Foundation Investigation and Design Report

Birchmount Road Overpass Rehabilitation (Site No. 37-212)
Highway 401 Westbound Core and Collector Lanes, Neilson Road to Warden Avenue, City of Toronto, Ontario
MTO G.W.P. 2162-11-00

Submitted to:

WSP
610 Chartwell Road, Suite 300
Oakville, ON Canada
L6J 4A5

Submitted by:

Golder Associates Ltd.
6925 Century Avenue, Suite #100 Mississauga, Ontario, L5N 7K2 Canada
+1 905 567 4444

GEOCRES No.: 30M14-492
Lat. 43.772815, Long. -79.294434

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1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been retained by WSP on behalf of the Ministry of Transportation, Ontario (MTO) to provide foundation engineering services for the detail design of the rehabilitation and operational improvements of the Highway 401 westbound (WB) core and collector lanes, from Neilson Road to Warden Avenue in the City of Toronto, Ontario (GWP 2162-11-00).

This report addresses the foundation investigation carried out to support the rehabilitation of the existing Birchmount Road overpass. This report was developed based on information from the current investigation, supplemented with information from a 1965 foundation investigation completed by others at the structure site, as follows:

- **MTO GEOCRES No. 30M14-073:** "Foundation Investigation Report for Proposed Extension of the Existing Bridge at Highway 401 and Birchmount Road, County of York, Township of Scarborough, District #6 (Toronto), W.J. 65-F-49 – W.P. 256-61", prepared by MTO Foundation Section – Materials and Testing Division, dated August 3, 1965.
- **MTO GEOCRES No. 30M14-338:** "Preliminary Foundation Investigation and Design Report, Bridge Widening and Replacement, Highway 401 Rehabilitation from Warden Avenue to Brock Road, Toronto, Ontario, W.O. 07-20012," prepared by Golder Associates Ltd., dated April 2012.

The Terms of Reference and Scope of Work for the foundation engineering services are outlined in MTO's Request for Proposal, dated November 21, 2016, which forms part of the Consultant Agreement (No. 2016-E-0009) for this project. The work has been carried out in accordance with Golder's Supplementary Specialty Plan for foundation engineering services for this project, dated July 10, 2017.

2.0 SITE DESCRIPTION

The Highway 401-Birchmount Road overpass is located in the City of Toronto, east of Warden Avenue. Birchmount Road appears to have been constructed near the original ground surface, which is understood to range from approximately Elevation 174 m to 176 m based on the 1965 Borehole Location and Soil Strata drawing. Highway 401 has been constructed on embankment fill, with its grade at about Elevation 185.7 m at the overpass location. A CP Rail line, which is oriented in a northeast-southwest direction, crosses under Highway 401 about 200 m east of Birchmount Road, and crosses under Birchmount Road less than 200 m south of Highway 401, such that Birchmount Road has been constructed on an embankment to the south of the highway. A commercial/industrial park is located south of the highway, while a residential zone is located north of the highway.

The existing Birchmount Road overpass (core and collector lanes) was constructed in 1969 and consists of two spans, with span lengths of approximately 14.9 m between the abutments and the pier. Based on available 1968 design drawings, the abutments and pier of the existing westbound core and collector lanes are supported on strip footings founded between about Elevation 172.4 m and 174.5 m. The existing WB core lanes structure (Site No. 37-212/4) is approximately 30.0 m long and 18.5 m wide. The WB collector structure (Site No. 37-212/2) is approximately 29.3 m long and 20.1 m wide.

The Highway 401 approach embankments are up to approximately 9 m in height relative to the surrounding grade, with the side slopes inclined at approximately 3 horizontal to 1 vertical (3H:1V) on the south side, and supported by a retaining wall on the north side. At the time of the 2018 investigation, visual observations suggested no evidence

of settlement of the WB lanes adjacent to the overpass abutments, nor of global instability of the embankment side slopes or retaining wall.

3.0 INVESTIGATION PROCEDURES

3.1 1965 Investigation

A total of six boreholes (Boreholes 1 to 6) were advanced as part of the 1965 investigation (GEOCRES No. 30M14-73) at the Birchmount Road overpass site. Three of these boreholes are located within or immediately adjacent to the footprint of the WB core and collector structures, while the other three are located within the eastbound (EB) structure area; the EB boreholes have been included in this report as they provide supplementary information on the adjacent geotechnical subsurface conditions. 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. 30M14-073 have been renumbered as 73-X, where X is the original borehole number.

The locations of the boreholes are summarized below and shown on Drawing 1. These borehole locations have been developed based on plotting the station and offset as shown on the 1965 borehole records and drawings, adjusted based on the site features shown on the drawings and converted to MTM NAD83 (Zone 10) coordinates. The borehole records from the 1965 investigation are presented in Appendix A and a summary of the borehole locations, ground surface elevation referenced to Geodetic datum and drilled depths are presented below.

Borehole No.	Borehole Location	MTM NAD 83 (Zone 10)		Borehole Elevation (m)	Borehole Depth (m)
		Northing (m)	Easing (m)		
73-1	EB Collector East Abutment	4,848,065.7	321,384.5	176.5	11.1
73-2	EB Collector West Abutment	4,848,054.1	321,349.6	175.9	12.6
73-3	EB Collector West Abutment / Pier	4,848,072.9	321,353.0	176.8	12.6
73-4	WB Collector West Abutment	4,848,129.9	321,320.5	175.0	11.1
73-5	WB Collector East Abutment	4,848,142.8	321,358.9	174.3	12.6
73-6	WB Collector East Abutment / Pier	4,848,121.5	321,356.0	175.0	11.1

The Standard Penetration Test (SPT) “N”-values in the 1965 investigation were obtained using a manual hammer. The manual hammer consisted of a 63.5 kg (140 pound) hammer falling over a distance of 760 mm (30 inches).

3.2 2018 Investigation

The foundation investigation for the Birchmount Road overpass WB structure was carried out between February 14 and May 30, 2018, during which time three boreholes were drilled. Borehole BR-01 was advanced immediately north of the central pier on Birchmount Road, and Boreholes BR-02 and BR-03 were advanced adjacent to the east and west abutments of the core and collector lanes from the Highway 401 grade, at the locations shown on Drawing 1.

The borehole investigation was carried out using a CME 75 truck-mounted drill rig, supplied and operated by Geo-Environmental Drilling Inc. of Acton, Ontario. Borehole BR-01 was advanced through the overburden using 203 mm outside diameter hollow stem augers to a depth of 15.9 m below the pavement surface. Boreholes BR-02 and BR-03 were advanced through the overburden using 165 mm outside diameter hollow stem augers to depths of 20.4 m below the existing pavement surface.

Soil samples were obtained at 0.75 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 Standard Penetration Test (SPT) procedures (ASTM D1586)[1].

The groundwater conditions in the open boreholes were observed during and immediately following the drilling operations. A standpipe piezometer was installed in Borehole BR-01 to permit monitoring of the water level. The installed piezometer consists of a 50 mm diameter PVC pipe, with a 1.5 m slotted screen sealed within a filter sand pack with the piezometer positioned near the bottom of the borehole. The borehole and annulus surrounding the piezometer pipe above the filter sand pack were backfilled to the ground surface with bentonite pellets. Piezometer installation details and water level readings are described on the borehole record in Appendix B. Boreholes BR-02 and BR-03 were backfilled to ground surface with bentonite, in accordance with Ontario Regulation 903 (Wells, as amended) and all boreholes were sealed at ground surface with cold patch asphalt.

The field work was monitored on a full-time basis by a member of Golder's technical staff who located the boreholes in the field, directed the sampling and in situ testing operations, logged the boreholes and examined the soil samples. The soil samples were identified in the field, placed in labelled containers and transported to Golder's laboratory in Mississauga for further visual review. Geotechnical laboratory index and classification testing consisting of natural moisture contents, Atterberg limits and grain size distributions, was conducted on selected samples in accordance with MTO and / or ASTM Standards as applicable. One sample from each of Boreholes BR-01 to BR-03, obtained using appropriate sampling protocols, was submitted to a specialist analytical laboratory under chain of custody procedures for testing of conductivity / resistivity, pH and chemical analysis of sulphate and chloride content, to assess the potential for the soil to cause deterioration to buried concrete and corrosion to steel.

The borehole locations were laid out in the field by Golder personnel relative to existing road features and pre-selected coordinates using a hand-held global positioning system (GPS) unit with an accuracy of 1 m in the horizontal and vertical directions; the locations were then measured relative to existing site features, and the ground surface elevation on the pavement established from the digital terrain model for the project. The locations given on the borehole records and shown on Drawing 1 are positioned relative to MTM NAD 83 (Zone 10) northing and easting coordinates and the ground surface elevations are referenced to Geodetic datum. The borehole locations,

[1] ASTM D1586 – Standard Test Method for Standard Penetration Tests and Split Barrel Sampling of Soils.

including both MTM NAD 83 and geographic coordinates, ground surface elevations and drilled depths are summarized below.

Borehole No.	MTM NAD83 (Zone 10)		Ground Surface Elevation (m)	Borehole Depth (m)
	Northing (m) (Latitude)	Easting (m) (Longitude)		
BR-01	4,848,140.7 (43.773051)	321,339.4 (-79.294553)	174.7	15.9
BR-02	4,848,119.1 (43.772900)	321,373.0 (-79.294110)	185.7	20.4
BR-03	4,848,109.6 (43.772811)	321,324.3 (-79.294796)	185.6	20.4

4.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

4.1 Regional Geology

This section of Highway 401 is located within the physiographic region known as the Peel Plain, according to *The Physiography of Southern Ontario* (Chapman and Putnam, 1984)[2].

A surficial till sheet, which generally follows the surface topography, is generally present throughout much of this area. The till is typically comprised of clayey silt to silty clay, with occasional sand to silt zones, and it is mapped in this area as the Halton Till. 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 melt water ponds scattered throughout the Peel Plain and concentrated near river valleys, such as the West and East Don 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.

4.2 Subsurface Conditions

The detailed subsurface soil and groundwater conditions as encountered in the boreholes advanced during the 2018 investigation and the results of the geotechnical laboratory tests carried out on selected soil samples are presented on the borehole records provided in Appendix B. The results of the in situ field tests (i.e., SPT “N”-values) as presented on the borehole records and in Section 4.2 are uncorrected. The Standard Penetration Test “N”-values from the 1965 investigation are based on use of a manual hammer, while those in the 2018 investigation are based on use of an automatic hammer; the values are reported with no adjustment in this report, although it is recognized that SPT “N”-values obtained using a manual hammer are frequently higher than those obtained using an automatic hammer. Plots of the results of the geotechnical laboratory testing are presented in Appendix C. The results of the analytical testing are provided in Appendix D.

The stratigraphic boundaries shown on the borehole records and on the stratigraphic profile and cross-section on Drawing 1 are inferred from non-continuous sampling, observations of drilling progress and the results of Standard Penetration Tests. These boundaries, therefore, represent transitions between soil types rather than exact planes

[2] Chapman, L.J. and Putman, D.F., 1984, The Physiography of Southern Ontario, Ontario Geological Society, Special Volume 2, Third Edition. Accompanied by Map p. 2715, Scale 1:600,000.)

of geological change. Furthermore, subsurface conditions will vary between and beyond the borehole locations, however, the factual data presented in the borehole records governs any interpretation of the site conditions.

In general, the subsurface conditions encountered at the site consist of the Highway 401 pavement and embankment fill and the Birchmount Road pavement structure, underlain by a glacial till deposit that varies in composition from clayey silt with sand to silt and sand. More detailed descriptions of the subsurface conditions are provided in the following sections of this report.

4.2.1 Topsoil

An approximately 0.3 m thick layer of topsoil was encountered immediately below ground surface in Boreholes 73-1, 73-2, 73-4 and 73-5 of the 1965 investigation.

4.2.2 Asphalt

An approximately 50 mm thick layer of asphalt pavement was encountered immediately below ground surface in Borehole BR-01, which was advanced along Birchmount Road. An approximately 200 mm and 560 mm thick layer of asphalt pavement was encountered immediately below ground surface in Boreholes BR-02 and BR-03, which were advanced along Highway 401.

4.2.3 Fill

A 2.2 m thick layer of fill was encountered underlying the pavement in Borehole BR-01, and an approximately 8.9 m and 8.5 m thick layer of fill was encountered underlying the pavement in Boreholes BR-02 and BR-03, respectively. An approximately 0.5 m and 0.3 m thick layer of fill was encountered immediately below ground surface in Boreholes 73-3 and 73-6. The base of the fill in the 2018 investigation extends to about Elevation 172.5 m in Borehole BR-01, and to approximately Elevation 176.5 m and 176.6 m in Boreholes BR-02 and BR-03, respectively. The upper portion of the fill, between about 0.6 m to 4.4 m in thickness, is comprised of gravelly sand to sand and gravel. Below this, the fill is variable in composition, ranging from silt and sand, to clayey silt with sand to sandy clayey silt, to gravelly sand in places. Cobble fragments were noted within the fill layer in Borehole BR-02 at a depth of about 8.8 m.

The SPT “N”-values measured within the non-cohesive portion of the fill range from 7 blows to 51 blows per 0.3 m of penetration in the upper gravelly sand to sand and gravel layer, indicating a loose to very dense level of compactness, and 3 blows to 37 blows per 0.3 m of penetration within the silt and sand portions of the fill, indicating a very loose to dense level of compactness. The SPT “N”-values measured within the cohesive fill range from 15 blows to 37 blows per 0.3 m of penetration, suggesting a stiff to hard consistency.

Grain size distribution testing was carried out on four samples of the non-cohesive fill and two samples of the cohesive fill, and the results are shown on Figures C-1 and C-2, respectively, in Appendix C. Atterberg limits testing was carried out on two samples of the cohesive fill layer and measured liquid limits of 17 and 20 per cent, plastic limits of 11 per cent and 14 per cent, and plasticity indices of 6 and 7 per cent. These results, which are plotted on a plasticity chart on Figure C-3 in Appendix C, indicate that the cohesive fill consists of clayey silt to silt of low plasticity. The natural water content measured on selected samples of the non-cohesive fill ranges from about 3 per cent to 20 per cent. The natural water content measured on selected samples of the cohesive fill ranges from about 12 to 14 per cent, near the plastic limit for the material.

4.2.4 Clayey Silt with Sand to Silt and Sand Till

A glacial till deposit was encountered underlying the topsoil and fill layers in all boreholes from the 1965 and 2018 investigations. The surface of the till was encountered in the boreholes between approximately Elevation 176.8 m and 172.5 m. All boreholes terminated within the till deposit, penetrating it for a thickness ranging from 7.8 m to 13.6 m.

Although the deposit was not interpreted as a till in the 1965 investigation, it has been re-interpreted as such based on the grain size distribution data from that investigation, the results of the 2018 investigation, and the physiographic mapping of the area. The till deposit is typically comprised of clayey silt with sand, trace to some gravel, to sandy silt / silt and sand / silty sand, trace clay, trace gravel. Cobble fragments and grinding were noted within the till deposit at various depths, as identified on the 2018 borehole records provided in Appendix B.

The SPT "N"-values measured within the till deposit range from 6 blows to 173 blows per 0.3 m of penetration and up to 80 blows for 0.06 m of penetration, indicating a generally loose to very dense level of compactness or stiff to hard consistency.

Grain size distribution testing was carried out on seven samples of the till from the 2018 investigation, and the results are shown on Figure C-4 in Appendix C. Atterberg limits testing was carried out on six selected samples of the till deposit from the 2018 investigation and measured liquid limits between 12 per cent and 17 per cent, plastic limits between 10 per cent and 12 per cent, and plasticity indices between 1 and 6 per cent. These results, which are plotted on a plasticity chart on Figures C-5 in Appendix C, indicate that the till varies from silt of slight plasticity to clayey silt of low plasticity (i.e., plasticity indices below and above 4 per cent, respectively). One Atterberg limits test within the silt and sand portion of the till deposit tested non-plastic. The natural water content measured on selected samples of the till ranges from about 2 to 16 per cent, typically below the plastic limit for the material.

4.3 Groundwater Conditions

The groundwater levels in the open boreholes were measured upon completion of drilling operations during both the 2018 and 1965 investigations, as summarized below.

Borehole No.	Ground Surface Elevation (m)	Depth to Groundwater (m)	Groundwater Elevation (m)	Date	Comments
BR-01	174.7	9.8	164.9	May 30, 2018	Piezometer at completion of installation
		8.0	166.7	Oct. 4, 2018	Piezometer
BR-02	185.7	Dry to 17.1 (Borehole caved)	Dry to 168.6	Feb. 22, 2018	Open borehole (borehole caved to 17.1 m depth)
BR-03	185.6	Dry at 18.3 (Borehole caved)	Dry at 167.3	Feb. 14, 2018	Open borehole (borehole caved to 18.3 m depth)
73-1	176.5	8.4	168.1	May 12, 1965	Open borehole

Borehole No.	Ground Surface Elevation (m)	Depth to Groundwater (m)	Groundwater Elevation (m)	Date	Comments
73-2	175.9	8.3	167.6	May 12, 1965	Open borehole
73-3	176.8	8.9	167.9	May 13, 1965	Open borehole
73-4	175.0	7.4	167.6	May 13, 1965	Open borehole
73-5	174.3	7.0	167.3	May 14, 1965	Open borehole
73-6	175.0	7.1	167.9	May 14, 1965	Open borehole

As these water levels were measured immediately after completion of drilling, they may not represent the stabilized groundwater level at the site, nor the current level in the case of the 1965 data. Based on the observed water conditions, together with soil colour transitions from brown to grey, it is estimated that the groundwater level is at approximately Elevation 169 m. The groundwater level will be subject to seasonal fluctuations and should be expected to be higher during the spring season or during and following periods of heavy precipitation.

4.4 Analytical Testing Results

Three soil samples were submitted for analysis of parameters used to assess the potential corrosivity of the site soil to steel and concrete. Detailed analytical test results are included in Appendix D and the test results are summarized below:

Borehole No. / Sample No.	pH	Resistivity (ohm-cm)	Electrical Conductivity (umho/cm)	Chlorides (ug/g)	Soluble Sulphates (ug/g)
BR-01 / 4	8.04	400	2490	1300	130
BR-02 / 11	7.73	1600	644	330	<20
BR-03 / 14	8.02	680	1480	730	270

5.0 CLOSURE

This Foundation Investigation Report was prepared by Ms. Nikol Kochmanová, P.Eng., a geotechnical engineer with Golder. Ms. Lisa Coyne, P.Eng., Principal and MTO Foundations Designated Contact for Golder, conducted an independent technical and quality control review of the report.

Golder Associates Ltd.

Nikol Kochmanová, Ph.D., P.Eng., PMP
Geotechnical Engineer

Lisa Coyne, P.Eng.
Principal, MTO Foundations Designated Contact

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PART B

FOUNDATION DESIGN REPORT
BIRCHMOUNT ROAD OVERPASS REHABILITATION (SITE NO. 37-212)
HIGHWAY 401 WESTBOUND CORE AND COLLECTOR LANES, NEILSON ROAD TO WARDEN AVENUE, CITY OF TORONTO, ONTARIO
MTO G.W.P. 2162-11-00

6.0 DISCUSSION AND ENGINEERING RECOMMENDATIONS

6.1 General

This section of the report presents an assessment of the geotechnical resistance of the existing foundations and provides foundation engineering parameters / values and general design considerations for the proposed temporary protection systems required for rehabilitation of the Birchmount Road overpass structure (Site No. 37-212/2 and 37-212/4) as part of the rehabilitation and operational improvements of the Highway 401 westbound core and collector lanes, from Neilson Road to Warden Avenue in the City of Toronto, Ontario.

