development, building, design or building assessment objectives and purpose as communicated by the Client. exp has relied in good faith upon such representations, information and instructions and accepts no responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of any misstatements, omissions, misrepresentation or fraudulent acts of persons providing information. Unless specifically stated otherwise, the applicability and reliability of the findings, recommendations, suggestions or opinions expressed in the Report are only valid to the extent that there has been no material alteration to or variation from any of the information provided to exp.

STANDARD OF CARE

The Report has been prepared in a manner consistent with the degree of care and skill exercised by engineering consultants currently practicing under similar circumstances and locale. No other warranty, expressed or implied, is made. Unless specifically stated otherwise, the Report does not contain environmental consulting advice.

COMPLETE REPORT

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Appendix A –
Site Photographs

Photo 1. Looking north at downstream side of existing bridge, east side of highway

Photo 2. Looking north at upstream side of existing bridge, west side of highway

Photo 3. Facing north on Highway 584 from existing bridge

Photo 4. Facing south on Highway 584 from existing bridge

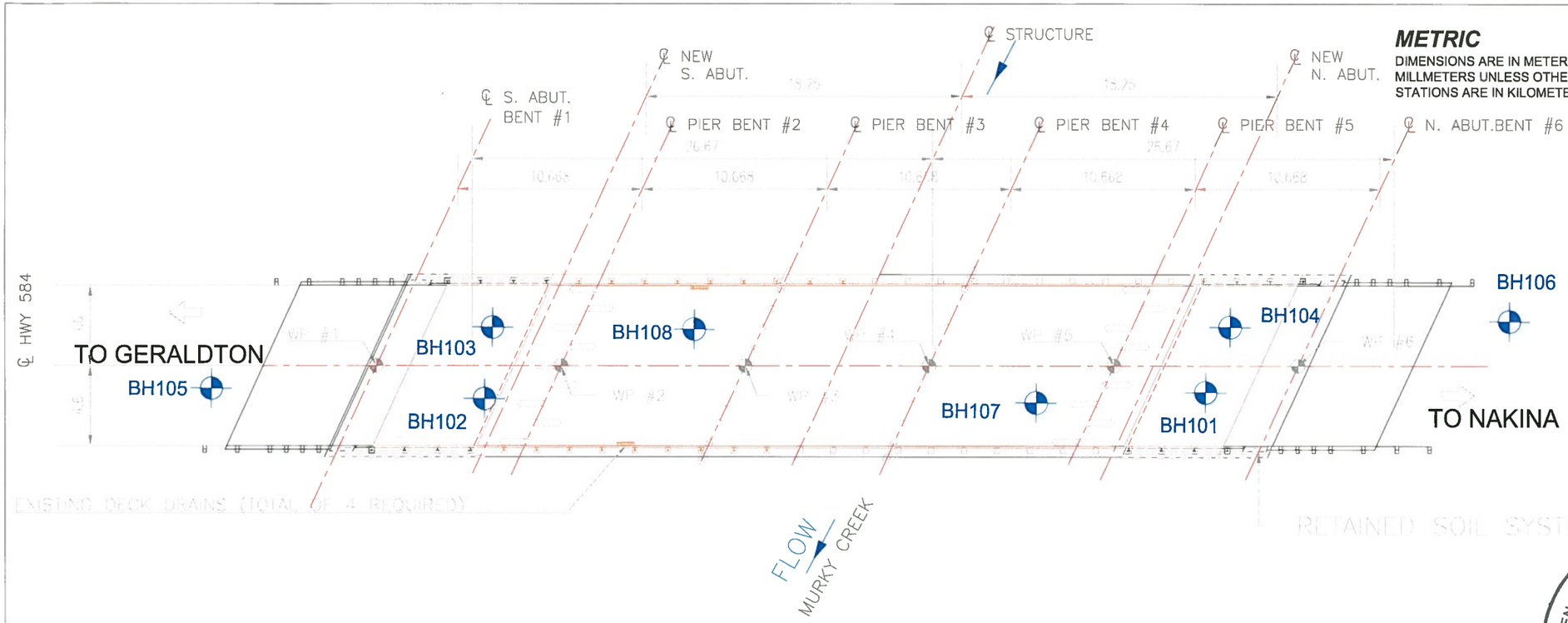
Photo 5. Embankment slope on east side facing south

Photo 6. Embankment slope on west side facing south

Photo 7. Existing north abutment slope facing northeast

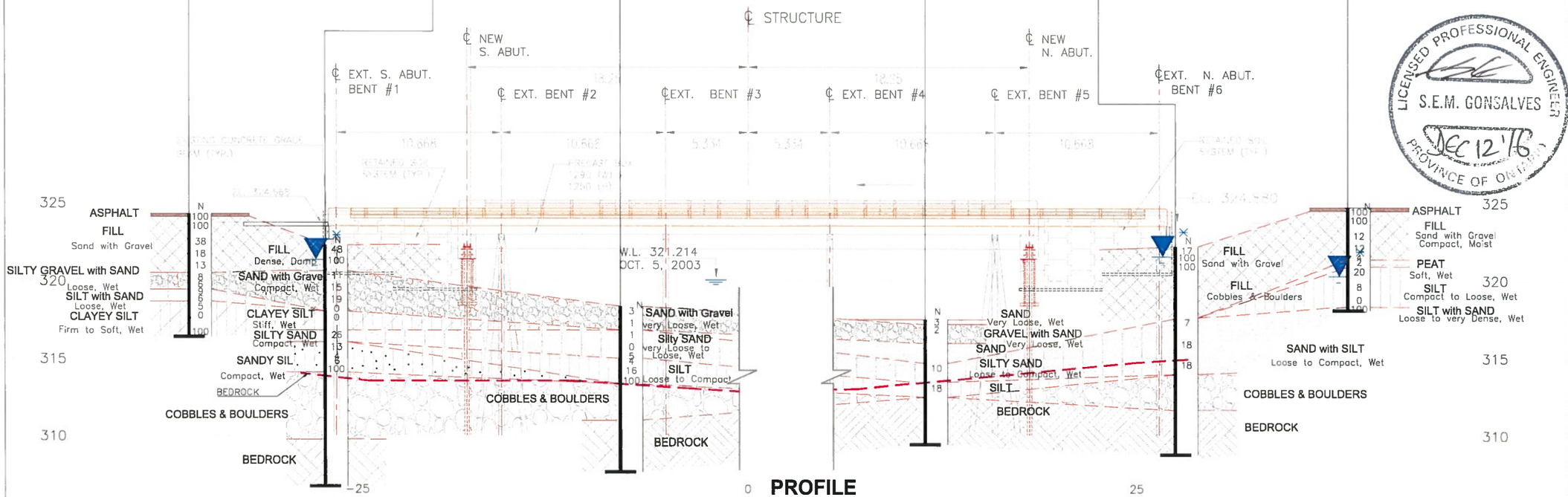
Photo 8. Existing south abutment slope facing southeast

