



APRIL 25, 2016

FOUNDATION INVESTIGATION REPORT

**HOGG'S HOLLOW STORM SEWER PIPE REPLACEMENT
SOUTH OF HIGHWAY 401
WEST OF HOGG'S HOLLOW BRIDGE
MINISTRY OF TRANSPORTATION, ONTARIO
G.W.P. 2191-15-00**

Submitted to:
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GEOCRES NO.: 30M11-263

Report Number: 1413191-5

Distribution:

1 Copy - Ministry of Transportation, Ontario - Foundation Section
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REPORT





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PART A

**FOUNDATION INVESTIGATION REPORT
HOGG'S HOLLOW STORM SEWER PIPE
SOUTH OF HIGHWAY 401, WEST OF HOGG'S HOLLOW BRIDGE
NORTH YORK
G.W.P. 2191-15-00**



1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been retained by the Ministry of Transportation, Ontario (MTO) to provide foundation engineering services in support of the proposed replacement of the 760 mm diameter, corrugated steel pipe (CSP) storm sewer outfall running from Maintenance Hole (MH) No. 19, located west of the Highway 401 Hogg's Hollow Bridge over the Don River West Branch, to near the toe of the river valley slope in the Don Valley Golf Course.

The terms of reference and scope of work for the foundation investigation are outlined in MTO Work Item Order Form No. 5 of Agreement No. 4014-E-0012, dated February 2, 2016 and in Golder's Understanding of the Scope. The Authorization to Proceed was received from MTO via an email on February 10, 2016.

This report addresses the investigation carried out by Golder along the approximately 65 m long section of the storm sewer outfall pipe from MH No. 19, down the slope to near the toe of the slope. The pertinent borehole record from a previous Foundation Investigation Report¹ to this section of the storm sewer pipe near MH No. 19 was used in preparation of this report, and this borehole record is included in Appendix D of this report. A geophysical investigation had been completed by Golder to map the location of the sewer pipe from MH No. 19 down the slope and beyond (to the outlet at the Don River)². The investigation area is shown on the Key Map on Drawing 1.

2.0 SITE DESCRIPTION

The 65 m long section of the storm sewer outfall pipe is planned to be replaced runs along the slope located on the south side of Highway 401 and west of the Hogg's Hollow Bridge over the Don River West Branch. The existing valley slope, which is densely covered with trees especially within its lower portion, is approximately 20 m high with a gradient of approximately 1.75 Horizontal to 1 Vertical (1.75H:1V) as shown on the site photographs included in Appendix E of this report. The Don Valley Golf Course is located south of the slope, within the floodplain of the Don River West Branch.

3.0 INVESTIGATION PROCEDURES

The field work was carried out between March 9 and 14 and on April 5, 2016, during which time a total of six boreholes were advanced along the storm sewer alignment. The locations of these boreholes, together with the location of a borehole from the previous investigation, are shown in plan on Drawing 1.

Boreholes 16-1 to 16-3 were advanced using a Big Beaver portable drill rig supplied and operated by Fisher Environmental of Markham, Ontario. The boreholes were advanced through the overburden using nominal 102 mm diameter solid stem augers. Soil samples were obtained at the ground surface and at intervals of depth of about 0.75 m, using a nominal 50 mm outside diameter split-spoon sampler driven by a manual hammer in accordance with the Standard Penetration Test (SPT) procedure. Boreholes 16-1 and 16-3 were advanced to refusal at depths of 5.4 m and 5.6 m, and Borehole 16-2 was advanced to a depth of

¹ Foundation Investigation and Design Report for Hogg's Hollow Bridge Sinkhole Remedial Measures SW Approach Embankment, by Peto MacCallum Ltd., dated November 25, 2015.

² Technical Memorandum for Geophysical Investigation Near Highway 401 at Yonge in Toronto, Ontario, by Golder Associates Ltd., dated January 22, 2016.



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approximately 6 m. The lower portion of the slope was not accessible to portable drilling equipment, and therefore Boreholes 16-4 to 16-6 were advanced using hand auger equipment to depths ranging from approximately 1.5 m to 1.8 m (the physical limit of penetration using this method of sampling), to collect auger samples.

The groundwater conditions in the open boreholes were observed during and upon completion of drilling operations. Piezometers were installed in Boreholes 16-2 and 16-3 to permit monitoring of the groundwater level at these locations. The piezometers consist of 25 mm diameter PVC pipe, with a slotted screen at selected depths within the boreholes. The boreholes surrounding the piezometer pipes above the screen and sand pack were backfilled with bentonite pellets to the existing ground surface. The piezometer installation details and water level readings are noted on the Record of Boreholes 16-2 and 16-3 in Appendix A. Boreholes not instrumented with piezometers were backfilled upon completion of drilling/augering in accordance with Ontario Regulation 903 (as amended).

The field work was observed by a member of Golder's engineering staff, who located the boreholes, arranged for the clearance of underground services, observed the drilling, sampling and in situ testing operations, logged the boreholes, completed the hand augering and examined the soil samples. The samples were identified in the field, placed in appropriate containers, labelled and transported to Golder's Mississauga geotechnical laboratory where the samples underwent further visual examination and laboratory testing. All of the laboratory tests were carried out to MTO and/or ASTM Standards, as appropriate. Classification testing (water content, grain size distribution and Atterberg limits) was carried out on selected soil samples. The results of the geotechnical laboratory testing are included in Appendix B. Two samples were submitted to Maxxam Analytics of Mississauga, Ontario for soil analytical testing (pH, sulphate, chloride, resistivity and electrical conductivity); the results are included in Appendix C.

The as-drilled borehole locations and elevations were measured relative to the known site features. The base plan containing the topographic data was provided to Golder by MTO. The borehole locations provided on the Record of Borehole sheets and shown in plan on Drawing 1 are positioned using MTM NAD83 northing and easting coordinates, and the ground surface elevations are referenced to geodetic datum. The borehole locations, ground surface elevations and drilled depths are summarized below.

Borehole Number	Location (MTM NAD83)		Ground Surface Elevation (m)	Borehole Depth (m)	Drilling Method
	Northing (m)	Easting (m)			
16-1	4,845,482.0	311,739.0	158.2	5.4	Power Auger
16-2	4,845,486.0	311,746.0	156.6	5.8	Power Auger
16-3	4,845,481.0	311,752.0	153.6	5.6	Power Auger
16-4	4,845,489.6	311,766.4	152.7	1.8	Hand Auger
16-5	4,845,493.9	311,777.0	150.3	1.7	Hand Auger
16-6	4,845,493.5	311,785.7	148.0	1.5	Hand Auger



4.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

4.1 Regional Geology

The site is located south of the northern limit of the physiographic region known as the South Slope, according to *The Physiography of Southern Ontario* (Chapman and Putnam, 1984)³.

The South Slope is a smooth and drumlinized till plain that has formed as a result of glacial action and deposition of till materials just south of the Oak Ridges Moraine. The till is typically comprised of clayey silt to silty clay, with occasional sand to silt zones; 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 meltwater ponds scattered throughout the Peel Plain and concentrated near river valleys, such as at this site. 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 encountered in the boreholes advanced as part of the current investigation, together with the results of in situ and laboratory testing are presented on the Record of Borehole sheets and laboratory test summary figures provided in Appendices A and B, respectively. The Record of Borehole sheet from the previous investigation is contained in Appendix D.