The discussions are based on interpretation of the factual data obtained from the boreholes advanced during the 1965 and 2018 subsurface investigations. The discussion and geotechnical parameters presented are intended to provide the designers with sufficient information to assess the feasible type(s) of protection systems, and to develop their construction cost estimate. The discussion and recommendations in the Foundation Design Report are intended for the use of the MTO and its design team, and shall not be used or relied upon for any other purpose or by any other parties, including the construction or design-build contractor. The contractor must make their own interpretation based on the factual data in Part A (Foundation Investigation) of the report to develop their temporary protection system designs. Those requiring information on aspects of construction must make their own interpretation of the factual information provided, as such interpretation may affect equipment selection, proposed construction methods, scheduling, and the like.

The existing Birchmount Road overpass consists of two spans, with span lengths of 14.9 m between the abutments and the pier. Based on available 1968 design drawings, the existing westbound core and collector lane abutments and pier are supported on spread footings founded at the elevations summarized below:

Structure	Foundation Element	Footing Width (m)	Founding Elevation (m)
Westbound Core (Segment III on 1968 Design Drawings)	East Abutment	5.6	173.8
	Center Pier	1.8	174.0
	West Abutment	5.6	173.6
Westbound Collector (Segment IV on 1968 Design Drawings)	East Abutment	6.2	173.2 stepping down to 172.5 to north
	Center Pier	1.8	173.1
	West Abutment	6.2	173.0 stepping down to 172.4 to north

The existing abutment footings also contain a shear key, to contribute to lateral/sliding resistance. Based on observations by Golder during the 2018 subsurface investigation, there is no visual evidence of settlement distress to the existing WB overpass structure, nor visual evidence of settlement or instability of the approach embankments.

The proposed bridge rehabilitation involves superstructure replacement including replacement of the approach slab, existing asphalt deck and girders; the rehabilitation will also include semi-integral abutment conversion, with excavation of the existing abutment backfill to a depth of about 3 m (approximately Elevation 180 m) to facilitate this conversion. The Birchmount Road overpass structure is planned to be rehabilitated in four stages, with the collector structure replaced first, followed by the core structure, then followed by the median connection between

the two structures. Temporary protection systems will be required along Highway 401 to facilitate the staged rehabilitation and semi-integral abutment conversion while maintaining traffic along Highway 401. Although the geometry and design of the protection system is the responsibility of the contractor, based on the design drawings provided by WSP, it is anticipated that the temporary protection systems will extend parallel to Highway 401 between the proposed rehabilitation stages.

6.2 Consequence and Site Understanding Classification

In accordance with Section 6.5 of the *Canadian Highway Bridge Design Code* CAN/CSA S6-14 (CHBDC (2014)) and its *Commentary*, the overpass and its foundation system may be classified as having large traffic volumes and their performance as having potential impacts on other transportation corridors, resulting in a "typical consequence level" associated with exceeding limit states design.

Based on the level of foundation investigation completed as part of the 1965 and 2018 investigations in comparison to the degree of site understanding in Section 6.5 of *CHBDC* (2014), the level of confidence for design for the Birchmount Road overpass has been assessed as "typical degree of site and prediction model understanding" based on having two boreholes near each foundation element.

The corresponding consequence factor, Ψ, and geotechnical resistance factors, ϕ_{gu} and ϕ_{gs}, from Tables 6.1 and 6.2 of the *CHBDC* (2014) have been used for the desktop assessment of the geotechnical resistance of the existing foundations below.

6.3 Assessment of Existing Foundations

Based on the 1968 design drawings (Drawings 1 (General Arrangement) and 3 (Footing Layout and Geometry)) for WP No. 256-61, the Birchmount Road overpass is a two-span structure with the abutments and pier supported on spread footings. The design drawings are attached in Appendix E for reference.

The footing width, founding elevation and depth, and founding soils for the existing abutment and pier foundations are summarized in the table below. Based on Golder's interpretation of the available information in the GEOCRES reports, and applying the applicable resistance factors from Tables 6.1 and 6.2 of the *CHBDC* (2014) for a "typical" consequence level and "typical" degree of site understanding, the factored ultimate geotechnical resistance and the factored serviceability geotechnical resistance (for 25 mm of settlement) for the abutment and pier footings are summarized in the table below. These values are based on the founding elevations/depths also provided in the table, based on current grading in the vicinity of the foundation elements.

Foundation Element	Footing Width (m)	Founding Elevation (m)	Approx. Founding Depth (m)*	Founding Soil	Factored Ultimate Geotechnical Resistance (kPa)	Factored Serviceability Geotechnical Resistance (kPa) (for 25 mm of Settlement)
East Abutment	5.6 – 6.2	173.8 – 172.5	2.2 – 3.5	Loose to very dense silty sand to sandy silt till	1,000	350
Center Pier	1.8	174.0 – 173.1	2.0 – 2.9	Dense to very dense silty sand to sandy silt till	800	575

Foundation Element	Footing Width (m)	Founding Elevation (m)	Approx. Founding Depth (m)*	Founding Soil	Factored Ultimate Geotechnical Resistance (kPa)	Factored Serviceability Geotechnical Resistance (kPa) (for 25 mm of Settlement)
West Abutment	5.6 – 6.2	173.6 – 172.4	2.4 – 6.3	Dense to very dense silty sand to sandy silt till	1,000	400

* Based on Birchmount Road grade at approximately Elevation 176 m

The geotechnical resistance values provided above are given for loads applied perpendicular to the surface of the footing. Where the load is not applied perpendicular to the surface of the footing, inclination of the load should be taken into account in accordance with Sections 6.10.4 and C6.10.4 in CHBDC (2014).

The unfactored lateral (sliding) resistance for the existing cast-in-place footings may be taken as 0.65.

6.4 Excavation and Groundwater Control

It is understood that the excavations for the bridge rehabilitation works will extend to about 3 m below the asphalt, to about Elevation 180 m. The proposed excavations will require removal of the asphalt and existing non-cohesive and cohesive fill material. All excavations should be carried out in accordance with the latest edition of the Ontario Occupational Health and Safety Act and Regulations for Construction Projects. The fills are classified as Type 3 soils above the groundwater level, and Type 4 soils if encountered below the groundwater table. Temporary excavations (i.e., those which are open for a relatively short time period) should be made with side slopes no steeper than 1 horizontal to 1 vertical (1H:1V) in Type 3 soil and 3H:1V in Type 4 soils.

During construction, stockpiles/equipment/materials should be located a minimum distance of 1.5 m from the top of the excavation or a distance equal to the depth of the excavation, whichever is greater; stockpile heights should be controlled to prevent surcharging the sides of the excavation and/or overall slope.

The water level was measured in the open boreholes and piezometers at approximately Elevation 168.0 m, which is below the proposed base of excavation. It is anticipated that any seepage from water “perched” within granular fill above cohesive fill layers can be controlled by pumping from properly filtered sump pumps installed within the excavation.

6.5 Temporary Protection Systems

The protection systems should be designed and constructed in accordance with OPSS.PROV 539 *(Temporary Protection Systems).* The lateral movement of the protection systems should meet Performance Level 2 as specified in OPSS.PROV 539.

It is anticipated that a driven interlocking sheet pile system would be suitable and constructible at this site, based on the Standard Penetration Test (SPT) “N”-values measured in the Highway 401 embankment fill as part of the 2018 investigation, although SPT “N”-values above 30 blows per 0.3 m were measured and this may necessitate heavier sheet pile sections to achieve the required penetration depth and minimize damage to the steel sections. A soldier pile and lagging system is also feasible.

The sheet piles or soldier piles will need to extend/be socketed to a sufficient depth below the base of the excavation, within the highway embankment fill, to provide the necessary passive resistance for the retained soil height, plus any surcharge loads behind the protection system. Lateral support to the sheet pile wall or soldier pile wall could be provided in the form of rakers or temporary anchors, if and as required.

While the selection and design of the protection system will be the responsibility of the contractor, the following information is provided to MTO and its designers to aid in assessment of a temporary protection system and its approximate construction cost.

Soil Type	Unit Weight (γ, kN/m^3)	Internal Angle of Friction (Φ, degrees)	Coefficient of Lateral Earth Pressure[1]		
			Active K_a	At Rest K_o	Passive K_p[2]
Existing compact to very dense gravelly sand to sand and gravel to silt and sand fill	19	34	0.28	0.44	3.54
Existing stiff to hard clayey silt to sandy clayey silt fill	19	30	0.33	0.5	3.0
Stiff to very stiff clayey silt till / Compact silt and sand till	21	32	0.31	0.47	3.25
Very stiff to hard clayey silt till / Dense to very dense silt and sand till	21	34	0.28	0.44	3.54

1. The earth pressure coefficients noted above are based on a horizontal surface adjacent to the excavation. If sloped surfaces are present behind the temporary protection system, the coefficient of earth pressure should be adjusted accordingly.
2. The total passive resistance below the base of the excavation (i.e., adjacent to the protection system) may be calculated based on the values of K_p indicated above but reduced by an appropriate factor that considers the allowable wall movement in accordance with Figure C6.16 of the CHBDC (2014) to account for the fact that a large strain would be required for mobilization of the full passive resistance.

It should be noted that the pressure distributions resulting from the above parameter values are the minimum for the ultimate stress condition. A stiffer design may be required to maintain displacements within an acceptable range.

Depending on the time of year, there may be perched water in the non-cohesive fill materials, above the cohesive fill. If perched groundwater is present, it is expected to be relatively limited; however, it would likely be necessary to control seepage or include measures to mitigate loss of soil particles through lagging boards if a soldier pile and lagging system is employed.

Consideration could be given to either partial or full removal of the protection system upon completion of construction or each stage of construction (as required). Where possible, full removal of the protection system should be considered to mitigate potential impediments to future rehabilitation/reconstruction work at the overpass site, or to the road structure above. If the temporary protection system is left in place, it should be cut off at or below

frost depth, not less than 1.2 m below the pavement surface. An NSSP is included in Appendix F that addresses the removal or cut-off of the protection system, for inclusion in the Contract Documents.

6.6 Obstructions

The fill material may contain cobbles, boulders or rubble-type materials. The type and depth of potential obstructions, as inferred from auger grinding and/or split spoon advancement, are described in the Foundation Investigation Report (Part A of this report). It is recommended that a Notice to Contractor be included in the Contract Documents to warn the Contractor of the possible presence of cobbles and/or boulders within the overburden soils; a Notice to Contractor is provided in Appendix F.

7.0 CLOSURE

This Foundation Design Report was prepared by Ms. Nikol Kochmanová, P.Eng., a geotechnical engineer with Golder. Ms. Lisa Coyne, P.Eng., a Principal and MTO Foundations Designated Contact of Golder, conducted an independent technical and quality control review of the report.

Golder Associates Ltd.

Nikol Kochmanová, Ph.D., P.Eng., PMP
Geotechnical Engineer

Lisa Coyne, P.Eng.
Principal, MTO Foundations Designated Contact

NK/JMAC/LCC/rb

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https://golderassociates.sharepoint.com/sites/16003g/6. deliverables/1. birchmount road/4. final/1669995 fidr01 2019jan16 hwy 401wb birchmount rd overpass.docx

REFERENCES

Canadian Geotechnical Society. 2006. *Canadian Foundation Engineering Manual (CFEM)*, 4th Edition. The Canadian Geotechnical Society, BiTech Publisher Ltd., British Columbia.

Canadian Standards Association (CSA). 2014. *Canadian Highway Bridge Design Code and Commentary on CAN/CSA-S6-14*. CSA Special Publication.

Chapman, L.J. and Putnam, D.F. 1984. *The Physiography of Southern Ontario, Ontario Geological Survey*, Special Volume 2, Third Edition. Accompanied by Map P.2715, Scale 1:600,000.

ASTM International:

ASTM D1586 Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils

Ontario Provincial Standard Specification:

OPSS.PROV 539 Construction Specification for Temporary Protection Systems

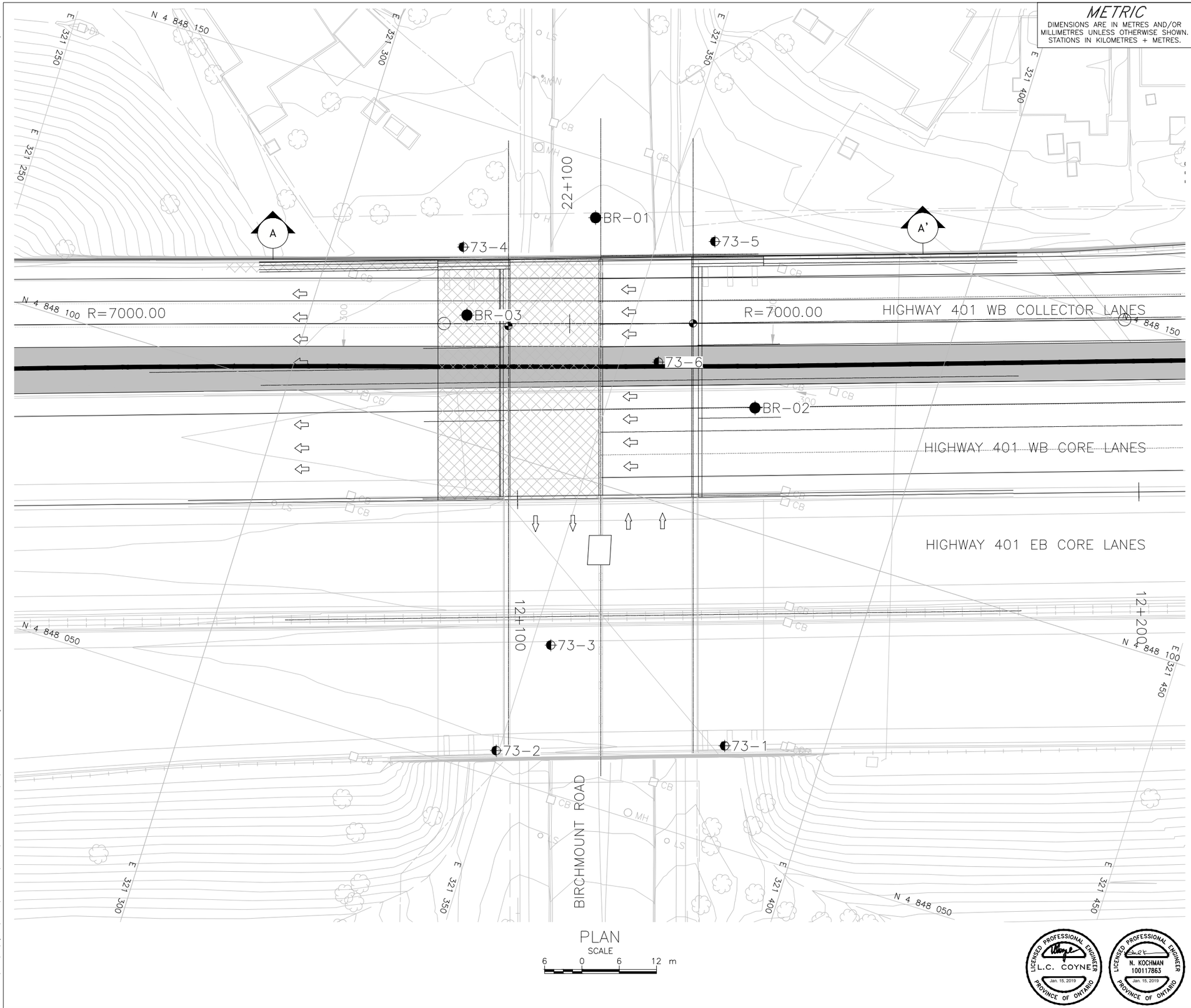
Ontario Water Resources Act:

Ontario Regulation 903 Wells (as amended)

Ontario Occupational Health and Safety Act:

Ontario Regulation 213/91 Construction Projects (as amended)

MINISTRY OF TRANSPORTATION, ONTARIO



PLAN
SCALE
6 0 6 12 m

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

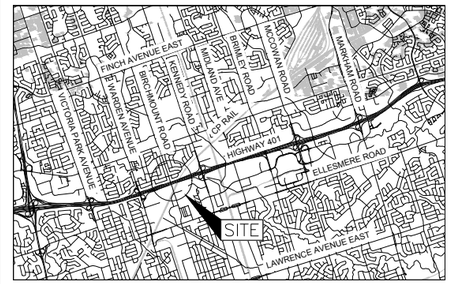
CONT No.
GWP No. 2162-11-00

BIRCHMOUNT ROAD OVERPASS
HIGHWAY 401 WESTBOUND CORE AND COLLECTORS

BOREHOLE LOCATIONS

SHEET

GOLDER



KEY PLAN
SCALE
1.5 0 1.5 3 km

LEGEND

- Borehole – 2018 Investigation
- Borehole – 1965 Investigation (GEOCRES No. 30M14-73)

BOREHOLE CO-ORDINATES (MTM NAD 83 ZONE 10)

No.	ELEVATION	NORTHING	EASTING
73-1	176.5	4848065.7	321384.5
73-2	175.9	4848054.1	321349.6
73-3	176.8	4848072.9	321353.0
73-4	175.0	4848129.9	321320.5
73-5	174.3	4848142.8	321358.9
73-6	175.0	4848121.5	321356.0
BR-01	174.7	4848140.7	321339.4
BR-02	185.7	4848119.1	321373.0
BR-03	185.6	4848119.6	321324.3

NOTES

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

The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

REFERENCE

Base plan provided in digital format by WSP, drawings files no. H17M-01449-00_XA01.dwg, No.H17M-01449-00_XB01.dwg and H17M-01449-00_XY01.dwg, received October 26, 2017.
Design Layout provided in digital format by WSP, drawing file no. H17M-01449-00_XN01.dwg, received November 28, 2017.
General Arrangement provided in digital format by WSP, drawings files no. 17M-01449-00-303-001GA.dwg, received June 5, 2018.
Existing ground provided in digital format by WSP, drawing file no. Contours Sept. 12, 2019.dwg, received September 12, 2018.

LICENSED PROFESSIONAL ENGINEER L.C. COYNER Jan. 15, 2019 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER N. KOCHMAN 100117863 Jan. 15, 2019 PROVINCE OF ONTARIO

NO.	DATE	BY	REVISION
.	.	.	.