Appendix B – Drawings



METRIC

DIMENSIONS ARE IN METERS AND/OR MILLMETERS UNLESS OTHERWISE SHOWN.
STATIONS ARE IN KILOMETERS +METERS



PROFILE

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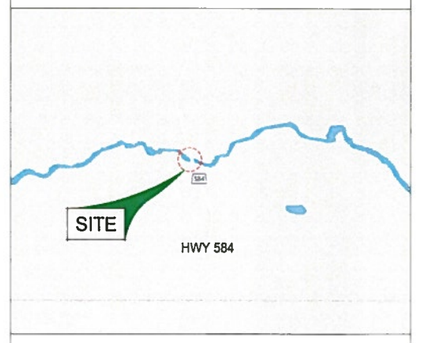
Agreement No. 6014-E-0017
Assignment No. 10
GWP 6054-08-00

MURKY CREEK BRIDGE REPLACEMENT, HWY 584
(UNSURVEYED TERRITORY)
BOREHOLE LOCATION PLAN AND SOIL STRATA

SHEET 1

exp Services Inc.

KEY PLAN



LEGEND

- ASPHALT
- FILL
- SILTY SAND
- BEDROCK
- PEAT
- SAND
- SAND AND GRAVEL
- COBBLES AND BOULDER
- SILT
- SILT

BH No.	APPROX. ELEV.	MTM CO-ORDINATES	
		NORTH	EAST
BH 101	322.01	5,544,593	320,776
BH 102	322.29	5,544,554	320,791
BH 103	322.30	5,544,553	320,787
BH 104	322.20	5,544,593	320,772
BH 105	324.31	5,544,607	320,767
BH 106	324.73	5,544,608	320,766
BH 107	317.49	5,544,584	320,780
BH 108	318.34	5,544,564	320,783

NOTE

This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents

The complete foundation investigation and design report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in the report and related documents are specifically excluded in accordance with the conditions of Section GC 2.01 of OPS Gen. Cond.

0 5 10 m
(scale)

DATE	BY	DESCRIPTION
	SM	SUBMISSION FOR MTO REVIEW
		GEOCRES NO. 42L-002
		PROJECT NO. ADM-00223648-J0

SUBM'D SM	CHECKED SM	DATE	2016.10.20
DRAWN SH	CHECKED SG	APPROVED SG	DWG. 1

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:

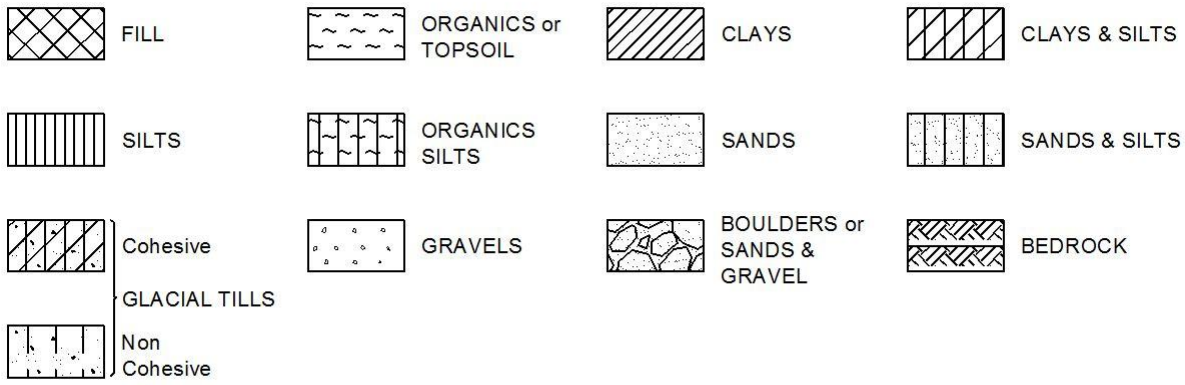
Table c: Consistency of Cohesive Soil

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 BH101 1 OF 1 METRIC

W.P. GWP No. 6054-08-00 LOCATION **Murky Creek Bridge (Site No. 48E-004) MTM ON-14 5,544,584N 320,774E** ORIGINATED BY RM

DIST 61 HWY 584 BOREHOLE TYPE CME 55 Track Carrier / HSA / NW/NQ COMPILED BY AM

DATUM **Geodetic** DATE 3.16.16 - 3.16.16 CHECKED BY 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
322.0	Fill										
0.0	**Well Graded SAND with Gravel (FILL)** - loose, brown, moist		S1	SS	8				○		
321.3											
0.8	**Well Graded GRAVEL with Sand (FILL)** - loose, brown, wet		S2	SS	5	▽	321		○		85 15 (0)
320.7											
1.4	- refusal to auger at 1.4 m depth continued with NW/NQ casing and coring **COBBLES & BOULDERS (FILL)**		S3	CORE			320				
	- washboring techniques initiated at about 2.9 m depth						319				
317.4							318				
4.7	**Poorly Graded SAND with Silt** - loose to compact, grey, wet		S4	SS	10		317		○		0 94 (6)
							316				
			S5	SS	18				○		
							315				
314.6			S6A	SS	3				○		
7.4	**SILT** - loose, grey, wet		S6B	SS	4				○		
314.0				SS	100		314				
8.1	- refusal to SPT at about 8.0 m depth **COBBLES AND BOULDERS**		S7	CORE			313				
312.3	- refusal to SPT at about 9.6 m depth			SS	100						
9.7	**BEDROCK** - medium strong, white, black, red to pink, fractured, medium grained, granite		S8	CORE			312				Recovery=98% RQD=60%
310.9							311				
11.1	**End of Borehole** Borehole advanced from top of bridge deck (324.6 m elevation), about 2.6 m above ground surface. Asphalt and concrete thickness were about 90 mm and 250 mm, respectively.										

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

RECORD OF BOREHOLE No BH102 1 OF 2 METRIC

W.P. GWP No. 6054-08-00 LOCATION **Murky Creek Bridge (Site No. 48E-004) MTM ON-14 5,544,554N 320,774E** ORIGINATED BY RM

