

## **Report on**

Geotechnical Slope Stability Assessment Serson Creek Lakeview Village, 800 Hydro Road Mississauga, Ontario

**Prepared For:** Lakeview Community Partners Limited



#### DS CONSULTANTS LTD.

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**Project No.** 18-519-102 July 19, 2019

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#### 1. INTRODUCTION

DS Consultants Ltd. (DS) was retained by Lakeview Community Partners Limited to undertake a geotechnical slope stability assessment for the Serson Creek bank slopes for the proposed Lakeview Village development at 800 Hydro Road in Mississauga, Ontario.

The purpose of this study was to assess the stability of the existing west bank slope of Serson Creek and determine the location of the long-term stable top of slope (LTSTOS) line.

This report is provided on the basis of the terms of reference presented above and, on the assumption, that the design will be in accordance with applicable codes and standards. If there are any changes in the design 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 Oborings and reporting before the recommendations can cater to the changed design.

The site investigation and recommendations follow generally accepted practice for geotechnical consultants in Ontario. The format and contents are guided by client specific needs and economics and do not conform to generalized standards for services. Laboratory testing for most part follows ASTM or CSA Standards or modifications of these standards that have become standard practice.

This report has been prepared for Lakeview Community Partners Limited, its architect and designers. Use of this report by third party without DS consent is prohibited.

#### 2. SUBSURFACE CONDITIONS

DS Consultants Ltd. carried out a preliminary geotechnical investigation, documented in the report No. 18-519-10, dated October 15, 2018. Nine (9) boreholes (BH18-01, BH18-03, BH18-04, BH18-36, BH18-38, BH18-41, BH18-42, BH18-43, and BH18-48) were drilled near the creek area. The borehole location plan and relevant borehole logs are attached in **Appendix A**. The subsurface information in these boreholes are used in this slope stability study.

Fill materials to variable depths were encountered in all boreholes, consisting of clayey silt, silty clay, sandy silt to sand. The fill was in a loose to compact state, with measured SPT 'N' values ranging from 4 to over 15 blows per 300 mm penetration. The native soils consisted of cohesive deposits of clayey silt to silty clay (till) and cohesionless deposits of silt, sandy silt to sand. Shale bedrock in the boreholes was at depths ranging from 3.1 m to more than 20 m.

Groundwater in the boreholes was within 6 m below the surface. In the slope area near the creek, the groundwater level will fluctuate with the water level in the creek.

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#### 3. SLOPE CONDITIONS AND PROFILES

A site visit was made by a senior geotechnical engineer from DS Consultants Ltd. on June 17, 2019. Selected photographs taken during our site visits are presented in **Appendix B**. The subject creek slopes are located between Lakeshore Blvd and about 100 m north of Lake Ontario.

For the convenience of discussion, Lakeshore Blvd. in the area is assumed in the east-west alignment. There is an existing bridge for the excess road from WWTP to the site. According to the slope conditions, the creek slopes are considered consisting of 2 reaches as follows:

- Reach S2 is located from the access road bridge to Lake Ontario, along the WWTP and the access road.
- Reach S3 is located from Lakeshore Blvd to the access road bridge.

Based on our site observations, the slope conditions are described as follows:

- The slope in Reach 3 area was generally 2 to 3 m in height, with steepness of 2H:1V to 3H:1V or flatter.
- The height of the west bank slope in Reach S2 area ranged from about 6 m near the bridge to about 3 m near the lake, decreasing toward south. The steepness of the slope was about 2H:1V to 3H:1V or flatter. At the south part, there was a ditch of 1 to 1.5 m in depth between the creek slope and the access road (see Photos B17 and B18 in Appendix B).
- The slope surface is generally well covered with mature trees and other vegetation.
- The width of the creek was generally 2 to 3 m. The water depth of creek was within 0.5 m during our site visit on June 17, 2019, while the creek bed in the area near the access road bridge was dry.
- No evidence of slope failure was observed during our site visit. Slope toe erosion at the creek water level were observed at various locations along the creek.

The existing slope profiles at 14 Sections (A-A to N-N, see Figure 1 for locations) were provided to us by Urbantech, as presented on Figures 2 to 15.

### 4. **EROSION CONSIDERATIONS**

In the Geomorphic Assessment Report by Beacon Environmental Limited, a long-term toe erosion allowance of 8 m is recommended for the Serson Creek bank slopes across the site (Reach S2 and S3). This recommended toe erosion allowance for the creek bank slopes is used in the slope stability assessment.

### 5. SOIL PARAMETERS

Based on the borehole information and our site observations, soil parameters used in the slope stability analyses are given on **Table 1**.

Soil Type	Unit Weight (kN/m³)	Cohesion c' (kPa)	Friction Angle <b>¢'</b> (degree)
Fill	20	0	30
Silty clay/clayey silt	21	5	28
Compact sandy silt to sand	21	0	32
Dense sandy silt to sand	21	0	34

Table 1: Soil Parameters for Long-term Slope Stability Analyses

## 6. STABILITY ANALYSES OF EXISTING SLOPES

The existing slope profiles at Sections A-A to N-N (see Figure 1 for locations) are presented on Figures 2 to 15. Long-term stability analyses of the existing slopes at three typical Sections A-A, L-L and N-N have been carried out with the computer program SLIDE (Version 8) using the Simplified Bishop method, Simplified Janbu method and GLE/Morgenstern-Price method. The analysis results are presented in Figures 16 to 18 and are summarized on Table 2 below.

Slope Location	Approximate Steepness	Calculated Factor of Safety (FS)	Long-Term Stability	
Section A-A	2H:1V	1.23	FS<1.5. Not stable	
(See Figure 16)				
Section L-L	2 511.11	1 56	ES>1 5 Stable	
(See Figure 17)	2.311.17	1.50	13-1.5, Stable	
Section N-N	2 24.11	1 4 2	FC <1 F Not Stable	
(See Figure 18)		1.45		

Table 2: Long-term Stability Analysis Results of Existing Slopes

The calculated factor of safety of the existing slope at Section L-L is 1.56, which is greater than the CVC's minimum acceptable value of 1.5. The existing slope at Section L-L is considered stable in terms of long-term stability based on CVC's requirements.

The calculated factors of safety of the existing slopes at Sections A-A and N-N range from 1.23 to 1.43, which are less than the CVC's minimum acceptable value of 1.5. The existing slopes at Sections A-A and N-N are considered not stable in terms of long-term stability based on CVC's requirements.

#### 7. STABILITY ANALYSES OF LONG-TERM STABLE SLOPE

As discussed previously, the existing slope at Section L-L is about 2.5H:1V, and is considered stable in terms of long-term stability. The existing slopes at Sections A-A and N-N are relatively steeper, and are considered not stable in terms of long-term stability.

For long-term stability, a toe allowance of 8 m is also required for analysing the long-term stable slope.

In order to determine the long-term stable slope, analysis of a 2.5H:1V slope with a toe erosion allowance of 8 m at Section A-A have been carried out, and the results are presented on Figure 19. The calculated factor of safety of the 2.5H:1V slope at Section A-A is 1.62, which is greater than the minimum acceptable value of 1.5. Similarly, stability analyses of stable slopes at Sections L-L and N-N are carried out, and the results are presented on Figures 20 and 21. Table 3 presents a summary of the results of long-term stable slopes.

Claus Loostian	Approximate	Toe Erosion	Calculated Factor of	Long-Term
Slope Location	Steepness	Allowance (m)	Salety (FS)	Stability
Section A-A	2 5H·1V	2.5H:1V 8.0	1.53	FS>1.5, Stable
(See Figure 19)	2.311.11			
Section L-L	2 511-11/	8.0	1 57	FC> 1 F Stable
(See Figure 20)	See Figure 20) 2.5H:1V		1.57	FS>1.5, Stable
Section N-N	2 5 4.1 1	8.0	1 57	FS>1 E Stable
(See Figure 21)	2.54:17	8.0	1.57	rovi.o, sladie

Table 3: Long-term Stability Analysis Results of Stable Slopes

The factor of safety values of the slopes as summarized on Table 3 are greater than the minimum required value of 1.5. Based on the analysis results, it can be concluded that a slope of 2.5H:1V with a toe erosion allowance of 8m is stable and acceptable in terms of long-term stability.

## 8. LONG-TERM STABLE TOP OF SLOPE (LTSTOS)

Based on the slope stability analysis results presented above, Points "S1", "S12" and "S14" in Figures 19 to 21 represent the long-term stable top of slope (LTSTOS) at Sections A-A, L-L and N-N, respectively. Accordingly, Points "S1", "S12" and "S14" are also shown in profile Figures (Figure 2, Figure 13 and Figure 15) at Sections A-A, L-L and N-N, respectively.

Similarly, the long-term stable top of slope (LTSTOS) at other sections (B-B to K-K, and N-N) can be obtained using a stable slope of 2.5H:1V and a toe erosion allowance of 8m, as shown in Figures 3 to 12, and Figure 14.

Based on the analysis results, the points representing the long-term stable top of slope (LTSTOS) at Sections A-A to N-N are as follows.

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- Point "S1" on Figure 2 represents the long-term stable top of slope at Section A-A.
- Point "S2" on Figure 3 represents the long-term stable top of slope at Section B-B.
- Point "S3" on Figure 4 represents the long-term stable top of slope at Section C-C.
- Point "S4" on Figure 5 represents the long-term stable top of slope at Section D-D.
- Point "S5" on Figure 6 represents the long-term stable top of slope at Section E-E.
- Point "S6" on Figure 7 represents the long-term stable top of slope at Section F-F.
- Point "S7" on Figure 8 represents the long-term stable top of slope at Section G-G.
- Point "S8" on Figure 9 represents the long-term stable top of slope at Section H-H.
- Point "S8" on Figure 10 represents the long-term stable top of slope at Section I-I.
- Point "S10" on Figure 11 represents the long-term stable top of slope at Section J-J.
- Point "S11" on Figure 12 represents the long-term stable top of slope at Section K-K.
- Point "S12" on Figure 13 represents the long-term stable top of slope at Section L-L.
- Point "S13" on Figure 14 represents the long-term stable top of slope at Section M-M.
- Point "S14" on Figure 15 represents the long-term stable top of slope at Section N-N.

Based on the long-term stable top of slope (LTSTOS) at Sections A-A to N-N, and our field observations, the recommended long-term stable top of slope line (Line S10-S11 ... S8-S9) is shown on Figure 1.

The derived the long-term stable top of slope (LTSTOS) line is based on the grade at the time of site survey for the topographic map in Figure 1. Where the grade elevation in the area along the creek slope has changed since the site survey, the location of long-term stable top of slope (LTSTOS) line may need to be adjusted.

#### 9. GENERAL COMMENTS AND LIMITATIONS OF REPORT

DS Consultants Ltd. (DS) should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, DS will assume no responsibility for interpretation of the recommendations in the report.

This report is intended solely for the Client named. The material in it reflects our best judgment in light of the information available to DS at the time of preparation. Unless otherwise agreed in writing by DS, it shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. No portion of this report may be used as a separate entity, it is written to be read in its entirety.

The conclusions and recommendations given in this report are based on information determined at the test hole locations. The information contained herein in no way reflects on the environment aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the

test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the test hole locations and should not be used for other purposes, such as grading, excavating, planning, development, etc.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of test holes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices.

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. DS 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.

We trust that the information contained in this report is satisfactory. Should you have any questions, please do not hesitate to contact this office.

DS CONSULTANTS LTD. A. SANGAR 100141185 BOUNCE OF ONTAR P.Eng F. ZHU ai Fanyu Zhu, Ph.D., P.Eng. ROUNCE OF ONTARIO

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# Figures

FIGURE 1:SLOPE LOCATION PLANFIGURES 2-15:SLOPE PROFILES AT SECTIONS A-A TO N-NFIGURES 16-18:STABILITY ANALYSIS RESULTS OF EXISTING SLOPESFIGURES 19-21:STABILITY ANALYSIS RESULTS OF LONG-TERM STABLE SLOPES



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	Project No:		Figure No.	
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# Appendix A

Location Plan and Logs of Boreholes by DS Consultants Ltd.









