REPORT

June 2013

FOUNDATION INVESTIGATION REPORT

Median Sewer
Highway 410 Widening
From South of Highway 401 to Queen Street
Regional Municipality of Peel
G.W.P. 2144-07-00

Submitted to:
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Golder Associates

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1.0 INTRODUCTION

Golder Associates Ltd. (Golder) was retained by URS Canada Inc. (URS) on behalf of the Ministry of Transportation, Ontario (MTO) to provide foundation engineering services in support of the preliminary design for the widening of Highway 410 from south of Highway 401 to Queen Street in the Cities of Mississauga and Brampton in the Regional Municipality of Peel, Ontario. This report summarizes the available existing subsurface information and provides foundation recommendations for the proposed median sewer installation associated with the overall Highway 410 widening project.

The design recommendations provided in this report for the proposed median sewer alignment are based on the subsurface information outlined below, and the Highway 410 information (existing and proposed widening) provided by URS. The information provided by URS included:

- Highway 410 Plan drawing: Hwy410_Plan.dwg, provided on September 18, 2012;
- Highway 410 Storm Sewer Plan and Profile drawing: 2012 09 19 - Storm Sewer Drawings (Plan & Profile).dwg, provided on September 19, 2012 and September 27, 2012;
- Highway 410 Utilities drawing: Hwy410_Utilities.dwg, provided September 18, 2012;
- Highway 410 Existing Topography drawing: Hwy 410 - Triangles 3-D.dwg, provided on September 18, 2012;
- Heart Lake Tunnel Alignment drawing: Heart Lake Tunnel Alignment – Hwy410 Drainage.dwg, provided September 27, 2012; and
- Contract drawings for existing structures along the Highway 410 alignment: Matheson Blvd overpass, 401/403/410 interchange ramps (underpasses), Heart Lake Tunnel, Courtney Park Drive underpass, Derry Road underpass, Highway 407 Flyover (underpass), Etobicoke Creek overpass, Steeles Avenue underpass, Glidden Road overpass, Canadian National Railway overhead, and the Orenda Road overpass.

The terms of reference and scope of work for the foundation investigation are outlined in MTO's Request for Proposal (RFP) dated November 2010, and in Section 6.8 of URS's *Technical Proposal* for this assignment.

1.1 Background Information

The subsurface information used in the preparation of this report was obtained from Golder's current borehole investigation program for the Highway 410 widening project (i.e. associated bridge structures, stormwater ponds, culvert extensions, overhead signs, high mast lights and the median sewers); as well as previous Foundation Investigation Reports prepared by others and available from the MTO Pavement and Foundation Section's GEOCRES database. The previous reports referenced from the GEOCRES database are as follows:

- **MTO GEOCRES No. 30M12-012**: Report title "Foundation Report on Underpass bridge at Highway 401 "Line "A" crossing Road Allowance (Lot 14, Con.VI) one mile northwest of Liagar, W.P. 78-57, W.J. F57-18," by Department of Highways, Ontario, Materials & Research Branch, Foundations Section, dated August 15, 1957.

- **MTO GEOCRES No. 30M12-025**: Report titled "Foundation Investigation for the Proposed Structure, Hwy. 401 EB Collector and Sub-Collector, Over Hwy 410 (Bridge No. 29), Town of Mississauga, County of Peel, District #6 (Toronto), W.O. 72-11166 – W.P. 127-66-22," by Ministry of Transportation and Communications, Foundations Office, dated April 19, 1973.
- **MTO GEOCRES No. 30M12-026**: Report titled "Foundation Investigation Report for the Proposed Structure at Hwy. 401 WB Collector over Hwy. 410 (Bridge #31) Site #24-323, District #6 (Toronto), W.O. 72-11167 – W.P. 127-66-20," by Ministry of Transportation and Communications, Foundations Office, dated April 30, 1973.
- **MTO GEOCRES No. 30M12-066**: Report titled "Foundation Investigation Report for the Proposed Structure No. 43, Ramp 'E-S' over Hwy. 410 NB core and collector, Town of Mississauga, County of Peel, Site No. 24-326, District No. 6 (Toronto), W.O. 73-11074 – W.P. 127-66-24," by Ministry of Transportation and Communications, Foundations Office, dated September 26, 1973.
- **MTO GEOCRES No. 30M12-086**: Report titled "Foundation Investigation Report for Proposed South Trunk Sewer from Heart Lake Road to North of Britannia Road, Hwy. 401-403-410 Complex, Town of Mississauga, County of Peel, District #6 (Toronto), W.O. 73-11014 – W.P. 127-66-53," by Ministry of Transportation and Communications, Foundations Office, dated August 1, 1973.
- **MTO GEOCRES No. 30M12-088**: Report titled "Foundation Investigation Report for the Proposed Ramp N-E Structure at the Crossing of Hwy 401 and Hwy 410 (Bridge #32), Site No. 24-325, Town of Mississauga, County of Peel, District #6 (Toronto), W.O. 73-11031 – W.P. 127-66-23," by Ministry of Transportation and Communications, Ontario, dated July 18, 1973.
- **MTO GEOCRES No. 30M12-090**: Report titled "Preliminary Foundation Investigation Report for Proposed Hwy's #403 and 401 from west limits of 401/27 Interchange through 401/403/410 Complex south-westerly to Hwy. #10, Town of Mississauga, County of Peel, District 6, Toronto, W.O. 72-11053, W.P. 127-66-01," by Ministry of Transportation and Communications, Foundations Office, dated July 18, 1972.
- **MTO GEOCRES No. 30M12-098**: Report titled "Foundation Investigation Report for Proposed Hwy 410 Underpass at Existing Hwy 7, Site #24-343, Town of Brampton, County of Peel, District No. 6 (Toronto), W.O. 73-11108, W.P. 134-73-02," by Ministry of Transportation and Communications, Ontario, Soil Mechanics Section, dated March 29, 1974.
- **MTO GEOCRES No. 30M12-110**: Report titled "Preliminary Foundation Investigation Report for Proposed Hwy. 410 from South Limits of Hwy. 401 to Hwy. 7, Regional Municipality of Peel, Cities of Mississauga and Brampton, District #6, Toronto, W.P. 103-69-00," by Ministry of Transportation and Communications, Soil Mechanics Section, Geotechnical Office, dated July 31, 1975.
- **MTO GEOCRES No. 30M12-113**: Report titled "Foundation Investigation Report for W.P. 36-74-01, Hwy. 403, District 6, Toronto, Proposed Culvert at the Crossing of Hwy. 403 and Little Etobicoke Creek (West Branch) just South of Matheson Blvd.," by Ministry of Transportation and Communications, Soil Mechanics Section, dated March, 1976.
- **MTO GEOCRES No. 30M12-115**: Report titled "Foundation Investigation Report for W.P. 36-74-02/03, Site No. 24-354, Matheson Blvd. SB Overpass Bridge No. 60, Matheson Blvd. NB Overpass Bridge No. 59,

Hwy. 403, District 6, Toronto" by Ministry of Transportation and Communications, Soil Mechanics Section, Geotechnical Office, dated April 22, 1976.

- **MTO GEOCRES No. 30M12-117**: Report titled "Foundation Investigation and Design Report, W.P. 103-69-09, Site 24-313, Hwy.410, District 6, Toronto, Etobicoke Creek Bridge," by Ministry of Transportation and Communications, dated June 28, 1976.
- **MTO GEOCRES No. 30M12-122**: Report titled "Foundation Investigation and Design Report, W.P. 103-69-08, Hwy. 410 from Steeles Avenue Southerly to Derry Road, Culverts" by Ministry of Transportation and Communications, Soil Mechanics Section, Geotechnical Office, dated December 21, 1976.
- **MTO GEOCRES No. 30M12-135**: Report titled "Foundation Investigation Report for Industrial Access Road Underpass, 1.2 Miles North of Hwy. 401/410, W.P. 103-69-13, Site 24-41, Hwy. 410, District 6, Toronto," by Ministry of Transportation and Communications, Highway Engineering Division, Engineering Materials Office, Soil Mechanics Section, dated October, 1978.
- **MTO GEOCRES No. 30M12-149A**: Report titled "Foundation Investigation Report for Culvert Sta. 13-125.659 under Hwy. 410, W.P. 21-79-03, Hwy. 410, District 6, Toronto," by Ministry of Transportation and Communications, Engineering Materials Office, Pavement and Foundation Design Section, dated August 25, 1982.
- **MTO GEOCRES No. 30M12-149B:** Report titled "Foundation Investigation Report for the Proposed Storm Sewer along Highway 410 (Station 430+00 to Station 470+00), Tow of Brampton, County of Peel, District 6 (Toronto), W.O. 73-11115, W.P. 134-73-01," by Ministry of Transportation and Communications, Ontario, Soil Mechanics Section, dated May 1, 1974.
- **MTO GEOCRES No. 30M12-159**: Report titled "Foundation Investigation Report for Bridge #34, Hwy 403 W.B. Expressway over Hwy 410 N.B. Expressway and Ramp S-W, W.P. 127-66-70, Site 24-81-464, Hwy 403, District 6, Toronto," by Ministry of Transportation and Communications, Engineering Materials Office, Pavement & Foundation Design Section, dated April 20, 1982.
- **MTO GEOCRES No. 30M12-160**: Report title "Foundation Investigation Report for Bridge #35, Hwy 403 E.B. Expressway over Hwy 410 N.B. Expressway and Ramp S-W, W.P. 127-66-69, Site 24-81-463, Hwy 403, District 6, Toronto," by Ministry of Transportation and Communications, Engineering Materials Office, Pavement & Foundation Design Section, dated May 5, 1982.
- **MTO GEOCRES No. 30M12-171**: Report titled "Foundation Investigation Report for Hwy. 410/CNR Overhead, W.P. 21-79-01; Site 24-145-477, District 6, Toronto," prepared by Dominion Soil Investigation Inc., Consulting Engineers, dated March 16, 1984.
- **MTO GEOCRES No. 30M12-172**: Report titled "Foundation Investigation Report for Orenda Road Overpass, W.P. 21-79-02; Site 24-145-476, Hwy. 410, District 6, Toronto," by Morton & Partners Limited, Consulting Engineers and Engineering Geologists, dated August 17, 1982.
- **MTO GEOCRES No. 30M12-176**: Report titled "Geotechnical Investigation, Retaining Walls, Highway 410 (Brampton By-Pass), Site 24, W.P. 21-79-15, Toronto," by Dominion Soil Investigation Inc., dated September, 1982.

- **MTO GEOCRES No. 30M12-186**: Report titled "Foundation Investigation Report for Glidden Road Overpass, W.P. 21-79-16; Site 24-145-487, Hwy # 410, District 6, Toronto," by Ministry of Transportation and Communications, dated June 4, 1985.
- **MTO GEOCRES No. 30M12-187**: Report titled "Foundation Investigation Report for Steeles Avenue Underpass, W.P. 21-79-18; Site 24-81-488, Hwy 410, Toronto," by Ministry of Transportation and Communications, Soil Mechanics Section, Geotechnical Office, dated October 18, 1984.
- **MTO GEOCRES No. 30M12-189**: Report titled "Foundation Investigation Report for Bridge #32, Ramp N-E 401/410 Interchange, W.P. 54-82-11; Site 24-325, District 6, Toronto," by Ministry of Transportation and Communications, Engineering Materials Office, Foundation Design Section, dated November 6, 1984.
- **MTO GEOCRES No. 30M12-190**: Report titled "Foundation Investigation Report for Bridge #67, Ramp W-N, Hwy. 401/Hwy. 410 Interchange, W.P. 54-82-10; Site 24-492, District 6, Toronto," by Ministry of Transportation and Communications, Engineering Materials Office, Pavement and Foundation Design Section, dated November 27, 1984.
- **MTO GEOCRES No. 30M12-193**: Report titled "Foundation Investigation Report for Derry Road Underpass, W.P. 103-69-15, Site 24-81-495, Hwy. 410, Toronto," by Ministry of Transportation and Communications, Soil Mechanics Section, Geotechnical Office, dated June 18, 1987.
- **MTO GEOCRES No. 30M12-195**: Report titled "Foundation Investigation Report for N.B.L. Structure Widening, Hwy # 410, W.P. 103-69-17; Site No. 24-81-313, District 6, Toronto," by Engineering Materials Office, Foundation Design Section, dated March 26, 1986.
- **MTO GEOCRES No. 30M12-196**: Report titled "Foundation Investigation Report for W.P. 54-82-09; High Mast Lighting (Hwy. 401/Hwy. 410 Interchange), Hwy. 401, Toronto," by Ministry of Transportation and Communications, Soil Mechanics Section, Geotechnical Office, dated March 30, 1987.
- **MTO GEOCRES No. 30M12-204**: Report titled "Foundation Investigation Report for Courtney Park Drive Underpass, 2.0 Kilometres North of Hwy 401/410, WP 103-69-19, Site 24-441, Hwy 410, District 6, Toronto," by Ministry of Transportation and Communications, Foundation Design Section, dated June 9, 1989.
- **MTO GEOCRES No. 30M12-205**: Report titled "Foundation Investigation Report for Hwy 401 – Hwy 410 Overpass Eastbound Core Lanes/Westbound Core Lanes, WP 54-82-15&16; Site No. 24-493, District #6, Toronto," by Ministry of Transportation and Communications, Engineering Materials Office, Foundation Design Section, dated June 7, 1988.
- **MTO GEOCRES No. 30M12-229**: Report titled "Foundation Investigation Report for High Mast Lighting, Hwy 410, Steeles Avenue to Highway 7N, W.P. 697-96-00, Central Region," by Ministry of Transportation, Ontario, dated October 8, 1996.

The previous boreholes used in this report have been renamed to show the MTO GEOCRES reference number followed by the original borehole designation. For example, the boreholes from MTO GEOCRES Report No. 30M12-117 have been renamed as 117-X, where X is the original borehole number.

The following points are noted regarding determining the locations of the previous boreholes, and assessing the previous boreholes for potential use with respect to the foundation design and construction recommendations for the proposed median sewer installation:

- The borehole locations in the previous Foundation Investigation Reports for the Highway 410 corridor are referenced to a number of coordinate or station systems. In general, the boreholes from all the GEOCRES reports were referenced to a global datum, and could be converted to the MTM NAD83 coordinate system. The accuracy of these borehole locations is considered to be generally consistent with the original survey.
- In general, the majority of the existing boreholes were located within approximately 50 m of the centerline of the median sewer alignment, and varied in spacing along the alignment. Where gaps were identified in the existing information, additional strategically placed boreholes have been completed as part of the current scope of work. Golder has reviewed the topography and subsurface conditions for the available boreholes along the proposed sewer alignment to confirm that the conditions are relatively consistent and applicable within the various sections outlined below.
- Where multiple boreholes were located within the same area of the median sewer alignment, all borehole information was considered in the design and construction recommendations.
- At several locations along the median sewer alignment, the existing boreholes were drilled from original ground surface prior to the construction of the Highway 410 embankment and / or cuts in these areas. The existing boreholes do not provide information on the material type and properties of the embankment fills or below the bottom of the cuts. In addition, the proposed grade along the median will be raised slightly to accommodate the median widening of Highway 410. It has been assumed that the existing Highway 410 fills were constructed to engineered fill standards and that the new fills will also be constructed to engineered fill standards. The material below the level of the cuts was considered to be consistent with the surrounding geology and may include fills and/or weathered materials (i.e. local shale bedrock), as applicable.

2.0 SITE DESCRIPTION

The proposed median sewer alignment begins approximately 0.7 km south of Matheson Boulevard and runs about 11.4 km north along Highway 403 / Highway 410 to just south of Clark Boulevard. The currently proposed crown of the sewer varies between about 1 m to 3 m below the proposed top of pavement (crown of road), which is proposed to vary from an approximate Elevation (El.) of El. 156 m at the southern limit of the alignment, to about El. 217 m at the proposed end of the alignment south of Clarke Boulevard. The proposed top of pavement (crown of road) is generally coincidental with the top of existing ground at the southern limit of the proposed alignment; and then varies up to approximately 3 m above the existing ground surface along the majority of the alignment moving north. These proposed areas of fill are generally located within the median ditch that currently separates the north of southbound lanes of Highway 410.

3.0 INVESTIGATION PROCEDURES

A total of nineteen (19) boreholes were drilled and one test pit dug in October and November 2012 as part of a geotechnical investigation program to support the proposed median sewer alignment. Fifteen (15) boreholes (12-1 to 12-8, 12-13 to 12-18 and C16-1) were drilled using a CME-75 drill rig and four boreholes (12-9 to 12-12) were drilled using a CME-55 drill rig. Boreholes 12-1 to 12-9, 12-12 and C16-1 were drilled using a truck-mount drill rig while Boreholes 12-10, 12-11 and 12-13 to 12-20 were drilled using track-mount equipment. The drill rigs were supplied and operated by Geo-Environmental Drilling Inc. of Milton, ON, and DBW Drilling of North York, ON. Three different CME-75 drill rigs were used to drill the boreholes; a 70 mm inner diameter hollow stem auger, a 108 mm inner diameter hollow stem auger, and a 101 mm diameter solid stem auger, as noted on the Borehole Records (Appendix A). The CME-55 drill rig utilized a 101 mm diameter solid stem auger. The one test pit, Test Pit C16-2, was hand dug to a depth of about 0.25 m below existing ground surface (see Appendix A).

The boreholes were advanced to depths ranging from approximately 4.5 m to 9.8 m below existing ground surface, including bedrock coring. Soil samples were obtained from approximately 0.6 m and 1.5 m intervals of depth using a 50 mm outer diameter split-spoon sampler driven by an automatic hammer in accordance with the Standard Penetration Test (SPT) procedure (ASTM D1586-08a Standard Test Method for Standard Penetration Test). Bedrock coring was completed in Boreholes 12-3 to 12-8, 12-13 to 12-15 and C16-1 using an HQ triple-tube diamond drill core barrel.

The groundwater conditions were observed in the open boreholes and test pit during and immediately following the drilling/digging operations. The water levels observed in the boreholes and test pit following completion of drilling/digging are indicated on the Borehole and Test Pit Records contained in Appendix A. All boreholes were backfilled with bentonite upon completion, in accordance with Ontario Regulation 903 (as amended).

The field work was supervised on a full-time basis by members of Golder's engineering staff who located the boreholes and the test pit in the field, cleared all locates of potential buried conflicts, directed the drilling/digging, sampling, in situ testing operations, and logged the subsurface conditions. The soil samples were identified in the field, placed in labelled containers and transported to Golder's laboratory in Mississauga for further examination and laboratory testing. Index and classification tests consisting of water content determinations, Atterberg limits testing and grain size distribution analyses were carried out on selected soil samples. Point load index and unconfined compression (UC) tests were carried out on selected rock samples.

The borehole and test pit locations were established in the field by Golder personnel relative to site features. The ground surface elevation at each borehole and the test pit were estimated from the digital terrain model for the site as provided by URS. The borehole and test pit locations (referenced to the MTM NAD83 co-ordinate system) and ground surface elevations (referenced to geodetic datum) are summarized in the following table and are shown on the Borehole Location and Soil Strata drawings contained in the Contract Documents. These drawings also show the locations of boreholes advanced as part of previous investigations undertaken along the proposed alignment.

Borehole No.	MTM NAD83 Northing (m)	MTM NAD83 Easting (m)	Ground Surface Elevation (m)	Borehole Depth (m)
12-1	4,831,684.5	293,473.6	154.0	9.8
12-2	4,832,044.7	293,126.9	162.5	9.5

Borehole No.	MTM NAD83 Northing (m)	MTM NAD83 Easting (m)	Ground Surface Elevation (m)	Borehole Depth (m)
12-3	4,832,719.3	292,532.9	169.5	4.5
12-4	4,832,947.0	292,338.8	173.0	4.5
12-5	4,833,124.6	292,098.7	172.0	4.7
12-6	4,833,263.0	291,876.3	173.0	4.7
12-7	4,833,508.7	291,631.5	176.0	4.5
12-8	4,833,866.9	291,282.9	180.0	9.1
12-9	4,834,184.3	290,966.4	183.0	8.8
12-10	4,834,449.2	290,709.2	185.5	9.5
12-11	4,835,114.2	290,066.4	183.5	9.5
12-12	4,836,085.5	289,128.5	189.1	8.2
12-13	4,836,711.3	288,541.9	193.5	4.7
12-14	4,837,913.0	288,085.2	193.5	8.8
12-15	4,838,615.1	287,574.0	197.0	9.3
12-16	4,838,833.4	287,367.5	201.5	7.8
12-17	4,839,261.0	286,946.7	212.0	8.7
12-18	4,840,141.1	286,094.7	215.8	9.2
C16-1	4,832,538.1	292,671.7	169.1	5.6
Test Pit No.	**MTM NAD83 Northing (m)**	**MTM NAD83 Easting (m)**	**Ground Surface Elevation (m)**	**Test Pit Depth (m)**
C16-2	4,832,534.5	292,665.7	168.1	0.25

4.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

4.1 Regional Geology

This section of Highway 410 is located within the Peel Plain physiographic region, as delineated in *The Physiography of Southern Ontario* (Chapman and Putnam, 1984).

The Peel Plain physiographic region covers the central portions of the Regional Municipalities of York, Peel and Halton. The general topography of this region consists of level to gently rolling terrain, sloping gradually southward toward Lake Ontario. A surficial till sheet, which generally follows the surface topography, is present throughout much of this area. The till, which is mapped in this area as Halton Till, typically consists of clayey silt to silty clay, with occasional sand to silt zones. Shallow, localized deposits of loose sand and silt and/or soft clay can overlie this uppermost till sheet, and these represent relatively recent deposits, formed in small glacial meltwater ponds scattered throughout the Peel Plain and concentrated near river valleys. The recent sand, silt and clay and uppermost till deposits in this area overlie and are interbedded with stratified deposits of sand, silt and clay. The study area, in the western portion of the Peel Plain, is underlain by grey shale of the Georgian Bay Formation.

4.2 Subsurface Conditions

As part of the current subsurface investigation, nineteen (19) boreholes (Boreholes 12-1 to 12-20 and C16-1) and one test pit (Test Pit C16-2) were advanced along the shoulder and center median area of Highway 410. The borehole and test pit locations, ground surface elevations and interpreted stratigraphic conditions are shown on the Borehole Location and Soil Strata drawings contained in the Contract Documents. Boreholes 12-1 to 12-8, 12-12 and C16-1 were drilled on the shoulder of the northbound lane. These boreholes were drilled on the left shoulder with the exception of Borehole 12-5, which was drilled on the right shoulder. Boreholes 12-9 to 12-11 and 12-13 to 12-18 were drilled at the center median (i.e. in the ditch separating the north and southbound lanes). Test Pit C16-2 was dug in the center median area adjacent to Borehole C16-1.

The detailed subsurface soil and groundwater conditions encountered in the boreholes advanced as part of the current investigation and the results of in situ and laboratory testing are given on the Borehole Records contained in Appendix A. The results of geotechnical laboratory testing are also contained in Appendix B. The borehole information from the previous Golder (associated with the Highway 410 widening project) and MTO investigations are presented in Appendix C.

The stratigraphic boundaries shown on the Borehole Records and on the interpreted stratigraphic profile and cross-sections on the Borehole Location and Soil Strata drawings are inferred from observations of drilling progress and from non-continuous sampling and, therefore, represent transitions between soil types rather than exact planes of geological change. The subsoil conditions will vary between and beyond the borehole and test pit locations.

In general, the subsurface conditions at the site consisted of surficial layers of topsoil, asphalt, roadway base granular fill and cohesive fill. These fill units were generally underlain by a clayey silt till deposit along the majority of the proposed alignment, which was all underlain by shale bedrock. In the following sections, the subsurface conditions are described in greater detail for sections of chainage along the median sewer alignment. The soil and groundwater conditions were based on the results of the boreholes and test pit advanced as part of the geotechnical investigation program. These results were compared with the subsurface conditions interpreted in earlier Golder and MTO reports and borehole logs.

4.2.1 Station (St.) 2+190 to St. 2+750 (South of Matheson Blvd.)

Two boreholes were advanced between stations 2+190 and 2+750 (12-1 and 12-2) to complement Boreholes 113-3 and 113-4, which were completed during the 1970's (see Borehole Location and Soil Strata Drawing 1). The subsurface conditions anticipated to be encountered are summarized below. The present ground surface along this section of the sewer ranges on average from an approximate Elevation (El.) of 156 m to 165 m from south to north. It is understood that there will be no appreciable grade raise along this section of the sewer.

4.2.1.1 Fill

An approximately 200 mm thick layer of asphalt was encountered starting at existing ground surface in Borehole 12-2. A layer of sand and gravel fill (with SPT "N" values ranging from 17 blows to 35 blows per 0.3 m of penetration, indicating a compact to dense relative density) was found underlying the asphalt in Borehole 12-2, and from ground surface to a depth of 0.8 m below existing ground surface in Borehole 12-1. Underlying the granular fill was a layer of clayey silt fill with sand, trace gravel and containing wood fragments, to depths ranging from about 1.5 m to 2.2 m below existing ground surface. The measured SPT "N" values in the clayey

silt fill ranged from 6 blows to 46 blows per 0.3 m of penetration, indicating a firm to hard relative density. Although not specifically encountered during the current investigation, the thickness of the fill unit may extend to approximately 7 m below existing ground surface based on historic site information.

4.2.1.2 Clayey Silt Till

A clayey silt till deposit was encountered underlying the fill units in the current boreholes and within the previously completed boreholes. The thickness of the till unit ranged from about 7.3 m to 8.3 m along this section of the proposed sewer alignment, and the current boreholes (12-1 and 12-2) were terminated within this unit. The thickness of the till appears to decrease towards Matheson Boulevard where the previously completed boreholes indicate a layer thickness of approximately 3 m.

The deposit generally consists of clayey silt with sand, trace to some gravel, and contained cobbles in the soil matrix. Atterberg limits testing completed on selected samples indicated that the plastic limits generally ranged from approximately 12 per cent to 17 per cent, liquid limits from about 18 per cent to 33 per cent, and corresponding plasticity indices of 6 to 16. The natural water content ranged from approximately 8 per cent to 16 per cent. The measured SPT “N” values within the clayey silt till ranged from 7 blows to over 50 blows per 0.3 m (or less) of penetration, suggesting a firm to hard relative density.

4.2.1.3 Silt to Silty Sand

Although not specifically encountered during the current investigation, the historic boreholes along this section of the proposed sewer alignment indicate an approximately 1.3 m thick layer of (likely discontinuous) silt to sandy silt underlying the clayey silt till. SPT “N” values of 133 blows per 0.3 m of penetration and 165 blows per 0.2 m of penetration were measured in the silt deposit indicating a very dense relative density.

4.2.1.4 Groundwater Conditions

The groundwater levels in the open boreholes were encountered at depths of about 7 m to 9 m below existing ground surface, and were assumed to have insufficient time to adequately recover. However, based on previously completed borehole and piezometer information in this area, the groundwater table is anticipated to be approximately 3 m to 4 m below the existing ground surface. It should be noted that the water table is expected to fluctuate seasonally in response to changes in precipitation and snow melt, and is expected to be higher during the spring season.

4.2.2 St. 2+750 to St. 4+950 (Including Matheson Boulevard, Highways 403 / 410 / 401 Interchanges and the Heart Lake Tunnel)

Six boreholes (12-3 to 12-7 and C16-1) were advanced between Matheson Boulevard and St. 4+950, and a shallow test pit (C16-2) was also completed in close proximity to Borehole C16-1 (see Borehole Location and Soil Strata Drawings 2 and 3). The purpose of these recent boreholes and test pit were to confirm and complement the subsurface information provided by the previously completed nineteen boreholes (025-3 to 025-6, 026-3, 026-4, 066-4, 086-17, 086-18, 090-16, 115-5, 115-6, 189-7, 190-11; MB-1 to MB-5) that were advanced during the 1970’s and more recently. The subsurface conditions anticipated to be encountered are summarized below. The present ground surface along this section of the sewer ranges on average from approximately El. 165 m to El. 177 m from south to north. It is understood that there will be no appreciable grade

raise along this section south of Highway 401, transitioning to an approximately 3 m grade raise in the section north of Highway 401.

4.2.2.1 Fill

An approximately 200 mm thick layer of asphalt was encountered starting at existing ground surface in Boreholes 12-3 to 12-7. An approximately 0.6 m thick layer of sand and gravel fill (i.e. road base material) was found underlying the asphalt layer. The sand and gravel fill unit was generally brown, with SPT "N" values ranging from 3 blows to 60 blows per 0.3 m of penetration, indicating a compact to dense state of compactness. Borehole 12-6 was an exception, where an approximately 0.7 m thick layer of dense silty sand fill with some gravel and trace to some clay was found underlying the surficial asphalt layer. Although not encountered in Boreholes 12-3 to 12-7 it is anticipated that clayey silt fill may also be encountered along the proposed sewer alignment, and may vary in thickness from 0.3 m to over 1.5 m within the road footprint and near bridge structures.

4.2.2.2 Shale Bedrock

Based on the results of the recent site investigation, the top of bedrock is generally located about 0.8 m below the existing ground surface for the length of proposed sewer alignment between Matheson Boulevard and St. 4+950. This corresponds well with the historic borehole information which indicates that a significant portion of this section of highway is within a cut (up to approximately 8 m deep) into the underlying native shale bedrock that was made for the original Highway 403/410 construction. The shale bedrock is of Georgian Bay Formation and is slightly weathered to fresh, laminated, grey and contains strong to very strong fossiliferous limestone interbeds and clay seams. Point load and UC tests conducted on selected samples resulted in unconfined compressive strength (UCS) values ranging from approximately 12 MPa to 102 MPa (with an average value of 46 MPa), which indicated a general rock mass strength of weak to medium strong.

The quality of the bedrock near surface was considered to be very poor to poor and increased in quality with depth. This is indicative of the weathering process typically observed in exposed areas of this formation.

4.2.2.3 Groundwater Conditions

Based on the observations made during the various site investigations and our understanding of the site, it is anticipated that the groundwater table is located approximately 1 m to 1.5 m below the existing ground surface between Matheson Boulevard and St. 4+950. It should be noted that the water table is expected to fluctuate seasonally in response to changes in precipitation and snow melt, and is expected to be higher during the spring season.

4.2.3 St. 4+950 to St. 6+250 (Between Heart Lake Tunnel and Courtney Park Drive)

Three boreholes (12-8 to 12-10) were advanced between St. 4+950 and St. 6+250 as part of site investigation program for the proposed median sewer (see Borehole Location and Soil Strata Drawings 3 and 4). These boreholes complemented Boreholes P1-1 to P1-3, which were advanced at the site of a proposed stormwater management pond. The subsurface conditions anticipated to be encountered are summarized below. The present ground surface along this section of the sewer ranges on average from approximately El. 177 m to El.

186 m from south to north. It is understood that there will be an average grade raise of approximately 1.5 m along this section of the alignment.

4.2.3.1 Fill

An approximately 200 mm thick layer of asphalt was encountered in Borehole 12-8, and up to 100 mm of topsoil was encountered at ground surface in Boreholes 12-9 and 12-10. Underlying these surficial units was an approximately 0.4 m to 0.7 m thick layer of clayey silt fill in Boreholes 12-9 and 12-10, and sand and gravel fill in Borehole 12-8. The fill was generally brown, with SPT "N" values ranging from 5 blows to 24 blows per 0.3 m of penetration in the clayey silt, suggesting a firm to very stiff relative density, and 39 blows per 0.3 m of penetration in the sand and gravel, which suggests a dense compactness.

4.2.3.2 Clayey Silt Till

A clayey silt till deposit was encountered underlying the surficial fill units in the current boreholes and within previously completed boreholes. The thickness of the till along this section of the alignment ranged from approximately 6.8 m in Borehole 12-8 to at least 8.7 m in Borehole 12-10. The till was brown to grey, contained sand and trace to some gravel, and had SPT "N" values ranging from 8 blows to 77 blows per 0.3 m of penetration, indicating a stiff to hard relative density. Cobbles and boulders were encountered approximately 3.0 m below the existing ground surface in some of the boreholes. Atterberg limits testing on selected samples of the till deposit estimated the plastic limit to range from 12 per cent to 16 per cent, the liquid limit to range from 18 per cent to 28 per cent, and corresponding plasticity indices of 5 per cent to 13 per cent.

4.2.3.3 Shale Bedrock

Shale bedrock was encountered at a depth of approximately 7.6 m below existing ground surface (at about El. 172.4 m) in Borehole 12-8 underlying the clayey silt till. The shale was slightly weathered to fresh, laminated, grey, and contained strong to very strong fossiliferous limestone interbeds and clay seams. Point load tests were conducted on selected cores of the shale sampled from Borehole 12-8 resulting in UCS values ranging from 83 MPa to 171 MPa. These UCS values may be attributed to the fact that the shale cores were sampled from a greater depth and the presence of strong to very strong limestone interbeds within the shale bedrock. Historic Borehole 110-1 encountered bedrock at approximately El. 170.8 m, suggesting that the depth to the top of the bedrock generally increases towards the north limit of this section along the proposed median sewer alignment.

4.2.3.4 Groundwater Conditions

The groundwater level was not observed in open Boreholes 12-8 and 12-10 upon completion of drilling, and was observed at a depth of approximately 8.4 m below the existing ground surface (at about El. 174.6 m) in Borehole 12-9. It was assumed that the groundwater was still in the process of recovering when these observations were made. Based on available piezometric information and our understanding of the site, it is anticipated that the groundwater table is located approximately 1.5 m to 4 m below the existing ground surface along this section of the proposed median sewer. The water table is expected to fluctuate seasonally in response to changes in precipitation and snow melt, and is expected to be highest during the spring season.

4.2.4 St. 6+250 to St. 9+000 (Including Courtney Park Drive, Derry Road and Highway 407 Flyover)

Two boreholes (12-11 and 12-12) were advanced between Courtney Park Drive and Highway 407 as part of the site investigation for the installation of the proposed median sewer (see Borehole Location and Soil Strata Drawings 4 to 6). The purpose of these boreholes was to complement and confirm the findings of fourteen (14) historic boreholes (110-1 to 110-3, 122-1(1), 122-1(2), 122-2(1), 122-2(2), 135-3, 135-4, 193-7, 193-8, and 204-4 to 204-6) and the ten (10) previously completed boreholes associated with the overall Highway 410 widening project (C4-1, C4-2, C5-1, C5-2, P2-1 to P2-3, and P3-1 to P3-3). The subsurface conditions anticipated to be encountered are summarized below. The present ground surface along this section of the sewer ranges on average from approximately El. 186 m to El. 194 m from south to north. It is understood that the grade raise along this section will generally range from 1 m to 3 m, with an average grade raise of approximately 2 m.

4.2.4.1 Fill

A clayey silt fill containing some sand, trace gravel and organics was encountered in the existing center median area along this section of the proposed median sewer alignment. The fill was generally brown and had a thickness of approximately 300 mm. An SPT “N” value of 6 blows per 0.3 m of penetration was measured in the clayey silt fill, indicating a firm relative density.

4.2.4.2 Clayey Silt Till

A brown to grey clayey silt till deposit was found to underlie the clayey silt fill along this section of the proposed median sewer alignment. This deposit ranged in thickness from approximately 2.7 m to 6.7 m thick in Boreholes 12-11 and 12-12. The thickness of the till deposit is anticipated to vary between about 1 m and 15 m within the limits of this section based on historic and previously completed borehole information. Atterberg limits testing performed on selected samples of the till deposit estimated the plastic limit to range from 12 per cent to 17 per cent, the liquid limit to range from about 17 per cent to 32 per cent, and corresponding plasticity indices of 5 per cent to 15 per cent. The natural water content ranged from approximately 7 per cent to 19 per cent. The measured SPT “N” values ranged from 17 blows per 0.3 m of penetration to 100 blows per 0.15 m of penetration, indicating a very stiff to hard relative density.

4.2.4.3 Silt to Sand and Silt

It is anticipated that layers of silt to sand and silt, containing trace clay and trace to some gravel, are contained within and underlie the clayey silt till unit. Layers of silt to sand and silt were encountered approximately 3.0 m below the existing ground surface (at about El. 180.5 m) in Borehole 12-11, and were also encountered during historic and previously completed site investigations associated with the overall Highway 410 widening project. The thickness of this layer(s) is anticipated to vary along this section of the proposed median sewer alignment. The measured SPT “N” values ranged from 17 blows to 53 blows per 0.3 m of penetration, indicating a compact to very dense state of compactness.

4.2.4.4 Groundwater Conditions

The groundwater level is anticipated to be approximately 3 m to 4 m below the existing ground surface along this section of the proposed median sewer. It should be noted that the water table is expected to fluctuate seasonally in response to changes in precipitation and snow melt, and is expected to be higher during the spring season.

4.2.5 St. 9+000 to St. 9+650 (Including Etobicoke Creek)

A single borehole (12-13) was advanced along the proposed median sewer alignment between the Highway 407 overpass and Etobicoke Creek (see Borehole Location and Soil Strata Drawings 6 and 7). This borehole complements four historic boreholes (110-4, 117-1, 195-1 and 195-4) and thirteen (13) previously completed boreholes associated with the overall Highway 410 widening project (P4-1 to P4-3, and EC-1 to EC-10). The subsurface conditions anticipated to be encountered are summarized below. The present ground surface along this section of the sewer ranges on average from approximately El. 194 m to El. 190 m from south to north, excluding Etobicoke Creek, which drops to an elevation below approximately El. 186 m. It is understood that a grade raise along this section will generally range from 1 m to 2 m, with an average grade raise of approximately 1.5 m.

4.2.5.1 Fill

An approximately 100 mm thick layer of topsoil was found to be underlain by an approximately 0.7 m thick layer of clayey silt fill starting at the ground surface. This clayey silt fill contained some sand, trace gravel and organics, is anticipated to be less than 1 m thick between St. 9+000 and St. 9+150, and may approach a thickness of about 0.1 m towards Etobicoke Creek. An SPT “N” value of 5 blows per 0.3 m of penetration was measured in the fill, indicating a firm relative density. An Atterberg limits test performed on a sample of the fill estimated a liquid limit of 34 per cent, a plastic limit of 18 per cent, and a corresponding plasticity index of 16 per cent. The sample had a natural water content of 18 per cent.

4.2.5.2 Clayey Silt Till

Although not encountered in Borehole 12-13 of the current site investigation, a layer of brown to grey clayey silt till containing sand and gravel is believed to exist at the southern limit of this section based the historic borehole records. The till unit is anticipated to be approximately 5.2 m thick near St. 8+975 and may thin out to zero near St. 9+150. The historic SPT “N” values suggest that this till has a hard relative density.

4.2.5.3 Sand and Gravel

A native sand and gravel layer was encountered in the boreholes that were completed for the associated bridge structure close to Etobicoke Creek for the Highway 410 widening project. The unit contained trace to some silt and clay, and was wet, due in part to the presence of the creek. This unit is not anticipated to be encountered during the installation of the median sewer based on the current information, as it was encountered at the general elevation of the creek and below the proposed sewer invert elevations in this area.

4.2.5.4 Shale Bedrock

Slightly weathered to fresh, laminated, grey, weak to medium strong shale bedrock (Georgian Bay Formation) containing strong to very strong fossiliferous limestone interbeds and clay seams was encountered in Borehole 12-13 underlying the clayey silt fill, and is believed to exist close to the existing ground surface along this particular section of the proposed median sewer alignment. The top of bedrock is anticipated to be less than 1 m below the existing ground surface (i.e. between approximately El. 192 m and El. 193 m) between St. 9+150 and Etobicoke Creek, but at a greater depth south of St. 9+150.

4.2.5.5 Groundwater Conditions

The groundwater table is anticipated to be between about El. 191 m and El. 192 m along the proposed median sewer alignment between St. 9+000 and St. 9+500. The water table is expected to fluctuate seasonally in response to changes in precipitation and snow melt, and is expected to be higher during the spring season.

4.2.6 St. 9+650 to St. 11+500 (Including Steeles Avenue)

Two boreholes (12-14 and 12-15) were advanced between St. 9+650 and St. 11+500 along the proposed median sewer alignment (see Borehole Location and Soil Strata Drawings 7 to 10). These boreholes obtained additional subsurface information along this section of the sewer alignment, and complemented the information obtained from the nine historic boreholes (110-5, 122-3(1), 122-3(2), 122-4(1), 122-4(2), 122-5(1), 122-5(2), 187-3 and 187-4) and the six previously completed boreholes associated with the overall Highway 410 widening project (P5-1 to P5-3, and P6A-1 to P6A-3). The subsurface conditions anticipated to be encountered are summarized below. The present ground surface along this section of the sewer ranges on average from approximately El. 190 m to El. 198 m from south to north. It is understood that there will be an average grade raise of about 1.5 m along this section of the alignment.

4.2.6.1 Fill

A brown clayey silt fill layer was encountered below an approximately 100 mm thick layer of topsoil along this section of the proposed sewer alignment. The clayey silt fill layer is anticipated to be approximately less than 0.5 m thick over the majority of the alignment, and possibly as thick as 2 m between St. 10+150 and St. 10+900 based on the available borehole information. The measured SPT “N” values ranged from 9 blows to 23 blows per 0.3 m of penetration, indicating a stiff to very stiff consistency.

4.2.6.2 Clayey Silt Till

The clayey silt till deposit was found underlying the surficial fill units in Boreholes 12-14 and 12-15. The till was generally brown to grey, containing trace to some gravel and cobbles, and is anticipated to vary in thickness along this section of the proposed sewer alignment. Borehole Records from current and past site investigations suggest that the till increases in thickness from approximately 2 m at Etobicoke Creek, to over 10 m between St. 10+200 and St. 10+800, to approximately 4 m at the northern limit of this section. A layer of cobbles and boulders was encountered within the deposit in Borehole 12-14 as described below. Atterberg limits testing conducted on selected samples of the till estimated the plastic limit to range from approximately 12 per cent to 15 per cent, the liquid limit to range from about 18 per cent to 27 per cent, and corresponding plasticity indices ranging from 6 per cent to 12 per cent. The natural water content was estimated to range between 6 per cent and 12 per cent. The measured SPT “N” values ranged from 23 blows to 90 blows per 0.3 m of penetration, indicating a very stiff to hard relative density.

4.2.6.3 Cobbles and Boulders

An approximately 2.3 m thick layer of cobbles and boulders was encountered in Borehole 12-14 at a depth of approximately 4 m below the existing ground surface (i.e. at approximately El. 189.5 m and some 2.5 m below the sewer invert level). This layer was not encountered at the adjacent boreholes approximately 150 m south and 200 m north of Borehole 12-14.

4.2.6.4 Shale Bedrock

Grey, slightly weathered to fresh, laminated shale bedrock (Georgian Bay Formation) with strong to very strong fossiliferous limestone interbeds and clay seams was encountered underlying the native clayey silt in Borehole 12-15. Unconfined compression and point load testing of selected samples measured UCS values of 13 MPa and 22 MPa, indicating a general rock mass strength ranging from weak to medium strong. While the subsurface conditions encountered indicate that the top of bedrock may be below the proposed invert of the median sewer along the majority of this section of the alignment, the bedrock was encountered close to the existing ground surface near the northern limit at an approximately 6.0 m depth below the existing ground surface (at about El. 191.0 m) in Borehole 12-15. Historic borehole records (see Appendix C1) indicate that the top of bedrock may even be closer to the surface further north from St. 11+325.

