

REPORT ON GEOTECHNICAL INVESTIGATION NW YONGE AND GREEN LANE SECONDARY PLAN EAST GWILLIMBURY, ONTARIO

REPORT NO.: 4007-14-G-YON-A REPORT DATE: JUNE 8, 2015

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TABLE OF CONTENTS

1.0	INT	RODUCTION	1	1
2.0	SITE	E CONDITION	1	1
3.0	INV	ESTIGATION PROCEDURE	1	1
4.0	SUM	IMARIZED SITE AND SUBSURFACE CONDI	TIONS	2
	4.1	Surface Course	2	2
	4.2	(Reworked) Fill	2	2
	4.3	Sandy Silt		3
	4.4	Clayey Silt	3	3
	4.5	Sandy Silt Till	2	1
	4.6	Clayey Silt Till	2	1
	4.7	Silty Sand/Sand		5
	4.8	Ground Water	5	5
5.0	REC	OMMENDATIONS	(6
	5.1	Site Preparation	-	7
	5.2	Pipe Bedding	-	7
	5.3	Foundation Design	-	7
	5.4	Perimeter Wall Construction	9)
	5.5	Slab Construction	9)
	5.6	Earthquake Consideration	1	10
	5.7	Excavation and Backfilling	1	10
	5.8	Pavement Construction	1	10
6.0	GEN	IERAL STATEMENT OF LIMITATION	1	12
<u>DRA</u>	WINC	<u>SS</u>		
		ocation Plan eholes 1 to 21	Drawing No. 1 Drawing No. 2 to 22	
FIG	URES			
Detai	ils of P	ermanent Perimeter Drainage System	Figure No. 1	

APPENDIX A

Guidelines of Engineered Fill



1.0 INTRODUCTION

Toronto Inspection Ltd. was retained by Yonge Green Lane GP Inc. to conduct a geotechnical borehole investigation for the proposed NW Yonge and Green lane Secondary Plan in East Gwillimbury, Ontario (hereinafter described as "the Site"). We understand that the Site will consist of the following uses: commercial mixed use, medium and low density residential, parks and schools.

The subject Site is undulating with grade difference of almost 27m between the borehole locations. Only a limited number of boreholes were carried out at the Site to provide a preliminary assessment of the Site conditions and the report should, therefore, be considered as a preliminary report.

The following preliminary geotechnical data has been provided on the basis of the subsoil and groundwater conditions, encountered at the borehole locations:

- General founding conditions
- Foundation design for foundations
- Pavement Design and Construction
- Other Recommendations of Construction

Additional geotechnical investigation(s) will have to be carried out, once the final Site grading and the type, elevations and locations of the proposed development have been established, to confirm the design features relevant to the geotechnical analyses and the recommendations and comments provided in the preliminary report.

2.0 SITE CONDITION

The Site, approximately 106 ha. in area, fronts on the west side of Yonge Street and on the north side of Green Lane in East Gwillimbury. At the time of investigation, the Site was a farmland with farmhouses, including barns and silos at the southeast portion of the Site. The existing site gradient is undulating, having a grade difference of more than 27m across the Site.

3.0 INVESTIGATION PROCEDURE

The field work for the preliminary investigation was carried out between December December 9 and 15, 2014, which included drilling 21 sampled boreholes (BH-1 to BH-21) using a track mounted drill rig, equipped with sampling rods and continuous solid



stem augers. The drilling and the sampling equipments were supplied and operated by a specialist drilling contractor.

The boreholes extended to depths of 6.2m to 6.6m from grade. Soil samples were recovered from the boreholes at regular intervals with a split spoon sampler in conjunction with Standard Penetration Tests using a driving energy of 475 joules (350 ft-lbs). The retrieved soil samples were identified and logged in the field. They were carefully bagged and delivered to our laboratory for later visual identification and determination of in-situ moisture contents. Groundwater observations were made in the open boreholes during and upon the completion of drilling. Boreholes BH-5, BH-14 to BH-17 and BH-20 were completed as observation wells to determine the current static groundwater condition.

The borehole locations were established with stakes in the field, at the locations shown on the appended Borehole Location Plan (Drawing No.1).

The geodetic ground elevations at the borehole locations were provided by the client.

4.0 SUMMARIZED SITE AND SUBSURFACE CONDITIONS

Reference is made to the Borehole Location Plan (Drawing No. 1) and the appended Logs of Borehole sheets (Drawing Nos. 2 to 22) for details of field work, including soil classification, inferred stratigraphy and groundwater observations carried out during and on completion of drilling of the boreholes.

The subsoil below the surficial topsoil, consisted of native deposits of silt, silt till and silty sand/sand layers or fill material of sandy silt to clayey silt below the topsoil in some of the borehole areas. Brief descriptions of the subsoils encountered at the borehole locations are as follows:

4.1 Surface Course

Topsoil, 250mm to 900mm in thickness, was contacted at the ground surface at the borehole locations.

4.2 (Reworked) Fill

At the locations of BH-2, BH-4, BH-8 to BH-10, BH-14 to BH-21, a layer of fill was contacted below the topsoil. It is our opinion that the fill may represent the



material used in previous regrading of the Site or the reworked soils during the previous farming process.

The fill consisted of dark brown to brown sandy silt to clayey silt with trace of rootlets, scattered or pockets of topsoil. It extended to depths of 0.6m to 1.7m from the existing ground level.

4.3 Sandy Silt

Underlying the topsoil at BH-1, BH-11 and BH-13 locations and below the fill at BH-4 location, at depths of 0.3m to 0.6m from grade, a sandy silt deposit, with silty sand, clayey silt, gravel or seams of sand, was contacted. Based on the Standard Penetration N-values of 5 to 25 blows per 0.3m penetration, the relative density of the sandy silt deposit was loose to compact.

The sandy silt deposit extended to depths of 1.4m to 4.3m from grade. The in-situ moisture content of the soil samples retrieved from this deposit ranged from 5% to 19%, indicating moist to wet conditions.

A lower sandy silt deposit was contacted below a sandy silt till deposit at BH-4 location, at a depth of 5.8m from grade. BH-4 was terminated in the lower sandy silt deposit and the lower limit of this deposit was not established.

Based on the Standard Penetration N-value of more than 100 blows per 0.3m penetration, the relative density of the lower sandy silt deposit was very dense. The in-situ moisture content of the soil sample retrieved from this deposit was 8%, indicating moist conditions.

4.4 Clayey Silt

Underlying the topsoil at BH-3 location and underlying the fill at BH-15, BH-16, BH-19 to BH-21 location, a clayey silt deposit was contacted at depths of 0.6m to 1.7m from grade. The clayey silt deposit contained trace to some sandy silt, gravel or seams of fine sand. Based on the Standard Penetration N-values of 4 to 13 blows per 0.3m penetration, the consistency of the deposit was firm to stiff.

The clayey silt deposit extended to depths of 1.4m to 4.3m from the existing ground level. The in-situ moisture content of the soil samples retrieved from the clayey silt deposits ranged from 13% to 28%, indicating moist to very moist conditions, with wet spots near the ground surface.



A lower clayey silt deposit was contacted below a sandy silt till deposit at BH-3 location, at a depth of 4.9m from grade. BH-3 was terminated in the lower clayey silt deposit and the lower limit of this deposit was not established.

Based on the Standard Penetration N-value of 25 blows per 0.3m penetration, the consistency of the lower clayey silt deposit was very stiff. The in-situ moisture content of the soil sample retrieved from this deposit was 12%, indicating moist conditions.

4.5 Sandy Silt Till

Underlying the topsoil, or fill or deposits of sandy silt or clayey silt or clayey silt till at BH-1 to BH-3, BH-5 to BH-12, BH-14, BH-17 and BH-19 to BH-21, at depths of 0.6m to 5.8m from grade, a sandy silt till deposit, with some silty sand , gravel, trace of clayey silt, or seams of fine sand, was contacted. Based on the Standard Penetration N-values of 9 to more than 100 blows per 0.3m penetration, the relative density of the silty silt till deposit was loose to very dense, generally in compact to dense state.