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Geotechnical   Environmental   Materials   Hydrogeology

#### LOG OF BOREHOLE BH18-01

DRILLING DATA

Diameter: 200 mm

Date: Jul-18-2018

Method: Hollow Stem Auger

PROJECT: Preliminary Geotechnical Investigation- Proposed Development

CLIENT: Lakeview Community Partners Ltd.

PROJECT LOCATION: 800 Hydro Road, Mississauga, ON

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1

DYNAMIC CONE PENETRATION RESISTANCE PLOT SOIL PROFILE SAMPLES PLASTIC NATURAL MOISTURE LIMIT CONTENT METHANE LIQUID LIMIT GROUND WATER CONDITIONS 5 NATURAL UNIT M (KN/m<sup>3</sup>) AND POCKET PEN. (Cu) (kPa) 20 40 60 80 100 (m) STRATA PLOT GRAIN SIZE BLOWS 0.3 m w WL SHEAR STRENGTH (kPa) Wp ELEVATION ELEV DEPTH DISTRIBUTION \_ . DESCRIPTION NUMBER O UNCONFINED (%) TYPE WATER CONTENT (%) × LAB VANE • QUICK TRIAXIAL ŗ 20 40 60 80 100 10 20 30 GR SA SI CL 82.8 . <u>^</u> 1<sub>/</sub> TOPSOIL:350mm 0.0 82.4 1 1 SS 14 С FILL: clayey silt, some organics, 0.4 trace gravel, grey, moist, stiff 82 2 SS 8 0 з SS 10 81 80.5 FILL: sandy silt, some organics, 2.3 grey, moist, loose 4 SS 8 80 79.7 SILTY CLAY TILL: some sand, 3.1 trace gravel, brown, moist, very stiff 5 SS 17 0 225 15 47 37 1 79 78.2 SANDY SILT TILL: trace to some 4.6 78 clay, trace gravel, grey, moist, very 6 SS 50 0 dense 77 € <u>76.7</u>  $\nabla$ ΙΦ SAND: trace silt, brown, wet, W. L. 76.7 m 6.1 during drilling dense SS 45 0 7 SOIL LOG 18-519-10 800 HYDRO ROAD GPJ DS GDT 18-10-12 76 F 7 75.2 SAND AND GRAVEL: trace silt, 7.6 ò . 6 75 brown, wet, very dense 8 SS 50 0 0 0 74 9 73.7 SILTY SAND TILL: some gravel to 76 9.1 gravelly, occassional 9 SS 78 cobble/boulders, trace clay, grey, moist to wet, very dense ŀ.¢ 73 SI1 Continued Next Page + <sup>3</sup>, ×<sup>3</sup>: Numbers refer O <sup>8=3%</sup> Strain at Failure <u>GRAPH</u> GROUNDWATER ELEVATIONS NOTES to Sensitivity ∑<sup>1st</sup>  $\mathbf{V}$   $\mathbf{V}$   $\mathbf{V}$ Measurement

REF NO.: 18-519-10

ENCL NO.: 2
05	DS CONSULTANTS LTD.
	Geotechnical � Environmental � Materials � Hydrogeology

PROJECT: Preliminary Geotechnical Investigation- Proposed Development

CLIENT: Lakeview Community Partners Ltd.

PROJECT LOCATION: 800 Hydro Road, Mississauga, ON

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1

ľ		SOIL PROFILE		S	AMPL	.ES			DYNAI RESIS	MIC CO TANCE	NE PEI PLOT		TION		DIAGT	NAT	URAL			L	METH	IANE
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	-	cobble/boulders, trace clay, grey, moist to wet, very dense(Continued)							-													
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REF. NO.: 18-519-10 ENCL NO.: 2

Diameter: 200 mm Date: Jul-18-2018

DRILLING DATA

Method: Hollow Stem Auger

05	DS CONSULTANTS LTD.
	Geotechnical ♦ Environmental ♦ Materials ♦ Hydrogeology

DRILLING DATA

Diameter: 150mm

Date: Jun-25-2018

Method: Hollow Stem Auger

PROJECT: Preliminary Geotechnical Investigation- Proposed Development

CLIENT: Lakeview Community Partners Ltd.

PROJECT LOCATION: 800 Hydro Road, Mississauga, ON

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1

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REF. NO.: 18-519-10

ENCL NO.: 4

05	DS CONSULTANTS LTD.
	Geotechnical ♦ Environmental ♦ Materials ♦ Hydrogeology

DRILLING DATA

Diameter: 150mm

Date: Jun-25-2018

Method: Hollow Stem Auger

PROJECT: Preliminary Geotechnical Investigation- Proposed Development

CLIENT: Lakeview Community Partners Ltd.

PROJECT LOCATION: 800 Hydro Road, Mississauga, ON

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1

	SOIL PROFILE		s	SAMPL	ES	~		DYNA RESIS	MIC CO	NE PEN PLOT		TION		PI AST		URAL			F.	METH	HANE
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63.1 - 18.3 -	CLAYEY SILT TILL: sandy, trace gravel, occasssional cobble/boulders, grey, moist, hard		15	SS	50/ 150mr	- m 	63	- - - - -							<b>d</b> 1						
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REF. NO.: 18-519-10

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15	DS CONSULTANTS LTD.
	Geotechnical � Environmental � Materials � Hydrogeology

PROJECT: Preliminary Geotechnical Investigation- Proposed Development

CLIENT: Lakeview Community Partners Ltd.

PROJECT LOCATION: 800 Hydro Road, Mississauga, ON

DATUM: Geodetic

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Method: Hollow Stem Auger Diameter: 150mm

Date: Jun-25-2018

DRILLING DATA

REF. NO.: 18-519-10 ENCL NO.: 4

ŀ	BURE			5		FS			DYNA			NETRA	TION									
ŀ			1.				Ë		RESIS		0 6	$\geq$	20 1	00	PLASTI L <b>I</b> MIT	C NAT	JRAL TURE	LIQUID LIMIT	z	T WT	METHA AND	NE D
	(m)		LOT			ŞΕ	WAT	z	SHEA			TH (ki	2a)	1	w <sub>P</sub>	CON	N	$W_{\rm L}$	ET PE (kPa)	VL UN	GRAIN	SIZE
ŀ	DEPTH	DESCRIPTION	VTA F	BER		BLOV		ATIO	IU O	NCONF	NED	+	FIELD V. & Sensiti	ANE ivity	10/0			F (0()	POCK (CU)	ATUR/ (Kh	UISTRIBU (%)	JHON
			STR/	MUN	TYPE	z	GRO CON	ELEV	0 QI	UICK TF 20 4	RIAXIAL 0 6	. × 50 6	LAB VA 30 11	ANE 00	1 VVA	0 2	0 3	1 (%) 30		ź	GR SA S	SI CL
þ	61.2		19.1	16	SS	92			-										>225			
Ī	20.2	END OF BOREHOLE																				
		1) Water level at 4.6 mbgl during																				
		drilling																				
10-1																						
T 18																						
GD																						
β																						
D.G																						
ROA																						
DRO																						
μ																						
10 80																						
519																						
18																						
Ĭ																						
SOIL																						
S			1	L																		

	Geotechnical V Environmental V Materials V Hydrogeology				200		501.		
PROJ	ECT: Preliminary Geotechnical Investig	ation-	- Pro	posed	Develo	opment	t	DRILLING DATA	
CLIEN	IT: Lakeview Community Partners Ltd.							Method: Hollow Stem Auger	
PROJ	ECT LOCATION: 800 Hydro Road, Mis	sissa	uga,	ON				Diameter: 150mm REF. N	0.: 1
DATU	M: Geodetic							Date: Jun-22-2018 ENCL	<b>√</b> 0.: 5
BORE	HOLE LOCATION: See Drawing 1								
	SOIL PROFILE		5	SAMPL	ES.				
(m)		Ŀ				ATER S		20 40 60 80 100 LIMIT CONTENT	U L L
ELEV	DESCRIPTION	PLO	6		3 m		NO		e) (kP
DEPTH	DESCRIPTION	RATA	MBEI	щ	BLO	NUC	VAT	UNCONFINED + FIELD VAIVE QUICK TRIAXIAL X LAB VANE     WATER CONTENT (%)	90 00
81.1		STF	INN	μ	z.	GR	ELE	20 40 60 80 100 10 20 30	
- 8 <b>8.9</b> - 0.1	- TOPSOIL: 150mm						81		-
-	moist, compact		1	SS	10				
-			┨	<u> </u>				-	
80.3	FILL: silt to clavey silt_trace	$\mathbb{X}$	}	<u> </u>					
1	organics, trace gravel, grey, moist,		2	ss	12		80		
-	compact								
-		$\otimes$		<u> </u>					
79.3			3	22	14				
1.8	CLAYEY SILT TILL: sandy, trace		1	00	14				
78.8	very stiff	FI/	-				79		-
- 2.3	SANDY SILT TO SILTY SAND:								
	brown, moist to wet, very dense to		4	SS	29			- O	
E.	compact			ļ					
3			L	<u> </u>			78		_
-					50/				
-			) °	55	150mn	h			
			<u> </u>						
4			1						
-							77		-
-			•						
-			6	SS	50/				
-					Somm		76		_
-									
6		+lill:	1		1	$\nabla$	1		

18-519-10

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NATURAL UNIT V (KN/m<sup>3</sup>) DISTRIBUTION (%) GR SA SI CL W. L. 75.1 m during drilling grey and wet below 6.1 m 7 SS 25 0 DS SOIL LOG 18-519-10 800 HYDRO ROAD GPJ DS.GDT 18-10-12 74 73.5 7.6 SILTY SAND TILL: trace clay, some gravel, occassional cobble/boulders, grey, wet, very SS 8 78 dense 73 72 9 SS 64 0 Continued Next Page <u>GRAPH</u> <u>NOTES</u> O <sup>€=3%</sup> Strain at Failure  $\frac{\text{GROUNDWATER ELEVATIONS}}{\text{Measurement}} \stackrel{\text{1st}}{\underbrace{\overset{2nd}{\Psi}}} \stackrel{\text{2nd}}{\underbrace{\overset{3rd}{\Psi}}} \stackrel{\text{4th}}{\underbrace{\overset{4th}{\Psi}}}$ + <sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity

METHANE

AND GRAIN SIZE



	PROJ DATU	ECT LOCATION: 800 Hydro Road, Miss M: Geodetic	sissa	uga,	ON				Dian Date	neter: 1 : Jun-2	50mm 22 <b>-</b> 2018	3					RI El	EF. NC	0.: 18 D.: 5	8-519	-10
	BORE	HOLE LOCATION: See Drawing 1						i		MIC CC		CTDA			1						
-		SOIL PROFILE	-	S	SAMPL	ES	Н		RESI	STANCE	PLOT				PLAST	IC NATI	URAL		7	TW.	
Ī	(m) <u>ELEV</u> DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	ТҮРЕ	"N" <u>BLOWS</u> 0.3 m	GROUND WATE CONDITIONS	ELEVATION	SHE OL OC	20 2 AR ST INCONF QUICK TI 20 2	RENGT	) 8 TH (kl + ×	30 1 Pa) FIELD V & Sensit LAB V 30 1	00 /ANE tivity ANE 00		CON 	TENT ~ O ONTEN 20 :	T (%)	POCKET PEN (Cu) (kPa)	NATURAL UN <mark>I</mark> T (KN/m <sup>3</sup> )	GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
-	-	SILTY SAND TILL: trace clay, some gravel, occassional cobble/boulders, grey, wet, very dense(Continued)						71	-												
-	<u>1</u>			10	sst	namme ounce	er d	70	-												
-	2							69	-												
-	- <u>3</u>		0  	11	SS	50/ 125mm	1		-							0					
-	67.4	SAND: trace silt grev wet verv						68	-												
-	4 -	dense		12	SS	62		67	-							0					
-	<u>5</u>	istabled of sill at 15.5 m						66	-												
-	6	Interded of sitt at 15.5 m		13	SS	53		65	-								0				
DT 18-10-12	-			14	SS	80		64	-							0					
CAD.GPJ DS.GI	- <u>8</u>								-												
10 800 HYDRO F	62.9 18.2	SILTY CLAY TILL: some sand, trace gravel, grey, moist, hard		15	SS	56		63	-							c			>225		
SOIL LOG 18-519-1	<u>9</u> -							62													
SQ	0	Continued Next Page	Ŵ	1					-												
	<u>GROUN</u>	DWATER ELEVATIONS 1st 2nd 3rd 4th				<u>)</u> 1	<u>GRAPH</u> NOTES	+ <sup>3</sup> ,	׳∶	Number to Sens	s refer itivity	С	<b>8</b> =3%	' Strain	at Failur	е					

PROJECT: Preliminary Geotechnical Investigation- Proposed Development CLIENT: Lakeview Community Partners Ltd.