4.2.6.5 Groundwater Conditions

The groundwater table is anticipated to be approximately 3 m to 4 m below the existing ground surface along this particular section of the proposed median sewer alignment. It is important to note that the water table is expected to fluctuate seasonally in response to changes in precipitation and snow melt, and is expected to be higher during the spring season.

4.2.7 St. 11+500 to St. 13+400 (Including Glidden Road, the Canadian National (CN) Rail overpass and Orenda Road)

Three boreholes (12-16 to 12-18) were advanced along the proposed median sewer alignment between St. 11+500 and St. 13+400 (see Borehole Location and Soil Strata Drawings 10 to 12), to complement the subsurface information from the forty-four (44) previously completed boreholes (110-6 to 110-8, 122-6(1), 149A-2, 149A-3, 149B-1 to 149B-7, 171-6, 171-7, 186-2, 186-11, 229-16(1) and 229-21; GR-1 to GR-7, CN-1 to CN-10, and OR-1 to OR-8). The subsurface conditions anticipated to be encountered are summarized below. The present ground surface along this section of the sewer ranges on average from approximately El. 198 m to El. 216 m from south to north. It is understood that there will be an average grade raise of approximately 1.5 m along this section of the alignment.

4.2.7.1 Fill

Fill materials consisting primarily of clayey silt and silty clay were encountered underlying a surficial topsoil layer, which was about 100 mm thick or less at the investigated borehole locations. In Borehole 12-17, a thin layer of sand and silt fill was encountered underlying the topsoil, and an approximately 0.5 m thick layer of pulverized asphalt was found at a depth of approximately 3.8 m below existing ground surface. Based on the results of current and historic site investigations, it is anticipated that the thickness of the fill layer ranges from less than 0.5 m at the southern limit of this section, to upwards of approximately 9 m in the vicinity of Orenda Road, and then decreases to about 3 m at the north end of this section. The predominant clayey silt fill units were brown to grey, and contained some sand and gravel. The measured SPT “N” values ranged from 2 blows to 23 blows per 0.3 m of penetration, indicating a soft to very stiff relative density. Atterberg limits testing conducted on selected samples of the clayey silt fill material estimated the plastic limit to range from 16 per cent to 25 per cent, the liquid limit to range from 30 per cent to 46 per cent, and corresponding plasticity indices ranged from 14 per cent to 26 per cent. The natural water content was estimated to range from about 11 per cent to 29 per cent.

4.2.7.2 Sandy Silt

An approximately 3.2 m thick layer of sandy silt was encountered underlying the fill in Borehole 12-18. The sandy silt was brown and contained trace gravel and clay. The measured SPT "N" values ranged from 9 blows to over 57 blows per 0.3 m of penetration, indicating a loose to very dense state of compactness. The natural moisture content was estimated to range from about 12 per cent to 13 per cent based on test results from selected samples.

4.2.7.3 Clayey Silt Till

A clayey silt till deposit was encountered beneath the surficial fill units. The till was brown to grey and contained trace sand to with sand, and some gravel to with gravel. Although not encountered during the site investigation, cobbles and / or boulders are anticipated to be present at depth within the till deposit. The measured SPT "N" values in the till ranged from 25 blows to over 92 blows per 0.3 m of penetration, indicating that the clayey silt till had a very stiff to hard relative density. The plastic limit ranged from about 15 per cent to 16 per cent, the liquid limit ranged from 27 per cent to 29 per cent, and corresponding plasticity indices ranged from 12 per cent to 13 per cent. The natural water content ranged from about 5 per cent to 12 per cent.

4.2.7.4 Shale Bedrock

Although not encountered in Boreholes 12-16, 12-17 and 12-18 the shale bedrock was found below the clayey silt till at an approximate 10 m to 14 m depth, some 6 to 10 m below the sewer invert level, in boreholes put down at the adjacent bridge structures.

4.2.7.5 Groundwater Conditions

The groundwater level was observed at depths of approximately 7.3 m and 8.6 m below the existing ground surface in Boreholes 12-16 and 12-17, respectively, and were anticipated to be still recovering at the time of observation. Historic information suggests that the groundwater level may be located approximately 4 m to 6 m below the existing ground surface along this median sewer section, and may be as high as 2 m below ground surface at the southern and north limits of this section. The water table is expected to fluctuate seasonally in response to changes in precipitation and snow melt, and is expected to be higher during the spring season.

4.2.8 Highway 403 Westbound (Southbound) – St. 4+250 to St. 4+600

One borehole (12-6) was advanced as part of the median sewer site investigation between St. 4+250 and St. 4+600 (see Borehole Location and Soil Strata Drawing 13). This borehole was advanced to complement the eight historic boreholes which were previously completed (25-3 to 25-6, 26-3, 26-4, 90-16, and 189-7). The subsurface conditions anticipated to be encountered are summarized below. The present ground surface along this section of the sewer ranges on average from approximately El. 173 m to El. 176 m from south to north. It is understood that there will be no appreciable grade raise along this section.

4.2.8.1 Fill

An approximately 200 mm thick layer of asphalt was encountered starting at the existing ground surface in Borehole 12-6. The asphalt was underlain by an approximately 0.7 m thick layer of silty sand fill (i.e. road base material). The silty sand fill was brown and contained some gravel and trace to some clay. An SPT "N" value of 41 blows per 0.3 m of penetration was measured in the fill, which suggests a dense state of compactness.

Although no boreholes were advanced in the center median area between St. 4+250 and St. 4+600, clayey silt fill is anticipated to also be present along this section of the median sewer alignment.

4.2.8.2 Shale Bedrock

Shale bedrock was encountered underlying the silty sand fill at an approximate depth of 0.8 m below the existing ground surface in Borehole 12-6. This corresponds well with the historic borehole information which indicates that a significant portion of this section of the highway is within a cut (up to approximately 8 m deep) into the underlying native shale bedrock that was made for the original Highway 403 / 410 construction. The shale bedrock encountered was of the Georgian Bay Formation, and was slightly weathered to fresh, laminated, grey, and weak to medium strong and contained strong to very strong fossiliferous limestone interbeds and clay seams.

4.2.8.3 Groundwater Conditions

The groundwater level is anticipated to be approximately 1 m to 2 m below existing ground surface along this section of the proposed median sewer alignment. It should be noted that the water table is expected to fluctuate seasonally in response to changes in precipitation and snow melt, and is expected to be higher during the spring season.

5.0 CLOSURE

This Foundation Investigation Report was prepared by Mr. Geoff Lay, M.A.Sc., E.I.T., and reviewed by Dr. Graeme Skinner, P.Eng., with input from Ms. Lisa Coyne, P.Eng., a geotechnical engineer and Principal with Golder. Mr. Fin Heffernan, P.Eng., a Designated MTO Foundations Contact for Golder, conducted an independent review of this report

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APPENDIX A

Borehole and Test Pit Records from Current Investigation

LIST OF ABBREVIATIONS

The abbreviations commonly employed on Records of Boreholes, on figures and in the text of the report are as follows:

I. SAMPLE TYPE

AS	Auger sample
BS	Block sample
CS	Chunk sample
SS	Split-spoon
DS	Denison type sample
FS	Foil sample
RC	Rock core
SC	Soil core
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

II. PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:
The number of blows by a 63.5 kg. (140 lb.) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) drive open sampler for a distance of 300 mm (12 in.)

Dynamic Cone Penetration Resistance; N_d:
The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60º cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH: Sampler advanced by hydraulic pressure
PM: Sampler advanced by manual pressure
WH: Sampler advanced by static weight of hammer
WR: Sampler advanced by weight of sampler and rod

Piezo-Cone Penetration Test (CPT)
A electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm^2 pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (Q_t), porewater pressure (PWP) and friction along a sleeve are recorded electronically at 25 mm penetration intervals.

III. SOIL DESCRIPTION

(a) Cohesionless Soils

Density Index / Relative Density	N Blows/300 mm or Blows/ft
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	over 50

(b) Cohesive Soils

Consistency	c_u, s_u kPa	c_u, s_u psf
Very soft	0 to 12	0 to 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1,000
Stiff	50 to 100	1,000 to 2,000
Very stiff	100 to 200	2,000 to 4,000
Hard	over 200	over 4,000

IV. SOIL TESTS

w	water content
w_p	plastic limit
w_l	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test[1]
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D_R	relative density (specific gravity, G_s)
DS	direct shear test
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO_4	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V	field vane (LV-laboratory vane test)
γ	unit weight

Note: 1 Tests which are anisotropically consolidated prior to shear are shown as CAD, CAU.

V. MINOR SOIL CONSTITUENTS

Percent by Weight	Modifier	Example
0 to 5	Trace	Trace sand
5 to 12	Trace to Some (or Little)	Trace to some sand
12 to 20	Some	Some sand
20 to 30	(ey) or (y)	Sandy
over 30	And (cohesionless) or With (cohesive)	Sand and Gravel / Silty Clay with sand / Clayey Silt with sand

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	3.1416
ln x,	natural logarithm of x
$\log_{10}$	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta\sigma$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
υ	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial effective overburden stress
σ_1, σ_2, σ_3	principal stress (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight)*
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e	void ratio
n	porosity
S	degree of saturation

* Density symbol is ρ. Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density multiplied by acceleration due to gravity)

(a) Index Properties (continued)

w	water content
w_l or LL	liquid limit
w_p or PL	plastic limit
I_p or PI	plasticity index = $(w_l - w_p)$
w_s	shrinkage limit
I_L	liquidity index = $(w - w_p) / I_p$
I_C	consistency index = $(w_l - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (over-consolidated range)
C_s	swelling index
C_α	secondary compression index
m_v	coefficient of volume change
c_v	coefficient of consolidation (vertical direction)
c_h	coefficient of consolidation (horizontal direction)
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation stress
OCR	over-consolidation ratio = σ'_p / σ'_{vo}

(d) Shear Strength

τ_p, τ_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction = tan δ
c′	effective cohesion
c_u, s_u	undrained shear strength ($\phi = 0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p′	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q	$(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$
q_u	compressive strength $(\sigma_1 - \sigma_3)$
S_t	sensitivity

Notes: 1 $\tau = c' + \sigma' \tan \phi'$

2 shear strength = (compressive strength)/2

LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

WEATHERINGS STATE

Fresh: no visible sign of weathering

Faintly weathered: weathering limited to the surface of major discontinuities.

Slightly weathered: penetrative weathering developed on open discontinuity surfaces but only slight weathering of rock material.

Moderately weathered: weathering extends throughout the rock mass but the rock material is not friable.

Highly weathered: weathering extends throughout rock mass and the rock material is partly friable.

Completely weathered: rock is wholly decomposed and in a friable condition but the rock and structure are preserved.

BEDDING THICKNESS

Description	Bedding Plane Spacing
Very thickly bedded	Greater than 2 m
Thickly bedded	0.6 m to 2 m
Medium bedded	0.2 m to 0.6 m
Thinly bedded	60 mm to 0.2 m
Very thinly bedded	20 mm to 60 mm
Laminated	6 mm to 20 mm
Thinly laminated	Less than 6 mm

JOINT OR FOLIATION SPACING

Description	Spacing
Very wide	Greater than 3 m
Wide	1 m to 3 m
Moderately close	0.3 m to 1 m
Close	50 mm to 300 mm
Very close	Less than 50 mm

GRAIN SIZE

Term	Size*
Very Coarse Grained	Greater than 60 mm
Coarse Grained	2 mm to 60 mm
Medium Grained	60 microns to 2 mm
Fine Grained	2 microns to 60 microns
Very Fine Grained	Less than 2 microns

Note: * Grains greater than 60 microns diameter are visible to the naked eye.

CORE CONDITION

Total Core Recovery (TCR)
The percentage of solid drill core recovered regardless of quality or length, measured relative to the length of the total core run.

Solid Core Recovery (SCR)
The percentage of solid drill core, regardless of length, recovered at full diameter, measured relative to the length of the total core run.

Rock Quality Designation (RQD)
The percentage of solid drill core, greater than 100 mm length, recovered at full diameter, measured relative to the length of the total core run. RQD varied from 0% for completely broken core to 100% for core in solid sticks.

DISCONTINUITY DATA

Fracture Index
A count of the number of discontinuities (physical separations) in the rock core, including both naturally occurring fractures and mechanically induced breaks caused by drilling.

Dip with Respect to Core Axis
The angle of the discontinuity relative to the axis (length) of the core. In a vertical borehole a discontinuity with a 90^{o} angle is horizontal.

Description and Notes
An abbreviation description of the discontinuities, whether naturally occurring separations such as fractures, bedding planes and foliation planes or mechanically induced features caused by drilling such as ground or shattered core and mechanically separated bedding or foliation surfaces. Additional information concerning the nature of fracture surfaces and infillings are also noted.

Abbreviations

JN	Joint	PL	Planar
FLT	Fault	CU	Curved
SH	Shear	UN	Undulating
VN	Vein	IR	Irregular
FR	Fracture	K	Slickensided
SY	Stylolite	PO	Polished
BD	Bedding	SM	Smooth
FO	Foliation	SR	Slightly Rough
CO	Contact	RO	Rough
AXJ	Axial Joint	VR	Very Rough
KV	Karstic Void		
MB	Mechanical Break		

Golder Associates

RECORD OF BOREHOLE No 12-1

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4831684.5 ;E 293473.6 ORIGINATED BY SB
DIST Central HWY 410 BOREHOLE TYPE CME 75 Truck-mount, 101 mm Diameter Solid Stem Augers COMPILED BY AV
DATUM Geodetic DATE November 11, 2012 CHECKED BY GDS

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
154.0	GROUND SURFACE								
0.0	Sand and gravel (FILL) Compact Black and grey Moist		1	SS	17				
153.2							153		
0.8	Clayey silt with sand, trace gravel, containing wood fragments (FILL) Firm Grey Moist		2	SS	6				
152.5							152		
1.5	CLAYEY SILT with SAND, trace gravel (TILL) Stiff to hard Grey Moist		3	SS	17				2 35 45 18
			4	SS	14		151		
			5	SS	16				
			6	SS	16		150		
			7	SS	14				
							149		
			8	SS	20	▽			2 39 44 15
							148		
			9	SS	28		147		
							146		
							145		
144.2			10	SS	43				
9.8	END OF BOREHOLE								

NOTES:

1. Water level in open borehole at a depth of 7.0 m (Elev. 147.0 m) below ground surface on completion of drilling.

2. Borehole backfilled with bentonite.

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × REMOULDED
20 40 60 80 100

PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L
WATER CONTENT (%) 10 20 30

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

Golder Associates

RECORD OF BOREHOLE No 12-2

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4832044.7 ;E 293126.9 ORIGINATED BY SB
DIST Central HWY 410 BOREHOLE TYPE CME 75 Truck-mount, 101 mm Diameter Solid Stem Augers COMPILED BY AV
DATUM Geodetic DATE November 12, 2012 CHECKED BY GDS

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES 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 × REMOULDED 20 40 60 80 100	PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
162.5	GROUND SURFACE										
0.0	ASPHALT										
0.2	Sand and gravel (FILL) Dense Grey Moist		1	SS	35		162				
161.7 / 0.8	Clayey silt with sand, trace gravel, containing wood fragments and oxidation staining (FILL) Stiff to hard Grey Moist to dry		2	SS	46				○		
			3	SS	10		161				
160.3 / 2.2	CLAYEY SILT with SAND, trace to some gravel, containing cobbles (TILL) Firm to hard Grey Moist		4	SS	62/0.20		160				
			5	SS	7		159				
			6	SS	12				○		
			7	SS	24		158				
			8	SS	38		157				12 33 37 18
			9	SS	17		156				
						▽	155				
153.0			10	SS	74/0.08		154				
9.5	END OF BOREHOLE						153		○		

NOTES:

1. Water level in open borehole at a depth of 8.8 m (Elev. 153.7 m) below ground surface on completion of drilling.

2. Borehole backfilled with bentonite.

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

GTA-MTO 001 1111110083.GPJ GAL-GTA.GDT 2/20/13

Golder Associates

RECORD OF BOREHOLE No 12-3

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4832719.3 ;E 292532.9 ORIGINATED BY SB
DIST Central HWY 410 BOREHOLE TYPE CME 75 Truck-mount, 101 mm Diameter Solid Stem Augers COMPILED BY AV/GL
DATUM Geodetic DATE November 14, 2012 CHECKED BY GDS

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 (20 40 60 80 100): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
169.5	GROUND SURFACE										
0.0	ASPHALT										
0.2	Sand and gravel, trace clay (FILL) Dense Brown Moist		1	SS	37		169		○		
168.7			2	SS	50/0.10						
0.8	SHALE (BEDROCK) Bedrock cored from 1.0 m to 4.5 m. Refer to Record of Drillhole 12-3 for rock coring details		1	RC	REC 50%						RQD = 0%
							168				
			2	RC	REC 83%						RQD = 15%
							167				
			3	RC	REC 94%		166				RQD = 36%
165.0											
4.5	END OF BOREHOLE						165				

NOTES:

1. Open borehole dry prior to rock coring.
2. Borehole backfilled with bentonite.

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

GTA-MTO 001 1111110083.GPJ GAL-GTA.GDT 2/20/13

PROJECT:

RECORD OF DRILLHOLE: 12-3

SHEET 1 OF 1

LOCATION: N 4832719.3 ;E 292532.9

DRILLING DATE:

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 75 Truck-mount

DRILLING CONTRACTOR: DBW Drilling

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		BEDROCK SURFACE		168.50																
1	NQRC / NW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION), containing fossiliferous LIMESTONE interbeds Slightly weathered to fresh Grey Laminated Weak to medium strong, containing strong to very strong interbeds		1.00	1															
2					2															9.5 MPa (Axial)
3																				
					3															(Axial)
4																				(Axial)
				164.99																
		END OF DRILLHOLE		4.51																
5																				
6																				
7																				
8																				
9																				
10																				
11																				

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 2/20/13

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: SB

CHECKED: GDS

Golder Associates

RECORD OF BOREHOLE No 12-4

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4832947.0 ;E 292338.8 ORIGINATED BY SB
DIST Central HWY 410 BOREHOLE TYPE CME 75 Truck-mount, 101 mm Diameter Solid Stem Augers COMPILED BY AV/GL
DATUM Geodetic DATE November 15, 2012 CHECKED BY GDS

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 (20 40 60 80 100): ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × REMOULDED	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
173.0	GROUND SURFACE										
0.0	ASPHALT										
0.2	Sand and gravel (FILL) Dense Brown Moist		1	SS	39				○		
172.2			2	SS	63/0.15						
0.8	SHALE (BEDROCK)		1	RC	REC 100%		172				RQD = 0%
	Bedrock cored from 1.1 m to 4.5 m Refer to Record of Drillhole 12-4 for rock coring details		2	RC	REC 90%		171				RQD = 45%
			3	RC	REC 100%		170				RQD = 62%
168.5							169				
4.5	END OF BOREHOLE										

NOTES:

1. Open borehole dry prior to rock coring.
2. Borehole backfilled with bentonite.

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

GTA-MTO 001 1111110083.GPJ GAL-GTA.GDT 2/20/13

PROJECT:

RECORD OF DRILLHOLE: 12-4

SHEET 1 OF 1

LOCATION: N 4832947.0 ;E 292338.8

DRILLING DATE:

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 75 Truck-mount

DRILLING CONTRACTOR: DBW Drilling

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN	FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		BEDROCK SURFACE		171.87																	
2	NQRC / NW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION), containing fossiliferous LIMESTONE interbeds Slightly weathered to fresh Grey Laminated Weak to medium strong, containing strong to very strong interbeds		1.13	1			80 60 20	80 60 40 20	80 60 20	5 10 15 20	0 30 60 90	0 30 60 90					10^{-6} 10^{-5} 10^{-4} 10^{-3}	2 4 6		
3					2																
4					3														•		(Axial) UC=33.2 MPa (Axial)
		END OF DRILLHOLE		168.46 4.54															•		
5																					
6																					
7																					
8																					
9																					
10																					
11																					

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: SB

CHECKED: GDS

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 2/20/13

Golder Associates

RECORD OF BOREHOLE No 12-5

SHEET 1 OF 1

METRIC

PROJECT 11-1111-0083

G.W.P. 2144-07-00 LOCATION N 4833124.6 ;E 292098.7 ORIGINATED BY SB

DIST Central HWY 410 BOREHOLE TYPE CME 75 Truck-mount, 101 mm Diameter Solid Stem Augers COMPILED BY AV/GL

DATUM Geodetic DATE November 15 and 16, 2012 CHECKED BY GDS

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 × REMOULDED (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
172.0	GROUND SURFACE										
0.0	ASPHALT										
0.2	Sand and gravel (FILL) Very dense Brown Moist		1	SS	60				○		
171.2			2	SS	50/0.10						
0.8	SHALE (BEDROCK)						171				
	Bedrock cored from 1.2 m to 4.7 m		1	RC	REC 100%						RQD = 0%
	Refer to Record of Drillhole 12-5 for rock coring details		2	RC	REC 88%		170				RQD = 60%
							169				
			3	RC	REC 97%						RQD = 80%
							168				
167.3											
4.7	END OF BOREHOLE										

NOTES:

1. Open borehole dry prior to rock coring.
2. Borehole backfilled with bentonite.

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

GTA-MTO 001 1111110083.GPJ GAL-GTA.GDT 2/20/13

PROJECT:

RECORD OF DRILLHOLE: 12-5

SHEET 1 OF 1

LOCATION: N 4833124.6 ;E 292098.7

DRILLING DATE:

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 75 Truck-mount

DRILLING CONTRACTOR: DBW Drilling

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		BEDROCK SURFACE		170.78																
2	NQRC / NW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION), containing fossiliferous LIMESTONE interbeds Slightly weathered to fresh Grey Laminated Weak to medium strong, containing strong to very strong interbeds		1.22	1															
					2															(Diametral) (Axial) UC=20.4 MPa
3																				(Axial)
					3															(Axial)
4				167.34																
		END OF DRILLHOLE		4.66																
5																				
6																				
7																				
8																				
9																				
10																				
11																				

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: SB

CHECKED: GDS

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 2/20/13

Golder Associates

RECORD OF BOREHOLE No 12-6

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4833263.0 ;E 291876.3 ORIGINATED BY SB
DIST Central HWY 410 BOREHOLE TYPE CME 75 Truck-mount, 101 mm Diameter Solid Stem Augers COMPILED BY AV/GL
DATUM Geodetic DATE November 16, 2012 CHECKED BY GDS

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 (20 40 60 80 100): ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × REMOULDED	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
173.0	GROUND SURFACE										
0.0	ASPHALT										
0.2	Silty sand, some gravel, trace to some clay (FILL) Dense Brown Moist		1	SS	41						
172.1			2	SS	50/0.15		172		○		18 55 20 7
0.9	SHALE (BEDROCK) Bedrock cored from 1.1 m to 4.7 m Refer to Record of Drillhole 12-6 for rock coring details		1	RC	REC 95%						RQD = 0%
			2	RC	REC 52%		171				RQD = 0%
							170				
			3	RC	REC 73%		169				RQD = 0%
168.3											
4.7	END OF BOREHOLE NOTES: 1. Open borehole dry prior to rock coring. 2. Borehole backfilled with bentonite.										

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

PROJECT:

RECORD OF DRILLHOLE: 12-6

SHEET 1 OF 1

LOCATION: N 4833263.0 ;E 291876.3

DRILLING DATE:

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 75 Truck-mount

DRILLING CONTRACTOR: DBW Drilling

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH	COLOUR % RETURN	RECOVERY: TOTAL CORE % (80 60 40 20)	RECOVERY: SOLID CORE % (80 60 40 20)	R.Q.D. % (80 60 40 20)	FRACT. INDEX PER 0.3 m (5 10 15 20)	DISCONTINUITY DATA: B Angle (0 30 60 90)	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS (0 30 60 90)	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec (10^{-6} 10^{-5} 10^{-4} 10^{-3})	Diametral Point Load Index (MPa) (2 4 6)	RMC -Q' AVG.	NOTES
		BEDROCK SURFACE		171.86																	
2	NQRC / NW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION), containing fossiliferous LIMESTONE interbeds Slightly weathered to fresh Grey Laminated Weak to medium strong, containing strong to very strong interbeds		1.14	1																
3					2																
4					3																
				168.31																	
		END OF DRILLHOLE		4.69																	
5																					
6																					
7																					
8																					
9																					
10																					
11																					

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: SB

CHECKED: GDS

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 2/20/13

Golder Associates

RECORD OF BOREHOLE No 12-7

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4833508.7 ;E 291631.5 ORIGINATED BY SB
DIST Central HWY 410 BOREHOLE TYPE CME 75 Truck-mount, 101 mm Diameter Solid Stem Augers COMPILED BY AV/GL
DATUM Geodetic DATE November 18 and 19, 2012 CHECKED BY GDS

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 × REMOULDED 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
176.0	GROUND SURFACE										
0.0	ASPHALT										
0.2	Sand and gravel (FILL) Compact		1	SS	23						
175.2	Brown Moist		2	SS	68/0.23		175		○		
0.8	SHALE (BEDROCK)										
	Bedrock cored from 1.5 m to 4.5 m										
	Refer to Record of Drillhole 12-7 for rock coring details		1	RC	REC 84%		174				RQD = 25%
							173				
			2	RC	REC 94%						RQD = 21%
171.5							172				
4.5	END OF BOREHOLE										
	NOTES: 1. Open borehole dry prior to rock coring. 2. Borehole backfilled with bentonite.										

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

PROJECT:

RECORD OF DRILLHOLE: 12-7

SHEET 1 OF 1

LOCATION: N 4833508.7 ;E 291631.5

DRILLING DATE:

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 75 Truck-mount

DRILLING CONTRACTOR: DBW Drilling

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		BEDROCK SURFACE		174.48																
2	NQRC / NW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION), containing fossiliferous LIMESTONE interbeds Slightly weathered to fresh Grey Laminated Weak to medium strong, containing strong to very strong interbeds		1.52	1		100	100	100											
3																				
4					2		100	100	100											
				171.50																
		END OF DRILLHOLE		4.50																
5																				
6																				
7																				
8																				
9																				
10																				
11																				

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 2/20/13

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: SB

CHECKED: GDS

Golder Associates

RECORD OF BOREHOLE No 12-8

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4833866.9 ;E 291282.9 ORIGINATED BY SB
DIST Central HWY 410 BOREHOLE TYPE CME 75 Truck-mount, 101 mm Diameter Solid Stem Augers COMPILED BY AV/GL
DATUM Geodetic DATE November 19, 2012 CHECKED BY GDS

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
180.0	GROUND SURFACE										
0.0	ASPHALT										
0.2	Sand and gravel (FILL) Dense Brown Moist		1	SS	39				○		
179.2							179				
0.8	CLAYEY SILT with SAND, trace to some gravel (TILL) Very stiff to hard Grey Moist		2	SS	49						
			3	SS	29		178		○ ⊢⊣		12 26 42 20
			4	SS	32						
	Containing cobbles below 3.0 m		5	SS	45		177		○		
			6	SS	77		176				
			7	SS	65/0.15				○ ⊢⊣		15 35 41 9
							175				
	Shale fragments below 6.1 m		8	SS	80/0.15		174				
172.4							173				
7.6	SHALE (BEDROCK) Bedrock cored from 7.6 m to 9.1 m Refer to Record of Drillhole 12-8 for rock coring details		1	RC	REC 87%		172				RQD = 50%
170.9							171				
9.1	END OF BOREHOLE										

NOTES:

1. Open borehole dry prior to rock coring.
2. Borehole backfilled with bentonite.

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

GTA-MTO 001 1111110083.GPJ GAL-GTA.GDT 2/20/13

PROJECT:

RECORD OF DRILLHOLE: 12-8

SHEET 1 OF 1

LOCATION: N 4833866.9 ;E 291282.9

DRILLING DATE:

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 75 Truck-mount

DRILLING CONTRACTOR: DBW Drilling

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH	COLOUR % RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		BEDROCK SURFACE		172.38																	
8	NQRC / NW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION), containing fossiliferous LIMESTONE interbeds Slightly weathered to fresh Grey Laminated Weak to medium strong, containing strong to very strong interbeds		7.62	1			100	100	100									6		(Diametral) 8.1 MPa (Diametral) 8.2 MPa (Axial) (Axial) 9.3 MPa (Axial)
9				170.86																	
		END OF DRILLHOLE		9.14																	
10																					
11																					
12																					
13																					
14																					
15																					
16																					
17																					

DEPTH SCALE

1 : 50

LOGGED: SB

CHECKED: GDS

Golder Associates

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 2/20/13

Golder Associates

RECORD OF BOREHOLE No 12-9

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4834184.3 ;E 290966.4 ORIGINATED BY TWB
DIST Central HWY 410 BOREHOLE TYPE CME 55 Truck-mount, 101 mm Diameter Solid Stem Augers COMPILED BY AV
DATUM Geodetic DATE October 11, 2012 CHECKED BY GDS

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 × REMOULDED (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
183.0	GROUND SURFACE										
0.0	TOPSOIL		1A	SS	5				○		
182.5	Clayey silt, some sand, trace gravel, containing organics and rootlets (FILL) Firm Brown Moist		1B				182				
0.5	CLAYEY SILT with SAND, trace to some gravel (TILL) Stiff to hard Brown to grey Moist		2	SS	12						
			3	SS	21		181		○ —		1 23 55 21
			4	SS	29						
	Containing cobbles and boulders below 3.0 m		5	SS	45		180		○ —		
			6	SS	49		179				
			7	SS	69/0.18				○ —		10 32 48 10
							178				
			8	SS	108/0.08		177				
							176				
			9	SS	82	▽	175		○		
174.2											
8.8	END OF BOREHOLE PRATICAL AUGER REFUSAL (ON INFERRED BEDROCK)										

NOTES:

1. Water level in open borehole at a depth of 8.4 m (Elev. 176.6 m) below ground surface on completion of drilling.

2. Borehole backfilled with bentonite.

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

GTA-MTO 001 1111110083.GPJ GAL-GTA.GDT 2/20/13

Golder Associates

RECORD OF BOREHOLE No 12-10

SHEET 1 OF 1

METRIC

PROJECT 11-1111-0083

G.W.P. 2144-07-00 LOCATION N 4834449.2 ;E 290709.2 ORIGINATED BY TWB

DIST Central HWY 410 BOREHOLE TYPE CME 55 Track-mount, 101 mm Diameter Solid Stem Augers COMPILED BY AV

DATUM Geodetic DATE October 12, 2012 CHECKED BY GDS

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
185.5	GROUND SURFACE										
0.0	TOPSOIL										
0.1	Clayey silt, some sand, trace gravel, containing organics and rootlets (FILL)		1	SS	24		185				
184.7	Very stiff										
0.8	Brown Moist		2	SS	26						3 35 43 19
	CLAYEY SILT with SAND, trace to some gravel (TILL) Stiff to hard Grey to brown Moist		3	SS	21		184				
			4	SS	10		183				
			5	SS	8		182				
			6	SS	8						
			7	SS	9		181				
							180				
			8	SS	13		179				
			9	SS	50/0.05		178				19 38 34 9
							177				
176.0			10	SS	121/0.08		176				
9.5	END OF BOREHOLE										

NOTES:

1. Open borehole dry on completion of drilling.
2. Borehole backfilled with bentonite.

$+^3, \times^3$: Numbers refer to Sensitivity

$\circ^{3\%}$ STRAIN AT FAILURE

Golder Associates

RECORD OF BOREHOLE No 12-11

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4835114.2 ;E 290066.4 ORIGINATED BY TWB
DIST Central HWY 410 BOREHOLE TYPE CME 55 Track-mount, 101 mm Diameter Solid Stem Augers COMPILED BY AV
DATUM Geodetic DATE October 9, 2012 CHECKED BY GDS

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
183.5	GROUND SURFACE										
0.0 / 183.2	Clayey silt, some sand, trace gravel, containig organics and rootlets (FILL) Firm Brown Moist		1	SS	6		183				
0.3	CLAYEY SILT with SAND, trace to some gravel (TILL) Very stiff to hard Brown Moist		2	SS	27						
			3	SS	60/0.05		182				
			4	SS	51		181				6 35 50 9
180.5											
3.0	SILT trace to some sand, trace clay Compact to very dense Grey to brown Moist		5	SS	53	▽	180				
			6	SS	22						0 5 92 3
			7	SS	17		179				
178.0											
5.5	Sandy SILT to SAND and SILT, trace clay, trace to some gravel (TILL) Compact to very dense Grey Moist		8	SS	14		178				
							177				
			9	SS	52		176				5 23 69 3
							175				
174.0			10	SS	50/0.08		174				
9.5	END OF BOREHOLE PRACTICAL AUGER REFUSAL										

NOTES:

1. Water level in open borehole at a depth of 3.7 m (Elev. 180.3 m) below ground surface on completion of drilling.

2. Borehole backfilled with bentonite.

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

GTA-MTO 001 1111110083.GPJ GAL-GTA.GDT 2/20/13

Golder Associates

RECORD OF BOREHOLE No 12-12

SHEET 1 OF 1

METRIC

PROJECT 11-1111-0083

G.W.P. 2144-07-00 LOCATION N 4836085.5 ;E 289128.5 ORIGINATED BY SB

DIST Central HWY 410 BOREHOLE TYPE CME 55 Truck-mount, 101 mm Diameter Solid Stem Augers COMPILED BY AV/GL

DATUM Geodetic DATE November 19, 2012 CHECKED BY GDS

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
189.1	GROUND SURFACE										
0.0	ASPHALT						189				
0.2	Sand and gravel, occasional cobbles (FILL) Compact Brown Moist		1	SS	25						
			2	SS	10		188				
187.6											
1.5	CLAYEY SILT with SAND, trace to some gravel (TILL) Very stiff to hard Brown to grey Moist		3	SS	17						
			4	SS	21		187				7 35 40 18
			5	SS	31		186				
			6	SS	63		185				
			7	SS	49		184				
			8	SS	68/0.15		183				
							182				
			9	SS	100/0.15						5 43 40 12
180.9							181				
8.2	END OF BOREHOLE PRACTICAL AUGER REFUSAL (ON INFERRED BEDROCK)										

NOTES:

1. Borehole dry upon completion of drilling.

2. Borehole backfilled with bentonite.

$+^3, \times^3$: Numbers refer to Sensitivity

$\circ^{3\%}$ STRAIN AT FAILURE

GTA-MTO 001 1111110083.GPJ GAL-GTA.GDT 2/20/13

Golder Associates

RECORD OF BOREHOLE No 12-13

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00
LOCATION N 4836711.3 ;E 288541.9
ORIGINATED BY PC
DIST Central HWY 410
BOREHOLE TYPE CME 75 Track-mount, 70 mm I.D. Hollow Stem Augers
COMPILED BY AV/GL
DATUM Geodetic
DATE October 25, 2012
CHECKED BY GDS

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 (20 40 60 80 100): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
193.5	GROUND SURFACE										
0.0	TOPSOIL										
0.1	Clayey silt with sand, trace to some gravel, containing rootlets (FILL)		1	SS	5		193				
192.7	Firm		2	SS	83/0.18						
0.8	Brown Moist										
	SHALE (BEDROCK)		1	RC	REC 100%		192				RQD = 0%
	Bedrock cored from 1.5 m to 4.7 m Refer to Record of Drillhole 12-13 for rock coring details		2	RC	REC 100%		191				RQD = 8%
			3	RC	REC 80%		190				RQD = 14%
188.8							189				
4.7	END OF BOREHOLE										

NOTES:

1. Open borehole dry upon completion of drilling.
2. Borehole backfilled with bentonite.

$+^3, \times^3$: Numbers refer to Sensitivity

$\circ^{3\%}$ STRAIN AT FAILURE

PROJECT:

RECORD OF DRILLHOLE: 12-13

SHEET 1 OF 1

LOCATION: N 4836711.3 ;E 288541.9

DRILLING DATE:

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 75 Track-mount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		BEDROCK SURFACE		192.00																
2	NQRC / NW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION), containing fossiliferous LIMESTONE interbeds Slightly weathered to fresh Grey Laminated Weak to medium strong, containing strong to very strong interbeds		1.50	1		80 60 20	80 60 40 20	80 60 20	5 10 15 20	0 30 60 90	0 30 60 90					10^{-6} 10^{-5} 10^{-4} 10^{-3}	2 4 6		
3					2															
4				188.82	3															
		END OF DRILLHOLE		4.68																
5																				
6																				
7																				
8																				
9																				
10																				
11																				

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 2/20/13

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: PC

CHECKED: GDS

Golder Associates

RECORD OF BOREHOLE No 12-14

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083 | G.W.P. 2144-07-00 | LOCATION N 4837913.0 ;E 288085.2 | ORIGINATED BY PC

DIST Central | HWY 410 | BOREHOLE TYPE CME 75 Track-mount, 108 mm I.D. Hollow Stem Augers | COMPILED BY AV/GL

DATUM Geodetic | DATE October 21, 2012 | CHECKED BY GDS

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES 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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
193.5	GROUND SURFACE										
0.0 / 0.1	TOPSOIL										
	Clayey silt, some sand, some gravel, trace rootlets (FILL) Stiff to very stiff Brown Moist		1	SS	9		193				
			2	SS	23						
192.0							192				
1.5	CLAYEY SILT with SAND, trace to some gravel (TILL) Very stiff Brown to gery Moist		3	SS	28				○		
			4	SS	26		191		○ ⊢⊣		6 33 43 18
			5	SS	28				○		
189.5			6	SS	50/0.18		190				
4.0	COBBLES and BOULDERS		1	RC	REC 70%						RQD = 0%
			2	RC	REC 24%		189				RQD = 0%
187.2							188				
	SAND and GRAVEL		7	SS	85						
6.5	CLAYEY SILT with SAND, trace to some gravel (TILL) Hard Grey Moist						187				
			8	SS	80		186		○ ⊢⊣		8 38 44 10
184.7							185				
8.8	END OF BOREHOLE PRACTICAL AUGER REFUSAL NOTES: 1. Borehole dry upon completion of drilling. 2. Borehole backfilled with bentonite.										

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

PROJECT:

RECORD OF DRILLHOLE: 12-14

SHEET 1 OF 1

LOCATION: N 4837913.0 ;E 288085.2

DRILLING DATE:

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 75 Track-mount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint, FLT - Fault, SH - Shear, VN - Vein, CJ - Conjugate | BD - Bedding, FO - Foliation, CO - Contact, OR - Orthogonal, CL - Cleavage | PL - Planar, CU - Curved, UN - Undulating, ST - Stepped, IR - Irregular | PO - Polished, K - Slickensided, SM - Smooth, RO - Rough, VR - Very Rough | MB - Mechanical Break, BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		189.51																
4		SHALE BEDROCK (GEORGIAN BAY FORMATION), contains fossiliferous LIMESTONE interbeds Slightly weathered to fresh Grey Laminated Weak to medium strong, containing strong to very strong interbeds		3.99	1															
5					2															
6				187.40																
		END OF DRILLHOLE		6.10																
7																				
8																				
9																				
10																				
11																				
12																				
13																				

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: PC

CHECKED:

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 2/20/13

Golder Associates

RECORD OF BOREHOLE No 12-15

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4838615.1 ;E 287574.0 ORIGINATED BY PC
DIST Central HWY 410 BOREHOLE TYPE CME 75 Track-mount, 108 mm I.D. Hollow Stem Augers COMPILED BY AV/GL
DATUM Geodetic DATE October 21, 2012 CHECKED BY GDS

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 × REMOULDED (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
197.0	GROUND SURFACE										
0.0	TOPSOIL										
0.1	Clayey silt, some sand, some gravel (FILL) Stiff Brown Moist		1	SS	10						
196.2							196				
0.8	CLAYEY SILT with SAND, trace to some gravel, containing cobbles and boulders (TILL) Very stiff to hard Brown to grey Moist		2	SS	23						
			3	SS	28		195		○		
			4	SS	30				○ —		10 32 43 15
			5	SS	75		194				
			6	SS	83		193		○ —		9 39 39 13
			7	SS	90						
191.0							192				
6.0	SHALE (BEDROCK)		1	RC	REC 71%		191				RQD = 0%
	Bedrock cored from 6.0 m to 9.3 m Refer to Record of Drillhole 12-15 for rock coring details		2	RC	REC 28%		190				RQD = 0%
			3	RC	REC 100%		189				RQD = 20%
187.7							188				
9.3	END OF BOREHOLE										

NOTES:

1. Open borehole dry upon completion of drilling.
2. Borehole backfilled with bentonite.

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

GTA-MTO 001 1111110083.GPJ GAL-GTA.GDT 2/20/13

PROJECT:

RECORD OF DRILLHOLE: 12-15

SHEET 1 OF 1

LOCATION: N 4838615.1 ;E 287574.0

DRILLING DATE:

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 75 Track-mount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint, FLT - Fault, SH - Shear, VN - Vein, CJ - Conjugate; BD - Bedding, FO - Foliation, CO - Contact, OR - Orthogonal, CL - Cleavage; PL - Planar, CU - Curved, UN - Undulating, ST - Stepped, IR - Irregular; PO - Polished, K - Slickensided, SM - Smooth, RO - Rough, VR - Very Rough; MB - Mechanical Break, BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		BEDROCK SURFACE		190.95																
7	NQRC / NW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION), containing fossiliferous LIMESTONE interbeds Slightly weathered to fresh Grey Laminated Weak to medium strong, containing strong to very strong interbeds		6.05	1		80 60 20	80 60 40 20	80 60 20	5 10 15 20	0 30 60 90	0 30 60 90									
8					2															
9					3													•		(Diametral) UC=21.5 MPa
		END OF DRILLHOLE		187.73 9.27																
10																				
11																				
12																				
13																				
14																				
15																				
16																				

DEPTH SCALE

1 : 50

LOGGED: PC

CHECKED: GDS

Golder Associates

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 2/20/13

Golder Associates

RECORD OF BOREHOLE No 12-16

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4838833.4 ;E 287367.5 ORIGINATED BY PC
DIST Central HWY 410 BOREHOLE TYPE CME 75 Track-mount, 108 mm I.D. Hollow Stem Augers COMPILED BY AV
DATUM Geodetic DATE October 22, 2012 CHECKED BY GDS

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 × REMOULDED)	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
201.5	GROUND SURFACE										
0.0 / 0.1	TOPSOIL										
	Clayey silt to silty clay, some sand, some gravel, trace rootlets (FILL) Stiff to very stiff Brown Moist		1	SS	10		201				
			2	SS	15						
			3	SS	8		200		46		
			4	SS	23		199				
198.5											
3.0	CLAYEY SILT with SAND, trace to some gravel (TILL) Very stiff to hard Brown to dark brown Moist		5	SS	25		198				4 32 45 19
			6	SS	62						
			7	SS	83		197				
			8	SS	92	▽	196				
							195				
193.7			9	SS	50/0.11		194				22 35 33 10
7.8	END OF BOREHOLE PRACTICAL AUGER REFUSAL (ON INFERRED BEDROCK)										

NOTES:

1. Water level in open borehole at a depth of 7.3 m (Elev. 194.7 m) below ground surface on completion of drilling.

2. Borehole backfilled with bentonite.

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

GTA-MTO 001 1111110083.GPJ GAL-GTA.GDT 2/20/13

Golder Associates

RECORD OF BOREHOLE No 12-17

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4839261.0 ;E 286946.7 ORIGINATED BY PC
DIST Central HWY 410 BOREHOLE TYPE CME 75 Track-mount, 108 mm I.D. Hollow Stem Augers COMPILED BY AV
DATUM Geodetic DATE October 22, 2012 CHECKED BY GDS

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
212.0	GROUND SURFACE										
0.0	TOPSOIL										
0.3	Sand and silt, trace gravel, trace rootlets (FILL) Brown Moist		1	SS	8						
	Clayey silt, some sand, some gravel (FILL) Soft to very stiff Brown Moist		2	SS	7		211				
			3	SS	4		210				
			4	SS	13						
			5	SS	16		209				
208.2											
3.8	Pulverized asphalt (FILL)		6	SS	21		208				
207.7											
4.3	Clayey silt, some sand, some gravel, trace asphalt, trace organics (FILL) Stiff Grey to dark grey Moist		7	SS	11		207				20 19 41 20
205.9							206				
6.1	CLAYEY SILT, some sand, some gravel (TILL) Hard Dark brown to grey Moist		8	SS	34						16 20 44 20
			9	SS	30		205				
203.3						▽	204				
8.7	END OF BOREHOLE PRACTICAL AUGER REFUSAL										

NOTES:

1. Water level in open borehole at a depth of 8.6 m (Elev. 202.9 m) below ground surface on completion of drilling.

2. Borehole backfilled with bentonite.

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

Golder Associates

RECORD OF BOREHOLE No 12-18

SHEET 1 OF 1

METRIC

PROJECT 11-1111-0083

G.W.P. 2144-07-00 LOCATION N 4840141.1 ;E 286094.7 ORIGINATED BY PC

DIST Central HWY 410 BOREHOLE TYPE CME 75 Track-mount, 70 mm I.D. Hollow Stem Augers COMPILED BY AV

DATUM Geodetic DATE October 24, 2012 CHECKED BY GDS

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
215.8	GROUND SURFACE										
0.0	TOPSOIL										
0.1	Silty clay, some sand, some gravel, trace organics and rootlets (FILL) Soft to stiff Brown Moist		1	SS	2		215				
			2	SS	11						
			3	SS	7		214				
			4	SS	7		213				
212.8											
3.0	Sandy SILT, trace gravel, trace clay Loose to very dense Brown Moist		5	SS	9						
			6	SS	32		212				1 26 70 3
			7	SS	57		211				
209.6			8	SS	50/0.08		210				
6.2	CLAYEY SILT with SAND and GRAVEL (FILL) Hard Grey Moist										
			9	SS	52		209				
							208				34 21 34 11
206.6			10	SS	50/0.08		207				
9.2	END OF BOREHOLE										

NOTES:

1. Borehole dry upon completion of drilling.

2. Borehole backfilled with bentonite.

$+^3, \times^3$: Numbers refer to Sensitivity

$\circ^{3\%}$ STRAIN AT FAILURE

Golder Associates

RECORD OF BOREHOLE No C16-1

SHEET 1 OF 1

METRIC

PROJECT 11-1111-0083

G.W.P. 2144-07-00 LOCATION N 4832538.1 ;E 292671.7 ORIGINATED BY SB

DIST Central HWY 410 BOREHOLE TYPE CME 75 Truck-mount, 101 mm Diameter Solid Stem Augers COMPILED BY AV/GL

DATUM Geodetic DATE November 14, 2012 CHECKED BY GDS

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 × REMOULDED (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
169.1	GROUND SURFACE						169				
0.0	ASPHALT										
0.2	Sand and gravel, trace to some silt, trace to some clay (FILL) Dense Brown Moist		1	SS	38						
168.3							168				
0.8	Gravelly sand and silt, some clay (FILL) Compact Brown Moist		2	SS	19						
			3	SS	15						22 33 30 15
166.8							167				
2.3	SHALE (BEDROCK) containing limestone interbeds Bedrock cored from 2.6 m to 5.6 m Refer to Record of Drillhole C16-1 for rock coring details		4	SS	75/0.15						
			1	RC	REC 97%		166				RQD = 17%
			2	RC	REC 56%		165				RQD = 15%
163.5							164				
5.6	END OF BOREHOLE NOTES: 1. Open borehole dry prior to rock coring. 2. Borehole backfilled with bentonite.										