DIST 61 HWY 584 BOREHOLE TYPE CME 55 Track Carrier / HSA / NW/NQ COMPILED BY AM

DATUM **Geodetic** DATE 3.17.16 - 3.18.16 CHECKED BY DG

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
322.3	Fill										
0.0	**Well Graded SAND with Gravel (FILL)** - dense, brown, damp		S1	SS	48		322				
	- frozen from about 0.9 m depth to about 1.7 m depth		S2	SS	100	▽					
320.6							321				
1.7	- about 150 mm blow up at about 1.7 m depth		S3	SS	11						
	Poorly Graded SAND with Gravel - compact, brown, wet, occasional cobbles and boulders in upper 2.4 m						320				
	- about 300 mm blow up at about 2.4 m depth		S4	SS	15						23 72 (5)
			S5	SS	19		319				
318.0	- becoming very loose at about 4.0 m depth		S6A	SS	0						
4.3	**Clayey SILT** - stiff, grey, wet		S6B	SS	0		318				0 4 40 56
			S7	VANE				+2			
316.8							317				
5.5	- about 600 mm of blow up at about 5.5 m depth		S8	SS	26						
	Silty SAND - compact, grey, wet										
316.0							316				
6.3	- about 900 mm of blow up at about 6.2 m depth		S9	SS	13						0 36 57 7
	Sandy SILT - compact, grey, wet										
	- about 1,200 mm of blow up at about 7.0 m depth		S10A	SS	4		315				
			S10B	SS	6						
314.1	- becoming very dense at about 7.8 m depth		S11	SS	100						
8.2	**COBBLES AND BOULDERS**		S12	CORE			314				
							313				
			S13	CORE			312				
							311				
309.8			S14	CORE			310				
12.5	**BEDROCK** - medium strong, white, black, red to pink, fractured to very sound, medium grained, granite										Recovery=100% RQD=66%
			S15	CORE			309				Recovery=100% RQD=100%
							308				

Continued Next Page

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

RECORD OF BOREHOLE No BH102 2 OF 2 METRIC

W.P. GWP No. 6054-08-00 LOCATION **Murky Creek Bridge (Site No. 48E-004) MTM ON-14 5,544,554N 320,774E** ORIGINATED BY RM

DIST 61 HWY 584 BOREHOLE TYPE CME 55 Track Carrier / HSA / NW/NQ COMPILED BY AM

DATUM **Geodetic** DATE 3.17.16 - 3.18.16 CHECKED BY 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
306.8	**BEDROCK** - continued		S16	CORE			307				Recovery=100% RQD=88%
15.5	**End of Borehole** Borehole advanced from top of bridge deck (324.4 m elevation), about 2.1 m above ground surface. Asphalt and concrete thickness were about 90 mm and 250 mm, respectively.										

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

RECORD OF BOREHOLE No BH103 1 OF 1 METRIC

W.P. GWP No. 6054-08-00 LOCATION **Murky Creek Bridge (Site No. 48E-004) MTM ON-14 5,544,554N 320,787E** ORIGINATED BY RM

DIST 61 HWY 584 BOREHOLE TYPE CME 55 Track Carrier / NW/NQ COMPILED BY AM

DATUM **Geodetic** DATE 3.18.16 - 3.19.16 CHECKED BY DG

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)	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
322.3	Fill										
0.0	**Well Graded SAND with Gravel (FILL)** - frozen, brown		S1	SS	100		322				
321.4						▽					
0.9	**Well Graded GRAVEL with Sand (FILL)** - frozen, brown		S2	SS	100		321				
320.6											
1.7	**Well Graded SAND with Gravel (FILL)** - loose, brown, wet		S3	SS	9		320				
319.9											
2.4	**Poorly Graded SAND with Silt** - very loose to loose, brown, wet		S4	SS	0						
	- becoming Poorly Graded SAND with Gravel at about 3.2 m depth		S5A	SS	8		319				
318.8											
3.5	**Clayey SILT** - soft to very soft, grey, wet		S5B	SS	3						
			S6	SS	0		318				0 0 46 54
317.4											
4.9	**Poorly Graded SAND with Silt** - compact, grey, wet		S7	VANE				>> max			Measured shear strength exceeded capacity of torque wrench (>122 KPa)
			S8	SS	20		317				0 90 5 5
			S9	SS	13		316				
	- becoming loose at about 7.0 m depth		S10	SS	7		315				
314.5											
7.8	**SILT** - compact to very dense, grey, wet		S11	SS	16						0 0 86 14
			S12	SS	100		314				
313.5											
8.8	**COBBLES & BOULDERS**		S13	CORE			313				
	- refusal to SPT at about 10.3 m depth			SS	100		312				
			S14	CORE							
310.4				SS	100		311				
11.9	**End of Borehole** - refusal to SPT										
	Borehole advanced from top of bridge deck (324.4 m elevation), about 2.1 m above ground surface. Asphalt and concrete thickness were about 90 mm and 250 mm, respectively.										

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

RECORD OF BOREHOLE No BH104 1 OF 1 METRIC

W.P. GWP No. 6054-08-00 LOCATION **Murky Creek Bridge (Site No. 48E-004) MTM ON-14 5,544,592N 320,773E** ORIGINATED BY RM

DIST 61 HWY 584 BOREHOLE TYPE CME 55 Track Carrier / HSA / NW/NQ COMPILED BY AM

DATUM **Geodetic** DATE 3.14.16 - 3.16.16 CHECKED BY 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
322.2	Fill										
0.0	**Well Graded SAND with Gravel (FILL)** - compact, brown, moist		S1	SS	17	▽	322				
	- frozen from about 0.6 m depth to about 1.6 m depth		S2	SS	100						
	- refusal to SPT and auger (HSA) at about 1.3 m depth continued with NW/NQ casing and coring			SS	100		321				
320.6											
1.6	**COBBLES & BOULDERS (FILL)**		S3	CORE			320				
	- washboring techniques initiated at about 3.1 m depth						319				
317.6							318				
4.6	**Poorly Graded SAND with Silt** - loose to compact, grey, wet		S4	SS	7						No Recovery
			S5	SS	18		317				3 89 (8)
			S6	SS	18		316				No Recovery
314.0							315				
8.2	**COBBLES & BOULDERS**		S7	CORE			314				
311.7							313				
10.5	**BEDROCK** - medium strong, white, black, red to pink, severely fractured to sound, medium grained, granite		S8	CORE			312				Recovery=100% RQD=35%
			S9	CORE			311				Recovery=95% RQD=80%
308.8							310				
13.4	**End of Borehole**						309				
	Borehole advanced from top of bridge deck (324.6 m elevation), about 2.4 m above ground surface. Asphalt and concrete thickness were about 90 mm and 250 mm, respectively.										

