GeoPro Consulting Limited

Geotechnical-Hydrogeology-Environmental-Materials-Inspection

Preliminary Geotechnical Investigation

Proposed Townhouse and Apartment Building Development

180 Groh Avenue, Cambridge, Ontario

Prepared For:

JD Development Group

GeoPro Project No.: 17-1764G

Report Date: February 21, 2017

Professional, Proficient, Proactive

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GeoPro CONSULTING LIMITED

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1. INTRODUCTION

GeoPro Consulting Limited (GeoPro) was retained by JD Development Group (the Client) to undertake a preliminary geotechnical investigation to support the acquisition due diligence for the proposed townhouse and apartment building development located at 180 Groh Avenue, Cambridge, Ontario.

The purpose of this preliminary geotechnical investigation was to obtain preliminary information on the existing subsurface conditions by means of a limited number of boreholes, in-situ tests and laboratory tests of soil samples to provide required preliminary geotechnical design information. Based on GeoPro's interpretation of the data obtained, preliminary geotechnical comments and recommendations related to the general planning and project concept design purposes are provided.

The report is prepared with the condition that the design will be in accordance with all applicable standards and codes, regulations of authorities having jurisdiction, and good engineering practice. Further, the recommendations and opinions in this report are applicable only to the proposed project as described above. On-going liaison and communication with GeoPro prior to and during the detailed design stage and construction phase of the project is strongly recommended to confirm that the preliminary recommendations in this report are applicable and/or correctly interpreted and implemented. Also, any queries concerning the geotechnical aspects of the proposed project shall be directed to GeoPro for further elaboration and/or clarification.

This report is provided on the basis of the terms of reference presented in our approved proposal prepared based on our understanding of the project. If there are any changes in the preliminary design and planning features relevant to the geotechnical analyses, or if any questions arise concerning the geotechnical aspects of the codes and standards, this office should be contacted to review the design. It may then be necessary to carry out additional borings and reporting before the recommendations can be relied upon.

Concurrent with this preliminary geotechnical investigation, a Hydrogeological Investigation has been carried out by GeoPro and the results of which will be addressed under a separate cover.

This report deals with geotechnical issues only. The geo-environmental (chemical) aspects of the subsurface conditions, including the consequences of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources, were not investigated and were beyond the scope of this assignment.

The site investigation and recommendations follow generally accepted practice for geotechnical consultants in Ontario. Laboratory testing for most part follows ASTM or CSA Standards or modifications of these standards that have become standard practice in Ontario.

This report has been prepared for the Client only. Third party use of this report without GeoPro's consent is prohibited. The limitation conditions presented in this report form an integral part of the report and they must be considered in conjunction with this report.

2. FIELD AND LABORATORY WORK

The field work for the geotechnical investigation was carried out from the period of February 1 to 3, 6, 8 to 10, 13 and 14, 2017, during which time thirteen (13) boreholes (Boreholes BH1 to BH13) were advanced at the locations shown on the Borehole Location Plan, Drawing No. 1. The boreholes were drilled to depths ranging from about 6.4 m to 14.0 m below the existing ground surface.

The boreholes were advanced using a continuous flight auger drilling equipment supplied by a drilling specialist subcontracted to GeoPro. Samples were retrieved with a 51 mm (2 inches) O.D. split-barrel (split spoon) sampler driven with a hammer weighing 624 N and dropping 760 mm (30 inches) in accordance with the Standard Penetration Test (SPT) method. The number of blows required to drive the sampler 300 mm (12 inches) depth into the undisturbed soil (SPT N values) gives an indication of the compactness condition or consistency of the sampled soil material.

Groundwater condition observations were made in the boreholes during drilling and upon completion of drilling. The boreholes were backfilled and sealed upon completion of drilling. Nest monitoring wells (51 mm O.D.) including a shallow well and a deep well were installed at the borehole locations BH2, BH8 and BH9 to monitor the long-term groundwater conditions.

The field work for this investigation was monitored by a member of our engineering staff, who also determined the approximate borehole locations in the field, logged the boreholes and cared for the recovered samples.

All soil samples obtained during this investigation were brought to our laboratory for further examination and classification.

The elevations at the as-drilled borehole locations were surveyed by a GPS unit. Since the elevations were not provided by a professional surveyor, information should be considered to be approximate. Contractor performing the work should confirm the elevations prior to construction.

3. SITE AND SUBSURFACE CONDITIONS

The borehole locations are shown on Drawing No.1. Notes on sample descriptions are presented on Enclosure No. 1A. An explanation of terms used in borehole logs is presented in Enclosure No. 1B. The subsurface conditions in the boreholes (BH1 to BH13) are presented on the borehole logs (Enclosure Nos. 2 to 14 inclusive). The following are the detailed descriptions of the major soil strata encountered in the boreholes.

3.1 Soil Conditions

Topsoil with thickness ranging from 130 mm to 610 mm were encountered surficially in all the boreholes except Boreholes BH2, BH9, BH12 and BH13. Fill materials consisting of cohesionless sandy silt, silty sand, sand and silt, sand, sand and gravel and gravelly sand encountered in all boreholes except Boreholes BH7 and BH10, and extended to depths ranging from about 1.5 m to 5.6 m below the existing ground surface. Probable fill materials consisting of cohesionless sandy silt and silty sand were encountered below the topsoil and fill materials in Boreholes BH6 and BH7, and extended to depths ranging from about 1.5 m to 3.4 m below the existing ground surface. Peat was encountered below the fill materials in Borehole BH4, and extended to a depth of about 3.0 m below the existing ground surface.

Native sandy/silty/gravelly deposits and/or glacial tills were encountered below the fill materials in all boreholes. It is noted that clayey silt till deposit was encountered below the gravelly sand to sand and gravel deposits in Borehole BH8, and extended to a depth of about 14.0 m below the existing ground surface.

3.2 Groundwater Conditions

Groundwater level measurements were conducted in monitoring wells BH1 to BH12 on February 17, 2017. Nest monitoring wells were also installed in Boreholes BH2, BH8 and BH9. The details of monitoring well construction and the measured groundwater levels are shown in the borehole logs, and also summarized in the following table:

Monitoring Well ID	Screen Interval (mBGS)	Date of Monitoring: Depth (mBGS)
		February 17, 2017
BH1	6.1 ~ 7.6	6.98
BH2 (Shallow Well)	6.1 ~ 7.6	7.62
BH2 (Deep Well)	12.2 ~ 13.7	7.86
BH3	6.1 ~ 7.6	6.69
BH4	5.9 ~ 7.5	6.08
BH5	6.1 ~ 7.6	7.65
BH6	6.1 ~ 7.6	3.44
BH7	3.1 ~ 4.6	0.05
BH8 (Shallow Well)	6.1 ~ 7.6	6.66
BH8 (Deep Well)	12.2 ~ 13.7	6.55
BH9 (Shallow Well)	6.1 ~ 7.6	7.47
BH9 (Deep Well)	12.2 ~ 13.7	7.71
BH10	9.5 ~ 11.0	6.39
BH11	10.7 ~ 12.2	4.88
BH12	6.4 ~ 7.9	7.77

Note: mBGS = meter below ground surface

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations in response to weather events.