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

PROJECT:

RECORD OF DRILLHOLE: C16-1

SHEET 1 OF 1

LOCATION: N 4832538.1 ;E 292671.7

DRILLING DATE:

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 75 Truck-mount

DRILLING CONTRACTOR: DBW Drilling

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		BEDROCK SURFACE		166.51																
3	NQRC / NW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION), containing fossiliferous LIMESTONE interbeds Slightly weathered to fresh Grey Laminated Weak to medium strong, containing strong to very strong interbeds		2.59	1		80 60 20	80 60 40 20	80 60 20	5 10 15 20	0 30 60 90	0 30 60 90					10^{-6} 10^{-5} 10^{-4} 10^{-3}	2 4 6		
4																				
5					2															
				163.46																
		END OF DRILLHOLE		5.64																
6																				
7																				
8																				
9																				
10																				
11																				
12																				

DEPTH SCALE

1 : 50

LOGGED: SB

CHECKED: GDS

Golder Associates

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 2/20/13

Golder Associates

RECORD OF BOREHOLE No TP C16-2

SHEET 1 OF 1

METRIC

PROJECT 11-1111-0083

G.W.P. 2144-07-00 LOCATION N 4832534.5 ;E 292665.7 ORIGINATED BY SB

DIST Central HWY 410 BOREHOLE TYPE Hand-Dug Test Pit COMPILED BY EB

DATUM Geodetic DATE November 15, 2012 CHECKED BY LCC

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 + FIELD VANE ● QUICK TRIAXIAL × REMOULDED (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
168.1	GROUND SURFACE										
0.0	Clayey silt, trace sand, trace gravel, containing rootlets and organics (FILL) Soft Brown Wet						168				
0.3	REFUSAL ON SHALE BEDROCK										

$+^3, \times^3$: Numbers refer to Sensitivity

$\circ^{3\%}$ STRAIN AT FAILURE

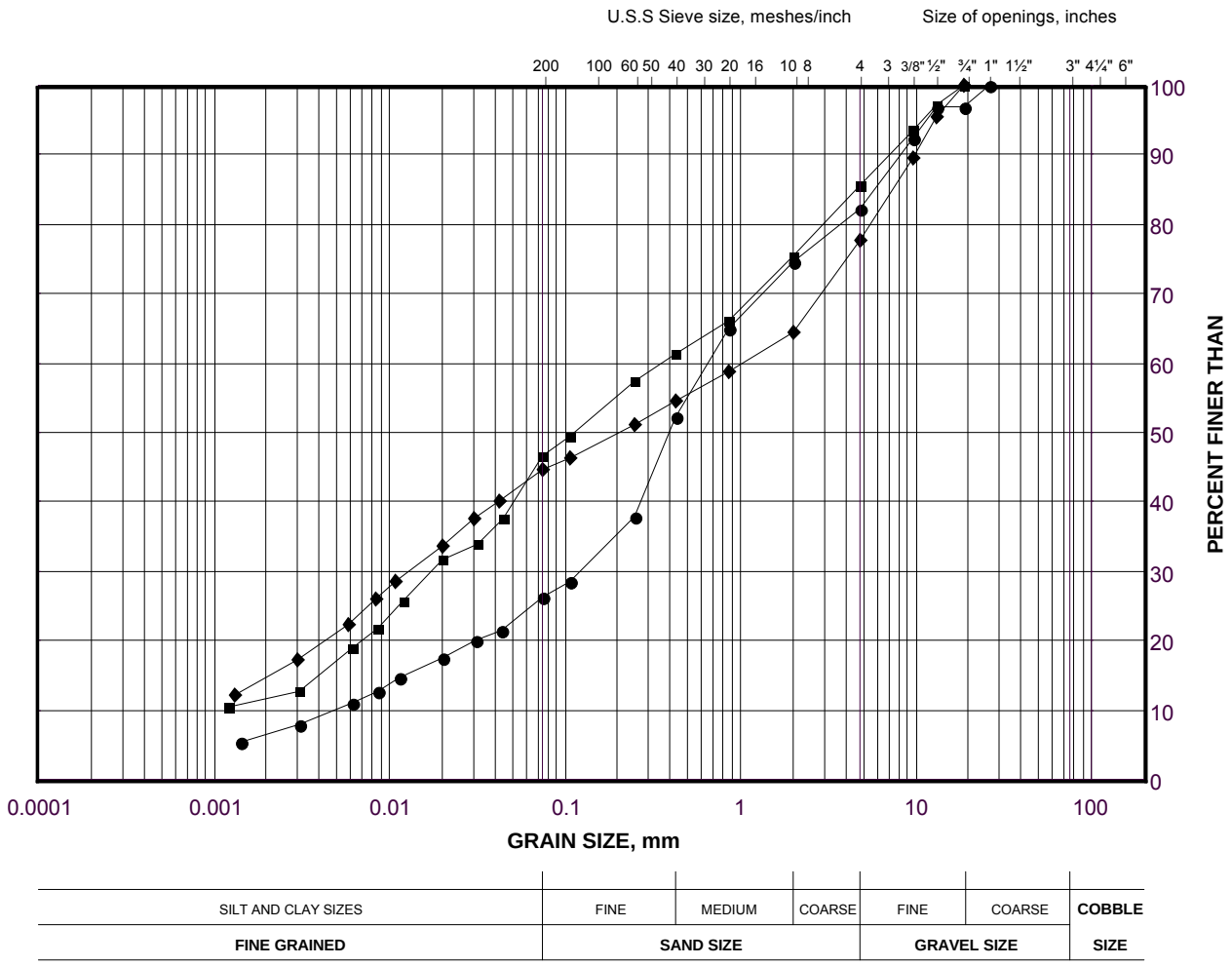
APPENDIX B

Laboratory Test Results

GRAIN SIZE DISTRIBUTION

Sand Fill

FIGURE B1



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	12-6	2	174.2
■	12-19	2A	212.8
◆	C16-1	3	167.2

Project Number: 11-1111-0083

Checked By: GL/GDS

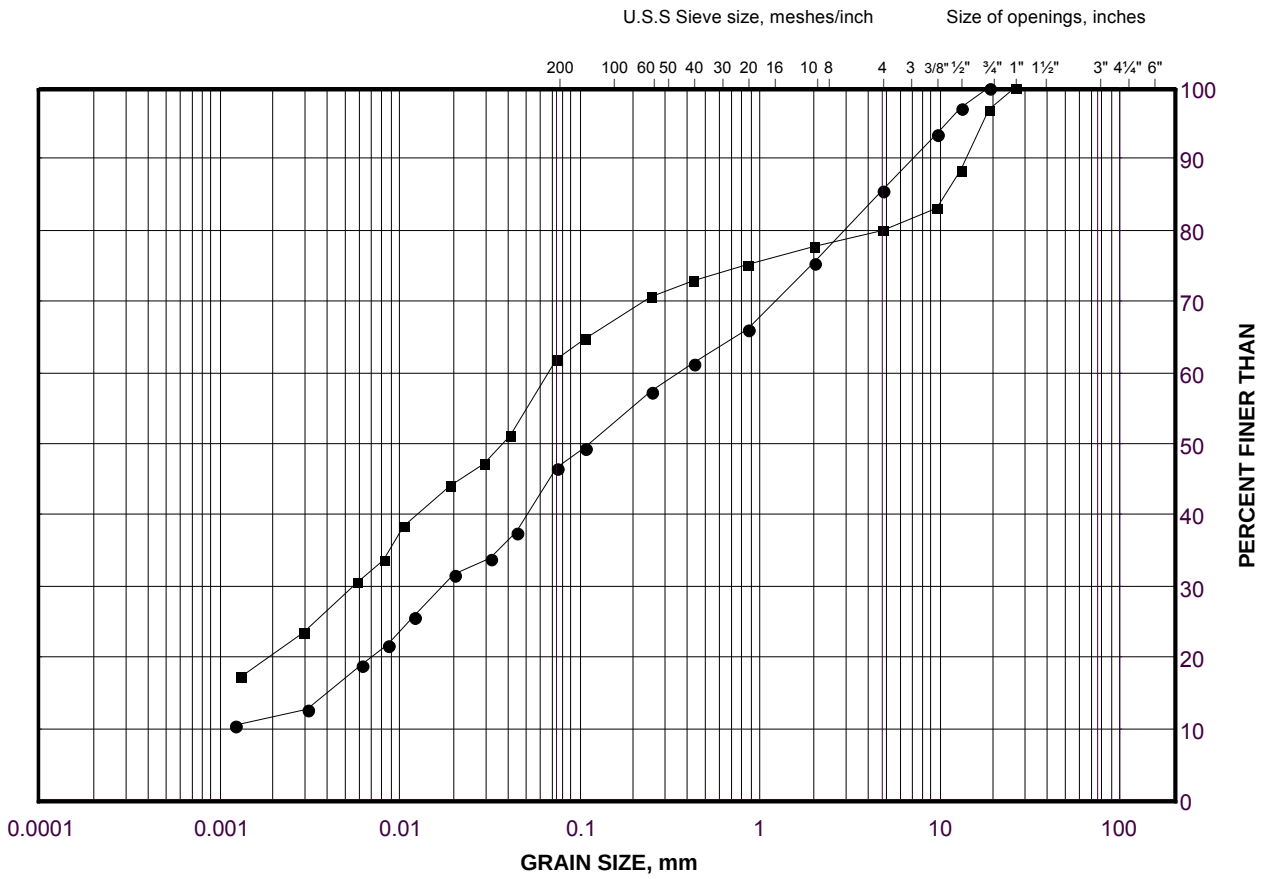
Golder Associates

Date: 11-Jan-13

GRAIN SIZE DISTRIBUTION

Clayey Silt Fill

FIGURE B2



LEGEND

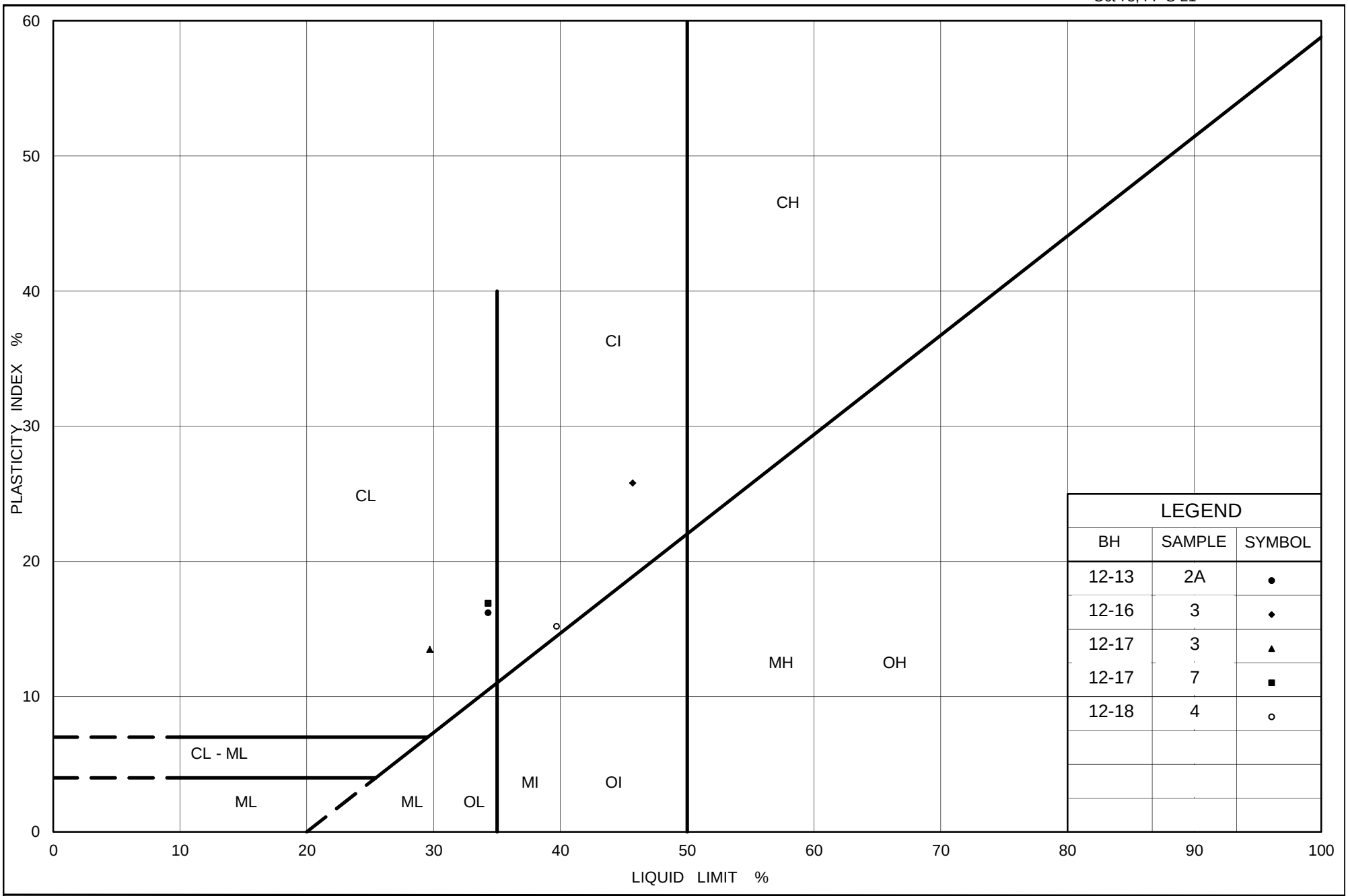
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	12-19	2A	212.8
■	12-17	7	206.9

Project Number: 11-1111-0083

Checked By: GL/GDS

Golder Associates

Date: 11-Jan-13



Ministry of Transportation

Ontario

PLASTICITY CHART
Clayey Silt Fill

Figure No. B3

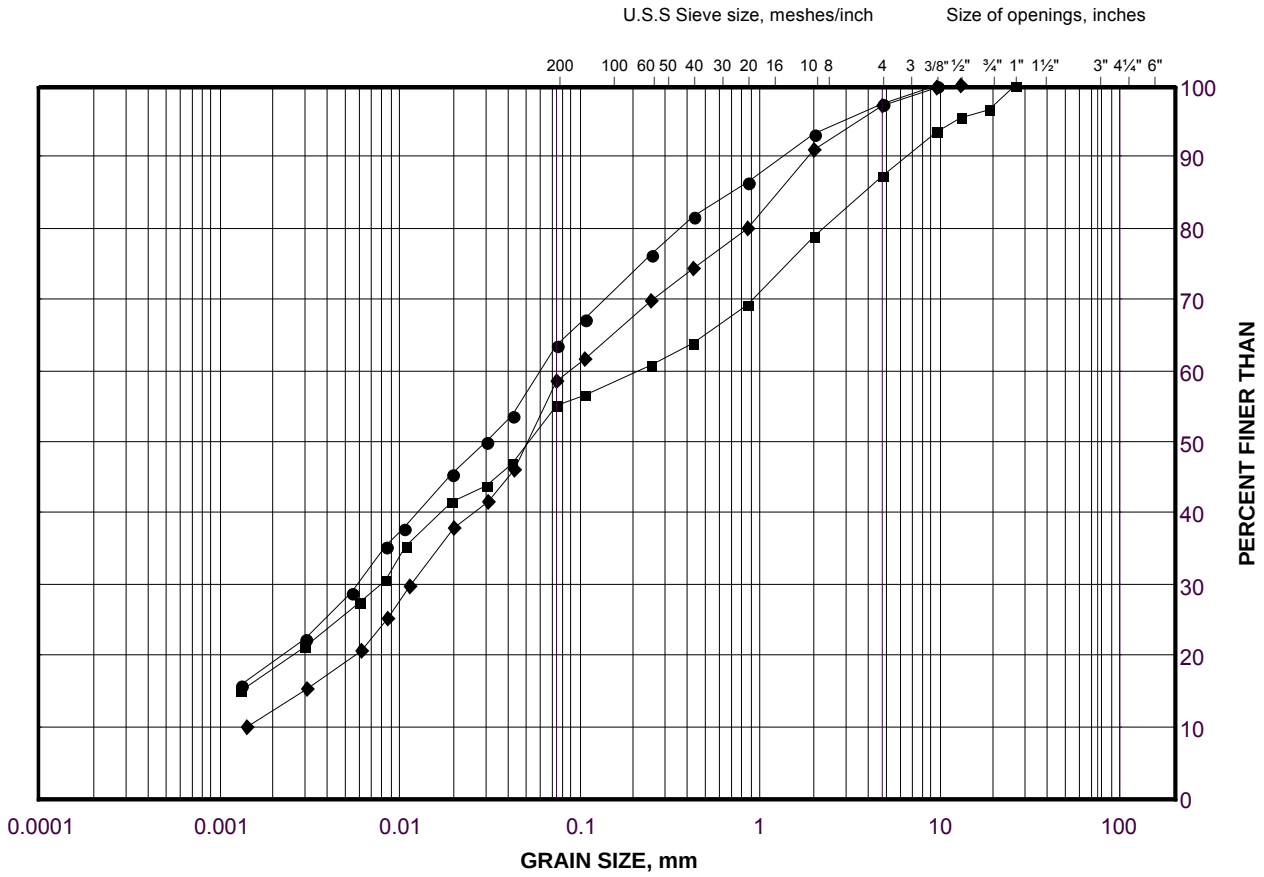
Project No. 11-1111-0083

Checked By: GL/GDS

GRAIN SIZE DISTRIBUTION

Clayey Silt Till

FIGURE B4



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	12-1	3	152.5
■	12-2	8	156.4
◆	12-1	8	147.9

Project Number: 11-1111-0083

Checked By: GL/GDS

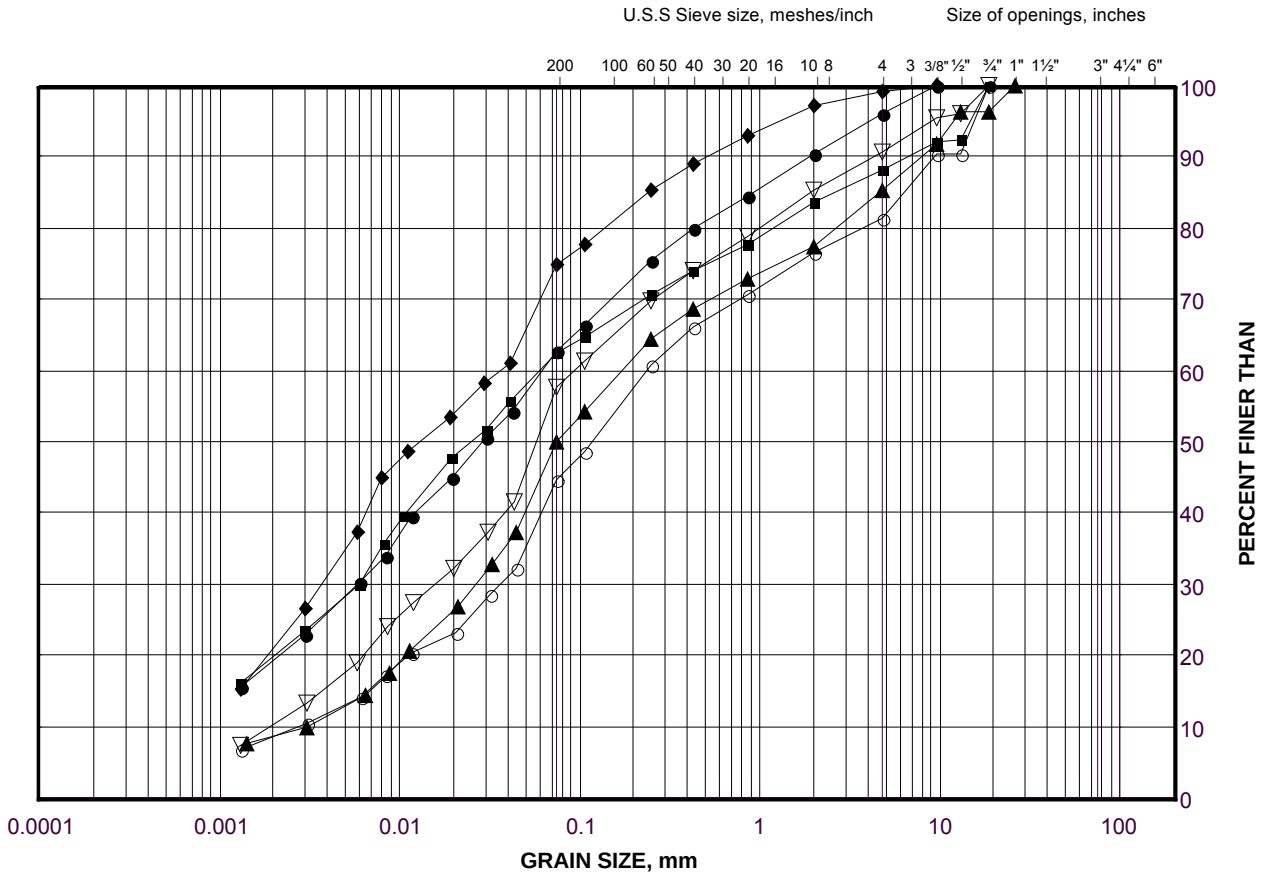
Golder Associates

Date: 11-Jan-13

GRAIN SIZE DISTRIBUTION

Clayey Silt Till

FIGURE B5



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	12-10	2	185.7
■	12-8	3	178.5
◆	12-9	3	183.5
▲	12-8	7	175.4
▽	12-9	7	180.4
❍	12-10	9	178.9

Project Number: 11-1111-0083

Checked By: GL/GDS

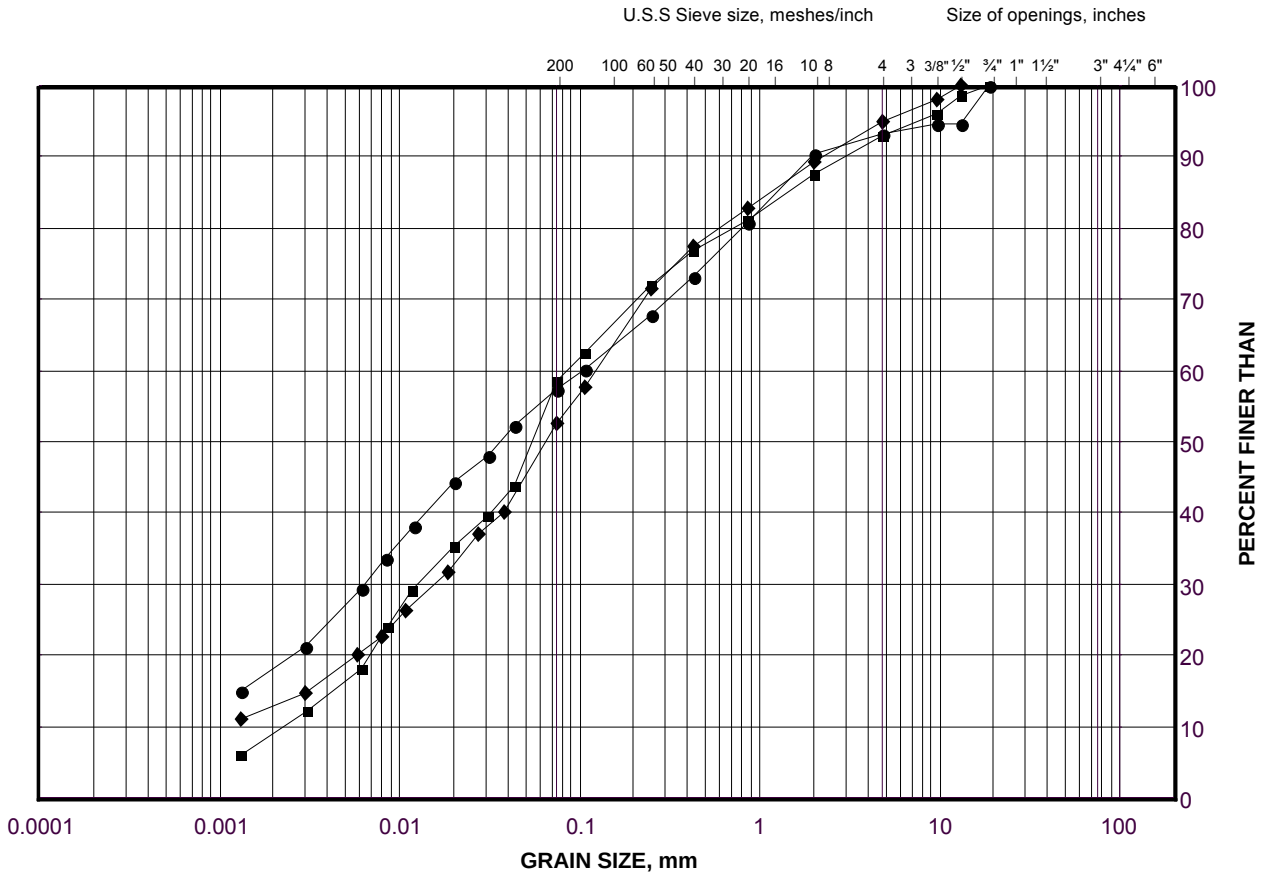
Golder Associates

Date: 11-Jan-13

GRAIN SIZE DISTRIBUTION

Clayey Silt Till

FIGURE B6



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	12-12	4	188.1
■	12-11	4	181.7
◆	12-12	9	182.8

Project Number: 11-1111-0083

Checked By: GL/GDS

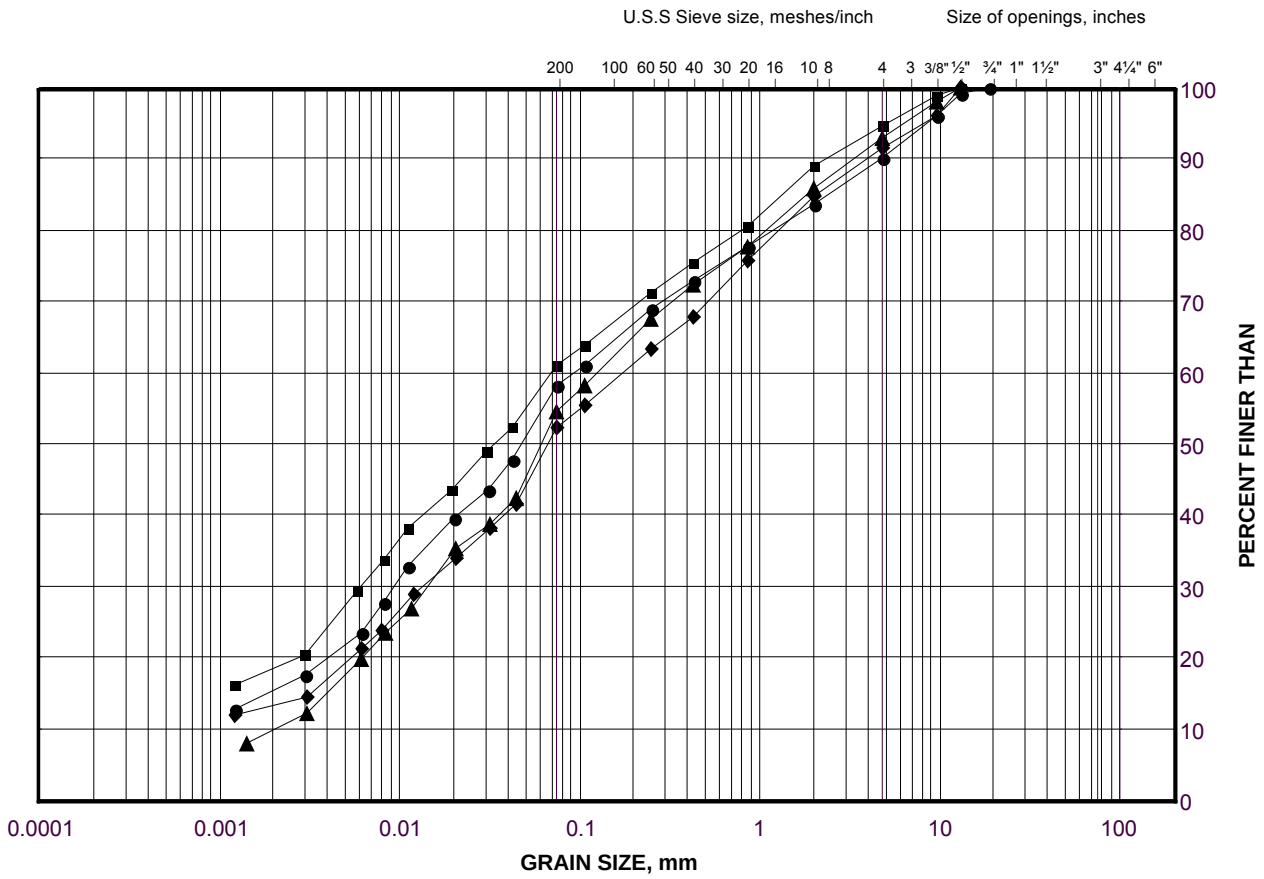
Golder Associates

Date: 11-Jan-13

GRAIN SIZE DISTRIBUTION

Clayey Silt Till

FIGURE B7



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	12-15	4	193.7
■	12-14	4	192.5
◆	12-15	6	192.0
▲	12-14	8	188.7

Project Number: 11-1111-0083

Checked By: GL/GDS

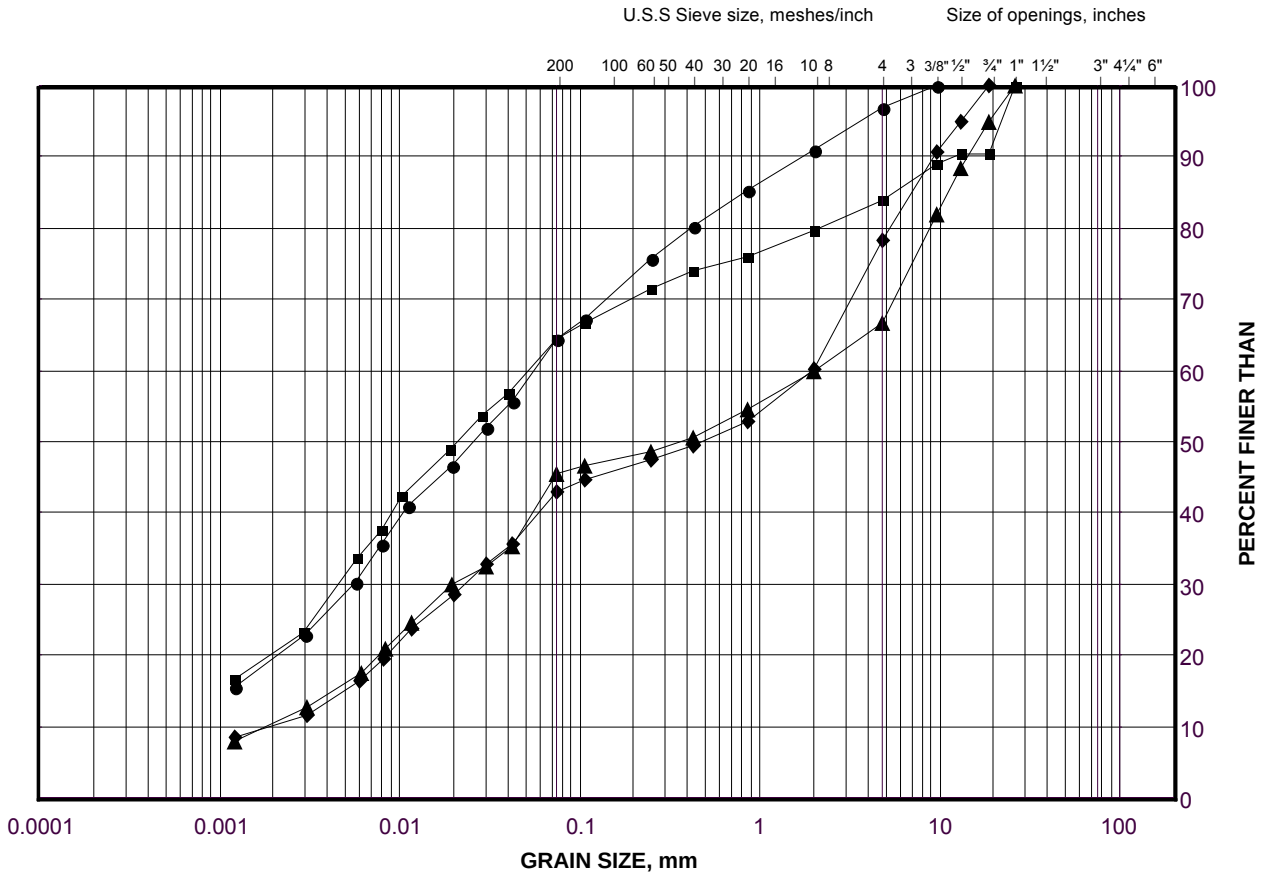
Golder Associates

Date: 11-Jan-13

GRAIN SIZE DISTRIBUTION

Clayey Silt Till

FIGURE B8



LEGEND

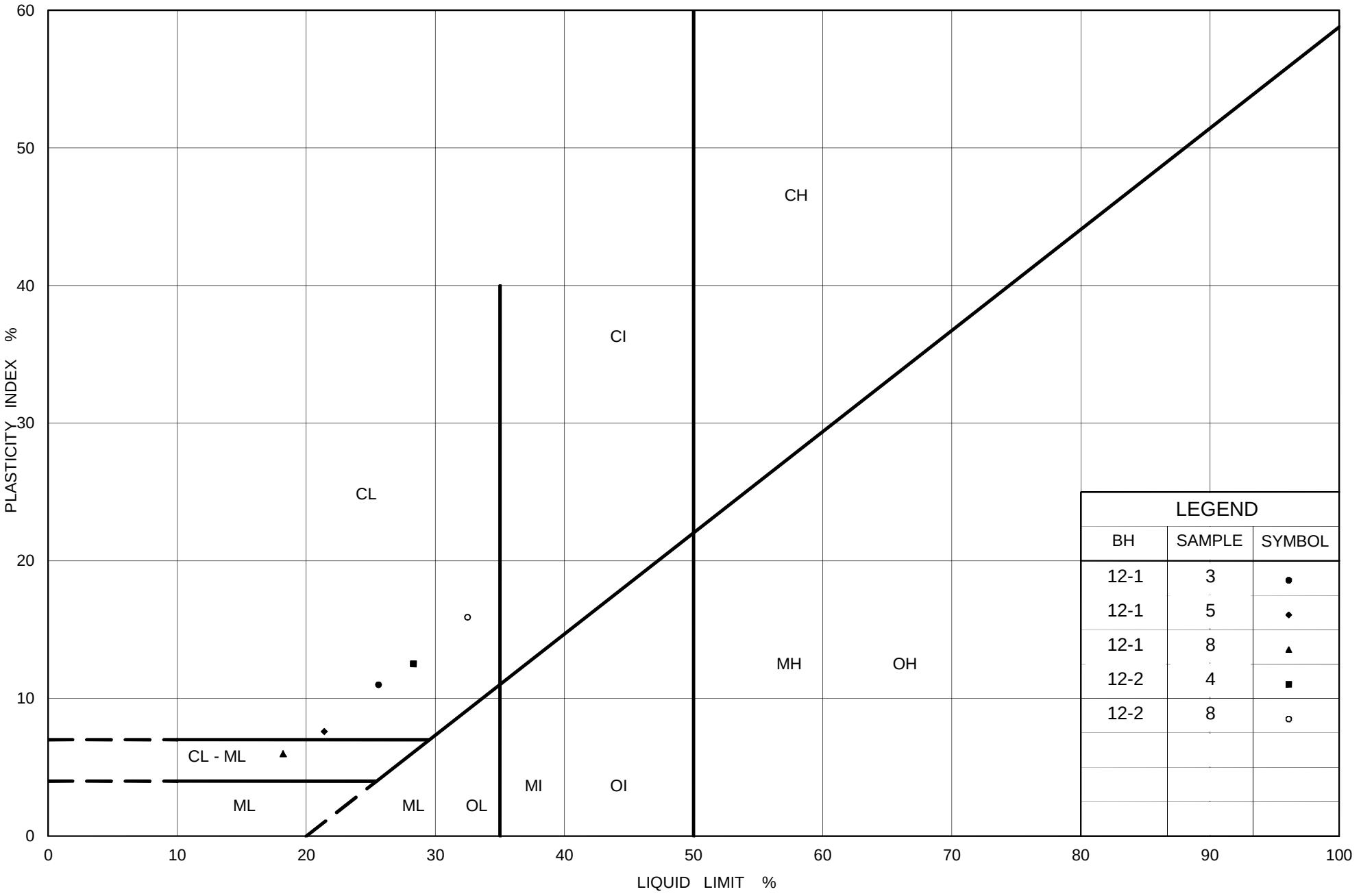
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	12-16	5	199.0
■	12-17	8	205.4
◆	12-16	9	194.4
▲	12-18	9B	209.1