Boreholes BH-2, BH-5, BH-6, BH-9 to BH-11, BH-17 and BH-19 to BH-21 were terminated in the sandy silt till deposit at depths of 6.2m to 6.6m from grade and the lower limit of this deposit was not established. The sandy silt till deposit, at BH-1, BH-3, BH-7, BH-8, BH-12 and BH-14 extended to depths of 2.1m to 5.8m from grade.

The in-situ moisture content of the soil samples retrieved from this deposit ranged from 7% to 20%, indicating moist to very moist conditions, with wet pockets or layers.

4.6 Clayey Silt Till

Underlying the topsoil or fill or deposits of sandy silt or clayey silt, at BH-4, BH-7, BH-13, BH-15 and BH-17 locations, a clayey silt till deposit was contacted at depths of 0.6m to 4.3m from grade. The clayey silt till deposit contained trace to some sandy silt or gravel. Based on the Standard Penetration N-values of 8 to 48 blows per 0.3m penetration, the consistency of the deposit was firm to hard, generally in firm to very stiff state.



Boreholes BH-13, BH-15 were terminated in the clayey silt till deposit at depths of 6.6m from grade and the lower limit of this deposit was not established. The clayey silt till deposit, at BH-4, BH-7 and BH-17 locations, extended to depths of 2.1m to 5.8m from the existing ground level. The in-situ moisture content of the soil samples retrieved from the clayey silt till deposits ranged from 8% to 22%, indicating moist to very moist conditions, with wet spots near the ground surface.

4.7 Silty Sand/Sand

Underlying deposits of sandy silt till or clayey silt or clayey silt till, at BH-7, BH-8, BH-12, BH-14, BH-16, BH-18 and BH-19 locations, at depths of 2.1m to 5.8m from garde, silty and or sand deposits were contacted. The deposits, generally fine to medium grained, consisted of some silt or gravel, with occasional trace of clayey silt. Based on the Standard Penetration N-values of 36 to more than 100 blows per 0.3m penetration, the relative density of the deposits was dense to very dense.

Boreholes BH-7, BH-8, BH-12, BH-14, BH-16 and BH-18 were terminated in the silty sand/sand deposits at depths of 6.2m to 6.6m from grade and the lower limit of these deposits was not established. The silty sand deposit, at BH-19 locations, extended to a depth of 5.8m from grade.

The in-situ moisture content of the soil samples retrieved from this deposit ranged from 8% to 17%, indicating moist to wet conditions.

4.8 Ground Water

Free water or wet cave-in was recorded in the open boreholes at BH-1, BH-2, BH-4, BH-7 to BH-16 and BH-18 to BH-20, at depths between 2.7m and 6.0m from the existing ground level, upon the completion of borehole drilling. No free water was contacted in the remaining boreholes throughout the investigation.



Well	Jan 5 &	\$ 6, 2015	Mar 2	6, 2015	Apr 14, 2015			
Location	Depth (m)			Elevation (m)	Depth * (m)	Elevation (m)		
BH-5	1.10	287.37	1.62	286.85	1.87	286.60		
BH-14	0.50	276.78	1.37	275.91	1.02	276.26		
BH-15	0.53	275.88	1.07	275.34	0.70	275.71		
BH-16	1.05	277.00	1.92	276.13	1.33	276.72		
BH-17	0.90	267.26	1.71	266.45	1.62	266.54		
BH-20	1.50	263.17	2.96	261.71	2.65	262.02		

On January 5, 6, March 24 and April 14, 2015, the water levels were documented in the observation wells at BH-5, BH-14 to BH-17 and BH-20:

*: Water levels in the wells were measured after bailing out and recharge on and after March 26, 2015.

Based on the field records and the moisture content profiles of soil samples, as shown on the appended borehole logs, it is our opinion that the depths of free water or cave-in represent perched water in discontinuous sand layers or lenses. It is our opinion that there is no continuous groundwater table at the Site, within the depths of investigation.

5.0 **RECOMMENDATIONS**

We understand that the Site will be used for commercial, residential, parks and schools. However, the details of the development and the final gradients of the Site will be determined at detailed design.

Since the existing site gradient is undulating, with a grade difference of more than 27m across the Site, we recommend that additional boreholes should be required to obtain site specific subsoil and groundwater data and confirm our recommendations. For the purpose of this preliminary report, we have assumed that the final grade will be close to the existing ground surface.

Based on the subsoil data obtained at the borehole locations, our recommendations are as follows:



5.1 Site Preparation

The soil description and depth of fill shown on the Borehole Logs are specific depths at the borehole locations only. The thickness of topsoil and the depth of fill at locations beyond the boreholes may be thicker or deeper, especially in the location of previous excavations. We recommend that the contractor bidding for the job should determine the depths of deleterious material by test pits and allow for removal of any deleterious fill and material, with high moisture and/or organic content, during the site preparation for site grading.

Compressible topsoil and fill material containing relatively high organic content will not be suitable for reuse in areas where future settlement cannot be tolerated. This material will have to be disposed off-site or reused in landscaped areas, subject to approval by the landscape architect.

Any new fill at the Site should consist of organic free material, placed in lifts of 200 to 300mm and compacted to at least 98% of its Standard Proctor maximum dry density (SPMDD).

5.2 Pipe Bedding

Based on the borehole information, the subsoil at service trench inverts may consist of fill, silt, till or sand deposits. Any unstable fill material at the trench invert should be sub-excavated and replaced with a granular material, compacted in lifts to the invert level to 98% of its SPMDD.

The pipe bedding for underground services, including catch basins and manholes, should consist of OPSS Granular A, 20mm crusher run limestone, or equivalent, compacted to 95% of its Standard Proctor maximum dry density (SPMDD). If free water is encountered in the trenches, from saturated sand layers, the bedding in the service trenches may consist of HL6 stone or equivalent, provided that a geotextile filter fabric (Terrafix 270R or equivalent) is used to separate the stone bedding from the base and the sides of the excavation. The geotextile filter fabric must surround the clear stone bedding completely.

5.3 Foundation Design

The existing fill is not competent to support building foundations. The proposed building foundations will have to extend through the fill and founded in the underlying native soil deposits.



The following design bearing pressures should be used for the design of footings, founded in the native undisturbed soils:

- Conventional footings founded in the sandy silt till or sandy silt deposits below the fill, at BH-2, B-4, BH-5, BH-8 to BH-10 and BH-12 locations, at a minimum depth of 1.2m from grade:
 - Factored Ultimate Limit State: 200 kPa
 - Serviceability Limit State: 150 kPa
- Conventional footings founded in the sandy silt, clayey silt, sandy silt till or clayey silt till deposits, at the remaining boreholes, at a minimum depth of 1.2m from grade:
 - Factored Ultimate Limit State: 150 kPa
 - Serviceability Limit State: 100 kPa

Other alternatives will be to remove all of the existing fill in the proposed building areas and replaced with selected on-site / imported organic free material, compacted in lifts not exceeding 200mm, in accordance with the engineered fill requirement (Guideline of Engineered Fill is attached in Appendix A). Conventional footings founded in the engineered fill can be designed for:

- Factored Ultimate Limit State: 200 kPa
- Serviceability Limit State: 150 kPa

The total and differential settlement of footings, with the designed bearing pressures as recommended above, will not exceed 25 mm and 20mm respectively.

Footings founded in engineered fill should be reinforced with at least $2 \ge 15M$ bars continuously. Consequently, the foundation walls on engineered fill should be reinforced with $2 \ge 15M$ bars at the top of the walls.

It should be noted that the recommendations for footings have been analysed by *Toronto Inspection Ltd.* from the information obtained at the borehole location. Further borehole investigation is necessary after the locations of the proposed buildings are finalised. In addition, the bearing material, the interpretation between the boreholes and the recommendations of this report must be checked through field inspection provided by *Toronto Inspection Ltd.* to validate the information for use during the construction stage.