Geocres No. 30M14-492

HWY. 401	PROJECT NO. 1669995		DIST.
SUBM'D. NK	CHKD. NK/JMAC	DATE: 01/15/2019	SITE: 37-212
DRAWN: DD	CHKD. LCC	APPD. LCC	DWG. 1

PLOT DATE: January 16, 2019
FILENAME: S:\Clients\MTO\Hwy_401\99_PROJ\1669995_RBS_MO_PROD\0003_Birchmount_Rd_Overpass\1669995-0003-BS-0001.dwg

MINISTRY OF TRANSPORTATION, ONTARIO

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

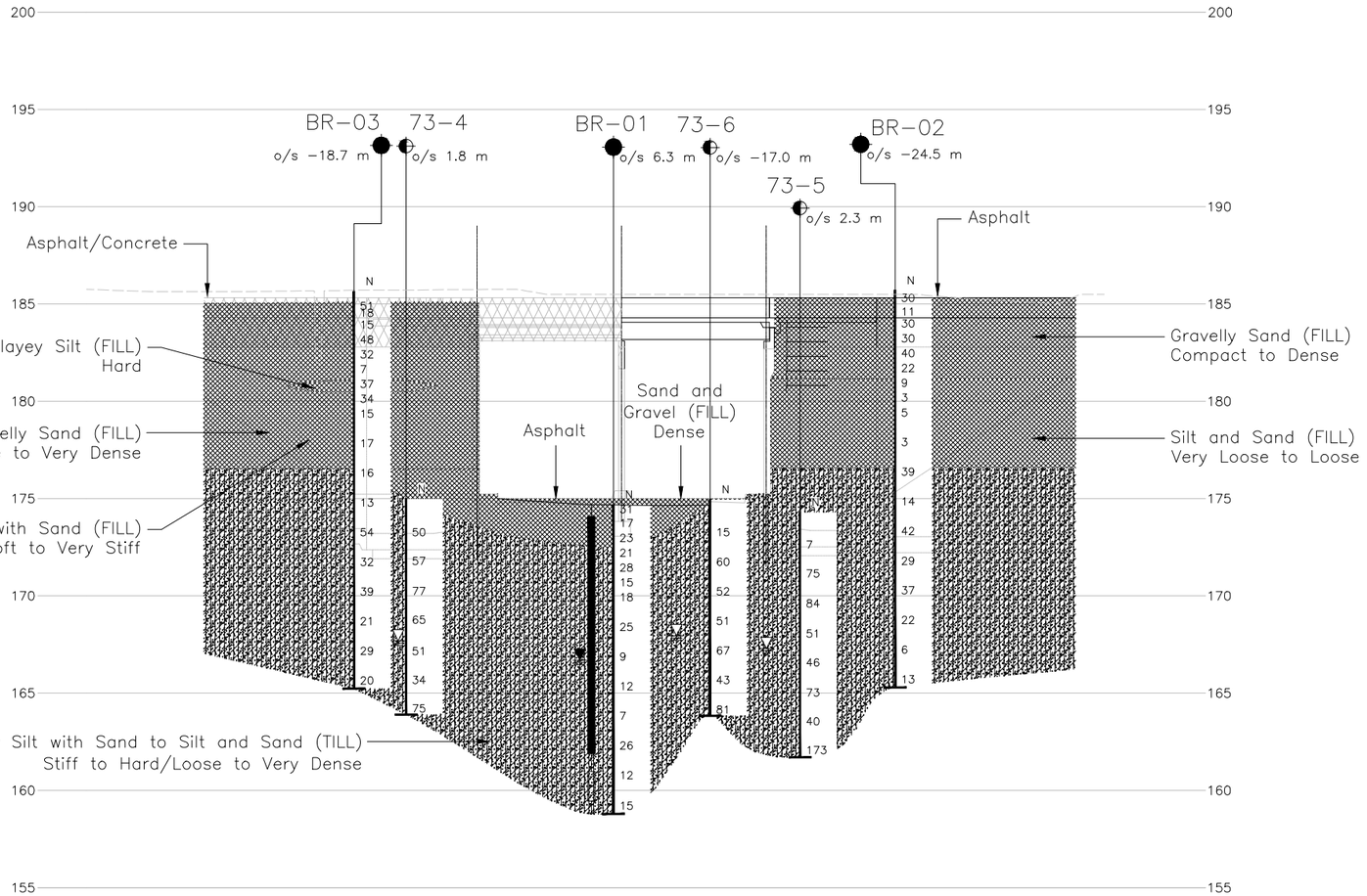
CONT No.
GWP No. 2162-11-00

BIRCHMOUNT ROAD OVERPASS
HIGHWAY 401 WESTBOUND CORE AND COLLECTORS

SOIL STRATA

SHEET

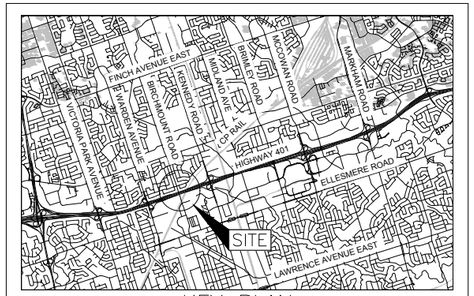
GOLDER



PROFILE A – A'

HORIZONTAL SCALE
6 0 6 12 m

VERTICAL SCALE
3 0 3 6 m



KEY PLAN
SCALE
1.5 0 1.5 3 km

LEGEND

- Borehole – 2018 Investigation
- Borehole – 1965 Investigation (GEOCRES No. 30M14-73)
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- WL in piezometer, measured October 4, 2018
- WL upon completion of drilling

BOREHOLE CO-ORDINATES (MTM NAD 83 ZONE 10)

No.	ELEVATION	NORTHING	EASTING
73-1	176.5	4848065.7	321384.5
73-2	175.9	4848054.1	321349.6
73-3	176.8	4848072.9	321353.0
73-4	175.0	4848129.9	321320.5
73-5	174.3	4848142.8	321358.9
73-6	175.0	4848121.5	321356.0
BR-01	174.7	4848140.7	321339.4
BR-02	185.7	4848119.1	321373.0
BR-03	185.6	4848119.6	321324.3

NOTES

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

The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

REFERENCE

Base plan provided in digital format by WSP, drawings files no. H17M-01449-00_XA01.dwg, No.H17M-01449-00_XB01.dwg and H17M-01449-00_XY01.dwg, received October 26, 2017.
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General Arrangement provided in digital format by WSP, drawings files no. 17M-01449-00-303-001GA.dwg, received June 5, 2018.
Existing ground provided in digital format by WSP, drawing file no. Contours Sept. 12, 2019.dwg, received September 12, 2018.

LICENSED PROFESSIONAL ENGINEER L.L.C. COYNER Jan. 15, 2019 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER N. KOCHMAN 100117863 Jan. 15, 2019 PROVINCE OF ONTARIO

NO.	DATE	BY	REVISION
.	.	.	.

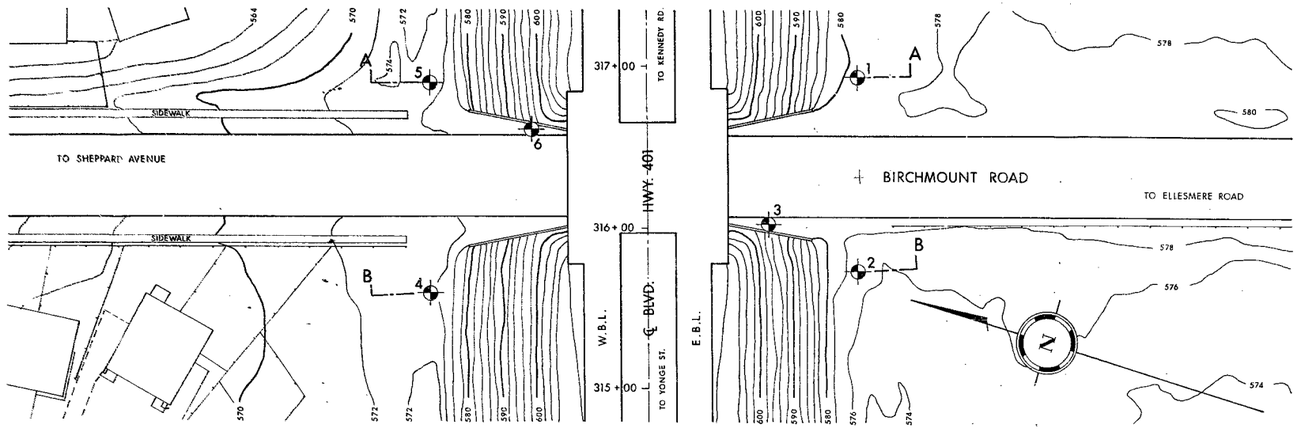
Geocres No. 30M14-492

HWY. 401	PROJECT NO. 1669995		DIST.
SUBM'D. NK	CHKD. NK/JMAC	DATE: 01/15/2019	SITE: 37-212
DRAWN: DD	CHKD. LCC	APPD. LCC	DWG. 2

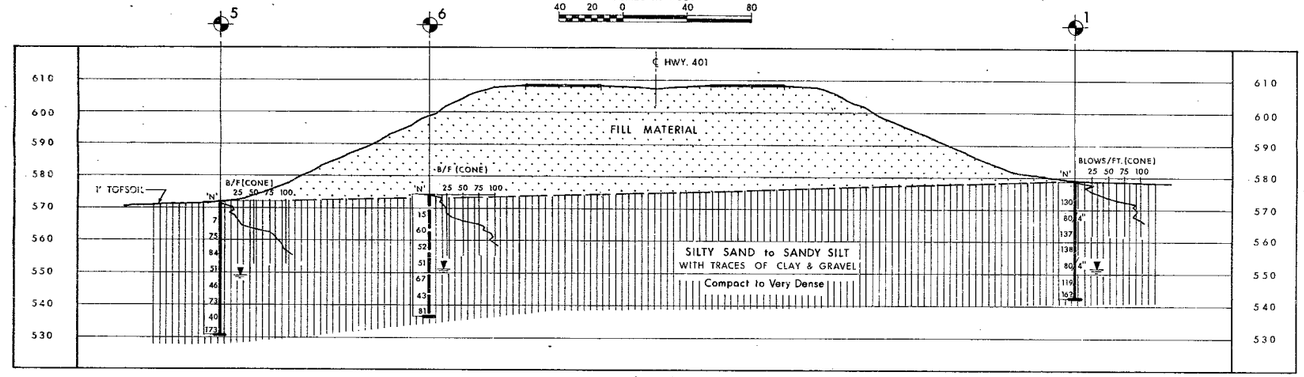
PLOT DATE: January 16, 2019
FILENAME: S:\Clients\MTO\Hwy_401\99_PROJ\1669995_RBS_MD_PROD\0003_Birchmount_Rd_Overpass\1669995-0003-BS-0002.dwg

APPENDIX A

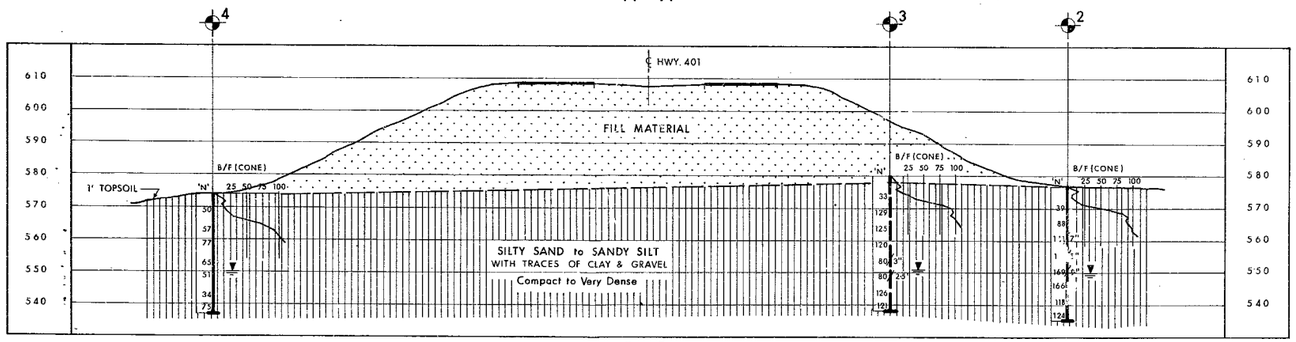
Borehole Records from 1965 Investigation (GEOCRES No. 30M14-73)



PLAN
SCALE IN FEET
40 20 0 40 80

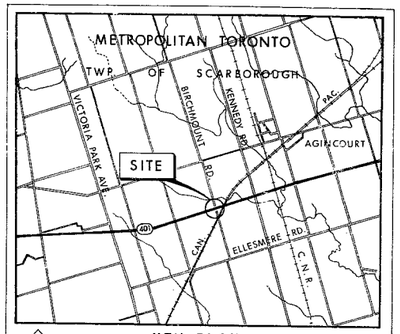


A – A



B – B

SECTIONS
SCALE IN FEET
20 10 0 20 40



LEGEND

- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- Water Levels established at time of field investigation. (MAY 1965)

NO.	ELEVATION	STATION	OFFSET
1	579·0	316 + 92	130' RT.
2	577·0	315 + 72	130' RT.
3	580·0	316 + 02	75' RT.
4	574·0	315 + 60	135' LT.
5	572·0	316 + 92	135' LT.
6	574·0	316 + 61	70' LT.

– NOTE –

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

PRINT RECORD		
NO	FOR	DATE

REVISIONS		
DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS – ONTARIO
MATERIALS & TESTING DIVISION – FOUNDATION SECTION

BIRCHMOUNT ROAD

KING'S HIGHWAY NO. 401 DIST. NO. 6
CO. YORK METRO TORONTO
TWP. SCARBOROUGH LOT 30 & 31 CON. II

BORE HOLE LOCATIONS & SOIL STRATA

SUBM'D. W. K.	CHECKED G.S.	W.P. NO. 256-61	M.B.T. DRAWING NO.
DRAWN I. M.	CHECKED H.R.	JOB NO. 65-F-49	65-F-49A
DATE 3 SEPT. 1965		SITE NO	BRIDGE DRAWING NO.
APPROVED A. Rutherman PRINCIPAL FOUNDATION ENGINEER		CONT. NO.	

FORM 08-MT-126 (FORMERLY 08-ML-126)
65-1831

OFFICE REPORT ON SOIL EXPLORATION

BH 73-1

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

JOB 65-F-49 LOCATION Hwy. #401 & Birchmount Rd Hwy #401 Ch 316+92 130'-0" Rt ORIGINATED BY W.W.K.
W.P 256-61 BORING DATE May 12, 1965. COMPILED BY W.W.K.
DATUM 579.0 BOREHOLE TYPE Penndrill 4" Auger. CHECKED BY K.G.S.

(W)	ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE
176.5	579.0	Groundlevel					
176.2	578.0	Black Org. Topsoil					
0.3	1.0						
		Silty sand to sandy silt with traces of clay and gravel.		1	SS	130	
				2	SS	80	570
		Compact to very dense.			for 4"		
				3	SS	137	
				4	SS	138	560
				5	SS	80	
					for 4"		
				6	SS	119	550
165.4	542.5			7	SS	162	
11.1	36.5	End of borehole.					540

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT 20 40 60 80 100
SHEAR STRENGTH P.S.F.

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
w_P w w_L
WATER CONTENT % 5 10 15

BULK DENSITY γ P.C.F.

REMARKS

W.L. El. 551.5 Observed in Borehole.

FORM OB-MT-126 (FORMERLY OB-ML-126)
65-1031

OFFICE REPORT ON SOIL EXPLORATION

BH 73-2

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

JOB 65-F-49 LOCATION Hwy. #401 Birchmount Rd Hwy #401 Ch 315+72 130'-0" Rt. ORIGINATED BY W.W.K.
W.P. 256-01 BORING DATE May 12, 1965. COMPILED BY W.W.K.
DATUM 572.0 BORE HOLE TYPE Penndrill 4" Auger CHECKED BY

(m) ELEV.	DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE
175.9	572.0	Groundlevel					
175.6	572.0	Black org. topsoil					
0.3	1.0						
		Silty sand to sandy silt with traces of clay and gravel.		1	SS	39	
							570
		Compact to very dense.		2	SS	88	
				3	SS	141	
					for	7"	560
				4	SS	101	
					for	5"	
				5	SS	169	
					for	9"	550
				6	SS	166	
				7	SS	118	
							540
163.7	535.5			8	SS	124	
12.6	41.5	End of borehole.					530

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT — 20 40 60 80 100
SHEAR STRENGTH P.S.F.

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
w_P w w_L
WATER CONTENT % 5 10 15

BULK DENSITY γ P.C.F.

REMARKS

W.L. El. ▼ 550.0
Observed in Borehole.

FORM DB-MT-126 (FORMERLY DB-ML-126)
65-1931

OFFICE REPORT ON SOIL EXPLORATION

BH 73-3

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 3

FOUNDATION SECTION

JOB 65-F-49 LOCATION Hwy #401 & Birchmount Rd Hwy #401 Ch 316+02 75'-0" Rt. ORIGINATED BY W.W.K.

W.P. 256-61 BORING DATE May 12 & 13, 1965. COMPILED BY W.W.K.

DATUM 580.0 BOREHOLE TYPE Penndrill 4" Auger. CHECKED BY

(W)	ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE
176.8	580.0	Groundlevel					
176.3	578.5	Sand, gravel - Fill					
0.5	1.5						
				1	SS	33	
		Silty sand to sandy silt with traces of clay and gravel.		2	SS	129	570
				3	SS	125	
		Compact to very dense.		4	SS	120	560
				5	SS	80 for 3"	
				6	SS	80 for 2½"	550
				7	SS	126	
164.1	538.5			8	SS	121	540
12.6	41.5	End of borehole.					

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT
20 40 60 80 100
SHEAR STRENGTH P.S.F.

LIQUID LIMIT ——— W_L
PLASTIC LIMIT ——— W_P
WATER CONTENT ——— W
W_P W W_L
WATER CONTENT %
5 10 15

BULK DENSITY
γ
P.C.F

REMARKS

W.L. El. 551.0
Observed in Borehole.

FORM OB-MT-126 (FORMERLY OB-ML-126)
65-1831

OFFICE REPORT ON SOIL EXPLORATION

BH 73-4

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 4

FOUNDATION SECTION

JOB 65-F-49 LOCATION Hwy #401 & Richmond Rd Hwy #401 Ch 315+60 135'-0" Lt. ORIGINATED BY W.W.K.
W.P. 256-61 BORING DATE May 13, 1965. COMPILED BY W.W.K.
DATUM 574.0 BOREHOLE TYPE Penndrill 4" Auger. CHECKED BY

(W)	ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS / FOOT	ELEV SCALE
115.0	574.0	Groundlevel					
114.7	573.0	Black org. topsoil					
0.3	1.0						570
		Silty sand to sandy silt with traces of clay and gravel. Compact to very dense.		1	SS	50	
				2	SS	57	560
				3	SS	77	
				4	SS	65	
				5	SS	51	550
				6	SS	34	
				7	SS	75	540
163.8	537.5						
11.1	36.5	End of borehole.					530

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT — 20 40 60 80 100
SHEAR STRENGTH P.S.F.

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_p
WATER CONTENT —— w
w_p w w_L
WATER CONTENT % 5 10 15

BULK DENSITY γ P.C.F.

REMARKS

W.L. El. 550.0 Observed in Borehole.

FORM DB-MT-126 (FORMERLY DB-ML-126)
65-1831

OFFICE REPORT ON SOIL EXPLORATION

BH 73-5

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 5

FOUNDATION SECTION

JOB 65-F-49 LOCATION Hwy #401 & Birchmount Rd Hwy #401 Ch 316+92 135'-0" Lt ORIGINATED BY W.W.K.
W.P. 256-61 BORING DATE May 14, 1965. COMPILED BY W.W.K.
DATUM 572.0 BOREHOLE TYPE Penndrill 4" Auger. CHECKED BY

(M) ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE
174.3 572.0	Groundlevel					
174.0 571.0	Black org. topsoil					
0.3 1.0	Silty sand to sandy silt with traces of clay and gravel. Compact to very dense.		1	SS	7	570
			2	SS	75	560
			3	SS	84	
			4	SS	51	550
			5	SS	46	
			6	SS	73	540
			7	SS	40	
161.7 530.5			8	SS	173	530
12.6 41.5	End of borehole.					

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100
SHEAR STRENGTH P.S.F.

LIQUID LIMIT — w_L
PLASTIC LIMIT — w_P
WATER CONTENT — w
w_P w w_L
WATER CONTENT % 5 10 15

BULK DENSITY γ P.C.F.

REMARKS

W.L. El. ▼ 549.0
Observed in Borehole.