Project Number: 11-1111-0083

Checked By: GL/GDS

Golder Associates

Date: 08-Feb-13



Ministry of Transportation

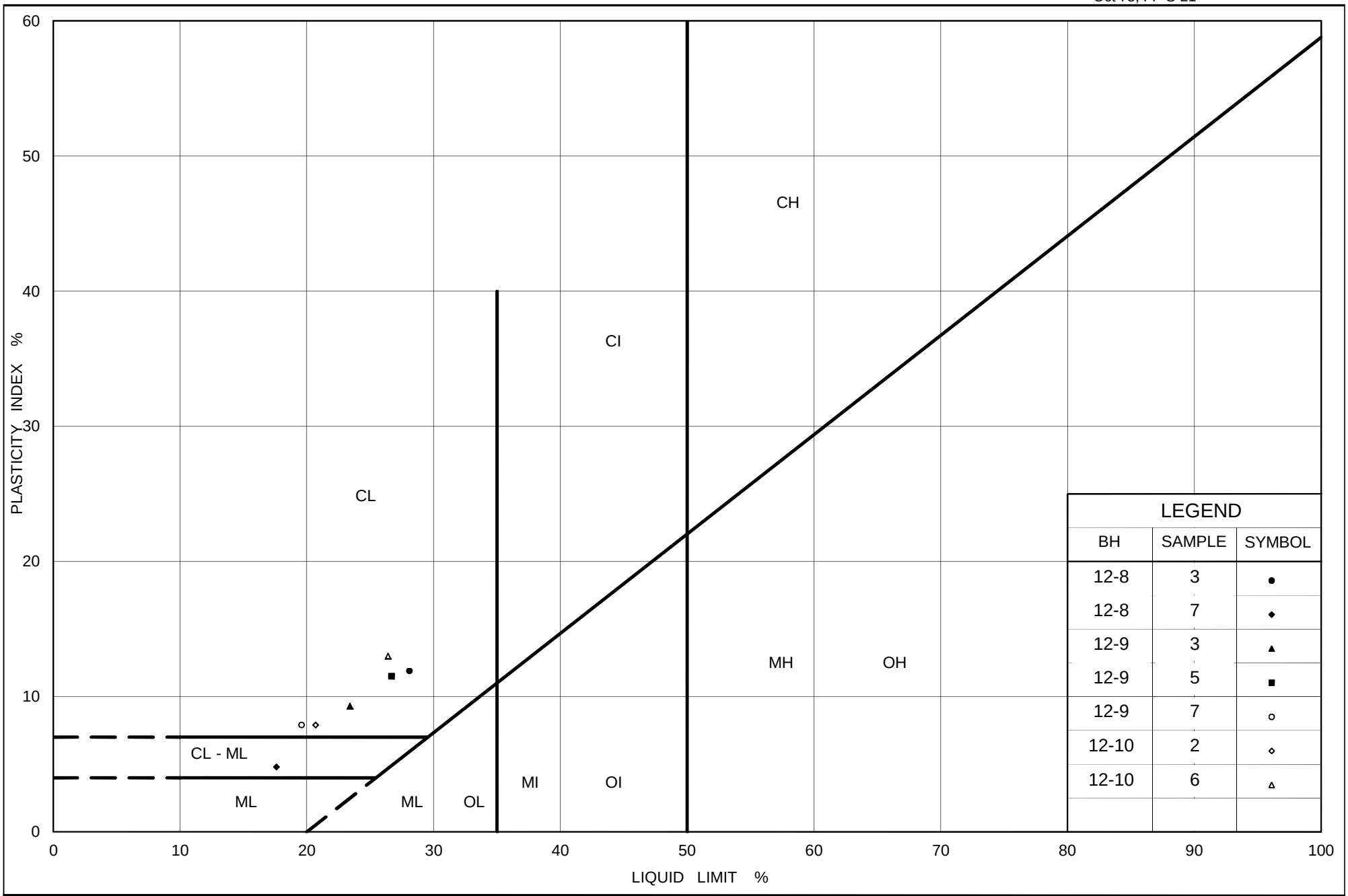
Ontario

PLASTICITY CHART
Clayey Silt Till

Figure No. B9

Project No. 11-1111-0083

Checked By: GL/GDS



Ministry of Transportation

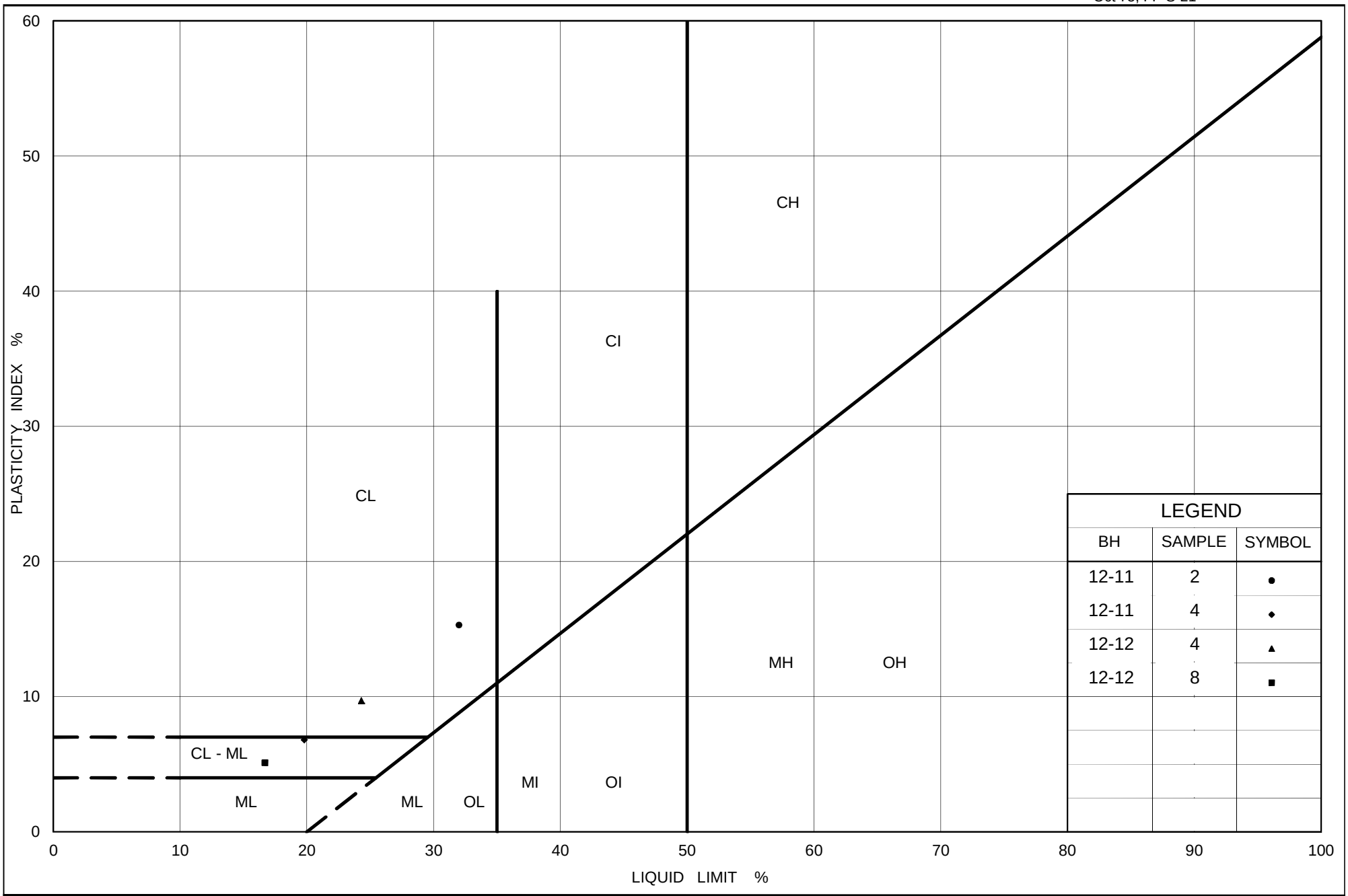
Ontario

PLASTICITY CHART
Clayey Silt Till

Figure No. B10

Project No. 11-1111-0083

Checked By: GL/GDS



Ministry of Transportation

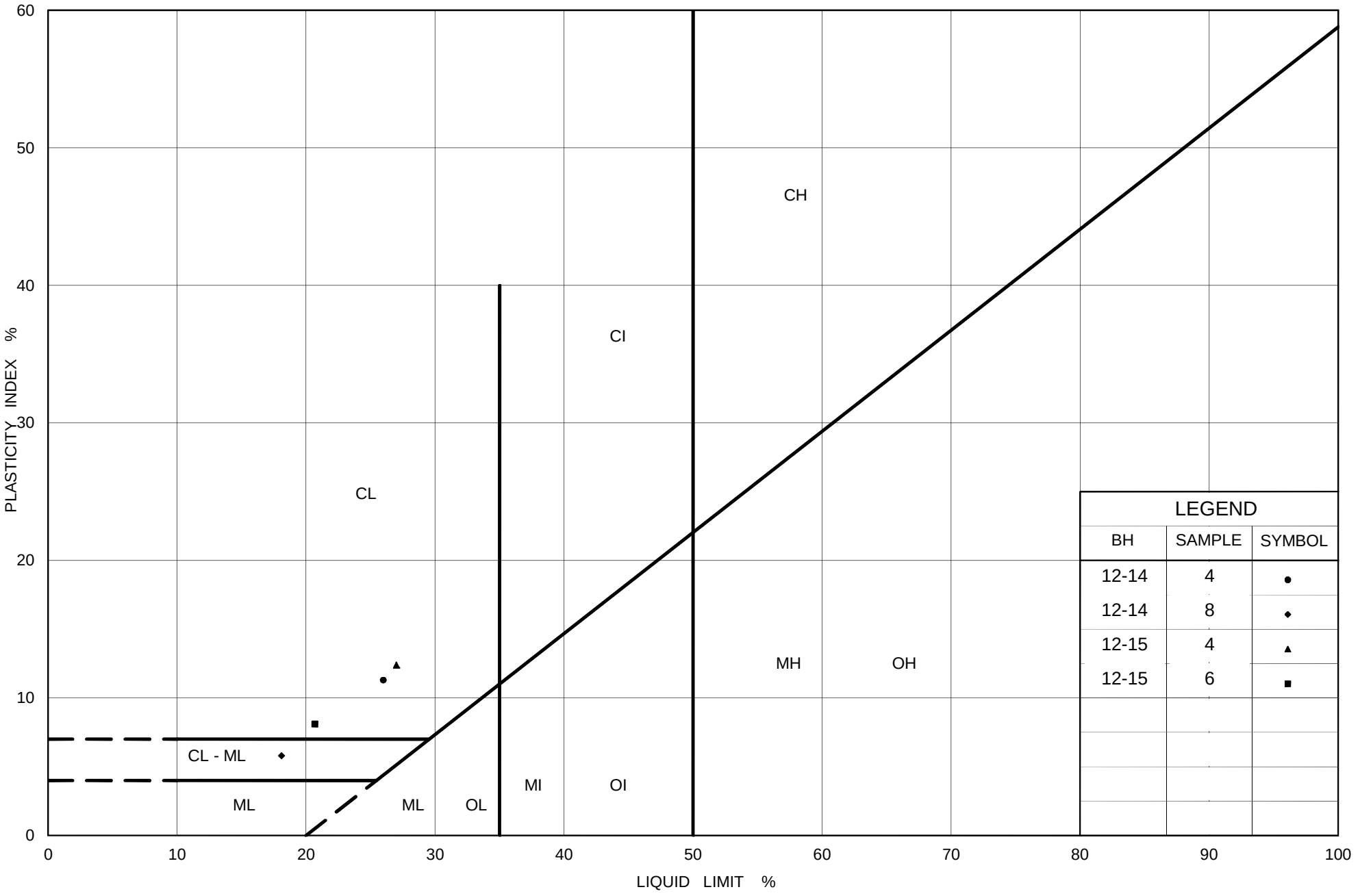
Ontario

PLASTICITY CHART
Clayey Silt Till

Figure No. B11

Project No. 11-1111-0083

Checked By: GL/GDS



Ministry of Transportation

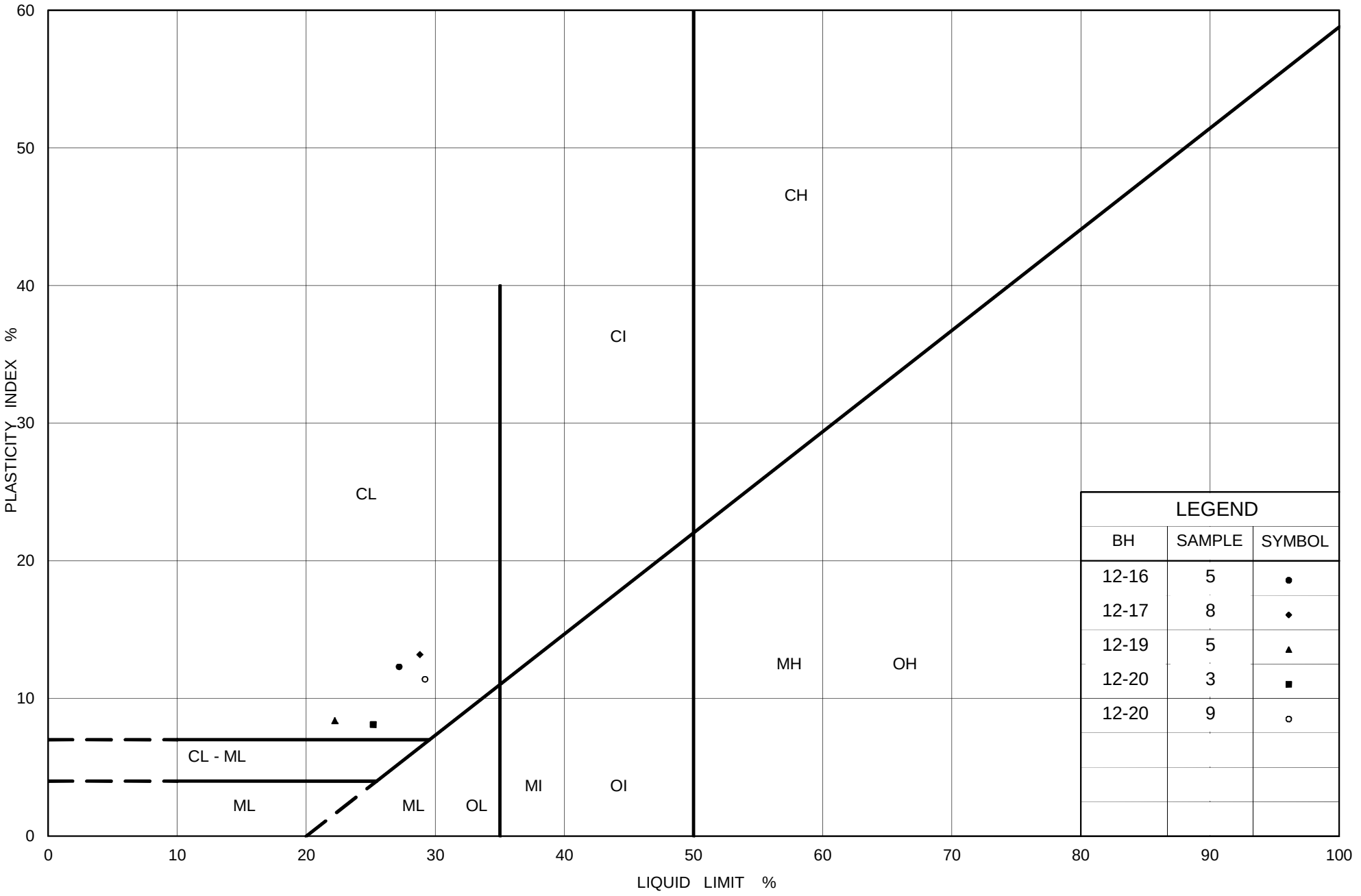
Ontario

PLASTICITY CHART
Clayey Silt Till

Figure No. B12

Project No. 11-1111-0083

Checked By: GL/GDS



Ministry of Transportation

Ontario

PLASTICITY CHART
Clayey Silt Till

Figure No. B13

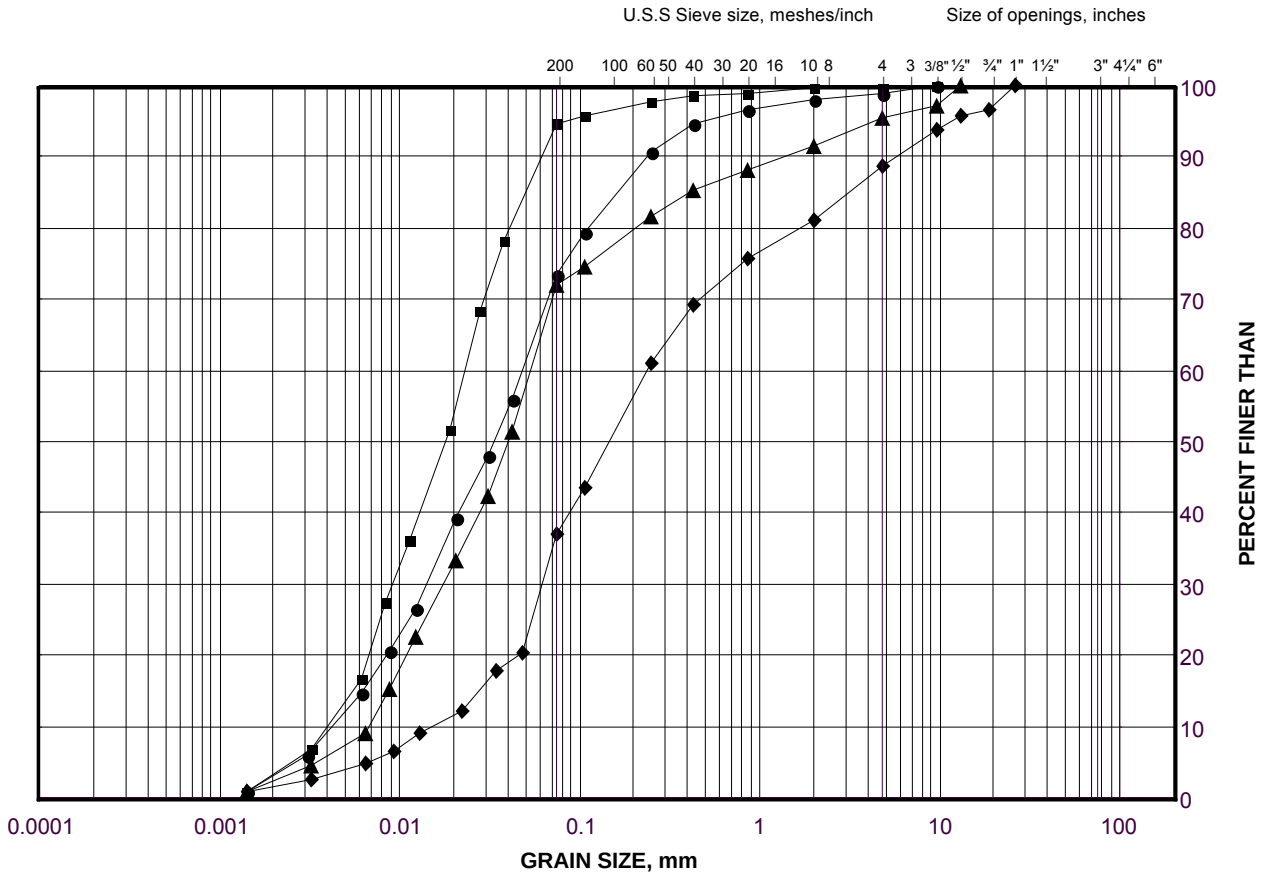
Project No. 11-1111-0083

Checked By: GL/GDS

GRAIN SIZE DISTRIBUTION

Silt to Sand and Silt

FIGURE B14



LEGEND

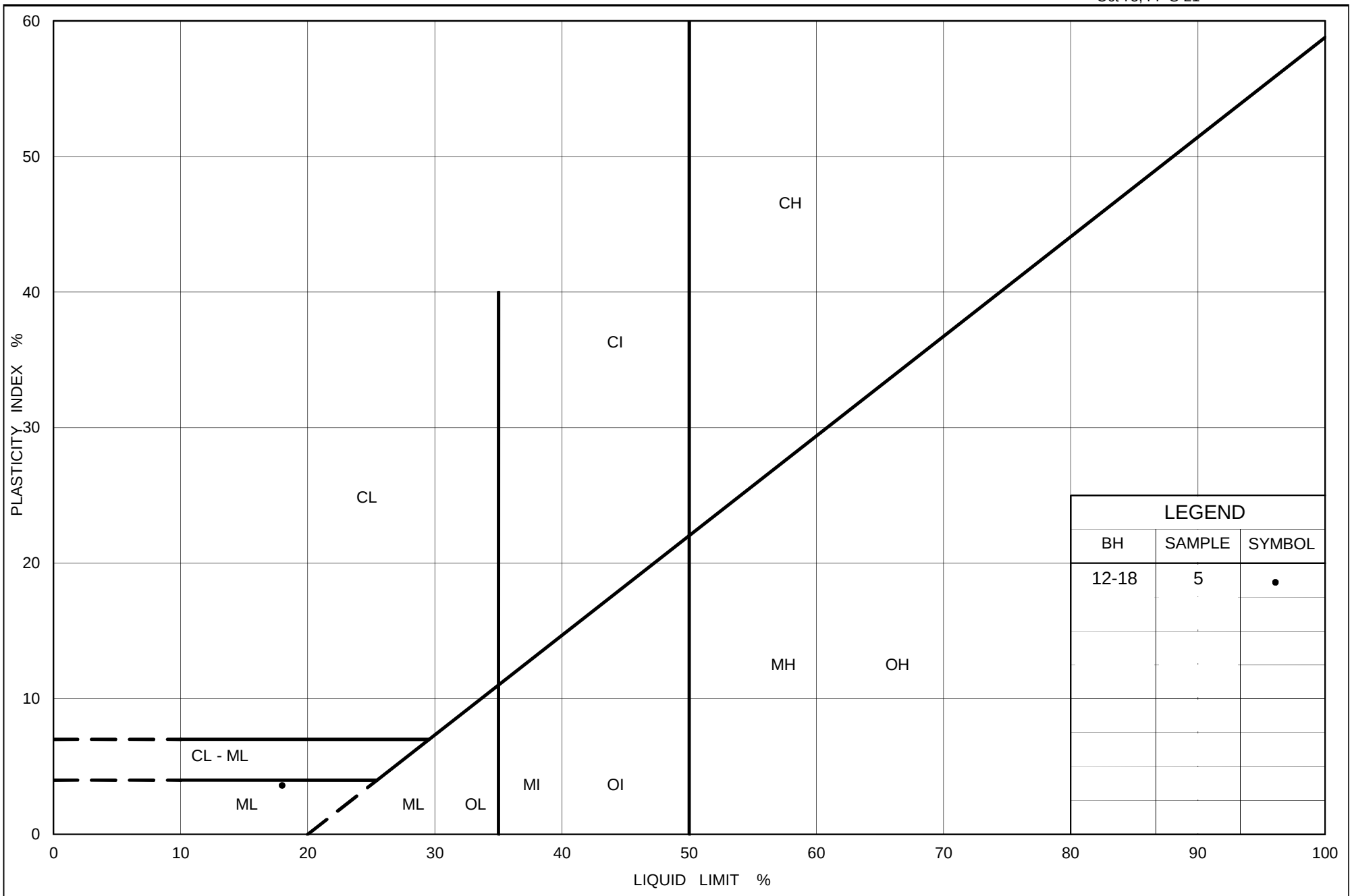
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	12-18	6	213.2
■	12-11	6	180.2
◆	12-20	7	213.5
▲	12-11	9	176.4

Project Number: 11-1111-0083

Checked By: GL/GDS

Golder Associates

Date: 11-Jan-13



Ministry of Transportation

Ontario

PLASTICITY CHART
Silt to Sand and Silt

Figure No. B15

Project No. 11-1111-0083

Checked By: GL/GDS

UNCONFINED COMPRESSION TEST (UC)

FIGURE B16

ASTM D 7012-07

SAMPLE IDENTIFICATION

PROJECT NUMBER	11-1111-0083	SAMPLE NUMBER	3
BOREHOLE NUMBER	12-4	SAMPLE DEPTH, m	4.00-4.12

TEST CONDITIONS

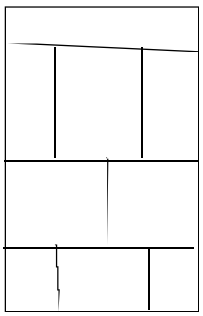
MACHINE SPEED, mm/min	-	TYPE OF SPECIMEN	Rock Core
DURATION OF TEST,min	>2 <15	L/D	2.34

SPECIMEN INFORMATION

SAMPLE HEIGHT, cm	11.00	WATER CONTENT, (specimen) %	2.05
SAMPLE DIAMETER, cm	4.71	UNIT WEIGHT, kN/m^3	25.61
SAMPLE AREA, cm^2	17.42	DRY UNIT WT., kN/m^3	25.09
SAMPLE VOLUME, cm^3	191.69	SPECIFIC GRAVITY	-
WET WEIGHT, g	500.71	VOID RATIO	-
DRY WEIGHT, g	490.65		

VISUAL INSPECTION

FAILURE SKETCH



TEST RESULTS

STRAIN AT FAILURE, %	-	COMPRESSIVE STRESS, MPa	33.2

REMARKS:

DATE: 12/6/2012

Checked By: GL/GDS

Golder Associates

UNCONFINED COMPRESSION TEST
ASTM D7012-07

FIGURE B16
(Sheet 2 of 2)

BEFORE COMPRESSION

AFTER COMPRESSION

Date 12/10/2012
Project 11-1111-0083

Golder Associates

Drawn Frank
Chkd. GL/GDS

FORM PRODUCED JUNE 1986

Form GA-D-4 (imperial)

UNCONFINED COMPRESSION TEST (UC)

FIGURE B17

ASTM D 7012-07

(Sheet 1 of 2)

SAMPLE IDENTIFICATION

PROJECT NUMBER	11-1111-0083	SAMPLE NUMBER	2
BOREHOLE NUMBER	12-5	SAMPLE DEPTH, m	2.52-2.62

TEST CONDITIONS

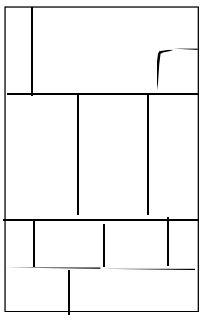
MACHINE SPEED, mm/min	-	TYPE OF SPECIMEN	Rock Core
DURATION OF TEST,min	>2 <15	L/D	1.98

SPECIMEN INFORMATION

SAMPLE HEIGHT, cm	9.33	WATER CONTENT, (specimen) %	2.23
SAMPLE DIAMETER, cm	4.71	UNIT WEIGHT, kN/m^3	25.14
SAMPLE AREA, cm^2	17.44	DRY UNIT WT., kN/m^3	24.59
SAMPLE VOLUME, cm^3	162.70	SPECIFIC GRAVITY	-
WET WEIGHT, g	417.25	VOID RATIO	-
DRY WEIGHT, g	408.15		

VISUAL INSPECTION

FAILURE SKETCH



TEST RESULTS

STRAIN AT FAILURE, %	-	COMPRESSIVE STRESS, MPa	20.4

REMARKS:

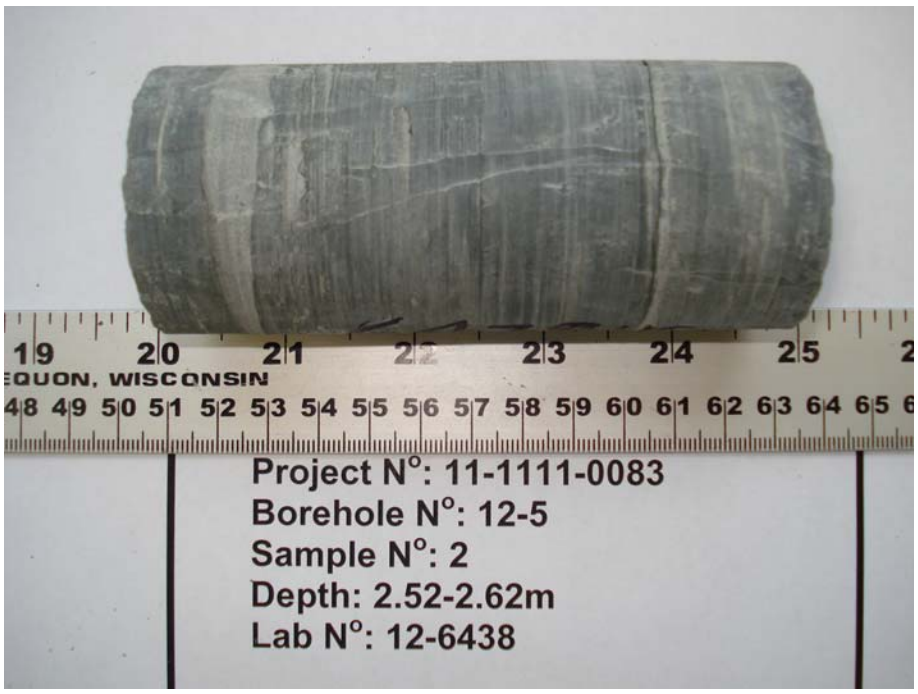
DATE: 12/6/2012

Checked By: GL/GDS

Golder Associates

UNCONFINED COMPRESSION TEST
ASTM D7012-07

FIGURE B17
(Sheet 2 of 2)



BEFORE COMPRESSION

AFTER COMPRESSION

Date 12/10/2012
Project 11-1111-0083

Golder Associates

Drawn Frank
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FORM PRODUCED JUNE 1986

Form GA-D-4 (imperial)

UNCONFINED COMPRESSION TEST (UC)

FIGURE B18

ASTM D 7012-07

(Sheet 1 of 2)

SAMPLE IDENTIFICATION

PROJECT NUMBER	11-1111-0083	SAMPLE NUMBER	3
BOREHOLE NUMBER	12-15	SAMPLE DEPTH, m	8.85-8.98

TEST CONDITIONS

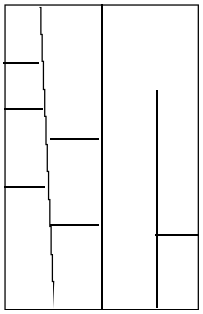
MACHINE SPEED, mm/min	-	TYPE OF SPECIMEN	Rock Core
DURATION OF TEST,min	>2 <15	L/D	2.21

SPECIMEN INFORMATION

SAMPLE HEIGHT, cm	10.45	WATER CONTENT, (specimen) %	2.10
SAMPLE DIAMETER, cm	4.73	UNIT WEIGHT, kN/m^3	25.42
SAMPLE AREA, cm^2	17.60	DRY UNIT WT., kN/m^3	24.90
SAMPLE VOLUME, cm^3	183.93	SPECIFIC GRAVITY	-
WET WEIGHT, g	477.01	VOID RATIO	-
DRY WEIGHT, g	467.20		

VISUAL INSPECTION

FAILURE SKETCH



TEST RESULTS

STRAIN AT FAILURE, %	-	COMPRESSIVE STRESS, MPa	21.5

REMARKS:

DATE: 12/6/2012

Checked By: GL/GDS

Golder Associates

UNCONFINED COMPRESSION TEST
ASTM D7012-07

FIGURE B18
(Sheet 2 of 2)

BEFORE COMPRESSION

AFTER COMPRESSION

Date 12/10/2012
Project 11-1111-0083

Golder Associates

Drawn Frank
Chkd. GL/GDS

FORM PRODUCED JUNE 1986

Form GA-D-4 (imperial)

UNCONFINED COMPRESSION TEST (UC)

FIGURE B19

ASTM D 7012-07

SAMPLE IDENTIFICATION

PROJECT NUMBER	11-1111-0083	SAMPLE NUMBER	3
BOREHOLE NUMBER	12-19	SAMPLE DEPTH, m	8.79-8.98

TEST CONDITIONS

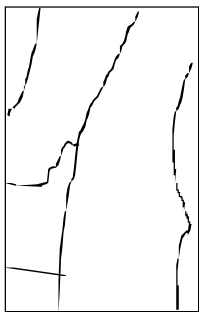
MACHINE SPEED, mm/min	-	TYPE OF SPECIMEN	Rock Core
DURATION OF TEST,min	>2 <15	L/D	2.31

SPECIMEN INFORMATION

SAMPLE HEIGHT, cm	10.99	WATER CONTENT, (specimen) %	0.30
SAMPLE DIAMETER, cm	4.75	UNIT WEIGHT, kN/m^3	25.93
SAMPLE AREA, cm^2	17.74	DRY UNIT WT., kN/m^3	25.86
SAMPLE VOLUME, cm^3	194.91	SPECIFIC GRAVITY	-
WET WEIGHT, g	515.63	VOID RATIO	-
DRY WEIGHT, g	514.09		

VISUAL INSPECTION

FAILURE SKETCH



TEST RESULTS

STRAIN AT FAILURE, %	-	COMPRESSIVE STRESS, MPa	145.5

REMARKS:

DATE: 12/6/2012

Checked By: GL/GDS

Golder Associates

UNCONFINED COMPRESSION TEST
ASTM D7012-07

FIGURE B19
(Sheet 2 of 2)

BEFORE COMPRESSION

AFTER COMPRESSION

Date 12/10/2012
Project 11-1111-0083

Golder Associates

Drawn Frank
Chkd. GL/GDS

FORM PRODUCED JUNE 1986

Form GA-D-4 (imperial)

APPENDIX C

Borehole Records from Previous Investigation

APPENDIX C1

Borehole Records from Associated Highway 410 Widening Bridge Sites

Golder Associates

RECORD OF BOREHOLE No MB-1

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00
LOCATION N 4832250.3 ;E 292926.1
ORIGINATED BY MS
DIST Central HWY 410
BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers
COMPILED BY NK
DATUM Geodetic
DATE November 16, 2011
CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
165.7	GROUND SURFACE										
0.0	TOPSOIL		1	SS	19				○		
	Clayey silt with sand, trace to some gravel, containing pockets of silty sand (FILL) Stiff to hard Brown to grey Moist		2	SS	13		165				
			3	SS	33		164		○ —		
162.7			4	SS	19		163				
3.0	SILTY CLAY, some gravel, trace to some sand (TILL) Hard Brown to grey Moist		5	SS	61/.28				○ —		14 9 59 18
162.3							162				
3.4	SHALE (BEDROCK) Weathered Grey		6	SS	98/.23				○		
161.5											
4.2	END OF BOREHOLE										

NOTE:

1. Borehole dry on completion of drilling.

$+^3, \times^3$: Numbers refer to Sensitivity

$\bigcirc^{3\%}$ STRAIN AT FAILURE

Golder Associates

RECORD OF BOREHOLE No MB-2

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4832266.9 ;E 292911.9 ORIGINATED BY MS
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY NK
DATUM Geodetic DATE January 4 and 5, 2012 CHECKED BY LCC

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 × REMOULDED (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
159.1	GROUND SURFACE										
0.0	ASPHALT										
0.2	Sand, trace to some silt, trace gravel (FILL) Compact Brown Moist										
157.0						▽	157				
156.7	Gravel, some sand (FILL) Compact										
2.4	Brown Wet		1	SS	65/0.28				○		
156.2	Weathered SHALE										
2.9	SHALE (BEDROCK)		1	RC	REC 100%		156				RQD = 49%
			2	RC	REC 100%		155				RQD = 24%
	Bedrock cored from 2.9 m to 7.3 m Refer to Record of Drillhole MB-2 for bedrock coring details		3	RC	REC 100%		154 153				RQD = 56%
			4	RC	REC 100%		152				RQD = 71%
151.8											
7.3	END OF BOREHOLE										

NOTES;

1. The top of 2.4 m of soil was removed prior to drilling the borehole using a vacuum truck, because the borehole was located in close proximity to existing underground services. The soil description in the upper 2.4 m is based on visual classification during field operations.

2. Water level in open borehole at a depth of 2.1 m (Elev. 157.0 m) upon completion of overburden drilling.

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

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: MB-2

SHEET 1 OF 1

LOCATION: N 4832266.9 ;E 292911.9

DRILLING DATE: January 4 and 5, 2012

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 55 Trackmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		156.17																
3	HQ RC / HW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION), containing fossiliferous LIMESTONE interbeds Slightly weathered to fresh Grey Laminated Medium strong		2.90	1															UC=17.7 MPa (Axial)
4					2															
5																				(Axial)
6					3															(Axial) UC=16.2 MPa
7				151.75	4															(Axial)
		END OF DRILLHOLE		7.32																
8																				
9																				
10																				
11																				
12																				

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: MS
CHECKED: NK

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 8/3/12

Golder Associates

RECORD OF BOREHOLE No MB-3

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4832274.4 ;E 292898.2 ORIGINATED BY MS
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY NK
DATUM Geodetic DATE January 4, 2012 CHECKED BY LCC

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 × REMOULDED (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
159.1	GROUND SURFACE										
0.0	ASPHALT						159				
0.2	Silty sand, some gravel, trace clay (FILL) Dense to compact Brown Moist		1	SS	38				○		17 62 20 1
			2	SS	17		158				
157.7						▽					
1.5	Gravelly sand, some silt, trace clay (FILL) Loose Grey Wet		3	SS	8				○		28 55 13 4
156.9	Weathered SHALE		4	SS	50/0.13		157				
2.5	SHALE (BEDROCK)		1	RC	REC 91%						RQD = 44%
			2	RC	REC 100%		156				RQD = 48%
	Bedrock cored from 2.5 m to 7.0 m Refer to Record of Drillhole MB-3 for bedrock coring details		3	RC	REC 100%		155				RQD = 43%
							154				
			4	RC	REC 100%		153				RQD = 48%
152.1											
7.0	END OF BOREHOLE NOTES: 1. Water level in open borehole at a depth of 1.5 m (Elev. 157.6 m) upon completion of overburden drilling.										

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

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: MB-3

SHEET 1 OF 1

LOCATION: N 4832274.4 ;E 292898.2

DRILLING DATE: January 4, 2012

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 55 Trackmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH	COLOUR % RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		156.64																	
3	HQ RC / HW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION), containing fossiliferous LIMESTONE interbeds, and highly weathered clay zones at depths of 3.4 m (Elev. 155.7 m), 5.8 m (Elev. 153.3 m) and 6.7 m (Elev. 152.4 m) Slightly weathered to fresh Grey Laminated Medium strong		2.45	1																
4					2																
5					3																
6																			•		(Axial)
7				152.06	4														•		(Axial)
		END OF DRILLHOLE		7.03																	
8																					
9																					
10																					
11																					
12																					

JN - Joint, FLT - Fault, SH - Shear, VN - Vein, CJ - Conjugate
BD - Bedding, FO - Foliation, CO - Contact, OR - Orthogonal, CL - Cleavage
PL - Planar, CU - Curved, UN - Undulating, ST - Stepped, IR - Irregular
PO - Polished, K - Slickensided, SM - Smooth, RO - Rough, VR - Very Rough
MB - Mechanical Break, BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE
1 : 50

LOGGED: MS
CHECKED: NK

Golder Associates

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 8/3/12

Golder Associates

RECORD OF BOREHOLE No MB-4

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00
LOCATION N 4832277.8 ;E 292903.0
ORIGINATED BY MS
DIST Central HWY 410
BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers
COMPILED BY NK
DATUM Geodetic
DATE January 5, 2012
CHECKED BY LCC

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 + FIELD VANE ● QUICK TRIAXIAL × REMOULDED 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
159.2	GROUND SURFACE										
0.0	ASPHALT										
0.2	Silty sand, trace gravel (FILL)		1	SS	36		159		○		
158.6	Dense										
0.6	Brown Moist										
			2	SS	90/0.25				○		
	SHALE (BEDROCK) Weathered Grey					▽	158				
157.7											
1.5	SHALE (BEDROCK)		1	RC	REC 100%						RQD = 0%
			2	RC	REC 100%		157				RQD = 23%
							156				
			3	RC	REC 100%		155				RQD = 41%
	Bedrock Cored from 1.5 m to 7.6 m Refer to Record of Drillhole MB-4 for bedrock coring details										
			4	RC	REC 88%		154				RQD = 27%
							153				
			5	RC	REC 100%						RQD = 90%
151.6							152				
7.6	END OF BOREHOLE										

NOTES:

1. Water level in open borehole at a depth of 1.5 m (Elev. 157.7 m) upon completion of overburden drilling.

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

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: MB-4

SHEET 1 OF 1

LOCATION: N 4832277.8 ;E 292903.0

DRILLING DATE: January 5, 2012

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 55 Trackmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH	COLOUR % RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		157.66																	
2	HQ RC / HW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION), containing fossiliferous LIMESTONE interbeds Slightly weathered to fresh Grey Laminated Medium strong		1.52	1																
3					2																(Axial)
4					3																
5					4																(Axial)
6																					
7				151.56	5																(Axial) UC-15.6 MPa
8		END OF BOREHOLE		7.62																	
9																					
10																					
11																					

JN - Joint, FLT - Fault, SH - Shear, VN - Vein, CJ - Conjugate
BD - Bedding, FO - Foliation, CO - Contact, OR - Orthogonal, CL - Cleavage
PL - Planar, CU - Curved, UN - Undulating, ST - Stepped, IR - Irregular
PO - Polished, K - Slickensided, SM - Smooth, RO - Rough, VR - Very Rough
MB - Mechanical Break, BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE
1 : 50

LOGGED: MS
CHECKED: NK

Golder Associates

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 8/3/12

Golder Associates

RECORD OF BOREHOLE No MB-5

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4832294.2 ;E 292887.4 ORIGINATED BY MS
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY NK
DATUM Geodetic DATE November 13, 2011 CHECKED BY LCC

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 × REMOULDED (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
166.5	GROUND SURFACE										
0.0	ASPHALT										
	Silty sand and gravel (FILL) Compact Brown Moist										
0.5	Clayey silt, trace to some sand, trace gravel (FILL) Very stiff Grey Moist		1	SS	22		166		w = 18		
165.1	SILTY CLAY with gravel, trace to some sand (TILL) Very stiff to hard Grey Moist to wet		2	SS	15	▼	165				
1.5			3	SS	60		164		w_P = 17, w = 18, w_L = 27		48 11 27 14
163.5			4	SS	50/.03						
3.1	SHALE (BEDROCK) Weathered Grey		5	SS	50/.03		163				
161.9			6	SS	50/.03		162				
4.6	END OF BOREHOLE										

NOTE:

1. Water level in piezometer at a depth of 1.6 m (Elev. 164.9 m) on November 13, 2011.

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

GTA-MTO 001 1111110083.GPJ GAL-MISS.GDT 8/3/12

Golder Associates

RECORD OF BOREHOLE No P1-1

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4833897.9 ;E 291310.4 ORIGINATED BY TWB
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 152 mm Solid Stem Augers COMPILED BY MAS
DATUM Geodetic DATE August 27, 2012 CHECKED BY LCC

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: 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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
179.5	GROUND SURFACE										
0.0	TOPSOIL										
0.1	CLAYEY SILT, with sand, trace to some gravel, containing rootlets to 0.6 m, containing cobbles and boulders below 3.0 m (TILL) Very stiff to hard Brown becoming grey below a depth of 3.0 m Moist		1	SS	22		179		○		
			2	SS	30						
			3	SS	26		178		○ —		11 24 42 23
			4	SS	33		177				
			5	SS	44				○		
			6	SS	106		176				
			7	SS	31		175		○ —		18 22 41 19
173.4							174				
6.1	SHALE (BEDROCK) Weathered Grey		8	SS	60/0.10	▽	173				
172.5											
7.0	END OF BOREHOLE AUGER REFUSAL										

NOTE:

1. Water level in open borehole at a depth of 6.1 m (Elev. 173.4 m) on completion of drilling.

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

Golder Associates

RECORD OF BOREHOLE No P1-2

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4833931.4 ;E 291281.0 ORIGINATED BY TWB
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 152 mm Solid Stem Augers COMPILED BY MAS
DATUM Geodetic DATE August 27, 2012 CHECKED BY LCC

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: 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 × REMOULDED (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
179.8	GROUND SURFACE										
0.0	TOPSOIL										
0.1	CLAYEY SILT with sand, trace gravel, containing rootlets to 0.6 m, containing cobbles and boulders below 3.2 m (TILL) Very stiff to hard Brown, becoming grey below a depth of 3.7 m Moist		1	SS	16		179				
			2	SS	32				○		4 21 47 28
			3	SS	23	▼	178				
			4	SS	27		177		○		
			5	SS	60						
			6	SS	39		176		○		4 37 43 16
			7	SS	114/0.20				○		
	Augers griniding heavily between 4.7 m and 6.1 m						175				
173.7							174				
6.1	SHALE (BEDROCK) Weathered Grey		8	SS	60/0.10						
172.6							173				
7.2	END OF BOREHOLE AUGER REFUSAL										

NOTES:

1. Water level in open borehole at a depth of 6.8 m (Elev. 173.0 m) on completion of drilling.

2. Water level measured in piezometer as follows:

Date	Depth	Elev.
Aug. 27/12	6.8 m	173.0 m
Sep. 24/12	1.5 m	178.3 m

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

GTA-MTO 001 1111110083.GPJ GAL-GTA.GDT 06/25/13

Golder Associates

RECORD OF BOREHOLE No P1-3

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4833960.1 ;E 291245.5 ORIGINATED BY TWB
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 152 mm Solid Stem Augers COMPILED BY MAS
DATUM Geodetic DATE August 23, 2012 CHECKED BY LCC

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 × REMOULDED) 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
180.2	GROUND SURFACE						180				
0.0	CLAYEY SILT, some sand Very stiff Brown		1	SS	17						
179.5	Moist						179				
0.7	CLAYEY SILT with sand, trace to some gravel, containing cobbles and boulders below 3.0 m (TILL) Very stiff to hard Brown becoming grey below a depth of 3.7 m Moist		2	SS	28						
			3	SS	25		178				7 24 45 24
			4	SS	42						
			5	SS	80/0.20		177				
			6	SS	49		176				
			7	SS	53						40 25 27 8
174.1						▽	175				
6.1	SHALE (BEDROCK / RESIDUAL SOIL) Highly weathered Grey		8	SS	87/0.20		174				
173.0							173				
7.2	SHALE (BEDROCK) Weathered Grey		9	SS	60/0.05						
172.3											
7.9	END OF BOREHOLE AUGER REFUSAL NOTE: 1. Water level in open borehole at a depth of 5.9 m (Elev. 174.3 m) on completion of drilling.										

