TECHNICAL MEMORANDUM

DATE November 11, 2016 **PROJECT No.** 13-1121-0186

TO Mr. Jim Burghout
Claridge Homes Corporation

FROM Caitlin Cooke
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GROUNDWATER IMPACT STUDY
PROPOSED RESIDENTIAL DEVELOPMENT, KELLAM LANDS
4789 BANK STREET, OTTAWA, ONTARIO

This report presents the results of a groundwater impact study carried out for the proposed residential development site to be located at 4789 Bank Street, in Ottawa, Ontario. The groundwater impact study is required by the City of Ottawa (City) prior to draft plan approval.

The purpose of this groundwater impact study was to determine the general soil and groundwater conditions across this site, by means of existing on-site borehole information and data from nearby sites, and to address possible construction-related impacts to private water supply wells. The on-site information was enhanced with published mapping and publicly available information. The water well records in the Ministry of the Environment and Climate Change (MOECC) Water Well Information System (WWIS) for nearby water wells were used to provide further information regarding hydrogeological conditions in the area and identify where nearby water well users are taking their water.

1.0 DESCRIPTION OF PROJECT AND SITE

A residential subdivision is planned to be developed on a site located on the east side of Bank Street, opposite Findlay Creek Drive, and south of Analdea Drive, in Ottawa, Ontario. The approximate location of the site is shown on the Key Map insert provided on the Site Plan, Figure 1.

The following is known about the site and project (Figure 1):

- The site is currently undeveloped, is approximately rectangular in shape and measures about 300 metres by 950 metres in plan area.
- The site will be developed as a conventional residential development with mixed use commercial at the west end and a park at the southeast corner of the property.
- The development will be serviced with municipal sewer and water.

2.0 GEOLOGY

The following sections describe the published local geology and hydrogeology in the vicinity of the site.

2.1 Surficial Geology

The surficial geology in the vicinity of the site is shown on Figure 2. The upper overburden material mapped within the development is glacial till (Unit 1a). The upper overburden material mapped beneath the eastern-most portion of the development is nearshore deposits of gravel, sand and boulders (Units 5a and 5b). This generally agrees with the site-specific data gathered by Golder Associates from test pits and boreholes completed within the development site (Golder Associates, 2013) and boreholes completed along the trunk sanitary sewer alignment (Golder Associates, 2010). These investigations found that the subsurface conditions on the site generally consist of sandy and silty soil underlain by a deposit of glacial till, which in turn overlies bedrock.

The locations of the test pits and boreholes is shown on Figure 1 and the test pit and borehole logs are provided in Attachment A.

Based on the data collected by Golder Associates, the bedrock surface typically exists at depths ranging from about 1.5 to 6.6 metres below the existing ground surface, increasing in depth from the west to the east. Published mapping indicates the bedrock surface to be at depths in the range of 2 to 50 metres below the ground surface in the vicinity of the site (Figure 3).

2.2 Bedrock Geology

The Ontario Geological Survey bedrock geology mapping indicates that the Queenston, Carlsbad, Lindsay, Nepean and March Formations are present in the area of the site (Figure 4). The Queenston, Carlsbad and Lindsay Formations generally consist of interbedded shale, siltstone and limestone. The Nepean Formation consists of quartz sandstone and the March Formation consists of interbedded sandstone, sandy dolostone and dolostone (Williams, 1991). Although not shown on Figure 4, the Oxford Formation, consisting of dolostone with subordinate shaley and sandy interbeds, has also been found near the site.

The site-specific bedrock geology in the vicinity of the site has been interpreted based on test pit and borehole information gathered for the development site, the Sundance Village Subdivision and associated trunk sanitary servicing (immediately north of the development site), the Findlay Creek Village Subdivision (located immediately west of the development site), and the installation of the stormwater management pond (SWMP) north of Blais Road and south of the development site. The following summarizes the review of the available site-specific bedrock information:

- All boreholes completed into the bedrock within the Findlay Creek Village Subdivision and adjacent Leitrim Wetland encountered an upper bedrock unit consisting of dolostone or dolomitic limestone. This bedrock unit is interpreted to be the Oxford Formation.
- Shale bedrock was observed in all of the test pits completed to bedrock in the Sundance Village Subdivision.
- From boreholes completed into bedrock along the trunk sanitary sewer alignment and in the vicinity of the SWMP, and as observed during installation of the trunk sewer, the upper bedrock unit changes from dolostone to shale going east from Bank Street. Based on a review of the available bedrock core, the shale unit is interpreted to be the Carlsbad Formation.

3.0 HYDROGEOLOGY

3.1 Regional Hydrogeology

The clay and glacial till deposits in the area of the development are generally not capable of supplying sufficient quantities of groundwater to be considered an aquifer. As a result, the principal aquifer within the vicinity of the site is considered to be the underlying bedrock formations.

The Nepean, March and Oxford Formations are considered to be highly transmissive aquifers, and generally provide an adequate resource for domestic water supplies. Groundwater flow in these formations is controlled predominately by fractures, as the primary porosity has been reduced by cementation.

The Queenston, Carlsbad and Lindsay Formations are generally known as relatively poor water producers from both a quantity and quality perspective. As such, very little testing of the hydraulic properties of these formations has been completed.

3.2 Site Specific Hydrogeology

A number of hydrogeological investigations have been completed on and nearby the site. Monitoring wells were sealed into various boreholes to allow for hydraulic response testing and measurements of the groundwater level. Estimates of hydraulic conductivity in monitoring wells where testing was completed as well as measured groundwater levels are provided in the following table.

Borehole Number	Geologic Unit	Ground Surface Elevation (masl)	Groundwater Depth (m)	Groundwater Elevation (masl)	Date of Measurement	Estimated Hydraulic Conductivity (m/s)
13-2	Silty Sand	94.55	0.48	94.07	Oct. 23, 2013	Not measured
13-7	Glacial Till	92.19	0.93	91.26	Oct. 23, 2013	Not measured
13-12	Glacial Till	89.99	0.98	89.01	Oct. 23, 2013	Not measured
10-1 A	Dolomitic Limestone	93.66	3.17	90.49	Sep. 28, 2010	2.2×10^{-6}
10-1 B	Dolomitic Limestone	93.66	3.72	89.94	Feb. 16, 2010	9.3×10^{-6}
10-2	Sand/Glacial Till	90.45	0.04	90.41	Mar. 29, 2010	2.8×10^{-6}
10-3	Silt	90.30	0.05	90.25	Mar. 29, 2010	3.5×10^{-7}
10-103	Glacial Till / Shale Bedrock	93.49	0.17	93.32	Sep. 28, 2010	3.4×10^{-6}
10-108 A	Shale Bedrock	89.54	0.06	89.48	Sep. 28, 2010	9.7×10^{-6}
10-108 B	Glacial Till	89.54	0.70	88.84	Sep. 28, 2010	4.1×10^{-8}

Water levels across the area surrounding the site range from 0 to 3.7 metres depth. It should be noted that groundwater levels are expected to fluctuate seasonally. Higher groundwater levels are expected during wet periods of the year, such as spring.

4.0 POTENTIAL IMPACTS TO EXISTING GROUNDWATER USERS

Municipal water service within the vicinity of the site is provided in the area of Bank Street from Leitrim Road to Rideau Road, the west end of Blais Road, Sundance Village Subdivision and Findlay Creek Village Subdivision. It is expected that the majority of wells recorded in the WWIS database in this area are no longer in use and the houses/businesses are connected to the municipal supply; however, it is possible that there could still be a limited number of water supply wells still in use. It is considered that the only potential for the proposed development to affect any wells that are still in use would be temporarily in association with temporary pumping from service trenches.

In the MOECC Water Well Information System (WWIS) database, one water supply well was located within 100 metres of the site. The WWIS indicates that the well was constructed to be used as domestic water supply. Details regarding the water supply well are presented in the following table. Refer to Figure 1 for the reported well location.

Well ID	Depth of Well (m)	Depth to Static Water Level (m)	Depth to Water Found (m)	Available Drawdown (m)	Type of Well
1514809	90.8	7.6	90.8	83.2	Bedrock

From the available well record, the water supply well obtains water from the bedrock aquifer. The available drawdown in the well, calculated as the difference between the static water level and the depth of the well) was 83.2 metres. A temporary drawdown due to construction dewatering from service trenches at the site could temporarily reduce the available drawdown in the well, but not likely to the degree that could negatively impact water supply. It is understood that there are no structures or land uses planned for the site that would permanently lower the groundwater levels in the area surrounding the site (i.e., deep drained foundations).

Based on the comparatively small amount of drawdown that would be required in service trenches compared to the available drawdown in the well, the installation of site services is not expected to adversely affect performance of any remaining wells in service within 100 metres of the site. In addition, installation of a deep trunk sanitary sewer was completed in 2011, east-west across the site and north to the Sundance Village Subdivision. At that time, there were no well interference complaints. Since the proposed service trenches on the site would be shallower than the trunk sanitary sewer trench constructed in 2011, impacts to existing groundwater users associated with temporary pumping from service trenches are not anticipated.