DS CONSULTANTS LTD. Geotechnical & Environmental & Materials & Hydrogeology

LOG OF BOREHOLE BH18-04

2 OF 3

DRILLING DATA Method: Hollow Stem Auger



PROJECT: Preliminary Geotechnical Investigation- Proposed Development

SAMPLES

CLIENT: Lakeview Community Partners Ltd.

PROJECT LOCATION: 800 Hydro Road, Mississauga, ON

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1

SOIL PROFILE

DRILLING DATA
Method: Hollow Stem Auger

Diameter: 150mm Date: Jun-22-2018

DYNAMIC CONE PENETRATION RESISTANCE PLOT

REF. NO.: 18-519-10 ENCL NO.: 5

	SOIL PROFILE		S	SAMPL	.ES	~		RESIS	TANCE	PLOT	>				NAT	URAL			ь	ME	<b>FHANE</b>
(m) <u>ELEV</u> DEPTH	DESCRIPTION	TRATA PLOT	UMBER	YPE	V" <u>BLOWS</u> 0.3 m	ROUND WATER ONDITIONS	LEVATION	2 SHEA O UI • QI	0 4 AR STI	0 6 RENG INED RIAXIAL	0 8 TH (kF + ×	Pa) FIELD V & Sensit LAB V/	00 I ANE ivity ANE			STURE TENT 0 DNTEN	UMIT WL T (%)	POCKET PEN (Cu) (kPa)	NATURAL UN <b>I</b> T M (KN/m <sup>3</sup> )	A GRA DISTR	ND IN SIZE IBUTIOI (%)
60.7	SILTY CLAY TILL: some sand, trace gravel, grey, moist, hard(Continued)	s isi	Ē 16	⊊ SS	<i>≧</i> 42	00	団 61		0 4	о е	08	30 1		1		20 3	30	>225		GR SA	A SI C
20.4	END OF BOREHOLE Notes: 1) Water level at 6.0 mbgl during drilling																				

05	DS CONSULTANTS LTD.	
	Geotechnical � Environmental � Materials � Hydrogeology	

DRILLING DATA

Diameter: 150mm

Date: Jun-27-2018

Method: Hollow Stem Auger

PROJECT: Preliminary Geotechnical Investigation- Proposed Development

CLIENT: Lakeview Community Partners Ltd.

PROJECT LOCATION: 800 Hydro Road, Mississauga, ON

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1

	SOIL PROFILE			SAMPL	ES			DYNA RESIS	MIC CO TANCE	NE PEI		TION		DIAST	_ NAT	URAL			ь	METH	ANE
(m ELE		PLOT	~		a m	D WATER	NO	2 SHE/	AR ST		SO E	30 1 Pa)	00			TURE TENT N		XET PEN. u) (kPa)	RAL UNIT W KN/m <sup>3</sup> )	AN GRAIN DISTRIE	D SIZE IUTION
DEP		STRATA	NUMBER	LYPE	0.3 N"		ELEVAT	0 U • Q	NCONF UICK TF 20 4	INED RIAXIAL .0 6	+ - × 50 6	FIELD V & Sensit LAB V 30 1	(ANE tivity ANE 00	WA <sup>-</sup>	TER CO	0 0 0	T (%) 30	DO DO	NATUR (}	(%	) 9) 91 CL
- 80	1.0 TOPSOIL :150 mm	<u>11/7</u>	-		-	00		-					1			-	1				
	<ul> <li>FILL: clayey silt, trace asphalt/concrete fragments, trace organics, grey to dark grey, moist, compact.</li> </ul>	X	1	SS	18		80	-										-			
	compact		2	SS	12			-													
- 78							79	-													
	gravel, brown, moist, very stiff		3	SS	25			-							c						
78	3.0	44	1				78	-													
- 2	2.3 SILTY CLAY:some sand, brown, moist, hard		4	SS	44			-							0	<b>-</b>				0 11	57 32
E		1	├─					E													
Ł			5	ss	50/		77								0						
F			1		100mn	1		-													
ţ.		1						-													
4								-													
Ē			1				70	-													
Ē			1				/0	-													
4		17	6	22	50/			-						0							
	1.8 weathered, grey		Ť	00	<del>75mm</del>									÷							
	END OF BOREHOLE:																				
	1) Borehole dry and open upon																				
	completion.																				
12																					
<del>2</del>																					
138																					
B																					
S																					
GP																					
DAD.			1																		
2RC																					
<u>DR(</u>																					
쉽																					
080			1																		
19-11																					
18-5			1																		
<sup>1</sup>																					
Ľ			1																		
so																					
SO																					
						GRAPH	. 3	3	Numbor	s rofor		<b>s</b> =3%									



REF. NO.: 18-519-10

ENCL NO.: 33

05	DS CONSULTANTS LTD.
	Geotechnical ♦ Environmental ♦ Materials ♦ Hydrogeology

DRILLING DATA

Diameter: 150mm

Date: Jun-27-2018

Method: Hollow Stem Auger

PROJECT: Preliminary Geotechnical Investigation- Proposed Development

CLIENT: Lakeview Community Partners Ltd.

PROJECT LOCATION: 800 Hydro Road, Mississauga, ON

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1

	SOIL PROFILE		s	AMPL	ES			RESIS	MIC CO STANCE	PLOT		HON .		DIACT		JRAL			μ	METH	HANE	
	(m)		1				ATEF		2	20 4	ю е	50 E	30 1	00	LIMIT	CON	TURE	LIMIT	a) EN	NIT N	AA CRAIN	
E	ELEV	DESCRIPTION	PL0	~		3 m	NOI	NO	SHE/	AR ST	RENG	TH (kl	Pa)		w <sub>P</sub>   <b>⊢</b> −−	\(	א כ	WL	CKET (KP	RAL L (kN/m	DISTRI	UTION
D	EPTH		RAT <sup>¢</sup>	MBE	Ы	립이		EVAT		NCONF U <b>I</b> CK TF	INED RIAXIAL	+ - ×	& Sensit	tivity ANE	WAT	FER CC	NTEN	T (%)	9 O	NATU	(9	%)
	80.3		STF	R	TYF	"Z	GR CO	ELE	2	20 4	ю е	50 E	30 1	00	1	0 2	0 3	30			GR SA	SI CL
E	88.9	TOPSOIL: 230mm	<u>×1 1/</u>						-													
Ē	0.2	FILL: clayey silt, trace gravel, trace cobbles, asphalt fragments, dark	$\mathbb{X}$	1	SS	11		80	-					-		c						
F		brown to dark grey, very moist,	$\otimes$						-													
Ē		compact	$\mathbb{X}$	<u> </u>					-													
1			$\otimes$	2	SS	16			-							o						
F			$\bigotimes$	-				79	-													
F			$\mathbb{X}$						-													
E	78.5		$\bigotimes$	3	SS	14			E								0					
2	1.8	CLAYEY SILT TILL: sandy, trace gravel, occasional cobble/boulder,		ľ	00				-													
F		brown, moist, stiff to hard	ł					70	-													
F								''	-													
F				4	SS	58			-							0						
3			H	<u> </u>					-													
Ē									-													
F			Hł	5	SS	50/ 100mm		77	-						0							
Ē									-													
F.				ł					-													
Ē									E													
E								76														
F	75.7	SHALE: Georgian Bay Formation	[ł.]			50/			-													
F	7 <u>5</u> 5 4.8		-	6	SS	<del>50mm</del>			-													
		END OF BOREHOLE Notes:																				
		1) Borehole dry and open upon completion																				
		completion.																				
-12																						
18-10																						
Ц																						
DS.G																						
L L L E																						
AD.0																						
0 RC																						
YDR																						
H 00%																						
-10 E																						
<del>3-</del> 519																						
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IL LO																						
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REF. NO.: 18-519-10 ENCL NO.: 35

05	DS CONSULTANTS LTD.
	Geotechnical ♦ Environmental ♦ Materials ♦ Hydrogeology

CLIENT: Lakeview Community Partners Ltd.

## LOG OF BOREHOLE BH18-41

PROJECT: Preliminary Geotechnical Investigation- Proposed Development

DRILLING DATA

Date: Jul-26-2018

Method: Solid Stem Auger Diameter: 150 mm

PROJECT LOCATION: 800 Hydro Road, Mississauga, ON

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1

	SOIL PROFILE			SAMPL	.ES			RESIS	TANCE	PLOT		HON			~ NAT	URAL			F	METH	IANE
()		L_				ER .		2	0 4	06	50 E	30 1	00	PLASTI LIMIT	C MOIS	TURE		z.	Ν	AN	ID
		07			Şε	NS NS	z	SHEA	R STI	RENG	L TH (kl	⊥ Pa)		WP	Ň	w	WL	(kPa	PL UN	GRAIN	SIZE
DEPTH	DESCRIPTION	TAF	ËR		3LOV		ATIO		NCONF	INED	+	FIELD V & Sensit	ANE			0		SQCK	TUR/ (kh	DISTRIE	SUTION
		LRA.	E E	ĥ	шı =	DND 20	Ň	• QI	J <b>I</b> CK TF	RIAXIAL	. ×	LAB V	ANE	WAT	TER CO	DNTEN	Γ(%)	"	NA	()	0)
83.3		5	ž	F	Ę	ΰΰ	Ш	2	:0 4	ο e	30 8 	30 1 	00	1	0 2	20 3	30 			GR SA	SI CL
- 89:9	TOPSOIL: 152mm	<u></u>						_													
- 0.2	FILL: clayey silt, trace rootlet, trace	$\mathbb{X}$	1	SS	12		83								o						
-	asphait, brown, moist, stin	$\otimes$	1					-													
F		$\otimes$	2					-													
Ē,		$\otimes$						-													
F		$\otimes$	2	SS	12			-							0						
E		$\otimes$					82	-													
- 81.8		$\bowtie$					02	-													
- 1.5	SILT : some sand, trace clay,																				
F	brown, wet, loose		3	SS	5			-								0					
2								-													
F 81 0								-													
- 2.3	CLAYEY SILT TILL : some sand,		1				81	-													
F	trace gravel, trace cobble, brown to	HH	1	SS	18			_							0						
Ł	grey, moist, very stiff to hard	ľ.H						_													
3		Hit	}—					-													
F		11						-													
-					50/		80	-													
-			5	SS	127mn	h		-							D						
-		[.]	<b></b>					-													
È,		W	ł					-													
-4		HH	1																		
Ł		19.	ł				70	-													
-		W.	1				19	-													
78.7	SILT: some sand trace clay, grey	НĤ				-		-													
- 4.0	very moist to wet, dense							-													
5	-		6	SS	32			-							0						
-								-													
-							78	-													
F																					
E								_													
6																					
<u> </u>	CLAVEY SILT TILL : some sand	H						-													
- 0.1	trace gravel, trace cobble, grey,		1_		50/		77														
-	moist, hard	łW	7	ss	127mn	h		-						0							
<u>1</u>			1					-													
<u>5</u>		ИĽ	1					-													
		1:16	ł					-													
		Kit	1				76	-													
šE		111					0	E													
75.7	SHALE: Georgian Bay Formation	14	_	00	50/			-													
	weathered, grey		l 8	55	100mn																
5 '.°	END OF BOREHOLE																				
	Notes:																				
	completion																				
8																					
5		1																			
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5																					
		<u> </u>	I	I	L		L		I			1	1	I		1	I	I	L		



1 OF 1

REF. NO.: 18-519-10

ENCL NO.: 38

05	DS CONSULTANTS LTD.
	Geotechnical ♦ Environmental ♦ Materials ♦ Hydrogeology

PROJECT: Preliminary Geotechnical Investigation- Proposed Development

CLIENT: Lakeview Community Partners Ltd.