5.4 Perimeter Wall Construction

Where subsurface walls will retain unbalanced earth loads, the lateral soil pressure may be computed using the following expression:

 $p = K (\gamma H + q)$

where	p = lateral earth pressure	(kPa)
	K = lateral earth pressure coefficient	0.4
	γ = bulk unit weight of backfill	21.0 kN/m^3
	H= depth of wall below the finished grade	(m)
	q = surcharge loads adjacent to the walls	(kPa)

This expression assumes that a permanent free drainage system is provided to prevent a build up of hydrostatic pressure next to the wall. A typical installation detail of the permanent perimeter drainage system is shown on appended Figure No.1. In addition, the ground surface around the building should be sloped away from the building.

5.5 Slab Construction

If the existing fill will be left in place for supporting a slab-on-grade, long term settlement may occur. If some movement in the floor slab is acceptable, conventional slab-on-grade can be constructed, having the floor subgrade re-compacted with a roller, to at least 95% of its Standard Proctor maximum dry density. Any loose or wet spot as identified in the compaction process will have to be removed and replaced with selected on-site dry material.

If no movement in the floor slab is tolerable, the fill below the slab-on-grade will have to be completely removed. Selected on-site / imported material, free of organics, may be used to bring the excavation to the required grade, compacted to a minimum of 98% of its Standard Proctor maximum dry density. If heavy floor loading is anticipated, especially for the industrial buildings, the fill should be compacted in 200mm lifts to at least 98% of its Standard Proctor maximum dry density.

A minimum of 150 mm thick layer of 19mm OPSS Granular A, or equivalent, is recommended as a moisture barrier below the floor slab. The bedding should be compacted to at least 100% SPMDD. In our opinion, no underfloor drains will be required below the ground floor slab or basement slab for depths of up to 2.0m from the existing grades.



5.6 Earthquake Consideration

The 2006 Ontario Building Code requires that all buildings be designed to resist earthquake forces. In accordance with Table 4.1.8.4.A of the Ontario Building Code, the site classification for the Seismic Site Response is Class D (stiff soils).

The acceleration and velocity based site coefficients, Fa and Fv, should conform to Tables 4.1.8.4.B and 4.1.8.4.C. of the Ontario Building Code. These values should be reviewed by the Structural Engineer.

5.7 Excavation and Backfilling

All excavations should comply with the Ontario Occupational Health and Safety Act. Any excavation deeper than 1.2m should be sloped back to a safe angle of around 45°. A flatter slope will be required for excavation in the fill or in saturated soils.

No groundwater problems are anticipated for excavation up to depths of 2.7m to 6.0m from grade, at the borehole locations. Groundwater seepage from wet sand layers will be minor which can be handled by pumping from filtered sumps, as necessary.

The on-site excavated material, separated from topsoil and organics, can be reused for site grading and trench backfill. In order to achieve the specified degree of compaction, drying of the on-site material may be required, prior to placement and compaction. Therefore, it is recommended that the excavation and backfilling process should be conducted in the dry and frost free seasons.

Any unsuitable fill, such as topsoil and other compressible fill, may be reused in landscape areas, subject to the approval of the landscape architect.

Backfill around catch basins, manholes and narrow trenches should consist of imported granular material, and should be compacted using a medium or light vibratory equipment.

5.8 **Pavement Construction**

The existing on-site material contains mixture of clayey silt to sandy silt, and is susceptible to frost heaving. The following pavement design is recommended



based on the assumption that perforated sub-drains will be installed to prevent buildup of water in the granular bases of the pavement:

			Light Duty	Heavy Duty
			<u>LD Parking</u>	Fire Route
Asphaltic Con	icrete	OPSS HL3 or equivalent	65mm	40mm
		OPSS HL8 or equivalent	-	60mm
Base: OPSS		Granular A or 20mm crusher-run	150mm	150mm
Sub-base:	OPSS	Granular B or 50mm crusher-run	200mm	350mm

Roads and driveways to be assumed by the local municipality should be constructed to the municipal standards.

The granular base and sub-base should be compacted to a minimum of 100% SPMDD. Asphaltic concrete should be compacted to at least 96% Marshall density.

The above pavement thicknesses are based on favourable site conditions and the construction being carried out during the drier time of the year, that the subgrade is stable, not heaving under construction traffic. If the subgrade is wet and unstable, additional thickness of sub-base material will be required.

Following site grading, the subgrade of the entire pavement should be proofrolled using a heavy vibratory roller. Any soft spots revealed by the proof-rolling should be sub-excavated and replaced with approved dry material and compacted to at least 95% of the Standard Proctor maximum dry density (SPMDD) to 300mm below the subgrade level. The upper 300mm of the subgrade should be compacted to 98% SPMDD.

Continuous perforated, OPSS 405, longitudinal drains, minimum diameter of 100mm, should be used as sub-drains, on both sides of the roadways. The subdrains should be installed on a positive gradient towards the outlets (collecting into catch basins), at a minimum depth of 800mm below the pavement level, to allow for a free flow of water. The backfill above the drains should comprise of free draining Granular B or its equivalent and should be continuous with the granular sub-base of the pavement. This will help in draining the pavement structure and minimize the differential heave of the pavement.



6.0 GENERAL STATEMENT OF LIMITATION

The comments and recommendations presented in this report are based on the subsoil and ground water conditions encountered at the borehole locations, indicated in the borehole location plan, and are intended for the guidance of the design engineer. Although we consider this report to be representative of the subsurface conditions at the subject property, the soil and the ground water conditions between and beyond the borehole locations may differ from those encountered at the time of our investigation and may become apparent during construction. Any contractor bidding on, or undertaking the works, should decide on their own investigation and interpretations of the groundwater and the soil conditions between the borehole locations.

Any use and/or the interpretation of the data presented in this report, and any decisions made on it by the third party are responsibility of the third parties. The responsibility of *Toronto Inspection Ltd.* is limited to the accurate interpretation of the soil and ground water conditions prevailing in the locations investigated and accepts no responsibility for the loss of time and damages, if any, suffered by the third party as a result of decisions or actions based on this report.

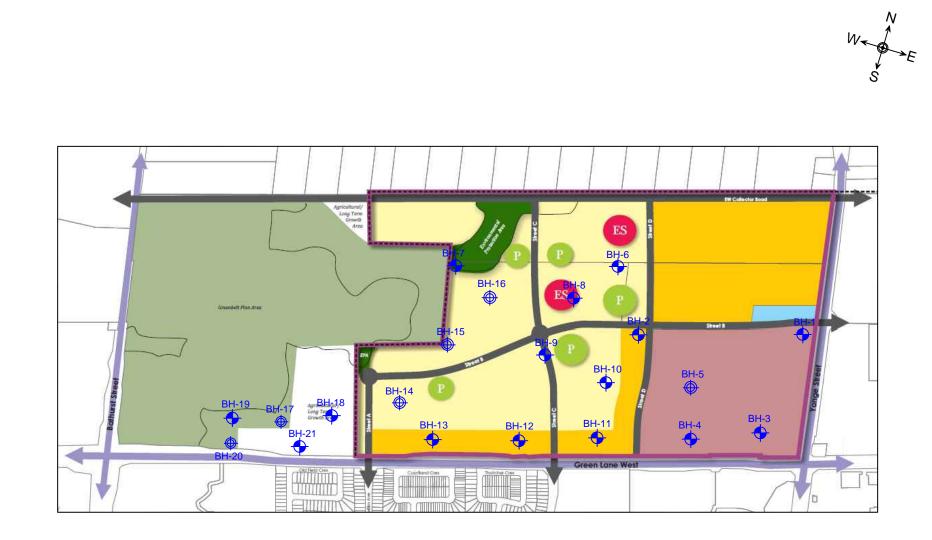
Any legal actions arising directly or indirectly from this work and/or *Toronto Inspection Ltd.'s* performance of the services shall be filed no longer than two years from the date of *Toronto Inspection Ltd.'s* substantial completion of the services. *Toronto Inspection Ltd.* shall not be responsible to the client for lost revenues, loss of profits, cost of content, claims of customers, or other special indirect, consequential or punitive damages.