FORM DB-MT-126 (FORMERLY DB-ML-126)
65-1831

OFFICE REPORT ON SOIL EXPLORATION

BH 73-6

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 6

FOUNDATION SECTION

JOB 65-F-49 LOCATION Hwy #401 & Birchmount Rd hwy #401 Ch 316+61 70'-0" Lt ORIGINATED BY W.W.K.
W.P. 250-01 BORING DATE May 14, 1965. COMPILED BY W.W.K.
DATUM 574.0 BOREHOLE TYPE Penndrill 4" Auger CHECKED BY

(W)	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.	LIQUID LIMIT W_L / PLASTIC LIMIT W_P / WATER CONTENT W — W_P W W_L — WATER CONTENT % 5 10 15	BULK DENSITY γ P.C.F.	REMARKS
175.0	574.0	Groundlevel									
174.7	573.0	Sand, Gravel-Fill									
0.3	1.0						570				
		Silty sand to sandy silt with traces of clay and gravel. Compact to very dense.		1	SS	15					
				2	SS	60	560				
				3	SS	52					
				4	SS	51					W.L. El. ▼ 551.0
				5	SS	67	550				Observed in Casing.
				6	SS	43					
							540				
163.8	537.5			7	SS	81					
11.1	36.5	End of borehole.									
							530				

APPENDIX B

Borehole Records from 2018 Investigation

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
FoS	factor of safety

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

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
DS	Denison type sample
FS	Foil sample
RC	Rock core
SC	Soil core
SS	Split-spoon
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) Non-Cohesive (Cohesionless) Soils

Compactness Condition	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

Per cent 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 (non-cohesive (cohesionless)) or With (cohesive)	Sand and Gravel Silty Clay with sand / Clayey Silt with sand

GOLDER

RECORD OF BOREHOLE No BR-01

SHEET 1 OF 2

METRIC

PROJECT 1669995

G.W.P. 2161-11-00

LOCATION N 4848140.7; E 321339.4 MTM NAD 83 ZONE 10 (LAT. 43.773051; LONG. -79.294553)

ORIGINATED BY DS

DIST Central HWY 401

BOREHOLE TYPE CME 75 Truck-Mounted Drill Rig, 203 mm O.D. Hollow Stem Augers

COMPILED BY SE

DATUM Geodetic

DATE May 30, 2018

CHECKED BY NK/LCC

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
174.7	GROUND SURFACE								
0.0 / 0.1	ASPHALT (50 mm)								
	Sand and gravel (FILL) Dense Brown Moist		1	SS	31				
174.0 / 0.7	Clayey silt with sand, trace to some gravel (FILL) Very stiff Brown Moist		2	SS	17				
			3	SS	23				3 39 42 16
172.5 / 2.2	SILT and SAND, trace to some clay, trace to some gravel (TILL) Loose to compact Grey Moist to wet below 10.7 m		4	SS	21				
			5	SS	28				
			6	SS	15				
			7	SS	18				3 41 43 13
			8	SS	25				
			9	SS	9	▼			
			10	SS	12				12 45 36 7
			11	SS	7				
			12	SS	26				
			13	SS	12				

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

ELEVATION SCALE: 174 173 172 171 170 169 168 167 166 165 164 163 162 161 160

Continued Next Page

+3, ×3: Numbers refer to Sensitivity

○3% STRAIN AT FAILURE

RECORD OF BOREHOLE No BR-01

SHEET 2 OF 2

METRIC

PROJECT 1669995

G.W.P. 2161-11-00

LOCATION N 4848140.7; E 321339.4 MTM NAD 83 ZONE 10 (LAT. 43.773051; LONG. -79.294553)

ORIGINATED BY DS

DIST Central HWY 401

BOREHOLE TYPE CME 75 Truck-Mounted Drill Rig, 203 mm O.D. Hollow Stem Augers

COMPILED BY SE

DATUM Geodetic

DATE May 30, 2018

CHECKED BY NK/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	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	--- CONTINUED FROM PREVIOUS PAGE ---										
158.8	SILT and SAND, trace to some clay, trace to some gravel (TILL) Loose to compact Grey Moist to wet below 10.7 m		14	SS	15		159				3 47 42 8
15.9	END OF BOREHOLE										

NOTES:

1. Water level in piezometer measured at a depth of 9.8 m below ground surface (Elev. 164.9 m) on completion of installation.

2. Water level measured in piezometer as follows:

Date	Depth (m)	Elev. (m)
10/04/18	8.0	166.7

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

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

WATER CONTENT (%): 10 20 30

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

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

GOLDER

RECORD OF BOREHOLE No BR-02

SHEET 1 OF 2

METRIC

PROJECT 1669995

G.W.P. 2161-11-00

LOCATION N 4848119.1; E 321373.0 MTM NAD 83 ZONE 10 (LAT. 43.772900; LONG. -79.294110)

ORIGINATED BY AB

DIST Central HWY 401

BOREHOLE TYPE CME 75 Truck-Mounted Drill Rig, 165 mm O.D. Hollow Stem Augers

COMPILED BY KAW

DATUM Geodetic

DATE February 21 and 22, 2018

CHECKED BY NK/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
185.7	GROUND SURFACE										
0.0	ASPHALT (203 mm)										
0.2	Gravelly sand, some silt, trace clay (FILL) Compact to dense Brown Moist		1	SS	30		185				
			2	SS	11						
			3	SS	30		184		○		
			4	SS	30		183		○		26 53 17 4
			5	SS	40						
			6	SS	22		182		○		
181.1											
4.6	Silt and sand, trace clay, trace gravel (FILL) Very loose to loose Brown to grey Moist to wet		7	SS	9		181				
			8	SS	3		180				
			9	SS	5				○		2 56 39 3
							179				
			10	SS	3		178		○		
	- Grinding on inferred cobble at a depth of approximately 8.8 m										
176.6							177				
9.1	CLAYEY SILT with SAND, trace gravel (TILL) Very stiff to hard Brown Moist to wet		11	SS	39		176				
			12	SS	14		175				
							174				
			13	SS	42		173		⊖		2 47 39 12
	- Grinding on inferred cobble at a depth of approximately 13.1 m										
			14	SS	29		172		○		
	- Grinding on inferred cobble at a depth of approximately 14.3 m						171				

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

○ 3% STRAIN AT FAILURE

GOLDER

RECORD OF BOREHOLE No BR-02

SHEET 2 OF 2 **METRIC**

PROJECT 1669995
G.W.P. 2161-11-00
DIST Central HWY 401
DATUM Geodetic

LOCATION N 4848119.1; E 321373.0 MTM NAD 83 ZONE 10 (LAT. 43.772900; LONG. -79.294110)
BOREHOLE TYPE CME 75 Truck-Mounted Drill Rig, 165 mm O.D. Hollow Stem Augers
DATE February 21 and 22, 2018

ORIGINATED BY AB
COMPILED BY KAW
CHECKED BY NK/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 ---										
	CLAYEY SILT with SAND, trace gravel (TILL) Very stiff to hard Brown Moist to wet		15	SS	37		170				
168.9							169				
16.8	SILT and SAND, trace to some clay, trace to some gravel (TILL) Loose to compact Grey Moist to wet		16	SS	22				○	NP	5 49 38 8
			17	SS	6		168				
							167				
							166				
165.3			18	SS	13				○		
20.4	END OF BOREHOLE NOTES: 1. Borehole caved to a depth of approximately 17.1 m upon removal of augers. 2. Open borehole dry above a depth of 17.1 m (Elev. 168.6 m) upon completion of drilling.										

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

GOLDER

PROJECT 1669995

RECORD OF BOREHOLE No BR-03

SHEET 1 OF 2

METRIC

G.W.P. 2161-11-00 LOCATION N 4848109.6; E 321324.3 MTM NAD 83 ZONE 10 (LAT. 43.772811; LONG. -79.294796) ORIGINATED BY AB

DIST Central HWY 401 BOREHOLE TYPE CME 75 Truck-Mounted Drill Rig, 165 mm O.D. Hollow Stem Augers COMPILED BY KAW

DATUM Geodetic DATE February 14, 2018 CHECKED BY NK/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
185.6	GROUND SURFACE										
0.0 / 185.0	ASPHALT/CONCRETE (559 mm)										
0.6	Gravelly sand, trace to some silt, trace clay (FILL) Loose to very dense Brown Moist		1	SS	51		185				
			2	SS	18				○		27 60 10 3
			3	SS	15		184		○		
	- Grinding on inferred cobble at a depth of approximately 2.3 m and between depths of approximately 3.0 m and 3.8 m		4	SS	48		183				
			5	SS	32				○		
			6	SS	7		182				
181.0											
4.6 / 180.4	Sandy clayey silt, trace gravel (FILL) Hard Brown Moist to wet		7	SS	37		181				
5.2	Gravelly sand, some silt, trace clay (FILL) Compact to dense Brown		8	SS	34		180		○		26 53 17 4
179.2	Moist to wet		9A / 9B	SS	15				○		
6.4	Clayey silt with sand, trace to some gravel (FILL) Stiff to very stiff Brown Moist						179				
			10	SS	17		178				
176.5							177				
9.1	CLAYEY SILT with SAND, trace to some gravel (TILL) Stiff to hard Frey Moist to wet below 16.8 m		11	SS	16		176		⊢○⊣		5 36 46 13
	- Trace organics at a depth of approximately 9.1 m to 10.7 m		12	SS	13		175				
	- 100 mm to 150 mm diameter cobbles encountered between depths of approximately 11.3 m and 12.2 m		13A / 13B	SS	54		174				
							173		⊢○⊣		12 36 39 13
	- Grinding on inferred cobble at a depth of approximately 13.1 m						172				
			14	SS	32						
							171				

Continued Next Page

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

GOLDER

RECORD OF BOREHOLE No BR-03

SHEET 2 OF 2

METRIC

PROJECT 1669995

G.W.P. 2161-11-00

LOCATION N 4848109.6; E 321324.3 MTM NAD 83 ZONE 10 (LAT. 43.772811; LONG. -79.294796)

ORIGINATED BY AB

DIST Central HWY 401

BOREHOLE TYPE CME 75 Truck-Mounted Drill Rig, 165 mm O.D. Hollow Stem Augers

COMPILED BY KAW

DATUM Geodetic

DATE February 14, 2018

CHECKED BY NK/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 ---										
	CLAYEY SILT with SAND, trace to some gravel (TILL) Stiff to hard Frey Moist to wet below 16.8 m		15	SS	39		170				13 34 40 13
			16	SS	21		169				
167.3							168				
18.3	SILT and SAND, trace to some gravel, trace to some clay (TILL) Compact Grey-brown Wet		17	SS	29		167				
165.2			18	SS	20		166				
20.4	END OF BOREHOLE NOTES: 1. Borehole caved to a depth of approximately 18.3 m upon removal of augers. 2. Open borehole dry above a depth of 18.3 m (Elev. 167.4 m) depth upon completion of drilling.										

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

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

GTA-MTO 001 S:\CLIENTS\MTO\HWY_401\02_DATA\GINT\HWY_401.GPJ GAL-GTA.GDT 01/16/19

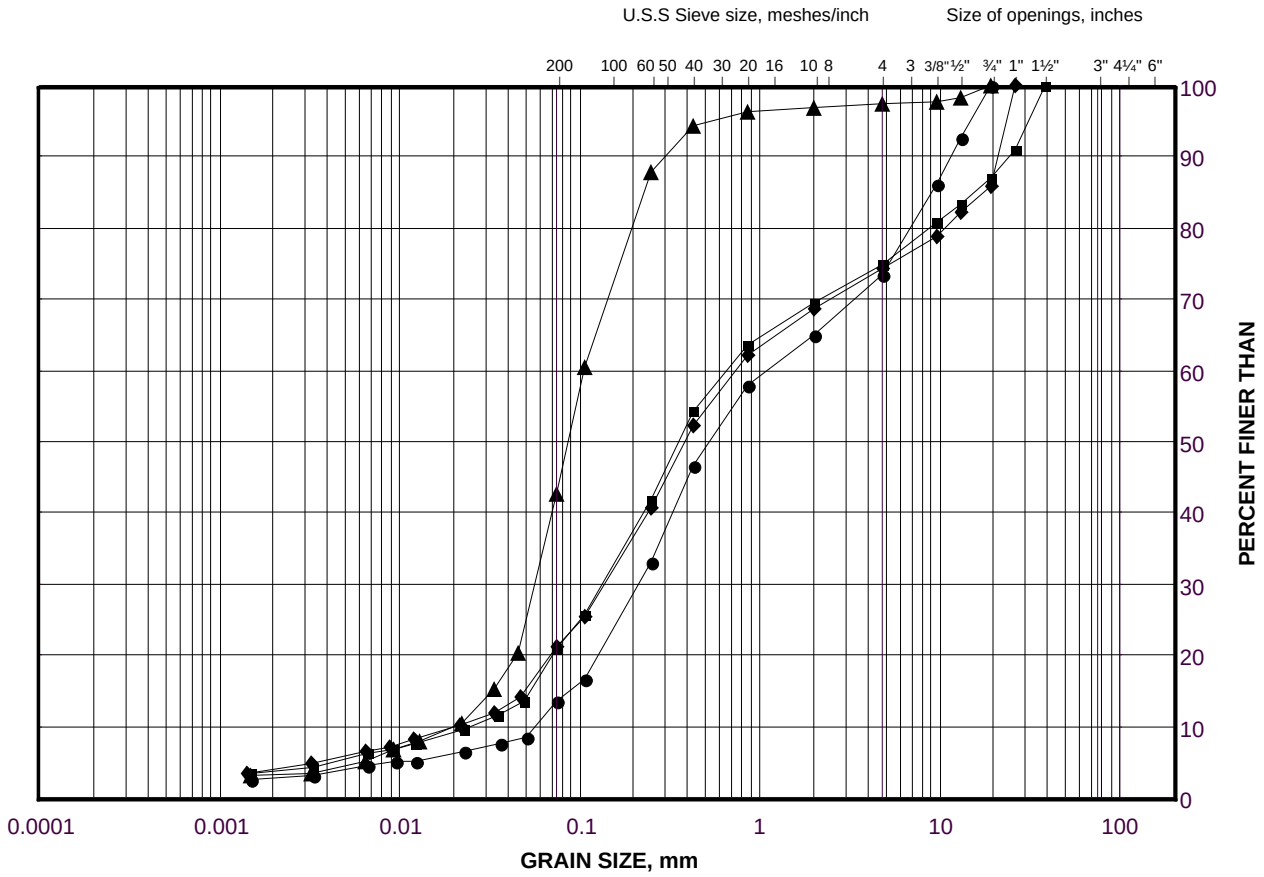
APPENDIX C

Geotechnical Laboratory Test Results

GRAIN SIZE DISTRIBUTION

Silt and Sand / Gravelly Sand (Fill)

FIGURE C-1



LEGEND

SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	BR-03	2	184.5
■	BR-02	4	183.1
◆	BR-03	8	180.0
▲	BR-02	9	179.3

Project Number: 1669995

Checked By: NK

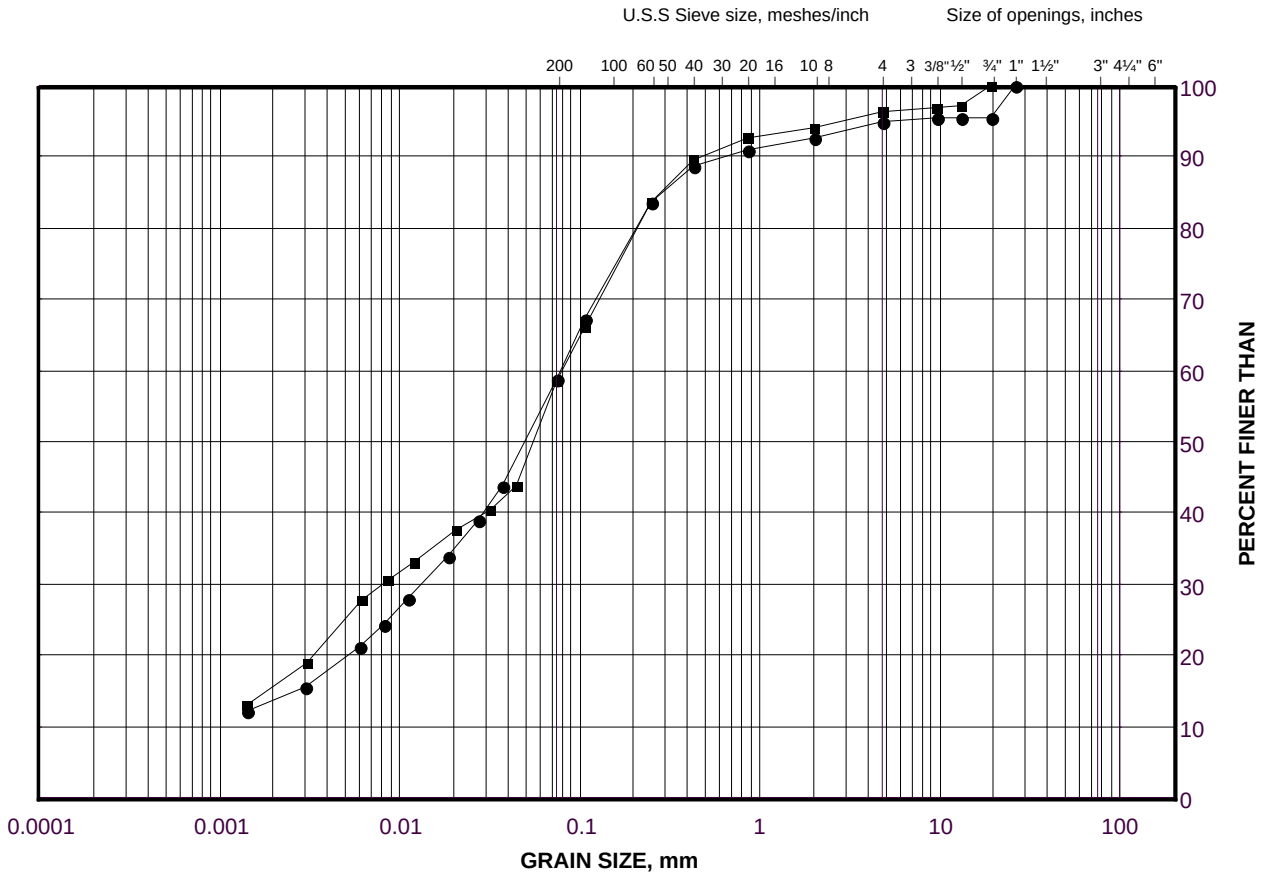
Golder Associates

Date: 08-Aug-18

GRAIN SIZE DISTRIBUTION

Clayey Silt with Sand (Fill)

FIGURE C-2



LEGEND

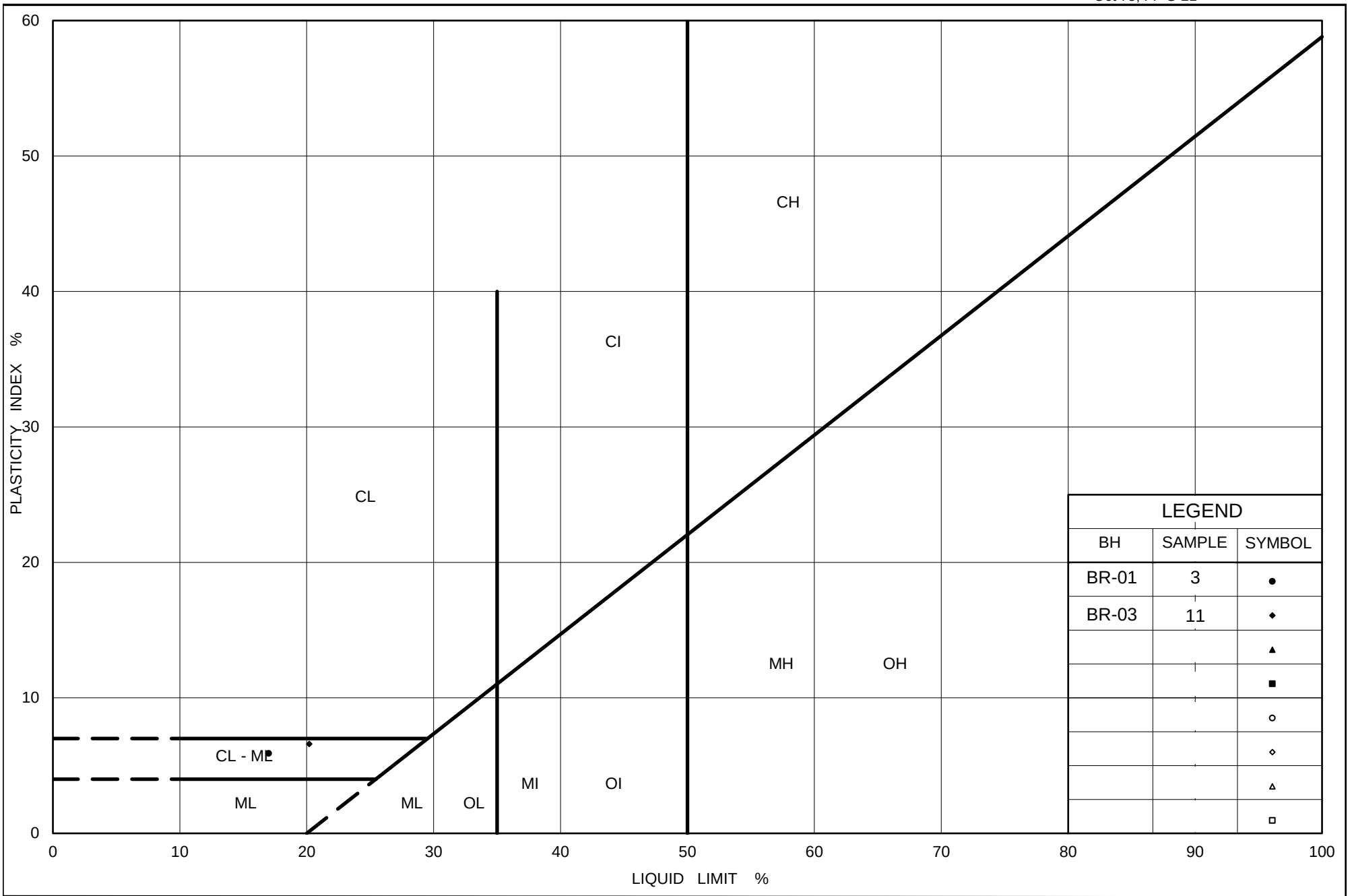
SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	BR-03	11	176.2
■	BR-01	3	172.9