PROJECT LOCATION: 800 Hydro Road, Mississauga, ON

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1

		SOIL PROFILE		s	AMPL	ES.			DYN/ RESI	MIC CC	NE PER		TION			- NAT	URAL			⊢	METH	HANE
	(m)		F				TER			20 4	io e	50 E	30 1	00			TURE		a) EN	NIT W	1A	ND
	ELEV	DESCRIPTION	PLC	~		3 m		NO	SHE	AR ST	RENG	TH (ki	Pa)		₩ <sub>P</sub>		w 0	WL	u) (kP	RAL U KN/m <sup>3</sup>	GRAI	N SIZE BUTION
	EPTH	DESCRIPTION	RATA	ABEF	щ	BLO		VAT			INED RIAXIAI	+ ×	& Sensit	ivity ANE	WAT	FER CO	ONTEN"	Г (%)	00 00	NATUR )	(¢	%)
	85.7		STF	NUI	ΤΫ́́Ε	"Z	GR	ELE		20 4	10 6	50 E	BO 1	00	1	0 2	20 3	30			GR SA	SI CL
E	0.0	TOPSOIL: 350 mm	<u>×1/</u>						Ŀ													
F	0.3	FILL: silty sand, trace	KX	1	SS	10			-								o					
F		topsoil/rootlets, some gravel, brown,	$\bigotimes$				-		È.													
F	84.9	FILL :sandy silt_trace clay_brown	$\bigotimes$				-	85	-													
F		wet, loose	$\bigotimes$	2	22	4			E							0						
F			$\bigotimes$	2	00				-													
F	84.2		$\bigotimes$				-		-													
Ē	1.5	grey, moist, stiff	$\bigotimes$	2	66			84	Ē							0						
2			$\bigotimes$		33	5			-							Ŭ						
F			$\bigotimes$						Ļ													
F			$\bigotimes$						-													
Ē			$\bigotimes$	4	SS	11		83	-							0						
Ē.			$\bigotimes$						1													
-			$\bigotimes$						-													
-	82.3		$\bigotimes$	5	66	10			Ē							0						
F	3.4	SANDY SILT: trace clay, brown, moist_compact		5	33				-							Ŭ						
F		moist, compact						82	-													
4									F													
E			.  .						-													
F	81 1								-													
F	4.6	CLAYEY SILT TILL: trace gravel,						81	-													
5		brown, moist, hard	11	6	SS .	50/ 150mn	m		Ē								<b>•</b>		>225			
F									È.													
F			HĽ						-													
E								80	-													
Ē			<u>i</u>						ŀ													
F	79.6	SHALE: Coordian Pay Formation	rk.	_		50/			-													
F	79:4 6.3	weathered, grey			55	00m			<b>F</b>						۲							
		END OF BOREHOLE Notes:																				
0-12		1) Borehole dry and open upon																				
18-1		completion.																				
GDT																						
DS.(																						
GPJ																						
AD.																						
0 R(																						
YDR																						
H 00																						
-10 8																						
-519																						
18																						
Ĭ																						
SOIL																						
SC																						

REF. NO.: 18-519-10 ENCL NO.: 39

Diameter: 150mm Date: Jun-29-2018

DRILLING DATA

Method: Hollow Stem Auger

15	DS CONSULTANTS LTD.
	Geotechnical ♦ Environmental ♦ Materials ♦ Hydrogeology

PROJECT: Preliminary Geotechnical Investigation- Proposed Development

CLIENT: Lakeview Community Partners Ltd.

PROJECT LOCATION: 800 Hydro Road, Mississauga, ON

DATUM: Geodetic

4

BOREHOLE LOCATION: See Drawing 1

Γ		SOIL PROFILE		5	SAMPL	.ES			DYNA RESIS	MIC CC	NE PEI PLOT		TION			NAT	URAL			F	METHAN	١E
	(m)		Ŀ				TER		2	20 4	io e	50 8	30 1	00		C MOIS	TURE	LIMIT	a) D	N LIN (	AND	
	ELEV	DESCRIPTION	PLO	۳.		3 a N	d W∌	NO	SHEA	AR ST	RENG	TH (kF	Pa)		₩ <sub>P</sub>	· · · ·	// 0	WL	u) (kP.	RN/m <sup>3</sup>	GRAIN SI	ZE ION
Ī	DEPTH	DESCRIPTION	RATA	MBEF	щ	BLO		VAT			INED RIAXIAI	+ ×	& Sensit	ivity ANE	WA.	TER CO	DNTEN	Г (%)	00 00	NATUR	(%)	
	83.5		STF	Ñ	Τ	r.	GR(	ELE	2	20 4	10 E	- ^ 50 8	80 1	00	1	0 2	20 3	30		-	GR SA SI	CL
E	0.0	TOPSOIL: 350mm	<u>×1/</u>						E .													
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REF. NO.: 18-519-10 ENCL NO.: 40

Diameter: 150mm Date: Jun-29-2018

Method: Hollow Stem Auger

DRILLING DATA

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PROJECT: Preliminary Geotechnical Investigation- Proposed Development CLIENT: Lakeview Community Partners Ltd.

DS CONSULTANTS LTD. Geotechnical & Environmental & Materials & Hydrogeology

DRILLING DATA Method: Hollow Stem Auger

1 OF 3

05	DS CONSULTANTS LTD.
	Geotechnical ♦ Environmental ♦ Materials ♦ Hydrogeology

PROJECT: Preliminary Geotechnical Investigation- Proposed Development CLIENT: Lakeview Community Partners Ltd.

PROJECT LOCATION: 800 Hydro Road, Mississauga, ON

DRILLING DATA

Method: Hollow Stem Auger Diameter: 150mm

Date: Jul-05-2018

REF. NO.: 18-519-10 ENCL NO.: 45

BOREHOLE LOCATION: See Drawing 1

DATUM: Geodetic

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PROJECT: Preliminary Geotechnical Investigation- Proposed Development

SAMPLES

CLIENT: Lakeview Community Partners Ltd.

PROJECT LOCATION: 800 Hydro Road, Mississauga, ON

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1

SOIL PROFILE

DRILLING DATA							
Method: Hollow Stem Auger							
Diameter: 150mm							

REF NO: 18-519-10

Date: Jul-05-2018

DYNAMIC CONE PENETRATION RESISTANCE PLOT

ENCL NO.: 45

LIQUID LIMIT

PLASTIC NATURAL MOISTURE LIMIT CONTENT GROUND WATER CONDITIONS NATURAL UNIT WT (kN/m<sup>3</sup>) POCKET PEN (Cu) (kPa) 40 60 80 . 100 20 (m) STRATA PLOT GRAIN SIZE BLOWS 0.3 m WP w WL ELEVATION ELEV DEPTH DISTRIBUTION Ŀ. -0--DESCRIPTION NUMBER O UNCONFINED 2 (%) × LAB VANE ТҮРЕ WATER CONTENT (%) QUICK TRIAXIAL z GR SA SI CL 20 40 60 80 100 10 20 30 SILT TO CLAYEY SILT: trace 16 SS 64 61 >22 sand, grey, very moist, very dense(Continued) 60.7 20.4 END OF BOREHOLE: Notes: 1) Water level at 3.1 mbgl during drilling

DS SOIL LOG 18-519-10 800 HYDRO ROAD GPJ DS GDT 18-10-12

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AND

# Appendix B

Site Photographs (taken on June 17, 2019)



Photo B1: Creek and Concrete Culvert at Lakeshore Blvd (looking north - upstream)



Photo B2: Creek conditions at south of Lakeshore Blvd (looking south - downstream)



Photo B3: Creek conditions at north of Section L-L (looking north - upstream)



Photo B4: Creek conditions at north of Section L-L (looking south - downstream)



Photo B5: Top of slope conditions to north of Section M-M (looking north toward Lakeshore Blvd)



Photo B6: Creek conditions at the turning point to south of Section M-M (looking northeast)



Photo B7: Creek conditions at west of Section N-N (looking east)



Photo B8: Top of slope conditions in area of and to west of Section N-N (looking east from Borehole BH18-41 area – See Appendix A)



Photo B9: Creek conditions at west of Section N-N (looking northwest)



Photo B10: Top of slope conditions to west of Section N-N (looking west)



Photo B11: Slope conditions to east of Section N-N near road bridge (looking west)



Photo B12: Creek conditions at north of Bridge (looking south - downstream)



Photo B13: Road Bridge area (looking east)



Photo B14: Top of slope conditions and road to west of creek in Reach S2 area (looking south)



Photo B15: Creek conditions to south of bridge (looking north - upstream)



Photo B16: Creek and slope conditions to south of bridge (looking south from bridge – looking downstream)



Photo B17: Ditch between Creek and Road at south part of Reach S2 area (looing south - downstream)



Photo B18: Ditch between Creek and Road at south part of Reach S2 area (looing north - upstream)



Photo B19: Creek Conditions to South of Steel Wire Fence at south end of Each S2 (looking north - upstream)



Photo B20: Slope Conditions at South of Steel Wire Fence to south end of Reach S2 area (looking northwest)

# **Report on**

Supplementary Geotechnical Slope Stability Assessment East Side Slope of Serson Creek Lakeview Village, 800 Hydro Road Mississauga, Ontario

**Prepared For:** Lakeview Community Partners Limited

**Project No.** 18-519-102 (East Slope) July 24, 2020



DS CONSULTANTS LTD.

6221 Highway 7, Unit 16 Vaughan, Ontario, L4H 0K8 Telephone: (905) 264-9393 <u>www.dsconsultants.ca</u>

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3.	SUBSURFACE CONDITIONS	2
4.	SLOPE CONDITIONS AND PROFILES	3
5.	EROSION CONSIDERATIONS	4
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STABILITY ANALYSIS RESULTS OF EXISTING SLOPE	16A
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APPENDIX I – LOCATION PLAN AND LOGS OF BOREHOLES BY DS CONSULTANTS LTD. APPENDIX II – LOCATION PLAN AND LOGS OF PREVIOUS BOREHOLES BY WSP APPENDIX III – SITE PHOTOGRAPHS

# 1. INTRODUCTION

DS Consultants Ltd. (DS) was retained by Lakeview Community Partners Limited to undertake a geotechnical slope stability assessment for the Serson Creek bank slopes for the proposed Lakeview Village development at 800 Hydro Road in Mississauga, Ontario.

In July 2019, DS Consultants Ltd. completed a geotechnical slope stability assessment for the <u>west side</u> <u>slope</u> of Serson Creek at the site, and the findings are documented in DS's previous report (No. 18-519-102) dated July 19, 2019.

This supplementary geotechnical slope stability assessment report is for the stability assessment of the <u>east side slope</u> of Serson Creek at site. The purpose of this study was to assess the stability of the existing east bank slope of Serson Creek and determine the location of the long-term stable top of slope (LTSTOS) line.