To the fullest extent permitted by law, the client's maximum aggregate recovery against *Toronto Inspection Ltd.*, its directors, employees, sub-contractors and representatives, for any and all claims by clients for all causes including, but not limited to, claims of breach of contract, breach of warranty and /or negligence, shall be the amount of the fee paid to *Toronto Inspection Ltd.* for its professional services rendered under the agreement with respect to the particular site which is the subject of the claim by the client.



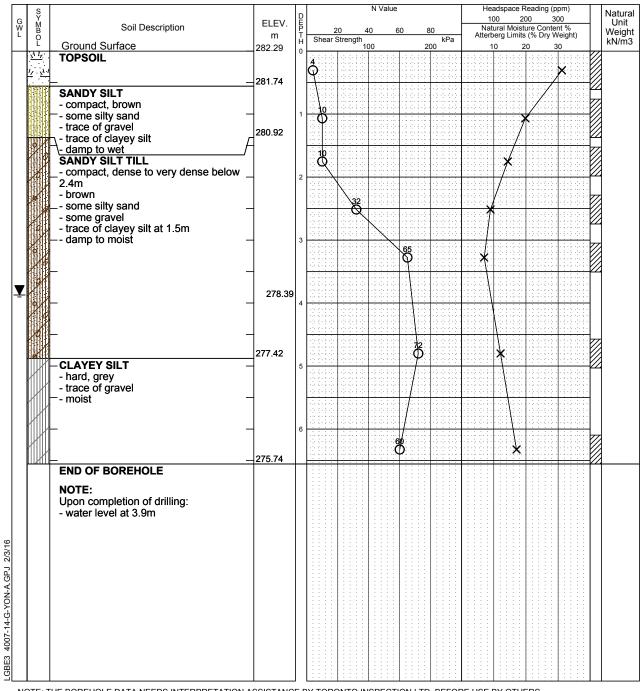


Drawings Borehole Location Plan Logs of Boreholes 1 to 22



TorontoInspection	TITLE: Borehole/ Monitoring Well Location Plan					
GEO-ENVIRONMENTAL CONSULTANTS Unit 16 Markham, Ontario L3R 9X2	LOCATION: NW Yonge and Green Lane Secondary Plan, East Gwillimbury, Ontario					
Tel: 905-940 8509 Fax: 905-940 8192 Email : TIL1@rogers.com	PROJECT NO. 4007-14-G-YON-A	DATE : December 2014	DRAWING NO : 1			

Project No.	<u> -1-1</u>					
				Dwg No.	2	
Project:	Geotechnical Investigation			Sheet No	o. <u>1</u> of	_1
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				Dwg No	. <u>3</u>
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	Time	Water Level (m)	Depth to Cave (m)							

Log of Borehole <u>BH-3</u> 4007-14-G-YON-A Project No. Dwg No. 4 Geotechnical Investigation Sheet No. 1 of 1 Project: NW Yonge and Green Lane Secondary Plan, East Gwillimbury, Ontario Location: Headspace Reading (ppm) . \boxtimes Auger Sample 12/9/14 × Date Drilled: Natural Moisture SPT (N) Value ΟØ Plastic and Liquid Limit -1 Drill Type: Track Mounted Drill Rig Dynamic Cone Test _

Shelby Tube

Field Vane Test

S Y		ELEV.	P				N Value	9		1 1	adspace F 00 2	00 3	00		Natura Unit
SY MB OL	Soil Description	m ELEV.	DEPTH	Shear	20 Stren	ath			80 kPa	Na Atter	tural Moist berg Limits	ture Conte s (% Dry V	nt % Veight)		Weigh kN/m3
L <u>\\ 1/</u>		280.20	0			10	0	: 	200		10 2	20 :	30 		KIN/III
<u> </u>		279.64		φ										¥	
	CLAYEY SILT	2/ 0.04													
ľ,	I - firm, brown I - trace of sandy silt -	-	1	Ι-φ								\checkmark			
H.	- trace of gravel - moist to damp														
HI		1		å											
H		278.07	2	1							[]				
9	SANDY SILT TILL	270.07									/				
1	compact, dense to very dense below _ 3.0m	-		0.000	ð		-2-6-2-6-				+*-				
19	- some clayey silt some gravel _														
ø	- seams of fine sand]	3			В					¥				
K	- moist 	-				Υ_					_				
X															
		1	4												
9															
6.		275.32					8				*				
	- CLAYEY SILT -		5	0000	100	· · · · · ·	\int							-2	
	- very stiff, grey - low plasticity			0.000		/									
11	- trace of sandy silt - trace of gravel	1				1									
ł1	moist	4	6			/								· · · ·	
HI					25 0						×				
	END OF BOREHOLE	273.65	_											-4	
	NOTES:														
	Upon completion of drilling: - no free water														
	- no free water														

NOTE: THE BOREHOLE DATA NEEDS INTERPRETATION ASSISTANCE BY TORONTO INSPECTION LTD. BEFORE USE BY OTHERS

Toronto Inspection Ltd.

Geodetic

Datum:

ORE	URE USE BT UTHERS									
	Time	Water Level (m)	Depth to Cave (m)							

Unconfined Compression

% Strain at Failure

Penetrometer

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Project No.	<u>4007-14-G-Y</u> ON-A Log C	of Borehol	le <u>B</u>	<u> -4</u>			
					Dwg No. 5	5	
Project:	Geotechnical Investigation				Sheet No.	<u>1</u> of	_1_
Location:	NW Yonge and Green Lane Secor	idary Plan, East G	willimbury	, Ontario			
Date Drilled:	12/9/14	Auger Sample SPT (N) Value	O 🛛	Headspace Re Natural Moistur Plastic and Lig	re	×	
Drill Type:	Track Mounted Drill Rig	Dynamic Cone Test - Shelby Tube	—	Unconfined Co % Strain at Fai	mpression	⊗ .	
Datum:	Geodetic	Field Vane Test	-	Penetrometer			

	ş			П			N Value					Reading (p		Natural
G W L	S Y B O L	Soil Description	ELEV.	1 P		20	40 (60 8	0	1 Nat	00 2 ural Mois	ture Conte s (% Dry V	800 ent %	Unit
L	p	Ground Surface	m	Ť	Shear	Strength	00		kPa					Weight kN/m3
	<u>×1</u> ,		283.29	0		1		20	00	1		20	30	-
			282.98		Ô							×		
			282.68							· : · : · : · : ·		1		
	rxxx1	- brown sandy silt to clayey silt			:::\\:								/	1
		moist	/		y y	LA						U I		
		SANDY SILT	′ ¬	1		¥						1		
		 compact, brown 										/		1
		 - trace of clayey silt 	-									1	7	
		- trace of gravel - seams of sand at 3.6m			Ċ	₿					*			
		- seams of sand at 3.6m	_	2		1								1
		- moist				1			• • • • • • • • •					
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			279.02			1221								
		CLAYEY SILT TILL - hard, grey	_				<u> </u>		• • • • • • • •					
		- some gravel					¥6 0							
		trace of sandy silt					φ				*			
		- moist	1	5					- 5 - 5 - 5 - 5 -		1.1.1.1		· · · · · · · · · · · · · · · · · · ·	1
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<u> </u>			27 7 7505	9							(
		SANDY SILT		6			50/65mr			· : · : · : /				
	0000	- very dense, grey	277.13	ļ			50/65mr			<u> </u>			Z Z	
		- some silty sand	П											
		- trace of gravel - moist	[]											
		END OF BOREHOLE	'											
		NOTES:												
		Upon completion of drilling:												
		- water level at 5.7m												
10														
2/3/														
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LGBE3 4007-14-G-YON-A.GPJ 2/3/16														
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ORE USE BT OTHE	-	
Time	Water Level (m)	Depth to Cave (m)