4. PRELIMINARY GEOTECHNICAL INFORMATION

This report contains the findings of GeoPro's preliminary geotechnical investigation, together with the preliminary geotechnical engineering recommendations and comments. These preliminary recommendations and comments are based on factual information and are intended only for use by the design engineers. The number of boreholes are not be sufficient for the detailed design and are not sufficient to determine all the factors that may affect construction methods and costs. Once the actual development plans are available, the information in this report should be reviewed by the geotechnical engineer from GeoPro and an additional detailed geotechnical investigation shall be carried out, compatible with the actual proposed development plans for the site.

It is understood that the proposed development consists of eight (8) blocks of residential townhouses and two (2) apartment buildings with one (1) basement level and an at-grade parking facility at 180 Groh Avenue, Cambridge, Ontario. Based on the results of this preliminary geotechnical investigation, the native soils encountered at the site are generally considered to be suitable for supporting proposed development. The following preliminary geotechnical information is provided for the planning and preliminary design of residential townhouses and apartment buildings, underground services, as well as paved roads at the site. The preliminary geotechnical recommendations provided in this report are not sufficient for final design or construction purposes. Once the actual residential development plans are available, the information in this report should be reviewed by the geotechnical engineer and an additional detailed geotechnical investigation shall be carried out, compatible with the actual proposed development plans for the site.

- The fill materials were encountered below the topsoil in all boreholes and extended to the depths ranging from about 1.4 m to 5.6 m below the existing ground surface. The existing fill materials are considered to be unsuitable for supporting residential townhouses and apartment buildings, and any other settlement sensitive structures. The existing fill materials are also considered to be unsuitable for supporting the engineered fill.

- Depending upon the final site grading scheme and proposed final grade elevations, the areas may need to be brought up to the underside of the footings, if required, using engineered fill. The materials proposed for use as engineered fill should be approved by qualified geotechnical personnel from GeoPro at the source, prior to hauling to the site. Most of the fill materials and native soils at the site would be suitable for reuse as engineered fill subject to the environmental quality of the soils. Imported materials approved by the geotechnical engineer may be considered for use as engineered fill. Details regarding placement and compaction requirements for engineered fill, if utilized at the site, can be provided once the actual development plans are available, as part of the detailed geotechnical recommendations for the project.

- Complete removal of the existing old foundations and underground utility pipes, etc. would likely to be required as part of the site redevelopment.

- The native cohesionless sandy/silty deposits and the glacial tills extending to depths ranging from about 1.5 m to 6.0 m below the existing ground surface at the site are considered to be suitable for supporting the proposed development. For the proposed residential townhouses, a preliminary allowable bearing pressure of 150 to 250 kPa may be assumed for conventional shallow spread and/or strip footings founded in the native cohesionless sandy/silty deposits and the glacial tills.

- For the proposed apartment buildings, a preliminary bearing resistances for conventional shallow spread and/or strip footings are provided in the following table.

Borehole No.	Bearing Resistance at SLS (kPa)	Factored Geotechnical Resistance at ULS (kPa)	Minimum Depth below Existing Ground (m)	Anticipated Bearing Soil
BH6	150	225	3.5	Compact Silt
BH10	100	150	1.0	Loose to Compact Sandy Silt
	250	375	2.5	Loose to Compact Sandy Silt
BH11	150	225	6.0	Compact Fine Sand

***the bearing resistances are preliminary and not sufficient for detailed designs**

- All exterior footings and footings in unheated areas should be protected with a minimum of 1.4 m of earth cover for frost protection.

- Based on the results of this preliminary geotechnical investigation, groundwater control during excavations within the fill materials and upper sandy/silty deposits above the prevailing groundwater tables and the glacial tills can be handled, as required, by pumping from properly constructed filtered sumps located within the excavations; however, significant groundwater seepage will be expected from the water bearing cohesionless soils in the lower sandy/silty/gravelly deposits below the prevailing groundwater tables. Some form of positive groundwater control should be required. It should be noted that a Permit To Take Water, issued by the Ontario Ministry of the Environment, will be required if the dewatering system/sumps result in a water taking of more than 50,000 L/day. The need for and the type of groundwater control measures can be reviewed by the engineer as part of the detailed geotechnical and hydrogeological investigations, which would be required to support the detailed designs of the proposed development.

- It is anticipated that the trench excavations for underground servicing would consist of conventional temporary open cuts with side slopes not steeper than 1 horizontal to 1 vertical. However, some local flattening of side slopes may be required in some area in looser soil zones or where significant water seepage is encountered. Conventional bedding thicknesses are anticipated for underground services founded within the native competent subsoils at the site. Additional bedding thickness may be required for services founded in wet sandy soils, depending upon the excavation depths and success of the contractor's groundwater control measures. It should be noted that cobbles and boulders should be encountered throughout the tills at the site. Excavation below the groundwater table in the lower sandy/silty/gravelly deposits, construction dewatering would be required. Active dewatering such as well points or eductors may be required prior to excavations in the cohesionless soils below the groundwater tables. Otherwise, it will result in an unstable base and flowing sides. The groundwater table must be lowered to at least 1.0 m below the lowest elevation of the excavation base. A contractor specializing in dewatering should be retained to design the dewatering systems. As noted above a Permit To Take Water, issued by the Ontario Ministry of the Environment, will be required if the dewatering system/sumps result in a water taking of more than 50,000 L/day.

- The type of foundation drainage system required (perimeter drains and/or underslab drains; damp-proofing or water-proofing) depends upon the proposed founding elevations, soil types in the area and actual stabilized groundwater levels. Basements founded in sandy soils below the groundwater level may require water-proofing and/or underslab drains. In any event, the type of foundation drainage should be confirmed by the geotechnical engineer once the site grading plans are available.

- Based on the subsoil conditions encountered, conventional asphaltic (flexible) pavement designs are considered to be appropriate for a proposed residential development at the site. Typical pavement designs are noted in the following table:

Material		**Thickness of Pavement Elements (mm)**	
		Collector Residential Streets	**Local Residential Streets**
Asphaltic Material (OPSS 1150)	HL 3 Surface Course	40	40
	HL 8 Binder Course	65	50
Granular Material (OPSS.MUNI 1010)	Granular A Base	150	150
	Granular B Type I Subbase	400	300
		Prepared and Approved Subgrade	

Prior to placing the granular subbase material, the exposed soil subgrade should be heavily proof-rolled in conjunction with inspection by qualified geotechnical personnel. Deleterious, organic, softened or loosened native subsoils or any fills will require sub-excavation and replacement with approved material (i.e. controlled fill), as directed by geotechnical personnel.