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

Golder Associates

RECORD OF BOREHOLE No C4-1

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4834903.6 ;E 290226.0 ORIGINATED BY TWB
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 152 mm Solid Stem Augers COMPILED BY MS/NK
DATUM Geodetic DATE August 22, 2012 CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
185.1	GROUND SURFACE						185				
0.0	Sand and gravel, some silt, trace clay (FILL) Loose Brown Moist										
184.2							184				
0.9	Clayey silt, with to some sand, trace gravel, containing rootlets (FILL) Firm to stiff Brown and grey with oxidation stains Moist		1	SS	7						
			2	SS	5		183		○		
			3	SS	8						
			4	SS	12		182		○—|			1 28 37 34
			5	SS	6		181				
180.4											
4.7	CLAYEY SILT, trace to some sand, trace gravel, containing cobbles and boulders (TILL) Very stiff to hard Brown with oxidation stains, becoming grey below 5.6 m Moist		6	SS	18				○		
			7	SS	26		179				
			8	SS	64		177		|—○—|			1 8 79 12
			9	SS	36		176				
174.9							175				
10.2	CLAYEY SILT, trace to some sand, trace gravel Hard Grey Moist		10	SS	60/0.08				|—○—|			1 12 70 17
174.2											
10.9	END OF BOREHOLE										

NOTES:

1. Borehole dry on completion of drilling.

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

Golder Associates

RECORD OF BOREHOLE No C4-2

SHEET 1 OF 1

METRIC

PROJECT 11-1111-0083

G.W.P. 2144-07-00 LOCATION N 4834902.1 ;E 290206.4 ORIGINATED BY CS

DIST Central HWY 410 BOREHOLE TYPE D-50 Track-mount, 108 mm Solid Stem Augers COMPILED BY MAS/NK

DATUM Geodetic DATE August 28, 2012 CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
182.1	GROUND SURFACE										
0.0	CLAYEY SILT with sand to some sand, containing rootlets above 1.5 m depth Firm to stiff Brown Moist		1	SS	8		182				
			2	SS	12		181		○		
179.9			3	SS	7				○		
2.2	CLAYEY SILT, trace sand Hard Brown, becoming grey at 3.1 m Moist		4	SS	30		180				
178.4			5	SS	39		179		○ ⊢		0 9 67 24
3.7	CLAYEY SILT to SILT, some sand, trace gravel (TILL) Hard/ very dense Grey Moist to wet		6	SS	84		178				
			7	SS	78		177		○⊢		2 11 74 13
175.8			8	SS	88/0.15		176				
6.3	END OF BOREHOLE NOTE: 1. Borehole dry on completion of drilling.										

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

Golder Associates

RECORD OF BOREHOLE No C5-1

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4835353.1 ;E 289779.4 ORIGINATED BY TWB
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 152 mm Solid Stem Augers COMPILED BY MS/NK
DATUM Geodetic DATE August 22, 2012 CHECKED BY LCC

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES 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 × REMOULDED 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
185.0	GROUND SURFACE										
0.0	Sand and gravel, some silt, trace clay (FILL) Loose Brown Moist										
184.2							184				
0.8	Clayey silt to silty clay, trace to some sand, trace gravel, containing rootlets (FILL) Firm Brown and grey with oxidation staining Moist		1	SS	7						
			2	SS	8		183				
			3	SS	8				42		0 16 45 39
			4	SS	8		182				
180.7			5	SS	7		181				
4.3	SAND and SILT, some gravel, trace clay (TILL) Dense Brown with oxidation staining, becoming grey below 5.6 m Moist		6	SS	30		180				
							179				
178.6			7	SS	41						
6.6	Silty SAND, trace clay Dense Grey Wet						178				
	SAND and SILT, some gravel, trace clay (TILL) Dense to very dense Moist		8	SS	95		177				
176.3											
8.7	CLAYEY SILT with sand, trace gravel (TILL) Hard Grey Moist		9	SS	66		176				3 21 55 21
							175				
174.0			10	SS	134/0.23		174				
11.0	END OF BOREHOLE										

NOTES:

1. Water level in open borehole at a depth of 5.6 m (Elev. 179.4 m) on completion of drilling.

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

GTA-MTO 001 1111110083.GPJ GAL-GTA.GDT 06/25/13

Golder Associates

RECORD OF BOREHOLE No C5-2

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4835357.7 ;E 289753.8 ORIGINATED BY TWB
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 152 mm Solid Stem Augers COMPILED BY MS/NK
DATUM Geodetic DATE August 22, 2012 CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
182.6	GROUND SURFACE										
0.0	TOPSOIL										
0.2	Clayey silt, some sand, trace gravel, containing rootlets to 0.7 m (FILL) Firm to very stiff Brown Moist		1	SS	17		182		○		
181.2			2	SS	7						
1.4	CLAYEY SILT, some sand, trace gravel Firm Brown and grey, containing oxidation stains Moist		3	SS	4		181		○		
180.2											
2.6	Silty SAND, trace clay Very dense Brown Wet		4	SS	71		180				
	CLAYEY SILT with sand to SAND and SILT, some clay, trace to some gravel (TILL) Hard/Very dense Grey, containing oxidation stains to 3.0 m Moist		5	SS	72		179		○ H		7 36 43 14
178.6			6	SS	57						
178.3											
4.3	Silty SAND, trace clay, trace gravel Very dense Grey Wet		7	SS	90		178		○ H		17 35 40 8
	SAND and SILT, trace to some clay, trace to some gravel, containing cobbles and boulders (TILL) Dense to very dense Grey Moist		8	SS	43		177				
							176				
			9	SS	54		175		○ H		15 38 33 14
173.9											
8.7	CLAYEY SILT, trace to some sand Hard Grey Moist						174				
173.1			10	SS	50/0.08						
9.5	END OF BOREHOLE										

NOTES:

1. Water level in open borehole at a depth of 3.9 m (Elev. 178.7 m) on completion of drilling.

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

GTA-MTO 001 1111110083.GPJ GAL-GTA.GDT 06/25/13

Golder Associates

RECORD OF BOREHOLE No P2-1

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4835088.4 ;E 290143.5 ORIGINATED BY TWB
DIST Central HWY 410 BOREHOLE TYPE D-50 Track-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY MAS
DATUM Geodetic DATE August 8, 2012 CHECKED BY LCC

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 (20 40 60 80 100): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
184.0	GROUND SURFACE										
0.0	TOPSOIL										
0.2	CLAYEY SILT, some sand, containing rootlets to a depth of 0.5 m		1	SS	8						
183.3							183				
0.7	Stiff Brown Moist SAND and SILT to Silty SAND, trace to some clay, trace to some gravel, containing rootlets to 0.5 m, containing cobbles and boulders below 2.3 m (TILL) Dense to very dense Brown Moist		2	SS	30						
			3	SS	38		182				
			4	SS	54				H		8 32 47 13
			5	SS	50		181				
			6	SS	108/0.25	▽	180				
	Becoming grey and wet below a depth of approximately 4.3 m		7	SS	43		179				19 43 27 11
			8	SS	33		178				
			9	SS	89		177 176				2 57 33 8
			10	SS	79		175				
174.4	SAND and GRAVEL, trace silt, trace clay, containing shale fragments Very dense Grey Wet										
9.8	END OF BOREHOLE										

NOTE:

1. Water level in open borehole at a depth of 4.3 m (Elev. 179.7 m) on completion of drilling.

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

GTA-MTO 001 1111110083.GPJ GAL-GTA.GDT 06/25/13

Golder Associates

RECORD OF BOREHOLE No P2-2

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4835120.9 ;E 290119.1 ORIGINATED BY TWB
DIST Central HWY 410 BOREHOLE TYPE D-50 Track-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY MAS
DATUM Geodetic DATE August 13, 2012 CHECKED BY LCC

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES 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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
184.6	GROUND SURFACE										
0.0	TOPSOIL										
0.2	CLAYEY SILT, some sand, containing organic matter and rootlets Stiff Brown Moist		1	SS	8		184				
183.5			2	SS	13						
183.1	Silty SAND, trace clay, containing clayey silt seams Compact Brown Moist		3	SS	16		183				
1.5	SAND and SILT, trace to some clay, trace to some gravel, containing wet silty sand layers, containing cobbles and boulders below 5.5 m (TILL) Compact to very dense Brown becoming grey below a depth of 3.1 m Moist		4	SS	40	▼	182				3 22 53 12
			5	SS	30		181				
			6	SS	59						
			7	SS	108/0.25		180				
			8	SS	84		179				15 35 42 8
			9	SS	60/0.08		178				
							177				
175.4			10	SS	60/0.10		176				
9.2	END OF BOREHOLE										

NOTES:

1. Water level in open borehole at a depth of 5.6 m (Elev. 179 m) on completion of drilling.

2. Water level measured in piezometer as follows:

Date	Depth	Elev.
Aug. 27/12	2.6 m	182.0 m
Sep. 24/12	2.4 m	182.2 m

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

Golder Associates

RECORD OF BOREHOLE No P2-3

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4835149.4 ;E 290089.6 ORIGINATED BY TWB
DIST Central HWY 410 BOREHOLE TYPE D-50 Track-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY MAS
DATUM Geodetic DATE August 9, 2012 CHECKED BY LCC

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 (20 40 60 80 100): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
184.0	GROUND SURFACE										
0.0	TOPSOIL										
0.2	CLAYEY SILT, some sand, containing rootlets to 0.5 m Stiff to very stiff Brown Moist		1	SS	10						
182.7			2	SS	19		183				
1.3	SAND and SILT, trace to some gravel, trace to some clay (TILL) Dense to very dense Brown Moist		3	SS	32		182				
			4	SS	54						10 31 47 12
180.6			5	SS	35		181				
180.3	SILT, trace clay, trace sand Dense										
3.7	Grey Wet		6	SS	28	▽	180				
	SAND and SILT, trace to some gravel, trace to some clay, containing cobbles and boulders (TILL) Compact to very dense Grey Moist		7	SS	43		179				3 37 49 11
			8	SS	63		178				
			9	SS	60/0.08		177				4 39 49 8
							176				
			10	SS	93		175				
174.2											
9.8	END OF BOREHOLE										

NOTE:

1. Water level in open borehole at a depth of 4.2 m (Elev. 179.8 m) on completion of drilling.

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

GTA-MTO 001 1111110083.GPJ GAL-GTA.GDT 06/25/13

Golder Associates

RECORD OF BOREHOLE No P3-1

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4835894.7 ;E 289367.8 ORIGINATED BY TWB
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 152 mm Solid Stem Augers COMPILED BY MAS
DATUM Geodetic DATE August 20, 2012 CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
186.3	GROUND SURFACE										
0.0	TOPSOIL										
0.2	Clayey silt, some sand, trace gravel, containing organic matter and rootlets (FILL) Stiff to hard Brown to grey Moist		1	SS	64		186		○		
185.1			2	SS	12						
1.4	Silty sand, some gravel, trace clay (FILL) Compact Grey Moist		3	SS	7		185		○		7 27 40 26
184.1											
2.2	Clayey silt with sand, trace gravel, containing organic matter and rootlets (FILL) Firm Brown to grey Moist		4	SS	24		184				
	CLAYEY SILT with sand, trace to some gravel, containing cobbles and boulders below 5.3 m (TILL) Very stiff to hard Brown becoming grey below a depth of 3.9 m Moist		5	SS	49		183				
			6	SS	87				○		7 26 41 26
			7	SS	78		182				
							181				
			8	SS	74		180		○		
							179				
			9	SS	60/0.10						
177.8							178				
8.5	SAND and SILT, trace gravel, trace to some clay (TILL) Very dense Grey Moist					▽					
176.8			10	SS	132/0.20		177		○		4 40 45 11
9.5	END OF BOREHOLE										

NOTE:

1. Water level in open borehole at a depth of 8.6 m (Elev. 177.7 m) on completion of drilling.

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

GTA-MTO 001 1111110083.GPJ GAL-GTA.GDT 06/25/13

Golder Associates

RECORD OF BOREHOLE No P3-2

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4835948.0 ;E 289320.8 ORIGINATED BY TWB
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 152 mm Solid Stem Augers COMPILED BY MAS
DATUM Geodetic DATE August 21, 2012 CHECKED BY LCC

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES 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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
187.5	GROUND SURFACE										
0.0	TOPSOIL										
0.2	Clayey silt, some sand, trace gravel, containing organics and rootlets (FILL) Firm Brown and grey Moist		1	SS	8		187				
186.1			2	SS	6	▼			○		3 19 46 32
1.4	CLAYEY SILT with sand, trace to some gravel, containing cobbles and boulders below 5.2 m (TILL) Very stiff to hard Brown becoming grey below a depth of 4.5 m Moist		3	SS	25		186				
			4	SS	48		185				
			5	SS	66		184		○		4 29 44 23
			6	SS	108						
			7	SS	48		183		○		
			8	SS	107		182		○		
180.5							181				
7.0	SAND and SILT, some gravel, trace clay (TILL) Very dense Grey Moist		9	SS	109/0.23		180		○		20 45 29 6
179.0											
8.5	SHALE (BEDROCK) Weathered Grey						179				
178.0			10	SS	126/0.25		178				
9.5	END OF BOREHOLE										

NOTE:

1. Water level in piezometer at a depth of 1.8 m (Elev. 185.7 m) on August 21, 2012.

2. Water level measured in piezometer as follows:

Date	Depth	Elev.
Aug. 27/12	1.1 m	186.4 m
Sep. 24/12	1.0 m	186.5 m

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

GTA-MTO 001 1111110083.GPJ GAL-GTA.GDT 06/25/13

Golder Associates

RECORD OF BOREHOLE No P3-3

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4835999.4 ;E 289275.7 ORIGINATED BY TWB
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 152 mm Solid Stem Augers COMPILED BY MAS
DATUM Geodetic DATE August 21, 2012 CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
187.5	GROUND SURFACE										
0.0	TOPSOIL										
0.3	Clayey silt, some sand, trace gravel (FILL) Stiff Brown Moist		1	SS	12		187		○		
			2	SS	8						
186.0	Silty SAND, trace clay, containing organic matter and rootlets (FILL) Loose to compact Brown Moist		3	SS	6		186		○		
185.7 1.8	CLAYEY SILT, some sand, trace gravel, containing rootlets Firm Dark brown Moist		4	SS	17		185				
	CLAYEY SILT with sand, trace to some gravel, containing cobbles and boulders below 3.8 m (TILL) Firm to hard Brown becoming grey below a depth of 3.7 m Moist		5	SS	35		184		○ ⊢		7 21 46 26
			6	SS	65						
			7	SS	60/0.13		183				
182.0 5.5	SAND and SILT, trace to some clay, trace gravel, containing cobbles and boulders (TILL) Very dense Grey Moist		8	SS	103/0.20		182		○		1 37 48 14
180.2 7.3	END OF BOREHOLE AUGER REFUSAL						181				

NOTE:

1. Open borehole dry upon completion of drilling.

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

Golder Associates

RECORD OF BOREHOLE No P4-1

SHEET 1 OF 1

METRIC

PROJECT 11-1111-0083

G.W.P. 2144-07-00 LOCATION N 4836957.9 ;E 288322.7 ORIGINATED BY CS

DIST Central HWY 410 BOREHOLE TYPE D-50 Track-mount, 152 mm Solid Stem Augers COMPILED BY MAS

DATUM Geodetic DATE August 28, 2012 CHECKED BY LCC

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 (20 40 60 80 100): ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
192.3	GROUND SURFACE									
0.0 / 191.8	SILTY CLAY, some sand, trace gravel, containing rootlets Stiff		1	SS	12		192			
0.5	Brown Moist		2	SS	50/0.10					
	SHALE (BEDROCK) Weathered Grey						191			
190.8			3	SS	50/0.01					
1.5	END OF BOREHOLE									

NOTES:

1. Water level in open borehole at a depth of 1.2 m (Elev. 191.1 m) on completion of drilling.

2. Water level measured in piezometer as follows:

Date	Depth	Elev.
Aug. 28/12	1.1 m	191.2 m
Sep. 24/12	1.5 m	190.8 m

$+^3, \times^3$: Numbers refer to Sensitivity

$\circ^{3\%}$ STRAIN AT FAILURE

Golder Associates

RECORD OF BOREHOLE No P4-2

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4836919.7 ;E 288337.0 ORIGINATED BY CS
DIST Central HWY 410 BOREHOLE TYPE D-50 Track-mount, 152 mm Solid Stem Augers COMPILED BY MAS
DATUM Geodetic DATE August 28 and 30, 2012 CHECKED BY LCC

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES 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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
192.1	GROUND SURFACE						192				
0.0 / 191.8	SILTY CLAY, some sand, trace gravel, containing rootlets		1	SS	19				○ —		7 16 47 30
0.3	Very stiff Brown Moist		2	SS	50/0.07	▽	191				
	SHALE (BEDROCK) Weathered Grey										
190.4			3	SS	50/0.13						
1.7	SHALE (BEDROCK) containing limestone interbeds Bedrock cored from 1.5 m to 9.6 m. Refer to Record of Drillhole P4-2 for rock coring details.		1	RC	REC 100%		190				RQD = 0%
			2	RC	REC 93%		189				RQD = 43%
			3	RC	REC 99%		188				RQD = 69%
			4	RC	REC 100%		187				RQD = 81%
			5	RC	REC 100%		186				RQD = 90%
			6	RC	REC 100%		185				RQD = 84%
182.5							184				
9.6	END OF BOREHOLE						183				

NOTES:

1. Water level in open borehole at a depth of 1.1 m below ground surface (Elev. 191.0 m) on completion of overburden drilling.

2. Drillhole P4-2 was advanced adjacent to Borehole P4-2 on August 30, 2012; the depth to bedrock and bedrock surface elevation vary between the borehole and drillhole.

3. Driller noted water return losses during coring.

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

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: P4-2

SHEET 1 OF 1

LOCATION: N 4836919.7 ;E 288337.0

DRILLING DATE:

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: D-50 Track-Mount

DRILLING CONTRACTOR: Walker Drilling

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		SEE RECORD OF BOREHOLE P4-2		190.58																
2		SHALE BEDROCK containing LIMESTONE interbeds (GEORGIAN BAY FORMATION) Slightly weathered to fresh Dark grey Thinly laminated Weak to medium strong		1.52	1								BD,PL,SM BD,PL,SM BD,PL,SM BD,PL,SM BD,PL,SM JN,PL,SM BD,PL,SM BD,PL,SM BD,PL,SM JN,UN,SM BD,PL,SM BD,PL,SM BD,PL,SM JN,UN,SM							
3					2								JN,UN,SM BD,PL,SM BD,PL,SM							
4					3								BD,PL,SM BD,PL,SM BD,PL,SM BD,PL,SM BD,PL,SM JN,PL,SM BD,PL,SM BD,PL,SM JN,PL,SM JN,PL,SM BD,PL,SM BD,PL,SM BD,PL,SM BD,PL,SM							
5					4								BD,PL,SM BD,PL,SM BD,PL,SM BD,PL,SM BD,PL,SM BD,PL,SM BD,PL,SM BD,PL,SM BD,PL,SM BD,PL,SM BD,PL,SM							
6					5								BD,PL,SM BD,PL,SM JN,ST,RO BD,PL,SM BD,PL,SM JN,VN,SM BD,PL,SM							
7					6								BD,, BD,, BB,, BD,PL,SM BD,PL,SM BD,PL,SM BD,PL,SM BD,PL,SM							
8													BD,PL,SM							
9				182.49																
10		END OF DRILLHOLE: NOTES: 1. Driller noted water return losses during coring.		9.61																
11																				

DEPTH SCALE

1 : 50

LOGGED: CS

CHECKED: LCC

Golder Associates

GTA-RCK 041 1111110083.GPJ GAL-MISS.GDT 06/25/13

Golder Associates

RECORD OF BOREHOLE No P4-3

SHEET 1 OF 1

METRIC

PROJECT 11-1111-0083

G.W.P. 2144-07-00 LOCATION N 4836878.4 ;E 288351.3 ORIGINATED BY CS

DIST Central HWY 410 BOREHOLE TYPE D-50 Track-mount, 152 mm Solid Stem Augers COMPILED BY MAS

DATUM Geodetic DATE August 28, 2012 CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
191.6	GROUND SURFACE										
0.0 / 0.1	SILTY CLAY, some sand, trace gravel, containing rootlets Firm Brown Moist		1	SS	85/0.20				○		1 14 50 35
	SHALE (BEDROCK) Weathered Grey		2	SS	50/0.15		191				
			3	SS	50/0.05		190				
188.5							189				
3.1	END OF BOREHOLE SPLIT-SPOON BOUNCING NOTE: 1. Open borehole dry upon completion of drilling.										

$+^3, \times^3$: Numbers refer to Sensitivity

$\circ^{3\%}$ STRAIN AT FAILURE

GTA-MTO 001 1111110083.GPJ GAL-GTA.GDT 06/25/13

Golder Associates

RECORD OF BOREHOLE No EC-1

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4837081.3 ;E 288357.7 ORIGINATED BY MS
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY NK
DATUM Geodetic DATE November 15, 2011 CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
190.5	GROUND SURFACE										
0.0 / 0.1	TOPSOIL										
	Clayey silt, trace to some sand, trace to some gravel, containing organics (FILL) Firm to hard Brown Moist		1	SS	8		190				
			2	SS	31						
			3	SS	7		189				
			4	SS	16		188	+ >121			
			5	SS	15						
186.7							187				
3.8	Clayey silt with sand, trace gravel, containing rootlets, wood fragments and organics (Possible FILL / ALLUVIUM)		6	SS	11						3 32 50 15
186.0							186				
4.5	Stiff Brown Moist		7	SS	5	▽					31 46 18 5
	SAND and GRAVEL, some silt, trace clay, containing shale fragments Loose Grey Wet						185				
184.1			8	SS	63/.20						
6.5	END OF BOREHOLE SPLIT-SPOON REFUSAL ON INFERRED BEDROCK										

NOTE:

1. Water level in open borehole at a depth of 4.9 m below ground surface (Elev. 185.5 m) on completion of drilling.

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

GTA-MTO 001 1111110083.GPJ GAL-GTA.GDT 1/7/13

Golder Associates

RECORD OF BOREHOLE No EC-2

SHEET 1 OF 1

METRIC

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4837100.8 ;E 288350.0 ORIGINATED BY MS
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY NK
DATUM Geodetic DATE November 15, 2011 CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
190.1	GROUND SURFACE										
190.0 / 0.1	TOPSOIL										
	Clayey silt with sand, trace to some gravel, containing organics (FILL) Firm to very stiff Brown to grey Moist		1	SS	7		190				
			2	SS	16		189				
			3	SS	13						
			4	SS	7		188				
			5	SS	7	▽	187				
			6	SS	18		186				7 50 30 13
185.6 / 4.5	SAND and GRAVEL, trace to some clay, some silt Compact Grey Wet		7	SS	29						24 35 19 22
184.9 / 5.2	SHALE (BEDROCK)		1	RC	REC 79%		185				RQD = 0%
	Bedrock cored from 5.2 m to 8.9 m Refer to Record of Drillhole EC-2 for rock coring details		2	RC	REC 100%		184 183				RQD = 75%
			3	RC	REC 100%		182				RQD = 58%
181.2 / 8.9	END OF BOREHOLE										

NOTES:

1. Water level in piezometer at a depth of 3.6 m below ground surface (Elev. 186.5 m) on completion of drilling.

2. Water level in piezometer at a depth of 3.9 m below ground surface (Elev. 186.2 m)

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

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: EC-2

SHEET 1 OF 1

LOCATION: N 4837100.8 ;E 288350.0

DRILLING DATE: November 15, 2011

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 55 Trackmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH	COLOUR % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		184.94																	
6	HQ RC / HW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION) containing fossiliferous LIMESTONE interbeds and 2-7 cm thick clay seams at depths of 5.4 m (Elev. 184.7 m) and 5.9 m(Elev. 184.2 m) Slightly weathered Grey Laminated Medium strong		5.18	1																
7					2																(Axial)
8					3																
				181.23																	
9		END OF DRILLHOLE		8.89																	
10																					
11																					
12																					
13																					
14																					
15																					

JN - Joint, FLT - Fault, SH - Shear, VN - Vein, CJ - Conjugate
BD - Bedding, FO - Foliation, CO - Contact, OR - Orthogonal, CL - Cleavage
PL - Planar, CU - Curved, UN - Undulating, ST - Stepped, IR - Irregular
PO - Polished, K - Slickensided, SM - Smooth, RO - Rough, VR - Very Rough
MB - Mechanical Break, BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE
1 : 50

LOGGED: MS

CHECKED:

Golder Associates

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 1/7/13

Golder Associates

RECORD OF BOREHOLE No EC-3

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4837113.8 ;E 288335.9 ORIGINATED BY MS
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY NK
DATUM Geodetic DATE November 21, 2011 CHECKED BY LCC

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 × REMOULDED) 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
187.0	GROUND SURFACE										
0.0 186.3	CLAYEY SILT with sand, trace to some gravel Stiff Brown		1	SS	12				○		
0.7 185.2	Moist SAND and GRAVEL, some silt trace clay Dense to very dense Grey Wet		2	SS	47	▽	186		○		44 27 24 5
			3	SS	71/.18						
1.8	SHALE (BEDROCK) Bedrock cored from 1.8 m to 4.9 m Refer to Record of Drillhole EC-3 for rock coring details		1	RC	REC 100%		185 184				RQD = 40%
182.1			2	RC	REC 100%		183				RQD = 59%
4.9	END OF BOREHOLE NOTE: 1. Water level in open borehole at a depth of 1.1 m below ground surface (Elev. 185.9 m) on completion of drilling.										

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

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: EC-3

SHEET 1 OF 1

LOCATION: N 4837113.8 ;E 288335.9

DRILLING DATE: November 21, 2011

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 55 Trackmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint, FLT - Fault, SH - Shear, VN - Vein, CJ - Conjugate | BD - Bedding, FO - Foliation, CO - Contact, OR - Orthogonal, CL - Cleavage | PL - Planar, CU - Curved, UN - Undulating, ST - Stepped, IR - Irregular | PO - Polished, K - Slickensided, SM - Smooth, RO - Rough, VR - Very Rough | MB - Mechanical Break, BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		185.13																
2	HQ RC / HW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION) containing fossiliferous LIMESTONE interbeds and highly weathered zone from 2.3 m (Elev. 184.7 m) to 2.5 m (Elev. 184.5 m) Slightly weathered Grey Laminated Medium strong		1.83	1															
3																				
4					2													●		(Axial)
				182.09																
5		END OF DRILLHOLE		4.87																
6																				
7																				
8																				
9																				
10																				
11																				

DEPTH SCALE

1 : 50

LOGGED: MS

CHECKED:

Golder Associates

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 1/7/13

Golder Associates

RECORD OF BOREHOLE No EC-4

SHEET 1 OF 1

METRIC

PROJECT 11-1111-0083

G.W.P. 2144-07-00 LOCATION N 4837114.0 ;E 288345.6 ORIGINATED BY MS

DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY NK

DATUM Geodetic DATE November 21, 2011 CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
186.9	GROUND SURFACE										
0.0	CLAYEY SILT with sand, trace to some gravel, containing cobbles and boulders		1	SS	14						
186.2	Stiff										
0.7	Brown Moist		2	SS	33	▽	186		○		
	SAND and GRAVEL, some silt, trace clay										
185.5	Dense										
185.1	Grey Wet		3	SS	70/.15				○——|		37 19 29 15
1.8	SHALE (BEDROCK) Weathered Grey						185				
	SHALE (BEDROCK)		1	RC	REC 100%						RQD = 17%
	Bedrock cored from 1.8 m to 4.9 m Refer to Record of Drillhole EC-4 for rock coring details						184				
			2	RC	REC 97%		183				RQD = 74%
182.0											
4.9	END OF BOREHOLE										

NOTE:

1. Water level in open borehole at a depth of 1.1 m below ground surface (Elev. 185.8 m) on completion of drilling.

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

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: EC-4

SHEET 1 OF 1

LOCATION: N 4837114.0 ;E 288345.6

DRILLING DATE: November 21, 2011

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 55 Trackmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH	COLOUR % RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		185.10																	
2	HQ RC / HW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION) containing fossiliferous LIMESTONE interbeds Slightly weathered to fresh Grey Laminated Medium strong		1.83	1																
3																					
4					2																UC=10.6 MPa (Axial)
				182.06																	
5		END OF DRILLHOLE		4.87																	
6																					
7																					
8																					
9																					
10																					
11																					

DEPTH SCALE

1 : 50

LOGGED: MS

CHECKED:

Golder Associates

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 1/7/13

Golder Associates

RECORD OF BOREHOLE No EC-5

SHEET 1 OF 1

METRIC

PROJECT 11-1111-0083
G.W.P. 2144-07-00
LOCATION N 4837114.0 ;E 288355.5
ORIGINATED BY MS
DIST Central HWY 410
BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers
COMPILED BY NK
DATUM Geodetic
DATE November 21, 2011
CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
187.0	GROUND SURFACE										
0.0 / 186.3	CLAYEY SILT with sand, some gravel, containing organics Stiff Brown Moist		1	SS	14						
0.7 / 185.6	SAND and GRAVEL, some silt, trace clay Dense Grey Wet		2	SS	43	▽	186				
1.4 / 182.2	SHALE (BEDROCK) Bedrock cored from 1.4 m to 4.8 m Refer to Record of Drillhole EC-5 for rock coring details		1	RC	REC 100%		185				RQD = 0%
			2	RC	REC 97%		184				RQD = 17%
			3	RC	REC 100%		183				RQD = 84%
4.8	END OF BOREHOLE NOTE: 1. Water level in open borehole at a depth of 1.1 m below ground surface (Elev. 185.9 m) on completion of drilling.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\circ^{3\%}$ STRAIN AT FAILURE

GTA-MTO 001 1111110083.GPJ GAL-GTA.GDT 1/7/13

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: EC-5

SHEET 1 OF 1

LOCATION: N 4837114.0 ;E 288355.5

DRILLING DATE: November 21, 2011

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 55 Trackmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		185.63																
2	HQ RC / HW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION) containing fossiliferous LIMESTONE interbeds Slightly weathered to fresh Grey Laminated Medium strong		1.37	1															
3					2															
4					3													•		(Axial)
				182.20																
		END OF DRILLHOLE		4.80																
5																				
6																				
7																				
8																				
9																				
10																				
11																				

DEPTH SCALE

1 : 50

LOGGED: MS

CHECKED:

Golder Associates

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 1/7/13

Golder Associates

RECORD OF BOREHOLE No EC-6

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083 | G.W.P. 2144-07-00 | LOCATION N 4837131.2 ;E 288341.4 | ORIGINATED BY MS

DIST Central | HWY 410 | BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers | COMPILED BY NK

DATUM Geodetic | DATE November 22, 2011 | CHECKED BY LCC

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: 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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
186.6	GROUND SURFACE										
0.0 / 185.9	CLAYEY SILT with gravel, some sand Stiff Grey		1	SS	12		186		○		54 22 17 7
0.7 / 185.4	Wet SHALE (BEDROCK) Weathered		2	SS	76	▽			○		
1.2	Grey SHALE (BEDROCK)		1	RC	REC 100%		185				RQD = 0%
	Bedrock cored from 1.2 m to 5.0 m Refer to Record of Drillhole EC-6 for rock coring details		2	RC	REC 100%		184				RQD = 47%
			3	RC	REC 100%		183 182				RQD = 48%
181.6											
5.0	END OF BOREHOLE NOTE: 1. Water level in open borehole at a depth of 0.9 m below ground surface (Elev. 185.7 m) on completion of drilling.										

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

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: EC-6

SHEET 1 OF 1

LOCATION: N 4837131.2 ;E 288341.4

DRILLING DATE: November 22, 2011

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 55 Trackmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		185.33																
2	HQ RC / HW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION) containing fossiliferous LIMESTONE interbeds Slightly weathered Grey Laminated Medium strong		1.22	1															
3					2															
4					3													•		(Axial)
5				181.52																
		END OF DRILLHOLE		5.03																
6																				
7																				
8																				
9																				
10																				
11																				

DEPTH SCALE

1 : 50

LOGGED: MS

CHECKED:

Golder Associates

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 1/7/13

Golder Associates

RECORD OF BOREHOLE No EC-7

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4837150.1 ;E 288321.9 ORIGINATED BY MS
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY NK
DATUM Geodetic DATE November 14, 2011 CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
191.9	GROUND SURFACE										
0.0	ASPHALT										
0.2	Sand and gravel, trace silt and clay (FILL) Compact to dense Brown Moist		1	SS	34		191		○		
			2	SS	15						
			3	SS	12		190		○		31 62 4 3
189.3											
2.6	CLAYEY SILT, trace to some sand, trace gravel (TILL) Very stiff to hard Grey Moist		4	SS	23		189		○ — —		
			5	SS	116/.15				○		
188.2											
187.9	SHALE (BEDROCK) Weathered Grey		6	SS	50/0.03		188				
4.0	SHALE (BEDROCK)		1	RC	REC 100%						RQD = 0%
	Bedrock cored from 4.0 m to 7.6 m Refer to Record of Drillhole EC-7 for rock coring details		2	RC	REC 100%		187				RQD = 38%
							186				
			3	RC	REC 92%		185				RQD = 44%
184.3											
7.6	END OF BOREHOLE										

NOTE:

1. Borehole dry on completion of overburden drilling.

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

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: EC-7

SHEET 1 OF 1

LOCATION: N 4837150.1 ;E 288321.9

DRILLING DATE: November 14, 2011

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 55 Trackmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint, FLT - Fault, SH - Shear, VN - Vein, CJ - Conjugate; BD - Bedding, FO - Foliation, CO - Contact, OR - Orthogonal, CL - Cleavage; PL - Planar, CU - Curved, UN - Undulating, ST - Stepped, IR - Irregular; PO - Polished, K - Slickensided, SM - Smooth, RO - Rough, VR - Very Rough; MB - Mechanical Break, BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN	FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		187.88																	
4	HQ RC / HW Casing	'SHALE BEDROCK (GEORGIAN BAY FORMATION) containing fossiliferous LIMESTONE interbeds and 2-10 cm thick clay seams at depths of 4.1 m (Elev. 187.8 m), 6.5 m (Elev. 185.4 m) and 6.7 m (Elev. 185.2 m). Slightly weathered Grey Laminated Me		3.98	1																
5																					
6					2																
7					3														●		(Axial)
				184.24																	
		END OF DRILLHOLE		7.62																	
8																					
9																					
10																					
11																					
12																					
13																					

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: MS

CHECKED:

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 1/7/13

Golder Associates

RECORD OF BOREHOLE No EC-8

SHEET 1 OF 1

METRIC

PROJECT 11-1111-0083
G.W.P. 2144-07-00
LOCATION N 4837148.2 ;E 288335.5
ORIGINATED BY MS
DIST Central HWY 410
BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers
COMPILED BY NK
DATUM Geodetic
DATE November 22, 2011
CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
188.4	GROUND SURFACE										
0.0	Clayey silt with sand, trace to some gravel, containing cobbles and boulders (FILL) Stiff to hard Brown Moist		1	SS	14		188				
			2	SS	58						
187.0	SHALE (BEDROCK)		3	SS	160/.15		187				
1.5	Weathered Grey SHALE (BEDROCK)		1	RC	REC 100%						RQD = 51%
	Bedrock cored from 1.5 m to 5.1 m Refer to Record of Drillhole EC-8 for rock coring details		2	RC	REC 100%		186				RQD = 35%
							185				
			3	RC	REC 100%		184				RQD = 53%
183.3											
5.1	END OF BOREHOLE										

NOTES:

1. Piezometer dry on November 22, 2011 (date of installation).

2. Water level in piezometer at a depth of 2.2 m below ground surface (Elev. 186.2 m) on January 19, 2012.

$+^3, \times^3$: Numbers refer to Sensitivity

$\circ^{3\%}$ STRAIN AT FAILURE

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: EC-8

SHEET 1 OF 1

LOCATION: N 4837148.2 ;E 288335.5

DRILLING DATE: November 22, 2011

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 55 Trackmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN	FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		186.87																	
2	HQ RC / HW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION) containing fossiliferous LIMESTONE interbeds Slightly weathered to fresh Grey Laminated Medium strong		1.52	1			80 60 20	80 60 40 20	80 60 20	5 10 15 20	0 90 180 270	0 30 60 90					10^{-6} 10^{-5} 10^{-4} 10^{-3}	2 4 6		(Axial)
3					2																(Axial)
4					3																
5				183.31																	(Axial)
		END OF DRILLHOLE		5.08																	
6																					
7																					
8																					
9																					
10																					
11																					

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 1/7/13

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: MS

CHECKED:

Golder Associates

RECORD OF BOREHOLE No EC-9

SHEET 1 OF 1

METRIC

PROJECT 11-1111-0083

G.W.P. 2144-07-00 LOCATION N 4837151.0 ;E 288348.1 ORIGINATED BY MS

DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY NK

DATUM Geodetic DATE November 13-14, 2011 CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
191.7	GROUND SURFACE										
0.0	ASPHALT										
0.2	Sand and gravel, trace silt and clay (FILL) Compact Brown Moist		1	SS	25		191		○		39 52 5 4
			2	SS	29						
190.3											
1.5	CLAYEY SILT with gravel and sand (TILL) Hard Brown becoming grey below a depth of 2.2 m Moist		3	SS	30		190		○		56 26 12 6
			4	SS	34		189				
			5	SS	92				○ —		
188.0							188				
187.7	SHALE (BEDROCK) Weathered Grey										
4.0	SHALE (BEDROCK)		1	RC	REC 89%						RQD = 54%
	Bedrock cored from 4.0 m to 7.3 m Refer to Record of Drillhole EC-9 for rock coring details		2	RC	REC 100%		187				RQD = 60%
			3	RC	REC 100%		186				RQD = 20%
184.4							185				
7.3	END OF BOREHOLE										

NOTE:

1. Borehole dry on completion of overburden drilling.

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

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: EC-9

SHEET 1 OF 1

LOCATION: N 4837151.0 ;E 288348.1

DRILLING DATE: November 13-14, 2011

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 55 Trackmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		187.73																
5	HQ RC / HW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION) containing fossiliferous LIMESTONE interbeds and 3-10 cm clay seams at a depth of 5.0 m (Elev. 186.7 m) and 6.9 m (Elev. 184.4 m) Slightly weathered Grey Laminated Medium strong		4.01	1															
6					2													●		(Axial)
7					3															
				184.46																
		END OF DRILLHOLE		7.28																
8																				
9																				
10																				
11																				
12																				
13																				
14																				

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: MS

CHECKED:

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 1/7/13

Golder Associates

RECORD OF BOREHOLE No EC-10

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4837173.2 ;E 288324.4 ORIGINATED BY MS
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY NK
DATUM Geodetic DATE November 16, 2011 CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
191.4	GROUND SURFACE										
0.0	TOPSOIL										
	Clayey silt with sand, some gravel (FILL) Very stiff to hard Grey Moist		1	SS	23		191		○		
			2	SS	35						
190.0							190				
1.5	CLAYEY SILT with sand, some gravel (TILL) Very stiff to hard Grey Moist		3	SS	25				○ —		27 36 21 16
			4	SS	78/.18		189		○		
188.6											
	SHALE (BEDROCK) Weathered		5	SS	100/.15						
188.2	Grey		1	RC	REC 70%		188				RQD = 0%
3.2	SHALE (BEDROCK) Bedrock cored from 3.2 m to 6.4 m Refer to Record of Drillhole EC-10 for rock coring details		2	RC	REC 99%		187				RQD = 72%
			3	RC	REC 100%		186				RQD = 34%
185.0							185				
6.4	END OF BOREHOLE NOTE: 1. Borehole dry on completion of overburden drilling.										

