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PROJECT No. 1658448-1000-1

TO Claridge Homes Corporation

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### DESKTOP HYDROGEOLOGICAL ASSESSMENT PROPOSED RESIDENTIAL DEVELOPMENT RIVERSIDE SOUTH LANDS RIVER ROAD AND SPRATT ROAD, OTTAWA, ONTARIO

This report presents the results of a desktop hydrogeological assessment carried out for the proposed residential development site to be located on the Riverside South Lands (east of River Road and west of Spratt Road) in Ottawa, Ontario.

The purpose of this hydrogeological assessment was to determine the general soil and groundwater conditions across this site, by means of existing on-site borehole information, 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 to identify where nearby water wells may be in use.

# 1.0 DESCRIPTION OF PROJECT AND SITE

Plans are being prepared to develop a proposed residential development within the Riverside South Lands which is located east of River Road and west of Spratt Road in Ottawa, Ontario (see Key Plan inset, Figure 1).

The following is known about the project and site.

- The western boundary of the site is located east of River Road, approximately 400 metres north of the intersection with Rideau Road. The eastern boundary of the site is located west of Spratt Road, approximately 845 metres north of the intersection with Rideau Road.
- The site is irregular in shape, with the southwestern portion adjacent to River Road measuring approximately 390 metres by 420 metres and the northern portion measuring about 200 metres by 1,110 metres.
- The site topography is relatively flat with a gentle downward slope from east to west (i.e., towards the Rideau River).
- The majority of the site is currently undeveloped and predominantly consists of agricultural land with localized vegetation and trees.
- It is understood that the proposed development will include conventional residential dwellings (single family homes and townhouses) as well as access roads and services within the subdivision. A park and institutional development are also proposed for the site.



# 2.0 GEOLOGY AND HYDROGEOLOGY

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

# 2.1 Surficial Geology

Based on published mapping (Figure 2), the surficial geology at the site is interpreted to predominantly consist of a thick deposit of silty clay. Glacial till and shallow bedrock are indicated to be present near the eastern boundary of the site. Published mapping indicates the bedrock surface to be at depths in the range of 5 to 15 metres below the ground surface, sloping down from the east to the west across the site (Figure 3).

# 2.2 Bedrock Geology

The Geological Survey of Canada bedrock geology mapping indicates that the bedrock on the site should consist of March Formation interbedded sandstone/dolostone and Oxford Formation dolostone on the northeast and southwest parts of the site, respectively (Figure 4). The bedrock formations are divided by the Hazeldean Fault, which crosses the site on a northwest to southeast trend.

## 2.3 Hydrogeology

## 2.3.1 Overburden Aquifer

The clay and glacial till deposits in the area 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.

## 2.3.2 Bedrock Aquifers

The Oxford formation and underlying March formation form the widely used Dolostone aquifer, which generally supplies adequate yields for domestic water supplies. Well yields in the Dolostone aquifer have been reported between 45 and 680 L/min. Groundwater flow within the Dolostone aquifer is controlled predominantly by fractures. In addition, the March formation, which contains sandstone interbeds, tends to yield more water than the Oxford formation, which contains shale interbeds (MRSPR, 2008), although the upper Oxford can be highly transmissive.

## 2.3.3 Local Water Supply Wells

There are a total of 15 water wells identified in the MOECC Water Well Information System (WWIS), with a location accuracy of 300 metres or less, located within 100 metres of the site. The WWIS indicates that all of the wells were constructed to be used as water supply (domestic or livestock). The depths of the wells range from 14 to 27 metres, and the depth to the static water level water ranges from 2 to 12 metres.

# 3.0 SITE SPECIFIC GEOLOGY AND HYDROGEOLOGY

# 3.1 General

Golder Associates completed a geotechnical investigation on this site in 2017, which included 35 boreholes advanced across the site (Golder Associates Ltd., 2017).

Golder Associates also previously completed several geotechnical investigations on or in the vicinity of this site, including an investigation that was carried out in 2007 for the City of Ottawa for the overall planning of the Riverside South Community.

Based on a review of those previous studies and published geological mapping, the subsurface conditions on the site likely consist of a thick deposit of sensitive and compressible silty clay; the silty clay is expected to thin towards the northeast portion of the site, adjacent to Spratt Road, where glacial till and potentially bedrock is expected at shallow depths. The borehole logs for the 2017 on-site investigation are included in Attachment A, and borehole locations are indicated on Figure 1.



# 3.2 Site Specific Geology

## **Topsoil and Fill**

Topsoil exists at the ground surface, or buried beneath the surficial fill, at most of the borehole locations, and typically ranges from about 60 to 300 millimetres in thickness. Fill (some of which is topsoil) exists at boreholes 17-7, 17-8, 17-29, 17-30, 17-31, 17-32, 17-33, and 17-35. The fill layers extend to depths of between about 0.1 to 1.1 metres below the existing ground surface. The fill consists of topsoil, asphaltic concrete, sand, sandy gravel, silty sand, silty clay, and/or sand and gravel.

## **Upper Sands and Silts**

A deposit of sandy silt, sand, or silty sand with varying amounts of gravel exists below the topsoil and/or fill in boreholes 17-2, 17-8, 17-9, 17-10, 17-12 to 17-16, 17-20, 17-21, 17-29, and 17-35. The deposit generally extends to depths ranging from about 0.4 to 1.3 metres below the existing ground surface, with the exception of borehole 17-21 where it extends to a depth of about 3.5 metres below the existing ground surface.

## Layered Silt, Clayey Silt, and Silty Sand

A deposit of layered silt, clayey silt, and silty sand exists below the topsoil in boreholes 17-3, 17-4, and 17-5. The layered deposit generally extends to depths ranging from about 1.4 to 2.0 metres below the existing ground surface.

## Weathered Silty Clay, Clayey Silt, and Silty Sand

Deposits of silty clay to clay and/or layered silty clay, clayey silt, and silty sand exists in all of the boreholes, with the exception of boreholes 17-20 and 17-21. These deposits have been weathered to a grey brown colour. These weathered deposits extend to depths of about 1.8 to 5.8 metres below the existing ground surface.

## Unweathered Silty Clay to Clay

The silty clay deposit below the depth of weathering in boreholes 17-5, 17-6, 17-8 to 17-19, 17-23, 17-24, and 17-26 is unweathered and grey in colour. The unweathered silty clay was fully penetrated to depth of about 3.8 to 6.3 metres below the existing ground surface at seven boreholes, where the thickness of the deposit ranges from about 0.3 to 3.2 metres. The unweathered silty clay was not fully penetrated in the remaining boreholes but was proven to depths ranging from about 5.8 to 7.9 metres below the existing ground surface.

## Lower Sand to Gravelly Silty Sand

A deposit of sand to gravelly silty sand exists below the weathered silty clay in boreholes 17-26, 17-27, and 17-28. This deposit was proven/inferred to depths of about 5.5 and 3.2 metres below the existing ground surface, at boreholes 17-26 and 17-28, respectively, and fully penetrated to a depth of about 3.3 metres below the existing ground surface at borehole 17-27. The deposit also contains cobbles and boulders.

## Glacial Till

A deposit of glacial till exists below the silty clay in boreholes 17-1, 17-3 to 17-7, 17-11, 17-19, 17-22, 17-24, and 17-25, and below the silty sand in boreholes 17-20 and 17-21. Glacial till was also inferred in borehole 17-2A below the silty clay and in borehole 17-22 below the upper portion of the glacial till, based on the results of the dynamic cone penetration testing. The glacial till generally consists of a heterogeneous mixture of gravel, cobbles, and boulders in a matrix of silty sand to sandy silt. The glacial till was encountered at depths ranging from about 0.9 to 6.3 metres below the existing ground surface, and proven to extend to depths ranging from about 4.2 to 8.2 metres below the existing ground surface.



# Silty Sand and Gravel

A layer deposit of silty sand and gravel was encountered below the glacial till in boreholes 17-20 and 17-21. This layered deposit was not fully penetrated at the borehole locations, but was proven to depths of about 6.1 and 7.9 metres, respectively, below the existing ground surface.

## Auger Refusal and Bedrock

Practical refusal to auger advancement was encountered at boreholes 17-1, 17-2, 17-4, 17-23, 17-24, 17-25, and 17-26 at depths ranging from about 3.8 to 6.7 metres below the existing ground surface. Refusal to dynamic cone penetration test advancement was encountered in boreholes 17-23A, 17-27A, and 17-28 at depths between about 3.2 and 4.3 metres below the existing ground surface. Refusal could indicate the bedrock surface or may reflect the presence of cobbles and boulders in the glacial till deposit.

In borehole 17-27, the bedrock was encountered below the overburden soils at a depth of about 3.3 metres below the existing ground surface, where it was cored for a depth of about 3.3 metres (i.e., to a total depth of about 6.6 metres below the existing ground surface).

The bedrock encountered was logged as fresh, thinly to medium bedded, grey, fine grained limestone.

## 3.3 Hydrogeology

Standpipe piezometers or monitoring wells were sealed into selected boreholes during the geotechnical investigation to allow for measurements of the groundwater level on January 30, 2017, as provided in the following table.

Borehole Number	Soil Strata	Ground Surface Elevation (m)	Water Level Depth (m)	Water Level Elevation (m)
17-1	Glacial Till	90.0	0.4	89.6
17-3	Glacial Till	91.1	1.3	89.8
17-9	Silty Clay	90.3	0.2	90.1
17-14A	Silty Clay	90.5	0.7	89.8
17-18A	Silty Clay	90.7	0.3	90.4
17-21	Silty Sand	94.7	2.5	92.2
17-24A	Silty Clay	92.6	0.8	91.8
17-27	Bedrock	93.9	0.8	93.1
17-28	Gravelly Silty Sand	94.0	0.3	93.7
17-29	Silty Clay	90.2	0.7	89.5
17-30	Silty Clay	90.0	0.6	89.4
17-31	Silty Clay	90.1	0.7	89.4

Water levels across the site range from 0.2 to 2.5 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

There are a total of 15 wells in the WWIS database that were constructed as water supply wells, located within 100 metres of the site. Details regarding the water supply wells are presented in the following table. Refer to Figure 1 for the well locations.

Well ID	Depth of Well (m)	Depth to Static Water Level (m)	Depth to Water Found (m)	Available Drawdown (m)	Type of Well
1500339	15.2	5.5	15.2	9.7	Bedrock
1500342	20.7	2.4	20.7	18.3	Bedrock
1500343	14.9	4.3	14.6	10.6	Bedrock
1500344	17.7	4.9	17.7	12.8	Bedrock
1500345	21.6	4.9	21.0	16.7	Bedrock
1500346	22.9	12.2	22.9	10.7	Bedrock
1500348	18.9	7.3	18.3	11.6	Bedrock
1500349	20.4	4.6	19.8	15.8	Bedrock
1510843	16.8	6.1	16.5	10.7	Bedrock
1511750	26.2	6.4	26.2	19.8	Bedrock
1513667	22.3	3.0	21.6	19.3	Bedrock
1516805	25.6	4.6	23.8	21.0	Bedrock
1517460	16.2	6.1	15.8	10.1	Bedrock
1517927	18.3	5.8	15.2; 17.1	12.5	Bedrock
7196225					

A review of aerial photographs for the site area suggests that there are approximately 26 dwellings along River Road that are within 100 metres of the site and that may be supplied by water wells. Given that only 15 well records were identified in the WWIS, it is possible that the records for some water wells in the vicinity of the site contained inaccurate location information and thus were not captured in the table above, or that they are shallow dug wells for which well records were not submitted.

The well record associated with Well ID 7196225 is for an extension of the well casing (above ground). The original well record for the well is not available. As such no details regarding the original construction of the well are available. From the available well records, water supply wells in the area generally obtain water from the bedrock aquifer. As such it is likely that Well ID 7196225 is completed in a similar fashion.

The available drawdown in the wells, calculated as the difference between the static water level and the depth of the well) ranges from 9.7 to 21.0 metres. Construction dewatering associated with typical site servicing could temporarily reduce the available drawdown in the wells 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).

If shallow dug wells are supplying dwellings are located within 100 metres of the site, there may be an increased potential for temporary well interference due to construction dewatering at the site.

Prior to construction at the site, it is recommended that a well survey be completed of the 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 from selected wells 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.

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## 6.0 CLOSURE

We trust this submission satisfies the requirements for a desktop hydrogeological assessment of the proposed residential subdivision development to be located on the Riverside South Lands (east of River Road and west of Spratt Road) in Ottawa, Ontario. If you have any questions regarding this report, please contact the undersigned.

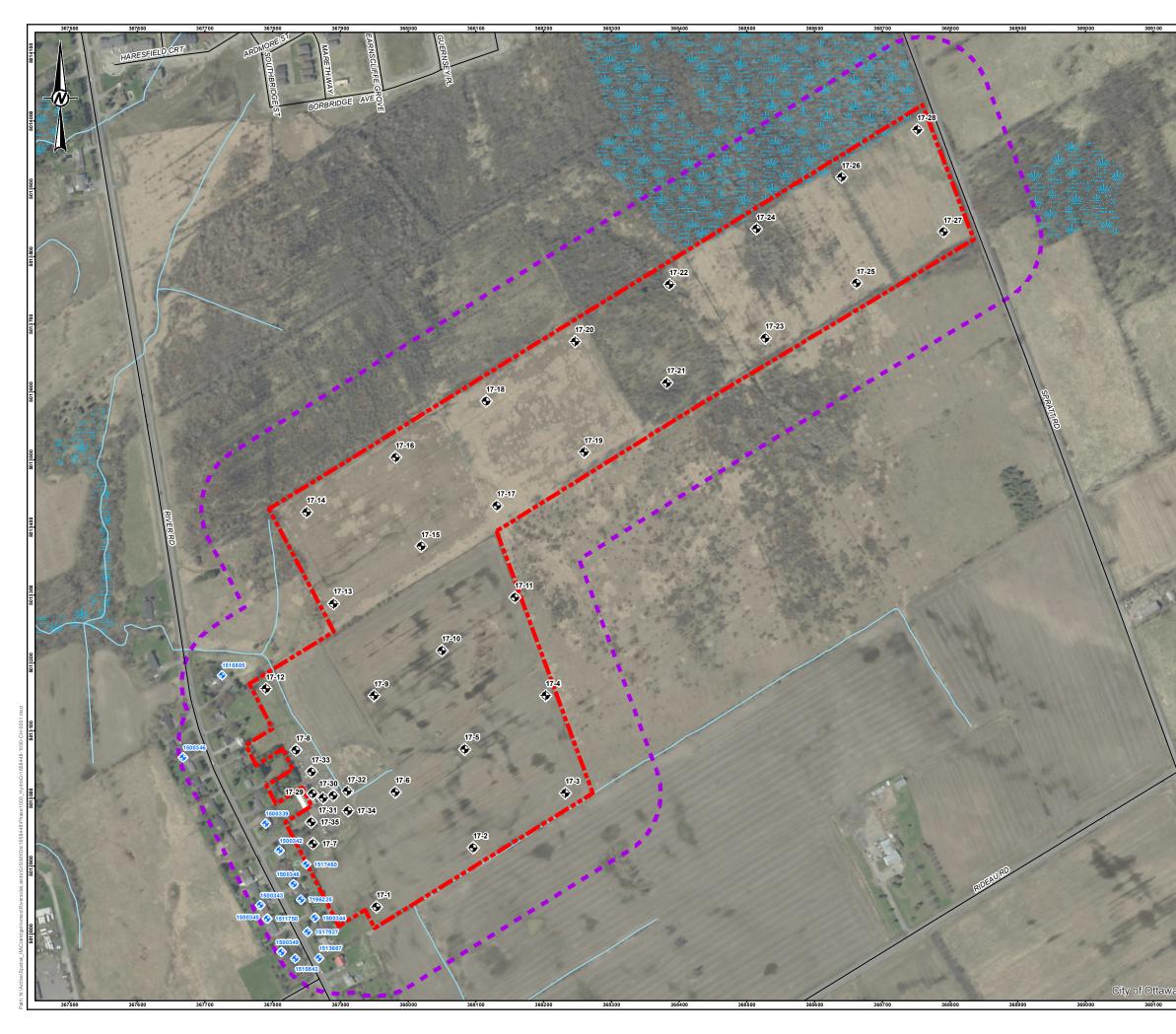
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Joen Soreins 100162667	mpl/
Loren Bekeris, M.Sc., P.Eng	Brian Byerley, M.Sc., P.Eng.
Environmental Engineer	Senior Hydrogeologist/Principal
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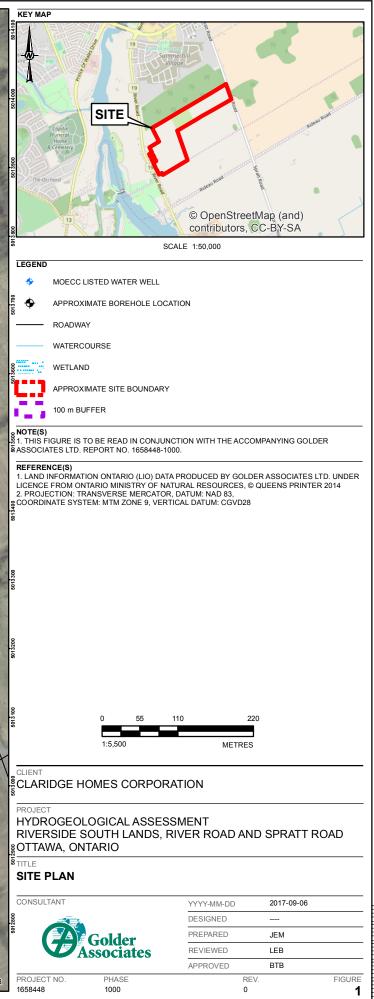
Attachments: Figures 1 to 4 Attachment A – Borehole Logs