Prior to construction at the site, it is recommended that a well survey be completed at residences with wells located within approximately 100 metres of the property boundary. Information to be collected during the well survey could include the depth of the well, type of pump, and static water level. Water quality samples could be collected and analyzed for a typical suite of parameters (i.e. the ‘subdivision package’ as per MOECC Procedure D-5-5).

5.0 LIMITATIONS AND USE OF MEMORANDUM

This technical memorandum was prepared for the exclusive use of Claridge Homes Corporation. The technical memorandum, which specifically includes all tables, figures and appendices, is based on data gathered by Golder Associates Ltd., and information provided to Golder Associates Ltd. by others. The information provided by others has not been independently verified or otherwise examined by Golder Associates Ltd. to determine the accuracy or completeness. Golder Associates Ltd. has relied in good faith on this information and does not accept responsibility for any deficiency, misstatements, or inaccuracies contained in the information as a result of omissions, misinterpretation or fraudulent acts.

The services performed as described in this technical memorandum were conducted in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practicing under similar conditions, subject to the time limits and financial and physical constraints applicable to the services.

Any use which a third party makes of this technical memorandum, or any reliance on, or decisions to be made based on it, are the responsibilities of such third parties. Golder Associates Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made, or actions taken based on this technical memorandum.

6.0 CLOSURE

We trust this submission satisfies the requirements for a groundwater impact study of the proposed Claridge Kellam Lands residential development, in Ottawa, Ontario. If you have any questions regarding this report, please contact the undersigned.

GOLDER ASSOCIATES LTD.

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ONTARIO

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Attachments: Figures 1 to 4
Attachment A – Borehole Logs

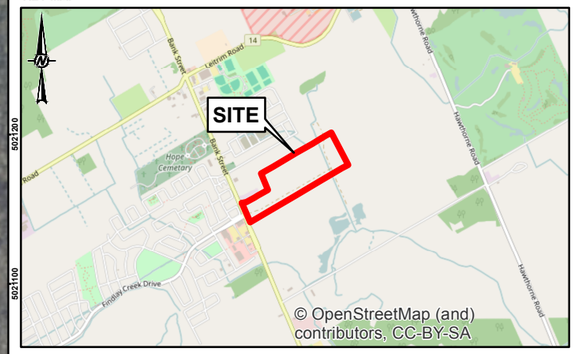
REFERENCES

Golder Associates Ltd., 2010. Report on Geotechnical Investigation, Proposed Trunk Sewers - Detailed Design, Sundance Village Development, Ottawa, Ontario. Report No. 10-1121-0014, October 2010.

Golder Associates Ltd., 2013. Report on Geotechnical Investigation, Proposed Residential Development, East of Bank Street and South of Analdea Drive, Ottawa, Ontario. Report No. 13-1121-0186, November 2013.

Williams, D.A., 1991. Paleozoic Geology of the Ottawa-St Lawrence Lowland, Southern Ontario; Ontario Geological Survey, Open File Report 5770, 292p.

KEY MAP



SCALE 1:50,000

LEGEND

- MOECC LISTED WATER WELL
- APPROXIMATE BOREHOLE LOCATION, PREVIOUS INVESTIGATION
- APPROXIMATE TEST PIT LOCATION, PREVIOUS INVESTIGATION
- ROADWAY
- WATERCOURSE
- STUDY AREA
- 100 m BUFFER

NOTE(S)

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 13-1121-0186-5000.

REFERENCE(S)

1. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2014
2. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: MTM ZONE 9, VERTICAL DATUM: CGVD28

0 40 80 160

1:4,000 METRES

CLIENT
CLARIDGE HOMES CORPORATION

PROJECT
GROUNDWATER IMPACT STUDY
4789 BANK STREET, OTTAWA, ONTARIO

TITLE
SITE PLAN

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-11-09
DESIGNED	----
PREPARED	JEM
REVIEWED	CAMC
APPROVED	BTB

PROJECT NO.	PHASE	REV.	FIGURE
13-1121-0186	5000	0	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm

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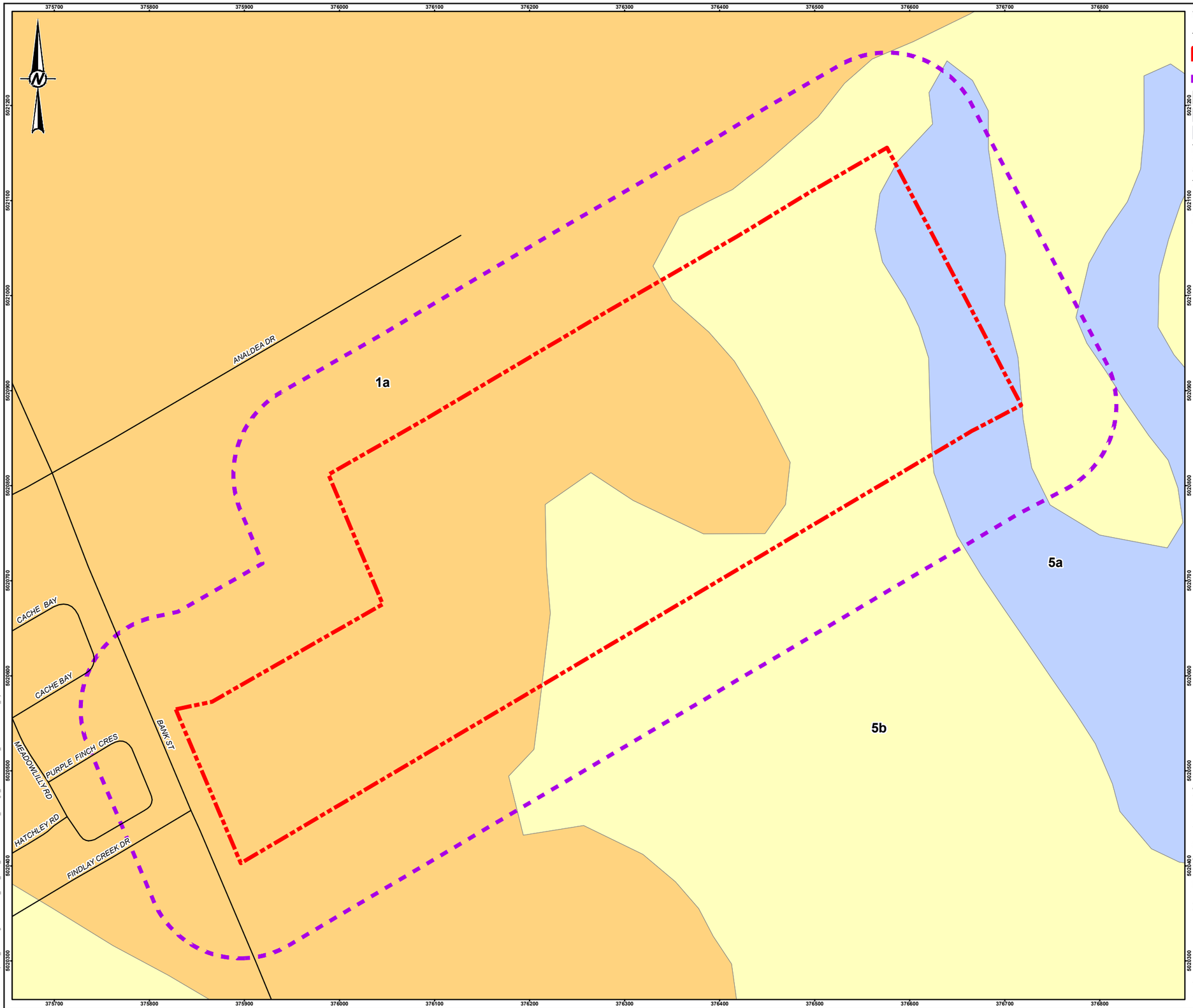

LEGEND

- ROADWAY
- STUDY AREA
- 100 m BUFFER
- 5a: NEARSHORE SEDIMENTS: GRAVEL, SAND & BOULDERS
- 5b: NEARSHORE SEDIMENTS: FINE TO MEDIUM GRAINED SAND
- 1a. TILL, PLAIN WITH LOCAL RELIEF <5 m

NOTE(S)

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 13-1121-0186-5000.