This report is provided on the basis of the terms of reference presented above and, on the assumption, that the design will be in accordance with applicable codes and standards. If there are any changes in the design 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 Oborings and reporting before the recommendations can cater to the changed design.

The site investigation and recommendations follow generally accepted practice for geotechnical consultants in Ontario. The format and contents are guided by client specific needs and economics and do not conform to generalized standards for services. Laboratory testing for most part follows ASTM or CSA Standards or modifications of these standards that have become standard practice.

This report has been prepared for Lakeview Community Partners Limited, its architect and designers. Use of this report by third party without DS consent is prohibited.

# 2. FIELD AND LABORATORY WORK

At the north part of the slope site where there in no existing boreholes near the east slope bank of the creek, three boreholes (BH20-1 to BH20-3) were drilled by DS Consultants Ltd. to refusal at depths ranging from 1.9 to 2.6m. The boreholes were drilled with portable equipment by a drilling sub-contractor under the direction and supervision of DS Consultants Ltd. personnel. Continuous samples were retrieved with a 50 mm O.D. split-barrel sampler driven with a hammer weighing 312 N and dropping 760 mm. The blow counts were converted to standard SPT 'N' values. The samples were logged in the field and returned to the DS Consultants Ltd. laboratory for detailed examination by the project engineer and for laboratory testing.

As well as visual examination in the laboratory, all of the soil samples were tested for moisture content. Two selected samples were tested for grain size distribution and Atterberg Limits, and the results are shown in the borehole logs and on **Drawing 5** in **Appendix I**.

Water level observations were made during drilling and in the open boreholes at the completion of the drilling operations. A piezometer was installed in each borehole for stabilized groundwater level measurement.

The ground surface elevations at the borehole locations were surveyed by DS, using a differential GPS unit.

# 3. SUBSURFACE CONDITIONS

## North Part of Site:

Three boreholes (BH20-1 to BH20-3) were drilled by DS Consultants Ltd. at the north part of the site. The borehole location plan, borehole logs, and grain size analysis results are presented on **Drawings 1 to 5** in **Appendix I**. The subsurface conditions in the boreholes are summarized in the following paragraphs.

In BH20-1 to BH20-3, a topsoil layer of 150 to 200 mm in thickness was found below surface. Below the topsoil, fill material was found, extending to depths ranging from 0.8 to 1.5 m. The fill consisted of stiff to very stiff clayey silt, with inclusions of topsoil and organics.

The native soil below the fill consisted of very stiff to hard silty clay till, extending to the explored depth of the boreholes. The till contains some sand and trace to some gravel.

Grain size analyses of 2 silty clay till samples (BH20-1/SS2 and BH20-3/SS3) were conducted and the results are presented in **Drawing 5** in **Appendix I** and on the borehole logs, with the following fractions:

Clay: 28 to 37% Silt: 46 to 49% Sand: 11 to 15% Gravel: 3 to 11%

The boreholes were found dry during the drilling operations. No groundwater was detected in the piezometers in the boreholes. In the slope area near the creek, the groundwater level will fluctuate with the water level in the creek.

## South Part of Site:

WSP Canada Inc. carried out a geotechnical investigation for the WWPT watermain extension, documented in the report No. 171-16737-00, dated April 27, 2018. The report by WSP was provided to us by the client. In WSP's geotechnical investigation, six (6) boreholes (BH16-1 to BH16-3, BH17-1, BH17-2 and BH17-4) were drilled near the east bank slope of Serson Creek. The borehole location plan and

relevant borehole logs are attached in **Appendix II**. The subsurface information in these boreholes are used in this slope stability study.

In the boreholes, fill materials were found extending to depths of 1.2 to 3.4 m. The fill consisted of clayey silt, silty clay, sandy silt to sand. The fill was in a loose to dense state, with measured SPT 'N' values ranging from 6 to over 30 blows per 300 mm penetration. The native soils consisted of very stiff to hard cohesive deposits of clayey silt to silty clay (till) and dense to very dense cohesionless deposits of silt, sand, sandy silt to silty sand.

Groundwater in the boreholes was within 6 m below the surface. In the slope area near the creek, the groundwater level will fluctuate with the water level in the creek.

# 4. SLOPE CONDITIONS AND PROFILES

A site visit was made by a senior geotechnical engineer from DS Consultants Ltd. on July 20, 2020 to inspect the slope and creek conditions. Selected photographs taken during our site visits are presented in **Appendix III**. The subject creek slopes are located between Lakeshore Blvd and about 100 m north of Lake Ontario.

For the convenience of discussion, Lakeshore Blvd. in the area is assumed in the east-west alignment. There is an existing bridge for the access road from WWTP to the site. According to the slope conditions, the creek slopes are considered consisting of 2 reaches as follows:

- Reach S2 is located from the access road bridge to Lake Ontario, along the WWTP and the access road.
- > Reach S3 is located from Lakeshore Blvd to the access road bridge.

In the area of Reach S3 (north of bridge, see Photos 1 to 10 in **Appendix III**), the slope conditions are described as follows:

- The slope in Reach 3 area was generally 2 to 3 m in height, with steepness of 2H:1V to 3H:1V or flatter. In some areas, the lower portion of the slope near the creek bed was steeper than 2H:1V.
- The slope surface is generally well covered with trees, grasses, bushes and other vegetation.
- The width of the creek was generally within 2 to 3 m. The water depth of creek was within 0.4 m during our site visit.
- No evidence of slope failure was observed during our site visit. Some erosions of the slope toe at the creek water level were observed at various locations along the creek.

In the area of Reach S2 (south of bridge, see Photos 11 to 28 in **Appendix III**), the slope conditions are described as follows:

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- The previous trees in the creek and slope area were removed. The slope was generally covered with grasses and some wood debris.
- There is a steel chain fence along the east side of the creek. There was a berm of about 1 to 2.5m high near and along the fence. At the north part and south part of the site, the berm was located to the east of the fence. In some areas at the middle part of the site, the berm was located at or to the west of the fence. The steepness of the berm slope facing the creek was typically 2H:1V to 3H:1V.
- The height of the east slope in Reach 2 area, including the berm, was typically 2 to 4 m from the creek bed level.
- The width of the creek was generally 2 to 3 m. The water depth of creek was generally within 0.3m during our site visit. However, the creek bed in the area near the access road bridge was dry.
- No evidence of slope failure was observed during our site visit. No active erosion at the creek level water level was observed, as he creek bed was mostly covered with wood debris, grasses and cobbles/boulders.

The existing slope profiles at 14 Sections (A-A to N-N, see Figure 1A for locations) were provided to us by Urbantech, as presented on Figures 2A to 15A.

# 5. EROSION CONSIDERATIONS

In the Geomorphic Assessment Report by Beacon Environmental Limited, a long-term toe erosion allowance of 8 m is recommended for the Serson Creek bank slopes across the site (Reach S2 and S3). This recommended toe erosion allowance for the creek bank slopes is used in the slope stability assessment.

# 6. SOIL PARAMETERS

Based on the borehole information and our site observations, soil parameters used in the slope stability analyses are given on **Table 6.1**.

Soil Type	Unit Weight (kN/m³)	Cohesion c' (kPa)	Friction Angle <b>¢'</b> (degree)
Fill	20	0	30
Silty clay/clayey silt deposits	21	5	28
Compact sandy silt to sand	21	0	32
Dense sandy silt to sand	21	0	34

Table 6.1: Soil	Parameters for	· Long-term	Slope St	tability	Analyses

# 7. STABILITY ANALYSES OF SLOPES

The existing slope profiles at Sections A-A to N-N (see Figure 1A for locations) are presented on Figures 2A to 15A.

In the previous report (No. 18-519-102, dated July 19, 2019) by DS Consultants Ltd. for the stability assessment of the west slope of Serson Creek, stability analyses of existing slopes and stable slopes were carried out. It was concluded that a slope of 2.5H:1V, together with toe erosion allowance of 8m, is considered stable in terms of long-term stability for the west side slope of the creek. Based on the boreholes, the soil conditions at the east side of the creek are similar to the west side of the creek. Therefore, a slope of 2.5H:1V, together with toe erosion allowance of 8m, is also considered stable in terms of long-term stability for the creek.

As confirmatory analyses, stability analyses of the existing east slope at Section L-L has been carried out with the computer program SLIDE (Version 8) using the Simplified Bishop method, Simplified Janbu method and GLE/Morgenstern-Price method. The analysis results are presented in Figure 16A. The calculated factor of safety of the existing east slope at Section L-L is 2.08, which is greater than the CVC's minimum acceptable value of 1.5 for stable slope.

For long-term stability, a toe allowance of 8 m is also required for analysing the long-term stable slope.

In order to determine the long-term stable slope, analysis of a 2.5H:1V slope with a toe erosion allowance of 8 m at Section L-L have been carried out for the east slope, and the results are presented on Figure 17A. The calculated factor of safety of the 2.5H:1V slope at Section L-L is 2.25, which is greater than the minimum acceptable value of 1.5.

Based on the analysis results, it is confirmed that a slope of 2.5H:1V with a toe erosion allowance of 8m is stable and acceptable in terms of long-term stability for the east slope of Serson Creek.

# 8. LONG-TERM STABLE TOP OF SLOPE (LTSTOS)

# Reach S3 (north of bridge):

Based on the slope stability analysis results presented above, Point "S12E" in Figure 17A represents the long-term stable top of slope (LTSTOS) of the east slope at Sections L-L. Accordingly, Point "S12E" is also shown in Figure 13A of the profile at Section L-L.

Similarly, the long-term stable top of slope (LTSTOS) of the east slope at other sections (J-J, K-K, M-M and N-N) can be obtained using a stable slope of 2.5H:1V and a toe erosion allowance of 8m, as shown in Figures 11A, 12A, 14A and 15A, respectively.

Based on the analysis results, the points representing the long-term stable top of slope (LTSTOS) at Sections J-J to N-N at the north part of the site are as follows.

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- Point "S10E" on Figure 11A represents the long-term stable top of the east slope at Section J-J.
- Point "S11E" on Figure 12A represents the long-term stable top of the east slope at Section K-K.
- Point "S12E" on Figure 13A represents the long-term stable top of the east slope at Section L-L.
- Point "S13E" on Figure 14A represents the long-term stable top of the east slope at Section M-M.
- Point "S14E" on Figure 15A represents the long-term stable top of the east slope at Section N-N.

Based on the long-term stable top of slope (LTSTOS) at Sections J-J to N-N, and our field observations, the recommended long-term stable top of slope line (Line S10E-S11E-S12E-S13E-S14E) is shown on Figure 1A for east slope of Serson Creek at the north part of the site (Reach 3).

## Reach S2 (South of Bridge):

In the area of Reach 2 to the south of the bridge, the existing slope profiles at Sections A-A to I-I, as shown in Figures 2A to 10A are provided up to the property line. The existing grade elevation to the east of the property line (i.e. beyond the property line) is not available. As shown in Figures 2A to 10A, the 2.5H:1V stable slope (with 8 m erosion allowable) extends beyond the property line. Because the existing ground profile beyond the property line is not available, the exact location of the long-term stable top of slope line (LTSTOS line) at the ground surface can not be determined.

The long-term stable top of slope line (LTSTOS line) at Sections A-A to I-I is located beyond the property line, i.e. to the east of the property line, and is located within WWPT property. As the existing ground profile beyond the property line is not available, the long-term stable top of slope line (LTSTOS line) at Sections A-A to I-I at the south part of the site can not be determined, and is not shown in Figure 1A.

# 9. GENERAL COMMENTS AND LIMITATIONS OF REPORT

DS Consultants Ltd. (DS) should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, DS will assume no responsibility for interpretation of the recommendations in the report.

This report is intended solely for the Client named. The material in it reflects our best judgment in light of the information available to DS at the time of preparation. Unless otherwise agreed in writing by DS, it shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. No portion of this report may be used as a separate entity, it is written to be read in its entirety.

