12304 Heart Lake Road, Caledon, Ontario

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Hydrogeological Investigation and Water Balance Assessment

Client:
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Attention: Mr. Ben Wilson

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1 Introduction

1.1 Project Description

EXP Services Inc. (EXP) was retained by Broccolini Limited Partnership No. 6. (the 'Client') to prepare a Hydrogeological Investigation and Water Balance Assessment Report associated with the proposed development located at 12304 Heart Lake Road, Caledon, Ontario (hereinafter referred to as the 'Site').

The project Site occupies an area of 30.04 hectares (91.52 acres) and is located on the west side of Heart Lake Road, with frontage centered approximately 845 m north of Mayfield Road, in the Town of Caledon, Ontario. Currently two (2) residences, one (1) farmhouse and associated farm buildings are located at the Site.

EXP understands that the proposed development will consist of one (1) single storey slab on grade building without a basement. Proposed development includes supporting truck loading docks, paved accessways, sewers, and truck and passenger vehicle parking areas. The proposed building (Buildings 1) will have a footprint of approximately 42,223 m^2. The Site location plan is shown on Figure 1. The proposed Site Plan for Building 1 is provided in Attachment 1.

EXP completed a Geotechnical Investigation and Phase 1 Environmental Site Assessment in 2021 and thirty (30) boreholes including five (5) monitoring wells covering the total site area were installed as part of the geotechnical investigation. The pertinent information gathered from the noted investigations is utilized for this report.

1.2 Project Objectives

The main objectives of the Hydrogeological Investigation and Water Balance Assessment are as follows:

- Establish the local hydrogeological settings within the Site;
- Assess construction dewatering flow rates and potential impacts;
- Assess groundwater quality;
- Conduct a well survey (desktop);
- Develop a site-specific water balance for pre- and post-development conditions using a Thornthwaite-Mather water balance approach and provide water balance deficits between pre- and post-development conditions (desk top study);
- Conduct one (1) year of water level monitoring at the Site; and,
- Prepare a Hydrogeological Investigation and Water Balance Assessment Report.

EXP has prepared the following work program to fulfill the objectives listed above.

1.3 Scope of Work

To achieve the investigation objectives, EXP has completed the following scope of work:

- Reviewed available geological information including geological and hydrogeological mapping, source water protection (SGRA, HVA, WHPA etc.);
- Developed and conducted Single Well Response Tests (SWRT) on all five (5) monitoring wells installed during the geotechnical investigation.
- Conducted two (2) rounds of water levels after the well installation and five (5) rounds of water level measurements in all monitoring wells for one (1) year as per conservation authority requirements (bi-monthly measurements) including the installation of three (3) data loggers for continuous groundwater monitoring.

  Note: One (1) year bi-monthly water level monitoring program is currently in progress
- Completed four (4) shallow infiltration test by hand auguring to less than one (1) mbgs.
- Collected one (1) groundwater sample from selected shallow monitoring well for laboratory testing of parameters listed in the Regional Municipality of Peel Sanitary and Storm Sewer By-Law and compare the results to the applicable criteria and additional Metals filtered sample.
- Evaluated construction dewatering needs and permitting requirements for temporary water taking and dewatering effluent disposal from regulatory agencies;
- Estimated construction dewatering flow rates and assess potential impacts and recommend mitigation measures;
- Reviewed private water supply wells on site and within 500 m of the property (database searches);
- Evaluated the information collected during the field investigation program, including borehole geological information, SWRT results, infiltration test results, groundwater level measurements and groundwater quality;
- Prepared site plans, cross sections, geological mapping, and groundwater contour mapping for the Site;
- Prepared source water protection and aquifer vulnerability maps;
- Reviewed available past 30 years of climatic data for the Site;
- Mapped existing areas in accordance with topography, soil cover, shallow soil types, and use a Thornthwaite-Mather approach to determine the water balance for pre- and post-development conditions (desk-top);
- Mapped surrounding natural features (desk-top) and review source water protection (HVA, WHPA etc.);
- Provided a pre-development water balance based on existing conditions and climatic data;
- Provided a post-development water balance based on development plans;
- Estimated deficits between pre- and post-development conditions, and identify areas where mitigation measures can be implemented; and,
- Prepared a Hydrogeological Investigation and Water Balance Assessment Report.

The Hydrogeological Investigation and Water Balance Assessment was prepared in accordance with the Ontario Water Resources Act, Ontario Regulation 387/04, Toronto and Region Conservation Authority (TRCA), and Ministry of the Environment, Conservation and Parks (MECP).

The Hydrogeological Investigation and Water Balance Assessment Report was prepared to support the Ministry of the Environment, Conservation and Parks (MECP) Environmental Activity and Sector Registry (EASR) in the event that the short-term construction dewatering flow rate exceed the threshold of 50,000 L/day. The assessment of construction dewatering, flow rates was completed using analytical methods.

The scope of work outlined above was made to assess dewatering and did not include a review of Environmental Site Assessments (ESA).

1.4 Review of Previous Reports

The following reports were reviewed as part of this Hydrogeological Investigation and Water Balance Assessment:

- EXP Services Inc. (April 14, 2021), Phase 1 Environmental Site Assessment, 12210, 12280 and 12304 Heart Lake Road, Caledon, Ontario, prepared for Broccolini Real Estate Group Ontario Inc.
- EXP Services Inc. (April 21, 2021), Preliminary Geotechnical Investigation, 12304 Heart Lake Road, Caledon, Ontario, prepared for Broccolini Real Estate Group Ontario Inc.
- EXP Services Inc. (September 28, 2021), Detailed Geotechnical Investigation, 12304 Heart Lake Road, Caledon, Ontario, prepared for Broccolini Limited Partnership 6.

2 Hydrogeological Setting

2.1 Regional Setting

2.1.1 Regional Physiography

The Site is located within a physiographic region named South Slope. The physiographic landform is known as the Till Plains (drumlinized) and a northwest-southeast esker is located approximately 800 m south of the Site. Heart Lake is located within the area of this esker. In the Site area, the South Slope lies to the southeast of Niagara Escarpment and northwest of Peel Plain (Chapman & Putnam, 2007).

The south slope is the southern slope of the Oak Ridges Moraine, which is also mapped south of the peel plain. For the most part, the south slope rises to the line of contact with the Oak Ridges Moraine at 250 to 300 masl.

2.1.2 Regional Geology and Hydrogeology

The surficial geology can be described as clay to silt till derived from glaciolacustrine deposits or shale (Ministry of Northern Development and Mines, 2012). The surficial geology of the Site and surrounding areas is shown on Figure 2.

Based on the available regional geology maps, the subsurface stratigraphy of the Site from top to bottom is summarized in Table 2-1 (TRCA, 2008 and Oak Ridge Moraine Groundwater Program, 2018). The overburden thickness is approximately 65 m.

Table 2-1: Summary of Subsurface Stratigraphy

Stratigraphic Unit	General Description	Top Elevation of Stratigraphic Unit
Halton Till or Equivalent (Aquitard)	This lithologic unit typically consists of sandy silt to clayey silt till interbedded with silt, clay, sand and gravel.	267
Oak Ridges Moraine or Equivalent (Aquifer)	This geology unit mainly consists of interbedded fine-grained sand and silt deposits where coarse-grained sand and gravel along with clay laminae are locally reported.	256
Newmarket Till (Aquitard)	This lithologic unit mainly consist of a massive and dense silty sand unit.	Not Mapped at this location
Thorncliffe Formation (Aquifer)	This geology formation generally consists of glaciofluvial (sand, silty sand) or glaciolacustrine deposits (silt, sand, pebbly silt and clay).	220
Queenston Formation	Bedrock primarily consists of interbedded shale, limestone, dolostone and siltstone. It belongs to the Upper Ordovician, (Ministry of Northern Development and Mines, 2012).	202

Regional groundwater across the area flows east / southeast, towards an un-named tributary of Etobicoke Creek (Oak Ridge Moraine Groundwater Program, 2018). Local deviation from the regional groundwater flow pattern may occur in response to changes in topography and/or soils, as well as the presence of surface water features and/or existing subsurface infrastructure.

2.1.3 Existing Water Well Survey

Water Well Records (WWRs) were compiled from the database maintained by the Ministry of the Environment, Conservation and Parks (MECP) and reviewed to determine the number of water wells documented within a 500-m radius of the Site boundaries. The locations of the MECP WWRs within 500 m of the Site are shown on Figure 3A. A summary of the WWR is included in Appendix A.

The MECP WWR database indicates that twenty-nine (29) water wells within a 500 m radius from the Site boundary, where four (4) wells are identified onsite (Figure 3A and Appendix A). Well distances are calculated relative to the Site centroid, therefore some distances in Appendix A exceed 500 m. Total of fifteen (15) water supply wells were identified within 500 m search area with two (2) water supply wells identified within the Site boundary.

The database indicates that the offsite wells are at approximately ten (10) m or greater from the Site boundary. All offsite wells were reportedly identified as monitoring and observation wells, test holes, dewatering wells, water supply wells, abandoned and/or listed with unknown use. The closest well to the Site boundary is identified as a water supply well (Well ID No. 4901240).

The reported water levels ranged from depths of 4.6 m to 61.0 meters below ground surface (mbgs).

It is expected that some of the water supply well within 500 m of the Site boundary may be still active.

2.2 Site Setting

2.2.1 Site Topography

The Site is in an agricultural land use setting. The topography is considered relatively flat with a local gradual southwesterly slope towards Etobicoke Creek.

As indicated on the borehole logs included in Appendix B, the surface elevation of the Site ranges between approximately 266.8 to 274.1 meters above sea level (masl).

2.2.2 Local Surface Water Features

The Site is within the Etobicoke Creek watershed. No surface water features exist onsite. Two seasonal un-named tributaries are starting immediately east and south of the site. One to the east is a tributary of Etobicoke Creek and the one to the south discharges to Heart Lake. Etobicoke Creek runs approximately 800 m southwest of the Site. Distance to Heart Lake is approximately 1.2 km from the Site boundary to the southeast.

2.2.3 Vulnerability Mapping

The Site is located within the Toronto Source Water Protection Area. MECP Source Protection Information Atlas was reviewed to determine the Wellhead Protection Areas (WHPAs), Highly Vulnerable Aquifers (HVAs), Significant Groundwater Recharge Areas (SGRAs) and Intake Protection Zones (IPZs) related to the Site area.

Well Head Protection Areas (WHPA) – The Site is located outside WHPA Zones Q1/ Q2.

Highly Vulnerable Aquifer Areas (HVA) – The Site is located outside HVA areas.

Significant Groundwater Recharge Areas (SGRA) – The entire Site is located outside of SGRA.

Intake Protection Zone (IPZ) – there is no intake protection zone within approximately 10 km from the Site.

Figures 3B shows all the above-mentioned vulnerable areas in relation to the Site location.

2.2.4 Local Geology and Hydrogeology

A summary of subsurface soil stratigraphy is provided in the following paragraphs. The soil descriptions are based on the geotechnical investigation report (EXP, 2021). They are summarized for the hydrogeological interpretations. As such, the information provided in this section shall not be used for construction design purposes.

The detailed soil profiles encountered in each borehole and the results of moisture content determinations are presented on the attached borehole logs (Appendix B). The soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect approximate transition zones for the Hydrogeological Investigation and Water Balance Assessment and shall not be interpreted as exact planes of geological change.

The "Notes on Sample Description" preceding the borehole logs form an integral part of and should be read in conjunction with this report. The following is a brief description of the soil conditions encountered during the investigation.

Based on the results of the geotechnical investigation, the general subsurface soil stratigraphy consists of the following units from top to bottom:

Topsoil

Surface cover comprises topsoil ranging in thickness from approximately 125 to 350 mm at all borehole locations. However, the boreholes were advanced in cultivated fields. As such, topsoil thicknesses up to approximately 600 mm associated with typical ploughed fields should be anticipated.

Fill

Fill was encountered following the topsoil in Boreholes 4, 8, 16, 20 to 22, 27 and 30. The fill extends to depths of approximately 1.4 to 2.1 m (~Elevation 268.1 to 273.4 m). The fill constitutes brown clayey silt to sand silt with trace gravel and minor stone fragments and appeared to be reworked on-site parent material. Moisture contents recorded in the fill ranged between approximately 12 and 26 percent. The higher moisture contents recorded in the upper regions of the fill and are likely associated with the transition from recently melted snow in the topsoil overlying the fill.

Clayey Silt Till

A clayey silt till deposit underlies the fill in Boreholes 4, 8, 16, 20 to 22, 27 and 30 and the topsoil at all other borehole locations. The clayey till extends to termination depths of approximately 8.0 to 8.2 m (~Elevation 258.7 to 266.8 m) in Boreholes 3, 5, 6, 10, 11, 14, 16, 17, 21, 25 and 28. The clayey silt till was fully penetrated approximately 4.1 to 7.2 m depth (~Elevation 265.9 to 266.5 m) in the remaining boreholes. The clayey silt till was found to be disturbed in the upper 200 to 300 mm at several borehole locations. The clayey silt till contains trace sand or fine sand seams/pockets, trace gravel and occasional boulder fragments. The clayey silt till is typically brown in colour becoming grey with depth. The consistency of the clayey silt till is generally very stiff to hard. Localized stiff zones were noted at depth in Boreholes 5, 8, 12, 14, 23, 24, 27 and 28, generally consistent with the change in colour from brown to grey. Moisture content of the clayey silt till were recorded at approximately 7 and 18 percent.

Sandy Silt Till

A sandy silt till deposit was intersected below the clayey silt till in Boreholes 1, 2, 4, 7 to 9, 12, 15, 18 to 20, 22 to 24, 26, 27, 29 and 30. The sandy silt till was fully penetrated in Borehole 30 at approximately 7.1 m depth (~Elevation 263.5 m). All other

boreholes where the sandy silt till was encountered were terminated in this deposit at depths of approximately 7.8 to 8.2 m (~Elevation 259.0 to 266.0 m). The sandy silt till contains trace clay, silt partings, fine sand seams, trace gravel and occasional boulder fragments. The sandy silt till is grey in colour except for Boreholes 4, 18, 20 and 30 where the deposit is brown. The degree of compactness of the sandy silt till was assessed as dense to very dense. Moisture content of the sandy silt till generally ranges from approximately 6 to 18 percent.

Sandy/Silty Sand

A discontinuous sandy to silty sand deposit follows the clayey silt till in Borehole 13 and the sandy silt till in Borehole 30. These boreholes were terminated in the sand to silty sand deposit at depths of approximately 7.8 to 8.1 m (~Elevation 261.8 to 262.5 m). The sand to silty sand is fine to medium grained and contains trace gravel. The sand to silty sand is brown in colour and exists in a very dense state of compactness. Moisture content of the sand to silty sand was recorded at approximately 10 to 13 percent.

The borehole and monitoring well locations are shown on Figure 4. Geological cross-sections were generated based on the available borehole logs completed as part of the previous and current investigations and shown on Figure 5 (Cross section A-A'). The cross section shows a simplified representation of soil conditions and soil deposits may be interconnected differently than represented. Borehole logs used to generate both cross-sections are provided in Appendix B.

3 Results

3.1 Monitoring Well Details

The monitoring well network was installed as part of the Geotechnical Investigation at the Site. It consists of the following:

- Five (5) shallow overburden monitoring wells (BH/MW 1, BH/MW 9, BH/MW 16, BH/MW 25 and BH/MW 30) were installed;

The diameter of all monitoring wells is 50 mm. All wells were installed with a stick-up protective casing. Borehole logs and monitoring well installation details are provided in Appendix B. The monitoring well locations are shown on Figure 4.

3.2 Water Level Monitoring

As part of the Hydrogeological Investigation and Water Balance Assessment, static water levels in the monitoring wells installed outside of the existing building were recorded in four (4) monitoring events, from September 29 to October 15, 2021. A summary of all static water level data as it relates to the elevation survey is given in Table 3-1 below.

The groundwater elevations recorded in the onsite monitoring wells ranged from 261.68 masl (6.73 mbgs at BH/MW 25 on October 7, 2021) to 269.34 masl (5.48 mbgs at BH/MW 16 on September 29, 2021).

The report will need to be updated to include the results of the one-year groundwater level monitoring program.

Table 3-1: Summary of Measured Groundwater Elevations

Monitoring Well ID	Ground Surface Elevation (masl)	Stick Up (m)	Approximate Full Well Depth (mbgs)	MW Bottom Elevation	Depth	29-Sep-21	7-Oct-21	12-Oct-21	15-Oct-21
BH/MW 1	273.11	0.64	7.60	265.51	mbTOP	4.88	4.88	4.67	4.67
					mbgs	4.24	4.24	4.03	4.03
					masl	268.87	268.87	269.08	269.08
BH/MW 9	269.95	0.99	7.57	162.38	mbTOP	6.78	6.91	6.95	6.98
					mbgs	5.79	5.92	5.96	5.99
					masl	264.16	264.03	263.99	263.96
BH/MW 16	274.82	0.91	7.49	267.33	mbTOP	6.39	6.51	6.45	6.47
					mbgs	5.48	5.60	5.54	5.56
					masl	269.34	269.22	269.28	269.26
BH/MW 25	268.41	0.93	7.55	260.86	mbTOP	6.98	7.66	7.59	7.94
					mbgs	6.05	6.73	6.66	7.01
					masl	262.36	261.68	261.75	261.40
BH/MW 30	270.57	1.00	7.58	262.99	mbTOP	DRY	DRY	DRY	DRY
					mbgs	>7.58	>7.58	>7.58	>7.58
					masl	<262.99	<262.99	<262.99	<262.99

One (1) map was created for the Site to show groundwater contours of the overburden water-bearing zone (Figure 6). Accordingly, the groundwater flow directions in overburden interpreted to be southeast and southwest of the Site.

Groundwater levels are expected to show seasonal fluctuations and vary in response to prevailing climate conditions. This may also affect the direction and rate of flow. It is recommended to conduct seasonal groundwater level measurements to provide more information on seasonal groundwater level fluctuations.

3.3 Hydraulic Conductivity Testing

Four (4) Single Well Response Tests (SWRT's) were completed on monitoring wells BH/MW 1, BH/MW 9, BH/MW 16, and BH/MW 25 on October 7 and 12, 2021. The tests were completed to estimate the saturated hydraulic conductivity (K) of the soils at the well screen depths. Please note that SWRT was not possible to conduct for BH/MW 30 since the well was dry during the monitoring period.

The static water level within each monitoring well was measured prior to the start of testing. In advance of performing SWRTs, each monitoring well underwent development to remove fines introduced into the screens following construction. The development process involved purging of the monitoring wells to induce the flow of fresh formation water through the screen. Each monitoring well was permitted to fully recover prior to performing SWRTs.

Hydraulic conductivity values were calculated from the SWRT and constant rate test data as per Hvorslev's solution included in the Aqtesolv Pro. V.4.5 software package. The semi-log plots for normalized drawdown versus time are included in Appendix C.

A summary of the hydraulic conductivities (K-values) estimated from the SWRTs are provided in Table 3-2.

Table 3-2: Summary of Hydraulic Conductivity Testing

Monitoring Well	Well Depth (mbgs)	Screen Interval (mbgs)		Soil Formation Screened	Estimated Hydraulic Conductivity (m/s)
		from	to		
BH/MW 1	7.60	4.60	7.60	Clayey Silt Till and Sandy Silt Till	3.1E-06
BH/MW 9	7.57	4.57	7.57	Clayey Silt Till and Sandy Silt Till	4.0E-07
BH/MW 16	7.49	4.49	7.49	Clayey Silt Till	3.3E-07
BH/MW 25	7.55	4.55	7.55	Clayey Silt Till	3.9E-07
				Highest Estimated K Value	3.1E-06
				Geometric Mean of Estimated K values	6.3E-07

SWRTs provide K-estimates of the geological formation surrounding the well screens and may not be representative of bulk formation hydraulic conductivity. As shown in Table 3-2, the highest K-value of the tested water-bearing zone is 3.1E-06 m/s, and the geometric mean of the K-values is 6.3E-07 m/s.

3.4 Groundwater Quality

To assess the suitability for discharging pumped groundwater into the sewers owned by the Regional Municipality of Peel / City of Mississauga during dewatering activities, one (1) groundwater sample was collected from monitoring well BH/MW 1 on October 12, 2021, using a peristaltic pump.

Prior to collecting the noted water sample, approximately three (3) standing well volumes of groundwater were purged from the referred well. The samples were collected unfiltered and placed into pre-cleaned laboratory-supplied vials and/or bottles provided with analytical test group specific preservatives, as required. Dedicated nitrile gloves were used during sample handling. The groundwater samples were submitted for analysis to Bureau Veritas Laboratory, a CALA certified independent laboratory in Mississauga, Ontario. Analytical results are provided in Appendix D.

Table 3-3 summarizes exceedance(s) of the Sanitary (Table 1) and Storm (Table 2) Sewer Use By-Law parameters.

When comparing the chemistry of the collected groundwater samples to the Regional Municipality of Peel Sanitary and Combined Sewer Discharge Criteria (By-Law Number 53-2010, Table 1), there were no parameter exceedances to be reported.

When comparing the chemistry of the collected groundwater samples to the Regional Municipality of Peel Storm Sewer Discharge Criteria (By-Law Number 53-2010, Table 2) the following parameters reported an exceedance: Total manganese and Chloroform

Reporting detection limits (RDLs) were below the Sewer Use By-Law parameter criteria of Tables 1 and 2.

Table 3-3: Summary of Analytical Results

Parameter	Units	City of Mississauga / Regional Municipality of Peel Sanitary and Combined Sewer Discharge Limit (Table 1)	City of Mississauga / Regional Municipality of Peel Storm Sewer Discharge Limit (Table 2)	Concentration BH/MW 1 12-Oct-21
Total Manganese (Mn)	µg/L	5,000	50	**78**
Chloroform	µg/L	40	2	**2.8**

Bold – Exceeds City of Mississauga / Regional Municipality of Peel Storm Sewer Discharge Limit (Table 2).

For the short-term dewatering system (construction phase), it is anticipated that TSS levels and some other parameters (for example, Total Metals) in the pumped groundwater may become elevated and exceed both, Sanitary and Storm Sewer Use By-Law limits. To control the concentration of TSS and associated metals, it is recommended that a suitable treatment method be implemented (filtration or decantation facilities and/ or any other applicable treatment system) during construction dewatering activities to discharge to the applicable sewer system. The specifications of the treatment system will need to be adjusted to the reported water quality results by the treatment contractor/process engineer.

The water quality results presented in this report may not be representative of the long-term condition of groundwater quality onsite. As such, regular water quality monitoring is recommended for the post-construction phase, as required by the City.

An agreement to discharge into the sewers owned by the City of Mississauga / Regional Municipality of Peel will be required prior to releasing dewatering effluent.

The Environmental Site Assessment Report(s) shall be reviewed for more information on the groundwater quality conditions at the Site.

3.5 Infiltration Testing

EXP completed four (4) infiltration rate tests (INF 1, INF 9, INF 25 and INF 30) within the Site area on October 7 and 12, 2021. These tests were conducted in proximity of selected monitoring wells: September 7, 2021, at BH/MW 1 (INF 1), BH/MW 9 (INF 9), BH/MW 30 (INF 30) and BH/MW 25 (INF 25).

Infiltration tests were conducted at depths ranged from 0.6 mbgs to 0.9 mbgs. The reported water levels at these monitoring wells are; 4.24 mbgs (BH/MW 1), 5.92 mbgs (BH/MW 9), and <7.58 (BH/MW 30) on October 7, 2021, and 6.66 mbgs (BH/MW 25) on October 12 15, 2021 (Table 3.2).

The stratigraphy of the shallow subsurface comprises a silt/sand with some pebbles. Table 3.5 below shows a summary of field saturated hydraulic conductivity (Kfs) testing and design infiltration rates, as per the Low Impact Development (LID) Stormwater Management Planning and Design Guide, CVC – TRCA, 2010, Appendix G. The estimated field saturated hydraulic conductivities were correlated to infiltration rates based on the relationship provided in Appendix D of the guideline.

Infiltration rate testing locations are shown on Figure 4 and infiltration rate analysis is provided in Appendix E.

Table 3.4: Summary of Infiltration Testing Results

Infiltration Test Location/ MW ID	Depth of Hole (mbgs)	Formation tested	Field Saturated Hydraulic Conductivity, Kfs (cm/s)	Infiltration Rate (mm/hr)
INF 1 (BH/MW 1)	0.60	Clayey Silt Till	3.4×10^{-6}	19
INF 9 (BH/MW 9)	0.75	Clayey Silt Till	3.5×10^{-6}	19
INF 25 (BH/MW 25)	0.90	Clayey Silt Till	2.7×10^{-6}	18
INF 30 (BH/MW 30)	0.70	Clayey Silt to Sandy Silt (Fill)	9.0×10^{-6}	24
		Geometric Mean	4.12×10^{-6}	20
			Design Infiltration Rate*	8 (20/2.5)

Notes:
*Safety Factor of 2.5 was applied to calculate the design infiltration rate (Low Impact Development (LID) Stormwater Management Planning and Design Guide, CVC – TRCA, 2010, Appendix D).

The estimated design infiltration rate based on percolation rate testing for the Site is 8 mm/hr.

4 Water Balance Study

4.1 Background Information

The current land use of the Site is agricultural. The topography is considered relatively flat with a local gradual southerly slope towards Etobicoke Creek.

EXP understands that the proposed total development will consist of one (1) single storey slab on grade building (Building 1)without a basement. Proposed development includes supporting truck loading docks, paved accessways, sewers, and truck and passenger vehicle parking areas. The Site location plan is shown on Figure 1. The proposed Site Plan for Building 1 is provided in Attachment 1.

The surficial geology can be described as clay to silt till derived from glaciolacustrine deposits or shale laminated (Ministry of Northern Development and Mines, 2012). Bedrock is made of shale, limestone, dolostone and siltstone of Queenston Formation.

No surface water features exist onsite. Two water courses start close to west and south Site boundaries. One is a tributary of Etobicoke Creek and the other tributary discharges to Heart Lake. Etobicoke Creek runs approximately 800 m southwest of the Site and the Heart Lake is location approximately 1.2 km southeast of the Site.

The groundwater flow direction is interpreted to be varied from west to south across the Site, towards Etobicoke Creek. Artesian groundwater conditions were not reported during the past monitoring events at the Site.

The Site is located within the Toronto Source Water Protection Area and the Site is located within WHPA Q2, with low vulnerability.

4.2 Methodology

The Thornthwaite water balance (Thornthwaite, 1948; Mather, 1978; 1979) is an accounting method used to analyze the allocation of water among various components of the hydrologic cycle. This methodology was used to complete the pre-construction (existing conditions) and post-development water balance. Inputs to the model are monthly temperature, precipitation, and Site latitude. Outputs include monthly potential and actual evapotranspiration, soil moisture storage, soil moisture storage change, surplus, infiltration, and runoff.

When precipitation (P) occurs, it can either runoff (R) through the surface water system, infiltrate (I) to the water table including an interflow component, or evapo-transpiration (ET) from the earth's surface and vegetation. The difference between total precipitation (P) and the total of evaporation and evapotranspiration (ET) is defined to be the water surplus (S) which is available for both infiltration (recharge to the groundwater system including interflow) and for runoff. When long-term averages of P, R, I and ET are used, no net change in groundwater storage (ST) is assumed. Annually, however, there is a potential for small changes in ST.