## References

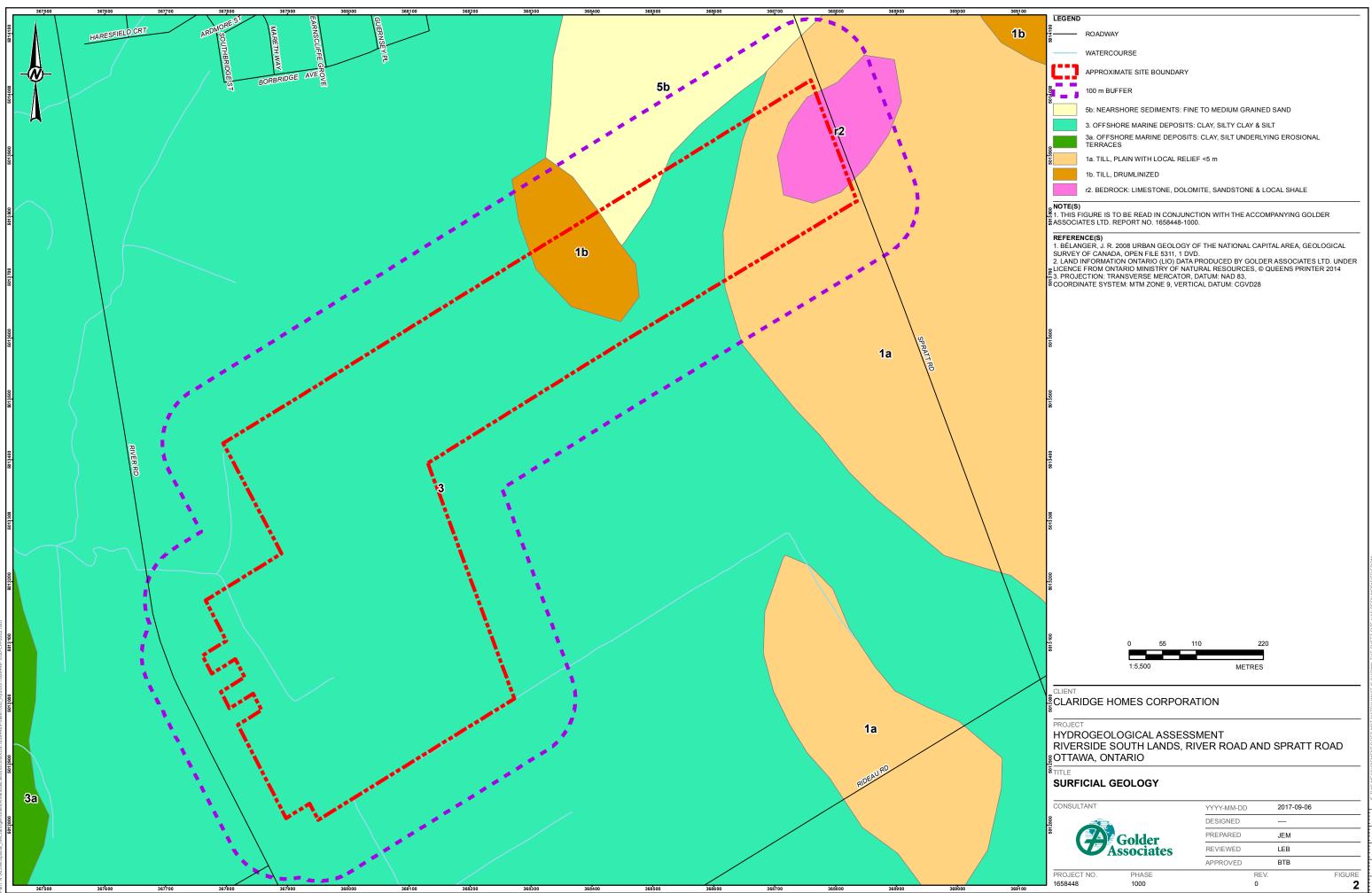
Mississippi-Rideau Source Protection Region. 2008. Water Characterization Report, Preliminary Draft. March 2008.

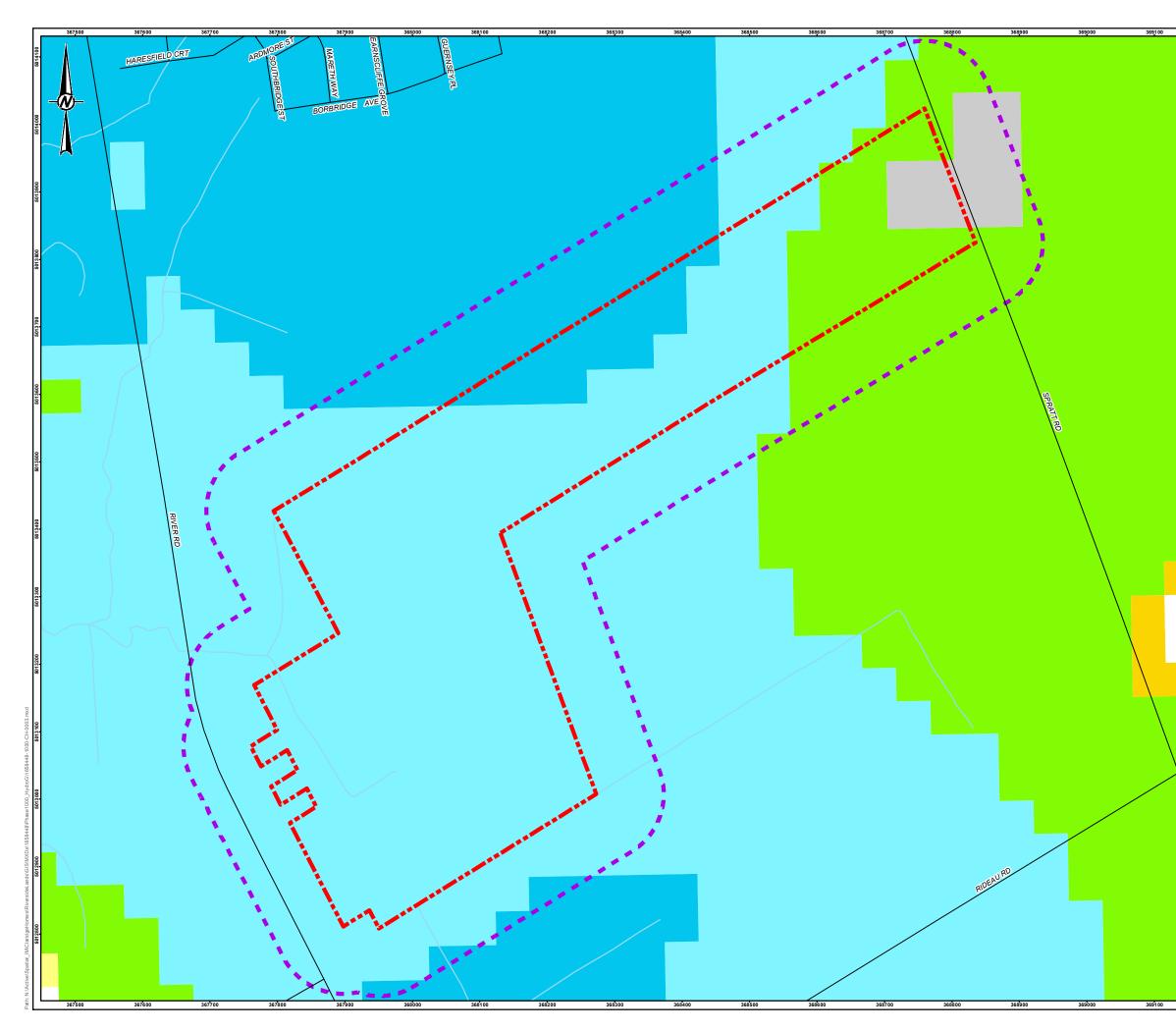


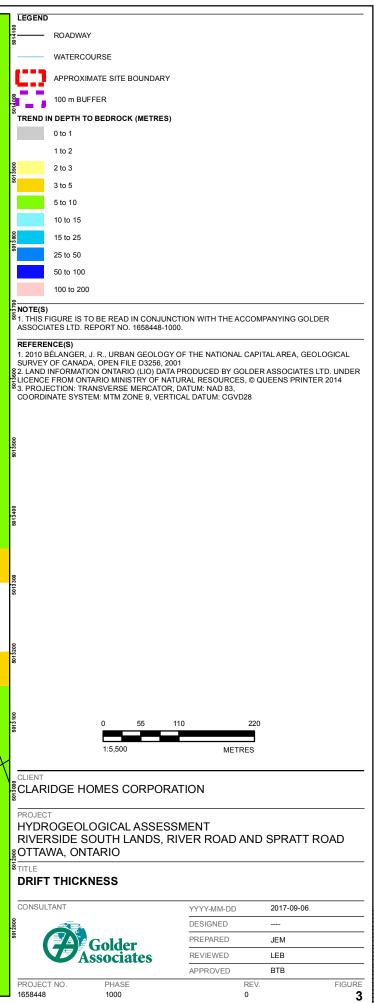




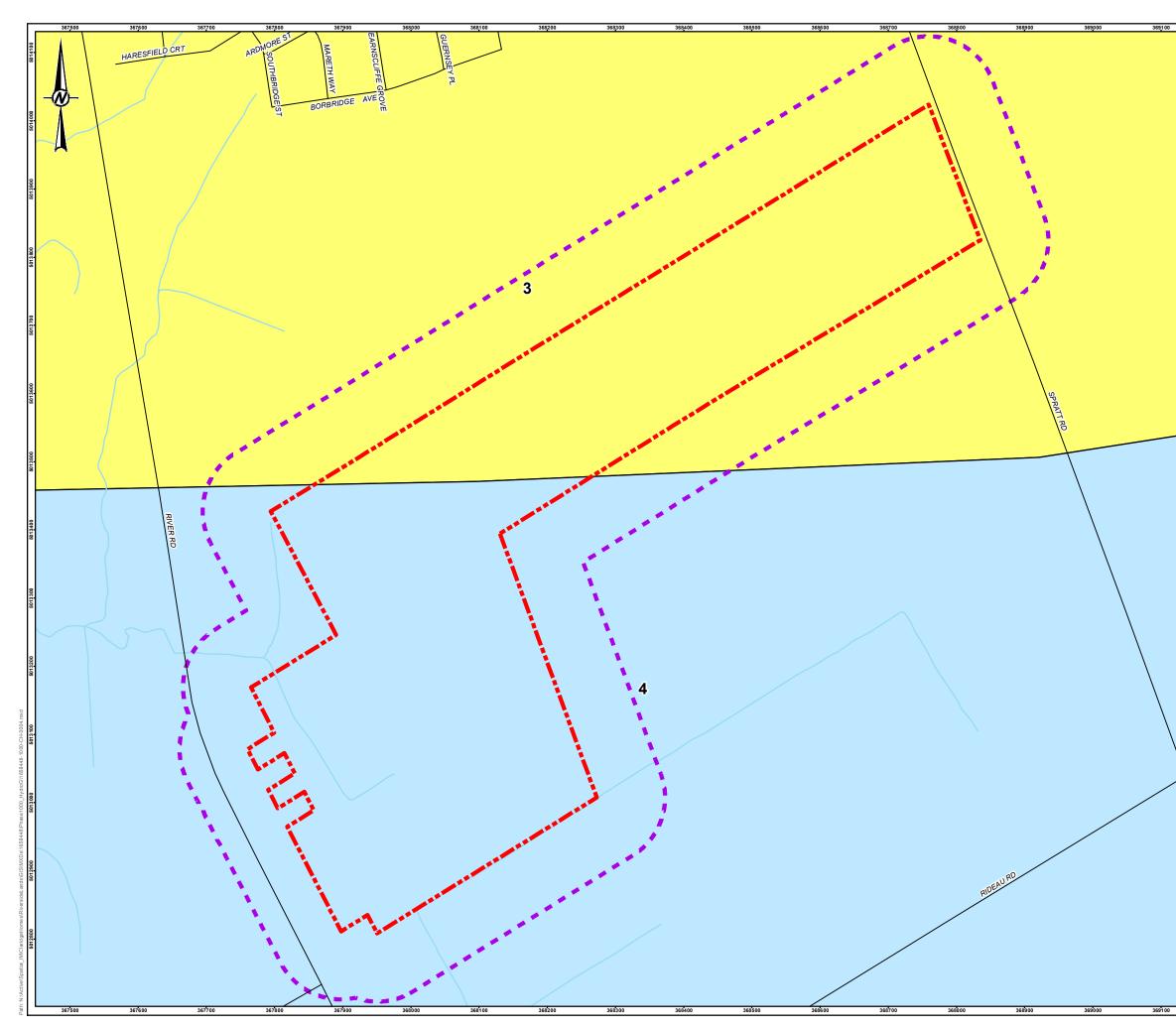
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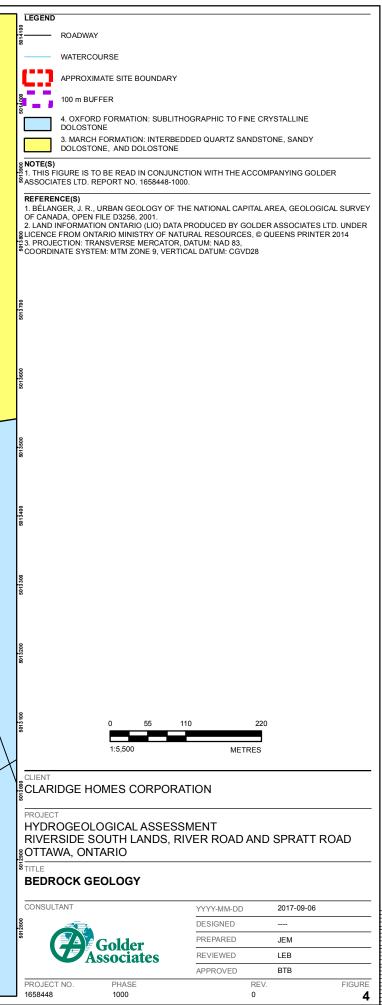






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# **ATTACHMENT A**

**Borehole Logs** 





# **METHOD OF SOIL CLASSIFICATION**

Organic or Inorganic	Soil Group	Type of	f Soil	Gradation or Plasticity	Cu	$=\frac{D_{60}}{D_{10}}$		$Cc = \frac{(D)}{D_{10}}$	$(xD_{60})^2$	Organic Content	USCS Group Symbol	Group Name							
	_	Gravels To . <u>∞</u> E ≤12%	mm) mm	is mm)	-	-	Poorly Graded		<4		≤1 or 3	≥3		GP	GRAVEL				
(ss	COARSE-GRAINED SOILS (>50% by mass is larger than 0.075 mm)	2 mm)	s 75 mm	5 mm	VELS / mass action 14.75 I	fines (by mass)	Well Graded		≥4		1 to 3	3		GW	GRAVEL				
by ma		GRAVELS (>50% by mass of coarse fraction is larger than 4.75 mm)	Gravels with >12%	Below A Line			n/a				GM	SILTY GRAVEL							
INORGANIC (Organic Content ≤30% by mass)	AINED rger th		fines (by mass)	Above A Line			n/a			<20%	GC	CLAYEY GRAVEL							
NORG	SE-GR/ ss is la	of is mm)	Sands with ≤12%	Poorly Graded		<6		≤1 or i	≥3	≤30%	SP	SAND							
ganic (	COARS by mai	SANDS 6 by mass se fraction than 4.75	fines (by mass)	Well Graded		≥6		1 to 3	3		SW	SAND							
(Or	(>50%	SANDS (≥50% by mass of coarse fraction is smaller than 4.75 mm)	Sands with	Below A Line			n/a				SM	SILTY SAND							
		smal	>12% fines (by mass)	Above A Line			n/a				SC	CLAYEY SAND							
Organic						I	Field Indica	tors											
or Inorganic	Group	Type of	f Soil	Laboratory Tests	Dilatancy	Dry Strength	Shine Test	Thread Diameter	Toughness (of 3 mm thread)	Organic Content	USCS Group Symbol	Primary Name							
	FINE-GRAINED SOILS (====================================	plot		I familed I family	Rapid	None	None	>6 mm	N/A (can't roll 3 mm thread)	<5%	ML	SILT							
(ss		.Organic Content 530% by mass) FINE-GRAINED SOILS % by mass is smaller than 0.075 mm	75 mm	ss) 75 mm	75 mm	75 mm	75 mm	75 mm	and LL ine w()	75 mm	Liquid Limit <50	Slow	None to Low	Dull	3mm to 6 mm	None to low	<5%	ML	CLAYEY SIL
by ma			SILTS SILTS astic or PI and below A-Line on Plasticity Chart below)			Slow to very slow	Low to medium	Dull to slight	3mm to 6 mm	Low	5% to 30%	OL	ORGANIC SILT						
ANIC ≤30%			NED Solv	NED Sum	NED Solv	NED S	NED S Ialler th	SILTS SILTS (Non-Plastic or PI and LL plot below A-Line on Plasticity Chart below)		Liquid Limit	Slow to very slow	Low to medium	Slight	3mm to 6 mm	Low to medium	<5%	МН	CLAYEY SIL	
INORGANIC Content ≤30%	-GRAIN s is sm	(Non		≥50	None	Medium to high	Dull to slight	1 mm to 3 mm	Medium to high	5% to 30%	ОН	ORGANIC SILT							
ganic (	FINE by mas	olot	ant art	Liquid Limit <30	None	Low to medium	Slight to shiny	~ 3 mm	Low to medium	0%	CL	SILTY CLAY							
D.	250% by	CLAYS and LL p	above A-Line on Plasticity Chart below)	Liquid Limit 30 to 50	None	Medium to high	Slight to shiny	1 mm to 3 mm	Medium	to 30%	CI	SILTY CLAY							
		(Pla	Plast	Liquid Limit ≥50	None	High	Shiny	<1 mm	High	(see Note 2)	СН	CLAY							
		Peat and mi mixtu								30% to 75%		SILTY PEAT SANDY PEA							
HIGHLY ORGANIC SOILS	by mai	Predominar may conta mineral soil, amorphou	in some fibrous or	me us or				75% to 100%	PT	PEAT									
40 30 ((d) X4	Low	Plasticity		SILTY CLAY	CLAY CH CLAYEY S ORGANIC			a hyphen, For non-co the soil h transitiona gravel.	for example, bhesive soils, as between Il material b	GP-GM, S the dual s 5% and etween "c	two symbols SW-SC and C ymbols must b 12% fines (i.e lean" and "di pol must be us	ML. e used whe e. to identif rty" sand c							
Plasticity Index (PI) 05 -				Aline				liquid limit	and plasticity	y index val	ues plot in the ty Chart at lef	CL-ML are							

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 indicate a range of similar soil types within a stratum.