5. CLOSURE

The preliminary geotechnical recommendations provided in this report are not sufficient for final design or construction purposes. Once the actual residential development plans are available, the information in this report should be reviewed by the geotechnical engineer and an additional detailed geotechnical and hydrogeological investigation carried out, compatible with the actual proposed development plans for the site. In this regard, GeoPro would be pleased to provide further geotechnical and hydrogeological services if site development plans proceed forward.

We appreciate the opportunity to be of service to you and trust that this report provides sufficient preliminary geotechnical engineering information to facilitate the planning and preliminary concept design of this project. We look forward to providing you with continuing service during the detailed design stage. Please do not hesitate to contact our office should you wish to discuss, in further detail, any aspects of this project.

Yours very truly,

GEOPRO CONSULTING LIMITED

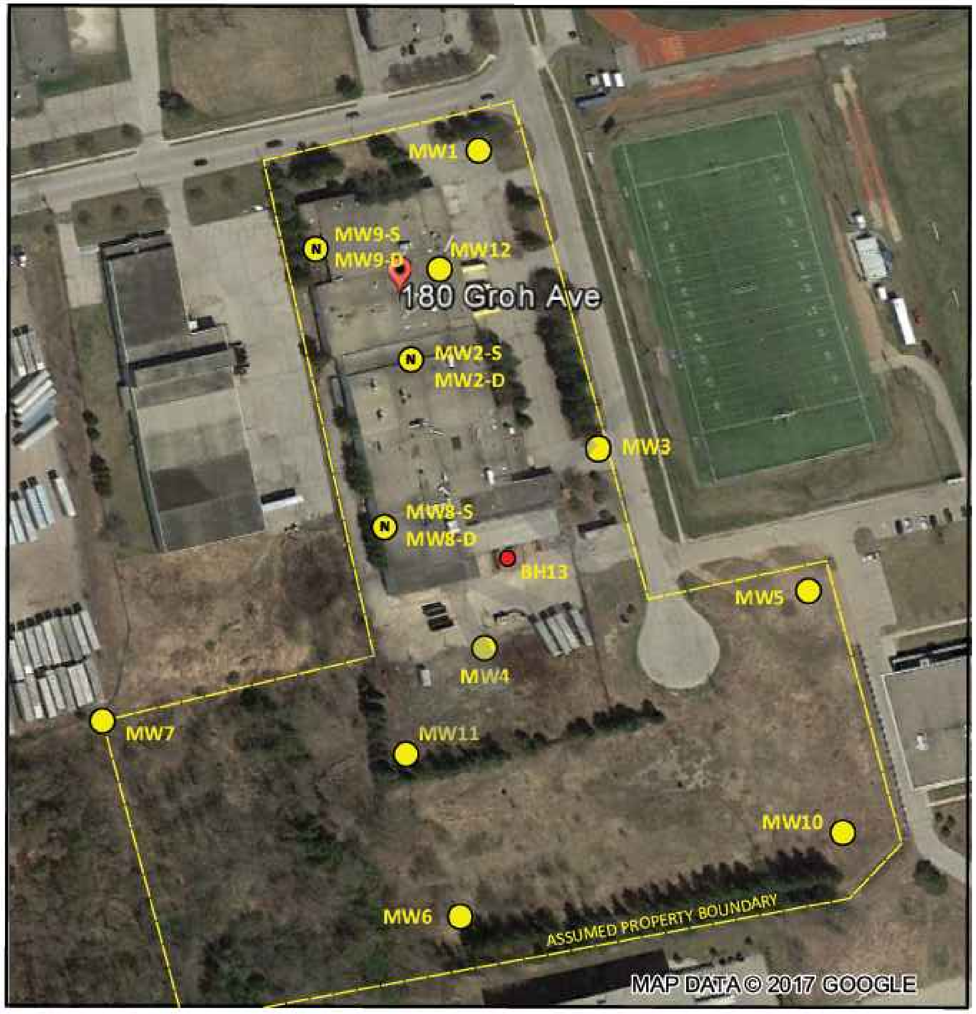
DRAFT

Maurice Leung, M.Eng., EIT, Project Engineer
Geotechnical Group

DRAFT

David B. Liu, P.Eng., Principal

DRAWINGS



Legend:

BOREHOLE LOCATION

BOREHOLE LOCATION WITH NESTED WELLS

Client: **JD Development Group**		Project No.: **17-1764GH**	Drawing No.: **1**
Drawn: **ML**	Approved: **DL**	Title: **Borehole Location Plan**	
Date: **February 2017**	Scale: **N.T.S**	Project: **Preliminary Geotechnical Investigation and Hydrogeological Assessment for Proposed Townhouse and Apartment Building Development at 180 Groh Avenue, Cambridge, Ontario**	
Original Size: **Letter**	Rev: -	GeoPro Consulting Limited	

ENCLOSURES

Enclosure 1A: Notes on Sample Descriptions

1. Each soil stratum is described according to the *Modified Unified Soil Classification System*. The compactness condition of cohesionless soils (SPT) and the consistency of cohesive soils (undrained shear strength) are defined according to Canadian Foundation Engineering Manual, 4th Edition. Different soil classification systems may be used by others. Please note that a description of the soil stratums is based on visual and tactile examination of the samples augmented with field and laboratory test results, such as a grain size analysis and/or Atterberg Limits testing. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional preliminary geotechnical site investigation.

3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

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Enclosure 1B: Explanation of Terms Used in the Record of Boreholes

Sample Type

AS	Auger sample
BS	Block sample
CS	Chunk sample
DO	Drive open
DS	Dimension type sample
FS	Foil sample
NR	No recovery
RC	Rock core
SC	Soil core
SS	Spoon sample
SH	Shelby tube Sample
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

Penetration Resistance

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

PM – Samples advanced by manual pressure
WR – Samples advanced by weight of sampler and rod
WH – Samples advanced by static weight of hammer

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

Piezo-Cone Penetration Test (CPT):
An electronic cone penetrometer with a 60 degree conical tip and a projected end area of 10 cm² pushed through ground at a penetration rate of 2 cm/s. Measurement of tip resistance (Q_t), porewater pressure (PWP) and friction along a sleeve are recorded electronically at 25 mm penetration intervals.