REFERENCE(S)

1. BÉLANGER, J. R. 2008 URBAN GEOLOGY OF THE NATIONAL CAPITAL AREA, GEOLOGICAL SURVEY OF CANADA, OPEN FILE 5311, 1 DVD.
2. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2014
3. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83,
COORDINATE SYSTEM: MTM ZONE 9, VERTICAL DATUM: CGVD28

0 40 80 160
1:4,000 METRES

CLIENT
CLARIDGE HOMES CORPORATION

PROJECT
GROUNDWATER IMPACT STUDY
4789 BANK STREET, OTTAWA, ONTARIO

TITLE
SURFICIAL GEOLOGY

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-11-09
DESIGNED	----
PREPARED	JEM
REVIEWED	CAMC
APPROVED	BTB

PROJECT NO.	PHASE	REV.	FIGURE
13-1121-0186	5000	0	**2**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
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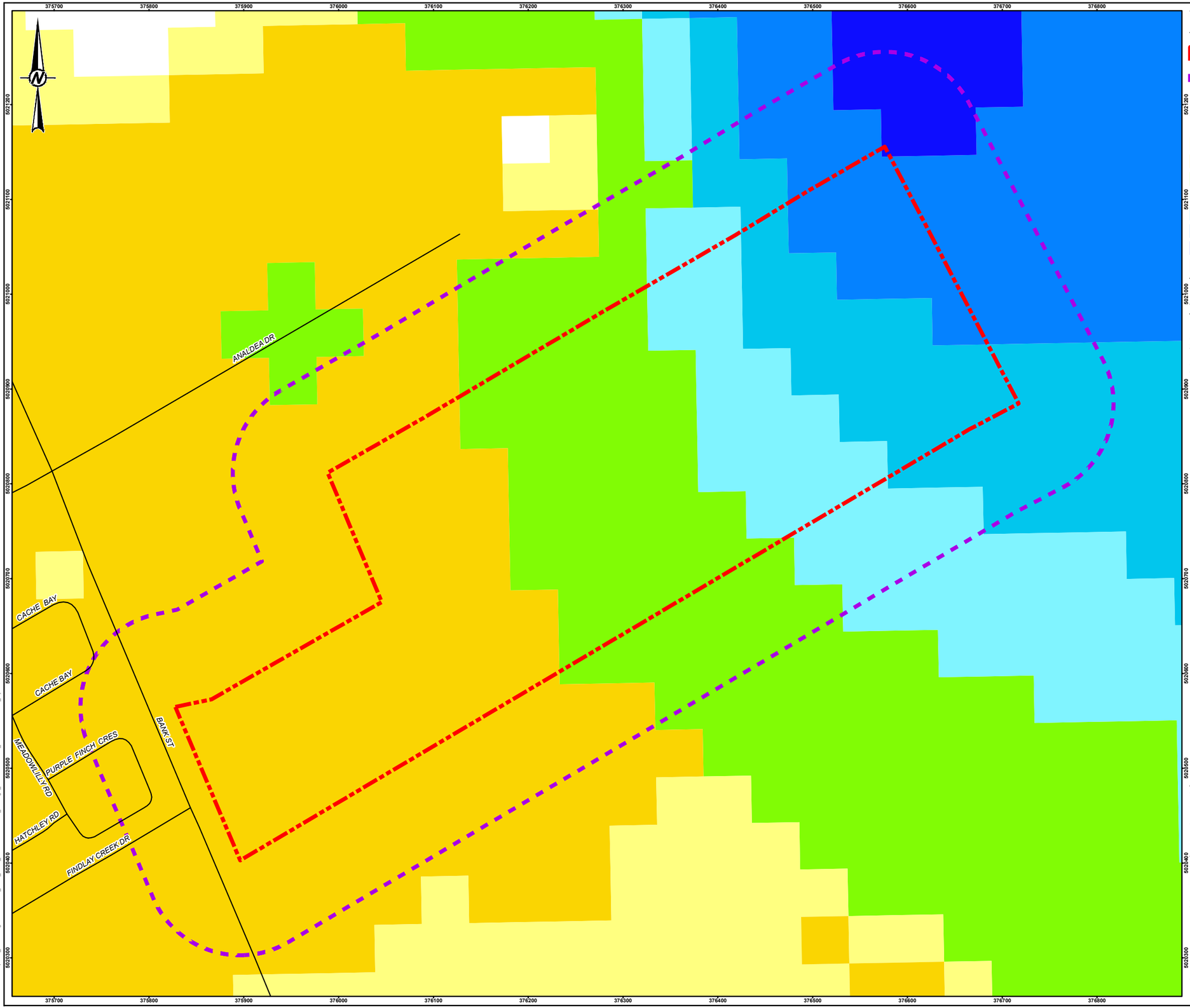

LEGEND

- ROADWAY
- STUDY AREA
- 100 m BUFFER

TREND IN DEPTH TO BEDROCK (METRES)

- 0 to 1
- 1 to 2
- 2 to 3
- 3 to 5
- 5 to 10
- 10 to 15
- 15 to 25
- 25 to 50
- 50 to 100
- 100 to 200

NOTE(S)

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 13-1121-0186-5000.

REFERENCE(S)

1. 2010 BÉLANGER, J. R., URBAN GEOLOGY OF THE NATIONAL CAPITAL AREA, GEOLOGICAL SURVEY OF CANADA, OPEN FILE D3256, 2001
2. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2014
3. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: MTM ZONE 9, VERTICAL DATUM: CGVD28

0 40 80 160
1:4,000 METRES

CLIENT
CLARIDGE HOMES CORPORATION

PROJECT
GROUNDWATER IMPACT STUDY
4789 BANK STREET, OTTAWA, ONTARIO

TITLE
DRIFT THICKNESS

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-11-09
DESIGNED	----
PREPARED	JEM
REVIEWED	CAMC
APPROVED	BTB

PROJECT NO.	PHASE	REV.	FIGURE
13-1121-0186	5000	0	3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
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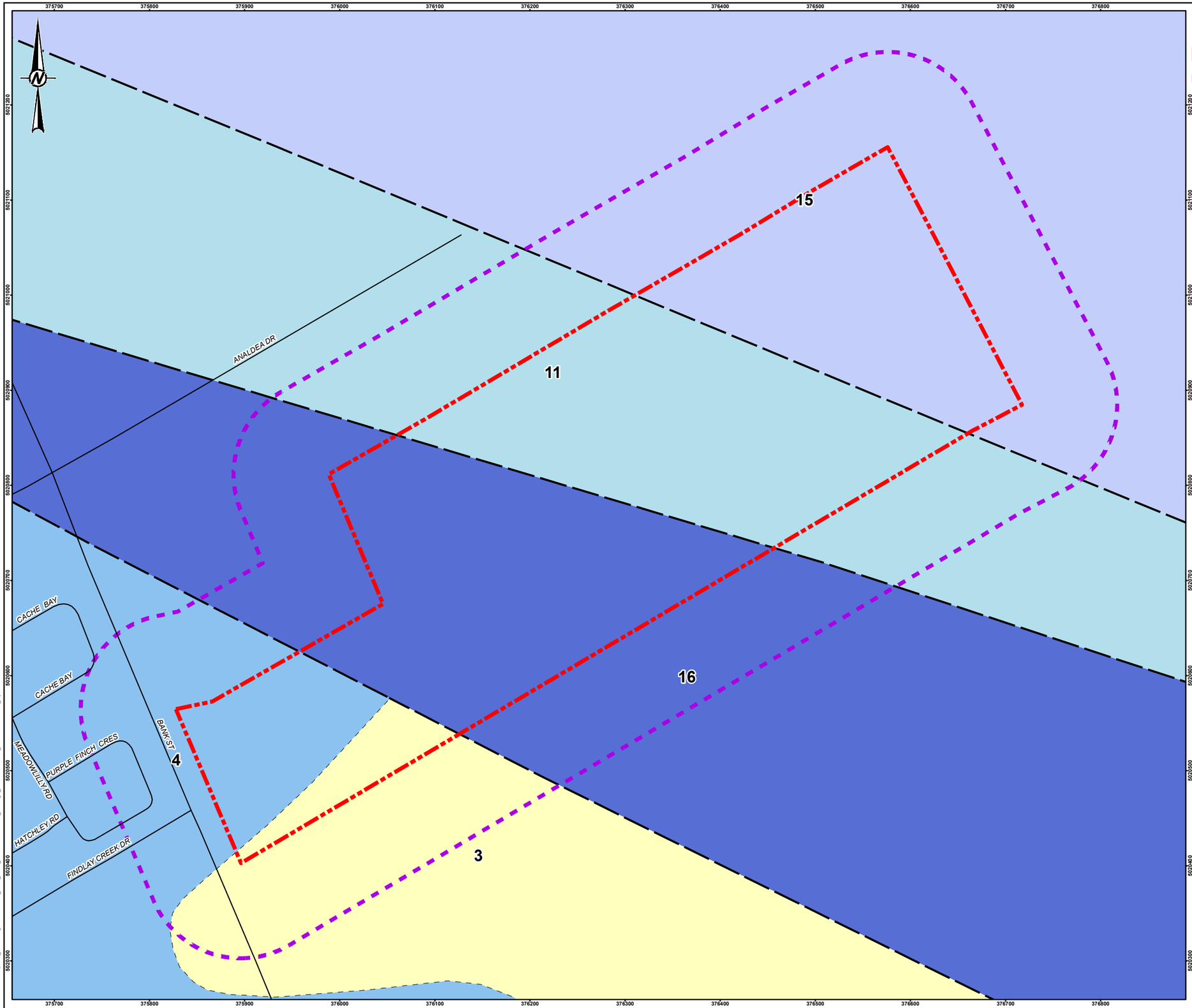

LEGEND

- ROADWAY
- STUDY AREA
- 100 m BUFFER
- 16: QUEENSTON FORMATION - SHALE, SILTSTONE, MINOR LIMESTONE AND SANDSTONE
- 15: CARLSBAD FORMATION - SHALE AND LIMESTONE
- 11: LINDSAY FORMATION - LIMESTONE; NODULAR TO BLACK LAMINATED
- 4: MARCH FORMATION - SANDSTONE, DOLOMITIC SANDSTONE, DOLOSTONE
- 3: NEPEAN FORMATION - SANDSTONE, MINOR CONGLOMERATE

NOTE(S)

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 13-1121-0186-5000.