											Dwg No			
Project:	Geotechnical Investigation										Sheet I	No. <u>1</u>	_ (of
ocation:	NW Yonge and Green La	ne Seco	nd	ary F	Plan,	East	Gwilli	mbur	y, On	itario				
			-				5	7	Heads	pace Rea	ading (pp	m)	•	
ate Drilled:	12/15/14		Auger Sample 🛛 Natural Moistu SPT (N) Value O 🖾 Plastic and Lig									—	×	
orill Type:	Track Mounted Drill Rig		_	Dynami Shelby [*]	c Cone T Tube	Test		-	Uncon	fined Cor ain at Fail	mpressio	n Ø))	
)atum:	Geodetic				ane Test		S	5		rometer				
• • S			р			N Value	9			adspace F			Π	Natu
	Soil Description	ELEV. m	DEPT		20 Strength	40	60 E	30 kPa	1 Nat Atter	00 2 tural Moist perg Limits		00 int % Veight)		Un Weid
	und Surface	288.47	н 0	4		100	2	00	•	10 2	20 3	30		kN/r
<u>1/ ×1</u>		287.91		Õ										
	IDY SILT TILL npact, very dense below 1.5m			λ	21									
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sor ─ - mo	ne gravel	_				52								
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			6	<u></u>		50/150m	im :		*					
	OF BOREHOLE													
Upor	n completion of drilling: free water													

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ORE USE BY UTHE	:K5	-
Time	Water Level (m)	Depth to Cave (m)
January 5, 2015	1.10m	
March 26, 2015	1.62m	
April 14, 2015	1.89m	

Project No.	4007-14-G-YON-A Log C	of Boreho	ole <u>Bl</u>	<u> 1-6</u>			
				Dwg No	. 7		
Project:	Geotechnical Investigation			Sheet N	o. <u>1</u> (of _	1
Location:	NW Yonge and Green Lane Secor	ndary Plan, East	Gwillimbury	, Ontario			
				Headspace Reading (ppm	n) •		
Date Drilled:	12/12/14	Auger Sample SPT (N) Value		Natural Moisture	́ x		
Drill Type:	Track Mounted Drill Rig	Dynamic Cone Test Shelby Tube		Plastic and Liquid Limit Unconfined Compression % Strain at Failure	⊢ ⊗		
Datum:	Geodetic	Field Vane Test	ŧ	Penetrometer			

	ş			N Value Headspace Reading (ppm)						Natural									
G W L	SY MB OL	Soil Description	ELEV.	DEPTH	Ĭ.		20		40	6	0 8	0		100 latural M	200 oisture C	30 onten	0 1t %	+	Natural Unit Weight kN/m3
Ľ	P		m	ΪĤ	Ţ	Shear	20 Stre	nath		0		kPa	Att		oisture C mits (% E				vveight kN/m3
	<u><u>x</u> 1₂</u>	Ground Surface TOPSOIL	288.89	0) .				100		2	00		10	20	30)	\square	
					G	5									V			Ø	
	<u>// ×</u>	<u></u>	288.28		9	Y							. : . : : :		X				
	nhir	SANDY SILT TILL	200.20			1												M	
	UY1L	- compact, dense to very dense below				١Į								1					
	IIII	[30m]	1	1	1	Ψ								Ť				10	
	19	- brown, grey below 6.0m trace of clayey silt													9.43			۴	
	I.M	trace of clayey silt _	-				1											Ы	
	ľ lø	- trace to some gravel - seams of fine sand					0							*					
	M	– - moist –	1	2	2		Ī	<u></u>										Ø	
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	HP11		282.49						C	9				*					
		END OF BOREHOLE			1	:::		: : :	1 : :	::		1111	:::	: : : :		11	::::		
		NOTES:																	
		Upon completion of drilling: - no free water			1	:::		: : :	111	11		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	:::	: : : :		11	::::		
		- no free water			1	:::		:::	111	11		1111	:::	: : : :		11	::::		
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Time	Water Level (m)	Depth to Cave (m)

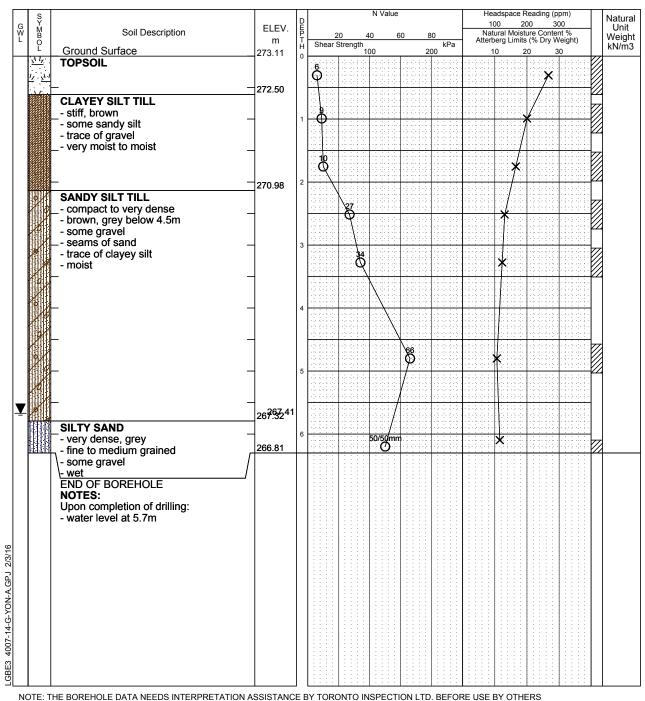
Log of Borehole <u>BH-7</u> 4007-14-G-YON-A Project No. Dwg No. 8 Geotechnical Investigation Sheet No. 1 of 1 Project: NW Yonge and Green Lane Secondary Plan, East Gwillimbury, Ontario Location: Headspace Reading (ppm) . \boxtimes Auger Sample 12/12/14 Х Date Drilled: Natural Moisture ΟØ SPT (N) Value Plastic and Liquid Limit _ Track Mounted Drill Rig Drill Type: Dynamic Cone Test **Unconfined Compression** \otimes Shelby Tube % Strain at Failure Geodetic Datum:

Field Vane Test

Penetrometer

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ORE USE BY UTH	ERS	
Time	Water Level (m)	Depth to Cave (m)

Log of Borehole BH-8 4007-14-G-YON-A Project No. Dwg No. 9 Geotechnical Investigation Sheet No. 1 of 1 Project: NW Yonge and Green Lane Secondary Plan, East Gwillimbury, Ontario Location: Headspace Reading (ppm) . \boxtimes Auger Sample 12/12/14 × Date Drilled: Natural Moisture SPT (N) Value ΟØ Plastic and Liquid Limit -1 Drill Type: Track Mounted Drill Rig Dynamic Cone Test _ Unconfined Compression \otimes Shelby Tube % Strain at Failure Geodetic Datum:

Field Vane Test

Penetrometer

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G Y W B L O L	Soil Description Ground Surface	ELEV. m 290.52	DEP T H		Strenath	N Valu 40 100	<u>60 8</u>	0 kPa 00	1 Nat Attert	00 2 tural Mois berg Limit	Reading (p 200 3 ture Conte is (% Dry V 20	opm) 800 ent % Veight) 30	Natural Unit Weight kN/m3
		290.52 290.11	0	ģ								×	
	- brown sandy silt - trace of rootlets - very moist SANDY SILT TILL - compact, very dense below 1.5m	289.76	1		\langle					*			
	- brown - some gravel some silty sand - moist	_	2				8		*				
Ţ	 	- 287.22	3				Č č		*				
0	-		4										
	SAND - very dense, brown - fine to medium grained silty at 4.5m - some gravel		5				2	5		\ *			
	- damp to wet 	_ 	6			50/150/n						77	
	END OF BOREHOLE NOTES: Upon completion of drilling: - water level at 3.3m - cave-in at 5.1m	204.27											
LGBE3 4007-14-G-YON-A.GPJ 2/3/16													

NOTE: THE BOREHOLE DATA NEEDS INTERPRETATION ASSISTANCE BY TORONTO INSPECTION LTD. BEFORE USE BY OTHERS

-0	DRE USE BY OTHE	RS	
	Time	Water Level (m)	Depth to Cave (m)