Liquid Limit (LL) 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.

CLAYEY SILT ML ORGANIC SILT OL

SILTY CLAY

20 25.5

SILTY CLAY-CLAYEY SILT, CL-MI

10

SILT ML (See Note 1)

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.



10

70



## 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>i.e.</i> , 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<sup>2</sup> 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); Nd:

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,  $60^{\circ}$  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

#### NON-COHESIVE (COHESIONLESS) SOILS

Compactness <sup>2</sup>					
	Term	SPT 'N' (blows/0.3m) <sup>1</sup>			
,	Very Loose	0 - 4			
	Loose	4 to 10			
	Compact	10 to 30			
	Dense	30 to 50			
١	/ery Dense	>50			
	Field Meint	ure Condition			
Term					
Term	Description				
Dry	Soil flows freely thre	Soil flows freely through fingers.			
	Soils are darker than in the dry condition and may feel cool.				
Moist		an in the dry condition and			
Moist Wet	may feel cool.	an in the dry condition and ree water forming on hands			

S V	MPI	ES
SA		LEG

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
GS	Grab Sample
RC	Rock core
SC	Soil core
SS	Split spoon sampler – note size
ST	Slotted tube
ТО	Thin-walled, open – note size
TP	Thin-walled, piston – note size
WS	Wash sample

#### SOIL TESTS

SUIL TESTS	
w	water content
PL, w <sub>p</sub>	plastic limit
LL, wL	liquid limit
С	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test <sup>1</sup>
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement <sup>1</sup>
D <sub>R</sub>	relative density (specific gravity, Gs)
DS	direct shear test
GS	specific gravity
М	sieve analysis for particle size
МН	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO <sub>4</sub>	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 whi	ch are anisotropically consolidated prior to shear are show

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

#### CONLOIVE C

Consistency			
Term	Undrained Shear Strength (kPa)	SPT 'N' <sup>1,2</sup> (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	

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

effects; approximate only.

 SPT 'N' values should be considered ONLY an approximate guide to consistency; for sensitive clays (e.g., Champlain Sea clays), the N-value approximation for consistency terms does NOT apply. Rely on direct measurement of undrained shear strength or other manual observations.

	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.			





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

I.	GENERAL	(a) w	Index Properties (continued) water content
π In x Iog <sub>10</sub> g t	3.1416 natural logarithm of x x or log x, logarithm of x to base 10 acceleration due to gravity time	w <sub>I</sub> or LL w <sub>p</sub> or PL I <sub>p</sub> or PI Ws I <sub>L</sub> IC emax emin	liquid limit plastic limit plasticity index = $(w_l - w_p)$ shrinkage limit liquidity index = $(w - w_p) / I_p$ consistency index = $(w_l - w) / I_p$ void ratio in loosest state void ratio in densest state
II.	STRESS AND STRAIN	ID	density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)
$\gamma \Delta$	shear strain change in, e.g. in stress: $\Delta \sigma$	<b>(b)</b> h	Hydraulic Properties hydraulic head or potential
E Ev	linear strain volumetric strain coefficient of viscosity	q v i	rate of flow velocity of flow hydraulic gradient
η υ σ	Poisson's ratio total stress	k	hydraulic conductivity (coefficient of permeability)
σ΄ σ΄ <sub>νο</sub>	effective stress ( $\sigma' = \sigma - u$ ) initial effective overburden stress principal stress (major, intermediate,	j	seepage force per unit volume
01, 02, 03	minor)	(c) C <sub>c</sub>	Consolidation (one-dimensional) compression index
$\sigma_{oct}$	mean stress or octahedral stress = $(\sigma_1 + \sigma_2 + \sigma_3)/3$	Cr	(normally consolidated range) recompression index
τ u	shear stress porewater pressure	Cs	(over-consolidated range) swelling index
E G	modulus of deformation shear modulus of deformation	Cα mv	secondary compression index coefficient of volume change
ĸ	bulk modulus of compressibility	Cv	coefficient of consolidation (vertical direction)
		Ch T	coefficient of consolidation (horizontal direction)
III.	SOIL PROPERTIES	Tv U	time factor (vertical direction) degree of consolidation
<b>(a)</b> ρ(γ)	Index Properties bulk density (bulk unit weight)*	σ΄ <sub>Ρ</sub> OCR	pre-consolidation stress over-consolidation ratio = $\sigma'_{P} / \sigma'_{vo}$
ρ(γ) ρ <sub>d</sub> (γ <sub>d</sub> )	dry density (dry unit weight)	(d)	Shear Strength
ρw(γw) ρs(γs) γ΄	density (unit weight) of water density (unit weight) of solid particles unit weight of submerged soil	τ <sub>ρ</sub> , τ <sub>r</sub> φ΄ δ	peak and residual shear strength effective angle of internal friction angle of interface friction coefficient of friction = tan $\delta$
DR	$(\gamma' = \gamma - \gamma_w)$ relative density (specific gravity) of solid particles (D <sub>R</sub> = $\rho_s / \rho_w$ ) (formerly G <sub>s</sub> )	μ C΄ Cu, Su	effective cohesion undrained shear strength ( $\phi = 0$ analysis)
e n S	void ratio porosity degree of saturation	p p' q q <sub>u</sub> St	mean total stress $(\sigma_1 + \sigma_3)/2$ mean effective stress $(\sigma'_1 + \sigma'_3)/2$ $(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$ compressive strength $(\sigma_1 - \sigma_3)$ sensitivity
where	ty symbol is $\rho$ . Unit weight symbol is $\gamma = \rho g$ (i.e. mass density multiplied by eration due to gravity)	<b>Notes:</b> 1 2	τ = c' + σ' tan φ' shear strength = (compressive strength)/2





#### 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**

Bedding Plane Spacing
Greater than 2 m
0.6 m to 2 m
0.2 m to 0.6 m
60 mm to 0.2 m
20 mm to 60 mm
6 mm to 20 mm
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**

<u>Size*</u>
Greater than 60 mm
2 mm to 60 mm
60 microns to 2 mm
2 microns to 60 microns
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° angle is horizontal.

#### **Description and Notes**

MB Mechanical Break

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	К	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		

Golder

LOCATION: N 5012839.8 ;E 367953.0

## RECORD OF BOREHOLE: 17-1

SHEET 1 OF 1

BORING DATE: January 13, 2017

DATUM: Geodetic PENETRATION TEST HAMMER, 64kg; DROP, 760mm

	SAN	/IPLE	R HAMMER, 64kg; DROP, 760mm						PEN	ETRATION TEST HAMME	ER, 64kg; DROP, 760mm
щ	Τ	QO	SOIL PROFILE			SA	MPL	ES	DYNAMIC PENETRATION HYDRAULIC CC RESISTANCE, BLOWS/0.3m k, cm/s	NDUCTIVITY,	0
SCAL	N LL LL	METH		гот		н		.30m	20 40 60 80 10 <sup>-6</sup> 10	0 <sup>5</sup> 10 <sup>-4</sup> 10 <sup>-3</sup>	PIEZOMETER OR U STANDPIPE
DEPTH SCALE	ME	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	TYPE	BLOWS/0.30m		D <sup>5</sup> 10 <sup>4</sup> 10 <sup>3</sup> 0 DNTENT PERCENT OWWI	
		BO		STF	(m)			BLO	20 40 60 80 20 4		-
-	0		GROUND SURFACE TOPSOIL - (ML) sandy SILT; dark brown; non-cohesive (CI/CH-ML and SM) SILTY CLAY, CLAYEY SILT and SILTY SAND; grey brown (MCETHERED CPLIST):		89.98 0.06						
	1		brown (WEATHERED CRUST); cohesive, w>PL, very stiff			1	ss	5	0		Native Backfill
	2	ler llow Stem)			87.85	2	ss	4			
-		Power Auger 200 mm Diam. (Hollow Stem)	(CI/CH) SILTY CLAY to CLAY; grey brown (WEATHERED CRUST); cohesive, w>PL, very stiff		2.13	3	ss	5		-	Bentonite Seal
-	3		(ML-SM) gravelly sandy SILT to SILTY SAND; grey brown, contains cobbles and boulders (GLACIAL TILL); non-cohesive, wet, compact		86.78 3.20	4	ss	8			Native Backfill
	4		noreonesive, wei, compact			5	ss	26	o		Silica Sand
-			End of Borehole		85.48 4.50		-				Standpipe
	5		Auger Refusal								WL in Standpipe at Elev. 89.58 m on – Jan. 30, 2017
	6										
-	7										
MC 21/2/	8										
AL-MIS.GDT 26,	9										
MIS-BHS 001 1658448 GPJ GAL-MIS GDT 26/7/17 JM	10										
MIS-BHS 001	DEF 1:5		SCALE	<u> </u>	1	1	I		Golder		Logged: Pah Checked: Sat

## **RECORD OF BOREHOLE: 17-2**

SHEET 1 OF 1 DATUM: Geodetic

LOCATION: N 5012927.0 ;E 368096.0

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: January 16, 2017

		머머	SOIL PROFILE	1.		SA	AMPL		DYNAMIC PENETRA RESISTANCE, BLOV	TION /S/0.3m	Ì,	HYDRAULIC k, cn	CONDUCT /s	IVITY,	-	<sup>R</sup>	PIEZOMETER
METRES		BORING METHOD		STRATA PLOT	ELEV.	ËR	ш	BLOWS/0.30m	20 40			10 <sup>-6</sup>		0 <sup>-4</sup> 10 <sup>-</sup>		LAB. TESTING	OR
ME		RING	DESCRIPTION	ATA	DEPTH	NUMBER	TYPE	WS/0	SHEAR STRENGTH Cu, kPa	nat V. + rem V. ⊕	Q - ● U - O				T C	AB. T	INSTALLATION
ſ		BO		STR	(m)	Ż		BLO	20 40	60 8	0	20		0 80		ני	
0			GROUND SURFACE	<b>_</b>	90.52												
0			TOPSOIL - (SM) SILTY SAND, fine; dark brown; non-cohesive		0.00 90.27												
			(SM) SILTY SAND, fine; brown; non-cohesive, moist		0.25	]											
			(CI/CH) SILTY CLAY to CLAY: arev		90.00 0.52												
			brown, contains silty fine sand seams, fissured (WEATHERED CRUST);			<u> </u>											
1			cohesive, w>PL, very stiff			1	SS	7									
					89.15												
		/ Stem)	(CI/CH-ML and SM) SILTY CLAY, CLAYEY SILT and SILTY SAND; grey brown (WEATHERED CRUST);		1.37	<u> </u>	-										
	Nuger	Hollov	brown (WEATHERED CRUST); cohesive, w>PL, very stiff			2	SS	3									
2	Power Auger	iam. (I			88.39			ľ									
	٩	200 mm Diam. (Hollow	(CI/CH) SILTY CLAY to CLAY; grey brown, fissured (WEATHRED CRUST); cohesive, w>PL, very stiff		2.13												
		200	cohesive, w>PL, very stiff														
						3	SS	4									
3						$\vdash$	-										
						4	SS	8									
					86.71	<u> </u>	-										
4	F		End of Borehole Auger Refusal		3.81	1											
4			nuyei nelusai														
5																	
6																	
7																	
8																	
9																	
5																	
10																	
	I																
DE	PT	TH S	CALE					(	Gold	er							OGGED: PAH
1:	50	)							Assoc	iates						CHE	ECKED: SAT

## RECORD OF BOREHOLE: 17-2A

LOCATION: N 5012927.0 ;E 368096.0

BORING DATE: January 16, 2017

SHEET 1 OF 1

DATUM: Geodetic

Big	S	ТНОБ	SOIL PROFILE			AMPLES		CE, BLOWS/0.3m	``	HYDRAULIC CONDUCTIVITY, k, cm/s	AL ING	PIEZOMETER
OPCOMD SUPPLE         OPCOMD S	DEPTH SCALE METRES	<b>BORING ME</b>	DESCRIPTION	TRATA PLO MILE (m)	TI.	TYPE I OWS/0 30n	20 SHEAR STF Cu, kPa	RENGTH nat V. + rem V. ⊕	Q - ● U - O	WATER CONTENT PERC		OR STANDPIPE INSTALLATION
7 8 End of DCPT 7.92 9	0 - 1 1 2 3 4		Probable Silty Clay to Clay	90.5	2 00					20 40 60 115 135 102		
	· 7 · 8		End of DCPT	82.6 7.9	02							

## RECORD OF BOREHOLE: 17-3

SHEET 1 OF 1 DATUM: Geodetic

LOCATION: N 5013008.0 ;E 368232.2 SAMPLER HAMMER, 64kg; DROP, 760mm BORING DATE: January 10, 2017

		P	SOIL PROFILE	L	1	SA	MPL		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	국 인 PIEZOMETER
METRES		Boring method	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	түре	BLOWS/0.30m	20         40         60         80           SHEAR STRENGTH         nat V. +         Q - ●           Cu, kPa         rem V. ⊕         U - O	10 <sup>6</sup> 10 <sup>5</sup> 10 <sup>4</sup> 10 <sup>3</sup> WATER CONTENT PERCENT Wp	PIEZOMETER OR STANDPIPE INSTALLATION
		ň	GROUND SURFACE	ST				В	20 40 60 80	20 40 60 80	
0		Π	TOPSOIL - (ML) CLAYEY SILT; brown; non-cohesive		91.08 0.00						
			(ML and SM) SILT, CLAYEY SILT and SILTY SAND; grey brown; non-cohesive, wet, very loose to loose		90.78 0.30		-				
1						1	ss	5		0	Native Backfill
					89.25	2	ss	3			
2			(CI/CH) SILTY CLAY to CLAY; grey brown, fissured (WEATHERED CRUST); cohesive, w>PL, very stiff		1.83		-				
	ger	(Hollow Stem)				3	SS	4		0	Bentonite Seal
3	Power Auger	mm Diam.	(SM) gravelly SILTY SAND; grey brown, contains cobbles and boulders (GLACIAL TILL); non-cohesive, wet, compact to dense		88.09 2.99	4	SS	10			
4		200				5	ss	34			
-							-				Native Backfill
5						6	ss	28		0	
											Silica Sand
6			End of Borehole		84.98 6.10	7	ss	32			Standpipe
											WL in Standpipe at Elev. 89.76 m on Jan. 30, 2017
7											
8											
9											
10											
10											
	РТ 50		CALE						Golder		LOGGED: PAH CHECKED: SAT