Project Number: 1669995

Checked By: NK

Golder Associates

Date: 08-Aug-18



Ministry of Transportation

Ontario

PLASTICITY CHART
Clayey Silt with Sand (Fill)

Figure No. C-3

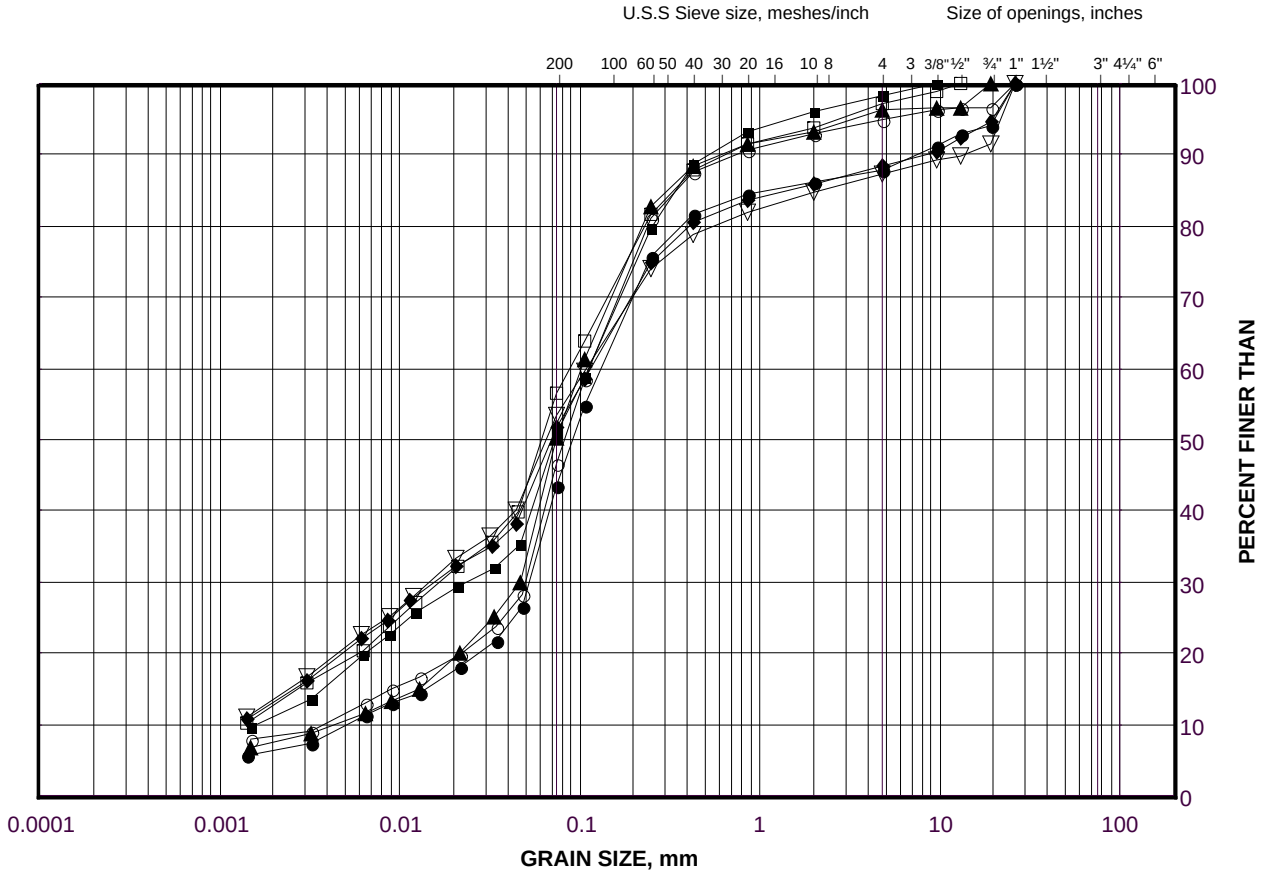
Project No. 1669995

Checked By: NK

GRAIN SIZE DISTRIBUTION

Clayey Silt with Sand to Silt and Sand (Till)

FIGURE C-4



LEGEND

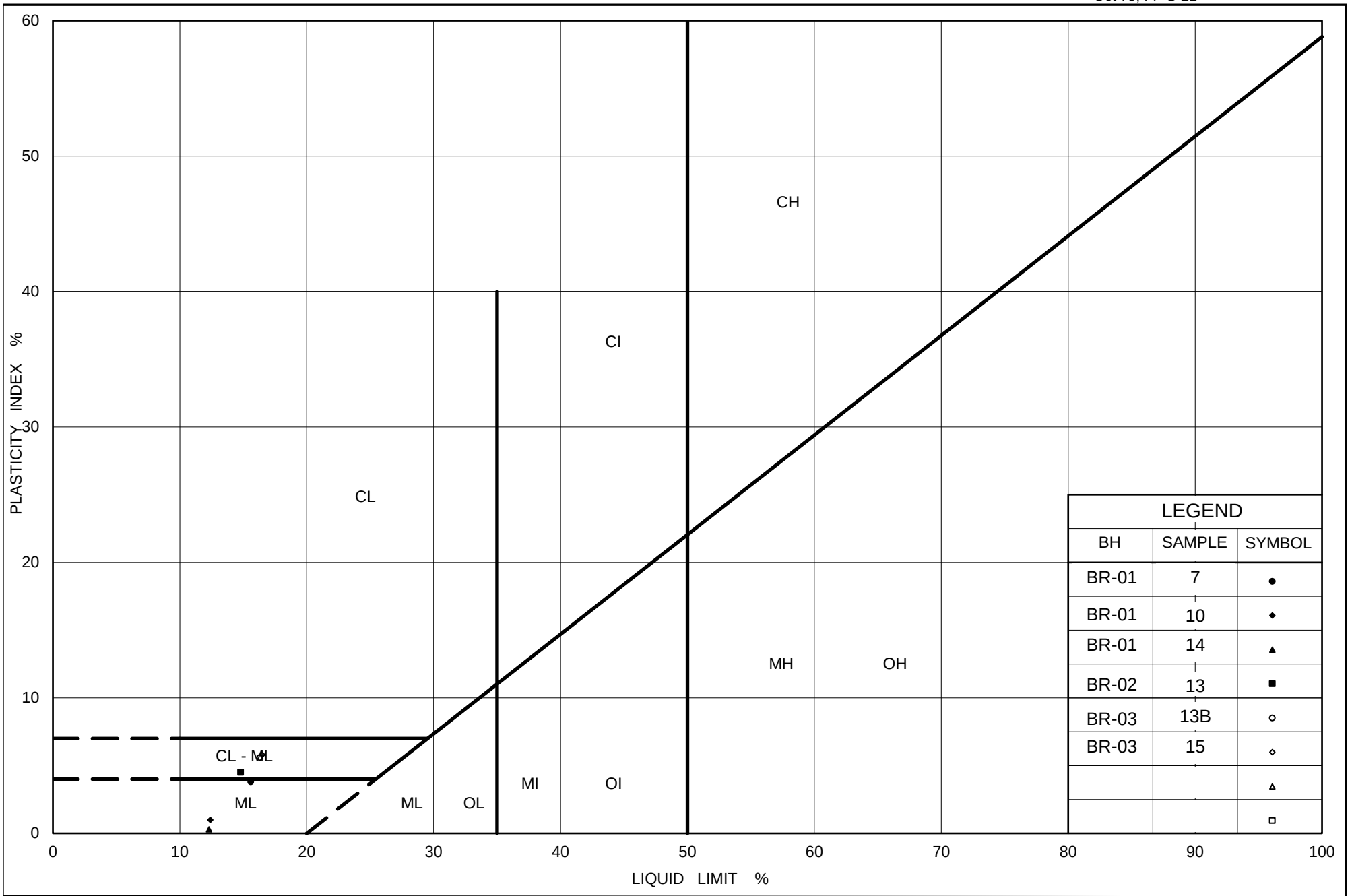
SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	BR-01	10	165.3
■	BR-02	13	173.2
◆	BR-03	13B	172.9
▲	BR-01	14	159.2
▽	BR-03	15	170.1
❍	BR-02	16	168.7
□	BR-01	7	169.8

Project Number: 1669995

Checked By: NK

Golder Associates

Date: 08-Aug-18



Ministry of Transportation

Ontario

PLASTICITY CHART
Clayey Silt with Sand to Silt and Sand (Till)

Figure No. C-5

Project No. 1669995

Checked By: NK

APPENDIX D

Analytical Laboratory Test Results

Maxxam
A Bureau Veritas Group Company

Your Project #: 1669995
Site Location: HWY 401 W SCARBOROUGH
Your C.O.C. #: 105772

Attention: Nikol Kochmanova

Golder Associates Ltd
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2018/03/26
Report #: R5054991
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B862090
Received: 2018/03/20, 12:06

Sample Matrix: Soil
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Chloride (20:1 extract)	4	N/A	2018/03/26	CAM SOP-00463	EPA 325.2 m
Conductivity	4	N/A	2018/03/26	CAM SOP-00414	OMOE E3530 v1 m
pH CaCl2 EXTRACT	4	2018/03/23	2018/03/23	CAM SOP-00413	EPA 9045 D m
Resistivity of Soil	4	2018/03/20	2018/03/26	CAM SOP-00414	SM 23 2510 m
Sulphate (20:1 Extract)	4	N/A	2018/03/26	CAM SOP-00464	EPA 375.4 m

Remarks:

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

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

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

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

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

Maxxam
A Bureau Veritas Group Company

Your Project #: 1669995
Site Location: HWY 401 W SCARBOROUGH
Your C.O.C. #: 105772

Attention: Nikol Kochmanova

Golder Associates Ltd
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2018/03/26
Report #: R5054991
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B862090
Received: 2018/03/20, 12:06

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Ema Gitej, Senior Project Manager
Email: EGitej@maxxam.ca
Phone# (905)817-5829

==========

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Maxxam Job #: B862090
Report Date: 2018/03/26

Golder Associates Ltd
Client Project #: 1669995
Site Location: HWY 401 W SCARBOROUGH
Sampler Initials: AB

SOIL CORROSIVITY PACKAGE (SOIL)

Maxxam ID		GHG238	GHG239	GHG240	GHG241			GHG241		
Sampling Date		2018/02/21	2018/02/22	2018/02/13	2018/02/09			2018/02/09		
COC Number		105772	105772	105772	105772			105772		
	UNITS	BR-02 SA#11	MA-02 SA#12	CP-02 SA#11	MR-03 SA#11	RDL	QC Batch	MR-03 SA#11 Lab-Dup	RDL	QC Batch
Calculated Parameters										
Resistivity	ohm-cm	1600	1100	1300	1200		5448848			
Inorganics										
Soluble (20:1) Chloride (Cl)	ug/g	330	430	400	340	20	5453941	360	20	5453941
Conductivity	umho/cm	644	890	745	848	2	5454237			
Available (CaCl2) pH	pH	7.73	7.89	7.94	7.79		5452380	7.86		5452380
Soluble (20:1) Sulphate (SO4)	ug/g	<20	140	<20	260	20	5453942	270	20	5453942

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

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Maxxam Job #: B862090
Report Date: 2018/03/26

Golder Associates Ltd
Client Project #: 1669995
Site Location: HWY 401 W SCARBOROUGH
Sampler Initials: AB

TEST SUMMARY

Maxxam ID: GHG238
Sample ID: BR-02 SA#11
Matrix: Soil

Collected: 2018/02/21
Shipped:
Received: 2018/03/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5453941	N/A	2018/03/26	Deonarine Ramnarine
Conductivity	AT	5454237	N/A	2018/03/26	Tahir Anwar
pH CaCl2 EXTRACT	AT	5452380	2018/03/23	2018/03/23	Neil Dassanayake
Resistivity of Soil		5448848	2018/03/26	2018/03/26	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5453942	N/A	2018/03/26	Deonarine Ramnarine

Maxxam ID: GHG239
Sample ID: MA-02 SA#12
Matrix: Soil

Collected: 2018/02/22
Shipped:
Received: 2018/03/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5453941	N/A	2018/03/26	Deonarine Ramnarine
Conductivity	AT	5454237	N/A	2018/03/26	Tahir Anwar
pH CaCl2 EXTRACT	AT	5452380	2018/03/23	2018/03/23	Neil Dassanayake
Resistivity of Soil		5448848	2018/03/26	2018/03/26	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5453942	N/A	2018/03/26	Deonarine Ramnarine

Maxxam ID: GHG240
Sample ID: CP-02 SA#11
Matrix: Soil

Collected: 2018/02/13
Shipped:
Received: 2018/03/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5453941	N/A	2018/03/26	Deonarine Ramnarine
Conductivity	AT	5454237	N/A	2018/03/26	Tahir Anwar
pH CaCl2 EXTRACT	AT	5452380	2018/03/23	2018/03/23	Neil Dassanayake
Resistivity of Soil		5448848	2018/03/26	2018/03/26	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5453942	N/A	2018/03/26	Deonarine Ramnarine

Maxxam ID: GHG241
Sample ID: MR-03 SA#11
Matrix: Soil

Collected: 2018/02/09
Shipped:
Received: 2018/03/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5453941	N/A	2018/03/26	Deonarine Ramnarine
Conductivity	AT	5454237	N/A	2018/03/26	Tahir Anwar
pH CaCl2 EXTRACT	AT	5452380	2018/03/23	2018/03/23	Neil Dassanayake
Resistivity of Soil		5448848	2018/03/26	2018/03/26	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5453942	N/A	2018/03/26	Deonarine Ramnarine

Maxxam ID: GHG241 Dup
Sample ID: MR-03 SA#11
Matrix: Soil

Collected: 2018/02/09
Shipped:
Received: 2018/03/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5453941	N/A	2018/03/26	Deonarine Ramnarine

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Maxxam Job #: B862090
Report Date: 2018/03/26

Golder Associates Ltd
Client Project #: 1669995
Site Location: HWY 401 W SCARBOROUGH
Sampler Initials: AB

TEST SUMMARY

Maxxam ID: GHG241 Dup
Sample ID: MR-03 SA#11
Matrix: Soil

Collected: 2018/02/09
Shipped:
Received: 2018/03/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
pH CaCl2 EXTRACT	AT	5452380	2018/03/23	2018/03/23	Neil Dassanayake
Sulphate (20:1 Extract)	KONE/EC	5453942	N/A	2018/03/26	Deonarine Ramnarine

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Maxxam Job #: B862090
Report Date: 2018/03/26

Golder Associates Ltd
Client Project #: 1669995
Site Location: HWY 401 W SCARBOROUGH
Sampler Initials: AB

GENERAL COMMENTS

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

Package 1	15.0°C

Results relate only to the items tested.

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Maxxam Job #: B862090
Report Date: 2018/03/26

QUALITY ASSURANCE REPORT

Golder Associates Ltd
Client Project #: 1669995
Site Location: HWY 401 W SCARBOROUGH
Sampler Initials: AB

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
5452380	Available (CaCl2) pH	2018/03/23			100	97 - 103			0.86	N/A
5453941	Soluble (20:1) Chloride (Cl)	2018/03/26	NC	70 - 130	105	70 - 130	<20	ug/g	7.9	35
5453942	Soluble (20:1) Sulphate (SO4)	2018/03/26	NC	70 - 130	100	70 - 130	<20	ug/g	3.5	35
5454237	Conductivity	2018/03/26			98	90 - 110	<2	umho/cm	0.099	10

N/A = Not Applicable

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

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

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

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

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

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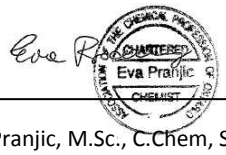
Maxxam Job #: B862090
Report Date: 2018/03/26

Golder Associates Ltd
Client Project #: 1669995
Site Location: HWY 401 W SCARBOROUGH
Sampler Initials: AB

VALIDATION SIGNATURE PAGE

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



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

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A Bureau Veritas Group Company

6740 Campobello Road, Mississauga, Ontario L5N 2L8
Phone: 905-817-5700 Fax: 905-817-5779 Toll Free: 800-563-6266
CAM FCD-01191/3

CHAIN OF CUSTODY RECORD 105772 Page 1 of 1

Invoice Information	Report Information (if differs from invoice)	Project Information (where applicable)	Turnaround Time (TAT) Required
Company Name: Golder Associates Ltd.	Company Name:	Quotation #:	[X] Regular TAT (5-7 days) Most analyses
Contact Name: Nikol Kachmanova	Contact Name:	P.O. #/ AFE#: [redacted]	PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address: 10925 Century Ave. #100 Mississauga ON	Address:	Project #: 1667995	Rush TAT (Surcharges will be applied)
Phone: 905-567-4444 Fax:	Phone: Fax:	Site Location: Hwy 401 W Scarborough	[ ] 1 Day [ ] 2 Days [ ] 3-4 Days
Email: Nikol_Kachmanova@golder.com	Email:	Site #:	Date Required:
		Sampled By: AB	Rush Confirmation #:

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

Regulation 153	Other Regulations
[ ] Table 1 [ ] Res/Park [ ] Med/ Fine	[ ] CCME [ ] Sanitary Sewer Bylaw
[ ] Table 2 [ ] Ind/Comm [ ] Coarse	[ ] MISA [ ] Storm Sewer Bylaw
[ ] Table 3 [ ] Agri/ Other	[ ] PWQO Region
[ ] Table ___	[ ] Other (Specify)
FOR RSC (PLEASE CIRCLE) Y / N	[ ] REG 558 (MIN. 3 DAY TAT REQUIRED)

Include Criteria on Certificate of Analysis: Y / N

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

	SAMPLE IDENTIFICATION	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED	FIELD FILTERED (CIRCLE) Metals / Hg / CrVI	BTEX/ PHC F1	PHCs F2 - F4	VOCs	REG 153 METALS & INORGANICS	REG 153 ICPMS METALS	REG 153 METALS (Hg, Cr VI, ICPMS Metals, HWS - B)	Community Package								HOLD- DO NOT ANALYZE	COMMENTS
1	BR-02 SA#11	2018/02/21	AM	Soil									X									
2	MA-02 SA#12	2018/02/27	AM	Soil									X									
3	CP-02 SA#11	2018/02/13	AM	Soil									X									
4	MR-03 SA#11	2018/03/04	AM	Soil									X									
5																						
6																						
7																						
8																						
9																						
10																						