Project No.	<u>4007-14-G-Y</u> ON-A	Log of Boreh	ole <u>B</u>	<u>H-9</u>
		-		Dwg No. <u>10</u>
Project:	Geotechnical Investigatio	n		Sheet No. <u>1</u> of <u>1</u>
Location:	NW Yonge and Green La	ane Secondary Plan, East	Gwillimbu	ıry, Ontario
Date Drilled: Drill Type: Datum:	12/15/14 Track Mounted Drill Rig Geodetic	Auger Sample SPT (N) Value Dynamic Cone Test Shelby Tube Field Vane Test		Headspace Reading (ppm) Natural Moisture X Plastic and Liquid Limit Unconfined Compression % Strain at Failure Penetrometer
		N Val	10	Headspace Boading (ppm)

G	Y		ELEV.	P				14 00				· ·	00	200 3	300		Natural
G W L	S Y B O L	Soil Description	m	DEPTH	0.5.1	20	4	0	6	0 8	0	Na Atter	tural Mo berg Lin	isture Contents (% Dry	ent % Neight)		Natural Unit Weight kN/m3
		Ground Surface	289.27	Ĥ		ir St	rength 1	00		20	kPa 00		10		30		kN/m3
	<u>×1/</u>	TOPSOIL		ľ	4											Ø	
	<u>1/ \1</u>		288.81	1	Q										×	Ø	
		REWORK FILL	200 54		1. 1.		0.000		;							12	
	ЖЖ	γ - dark brown to brown sandy silt	288.51			18								Χ			
	ШИL	<u> moist</u> // SANDY SILT TILL	-	1		ğ	······				· · · · · · · ·		$+ \times$			Ø	
	ШИ	- compact, dense to very dense below				- P	\mathbf{X}						/			14	
	4911	- 1.5m -				-	$\sum_{i=1}^{n}$						/				
	I M	- brown					3	9					1				
	l la	 layers of silty sand 				÷ :	2. : : : : :	K.			• • • • • • •			<u>e e e e e</u>		Ø	
	UM.	some gravel -	-	2		÷			<u> </u>							۴ſ	
	1111/1	- moist, wet below 4.5m				34			\mathbb{N}					3 3 3 3 3			
			-		100 CO2 +	<u>-</u>				<u>8</u>		×		<u></u>		Ø	
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	HIIM		283.07	Ē			<u></u>	0/10 C	Š				<u>* </u>				
		END OF BOREHOLE															
		NOTES:															
		Upon completion of drilling:							: : :								
		- water level at 4.2m				2	::::	::	:::		::::	::::					
						2	::::	::	: : :			::::					
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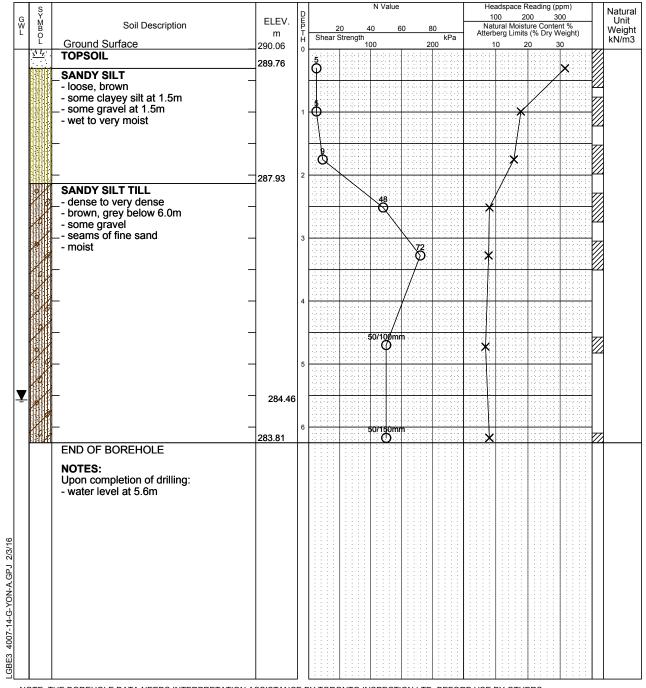
Time	Water Level (m)	Depth to Cave (m)							

Project No.	<u>4007-14-G-Y</u> ON-A LO	g c	of Boreho	ole <u>B</u>	<u>H-10</u>	
					Dwg No.	<u>11</u>
Project:	Geotechnical Investigation				Sheet No.	. <u>1</u> of <u>1</u>
Location:	NW Yonge and Green Lane S	Secor	ndary Plan, East	Gwillimbur	y, Ontario	
Date Drilled:	12/15/14		Auger Sample	O ⊠ ⊠	Headspace Reading (ppm) Natural Moisture	• ×
Drill Type:	Track Mounted Drill Rig		SPT (N) Value Dynamic Cone Test Shelby Tube		Plastic and Liquid Limit Unconfined Compression % Strain at Failure	⊢ ⊗
Datum:	Geodetic		Field Vane Test	S	Penetrometer	A
G Y W M	Soil Description	ELEV.	N Valu E	e	Headspace Reading (ppm) 100 200 300	

G W L	M B O L	Soil Description	ELEV. m	E P T H	Shear	Strength			0 kPa	Nat Attert	ural Moist berg Limits	ture Conte s (% Dry V			Unit Weight kN/m3
	<u> </u>	Ground Surface TOPSOIL	295.25 294.92	0	4	10		20	0	1	0 2	20 3	30 X		
		_ REWORK FILL - dark brown to brown sandy silt	294.49	1		æ					*				
		 compact, dense to very dense below 1.5m brown layers of silty sand some gravel trace of clayey silt at 6.0m moist, damp at 6.0m 	_	2			49 8			*	/				
	10/0	moist, damp at 6.0m	_	3			30/100m	n Ne8 N		*					
			_	4										· · ·	
	10/10/10		_	5			0/150m O				*				
Ţ		- END OF BOREHOLE	289.55	6			50/75mr				X				
		NOTES: Upon completion of drilling: - water level at 5.7m													
LGBE3 4007-14-G-YON-A.GPJ 2/3/16															

Time	Water Level (m)	Depth to Cave (m)								

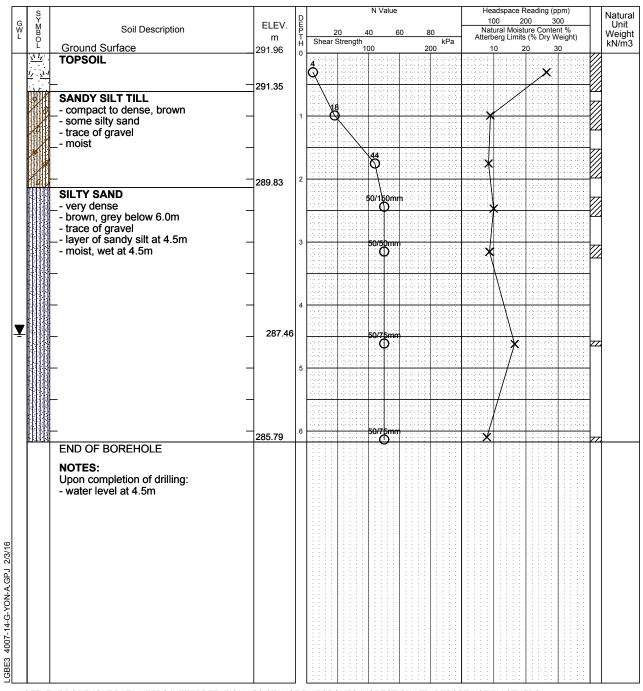
Project No.	<u>4007-14-G-Y</u> ON-A	og of Boreh	ole <u>B</u>	<u>H-11</u>	
				Dwg No.	12
Project:	Geotechnical Investigation			Sheet No.	_1_ of _1_
Location:	NW Yonge and Green Lane	e Secondary Plan, East	Gwillimbu	ry, Ontario	
Date Drilled: Drill Type:	12/9/14 Track Mounted Drill Rig	Auger Sample SPT (N) Value Dynamic Cone Test Shelby Tube		Headspace Reading (ppm) Natural Moisture Plastic and Liquid Limit Unconfined Compression % Strain at Failure	× ⊢ ⊗
Datum:	Geodetic	Field Vane Test	S	Penetrometer	