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

ON_MOT F-16103-AG - ADM-00223648-J0 - MTO 10 & 11 - MURKY CREEK BRIDGE.GPJ ON_MOT.GDT 4/6/16

RECORD OF BOREHOLE No BH105 1 OF 1 METRIC

W.P. GWP No. 6054-08-00 LOCATION **Murky Creek Bridge (Site No. 48E-004) MTM ON-14 5,544,607N 320,767E** ORIGINATED BY RM

DIST 61 HWY 584 BOREHOLE TYPE CME 55 Track Carrier / SSA / HSA COMPILED BY AM

DATUM **Geodetic** DATE 3.14.16 - 3.14.16 CHECKED BY 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
324.3	Asphalt										
324.0	**ASPHALT** - about 200 mm										
0.2	**Well Graded SAND with Gravel (FILL)** - frozen, brown		S1	SS	100		324				No Recovery. Sample collected from augers.
			S2	SS	100						No Recovery. Sample collected from augers.
	- becoming dense, moist at about 1.5 m depth		S3	SS	38		323		○		
	- becoming compact at about 2.3 m depth		S4	SS	18		322		○		
	- becoming wet at about 3.0 m depth		S5	SS	13		321		○		
320.5											
3.8	**Silty GRAVEL with Sand** - loose, grey, wet		S6	SS	8		320		○		43 38 (19)
319.4			S7A	SS	6				○		
4.9	**SILT with Sand** - loose, grey, wet		S7B	SS	9				○		
318.7			S8A	SS	6		319		○		0 28 63 9
5.6	**Clayey SILT** - firm to soft, grey, wet		S8B	SS	5				○		
			S9	VANE				+1			
			S10	SS	0		318		○		0 3 66 31
			S11	VANE				+1			
	- refusal to auger at about 7.3 m depth		S12	SS	100		317			○	
316.4											
7.9	**End of Borehole** - refusal to SPT										

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

RECORD OF BOREHOLE No BH106 1 OF 1 METRIC

W.P. GWP No. 6054-08-00 LOCATION **Murky Creek Bridge (Site No. 48E-004) MTM ON-14 5,544,540N 320,798E** ORIGINATED BY RM

DIST 61 HWY 584 BOREHOLE TYPE CME 55 Track Carrier / SSA / HSA COMPILED BY AM

DATUM **Geodetic** DATE 3.14.16 - 3.14.16 CHECKED BY DG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"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
324.7	Asphalt										
324.5 0.2	**ASPHALT** - about 230 mm		S1	SS	100		324				
	Well Graded SAND with Gravel (FILL) - frozen, brown		S2	SS	100						
	- becoming compact, moist at about 1.5 m depth		S3	SS	12		323				26 69 (5)
	- becoming moist to wet at about 2.3 m depth		S4	SS	12		322				
321.4			S5A	SS	4						
3.4 320.9	**PEAT** - soft, dark brown, wet		S5B	SS	2		321				
3.8	**SILT** - compact to loose, grey, wet		S6	SS	20	▽					0 1 83 16
			S7	VANE			320	+2			
			S8	SS	8						
			S9	VANE			319	+2			
318.3			S10A	SS	0						
6.4 318.1	**SILT with Sand** - loose to very dense, grey, wet		S10B	SS	100						
6.6	**End of Borehole** - refusal to auger and SPT										

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

RECORD OF BOREHOLE No BH107 1 OF 1 METRIC

W.P. GWP No. 6054-08-00 LOCATION **Murky Creek Bridge (Site No. 48E-004) MTM ON-14 5,544,582N 320,778E** ORIGINATED BY RM

DIST 61 HWY 584 BOREHOLE TYPE CME 55 Track Carrier / NW/NQ COMPILED BY AM

DATUM **Geodetic** DATE 3.17.16 - 3.17.16 CHECKED BY 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
317.5	Sand										
0.0 / 317.2	**Poorly Graded SAND** - very loose, brown to grey, wet		S1A	SS	3		317				
0.3	**Poorly Graded GRAVEL with Sand** - very loose, brown, wet		S1B	SS	2						
316.0							316				
1.5	**Poorly Graded SAND** - loose to compact, brown, wet, medium grained		S2	SS	--						0 99 (1) Casing continuously moved during SPT
314.7							315				
2.8	**Silty SAND** - loose to compact, brown, wet		S3	SS	10						
313.4							314				
4.1	**SILT** - compact, grey, wet		S4	SS	18						0 0 91 9
312.5			S5	VANE			313	+ 2			
5.0	**BEDROCK** - medium strong, white, black, red to pink, severely fractured to fractured, medium grained, granite		S6	CORE			312				Recovery=97% RQD=60%
			S7	CORE			311				Recovery=100% RQD=48%
309.4							310				
8.1	**End of Borehole**										

Borehole advanced from top of bridge deck (324.6 m elevation), about 3.4 m above top of ice/water and about 7.1 above ground surface. Asphalt and concrete thickness were about 90 mm and 250 mm, respectively.

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

RECORD OF BOREHOLE No BH108 1 OF 1 METRIC

W.P. GWP No. 6054-08-00 LOCATION **Murky Creek Bridge (Site No. 48E-004) MTM ON-14 5,544,561N 320,784E** ORIGINATED BY RM

DIST 61 HWY 584 BOREHOLE TYPE CME 55 Track Carrier / NW/NQ COMPILED BY AM

DATUM **Geodetic** DATE 3.19.16 - 3.20.16 CHECKED BY 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
318.3	Sand										
0.0	**Poorly Graded SAND with Gravel** - very loose, brown, wet		S1	SS	3		318				
			S2	SS	1						
316.8							317				
1.5	**Silty SAND** - very loose to loose, brown, wet		S3	SS	1				○		
			S4	SS	0		316		○		
315.0	- becoming grey at about 3.0 m depth		S5A	SS	5				○		0 69 18 13
3.4	**SILT** - loose to compact, grey, wet		S5B	SS	4		315		○		
			S6	SS	16				H ○		0 0 90 10
313.3	- becoming very dense at about 4.6 m depth		S7	SS	100		314		○		
5.0	**COBBLES & BOULDERS** - some gravel, some sand		S8	CORE			313				
			S9	CORE			312				
311.0											
7.3	**BEDROCK** - medium strong, white, black, red to pink, severely fractured to sound, medium grained, granite		S10	CORE			311				Recovery=92% RQD=42%
			S11	CORE			310				Recovery=80% RQD=73%
			S12	CORE			309				Recovery=98 % RQD=80%
307.7							308				
10.7	**End of Borehole** Borehole advanced from top of bridge deck (324.4 m elevation), about 3.4 m above top of ice/water and about 6.1 above ground surface. Asphalt and concrete thickness were about 90 mm and 250 mm, respectively.										