The stratigraphic boundaries shown on the Record of Borehole sheets are inferred from observations of drilling progress and non-continuous sampling and, therefore, represent transitions between soil types rather than exact planes of geological change. The subsoil conditions will vary between and beyond the borehole locations.

In general, the subsurface conditions along the proposed sewer pipe replacement consist of cohesive and non-cohesive fill materials, underlain by a deposit of clayey silt till. A detailed description of the subsurface conditions encountered in the boreholes is provided in the following sections.

4.2.1 Topsoil/Fill

An approximately 0.1 m thick layer of topsoil was encountered immediately below the ground surface in Borehole 16-3 at about Elevation 153.6 m.

Fill materials were encountered at the ground surface or below the topsoil in all boreholes. The top of the fill layer ranges from Elevations 160.4 m to 148.0 m at the investigated locations on the valley slope, and its thickness varies between 0.9 m and 4.3 m. The fill is comprised of non-cohesive silty sand to sand, some gravel, to gravelly sand, to sand and gravel, as well as cohesive clayey silt, sandy to with sand portions. The non-cohesive fill in places contains clayey silt seams.

The Standard Penetration Test (SPT) "N"-values measured within the cohesive fill generally range from 10 blows to 23 blows per 0.3 m of penetration, suggesting a stiff to very stiff state of consistency, and the SPT 'N'-values measured within the non-cohesive fill range from 7 blows to 59 blows per 0.30 m of penetration, indicating a loose to very dense state of compactness.

³ 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.



The water content measured on 12 samples of the fill, obtained during the current investigation, ranges from about 7 per cent to about 19 per cent.

The grain size distributions of two samples of the non-cohesive fill and two samples of the cohesive fill, obtained during the current investigation, are shown on Figures B1 and B2, respectively in Appendix B.

An Atterberg limits test was carried out on the fines portion of a sample of clayey silt with sand fill, and measured a liquid limit of about 24 per cent, a plastic limit of about 14 per cent, corresponding to a plasticity index of about 10 per cent. The result of the Atterberg limits test is shown on the plasticity chart on Figure B3 in Appendix B and indicates that the material is classified as a clayey silt of low plasticity.

4.2.2 Glacial Till

A deposit of glacial till comprised of clayey silt, trace to some sand, trace to some gravel was encountered below the fill in all boreholes. The surface of the till layer was encountered at the investigation locations on the valley slope between Elevations 156.1 m and 146.8 m. Borehole 16-2 penetrated a 0.7 m thick layer of silt and sand till below the clayey silt till, at about Elevation 151.5 m. All boreholes were terminated within this deposit between Elevations 155.3 m and 146.5 m. The presence of cobbles and/or boulders was inferred from split-spoon sampler refusals noted within this deposit.

The SPT “N”-values measured within the glacial till deposit range from 30 blows per 0.10 m to 90 blows per 0.25 m of penetration, suggesting a hard consistency. One SPT “N”-value of 40 blows per 0.30 m of penetration was measured within the silt and sand till in Borehole 16-2, indicating a dense state of compactness.

The water content measured on seven samples of this deposit, obtained during the current investigation, ranges from about 14 per cent to 19 per cent.

The grain size distributions of two samples of the clayey silt till, obtained during the current investigation, are shown on Figure B4 in Appendix B.

Two Atterberg limits tests were carried out on samples of the clayey silt till deposit, and measured liquid limits of about 21 per cent and 25 per cent, plastic limits of about 14 per cent and 19 per cent, and plasticity indices of about 6 per cent and 7 per cent. The results of the Atterberg limits tests are shown on the plasticity chart on Figure B5 in Appendix B and indicate that the material is classified as a clayey silt of low plasticity.

The grain size distribution of a sample of the silt and sand till, obtained during the current investigation, is shown on Figure B6 in Appendix B.

4.3 Groundwater Conditions

In general, the soil samples taken during the current investigations were moist. All boreholes were observed to be dry upon completion of drilling.

Piezometers were installed in Boreholes 16-2 and 16-3. These piezometers were noted to be dry in the subsequent visits as listed in the following table.



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Borehole No.	Screened Deposit	Date	Depth (m)	Elevation (m)
16-2	Sand to Sand and Gravel Fill	March 14, 2016	Dry to 2.4	Dry to 154.2
		March 28, 2016	Dry to 2.4	Dry to 154.2
		April 5, 2016	Dry to 2.4	Dry to 154.2
16-3	Clayey Silt Till	March 10, 2016	Dry to 5.6	Dry to 148.0
		March 14, 2016	Dry to 5.6	Dry to 148.0
		March 28, 2016	Dry to 5.6	Dry to 148.0
		April 5, 2016	Dry to 5.6	Dry to 148.0

Although the groundwater level within the valley slope was below the shallow piezometers that were installed as part of this investigation, it should be noted that the groundwater level is expected to fluctuate seasonally in response to changes in precipitation and snow melt, and is expected to be higher during the spring and periods of precipitation. In addition, groundwater may be “perched” locally in non-cohesive fill materials, atop the cohesive till deposit, particularly following periods of precipitation.



5.0 CLOSURE

Mr. Martin Legroulx, B.A.Sc., of Golder's Geotechnical Engineering Group, supervised the borehole investigation program. This Foundation Investigation Report was prepared by Messrs. Martin Legroulx and Al Varshoi, P.Eng., and was reviewed by Ms. Lisa Coyne, P.Eng., senior geotechnical engineer and a Principal of Golder. Mr. Fin Heffernan, P.Eng. Golder's Designated MTO Foundations Contact for this project conducted an independent quality control review of the report.

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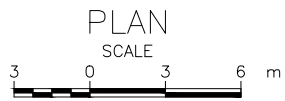
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Ontario Provincial Standard Specifications (OPSS)

OPSS 401	Construction Specification for Trenching, Backfilling, and Compacting
OPSS 410	Construction Specification for Pipe Sewer Installation in Open Cut
OPSS.PROV 501	Construction Specification for Compacting
OPSS.PROV 539	Construction Specification for Temporary Protection Systems
OPSS 802	Construction Specification for Topsoil
OPSS 803	Construction Specification for Sodding
OPSS.PROV 804	Construction Specification for Seed and Cover
OPSS 942	Construction Specification for Prestressed Soil and Rock Anchors
OPSS.PROV 1010	Material Specification for Aggregates – Base, Subbase, Select Subgrade and Backfill Material



DRAWING



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



SHEET






HOGG'S HOLLOW STORM SEWER
PIPE REPLACEMENT
BOREHOLE LOCATIONS AND SOIL
STRATA



KEY PLAN
SCALE



LEGEND

- | | |
|---|--|
|  | Borehole – Current Investigation |
|  | Borehole – Previous Investigation |
|  | Borehole – Hand Auger |
|  | Seal |
|  | Piezometer |
| N | Standard Penetration Test Value |
| 16 | Blows/0.3m unless otherwise stated
(Std. Pen. Test, 475 j/blow) |

BOREHOLE CO-ORDINATES

No.	ELEVATION	NORTHING	EASTING
15-2	160.4	4845478.2	311729.7
16-1	158.2	4845482.0	311739.0
16-2	156.6	4845486.0	311746.0
16-3	153.6	4845481.0	311752.0
16-4	152.7	4845489.6	311766.4
16-5	150.3	4845493.9	311777.0
16-6	148.0	4845493.5	311785.7

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.