The annual water budget can be stated as follows:

$$P = ET + R + I + ST$$

Where:

P = precipitation
ET = evapotranspiration
R = surface water runoff
I = infiltration
ST = change in groundwater storage

For this assessment, the Thornthwaite and Mather method was used to estimate average annual infiltration rates.

Infiltration is governed by the surficial soil types, topography, and land cover. If the water table is at surface, as measured in shallow monitoring wells, then the percolation rate of precipitation into the shallow soils is considered negligible.

For ease of calculation, a spreadsheet model was used for the computation. The Thornthwaite and Mather Model is based on the United Stated Geological Survey (USGS) graphical user interface (Thornthwaite Monthly Water-Balance program, 2007).

4.3 Meteorological Data

Meteorological data including average monthly precipitation and average temperatures were obtained from the National Climate Data and Information Archive (Environment Canada) for the Richmond Hill (Station ID No. 6157012) climatic station (elevation 240 masl).

Meteorological data of 30 years from 1977 to 2006 was utilized for the assessment. Summary of input data is provided in Appendix F-1.

4.4 Pre- and Post-Development Site Characteristics

4.4.1 Pre-Development Site Characteristics

The Site is currently an agricultural field. A summary of the existing (pre-development) landscape features is provided in Table 4.1:

Table 4.1: Pre-Development (Existing) Land Use

Description	Pre-Construction (Existing) (m^2)	Percentage %
Buildings	1,700	0.4
Paved Surfaces	1,800	0.5
Site Area Available for Infiltration (Agricultural lands)	372,700	99.1
Total Site Area	376,200	100.0

It should be noted that the areas provided in Table 4.1 above were determined based on a review of available Site plans and these estimates are considered appropriate for estimating the water balance.

As evident from the information provided in Table 4.1, under pre-development conditions, approximately 99.1% of the Site area is pervious and available for groundwater infiltration (Figure 7).

4.4.2 Post-Development Site Characteristics

As provided in the draft Site Plan, Table 4.2 provides a summary of the post-development Site characteristics.

Table 4.2: Post-Development Site Characteristics

Description	Impervious Areas m^2	Pervious Areas available for Infiltration m^2	Total Areas Post-Construction (Proposed) m^2
ROW (roads, sidewalks, parking) paved	41,000	0	41,000
Building roofs (Building 1)	49,400	0	49,400
Agricultural / Landscaped areas	0	285,800	285,800
Totals	90,400	285,800	376,200
Percentage %	24.0	76.0	100.0

Under post-development conditions, the total pervious area is reduced from 99.1% to 76.0% of the total Site area (Tables 4.1 and 4.2).

4.5 Pre-Development Water Balance Estimates

4.5.1 Climate Data Analysis

The mean annual water surplus was calculated by using the Thornthwaite and Mather (1955) method. Monthly average precipitation values were obtained for 30 years (1977 to 2006) from the National Climate Data and Information Archive (Environment Canada) for the Richmond Hill (Station ID No. 6157012).

Moisture storage of 200 mm/year was assumed for soils and considered to be representative of pre-construction Site conditions. The closest latitude to the Site is 44^0, which was used in the USGS model (2007).

Table 4.3 summarizes the climatic water balance analysis. Appendix F-1 and F-2 provide the model input and output, respectively.

Table 4.3: Summary of Climatic Water Balance Analysis in Pre-Development Conditions

Soil Moisture Storage (mm/yr)	Precipitation (mm/yr)	Actual ET (mm/yr)	Surplus (mm/yr)
200 mm/yr Silt and Clay	897.38	547.63	322.75

Note: ET = Evapotranspiration

The results of climatic water balance analysis for the Site suggest that a surplus of 322.75 mm/year of water is available for surface runoff and infiltration.

4.5.2 Infiltration

The infiltration is expected to be controlled by soil type, topography, and soil cover type. Surplus water is portioned between runoff and infiltration based on the controlling factors provided by MOE (1995). It is noted that the controlling factors provided by the MOE were used for estimating infiltration factors.

Using this method, a total infiltration factor for the Site was estimated by using the individual sub-factors, which are representative of the topography, soil type and land cover conditions (Figures 2, 7 and 9). Appendix F-3 provides a summary of the sub factors and total factor based on the Site conditions. The infiltration sub-factors were determined for estimating pre-development infiltration rates of the entire Site.

The estimated pre-development total infiltration factor of 0.45 (or 45%) represents the fraction of the water surplus available for infiltration. The complementary fraction of the available water for runoff is 0.55. The infiltration factor is utilized to calculate the amount of annual infiltration (in units of m^3/yr) at the Site by multiplying it with the average yearly water surplus estimate and with the Site area available for infiltration.

Applying the infiltration factor of 0.45 and a water surplus of 322.75 mm/yr, the estimated pre-development infiltration rate of the whole Site is 145.24 mm/yr.

In areas with water table at or above surface and areas with shallow bedrock less than approximately 1.0 m below surface, the infiltration rate was considered negligible for existing and proposed grade. However, water level above ground surface or less than 1 m below ground surface were not reported during water level monitoring at this Site.

4.5.3 Pre-Development Water Balance Analysis

The water balance analysis is based on available information on a regional scale and considered representative for the Site. Table 4.4 provides a summary of water balance analysis for the Site.

Table 4.4: Summary of Overall Pre-Development Water Balance Results

Location	Total Site Area (m^2)	Area Available for Infiltration (m^2)	Total Precipitation (m^3/yr)	Actual Evapo-transpiration (m^3/yr)	Runoff (m^3/yr)	Infiltration (m^3/yr)
Total Site	376,200	372,700	337,594	216,176	67,288	54,130
Percentage of Total Precipitation			100.0	64.0	20.0	16.0

The total property area was used to estimate the annual precipitation volume of the Site (Appendix F-4). As summarized in Table 4.4, the breakdown of the pre-development water balance is as follows: 64.0% of the total precipitation is subject to evapotranspiration, 20.0% to runoff, and 16.0% to infiltration.

The pre-development water balance, on a weighted average depth basis (in mm/year) is as follows:

$$P\ (897.38) = ET\ (574.63) + R\ (177.51) + I\ (145.24) + ST\ (0)$$

4.6 Post-Development Water Balance Estimates

4.6.1 Post-Development Water Balance

Based on the proposed development drawings, the total area of pervious surfaces under post-development conditions is approximately 285,800 m^2, representing approximately 76.0% of the total Site area of 376,200 m^2 (Table 4.2). The remaining 90,400 m^2 is not available to contribute to infiltration during the post-development stage (approximately 24.0% of the total land area).

Post-development infiltration sub-factors were determined in a similar manner as for estimating infiltration sub-factors for pre-development Site conditions, both based on the method recommended by MOE (1995). For post-development infiltration sub-factors, the landscaped areas were assumed to be consistent with cultivated cover with an infiltration sub-factor of 0.1 (Appendix E-3). The estimated post-development total infiltration factor of 0.45 (or 45.0%).

Table 4-5 presents a summary of the overall post-development water balance assessment.

Table 4.5: Summary of Overall Post-Development Water Balance Forecast

Location	Total Site Area (m^2)	Area Available for Infiltration (m^2)	Total Precipitation (m^3/yr)	Evapo-transpiration (m^3/yr)	Runoff (m^3/yr)	Infiltration (m^3/yr)
Total Site	376,200	285,800	337,594	164,229	131,856	41,509
Percentage of Total Precipitation			100%	48.6%	39.1%	12.3%

If no remedial measures are implemented to maintain infiltration, it is expected that the annual infiltration volume will be reduced from approximately 54,130 m^3/year to 41,509 m^3/year in post-development, resulting in a deficit of 12,621 m^3/year (Appendix F-4).

Infiltration deficits based on pre- and post-development Site conditions can be utilized to guide mitigation measures under idealized soil and groundwater conditions. If suitable mitigation measures are implemented, it is expected that the unmitigated infiltration deficit of 12,621 m^3/year can be maintained under the post-development Site conditions under sound conditions. Reasonable mitigation measures onsite are therefore recommended to maintain the pre-development infiltration under post-development Site conditions.

Under unmitigated post-development conditions, a reduction in annual infiltration volume may occur, as compared to pre-development conditions. Consequently, water contribution from infiltration to downgradient drainage features would decrease.

4.7 Impact and Proposed Mitigation Measures

Mitigation measures should be implemented to balance the estimated pre-development infiltration rate deficit of 12,621 m^3/year (Appendix F-4). To offset the noted deficit, approximately 43% from the available runoff from roof-top water of 29,554 m^3/year (in 8 months) would need be infiltrated. This could be accommodated in Low Impact Development (LID) facilities, such as infiltration galleries and enhanced grass swales implemented onsite to maintain the pre-development infiltration rates during the post-development phase.

The existing surface water body (seasonal tributary) may become impacted if the expected water deficit is not balanced (mitigated) during the post-construction phase of the project. By implementing appropriate mitigations measures, negative developmental impacts on the existing surface water drainage features can be reduced and compensated.

As per the CVC guidelines, the invert of the infiltration system needs to be 1.0 m above the highest water level or top of bedrock measured at location of the infiltration system, as a minimum. It should be noted that the at the time of preparation of this report, information on final grades for the proposed development is not available. Therefore, when the final grades for the development are available, updating water balance assessment will be required.

Consideration should be given to assess the extent of potential mounding and on the potential interference of the proposed infiltration system/s with existing and proposed surrounding basements and infrastructures (ex: retaining walls, underground servicing etc.).

The following mitigation measures are proposed to be implemented onsite to maintain the pre-development infiltration rates during the post-development phase:

- **Infiltration Galleries**

To balance the infiltration deficit in 8 months per year a LID system (infiltration gallery) with a total of approximately 2,085 m^2 in size would be required. The LID area is based on the estimated design infiltration rate of 8 mm/hr, on the assumption that precipitation is evenly distributed during the year, and bi-weekly volumes from roof will be infiltrated in 48-hour. The infiltration system will need to have a minimum storage of 789 m^3 to store two weeks of precipitation to meet the pre-development infiltration levels. This means that 380 mm of LID-storage per square meter (m^2) exists (Appendix E-2 and F-5).

As per the regulatory requirements, the invert of the infiltration system needs to be 1.0 m above the highest water level or top of bedrock measured at location of the infiltration system, as a minimum.

Consideration should be given to assess the extent of potential mounding and on the potential interference of the proposed infiltration system/s with existing and proposed surrounding basements and infrastructures (ex: retaining walls, underground servicing etc.).

- **Enhanced Grass Swales and Rain Gardens**

To increase the post-development infiltration onsite, enhanced grass swales and / or rain gardens are also recommended where feasible.

These facilities are recommended to be designed to mimic current shallow groundwater (interflow). Where possible, selected areas can also be used as rain gardens to enhance groundwater infiltration.

5 Dewatering Assessment

EXP understands that the proposed development will consist of one (1) single storey slab on grade building without a basement. Proposed development includes supporting truck loading docks, paved accessways, sewers, and truck and passenger vehicle parking areas. The proposed building (Buildings 1) will have a footprint of approximately 42,223 m^2 . The proposed Site Plan for Building 1 is provided in Attachment 1.

Based on ground elevations at borehole locations, there is approximately 7 m difference between highest and lowest ground elevations. Therefore, it is anticipated that cut and fill operations will be required at the Site. EXP Geotechnical (September 28, 2021) Investigation report suggests that the proposed structures can be supported on conventional spread and stripe footings or augered piers founded at depths of 1.0 to 2.0 m below the fill, on the undisturbed native clayey silt till.

Table 4-1 presents the assumptions used to calculate the dewatering rate for the Site.

Table 4-1 Construction Dewatering Estimate Assumptions

Input Parameter	Building 1	Units	Notes
Ground Surface Elevation	266.8 to 274.1	masl	Approximate elevation based on the borehole logs and Site
Groundwater elevation	265.0	masl	The highest recorded groundwater elevation based on the interpreted groundwater elevation within the building area plus 1.0 meter to account for some seasonal fluctuation
Point Towers/Podiums	0 Towers, 0 Podiums	-	
Number of Subgrade Levels	0 Levels	-	
Top of Slab Elevation	not available	masl	
Lowest Footing Elevation	265.3	masl	Lowest spread and strip footing/sugared Pier elevation recommended by geotechnical report (September 28, 2021)
Construction Dewatering Elevation Target	264.3	masl	Assumed to be approximately 1.0 m below the lowest footing elevation
Bottom Elevation of Water-Bearing Zone	261.3	masl	Assumed 3 m below target water level
Footing Excavation Area (Length x Width)	450 (300 x 1.5)	m^2 (m x m)	Approximate area (length x width) of longest footing for the proposed development
Hydraulic Conductivity (K)	6.3E-07	m/s	Geometric Mean K-value for overburden
Specific Yield	0.05		Assumed

5.1 Dewatering Flow Rate Estimate and Zone of Influence

The Dupuit-Forcheimer equation for radial flow to both sides of an excavation through an unconfined aquifer resting on a horizontal impervious surface was used to obtain a flow rate estimate. Dewatering flow rate is expressed as follows:

$$Q_w = \frac{\pi K(H^2 - h^2)}{Ln\left[\frac{R_o}{r_e}\right]}$$

$$r_e = \frac{a+b}{\pi} \qquad R_o = R_{cj} + r_e$$

Where:

Q_w = Rate of pumping (m^3/sec)
X = Length of excavation (m)
K = Hydraulic conductivity (m/sec)
H = Hydraulic head beyond the influence of pumping (static groundwater elevation) (m)
h = Hydraulic head above the base of aquifer in an excavation (m)
R_0 = Radius of Influence (m)
R_{cj} = Cooper Jacob Radius of Influence (m)
r_e = Equivalent perimeter (m)
a = Length of the excavation area (m)
b = Width of the excavation area (m)

It is expected that the initial dewatering rate will be higher to remove groundwater from within the overburden formation. The dewatering rates are expected to decrease once the target water level is achieved in the excavation footprint as groundwater will have been removed, primarily from storage, resulting in lower seepage rates into the excavation.

5.2 Cooper-Jacob's Radius of Influence

The radius of influence (Rcj) for the construction dewatering was calculated based on Cooper-Jacob equation. This equation is used to predict the distance at which the drawdown resulting from pumping is negligible.

The estimated radius of influence due to pumping is based on Cooper-Jacob formula as follows:

$$\mathrm{R}_{cj} = \sqrt{2.25KDt/s}$$

Where:

Rcj = Estimated radius of influence (m)
D = Aquifer thickness (original saturated thickness) (m)
K = Hydraulic conductivity (m/sec)
S = Storage coefficient
t = Duration of pumping (s)

5.3 Stormwater

Additional pumping capacity may be required to maintain dry conditions within the excavation during and following significant precipitation events. Therefore, the dewatering rates at the Site should also include removing stormwater from the excavation.

A 15 mm precipitation event was utilized for estimating the stormwater volume. The calculation of the stormwater volume is included in Appendix G.

The estimate of the stormwater volume only accounts for direct precipitation into the excavation. The dimensions of the excavation are considered in the dewatering calculations. Runoff from outside of the excavation's footprint is excluded and it should be directed away from the excavation.

During precipitation events greater than 15 mm (ex: 100-year storm), measures should be taken by the contractor to retain stormwater onsite in a safe manner to not exceed the allowable water taking and discharge limits, as necessary. A two (2) and a one hundred (100) year storm events over a 24-hour period are 57.3 and 125.2 mm, respectively, which would produce 2,419 and 5,286 L of water within Building 1 footprint area.

5.4 Results of Dewatering Rate Estimates

5.4.1 Construction Dewatering Rate Estimate

For this assessment, it was assumed that the proposed construction plans include an excavation without shoring system. EXP should be retained to review the assumptions outlined in this section, should a shoring system be included.

Short-term (construction) dewatering calculations are presented in Appendix G.

Based on the assumptions provided in this report, the results of the dewatering rate estimate can be summarized as follows:

Table 4-2 Summary of Construction Dewatering Rate (Without Basement)

Description	Building 1 (L/day)
Estimated Short Term Dewatering Rate (without safety factor or precipitation)	5,000
With Factor of Safety of 2.0 (excluding precipitation) for permit	**10,000**
From Precipitation Event of 15 mm in one day for whole building footprint	630,000
With Factor of Safety of 2.0 (including precipitation) for designs, and budgeting	640,000
Radius of Influence from sides of excavation (m)	16

It should be noted that the construction dewatering is required mainly to remove rainwater from the excavation after rainfall events. The MECP regulates the groundwater taking and since the estimated flow rate is less than 50,000 L/day then no MECP water taking permit (EASR or PTTW) is required.

The peak dewatering flow rates does not account for flow from utility beddings and variations in hydrogeological properties beyond those encountered during this investigation. Local dewatering may be required for pits (elevator pits, sump pits, raft) and for localized areas with permeable, soft, or wet soil conditions. Local dewatering is not considered to be part of this assessment, but contractor should be ready to install additional system to manage such conditions. Dewatering estimates should be reviewed once the pit dimensions are available.

All grading around the perimeter of the excavation should be graded away from the excavation and ramp/site access to redirect runoff away from excavation.

The contractor is responsible for the design of the dewatering system to ensure that dry conditions are always maintained within the excavation at all costs.

As shown on Table 4.2, more than 90% of the dewatering volume is expected to be required after rainfall events. As such it is suggested to revise the construction plan to reduce the area of excavation kept open at any given point of time.

5.4.2 Post-Construction Dewatering Rate Estimate

As per preliminary Site drawings, it is our present understanding that the proposed Building 1 will be constructed without basements. Therefore, no long-term dewatering requirements are anticipated for the proposed Building 1.

5.5 MECP Water Taking Permits

5.5.1 Short-Term Discharge Rate (Construction Phase)

In accordance with the Ontario Water Resources Act, if the water taking for the construction dewatering is more than 50,000 L/day but less than 400,000 L/day, then an online registration in the Environmental Activity and Sector Registry (EASR) with the MECP will be required. If groundwater dewatering rates onsite exceed 400,000 L/day, a Category 3 Permit to Take Water (PTTW) will be required from the MECP.

As of July 1, 2021, an amendment of O. Reg. 63/16 has come into effect and replaced the former subsection 7 (5) such that the water taking limit of 400,000 L/day would apply to groundwater takings of each dewatered work area only, excluding stormwater.

The dewatering estimates including a safety factor and excluding precipitation is stated below. The MECP construction dewatering rate excludes the precipitation amount and is the rate used for the permit application.

Table 4-4: MECP Construction Dewatering Flow Rate

Scenario	Total Flow Rate Buildings 1 (L/day)
MECP Construction Dewatering Flow Rate with Safety Factor of 2.0 (excluding rainwater collection)	10,000

Based on the estimated construction dewatering rates, an EASR from the MECP will not be required to facilitate the construction dewatering program of the Site.

6 Environmental Impacts

6.1 Surface Water Features

The Site is within the Etobicoke Creek watershed. No surface water features exist onsite. Two un-named tributaries are starting immediately east and south of the site. One to the east is a tributary of Etobicoke Creek and the one to the south discharges to Heart Lake. Etobicoke Creek runs approximately 800 m southwest of the Site. Distance to Heart Lake is approximately 1.2 km from the Site boundary to the southeast.

Due to the limited extent of zone of influence and the limited water taking rate, no detrimental impacts on surface water features are expected during construction activities.

6.2 Groundwater Sources

Well Records from the MECP Water Well Record (WWR) Database were reviewed to determine the presence and number of water supply wells within a 500 m radius of the Site boundaries. Given that the dewatering zone of influence is limited, no dewatering related impact is expected on the water wells in the area.

However residential water supply wells were identified from distances approximately 10 m away from the site boundary. Therefore, it is recommended to conduct a door-to-door water supply well survey prior to commence the site construction activities.

6.3 Geotechnical Considerations

The water taking should not have unacceptable interference on soils and underground structures (foundations, utilities, etc.).

A letter related to geotechnical issues as it pertains to the Site is required to be completed under a separate cover.

6.4 Groundwater Quality

It is our understanding that the potential effluent from the dewatering system during the construction will be released to the municipal sewer system. As such, the quality of groundwater discharge is required to conform the City of Mississauga / Regional Municipality of Peel Sewer Use By-Law.

For the short-term dewatering system (construction phase), it is anticipated that TSS levels and some other parameters (for example, Total Metals) in the pumped groundwater may become elevated and exceed both, Sanitary and Storm Sewer Use By-Law limits. To control the concentration of TSS and associated metals, it is recommended that a suitable treatment method be implemented (filtration or decantation facilities and/ or any other applicable treatment system) during construction dewatering activities to discharge to the applicable sewer system. The specifications of the treatment system will need to be adjusted to the reported water quality results by the treatment contractor/process engineer.

For the long-term dewatering discharge to the sanitary sewer system (post-development phase), and based on the water quality test results, the water is suitable to be released without a treatment system.

Dewatering (short and long-term) may induce migration of contaminants within the zone of influence and beyond due to changing hydraulic gradients, hydrogeological conditions beyond Site boundaries and preferential pathways in utility beddings etc. The water quality sampling conducted as part of this assessment was performed under static conditions. As a result, monitoring may be required during dewatering activities (short and long-term) to monitor potential migration, and this should be performed more frequently during early dewatering stages.

For the long-term dewatering discharge to the storm sewer system (post-development phase) and based on the water quality results, it is recommended to implement a suitable pre-treatment, as required.

The water quality results presented in this report may not be representative of the long-term condition of groundwater quality onsite. As such, regular water quality monitoring is recommended for the post-construction phase as required by the City.

An agreement to discharge into the sewers owned by the City of Mississauga / Regional Municipality of Peel will be required prior to releasing dewatering effluent.

The Environmental Site Assessment Report(s) shall be reviewed for more information on the groundwater quality conditions at the Site.

6.5 Well Decommissioning

In conformance with Regulation 903 of the Ontario Water Resources Act, the installation and eventual decommissioning of any dewatering system wells or monitoring wells must be completed by a licensed well contractor. This will be required for all wells that are no longer in use.

7 Conclusions and Recommendations

Based on the findings of the Hydrogeological Investigation and Water Balance Assessment, the following conclusions and recommendations are provided:

- When comparing the chemistry of the collected groundwater samples to the Regional Municipality of Peel Sanitary and Combined Sewer Discharge Criteria (By-Law Number 53-2010, Table 1), there were no parameter exceedances to be reported.
- When comparing the chemistry of the collected groundwater samples to the Regional Municipality of Peel Storm Sewer Discharge Criteria (By-Law Number 53-2010, Table 2) the following parameters reported an exceedance: Total manganese and Chloroform.
- The report will need to be updated to include the results of the one-year by-monthly water level monitoring (manual and continuous) program is completed.
- If no remedial measures are implemented to maintain infiltration, it is expected that the annual infiltration volume will be reduced from approximately 54,130 m^3/year to 41,509 m^3/year in post-development, resulting in a deficit of 12,621 m^3/year.
- To balance the infiltration deficit in 8 months per year a LID system (infiltration gallery) with a total of approximately 2,085 m^2 in size would be required. The LID area is based on the estimated design infiltration rate of 8 mm/hr, on the assumption that precipitation is evenly distributed during the year, and bi-weekly volumes from roof will be infiltrated in 48-hour. The infiltration system will need to have a minimum storage of 789 m^3 to store two weeks of precipitation to meet the pre-development infiltration levels. This means that 380 mm of LID-storage per square meter (m^2) exists
- Based on the assumptions outlined in this report, the estimated peak MECP dewatering rate for proposed construction activities is approximately 10,000 L/day. As the groundwater dewatering flow rate estimate is less than 50,000 L/day, MECP permitting will not be required to facilitate the construction dewatering program for the Site.
- Considering a 15 mm precipitation event over the building footprint, the estimated peak dewatering rate for proposed construction activities is approximately 640,000 L/day for Building 1 (groundwater extraction with a factor of 2.0 and precipitation). This volume does not consider the total area of the site which should also be considered as part of the drainage plan prepared by the civil consultant. Approval from the agencies will be required to discharge to the natural environment and/or municipal sewer system.
- The construction dewatering volumes is based on the assumptions outlined in this report. Any variations in hydrogeological conditions beyond those encountered as part of this preliminary investigation may significantly influence the discharge volumes.
- It is recommended to conduct a door-to-door well survey prior to commence construction activities at the Site.
- For the short-term dewatering system (construction phase), it is anticipated that TSS levels and some other parameters (for example, Total Metals) in the pumped groundwater may become elevated and exceed both, Sanitary and Storm Sewer Use By-Law limits. To control the concentration of TSS and associated metals, it is recommended that a suitable treatment method be implemented (filtration or decantation facilities and/ or any other applicable treatment system) during construction dewatering activities to discharge to the applicable sewer system. The specifications of the treatment system will need to be adjusted to the reported water quality results by the treatment contractor/process engineer.
- For the long-term dewatering discharge to the sanitary sewer system (post-development phase) and based on the water quality test results, the water is suitable to discharge without a treatment system.
- An agreement to discharge into the sewers owned by the City of Mississauga / Regional Municipality of Peel will be required prior to releasing dewatering effluent.

- In conformance with Regulation 903 of the Ontario Water Resources Act, the installation and eventual decommissioning of any dewatering system wells or monitoring wells must be completed by a licensed well contractor. This will be required for all wells that are no longer in use.

The conclusions and recommendations provided above should be reviewed in conjunction with the entirety of the report. They assume that the present design concept described throughout the report will proceed to construction. This report is solely intended for the construction and long-term dewatering assessments. Any changes to the design concept may result in a modification to the recommendations provided in this report.

8 Limitations

This report is based on a limited investigation designed to provide information to support an assessment of the current hydrogeological conditions within the study area. The conclusions and recommendations presented within this report reflect Site conditions existing at the time of the assessment. EXP must be contacted immediately, if any unforeseen Site conditions are experienced during construction activities. This will allow EXP to review the new findings and provide appropriate recommendations to allow the construction to proceed in a timely and cost-effective manner.

Our undertaking at EXP, therefore, is to perform our work within limits prescribed by our clients, with the usual thoroughness and competence of the geoscience/engineering profession. No other warranty or representation, either expressed or implied, is included or intended in this report.

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We trust that this information is satisfactory for your purposes. Should you have any questions or comments, please do not hesitate to contact this office.

Sincerely,

EXP Services Inc.

Jay Samarakkody, M. Phil., P. Geo.
Senior Hydrogeologist
Environmental Services

Francois Chartier, M. Sc., P. Geo.
Discipline manager, Hydrogeology
Environmental Services

.