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

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: EC-10

SHEET 1 OF 1

LOCATION: N 4837173.2 ;E 288324.4

DRILLING DATE: November 16, 2011

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 55 Trackmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH	COLOUR % RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		188.16																	
4	HQ RC / HW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION) containing fossiliferous LIMESTONE interbeds Slightly weathered to fresh Grey Laminated Medium strong		3.20	1																
5					2																
6				184.96	3																
		END OF DRILLHOLE		6.40																	

DEPTH SCALE

1 : 50

LOGGED: MS

CHECKED:

Golder Associates

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 1/7/13

Golder Associates

RECORD OF BOREHOLE No P5-1

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4837409.1 ;E 288320.9 ORIGINATED BY TWB
DIST Central HWY 410 BOREHOLE TYPE D-50 Track-mount, 152 mm Solid Stem Augers COMPILED BY MAS
DATUM Geodetic DATE August 26, 2012 CHECKED BY LCC

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 (20 40 60 80 100): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
191.7	GROUND SURFACE										
0.0	TOPSOIL										
0.1	CLAYEY SILT with sand, trace to some gravel, containing cobbles and boulders, containing rootlets to 0.8 m (TILL) Hard Brown becoming grey below a depth of 2.7 m Moist		1	SS	34		191				
			2	SS	39				○		
			3	SS	60		190				
			4	SS	68		189		○ H		8 27 44 21
			5	SS	58						
187.4			6	SS	87		188		○		
4.3	Gravelly SAND and SILT, trace to some clay, containing cobbles and boulders (TILL) Very dense Grey Moist		7	SS	60/0.10	▽	187		○		
			8	SS	97/0.23		186		○ H		22 27 41 10
184.7							185				
7.0	SHALE (BEDROCK) Weathered Grey		9	SS	86/0.23		184				
183.8											
7.9	END OF BOREHOLE AUGER REFUSAL										

NOTE:

1. Water level in open borehole at a depth of 4.4 m (Elev. 187.3 m) on completion of drilling.

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

GTA-MTO 001 1111110083.GPJ GAL-GTA.GDT 06/25/13

Golder Associates

RECORD OF BOREHOLE No P5-2

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4837502.0 ;E 288275.5 ORIGINATED BY TWB
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 152 mm Solid Stem Augers COMPILED BY MAS
DATUM Geodetic DATE August 26, 2012 CHECKED BY LCC

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES 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 × REMOULDED (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
191.8	GROUND SURFACE										
0.0	TOPSOIL										
0.1	CLAYEY SILT with sand, some gravel, containing rootlets to 0.8 m (TILL) Stiff to hard Brown becoming grey below a depth of 2.6 m Moist		1	SS	14		191				
			2	SS	35				○		
			3	SS	57		190				
			4	SS	67		189		○ —		16 26 40 18
			5	SS	40						
187.8							188				
4.0	Gravelly SAND and SILT, trace clay, containing cobbles and boulders (TILL) Very dense Grey Moist		6	SS	85				○		22 22 50 6
187.3											
4.5	CLAYEY SILT, some sand, trace gravel, containing cobbles and boulders (TILL) Hard Grey Moist		7	SS	105		187				
						▽	186				
			8	SS	60/0.05						
185.2											
6.6	END OF BOREHOLE AUGER REFUSAL NOTE: 1. Water level in open borehole at a depth of 6.0 m (Elev. 185.8 m) on completion of drilling.										

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

Golder Associates

RECORD OF BOREHOLE No P5-3

SHEET 1 OF 1

METRIC

PROJECT 11-1111-0083

G.W.P. 2144-07-00 LOCATION N 4837528.2 ;E 288319.0 ORIGINATED BY TWB

DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 152 mm Solid Stem Augers COMPILED BY MAS

DATUM Geodetic DATE August 27, 2012 CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
190.6	GROUND SURFACE										
0.0	TOPSOIL										
0.1	CLAYEY SILT with sand to some sand, trace to some gravel, containing rootlets to 0.8 m, containing cobbles and boulders below 2.7 m (TILL) Stiff to hard Brown becoming grey below a depth of 2.7 m Moist		1	SS	12		190				
			2	SS	35						
			3	SS	35		189				6 31 43 20
			4	SS	39		188				
			5	SS	43						
186.9							187				
3.7	Silty SAND and GRAVEL, trace clay, containing cobbles and boulders (TILL) Very dense to dense Grey Moist becoming wet below a depth of 4.6 m		6	SS	73						35 32 28 5
185.6			7	SS	45		186				
5.0	CLAYEY SILT, some sand, some gravel, containing shale fragments below a depth of 5.6 m (TILL) Hard Grey Moist						185				
			8	SS	92/0.20						
183.9							184				
6.7	END OF BOREHOLE AUGER REFUSAL										

NOTES:

1. Water level in open borehole at a depth of 3.8 m (Elev. 186.8 m) on completion of drilling.

2. Water level measured in piezometer as follows:

Date	Depth	Elev.
Aug. 27/12	1.9 m	188.7 m
Sep. 24/12	2.1 m	188.5 m

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

Golder Associates

RECORD OF BOREHOLE No P6-1

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4838326.0 ;E 287902.3 ORIGINATED BY CS
DIST Central HWY 410 BOREHOLE TYPE D-25 Track-mount, 152 mm Solid Stem Augers COMPILED BY MAS
DATUM Geodetic DATE August 26, 2012 CHECKED BY LCC

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
197.7	GROUND SURFACE								
0.0	Silty sand, some gravel, trace clay, containing rootlets (FILL) Compact Brown		1	SS	14				
197.0							197		
0.7	Moist								
	Clayey silt to silty clay, trace to some sand (FILL) Stiff to very stiff Brown and grey Moist		2	SS	18				
			3	SS	12		196		0 10 57 33
			4	SS	20				
194.7							195		
3.0	CLAYEY SILT with sand, trace to some gravel, containing cobbles and boulders below 4.6 m (TILL) Very stiff to hard Brown becoming grey below a depth of 4.6 m Moist		5	SS	29				
			6	SS	50/0.08		194		
			7	SS	85/0.28		193		6 25 46 23
			8	SS	91		192		
			9	SS	63/0.15		191		
			10	SS	99/0.28		190		16 35 36 13
							189		
							188		
186.9			11	SS	74/0.15		187		
10.8	END OF BOREHOLE								

NOTE:

1. Open borehole dry upon completion of drilling.

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED; 20 40 60 80 100

PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

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

Golder Associates

RECORD OF BOREHOLE No P6-2

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4838372.4 ;E 287879.1 ORIGINATED BY CS
DIST Central HWY 410 BOREHOLE TYPE D-50 Track-mount, 152 mm Solid Stem Augers COMPILED BY MAS
DATUM Geodetic DATE August 26 and 27, 2012 CHECKED BY LCC

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES 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 × REMOULDED 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
199.9	GROUND SURFACE										
0.0	Clayey silt with sand, some gravel, containing rootlets (FILL) Very stiff to stiff Brown becoming grey below 3.2 m Moist		1	SS	20				○		
			2	SS	17		199				
			3	SS	9		198		○ —		16 40 27 17
			4	SS	10						
			5	SS	18		197		○		
196.2											
3.7	CLAYEY SILT with sand, trace to some gravel, containing cobbles and boulders below 8.2 m (TILL) Hard Grey Moist		6	SS	39	▼	196				
			7	SS	50		195				
							194				
			8	SS	61				○ —		3 26 49 22
							193				
			9	SS	73		192				
							191				
			10	SS	48				○ —		15 23 49 13
189.1							190				
10.8	END OF BOREHOLE AUGER REFUSAL										

NOTES:

1. Open borehole dry upon completion of drilling.

2. Water level measured in piezometer as follows:

Date	Depth	Elev.
Aug. 27/12	Dry	N/A
Sep. 24/12	4.3 m	195.6 m

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

GTA-MTO 001 1111110083.GPJ GAL-GTA.GDT 06/25/13

Golder Associates

RECORD OF BOREHOLE No P6-3

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4838418.2 ;E 287893.0 ORIGINATED BY CS
DIST Central HWY 410 BOREHOLE TYPE D-50 Track-mount, 152 mm Solid Stem Augers COMPILED BY MAS
DATUM Geodetic DATE August 27, 2012 CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
197.5	GROUND SURFACE										
0.0	Clayey silt, trace gravel and sand, containing rootlets (FILL) Very stiff Brown Moist		1	SS	24		197		○		
196.8 / 0.7	Sand, trace gravel, trace silt, trace clay (FILL) Compact Brown Moist		2	SS	13						
196.1 / 1.5	Clayey silt, with to some sand, trace to some gravel (FILL) Firm to very stiff Brown to grey Moist		3	SS	10		196		○ ⊢		11 20 40 29
			4	SS	15		195				
193.8			5	SS	6		194		○		
3.7	CLAYEY SILT with to some sand, trace to some gravel (TILL) Very stiff to hard Grey Moist		6	SS	23						
			7	SS	34		193		○ ⊢		5 15 52 28
			8	SS	61		192				
	Containing cobbles and boulders below 7.6 m		9	SS	62		191				
			10	SS	62/0.15		190		○ ⊢		8 33 42 17
							189				
							188				
186.7			11	SS	100/0.13		187				
10.8	END OF BOREHOLE										

NOTE:

1. Open borehole dry upon completion of drilling.

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

GTA-MTO 001 1111110083.GPJ GAL-GTA.GDT 06/25/13

Golder Associates

RECORD OF BOREHOLE No GR-1

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4839008.9 ;E 287180.4 ORIGINATED BY MS
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY NK
DATUM Geodetic DATE November 6, 2011 CHECKED BY LCC

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 (20 40 60 80 100): ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × REMOULDED	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
206.4	GROUND SURFACE										
0.0	ASPHALT										
0.2	Silty sand and gravel (FILL) Compact Brown		1	SS	21		206		○		
205.7											
0.7	Moist										
	Clayey silt with sand, some gravel (FILL) Firm to very stiff Brown Moist		2	SS	12				○		
			3	SS	7		205				
			4	SS	24		204		○—|			14 36 37 13
			5	SS	12						
202.7							203				
3.7	Sand and silt, trace clay and gravel (FILL) Compact Brown		6	SS	20				○		2 55 40 3
201.9	Wet						202				
4.5	Clayey silt, some sand, trace to some gravel (FILL) Stiff Brown Moist		7	SS	11						
200.8							201				
5.6	CLAYEY SILT, trace to some sand, trace gravel (TILL) Hard Brown Moist		8	SS	30		200		○—|			
199.7											
6.7	END OF BOREHOLE										

NOTE:

1. Borehole dry on completion of drilling.

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

Golder Associates

RECORD OF BOREHOLE No GR-2

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00
DIST Central HWY 410
DATUM Geodetic

LOCATION N 4839025.0 ;E 287165.3
BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers
DATE November 6, 2011

ORIGINATED BY MS
COMPILED BY NK
CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
207.1	GROUND SURFACE						207				
0.0 / 206.4	Clayey silt with sand, trace gravel (FILL) Stiff Brown Moist		1	SS	11						
0.7 / 205.6	Sandy silt, trace gravel, trace clay (FILL) Compact Brown Moist		2	SS	10		206				
1.5	Clayey silt with sand, trace gravel (FILL) Firm to stiff Brown Moist		3	SS	5		205				
			4	SS	13						
			5	SS	6		204				
			6	SS	6		203				5 40 39 16
201.5			7	SS	6		202				
5.6	CLAYEY SILT with sand, some gravel, containing rootlets (TILL) Very stiff to hard Brown becoming grey at a depth of 7.6 m Moist		8	SS	15		201				
			9	SS	34		200				15 35 36 14
198.0			10	SS	50/.03		199				
9.1	SHALE (BEDROCK)		1	RC	REC 79%		198				RQD = 14%
	Bedrock cored from 9.1 m to 12.1 m Refer to Record of Drillhole GR-2 for rock coring details		2	RC	REC 97%		197				RQD = 0%
195.0							196				
12.1	END OF BOREHOLE NOTE: 1. Borehole dry on completion of overburden drilling.						195				

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

GTA-MTO 001 1111110083.GPJ GAL-GTA.GDT 9/27/12

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: GR-2

SHEET 1 OF 1

LOCATION: N 4839025.0 ;E 287165.3

DRILLING DATE: November 6, 2011

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 55 Trackmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH	COLOUR % RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		198.00																	
10	NQ RC / NW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION) containing fossiliferous LIMESTONE interbeds, highly weathered clay zones between depth of 10.9 m (Elev. 196.2 m) and 11.1 m (Elev. 196.0 m) and from 11.3 m (Elev. 195.8 m) and 11.5 m (Elev. 195.62 m) Slightly to moderately weathered Grey Laminated Medium strong		9.10	1																
11					2																(Axial)
12				194.98																	(Axial)
		END OF DRILLHOLE		12.12																	
13																					
14																					
15																					
16																					
17																					
18																					
19																					

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: MS
CHECKED: LCC

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 9/27/12

Golder Associates

RECORD OF BOREHOLE No GR-3

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4839035.9 ;E 287176.5 ORIGINATED BY MS
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY NK
DATUM Geodetic DATE November 6, 2011 CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
207.2	GROUND SURFACE										
0.0	Clayey silt with to some sand, some gravel, containing pockets of silty sand (FILL) Firm to very stiff Brown Moist		1	SS	7		207				
			2	SS	8		206				
			3	SS	6						7 28 49 16
			4	SS	5		205				
			5	SS	11		204				
			6	SS	10		203				
			7	SS	10						
			8	SS	16		202				
200.0							201				
7.2	CLAYEY SILT, some sand and gravel (TILL) Very stiff Grey - brown Moist		9	SS	21		200				14 15 46 25
198.1							199				
9.1	SHALE (BEDROCK)		1	RC	REC 79%		198				RQD = 0%
	Bedrock cored from 9.1 m to 12.2 m Refer to Record of Drillhole GR-3 for rock coring details		2	RC	REC 60%		197				RQD = 5%
195.0							196				
12.2	END OF BOREHOLE NOTE: 1. Borehole dry on completion of overburden drilling.						195				

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

GTA-MTO 001 1111110083.GPJ GAL-GTA.GDT 9/27/12

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: GR-3

SHEET 1 OF 1

LOCATION: N 4839035.9 ;E 287176.5

DRILLING DATE: November 6, 2011

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 55 Trackmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH	COLOUR % RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		198.06																	
10	NQ RC / NW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION) containing fossiliferous LIMESTONE interbeds Slightly weathered Grey Laminated Medium strong		9.14	1																
11					2																
12				194.96															4		(Axial)
		END OF DRILLHOLE		12.24																	
13																					
14																					
15																					
16																					
17																					
18																					
19																					

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: MS

CHECKED: LCC

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 9/27/12

Golder Associates

RECORD OF BOREHOLE No GR-4

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00
DIST Central HWY 410
DATUM Geodetic

LOCATION N 4839040.5 ;E 287149.7
BOREHOLE TYPE CME 75 Truck-mount, 108 mm Inner Diameter Hollow Stem Augers
DATE November 3, 2011

ORIGINATED BY MS
COMPILED BY NK
CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
200.4	GROUND SURFACE										
0.0	Asphalt										
0.2	Silty sand and gravel (FILL) Compact Brown		1	SS	24		200		○		
199.7											
0.7	Moist										
	CLAYEY SILT with to some sand, some gravel (TILL) Very stiff to hard Brown becoming grey at a depth of 0.9 m Moist		2	SS	24		199		○ — ⊢		15 26 43 16
			3	SS	45				○		
197.8			4	SS	109/0.18		198				
2.6	SHALE (BEDROCK)		1	RC	REC 80%		197				RQD = 0%
			2	RC	REC 79%		196				RQD = 20%
	Bedrock cored from 2.6 m to 6.5 m										
	Refer to Record of Drillhole GR-4 for rock coring details		3	RC	REC 100%		195				RQD = 45%
193.9							194				
6.5	END OF BOREHOLE										

NOTE:

1. Borehole dry on completion of overburden drilling.

$+^3, \times^3$: Numbers refer to Sensitivity

$\circ^{3\%}$ STRAIN AT FAILURE

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: GR-4

SHEET 1 OF 1

LOCATION: N 4839040.5 ;E 287149.7

DRILLING DATE: November 3, 2011

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 75 Trackmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		197.79																
3	HQ RC / HW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION) containing fossiliferous LIMESTONE interbeds and 1-5 cm thick clay seams at depths of 3.6 m (Elev. 196.8 m), 5.0 m (Elev. 195.4 m) and 5.5 m (Elev. 194.9 m) Slightly weathered Grey Laminated Medium strong		2.61	1															
4					2															(Axial)
5					3															(Axial)
6				193.88																
		END OF DRILLHOLE		6.52																
7																				
8																				
9																				
10																				
11																				
12																				

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: MS

CHECKED: LCC

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 9/27/12

Golder Associates

RECORD OF BOREHOLE No GR-5

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4839049.0 ;E 287164.0 ORIGINATED BY MS
DIST Central HWY 410 BOREHOLE TYPE CME 75 Truck-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY NK
DATUM Geodetic DATE November 3, 2011 CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
200.5	GROUND SURFACE										
0.0	Asphalt										
0.2	Silty sand and gravel (FILL) Compact Brown		1	SS	29		200		○		
199.8											
0.7	Moist										
	SILTY CLAY, some gravel, trace to some sand (TILL) Very stiff Grey Moist		2	SS	18						
			3	SS	17	▼	199		○ — 40		17 7 55 21
198.0			4	SS	50/0.07				○		
2.5	SHALE (BEDROCK)		1	RC	REC 88%		198				RQD = 24%
			2	RC	REC 95%		197				RQD = 7%
	Bedrock cored from 2.5 m to 6.5 m		3	RC	REC 100%		196				RQD = 35%
	Refer to Record of Drillhole GR-5 for rock coring details						195				
194.0							194				
6.5	END OF BOREHOLE										

NOTES:

1. Piezometer dry on completion of drilling.
2. Water level in piezometer at a depth of 1.6 m below ground surface (Elev. 198.9 m) on January 19, 2012.
3. Water level in piezometer at a depth of 1.7 m below ground surface (Elev. 198.8 m) on January 30, 2012.

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

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: GR-5

SHEET 1 OF 1

LOCATION: N 4839049.0 ;E 287164.0

DRILLING DATE: November 3, 2011

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 75 Trackmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint, FLT - Fault, SH - Shear, VN - Vein, CJ - Conjugate
BD - Bedding, FO - Foliation, CO - Contact, OR - Orthogonal, CL - Cleavage
PL - Planar, CU - Curved, UN - Undulating, ST - Stepped, IR - Irregular
PO - Polished, K - Slickensided, SM - Smooth, RO - Rough, VR - Very Rough
MB - Mechanical Break, BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH	COLOUR % RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		198.01																	
3	HQ RC / HW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION) containing fossiliferous LIMESTONE interbeds and 2-10 cm thick clay seams at a depth of 3.2 m (Elev. 197.3 m) and 3.5 (Elev. 197.0 m) Slightly weathered Grey Laminated Medium strong		2.49	1																
4					2																(Axial)
5					3																(Axial)
6				193.97																	
		END OF DRILLHOLE		6.53																	
7																					
8																					
9																					
10																					
11																					
12																					

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: MS
CHECKED: LCC

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 9/27/12

Golder Associates

RECORD OF BOREHOLE No GR-6

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4839053.3 ;E 287147.6 ORIGINATED BY MS
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY NK
DATUM Geodetic DATE November 7, 2011 CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
207.7	GROUND SURFACE										
0.0	Clayey silt, trace to some sand, trace gravel (FILL) Firm to stiff Brown Moist		1	SS	5		207		○		
206.4			2	SS	11						
1.3	Sand and silt, trace clay, trace gravel (FILL) Compact Brown Moist		3	SS	18		206		○		4 53 36 7
205.5											
2.2	Clayey silt, trace to some sand, trace gravel, containing pockets of sandy silt (FILL) Firm to stiff Brown Moist		4	SS	9		205				
			5	SS	7				○		
203.4			6	SS	7		204				
4.3	Gravelly sand, some silt, trace clay (FILL) Dense Brown Moist		7	SS	31		203		○		27 58 13 2
202.1											
5.6	Clayey silt, with to some sand, some gravel, containing rootlets (FILL) Very stiff Grey Moist		8	SS	15		202		○		16 23 34 27
200.7											
200.4	Boulder		9	SS	50/.05		201				
7.3	Clayey silt, with to some sand, some gravel (FILL) Very stiff Grey Moist						200				
198.3											
9.4	Concrete						199				
197.8											
9.9	SHALE (BEDROCK)		1	RC	REC 90%		198				RQD = 15%
	Bedrock cored from 9.9 m to 13.0 m Refer to Record of Drillhole GR-6 for rock coring details.		2	RC	REC 94%		197				RQD = 16%
194.7			3	RC	REC 91%		196				RQD = 21%
13.0	END OF BOREHOLE NOTE: 1. Borehole dry on completion of overburden drilling.						195				

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

GTA-MTO 001 1111110083.GPJ GAL-GTA.GDT 9/27/12

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: GR-6

SHEET 1 OF 1

LOCATION: N 4839053.3 ;E 287147.6

DRILLING DATE: November 7, 2011

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG:

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH	COLOUR % RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		197.80																	
10	HQ RC / NW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION) containing fossiliferous LIMESTONE interbeds and a 3 cm thick clay seam at a depth of 12.4 m (Elev. 195.3 m) Slightly weathered Grey Laminated Medium strong		9.90	1																
11																					
12					2																(Axial)
13					3																(Axial)
		END OF DRILLHOLE		194.73 12.97																	
14																					
15																					
16																					
17																					
18																					
19																					

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: MS
CHECKED: LCC

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 9/27/12

Golder Associates

RECORD OF BOREHOLE No GR-7

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4839074.4 ;E 287127.5 ORIGINATED BY MS
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY NK
DATUM Geodetic DATE November 7, 2011 CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
207.1	GROUND SURFACE						207				
0.0	TOPSOIL										
0.1	Clayey silt, some sand, containing organics and pockets of sandy silt (FILL)		1	SS	8						
206.4							206				
0.7	Stiff Brown Moist		2	SS	18						
205.6	Silty sand, containing pockets of clayey silt (FILL)										
1.5	Compact Brown Moist		3	SS	6		205				
	Clayey silt to silty clay, with to some sand, trace gravel, containing organics and pockets of sandy silt (FILL) Firm to very stiff Brown to black Moist		4	SS	10						3 36 40 21
			5	SS	16		204				
			6	SS	18		203				
			7	SS	9		202				
							201				
			8	SS	11				47		1 25 59 15
200.4											
6.7	END OF BOREHOLE										

NOTE:

1. Borehole dry on completion of drilling.

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

Golder Associates

RECORD OF BOREHOLE No CN-1

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4839425.0 ;E 286786.4 ORIGINATED BY SB
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 57 mm Inner Diameter Hollow Stem Augers COMPILED BY NK
DATUM Geodetic DATE March 27, 2012 CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
216.5	GROUND SURFACE										
0.0	Clayey silt, some sand, trace gravel, containing rootlets (FILL) Firm to stiff Brown Moist		1	SS	5		216				
215.1			2	SS	10		215		○		
1.4	Sand and silt, some gravel, trace to some clay (FILL) Loose to dense Brown Moist to wet		3	SS	26		214		○	NP	12 38 43 7
			4	SS	10		213				
	Samples 5 and 6 wet between approximately 3.0 m and 4.5 m depth		5	SS	5		212		○		
			6	SS	20		211				
			7	SS	20		210		○	NP	12 31 45 12
			8	SS	36		209				
			9	SS	14		208				
207.8											
8.7	CLAYEY SILT with sand, trace gravel (TILL) Stiff Brown Moist		10	SS	13		207		⊢●⊣		5 24 42 29
206.8											
9.8	END OF BOREHOLE										

NOTE:

1. Open borehole dry upon completion of drilling.

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

Golder Associates

RECORD OF BOREHOLE No CN-2

SHEET 1 OF 2 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00
LOCATION N 4839441.7 ;E 286770.8
ORIGINATED BY SB
DIST Central HWY 410
BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers
COMPILED BY NK
DATUM Geodetic
DATE March 27, 2012
CHECKED BY LCC

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
217.4	GROUND SURFACE					
0.0	Clayey silt, some sand, trace gravel, containing rootlets and organics (FILL)	1	SS	6		
216.8	Firm					
0.6	Brown Moist	2	SS	16		
	Gravelly sand and silt, trace clay, containing pockets of clayey silt (FILL) Very loose to very dense Moist Brown	3	SS	15		
		4	SS	3		
		5	SS	13	NP	27 35 32 6
		6	SS	9		
		7	SS	60		
		8	SS	53		
210.2						
7.2	Clayey silt with sand, some gravel (FILL) Stiff Brown Moist	9	SS	10		16 36 34 14
208.7						
8.7	CLAYEY SILT, some to with sand, trace gravel (TILL) Stiff to hard Brown Moist	10	SS	10		
		11	SS	39		2 21 47 30
205.4						
12.2	SHALE (BEDROCK) Weathered Grey	12	SS	50/0.15		
	SHALE (BEDROCK) containing limestone interbeds Bedrock cored from 12.2 m to 15.4 m Refer to Record of Drillhole CN-2 for rock coring details	1	RC	REC 88%		RQD = 40%
		2	RC	REC 93%		RQD = 66%

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED; 20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

ELEVATION SCALE: 217 216 215 214 213 212 211 210 209 208 207 206 205 204 203

Continued Next Page

$+^3, \times^3$: Numbers refer to Sensitivity

$\circ^{3\%}$ STRAIN AT FAILURE

Golder Associates

RECORD OF BOREHOLE No CN-2

SHEET 2 OF 2 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4839441.7 ;E 286770.8 ORIGINATED BY SB
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY NK
DATUM Geodetic DATE March 27, 2012 CHECKED BY LCC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	--- CONTINUED FROM PREVIOUS PAGE ---										
202.0			2	RC	REC 93%						RQD = 66%
15.4	END OF BOREHOLE NOTES: 1. Open borehole dry upon completion of overburden drilling. 2. Water level in piezometer at a depth of 7.2 m (Elev. 210.2 m) on completion of drilling.										

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

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: CN-2

SHEET 1 OF 1

LOCATION: N 4839441.7 ;E 286770.8

DRILLING DATE: March 27, 2012

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 55 Trackmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		205.23																
13	NQ RC	SHALE BEDROCK (GEORGIAN BAY FORMATION) containing fossiliferous LiMESTONE interbeds Slightly to moderately weathered Dark grey Weak to strong		12.20	1	100%														
14					2	100%														
15				202.06																
		END OF DRILLHOLE		15.37																
16																				
17																				
18																				
19																				
20																				
21																				
22																				

DEPTH SCALE

1 : 50

LOGGED: SB

CHECKED:

Golder Associates

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 8/8/12

Golder Associates

RECORD OF BOREHOLE No CN-3

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4839465.8 ;E 286760.7 ORIGINATED BY SB
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY NK
DATUM Geodetic DATE April 11, 2012 CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
209.2	GROUND SURFACE										
0.0	Silty sand, some gravel, trace clay, containing organics (FILL) Loose Brown		1	SS	9		209		○		
208.5 / 0.7	Moist										
	Clayey silt, some sand, trace gravel (FILL)		2	SS	7						
207.8 / 1.4	Firm Brown Moist						208				
	CLAYEY SILT with sand, trace to some gravel (TILL) Very stiff to hard Brown Moist		3	SS	17				○—|		9 29 37 25
			4	SS	31		207				
206.2 / 3.0	SHALE (BEDROCK) Weathered Grey		5	SS	50/0.15		206		○		
205.2 / 4.0	SHALE (BEDROCK) containing limestone interbeds Bedrock cored from 4.0 to 7.0 m Refer to Record of Drillhole CN-3 for rock coring details		1	RC	REC 79%		205				RQD = 0%
			2	RC	REC 95%		204				RQD = 73%
			3	RC	REC 100%		203				RQD = 67%
202.2 / 7.0	END OF BOREHOLE NOTE: 1. Open borehole dry upon completion of overburden drilling.										

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

GTA-MTO 001 1111110083.GPJ GAL-MISS.GDT 8/8/12

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: CN-3

SHEET 1 OF 1

LOCATION: N 4839465.8 ;E 286760.7

DRILLING DATE: April 11, 2012

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 55 Trackmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN	FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		205.23																	
4	NQ RC	SHALE BEDROCK (GEORGIAN BAY FORMATION) containing fossiliferous LIMESTONE interbeds Slightly to moderately weathered Dark grey Weak to medium strong		3.96	1	100%															
5					2	100%															
6					3	100%															
7				202.18																	
		END OF DRILLHOLE		7.01																	
8																					
9																					
10																					
11																					
12																					
13																					

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: SB
CHECKED: NK

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 8/8/12

Golder Associates

RECORD OF BOREHOLE No CN-4

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4839460.9 ;E 286741.3 ORIGINATED BY SB
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY NK
DATUM Geodetic DATE April 11, 2012 CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
209.0	GROUND SURFACE										
0.0	Clayey silt, trace to some sand, trace to some gravel, containing organics (FILL) Firm Brown to grey Moist		1	SS	5				○		
207.7			2	SS	5		208				
1.3	CLAYEY SILT with sand to some sand, some gravel (TILL) Very stiff to hard Brown Moist		3	SS	18		207		ϕ		
			4	SS	45				○		13 21 47 19
205.7			5	SS	84/0.15		206		○		
3.3	SHALE (BEDROCK) Weathered Grey										
205.0							205				
4.0	SHALE (BEDROCK) containing limestone interbeds Bedrock cored from 4.0 to 7.3 m Refer to Record of Drillhole CN-4 for rock coring details		1	RC	REC 92%						RQD = 25%
			2	RC	REC 95%		204				RQD = 46%
			3	RC	REC 94%		203				RQD = 76%
201.7							202				
7.3	END OF BOREHOLE NOTE: 1. Open borehole dry upon completion of overburden drilling.										

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

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: CN-4

SHEET 1 OF 1

LOCATION: N 4839460.9 ;E 286741.3

DRILLING DATE: April 11, 2012

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 55 Trackmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate; BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage; PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular; PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough; MB - Mechanical Break; BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		205.03																
4	NQ RC	SHALE BEDROCK (GEORGIAN BAY FORMATION) containing fossiliferous LIMESTONE interbeds Slightly to moderately weathered Dark grey Weak to medium strong		3.96	1	100%														
5					2	100%														
6					3	100%														
7				201.67																
		END OF DRILLHOLE		7.32																
8																				
9																				
10																				
11																				
12																				
13																				

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: SB

CHECKED: NK

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 8/8/12

Golder Associates

RECORD OF BOREHOLE No CN-5

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00
LOCATION N 4839489.5 ;E 286737.8
ORIGINATED BY SB
DIST Central HWY 410
BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers
COMPILED BY NK
DATUM Geodetic
DATE April 9, 2012
CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
210.4	GROUND SURFACE										
0.0 / 209.7	Silty sand, trace clay, trace gravel, containing organics (FILL) Compact Brown		1	SS	14		210				
0.7	Moist										
	Clayey silt with sand, some gravel, containing organics (FILL) Firm to stiff Brown Moist		2	SS	14						
			3	SS	4		209				23 30 35 12
208.0			4	SS	50/0.05		208				
2.4 / 207.4	CONCRETE										
3.1	CLAYEY SILT with sand and gravel (TILL) Hard Brown Moist		5	SS	35		207				
			6	SS	93						35 27 28 10
206.0							206				
205.7	SHALE (BEDROCK) Weathered		7	SS	50/0.15						
4.7	Grey										
	SHALE (BEDROCK) containing limestone interbeds Bedrock cored from 4.7 to 8.5 m Refer to Record of Drillhole CN-5 for rock coring details		1	RC	REC 75%		205				RQD = 24%
			2	RC	REC 100%		204				RQD = 84%
			3	RC	REC 97%		203				RQD = 79%
201.9							202				
8.5	END OF BOREHOLE NOTE: 1. Open borehole dry upon completion of overburden drilling.										

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

GTA-MTO 001 1111110083.GPJ GAL-MISS.GDT 8/8/12

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: CN-5

SHEET 1 OF 1

LOCATION: N 4839489.5 ;E 286737.8

DRILLING DATE: April 9, 2012

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 55 Trackmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		205.78																
5	NQ RC	SHALE BEDROCK (GEORGIAN BAY FORMATION) containing fossiliferous LIMESTONE interbeds Slightly to moderately weathered Dark grey Weak to medium strong		4.57	1	100%														
6					2	100%														
7					3	100%														
8				201.81																
		END OF DRILLHOLE		8.54																
9																				
10																				
11																				
12																				
13																				
14																				

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: SB

CHECKED: NK

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 8/8/12

Golder Associates

RECORD OF BOREHOLE No CN-6

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00
DIST Central HWY 410
DATUM Geodetic

LOCATION N 4839486.8 ;E 286731.4
BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers
DATE April 10, 2012

ORIGINATED BY SB
COMPILED BY NK
CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
210.2	GROUND SURFACE										
0.0 / 209.5	Clayey silt, some gravel, trace sand, containing organics (FILL) Stiff Brown		1	SS	8		210		○		
0.7	Moist										
	CLAYEY SILT with to some sand, trace gravel (TILL) Very stiff to hard Moist Brown		2	SS	16		209				
			3	SS	28				○——		2 22 48 28
			4	SS	21		208				
			5	SS	43		207		○—		
			6	SS	77/0.18						
205.6			7	SS	50/0.05		206				
4.6	SHALE (BEDROCK) containing limestone interbeds Bedrock cored from 4.6 to 8.8 m Refer to Record of Drillhole CN-6 for rock coring details		1	RC	REC 72%		205				RQD = 31%
			2	RC	REC 67%		204				RQD = 14%
			3	RC	REC 100%		203				RQD = 84%
201.4							202				
8.8	END OF BOREHOLE NOTE: 1. Open borehole dry upon completion of overburden drilling.										

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

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: CN-6

SHEET 1 OF 1

LOCATION: N 4839486.8 ;E 286731.4

DRILLING DATE: April 10, 2012

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 55 Trackmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN	FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		205.64																	
5	NQ RC	SHALE BEDROCK (GEORGIAN BAY FORMATION) containing fossiliferous LIMESTONE interbeds Slightly to moderately weathered Dark grey Weak to medium strong		4.57	1		100%														
6					2		100%														
7																					
8					3		100%														
				201.37																	
9		END OF DRILLHOLE		8.84																	
10																					
11																					
12																					
13																					
14																					

DEPTH SCALE

1 : 50

LOGGED: SB

CHECKED: NK

Golder Associates

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 8/8/12

Golder Associates

RECORD OF BOREHOLE No CN-7

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4839485.3 ;E 286719.0 ORIGINATED BY SB
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY NK
DATUM Geodetic DATE April 10, 2012 CHECKED BY LCC

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 × REMOULDED (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
210.4	GROUND SURFACE										
0.0	Clayey silt, with to some sand, trace gravel, containing organics (FILL) Stiff Brown Moist		1	SS	12		210				
			2	SS	11				○		1 22 50 27
208.9							209				
1.5	CLAYEY SILT with sand, trace to some gravel (TILL) Very stiff to hard Brown Moist		3	SS	24						
			4	SS	27		208		○		
			5	SS	26		207				
			6	SS	50/0.15				○		10 32 40 18
206.0							206				
4.4	SHALE (BEDROCK) Weathered Grey		7	SS	50/0.08						
205.2							205				
5.2	SHALE (BEDROCK) containing limestone interbeds Bedrock cored from 5.2 m to 9.2 m Refer to Record of Drillhole CN-7 for rock coring details		1	RC	REC 36%						RQD = 17%
			2	RC	REC 88%		204				RQD = 59%
			3	RC	REC 100%		203				RQD = 84%
201.3							202				
9.2	END OF BOREHOLE NOTE: 1. Open borehole dry upon completion of overburden drilling.										

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

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: CN-7

SHEET 1 OF 1

LOCATION: N 4839485.3 ;E 286719.0

DRILLING DATE: April 10, 2012

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 55 Trackmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		205.19																
6	NQ RC	SHALE BEDROCK (GEORGIAN BAY FORMATION) containing fossiliferous LIMESTONE interbeds Slightly to moderately weathered Dark grey Weak to strong		5.18	1	100%														
7					2	100%														
8					3	100%														
9				201.22																
		END OF DRILLHOLE		9.15																
10																				
11																				
12																				
13																				
14																				
15																				

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: SB
CHECKED: NK

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 8/8/12

Golder Associates

RECORD OF BOREHOLE No CN-8

SHEET 1 OF 2 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00
LOCATION N 4839507.7 ;E 286707.7
ORIGINATED BY SB
DIST Central HWY 410
BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers
COMPILED BY NK
DATUM Geodetic
DATE March 25, 2012
CHECKED BY LCC

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
218.9	GROUND SURFACE								
0.0	Sand and silt, trace clay, trace to some gravel, containing rootlets and pockets of clayey silt (FILL) Very loose to compact Brown Moist		1	SS	5				
			2	SS	18		218		
			3	SS	3		217		10 38 39 13
			4	SS	7				
215.9							216		
3.0	Clayey silt, some sand, trace gravel, containing organics at a depth of 4.0 m (FILL) Soft to very stiff Brown Moist		5	SS	3				
			6	SS	5		215		
			7	SS	14		214		2 17 51 30
			8	SS	15		213		
			9	SS	19		212		
210.2							211		
8.7	CLAYEY SILT with to some sand, trace to some gravel (TILL) Very stiff to hard Brown Moist		10	SS	19		210		
			11	SS	28		209		
			12	SS	77		208		6 25 42 27
206.0							207		
12.9	SHALE (BEDROCK) Weathered Grey						206		
205.2									
13.7			1	RC	REC 93%		205		RQD = 55%

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED; 20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

Continued Next Page

$+^3, \times^3$: Numbers refer to Sensitivity

$\circ^{3\%}$ STRAIN AT FAILURE

Golder Associates

RECORD OF BOREHOLE No CN-8

SHEET 2 OF 2 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4839507.7 ;E 286707.7 ORIGINATED BY SB
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY NK
DATUM Geodetic DATE March 25, 2012 CHECKED BY LCC

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 × REMOULDED (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	--- CONTINUED FROM PREVIOUS PAGE ---										
	Shale (BEDROCK) containing limestone interbeds		1	RC							RQD = 55%
	Bedrock cored from 13.7 m to 16.9 m Refer to Record of Drillhole CN-8 for rock coring details		2	RC	REC 97%		203				RQD = 80%
202.0 16.9	END OF BOREHOLE NOTE: 1. Open borehole dry upon completion of overburden drilling.										

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

GTA-MTO 001 1111110083.GPJ GAL-MISS.GDT 8/8/12

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: CN-8

SHEET 1 OF 1

LOCATION: N 4839507.7 ;E 286707.7

DRILLING DATE: March 25, 2012

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 55 Trackmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		205.22																
14	NQ RC	SHALE BEDROCK (GEORGIAN BAY FORMATION) containing fossiliferous LIMESTONE interbeds Slightly to moderately weathered Dark grey Weak to strong		13.72	1	100%														
15																				
16					2	100%														
				202.08																
17		END OF DRILLHOLE		16.86																
18																				
19																				
20																				
21																				
22																				
23																				

DEPTH SCALE

1 : 50

LOGGED: SB

CHECKED:

Golder Associates

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 8/8/12

Golder Associates

RECORD OF BOREHOLE No CN-9

SHEET 1 OF 2 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4839502.3 ;E 286694.8 ORIGINATED BY SB
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY NK
DATUM Geodetic DATE March 26, 2012 CHECKED BY LCC

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES 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 × REMOULDED 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
219.8	GROUND SURFACE										
0.0	ASPHALT										
0.2	Sand and gravel, some silt (FILL) Compact Brown Moist		1	SS	15		219		○		
218.4											
1.5	Gravelly sand, some silt, trace clay (FILL) Loose to compact Brown Moist		2	SS	9		218				
			3	SS	11		217		○		26 51 18 5
216.1			4	SS	3						
3.7	Clayey silt with sand, some gravel (FILL) Soft to very stiff Brown Moist		5	SS	3		216				
			6	SS	9		215		⊢○⊣		19 35 31 15
			7	SS	11		214				
			8	SS	17		213				
211.1							212		○		
8.7	CLAYEY SILT with to some sand, trace gravel, containing rootlets to a depth of 9.8 m (TILL) Stiff to hard Brown Moist		9	SS	13		211				
			10	SS	33		210		⊢○⊣		2 22 47 29
			11	SS	31		209				
			12	SS	50/.13		208		○		
205.5							207				
14.3			1	RC	REC 89%		206				RQD = 52%
							205				

Continued Next Page

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

Golder Associates

RECORD OF BOREHOLE No CN-9

SHEET 2 OF 2 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4839502.3 ;E 286694.8 ORIGINATED BY SB
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY NK
DATUM Geodetic DATE March 26, 2012 CHECKED BY LCC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	--- CONTINUED FROM PREVIOUS PAGE ---										
	SHALE (BEDROCK) containing limestone interbeds Bedrock cored from 14.3 m to 17.5 m Refer to Record of Drillhole CN-9 for rock coring details		1	RC	REC 89%		204				RQD = 52%
			2	RC	REC 94%		203				RQD = 71%
202.3 17.5	END OF BOREHOLE NOTE: 1. Open borehole dry upon completion of overburden drilling.										

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

GTA-MTO 001 1111110083.GPJ GAL-MISS.GDT 8/8/12

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: CN-9

SHEET 1 OF 1

LOCATION: N 4839502.3 ;E 286694.8

DRILLING DATE: March 26, 2012

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 55 Trackmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		205.51																
15	NQ RC	SHALE BEDROCK (GEORGIAN BAY FORMATION) containing fossiliferous LIMESTONE interbeds Slightly to moderately weathered Dark grey Weak to strong		14.33	1	100%														
16																				
17					2	100%														
				202.37																
		END OF BOREHOLE		17.47																
18																				
19																				
20																				
21																				
22																				
23																				
24																				

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: SB

CHECKED:

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 8/8/12

Golder Associates

RECORD OF BOREHOLE No CN-10

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00
LOCATION N 4839520.5 ;E 286693.7
ORIGINATED BY SB
DIST Central HWY 410
BOREHOLE TYPE CME-55 Track-mount, 57 mm Inner Diameter Hollow Stem Augers
COMPILED BY NK
DATUM Geodetic
DATE March 26, 2012
CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
218.5	GROUND SURFACE										
0.0	Clayey silt, some sand, trace gravel, containing rootlets and pockets of silty sand (FILL) Firm to stiff Brown Moist		1	SS	5		218		○		
217.1			2	SS	8						
1.5	Sandy silt, trace clay, trace gravel, containing pockets of clayey silt (FILL) Very loose to compact Brown Moist becoming wet below a depth of 3.0 m		3	SS	19		217		○		
			4	SS	6		216				
			5	SS	3		215		○		1 26 61 12
			6	SS	18						
212.9			7	SS	11	▽	214				
5.6	Clayey silt with sand, some gravel (FILL) Firm to very stiff Moist Brown		8	SS	5		213		○—|		13 39 34 14
			9	SS	18		212				
209.8							211				
8.7	CLAYEY SILT with sand, trace gravel (TILL) Hard Brown Moist		10	SS	34		210		○—|		4 21 46 29
208.8							209				
9.8	END OF BOREHOLE										

NOTE:

1. Water level in open borehole at a depth of 5.2 m (Elev. 213.3 m) on completion of drilling.

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

GTA-MTO 001 1111110083.GPJ GAL-MISS.GDT 8/8/12

Golder Associates

RECORD OF BOREHOLE No OR-1

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00
DIST Central HWY 410
DATUM Geodetic

LOCATION N 4839689.5 ;E 286531.3
BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers
DATE November 8, 2011

ORIGINATED BY MS
COMPILED BY NK
CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
219.9	GROUND SURFACE										
0.0	Clayey silt with sand, trace gravel (FILL) Stiff Brown Moist		1	SS	10						
219.2							219				
0.7	Sandy silt, trace clay (FILL) Dense Brown Moist		2	SS	34				○		
218.4							218				
1.5	Clayey silt with sand, trace gravel (FILL) Very stiff Brown Moist		3	SS	15				○		
217.7							217				
2.2	Sand and silt, trace to some gravel, trace clay, containing pockets of clayey silt (FILL) Very loose to compact Brown Moist		4	SS	14				○		
			5	SS	2				○		8 43 41 8
			6	SS	4		216				
			7	SS	65		215				
214.4	Cobbles/boulders inferred below approximately 5 m depth						214				
5.5	Silty clay, some sand, trace to some gravel, containing organics (FILL) Stiff Brown Moist		8	SS	8				○		5 18 41 36
213.2							213				
6.7	CLAYEY SILT, some sand, trace gravel (TILL) Very stiff Brown Moist		9	SS	29		212		○		
211.7											
8.2	END OF BOREHOLE										

NOTE:

1. Borehole dry on completion of drilling.

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

Golder Associates

RECORD OF BOREHOLE No OR-2

SHEET 1 OF 2 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00
DIST Central HWY 410
DATUM Geodetic

LOCATION N 4839702.4 ;E 286519.0
BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers
DATE November 8, 2011

ORIGINATED BY MS
COMPILED BY NK
CHECKED BY LCC

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
220.8	GROUND SURFACE				
0.0	Silty sand, some gravel (FILL) Compact Brown	1	SS	19	
220.1	Moist				
0.7	Clayey silt, trace to some sand, trace gravel (FILL) Stiff	2	SS	8	
219.3	Brown				
1.5	Moist Sand and silt, trace to some clay, trace to some gravel, containing pockets of clayey silt (FILL) Loose to compact Brown Moist	3	SS	8	
		4	SS	13	
		5	SS	11	9 38 34 19
	Cobbles/boulders inferred below approximately 3.8 m depth	6	SS	84/.20	
		7	SS	19	8 35 52 5
		8	SS	11	
212.1		9	SS	17	
8.7	CLAYEY SILT, some sand, trace to some gravel (TILL) Very stiff to hard Brown becoming grey at a depth of 12 m Moist	10	SS	40	
		11	SS	26	6 21 48 25
207.7		12	SS	80/.23	
13.1	SHALE (BEDROCK) Bedrock cored from 13.1 m to 16.9 m Refer to Record of Drillhole OR-2 for rock coring details	1	RC	REC 78%	RQD = 19%
		2	RC	REC 100%	RQD = 83%

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH kPa (20 40 60 80 100)
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × REMOULDED

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

UNIT WEIGHT γ kN/m³

ELEVATION SCALE: 220 219 218 217 216 215 214 213 212 211 210 209 208 207 206

Continued Next Page

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

Golder Associates

RECORD OF BOREHOLE No OR-2

SHEET 2 OF 2 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4839702.4 ;E 286519.0 ORIGINATED BY MS
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY NK
DATUM Geodetic DATE November 8, 2011 CHECKED BY LCC

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 + FIELD VANE ● QUICK TRIAXIAL × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	--- CONTINUED FROM PREVIOUS PAGE ---										
	SHALE (BEDROCK) Bedrock cored from 13.1 m to 16.9 m Refer to Record of Drillhole OR-2 for rock coring details		2	RC							RQD = 83%
			3	RC	REC 100%		205				RQD = 34%
203.9							204				
16.9	END OF BOREHOLE NOTE: 1. Borehole dry on completion of overburden drilling.										