## RECORD OF BOREHOLE: 17-4

SHEET 1 OF 1 DATUM: Geodetic

LOCATION: N 5013152.1 ;E 368203.6

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: January 10, 2017

Ľ.	DOH	SOIL PROFILE	1	S/	AMPLE	RESISTANCE, BLC		HYDRAULIC CONE k, cm/s		≓2 PI	EZOMETER
METRES	BORING METHOD	DESCRIPTION	STRATA PLOT (m) (m)		TYPE	20 40 SHEAR STRENGT Cu, kPa	60 80 H nat V. + Q - ● rem V. ⊕ U - C	10 <sup>-6</sup> 10 <sup>-5</sup> WATER CONT Wp I	10 <sup>-4</sup> 10 <sup>-3</sup> I I I FENT PERCENT	S TEST	OR TANDPIPE STALLATION
	В	GROUND SURFACE		_	ā	20 40	60 80	20 40	60 80		
0		TOPSOIL - (ML) CLAYEY SILT; dark	91.0 EEE 0.0								
		brown; non-cohesive (ML and SM) SILT, CLAYEY SILT and SILTY SAND; grey brown; non-cohesive,	90.7 0.3	1 D							
		wet, very loose to loose		1	ss						
1											$\overline{\Delta}$
				2	ss						
2		(CI/CH) SILTY CLAY to CLAY; grey brown, fissured (WEATHERED	<u>89.0</u> 1.9	3 B							
		CRUST); cohesive, w>PL, very stiff		3	ss						
3	Stem)			_							
	Power Auger mm Diam. (Hollow Stem)	(SM) gravelly SILTY SAND; grey brown, contains cobbles and boulders (GLACIAL TILL); non-cohesive, wet,	87.7 3.2		SS						
	200 mm Di	(GLACIAL TILL); non-cohesive, wet, compact to very dense									
4				5	SS 2						
				6	ss >	0					
5											
				7	ss 2						
6				-							
				8	SS 1	9					
		End of Borehole Auger Refusal	84.2 6.7								
7										WL in ope borehole a depth belo ground su upon com drilling	n at 1.10 m w rface
										drilling	
8											
9											
10											
DE	PTH S	SCALE				<b>A</b> Col	der ciates			LOGGED:	PAH

## **RECORD OF BOREHOLE: 17-5**

SHEET 1 OF 1 DATUM: Geodetic

LOCATION: N 5013072.9 ;E 368083.3

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: January 10, 2017

ц Д	Ū.	Ē	SOIL PROFILE	- L-	-	SA	MPL	_	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	ВÅ	PIEZOMETER
METRES	DODING METHOD	מאואפ שבו	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	түре	BLOWS/0.30m	20         40         60         80           SHEAR STRENGTH Cu, kPa         nat V. + Q - ● rem V. ⊕ U - O	10 <sup>6</sup> 10 <sup>5</sup> 10 <sup>4</sup> 10 <sup>3</sup> WATER CONTENT PERCENT Wp → <sup>W</sup> WI	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
	-		GROUND SURFACE	ν	90.40			B	20 40 60 80	20 40 60 80		
0		Π	TOPSOIL - (ML) CLAYEY SILT; brown;		0.00	1	GRAB	-				
1			non-cohesive (ML and SM) SILT, CLAYEY SILT and SILTY SAND; grey brown; non-cohesive, wet, very loose to loose		90.15 0.25	2	SS	4				Ā
2			(CI/CH) SILTY CLAY to CLAY; grey brown, fissured, contains clayey silt layers (WEATHERED CRUST); cohesive, w>PL, very stiff		89.03 1.37 88.27	3	ss	4				
		Stem)	(CI/CH-ML and SM) SILTY CLAY, CLAYEY SILT and SILTY SAND; grey brown (WEATHERED CRUST); cohesive, w>PL, very stiff		2.13	4	ss	3				
3	Power Auger	ollo	(CI/CH) SILTY CLAY to CLAY; grey brown, fissured (WEATHERED CRUST); cohesive, w>PL, very stiff		87.50 2.90	5	ss	2				
		200 n										
4									>96 +			
									>96 +			
						6	SS	2				
5												
									>96 +			
			(CI/CH) SILTY CLAY to CLAY; grey,		84.76 5.64				>96 +			
			contains clayey silt seams; cohesive, w>PL, very stiff		84.46	7	SS	4				
6			(ML) sandy SILT, some gravel; grey (GLACIAL TILL); non-cohesive, wet,		5.94 84.15							
			very loose to loose/		6.25							WL in open
											1 1	borehole at 0.80 m depth below ground surface
7												upon completion of drilling
8												
9												
10												
				1								
DE	PT	H S	CALE					(	Golder		LC	GGED: PAH

## **RECORD OF BOREHOLE: 17-6**

DATUM: Geodetic

LOCATION: N 5013009.8 ;E 367980.8

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: January 9, 2017

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

u T	DOH.	╞	SOIL PROFILE	1.	r	SA	MPL		DYNAMIC PENETRATION Y RESISTANCE, BLOWS/0.3m	`	HYDRAULIC CONDUCTIVITY, k, cm/s	AL	PIEZOMETER
METRES	BORING METHOD		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.30m	20 40 60 80 I I I I SHEAR STRENGTH nat V. + Q Cu, kPa rem V. ⊕ U		10 <sup>-6</sup> 10 <sup>-5</sup> 10 <sup>-4</sup> 10 <sup>-3</sup> WATER CONTENT PERCENT Wp - O <sup>W</sup> WI	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
0	Power Auger BC		GROUND SURFACE TOPSOIL - (ML) CLAYEY SILT; dark brown; non-cohesive (CI/CH-ML and SM) SILTY CLAY, CLAYEY SILT and SILTY SAND; grey brown (WEATHERED CRUST); cohesive, w>PL, very stiff		90.26		\$\$ \$\$ \$\$ \$\$	3 2 2			20 40 60 80		 ₽
4	Power	200	(CI/CH) SILTY CLAY to CLAY; grey brown, fissured (WEATHERED CRUST); cohesive, w>PL, very stiff (CI/CH) SILTY CLAY to CLAY; grey; cohesive, w>PL, stiff		3.05 85.99 4.27	4	SS	3		96 + 96 +	0		
5			(SM) gravelly SILTY SAND, some gravel; grey, contains cobbles and boulders (GLACIAL TILL); non-cohesive, wet, compact End of Borehole		85.08 5.18 84.16 6.10	6	ss	16			0	МН	WL in open borehole at 1.22 m depth below
7													ground surface upon completion of drilling
9													
DE 1:		l I SC	CALE	<u> </u>		L			Golder				DGGED: PAH ECKED: SAT

SHEET 1 OF 1

LOCATION: N 5012933.6 ;E 367859.5

SAMPLER HAMMER, 64kg; DROP, 760mm

## RECORD OF BOREHOLE: 17-7

SHEET 1 OF 1 DATUM: Geodetic

BORING DATE: January 5, 2017

Ш Д.	ПОН	SOIL PROFILE			S/	AMPL		DYNAMIC PENETRATION RESISTANCE, BLOWS	UN \$ ;/0.3m \$	HYDRAULIC CO k, cm/s	NDUCTIVITY,	RGF	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD		STRATA PLOT	FI FV	ËR	ω	BLOWS/0.30m		60 80 <b>`</b>	10 <sup>-6</sup> 10		ADDITIONAL LAB. TESTING	OR STANDPIPE
ΞΨ	RING	DESCRIPTION	ATA	ELEV. DEPTH (m)	IUMB	TYPE	)/S//(	SHEAR STRENGTH	nat V. + Q - ● rem V. ⊕ U - O	WATER CO		ADDI AB. T	INSTALLATION
L	BO		STR	(m)			BLC	20 40 6	60 80	20 40		<u> </u>	
0				90.24								$\perp$	
		FILL/TOPSOIL - (SM) SILTY SAND; dark brown; moist		0.00 89.94									
		FILL - (SP-CL/CI) Mixture of SAND and SILTY CLAY; brown to grey brown;		0.30		1							
		non-cohesive, moist, loose to very loose			1	GRAE	3 -						
1		(CI/CH) SILTY CLAY to CLAY, some	Ĩ	89.18 1.06	2	SS	4						
		sand; grey brown (WEATHERED CRUST); cohesive, w>PL, very stiff											
					-								
					3	SS	6						
2													
					$\vdash$								
					4	SS	2						
							-						
3						1							
					5	SS	3						
					$\vdash$								
4	Power Auger								>96+				
	Jwer 4												
	Ĩ												
						1							
5					6	SS	4						
					<u> </u>	-							
						1							
				84.45	7	SS	2						
6		(SM) SILTY SAND, some gravel; grey, contains clayey silt seams, cobbles and boulders (GLACIAL TILL); non-cohesive,		5.79									
Ū		boulders (GLACIAL TILL); non-cohesive, wet, compact				1							
					8	SS	24						
					$\vdash$								
7					9	SS	10						
					$\vdash$								
					10	SS	11						
8				82.02									
		End of Borehole		8.22		1							
9													
10													
DE	PTH	SCALE						Coldo				LO	GGED: DG
	50							Golde	r Ates				CKED: SAT

## **RECORD OF BOREHOLE: 17-8**

BORING DATE: January 23, 2017

SHEET 1 OF 1

DATUM: Geodetic

LOCATION: N 5013071.6 ;E 367834.3 SAMPLER HAMMER, 64kg; DROP, 760mm

Ц	P		SOIL PROFILE			SA	MPL		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3	3m i	く	k, cm	s		μŞ	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.30m		V.⊕ U	2-● 2-0				ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
		+	GROUND SURFACE	0,	89.77	-	$\left  \right $	ш —	20 40 60	80		20	40 60	080		
0			FILL - (SP/GP) SAND and GRAVEL; dark grey to black, contains asphaltic concrete fragments; non-cohesive, moist (SM) SILTY SAND; brown;		0.00 89.36	1	GRAB									
		ł	non-cohesive, moist		0.41 89.16 0.61	2	GRAB	-								
1			(CI/CH) SILTY CLAY to CLAY; red brown to grey brown, fissured (WEATHERED CRUST); cohesive, w>PL, very stiff		88.40	3	ss	5								
			(CI/CH-ML and SM) SILTY CLAY, CLAYEY SILT and SILTY SAND; grey brown (WEATHERED CRUST); cohesive, w>PL, very stiff		1.37	4	ss	5								
2																
		Ê				5	SS	2								
	e	low Ste														
3	Power Auger	IM. (Hol	(CI/CH) SILTY CLAY to CLAY; grey brown, contains silty fine sand seams		86.87 2.90		$\left  \right $									
	Ром	nm Dia	WEATHERED CRUST); cohesive, w>PL, very stiff			6	SS	2								
		200	·····													
					85.81					>	96 +					
4		ŀ	(CI/CH) SILTY CLAY to CLAY; grey; cohesive, w>PL, stiff		3.96					+	+					
			,													
						7	SS	W.LI								
5						,	33	vvii								
-																
									⊕ +							
									+							
6		1	End of Borehole		83.83 5.94					+	-					
7																
8																
				1												
. 9																
10																
				1			1 1			I			_1	I		
DE	PTH	1 S	CALE					4	Golder						LO	gged: Pah

## **RECORD OF BOREHOLE: 17-9**

SHEET 1 OF 1 DATUM: Geodetic

LOCATION: N 5013151.7 ;E 367949.8

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: January 16, 2017

ų.	ДŎ	SOIL PROFILE			SA	MPLE		DYNAMIC PENETRATIC RESISTANCE, BLOWS	ON \ /0.3m \	HYDRAULIC CONDUCTIVITY, k, cm/s	μ	PIEZOMETER
METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.30m	20 40 6 J J SHEAR STRENGTH r Cu, kPa r	0 80	10 <sup>-6</sup> 10 <sup>-5</sup> 10 <sup>-4</sup> 10 <sup>-3</sup> WATER CONTENT PERCENT Wp	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
0		GROUND SURFACE TOPSOIL - (SM) SILTY SAND; dark brown; non-cohesive (SM) SILTY SAND; grey brown; non-cohesive, wet (CI/CH) SILTY CLAY to CLAY; grey brown, contains silty fine sand seams, fissured (WEATHERED CRUST);		90.26 0.00 0.15 89.85 0.41	1	GRAB	-					
1		cohesive, w>PL, very stiff			2	SS SS	5					Bentonite Seal
3					4	SS	2					
4	Power Auger Diam. (Hollow Stem)			86.30 3.96	5	SS	3		>96 +			Native Backfill
5	Po 200 mm Di				6	SS		<ul> <li>⊕</li> <li>+</li> <li>⊕</li> <li>+</li> </ul>	+			
6						-		• +				Silica Sand
7					7	SS SS		⊕ +				Standpipe
8		End of Borehole		82.34 7.92				⊕ ⊕	+ + +			Silica Sand
9												WL in Standpipe at Elev. 90.04 m on Jan. 30, 2017
10												
DE 1:		ISCALE		L		<u> </u>		Golder	r			I OGGED: PAH IECKED: SAT

## **RECORD OF BOREHOLE: 17-10**

BORING DATE: January 16, 2017

SHEET 1 OF 1

DATUM: Geodetic

LOCATION: N 5013218.5 ;E 368049.9 SAMPLER HAMMER, 64kg; DROP, 760mm

L J	ЦЧ	SOIL PROFILE	_		SA	MPL		DYNAMIC PENETRATIC RESISTANCE, BLOWS/		HYDRAULIC CONDUCTI k, cm/s		μģ	PIEZOMETER
METRES	BORING METHOD		STRATA PLOT		Ř		BLOWS/0.30m	20 40 6	0 80	10 <sup>-6</sup> 10 <sup>-5</sup> 10	<sup>-4</sup> 10 <sup>-3</sup>	ADDITIONAL LAB. TESTING	OR
WE -	- NG	DESCRIPTION	TAF	ELEV. DEPTH	NUMBER	TYPE	VS/0.	SHEAR STRENGTH n Cu, kPa n	at V. + Q-● em V.⊕ U-O	WATER CONTENT		DDIT B. TE	STANDPIPE INSTALLATION
5	BOR		TRA	(m)	Ŋ	-	3LOV					LAA	
	-	GROUND SURFACE	S				ш	20 40 6	0 80	20 40 60	80	+ +	
0		TOPSOIL - (SM) SILTY SAND; dark		90.56 0.00	1	GRAB						+ +	
		brown; non-cohesive		90.33	1	GRAE	-						
		(SM) SILTY SAND; brown; non-cohesive, moist		90.10									
		(CI/CH) SILTY CLAY to CLAY; grey brown to red brown, fissured		0.46									
		(WEATHERED CRUST); cohesive,			2	SS	6						
1		w>PL, very stiff			2	55	0						
				89.19									
		(CI/CH-ML and SM) SILTY CLAY,		1.37									
		CLAYEY SILT and SILTY SAND; grey brown (WEATHERED CRUST);			3	ss	3						
		cohesive, w>PL, very stiff											
2													
	(me				4	SS	3						
	1												
	Auge												
3	ower												
	200 mm Diam (Hollow Stem)				5	SS	3						
	000												
		(CI/CH) SILTY CLAY to CLAY; grey;		86.90 3.66									
		cohesive, w>PL, firm to stiff						Ð	+				
4								+					
					6	SS	wн						
5													
5													
								<b>⊕</b>	+				
									+				
6		End of Borehole		84.62 5.94					+				
7													
8													
9													
10													
<b>DF</b>	ртн	SCALE						Golden				LOC	GED: PAH
DE												-00	

# RECORD OF BOREHOLE: 17-10A

LOCATION: N 5013218.0 ;E 368050.0

BORING DATE: January 16, 2017

SHEET 1 OF 1

DATUM: Geodetic

Ц	ПОН	SOIL PROFILE	1.		SA	MPL		DYNAMIC PENETRA RESISTANCE, BLOV			C CONDUCTIV m/s		ج ل	PIEZOMETER
IRES	MET		PLOT		н		. 30m	20 40	60 80		10 <sup>-5</sup> 10 <sup>-4</sup>			OR STANDPIPE
METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	TYPE	BLOWS/0.30m	SHEAR STRENGTH Cu, kPa	nat V. + Q - ● rem V. ⊕ U - O		R CONTENT P		ADDITIONAL LAB. TESTING	INSTALLATION
ı	BOI		STR.	(m)	Ż		BLO	20 40	60 80		40 60			
0	_	GROUND SURFACE		90.56										
Ŭ		For soil stratigraphy refer to Record of Borehole 17-10		0.00										
1														
	em)													
2	ev St													
-	r Aug													
	Powe													
	Power Auger 200 mm Diam. (Hollow Stem)													
	20													
3														
4														
ĺ					1	TP	PH							
		End of Dorobs's		86.14										
		End of Borehole		4.42										
5														
6														
7														
8														
9														
10														
								Gold		<u> </u>		I		
		SCALE					(	Gold	er					GGED: PAH
1:	50							Assoc	<u>iates</u>				CHE	CKED: SAT

## **RECORD OF BOREHOLE: 17-11**

BORING DATE: January 17, 2017

SHEET 1 OF 1

DATUM: Geodetic

LOCATION: N 5013297.0 ;E 368157.3 SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