9 References

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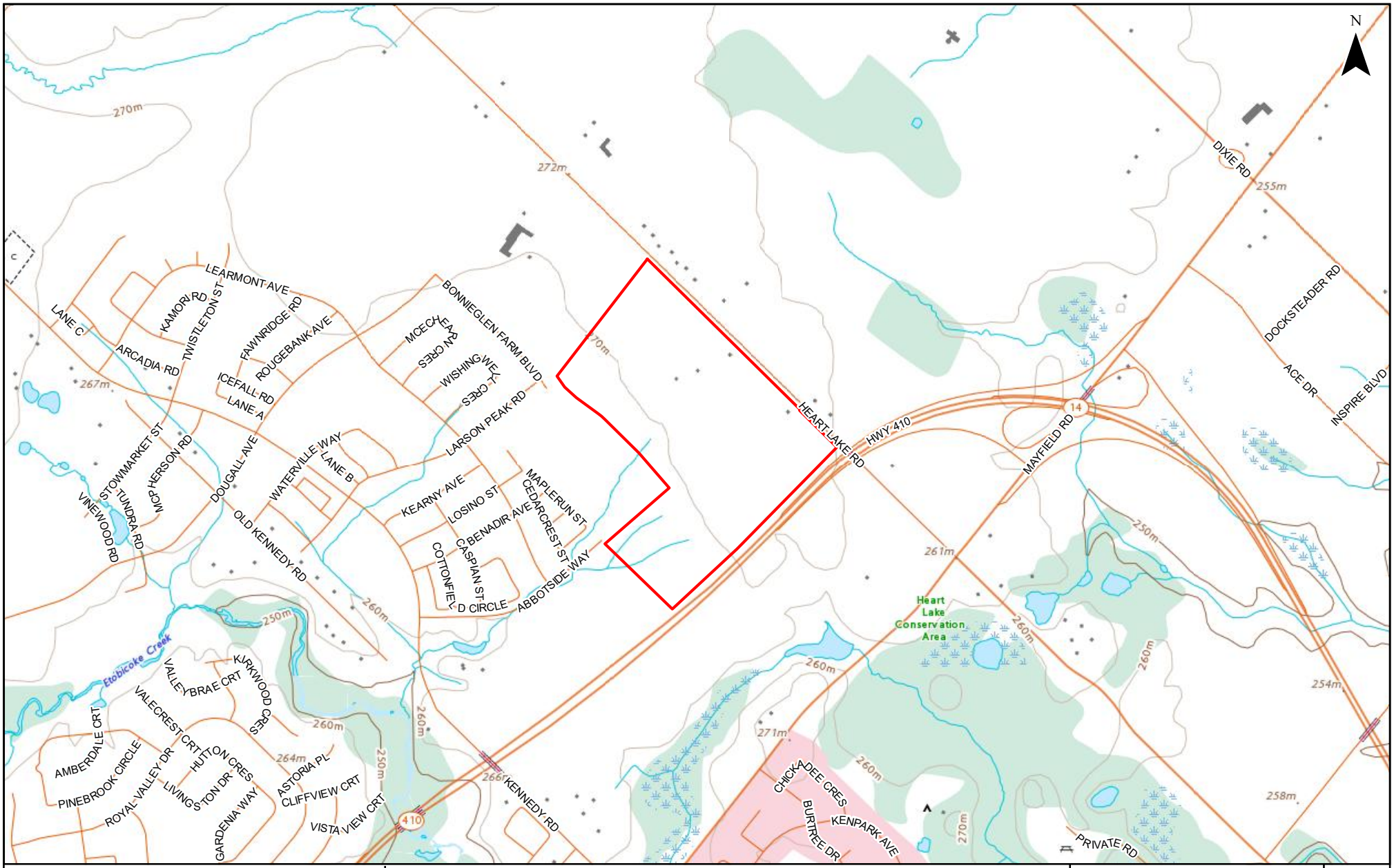
Figures



SCALE:

0 150 300 450 600 750 m

LEGEND:

APPROXIMATE SITE BOUNDARY

DRAWN BY:	CHECKED BY:
AC	JS

SITE LOCATION PLAN

FIGURE: 1

HYDROGEOLOGICAL INVESTIGATION
AND WATER BALANCE ASSESSMENT
12304 HEART LAKE ROAD
CALEDON, ONTARIO

PROJECT NUMBER: BRM-21004344-D0

DATE: OCTOBER 2021

SCALE:

0 100 200 300 400 500 m

SOURCE:

BASED ON ONTARIO GEOLOGICAL SURVEY DATA PUBLISHED IN 2010

exp.

DRAWN BY:	CHECKED BY:
AC	JS

LEGEND:

- APPROXIMATE SITE BOUNDARY
- 20: ORGANIC DEPOSITS
- 5D: GLACIOLACUSTRINE-DERIVED SILTY TO CLAYEY TILL

SURFICIAL GEOLOGY

FIGURE: 2

HYDROGEOLOGICAL INVESTIGATION
AND WATER BALANCE ASSESSMENT
12304 HEART LAKE ROAD
CALEDON, ONTARIO

PROJECT NUMBER: BRM-21004344-D0

DATE: OCTOBER 2021

SCALE:

0 150 300 450 600 750 m

SOURCE:

BASED ON GOOGLE EARTH IMAGERY DATED 2020,
AVAILABLE WELL RECORD INFORMATION AS OF SEPTEMBER 2019

exp.

DRAWN BY:	CHECKED BY:
AC	JS

LEGEND:

- MONITORING WELL / TEST HOLE
- WATER SUPPLY WELL
- ABANDONED WELL
- UNCLASSIFIED / UNFINISHED WELL
- APPROXIMATE SITE BOUNDARY
- 500 m ZONE

MECP WATER WELL RECORDS MAP

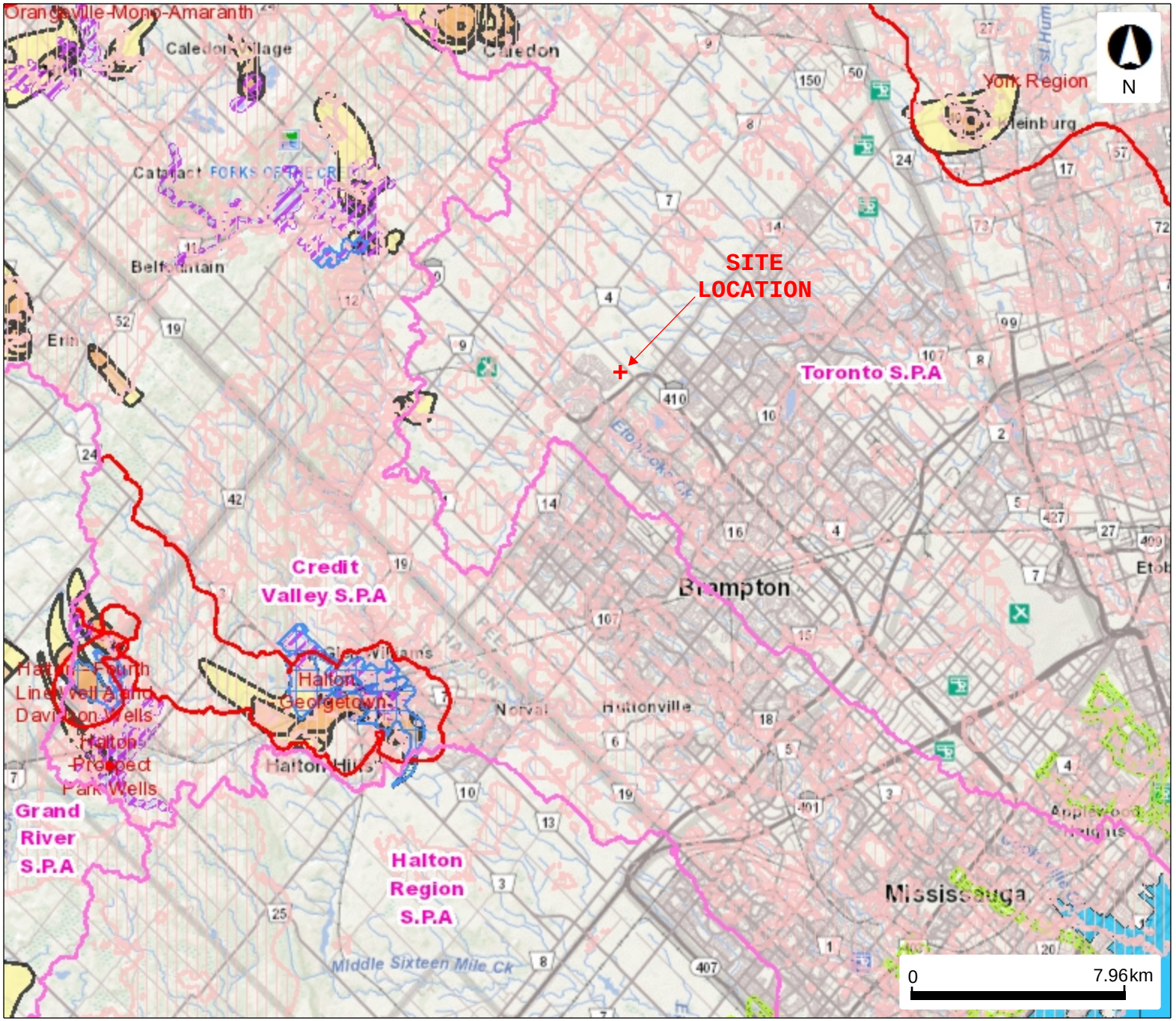
FIGURE: 3A

HYDROGEOLOGICAL INVESTIGATION
AND WATER BALANCE ASSESSMENT
12304 HEART LAKE ROAD
CALEDON, ONTARIO

PROJECT NUMBER: BRM-21004344-D0

DATE: OCTOBER 2021

Figure 3B - Vulnerability Mapping



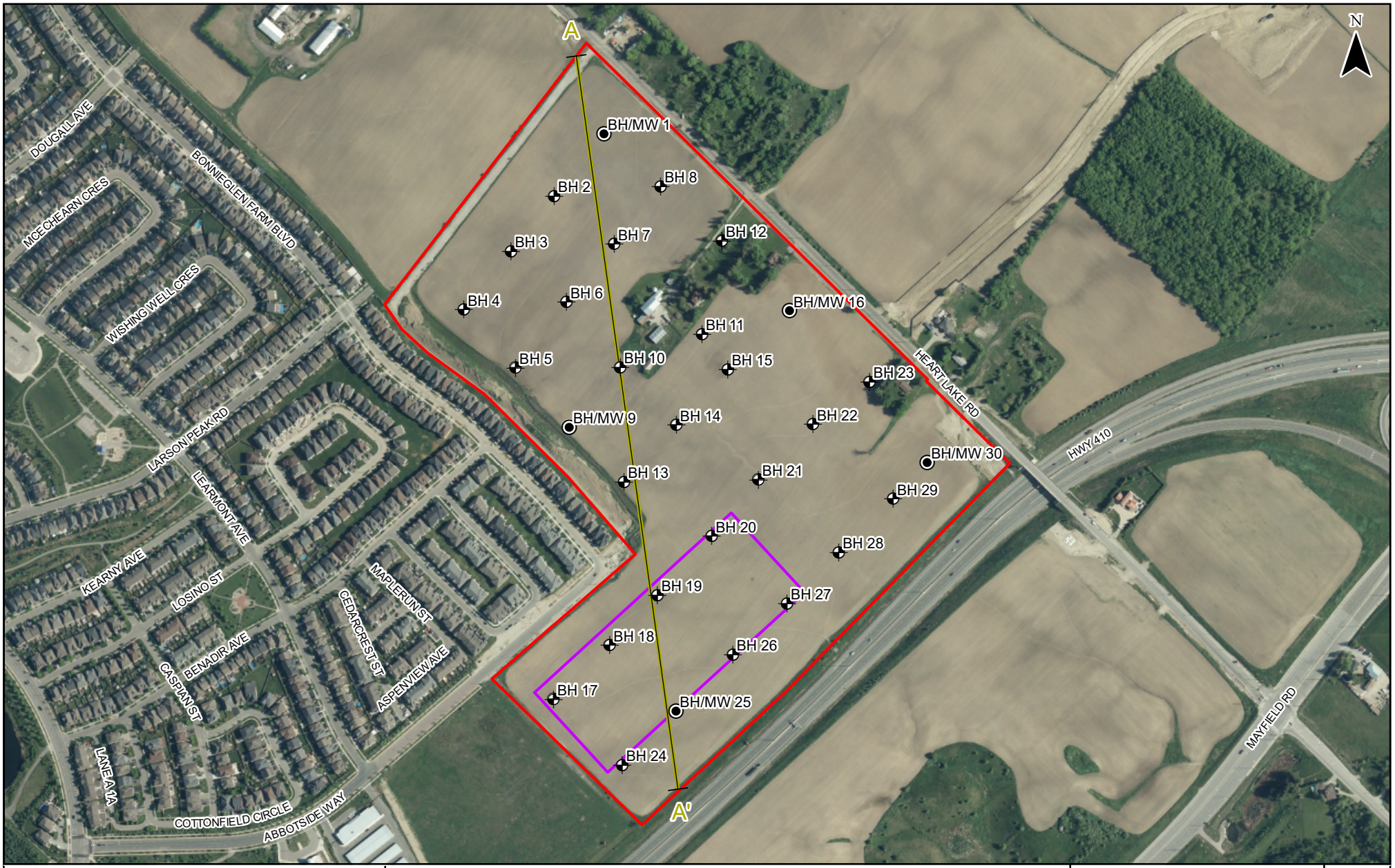
Legend

- Source Protection Areas
- Wellhead Protection Area Q1
- Wellhead Protection Area Q2
- Issue Contributing Areas
- Highly Vulnerable Aquifers
- WHPA Groundwater Under Direct Influence (WHPA-E)
- Wellhead Protection Area
  - A
  - B
  - C
  - C1
  - D
  - F
- Intake Protection Zone 1
- Event Based Areas
- Intake Protection Zone 2

This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Environment, Conservation and Parks (MECP) shall not be liable in any way for the use or any information on this map. of, or reliance upon, this map.

Ontario

Map Created: 10/25/2021
Map Center: 43.71137 N, -79.82875 W



SCALE:

0 80 160 240 320 400 m

LEGEND:

- BOREHOLE (EXP, 2021)
- BOREHOLE / MONITORING WELL (EXP, 2021)
- CROSS SECTION AXIS
- PROPOSED BUILDING FOOTPRINT
- APPROXIMATE SITE BOUNDARY

exp.

DRAWN BY:	CHECKED BY:
AC	JS

BOREHOLE / MONITORING WELL LOCATION PLAN

FIGURE: 4

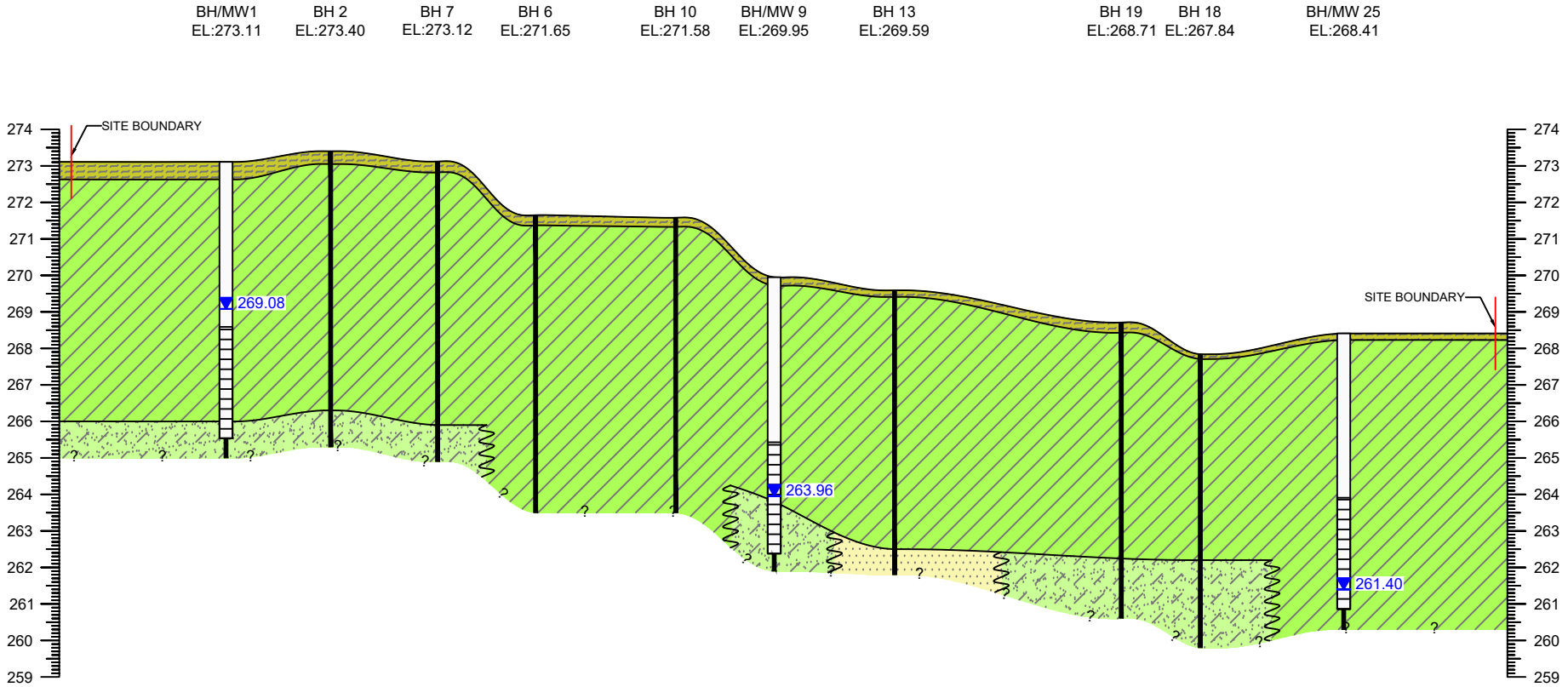
HYDROGEOLOGICAL INVESTIGATION
AND WATER BALANCE ASSESSMENT
12304 HEART LAKE ROAD
CALEDON, ONTARIO

PROJECT NUMBER: BRM-21004344-D0

DATE: NOVEMBER 2021

A
NORTH

A'
SOUTH



VERTICAL SCALE: AS SHOWN

HORIZONTAL SCALE:

0 40 80 120 160 200 m

EXP Services Inc.
t: +1.905.793.9800 | f: +1.905.793.0641
1595 Clark Boulevard
Brampton, ON L6T 4V1
Canada
www.exp.com

LEGEND:

- TOPSOIL
- CLAYEY SILT TILL
- SANDY SILT TILL
- SAND

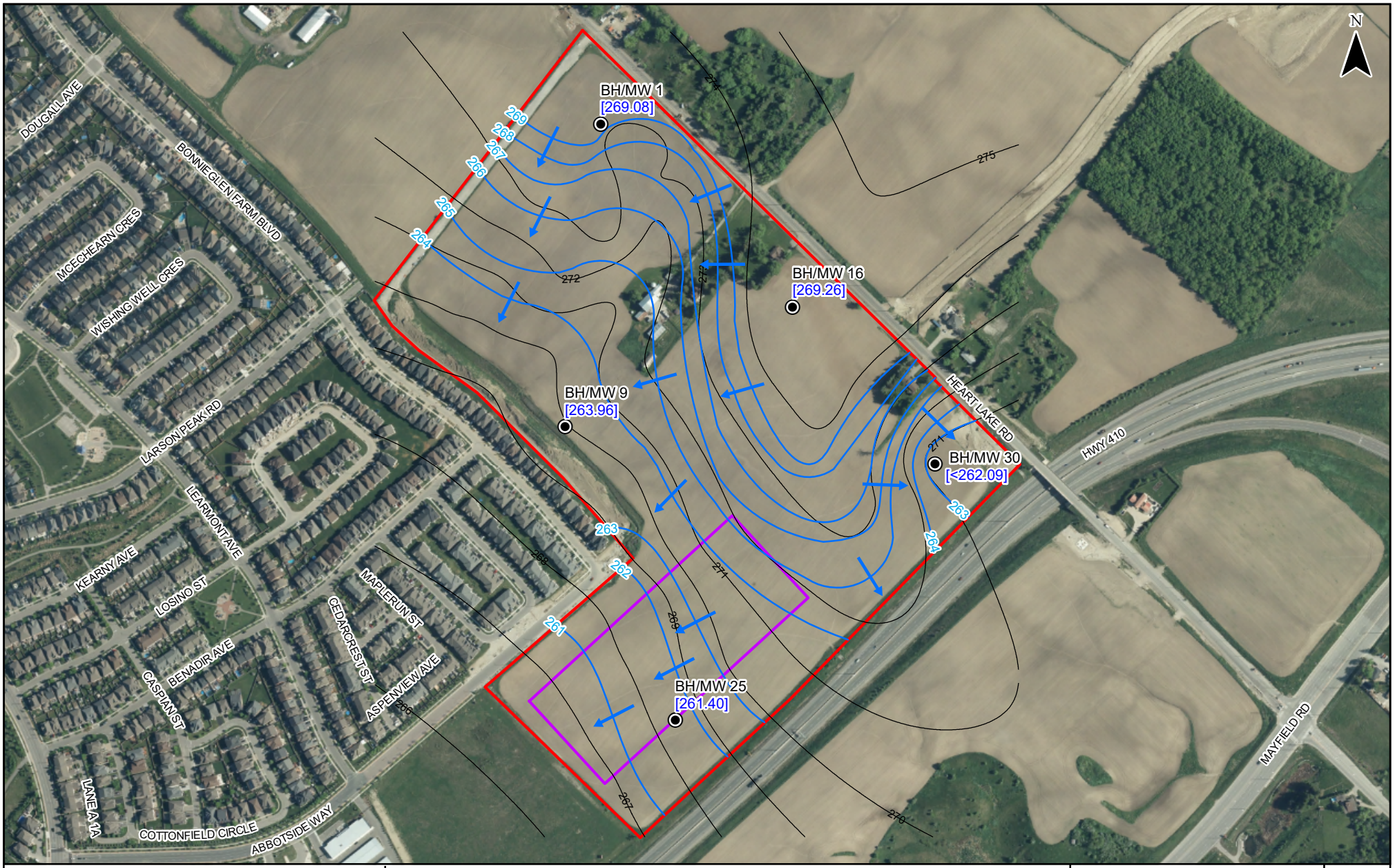
▼ GROUNDWATER ELEVATION (masl)
AS MEASURED ON OCTOBER 15, 2021

TITLE AND LOCATION:

CROSS SECTION A-A'
HYDROGEOLOGICAL INVESTIGATION
AND WATER BALANCE ASSESSMENT
12304 HEART LAKE ROAD
CALEDON, ONTARIO

PROJECT NO.:	DWN.:
BRM-21004344-D0	JA
SCALE: AS NOTED	CK: JS
DATE: OCTOBER 2021	FIG. NO.: 5

E:\BRM\BRM-21004344-D0\60 Execution\65 Drawings\Water Balance\Cross Sections\BRM-21004344-D0.dwg



SCALE:

0 80 160 240 320 400 m

exp.

DRAWN BY:	CHECKED BY:
AC	JS

LEGEND:

- BOREHOLE / MONITORING WELL (EXP, 2021)
- PROPOSED BUILDING FOOTPRINT
- APPROXIMATE SITE BOUNDARY
- ~~XX.XX~~ TOPOGRAPHIC CONTOUR (m asl)
- GROUNDWATER ELEVATION (m asl) AS MEASURED ON OCTOBER 15, 2021
- GROUNDWATER CONTOUR
- GROUNDWATER FLOW DIRECTION

GROUNDWATER CONTOUR PLAN

FIGURE: 6

HYDROGEOLOGICAL INVESTIGATION
AND WATER BALANCE ASSESSMENT
12304 HEART LAKE ROAD
CALEDON, ONTARIO

PROJECT NUMBER: BRM-21004344-D0

DATE: NOVEMBER 2021

SCALE:

0 80 160 240 320 400 m

LEGEND:

- AGRICULTURE / LANDSCAPE
- BUILDING
- PAVED SURFACE
- APPROXIMATE SITE BOUNDARY

exp.

DRAWN BY:	CHECKED BY:
AC	JS

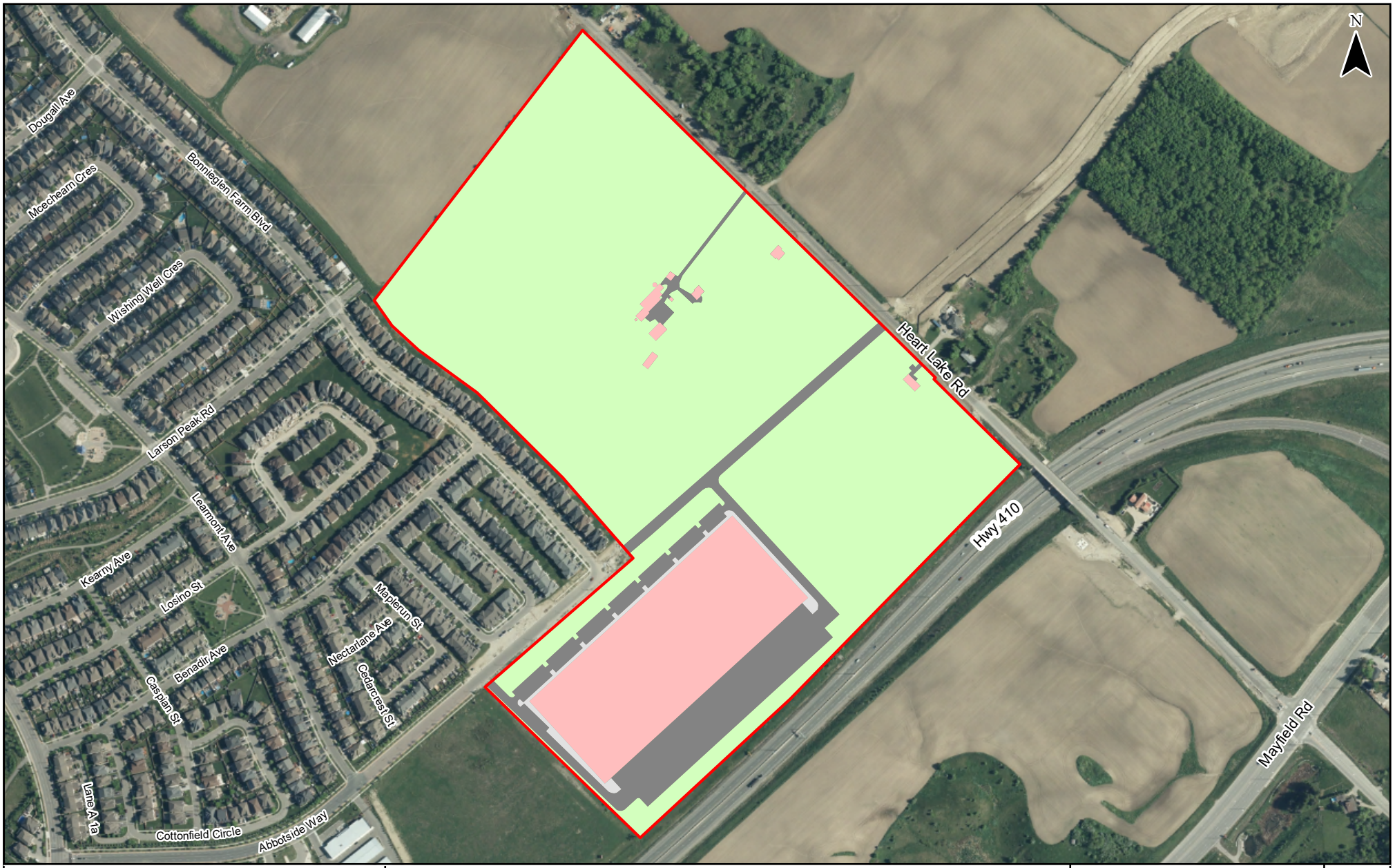
EXISTING LAND USE

FIGURE: 7

HYDROGEOLOGICAL INVESTIGATION
AND WATER BALANCE ASSESSMENT
12304 HEART LAKE ROAD
CALEDON, ONTARIO

PROJECT NUMBER: BRM-21004344-D0

DATE: OCTOBER 2021



SCALE:
0 60 120 180 240 300 m

SOURCE:
CONCEPTUAL SITE PLAN - 12304 HEART LAKE ROAD.
WARE MALCOMB, OCT 27 2021. PROJECT #: TOR21-0032-00.
DRAWING PDF: 2021 10 27 Livingston Building 1 Site Plan

exp.