The complete Foundation Investigation and Design Report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with Section GC 2.01 of OPS General Conditions.

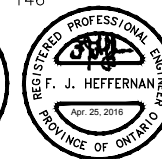
REFERENCE

Base plans provided in digital format by MTO, drawing file nos. W1527108–Dec2015.dwg, received March 15, 2016 and W1527108.dwg, received March 29, 2016.

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NO.	DATE	BY	REVISION

Geocres No. 30M11-263

HWY. 401	PROJECT NO. 1413191	DIST. .
SUBM'D. MPL	CHKD. ARV DATE: 4/12/2016	SITE:
DRAWN: DD	CHKD. ARV APPD. LCC	DWG. 1





APPENDIX A

Borehole Records from Current 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
ν	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	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

(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 = $\tan \delta$
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

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

Notes: 1
2

$$\tau = c' + \sigma' \tan \phi'$$

$$\text{shear strength} = (\text{compressive strength})/2$$



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, 60° 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 cm² 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

Density Index	N
Relative Density	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	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



LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

WEATHERINGS STATE

Fresh: no visible sign of weathering

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

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

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

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

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

BEDDING THICKNESS

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

JOINT OR FOLIATION SPACING

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

GRAIN SIZE

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

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

CORE CONDITION

Total Core Recovery (TCR)

The percentage of solid drill core recovered regardless of quality or length, measured relative to the length of the total core run.

Solid Core Recovery (SCR)

The percentage of solid drill core, regardless of length, recovered at full diameter, measured relative to the length of the total core run.

Rock Quality Designation (RQD)

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

DISCONTINUITY DATA

Fracture Index

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

Dip with Respect to Core Axis


The angle of the discontinuity relative to the axis (length) of the core. In a vertical borehole a discontinuity with a 90° angle is horizontal.

Description and Notes

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

Abbreviations

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

PROJECT 1413191		RECORD OF BOREHOLE No 16-1				SHEET 1 OF 1		METRIC						
G.W.P. 2191-15-00		LOCATION N 4845482.0 ; E 311739.0				ORIGINATED BY ML								
DIST _____ HWY _____		BOREHOLE TYPE Power Auger, 102 mm O.D. Solid Stem Augers				COMPILED BY NN								
DATUM Geodetic		DATE March 14, 2016				CHECKED BY ARV								
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
158.2	GROUND SURFACE							20 40 60 80 100	20 40 60 80 100	10 20 30				
0.0	Sandy clayey silt, trace gravel (FILL) Very stiff Brown Moist		1	SS	21									
157.5	Sand, some gravel, trace silt (FILL) Compact Brown Moist		2	SS	18									
156.8	Clayey silt with sand, trace gravel (FILL) Stiff to very stiff Mottled brown with oxidation staining Moist		3	SS	23									
155.3	CLAYEY SILT, some sand, trace to some gravel (TILL) Hard Brown, becoming grey below a depth of 4.6 m Moist		4	SS	11									
2.9			5	SS	80/0.28									
			6	SS	50/0.13									
			7	SS	50/0.10									
152.8			8	SS	50/0.10									
5.4	SPLIT-SPOON SAMPLER REFUSAL END OF BOREHOLE NOTE: 1. Borehole dry upon completion of drilling.													

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PROJECT 1413191		RECORD OF BOREHOLE No 16-2				SHEET 1 OF 1		METRIC									
G.W.P. 2191-15-00		LOCATION N 4845486.0 ; E 311746.0				ORIGINATED BY ML											
DIST _____ HWY _____		BOREHOLE TYPE Power Auger, 102 mm O.D. Solid Stem Augers				COMPILED BY NN											
DATUM Geodetic		DATE March 10, 2016				CHECKED BY ARV											
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
156.6	GROUND SURFACE						20	40	60	80	100						
0.0	Sandy clayey silt, some gravel, trace organics (FILL) Stiff Brown Moist		1	SS	12												
155.9			2	SS	25							○				32 57 10 1	
0.7	Sand and gravel to sandy gravel, trace to some silt, trace to some clay, containing clayey silt seams below a depth of 2.1 m (FILL) Compact to very dense Brown Moist		3	SS	53							○				45 25 18 12	
			4	SS	40							○					
			5	SS	26							○					
152.9																	
3.7	CLAYEY SILT, some sand (TILL) Hard Grey Moist		6	SS	90/0.25								4	1		0 13 67 20	
			7	SS	50/0.15												
151.5																	
5.1	SILT and SAND, trace to some gravel, trace to some clay (TILL) Dense Brown Moist		8	SS	40											11 34 46 9	
150.8																	
5.8	END OF BOREHOLE																
NOTES: 1. Borehole dry upon completion of drilling. 2. Groundwater level measurements in piezometer: Date Depth (m) 03/14/16 Dry to 2.4 m 03/28/16 Dry to 2.4 m 04/05/16 Dry to 2.4 m																	

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PROJECT		1413191		RECORD OF BOREHOLE No 16-3				SHEET 1 OF 1		METRIC							
G.W.P.		2191-15-00		LOCATION		N 4845481.0 ; E 311752.0		ORIGINATED BY		ML							
DIST		HWY		BOREHOLE TYPE		Power Auger, 102 mm O.D. Solid Stem Augers		COMPILED BY		NN							
DATUM		Geodetic		DATE		March 9, 2016		CHECKED BY		ARV							
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
153.6	GROUND SURFACE						20	40	60	80	100						
0.9	TOPSOIL		1	SS	10												
152.7	Sandy clayey silt, some gravel, trace organics (FILL) Stiff		2	SS	18												
0.9	Mottled brown and grey Moist																
152.2	Sand, some gravel, trace silt (FILL)																
1.4	Compact Brown with oxidation staining Moist		3	SS	13												
151.6	Clayey silt with sand, trace to some gravel (FILL) Stiff Brown Moist		4	SS	30/0.15												
2.0	CLAYEY SILT, trace sand (TILL) Brown, becoming grey below a depth of 2.4 m Hard Moist		5	SS	30/0.15												
			6	SS	50/0.10												
			7	SS	50/0.13												
	Silty sand seam from depths of about 5.3 m to 5.5 m		8A 8B	SS	50/0.10												
148.0	SPLIT-SPOON SAMPLER REFUSAL END OF BOREHOLE																
5.6	NOTES: 1. Auger refusal encountered at a depth of 2.0 m in the first two attempts of borehole advancement. Borehole was moved about 3.0 m east of the original location and samples were taken below a depth of 2.3 m to borehole termination depth of 5.6 m. 2. Borehole dry upon completion of drilling. 3. Groundwater level measurements in piezometer: Date Depth (m) 03/10/16 Dry to 5.6 m 03/14/16 Dry to 5.6 m 03/28/16 Dry to 5.6 m 04/05/16 Dry to 5.6 m																

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PROJECT <u>1413191</u>		RECORD OF BOREHOLE No 16-4		SHEET 1 OF 1		METRIC	
G.W.P. <u>2191-15-00</u>		LOCATION <u>N 4845489.6 ;E 311766.4</u>		ORIGINATED BY <u>ML</u>			
DIST <u> </u> HWY <u> </u>		BOREHOLE TYPE <u>Hand Auger</u>		COMPILED BY <u>ML</u>			
DATUM <u>Geodetic</u>		DATE <u>April 5, 2016</u>		CHECKED BY <u>ARV</u>			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)							
152.7	GROUND SURFACE																			
0.0	Silty sand, trace to some gravel (FILL) Brown Moist		1	AS	-		152													
			2	AS	-															
			3	AS	-															
			4	AS	-															
			5	AS	-															
151.2			6	AS	-		151													
150.9	CLAYEY SILT, some sand, trace gravel (TILL) Brown Moist																			
1.8	END OF BOREHOLE																			
NOTE: 1. Borehole dry upon completion of hand augering.																				