The conclusions and recommendations given in this report are based on information determined at the test hole locations. The information contained herein in no way reflects on the environment aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. The benchmark and elevations used in this report are primarily to establish relative

elevation differences between the test hole locations and should not be used for other purposes, such as grading, excavating, planning, development, etc.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of test holes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices.

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. DS 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.

We trust that the information contained in this report is satisfactory. Should you have any questions, please do not hesitate to contact this office.

DS CONSULTANTS LTD ROFESSIONAL LICENSE A. SANGAR 100141185 VINCE OF ON PROFESSIONAL LICENA NGINEEN F. ZHU Fanyu Zhu, Ph.D., P.Eng. BOLINICE OF ONTARIO

# Figures

FIGURE 1A:SLOPE LOCATION PLANFIGURES 2A-15A:SLOPE PROFILES AT SECTIONS A-A TO N-NFIGURES 16A:STABILITY ANALYSIS RESULTS OF EXISTING SLOPEFIGURES 17A:STABILITY ANALYSIS RESULTS OF LONG-TERM STABLE SLOPE


	Drawn By:		Date:	
F.Z		S.Y		July 2020
	Project No:		Figure No.	
As Shown		18-519-102		1A

















































# Appendix I

Location Plan and Logs of Boreholes by DS Consultants Ltd.



Legend

+ Borehole Location

DS CONSULTANTS LTD. 6221 Highway 7, UNIT 16 Vouebog Costraio I (JH 0K8	Project:	Geotechnica	Investigation	n - Slope Sta	bility at Serson	Creek, ON		and a start of the
Telephone: (905) 264-9393 www.dsconsultants.ca	Title:	Borehole L	ocation Pla	n				Ø
Client:	Size:	Approved By:	FZ	Drawn By:	MM	Date:	July,	2020
Lakeview Community Partners Limited	Rev:	Scale:	As Shown	Project No.:	18-519-102	Figure No.:	1	
	0	Image/Map Source	: Google Satellite Ima	ge				



DRILLING DATA

Diameter: 50 mm

Date: Jun/30/2020

Method: Manual SPT

1	OF	1
•	•••	

REF. NO.: 18-519-102

ENCL NO.: 2

PROJECT: Slope Stability at Serson Creek

CLIENT: Lakeview Community Partners Limited

PROJECT LOCATION: 800 Hydro Road, Mississauga, ON

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4826107.86 E 616676.52

Γ		SOIL PROFILE		5	SAMPL	ES			DYNA RESIS	MIC CC	DNE PE E PLOT		ATION			o NAT	URAL			⊢	ME	THAN	=
	(m)		DT			(0)	ATEF		2	20 4	06	0 8	80 1	00	LIMIT	C MOIS	TURE	LIQUID	PEN.	WIT N			7E
	ELEV	DESCRIPTION	A PLO	щ		OWS 3 m	ION:	NOIT	SHEA	R STI	RENG	TH (kl	Pa) FIELD V	ANE	W <sub>P</sub>		∾ ⊃	WL	CKET Su) (kP	IRAL U (kN/m <sup>3</sup>	DIST	RIBUTI	.e ON
ľ	DEPTH		RAT/	IMBE	Щ			EVA.	• Q	NCONF UICK TI	RIAXIA	L X	& Sensit LAB V	ivity ANE	WA	TER CO	ONTEN	T (%)	9 S	NATL		(%)	
	83.1	TOPSOIL 150mm	5	z	L	, Z	50	Ш	2	20 4	0 6	6 B	80 1	00	1	0 2	20 3	30			GR S	A SI	CL
Ē	83:0 0.2	FILL: clavey silt, trace topsoil, trace	XX				:目:	83	_														
ł	0.2	rootlets, brown, moist, stiff (possible	$\bigotimes$	1	SPT	11	ŀ∃:		-							0							
ŀ		weathered son)	$\bigotimes$				:目:		-														
-	82.3		$\bigotimes$				:目:		-														
F	0.8	SILTY CLAY TILL: some sand, trace gravel/ cobble_brown_moist							-														
F	-	hard		2	SPT	44	目.	Slotte	[ d pipe	 in san	 										11 1	546	28
F							l:≣:		ŀ							•		-					-
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ļ				3	SPT	62	[:目:		-							0							
	2							. 81	-														
ļ									-														
ŀ	00.5	grey below 2.3m		4	SPT	50/ 150mr	 n		-						0								
ł	2.6	END OF BOREHOLE:																					_
		Notes: 1) Piezometer installed at 2.3m																					
		depth. 2) Water level Readings:																					
		Date: Water Depth (mbgs)																					
		July 21, 2020 Dry																					
22/20																							
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9 <u>0</u>																							
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DS S																							
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DRILLING DATA

Diameter: 50 mm

Date: Jul/07/2020

Method: Manual SPT

1	OF	1
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REF. NO.: 18-519-102

ENCL NO.: 3

PROJECT: Slope Stability at Serson Creek

CLIENT: Lakeview Community Partners Limited

PROJECT LOCATION: 800 Hydro Road, Mississauga, ON

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4826031.43 E 616760.9

ſ		SOIL PROFILE		S	SAMPL	ES	~		DYNA RESIS	MIC CO	DNE PE E PLOT		ATION			o NAT	URAL			+	METHA	ANE
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ſ	DEPTH	DESCRIPTION	ZAT/	MBE	ш	O.	NUO	EVAT		UICK T	'INED RIAXIA	+ L X	& Sensiti LAB V.		WAT	TER CO	ONTEN	Г (%)	δ <sub>Ω</sub>	NATU	(%)	)
	82.0		ST	R	Σ	Ż	80 80 80 80	ELE	2	20 4	0 6	8 06	0 1	00	1	0 2	20 3	0			GR SA S	SI CL
Ŀ	0.0 81.8	TOPSOIL 200mm	<u>× //</u>				:目:		ŀ													
-	0.2	FILL: clayey silt, trace gravel, trace	$\bigotimes$	1	SPT	9	[:目:	1	-							o						
F	.	(possible weathered soil)	$\bigotimes$						F													
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Ŀ	1		$\bigotimes$	2	SDT	13	に目い	81														
-			$\bigotimes$	2	011	15	:目:	Slotte	d pipe F	in san	ld						Ĭ					
F	80.5		$\bigotimes$				「目う		Ē													
F	1.5	SILTY CLAY TILL: some sand,	Ŕ				l:目:		F													
ļ		brown, moist, very stiff to hard		3	SPT	28	:目:		Ŀ							•						
Ŀ	2						[:目:	80	-													
-							ŀ∃:	00	ŀ													
F		arev below 2.3m			ODT	50/	:¤:	1	F											1		
ŀ	79.5	END OF BOREHOLE:	i'r	4	SPT	75			<u> </u>							0						
		Notes:																		1		
		depth.																				
		2) Water level Readings:																				
		Date: Water Depth (mbgs)																				
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DS CONSULTANTS LTD.
Geotechnical � Environmental � Materials � Hydrogeology

DRILLING DATA

Diameter: 50 mm

Date: Jul/07/2020

Method: Manual SPT

1	OF	1
	<u> </u>	

REF. NO.: 18-519-102

ENCL NO.: 4

PROJECT: Slope Stability at Serson Creek

CLIENT: Lakeview Community Partners Limited

PROJECT LOCATION: 800 Hydro Road, Mississauga, ON

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4826046.48 E 616883.77

f		SOIL PROFILE		5	SAMPL	ES	Ĺ		DYN/ RESI		DNE PE		ATION			ΝΑΤΙ	IDAI			_	MET		-
ŀ	()		⊢				TER			20 4	0 6	<u>ح</u>	30 1	00	PLASTI LIMIT	C MOIS	TURE	LIQUID LIMIT	Ŀ.	TN TI	A	ND	
	(m)		DLO.			SNE	NS NS	z	SHE	AR STR	RENG	TH (kf	Pa)	ī —	WP	v	v	WL	(kPa	√m³)	GRAI	N SIZE	
ī	DEPTH	DESCRIPTION	ITA	BER		0.3		ATIC	οu	NCONF	INED	+	FIÉLD V. & Sensiti	ANE vity				T (0()	DOC DOC	TUR)		во пок %)	1
	00.4		TRA	IM N	ΥPE	ž	INO:	LEV	• •		RIAXIAL	_ ×	LAB V	ANE	WA 1	1 ER CC		I (%) NO		Ž			.
⊢	82.1	TOPSOIL 180mm	0)	2	-	-										0 2					GR SA	51 0	-
F	81.9	FILL: clayov silt, traco gravel, traco	$\sim$				E	82	-										1				
t	0.2	limestone, trace topsoil, brown,	$\bigotimes$	1	SPT	15	l∙⊟.		Ē							þ							
ŀ		moist, very stiff (possible weathered	$\bigotimes$				[:目:	·	-								0						
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ŀ	80.6	SILTY CLAY TILL: some sand	X	1					ŀ														
ļ	1.0	trace gravel, sand seams, brown,		3	SPT	50/			F							∘⊢		<b>—</b>			3 11	49 37	7
Ŀ	80.2	moist, hard				200mr	<b>n</b>		-							-		•					
ſ	1.9	END OF BOREHOLE:																					٦
		1) Piezometer installed at 1.5m																					
		depth. 2) Water level Readings:																					
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# Appendix II

Location Plan and Logs of Previous Boreholes by WSP





PROJECT: Geotechnical Investigation - GE Booth WWTP

CLIENT: Region of Peel

PROJECT LOCATION: 1300 Lakeshore Road E, Mississauga, ON

DATUM: Geodetic

BH LOCATION: N 4825675 E 617129

DYNAMIC CONE PENETRATION RESISTANCE PLOT SAMPLE SOIL PROFILE PLASTIC LIMIT NATURAL MOISTURE CONTENT REMARK GROUND WATER CONDITION LIQUID 20 40 60 LIMI POCKET PEN. (Cu) (kPa) AND 80 100 (m) Ī STRATA PLOT SHEAR STRENGTH (kPa) O UNCONFINED + FIELD VANE & Sensitivity GRAIN SIZE WL WP BLOW 0.3 m w NATURAL U ELEVATION ELEV DEPTH 0 DISTRIBUTION н DESCRIPTION NUMBER (%) TYPE × LAB VANE WATER CONTENT (%) QUICK TRIAXIAL ŗ 20 40 60 80 100 10 20 30 79.5 Ground Surface 79.9 ASPHALT:100 mm 78.2 GRANULAR: 180 m 0.3 Gravel) GR SA SI CL ò GRANULAR: 180 mm (sand and 1 s 29 0 gravel) 79 FILL: sand, some silt, some gravel, <u>78.7</u> brown, moist, compact 0.8 FILL: clayey silt to silty clay, some 2 S 29 0 sand, trace to some gravel, brown to grey, moist, firm to hard some gravel above 1.5 m 78 trace organics below 1.5 m 3 s 6 inferred cobble/boulder 77 50/ 4 S 0 50mm <sup>3</sup> 76.4 SANDY SILT: trace clay, contains 3.1 sand layers, brown, moist to wet, 5 S 54 0 38 54 8 76 very dense 75 74.9 SANDY SILT TILL: trace clay, trace 4.6 50/ gravel, occasional cobble/boulder, s 6 0 25m grey, moist, very dense wet below 5.2 m 74 50/ 7 S С 25mr 73 72 71.9 7.6 END OF THE BOREHOLE Note: 1) Water level was at 5.2 m during drilling.