DRAWN BY:	CHECKED BY:
AC	JS

LEGEND:
- APPROXIMATE SITE BOUNDARY
- BUILDING
- AGRICULTURAL / LANDSCAPE
- PAVEMENT
- SIDEWALK

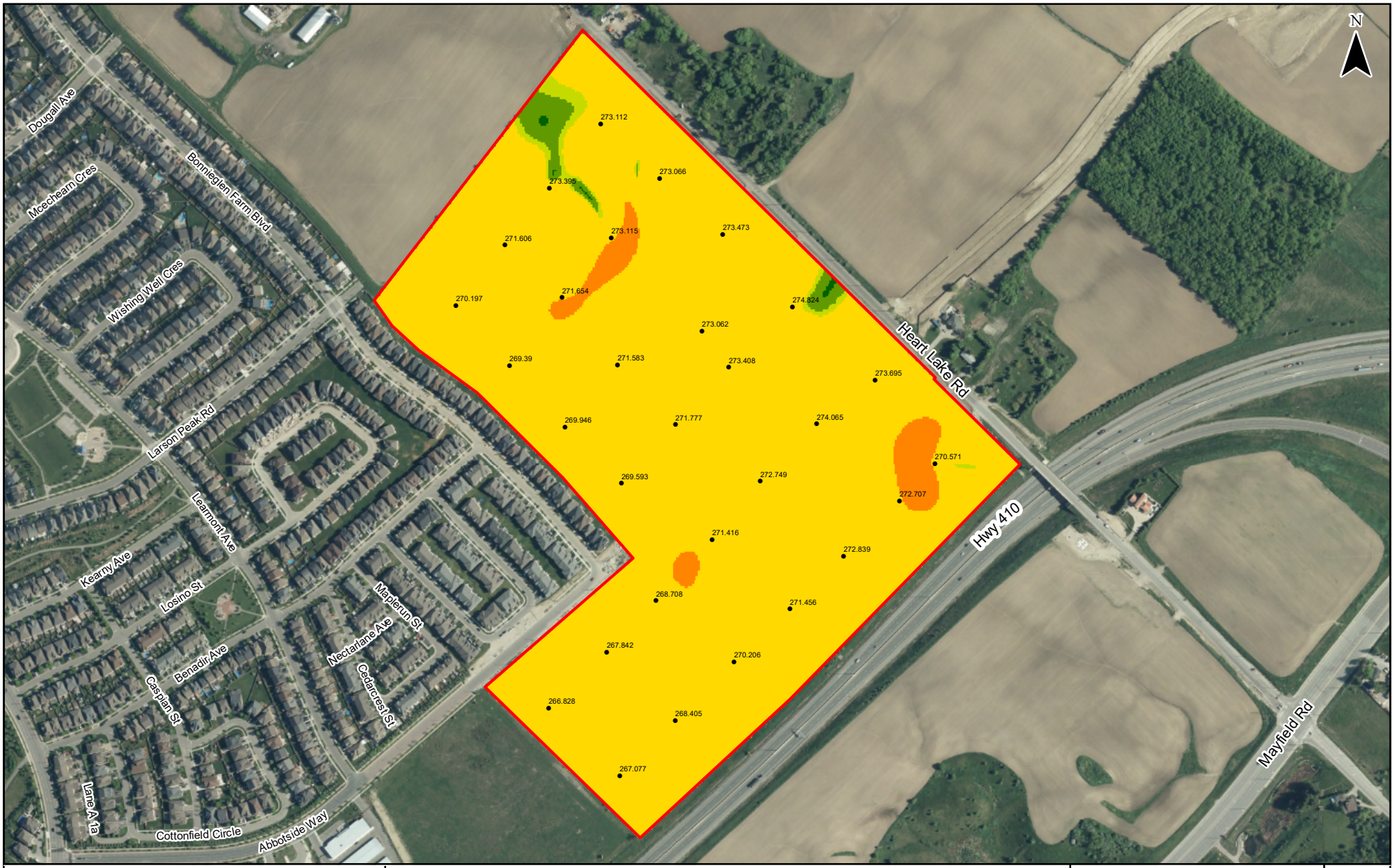
PROPOSED LAND USE

FIGURE: 8

HYDROGEOLOGICAL INVESTIGATION
AND WATER BALANCE ASSESSMENT
12304 HEART LAKE ROAD
CALEDON, ONTARIO

PROJECT NUMBER: BRM-21014344-D0

DATE: NOVEMBER 2021



SCALE:
0 80 160 240 320 400 m

SOURCE:
EXISTING GRADE POINTS BASED ON FIELD DATA
OBTAINED BY EXP STAFF ON MARCH 8, 2021

exp.

DRAWN BY:	CHECKED BY:
AC	JS

LEGEND:

- EXISTING GRADE POINT (m asl)
- APPROXIMATE SITE BOUNDARY

EXISTING SLOPE (INFILTRATION FACTOR):

- <0.06% (0.30)
- 0.06 - 0.28% (0.25)
- 0.28 - 0.38% (0.20)
- 0.38 - 2.8% (0.15)
- 2.8 - 4.7% (0.10)
- >4.7% (0.05)

EXISTING SLOPE

FIGURE: 9

HYDROGEOLOGICAL INVESTIGATION
AND WATER BALANCE ASSESSMENT
12304 HEART LAKE ROAD
CALEDON, ONTARIO

PROJECT NUMBER: BRM-21004344-D0

DATE: OCTOBER 2021

Appendix A – MECP WWR Summary Table

Appendix A
MECP Water Well Database Search Results
(Water Wells within 500 m of Site Boundary)

On-Site

No.	BH ID	WELL_ID	DATE	EAST83	NORTH83	ELEVATION (m ASL)	LOCATION ACCURACY	STREET	CITY	DISTANCE FROM SITE CENTROID (m)	CONSTRUCTION METHOD	WELL DEPTH (m bgs)	WATER FOUND (m bgs)	CASING DIAMETER (cm)	1st USE	2nd USE	FINAL STATUS
1	10316085	4901239	7/24/1965	595558	4845671	273.1	margin of error : 100 m - 300 m			194	Cable Tool	39.0	38.1	17.8	Livestock	Domestic	Water Supply
2	10318900	4904112	7/16/1973	595598	4845747	273.4	margin of error : 30 m - 100 m			269	Rotary (Convent.)	53.6	50.6	12.7	Domestic		Water Supply
3	1004663361	7212525	11/26/2013	595977	4845443	269.6	margin of error : 10 - 30 m	HEART LAKE RD.	Brampton	394	Rotary (Convent.)	52.4		10.2	Monitoring		Observation Wells
4	1005846795	7255007	11/26/2015	595532	4845655	272.7	margin of error : 30 m - 100 m	12304 HEART LAKE RD.	CALEDON	184			7.9				Abandoned-Other

Off-Site

No.	BH ID	WELL_ID	DATE	EAST83	NORTH83	ELEVATION (m ASL)	LOCATION ACCURACY	STREET	CITY	DISTANCE FROM SITE CENTROID (m)	CONSTRUCTION METHOD	WELL DEPTH (m bgs)	WATER FOUND (m bgs)	CASING DIAMETER (cm)	1st USE	2nd USE	FINAL STATUS
1	10316086	4901240	5/7/1966	595919	4845528	271.0	margin of error : 100 m - 300 m			338	Cable Tool	53.9	49.7	12.7	Domestic		Water Supply
2	10316089	4901243	12/19/1961	595184	4846190	272.0	margin of error : 100 m - 300 m			817	Boring	16.2	12.2	76.2	Livestock		Water Supply
3	10316091	4901245	8/18/1966	595164	4846070	272.0	margin of error : 100 m - 300 m			726	Cable Tool	39.0	36.9	17.8	Livestock	Domestic	Water Supply
4	10316190	4901344	11/17/1964	596030	4845503	268.9	margin of error : 100 m - 300 m			446	Cable Tool	50.0	44.2	10.2	Domestic		Water Supply
5	10316191	4901345	5/28/1959	595929	4845588	270.4	margin of error : 100 m - 300 m			361	Boring	19.8	19.8	76.2	Domestic		Water Supply
6	10316192	4901346	12/7/1962	595742	4845878	272.7	margin of error : 100 m - 300 m			429	Cable Tool	54.9	52.4	15.2	Livestock	Domestic	Water Supply
7	10316193	4901347	3/27/1965	595576	4845952	274.5	margin of error : 100 m - 300 m			474	Cable Tool	54.9	51.2	17.8	Domestic		Water Supply
8	10319150	4904365	6/14/1974	595489	4846085	275.2	margin of error : 30 m - 100 m			614	Rotary (Convent.)	27.4	24.4	12.7	Domestic		Water Supply
9	10320555	4905881	11/20/1981	595315	4846373	275.5	margin of error : 100 m - 300 m			934	Rotary (Convent.)	55.2	53.6	12.7	Livestock	Domestic	Water Supply
10	10321191	4906627	3/31/1987	595315	4846371	275.5	margin of error : 100 m - 300 m			932	Rotary (Convent.)	50.6	49.1	12.7	Domestic	Livestock	Water Supply
11	10321552	4906991	11/10/1988	596118	4845362	268.5	margin of error : 3 - 10 m			546	Boring	25.3	18.3	76.2	Domestic		Water Supply
12	10321635	4907074	3/1/1989	596118	4845362	268.5	margin of error : 3 - 10 m			546	Cable Tool	61.0	61.0	15.2	Domestic		Water Supply
13	10322017	4907458	6/27/1990	595352	4846326	276.0	margin of error : 3 - 10 m			879	Rotary (Convent.)	61.3	60.3	12.7	Domestic	Livestock	Water Supply
14	1003636975	7175428	12/22/2011	595275	4846187	272.8	margin of error : 30 m - 100 m	50 SOUTH OF 12506 HEART LAKE ROAD	Brampton	773	Rotary (Convent.)	7.6	4.6	5.1	Monitoring and Test Hole		Observation Wells
15	1003950600	7183229	4/9/2012	595978	4845545	270.0	margin of error : 30 m - 100 m	12179 HEARTLAKE RD		399					Not Used		Abandoned-Other
16	1004603550	7209474	41544	596360	4845117	262.6	margin of error : 30 m - 100 m	MAYFIELD/HEART LAKE RD.	CALEDON	856	Boring	6.1		5.1	Monitoring		Observation Wells
17	1001840812	7113604	7/21/2008	595244	4845062	264.0	margin of error : 10 - 30 m	12267 KENNEDY RD - N. OF MAYFIELD RD.	CALEDON	538	HSA				Monitoring		Abandoned-Other
18	11766997	7044576	5/15/2007	595757	4845889	272.1	margin of error : 10 - 30 m	HEART LAKE RD AT MAYFIELD RD	CALEDON	445	Boring	6.1		5.0	Not Used		Observation Wells
19	1006034911	7264134	5/4/2016	595285	4845538	269.6	margin of error : 30 m - 100 m	NW FIELD, MAYFIELD RD & HEARTLAKE RD	CALEDON	305							
20	1006035731	7264135	5/4/2016	595167	4845586	269.8	margin of error : 30 m - 100 m	NW FIELD, MAYFIELD RD & HEART LAKE RD.	CALEDON	431							
21	1006035740	7264136	5/4/2016	595340	4845198	266.3	margin of error : 30 m - 100 m	NW FIELD, MAYFIELD RD & HEARTLAKE RD.	CALEDON	372							
22	1006035802	7264137	5/4/2016	595290	4845403	268.6	margin of error : 30 m - 100 m	NW FIELD, MAYFIELD RD & HEARTLAKE RD	CALEDON	304							
23	1006035815	7264138	5/4/2016	595173	4845511	269.1	margin of error : 30 m - 100 m	NW FIELD MAYFIELD RD & HEART LAKE RD	CALEDON	413							
24	11099304	4909283	9/30/2003	595678	4844817	265.0	UTM very unreliable			668	Digging				Not Used		Abandoned-Other
25	1004479340	7205656	7/2/2013	595192	4845576	269.7	margin of error : 30 m - 100 m			404							

Appendix B – Borehole Logs

Log of Borehole 1

Project No. BRM-210004344-B0

Drawing No. 2

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 12304 Heart Lake Road

Caledon, Ontario

Date Drilled: Mar 18, 2021

Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at % Strain at Failure

Penetrometer

Soil Description	ELEV. m	Natural Unit Weight kN/m³
~ 200 mm **TOPSOIL** over	273.11	
CLAYEY SILT TILL: Disturbed in upper ~ 200 mm, trace sand and sand pockets, trace gravel, brown, moist, very stiff to hard	~272.9	
		22.2
		22.4
		22.7
- becomes grey		
- wet fine sand layer		23.3
- wet sand seams below		
		23.6
	~266.0	
SANDY SILT TILL: trace clay, trace gravel, occasional rock fragments, grey, dense		
	~265.0	
END OF BOREHOLE		

Date	Water Level (m)	Hole Open to (m)
On Completion	19.98	7.62
March 25, 2021	1.46	
April 9, 2021	1.33	

EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Log of Borehole 2

Project No. BRM-210004344-B0 | Drawing No. 3

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: 12304 Heart Lake Road

Caledon, Ontario

Date Drilled: Mar 17, 2021

Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m	Natural Unit Weight kN/m³
~ 350 mm **TOPSOIL** over	273.40	
	~273.1	
CLAYEY SILT TILL: Distrubed in upper ~ 200 mm, fine sand seams, trace gravel, occasional boulder fragments, brown, moist, hard		20.6
		22.7
		23.0
- wet coarse sand layer, trace clay, trace gravel		22.9
- becoming grey, wet		23.5
	~266.3	
SANDY SILT TILL: silt partings, trace gravel, occasional boulder fragments, grey, moist, very dense		23.4
	~265.3	
END OF BOREHOLE		

SPT (N Value) 20 40 60 80 — Shear Strength 100 200 kPa

Combustible Vapour Reading (ppm) 25 50 75 — Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Depth (m) 0 1 2 3 4 5 6 7 8

SPT values: 10, 26, 22, 27, 25, 39, 31, 59

Date	Water Level (m)	Hole Open to (m)
On Completion	3.20	7.01

exp.

EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Log of Borehole 3

Project No. BRM-210004344-B0

Drawing No. 4

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 12304 Heart Lake Road

Caledon, Ontario

Date Drilled: Mar 17, 2021

Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

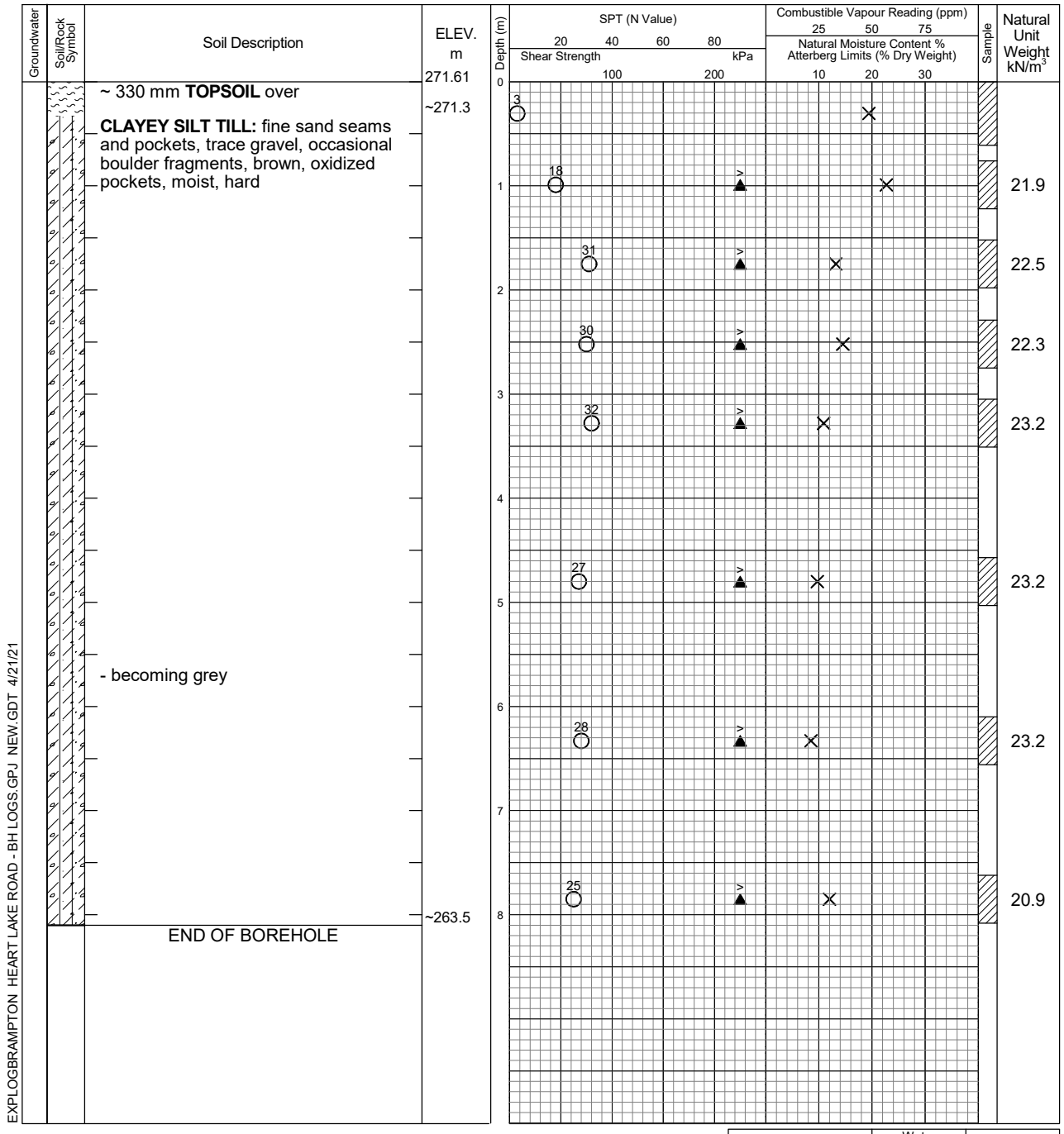
Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at % Strain at Failure

Penetrometer



EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Date	Water Level (m)	Hole Open to (m)
On Completion	Dry	7.62

Log of Borehole 4

Project No. BRM-210004344-B0

Drawing No. 5

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 12304 Heart Lake Road

Caledon, Ontario

Date Drilled: Mar 17, 2021

Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at % Strain at Failure

Penetrometer

Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Natural Unit Weight kN/m³
~ 250 mm **TOPSOIL** over	270.20	0		
FILL: clayey silt to sandy silt, trace gravel, brown, moist (reworked parent material)	~270.0		6	
		1	8	20.3
			9	19.3
	~268.1	2		
CLAYEY SILT TILL: fine sand pockets, trace gravel, brown, moist, hard			47	22.6
		3	43	
		4		
			79	23.1
- becoming grey		5		
		6	45	22.9
	~263.1	7		
SANDY SILT TILL: silt seams, trace gravel, brown, moist, very dense			50/102mm	
	~262.3	8		
END OF BOREHOLE				

Combustible Vapour Reading (ppm): 25 50 75

Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10 20 30

Sample

Date	Water Level (m)	Hole Open to (m)
On Completion	5.18	6.86

EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Log of Borehole 5

Project No. BRM-210004344-B0

Drawing No. 6

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 12304 Heart Lake Road

Caledon, Ontario

Date Drilled: Mar 17, 2021

Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at % Strain at Failure

Penetrometer

Soil Description	ELEV. m	Depth (m)	Natural Unit Weight kN/m³
~ 225 mm **TOPSOIL** over	269.39	0	
CLAYEY SILT TILL: disturbed in upper ~ 200 mm, fine sand seams, trace gravel, brown, oxidized partings, moist, hard	~269.2		21.4
		1	23.0
		2	
		3	21.1
- becoming grey, stiff to hard		4	
		5	
		6	22.2
		7	
END OF BOREHOLE	~261.3	8	

SPT (N Value): 6, 21, 26, 38, 59, 31, 18, 32

Shear Strength kPa: 20 40 60 80 / 100 200

Combustible Vapour Reading (ppm): 25 50 75

Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

Sample

Date	Water Level (m)	Hole Open to (m)
On Completion	5.79	7.01

EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Log of Borehole 6

Project No. BRM-210004344-B0

Drawing No. 7

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 12304 Heart Lake Road

Caledon, Ontario

Date Drilled: Mar 16-17, 2021

Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at % Strain at Failure

Penetrometer

Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Natural Unit Weight kN/m³
~ 280 mm **TOPSOIL** over	271.65	0	8		
CLAYEY SILT TILL: fine sand seams and pockets, trace gravel, occasional boulder fragments, brown, oxidized partings, moist, hard	~271.4	1	17		20.9
		2	36		22.5
		3	33, 32		22.4
- Becoming grey		4			
		5	38		22.9
		6	49		22.9
		7			
		8	55		23.4
END OF BOREHOLE	~263.5				

Date	Water Level (m)	Hole Open to (m)

EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Log of Borehole 7

Project No. BRM-210004344-B0

Drawing No. 8

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 12304 Heart Lake Road

Caledon, Ontario

Date Drilled: Mar 16, 2021

Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at % Strain at Failure

Penetrometer

Soil Description	ELEV. m	Depth (m)	Natural Unit Weight kN/m³
~ 300 mm **TOPSOIL** over	273.12		
CLAYEY SILT TILL: disturbed in upper ~ 200 mm, fine sand seams, trace gravel, occasional boulder fragments, brown, moist, hard	~272.8	0–1	
		1–2	21.9
		2–3	22.8
- coarse sand layer, trace gravel, wet - becoming grey		3–5	23.2
		5–6	23.6
	~265.9	6–8	23.7
SANDY SILT TILL: trace gravel, occasional boulder fragments, grey, moist, very dense	~264.9		
END OF BOREHOLE			

SPT (N Value): 10, 21, 25, 31, 32, 47, 34, 65

Shear Strength (kPa): 100, 200

Combustible Vapour Reading (ppm): 25, 50, 75

Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10, 20, 30

Date	Water Level (m)	Hole Open to (m)

EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Log of Borehole 8

Project No. BRM-210004344-B0

Drawing No. 9

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 12304 Heart Lake Road

Caledon, Ontario

Date Drilled: Mar 16, 2021

Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test (S)

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at % Strain at Failure

Penetrometer

Soil Description	ELEV. m	Depth (m)	Sample	Natural Unit Weight kN/m³
~ 300 mm **TOPSOIL** over	273.07	0		
FILL: sand, medium to coarse grained, clayey silt pockets, brown, wet, compact	~272.8			
	~271.2	2		
CLAYEY SILT TILL: fine sand seams and pockets, trace gravel, brown, moist to wet, stiff to very stiff				
- becoming grey				23.0
	~267.4	5		
SANDY SILT TILL: fine sand seams, trace gravel, occasional boulder fragments, grey, moist, very dense				
	~264.9	8		23.8
END OF BOREHOLE				

SPT (N Value): 20 40 60 80

Shear Strength: 100 200 kPa

Combustible Vapour Reading (ppm): 25 50 75

Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

SPT values: 8, 13, 14, 25, 10, 28, 50/51mm, 85

Date	Water Level (m)	Hole Open to (m)

EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Log of Borehole 9

Project No. BRM-210004344-B0 | Drawing No. 10

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: 12304 Heart Lake Road

Caledon, Ontario

Date Drilled: Mar 25, 2021

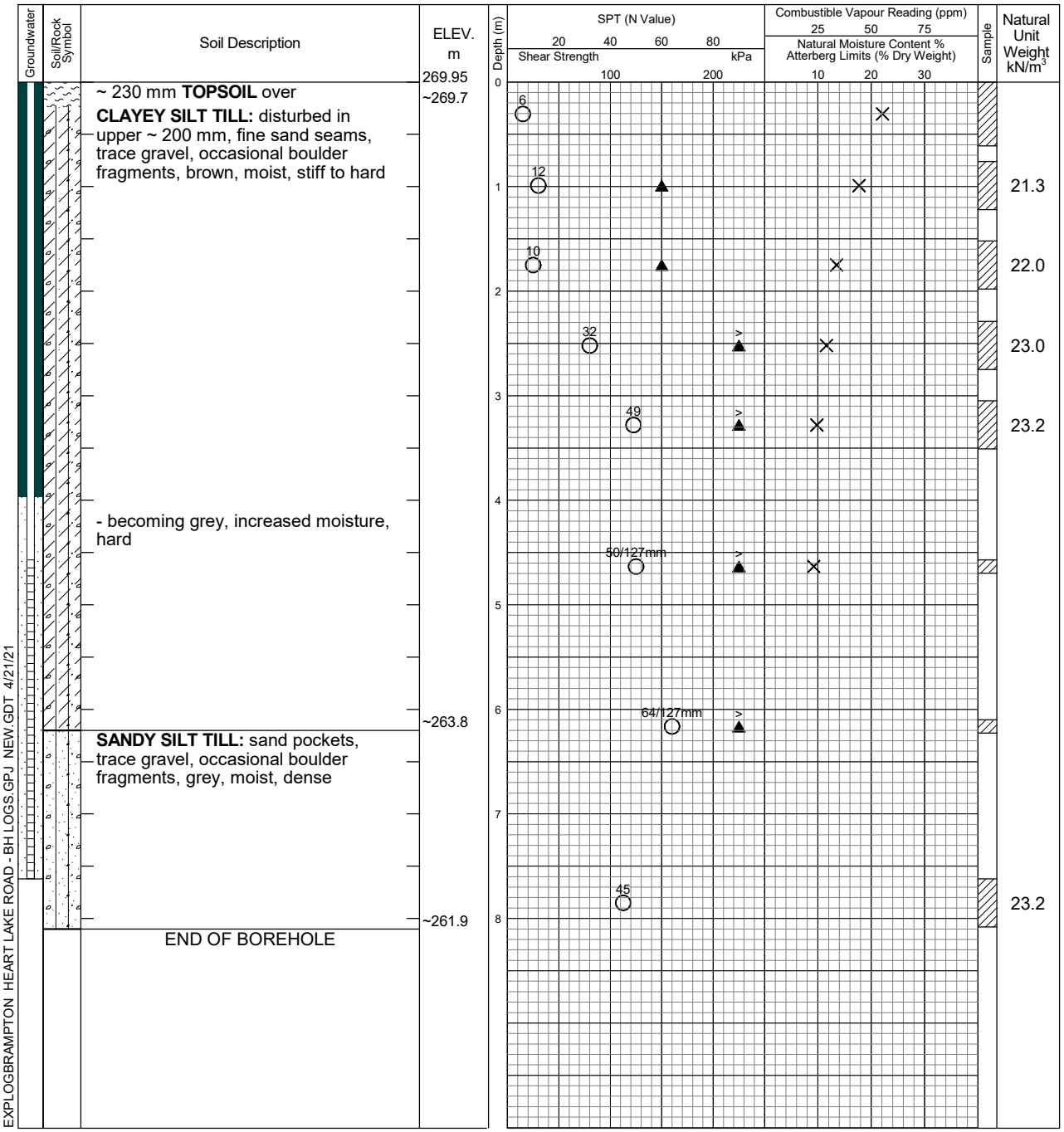
Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Soil Description	ELEV. m
~ 230 mm **TOPSOIL** over	269.95
CLAYEY SILT TILL: disturbed in upper ~ 200 mm, fine sand seams, trace gravel, occasional boulder fragments, brown, moist, stiff to hard	~269.7
- becoming grey, increased moisture, hard	
	~263.8
SANDY SILT TILL: sand pockets, trace gravel, occasional boulder fragments, grey, moist, dense	
	~261.9
END OF BOREHOLE	



EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Date	Water Level (m)	Hole Open to (m)
On Completion	2.22	7.62
March 25, 2021	2.22	
April 9, 2021	2.13	

Log of Borehole 10

Project No. BRM-210004344-B0

Drawing No. 11

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 12304 Heart Lake Road

Caledon, Ontario

Date Drilled: Mar 25, 2021

Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at % Strain at Failure

Penetrometer

Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Natural Unit Weight kN/m³
~ 250 mm **TOPSOIL** over	271.58	0	6	
CLAYEY SILT TILL: disturbed in upper ~ 200 mm, fine sand seams, trace gravel, occasional boulder fragments, brown, oxidized pockets, moist, stiff to hard	~271.3	1	19	
		2	26	22.3
		2	25	22.0
		3	39	22.3
		4		
		5	31	23.4
- becoming grey, wet, stiff to hard		6	20	23.1
		7		
		8	46	23.6
	~263.5			
END OF BOREHOLE				

Combustible Vapour Reading (ppm) 25 50 75

Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Sample

Date	Water Level (m)	Hole Open to (m)
On Completion	Dry	4.57

EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Log of Borehole 11

Project No. BRM-210004344-B0

Drawing No. 12

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 12304 Heart Lake Road

Caledon, Ontario

Date Drilled: Mar 18, 2021

Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at % Strain at Failure

Penetrometer

Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Natural Unit Weight kN/m³
~ 300 mm **TOPSOIL** over	273.06	0	5		
CLAYY SILT TILL: disturbed in upper ~ 200 mm, fine sand seams, trace gravel, occasional boulder fragments, brown, moist, hard	~272.8	1	22		
		2	33		22.3
			34		22.9
		3	30		19.8
- becoming grey, very stiff		4			
		5	26		23.0
- becoming wet, hard		6	33		23.6
		7			
			50		
	~265.0	8			
END OF BOREHOLE					

Date	Water Level (m)	Hole Open to (m)
On Completion	7.32	7.62

EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Log of Borehole 12

Project No. BRM-210004344-B0 | Drawing No. 13

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: 12304 Heart Lake Road

Caledon, Ontario

Date Drilled: Mar 16, 2021

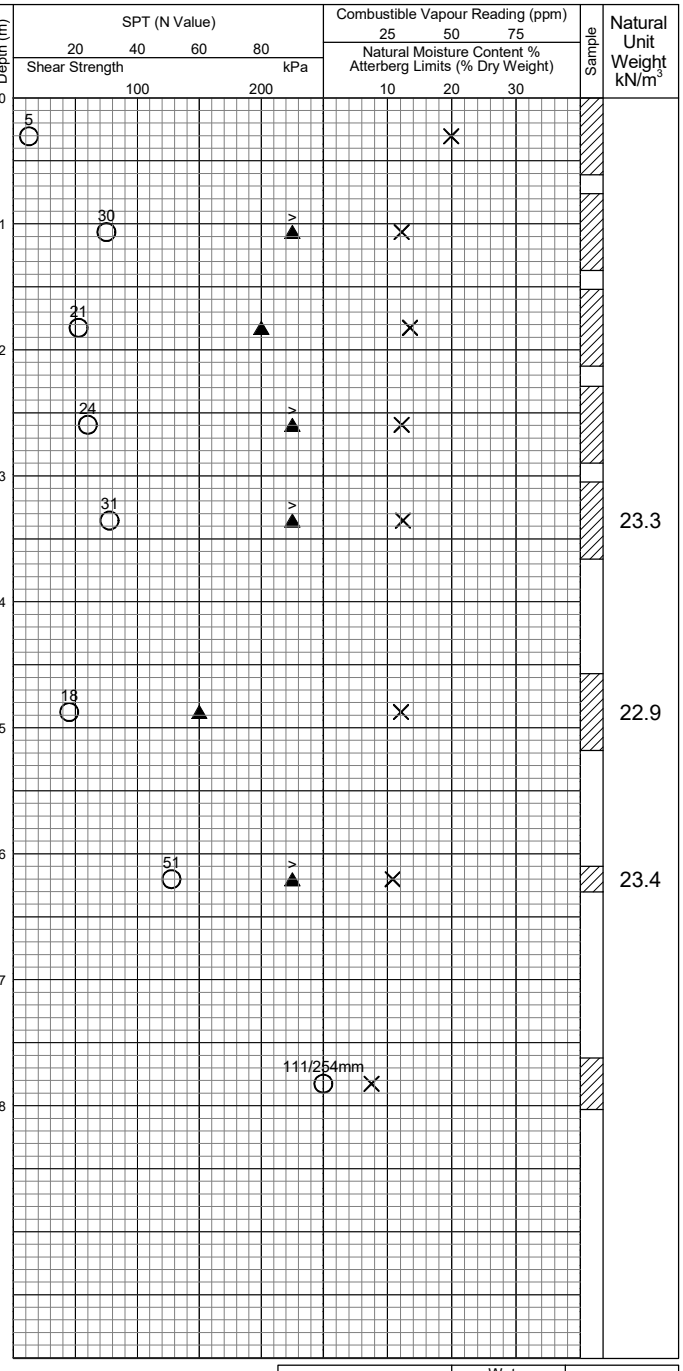
Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Soil Description	ELEV. m
~ 250 mm **TOPSOIL** over	273.47
CLAYEY SILT TILL: disturbed in upper ~ 200 mm, fine sand seams and layers, trace gravel, brown, moist, very stiff to hard	~273.2
- becoming grey, wet, stiff to hard	
- wet sand layer	
SANDY SILT TILL: fine sand seams, occasional cohesive zones, trace gravel, grey, moist, very dense	~266.5
END OF BOREHOLE	~265.4



Natural Unit Weight kN/m³
23.3
22.9
23.4

Date	Water Level (m)	Hole Open to (m)

EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Log of Borehole 13

Project No. BRM-210004344-B0 | Drawing No. 14

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: 12304 Heart Lake Road

Caledon, Ontario

Date Drilled: Mar 25, 2021

Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit |—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Soil Description	ELEV. m	Natural Unit Weight kN/m³
	269.59	
~ 180 mm **TOPSOIL** over	~269.4	
CLAYEY SILT TILL: fine sand seams and layers, trace gravel, occasional boulder fragments, brown, moist, very stiff to hard		
- increased sand content to 2.9 m depth, dense		23.3
		23.4
- becoming wet		22.1
	~262.5	
SAND: medium grained, trace gravel, brown, moist, very dense		23.6
	~261.8	
END OF BOREHOLE		

SPT (N Value) 20 40 60 80 — Shear Strength 100 200 kPa

Combustible Vapour Reading (ppm) 25 50 75 — Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Depth (m): 0 1 2 3 4 5 6 7

SPT values: 5, 18, 24, 31, 48, 80/280mm, 36, 70/152mm

Date	Water Level (m)	Hole Open to (m)
On Completion	6.89	7.47

EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Log of Borehole 14

Project No. BRM-210004344-B0 | Drawing No. 15

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: 12304 Heart Lake Road

Caledon, Ontario

Date Drilled: Mar 24, 2021

Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test ——
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Soil Description	ELEV. m	Natural Unit Weight kN/m³
~ 125 mm **TOPSOIL** over	271.78	
CLAYEY SILT TILL: distrubed in upper ~ 300 mm, fine sand seams, trace gravel, brown, oxidized partings, moist, very stiff to hard	~271.7	-2.7
		22.1
		22.4
		22.3
- becoming grey, stiff to hard		22.9
	~263.7	
END OF BOREHOLE		

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30
Depth (m) 0 1 2 3 4 5 6 7 8
Sample
Groundwater
Soil/Rock Symbol

5 20 22 29 24 17 29 34

Date	Water Level (m)	Hole Open to (m)
On Completion	Dry	7.62

EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Log of Borehole 15

Project No. BRM-210004344-B0

Drawing No. 16

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 12304 Heart Lake Road

Caledon, Ontario

Date Drilled: Mar 17, 2021

Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at % Strain at Failure

Penetrometer

Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Natural Unit Weight kN/m³
~ 230 mm **TOPSOIL** over	273.41	0			
CLAYEY SILT TILL: disturbed in upper ~ 300 mm, fine sand seams, trace gravel, occasional boulder fragments, brown, oxidized zones, moist, very stiff to hard	~273.2	1	6, 21		
		2	24		
		3	30, 35		22.0, 22.6
- becoming grey, wet		4			
		5	20		22.9
		6	29		
SANDY SILT TILL: fine sand seams, trace gravel, occasional boulder fragments, grey, wet, dense to very dense	~266.3	7			
		8	50		
END OF BOREHOLE	~265.3				

Date	Water Level (m)	Hole Open to (m)
On Completion	4.28	6.10

EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Log of Borehole 16

Project No. BRM-210004344-B0

Drawing No. 17

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 12304 Heart Lake Road

Caledon, Ontario

Date Drilled: Mar 18, 2021

Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at % Strain at Failure

Penetrometer

Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Natural Unit Weight kN/m³
~ 300 mm **TOPSOIL** over	274.82	0	6		
FILL: clayey silt and sandy silt, trace gravel, brown, moist (reworked parent material)	~274.5	1	21		
	~273.4	2	26		
CLAYEY SILT TILL: fine sand seams, trace gravel, occasional boulder fragments, brown, moist, very stiff to hard		2	19		21.9
		3	21		21.6
		5	26		22.4
- becoming grey, wet		6	25		23.1
		7	94/203mm		
END OF BOREHOLE	~266.8	8			

Date	Water Level (m)	Hole Open to (m)
On Completion	4.60	7,62
March 25, 2021	3.03	
April 9, 2021	2.67	

EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Log of Borehole 17

Project No. BRM-210004344-B0 | Drawing No. 18

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: 12304 Heart Lake Road

Caledon, Ontario

Date Drilled: Mar 17, 2021

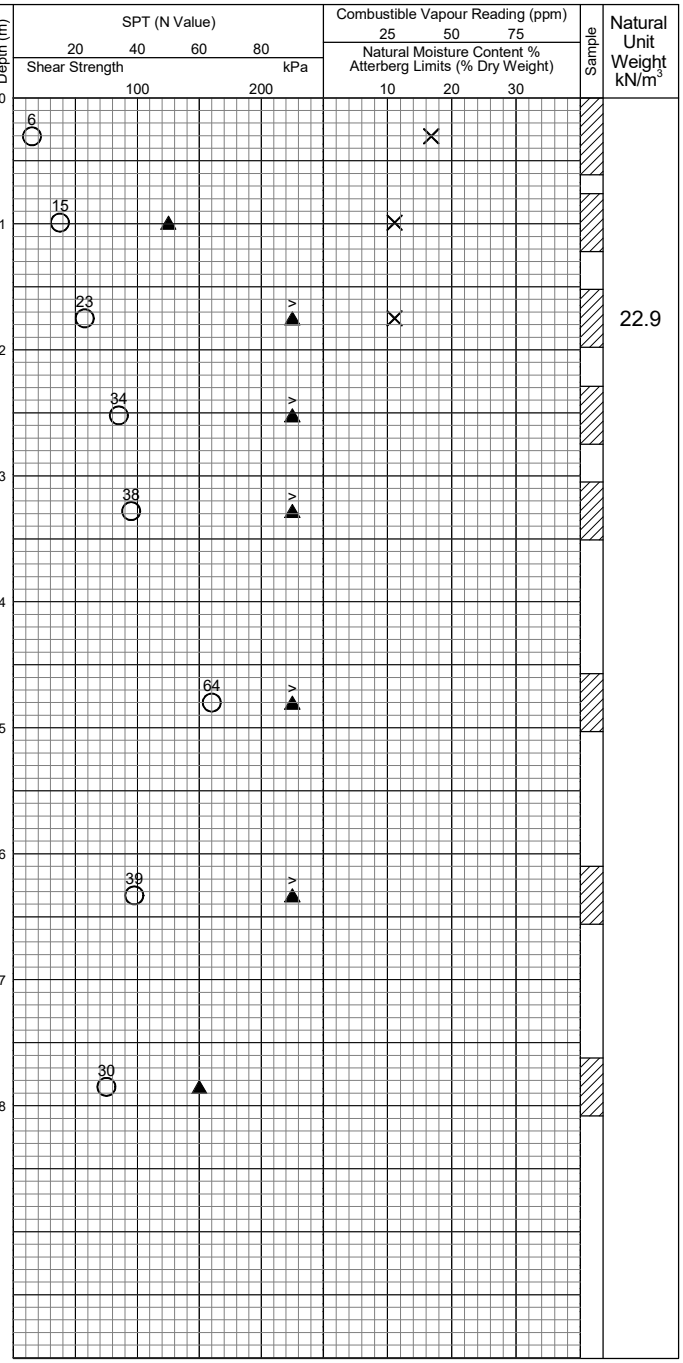
Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test ——
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Soil Description	ELEV. m
~ 280 mm **TOPSOIL** over	266.83
CLAYEY SILT TILL: disturbed in upper ~ 300 mm, fine sand seams and layers, trace gravel, occaional boulder fragments, brown, oxidized zones, moist, stiff to hard	~266.6
- becoming grey	
- wet silty clay layers below	
END OF BOREHOLE	~258.7



Date	Water Level (m)	Hole Open to (m)
On Completion	Dry	7.62

EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Log of Borehole 18

Project No. BRM-210004344-B0 | Drawing No. 19

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: 12304 Heart Lake Road

Caledon, Ontario

Date Drilled: Mar 18, 2021

Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m	Depth (m)	Sample	Natural Unit Weight kN/m³
	267.84			
~ 130 mm **TOPSOIL** over **CLAYEY SILT TILL:** disturbed in upper ~ 250 mm, fine sand seams, trace gravel, occasional boulder fragments, brown, oxidized pockets, moist, very stiff to hard	~267.7	0		19.8
		1		22.8
		2		23.1
- wet sand layer, trace to some gravel		3		22.9
		4		23.2
	~262.2	5		
SANDY SILT TILL: fine sand seams, trace gravel, trace clay, occasional boulder fragments, brown, moist, very dense		6		22.2
		7		
	~259.8	8		
END OF BOREHOLE				

SPT (N Value): 20 40 60 80 — Shear Strength: 100 200 kPa

Combustible Vapour Reading (ppm): 25 50 75

Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

7 | 24 | 29 | 50/102mm | 31 | 44 | 82/280mm | 91/203mm

Date	Water Level (m)	Hole Open to (m)
On Completion	Dry	7.62

EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Log of Borehole 19

Project No. BRM-210004344-B0 | Drawing No. 20

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: 12304 Heart Lake Road
Caledon, Ontario

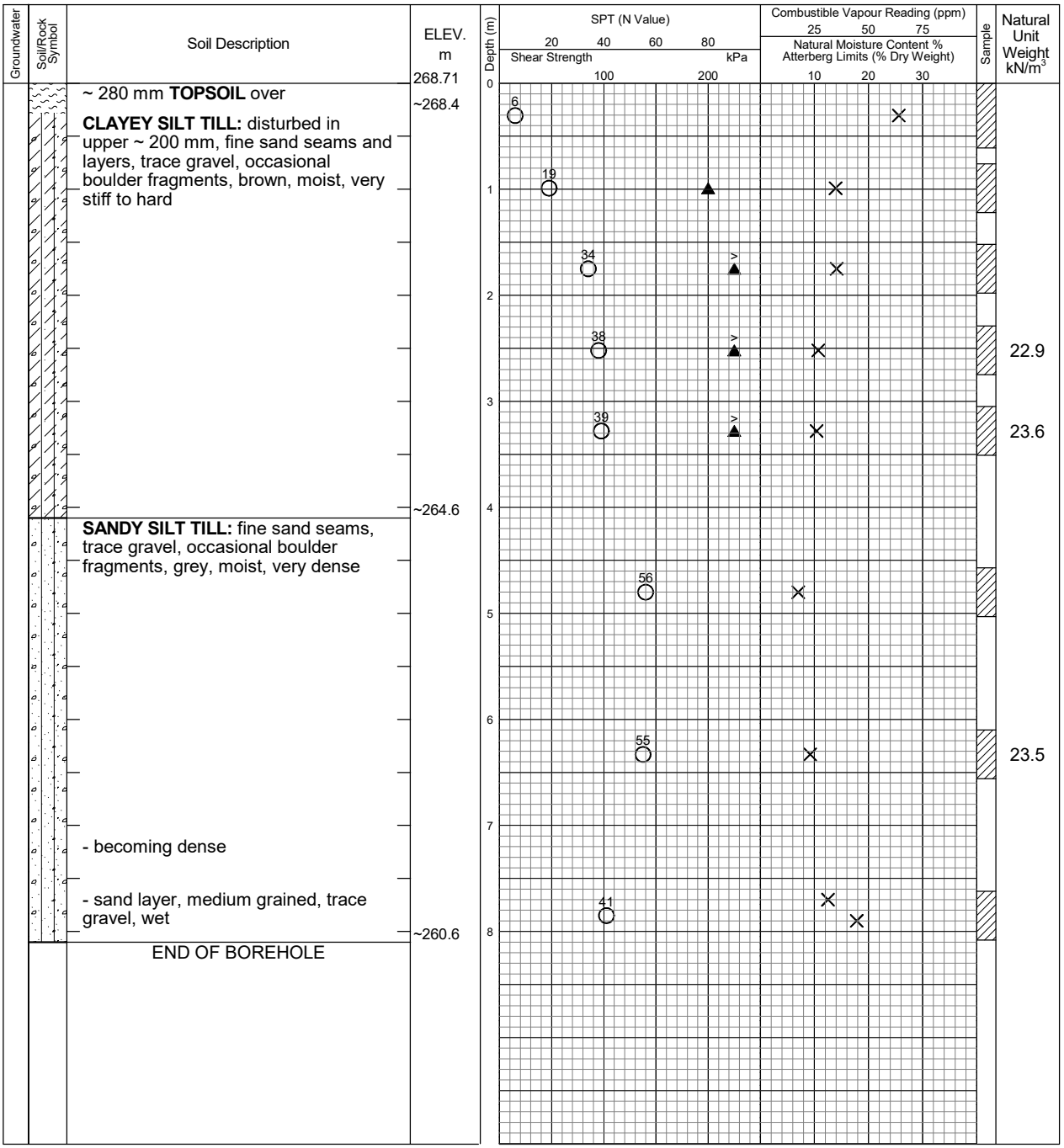
Date Drilled: Mar 22, 2021

Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



Date	Water Level (m)	Hole Open to (m)
On Completion	6.40	7.32

EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Log of Borehole 20

Project No. BRM-210004344-B0

Drawing No. 21

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 12304 Heart Lake Road

Caledon, Ontario

Date Drilled: Mar 22, 2021

Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at % Strain at Failure

Penetrometer

Soil Description	ELEV. m	Depth (m)	Natural Unit Weight kN/m³
	271.42		
~ 130 mm **TOPSOIL** over **FILL:** clayey silt to sandy silt, trace gravel, brown, moist (reworked parent material)	~271.3	0	
	~270.0	1	
CLAYEY SILT TILL: fine sand seams, trace gravel, occasional boulder fragments, brown, moist, very stiff to hard		2	21.1
		3	22.5
		4	22.1
		5	23.0
	~265.8	6	
SANDY SILT TILL: fine sand seams, trace gravel, occasional boulder fragments, brown, moist, very dense		7	
	~263.6	8	
END OF BOREHOLE			

SPT (N Value): 20 40 60 80

Shear Strength: 100 200 kPa

Combustible Vapour Reading (ppm): 25 50 75

Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

Sample

SPT values: 6, 12, 14, 24, 36, v, 31, v, 87, 50/51mm

Date	Water Level (m)	Hole Open to (m)
On Completion	Dry	7.62

EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Log of Borehole 21

Project No. BRM-210004344-B0 | Drawing No. 22

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: 12304 Heart Lake Road
Caledon, Ontario

Date Drilled: Mar 22, 2021

Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m	Depth (m)	Natural Unit Weight kN/m³
~ 200 mm **TOPSOIL** over	272.75	0	
FILL: clayey silt to sandy silt, stone fragments, trace gravel, brown, moist (reworked parent material)	~272.6		
	~271.4		
CLAYEY SILT TILL: fine sand seams, trace gravel, occasional boulder fragments, brown, moist, very stiff to hard		1	
		2	22.4
			23.0
		3	22.9
- becoming grey		4	
		5	23.1
		6	
		7	
		8	23.5
	~264.7		
END OF BOREHOLE			

SPT (N Value): 6, 19, 30, 24, 28, 32, 21, 32

Shear Strength (kPa): 100, 200

Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10, 20, 30

Combustible Vapour Reading (ppm): 25, 50, 75

Date	Water Level (m)	Hole Open to (m)
On Completion	Dry	7.01

EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Log of Borehole 22

Project No. BRM-210004344-B0 | Drawing No. 23

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: 12304 Heart Lake Road
Caledon, Ontario

Date Drilled: Mar 22, 2021

Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m	Depth (m)	Natural Unit Weight kN/m³
	274.07		
~ 230 mm **TOPSOIL** over **FILL:** clayey silt, some sand, brown, moist (reworked parent material)	~273.8		
	~272.7		
CLAYEY SILT TILL: fine sand seams, trace gravel, occasional boulder fragments, brown, oxidized pockets, moist, very stiff to hard		1	22.6
		2	22.6
		3	22.7
	~268.5	4	
SANDY SILT TILL: fine sand seams and layers, trace gravel, occasional boulder fragments, grey, moist to wet, dense		5	23.7
		6	
		7	23.5
	~266.0	8	
END OF BOREHOLE			

SPT (N Value): 20 40 60 80
Shear Strength: 100 200 kPa
Combustible Vapour Reading (ppm): 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30
Sample

Date	Water Level (m)	Hole Open to (m)
On Completion	5.49	7.32

EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Log of Borehole 23

Project No. BRM-210004344-B0 | Drawing No. 24

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: 12304 Heart Lake Road

Caledon, Ontario

Date Drilled: Mar 19, 2021

Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m	Natural Unit Weight kN/m³
~ 280 mm **TOPSOIL** over	273.70	
	~273.4	
CLAYEY SILT TILL: disturbed in upper ~ 200 mm, fine sand seams, trace gravel, occasional boulder fragments, brown, oxidized zones, moist, very stiff to hard		-1.7
		22.6
		22.5
		22.9
- becoming grey, stiff		
		23.4
	~268.1	
SANDY SILT TILL: fine sand seams and layers (wet), trace gravel, occasional boulder fragments, grey, moist, compact to very dense		23.1
	~265.6	
END OF BOREHOLE		

SPT (N Value): 20 40 60 80
Shear Strength: 100 200 kPa
Combustible Vapour Reading (ppm): 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30
Depth (m): 0 1 2 3 4 5 6 7 8

Date	Water Level (m)	Hole Open to (m)
On Completion	Dry	7.62

EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Log of Borehole 24

Project No. BRM-210004344-B0 | Drawing No. 25

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: 12304 Heart Lake Road

Caledon, Ontario

Date Drilled: Mar 23, 2021

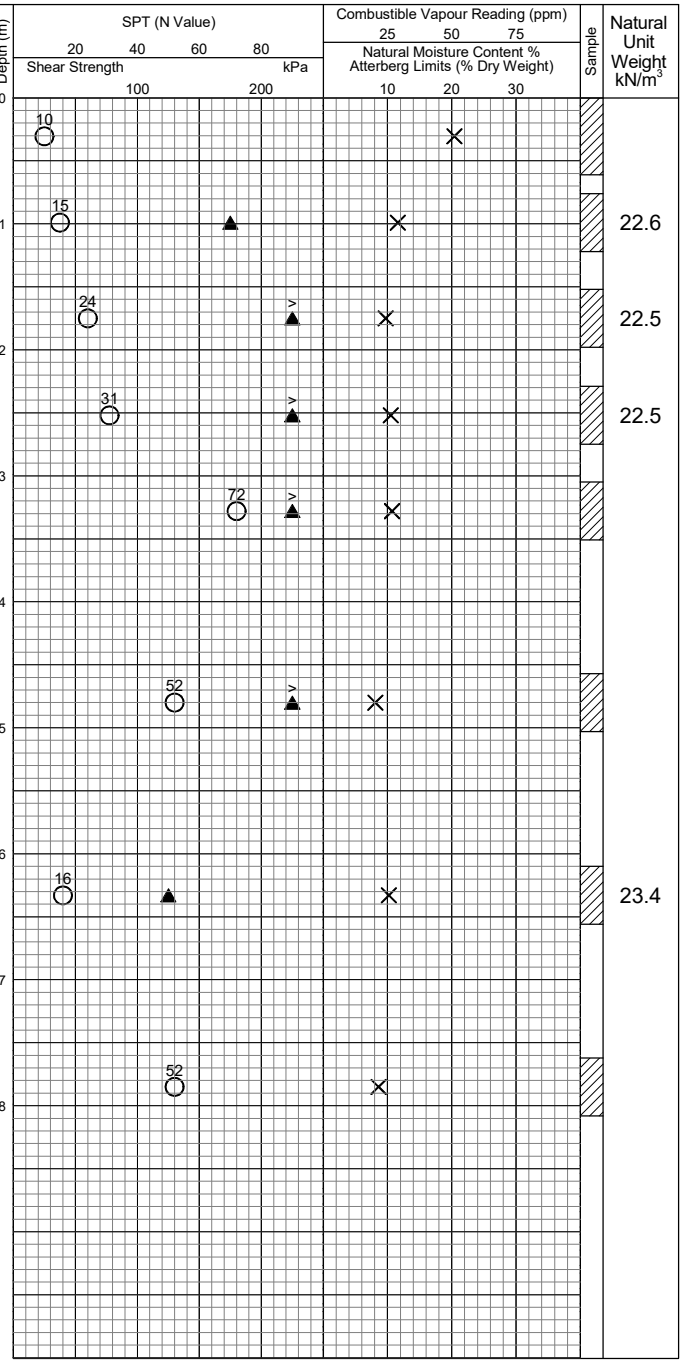
Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test ——
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Soil Description	ELEV. m
~ 250 mm **TOPSOIL** over	267.08
CLAYEY SILT TILL: disturbed in upper ~ 300 mm, numerous fine sand layers, trace gravel, brown, moist, very stiff to hard	~266.8
- becoming grey, wet, stiff	~260.0
SANDY SILT TILL: fine sand seams, trace gravel, occasional boulder fragments, grey, moist, very dense	~259.0
END OF BOREHOLE	