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

PROJECT 1413191		RECORD OF BOREHOLE No 16-6				SHEET 1 OF 1		METRIC											
G.W.P. 2191-15-00		LOCATION N 4845493.5 ; E 311785.7				ORIGINATED BY ML													
DIST _____ HWY _____		BOREHOLE TYPE Hand Auger				COMPILED BY ML													
DATUM Geodetic		DATE April 5, 2016				CHECKED BY ARV													
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)	
148.0	GROUND SURFACE							20	40	60	80	100							
0.0	Silty sand, trace gravel (FILL) Brown Moist		1	AS	-		147												
			2	AS	-														
147.1			3	AS	-														
146.8	Sandy clayey silt (FILL) Brown Moist		4	AS	-														
146.5	CLAYEY SILT, some sand, trace gravel (TILL) Brown Moist		5	AS	-														
1.5	END OF BOREHOLE																		
NOTE: 1. Borehole dry upon completion of hand augering.																			

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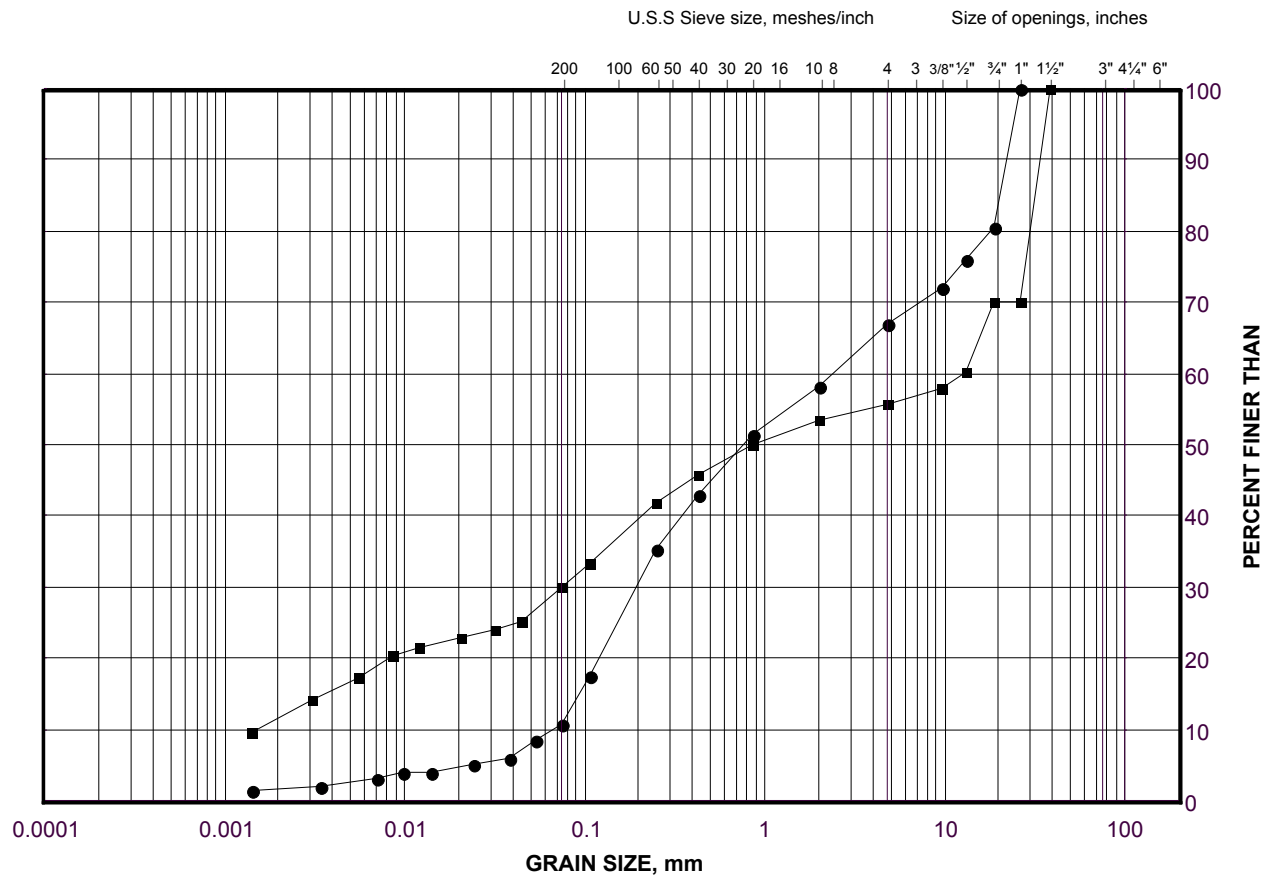
APPENDIX B

Geotechnical Laboratory Test Results

GRAIN SIZE DISTRIBUTION

Sand and Gravel to Sandy Gravel (Fill)

FIGURE B1



SILT AND CLAY SIZES			FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED			SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	16-2	2	155.6
■	16-2	3	154.8