REFERENCE(S)

1. ARMSTRONG, D.K. AND DODGE, J.E.P. 2007. PALEOZOIC GEOLOGY OF SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MISCELLANEOUS RELEASE--DATA 219
2. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2014
3. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83,
COORDINATE SYSTEM: MTM ZONE 9, VERTICAL DATUM: CGVD28

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1:4,000 METRES

CLIENT
CLARIDGE HOMES CORPORATION

PROJECT
GROUNDWATER IMPACT STUDY
4789 BANK STREET, OTTAWA, ONTARIO

TITLE
BEDROCK GEOLOGY

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-11-09
DESIGNED	----
PREPARED	JEM
REVIEWED	CAMC
APPROVED	BTB

PROJECT NO.	PHASE	REV.	FIGURE
13-1121-0186	5000	0	4

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ATTACHMENT A

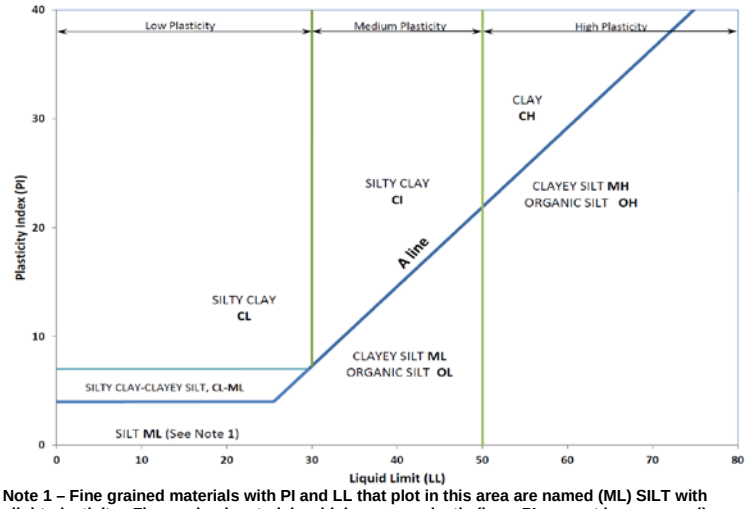
Borehole Logs

METHOD OF SOIL CLASSIFICATION

The Golder Associates Ltd. Soil Classification System is based on the Unified Soil Classification System (USCS)

Organic or Inorganic	Soil Group	Type of Soil		Gradation or Plasticity	$Cu = \frac{D_{60}}{D_{10}}$	$Cc = \frac{(D_{30})^2}{D_{10} x D_{60}}$	Organic Content	USCS Group Symbol	Group Name
INORGANIC (Organic Content ≤30% by mass)	COARSE-GRAINED SOILS (>50% by mass is larger than 0.075 mm)	GRAVELS (>50% by mass of coarse fraction is larger than 4.75 mm)	Gravels with ≤12% fines (by mass)	Poorly Graded	<4	≤1 or ≥3	≤30%	GP	GRAVEL
				Well Graded	≥4	1 to 3		GW	GRAVEL
			Gravels with >12% fines (by mass)	Below A Line	n/a			GM	SILTY GRAVEL
				Above A Line	n/a			GC	CLAYEY GRAVEL
		SANDS (≥50% by mass of coarse fraction is smaller than 4.75 mm)	Sands with ≤12% fines (by mass)	Poorly Graded	<6	≤1 or ≥3		SP	SAND
				Well Graded	≥6	1 to 3		SW	SAND
			Sands with >12% fines (by mass)	Below A Line	n/a			SM	SILTY SAND
				Above A Line	n/a			SC	CLAYEY SAND

Organic or Inorganic	Soil Group	Type of Soil		Laboratory Tests	Field Indicators					Organic Content	USCS Group Symbol	Primary Name
					Dilatancy	Dry Strength	Shine Test	Thread Diameter	Toughness (of 3 mm thread)			
INORGANIC (Organic Content ≤30% by mass)	FINE-GRAINED SOILS (≥50% by mass is smaller than 0.075 mm)	SILTS (Non-Plastic or PI and LL plot below A-Line on Plasticity Chart below)		Liquid Limit <50	Rapid	None	None	>6 mm	N/A (can't roll 3 mm thread)	<5%	ML	SILT
					Slow	None to Low	Dull	3mm to 6 mm	None to low	<5%	ML	CLAYEY SILT
					Slow to very slow	Low to medium	Dull to slight	3mm to 6 mm	Low	5% to 30%	OL	ORGANIC SILT
				Liquid Limit ≥50	Slow to very slow	Low to medium	Slight	3mm to 6 mm	Low to medium	<5%	MH	CLAYEY SILT
					None	Medium to high	Dull to slight	1 mm to 3 mm	Medium to high	5% to 30%	OH	ORGANIC SILT
		CLAYS (PI and LL plot above A-Line on Plasticity Chart below)		Liquid Limit <30	None	Low to medium	Slight to shiny	~ 3 mm	Low to medium	0% to 30% (see Note 2)	CL	SILTY CLAY
				Liquid Limit 30 to 50	None	Medium to high	Slight to shiny	1 mm to 3 mm	Medium		CI	SILTY CLAY
				Liquid Limit ≥50	None	High	Shiny	<1 mm	High		CH	CLAY
HIGHLY ORGANIC SOILS (Organic Content >30% by mass)		Peat and mineral soil mixtures								30% to 75%	PT	SILTY PEAT, SANDY PEAT
		Predominantly peat, may contain some mineral soil, fibrous or amorphous peat								75% to 100%		PEAT



Note 1 – Fine grained materials with PI and LL that plot in this area are named (ML) SILT with slight plasticity. Fine-grained materials which are non-plastic (i.e. a PL cannot be measured) are named SILT.
Note 2 – For soils with <5% organic content, include the descriptor "trace organics" for soils with between 5% and 30% organic content include the prefix "organic" before the Primary name.

Dual Symbol — A dual symbol is two symbols separated by a hyphen, for example, GP-GM, SW-SC and CL-ML.
For non-cohesive soils, the dual symbols must be used when the soil has between 5% and 12% fines (i.e. to identify transitional material between "clean" and "dirty" sand or gravel.
For cohesive soils, the dual symbol must be used when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart (see Plasticity Chart at left).

Borderline Symbol — A borderline symbol is two symbols separated by a slash, for example, CL/CI, GM/SM, CL/ML.
A borderline symbol should be used to indicate that the soil has been identified as having properties that are on the transition between similar materials. In addition, a borderline symbol may be used to ~~or~~ indicate~~s~~ a range of similar soil types within a stratum.

ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

PARTICLE SIZES OF CONSTITUENTS

Soil Constituent	Particle Size Description	Millimetres	Inches (US Std. Sieve Size)
BOULDERS	Not Applicable	>300	>12
COBBLES	Not Applicable	75 to 300	3 to 12
GRAVEL	Coarse Fine	19 to 75 4.75 to 19	0.75 to 3 (4) to 0.75
SAND	Coarse Medium Fine	2.00 to 4.75 0.425 to 2.00 0.075 to 0.425	(10) to (4) (40) to (10) (200) to (40)
SILT/CLAY	Classified by plasticity	<0.075	< (200)

MODIFIERS FOR SECONDARY AND MINOR CONSTITUENTS

Percentage by Mass	Modifier
>35	Use 'and' to combine major constituents (*i.e.,* SAND and GRAVEL, SAND and CLAY)
> 12 to 35	Primary soil name prefixed with "gravelly, sandy, SILTY, CLAYEY" as applicable
> 5 to 12	some
≤ 5	trace

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.) split-spoon sampler for a distance of 300 mm (12 in.).

Cone Penetration Test (CPT)

An 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 (u) and sleeve frictions are recorded electronically at 25 mm penetration intervals.

Dynamic Cone Penetration Resistance (DCPT); 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

SAMPLES

AS	Auger sample
BS	Block sample
CS	Chunk sample
DO or DP	Seamless open ended, driven or pushed tube sampler – note size
DS	Denison type sample
FS	Foil sample
RC	Rock core
SC	Soil core
SS	Split spoon sampler – note size
ST	Slotted tube
TO	Thin-walled, open – note size
TP	Thin-walled, piston – note size
WS	Wash sample

SOIL TESTS

w	water content
PL , w_p	plastic limit
LL , 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, Gs)
DS	direct shear test
GS	specific gravity
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 (FV)	field vane (LV-laboratory vane test)
γ	unit weight

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

NON-COHESIVE (COHESIONLESS) SOILS

Compactness[2]

Term	SPT 'N' (blows/0.3m)[1]
Very Loose	0 - 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	>50

1. SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure effects.
2. Definition of compactness descriptions based on SPT 'N' ranges from Terzaghi and Peck (1967) and correspond to typical average N_{60} values.

Field Moisture Condition

Term	Description
Dry	Soil flows freely through fingers.
Moist	Soils are darker than in the dry condition and may feel cool.
Wet	As moist, but with free water forming on hands when handled.