;	Q	SOIL PROFILE		1	SA	MPLE		DYNAMIC PENETRA RESISTANCE, BLOW	FION 'S/0.3m	ì	HYDR	AULIC C k, cm/s	ONDUCTI	VITY,	ı 9 ل	PIEZOMETER
METRES	BORING METHOD		LOT		щ		.30m	20 40		80	1	0 <sup>-6</sup> 1	0 <sup>-5</sup> 10	<sup>-4</sup> 10 <sup>-3</sup>	ADDITIONAL LAB. TESTING	OR
MET	SING	DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	TYPE	BLOWS/0.30m	SHEAR STRENGTH Cu, kPa	nat V. + rem V. €	- Q - ● Ə U - O				PERCENT	B. TE	STANDPIPE INSTALLATION
5	BOR		STR∕	(m)	Z	-	BLO/	20 40		80						
		GROUND SURFACE		90.58			-	20 40			† í			, 00	+	
0		TOPSOIL - (ML) sandy SILT; dark		0.00											+	
		brown; non-cohesive (CI/CH-ML and SM) SILTY CLAY,		0.20	1											
		CLAYEY SILT and SILTY SAND; grey brown (WEATHERED CRUST);														
		cohesive, w>PL, very stiff														
1					1	SS	6									
					2	ss	2					0				
				88.60												
2		(CI/CH) SILTY CLAY to CLAY; grey brown, contains silty fine sand seams, fissured (WEATHERED CRUST);		1.98												
	_															
	Stem)	CONCOUNC, WEIL, VOLY SUIT			3	SS	4									
	lollow															
3	200 mm Diam. (Hollow Stem)															
	n Di				4	SS	2						0			
	200 n															
				86.77						>96 +						
4		(CI/CH) SILTY CLAY to CLAY; grey; cohesive, w>PL, stiff		3.81						>90 +						
·									+							
					ļ _											
					5	SS	1						0			
5																
		(ML) sandy SILT, some gravel; grey,		85.25 5.33				<b>⊕</b>	+							
		(ML) sandy SiLT, some graver, grey, contains cobbles and boulders (GLACIAL TILL); non-cohesive, wet,			6	SS	69				0					
		very dense				33	09									
6		End of Borehole	OCX58	84.64 5.94												
7																
ŕ																
8																
9																
10																
		I		I							L	1				
DE	PTH S	SCALE					(	Cold	74.						LO	GGED: PAH
1:	50							Gold	ates						CHE	CKED: SAT

## RECORD OF BOREHOLE: 17-12

BORING DATE: January 20, 2017

SHEET 1 OF 1

DATUM: Geodetic

LOCATION: N 5013161.9 ;E 367790.1 SAMPLER HAMMER, 64kg; DROP, 760mm

L L	гнор	SOIL PROFILE			SA	MPLES		PENETRA NCE, BLOW		$\langle \rangle$	k,	IC CONDUCT cm/s		ING	PIEZOMETER
METRES	BORING METHOD	DESCRIPTION		ELEV. DEPTH (m)	NUMBER	TYPE BLOWS/0.30m	20 SHEAR S Cu, kPa 20	40 TRENGTH 40	nat V. + rem V. €	30 · Q - • · U - O 30	10 <sup>-6</sup> WATE Wp H 20	10 <sup>-5</sup> 10 ER CONTENT 0 <sup>W</sup> 40 6	PERCENT	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
0		GROUND SURFACE TOPSOIL - (SM) SILTY SAND; dark brown; non-cohesive (SM) SILTY SAND; grey brown; non-cohesive, moist (CI/CH) SILTY CLAY to CLAY; red		89.76 0.00 0.08 89.15 0.61	1 (	GRAB -									
1		(WEATHERED CRUST); cohesive, w>PL, very stiff		0.01	2	SS 5						0			
2		(CI/CH-ML and SM) SILTY CLAY, CLAYEY SILT and SILTY SAND; grey brown (WEATHERED CRUST);		87.63 2.13	3	SS 5									Σ
3	Power Auger 200 mm Diam. (Hollow Stem)	brown (WEATHERED CRUST); cohesive, w>PL, very stiff (CI/CH) SILTY CLAY to CLAY; grey brown, fissured (WEATHERED CRUST); cohesive, w>PL, very stiff		<u>86.86</u> 2.90	5	SS 2 SS 2						0			
4	200 mm									>96 +					
5		(CI/CH) SILTY CLAY to CLAY; grey with black mottling; cohesive, w>PL, firm		85.49 4.27	6	ss w	4								
				83.82			Φ	+ +							
6		End of Borehole	~~~~	5.94				+							WL in open borehole at 2.35 m depth below ground surface upon completion of drilling
7															aniling
8															
9															
10															
DE	PTH :	 SCALE	1					Golde	 >r	<u> </u>				LC	DGGED: PAH

# RECORD OF BOREHOLE: 17-12A

LOCATION: N 5013162.0 ;E 367790.0

BORING DATE: January 23, 2017

SHEET 1 OF 1

DATUM: Geodetic

L.	ПОН	SOIL PROFILE			SA	AMPL		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3r		HYDRAULIC CO k, cm/s	ONDUCTIVITY,	μģ	PIEZOMETER
METRES	BORING METHOD		STRATA PLOT	ELEV.	ER		BLOWS/0.30m	20 40 60	80		0 <sup>-5</sup> 10 <sup>-4</sup> 10 <sup>-3</sup>	ADDITIONAL LAB. TESTING	OR
Е Ч	RING	DESCRIPTION	ATA	DEPTH	NUMBER	TYPE	)/S/(	SHEAR STRENGTH nat V Cu, kPa rem V	/. + Q - ● V. ⊕ U - O			ADDI AB. T	INSTALLATION
د	ВО		STR	(m)	z		BLO	20 40 60	80		0 60 80	Ľ 1	
0		GROUND SURFACE		89.76									
Ĩ		For soil stratigraphy refer to Record of Borehole 17-12		0.00									
1													
2	em)												
	ow St												$\overline{\Delta}$
	Power Auger Diam. (Hollo												<u></u> -
	Diam												
3	Power Auger 200 mm Diam. (Hollow Stem)												
Ĩ	5												
4													
					1	TP	PH				• •	с	
5		End of Borehole		84.73 5.03		$\left  \right $							
													WL in open porehole at 2.35 m
													WL in open orehole at 2.35 m depth below ground surface upon completion of drilling
												i c	upon completion of drilling
6													
7													
·													
8													
9													
10													
ר⊏י	otn c	CALE										10	GGED: PAH
	50 50							Golder					CKED: SAT

## **RECORD OF BOREHOLE: 17-13**

BORING DATE: January 20, 2017

SHEET 1 OF 1

DATUM: Geodetic

LOCATION: N 5013287.2 ;E 367889.6 SAMPLER HAMMER, 64kg; DROP, 760mm

	ЦОН	SOIL PROFILE	-		SA	MPLE		DYNAMIC PENETRATION RESISTANCE, BLOWS	/0.3m	k, cm/s	ŞĿ	PIEZOMETER
METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	түре	BLOWS/0.30m	SHEAR STRENGTH Cu, kPa		Wp		STANDPIPE INSTALLATION
0	-	GROUND SURFACE	5	90.32			B	20 40 6	80 80	20 40 60	80	
-		TOPSOIL - (SM) SILTY SAND; dark brown; non-cohesive (SP) SAND, some non-plastic fines; grey brown; non-cohesive, moist		0.00 90.09 0.23 89.59	1	GRAB	-					
1		(CI/CH-ML and SM) SILTY CLAY, CLAYEY SILT and SILTY SAND; grey brown (WEATHERED CRUST); cohesive, w>PL, very stiff		89.59 0.73 89.10 1.22	2	SS	4					Σ
		(CI/CH) SILTY CLAY to CLAY; red brown and grey brown, fissured (WEATHERED CRUST); cohesive, w>PL, very stiff		1.22	3	ss	4					
2	ger illow Stem)	(CI/CH-ML and SM) SILTY CLAY, CLAYEY SILT and SILTY SAND; grey brown (WEATHERED CRUST); cohesive, w>PL, very stiff to stiff		88.19 2.13	4	ss	2					
3	Power Auger 200 mm Diam. (Hollow Stem)	(CI/CH) SILTY CLAY to CLAY; grey, contains silty fine sand seams; cohesive, w>PL, firm		87.20 3.12	5	ss	2					
4								⊕ +				
5					6	SS N	wн					
-								⊕ - +				
6		End of Borehole		84.38 5.94				+				WL in open borehole at 1.00 m
7												depth below ground surface upon completion of drilling
8												
9												
10 DEI	отн о	GCALE						Golde				OGGED: PAH

## RECORD OF BOREHOLE: 17-14

BORING DATE: January 19, 2017

SHEET 1 OF 1

DATUM: Geodetic

LOCATION: N 5013422.4 ;E 367850.2 SAMPLER HAMMER, 64kg; DROP, 760mm

L J	9	물	SOIL PROFILE			SA	MPL	_	DYNAMIC PENETRA RESISTANCE, BLOW	ION S/0.3m	2	HYDRAULIC CONDUCTIVITY, k, cm/s	Ę۴	PIEZOMETER
METRES		BORING METHOD		STRATA PLOT		ЯË		BLOWS/0.30m	20 40		80		ADDITIONAL LAB. TESTING	OR
ΞΨ		SING	DESCRIPTION	ATA F	ELEV. DEPTH	NUMBER	TYPE	WS/0	SHEAR STRENGTH Cu, kPa	nat V. + rem V. €	Q - •	WATER CONTENT PERCE		INSTALLATION
ĩ		BÖ		STR,	(m)	ž	Ľ	BLO	20 40		80		WI ZZ	
	T		GROUND SURFACE	1	90.50								Ť	
0	F	Π	TOPSOIL - (SM) SILTY SAND; dark		0.00									
			brown; non-cohesive (SM) SILTY SAND; brown, contains	222	90.20									
			clayey silt seams; non-cohesive, wet, loose											
			loose											
1						1	SS	8				0		₽
					89.20									
			(CI/CH) SILTY CLAY to CLAY; red		1.30									
			(CI/CH) SILTY CLAY to CLAY; red brown and grey brown, contains silty fine sand seams, fissured (WEATHERED CRUST); cohesive, w>PL, very stiff			2	SS	3						
			CRUST); conesive, w>PL, very stiff											
2					1		1							
											>96 +			
		Stem)									>96+			
	Jer	S wolk	(CI/CH) SILTY CLAY to CLAY; grey,		87.76 2.74						- 50 -			
3	er Aug	n. (Ho	contains silty fine sand seams; cohesive, w>PL, firm		1	-	1							
	Pow	n Diar	w∽ı ∟, IIIII			3	SS	1				o l		
		200 mm Diam. (Hollow Stem)			86.99									
			(CI/CH) SILTY CLAY to CLAY; grey with black mottling; cohesive, w>PL, firm		3.51									
									⊕ +					
4														
						4	SS	wн				0		
5														
									⊕					
									+					
					84.56				+					
6			End of Borehole		5.94									
														WL in open borehole at 1.00 m depth below
														around surface
														upon completion of drilling
7														
8														
o														
9														
10														
10														
	L	1		1	1	I	I				1			1
DE	PT	ΉS	CALE						Gold	<b>&gt;</b> #			L	OGGED: PAH
	50									-				ECKED: SAT

# RECORD OF BOREHOLE: 17-14A

LOCATION: N 5013422.0 ;E 367850.0

BORING DATE: January 20, 2017

SHEET 1 OF 1

DATUM: Geodetic

щ	₽Ģ	SOIL PROFILE			SA	MPL	ES	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s		
DEPTH SCALE METRES	BORING METHOD		LOT		£		30m	20 40 60 80	10 <sup>-6</sup> 10 <sup>-5</sup> 10 <sup>-4</sup> 10 <sup>-3</sup>	PIEZON O STANI ADDITIONAL STANI NSTALI	R
METI	NG N	DESCRIPTION	TAP	ELEV.	NUMBER	TYPE	/S/0.	SHEAR STRENGTH nat V. + Q - ● Cu, kPa rem V. ⊕ U - O	WATER CONTENT PERCENT		DPIPE _ATION
ц П	BORI		STRATA PLOT	DEPTH (m)	Ŋ		BLOWS/0.30m			LAI	
	<u> </u>	GROUND SURFACE	S			$\vdash$	6	20 40 60 80	20 40 60 80	+ +	
0		For soil stratigraphy refer to Record of Borehole 17-14	-	90.50 0.00							×
		Borehole 17-14									
											$\Sigma$
1											
'											
	Ê									Native Backfill	
	Power Auger 200 mm Diam. (Hollow Stem)										
2	Power Auger Diam. (Hollov										
	ower										
	E E										
	200										
3											8
з										Bentonite Seal	
											1
										Silica Sand	2
											$\mathcal{L}_{\mathcal{M}}$
4					1	TP	PH			Standpipe	2
		End of Borehole	_	86.23 4.27							<i>K</i>
										WL in Standpip Elev. 89.78 m c	e at
5										Jan. 30, 2017	
6											
7											
8											
9											
40											
10											
	I										
DE	PTH S	SCALE						Golder		LOGGED: PAH	ł
1:	50									CHECKED: SAT	-

LOCATION: N 5013372.2 ;E 368018.8

SAMPLER HAMMER, 64kg; DROP, 760mm

## **RECORD OF BOREHOLE: 17-15**

SHEET 1 OF 1 DATUM: Geodetic

BORING DATE: January 20, 2017

АГЕ У	DH	SOIL PROFILE			S/	AMPL		DYNAMIC PENETRA RESISTANCE, BLO		Ľ,	HYDRAULIC COI k, cm/s		RGAL	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	IMBER	TYPE	BLOWS/0.30m	20 40 I I SHEAR STRENGTH Cu, kPa		80	10 <sup>-6</sup> 10 <sup>-1</sup> WATER CO	NTENT PERCENT	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
DE	BOR		STRA	(m)	Z		BLOV	20 40		80	Wp		LA	
		GROUND SURFACE		90.66										
• 0		TOPSOIL - (SM) SILTY SAND; dark brown; non-cohesive		0.00 90.43		GRAE	3 -							
		(SP) SAND, fine, some non-plastic fines;		0.23 90.25										
		brown; non-cohesive, moist (CI/CH) SILTY CLAY to CLAY; red		0.41										
		brown to grey brown, contains silty fine sand seams, fissured (WEATHERED												
• 1		CRUST); cohesive, w>PL, very stiff to stiff			2	SS	4							$\overline{\Sigma}$
					<u> </u>	-								
					3	SS	4							
2														
-														
								Ð		+				
										>96 +				
		(CI/CH) SILTY CLAY to CLAY, some		87.7 <u>6</u> 2.90		4								
3		sand; grey with black mottling, contains silty fine sand seams; cohesive, w>PL,		2.90	4	SS	2							
	Į.				4	35								
	er Ste					1								
	Power Auger							<b>⊕</b>	+					
4	Powe							+						
	00													
	ſ	1												
					5	SS	wн							
- 5														
								<b>⊕</b> .	+					
									+					
- 6					-									
					6	SS	wн							
7									+					
-									+					
									.	+				
				82.89										
8		End of Borehole		7.77	]									WL in open
o														WL in open borehole at 1.00 m depth below ground surface
														ground surface upon completion of drilling
														Ĩ
9														
10						1								
						1								L
DE	PTH	SCALE						233 N. 1	Рľ				L	.OGGED: PAH
1:	50							Gold	iates				CH	HECKED: SAT

## RECORD OF BOREHOLE: 17-16

BORING DATE: January 19, 2017

SHEET 1 OF 1

DATUM: Geodetic

LOCATION: N 5013504.1 ;E 367981.5 SAMPLER HAMMER, 64kg; DROP, 760mm

	0	물					AMPLE		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m			k	HYDRAULIC CONDUCTIVITY, k, cm/s				NG	PIEZOMETER	
METRES	BORING METHOD	ME				ER		BLOWS/0.30m	20 40 60 80		1	10 <sup>-6</sup> 10 <sup>-5</sup> 10 <sup>-4</sup> 10 <sup>-3</sup>				ADDITIONAL LAB. TESTING	OR		
ME		SING	DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	TYPE	WS/C	SHEAR S Cu, kPa	TRENGTH	nat V. rem V	+ Q-● ⊕ U-C			NTENT	PERCEN		AB. TE	STANDPIPE INSTALLATION
		in l		STR,	(m)	ž		BLO	20	40	60	80	Wp H 20	40				L/	
_		1	GROUND SURFACE		90.43					Ĭ	Ť						-		
0		Π	TOPSOIL - (ML) sandy SILT; dark brown; non-cohesive		0.00 90.18	1	GRAB	-											
			(SM) SILTY SAND; brown, contains	TT	0.25														
			clayey silt seams; non-cohesive, wet			2	GRAB	-											$\overline{\Delta}$
			(CI/CH ML and SM) SILTY CLAY		89.67 0.76														-
1			(CI/CH-ML and SM) SILTY CLAY, CLAYEY SILT and SILTY SAND; grey brown, fissured (WEATHERED		0.70	3	SS	2											
			CRUST); cohesive, w>PL, very stiff		89.21														
			(CI/CH) SILTY CLAY to CLAY; red		1.22														
			brown and grey brown, fissured (WEATHERED CRUST); cohesive,			4	SS	2											
			w>PL, very stiff																
2																			
												>96 +							
		Stem)			87.84							>96 +	-						
	ger	wolic	(CI/CH) SILTY CLAY to CLAY; grey with black mottling; cohesive, w>PL, stiff to		2.59														
	Power Auger	200 mm Diam. (Hollow	black mottling; cohesive, w>PL, stiff to firm																
3	Pow	n Diar				5	SS	wн											
		00 m																	
		Ñ																	
									Ð		+								
4											+								
						6	SS	wн											
5																			
											+								
										+									
					84.64					+									
6			End of Borehole		5.79														W/L in onen
																			WL in open borehole at 0.60 m depth below
																			ground surface upon completion of
																			drilling
7																			
8																			
U																			
9																			
10																			
DE	PT	нs	CALE							Gold	0.77							LC	)GGED: PAH
1:										<b>N-Old</b>	er								