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

BH101 - Bedrock Core Samples with Depths and Elevations

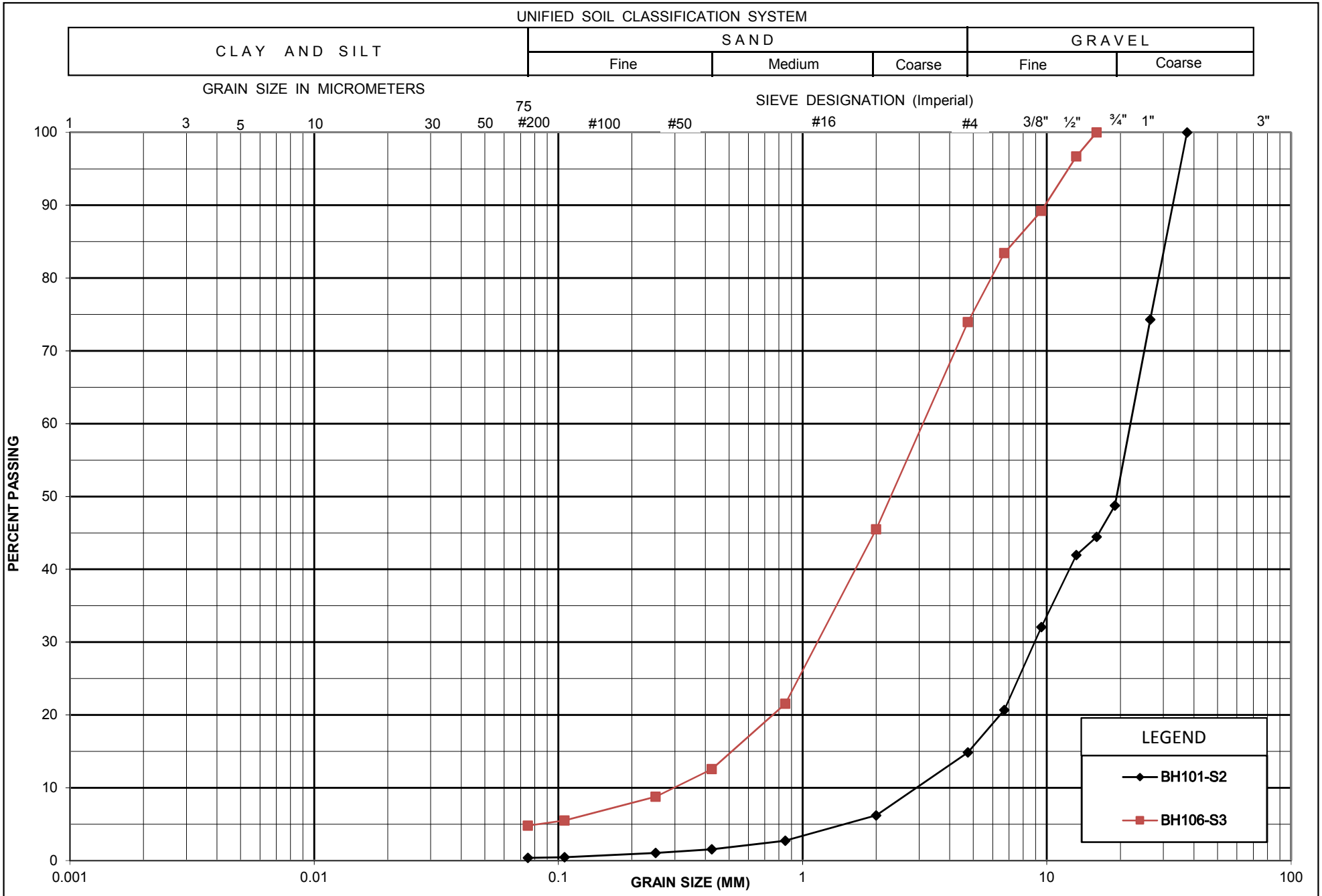
BH102 - Bedrock Core Samples with Depths and Elevations

BH104 - Bedrock Core Samples with Depths and Elevations

BH107 - Bedrock Core Samples with Depths and Elevations

BH108 - Bedrock Core Samples with Depths and Elevations

Appendix D – Laboratory Data



GRAIN SIZE DISTRIBUTION

FILL

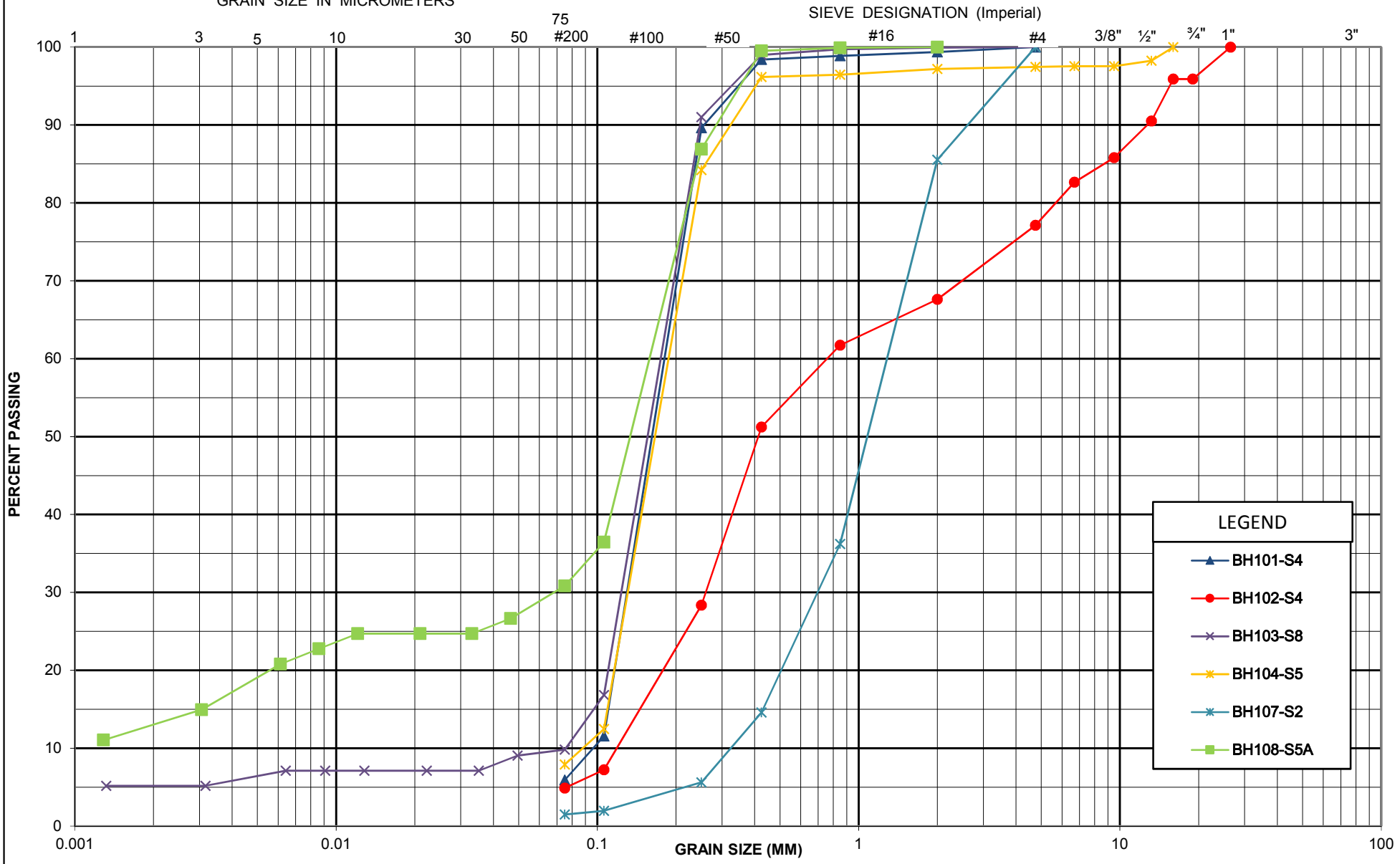
FIGURE: No. 1

GWP: 6054-08-00

DATE : April 4, 2016

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



exp.