-0										
	Time	Water Level (m)	Depth to Cave (m)							

Project No.	<u>4007-14-G-Y</u> ON-A	Log of Boreh	ole <u>B</u>	<u>H-12</u>	
Project:	Geotechnical Investigati	on		Dwg No. Sheet No.	
Location:	NW Yonge and Green I	_ane Secondary Plan, Eas	Gwillimbu	ıry, Ontario	
Date Drilled:	12/9/14	Auger Sample SPT (N) Value	O 🛛	Headspace Reading (ppm) Natural Moisture	×
Drill Type: Datum:	Track Mounted Drill Rig Geodetic			Plastic and Liquid Limit Unconfined Compression % Strain at Failure Penetrometer	⊢ ⊗ ▲

Field Vane Test



NOTE: THE BOREHOLE DATA NEEDS INTERPRETATION ASSISTANCE BY TORONTO INSPECTION LTD. BEFORE USE BY OTHERS

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	Time	Water Level (m)	Depth to Cave (m)							

Project No.	4007-14-G-YON-A	_og of Boreh	ole <u>B</u>	<u>H-13</u>		
Project:	Geotechnical Investigatior	1		Dwg No. Sheet No.		_ 1
Location:	NW Yonge and Green La		Gwillimbu		0	<u>-</u>
Date Drilled:	12/10/14	Auger Sample SPT (N) Value	O ⊠ ⊠	Headspace Reading (ppm) Natural Moisture Plastic and Liquid Limit	• ×	
Drill Type: Datum:	Track Mounted Drill Rig Geodetic	Dynamic Cone Test Shelby Tube Field Vane Test	S S	Unconfined Compression % Strain at Failure Penetrometer	⊗	

G W L	;	SY MB L	Soil Description	ELEV.	DEP			20		N Value	 0	1	00	Reading (200 : sture Cont	300	Natural Unit Weight kN/m3
ľ			Ground Surface	m 283.04	H	Sh	ear	20 Strer	4 gth 10		80 kPa 00		perg Lim	sture Cont its (% Dry 20	Weight) 30	vveight kN/m3
		<u> </u>	TOPSOIL		0	ą									×	
			SANDY SILT compact, brown	282.43	1		<u></u>									
			- some silty sand - wet - CLAYEY SILT TILL -	281.67										1		
		_	 - firm to very stiff, hard below 6.0m - brown, grey below 4.8m - trace of some gravel 		2	Ô)						×			
	-		 - firm to very stiff, hard below 6.0m - brown, grey below 4.8m - trace of some gravel - trace of sandy silt - layers of sandy silt at 4.5m - moist to damp 										*			
<u> </u>	-			280.34	3											
				_			₿ 						*			
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Loc	cation:	NW Yonge and Green Lar	ie Secol	nd	lary F	Plan,	East	Gwi	llimbur	y, On	tario				
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LGBE3 4007-14-G-YON-A.GPJ 2/3/16	NOT Upor - wat	ES: n completion of drilling: ter level 4.5m													

Time	Water Level (m)	Depth to Cave (m)								
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April 14, 2015	1.02m									

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roject:	Geotechnical Investigation		_					0				Sheet I	No. <u>1</u>	_ of _	
ocation:	NW Yonge and Green La	ne Secol	na	ary I	la	n, I	<u>ast</u>	Gwilli	mbur	y, On	itario				
ate Drilled:	12/15/14		-	Auger S	Samp	ole				Headspace Reading (ppm) • Natural Moisture X					
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Time	Water Level (m)	Depth to Cave (m)									
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March 26, 2015	1.07m										
April 14, 2015	0.70m										

Project No.	<u>4007-14-G-Y</u> ON-A	Log d	D	fΒ	ore	ehe	ole	B	H-1	<u> 6</u>			
										I	Dwg No	b. <u>17</u>	
Project:	Geotechnical Investigatio	n								:	Sheet N	No. <u>1</u>	_ of
Location:	NW Yonge and Green La	ane Seco	nd	ary F	Plan,	East	Gwilli	mbur	y, On	tario			
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NOT Upor	OF BOREHOLE TES: n completion of drilling: ter level at 3.2m	271.83				<u> </u> 0				<u>×</u>			8

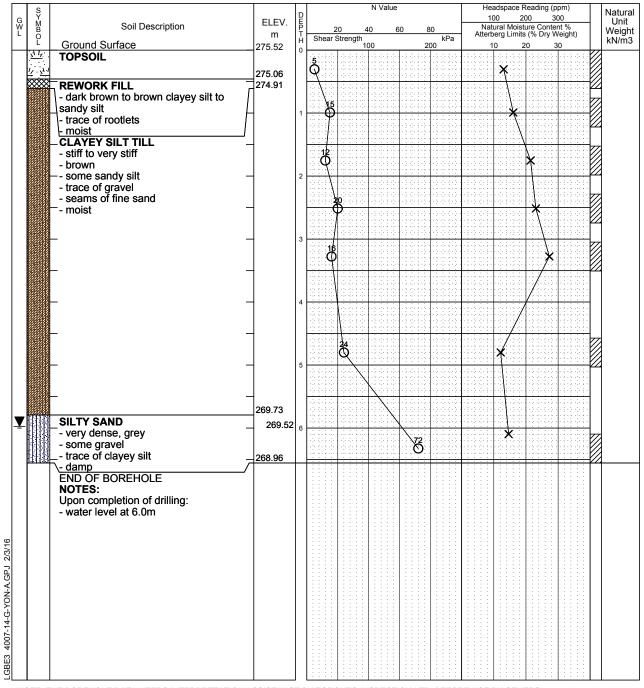
Time	Water Level (m)	Depth to Cave (m)
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Project:	Geotechnical Investigation										-	o. <u>18</u> No. <u>1</u>		f
Location:	NW Yonge and Green Lan	e Seco	nda	ary F	Plan,	East	Gwill	imbur	y, Or	ntario				
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Drill Type:	Track Mounted Drill Rig		SPT (N) Value O 🛛 Dynamic Cone Test						c and Liqu			-	-1	
Datum:	Geodetic			helby ield Va	Tube ane Tes	t		ŝ	% Strain at Failure Penetrometer					
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 Time
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 Depth to Cave (m)

 January 6, 2015
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 1.71m 1.62m

Project No.	4007-14-G-YON-A LOG C	of Boreho	ole <u>B</u> l	<u></u>	
Project:	Geotechnical Investigation			Dwg No. <u>19</u> Sheet No.	
Location:	NW Yonge and Green Lane Secon	idary Plan, East	Gwillimbury		
Date Drilled: Drill Type: Datum:	12/15/14 Track Mounted Drill Rig Geodetic	Auger Sample SPT (N) Value Dynamic Cone Test Shelby Tube Field Vane Test		Headspace Reading (ppm) Natural Moisture Plastic and Liquid Limit H Unconfined Compression % Strain at Failure Penetrometer	× ×