Project Number: 1413191

Checked By: PKS

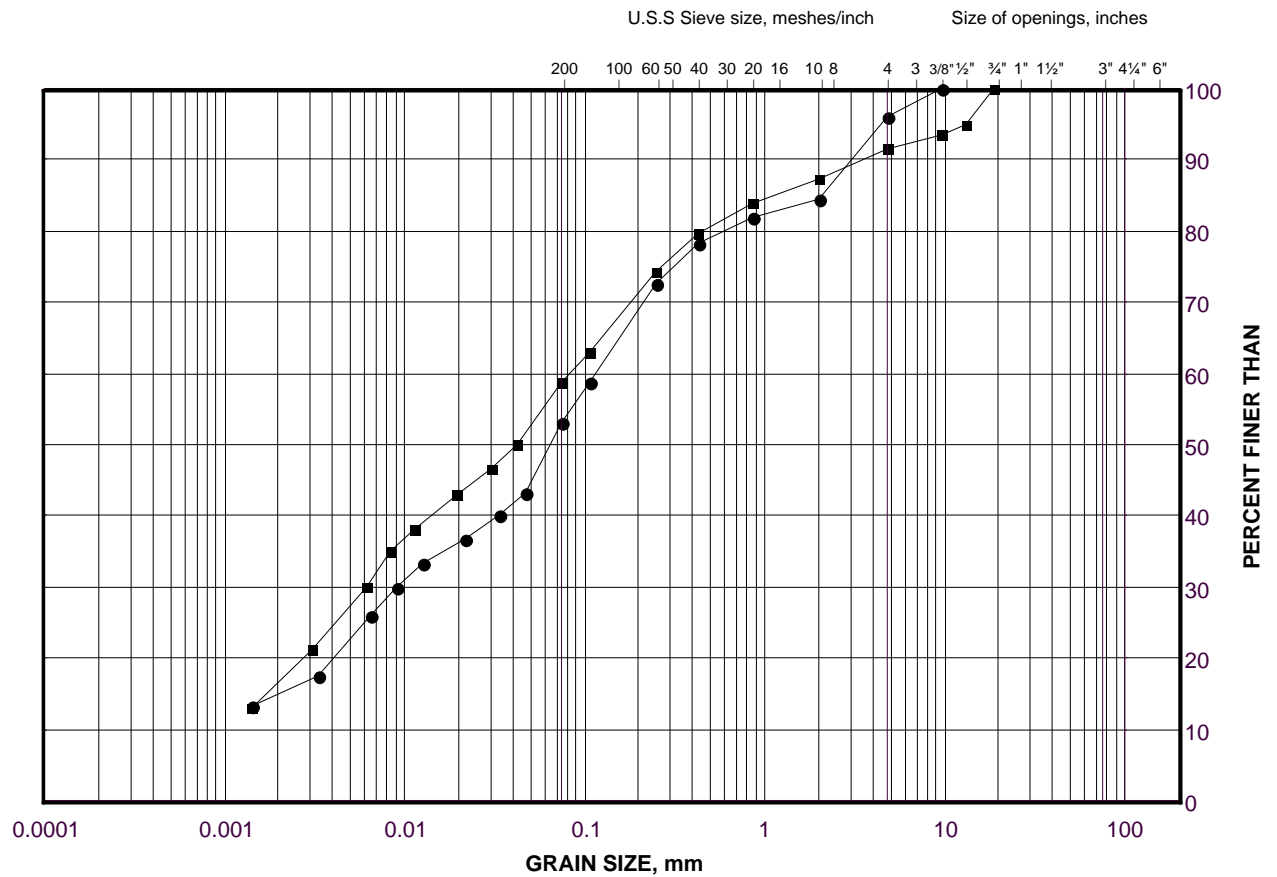
Golder Associates

Date: 31-Mar-16

GRAIN SIZE DISTRIBUTION

Clayey Silt with Sand (Fill)

FIGURE B2



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

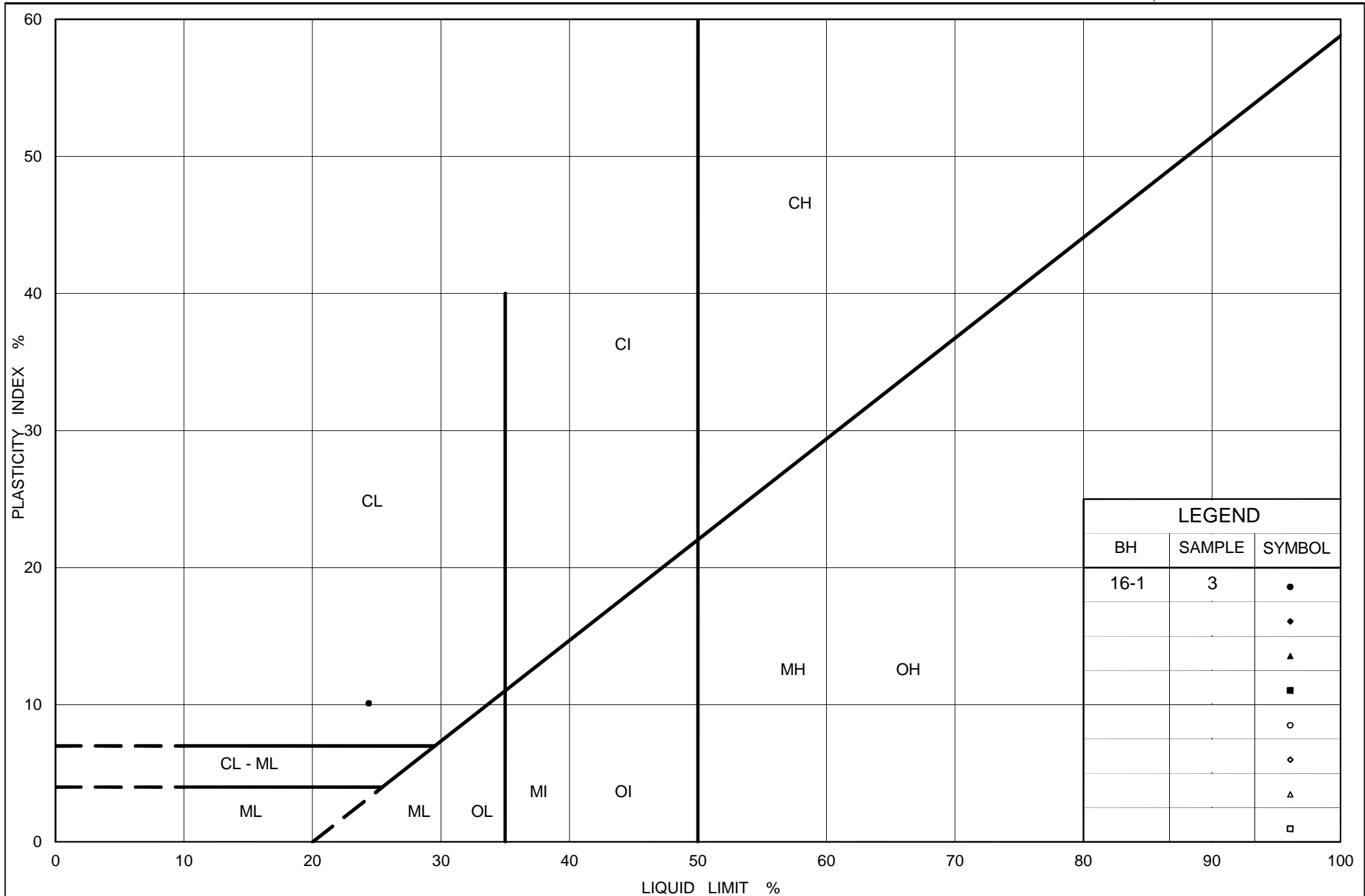
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	16-1	3	156.4
■	16-3	3	151.8

Project Number: 1413191

Checked By: PKS

Golder Associates

Date: 31-Mar-16



Ministry of Transportation

Ontario

PLASTICITY CHART Clayey Silt with Sand - Fines Portion (Fill)