Date	Water Level (m)	Hole Open to (m)
On Completion	Dry	7.32

EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Log of Borehole 25

Project No. BRM-210004344-B0

Drawing No. 26

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 12304 Heart Lake Road

Caledon, Ontario

Date Drilled: Mar 23, 2021

Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at % Strain at Failure

Penetrometer

Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Natural Unit Weight kN/m³
~ 180 mm **TOPSOIL** over	268.41	0			
CLAYEY SILT TILL: disturbed to upper ~ 200 mm, fine sand seams, trace gravel, occasional boulder fragments, brown, oxidized partings, moist, very stiff to hard	~268.2	1	8, 18		20.7
		2	21, 22		22.5
		3	39		
- increased sand content to ~ 7.1 m depth, very dense		4			
		5	29		
		6	73		
- becoming grey, very stiff		7			
		8	21		23.5
	~260.3				
END OF BOREHOLE					

Date	Water Level (m)	Hole Open to (m)
On Completion	Dry	7.62
March 25, 2021	2.28	
April 9, 2021	1.45	

EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Log of Borehole 26

Project No. BRM-210004344-B0 | Drawing No. 27

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: 12304 Heart Lake Road

Caledon, Ontario

Date Drilled: Mar 23, 2021

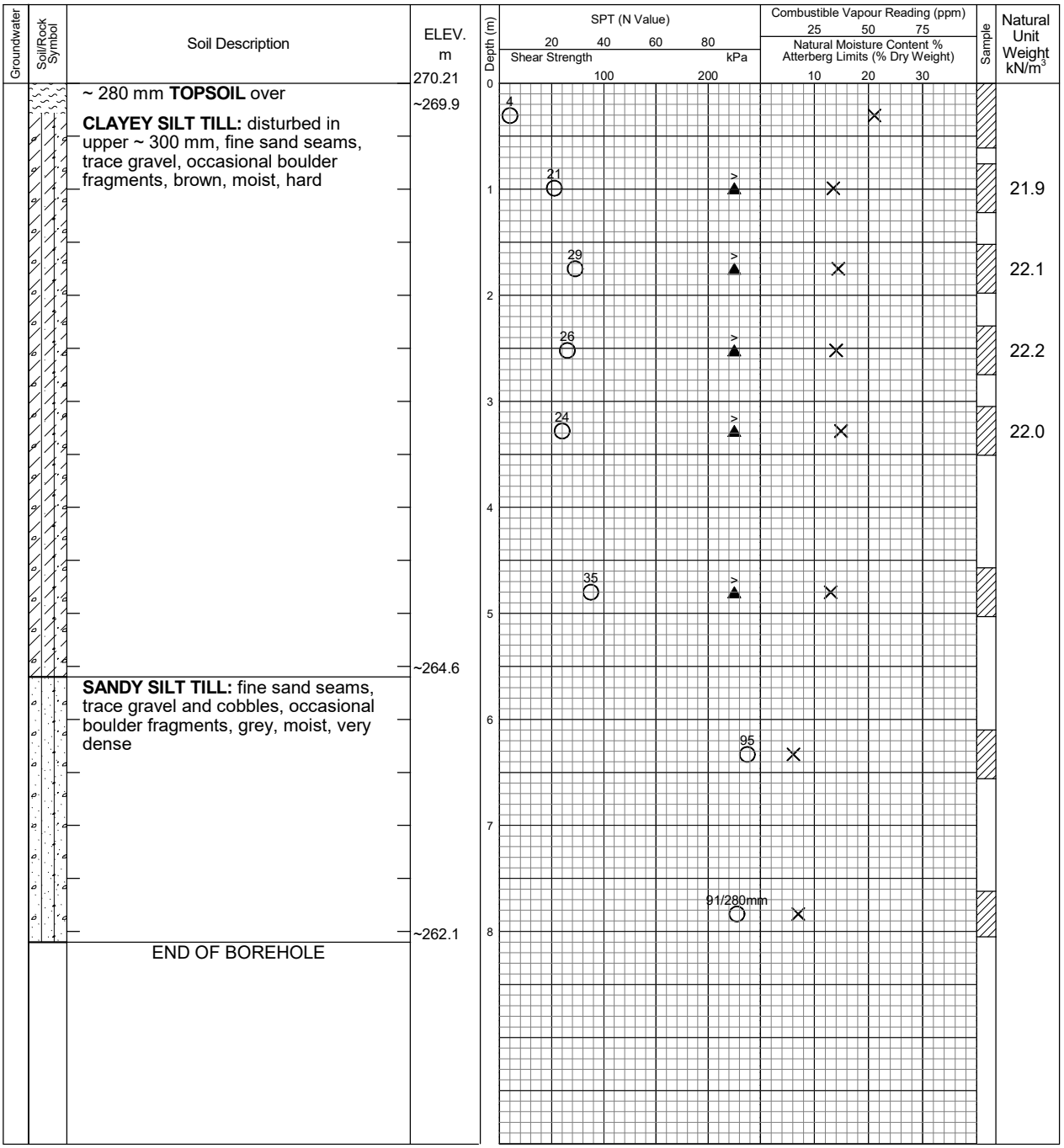
Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer

Soil Description	ELEV. m	Natural Unit Weight kN/m³
~ 280 mm **TOPSOIL** over	270.21	
CLAYEY SILT TILL: disturbed in upper ~ 300 mm, fine sand seams, trace gravel, occasional boulder fragments, brown, moist, hard	~269.9	21.9
		22.1
		22.2
		22.0
SANDY SILT TILL: fine sand seams, trace gravel and cobbles, occasional boulder fragments, grey, moist, very dense	~264.6	
END OF BOREHOLE	~262.1	



Date	Water Level (m)	Hole Open to (m)
On Completion	Dry	7.62

EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Log of Borehole 27

Project No. BRM-210004344-B0 | Drawing No. 28

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: 12304 Heart Lake Road

Caledon, Ontario

Date Drilled: Mar 23, 2021

Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m	Depth (m)	Natural Unit Weight kN/m³
	271.46		
~ 230 mm **TOPSOIL** over **FILL:** clayey silt to sandy silt, trace sand, trace gravel, brown and grey, moist (reworked parent material)	~271.2	0	
	~270.1	1	22.5
CLAYEY SILT TILL: numerous fine sand seams and layers, trace gravel, occasional boulder fragments, brown, oxidized partings, moist, hard		2	22.1
		3	22.0
		4	
		5	
- becoming grey, wet, stiff		6	23.4
	~264.4	7	
SANDY SILT TILL: fine sand seams, trace gravel, occasional boulder fragments, grey, moist, very dense			
	~263.4	8	
END OF BOREHOLE			

SPT (N Value): 20 40 60 80
Shear Strength: 100 200 kPa
Combustible Vapour Reading (ppm): 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

SPT values: 7, 24, 27, 34, 26, 32, 12, 91

Date	Water Level (m)	Hole Open to (m)
On Completion	Dry	7.62

EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Log of Borehole 28

Project No. BRM-210004344-B0 | Drawing No. 29

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: 12304 Heart Lake Road

Caledon, Ontario

Date Drilled: Mar 24, 2021

Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test ——
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Soil Description	ELEV. m	Natural Unit Weight kN/m³
~ 250 mm **TOPSOIL** over	272.84	
CLAYEY SILT TILL: disturbed in upper ~ 300 mm, fine sand seams and layers, trace gravel, brown, moist, stiff to very stiff	~272.6	22.2
		22.4
		22.3
- becoming grey, stiff		23.2
		23.0
	~264.7	23.0
END OF BOREHOLE		

SPT (N Value) 20 40 60 80 — Shear Strength 100 200 kPa

Combustible Vapour Reading (ppm) 25 50 75 — Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Date	Water Level (m)	Hole Open to (m)
On Completion	Dry	7.62

EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Log of Borehole 29

Project No. BRM-210004344-B0 | Drawing No. 30

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: 12304 Heart Lake Road

Caledon, Ontario

Date Drilled: Mar 24, 2021

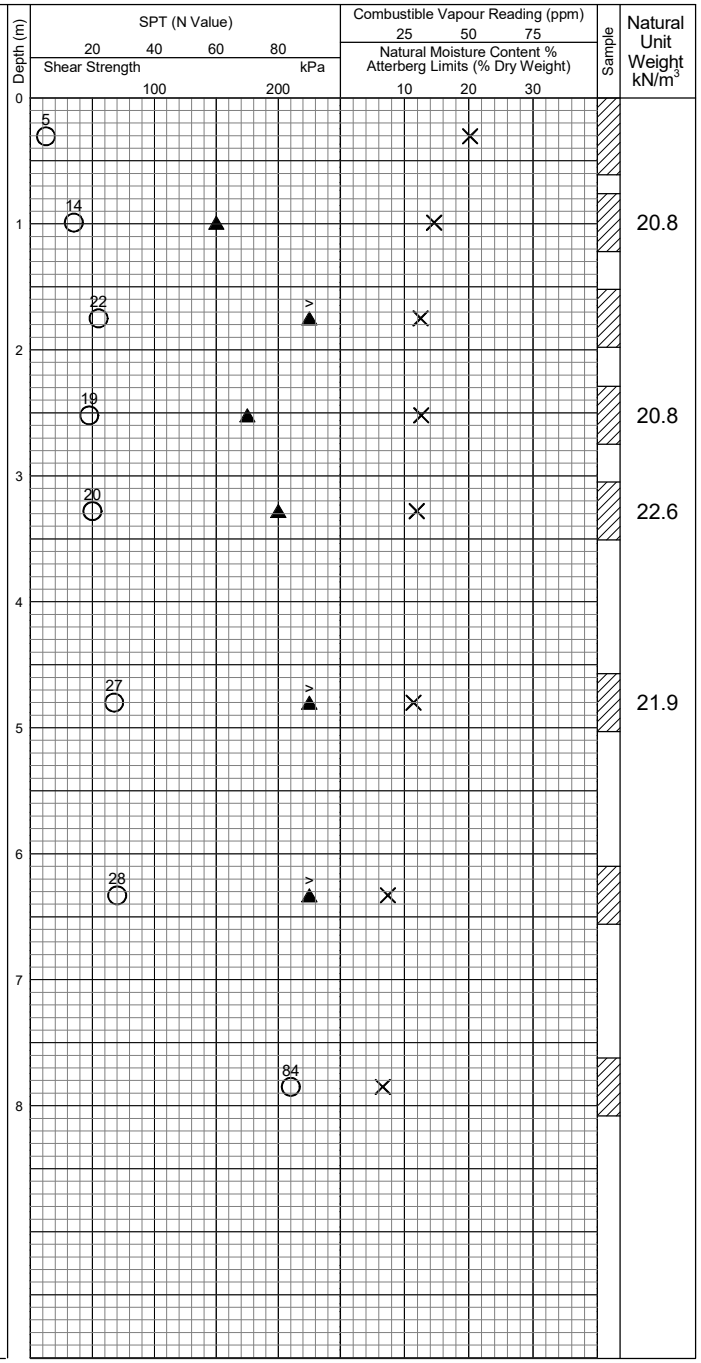
Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m
~ 230 mm **TOPSOIL** over	272.71
CLAYEY SILT TILL: disturbed in upper ~ 300 mm, fine sand seams and layers, trace gravel, occasional boulder fragments, brown, moist, very stiff to hard	~272.5
- becoming grey	
SANDY SILT TILL: fine sand seams, trace gravel, occasional boulder fragments, grey, moist, very dense	~265.6
END OF BOREHOLE	~264.6



Date	Water Level (m)	Hole Open to (m)
On Completion	Dry	7.62

EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

Log of Borehole 30

Project No. BRM-210004344-B0 | Drawing No. 31

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: 12304 Heart Lake Road

Caledon, Ontario

Date Drilled: Mar 24, 2021

Drill Type: CME55 Solid Auger Bomb

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Natural Unit Weight kN/m³
~ 250 mm **TOPSOIL** over	270.57	0		
FILL: clayey silt to sandy silt, trace gravel, brown, moist (reworked parent material)	~270.3			
	~269.2	1	4, 10	22.4
CLAYEY SILT TILL: fine sand seams and layers, trace gravel, occasional boulder fragments, brown, moist, stiff to hard		2	14, 23	22.6, 22.4
	~266.5	3	33	22.1
SANDY SILT TILL: numerous fine sand seams, cohesive layers, trace gravel, occasional boulder fragments, brown, moist, very dense		4		
		5	74	23.1
		6	83/229mm	
	~263.5	7		
SILTY SAND, fine to medium grained, brown, moist, very dense		8	86/280mm	
	~262.5			
END OF BOREHOLE				

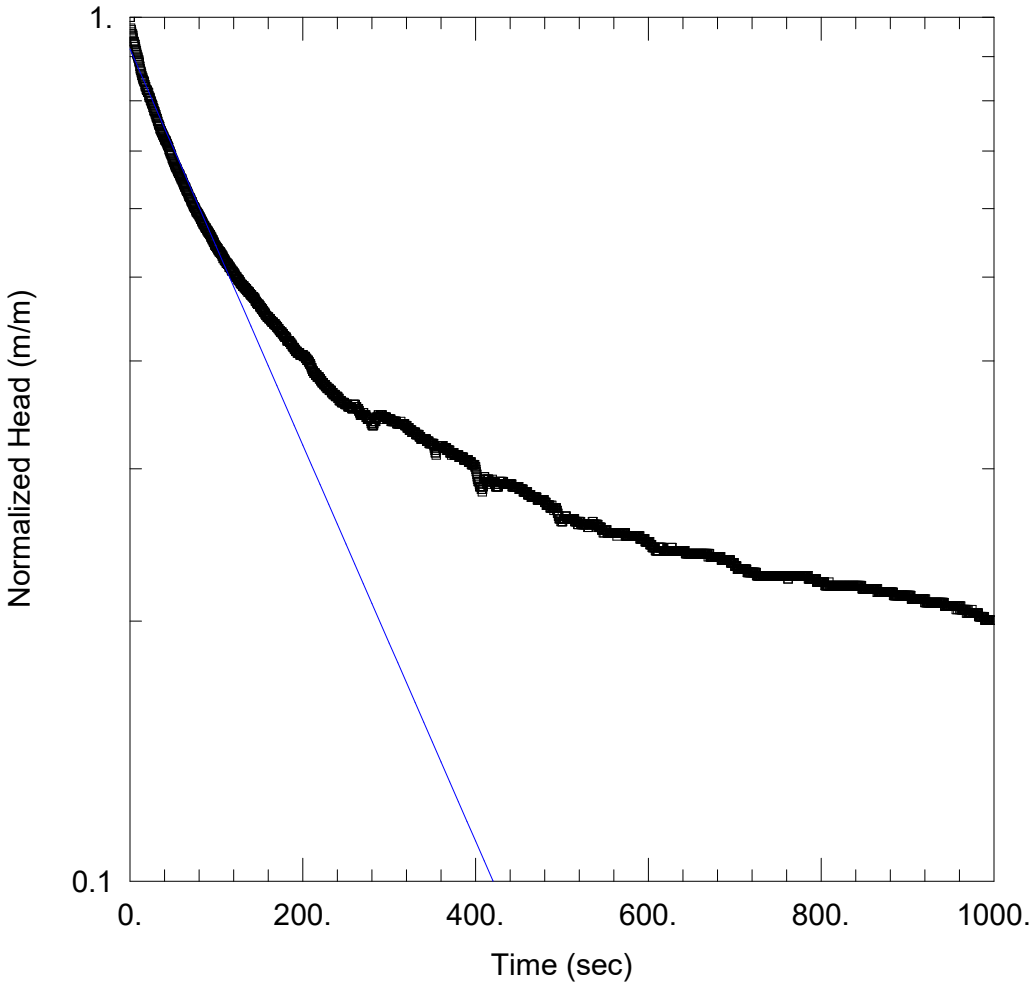
Combustible Vapour Reading (ppm): 25, 50, 75
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10, 20, 30
Sample

Date	Water Level (m)	Hole Open to (m)
On Completion	Dry	7.62
March 25, 2021	Dry	
April 9, 2021	Dry	

EXPLOGBRAMPTON HEART LAKE ROAD - BH LOGS.GPJ NEW.GDT 4/21/21

exp.

Appendix C – SWRT Procedures and Results



WELL TEST ANALYSIS

Data Set: E:\BRM\BRM-21004344-D0\50 Input\Field Work\SWRT\Working File\BH 1.aqt
Date: 10/08/21 Time: 14:55:22

PROJECT INFORMATION

Company: EXP
Client: Boccolini Limited Partnership
Project: BRM-21004344-D0
Location: 12304 Heart Lake Rd
Test Well: BH 1
Test Date: 7 Oct 2021

AQUIFER DATA

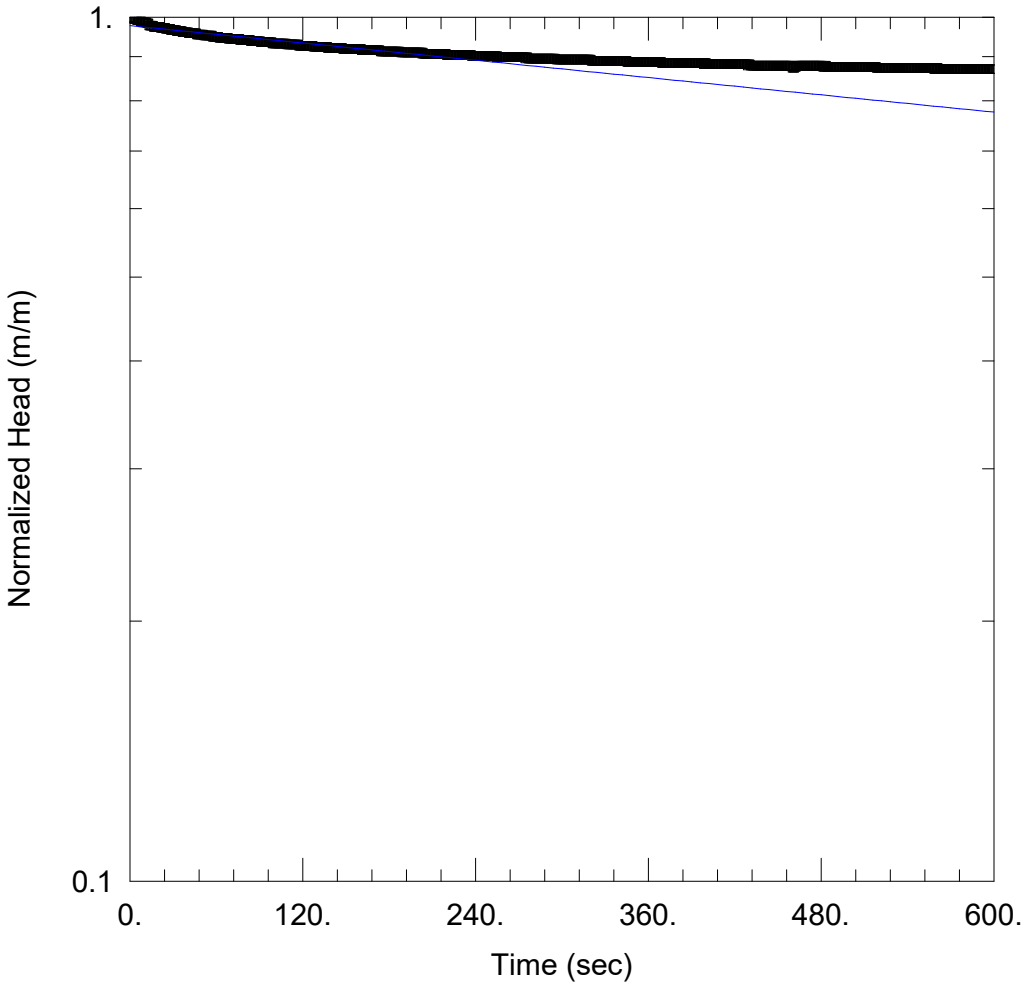
Saturated Thickness: 2.95 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH 1)

Initial Displacement: 1.542 m
Total Well Penetration Depth: 3. m
Casing Radius: 0.0254 m
Static Water Column Height: 2.95 m
Screen Length: 3. m
Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 3.058E-6 m/sec
y0 = 1.417 m



WELL TEST ANALYSIS

Data Set: E:\BRM\BRM-21004344-D0\50 Input\Field Work\SWRT\Working File\BH 9.aqt
Date: 10/08/21 Time: 15:20:36

PROJECT INFORMATION

Company: EXP
Client: Boccolini Limited Partnership
Project: BRM-21004344-D0
Location: 12304 Heart Lake Rd
Test Well: BH 9
Test Date: 7 Oct 2021

AQUIFER DATA

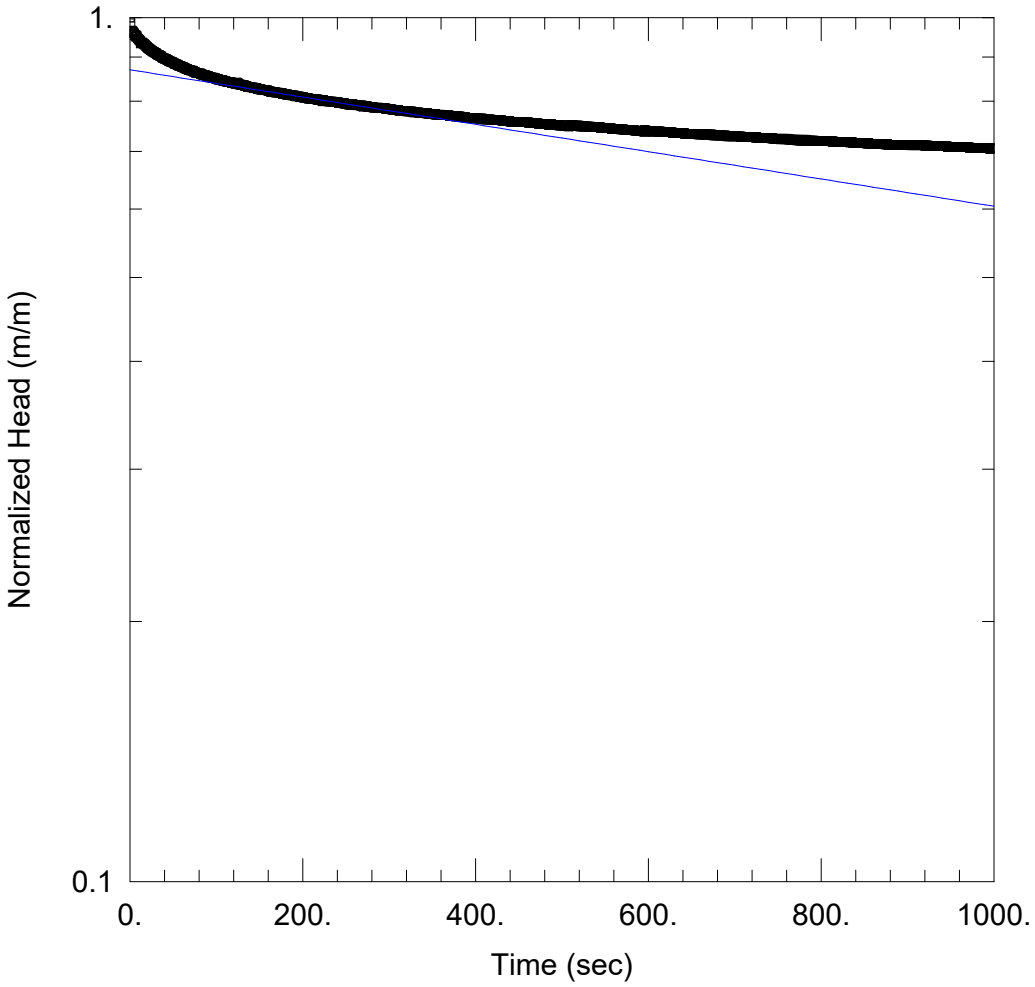
Saturated Thickness: 1.65 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH 9)

Initial Displacement: 1.065 m
Total Well Penetration Depth: 3. m
Casing Radius: 0.0254 m
Static Water Column Height: 1.65 m
Screen Length: 3. m
Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 3.976E-7 m/sec
y0 = 1.041 m



WELL TEST ANALYSIS

Data Set: E:\BRM\BRM-21004344-D0\50 Input\Field Work\SWRT\Working File\BH 16 - Jay.aqt
Date: 10/14/21 Time: 11:07:41

PROJECT INFORMATION

Company: EXP
Client: Boccolini Limited Partnership
Project: BRM-21004344-D0
Location: 12304 Heart Lake Rd
Test Well: BH 16
Test Date: 7 Oct 2021

AQUIFER DATA

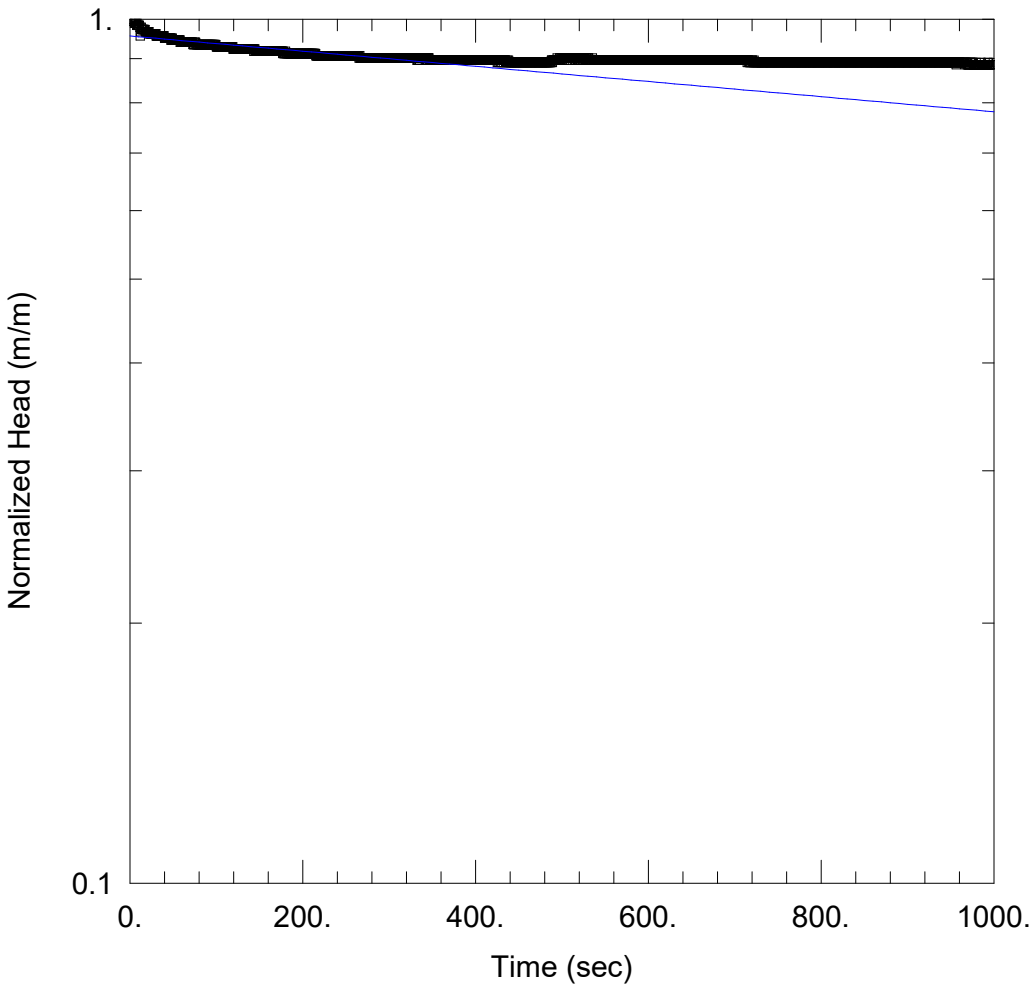
Saturated Thickness: 1.89 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH 16)