## RECORD OF BOREHOLE: 17-17

BORING DATE: January 17, 2017

SHEET 1 OF 1

DATUM: Geodetic

LOCATION: N 5013432.3 ;E 368131.3 SAMPLER HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES								ES	DYNAMIC PENETRA RESISTANCE, BLOV	FION /S/0.3m		HYDRAULIO k, c	m/s	TIVITY,	ĘF	PIEZOMETER
	BORING METHOD				ELEV.	ER		BLOWS/0.30m	20 40	60 80	`	10 <sup>-6</sup>	10-5	ADDITIONAL LAB. TESTING	OR STANDPIPE	
ΞΨ	UNIS NIS		DESCRIPTION	STRATA PLOT	DEPTH	NUMBER	түре	WS/C	SHEAR STRENGTH Cu, kPa	nat V. + Q - rem V. ⊕ U -	•			T PERCENT	AB. TI	INSTALLATION
ב	L G			STR,	(m)	ž		BLO	20 40	60 80		Wp — 20		60 80		
0			GROUND SURFACE		90.44									Í		
0			TOPSOIL - (ML) CLAYEY SILT; dark brown; non-cohesive		0.00											
			(CI/CH) SILTY CLAY to CLAY: red													
			brown and grey brown, fissured (WEATHERED CRUST); cohesive, w>PL, very stiff													_
			WPT E, Voly Sun			1	SS	7								Σ
1																
					89.07											
			(CI/CH-ML and SM) SILTY CLAY, CLAYEY SILT and SILTY SAND, fine; grey brown (WEATHERED CRUST);		1.37											
			grey brown (WEATHERED CRUST); cohesive, w>PL, stiff to very stiff			2	SS	2								
2																
		Stem)				3	SS	2								
	ger	S wollc	(CI/CH) SILTY CLAY to CLAY; grey;		87.70 2.74											
3	Power Auger	200 mm Diam. (Hollow Stem)	cohesive, w>PL, firm													
	Pov	m Dia				4	SS	wн								
		200 n														
4					86.48 3.96				€ +							
			(CL/CI) SILTY CLAY to CLAY; grey with black mottling, contains clayey silt seams; cohesive, w>PL, stiff		0.90					+						
			Seams, conesive, w/PL, SUII													
						5	92	wн								
_							33									
5																
									0	+						
										+						
					84.50											
6		1	End of Borehole		5.94					+						
																WL in open borehole at 0.80 m depth below
																around surface
																upon completion of drilling
7																
8																
9																
9																
10																
	L			<u> </u>												
DE	PTł	H S	CALE					(	20 KT	<b>71</b> *					L	OGGED: PAH
1:	50								Gold	atos					СН	ECKED: SAT

# RECORD OF BOREHOLE: 17-17A

LOCATION: N 5013432.0 ;E 368131.0

BORING DATE: January 17, 2017

SHEET 1 OF 1

"Ar	тнор	SOIL PROFILE			SA	MPL	_	RESISTANCE, BLOWS/0.3III	HYDRAULIC CONDUCTIVITY, k, cm/s	ING	PIEZOMETER
METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.30m	20 40 60 80 SHEAR STRENGTH nat V. + Q- Cu, kPa rem V. ⊕ U -	10 <sup>-6</sup> 10 <sup>-5</sup> 10 <sup>-4</sup> 10 <sup>-3</sup>	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
-	В	GROUND SURFACE	SI				B	20 40 60 80	20 40 60 80	+ +	
0		For soil stratigraphy refer to Record of Borehole 17-17		90.44 0.00							
1											
	Stem)										
	Iger Iollow S										
	wer Au am. (H										
2	Power Auger 200 mm Diam. (Hollow Stem)										
	200										
3											
					1	TP	PH				
		End of Borehole	+	86.78 3.66							
4											
5											
6											
7											
'											
8											
9											
10											
DEI	PTH S	CALE					(	Golder			BED: PAH
DEI		CALE						Golder			GED: PAH KED: SAT

### RECORD OF BOREHOLE: 17-18

BORING DATE: January 19, 2017

SHEET 1 OF 1

DATUM: Geodetic

LOCATION: N 5013586.9 ;E 368115.5 SAMPLER HAMMER, 64kg; DROP, 760mm

	ПОН	SOIL PROFILE		SA	MPLE		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	
METRES	BORING METHOD	DESCRIPTION	STRATA PLOT		TYPE	BLOWS/0.30m	20 40 60 80 H H H H H H H H H H H H H H H H H H H	10 <sup>-6</sup> 10 <sup>-5</sup> 10 <sup>-4</sup> 10 <sup>-3</sup> WATER CONTENT PERCENT Wp - O <sup>W</sup> WI	PIEZOMETER OR ULLS OR STANDPIPE INSTALLATION
	ш	GROUND SURFACE		0.69	+	8	20 40 60 80	20 40 60 80	
0		TOPSOIL - (ML) sandy SILT; dark brown; non-cohesive		0.00					
1		C(I/CH) SILTY CLAY to CLAY; red brown and grey brown, fissured (WEATHERED CRUST); cohesive, w>PL, very stiff		0.39	ss	5		0	
2		(CI/CH-ML and SM) SILTY CLAY, CLAYEY SILT and SILTY SAND; grey brown (WEATHERED CRUST); cohesive, w>PL, very stiff to stiff	8	9.01 1.68 2	ss	2	€ +		
3	ger bllow Stem)	(CI/CH) SILTY CLAY to CLAY, some sand; grey with black mottling, contains silty fine sand seams; cohesive, w>PL, firm	8	7.95 2.74 3	ss	2	>96 +	0	
4	Power Auger 200 mm Diam. (Hollow Stem)			4	SSI	0	> + +	0	
5		(CI/CH) SILTY CLAY to CLAY; grey with black mottling, contains clayey silt seams; cohesive, w>PL, stiff		5.6 <u>6</u> 5.03	-	Ф	€ + +		
6				5	ss	2		o	
7		End of Borehole	8	<u>3.22</u> 7.47			⊕ + + + + + + + + + + + + + + + + + + +		
8									WL in open borehole at 1.00 m depth below ground surface upon completion of drilling
9									
10									
DEF	PTH S	CALE	•			(	Golder		LOGGED: PAH

## RECORD OF BOREHOLE: 17-18A

LOCATION: N 5013586.9 ;E 368115.5

BORING DATE: January 19, 2017

SHEET 1 OF 1

щ	₽	SOIL PROFILE			SA	MPL	ES	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	ں _	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD		LOT		н.		.30m	20 40 60 80	10 <sup>-6</sup> 10 <sup>-5</sup> 10 <sup>-4</sup> 10 <sup>-3</sup>	ADDITIONAL LAB. TESTING	OR
MET	SING	DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	TYPE	BLOWS/0.30m	SHEAR STRENGTH nat V. + Q - ● Cu, kPa rem V. ⊕ U - O	WATER CONTENT PERCENT	B. TE	STANDPIPE INSTALLATION
ž	BOF		STR∕	(m)	٦		BLO/	20 40 60 80	Wp	LAA	
		GROUND SURFACE		90.69			1				
0		For soil stratigraphy refer to Record of Borehole 17-18		0.00							
											¥₩
1											
											Native Backfill
	/ Stem										
2	Hollow										
	Power Auger Diam. (Hollov										
	Power Auger 200 mm Diam. (Hollow Stem)										×
	200										
3											Bentonite Seal
											Demonite Seal
											Silica Sand
4					1	TP	PH			с	Standpipe
4				86.42							
		End of Borehole		4.27							
											WL in Standpipe at Elev. 90.39 m on
-											Elev. 90.39 m on Jan. 30, 2017
5											
6											
7											
8											
9											
10											
									· · · · · ·		
DE	PIHS	CALE						Golder		LC	DGGED: PAH

#### **RECORD OF BOREHOLE: 17-19**

BORING DATE: January 17, 2017

SHEET 1 OF 1

DATUM: Geodetic

LOCATION: N 5013512.2 ;E 368260.2 SAMPLER HAMMER, 64kg; DROP, 760mm

ц Г. Б	DOH.	SOIL PROFILE	- <u> </u>	·	SA	MPL		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	RG₽	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	түре	BLOWS/0.30m	20 40 60 80 SHEAR STRENGTH nat V. + Q - ● Cu, kPa rem V. ⊕ U - O	wp - O'' wi	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
	ш	GROUND SURFACE	N.	91.35			В	20 40 60 80	20 40 60 80	$\left  \right $	
0		TOPSOIL - (ML) sandy SILT to CLAYEY SILT; dark brown; non-cohesive (CI/CH-ML and SM) SILTY CLAY, CLAYEY SILT and SILTY SAND; grey brown (WEATHERED CRUST); cohesive, w>PL, very stiff		0.00 91.15 0.20		ss	4				Ā
- 2		(CI/CH) SILTY CLAY to CLAY, some clayey silt seams, fissured (WEATHERED CRUST); cohesive,		<u>89.37</u> 1.98	2	ss	3	>96 +			
	ger ollow Stem)	w>PL, very stiff			3	ss	3	-90 T			
- 3	Power Auger 200 mm Diam. (Hollow Stem)				4	SS	3				
· 4	Ñ							>96 +			
5		(CI/CH) SILTY CLAY to CLAY; grey;		86.78 4.57 86.24	5	ss	1				
		(SM) gravelly SILTY SAND; grey, contains cobbles and boulders (GLACIAL TILL); non-cohesive, wet, compact		5.11							
6		End of Borehole		85.25 6.10		SS	24				WL in open borehole at 1.00 m
- 7										1 1	depth below ground surface upon completion of drilling
- 8											
- 9											
10											
DE	PTH S	SCALE	-	1				Golder			DGGED: PAH ECKED: SAT

#### RECORD OF BOREHOLE: 17-20

BORING DATE: January 18, 2017

SHEET 1 OF 1

DATUM: Geodetic

LOCATION: N 5013674.4 ;E 368246.4 SAMPLER HAMMER, 64kg; DROP, 760mm

DEP IN SUALE METRES	Ē								DYNAMIC PENETRATION	k, cm/s	1	
E House	ž			LOT		н.		30m	20 40 60 80	10 <sup>-6</sup> 10 <sup>-5</sup> 10 <sup>-4</sup> 10 <sup>-3</sup>	ADDITIONAL LAB. TESTING	PIEZOMETER OR
- <u>-</u> ₩	BORING METHOD		DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	TYPE	BLOWS/0.30m	SHEAR STRENGTH nat V. + Q - ● Cu, kPa rem V. ⊕ U - O	WATER CONTENT PERCENT	B. TE	STANDPIPE INSTALLATION
i i	BOR			STR≜	(m)	۲		BLO/	20 40 60 80	Wp	PA	
			GROUND SURFACE		92.23			_				
0			TOPSOIL - (SM) SILTY SAND; dark		0.00		GRAB	-				
		Γ	brown; non-cohesive (SM) SILTY SAND; grey brown;	- Fii	91.98 0.25	I						
			non-cohesive, wet, loose									$\overline{\Delta}$
					]							<u> </u>
1		┢	(SM) gravelly SILTY SAND: grev brown.	- ARR	91.32 0.91	2	SS	11				
			(SM) gravelly SILTY SAND; grey brown, contains cobbles and boulders (GLACIAL TILL); non-cohesive, wet,									
			compact to dense									
						3	SS	26				
2												
							1					
		_				4	SS	50				
		Ster										
	uger	200 mm Diam. (Hollow Stem)										
3	Power Auger	am. (F						~				
	P	i Di				5	SS	32				
		200 r				<u> </u>	$\left  \right $					
4						6	SS	25				
						7	SS	11				
						<i>'</i>						
5					87.05							
			(SM/GM) SILTY SAND and GRAVEL; grey; non-cohesive, wet, compact		5.18							
						8	ss	15				
6					86.13							
			End of Borehole		6.10							
												WL in open borehole at 0.61 m
												depth below ground surface
												ground surface upon completion of drilling
7												
8												
9												
10												
											-	
DE	PTł	H SC	CALE						Golder			ogged: Pah Ecked: Sat

#### RECORD OF BOREHOLE: 17-21

BORING DATE: January 18, 2017

SHEET 1 OF 1

DATUM: Geodetic

LOCATION: N 5013613.9 ;E 368382.0 SAMPLER HAMMER, 64kg; DROP, 760mm

Ш	ПОН	SOIL PROFILE	1.		SA	AMPL		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	ξĘ	PIEZOMETER
DEPTH SCALE METRES	<b>BORING METHOD</b>	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)		түре	BLOWS/0.30m	20         40         60         80           SHEAR STRENGTH         nat V. + Q Q.           Cu, kPa         rem V. ⊕ U - Q.           20         40         60         80	10 <sup>6</sup> 10 <sup>5</sup> 10 <sup>4</sup> 10 <sup>3</sup> WATER CONTENT PERCENT Wp	ADDITIONAL LAB. TESTING	STANDPIPE INSTALLATION
0		GROUND SURFACE		94.69							
0		TOPSOIL - (SM) SILTY SAND; dark brown; non-cohesive		0.00 94.46	1	GRAE	-				
		(SM) SILTY SAND, some gravel; brown; non-cohesive, moist		0.23			>50				Native Backfill
• 1		(SM/GM) SILTY SAND and GRAVEL; grey brown, contains cobbles and boulders; non-cohesive, moist, dense to very dense		0.79		55	>50				Bentonite Seal
2					3	ss	47		0		
				91.79	4	ss	81				
3	em)	(SM) SILTY SAND, some gravel; grey brown; non-cohesive, wet, compact		2.90 91.18 3.51	5	SS	28		0	мн	
4	Power Auger	(ML) sandy SILT, some gravel; grey brown, contains cobbles and boudlers (GLACIAL TILL); non-cohesive, wet, compact		3.51	6	ss	17		0		
5	200 m				7	ss	21				Native Backfill
		(SM) gravelly SILTY SAND; grey, contains cobbles and boulders (GLACIAL TILL); non-cohesive, wet, compact		89.51 5.18	8	ss	12		0	мн	
6					9	ss	18				
7		(SM) SILTY SAND; grey; non-cohesive, wet, compact		87.68 7.01		_					
- 8		End of Borehole		86.77		ss	15				Standpipe
											WL in Standpipe at Elev. 92.15 m on Jan. 30, 2017
- 9											
· 10											
DE	PTH	SCALE			<u> </u>			Golder		L	OGGED: PAH

## RECORD OF BOREHOLE: 17-22

BORING DATE: January 24, 2017

SHEET 1 OF 1

DATUM: Geodetic

LOCATION: N 5013759.1 ;E 368386.0 SAMPLER HAMMER, 64kg; DROP, 760mm

Ш		员	SOIL PROFILE	- <u> </u> .		SA	MPLE		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	문 원 PIEZOMETER
DEPTH SCALE METRES		BORING METHOD		STRATA PLOT		ЕR		BLOWS/0.30m	20 40 60 80	10 <sup>-6</sup> 10 <sup>-5</sup> 10 <sup>-4</sup> 10 <sup>-3</sup>	PIEZOMETER OR STANDPIPE INSTALLATION
ΪĘ		SING	DESCRIPTION	ATA F	ELEV. DEPTH	NUMBER	TYPE	WS/C	SHEAR STRENGTH Cu, kPanat V. + Q - ● rem V. ⊕ U - O	WATER CONTENT PERCENT	
ī		BQF		STR/	(m)	۲		BLO	20 40 60 80	Wp	≤ <u>∽</u>
			GROUND SURFACE		91.97						
0	⊢		TOPSOIL - (ML) CLAYEY SILT; dark	EEE	0.00						
			brown; non-cohesive (CI/CH-ML and SM) SILTY CLAY,		91.74 0.23						
			CLAYEY SILT and SILTY SAND; grey								
			CLAYEY SILT and SILTY SAND; grey brown (WEATHERED CRUST); cohesive, w>PL, very stiff								
						1	ss	5			
• 1											
		Ê			90.60						
		200 mm Diam. (Hollow Stem)	(CI/CH) SILTY CLAY to CLAY; grey brown, fissured (WEATHERED		1.37						
	Auger	) 원	CRUST); cohesive, w>PL, very stiff								
2	wer /	iam.			89.99	2	SS	4			
2	ď	E E	(ML) sandy SILT, some gravel; grey brown, contains cobbles and boulders		1.98						
		200	(GLACIAL TILL); non-cohesive, wet, compact		1						
						3	SS	17			
3					88.92						
			(SM) SILTY SAND, some gravel; grey, contains cobbles and boulders		3.05						
			(GLACIAL TILL); non-cohesive, wet, compact			4	SS	10			
	_	$\left  \right $	Probable Glacial Till		88.3 <u>1</u> 3.66						
					0.00						
4											
									$\chi$		
5	DCPT	Open Hole									
	Ы	Oper							`\		
6											
					05 5-						
	⊢		End of Borehole		85.57 6.40						
			End of DCPT								
-											
- 7											
8											
9											
. 10											
10											
	L				1	I					1 1
DE	PT	TH S	CALE					(	Golder		LOGGED: PAH
1:	50								<b>T</b>		CHECKED: SAT