Figure No. B3

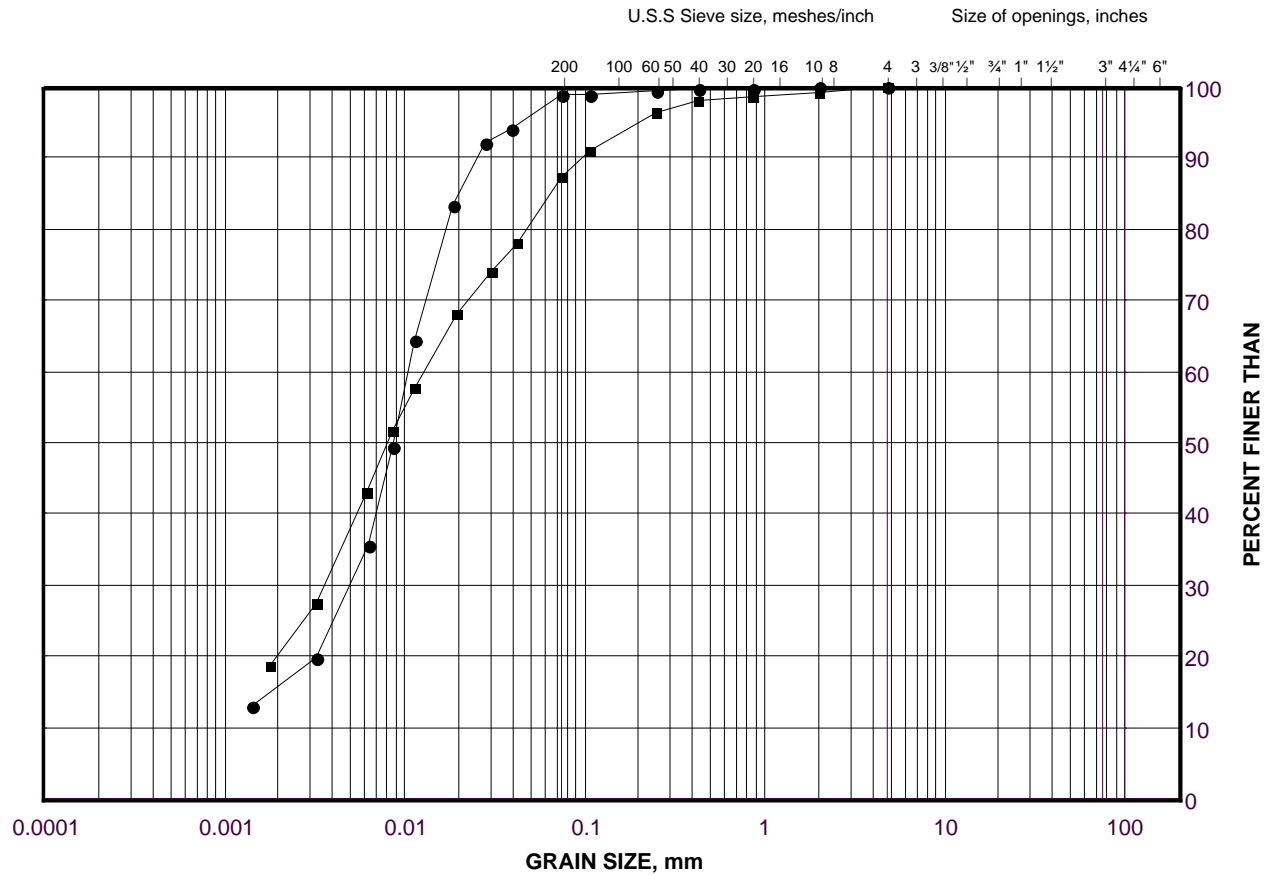
Project No. 1413191

Checked By: PKS

GRAIN SIZE DISTRIBUTION

Clayey Silt (Till)

FIGURE B4



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

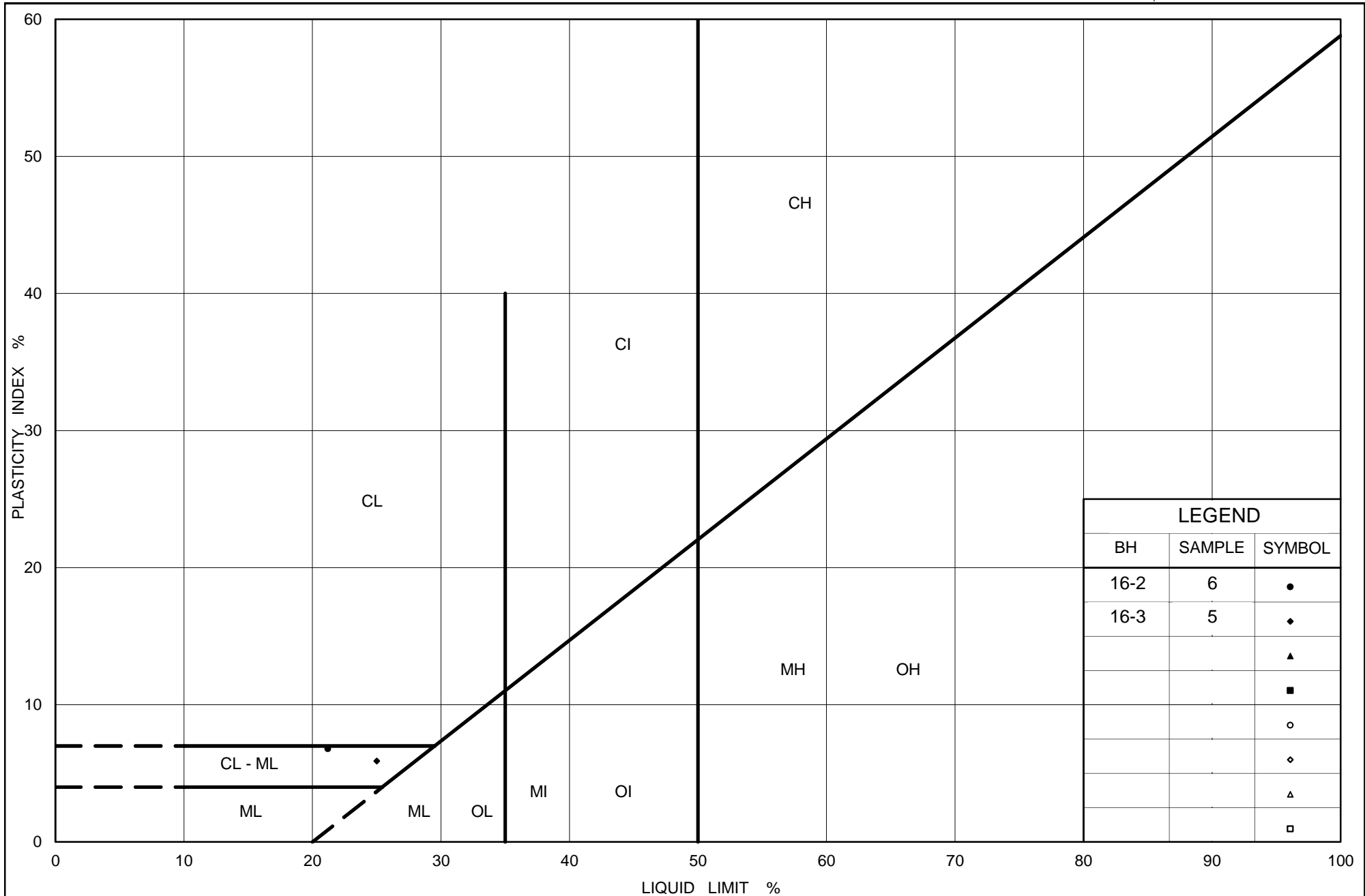
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	16-3	5	150.5
■	16-2	6	152.7

Project Number: 1413191

Checked By: PKS

Golder Associates

Date: 31-Mar-16



Ministry of Transportation

Ontario

PLASTICITY CHART Clayey Silt (Till)