COHESIVE SOILS

Consistency

Term	Undrained Shear Strength (kPa)	SPT 'N'[1] (blows/0.3m)
Very Soft	<12	0 to 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	>200	>30

1. SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure effects; approximate only.

Water Content

Term	Description
w < PL	Material is estimated to be drier than the Plastic Limit.
w ~ PL	Material is estimated to be close to the Plastic Limit.
w > PL	Material is estimated to be wetter than the Plastic Limit.

LIST OF SYMBOLS

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

I. GENERAL

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

II. STRESS AND STRAIN

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

III. SOIL PROPERTIES

(a) Index Properties

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

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

(a) Index Properties (continued)

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

(b) Hydraulic Properties

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

(c) Consolidation (one-dimensional)

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

(d) Shear Strength

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

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

2 shear strength = (compressive strength)/2

LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

WEATHERINGS STATE

Fresh: no visible sign of rock material 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, as measured along the centerline axis of the core, relative to the length of the total core run. RQD varies from 0% for completely broken core to 100% for core in solid segments.

DISCONTINUITY DATA

Fracture Index
A count of the number of naturally occuring discontinuities (physical separations) in the rock core. Mechanically induced breaks caused by drilling are not included.

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

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

Abbreviations

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

Golder Associates

PROJECT: 13-1121-0186

RECORD OF BOREHOLE: 13-1

SHEET 1 OF 1

LOCATION: N 5020559.0 ;E 375921.5

BORING DATE: Oct. 7, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		96.38							
0	Power Auger 200mm Diam (Hollow Stem)	TOPSOIL		0.00 96.15							
		(SM) - SILTY SAND, some gravel; brown; non-cohesive, moist, loose to compact		0.23	1	50 DO	8				
1											
					2	50 DO	27				
2				94.09							
		(SM) SILTY SAND, some gravel; brown, with cobbles and boulders, (GLACIAL TILL); non-cohesive, moist, dense		2.29	3	50 DO	35		○	MH	
3											
					4	50 DO	35				
				92.42	5	50 DO	>50				
4		End of Borehole Auger Refusal		3.96							Borehole dry upon completion of drilling Oct. 7, 2013
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DG

CHECKED: WAM

MIS-BHS 001 1311210186.GPJ GAL-MIS.GDT 11/12/13 SL/JM

PROJECT: 13-1121-0186

RECORD OF BOREHOLE: 13-2

SHEET 1 OF 1

LOCATION: N 5020642.9 ;E 376050.4

BORING DATE: Oct. 7 and 8, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m
0		GROUND SURFACE		94.55			
	Power Auger 200mm Diam (Hollow Stem)	TOPSOIL		0.00 94.32			
		(ML) - SANDY SILT; grey brown; non-cohesive, moist		0.23 93.71			
1		(SM) - SILTY SAND, some gravel; grey brown; non-cohesive, moist, dense		0.84 93.25	1	50 DO	37
		(SM) - SILTY SAND; grey, with shale fragments; non-cohesive, moist, dense		1.30			
		End of Borehole Auger Refusal		1.47			
2							
3							
4							
5							
6							
7							
8							
9							
10							

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

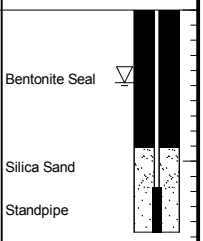
SHEAR STRENGTH Cu, kPa — nat V. + Q - ● rem V. ⊕ U - ○: 20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp — W — Wl: 20 40 60 80

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



W.L. in Standpipe at Elev. 94.07 m on Oct. 23, 2013

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DG

CHECKED: WAM

MIS-BHS 001 1311210186.GPJ GAL-MIS.GDT 11/12/13 SL/JM

PROJECT: 13-1121-0186

RECORD OF BOREHOLE: 13-3

SHEET 1 OF 1

LOCATION: N 5020787.5 ;E 376022.5

BORING DATE: Oct. 8, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		96.38							
0	Power Auger 200mm Diam (Hollow Stem)	TOPSOIL		0.00							
		(CI) - SILTY CLAY; brown; cohesive, w>PL, very stiff		0.13							
				95.54							
1		(SM) - SILTY SAND; brown; non-cohesive, moist, loose		0.84	1	50 DO	6				
				94.86							
		Weathered SHALE BEDROCK		1.52	2	50 DO	56				
2					3	50 DO	>50				
				93.81							
		End of Borehole Auger Refusal		2.57							Borehole dry upon completion of drilling Oct. 8, 2013
3											
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: DG

CHECKED: WAM

MIS-BHS 001 1311210186.GPJ GAL-MIS.GDT 11/12/13 SL/JM

PROJECT: 13-1121-0186

RECORD OF BOREHOLE: 13-4

SHEET 1 OF 1

LOCATION: N 5020723.9 ;E 376152.8

BORING DATE: Oct. 8, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		92.37							
0	Power Auger 200mm Diam (Hollow Stem)	TOPSOIL		0.00 / 92.19							
		(SM) SILTY SAND, some gravel; brown, with cobbles and boulders, (GLACIAL TILL); non-cohesive, moist, compact		0.18	1	50 DO	26		○		
					2	50 DO	>50				
				90.59							
1		End of Borehole Auger Refusal		1.78							Borehole dry upon completion of drilling Oct. 8, 2013
2											
3											
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DG

CHECKED: WAM

MIS-BHS 001 1311210186.GPJ GAL-MIS.GDT 11/12/13 SL/JM

PROJECT: 13-1121-0186

RECORD OF BOREHOLE: 13-5

SHEET 1 OF 2

LOCATION: N 5020864.4 ;E 376156.1

BORING DATE: Oct. 8, 15 and 16, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		93.08							
0	Power Auger 200mm Diam (Hollow Stem)	TOPSOIL		0.00							
		(SM) SILTY SAND, some gravel; brown, with shale fragments, cobbles and boulders, (GLACIAL TILL); non-cohesive, moist to wet, compact to very dense		0.15							
1					1	50 DO	17		○		
2					2	50 DO	68				
					3	50 DO	39				▽
3				90.01							
	Rotary Drill NQ Core	Moderately weathered, thinly bedded, black SHALE BEDROCK		3.07	C1	NQ RC	DD				
4					C2	NQ RC	DD				
				88.66							
		End of Borehole		4.42							W.L. in open hole at Elev. 90.64 m upon completion of drilling Oct. 16, 2013
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DG

CHECKED: WAM

MIS-BHS 001 1311210186.GPJ GAL-MIS.GDT 11/12/13 SL/JM

PROJECT: 13-1121-0186

RECORD OF DRILLHOLE: 13-5

SHEET 2 OF 2

LOCATION: N 5020864.4 ;E 376156.1

DRILLING DATE: Oct. 8, 15 and 16, 2013

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG:

DRILLING CONTRACTOR:

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

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jcon	Jr	Ja	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES WATER LEVELS INSTRUMENTATION
		Continued from previous page		90.01																
4	Rotary Drill NQ Core	Moderately weathered, thinly bedded, black SHALE BEDROCK		3.07	C1	100														
					C2	100														
				88.66																
		End of Drillhole		4.42																W.L. in open hole at Elev. 90.64 m upon completion of drilling Oct. 16, 2013
5																				
6																				
7																				
8																				
9																				
10																				
11																				
12																				
13																				

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: DG
CHECKED: WAM

MIS-RCK 004 1311210186.GPJ GAL-MISS.GDT 11/12/13 SL/JM

PROJECT: 13-1121-0186

RECORD OF BOREHOLE: 13-6

SHEET 1 OF 1

LOCATION: N 5020797.4 ;E 376289.0

BORING DATE: Oct. 8, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80)	SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3})	WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		90.46									
0	Power Auger 200mm Diam (Hollow Stem)	TOPSOIL		0.00 / 90.18									
		(ML) - sandy CLAYEY SILT; brown; cohesive, w~PL, very stiff		0.28	1	50 DO	5						
1													
					2	50 DO	10						
2		(ML) - CLAYEY SILT; grey; cohesive, w>PL, stiff to very stiff		1.98 / 88.48									▽
					3	50 DO	4						
3		(SM) SILTY SAND, some gravel; grey, with cobbles and boulders, (GLACIAL TILL); non-cohesive, wet, compact		2.89 / 87.57						○			
					4	50 DO	26						
4					5	50 DO	27						
		(SM) SILTY SAND, some gravel; grey, with shale fragments, cobbles and boulders, (GLACIAL TILL); non-cohesive, wet, very dense		4.57 / 85.89	6	50 DO	>50						
5		End of Borehole Auger Refusal		5.05 / 85.41									W.L. in open hole at Elev. 88.02 m upon completion of drilling Oct. 8, 2013
6													
7													
8													
9													
10													

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DG

CHECKED: WAM

MIS-BHS 001 1311210186.GPJ GAL-MIS.GDT 11/12/13 SL/JM

PROJECT: 13-1121-0186

RECORD OF BOREHOLE: 13-7

SHEET 1 OF 1

LOCATION: N 5020942.3 ;E 376283.2

BORING DATE: Oct. 9, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		92.19							
0	Power Auger 200mm (Diam Hollow Stem)	TOPSOIL		0.00							
		(SM) SILTY SAND, some gravel; brown, with cobbles and boulders, (GLACIAL TILL); non-cohesive, moist, compact		0.15							
1					1	50 DO	21				Native Backfill
											Bentonite Seal
2					2	50 DO	35		○		Silica Sand
				90.12							
		(SM) SILTY SAND, some gravel; grey, with shale fragments, cobbles and boulders, (GLACIAL TILL); non-cohesive, wet, dense		2.07							
					3	50 DO	>50				Standpipe
				89.37							
3		End of Borehole Auger Refusal		2.82							
											W.L. in Standpipe at Elev. 91.26 m on Oct. 23, 2013
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DG