Textural Classification of Soils (ASTM D2487)

Classification	Particle Size
Boulders	> 300 mm
Cobbles	75 mm - 300 mm
Gravel	4.75 mm - 75 mm
Sand	0.075 mm – 4.75 mm
Silt	0.002 mm-0.075 mm
Clay	<0.002 mm(*)

(*) Canadian Foundation Engineering Manual (4th Edition)

Coarse Grain Soil Description (50% greater than 0.075 mm)

Terminology	Proportion
Trace	0-10%
Some	10-20%
Adjective (e.g. silty or sandy)	20-35%
And (e.g. sand and gravel)	> 35%

Soil Description

a) Cohesive Soils(*)

Consistency Value	Undrained Shear Strength (kPa)	SPT "N"
Very soft	<12	0-2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very stiff	100-200	15-30
Hard	>200	>30

(*) Hierarchy of Shear Strength prediction
1. Lab triaxial test
2. Field vane shear test
3. Lab. vane shear test
4. SPT "N" value
5. Pocket penetrometer

b) Cohesionless Soils

Density Index (Relative Density)	SPT "N" Value
Very loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

Soil Tests

w	Water content
w_p	Plastic limit
w_l	Liquid limit
C	Consolidation (oedometer) test
CID	Consolidated isotropically drained triaxial test
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement
D_R	Relative density (specific gravity, Gs)
DS	Direct shear test
ENV	Environmental/ chemical analysis
M	Sieve analysis for particle size
MH	Combined sieve and hydrometer (H) analysis
MPC	Modified proctor compaction test
SPC	Standard proctor compaction test
OC	Organic content test
U	Unconsolidated Undrained Triaxial Test
V	Field vane (LV-laboratory vane test)
γ	Unit weight

LOG OF BOREHOLE BH1

PROJECT: Geotechnical Investigation for Proposed Development
CLIENT: JD Development Group
PROJECT LOCATION: 180 Groh Avenue, Cambridge, Ontario
DATUM: Geodetic
BH LOCATION: See Borehole Location Plan N 4807754.877 E 555071.009

DRILLING DATA
Method: Continuous Flight Auger- Auto Hammer
Diameter: 205 mm
Date: Feb/06/2017

REF. NO.: 17-1764G
ENCL NO.: 2

SOIL PROFILE (m) ELEV DEPTH	DESCRIPTION	SAMPLES NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION
310.2 / 0.0	**TOPSOIL:** (600 mm)	1	SS	5	Concrete	
309.6						
309.5 / 0.7	**FILL:** sandy silt, trace clay, trace organics, trace rootlets, dark brown, moist, loose to compact **PROBABLE FILL:** sand, trace gravel, brown, moist, compact	2	SS	17		309
		3	SS	21		
308.0 / 2.1	**SAND AND GRAVEL:** containing cobbles and boulders, brown, moist, dense to very dense	4	SS	45		308
		5	SS	53	Bentonite	307
						306
		6	SS	44		305
		7	SS	50/150 mm		304
					Sand	
					Screen W. L. 303.2 m Feb 17, 2017	
		8	SS	50	Natural Pack	302
301.9 / 8.2	**END OF BOREHOLE**					

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED + FIELD VANE & Sensitivity ● QUICK TRIAXIAL × LAB VANE; 20 40 60 80 100

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

WATER CONTENT (%): 10 20 30

POCKET PEN. (Cu) (kPa) | NATURAL UNIT WT (kN/m^3) | REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

Notes
1) Water encountered at a depth of 7.3 m below the existing ground surface (mBGS) during drilling.
2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling

Water Level Readings

Date	W. L. Depth (mBGS)
2017/02/17	6.98

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH10

PROJECT: Geotechnical Investigation for Proposed Development
CLIENT: JD Development Group
PROJECT LOCATION: 180 Groh Avenue, Cambridge, Ontario
DATUM: Geodetic
BH LOCATION: See Borehole Location Plan N 4807497.64 E 555176.418

DRILLING DATA
Method: Continuous Flight Auger- Auto Hammer
Diameter: 205 mm
Date: Feb/02/2017

REF. NO.: 17-1764G
ENCL NO.: 11

SOIL PROFILE (m) ELEV DEPTH	DESCRIPTION	SAMPLES NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION
306.4						
306.2 / 0.0	**TOPSOIL:** (200 mm)				Concrete	
0.2	**SANDY SILT:** trace clay, trace gravel, containing cobbles and boulders, brown, moist to wet, loose to compact	1	SS	6		306
		2	SS	10		305
		3	SS	9		
		4	SS	27		304
303.5 / 3.0	**SAND AND SILT TILL:** trace clay, trace gravel, containing cobbles and boulders, brown, moist, very dense	5	SS	61		303
						302
		6	SS	58	Bentonite	
						301
		7	SS	91	W. L. 300.0 m Feb 17, 2017	300
						299
		8	SS	56		
						298
		9	SS	50/152mm		297

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × LAB VANE: 20 40 60 80 100

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L

WATER CONTENT (%): 10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m^3)

REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH10

PROJECT: Geotechnical Investigation for Proposed Development
CLIENT: JD Development Group
PROJECT LOCATION: 180 Groh Avenue, Cambridge, Ontario
DATUM: Geodetic
BH LOCATION: See Borehole Location Plan N 4807497.64 E 555176.418

DRILLING DATA
Method: Continuous Flight Auger- Auto Hammer
Diameter: 205 mm
Date: Feb/02/2017

REF. NO.: 17-1764G
ENCL NO.: 11

ELEV (m) / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	REMARKS
296.2					Sand, Screen		
10.2	**SANDY GRAVEL:** trace silt, containing cobbles and boulders, brown, wet, very dense	10	SS	50/152mm		296	
295.5 / 10.9	**SILTY FINE SAND:** trace clay, trace gravel, containing cobbles and boulders, brown, moist, very dense	11	SS	50/127mm	Natural Pack		
295.2 / 11.3	**END OF BOREHOLE**						

Column headings (no data on this page): DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × LAB VANE (20 40 60 80 100); PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) (10 20 30); POCKET PEN. (Cu) (kPa); NATURAL UNIT WT (kN/m^3); REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL; STRATA PLOT.