Analysis Requested

CUSTODY SEAL Y / N		COOLER TEMPERATURES
Present	Intact	
Y	N	9/17/19

COOLING MEDIA PRESENT: Y / (N)

RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)
Katie Nero	2018/03/20	12:05PM	Rosberg / Rosberg & Rosberg	2018/03/20	12:06

20-Mar-18 12:06
Emà Gitej
B862090
URE ENV-1226

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COC-1004 (03/17)

White: Maxxam ~ Yellow: Client

Maxxam
A Bureau Veritas Group Company

Your Project #: 1669995
Site Location: 401W

Attention: Nikol Kochmanova

Golder Associates Ltd
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Your C.O.C. #: 668025-02-01, 668025-03-01, 668025-04-01, 668025-05-01

Report Date: 2018/06/08
Report #: R5226716
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8D5245
Received: 2018/06/05, 16:46

Sample Matrix: Soil
Samples Received: 31

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Chloride (20:1 extract)	31	N/A	2018/06/08	CAM SOP-00463	EPA 325.2 m
Conductivity	20	N/A	2018/06/07	CAM SOP-00414	OMOE E3530 v1 m
Conductivity	11	N/A	2018/06/08	CAM SOP-00414	OMOE E3530 v1 m
pH CaCl2 EXTRACT	20	2018/06/07	2018/06/07	CAM SOP-00413	EPA 9045 D m
pH CaCl2 EXTRACT	11	2018/06/08	2018/06/08	CAM SOP-00413	EPA 9045 D m
Resistivity of Soil	20	2018/06/06	2018/06/07	CAM SOP-00414	SM 23 2510 m
Resistivity of Soil	11	2018/06/06	2018/06/08	CAM SOP-00414	SM 23 2510 m
Sulphate (20:1 Extract)	31	N/A	2018/06/08	CAM SOP-00464	EPA 375.4 m

Remarks:

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

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

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

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

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Your Project #: 1669995
Site Location: 401W

Attention: Nikol Kochmanova

Golder Associates Ltd
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Your C.O.C. #: 668025-02-01, 668025-03-01, 668025-04-01, 668025-05-01

Report Date: 2018/06/08
Report #: R5226716
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8D5245
Received: 2018/06/05, 16:46

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Ema Gitej, Senior Project Manager
Email: EGitej@maxxam.ca
Phone# (905)817-5829

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Maxxam Job #: B8D5245
Report Date: 2018/06/08

Golder Associates Ltd
Client Project #: 1669995
Site Location: 401W
Sampler Initials: AM

RESULTS OF ANALYSES OF SOIL

Maxxam ID		GWL599	GWL600	GWL601		GWL601		
Sampling Date		2018/02/14	2018/04/09	2018/02/28		2018/02/28		
COC Number		668025-02-01	668025-02-01	668025-02-01		668025-02-01		
	UNITS	BR-03 SA#14	RW-02 SA#9	MR-01 SA#10	QC Batch	MR-01 SA#10 Lab-Dup	RDL	QC Batch
Calculated Parameters								
Resistivity	ohm-cm	680	6300	1400	5567331			
Inorganics								
Soluble (20:1) Chloride (Cl)	ug/g	730	<20	390	5569372	420	20	5569372
Conductivity	umho/cm	1480	160	718	5568916	708	2	5568916
Available (CaCl2) pH	pH	8.02	8.28	8.08	5568601			
Soluble (20:1) Sulphate (SO4)	ug/g	270	68	50	5569377	51	20	5569377

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

Maxxam ID		GWL602		GWL603		GWL604		GWL605		
Sampling Date		2018/04/11		2018/04/12		2018/03/19		2018/03/21		
COC Number		668025-02-01		668025-02-01		668025-02-01		668025-02-01		
	UNITS	OH-7 SA#5	QC Batch	OH-4 SA#4	RDL	MRU-01 SA#4	RDL	BRU-01 SA#6	RDL	QC Batch
Calculated Parameters										
Resistivity	ohm-cm	710	5567331	1300		330		990		5567331
Inorganics										
Soluble (20:1) Chloride (Cl)	ug/g	680	5569369	220	20	1700	60	620	20	5569369
Conductivity	umho/cm	1410	5570740	764	2	3050	2	1010	2	5570740
Available (CaCl2) pH	pH	7.99	5568601	8.01		8.07		8.07		5569005
Soluble (20:1) Sulphate (SO4)	ug/g	280	5569370	370	20	<20	20	<20	20	5569370

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B8D5245
Report Date: 2018/06/08

Golder Associates Ltd
Client Project #: 1669995
Site Location: 401W
Sampler Initials: AM

RESULTS OF ANALYSES OF SOIL

Maxxam ID		GWL606			GWL606			GWL607	GWL608		
Sampling Date		2018/03/14			2018/03/14			2018/03/22	2018/04/05		
COC Number		668025-02-01			668025-02-01			668025-02-01	668025-02-01		
	UNITS	CN-02 SA#23B	RDL	QC Batch	CN-02 SA#23B Lab-Dup	RDL	QC Batch	KR-01 SA#9	NW1-04 SA#6	RDL	QC Batch
Calculated Parameters											
Resistivity	ohm-cm	3200		5567331				940	2000		5567331
Inorganics											
Soluble (20:1) Chloride (Cl)	ug/g	<20	20	5569369				580	230	20	5569372
Conductivity	umho/cm	312	2	5570740	314	2	5570740	1070	508	2	5568916
Available (CaCl2) pH	pH	8.12		5568601				8.01	8.26		5568601
Soluble (20:1) Sulphate (SO4)	ug/g	200	20	5569370				<20	<20	20	5569377

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

Maxxam ID		GWL609	GWL610	GWL611	GWL612	GWL613	GWL614		
Sampling Date		2018/02/25	2018/04/11	2018/02/26	2018/04/11	2018/04/06	2018/04/10		
COC Number		668025-03-01	668025-03-01	668025-03-01	668025-03-01	668025-03-01	668025-03-01		
	UNITS	KR-03S SA#10	NW-05 SA#7B	MA-01 SA#11	NW-04 SA#4	NW-03S SA#7	NW-08 SA#7	RDL	QC Batch
Calculated Parameters									
Resistivity	ohm-cm	2300	620	1300	1000	1600	1300		5567331
Inorganics									
Soluble (20:1) Chloride (Cl)	ug/g	210	820	280	510	340	350	20	5569372
Conductivity	umho/cm	437	1620	797	979	643	778	2	5568916
Available (CaCl2) pH	pH	8.21	8.11	8.09	8.16	8.08	8.13		5568601
Soluble (20:1) Sulphate (SO4)	ug/g	<20	24	310	<20	23	77	20	5569377

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B8D5245
Report Date: 2018/06/08

Golder Associates Ltd
Client Project #: 1669995
Site Location: 401W
Sampler Initials: AM

RESULTS OF ANALYSES OF SOIL

Maxxam ID		GWL615		GWL616		GWL617		GWL618		
Sampling Date		2018/04/10		2018/03/25		2018/03/28		2018/03/26		
COC Number		668025-03-01		668025-03-01		668025-03-01		668025-03-01		
	UNITS	NW-07 SA#5A	QC Batch	NBP1-3 SA#6	QC Batch	RW-01 SA#3	QC Batch	NW1-02 SA#3	RDL	QC Batch
Calculated Parameters										
Resistivity	ohm-cm	610	5567331	1600	5567331	1300	5567331	2300		5567331
Inorganics										
Soluble (20:1) Chloride (Cl)	ug/g	810	5569372	320	5569369	370	5569372	170	20	5569372
Conductivity	umho/cm	1630	5568916	627	5568916	743	5568916	429	2	5570740
Available (CaCl2) pH	pH	8.10	5568601	8.00	5568601	8.07	5568601	8.13		5568601
Soluble (20:1) Sulphate (SO4)	ug/g	<20	5569377	<20	5569370	<20	5569377	<20	20	5569377

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		GWL618		GWL619		GWL620		GWL621		
Sampling Date		2018/03/26		2018/03/26		2018/04/09		2018/03/06		
COC Number		668025-03-01		668025-04-01		668025-04-01		668025-04-01		
	UNITS	NW1-02 SA#3 Lab-Dup	QC Batch	NW1-01 SA#4	QC Batch	NBP1-01 SA#9	QC Batch	CN-01 SA#20A	RDL	QC Batch
Calculated Parameters										
Resistivity	ohm-cm			4200	5567331	1200	5567331	2900		5567331
Inorganics										
Soluble (20:1) Chloride (Cl)	ug/g			78	5569372	460	5569369	120	20	5569372
Conductivity	umho/cm			238	5568916	835	5570740	343	2	5568916
Available (CaCl2) pH	pH	8.09	5568601	8.24	5568601	8.13	5569005	8.34		5568601
Soluble (20:1) Sulphate (SO4)	ug/g			<20	5569377	<20	5569370	92	20	5569377

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

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Report Date: 2018/06/08

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Sampler Initials: AM

RESULTS OF ANALYSES OF SOIL

Maxxam ID		GWL622		GWL623		GWL624		
Sampling Date		2018/02/25		2018/04/12		2018/04/13		
COC Number		668025-04-01		668025-04-01		668025-04-01		
	UNITS	CP-01 SA#12	QC Batch	OH-5 SA#7	QC Batch	OH-9 SA#5	RDL	QC Batch
Calculated Parameters								
Resistivity	ohm-cm	1500	5567331	1000	5567331	1400		5567331
Inorganics								
Soluble (20:1) Chloride (Cl)	ug/g	340	5569369	490	5569372	330	20	5569369
Conductivity	umho/cm	649	5570740	974	5568916	733	2	5570740
Available (CaCl2) pH	pH	8.10	5569005	8.14	5568601	8.16		5569005
Soluble (20:1) Sulphate (SO4)	ug/g	<20	5569370	29	5569377	<20	20	5569370

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		GWL624			GWL625			GWL626		
Sampling Date		2018/04/13			2018/05/29			2018/04/12		
COC Number		668025-04-01			668025-04-01			668025-04-01		
	UNITS	OH-9 SA#5 Lab-Dup	RDL	QC Batch	NB-02 SA#4	RDL	QC Batch	OH-01 SA#7	RDL	QC Batch
Calculated Parameters										
Resistivity	ohm-cm				870		5567331	300		5567331
Inorganics										
Soluble (20:1) Chloride (Cl)	ug/g	330	20	5569369	670	20	5569372	1700	60	5569369
Conductivity	umho/cm				1150	2	5568916	3300	2	5570740
Available (CaCl2) pH	pH				8.24		5569005	7.47		5569005
Soluble (20:1) Sulphate (SO4)	ug/g	<20	20	5569370	62	20	5569377	250	20	5569370

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

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Report Date: 2018/06/08

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Site Location: 401W
Sampler Initials: AM

RESULTS OF ANALYSES OF SOIL

Maxxam ID		GWL627			GWL628			GWL629		
Sampling Date		2018/05/09			2018/05/07			2018/05/30		
COC Number		668025-04-01			668025-04-01			668025-05-01		
	UNITS	KR-02 SA#3	RDL	QC Batch	MR-02 SA#7	RDL	QC Batch	BR-01 SA#4	RDL	QC Batch
Calculated Parameters										
Resistivity	ohm-cm	470		5567331	760		5567331	400		5567331
Inorganics										
Soluble (20:1) Chloride (Cl)	ug/g	1100	40	5569369	670	20	5569372	1300	60	5569369
Conductivity	umho/cm	2140	2	5568916	1310	2	5568916	2490	2	5570740
Available (CaCl2) pH	pH	8.24		5569005	8.08		5569005	8.04		5569005
Soluble (20:1) Sulphate (SO4)	ug/g	26	20	5569370	70	20	5569377	130	20	5569370

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B8D5245
Report Date: 2018/06/08

Golder Associates Ltd
Client Project #: 1669995
Site Location: 401W
Sampler Initials: AM

TEST SUMMARY

Maxxam ID: GWL599
Sample ID: BR-03 SA#14
Matrix: Soil

Collected: 2018/02/14
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569372	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5568916	N/A	2018/06/07	Tahir Anwar
pH CaCl2 EXTRACT	AT	5568601	2018/06/07	2018/06/07	Gnana Thomas
Resistivity of Soil		5567331	2018/06/07	2018/06/07	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569377	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL600
Sample ID: RW-02 SA#9
Matrix: Soil

Collected: 2018/04/09
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569372	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5568916	N/A	2018/06/07	Tahir Anwar
pH CaCl2 EXTRACT	AT	5568601	2018/06/07	2018/06/07	Gnana Thomas
Resistivity of Soil		5567331	2018/06/07	2018/06/07	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569377	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL601
Sample ID: MR-01 SA#10
Matrix: Soil

Collected: 2018/02/28
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569372	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5568916	N/A	2018/06/07	Tahir Anwar
pH CaCl2 EXTRACT	AT	5568601	2018/06/07	2018/06/07	Gnana Thomas
Resistivity of Soil		5567331	2018/06/07	2018/06/07	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569377	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL601 Dup
Sample ID: MR-01 SA#10
Matrix: Soil

Collected: 2018/02/28
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569372	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5568916	N/A	2018/06/07	Tahir Anwar
Sulphate (20:1 Extract)	KONE/EC	5569377	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL602
Sample ID: OH-7 SA#5
Matrix: Soil

Collected: 2018/04/11
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569369	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5570740	N/A	2018/06/08	Tahir Anwar
pH CaCl2 EXTRACT	AT	5568601	2018/06/07	2018/06/07	Gnana Thomas

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Maxxam Job #: B8D5245
Report Date: 2018/06/08

Golder Associates Ltd
Client Project #: 1669995
Site Location: 401W
Sampler Initials: AM

TEST SUMMARY

Maxxam ID: GWL602 **Collected:** 2018/04/11
Sample ID: OH-7 SA#5 **Shipped:**
Matrix: Soil **Received:** 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Resistivity of Soil		5567331	2018/06/08	2018/06/08	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569370	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL603 **Collected:** 2018/04/12
Sample ID: OH-4 SA#4 **Shipped:**
Matrix: Soil **Received:** 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569369	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5570740	N/A	2018/06/08	Tahir Anwar
pH CaCl2 EXTRACT	AT	5569005	2018/06/08	2018/06/08	Gnana Thomas
Resistivity of Soil		5567331	2018/06/08	2018/06/08	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569370	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL604 **Collected:** 2018/03/19
Sample ID: MRU-01 SA#4 **Shipped:**
Matrix: Soil **Received:** 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569369	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5570740	N/A	2018/06/08	Tahir Anwar
pH CaCl2 EXTRACT	AT	5569005	2018/06/08	2018/06/08	Gnana Thomas
Resistivity of Soil		5567331	2018/06/08	2018/06/08	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569370	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL605 **Collected:** 2018/03/21
Sample ID: BRU-01 SA#6 **Shipped:**
Matrix: Soil **Received:** 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569369	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5570740	N/A	2018/06/08	Tahir Anwar
pH CaCl2 EXTRACT	AT	5569005	2018/06/08	2018/06/08	Gnana Thomas
Resistivity of Soil		5567331	2018/06/08	2018/06/08	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569370	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL606 **Collected:** 2018/03/14
Sample ID: CN-02 SA#23B **Shipped:**
Matrix: Soil **Received:** 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569369	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5570740	N/A	2018/06/08	Tahir Anwar
pH CaCl2 EXTRACT	AT	5568601	2018/06/07	2018/06/07	Gnana Thomas
Resistivity of Soil		5567331	2018/06/08	2018/06/08	Automated Statchk

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Report Date: 2018/06/08

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Site Location: 401W
Sampler Initials: AM

TEST SUMMARY

Maxxam ID: GWL606
Sample ID: CN-02 SA#23B
Matrix: Soil

Collected: 2018/03/14
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphate (20:1 Extract)	KONE/EC	5569370	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL606 Dup
Sample ID: CN-02 SA#23B
Matrix: Soil

Collected: 2018/03/14
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Conductivity	AT	5570740	N/A	2018/06/08	Tahir Anwar

Maxxam ID: GWL607
Sample ID: KR-01 SA#9
Matrix: Soil

Collected: 2018/03/22
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569372	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5568916	N/A	2018/06/07	Tahir Anwar
pH CaCl2 EXTRACT	AT	5568601	2018/06/07	2018/06/07	Gnana Thomas
Resistivity of Soil		5567331	2018/06/07	2018/06/07	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569377	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL608
Sample ID: NW1-04 SA#6
Matrix: Soil

Collected: 2018/04/05
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569372	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5568916	N/A	2018/06/07	Tahir Anwar
pH CaCl2 EXTRACT	AT	5568601	2018/06/07	2018/06/07	Gnana Thomas
Resistivity of Soil		5567331	2018/06/07	2018/06/07	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569377	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL609
Sample ID: KR-03S SA#10
Matrix: Soil

Collected: 2018/02/25
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569372	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5568916	N/A	2018/06/07	Tahir Anwar
pH CaCl2 EXTRACT	AT	5568601	2018/06/07	2018/06/07	Gnana Thomas
Resistivity of Soil		5567331	2018/06/07	2018/06/07	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569377	N/A	2018/06/08	Alina Dobreanu

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Sampler Initials: AM

TEST SUMMARY

Maxxam ID: GWL610
Sample ID: NW-05 SA#7B
Matrix: Soil

Collected: 2018/04/11
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569372	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5568916	N/A	2018/06/07	Tahir Anwar
pH CaCl2 EXTRACT	AT	5568601	2018/06/07	2018/06/07	Gnana Thomas
Resistivity of Soil		5567331	2018/06/07	2018/06/07	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569377	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL611
Sample ID: MA-01 SA#11
Matrix: Soil

Collected: 2018/02/26
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569372	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5568916	N/A	2018/06/07	Tahir Anwar
pH CaCl2 EXTRACT	AT	5568601	2018/06/07	2018/06/07	Gnana Thomas
Resistivity of Soil		5567331	2018/06/07	2018/06/07	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569377	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL612
Sample ID: NW-04 SA#4
Matrix: Soil

Collected: 2018/04/11
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569372	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5568916	N/A	2018/06/07	Tahir Anwar
pH CaCl2 EXTRACT	AT	5568601	2018/06/07	2018/06/07	Gnana Thomas
Resistivity of Soil		5567331	2018/06/07	2018/06/07	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569377	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL613
Sample ID: NW-03S SA#7
Matrix: Soil

Collected: 2018/04/06
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569372	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5568916	N/A	2018/06/07	Tahir Anwar
pH CaCl2 EXTRACT	AT	5568601	2018/06/07	2018/06/07	Gnana Thomas
Resistivity of Soil		5567331	2018/06/07	2018/06/07	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569377	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL614
Sample ID: NW-08 SA#7
Matrix: Soil

Collected: 2018/04/10
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569372	N/A	2018/06/08	Deonarine Ramnarine

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Maxxam Job #: B8D5245
Report Date: 2018/06/08

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Sampler Initials: AM

TEST SUMMARY

Maxxam ID: GWL614
Sample ID: NW-08 SA#7
Matrix: Soil

Collected: 2018/04/10
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Conductivity	AT	5568916	N/A	2018/06/07	Tahir Anwar
pH CaCl2 EXTRACT	AT	5568601	2018/06/07	2018/06/07	Gnana Thomas
Resistivity of Soil		5567331	2018/06/07	2018/06/07	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569377	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL615
Sample ID: NW-07 SA#5A
Matrix: Soil