CHECKED: WAM

MIS-BHS 001 1311210186.GPJ GAL-MIS.GDT 11/12/13 SL/JM

PROJECT: 13-1121-0186

RECORD OF BOREHOLE: 13-8

SHEET 1 OF 2

LOCATION: N 5020878.4 ;E 376388.2

BORING DATE: Oct. 9 and 11, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		91.20							
0	Power Auger 200mm Diam (Hollow Stem)	TOPSOIL		0.00							
		(SP) - SAND, some gravel; grey brown; non-cohesive, moist, compact to dense		0.15	1	50 DO	20				
1											
					2	50 DO	48		○		▽
2				88.91							
		(SM) - SILTY SAND, some gravel; grey, with shale fragments, non-cohesive, wet, very dense		2.29	3	50 DO	81				
				88.33							
3	Washboring NW casing	(SM) - SILTY SAND, some gravel; grey, with cobbles and boulders, (GLACIAL TILL); non-cohesive, wet, dense to very dense		2.87							
					4	50 DO	>50				
4											
					5	50 DO	45				
5											
					6	50 DO	99				
				85.26							
6	Rotary Drill NQ Core	Moderately weathered, thinly bedded, black SHALE BEDROCK		5.94	C1	NQ RC	DD				
				84.32							
7		End of Borehole		6.88							W.L. in open hole at Elev. 89.22 m upon completion of drilling Oct. 11, 2013
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DG

CHECKED: WAM

MIS-BHS 001 1311210186.GPJ GAL-MIS.GDT 11/12/13 SL/JM

PROJECT: 13-1121-0186

RECORD OF DRILLHOLE: 13-8

SHEET 2 OF 2

LOCATION: N 5020878.4 ;E 376388.2

DRILLING DATE: Oct. 9 and 11, 2013

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG:

DRILLING CONTRACTOR:

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

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH	COLOUR % RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jcon	Jr	Ja	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES WATER LEVELS INSTRUMENTATION
		Continued from previous page		85.26																	
6	WB / NW; Rotary Drill / NQ Core	Moderately weathered, thinly bedded, black SHALE BEDROCK		5.94	C1																
				84.32																	
7		End of Drillhole		6.88																	W.L. in open hole at Elev. 89.22 m upon completion of drilling Oct. 11, 2013
8																					
9																					
10																					
11																					
12																					
13																					
14																					
15																					

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: DG
CHECKED: WAM

MIS-RCK 004 1311210186.GPJ GAL-MISS.GDT 11/12/13 SL/JM

PROJECT: 13-1121-0186

RECORD OF BOREHOLE: 13-9

SHEET 1 OF 1

LOCATION: N 5021017.6 ;E 376413.7

BORING DATE: Oct. 9, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		90.39							
0	Power Auger 200mm Diam (Hollow Stem)	TOPSOIL		0.00 / 90.21							
		(SM) - SILTY SAND; brown; non-cohesive, wet		0.18 / 89.48							
1		(ML) - CLAYEY SILT; grey brown; non-cohesive, moist, very stiff		0.91	1	50 DO	18				
					2	50 DO	10		○	MH	
2				88.29							
		(SM) SILTY SAND, some gravel; grey, with cobbles and boulders, (GLACIAL TILL); non-cohesive, wet, compact to dense		2.10	3	50 DO	39				▽
3					4	50 DO	26				
4					5	50 DO	36				
				85.82							
		(SM) SILTY SAND, some gravel; grey, with shale fragments, cobbles and boulders, (GLACIAL TILL); non-cohesive, wet, very dense		4.57	6	50 DO	>50				
5											
				84.88	7	50 DO	>50				
		End of Borehole Auger Refusal		5.51							W.L. in open hole at Elev. 88.10 m upon completion of drilling Oct. 9, 2013
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DG

CHECKED: WAM

MIS-BHS 001 1311210186.GPJ GAL-MIS.GDT 11/12/13 SL/JM

PROJECT: 13-1121-0186

RECORD OF BOREHOLE: 13-10

SHEET 1 OF 1

LOCATION: N 5021001.3 ;E 376535.1

BORING DATE: Oct. 10, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		90.38							
0	Power Auger 200mm Diam (Hollow Stem)	TOPSOIL		0.00							
		(CI) - SILTY CLAY; grey brown; cohesive, w>PL, very stiff		0.10							
1				89.31	1	50 DO	10				
		(ML) - CLAYEY SILT; grey brown; non-cohesive, moist to wet, very stiff		1.07							
2					2	50 DO	14				▽
				87.79	3	50 DO	17		○	MH	
		(SM) - SILTY SAND, some gravel; grey, with shale fragments, cobbles and boulders, (GLACIAL TILL); non-cohesive, wet, compact to very dense		2.59							
3					4	50 DO	22				
4					5	50 DO	61				
					6	50 DO	>50				
				85.48							
5		End of Borehole Auger Refusal		4.90							W.L. in open hole at Elev. 88.25 m upon completion of drilling Oct. 10, 2013
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DG

CHECKED: WAM

MIS-BHS 001 1311210186.GPJ GAL-MIS.GDT 11/12/13 SL/JM

PROJECT: 13-1121-0186

RECORD OF BOREHOLE: 13-11

SHEET 1 OF 1

LOCATION: N 5021099.3 ;E 376532.5

BORING DATE: Oct. 9, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		90.48							
0	Power Auger 200mm Diam (Hollow Stem)	TOPSOIL		0.00							
		(ML) - SANDY SILT; grey brown; non-cohesive, moist, loose to compact		0.15							
1					1	50 DO	20		○		
					2	50 DO	4				
2				88.19							
		(SM/ML) - SILTY SAND to SANDY SILT; grey; non-cohesive, wet, loose to compact		2.29	3	50 DO	12				▽
3					4	50 DO	11		○		
4					5	50 DO	6				
				85.91							
		(ML) - CLAYEY SILT, some sand; grey; non-cohesive, wet		4.57	6	50 DO	3				
5				85.15							
		(SM) SILTY SAND, some gravel; grey, with shale fragments, cobbles and boulders, (GLACIAL TILL); non-cohesive, wet, compact to dense		5.33	7	50 DO	14				
6					8	50 DO	49				
				83.90							
		End of Borehole Auger Refusal		6.58							W.L. in open hole at Elev. 88.04 m upon completion of drilling Oct. 9, 2013
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DG

CHECKED: WAM

MIS-BHS 001 1311210186.GPJ GAL-MIS.GDT 11/12/13 SL/JM

PROJECT: 13-1121-0186

RECORD OF BOREHOLE: 13-12

SHEET 1 OF 1

LOCATION: N 5020904.7 ;E 376603.9

BORING DATE: Oct. 9 and 10, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		89.99							
0	Power Auger 200mm Diam (Hollow Stem)	TOPSOIL		0.00							
		(SM) - SILTY SAND, very fine; brown; non-cohesive, wet		0.15 89.46	1	GRAB	--				Native Backfill
		(SP) SAND, some low plasticity fines; brown; non-cohesive, wet		0.53 89.08							Bentonite Seal
1		(SM/ML) SILTY SAND to sandy SILT; grey; non-cohesive, wet, compact		0.91	2	50 DO	28				
					3	50 DO	20				
2					4	50 DO	23				
											Native Backfill
3					5	50 DO	20				
		(ML) - sandy SILT; grey; non-cohesive, wet, very loose		3.66 86.33							
4					6	50 DO	4				
		(SM) SILTY SAND, some gravel; grey, with cobbles and boulders, (GLACIAL TILL); non-cohesive, wet, compact		4.27 85.72							
5					7	50 DO	22				Bentonite Seal
					8	50 DO	20				Silica Sand
6											
					9	50 DO	>50				Standpipe
				83.44							
		End of Borehole Auger Refusal		6.55							
7											W.L. in Standpipe at Elev. 89.01 m on Oct. 23, 2013
8											
9											
10											

DEPTH SCALE

1 : 50

LOGGED: DG

CHECKED: WAM

Golder Associates

MIS-BHS 001 1311210186.GPJ GAL-MIS.GDT 11/12/13 SL/JM

TABLE 1

RECORD OF TEST PITS

Test Pit Number (Elevation)	Depth (metres)	Description
10-A	0.00 – 0.30	TOPSOIL
	0.30 – 2.20	Brown SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)
	2.20	Refusal on grey DOLOMITIC LIMESTONE BEDROCK
		Note 1: Test pit excavated just north of borehole 10-102. Note 2: Boulders and cobbles were encountered within the glacial till (maximum boulder dimension: about 0.7 metres x 1.5 metres). Note 3: Water seepage at about 1.7 metres depth. Note 4: A test pit was also excavated just to the south of borehole 10-102. Refusal encountered at about 1.6 metres depth on a probable large boulder.
10-B	0.00 – 0.30	TOPSOIL
	0.30 – 0.55	Brown CLAYEY SILT, some sand
	0.55 – 2.20	Brown fine to coarse SAND, trace to some silt
	2.20 – 2.70	Grey SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)
	2.70	Refusal on black weathered SHALE BEDROCK
		Note 1: Test pit excavated just east of borehole 10-104. Note 2: Water seepage at about 1.0 metres depth.