### RECORD OF BOREHOLE: 17-23

BORING DATE: January 25, 2017

SHEET 1 OF 1

DATUM: Geodetic

LOCATION: N 5013679.9 ;E 368527.7 SAMPLER HAMMER, 64kg; DROP, 760mm

ш Л.	DOH.	SOIL PROFILE			SA	MPL		DYNAMIC PENETRA RESISTANCE, BLOW		HYDRAULIC CONDUCTIVITY, k, cm/s	NG P	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	TYPE	BLOWS/0.30m	20 40 SHEAR STRENGTH Cu, kPa	60 80 nat V. + Q - ● rem V. ⊕ U - O	WATER CONTENT PERCE		OR STANDPIPE INSTALLATION
Ĩ	BOF		STR/	(m)	ž		BLO	20 40	60 80		WI LA IN	
- 0		GROUND SURFACE		92.56								
Ŭ		TOPSOIL - (ML) CLAYEY SILT; dark brown; non-cohesive		0.00 92.26	1	GRAE	-					
		(CI/CH-ML and SM) SILTY CLAY, CLAYEY SILT and SILTY SAND: grey		0.30								
		CLAYEY SILT and SILTY SAND; grey brown (WEATHERED CRUST); cohesive, w>PL, very stiff										
- 1					2	SS	5					
				91.34								
		(CI/CH) SILTY CLAY to CLAY; grey brown, fissured (WEATHERED CRUST); cohesive, w>PL, very stiff		1.22								
					3	SS	4					
- 2	ger											
-	Power Auger								>96 +			
	Po											
	000								>96 +			
- 3		(CI/CH) SILTY CLAY to CLAY; grey,		89.6 <u>6</u> 2.90								
		contains clayey silt seams; cohesive, w>PL, stiff			4	SS	1					
								<b>⊕</b>	<b>↓</b>			
- 4												
				88.22					+			
		End of Borehole Auger Refusal		4.34								
- 5												
- 6												
_												
- 7												
- 8												
5												
- 9												
· 10												
DE	РТН	SCALE									LO	GGED: PAH
1:								Golde	er inter			CKED: SAT

# RECORD OF BOREHOLE: 17-23A

LOCATION: N 5013679.9 ;E 368527.7

BORING DATE: January 25, 2017

SHEET 1 OF 1

Ц	ДОН	SOIL PROFILE	1.		SA	MPL		DYNAMIC PENETRA RESISTANCE, BLOV		HYDRAULIC CONDUCTIVITY, k, cm/s	무역	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.30m	20 40 I SHEAR STRENGTH Cu, kPa			ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
		GROUND SURFACE	<u>ن</u>	92.56			Ē	20 40	60 80	20 40 60 80		
- 0		For soil stratigraphy refer to Record of Borehole 17-23	T	0.00								
• 1												
- 2	DCPT Open Hole											
	ODec											
- 3												
· 4				88.29								
		End of Borehole DCPT Refusal		4.27								
• 5												
- 6												
- 7												
- 8												
9												
· 10												
DEI	PTH S	CALE	<u> </u>		<u> </u>			Gold	_   _#			GED: PAH

#### RECORD OF BOREHOLE: 17-24

BORING DATE: January 24, 2017

SHEET 1 OF 1

DATUM: Geodetic

LOCATION: N 5013840.9 ;E 368514.0 SAMPLER HAMMER, 64kg; DROP, 760mm

ц Д.,			SOIL PROFILE			SA	MPLI		DYNAMIC PE RESISTANCE	E, BLOV	/S/0.3m	λ,		k, cm/s	ONDUC			2gF	PIEZOMETER
DEPTH SUALE METRES	BORING METHOD			STRATA PLOT	ELEV.	Я	ы П	BLOWS/0.30m	20	40	60	80		1		1	0-3	ADDITIONAL LAB. TESTING	OR STANDPIPE
ΞΨ	RING		DESCRIPTION	ATA	DEPTH	NUMBER	TYPE	WS/C	SHEAR STRE Cu, kPa	INGTH	nat V. rem V.	+ Q-● ⊕ U-O			ONTENT			ADDI AB. T	INSTALLATION
L	BOF			STR,	(m)	Ž		BLO	20	40	60	80					WI 30	1,7	
_			GROUND SURFACE	1	92.58					Í	T		1		T ,	Ì			
0			TOPSOIL - (ML) sandy SILT; dark		0.00														
		┢	brown; non-cohesive (CI/CH-ML and SM) SILTY CLAY.		92.31 0.27														
			(CI/CH-ML and SM) SILTY CLAY, CLAYEY SILT and SILTY SAND; grey brown (WEATHERED CRUST);																
			cohesive, w>PL, very stiff																
1						1	ss	4											
'																			
						2	SS	2						0					
2		F			90.60														
			(CI/CH) SILTY CLAY to CLAY; grey brown, slightly fissured (WEATHERED CRUST); cohesive, w>PL, stiff		1.96														
			CRUST); cohesive, w>PL, stiff			3	SS	1								0			
		tem)																	
3	er	200 mm Diam. (Hollow Stem)			89.53 3.05														
	r Auger	Hoi	(CI/CH) SILTY CLAY to CLAY; grey, contains silty fine sand seams; cohesive, w>PL, firm to stiff		3.05	4	SS	wн											
	Power.	Diar	w>PL, firm to stiff																
		0 mm																	
		20							⊕ ·	+									
4										+									
						5	SS	wн							0				
5																			
5																			
											+								
										+									
6																			
			(ML) construction (ML)		86.33	6	SS	3											
			(ML) sandy SILT, some gravel; grey, contains cobbles and boulders		6.25 86.03														
		╢	(GLACIAL TILL); non-cohesive, wet, very loose		6.55														
			End of Borehole	´															
7			Auger Refusal																
8																			
o																			
9																			
10																			
	рті	1 64	CALE															10	OGGED: PAH
DE	- 11	130								old	er iates							LC	IGGED. FAN

## RECORD OF BOREHOLE: 17-24A

LOCATION: N 5013841.0 ;E 368514.0

BORING DATE: January 24, 2017

SHEET 1 OF 1

Щ	ДОН	SOIL PROFILE	1.		SA	MPLI		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	4G 4	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	TYPE	BLOWS/0.30m	20 40 60 80 <sup>^</sup> SHEAR STRENGTH nat V. + Q - ● Cu, kPa rem V. ⊕ U - O	10 <sup>-6</sup> 10 <sup>-5</sup> 10 <sup>-4</sup> 10 <sup>-3</sup> WATER CONTENT PERCENT	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
ä	BOF		STR/	(m)	Ŋ	Ĺ	BLO	20 40 60 80	Wp <b>⊢ → → → → →</b> WI 20 40 60 80	A	
0 -		GROUND SURFACE For soil stratigraphy refer to Record of Borehole 17-24		92.58 0.00							
· 1	Power Auger 200 mm Diam. (Hollow Stem)										Native Backfill
- 3					1	TP	PH		H	с	Bentonite Seal
• 4		End of Borehole		89.07 3.51							WL in Standpipe at Elev. 91.78 m on Jan. 30, 2017
5											
6											
7											
8											
9											
10											
DEF	PTH S	GCALE	_1	1		<u> </u>		Golder		L	OGGED: PAH

### RECORD OF BOREHOLE: 17-25

BORING DATE: January 25, 2017

SHEET 1 OF 1

DATUM: Geodetic

LOCATION: N 5013760.8 ;E 368661.4 SAMPLER HAMMER, 64kg; DROP, 760mm

ÅLF V	ДОН.	SOIL PROFILE	-	1	SA	MPLE		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	PG	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	TYPE	BLOWS/0.30m	20 40 60 80 SHEAR STRENGTH nat V. + Q - ● Cu, kPa rem V. ⊕ U - O	10 <sup>-6</sup> 10 <sup>-5</sup> 10 <sup>-4</sup> 10 <sup>-3</sup> WATER CONTENT PERCENT Wp → W WI	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
с С	BOF		STR	(m)	ž		BLO	20 40 60 80	Wp - O <sup>W</sup> Wi 20 40 60 80		
0		GROUND SURFACE TOPSOIL - (ML) sandy SILT; dark brown; non-cohesive (CI/CH-ML and SM) SILTY CLAY, CLAYEY SILT and SILTY SAND; grey brown (WEATHERED CRUST); cohesive, w>PL, very stiff		93.17 0.00 92.92 0.25							Ā
1	(L	(CI/CH) SILTY CLAY to CLAY; grey brown, contains clayey silt seams,		<u>91.95</u> 1.22	1		6				
2	Power Auger 200 mm Diam. (Hollow Stem)	cohesive, w>PL, very stiff			2		5				
3	2001				4		2				
4		(ML) sandy SILT, some gravel; grey, contains cobbles and boulders		89.33 3.84	5	SS	>50	>96 +			
5		(GLACIAL TILL); non-cohesive, wet, very dense End of Borehole Auger Refusal		88.98 4.19							WL in open borehole at 0.30 m depth below ground surface upon completion of drilling
6											
7											
8											
9											
10											
DE 1:		SCALE				4	(	Golder			)GGED: PAH ECKED: SAT

#### **RECORD OF BOREHOLE: 17-26**

BORING DATE: January 25, 2017

SHEET 1 OF 1

DATUM: Geodetic

LOCATION: N 5013917.4 ;E 368640.0 SAMPLER HAMMER, 64kg; DROP, 760mm

			SOIL PROFILE	F		S/	AMPL	_	DYNAMIC PEN RESISTANCE,			Ľ,		:m/s		NG AL	PIEZOMETER
METRES	DODING METHOD	U ME	DECODIDATION	STRATA PLOT	ELEV.	BER	Н	BLOWS/0.30m	20 4 SHEAR STREN		1	Q - ●	10 <sup>-6</sup>	10 <sup>-5</sup> 1 R CONTENT	0 <sup>-4</sup> 10 <sup>-3</sup>	ADDITIONAL LAB. TESTING	OR STANDPIPE
. W			DESCRIPTION	ATA.	ELEV. DEPTH (m)	NUM	TYPE	OWS	SHEAR STREN Cu, kPa		rem V. ⊕	ũ - Ō	Wp			ADD LAB.	INSTALLATION
	à	'n		ST			-	BL	20 4	0	60 8	0	20	40 6	80 80		
0		$ \dashv$	GROUND SURFACE TOPSOIL - (ML) CLAYEY SILT; dark	ESS	93.09 0.00		GRAE				+						
			brown; non-cohesive		92.86 0.23		GRAD	-									
			(CI/CH) SILTY CLAY to CLAY; grey brown, fissured (WEATHERED CRUST); cohesive, w>PL, very stiff to														₽
			stiff														
1						2	SS	5									
						3	SS	4									
2																	
		v Stem)							Ð			+					
	Auger	Hollow										+					
	ower /	)iam. (															
3	ď	200 mm Diam. (Hollow S	(CI/CH) SILTY CLAY to CLAY; grey,		90.04 3.05	1											
		200	contains clayey silt seams; cohesive, w>PL, stiff			4	SS	1									
							1										
			(SP) SAND; grey brown; non-cohesive,		89.28 3.81					+							
4			wet, compact														
						5	SS	11									
			(SM) gravelly SILTY SAND; brown,		88.52 4.57		1										
			contains cobbles and boulders; non-cohesive, wet, compact to very	继													
5			dense														
						6	ss	>50									
		Ч	End of Borehole	-335	87.57 5.52												
			Auger Refusal														WL in open borehole at 0.50 m depth below
6																	depth below ground surface upon completion of
																	drilling
7																	
8																	
9																	
10																	
											-						
DE	۲T	нS	CALE							JAo	r Ates					L	ogged: Pah

## RECORD OF BOREHOLE: 17-27

SHEET 1 OF 2 DATUM: Geodetic

LOCATION: N 5013836.4 ;E 368790.7

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: January 25-26, 2017

Ц	머니	SOIL PROFILE			SA	MPL		DYNAMIC PENETRA RESISTANCE, BLO	VS/0.3m		HYDRAULIC k, cr	n/s	,	ĘΈ	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD		STRATA PLOT		ER	ы. П.	BLOWS/0.30m	20 40		80	10 <sup>-6</sup>		0 <sup>-4</sup> 10 <sup>-3</sup>	ADDITIONAL LAB. TESTING	OR
	RING	DESCRIPTION	ATA F	ELEV. DEPTH	NUMBER	түре	WS/0	SHEAR STRENGTH Cu, kPa	nat V rem V. 6	+ Q-● ∌ U-O	WATER		PERCENT	ADDI AB. TI	INSTALLATION
	BOI		STR/	(m)	ĩ		BLO	20 40		80	₩p — 20		WI 80		
		GROUND SURFACE		93.85						Ť	Ĩ				
0		TOPSOIL - (CL) SILTY CLAY; dark brown; cohesive		0.00 93.65											×
		(CI/CH) SILTY CLAY to CLAY; grey		0.20											
		brown, fissured (WEATHERED CRUST); cohesive, w>PL, very stiff													
	(L														
1	v Ster				1	SS	6					- <del> </del>			
	Hollov														
	Power Auger Diam. (Hollo														
	Power Auger 200 mm Diam. (Hollow Stem)				2	SS	4					0			
	200 r	(SM) gravelly SILTY SAND: brown		92.02 1.83	-		·				0				
2		(SM) gravelly SILTY SAND; brown, contains cobbles and boulders;	- 34	1.00											
		non-cohesive, wet, loose													Native Backfill
			继		3	SS	8				•			МН	🛛 🕅
ŀ															🛛 🕅
	ry Dri				4	RC	חח								🛛 🕅
3	Rotary Drill NW Tricone		渊		-										🛛 🕅
		Borehole continued on RECORD OF	- ERES	90.57 3.28		1									🗠
		DRILLHOLE 17-27													
4															
5															
5															
6															
Į															
7															
8															
9															
10															
							· I								
DEI	PTH S	SCALE						Gold	or					L	OGGED: PAH

atic					RD		DR DR DR	XILL XILL	ING RIG	i DA 3: (C i CC	ATE: CME ONT	: J: E 85 RA(	anu 50 CTC	lary	25- C(	-26, CC	2017											DA	IEET 2 OF 2 .TUM: Geodetic	c
DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	USH <u>COLO</u>	SHF VN CJ RE TOT/ CORE	R-She - Vei - Col COV	ear n njuga ERY SOLIE	R D %	2.Q.D %	CO- C OR- C CL - C FF 0. IN F 0.	Conta Drtho Cleav RACT NDEX PER .25 m	act ogona /age T. K B	Angle		CU- C JN- U ST - S R - I DISC DISC P w.r.: CORE AXIS	Curved Indulat Stepper rregula	ting d r IUITY [	K - SM- SM- Ro - I MB- I DATA	Slick Smo Roug Mech	ensio oth gh	al Bi	YDR. NDU K, cn	NOT abbro of ab symb AULIC CTIVI	E: Fo eviatio borevia bols.	ir addi ons re ations iame oint Lo Inde: (MPa	tional fer to I & tral oad RI X -(	list		
NW Tricone	Fresh, thinly to medium bedded, grey, fine grained LIMESTONE BEDROCK		3.28	1	100																								Native Backfill	
otary Unil Q Core				2	100																									$(2N_{1}^{\prime})_{1}(2N_{1}^{\prime})_{2}$
ŽŽ	End of Drillhole		<u>87.24</u> 6.61	3	100																							:	Standpipe	ચહુચ્છુ,ચ્છુ,ચ્છુ,ચ્છુ,ચ્છુ,ચ્છુ,
																												1	WL in Standpipe at Elev. 93.05 m on Jan. 30, 2017	t
		DESCRIPTION DESCRIPTION BEDROCK SURFACE Fresh, thinly to medium bedded, grey, fine grained LIMESTONE BEDROCK	DESCRIPTION 00 01 01 00 00 01 01 00 00 00 01 01 00 00	LINATION: -90° AZIMUTH:	LINATION: -90° AZIMUTH:	LINATION: -90° AZIMUTH:	LINATION: -90° AZIMUTH:	AZIMUTH: BR AZIMUTH: BR DESCRIPTION 0 U U U V V V V V V V V V V V V V V V V	LINATION: -90° AZIMUTH:  DESCRIPTION  DE	DESCRIPTION OUT OWNERS OUT AND A CONSTRACT OF A CON	DESCRIPTION OUT OF ALL STONE BEDROCK The second and a sec	LINATION: -90° AZMUTH: DESCRIPTION OT OUT OWNS DESCRIPTION OUT OWNS DESCRIPTION OT OUT OWNS DESCRIPTION OT OUT OWNS DESCRIPTION OT OUT OWNS DESCRIPTION OT OUT OWNS DESCRIPTION OUT OWNS DESCRIPTI	LINATION: -90°     AZMUTH:     DRILER: CME & DRILLOR CONTRAL       OOD UT OUT OUT OUT OUT OUT OUT OUT OUT OUT	LINATION: -90° AZIMUTH: DELLEV. 100 DESCRIPTION 01 BEDROCK SURFACE 90.57 Fresh, thinly to medium bedded, grey, Fine grained LIMESTONE BEDROCK 11 00 00 00 00 00 00 00 00 00	LINATION: -90° AZIMUTH: DRLL RIG: CME 850 DRLLING CONTRACTOR DESCRIPTION DESCRIPTION	LINATION: -90° AZMUTH: DESCRIPTION OCUPY DESCRIPTION BEDROCK SURFACE Presh, thinly to medium bedded, grey, fine grained LIMESTONE BEDROCK 00-57 0.225 0.227 0.257 0.277 0.257 0.257 0.277 0.257 0.277 0.207 0.257 0.277 0.207 0.257 0.277 0.207 0.257 0.277 0	LINATION: -90° AZMUTH: DESCRIPTION OUT	LINATION: -9° AZIMUTH: BRILL RG: CME 830 DESCRIPTION 00 00 00 00 00 00 00 00 00 00	LINATION: -9° AZIMUTH:	LINATION: -90° AZMUTH: DESCRIPTION USAGES CONTRACTOR: CDC DESCRIPTION USAGES DESCRIPT			INATION: -90° AZMUTH: BRILLEY. 000 000 000 000 000 000 000 0		BEDROCK SURFACE 00.57 Presh, thinly to medium bedded, grey, regination of the presh thinly to the presh thinly to the presh thinly the presh the presh thinly the presh th	DESCRIPTION O' AZIMUTH:				