+ <sup>3</sup>, × <sup>3</sup>: Numbers refer to Sensitivity

<u>GRAPH</u>

NOTE

 $\odot$   $^{\epsilon=3\%}$  Strain at Failure

1 OF 1

Method: Solid Stem Auger Diameter: 115mm

Date: Oct/24/2016

REF. NO.: 161-14544-00 ENCL NO.: 2



PROJECT: Geotechnical Investigation - GE Booth WWTP

CLIENT: Region of Peel

PROJECT LOCATION: 1300 Lakeshore Road E, Mississauga, ON

DATUM: Geodetic

BH LOCATION: N 4825731 E 617094

#### DYNAMIC CONE PENETRATION RESISTANCE PLOT SAMPLE SOIL PROFILE PLASTIC NATURAL LIMIT CONTENT REMARK LIQUID GROUND WATER LIMI AND 20 40 60 POCKET PEN. (Cu) (kPa) 80 100 (m) z STRATA PLOT GRAIN SIZE WL WP BLOW 0.3 m w NATURAL U CONDITION ELEV DEPTH ELEVATION DISTRIBUTION 0 DESCRIPTION NUMBER O UNCONFINED + (%) 80.1 Ground Surface 88.9 ASPHALT: 80 mm 78.2 GRANULAD WATER CONTENT (%) TYPE QUICK TRIAXIAL × LAB VANE ŗ 40 60 80 100 10 20 30 20 GR SA SI CL 80 GRANULAR: 150 mm (sand and 1 s 12 0 gravel) FILL: clayey silt, some sand, trace gravel, trace organics, brown to grey, moist, firm to very stiff 2 s 9 79 3 s 7 0 78 77.8 CLAYEY SILT TILL: some sand 23 trace gravel, brown, moist, very stiff 4 S 28 0 3 77.0 77 SANDY SILT TILL: trace clay, 50/ 3.1 5 S 0 some gravel, occasional (00mr cobble/boulder, brown, moist, very dense 76 grey below 4.6 m 6 S 50/ 0 50mi W. L. 75.1 m Nov 03, 2016 <sup>6</sup> 74.0 74 SILTY SAND: trace clay, contains 6.1 silt seams, grey, wet to saturated, 7 S 34 0 dense 73 72.5 SAND: coarse, some silt, trace clay, trace gravel, embedded layers 7.6 8 S 55 7 77 12 4 of silty sand till, grey, wet, very 72 dense <sup>9</sup> 71.0 71 **GRAVELLY SAND:** trace silt, trace clay, grey, saturated, dense 9.1 0.0 9 S 45 , . Q 0 70 , O 6.1 69.4 с 50/ SANDY SILT TILL: trace clay, 16 10 S 10.7 some gravel, sand seams/layers, 50mr 69 grey, moist, very dense Continued Next Page + <sup>3</sup>, $\times$ <sup>3</sup>: Numbers refer to Sensitivity $\odot$ <sup> $\epsilon = 3\%$ </sup> Strain at Failure GRAPH GROUNDWATER ELEVATION NOTE

 $\begin{array}{c|c} \hline \\ \mbox{Measurement} & \underline{ } & \underline{ } \\ \hline \\ \mbox{Measurement} & \underline{ } & \underline{ } \\ \hline \\ \mbox{Measurement} & \underline{ } & \underline{ } \\ \hline \\ \mbox{Measurement} & \underline{ } \\$ 



Method: Hollow Stem Auger Diameter: 203mm

Date: Oct/24/2016

REF. NO.: 161-14544-00

ENCL NO.: 3



PROJECT: Geotechnical Investigation - GE Booth WWTP

CLIENT: Region of Peel

PROJECT LOCATION: 1300 Lakeshore Road E, Mississauga, ON

DATUM: Geodetic

BH LOCATION: N 4825731 E 617094

 $\begin{array}{c} \underline{\text{GROUNDWATER ELEVATION}}\\ \text{Measurement} \quad \overset{\text{1st}}{\underline{\nabla}} \quad \overset{\text{2nd}}{\underline{\Psi}} \quad \overset{\text{3rd}}{\underline{\Psi}} \quad \overset{\text{4th}}{\underline{\Psi}} \end{array}$ 

Method: Hollow Stem Auger

Diameter: 203mm

DVNAMIC CONE DENETRATI

Date: Oct/24/2016

REF. NO.: 161-14544-00 ENCL NO.: 3

	SOIL PROFILE		S	SAMPL	E			RESIS	TANCE	PLOT		non			NAT	URAL			F	REMARK
(m)		F				TER		2	0 4	0 6	0 8	0 10	00	LIMIT	MOIS CON	TURE	LIMIT	Ü,	× ⊢N	AND
FLEV		PLO			≥٤	N N N	R	SHEA	R STR	RENG	TH (kF	Pa)		W <sub>P</sub>	\	N 0	WL	KET F	N/W N/W	GRAIN SIZE
DEPTH	DESCRIPTION	Į	BER		0.3	IN È	ATI	οU	CONFI	NED	+	FIÉLD VA & Sensiti	ANE vity				- (0()	0 0 0	Ъ, ÷	(%)
		TRA	ΠM	Å PE		NOI ONI	LE V	• QI	JICK TF		×	LAB VA	NE	WA	IER CC	DNIEN	I (%)		Ž	(
	Continued	N I	z	⊢ 	f	00	ш	2	4	0 6	0 8		JU			1 3	1			GR SA SI CL
67.9	SILTY SAND THE gravelly trace		44	<u> </u>	50/		68	_						_						
<u> </u>	clay, grey, wet, very dense	14.5	11	5	<del>75mm</del>			_						0						
12.4	END OF THE BOREHOLE																			
	1) 50 mm monitoring well was																			
	installed upon completion of drilling.																			
	2) Water Level Readings:																			
	November 1, 2016 5.0																			
	November 3, 2016 5.0																			

 $\frac{\text{GRAPH}}{\text{NOTE}} + {}^3, \times {}^3: \begin{array}{c} \text{Numbers refer} \\ \text{to Sensitivity} \end{array}$ 

 $\odot$  <sup> $\epsilon$ =3%</sup> Strain at Failure

2 OF 2



PROJECT: Geotechnical Investigation - GE Booth WWTP

CLIENT: Region of Peel

PROJECT LOCATION: 1300 Lakeshore Road E, Mississauga, ON

DATUM: Geodetic

BH LOCATION: N 4825803 E 617009

#### DYNAMIC CONE PENETRATION RESISTANCE PLOT SAMPLE SOIL PROFILE PLASTIC NATURAL LIMIT CONTENT REMARK LIQUID GROUND WATER LIMI POCKET PEN. (Cu) (kPa) AND 20 40 60 80 100 (m) Ī STRATA PLOT GRAIN SIZE WL SHEAR STRENGTH (kPa) O UNCONFINED + FIELD VANE & Sensitivity WP BLOW 0.3 m w NATURAL U ELEV DEPTH CONDITION ELEVATION DISTRIBUTION 0 DESCRIPTION NUMBER (%) WATER CONTENT (%) TYPE QUICK TRIAXIAL × LAB VANE ŗ 40 60 80 100 10 20 30 81.0 Ground Surface 8₿.9 **TOPSOIL:** 100 mm 20 GR SA SI CL 88.9 FILL: sand and gravel, trace 1 s 19 topsoil, trace rootlets, brown, moist, compact 80.2 FILL: clayey silt, sandy, trace 0.8 80 gravel, trace organics, brown, moist, 2 S 17 79.8 very stiff 1.2 CLAYEY SILT: trace sand, contains silt seams, brown, moist, very stiff to hard 3 s 36 0 79 78.7 CLAYEY SILT TILL: some sand, 23 trace gravel, occasional 4 S 39 cobble/boulder, brown, moist, hard 78 77.8 3.2 SANDY SILT: seams of clayey silt, 5 S 56 0 brown, moist to wet, very dense 77 6 S 70 0 grev, wet below 4.6 m W. L. 76.4 m Nov 03, 2016 7 S 60 0 75.7 SILTY SAND: trace clay, trace 5.3 gravel, grey, wet, very dense 8 S 57 0 <sup>6</sup> 74.9 75 SAND: trace silt, trace clay, seams 6.1 of clayey silt, trace gravel, grey, wet, 9 S 52 0 very dense 74.1 SILTY SAND: trace clay, grey, saturated, dense to very dense 74 6.9 10 S 46 0 seams of clayey silt above 6.9 m 11 S 52 0 73 12 S 55 0 <u>9</u>71.9 72 9.1 SILT: some sand, trace clay, grey, saturated, very dense 13 S 55 71 3 END OF THE BOREHOLE 9.7 Notes: 1) 50 mm monitoring well was installed upon completion of drilling. 2) Water Level Readings: Date W.L.Depth (m) November 1, 2016 November 3, 2016 4.6 4.7

1 OF 1

Method: Hollow Stem Auger

Diameter: 203mm Date: Oct/20/2016

ionini

REF. NO.: 161-14544-00

ENCL NO.: 4

 $\frac{\text{GRAPH}}{\text{NOTE}} + {}^3, \times {}^3: \begin{array}{c} \text{Numbers refer} \\ \text{to Sensitivity} \end{array}$ 

 $\odot$  <sup> $\epsilon = 3\%$ </sup> Strain at Failure

# NSD

### LOG OF BORFHOLF BH17-1

					20					51117	- 1										
PROJ	ECT: Geotechnical Investigation - G. E.	Boot	th (La	akevie	w) WM	/TP - W	aterma	ain Ext	ension								REF.	. NO.	: 17	1-167	37-00
CLIEN	IT: CIMA							Meth	od: Sol	id Ster	n Aug	er					ENC	L NC	0.: 1		
PROJ	ECT LOCATION: 1300 Lakeshore Road	1 E, C	City c	of Miss	issauga	a, ON		Diam	eter: 1	50mm							ORIC	3INA	TED	BY I	=0
DATU	M: Geodetic							Date:	Jan/1	9/2018	5						CON	1PILE	D B	7 I	MW
BH LC	OCATION: See Borehole Location Plan	N 48	2583	84.795	E 617	213.079	3	Eqipr	ment: F		rilling		5 75 (T	rack)			CHE	CKE	D BY		_C
ļ,	SOIL PROFILE		5	SAMPL	.E	2		RESIS	STANCE	PLOT				PLAST		URAL	LIQUID		Υ	RE	MARK
PROJECT: Genetational Investigation -0. E. Boott: database (MWP) - Watermain Extension         Network State Part (MWP)         PEE NOI: 171-1037-00           CUENT: Class         PROJECT: COCATION: 1300 Lakeshore Road E. Clay of Mexisteage ON         Network State Part (MWP)         Network State Part (MWP)         PEE NOI: 171-1037-00           PROJECT: COCATION: 1300 Lakeshore Road E. Clay of Mexisteage ON         Network State Part (MWP)         Network State Part (MWP)         PEE NOI: 171-1037-00           PROJECT: COCATION: 1300 Lakeshore Road E. Clay of Mexisteage ON         Network State Part (MWP)         Network State Part (MWP)         PEE NOI: 171-1037-00           PROJECT: COCATION: 1300 Lakeshore Road E. Clay of Mexisteage ON         Data Mexisteage ON         Network State Part (MWP)         PEE NOI: 171-1037-00           PROJECT: COCATION: 1300 Lakeshore Road E. Clay of Mexisteage ON         Decomment State Part (MWP)         PEE NOI: 171-1037-00         PEE NOI: 171-1037-00           PROJECT: COCATION: 1300 Lakeshore Road E. Clay of Mexisteage ON         Decomment State Part (MWP)         PEE NOI: 171-1037-00         PEE NOI: 171-1037-00           PROJECT: COCATION: 1300 Lakeshore Road E. Clay of Mexisteage ON         Decomment State Part (MWP)         PEE NOI: 171-1037-00         PEE NOI: 171-1037-00           PROJECT: Mark of Mexisteage ON         Decomment State Part (MWP)         PEE NOI: 171-100         PEE NOI: 171-100         PEE NOI: 171-100           PROJECT: Mark of Mexisteage ON																					
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- 719.17 0.2	FILL: silty clay, trace sand, trace	$\overline{\mathbf{x}}$						E													
	rootlets, moist, stiff to har	$\bigotimes$		5	14			-								0					
		$\bigotimes$	╞					È.													
-		$\bigotimes$					78											-			
<u> </u>	FILL: sandy silt some day brown	$\bigotimes$	2	s	34			E							0	>					
77.5	moist, dense	$\bigotimes$						-													
- 1.4	FILL:silty clay, trace sand, trace	$\bigotimes$	}					È.													
	g.a.o., 2.o., molo, 10. your	$\bigotimes$	3	s	25		77	F													
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- 76.2		$\mathbb{X}$						-													
- 2.6	SILTY CLAY TILL:	131	4	S	24			Ē								¢					
3	some sand, trace gravel, trace oxidized, grev, moist, very stiff						76														
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- 3.0 4	COMPLEX: some sand to sandy,	旧		6	50/		75	Ŀ													
E	trace gravel, contains boulder/cobbles and rock		°	3	75mm			È.													
	fregments/slabs, grey, moist, har							F													
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-	boulder/cobble (inferred)		8	s	50/			E						0						Spool	ŋ
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72.6		ľÈ	9	S	50/			-						0							
6.3	END OF BOREHOLE					[															
	Note: 1) Borehole was dry and caved in at																				
	5.6m upon completion.																				
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	EC: Controlled Investigation - 0.2. E. Booth (Lakwew) WWTP - Watemark Extension       REF. NO: 171-1073-00         NT: CHA       Method Sold Sen Auger       EXCURNED: 1500 Linkeholde Fould E, City of Maissesaga, CN         JAC CodeCit       CodeCity See Sendo Location Plin 14 (42554)-05 E 51721 30700       Daradeel: 50mm       CodeCity See Sendo Location Plin 14 (42554)-05 E 51721 30700       Daradeel: 50mm       CodeCity See Sendo Location Plin 14 (42554)-05 E 51721 30700       December 27 (1100)       CodeCity See Sendo Location Plin 14 (42554)-05 E 51721 30700       December 27 (1100)       CodeCity See Sendo Location Plin 14 (42554)-05 E 51721 30700       December 27 (1100)       CodeCity See Sendo Location Plin 14 (42554)-05 E 51721 30700       December 27 (1100)       CodeCity See Sendo Location Plin 14 (42554)-05 E 51721 30700       December 27 (1100)       Decemb																				
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<u>GROUN</u>	DWATER ELEVATION		1.04	2n		NOTE	+ 3,	× 3:	to Sensi	s reier tivity	С	<b>e</b> =3%	Strain	at Failur	re						
Shallow/	Single Installation 💆 💆 Deep/Dual Instal	lation	Ĭ	Ϊ																	