Notes
1) Water encountered at a depth of about 10.7 m below the existing ground surface (mBGS) during drilling.
2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling

Water Level Readings

Date	W. L. Depth (mBGS)
2017/02/17	6.39

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH11

PROJECT: Geotechnical Investigation for Proposed Development
CLIENT: JD Development Group
PROJECT LOCATION: 180 Groh Avenue, Cambridge, Ontario
DATUM: Geodetic
BH LOCATION: See Borehole Location Plan N 4807517.773 E 555041.145

DRILLING DATA
Method: Continuous Flight Auger- Auto Hammer
Diameter: 205 mm
Date: Feb/10/2017

REF. NO.: 17-1764G
ENCL NO.: 12

(m) ELEV DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
308.0							
307.9 / 0.2	**TOPSOIL:** (150 mm)						
307.8 / 0.2	**FILL:** silty sand to sandy silt, trace clay, trace gravel, trace organics, dark brown, moist, very loose to compact	1	SS	6	Concrete		
		2	SS	3		307	
		3	SS	4		306	
		4	SS	9		305	
		5	SS	14		304	
	--- Containing Asphalt Pieces	6	SS	9	W. L. 303.1 m Feb 17, 2017; Bentonite		
302.4 / 5.6	**FINE SAND:** trace silt, brown, wet, compact					302	
		7	SS	19		301	
300.8 / 7.2	**SILTY SAND:** trace clay, trace gravel, containing cobbles and boulders, brown, wet, compact	8	SS	11		300	
						299	
298.6 / 9.4	**GRAVELLY SAND:** trace silt, containing cobbles and boulders, brown, wet, compact to very dense	9	SS	19			

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE; 20 40 60 80 100
PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30
POCKET PEN. (Cu) (kPa); NATURAL UNIT WT (kN/m³)

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

PROJECT: Geotechnical Investigation for Proposed Development
CLIENT: JD Development Group
PROJECT LOCATION: 180 Groh Avenue, Cambridge, Ontario
DATUM: Geodetic
BH LOCATION: See Borehole Location Plan N 4807517.773 E 555041.145

DRILLING DATA
Method: Continuous Flight Auger- Auto Hammer
Diameter: 205 mm
Date: Feb/10/2017

REF. NO.: 17-1764G
ENCL NO.: 12

SOIL PROFILE (m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED + FIELD VANE & Sensitivity ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT W_P NATURAL MOISTURE CONTENT W LIQUID LIMIT W_L / WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m^3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	GRAVELLY SAND: trace silt, containing cobbles and boulders, brown, wet, compact to very dense(Continued)											
11			10	SS	80	Sand Screen	297					
296.2 11.7	**SANDY SILT TILL:** trace clay, trace gravel, containing cobbles and boulders, brown, grey, moist, very dense											
12							296					
295.7 12.3			11	SS	50/127mm	Natural Pack						
	END OF BOREHOLE Notes 1) Water encountered at a depth of about 6.1 m below the existing ground surface (mBGS) during drilling. 2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling Water Level Readings Date W. L. Depth (mBGS) 2017/02/17 4.88											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES $+^3, \times^3$: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH12

PROJECT: Geotechnical Investigation for Proposed Development
CLIENT: JD Development Group
PROJECT LOCATION: 180 Groh Avenue, Cambridge, Ontario
DATUM: Geodetic
BH LOCATION: See Borehole Location Plan N 4807706.486 E 555048.692

DRILLING DATA
Method: Continuous Flight Auger- Auto Hammer
Diameter: 205 mm
Date: Feb/14/2017

REF. NO.: 17-1764G
ENCL NO.: 13

(m) ELEV DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION
310.9 / 0.0	**FILL:** sand and gravel to gravelly sand, trace silt, dark brown to brown, wet, loose to compact	1	SS	8	Concrete	
		2	SS	12		310
		3	SS	5		309
308.6 / 2.3	**FILL:** sand, trace silt, trace gravel, brown, moist, compact	4	SS	24		
307.9 / 3.0	**FILL:** gravelly sand, trace silt, brown, moist, compact					308
		5	SS	15	Bentonite	
307.5 / 3.4	**SILTY SAND:** trace clay, trace gravel, containing cobbles and boulders, brown, wet, compact					307
306.8 / 4.1	**SAND AND GRAVEL:** trace silt, containing cobbles and boulders, brown, moist, dense to very dense					
		6	SS	43		306
						305
		7	SS	43		
					Sand, Screen	304
		8	SS	50/25mm	W. L. 303.1 m Feb 17, 2017	
302.9 / 8.0	**END OF BOREHOLE**					

Note
1) 51 mm dia. monitoring well was installed in borehole upon completion of drilling

Water Level Readings

Date	W. L. Depth (mBGS)
2017/02/17	7.77

Plot headings: STRATA PLOT; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH (kPa) ○ UNCONFINED + FIELD VANE & Sensitivity ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100; PLASTIC LIMIT W_P NATURAL MOISTURE CONTENT W LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30; POCKET PEN. (Cu) (kPa); NATURAL UNIT WT (kN/m^3); REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES $+^3, \times^3$: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH13

PROJECT: Geotechnical Investigation for Proposed Development
CLIENT: JD Development Group
PROJECT LOCATION: 180 Groh Avenue, Cambridge, Ontario
DATUM: Geodetic
BH LOCATION: See Borehole Location Plan N 4807589.266 E 555079.864

DRILLING DATA
Method: Continuous Flight Auger- Auto Hammer
Diameter: 205 mm
Date: Feb/14/2017

REF. NO.: 17-1764G
ENCL NO.: 14

(m) ELEV / DEPTH	SOIL PROFILE: DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa)	PLASTIC LIMIT W_P / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
310.2 / 0.0	**FILL:** sand and gravel, trace silt, brown, moist, loose		1	SS	9		310					
309.5 / 0.7	**FILL:** silty sand, trace to some gravel, brown, moist, very loose		2	SS	3		309					
308.8 / 1.4	**END OF BOREHOLE**											

Dynamic cone scale: 20 40 60 80 100. Shear strength scale: 20 40 60 80 100. Water content scale: 10 20 30.

Shear strength legend: O UNCONFINED; + FIELD VANE & Sensitivity; ● QUICK TRIAXIAL; × LAB VANE

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; O ε=3% Strain at Failure

LOG OF BOREHOLE BH2

PROJECT: Geotechnical Investigation for Proposed Development
CLIENT: JD Development Group
PROJECT LOCATION: 180 Groh Avenue, Cambridge, Ontario
DATUM: Geodetic
BH LOCATION: See Borehole Location Plan N 4807668.746 E 555037.161

DRILLING DATA
Method: Continuous Flight Auger- Auto Hammer
Diameter: 205 mm
Date: Feb/13/2017

REF. NO.: 17-1764G
ENCL NO.: 3

(m) ELEV DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION
310.8						
0.0	**FILL:** sand and gravel, brown, moist, compact	1	SS	25	Concrete	
310.1 / 0.7	**FILL:** silty sand, trace gravel, brown to dark brown, moist, very loose to loose	2	SS	10		310
		3	SS	6		309
308.4 / 2.4	--pocket of clayey silt					
308.2 / 2.7	**FILL:** sand, trace silt, brown, moist, very loose	4	SS	3		308
	SANDY SILT: trace gravel, trace clay, containing cobbles and boulders, brown, moist, very loose to compact	5	SS	14	Bentonite	307
306.7 / 4.1	**GRAVELLY SAND:** containing cobbles and boulders, brown, moist, compact to very dense	6	SS	25		306
		7	SS	60	Sand; Screen	305
303.7 / 7.2	**SAND AND GRAVEL:** containing cobbles and boulders, brown, wet, dense to very dense	8	SS	45	W. L. 303.2 m Feb 17, 2017; W. L. 303.0 m Feb 17, 2017	
		9	SS	50/75 mm	Bentonite	302
						301