TABLE 1

RECORD OF TEST PITS

Test Pit Number (Elevation)	Depth (metres)	Description
10-C	0.00 – 0.05	TOPSOIL
	0.05 – 0.50	Brown SILT, trace to some sand
	0.50 – 3.20	Grey brown medium to coarse SAND, with gravel and cobbles
	3.20 – 4.50	Grey SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)
	4.50	Refusal on probable weathered SHALE BEDROCK
		Note 1: Test pit excavated just south of borehole 10-2. Note 2: Unable to excavate further due to water inflow and considerable sloughing of excavation side walls. Note 3: Water inflow at about 3.8 metres depth.
10-D	0.00 – 0.30	TOPSOIL
	0.30 – 1.70	Brown SILTY SAND
	1.70 – 1.90	Brown SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)
	1.90	Refusal on grey DOLOMITIC LIMESTONE BEDROCK
		Note 1: Test pit excavated just north of borehole 10-101. Note 2: Test pit dry upon completion

PROJECT: 10-1121-0014

RECORD OF BOREHOLE: 10-1

SHEET 1 OF 3

LOCATION: See Site Plan

BORING DATE: Jan. 26 & Sept. 16-17, 2010

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		93.66							
0	Power Auger 200mm Diam. (Hollow Stem)	Black sandy silt, with organic matter (TOPSOIL)		0.00 / 93.30							
		Loose to compact brown SILT, some sand, trace clay		0.36	1	50 DO	8				
1											
					2	50 DO	10		○	MH	Native Backfill and Bentonite mix
2				91.37							
		Compact to dense grey SANDY SILT to SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		2.29	3	50 DO	49				
3											▽
					4	50 DO	25				▽
4											
					5	50 DO	16		○	MH	
				89.04	6	50 DO	>100				Bentonite Seal
5	Rotary Drill NQ Core	Fresh thinly bedded grey DOLOMITIC LIMESTONE BEDROCK, with black shale interbeds		4.62	C1	NQ RC	DD				Silica Sand
											32mm Diam. PVC #10 Slot Screen 'B'
6					C2	NQ RC	DD				
7											
					C3	NQ RC	DD				Bentonite Seal
8											
											Silica Sand
9					C4	NQ RC	DD				32mm Diam. PVC #10 Slot Screen 'A'
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.G.

CHECKED: _____

MIS-BHS 001 1011210014-1000.GPJ GAL-MIS.GDT 12/8/10 JM

PROJECT: 10-1121-0014

RECORD OF BOREHOLE: 10-1

SHEET 2 OF 3

LOCATION: See Site Plan

BORING DATE: Jan. 26 & Sept. 16-17, 2010

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
10	Rotary Drill NQ Core	Fresh thinly bedded grey DOLOMITIC LIMESTONE BEDROCK, with black shale interbeds			C4	NQ RC	DD				
11					C5	NQ RC	DD				32mm Diam. PVC #10 Slot Screen 'A'
12				81.62							
		End of Borehole Note: Probable void or mud seam encountered between 8.1m and 8.7m depth.		12.04							W.L. in screen 'A' at Elev. 90.49m on Sept. 28, 2010 W.L. in screen 'B' at Elev. 89.94m on Feb. 16, 2010
13											
14											
15											
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.G.

CHECKED: _____

MIS-BHS 001 1011210014-1000.GPJ GAL-MIS.GDT 12/8/10 JM

PROJECT: 10-1121-0014

RECORD OF DRILLHOLE: 10-1

SHEET 3 OF 3

LOCATION: See Site Plan

DRILLING DATE: Jan. 26 & Sept. 16-17, 2010

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 55

DRILLING CONTRACTOR: Marathon Drilling

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	COLOUR % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K_s cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		BEDROCK SURFACE		89.04												
5	Rotary Drill NQ Core	Fresh thinly bedded grey DOLOMITIC LIMESTONE BEDROCK, with black shale interbeds		4.62	1											Bentonite Seal Silica Sand
6					2											32mm Diam. PVC #10 Slot Screen 'B'
7																
8					3A											Bentonite Seal
					3B											
9					3C											Silica Sand
10					4											
11					5											32mm Diam. PVC #10 Slot Screen 'A'
12				81.62												
		End of Borehole Note: Probable void or mud seam encountered between 8.1m and 8.7m depth.		12.04												W.L. in screen 'A' at Elev. 90.49m on Sept. 28, 2010 W.L. in screen 'B' at Elev. 89.94m on Feb. 16, 2010
13																
14																

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.G.

CHECKED: _____

MIS-RCK 001 1011210014-1000 (ROCK).GPJ GAL-MISS.GDT 12/9/10 JM

PROJECT: 10-1121-0014

RECORD OF BOREHOLE: 10-2

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: Jan. 26-27, 2010

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl; 20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		90.45							
	Power Auger 200mm Diam. (Hollow Stem)	Black sandy silt, with organic matter (TOPSOIL)		0.00 / 90.15							
		Loose grey brown SILT, some sand, trace clay		0.30	1	50 DO	4		○		Native Backfill and Bentonite mix
				88.93							
2		Compact brown fine SAND, trace silt		1.52	2	50 DO	15				Bentonite Seal
				88.16							
		Compact grey fine SAND, some silt		2.29	3	50 DO	15				Silica Sand
3				87.40							
		Compact to very dense grey SILTY SAND, some gravel and shale fragments, trace clay, with cobbles and boulders (GLACIAL TILL)		3.05	4	50 DO	13		○	MH	32mm Diam. PVC #10 Slot Screen
4					5	50 DO	18				
					6	50 DO	>100				Bentonite Seal
				85.60							
5		Highly weathered to weathered black SHALE BEDROCK		4.85	7	50 DO	>100				
6					8	50 DO	>100				Caved Material
7					9	50 DO	>100				
				82.98							
		End of Borehole		7.47							
8											W.L. in screen at Elev. 90.41m on Mar. 29, 2010
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.G.

CHECKED: _____

MIS-BHS 001 1011210014-1000.GPJ GAL-MIS.GDT 12/8/10 JM

PROJECT: 10-1121-0014

RECORD OF BOREHOLE: 10-3

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: Jan. 27, 2010

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		90.30							
0	Power Auger 200mm Diam. (Hollow Stem)	Black sandy silt, with organic matter (TOPSOIL)		0.00							
				89.77							
		Compact grey brown SILT, some sand, trace clay		0.53							
1					1	50 DO	11				Native Backfill and Bentonite mix
					2	50 DO	12				
2				88.01							
		Very loose to loose grey SILT, some sand and clay, with occasional gravel		2.29	3	50 DO	6				Bentonite Seal
3											Silica Sand
					4	50 DO	4			MH	
											32mm Diam. PVC #10 Slot Screen
4					5	50 DO	2				
				85.73							
		Compact dark grey SANDY SILT to SILTY SAND, some gravel and shale fragments, trace clay (GLACIAL TILL)		4.57							Silica Sand
					6	50 DO	25				Bentonite Seal
5											
					7	50 DO	18			MH	Caved Material
6											
				84.05	8	50 DO	>100				
		Highly weathered to weathered black SHALE BEDROCK		6.25							Bentonite Seal
				83.59	9	50 DO	>100				
		End of Borehole Auger Refusal		6.71							
7											W.L. in screen at Elev. 90.25m on Mar. 29, 2010
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.G.

CHECKED: _____

MIS-BHS 001 1011210014-1000.GPJ GAL-MIS.GDT 12/8/10 JM

PROJECT: 10-1121-0014

RECORD OF BOREHOLE: 10-101

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: Sept. 17, 2010

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		94.24							
0	Power Auger 200mm Diam. (Hollow Stem)	Black sandy silt, with organic matter (TOPSOIL)		0.00 / 93.96							
		Brown SANDY SILT		0.28 / 92.79	1	GRAB					
1		SILTY SAND, with cobbles and boulders (GLACIAL TILL)		1.45 / 91.75							
2		End of Borehole Auger Refusal Note: Soil stratigraphy inferred from limited sampling		2.49							
3											
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: D.G.

CHECKED: _____

MIS-BHS 001 1011210014-1000.GPJ GAL-MIS.GDT 12/8/10 JM

PROJECT: 10-1121-0014

RECORD OF BOREHOLE: 10-102

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: Sept. 17, 2010

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		94.30							
0	Power Auger 200mm Diam. (Hollow Stem)	Dark brown sandy silt, with organic matter (TOPSOIL)		0.00 / 94.00							
		Dense brown SANDY SILT, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		0.30	1	GRAB					
1											
					2	50 DO	33				
2				91.73							
		End of Borehole Auger Refusal Note: Soil stratigraphy inferred from limited sampling		2.57							Borehole dry upon completion of drilling
3											
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

LOGGED: D.G.