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

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: OR-2

SHEET 1 OF 1

LOCATION: N 4839702.4 ;E 286519.0

DRILLING DATE: November 8, 2011

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 55 Trackmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		207.70																
14	NQ RC / NW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION) containing fossiliferous LIMESTONE interbeds and 2-3 cm thick clay seams at a depth of 13.8 m (Elev. 207.0 m) and 14.4 m (Elev. 206.4 m) Slightly weathered Grey Laminated Medium strong		13.10	1															
15					2															
16					3															(Axial)
				203.94																
17		END OF DRILLHOLE		16.86																
18																				
19																				
20																				
21																				
22																				
23																				

DEPTH SCALE

1 : 50

LOGGED: MS

CHECKED:

Golder Associates

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 9/27/12

Golder Associates

RECORD OF BOREHOLE No OR-3

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00
LOCATION N 4839707.0 ;E 286503.7
ORIGINATED BY MS
DIST Central HWY 410
BOREHOLE TYPE CME 75 Truck-mount, 108 mm Inner Diameter Hollow Stem Augers
COMPILED BY NK
DATUM Geodetic
DATE November 2, 2011
CHECKED BY LCC

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES 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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
213.8	GROUND SURFACE										
0.0	Asphalt										
0.2	Silty sand and gravel (FILL) Dense Brown		1	SS	35						
213.1							213				
0.7	Moist CLAYEY SILT with to some sand, trace to some gravel (TILL) Stiff to hard Brown becoming grey at a depth of 3.8 m Moist		2	SS	17						6 16 53 25
			3	SS	23		212				
			4	SS	19		211				
			5	SS	31						
			6	SS	16		210				
			7	SS	14		209				4 29 44 23
207.6			8	SS	50/0.10		208				
6.2	SHALE (BEDROCK) Bedrock cored from 6.2 m to 9.5 m Refer to Record of Drillhole OR-3 for rock coring details		1	RC	REC 100%						RQD = 0%
			2	RC	REC 97%		207				RQD = 51%
			3	RC	REC 100%		206				RQD = 57%
204.3							205				
9.5	END OF BOREHOLE NOTE: 1. Borehole dry on completion of overburden drilling.										

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

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: OR-3

SHEET 1 OF 1

LOCATION: N 4839707.0 ;E 286503.7

DRILLING DATE: November 2, 2011

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 75 Truckmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		207.60																
7	HQ RC / HW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION) containing fossiliferous LIMESTONE interbeds and a 5 cm thick clay seams at a depth of 7.2 m (Elev. 206.6 m) Slightly weathered Grey Laminated Medium strong		6.20	1															
8					2													●		(Axial)
9					3															
				204.27																
		END OF DRILLHOLE		9.53																
10																				
11																				
12																				
13																				
14																				
15																				
16																				

DEPTH SCALE

1 : 50

LOGGED: MS

CHECKED:

Golder Associates

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 9/27/12

Golder Associates

RECORD OF BOREHOLE No OR-4

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4839713.5 ;E 286519.2 ORIGINATED BY MS
DIST Central HWY 410 BOREHOLE TYPE CME 75 Truck-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY NK
DATUM Geodetic DATE November 2, 2011 CHECKED BY LCC

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 × REMOULDED (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
213.7	GROUND SURFACE										
0.0	Asphalt										
0.2	Sand and gravel, some silt, trace clay (FILL)		1	SS	26				○		47 42 10 1
213.0	Compact						213				
0.7	Brown Moist CLAYEY SILT with to some sand, trace to some gravel (TILL) Stiff to hard Brown becoming grey at a depth of 3.8 m Moist		2	SS	16						
			3	SS	24		212		○		
			4	SS	32		211				
			5	SS	25				○—|			6 24 39 31
			6	SS	12		210				
			7	SS	12		209		—○—		
207.5			8	SS	50/0.10		208				
6.2	SHALE (BEDROCK) Bedrock cored from 6.2 m to 9.5 m Refer to Record of Drillhole OR-4 for rock coring details		1	RC	REC 100%						RQD = 70%
			2	RC	REC 100%		207				RQD = 46%
			3	RC	REC 100%		206				RQD = 50%
204.2							205				
9.5	END OF BOREHOLE NOTE: 1. Borehole dry on completion of overburden drilling.										

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

GTA-MTO 001 1111110083.GPJ GAL-GTA.GDT 9/27/12

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: OR-4

SHEET 1 OF 1

LOCATION: N 4839713.5 ;E 286519.2

DRILLING DATE: November 2, 2011

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 75 Truckmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint, FLT - Fault, SH - Shear, VN - Vein, CJ - Conjugate; BD - Bedding, FO - Foliation, CO - Contact, OR - Orthogonal, CL - Cleavage; PL - Planar, CU - Curved, UN - Undulating, ST - Stepped, IR - Irregular; PO - Polished, K - Slickensided, SM - Smooth, RO - Rough, VR - Very Rough; MB - Mechanical Break, BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		207.50																
7	HQ RC / HW Casing	SHALE BEDROCK (GEORGIAN GAY FORMATION) containing fossiliferous LIMESTONE interbeds and 5-8 cm thick clay seams at a depth of 6.7 m (Elev. 207.0 m) and 8.0 m (Elev. 205.7 m) Slightly weathered Grey Laminated Medium strong		6.20	1															
					2													2		(Axial)
8																				
					3													2		(Axial)
9				204.16																
		END OF DRILLHOLE		9.54																
10																				
11																				
12																				
13																				
14																				
15																				
16																				

DEPTH SCALE

1 : 50

LOGGED: MS

CHECKED:

Golder Associates

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 9/27/12

Golder Associates

RECORD OF BOREHOLE No OR-5

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00
LOCATION N 4839716.3 ;E 286495.0
ORIGINATED BY MS
DIST Central HWY 410
BOREHOLE TYPE CME 75 Truck-mount, 108 mm Inner Diameter Hollow Stem Augers
COMPILED BY NK
DATUM Geodetic
DATE November 1, 2011
CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
213.8	GROUND SURFACE										
0.0	Asphalt										
0.2	Sand and gravel, trace to some silt, trace clay (FILL) Very loose to compact Brown Moist to wet		1	SS	30						
			2	SS	23		213		○		27 58 7 8
			3	SS	2		212				
211.5											
2.3	CLAYEY SILT with to some sand, trace to some gravel (TILL) Stiff to hard Brown becoming grey at a depth of 3.8 m Wet		4	SS	34		211				
			5	SS	35						
			6	SS	18		210				7 26 45 22
			7	SS	14		209		○		
208.5											
5.3	SHALE (BEDROCK) Weathered Grey		8	SS	100/0.13		208				
207.7											
6.1	SHALE (BEDROCK)		9	SS	50/0.13						
			1	HQRC	REC 58%						RQD = 0%
			2	HQRC	REC 60%		207				RQD = 33%
	Bedrock cored from 6.1 m to 9.5 m Refer to Record of Drillhole OR-5 for rock coring details		3	HQRC	REC 85%		206 205				RQD = 58%
204.3											
9.5	END OF BOREHOLE										

NOTES:

1. Water level in piezometer at a depth of 6.8 m below ground surface (Elev. 207.0 m) on November 1, 2011.

2. Water level in piezometer at a depth of 0.9 m below ground surface (Elev. 212.9 m) on November 18, 2011.

3. Water level in piezometer at a depth of 1.1 m below ground surface (Elev. 212.7 m) on January 19, 2012.

$+^3, \times^3$: Numbers refer to Sensitivity

$\circ^{3\%}$ STRAIN AT FAILURE

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: OR-5

SHEET 1 OF 1

LOCATION: N 4839716.3 ;E 286495.0

DRILLING DATE: November 1, 2011

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 75 Truckmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN	FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		207.71																	
7	HQ RC / HW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION) containing fossiliferous LIMESTONE interbeds and a clay/sand seam at 7.8 m (Elev. 206.0 m) Slightly weathered Laminated Grey Medium strong		6.09	1																
8					2																
9					3																(Axial) (Axial)
		END OF DRILLHOLE		204.26 9.54																	
10																					
11																					
12																					
13																					
14																					
15																					
16																					

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: MS
CHECKED: LCC

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 9/27/12

Golder Associates

RECORD OF BOREHOLE No OR-6

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00
LOCATION N 4839722.9 ;E 286510.5
ORIGINATED BY MS
DIST Central HWY 410
BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers
COMPILED BY NK
DATUM Geodetic
DATE November 18, 2011
CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
213.7	GROUND SURFACE										
0.0	ASPHALT										
0.2	Silty sand and gravel (FILL) Dense to compact Brown Moist		1	SS	47		213		○		
			2	SS	11						
212.2											
1.5	CLAYEY SILT with to some sand, trace to some gravel (TILL) Stiff to hard Brown becoming grey at a depth of 3.4 m Moist		3	SS	18		212		○ —		3 21 52 24
			4	SS	38		211				
			5	SS	27				○		
			6	SS	13		210				
			7	SS	34		209		○ —		12 30 47 17
207.6							208				
6.1	SHALE (BEDROCK)		1	RC	REC 93%						RQD = 37%
			2	RC	REC 100%		207				RQD = 64%
	Bedrock cored from 6.1 m to 9.3 m Refer to Record of Drillhole OR-6 for rock coring details						206				
			3	RC	REC 100%		205				RQD = 78%
204.4											
9.3	END OF BOREHOLE NOTE: 1. Borehole dry on completion of overburden drilling.										

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

GTA-MTO 001 1111110083.GPJ GAL-GTA.GDT 9/27/12

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: OR-6

SHEET 1 OF 1

LOCATION: N 4839722.9 ;E 286510.5

DRILLING DATE: November 18, 2011

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 55 Trackmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH	COLOUR % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		207.60																	
7	HQ RC / HW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION) containing fossiliferous LIMESTONE interbeds Slightly weathered Grey Laminated Medium Stong		6.10	1																(Axial)
8					2																(Axial)
9					3															9.2	UC=9.2 MPa
				204.40																	(Axial)
		END OF DRILLHOLE		9.30																	
10																					
11																					
12																					
13																					
14																					
15																					
16																					

JN - Joint, FLT - Fault, SH - Shear, VN - Vein, CJ - Conjugate

BD - Bedding, FO - Foliation, CO - Contact, OR - Orthogonal, CL - Cleavage

PL - Planar, CU - Curved, UN - Undulating, ST - Stepped, IR - Irregular

PO - Polished, K - Slickensided, SM - Smooth, RO - Rough, VR - Very Rough

MB - Mechanical Break, BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE

1 : 50

LOGGED: MS

CHECKED:

Golder Associates

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 9/27/12

Golder Associates

RECORD OF BOREHOLE No OR-7

SHEET 1 OF 2 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00
LOCATION N 4839726.3 ;E 286495.1
ORIGINATED BY MS
DIST Central HWY 410
BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers
COMPILED BY NK
DATUM Geodetic
DATE November 10, 2011
CHECKED BY LCC

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (20 40 60 80 100): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
220.5	GROUND SURFACE										
0.0	Clayey silt with sand, containing pockets of silty sand (FILL) Stiff to very stiff Brown Moist		1	SS	26		220	○	○		
			2	SS	12						
219.0							219				
1.5	Sandy silt to sand and silt, trace clay, trace to some gravel, containing pockets of clayey silt (FILL) Loose to compact Brown Moist		3	SS	5				○ H		
			4	SS	8		218				
			5	SS	4		217		○ H		9 39 41 11
			6	SS	29						
			7	SS	13		216		○		5 31 51 13
							215				
			8	SS	29		214				
213.3											
7.2	CLAYEY SILT, with to some sand, trace gravel (TILL) Very stiff Brown becoming grey at a depth of 10.7 m Moist		9	SS	26		213		○		
							212				
			10	SS	27		211				
			11	SS	19		210		○ H		3 25 46 26
208.6							209				
11.9	SHALE (BEDROCK)		1	RC	REC 63%						RQD = 0%
			2	RC	REC 66%		208				RQD = 13%
	Bedrock cored from 11.9 m to 15.3 m Refer to Record of Drillhole OR-7 for rock coring details		3	RC	REC 99%		207				RQD = 76%
							206				

Continued Next Page

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

Golder Associates

RECORD OF BOREHOLE No OR-7

SHEET 2 OF 2 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4839726.3 ;E 286495.1 ORIGINATED BY MS
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY NK
DATUM Geodetic DATE November 10, 2011 CHECKED BY LCC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	--- CONTINUED FROM PREVIOUS PAGE ---										
205.2	SHALE (BEDROCK)		3	RC							RQD = 76%
15.3	END OF BOREHOLE										
	NOTE:										
	1. Borehole dry on completion of overburden drilling.										

$+^3, \times^3$: Numbers refer to Sensitivity

$\circ^{3\%}$ STRAIN AT FAILURE

PROJECT: 11-1111-0083

RECORD OF DRILLHOLE: OR-7

SHEET 1 OF 1

LOCATION: N 4839726.3 ;E 286495.1

DRILLING DATE: November 10, 2011

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 55 Trackmount

DRILLING CONTRACTOR: Geo-Environmental Drilling Inc.

JN - Joint; FLT - Fault; SH - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; RO - Rough; VR - Very Rough
MB - Mechanical Break; BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN	FLUSH	RECOVERY: TOTAL CORE % (80 60 40 20)	RECOVERY: SOLID CORE % (80 60 40 20)	R.Q.D. % (80 60 40 20)	FRACT. INDEX PER 0.3 m (5 10 15 20)	DISCONTINUITY DATA: B Angle (0 30 60 90)	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS (0 30 60 90)	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	HYDRAULIC CONDUCTIVITY K, cm/sec (10^{-6} 10^{-5} 10^{-4} 10^{-3})	Diametral Point Load Index (MPa) (2 4 6)	RMC -Q' AVG.	NOTES
		GROUND SURFACE		208.61																	
12	NQ RC / NW Casing	SHALE BEDROCK (GEORGIAN BAY FORMATION) containing fossiliferous LIMESTONE interbeds Slightly to highly weathered Grey Laminated Medium strong		11.89	1																
13					2																
14					3														●		(Axial)
15				205.16																	
		END OF DRILLHOLE		15.34																	
16																					
17																					
18																					
19																					
20																					
21																					

DEPTH SCALE

1 : 50

LOGGED: MS

CHECKED:

Golder Associates

GTA-RCK 018 1111110083.GPJ GAL-MISS.GDT 9/27/12

Golder Associates

RECORD OF BOREHOLE No OR-8

SHEET 1 OF 1 **METRIC**

PROJECT 11-1111-0083
G.W.P. 2144-07-00 LOCATION N 4839738.6 ;E 286484.1 ORIGINATED BY MS
DIST Central HWY 410 BOREHOLE TYPE CME-55 Track-mount, 108 mm Inner Diameter Hollow Stem Augers COMPILED BY NK
DATUM Geodetic DATE November 10, 2011 CHECKED BY LCC

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 × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
219.4	GROUND SURFACE										
0.0	Sandy silt, trace clay, trace gravel, containing pockets of clayey silt, containing organics (FILL) Loose to compact Brown Moist		1	SS	9		219				
			2	SS	11						
217.9							218				
1.5	Clayey silt with sand, trace gravel, containing pockets of silty sand (FILL) Hard Brown Moist		3	SS	34						
217.0							217				
2.4	Sand and silt, some gravel, trace clay, containing pockets of clayey silt (FILL) Compact Brown Moist		4	SS	14						
			5	SS	25		216				
215.0			6	SS	24						27 30 31 12
4.4	Clayey silt, some sand, trace gravel (FILL) Firm Brown Moist		7	SS	6		215				
213.8							214				
5.6	CLAYEY SILT, some sand, trace gravel (TILL) Very stiff to hard Brown Moist		8	SS	29		213				1 11 53 35
			9	SS	34		212				
211.2											
8.2	END OF BOREHOLE										

NOTE:

1. Borehole dry on completion of drilling.

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

APPENDIX C2

Historic MTO Boreholes Records

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 3 BH-113-3

WP 36-74-04 LOCATION Co-ords. 15,851,638 N; 962,259 E. ORIGINATED BY VK

DIST 6 HWY 403 BORING DATE December 5, 1975 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE CME M.V.H.S. CHECKED BY

(m) ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	LIQUID LIMIT w_L / PLASTIC LIMIT w_p / WATER CONTENT w (w_p — w — w_L) / WATER CONTENT % (10 20 30)	UNIT WEIGHT γ	REMARKS / % GR SA SI CL
151.2 496.0	Ground Level									
0.0	Het.mix.of clayey silt, sand & gravel Glacial Till		1	SS	20	490				4 30 48 18
147.5 484.0	Very Stiff to Hard		2	SS	93					
3.7	12.0 Silty Sand									
146.2	479.5 Very Dense		3	SS	165/8"	480				0 88 (12)
5.0	16.5 End of Borehole									

20
15 ⊹ 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 4 BH-113-4

WP 36-74-04 LOCATION Co-ords. 15,851,769 N; 962,334 E. ORIGINATED BY VK

DIST 6 HWY 403 BORING DATE December 5, 1975 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE CME M.V.H.S. CHECKED BY

(m) ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER LEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (o UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w (w_P — w — w_L) / WATER CONTENT % (10 20 30)	UNIT WEIGHT γ	REMARKS / % GR SA SI CL
150.9 495.0	Ground Level									
0.0	Het.mix. of clayey silt, sand & gravel Glacial Till Very Stiff to Hard		1	SS	27	490		e		4 31 50 15
147.2 483.0			2	SS	61			o		5 20 69 6
3.7 12.0	Silt to sandy silt									
145.9 478.5	Very Dense		3	SS	133	480		o		0 10 88 2
5.0 16.5	End of Borehole									

20
15 ◇ 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No 3

FOUNDATIONS OFFICE

BH-25-3

JOB 72-11166 LOCATION Co-ords. 856,279 N; 957,758 E. ORIGINATED BY VK

W.P. 127-66-22 BORING DATE Feb. 20, 1973 COMPILED BY DB

DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger and Cone Test CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W	BULK DENSITY	REMARKS
(m) ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	WATER CONTENT % 10 20 30	γ P.C.F.	GR. SA. SI. CL.
183.9 603.2	Ground Level									
0.0	(Glacial Till) Het.mix.of clayey silt, some sand and gravel, Brown									Hole dry at time of investigation
			1	SS	129/10"	600		o		37 11 31 21
182.2 597.7	Stiff to Hard									
1.7	5.5 End of Borehole Probable Bedrock				100/4"	595				

OFFICE REPORT - SOIL EXPLORATION

20
15 ◇ 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No 4

FOUNDATIONS OFFICE BH-25-4

JOB 72-11166 LOCATION Co-ords. 856,205 N; 957,855 E. ORIGINATED BY WK

W.P. 127-66-22 BORING DATE Feb. 20, 1973 COMPILED BY RB

DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger, Cone test and BXL Rock Core CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE
184.1 / 0.0	(Glacial Till) Ground Level					
	Het. mix. of clayey silt some sand & gravel. Brown					
182.8 / 599.7	Stiff to Hard		1	SS	15/.8"	
1.3 / 4.4	Bedrock			RC		
			2	BXL	75%	
181.4 / 595.3	Weathered		3	BXL	78%	
2.1 / 8.8	Interbedded shale and limestone		4	BXL	91%	
			5	BXL	91%	
			6	BXL	100%	
	Dark Grey					
	Sound		7	BXL	100%	
			8	BXL	100%	
			9	BXL	100%	
174.8 / 573.6						
9.3 / 30.5	End of Borehole					

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100

SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE

100/4"

LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w w_p w w_L

WATER CONTENT % 10 20 30

BULK DENSITY γ P.C.F.

REMARKS

GR. SA. SI. C.

29 23 37 11

597.6

600 595 590 585 580 575 570

OFFICE REPORT - SOIL EXPLORATION

20
15 ◇ 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS–ONTARIO

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No 5

FOUNDATIONS OFFICE

BH-25-5

JOB 72-11166 LOCATION Co-ords. 856,230 N; 957,642 E. ORIGINATED BY VK

W.P. 127-66-22 BORING DATE Feb. 20, 1973 COMPILED BY DB

DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger, Cone Test & BXL Rock Core CHECKED BY

(m) ELEV.	DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT
184.9	606.7	Ground Level				
	0.0	Glacial Till				
		Het.mix.of clayey silt, some sand & gravel. Brown		1	SS	23
183.1	600.7	Stiff to Very Stiff				
1.8	6.0	Bedrock				
		Shale		2	RC BXL	80%
181.9	596.8	dark grey weathered				
3.0	9.9					
		Interbedded shale		3	BXL	84%
		and limestone		4	BXL	95%
		Dark Grey				
		Sound		5	BXL	93%
				6	BXL	88%
175.8	576.7					
9.1	30.0	End of Borehole				

ELEV. SCALE: 605, 600, 595, 590, 585, 580, 575

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100

SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE

LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w

w_p w w_L

WATER CONTENT % 10 20 30

BULK DENSITY γ P.C.F

REMARKS

GR SA SI CL

3 29 48 20

▼601.7

OFFICE REPORT SOIL EXPLORATION

20 15 5 10 % STRAIN AT FAILURE

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS–ONTARIO

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No 6

FOUNDATIONS OFFICE

BH-25-6

JOB 72-11166 LOCATION Co-ords. 856,151 N; 957,719 E. ORIGINATED BY VK

W.P. 127-66-22 BORING DATE Feb. 20, 1973 COMPILED BY DB

DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger and Cone Test CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT (20 40 60 80 100) / SHEAR STRENGTH P.S.F. (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	LIQUID LIMIT w_L / PLASTIC LIMIT w_p / WATER CONTENT w (w_p w w_L) / WATER CONTENT % (10 20 30)	BULK DENSITY γ P.C.F.	REMARKS / GR SA SI CL
185.3										
607.8	Ground Level									
0.0	(Glacial Till) Het.mix.of clayey silt, some sand and gravel. Brown		1	SS	36	605				Hole dry at time of investigation. 8 27 45 20
182.0	Stiff to Hard		2	SS	100/5"					36 21 27 16
600.2						600				
2.3	End of Borehole									
7.6	Probable Bedrock									

OFFICE REPORT — SOIL EXPLORATION

20
15 ◇ 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS–ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE No 3

BH-26-3

JOB 72-11167 — LOCATION Co-ords. 856,608 N; 957,324 E. — ORIGINATED BY VK

W.P. 127-66-20 — BORING DATE Feb. 19, 1973 — COMPILED BY DB

DATUM Geodetic — BOREHOLE TYPE Hollow Stem Auger and Cone Test — CHECKED BY

(m) ELEV. / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT (20 40 60 80 100) — SHEAR STRENGTH P.S.F. o UNCONFINED + FIELD VANE • QUICK TRIAXIAL × LAB VANE	LIQUID LIMIT w_L — PLASTIC LIMIT w_p — WATER CONTENT w — WATER CONTENT % (10 20 30)	BULK DENSITY γ P.C.F.	REMARKS GR SA SI CL
183.5 / 602.0	Ground Level									
0.0	Het.mix.of clayey sil some sand & gravel (Glacial Till)					600				
			1	SS	37		100/6"	o		5 23 47 25
	Grey									▼ 596.5
	Stiff to Hard		2	SS	103	595		o		13 12 54 21
180.6 / 592.5			3	SS	100/7"			o		13 15 46 26
180.3 / 591.5	Weathered Shale									
3.2 / 10.5	End of Borehole					590				

OFFICE REPORT – SOIL EXPLORATION

20
15 ◇ 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE No 4

BH-26-4

JOB 72-11167 LOCATION Co-ords. 856,550 N; 957,385 E. ORIGINATED BY VK

W.P. 127-66-20 BORING DATE Feb. 22, 1973 COMPILED BY DB

DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger, Cone Test & BX Rock Core CHECKED BY

(m) ELEV.	DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT
184.3	604.7	Ground Level				
	0.0	Hot mix of clayey silt, some sand and traces of gravel (Glacial Till)		1	SS	55
		Brown				
182.0	597.0	Very Stiff to Hard		2	SS	59
2.3	7.7	Bedrock		3	HC BX	50%
		Shale		4	BX	25%
		Dark Grey		5	BX	100%
180.1	591.0	weathered		6	BX	66%
4.2	13.7			7	BX	74%
		Interbedded shale and limestone		8	BX	28%
		Dark Grey		9	BX	90%
		Sound				
174.9	574.0			10	BX	100%
9.4	30.7	End of Borehole				

SAMPLES

ELEV. SCALE: 600, 595, 590, 585, 580, 575, 570

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100

SHEAR STRENGTH P.S.F.
o UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE

100/7"

LIQUID LIMIT w_L
PLASTIC LIMIT w_P
WATER CONTENT w
w_P w w_L
WATER CONTENT % 10 20 30

BULK DENSITY γ P.C.F.

REMARKS GR. SA. SI. CL.

3 25 48 24

4 28 33 15

595.8

20
15 ✣ 5 % STRAIN AT FAILURE
10

OFFICE REPORT SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE No 4

BH-066-4

JOB 73-1107L LOCATION Co-ords. 15,855,596 N; 958,711 E. ORIGINATED BY VK

W.P. 127-66-24 BORING DATE Sept. 15, 1973 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and core with CME 750 CHECKED BY

(m) ELEV.	DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE
181.6	595.9	Ground Level					
	0.0	Het. mix of silty clay, sand and gravel. (Glacial Till)		1	SS	58	
				2	SS	43	
179.2	587.9	Very Stiff to Hard		3	SS	27	590
2.4	8.0	Sound Shale Bedrock		4	BXL	100%	
				5	BXL	100%	580
175.5	575.9			6	BXL	100%	
6.1	20.0	End of Borehole					570

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT

SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE

LIQUID LIMIT w_L
PLASTIC LIMIT w_P
WATER CONTENT w
w_P w w_L
WATER CONTENT %
15 30 45

BULK DENSITY γ P.C.F.

REMARKS GR. SA. SI. C

1 24 53 [illegible]
▼590.4
0 12 67 2

OFFICE REPORT SOIL EXPLORATION

20
15 ◇ 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No 17

FOUNDATIONS OFFICE

BH-086-17

JOB 73-1101L LOCATION Co-ords. 15,857,245N & 956,874E ORIGINATED BY V.K.

W.P. 127-66-3L BORING DATE May 16, 1973 COMPILED BY C.S.P.

DATUM Geodetic BOREHOLE TYPE Auger and BXL Rock Core CHECKED BY S.P.

(m) ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE
179.8 590.0	Ground level					
0.0	Heterogeneous mixture of clayey silt, sand and gravel (Glacial till)					
177.2 581.3			1	BXL RC	33% Rec	
8.7	Interbedded - limestone					
176.4 57?.?	and shale, weathered		2	BXL RC	100% Rec	580
3.4 11.3	BEDROCK - SHALE Occasional limestone layers (up to 7" in thickness)		3	BXL RC	100% Rec	
172.9 567.5	Dark grey Sound		4	BXL RC	100% Rec	570
6.9 22.5	End of Borehole					560

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT

SHEAR STRENGTH P.S.F.
O UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE

LIQUID LIMIT W_L
PLASTIC LIMIT W_P
WATER CONTENT W
W_P — W — W_L
WATER CONTENT %

BULK DENSITY γ P.C.F

REMARKS

▼ W.L. Elev. 587.5 June 1973.

GR. SA. SI. CL

OFFICE REPORT / SOIL EXPLORATION

20
15 ⊹ 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No 18

FOUNDATIONS OFFICE

BH-086-18

JOB 73-1101H

W.P. 127-66-34

DATUM Geodetic

LOCATION Co-ords. 15,857,388N & 956,614E

BORING DATE May 14, 1973

BOREHOLE TYPE Auger and BXL Rock Core

ORIGINATED BY V.K.

COMPILED BY C.S.P.

CHECKED BY S.E.

(m) ELEV.	DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE
178.5	585.6	Ground level					
	0.0	Heterogeneous mixture of clayey silt, sand and gravel (Glacial till)		1	SS	100/3"	
177.3	581.6			2	BXL RC	79% Rec	
1.2	4.0	SHALE		3	BXL RC	67% Rec	580
				4	BXL RC	67% Rec	
174.5	572.6	Weathered		5	BXL RC	67% Rec	
4.0	13.0	BEDROCK — SHALE		6	BXL RC	100% Rec	570
		Occasional weathered zones		7	BXL RC	92% Rec	
		Occasional limestone layers (up to 6" in thickness)		8	BXL RC	100% Rec	560
				9	BXL RC	100% Rec	
				10	BXL RC	73% Rec	550
		Dark grey		11	BXL RC	83% Rec	
				12	BXL RC	96% Rec	540
162.5	533.1			13	BXL RC	96% Rec	
16	52.5	End of Borehole					530

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT

SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE

LIQUID LIMIT W_L
PLASTIC LIMIT W_P
WATER CONTENT W
W_P — W — W_L
WATER CONTENT %
10 20 30

BULK DENSITY γ
P.C.F.

REMARKS
G.W.L. Elev. 585.6 June 1973

G R S A Si Cl

OFFICE REPORT – SOIL EXPLORATION

15 20 10 5 % STRAIN AT FAILURE

FORM OB-MT-126 (REV. 1971)

OFFICE REPORT ON SOIL EXPLORATION

BH-090-16

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS
DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No. 16

FOUNDATION SECTION

JOB 72-11053 LOCATION Co-ord's 856,560 N. 957,399 E. ORIGINATED BY V.K.

W.P. 127-66-01 BORING DATE April 20, 1972 COMPILED BY A.T.

DATUM Geodetic BOREHOLE TYPE Auger and Cone Test CHECKED BY

(m) ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE
184.2 / 604.3	Ground level.					
0.0	Clayey silt with some sand, and gravel. (Glacial Till) Hard.		1	SS	39	600
			2	SS	110/6"	
			3	SS	100/3"	
180.2 / 591.3			4	SS	110/6"	
4.0	13.0 Bedrock Weathered		5	BX RC	Rec 80%	590
			6	BX-RC	67%	
	Dark grey shale with minor limestone bands		7	BX RC	Rec 77%	
177.6 / 582.8	Sound					
6.6	21.5 End of borehole.					580

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT — 20 40 60 80 100

SHEAR STRENGTH P.S.F.
o UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w

w_P — w — w_L

WATER CONTENT % 10 20 30

o

BULK DENSITY γ P.C.F.	REMARKS GR.SA.SI.CL.
	13 27 36 24

BH-090-16

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS–ONTARIO

ENGINEERING SERVICES BRANCH - GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 5 BH-115-5

WP 36-74-02/03 LOCATION Co-ords. 15,853,174 N; 960,970 E. ORIGINATED BY VK

DIST 6 HWY 403 BORING DATE December 1, 1975 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE CME (5.1) M.V.H.S. CHECKED BY MT

SOIL PROFILE				SAMPLES			GROUND WATER	DYNAMIC CONE PENETRATION RESISTANCE PLOT	LIQUID LIMIT W_L / PLASTIC LIMIT W_P / WATER CONTENT W	UNIT WEIGHT	REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES	ELEV	20 40 60 80 100 SHEAR STRENGTH: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	W_P — W — W_L WATER CONTENT % 10 20 30	γ	% GR SA SI CL
164.7 / 540.4	Ground Level					540				
	Topsoil									
0.5 / 1.5	Weathered		1	SS	91					
161.7 / 530.4			2	SS	100/1"	530				
3.0 / 10.0	Sound		3	BXL	Rec 100%					
			4	BXL	Rec 80%					
	Shale Bedrock with limestone bands		5	BXL	Rec 80%	520				
155.6 / 510.4			6	BXL	Rec 95%					
9.1 / 30.0	End of Borehole					510				

OFFICE REPORT OF SOIL EXPLORATION

15 20 10 5 % STRAIN AT FAILURE

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH - GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 6 BH-115-6

WP 36-74-02/03 LOCATION Co-ords. 15,853,030 N; 960,930 E. ORIGINATED BY VK

DIST 6 HWY 403 BORING DATE December 1, 1975 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE CME (5.1) M.V.H.S. CHECKED BY MT

(m) ELEV	DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH o UNCONFINED + FIELD VANE • QUICK TRIAXIAL x LAB VANE	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w (w_P — w — w_L) / WATER CONTENT %	UNIT WEIGHT γ	REMARKS % GR SA SI CL
165.2	542.0	Ground Level									
		Topsoil					540				
0.5	1.5	Weathered Shale									
163.7	537.0			1	SS	100/1"					
1.5	5.0	End of Borehole					530				

20
15 ◇ 5 % STRAIN AT FAILURE
10

Ministry of Transportation and Communications
Ontario

BH-189-7

RECORD OF BOREHOLE No 7 BH-189-7 METRIC

W P 54-82-11 LOCATION Co-ords. N 4 833 016.2; E 291 897.0 ORIGINATED BY DT
DIST 6 HWY 410/401 BOREHOLE TYPE Solid Stem Auger, BQ Rock Core COMPILED BY HS
DATUM Geodetic DATE 84 10 01 CHECKED BY GP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE			PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			REC	RQD	Weathering			
172.7	Ground Surface												
0.0 / 172.2	Heterogeneous Mixture of Silty Clay some sand					*							
0.5	Grey Shale Bedrock with Limestone Layers 4 to 20 cm thick		1	RC BQ			172	69%	21%	Highly			
			2	RC BQ			171	100%	14%	Slightly to Unweathered			
			3	RC BQ			170	100%	25%				
169.4 / 3.3	End of Borehole												

* Note: Water level not obtained

OFFICE REPORT ON SOIL EXPLORATION

+³, ×⁵ : Numbers refer to Sensitivity

15 20/10 δ (%) STRAIN AT FAILURE

Ministry of Transportation and Communications
Ontario

190-11

RECORD OF BOREHOLE No 11 METRIC

W P 34-82-10 LOCATION Co-ords. N 4 833 148; E 291 738 ORIGINATED BY DT
DIST 6 HWY 401/410 BOREHOLE TYPE S.S. Auger, B Core COMPILED BY DD
DATUM Geodetic DATE 84 10 04 CHECKED BY GP.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (□ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
173.6 / 0.0	Ground Surface										
173.0 / 0.6	Silty Clay (CL) with/some sand *		1	SS	14	**	173				
			2	RC	REC 100%						
	Weathered — — — — Unweathered						172				
	Bedrock Shale with limestone layers		3	RC	REC 100%						
170.4 / 3.2			4	RC	REC 100%		171				
	End of Borehole										

* some/trace gravel stiff to hard

**groundwater elevation not determined

+3, ×5 : Numbers refer to Sensitivity

15 20/10 5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS - ONTARIO

ENGINEERING SERVICES BRANCH - GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 1 BH-110-1

W.P. 103-69-00 LOCATION Co-ords. 861,012 N; 953,060 E. ORIGINATED BY VK

DIST. 6 HWY. 410 BORING DATE June 30, July 3, 1975 COMPILED BY OY

DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & BX Casing CHECKED BY

(m) ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	LIQUID LIMIT W_L / PLASTIC LIMIT W_P / WATER CONTENT W (W_P — W — W_L) / WATER CONTENT % (10 20 30)	UNIT WEIGHT γ	REMARKS % GR. SA. SI. CL.
187.5 615.0	Ground Level									
0.0	Brown / Grey Het. mixture of clayey silt, sand & gravel (Glacial Till)		1	SS	33	610		○		4 26 42 28
			2	SS	45					
			3	SS	16	600		○		7 48 34 11
			4	SS	19					
			5	SS	118	590		○		7 30 46 17
			6	SS	140					
176.1 577.5	Very stiff to Hard		7	SS	200/4"	580		○		5 27 44 24
11.4 37.5 / 175.2 574.3	Silty sand & gravel		8	SS	175/9"			○		
12.3 40.5						570				
170.7 560.0						560				
16.8 55.0 / 169.2 555.0	Bedrock Sound Shale		9	BXL	100% REC					
18.3 60.0	End of Borehole									

OFFICE REPORT ON SOIL EXPLORATION

15 20 5 10 % STRAIN AT FAILURE

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 2 BH-110-2

W.P. 103-69-00 LOCATION Co-ords. 864,490 N; 949,700 E. ORIGINATED BY VK

DIST. 6 HWY. 410 BORING DATE June 30, 1975 COMPILED BY OY

DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & BX Casing CHECKED BY

(m) ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) SHEAR STRENGTH: o UNCONFINED, • QUICK TRIAXIAL, + FIELD VANE, × LAB VANE	LIQUID LIMIT w_L, PLASTIC LIMIT w_P, WATER CONTENT w (w_P — w — w_L) WATER CONTENT % (10 20 30)	UNIT WEIGHT γ	REMARKS % GR. SA. SI. CL.
186.5 / 611.8	Ground Level									
0.0	Het. mixture of clayey silt, sand and gravel (Glacial Till) V. Stiff to Hard		1	SS	22	610		o		1 9 53 37
			2	SS	26					
			3	SS	65					4 29 49 18
			4	SS	76			o		
			5	SS	117	600				
	Brown		6	SS	71					
	Grey									
180.4 / 591.8			7	SS	197/8"			o		11 36 40 13
6.1 / 20.0	Silty sand with some gravel & trace of clay					590				
			8	SS	149					
			9	SS	109			o		17 36 42 5
						580				
			10	SS	91					
	Very Dense									
			11	SS	65			o		15 36 42 5
172.9 / 567.3						570				
172.2 13.6 / 564.8	Bedrock Shale		12	BXL	REC 80%					
14.3 / 47.0	End of Borehole									

OFFICE REPORT ON SOIL EXPLORATION

15 20 10 5 % STRAIN AT FAILURE

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 3 BH-110-3

W.P. 103-69-00 LOCATION Co-ords. 867,280 N; 946,985 E. ORIGINATED BY VK

DIST. 6 HWY. 410 BORING DATE June 26, 1975 COMPILED BY OY

DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & BX Casing CHECKED BY

(m) ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH: o UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w / WATER CONTENT % (10 20 30)	UNIT WEIGHT γ	REMARKS % GR. SA. SI. CL.
193.4 634.5	Ground Level									
0.0	Het. mixture of clayey silt, sand and gravel		1	SS	124	630				
	Brown / Grey		2	SS	100/6"			o		
188.8 619.5	Hard									
188.2 13.0 617.5	Weathered		3	SS	106/6"	620		o —		
5.2 17.0	Sound Shale Bedrock				90%					
186.5 612.0			4	BXL	REC					
6.9 22.5	End of Borehole									

OFFICE REPORT ON SOIL EXPLORATION

20
15 ◇ 5 % STRAIN AT FAILURE
10

ENGINEERING SERVICES BRANCH - GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE Nº 1 (1) (Culvert 1) BH-122-1(1)

WP 103-69-08 LOCATION Co-ords. N 15,865,017 E 949,335 ORIGINATED BY WK

DIST 6 HWY 410 BORING DATE July 28, 1976 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE C.M.E. 5.1 (1) M.V.H.S. CHECKED BY

(m) ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100) / SHEAR STRENGTH (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	LIQUID LIMIT W_L / PLASTIC LIMIT W_P / WATER CONTENT W / WATER CONTENT % (10, 20, 30)	UNIT WEIGHT γ	REMARKS / % GR SA SI CL
184.7 / 605.9	Ground Level									
0.0			1	SS	23					4 27 52 17
	Brown		2	SS	60	600				7 23 53 17
	Grey		3	SS	72	6"				3 27 56 14
	Het. mix. of clayey silt, sand and gravel (Glacial Till)		4	SS	172	9"				4 37 50 9
			5	SS	100	6" 590	100/4"			
			6	SS	100	6"				
	Very Stiff to hard		7	SS	52	580				10 29 51 10
175.4 / 575.4			8	SS	100	6"				
9.3 / 30.5	End of Borehole									

20
15 ○ 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH - GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE Nº 1 (2) (Culvert 1) BH-122-1(2)

WP 103-69-08 LOCATION Co-ords. N 15,864,997 E 949,213 ORIGINATED BY VK

DIST 6 HWY 410 BORING DATE July 27, 1976 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE C.M.E. 5.1 (1) M.V.H.S. CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC CONE PENETRATION RESISTANCE PLOT	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w	UNIT WEIGHT	REMARKS
(m) ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES	ELEV	20 40 60 80 100 SHEAR STRENGTH: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	w_P — w — w_L WATER CONTENT % 10 20 30	γ	% GR SA SI CL
185.0 606.8	Ground Level									
0.0	Brown Grey Het. mix. of clayey silt, sand and gravel (Glacial Till) Very stiff to hard		1	SS	28	600		o		1 24 54 21
			2	SS	67		100/9"	o		16 23 44 17
			3	SS	105			o		6 29 46 19
			4	SS	160					
			5	SS	182/9"	590				
			6	SS	100/6"			o		11 30 48 11
176.6 8.4 579.3 27.5	End of Borehole					580				

OFFICE REPORT ON SOIL EXPLORATION

20
15 ◇ 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 2 (1) (Culvert 2) BH-122-2(1)

WP 103-69-08 LOCATION Co-ords. N 15,866,682 E 947,725 ORIGINATED BY VK

DIST 6 HWY 410 BORING DATE July 23, 1976 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE C.M.E. 5.1 (1) M.V.H.S. CHECKED BY GP

(m) ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w (w_P — w — w_L) / WATER CONTENT % (10 20 30)	UNIT WEIGHT γ	REMARKS % GR SA SI CL
189.2 620.6	Ground Level									
0.0						620				
			1	SS	27					2 15 57 26
			2	SS	132					17 33 40 10
	Brown									
	Grey		3	SS	119	610				13 29 45 13
	Het. mix. of clayey silt, sand and gravel (Glacial Till)		4	SS	100/6"					
			5	SS	100/6"					
	Very stiff to hard					600				
181.7 596.1			6	SS	100/6"					30 27 35 8
7.5			7	SS	100/6"					
24.5	End of borehole									

20
15 ◇-5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 2 (2) (Culvert 2) BH-122-2(2)

WP 103-69-08 LOCATION Co-ords. N 15,866,670 E 947,592 ORIGINATED BY VK

DIST 6 HWY 410 BORING DATE July 23, 1976 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE C.M.E. 5.1 (1) M.V.H.S. CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC CONE PENETRATION RESISTANCE PLOT	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w	UNIT WEIGHT	REMARKS
(m) ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES	ELEV	20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	WATER CONTENT % 10 20 30	γ P.C.F	% GR SA SI CL
189.7 622.3	Ground Level									
0.0						620			Org. 0.53%	10 32 41 17
			1	SS	11					
	Brown Grey		2	SS	43		100/3"		0.72%	
	Het. mix. of clayey silt, sand and gravel (Glacial Till)		3	SS	64	610				32 17 37 14
			4	SS	144					32 5 46 17
184.0 603.5	Stiff to hard		5	SS	100/3"					49 13 31 7
-5.7 18.8	End of Borehole									

OFFICE REPORT ON SOIL EXPLORATION

20
15 ○ 5 % STRAIN AT FAILURE
10

Ontario Ministry of Transportation and Communications

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 3 BH-135-3

W P 103-69-13 LOCATION Coords. N 861 122; E 952 943 ORIGINATED BY B.L.