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × LAB VANE: 20 40 60 80 100
PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%): 10 20 30
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m^3)
REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

PROJECT: Geotechnical Investigation for Proposed Development
CLIENT: JD Development Group
PROJECT LOCATION: 180 Groh Avenue, Cambridge, Ontario
DATUM: Geodetic
BH LOCATION: See Borehole Location Plan N 4807668.746 E 555037.161

DRILLING DATA
Method: Continuous Flight Auger- Auto Hammer
Diameter: 205 mm
Date: Feb/13/2017

REF. NO.: 17-1764G
ENCL NO.: 3

ELEV (m) DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION
	SAND AND GRAVEL: containing cobbles and boulders, brown, wet, dense to very dense(Continued)	10	SS	95/250 mm		300
299.1 11.7	**SANDY SILT TILL:** trace gravel, trace clay, containing cobbles and boulders, brown, moist, very dense	11	SS	50/50 mm	Sand; Screen	299
296.9		12	SS	50/75 mm	Cave in	
14.0	**END OF BOREHOLE**					

Notes
1) The borehole was dry during drilling.
2) Two 51 mm dia. monitoring wells were installed in borehole upon completion of drilling

Water Level Readings

Date	W. L. Depth (mBGS)
2017/02/17	Dry (Shallow)
2017/02/17	7.86 (Deep)

Column headings (no data plotted): DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH (kPa) ○ UNCONFINED + FIELD VANE & Sensitivity ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100; PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30; POCKET PEN. (Cu) (kPa); NATURAL UNIT WT (kN/m³); REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Depth scale: 11, 12, 13

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH3

PROJECT: Geotechnical Investigation for Proposed Development
CLIENT: JD Development Group
PROJECT LOCATION: 180 Groh Avenue, Cambridge, Ontario
DATUM: Geodetic
BH LOCATION: See Borehole Location Plan N 4807638.108 E 555100.404

DRILLING DATA
Method: Continuous Flight Auger- Auto Hammer
Diameter: 205 mm
Date: Feb/03/2017

REF. NO.: 17-1764G
ENCL NO.: 4

ELEV (m) / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION
309.9						
309.7 / 0.1	**TOPSOIL:** (130 mm)				Concrete	
	FILL: silty sand, trace organics, containing cobbles and boulders, dark brown, moist	1	SS	13		
		2	SS	21		309
308.4 / 1.5	**SANDY SILT:** trace clay, trace gravel, containing cobbles and boulders, brown, moist, compact to dense	3	SS	18		308
		4	SS	15	Bentonite	
		5	SS	43		306
305.7 / 4.1	**GRAVELLY SAND:** containing cobbles and boulders, brown, moist, very dense	6	SS	73		305
						304
		7	SS	65	Sand; W. L. 303.2 m Feb 17, 2017	
301.8 / 8.1		8	SS	92	Natural Pack	
	END OF BOREHOLE					

Notes:
1) Water encountered at 7.6 m below the existing ground surface (mBGS) during drilling.
2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling

Water Level Readings

Date	W. L. Depth (mBGS)
2017/02/17	6.69

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH (kPa): O UNCONFINED; + FIELD VANE & Sensitivity; ● QUICK TRIAXIAL; × LAB VANE; 20 40 60 80 100
PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%): 10 20 30
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m^3)
REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement: 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; O ε=3% Strain at Failure

LOG OF BOREHOLE BH4

GeoPro CONSULTING LIMITED

PROJECT: Geotechnical Investigation for Proposed Development
CLIENT: JD Development Group
PROJECT LOCATION: 180 Groh Avenue, Cambridge, Ontario
DATUM: Geodetic
BH LOCATION: See Borehole Location Plan N 4807552.216 E 555066.227

DRILLING DATA
Method: Continuous Flight Auger- Auto Hammer
Diameter: 205 mm
Date: Feb/03/2017

REF. NO.: 17-1764G
ENCL NO.: 5

ELEV (m) / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION
309.1 / 0.0	**TOPSOIL:** (150 mm)				Concrete	
0.2	**FILL:** sandy silt, to silty sand, trace clay, trace gravel, containing asphalt pieces, trace organics, brown, moist, loose to compact	1	SS	15		
		2	SS	6		308
	--layer of organic silt	3	SS	8		
306.9 / 2.2	**PEAT:** trace sand, trace gravel, some silt, trace rootlets, containing wood fragments, black, moist, loose	4	SS	10	Bentonite	307
306.2 / 3.0	**SANDY SILT:** trace clay, trace gravel, trace organic, brown to dark brown, moist, loose to dense	5	SS	5		306
						305
	---containing cobbles and boulders, brown, wet, compact to dense	6	SS	14		304
		7	SS	41	W. L. 303.0 m Feb 17, 2017; Sand; Screen	303
302.0 / 7.2	**SAND:** trace to some gravel, trace silt, brown, wet, very dense	8	SS	80	Natural Pack	302, 301
300.9 / 8.2	**END OF BOREHOLE**					

Notes
1) Water encountered at 7.6 m below the existing ground surface (mBGS) during drilling.
2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling

Water Level Readings

Date	W. L. Depth (mBGS)
2017/02/17	6.08

Chart headings: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100); SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × LAB VANE (20, 40, 60, 80, 100); PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) (10, 20, 30); POCKET PEN. (Cu) (kPa); NATURAL UNIT WT (kN/m^3); REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES $+^3, \times^3$: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH5

PROJECT: Geotechnical Investigation for Proposed Development
CLIENT: JD Development Group
PROJECT LOCATION: 180 Groh Avenue, Cambridge, Ontario
DATUM: Geodetic
BH LOCATION: See Borehole Location Plan N 4807589.65 E 555185.926

DRILLING DATA
Method: Continuous Flight Auger- Auto Hammer
Diameter: 205 mm
Date: Feb/01/2017