Collected: 2018/04/10
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569372	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5568916	N/A	2018/06/07	Tahir Anwar
pH CaCl2 EXTRACT	AT	5568601	2018/06/07	2018/06/07	Gnana Thomas
Resistivity of Soil		5567331	2018/06/07	2018/06/07	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569377	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL616
Sample ID: NBP1-3 SA#6
Matrix: Soil

Collected: 2018/03/25
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569369	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5568916	N/A	2018/06/07	Tahir Anwar
pH CaCl2 EXTRACT	AT	5568601	2018/06/07	2018/06/07	Gnana Thomas
Resistivity of Soil		5567331	2018/06/07	2018/06/07	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569370	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL617
Sample ID: RW-01 SA#3
Matrix: Soil

Collected: 2018/03/28
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569372	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5568916	N/A	2018/06/07	Tahir Anwar
pH CaCl2 EXTRACT	AT	5568601	2018/06/07	2018/06/07	Gnana Thomas
Resistivity of Soil		5567331	2018/06/07	2018/06/07	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569377	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL618
Sample ID: NW1-02 SA#3
Matrix: Soil

Collected: 2018/03/26
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569372	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5570740	N/A	2018/06/08	Tahir Anwar

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TEST SUMMARY

Maxxam ID: GWL618
Sample ID: NW1-02 SA#3
Matrix: Soil

Collected: 2018/03/26
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
pH CaCl2 EXTRACT	AT	5568601	2018/06/07	2018/06/07	Gnana Thomas
Resistivity of Soil		5567331	2018/06/08	2018/06/08	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569377	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL618 Dup
Sample ID: NW1-02 SA#3
Matrix: Soil

Collected: 2018/03/26
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
pH CaCl2 EXTRACT	AT	5568601	2018/06/07	2018/06/07	Gnana Thomas

Maxxam ID: GWL619
Sample ID: NW1-01 SA#4
Matrix: Soil

Collected: 2018/03/26
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569372	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5568916	N/A	2018/06/07	Tahir Anwar
pH CaCl2 EXTRACT	AT	5568601	2018/06/07	2018/06/07	Gnana Thomas
Resistivity of Soil		5567331	2018/06/07	2018/06/07	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569377	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL620
Sample ID: NBP1-01 SA#9
Matrix: Soil

Collected: 2018/04/09
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569369	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5570740	N/A	2018/06/08	Tahir Anwar
pH CaCl2 EXTRACT	AT	5569005	2018/06/08	2018/06/08	Gnana Thomas
Resistivity of Soil		5567331	2018/06/08	2018/06/08	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569370	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL621
Sample ID: CN-01 SA#20A
Matrix: Soil

Collected: 2018/03/06
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569372	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5568916	N/A	2018/06/07	Tahir Anwar
pH CaCl2 EXTRACT	AT	5568601	2018/06/07	2018/06/07	Gnana Thomas
Resistivity of Soil		5567331	2018/06/07	2018/06/07	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569377	N/A	2018/06/08	Alina Dobreanu

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Maxxam Job #: B8D5245
Report Date: 2018/06/08

Golder Associates Ltd
Client Project #: 1669995
Site Location: 401W
Sampler Initials: AM

TEST SUMMARY

Maxxam ID: GWL622
Sample ID: CP-01 SA#12
Matrix: Soil

Collected: 2018/02/25
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569369	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5570740	N/A	2018/06/08	Tahir Anwar
pH CaCl2 EXTRACT	AT	5569005	2018/06/08	2018/06/08	Gnana Thomas
Resistivity of Soil		5567331	2018/06/08	2018/06/08	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569370	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL623
Sample ID: OH-5 SA#7
Matrix: Soil

Collected: 2018/04/12
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569372	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5568916	N/A	2018/06/07	Tahir Anwar
pH CaCl2 EXTRACT	AT	5568601	2018/06/07	2018/06/07	Gnana Thomas
Resistivity of Soil		5567331	2018/06/07	2018/06/07	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569377	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL624
Sample ID: OH-9 SA#5
Matrix: Soil

Collected: 2018/04/13
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569369	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5570740	N/A	2018/06/08	Tahir Anwar
pH CaCl2 EXTRACT	AT	5569005	2018/06/08	2018/06/08	Gnana Thomas
Resistivity of Soil		5567331	2018/06/08	2018/06/08	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569370	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL624 Dup
Sample ID: OH-9 SA#5
Matrix: Soil

Collected: 2018/04/13
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569369	N/A	2018/06/08	Deonarine Ramnarine
Sulphate (20:1 Extract)	KONE/EC	5569370	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL625
Sample ID: NB-02 SA#4
Matrix: Soil

Collected: 2018/05/29
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569372	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5568916	N/A	2018/06/07	Tahir Anwar
pH CaCl2 EXTRACT	AT	5569005	2018/06/08	2018/06/08	Gnana Thomas
Resistivity of Soil		5567331	2018/06/07	2018/06/07	Automated Statchk

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Maxxam Job #: B8D5245
Report Date: 2018/06/08

Golder Associates Ltd
Client Project #: 1669995
Site Location: 401W
Sampler Initials: AM

TEST SUMMARY

Maxxam ID: GWL625
Sample ID: NB-02 SA#4
Matrix: Soil

Collected: 2018/05/29
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphate (20:1 Extract)	KONE/EC	5569377	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL626
Sample ID: OH-01 SA#7
Matrix: Soil

Collected: 2018/04/12
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569369	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5570740	N/A	2018/06/08	Tahir Anwar
pH CaCl2 EXTRACT	AT	5569005	2018/06/08	2018/06/08	Gnana Thomas
Resistivity of Soil		5567331	2018/06/08	2018/06/08	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569370	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL627
Sample ID: KR-02 SA#3
Matrix: Soil

Collected: 2018/05/09
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569369	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5568916	N/A	2018/06/07	Tahir Anwar
pH CaCl2 EXTRACT	AT	5569005	2018/06/08	2018/06/08	Gnana Thomas
Resistivity of Soil		5567331	2018/06/07	2018/06/07	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569370	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL628
Sample ID: MR-02 SA#7
Matrix: Soil

Collected: 2018/05/07
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569372	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5568916	N/A	2018/06/07	Tahir Anwar
pH CaCl2 EXTRACT	AT	5569005	2018/06/08	2018/06/08	Gnana Thomas
Resistivity of Soil		5567331	2018/06/07	2018/06/07	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569377	N/A	2018/06/08	Alina Dobreanu

Maxxam ID: GWL629
Sample ID: BR-01 SA#4
Matrix: Soil

Collected: 2018/05/30
Shipped:
Received: 2018/06/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5569369	N/A	2018/06/08	Deonarine Ramnarine
Conductivity	AT	5570740	N/A	2018/06/08	Tahir Anwar
pH CaCl2 EXTRACT	AT	5569005	2018/06/08	2018/06/08	Gnana Thomas
Resistivity of Soil		5567331	2018/06/08	2018/06/08	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5569370	N/A	2018/06/08	Alina Dobreanu

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Maxxam Job #: B8D5245
Report Date: 2018/06/08

Golder Associates Ltd
Client Project #: 1669995
Site Location: 401W
Sampler Initials: AM

GENERAL COMMENTS

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

Package 1	20.0°C

Most samples have been received and analyzed past the recommended hold time of 30 days as per client request.

Results relate only to the items tested.

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Maxxam Job #: B8D5245
Report Date: 2018/06/08

QUALITY ASSURANCE REPORT

Golder Associates Ltd
Client Project #: 1669995
Site Location: 401W
Sampler Initials: AM

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
5568601	Available (CaCl2) pH	2018/06/07			100	97 - 103			0.50	N/A
5568916	Conductivity	2018/06/07			98	90 - 110	<2	umho/cm	1.4	10
5569005	Available (CaCl2) pH	2018/06/08			101	97 - 103			0.13	N/A
5569369	Soluble (20:1) Chloride (Cl)	2018/06/08	NC	70 - 130	108	70 - 130	<20	ug/g	0.23	35
5569370	Soluble (20:1) Sulphate (SO4)	2018/06/08	114	70 - 130	107	70 - 130	<20	ug/g	NC	35
5569372	Soluble (20:1) Chloride (Cl)	2018/06/08	NC	70 - 130	107	70 - 130	<20	ug/g	7.2	35
5569377	Soluble (20:1) Sulphate (SO4)	2018/06/08	NC	70 - 130	102	70 - 130	<20	ug/g	2.5	35
5570740	Conductivity	2018/06/08			98	90 - 110	<2	umho/cm	0.64	10

N/A = Not Applicable

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

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

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

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

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

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

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Maxxam Job #: B8D5245
Report Date: 2018/06/08

Golder Associates Ltd
Client Project #: 1669995
Site Location: 401W
Sampler Initials: AM

VALIDATION SIGNATURE PAGE

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

Cristina Carriere

Cristina Carriere, Scientific Service Specialist

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

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CHAIN OF CUSTODY RECORD

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Page 2 of 4

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name:	#1326 Golder Associates Ltd	Company Name:		Quotation #:	B80683	Maxxam Job #:	Bottle Order #:
Attention:	Accounts Payable	Attention:	Nikol Kochmanova	P.O. #:			668025
Address:	6925 Century Ave Suite 100 Mississauga ON L5N 7K2	Address:		Project:	1669995	COC #:	Project Manager:
Tel:	(905) 567-4444 Fax: (905) 567-6561	Tel:	(905) 567-6100 Ext: 1459 Fax:	Project Name:	401 W	C#668025-02-01	Ema Gitej
Email:	AP_CustomerService@golder.com	Email:	Nikol_Kochmanova@golder.com	Site #:			
				Sampled By:			

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

Regulation 153 (2011)	Other Regulations	Special Instructions
☐ Table 1 ☐ Res/Park ☐ Medium/Fine ☐ Table 2 ☐ Ind/Comm ☐ Coarse ☐ Table 3 ☐ Agri/Other ☐ For RSC ☐ Table ___	☐ CCME ☐ Sanitary Sewer Bylaw ☐ Reg 558 ☐ Storm Sewer Bylaw ☐ MISA Municipality ___ ☐ PWQO ☐ Other	

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

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

Turnaround Time (TAT) Required:
Please provide advance notice for rush projects

Regular (Standard) TAT: ☒
(will be applied if Rush TAT is not specified):
Standard TAT = 5-7 Working days for most tests..
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required: ___ Time Required: ___ ☐
Rush Confirmation Number: ___ *(call lab for #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	Corrosivity pkg (Cl, SO4, pH, Resistivity/EC - no Sulphide and Redox Potential)	# of Bottles	Comments
1		BR-03 SA#14	Feb 14/18	AM	SOIL		X		
2		RW-02 SA# 9	April 9/18	AM	SOIL		X		
3		MR-01 SA# 10	Feb 28/18	AM	SOIL		X		
4		OH-7 SA#5	Apr 11/18	AM	SOIL		X		
5		OH-4 SA#4	Apr 12/18	AM	SOIL		X		
6		MEW-01 SA#4	Mar 19/18	AM	SOIL		X		
7		BRW-01 SA #6	Mar 21/18	AM	SOIL		X		
8		CN-02 SA#23b	Mar 14/18	AM	SOIL		X		
9		KR-01 SA# 9	Mar 22/18	AM	SOIL		X		
10		NW1-04 SA#6	Apr 5/18	AM	SOIL		X		

05-Jun-18 16:46
Ema Gitej
B8D5245
GK1 ENV-1309

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted	Laboratory Use Only			
Alex MacMillan	18/06/05	16:45	[illegible]	18/06/05	16:46		Time Sensitive	Temperature (°C) on Recei	Custody Seal	Yes / No
								20/20/20	Present / Intact	

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** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT HTTP://MAXXAM.CA/WP-CONTENT/UPLOADS/ONTARIO-COC.PDF.

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

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CHAIN OF CUSTODY RECORD

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Page 1 of 5

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name:	#1326 Golder Associates Ltd	Company Name:		Quotation #:	B80683	Maxxam Job #:	Bottle Order #:
Attention:	Accounts Payable	Attention:	Nikol Kochmanova	P.O. #:			668025
Address:	6925 Century Ave Suite 100 Mississauga ON L5N 7K2	Address:		Project:	1669995	COC #:	Project Manager:
Tel:	(905) 567-4444 Fax: (905) 567-6561	Tel:	(905) 567-6100 Ext: 1459 Fax:	Project Name:	401 W	C#668025-03-01	Ema Gitej
Email:	AP_CustomerService@golder.com	Email:	Nikol_Kochmanova@golder.com	Site #:			
				Sampled By:			

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

Regulation 153 (2011)	Other Regulations	Special Instructions
☐ Table 1 ☐ Res/Park ☐ Medium/Fine ☐ Table 2 ☐ Ind/Comm ☐ Coarse ☐ Table 3 ☐ Agri/Other ☐ For RSC ☐ Table ___	☐ CCME ☐ Sanitary Sewer Bylaw ☐ Reg 558 ☐ Storm Sewer Bylaw ☐ MISA Municipality ___ ☐ PWQO ☐ Other ___	

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

Turnaround Time (TAT) Required:
Please provide advance notice for rush projects

Regular (Standard) TAT:
(will be applied if Rush TAT is not specified):
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required: ___ Time Required: ___
Rush Confirmation Number: ___ *(call lab for #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	ANALYSIS REQUESTED (PLEASE BE SPECIFIC): Corrosivity pkg (Cl, SO4, pH, Resistivity/EC - no Sulphide and Redox Potential)	# of Bottles	Comments
1		KR_03 SA#10	Feb 25,18	AM	SOIL		X		
2		NW-05 SA#7B	Apr 11/18	AM	SOIL		X		
3		MA_01 SA#11	Feb 26/18	AM	SOIL		X		
4		NW-04 SA#4	Apr 11/18	AM	SOIL		X		
5		NW-03 SA#7	Apr 6/18	AM	SOIL		X		
6		NW-02 SA#7	Apr 10/18	AM	SOIL		X		
7		NW-07 SA#5A	Apr 10/18	AM	SOIL		X		
8		NBP1-3 SA#6	Mar 25/18	AM	SOIL		X		
9		RW-01 SA#3	Mar 28/18	AM	SOIL		X		
10		NWL02 SA#3	Mar 26/18	AM	SOIL		X		

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted	Laboratory Use Only				
Sep page 1			See page one				Time Sensitive	Temperature (°C) on Recei	Custody Seal	Yes	No
									Present		
									Intact		

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

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CHAIN OF CUSTODY RECORD

Page 4 of 8

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name:	#1326 Golder Associates Ltd	Company Name:		Quotation #:	B80683	Maxxam Job #:	Bottle Order #:
Attention:	Accounts Payable	Attention:	Nikol Kochmanova	P.O. #:			668025
Address:	6925 Century Ave Suite 100 Mississauga ON L5N 7K2	Address:		Project:	1669995	COC #:	Project Manager:
Tel:	(905) 567-4444 Fax: (905) 567-6561	Tel:	(905) 567-6100 Ext: 1459 Fax:	Project Name:	4 of W	C#668025-04-01	Ema Gitej
Email:	AP_CustomerService@golder.com	Email:	Nikol_Kochmanova@golder.com	Site #:			
				Sampled By:			

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

Regulation 153 (2011): ☐ Table 1 ☐ Res/Park ☐ Medium/Fine ☐ Table 2 ☐ Ind/Comm ☐ Coarse ☐ Table 3 ☐ Agri/Other ☐ For RSC ☐ Table ___

Other Regulations: ☐ CCME ☐ Sanitary Sewer Bylaw ☐ Reg 558 ☐ Storm Sewer Bylaw ☐ MISA Municipality ___ ☐ PWQO ☐ Other ___

Special Instructions

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

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

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(will be applied if Rush TAT is not specified):
Standard TAT = 5-7 Working days for most tests..
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Job Specific Rush TAT (if applies to entire submission) *
Date Required: ___ Time Required: ___ ☐
Rush Confirmation Number: ___ *(call lab for #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	Corrosivity pkg. (Cl, SO4, pH, Resistivity/EC - no Sulphide and Redox Potential)	# of Bottles	Comments
1		NW1-01 SA#4	Mar 26/18	AM	SOIL		X		
2		NBP1-1 SA#9	Apr 9/18	AM	SOIL		X		
3		CN-01 SA#20A	Mar 6/18	AM	SOIL		X		
4		CP-01 SA#12	Feb 25/18	AM	SOIL		X		
5		OH-5 SA#7	Apr 12/18	AM	SOIL		X		
6		OH-1 SA#5	Apr 13/18	AM	SOIL		X		
7		NB-02 SA#4	May 29/18	AM	SOIL		X		
8		OH-1 SA#7	Apr 12/18	AM	SOIL		X		
9		KR-02 SA#3	May 9/18	AM	SOIL		X		
10		MR-02 SA#7	May 7/18	AM	SOIL		X		

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted	Laboratory Use Only: Time Sensitive	Temperature (°C) on Recei	Custody Seal Present	Yes	No
See Page 1			See page one						Intact		

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* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT HTTP://MAXXAM.CA/WP-CONTENT/UPLOADS/ONTARIO-COC.PDF.

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

White: Maxxa Yellow: Client

Maxxam Analytics International Corporation o/a Maxxam Analytics

4 of 4

Maxxam
A Bureau Veritas Group Company

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

CHAIN OF CUSTODY RECORD

Page 5 of 5

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name:	#1326 Golder Associates Ltd	Company Name:		Quotation #:	B80683	Maxxam Job #:	Bottle Order #:
Attention:	Accounts Payable	Attention:	Nikol Kochmanova	P.O. #:			668025
Address:	6925 Century Ave Suite 100 Mississauga ON L5N 7K2	Address:		Project:	1669995	COC #:	Project Manager:
Tel:	(905) 567-4444 Fax: (905) 567-6561	Tel:	(905) 567-6100 Ext: 1459 Fax:	Project Name:		C#668025-05-01	Ema Gitej
Email:	AP_CustomerService@golder.com	Email:	Nikol_Kochmanova@golder.com	Site #:			
				Sampled By:			

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

Regulation 153 (2011)	Other Regulations	Special Instructions
☐ Table 1 ☐ Res/Park ☐ Medium/Fine ☐ Table 2 ☐ Ind/Comm ☐ Coarse ☐ Table 3 ☐ Agri/Other ☐ For RSC ☐ Table ___	☐ CCME ☐ Sanitary Sewer Bylaw ☐ Reg 558 ☐ Storm Sewer Bylaw ☐ MISA Municipality ___ ☐ PWQO ☐ Other ___	

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

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	ANALYSIS REQUESTED (PLEASE BE SPECIFIC): Corrosivity pkg (Cl, SO4, pH, Resistivity/EC - no Sulphide and Redox Potential)	# of Bottles	Comments
1		BR_01 SA#4	May 30/18	AM	SOIL		X		
2									
3									
4									
5									
6									
7									
8									
9									
10									

Turnaround Time (TAT) Required:
Please provide advance notice for rush projects

Regular (Standard) TAT: ☐
(will be applied if Rush TAT is not specified):
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required: ___ Time Required: ___ ☐
Rush Confirmation Number: ___ *(call lab for #)*

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted	Laboratory Use Only: Time Sensitive	Temperature (°C) on Recei	Custody Seal Present	Yes	No
See page 1			See page one						Intact		

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO MAXXAM'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.MAXXAM.CA/TERMS.

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT HTTP://MAXXAM.CA/WP-CONTENT/UPLOADS/ONTARIO-COC.PDF.