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### LOG OF BOREHOLE BH17-2

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PROJ	ECT LOCATION: 1300 Lakeshore Road	3 E, (	City c	t Miss	issauga	a, ON		Diam	eter: 1	50mm	•						ORIC			, I Ri i	
DATU								Date:	Jan/1	9/201	8	<b>.</b>	/				CON	IPILE	D BI	' I	0100
BH LO	Control         Description         Production         Productio																				
	TROUCTCT: Genetachical Investigation: G. E. Booth (Laterway) WWTP - Valarmania Estanzian         REF. NO.: 171/1877.00           DUENT: Cold         Matheway (WWTP - Valarmania Estanzian)         Matheway (WWTP - Valarmania Estanzian)         REF. NO.: 171/1877.00           DUENT: Cold         Matheway (WWTP - Valarmania Estanzian)         Matheway (WWTP - Valarmania Estanzian)         Matheway (WWTP - Valarmania Estanzian)         REF. NO.: 171/1877.00           DUENT: TO: MATHEWAY (WWTP - Valarmania Estanzian)         Matheway (WWTP - Valarmania Estanzian)         Matheway (WWTP - Valarmania Estanzian)         REF. NO.: 171/1877.00         EXX.01.2           DATUE (Cacholic Stanzian)         No.: 171/1877.00         Data: Jan 192018         Cold To: 171/1877.00         EXX.01.2           MUECATION See Interview (Latarian Park NET REPAID Holing CME 75 (Trevi)         OURCENTED BY FOR         Cold To: 171/1877.00         Desc.01.171/1877.00         Desc.01.17																				
PROJECT:         Local Division Print         Division Print<																					
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78.6	ASPHALT: 100mm.	88	ž					Ē													
- 78.4	270mm	×	1	s	50			Ŀ							þ						
- 0.1	gravelly sand, trace silt, moist, very	$\bigotimes$	<u> </u>					Ŀ													
	FILL: clayey silt to silty clay, trace	$\otimes$	}—				78	-													
1	sand, moist, firm to stiff	$\mathbb{X}$	2	s	11			È.													
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76.4		<b>₩</b>	-					ŀ													
- 2.3	trace sand, trace gravel, brown,	12	1.					L .								.					
	moist, very stiff	H.	4	5	16		76								Ψ			4		0	1 76 2
3		R				-		F													
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- 3.0 4	some sand to sandy, trace gravel,	12			50/			L.													
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6.3	END OF BOREHOLE	1			75mm																
	Note:																				
	1) Borehole was dry and caved in at 5 5m upon completion																				
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	Control (Control Investigation - 0. E. Booh (Lakeeve) WVTF - Valammen Extension LIENT- CAM     Marbox Solid Sem Auger     Control (Control 1500 Lakeeve) Road E. Oly of Massissaya, N     ATUM Control 1500 Lakeeve Road E. Oly of Massissaya, N     Control (Control 1500 Lakeeve) Road E. Oly of Massissaya, N     Control (Control 1500 Lakeeve) Road E. Oly of Massissaya, N     Control (Control 1500 Lakeeve) Road E. Oly of Massissaya, N     Control (Control 1500 Lakeeve)     Control (Control 1500 Lakeeve																				
	DLECT: Candend Structure (1997) 0. E. E. Both (Lakeview) WWTP: - Vaterman Edemoids and Stem Auger DEF 10: MA DLECT ACTION: Stop Lakebox Road E. Chy of Masissaugo, ON LOCATION: Stop Lakebox Road E. Chy of Masissaugo, ON Durreiter 1997 0. Durreiter 1997 0. Durreiter 1997 0. Durreiter 1997 0. Durreiter 1997 0. Durreiter 1997 0. DEF 10: 0.7178 0.																				
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Shallow/	Single Installation 🖳 👤 Deep/Dual Instal	lation	Ţ	$\mathbf{V}$																	

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### LOG OF BOREHOLE BH17-4

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PROI	FCT LOCATION: 1300 Lakeshore Road	1 F (	City o	of Micc	issaur	a Ol	N		Diam	eter <sup>,</sup> 1	50mm	n Aug						ORIC		/ 4 TFD	BY FO		
DATUM: Geodetic										Dameter: 190mm													
BHLC	CATION: See Borehole Location Plan	N 48	2607	75.007	E 616	967.0	0517		Egipr	nent: F	Pontil D	rilling	CME	E 75 (1	rack)			CHE	CKE	D BY	LC		
	SOIL PROFILE	-	5	SAMPI	E	T			DYNA			ETRA	TION	- (				-			DEMARK		
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82.9	Ground Surface	STR	NUN	ΙΔ	ŗ	GRC				01CK 11		× ניג	LAB V. 30 1	OO	1	0 2	20 3	3 <sub>0</sub>		z	GR SA SI C		
- 80.0	ASPHALT: 125mm.	XX					Kce	mei	L nt														
82:5	GRANULAR BASE/SUBBASE:	X	1	s	50	$\otimes$	$\otimes$		Ê						0								
- 0.0	Very dense	$\bigotimes$							F														
:	moist, very dense	$\bigotimes$	}					82	-														
1		$\bigotimes$	2	s	49			02	t l						0								
81.5	boulder/cobble (inferred)	$\boxtimes$							Ē.														
1.4	FILL: silty clay, trace sand, trace	$\boxtimes$							Ē												Auger grindin at 1 35m		
	Tooliels, brown, moist, very sun	$\bigotimes$			17				-														
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:	trace sandy silt layers below 2.6m	$\boxtimes$	4	S	26				F							0							
3		$\bigotimes$	}					80	-														
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79.5		X	5	s	22				-								0						
- 3.4	trace sand, trace gravel, brown,	R.							E														
79.1	moist, very stiff	μx	-					79															
-	greyish brown, moist, dense to very		6	s	50				F							0							
:	dense						-sa	ın	Ē														
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5 <u>77.9</u> 5.0	SILTY CLAY:	I.	7B	s		ĿΕ		10	-							0							
77.6	trace sand, trace gravel, brown to				-	E			-														
- 5.3	SILTY SAND TO SAND AND SILT:	臣	8T	s	50/ 275mr	L E			Ē							<b>\$</b>							
	trace clay, brown to grey, moist, dense to very dense	臣	8B	s		11	w.	L. 1	լ 77.2 m	1						0							
6	trace clayey silt layers from 5.6m to	많	-		1	ΙE	Jai	n 31	l, 2018 F	3 I													
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74.7							·																
8.2	END OF BOREHOLE		1																				
	Notes: 1) Borebole caved in at 7 5m upon																						
	completion.																						
	<ol> <li>Dumm monitoring well installe upon completion of drilling.</li> </ol>																						
	3) Water Level Readings: Date W. L. Denth (m)																						
	Jan 31, 2018 5.68m																						
			1			1									1				1	1			
GROUN	DWATER ELEVATION						<u>- 14</u>	+ <sup>3</sup> ,	× <sup>3</sup> :	Number	s refer	С	<b>ε</b> =3%	Strain	at Failur	re							
Shallow/	Single Installation V Deep/Dual Instal	lation	1st	$\mathbf{V}^{2n}$																			

# Appendix III

Site Photographs (taken on July 20, 2020)



Photo 1: Creek and concrete culvert at Lakeshore Blvd (looking north - upstream)



Photo 2: Creek conditions at south of Lakeshore Blvd (looking south - downstream)



Photo 3: Top of slope area at BH20-1 (looking south)



Photo 4: Creek conditions near BH20-1 (looking south - downstream)



Photo 5: Top of slope conditions to north of Section L-L (looking north toward Lakeshore Blvd)



Photo 6: Creek conditions to north of Section L-L (looking northeast)


Photo 7: Top of slope area to north of Section M-M (looking northwest)



Photo 8: Top of slope conditions in area of and to west of Section N-N (looking east)



Photo 9: Creek conditions at west of Section N-N (looking west)



Photo 10: Creek conditions to east of Section N-N and to north of bridge (looking west)



Photo 11: Road Bridge to north of Section A-A (looking west)



Photo 12: Creek and east slope conditions in Reach S2 (looking south from road bridge)



Photo 13: Creek conditions to south of road bridge (looking north - upstream)



Photo 14: Creek and slope conditions to south of road bridge (looking south – downstream)



Photo 15: East slope near fence at north part of Reach S2 area (looing south - downstream)



Photo 16: Conditions to east of fence at north part of Reach S2 area (looing south)



Photo 17: Creek conditions at middle-north part of Reach S2 (looking north - upstream)



Photo 18: Creek conditions at middle-north part of Reach S2 (looking south - downstream)



Photo 19: East slope near fence at middle-north part of Reach S2 (looking north - upstream)



Photo 20: East slope near fence at middle-north part of Reach S2 (looking south - downstream)



Photo 21: East slope near fence at middle-south part of Reach S2 (looking north - upstream)



Photo 22: East slope near fence at middle-south part of Reach S2 (looking south - downstream)



Photo 23: Creek conditions at middle-south part of Reach S2 (looking north - upstream)



Photo 24: Creek conditions at middle-south part of Reach S2 (looking south - downstream)



Photo 25: East slope near fence at south part of Reach S2 (looking northeast)



Photo 26: Creek conditions at south part of Reach S2 (looking north - upstream)



Photo 27: South end of Reach S2 (looking southeast from west side of creek)



Photo 28: South part of Reach S2 (looking northeast from west side of creek)