-ORE USE	URE USE BY OTHERS											
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Project No.	<u>4007-14-G-Y</u> ON-A	og o	of Borehole B	<u>H-19</u>
		-		Dwg No. 20
Project:	Geotechnical Investigation			Sheet No. <u>1</u> of <u>1</u>
Location:	NW Yonge and Green Lane	Seco	ndary Plan, East Gwillimbur	y, Ontario
Date Drilled: Drill Type: Datum:	12/11/14 Track Mounted Drill Rig Geodetic		Auger Sample SPT (N) Value Dynamic Cone Test Shelby Tube Field Vane Test S	Headspace Reading (ppm) Natural Moisture Plastic and Liquid Limit Unconfined Compression % Strain at Failure Penetrometer
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	- very moist to damp - CLAYEY SILT - firm to stiff, brown - some sandy silt			Ô						×	
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	SANDY SILT TILL - very dense, brown - trace of gravel moist	_	6				83 Ö	>	/ {		
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Water Level (m)	Depth to Cave (m)							
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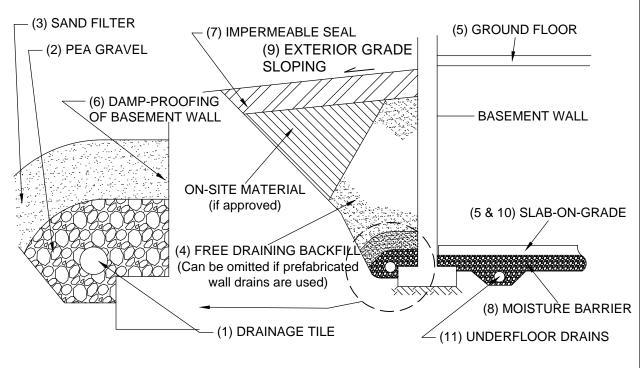
Project No.	<u>4007-14-G-Y</u> ON-A LOG	Log of Borehole <u>BH-21</u>							
				Dwg No.	22				
Project:	Geotechnical Investigation			Sheet No	o. <u>1</u> of	_1_			
Location:	NW Yonge and Green Lane Sec	ondary Plan, East	Gwillimbur	y, Ontario					
Date Drilled:	12/11/14	Auger Sample SPT (N) Value	O ⊠ ⊠	Headspace Reading (ppm) Natural Moisture Plastic and Liquid Limit	×				
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	í µ	- moist to very moist					2.27			100								
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Time	Water Level (m)	Depth to Cave (m)						



Figure Details of Permanent Perimeter Drainage System



Notes:

- 1. **Drainage tile**: consist of 100mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet. invert to be at minimum of 150mm (6") below underside of basement floor level.
- 2. **Pea gravel**: at 150mm (6") on the top and sides of drain. If drain is not placed on footing, provide 100mm (4") of pea gravel below drain. The pea gravel may be replaced by 20mm clear stone provided that the drain is covered by a porous geotextile membrane of Terrafix 270 R or equivalent.
- 3. **Filter material**: consists of C.S.A. fine concrete aggregate. A minimum of 300mm (12") on the top and sides of gravel. This may be replaced by an approved porous geotextile membrane of Terrafix 270R or equivalent.
- 4. **Free-draining backfill**: OPSS Granular B or equivalent, compacted to 93 to 95% (maximum) Standard Proctor Density. Do not ocmpact closer than 1.8m (6ft.) from wall with heavy equipment. This may be replaced by on site material if prefabicated wall drains (Miradrain) extending from the finished grade to the bottom of the basement wall are used.
- 5. Do not backfill until the wall is supported by the basement floor slab and ground floor framing, or adequate bracing.
- 6. Damp-proofing of the basement wall is requred before backfilling.
- 7. Impermeable backfill seal of compacted clay, clayey silt or equivalent. If the original soil in the vicinity is a free draining sand, the seal may be omitted.
- 8. **Moisture barrier**: consists of 20mm clear stone or compacted OPSS Granular A, or equivalent. The thickness of this layer to be 150mm (6") minimum.
- 9. Exterior Grade: slope away from basement wall on all the sides of the building.
- 10. Slab-on-grade should not be structurally connected to walls or foundations.
- 11. Underfloor drains * should be placed in parallel rows at 6-8m (20-25 ft.) centre, on 100mm (4") of pea gravel with 150mm (6") of pea gravel on top and sides. The invert should be at least 300mm (12") below the underside of the floor slab. The drains should be connected to positive sumps or outlets. Do not connect the underfloor drains to the perimeter drains.
- * Underfloor drains can be deleted where not required.

	TorontoInspection	TITLE:
	GEO-ENVIRONMENTAL CONSULTANTS	Suggested Backfill and Drainage System for Open Cut Excavation
110 Konrad Cresen	t, Unit 16, Markham, Ontario L3R 9X2	FIGURE NO.
Tel: 905-940 8509	Fax: 905-940 8192	1

NOT TO SCALE



Appendix A Guidelines of Engineered Fill



GUIDELINES FOR ENGINEERED FILL

The information presented in this guideline is intended for general guidance only. Site specific and prevailing weather conditions may require modification of the material(s) to be used and the compaction standards or procedures changed. The site preparation and the material(s) to be used must be discussed and procedures agreed with *Toronto Inspection Ltd.* prior to the start of the earthworks and must be subjected to on going review during construction.

For fill to be classified as engineered fill, suitable for supporting structural loads, a number of conditions must be satisfied, including but not necessarily limited to the following:

1. Areal Extent

The engineered fill must extend beyond the envelope of the structure to be supported. The minimum extent should be 2.0m beyond the envelope in all directions at the foundation level, including the loading dock pad and the front sidewalk, and sloping downwards to the sub-grade at 45°. Once the envelope is set, the structure cannot be moved out of the envelope without consultation with *Toronto Inspection Ltd.* Similarly, no excavation should encroach on the engineered fill envelope without consultation with *Toronto Inspection Ltd.*

2. Survey Control

Accurate survey control is essential to the success of an engineered fill project. The boundaries of the engineered fill must be laid out by a surveyor. During construction. it is necessary to have qualified surveyors providing control stations on the three-dimensional extent of the engineered fill.

3. Subsurface Preparation

Prior to placement of the engineered fill, the sub-grade must be prepared to the satisfaction of *Toronto Inspection Ltd.* All deleterious material must be removed and in some cases excavation of native mineral soils may also be required. Particular attention must be paid to wet sub-grade and possible additional measures required to achieve sufficient compaction. Where fill is placed against a slope, benching will be necessary and natural drainage paths must not be blocked.

4. Suitable Fill Material

All material to be used as fill must be approved by *Toronto Inspection Ltd.* Such approval will be influenced by weather factors. External sources of fill material must be sampled, tested and approved prior to material being hauled to the job site.

5. Trial Test Section

In advance of the construction of the engineered fill pad, the contractor should conduct a trial test section. The compaction criterion will be assessed for the backfill material to be used, using specified lift thicknesses and number of passes for the compaction equipment proposed by the contractor. To achieve a uniform degree of compaction of each layer, the lift thickness of loose



material, prior to start of compaction, must not exceed 200mm (8 inches). Additional trial test section(s) may be required throughout the course of the project to reflect changes in material sources, the moisture content of the material and the weather conditions.

6. Degree of Compaction

The minimum degree of compaction for the engineered fill should not be less than 100% of the Standard Proctor maximum dry density, or 95% of the Modified Proctor maximum dry density, to the level at or above 0.3m from proposed footing founding level. Each layer must be tested and approved by this office before the next layer is placed.

7. Inspection and Testing

Uniform and thorough compaction is crucial to the performance of the fill and the supported structure. Hence, all subgrade preparation, filling and compacting must be done with full time inspection and to the satisfaction of *Toronto Inspection Ltd.* All founding surfaces must be inspected and approved by *Toronto Inspection Ltd.* prior to placement of concrete.

8. **Protection of Fill**

Fills are generally more susceptible to the effects of weather than are natural soils. Fill placed and approved to the level at which structural support is required must be protected from excessive wetting, drying, erosion or freezing. Where inadequate protection had been provided, it may be necessary to provide deeper founding level for footings or to strip and re-compact some of the filled layers.

9. Limitations

The engineered fill is subjected to the following limitations:

- i. Proper drainage must be maintained at all times within the engineered fill pad.
- ii. If the engineered fill is left in place during the winter months, adequate protection must be provided against frost penetration to the proposed footing depths.
- iii. If the engineered fill depth exceeds 5m below the foundation depth, the construction of the foundations might have to be delayed for a period of 1 year after placement, depending on the type of fill material used.
- iv. Strip footings and foundation walls founded on engineered fill must be reinforced continuously with a minimum of two 15mm steel bars with at least 1m of overlap.