REF. NO.: 17-1764G
ENCL NO.: 6

ELEV (m) / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION
310.8 / 0.0	**TOPSOIL:** (430 mm)	1	SS	10	Concrete	
310.3 / 0.4	**FILL:** sand and silt to silty sand, trace organics, trace rootlets, dark brown to brown, moist, very loose to loose	2	SS	4		310
309.3 / 1.5	**SAND:** trace silt, trace to some gravel, containing cobbles and boulders, brown, moist, compact to dense	3	SS	18		309
		4	SS	33		308
307.9 / 2.9	**SAND AND SILT TILL:** trace clay, trace to some gravel, layers of sand, containing cobbles and boulders, brown, moist, dense to very dense	5	SS	48	Bentonite	307
306.1 / 4.7	**SAND AND GRAVEL:** trace silt, containing cobbles and boulders, brown, moist, very dense	6	SS	50/100 mm		306
305.2 / 5.6	**SAND AND SILT TILL:** trace clay, trace gravel, containing cobbles and boulders, brown, moist, very dense	7	SS	50/125 mm	Sand; Screen	305
303.6 / 7.2	**GRAVELLY SAND:** trace silt, containing cobbles and boulders, brown, wet, very dense	8	SS	117	W. L. 303.1 m Feb 17, 2017	
302.7 / 8.1	**END OF BOREHOLE**					

Notes
1) Water encountered at 7.6 m below the existing ground surface (mBGS) during drilling.
2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling

Water Level Readings

Date	W. L. Depth (mBGS)
2017/02/17	7.65

Chart columns: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100); SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × LAB VANE (20, 40, 60, 80, 100); PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) (10, 20, 30); POCKET PEN. (Cu) (kPa); NATURAL UNIT WT (kN/m^3); REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH6

PROJECT: Geotechnical Investigation for Proposed Development
CLIENT: JD Development Group
PROJECT LOCATION: 180 Groh Avenue, Cambridge, Ontario
DATUM: Geodetic
BH LOCATION: See Borehole Location Plan N 4807472.021 E 555093.865

DRILLING DATA
Method: Continuous Flight Auger- Auto Hammer
Diameter: 205 mm
Date: Feb/01/2017

REF. NO.: 17-1764G
ENCL NO.: 7

ELEV (m) / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS
304.0 / 0.0					
303.8 / 0.0	**TOPSOIL:** (200 mm)				Concrete
0.2	**FILL:** silty sand, trace to some gravel, trace clay, trace organic, trace rootlets, containing wood pieces, dark brown to brown, moist, loose to compact	1	SS	16	
		2	SS	8	
		3	SS	13	
301.9 / 2.1	**PROBABLE FILL:** silty sand to sandy silt, trace clay, trace gravel, seams of sand, trace organics, trace rootlets, dark brown to brown, moist, very loose	4	SS	4	
301.1 / 2.9	**PROBABLE FILL:** silty sand, trace to some gravel, brown, wet, compact				Bentonite
300.7 / 3.4	**SILT:** trace clay, trace to some fine sand, brown, wet, compact	5	SS	14	W. L. 300.6 m Feb 17, 2017
299.9 / 4.1	**SAND AND SILT:** some clay, trace to some gravel, layers of silty sand, brown, wet, compact	6	SS	14	
297.7 / 6.3	**SANDY SILT TILL TO SILTY SAND TILL:** trace clay, trace to some gravel, containing cobbles and boulders, brown to grey, moist, very dense	7	SS	86/200 mm	Sand, Screen
		8	SS	88/250 mm	Natural Pack
296.0 / 8.0	**END OF BOREHOLE**				

Elevation scale: 303, 302, 300, 299, 298, 297, 296

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH (kPa): ○ UNCONFINED; + FIELD VANE & Sensitivity; ● QUICK TRIAXIAL; × LAB VANE — 20 40 60 80 100
PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L; WATER CONTENT (%): 10 20 30
POCKET PEN. (Cu) (kPa) | NATURAL UNIT WT (kN/m^3) | REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

Notes
1) Water encountered at 3.4 m below the existing ground surface (mBGS) during drilling.
2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling

Water Level Readings

Date	W. L. Depth (mBGS)
2017/02/17	3.44

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH7

PROJECT: Geotechnical Investigation for Proposed Development
CLIENT: JD Development Group
PROJECT LOCATION: 180 Groh Avenue, Cambridge, Ontario
DATUM: Geodetic
BH LOCATION: See Borehole Location Plan N 4807521.882 E 554969.286

DRILLING DATA
Method: Continuous Flight Auger- Auto Hammer
Diameter: 205 mm
Date: Feb/09/2017

REF. NO.: 17-1764G
ENCL NO.: 8

ELEV (m) / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS
300.7 / 0.0	**TOPSOIL:** (610 mm)	1	SS	2	W. L. 300.7 m Feb 17, 2017
300.1 / 0.6	**PROBABLE FILL:** silty sand, trace gravel, brown, moist, compact	2	SS	9	Bentonite
299.3 / 1.5	**SAND:** trace gravel, trace silt, dark brown, wet, compact	3	SS	16	
298.5 / 2.2	**SILT:** trace to some sand, trace clay, layers of fine sand, brown, wet to saturated, very loose to compact	4	SS	3	
		5	SS	14	Sand
297.3 / 3.4	**SILTY SAND TO SAND:** trace to some gravel, brown, wet, compact				Screen
		6	SS	0	
295.6 / 5.1	**FINE SAND AND SILT:** brown, wet, very loose to compact				Natural Pack
		7	SS	16	
294.3 / 6.4	**END OF BOREHOLE:**				

Elevation scale: 300, 299, 298, 297, 296, 295

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × LAB VANE; 20 40 60 80 100
PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L
WATER CONTENT (%): 10 20 30
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m^3)
REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

Notes
1) Water encountered at 1.5 m below the existing ground surface (mBGS) during drilling.
2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling

Water Level Readings

Date	W. L. Depth (mBGS)
2017/02/17	0.05

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH8

PROJECT: Geotechnical Investigation for Proposed Development
CLIENT: JD Development Group
PROJECT LOCATION: 180 Groh Avenue, Cambridge, Ontario
DATUM: Geodetic
BH LOCATION: See Borehole Location Plan N 4807603.07 E 555028.313

DRILLING DATA
Method: Continuous Flight Auger- Auto Hammer
Diameter: 205 mm
Date: Feb/06/2017

REF. NO.: 17-1764G
ENCL NO.: 9

SOIL PROFILE

ELEV (m) / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION
309.7						
309.5 / 0.0	**TOPSOIL:** (250 mm)				Concrete	
0.3	**FILL:** gravelly sand, to sand and gravel, trace silt, containing concrete fragments, brown, moist, compact to dense	1	SS	17		309
		2	SS	35		
		3	SS	22		308
		4	SS	25		307
306.8 / 2.9	**SANDY SILT:** some gravel, containing cobbles and boulders, brown, moist, compact				Bentonite	
306.4 / 3.3	**GRAVELLY SAND TO SAND AND GRAVEL:** containing cobbles and boulders, trace silt, brown, moist to wet, compact to very dense	5	SS	27		306
		6	SS	50/50 mm		305
						304
		7	SS	73	W. L. 303.2 m; W. L. 303.0 m Feb 17, 2017	
		8	SS	87/230 mm		302
						301
		9	SS	39	Bentonite	

