

TECHNICAL MEMORANDUM**DATE** September 11, 2018**Project No.** 07-1121-0232-7100**TO** Vincent Denomme
Claridge Homes**CC** Ryan Magladry
IBI Group**FROM** Sean Spanik, EIT**EMAIL** sspanik@golder.com**INFILTRATION RATE ASSESSMENT
380 ROLLING MEADOW CRESCENT, OTTAWA, ONTARIO**

Golder Associates Ltd. (Golder), under contract with Claridge Homes (Claridge), undertook an assessment of the infiltration characteristics of three soil strata within the footprint of a proposed development. The tests were completed at 380 Rolling Meadow Crescent Ottawa, Ontario in the vicinity of BH 08-206. Figure 1, attached, shows the site and testing location.

Method

Measurement of the field-saturated hydraulic conductivity (K_{fs}) of near surface soils was carried out using a Guelph Permeameter apparatus (Model 2800K1) by Golder personnel between September 4 and September 6, 2018. The testing methodology was based on the stormwater infiltration best management practices described in the Stormwater Management Criteria: Appendix B: Water Balance and Recharge document prepared by the Credit Valley Conservation Authority (CVCA, 2012).

At each testing location, the Guelph Permeameter was installed in a 6 centimeter (cm) diameter hand-augered hole at a depth ranging from 0.57 to 2.05 metres below ground surface. All tests were completed in unsaturated soils (above the water table) near borehole 08-206. The soils encountered during the hand augering were documented. The Guelph Permeameter was operated according to the single head method. The outflow of water at the testing depth was monitored until it was determined that it had reached steady-state. The field-saturated hydraulic conductivity of the soil was estimated using the following equation (Elrick et al., 1989):

$$K_{fs} = \frac{C_1 Q_1}{2H_1^2 + \pi a^2 C_1 + 2\pi \frac{H_1}{a^*}}$$

Where: C_1 = shape factor
 Q_1 = flow rate (cm^3/s)
 H_1 = water column height (cm)
 a = well radius (cm)
 a^* = alpha factor (0.12 cm^{-1})

In accordance with CVCA, 2012, the percolation rate ("T-time" in min/cm) corresponding to each K_{fs} was estimated based on information presented in Tables 2 and 3 of the Supplementary Standard SB-6 Percolation Time and Soil Descriptions, of the Ontario Building Code (OMMAH, 2012) summarized below:

Field-Saturated Hydraulic Conductivity K_{fs} (cm/s)	Estimated Percolation Time, T (min/cm)	Infiltration Rate, 1/T (mm/hr)
10^{-1}	2	300
10^{-2}	4	150
10^{-3}	8	75
10^{-4}	12	50
10^{-5}	20	30
10^{-6}	50	12

Design infiltration rates were then determined in accordance with Table B3 of the Stormwater Management Criteria: Appendix B: Water Balance and Recharge document prepared by the Credit Valley Conservation Authority (CVCA, 2012).

Results

The soils encountered during the hand augering for the Guelph Permeameter testing were as follows:

Depth (m)	Description
0 – 0.85	SILTY SAND; brown; non-cohesive; contains cobbles and gravel (Fill)
0.85 – 1.05	SAND; yellow-brown; non-cohesive; moist
1.05 – 1.80	SILTY SAND; grey-brown; non-cohesive; moist
1.80 – 2.05	SILTY CLAY; grey-brown; cohesive; moist (Weathered Crust)

The results of the infiltration tests are summarized in the attached Table 1. Based on the testing results, the field-saturated hydraulic conductivity of the native soils ranges from 2×10^{-3} cm/s (silty sand) to 4×10^{-5} cm/s (silty clay). One test was completed in the silty sand fill. Testing results indicate that the saturated hydraulic conductivity of the fill is 6×10^{-5} cm/s.

The percolation times (T-time) and the infiltration rates associated with each test result were determined, and are also summarized in Table 1. Percolation times range from 6 min/cm to 17 min/cm. Infiltration rates (the inverse of the T-times) were calculated to range from 36 mm/hr to 105 mm/hr.

Because the results of the Guelph Permeameter testing and the record of borehole 08-206 indicate that there are less permeable soil horizons (silty clay) below the more permeable sand and silty sand, the recommended "safety correction factor" to calculate the design infiltration rate is 3.5 (CVCA, 2012). Therefore, the design infiltration rates for the native soil were calculated to range from 12 mm/hr to 29 mm/hr.

Closure

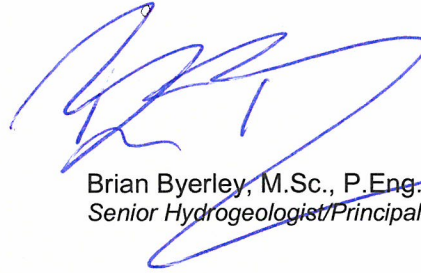
We trust the information included meets your current needs. Should you require clarification, please do not hesitate to contact us.