GRAIN SIZE DISTRIBUTION

SAND

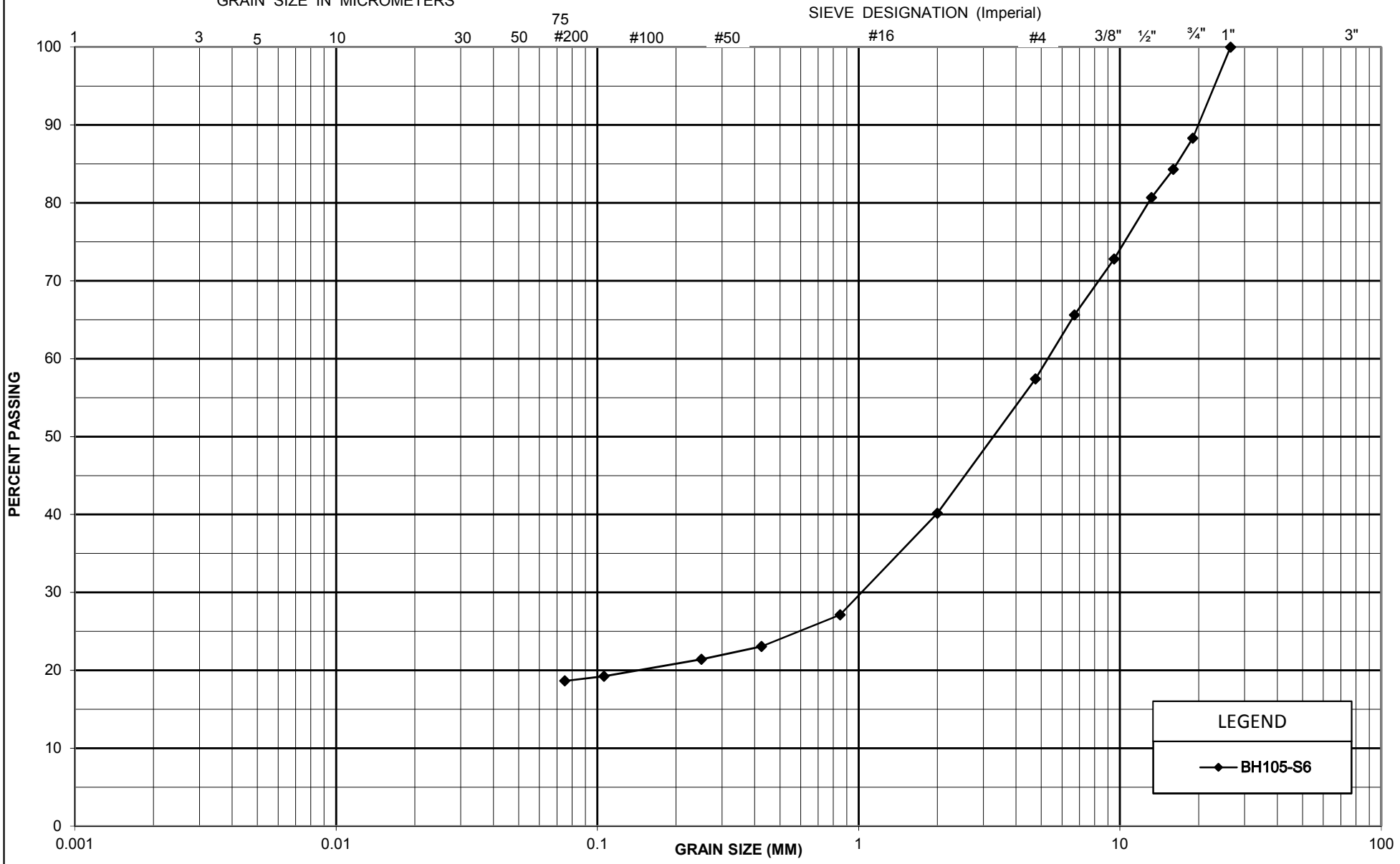
FIGURE: No. 2

GWP: 6054-08-00

DATE : April 4, 2016

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



GRAIN SIZE DISTRIBUTION

Silty GRAVEL with Sand

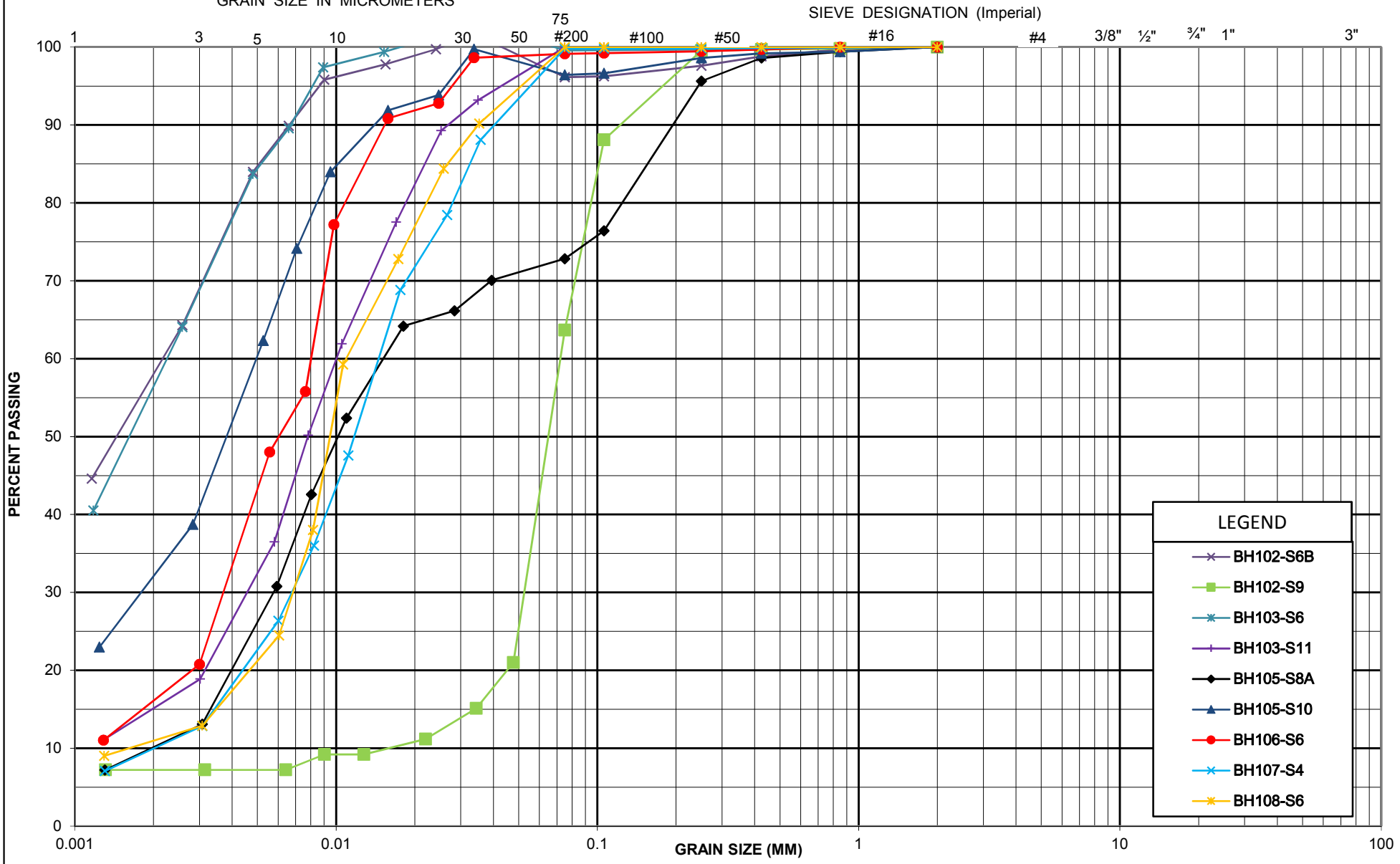
FIGURE: No. 3

GWP: 6054-08-00

DATE : April 5, 2016

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



exp.

GRAIN SIZE DISTRIBUTION

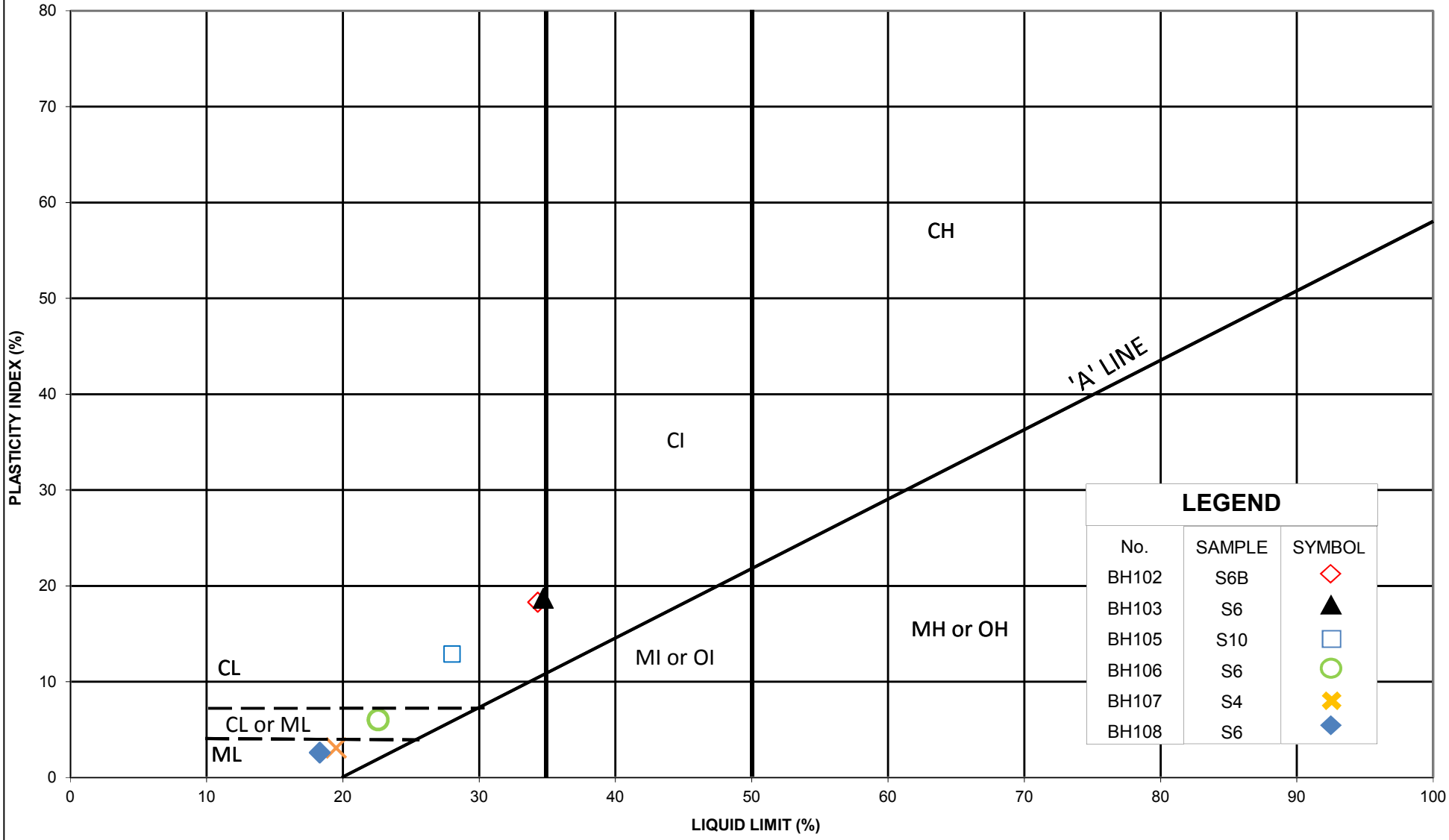
Clayey SILT to SILT

FIGURE: No. 4

GWP: 6054-08-00

DATE : April 5, 2016

Murky Creek Bridge Replacement (Site No. 48E-004)
GWP No. 6054-08-00, Highway 584, District of Thunder Bay, Ontario



PLASTICITY CHART

Clayey SILT to SILT

FIGURE No. 5

ADM-00223648-J0 / K0

March 31, 2016

Appendix E – Chemical Analyses

Your Project #: ADM-00223648-J0
Site Location: HWY 584
Your C.O.C. #: 81617

Attention:Ahileas Mitsopoulos/Michael S

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

Report Date: 2016/04/01
Report #: R3948724
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B660807
Received: 2016/03/29, 09:02

Sample Matrix: Soil
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Chloride (20:1 extract)	2	N/A	2016/04/01	CAM SOP-00463	EPA 325.2 m
Conductivity	2	N/A	2016/04/01	CAM SOP-00414	OMOE E3138 v2 m
pH CaCl2 EXTRACT	2	2016/03/31	2016/03/31	CAM SOP-00413	EPA 9045 D m
Resistivity of Soil	2	2016/03/29	2016/04/01	CAM SOP-00414	SM 22 2510 m
Sulphate (20:1 Extract)	2	N/A	2016/04/01	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.

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.