CHECKED: _____

Golder Associates

MIS-BHS 001 1011210014-1000.GPJ GAL-MIS.GDT 12/8/10 JM

PROJECT: 10-1121-0014

RECORD OF BOREHOLE: 10-103

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: Sept. 17, 2010

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		93.49							
	Power Auger 200mm Diam. (Hollow Stem)	Black sandy silt, with organic matter (TOPSOIL)		0.00 / 93.11							
1		Compact to very dense SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		0.38	1	50 DO	13				Bentonite Seal
					2	50 DO	>50				Silica Sand
2				91.36							
		Highly weathered to weathered black SHALE BEDROCK		2.13	3	50 DO	>50				50mm Diam. PVC #10 Slot Screen
3				90.49	4	50 DO	>50				
		End of Borehole Auger Refusal		3.00							W.L. in screen at Elev. 93.32m on Sept. 28, 2010
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.G.

CHECKED: _____

MIS-BHS 001 1011210014-1000.GPJ GAL-MIS.GDT 12/8/10 JM

PROJECT: 10-1121-0014

RECORD OF BOREHOLE: 10-104

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: Sept. 20, 2010

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		92.04							
0	Power Auger 200mm Diam. (Hollow Stem)	Black sandy silt, with organic matter (TOPSOIL)		0.00 / 91.74							
		Grey brown CLAYEY SILT		0.30 / 91.38							
1		Loose brown fine to medium SAND, trace silt		0.66 / 90.36	1	50 DO	3				
2		Compact grey fine SAND, trace silt		1.68 / 89.97	2	50 DO	24				
		Grey SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		2.07 / 88.84							
3		Probable highly weathered to weathered Shale Bedrock		3.20 / 87.93							
4		End of Borehole Auger Refusal Note: Soil stratigraphy inferred from limited sampling		4.11							W.L. in borehole at 0.6m depth below ground surface upon completion of drilling
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.G.

CHECKED: _____

MIS-BHS 001 1011210014-1000.GPJ GAL-MIS.GDT 12/8/10 JM

PROJECT: 10-1121-0014

RECORD OF BOREHOLE: 10-105

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: Sept. 20, 2010

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		92.51							
0	Power Auger 200mm Diam. (Hollow Stem)	Black sandy silt, with organic matter (TOPSOIL)		0.00 / 92.15							
1		Compact brown fine to medium SAND, some gravel, trace silt		0.36	1	50 DO	24				
				90.99							
2		Brown to dark grey SANDY SILT, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		1.52	2	50 DO	28				▽
4				87.79							
5		Probable highly weathered to weathered Shale Bedrock		4.72							
				87.18							
5		End of Borehole Auger Refusal Note: Soil stratigraphy inferred from limited sampling		5.33							W.L. in borehole at 3.1m depth below ground surface upon completion of drilling

DEPTH SCALE

1 : 50

LOGGED: D.G.

CHECKED: _____

Golder Associates

MIS-BHS 001 1011210014-1000.GPJ GAL-MIS.GDT 12/8/10 JM

PROJECT: 10-1121-0014

RECORD OF BOREHOLE: 10-106

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: Sept. 20, 2010

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		90.13							
0	Power Auger 200mm Diam. (Hollow Stem)	Black sandy silt, with organic matter (TOPSOIL)		0.00							
				89.77							
		Stiff grey brown CLAYEY SILT, trace sand		0.36							
1											
					1	50 DO	2				
2											
				87.54							▽
		Compact grey SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		2.59							
3											
					2	50 DO	21				
4											
				85.18							
5		End of Borehole Auger Refusal		4.95							W.L. in borehole at 2.6m depth below ground surface upon completion of drilling
		Note: Soil stratigraphy inferred from limited sampling									
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.G.

CHECKED: _____

MIS-BHS 001 1011210014-1000.GPJ GAL-MIS.GDT 12/8/10 JM

PROJECT: 10-1121-0014

RECORD OF BOREHOLE: 10-107

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: Sept. 20, 2010

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80)	SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕; Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3})	WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		89.62									
0	Power Auger 200mm Diam. (Hollow Stem)	Black silty clay, with organic matter (TOPSOIL)		0.00 / 89.26									
		Brown to grey brown CLAYEY SILT, trace sand		0.36	1	GRAB							▽
1													
2					2	50 DO	5						
				87.33									
		Stiff grey CLAYEY SILT		2.29	3	50 DO	3						
				86.75									
3		Grey SILTY SAND, with cobbles and boulders (GLACIAL TILL)		2.87									
4													
				84.82									
		Probable highly weathered to weathered Shale Bedrock		4.80									
5		End of Borehole Auger Refusal Note: Soil stratigraphy inferred from limited sampling		4.93									W.L. in borehole at 0.6m depth below ground surface upon completion of drilling
6													
7													
8													
9													
10													

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.G.

CHECKED: _____

MIS-BHS 001 1011210014-1000.GPJ GAL-MIS.GDT 12/8/10 JM

PROJECT: 10-1121-0014

RECORD OF BOREHOLE: 10-108

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: Sept. 21-22, 2010

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		89.54					
0	Power Auger 200mm Diam. (Hollow Stem)	Dark brown silty clay, with organic matter (TOPSOIL)		0.00 / 89.34					
		Very stiff grey brown CLAYEY SILT, trace sand		0.20	1	50 DO	9		Native Backfill and Bentonite
1					2	50 DO	6		
		Stiff grey CLAYEY SILT, trace sand		87.71 / 1.83				MH	
2					3	50 DO	3		
									Bentonite Seal
3				86.19	4	50 DO	8		
		Compact grey SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		3.35					Silica Sand
4					5	50 DO	13		50mm Diam. PVC #10 Slot Screen 'B'
				84.97					Silica Sand
									Bentonite Seal
		Highly weathered to weathered black SHALE BEDROCK		4.57	6	50 DO	18		Native Backfill
5					7	50 DO	>100		
									Bentonite Seal
6									Silica Sand
									50mm Diam. PVC #10 Slot Screen 'A'
7				82.07					
		End of Borehole Auger Refusal		7.47					
8									W.L. in screen 'A' at Elev. 89.48m on Sept. 28, 2010
									W.L. in screen 'B' at Elev. 88.84m on Sept. 28, 2010
9									
10									

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

SHEAR STRENGTH Cu, kPa — nat V. + Q - ● rem V. ⊕ U - ○ — 20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp W Wl — 20 40 60 80

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.G.

CHECKED: _____

MIS-BHS 001 1011210014-1000.GPJ GAL-MIS.GDT 12/8/10 JM

PROJECT: 10-1121-0014

RECORD OF BOREHOLE: 10-109

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: Sept. 23, 2010

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		89.60							
0	Power Auger 200mm Diam. (Hollow Stem)	Black sandy silt, with organic matter (TOPSOIL)		0.00 89.37							
		Very stiff to stiff grey brown to grey CLAYEY SILT, occasional sand seam, trace gravel		0.23	1	GRAB					
1											
					2	50 DO	5				
2											
3				86.45							
		SILTY SAND, with cobbles and boulders (GLACIAL TILL)		3.15							
4											
5											
				83.76							
6		End of Borehole Auger Refusal Note: Soil stratigraphy inferred from limited sampling		5.84							
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.G.

CHECKED: _____

MIS-BHS 001 1011210014-1000.GPJ GAL-MIS.GDT 12/8/10 JM

PROJECT: 10-1121-0014

RECORD OF BOREHOLE: 10-110

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: Sept. 22, 2010

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		90.06							
0	Power Auger 200mm Diam. (Hollow Stem)	Black sandy silt, with organic matter (TOPSOIL)		0.00 / 89.88							
		Very stiff brown to grey brown CLAYEY SILT, trace sand and gravel		0.18	1	GRAB					▽
1											
					2	50 DO	21				
2											
3				86.71							
		SANDY SILT, with cobbles and boulders (GLACIAL TILL)		3.35							
4											
5											
6											
				83.35							
		Probable highly weathered to weathered Shale Bedrock		6.71							
7				82.74							
		End of Borehole Auger Refusal		7.32							
		Note: Soil stratigraphy inferred from limited sampling									W.L. in borehole at 1.2m depth below ground surface upon completion of drilling
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.G.

CHECKED: _____

MIS-BHS 001 1011210014-1000.GPJ GAL-MIS.GDT 12/8/10 JM

PROJECT: 10-1121-0014

RECORD OF BOREHOLE: 10-111

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: Sept. 23, 2010

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		90.34							
0	Power Auger 200mm Diam. (Hollow Stem)	Dark grey silty clay, with organic matter (TOPSOIL)		0.00 90.11							
		Stiff brown to grey brown CLAYEY SILT, trace gravel, occasional sand seam		0.23	1	GRAB			○		▽
1											
					2	50 DO	6		○		
2											
3											
4				86.23							
		SILTY SAND, with cobbles and boulders (GLACIAL TILL)		4.11							
5											
				84.85							
		Probable highly weathered to weathered Shale Bedrock		5.49 84.50							
6		End of Borehole Auger Refusal Note: Soil stratigraphy inferred from limited sampling		5.84							W.L. in borehole at 1.1m depth below ground surface upon completion of drilling
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.G.

CHECKED: _____

MIS-BHS 001 1011210014-1000.GPJ GAL-MIS.GDT 12/8/10 JM