Yours truly,

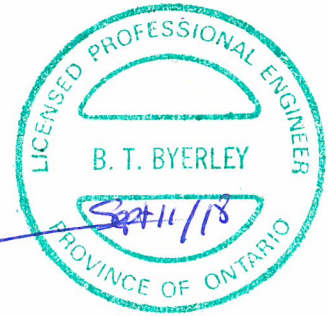
Golder Associates Ltd.



Sean Spanik, M.A.Sc., EIT
Environmental Consultant



Brian Byerley, M.Sc., P.Eng.
Senior Hydrogeologist/Principal



SPS/BTB/sg

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Attachments: Table 1 – Guelph Permeameter Infiltration Rate Testing Results September 2018
Figure 1 – Field Investigation Locations
Attachment 1 – Borehole Record

References

Elrick, D.E., W.D. Reynolds, and K.A. Tan. 1989. Hydraulic conductivity measurements in the unsaturated zone using improved well analyses. *Ground Water Monitoring Review*. 9:184-193.

Credit Valley Conservation Authority (CVCA). 2012. Stormwater Management Criteria: Appendix B: Water Balance and Recharge document.

Ontario Ministry of Municipal Affairs and Housing (OMMAH). 2012. Supplementary Guidelines to the Ontario Building Code 2012. SG-6 Percolation Time and Soil Descriptions. Toronto, Ontario.

Table 1: Guelph Permeameter Infiltration Rate Testing Results September 2018

Test ID	Test Depth (m)	Material	K_{sat} (cm/s)	T-Time (min/cm)	1/T (Infiltration Rate mm/hr)	Design Infiltration Rate (mm/hr)
GP-01	0.57	silty sand with gravel and cobbles (fill)	6E-05	13	46	13
GP-02	1.27	silty sand	2E-03	6	100	29
GP-03	2.05	silty clay (weathered crust)	4E-05	14	43	12

Notes: All auger holes were dry upon completion



LEGEND

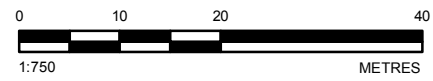
- ★ APPROXIMATE GUELPH PERMEAMETER TEST LOCATION
- ⊕ APPROXIMATE BOREHOLE LOCATION
- ROADWAY
- ▬ APPROXIMATE SITE BOUNDARY

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

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



CLIENT CLARIDGE HOMES			
PROJECT HYDROGEOLOGY INVESTIGATION INFILTRATION ASSESSMENT 380 ROLLING MEADOW CRESCENT, OTTAWA, ONTARIO			
TITLE FIELD INVESTIGATION LOCATIONS			
CONSULTANT	YYYY-MM-DD	2018-09-10	
	DESIGNED	---	
	PREPARED	BR/JEM	
	REVIEWED	SS	
APPROVED	BTB		
PROJECT NO. 07-1121-0232	PHASE 7100	REV. 0	FIGURE 1

ATTACHMENT 1

Borehole Record

PROJECT: 07-1121-0232

RECORD OF BOREHOLE: 08-206

SHEET 1 OF 1







LOCATION: N 5032572.3 ; E 381786.6

BORING DATE: October 9, 2008

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION		
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.30m												
								SHEAR STRENGTH Cu, kPa				WATER CONTENT PERCENT							
								20	40	60	80	nat V. rem V.	+ ⊕	Q - U - ● ○	10 ⁻⁶				10 ⁻⁵
								Wp ———— W ———— WI											
								20	40	60	80	20	40	60	80				
0		GROUND SURFACE		78.91															
	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00															
		Yellow brown SILTY SAND		78.61															
		Loose, brown SAND, trace silt		0.30															
				78.36															
				0.55															
1			Compact, brown SILTY SAND		77.81	1	SS	12											
					1.10														
			Very stiff to stiff, grey brown SILTY CLAY (WEATHERED CRUST)		77.54														
					1.37														
2						2	SS	5											
			Stiff to firm, grey SILTY CLAY, with occasional sand seams		76.47				⊕			+							
					2.44				⊕			+							
3																			
			Firm, grey SILTY CLAY		75.56				⊕			+							
					3.35				⊕		+								
4									⊕		+								
								⊕											
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5								⊕											
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6								⊕											
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								⊕		+									
7								⊕											
								⊕		+									
								⊕											
		End of Borehole		71.29				⊕		+									
				7.62															
8																			
9																			
10																			

DEPTH SCALE

1 : 50

**GOLDER**

LOGGED: D.J.S.

CHECKED: S.A.T.

MIS-BHS 001 07-1121-0232.GPJ GAL-MIS.GDT 7/16/18 JM