Figure No. B5

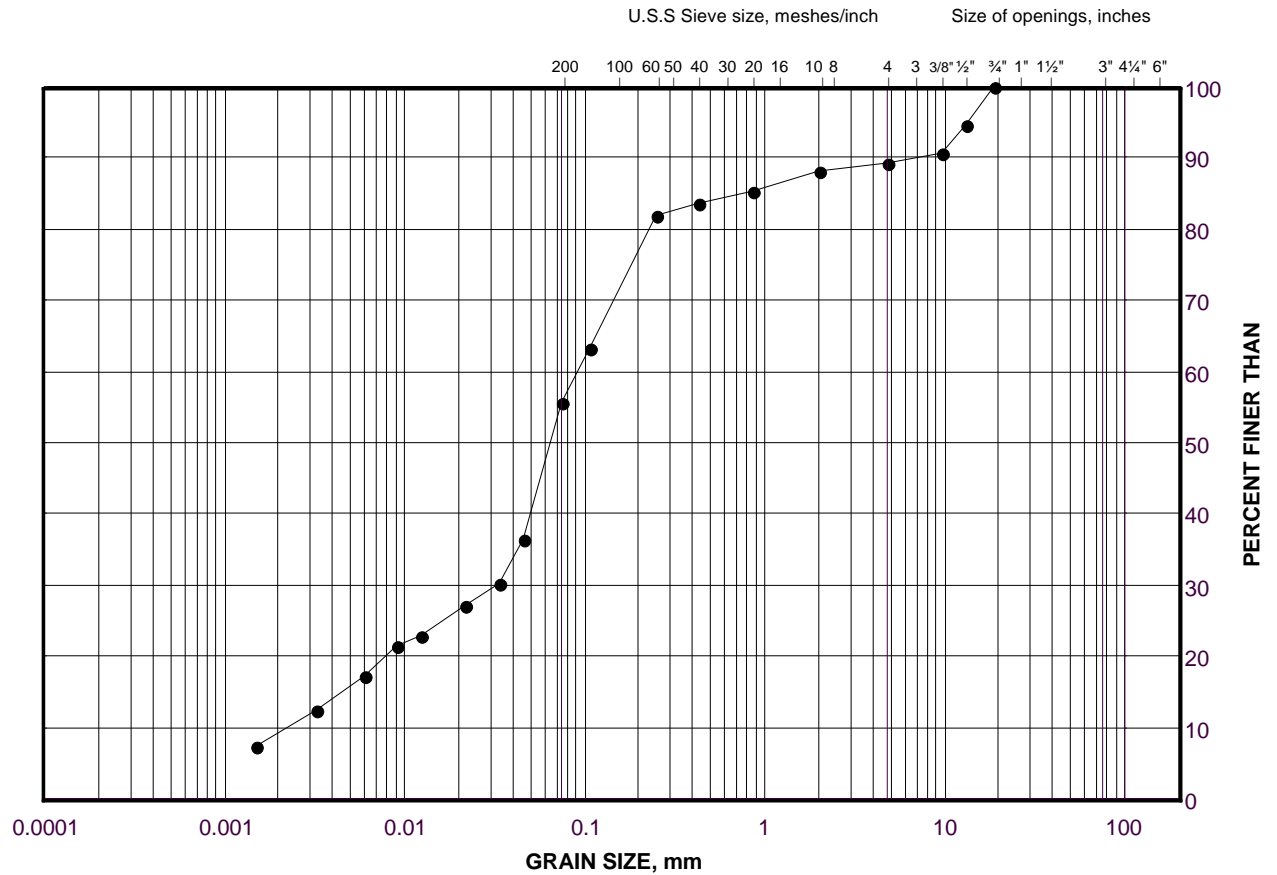
Project No. 1413191

Checked By: PKS

GRAIN SIZE DISTRIBUTION

Silt and Sand (Till)

FIGURE B6



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	16-2	8	151.1

Project Number: 1413191

Checked By: ARV

Golder Associates

Date: 11-Apr-16



APPENDIX C

Analytical Laboratory Test Results

Your Project #: 1413191
Site Location: HOGG'S HOLLOW
Your C.O.C. #: 70732

Attention: Al Varshoi

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

Report Date: 2016/03/31
Report #: R3946728
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B658815

Received: 2016/03/23, 18:40

Sample Matrix: Soil
Samples Received: 2

Analyses	Date		Date	Laboratory Method	Reference
	Quantity	Extracted			
Chloride (20:1 extract)	2	N/A	2016/03/30	CAM SOP-00463	EPA 325.2 m
Conductivity	2	N/A	2016/03/30	CAM SOP-00414	OMOE E3138 v2 m
pH CaCl2 EXTRACT	1	2016/03/29	2016/03/29	CAM SOP-00413	EPA 9045 D m
pH CaCl2 EXTRACT	1	2016/03/30	2016/03/30	CAM SOP-00413	EPA 9045 D m
Resistivity of Soil	2	2016/03/23	2016/03/30	CAM SOP-00414	SM 22 2510 m
Sulphate (20:1 Extract)	2	N/A	2016/03/30	CAM SOP-00464	EPA 375.4 m

Remarks:

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

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

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ema Gitej, Senior Project Manager

Email: EGitej@maxxam.ca

Phone# (905)817-5829

=====

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.

RESULTS OF ANALYSES OF SOIL

Maxxam ID		CBP366		CBP367	CBP367			
Sampling Date		2016/03/14 15:00		2016/03/09 15:00	2016/03/09 15:00			
COC Number		70732		70732	70732			
	UNITS	BH16-1 SA 8	QC Batch	BH16-3 SA 2B	BH16-3 SA 2B Lab-Dup	RDL	QC Batch	MDL
Calculated Parameters								
Resistivity	ohm-cm	570	4430571	3000			4430571	
Inorganics								
Soluble (20:1) Chloride (Cl)	ug/g	830	4436221	110		20	4436221	20
Conductivity	umho/cm	1760	4436220	330	331	2	4436220	1
Available (CaCl2) pH	pH	7.77	4435556	7.64			4435019	
Soluble (20:1) Sulphate (SO4)	ug/g	170	4436222	<20		20	4436222	N/A
RDL = Reportable Detection Limit								
QC Batch = Quality Control Batch								
Lab-Dup = Laboratory Initiated Duplicate								

Maxxam Job #: B658815
Report Date: 2016/03/31

Golder Associates Ltd
Client Project #: 1413191
Site Location: HOGG'S HOLLOW
Sampler Initials: ML

TEST SUMMARY

Maxxam ID: CBP366
Sample ID: BH16-1 SA 8
Matrix: Soil

Collected: 2016/03/14
Shipped:
Received: 2016/03/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	4436221	N/A	2016/03/30	Deonarine Ramnarine
Conductivity	AT	4436220	N/A	2016/03/30	Lemeneh Addis
pH CaCl2 EXTRACT	AT	4435556	2016/03/30	2016/03/30	Neil Dassanayake
Resistivity of Soil		4430571	2016/03/30	2016/03/30	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	4436222	N/A	2016/03/30	Deonarine Ramnarine

Maxxam ID: CBP367
Sample ID: BH16-3 SA 2B
Matrix: Soil

Collected: 2016/03/09
Shipped:
Received: 2016/03/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	4436221	N/A	2016/03/30	Deonarine Ramnarine
Conductivity	AT	4436220	N/A	2016/03/30	Lemeneh Addis
pH CaCl2 EXTRACT	AT	4435019	2016/03/29	2016/03/29	Neil Dassanayake
Resistivity of Soil		4430571	2016/03/30	2016/03/30	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	4436222	N/A	2016/03/30	Deonarine Ramnarine

Maxxam ID: CBP367 Dup
Sample ID: BH16-3 SA 2B
Matrix: Soil

Collected: 2016/03/09
Shipped:
Received: 2016/03/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Conductivity	AT	4436220	N/A	2016/03/30	Lemeneh Addis

Maxxam Job #: B658815
Report Date: 2016/03/31

Golder Associates Ltd
Client Project #: 1413191
Site Location: HOGG'S HOLLOW
Sampler Initials: ML

GENERAL COMMENTS

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

Package 1	16.0°C
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Results relate only to the items tested.