Initial Displacement: 1.869 m
Total Well Penetration Depth: 3. m
Casing Radius: 0.0254 m
Static Water Column Height: 1.89 m
Screen Length: 3. m
Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 3.288E-7 m/sec
y0 = 1.626 m



WELL TEST ANALYSIS

Data Set: E:\BRM\BRM-21004344-D0\50 Input\Field Work\SWRT\Working File\BH 25.aqt
Date: 10/14/21 Time: 15:06:38

PROJECT INFORMATION

Company: EXP
Client: Boccolini Limited Partnership
Project: BRM-21004344-D0
Location: 12304 Heart Lake Rd
Test Well: BH 25
Test Date: 12 Oct 2021

AQUIFER DATA

Saturated Thickness: 0.89 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH 25)

Initial Displacement: 0.549 m
Total Well Penetration Depth: 3. m
Casing Radius: 0.0254 m
Static Water Column Height: 0.89 m
Screen Length: 3. m
Well Radius: 0.0762 m

SOLUTION

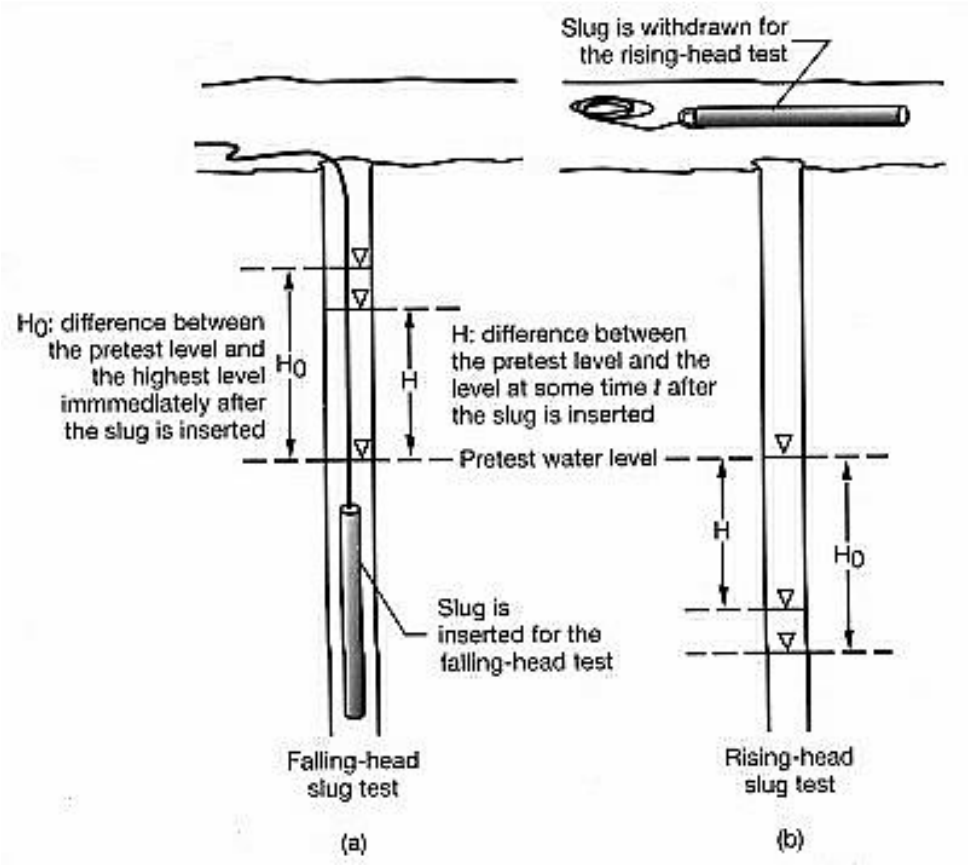
Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 3.879E-7 m/sec
y0 = 0.5248 m

Single Well Response Test Procedure

A Single Well Response Test (SWRT), also known as a bail test or a slug test, is conducted in order to determine the saturated hydraulic conductivity (K) of an aquifer. The method of the SWRT is to characterize the change of groundwater level in a well or borehole over time.

In order to ensure consistency and repeatability, all **exp** employees are to follow the procedure outlined in this document when conducting SWRTs.

The figure below depicts a schematic of a slug and bail test and the respective water level changes.



Initials ___

Slug Test Procedure

Equipment Required

- Copy of a signed health and safety plan
- Copy of the work program
- PPE as required by Site-Specific HASP
- Copy of the monitoring well location plan/site plan
- Waterproof pen and bound field note book
- SWRT field data Entry form
- Disposable gloves
- Duct tape
- Deionized water
- Alconox (phosphate free detergent)
- Spray bottles
- Electronic water level meter and spare batteries
- Solid PVC or stainless steel slug of known volume or clean water
- String (nylon)
- Water pressure transducer (data logger) and baro-logger
- Watch or stop watch with second hand
- Plastic sheeting

Testing Procedure

1. Remove cap from well and collect static water level
2. Remove waterra tubing/bailer and place in garbage bag. Record static water level measurement again.
3. Lower the slug into the well and record the dynamic water level.
4. Record the drawdown (for the slug test) at set five (5) second intervals for the first five (5) minutes, then reduce to every one (1) minute.
5. Continue recording the drawdown until 95% recovery is reached. To calculate this value: Find the difference between the dynamic water level and the static water level, then multiply by 95% (.95). Add the resulting value to the dynamic water level.

   (Static Water Level – Dynamic Water Level).95 + Static Water Level = 95% Recovery Value
6. Once complete, replace the waterra tubing/bailer and re-secure the well cap.

Note: If the well is deep, more than one slug may be inserted by attaching the slugs to a series.

Slugs must be washed with methanol, then lab grade soap, and then rinsed with de-ionized water after each use.

Based on the recorded observations, the hydraulic conductivity (in m/s) of the aquifer will be determined. In order to determine the hydraulic conductivity; the well diameter, radius of the borehole and length of the screen will also be required.

Bail Test Procedure

Equipment Required

- 20 L (5 gal) Graduated pail
- Stop watch or watch with seconds
- Garbage bags
- Water level meter
- Field sheets/log book
- Latex Gloves
- Bailer and Rope

Procedure

1. Remove cap from well and collect static water level.
2. If using a **bailer**:
    a. Affix the rope to the bailer.
    b. Remove the waterra tubing and place in garbage bag
    c. Record static water level measurement again.
    d. Record how much water was removed by either counting the number of full bailers or emptying removed water into a container.
    e. Quickly lower the bailer into the well and remove.
    f. Continue this process until the water level will reduce no further.
    g. Record the dynamic water level.
3. If using **waterra** to bail the water:
    a. Pump the water into graduated bucket until the water level will reduce no further.
    b. Record how much water has been removed.
    c. Record the dynamic water level.
4. Record the recovery at set five (5) second intervals for the first (5) minutes, then reduce to every one (1) minute.
5. Continue recording the drawdown/recovery until 95% recovery is reached.
6. Once complete, replace any waterra tubing that may have been removed from the well and re-secure the well cap.

Appendix D – Laboratory Certificates of Analysis

Your P.O. #: ENV-BRM
Your Project #: BRM-21004344-D0
Site Location: 12304 HEART LAKE
Your C.O.C. #: 828273-06-01

Attention: Francois Chartier

exp Services Inc
1595 Clark Blvd
Brampton, ON
CANADA L6T 4V1

Report Date: 2021/10/21
Report #: R6862632
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BV LABS JOB #: C1T6332
Received: 2021/10/13, 08:00

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
ABN Compounds in Water by GC/MS	1	2021/10/15	2021/10/18	CAM SOP-00301	EPA 8270 m
Carbonaceous BOD	1	2021/10/14	2021/10/19	CAM SOP-00427	SM 23 5210B m
Total Cyanide	1	2021/10/15	2021/10/15	CAM SOP-00457	OMOE E3015 5 m
Fluoride	1	2021/10/16	2021/10/18	CAM SOP-00449	SM 23 4500-F C m
Mercury in Water by CVAA	1	2021/10/15	2021/10/18	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by ICPMS	1	N/A	2021/10/20	CAM SOP-00447	EPA 6020B m
E.coli, (CFU/100mL)	1	N/A	2021/10/13	CAM SOP-00552	MOE LSB E3371
Total Nonylphenol in Liquids by HPLC	1	2021/10/15	2021/10/15	CAM SOP-00313	In-house Method
Nonylphenol Ethoxylates in Liquids: HPLC	1	2021/10/15	2021/10/15	CAM SOP-00313	BV Labs Method
Animal and Vegetable Oil and Grease	1	N/A	2021/10/21	CAM SOP-00326	EPA1664B m,SM5520B m
Total Oil and Grease	1	2021/10/20	2021/10/21	CAM SOP-00326	EPA1664B m,SM5520B m
Polychlorinated Biphenyl in Water	1	2021/10/15	2021/10/16	CAM SOP-00309	EPA 8082A m
pH	1	2021/10/16	2021/10/18	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2021/10/14	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Colourimetry	1	N/A	2021/10/18	CAM SOP-00464	EPA 375.4 m
Total Kjeldahl Nitrogen in Water	1	2021/10/15	2021/10/18	CAM SOP-00938	OMOE E3516 m
Mineral/Synthetic O & G (TPH Heavy Oil) (1)	1	2021/10/20	2021/10/21	CAM SOP-00326	EPA1664B m,SM5520F m
Total Suspended Solids	1	2021/10/14	2021/10/18	CAM SOP-00428	SM 23 2540D m
Volatile Organic Compounds in Water	1	N/A	2021/10/16	CAM SOP-00228	EPA 8260C m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report.

Your P.O. #: ENV-BRM
Your Project #: BRM-21004344-D0
Site Location: 12304 HEART LAKE
Your C.O.C. #: 828273-06-01

Attention: Francois Chartier

exp Services Inc
1595 Clark Blvd
Brampton, ON
CANADA L6T 4V1

Report Date: 2021/10/21
Report #: R6862632
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BV LABS JOB #: C1T6332
Received: 2021/10/13, 08:00

Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Note: TPH (Heavy Oil) is equivalent to Mineral / Synthetic Oil & Grease

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Patricia Legette, Project Manager
Email: Patricia.Legette@bureauveritas.com
Phone# (905)817-5799
==========
BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Bureau Veritas Job #: C1T6332
Report Date: 2021/10/21

exp Services Inc
Client Project #: BRM-21004344-D0
Site Location: 12304 HEART LAKE
Your P.O. #: ENV-BRM
Sampler Initials: TM

PEEL SANITARY & STORM SEWER (53-2010)

Bureau Veritas ID				QXK068			QXK068		
Sampling Date				2021/10/12 16:00			2021/10/12 16:00		
COC Number				828273-06-01			828273-06-01		
	UNITS	Criteria	Criteria-2	BH 1	RDL	QC Batch	BH 1 Lab-Dup	RDL	QC Batch
Calculated Parameters									
Total Animal/Vegetable Oil and Grease	mg/L	150	-	ND	0.50	7633045			
Inorganics									
Total Carbonaceous BOD	mg/L	300	15	ND	2	7635932			
Fluoride (F-)	mg/L	10	-	0.24	0.10	7641412			
Total Kjeldahl Nitrogen (TKN)	mg/L	100	1	0.64	0.10	7639522			
pH	pH	5.5:10.0	6.0:9.0	7.86		7641415			
Phenols-4AAP	mg/L	1	0.008	ND	0.0010	7636523			
Total Suspended Solids	mg/L	350	15	10	10	7636921			
Dissolved Sulphate (SO4)	mg/L	1500	-	82	1.0	7641373	82	1.0	7641373
Total Cyanide (CN)	mg/L	2	0.02	ND	0.0050	7639849			
Petroleum Hydrocarbons									
Total Oil & Grease	mg/L	-	-	ND	0.50	7649903			
Total Oil & Grease Mineral/Synthetic	mg/L	15	-	ND	0.50	7649907			
Miscellaneous Parameters									
Nonylphenol Ethoxylate (Total)	mg/L	0.2	-	ND	0.025	7638828			
Nonylphenol (Total)	mg/L	0.02	-	ND	0.001	7638824			
Metals									
Mercury (Hg)	mg/L	0.01	0.0004	ND	0.00010	7639524			
Total Aluminum (Al)	ug/L	50000	-	370	4.9	7642069			
Total Antimony (Sb)	ug/L	5000	-	ND	0.50	7642069			
Total Arsenic (As)	ug/L	1000	20	1.7	1.0	7642069			
Total Cadmium (Cd)	ug/L	700	8	ND	0.090	7642069			
Total Chromium (Cr)	ug/L	5000	80	ND	5.0	7642069			

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: The Regional Municipality of Peel Sanitary Sewer Discharge.
By-Law Number 53-2010.
Criteria-2: The Regional Municipality of Peel Storm Sewer Discharge.
By-Law Number 53-2010.
ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Bureau Veritas Job #: C1T6332
Report Date: 2021/10/21

exp Services Inc
Client Project #: BRM-21004344-D0
Site Location: 12304 HEART LAKE
Your P.O. #: ENV-BRM
Sampler Initials: TM

PEEL SANITARY & STORM SEWER (53-2010)

Bureau Veritas ID				QXK068			QXK068		
Sampling Date				2021/10/12 16:00			2021/10/12 16:00		
COC Number				828273-06-01			828273-06-01		
	UNITS	Criteria	Criteria-2	BH 1	RDL	QC Batch	BH 1 Lab-Dup	RDL	QC Batch
Total Cobalt (Co)	ug/L	5000	-	0.64	0.50	7642069			
Total Copper (Cu)	ug/L	3000	50	2.3	0.90	7642069			
Total Lead (Pb)	ug/L	3000	120	ND	0.50	7642069			
Total Manganese (Mn)	ug/L	5000	50	**78**	2.0	7642069			
Total Molybdenum (Mo)	ug/L	5000	-	2.9	0.50	7642069			
Total Nickel (Ni)	ug/L	3000	80	1.9	1.0	7642069			
Total Phosphorus (P)	ug/L	10000	-	ND	100	7642069			
Total Selenium (Se)	ug/L	1000	20	ND	2.0	7642069			
Total Silver (Ag)	ug/L	5000	120	ND	0.090	7642069			
Total Tin (Sn)	ug/L	5000	-	ND	1.0	7642069			
Total Titanium (Ti)	ug/L	5000	-	9.6	5.0	7642069			
Total Zinc (Zn)	ug/L	3000	40	ND	5.0	7642069			
Semivolatile Organics									
Bis(2-ethylhexyl)phthalate	ug/L	12	8.8	ND	2.0	7638687			
Di-N-butyl phthalate	ug/L	80	15	ND	2.0	7638687			
Volatile Organics									
Benzene	ug/L	10	2	ND	0.40	7634550			
Chloroform	ug/L	40	2	**2.8**	0.40	7634550			
1,2-Dichlorobenzene	ug/L	50	5.6	ND	0.80	7634550			
1,4-Dichlorobenzene	ug/L	80	6.8	ND	0.80	7634550			
cis-1,2-Dichloroethylene	ug/L	4000	5.6	ND	1.0	7634550			
trans-1,3-Dichloropropene	ug/L	140	5.6	ND	0.80	7634550			
Ethylbenzene	ug/L	160	2	ND	0.40	7634550			
Methylene Chloride(Dichloromethane)	ug/L	2000	5.2	ND	4.0	7634550			

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: The Regional Municipality of Peel Sanitary Sewer Discharge.
By-Law Number 53-2010.
Criteria-2: The Regional Municipality of Peel Storm Sewer Discharge.
By-Law Number 53-2010.
ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.

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Bureau Veritas Job #: C1T6332
Report Date: 2021/10/21

exp Services Inc
Client Project #: BRM-21004344-D0
Site Location: 12304 HEART LAKE
Your P.O. #: ENV-BRM
Sampler Initials: TM

PEEL SANITARY & STORM SEWER (53-2010)

Bureau Veritas ID				QXK068			QXK068		
Sampling Date				2021/10/12 16:00			2021/10/12 16:00		
COC Number				828273-06-01			828273-06-01		
	UNITS	Criteria	Criteria-2	BH 1	RDL	QC Batch	BH 1 Lab-Dup	RDL	QC Batch
Methyl Ethyl Ketone (2-Butanone)	ug/L	8000	-	ND	20	7634550			
Styrene	ug/L	200	-	ND	0.80	7634550			
1,1,2,2-Tetrachloroethane	ug/L	1400	17	ND	0.80	7634550			
Tetrachloroethylene	ug/L	1000	4.4	ND	0.40	7634550			
Toluene	ug/L	270	2	ND	0.40	7634550			
Trichloroethylene	ug/L	400	8	ND	0.40	7634550			
p+m-Xylene	ug/L	-	-	ND	0.40	7634550			
o-Xylene	ug/L	-	-	ND	0.40	7634550			
Total Xylenes	ug/L	1400	4.4	ND	0.40	7634550			
PCBs									
Total PCB	ug/L	1	0.4	ND	0.05	7639857			
Microbiological									
Escherichia coli	CFU/100mL	-	200	<10	10	7634654			
Surrogate Recovery (%)									
2,4,6-Tribromophenol	%	-	-	67		7638687			
2-Fluorobiphenyl	%	-	-	68		7638687			
2-Fluorophenol	%	-	-	30		7638687			
D14-Terphenyl	%	-	-	91		7638687			
D5-Nitrobenzene	%	-	-	70		7638687			
D5-Phenol	%	-	-	22		7638687			
Decachlorobiphenyl	%	-	-	81		7639857			
4-Bromofluorobenzene	%	-	-	88		7634550			
D4-1,2-Dichloroethane	%	-	-	107		7634550			
D8-Toluene	%	-	-	92		7634550			

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: The Regional Municipality of Peel Sanitary Sewer Discharge.
By-Law Number 53-2010.
Criteria-2: The Regional Municipality of Peel Storm Sewer Discharge.
By-Law Number 53-2010.
ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.

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Bureau Veritas Job #: C1T6332
Report Date: 2021/10/21

exp Services Inc
Client Project #: BRM-21004344-D0
Site Location: 12304 HEART LAKE
Your P.O. #: ENV-BRM
Sampler Initials: TM

TEST SUMMARY

Bureau Veritas ID: QXK068
Sample ID: BH 1
Matrix: Water

Collected: 2021/10/12
Shipped:
Received: 2021/10/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
ABN Compounds in Water by GC/MS	GC/MS	7638687	2021/10/15	2021/10/18	Anh Lieu
Carbonaceous BOD	DO	7635932	2021/10/14	2021/10/19	Surleen Kaur Romana
Total Cyanide	SKAL/CN	7639849	2021/10/15	2021/10/15	Nimarta Singh
Fluoride	ISE	7641412	2021/10/16	2021/10/18	Surinder Rai
Mercury in Water by CVAA	CV/AA	7639524	2021/10/15	2021/10/18	Meghaben Patel
Total Metals Analysis by ICPMS	ICP/MS	7642069	N/A	2021/10/20	Arefa Dabhad
E.coli, (CFU/100mL)	PL	7634654	N/A	2021/10/13	Tharmini Sivalingam
Total Nonylphenol in Liquids by HPLC	LC/FLU	7638824	2021/10/15	2021/10/15	Dennis Boodram
Nonylphenol Ethoxylates in Liquids: HPLC	LC/FLU	7638828	2021/10/15	2021/10/15	Dennis Boodram
Animal and Vegetable Oil and Grease	BAL	7633045	N/A	2021/10/21	Automated Statchk
Total Oil and Grease	BAL	7649903	2021/10/20	2021/10/21	Saumya Modh
Polychlorinated Biphenyl in Water	GC/ECD	7639857	2021/10/15	2021/10/16	Sarah Huang
pH	AT	7641415	2021/10/16	2021/10/18	Surinder Rai
Phenols (4AAP)	TECH/PHEN	7636523	N/A	2021/10/14	Deonarine Ramnarine
Sulphate by Automated Colourimetry	KONE	7641373	N/A	2021/10/18	Avneet Kour Sudan
Total Kjeldahl Nitrogen in Water	SKAL	7639522	2021/10/15	2021/10/18	Rajni Tyagi
Mineral/Synthetic O & G (TPH Heavy Oil)	BAL	7649907	2021/10/20	2021/10/21	Saumya Modh
Total Suspended Solids	BAL	7636921	2021/10/14	2021/10/18	Sandeep Kaur
Volatile Organic Compounds in Water	GC/MS	7634550	N/A	2021/10/16	Chandni Khawas

Bureau Veritas ID: QXK068 Dup
Sample ID: BH 1
Matrix: Water

Collected: 2021/10/12
Shipped:
Received: 2021/10/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphate by Automated Colourimetry	KONE	7641373	N/A	2021/10/18	Avneet Kour Sudan

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Bureau Veritas Job #: C1T6332
Report Date: 2021/10/21

exp Services Inc
Client Project #: BRM-21004344-D0
Site Location: 12304 HEART LAKE
Your P.O. #: ENV-BRM
Sampler Initials: TM

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	14.0°C

Revised Report (2021/10/21): Site location address has been revised in this CofA.

Sample QXK068 [BH 1] : VOC Analysis: Due to the sample matrix, sample required dilution. Detection limits were adjusted accordingly.

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7634550	4-Bromofluorobenzene	2021/10/16	102	70 - 130	101	70 - 130	92	%				
7634550	D4-1,2-Dichloroethane	2021/10/16	105	70 - 130	99	70 - 130	106	%				
7634550	D8-Toluene	2021/10/16	107	70 - 130	109	70 - 130	93	%				
7638687	2,4,6-Tribromophenol	2021/10/15	89	10 - 130	83	10 - 130	81	%				
7638687	2-Fluorobiphenyl	2021/10/15	45	30 - 130	50	30 - 130	55	%				
7638687	2-Fluorophenol	2021/10/15	28	10 - 130	38	10 - 130	46	%				
7638687	D14-Terphenyl	2021/10/15	97	30 - 130	92	30 - 130	97	%				
7638687	D5-Nitrobenzene	2021/10/15	57	30 - 130	63	30 - 130	66	%				
7638687	D5-Phenol	2021/10/15	22	10 - 130	27	10 - 130	30	%				
7639857	Decachlorobiphenyl	2021/10/16	89	60 - 130	84	60 - 130	88	%				
7634550	1,1,2,2-Tetrachloroethane	2021/10/16	94	70 - 130	89	70 - 130	ND, RDL=0.40	ug/L	NC	30		
7634550	1,2-Dichlorobenzene	2021/10/16	85	70 - 130	88	70 - 130	ND, RDL=0.40	ug/L	NC	30		
7634550	1,4-Dichlorobenzene	2021/10/16	98	70 - 130	104	70 - 130	ND, RDL=0.40	ug/L	NC	30		
7634550	Benzene	2021/10/16	83	70 - 130	82	70 - 130	ND, RDL=0.20	ug/L	NC	30		
7634550	Chloroform	2021/10/16	91	70 - 130	88	70 - 130	ND, RDL=0.20	ug/L	2.8	30		
7634550	cis-1,2-Dichloroethylene	2021/10/16	92	70 - 130	89	70 - 130	ND, RDL=0.50	ug/L	0.14	30		
7634550	Ethylbenzene	2021/10/16	78	70 - 130	82	70 - 130	ND, RDL=0.20	ug/L	NC	30		
7634550	Methyl Ethyl Ketone (2-Butanone)	2021/10/16	107	60 - 140	96	60 - 140	ND, RDL=10	ug/L	NC	30		
7634550	Methylene Chloride(Dichloromethane)	2021/10/16	106	70 - 130	100	70 - 130	ND, RDL=2.0	ug/L	NC	30		
7634550	o-Xylene	2021/10/16	77	70 - 130	84	70 - 130	ND, RDL=0.20	ug/L	NC	30		
7634550	p+m-Xylene	2021/10/16	82	70 - 130	86	70 - 130	ND, RDL=0.20	ug/L	NC	30		
7634550	Styrene	2021/10/16	72	70 - 130	79	70 - 130	ND, RDL=0.40	ug/L	NC	30		
7634550	Tetrachloroethylene	2021/10/16	83	70 - 130	87	70 - 130	ND, RDL=0.20	ug/L	NC	30		
7634550	Toluene	2021/10/16	87	70 - 130	89	70 - 130	ND, RDL=0.20	ug/L	NC	30		
7634550	Total Xylenes	2021/10/16					ND, RDL=0.20	ug/L	NC	30		
7634550	trans-1,3-Dichloropropene	2021/10/16	95	70 - 130	80	70 - 130	ND, RDL=0.40	ug/L	NC	30		
7634550	Trichloroethylene	2021/10/16	91	70 - 130	92	70 - 130	ND, RDL=0.20	ug/L	NC	30		
7635932	Total Carbonaceous BOD	2021/10/19					ND,RDL=2	mg/L	7.8	30	99	85 - 115
7636523	Phenols-4AAP	2021/10/14	94	80 - 120	95	80 - 120	ND, RDL=0.0010	mg/L	NC	20		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7636921	Total Suspended Solids	2021/10/18					ND, RDL=10	mg/L	2.1	25	100	85 - 115
7638687	Bis(2-ethylhexyl)phthalate	2021/10/16	89	30 - 130	89	30 - 130	ND, RDL=2.0	ug/L	NC	40		
7638687	Di-N-butyl phthalate	2021/10/16	94	30 - 130	94	30 - 130	ND, RDL=2.0	ug/L	NC	40		
7638824	Nonylphenol (Total)	2021/10/16	86	50 - 130	79	50 - 130	ND, RDL=0.001	mg/L	NC	40		
7638828	Nonylphenol Ethoxylate (Total)	2021/10/15	91	50 - 130	74	50 - 130	ND, RDL=0.025	mg/L	NC	40		
7639522	Total Kjeldahl Nitrogen (TKN)	2021/10/18	96	80 - 120	104	80 - 120	ND, RDL=0.10	mg/L	9.9	20	101	80 - 120
7639524	Mercury (Hg)	2021/10/18	94	75 - 125	94	80 - 120	ND, RDL=0.00010	mg/L	NC	20		
7639849	Total Cyanide (CN)	2021/10/15	98	80 - 120	99	80 - 120	ND, RDL=0.0050	mg/L	NC	20		
7639857	Total PCB	2021/10/16	79	60 - 130	82	60 - 130	ND, RDL=0.05	ug/L	NC	40		
7641373	Dissolved Sulphate (SO4)	2021/10/18	NC	75 - 125	102	80 - 120	ND, RDL=1.0	mg/L	0.48	20		
7641412	Fluoride (F-)	2021/10/18	104	80 - 120	102	80 - 120	ND, RDL=0.10	mg/L	1.4	20		
7641415	pH	2021/10/18			102	98 - 103			0.86	N/A		
7642069	Total Aluminum (Al)	2021/10/20	125 (1)	80 - 120	104	80 - 120	ND, RDL=4.9	ug/L	0.77	20		
7642069	Total Antimony (Sb)	2021/10/20	111	80 - 120	108	80 - 120	ND, RDL=0.50	ug/L				
7642069	Total Arsenic (As)	2021/10/20	106	80 - 120	104	80 - 120	ND, RDL=1.0	ug/L				
7642069	Total Cadmium (Cd)	2021/10/20	106	80 - 120	106	80 - 120	ND, RDL=0.090	ug/L	NC	20		
7642069	Total Chromium (Cr)	2021/10/20	100	80 - 120	100	80 - 120	ND, RDL=5.0	ug/L	NC	20		
7642069	Total Cobalt (Co)	2021/10/20	107	80 - 120	105	80 - 120	ND, RDL=0.50	ug/L				
7642069	Total Copper (Cu)	2021/10/20	105	80 - 120	104	80 - 120	ND, RDL=0.90	ug/L	2.4	20		
7642069	Total Lead (Pb)	2021/10/20	104	80 - 120	102	80 - 120	ND, RDL=0.50	ug/L	2.2	20		
7642069	Total Manganese (Mn)	2021/10/20	103	80 - 120	100	80 - 120	ND, RDL=2.0	ug/L				
7642069	Total Molybdenum (Mo)	2021/10/20	103	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L				
7642069	Total Nickel (Ni)	2021/10/20	104	80 - 120	104	80 - 120	ND, RDL=1.0	ug/L	14	20		
7642069	Total Phosphorus (P)	2021/10/20	NC	80 - 120	96	80 - 120	ND, RDL=100	ug/L				
7642069	Total Selenium (Se)	2021/10/20	108	80 - 120	108	80 - 120	ND, RDL=2.0	ug/L				

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7642069	Total Silver (Ag)	2021/10/20	NC	80 - 120	103	80 - 120	ND, RDL=0.090	ug/L				
7642069	Total Tin (Sn)	2021/10/20	106	80 - 120	105	80 - 120	ND, RDL=1.0	ug/L				
7642069	Total Titanium (Ti)	2021/10/20	101	80 - 120	97	80 - 120	ND, RDL=5.0	ug/L				
7642069	Total Zinc (Zn)	2021/10/20	106	80 - 120	104	80 - 120	ND, RDL=5.0	ug/L	2.2	20		
7649903	Total Oil & Grease	2021/10/21			99	85 - 115	ND, RDL=0.50	mg/L	2.6	25		
7649907	Total Oil & Grease Mineral/Synthetic	2021/10/21			94	85 - 115	ND, RDL=0.50	mg/L	3.8	25		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Metal Analysis:Matrix Spike exceeds acceptance limits, probable matrix interference

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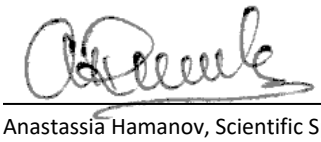
Bureau Veritas Job #: C1T6332
Report Date: 2021/10/21

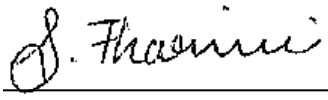
exp Services Inc
Client Project #: BRM-21004344-D0
Site Location: 12304 HEART LAKE
Your P.O. #: ENV-BRM
Sampler Initials: TM

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:



Anastassia Hamanov, Scientific Specialist



Tharmini Sivalingam, Manager, Food Microbiology Laboratory

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports.
For Service Group specific validation please refer to the Validation Signature Page.