DIST 6 HWY 410 BOREHOLE TYPE 3¼" Hollow Stem Augers COMPILED BY B.L.

DATUM Geodetic DATE October 12, 1978 CHECKED BY e/s

(m) 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 (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT Wl — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
186.4 611.5	Ground Surface						610				
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till)		1	SS	40	▼					
	Brown — Grey — Very Stiff to Hard		2	SS	35		600				
	Stiff to Very Stiff		3	SS	25						
			4	SS	94		590				
	Hard		5	SS	97						
			6	SS	60		580				
172.8 567.0	(Probable Bedrock) Shale Fragments		7	SS	90/3"		570				
13.6 44.5	End of Borehole										

OFFICE REPORT ON SOIL EXPLORATION

+3, ×5 : Numbers refer to Sensitivity

15 20 5 (%) STRAIN AT FAILURE

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 4 BH-135-4

W P 103-69-13 LOCATION Coords. N 861 102; E 952 962 ORIGINATED BY B.L.

DIST 6 HWY 410 BOREHOLE TYPE 3¼" Hollow Stem Augers COMPILED BY B.L.

DATUM Geodetic DATE October 12, 1978 CHECKED BY W.J.

(m) ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
186.4 611.5	Ground Surface										
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Brown / Grey : Hard		1	SS	56	▼	610				
			2	SS	27		600				
	Stiff to Very Stiff		3	SS	31						
			4	SS	70		590				
	Hard		5	SS	47						
177.1 581.0			6	SS	94						
9.3 30.5	End of Borehole										

OFFICE REPORT ON SOIL EXPLORATION

Ontario Communications

BH-193-07

RECORD OF BOREHOLE No 7 METRIC

W P 103-69-15 LOCATION Co-ords. 4 835 502.5 N; 289 456 E. ORIGINATED BY IW

DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AEL

DATUM Geodetic DATE 1985 12 06 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT N (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
187.0 / 0.0	Ground Level										
186.5 / 0.5	Topsoil		1	SS	5	*	187				
	Very stiff		2	SS	23		186				
	Hard		3	SS	22		185				
	Heterogeneous mixture of silty clay, sand & gravel (Glacial Till)		4	SS	40		184				
			5	SS	66		183				
	Brown / Grey		6	SS	36		182				
			7	SS	70/0.20		181				
			8	SS	78/0.15		180				
							179				
177.4 / 9.6			9	SS	76		178				
	End of Borehole										

* Groundwater level not established

OFFICE REPORT ON SOIL EXPLORATION

Ontario

BH-193-08

RECORD OF BOREHOLE No 8 METRIC

W P 103-69-15 LOCATION Co-ords. 4 835 522.5 N; 289 437.5 E. ORIGINATED BY IW

DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Augers; BX Rock Core COMPILED BY AEL

DATUM Geodetic DATE 1985 12 06-09 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT Wl — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
186.6	Ground Level										GR SA SI CL
0.0											
186.3	Topsoil										
0.3			1	SS	8		186				
	Very stiff										
			2	SS	28						
	Hard						185				
	Heterogeneous mixture of silty clay, sand & gravel		3	SS	45						
			4	SS	68		184				
	(Glacial Till)										
			5	SS	64		183				5 33 44 18
	Brown Grey										
			6	SS	74		182				
							181				
			7	SS	100/ 0.1[illegible]						
							180				
							179				7 39 50 4
			8	SS	74						
							178				
			9	SS	83		177	DH			
							176				
			10	SS	70						
							175				
174.3											
12.3			11	SS	80/ 0.1[illegible]						
	Shale bedrock						174				
	Weathered										
	Dark Grey						173				
			12	RC BX	94%						RQD 25%
171.4							172				
			13	RC BX	92%						0%
15.2	End of Borehole										

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

BH-204-4

12

RECORD OF BOREHOLE No 4 METRIC

W P 101-69-19 LOCATION Co-ords. N 4 834 458.9; E 290 470.3 ORIGINATED BY TS

DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger COMPILED BY TS

DATUM Geodetic DATE 87 12 03 CHECKED BY GP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL / WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						GR SA SI CL
186.0	Ground Surface										
0.0	Heterogeneous Mixture of Silty Clay Sand and Gravel (Glacial Till) Very Stiff to Hard Brown Grey		1	SS	80	▼	184		o		3 29 52 16
			2	SS	27		182				
	Stiff		3	SS	17				●		5 32 43 20
			4	SS	38		180				
			5	SS	110		178				
			6	SS	100		176				
174.9			7	SS	105						
11.1	End of Borehole										

OFFICE REPORT ON SOIL EXPLORATION

$+^3$, $\times^5$: Numbers refer to Sensitivity

20
15 ⊹ S (%) STRAIN AT FAILURE
10

Ministry of Transportation and Communications Ontario

RECORD OF BOREHOLE No 5 METRIC

W P 103-89-19 LOCATION Co-ords. N 4 834 446.61 E 290 481.3 ORIGINATED BY TS

DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger, Cone Test COMPILED BY TS

DATUM Geodetic DATE 87 12 03 CHECKED BY GP.

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
186.2	Ground Surface										
0.0	Heterogeneous Mixture of Silty Clay Sand and Gravel (Glacial Till)		1	SS	68		186	120/15 cm			
	Brown Grey		2	SS	38		184				5 27 47 21
	Hard		3	SS	65						
			4	SS	29		182				8 28 42 24
			5	SS	25						
	Very Stiff		6	SS	25		180				
			7	SS	Bounding						
			8	SS	110		178				
	Hard		9	SS	100/	15 cm					4 23 66 7
			10	SS	100/	15 cm	176				
173.9			11	SS	100/	12 cm	174				
12.3	End of Borehole Probable Bedrock										

OFFICE REPORT ON SOIL EXPLORATION

$*^3$, $*^5$: Numbers refer to Sensitivity

20 / 15 ✣ 3 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation and Communications
Ontario

BH-204-6

RECORD OF BOREHOLE No 6 METRIC

W P 103-69-19 LOCATION Co-ords. N 4 834 433.6; E 290 448.2 ORIGINATED BY TS
DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger, Cone Test COMPILED BY TS
DATUM Geodetic DATE 87 12 04 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
187.0	Ground Surface										
0.0	Heterogeneous Mixture of Silty Clay Sand and Gravel (Glacial Till)		1	SS	53		186			23.1	12 23 41 24
	Brown Grey Hard		2	SS	50		184				
			3	SS	24						
			4	SS	29		182			23.6	8 32 44 16
			5	SS	30						
	Very Stiff		6	SS	18						
			7	SS	55		180				
			8	SS	75						13 30 32 25
	Silt Very Dense		9	SS	70		178				
			10	SS	100		176				
	Hard										
			11	SS	100/15 cm		174				
173.2			12	SS	100/7 cm						
13.8	End of Borehole Probable Bedrock										

OFFICE REPORT ON SOIL EXPLORATION

$+^3$, $\times^5$: Numbers refer to Sensitivity

20
15 ⊹ 5 (%) STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 4 BH-110-4

W.P. 103-69-00 LOCATION Co-ords. 868,935 N; 946,010 E. ORIGINATED BY VK

DIST. 6 HWY. 410 BORING DATE June 25, 1975 COMPILED BY OY

DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & BX Casing CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC CONE PENETRATION RESISTANCE PLOT	LIQUID LIMIT W_L / PLASTIC LIMIT W_P / WATER CONTENT W	UNIT WEIGHT	REMARKS
ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES	ELEV.	20 40 60 80 100 SHEAR STRENGTH: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	W_P — W — W_L WATER CONTENT % 10 20 30	γ	% GR. SA. SI. CL.
187.7 / 615.7	Ground Level									
0.0	Silty sand with gravel, trace of clay Compact									
185.9 / 609.7			1	SS	14	▼610				38 24 28 10
1.8 / 6.0	Het. mix; of clayey si. sa. and gravel Brown Stiff to Hard Grey									
184.5 / 605.2	Weathered		2	SS	100/6"					
3.2 / 11.5	Sound Shale Bedrock		3	BXL	REC 100%					
182 / 599.2						600				
5.0 / 16.5	End of Borehole									

OFFICE REPORT ON SOIL EXPLORATION

15 20 5 % STRAIN AT FAILURE

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH - GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 1 BH-117-01

WP 103-69-09 LOCATION Co-ords. 15,869,046 N; 945,989 E. ORIGINATED BY VK

DIST 6 HWY 410 BORING DATE April 30, 1976 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger, BX Casing; BXL Rock Core & Cone Test CHECKED BY

(m) ELEV	DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	LIQUID LIMIT W_L / PLASTIC LIMIT W_P / WATER CONTENT W (10 20 30)	UNIT WEIGHT γ	REMARKS % GR SA SI CL
186.8	613.0	Ground Level									
185.9	0.0 / 610.0	Clayey silt with sand & gravel. (Glac.Till)									
185.3	608.0	Gravel with silty sand & tr.of clay. Compact to		1	SS	19	610				61 28 (11)
1.5	5.0	weathered – – – – sound		2	BXL	65%		100/2"			
		Bedrock		3	BXL	80%					
		Grey shale with occ. layers of limestone.		4	BXL	100%	600				
182.0	597.2										
4.8	15.8	End of Borehole									

SHEAR STRENGTH: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE

WATER CONTENT % (10 20 30)

20 15 ◇ 5 10 % STRAIN AT FAILURE

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 1 METRIC

W P 103-69-09 LOCATION CO-ORDS. N 4 836 885.2; E 288 337.5 ORIGINATED BY V.K.
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Auger, BX Casing; BXL Rock Core and Cone Test COMPILED BY V.K.
DATUM Geodetic DATE 76 04 30 CHECKED BY

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
186.8	Ground Level										
0.0	Silty Clay with Sand and Gravel (Glacial Till)						186				
185.9											
0.9	Gravel with Silty Sand and trace Clay Compact		1	SS	19				○		61 28 (11)
185.3							185	100/5 cm			
1.5	weathered		2	BXL	REC 65%						
	Bedrock						184				
	Grey Shale with occ. layers of Limestone		3	BXL	REC 80%						
							183				
	Sound		4	BXL	REC 100%						
182.0											
4.8	End of Borehole										

$+^3$, $\times^5$: Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 4 METRIC

W P 103-69-09 LOCATION CO-ORDS. N 4 836 911.4; E 288 331.7 ORIGINATED BY V.K.
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Auger, BX Casing and BXL Rock Core COMPILED BY V.K.
DATUM Geodetic DATE 76 05 04 CHECKED BY

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
186.3	Ground Level										
0.0	Gravel with Shale fragments						186				
185.5											
0.8	BEDROCK Grey Shale with occasional layers of Limestone		1	BXL	REC 100%		185				
							184				
	Sound		2	BXL	REC 100%						
182.6							183				
3.7	End of Borehole										

+3, ×5 : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE Nº 5 BH-110-5

W.P. 103-69-00 LOCATION Co-ords. 873,421 N; 944,073 E. ORIGINATED BY VK

DIST. 6 HWY. 410 BORING DATE June 23, 1975 COMPILED BY OY

DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & BX Casing CHECKED BY

(m) ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV.
197.3 / 647.4	Ground Level					
0.0			1	SS	30	▽ 640
	Brown / Grey		2	SS	55	
	Het. Mixture of Clayey Silt, Sand and Gravel (Glacial Till)		3	SS	60	630
			4	SS	99	
	Hard		5	SS	120	620
			6	SS	30/5"	
186.6 / 612.4			7	SS	120/4"	
10.7 / 35.0	Weathered					610
185.0 / 606.9			8	SS	285/4½"	
12.3 / 40.5	Sound Shale Bedrock		9	BXL	REC 98%	
183.3 / 601.4						
14.0 / 46.0	End of Borehole					

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE

LIQUID LIMIT w_L — PLASTIC LIMIT w_P — WATER CONTENT w (w_P — w — w_L)

WATER CONTENT % (10 20 30)

UNIT WEIGHT γ

REMARKS: % GR. SA. SI. CL.

12 25 53 10

19 29 40 12

OFFICE REPORT ON SOIL EXPLORATION

15 20 5 % STRAIN AT FAILURE

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO BH-122-3(1)

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 3(1) (Culvert 3)

WP 103-69-08 LOCATION Co-ords. N 15,870,340 E 945,576 ORIGINATED BY VK

DIST 6 HWY 410 BORING DATE July 21, 1976 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE C.M.E. 5.1 (1) M.V.H.S. CHECKED BY

(m)

SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC CONE PENETRATION RESISTANCE PLOT	LIQUID LIMIT W_L / PLASTIC LIMIT W_P / WATER CONTENT W	UNIT WEIGHT	REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES	ELEV	20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	W_P — W — W_L WATER CONTENT % 10 20 30	γ	% GR SA SI CL
192.7 632.2	Ground Level									
0.0	Brown Grey Het. mix. of clayey silt, sand and gravel (Glacial Till) Hard		1	SS	34	630				5 18 47 30
			2	SS	70		100/9"			
			3	SS	100/6"	620				5 28 48 19
			4	SS	115					
			5	SS	115					13 34 52 1
			6	SS	75/6"	610				
			7	SS	70/6"					
183.5 602.1			8	SS	80/1"					4 23 47 26
9.2 30.1	End of Borehole									

20
15 ◇ 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO BH-122-3(2)

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE Nº 3(2) (Culvert 3)

WP 103-69-08 LOCATION Co-ords. N 15,870,376; E 945,660 ORIGINATED BY VK

DIST 6 HWY 410 BORING DATE July 22, 1976 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE C.F.E. 5.1 (1) M.V.H.S. CHECKED BY GP

SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC CONE PENETRATION RESISTANCE PLOT	LIQUID LIMIT / PLASTIC LIMIT / WATER CONTENT	UNIT WEIGHT	REMARKS
(m) ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES	ELEV	20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	W_L W_P W WATER CONTENT % 10 20 30	γ	% GR SA SI CL
1920 630.0	Ground Level									
0.0	Brown / Grey Het. mixture of clayey silt, sand and gravel (Glacial Till) Hard		1	SS	43					8 22 49 21
			2	SS	129					25 32 29 14
			3	SS	50	620				
			4	SS	120					9 33 56 2
			5	SS	137/6"					
			6	SS	100/6"	610				
183.9 603.5			7	SS	160					14 23 46 19
8.1 26.5	End of Borehole									

OFFICE 'REPORT' ON SOIL EXPLORATION

20
15 ⊹ 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO BH-122-4(1)

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 4 (1) (Culvert 4)

WP 103-69-08 LOCATION Co-ords. N 15,871,122; E 945,418 ORIGINATED BY VK

DIST 6 HWY 410 BORING DATE July 20, 1976 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE C.M.E. 5.1 (1) M.V.H.S. CHECKED BY GP

SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC CONE PENETRATION RESISTANCE PLOT	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w	UNIT WEIGHT	REMARKS
(m) ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES	ELEV	20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	w_P w w_L WATER CONTENT % 10 20 30	γ p.c.f.	% GR SA SI CL
191.5 628.4	Ground Level									
0.0	Brown Grey		1	SS	17				Org. 1.992	1 21 55 23
			2	SS	67	620				0 26 57 17
			3	SS	110/6"		100/7"			
	Het. mix. of clayey silt, sand and gravel		4	SS	145					15 30 45 10
			5	SS	100					15 32 43 10
						610				
	(Glacial Till)		6	SS	105/8"					
			7	SS	80/3"					
	Very Stiff to hard					600				
182.1 597.6			8	SS	100/3"					18 36 36 10
9.4 30.8	End of Borehole									

20
15 ◇ 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

BH-122-4(2)

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS - ONTARIO

ENGINEERING SERVICES BRANCH - GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 4 (2) (Culvert 4)

WP 103-69-08 LOCATION Co-ords. N 15,871,165; E 945,314 ORIGINATED BY VK

DIST 6 HWY 410 BORING DATE July 20, 1976 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE C.M.E. 5.1 (1) M.V.H.S. CHECKED BY

(m) ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB. VANE)	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w (WATER CONTENT % 10 20 30)	UNIT WEIGHT γ	REMARKS % GR SA SI CL
191.6 628.5	Ground Level									
0.0	Brown Grey Het. mixture of clayey silt, sand and gravel (Glacial Till)		1	SS	12					4 21 50 25
			2	SS	35	620				11 23 48 18
			3	SS	50/2"		100/9"			7 33 51 9
			4	SS	110/9"					
			5	SS	66					17 30 43 10
			6	SS	100/1"	610				4 34 44 18
			7	SS	85					
182.2 597.8	Stiff to hard		8	SS	100/2"	600				17 18 47 18
9.4 30.7	End of Borehole									

OFFICE REPORT ON SOIL EXPLORATION

20
15 ◇ 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH - GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 5 (1) (Culvert 5)

122-5(1)

WP 103-69-08 LOCATION Co-ords. N 15,872,360; E 944,915 ORIGINATED BY VK

DIST 6 HWY 410 BORING DATE July 15, 1976 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE C.M.E. 5.1 (1) M.V.H.S. CHECKED BY GP.

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV
631.1	Ground Level					630
0.0	Brown Grey Het. mixture of clayey silt, sand and gravel (Glacial Till)		1	SS	8	
			2	SS	100/6"	
			3	SS	100/6"	620
			4	SS	85/6"	
			5	SS	120/5"	610
604.2	Stiff to hard		6	SS	50/5"	
26.9	End of Borehole					

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH: o UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE

LIQUID LIMIT w_L, PLASTIC LIMIT w_P, WATER CONTENT w

WATER CONTENT % (10 20 30)

UNIT WEIGHT γ P.C.F.

REMARKS	% GR	SA	SI	CL
Org. 0.23%	0	27	53	20
	9	26	40	25
	3	29	47	21
	46	26	23	5

20
15 ⊙ 5 % STRAIN AT FAILURE
10

OFFICE 'REPORT' ON SOIL EXPLORATION;

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 5(2) (Culvert 5)

122-5(2)

WP 103-69-08 LOCATION Co-ords. N 15,872,368 E 944,803 ORIGINATED BY VK

DIST 6 HWY 410 BORING DATE July 15, 1976 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE C.M.E. 5.1 (1) M.V.H.S. CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC CONE PENETRATION RESISTANCE PLOT	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w	UNIT WEIGHT	REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES	ELEV	20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	w_P w w_L WATER CONTENT % 10 20 30	γ P.C.F.	% GR SA SI CL
631.6	Ground Level									
0.0	Brown Grey Het. mixture of clayey silt, sand & gravel (Glacial Till)		1	SS	20	630			Org. 0.42%	2 30 48 20
			2	SS	97					9 29 47 15
			3	SS	85/6"					9 31 43 17
			4	SS	80/6"	620				
			5	SS	75/6"					
			6	SS	89	610				15 29 47 9
			7	SS	110/3"					
601.6	Very stiff to hard		8	SS	120/6"					8 51 31 10
30.0	End of Borehole									

20
15 ○ 5 % STRAIN AT FAILURE
10

OFFICE 'REPORT' ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

BH-187-3

RECORD OF BOREHOLE No 3 METRIC

W P 21-79-18 LOCATION Co-ords. N 4 838 214.5; E 287 746.8 ORIGINATED BY JA
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Auger, Washboring, Cone Test COMPILED BY JA
DATUM Geodetic DATE 84 08 07 CHECKED BY AS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
197.5	Ground Surface										
0.0 / 196.8	Sand and Gravel (shoulder)										
0.7	Heterogeneous Mixture of Silty Clay with sand some gravel (Glacial Till) Hard		1	SS	9						
			2	SS	27						
			3	SS	32						
			4	SS	64			100/ 25 cm	○		12 30 41 17
	Brown / Grey		5	SS	42						
			6	SS	72						
			7	SS	82				○		23 30 34 13
			8	SS	128						
			9	SS	90/ 10 cm						
			10	SS	100/ 18 cm						
			11	SS	100/ 13 cm						
188.2			12	SS	100/ 18 cm						
9.3	End of Borehole										

* W.L. not established

+3, ×5 : Numbers refer to Sensitivity

15 20/10 5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

BH-187-4

RECORD OF BOREHOLE No 4 METRIC

W P 21-79-18 LOCATION Co-ords. N 4 838 214.3; E 287 693.0 ORIGINATED BY JA
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Auger, Washboring, Cone Test COMPILED BY JA
DATUM Geodetic DATE 84 08 08 CHECKED BY PS

ELEV DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (o UNCONFINED, • QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT Wl / WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
197.5	Ground Surface							20 40 60 80 100	10 20 30		
0.0	Topsoil, Fill					*	197				
196.6											
0.9	Heterogeneous Mixture of Silty Clay with sand some gravel (Glacial Till) Hard Brown Grey		1	SS	49		196				
			2	SS	67		195	100/28 cm			
			3	SS	61		194				
			4	SS	75		193				
			5	SS	132/25 cm				o		9 33 48 10
			6	SS	136		192				
			7	SS	100/15 cm		191		o		28 26 33 13
			8	SS	100/13 cm						
189.6			9	SS	100/15 cm		190				
7.9	End of Borehole										

* W.L. not established

+3, ×5 : Numbers refer to Sensitivity

20
15 ☼ 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS–ONTARIO

ENGINEERING SERVICES BRANCH - GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 6 BH-110-6

W.P. 103-69-00 LOCATION Co-ords. 875,402 N; 942,048 E. ORIGINATED BY VK

DIST. 6 HWY. 410 BORING DATE July 1, 1975 COMPILED BY OY

DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & BX Casing CHECKED BY

(m) ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH o UNCONFINED + FIELD VANE • QUICK TRIAXIAL × LAB VANE	LIQUID LIMIT W_L / PLASTIC LIMIT W_P / WATER CONTENT W / WATER CONTENT % 10 20 30	UNIT WEIGHT γ	REMARKS % GR. SA. SI. CL.
261.4 / 660.8	Ground Level									
0.0 / 0.0	Het. mixture of clayey silt, sand & gravel (Glacial Till) Stiff to Hard		1	SS	13	660		o		6 25 50 19
198.2 / 650.3			2	SS	100/5"	650				
3.2 / 10.5	Weathered									
	Sound Shale Bedrock		3	BXL	REC 100%					
195.8 / 642.5										
5.6 / 18.3	End of Borehole									

OFFICE REPORT ON SOIL EXPLORATION

15 20 5 10 % STRAIN AT FAILURE

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS–ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 7 BH-110-7

W.P. 103-69-00 LOCATION Co-ords. 876,719 N; 940,790E. ORIGINATED BY VK

DIST. 6 HWY. 410 BORING DATE July 1, 1975 COMPILED BY OY

DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & BX Casing CHECKED BY

(m) ELEV.	DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	LIQUID LIMIT W_L / PLASTIC LIMIT W_P / WATER CONTENT W / WATER CONTENT % 10 20 30	UNIT WEIGHT γ	REMARKS % GR. SA. SI. CL.
208.3	683.3	Ground Level									
	0.0	Het. mixture of clayey silt, sand & gravel (Glacial Till)		1	SS	35	680		○		1 21 56 22
		Brown-Grey									
205.1	672.8	Hard		2	SS	100/6"					
3.2	10.5	Weathered					670				
		Sound Shale Bedrock		3	BXL	REC 80%					
202.5	664.3										
5.8	19.0	End of Borehole									

OFFICE REPORT ON EXPLORATION

20 15 5 10 % STRAIN AT FAILURE

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 8 BH-110-8

W.P. 103-69-00 LOCATION Co-ords. 877,610 N; 939,892 E. ORIGINATED BY VK

DIST. 6 HWY. 410 BORING DATE July 2, 1975 COMPILED BY OY

DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & BX Casing CHECKED BY

(cm) ELEV.	DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w (w_P — w — w_L) / WATER CONTENT % (10 20 30)	UNIT WEIGHT γ	REMARKS % GR. SA. SI. CL.
214.2	702.6	Ground Level									
	0.0	Het. mixture of clayey silt, sand & gravel (Glacial Till)		1	SS	25	700		○		3 17 55 25
				2	SS	46					
		Brown					▼ 690				
209.0	685.6	Grey Very Stiff to Hard		3	SS	71					3 5 55 37
5.2	17.0	Weathered									
		Sound		4	BXL	REC 75%					
207.5	680.6	Shale Bedrock									
6.7	22.0	End of Borehole									

OFFICE REPORT ON SOIL EXPLORATION

20 15 ◇ 5 10 % STRAIN AT FAILURE

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 6 (1) (Culvert 6) BH-122-6(1)

WP 103-69-08 LOCATION Co-ords. N 15,878,285; E 939,065 ORIGINATED BY VK

DIST 6 HWY 410 BORING DATE July 14, 1976 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE C.M.E. 5.1 (1) M.V.H.S.-Core with BXL Bit CHECKED BY GP

(m) ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w (w_P — w — w_L) / WATER CONTENT % (10 20 30)	UNIT WEIGHT γ	REMARKS / % GR SA SI CL
211.5 694.0	Ground Level									
0.0	Brown Grey Het.mix. of clayey silt, sand & gravel (glacial till) hard		1	SS	51	690				11 39 42 8
			2	SS	60		100/3"			21 14 43 22
208.0 682.5			3	SS	100					13 7 60 20
3.5 11.5	Bedrock Sound Shale		4	BXL RC	100% REC	680				
206.5 678.5										
5.0 16.5	End of Borehole									

20
15 ⊖ 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

149A-2

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 2 METRIC 9

W P 21-79-03 LOCATION Co-ords N 4 839 677.2; E 286 283.0 ORIGINATED BY H.S.
DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger COMPILED BY T.J.K.
DATUM Geodetic DATE 1981 12 08 CHECKED BY GP.

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 (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
212.8	Ground Surface										
0.0	(Glacial Till)						212				
	Silty Clay some sand trace of gravel		1	SS	12						
			2	SS	18	▼	211				8 16 47 29
	Stiff to Hard		3	SS	33						
							210				
	Detached slabs and weathered fragments of shale and limestone		4	SS	74						12 13 51 24
208.8			5	SS	75/5 cm		209				
4.0	Shale (weathered) Bedrock soft		6	SS	100/8 cm						
207.7							208				
5.1	End of Borehole		7	SS	100/2 cm						

+3, ×5 : Numbers refer to Sensitivity

15 (20/10) 5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

149A-3

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 3

METRIC 10

W P 21-79-03 LOCATION Co-ords N 4 839 677.4; E 286 339.1 ORIGINATED BY H.S.

DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger & Rock Core COMPILED BY T.J.K.

DATUM Geodetic DATE 1981 12 08 and 09 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						GR SA SI CL
212.5	Ground Surface										
0.0	(Glacial Till)						212				
	Silty Clay some sand trace of gravel Very Stiff to Hard		1	SS	31	*					
			2	SS	26		211		W		0 4 71 25
			3	SS	72		210				
	Detached slabs and weathered fragments of shale and limestone		4	SS	100/15 cm		209				
208.4											
4.1	Interbedded soft shales and very hard dolomitic limestone		5	SS	100/13 cm		208				
			6	BX RC	95% REC		207				
206.1											
6.4	End of Borehole										

* Borehole water level after 24 hours

+3, ×3 : Numbers refer to Sensitivity

15 20/10 δ (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

149B-1

RECORD OF BOREHOLE No 1

METRIC 22

W P 21-79-03 LOCATION Co-ords. N 4 839 738; E 286 378 ORIGINATED BY V.K.

DIST 6 HWY 410 BOREHOLE TYPE Auger & Sample with C.M.E. - 55 COMPILED BY S.O.

DATUM Geodetic DATE 74 03 06 CHECKED BY [illegible]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL ◆ FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						GR SA SI CL
212.7	Ground Level										
0.0 / 211.2	Silty Clay, Traces of Sand and Gravel Fill Material, Stiff		1	SS	9		212		○		
1.5 / 208.3	Wet. Mixture of Silty Clay, Sand and Gravel Glacial Till Hard		2	SS	150	28 cm	210		○		13 27 43 17
			3	SS	100/	26 cm			○		19 38 29 14
			4	SS	100/	3 cm					
4.4 / 207.1	Limestone Bedrock		5	BXL	100% REC		208				
9.6	End of Borehole										

+3, ×5 : Numbers refer to Sensitivity

15 ◇ 5 (%) STRAIN AT FAILURE (20 / 10)

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

149B-2

RECORD OF BOREHOLE No 2

METRIC 23

W P 21-79-03 LOCATION Co-ords. N 4 839 697; E 286 332 ORIGINATED BY V.K.

DIST 6 HWY 410 BOREHOLE TYPE Auger & Sample with C.M.E. - 55 COMPILED BY S.O.

DATUM Geodetic DATE 74 03 05 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL / WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						GR SA SI CL
212.9	Ground Level										
0.0	Wet. Mixture of Silty Clay, Sand and Gravel Glacial Till Hard		1	SS	70		212				
			2	SS	168	22 cm ▼	210				8 26 58 8
208.6			3	SS	100/3 cm						
4.3	End of Borehole										

OFFICE REPORT ON SOIL EXPLORATION

+3, ×5 : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

Ministry of Transportation and Communications
Ontario

149 B-3

RECORD OF BOREHOLE No 3

METRIC 24

W P 21-79-03 LOCATION Co-ords. N 4 839 712; E 286 275 ORIGINATED BY V.K.

DIST 6 HWY 410 BOREHOLE TYPE Auger & Sample with C.M.E. - 55 COMPILED BY S.O.

DATUM Geodetic DATE 74 03 05 CHECKED BY

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
211.5	Ground Level										
0.0	Mat. Mixture of Silty Clay, Sand and Gravel Glacial Till Hard		1	SS	100	5 cm	210		○		
			2	SS	148				○ ⊢—⊣		30 13 37 20
208.0			3	SS	100	3 cm	208				
3.5	End of Borehole										

$+^3$, $\times^3$: Numbers refer to Sensitivity

20
15 ◇ S (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

149B-4

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 4

METRIC 25

W P 21-79-03 LOCATION Co-ords. N 4 839 756; E 286 238 ORIGINATED BY V.K.

DIST 6 HWY A10 BOREHOLE TYPE Auger & Sample with C.M.E. - 55 COMPILED BY S.O.

DATUM Geodetic DATE 74 03 05 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT Wl — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
211.9	Ground Level										GR SA SI CL
0.0	Het. Mixture of Silty Clay, Sand and Gravel Glacial Till Hard		1	SS	46		210		●		
			2	SS	106				○		2 6 60 32
208.4											
3.5	Limestone Bedrock		3	SS	(100)	▽ 3 Jun					
207.5			4	RXL	100% REC		208				
4.4	End of Borehole										

OFFICE REPORT ON SOIL EXPLORATION

+3, ×5 : Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation and Communications
Ontario

149 B-5

RECORD OF BOREHOLE No 5

METRIC 26

W P 21-79-03 LOCATION Co-ords. N 4 839 800; E 286 192 ORIGINATED BY V.K.

DIST 6 HWY 410 BOREHOLE TYPE Auger & Sample with C.M.E. - 55 COMPILED BY S.O.

DATUM Geodetic DATE 74 03 05 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						GR SA SI CL
215.0	Ground Level										
0.0	Silty Clay with Some Sand and Traces of Gravel and Organics Fill Material Stiff		1	SS	12		214				
212.0			2	SS	11		212		o —		0 19 46 35
3.0	Het. Mixture of Silty Clay, Sand and Gravel Glacial Till Hard		3	SS	100/13 cm	▼			o —		
			4	SS	100/13 cm		210		o		32 23 32 12
208.0			5	SS	100/8 cm		208		o		62 20 (18)
7.0	End of Borehole										

OFFICE REPORT ON SOIL EXPLORATION

+3, ×5 : Numbers refer to Sensitivity

15 (20/10) 5 (%) STRAIN AT FAILURE

149B-6

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 6

METRIC 27

W P 21-79-03 LOCATION Co-ords. N 4 839 843; E 286 149 ORIGINATED BY V.K.

DIST 6 HWY 410 BOREHOLE TYPE Auger & Sample with C.M.E. - 55 COMPILED BY S.O.

DATUM Geodetic DATE 76 03 04 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT N (20 40 60 80 100) SHEAR STRENGTH: o UNCONFINED, • FIELD VANE, ● QUICK TRIAXIAL, x LAB VANE	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						GR SA SI CL
216.9 Ground Level											
0.0	Silty Clay, Some Sand & Traces of Gravel & Organics Fill Material Stiff		1	SS	14		216				
			2	SS	14	▼	214				0 16 57 27
213.5 3.4	Ret. Mixture of Silty Clay, Sand and Gravel Glacial Till Hard		3	SS	81				o		
			4	SS	135	30 cm	212		o		23 13 40 24
			5	SS	100/	15 cm	210				
208.5			6	SS	100/	8 cm			o		0 32 46 22
8.4	End of Borehole										

OFFICE REPORT ON SOIL EXPLORATION

+3, x5 : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

149B-7

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 7

METRIC 28

W P 21-79-03 LOCATION Co-ords. N 4 839 887; E 286 105 ORIGINATED BY V.K.

DIST 6 HWY 410 BOREHOLE TYPE Auger & Sample with C.M.E. - 55 COMPILED BY S.O.

DATUM Geodetic DATE 74 03 04 CHECKED BY [illegible]

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
217.2	Ground Level										
0.0	Silty Clay with Some Sand and Traces of Gravel and Organics Fill Material Stiff to V. Stiff		1	SS	13		216				
			2	SS	21		214				0 17 52 31
213.8						▼					
3.4	Silt with Some Sand and Traces of Gravel and Clay Slightly Plastic		3	SS	62						5 32 58 5
211.6	V. Dense						212				
5.6	Mat. Mixture of Silty Clay, Sand and Gravel Glacial Till Hard		4	SS	100/15 cm						
			5	SS	100/13 cm		210				14 16 52 18
208.7			6	SS	100/8 cm						
8.5	End of Borehole										

+3, ×6 : Numbers refer to Sensitivity

15 20/10 5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

Ref. No. 82-7-2

Enclosure No. 6

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 6 BH-171-6 METRIC 13

W P 21-79-01 LOCATION Co-ords. 4,839,243 N.; 286,750 E. ORIGINATED BY R.M.

DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Auger, NXL Rock Core COMPILED BY R.M.

DATUM Geodetic DATE 1982 08 12 CHECKED BY I.P.L.

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 100 300 500	PLASTIC LIMIT Wp — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L / WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
208.5 0.0	GROUND SURFACE						208				W.L. 205.5m after coring
	Brown hard SILTY CLAY (Glacial Till)		1	SS	46		207				
			2	SS	41						
			3	SS	75		206				
205.4	shale fragments										
3.1	Grey weathered SHALE with hard limestone layers.		4	RC NXL	100% RQD 19%		205 204				
203.6 4.9	END OF BOREHOLE										

OFFICE REPORT ON SOIL EXPLORATION

+³, ×⁵: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

Ministry of Transportation and Communications Ontario

Ref. No. 82-7-2

Enclosure No. 7

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 7 BH-171-7 METRIC

14

W P 21-79-01 LOCATION Co-ords 4,839,268 N.; 286,726 E. ORIGINATED BY R.M.

DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Auger COMPILED BY R.M.

DATUM Geodetic DATE 1982 07 14 CHECKED BY I.P.L.

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES 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 100 300 500	PLASTIC LIMIT Wp — NATURAL MOISTURE CONTENT W — LIQUID LIMIT WL / WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
210.1	GROUND SURFACE									
0.0	0.15 m Topsoil						210			Filled piezometer tubing with water. Date W.L. 07-14 209.5 07-15 208.6 08-24 208.0
	Hard brown SILTY CLAY some sand and embedded gravel, rock fragments. (Glacial Till)		1	SS	36		209			
			2	SS	38				21.4	
			3	SS	31	Bentonite Seal	208			5 19 38 38
			4	SS	79		207			
			5	SS	50/12 cm		206			
205.5					✓	Piezometer				
4.6	END OF BOREHOLE REFUSAL, PROBABLY BEDROCK									

OFFICE REPORT ON SOIL EXPLORATION

+3, ×5: Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation and Communications Ontario

RECORD OF BOREHOLE No 2 BH-186-2 METRIC

W P 21-79-15 LOCATION Concords N 4 838 846.0; E 287 153.7 ORIGINATED BY DT

DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger COMPILED BY DT

DATUM Geodetic DATE 84-01-10, 11 CHECKED BY GP

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH ○ UNCONFINED ⊕ FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
201.7	Ground Surface										
0.0	Heterogeneous mixture Silty Clay Trace to some sand, gravel (Glacial Till)		1	SS	17		201		○		12 22 43 23
			2	SS	38	▼	200				
			3	SS	60		199				9 12 35 24
198.8	V. stiff to hard										
2.9	Grey Shale Bedrock		4	SS	38		198				
	Highly weathered		5	SS	62/5cm						
197.0											
4.7	End of Borehole Refusal to auger										

OFFICE REPORT ON SOIL EXPLORATION

+[3], ×[3]: Numbers refer to Sensitivity

20
15 ◇ ε (%) STRAIN AT FAILURE
10

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 11

METRIC

BH-186-11

W P 21-79-16 LOCATION Co-ords. N 4 838 823.3; E 287 161.8 ORIGINATED BY HS

DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger & BXL Rock Core COMPILED BY DT

DATUM Geodetic DATE 84-01-16 CHECKED BY

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: o UNCONFINED, • FIELD VANE, ⊕ QUICK TRIAXIAL, × LAB VANE	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
200.8	Ground Surface										
0.0	Heterogeneous Mixture Silty Clay Trace to Some Sand, Gravel (Glacial Till)		1	SS	10	#	200				
198.9	Stiff to V. Stiff		2	SS	19		199		+o—		10 4 54 32
1.9	Grey Shale Bedrock		3	SS	100/3cm						
			4	SS	100/10cm		198				
	Weathered Limestone shale with randomly interbedded limestone seams 20mm thick Highly weathered		5	BXL RC	55% REC		197				RQD = 21%
			6	BXL RC	68% REC						RQD = 0%
							196				
			7	BXL RC	65% REC		195				RQD = 42%
194.4	Unweathered										
6.4	End of Borehole										

*Note: Groundwater level not observed

OFFICE REPORT ON SOIL EXPLORATION

+3, ×5 : Numbers refer to Sensitivity

20 / 15 ◇ 5 (%) STRAIN AT FAILURE / 10

Ministry of Transportation and Communications Ontario

BH-229-16(1)

7

WP 697-93-00

RECORD OF BOREHOLE No 16

METRIC

W P 21-79-16 (FORMERLY) LOCATION Co-ords. N 4 838 752.7; E 287 260.0 ORIGINATED BY HS

DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger COMPILED BY DT

DATUM Geodetic DATE 84-01-16 CHECKED BY CR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT N (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT W_P / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
199.5	Ground Surface										GR SA SI CL
0.0	Heterogeneous Mixture Silty Clay Trace to Some Sand, Gravel (Glacial Till)					*	199				
			1	SS	49				○		8 23 52 17
197.5	Hard						198				
2.0	Grey Shale Bedrock		2	SS	63						
197.2	Weathered										
2.3	End of Borehole Refusal to Auger *Note: Water level not observed										

$+^3$, $\times^5$: Numbers refer to Sensitivity

$\frac{20}{15}\diamond_{10}^{5}$ (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications Ontario

BH-229-21

6

WP 697-93-00

RECORD OF BOREHOLE No 21

METRIC

W P 21-79-16 (FORMERLY) LOCATION Co-ords. N 4 838 659.7; E 287 358.3 ORIGINATED BY DT

DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger & BXL Rock Core COMPILED BY DT

DATUM Geodetic DATE 84-01-19, 20 CHECKED BY

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
199.3 Ground Surface											
0.0	Heterogeneous Mixture Silty Clay Trace to Some Sand, Gravel (Glacial Till)		1	SS	29		199				
			2	SS	34	▽	198		o —		5 15 47 33
			3	SS	27		197		o —		6 28 51 15
			4	SS	34		196				
195.0	V. Stiff to Hard		5	SS	26		195				
4.3	Grey Shale Bedrock		6	SS	100/3cm		194				
	Weathered Shale randomly interbedded with limestone seams 20-110 mm thick		7	BXL RC	90% REC		193				RQD = 23%
192.6 6.7	Weathered End of Borehole										

+3, ×5 : Numbers refer to Sensitivity

20 / 15 ◇ 5 (%) STRAIN AT FAILURE / 10

OFFICE REPORT ON SOIL EXPLORATION

At Golder Associates we strive to be the most respected global group of companies specializing in ground engineering and environmental services. Employee owned since our formation in 1960, we have created a unique culture with pride in ownership, resulting in long-term organizational stability. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees now operating from offices located throughout Africa, Asia, Australasia, Europe, North America and South America.

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