# RECORD OF BOREHOLE: 17-27A

LOCATION: N 5013836.4 ;E 368790.7

BORING DATE: January 25, 2017

SHEET 1 OF 1

SCALE	AETHOD	SOIL PROFILE	-OT			MPLES		MIC PEN STANCE, 20 4			30		AULIC C k, cm/s 0 <sup>-6</sup> 1			10 <sup>-3</sup>	ONAL STING	PIEZOMETER OR
METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE BLOWS/0 30m	SHEA Cu, kF	R STREM Pa	IGTH	nat V. + rem V. €		W W	ATER C		r perce	ENT	ADDITIONAL LAB. TESTING	STANDPIPE INSTALLATION
0		GROUND SURFACE		93.85														
		For soil stratigraphy refer to Record of Borehole 17-27		0.00														
1	Stem)																	
2	200 mm Diam. (Hollow Stem)																	
	200																	
3		End of Borehole		<u>90.41</u> 3.44					<b>`</b>			138						
4		DCPT Refusal		3.44														
5																		
6																		
Ū																		
7																		
8																		
9																		
Ĩ																		
10																		
DEF	TH S	CALE	1				Â		lde	r <u>Ates</u>	<u> </u>	I			1			GGED: PAH

## RECORD OF BOREHOLE: 17-28

BORING DATE: January 26, 2017

SHEET 1 OF 1

DATUM: Geodetic

LOCATION: N 5013987.7 ;E 368751.8 SAMPLER HAMMER, 64kg; DROP, 760mm

ц	Ц	SOIL PROFILE			SA	MPL		DYNAMIC PENETRA RESISTANCE, BLOV		HYDRAULIC CONDUCTIVITY, k, cm/s	ې ب	PIEZOMETER
DEP IN SUALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	TYPE	BLOWS/0.30m	20 40 I I SHEAR STRENGTH Cu, kPa	60 80 nat V. + Q - ● rem V. ⊕ U - ○	10 <sup>6</sup> 10 <sup>-5</sup> 10 <sup>-4</sup> 10 <sup>-3</sup> WATER CONTENT PERCENT Wp	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
	ă		ST	(m)			В	20 40	60 80	20 40 60 80	_	
0		GROUND SURFACE TOPSOIL - (ML) CLAYEY SILT; dark	ESS	93.95 0.00		$\left  \right $					_	<b>K</b>
1	v Stem)	brown; non-cohesive (CI/CH) SILTY CLAY to CLAY; grey brown, fissured (WEATHERED CRUST); cohesive, w>PL, very stiff		9 <u>3.72</u> 0.23	1	SS	5					\Native Backfill
	Power Auger 200 mm Diam. (Hollow Stem)				2	SS	6					Silica Sand
2		(SM) gravelly SILTY SAND; brown, contains cobbles and boulders; non-cohesive, wet, compact to dense		91.82 2.13	3	ss	29					Standpipe
3	DCPT Open Hole	End of Borehole		90.75 3.20								Cave
4		DCPT Refusal										WL in Standpipe at Elev. 93.65 m on Jan. 30, 2017
4												
5												
6												
7												
8												
9												
10												
DE	PTH S	SCALE						Gold	 er		L	) DGGED: PAH

## RECORD OF BOREHOLE: 17-29

BORING DATE: January 23, 2017

SHEET 1 OF 1

DATUM: Geodetic

LOCATION: N 5013007.0 ;E 367859.2 SAMPLER HAMMER, 64kg; DROP, 760mm

ALE		ГНОВ	SOIL PROFILE		1	S/	AMPL	-	HEADSPACE ORGANIC VAPOL CONCENTRATIONS [PPM] ND = Not Detected 20 40 60 8	JR ⊕		AL	PIEZOMETER
DEPTH SCALE METRES		BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.30m	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [%LEL] ND = Not Detected		Wp Wi	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
	┢		GROUND SURFACE	0)	00.00		$\vdash$			0	20 40 60 80	+	
0	┢		FILL - Asphaltic concrete grinding and	<b>***</b>	90.22 0.00		GRAI					+	Flush Mount
			chunks		89.84		GRAI	-					Casing
		Ē	TOPSOIL - (SM) SILTY SAND; dark brown; non-cohesive	<b>A</b>	0.38		-						Bentonite Seal
		/ Sten	(ML) sandy SILT; grey, with black		89.46		GRAI	-	Φ				Silica Sand
	Der	Iollow	staining; non-cohesive, moist (CI/CH) SILTY CLAY to CLAY; dark grey		0.76				<b>⊕</b>				
'	Power Auger	am. (F	to red grey with staining, fissured (WEATHERED CRUST); cohesive,			3	SS	5					
	đ	200 mm Diam. (Hollow Stem)	w>PL, very stiff						⊕				50 mm Diam. PVC #10 Slot Screen
		200 r											
						4	SS	5	Ð				4
2					88.09								
		-	End of Borehole		2.13		1						
													WL in Screen at
													Elev. 89.45 m on Jan. 30, 2017
3													
4													
5													
J													
6													
7													
8													
9													
10													
	L			<u> </u>		L	<u> </u>	1					
DE	P	TH S	CALE					(	Golder			L	OGGED: PAH
1:	50	0							Associates			CH	IECKED: SAT

## RECORD OF BOREHOLE: 17-30

BORING DATE: January 13, 2017

SHEET 1 OF 1

DATUM: Geodetic

LOCATION: N 5013004.5 ;E 367889.2 SAMPLER HAMMER, 64kg; DROP, 760mm

Ц	ЦОН	SOIL PROFILE			SA	MPLI		HEADSPACE ORGANIC VAPOUR CONCENTRATIONS [PPM] ⊕ ND = Not Detected 20 40 60 80	HYDRAULIC CONDUCTIVITY, k, cm/s	
DEPTH SCALE METRES	BORING METHOD		STRATA PLOT		К		.30m		10 <sup>-6</sup> 10 <sup>-5</sup> 10 <sup>-4</sup> 10 <sup>-3</sup>	PIEZOMETER OR UILLU STANDPIPE INSTALLATION
E E	NG	DESCRIPTION	TAF	ELEV. DEPTH	NUMBER	TYPE	VS/0.	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS	WATER CONTENT PERCENT	
Ľ	BOR		STRA	(m)	₽	[ ]	BLOWS/0.3	[%LEL] ND = Not Detected		
		GROUND SURFACE	0,	89.95			-	20 40 60 80	20 40 60 80	
0		ASPHALTIC CONCRETE		89.95 0.00 0.10						Flush Mount
		FILL - (SW-GW) SAND and GRAVEL; dark grey brown (PAVEMENT		0.20				⊕ ⊕		Casing Silica Sand
		STRUCTURE); non-cohesive, moist TOPSOIL - (SM) SILTY SAND, fine;		0.34	1	SS	18	⊕		Bentonite Seal
		black and grey; non-cohesive								Silica Sand
1	Stem)	(CI/CH) SILTY CLAY to CLAY; grey brown, contains silty fine sand seams,								
	_ lă	fissured (WEATHERED CRUST); cohesive, w>PL, very stiff			2	SS	7	θ		
	Auge (Holk									
	Power Auger 200 mm Diam. (Hollow									50 mm Diam. PVC #10 Slot Screen
	1				3	ss	3	Ð		
2	200									
										Silica Sand
					4	SS	2	Φ		Bentonite Seal
3		End of Borehole	-444	87.05 2.90						
3										
										WL in Screen at Elev. 89.36 m on
										Jan. 30, 2017
4										
5										
6										
7										
8										
-										
9										
10										
DE	PIH:	SCALE						Golder		LOGGED: PAH CHECKED: SAT

# RECORD OF BOREHOLE: 17-31

BORING DATE: January 13, 2017

DATUM: Geodetic

LOCATION: N 5013000.4 ;E 367874.4 SAMPLER HAMMER, 64kg; DROP, 760mm

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SHEET 1 OF 1

I.S.	ETHOD	SOIL PROFILE	5			MPL		HEADSPACE ORGANIC VAPOUR CONCENTRATIONS [PPM] ⊕ ND = Not Detected 20 40 60 80	HYDRAULIC CONDUCTIVITY, k, cm/s 10 <sup>-6</sup> 10 <sup>-5</sup> 10 <sup>-4</sup> 10 <sup>-3</sup>	NAL	PIEZOMETER OR
METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	түре	BLOWS/0.30m	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS	WATER CONTENT PERCENT	ADDITIONAL LAB. TESTING	STANDPIPE INSTALLATION
	ш	GROUND SURFACE	ەن ا	90.07			В	20 40 60 80	20 40 60 80		
0		FILL - (GP) sandy GRAVEL, angular; grey, contains asphalt fragments;		0.00	1	GRAB	- 1	<b>⊕</b>			Flush Mount Casing Silica Sand
		non-cohesive, moist (CI/CH) SILTY CLAY to CLAY: grev	Î	0.30							Bentonite Seal
		brown, contains silty fine sand seams, fissured (WEATHERED CRUST);									Silica Sand
1	tem)	cohesive, w>PL, very stiff			2	SS	5	Δ			
	Ider Iollow S						Ű				
	200 mm Diam. (Hollow Stem)										50 mm Diam. PVC #10 Slot Screen
	D mm D				3	ss	6	Φ			
2	20										
											Silica Sand
					4	ss	2	Φ			Bentonite Seal
3		End of Borehole		87.1 <u>7</u> 2.90							
-											WL in Screen at
											Elev. 89.44 m on Jan. 30, 2017
4											
5											
-											
6											
7											
-											
8											
9											
-											
10											
DEF	PTH S	CALE						Golder		L	DGGED: PAH ECKED: SAT

### RECORD OF BOREHOLE: 17-32

BORING DATE: January 13, 2017

SHEET 1 OF 1

DATUM: Geodetic

LOCATION: N 5013010.6 ;E 367910.1 SAMPLER HAMMER, 64kg; DROP, 760mm

ц Г	DOH.	SOIL PROFILE	1.	1	SA	MPLI			PACE O	RGANI ONS [PI	, vapol PM]	ir ⊕	HYDRA	k, cm/s	ONDUC	I IVI I Y,		NGA	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.30m	VAPOL [%LEL]	PACE C IR CONC ND = No	OMBUS ENTRA	TIBLE TIONS ed		Wp	ATER C		I PERCI	WI	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
_	ш	GROUND SURFACE	ò			$\mid \mid$	ē	20	) 41	06	s 0	0	20	) 4	10 (	50	80		
• 0 •	w Stem)	FILL - (SM-GM) SILTY SAND and GRAVEL; brown; non-cohesive TOPSOIL - (ML) sandy SILT; dark brown to black; non-cohesive (CI(CH) SILTX CI AV to CI AV; grey		89.84 0.00 0.08 89.54 0.30	1	GRAB	-	€											
1	Power Auger 200 mm Diam. (Hollow Stem)	brown, contains stift fine sand seams, fissured (WEATHERED CRUST); cohesive, w>PL, very stiff			2	SS	7	Ð											Ţ
2		Fad of Darabala		87.71	3	SS	3	⊕											
		End of Borehole		2.13															WL in open borehole at 1.30 m depth below ground surface upon completion of drilling
3																			
4																			
5																			
6																			
2																			
7																			
8																			
9																			
10																			
DE	PTH S	CALE						Â	Go	Jda-	•							LC	DGGED: PAH

# RECORD OF BOREHOLE: 17-33

BORING DATE: January 23, 2017

SHEET 1 OF 1

DATUM: Geodetic

LOCATION: N 5013039.4 ;E 367857.2 SAMPLER HAMMER, 64kg; DROP, 760mm

Ч Д	IHOI	SOIL PROFILE	_ ∟		SA	MPLI		HEADSPACE ORGANIC VAPOUR CONCENTRATIONS [PPM] ND = Not Detected 20 40 60 80	⊕	k, cm/s		<b>I</b> <sup>R</sup> A	PIEZOMETER
METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	түре	BLOWS/0.30m	HEADSPACE COMBUSTIBLE		10 <sup>-6</sup> 10 WATER CC Wp	NTENT PERCEN	л	OR STANDPIPE INSTALLATION
1	BO		STF	(m)			BLC	[%LEL] ND = Not Detected 20 40 60 80		20 40			
0	_	GROUND SURFACE ASPHALTIC CONCRETE		89.99 0.00					_				
		FILL - Asphaltic concrete		0.00 0.12 89.66	1 1	GRAB	-	<b>⊕</b>					
		(ML) CLAYEY SILT; grey with black staining (WEATHERED CRUST);		0.33		GRAB		⊕					
	tem)	Conesive, w>PL		89.38 0.61	2		-						
	low S	(CI/CH) SILTY CLAY to CLAY; grey brown and red brown, fissured		0.01									
1	r Aug	(WEATHERED CRUST); cohesive,			3	ss	6	Φ					
	Powe Dian	w>PL, very stiff											
	Power Auger 200 mm Diam. (Hollow Stem)			88.47									
	5(	(CI/CH-ML and SM) SILTY CLAY, CLAYEY SILT and SILTY SAND; grey brown (WEATHERED CRUST);		1.52									
2		brown (WEATHERED CRUST); cohesive, w>PL, very stiff			4	SS	3	<b>⊕</b>					
2		End of Borehole		87.86 2.13									
3													
~													
-+													
5													
6													
5													
7													
8													
9													
10													
			<u>.</u>	-						I		· · ·	
DE	PTH S	SCALE						Golder				10	GGED: PAH

### RECORD OF BOREHOLE: 17-34

BORING DATE: January 13, 2017

SHEET 1 OF 1

DATUM: Geodetic

LOCATION: N 5012981.8 ;E 367911.1 SAMPLER HAMMER, 64kg; DROP, 760mm

y 10, 2017

а РГЕ	ГНОВ	SOIL PROFILE		1	SA	MPL		HEADSPACE ORGANIC VAP CONCENTRATIONS [PPM] ND = Not Detected			k, cm/s	OUCTIVITY,	NG	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.30m	ND = Not Detected 20 40 60 HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [%LEL] ND = Not Detected 20 40 60	80 5 □ 80		ATER CON	10 <sup>-4</sup> 10 <sup>-3</sup> TENT PERCENT → <sup>W</sup> W 60 80	ADDITIO	OR STANDPIPE INSTALLATION
		GROUND SURFACE		89.99			-			2				
- 0 -	r Stem)	TOPSOIL - (ML) sandy SILT; dark brown; non-cohesive (CI/CH) SILTY CLAY to CLAY; grey brown, contains silty sand seams, fissured (WEATHERED CRUST); cohesive, w>PL, very stiff		0.00 89.69 0.30	1	GRAB	-	⊕						
1	Power Auger 200 mm Diam. (Hollow Stem)				2	ss	6	•						Σ
- 2	50	End of Borehole		87.86 2.13	3	SS	3	Ð						
- 3														WL in open borehole at 1.06 m depth below ground surface upon completion of drilling
4														
5														
6														
7														
- 8														
9														
· 10														
DEI 1:{		CALE					(	Golder			<b>!</b>			OGGED: PAH IECKED: SAT

# RECORD OF BOREHOLE: 17-35

BORING DATE: January 13, 2017

SHEET 1 OF 1

DATUM: Geodetic

LOCATION: N 5012965.0 ;E 367856.7 SAMPLER HAMMER, 64kg; DROP, 760mm

щ	ДŎ	SOIL PROFILE			SA	MPLI		CONCE	ACE ORGANIC	M]	`⊕		AULIC C k, cm/s	,		ں ب	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.30m	HEADS	NTRATIONS [PF t Detected 40 6 PACE COMBUS CONCENTRA ND = Not Detected 40 6	TIBLE TIONS		w wr	ATER C	PERCE		ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
- 0		GROUND SURFACE		90.45													
	er low Stem)	ASPHALTIC CONCRETE FILL - (SP-GP) SAND and GRAVEL, angular; grey (PAVEMENT STRUCTURE); non-cohesive, moist TOPSOIL - (ML) sandy SILT; dark brown; non-cohesive (SM) SILTY SAND; grey brown, contains		0.06 90.11 0.34 89.84 0.61	1 (	GRAB	-	Ð									
1	Power Auger 200 mm Diam. (Hollow Stem)	Clayey silt seams; non-cohesive, wet, loose (CI/CH) SILTY CLAY to CLAY; grey brown, fissured (WEATHERED		89.23 1.22	2	SS	7	0									
	200 m	CRUST); cohesive, w>PL, very stiff			3	SS	5	⊕									
2		End of Borehole		88.32 2.13													
- 3																	
4																	
5																	
6																	
7																	
- 8																	
9																	
· 10																	
DE	PTH	SCALE				1	_	Â	Golder						-	LC	OGGED: PAH