QUALITY ASSURANCE REPORT

Golder Associates Ltd
Client Project #: 1413191
Site Location: HOGG'S HOLLOW
Sampler Initials: ML

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
4435019	Available (CaCl ₂) pH	2016/03/29			99	97 - 103			0.17	N/A
4435556	Available (CaCl ₂) pH	2016/03/30			98	97 - 103			0.051	N/A
4436220	Conductivity	2016/03/30			99	90 - 110	<2	umho/cm	0.30	10
4436221	Soluble (20:1) Chloride (Cl)	2016/03/30	NC	70 - 130	111	70 - 130	<20	ug/g	5.6	35
4436222	Soluble (20:1) Sulphate (SO ₄)	2016/03/30	NC	70 - 130	106	70 - 130	<20	ug/g	NC	35

N/A = Not Applicable

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

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

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

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

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

VALIDATION SIGNATURE PAGE

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



Brad Newman, Scientific Specialist

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

Invoice Information		Report Information (if differs from invoice)		Project Information (where applicable)		Turnaround Time (TAT) Required	
Company Name: <u>Golder Associates</u>	Company Name:	Quotation #:	<input checked="" type="checkbox"/> Regular TAT (5-7 days) Most analyses				
Contact Name: <u>Al Varshoi</u>	Contact Name:	P.O. #/ A/E#:	PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS				
Address: <u>6925 Century Ave. Suite#100</u>	Address:	Project #: <u>1413191</u>	Rush TAT (Surcharges will be applied)				
Phone: <u>905-567-4444</u> Fax: <u>905-567-6561</u>	Phone:	Site Location: <u>Hogg's Hollow</u>	<input type="checkbox"/> 1 Day <input type="checkbox"/> 2 Days <input type="checkbox"/> 3-4 Days				
Email: <u>AVarshoi@golder.com</u>	Email:	Site #:	Date Required:				
		Sampled By:	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		Analysis Requested			
<input type="checkbox"/> Table 1 <input type="checkbox"/> Res/Park <input type="checkbox"/> Med/ Fine <input type="checkbox"/> Table 2 <input type="checkbox"/> Ind/Comm <input type="checkbox"/> Coarse <input type="checkbox"/> Table 3 <input type="checkbox"/> Agri/ Other <input type="checkbox"/> Table _____ FOR RSC (PLEASE CIRCLE) Y / N		<input type="checkbox"/> CCME <input type="checkbox"/> Sanitary Sewer Bylaw <input type="checkbox"/> MISA <input type="checkbox"/> Storm Sewer Bylaw <input type="checkbox"/> PWQO <input type="checkbox"/> Region <input type="checkbox"/> Other (Specify) _____ <input type="checkbox"/> REG 558 (MIN. 3 DAY TAT REQUIRED)		REFER TO BACK OF COC REG 153 METALS & INORGANICS REG 153 ICPMS METALS REG 153 METALS (Hg, Cr VI, ICPMS Metals, HWS - B) Sulphate EC Chloride PH Resistivity			
Include Criteria on Certificate of Analysis: Y / N		SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM		LABORATORY USE ONLY			
SAMPLE IDENTIFICATION		DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED	FIELD FILTERED (CIRCLE) Metals / Hg / CVI	CUSTOMER SEAL Y / (N)
1 BH 16-1 SA 8	2016/03/14	3:00pm	Soil	2			COOLER TEMPERATURES
2 BH 16-3 SA 2B	2016/03/09	3:00pm	Soil	2			16/16/16
3							
4							
5							
6							
7							
8							
9							
10							
RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	COOLING MEDIA PRESENT: Y / (N)	
Martin Legault	2016/03/23	6:00pm	RACHEL DENIN	2016/03/23	18:40	COMMENTS	

23-Mar-16 18:40

Ema Gitej



B658815

RGN ENV-086



APPENDIX D

Borehole Record from Previous Investigation

RECORD OF BOREHOLE No 15-2

1 of 1

METRIC

G.W.P. 2013-E-0039-007A	LOCATION	Coords: 4 845 478.2 N; 311 729.7 E	ORIGINATED BY F.P.
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DIST	Central	HWY	401	BOREHOLE TYPE	Continuous Flight Solid Stem Augers	COMPILED BY	M.K.
------	---------	-----	-----	---------------	-------------------------------------	-------------	------

DATUM Geodetic DATE August 13 & 14, 2015 CHECKED BY C.N.


[illegible]



APPENDIX E

Site Photographs



PROJECT	Hogg's Hollow Sewer Replacement GWP 2191-15-00				
	TITLE				
Site Photograph Upper portion of the slope looking up slope					
	PROJECT No.	1413191	FILE No.	----	
	DESIGN	MPL	APR 16	SCALE	NTS
	CADD				REV
	CHECK	MPL	APR 16	FIGURE 1	
	REVIEW	AV	APR 16		



PROJECT

**Hogg's Hollow Sewer Replacement
GWP 2191-15-00**

TITLE


**Site Photograph
Lower portion of the slope looking up slope**



PROJECT No.	1413191	FILE No.	----
DESIGN	MPL	APR 16	SCALE NTS
CADD	MPL	APR 16	REV
CHECK	MPL	APR 16	
REVIEW	AV	APR 16	

FIGURE 2



PROJECT		Hogg's Hollow Sewer Replacement GWP 2191-15-00			
TITLE		Site Photograph Lower portion of the slope looking downslope			
	PROJECT No.	1413191	FILE No.	----	
	DESIGN	MPL	APR 16	SCALE	NTS
	CADD				REV
	CHECK	MPL	APR 16	FIGURE 3	
	REVIEW	AV	APR 16		



PROJECT

**Hogg's Hollow Sewer Replacement
GWP 2191-15-00**


TITLE

**Site Photograph
Upper portion of the slope looking downslope**



PROJECT No. 1413191			FILE No. ----		
DESIGN			SCALE	NTS	REV.
CADD	MPL	APR 16	FIGURE 4		
CHECK	MPL	APR 16			
REVIEW	AV	APR 16			



PROJECT		Hogg's Hollow Sewer Replacement GWP 2191-15-00			
TITLE		Site Photograph Storm sewer alignment on upper portion of slope			
	PROJECT No.	1413191	FILE No.	----	
	DESIGN	MPL	APR 16	SCALE	NTS
	CADD	MPL	APR 16		REV
	CHECK	MPL	APR 16	FIGURE 5	
	REVIEW	AV	APR 16		



PROJECT

**Hogg's Hollow Sewer Replacement
GWP 2191-15-00**

TITLE

**Site Photograph
Upper portion of the slope looking upslope**



PROJECT No.	1413191	FILE No.	----
DESIGN	MPL	APR 16	SCALE NTS
CADD	MPL	APR 16	REV
CHECK	MPL	APR 16	
REVIEW	AV	APR 16	

FIGURE 6

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