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × LAB VANE: 20 40 60 80 100
PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L
WATER CONTENT (%): 10 20 30
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m^3)
REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

PROJECT: Geotechnical Investigation for Proposed Development
CLIENT: JD Development Group
PROJECT LOCATION: 180 Groh Avenue, Cambridge, Ontario
DATUM: Geodetic
BH LOCATION: See Borehole Location Plan N 4807603.07 E 555028.313

DRILLING DATA
Method: Continuous Flight Auger- Auto Hammer
Diameter: 205 mm
Date: Feb/06/2017

REF. NO.: 17-1764G
ENCL NO.: 9

(m) ELEV / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	GRAVELLY SAND TO SAND AND GRAVEL: containing cobbles and boulders, trace silt, brown, moist to wet, compact to very dense(Continued)	10	SS	73		299	
298.0 / 11.7	**CLAYEY SILT TILL:** trace sand, trace gravel, layers of sandy silt, brown, moist, very dense	11	SS	50		298	
					Sand, Screen	297	
		12	SS	50	Cave in	296	
295.7 / 14.0	**END OF BOREHOLE**						

Notes
1) Water encountered at 6.4 m below the existing ground surface (mBGS) during drilling.
2) Two 51 mm dia. monitoring wells were installed in borehole upon completion of drilling

Water Level Readings

Date	W. L. Depth (mBGS)
2017/02/17	6.66 (Shallow)
2017/02/17	6.55 (Deep)

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH (kPa): ○ UNCONFINED; + FIELD VANE & Sensitivity; ● QUICK TRIAXIAL; × LAB VANE: 20 40 60 80 100
PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT W_L
WATER CONTENT (%): 10 20 30
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m^3)

Depth scale: 11, 12, 13, 14

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH9

PROJECT: Geotechnical Investigation for Proposed Development
CLIENT: JD Development Group
PROJECT LOCATION: 180 Groh Avenue, Cambridge, Ontario
DATUM: Geodetic
BH LOCATION: See Borehole Location Plan N 4807702.583 E 555002.228

DRILLING DATA
Method: Continuous Flight Auger- Auto Hammer
Diameter: 205 mm
Date: Feb/08/2017

REF. NO.: 17-1764G
ENCL NO.: 10

ELEV (m) / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS
310.8 / 0.0	**FILL:** sandy silt, trace gravel, trace rootlets, dark brown, moist, compact	1	SS	11	Concrete
310.1 / 0.7	**FILL:** sand, trace silt, trace gravel, trace rootlets, trace organics, brown, moist, very loose to compact	2	SS	4	
		3	SS	6	
308.2 / 2.6	**FILL:** gravelly sand, trace silt, trace organics, brown to dark brown, moist, compact	4	SS	28	
307.9 / 3.0	**SANDY SILT:** trace clay, trace gravel, containing cobbles and boulders, brown, moist, dense	5	SS	32	Bentonite
306.7 / 4.1	**SANDY SILT TILL:** trace clay, trace gravel, containing cobbles and boulders, brown, moist, very dense	6	SS	50/152mm	
305.2 / 5.6	**GRAVELLY SAND TO SAND AND GRAVEL:** trace silt, brown, moist to wet, very dense	7	SS	50	Sand; Screen
					W. L. 303.4 m Feb 17, 2017; W. L. 303.1 m Feb 17, 2017
	-wet	8	SS	75	
		9	SS	69	Bentonite

Elevation scale: 310, 309, 308, 307, 306, 305, 302, 301

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH (kPa): O UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × LAB VANE: 20 40 60 80 100
PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L
WATER CONTENT (%): 10 20 30
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m^3)
REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; O ε=3% Strain at Failure

PROJECT: Geotechnical Investigation for Proposed Development
CLIENT: JD Development Group
PROJECT LOCATION: 180 Groh Avenue, Cambridge, Ontario
DATUM: Geodetic
BH LOCATION: See Borehole Location Plan N 4807702.583 E 555002.228

DRILLING DATA
Method: Continuous Flight Auger- Auto Hammer
Diameter: 205 mm
Date: Feb/08/2017

REF. NO.: 17-1764G
ENCL NO.: 10

(m) ELEV DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION
	GRAVELLY SAND TO SAND AND GRAVEL: trace silt, brown, moist to wet, very dense(Continued)	10	SS	63		300
299.1 11.7	**SANDY SILT TILL:** trace clay, trace gravel, containing cobbles and boulders, brown, moist, very dense	11	SS	50/152mm	Sand; Screen	299
297.1		12	SS	50/152mm		
13.7	**END OF BOREHOLE** Note 1)Two 51 mm dia. monitoring wells were installed in borehole upon completion of drilling Water Level Readings Date W. L. Depth (mBGS) 2017/02/17 7.47 (Shallow) 2017/02/17 7.71 (Deep)					

Depth scale: 11, 12, 13

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × LAB VANE; 20 40 60 80 100
PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L; WATER CONTENT (%): 10 20 30
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m^3)
REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LIMITATIONS TO THE REPORT

This report is intended solely for the Client named. The report is prepared based on the work has been undertaken in accordance with normally accepted geotechnical engineering practices in Ontario.

The comments and recommendations given in this report are based on information determined at the limited number of the test hole and test pit locations. The boundaries between the various strata as shown on the borehole logs are based on non-continuous sampling and represent an inferred transition between the various strata and their lateral continuation rather than a precise plane of geological change. Subsurface and groundwater conditions between and beyond the test holes and test pits may differ significantly from those encountered at the test hole and test pit locations. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the test hole and test pit locations and should not be used for other purposes, such as grading, excavating, planning, development, etc.

The report reflects our best judgment based on the information available to GeoPro Consulting Limited at the time of preparation. Unless otherwise agreed in writing by GeoPro Consulting Limited, it shall not be used to express or imply warranty as to any other purposes. No portion of this report shall be used as a separate entity, it is written to be read in its entirety. The information contained herein in no way reflects on the environment aspects of the project, unless otherwise stated.

The design recommendations given in this report are applicable only to the project designed and constructed completely in accordance with the details stated in this report.

Should any comments and recommendations provided in this report be made on any construction related issues, they are intended only for the guidance of the designers. The number of test holes and test pits may not be sufficient to determine all the factors that may affect construction activities, methods and costs. Such as, the thickness of surficial topsoil or fill layers may vary significantly and unpredictably; the amount of the cobbles and boulders may vary significantly than what described in the report; unexpected water bearing zones/layers with various thickness and extent may be encountered in the fill and native soils. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and make their own conclusions as to how the subsurface conditions may affect their work and determine the proper construction methods.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. GeoPro Consulting Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.