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 #: B660807
Report Date: 2016/04/01

exp Services Inc
Client Project #: ADM-00223648-J0
Site Location: HWY 584
Sampler Initials: RM

RESULTS OF ANALYSES OF SOIL

Maxxam ID		CCA483	CCA483	CCA484		
Sampling Date		2016/03/16 12:00	2016/03/16 12:00	2016/03/17 10:00		
COC Number		81617	81617	81617		
	UNITS	**BH101-S5**	**BH101-S5 Lab-Dup**	**BH102-S6B**	**RDL**	**QC Batch**
Calculated Parameters						
Resistivity	ohm-cm	11000		1700		4434942
Inorganics						
Soluble (20:1) Chloride (Cl)	ug/g	<20		240	20	4439872
Conductivity	umho/cm	89	89	575	2	4440067
Available (CaCl2) pH	pH	8.05		7.63		4437390
Soluble (20:1) Sulphate (SO4)	ug/g	30	22	<20	20	4439873

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B660807
Report Date: 2016/04/01

exp Services Inc
Client Project #: ADM-00223648-J0
Site Location: HWY 584
Sampler Initials: RM

TEST SUMMARY

Maxxam ID: CCA483
Sample ID: BH101-S5
Matrix: Soil

Collected: 2016/03/16
Shipped:
Received: 2016/03/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	4439872	N/A	2016/04/01	Deonarine Ramnarine
Conductivity	AT	4440067	N/A	2016/04/01	Lemeneh Addis
pH CaCl2 EXTRACT	AT	4437390	2016/03/31	2016/03/31	Neil Dassanayake
Resistivity of Soil		4434942	2016/04/01	2016/04/01	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	4439873	N/A	2016/04/01	Deonarine Ramnarine

Maxxam ID: CCA483 Dup
Sample ID: BH101-S5
Matrix: Soil

Collected: 2016/03/16
Shipped:
Received: 2016/03/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Conductivity	AT	4440067	N/A	2016/04/01	Lemeneh Addis
Sulphate (20:1 Extract)	KONE/EC	4439873	N/A	2016/04/01	Deonarine Ramnarine

Maxxam ID: CCA484
Sample ID: BH102-S6B
Matrix: Soil

Collected: 2016/03/17
Shipped:
Received: 2016/03/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	4439872	N/A	2016/04/01	Deonarine Ramnarine
Conductivity	AT	4440067	N/A	2016/04/01	Lemeneh Addis
pH CaCl2 EXTRACT	AT	4437390	2016/03/31	2016/03/31	Neil Dassanayake
Resistivity of Soil		4434942	2016/04/01	2016/04/01	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	4439873	N/A	2016/04/01	Deonarine Ramnarine

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Maxxam Job #: B660807
Report Date: 2016/04/01

exp Services Inc
Client Project #: ADM-00223648-J0
Site Location: HWY 584
Sampler Initials: RM

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 #: B660807
Report Date: 2016/04/01

QUALITY ASSURANCE REPORT

exp Services Inc
Client Project #: ADM-00223648-J0
Site Location: HWY 584
Sampler Initials: RM

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
4437390	Available (CaCl2) pH	2016/03/31			98	97 - 103			0.36	N/A
4439872	Soluble (20:1) Chloride (Cl)	2016/04/01	NC	70 - 130	108	70 - 130	<20	ug/g	1.1	35
4439873	Soluble (20:1) Sulphate (SO4)	2016/04/01	NC	70 - 130	104	70 - 130	<20	ug/g	NC	35
4440067	Conductivity	2016/04/01			99	90 - 110	<2	umho/cm	0.56	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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Maxxam Job #: B660807
Report Date: 2016/04/01

exp Services Inc
Client Project #: ADM-00223648-J0
Site Location: HWY 584
Sampler Initials: RM

VALIDATION SIGNATURE PAGE

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

Cristina Carriere

Cristina Carriere, Scientific Services

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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CHAIN OF CUSTODY RECORD

81617 Page 1 of 1

Maxxam 6740 Campobello Road, Mississauga, ON L5N 2L8
Phone: 905-817-5700 Fax: 905-817-6779 Toll Free: (800) 563-6266

INVOICE INFORMATION
Company Name: exp Services Inc
Contact Name: Robert Moen, Akiles Mitsopoulos
Address: 1142 Roland Street, Thunder Bay ON P7B 5M4
Phone: 807 628 9465 Fax: 807 623 8070
Email: robert.moen@exp.com

REPORT INFORMATION (if differs from invoice)
Company Name:
Contact Name:
Address:
Phone: Fax:
Email:

PROJECT INFORMATION
Quotation #:
P.O. #:
Project #: ADM-00273648-J0
Site Location: Hwy 584
Site #:
Sampled By: Robert Moen

MAXXAM JOB NUMBER

CHAIN OF CUSTODY #
00

Note: For MOE Regulated Drinking Water samples, please use the Drinking Water CofC.

Regulation 153 (2011)
- [ ] Table 1 [ ] Res/Park [ ] Med/Fine
- [ ] Table 2 [ ] Ind/Comm [ ] Coarse
- [ ] Table 3 [ ] Agri/Other
- [ ] Table ____

For RSC: [ ] Yes [X] No

Other Regulations
- [ ] CCME [ ] Sanitary Sewer Bylaw
- [ ] Reg. 558 [ ] Storm Sewer Bylaw
- [ ] MISA Municipality: ____
- [ ] PWQO
- [ ] Other (specify): ____

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

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

ANALYSIS REQUESTED (Please be specific)

	Sample Identification	Date Sampled	Time Sampled	Matrix (GW, SW, Soil, etc.)	MOE Regulated Drinking Water? (Y / N)	Metals Field Filtered? (Y / N)	pH	Water Soluble Sulphate	Resistivity	Conductivity	Chloride	# of Cont.	COMMENTS / TAT COMMENTS
1	BH101 - S5	Mar 16/16	12:00pm	Soil	N	N	X	X	X	X	X	2	
2	BH102 - S6B	Mar 17/16	10:00am	Soil	N	N	X	X	X	X	X	2	
3													
4													
5													
6													
7													
8													
9													
10													

TURNAROUND TIME (TAT) REQUIRED
PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS.

Regular (Standard) TAT: [X]
(5-7 working days for most tests)

Rush TAT:
Samples must be received by 3pm to guarantee your TAT
Rush Confirmation #: PN ____
[ ] 1 day [ ] 2 days [ ] 3 days
Date Req'd: ____

TATs for certain tests are > 5 days. Please contact your Project Manager for details.

29-Mar-16 09:02
Hina Siddiqui
B660807
J L ENV-931

*RELINQUISHED BY (Signature/Print)	Date (YYYY/MM/DD)	Time:	RECEIVED BY: (Signature/Print)	Date (YYYY/MM/DD)	Time:
Robert Moen	2016/03/28	11:30am	ASAD BHATTI	2016/03/29	09:02

#JARS USED AND NOT SUBMITTED

Laboratory Use Only

Custody Seal	Yes	No
Present	✓	
Intact	✓	

Temperature (°C) on Receipt: 1/4/3

*MANDATORY SECTIONS IN GREY MUST BE FILLED OUT. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

COC-1004 (06/12) - ENV. ENG

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