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MICRO

Bureau Veritas Laboratories
Unit 6 Campobello Road, Mississauga, Ontario Canada L5N 2L8 Tel:(905) 817-5700 Toll-free 800-563-6266 Fax:(905) 817-5777 www.bvlabs.com

CHA

13-Oct-21 08:00

Page 1 of 1

Patricia Legette

C1T6332

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:	
Company Name:	#30554 exp Services Inc	Company Name:	EXP Services Inc	Quotation #:	B91717
Attention:	Central Services	Attention:	Francois Chartier	P.O. #:	ENV-BRM
Address:	1595 Clark Blvd Brampton ON L6T 4V1	Address:	Thabiso.Modise@exp.com Jeffrey.Leon@exp.com	Project:	BRM-21004344-D0
Tel:	(905) 793-9800 Fax: (905) 793-0641	Tel:	(905) 793-9800 Ext: 2523 Fax:	Project Name:	12304 Heart Lake
Email:	AP@exp.com; Karen.Burke@exp.com	Email:	Francois.Chartier@exp.com	Site #:	
				Sampled By:	Thabiso Modise

I_L ENV-1166

e Order #:

828273

COC #: C#828273-06-01

Project Manager: Patricia Legette

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BV LABS DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011): ☐ Table 1 ☐ Res/Park ☐ Medium/Fine ☐ Table 2 ☐ Ind/Comm ☐ Coarse ☐ Table 3 ☐ Agri/Other ☐ For RSC ☐ Table ___

Other Regulations: ☐ CCME ☑ Sanitary Sewer Bylaw ☐ Reg 558 ☑ Storm Sewer Bylaw ☐ MISA Municipality Peel ☐ PWQO ☐ Reg 406 Table ☐ Other

Special Instructions: PLEASE FILTER ADDITIONALS METALS SAMPLE

Include Criteria on Certificate of Analysis (Y/N)? ____

Field Filtered (please circle): Metals / Hg / Cr VI

ANALYSIS REQUESTED (PLEASE BE SPECIFIC):

Toronto Sanitary & Storm Sewer Package

Peel Sanitary & Storm Sewer ✓

Turnaround Time (TAT) Required:

Please provide advance notice for rush projects

Regular (Standard) TAT: ☑

(will be applied if Rush TAT is not specified)

Standard TAT = 5-7 Working days for most tests.

Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)

Date Required: ____ Time Required: ____ ☐

Rush Confirmation Number: ____ *(call lab for #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	# of Bottles	Comments
1		BH 1	12/Oct/21	16:00	GW	18	PLEASE MEET 5 DAY TAT
2							
3							PLEASE INCLUDE COC
4							IN CERTIFICATE OF ANALYSIS
5							
6							
7							
8							
9							
10							on ice

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
Thabiso Modise	21/10/13	07:40		21/10/13	08:00	

Laboratory Use Only

Time Sensitive

Temperature (°C) on Recei: 14/14/14

Custody Seal	Yes	No
Present	✓	
Intact	✓	

White: BV Labs Yellow: Client

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BV LABS' STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVLABS.COM/TERMS-AND-CONDITIONS.

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** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVLABS.COM/RESOURCES/CHAIN-OF-CUSTODY-FORMS.

SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS

Bureau Veritas Canada (2019) Inc.

Bureau Veritas Laboratories
6740 Campobello Road, Mississauga, Ontario Canada L5N 2L8 Tel:(905) 817-5700 Toll-free:800-563-6266 Fax:(905) 817-5777 www.bvlabs.com

CHAIN OF CUSTODY RECORD

Page 1 of 1

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name:	#30554 exp Services Inc	Company Name:	EXP Services Inc	Quotation #:	B91717	BV Labs Job #:	Bottle Order #: 828273
Attention:	Central Services	Attention:	Francois Chartier	P.O. #:	ENV-BRM		
Address:	1595 Clark Blvd Brampton ON L6T 4V1	Address:	Thabiso.Modise@exp.com Jeffrey.Leon@exp.com	Project:	BRM-21004344-DO	COC #: C#828273-07-01	Project Manager: Patricia Legette
Tel:	(905) 793-9800 Fax: (905) 793-0641	Tel:	(905) 793-9800 Ext: 2523 Fax:	Project Name:	12304 Heart Lake		
Email:	AP@exp.com; Karen.Burke@exp.com	Email:	Francois.Chartier@exp.com	Site #:			
				Sampled By:	Thabiso Modise		

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BV LABS DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011)	Other Regulations	Special Instructions
☐ Table 1 ☐ Res/Park ☐ Medium/Fine ☐ Table 2 ☐ Ind/Comm ☐ Coarse ☐ Table 3 ☐ Agri/Other ☐ For RSC ☐ Table ___	☐ CCME ☐ Sanitary Sewer Bylaw ☐ Reg 558 ☐ Storm Sewer Bylaw ☐ MISA Municipality ___ ☐ PWQO ☐ Reg 406 Table ___ ☐ Other ___	PLEASE FILTER METALS SAMPLE

Include Criteria on Certificate of Analysis (Y/N)? ___

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

Field Filtered (please circle): Metals / Hg / Cr VI

~~Toronto Sanitary & Storm Sewer~~ Peel Sanitary & Storm Sewer ~~Hamilton~~

Turnaround Time (TAT) Required:

Please provide advance notice for rush projects

Regular (Standard) TAT: ☑
(will be applied if Rush TAT is not specified):
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required: ___ Time Required: ___ ☐
Rush Confirmation Number: ___ *(call lab for #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	# of Bottles	Comments
1		BH 1	15/Oct/21	12:00	GW	2	PLEASE INCLUDE COC IN CERTIFICATE OF ANALYSIS
2							
3							
4							
5							
6							
7							
8							
9							
10							

Additional

13-Oct-21 08:00
Patricia Legette
C1T6332
ENV-1166

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted	Laboratory Use Only: Time Sensitive	Temperature (°C) on Recei	Custody Seal Present / Intact	Yes	No
Thabiso Modise	21/10/15	14:45			1446			9/9/12		✓	

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SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS

White: BV Labs Yellow: Client

Bureau Veritas Canada (2019) Inc.

Exceedance Summary Table – Peel Region Sanitary 2010

Result Exceedances

Sample ID	Bureau Veritas ID	Parameter	Criteria	Result	DL	UNITS
No Exceedances						

The exceedance summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines.

Exceedance Summary Table – Peel Region Storm 2010

Result Exceedances

Sample ID	Bureau Veritas ID	Parameter	Criteria	Result	DL	UNITS
BH 1	QXK068-13	Chloroform	2	2.8	0.40	ug/L
BH 1	QXK068-08	Total Manganese (Mn)	50	78	2.0	ug/L

The exceedance summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines.

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Appendix E – Infiltration Rate Testing Results

Appendix E-1 Estimate of Field Saturated K

Location: 12304 Heart Lake Rd

Date: 7-Oct-21

Weather: Cloudy

Analyst: TM

Borehole radius (cm):	2.5
Soil class:	Default

12.0 2.074 0.093 0.754

Measurement	Start depth of water (cm)	End depth of water (cm)	Start time (decimal min)	End time (*decimal min)	Elapsed time (min)	Change in head (cm)	Perc test result (min/cm)	Perc test (hr/mm)	mean head (m)
INF 1	37.5	33.9	0.0	102.2	102.17	3.6	28.4	0.0473	0.357
INF 9	48.3	45.3	0.0	57.7	57.73	3.0	19.2	0.0321	0.468
INF 30	43.5	36.6	0.0	63.9	63.88	6.9	9.3	0.0154	0.401
INF 25	60.9	58.2	0.0	47.1	47.10	2.7	17.4	0.0291	0.596

Measurement	H/a (unitless)	2H^2 (m2)	2H/* (unitless)	C (unitless)	Ca2 (m2)	Denom	K_{fs} (mm/hr)	Kfs (cm/sec)	Kfs (m/sec)
INF 1	14.280	0.255	0.060	2.9494	0.00184	0.01495851	0.1	3.4E-06	3.4E-08
INF 9	18.720	0.438	0.078	3.3180	0.00207	0.016617316	0.1	3.5E-06	3.5E-08
INF 30	16.020	0.321	0.067	3.1058	0.00194	0.006009837	0.3	9.0E-06	9.0E-08
INF 25	23.820	0.709	0.099	3.6425	0.00228	0.023572301	0.1	2.7E-06	2.7E-08

Appendix E-2
12304 Heart Lake Rd, Caledon, Ontario
BRM-21004344-D0
Low Impact Design (LID) Calculations for Design Infiltration Rate

Test Location	Hydraulic Conductivity (K_{fs}) (cm/s)	Infiltration Rate (IR) (mm/hr)	Discrete Design Infiltration Rate(DIR) (mm/hr)	Percolation Time (min/cm)
INF 1	3.4E-06	19	7	80
INF 9	3.5E-06	19	8	80
INF 25	2.7E-06	18	7	85
INF 30	9.0E-06	24	10	62

Geology Units	Geometric Mean of K_{fs} (cm/s)	Infiltration Rate (I) (mm/hr)*	Ratio of Mean Measured Infiltration Rates	Safety Correction Factor (SCF)
Overlying Geology Unit	4.12E-06	20	1.0	2.5
Underlying Geology Unit (1.5 m below the bottom of trench)	4.12E-06	20		

Design Infiltration Rate(DIR) (mm/hr)	Minimum	7	**Percolation Time (min/cm)**	62
	Maximum	10		85
	Geometric Mean	**8**		82

Note:
Analytical Solutions (CVC and TRCA 2010)

$$Infiltration\ Rate\ (IR) = \left(\frac{K_{fs}}{6x10^{-11}}\right)^{\frac{1}{3.7363}}$$

$$Design\ Infiltration\ Rate\ (DIR) = \frac{IR}{SCF}$$

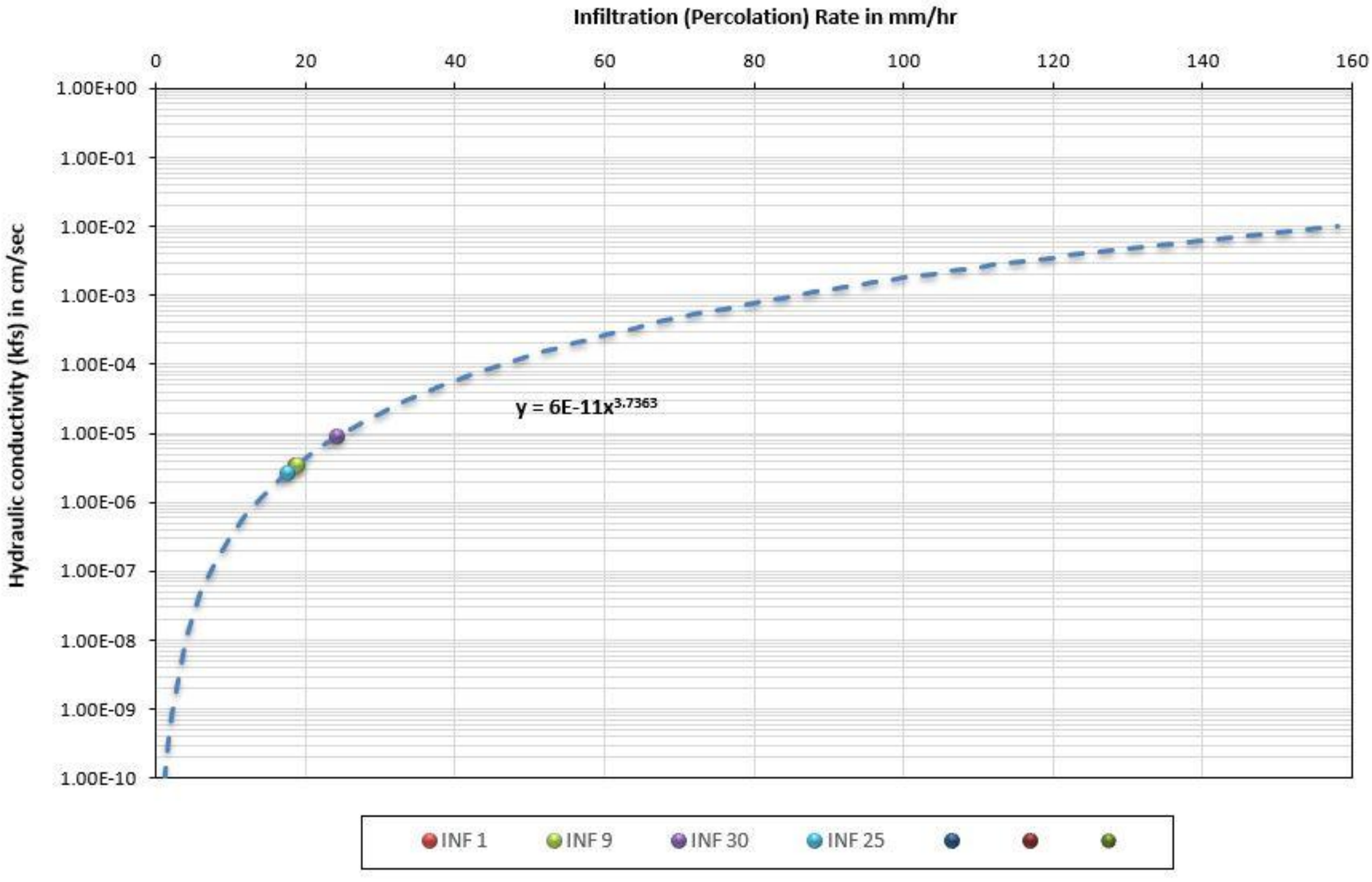
Kfs: hydraulic conductivity (cm/sec)

IR: infiltration rate (mm/hr)

DIR: design infiltration rate (mm/hr)

SCF: Safety Correction Factor (based on the chart recommended by CVC and TRCA, 2010)

Figure : Approximate relationship between infiltration rate and hydraulic conductivity (LID SWM planning and Design Guide, Appendix C1)



Appendix F – Water Balance Analysis

Appendix F-1: Model Input

12304 Heart Lake Rd, Caledon, Ontario

BRM-21004344-D0

Period	Month	Average Temperature (^{0}C)	Average Precipitation (mm)
1977-2006	1	-6.53	64.18
1977-2006	2	-5.37	53.93
1977-2006	3	-0.30	60.72
1977-2006	4	6.80	71.86
1977-2006	5	13.36	80.25
1977-2006	6	18.40	79.44
1977-2006	7	21.33	82.17
1977-2006	8	20.27	89.08
1977-2006	9	15.80	88.57
1977-2006	10	8.95	70.99
1977-2006	11	3.09	85.61
1977-2006	12	-2.90	70.57

Note:

Station Name	RICHMOND HILL	
Station ID	6157012	
Longitude	-79.45	
Latitude	43.88	
Elevaion	240.0	masl

Appendix F-2: Model Output

12304 Heart Lake Rd, Caledon, Ontario

BRM-21004344-D0

Month	PET	P	P-PET	Soil Moisture	AET	PET-AET	Snow Storage	Surplus
January	8.40	64.18	17.62	195.91	8.34	0.05	64.58	16.73
February	10.27	53.93	27.12	198.02	10.27	0.00	81.15	25.02
March	20.11	60.72	58.55	200.00	20.11	0.00	63.21	56.57
April	38.81	71.86	64.65	200.00	38.81	0.00	31.60	64.65
May	72.80	80.25	23.42	195.49	72.80	0.00	15.64	27.94
June	105.34	79.44	-17.39	170.06	104.68	0.65	7.14	8.70
July	124.90	82.17	-37.05	136.16	117.54	7.34	1.47	4.20
August	99.41	89.08	-8.86	127.97	90.91	8.51	0.00	7.82
September	57.61	88.57	30.96	145.83	56.53	1.08	0.00	14.19
October	29.82	70.99	41.17	169.07	29.59	0.23	0.00	18.16
November	15.41	85.61	69.04	191.17	15.41	0.00	1.16	46.93
December	9.63	70.57	35.69	196.63	9.63	0.00	26.40	30.23
Annual rate (mm/yr)	**592.51**	**897.38**			**574.63**		**292.36**	**322.75**

Note:

Station Name	RICHMOND HILL
Station ID	6157012
Longitude	-79.45
Latitude	43.88
Elevaion	240.0 masl

APPENDIX F-3
Average Infiltration Factors

12304 Heart Lake Rd, Caledon, Ontario
BRM-21004344-D0

F-3-1. Average Infiltration Factor – Pre Development Conditions

Un-Mitigated

Category	Weighted Infiltration Factor
Topography/Slope	0.15
Soil Type Glaciolacustrine deposits (Silty to Clayey)	0.20
Cover Cultivated Lands	0.10
Total weighted Infiltration factor	**0.45**

F-3-2. Average Infilteration Factor – Post Development Conditions

Un-Mitigated

Category	Weighted IInfiltration Factor
Topography/Slope	0.150
Soil Type Glaciolacustrine deposits (Silty to Clayey)	0.20
Cover Landscaped areas	0.10
Total weighted Infiltration factor	**0.45**

Notes:
Landscaped area considered equivalent to Cultivated Cover
Assumed existing and proposed slopes are similar

Appendix F-4
Summary of Pre and Post-Development Water Balance

12304 Heart Lake Rd, Caledon, Ontario
BRM-21004344-D0

F-4-1. Climate Data

Item	Pre-Development mm/a		Post-Development Un-Mitigated mm/a
Precipitation	897.38		897.38
Evapotranspiration	574.63		574.63
Water Surplus	322.75		322.75
Infiltration Rate	145.24		145.24
Runoff	177.51		177.51

F-4-2. Pre-Developed Area Statistics

Open spaces/ Agricultural	372,700	sq.m.
Paved Surfaces	1,800	sq.m.
Existing Buildings	1,700	sq.m.
TOTAL	376,200	sq.m.

F-4-3. Post Development Area Statistics
Commercial Development

Building Roofs	49,400	sq.m.
ROW (roads, sidewalks, parking) - Paved	41,000	sq.m.
Landscaped Areas	285,800	sq.m.
TOTAL	376,200	sq.m.

F-4-4-1. Annual Pre-Development Water Balance

Land Use	Area (sq.m.)	Precipitation (cu.m.)	Actual Evapotranspiration (cu.m.)	Infiltration Rate (cu.m.)	Run-off (cu.m.)
Total Impervious (Buildings and paved surfaces)	3,500	3,141	2,011	0	1,130
Open Spacces/Agricultural Lands	372,700	334,454	214,165	54,130	66,159
TOTAL	376,200	337,594	216,176	54,130	67,289
			Pre-development Infiltration Rate	**143.89**	**mm/a**
		100	64	16	20

Appendix F-4
Summary of Pre and Post-Development Water Balance

12304 Heart Lake Rd, Caledon, Ontario
BRM-21004344-D0

F-4-5-1. Annual Post-Development Water Balance

Land Use	Area (sq.m.)	Precipitation (cu.m.)	Actual Evapotranspiration (cu.m.)	Infiltration Rate (cu.m.)	Run-off (cu.m.)
Building Roofs	49,400	44,331			44,331
ROW (roads, sidewalks, parking) - Paved	41,000	36,793	0	0	36,793
Landscaped Areas	285,800	256,471	164,229	41,509	50,733
TOTAL	376,200	337,594	164,229	41,509	131,856
		Post-development Infiltration Rate Not-Corrected		**110.3**	**mm/a**
		100	48.6	12.3	39.1

F-4-6-1. Comparison of Pre-Development and Post-Development

Item	Precipitation (cu.m.)	Actual Evapotranspiration (cu.m.)	Run-off (cu.m.)	Corrected Infiltration Rate for Areas with Shallow Groundwater Table (cu.m.)
Pre-Development	337,594	216,176	67,289	54,130
Post Development	337,594	164,229	131,856	41,509
			Pre-development Infiltration Rate	**143.9**
			Post-development Infiltration Rate Not-Corrected	**110.3**
			Deficit Post Development Not-Corrected	**12,621**

APPENDIX F-5
12304 Heart Lake Rd, Caledon, Ontario
BRM-21004344-D0
Estimate of Area for Infiltration System

1. Design Infilteration Rate

Item	Value	Unit
Geometric mean of design infiltration rates	8	mm/h
	189.19	mm/day
	0.19	m/day/m^2
	0.38	m/48 hrs/m^2

2. Climate Data

Total precipitation based on weather station records	897.38	mm/yr
Total rain in an eight (8) month precipitation period	598.25	mm/8 months
Based on a 32-week precipitation period	18.70	mm/week
	0.019	m/week

3. Roof and Resulted Runoff Volume

Total roof area	49,400	m^2
Rooftop runoff volume in an eight (8) month precipitation period	29,554	m^3/year
Total rooftop runoff volume per 2 week	1,847	m^3/2 week

3. Estimated Deficit Volume

Estimated deficit based on water balance calculations	12,621	m^3/yr
Deficit over available water (roof runoff) for infiltration	43%	-
Storage to infiltrate to meet deficit	789	m^3/2 week

Area of infiltration system required to mitigate infiltrate deficit (rounded)	**2,085**	m^2

Note: only roof water to be infiltrated (clean water)

Appendix G – Construction Dewatering Flow Rate Calculations

APPENDIX G: Short-Term Flow Rate

12304 Heart Lake Road, Caledon ON
BRM-21004344-D0

Table G-1: Flow from Construction Dewatering System

Parameters	Symbols	Unit	Building 1
Geological Formation	-	-	Glacial Deposit
Ground Elevation	-	mASL	266.8 to 274.1
Lowest Top Slab Elevation	-	mASL	na
Highest Groundwater Elevation	-	mASL	265.0
Lowest Footing Elevation	-	mASL	**265.3**
Dewatering Target Elevation	-	mASL	264.3
Base of the Water-Bearing Zone	-	mASL	261.3
Height of Static Water Table Above the Base of the Water-Bearing Zone	**H**	m	3.7
Height of Target Water Level Above the Base of Water-Bearing Zone	**h_w**	m	3.0
Hydraulic Conductivity	**K**	m/s	6.3E-07
Length of Excavation	-	m	300.0
Width of Excavation	-	m	1.5
Witdth of Building		m	140.0
Equivalent Radius (equivalent perimeter)	**r_e**	m	96.0
Method to Calculate Radius of Influence	-	-	**Cooper-Jacob**
Time (30 days)	**t**	s	2592000
Specific Yield	**Sy**		0.05
Cooper-Jacob's Radius of Influence from Sides of Excavation	**Rcj**	m	**16**
Radius of Influence	**Ro**	m	112.46
Dewatering Flow Rate (unconfined radial flow component)	**Q**	m^3/day	**5**
Factor of Safety	**fs**	-	2.0
Dewatering Flow Rate (multiplied by factor of safety)	**Q.fs**	m^3/day	**10**
Precipitation Event	-	mm/day	15
Volume from Precipitation (for whole building footprint)	-	m^3/day	**630**
Dewatering Flow Rate **Without Safety Factor** (including stormwater collection)	-	m^3/day	640
Dewatering Flow Rate **With Safety Factor** (including stormwater collection)	-	m^3/day	**640**

Notes:
mASL - meters above sea level

Analytical Solution for Estimating Radial Flow from an Unconfined Aquifer to a Fully-Penetrating Excavation

$$Q_w = \frac{\pi K(H^2 - h^2)}{Ln\,[\frac{R_o}{r_e}]}$$

(Based on the Dupuit-Forcheimer Equation)

$$r_e = \frac{a+b}{\pi} \qquad R_o = R_{cj} + r_e \qquad R_{cj} = \sqrt{2.25KDt/S}$$

Where:

Q = Dewatering Flow Rate without Safety Factor (m^3/s)

K = Hydraulic conductivity (m/s)

H = Height of static water table above base of water-bearing zone (m)

h_w = Height of target water level above the base of water-bearing zone (m)

Rcj=Cooper Jacob Radius of Influence (m)

R_o=Radius of influence (m)

re=Equivalent perimeter (m)