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

White: Maxxa Yellow: Client

Maxxam Analytics International Corporation o/a Maxxam Analytics

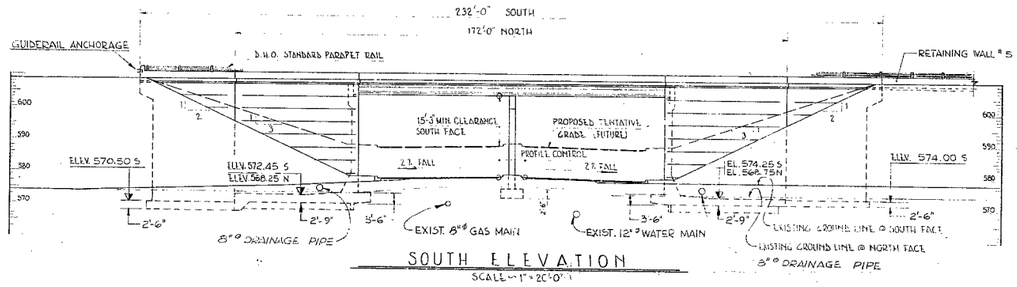
APPENDIX E

Drawing Nos. D-5822-1 and D-5822-3

CONSTRUCTION NOTES

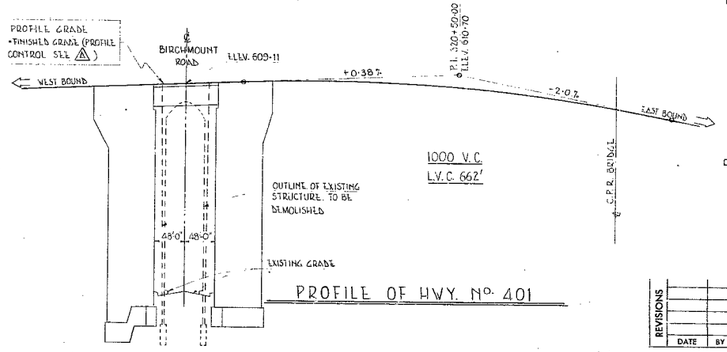
- SEGMENTS I & IV TO BE CONSTRUCTED IN STAGE 1. SEGMENTS II & III IN STAGE 2
- THE CONTRACTOR SHALL NOT BACKFILL BEHIND ABUTMENTS ABOVE ELEVATION 579.50 UNTIL THE DECK AND DIAPHRAGMS HAVE ATTAINED A MINIMUM STRENGTH OF 4000 P.S.I. THE DECK AND THE GIRDERS ARE DESIGNED AS A STRUT SUPPORTING THE ABUTMENT WALLS. THE BACKFILL SHALL BE PLACED SIMULTANEOUSLY AT WEST & EAST ABUTMENTS AND UNIFORMLY IN NORTH & SOUTH DIRECTIONS.
- 8"ø GAS MAIN & 12"ø WATER MAIN TO BE LEFT UNTOUCHED
- THE BACKFILLING OF THE SEGMENT I WINGWALLS ABOVE ELEVATION 579.50 SHOULD BE SIMULTANEOUS AT NORTH AND SOUTH FACES AND AFTER CONCRETE OF WALLS HAS ATTAINED A MINIMUM STRENGTH OF 2500 P.S.I.
- THE RETAINING WALLS WILL DEFLECT AFTER THE BACKFILLING. THEREFORE THE WALL CURBS SHALL NOT BE POURED UNTIL AFTER THE BACKFILL HAS BEEN PLACED.
- CLASS OF CONCRETE : DECK, CURBS & PARAPET WALLS - 4000 P.S.I.
  APPROACH SLAB & PRESTRESSED GIRDERS - 5000 P.S.I.
  REMAINDER - 3000 P.S.I.
- CLEAR COVER ON REINFORCING STEEL: FOOTINGS, ABUTMENTS & RETAINING WALLS - 3", CURBS - 2"
  DECK - 1½" TOP - 1" BOTTOM, APPROACH SLABS - 2", PARAPET WALLS - 1½", GIRDERS - SEE D-5828-11
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR FINISHING THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF ± 1/8". NO CONCRETE SHALL BE PLACED ABOVE THE ELEVATION A' (SEE D-5828-4) UNTIL THE GIRDERS HAVE BEEN PLACED.
- FOR DRAINAGE OF STRUCTURE SEE DRAINAGE DRAWINGS. FOR DETAILS OF EMBEDDED ELECTRICAL WORK SEE ELECTRICAL DRAWINGS.

KEY PLAN

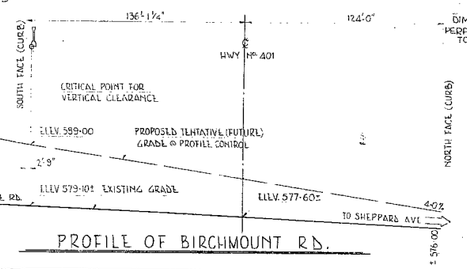


SOUTH ELEVATION

SCALE - 1" = 20'-0"



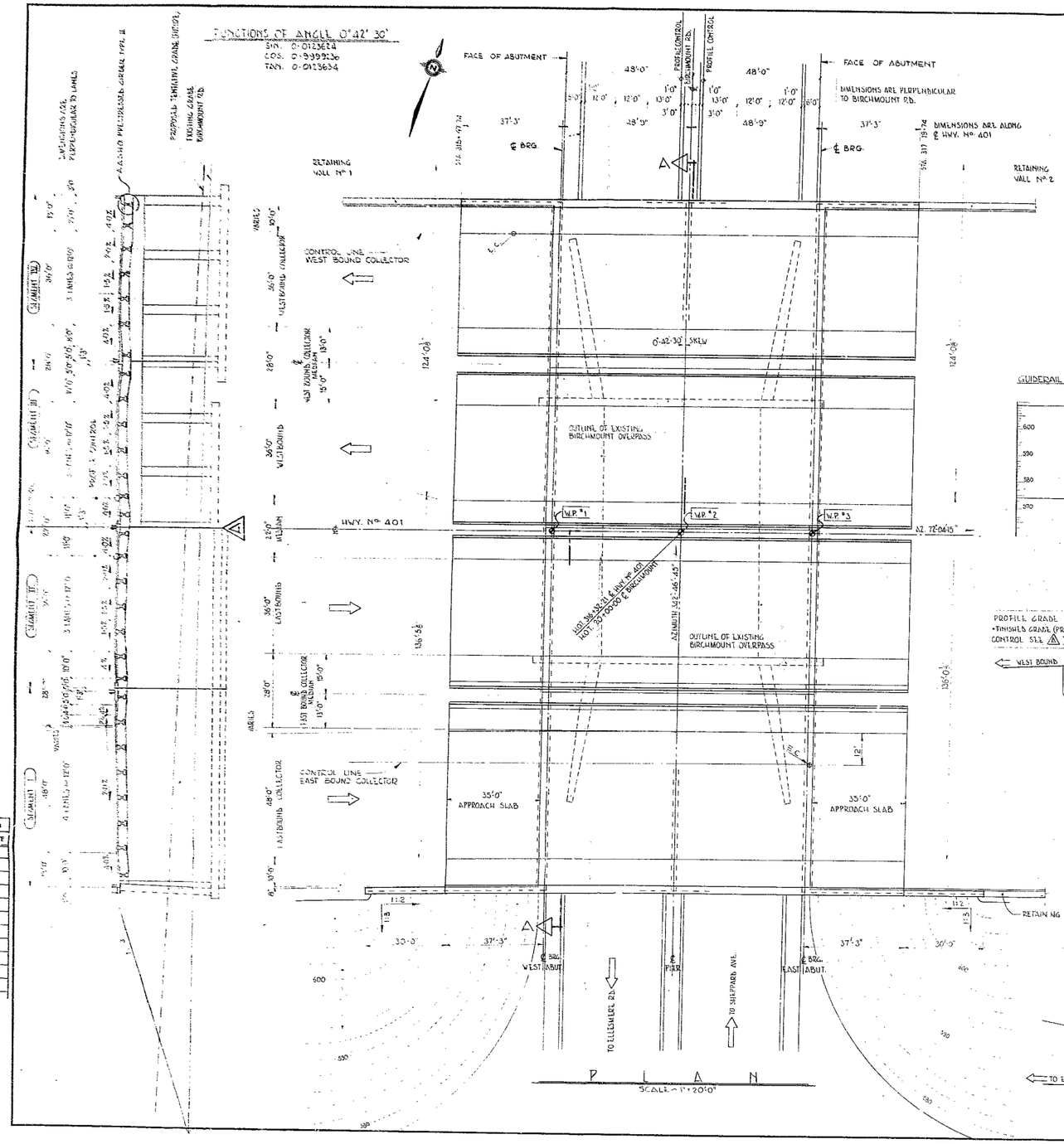
PROFILE OF HWY. No. 401



PROFILE OF BIRCHMOUNT RD.

LIST OF DRAWINGS

D-5828-1	GENERAL ARRANGEMENT
-2	BORE HOLE LOCATIONS & SOIL STRATA
-3	FOOTING LAYOUT & GEOMETRY
-4	LAYOUT & DETAILS OF ABUTMENTS & WINGWALLS I
-5	LAYOUT & DETAILS OF ABUTMENTS & WINGWALLS II
-6	ABUTMENT REINFORCING
-7	WINGWALL REINFORCING
-8	PIER FOOTING
-9	PIER DETAILS
-10	PIER REINFORCING
-11	PRESTRESSED GIRDERS
-12	DECK ELEVATIONS & DETAILS
-13	DECK REINFORCING
-14	APPROACH SLAB
-15	PARAPET WALL DETAILS
-16	STANDARD STEEL PARAPET RAIL
-17	STANDARD DETAILS
D-5828-18	CONSTRUCTION SEQUENCE



P L A N

SCALE - 1" = 20'-0"

PRINT RECORD

No.	FOR	DATE

REVISIONS

DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION

BIRCHMOUNT ROAD OVERPASS

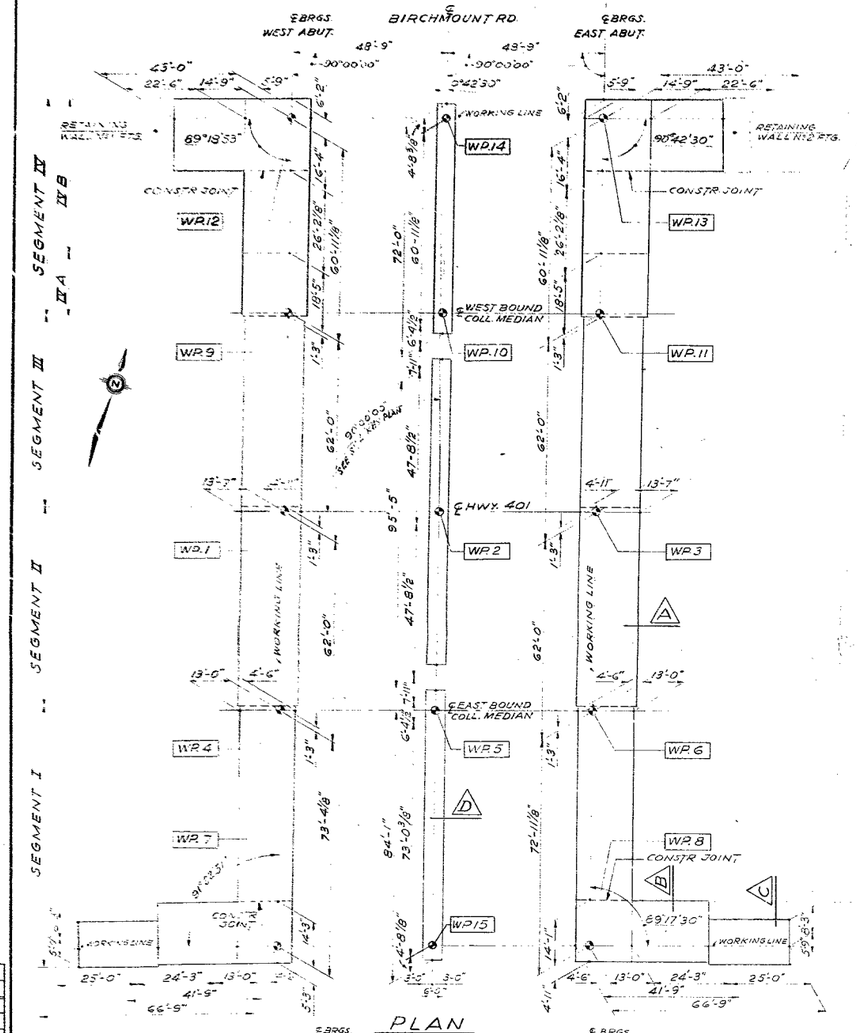
KING'S HIGHWAY No. 401 — DIST. No. 6
CO. YORK
BOROUGH SCARBOROUGH — LOT 30 & 31 — CON. II

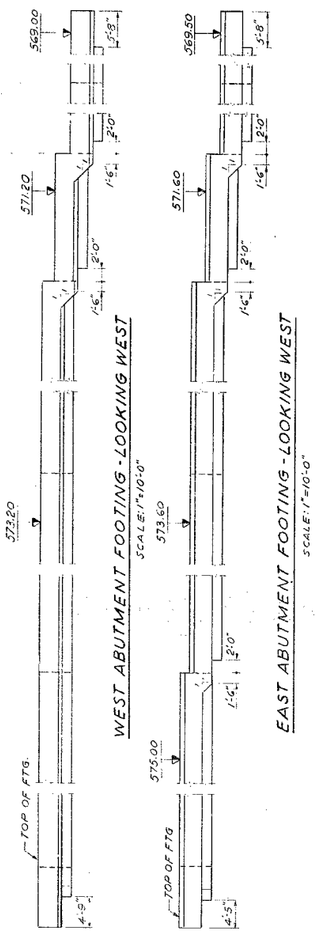
GENERAL ARRANGEMENT

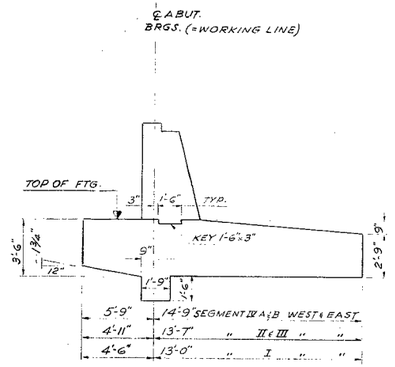
APPROVED _____ BRIDGE ENGINEER

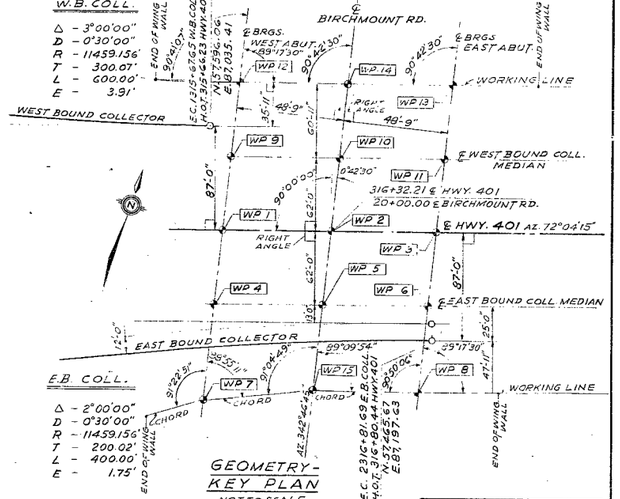
DESIGN	K	CHECK	J.L.K.
DRAWING	B.W.H.	CHECK	K.S.K.
DATE	JUNE 1968	LOADING	HS 20-44

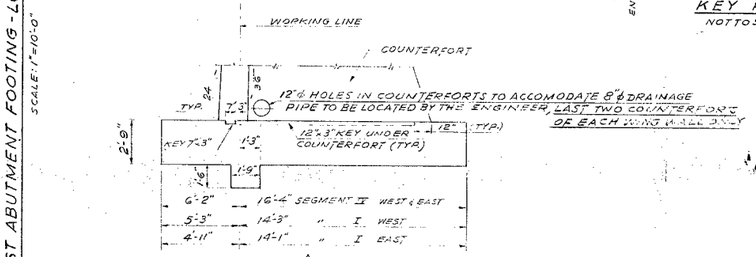
SITE No. 37-212 — W.P. No. 256-61
CONTRACT Nos.
DRAWING No. D-5828-1

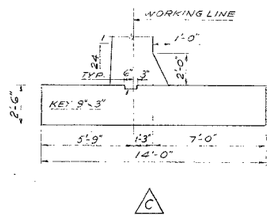


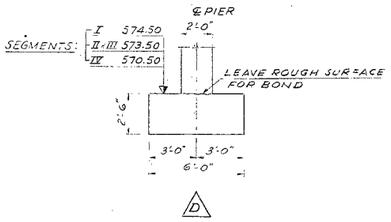












SCALE: ¼" = 1'-0" FOR SECTIONS A, B, C & D

- EXISTING STRUCTURE FOOTINGS TO BE REMOVED. THE EXCAVATIONS DUE TO FOOTING REMOVAL TO BE BACKFILLED WITH GRANNULAR "B" & WELL COMPACTED IN ACCORDANCE WITH SPECIAL PROVISIONS. THE OVEREXCAVATED AREAS UNDER NEW STRUCTURE FOOTINGS TO BE BACKFILLED WITH MASS CONCRETE AS DIRECTED BY THE ENGINEER.

WORKING POINTS		
W.P. Nº	COORDINATES NORTH	EAST
1	57,518.59	87,078.58
2	57,533.60	87,124.96
3	57,548.61	87,171.34
4	57,459.37	87,096.93
5	57,474.38	87,143.32
6	57,489.39	87,189.70
7	57,389.31	87,118.65
8	57,419.73	87,211.29
9	57,577.91	87,060.22
10	57,592.82	87,106.60
11	57,607.83	87,152.99
12	57,636.01	87,042.19
13	57,666.03	87,134.95
14	57,651.02	87,088.57
15	57,404.62	87,164.94

NOTES:

- EXCAVATIONS FOR ALL FOOTINGS SHALL BE KEPT DRY AT ALL TIMES AND FOOTINGS SHALL BE CONSTRUCTED IMMEDIATELY AFTER COMPLETION OF EXCAVATIONS.
- THE EXCAVATIONS SHALL BE NEAT AND FOOTINGS POURED AGAINST UNDISTURBED SOIL.
- ALL WING WALLS ARE STRAIGHT FOLLOWING GIVEN WORKING LINES
- OUTSIDE EDGES OF DECK ARE STRAIGHT FOLLOWING GIVEN WORKING LINES
- ALL CURBS & PARAPET WALLS TO FOLLOW THE CURVATURE OF ROADWAY

REVISIONS		
DATE	BY	DESCRIPTION

PRINT RECORD

No.	FOR	DATE

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION

BIRCHMOUNT ROAD O'PASS

KING'S HIGHWAY No. 401 — DIST. No. 6
CO. YORK
TWP. SCARBOROUGH — LOT 30 & 31 — CON. II

FOOTING LAYOUT & GEOMETRY

APPROVED _____ BRIDGE ENGINEER

DESIGN	AK	CHECK	R.S.L.	SITE No. 37-212	W.P. No. 256-61
DRAWING	A.S.	CHECK	R.S.L.	CONTRACT Nos.	
DATE	JUNE 1968	LOADING	HS 2044	DRAWING No.	D-5828-3

APPENDIX F

Non-Standard Special Provisions

PROTECTION SYSTEM – Item No.

Special Provision

Amendment to OPSS 539, November 2014

593.07.02 Removal of Protection Systems

Subsection 539.07.02 of OPSS 539 is deleted in its entirety and replaced with the following:

Protection systems shall be removed from the right-of-way unless it is specified in the Contract Documents that the protection system may be left in place.

Where piles are left in place, the top shall be removed to at least 1.5 m below the finished grade or ground level.

The method and sequence of removal shall be such that there shall be no damage to the new work, existing work and facility being protected.

All disturbed areas shall be restored to an equivalent or better condition than existing prior to the commencement of construction.

OBSTRUCTIONS – Item No.

Notice to Contractor

The Contactor shall be alerted to the potential presence of wood fragments in the fill material and the potential presence of cobbles and boulders within the fill and the native deposits. Consideration of the presence of these obstructions must be made in the selection of appropriate equipment and procedures for excavations and installation of temporary protection systems.

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